

# **EXPERIENCES IN THE DEVELOPMENT OF A PROTOTYPE SYSTEM FOR THE EXCHANGE OF MANAGEMENT INFORMATION STUDY CASE: COLOMBIA**

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## **Summary**

CINTEL as a R&D Center in which the many different players of the Colombian telecommunications environment can interact, leads and coordinates sector wide projects and has been working in a project for the development of a common, concerted and automated system for the exchange of management information to guarantee end to end service in an open market where there's total competition in all of the telecommunications services (local, long distance, etc).

This article presents the Colombian experience in the development of a common interface for the exchange of management information, which has counted with the participation of professionals from local and long distance operators, national and international experts.

**Keywords :** Prototype, Telecommunications management, information exchange, Billing, Trouble tickets, QoS.

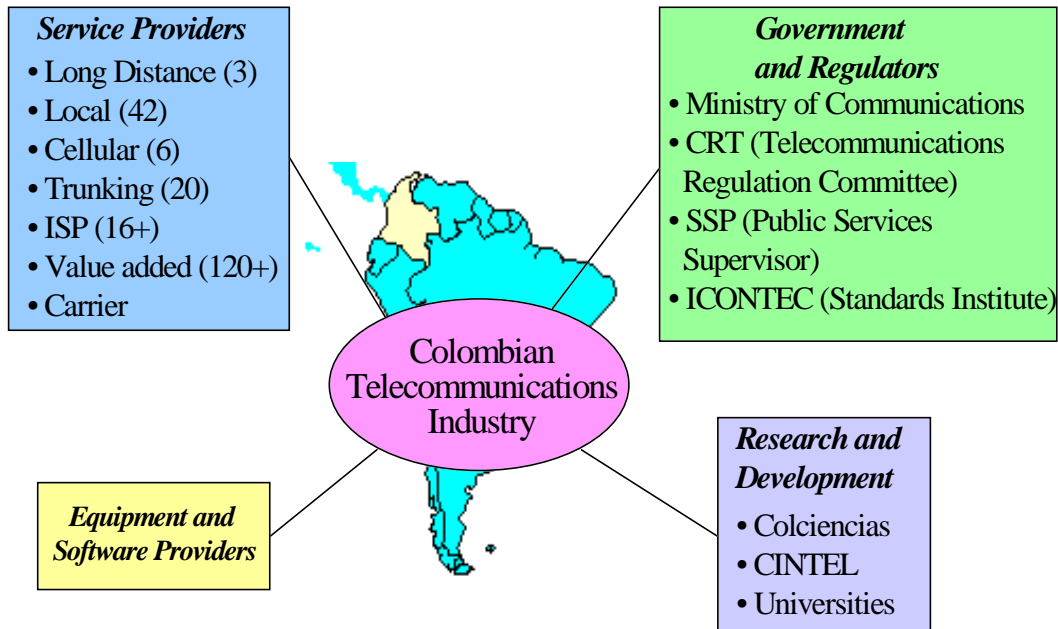
## **1. Introduction**

The rapid pace of convergence of services, the liberalization and deregulation of markets and globalization are aspects that have been influencing the growth of the telecommunications sector worldwide and Colombia is not an exception. In this scenario the differentiation between service providers and network operators is given by the characteristics of the services and products each offers.

The actual Colombian telecommunications environment has many players in it (see figure 1). Competition is open and moving strongly in the long distance and local telephony markets. There is also a growing number of value-added service providers and as soon as PCS (Personal Communication Services) regulation is passed there will be new mobile service offerings. With such strong competition the establishment of certain parameters that guarantee it within regulatory and commercial limits is a must.

One of the fundamental aspects to consider in a competitive environment is that of interconnection between service providers. CINTEL with the participation of more than 20 service providers in Colombia is leading the Project for the Exchange of Management Information Between Service Providers. The main objective of the project is the definition of common formats, processes and interfaces for the establishment of an automated exchange of management information between

service providers (SP) to allow a better and faster interaction in those key processes and services that require mutual collaboration especially when more than one SP is involved in the provision of an end-to-end service.



**Figure 1. The Colombian Telecommunications environment.**

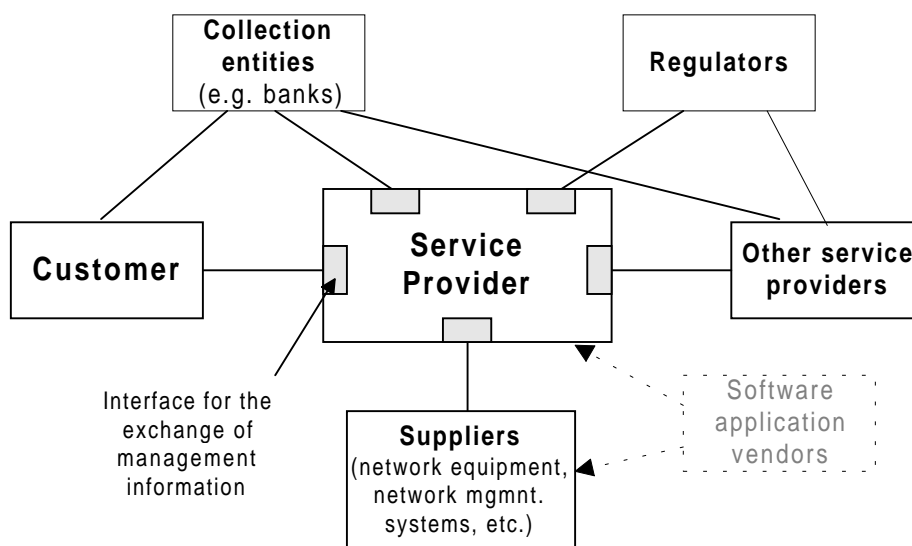
## 2. Description of the project - phases

With so many players in a telecommunications environment like the one in Colombia, many problems arise and common mechanisms for the solution of such problems must be established. With this in mind, CINTEL and its member companies<sup>1</sup> defined that given the vast number of issues to be treated in such big and dynamic sector, some kind of prioritization was required.

The first phase of the project initiated with the identification of the actors in the telecommunications business (clients, regulators, banks, etc.) with which a SP has to exchange information and what type of information is exchanged. Afterwards, an analysis between all the participant companies led to the definition of the key areas in which common mechanisms for the exchange of information were required with most importance taking into account the needs of the SPs, customers and regulation.

Although a service provider has to exchange information with many actors of the telecommunications business (see figure 2), the exchange between service providers was identified as the one with the most problems and the one with the greatest importance to guarantee end-to-end service.

<sup>1</sup> The members of CINTEL are: Ministry of Communications, about 30 telecommunication service providers, equipment providers, universities and COLCIENCIAS (Government entity that supports and finances R&D in Colombia)



**Figure 2. Actors in the telecommunications business**

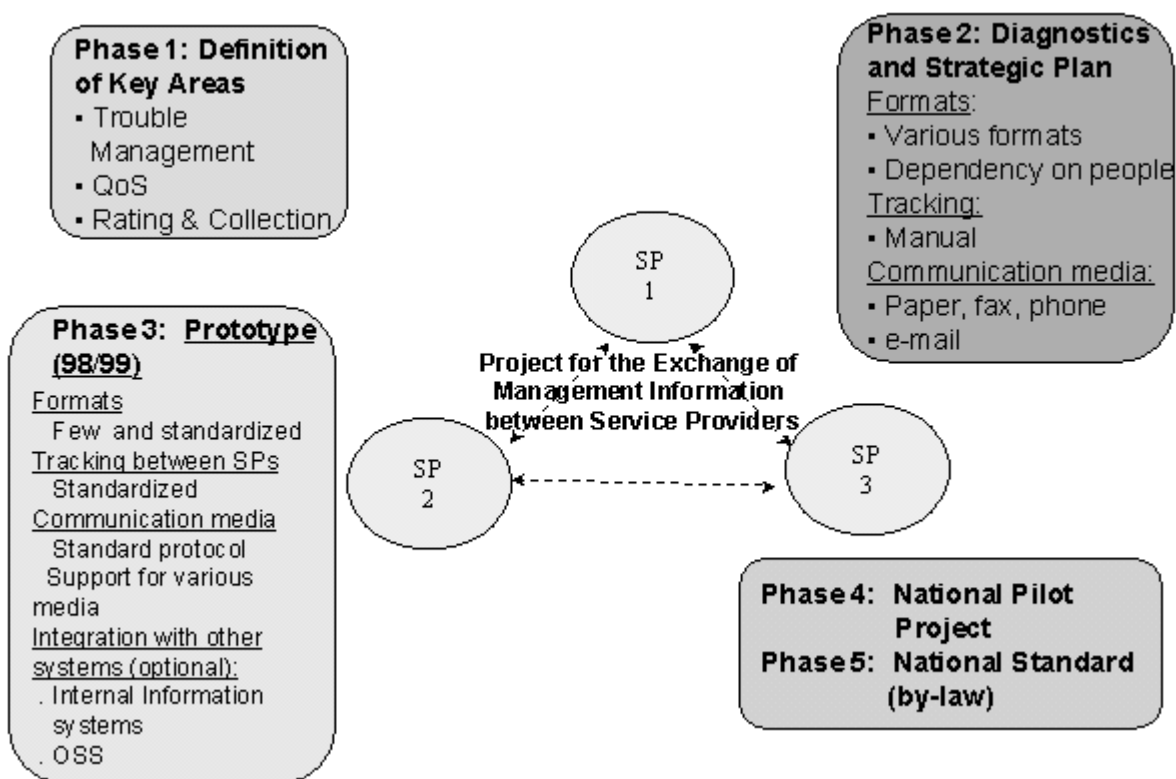
After a series of discussions, three key areas were selected due to their relative importance in the interconnection between service providers: trouble ticket management, quality of service management, and exchange of billing and collection information.

Having limited the problem and after totally defining the phases of the project (see figure 3), the second phase consisted in making a diagnosis of how the national service providers exchange information in the key areas defined, what type of information systems they had, which was the degree of automation of internal processes, and what was their capacity to migrate to a new way of exchanging information. Another activity in this phase was the elaboration of the strategies for the solution of the problems that were found in the key areas.

From the diagnosis some of the problems observed are :

- Inadequate understanding and definition of certain processes in the key areas
- Existence of multiple formats and no standard protocols to exchange information
- Inadequate handling of interconnection problems
  - No historical record
  - Lack of formal mechanisms to report and solve problems
  - Manual exchange and tracking of information
- Complicated exchange of billing records (CDRs basically) and collection information
  - Conciliations<sup>2</sup> are difficult due to non-uniformity of data and measures.
- Lack of standard QoS reports between service providers
- Too many metrics and measuring methods

<sup>2</sup> Conciliation is defined for the purposes of this work only as the process in which two service providers with an interconnection agreement meet to establish the amount of traffic they generated and received to and from the other service provider so that a difference can be calculated and “agreed” on since it has economical implications.



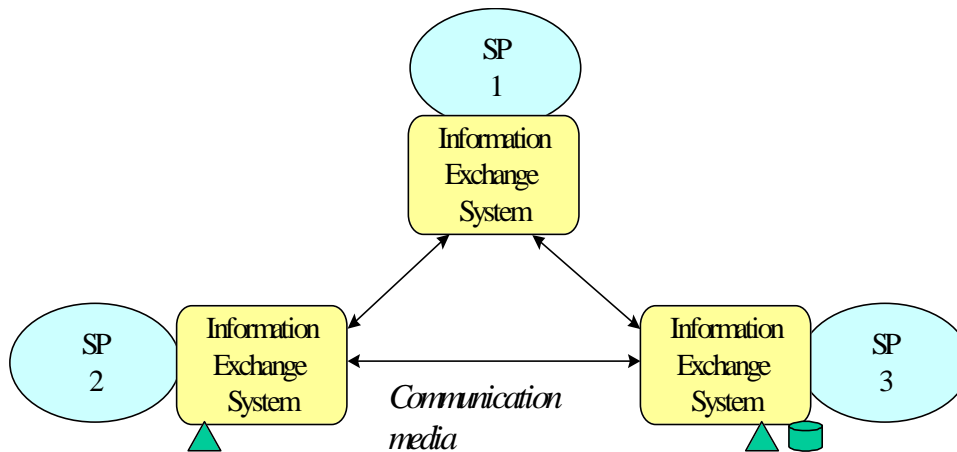
**Figure 3. Phases of the project for the Exchange of Management Information between Services Providers.**

After the diagnosis and keeping in mind the objective to facilitate the automation of the exchange of information, the third phase of the project, which is currently under way with financial support from the Ministry of Communications and Colciencias, has as its main objective the development of a prototype system for the exchange of management information between service providers.

The system should comply to the following requirements :

- To handle the exchange of information based on few and standardized formats.
- To allow the tracking of service problem resolution between service providers.
- Use a standard protocol for information exchange.
- Support various communication media.
- Support future integration with internal OSS systems of a service provider.

The exchange of management information was initially defined to work in a scenario like the one shown in figure 4.



**Figure 4. Scenario for the exchange of management information between SPs.**

The definition of formats for information exchange required an evaluation of the current Colombian regulation in telecommunications, as well as the analysis of some international standards and recommendations produced by the ITU-T and the Telemangement Forum-TMF, but certain aspects of these documents had to be carefully reviewed and adapted due to the characteristics of the Colombian environment. Some of those aspects are:

*In Regulation :*

- Parameters to guarantee QoS between service providers, to the end user, and a free competition environment are defined, but service providers have had trouble in laying the infrastructure to be able to support them.
- Methodologies and procedures for the measurement of a service provider's QoS parameters are being defined.

*TMF Guidelines and Business Agreements*

- The existence of corporate integrated information systems is required in most of TMF documents but Colombian operators lack of these systems
- SP to SP interactions are defined mostly for the Ordering process
- Many recommendations for advanced services, few for POTS.

*ITU Recommendations*

- ITU X. 790 – has few indications for SP to SP trouble management so it must be adapted

Finally, after a series of meetings in which personnel from many service providers participated, an initial set of information exchange formats were defined with the following characteristics :

*a) Format for the exchange of trouble management information*

- Supported on ITU-T recommendation X.790
- It defines the required attributes for trouble management in Colombia
- Total number of attributes: 49

- b) *Format for the exchange of quality of service information*
  - Based on the Telemanagement Forum's (TMF) business agreement NMF 503 and on information agreement NMF 701
  - Total number of attributes : 25
  
- c) *Format for the exchange of billing information*
  - Based on TMF's business agreement NMF 505
  - Total number of attributes : 27
  
- d) *Format for the exchange of collection information*
  - Based on TMF's business agreement NMF 505
  - Total number of attributes : 16

An agreement on these formats was achieved on the end February/1999, but a series of "refinements" were made especially to the format for the exchange of billing information due to the great interest of many SPs and the Ministry of Communications on standardization of information exchange formats. Refinements were received and voted on by all companies until September/1999 after which a final format for the exchange of billing information was established.

Due to the fact that many billing systems are used by the Colombian SPs, an additional test phase is being conducted at the moment of this writing, to be able to measure the difficulty in the adoption of the new format and its implications on the internal processes and systems of certain companies. This test goes along with CINTEL's philosophy of reaching and promoting the adoption of agreements first and then try to establish regulation, in this way SPs can be assured that they will be able to comply with the regulation.

Also, two new formats have been defined which are now under discussion by the SPs, which are:

- Format for reporting billing inconsistencies (mistakes).
- Format for reporting past bills.

Work for the definition of a format for the exchange of customer complaints between SPs (when such complaints concern more than one SP) is also being conducted. The incorporation of the other formats in the processes of SPs will follow the same methodology used for the introduction of the common format for the exchange of billing information as more and more interest in the other key areas of the project grows but it's expected that the other phases of the project to be described later will accelerate it.

### **3. Structure of the prototype system for the exchange of management information**

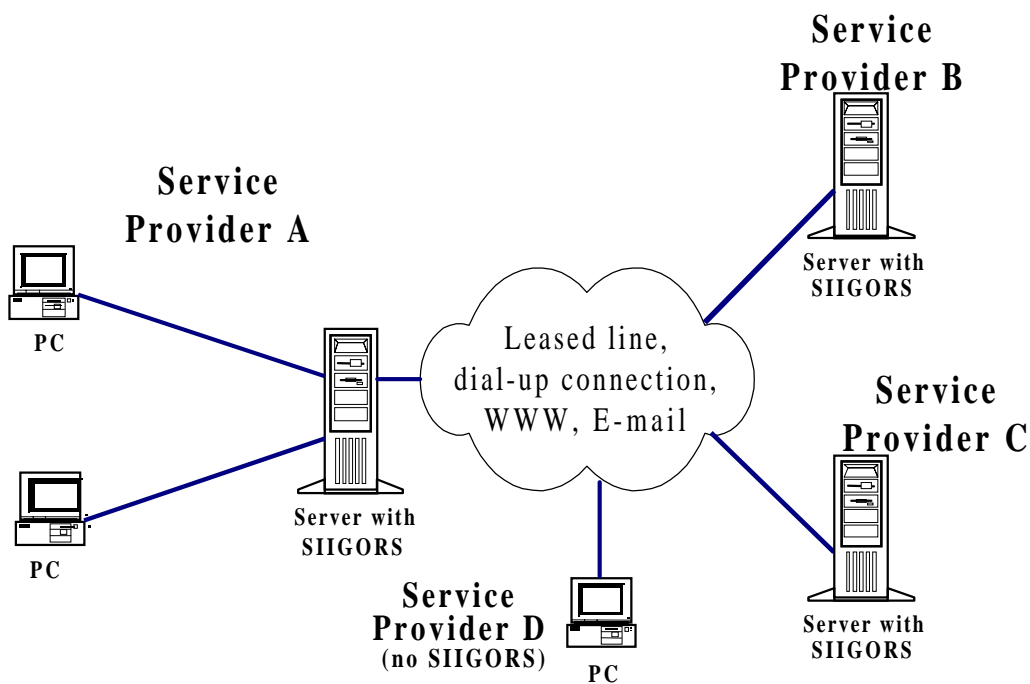
To engage the development of the prototype system an analysis of the processes involved in each area was made, along with a definition of the business, functional and technical requirements for an interface that would handle the exchange of information in each area and which would be part of the system. Also, the following characteristics for the system were defined by agreement between the participating service providers:

- a) The problem handling module that will manage the exchange of trouble tickets between service providers is based on an adaptation of ITU-T recommendation X.790 to the Colombian environment. Due to the existence of commercial trouble management platforms that support ITU-T X.790 and to the great difficulty of developing such application, it was initially decided that this part of the system would consist of a commercial solution that can be able to comply with the Colombian X.790 requirements.

A public invitation was made to application providers and since no concrete offering to participate in the development process of this part of the system was established with any X.790 application vendor, it was later determined to have CINTEL develop a very basic trouble ticket management system which is currently in its initial stages. The participation of application providers is expected in the next phase of the project that's described later.

- b) The handling of the exchange of information in the areas of quality of service and billing/collection is at the moment of this writing being developed by CINTEL. Most commercial applications for these areas are focused on value added services, mobile or advanced services other than POTS and are expensive, so an in-house solution adapted to the Colombian environment was in order. In the last two years however, the tools and applications for billing systems have become more widespread and some have taken into account the characteristics of the Colombian environment where a local telecommunications service provider must bill the services provided by other SPs (long distance, cellular) to the customer. So providers of these applications could later also participate in the development of the system.

The general utilization scenario for the system for the exchange of management information that's being developed is shown in figure 5.



**Figure 5: Working scenario for the System for Management Information Exchange – SIIGORS**

Due to the fact that the characteristics of the Colombian telecommunications service operators range from big companies which cover the big cities to small companies that don't have many customers and switches, it was necessary to plan a solution that would be able to satisfy the needs of all the companies and be affordable.

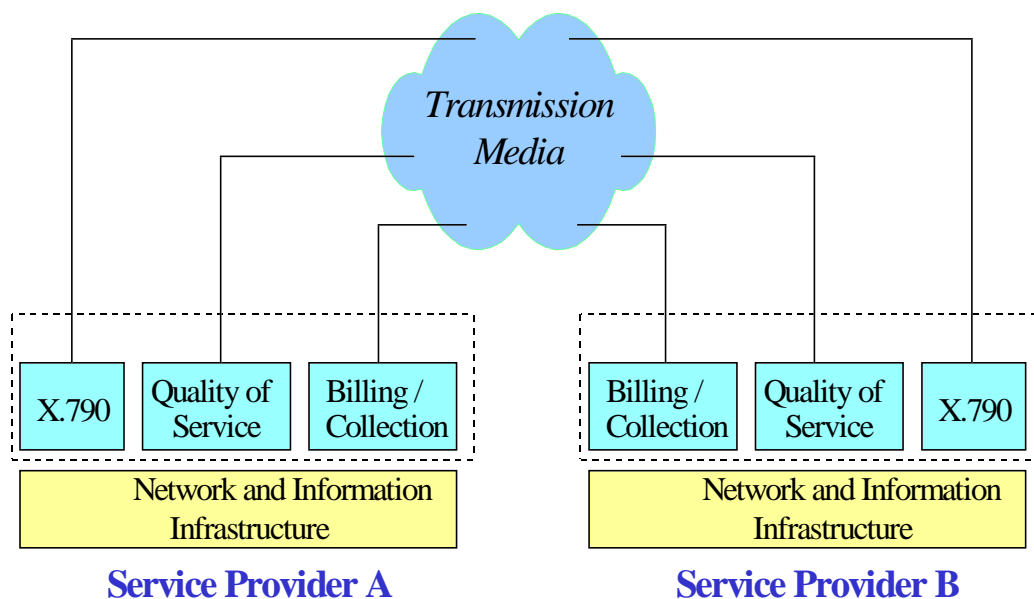
The system supports various communication media for the exchange of information. The media supported are : leased line, dial-up access and e-mail. An interaction via WWW so that a small service provider can exchange information with a big service provider that has the system is also going to be considered.

Personnel from a service provider can send files with records (bills, QoS reports, etc) to be exchanged with other SP through a web-enabled browser, monitor the operation of the system and be warned that the date to send information to a specific SP is getting close, and also monitor and be alerted of the reception of information from a SP.

To support all the functionalities needed, the system consists of four main modules:

1. Configuration module: which allows the establishment of operational information and the details needed to exchange information with other SPs. The configuration of the dates and early warning alarms for the exchange of information are also done here.
2. Billing and collection module
3. QoS report management module
4. Trouble management module

The general interaction environment for two service providers that have the system is shown in figure 6. It's worth to mention that a service provider might decide to have a version of the system that does not include the trouble management module.



**Figure 6. Interaction between service providers with the system for exchange of management information.**



In summary, the project's end is to give to the service providers a system that supports different ways and alternatives for the automated and secure exchange of management information where each SP can know the limitations and advantages of each method and the needs in infrastructure to support the method that he considers best.

#### **4. System development characteristics**

The development of the prototype system is being carried on using modern software development methods and languages. Some of the development characteristics worth mentioning are :

- UML for system modeling : The Unified Modeling Language offers a basis for modeling the complete system without committing to any specific programming language. It's also very useful for designing the architecture and inner logic of the system.
- Java and C++ for implementation and GUI.
- TCP / IP is used as the communication protocol
- The initial information model of the system was developed in GDMO-ASN.1
- Support for CORBA based interactions is planned for the future

The final product of the development will be a software application that will be running on a server and which will coordinate the exchange of information with other similar systems of other service providers. The exchange of information will be made through any of the supported communications media and will use the previously agreed information exchange formats.

To handle the communication between server systems of different service providers, several technologies have been analyzed, they are:

- RMI (Remote Method Invocation): The actual prototype uses this technology which is included with the JAVA platform and allows the rapid development of distributed applications. Unfortunately it's not very efficient and robust as other alternatives which will be used in the future.
- Data Interfacing: It's a technology that allows the sharing of information between different applications and the future establishment of standard mechanisms for handing information (business rules). It enables moving data directly between application databases using data manipulation languages to change data values based on business rules and validate the data to conform to the rules of the target database.
- CORBA (Common Object Request Broker Architecture): The most standardized middleware technology which is being used to develop modern telecommunications management applications. Currently our development is being shifted to this technology.

## **5. Future activities and perspectives**

After the development of the prototype is finished, phase four of the project will be initiated which consists in testing the system under real load and information conditions within a national pilot project that will count with the participation of at least three service providers.

This will give us some feedback for refining the system, adapting it to real world conditions and to incorporate new features that the service providers find adequate.

Finally on phase five, CINTEL supported by the service providers and the experience obtained with the system in real world conditions will make a proposal to the Telecommunications Ministry and the CRT – (Telecommunications Regulation Committee) of a national technical standard for the exchange of management information between SPs.

It's also worth mentioning that this project has brought up some issues related to the complexity of the Colombian telecommunications environment in which some of the results of the project could be applied. With the existence of more than 70 service and network providers that are interconnected in this environment, it's becoming more evident the need for the existence of an independent trusted and neutral entity for the administration, management and control of the exchange of management information between SPs. This will involve the identification and agreement on the functions that this entity must accomplish and how it will be operated and financed.

The entity or independent organization can have functions that start with the handling of simple transmission and reception functions that accomplish the exchange of information and guarantee it, the issuing of digital certificates, and end up with handling the billing and conciliation processes between service providers.

Another perspective of the project is to be able to transfer the experience and knowledge in the Andean region and Latin America to the exchange of information between international service providers, where applying the same methodology, agreements on the top problems between international SPs may be reached and solutions to them developed.

## **6. Conclusions**

The Colombian telecommunications market has a great deal of competition in the local, long distance and mobile services which offers many and complex challenges in the adequate handling of interactions between service providers for the establishment of an end to end service.

In the agreement and consolidation of common formats for information exchange, it is vital to assure that only the minimum required information will be exchanged and that such information should not be withheld because it may have an strategic value but it's necessary to guarantee the operation and quality of the services offered to customers.

The automation of processes is very important for service providers but tests and transition mechanisms must be adequately developed to support the change towards an automated environment and to encourage the standardization of common automated interfaces.

The system described in this article covers the exchange of information of certain key processes. This system can serve as a basis for the development of other systems that support information for other processes, and also for establishing and automated information exchange between providers of different countries.

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