INDUSTRY CANADA
AND
THE RADIO ADVISORY BOARD OF CANADA

INDUSTRIE CANADA
ET
LE CONSEIL CONSULTATIF CANADIEN DE LA RADIO

Spectrum Spectre 20/20 1994

PROCEEDINGS
COMPTE RENDU

S'affranchir des entraves
Breaking Loose

OTTAWA, CANADA 7 & 8 DECEMBER DECEMBRE 1994

SPECTRUM 20/20 SPECTRE 20/20

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Jointly sponsored by:
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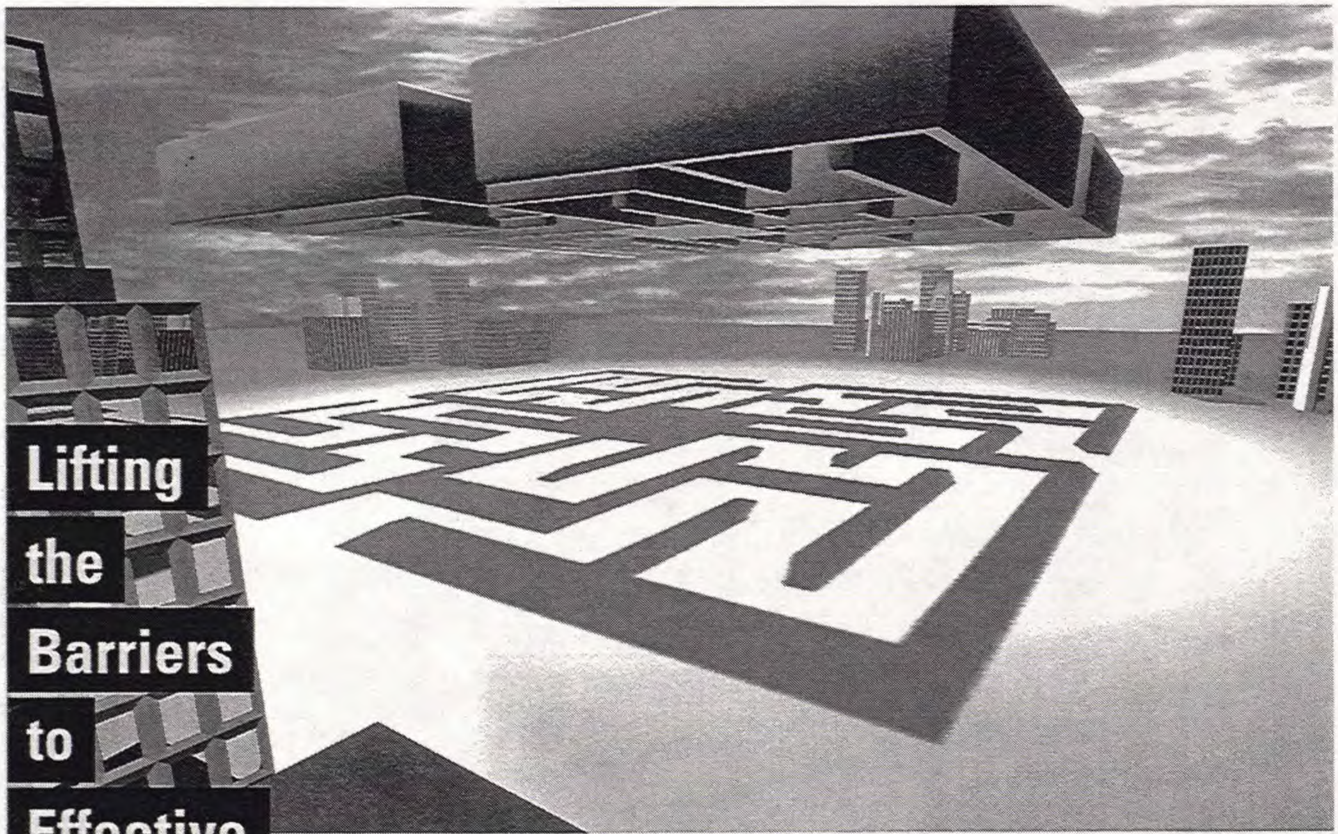

MPR Teltech is pleased to sponsor these Proceedings. We commend Industry Canada and the Radio Advisory Board of Canada for arranging the Spectrum 20/20 series of symposia, and congratulate the Board on its 50th Anniversary.

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RABC 50th Anniversary

1994 marks 50 years of Industry/Government co-operation through the RABC. To celebrate this event, a reception will be held in the Parliament Buildings on Tuesday evening, 6 December, from 5:30 to 8 pm. All Spectrum 20/20 delegates and speakers are cordially invited to attend.

The celebration will be held in Room 200 of the West Block. From the Château Laurier turn right (west) at the front door and take any entrance onto Parliament Hill. The first building, near Wellington Street, is the East Block, the second building, set back from the street, is the Centre Block, and the third side of the square is occupied by the West Block. Limited parking is available on the west side of the West Block.

50

50e anniversaire du CCCR

L'année 1994 marque le 50e anniversaire de la collaboration entre l'industrie et le gouvernement par l'entremise du CCCR. Pour souligner l'événement, une réception aura lieu au Parlement le mardi 6 décembre, de 17 h 30 à 20 h. Tous les délégués et les conférenciers participant à Spectre 20/20 y sont cordialement invités.

La réception se tiendra à la salle 200 de l'Édifice de l'Ouest. Partant du Château Laurier, tournez à droite sur la rue Wellington et franchissez la grille qui délimite la colline parlementaire. Le premier édifice à proximité de la rue Wellington est l'Édifice de l'Est. Le deuxième, plus en retrait, est l'Édifice du Centre. Le troisième, enfin, est l'Édifice de l'Ouest. Vous trouverez quelques places de stationnement du côté ouest de l'Édifice de l'Ouest.

1994

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Welcome by

The Honourable John Manley

Minister of Industry

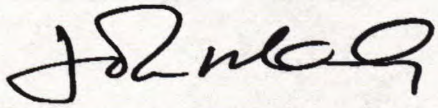
Since Marconi's experiments on Signal Hill in Newfoundland in 1901, Canadians have had an enduring relationship with radio. In the 1950s, we could boast of the world's longest microwave system. Twenty years later as technology changed, we had the longest digital microwave route. Earlier in the 1970s we launched the first satellite for domestic use. We operate microwave systems in rugged territory and adverse conditions not encountered in most countries.

The more recent examples of technological advance are just as dramatic. The radio spectrum is a finite resource, but we are extending the upper range and we are making greater use of the more accessible parts of the spectrum by more and more efficient techniques. Digitalization of cellular networks is a case in point.

Those of you who are steeped in this business are fully aware of the challenges presented by what may appear to be a simple application of known technology. I like to sum it up as making radio into a commodity. A few transistors made the portable broadcast radio receiver into a commodity, thus creating new classes of consumers and new industry. Making a commodity of two-way radio will have an even greater impact as consumers discover the advantages of extending their capacity to communicate. PCS will be an engine of industrial growth both for those in the industry and, more importantly, for its users.

This is one of the most dynamic sectors of the telecommunications industry. It presents the challenges of ensuring technical excellence in a highly competitive marketplace. You are where the action is, and this is where we have designed Spectrum 20/20 to be.

As Minister responsible for Industry, I take great pleasure in welcoming you to this symposium. The breadth of experience and knowledge of the speakers, and the backgrounds of the attendees confirm my belief that this symposium will be one more positive step in the relationship between Canada and radio.



John Manley
Minister of Industry

Mots de bienvenue par

L'honorable John Manley

Ministre de l'Industrie

Depuis que Marconi a réalisé ses expériences à Signal Hill (Terre-Neuve) en 1901, les Canadiens accordent une place de choix à la radio. Dans les années 50, nous disposions du plus vaste réseau de transmission par micro-ondes au monde. Vingt ans plus tard, la technologie ayant évolué, nous pouvions compter sur le plus vaste réseau de transmission numérique par micro-ondes. Au début des années 70, nous avons lancé le premier satellite desservant le territoire canadien. De nos jours, nous exploitons des systèmes à micro-ondes dans des régions accidentées et dans des conditions climatiques dont la plupart des pays n'ont aucune idée.

Les exemples plus récents de progrès technologiques sont tout aussi probants. Le spectre radio n'est pas infini, mais nous en repoussons la limite supérieure et nous utilisons davantage les parties plus accessibles au moyen de techniques nouvelles et plus efficientes. La numérisation des réseaux de communications cellulaires en est un exemple.

Vous qui oeuvrez dans cette industrie êtes parfaitement conscients des défis que pose ce qui semble se résumer à l'application toute simple d'une technologie déjà connue. Pour ma part, j'appelle cela faire de la radio un produit d'utilisation courante. Il a suffi de quelques transistors pour faire de l'émetteur-récepteur radio un produit d'utilisation courante, donnant ainsi naissance à de nouveaux groupes de consommateurs et à de nouvelles industries. La transformation de la radio bidirectionnelle en un produit d'utilisation courante aura de plus vastes répercussions encore à mesure que les consommateurs découvriront les avantages d'une plus grande capacité de communiquer. Les systèmes personnels de communication alimenteront la croissance industrielle du point de vue de l'industrie et, ce qui importe davantage, du point de vue des utilisateurs.

Ce secteur est l'un des plus dynamiques de l'industrie des télécommunications. Il nous défie d'exceller sur le plan technique sur un marché des plus concurrentiels. Vous êtes au coeur de l'action et c'est la place que nous destinons à Spectre 20/20.

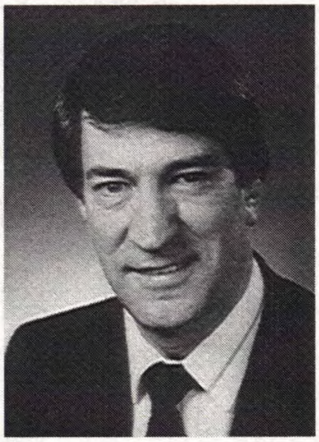
En qualité de ministre de l'Industrie, je suis très heureux de vous accueillir à ce symposium. L'étendue de l'expérience et des connaissances des conférenciers et la diversité des antécédents des participants m'a convinçu que ce symposium contribuera à renforcer davantage les liens qui unissent le Canada et la radio.

John Manley
Ministre de l'Industrie

Welcome by / Mots de bienvenue par

Roger Poirier

President RABC / President CCCR



Breaking Loose

As we approach the end of this century, traditional services and technologies are quickly evolving making way for new forms of communications. We are entering an age of personalized communications empowering individuals around the globe with powerful new tools for personal and business applications. In a very real sense, we are breaking loose from traditional bonds as these emerging technologies provide greater and greater control over our daily lives from on-demand entertainment to anywhere, anytime communications.

Within this environment, the challenges to meet spectrum demand have never been greater. Yet the tools at our disposal through innovative engineering and creative spectrum management have also never been greater.

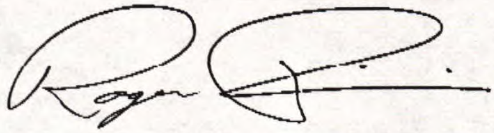
As the Radio Advisory Board of Canada celebrates fifty years of partnership with government, we are pleased to bring you this major conference on spectrum. "Breaking Loose" will provide an up-to-date perspective on the major issues facing an emerging new age of radiocommunications.

S'affranchir des entraves

Plus nous approchons du tournant du siècle, plus les services et techniques traditionnels cèdent le pas à de nouvelles formes de communication. Nous sommes à l'aube de l'ère des communications personnalisées, où le particulier aura à sa disposition de puissants outils d'application tant personnelles que commerciales. Les techniques qui se font jour affranchissent l'individu de toutes entraves, de façon très réelle, en lui assurant une maîtrise croissante de son environnement - que ce soit en lui permettant de commander ses divertissements quand bon lui semble ou en lui procurant un moyen de communiquer, n'importe où n'importe quand.

Étant donné ces besoins nouveaux, il n'a jamais été plus difficile de satisfaire à la demande de fréquences. D'un autre côté, grâce aux innovations techniques et à une ingénieuse gestion du spectre, nous n'avons jamais eu autant de moyens d'y répondre.

En ce cinquantième anniversaire de la collaboration du Conseil consultatif canadien de la radio avec le gouvernement, il nous fait plaisir de vous accueillir à cette importante conférence sur le spectre. Explorant le thème "S'affranchir des entraves", nous ferons le point sur les questions de l'heure, à l'aube d'une nouvelle ère des radiocommunications.



Roger Poirier
President
Radio Advisory Board of Canada

Roger Poirier
Président
Conseil consultatif canadien de la radio

Programme générales

Mardi, le 6 décembre

17 h 30 à 20 h	Inscription	Corridor «French »
17 h 30 à 20 h	Réception - 50^{e} anniversaire du CCCR	Salle 200, Édifice de l'Ouest, Colline parlementaire

Mercredi, le 7 décembre

de 07 h	Inscription	Corridor «French »
08 h 15	Ouverture et mots de bienvenue	Salle de bal
08 h 30 à 09 h 30	Conférencier principal	Salle de bal
09 h 30 à 10 h	Café	Salon Banquet
10 h à 12 h	Séance 1	Salle de bal
12 h à 14 h	Déjeuner	Salon «Drawing»
14 h à 17 h 30	Séance 2	Salle de bal
15 h (environs)	Café	Salon Banquet
19 h	Réception	Salon Banquet
20 h	Diner	Salle Adam

Jeudi, le 8 décembre

08 h 30 à 12 h	Séance 3	Salle Adam
10 h (env.)	Café	
12 h à 14 h	Déjeuner	Salle Canadienne
14 h à 15 h 30	Séance 4	Salle Adam
15 h 30	Cloture	

Program Outline

Tuesday, 6 December

17:30 - 20:00	Registration	"French Corridor"
17:30 - 20:00	RABC 50th Anniversary Reception	Room 200, West Block Parliament Hill

Wednesday, 7 December

From 07:00	Registration	"French Corridor"
08:15	Opening and Welcoming Addresses	Ballroom
08:30 - 09:30	Keynote Speaker	Ballroom
09:30 - 10:00	Coffee	Banquet Room
10:00 - 12:00	Session 1	Ballroom
12:00 - 14:00	Lunch	Drawing Room
14:00 - 17:30	Session 2	Ballroom
15:00 (appx.)	Coffee	Banquet Room
19:00	Reception	Banquet Room
20:00	Banquet	Adam Room

Thursday, 8 December

08:30 - 12:00	Session 3	Adam Room
10:00 (appx.)	Coffee	TBA
12:00 - 14:00	Lunch	Canadian Room
14:00 - 15:30	Session 4	Adam Room
15:30	Closure	

Speakers & Papers

Wednesday, 7 December

Opening and Welcoming Address	Roger Poirier & Harry Swain
Keynote Speaker	**George Gilder**

Session 1

Theme: Breaking Loose - Personalization of Communications
Chairman: Michael Binder (Industry Canada)

1.1 Personal Communications	David Gergacz (Rogers/Cantel)
1.2 New Media	Michael McCabe (CAB)
1.3 Wireless Systems	Robert Ferchat (BCE Mobile)
1.4 Networks	Brian Hewat (BNR)

Luncheon Speaker	**The Hon. John Manley**

Session 2

Theme: Breaking Loose - Cutting the Bonds
Chairman: Bob Simmonds (Clearnet)

2.1 End-user Requirements for PCS	Malcolm Cowan (Northern Telecom)
2.2 Digital Radio Broadcasting	Daniel Sauvet-Goichon (TDF - France)
2.3 The Age of non-GSO Mobile Satellite Systems	Don Jansky (Jansky/Barmat, U.S.)
2.4 IVHS Wireless Communications Opportunities	Jackson Wang (MOT, Ontario)
2.5 ATM for Multi-Media & Broadband	Claude Haw (Newbridge) & Abdul Lakhani (Telesat)
2.6 Advanced Television	Bill Sawchuk (CRC)
2.7 Wireless Data - Challenges and Promises	John Chung (MPR Teltech)

Banquet Speaker	**Sir Nicholas Bayne**

Thursday, 8 December

Session 3

Theme	Breaking Loose - Removing the Barriers
Chairman	Len Katz (Rogers/Cantel)

3.1 Social Impacts of PCS	R. Hal Turner (Telezone)
3.2 Regulatory Barriers	Peter Barnes (Mobility Canada)
3.3 Developments in Argentina	Roberto Door (CNT - Argentina)
3.4 Role of Standards	Peter Hamelberg (Dutch PTT/ETSI)
3.5 EMI/EMC Considerations	Rick Engelman (FCC)
3.6 Licensing Options in the U.S.	William Maher (Halprin, Temple & Goodman, U.S.)

Luncheon Speaker — **Charles Sirois**

Session 4

Panel Session	Breaking Loose - The Next Steps
Moderator	Ted Campbell (DND)

Panellists

- Tom Stanley (FCC)
- Joe Sarnecki (Bell Mobility Cellular)
- Steve Edwards (Rogers Broadcasting)
- John W. Thomas (Stentor)
- Bob Jones (Industry Canada)

Closure

Roger Poirier

Conférenciers et Papiers

Mercredi, le 7 décembre

Ouverture et allocutions des bienvenues	Roger Poirier et Harry Swain
Conférencier principal	**George Gilder**

Séance 1

Théme S'affranchir des entraves - Personnalisation des communications
Président Michael Binder (Industrie Canada)

1.1 Communications personnelles	David Gergacz (Rogers/Cantel)
1.2 Nouveaux médias	Michael McCabe (Association canadien des radiodiffuseurs)
1.3 Communications sans fil	Robert Ferchat (Communications Mobile BCE)
1.4 Maillage en réseaux	Brian Hewat (Recherches Bell-Northern)

Déjeuner

Conférencier invité **l'honorable John Manley**

Séance 2

Thème S'affranchir des entraves - Briser les liens
Président Bob Simmonds (Clearnet)

2.1 Les exigences de l'utilisateur final	Malcolm Cowan (Northern Telecom)
2.2 La radiodiffusion sonore numerique	Daniel Sauvet-Goichon (TDF - France)
2.3 L'ère des satellites non-géostationnaires	Don Jansky (Jansky/Barmat, É.-U.)
2.4 Occasions de communications sans fil pour SAVI	Jackson Wang (Ministry of Transport - Ontario)
2.5 ATM pour multi-media et à large bande	Claude Haw (Newbridge) et Abdul Lakhani (Telesat)
2.6 Télévision avancée	Bill Sawchuk (CRC)
2.7 Donées sans fil - Défis et promesses	John Chung (MPR Teltech)

Banquet

Conférencier invité **Sir Nicholas Bayne**

Jeudi, le 8 décembre

Séance 3

Théme	S'affranchir des entraves - Faire sautier les obstacles
Président	Len Katz (Rogers/Cantel)

3.1 Impact social des SCP	R. Hal Turner (Telezone)
3.2 Contraintes de réglementation	Peter Barnes (Mobilité Canada)
3.3 Developpements dans l'Argentine	Roberto Door (CNT - Argentina)
3.4 Rôle de la normalisation	Peter Hamelberg (PTT des Pays-bas/IENT)
3.5 Considérations des BEM/CEM	Rick Engelman (FCC, É.-U.)
3.6 Options de déliverance de licences aux États-Unis	William Maher (Halprin, Temple & Goodman, É.-U.)

Déjeuner

Conférencier invité — **Charles Sirois**

Séance 4

Panel de discussion	S'affranchir des entraves - Les prochaines étapes
Moderator	Ted Campbell (Défense nationale)

Panélists

Tom Stanley (FCC, É.-U.)

Bob Jones (Industrie Canada)

Steve Edwards (Rogers Broadcasting)

Joe Sarnecki (Bell Mobilité Cellulaire)

John W. Thomas (Centre de ressources Stentor)

Clôture

Roger Poirier

What is the RABC?

The Radio Advisory Board of Canada (RABC) is a non-profit association of twenty-seven organizations which are concerned with the use of the radio spectrum. These in turn represent the users of radio communications and related service providers and manufacturers. There are nearly 2000 organizations and 10,000 radio amateurs represented by the member organizations of the RABC.

Known as the Canadian Radio Technical Planning Board when it was founded in 1944, the Board has worked with the Government of Canada for fifty years for the co-operative administration of a major public resource - the radio spectrum.

The Board's purpose is to advise Industry Canada on behalf of the Canadian radio industry on matters concerning the management of the radio spectrum and the development of standards and radio regulations. The Board's resources, because of its broad industry representation, provide a powerful and recognised voice in technical, economic and policy dimensions of radiocommunications. In recent years and with government encouragement, the Board has adopted a pro-active role in advising Industry Canada on telecommunications matters affecting the radio spectrum.

Today the Board is recognised by the Federal Government as industry's voice in spectrum affairs.

Qu'est-ce que le CCCR?

Le Conseil consultatif canadien de la radio (CCCR) est une association à but non lucratif réunissant vingt-sept organismes qui s'intéressent à l'utilisation du spectre des fréquences radioélectriques. Ces organismes, pour leur part, représentent les utilisateurs et fournisseurs de services de radiocommunications et des fabricants. Les organismes membres du CCCR représentent, quant à eux, près de 2 000 organismes et 10 000 radioamateurs.

Fondé en 1944 sous le nom *Canadian Radio Technical Planning Board*, le Conseil a, pendant cinquante ans, servi de tribune à la gestion coopérative d'une des plus importantes ressources publiques, le spectre des fréquences radioélectriques.

Le Conseil représente l'ensemble de l'industrie canadien de la radio auprès de l'Industrie Canada et a pour mandat de conseiller ses représentants sur la gestion du spectre des fréquences radioélectriques et l'élaboration de normes et de règlements sur la radiodiffusion. Étant donné qu'il regroupe un très grand nombre de représentants de l'industrie, le Conseil dispose de ressources qui lui permettent d'être reconnu et considéré pour tout ce qui touche les aspects techniques, économiques et politiques de la gestation du spectre. Grâce à l'appui du gouvernement, le Conseil a, au cours des dernières années, joué un rôle de premier plan auprès de Industrie Canada en le conseillant en matière de télécommunications en ce qui concerne le spectre des fréquences radioélectriques.

Aujourd'hui, le gouvernement fédéral considère le Conseil comme étant le porte-parole de l'industrie pour toutes les questions relatives au spectre.

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GEORGE GILDER

Senior Fellow - Discovery Institute Seattle

George Gilder is senior fellow at the Discovery Institute in Seattle. A graduate of Harvard University, he majored in government, studied under Henry Kissinger, and later taught as a fellow at the Kennedy Institute of Politics. He is the author of nine books and is a contributing editor of *Forbes* and *Forbes ASAP*. He contributes regularly to a wide range of publications, including the Wall Street Journal, American Spectator, National Review and a variety of electronic business publications.

Gilder pioneered in the formation of supply-side economics when he served as chairman of the Lehrman's Institute's Economic Roundtable. Since the publication of "Wealth and Poverty" he consulted regularly with key figures in the Reagan and Bush Administrations and with leaders of America's high technology businesses. According to a study of Reagan's speeches, he was the President's most frequently quoted living author.

In a 1993 article in *The Economist*, Gilder states, "Industries organized around telephones and televisions will not survive the century. Still, telecoms executives want to believe that televisions and telephones can evolve bit by bit into the new digital world. This dream can not come true. Even to talk of 'telephones' and 'televisions' reflects a lexicographic lag that prevents many business leaders from detecting the onset of rigor mortis in their still-profitable products. In coming years, the very words will ring as quaintly as 'horseless carriage', 'icebox', or 'picture radio,' today."

Gilder has been chairman of a small business himself and serves on the boards of directors of several high technology companies. In 1986, President Reagan gave him a White House award for entrepreneurial excellence.

George Gilder est agrégé supérieur de recherches au Discovery Institute de Seattle. Diplômé de la Harvard University, il s'est spécialisé en administration publique et a suivi des cours donnés par Henry Kissinger. Il a par la suite été boursier chargé de cours au Kennedy Institute of politics. Il est auteur de neuf livres et collaborateur de rédaction chez Forbes and Forbes ASAP. Il collabore régulièrement à un large éventail de publications, dont le *Wall Street Journal*, l'*American Spectator*, le *National Review* et différentes publications portant sur l'électronique.

Gilder a fait oeuvre de pionnier dans la création de l'économie de l'offre lorsqu'il a été président de la table ronde sur l'économie du Lehrman's Institute. Depuis la publication de «Wealth and Poverty», il a eu régulièrement des entretiens avec de hauts fonctionnaires des administrations Reagan et Bush ainsi qu'avec des chefs d'entreprises de haute technologie d'Amérique. Selon une étude portant sur les discours du Président Reagan, il était l'auteur vivant le plus souvent cité de ce dernier.

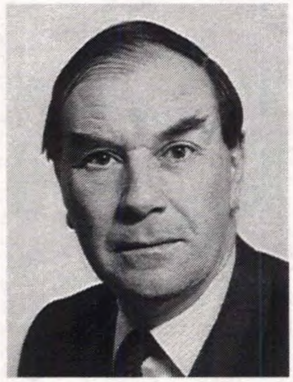
Dans un article publié en 1993 dans *The Economist*, Gilder déclare : «Les industries dont les activités sont axées sur le téléphone et la télévision n'existeront plus en l'an 2000. Les dirigeants d'entreprise de télécommunications croient toujours que la télévision et le téléphone peuvent être peu à peu intégrés au nouvel univers numérique. Ce rêve ne peut pas devenir réalité. Même le fait de parler de «téléphones» et de «télévisions» dénote un retard lexicographique qui fait que de nombreux chefs d'entreprise ne remarquent pas que leurs produits, jusqu'ici rentables, commencent a dépérir. Au cours des prochaines années, ces mots auront une résonance aussi bizarre que «voiture sans chevaux», «glacière» ou «radio à images».

Gilder a été lui-même président d'une petite entreprise et est membre du conseil d'administration de plusieurs entreprises de haute technologie. En 1986, le Président Reagan lui a remis le prix de l'entrepreneur par excellence de la Maison Blanche.

BANQUET SPEAKER/CONFÉRENCIER INVITÉE

SIR NICHOLAS BAYNE, KCMG

British High Commissioner



Nicholas Bayne est né le 15 février 1937. Après avoir fréquenté Eton College, il fait ses études au Christ Church College d'Oxford (MA, DPhil). Il entre au Service diplomatique en 1961 et travaille d'abord en Grande-Bretagne; il est ensuite affecté à Manille en 1963. Il se retrouve au ministère des Affaires étrangères et du Commonwealth (FCO) de 1966 à 1969, lorsqu'il est appelé à servir à Bonn. De retour au FCO en 1972, il est détaché, en 1974, au ministère des Finances. En 1975, il est nommé conseiller financier à Paris. Il rentre au FCO en 1979, pour y occuper le poste de chef du Bureau des relations économiques, avant d'être attaché, en 1982, au Royal Institute of International Affairs de Londres. En 1983, il est nommé ambassadeur à Kinshasa et, concurremment, ambassadeur (non-résident) au Congo, au Ruanda et au Burundi (1984). Affecté provisoirment à la Commission de sélection de la Fonction publique en 1985, il est nommé, au cours de la même année, représentant permanent à l'Organisation de coopération et de développement économique, à Paris (au rang d'ambassadeur à titre personnel). De retour au FCO depuis juillet 1988, en tant que directeur (Deputy Under Secretary of State) aux Affaires économiques, il est nommé haut-commissaire au Canada à partir du mois d'avril 1992.

Sir Nicholas est coauteur - avec Robert D. Putnam - de "Hanging Together: the 'Seven Power Summits'" (Londres, 1984; édition révisée, 1987, et versions allemande, japonaise et italienne de l'ouvrage).

Nommé Compagnon de l'Ordre de Saint-Michel et Saint-Georges en 1984, il est fait Chevalier Commandeur de cet ordre en juin 1992, au moment où S.M. la Reine confère décorations et promotions à l'occasion de son anniversaire.

Il a épousé Diana (née Wilde). Sir Nicholas et Lady Bayne ont deux fils.

Nicholas Bayne was born on 15 February 1937 and was educated at Eton College and Christ Church, Oxford (MA, DPhil). He entered the Diplomatic Service in 1961. After service at home he went to Manila in 1963. He returned to the Foreign and Commonwealth Office in 1966 and stayed there until 1969 when he was posted to Bonn. He returned to the FCO for a further spell of duty in 1972 and was loaned to the Treasury in 1974. He went to Paris as Counsellor (Financial) in 1975. On returning to the Foreign Office in 1979 he was Head of the Economic Relations Department until 1982. In that year he was attached to the Royal Institute of Foreign Affairs in London. In 1983 he was appointed Ambassador at Kinshasa and concurrently Ambassador (non-resident) to the Congo, to Rwanda and to Burundi (1984). In 1985 he was seconded to the Civil Service Selection Board and was appointed Permanent Representative to the OECD, Paris (with personal rank of Ambassador) later in the same year. He returned to the FCO in July 1988 as Deputy Under Secretary of State for Economic Affairs; and was appointed High Commissioner to Canada with effect from April 1992.

Sir Nicholas is the author, with Robert D. Putnam, of "Hanging Together: the 'Seven Power Summits'" (London 1984, revised 1987; also German, Japanese and Italian versions).

He was made a Companion of the Order of St. Michael and St. George in 1984 and a Knight Commander of the Order in the 1992 Birthday Honours.

Sir Nicholas is married to Diana (née Wilde) and they have two sons.

LUNCHEON SPEAKER/CONFÉRENCIER INVITÉ

CHARLES SIROIS

Chairman and Chief Executive Officer, Teleglobe Inc.

Charles Sirois is a leader in the development and management of communications and telecommunications businesses in Canada. At 40, he is Chairman of the Board, Chief Executive Officer and a majority shareholder in National Telesystem Ltd. (NTL), a holding company with extensive interests in the communications and telecommunications industry in Canada and abroad. In 1990, NTL established Intermedia Financial Corporation, now called Telesystem Financial Corporation, a merchant bank with capital resources in excess of $100 million. In May 1991, it founded Optinet Telecommunications, a telephone service reseller, as a subsidiary of National Telesystem Ltd. to further expand the range of its services to the industry.

In 1992, National Telesystem became a major investor in Teleglobe Inc., a world leader in the global telecommunications market. Mr. Sirois is Chairman and Chief Executive Officer of Teleglobe Inc., which develops telecommunications-related business opportunities around the world and offers project management and consulting services. Through Teleglobe Canada's network, it also provides international telecommunications links from Canada to over 230 countries and territories around the world.

A native of Chicoutimi, Quebec, Mr. Sirois comes from a family of entrepreneurs. After obtaining a bachelor's degree in finance from the University of Sherbrooke and a master's degree in finance from Laval University, he began his career in 1978 when he assumed the management of a family business, Setelco, which operated a local paging network.

In 1986, Charles Sirois became President and Chief Executive Officer of National Pagette, Canada's largest paging company, and Chief Executive

Charles Sirois est un chef de file dans le développement et la gestion d'entreprises de communications et de télécommunications au Canada. À 40 ans, il est président du conseil d'administration et directeur général et actionnaire majoritaire de Télésystème national Ltée (TNL), une société de portefeuille aux intérêts importants dans l'industrie des communications et des télécommunications, au Canada et à l'étranger. En 1990, TNL créa *Intermedia Financial Corporation*, maintenant appelée *Telesystem Financial Corporation*, une banque d'investissement dont les ressources en capital dépassent 100 millions de dollars. En mai 1991, TNL fonda *Optinet Telecommunications*, une société revendeuse de services de téléphone, à titre de filiale de Télésystème national Ltée afin d'élargir davantage la portée de ses services à l'industrie.

En 1992, la société Télésystème national est devenue un investisseur principal de Téléglobe Inc., un meneur mondial du marché universel des télécommunications. M. Sirois est président et directeur général de Téléglobe Inc., qui crée, dans le monde entier, des possibilités d'affaires liées aux télécommunications et offre des services de gestion de projet et de consultation. Par le truchement du réseau de Téléglobe Canada, l'entreprise assure les liaisons internationales de télécommunications entre le Canada et plus de 230 pays et territoires du monde entier.

Né à Chicoutimi, M. Sirois est issu d'une famille d'entrepreneurs. Après avoir obtenu un baccalauréat en finances de l'Université de Sherbrooke et une maîtrise en finances de l'Université Laval, il commença sa carrière en 1978 lorsqu'il prit en charge la gestion de l'entreprise familiale, Setelco, qui dirigeait un réseau local de téléappel.

Officer of National Mobile Communications Inc., two companies which were merged with Bell Cellular to create BCE Mobile Communications Inc. in 1987. From 1988 to 1990, he assumed the duties of Chairman of the Board and Chief Executive Officer of BCE Mobile, today one of the largest mobile communications companies in Canada. In November 1991, Mr. Sirois resigned from the Board of directors of BCE Mobile Inc. He is currently a director of the following companies: Radiomutuel Inc., SNC-Lavalin Group Inc., DMR Group Inc., *Société québécoise de développement de la main-d'oeuvre; École nationale de l'humour.* Moreover, he is a member of the Information Highway Advisory Council.

En 1986, Charles Sirois devint président et directeur général de *National Pagette*, la plus importante société de téléappel au Canada, et directeur général de *National Mobile Communications Inc.*, deux sociétés qui se sont fusionnées avec Bell Cellulaire pour créer Radiocommunications BCE Mobile, en 1987. De 1988 à 1990, il fut président du conseil d'administration et directeur général de BCE Mobile, aujourd'hui l'une des plus grandes entreprises de communications mobiles du Canada. En novembre 1991, M. Sirois démissionna du conseil d'administration de BCE Mobile Inc. Il est actuellement un directeur des sociétés suivantes : Radiomutuel Inc., le Groupe SNC-Lavallin Inc., le Groupe DMR Inc., la Société québécoise de développement de la main-d'oeuvre, l'École nationale de l'humour. En outre, il est membre du Comité consultatif sur l'autoroute de l'information.

Session 1

PERSONAL COMMUNICATIONS
COMMUNICATIONS PERSONNELLES

David S. Gergacz

President and Chief Executive Officer
Rogers Cantel Mobile Communications Inc.
10 York Mills Road
Toronto, Ontario, M2P 2C9

BIOGRAPHY

David Gergacz was appointed President and Chief Executive Officer of Rogers Cantel Mobile Communications Inc. (RCMCI) in April 1993. He was also elected a member of the board of directors of RCMCI.

Mr. Gergacz came to Cantel from Boston Technology Inc. of Wakefield, Massachusetts, where he was President and Chief Executive Officer. Boston Technology Inc. is a Manufacturer of advanced hardware for the telecommunications industry worldwide. Between 1984 and 1990 Mr Gergacz held a number of positions with U.S. Sprint, latterly as President and Chief Operating Officer of the Network Systems Division. Prior to this he held management positions with AT&T, Bell Labs and NYNEX.

Mr. Gergacz graduated from Purdue University, Lafayette, Indiana with a Bachelor of Science Degree in Engineering and Economics (Magne Cum Laude, Phi Beta Kappa) in 1971.

BIOGRAPHIE

M. David Gergacz a été nommé président-directeur général de Rogers Cantel Mobile Communications Inc. (RCMCI) en avril 1993. Il a aussi été élu membre du conseil d'administration de RCMCI.

M. Gergacz est arrivé chez Cantel en provenance de Boston Technology Inc., de Wakefield (Massachusetts) où il était président-directeur général. Boston Technology Inc. fabrique du matériel de pointe destiné à l'industrie mondiale des télécommunications. De 1984 à 1990, M. Gergacz a occupé un certain nombre de postes chez U.S. Sprint, finalement à titre de président et chef des opérations de la division des systèmes de réseaux. Auparavant, il a occupé des postes de gestion chez AT&T, Bell Labs et NYNEX.

M. Gergacz a obtenu un baccalauréat en génie et en économie avec mention honorable (Phi, Beta, Kappa) de l'Université Purdue, à Lafayette (Indiana), en 1971.

To ensure up-to-the-minute coverage of his topic, Mr. Gergacz will provide copies of his paper at the time of his presentation.

David S. Gergacz
Chief Executive Officer

CANTEL®

Working for people on the move™

North America's Only National Wireless Company

The Future Of Personal Communications Services In Canada

CANTEL

The Future Will Be Determined By The Market

CANTEL

The Customer Is Always Right, And They Are Indifferent To Technology

CANTEL

Customers View PCS As A Product, Not A Technology

CANTEL

What is PCS?

Mobile Access Wireless	A platform of Enabling Technologies	Fixed Access Landline
Cellular - Voice - Data SMR PCS Satellite	The Network An Electronic Route to Connect Users & Resources	Telephony CATV Satellite

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Wireless Access

Anywhere,
Anytime Connectivity

You're Always Connected

CANTEL

Wireless Capabilities

Imaging

Voice

Data

"The Utility is Obvious"

Video

Messaging

CANTEL

What Do Customers Want?

- Reliable Services
- Broad Coverage
- Ease of Use
- Useful Features
- Attractive Pricing
- Easy To Purchase

CANTEL

A Market Test For PCS

- Affordable
- Accessible
- Low monthly fee for Safety
- Flat fee for weekends and evenings

CANTEL

The Virtual Office

Anytime, Anywhere,
Access to Your Business

- *Wireless*
- *Data Access*
- *Wireless LAN Access to all office applications*

CANTEL

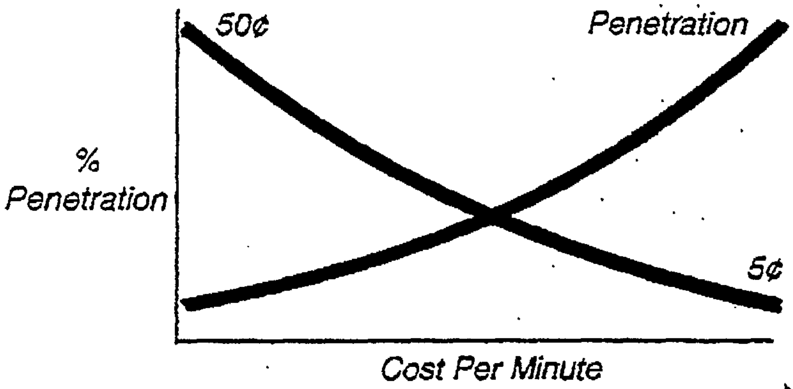
Applications Compete for Market Dollars and Succeed if They Provide:

Business & Personal

- *Value*
- *Functionality*
- *Entertainment*
- *Ease of use*

CANTEL

We Must Change The Value Proposition



CANTEL

Navigation and Location

- A virtual roadmap to anywhere

CANTEL

Entertainment

- *Access to games*
- *Leisure information*
- *Sports*
- *Even in the air (Air to Ground)*

CANTEL

PCS is a Business Opportunity

CANTEL

...It Will Be Driven by Competition

CANTEL

Enabling Technologies Risk Commodity Status

CANTEL

The Best Developers and Merchandisers of Applications Will Succeed!!

CANTEL

NEW MEDIA
NOUVEAUX MÉDIAS

Michael McCabe

President and CEO
Canadian Association of Broadcasters
P.O. Box 627, Station B
Ottawa, Ontario, K1P 5S2

BIOGRAPHY

Mr. McCabe left his own successful communications consulting firm in 1988 to become President and Chief Executive Officer of the Canadian Association of Broadcasters, the national trade association representing most of Canada's private radio and television stations.

Under his leadership the CAB launched new strategic directions which won the industry high respect, wide recognition and many major gains. Achievements range from significantly reduced radio regulations and a major licence fee decrease for most radio stations, to respected world leadership in Digital Radio. Mr. McCabe is also working hard to advance television broadcasters' rights and gain recognition for their vital role as the key program suppliers, on and off the information highway. The CAB recently earned high marks and international coverage for its tough new TV Violence Code and related nationwide Public Service Announcements and community action plan.

Prior to setting up his own company in 1981, Mr. McCabe held several senior positions with the federal government and crown corporations. These included terms as Executive Director of the Canadian Film Development Corporation (now Telefilm Canada), Assistant Deputy Minister for Consumer and Corporate Affairs and Chairman of Policy and Research, Canada Mortgage and Housing Corporation. He graduated form the University of Toronto in 1959 with an Honours degree in Philosophy and English.

BIOGRAPHIE

En 1988, M. McCabe quitte sa propre société d'experts-conseil, alors florissante, pour devenir président-directeur général de l'Association canadienne des radiodiffuseurs (ACR), l'association professionnelle nationale qui représente la plupart des stations privées de radio et de télévision du Canada.

Sous sa direction, l'ACR établit de nouvelles orientations stratégiques qui vaudront à l'industrie un grand respect, une vaste reconnaissance et de nombreux gains importants. Ses réalisations comprennent, par exemple, un assouplissement notable de la réglementation de la radio, une importante diminution des droits de licence pour la plupart des stations radio ainsi qu'une position mondialement reconnue de chef de file en radiodiffusion audionumérique. M. McCabe travaille également beaucoup pour faire progresser les droits des télédiffuseurs et faire reconnaître leur rôle crucial en tant que principaux fournisseurs d'émissions, entre autres sur l'autoroute de l'information. L'ACR s'est récemment distinguée et a éveillé l'attention internationale avec son code rigoureux contre la violence à la télévision, accompagné de messages d'intérêt public et d'un plan d'action communautaire.

Avant d'établir sa propre société en 1981, M. McCabe occupe plusieurs postes dans l'administration fédérale et les sociétés d'État : directeur exécutif de la Société de développement de l'industrie cinématographique canadienne (aujourd'hui Téléfilm Canada), sous-ministre adjoint à Consommation et Affaires commerciales et président de la Politique et de la Recherche à la Société canadienne d'hypothèques et de logement. En 1959, il obtient un baccalauréat spécialisé en philosophie et en anglais à l'Université de Toronto.

ABSTRACT

Both radio and television broadcasters are converting to digital technology, partly to meet the anticipated increased future demand for personalized information and entertainment services. These same demands are pushing them beyond broadcasting to "nichecasting" and, eventually, interactive "profilecasting". In this context, broadcasters see an ongoing requirement for off-air spectrum in order to reach mobile/portable audiences and uncabled areas. The broadcast technical infrastructure is ideal for the delivery of real-time one-way data to large numbers of potential receiving locations, particularly those that are portable or mobile. Point to multi-point data capability can be added at little cost to future consumer-level TV and radio receivers.

RÉSUMÉ

Les entreprises de radiodiffusion et de télévision se convertissent à la technologie numérique, en partie en prévision de la demande accrue de services personnalisés dans les domaines de l'information et du spectacle. Ces mêmes exigences les poussent au-delà de la radiodiffusion vers la «diffusion par créneaux» et, éventuellement, la «diffusion adaptée» interactive. Dans ce contexte, les radiodiffuseurs voient un besoin constant de fréquences de radiodiffusion si l'on veut atteindre les utilisateurs de matériel mobile/portatif et les secteurs non desservis par les câblodistributeurs. L'infrastructure technique de radiodiffusion est idéale pour fournir des données unidirectionnelles en temps réel à de nombreux sites récepteurs éventuels, particulièrement ceux qui sont portatifs ou mobiles. La capacité de transmission de données point-multipoint peut être ajoutée à un coût minime pour le consommateur aux futurs récepteurs radiophoniques et récepteurs de télévision.

To ensure up-to-the-minute coverage of his topic, Mr. McCabe will provide copies of his paper at the time of his presentation.

SPECTRUM 20/20 1994
DECEMBER 7, 1994, OTTAWA, ONTARIO
NOTES FOR A PRESENTATION BY MICHAEL McCABE
ON
"NEW MEDIA"

1. INTRODUCTION

* In this presentation, I intend to provide some insight into the various forms of so-called "New Media" services that Canadian private broadcasters anticipate will develop in the coming years.

* As the term "New Media" covers a very wide area, I will confine my comments to those media forms that fit within the general theme of this Conference. That is, those which are likely to be ***"Breaking Loose"*** from the confined distribution of wire, cable, or fibre systems and seeking the comparative freedom of wireless distribution.

* Finally, I will describe for you the plans that traditional broadcasters are making to achieve substantial improvements in their existing over-the-air services, and to introduce new ones.

2. WIRELESS SERVICES: EVERYTHING OLD IS NEW AGAIN

* Broadcasters have always been masters of wireless distribution. It is their particular forte and they do it extremely well. We see the over-the-air capabilities of broadcasting as a definite plus in the era of the "Information Highway" and intend to build on the strengths that this delivery technology already has developed.

* In the 1970's and 1980's, TV viewers appeared willing to trade away some of the flexibility of wireless broadcasting in return for an increase in the sheer number of services provided by wired connections, especially cable. Radio listeners, of course, have never wanted anything but the extreme portability that wireless technology offers.

* But the public seems to be developing a new-found attraction to wireless telecommunication services of all types. From burglar alarms and garage door openers to wireless home video distribution systems and satellite dishes, people want the flexibility and mobility that radio-based services can provide. This is a reflection of our increasingly mobile societies in the developed countries.

* Moreover, new technologies are making it more possible now to have the best of both worlds: higher capacity <u>and</u> wireless flexibility can be achieved through the use of digital technologies and new, much higher frequency bands.

* I suggest that what this really means is that the old ***"Wired World"*** concept of

the 1970's is dead. Almost everyone now realizes that the public demand for telecommunication services cannot possibly be fully met via wires, cables, or even optical fibres. Terrestrial and satellite radio transmitters are required as well, in order to provide a complete range of services to the public wherever they move, inside their homes and out. **Mobility** and **Ubiquity** are the keywords for future telecommunication services.

* But growth in wireless services will place increased demands on the radio spectrum.

  - All users will have to ensure that the communications capacity of their systems is used efficiently and this will inevitably require all users to "go digital".

* Broadcasters will be part of the "digital evolution" and have already created extensive plans to allow this to happen.

3. BROADCASTERS ALREADY EXCEL IN WIRELESS SIGNAL DELIVERY

* Many telecommunications providers are only now catering to the growing demand for mobility and ubiquity in telecom services.

* But the ability to reach people wherever they may be has always been the very essence of broadcasters' services.

  - Off-air TV & radio is available at no direct cost to 99.8% of the population.

  - Even though 95% of the population could have access to TV via cable, 7.8M Canadians (27%) receive signals only via off-air transmitters.

  - Hourly personal use of broadcast spectrum by the public is far larger than their use of all other radio-communication services put together. The average Canadian uses TV 23 hrs/wk and radio 22 hrs/wk.

* Broadcasters are now developing plans to convert from analog to digital radio/TV delivery systems.

  - These new services will have very high reception quality and reliability.

  - Spectrum will be used very efficiently.

4. ON-DEMAND PROGRAMMING WILL NOT ECLIPSE CONVENTIONAL TV/RADIO

* Some media gurus believe that conventional broadcasting will disappear, to be replaced by "on-demand" services. Broadcasters do not share this view.

  - Even though 80% of homes have VCRs, tape viewing account for only 5% of TV viewing hours. Fully 95% of viewing time is spent watching conventional stations in real time.

- Broadcasters anticipate that Video-on-Demand (VOD) services will only account for 10-15% of viewing hours in the next 10 years. Event programming such as news, sports, and scheduled popular entertainment, will continue to predominate.

* The key changes that will take place in the system could involve an increase in interactivity between viewers and the broadcast programmers, as well as greater effort by broadcasters to charge directly for any service improvements.

* Given these conclusions, broadcasters have totally rejected any thought that over-the-air distribution of information and entertainment programming, especially television, could be discontinued in the future and replaced solely by wired connections. Nor will this situation change when current analog TV and radio facilities are replaced by digital technology.

5. BROADCASTING IS A LOGICAL LINK IN THE "INFORMATION HIGHWAY"

* In the face of these realities, CAB's members believe that over-the-air broadcasting cannot and should not be replaced by an "Information Highway" that is solely of the "wired" variety.

* It is certain that the Highway that many are anticipating cannot possibly be achieved without an extensive wireless component.

* In the broadcasters' view, a much more logical option is to use the wired component of the future Highway as a <u>complementary</u> means of delivering broadcast programming, along of course with a whole host of other services.

* On the other hand, development of the Information Highway will create new demands for point-to-multipoint signal delivery of digital signals of all types over large geographic areas. The broadcasting distribution infrastructure is ideal for this purpose because:

  - It exists virtually everywhere in Canada.

  - It accommodates local, regional, or national signal routing.

  - It uses wireless technology that can easily serve portable and mobile receivers.

* New digital broadcast TV/Radio receivers will be capable of serving as simple, inexpensive terminals for the Information Highway for many types of users.

* Consumer-level digital broadcast receivers will be capable of providing a multiplicity of broadcast and non-broadcast data functions, eliminating the need for the public to purchase separate receivers for each job. Receivers are expected to be:

  - inexpensive and individually addressable.

- capable of accommodating considerable auxiliary data in addition to standard broadcast programming.

- devices that are relatively simple-to-operate, and with which the public will feel comfortable.

* Considerable interactivity will be possible between the user and the receiver:

  - For example receivers will be capable of capturing more data than would normally be displayed: users will be able to ask the receiver for "more info" when required.

* Where full interactivity with the source is required, broadcasters will form partnerships or move to new technologies. For example,

  - fixed and cell-phone facilities can be used to place orders for data that is then delivered via digital over-the-air broadcast transmitters to any location, even to moving vehicles.

  - New off-air multi-channel TV distribution systems such as CellularVision may also provide return link capabilities.

6. BROADCASTERS ARE NATURAL PROGRAMMING SOURCES FOR NEW DIGITAL MEDIA SYSTEMS

* Broadcasters are skilled at creating appealing programs and marketing them to the public.

  - 60% of content on Canadian TV is Canadian

  - 65% of all viewing is to Canadian stations

  - 30% of all music content on radio is Canadian; the vast majority of all other content is Canadian.

  - 95% of all radio listening is to Canadian stations.

* Regulators will include national cultural and sovereignty considerations in the new "Information Highway" rules: Broadcasters already pass all the tests.

  - The Broadcast System is already overwhelmingly Canadian.

  - Broadcasters are accustomed to dealing with cultural requirements and have adapted to them.

  - Broadcasters are already spending the majority of their programming dollars (65%) on Canadian programming.

7. BROADCASTERS ARE NOW PLANNING WHAT THEY WILL CONTRIBUTE AS "NEW MEDIA" PLAYERS

IN TELEVISION

* Broadcasters intend to strongly promote our planned new off-air digital delivery infrastructure as a logical means of achieving:

  - continuing free access by the public to local, regional, and national TV programming of high calibre;

  - distribution of multiple video/audio programs within the same channel, using advanced video compression techniques.

  - reliable wireless communication to homes and businesses, using both fixed and portable receivers, for broadcast and non-broadcast data.

* These new services will be delivered by digital transmitters operating:

  - In the current VHF/UHF TV bands, using channels that cannot be used for analog TV or by any other services at present;

    or in microwave spectrum (above 25 GHz);

    or in the satellite bands used for TV delivery.

* Broadcasters will be seeking markets for auxiliary data capacity on digital broadcast systems for new revenue-producing purposes. Examples include:

  - **Program-related services for TV:**

    o multiple-programs;

    o limited interactivity;

    o enhanced captioning;

    o second-language audio;

    o "Tell-Me-More" advertising features;

    o Product Coupon delivery;

    o hard-copy news delivery

  - **Quasi-broadcast services:**

    o emergency alerts;

    o weather data;

o government service announcements

- **High-speed, high-volume data delivery**, of non-broadcast material, especially to vehicular/portable receivers:

  o Stock-market reports;

  o Electronic Data Processing (EDP) data.

IN RADIO

* Broadcasters are aggressively planning for a complete overhaul of the present analog AM/FM radio system and its replacement by new wideband digital services over a period of 10-15 years.

* The new system will bring:

  - continued free access by the public to all existing radio programming;

  - Technical quality equivalent to that of compact discs.

  - a robust delivery system that is designed specifically to meet the demands of mobile reception.

  - radio services in a new band (1452-1492 MHz), not now used for broadcasting services.

* The new digital radio delivery system will allow new service concepts to be developed, including:

  - **Program-related services for Radio:**

    o "Tell-Me-More" advertising features;

    o second monophonic audio program;

    o artist information data (music);

    o new audience-response contests;

    o Product Coupon delivery;

    o Pay-radio concerts.

  - **Quasi-broadcast services:**

    o Highway traffic data;

    o public transportation schedules;

    o emergency alerts;

o weather data:

o government service announcements.

- **High-speed, highly-reliable, data delivery** of non-broadcast material, especially to vehicular/portable receivers:

o Paging;

o satellite geo-positioning auxiliary data.

* Broadcasters have been encouraged by the federal government to include auxiliary services as part of their digital radio plans:

- Ref: Address by the Hon Michel Dupuy to the Second International Symposium on Digital Audio Broadcasting (Toronto 15 March 94): "I recognize that digital radio brings some auxiliary capacity from which all broadcasters could benefit. This is good news to the industry".

* As an example of the new service areas that are being developed, broadcasters are already working with the Ontario Ministry of Transportation to test the use of digital radio transmitters as a means of delivering reliable data on traffic and public transportation schedules.

- digital radio can provide the high-volume data capacity that transportation officials need for "Intelligent Vehicle Highway Systems". The public would not need a separate receiver for this data - the DRB broadcast receiver would do everything.

- demonstrations are planned in Toronto in Feb 95, at the Auto Show.

8. CONCLUSIONS

* Broadcasters will do what is necessary to ensure that they are key players in both the "New Media" (software) and the "Information Highway" (Distribution), as these develop in the coming years.

* Due to the architecture of their distribution plant, broadcasters are uniquely situated to provide delivery of digital data in all its forms over large areas.

* The robust digital technologies being developed will allow reliable services to be provided to portable and mobile receivers, as well as to fixed locations.

* New digital broadcasting systems will be highly spectrum-efficient and reliable and capable of carrying more than just traditional programming.

* Broadcasters have the programming expertise to meet the demands created by any new services that may be delivered by new digital technologies.

* Including the broadcast element as an integral part of this new delivery architecture will ensure that Canadians continue to have access to a wide variety of free basic services as well as to cost-effective optional services.

* Broadcasters look forward to participating in both the regulatory and technical planning that will allow this all to happen.

ooOOOoo

WIRELESS SYSTEMS
COMMUNICATIONS SANS FIL

Robert A. Ferchat

Chairman, President and Chief Executive Officer
BCE Mobile Inc.
20 Carlson Court, Suite 900
Etobicoke, Ontario, M9W 6V4

BIOGRAPHY

Mr. Ferchat was appointed to the positions of Chairman, President and Chief Executive Officer of BCE Mobile Inc. in November 1994, bringing with him over three decades of senior management experience in leading corporations. He previously served as Chairman of Telesat Mobile Inc., now TMI Communications.

Prior to that appointment he held a number of senior positions in Northern Telecom Limited, including Vice President Controller, Executive Vice President and Chief Financial Officer, President of Northern Telecom International, and President of Northern Telecom Canada. The early years of his career were spent at Ford Motor Company of Canada, where he served in a number of managerial roles. Mr. Ferchat is very active in the business community serving on the boards of directors of a number of major Canadian and international corporations.

To ensure up-to-the-minute coverage of his topic, Mr. Ferchat will provide copies of his paper at the time of his presentation.

NOTES

Working Backwards, Moving Forward

Robert A. Ferchat
Chairman, President and CEO
BCE Mobile
Spectrum 20/20 Conference
Ottawa, Ontario

December 7-8, 1994

One of the great advantages of having been in the telecommunications business for a few years like I have, is that you acquire a perspective on the industry that's rooted in history and occasionally, like today, have an opportunity to share it.

In so doing I'll be mindful of what Marshall McLuhan once said about time and speaking: "Time is not the same for the speaker as for the audience. To the speaker, it is all too brief for what he has to say. For the audience, it is the grim foretaste of eternity."

Well, not today.

Tomorrow my colleague Joe Sarnecki will be speaking about the shape of the networks of the future.

Without preempting Joe, I think that the metaphor of building is especially appropriate for those of us who make up Canada's wireless industry, particularly as we stand on the threshold of yet another technological revolution that will again change how Canadians communicate.

...and by working backwards from this ideal, how we can make the necessary decisions today that will let us design and build what our imagination now sees with startling clarity.

So working backwards will let us move forward. That's the key point I want to leave with you.

How do you see the future?

While you don't ignore the past, you don't necessarily look to it for inspiration either.

Instead you realize that the past is the first step into the future.

Despite all of the advances in technology, communications isn't necessarily getting any easier.

And what numbers do you have?

- An office number.
- A fax number.
- Your direct office line.
- A home number.
- A second home number.
- A cellular number—I hope.
- Maybe a pager.
- Perhaps a home fax number.

If you work in two cities, then you can add another number or two to that list.

You know the story. The day after you uncrate your newest desktop wonder the price drops by 25%, and two weeks later it's replaced by another one that's faster, smaller and cheaper.

Feel abandoned?

That's what we're hearing from customers.

Improve all you like but make sure you don't strand us by the wayside as you zoom along the information highway.

So as we think about designing the telecommunications services of tomorrow, we can't forget the customers who support our industry today. We can't declare open season on early adopters in the name of some kind of higher good.

I know because I've got 750,000 wireless customers to worry about. Every one of them deserves no less from Bell Mobility than to know their investment in wireless will continue to pay dividends in terms of productivity, convenience and security for a long time to come.

And my colleagues in Mobility Canada have the same concerns, even though today they've announced an outstanding achievement.

If you haven't heard, Mobility Canada today announced that its member companies have become the first cellular network in Canada to sign up one million customers.

One million. That's the size of some provinces. Think about the obligation that creates to ensure that those one million Canadians have a wireless future they can count on.

The message is coming through loud and clear: no limits.

To sum up, we're hearing consistently three messages from customers: fewer numbers, no orphan technologies, and easier, seamless communications.

That's the blueprint they're sketching for the communications world of tomorrow.

It's a blueprint that describes pretty well a new telecommunications service concept called PCS.

That stands for personal communications services, or, putting my own spin on it and changing the acronym to mean personally convenient services or personally customizable services.

And while I'm no expert on PCS, I do know that it represents what the philosopher of science Thomas Kuhn called a paradigm shift, a massive recalibration of belief, expectation and possibilities, brought about by an underlying change in the way the world works.

PCS has the potential to change communications because it will provide its customers with less and more at the same time.

Less in that you'll only need one device and one number to conduct all your business and personal communications.

More because you'll be calling people, not locations.

Quite a dream home...with room inside for everyone.

So working backwards, how can we get to PCS?

Let me first make a couple of points that I'd like you to consider as you think about building the services of tomorrow. Consider these a small paradigm shift in how we think about telecommunications in Canada.

First, let's agree that the purpose of technology is to make people's lives easier, simpler, and better.

This isn't a hard proposition to accept if you think of the converse: we wouldn't get far if we set out to use technology to make our customers' lives harder, more complex, and worse.

Technology must have at its core a customer service concept, which means that decisions about licensing and industry structure have to be viewed through a different lens.

Licenses to provide PCS are as much about providing service as they are about using spectrum.

While spectrum is scarce, so too is service.

And unlike spectrum, service isn't ambient in the environment, waiting to be purposefully harnessed.

As technologies evolve, we also must accept the obligation to our customers to support the evolution of their ambitions, by providing a migration path to higher and higher levels of mobility, of functionality, and of service as their needs change and grow.

The choices we face are quite clear: whether we continue to do as we've done in the past and approach the market on a technology-by-technology basis or whether we can do better...

...you know the direction I'll take. Design for the future. Build a service that will serve Canadians for decades.

In approaching this task, I strongly believe we must adhere to some fundamental strategies for success.

By that I mean we need to:

- design for the future, linking the development of PCS to the goals we share with customers;
- make access the cornerstone of our distribution philosophy, access for all the diverse markets we serve;
- preserve our ability to design and build a system that's right for Canada and for the needs of Canadians;
- make things simpler and more convenient for customers, understanding their natural desire to grow with their service and to be constantly delighted by what they can do with it;

NETWORKS
MAILLAGE EN RESEAUX

W. Brian Hewat

President, Bell-Northern Research
P. O. Box 3511, Station C
Ottawa, K1Y 4H7

BIOGRAPHY

W.B. (Brian) Hewat is Chairman and Chief Executive Officer of Bell-Northern Research Ltd., one of the world's leading telecommunications R&D organizations. The company's approximately 10,000 employees are located in BNR's global network of labs in Canada, the United States, the United Kingdom, and the Asia/Pacific region.

Born in Noranda, Quebec, Mr. Hewat was educated in Moncton, New Brunswick, and London, Ontario. He attended the University of Western Ontario in London and graduated with a Bachelor of Engineering Science degree in 1959.

Mr. Hewat's career spans more than three decades in the telecommunications industry, including 13 years as EVP Marketing and Technology for Bell Canada, followed by the position of President and Chief Executive Officer of Stentor Resource Centre, Inc., an alliance of Canada's nine major telecommunications operating companies.

He is a Director of Bell-Northern Research Inc., BNR Ltd., and BCE Telecom (International). He is also past chairman of Bell Mobility, the Conference Board of Canada Council of Marketing Executives, and the Ottawa Liaison Committee of the Canadian Chamber of Commerce. In addition, he is a member of the Business Advisory Board of the Center for Canadian-U.S. Business Studies at Clarkson University in Potsdam, New York, and a member of the University of Western Ontario Engineering & Science Advisory Council.

BIOGRAPHIE

M. W.B. (Brian) Hewat est président-directeur général des Recherches Bell-Northern Ltée, une des plus importantes sociétés de R-D en télécommunications au monde. La société compte environ 10 000 employés disséminés dans les laboratoires du réseau mondial de BNR, au Canada, aux États-Unis, au Royaume-Uni et dans la région Asie/Pacifique.

Né à Noranda (Québec), M. Hewat a fait ses études à Moncton (Nouveau-Brunswick) et London (Ontario). Il a obtenu un baccalauréat en génie de l'Université de Western Ontario à London, en 1959.

La carrière de M. Hewat s'étend sur plus de trois décennies dans le secteur des télécommunications, dont trois comme vice-président exécutif, Commercialisation et technologie chez Bell Canada, suivies d'un poste de président-directeur général du Centre de ressources Stentor, Inc., alliance des neuf sociétés de télécommunications les plus importantes au Canada.

Il est administrateur des Recherches Bell-Northern Inc., de BNR Ltée et de BCE Telecom (International). Il est aussi ancien président de Bell Mobilité, du Conference Board du Canada, du Council of Marketing Executives et du Comité de liaison de la Chambre de commerce du Canada à Ottawa. En outre, il est membre du Business Advisory Board du Center for Canadian-U.S. Business Studies, à l'Université Clarkson de Potsdam (New York) et du conseil consultatif de génie et de sciences de l'Université de Western Ontario.

ABSTRACT

Personal communications services (PCS), as defined by Mr. Hewat, are a suite of services that make it possible for the network to "follow" users no matter where in the world they are located and regardless of the type of device they are using. PCS, in other words, combines the benefits of both wireless and wireline networks. In his presentation, Mr. Hewat looks at the business drivers that are encouraging new entrants into this market, as well as looks at the business, economic, regulatory, and behavioural issues of integrating wireless and wireline technologies and services.

RÉSUMÉ

Les services de communications personnels (SCP), tels que définis par M. Hewat, constituent une suite de services qui permettent à l'utilisateur de rester «branché» sur le réseau, peu importe où il se trouve sur la planète et quel que soit le type d'appareil qu'il utilise. Autrement dit, les SCP joignent les avantages des réseaux sans fil et avec fil. Dans sa présentation, M. Hewat examine les motivations commerciales qui attirent de nouveaux intervenants dans ce marché et il traite aussi de questions commerciales, économiques, réglementaires et sociales reliées à l'intégration des services et des technologies avec ou sans fil.

To ensure up-to-the-minute coverage of his topic, Mr. Hewat will provide copies of his paper at the time of his presentation.

Without a doubt, PCS is being driven by wireless technology. But PCS will go far beyond what wireless technology provides, in terms of both service functionality and market appeal.

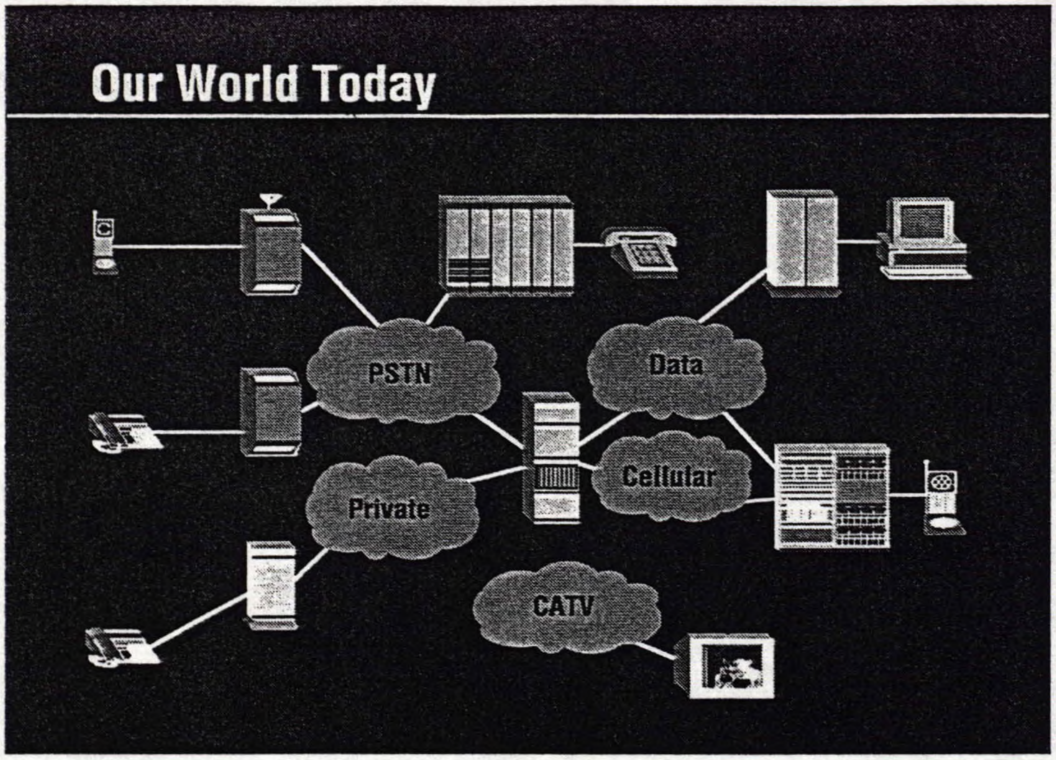
Today, we have a suite of wireless, wireline, and video technologies. If we think about them in those terms, we can blend them. If they're all kept separate and apart because of government, and they're run by different entrepreneurs with different agendas, then we cannot bring them together with any elegance.

The result will be a multiplicity of terminals that are service dependent, and a multiplicity of ways of enabling or calling up similar services, with pricing models that provide little incentive to use services across all of the domains in which a customer finds him or herself — the car, the home, the bus, the airport, etc.

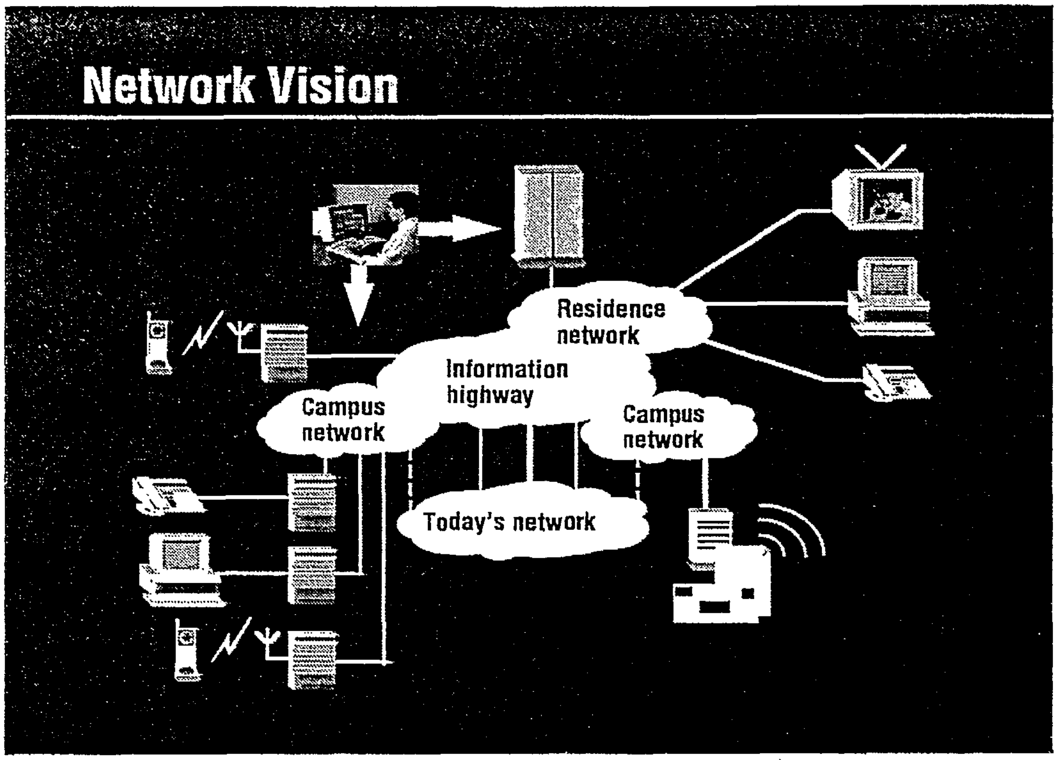
Is it appropriate to have wireless now linked to what we previously characterized as landline components? The answer is "yes." New business opportunities are possible through the amalgamation of the various technologies.

Agenda

- Network Evolution
- PCS Network Evolution
- Evolution of Personal Communications Services
- Trial Example
- Key User Values
- Product Concepts



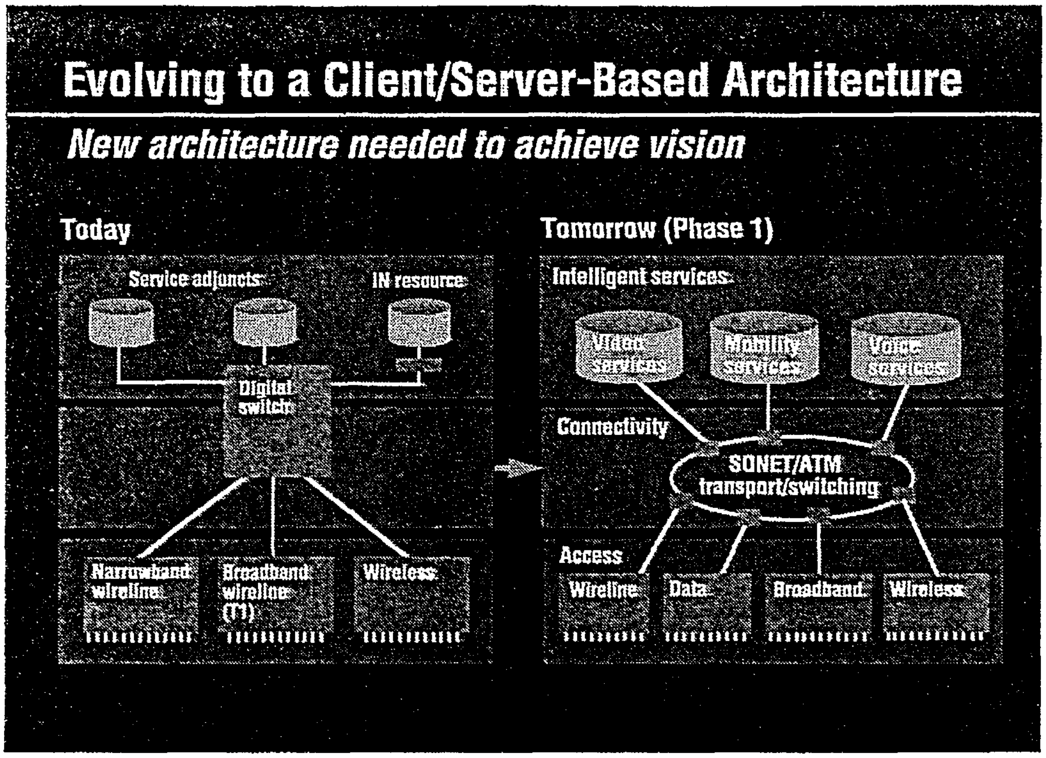
Today, an assortment of networks exists — the public switched telephone network, data networks, cellular networks, private corporate networks, leased networks, and cable television networks, among others. These networks typically do not interconnect very efficiently or elegantly, and in some cases — cable TV, for example — they don't interconnect at all.



We're heading toward a continuous network, where the boundaries between networks will essentially become seamless — a "network of networks." The network itself will be a carry-anything, carry-anywhere structure that will spread to campuses, to businesses, to residences, etc. Everything will be carried from one point to another at very high speed.

In this new network, the intelligence will be pushed to the periphery of the network.

The type of products around the network fit into two categories:
(1) products that give access to the network; and
(2) products that give services.



Achieving a "network of networks" will require a totally new network architecture, the evolution of which will begin with today's public network — the largest, most sophisticated, and most useful machine ever built.

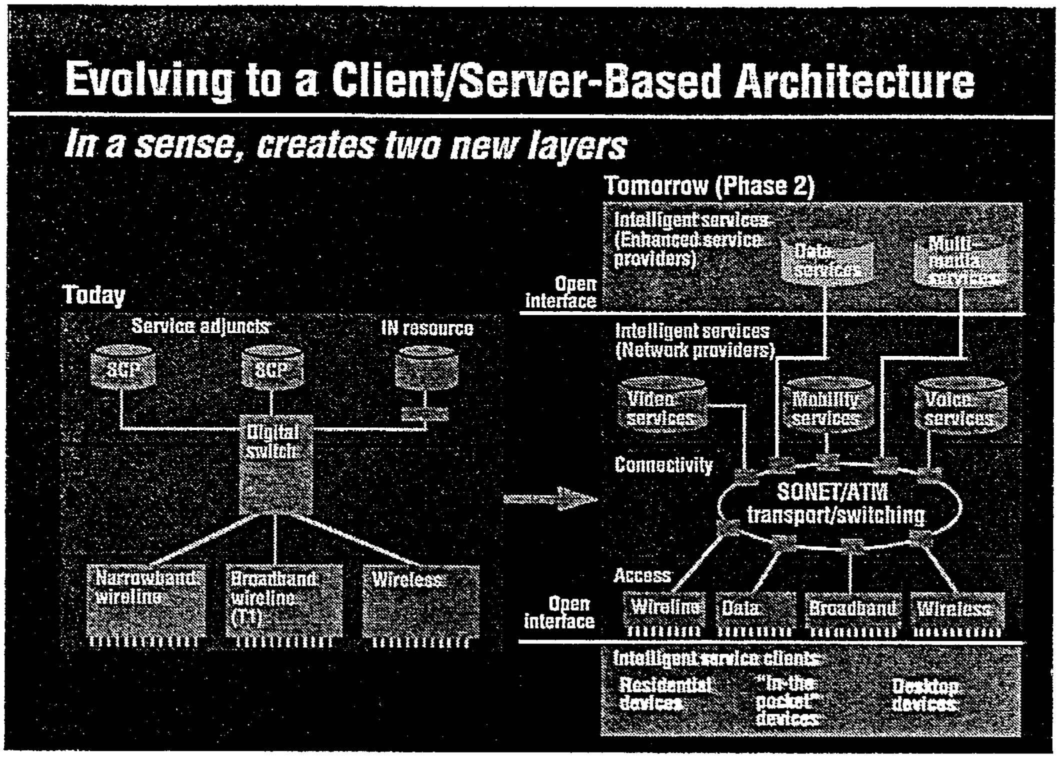
The switch has historically been placed in control of the conventional network — directing traffic and implementing services — because transmission capacity, until recently, has been an expensive resource; the role of the switch has been to conserve or allocate transmission.

But, today, transmission is no longer expensive. With the incredible advances being made in optical fiber and optoelectronics, the cost of basic transport has declined at an exponential rate, to the point where bits are essentially free.

As a result, the digital switch — which will continue to play a crucial network role — will be re-positioned in a ubiquitous transmission network as a voice server, protecting the value of the service provider's investment. The transport network will evolve into a high-speed, high-capacity transmission and routing network that will form a common highway for all services — voice (wireline and wireless), video, and data.

This new network structure mirrors the client/server architecture of the computing industry. In the computing industry, it was triggered by low-cost computers and memory. In the telecommunications network, the trigger is low-cost bits per kilometer.

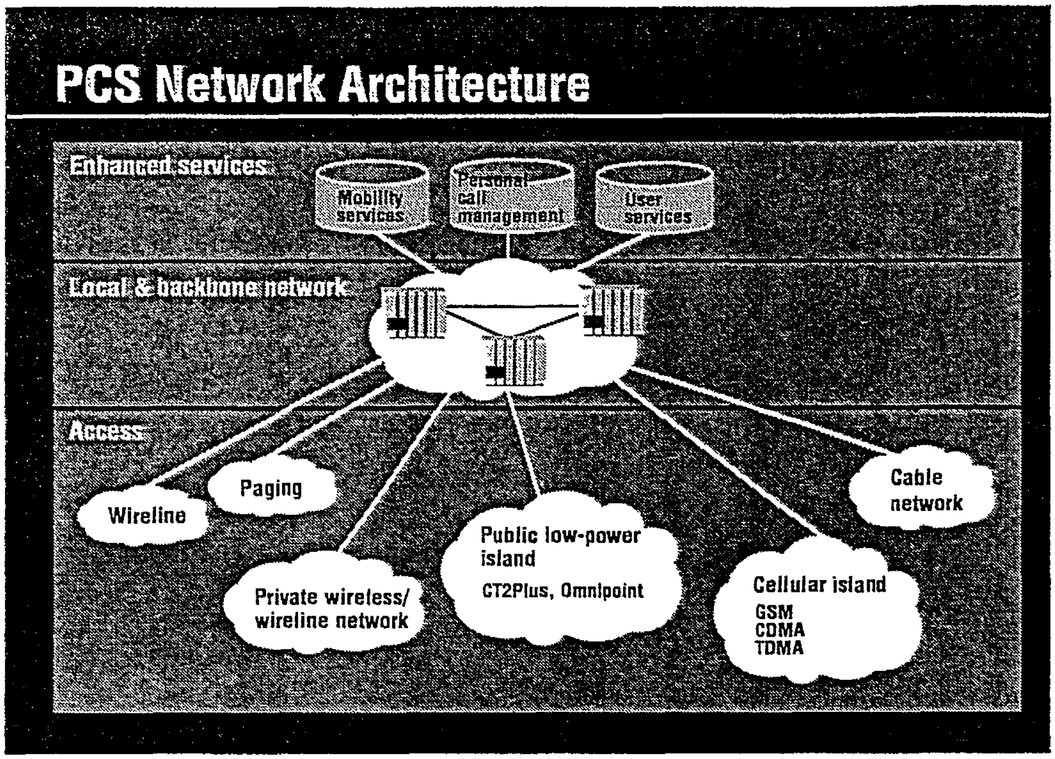
In both cases, the architecture offers many advantages. It simplifies the engineering and the operations of the network, and makes it possible to deploy services much faster.



This new architecture, in a sense, also creates two new layers:

(1) an additional **intelligent services layer**, which allows players other than the traditional telco to connect to the network and provide services; and

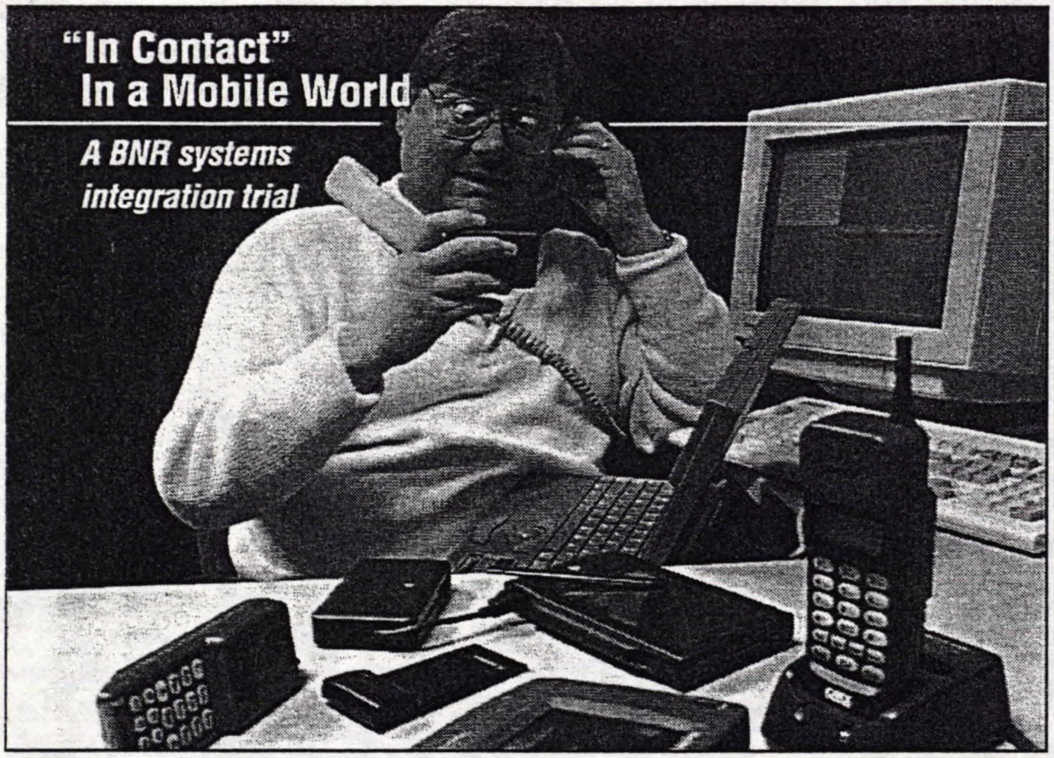
(2) the **intelligent client layer**, which supports such "clients" as personal digital assistants, workstations, PCs, personal communications devices, and television set-tops.



To realize PCS today, various servers can be overlaid on today's public network and can then be re-used as the network evolves into the client/server-based architecture shown on previous charts. The server functionality can be imbedded in separate servers or, in the case of Northern Telecom's Mobility Control Point (MCP), designed by BNR, reside in a single server.

The ability to connect the various communications islands together will create new businesses. In fact, the permutations and combinations of possible services are mind-boggling.

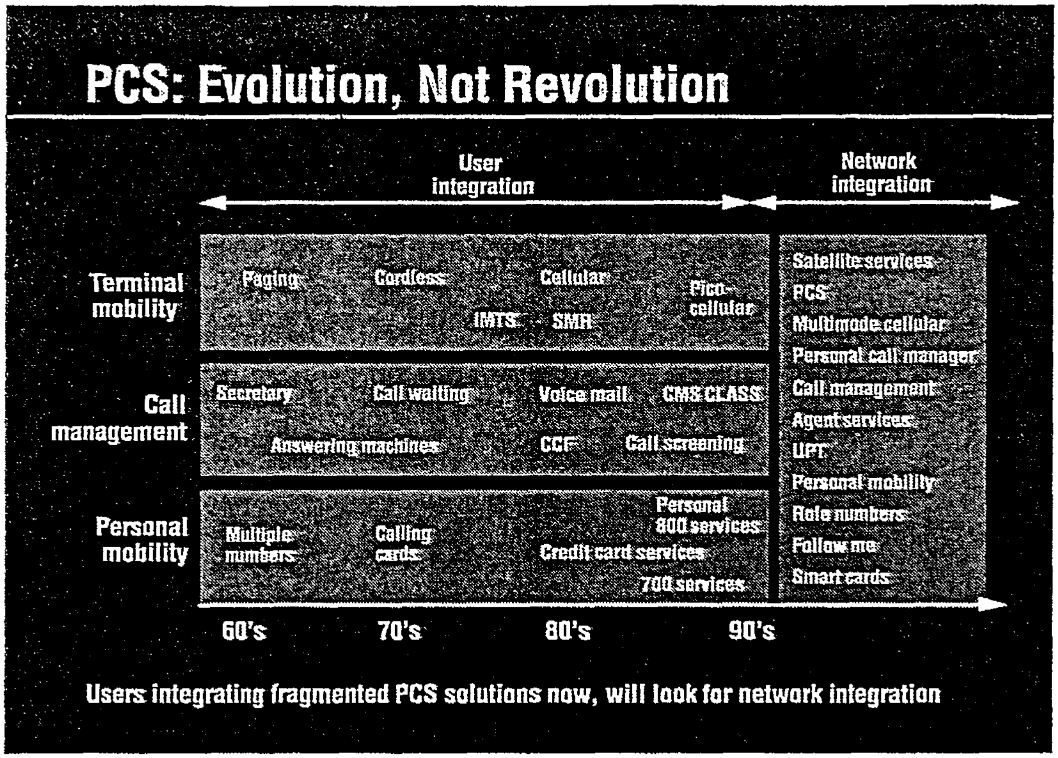
To benefit the end user, it is essential that regulations encourage cooperation between the various industries.



BNR is conducting an advanced project that is looking at the end-user value of being able to pull together some of the separate networks. The project, called "In Contact," is implementing the architecture and trialing the techniques for keeping "in contact" in a mobile world.

For example, it's looking at the benefits of, and the technologies required to, connect a voice mail service, with an electronic mail service, with a cellular service, with a paging service, with a fax service, etc. to give value to the end user.

This slide also highlights the number of devices that people today use to keep "in contact."

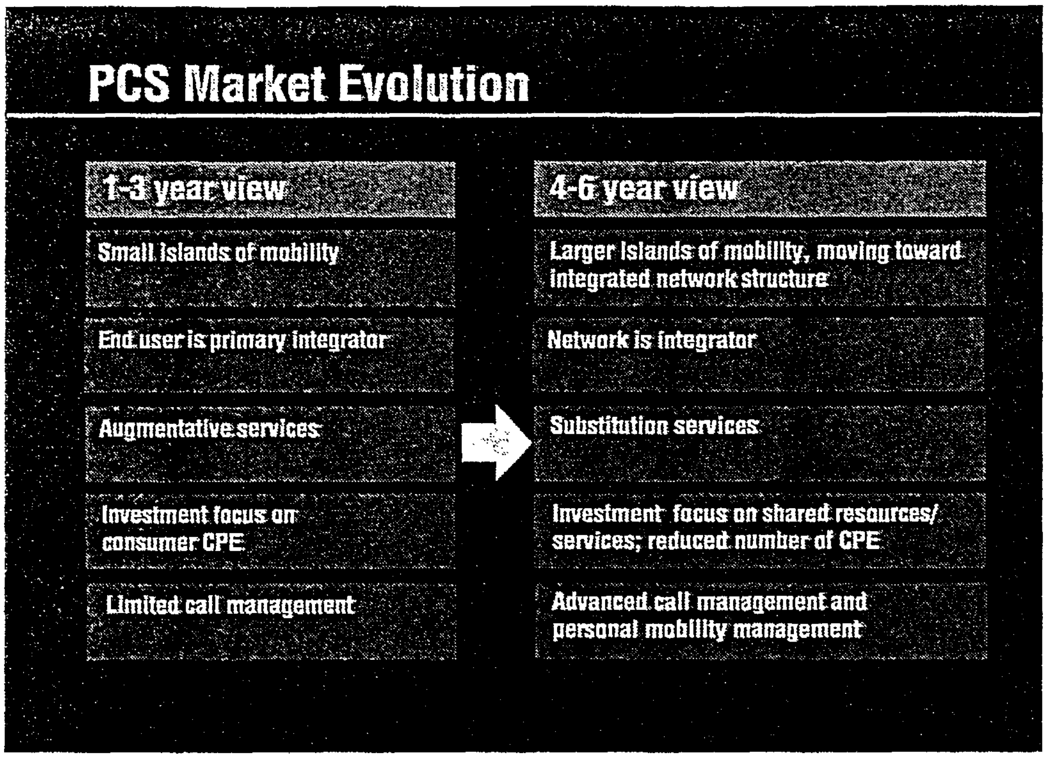


Just as the network will evolve, so, too, will Personal Communications Services themselves.

Although not explicitly recognized as PCS, end users over the last several decades have been buying a range of devices and services to meet their personal communications services needs. These devices and services have given them terminal mobility, personal mobility, and call management.

The burden of integration, however, has always fallen upon the user.

Today, although users are still willing to buy new technologies to enhance their communications needs, even if it means the users themselves must be the systems integrators, these expectations will change within the next five years or so, when users will expect the network to be the integrator.



In terms of market evolution, the PCS market will also evolve:

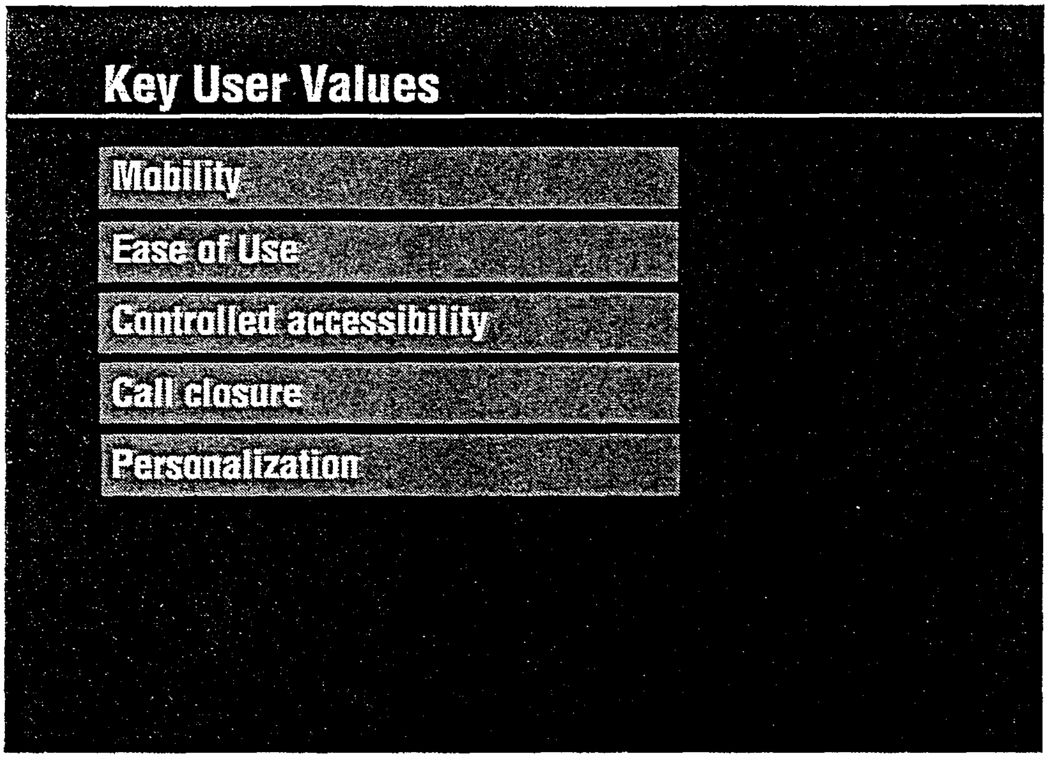
• We'll move from small, discrete islands of urban mobility to larger islands of mobility, with city-wide service available in some areas.

• In the short term, the end user will be the primary services integrator, and will mix and match technologies to meet specific needs. Within approximately five years, the network will offer some users a "single" solution.

• In the next couple of years, users will buy unique niche applications that augment existing services. Within five years, integrated solutions will allow replacement of some independent technologies.

• In the near term, investment will focus on consumer CPE (customer premises equipment) eventually shifting to shared resources and a reduced number of CPE.

• Plain Old Wireless Service will address users' initial need for terminal mobility, but will create a trend, in the evolution process, for the need for call management and personal mobility.



In recent studies with end users throughout North America and abroad, BNR identified five key attributes that users value most in terms of personal communications devices.

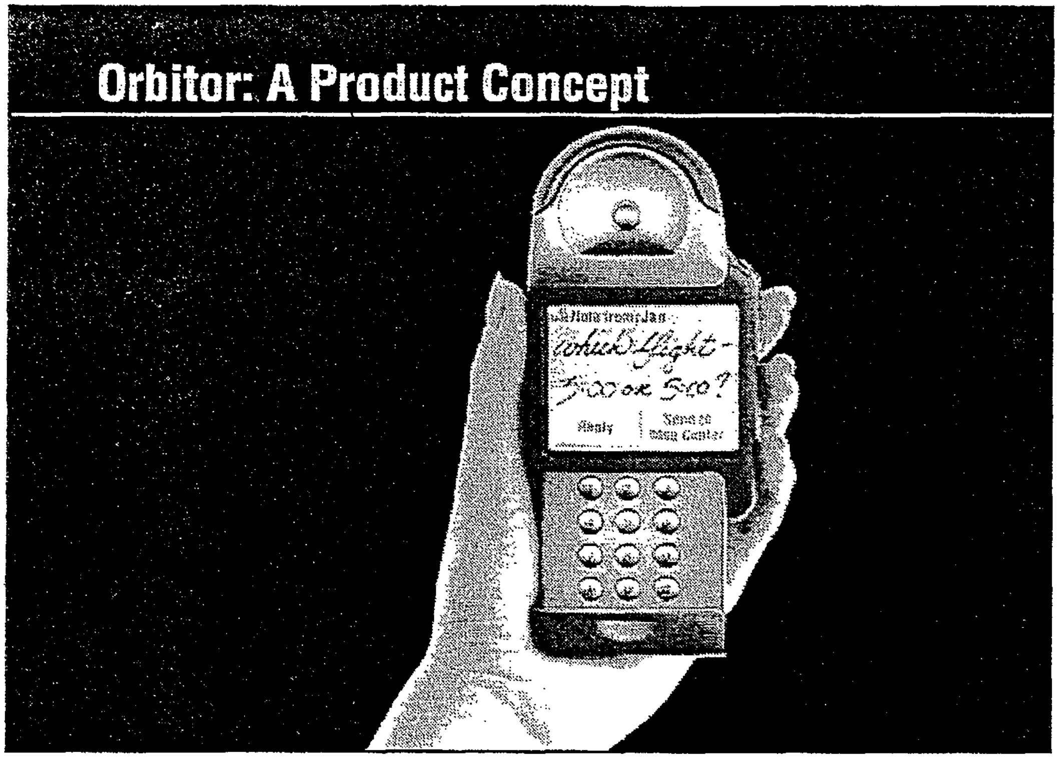
(1) <u>Mobility</u>
Users placed the highest value on mobility because it meant they were never out of touch. Indeed, many users placed such a degree of importance on mobility that they wanted all their vital business and personal communications needs to be met by a single device that would enable them to keep track of changing events in their lives and respond to new information as it became available.

(2) <u>Ease of Use</u>
Ease of use was the second most important value. Generally, user groups felt that today's electronic devices are too complicated. As one participant said, "I can build a bridge, but I can't program my VCR." Despite the underlying complexity of a device, people want to accomplish a task with the least amount of effort. They want and value simplicity.

(3) <u>Controlled Accessibility</u>
Users want to be accessible so they can stay in close contact with business associates, friends, and family members. At the same time, however, they want to be in control of which callers can reach them and at what times.

(4) <u>Call Closure</u>
In today's communications environment, the failure to complete a call because the line is busy or the person is not there often ties a user to his or her desk until the communication has been completed. Users value the ability to complete a call.

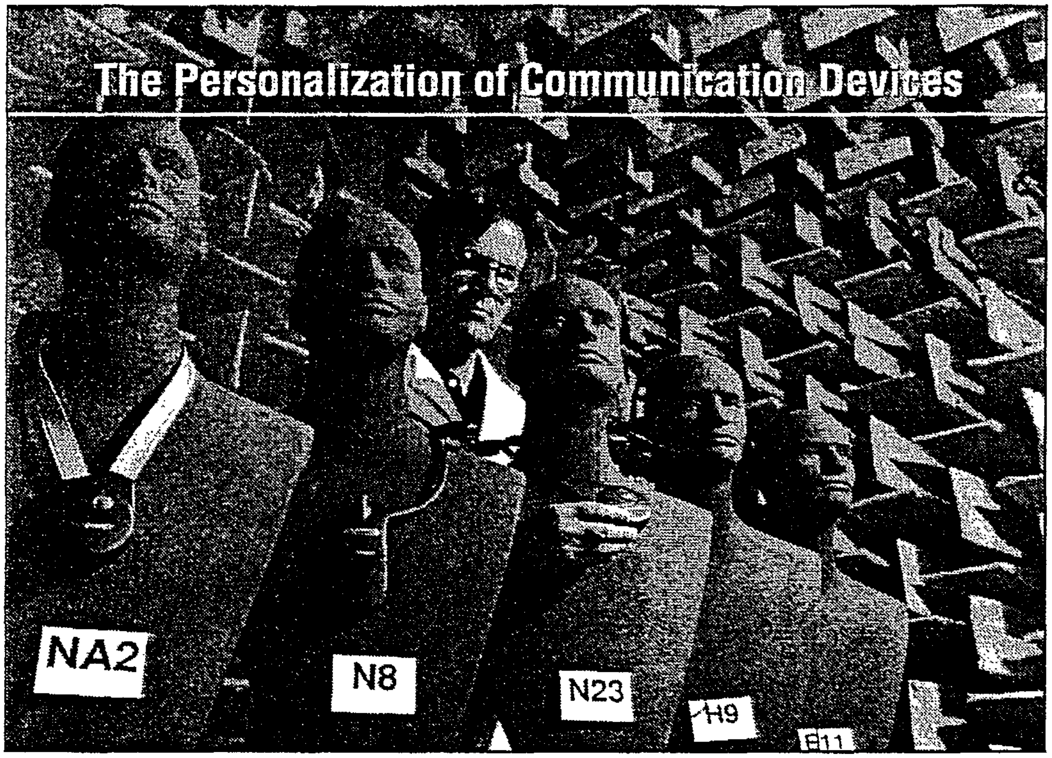
(5) <u>Personalization</u>
With PCS, the telephone will no longer be a shared device, but rather a personal item that people can carry with them most, if not all, of the time. Users want to be able to "personalize" the devices, in terms of style and function.



Based on the results of these studies, BNR has developed a number of product concepts. The one shown in the photograph above is called Orbitor.

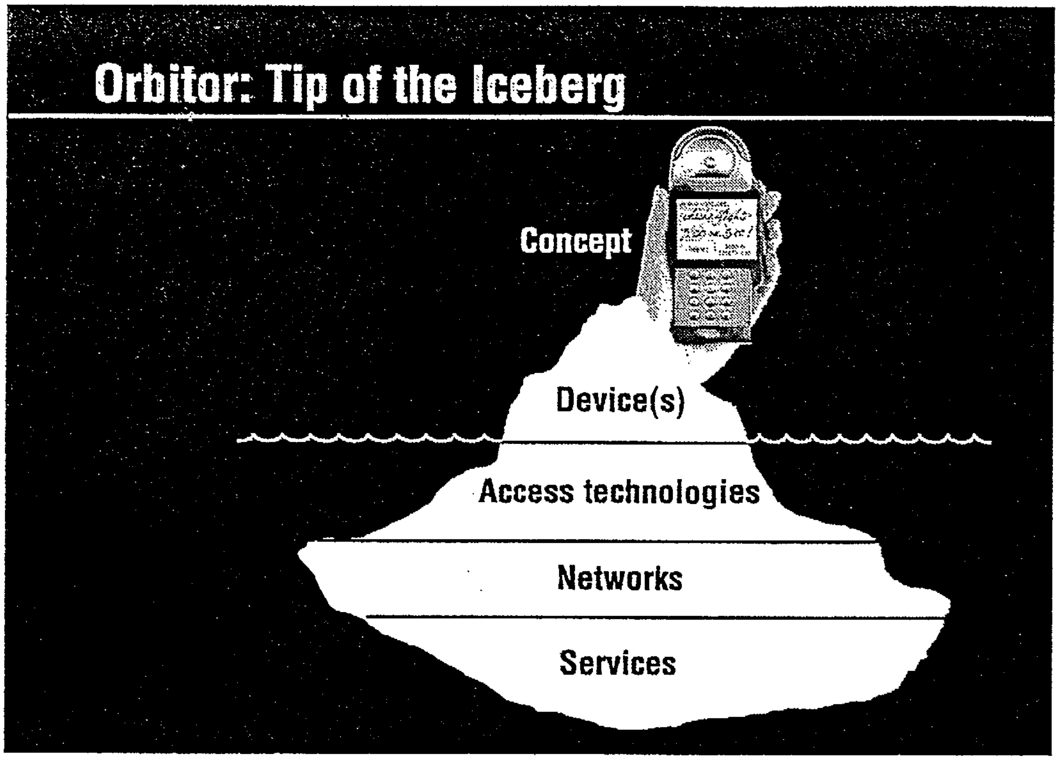
Orbitor is a personal communicator that will provide a window to a variety of information and communications services. It has a touch-sensitive screen and voice-recognition capabilities. Users can write a message or receive a fax. It also has a detachable speaker that will fit comfortably over a user's ear for handsfree operation and private conversation.

Orbitor envisages a powerful vision of how PCS will evolve over the next decade.



This photograph shows some of the other product concepts BNR is working on — primarily for handsfree operation in a desktop environment.

Apart from style and design issues, BNR is also working on the technology challenges of providing high-quality audio in a physically small package and providing high-quality display functionality.



The actual communications device, however, is just the tip of the iceberg. A tremendous amount of work still needs to be done in terms of access technologies, services and, in particular, networking those services among different islands and geographical locations.


The Personalization
of Communications
W. Brian Hewat
Chairman and CEO
Bell-Northern Research

Session 2

END USER REQUIREMENTS FOR PCS
LES EXIGENCES DE L'UTILISATEUR FINAL

Malcolm Cowan

General Manager, Public Cordless Ntworks
Northern Telecom
2920 Matheson Boulevard
Mississauga, Ontario
L4W 4M7

BIOGRAPHY

Malcolm Cowan joined Northern Telecom and is general manager, Public Cordless Networks. In this role he heads up Northern Telecom's global Public Cordless Network business based on low/mid power radio technologies.

Mr. Cowan has held a number of prior management positions in the corporation, including the product management of Meridian 1 Small Systems for the Multimedia Communications System group, based in Richardson, Texas, and as assistant vice-president of the Centre of Excellence for CPE products for Europe introducing the successful Option 11 PBX, based in Paris, France.

BIOGRAPHIE

Malcolm Cowan travaille pour la Northern Telecom comme directeur général des réseaux publics sans fil. À ce titre, il dirige les activités du réseau public sans fil de la Northern Telecom, réseau qui est fondé sur les technologies radio à faible/moyenne puissance.

M. Cowan a auparavant assumé un certain nombre de fonctions dans cette entreprise, notamment la gestion de produit des petits systèmes Meridian 1 pour le groupe Multimedia Communications System dont les bureaux sont à Richardson, au Texas. Il a en outre été vice-président adjoint du Centre d'excellence pour l'équipement appartenant à l'abonné, secteur de l'Europe, chargé d'introduire la populaire Option 11 PBX; les bureaux du Centre se trouvent à Paris, en France.

ABSTRACT

Mr. Cowan will present the evolution of mobile networks into Personal Communications Systems from an end-user perspective, discussing their needs and applications. These views will be based on feedback from numerous trials which Northern Telecom has conducted in many markets, as well as real customer experience. These needs will then be related back to the implementation of the various technologies which are the main candidates for the PCS business.

RÉSUMÉ

M. Cowan présentera l'évolution des réseaux mobiles vers des Systèmes de communications personnels (SCP), du point de vue de l'utilisateur final, de ses besoins et de ses applications. Ces opinions sont fondées sur la rétroaction provenant de nombreux essais effectués par Northern Telecom dans divers marchés, ainsi que sur l'expérience de clients réels. Ces besoins seront alors reliés à la mise en oeuvre des diverses technologies qui sont les principales candidates pour les systèmes personnels de communications.

NOTES

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Personal Communications Systems

User Needs
and
PCS Technologies

Malcolm Cowan
General Manager
Public Cordless Networks
Northern Telecom

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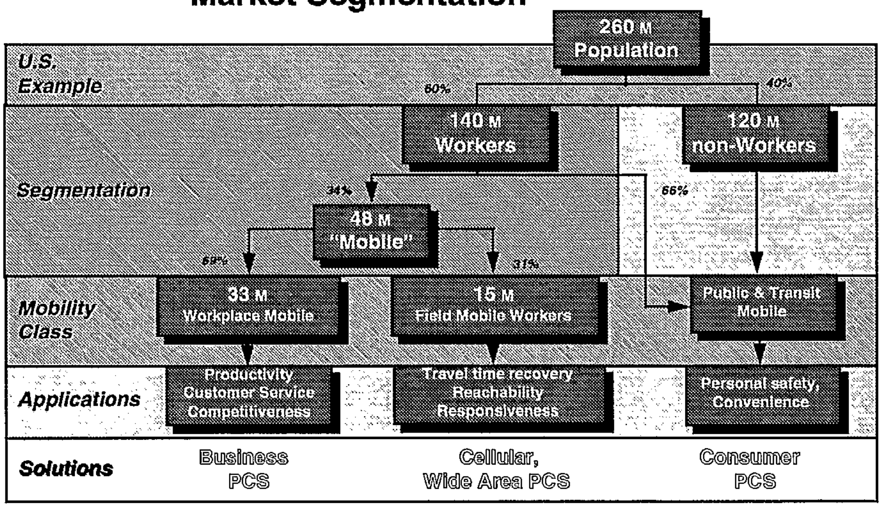
Market Segmentation



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The New PCS Market Opportunities

- New spectrum, new players
- Differentiation or Price War
- Wide Area Business individual roamers all taken
- The new frontiers:
  - Business PCS
  - Residential PCS
  - Mobile Data

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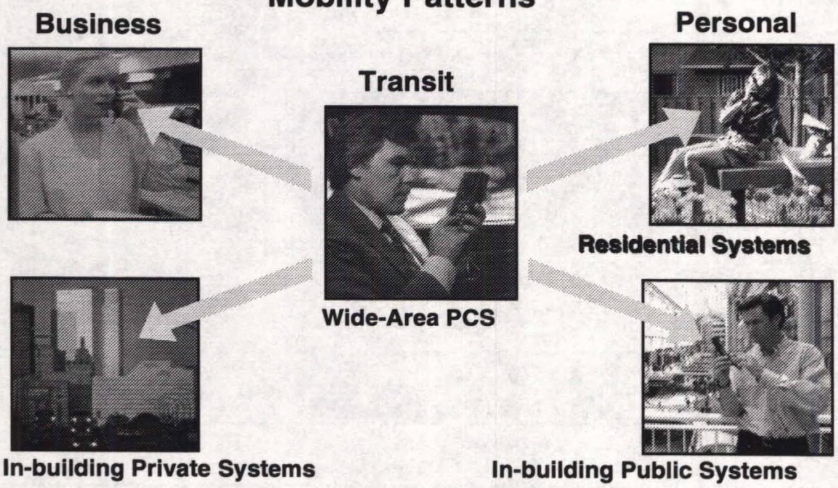
Mobility Patterns



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Business PCS Service Attributes

Private
- Packaged or Co-marketed with PBX, Centrex
- Mobile Terminal Twinned with Office Phone
- Linked to PBX Features: Voice Mail, Conference, Calling Name Display
- Vertical Market Targeted

Public
- Shared Tenant Service / Wireless Centrex
- Campus/Mall Mobility
- Private ◄——► Public Roaming ◄——► Private Roaming
- Public Operator or Commercial Service (Hotel, Theme Park)

Business User Locatable via Office Phone Number

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Residential PCS - Service Attributes

- Residential Cordless Handsets
- Multiple Handsets per Family
- Family Member Personal Numbering, Locatability
- Residence ◄——► Public Roaming
- Contactability, Safety, Convenience Drivers
- Co-marketed with Residential Phone Service, Long Distance or Cable Service

Residential User Located Via Home Phone Number

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Mobile Data - Service Attributes

The Road Warrior
- Lap Top Computers
- Send/Receive Charts, Faxes, Price Books
- Public Venues (Airports, Hotels)
- Business Productivity Driven

The Consumer
- Short Message Service (Paging "Plus")
- PDA Messaging
- Info - Telephony
- Industry Marketing Driven
- Wide Area Accessibility/Contactibility

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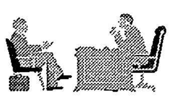
Mobility Requirements & Solutions

Primary	Usage Characteristics	Technologies
Car and Public 	Low usage (100 m/mth) Wide-area coverage High speed mobile Secure communication	High power, large cell networks
Workplace 	High usage (1050 m/mth) Site-wide coverage Quality sound Workday duty cycle More secure communication	Low power, multi-cell systems
Home 	Moderate usage (750 m/mth) Home-wide coverage Quality sound Low speed mobile	Low power, single cell systems

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The Technologies of PCS

- Radio
- Networks
- Services Platforms
- Terminals

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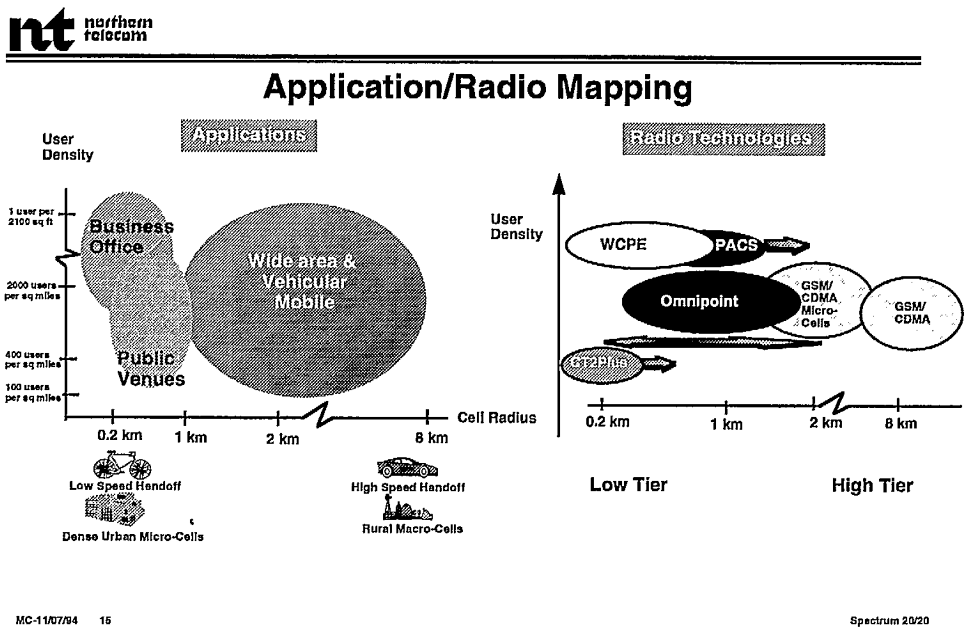
Radio Technology Characteristics

Low Power
- Range 50M → 300M
- Wireline Voice Quality
- Pedestrian Speed Hand-off
- High Data Rates
- Long Battery Life
- Small, Inexpensive Handsets

High Power
- Range 300M → 10+ km
- Vehicular Hand-Off

In-Building Optimized

Wire-Area Optimized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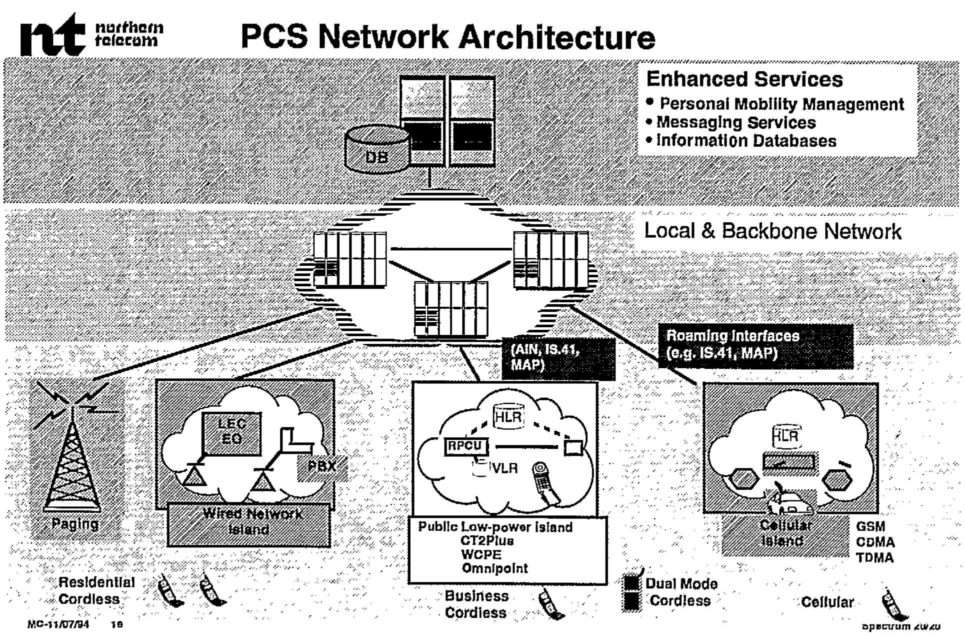
Application/Radio Mapping
Applications
Radio Technologies
User Density
Business Office
Wide area & Vehicular Mobile
Public Venues
Cell Radius
0.2 km
1 km
2 km
8 km
Low Speed Handoff
Dense Urban Micro-Cells
High Speed Handoff
Rural Macro-Cells
WCPE
PACS
Omnipoint
GSM/ CDMA Micro-Cells
GSM/ CDMA
CT2Plus
Low Tier
High Tier
MC-11/07/94 15
Spectrum 20/20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PCS Network Architecture
Enhanced Services
• Personal Mobility Management
• Messaging Services
• Information Databases
DB
Local & Backbone Network
(AIN, IS.41, MAP)
Roaming Interfaces (e.g. IS.41, MAP)
Paging
LEC EO
PBX
Wired Network Island
HLR
RPCU
VLR
Public Low-power Island
CT2Plus
WCPE
Omnipoint
HLR
Cellular Island
GSM
CDMA
TDMA
Residential Cordless
Business Cordless
Dual Mode Cordless
Cellular
MC-11/07/94 16

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Application/Technology Summary

APPLICATIONS	TECHNOLOGIES
Business PCS	Low Power Sub-Nets or Cellular Micro-Cells
Business → Public Roaming	IS.41 (Cellular) or MAP (GSM)
Residential → Public Roaming	AIN (Wireline)
Terminals	Dual Mode Smart Cards

LA RADIODIFFUSION SONORE NUMÉRIQUE
DIGITAL AUDIO BROADCASTING

Daniel Sauvet-Goichon

Directeur de TDF-C2R
(Centre de recherche en Radiodiffusion et Radiocommunications)
Télédiffusion De France
10, rue d'Oradour-sur-Glane
75732 Paris Cedex 15

BIOGRAPHY

Daniel Sauvet-Goichon is Director of TDF-C2R, Paris and Metz research centre of "Télédiffusion De France" (TDF), the French major broadcating company. In his previous assignment, he was in charge of frequency management in TDF.

He has participated in most of the I.T.U. broadcasting Administrative Conferences since 1977 and became an expert in radio-frequency regulations.

He is Chairman of the EBU Working Party R, dealing with sound and TV broadcasting. He participates in the European DVB (Digital Video Broadcasting) Project as Vice-Chairman of the Technical Module of the project.

Daniel Sauvet-Goichon is a graduate of the "École Polytechnique", Paris, 1967 and of the French National Communications College (École Nationale Supérieure des Télécommunications, Paris) 1970.

BIOGRAPHIE

Daniel Sauvet-Goichon est directeur de TDF-C2r, centre d'études et de recherches, situé à Paris et Metz, de "Télédiffusion De France" (TDF), le principal opérateur de diffusion français. Auparavant, il était responsable des questions de fréquence à TDF.

Il a participé à la plupart des Conférences Adminisdtratives de l'UIT sur la radiodiffusion depuis 1977 et est devenu expert en réglementation des fréquences.

Il préside le Groupe de travail R de l'UER, chargé des études techniques en matière de diffusion du son et de la télévision. Il participe au project européen DVB (Digital Video Broadcasting), comme vice-président du module technique de ce projet.

Daniel Sauvet-Goichon est diplômé de l'École Polytechnique, Paris, 1967 et de l'École Nationale Supérieure des Télécommunications, Paris, 1970.

ABSTRACT

"Breaking loose; cutting the bonds" is the theme of the session.

The shackles: for a long time, radio broadcasting has been able to carry information to the listener on the other side of the world by means of short wave, nearer the transmitter, even while driving, FM is effective.

RÉSUMÉ

"S'affranchir des entraves; Briser les liens" dit le thème de la session.

Les entraves; la radiodiffusion s'en est depuis longtemps affranchi en apportant l'information à l'auditeur qu'il soit à l'autre bout du monde, par la voix des ondes courtes, ou proche de l'émetteur, au volant de sa voiture, par la modulation de fréquence.

The bonds: rather than break them, we should improve the quality of the technology. That is the primary objective of digital audio broadcasting, especially of the Eureka 147 European project. DAB is at the leading edge of the technology and has been adopted by a large number of countries of which Canada is one. It is ready to take its place in broadcasting.

The DAB project is based on a proven set of techniques, in particular the MUSICAM coding, adopted for MPEG standards, and OFDM modulation. They provide CD quality for mobile or portable reception. However, even more interesting for frequency spectrum management, these techniques permit economical use of spectrum, particularly when using the concept of the single frequency station.

But where can one find frequencies with which to implement new services based on DAB? Canada and France have reserved the bandwidth from 1452 to 1492 Mhz. Other countries are looking at other frequencies. In Europe, CEPT coordinates this research and will organize a European planning conference in 1995.

For terrestrial broadcasting, the introduction of DAB has started an important process. DAB "clubs" are being created in each country where experimental transmissions take place. They are no longer limited by the technology but are concerned instead with services. Receiver manufacturers are prepared, and the first product launches have been made.

With regard to satellite broadcasting, perspectives are longer and the technology debate less clear. Nevertheless, American and European short wave broadcasters are getting ready and are working out preliminary issues.

Les liens; ne les brisons pas mais améliorons leur qualité technique. C'est l'objectif premier de la radiodiffusion sonore numérique, en particulier du projet européen Euréka 147 "DAB", au point techniquement, adopté par un grand nombre de pays dont le Canada et prêt à prendre son essor radiophonique.

Le projet DAB est fondé sur un ensemble de techniques bien démontrées, en particulier le codage MUSICAM, adopté par les normes MPEG, et la modulation OFDM. Elles conduisent à une écoute de qualité CD en réception mobile ou portable. Mais plus intéressant encore pour le gestionnaire du spectre des fréquences, ces techniques permettent d'économiser la ressource en fréquences, en particulier par le concept de réseau monofréquence.

Mais où trouver des fréquences pour mettre en oeuvre de nouveaux services fondés sur le DAB? Le Canada et la France privilégient la gamme 1452-1492 MHz. D'autres pays recherchent d'autres voles. En Europe la Cept coordonne cette recherche et prévoit d'organiser une conférence européenne de planification en 1995.

En diffusion terrestre, l'introduction du DAB connaît un dynamique forte. Des "clubs" DAB se créent dans chaque pays, des émissions expérimentales ont lieu. Elles ne se limitent plus à la technique mais concernent également les services. Les fabricants de récepteurs se préparent et les premières annonces de lancement ont été faites.

En diffusion par satellite, les perspectives sont plus lointaines et le débat technique moins clair. Les radiodiffuseurs en ondes courtes, américains et européens, s'y préparent néanmoins et élaborent des réflexions préliminaires.

LA RADIODIFFUSION SONORE NUMÉRIQUE
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Daniel Sauvet-Goichon

Directeur de TDF-C2R
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10, rue d'Oradour-sur-Glane
75732 Paris Cedex 15

1. Introduction

Durant les 10 dernières années un travail considérable a été mené sur la radiodiffusion sonore numérique, selon deux approches qui d'année en année ont convergé vers un système unique, adapté tant à la diffusion terrestre qu'à la diffusion par satellite.

La première approche a été lancée par la CAMR 79 de l'UIT. Une Résolution invitait les Administrations à effectuer des expérimentations de radiodiffusion sonore par satellite dans la gamme 0.5 - 2 GHz, à destination de récepteurs portables ou mobiles. Une future conférence devait ensuite prendre les décisions appropriées à l'ouverture de ce service.

La seconde approche fut terrestre. Pendant la dernière décennie, la bande de radiodiffusion sonore à modulation de fréquence est devenue saturée dans de nombreux pays. La qualité des signaux reçus baissait à cause des brouillages tandis que l'auditeur devenait plus exigeant en s'habituant à l'excellence du son du disque laser.

Pour ces raisons, l'Europe a lancé en 1986 un projet de recherche, nommé "Eurêka 147" ou plus schématiquement "DAB" (Digital Audio Broadcasting), avec l'objectif principal de fournir une qualité de service de diffusion sonore numérique équivalente à celle du disque laser, pour des récepteurs portables ou mobiles. Le service devait pouvoir fonctionner en diffusion terrestre comme par satellite.

Le système DAB est au point. Il a fait l'objet des multiples démonstrations depuis 1988 et de nombreux pays dont le Canada l'ont adopté. Il est prêt à prendre son essor radiophonique.

Les États-Unis, considèrent une approche différente. Elle reflète certaines contraintes dont l'absence de nouvelles disponibilités en fréquences et le besoin de maintenir la structure des réseaux de diffusion FM sans changement. Des systèmes ont été proposés pour ajouter un signal numérique au signal analogique actuel dans les bandes AM ou FM. C'est la raison pour laquelle ces systèmes sont nommés "in-band".

Venus bien plus tard que le système Eurêka DAB, ils doivent encore être évalués, en particulier sur la question de la réception vers les mobiles.

Dans ce papier, seuls le système Eurêka 147 DAB et sa mise en oeuvre sont traités.

2. DAB, un système efficace

En codage de source

Le système Eurêka 147 DAB est fondé sur une méthode de codage source extrêmement efficace qui permet de réduire le débit binaire de 768 kbit/s à environ 100 kbit/s par voie monophonique.

Comparées aux méthodes de diffusion analogique, la quantité d'information transmise et donc l'occupation en fréquences sont réduites une

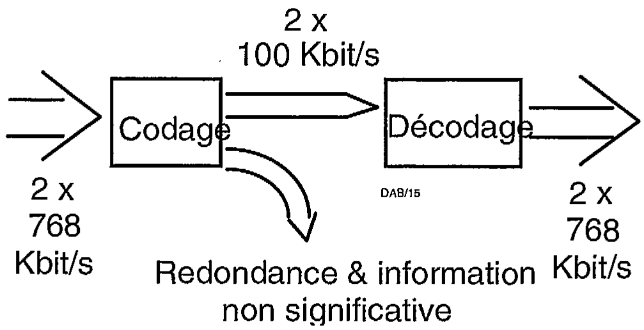

Figure 1

première fois.

En modulation

La méthode de modulation du DAB s'appelle : **OFDM** (Orthogonal Frequency Division Multiplex).

Le signal numérique est réparti sur un très grand nombre de sous porteuses élémentaires à bande étroite. Elles sont groupées dans un "Bloc" de fréquences. Plusieurs programmes (5 à 6 en stéréo) partagent le même bloc.

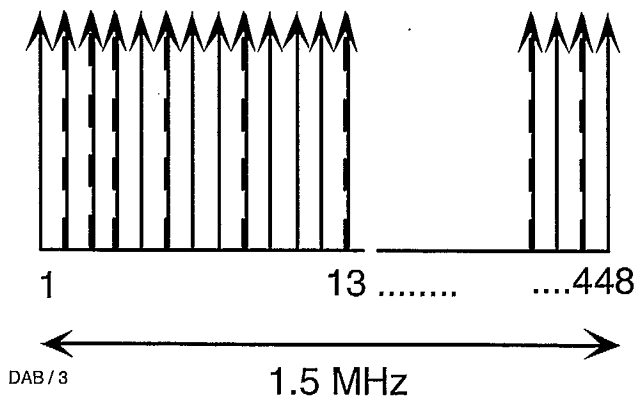

Figure 2

Exemple: 6 programmes stéréo dans 1.5 MHz.

Dans le multiplex, il faut éviter les brouillages entre sous porteuses. Avec l'OFDM, ceci est réalisé par l'orthogonalité des sous porteuses (à chaque fréquence où une sous porteuse a son amplitude maximale, toutes les autres ont une amplitude nulle).

Par cette orthogonalité, les sous porteuses sont aussi proches que possible. C'est la source d'une seconde économie d'occupation du spectre des fréquences.

Les réseaux monofréquence

Une des raisons du succès du DAB est sa propriété

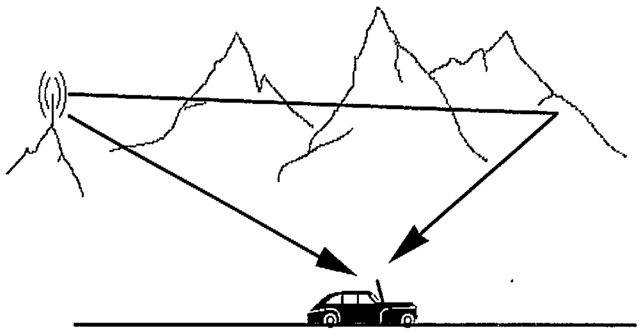

Figure 3

de tirer parti des échos de façon constructive au lieu d'en être gêné (fig. 3).

En conséquence, si plusieurs émetteurs d'un réseau diffusent le même programme et sont reçus en un même point avec divers décalages de temps (fig. 4), les signaux correspondants peuvent être vus par le récepteur comme un signal direct provenant de l'émetteur le plus proche suivi par des "échos" provenant des autres émetteurs. Aucune perturbation ne résulte de ces échos.

Avec la technique OFDM du DAB, le concept de

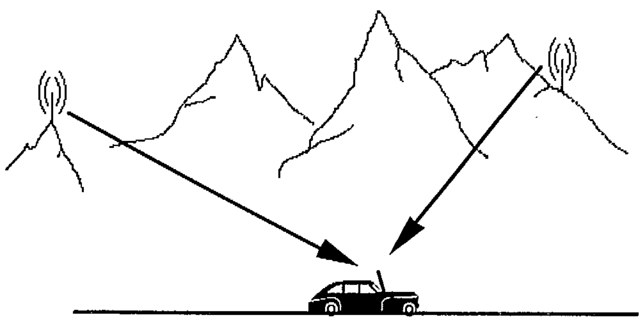

Figure 4

réseau monofréquence (SFN) devient réalité.

3 DAB au Canada

Au Canada, la mise en oeuvre des techniques SFN est l'objet d'un programme d'études de 3 ans, sur la base du système DAB Eurêka 147. La première réalisation, à l'automne 1992, a été la constitution en bande L d'un réseau de diffusion numérique à 2 sites, Toronto et Barrie, Ontario. Les mesures effectuées ont montré la possibilité d'espacer des émetteurs jusqu'à 85 km avc un réseau synchronisé en bande L.

A la suite, Digital Radio Research Incorporated (DRRI), un consortium réunissant radiodiffuseurs privés et CBC a établi, été 1993, un autre site expérimental à Trois-Rivière, Québec, pour compléter l'étude de la propagation et des caractéristiques de couverture.

Janvier 1994, un réseau à 3 émetteurs a été installé dans la région de Montréal et une station pré-opérationnelle a été lancée à Toronto. Ces stations vont fonctionner pour diverses expérimentations pendant 2 ans.

4 Terrestre ou satellite ?

Le concept de réseau hybride

La faisabilité et le coût d'un système de radiodiffusion sonore par satellite dépendent essentiellement de la puissance d'émission nécessaire à bord du satellite. Le bilan de liaison doit tenir compte :

- des pertes de propagation en espace libre,
- d'autres effets (absorption gazeuse...),
- de l'atténuation par masquage par les bâtiments ou les feuillages.

L'antenne de réception d'un récepteur portable ou mobile est pratiquement omnidirectionnelle.

Une marge de puissance est nécessaire pour s'affranchir des atténuations d'obstacle :
Pratiquement, il serait très difficile de compenser les plus larges atténuations. Seules des valeurs de

	Marge dB
Zones rurales	**5**
Zones urbaines	**10 à 15**
A l'intérieur des bâtiments	**> 20**

marge de l'ordre de 5 dB peuvent être envisagées sans coût excessif. Le système doit donc être conçu pour couvrir les zones rurales ou suburbaines.

Le complément de couverture dans les zones denses urbaines se fera par l'emploi de re-transmetteurs terrestres.

Mais grâce à DAB, ces re-transmetteurs opéreront sur la même fréquence que le satellite. Le signal du re-transmetteur sera considéré comme un écho du signal du satellite. Il contribue à améliorer la réception. Sa puissance peut être très faible.

Ce concept, nommé "système hybride", permet des satellites à puissance raisonnable. L'importance de cet élément explique le mandat de la CAMR 92 de l'UIT sur ce sujet :

"Considérer l'attribution d'une bande de fréquences... pour la radiodiffusion sonore par satellite, y compris la possibilité d'utilisation terrestre complémentaire dans cette bande".

Les attributions de la CAMR 92

La bande de fréquences 1452 - 1492 MHz a été allouée sur une base mondiale au Service de Radiodiffusion par Satellite et au Service de Radiodiffusion terrestre.

En Europe, la bande 1452 - 1492 MHz ne sera pratiquement pas disponible pour la diffusion par satellite avant 2007. Par contre, l'utilisation terrestre peut commencer dès maintenant.

En addition, des notes de bas de page du Règlement des Radiocommunications spécifient pour certains pays d'autres attributions dans les gammes 2310 - 2360 MHz et 2535 - 2655 MHz.

Ces pays sont les suivants :
Le concept mixte satellite/terrestre

1,5 GHz	2,3 GHz	2,6 GHz
Mondiale sauf U.S.A.	**U.S.A. Inde**	**Russie Ukraine Biélorussie Chine Corée Inde Japon Pakistan Singapour Sri Lanka Thaïlande**

Une fois qu'une bande de fréquences commune a été attribuée au Service de Radiodiffusion par Satellite et au Service de Radiodiffusion terrestre (concept hybride), on peut facilement imaginer d'en faire une utilisation plus intensive pour les deux services de façon à satisfaire les besoins des radiodiffuseurs depuis des émissions locales jusqu'à des émissions nationales, voire supra nationales.

Le service par satellite diffuserait les programmes nationaux sur certains canaux et des émetteurs terrestres dans la même zone mais sur des canaux différents diffuseraient les programmes locaux. Les deux services, satellite et terrestre, seraient complétés par des réémetteurs iso-fréquence pour combler les zones d'ombre à l'intérieur des zones de service ou pour étendre les couvertures à la périphérie de ces zones.

5 DAB terrestre en Europe

Les principales difficultés pour créer un nouveau service de radiocommunication sont de trouver une bande de fréquences appropriée puis de motiver des investisseurs pour la construction des nouveaux réseaux.

Quelles sont les bandes de fréquences disponibles pour le DAB terrestre ?

En Europe, les radiodiffuseurs utilisent déjà une large part du spectre des fréquences au dessous de 1 GHz. Beaucoup de pays auraient de sérieuses difficultés à libérer de nouvelles fréquences dans cette gamme. Il était donc d'abord nécessaire d'étudier si les bandes de radiodiffusion peuvent accommoder le service DAB en plus des utilisations actuelles.

Une première tendance existe chez ceux qui peuvent libérer la gamme 223 - 230 MHz, peu utilisée par des émetteurs TV, et même l'étendre à la gamme 230 - 240 MHz.

Pour d'autres pays, la gamme 223 - 240 MHz n'est pas allouée à la radiodiffusion. Ils ne peuvent suivre cette tendance car les utilisateurs actuels refusent de libérer cette partie du spectre.

Ces pays, dont la France et l'Allemagne, ont décidé d'utiliser la nouvelle bande de fréquences 1452-1492 MHz. Ils pensent que la diffusion par satellite ne convient pas à la programmation locale ou régionale qui est le principal marché de la radiodiffusion sonore en Europe. La bande est donc tout à fait appropriée à la diffusion terrestre.

Clubs, plateformes, forum DAB ...

De 1988 à 1992, de nombreuses émissions expérimentales à travers l'Europe, comme au Canada, ont prouvé les bonnes performances techniques du système DAB Eurêka 147 en terrestre.

Dès lors, des stratégies de mise en oeuvre pouvaient être étudiées par toutes les parties intéressées. Dans pratiquement chaque pays européen, des entités nommées "Club DAB", "DAB Platform", "DAB forum"... se sont créées, groupant autorités de régulation, radiodiffuseurs privés et publics et industriels.

Par exemple, en France, le "Club DAB" se réunit régulièrement pour définir les projets et suivre leur avancement au sein de diverses commissions : Fréquences, Récepteurs et Services, Recherche prospective, Aspects juridiques et Communication.

En 1993 ou 1994, quelques événements ou signes ont montré que la mise en service effective se rapprochait. Par exemple :

- Le gouvernement anglais a décidé de rendre disponible 12.5 MHz de spectre VHF au profit du DAB terrestre (décision de janvier 93).

- La diffusion de 10 programmes a débuté à Paris (octobre 93) pour une expérimentation de services (les expériences précédentes étaient purement techniques).

6 Conférence européenne 1995

La CEPT (Conférence Européenne des Postes et Télécommunications) a décidé la tenue d'une conférence de planification européenne pour le DAB terrestre en juillet 1995. L'objectif est de développer un plan d'allotissement de fréquences pour faciliter l'introduction rapide du DAB en Europe. Les fréquences disponibles seront partagées entre les pays selon une base équitable, particulièrement dans les zones frontalières à forte densité de stations radio.

La France a oeuvré pour que ce soit la bande 1,5 GHz qui soit utilisée pour l'introduction du DAB. C'est en effet la seule gamme qui présente une capacité suffisante pour assurer le réel succès de cette action de planification. Cette analyse est partagée par plusieurs autres pays européens.

Néanmoins, le plan d'allotissement couvrira plusieurs bandes : 47 - 68 MHz, 174 - 230 ou 240 MHz et une partie de 1452 - 1492 MHz.

Contrairement aux plans de fréquences de radiodiffusion actuels, préférence a été donnée à un plan d'allotissement plutôt qu'un plan d'assignations. Cela permettra plus de flexibilité à chaque pays pour la mise en oeuvre du service. Cela a été rendu possible par le concept de réseau monofréquence : dès lors que l'on peut mettre plusieurs émetteurs en service avec la même fréquence dans la même zone, il devient inutile de spécifier l'emplacement exact de chaque station, pourvu qu'elle respecte certaines contraintes de puissance.

En mi 1994, la CEPT a demandé à tous ses membres de fournir la liste de leurs besoins pour la planification. Le temps restant jusqu'à la conférence est utilisé pour des études de planification sur la base des besoins recensés.

Les besoins français

Pour préparer ses besoins en vue de la conférence CEPT, le "Club DAB" français a défini 4 types de couverture et de service :

- Des réseaux nationaux pour le service public (6 programmes),
- Des réseaux quasi nationaux, "Grid networks" (26 programmes) couvrant zones denses et axes routiers,
- Des réseaux régionaux (6 programmes par région)
- Des stations locales (6 programmes par zone locale).

Cela fait un total d'environ 44 programmes en tout point du territoire français et donc 8 à 9 blocs de fréquences DAB. C'est là une raison supplémentaire d'insister pour l'utilisation de la bande L, la partie VHF du spectre ne permettant pas d'offrir cette capacité à tous les pays européens.

7 Radiodiffusion internationale

Certains radiodiffuseurs internationaux voient l'attribution de la bande 1.5 GHz pour la diffusion par satellite à destination de récepteurs portables ou mobiles comme une opportunité de compléter, voire remplacer, la diffusion en ondes courtes.

Il y a cependant une menace potentielle pour cette possibilité si de plus en plus de pays utilisent la bande pour la radiodiffusion locale terrestre. Au sein de l'UER (Union Européenne de Radiodiffusion) un groupe de travail a été établi avec la tâche spécifique de définir les besoins pour la diffusion internationale du son par satellite ainsi que les contraintes techniques éventuelles. A ce groupe participent, entre autres, BBC World Service, Deutsche Welle, Radio France Internationale, Radio Netherlands, Radio Vatican, CBC et la Voix de l'Amérique.

Parmi les besoins exprimés :

- Qualité audio équivalente à la FM monophonique
- Récepteurs fixes ou portables pour un coût inférieur à 200 US $

Le système Eurêka 147 répond à ces besoins mais n'est pas le seul possible.

Du point de vue des fréquences, une étape importante était d'estimer le nombre maximum de programmes destinés simultanément à chaque région, en fonction des horaires. La situation actuelle en ondes décamétriques a été prise comme référence. Le nombre maximal d'émissions simultanées a été trouvé sur l'Europe. A l'heure de pointe (18 30 - 19 00 UTC), environ 85 canaux seraient nécessaires pour transmettre les programmes actuels en ondes courtes.

Afrispace, Inmarsat, Worldspace...

Plusieurs projets sont évoqués ou font l'objet d'études préliminaires.

Le projet Afrispace date de 1990. Il pourrait fournir un service en bande L à destination de l'Afrique ou du Moyen Orient. En Europe, par exemple, Radio Netherlands soutient le projet. Afrispace a contracté avec Motorola pour fournir des récepteurs qui pourraient être vendus environ 100 US$. Afrispace est aujourd'hui dans la phase cruciale d'étude de montage financier.

INMARSAT a proposé à des radiodiffuseurs internationaux des expérimentations de diffusion sonore en 1995. WORLDSPACE constitue un autre projet potentiel.

Pour poursuivre la réflexion sur ces sujets, à l'initiative de la BBC un groupe de travail "Digital Radio for the World" a été récemment constitué.

Archimède

Archimède est un système expérimental de l'ASE (Agence Spatiale Européenne) pour la diffusion sonore par satellite. Ce système utiliserait 3 ou 6 satellites à défilement sur orbite elliptique inclinée. Ce type d'orbite permet à un des satellites de demeurer pendant 6 à 8 heures quasiment à la verticale au dessus de la zone de service choisie, avant de disparaître pour compléter son périple autour de la terre. Au moment où il part de la zone de service, le satellite suivant arrive et prend le relais pour assurer la continuité du service de diffusion. L'ASE a demandé à la CEPT de lui réserver environ 10 MHz de la bande L pour cette expérimentation qui pourrait avoir lieu vers la fin de la décennie 90.

8 Une question ouverte

Ce type de radiodiffusion internationale par satellite est évidemment incompatible avec la radiodiffusion terrestre à couverture locale, régionale ou nationale dans la même bande de fréquences. Par conséquent, la gamme 1452 - 1492 MHz devrait probablement dans un futur pas trop éloigné être séparée en 2 parties avec des procédures et des règles d'utilisation différentes. Un tel partage ne pourrait être fait que par une conférence de l'UIT qui aurait ce point à son ordre du jour.

Malheureusement, ce n'est pas la cas des prochaines conférences de l'UIT, prévues en 1995 et 1997. Peut-être en 1999 ?

THE AGE OF NON-GSO MOBILE SATELLITE SYSTEMS
L'ÈRE DES MSAT NON GÈO-STATIONNAIRES

Don Jansky

President
Jansky/Barmat Teleommunications, Inc.
1899 L Street N.W., Suite 1010
Washington, D.C. 20036

BIOGRAPHY

Mr. Jansky has been President of Jansky/Barmat Telecommunications, Inc. since 1983. In this capacity he has been deeply involved in frequency management and utilization issues. He has represented the United States at many ITU meetings including WARC, IFRB and CCIR Study Groups 4, 5 and 8. In addition, his company has assisted in a number of successful ITU coordination discussions involving satellite communication systems, including those of Luxembourg and Spain.

His early career was as Associate Administrator for Federal Systems and Spectrum Management in the NTIA, Department of Commerce. As well as representing the U.S. at ITU and other international meetings, he sponsored research into new methods of spectrum management and pioneered orbit/spectrum management research. In addition he developed the first U.S. National Security Telecommunications Preparedness Plan and the U.S. Radio Navigation Plan.

Mr. Jansky is the author of three books and has authored or published over 50 papers in various journals. His CCIR activities included preparation of numerous contributions to the work of Study Group 4 (Fixed Satellite) and Study group 8D (Mobile Satellite). He is a graduate of Dartmouth college with a B.A. (1962) and a B.E.E. degree in Engineering Science (1963), and has an M.S.E. from Johns Hopkins University (1970).

BIOGRAPHIE

M. Jansky est président de Jansky/Barmat Telecommunications, Inc. depuis 1983. À ce titre, il travaille beaucoup dans le domaine de la gestion et de l'utilisation des fréquences. Il a représenté les États-Unis à de nombreuses réunions de l'UIT, y compris celles de la CAMR, du IFRB et des groupes d'études 4, 5 et 8 du CCIR. De plus, son entreprise a participé à un certain nombre de discussions fructueuses sur la coordination de l'UIT, portant entre autres sur les systèmes de communication par satellite, dont ceux du Luxembourg et de l'Espagne.

Au début de sa carrière, il était administrateur associé des Systèmes fédéraux et Gestion du spectre à la NTIA, département du Commerce. En plus de représenter les États-Unis à l'UIT et à d'autres réunions internationales, il a parrainé la recherche sur de nouvelles méthodes de gestion du spectre et a fait oeuvre de pionnier dans la recherche sur la gestion de l'orbite/spectre. Il a de plus élaboré le premier plan d'urgence national des États-Unis en matière de télécommunications et le plan de radionavigation des États-Unis.

M. Jansky est auteur de trois livres et a rédigé ou publié plus de 50 articles dans diverses revues. Parmi ses activités au CCIR, il convient de mentionner la préparation de nombreuses contributions aux travaux du groupe d'étude 4 (service fixe par satellite) et du groupe d'étude 8D (service mobile par satellite). Il est titulaire d'un baccalauréat ès arts du collège de Dartmouth (1962), d'un baccalauréat d'enseignement élémentaire en génie (1963) et d'une maîtrise ès sciences en génie de la Johns Hopkins University.

ABSTRACT

This paper will review the status and prospects of both "big" and "little" Leo Mobile Communication Satellites. It will review the status of licensing and the requirement for additional spectrum at WRC '95. In addition it will discuss the various ways in which technology is leading policy, and what are the difficult policy problems lying ahead.

RÉSUMÉ

Ce document portera sur l'état et les perspectives d'avenir des «gros» et des «petits» services mobiles par satellite à OBT. Il traitera aussi de l'état de l'octroi de licence et du besoin d'un spectre additionnel à la CAMR 1995. De plus, l'auteur discutera des diverses façons dont la technologie dirige la politique et des graves problèmes d'orientation auxquels il faudra faire face.

IVHS WIRELESS COMMUNICATION OPORTUNITIES
L'OCCASIONS DE COMMUNICATION SANS FIL POUR SAVI

Jackson K. Wang, P.Eng.

Research Engineer, IVHS Development Office
Strategic Transportation Research Branch
Ministry of Transportation of Ontario
201 Wilson Avenue, Rm 333 Centre Bldg.
Downsview, Ontario, M3M 1J8

BIOGRAPHY

Jackson completed his undergraduate work in the Engineering science program at the University of Toronto. He has also done graduate level work in Electrical Engineering at the Institute of Biomedical Engineering also at the University of Toronto.

Currently employed at the Ministry of Transportation of Ontario, Jackson is managing several project areas in IVHS. He is particularly interested in Traffic, Technical Standards development and Private/Public Venture issues.

During the summer of 1993, he was confirmed as the Head of Delegation for Canada on the ISO/TC 204 committee on IVHS standards. In addition, he also currently serves as the committee chairman on International Traveller Information Interchange Standards (ITITS) at the Society of Automotive Engineers (SAE) and Enterprise States (a consortium of State DOTs).

Prior to joining the Ministry, Jackson was a Senior Systems Engineer on the United States Tomahawk Cruise Missile Guidance program at Litton Systems and has held a Queen's Commission with the classification of Aerospace Engineering Officer in the Canadian Armed Forces. Jackson is an active member of the Association of Professional Engineers of Ontario as well as the Society of Automotive Engineers.

BIOGRAPHIE

M. Jackson Wang a terminé ses études de premier cycle en génie à l'Université de Toronto. Il a aussi fait des travaux au niveau des études supérieures en génie électrique à l'Institut de génie biomédical, également à l'Université de Toronto.

Actuellement à l'emploi du ministère des Transports de l'Ontario, il administre divers projets sectoriels en SVI. Il s'intéresse particulièrement à l'élaboration de normes techniques et de trafics, ainsi qu'aux projets conjoints privés/publics.

Durant l'été 1993, il a été confirmé comme chef de la délégation canadienne au comité ISO/TC 204 sur les normes SVI. En outre, il sert présentement à titre de président du comité sur les normes internationales d'échanges de renseignements sur les voyageurs internationaux (NIERVI), à la Society of Automotive Engineers (SAE) et à l'Enterprise States (un conglomérat des départements des transports d'États américains).

Avant d'entrer au Ministère, Jackson était ingénieur principal des systèmes du programme de guidage des missiles américains Tomahawk, chez Litton Systems, et il a été détenteur d'un mandat royal, avec la classification d'officier du génie aérospatial, dans les Forces armées canadiennes. Jackson est membre actif de l'Association des ingénieurs professionnels de l'Ontario, ainsi que de la Society of Automotive Engineers.

ABSTRACT

Intelligent Vehicle and Highway Systems (IVHS) projects utilizing multi-model information braodcast to automotive route guidance systems, hand-held devices, and traveller information kiosks are under way or being launched in a number of metropolitan areas world-wide. Some of these projects involve sophisticated real time, traffic and transit monitoring and control systems. Transportation and other types of information such as "yellow pages" can be communicated to travellers by a variety of means.

This paper will outline opportunities in broadcasting with respect to these IVHS user services. In addition the paper will conduct a brief review of related enabling standards activites and IVHS projects such as MTO TravelGuide.

RÉSUMÉ

Les projets de systèmes de véhicules et d'autoroutes intelligents (SVAI) qui utilisent une diffusion multimodale de l'information vers des systèmes de guidage routiers, des appareils portatifs et des kiosques d'information des voyageurs, sont en cours de lancement dans un certains nombre de grandes villes du monde. Certains de ces projets utilisent des systèmes complexes de contrôle et de suivi de la circulation et des transports publics en temps réel. Des renseignements sur le transport ou divers types d'information de type «pages jaunes» peuvent être communiqués aux voyageurs par diverses gammes de moyens.

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INTRODUCTION

Intelligent Transportation System or ITS (formerly known as IVHS) is a new multi-billion dollar industry which involves transportation and communication technologies and infrastructure.

One goal of ITS is to enhance the efficiency of the transportation infrastructure. An example of efficiency enhancement is the optimal time synchronization of arterial signals taking into account historic travel pattern and real time traffic volumes.

Another ITS goal is to elevate the level of service to the travelling public through the availability of relevant real-time transportation and consumer services information like "on-line yellow pages".

Some of us in the ITS industry believe that the marriage of real-time goods and services pricing and transportation information to the consumer is an exciting one. After all, one usually shops at places that are familiar, partially due to the fact that one will not be lost. Now imagine the knowledge of "best price" of the desired item to go along with the assurance of not getting lost. How then, will this impact the way shopping is done? I believe cost effective wireless broadcast technology will play a key role in this scenario.

This paper will describe the ITS architecture in general terms. It will also highlight ITS user services and opportunities, taking into account enabling standards and status of the industry. Finally, it will suggest some possible next steps for the public and private sectors in Canada, to seize the opportunity that is now available.

ITS Architecture

The ITS architecture as viewed by the Society of Automotive Engineers can be summarized in figure 1.

The flow of information in this architecture consists of four distinct parts:

i. The link between road sensors, signal controllers and other road furniture to the Transportation Management Centres (TMC).

ii. The link between TMCs and Value Added Service Providers (VASPs) as well as TMC to TMC.

   An example of a TMC-TMC link would be TTC-TMC (Toronto Transit Commission) to MTO-TMC (Ministry of Transportation of Ontario). In Europe, there is a project to link the Dutch national TMC to the National German Police TMC to form an intelligent highway corridor.

iii. The link between VASPs and the actual consumer media transmitter.

iv. The link between the media transmitter and the end consumer receiver device.

Each of these four links will form part of the "information highway" in an appropriate manner taking into account business and technical issues.

ITS User Services

In 1994, the US Department of Transportation through the Federal Highway Administration published a list of ITS User Services as part of the $30 Million dollar national ITS architecture study.

The ITS User Services are as follows:

A. Travel & Traffic Management
  1. Pre-trip Travel information
  2. En-Route Driver Information
  3. Route Guidance
  4. Ride Matching and Reservation
  5. Traveller Services Information
  6. Traffic Control
  7. Incident Management
  8. Travel Demand Management

B. Public Transportation Management
  1. Public Transportation Management
  2. En-Route Transit Information
  3. Personalized Pubic Transit
  4. Public Travel Security

C. Traveller Payment
  1. Electronic Payment Services

D. Commercial Vehicle Operations
  1. Commercial Vehicle Electronic Clearance
  2. Automated Roadside Safety Inspection
  3. On-Board Safety Monitoring
  4. Commercial Vehicle Administrative Processes
  5. Hazardous Material Incident Notification
  6. Commercial Fleet Management

E. Emergency Management
  1. Emergency Notification & Personal Security
  2. Emergency Vehicle Management

F. Advanced Vehicle Safety Systems
  1. Longitudinal Collision Avoidance
  2. Lateral Collision Avoidance
  3. Intersection Collision Avoidance
  4. Vision Enhancement for Crash Avoidance
  5. Pre-Crash Restraint Deployment
  6. Safety Readiness
  7. Automated Vehicle Operation

Given the time and scope of this paper it would not be possible to discuss at length each of the (28+ and growing) user service. However, it should be obvious that the ITS framework yields unlimited possibilities for private/public partnerships to provide beneficial and profitable ventures.

For the broadcaster/datacaster, a sample set of ITS and ancillary User Services may include:

i. Real-time traffic/transit/weather information using the International Traveller Information Interchange Standard (ITIIS) format.

ii. Download and update full and abbreviated digital maps.

iii. Personal Paging.

iv. Differential Global Positioning System (GPS) correction signals.

v. As mentioned in the introduction, on-line "yellow pages" to match individual consumer "wish list" specifications with vendor submissions. ITS will help the consumer decide which vendor to buy from, and how to get there while bypassing construction and traffic jams. The quality of route guidance instructions to the consumer will somewhat depend on the hardware involved. However, the ITS architecture outlined allows for a vast variety of end consumer devices. They range from Interactive Television to TravelGuide to In-vehicle navigation systems.

A possible In-Vehicle data-bus structure to support services i. to v is outlined by figure 2.0 as provided by Chrysler.

The International Traveller Information Interchange Standard (ITIIS)

A key element to the success of Advanced Traveller Information Systems (ATIS) will be the ability to exchange traveller information between in-vehicle systems, traffic and transit information broadcasters, traffic control centres, police and fire departments, and transit authorities. The ability to exchange information will become increasingly important as fully integrated ITS systems are deployed.

Since different ITS applications will be using different communications media, hardware, and software, the exchange of information among different systems requires standard message formats for traffic data, road construction information, transit schedules, etc. There must also be a standard way of identifying road locations in order to pinpoint where incidents have occurred and to communicate that information to applications using different map databases.

The ITIIS standard consists of 5 parts, they are:

i. The message list

This list unambiguously defines the Traffic/Transit/Weather/Public Advisory condition. It is also language independent, thus allowing for end receivers to interpret the data in Italian as well as in English.

There is a cooperative effort between SAE and Enterprise (a consortium of primarily US State DOTs) to develop a comprehensive message list to support the full US FHWA 28+ IVHS user services. Negotiation are currently under way to submit the SAE list as the basis for an ISO standard. This is currently being negotiated in Paris (Dec 1994).

The message list is a particularly important item, as the content of the message lists will dictate what type information can be given. Which, in turn will affect consumer acceptance of a particular commercial ITS package.

ii. The Location Code

The Location Code is needed for different applications using different commercial digital maps to unambiguously pinpoint the locations of incidents, links, bus stops, etc.

iii. The Bearer Independent Format (BIF)

The Bearer Independent Format will allow the traffic management centre to collect information from a variety of sources, fuse it, and disseminate traveller information to a wide variety of Value Added Service Providers (VASPs) via the information super highway.

The main advantage of the BIF is that it is independent of any particular communications medium, therefore, it is by definition compatible with the various schemes of the information super highway.

Enterprise states is currently planning to field test an EDIFACT (ISO 9735) BIF. EDIFACT stands for Electronic Data Interchange For Administration, Commerce and Transportation. EDIFACT may play an important role in the deployment of "yellow pages" services in combination with Transportation data. In Europe, similar

EDIFACT field trials are being planned.

iv. The Bearer Application Protocols (BAPs)

A Bearer Application Protocol specifies the means of adapting the travel information defined in the BIF for presentation to the end user through a particular communications medium, such as Digital Radio (Eureka 147).

v. The Data Dictionary

The data dictionary will precisely define the terms used in the message list, as well as the context of the various technical modes of deployment.

MTO TravelGuide Project

An example of an ATIS device is the MTO TravelGuide. The TravelGuide concept is a low cost "palm top" type general purpose electronic personal assistant unit with special software and a RF receiver to provide real-time route guidance and transit information.

For the initial MTO TraveGuide demonstration, Traffic and Transit (ITIIS) data will be transmitted during the spring of 1995 in Toronto using the experimental Digital Audio Broadcasting transmitter operated by Digital Radio Research Inc (DRRI). The transmission of ITIIS data over DAB will be a world first.

The trial will be showcased in February 1995 at the Toronto International Auto show. An in-vehicle unit based on the TravelGuide prototype will interpret a real time ITIIS data stream, and convey the traffic and transit information in both official languages. This project is done in cooperation with DRRI[1], whose membership includes the CBC, private radio broadcasters and Cancom, and with Pioneer, Sony, Industry Canada and Chrysler Canada. So in addition to a technical prototype, we have a working model for future business arrangements, as all partners are bringing valuable expertise to the table.

There are also plans to deploy the TravelGuide/DAB demonstration in Montreal in cooperation with Transport Canada and the Ministry of Transportation of Quebec during 1995. Real time information will be provided by MTQ and is expected to include incident information from the Autoroutes Metropolitaine and Decarie.

CONCLUSIONS

In business, a desirable strategic position would be "on the ground floor" of a large emerging industry. ITS is a multi-billion dollar industry where no monopolies currently exists. Over the next few years, various communication medias will be competing vigorously to vie for market share to provide some of the 28+ user services outlined above.

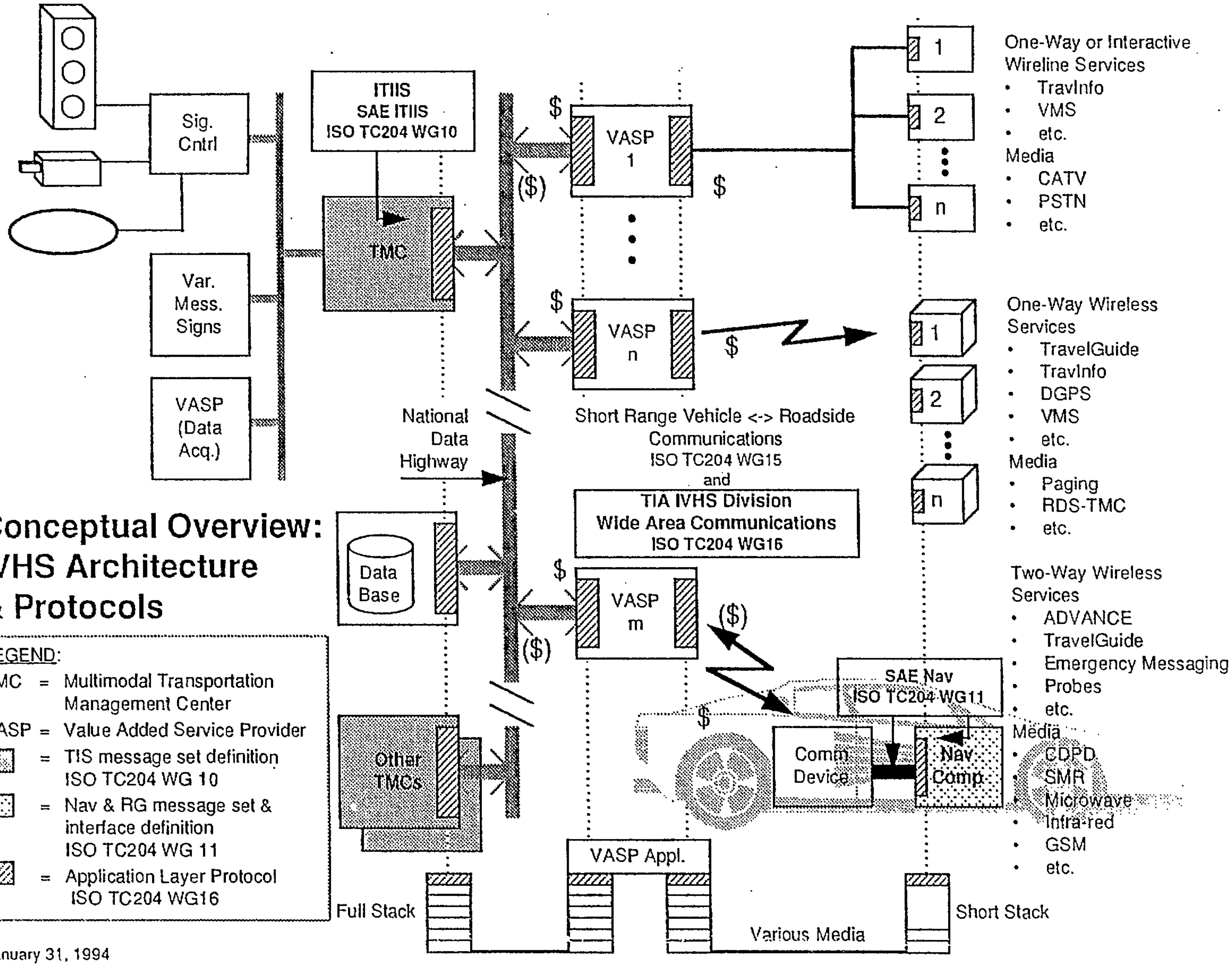
Canada has a strong telecommunications industry, therefore, Canada should be a major player in both ITS infrastructure and end user technology. Inaction to pursue these opportunities will force Canada to import technology from the US, Europe and Japan. This will be a tragady, especially in light of our huge national debt. Building a better mouse trap and creating a trade surplus is the only positive method of maintaining our high standard of living.

Canada needs to be active in shaping ITS in the United States and the world. IVHS Canada (soon to be ITS Canada) is the appropriate forum to form the

1 Digital Radio Research (DRRI) Inc. is a non-profit company with a mandate to conduct digital radio research and development. It is composed of CHUM Limited, Cogeco, Golden West Broadcasting, Okanagan Skeena Group, Power Broadcasting, Radiomutuel, Rogers Broadcasting, Shaw Radio, Telemedia Communication and Cancom. It's a mix of large and small companies, all betting that digital radio is their future. With the assistance of Industry Canada, the CBC and these private broadcasters, a budget of $2.3 million dollars has been raised to establish the now active digital radio transmitters in Montreal and Toronto.

necessary consortia to venture into this exciting industry.

IVHS Canada is a national forum designed to facilitate information sharing, foster the formation of Canadian Consortia and to assemble lobbying resources. For information on IVHS Canada, please call Dr. William Johnson of Transport Canada at (514) 283 0001. Dr. Johnson is the current Chairman of IVHS Canada. In addition, the author can be reached in Toronto at (416) 235-5021.

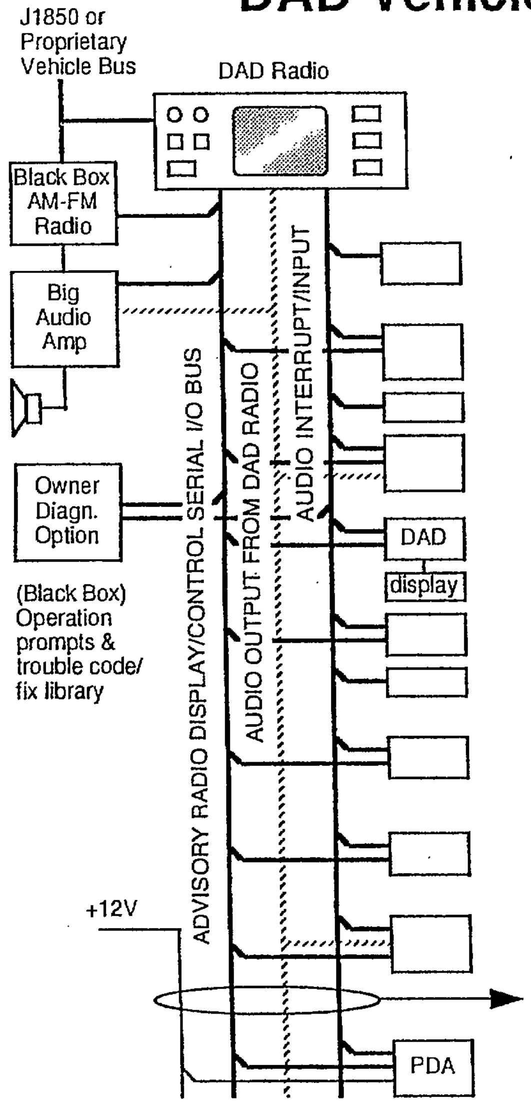


Conceptual Overview: IVHS Architecture & Protocols

LEGEND:
- TMC = Multimodal Transportation Management Center
- VASP = Value Added Service Provider
- [dotted box] = TIS message set definition ISO TC204 WG 10
- [dotted box] = Nav & RG message set & interface definition ISO TC204 WG 11
- [hatched box] = Application Layer Protocol ISO TC204 WG16

January 31, 1994

DAD Vehicle Open Architecture Concept



DAD = Driver Advisory Display

HARDWARE	PROVISIONS
Controls & display, AM, FM-ST receiver, vol, tone, bal, preamp functions, output amplifier.	Serial I/O bus (expandable), audio interrupt/ input, remote display/ controls (programmable), digital control, audio (line level) output, formattable display
Navigation/route guidance unit (stand alone), voice synthesis, advisories, GPS, etc.	Audio interrupt of radio
Navigation/route guidance unit (integrated black box)	System control via radio Nav/route display via radio
Cellular phone (stand alone)	Audio interrupt of radio when in use
Cellular phone (integrated)	System control/display via radio, except voice handset or hands free, auto "mayday" services
DAD receiver (1-way), voice synthesis, advisories, flexible as to reception freq, mode, etc., could be modular, expandable	Receives DAD channel(s), interrupts radio, control/display via radio, output to aux. display
2-way request for help/service	Defines service options
Basic paging receiver (1-way)	Normal paging services, audio interrupt on page or signal tone
Advanced paging unit (2-way)	Message alert/display on radio, programmable features with enhanced display, "mayday" services, all paging services available
Specialized mobile radio (1-way or 2-way)	• Taxi • EMS • Gov't • Service/business fleets
Vehicle location/ID, security systems, emergency beacon systems, ETTM	Flexibility for feature expansion and upgrade of systems
PPATIS I/O docking provisions (SAE)	
Use/charge/ expanded service for handheld/pocket electronic devices	Interface to on-board or other DAD systems to enhance or download data, etc.

DIAGRAM COURTESY IVY RENGA, CHRYSLER - 07/25/94

NOTES

ATM FOR MULTIMEDIA AND BROADBAND
ATM POUR MULTI-MEDIA ET Á LARGE BANDE

Claude Haw

Newbridge Networks Corporation
600 March Road
Kanata, Ontario, K2K 2E6

Abdul Lakhani

Telesat Canada
1601 Telesat Court
Gloucester, Ontario, K1B 5P4

BIOGRAPHY
CLAUDE HAW

Claude C. Haw graduated with a Bachelor of Engineering (Electrical) degree from Lakehead University in 1979 and is a member of the Professional Engineers of Ontario. He has worked for a number of communications organizations since 1975 including Department of Communications (Canada), Mitel Corporation, Leigh Instruments Limited and Newbridge Networks Corporation.

He is Vice President of the Fast Packet Networks Business Unit at Newbridge Networks Corporation in Kanata, Ontario. Claude is responsible for Asynchronous Transfer Mode (ATM), Frame Relay and X.25 Packet Switching products for Wide Area Networking (WAN) applications.

BIOGRAPHY
ABDUL LAKHANI

Abdul Lakhani is a Network Planning Specialist in the Future Technology Division of Telesat. His responsibilities are to investigate new technologies and concepts which will impact telecommunications networks and to develop plans for the Telesat Canada network evolution. He also provides technical support to other divisions in Telesat. He is currently leading an ATM team to both explore the ATM market and test ATM over satellite infrastructures. Mr. Lakhani has over 20 years of experience in the communications field in Africa, Europe and North America.

BIOGRAPHIE
CLAUDE HAW

M. Claude C. Haw a obtenu un baccalauréat en génie électrique de l'Université Lakehead en 1979 et il est membre de l'Association des ingénieurs professionnels de l'Ontario. Il oeuvre au sein de nombreuses sociétés de télécommunications depuis 1975, entre autres le ministère des Communications du Canada, la société Mitel, Leigh Instruments Limited et Newbridge Networks Corporation.

Il est vice-président de l'unité des réseaux commerciaux rapides à paquets, chez Newbridge Networks Corporation, de Kanata (Ontario). Il est chargé du mode de transmission asynchrone (ATM), des relais de trames et des produits de commutation de paquets X.25 destinés à des applications sur grand réseau (WAN).

RÉSUMÉ

Le mode de transmission asynchrone ou ATM, a été normalisé comme infrastructure de commutation et de télécommunication par l'UIT-T (anciennement CCITT). La majorité des administrations de télécommunications dans le monde prévoient, ou sont en train de réaliser, une expansion majeure des services et des technologies fondés sur l'ATM. L'évolution rapide et la compatibilité de ces normes a été encouragée par le Forum sur l'ATM, organisme spécial constitué de vendeurs de matériel, de fournisseurs de services et d'utilisateurs finals.

L'ATM, ou relais de cellules, repose sur un paquet

ABSTRACT

Asynchronous Transfer Mode or ATM has been standardized as a communications transport and switching infrastructure by ITU-T (formerly CCITT). Roll-out of ATM-based services and technology is underway or planned by most telecommunications administrations around the world. The fast evolution and agreement of these standards has been promoted by the ATM Forum, an ad hoc body represented by equipment vendors, service providers and end users.

ATM or cell relay is based on a standard, fixed length packet called a cell. A cell consists of 48 bytes or octets of information to be transported or switched and a 5 byte or ocxtet leader which contains addressing or routing and priority information. By having a standard cell size it is possible to transport and switch a variety of information at broadband rates.

ATM switching equipment is now being deployed by network service providers around the world to provide cell relay, frame relay and packet services to end users. In addition this equipment is also being used to provide legacy services including high speed LAN interconnection, premium video as well as transport of circuit mode voice and data.

New applications, not previously possible, and a wide range of existing applications are now economically feasible due to ATM deployment. These applications include distance learning, remote medical consultation, remote access to super-computers, wire speed LAN interconnection, shared simulations, etc.

This paper outlines the background, current status, applications and ongoing issues associated with ATM or cell relay switching. The state of the various standards activities and the range of applications made possible by ATM are also detailed.

normalisé de longueur fixe, appelé cellule. Une cellule comporte 48 octets d'information qui doivent être transportés, ou commutés, et une amorce de 5 octets qui contient l'information d'adressage ou d'acheminement et l'information prioritaire. L'uniformisation des formats de cellules permet de transporter et de commuter toute une gamme d'informations aux vitesses des larges bandes.

Dans le monde entier, les fournisseurs de services déploient présentement du matériel de commutation ATM afin d'assurer aux utilisateurs finals des services de relais de cellules, de relais de trames et de commutation de paquets. De plus, ce matériel permet d'utiliser des services par délégation, y compris des interconnexions à haute vitesse de réseaux locaux, des transmissions vidéo de qualité supérieure, ainsi que le transport de la voix et des données par commutation de circuits.

De nouvelles applications, impossibles auparavant, et une vaste gamme d'applications actuelles, sont maintenant économiquement rentables grâce au déploiement de l'ATM. Ces applications comprennent le téléapprentissage, les consultations médicales à distance, l'accès éloigné aux superordinateurs, les interconnexions de réseaux locaux, les simulations partagées, etc.

Le document décrit les antécédents, la situation actuelle, les applications et les problèmes permanents reliés à l'ATM ou à la commutation des relais de cellules. L'état de l'activité entourant les diverses normes et la portée des applications rendues possibles par l'ATM sont aussi décrits en détails.

ATM FOR MULTIMEDIA AND BROADBAND
ATM POUR MULTI-MEDIA ET Á LARGE BANDE

Claude Haw

Newbridge Networks Corporation
600 March Road
Kanata, Ontario, K2K 2E6

Abdul Lakhani

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1601 Telesat Court
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I. OVERVIEW

Asynchronous Transfer Mode or ATM has been standardized as a communications transport and switching infrastructure by ITU-T (formerly CCITT). Roll-out of ATM-based services and technology is underway or planned by most telecommunications administrations around the world. The fast evolution and agreement of these standards has been promoted by the ATM Forum, an ad-hoc body represented by equipment vendors, service providers and end users. The details of the ATM terminology and the state of the standards are described in the Section 2.

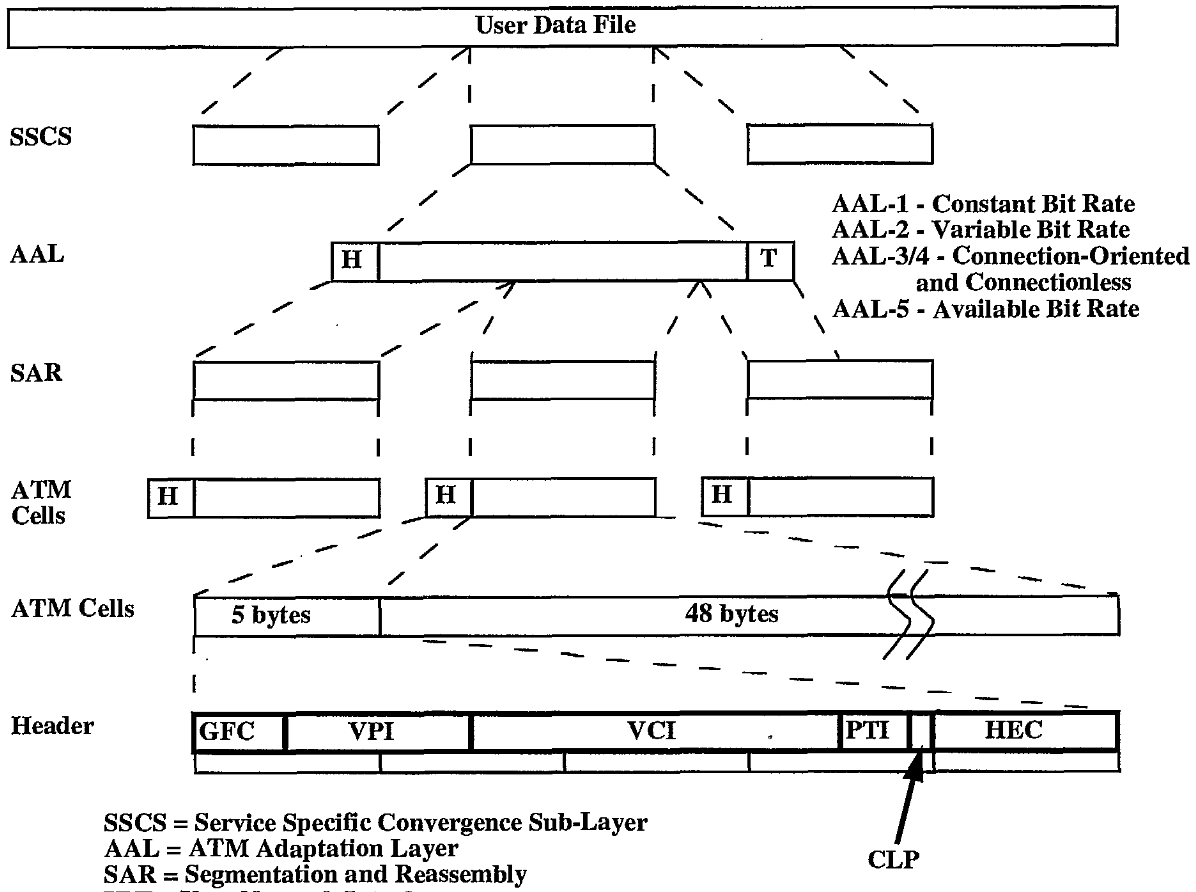
Although a number of possible broadband switch architectures have been defined, a couple have received general acceptance at this time. These are outlined in Section 3. Section 4 describes a number of real applications which, in many cases, allow end user applications which were either impossible or not cost effective until the advent of broadband technologies.

II. ATM STANDARDS

ATM or cell relay is based on a standard, fixed length packet called a cell. A cell consists of 48 bytes or octets of information to be transported or switched and a 5 byte or octet header which contains addressing or routing and priority information. By having a standard cell size it is possible to transport and switch a variety of information at broadband rates. In this paper all discussions are oriented to the User - Network Interface (UNI). Please refer to Figure 1 for a pictorial representation of the ATM cell structure.

The user data file or data stream is prepared for transmission by passing through the Service Specific Convergence Sublayer (SSCS) which essentially converts the data stream to variable length packets. Note that for many types of information the data is already in this form. The ATM Adaptation Layer (AAL) then adds Header (H) and Tailing (T) information to allow end to end error control. Each AAL frame is then segmented by the Segmentation and Reassembly (SAR) function into uniform 48 byte blocks of information. Each block of information has 5 bytes of cell header attached to make an ATM cell of 53 bytes. All types of information is transmitted through the network in standard 53 byte cells using the same structure for addressing. This allows the switching hardware to be optimized for high speed, low delay switching of broadband information.

The cell header consists of five bytes or 40 bits of addressing and control information. The first 4 bits are reserved for Generic Flow Control (GFC), currently unused, followed by 8 bits for Virtual Path Identifier (VPI), 16 bits for Virtual Connection Identifier (VCI), 3 bits for Payload Type Identifier (PTI), 1 bit for Cell Loss Priority (CLP) and 8 bits for Header Error Check (HEC). The VPI/VCI together define the virtual circuit with a given origination and destination and is used by switches to route the cells. The PTI and CLP bits are used in determining the priority for queuing and transmission on



SSCS = Service Specific Convergence Sub-Layer
AAL = ATM Adaptation Layer
SAR = Segmentation and Reassembly
UNI = User-Network Interface
GFC = Generic Flow Control
VPI = Virtual Path Identifier
VCI = Virtual Circuit Identifier
PTI = Payload Type Identifier
CLP = Cell Loss Priority
HEC = Header Error Control

Figure 1. ATM Cell Structure and Mapping

outgoing links. The CLP bit indicates whether a cell may be discarded either because the originator has marked it so or the switch at entry to the network has determined that the originator has exceeded his guaranteed cell rate. Cells are only discarded when congestion occurs or a bad cell header is received. The HEC contains the Cyclic Redundancy Check (CRC) across the five byte header and is used to correct all single bit errors and detect all other errors.

As shown in Figure 1, there are a number of ATM Adaptation Layers (AAL) defined, although they are not all in general use today. AAL-1 is intended for connection oriented Constant Bit Rate (CBR) traffic like voice and video. AAL-1 is used to emulate familiar network services such as T-1, E-1 and DS-3, commonly referred to as circuit emulation. The incoming bit stream is converted to cells to be reproduced completely intact at the other side of the ATM network. Video services can be carried
in the same way as they would over a dedicated transport service. Because CBR traffic is generally of a time sensitive nature there is no guarantee of delivery in the AAL-1 overhead.

AAL-2 has been defined for connection oriented

Variable Bit Rate (VBR) with transport of timing end to end. This AAL is not in common use today. AAL-3 (Connection Oriented VBR) and AAL-4 (Connectionless VBR) have been combined into a single AAL-3/4 which is the preferred method for transport of connectionless services such as SMDS and IEEE 802.6 MAN information.

The final ATM Adaptation Layer type, AAL-5, is now referred to as Available Bit Rate (ABR) and sometimes as Simple and Effective Adaptation Layer (SEAL). AAL-5 is very efficient for variable length packet traffic such as that found in common Local Area Network (LAN) and Frame Relay networks.

Several refinements to the existing ATM and Broadband standards are in process at the ATM Forum, T1 Committees (T1S1 etc.), ITU-T etc. In addition, there are significant activities by a number of related groups to allow the various types of standard information to be accommodated in an efficient manner in the new broadband networks, especially for transport over ATM. These groups include IEEE (LAN standards), IETF (LAN focus) and MPEG (compressed video focus). The energy of these groups is being devoted to agree on standards which allow the various broadband networking applications possible.

III. ATM SWITCHING EQUIPMENT

ATM switching equipment is now being deployed by network service providers around the world to provide cell relay, frame relay and packet services to end users. In addition this equipment is also being used to provide legacy services including high speed LAN interconnection, premium video as well as transport of circuit mode voice and data. End users are starting to deploy ATM switches to address the scalability issues in their local networks.

Because ATM is based on a very simple cell structure which is common to all types of traffic, it is possible to scale the switching equipment to support very high cell transfer rates. It is still necessary to choose the appropriate architecture for the switch to ensure that the traffic will be handled with acceptable Quality of Service (QoS) parameters, i.e. with acceptable delay and cell loss characteristics.

The most common switch architectures which have been proposed for broadband applications are crosspoint matrix, shared bus/shared memory, banyan matrix and broadcast matrix. Although some interesting applications exist for the cross point matrix switch, particularly for narrowband requirements, it is now generally agreed that due to performance problems it is not acceptable for broadband applications.

The shared bus/shared memory architecture is very common for packet switches today and therefore is worthy of discussion in the context of broadband systems. Although current technology will allow ATM switches to be constructed using shared bus techniques, they are limited to around 1 Gb/s today.
The cost of implementing large systems with this architecture increases rapidly with size and therefore it is generally applicable for small switches only. This architecture is very applicable to multiplexer or concentrator applications where high throughput is not required.

Banyan or Batcher-Banyan matrix switches use a self routing header which allows each cell to navigate from the input port to the output port through an number of switching stages. Each stage makes the switching decision based on the information contained within the cell header. This architecture allows for very efficient and therefore very high speed switching elements. Unfortunately this architecture results in high cell loss due to collisions which occur when two cells arrive simultaneously at a switching element. This can be overcome by adding buffer memory at each switch element but this results in longer delays, variable delays and excessive complexity. In addition the Banyan switch does not handle broadcast messages, or multicast as they are commonly referred to in ATM-speak. Because of these problems, few, if any commercial switch implementations use these architectures.

The most common and widely accepted architecture for broadband switches is the Broadcast matrix, also called direct-wired, output buffered. This architecture is shown in Figure 2 below. When a cell arrives at an input a self-routing header is attached (as in the Banyan matrix), but instead of traversing multiple switching stages, is broadcast to all output ports over dedicated paths. Each output port simply throws away those cells which are not destined for that port. This technique handles the broadcast or multicast situation very well since the cells are broadcast by default. Buffering is required at the output

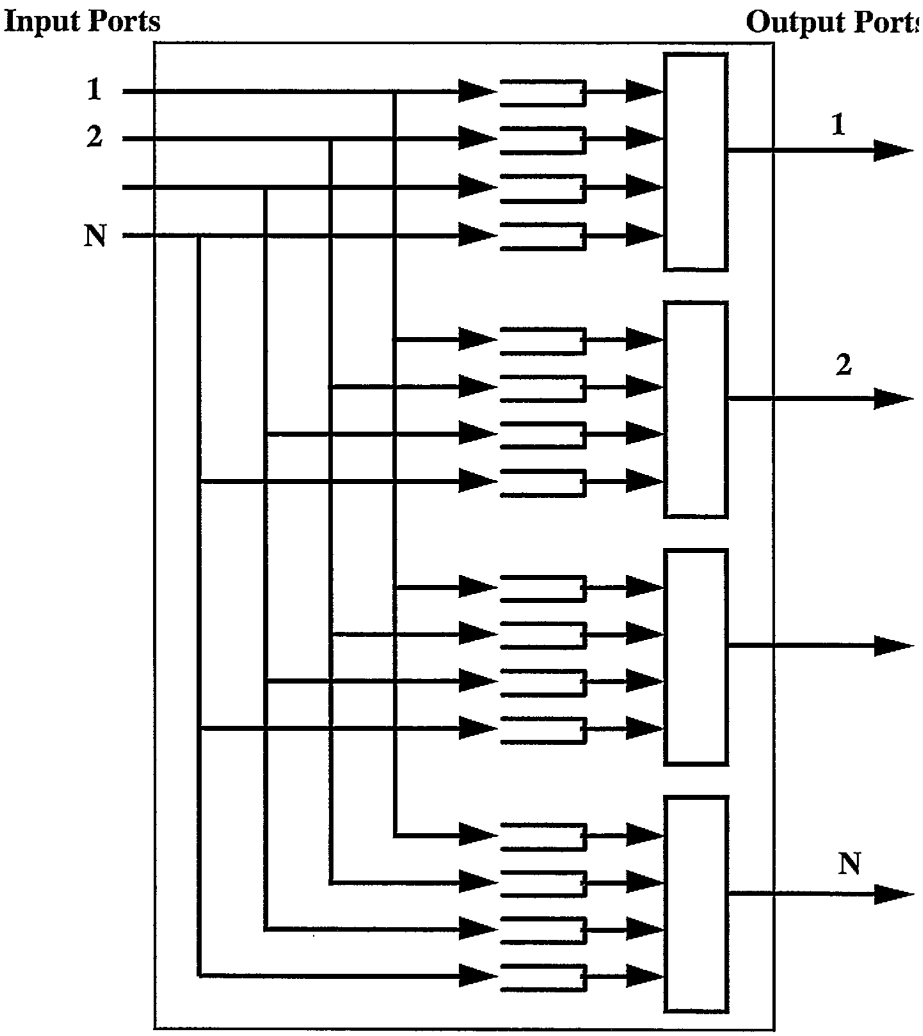


Figure 2. ATM Switch Architecture - Broadband Matrix

to handle the event that multiple inputs have information for an output port at the same time. The major issue with this architecture is proper management of the output buffers to ensure high throughput, low
delay and low cell loss. Each of these parameters may vary depending on the type of traffic being carried, i.e. low delay is critical for CBR traffic while high throughput and low cell loss is more important for ABR traffic. This architecture results in the most predictable behavior and scales well to large sizes. For very large switch requirements,

multi-stage configurations a possible.

Although a number of switch architectures are possible for broadband systems as described above, the most common are the shared bus/shared memory approach for low end concentrator systems and the broadcast matrix for backbone and access switches. The Newbridge *36150 MainStreet* Access Switch and the *36170 MainStreet* Backbone Switch both have a Broadcast matrix architecture.

IV. BROADBAND APPLICATIONS

New applications, not previously possible, and a wide range of existing applications are now economically feasible due to ATM deployment. These applications include distance learning, remote medical consultation, remote access to super-computers, wire speed LAN interconnection, shared simulations and more. Figure 3 provides a pictorial representation of some of these applications, including some which can be made available to users who are located in sparsely populated and remote communities.

The role of satellite networks is of strategic importance for communications in this new environment and specifically so in Canada because a significant proportion of its population resides in under served areas. The role of satellite communications is also of strategic importance in developing countries where terrestrial networks cannot be economically and rapidly deployed. COMSAT in the United States has been experimenting with ATM formatted DS3 (45 Mbps) satellite links and has demonstrated such a link for a number of applications. Telesat Canada recognizes the importance of satellite networks in the information highway era and has been working on developing it's own infrastructure that is compatible with the terrestrial networks to offer seamless services over hybrid networks and to be able to export this technical know-how to the rest of the world.

Telesat believes that a two pronged approach is essential to realize the information highways:

¥ Develop terrestrial/satellite hybrid infrastructures based on ATM technology

¥ Concurrently, develop new applications which can be supported on these new infrastructures

One without the other will seriously hinder the realization of the information highways. The developed infrastructures can support several applications envisaged in the information highway era including:

<u>Medical Applications</u>: These can be realized by interconnecting hospitals, clinics and distant medical posts with the possibility to exchange medical data e.g. view and diagnose X-rays and CATSCANs. The same sessions could be used to educate and train personnel. These applications are now running in live ATM based networks such as the Texas Video Showcase.

<u>Industrial Applications</u>: These can be realized by interconnecting companies and institutions spread over several locations in developed and under-developed areas and communicating via data, voice, image, video and multimedia. For example, robots in mining environment in remote locations in Canada can be monitored and controlled from the comfort of office environment. Helicopters surveying forests can be viewed from central locations. Off-shore platforms can be in communication with their respective offices.

<u>Distance Learning Applications</u>: These can be realized by interconnecting companies and institutions to effectively and efficiently train personnel dispersed over wide geographical distances. For example, teachers, lecturers and instructors can conduct interactive multimedia sessions with students and company personnel.

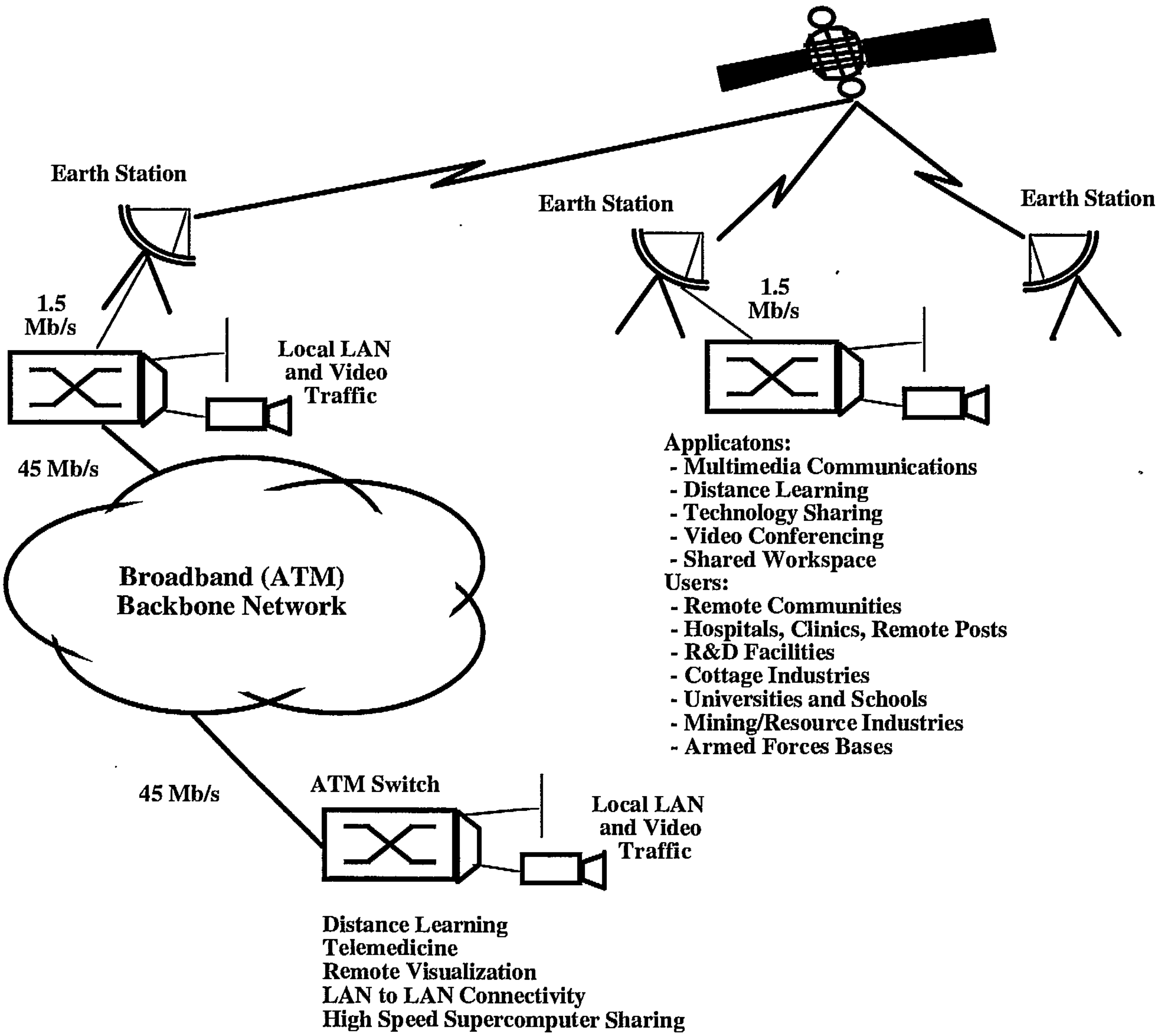


Figure 3. Broadband Multi-Media Applications

The message from these examples is that ATM formatted satellite links can support multimedia applications. Moreover, the use of ATM technology provides the mechanism for integrating terrestrial and satellite infrastructures to form hybrid networks.

The development of such applications is underway and organizations and institutions are being asked to participate in setting up actual field trials. To make this happen now, Telesat and Newbridge are promoting the use of in-place ATM based terrestrial/satellite networks e.g. OCRInet in the Ottawa Carleton region that connect hospitals, universities and various industrial sectors. The reach of the terrestrial portions of these networks can be extended to any part of Canada and the United States. Various organizations have interest in the applications discussed and field trials are now in progress. Interested parties are being offered support to design and develop the infrastructures. Additionally, Telesat is offering the use of satellite space segment at no cost for non-commercial experimentation, on an as-available basis to these experimenters to the end of 1995.

V. EXPERIMENTAL WORK

For broadband networks, Asynchronous Transfer Mode (ATM) has been selected as the switching technique. It is seen as the target technique for unifying a variety of networking requirements and to support many applications, e.g., LAN interconnection, Metropolitan Area Networks, Wide Area Networks, voice, data, image video and multimedia.

The initial data rates specified for ATM at the user interface (45, 155 and 622 Mbps full duplex) are required for the high-end applications. However, lower speed access at T1 (1.544 Mbps) and E1 (2.048 Mbps) will be essential for satellite use and because the terrestrial infrastructure for which ATM was designed will not be immediately available everywhere.

ATM technology is first being implemented in the local area followed by metropolitan areas, creating local ATM islands which are being interconnected by ATM trunks. The advantages derived from the use of satellite links for interconnecting these ATM broadband islands are apparent: easier set-up of the network infrastructure, rapid reconfiguration of the network, inherent possibility to implement multicasting and wide area coverage potential. It is, therefore, expected that satellite systems can play a major role in the evolving broadband networks. Telesat is playing an active role in experimenting with ATM technology over satellite and promoting and demonstrating different applications. A brief report of these activities is provided here.

The experimental work is aimed towards the integration of communications satellites in fast packet switching (ATM) networks. This involves the identification of the strategic areas to be addressed by satellite communications systems, leading to the development of equipment or systems necessary for this purpose. The experimental work is being handled in the following manner:

<u>Analysis of ATM Networks and Service Deployment</u>

ATM is seen as the unifying technology between the corporate LAN/WAN and the public networks and for applications based on all media including data, voice, image, video and multimedia. Additionally, ATM hybrid networks could provide seamless services in under served areas.

<u>ATM Compatible Satellite System Design</u>

Telesat has put together a test-bed with readily available hardware and software. The configuration is based on the current supply of hardware and software in the early days of ATM technology. An ATM formatted T1 satellite link connects the remote location and the central site and an ATM formatted DS-3 link connects Telesat and CRC via OCRInet. These form a hybrid network. Multimedia traffic is generated by SPARC workstations equipped with Insoft Communiqu• software. This traffic goes over Ethernet segments using TCP/IP protocol. These streams are converted to T1-ATM and then carried over the satellite. Two Newbridge *36150 MainStreet* switches connect the Ethernet segments to the OCRInet for the terrestrial link.

These demonstrations illustrate the capability of satellite links to provide remote access multimedia communication. In essence, anyone, anywhere (with an earth station) can communicate at anytime.

<u>ATM compatible satellite system performance evaluation</u>

To date, measurements have been performed at the TCP/IP level, in absence of T1 ATM test equipment, and visual inspections. The performance has been excellent when the satellite link Bit Error Rate (BER) has been 10E-7 or better. More tests and performance evaluations are planned.

Telesat plans the following activities:

¤ Conduct tests at E1 (2.048 Mb/s), E3 (34 Mb/s) and DS3 (45 Mb/s) speeds at physical, ATM adaptation and higher (e.g., TCP/IP) layers

¤ Participate in the VISTAR project to develop TDMA access terminals

¤ Work with COMSAT to use Link Enhancers to allow operation at BER lower than 10E-7

¤ Work with vendors to develop components for hybrid networks which will allow seamless services over these networks

¤ Actively work with experimenters to design and develop ATM based infrastructures and demonstrate new applications

¤ Closely work with Stentor to develop ATM based hybrid networks

Newbridge plans the following activities:

¤ Work with a variety of other vendors to ensure interoperability of ATM equipment

¤ Work with a variety of applications developers to increase the number of multi-media and other applications available to end users and service providers

¤ Develop, with partners and affiliate companies, a range of applications including telemedicine, distance learning, remote visualization, information kiosks, etc.

¤ Continue to enhance the ATM family of products to allow a feature rich infrastructure to support a broad range of applications.

VI. CONCLUSIONS

A wide variety of broadband applications are now being implemented for both experimental and commercial use based on the standard ATM techniques. This is expected to very a very high growth area as a complete range of new end user applications become possible over the local and wide area network. Broadband networking and ATM techniques make entirely new applications possible and also make existing applications more cost effective to achieve wide spread deployment.

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ADVANCED TELEVISION
TÉLÉVISION AVANCÉE

William Sawchuk

Vice President
Communications Research Center
3701 Carling Avenue
Ottawa, Ontario K2H 8S2

BIOGRAPHY

William Sawchuk is Vice President of the Radiocommunications and Broadcast Research Branch at the Communications Research Center, Department of Industry Canada. This Branch is responsible for research into radiocommunications, broadcast and related technologies, systems and networks. Dr. Sawchuk has an engineering degree from the University of Saskatchewan and a doctorate in physics from the University of Calgary. Since joining the federal public service in 1974, he has held a variety of research and managerial positions in various areas of communications and information technology.

BIOGRAPHIE

William Sawchuk est vice-président de la Direction générale de la recherche en radiocommunications et en radiodiffusion au Centre de recherches sur les Communications d'Industrie Canada. Cette direction est responsable de la recherche sur les radiocommunications, la radiodiffusion ainsi que les technologies, systèmes et réseaux connexes. M. Sawchuk possède un diplôme en génie de l'Université de la Saskatchewan et un doctorat en physique de l'Université de Calgary. Depuis son entrée dans la fonction publique en 1974, il a occupé divers postes de recherche et de gestion dans divers secteurs de la technologie des communications et de l'information.

ABSTRACT

Advanced television technology has entered a new phase with the development of a fully digital, high definition television (HDTV) systems in the United States, Europe and Japan. At the same time, 525-line formats, that use digital video compression techniques to improve image quality while minimizing bandwidth, have generated great interest.

This paper outlines digital advanced television approaches and assesses their characteristics in terms of standards development and spectrum requirements. Particular consideration is given to digital transmission in an over-the-air environment and interoperability with other service delivery modes. As well, an update is provided on the

RÉSUMÉ

La technologie de la télévision de pointe est entrée dans une nouvelle phase avec la création de systèmes entièrement numériques de télévision haute définition (TVHD) aux États-Unis, en Europe et au Japon. Par la même occasion, des formats 525 lignes, qui utilisent les techniques de compression vidéo numérique pour améliorer la qualité de l'image tout en réduisant le plus possible la largeur de bande, ont suscité beaucoup d'intérêt.

Ce document décrit des méthodes numériques pour la télévision de pointe et évalue leurs caractéristiques par rapport à l'élaboration de normes et aux exigences du spectre. Une attention spéciale est accordée à la transmission numérique en direct et à l'interfonctionnement avec d'autres modes

evaluation of advanced television systems being done at the CRC.

de prestation de services. Il contient aussi une mise à jour sur l'évaluation des systèmes de télévision avancée effectuée par le CRC.

ADVANCED TELEVISION
TÉLÉVISION AVANCÉE

William Sawchuk, Bernard Caron & Metin Akgun

Communications Research Center
3701 Carling Avenue
Ottawa, Ontario K2H 8S2

1. Introduction

The color television technology now used in North America is over 40 years old. It requires channels with a 6 MHz bandwidth. Moreover in order to permit sufficient coverage and to avoid mutual interference of television transmission only a few of the available channels can be used in a given area. The channel allocation rules which are governed by such considerations result in an inefficient use of the existing television broadcast spectrum. At the time when NTSC television was introduced there were only a few other radio communications services that were utilizing the VHF and UHF bands, hence this matter was not of concern. Today however, new services such as cellular telephone have transformed the spectrum into a "hot commodity" worth millions of dollars. It is therefore very important that new television systems be spectrum efficient, and permit, if possible, the re-use of some parts of the present television broadcast spectrum for other services in the future.

2. HDTV Development

Early research on higher definition television started in the 1970's in Japan. This resulted in the analog MUSE system which has roughly twice the resolution in both the horizontal and vertical direction as well as a wider picture aspect ratio: 16:9 instead of the 4:3 of NTSC. Such television images carry about 5 times (30 MHz) the information of a comparable NTSC image. It is obvious that in the late 1980's, when this service was considered, a bandwidth of 30 MHz per program was not available in the spectrum. The Japanese MUSE HDTV system reduces this requirement to only 9 MHz using signal compression techniques. Moreover, since the MUSE system was not intended for terrestrial broadcasting, but for direct-to-home broadcasting via satellite, it did not place additional demands on the VHF and UHF television broadcast spectrum.

3. HDTV Development in North America

HDTV system developments seriously started in 1987 with the appointment by the FCC in the US of the Advisory Committee on Advanced Television Service (ACATS) to advise the FCC "on the facts and circumstances regarding Advanced Television (ATV) systems...". Its membership was drawn from a wide spectrum of the television industry. In Canada in the same year an industry-government committee, Canadian Advanced Broadcast Systems Committee (CABSC) was formed to deal both with future television as well as radio broadcast systems. It since has evolved into the Advanced Broadcast Systems of Canada (ABSOC), an industry association and the Joint Technical Committee on Advanced Broadcasting (JTCAB), an industry/government committee.

With the possibility of terrestrial HDTV service emerging, the FCC issued a number of directions to the industry: make use of the existing TV broadcast spectrum; abide by the present 6 MHz channeling plan; enable all existing TV broadcast stations to acquire spectrum for HDTV broadcasting in addition to their NTSC service; provide same coverage for HDTV as for NTSC and maintain NTSC service for a limited time such as 15 years along-side HDTV.

During the first phase of HDTV systems development, it was General Instrument that proposed and demonstrated for the first time a fully digital ATV system that could be transmitted over a 6 MHz channel. The first phase of ATV systems evaluation and selection process, in which Canada participated by carrying out the subjective assessment of all proposed systems at CRC's Advanced Television Evaluation Laboratory, was completed in February 1993. At that time, the ACATS decided that further work was to be carried out to implement improvements on the four digital television systems that remained under consideration. With a decision of the seven companies, who had developed these systems, to form a Grand Alliance, and pursue jointly the development of only one digital HDTV system, the North American ATV system selection process has entered into its second phase. Present schedules call for the completion of laboratory and field tests in 1995 with a recommendation for an HDTV emission standard in late 1995.

4. International Development

In parallel to these developments in North America the International Organization for Standards (ISO) has been active in its Moving Picture Experts Group (MPEG) to develop a family of video compression standards that could be used in communications, computers and broadcasting and would thus provide full compatibility between different applications. This standard, which was just approved in November 1994, is known as MPEG-2. Canada has significantly been involved in both the development of the MPEG-2 standard as well as in its adoption for the North American HDTV system currently being developed by the Grand Alliance in the U.S.

Europe is also now moving towards a digital standard and high definition television. More than 130 organizations are working together on a Digital Video Broadcasting (DVB) Project to build a family of digital television systems for satellite, cable, and terrestrial broadcasting. Agreement has already been reached on standards to be used for delivery of standard definition television via cable and satellite. These systems will also be based on the MPEG-2 standard. However, the modulation technology may differ from the one currently adopted by the Grand Alliance HDTV System. The Communications Research Centre together with interested Broadcasters in Canada and the U.S. are currently carrying out comparative studies to evaluate the respective merits of single- and multi-carrier modulation technologies considered in Europe and North America.

5. Some Characteristics of Digital Television

The characteristics of digital television will have a significant impact on spectrum usage. For example, in order to achieve a satisfactory television picture, an analog system such as NTSC, requires a signal to noise ratio of about 40 dB or better. For digital television, the requirement is significantly lower, in the order of 20 dB. Consequently at the same frequency to achieve the same coverage, much lower transmitter power will suffice. In the analog world the quality of the received signal may either be degraded by noise or co- and adjacent channel interference. Therefore to avoid interference problems in the analog world in a given service area, taboo channels are defined which cannot be used. Since the spectrum of digital television is very much like white noise, interference from co- and adjacent channels can be treated almost like noise. In combination with the fact that the signal level of digital television can be significantly lower, this permits the use of certain taboo channels for ATV service in an NTSC environment without causing noticeable interference into the existing NTSC service or an adjacent ATV channel. This results in a much more efficient use of the TV broadcast spectrum.

It is expected that to protect the consumers investment in television equipment NTSC service will continue for some time. The experience with HDTV picture compression techniques has shown, and since also practically demonstrated, that NTSC-quality television can also be transmitted digitally in only a fraction of a standard television channel. This fact has not gone unnoticed by both the cable and the satellite broadcasting industry, who are expected to take advantage of this fact to provide significantly more NTSC-quality television programming on existing transmission media, thus lowering the cost of service, and in particular making Direct-to-Home (DTH) satellite service competitive. Depending on program material and transmission channel conditions, anywhere between 3 to 8 programs could be broadcasted instead of one analog program. The cost of providing digital-to-analog set-top converters to enable consumers to continue using their NTSC receivers is more than compensated for by the ability to provide more service without the need for costly transmission plant upgrades. As we all know it is only a matter of time, and a rather short time at that, until we will see digital NTSC-quality television services being introduced by cable and satellites. This is the beginning of the 300 television channel world. Or more?

The interesting question is what will be the impact of digital transmission techniques on terrestrial television and on the use of the spectrum?

6. Future Evolution of ATV and the Spectrum

NTSC television and ATV are expected to co-exist for many years. A significant gain in spectrum efficiency will already be achieved by using digital transmission techniques to provide one new ATV service for each existing NTSC service without increasing the spectrum allocated to television broadcasting. This, essentially, doubles the number of television broadcasts with no need for new spectrum!

In the future when NTSC services will cease to exist, the 6 MHz band allocated for this service could be used in a number of ways.

1. The channel may not be used any longer for television broadcasting. The new ATV service will replace it.

While no detailed studies have been carried out, it is estimated, based on current knowledge of digital television, that perhaps 30% or even 50% of the spectrum could be saved. A new spectrum use and channel allocation plan would be required that may allow the allocation of part of the television broadcast band to emerging new wireless communications services.

2. There may be a need for terrestrial digital TV broadcasting services of an NTSC-like quality similar to services that will soon be available on cable and satellites. Two scenarios are possible:

   i) Each broadcaster may be licensed for only one NTSC quality digital TV service;

   ii) Each broadcaster may be licensed for the use of a 6 MHz channel that could provide multiple TV programs or a mix of TV programs and other services.

In the first scenario the single digital TV service will not require a full 6 MHz channel; perhaps 3 to 4 programs could share it. For spectrum efficiency reasons, new channel allocation rules need to be established. It is entirely conceivable that a single transmitter with a 6 MHz or even 12 MHz (two adjacent channels) bandwidth could be shared by several broadcasters. This concept is already being considered for digital radio broadcasting in the L-band, although for other reasons.

In the second scenario the opportunity for delivering more services emerges. Even in this case by using a second channel for digital broadcasting, rather than analog NTSC broadcasting, spectrum efficiencies could be achieved because of the changing sensitivities of mutual interference.

3. Some of the digital TV services (NTSC quality as well as HDTV) could be

delivered by satellite.

While in many instances TV service may be considered a local community service, independent of services provided in other communities, there are also many services that are provided nationally or regionally. The proven technology of today is to repeat the broadcast with a number of suitably located terrestrial television transmitters in that region, each transmitter being assigned a different frequency in accordance with the existing channel allocation rules. Such a use of the spectrum is rather wasteful, but was a necessity up until now.

With the introduction of digital television, at least for NTSC-quality television programming, a much better usage of satellite transponder capacity can be achieved, thus reducing the cost per program and making DTH broadcasting much more competitive. The soon to be introduced discretionary DTH television programs via satellite are expected to prove not only the technical but also economic viability of television service delivery via satellites. Consideration needs therefore to be given to also move other free (advertiser funded) television services to satellite.

4. Consideration could be given to low power cellular television ("wireless" cable).

The cellular service concept is well known and used in wireless communication. By using low power transmitters a high re-use of limited spectrum is achieved. Assuming that no mobile television is considered, the issue of handing over the communication from one cell to the other would disappear and with it the potential of any hand-over glitches. Cellular television is already being trialed in both the US and Canada at 28-29 GHz using analog techniques. With the introduction of digital techniques the number of multiplexed television programs can be significantly increased. Digital cellular television may therefore also be an approach to replace present terrestrial television broadcast services and thus release at least part of the spectrum under 1 GHz to other users.

7. Summary

The introduction of digital technologies for television broadcasting has opened up the possibility for a more efficient use of the current VHF and UHF spectrum allocated to television broadcasting, in particular after the current analog NTSC system is phased out. New spectrum and channel allocation plans and rules need to be established to provide long-term guidance to broadcasters in the introduction of digital television services. Moreover advantage can be taken of the fact that current NTSC-quality digital television services, should they be needed in the future, would require a transmission channel which is significantly less than 6 MHz. Consideration needs therefore to be given to multiplexing several programs from different broadcasters onto a single transmitter similarly as has been proposed for digital radio broadcasting. Furthermore providing some of the television services via satellite or cellular systems at microwave frequencies could free further VHF and in particular UHF spectrum. It would be unrealistic to assume that the amount of spectrum currently assigned to television broadcasting can be retained in the longer term when significant efficiencies can be gained with available technical alternatives.

These are challenges the broadcasting industry and the government, who is responsible for the management of the spectrum for the benefit of all users, must face and resolve in order to be ready for the 21st Century.

WIRELESS DATA - CHALLENGES AND PROMISES
DONÉES SANS FIL - DÉFIS ET PROMESSES

John Chung

MPR Teltech Limited
8999 Nelson Way
Burnaby, British Columbia
V5A 4B5, CANADA

1 INTRODUCTION

The demand for wireless communications has experienced tremendous growth in the past decade as the customer base for paging and cellular services has reached 20 million and 19 million in North America respectively.

With the continuous growth of the mobile workforce, wireless data is now poised to be the next phase of the wireless revolution. As companies continue to reduce costs, increase productivity and provide better customer services, wireless data services provide the capability to meet some of these goals.

Despite the perceived benefits of wireless data, market penetration has been below expectation. Dedicated data networks, such as Ardis Co. and RAM Mobile Data Inc., have been deployed for some time. To date, Ardis and RAM have 40,000 and 12,000 subscribers respectively. Factors attributing to a lack of strong acceptance of wireless data are high equipment and service costs, confusing array of products and services, and lack of application solutions. Corporate users appear to be hesitant to commit to any significant investment.

Although wireless carriers are experiencing marketing and technical challenges in developing a major data business, no one is dismissing their potential. Cellular carriers are moving to position themselves as major players by offering Cellular Digital Packet Data (CDPD) along with the existing circuit-switched data service.

This paper addresses the challenges and promises in the emerging wireless data market, and focuses on the following major topics:

- Market Segments
- Wireless Data Networks
- Marketing and Technical Challenges
- Future Direction and Trends

2 MARKET SEGMENTS

The market segments for wireless data can be grouped into four major categories:

1) *Field Services and Logistic:*

   These are typically event driven occupations such as package pickup and delivery, repair service, public safety and utilities.

2) *Corporate Applications Extension:*

   These are typically field based white collar workers such as insurance agents and salespersons.

3) *Mobile Office:*

   These are typically professionals and managers who are occasionally mobile such as accountants and lawyers.

4) *Personal Communications and Organization:*

   These are typically consumers of information services.

The mobile workforce in the first three categories have a mixture of tasks which involve varying degree of structured *(form filling) and unstructured (thinking) work contents. In general, the mobile workers can be categorized as follows:*

- ¤ *Knowledge workers:* whose job functions involve thinking - journalists, engineers, etc.
- ¤ *Administrators:* whose job functions involve a mixture of thinking and structured reporting - salespersons, repair service persons, etc.
- ¤ *Reporters:* whose job functions involve supplying information in a highly structured form - couriers, rental car staff, etc.

The more structured the information, the less data need to be transmitted. With very unstructured information, such as complex graphical data, the amount of data for transmission could be large. Certainly this will affect response time and costs.

Regardless of job functions, all mobile workforce use wireless data service as an extension of their corporate network facilities; and as such, ubiquitous coverage, including in-building, is essential.

The fourth category of the market segment includes individual users who subscribe to on-line news sources such as stock market information, weather reports and sport results.

3 WIRELESS DATA NETWORKS

Several types of wireless data networks exist today, and each of these is suitable for different applications. There are three major classes of wireless data networks.

1) Wireless metropolitan area networks (MANs) offer connectivity in most major metropolitan areas.

2) Wireless local area networks (LANs) offer connectivity within specific buildings or campuses.

3) Wireless wide area networks (WANs) offer connectivity everywhere in North America.

3.1 WIRELESS MANs

Wireless MANs provide wireless data connectivity in most major metropolitan areas in North America. In general, these wireless MANs can be grouped into cellular networks, packet-switched networks, enhanced specialized mobile radio (ESMR) networks, and paging networks.

Cellular Networks

Circuit-switched data transmission is supported by the AMPS cellular network, which now has 14,740 cell sites in the U.S., through the use of cellular modems. Most cellular modems nowadays use forward error correction protocols, such as AT&T Paradyne's ETC (Enhanced Throughput Cellular) protocol and Microcom's MNP 10 protocol; and can achieve data rates up to 14.4 Kbps. Cellular circuit-switched data use voice channels on a dedicated basis, and therefore users have to pay for connection time including the time for call setup and teardown. The drawbacks of circuit-switched data are possible data loss during handoff and poor security. This mode of wireless data transmission is well suited for the exchange of large volume of data such as file transfers, for instance, between a mobile terminal and a host computer.

Cellular Digital Packet Data (CDPD) is a new wireless data technology supported by almost all of the U.S. cellular carriers. CDPD operates on the principle that data can be transmitted during the idle time in the cellular voice channels, and uses channel hopping technique to utilize gaps of unused channel time for data transmission. CDPD can also be provided on a dedicated channel basis if required. Users share the same data stream(s), and transmit data in packets. The data transmission rate is 19.2 Kbps. The cellular carriers are targeting at nationwide seamless coverage as they start to roll-out services. CDPD will be ideal for short, bursty type of data traffic. Due to the extensive cellular coverage in North America and enormous network capacity, cellular carriers are expected to play a major role in the wireless data business in the latter half of the nineties. While it is unclear how CDPD will be affected by the migration to digital technology, CDPD will co-exist with other cellular technologies for some time.

One distinct advantage of CDPD is its direct support of Internet Protocol (IP) and Connectionless Network Protocol (CLNP). Existing applications that run on TCP/IP should be able to operate on CDPD without modifications.

Packet-Switched Networks

Prior to the introduction of CDPD, the two packet-switched wireless MAN data networks in North America have been Ardis and RAM.

Ardis Co. is solely owned by Motorola; and has a subscriber base of 40,000 users, mostly in the vertical market of field services. Ardis operates on a single channel in most metropolitan statistical areas (MSAs) at a data rate of 4,800 bps; except in large cities like New York and Los Angeles where up to seven channels are provided at data rates of 4,800/19,200 bps. The Ardis network is targeted at nationwide coverage with about 1,400 cell sites deployed. Because of its single frequency re-use plan, network capacity could be relatively low. However, Ardis provides excellent in-building penetration due to coverage overlap.

RAM Mobile Data is owned jointly by RAM Broadcasting Corporation and BellSouth Enterprises; and has a subscriber base of 12,000 users, splitting between 60% and 40% in the vertical and horizontal markets respectively. RAM provides nationwide coverage with 870 cell sites, and operates on 10 to 30 channels per MSA with a cellular-like frequency re-use plan. RAM uses the Ericsson Mobitex protocol at a data rate of 8,000 bps. Similar to CDPD, network capacity is potentially high due to frequency re-use.

A new comer, Metricom Inc. is establishing a wireless mesh of small cells. The Metricom's Ricochet wireless data network operates in the 902 to 928 MHz range, and does not require FCC licensing. Data rates of 2.4, 9.6, 19.2 or 38.4 Kbps can be selected by the users at subscription time. Metricom has installed 400 base stations in the Silicon Valley, and expects to reach 30 U.S. cities by late 1996. Due to restricted transmitter output power level, the area of coverage of a single cell is about one square mile. The Metricom network is well suited to users who remain within a cell while sending data.

Enhanced Specialized Mobile Radio Networks

Enhanced specialized mobile radio carriers, such as the well publicized Nextel, are also building nationwide digital networks. In addition to voice services, the Nextel network will support both circuit-switched and packet-switched data. Nextel has announced that high data rates (up to 56 Kbps) will be supported.

Paging Networks

There are 20 million existing subscribers in North America. The recent nationwide narrowband PCS licenses auction in U.S. has created new opportunities for the successful bidders such as PageNet, McCaw and Mtel Destineer. It is expected that new services, such as acknowledgment paging and VoiceNow services, will sustain continued growth. Because of the relatively low cost of paging services, paging will still be a competitor in the short message services marketplace.

3.2 WIRELESS LANs

Wireless LANs provide connectivity covering floor(s) within a building, and within a campus by linking subnetworks. High bandwidth can be provided through the use of spread spectrum, narrowband radio, and infrared technologies. Each has specific strengths and weaknesses in terms of speed, reliability, data security, and distances covered. NCR, Motorola, Proxim, Photonics, WinData, and BICC Communications are examples of companies that offer products based on these technologies.

One major factor that has limited user acceptance of wireless LANs is the nominal performance disparity between wireless and wired networks. Conventional Ethernet runs at 10 Mbps and token ring at 16 Mbps, while most wireless LANs run at less than 5

Mbps. A few wireless LAN products that promise to match the Ethernet data rate cost about 5 to 6 times higher than the conventional adapter-and-cabling wired installations.

3.3 WIRELESS WANs

Ubiquitous continental coverage requires satellite technologies. Either geostationary earth orbit (GEO) or low earth orbit (LEO) technology provides continuous over-the-road, low-speed, two-way data messaging and location services almost anywhere in North America. Qualcomm, American Mobile Satellite Corp., and Orbital Communications Corp. are examples of companies that offer wireless WAN services.

Satellite data networks tend to have high usage costs, modest data rates, and limited capacity. They are best suited for simple mission-critical messaging applications, such as long-haul trucking, where remote access is an absolute requirement.

4 MARKETING AND TECHNICAL CHALLENGES

The development of the wireless data market has been quite slow, and general acceptance of products and services have been impeded by the following factors:

1. There is a lack of off-the-shelf application software packages that are inexpensive and easy-to-use. Typically, solutions are too complex and too expensive for users.

2. Users are generally confused by the different technologies and networks. Most of them are waiting for the winning technology to emerge in the marketplace.

3. Wireless data equipment and services are still expensive.

4. There has been little concerted effort to educate the market, and awareness among users about wireless data is low.

5. The lack of system integrators who can offer end-to-end solutions.

Corporations have been hesitant to adopt wireless data or even participate in market trial because of the risk of affecting existing operation and impacting on many parts of the business. Most executives still perceive wireless data as unproven technology.

What will a user be looking for? The acceptance criteria can be summarized as follows:

- Ubiquitous - regional and nationwide coverage
- Roaming - terminal works everywhere
- Reliability - messages always delivered
- Economy - terminals and service
- Applications - business benefits

The marketing challenges in wireless data will therefore include the following strategies:

- *Educate the market:* Service providers need to break down the inherent complexity of wireless data, and to educate the market in general terms.

- *Focus:* User needs are varied and fragmented. Service providers need to focus on the breadth and depth of their needs.

- *Develop packaged solutions:* The emphasis will be on delivering cost effective, easy-to-use, and end-to-end solutions.

On the technical side, standards have not been imposed on the market in North America, and it is left to market forces to decide which is the most appropriate technology. Interoperability between networks using different standards will not be possible in the near future. CDPD, which is the de facto standard endorsed by the major U.S. cellular carriers, is attracting the support of major equipment vendors, system integrators, and software developers.

5 FUTURE DIRECTION AND TRENDS

With the social changes for greater mobility, time pressure to obtain information will move the market from its current emphasis on vertical and early horizontal applications to the longer term market position where mainstream horizontal applications account for the bulk of the wireless data market. More general services will be introduced in the latter half of the 1990's; and it is unclear which applications will lead, but the industry consensus would indicate the following:

- E-Mail
- Two-way messaging
- Increased utilization of notebooks, subnotebooks and PDAs
- Extension of corporate applications
- Fixed wireless data services

Towards the year 2000, the trend is to provide seamless access to communication services which will be enabled by:

- Multimode terminals
- Simultaneous voice/data access
- Subscriber service profiles that contain all service data
- Common subscriber authentication database
- Common subscriber accounting

6 CONCLUSIONS

The future for the wireless data market is bright, but not without challenges. The transition from the current emphasis on the vertical market to the longer term horizontal market will require market education, user needs focus and applications development. The success of the mainstream horizontal market can be achieved by delivering cost effective, easy-to-use, reliable end-to-end solutions provided by terminal vendors, service providers and application developers.

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NOTES

Session 3

SOCIAL IMPACTS OF PCS
IMPACT SOCIAL DES SCP

R. Hal Turner

President & CEO
TeleZone Corporation
Scotia Plaza, 40 King Street West, Suite 3300
Toronto, M5H 3Y2

BIOGRAPHY

Mr. Hal Turner, as President & CEO is leading TeleZone Corporation in bringing Personal Communications Service (PCS) to Canada. Mr. Turner brings extensive international experience in the telecommunications industry to this role, most recently as President and Chief Executive Officer of PTT Telecom Netherlands U. S. Inc., a subsidiary of Royal PTT Nederland. There he set the strategy for PTT's international ventures and developed American alliances. Previously he oversaw the growth of BellSouth Communications Inc., as President and Chief Operations Officer. Prior to that Mr. Turner worked with AT&T in senior Sales and Marketing Management positions. Mr. Turner also combines his Global Fortune 500 Company experience with start-up assignments which included Norlite Computer Systems Inc., and Insightguide, an Olympia and York, New York City based joint venture.

In 1973, Mr. Turner earned a Masters of Business Administration Degree from the University of South Carolina in Columbia, South Carolina.

TeleZone Corporation was designated as a PCS provider in December 1992, by the then Federal Department of Communications. TeleZone, Canada's leading pioneer in the development of PCS, is the first Canadian company to announce the deployment of a national PCS network.

BIOGRAPHIE

M. Hal Turner, à titre de président-directeur général de TeleZone Corporation, dirige les efforts de l'entreprise pour introduire au Canada le service de communications personnelles. Dans l'exercice de ses fonctions, M. Turner tire profit de la vaste expérience qu'il a acquise dans l'industrie des télécommunications. Il a récemment été président-directeur général de PTT Telecom Netherlands U.S. Inc., une filiale de Royal PTT Nederland. À ce titre, il a établi une stratégie concernant les entreprises commerciales internationales de PTT et a créé des alliances avec des entreprises américaines. Avant d'occuper ce poste, il était chargé, à titre de président et de directeur des opérations, de faire prospérer BellSouth Communications Inc. Avant cela, il a occupé des postes de direction dans les domaines de la vente et de la commercialisation au sein de la société AT&T. M. Turner a également acquis de l'expérience au sein de Global Fortune 500 dans le cadre de projets de lancement d'entreprises, dont Norlite Computer Systems Inc., et Insightguide, une entreprise du groupe Olympia & York, établie à New York.

En 1973, M. Turner a obtenu une maîtrise en administration des affaires de l'Université de la Caroline du Sud, à Columbia (Caroline du Sud).

TeleZone Corporation a été désignée fournisseur de services de communications personnelles (SCP) par l'ancien ministère fédéral des Communications, en décembre 1992. TeleZone, le principal pionnier canadien dans le domaine des SCP, est la première entreprise canadienne à annoncer le déploiement d'un réseau national de communications personnelles.

NOTES

FUTURE CHALLENGES TO THE DELIVERY OF SPECTRUM-BASED TELECOMMUNICATIONS SERVICES IN CANADA
CONTRAINTES DE RÉGLEMENTATION

Peter Barnes

Vice-President - Government and Regulatory Affairs
***Mobility* Canada**
45 O'Connor Street, Suite 1800
Ottawa, Ontario, KIP 1A4, Canada

BIOGRAPHY

Peter Barnes is Vice President - Government and Regulatory Affairs for Mobility Canada, a consortium of twelve wireless service companies across Canada. Mobility Canada and its owners collectively operate the largest paging and cellular networks in Canada. The company was also awarded a licence to provide the next generation of personal communications services -- digital cordless telephone service.

He is currently involved with the issues of the introduction of digital cordless telephone service, current and future radio spectrum licencing, regulatory reform, and the protection of the privacy of cellular customers.

Peter began his career in telecommunications with Bell Canada in 1969. Since then he has held senior positions as Assistant Vice-President, Government and Regulatory Matters with BCE Mobile, as Director, Fiscal and Strategic Policy at the Canadian Department of Communications, and as Director General Strategic Planning at the Canadian Radio-television and Telecommunications Commission (CRTC).

Peter also represents Mobility Canada as Vice-Chairman of the Board for the Radiocomm Association of Canada.

Peter is a graduate of the universities of Ottawa and Montréal and of l'École nationale d'administration publique.

BIOGRAPHIE

Peter Barnes est Vice-président aux Affaires gouvernementales et réglementaires de Mobilité Canada, un consortium regroupant douze sociétés canadiennes de communications sans fil. Mobilité Canada et ses compagnies propriétaires exploitent ensemble le plus important réseau canadien de téléphonie cellulaire et de téléavertissement. L'entreprise a d'ailleurs obtenu un permis d'exploitation de la prochaine génération de services téléphoniques personnalisés (STP) - la téléphonie numérique sans fil.

M. Barnes s'occupe à l'heure actuelle des questions touchant l'introduction des services téléphoniques numériques sans fil, les permis d'exploitation radiotéléphoniques actuels et futurs, la réforme de la réglementation et la confidentialité des appels cellulaires.

Peter Barnes a commencé sa carrière dans le secteur des télécommunications auprès de Bell Canada en 1969. Depuis, il a occupé divers postes de direction chez BCE Mobile, au ministère fédéral des Communications et au Conseil de la radiodiffusion et des télécommunications canadiennes (CRTC).

Il est également le représentant de Mobilité Canada auprès de l'Association RadioComm du Canada, dont il est le Vice-président du conseil d'administration.

M. Barnes est diplômé des universités d'Ottawa et de Montréal, de même que de l'École nationale d'administration publique.

ABSTRACT

This paper will examine existing barriers to the delivery of spectrum-based telecommunications services in Canada, draw upon an analysis of relevant practices in other countries, test these barriers against public policy principles and provide recommendations for changes.

The provision of spectrum-based telecommunications services in Canada is subjected to a number of regulatory constraints. These are applied at the level of market entry and also affect ongoing operations. Two major regulatory agencies are involved, Industry Canada, responsible for radio licensing and spectrum allocation and the CRTC, responsible for telecommunications carrier regulation.

Industry Canada, in applying the Radiocom-munication Act, issues operating and site specific licences, establishes policies for market entry, establishes technical standards, allocates spectrum bands to specific types of services and maintains overall authority to authorize renewal or termination of licences.

The CRTC is responsible, among other matters, for determination of the eligibility to operate of telecommunications common carriers, regulation of rates, connection agreements between carriers, and adjudication in matters of unjust discrimination and undue preference.

Other government agencies are also involved in the field. These include Health Canada and the Bureau of Competition Policy (also part of Industry Canada).

The public policy considerations involved in these regulatory responsibilities include availability of service, technological development, industrial development (e.g. research and development), protection of privacy, competition, economic efficiency and health and safety.

As in all public policy matters, there are often conflicting considerations which come to bear, thus rendering the decisions more complex. In addition, procedural requirements can create delays to service delivery.

The paper will examine a number of the key regulatory hurdles and propose suggestions for improvements.

RÉSUMÉ

Ce document traite des obstacles actuels à la prestation de services de télécommunications fondés sur le spectre, au Canada, à partir d'une analyse des pratiques pertinentes dans les autres pays. Nous examinons ces obstacles à la lumière de certains principes publics et recommandons des changements.

La prestation de services de télécommunications fondés sur le spectre au Canada fait l'objet de nombreuses contraintes réglementaires. Celles-ci sont appliquées au niveau du marché, mais elles touchent aussi les opérations courantes. Deux organismes de réglementation principaux y participent : Industrie Canada, chargé de la délivrance des licences radio et de l'attribution des fréquences du spectre et le CRTC, chargé de la réglementation régissant les entreprises de télécommunications.

Industrie Canada, dans son application de la Loi sur la radiocommunication, délivre des licences d'exploitation et des licences pour un emplacement précis, définit les politiques d'entrée sur le marché, définit les normes techniques, attribue les bandes de fréquences à des types donnés de services et conserve le pouvoir global de renouveler des licences ou d'y mettre fin.

Entre autres sujects, le CRTC est chargé de déterminer l'admissibilité à exploiter des entreprises publiques de télécommunication, réglemente les tarifs, régit les ententes de connexion entre les sociétés exploitantes et juge les questions de discrimination injustifiée et de préférence indue.

D'autres organismes gouvernementaux participent aussi à ce secteur d'activité. On peut citer, entre autres, Santé et Bien-Être social Canada et le Bureau de la politique de concurrence (qui fait partie d'Industrie Canada).

Comme dans toutes les questions de politique publique, des considérations souvent contradictoires entrent en jeu, ce qui rend les décisions plus complexes. En outre, les exigences de procédure peuvent retarder la prestation des services.

Le document étudie un certain nombre d'obstacles importants dus à la réglementation et présente des suggestions d'améliorations.

Mobility CANADA

Future Challenges to the Delivery of Spectrum-Based Services in Canada

Notes for an address

by

Peter Barnes
Vice-President
Government and Regulatory Affairs
***Mobility* Canada**

to

Spectrum 20/20 1994

December 8, 1994
Ottawa, Ontario

I'm intrigued by the theme chosen for this conference -- "Breaking Loose". To me, it implies destroying barriers -- taking off -- "boldly going where no-one has gone before". I'm not a "trekkie", but that's an image with a lot of power. It means excitement, challenge, and the exhilarating anticipation of winning.

In a word, it means "liberty". But, let's remember that "liberty" is a package deal. With it, comes responsibilities and consequences.

Today, I'd like to discuss the freedoms and strengths the mobile communications industry in Canada enjoys and the responsibilities of government and the industry in creating and maintaining that environment.

I would also like to take a look at recent developments in Europe and the U.S. and their potential consequences. Then, I would like to examine where I think Canada is heading and how I think Canadian customers can continue to be the big winners.

To begin, let's start with where we are now. It's clear that services that depend on the radio spectrum have been implemented quickly and uniformly across Canada.

Mobility Canada's customer base continues to grow at annual rates in excess of 25 per cent and, as you heard yesterday, we recently connected our one millionth cellular customer.

Not bad -- especially when you consider that initial forecasts predicted there would only be one million customers throughout North America by the year 2000.

Within the decade, half of the telecommunications traffic in Canada is expected to be wireless-based at least at one-end and therefore, spectrum dependent.

This growth, coupled with accelerating convergence of previously distinct industries and the increasing need for seamless international services, all require that Canada continue to make quick and decisive moves. And the best way to achieve that, I believe, is through industry and government working together.

Our colleagues at Industry Canada have indeed been very quick and decisive. Very recently, as we know, a spate of Gazette Notices have announced policy and licensing decisions and accelerated timetables at an unprecedented pace. For example, licensing decisions for 2 GHz are expected during 1995.

What about the rest of the world? We have a head start, for the time-being, but that window of opportunity can close very quickly.

For example, in Europe, mobile communications is the fastest growing area in telecommunications. Europe now has more than 8 million cellular phone users, more than double the number just three years ago.

It is forecast, that by the year 2000, there could be nearly 40 million users in the European Union. With the expansion into new frequencies, that number could balloon to 80 million users by the year 2010.

Europe, a world leader in terms of technology, has attracted substantial public and private investment in mobile communications. However, the industry stands at the crossroads as it makes the move from analog to digital technology and from niche to mass market player.

And it seems that Europe has dramatically changed direction, of late. The European Community's progressive Green Paper on mobile and the growing suite of Personal Communications Services has come under attack.

The paper's stated purposes were to promote the development of fixed and radio-based PCS, to boost mobile communications services, and to ultimately drive prices down.

And it was hoped that these policy measures would catapult Europe toward true personal communications based on a combination of wired and wireless services. However, bowing from pressure from several member states, the EC has removed discussion of network infrastructure competition from the paper.

The issue surrounding alternative infrastructure will now be debated as one element of the much larger discussion of network competition. At a minimum, this approach will delay decisions on mobile network policy. This will likely scare off some of the larger investors and will probably hurt Europe -- at least in the short term.

Meanwhile, events in the United States have been equally compelling. The mobile market has been very successful in the U.S. According the U.S. Cellular Telecommunications Industry Association, more than 17,000 new cellular customers are added each day.

Currently, there are more than 19 million users and annual service revenues for the 12 months ending June 30, 1994 totaled nearly $12.6 billion.

This success has sparked intense market interest. Earlier this year, AT&T merged with McCaw Cellular Communications in a $12.6 billion deal. And, last fall, Bell Atlantic created quite a stir with talks about creating an even larger concern by joining together with Nynex and Sprint.

That deal fell through but Bell Atlantic, Nynex, US West and Air Touch have formed a venture called PrimeCo. And Sprint, together with its three new cable partners, have announced their intention to build a national PCS network.

In any event, it appears that these operators have concluded that national coverage, shared development costs and sophisticated technologies are the only way to compete. Just think about the size and scope of these emerging U.S. organizations and the economies of scale they can generate to the advantage of their customers. Customers who compete globally with Canadian customers.

Industry analysts expect a handful of wireless mega-carriers to emerge in the United States, each marketing national services under a well-known brand name. Ensuring that Canadian players can take on these mega-carriers will be no mean feat.

The major new market interest south of the border lies in services to be carried in the 1.8 to 2 GHz band. The lottery system for granting cellular licenses in the U.S. created many problems. To address concerns, the FCC has adopted an auctioning process for seven-year licenses in this band. It has further allocated the use of 160 MHz in this band for PCS.

This large bandwidth will allow U.S. companies to offer improved transmission quality and new services. How will Canada maintain its lead in mobile communications and ensure that Canadian customers also benefit from the growing suite of PCS services?

I believe there are two important ways to make that happen. First and foremost, is giving customers choice through competition.

Given the results, most people would agree that competition in telecommunications markets - giving customers true choice -- has been good for the industry and more importantly, for its customers.

The cellular industry in Canada, characterized by choice and competitive markets from the start, has flourished. The CRTC has already taken the necessary steps to forebear from regulating cellular and digital cordless telephone services in Canada.

In addition, through Decision 94-19, the Commission plans to dramatically alleviate regulatory requirements and introduce competition in local service markets.

Consequently, Canada leads the world in terms of its regulatory environment for telecommunications. Our challenge is to leverage this progressive environment to put Canada at the forefront of PCS.

In addition, Canadian industry players -- both large and small -- both established and new -- will gain experience, market knowledge, and revenues --- assets that will enable them to develop and introduce further advanced personal mobility services.

A "made in Canada" approach is essential. In contrast to the U.S., the Canadian government awarded what amounted to two national licenses for cellular service.

It meant that Canadians had greater access to continuous cellular service, while in the U.S. customers experienced fragmented pockets of cellular service.

The recent flurry of mergers in the U.S. suggests that American players are now trying to accomplish what the Canadian government had done from the outset — the creation of two nation-wide cellular service providers.

That same drive to develop a "made in Canada" approach to 2 GHz services will be essential to the success of this new market in Canada.

I was very pleased to hear Industry Canada's Michael Binder speak at November's RadioComm PCS conference. For one, he said that the government's "current thinking is not to use auctions to assign spectrum at 2 GHz." He also said that the government will soon issue a set of licensing service standards. That's a wise approach to help keep Canada on top.

In addition, Mike Binder had "food for thought" about the future direction of the industry during his talk in November. For example, he asked:

- Are the rules designed for specific services too restrictive as lines of business continue to diversify?
- Do we need to set aside some spectrum as an 'incubator site' so entrepreneurs can try out new ideas?

In addition, Canadian industry players -- both large and small -- both established and new -- will gain experience, market knowledge, and revenues --- assets that will enable them to develop and introduce further advanced personal mobility services.

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In addition, Mike Binder had "food for thought" about the future direction of the industry during his talk in November. For example, he asked:

- Are the rules designed for specific services too restrictive as lines of business continue to diversify?
- Do we need to set aside some spectrum as an 'incubator site' so entrepreneurs can try out new ideas?

The key to that success lies in providing customer choice in an open, competitive environment that is also consistent with the prudent allocation of spectrum.

The second major way to help ensure the success of Canada in future mobile services is building on strengths. In the last decade, strong players have emerged in the Canadian mobile communications industry. That's largely because of the current licensing criteria in Canada.

When Industry Canada selects licensees among competing applicants, they evaluate the experience and credibility of those applicants. Applications are also evaluated on technical, social, and economic factors, in addition to the access and speed of availability of service to customers.

This comparative licensing process has given customers the ability to choose suppliers whose mix of operations, marketing, technical and financial expertise and resources assures them of dependable, top-grade service.

That benefit, currently enjoyed by cellular customers in Canada, should be a key determinant of how new services evolve in Canada.

Indeed, with the accelerating demand and interest in mobile services, it is critical to the growth of Canadian players in the highly competitive services of the future.

New services at 2 GHz will be a big step towards the next generation in mobility services: Future Public Land Mobile Telephone Service (FPLMTS), which will have worldwide market potential.

By encouraging investment in new innovative services at the 2 GHz market, Industry Canada will help ensure that Canadian consumers and businesses benefit from the ability to choose new services that truly meet their needs.

The comparative selection process already encourages and rewards innovation and success, including the applicants' previous level of success. But, relaxing rules about lines of business and giving entrepreneurs the freedom to experiment, would inevitably excite innovation even more.

In addition, the government could reward investment in infrastructure, distribution of technology and services, and employment creation. Tax incentives and license fees offset by the level of investment in new technology, are two other ways to reward investment and innovation.

To date, the Canadian government's approach to regulating and licensing mobile services has provided Canadians with high quality services at affordable rates. It has also engendered the creation of strong, viable players in Canada whose resources and experience match or surpass those of global players.

With demand accelerating worldwide and the flurry of activity in other countries, future mobile service markets certainly present great opportunities for Canadian consumers and Canadian business. And continued government-industry cooperation and refinements to the licensing processes to encourage investment and innovation, are essential.

These moves will give the industry and the customers it serves, the freedom to "break loose", beat the odds, and stay ahead of the pack.

FUTURE CHALLENGES TO THE DELIVERY OF SPECTRUM-BASED TELECOMMUNICATIONS SERVICES IN CANADA
CONTRAINTES DE RÉGLEMENTATION

Peter Barnes

Vice-President - Government and Regulatory Affairs
***Mobility* Canada**
45 O'Connor Street, Suite 1800
Ottawa, Ontario, KlP 1A4, Canada

1. Introduction

Iain Vallance, Chairman of British Telecom, in an opinion piece in Communications Week International, wrote that "... regulation and technological change remain diametrically opposed: Technology is dynamic and drives explosive change, while regulation, however far-sighted, inhibits change."

Yet, in that same editorial, he also penned his agreement with U.S. Vice-President Al Gore that "... technological convergence is compelling a move away from the adversarial relationship between business and government and toward a consensus model that can obviate many governmental mandates."

Through government and industry cooperation in Canada, the services that depend on the radio spectrum have been implemented quickly and uniformly across the country. For example, from the initial assessment of the technology to the granting of licenses, it only took about 18 months to deploy cellular services in Canada.

As a finite resource, the careful management of spectrum is crucial, especially in a country like Canada where geography and economic feasibility dictate the use of airwaves to allow all Canadians to communicate.

Within the decade, half of the telecommunications traffic in Canada is expected to be wireless-based at least at one-end and therefore, spectrum dependent.

With this unprecedented growth, the convergence of previously distinct communications industries, the increasing need for seamless international services, Canada must move quickly. Otherwise, it could risk its lead in the development and introduction of wireless services and technologies.

This paper first examines how spectrum-based services are currently regulated in Canada. Second, it highlights major developments in the United States and Europe. And, third, in view of how the market for new personal communications services (PCS) is advancing rapidly, it details the challenges facing the Canadian mobile communications industry.

2. The Regulation of Spectrum-Based Services Today

The provision of spectrum-based telecommunications services in Canada is subject to a number of regulatory constraints. These are applied at the level of market entry and also affect ongoing operations. Two major regulatory agencies are involved: Industry Canada, which is responsible for radio licensing and spectrum allocation; and the Canadian Radio-television and Telecommunications Commission (CRTC), which is responsible for telecommunications carrier regulation.

In applying the *Radiocommunications Act*, Industry Canada issues operating and site specific licenses, establishes policies for market entry, sets technical standards, allocates spectrum bands to specific types of services and maintains overall authority to renew or terminate licenses.

The CRTC, among other responsibilities, determines the eligibility of telecommunications common carriers to operate, regulates rates, oversees connection agreements between carriers and adjudicates in matters of unjust discrimination and undue preference.

In addition, other federal government agencies, such as Health Canada and the Bureau of Competition Policy (also part of Industry Canada) play a role in the regulation of spectrum-based telecommunications services.

From a public policy perspective, there are often conflicting considerations which come to bear, thus rendering the decision-making process complex and time-intensive. Also, procedural requirements can create delays to service delivery.

Add to all this, the necessity of cooperating and working with international bodies, such as the International Telecommunications Union's (ITU) Radio Communications Bureau, and the complexity of spectrum-based regulation becomes even more apparent.

3. International Developments - Europe

The mobile communications industry is the fastest growing area in the telecommunications sector in Europe. Europe now has more than 8 million cellular phone users, more than double the number just three years ago. It is forecast, that by the year 2000, there could be nearly 40 million users in the European Union. With the expansion into new frequencies, that number could balloon to 80 million users by the year 2010.

Clearly, this tremendous growth will have a significant impact on the entire telecommunications industry. Europe, a world leader in terms of technology, has attracted substantial public and private investment in mobile communications. However, the industry stands at the crossroads as it makes the move from analog to digital technology and from niche to mass market player.

The European Community released its long-awaited Green Paper on mobile and PCS earlier this year. Its stated purposes are to promote the development of fixed and radio-based PCS, to boost mobile communications services, and to ultimately drive prices down. The Green Paper calls for five major changes:

- the removal of all exclusive and special rights, subject to the establishment of appropriate licensing conditions, where required;
- ensuring that service providers have non-restricted entry in all European markets;
- guaranteeing full freedom to mobile operators to operate and develop their networks;
- providing unrestricted combined offering of services through both fixed and mobile networks;
- facilitating operation and service provision throughout Europe.

If successful, these new policy measures promise to catapult Europe to the forefront of mobile services, speeding its progress toward true personal communications based on a combination of wired and wireless services. The market would be the ultimate arbitrator.

This approach is expected to prepare Europe for a smooth, market-led transition to Future Public Land Mobile Telephone Services (FPLMTS).

4. International Developments - United States

Cellular telephony began in the United States with the reallocation of the 806-946 MHz portion of the radio spectrum to land mobile communications in 1975. However, regulatory and industry conflict delayed actual market operation until 1983. And, unlike Canada, where coverage evolved uniformly, the Federal Communications Commission's (FCC) cellular licensing process resulted in extensive, often congested, coverage of urban areas and spotty coverage in rural areas.

Nevertheless, the mobile market has been very successful in the U.S. According to the U.S. Cellular Telecommunications Industry Association, more than 17,000 new cellular customers are added each day. Currently, there are more than 19 million users and annual service revenues for the 12 months ending June 30, 1994 totaled nearly $12.6 billion.

This success has sparked intense market interest. AT&T recently merged with McCaw Cellular Communications in a $12.6 billion deal. Sprint is now negotiating with Bell Atlantic and Nynex to merge their cellular assets. Ameritech, a third Regional Bell Operating Company, has also joined these talks and Sprint has reportedly approached cable giants as well.

The Sprint/Bell Atlantic/Nynex merger would be even bigger than AT&T and McCaw. Together, the companies would have more than 3 million subscribers and almost 76 million potential customers. McCaw has just under 3 million subscribers and less than 74 million potential customers.

These operators have clearly concluded that national coverage, shared development costs and sophisticated technologies are the only way to compete with the new services and bandwidths offered by wireline companies. Industry analysts expect a handful of cellular mega-carriers to emerge in the United States,
each marketing national services under a well-known brand name.

The major new market interest lies in yet another component to the suite of PCS, those to be carried in the 1.8 to 2 GHz band. The lottery system for granting cellular licenses in the U.S. created many problems. As a result, the FCC has adopted an auctioning process for seven-year licenses in this band. It has further allocated the use of 160 MHz in this band for PCS.

This large bandwidth will allow U.S. companies to offer improved transmission quality and new services. Given the amount of auction revenue anticipated in the U.S., licensees will likely be very aggressive in offering services to recoup their investment.

As a result, another challenge for Canada is to ensure that Canadian customers also benefit from the new suite of PCS services. This will be key to maintaining Canada's lead in mobile communications.

5. Personal Communications Services - The next competitive frontier

PCS are the full complement of communications services -- both fixed and wireless -- which will allow people to communicate anywhere, anytime. It is clear from the level of activity in Europe and the U.S. that major industry players believe PCS will be a highly profitable business. How do we ensure that Canada continues to be successful in the PCS marketplace?

There are two important considerations. First and foremost, is ensuring choice for customers through competition. Given the results, most people would agree that competition in telecommunications markets -- giving customers true choice -- has been good for the industry and more importantly, for its customers.

The cellular industry in Canada, characterized by choice and competitive markets from the start, has flourished. Today, 82 per cent of the Canadian population enjoys access to cellular service and there are more than 1.4 million subscribers.

Recently, in light of Canada's new *Telecommunications Act*, the CRTC took the necessary steps to forebear from regulating cellular and digital cordless telephone services in Canada. In addition, through Decision 94-19, the Commission plans to dramatically alleviate regulatory requirements and introduce competition in local service markets.

Consequently, Canada may well soon have the most progressive regulatory environment for telecommunications in the world. And this progressive environment, which sets the stage for competition between wireline and wireless service providers, could put Canada at the forefront of PCS.

The challenge is to ensure that future mobile service markets thrive by providing customer choice in an open, competitive environment that is also consistent with the prudent allocation of spectrum.

The second major consideration for the success of Canada in future mobile services is ensuring that Canada builds on its strengths. In the last decade, strong players have emerged in the Canadian mobile communications industry. That's largely because of the current licensing criteria in Canada.

When Industry Canada selects licensees amongst competing applicants, they evaluate the experience and credibility of those applicants. Applications are also evaluated on technical, social, and economic factors, in addition to the access and speed of availability of service to customers.

This comparative licensing process has given customers the ability to choose suppliers whose mix of operations, marketing, technical and financial expertise and resources assures them of dependable, top-grade service.

That benefit, currently enjoyed by cellular customers in Canada, should be a key determinant of how new services evolve in Canada. In fact, it will be critical to the growth of Canadian players in the highly competitive services of the future.

New services at 2 GHz will be a big step toward the next generation in mobility services: Future Public Land Mobile Telephone Service (FPLMTS), which will have worldwide market potential. Decisions taken now about licensing these services will most certainly affect the future development in Canada of advanced mobility services.

By encouraging investment in new innovative services in the 2 GHz market, Industry Canada will help ensure that Canadian consumers and businesses benefit from the ability to choose new services that truly meet their needs.

In addition, Canadian industry players -- both large and small -- will gain experience, market knowledge, and the revenues that will enable them to take the necessary steps toward developing and introducing further advanced personal mobility services.

A "made in Canada" approach is essential. And a good example of such an approach has been the licensing of cellular service. In contrast to the U.S., the Canadian government awarded what amounted to two national licenses for cellular service.

It meant that Canadians had greater access to continuous cellular service, while in the U.S. customers experienced fragmented pockets of cellular service. The recent flurry of mergers in the U.S. suggests that American players are now trying to accomplish what the Canadian government had done from the outset - the creation of two nation-wide cellular service providers.

However, the current comparative process does have its drawbacks. For one, it is relatively time consuming. This can affect product-to-market speed and create delays for new services. Time limits in the various phases of the licensing process would address that problem.

There is also criticism about the "closed" nature of today's process. Consulting mechanisms like the "Industry Advisory Group" constituted for Digital Cordless Telephone Service, would help alleviate that concern. These advisory groups could well be expanded to include consumer representatives, providing a broad base of opinion upon which to base public policy decisions.

The comparative selection process already encourages and rewards innovation and success, including the applicants' previous level of success. In addition, it could reward investment in infrastructure, distribution of technology and services, and employment creation. Tax incentives and license fees offset by the level of investment in new technology, are two other ways to reward investment and innovation.

6. Conclusion

To date, the Canadian government's approach to regulating and licensing mobile services has provided Canadians with high quality services at affordable rates. It has also engendered the creation of strong, viable players in Canada whose resources and experience match or surpass those of global players.

With demand accelerating worldwide and the flurry of activity in other countries, future mobile service markets certainly present great opportunities for Canadian consumers and Canadian businesses.

Mr. Vallance, BT's chairman, believes that the new competitive environment evolving in telecommunications worldwide will eliminate the need for government involvement. However, as ITU Secretary General Pekka Tarjanne noted, while governments cannot take on the responsibility of building new networks and systems, they still have an essential role to fulfill in shaping that environment.

Continued government-industry cooperation and refinements to the licensing processes that encourage long-term investment and innovation, will ensure that Canada remains a world leader in mobility communications. It will further ensure that Canadian consumers have the services they need to improve their quality of life and that Canadian business has the tools it needs to effectively compete on a global scale.

NOTES

PRIVATIZATION IN ARGENTINA
DEVELOPPEMENTS DANS L'ARGENTINE

Ing. Roberto C. Door

Comisión Nacional de Telecomunicaciones
Perú 103 - 10º Piso
1067 - Buenos Aries
Argentina

BIOGRAPHY

Roberto C. Door, graduated from La Plata University with the degrees of Electrical Engineer (1957) and Telecommunications Engineer (1961).

He has worked in the communications field since 1955 when he joined, at that time government owned, Argentine Telco, ENTel. He was Transmission Engineer responsible for the tests and cutover of multichannel radio links up to his appointment in 1968 as Chief Engineer. From 1972 he was Director of Telecommunications, General Manager or Project Manager of different Argentine telecom companies associated with, among others, AMP, Reliable, Alsthom Atlantique - Alcatel, Southwestern Bell and Bell Canada.

He is Chairman of the Board of the National Commission of Telecommunications (CNT), the Argentine Regulatory Authority.

BIOGRAPHIE

M. Roberto C. Door a obtenu des diplômes en génie électrique (1957) et en génie des télécommunications (1961), de l'université La Plata.

Il travaille dans le domaine des communications depuis 1955, année où il s'est joint à une entreprise d'État, Argentine Telco, ENTel, au sein de laquelle il a occupé le poste d'ingénieur au transport d'énergie électrique responsable de la réalisation d'essais et du raccordement de relais hertziens multivoies, jusqu'à ce qu'il soit nommé ingénieur en chef en 1968. À compter de 1972, il a été directeur des télécommunications et directeur général ou gestionnaire de projet au sein de diverses entreprises de télécommunications de l'Argentine associées notamment à AMP, Reliable, Alsthom Atlantique - Alcatel, Southwestern Bell et Bell Canada.

Il est président du conseil d'administration de la commission nationale des télécommunications, l'organisme de réglementation des télécommunications en Argentine.

ABSTRACT

Mr. Door will trace the developments in Argentina involved in privatizing ENTel, a government owned monopoly. Under government control the situation was one of low penetration (11.6 lines per 100 population), poor service and high cost, compounded by interference from politicians, labour

RÉSUMÉ

M. Door retracera les progrès réalisés en Argentine concernant la privatisation de ENTel, un monopole nationalisé. Sous le contrôle du gouvernement, l'entreprise enregistrait une faible pénétration du marché (11,6 lignes par 100 habitants), offrait une faible qualité de service à un prix élevé, ce qui était

unions and suppliers.

The present government, which took office in 1989 started a reform program to encourage foreign investment and to get the state out of businesses which could be run effectively by the private sector. The government chose ENTel as one of the first state industries to be offered for privatization, keeping for itself the role of regulator.

Two companies were allowed to buy 60% of the Northern Region and the Southern Region respectively. The terms of their monopolies are - 7 to 10 years (depending on performance); for local, long-distance and international telephony, including data, telex and value added services. As a condition of licence certain investment and performance goals must be attained.

The current situation is that an additional 30% of the shares have been sold to the public and the remaining 10% have been retained for staff stock purchase plans.

aggravé par l'ingérence des politiciens, des syndicats ouvriers et des fournisseurs.

Le gouvernement actuel, porté au pouvoir en 1989, a amorcé une réforme afin de promouvoir l'investissement étranger et d'éliminer le contrôle de l'État sur les entreprises qui pouvait être gérées efficacement par le secteur privé. Le gouvernement a choisi ENTel comme l'une des premières entreprises nationalisées à privatiser, conservant pour lui le rôle d'organisme de réglementation.

Deux entreprises ont été autorisées à acquérir des droits de licence portant sur 60 % des régions du Nord et du Sud respectivement. Leur monopole était assujetti aux conditions suivantes : il pouvait être exercé pour une durée de 7 à 10 ans (selon le rendement) sur les services téléphoniques locaux, interurbains et internationaux, y compris les services liés à la transmission des données, les services télex et les services à valeur ajoutée. La licence est assujettie, entre autres, à des normes d'investissement et de rendement.

On note actuellement que 30 % d'actions de plus ont été vendues au public et que 10 % ont été conservées aux fins de régimes d'actionnariat privilégiés.

PRIVATIZATION IN ARGENTINA
DEVELOPPEMENTS DANS L'ARGENTINE

Ing. Roberto C. Door

Comisión Nacional de Telecomunicaciones
Perú 103 - 10° Piso
1067 - Buenos Aries
Argentina

Before privatization, in November 1990, telecom service in Argentina was poorly provided by the National Enterprise of Telecommunications (ENTel).

With 3,000,000 lines in service, 11.6 lines/100 inhabitants density, 13% digitalization, 30 days repair time, more than 5 years waiting time for a new line, US$1,800 connection charge, etc., ENTel mismanagement demanded a solution distant from the negative interference of politicians, labor unions and suppliers.

When the present government took office in July 1989, it started a reform program strongly encouraging foreign investments, mainly by getting the state out of any participation in economic activites which could be undertaken by private operators.

The best message for the investors was to start with ENTel as a flagship case showing that the State was willing to give up its position as "judge and party" and turned into an independent referee.

The model chosen by the Government for the privatization of the public telecom service was to have free competition in the medium term for the basic telephone service and immediate free competition for the rest of the telecommunication services.

A temporary monopoly (7 to 10 years, depending on the licensees' performance) was established for the basic telephone service. This was defined as:

"The provision of telecommunications fixed links forming part of or connected to the Public Switched Telephone Network (PSTN), and the provision by those links of local, long distance and international interactive voice telephony."

The monopoly was also extended to international telecommunication services: voice, data, telex and point-to-point links for telephony, data transmission and/or value added services.

As a counterweight to the exclusivity granted, the basic services licensees were required to attain service quality and penetration goals and a minimum plan of investments, under the penalty of license forfeiture.

Furthermore, for the provision of the national basic service the country and the Buenos Aires area were divided in two regions, North and South.

In January 1990 a public international call for bids was made for the 60% of each the North and South Companies created for the telephone basic service. These two companies were also entitled to form in a 50/50 basis two other companies: International Services (SPCI) and Services in Competition (SSEC).

In May 1990 the bids were openied and on November 8, 1990 the Northern Region was awarded to TELECOM a consortium operated by Stet and France Telecom and the Southern Region was awarded to TASA a company operated by Telefónica of Spain.

	Price	TASA + TELEC	k	Cost	TASA + TELEC
Cash	214	114 + 110	1	214	114 + 110
Foreign debt bonds	5,029	2,721 + 2,308	0.19	956	517 + 439
Six half-yearly notes	381	203 + 178	1	381	203 + 178
TOTAL	**5,624**	**3,028 + 2,596**	**0.28**	**1,551**	**834 + 727**

As of November 1990 Argentine bonds were quotated at 19 cents on the dollar. The above table shows both parties made a good bargain for the 60% of ENTel.

- The State sold at a price of US$ 5.624 million (US$ 2,507/line)
- The awardees bought at a cost of US$ 1.551 million (US$ 560/line)

In December 1991 and March 1992, 30% of Telefónica and Telecom, respectively, shares of stock were offered to the public. The State obtained US$ 2,057 million (830 + 1,227).

It is worth noting that the public paid cash for this 30%, 1/3 more than the equivalent amount paid by both licensees for the first 60%.

The remaining 10% of ENTel was retained for its personnel.

In the same privatization context, the National Telecommunications Commission (CNT) was created in June 1990 to regulate for the new situation.

As regulatory authority, CNT's main objectives are to regulate the temporary monopolies simulating a market behaviour and to regulate at the minimum possible level telecom services competition, protecting public interests and assuring the continuity, regularity, equality and universality of the telecom services for all - users and operators.

ETSI - THE EUROPEAN APPROACH TO STANDARDS PLANNING
IENT - L'APPROCHE EUROPÉEN Á LA PLANIFICATION DES NORMES

Peter J. C. Hamelberg

Chairman of the ETSI Technical Assembly
PTT Telecom BV
P. O. Box 30150
NL-2500 GD The Hague
The Netherlands

BIOGRAPHY

Peter Hamelberg is currently Director of Standards and International Affairs for PTT Telecom BV of the Netherlands. Prior to this, he has held leading posts in the fields of transmission, data communication and business communications in the Dutch PTT. He was actively involved in the preparation and in the start of ETSI in 1988 and has continued to contribute to the ETSI work ever since. In 1992, he was elected Chairman of the ETSI Technical Assembly.

Mr. Hamelberg obtained a M.Sc. Degree in Electronics from the Technical University of Delft in 1964 and entered the PTT of the Netherlands in 1966.

He has represented his company in many international organisations such as the ITU, the CEPT, the EC and ETNO, the European Public Telecommunications Network Operators' Association. He was also President of the society of PTT Engineers in the Netherlands (1984-1989) and President of the Federation of Telecommunications Engineers of the European Community (FITCE) (1988-90).

BIOGRAPHIE

M. Peter Hamelberg est présentement directeur de la normalisation et des affaires internationales pour PTT Telecom BV des Pays-Bas. Auparavant, il occupait des postes importants dans le secteur des transmissions, des communications de données et des communications commerciales aux PTT néerlandais. Il a participé activement à la préparation et à la fondation de l'IENT en 1988 et il contribue aux travaux de cet organisme depuis cette date. En 1992 il a été élu président de l'Assemblée technique de l'IENT.

M. Hamelberg a obtenu une maîtrise en sciences (électronique) à l'Université technique de Delft en 1964 et est entré au service des PTT néerlandais en 1966.

Il a représenté son employeur auprès de plusieurs organismes internationaux, tels que l'UIT, le CEPT, la Communauté européenne et l'Association européenne des exploitants de réseaux publics de télécommunications (AEERPT). Il a aussi été président de la société des ingénieurs des PTT des Pays-Bas (1984-1989) et président de la Fédération des ingénieurs en télécommunications de la

ABSTRACT

Technical areas covered by ETSI are public telecommunication networks, corporate (private) networks, radio communications, terminal equipment plus some aspects of information

RÉSUMÉ

Les domaines techniques auxquels s'intéresse l'Institut européen des normes de télécommunications comprennent les réseaux de télécommunications, les réseaux d'entreprises

technology, equipment engineering, human factors, testing methods etc.

The standardization work is organized in 11 Technical Committees (TCs) with around 60 SubTechnical Committees (STCs); some 2500 experts participate directly in the work. Project Teams may be established for drafting of urgent standards; these are paid from the ETSI budget; some 25 PTs are in operation on average. On the strategy level, the Programme Advisory Committee analyses the ETSI Work Programme and indicates priorities, in order to achieve an optimum deployment of limited resources. Furthermore, specific areas of interest may be studied by Strategic Review Committees. Note that the area covered by ETSI is much larger than the ITU.

Radio communications standards are in important part of the ETSI Work Programme. GSM, the digital cellular system, certainly represents a success story inside and outside Europe; enhanced versions of the GSM standards are under way. Furthermore there is e.g. the Digital European Cordless Telecommunications System (DECT), the European Radio MEssaging System (ERMES), digital trunking, radio LANs and work on EMC.

Satellite communication work concentrates on VSATs and their interconnection with terrestrial networks and services, including test specifications. Last but not least: ETSI is active in Digital Audio Broadcasting and Digital Video Broadcasting, in collaboration with the European Broadcasting Union.

A recent agreement with the radio regulators in the CEPT (European Post & Telecommunications Conference) ensures early consultations in the area of Spectrum Management.

ETSI now produces around 150 ETSs a year.

privées, la radiocommunication et les équipements terminaux. L'Institut s'intéresse aussi à certains aspects de la technologie de l'information, du génie de l'équipement, de l'ergonomie et des méthodes d'essai.

Les travaux de normalisation sont effectués par 11 comités techniques regroupant environ 60 sous-comités techniques; quelque 2 500 spécialistes prennent part à ces travaux. En moyenne, l'organisme exploite quelque 25 terminaux intelligents. Sur le plan stratégique, le comité consultatif des programmes analyse le programme de travail de l'Institut et établit les priorités pour assurer la meilleure utilisation possible de ressources restreintes. De plus, certains domaines précis d'intérêt peuvent être étudiés par des comités d'examen stratégique. Il est à noter que l'Institut s'intéresse à une gamme de domaines plus large que l'Union internationale des télécommunications.

L'élaboration de normes de radiocommunication est un volet important du programme de travail de l'Institut. Le système cellulaire numérique GSM est, sans conteste, un exemple de réussite tant à l'intérieur qu'à l'extérieur de l'Europe. On travaille actuellement à l'amélioration de normes concernant le GSM. Des travaux sont également en cours dans les domaines suivants : le système numérique européen de télécommunications sans fil, le système ERMES, la liaison numérique, les réseaux locaux de radiodiffusion et la CEM.

Les travaux relatifs aux communications par satellite sont axées sur les microstations terriennes et leur interconnexion avec des réseaux et des services de Terre, et portent notamment sur les spécifications de tests. Il est aussi important de signaler que l'Institut collabore avec l'Union européenne de radiodiffusion à des travaux dans les domaines de la radiodiffusion numérique et de la diffusion vidéo numérique.

Une entente conclue récemment avec les organismes de réglementation de la radiodiffusion au sein de la CEPT assure la tenue rapide de consultations dans le domaine de la gestion du spectre.

L'Institut élabore maintenant environ 150 normes d'essais techniques par année.

ETSI - THE EUROPEAN APPROACH TO STANDARDS PLANNING
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Peter J. C. Hamelberg

Chairman of the ETSI Technical Assembly
PTT Telecom BV
P. O. Box 30150
NL-2500 GD The Hague
The Netherlands

Summary: In the introduction to this paper, the European Telecommunications Standards Institute is placed in the general context of standardization on the world level, the regional level and the national level. After that the structure and the activities of ETSI are described briefly, with specific emphasis on the work in the area of radio communications. Next, the main aspects of the procedures needed to arrive at European Telecommunications Standards are outlined and the complex relationship between standards and regulations is explained. Also, the relations between ETSI and the European Union and a large number of other organizations are clarified and some aspects of the ETSI arrangements on the national level are highlighted.

1. INTRODUCTION

The structures for standardization in the field of telecommunications are very complex. At the international level there is the ITU with the Telecommunication Standardization Sector and the Radiocommunication Sector (formerly CCITT and CCIR). In parallel we have ISO and IEC which are organized on an entirely different basis i.e. their national committees.

At the European level we have CEN and CENELEC - based again on the respective. national committees - and for telecommunications there is of course ETSI, which is an association and has direct membership from companies, institutes, etc etc in almost all European countries. Furthermore there are various committees in the EU context, but these have more of an advisory role.

Usually a similar structure is found on the national level, although the way in which ETSI activities relate to this structure may differ from country to country.

The question is whether these separate activities at the different levels are in fact necessary. The answer is that - in order to ensure full interconnectivity of services and systems - there is a need for European standards indeed. International standards often leave too many options open and Europe can not always wait for the rest of the world. Also, a co-ordinated European contribution to the ITU, for example, is particularly useful as it ensures proper two-way communication with ETSI. It should be quite clear however, that the pre-eminence of the ITU in telecommunications standardization is fully recognized.

2. THE EUROPEAN TELECOMMUNICATIONS STANDARDS INSTITUTE

2.1. `Objective and membership

ETSI was created in 1988 on the initiative of the CEPT together with European industry. The objective was clearly and simply the production of European Telecommunications Standards (ETSs) wherever and whenever needed and based on international standards (ITU Recommendations mainly) as far as possible and available.

ETSI is an association based on French law and it is established in Sophia-Antipolis near Nice in the South of France. Members of ETSI are Administrations, Manufacturers, Network Operators, Users and User Organizations and many others. In total ETSI has over 340 members, plus some associate members (most of them outside Europe), plus around 60 observers, plus counsellors (EU and EFTA) and special guests.

2.2. General structure

ETSI has two Assemblies where all members get together two or three times a year:
The General Assembly determines the general policy of ETSI and decides on management matters, such as the budget, the Rules of Procedure etc.
The Technical Assembly is responsible for the technical work; this includes the ETSI Work Programme, the creation and cessation of Technical Committees and Project Teams and the approval of standards and other forms of technical output.
The ETSI Secretariat, headed by the Director, supports the activities of ETSI in the widest sense.

2.3. Technical Committees

There are now 12 Technical Committees and some 60 SubTechnical Committees and these are active in the following areas:

(i) Public Networks:

TC NA =	Network Aspects
TC SPS =	Signalling Protocols and Switching
TCTM =	Transmission and Multiplexing

(ii) Corporate Networks:
TC BTC = Business Telecommunications and the ECMA TC 32; this is based on a special agreement between ETSI and ECMA.

Furthermore there is the TC TE = Terminal Equipment which covers a large number of applications in the public domain and in the private area as well.

(iii) Radio:

TC SMG =	Special Mobile Group (mainly GSM)
TC RES=	Radio Equipment and Services (public and private applications)
TC SES=	Satellite Earth Stations

(iv) General:

TC EE =	Equipment Engineering
TC HF =	Human Factors
TC MTS=	Methods for Testing and Specification

The "products" of these "horizontal" TCs are to be used by the others.

Please note that the area covered by ETSI is much wider than that of the ITU.

2.4. Project Teams

Apart from all those TCs and STCs we have around 25 Project Teams in operation (average number active at any given moment); these are small groups of experts who are recruited by ETSI for a limited period. The capacity for this type of activity is around 600 man-months a year. Around half of that is financed directly from the ETSI budget under the so-called Costed Work Programme; the rest is paid by the EU or other sponsors under the Voluntary Work Programme.

Particular attention is given to including test specifications in each standard. In many cases Project Teams are used to produce the text for such a test specification; three experts in testing are available in the ETSI Secretariat to support this work.

2.5. Special committees

Next to the "regular" TCs and STCs there are a number of Special Committees. Some of these have a general - more strategic - orientation, others have the task to co-ordinate the technical work in complex areas, where a number of TCs may be involved.

A Strategic Review Committee may be set up in order to study a certain area of ETSI activity and make recommendations on the work programme in that area and the priorities for that work. Examples are Mobile Communications (1989/90) and Public Networks (1991/92). The report of SRC5 on Corporate Telecommunications Networks was presented to the Technical Assembly in October 1993 and a large number of Recommendations from that report was endorsed by the TA; these are now being further elaborated by the relevant TCs and progress reports are presented in the TA meetings.

In 1992 the Programme Advisory Committee (PAC) was created in order to improve the priority setting for the ETSI Work Programme in general. The first report was also presented in October 1993 and contained a well defined set of areas and sub-areas for the classification of the ETSI work items (now over 1700!!) and a methodology for setting priorities. Although further work is being done in this field, the first results were used already when establishing the 1994 programme for ETSI Project Teams.

2.6. Project Management

The internal organisation in ETSI is now focused strongly on Project Management. This means that the technical work in a certain area or sub-area is managed as a project, in order to ensure the necessary synchronization between various groups or committees involved and also to guarantee technical consistency of the output from those groups. A number of pilot projects have been defined and will pave the way for a more general application of professional project management techniques. Projects are usually managed at the STC or TC level; in exceptional cases a separate Co-ordination Committee may be established (example: ISDN).

2.7. Co-operation with other organizations

Of course a lot of co-ordination is necessary with other organizations in the field of standardization. In some cases ETSI has a co-operation agreement with them or even a joint committee. Examples are the EBU - ETSI agreement, under which a Joint Technical Committee (JTC) operates for standardization work in the area of Sound and TV Broadcasting (this includes Digital Video Broadcasting) and the ETSI - ECMA agreement under which ECMA TC 32 operates more or less as an ETSI TC. There is a very good collaboration with EWOS also, which has led to some ETSI STCs operating in a fully integrated mode with some EWOS Experts Groups; examples are Message Handling and Directory Systems.

On the European level there is an extensive and detailed co-ordination with CEN and CENELEC, in order to maintain the necessary consistency and to avoid duplication of efforts; experts are scarce and they are expensive!

2.8. External Relations

ETSI maintains good relations with very many organizations which have an interest in standardization, not only with other standards bodies all over the world (ITU, the Global Standards Collaboration Group, CEN, CENELEC etc) but also R&D institutes and programmes (e.g. RACE and EUREKA), implementors' groups such as the GSM MoU Group, the ATM Forum, etc and last but not least organizations of telecomms users. ETSI has established a User Group, which organizes Topic Groups on various subjects, together with user representatives and other interested persons and entities.

2.9. Intellectual Property Rights

In March 1993, after several years of debate, the ETSI General Assembly adopted an "ETSI Interim IPR Policy & Undertaking". These were based of course on existing international practices, but in particular the Undertaking was more specific on a number of points. Holders of "essential" IPRs are invited to announce their intentions within a certain time frame if they would not be willing to license these IPRs under fair and reasonable and non-discriminatory terms. One reason why Europe would need a more sophisticated IPR policy is the fact that via EU regulations some standards may become mandatory and the user of such as standard will then need a guarantee for access to any IPRs in that case on fair and reasonable, etc terms.

After March 1993, however, considerable difficulties arose when ETSI had to implement the adopted Policy & Undertaking. Unfortunately, it was not possible to solve these problems and in the summer of 1994 the ETSI members decided to abandon the Undertaking altogether. The remaining Policy document will contain the general outlines as indicated above and is expected to be approved by the ETSI General Assembly in November 1994.

3. ETSI WORK IN RADIO COMMUNICATIONS

3.1. Special Mobile Group

The TC SMG is responsible for the development of the GSM standards. This includes the GSM systems in the 900 MHz band and the so-called DCS 1800 for the 1800 MHz band as well. There is a close co-operation with the GSM implementors' group i.e. the GSM MoU Group. GSM is now operational in most European countries and also in an increasing number of countries outside Europe.

The GSM service which is now in operation is based on the GSM Phase 1 Standard. This includes various bearer services up to 9600 bit/s, various teleservices (telephony, short message service, fax group 3) and a limited set of supplementary services (call forwarding, barring of incoming/outgoing/international calls). The Phase 2 Standard, which is right now subject to the last refinements and corrections, covers a far larger set of services and features. Moreover, a number of GSM Phase 1 functionalities have been optimized, such as network-cell selection procedures and handover mechanisms. There are capacity improvements as well, such as the extended frequency band for GSM 900 (50 additional channels) and the introduction of halfrate channels; the decisions on the halfrate codec are under way. There will be a large number of further supplementary services, e.g. Calling Line Identification, Connected Line Identification, Call Waiting, Call Hold, Closed User Group, Advice of Charge, etc etc.

The next step which is labeled Phase 2+ is in preparation. It may include enhancements for business oriented applications such as Virtual Private Networks, Centrex, Private numbering plans and general improvements e.g. DECT access to GSM and GSM in the Radio Local Loop, Packet Radio, etc etc. Full compatibility with the earlier phases is essential of course.

On the longer term the Universal Mobile Telecommunications System (UMTS) will be introduced; it may be seen as an enhanced GSM for the year 2000, but it will also require further integration with other components of the telecommunications system as a whole. UMTS will be closely linked to the ITU's FPLMTS (Future Public Land Mobile Telecommunications System).

3.2. Radio Equipment and Systems

A large number of radio communication systems is being standardized in TC RES, for use in public and in private networks as well. I would like to mention some of them:

- Cordless Telecommunications. The standards for DECT (Digital European Cordless Telecomms) are available. DECT is a TDMA access system in the 1800 MHz band. The I-ETS for CT2 represents an older technology (FDMA, 900 MHz) but is still fully valid.

- Paging. Standards for ERMES (European Radio MEssage System) are ready. This is a true Pan-European paging system. Implementation is co-ordinated by the ERMES MoU group and is starting right now.

- TFTS. A standard for the Terrestrial Flight Telephone System is available. The implementation of the system is co-ordinated by an MoU group of interested parties.

- Trunking. There is a lot of interest in trunking systems, both for public and for private applications. A standard for a digital trunking system TETRA (TransEuropean Trunked RAdio) is being developed.

- Radio LANs. A standard for radio LANs in the 2,5 GHz band (spread spectrum) is available. Work is now being done on standards for a HIPERLAN (High Performance Radio LAN) in the 5 GHz and 17 GHz band. This standard will accommodate system densities in the order of 100-1000 Mbit/s/ha/floor with instantaneous terminal bitrates of 20 Mbit/s.

- EMC. TC RES is very active in the area of ElectroMagnetic Compatibility; it provides the necessary expertise and produces specific standards in this area, in line with the relevant EU Directives.

3.3 . Satellite Earth stations and Systems

The activities of TC SES have been mainly in the area of VSATs (Very Small Aperture Terminals) so far. Another area of interest is the interconnection between satellite systems and terrestrial networks; in designing telecommunication systems the specific requirements of satellite transmission have to be taken into account.

3.4. Transmission and Multiplexing

A lot of work is done in TC TM in the area of microwave links. The emphasis is now on digital radio links in the framework of the ITU's Synchronous Digital Hierarchy.
NB Radio Local Loop matters are studied in TC RES.

3.5. Broadcasting

In the area of radio and television broadcasting the Joint Technical Committee EBU-ETSI is responsible. Initially the emphasis was on D-MAC, D2-MAC and HD-MAC, but the focus of attention is now entirely in digital broadcasting. Standards for Digital Audio Broadcasting will be available later in 1994 and parts of the required set of standards for Digital Video Broadcasting are under way already. As far as DVB is concerned there is a close co-operation with the European DVB Project; their Technical Module is producing the draft documents which are processed by ETSI in order to make them full European Telecomms Standards.

Furthermore a standard for PAL+ is under study.

4. THE ETSI PROCESS

Once a work item had been approved the technical work in ETSI can start. This will result - after sometimes long debate and on the basis of the contributions from the members - in a draft ETS. This draft ETS will then be sent out for public enquiry; if there are substantial comments further technical work may be necessary and a revised draft ETS has to be produced. Finally the (final) draft is sent out for voting and if the required 71% (weighted national voting) is attained the ETS will be distributed and thus is ready for use by everybody.

At the moment the average time from approved work item to (first) draft ETS is around two years, although it varies widely. The average period needed for public enquiry, possibly further work and final approval is also considerable; recent figures indicate around 18 months. One main reason for this is the time needed for analysing and deciding on the many comments which may be received in the Public Enquiry. However, given the fact that the lifecycles of products tend to become shorter the total period is far too long and the success of some de facto "standards" is not surprising therefore.

It should be noted here, that the EC has imposed the same rules for public enquiry, voting, etc on all three European standards bodies.

Inside ETSI, a lot is being done to improve the situation. A Quality Management Group has been set up and detailed plans for improved working procedures are being made. The ETSI Secretariat has passed the test for ISO 9002 certification in March 1994. Of course it is not only the ETSI Secretariat which is involved in Quality and the full co-operation of the members and in particular those who participate in the work of TCs and STCs is required.

Usually the product of the ETSI work will be an ETS, a European Telecommunications Standard. In some cases, e.g. when the technology is not stable yet, there will be an I-ETS, an Interim ETS, which at a later stage may become an ETS. In other cases, the deliverable is an ETR = ETSI Technical Report, which may serve as a basis for further work in a certain area or give guidance to users of certain ETSs.

The ETSI production is now in the area of 150 ETSs a year, a respectable figure!

5. VOLUNTARY STANDARDS AND REGULATORY ASPECTS

In principle all standards are voluntary and their application can not be enforced by law. However, traditionally, each country has a certain number of mandatory standards which must be adhered to, e.g. in the area of safety and the type approval requirements for telecommunications terminal equipment to be connected to a public network. Radio regulations have a similar status.

As far as the member states of the European Union are concerned, some standards are made mandatory by including them in or by making references to them in EU Directives; these Directives have legal force in the EU countries; a good example is the Public Procurement Directive. In order to restrict the amount of mandatory requirements the EU have developed the concept of "essential requirements" which means that only a limited number of "essential" items will be included in such a standard. At the moment, the main areas are type approval standards for terminal equipment and standards for Open Network Provision, which is the EU concept (based on EU Directives) aimed at the realization of an open market for telecommunications equipment and services.

In order to distinguish between "ordinary" standards and those (parts of) standards which are to become mandatory, the latter are labeled TBR = Technical Basis for Regulation. After completion by ETSI the TBRs will become part of a Common Technical Regulation (CTR), which has to be screened by TRAC (CEPT) and finally approved by the EU committee responsible i.e. ACTE - all in all a very complicated procedure.

It should be noted, that although EU Directives do not have legal force in countries outside the EU, their impact goes far beyond EU borders. The EFTA countries are implementing an "European Economic Area" together with the EU countries and they will follow - in general - the EU telecommunications policy and regulations.

Apart from regulations, the EU is also actively involved in other ways. They issue mandates for standards which they consider urgent and in some cases they give financial support as well. The EU also invests large sums in R&D and some of the results of that work will be fed into the standardization process of course.

An important area for ETSI is spectrum management. An MoU between ETSI and the European radio regulators in CEPT/ERC was signed in December 1993 and in an annex to that MoU a procedure is described which is intended to ensure consultation between ETSI and CEPT/ERC at an early stage of development of a new standard in the radio area. Apart from this, Telecommunications Administrations respective radio regulatory branches are members of ETSI in their own right as well.

6. NATIONAL ARRANGEMENTS

In order to support the work of ETSI a certain number of activities has to take place on the national level in each country where ETSI members exist. The most important ones are:

(i) standstill, which means that no work on conflicting national standards may take place;

(ii) the public enquiry, i.e. to send out draft ETSs to interested persons or entities in that country, to collect their comments (if any) and to send these back to the ETSI Secretariat;

(iii) the establishment of the vote; the draft ETSs have to be voted upon on the basis of national weighted voting;

(iv) transposition, which means that the ETSs once approved have to be transposed into national standards and conflicting standards (if they exist) have to be withdrawn;

(v) publication, distribution and sales of ETSI "products" in that country.

For the implementation of these activities each country has to designate a so-called RNSO = Recognized National Standards Organization. In many cases the national branch of ISO and/or IEC acts as RNSO, but in some countries the Ministry of Telecommunications or the Telecommunications Administration is the RNSO.

7. CLOSING REMARKS

I have tried to briefly describe the field in which ETSI is active - with special emphasis on radio communications - and the way in which ETSI is managing the work. I have also tried to describe the environment in which ETSI is operating and to explain the link between ETSI and the world of Regulations in general and the European Union in particular.

Please excuse the extensive use of acronyms; it is difficult to avoid and I refer to the list of acronyms which is annexed.

LIST OF USEFUL ACRONYMS

ACTE	Approvals Committee for Terminal Equipment (EU)
ANSI	American National Standards Institute (USA)
AP	Assemblée Plénière (CEPT, CCIR, CCITT)
APP	Additional Plenipotentiary Conference (ITU)
CCIR	Comité Consultatif International des Radio communications (ITU old)
CCITT	Comité Consultatif International Télégraphique et Téléphonique
CEC	Commission of European Communities (EU)
CEN	Comité Européen de Normalisation
CENELEC	Comité Européen de Normalisation Electrotechnique
CEPT	Comité Européen des Administrations des Postes et des Télécommunications
CTR	Common Technical Regulation (ACTE/TRAC)
EBU	European Broadcasting Union
ECMA	European Computer Manufacturers Association
EEA	European Economic Area
EFTA	European Free Trade Association
EN(V)	European Standard (Provisional) (CEN-CENELEC)
ERC	European Radio Communications Committee (CEPT)
ETNO	European Telecom Network Operators
ETR	ETSI Technical Report
ETS	European Telecommunication Standard
ETSI	European Telecommunications Standards Institute
EWOS	European Workshop for Open Systems
FS	Functional Standard (Europe)
GA	General Assembly (ETSI a.o.)
GATT	General Agreement on Tariffs & Trade
GSC	Global Standards Collaboration
GSM	Group Spécial Mobile (digital mobile system)

IEC	International Electrotechnical Committee
I-ETS	Interim ETS
INTUG	International Telecommunications User Group
IPRs	Intellectual Property rights
ISDN	Integrated Services Digital Network
ISO	International Organization for Standardization
ISP	International Standards Profile (ISO, IEC)
IT	Information Technology
ITSC	Interregional Telecommunications Standards Conference (old)
ITSTC	IT Steering Committee (CEN-CENELEC-ETSI etc)
ITU	International Telecommunications Union
MoU	Memorandum of Understanding
NET	Norme Européenne de Télécommunications (TRAC)
ONP	Open Network Provision (EU regulatory framework)
PNO	Public Network Operator
RACE	Research Advanced communications Europe (EU)
RNSO	Recognized National Standards Organization
SOGT	Senior Officials Group Telecommunications (EU)
SOGITS	Senior Officials Group IT Standardization (EU)
T1	Standards Committee T1 Telecommunications (ANSI/USA)
TA	Technical Assembly (ETSI, EWOS a.o.)
TBR	Technical Basis for Regulation
TC	Technical Committee (ETSI)
TRAC	Technical Recommendations Application Committee (CEPT)
TTC	Telecommunication Technology Committee (Japan)
UIT	Union Internationale des Télécommunications
XEC	National Electrotechnical Committee in Country X
XSI	National Standards Institute in country X

EMI/EMC CONSIDERATIONS IN REMOVING THE BARRIERS
CONSIDÉRATIONS SUR LA CEM ET LE BEM DANS L'ÉLIMINATION DES OBSTACLES

Richard B. Engelman

Chief, Technical Standards Branch
Federal Communications Commission
2025 M St., NW -- Room 7122/MS 1300-B4
Washington, DC 20554 USA

BIOGRAPHY

Richard B. Engelman has worked for the Federal Communications Commission (FCC), in a wide variety of positions, since 1977. He has substantial field experience in identifying EMI/EMC problems, and previously was in charge of the FCC's field inspections and investigations program. Since 1989, he has been Chief, of the Technical Standards Branch in the FCC's Office of Engineering and Technology. The Technical Standards Branch is responsible for writing, maintaining, and interpreting the EMI/EMC rules contained in Parts 15 and 18 of the FCC Rules and Regulations. He graduated with a BSEE degree from Rose-Hulman Institute of Technology in 1973 and is a Senior Member of the Institute of Electrical and Electronics Engineers.

Mr. Engelman is the Chairman of International Standardization Subcommittee of the ANSI-Accredited Standards Committee on Electromagnetic Compatibility, C63. This subcommittee acts as the US Advisory Group on matters relating to the International Special Committee on Radio Interference (CISPR). He also participates in US Advisory Groups for CISPR activities dealing with interference relating to industrial, scientific and medical radio-frequency apparatus, interference relating to radio receivers, and interference relating to information technology equipment. Mr. Engelman is the US Representative to ITU-Radiocommuncation Task Group 8/1, dealing with future public land mobile telecommunications systems.

BIOGRAPHIE

M. Richard B. Engelman a occupé divers postes à l'emploi de la Federal Communications Commission (FCC), depuis 1977. Il a à son actif une expérience pratique importante dans la détection des problèmes de BEM/CEM et il fut, auparavant, chargé du programme d'inspections et d'enquêtes sur place de la FCC. Depuis 1989, il est le chef de la direction des normes techniques du bureau de génie et de technologie de la FCC. La direction des normes techniques est responsable de la rédaction, de la tenue et de l'interprétation des règles de BEM/CEM figurant aux parties 15 et 18 des règlements de la FCC. Il est titulaire d'un diplôme en génie électronique du Rose Hulman Institute of Technology, obtenu en 1973 et il est membre actif de l'IEEE (Institut des ingénieurs en électricité et en électronique).

M. Engelman est président du sous-comité international de normalisation de l'ANSI - Comité des normes de compatibilité électromagnétique, C63. Ce sous-comité agit à titre de groupe consultatif des États-Unis sur les questions relevant du Comité international spécial des perturbations radioélectriques (CISPR). Il participe en outre aux activités des groupes consultatifs américains du CISPR pour les questions relatives aux appareils à radiofréquences utilisés à des fins ISM, au brouillage touchant les récepteurs radio et aux perturbations relatives au matériel de technologie de l'information. M. Engelman est le représentant des États-Unis au sein du Groupe de travail de l'UIT sur les radiocommunications 8/1, qui s'occupe des futurs systèmes de télécommunications mobiles terrestres publics.

ABSTRACT

A new world is dawning in telecommunications: people will be able to communicate with each other directly whenever, wherever, and however they like, without being tied to the wireline telephone network. Personal communications won't be focused, as it is today, around telephone instruments located on workdesks or on kitchen walls. Instead, personal communications will be centered on light-weight, small and inexpensive radio telephones and other radio devices that people carry with them wherever they go.

While these new personal communications devices will spawn a broad array of new communications uses, they will also have to face substantial hurdles in dealing with electromagnetic interference (EMI) and electromagnetic compatibility (EMC) concerns.

Existing radio frequency (RF) devices have been suspected of causing interference to airplane control systems, to automobile computer systems, and to medical devices in hospitals. As new personal communications systems become commonplace, will we be faced with new and more significant EMI/EMC problems?

Existing international standards that are intended to control EMI/EMC problems generally don't apply for frequencies above 1 GHz. Will personal communications devices have problems communicating because of RF noise created by other RF devices?

This paper will discuss these potential barriers as well as some possible solutions that could allow personal communications services to "break loose."

RÉSUMÉ

Une aube nouvelle se lève sur le monde des télécommunications. Les gens pourront communiquer directement les uns avec les autres, quand et comme ils le veulent, sans être rattachés aux fils du réseau téléphonique. Les communications personnelles ne seront pas axées, comme c'est le cas aujourd'hui, sur des appareils téléphoniques situés sur des bureaux ou des murs de cuisine. En effet, les communications personnelles seront plutôt axées sur des radiotéléphones légers, petits et à bas prix, ainsi que sur d'autres appareils radio que les personnes pourront porter sur elles dans tous leurs déplacements.

Même si ces nouveaux appareils de communication personnels faciliteront une vaste gamme de nouvelles utilisations des télécommunications, ils devront aussi surmonter de nombreux obstacles aux chapitres du brouillage électromagnétique (BEM) et de la compatibilité électromagnétique (CEM).

On soupçonne les appareils à radiofréquences (RF) actuels de causer du brouillage dans les systèmes de contrôle aérien, les ordinateurs d'automobile et les appareils médicaux dans les hôpitaux. Comme les nouveaux systèmes de communications personnels deviennent de plus en plus répandus, serons-nous confrontés à des problèmes de BEM/CEM nouveaux et plus graves?

Les normes internationales actuelles, qui visent à contrôler ces problèmes de BEM/CEM, ne s'appliquent généralement pas aux fréquences supérieures à 1 GHz. Les appareils de communications personnels auront-ils des problèmes à communiquer à cause des bruits RF causés par d'autres appareils RF?

Le document traitera de ces obstacles éventuels, ainsi que de diverses solutions possibles qui pourraient permettre de «libérer» les services de communications personnels.

EMI/EMC CONSIDERATIONS IN REMOVING THE BARRIERS
CONSIDÉRATIONS SUR LA CEM ET LE BEM DANS L'ÉLIMINATION DES OBSTACLES

Richard B. Engelman

Chief, Technical Standards Branch
Federal Communications Commission
2025 M St., NW -- Room 7122/MS 1300-B4
Washington, DC 20554 USA

[The views expressed are those of the author and do not necessarily reflect the views of the Federal Communications Commission.]

1. Introduction

Many electrical and electronic devices generate radio noise as a by-product of their operation. To reduce the potential for harmful interference being caused to communications users, countries have adopted technical standards limiting the amount of radio noise that can be emitted by these devices. Most of these technical standards were developed over ten years ago, however, and rely on interference models that may no longer be valid.

The use of mobile communications is growing rapidly. There are now 20 million cellular telephone users in the US, and this is expected to grow by 400% over the next decade. At the same time, the use of electronic devices is pervasive, not only in homes, but in offices, stores, and vehicles. Each of these devices is a possible source of radio noise and radio interference. Nevertheless, users and service providers assume that mobile radios, such as cellular telephones, will be able to operate anywhere, including locations where there may be many electronic devices generating radio noise.

Users of electronic devices also will assume that their devices will continue to function properly even when mobile radio transmitters are nearby. However, many electronic devices, in addition to generating radio noise, are susceptible to disruption of their operation by the presence of strong radio signals. In the last few years, interference to telephones has become one of the largest sources of complaints to the FCC. The malfunctioning of medical devices due to nearby communications devices has also been well publicized recently.

Are the dramatic expansions in the use of electronic devices and mobile radios headed for a collision? Hopefully not, provided equipment manufacturers recognize the problems and take appropriate steps to address them.

2. EMI/EMC Regulations Yesterday and Today

The Institute for Electrical and Electronics Engineers (IEEE) defines electromagnetic interference (EMI) as "the impairment of a wanted electromagnetic signal by an electromagnetic disturbance".[1] IEEE similarly defines radio interference as "degradation of the reception of a wanted signal caused by RF disturbance".[2]

Radio interference has existed since the earliest days of radio communications. Many electrical and electronic devices in their operation are capable of emitting radio frequency energy. In 1938, the Federal Communications Commission (FCC), the body that regulates the non-government use of radio transmissions and radio energy in the United States, adopted its first regulations governing these devices.[3]

The FCC defines a radio frequency (RF) device to be "any device which in its operation is capable of emitting radiofrequency energy by radiation, conduction, or other means."[4] Part 15 of the FCC regulations governs the use of RF devices in the United States.[5] These rules prohibit RF devices from causing harmful interference to communications users, and in many cases limit the amount of RF energy that can be conducted onto a power line, or radiated into the ether, by an RF device.

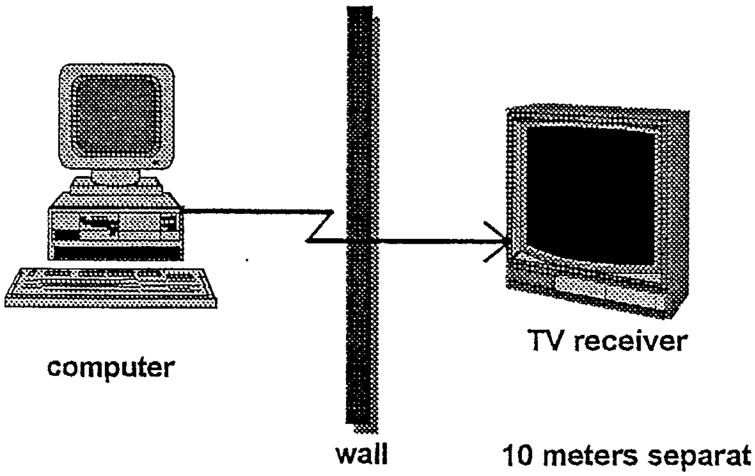
Part 15 divides RF devices into three categories:

> incidental radiators -- devices that generate RF energy although the device is not intentionally designed to generate or emit RF energy. Examples include dc motors, mechanical light switches, etc.
>
> unintentional radiators -- devices that intentionally generate RF energy for use within the device, or for conduction to associated equipment via connecting wiring, but which are not intended to emit RF energy by radiation or induction. Examples include radio receivers, computers, switching power supplies, and cable television converter boxes.
>
> intentional radiators -- low power devices that generate and emit RF energy by radiation or induction and do not require a station license in order to be operated. Examples include cordless telephones and garage door openers.

Since 1937, Part 15 has prohibited all RF devices from causing harmful interference to communications users. However, until 15 years ago, Part 15 provided technical standards limiting RF emissions only for intentional radiators and certain radio receivers.

In 1979, after receiving numerous complaints about interference being caused by the first generation of home computers, the FCC adopted technical standards for RF emissions from computing devices and computing device peripherals.[6] Since then, the International Special Committee on Radio Interference (CISPR) for information technology equipment has adopted similar technical standards for information technology equipment.[7] The CISPR standards form the basis for EMI regulations throughout the world.

The 1979 technical standards for radiated emissions from computing devices in home environments were based on an interference model that made several assumptions. First, it was assumed that most RF interference would be caused to television receivers in the home. Accordingly, the standards covered only the frequency range from 30 MHz to 1000 MHz. Second, it was assumed that RF device technical standards should not be so strict as to require protection from the computer user to radio receivers controlled by the computer user; rather they should only protect radio receivers operated by other parties. As a result, the interference model for developing the radiated emissions limits used desired signal levels and protection levels that were appropriate for television signals, and assumed that protection should be provided when the RF device and television receiver were separated by 10 meters with an intervening wall. More relaxed standards were adopted for computing devices that are used in commercial, business, or industrial locations, recognizing that the potential for interference to radio communications was less and that the commercial user would be able to take corrective measures more easily than the general public.



In 1989, the FCC expanded the application of the computing device technical standards to most other unintentional radiators.[8] Recognizing that new communications uses above 1000 MHz were beginning, and recognizing that computing devices would ultimately be capable of generating RF energy emissions above 1000 MHz, the FCC adopted limits on radiated emissions above 1000 MHz. CISPR is similarly considering limits above 1000 MHz.

While the FCC adopted rules that were intended to limit RF interference, it did not deal with electromagnetic compatibility (EMC) issues. The IEEE defines EMC as "the ability of a device, equipment, or system to function satisfactorily in its electromagnetic environment ..."[9] Traditionally, the FCC has considered EMC to be a quality issue that was best decided by the manufacturer and user of an electronic device. However, in the 1970's as citizens band (CB) radios began to increase in popularity, the FCC began to receive tens of thousands of complaints each year about CB transmissions adversely affecting the reception of TV signals. While some of these complaints were clearly due to over-powered or improperly-operating CB stations, many also appeared to be due to the susceptibility of TV receivers to malfunctioning when relatively strong CB transmissions were also being received.

In 1982, the FCC received specific legal authority to establish minimum performance standards for home electronic equipment and systems to reduce their susceptibility to interference from RF energy.[10] However, rather than mandate EMC standards for home electronic equipment, the FCC has chosen to work with industry to adopt voluntary standards for susceptibility, when needed. These efforts have been somewhat successful. For example, since the adoption of television immunity standards developed by the Electronic Industries Association, the number of complaints of television interference received by the FCC has dropped significantly. Similarly, the Telecommunications Industry Association is finalizing standards that should help reduce the number of complaints of telephone interference.

Other parts of the world have chosen to mandate EMC standards. For example, in 1989, the Council of the European Communities adopted an EMC Directive that requires, among other things, that apparatus have "an adequate level of intrinsic immunity of electromagnetic disturbance to enable it to operate as intended".[11] As a result, European standards developers, as well as CISPR and the International Electrotechnical Commission, have been developing EMC standards.

3. EMI/EMC Challenges

The use of mobile communications is growing rapidly. There are now 20 million cellular telephone users in the United States, and within ten years there could be 100 million users.[12] At the same time, the use of electronic devices is also growing rapidly. Personal computers are pervasive in homes and offices, and digital circuitry is used to control virtually every type of apparatus. Because of these growth trends, the challenges associated with EMI and EMC will be significant.

Challenging communications environments. The concept behind personal communications services (PCS) is that of providing communications anytime and anywhere.[13] Similarly, mobile satellite service (MSS) providers are looking to provide regional and world-wide roaming capability. Future public land mobile telecommunications systems (FPLMTS), under development within the International Telecommunications Union for the year 2000 and beyond, promise to expand the anytime/anywhere concept to allow world-wide roaming of small, hand-held terminals by integrating terrestrial and satellite capabilities.

Each of these future services or systems is intended to operate in a variety of operating environments, such as outdoor pedestrian, outdoor mobile, indoor office and indoor residential. However, many of the various environments in which PCS and other mobile communications systems will operate pose significant EMI/EMC challenges. For example, in the home environment, mobile communications will have to work in close proximity not only to personal computers and home appliances, but also to other potential RF noise sources such as digital clocks, CD players, television receivers, video cameras and video cassette recorders, and RF-excited light bulbs. Outdoors, vehicles such as cars and trucks, electric trains and subways, and power lines are potential RF noise sources. And the office environment may be the most challenging of all, with computers, printers, copiers, and fax machines everywhere.

Use of higher frequencies. The frequencies used by computing devices, and other RF devices, are increasing. A major computer manufacturer announced at the recent COMDEX trade show that it will soon be offering a personal computer with a clock speed of 130 MHz. Computers often emit radio noise on frequencies as high as the tenth harmonic of the clock frequency, so it is likely that radio noise at UHF and above will be increasing.

There are additional challenges associated with the use of higher frequencies in RF devices. As frequency increases, wavelength decreases, which results in an increased efficiency for shorter lengths of wire or traces on printed circuit boards to become more effective RF radiators. Similarly, holes in RF device enclosures may allow more RF energy to escape on higher frequencies. These characteristics will pose significant challenges for RF device manufacturers.

Adequacy of existing EMI standards. As discussed previously, today's technical standards to control EMI are based on some assumptions that may not be valid anymore. This raises several questions. For example, given the high level of mobility desired for mobile communications, can we continue to rely on an interference model that assumes that the interfering RF device and radio receiving device will be separated by 10 meters and an intervening wall? Can we also continue to rely on the user to identify the source of interference and take corrective actions, or should we instead adopt standards that helps protect the user against interference to themselves?

Workers in businesses will expect reliable wireless communications even though many RF devices, such as computers, printers, fax machines, and copiers, are nearby. Should we continue to have relaxed technical standards for RF devices used in commercial, business, and industrial environments?

With the increasing use of higher frequencies in RF devices, are the limits for emissions above 1000 MHz adequate? CISPR has begun efforts to development international standards above 1000 MHz, but will the current lack of international standards for emissions above 1000 MHz pose a challenge?[14] The answers to all of these questions about the adequacy of the existing EMI standards are not yet obvious.

EMC immunity. As mobile communications become common in new environments, new EMC challenges will emerge. Mobile radio transmitters will be operated nearer to potentially susceptible electronic equipment. As a result, devices that operated perfectly fine before the explosion in mobile communications may no longer work. In addition, a recent editorial in EMC Test & Design points out that many new electronic devices are going to be radio-based products and, as such, they will have greater sensitivity to RF emissions that most other types of electronic equipment.[15] The editorial goes on to state that users will expect these products to work as well as existing wired systems, and that users won't tolerate new high-tech devices that don't work because of EMC problems.

EMC problems are not new. However, in the US there have been several recent problems with EMC that might provide lessons for the future. Several years ago, retailers began selling inexpensive electronic telephones to consumers. Immediately, the FCC began to receive telephone calls complaining about interference from radio communications such as CB, amateur, and AM broadcasting. Over the years, the volume of telephone complaints has grown to where it is now the second largest type of interference complaint that the FCC receives. As mentioned previously, the FCC is working with the Telecommunications Industry Association to finalize and implement an

EMC standard for telephones that, hopefully, will eliminate most of these problems.

Recent articles in the Wall Street Journal and Compliance Engineering indicate that there is evidence that electronic medical equipment is vulnerable to increasing levels of RF energy.[16][17] Although people have tried to portray this problem as having been caused by the use of mobile and other types of communications, recent testimony by Tom Stanley, Chief Engineer of the FCC, before a US House of Representatives subcommittee indicates that the only solution to the EMC problem is "to make medical devices more immune to undesired transmissions."[18]

4. Possible EMI/EMC Solutions

Digital communications technology. There's a big advantage with respect to EMI that mobile communications of the future will have over today's mobile communications: the use of digital technologies. Digital communications will have a much greater ability to tolerate co-channel interference than analog communications.[19] In addition, information passed through a digital communication system generally does not indicate deterioration due to noise conditions until a certain interference threshold is reached. Thus, digital communications systems should be much more tolerant of moderate levels of EMI than today's analog systems.

Recently completed tests associated with advanced television (ATV) in the US provide concrete evidence of the improvement that the use of digital technology can bring over analog technology.[20] In looking at service performance within the predicted NTSC service area for TV channel 6 (82-88 MHz), 39.6% of locations had satisfactory NTSC reception while 81.7% of locations had satisfactory ATV reception. (NTSC is the existing analog television transmission standard in the US, Canada, and elsewhere). On channel 53 (704-710 MHz), 76.3% of locations had satisfactory NTSC reception while 91.5% of locations had satisfactory ATV reception. The ATV improvements are even more remarkable considering that the average power level of the ATV signals was 12 dB below the peak visual power of the NTSC transmissions.

New digital technologies may also make further improvements. Digital broadband radios, where a large section of RF is received and analyzed by computer software, may allow further improvements in avoiding EMI.[21] In addition, Superconducting Core Technologies of Golden, Colorado, just announced that they had developed a superconductor microwave filter "that is automatically tuned by microprocessors to allocate frequencies and improve channel reuse."[22]

Improvement and Internationalization of EMI/EMC Standards. Existing EMI standards need to be reexamined to see if they are still adequate to control interference from RF devices to radio communications, given the new mobility and growth in use of both types of devices. EMC standards should be completed and made available to manufacturers as soon as possible.

Trade is becoming more international in nature and manufacturers of all kinds of products are looking to sell throughout the world. The North American Free Trade Agreement (NAFTA) and the General Agreement on Trade and Tariffs (GATT) both have language encouraging worldwide harmonization of standards in order to encourage such world trade and to remove existing trade barriers. Accordingly, CISPR and IEC should be the focal points for these standards efforts.

Awareness. One of the key solutions to avoiding future EMI problems is awareness. Awareness by the RF device manufacturer of potential EMI problems and of national and international EMI regulations. Awareness that, as frequencies go up, shorter wires, pieces of metal and even circuit board traces can become more effective radiators. And awareness that the easiest and best solution to EMI problems is to design the RF device with EMI considerations in mind from the start.

Electronics device manufacturers need to be aware of potential for EMC problems. They need to learn to design their product so it can live in the mobile communications environments of the future.

5. Conclusion

Potential EMI/EMC problems present a barrier to the ability for mobile communications to break loose. To avoid these problems, it is essential that ***cooperation*** be established between the manufacturers of mobile communications systems, the manufacturers of RF devices, and the manufacturers of electronics devices that may be susceptible to the presence of RF energy. The public expects that these products will be able to work together. That can only happen if mobile communications manufacturers design their systems with significant robustness so that moderate RF noise levels will not disrupt communications. Similarly, RF device manufacturers must recognize that excessive RF noise generated by their product may make mobile communications unusable; something that would cause adverse consequences for both the mobile communications world and the RF device world. Finally, electronic device manufacturers must understand that mobile communication usage is growing and that they must design their product to operate in the presence of RF signals. With such cooperation, and a little helpful guidance and education from your friendly communications regulators, the barriers will be removed and mobile communications will truly "**break loose**".

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NOTES

LICENSING OPTIONS IN THE UNITED STATES
OPTIONS DE DÉLIVRANCE DE LICENCES AUX ÉTATS-UNIS

William F. Maher, Jr.

Halprin, Temple & Goodman
1150 New York Avenue, NW
Suite 650 East
Washington, DC 20005 USA

BIOGRAPHY

William Maher is a partner in the law firm of Halprin, Temple & Goodman. Until May 1994, Mr. Maher served in the National Telecommunications and Information Administration (NTIA), U.S. Department of Commerce, where he headed the Office of Policy Analysis and Development. In that position, Mr. Maher participated in developing telecommunications policy recommendations for the U.S. government in such important areas as spectrum flexibility and the use of competitive bidding for new radio services, broadcast and cable television regulatory reform, and the national information infrastructure.

Prior to his service at NTIA, Mr. Maher was Special Counsel for Competitive Issues in the Federal Communication Commission's Common Carrier Bureau. Before becoming a lawyer, Mr. Maher was a research engineer at Bell Labs.

Mr. Maher received his J.D. from Harvard Law School, an S.M. in electrical engineering from the Massachusetts Institute of Technology, and a B.S.E.E. from the University of Notre Dame in 1978.

BIOGRAPHIE

M. William Maher est associé dans l'étude juridique Halprin, Temple & Goodman. Jusqu'en mai 1994, M. Maher oeuvrait à la National Telecommunications and Information Administration (NTIA) du département du Commerce des États-Unis, où il dirigeait le bureau d'analyse et d'élaboration des politiques. À ce titre, M. Maher a participé à l'élaboration de recommandations de politiques de télécommunications pour le gouvernement américain, dans des secteurs aussi importants que la souplesse d'utilisation du spectre et les appels d'offres pour les nouveaux services de radiodiffusion, la réforme de la réglementation de la télédiffusion et de la télévision par câble, ainsi que l'infrastructure nationale d'information.

Avant de passer à la NTIA, M. Maher était conseiller spécial pour les problèmes de concurrence au Bureau des entreprises de télécommunications de la FCC. Avant d'être avocat, M. Maher était ingénieur chercheur chez Bell Labs.

M. Maher est diplômé en droit de Harvard et titulaire d'une maîtrise en génie électrique et électronique du Massachusetts Institute of Technology, ainsi que d'un baccalauréat en génie électrique et électronique de l'Université Notre Dame, depuis 1978.

ABSTRACT

The United States has used a variety of means to license the use of the radio spectrum. Traditionally these have included comparative hearings, first come/first served, and lotteries.

In July 1994, the Federal Communications Commission (FCC) began using various types of competitive bidding, or auctions, to assign licenses in, for example, narrowband Personal Communications Service (PCS) and Interactive Video Services (IVDS).

This presentation provides a survey of these assignment techniques and the results of the initial uses of competitive bidding in the United States. It discusses licensing options in light of efficient assignment of the resource, administrative ease, and revenue.

RÉSUMÉ

Les États-Unis ont eu recours à divers moyens pour délivrer des licences d'utilisation du spectre radioélectrique. Traditionnellement, ils ont eu recours à des audiences comparatives, à l'ordre de présentation des demandes, ou à des loteries.

En juillet 1994, la Federal Communications Commission (FCC) (Commission fédérale des communications) a commencé à recourir à divers types d'appels d'offres ou d'enchères pour la délivrance de licences, notamment pour des services de communications personnels (SCP) et des services vidéo interactifs (SVI).

Cet exposé présente un survol de ces techniques d'assignation et les résultats des utilisations initiales des appels d'offres aux États-Unis. Il porte sur les options de délivrance de licences en tenant compte de l'assignation efficace de la ressource, de la facilité d'administration et des recettes.

To include coverage of the FCC auctions, which were scheduled to start on 5 December 1994, and some of the activities leading up to that event, Mr. Maher will provide copies of his paper at the time of his presentation.

Industry Canada & Radio Advisory Board of Canada

1994 Spectrum 20/20 Proceedings
December 8, 1994

Licensing Options In the United States

presented by

William F. Maher, Jr.
Halprin, Temple & Goodman
Washington, D.C.

United States Trends/Licensing Options

- Information Superhighway
- Global emphasis
- Licensing Objectives
  - ✓ Interference Protection
  - ✓ Productive Spectrum Use
  - ✓ Industry Development

United States Trends/Licensing Options

Information Superhighway

- Emphasis on Telecommunications as a "Social Good" at the Highest Levels
- Relative Under-emphasis of Wireless Role in Information Superhighway
- Impact of Policy Changes (legislative, FCC, judicial)
  - ✓ Telco into video, long distance and manufacturing; and
  - ✓ Long distance and cable into local exchange, including voice;
  - ✓ Wireless impact;
  - ✓ Related demand for investment dollars.
- Licensing Authorities Play Crucial Role

United States Trends/Licensing Options

Global Emphasis

- Vice President Gore - Global Information Infrastructure

- Can the United States Retain Its Historic Role in Wireless Communications?

  - ✓ Standards

    - GSM/CDMA/Other standards

  - ✓ Public-private partnerships

- Does the U.S. Government Understand the Role of Wireless?

  - ✓ Cellular/PCS

  - ✓ Wireless local loop

  - ✓ Satellite

United States Trends/Licensing Options

Wireless/Auctions

- "Traditional"
  - ✓ Comparative Hearings
  - ✓ First Come, First Served
  - ✓ Lotteries
    - ✓ Low Power Television (November 1994)
- PCS rules
  - ✓ Near "final" form
- FCC Wireless Bureau
- Auctions

United States Trends/Licensing Options

Auctions

The value of the radio spectrum

- Narrowband national licenses (July 1994)
  $617 million

- Interactive Video and Data Service (IVDS) (July 1994)
  Total:
  $ 215 million (total bid)
  \- 83.2 million (total default)
  $ 131.8 million

- Regional Narrowband PCS (October-November 1994)

  Gross Revenue: $490,901,78

  Net Revenue: $394,835,784 allowing for 40% bidding credits

- Broadband PCS

  ✓ 2 30 MHz MTAs in 99 license areas (began December 5, 1994)

  ✓ Designated entity blocks

  986 licenses in 493 licensing areas

  ✓ 10 MHz blocks

  986 licenses in 493 licensing areas

United States Trends/Licensing Options

Broadband Auctions

Estimated revenues

- Budget numbers -- about $12.5 billion (U.S. Office of Management & Budget)
- To Date in the Auction:

  After two rounds, total revenue of *$489,205,728*

United States Trends/Licensing Options

Broadband Auctions

Effects on FCC/U.S. public policymakers

- Rapid implementation and focus
- Decreased emphasis on other spectrum reforms (spectrum flexibility)
- More calculated approach to service definition and spectrum allocation

United States Trends/Licensing Options

Broadband Auctions

International Effects

- Auctions of spectrum
- Amount of capital for infrastructure investment
- Speed
  - ✓ Time to market issues for equipment suppliers
  - ✓ Standards Development

Session 4

PANEL DISCUSSION - THE NEXT STEPS
PANEL DE DISCUSSION - LES PROCHAINES ÉTAPES

Thomas P. Stanley

Chief Engineer
Office of Engineering and Technology
Federal Communications Commission
2025 M St., N.W.
Washington, DC, 20554

BIOGRAPHY

Dr. Stanley has served as Chief Engineer of the FCC and Chief of the Office of Engineering and Technology since February 1986. He has held a number of other positions in the Office of Engineering and Technology (formerly the Office of Science and Technology) since joining the FCC in 1981, including Chief Scientist. Prior to his work with the FCC, he was affiliated with the Institute of Defense Analysis, the U.S. Army Signal Corps, and Bell Telephone Laboratories.

Dr. Stanley received his Ph.D. and M.A. in Electrical Engineering from Princeton University and his B.E.S. in Electrical Engineering from Johns Hopkins University.

BIOGRAPHIE

Titulaire d'un doctorat, M. Stanley est ingénieur chef de la FCC et chef du bureau de génie et de technologie depuis février 1986. Il a occupé divers autres postes au bureau de génie et de technologie (ancien Office des sciences et de la technologie) depuis qu'il a joint les rangs de la FCC en 1981, y compris celui d'ingénieur chef. En plus de ses travaux à la FCC, il est affilié à l'Institute of Defense Analysis, au U.S. Army Signal Corps et à Bell Telephone Laboratories.

M. Stanley a obtenu son doctorat et sa maîtrise en génie électrique à l'Université Princeton et son baccalauréat en génie électrique à l'Université Johns Hopkins.

NOTES

PANEL DISCUSSION - THE NEXT STEPS
PANEL DE DISCUSSION - LES PROCHAINES ÉTAPES

Joseph P. Sarnecki

Vice-President - Network Services
Bell Mobility Cellular Inc.
20 Carlson Court, Suite 900
Etobicoke, Ontario, M9W 6V4

BIOGRAPHY

Joe graduated from Ryerson Polytechnical Institute of Toronto in 1972 with a diploma in Civil Engineering Technology and in 1989 completed the Executive Management program at the University of Western Ontario.

Joining Bell Canada in 1973, Joe progressed through management positions in various engineering disciplines. In 1984 he accepted a position to start a new subsidiary - Bell Cellular (currently Bell Mobility Cellular). With a mandate to develop and introduce cellular radiotelephone services, his responsibilities encompassed design, product procurement, network deployment, operations, financial management and technology planning.

In 1985 he was appointed Vice President - Network Services and on April 1, 1992, was appointed Vice President of BCE-Mobile Communications Inc. In his current position, Joe is responsible for the corporate strategic technology planning and development of current and future wireless communications technologies and services, including Personal Cordless Telephony (PCT).

Joe is also active through his industry participation in chairing various telecommunications committees in Canada and the United States for RadioComm, IEEE and CTIA. Joe is currently Chairman of CTIA Chief Technical Officers' Committee, a member of CTIA Technology and Operations Committee and also a member of the Radio Advisory Board of

BIOGRAPHIE

M. Sarnecki a obtenu un diplôme en technique de travaux publics du Ryerson Polytechnical Institute, à Toronto, en 1972, et un diplôme de gestion supérieure de l'université Western Ontario en 1989.

Entré chez Bell Canada en 1973, M. Sarnecki y a occupé des postes de gestion de responsabilité croissante dans divers domaines techniques. En 1984, il a accepté la responsabilité de mettre sur pied une nouvelle filiale de Bell Canada, Bell Cellulaire (devenue Mobilité Cellulaire Inc.). Il avait pour mandat d'assurer le développement et l'introduction de services de radiotéléphonie cellulaire; il était responsable de la conception, de l'achat de produits, de la mise en place de réseaux, des opérations, de la gestion financière et de la planification technique.

M. Sarnecki est nommé vice-président, Services de réseau, en 1985, et vice-président de Radiocommunications BCE Mobile Inc., le 1er avril 1992. Ses responsabilités actuelles comprennent la planification technique stratégique et le développement de techniques et de services actuels et futurs de communication sans fil, dont les services de communications personnelles sans fil.

M. Sarnecki est aussi actif au sein de l'industrie; il est président de divers comités canadiens et américains oeuvrant dans le domaine des télécommunications, dont RadioCOMM, IEEE et CTIA. Il est actuellement président du comité des agents en chef des services techniques et membre du

Canada.

comité de la technologie et des opérations de la CTIA; il est également membre du Conseil consultatif canadien de la radio.

NOTES

Horizontal Castles

Joe Sarnecki
Vice President, Network Services
Bell Mobility

For someone responsible for engineering within a wireless telecommunications company, a speech about "The Next Steps" could be mercifully short: spec it, design it, build it, test it, operate it, and improve it.

However, defining what "it" is, is the hard job. The decision as to what constitutes "it", is today perhaps the most pressing decision in telecommunications, and not a trivial one either.

This has become the case even in an environment of technological abundance, because the decision as to the shape and contents of a new service provides, paradoxically, both a platform that creates immediate value for customers and a ceiling against which their future ambitions may someday bump.

Winston Churchill expressed this thought well when he noted, talking about architecture, that "first we shape the buildings, thereafter they shape us."

My remarks today will draw on the thoughts of another great writer, the playwright Henrik Ibsen. In his play "The Master Builder", Ibsen wrote: "Castles in the air—they are so easy to take refuge in. And so easy to build, too."

Well, anyone involved with the deployment of a wireless service would tell you that building our own castles in the air is anything but easy.

Ibsen's metaphor will serve as the organizing principle for my own remarks today, which will touch on three themes: how we've grown the wireless industry so far, what the castles of the future will look like, and how we accomplish growth while improving service to the customer.

Let me begin with a brief recap of our growth to date. Ibsen's perspective is valuable because the history of wireless telecommunications in Canada so far has been about building castles in the air—vertical castles.

I call these castles vertical turrets because they are castles of technology—cellular, paging, ARDIS, air-to-ground, radio, and soon, two varieties of satellite.

And the features we've added, including voice mail, PrimeLine, off-peak rates, international paging, and so on, are like the spires on our castles. Perched on top of the main structure, but still vertical in orientation.

However, don't get me wrong--vertical castles have worked well for both customers and carriers--but only to a point.

At Bell Mobility alone, we support three-quarters of a million customers on all of our technology platforms. And this month Mobility Canada signed up its one millionth cellular customer, making it the first cellular carrier in Canada to reach this milestone.

We've introduced these hundreds of thousands of people to wireless, they've incorporated wireless into their lives, and on balance our surveys indicate that they're quite happy with their service. For them, the availability of reliable, versatile and cost-effective wireless services has created value in the form of Productivity, Convenience, Safety and Security and we hope will continue to do so for a long time.

For the carrier, a different kind of value has been created. Being technology-focused has allowed us to optimize the configuration and operation of our services, meaning that while our castles have had few interconnections, they've been built well. While our customers are the main beneficiaries of our work to date, we've also become quite proficient at castle-building and castle maintenance.

But as you know from history, the traditional style of vertical castle became obsolete once city-states became nations. Reaching a critical mass meant that scarce resources could be directed toward new activities that, in time, led to widespread growth and prosperity through two successive revolutions, agricultural and industrial, that have brought us to the present day.

Now we stand in the midst of the third great revolution in our history, the information revolution, and seek new directions and new designs for the structures we need to build for the future. That brings me to my second point.

I believe that in the years ahead, the structures that shape the services we offer will still be castles. But unlike the castles built so far during the brief history of Canada's wireless industry, the castles of tomorrow will be horizontal.

However, before we are able to achieve this, we must first learn to provide the linkages or bridges between the many turrets of today's technologies to deliver tomorrow's services.

By horizontal I mean that no longer will our castles be built according to technology. In the future they'll be built according to use. There will be voice castles, data castles, and whatever other structures are needed to give customers what they want, when they want it, and where they want it.

The castles of the future will take the best bricks from existing castles and recombine them in ways that create new value for customers.

And the skills needed to build horizontal castles will be different too. It won't be enough to get one network up and running: castle builders will need to understand all of them. It won't be enough to replicate the design or functionality of an existing castle, because that's not what the customers of tomorrow will want.

What they want, need, and will get will be a reconceptualization of the growth paradigm that we've used to date. Customers want services without limits; they don't want to hit their heads against the ceilings that existing technologies, designed into vertical castles, have built over their rising expectations.

You may ask how I can say this with confidence. After all, you can't predict the future, and the castle-builders of old wouldn't have laboured so long to create their monuments if they felt that the trends which were evident at the time pointed toward obsolescence.

My prediction is based on a different reading of history, one that looks at the sustained, incremental growth in the desire of people for more, better, and faster things. There isn't a limit in human history that someone hasn't thought longingly about eliminating.

And while some limits are necessary for the preservation of civilized society, the removal of others will herald a new era of growth and prosperity, just as the advent of the agricultural and industrial revolutions swept before them limits that were thought to be immutable and replaced them with new paradigms of growth that went beyond anyone's imagination.

That's where we stand today. In the midst of a new revolution, one whose benefits have only started to be realized. And as we look longingly towards an era of fewer limits, a time where the free rein of human creativity will be supported even more by technology, the practical question of how we get there confronts all of us, especially people like me who are called upon to make the magic work 24 hours a day, seven days a week.

This brings me to my third point: how do we build our new castles so as to improve service to the customer?

The first step is to become more comfortable with uncertainty. It's highly likely that there won't be one right design. In fact, there probably will be many designs, many standards, and many conceptualizations of what a truly customer-focused telecommunications service should be.

Consequently, a good strategy to move forward will be ensuring that those Canadian companies with the right competencies are allowed to begin building the telecommunications services of tomorrow. In my view, these competencies include experience in managing a family of technologies and in providing real-time customer support.

Personal communications services, or PCS, is undoubtedly one of those service concepts of tomorrow. PCS is a combination of wired and wireless services that will rely on a single number, a single device and an intelligent agent to deliver service and thus create value for customers.

I can't think of a better example of a horizontal castle than PCS. Customers will enjoy ready access to voice and data services, presented to them as a seamless, integrated whole by a service provider or providers acting in tandem.

One powerful service, combined from functional subsets, put before customers by a reliable carrier who not only operates the networks that deliver value but organizes others who do likewise.

PCS means that a carrier must not only have skills in network operation within a family of technologies, but must be able to link those technologies together, understand how wired and wireless will work together, plus have the ability to build and manage bridges to new, standalone applications developers.

This entire package consisting of core services, network operations, wired and wireless links, together with value-added applications, will be put before the customer as a seamless whole and called PCS.

This recognition that not all the skills needed to offer PCS will be resident within one company is quite a change from the past, but makes good sense once you consider that what we know today about the operation of a telecommunications service is only a subset of what we'll know one year hence, not to mention two, five and ten years hence.

Consequently, it makes sense to conceptualize PCS as being flexible and technology-independent. Horizontal, not vertical. Directed to the customer. Focused on creating value.

For a company like Bell Mobility, this view of PCS has two significant strategic implications.

First, we are looking forward to commenting on the federal government's PCS Gazette Notice and hope to be active participants, on behalf of the one million Canadians who buy wireless services from us, in the 2 GHz licensing process that will begin next year.

These Canadians are the early adopters of wireless and have used the technologies that we brought to market as a platform to grow, operate and improve their businesses, or to bring a greater degree of convenience, safety and security to their lives and to the lives of their families.

We believe that we have an obligation to continue supporting their wireless use especially as new services become available.

We see the PCS comment and licensing process as essential first steps leading to the creation of an exciting, powerful and customer-focused service, one that will let our customers boldly go into the next millennium with more confidence, more capability, and more control than ever before.

Second, we are actively seeking alliances with value-added applications developers and others within the wireless world for three reasons.

Alliances lower the cost of acquiring and internalizing knowledge.

Alliances enable us to seek out best practices and bring them to the service of our customers in Ontario and Quebec, and through Mobility Canada, to all Canadians who live or travel through our coverage areas.

And last, alliances speed up the introduction of services to market, by linking specialized skills to the technology platforms we will be operating.

These goals are entirely consistent with our PCS strategy. We intend to continue the "best-to-market" approach that has kept our service and customer satisfaction levels high and our churn rates low. We also recognize that the move to 2 GHz creates a unique opportunity to offer Canadians genuinely new services, not just cellular look-alikes. Our intent is the provide Canadians with the former, not the latter.

In five years time I hope to be able to describe a telecommunications world of choices, capabilities and performance well in excess of what anyone anticipates today.

I also hope that the decisions that soon will be made about PCS and the structure of the industry that provides it are reached with the aim of creating opportunities for participation by Canadian companies and ensuring that customers receive the high quality of service that they are entitled to have and have had to date, and consequently have come to expect.

I believe that the pillars of PCS success will be network operations experience, technology management experience, a "best to market" orientation which grows out of a philosophy of quality, and the ability to seek and secure the best alliances in a competitive market.

With this in mind, Canada and Canadian companies will continue to be seen as leaders in developing and delivering the most innovative and highest quality telecommunications systems and services, domestically and globally.

And there is no better time to take the next step towards a better future than right now.

PANEL DISCUSSION - THE NEXT STEPS
PANEL DE DISCUSSION - LES PROCHAINES ÉTAPES

Stephen L. Edwards, P. Eng.

Vice-President Corporate Engineering & Technology
Rogers Broadcasting Limited
25 Adelaide Street East
Toronto, Ontario, M5C 1H3

BIOGRAPHY

A native of Trail, B.C., Steve attended the University of British Columbia, graduating with a B.A.Sc. in Electrical Engineering in 1970. Awarded an Athlone Fellowship for post-graduate studies in the United Kingdom, he subsequently received an M.Sc. from the University of Wales.

Since his return to Canada, Steve has gained extensive experience in all engineering aspects of the radio and television industries, latterly as Vice-President of Corporate Engineering and Technology for Rogers Broadcasting Limited.

Steve is also widely involved in industry activities including being a Director of the Canadian Association of Broadcasters and chairman of the CAB's Engineering and Technology Council.

His industry activities have included heavy involvement in all national and international aspects of Digital Audio Broadcasting over the past five years, including being a member of both the CAB and NAB Digital Radio Task Forces.

BIOGRAPHIE

Né à Trail (C.-B.), Steve étudie à l'Université de la Colombie-Britannique, où il obtient un B.Sc.A. en génie électrique en 1970. Lauréat d'une bourse *Athlone* qui lui permet de faire des études supérieures au Royaume-Uni, il reçoit par la suite une M.Sc. de l'Université du Pays de Galles.

Depuis son retour au Canada, Steve a acquis une vaste expérience de tous les aspects techniques des industries de la radio et de la télévision, récemment à titre de vice-président, *Corporate Engineering and Technology*, pour *Rogers Broadcasting Limited.*

En outre, Steve participe largement à des activités de l'industrie, notamment à titre d'administrateur de l'Association canadienne des radiodiffuseurs (ACR) et de président du conseil de l'ingénierie et de la technologie de l'ACR.

Il a notamment été étroitement associé à tous les aspects nationaux et internationaux de la radiodiffusion audionumérique depuis cinq ans, entre autres à titre de membre de groupes de travail de l'ACR et de la NAB chargés d'étudier cette question.

NOTES

PANEL DISCUSSION - THE NEXT STEPS
PANEL DE DISCUSSION - LES PROCHAINES ÉTAPES

Robert W. Jones

Director General, Radio Regulatory Branch
Industry Canada,
300 Slater Street
Ottawa, OntarioK1A 0C8

BIOGRAPHY

Robert W. Jones is Director General of the Radio Regulatory Branch in the Canadian Department of Communications. He holds Bachelor of Applied Science and Master of Applied Science degrees in Electrical Engineering from the University of Toronto and a Master of Business Administration degree from York University. In addition to ten years in the Canadian radio communications manufacturing industry and fifteen years in increasing responsibilities at the Department of Communications, he held a senior position with the International Telecommunications Union in Geneva for two years. Mr. Jones headed the Canadian delegation to the ITU World Administrative Radio Conference at Torremalinos, Spain.

At the recent Plenipotentiary Assembly of the ITU, Mr. Jones was elected Director, Radiocommunication Bureau. He takes up his new appointment in January, 1995.

BIOGRAPHIE

M. Robert W. Jones est directeur général de la réglementation des radiocommunications au ministère des Communications du Canada. Il détient un baccalauréat et une maîtrise en sciences appliquées de l'Université de Toronto et une maîtrise en administration de l'Université York. En plus d'avoir passé dix ans dans l'industrie canadienne de la fabrication d'appareils de radiocommunications et quinze ans à acquérir des responsabilités accrues au ministère des Communications, il a occupé un poste important à l'Union internationale des télécommunications, à Genève, pendant deux ans. M. Jones dirigeait la délégation canadienne à la Conférence administrative mondiale des radiocommunications de l'UIT, à Torremolinos, Espagne.

Lors de la dernière assemblée plénipotentiare de l'UIT, M. Jones a été élu Directeur, Bureau des radiocommunications. Il assumera ses nouvelles fonctions en janvier 1995.

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PANEL DISCUSSION - THE NEXT STEPS
PANEL DE DISCUSSION - LES PROCHAINES ÉTAPES

John W. Thomas

Director - Corporate Development
Stentor Resource Centre Inc.
Suite 1260, 160 Elgin Street
Ottawa, Ont K1G 3J4

BIOGRAPHY

John is currently the project leader within SRCI for the development of PCS business strategy for the Stentor Alliance. He also is a key team member in the development of BCE's PCS strategy for the domestic market and for prospective U.S. investments and alliances.

In 1993, as Director of Strategic Planning, John was responsible for developing and proposing overall strategic direction for the Stentor Alliance during its inaugural year. John laid key groundwork for two significant departures from business as usual: Stentor's advocacy for a fully competitive environment for the telecommunications / information / entertainment industries and Stentor's decision to move beyond traditional lines of business into new business areas such as Infotainment. He was instrumental in preparing strategic and marketing rationale underlying the Stentor companies' positions in the PN 92-78 regulatory reform proceeding and in Stentor's Information Highway initiative.

John began his career with Bell Canada in 1976 and has held numerous marketing and business development assignments including: strategic planning; alliance development; financial analysis of new ventures and new business opportunities; service development; product management; telemarketing program planning; development of major regulatory submissions; revenue forecasting and econometric modeling.

BIOGRAPHIE

John Thomas est actuellement chef de projet à CRSI, responsable du développement de la stratégie SCP pour l'alliance Stentor. Il est également un des principaux membres de l'équipe chargée de l'élaboration de la stratégie SCP de BCE pour le marché national et les placements et alliances futurs aux États-Unis.

En 1993, à titre de chef divisionnaire à la planification stratégique, M. Thomas élabore l'orientation stratégique globale de l'alliance Stentor pour la première année d'activité de cette dernière. Il pose les assises de deux prises de position majeurs et déterminantes de Stentor: promouvoir l'ouverture totale des industries des télécommunications, de l'information et du divertissement à la concurrence et aller au-delà des secteurs d'activité traditionnels en développant de nouveaux créneaux tels que l'infodivertissement. Il joue également un rôle prépondérant dans la préparation des arguments stratégiques et de marketing sous-tendant les propositions des compagnies membres de Stentor dans l'instance 92-78 sur la refonte du cadre de réglementation, ainsi que le projet d'autoroute de l'information de Stentor.

M. Thomas entre au service de Bell Canada en 1976, où il assume diverses fonctions de marketing et de planification des marchés. Ses responsabilités comprennent, notamment, la planification stratégique, le développement des alliances, l'analyse financière de nouvelles entreprises et nouveaux débouchés, le développement de services, la gestion de produits, la planification du programme de télémarketing, la préparation d'importants mémoires réglementaires, l'établissement de prévisions de revenus et la modélisation économétrique.

M. Thomas détient une maîtrises en mathématiques de l'Université de Waterloo décernée en 1976.

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