The devil is in the details.

Why Telecommunication Back Office Operation Support Systems Fail – experiences from running a competitive local exchange carrier!

By

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Abstract

The telecommunications Act of 1996 opened for competition in the local exchange telecommunication market in the US. This act was followed by detailed orders that forced the incumbents to open both their physical and logical infrastructure for the competition, i.e., so that these could access existing copper wire, exchanges, databases and software systems. However, telecommunication is a complex business and this unbundling is not easy to achieve in practice. In this paper we focus on the practical problems that face a competitive entrant with regard to get back office systems up and running.

Introduction

Starting in the nineteen seventies, we have seen a deregulation effort in very many sectors. Government organizations that were established during the "New Deal" period to safeguard public interests have been weakened in order to let the marketplace work more freely. Interesting enough, these efforts have been supported both by liberals and conservatives. The agenda of the liberals have been to reduce corporate interest over the regulation agencies, the conservatives to get the "government off the backs of the industry". A basic idea has been to increase competition, to get better service and lower prices.

Airlines, trucking, railways, inter city busing and telecommunication has been some of the targets for this deregulation. To a large extent we have got increased competition and lower prices. Airlines are a primary example. In many areas the new bargain airlines, such as XXX in the US and Ryan Air in Europe, are determining the game. They are forcing incumbents to lower prices, but also service. While air fare previously was viewed as a luxury product, characterized by excellent service, food and drinks "on the house", hotel accommodation if one failed to reach a connection, etc., it is now down to basics – to the transportation part only. In the telecommunication sector we have seen an abundance of new firms emerging, both to provide new services such as data networks and cell phones, but also to compete with established telephone services.

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While deregulation opened for competition in these areas, many of the new services have been made possible by the advent of new technologies: wireless services, broadband on a twisted pair cable, optical fiber, digital switchboards, the Internet and the Web standards. In many cases the new entrants have been the first to apply these technologies. A good example is XXX (seattle) that managed to get the first cell phone network up and running in the US.

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While deregulation can offer many success stories we are starting to see some of the disadvantages of giving the free market control over important infrastructure. Britain is now, after a set of serious accidents, considering more governmental control over their railways and in both the US and Europe there has been severe blackouts due to an inadequate power system. It seems that long term investments and preemptive maintenance is not the primary focus for private enterprises that have stockholders with a short term view on their capital.

In the telecommunication sector the Telecommunication Act of 1996 opened for competition also on the local voice and data services. The incumbents, the Regional Bell Operating Companies (RBOC) were forced to lease infrastructure to the new entrants, what is often called the Competitive Local Exchange Carriers (CLEC). Many CLEC managed to get their business and their networks up and running in a remarkably short time. However, as Martin F. McDermott states in his book *CLEC* [McDermott, 2002], problems occurred primarily in other areas. One area that caused major problems was billing and Operations and Support Systems (OSS).

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”An incumbent LEC shall provide nondiscriminatory access… on an unbundled basis to any requesting telecommunication carrier for the provisioning of a telecommunications service…” “…Operations support systems functions consist of pre-ordering, ordering, provisioning, maintenance and repair, and billing functions supported by an incumbent LEC’s databases and information.” “An incumbent LEC must provide electronic access… Providing access to OSS functions… is a critical requirement …”

Table 1 FCC Orders

The Federal Communications Commission (FCC) recognized the fact that access to the physical infrastructure was not enough to open for competition. In their first order in Docket 96-98, an interpretation of the Telecommunication Act, they determined that the OSS systems and the data within these constituted a “network element”. Thus, the CLEC was to be granted access also to these parts. The idea was to let CLECs have the possibility of operating “at parity” with the incumbent local exchange carriers (ILECs). As seen from the FCC orders in Table 1, the CLEC’s are also granted electronic access to these systems.

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Thus, by 1996 we had both a political ruling and orders that lay a foundation for competition in local exchange telecommunication in the US. This was a go ahead for many new companies. In 2000 there were more than 700 CLECs. Some of these where sales company only, using the ILEC infrastructure to sell telecommunication services using different market plans and often lower prices. Others used new types of equipment, for example to provide both data and phone services on the standard local loop. We should expect, even if many of these companies were established in the euphorian “dot-com” years, that there was a reasonable market and business idea behind each company. Yet, more than 90% of these companies failed. The congress did not get the highly competitive market they wanted, and huge amounts of dollars were

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spent in this, often futile race. While investments in new companies and new technology are always a risky business, the huge losses in telecommunications have reduced the amount of available venture capital today and made investors very reluctant in going into new projects.

What did go wrong? In this paper we shall try to present one answer based on experience from running the OSS of a CLEC. We shall see that while the FCC orders were reasonable enough, the implementation of these were not straightforward. Telecommunication is an extremely complex business. It is based on a technology that was invented more than a hundred years ago. Much of the infrastructure has been laid down over a very long period. It is in the process of converting from analog to digital. Where we previously found exchanges full of electrical switches and relays, we now find computers and complex software. In addition telecommunication is research driven. Equipment that was in the research laboratory just a few years ago is now used by large parts of the population. New development within wireless systems, satellite communication and electronic devices are offering great challenges for the future. If this is not enough, there are reasons to believe that it may be more difficult to get revenue out of basic communication only, and many companies are now starting to look into both service and content parts.

If we compare with other areas that have been deregulated we see that Telecommunication is inherently different from all of these. For example, within the airline industry we accept that a bargain airline only offer a limited set of destinations, and that they perhaps also use secondary airports for many big cities. If we have complex travel patterns we may have to use an incumbent airline, or accept to buy tickets from more than one (bargain) company. If we don’t make a connection this will usually be at our own risk. That is, all interconnection problems have to be handled by the customer. Most of these airlines let the customer perform the booking part themselves on the Internet. There are no standards for these Business-to-Consumer (B2C) systems; the customer will have to learn to use each different interface. However, with the large degree of formalization, the few data items that are needed to book a flight and with similarities in look and feel of the various interfaces, this is not a major problem.

On the telephone network, however, customers expect to be able to pick up any phone at any time and call anybody, within the country or internationally, independent of which phone company they or the recipient use. That is, the interconnection problems are a matter for the telecom companies. While the technical issues of this connection often are handled by the network routers of the incumbent telephone companies the OSS systems of the CLECs must at least handle the billing part. As we shall see, this is quite a complex matter as many different companies and an abundance of price policies may be involved.

However, billing is only a part of the functionality that the OSS systems must provide. CLECs must have functionality on place for provisioning new customers (often customers that earlier were connected to an ILEC), or for deprovisioning, when they lose a customer to a competitor. While airline customers can do this “provisioning” on their own, using the B2C systems for establishing and maintaining a customer profile, the company must do the job for telephone services – at least today. As we shall see, provisioning of phone and data services are not an easy matter in the first place and made even more complex by the lack of strict standards.

While deregulation has opened for competition there are other regulations that are in place and that have to be followed. For example, all companies must provide 911 services. This includes the ability to tell the emergency facility where the caller is located. Other services, such as “caller ID” also involves the ability to access and update national databases. An easy task if all the standards were in place, but as we shall see these services require detailed adjustment to many different formats and processes.

To perform all these services a CLEC needs reliable back office systems. In principle these can be developed in-house, or being leased or bought from vendors. In practice, only the two latter alternatives are feasible if a CLEC wants to be up and running in a short time. However, as we shall see the OSS available today are not reliable. They are difficult to implement, lack documentation and do not confirm fully to standards. Competent personnel that really understand these systems are in short demand. The issues are further complicated by the fact that the incumbents run systems that do not follow standards. Thus, a CLEC end up with an overwhelming number of small and large problems that are difficult and time consuming to solve.

In the following we shall study some of the problems that CLEC face with regard to their back office systems. As we shall see these are more of a practical than a principal nature. Still, we believe that these problems have been a major reason for all the failures we have seen in this are. Thus, access to copper wire and switches may not be enough to get competition in this area.

Background and overview

One of the keys to the success of a telecommunication company that offers a range of narrow and broadband voice and data services is how effectively and efficiently the back office Operations Support System functions. This system has been defined as the set of hardware, software, procedures, policies, and personnel that support the following main activities:

- Network Design and Inventory
- Provisioning and Activation of Services
- Service Assurance
- Interconnection
- Customer Care & Billing
- Work and Workforce Management

One of the more obvious characteristics that stand out from the list presented above and from the more detailed view presented in **Error! Reference source not found.** is the widely diverse but highly interrelated nature of these activities. But the real devil is in the details associated with of each of these functions and their relationships. Understanding the technology of telecommunications is one thing, understanding the *business* of telecommunications is quite another.

An OSS is intended to support the business of telecommunications which includes the hardware, software, people, policies, procedures as well as the customers. The logical part of an OSS is a set of software modules that ideally should model the telecommunication business and reflect all the relationships among components. In practice, this is not the case. Even the incumbents experience difficulties with their legacy OSS because it does not accurately model the ever changing nature of the telecommunication business. The underlying technology for voice and data services has been evolving for over 100 years and although the technology continues to change in areas such as wireless, broadband, DSL, and Voice over Internet (VoIP), the basic architecture of the national and regional backbones has not changed very rapidly. What have changed more drastically over the last 20 years are the business environment and regulatory aspects of the telecommunication's business.

- Network Design and Inventory
    - Provide network design, documentation and maintenance capabilities
    - Provide work order creation, management and reporting.
    - Provide physical and virtual paths between connected network components with connectivity attributes and the ability to isolate problem areas in the network.
    - Provide complete connectivity management from a customer service point to the central office.
- Provisioning and Activation of Services
    - Deliver accurate, reliable, and flow-through provisioning and activation of customer services.
- Service Assurance
    - Monitor key indicators of network performance.
    - Assure that QoS levels and Service Level Agreements (SLAs) are maintained.
    - Identify actual and potential network performance problems.
    - Report on network performance trends for decision-making and planning purposes.
    - Automatically detect and perform notification of any alarm conditions resulting from network failures or service degradation.
    - Isolate the cause of actual and potential service disruptions.
    - Collect data that can be used to guarantee service levels, provide warning of potential problems, and isolate problem components
- Interconnection
    - Provide automated interconnection among multiple trading partners to exchange pre-order inquiries, order messages, and trouble and provisioning information. Must be capable of automatically formatting inquiries and messages according to established protocols and business rules.
- Customer Care & Billing
    - Create and integrate automated systems for accurate order flow-though, from initial customer contact through service provisioning and billing.
    - Support customer relationships to help reduce customer acquisition costs and increase retention.
    - Increase revenue assurance and enable timely response to market conditions.
    - Facilitate interconnection between trading partners.
- Work and Workforce Management
    - Integrated Work and Workforce Management for accurate, timely and efficient dispatch.
    - Track technician activities and exception reporting.
    - Provide Remote Field Access for Technicians.
- Control Work Order Changes.

Table 2. OSS functions

What this legislation has done is make the business environment for tele-communications much more complex than it already was. While the "natural monopoly" of telecommunication, i.e., the idea that there are advantages of having only one company has been challenged [Perez, 1994] the business complexity of having many companies "sharing" parts of a common infrastructure has perhaps not been fully understood.

New entrants into the market see the potential for using new technologies to take customers from the incumbents and make money. The number of CLECs that has failed show that most of those who are involved with these new companies do not understand the details of the business and consistently underestimate the cost, time, skill, and knowledge that it takes to offer and maintain a wide array of telecommunication services with an adequate Quality of Service and Service Level Agreement. The complexity of making and completing a phone call based on current technologies is astounding but the OSS activities required to acquire a customer, provision the service, manage the technology that delivers the service, acquire data for billing and legal purposes, and monitor the service and its underlying technology for problems is actually much more complex and changes on an almost daily basis.

Business processes

When a CLEC acquires a customer from an incumbent, there are a series of formal communications (usually electronic) that must take place between the CLEC and the incumbent. Since most new entrants utilize some of the unbundled network elements (UNE) of the incumbent to provide their services (for example a local loop), the new entrant must order these UNEs using the systems provided by the incumbent. This requires an interconnection between the incumbent's OSS and the competitor's OSS. The ordering process (LSR or Local Service Request and ASR or Access Service Request) requires knowledge of how the telephone business operates, the business rules used by the incumbent and the special language used. For instance, when ordering a local loop, you must know the CLLI (Common Language Location Identifier) code of the central office to which the customer will be connected. The CLLI code can be found in a file called the Local Exchange Routing Guide (LERG).

The ordering of UNE's, their installation by the incumbent, the installation of equipment at the customer's premise, disconnecting the current incumbent's service, and the activation of the competitor's service must be scheduled and monitored carefully so as to not leave a customer without service. But that is only part of the story. For example, a telephone service must provide 911 capabilities. This requires a trunk from a telephone company's local central office to a 911 center (called a PSAP) and this, in turn, requires that the telephone company maintain a database of addresses where telephone lines are terminated along with the telephone number associated with each line. Since telephone numbers can be "ported" (that is you can take your telephone number with you when you move within a region), there is a national database that must be updated with this porting information. If a caller wants an 800 number, this also requires interactions with other vendors and updating a national database. Likewise, if caller ID is desired by the customer, this requires that another national database be updated as well!

In order for a new entrant to connect to the public telephone network, it must establish an interconnection agreement with the incumbent telephone company to connect to their tandem switch which is connected to the public network. If a calling card service is to be offered to customers, then an agreement with the Centralized Message Distribution Service (CMDS) must be established and Call Detail Records (CDR) or billing records must be exchanged on a timely basis. Since most customers want a long distance service, interconnection arrangements must be made with the long distance carriers and if convergent billing is offered, the ability to acquire and exchange CDRs with the inter-exchange carriers (IXC or long distance – LD) is a must. Likewise, the equal access regulation requires the exchange of CARE information (Customer Account Record Exchange) to notify the LD carriers when they are losing or gaining a customer.

When a customer disconnects, many of the actions that were done to connect a customer must be undone. In addition to these relationships, a central office switch must have a dial plan so that calls get switched or routed correctly. Dial plans are extremely complex data structures that must satisfy a number of rules about the new entrant's network, the incumbent's network, and the IXC's network.

There is also the electronic exchange of billing data from the incumbent for the UNE components that have been leased. This data must be reconciled with the company's internal inventory of network components and the accounts payable system. When a service is sold to a customer, the network devices and associated logical attributes must be installed or allocated, interconnected, configured, activated, and tested. This is the service provisioning and activation process. This process starts at the central office switch, router, or multiplexer and extends through all the physical components such as ports, circuits, trunks, jacks, frames, panels, and network interface device including the logical components such as IP addresses, telephone numbers, virtual paths, and virtual circuits. Any specific attributes associated with these components must also be tracked, e.g. data speed, and calling features. Tracking what has been allocated to a customer and being able to trace the path from the customer premise device, port, jack, circuit, frame, panel, telephone number, IP address, virtual path, and virtual port is critical to managing and maintaining the service.

However, the most complex aspect of an OSS is billing. It is complex because of several factors. One is that rating calls accurately can be a logical nightmare because a caller can theoretically call from anywhere in the world to anywhere in the world at anytime. The second is that the United States has divided its geographical area into LATAs (Local Access Transport Areas) over which a call is considered a long distance call. Unfortunately, LATAs cross state boundaries which make determining the type of call more difficult. Typically calls are rated based on the following categories: Intra-LATA Intra-state, Intra-LATA Inter-state, Inter-LATA intra-state, Inter-LATA inter-state, and international. But, Canada, Mexico and the Caribbean are treated differently than other international calls. Then, there are the message unit charges for local calls that extend over certain distances (zones) from the caller's central office. As complex as determining the type of call may sound thus far, it is only one piece of the story. A call may come from a ship at sea, an airplane, a hotel, a prison, a pay phone, etc. all of which are rated differently. To add even more complexity to the billing issue, competition has forced many companies to offer special plans, special rates, and special rate conditions. The billing system must not only determine what type of call was made but also what plan a customer has and how the charge must be computed, e.g. was it a week day or weekend day, after 9:00 pm, over 1,000 minutes of usage, etc?

In addition to the difficulties in rating calls and computing the charge, there are other charges that must be computed as well. Sales and Usage taxes as well as special telecommunication taxes must be computed. These taxes differ across political jurisdictions and change frequently. There are other charges such as a 911 surcharge that must be computed for the customer invoice. Then there are the data management issues arising from the large volume of call detail records (CDRs) that are generated for every call which is originated or terminated at a switch. This volume quickly reaches millions per month even for a small carrier. These records must not only be processed for billing but must be archived for law enforcement agencies as well. A carrier must also have fraud detection software that looks for patterns of abuse in these CDRs. The billing data must also be interfaced with the journaling and other accounts receivable functions of the company.

This summary of the business issues only touches the surface of the details associated with the business of telecommunications. The bottom line is that the fractionation of the telecommunication business by law makers, regulators, and the incumbents have made it overly complex to the point that making an OSS that can function in an integrated, cost/effective and stable manner is nearly impossible.

Incomplete and Non-integrated OSS Software

There are a number of options that a telecommunications company has when it comes to OSS software. One is to develop the software in-house. This option will be guaranteed to fail unless there is a source of knowledge available that understands the details and the complexity of the business. Even then, the time it takes to get the specifications, develop the code, test the code, test the relationships, documents the system, and train users usually far exceeds the time and expense estimated or resources a CLEC is willing to commit.

A second option is to purchase software from one of the vendor's of OSSes. The first shock related to off-the-shelf OSSes is the price tag and the second shock is how poorly they function, especially from an integrated stand point. Most of the OSS products on the market perform one or two functions quite well but either don't perform other functions or perform them with poor, little or no integration across functions which requires additional personnel and or in-house software development to fill the gaps.

A third option is to outsource the OSS functions via an ASP (Application Service Provider) arrangement. This option theoretically gets you up and running very quickly. But, most of the ASP vendors are using the same off-the-shelf software you would have acquired. It will leave you with the same non-functional capabilities that you would have had if you had acquired the software yourself. In addition, the cost of using an ASP arrangement and the lack of control over processes and quality will not allow your business to prosper.

Lack of Knowledge of the Telecommunication Business

Many new entrants believe they have all the knowledge necessary to operate a telecommunication's company only to find that their business OSS knowledge was lacking and in many cases turns out to be the biggest obstacle to success. Without a complete set of in-depth, knowledgeable people who can either specify the functionality and integration points for developing an OSS in-house or who understand how to configure an existing OSS to meet the business requirements, an OSS is doomed to failure. Since most off-the-shelf OSSes are incomplete, it is important to have professionals who know their own system well enough to specify those points where software needs to be developed by the customer to integrate certain functionality. These may be APIs or simply interfacing at the database level. Without this knowledge, failure will be certain.

The solution is twofold, short and long term. For the first view you acquire the expert consultants that shall help you to configure the system. For the second you send your own personnel to training classes. However, it very soon becomes clear that the professional service personnel sent to help configure the system are not highly competent as they spend hours on the phone with "experts" back at their headquarters and they repeatedly attempt installation and configurations that fail. The fact is that there are few who can deliver the in-depth knowledge necessary to either develop a new OSS or configure an existing system to function adequately. Many of the experts either have general knowledge across a number of OSS functions or in-depth knowledge in a single function. In either case, it is inadequate to get an OSS system up and running successfully. This leads to frustration and an adversarial relationship which is a guarantee for failure.

You also are informed that there are certain software utilities that are required that were never mentioned when you were considering buying the system. The progress is slow and it is recommended that more professional service personnel be brought on board that have special, niche expertise needed to configure the system. What choice do you have?

Training classes are necessary because configuring the software is not only convoluted but, as we shall see, the documentation is poorly done, incorrect and out dated. So, management feel that the IT personnel who attend the classes will be able to support, maintain and change the configuration of the system. What you will find out is that the training was, for the most part, superficial and introductory. In fact, the trainers, in some cases, are not really technically trained but simply follow a lesson plan with canned examples that teach the students how to navigate menus and complete data fields for the simple examples. Of course, the simple examples never come close to your own company's actual situation. After many months of delays, restarts, dozens of professional service personnel, millions of dollars, and tremendous frustration on everyone's part, you get a skeleton system up and running with about 50% of the functionality you need and were promised. If you are lucky, one or more of your own IT people will have learned enough about the system to make it function and are learning to configure it to do what is needed or to develop software that adds the needed functionality by interfacing with the system, usually via a database interface.

Failure of Following Standards

There are many standards in the telecommunications industry, but participants in the industry compromise the standards to meet their legacy systems or for other unexplained reasons. For example, there is a NENA standard for the data elements and format for the 911 data exchange between incumbents, PSAPs and competitive local exchange carriers (CLECS). This standard is to be followed by the PSAPs, the ILECs (who are typically the 911 database vendors), and the CLECs. The PSAPs and ILECs choose to compromise the standard due to their legacy systems or local preference by not using fields as defined, combining data from several fields into a single filed, adding new fields, or using fields in ways never intended by the standard. This places a CLEC in the position of having to develop overly complex software to process the different record formats from hundreds of PSAPs and several ILECS in their geographic service regions.

Likewise, the LSR (Local Service Request) is supposed to be a standard developed by the ATIS organization but each ILEC has different rules about how various fields in the record are used. This same type of compromise is found in the billing record exchange (EMI) format as well as in CDR records and other standards that affect back office OSS operations. This leads to overly complex, costly, and unreliable software. In addition, the formats and business rules associated with these data exchange formats are changed several times each year making change control a nightmare for new entrants.

Inadequate Documentation on Interfaces for Flow-Through Provisioning

In order to configure and activate services for a customer, local loops must be acquired and installed, devices such as switches, multiplexers, routers, and customer premise interface access devices must be configured by setting device parameters to meet the attributes of the services purchased; and databases must be updated for porting numbers, 800 numbers, caller ID, 911, etc.. Typically, the devices on the service path between the customer premise and the switch have a Telnet interface with a menu driven or command line capability to configure ports, assign IP addresses, assign telephone numbers, assign virtual path and virtual circuit ids, set attributes such as transmission speed, call forwarding, caller ID, three way calling, etc. These steps along with others that precede them are referred to as provisioning and activation of the service.

Although the Telnet interface for device configuration does work, it is error prone and time consuming. Ideally, the work order generated by the customer service order has all the information necessary to perform the provisioning and service activation in electronic form. But the Telnet or other interfaces to the devices that must be configured require the information be retyped into the forms or prompts provided or issued as commands using a UNIX style syntax. This opens the door for many types of errors. In addition, it may require accessing and configuring many devices that sit on the transport path between the customer premise and the switch.

For example, a last mile DSL provider of voice and data may need to access and configure the following devices to activate the service for a customer:

1. Interface Access Device (IAD) at the customer premise
2. DSL Multiplexer at the Local Service Office
3. ATM Router at the Central Office
4. Internet Router at the Central Office
5. 5ESS voice switch at the Central Office
6. Internet server
7. VPN server
8. Voice Mail server.

Ideally, this can be done via the appropriate provisioning software. The IAD, multiplexers, and routers typically utilize the standard Simple network mail protocol (SNMP) with a MIB to store configuration parameters. With the proper documentation, the provisioning software can developed to automatically store the configuration parameters in the MIB directly from the work order without any retyping. In addition, this can occur in seconds as opposed to the several minutes it takes a human provisioner to accomplish the same function. Those devices such as a 5ESS switch that use a combination of navigational menus and command lines to provision a telephone line service can also be driven by provisioning software if the appropriate documentation is made available.

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The process of having software that will automatically order a local loop, manage its installation, update all the regional and national databases, and configure the devices necessary to activate a customer service is called flow-through provisioning and can improve the effectiveness and efficiency of provisioning and activating a service significantly. Unfortunately, the documentation necessary to make this happen automatically is incomplete, outdated, or simply incorrect. This makes complete automation of the provisioning and activation process a trial and error process that is quite time consuming and costly. Many new entrants try to use the million monkeys approach by throwing more people at the process. This typically does not work because more mistakes are made at a faster rate which tends to intensify the difficulty of recovering from errors. When provisioning and activation of customer service is incorrect or not performed on a timely basis, customers will cancel the service and return to the incumbent.

Incorrect and Incomplete Billing

Billing is the life blood of the revenue stream. The ability to account for every CDR in the billing process without dropping potential revenue on the floor is critical to the survival of a telecommunication's company. But this is not an easy thing to do. Billing is complex because all calls must be typed and rated correctly and unfortunately there are hundreds of call types. We know of no company that claims 100% CDR rating and 100% correct bills because of the complexity of determining call types and rating them correctly. It is our opinion that much of this problem exists because the Federal Communications Commission (FCC) and state public utility commissions (PUCs) have allowed themselves to be lobbied by special interest groups over the years to the extent that almost every communication situation is a special case. Of course, the incumbent telephone companies (ILECS and IXCs) are not without blame since they let these special cases become reality in order to get other concessions from the FCC and PUCs. And in some instances, the ILECS and IXCs created the special cases in order to enhance revenue. These special cases cause calls to be rated and billed incorrectly and, for many call types, the CDRs are simply "dropped on the floor" resulting in millions of dollars of lost revenue.

Of course, the software packages available on the market to perform billing are inadequate in terms of rating the many different call types. This loss of revenue by a new entrant will eventually drive them from the market place.

Scalability and Reliability

To be successful, a telecommunication company needs to acquire customers and lots of them. The capital, circuit, and labor cost for a telecommunication company is very high and therefore the need to utilize the available capacity to produce revenue is essential for survival. The OSS, like the customer service network, must be highly reliable. The OSS must be able to scale with the business and must be available at all times. The scaling can only be accomplished by using efficient application software, database management system, operating system, and hardware as well as adequate network bandwidth for users of the OSS.

The typical OSS runs on a UNIX operating system such as Solaris using a Sun Microsystem 4500 or larger CPU with clustering capabilities, an Oracle database management system, and application software written in C or C++. The system architecture is usually client server with Microsoft NT or 2000 as the desktop client with a TCP/IP network over a 100 megabit/second Ethernet network. The Server CPUs are networked for high availability access with multiple network connections. The network disk storage is usually RAID 5 or higher to guarantee data integrity. The database is replicated to ensure a fault tolerant data environment. A hot backup or a cluster is used to guarantee continuous operation. A disaster recovery plan and associated resources are in place. The internal network has redundant paths between remote offices and the OSS system location as well as the disaster recovery location. Backups are a way of life and enterprise backups are essential.

How much does all this cost? A lot! But, companies that fail to invest in the resources to guarantee scalability and reliability will suffer greatly when the capacity to handle the next million CDR records is exceeded or the system is not available for sales, provisioning, installation, customers, and management personnel due to a system failure. The lost of revenue because of such failures is serious but the loss of confidence in the IT department is a severe blow. The need for excess capacity and redundancy at startup is hard to sell to management for a new company but the cost of upgrading and the potential for downtime at a critical stage in the growth of a company can be a disaster. One way to mitigate the high initial cost of a more or less centralized system with the required capacity and redundancy is to design a distributed system that can be upgraded in more manageable cost increments. Many of the OSSes on the market do not scale and are not reliable which in turn can cause a new company to fail.

Conclusion

The Telecommunication’s Act of 1996 and subsequent amendments to that act created visions of competition, more services, better services, and lower costs. While the need for access, also electronic, to the incumbents data systems were foreseen, the practical difficulties of administering a wide range of services over a complex infrastructure with many competitive companies may have been underestimated. We have pointed out that a reliable OSS is a necessity for a CLEC, but have also seen that these systems do not fulfill expectations. This is the major reason for the downfall of many new entrants to the telecommunication business.

There is no single reason that OSSes fail but the issues discussed above all contribute to a potential failure. The fact that a company has an OSS that is operating does not mean that it is successful. Most OSSes are incomplete, not integrated, do not match the company’s business, do not scale, and are not reliable. In addition, they tend to be inflexible and suffer performance problems on an almost daily basis. The complexity of the telecommunication’s environment in the United States contributes to the likelihood of an OSS failing to perform all the necessary functions in an effective, efficient manner at a reasonable cost. The fact that very few individuals or groups of individuals understand at an adequate level of detail the complexity of an OSS leads to incorrect requirements and specifications upon which the OSSes have been and continue to be built. Likewise, many of the professional service personnel are not only lacking in an understanding of the telecommunication business but in many cases do not even understand their own products. And finally, many companies do not provide adequate resources to guarantee a scalable, reliable, integrated, and fully functional OSS.

The remedy, if one wants to make it practical possible for new entrants to compete must be strict and well-documented standards. This will determine the foundation for developing reliable OSSes, but will require a major effort in updating both the physical and logical network infrastructure so that each part conform to the standard.

References

McDermott, Martin F. (2002) CLEC: An Insiders Look at the Rise and Fall of Competition in the Local Exchange Competition, Penobscot Press.

Perez, F. (1994) The case for a deregulated free market telecommunications industry, IEEE Communications Magazine, December.