*The following white paper examines the business drivers of the rapidly expanding next-generation network (NGN) and outlines the challenges the network poses for providers who use it to offer new data, voice and convergent data/voice multimedia services. The paper then suggests how providers should position themselves to handle these challenges, and explains how the selection of a superior operational support system (OSS) is critical to success. Finally, the paper outlines the forces affecting OSS vendors, the factors fueling the demand for quality OSS and the characteristics of a forward-looking OSS solution designed with the NGN in mind.*

*We would be pleased to receive any feedback about this paper. Please send your comments or questions to info@eftia.com.*

# OSS for Managing Next-Generation Networks

Revolutionized by the effects of widespread deregulation and unprecedented technological advances, such as the convergence of data and voice, the communications industry is changing and growing at a remarkable rate. One result of this pandemic change has been the convergence of some of the industry's major players to create massive new companies that, in turn, have accelerated the development and deployment of a host of new services and applications. Another result has been the impressive emergence of new players competing for market share in the communications services market. The number of new competitive and next-generation service providers in the United States alone has increased by nearly fourfold in the past two years (Bonner 2000).

In this explosive market, the most notable new entrants are the communication service providers using next-generation networks (NGN) to offer new data, voice and convergent data/voice multimedia services. Competitive local exchange carriers (CLEC), data local exchange carriers (DLEC), Internet service providers (ISP), application service providers (ASP), data-centric wireless providers, metropolitan ethernet service providers, satellite communications service providers, wholesale optical carriers and utility providers are all integral players in the evolution and deployment of NGNs.

How do we define the NGN? It is a public infrastructure that uses packet-based transmission and switching for real-time communications, including telephony, audio/videoconferencing and multimedia collaborations.

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Service providers face numerous current and anticipated challenges in meeting end users' expectations and demands in the ever-changing communications marketplace. In striving to position themselves to meet these challenges while dramatically slashing costs, providers are discovering that the selection and use of an operational support system (OSS) is critical to their success. By partnering with a forward-looking OSS vendor, service providers can not only speed their services to market today, but they can also be well positioned to evolve as the NGN unfolds.

## Market Opportunity

John McQuillan and Liza Draper, Chairman and Manager, respectively, of the recent NGN Ventures 2000 Conference, observe that the highly fragmented industry structure means that no one vendor—or set of vendors—controls the market and that niches for hundreds of new vendors open up every month. As long as the bull market continues, they add, "we expect burgeoning VC investment in sectors like optical networking, next generation telephony, business-to-business web plays and next generation service providers" (bcr.com March 2000). There is already much at stake in the drive to be first to market—or a fast follower—with dynamic services; industry analysts estimate that global revenues for next-generation services will exceed $1 trillion this year (tivoli.com 2000). And that's just the beginning. According to numerous industry reports, all segments of this market are poised for tremendous growth in the coming months and years.

## The Next Generation Network

While the market is alluring, the next-generation network itself is intimidating. Viewed in its entirety, the NGN is big, pervasive and complex—and it is becoming more so each day. Deregulation, the growth of the World Wide Web (WWW) and accessible venture capital money have not only facilitated new company entries, but have also spurred unprecedented technological innovation. The list of technologies enabling the NGN and NGOSS is already daunting: multimedia hypertext transfer protocol (HTTP), Java servlets, Internet protocol telephony (IPtel), IP security (IPsec), IP multicasting, computer integrated telephone (CIT), enterprise Java beans (EJB), Java management extensions (JMX), extensible markup language (XML), lightweight directory access protocol (LDAP), Jini, publish and subscribe (pub/sub), public key infrastructure (PKI), digital certificates, and transaction management protocol (XA) distributed transactions.

To complicate matters, the growth rate of managed elements is also accelerating. These new networks consist of increasing numbers of many types of small devices rather than a few big switches. In fact, the NGN will support about 10,000 times more interfaces than what exists in current networks. Bandwidth capacity is also doubling every few months; industry analysts predict that NGNs will have as much as 1,000 times the current bandwidth capacity within five years (Barton 2000).

Obviously, network management cannot be performed through the use of stovepipe network management systems, as it has been to date. Although it is imperative that service providers handle the network's exponential growth, it simply isn't feasible to use current expense ratios to do so. Quantum improvement in cost reduction is required to make scaling to this enormous size and complexity economically feasible. While OSS development, operational support and network management currently account for 50% of service providers' selling, general and administrative (SG&A) expenses, some service providers are targeting to reduce this figure to 10% (Green 2000). To realize this goal, service providers, hardware manufacturers and OSS vendors must collaborate in leveraging new technologies and re-engineering business processes to achieve greater efficiencies.

## Challenges in Providing Next-Generation Services

The challenges inherent in provisioning communications services are largely a product of the NGN business drivers. These drivers include

- Rapid growth in network size and capacity
- Introduction of new network technologies and service technologies in very short cycles
- Reduction in the time for providing support for new technologies and products
- Increased productivity demanded per operator and per expense dollar
- Globalization of network, services and support
- Intense corporate environment of mergers, acquisitions and divestitures
- Short supply of skilled technical labor

The efficient and timely delivery of diverse services over increasingly complex networks to a rapidly expanding market is—and will continue to be—the objective of service providers. While each type of provider offering services over the NGN faces its own unique operational complexities, they are generally presented with similar challenges in pursuit of a common goal. They all compete with incumbent local exchange carriers (ILEC), whose financial strength is derived from the advantages of scale, established brand and strong relationships with customers.

While striving to establish a viable presence in today's market, service providers should also take steps to position themselves to handle the long-term challenges posed by the development of the network. To that end, providers must look to

- **Increase new service innovation and time to market**

  Elizabeth Adams, President and CEO of TeleManagement Forum (TM Forum), warns that "margins from the traditional circuit-switched voice business will no longer be there to fuel the investment that must be made by service providers if they are to stake out a seat at the winner's table." Basic connectivity, she argues, is nothing more than a platform upon which next-generation winners will deliver services that have a direct bearing on their customers' bottom line (Adams 1999). In this era of rapid

technological change, shortened product life cycles and a volatile customer base, service providers must quickly develop and speed to market a broad range of new services tailored to the needs of their customers. Providers must also be able to protect their investment in existing services as they build, deliver, manage and support new services based on rapidly evolving technologies.

- **Offer superior customer care**

  While consumers may be most concerned with service and network performance, they also expect individualized customer service. Responsiveness is the watchword for NGNs. Providers must establish a pleasant and efficient means of conducting business throughout the customer life cycle, including customer targeting, account initiation, service provisioning and modification, service level agreement (SLA) monitoring and reporting, billing, account usage inquiry and reporting, service problem and performance management. Providers also must accommodate customer requests for specific quality of service (QoS) for each service, such as high-bandwidth throughput for Internet browsing or secure data transfer for E-commerce applications. Finally, providers must respond to the growing trend towards customer self-care by empowering their customers to be directly involved in the creation and maintenance of their accounts. To this end, computer aided telephony (CAT) and IPtel technology are being combined with Internet portals to provide multimedia enabled customer service. Eventually, these service centers will allow customers to reach the right expert any time, anywhere.

- **Realign their business model**

  Service providers must realign their business model to shift focus away from transport and access towards value-added services. Web-based customer self care is just one means by which providers can lower costs while providing higher levels of customer responsiveness. Similar measures must be adopted across the board to reduce providers' operating costs while improving their operational efficiency. For instance, features such as automated service fulfillment, an integrated billing solution and an integrated network management and service level management solution reduce manual labor requirements and improve efficiency by generating fast, accurate and reliable transactions. Still, these initiatives will produce only incremental improvements. Ultimately, providers will be unable to grow along with the projected expansion of the NGN without a revolutionary shift in their operations processes. Instead of thinking merely in terms of cost control, providers must radically reduce the expenses incurred in service delivery. While revolutionary technological breakthroughs may provide the answer in the long run, encouraging customers to become more involved in the entire service life cycle—from account creation to trouble reporting—is one potentially effective short-term solution.

## The OSS Solution

As the communications industry transforms, so too does the business of supplying, integrating and using OSS solutions. In response to the current and anticipated complexities of the NGN, several providers and vendors have been individually exploring new software technologies, fresh OSS architectures and the application of business re-engineering to service support. While some convergence of approaches has occurred and early implementations are taking place, this ad hoc method of change is not an effective way of driving this work to maturity. New standards are certainly required, but even more necessary is a new reference architecture for the NGN. The TM Forum is positioned to provide leadership in this endeavor; it is currently working towards substantiating the business case for a new model, outlining its requirements and proposing an architecture for its accomplishment. The results of these initiatives will be presented at TeleManagement World in November 2000.

According to the TM Forum, the building blocks of the NGN and the NGOSS have already been generally agreed upon. Together, the following features will ensure rapid, flexible, scalable, efficient and reliable service:

- Systems should be built from industry standard, compliant software components.
- Work-flow tools should be able to change system behavior and provide differentiation without reprogramming.
- Systems integration complexity and time scale should be significantly reduced.
- As many back-office operations as possible should be moved to front-office operations so that they can be performed in real time.
- Customers and operators should interface through a common Internet portal to follow processes and perform activities controlled by work management systems.
- Software applications should intercommunicate via pub/sub message busses built on component software, such as EJB and CORBA.
- New applications should be integrated via commonly shared business objects.
- Heritage applications should be integrated via enterprise application integration (EAI).
- Business functions should be divided by need into real-time support and off-line data warehouse applications.
- Policy driven management should enable near real-time system behavior updates.
- Direct object interfaces should exist between network elements.
- A component-based, plug and play framework should ensure interoperability and dynamically distributed management applications.
- Applications should be self-loading and self-managing.
- Networks should be end user focused.

To ensure that independent software vendors (ISV) develop OSSs in accordance with the evolving demands of the NGN, industry players should work together to set generic requirements and develop new standards through industry associations. Security, for instance, is an increasingly important issue as networks become more complex, and threats from viruses and hackers become more insidious. With clearly defined requirements from an association such as the TM Forum, service providers could collaborate with OSS vendors to revolutionize security measures so that they are effectively embedded in their systems. Furthermore, in addition to conducting studies to determine OSS scalability and quantify new efficiencies, OSS vendors and service providers should conduct trial development and deployment programs. To accomplish these initiatives, the industry will have to secure venture capital comparable to that provided for the network build out.

## Forces Affecting OSS Vendors

The TM Forum has recently pinpointed eight drivers affecting OSS suppliers:

(1) Profits must come from prepackaged solutions: OSS suppliers have to transform their businesses to provide market standard products instead of developing custom software solutions.

(2) Rationalization of development: Equipment suppliers want to rationalize their software development around a common product family but don't want to produce bottlenecks by having one group producing all of their software. Therefore, a parallel development model using common components and software sub-assemblies built to industry standards is now essential.

(3) Profitability challenges: Providers are turning to their equipment vendors for business, service and network management capabilities bundled into the network sale at or below cost. Although this tactic has proven to be risky, complex and apt to result in low return on investment, it has nonetheless depressed pricing expectations for OSS across the market.

(4) Disorganized industry structure: Systems design and architecture can no longer rely on a known and ordered implementation model because the service supply structure has become uncertain and chaotic.

(5) Longer value chain: Process chains are becoming longer and are crossing more organizational boundaries, thus increasing security concerns regarding information and network integrity.

(6) Time to market and price pressure: Increasing pressure to bring new networks and services to market quickly is driving down the time to deploy OSSs. Furthermore, operators expect suppliers to reap economies of scale and drive towards commodity pricing.

(7) Exponential increase in speed of service and network evolution: Many systems are becoming obsolete in the face of the rapid development and evolution of network technologies. Fundamentally different approaches—such as the move from circuit switched to packet switched technologies—sometimes necessitate the outright replacement of systems.

(8) Global shortage of software skills: Software needs are rising rapidly in all sectors of the information and communications industry. As a result, the OSS industry is driving towards reusable software based on industry-wide de facto standards so that software engineers from outside the communications sector can be quickly brought up to speed.

## Characteristics of an OSS for Managing Next-Generation Networks

To gain competitive advantage today and be well-positioned to remain competitive as the NGN develops, service providers should seek out forward-looking OSS vendors who have the following elements in their current solution, or in their product development goals:

- Emphasis on customer self service, and common customer and operator interfaces via the Web
- Emphasis on smart network technologies
- Rapid service development, real-time service delivery and real-time billing
- All-encompassing crypto-based security
- Business re-engineering of processes, emphasizing simplicity and re-use
- Application integration via common business objects
- Common management of applications, servers and network elements
- Distributed management applications
- Object-interfaces to network elements

It is important to note, however, that even as they work to meet the rapidly evolving needs of service providers, OSS vendors anticipate a fundamental re-visioning of the theories and models underpinning the entire industry. The Telecommunications Management Network (TMN) model as a narrow, pyramidal reference architecture is being supplanted by direct, guaranteed event/message delivery and by a tight transaction-based coupling of business, service and network elements. To remain competitive, OSS vendors must rethink their roles within the evolving model. Those that have traditionally offered service management solutions are compelled to expand their offerings to address business management and the customer-facing section of network management as well. OSS vendors who anticipate trends, such as the rise of policy-based management systems and the gradual integration of network management with service and element management, will lead the charge to overcome the future challenges of delivering and maintaining services over the NGN.

The current demand for OSS to manage NGNs is fueled by several factors:

- The NGN is a digital packet network and its services are mostly built on top of connectionless IP, which has more complex performance, activation and workflow requirements, including the need to manage special gateway functionality and interoperability with the public switched telephone network (PSTN).
- As NGN providers strive to increase responsiveness with fewer employees, they must rely on OSSs to speed services to market and to ensure customer satisfaction.
- Support software must be integrated and multi-functional.
- Internet middleware is providing more functionality and requiring that servers be managed as part of the network.
- Industry competition mandates a higher level of interactivity with customers, which requires that new bundles of service and applications be offered and managed.

An OSS designed with the present and future needs of service providers in mind will enhance their ability to respond to market opportunities and customers' specific communications requirements, resulting in better differentiation of product and service offerings. Service providers should look for an OSS that is

- Quickly deployed: A prepackaged solution can have the service provider up and running in three to four months.
- Rapidly integrated: Open systems frameworks enable the fast, flexible implementation and interoperability of best of breed solutions. Integrated network operations with service assurance delivers the highest availability and reliability of the network and resultant QoS to customers.
- Highly configurable: Service providers can tailor the software to define a whole range of specific functions and introduce new services via configuration.
- Component based: A components-based solution allows service providers to bring new users and functions on line simply.
- Automated: Through automation, service providers can define activities, task definitions, operational groups and their accountability; manage workflows relevant to handling different services; define escalation parameters; and configure service offerings from engineering components. Efficient, automated data flow ensures faster time to market at reduced service fulfillment costs.
- Flexible and massively scalable: The increased ability to negotiate multi-technology, multi-vendor and multi-platform environments enables service providers to readily adapt their systems to meet the demands of rapidly evolving technologies, customer needs and service offerings.

# Conclusion

There are some very large issues looming on the horizon that will significantly alter the manner in which all sectors of the global communications industry conduct business. Some expect that those who don't adapt will disappear by 2004. The remarkable growth and development of the next-generation network is driving this change. Communications providers offering services over the NGN will have to meet its complex challenges continually in order to succeed. Current trends indicate that they will likely refocus their attention on business processes and step up their efforts to create value for their customers. In response, OSS vendors must evolve their solutions to support these new processes and objectives. In fact, unprecedented cooperation among service providers, OSS vendors, equipment manufacturers and standards organizations will be required to achieve the industry overhaul necessary to enable providers to keep pace with the network. Those who recognize that this evolution requires revolutionary thinking will emerge as the major players in tomorrow's communications marketplace.

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