BENCHMARKING ACTIVITIES
RELATIVE TO
SPECIALIZED TELECOMMUNICATIONS

Hydro-Quebec TRANSÉNERGIE

Contents

1 INTRODUCTION

The particulars of the specialized telecommunications and mobile radio networks and the lack of services and public suppliers comparable to the network of TransÉnergie makes difficult any objective exercise of in this matter. A comparative study, submitted within the framework of the request R 3401-98, limited to the examination of the methods of establishing the prices as regards to telecommunication was carried out by Meta Group for the Transmission Operators. However, there was no cost of service included in the evaluation. These particular conditions in the evaluation of the performance and efficiency of the Transmission Operator like all the actual objective activities to come.

2 CHARACTERISTICS OF THE SPECIALIZED TELECOMMUNICATIONS SERVICES

2.1 Telecommunication system

The architecture of the telecommunications network is based on the criteria of protection and operation of the electrical supply network. These criteria are dictated by the large North American organizations that govern the exchanges between the various electrical supply networks, North American Electric Reliability Council, Federal Energy Regulatory Commission, and Northeast Power Coordinating Council.

The telecommunications network of TransÉnergie must meet robustness criteria unparalleled in the world of telecommunications. Moreover, its

network must cover the whole of the Quebec territory, very often in places where no telecommunications company would like to operate.

This network, transmitting vital signals of the electricity transmission network, allows it to ensure the operation, to maintain the stability and the continuity of the power supply for the province of Quebec and customers outside its borders.

Because of the requirements of the electrical supply network, the transmitted signals must react in a very timely manner in order to avoid an isolated event, following an avalanche effect, disturbs the whole network and generates an outage on the scale of the whole province.

In a more specific way, the telecommunications network covers the following functions:

- rapid elimination via remote protection links, of the defaults affecting the lines of electricity transmission;
- interruption of generation and shedding of load in order to ensure a network stability at the time of an outage;
- isolating portions of the network in an orderly fashion if a major disturbance affects the transmission;
- adjustment of the network power frequency in order to maintain the stability of the frequency at 60 cycles/sec (wave quality and clocks precision);
- monitoring of the angular shift in order to ensure the maximum transmission on all the lines of the network by optimizing the distribution of these transmission;

- reading and transmission in the operation centers (CED) of the different network parameters allowing to carry out the remote control of installations.

The telecommunications network is also used for the routing of the mobile radio and administrative communications of the company.

2.2 The mobile radio network

The mobile radios network of Hydro Quebec TransÉnergie, whose principal user is Hydro-Quebec Distribution, presents the following characteristics:

- **Large geographical range**: The covered territory represents a vast geographical range, with a very high number of points to be served. The infrastructures and operational costs are naturally proportional to the geographic area covered.
- **System developed for Hydro-Quebec**: The work standards code specifies the requirements that Hydro-Quebec must meet to ensure the safety of the employees. The only means of telecommunications that meets these requirements is mobile radio since it allows group communications. The system of distribution of radio operator calls was developed by Motorola for Hydro-Quebec TransÉnergie. This system is used for prioritizing the calls in the operation centers while optimizing the number of human resources assigned to this task.
- **Safety**: The system of distribution of the radio calls put in place by Hydro-Quebec TransÉnergie makes it possible to ensure in any time the safety of the employees working on the electrical supply network. A functionality of the system allows it to prioritize the calls to the operation centers.

3 CONSTRAINTS AND LIMITS OF THE OBJECTIVES IN SPECIALIZED TELECOMMUNICATIONS

Although a major part of the telecommunications network can be compared with a public network, specificities related to the electric field make any comparison difficult.

3.1 Telecommunication system

Here is a short outline of specificities:

- **Diversity of technology[1]:** A diversity of technologies (hertzian and optical fiber) is necessary because of the network automatisms and the requirements to the level of the diversity of the transmission resources.

- **Redundancy of equipment[1]:** The redundancy of the systems of batteries and feed must be ensured at all time. Moreover, the installation of equipment transmitting the signals must be done according to a particular arrangement that minimizes the effects of an outage on the network, that is to say the diversity of transmission operators (ex: the signal is routed for two distinct courses), the diversity of placement (ex: framed from distinct equipment, in the same room) and the diversity of resources (ex: not having the same technology to transmit the two signals).

- **Specific course:** The design of microwave or optics networks, requires to pass by electric stations that are not necessarily located in places favorable to the wave propagation. Moreover, the distances to be traversed are so large that particular technologies

[1] Characteristic dictated by organizations NERC, FERC, or NPCC

must be used. This leads to an increase in costs of construction by the addition of assets or additional repeater sites.

- **Supply for a site:** Many sites being outside the network, the power supply must be ensured by sophisticated means: solar panels, supply by underground cable, etc. Moreover, all the sites must be equipped with an emergency power supply in the event of an electric outage: batteries, chargers and generators.

- **Limited maintenance:** Following the constraints dictated by the operation of the electric network, the period of time during which the maintenance personnel can conduct the preventive maintenances is between April and November. This concentration in time requires a larger availability of personnel.

- **Equipment specific to Hydro-Quebec:** For the needs suitable for the electric network, specific equipment must be acquired and supported. (Ex: interface equipment for the 'HCB' relays, automatic Oscilloquartz synchronization, etc.)

- **Technology specific to Hydro-Quebec:** For the needs suitable for the electric network, certain transmission technologies must be used (ex: current on the transmission line).

- **Access to the sites:** Several sites are installed along the electricity transmission line, in difficult places of access. Several sites would be considered outside the network by public telecommunications companies, which would generate extra costs (ex: construction, maintenance, power supply, access roads, heliport, etc).

In the majority of the cases, these elements bring about higher costs in fixed assets and operating cost. They also reveal that the specialized telecommunications in Hydro-Quebec cannot be compared with other companies of telecommunications.

3.2 Mobile radio network

This lack of comparability can also be found at the mobile radio network level. No other company in the world has an infrastructure of mobile radios similar to that of Hydro-Quebec. In effect, in spite of the fact that there are 300 *Smartzone* systems sold in the world, none is similar to that of Hydro-Quebec. In the past, steps were taken at Motorola with the goal of finding a similar customer making it possible to consider an operation. Motorola[2] had then found none which was comparable to the network of mobile radios of Hydro-Quebec.

[2] See letter in Appendix

4 OPERATIONAL ACTIVITIES

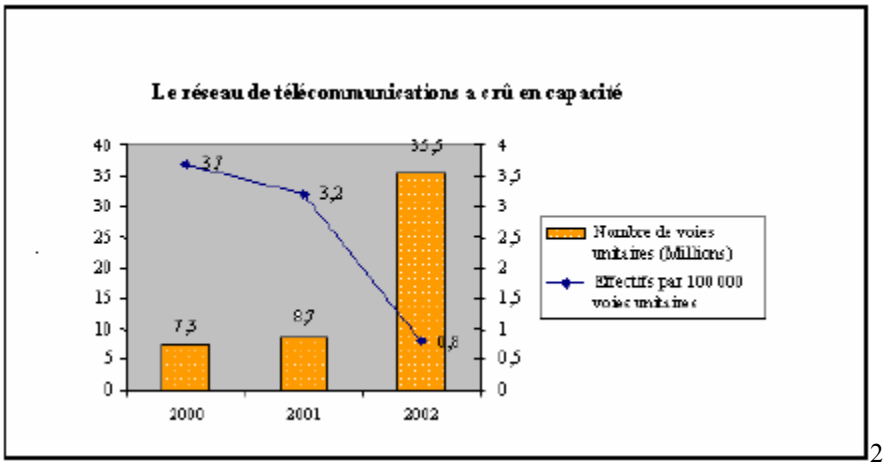
The difficulties of comparison with external telecommunication companies make it so that the Transmission Operator operational activities in its domain are mainly centered on the increase in internal efficiency, performance of the processes and the establishment of best practices.

4.1 Efficiency Indicators

4.1.1 Telecommunication systems

From year to year, the Transmission Operator closely follows the evolution of certain productivity indicators. The following graphs show that in spite of a strong growth in the capacity, in the complexity and in the extent of the network, the efficiency of the Transmission Operator improved. Over the period 2000-2002, the capacity of the network increased, the network became increasingly more complex and extended without affecting in any major way the requirements for personnel appointed to the telecommunication activities.

1


Le réseau de télécommunications a crû en capacité
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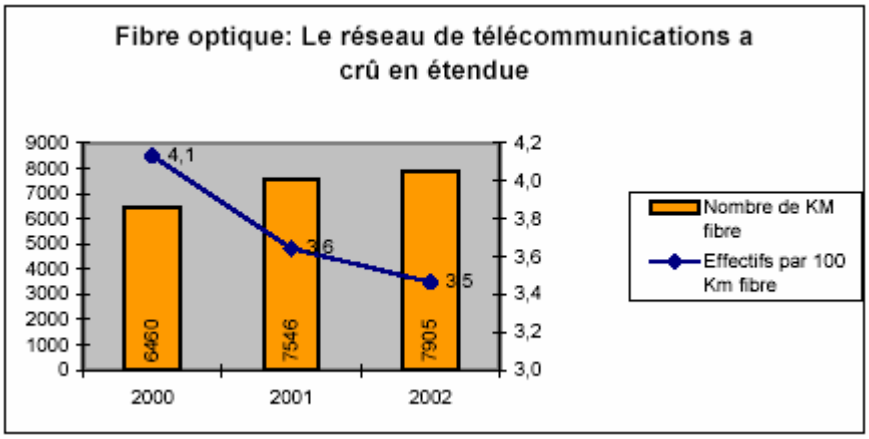
2000
2001
2002
Nombre de voies unitaires (Millions)
Effectifs par 100 000 voies unitaires

2 2


Fibre optique: Le réseau de télécommunications a crû en étendue
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Nombre de KM fibre
Effectifs par 100 Km fibre

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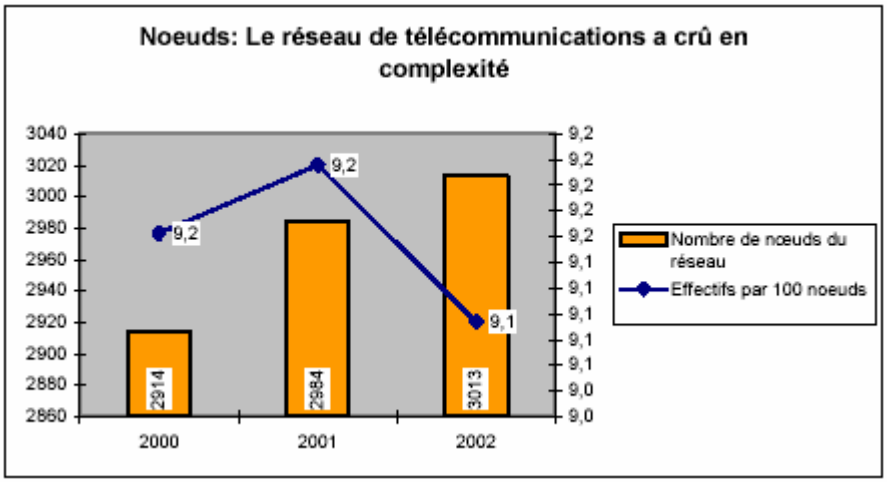
Noeuds: Le réseau de télécommunications a crû en complexité
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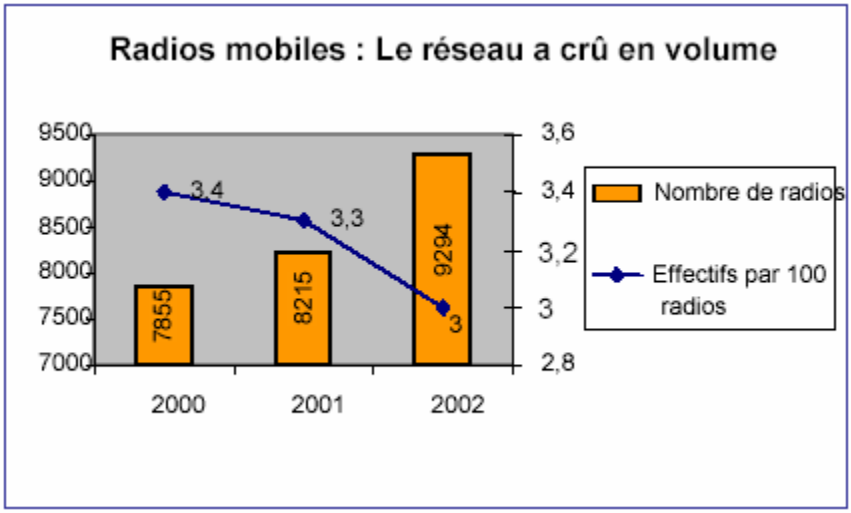
2914
2984
3013
2000
2001
2002
Nombre de noeuds du réseau
Effectifs par 100 noeuds

4

4.1.2 Mobile radios

The improvement of the efficiency observed as regarding telecommunications also emerges at the level of mobile radios. The following graph indicates in effect that the number of manpower required for each 100 mobile radios diminished largely between 2000 and 2002.



Globally, these improvements on both the level of the specialized telecommunications and in the mobile radios benefit the Transmission Operator, principal user of the sophisticated telecommunications network, and indirectly to all users of this network including the Distributor.

4.2 Adoption of best practices

In addition to a comparison of internal efficiency, the Transmission Operator aims on the identification and adoption of best practices recognized in the industry of telecommunications. Two of these principle practices, applicable to specialized telecommunication circuits, are remote management and the digitalization of the network.

4.2.1 Remote management

Remote management consists in carrying out, remotely, a whole range of actions that improve in a substantial manner, the quality of the customers service. In a broad outline, these actions include:

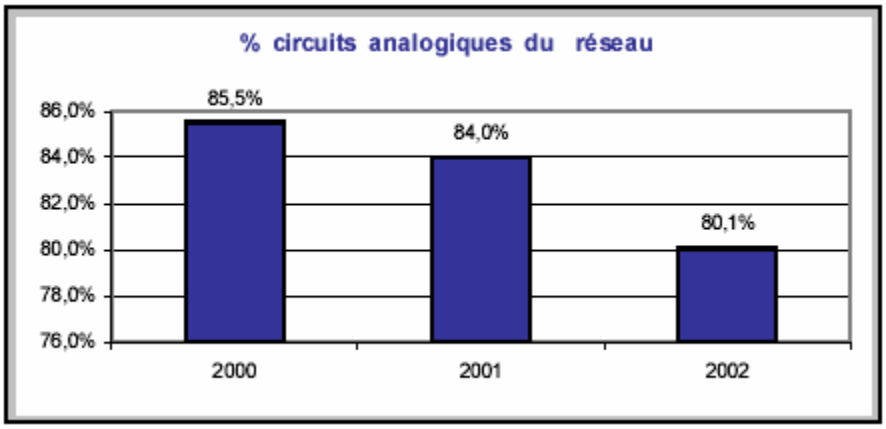
- Faster re-establishment of the outages, following a precise diagnosis using correlation of events;
- Easier reconnection of the circuits in order to limit the time of interruption to the customer;
- Fast and uniform deployment of the configurations in the event of the supply of new services;
- Inventories more easily up to date and the possibility of measuring the performance of the telecommunications networks in order to evaluate the levels of services provided to the customers;
- Breakdown prevention by automated uniform checks, and detection of recurring anomalies;
- Better historical documentation of the breakdowns;
- Increased network, access being centralized and controlled;
- Optimization of license usage.

In 2001, TransÉnergie explored the remote management market, examined the implementation modes and observed the practices in this market. Since then, remote control has been more and more important at Hydro-Quebec. Not only does a centralized management offer a single accountability, but this practice also makes it possible to optimize costs.

1

4.2.2 The digitalization

2 In the course of the last few years, the conversion of the analog networks'
3 circuits to digital networks has proven to be a very strong tendency that
4 Hydro-Quebec TransÉnergie that cannot ignore. The graph below also
5 shows that the Transmission Operator drives this change. It has already
6 started to modernize its circuits to digital technology.



7

4.3 Conclusion

8 Within the framework of the Decision D-2002-95, the Régie asks of the
9 Transmission Operator to present at the time of its next tariff case, an
10 operation on the performance indicators, either externally, or between
11 areas inside its transmission network. Moreover, the Régie asks of the
12 Transmission Operator to provide specific information to
13 telecommunications, that is to say:

> "*within the framework of the next tariff filing, to present, for examination, additional information concerning the activities of telecommunications, that is to say fixed assets to be included in the tariff base and the expenditures, by category, necessary to provide services, with the same level of detail as for the transmission operators direct loads"(D-2002-95, pages 93 and 94).*

In accordance with the Decision D-2002-95, the Transmission Operator envisions thus responding to the request and to submit, within the framework of its next rate case, an objective plan including a specific section dedicated to the activities of specialized telecommunications and mobile radios.

Appendix 1
LETTER OF MOTOROLA CANADA

Universal  **Intelligence**

January 1st, 2003

Mr. André Saint-Arnaud
Chief Expert, Mobile radio research and development
Desjardins Complex, East Tour – Building 2
CP 10000
Montreal, (Quebec) H5B 1H7
Canada

Re: Comparable systems to your Smartzone system

Sir,

In response to your request, it is not possible to identify the system of radio communication based on the Smartzone architecture which could reasonable form an appreciable objective comparison, and this is for many reasons.

Indeed, we must initially recall that the system was concieved to take account of the geographical components specific to the field of business of Hydro-Quebec. The extent and the same characteristics of the service territory have not been found in equivalence, which renders any exercise a random comparison.

In addition, your version 3 system was the subject of two modifications which renders it unique:

- the maximum number of ports of a system of version 3 is 48; only the Hydro-Quebec system was modified our to accommodate 64.

- The system of Hydro-Quebec was modified to incorporate an interface designed as being the "system of distribution of radio calls". This interface developed at the time by the firm DMR is specific to Hydro-Quebec's function, and consequently constitutes a major functional characteristic which is unique to them.

Finally, few Smartzone systems combine the use of different bands (800MHz and VHF) on a similar infrastructure, and to our knowledge, there is not another public utility company which does so.

We are sorry not to have been able to provide you the requested information. However be assured that we remain available for any other information which you could request.

Please accept, dear Mr Saint-Arnaud, the expression of my best sentiments.

Michel Blouin,
General Director – Province of Quebec
Motorola Canada