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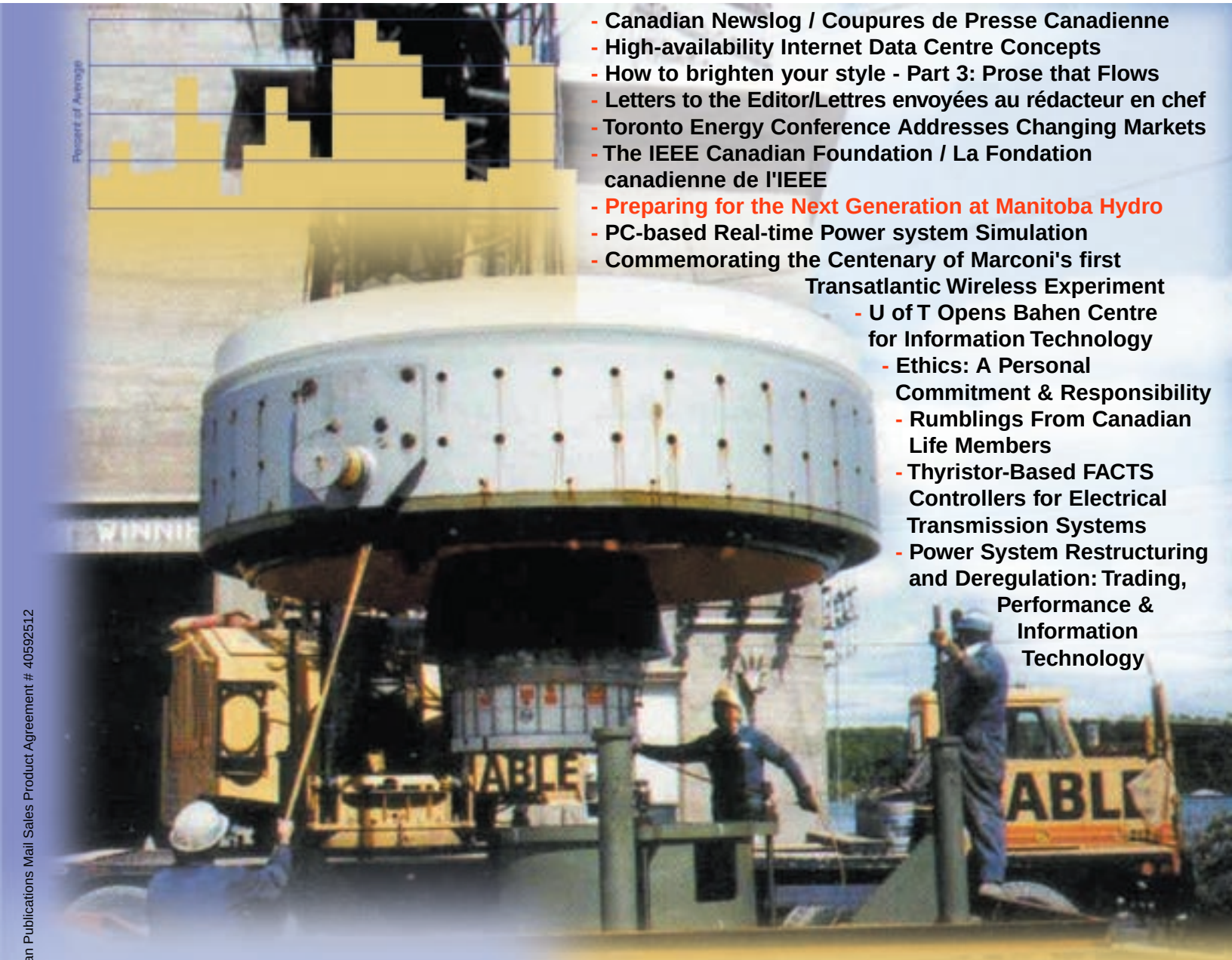

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To ensure that the ***IEEE Canadian Review*** has the desired breadth and depth, editors are responsible for screening articles submitted according to the following general themes:

1- National Affairs	4- Education	7- Computers
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Managing Editor
Rédacteur en chef

Vijay K. Sood
Hydro-Québec (IREQ)
1800 boulevard Lionel-Boulet
Varennes, Québec. J3X 1S1
tel: (450) 652-8089
fax: (450) 652-8051
email: v.sood@ieee.org

Associate Editors
Adjoints à la rédaction

Terrance J. Malkinson
Engagement Services Organization
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Calgary, Alberta. T2P 3P2
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Shaowen Song
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Chela Vaidyanathan
Northern Telecom (NORTEL)
P.O.Box 3511, Station C
Mail Stop 622
Ottawa. Ontario. K1Y 4H7
tel: (613)765-1920
email: vaidy@ieee.org

Slawo Wesolkowski
Systems Design Engineering
University of Waterloo
Waterloo, Ontario N2L 3G1
email: s.wesolkowski@ieee.org

Assistant Editor
Adjoints à la rédaction

Camille-Alain Rabbath
Defence Research & Dev. Canada
2459 Pie-XI Blvd. North
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tel: 418-844-4000 x4756
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Quelques mots du rédacteur en chef

Vijay K. Sood, Hydro-Québec

Cette parution du RCI nous amène à la fin de l'année 2002. La version en-ligne du RCI est maintenant notre priorité numéro un. Je tiens à souligner que ce projet a été complété avec succès grâce à la participation de Bob Alden, notre webmestre. Toutefois, nous avons besoin de vos commentaires et suggestions pour aller de l'avant avec le site web ou pour simplement l'améliorer. Sans votre participation, que ce soit en nous envoyant des remarques tant positives que négatives, nous ne pouvons déterminer si nous sommes sur la bonne voie. Donc, SVP prenez le temps de visiter le site web www.ieee.ca, suivez les liens à RCI, puis envoyez-moi un courriel.

La forme que prendra le RCI dans le futur est en train de se décider par les membres de notre comité. Une des questions d'intérêt pour nous est de savoir si la version imprimée doit être maintenue et d'y aller strictement avec la version en-ligne? L'option prisée en ce moment est celle d'y aller en partie avec le format imprimé et en partie avec la version en-ligne. Tout de même, il est crucial que vous nous communiquiez votre préférence quant au format du RCI. Cette importante démarche ne peut être réussie que si vous participez au processus de décision. Nous attendons vos commentaires à ce sujet.

Je vais entreprendre une période de réflexion sur les orientations futures du RCI au cours de la prochaine année. Ce fut un réel défi pour moi que de produire une revue de qualité avec **un contenu canadien**. En fait, j'ai beaucoup apprécié préparer le RCI. L'exercice a été très gratifiant et en a valu la peine. J'espère que vous avez apprécié lire le RCI.

Je tiens à remercier tous ceux qui m'ont offert leur soutien au cours des dernières années: les auteurs et tous ceux qui ont contribué au RCI, les nombreux bénévoles de l'IEEE, les adjoints à la rédaction (Terry, Slawo, Chela, Shaowen, Camille-Alain et Brunilde), Bruce et Bart, Glee et Vina, etc.

Je vous offre mes meilleurs vœux pour la période des Fêtes.

Contest:

An interested reader sent in this photograph taken on 29 October 2001, somewhere in LaLa Land. It certainly reminded me of many things. Readers may want to submit a caption for this photo, such as:

1. What was I planning ...? (Planning Engineer)

2. As I was driving down the highway ... (Racing car driver)

3. Pylons have Right of Way? .... (Elephant crossing the parkway)

Cover picture / *Photo de couverture*

The Straflo Demonstration Project was approved in 1996 and construction commenced in 1998 and was completed in fall of 1999. This project saw the replacement of one existing 3.5 MW Francis turbine generator (1911) with a new 8.4 Straflo turbine generator. The turbine runner is shown on the cover page of this issue during the installation.

A few words from the Managing Editor

This issue of the CR brings 2002 to a close. At present, the online issue of the CR has taken priority and, with the co-operation of Bob Alden (our webmaster), this project has been completed to our immediate satisfaction. We now need feedback from you to move forward or make a second attempt at improving the website. Remember, without feedback from you—positive or negative—we will be in the dark regarding our successes and failures. So do take the time to visit the website at www.ieee.ca and follow the links to the Review, and then email me.

The future plans for the CR are in flux, to some extent, as our committee decides how to move forward. One of the burning questions is whether to continue with the hardcopy version at all and/or go completely on-line? A stop-gap measure to go partially with the hardcopy and partially online seems to be the current favourite. However, your feedback is crucial for us to decide. We look forward to hearing from you.

The new year is upon us, and I will take time out to reflect about future directions for the CR. The CR objective to bring to you a quality magazine **with Canadian content** has provided a real challenge. I have enjoyed preparing the CR, and it has been a worthwhile and rewarding exercise so far. I hope that you felt the same along the way.

There are many people to thank for their support over the years: the authors and contributors, the many IEEE Canada volunteers, the associate editors (Terry, Slawo, Chela, Shaowen, Camille-Alain and Brunilde), Bruce and Bart, Glee and Vina etc.

Wishing you the Best for the Holiday Season.

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Canadian Newslog / Coupures de presse Canadienne

Newslog Editor

Alexandre Abecassis is a patent agent trainee in Montreal at Ogilvy Renault, Lawyers and Patent and Trade-mark Agents.

Alexandre Abecassis travaille à Montréal chez Ogilvy Renault, Avocats et agents de brevets et de marques de commerce, comme agent de brevets en formation.

Send any news clippings you would like to contribute via e-mail to alexandre.abecassis@ieee.org

Veuillez faire parvenir les coupures de presse proposées par e-mail à alexandre.abecassis@ieee.org

Rédactrice des Coupures de presse

CALGARY, AB, Jun. 18, 2002. The City of Calgary has chosen McData Corporation to provide a storage networking solution to ensure a non-stop access to critical information of the city. More precisely, a scalable manageable storage area network (SAN) is provided.

LAVAL, QC, Oct. 4, 2002. Simgraph has sold eight software modules for the training of maintenance technicians of Hercules C-130 planes. Simgraph is specialized in the creation of customized multimedia training solutions for complex technical subject matter.

TORONTO, ON, le 23 sept. 2002.ViXS Systems Inc a fait l'annonce du début de la distribution d'un processeur réseau vidéo. Ce processeur réseau vidéo permet la transmission de la vidéo sur des réseaux sans fil. De plus, le processeur permet notamment un ajustement du débit, de la résolution et du format de contenu vidéo MPEG en temps réel. Le contenu vidéo peut ensuite être visualisé notamment grâce à un assistant numérique ou un ordinateur. Une application possible de ce processeur est dans un environnement WiFi (IEEE 802.11b).

OTTAWA, ON, le 4 sept. 2002. Le système d'exploitation de QNX Software Systems supporte désormais le multitraitement parallèle ainsi que la technologie "Hyper-Threading". Cette technologie est offerte dans les processeurs Xeon d'Intel. La technologie "Hyper-Threading" permet d'exécuter de nombreux processus concurrents sur chaque processeur.

GUELPH, ON, Le 10 juil. 2002. L'Université de Guelph va prochainement installer un réseau permettant l'intégration de la voix, de la vidéo et des données. L'installation de ce réseau sera une première parmi les universités canadiennes. Les données seront transmises en utilisant le protocole Internet (IP). Le réseau comprendra notamment 7000 téléphones IP et 12000 entrées de données.

RIMOUSKI, QC, le 8 oct. 2002. L'entreprise PG Systèmes d'Information sera lauréate en novembre 2002 d'un prix d'excellence lors de la remise des prix au "Canadian Information Productivity Awards 2002". Ce prix récompensera une solution combinant l'utilisation de l'Intranet et de l'Extranet.

VANCOUVER, BC, Sept. 19, 2002. Industry Minister Allan Rock has announced the awarding of a contract to MDA in order to support the Canadian Space Agency in defining Canada's contribution to space mission to Mars. More precisely, the study will be focused on a development of a laser-based solution for landing a spacecraft on the Martian surface.

MONTREAL, QC, Le 17 oct. 2002. Air Canada et IBM ont conjointement mis au point un dispositif permettant la maintenance en ligne des appareils de la flotte du transporteur. Les techniciens, grâce des ordinateurs portables, pourront accéder, via un portail Web personnalisé, à de l'information concernant la maintenance des aéronefs. La solution utilise notamment la technologie WiFi (IEEE 802.11b).

TORONTO, ON, Aug. 15, 2002. Bioscrypt Inc has won, with its algorithm, the International FVC 2002 Fingerprint Verification Competition. The algorithm is based on fingerprint ridge pattern recognition. Most of the competitors used minutiae-based algorithms, which compare local points where fingerprint ridgelines intersect.

MONTREAL, QC, Oct. 8, 2002. The International Institute of Telecommunications (IIT) has signed a partnership agreement with APIS Training and Seminars U.S., Inc, which provides technical training. The International Institute of Telecommunications provides industrial training covering all major industry telecommunication standards.

TORONTO, ON, Sept. 25, 2002. Bell Canada has now launched the first digital music web service licensed in Canada. This web service will offer streaming music for a subscription.

WATERLOO, ON, Aug. 19, 2002. Research In Motion (RIM) is working with the US National Security Agency (NSA) to comply with NSA standards related to the support of S/MIME and PKI. Blackberry wireless handhelds will be used by the Agency. Research In Motion will receive incremental licensing revenue on a per user basis.

MISSISSAUGA, ON, Le 26 août 2002. L'entreprise Globalstar, qui fournit un accès téléphone satellite, a baissé ses tarifs d'accès au service. Cette baisse a pour objectif de démocratiser l'utilisation du téléphone satellite.

VANCOUVER, BC, July 23, 2002. FatPort Corporation has signed an agreement with iPass Inc. FatPort Corporation provides public high-speed wireless Internet access to individuals and corporate subscribers while iPass Inc provides secure network access solutions.

QUEBEC, QC, le 17 juin 2002. Bell Canada a remporté un prix Octas lors du Gala annuel de la Fédération de l'informatique du Québec (FIQ) qui récompense le travail des créateurs québécois de la nouvelle économie. Le projet BellNet, portail des employés de Bell Canada a été primé par ce prix.

OTTAWA, ON, Sept. 25, 2002. Mitel Networks will implement an IP communication solution for the University of Ottawa's School of Information Technology and Engineering. The solution will enable students and staff to access rich learning environment.

High-availability Internet Data Centre Concepts

1.0 Introduction

With today's growing Internet use, 24x7 schedules and global availability via the web, mission-critical corporate web sites and e-commerce operations simply can't stop working. Down time clearly costs money, either through lost customers, revenue, or productivity.

Internet Data Centres (IDCs) are carefully-designed installations which combine central office reliability and data processing centre concepts with state-of-the-art physical security. The result? An extremely robust infrastructure. In fact, leading IDCs are meticulously designed to do just two things:

- Offer always-up service by minimizing the risk of any outages, and
- If an outage were ever to occur, recover as quickly as possible.

However, this high-availability infrastructure comes at a high cost. Internet data centres require carefully-selected real estate, a custom-purpose building, physical and IT security systems, environmental control systems, standby power capability, and complete redundancy. Sharing these costs between many users decreases the per-user cost to an affordable level, which is the fundamental concept behind the Internet data centre business model.

This article looks at the concepts behind Internet data centres, and how risk is designed out of an IDC right from the beginning.

2.0 What is Inside a Data Centre?

What's inside a data centre depends on its business model. In general, IDCs make their money from:

- Renting space, power and connectivity,
- Operating outsourced IT operations, and
- Offering a suite of optional professional services.

2.1 Carrier Hotels

A data centre offer can be as simple as providing space to communication service providers who install their networking equipment in it. The service provider rents temperature-controlled space with power and connectivity.

Location is key since proximity to the service provider's customers, and redundant fibre connections, is desirable. This is especially important when data centres are located in crowded downtown cores where availability to these items can be limited.

Note that the service providers are responsible for the installation and operation of their equipment and service. The data centre operator is merely a landlord.

When more than one communications carrier offers connection to the same data centre, it becomes a “carrier hotel”. This interconnectivity is used by the carriers themselves to exchange off-net traffic. This benefits their customers, too. In a carrier hotel, customers have a greater choice of potential suppliers -- they can connect to any carrier in the carrier hotel without relocating their equipment.

2.2 Co-Location

The business practice of deploying and operating equipment on someone else's premises is called “co-location”. A data centre operated by a carrier can generate co-location revenue by providing space and connectivity to competitive local exchange carriers, competitive availability provides, and Internet service providers. These tenants obtain connections to the public switched telephone network without the expense of developing their own costly facilities.

Devices such as switches, gateways and availability multiplexors reside in the central office and connect directly to the local loop. Redundant trunk lines guarantee high availability under almost any conditions. Traditional central offices (CO) were thus the first data centres. The primary difference is that IDCs house servers while COs house switches and availability equipment.

by *Gregory J. Graham*
Telecom Marketing Associates, Kanata, ON

Abstract

As services based on the Internet have become part of everyday life for Canadians, the infrastructure that provides these services must scale upwards in robustness and capacity. Lessons learnt from the public switched telephone network are being applied, with new twists, to Internet infrastructure. The importance of providing secure, high-availability infrastructure has become even more obvious following the recent events of September 11, 2001.

This article describes leading approaches to designing high-availability data centres used for web-hosting, e-commerce, storage and other IP applications.

Sommaire

Comme les services basés sur l'Internet font maintenant partie de la vie quotidienne des canadiens, l'infrastructure qui assure ces services doit être “scale upwards” en robustesse et en capacité. Les leçons apprises des réseaux téléphoniques publics à interrupteurs sont appliqués à l'infrastructure de l'Internet avec des variantes. Suite aux évènements du 11 septembre 2001, il est devenu encore plus important d'offrir une infrastructure sécuritaire et a disponibilité élevée. Cet article décrit les approches d'avant-garde dans la conception de centres de données à haute disponibilité utilisés pour hôtes de pages web, commerce électronique, entreposage de données et autres applications utilisant le protocole Internet.

2.3 Managed Hosting

Unlike co-location, managed hosting is a turn-key service. Customers outsource their web business to the operator of the Internet data centre. In return, IDC operators provide their customers with quality guarantees via Service Level Agreements (SLAs) -- contracts specifying pricing, terms, metrics, and performance penalties. Equipment can be owned either by the customer or the IDC operator, depending upon the commercial arrangements.

A twist on managed hosting is dedicated hosting, a operational approach that dedicates distinct servers for each customer. This eliminates potential issues such as software conflicts and the difficulty of scheduling maintenance for shared equipment.

2.4 Value-Added Services

Internet data centres have supplemented these basic business models with a host of à la carte services. Professional services offered often include firewalls, network monitoring, load balancing, performance testing, security audits, private data networks and database services. These services all require networking expertise which the customer may not have in-house.

3.0 From The Central Office To The IDC

Central offices (COs) have long been outfitted with heating, air conditioning, massive battery backup systems, and redundant trunk lines to supply conditioned space, power, security, and network connectivity.

Because central offices terminate telephone local loops on switches, switch ports are the basic unit of CO operations. A typical central office in North America might terminate 10,000 local loops, and thus require a switch with 10,000 ports.

However, enterprises need physical facilities to house the servers that deliver their web content, e-commerce, and customer relationship management systems. These systems more frequently operate on 110 VAC rather than the 48 VDC power traditionally available in a central office. This is a key difference between a CO and an IDC.

Space within an IDC can be separated into areas containing equipment racks, electrical power, and connectivity. Depending on the customer's wishes and management philosophy, equipment racks may be standalone, ganged in rows, in locked cages, or even in separate locked vaults.

Regardless of how space is rented, customers' equipment usually ends up mounted in a rack. A rack is the basic unit of data centre operations since space utilization -- rather than switch ports -- drives revenues and costs. The footprint of a rack ranges from 20 to 30 square feet (1.85 to 2.79 square metres); reducing this footprint increases the density of racks and thus potential revenues.

Density can also be increased by extending rack height. Server manufacturers have continually reduced the physical size of servers. While the latest servers resemble a pizza box and are as little as 1.75 inches high (4.45 cm or 1 rack unit; a standard 78-inch high rack has 45 rack units), servers vary widely in their size and processing power. Very large servers are supplied with stand-alone custom cabinets while over forty of the latest pizza-box server appliances can fit into a single rack.

This goal of fitting a maximal number of servers into a minimal volume of space creates severe electrical supply and cooling problems which did not exist for central offices. COs of the past had limited computing power and large numbers of space-consuming I/O ports. In contrast, data centres have staggering amounts of computing power which dissipates enormous amounts of heat.

4.0 Designing Out Risk Factors

4.1 Location

Designing out risk starts with the location of a data centre. Selection of a site can minimize the risk of natural disaster by avoiding flood zones and areas with frequent tornadoes, etc. Data centres should also be located a safe distance from highways, railroad tracks, and flight paths.

Availability of optical fibre communications facilities is another consideration. Ideally, an IDC should be situated so that it can connect to redundant fibre connections from more than one carrier.

Figure 1 (left): The hardened lobby of a TELUS intelligent Internet Data Centre has bullet-resistant glass and walls, a locked mantrap, biometric scanners, and 24x7 security guards.

4.2 Construction

Next, the building envelope of a data centre should be constructed to withstand both natural disasters and attack. Although such design practises should be routine, these features are increasingly sought in today's post 9/11 reality. Internet data centers usually have not just thick concrete walls, a minimum of windows, bullet-resistant glazing, bullet-resistant lobby walls with steel-plating concealed under the drywall, and a locking mantrap entrance, but may even be structurally-reinforced to withstand bomb blasts and earthquakes (Figure 1).

As noted above, increasing the amount of equipment in each rack improves the economics of a data centre. But increasing the rack or server density may require thicker floor slabs. The soil under the building must also be able to carry exceptionally heavy loads, so new construction must be specified accordingly. An existing building being considered for retrofit should be carefully inspected by structural experts to ensure that it can meet any increased load requirements.

4.3 Physical Security

High levels of both physical and IT security are fundamental for IDCs. Typical physical security measures include perimeter fences, motion sensors, alarms, guards, video surveillance, and controlled availability to equipment.

In particular, security staff and measures must prevent customers from having physical availability to each others' equipment, especially competitors' equipment.

For example, in TELUS data centres, persons attempting to gain entrance must pass several levels of scrutiny. First, customers provide a list of personnel for whom they wish to authorize physical access to their equipment in the data centre. All customer personnel must pass a criminal background check by local police authorities. Next, authorized personnel are issued a photo ID card with a swipestrip. Finally, biometric data in the form of a fingerprint is collected.

Someone entering the data centre must thus appear on the list, present the photo ID card to security guards, have it verified by swiping it in a card reader, scan their fingerprint, and only then can pass through a mantrap which is normally kept locked (Figures 2 and 3).

Once inside, a visitor is not left free to roam throughout the data centre. Physical availability to unauthorized areas of the IDC is prevented since doors and elevators can only be activated by additional card readers and fingerprint scanners. All equipment is secured with individually-keyed locks. Some data centres provide security escorts, but this is considered inherently less secure. There is a small risk that security escorts might possibly be distracted or require a bio break, leaving a potential saboteur momentarily unguarded.

In the eventuality of an emergency condition, the data centres are connected to fire, police and other authorities via a remote facility.

This comprehensive approach allows intelligent Internet Data Centers to deliver the ultimate in security-using a range of physical and electronic means -- biometric scanners, 24-hour on-site security guards, bullet-resistant glass, advanced network intrusion detection, and multi-layer firewalls.

Figure 2 (right): Biometric verification methods ensure that the person is actually who he/she claims to be. Shown here is a fingerprint scanner at a TELUS intelligent Internet Data Centre.

4.4 Network Security

The cornerstone of network security is the firewall, a device that inspects network traffic. Firewalls filter traffic based on packet origination and destination addresses, port numbers and other parameters so that unauthorized traffic can be blocked from entering the data centre's network.

One common network architectural practise is to connect co-location and managed hosting servers on separate subnets. A second layer of firewalling is used to isolate the managed hosting servers from the co-located servers. Sometimes a different vendor of firewall is used for this second layer, so that hackers with great expertise who are familiar with any potential security issues with one firewall product would be stumped by the second product.

Individual data centre customers can also implement a third layer of protection by implementing their own security policies in their own dedicated firewall. Installing, configuring and operating firewalls is one of the most popular professional services offered by data centres.

The next vital IT security measure is an intrusion detection system, or IDS. An IDS monitors the traffic on a network segment to detect potential attack streams.

Many hacker attacks exploit vulnerabilities in communication protocols to deliberately create errors, or other conditions under which mischief can be done. The difference between a firewall and an intrusion detection system is that an IDS maintains protocol state and contextual information in real-time. This allows malicious traffic, which has been passed through the firewall on the basis of using authorized IP addresses and port numbers, to be detected. The IDS can then issue network management alerts, terminate user sessions, or even reconfigure firewalls to block traffic.

In the case of an Internet data centre operated by a carrier, these IT security systems can be integrated or operated independently to offer very high levels of security. For example, most IP backbone operators also have firewall and IDS systems in place.

4.5 Redundancy

Very high availability is almost always achieved through the use of redundancy. In theory, Internet data centres should have no single point of failure. This implies that all systems must have a hot standby available -- even when systems are taken out of service for maintenance.

At minimum, multiple fibre trunks are required, ideally from different service providers and entering the IDC at different physical locations.

The long-term availability of sufficient electricity is a significant consideration. Just consider the recent history of brownouts and blackouts in California, the largest geographical data centre market.

Internet data centres typically use from 85 to 100 watts per square foot to power equipment and meet their air conditioning requirements. This is as much as twenty times the average commercial space usage. When possible, an IDC should have availability to redundant power grids. Uninterruptible power supplies and backup diesel generators are also commonly used to guarantee a continuous supply of electricity.

Given the high power densities of IDCs, a cooling system failure would cause a rapid temperature rise. Although an IDC melt-down has not been publicly reported, it is a real possibility and thus redundant cooling systems are essential. But don't necessarily expect to see two enormous air conditioners in a data centre. This redundancy is sometimes achieved through deliberate over-sizing of a cooling plant composed of modular air conditioners, and the use of redundant cool air distribution facilities, rather than the twinning of a massive single air conditioner.

Figure 3: A single point of ingress and egress not only controls entry authorization, but prevents unauthorized equipment removal and impedes a physical attack.

One concept borrowed directly from corporate data processing centres is the use of raised floors. Although raised floors can simplify cabling, they also provide an efficient air duct for cooling. Some IDC have raised floors that are over two feet high for this reason.

The ultimate redundancy is a second data centre. Some IDC operators are plan to build networks interconnecting their data centres, so that they can remotely back up and restore each other.

TELUS data centres solve this problem in a tidy fashion by using Cisco Systems, Inc.'s global load balancing technology to geographically distribute server loads among data centres. For example, an enterprise could have its web operations hosted simultaneously in both Calgary and Toronto. The load balancing technology senses the user's location and balances the load on a geographical basis for best performance and response time. If the unthinkable were ever to occur and one data centre experienced an outage, the load balancer would automatically shift traffic to the other data centre.

4.6 Management

The availability of information technology skills is another issue driving demand for IDCs. Data centres are typically operated by third parties, an arrangement which offers several benefits.

First, outsourcing web operations to a third party may be a strategic objective, especially when not within the scope of a firm's core business or competencies.

Second, a third party at arm's length can be held accountable for delivering on service level agreements. This might be difficult when using an in-house facility.

And third, a neutral third party can aggregate demand from customers who may not normally wish to interact. A larger scale of operations could benefit them by driving down costs for all involved.

Specialized technical and management expertise is an important component of the data centre value proposition.

5.0 Conclusion

Internet data centres offer a high-availability environment so that mission-critical Internet operations can be offered with minimal risk of interruption.

The high costs of an IDC are usually unaffordable by a single enterprise. But, when shared by many, economies of scale transform a multi-million dollar capital investment into a much lower operating expense. This cost-sharing permits IDC customers to take advantage of risk-reduction technology that would not otherwise be within their reach, and they ultimately obtain much higher reliability at much lower cost.

6.0 Acknowledgements

The contributions of Craig Richardson, Director, Hosting Solutions at TELUS Business Solutions, Calgary in the preparation of this publication are gratefully acknowledged.

About the author

Gregory Graham holds a Bachelor of Electrical Engineering from Concordia University in Montreal and an MBA from the University of Alberta in Edmonton.

He has almost 20 years of experience in the telecommunications and computer industries. His background includes increasingly-responsible roles in marketing and strategic planning at Hewlett-Packard, TELUS Advanced Communications, and Nortel Networks. He was a member of the management team that grew TELUS PLAnet into western Canada's largest Internet service provider, and introduced North America's first residential ADSL service. He also created Canada's first wholesale VoIP call termination service offered by a telco. He can be reached at greg_graham@compuserve.com.

How To Brighten Your Style - Part 3: For Flow in Writing ... Connect!

by *Cheryl and Peter Reimold*
PERC Communications, Scarsdale, NY.

SUMMARY SENTENCE:
Connect your thoughts in three ways: set up a plan and follow it, repeat words or structures, or use transition words.

For your thoughts to reach your reader in a smooth, coherent flow, you must show the reader how they connect. The key to flowing, connected writing in business and science is an overall pyramid structure: you begin your memo, letter, report, or e-mail with your main message and then make sure everything that follows relates to this main message. However, it's also important to show how the subsections connect to each other.

Let's begin with sentences. Here are three ways to connect them.

1.0 Set up a plan in the first sentence of the paragraph and then follow it.

Very simply, this means you tell the reader that you will consider several aspects of a message. Then you go on to address these issues one after another. Here is an example:

There are **three main kinds** of business meetings. **The first** is the brainstorming meeting, which allows everyone to throw out ideas and get pats on the back for doing so. **The second** is the progress meeting, which offers project members the chance to explain why they haven't made any. **The third** is the administrative meeting, which brings people together to plan future meetings. Of the three, this one is clearly the most popular, as it is the most frequent.

2.0 Repeat key words or structures.

Look at two passages from Winston Churchill's impassioned statements during World War II. By repeating words and structures, he enhances the power and connection of the thoughts in his message:

When I told the French that Britain would fight on alone whatever they did, their generals told their prime minister and his divided cabinet, "In three weeks, England will have her neck wrung like a chicken." Some **chicken,** some **neck.**

Never in the field of human conflict was **so much** owed by **so many** to **so few**.

Oscar Wilde achieves the same effect, on a lighter note, in *The Importance of Being Earnest:*

Of course the **music** is a great difficulty. You see, if one plays good **music,** people don't listen, and if one plays bad **music**, people don't talk.

3.0 Use transition words that show connection through time, space, or logic.

These small words were made for transitions. They aren't the most elegant form of connection, but used sparingly, they work. Here are some examples.

Time: *before, meanwhile, afterwards*
Space: *above, beneath, in front*
Logic: *because, if, therefore, however, as a result*

Look at the way Montesquieu uses transition words to connect his thoughts:

If we wanted to be happy, it would be easy. **However,** we want to be happier than other people. This is almost always difficult, **since** we think them happier than they really are.

More powerful still is the use of transition words not just to connect thoughts but actually to guide the reader through images to an inescapable conclusion. Chief Seattle does this in his letter to President Franklin Pierce on the proposed sale of Indian land:

If we agree, it will be to secure the reservation you have promised. **There [connects to "reservation"]**, perhaps, we may live out our brief days as we wish. **When [connects to "brief days"]** the last red man has vanished from this earth, and his memory is only the shadow of a cloud moving across the prairie, these shores and forests will still hold the spirits of my people. **For** they love this earth as a new-borne loves its mother's heartbeat. **So,** if we sell our land, love it as we've loved it.

Strong connections can breathe life into your writing and make it both memorable and persuasive.

Cheryl and Peter Reimold (telephone 1+ 914-725-1024, e-mail perccom@aol.com) have taught communication skills to engineers, scientists, and businesspeople for 18 years. Visit their new educational web site at www.allaboutcommunication.com

This article is the third in a series of "tips and techniques" for the purpose of assisting you in developing an effective communication style. We hope that this series will be of value to you professionally and personally. We value your feedback.

Obituary

Wednesday, November 6, 2002

TANNER, Robert H. 1915-2002.

With his wife of 62 years by his side, Robert Tanner quietly passed away on November 2, 2002 in Naples, Florida. Left to mourn are his beloved wife, Joan; his sons and daughter Chris, Rosemary (Raymond Langston), Peter (Susan), and David (Natalie); and his grandchildren Emily Wanechko and Laura, Heather, and Michael Tanner. Following service in the Royal Signals during WWII, Robert emigrated to Canada with his young family in 1947. He joined Northern Electric in Belleville, Ontario. He moved to Ottawa in 1960 where he helped found Northern Electric's research and development division, Bell Northern Research. An accomplished acoustical engineer, with the acoustic design of many churches and theatres to his credit, Robert was especially proud of his work on the Festival Theatre in Stratford, Ontario; the Elgin and Winter Garden Theatres in Toronto, and the Naples Philharmonic Hall. He was active for many years in the IEEE (Institute of Electrical and Electronics Engineers), serving as President in 1972. The IEEE awarded him the McNaughton Gold Medal, the Haraden Pratt Award for Service, and the United States Activities Award for Engineering Professionalism. In 1989, Concordia University in Montreal bestowed on him an Honorary LL.D. for his services to engineering. Robert and Joan moved to Naples, Florida in 1975. Private arrangements have been made. Donations in Robert's name to The Hospice of Naples, 1095 Whippoorwill Lane, Naples, Florida 34105 would be greatly appreciated. Condolences may be sent to Joan at 1001 Arbor Lake Drive, Naples, Florida, 34110.

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TORONTO ENERGY CONFERENCE ADDRESSES CHANGING MARKETS

May 10, 2002

The IEEE Toronto Section and the IEE Toronto Branch combined forces once again to host the 2002 International Energy Conference at the Metro Toronto Convention Centre on May 6 and 7. Since the event coincided with the opening to wholesale and retail competition of the Ontario Electricity Market the conference theme "Coping with Market Changes" was timely and topical.

The key question addressed by the Conference: Is the industry coping with market changes and making the most of the opportunities new markets are creating? The answer is "YES" and future changes and developments will continue to reap benefits to customers and the industry.

Summary of Sessions

Robert (Bob) Hanna, Chair of the IEEE Toronto Section opened the Conference by welcoming delegates, speakers and sponsors and set the scene for the Sessions. Bob read a letter from John Estey, President of the IEEE Power Engineering Society conveying best wishes for a successful Conference and briefly describing current strategies and initiatives to better serve IEEE-PES members. Bob then introduced the Conference Moderator Kim Allen, CEO of Universe2U. Kim introduced each session and the speakers. He ensured a well run discussion period in each panel session.

Bob Taylor, Managing Director of East Midlands Electricity Distribution, Powergen, UK was the opening speaker in Session One dealing with Lessons Learned and Future Developments - Part One. Bob provided Ontario transmission and distribution companies a glimpse of what is in store for them when performance based regulation comes into full force here. Bob was followed by Dan Engel of Nexant Consultants in California who provided a lively explanation of the reasons behind the market upsets in California and the lessons learned. He also provided an overview of the status of restructuring in a number of other states.

Session Two switched to the Ontario Scene - Part One with presentations from Norm Fraser, VP Distribution Networks at Hydro Ottawa; John Brace, President of the Independent Power Producers Society of Ontario; and Klaas Degroot chair of the Electricity Distributors Association. This panel focused on how their organizations and members are coping with the transition to the new Ontario market while maintaining good customer service. They also raised some of the issues and concerns that will need to be addressed as the market evolves.

The keynote speaker at Monday's lunch, which was sponsored by Hydro One, was Robin MacLaren, an IEE Trustee and Managing Director of SP Transmission & Distribution, a subsidiary of Scottish Power, UK. Robin conveyed best wishes from the IEE President and Board of Trustees and briefly described the IEE's Professional Networks initiative and how to participate. He then described how SP Transmission & Distribution are coping with market changes both in the UK and in the North West USA.

Session Three after lunch returned to Lessons Learned and Future Developments - Part Two. Ian Davis, VP of Transmission for National Grid USA provided an overview of the growth of the bulk delivery business in North America with some interesting comparisons to UK experience. Ian was followed by Murray Davis, VP and Chief Technology Officer of DTE Energy, a Detroit Edison subsidiary who presented the results of case studies showing the significant advantages that a distributed generation approach can offer compared to the traditional centralized large generating station approach.

The final session on Monday focused on the Alberta Market Experience with presentations from Bill Kennedy, standing in for Vincent Flynn President & CEO of ESBI Alberta, the Transmission Administrator in Alberta; Brian Vaasjo, EVP and President Energy Division, EPCOR; and Dale McMaster, COO of the Power Pool of Alberta. These three speakers covered many aspects of the Alberta market and made some comparisons with Ontario. Main conclusions are that the Alberta market is now successful after a rocky start. The Ontario market is better positioned for success at the outset, although the dominance of OPGI is still a concern.

Participants enjoyed the Monday evening reception sponsored by GE Canada.

The opening session on Day Two returned to The Ontario Scene - Part Two. Derek Cowbourne, VP Market Services of the IMO which is the market operator and system operator in Ontario. Derek stressed the need for greater education and understanding of the new market in Ontario by the public and market participants alike. This is essential if maximum opportunities are to be realised from opening the market to competition and choice. Derek also provided some results from the first few days of the new market. He cautioned that while the market is responding as expected so far it is "too early to tell what is working well and what is not." Nabila Yousef, Senior Advisor for North America at DTE Energy, then described how they are seizing the opportunity of competitive markets to promote a range of distributed generation solutions to meet customer needs for reliable, high quality stable cost power.

Session Six dealt with "Enabling Technology" and how technology is facilitating new markets and their evolution. Particularly how to cope with the explosion of data points and information flows that now have to be handled. Also how competitive markets are driving some of the new technology developments and associated changes to power system design, operations, power quality and energy management. Excellent presentations were given on these topics by Larry Sollecito, President & General Manager of GE Power Management; Randy Berry, standing in for JD Hammerly VP Marketing and Sales at ALSTOM Energy Management & Markets; Narain Hingorani, HVDC pioneer and father of FACTS and Custom Power innovations; and Dave Felzien, Product Manager, Energy Information Systems, ABB-USA.

The keynote speaker at Tuesday's lunch was Jim Farmer, General Manager Maritime Business Unit, Xwave, a subsidiary of Aliant. Jim provided an IT perspective on coping with market changes and introduced the Xwave concept of company-wide "Co-Integration" of computing and information services and how it can lead to a sustainable competitive advantage.

The closing session after lunch focused on current issues facing the industry and the industry's response. The panel of experts included Peter Fraser, Senior Policy Advisor - Electricity from IEA France who spoke on distributed generation in liberalised markets; Stuart Brindley, Manager Emergency Preparedness & Information Security, the IMO who described emergency planning in the Ontario and larger North American markets, post 9/11; and finally Peter Love, Executive Director of the Canadian Energy Efficiency Alliance explained how Energy Efficiency initiatives are being maintained in competitive markets. This generated a lively discussion period.

The Conference was closed out by the Conference Co-chairs, Vince Green and Jim McConnach thanking the delegates, Speakers, Moderator Kim Allen, the Sponsors the organizing committee and the conference services for their excellent participation and contribution to the success of the sessions and events.

Organization and Conference Record

The Conference was organized by the Power Engineering Society chapter of IEEE Toronto and the IEE Toronto Branch. Thanks and appreciation are due to the Speakers and to the generous sponsorship and support provided by Hydro One; GE Canada; ALSTOM; ABB Inc; DTE Energy; ADWEL and Black & McDonald. A Conference of this quality would not have been possible without the generous support provided by the Speakers and Sponsors.

Copies of the Conference Record are available at a modest price. This includes the full program of speakers, abstracts, bios, presentations and papers. Visit the Conference web-site at: http://www.tor.ieee.ca/energy for further details or contact Georgina Smith at GDS Registration Services, phone (416) 691 4001 or e-mail gd.smith@sympatico.ca.

For further information contact Jim McConnach at: jsmcconnach@iee.org.

The IEEE Canadian Foundation

Going National

The foundation was created in 1992 by transforming IEEC Inc., which operated a conference in Toronto that ran from 1955 to 1987. Charitable activities started in 1972 when excess conference reserve funds were directed to support IEEE activities in Canada. In time, a pattern of primarily funding student activities at Canadian IEEE student branches emerged through a program of Grants and Scholarships.

The IEEC Inc. directors were from the Toronto area, the conference venue. This local group was augmented by adding, every second year, the retiring IEEE Canadian directors - sequentially from western, central, and eastern Canada.

The foundation is continually evolving its program of grants and scholarships, in a manner which conforms to Canadian charitable institution law, with a recipient and donor base which is quintessentially Canadian - two languages and geographically widespread.

Milestones

- 1972 - first grant to Canadian Region
- 1979 - first McNaughton Centre at the University of Manitoba - the brainchild of Ted Glass (1978-79 Director)
- 1985 - first scholarships were awarded to a University of Toronto student.
- 1989-92 - legal process to create the foundation
- 1993 - charitable (tax) status is granted
- 1994 - first solicitation of donations using membership renewal
- 1995 - first use of the web - which becomes our major communication channel and business mode
- 2001 - first cross-Canada committee (members from Vancouver, Kitchener-Waterloo, & Canadian Atlantic sections)
- 2002 - first Québec members elected
- 2003 (planned) - first use of web conferencing for annual meeting

Our 29 McNaughton Learning Resource Centres are distributed across Canada as follows; Western Canada 8, Ontario 12, Québec 6, Maritimes 3.

Communication with the fifty some student branches was initially through the IEEE Canada office. Following the office closure in 1992, the foundation started to use e-mail and progressed to web-based services as a cost effective communication medium to reach all Canadians.

We believe that the synergy of combining human and financial resources in Toronto and Montreal offers the best way be reach our goal to provide web-based services (general information, on-line and mail-in application forms, donation mechanisms, feedback and inquiries) in both languages and with the necessary sensitivity to differing cultures that characterize our Canadian sections and student branches.

Foundation Contacts:

web: http://www.ieeecanadianfoundation.org

Donation phone number: 705 743 7712

La Fondation canadienne de l'IEEE

S'étend et devient nationale

La fondation a été mise sur pied en 1992 à partir de IEEC Inc, qui organisait des conférences à Toronto de 1955 à 1987. Cependant, dès 1972, le surplus des conférences servaient à supporter les activités de l'IEEE au Canada. Les fonds ont été principalement utilisés pour soutenir le développement des branches étudiantes par le truchement de subventions et de bourses d'études.

Les directeurs de IEEC inc. provenaient de Toronto, ville ou se tenaient les conférences. Avec le temps, ce groupe a été élargi par l'addition, à tous les deux ans, des directeurs canadiens de l'IEEE qui sont habituellement choisis en rotation dans les trois conseils, (ouest, centre et est) du IEEE Canada.

Les programmes de subventions et de bourses d'études ont évolué afin de satisfaire aux lois canadiennes sur les organismes de charité et de respecter les réalités canadiennes: répartition géographique des donneurs et des récipiendaires et bilinguisme.

Historique

- 1972 - Première subvention à la région canadienne de l'IEEE.
- 1979 - premier Centre McNaughton à l'Université du Manitoba, une idée originale de Ted Glass directeur en 1978, 1979.
- 1985 - première bourse d'études accordée à un étudiant de l'Université de Toronto.
- 1989-1992 - démarches légales pour créer la fondation.
- 1993 -octroi du statut d'organisme de charité.
- 1994 - première sollicitation publique lors du renouvellement de la cotisation annuelle des membres de l'IEEE.
- 1995 - début de l'utilisation de l'Internet qui est devenu le principal canal de communication et d'opération.
- 2001 - premier comité pan-canadien avec des membres de Vancouver, Kitchener-Waterloo et des sections de l'Atlantique.
- 2002- élection des premiers membres québécois
- 2003 - assemblée annuelle via l'Internet?

Nos 29 Centres McNaughton sont répartis d'un bout à l'autre du Canada: ouest canadien: 8, Ontario: 12, Québec 6 et région Atlantique: 3.

Les communications entre les branches étudiantes se faisaient originalement au travers du secrétariat de l'IEEE. Après sa fermeture en 1992, la fondation a commencé à utiliser le courrier électronique, moyen qui, par la suite, à évoluer, vers l'utilisation des services en ligne qui rejoignent maintenant tous les membres canadiens.

Nous croyons que le temps est venu de combiner les ressources humaines et matérielles de Toronto et de Montréal afin d'atteindre les objectifs de la fondation et d'offrir des services en ligne bilingues (information générale, formulaires électroniques, mécanismes de don, demandes de renseignement et réponses) qui satisferont les particularités de diverses sections canadiennes et des branches étudiantes.

Coordonnées de la Fondation:

Internet: http://www.ieeefondationcanadienne.org

Dons par téléphone: 705 743 7712

About the authors

Bob Alden is the president of the IEEE Canadian Foundation and a former IEEE director and vice-president of IEEE.

Bob Alden est le president de la Fondation canadienne de l'IEEE et ancien directeur et vice-président de l'IEEE.

A propos de l'auteurs

Guy Olivier est membre de la Fondation canadienne de l'IEEE, président de la section de Montréal et de IEEE Montreal Conferences Inc.

Guy Olivier is a member of the IEEE Canadian Foundation, the IEEE Montreal section Chair, and President of Montreal Conferences Inc.

Preparing for the Next Generation at Manitoba Hydro

by *Hilmi M. Turanli*
Manitoba Hydro, Manitoba, MB

Abstract

Manitoba Hydro's current and future generation mix is described. The present system is approximately 95% hydro, and 5% thermal. Planned additions and retrofits of grid-connected generation are mainly single cycle combustion turbines (SCCTs), fuel switching from coal to natural gas, with some alternate energy projects in Demand Side Management and System Efficiency Improvements. Manitoba Hydro is also studying the possible development of new hydroelectric generating stations in northern Manitoba. Manitoba Hydro's views on sustainable generation projects, co-operation and possibly partnerships with Cree Nations are also discussed.

Sommaire

La génération mixte actuelle et future de Manitoba Hydro est décrite. En ce moment, la génération est approximativement 95% hydro et 5% thermale. Les ajouts et modifications planifiés à la génération « reliée à la grille » sont principalement des turbines à combustion à cycle simple, le passage du charbon au gaz naturel, avec quelques projets en "Demand Side Management" et en amélioration de l'efficacité des systèmes. De plus, Manitoba Hydro étudie la possibilité de développer de nouvelles centrales hydroélectriques au nord de la province. Le point de vue de Manitoba Hydro sur des projets de génération durables, et sur la coopération, et possiblement un partenariat, avec les premières nations Cris sont aussi discutés.

1.0 Introduction:

Manitoba Hydro is studying the possible development of new hydroelectric generating stations in northern Manitoba. Three sites are under consideration: Gull Rapids on the Nelson River, Notigi on the Rat River and Wuskwatim on the Burntwood River. The necessary community consultation, engineering, economic and environmental studies are currently underway to enable decisions to be made on continuing development. The projects had been modified to have less effect on the environment, greater public and market acceptability, but higher costs and lower generation capacities. No final decision has yet been made regarding which, if any, sites will be developed.

2.0 Resource Planning Process:

Manitoba Hydro's resource planning process starts with development of a menu of resource options. The range of power resource options includes demand side management, efficiency improvements for existing plants, plant life extensions for existing thermal units, new hydro plants, extra-provincial imports, new coal burning plants, combustion turbines, micro turbines, fuel cells, co-generation, wind, and solar and bio-mass options. Also included in the resource planning procedure are load forecasts including various sensitivities such as low, medium, high demand levels; interest, escalation and exchange rate predictions and the cost of fuel such as natural gas and coal.

3.0 Planning criteria for supplying the load have two components:

Capacity: A firm capacity is required including a minimum of 12% reserve over the forecast peak domestic load demand.

Energy: The dependable energy resource must be adequate to supply forecast load energy under a repeat of the lowest historic flows.

Examination of the base Manitoba load and contractual export sales compared to annual dependable energy dictates that new resources must come on line by the year 2019 at the latest. Other factors in considering new resources are overall system economics, domestic electricity prices, market opportunity, financial criteria including borrowing requirements, risks and uncertainties, system reliability, environmental impacts such as bio-physical, socio-cultural and economic, affected community acceptance, and public and political acceptance.

4.0 Existing Generation:

Currently Manitoba Hydro has a total generation capacity of 5200 MW. Hydro constitutes 95% of this and the remaining generation is coal fired. Total import capability through interconnections amounts to about 2450 MW. Committed Manitoba projects include “Power Smart” programs (282 MW by 2011), system efficiency improvements (80 MW by 2001), new interconnection (200 MW by 2002) and combustion turbine under construction (280 MW by 2002). It is also proposed that the Selkirk G.S. (132 MW) be converted to gas by 2005, and Brandon G.S. Unit #5 (105 MW) license be renewed by 2006.

5.0 Future Hydro Potential:

There are three hydro options considered and these are all low impact projects. Major re-designs of Wuskwatim and Gull would minimize their environmental impacts. Flooding would be less than 1-km square at Wuskwatim, Gull would be in the order of 48-km square, and Notigi Plant would have no flooding as the water control structure already exits. When partial development (at 235 m forebay level) of Wuskwatim is compared to full development (at 243.2 m forebay level), the estimated flooded area drops by 90% and average annual energy is about 25% less. Figure 1 shows a comparison of the flooded area for existing and potential hydro plants.

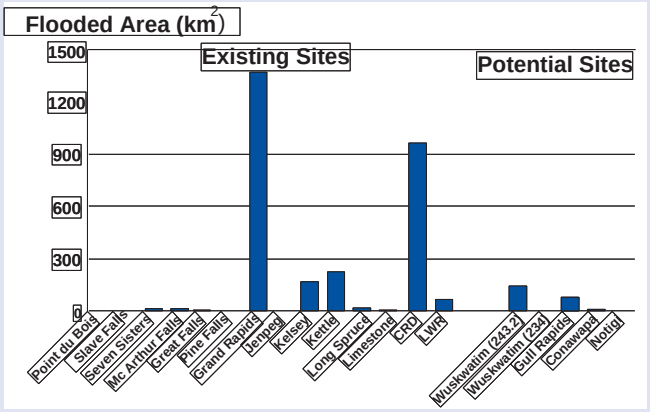

Figure 1: Comparison of Existing and Potential Hydro Sites

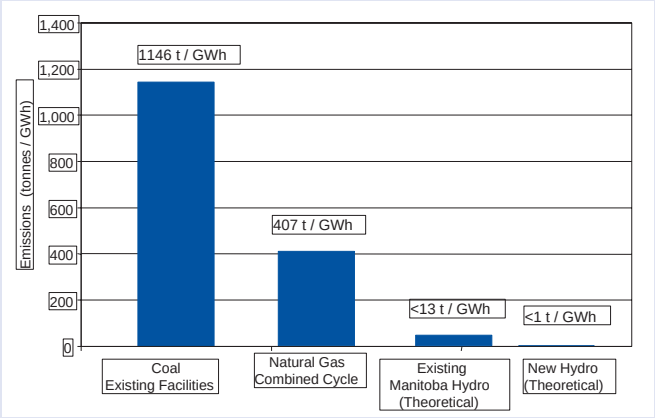

Figure 2: Comparison of Emission Intensities

- tonnes of CO2 equivalence per unit of energy

- the new hydro estimate represents the average emission for the undeveloped Manitoba sites

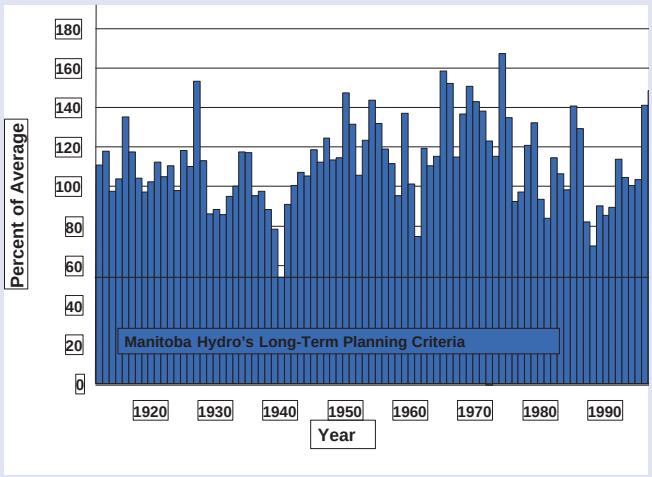

Figure 4: Historic variability of water supply: Churchill/Nelson River Drainage Basin

Methyl mercury production due to flooding would be minimal and Green House Gas (GHG) emissions would essentially be zero. Figure 2 shows a comparison of emission intensities per GWh energy produced for coal and gas fired generation in relation to existing and new hydro plants in Manitoba.

The re-designed generation projects have less environmental effects, higher costs, lower generation capacities, greater public and market acceptability.

Manitoba Hydro has a potential of 600 MW at Gull and 1300 MW at Conawapa (and possibly 1900 MW more) on Nelson River. We also have 100 MW at Notigi and 200 MW at Wuskwatim (and possibly 650 MW more) on Burntwood River. Other potential from partially developable hydro sites in the province amounts to about 4000 MW.

Potential projects considered include three smaller or mid range hydro plants as described above. Construction cost including the transmission cost would be in the order of $0.5 B for Notigi, $1 B for Wuskwatim, $3 B for Gull [1]. Additional CTs with a generation capability of 140-280 MW would cost about $0.1-$0.2 B. A larger hydroelectric plant at Conawapa would cost about $5 B including transmission to the load centers in the south.

Historic variability of water supply in the Nelson and Churchill Rivers Drainage basin (Figure 3) over the last 80 to 100 years shows a range of percent average flow from a low of 55% to a high of 160% (Figure 4).

Manitoba Hydro's long term planning criteria must consider the lowest historical level for power resource planning, but plant structures including the spillways must be designed for maximum flood conditions.

Figure 5 shows the Manitoba Hydro hydraulic system with respect to the elevation levels along with the existing plant locations indicated. Figure 6 shows the annual average energy potential. Figure 7 shows an illustrative view of Burntwood and Nelson Rivers areas in reference to the potential new generation.

6.0 Transmission Access:

Manitoba Hydro is experiencing strong growth in its export sales, while provincial requirements are growing steadily. Export revenues have grown almost 50 percent in the past four years from $250 million in 1996 to $376 million in 2000. Regulatory changes in the U.S. market, coupled with a burgeoning economy and a lack of new generation and transmission in the U.S. have meant steadily increasing prices for wholesale electricity.

Manitoba Hydro has been able to benefit from these changes, and now has the ability to market to 35 export customers, compared to the seven export customers it had in 1996. (Figure 8). With domestic electricity consumption in Manitoba growing slowly but steadily, this means that over time the utility will have less and less available energy to sell on the export market. If it wants to maintain its current level of sales, it will

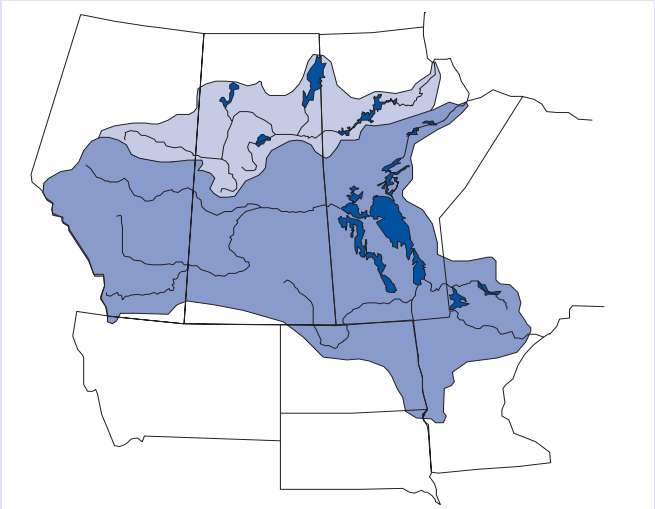

Figure 3: Churchill/Nelson River Drainage Basin

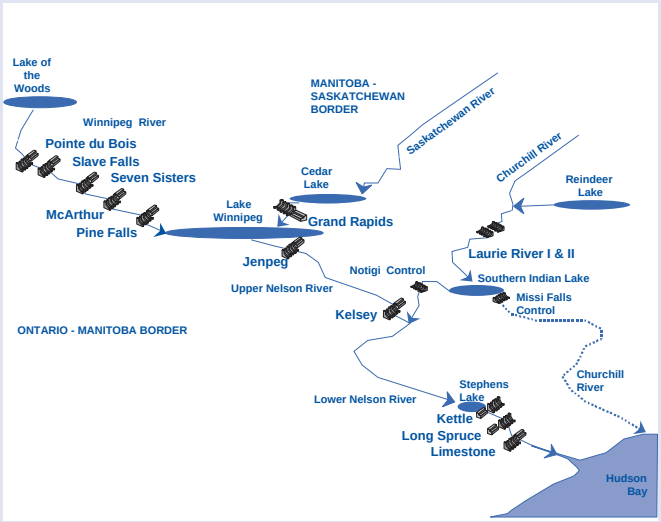

Figure 5: Manitoba Hydro System

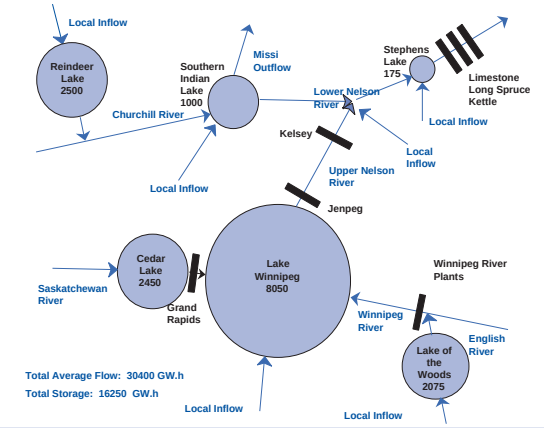

Figure 6: Annual Average Energy

Figure 8: Manitoba Hydro's Export Marketplace

have to build new sources of generation.

Strong export sales have been a key reason that electricity rates in Manitoba have not risen for four years (for industrial customers, the rates have remained stable for 9 years).

Figure 9 shows the generation and interconnection capability for Manitoba Hydro's immediate vicinity in western Canada and in mid west U.S. A number of east - west interconnection schemes were studied in the past such as the Manitoba - Ontario connection which included new generation in northern Manitoba with a north - south HVDC line. This project had an estimated cost of $2 B (Figure 10). Another east - west scheme studied was 500 kV HVDC multi terminal concept which covered Manitoba, Saskatchewan and Alberta, also known as western grid, as shown in Figure 11.

There has also been a number of north - south interconnection studies in the past to the States of Minnesota, North Dakota, Nebraska and Wisconsin. One current project which is approved and under construction is a 230 kV connection between western Manitoba and central North Dakota with a transmission line length of 200 km and a cost of $55 million (Figure 12). This project will re-establish Manitoba Hydro's import capability to 500 MW, it will also increase the import and export capabilities by 200 MW. The in service date for this project is fall of 2002.

Figure 13 shows Manitoba Hydro integrated system. Figure 14 shows the existing dc system including the route for a possible third dc line between north and south. Overview of the system including the connections to the neighbouring provinces of Ontario and Saskatchewan and connections to the U.S. are schematically shown in Figure 15.

7.0 Agreements in Principle:

The work on these potential hydroelectric generating stations represents a fundamental change in Manitoba Hydro's relationship with Cree Nations. Early in the process, the Corporation began working with potentially affected Cree Nations communities to identify and reduce possible negative impacts and maximize local opportunities. Manitoba Hydro is engaged in a collaborative planning process with the Nisichawayasihk (formerly Nelson House) Cree Nation with respect to the Notigi and Wuskwatim projects and with the Tateskweyak (formerly Split Lake) Cree and War Lake First Nations on Gull project. The proposed planning process includes joint investigation of possible environmental impacts, consultation on design, discussion about business opportunities, including the possibility of equity participation by the First Nations in the projects. Consultation is also under way with regulators, environmental community, unions and other interested parties [2,3].

In late 2000, that process led to a historic agreement in principle between Manitoba Hydro and the Tateskweyak Cree First Nation and potentially other Cree Nations within the Split Lake resource management area. This agreement would provide the opportunity to invest in the proposed Gull Generating Station. The agreement in principle was approved by a community wide recent vote, just as any final agreement

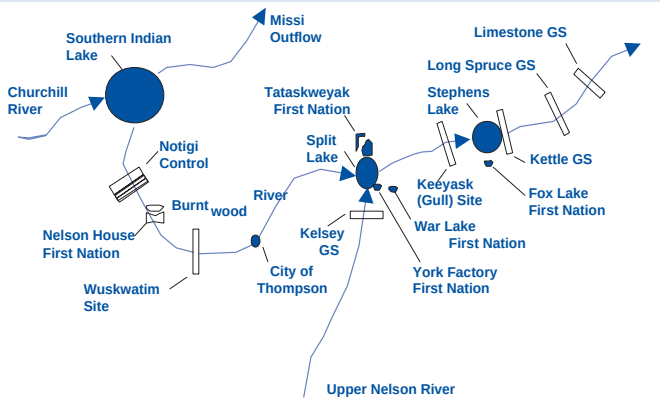

Figure 7: Potential New Generation - illustrative view of Burntwood/ Nelson River area

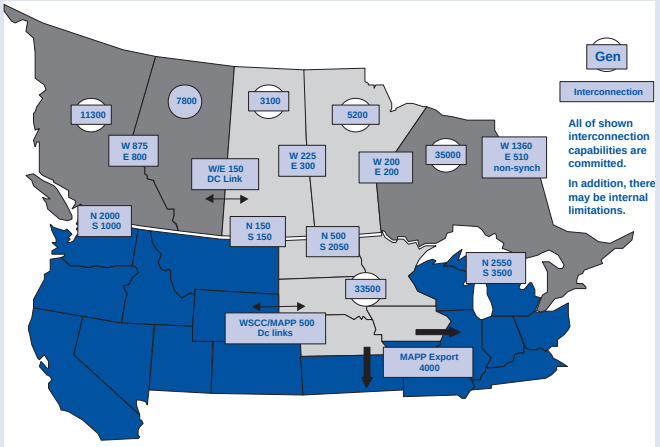

Figure 9: Generation and Interconnection Capability (MW)

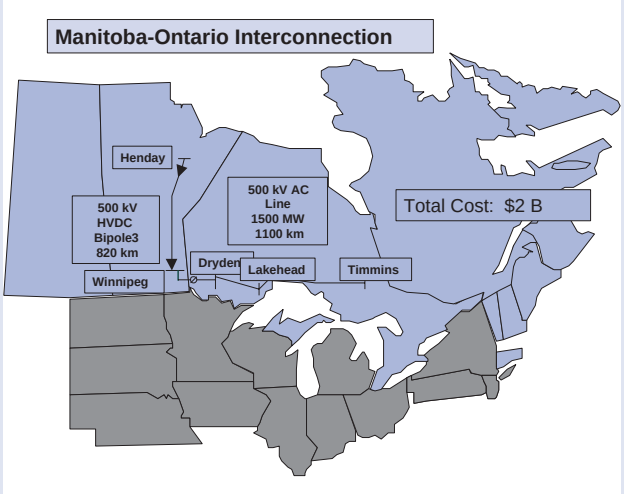

Figure 10: Transmission Expansion studied in the past.

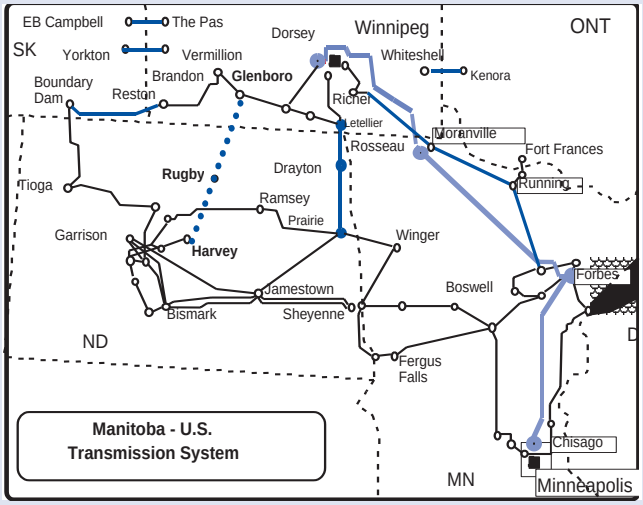

Figure12: Manitoba - U.S. Transmission System

would be subject to a community vote. A similar agreement in principal was approved by the Nisichawayasihk Cree Nation (NCN) in the summer of 2001. Manitoba Hydro announced the signing of an Agreement in Principle with the NCN regarding possible future development of two hydroelectric generating station projects [4].

While Manitoba Hydro continues to study the three potential projects, no decision has been made to proceed with the construction. Once a decision is made, a public review will be held and environmental licensing by provincial and federal agencies would be required. Finally, approval must then be received from the provincial government. Final project development agreements would also have to be negotiated with any affected Cree Nations.

The earliest any construction is expected to begin is 2004, with the earliest in service date for Notigi being 2008, for Wuskwatim in 2009 and Gull Rapids, 2011.

8.0 Demand Side Management:

These are projects supported by the Corporation which are also known as "Power Smart" initiatives. They include energy surveys and audits; the introduction, promotion and in some cases partial subsidy projects such as use of energy-efficient appliances; weather stripping doors and windows; installing energy-efficient showerheads; insulating basement walls; installing programmable thermostats; use of block heater timers; use of energy efficient lights in residential and commercial buildings; and the use of energy efficient drives and other equipment in industrial plants.

The projected energy savings currently achieved in this category is 188 MW of power and 444 GWh/year of energy. It is projected that total savings of 299 MW of power and 983 GWh/year of energy would be achieved by year 2011.

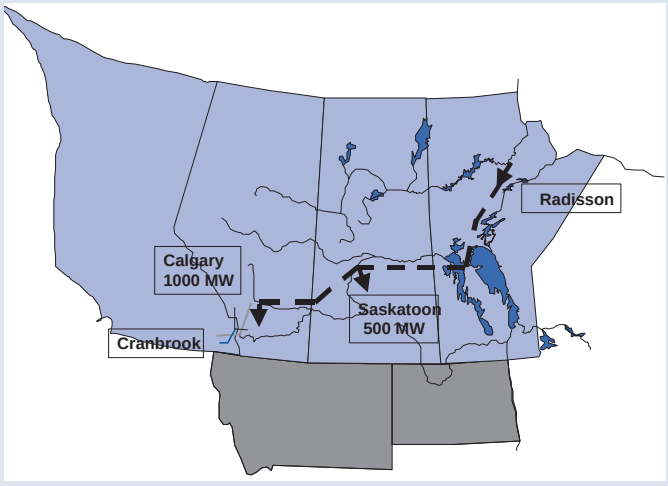

Figure 11: Western Grid - 500 kV HVDC Multi-terminal 1825 km line

Figure 13: Manitoba Hydro integrated system

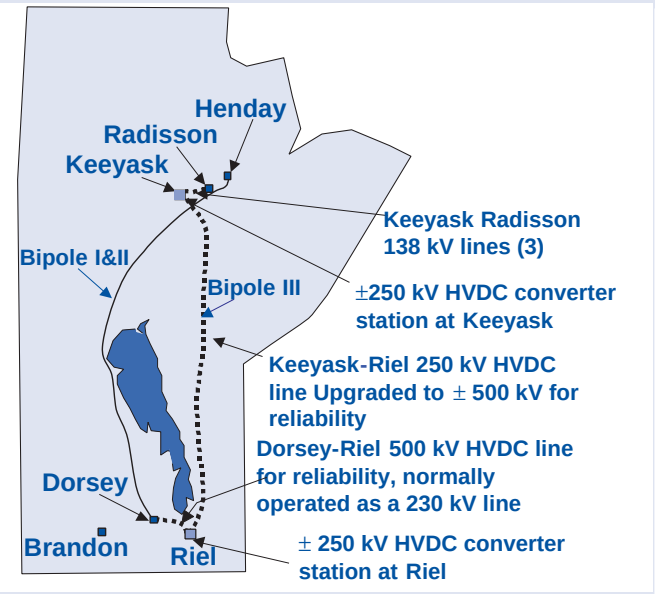

Figure 14: DC system

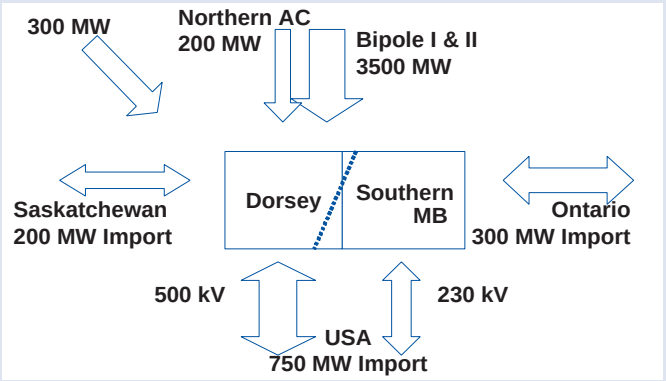

Figure 15: System overview

9.0 Supply Side Efficiency Improvements:

These are proposed and achieved efficiency improvements to existing generators either initiated based on a benefit versus cost basis or during scheduled maintenance and outages. To date, 31 MW of capacity in total has been added to the system. There are various projects under consideration which will bring the total up to 80 MW.

One such example is Winnipeg Hydro's Pointe Du Bois Project. Winnipeg Hydro is a sister utility which owns and operates two hydraulic plants on the Winnipeg River. One is Pointe Du Bois (69 MW) built in 1911 and the other is Slave Falls (71 MW) built in 1931. These plants supply 45% of energy requirements and 30% of peak demand for Winnipeg Hydro's 96,000 customers. In 1995, KGS Group was retained by Winnipeg Hydro to conduct a preliminary engineering study comparing plant redevelopment versus plant rehabilitation. The study concluded that the old plant could be successfully rehabilitated, using the compact Straflo turbine technology, for a total cost of approximately $100 million less than the cost of building a new plant (estimated at $310 to $380 million in 1995 dollars) [5]. The total replacement of the original turbine generators was estimated to increase the plant capacity from 69 MW to 134 MW. Waterpower is a major source of renewable electrical energy, and the rehabilitation of Pointe du Bois G. S. would nearly double the plant's output with no major impact on the environment.

The Straflo Demonstration Project was approved in 1996 and construction commenced in 1998 and was completed in fall of 1999. This project saw the replacement of one existing 3.5 MW Francis turbine generator (1911) with a new 8.4 Straflo turbine generator. The turbine runner is shown on the cover page of this issue during the installation.

A decision on the replacement of additional turbines will be based upon an in-depth engineering and economic analysis and study of alternatives by KGS Group.

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About the author

Hilmi M. Turanli received his B. Sc. and M. Sc. degrees (both in Electrical Engineering) from the Middle East Technical University, Ankara, Turkey in 1976 and 1980, respectively. He was granted his Ph. D. degree from the University of Manitoba in 1984.

He was with the Electrical Engineering Department, University of Manitoba working on a special research project for Manitoba Hydro. Later, he taught for the Department of Electrical Engineering at the University of New Orleans as an Assistant Professor. He also worked as a consultant for Louisiana Power and Light Company.

In June 1986, Dr. Turanli started working for Manitoba Hydro. Currently he is the Interconnections & Grid Supply Studies Engineer in the System Planning Department. His research interests involve the digital simulation of power-electronics circuits, HVDC transmission, and power system planning.

Dr. Turanli is a Professional Engineer registered in the Province of Manitoba. He is a Senior Member of IEEE. He is the author or co-author of several published technical papers. In March 2001, he was designated as a Fellow of Engineering Institute of Canada.

PC-based Real-time Power-system Simulation Takes an Effective Step Forward

by Christian Dufour, Jean Bélanger and Simon Abourida of Opal-RT Technologies Inc., Montreal, QC, and Paul Baracos of ACS Enrg., Montreal, QC

Abstract

In the Summer 2001 issue of the IEEE Canadian Review, Lechevin, Rabbath and Baracos reported on distributed real-time simulation of power systems using off-the-shelf software. Since then, improvements in the ARTEMIS solver now allow a significant reduction in numeric error for a given integration step size in switching networks. The innovation comes from implementing an interpolation mechanism that accurately takes into account between-step switching events. This means that a given system can be simulated at a relatively large step size, but with the same accuracy as if a smaller, and more computationally intensive, step size had been used. By interpolating between time steps, the algorithm gives a smaller effective step size for greater integration accuracy.

This paper shows how the new algorithm improves the accuracy of a six-pulse-inverter simulation and discusses a number of possible applications involving electric drives and power converters.

Sommaire

Dans l'édition "Été 2001" de La revue canadienne de l'IEEE, Lechevin, Rabbath et Baracos ont discuté de méthodes de simulation en temps-réel de réseaux électriques utilisant des ordinateurs non-spécialisés disponibles commercialement. Depuis, des améliorations au programme ARTEMIS permettent une encore plus grande précision de simulation dans les systèmes électrique comprenant des commutateurs. L'innovation vient de l'implantation d'un mécanisme d'interpolation permettant de prendre en compte précisément les commutations qui se produisent entre les pas de calcul. Cela permet de simuler un système électrique à un pas de calcul beaucoup plus grand que sans interpolation, tout en conservant une précision équi-valente. En interpolant entre les pas de calcul, l'algorithme a donc un pas de calcul effectif plus petit et donc une précision de calcul plus grande.

Cet article montre comment le nouvel algorithme améliore la précision de simulation en temps-réel d'un onduleur triphasé. L'article discute aussi de quelques autres applications possibles, tels que convertisseurs de puissance et circuits d'alimentation de machines électriques.

1.0 Introduction

In the Summer 2001 issue of the IEEE Canadian Review [1], Lechevin, Rabbath and Baracos reported on distributed real-time simulation of power systems using off-the-shelf software with the Advanced Real-Time Electro-Mechanical Transient Simulator (ARTEMIS) algorithm. Whereas conventional system simulation tools [3,6] use the Tustin, or trapezoidal, discretization method, whose drawbacks include undamped switching oscillations and poor discretization of discrete components near the Nyquist limit, ARTEMIS' proprietary discretization methods [1] often can reduce numeric oscillation and improve discretization. The result is oscillation-free simulation of switching energy systems, without needing snubbers or other stabilizing schemes [4], and greater accuracy in circuits containing slightly damped components, which the well-known trapezoidal method sometimes handles inadequately.

However, as with other fixed-time-step-capable simulation software like EMTP [2] and SimPowerSystems (formerly known as the Simulink Power System Blockset) [6], the standard ARTEMIS software cannot precisely simulate circuits that contain switches that toggle in the middle of time-steps. This is due to the non-iterative integration algorithm of these software packages, in which changes in network topology can only be taken into account at the beginning of the time-step. Events that occur in the middle of the time-step can only take effect at the following time-step. In the case of systems that include switching components such as thyristors and GTO converters, this variable discrete switching latency distorts the output spectrum of the simulation by introducing low frequency jitter components. This jitter is introduced by the simulation method and is not a real phenomenon.

To solve this problem we have developed an extension of the ARTEMIS algorithm to allow Real Time compensation of between-step switching Events (ARTEMIS-RTE). This algorithm can give very significant improvements in numeric accuracy with only a small increase in computational overhead, typically less than 10% of the real-time step. It can therefore be used in real-time applications with negligible increase in the computational costs.

This paper compares of accuracy of conventional and compensated fixed-time-step simulations of switched systems Section 2.0 describes the jitter problem encountered in the fixed-time-step simulation of a simple thyristor converter. Section 3.0 demonstrates the use of the ARTEMIS-RTE algorithm in the single thyristor converter while Section 4.0 does the same for a multi-switch system, a three-phase inverter. Section 5.0 briefly describes the RT-Event blockset used to design event-compensated controls. Finally, conclusions are put forward in Section 6.0.

2.0 Jitter: an Artifact of Fixed-Time-Step Simulation

Standard fixed-time-step simulation of cyclically switched circuits often leads to numerically induced jitter in the simulation outputs. This jitter is purely an artifact of the numeric simulation process - it is absent from the real system or even from a variable-time-step simulated system, which can therefore serve as a reference.

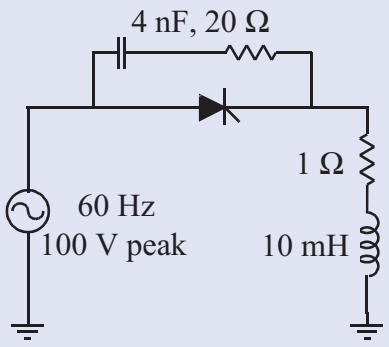

Figure 1: A single-phase thyristor converter.

Very simple switching circuit simulations can exhibit numerically induced jitter. The simple thyristor converter illustrated in Figure 1 is an example. Suppose that the thyristor is activated with a constant firing angle θ. In fixed-step simulation, θ is rounded to the next time-step hit. As a result, the fixed-step simulation output exhibits a jitter that is absent from the reference simulation, as shown for θ=120° and Ts=50 μs in Figures 2 and 3.

3.0 ARTEMIS-RTE Real-Time Event Compensation

An interpolation-extrapolation algorithm has been implemented in ARTEMIS-RTE to compensate for switching events that occur in the middle of fixed-time-steps. When a switching discontinuity is detected, states are interpolated for the fraction of the step detected. After the dis-

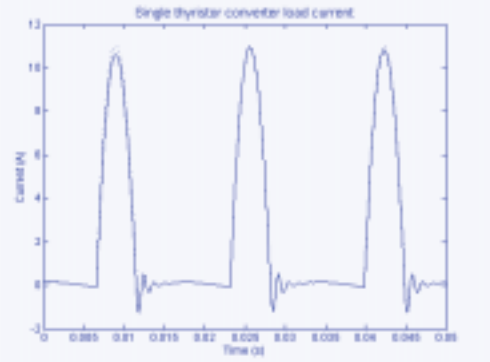

Figure 2: Thyristor converter: simulated load current.

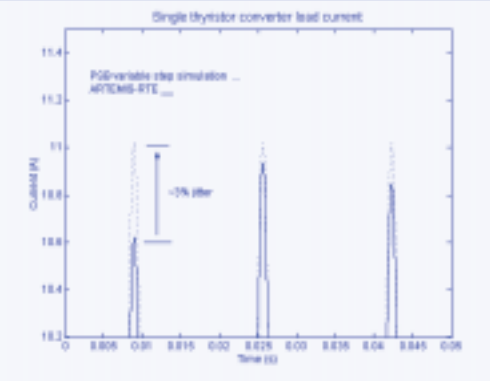

Figure 3: Detail of the load current showing the jitter.

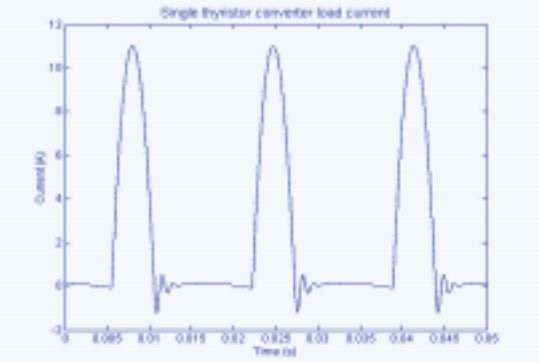

Figure 4: ARTEMIS-RTE simulation of the thyristor circuit's load current.

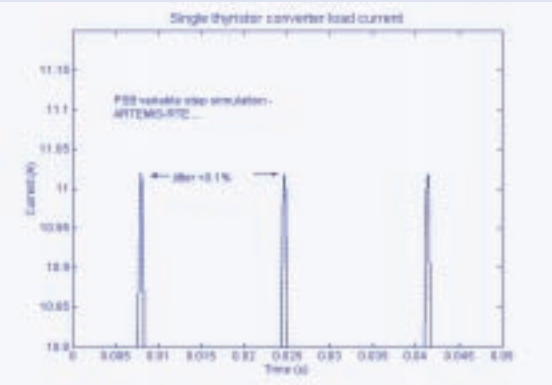

Figure 5: ARTEMIS-RTE simulation output detail showing reduced jitter.

continuity has been interpolated, a normal iteration is made, followed by an extrapolation to resynchronize the simulation with the next fixed time-step frame.

The ARTEMIS-RTE simulation of the simple thyristor circuit from Figure 1 is shown in Figures 4 and 5.

The conventional fixed-step simulation's 3% jitter, measured at the peak values of load current, has come down to less than 0.1% with ARTEMIS-RTE. Both simulations used a time-step of 50µs. Clearly, the ARTEMIS-RTE simulation output is more accurate in both peak and average levels.

The effect of the ARTEMIS-RTE algorithm can also be noted in the frequency spectrum, through the use of Discrete Fourier Transform. Figure 6 show the jitter improvement for the thyristor converter for a time-step of 60µs.

4.0 Simulation case: DC-AC inverter

The simulated circuit schematic is shown in Figure 7. It is a DC-AC inverter composed of a DC source feeding a six-pulse IGBT bridge, a three-phase transformer and a R-C load. Simulation is carried out in open loop and the firing control is a standard PWM scheme. The circuit has 12 states, 13 inputs, 14 outputs and 6 switches.

This circuit is especially difficult to accurately simulate in fixed time step because of the occurrences of multiple switching events in a single step. The ARTEMIS-RTE algorithm deals well with this type of circuits with no extra computational time, as compared with the single-event case.

The simulation of this circuit with standard SimPowerSystems at a real-time compatible time step of 50 µs is shown in Figure 8. Output voltage is noisy and inaccurate, mainly because PWM switching scheme involves very-high and precise switching sequences that a standard non-iterative simulation algorithm cannot follow.

In contrast, the ARTEMIS-RTE algorithm deals well with this kind of switching patterns, dividing Total Harmonic Distortion (THD) by a factor of three. Those patterns include multiple switching in a single time-step and instantaneous switching of diodes.

4.1 Linearity of the DC-AC inverter

The linearity of the voltage output versus the modulation index input is shown in Figure 9. As can be seen in the figure, the ARTEMIS-RTE simulation is linear as opposed to the general Tustin case. The Tustin method of SimPowerSystems works well only when the time step size is an exact sub-multiple of both output period and PWM period. For 60 Hz output and 1080 Hz PWM frequency, this happens only for time steps calculated as shown below:

Step size (seconds) = 1/(60*1080*n), for $n \in 1, 2, 3 \ldots$)

These exact time steps of 15.432 µs, 7.716 µs, 5.144 µs, …, are unattainable using current PC technology. At the more practical time step size of 50 µs, not a sub-multiple of output and PWM frequencies, the ARTEMIS-RTE algorithm exhibits excellent linearity while the Tustin shows some non-linearity. The two curves in Figure 9 show the maximum and minimum values of the measured fundamental generated using the Tustin method with a 50 µs time step, because this value is subject to jitter.

4.2 Achievable step size versus PWM frequency.

The non-iterative nature of the ARTEMIS-RTE algorithm typically causes a minor increase of both average and real-time simulation step times when compared to the uncompensated case. This non-iterative method has some limitations with regards to the frequency of switching in the simulation. Nevertheless, the ARTEMIS-RTE works well at time steps achievable in real-time applications with a switching scheme like the PWM converter of Figure 7.

As seen in Figure 10, the ARTEMIS-RTE algorithm can keep minimal error (<1%) at time steps compatible with real-time implementation. In contrast, the Tustin method is not designed to handle discrete-switching events occurring in PWM schemes at large time step sizes.

For a 2 kHz PWM carrier frequency, a 47 µs ARTEMIS-RTE simulation has an effective time step of 2 µs, meaning that one would have to lower the time step size to 2 µs in a regular uncompensated simulation

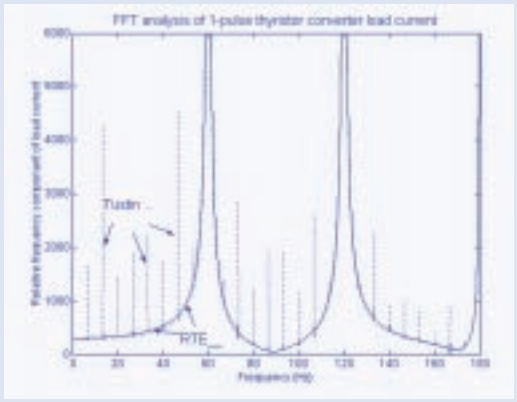

Figure 6: Frequency spectrum of the thyristor controller's load current: ARTEMIS-RTE vs. uncompensated Tustin method.

to obtain the same accuracy as an ARTEMIS-RTE simulation at 47 µs.

4.3 Achievable real-time step size.

RT-LAB software from Opal-RT Technologies is a real-time application software that enables simulation of Simulink-RTW schematics on a variety of low-cost target platforms, either single-processor or multi-processor Pentium-class machines such as the three-processor unit shown in Figure 11. The unit shown is slated for delivery to vehicle manufacturer who will use it to test thyristor and IGBT based motor drive controllers. Similar simulators have been delivered to train manufacturers.

Table 1: Computation times for PWM Inverter (Pentium III, 1GHz)

	ARTEMIS-RTE
Average time step	12 µs
Real-time step	14 µs

Including processor communication time overhead brings the minimum achievable step size in RT-Lab to 35µs for the PWM inverter. This shows that the PWM inverter can be simulated in real-time within the ARTEMIS-RTE limits of Figure 10.

The real-time performance of ARTEMIS-RTE is due to the fact that the algorithm is always non-iterative, even during the steps that have switch actions. This is in contrast with software with similar capabilities that iterate one or more times during discontinuity-occurring steps [5,7].

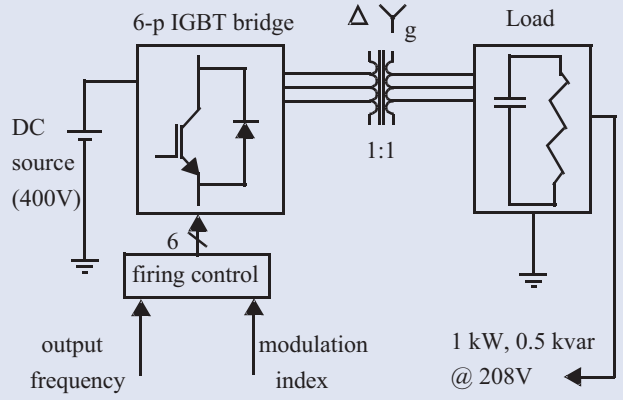

Figure 7: PWM inverter schematic

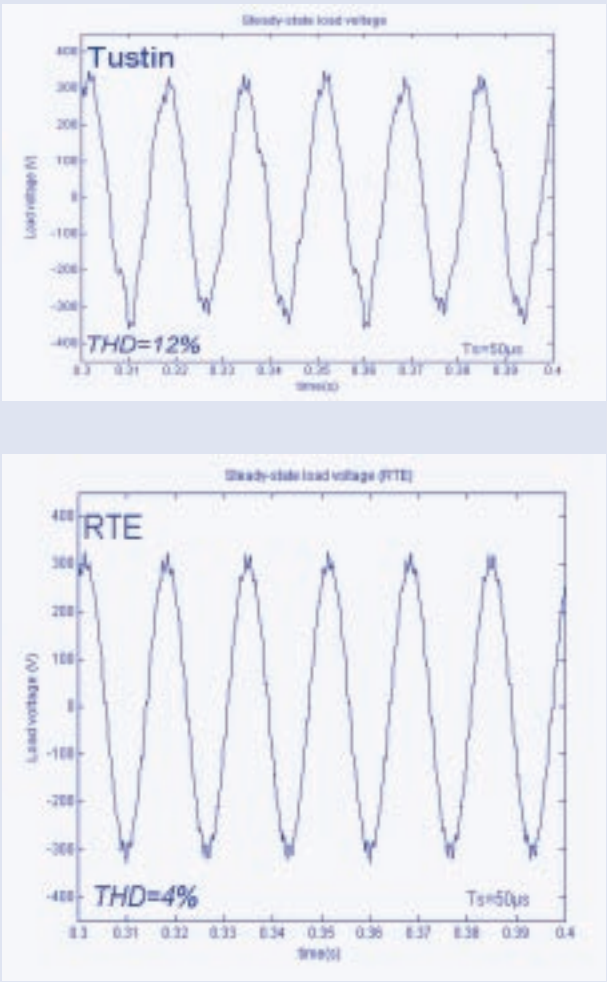

Figure 8: PWM simulation results.

The ARTEMIS-RTE algorithm is commercially available as an add-on to the popular Simulink/SimPowerSystems package or as an integral part of the RT-LAB Electric Drive Simulator which is a table-top simulation device that provides a low-risk, low-cost entry point to high-fidelity hardware-in-the-loop real-time modeling and control prototyping using high-speed I/O cards available off-the-shelf from National Instruments. Typical SimPowerSystems models update in less than 50 microseconds with 200 nanosecond gate-firing precision. This performance level can be maintained for larger models by adding processors (up to seven!) in a shared-memory industrial chassis no larger than a standard desktop computer.

Typical applications include controllers and simulators for electric drives, electric vehicles, gas-turbine generator sets, wind turbines and small to medium-sized electric systems of all sorts.

5.0 Applying between-step event compensation to control block diagram

The ARTEMIS-RTE algorithm applies between-step event compensation to electric systems modeled with SimPowerSystems, but it is not applicable to the remaining subsystems of a Simulink block diagram such as the control subsystems. When between-step events cause numeric problems in control subsystems, compensation can be introduced manually using the RT-Events toolbox. This was the case with PWM inverter of Figure 7. The RT-Events toolbox contains a number of standard blocks, such as comparators and integrators, which are used to replace corresponding blocks from the standard Simulink libraries. In other respects, the block diagram is unmodified, as shown in Figure 12.

The RT-Event blocks have the same functionality as their Simulink counterparts except that they output additional timing information on

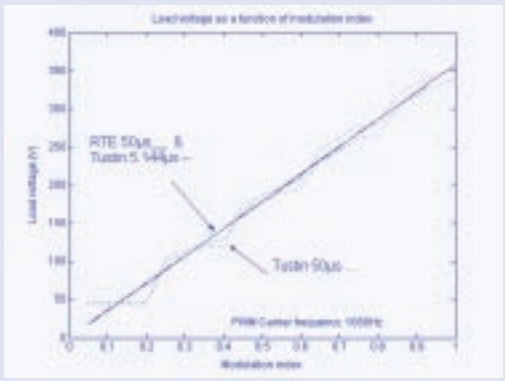

Figure 9: PWM inverter linearity.

between-step events such as zero-crossings. The RT-Events blockset has already been successfully used by Ford Motor to model internal combustion engine and is detailed in [8].

6.0 Conclusion

This article highlights a novel algorithm called Real Time compensation of switching Events. This algorithm allows a more accurate fixed-step simulation of time-segment linear dynamic systems with switching events that occur in the middle of time-steps.

Some simple simulation cases have been discussed, to show the increased precision of the algorithm. The cases presented exhibited output jitter when not compensated, a common problem arising in the fixed-step simulation of electrical systems containing non-linear components like switches.

The discrete simulation of a DC-AC inverter with ARTEMIS-RTE has shows that it results in a small signal linear characteristic for the inverter in fixed time step. This characteristic is obtained at time steps compatible with real-time implementation and thus makes the software ideal for discrete control or HIL applications.

It has been shown that this algorithm has dramatically reduced simulation jitter in the presented cases, with very small computational overhead in all cases. This overhead, even in single-step multi-event cases, represents less than 10% of the normal ARTEMIS state-space iteration routine.

The ARTEMIS-RTE algorithm is currently implemented in the ARTEMIS Add-On for the Power System Blockset for Simulink, but can be adapted to other simulation packages.

Suggested application areas include controllers and simulators for electric drives, electric vehicles, gas-turbine generator sets, wind turbines and small to medium-sized electric systems of all sorts.

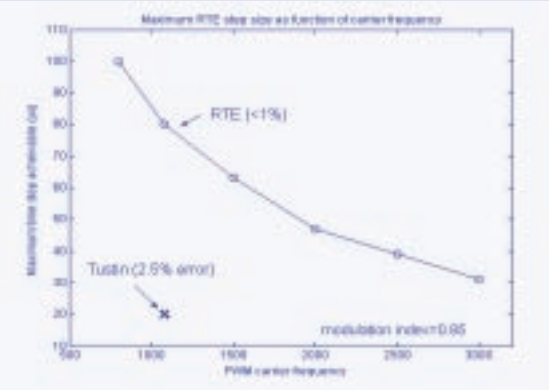

Figure 10: Maximum ARTEMIS-RTE time step for 1% error in the fundamental component amplitude vs. PWM frequency.

Figure 11: Multi-processor Electrical Engineering Simulator, an industrial-quality unit equipped with three 1 GHz CPUs (expandable to 5 by adding one dual-CPU board). The CPUs communicate via shared memory, and multiple units can be linked via FireWire to assemble a mega-simulator.

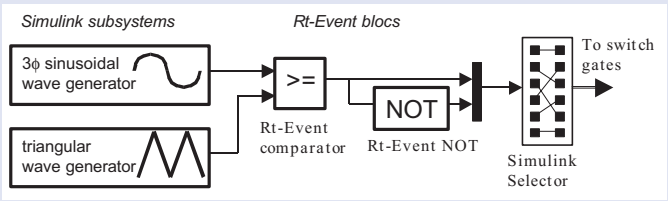

Figure12: RT-Events PWM controller

7.0 Acknowledgments

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About the authors

Christian Dufour is a Simulation Software Specialist at Opal-RT Technologies. He received his Ph.D. degree from Laval University, Quebec in 2000. Since 1992, he has worked in the development of IREQ real-time simulator as well as The MathWorks' Power System Blockset. His current research interests are mainly focused on numerical techniques related to real-time power system simulations.

Simon Abourida has a Masters degree in electrical engineering from École Polytechnique, with specialization in power systems and power electronics (1994). He has worked for Hydro-Quebec's International Real-Time Power System Simulator, and at Technologies M4. He is now with Opal-RT Technologies as the Electromechanical Modeling & Simulation Group Leader where he is involved in the design and testing of real-time digital simulators and other related real-time applications.

Jean Belanger is president of Opal-RT Technologies, Inc. He is a specialist in real-time simulations, with more than 20 years of experience in the field, including many years as part of the simulation division of Hy-dro-Quebec. He received his M.A.Sc. from Laval University, Quebec, and is a member of the Order of Professional Engineers of Quebec.

Paul Baracos has been involved in simulation and control systems since 1976. He has a B.Sc. in Physics from the University of Manitoba, an M.A.Sc from Systems Design Engineering from the University of Waterloo and a Ph.D. in Mechanical Engineering from McGill University. He has had twenty-years experience as professional engineers, and is currently president of ACS Enrg., a registered consulting and software company.

Letters to the Managing Editor / *Lettres envoyées au rédacteur en chef*

Obituary

Michel Lecours - Engineering educator

Michel Lecours, Fellow member, died 21 October. He was 62 years old.

Mr. Lecours graduated from École Polytechnique, Montréal, Canada, in 1963, and received his Ph.D. degree in electronics and communications from the Imperial College, London, England, in 1967. From 1967 to 2001, he was a Professor in the Electrical Engineering Department, Laval University, Quebec City, Canada. He was Head of the Electrical Engineering Department, Laval University, from 1975 to 1977, and Vice-Dean of the Faculty of Science and Engineering from 1977 to 1985. He was involved in transmission system engineering at Bell Northern Research, Ottawa, Canada, and was a Visiting Research Scientist in the Digital Mobile Radio Section, Electrical Communication Laboratories, NTT, Yokosuka, Japan. His research interests were in the field of mobile and wireless radio channels, microstrip antenna arrays for mobile communications and radar, and applications of data fusion to identity information expert systems. In the field of technology transfer, he collaborated with Lab-Volt Ltd., Quebec City, Canada, in the development of telecommunication, microwave, radar, and antenna training equipment.

He was Editor of the Canadian Journal of Electrical and Computer Engineering from 1992 to 1998 and served on the executive committee of IEEE Canada (Region 7) from 1995 to 1997. He was the recipient of the 1987 Annual Merit Award presented by the École Polytechnique of Montreal Alumni Association, the 1997 John B. Stirling Medal of the Engineering Institute of Canada, and the 1997 IEEE Regional Activities Board Larry K. Wilson Transnational Award.

He is survived by his wife, three children and two grandchildren.

CR40 - Spring editorial - Income Tax Software

Vijay,

You made an excellent point about the cost of acquiring the software to do your own income tax when the government (CCRA) should provide each taxpayer upon request with the software. However, it is not necessary for them to send a disk as it could be downloaded from a secure site using the SIN number of the taxpayer to access their site. One would then complete the forms and send them back to the CCRA site. This would be cheaper for all. I find that preparing my information and then having my tax accountant fill the form that he gets from CCRA is the cheapest but that is still $50.00 plus GST. The advantage of this approach is that one does not have to supply the receipts and T-slips. **We should all send this suggestion to the Minister responsible for the CCRA and our MP's.**

Harvey Buckmaster

BC.

Vijay

Thank you for your continued efforts in publishing the IEEE Canadian Review.

I always seem to find an interesting article that causes me to read through the entire publication. I was very impressed with Dr. Luchien Chang's article on Wind Energy Conversions Systems (Spring 2002 Publication) as I had some exposure to Dr. Chang's research when he first began and it was interesting to read how his research has progressed. Thank you again for ensuring that we have interesting articles in the Canadian Review.

Stephen A. Galbraith

Ottawa, ON

Editor's note:

We do appreciate your feedback. Thanks.

Subject: Investment tips

If you had bought $1000.00 worth of Nortel stock one year ago, it would now be worth $49.00.

With Enron, you would have $16.50 of the original $1,000.00.

With Worldcom, you would have less than $5.00 left.

If you had bought $1,000.00 worth of Molson (the beer, Stupid, not the stock) one year ago, drank all the beer, then turned in the cans for the 10 cent deposit, you would have $214.00.

Based on the above, my current investment advice is to drink heavily and recycle.

Ann McLoud

Toronto, ON

ps: Valuations may fluctuate with the time/day of the week, but you get the drift. Readers should note that drinking may be harmful to your health; ... to say nothing of investing in the stock market. However, recycling is most definitely recommended.

Editor's note:

The views expressed are the sole responsibility of the author(s). The editor does not condone or support any investment advice received from readers. The mentioning of corporate entities does not mean that such corporations are recommended or otherwise.

IEEE, ITRE, Memorial University and Amateur Radio Groups Commemorate the Centenary of Marconi's first Transatlantic Wireless Experiment

by Joe Craig, Siu O'Young and Len Zedel
Memorial University, St. John's, NL

Abstract

On 12 December 2001, 100 years after Marconi's first transatlantic wireless experiment, the IEEE, ITRE (Tasmania) and Memorial University hosted dignitaries, student competitors in the Marconi Crystal Radio contest as well as the Poldhu Amateur Radio Club and the Marconi Radio Club of Newfoundland. Students were given an opportunity to experience first hand the wonders of radio communication by designing and building their own radios and witnessing amateur radio transmissions from around the world. Marconi's famous experiment was re-enacted by receiving three sharp clicks from Poldhu on an original Marconi receiver. The event marked the culmination of two years of planning and collaboration between many groups. It was an outstanding success in promoting science, engineering and traditional amateur radio to our youth and the public, in addition to fostering international goodwill over the radio.

Sommaire

Le 12 décembre 2001, 100 ans après la première expérience de communication sans fil de part et d'autre de l'océan atlantique, l'IEEE, l'ITRE (Tasmanie) et l'Université Memorial étaient les hôtes de dignitaires, d'étudiants participant au concours du Marconi Crystal Radio, du club de radio amateur Poldhu ainsi que du club de radio Marconi de Terre-Neuve. Les étudiants ont put faire l'expérience des merveilles des communications radio en concevant et en construisant leur propre radio en plus d'être les témoins privilégiés de transmissions provenant des quatre coins du monde. Entre autres, la célèbre expérience de Marconi fut reproduite par la réception, sur un récepteur Marconi d'origine, de trois déclics transmis par les gens de Poldhu. Cet évènement fut le point culminant de deux ans de planification et de collaboration entre plusieurs groupes. L'évènement fut un succès retentissant en permettant la promotion de la science, du génie et de la radio amateur auprès des jeunes et du public en général, et en encourageant les échanges internationaux par le biais des ondes radiophoniques.

1.0 Introduction

On the morning of the centenary day, on the campus of Memorial University just a few kilometres from where the building once was where Marconi made history a century earlier, weak but readable signals in Morse Code were heard on a radio operated by members of the Marconi Radio Club of Newfoundland. The signal was greetings from His Excellency Sir Guy Green, Governor of Tasmania on the opposite side of the world, to His Honour Dr. Maxwell House, Lt. Governor of Newfoundland, commemorating the historic day.

Later, following a ceremony at which the young winners of the Marconi Crystal Radio Contest were announced, a radio message from Poldhu England relayed greetings to all participants including many dignitaries and event organisers.

Just after 12:30 local time, a succession of S's transmitted from Poldhu by Carolyn Rule were heard as clicks on a receiver manufactured by the company Marconi started himself. This event marked the centenary with the most authentic re-enactment of Marconi's experiment yet achieved.

Wednesday 12 December 2001, the centenary of Marconi's first transatlantic wireless experiment, was marked by a joint effort by the Institute of Electronics and Electrical Engineers (Newfoundland and Labrador Section) the ITRE in Tasmania, Memorial University of Newfoundland and the Poldhu Amateur Radio Club (PARC) and Marconi Radio Club of Newfoundland (MRCN).

2.0 An early start

Collaboration between these groups when the author, while in conversation with Mr. Frank Davis, P. Eng, MIEEE early in 2000. Frank suggested that Mr. Yves Fontaine, P. Eng and chair of the Newfoundland Section of the IEEE should be contacted so that arrangements could be made to make the centenary event both productive and memorable. The event had been commemorated by several amateur radio organisations for the past four decades, and more recently by re-enacting a transmission from Poldhu where Marconi's original transmitter was located using modern equipment. The centenary year we wanted to re-enact the original experiment in as much detail as possible, bearing in mind the remark of Mr. Fontaine that we should plan things so that we had a reasonable chance of success; a caution that was taken very seriously. Some time later, Mr. Fontaine contacted Prof. Siu O'Young who would be in charge of the IEEE participation in the event. Following a meeting between Profs. O'Young and Zedel of the Physics Department and myself, the idea of a special competition and re-enactment on the 12th of December was conceived. We considered this to be an excellent opportunity for collaboration for promotion of science, engineering and Amateur Radio.

3.0 A re-enactment?

It was thought that it might be possible to use apparatus similar to that used in 1901, but was quickly decided that this was not practical. There was too much man-made interference to use a crude receiver although methods of synchronous diode detection was discussed. In addition, a spark transmission of sufficient power would disrupt existing radio services. Instead, to preserve some authenticity, several Marconi receivers were obtained and refurbished, thanks to the assistance of Mr. Barry Hayes. Mr. Hayes of CMC electronics, formerly the Canadian Marconi Company, arranged for the supply of surplus equipment and provided technical expertise. The IEEE assisted in obtaining crystals for the local oscillators in the superheterodyne receivers.

4.0 Promotion to our youth

The promotional aspect of the event was to be in the form of a receiver competition for junior high school students. Exposing students in this age group to radio and electronic principles created a valuable opportunity to spark their interest in both engineering and amateur radio. Further meetings centred on defining the parameters of the competition: no amplification was to be used and they would be judged on merit in terms of sensitivity and selectivity. The receivers would be built from inexpensive parts provided by the university students who designed a kit while working at Dr. O'Young's Instrumentation, Control and Automation (INCA) Centre at Memorial University under the direction of engineering student Jeff Newhook.

There was considerable input from traditional radio amateur operators who were well known for their wealth of experience and expertise especially as it pertains to designing and building radio apparatus. During

Figure 1: (Top) Prototype receiver. The aerial is inductively coupled to the first of three capacitively coupled tuned circuits. The output is taken from the third stage and detected with a geranium diode in half wave mode. The meter measures micro-amps and is in series with the headphones. (Bottom) The Marconi XH-100 superheterodyne receiver used in the re-enactment.

Figure 2: Atop the Music Building at Memorial University. Behind and to the right of the quarter wave monopole aerial are the Science, Chemistry-Physics and Engineering Buildings.

one meeting at the University, we were privileged to have Mr. Davis P.Eng, VO1HP on the speaker phone to provide some insight into the design of crystal radios. Every traditional radio amateur has had some experience with crystal radio design and Frank was no exception. He highlighted the importance deploying a satisfactory aerial and adequate grounding.

Using parts from several radio amateurs including Mr. Bob Lewis, VO1BL, Mr. Jack Norman, VO1JN, Dr. J. Craig VO1FB, and Mr. M. Mercer VO1FR, a prototype three stage receiver was constructed. The tank coils were made by winding #26 enamelled wire onto a 35mm film cannister. The wire was provided by the Physics Department. These formed a tuned circuit when connected across each of the three ganged 365 pF variable capacitor sections. Interstage coupling was achieved through 60 pF variable capacitors. These were adjusted for optimal selectivity and sensitivity as measured on a signal strength meter. This was a micro-ammeter provided by the late Distinguished Professor Murray Brooker, an avid promoter of science. The tuning range of the receiver was about 500 to 2000 kHz. It was noted that about 25 μA of current could be obtained in the 3rd stage following detection when tuned to an AM broadcast station about 15 km away when using an unterminated Beverage aerial 160 metres long. The internal resistance of the meter was measured at 2.7 kilo ohm so that the corresponding power was:

$$P = I^2R = (25 * 10^{-6})^2 * (2.7 * 10^3)$$
$$= 1.7\ \mu W \qquad (1)$$

This signal was clearly audible in high impedance head phones connected in series with the detector circuit. The contraption was later dubbed the IEEE receiver and it became symbolic of the collective contributions to the crystal radio competition project from the Amateur Radio fraternity. At one point, the INCA laboratory had a box full of wire and 35mm film cannisters, but efforts to emulate the IEEE crystal receiver were hampered by the formidable challenge of reproducing a triple-ganged variable capacitor with household items.

5.0 The initial tests

Several meetings followed involving Drs. Zedel, O'Young and myself in the INCA laboratory and elsewhere in the Engineering building. At one point we tested wire aerials and some prototype crystal receivers. These were tried in a lab on the ground floor in the Engineering building. A wire was strung out the window and over some nearby trees. A ground connection was made via the mains ground with good results, although a bit noisy. The IEEE receiver worked better than the other prototypes but this was no surprise. The others had only one stage and no commercially manufactured tuning capacitor. With a broadcast station about 1 km away, it was not difficult to pin the 50 μA meter in the IEEE receiver. Over the following months, engineering student Jeff Newhook refined the receiver competition kits. It would include a diode, some wire, a high impedance earphone and instructions on how to build a tunable receiver from common house-hold parts. Because many of the communities outside St. John's were quite far from an AM broadcast station, Dr. O'Young suggested a small low power transmitter should be made available to test the receivers for students in these areas. A 1.8 MHz transmitter with an output of 0.5 watts was brought to the INCA laboratory. This transmitter had been previously used as a propagation beacon to study the diurnal variability as a function of distance up to 1200 km. It was a satisfying moment when the transmitter was switched on and started sending its identifier in Morse code. As we took turns listening to the headphones of the IEEE receiver, we could hear he clicks from the transmitter. It was very reminiscent of the accounts of Marconi as he passed the ear-phone a century earlier. Unfortunately, this transmitter could not be duplicated and modulated in the time remaining, but a source of low power AM transmitter kits was located. These kits were used instead.

Royal Institution, London, England, 13 March 1908

"...My assistants in Poldhu, in Cornwall, had received instructions to send on and after 11 December, during certain hours every day, a succession of S's followed by a short message, the whole to be transmitted, at a certain pre-arranged speed, every ten minutes, alternating with 5 minutes' rest.

"Owing to the constant variations in the capacity of the aerial wire in Newfoundland, it was soon discovered that an ordinary syntonic receiver was not suitable, although, at one time, a number of doubtful signals were recorded. I therefore tried various microphonic self-restoring coherers placed either directly in the aerial or included in the secondary circuit of an oscillation transformer, the signals being read on a telephone.

"On 12 December [1901] the signals transmitted from Cornwall were clearly received at the pre-arranged times, in many cases a succession of S's being heard distinctly although probably in consequence of the weakness of the signals and the constant variations in the height of the receiving aerial, no actual message could be deciphered.

"The following day we were able to confirm the result. The signals were actually read by myself and by my assistant Mr. G.S. Kemp."

- Guglielmo Marconi addressing the Royal Institution, London, England. Memorial University, St. John's, Newfoundland, 12 December 2001.

6.0 Final preparation

Towards the end of November, the site for the Marconi Crystal Radio Contest was chosen. It was decided that the music building at Memorial University was the best site. It had high ceilings so that the aerials for the receiver competition could be raised with helium balloons and a good location for an aerial for the amateur radio transmitter which would operate on 14 MHz for the contacts with Hobart on the opposite side of the world, Poldhu and other sites of historic importance in the Marconi Legacy.

The aerial was constructed with the assistance of the Physics Department machine shop and parts provided by Dr. J. C. Craig, who participated in the 1961 commemoration and the author's father. We also received help from the CBC. The aerial comprised telescoping aluminium tubing 3 cm at base to 1 cm diameter at top and its length was determined from the standard equation,

$$\lambda = c/4f = 300\ m\mu s^{-1}/(4 * 14MHz)$$
$$= 5.4m \qquad (2)$$

Figure 3: Mr D Colton uses radiotelegraphy to exchange greetings with radio amateurs in Villa Griffone, Italy where Marconi did his early work. Dr Zedel establishes an internet contact with Tunisia while Mr Roberts displays the Canadian Flag for the 'web cam'.

Figure 5: Competition room where receivers were judged. Note the helium balloons supporting the wire aerials aloft. (Photo: C. Hammond)

A theoretical monopole of this length would have an impedance of

$$Z = 36.5 + j21.25 \text{ ohms} \quad (3)$$

The reactance was reduced by shortening the monopole by five percent. A total of 9 radial wires 5 metres long were used as a ground plane. The aerial was installed by members of the MRCN and with the assistance of personnel from the University Works and Mr. J. Foley of the Department of Physics and Physical Oceanography. Dr. Zedel completed the wind stress calculations and determined the weight of lead needed at the base to keep the aerial from toppling in the wind.

Unfortunately, there was some reluctance expressed by the building custodian to permit drilling a hole for passing the transmission line into the building. Dr. Zedel suggested that we use a short section of thin line to pass through the door jamb. This worked to our satisfaction. During testing, we found that the resonant frequency of the aerial was very close to the intended operating frequency. To verify that the aerial was working, two contacts were made with Europe the first using a transmitter power output of 100 watts, the second with only 1 watt.

The day before the event, Dr. Zedel and Chris Hammond and I did some final testing and audio tests with connections between the HF transceiver and PA system in the auditorium. Dr. Zedel also made the preparations for the exchange of greetings between the Governor or Tasmania and the Lt. Governor in Newfoundland.

Figure 4: Dr. Len Zedel (standing) and Mr. Yves Fontaine listen as Joe Craig acknowledges official greetings from Poldhu on HF radio. The equipment in the picture included an online computer, a 100 watt HF transceiver, a Canadian Marconi XH-100 receiver and a 1 watt home built transmitter.

(Photo: C. Hammond)

7.0 The Centenary

On the big day, MRCN members gathered on stage and activated the station. At about 7:00 AM radio contact was established with the United Kingdom, but there was some apprehension if radio conditions were satisfactory for a contact with the antipodes. Fortunately, the pre-arranged Morse code contact was established with Richard Rogers, VK7RO, who along with the ITRE were participating in gala event organised by David Edwards in Hobart Tasmania. David had participated with us on the 12 December Radio Foundation Day since 1995. The texts to and from the Lt. Governor and the Governor of Tasmania were sent and received after a few tries: interference was a problem at times. Following this, contacts were had all over the world notably with sites of significance to the Marconi legacy. The operators included Dave Colton, VO1TK and Frank Davis. We also used internet links to various sites around the globe and sent video images of the event.

At about 9:00 AM the grade-nine student contestants in the Marconi Crystal Radio Contest brought their home built radios in to be tested. Aerials were made available for each by suspending wires with helium balloons.

After the testing for selectivity and sensitivity, the contestants and guests were assembled in the auditorium to hear speeches by dignitaries which included the IEEE Chairman, Mr. Yves Fontaine, MUN president Dr. Axel Meisen and the Lt. Governor Dr. Maxwell House. Following His Honour's address, the winners of the competition, Courtney Barbour, Alex Goncharov and Sarah Watson were announced. The spotlight then moved to the MRCN radio station VD1GM on the stage. Warm greetings on the occasion of the special centenary were transmitted by John Rule of the Poldhu Amateur Radio Club station GB100GM from Poldhu, England, the site where Marconi's signal was sent a century earlier.

The audio from the radio was fed through the PA system in the auditorium so all could hear the signals from across the Atlantic ocean. An hour later, we had the honour of listening to simulated spark transmitter sounds from the station of distinguished radio scientist Dr. John Belrose, VE2CV Director of Radio Science at the Communications Research Centre in Ottawa. We were then joined by Mr. Dave Bouzane and Mr. Rene Guerrette from Industry Canada and Mr. Jack Harris, Member of the House of Assembly for Signal Hill-Quidi Vidi. VD1GM was then called by our long time friend Carolyn Rule, M0ADA from the Poldhu station GB100GM. Official telegrams were sent from representatives of the national radio organisation Radio Amateurs of Canada and a prepared statement from Mr. Norman Doyle, Member of Parliament for St. John's East was sent to Mr. Andrew George, Member of Parliament for Cornwall, England. We were very honoured to receive a transmission recorded by Dr. Zedel of greetings from Lady Mary Holborough, the Queen's representative and to accept an invitation from Chairman Rule to formally affiliate PARC and MRCN. Mr. Harris exchanged greetings with Dennis Casley, who along with Mrs. Rule is a councillor for Mullion. Mr. Harris received transatlantic congratulations on the 11th anniversary of his seat in the House of Assembly. Mr. Bob Lewis VO1BL sent a message to Poldhu announcing that this was his 70th year as a licensed radio amateur. This was followed by an official transmission from Mr. Rene Guerrette, District Director of Industry Canada to Mr. Barry Maxwell, the director of the Radio Communications Agency in the United Kingdom. Mr. Maxwell was also greeted by Dr. Eric Gill, professor of Electrical Engineering and authority on radio propagation and antennas. At this point, MRCN requested that PARC send a succession of 'S's. Dr. Zedel connected the Marconi Receiver to the antenna and much to our delight, we heard what would have been heard 100 years ago from a spark transmitter - a series of three sharp

Figure 6: The winning receiver (above), skilfully crafted by Ms Courtney Barbour (right - center) of Leary's Brook Junior High School. Seen also in the photo are Vijay Bhargava (left) and Wally Read (right) from IEEE Canada.

(Photo: C. Hammond)

Figure 7 (Left to Right): Mr. Jack Harris, MHA for Signal Hill Quidi Vidi, Prof. Eric Gill, Mrs. Michelle Craig, VO1RL, Mr. Dave Bouzane, VO1DU, Radio Inspector, I.C., Mr. Rene Guerrette, District Director, I.C., Mr. Joe Craig VO1NA, Prof. Len Zedel, Mr. Bob Lewis, VO1BL.

Missing from Photo: Dr. T. Avery, VE3PPM, Mr. Frank Davis, VO1HP, Dr. J. Craig VO1FB, Mr. Dave Colton, VO1TK, Mr. Roy Dodge, VO1XP, Mr. Barry Roberts, Prof. Siu O'Young and Mr. Nate Penney, VO1NP.

(Photo: Cathy Young)

clicks. We acknowledged to Mrs. Rule the reception of 'S's and that the re-enactment of the event a century earlier had been a success. After a happy final exchange, VD1GM signed clear with GB100GM and continued to make contacts across Canada and the world.

8.0 Epilogue

In the month that followed during which VD1GM was authorised by industry Canada to operate as commemorative radio station, contacts were made by MRCN members in over 100 different countries. Other Marconi stations such as Villa Griffone Italy, Cape Cod, USA and Table Head, NS were contacted. Dr. Craig, VO1FB even made contact with all 6 continents in the span of a few hours. Contacts were made on 12 bands spanning MF to UHF. On National Engineering week 2002, the student chapter of the IEEE had a booth set up in a shopping mall featuring the Receiver Competition. I was there to represent MRCN and at one point we met one of the winners in the contest, Alex Goncharov. He seemed quite interested in a small home built transmitter and indicated he was quite familiar with the process of accidently frying semiconductors when I explained the history of the transmitter - a sign of a true analogue electronics experimenter. He was optimistic about a career in electrical engineering and a hobby in amateur radio.

The centenary event was an excellent success and achieved what we had all hoped it would - to bring electrical engineering, science and amateur radio to the public and in the hands of our youth to carry on to future generations.

9.0 For Furthur Reading

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About the authors

Joe Craig did undergraduate work in Chemistry and Physics at Memorial University of Newfoundland. After working with the Physics Department at Memorial as a research assistant, he did graduate work in Physical Chemistry and received an M.Sc. degree in 2000. He is presently a Physical Scientist with the Canadian Government and is interested in the density structure of the coastal ocean and radio methods of elucidating surface dynamics.

Len Zedel received the B.Sc. and M.Sc. degrees in physics from the University of Victoria, Canada in 1982 and 1985, and the Ph.D. degree in physical oceanography from the University of British Columbia, Canada in 1991. He is currently an Associate Professor in the Department of Physics and Physical Oceanography at Memorial University of Newfoundland, St. John's, Newfoundland, Canada. His research interests are in ocean acoustics, fisheries acoustics, near surface processes, ocean ambient sound, and suspended sediment dynamics. Dr. Zedel is a member of the American Geophysical Union.

Siu O'Young obtained his B.Eng. at the University of Saskatchewan and Master's and Ph.D. degrees from the University of Waterloo all in Electrical Engineering and is a Professional Engineer. He has previously held faculty appointments at Oxford University and at the University of Toronto and is presently an Associate Professor at the Faculty of Engineering at Memorial University of Newfoundland. Dr. O'Young is engaged in research on mechatronics and autonomous avionics systems for unmanned airplanes (UAV) for the iceberg surveillance and environmental monitoring.

The Bahen Centre for Information Technology opens at the University of Toronto

The Bahen Centre for Information Technology at 40 St. George Street embodies UofT's international leadership in information technology (IT) education and research. Renowned Toronto-based architects Diamond and Schmitt Architects Inc. designed this highly visible, 400,000 sq.ft. facility which speaks clearly to the information age.

Home to 3,000 IT undergraduate and graduate students, with 11 lecture halls, 14 tutorial/seminar rooms and over 50 laboratories, the Bahen Centre presents opportunities for collaboration and creativity to the members of the faculties of Applied Science and Engineering and Arts and Science. This state of the art facility will enable the University of Toronto to meet Canada's increasing demand for highly trained IT professionals by doubling the university's enrolment in electrical and computer engineering, computer science and IT research. Its specialist research institutes will focus on technology, innovation and research in partnership with industry, to facilitate technology transfer.

As befits its purpose, the building's own systems have been designed innovatively. The interior features a raised floor design for the distribution of power and data cabling, which allows for complete flexibility and accessibility. The building's symbolic and functional focal point is a dramatic, eight storey lantern-like circular staircase. At each level are meeting and seminar rooms that are shared between the different programs and institutes that work together in the centre.

The Bahen Centre will house:

- The Edward S. Rogers Sr. Department of Electrical and Computer Engineering
- Department of Mechanical and Industrial Engineering, Mechatronics and Information Engineering Options
- Division of Engineering Science
- Department of Computer Science
- Centre for Advanced Coating Technologies
- Jeffrey Skoll BASc/MBA Program
- Nortel Institute for Telecommunications
- Bell University Research Laboratories
- Computer Systems Research Group
- Professional Experience Year Program
- Knowledge Media Design Institute

Funding

- John Bahen, former President and CEO of Peter Kiewit Sons Co. Ltd.
- Nortel Networks
- Bell Canada
- Motorola Canada Ltd.
- Rogers AT&T Wireless
- Shell Canada
- Province of Ontario: SuperBuild Fund and Access to Opportunities Program
- Lee and Margaret Lau
- Robert C. Simmonds
- Jeffrey S. Skoll
- Carl Mitchell
- Glynn Williams
- William and Monique Blundell
- Gregory Wolfond, and
- The Engineering Class of 1945.

Wired with nearly 6.5 kilometres of fibre optic cable, the University of Toronto's Bahen Centre for Information Technology held its official opening on Tuesday, Oct. 8 at 5 p.m.

The $105-million complex will expand U of T's IT program and pave the way for innovation and research in partnership with industry. It will house faculty, staff and students from the Department of Computer Science, The Edward S. Rogers Sr. Department of Electrical and Computer Engineering, the Division of Engineering Science and the Department of Mechanical and Industrial Engineering's new mechatronics and information engineering options.

Photo above shows (l-r) Dean Emeritus Michael Charles, Dr. John Bahen O.C. and assistant David Reichart.

At the opening, U of T president Robert Birgeneau offered opening remarks and welcomed speakers including Chancellor Henry N.R. Jackman, deans Tas Venetsanopoulos (applied science and engineering) and Carl Amrhein (arts and science), lead donors John and Margaret Bahen, Thomas Simpson, chair of Governing Council, Michael Charles, Dean Emeritus and Janet Ecker, minister of finance for Ontario.

Public funding was provided by the government of Ontario's Access to Opportunities Program, the University Infrastructure Investment Fund, SuperBuild, the Canada Foundation for Innovation, the Ontario Innovation Trust and the Ontario Research and Development Challenge Fund.

Photo on left shows honored guests cutting the ribbon to open the Bahen Centre at U of T.

The photo on the right shows the three-storey Lee and Margaret Lau Atrium.

Photo on the far right: The Lady Godiva Memorial Band, a U of T engineering tradition, entertains at the opening.

Ethics - A Personal Commitment And Responsibility

by Wally Read
IEEE Canada, St. John's, NL

1.0 Introduction

One dictionary definition describes ethics in broad terms as "the study of the general nature of morals and of the specific moral choices to be made by the individual in his or her relationship with others". Another perhaps sharper definition, and one more closely aligned to what IEEE does, states that ethics are "the rules or standards governing the conduct of the members of a profession".

But it is one thing to define "ethics" and quite another to write effective rules, standards or guidelines for proper behavior. It becomes even more difficult to introduce, where applicable, penalties for non- compliance to those rules. Add to all this we have other challenges. Because our technologies are so pervasive in society, ethical issues come to our attention which, in order to resolve would require a certain amount of confrontational action with other institutions. Finally, the IEEE is a worldwide organization embracing many different cultures, not all of which would necessarily agree with every approach we might wish to pursue.

All in all, the IEEE has established a middle ground policy on ethics and while it may not fit every member's desire for a more proactive approach, it does strike the right note on what our organization expects of its members. But what is probably more important, it does require the individual member to take charge of his or her conduct under these guidelines. That is why I headlined this talk "Ethics - A Personal Commitment and Responsibility".

Based on a talk given in Singapore to the IEEE Region 10, 2002 Student Congress, July 17, 2002

2.0 The Ethics And Member Conduct Committee

To assist each IEEE member in the discharge of this responsibility we have in place the Ethics and Member Conduct Committee (EMCC). Unfortunately most of our members are unaware of the committee's role and for that reason we have redrafted our vision, and mission statements in the proper context of our current mandate and emphasized the limits on our activities. Those words now read:

Vision: A world in which engineers and scientists are respected for their exemplary ethical behavior and the IEEE and EMCC are recognized as major drivers in this regard.

Mission: EMCC advises the Board of Directors on ethics policy and concerns, as well as fostering awareness on ethical issues and promoting ethical behavior amongst individuals and organizations working within the IEEE fields of interest. EMCC also manages an open process whereby complaints by one IEEE member against another concerning ethical conduct can be heard and resolved.

Limits: EMCC will not be involved in employer-employee disputes.

In short our primary role is to define what should constitute ethical behavior among our members and promote adherence to those principles as defined in the IEEE Code of Ethics. The principles of our Code were first expounded in 1906 and have been updated several times since then. The current 1990 version is regarded by many institutions as a fine example for emulation.

EMCC does not engage in "fishing expeditions" to determine whether breaches of ethical behavior have occurred, but we do react to formal complaints made by a member, will constitute formal hearings and will recommend to the IEEE Board of Directors disciplinary measures that might be appropriate.

With respect to advisory services for individual members we limit that role to pointing them in the direction of other institutions that may be in a position to assist. In addition we keep a membership in and a close contact with the National Institute for Engineering Ethics (NIEE) and the Ethics Officer Association (EOA), two U.S. groups which are active in this field.

Our only plea to members is to recognize the scope and limitations of our committee's activities and to understand that all requests of the IEEE EMCC office at headquarters may not receive the positive answers one may have expected.

3.0 Our Profession

I would be very remiss if I did not take this opportunity to say a few words on the importance of our profession to humanity as a whole and how important each of you are to the continuing success of the IEEE.

Having only wood as a material, Leonardo de Vinci's detailed plans for a rotary construction crane, similar to the ones we see around our cites today, (those plans) had to gather dust until the advent of steel some centuries later. Likewise on the technology front it was a long time between the discovery of electricity and the days of Samuel Morse and Thomas Edison whose ingenuity found ways to put electricity to work.

Today, each of us has access to a vast array of metals, glass, plastics, ceramics and epoxies to name just a few of the exciting new materials. Equally, we have been witness to an unprecedented explosion in new technologies and we haven't seen the end yet. All this activity has served too compress the time needed to turn a dream, your dream, into reality. And this is the bright new world that we now enter. What an opportunity! What a challenge!

The expansion in technology and materials development, particularly in the fields of medicine, communications and computer engineering has been so rapid that, for the first time in our history, we have made obsolete many of the rules and much of the infrastructure that has served society's needs up until this time.

We have experienced and will continue to encounter tremendous change, quantum leaps in available technologies and exponential growth in the rapidity of implementation of those technologies. We are in the business of engineering. I like to refer to it as the business of creating. It is a very privileged role to play in our society. Think about it - with the exception of the artist and perhaps the teacher, no other profession is so honored or aspires to so great a task.

Important as the work of other professionals is, they are not the ones designated to create and build - only engineers are. The medical profession has a maintenance function, it is responsible for our minds and bodies as long as we inhabit this planet; the legal profession is a service and operates mainly as a consequence of our weaknesses and not our strengths; the accounting profession is also a service, it is an aide to the orderly reckoning of our activities; the priesthood is dedicated to the maintenance of our spiritual needs and I could go on and on. Now please don't get me wrong, all of these professions are important, all of them are needed, but they are after all only maintenance and service functions.

You, the engineers, are the ones that will be creating and building new facilities and devices for people's enjoyment and comfort. This exclusive profession of ours has numbered many great people in its ranks, role models if you like, worthy of emulation.

As an engineer you must accept the building challenge with the same zeal that Imhoptep had in 2700 BC when he constructed the step pyramid of Zoser, the forerunner of the great pyramids along the Nile; you must accept it with the feeling that General Meng Tien experienced in 215 BC when he was ordered by his Emperor to build the Great Wall of China; and with the exultation of Hiram when he was appointed master builder of King Solomon's Temple in Jerusalem.

You stand side by side with Michelangelo, the designer of St. Peter's in Rome; along side Leonardo Da Vinci, who before he became famous as an artist and sculptor, was a great 15th Century military engineer; side by side with Linet and Mongel, who designed the Suez Canal for Delesseps, and the hundreds of thousands who have followed in their footsteps. The calling of an engineer, which includes ethical conduct, is a noble one and I hope you will speak out in public on its behalf every chance you get.

Let me close by referring back to the responsibility each of you have to act ethically in performing the work of your profession.

When visiting a university a few years ago in Lebanon, I was impressed to see a statement carved in the wall of the foyer that read like this:

"To Strive, to Seek, to Find and Not to Yield."

Engineer's and Architect's Oath

"Using the heritage left by my professional forebears, I dedicate myself to the pursuit of knowledge and the search for truth in the extension of the benefits of my profession to humanity. I will strive always to disseminate what professional knowledge I acquire. And I will fully accept my responsibility for the instruction of the younger members of my profession.

Zealous of the high repute of my calling, I will strive to protect the interests and the good name of any member of my profession.

To all, I pledge integrity and fair dealing, tolerance and respect, and devotion to the standards and dignity of my profession. I gladly accept the obligation to use my special knowledge and expertness to serve humanity with complete sincerity.

I will serve faithfully to fulfill the solemn obligations of my profession and to govern my life and practice by its canons of ethics."

IEEE Canada News

Rumblings From Canadian Life Members

1.0 Organizational Move

Commencing in 2003 the Western Canada LM Chapter Chair will be Om Malik of Calgary, Alberta. Om also sits on the IEEE LM Committee and in that role will provide us with a better link with our parent body. Many thanks to Mo Sachdev for filling this slot in the interim.

2.0 Two Major LM Chapters In The Incubator, Another Close

2.1 Vancouver Chapter

At the invitation of Gruja Blagojevic, Vancouver Section Chairman, a number of Life Members (LMs) from the area gathered for lunch on July 8, 2002 to explore the possibility of forming a Life Member Chapter. There are 130 LMs on the Section register and it was felt that many of them would welcome the opportunity to serve the Vancouver Section and IEEE further.

George Davies acted as Chair for the meeting and Wally Read, who was in the area at the time, attended serving as a resource person. A very open discussion took place and it soon became clear that a positive attitude prevailed. So we are off and running with the formation of a new LM Chapter in Canada. The application will have been filed by the time you read this and the first meeting is planned for October 9th. Ron Potts, Chair of the IEEE Canada Life Members Committee will be attending the inaugural event.

Congratulations Gruja, George and all who attended the organizing meeting. It truly is Vancouver's day in the sun.

2.2 Toronto Chapter

At an exploratory session with Toronto Section Chair Bob Hanna, Wallas Khella and Bob Alden, Ron Potts outlined his views on the value of an LM Chapter for Canada's largest IEEE Section and one which will shortly be celebrating its centennial. Again the concept was well received and quickly the conversation shifted to how fast they could mobilize and energize potential members.

Bob Alden and Wallas Khella stepped up to the mark and agreed to co-direct the organizational activities. With over 200 LMs on the roster it looks like full steam ahead for registration and a first meeting on October 29, 2002.

The Section has pledged its support and this first luncheon will provide the opportunity for prospective members to meet with Ron Potts and Neil Magrath, CCC representative to IEEE Canada's Life Member Committee. Well done guys.

2.3 Montreal Chapter

Montreal Section is taking the first steps toward forming its own LM Chapter with Arthur Yelon acting as initial Chair and Renato Bosisio as the Volunteer Representative to the Eastern Canada LM Chapter. We look forward to great results.

Wally Read, IEEE Life Fellow,

Newfoundland, Canada.

Thyristor-Based FACTS Controllers for Electrical Transmission Systems

Thyristor-Based FACTS Controllers for Electrical Transmission Systems

by R. Mohan Mathur and Rajiv K. Varma

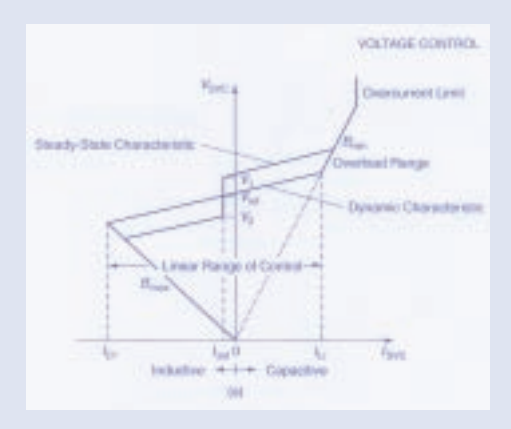
IEEE Press and J.Wiley & Sons,

2002, ISBN 0-471-20643-1, 495 pages

by *Vijay K. Sood,*
Hydro-Quebec, Varennes, QC

Canadian expertise and research in the electrical power industry is well known globally. It is, therefore, fitting that one of the latest books dealing with Flexible AC Transmission System (FACTS) controllers should be authored by researchers with a strong connection to the University of Western Ontario.

The electrical industry is undergoing restructuring to accommodate competing suppliers to reach consumers. Controlling power in a secure efficient manner so that stability and thermal limits are not exceeded requires the assistance of fast, electronic controllers. The book deals at length with the first generation FACTS equipment i.e. the Static Var Compensator (SVC) which has been in service since the 1970s when the acronym FACTS had not even been dreamt of. The other controller that is concentrated on is the thyristor controlled series compensation (TCSC). These two controllers were both based on thyristor technology due to the initial availability of high power and high voltage semi-conductor devices. However, since the thyristor can only be turned on by a gate pulse and not turned off by a control signal, its application had certain control limitations. The second generation switches like the gate-turn off thyristor (GTO) become available in the early 1990s, and led to the new generation of force commutated Static Compensators (STATCOMs) which provided additional levels of control over the earlier equipment. These controllers are dealt with in the latter half of the book.



The book is split into 10 chapters:

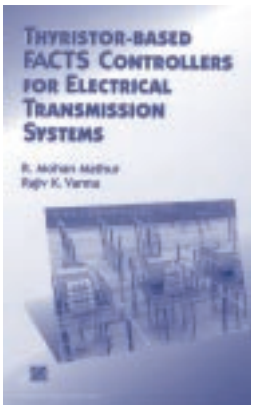
Chapter 1 is an introduction to the subject dealing with the typical control mechanisms employed in power systems, high power semiconductor devices and series/shunt line compensation.

Chapter 2 deals with the fundamental principles of reactive power control and compares the performance of lines with and without shunt-series compensation.

Chapter 3 deals with the principles of conventional reactive power compensators.in a straight forward and effective way.

Chapter 4 deals with SVC components and models. The discussion about measurement systems is useful for students of the subject.

Chapter 5 describes the basic concepts for designing the voltage Controller of a SVC and presents an overview of the topic. Example 5.1 will be interesting for students to gauge the change in the regulator parameters as a function of the short circuit level of the ac system. Sections 5.3.1 and 5.3.2 are practical and describe the critical power system parameters needed to be considered for design of the SVC. Figure 5.15 is very interesting and shows the transient response of the voltage regulator with varying gains. In fact, the figures in all of the book are professionally drawn and presented.



Chapter 6 deals with SVC applications such as stability enhancement, damping of subsynchronous oscillations and improvements in HVDC link performance. A theoretical basis of such applications is presented adequately. However, the lack of discussion of practical examples of such applications is apparent. This may be due to the lack of such data being available from manufacturers and utilities.

One notable exception to the topic is the absence of any reference to the inter-actions between the SVC and HVDC converters at the Chateauguay installation in Quebec. The bibliography at the end of Chapter 6 also did not reflect this. This is perhaps an oversight that the authors might consider for a second edition of the book.

Chapters 7 and 8 focus on the TCSC and forms a core for the book. Chapter 9 deals with coordination aspects of FACTS controllers.

Chapter 10 deals with emerging FACTS controllers and is a brief but adequate overview of such controllers. The subject is so vast that it would not be appropriate for the theme of this book.

I found the Appendix A on the design of an SVC voltage regulator particularly useful. The addition of data for the example is comprehensive and this will form a useful guide to students of the subject.

I read this excellent book with great interest. I found it to both readable and informative. Although the authors did indicate that mathematical material/coverage is not exhaustive, I found it to be adequate for most practising engineer and researcher needs. There are plenty of well drawn diagrams to illustrate the subject matter. The editing has been well done, and is a complement to the proof reader(s) - I did find the odd typographical errors, but nothing too drastic. The book is an excellent compilation in one document of the wealth of material on the topic available from IEEE, CIGRE, and CEA publications.

Following the tradition of the first book on SVCs by T.J.E. Miller in 1982, this book is a much needed update on the technology in a compact edition, and is going to be a valuable addition to the domain of reactive power controllers. It is going to be on the must-read and must-have list of most power utility engineers and academics. It will be a reference book that most technical libraries must obtain.

The CR Editor acknowledges the support of Ms Aida Krneta (email: akrneta@wiley.com), J.Wiley and Sons Publishers for her support of this Book Review.

Power System Restructuring and Deregulation: Trading, Performance & Information Technology

Power System Restructuring and Deregulation: Trading, Performance & Information Technology

Edited by Loi Lei Lai,

John Wiley & Sons Ltd., 2001, xxix + 468 pp.

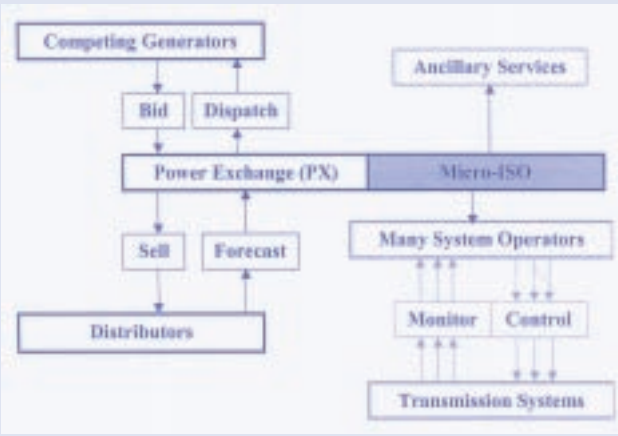
ISBN:0 471 49500X

by *Om Malik,*
University of Calgary, Calgary, AB

The past fifteen years have seen the first major restructuring of the electric utility industry since it started to develop in the late 1800s. This has brought about significant changes in how the entire electric energy business is conducted in various parts of the world.

Up until the advent of restructuring, the power systems were operated as vertically integrated entities, incorporating generation, transmission and distribution, purely on the consideration of efficiency, reliability and security of supply enhanced by research and implementation of improved technology.

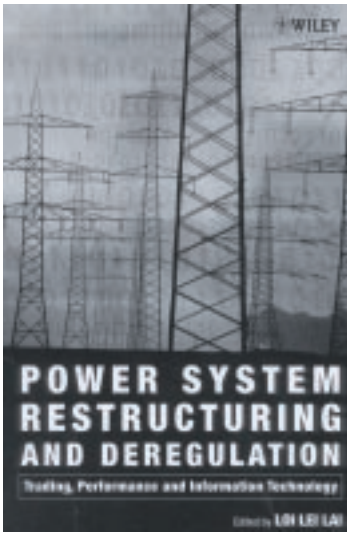
Restructuring and deregulation has brought in the notions of competition and marketing strategies in addition to introducing new technical considerations in the operation of these independently owned but operationally interconnected parts of the system under the control of another independent authority with the generic name of Independent System Operator (ISO). ISO holds a unique position of having the responsibility and authority for secure operation of the system without owning it.



Such far-reaching changes have resulted in the development of completely new strategies for the operation of the power systems, marketing of electric energy, and planning, operation and maintenance of the system over a relatively brief period. Recent events in California have highlighted the uncertainty and enormous challenges facing the electric power industry during the transition period. It is important to pay attention to the proper functioning of the markets, develop technologies to monitor market performance and systems to manage system reliability. In this regard, the appearance of this book is very timely.

This book is a compilation of the recent developments particularly in response to the demands dictated by restructuring and deregulation. Because of the pervasive effects of restructuring on every facet and every level of the power system, new developments span a very wide area. This has, of-course, resulted a major shift in not only the operation and management aspects but also in the research and teaching related to power systems. Growth in the capabilities of computers, artificial intelligence techniques and information technology has had a major impact in this area.

Written by twenty well-known individuals, experts in their own areas, this book covers most aspects of the way restructuring has impacted the operation of electric supply systems. The first seven chapters cover the background to deregulation in a number of countries, competitive electricity markets, transmission open access and pricing practices, transmission expansion and distribution design under the restructured environment, and costs and benefits associated with restructuring coupled with environmental impacts.



Competitive environment requires improvements in productivity through better use of resources. Improvements in productivity can be achieved by better asset management and employment of new technology. These aspects are covered in the last five chapters.

Application of new technologies such as FACTS to help achieve the desired power flows and Internet to monitor contracted power trading is described in Chapters 8 and 12, respectively. Application of wavelet transform and artificial intelligence techniques, such as neural networks and fuzzy logic, to model and analyze power plants and system disturbances is well described in Chapter 10. Internet is becoming pervasive. General background to Internet technology and its use to help monitor power system operation from remote locations is described in Chapter 12.

General application of information technology to a number of functions in a power system is demonstrated in Chapter 11. The title of this chapter may mislead a casual reader as the techniques described in this chapter, such as genetic algorithm, evolutionary programming, artificial neural networks, etc., are more commonly described as artificial intelligence rather than information technology. The contents of this chapter also do not form a homogenous set leaving the impression of a collection of miscellaneous items.

Overall, the contents of the book are well balanced between the introduction of electric power utility restructuring, its impact and the new technologies developed in response to the transition from the vertically integrated utility to the competitive market environment. All chapters are supported by extensive set of references. Considering the number of contributors covering such a wide set of topics, some overlapping of the material between chapters and differences in viewpoints in inevitable. That simply enhances the usefulness of the book particularly at this rather early stage in this newly evolving field. This book is certainly a valuable source of material for all those involved in any aspect of electrical energy matters, be they in planning, design, operation, research or be managers and policy makers in the electric energy field.

The CR Editor acknowledges the support of Ms Aida Krneta (email: akrneta@wiley.com), J.Wiley and Sons, Publishers for her support of this Book Review.

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CCGEI 2003

Pour une technologie équitable

Congrès canadien en génie électrique et informatique
4 au 7 mai 2003, Hôtel Delta Centre-Ville
777 Université, Montréal, Canada

APPEL AUX COMMUNICATIONS

Le congrès canadien en génie électrique et informatique 2003 de l'IEEE offre un forum pour la présentation de travaux de recherche et de développement dans les domaines du génie électrique et du génie informatique provenant tant du Canada que de partout ailleurs dans le monde. Des communications en français ou en anglais sont sollicitées sur des sujets qui incluent, mais ne sont pas limités à :

- Ingénierie biomédicale
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- Génie logiciel
- Systèmes intelligents
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1.0 Soumission de la communication régulière :

Veuillez soumettre par courrier électronique un résumé de 300 mots de votre communication en français ou en anglais à ccece03@congresbcu.com. Votre soumission doit inclure un sujet, trois mots clés et le nom de l'auteur principal avec son adresse électronique et postale ainsi que son numéro de téléphone et de télécopieur. Les versions finales devront être soumises électroniquement en format pdf.

2.0 Soumission de propositions de tutoriaux et de sessions sur invitation :

Les propositions pour les ateliers, les cours intensifs et les sessions sur invitation seront acceptées jusqu'au 10 janvier 2003. Prière de contacter le responsable du comité des cours et sessions spéciales à l'adresse du secrétariat du congrès afin d'obtenir des instructions détaillées.

3.0 Compétition de communications par des étudiants :

Afin d'être éligible à la compétition, le premier auteur doit être un étudiant. La communication soumise doit être clairement identifiée "Compétition de communications par des étudiants". Les résultats de la compétition seront basés sur l'évaluation des textes complets. Des versions étendues des textes seront publiées dans la Revue canadienne de génie électrique et informatique, sujet à l'acceptation par la Revue.

4.0 Expositions industrielles :

Veuillez contacter le responsable des liaisons industrielles et des expositions afin d'obtenir des informations au sujet des présentations industrielles durant le congrès.

5.0 Dates importantes :

Date limite pour la soumission des résumés de communications: ..... le vendredi 29 novembre 2002

Date limite pour la soumission de session spéciale: ..... le vendredi 10 janvier 2003

Avis d'acceptation: ..... le vendredi 10 janvier 2003

Date limite pour la soumission de la version finale: ..... le lundi 3 mars 2003

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CCECE 2003

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- Mobile and Pervasive Computing
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- High-Performance Computing
- Software Engineering
- Intelligent Systems
- Neural Networks and Fuzzy Logic
- Database and Data Mining
- Evolutionary Computation
- Virtual Reality and Artificial Life
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- Human-Machine Interactions
- Nanotechnology and Nanorobotics
- Real-Time Embedded Systems
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Please submit only by e-mail a 300-word abstract either in French or English of your paper to the ccece03@congresbu.com. Your submission should include the topic three keywords and the name of a contact person with e-mail, postal address, as well as a fax and phone number. The final paper should be submitted electronically in pdf format.

2.0 Workshop, Tutorial, and Invited Session Proposal Submission :

Proposals for invited sessions, conference workshops and tutorials will be accepted before January 10, 2003. Please contact the Tutorials and Special Sessions Chair at the Conference Secretariat address shown on the left for detailed instructions.

3.0 Student Paper Competition :

To be eligible, the first author of a paper must be a student. The submitted paper summary must be clearly marked "Student Paper Competition". The competition results will be based on reviews of the full papers. Extended versions of the winning student papers will be published in the Canadian Journal of Electrical and Computer Engineering subject to the final editorial acceptance by the Journal.

4.0 Industrial Exhibits :

Please contact the Exhibits Chair at the Conference Secretariat for information about industrial exhibits.

5.0 Important Dates :

Paper abstracts must be received by: ..... Friday November 29, 2002

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Notification of acceptance will be sent out by: ..... Friday, January 10, 2003

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