Telcordia Technologies
Performance from Experience

Next Generation Network (NGN) Services

A White Paper

1.0 Introduction

Intense competition is expected in the information networking arena over the next 5-10 years. As the competition increases, it will be essential for companies to position themselves appropriately to take advantage of their core competencies and to prepare for the emerging telecommunications environment. In this competitive environment, mergers, alliances, and the onslaught of new entrants into the market have service providers struggling to find innovative ways to retain and/or attract the most lucrative subscribers. Today's service providers are striving to differentiate themselves within this expanding competitive landscape by searching for ways to brand and bundle new services, achieve operational cost reductions, and strategically position themselves in relation to their competition. As Figure 1 illustrates, the top 15% of today's residential subscribers in the US are said to account for about 95% of carrier profits! Thus, many service providers are looking to Next Generation Network (NGN) services as a means to attract and/or retain the most lucrative customers.

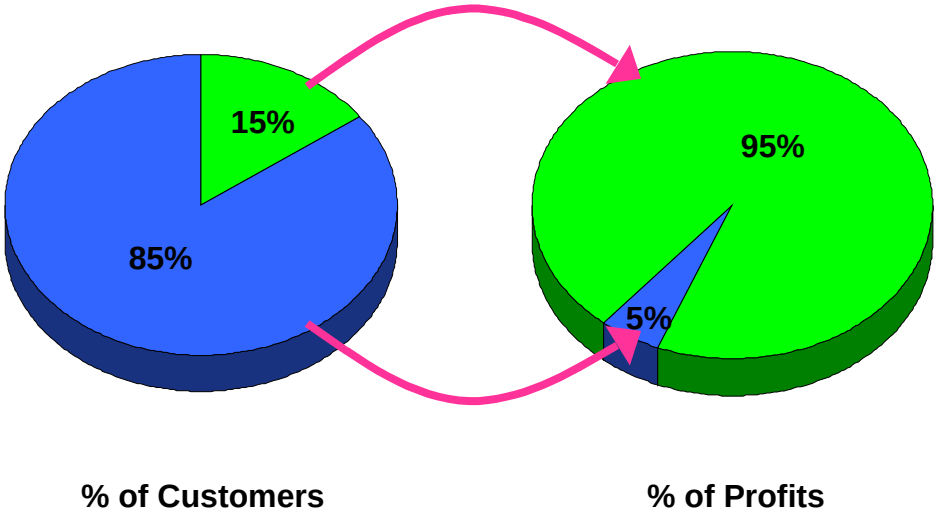

Figure 1: Carrier Profits from Residential Customers in US

While this paper is not intended to describe NGNs in detail, it may be helpful to provide a brief, high-level definition of what an NGN is to help set the stage for the remainder of the paper. For

this paper, an NGN can be thought of as a packet-based network where the packet switching and transport elements (e.g., routers, switches, and gateways) are logically and physically separated from the service/call control intelligence. This control intelligence is used to support *all* types of services over the packet-based transport network, including everything from basic voice telephony services to data, video, multimedia, advanced broadband, and management applications, which can be thought of as just another type of service that NGNs support.

From a user's perspective, today's networks have come a long way in fulfilling their purpose of enabling people and their machines to communicate at a distance. However, a key critical success factor (among many) is focused telecommunications industry attention on NGN service concepts and how these concepts can be realized in an NGN environment, from the edges to the core of the network. This focus is lacking today, with most of the attention on specific NGN technology issues. For example, what type of access will be supported (e.g., Hybrid Fiber Coax [HFC], Asymmetric Digital Subscriber Loop [ADSL], wireless, others)? How will the backbone transport network be designed (e.g., based on Internet Protocol [IP], Asynchronous Transfer Mode [ATM], others)? How will operations and management be handled in this new environment? Although these are all critical questions, we believe the most important issues to be addressed relate to NGN services and how they can be realized in an NGN environment. Common industry understanding of an NGN services vision will help crystallize the requirements for each of the technology issues, as well as identify areas where industry cooperation is needed.

This White Paper addresses three critical questions:

- Why are NGNs important for service providers?
- What are the important trends, characteristics, and services in an NGN environment?
- What attributes should a Next Generation Service Architecture possess?

2.0 NGN Value Proposition for Service Providers

The Internet community is already well on its way to handling all of our emerging and new service needs. Their solution is simple…with advanced CPE such as PCs, smart phones, set-top boxes, etc., much of the "intelligence" should be pushed out to the edges of the network. Services will execute at the end systems. Enterprise, computing, and software companies (and an increasing number of college and high school computer science students) will develop the applications and download them over the Internet to our smart CPE. All we need from the public network carriers is reliable, high-bandwidth transport.

So why should traditional telecommunications carriers care about NGN services? Why don't they just throw in the towel, forget about providing network-based NGN services, and focus on their wholesale "pipe" business? Let us count the reasons:

1. Public network carriers may survive with this strategy (if they're lucky), but they certainly won't prosper. The "pipe" business is increasingly becoming a commodity business. Network providers are being forced to compete by price for ever-shrinking profit margins. In the mean time, competitors are offering more sophisticated services to skim off the incumbents' high-margin customers. If the public network carriers want to prosper in the new millennium, they must find ways to add value to their transport services. NGNs that

support new advanced services will allow them to retain key customers and expand their addressable markets into new areas.

2. One size doesn't fit all. There is no doubt that services for certain customers will migrate out to the edges of the network. Public network providers cannot prevent this trend. However, that doesn't mean they should hide their heads in the sand and admit defeat. The new information services business is going to be a multi-billion dollar industry. There's plenty to go around. After all, even though many people have answering machines sitting on their nightstands, the public network carriers are making quite a profit with their network-based voice messaging service offerings! The reality is that some customers will want CPE-based services, but others will prefer network-based services.

3. Network-based services make sense. For small numbers of simple services that do not require interworking between one another, the CPE-based approach is adequate. However, as the number, sophistication, and degree of interworking between services increases, network-based approaches hold a number of important advantages. For example, network-based approaches provide more efficiency and scalability than CPE-based approaches. With CPE-based approaches, the CPE will need to become more sophisticated (and therefore, more expensive) to keep up with the demands of more advanced applications. Network-based solutions allow for shared resources and economies of scale to meet these demands. Secondly, it is more difficult to support service and user mobility with CPE-based approaches. If users want to access their services from a different location, they will need to bring their CPE with them or download software at the new location, wasting time and network resources. With network-based services, users can authenticate themselves from wherever they are and gain access to their complete suite of services. Finally, customer care, billing, configuration management, provisioning, and other management concerns are more easily handled with network-based solutions. History has shown that most end users quickly tire of loading applications themselves, keeping their software and hardware up to date, and troubleshooting when problems arise. Some like to "tinker", and see this as a hobby, but most would prefer to get on with more meaningful activities by "outsourcing" these tedious duties to someone else.

4. The network is the computer. Sun Microsystems and IBM have been saying it for quite a while, and even Microsoft is starting to admit it with a number of their recent press announcements and acquisitions. In a recent interview, Scott McNealy, the CEO of Sun Microsystems, described why he believes the traditional telecommunications carriers are the most logical providers of this new network. He stated, "(The telephone companies) have done dialtone or video tone or wireless tone or whatever for a long time. They've done it very well and, in fact, have provided tone far more reliably and predictably and credibly than we have in the computer industry with our current models of computing. I just see moving naturally back to the service provider to provide Web-site tone, application tone, video tone, mail tone, you-name-it tone to all of us in a much better way." What gives Mr. McNealy such faith in the telephone companies? "Reliability. Ubiquity. They know how to bill millions of people for billions of small transactions. They have a field service organization, the man in the van. They have the infrastructure. So it's a natural. It's just unnatural for individuals to have 50 million lines of software on their desktop with volume managers and file managers and backup systems and antiviral

utilities from Norton and a 4,000-feature word processor. I mean, there is just something totally, absolutely, completely unnatural about a PC. It's about as natural as building and flying your own airplane or having a nuclear power plant in your basement."

NGNs will allow carriers' networks to cost effectively support a new suite of sophisticated services by building on core competencies related to traditional transport services. In addition, a unified and consistent NGN approach will help reduce costs by eliminating the inefficiencies of current service-specific, proprietary, and non-reusable solutions. NGN approaches will also reduce the time to market and life-cycle costs of offering new services. Finally, NGNs will enable carriers to deploy advanced services, allowing them to remain competitive as well as expand their capabilities to enter new markets. The bottom line is that, in addition to their wholesale transport businesses, public network carriers should (and must) pursue Next Generation Service Architectures to offer value-added services. As Figure 2 states, this will be their new strategic differentiator.

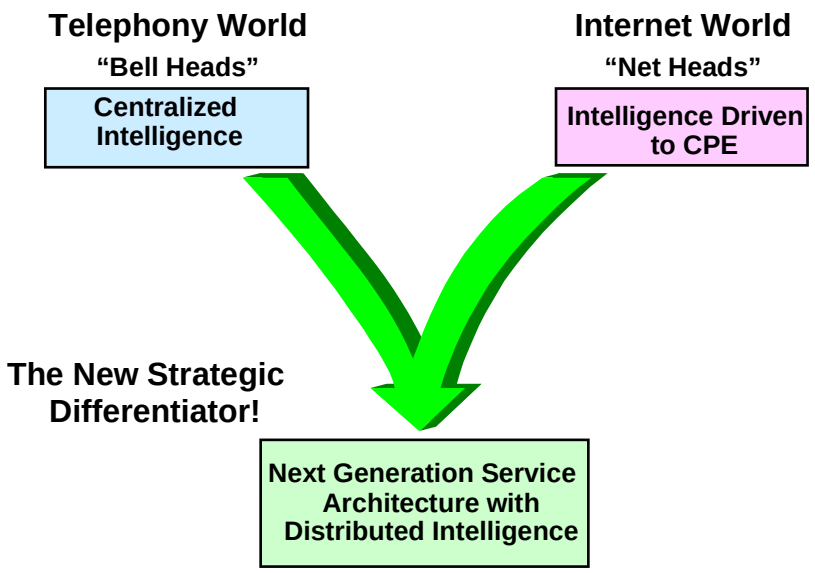

Figure 2: Convergence of Telephony World and Internet World

3.0 Next Generation Services

"Making predictions is risky, especially when it involves the future." - N. Bohr

3.1 What Do We Know? – NGN Service Characteristics

Although it is difficult to predict what the next killer applications will be, we can infer the types of service characteristics and capabilities that will be important in the NGN environment by examining current service-related industry trends. It is certainly true that we are moving from Time Division Multiplex (TDM)-based, circuit switched networks to packet-, cell-, and frame-based networks. However, these changes in the transport networks are merely enablers for the dramatic changes we will see at the service level.

The major thrust of traditional network service providers has been to offer the mass market basic transport of information between end users, with various value-added capabilities. These services tended to involve narrowband voice calls, with a single point-to-point connection per call. However, this view of services is rapidly changing as the world's economies are becoming increasingly reliant on information as a basic resource.

While existing services will remain part of service providers' offerings, customers' expectations will migrate towards more advanced broadband multimedia and information intensive services. End users will interact with the network via sophisticated CPE, and be able to select from a wide range of Quality-of-Service (QoS) and bandwidth. In the future, network intelligence will not just relate to the creative routing of connections based on simple database look-ups, but may take on a much broader meaning (e.g., multimedia session management, coordination of multi-technology connections, intelligent management/operations, advanced security, true user agents, user-installable scripts/applets, on-line directory services, and proxy agents).

The current evolution of telecommunication services points to a world where service providers will have the flexibility to focus on micro-marketing (as opposed to mass-marketing). Decisions about their service offerings may have as much to do with packaging (e.g., pricing, bundling, marketing, and convenience), as they will with the actual services offered. As multiple carriers, service providers, equipment vendors, and other business entities all become involved in providing services to end users, federated network and business systems will become increasingly important.

The primary goal will be to enable users to get the information content they want, in any media/format, over any facilities, anytime, anywhere, and in any volume. Based on the above-mentioned trends, the following is a summary of several service characteristics likely to be important in an NGN environment:

- Ubiquitous, real-time, multi-media communications - The only hope for dramatically increased fidelity, akin to communicating in person, is high-speed access and transport for any medium, anytime, anywhere, and in any volume.
- More "personal intelligence" distributed throughout the network - This includes applications that can access users' personal profiles (e.g., subscription information and personal preferences), learn from their behavior patterns, and perform specific functions on behalf of them (e.g., "intelligent agents" that notify them of specific events or that search for, sort, and filter specific content).
- More "network intelligence" distributed throughout the network - This includes applications that know about, allow access to, and control network services, content, and resources. It can also perform specific functions on behalf of a service or network provider (e.g., "management agents" that monitor network resources, collect usage data, provide troubleshooting, or broker new services/content from other providers).
- More simplicity for users - This shields users from the complexity of information gathering, processing, customization, and transportation. It allows them to more easily access and use network services/content, including user interfaces that allows for natural interactions between users and the network. It involves providing context-sensitive options/help/information, transparently managing interactions among multiple services,

providing different menus for novices vs. experienced users, and providing a unified environment for all forms of communication.

- Personal service customization and management - This involves the users' ability to manage their personal profiles, self-provision network services, monitor usage and billing information, customize their user interfaces and the presentation and behavior of their applications, and create and provision new applications.
- Intelligent information management - This helps users manage information overload by giving them the ability to search for, sort, and filter content, manage messages or data of any medium, and manage personal information (e.g., calendar, contact list, etc.).

3.2 What Don't We Know? – Specific NGN Services

Although we have a feel for the types of service characteristics that will be important in an NGN environment, no one really knows what the "killer applications" will be. Fortunately, the Next Generation Service Architecture will enable a number of key features that can be particularly beneficial to a wide array of potential services.

A variety of services, some already available, others still at the conceptual stage, have been linked to NGN initiatives and considered likely candidates for NGN implementations. While some of these services can be offered on existing platforms, others benefit from the advanced control, management, and signaling capabilities of NGNs. Although emerging and new services are likely to be the strongest drivers for NGNs, most of the initial NGNs profits may actually result from the bundling of traditional services. Thus, bundled traditional services will pay for the network, whereas emerging services will fuel the growth.

Most traditional services relate to basic access/transport/routing/switching services, basic connectivity/resource and session control services, and various value-added services. NGNs will likely enable a much broader array of service types, including:

- Specialized resource services (e.g., provision and management of transcoders, multimedia multipoint conferencing bridges, media conversion units, voice recognition units, etc.)
- Processing and storage services (e.g., provision and management of information storage units for messaging, file servers, terminal servers, OS platforms, etc.)
- Middleware services (e.g., naming, brokering, security, licensing, transactions, etc.)
- Application-specific services (e.g., business applications, e-Commerce applications, supply-chain management applications, interactive video games, etc.)
- Content provision services that provide or broker information content (e.g., electronic training, information push services, etc.)
- Interworking services for interactions with other types of applications, services, networks, protocols, or formats (e.g., EDI translation)
- Management services to maintain, operate, and manage communications/computing networks and services.

Figure 3 and the following text give a brief description of several services that we currently believe will be important drivers in the NGN environment (e.g., in terms of how pervasive they will be, how much profit margins they are likely to generate, how much they will benefit from an

NGN type of environment, and/or how "glamorous" they are). We intentionally included a broad range of services (e.g., from basic voice telephony to more futuristic services such as Distributed Virtual Reality) to emphasize that the Next Generation Service Architecture will support a wide variety of services.

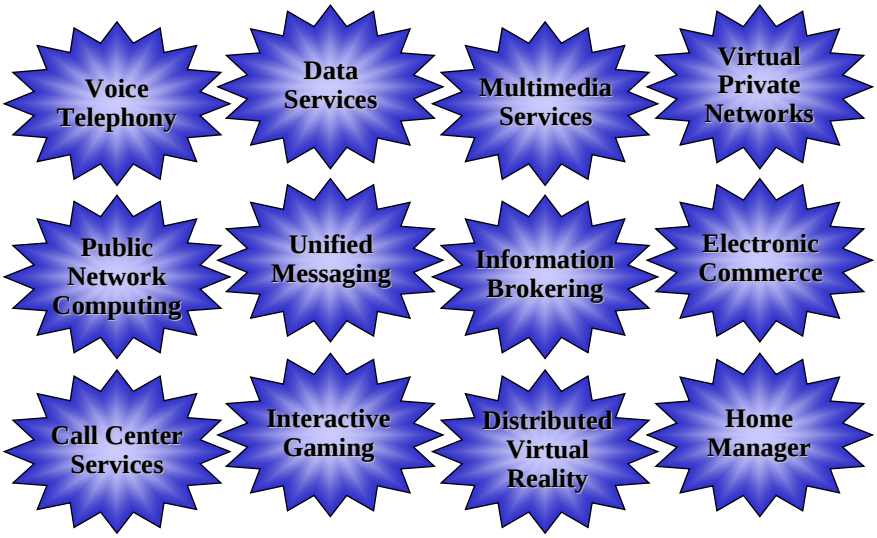

Figure 3: Example NGN Service Drivers

- Voice Telephony – NGNs will likely need to support various existing voice telephony services (e.g., Call Waiting, Call Forwarding, 3-Way Calling, various AIN features, various Centrex features, and various CLASS features). Note, however, that NGNs are not trying to duplicate each and every traditional voice telephony service currently offered. Rather, they will likely attempt to support only a small percentage of these traditional services, with an initial focus on the most marketable voice telephony features and the features required from a regulatory perspective.
- Data (Connectivity) Services – Allows for the real-time establishment of connectivity between endpoints, along with various value-added features (e.g., bandwidth-on-demand, connection reliability/resilient Switched Virtual Connections [SVCs], and bandwidth management/call admission control).
- Multimedia Services – Allows multiple parties to interact using voice, video, and/or data. This allows customers to converse with each other while displaying visual information. It also allows for collaborative computing and groupware.
- Virtual Private Networks (VPNs) – Voice VPNs improve the interlocation networking capabilities of businesses by allowing large, geographically dispersed organizations to combine their existing private networks with portions of the PSTN, thus providing subscribers with uniform dialing capabilities. Data VPNs provide added security and networking features that allow customers to use a shared IP network as a VPN.

- Public Network Computing (PNC) – Provides public network-based computing services for businesses and consumers. For example, the public network provider could provide generic processing and storage capabilities (e.g., to host a web page, store/maintain/backup data files, or run a computing application). The public network provider would charge users for the raw processing and storage used, but would have no knowledge of the specific content/application. Alternatively, the public network provider could provide specific business applications (e.g., Enterprise Resource Planning [ERP], time reporting, vouchers, etc.) or consumer applications (e.g., TaxCut, kitchen remodeling program, etc.), with all or part of the processing/storage happening in the network. The public network provider could charge based on an hourly, daily, weekly, etc. licensing fee for the service (e.g., rent-an-app).
- Unified Messaging – Supports the delivery of voice mail, email, fax mail, and pages through common interfaces. Through such interfaces, users will access, as well as be notified of, various message types (voice mail, email, fax mail, etc.), independent of the means of access (i.e., wireline or mobile phone, computer, or wireless data device).
- Information Brokering – Involves advertising, finding, and providing information to match consumers with providers. For example, consumers could receive information based on pre-specified criteria or based on personal preferences and behavior patterns.
- E-Commerce – Allows consumers to purchase goods and services electronically over the network. This could include processing the transactions, verifying payment information, providing security, and possibly trading (i.e., matching buyers and sellers who negotiate "trades" for goods or services). Home banking and home shopping fall into this category of services. This also includes business-to-business applications (e.g., supply-chain management and knowledge management applications).
- Call Center Services – A subscriber could place a call to a call center agent by clicking on a Web page. The call could be routed to an appropriate agent, who could be located anywhere, even at home (i.e., virtual call centers). Voice calls and e-mail messages could be queued uniformly for the agents. Agents would have electronic access to customer, catalog, stock, and ordering information, which could be transmitted back and forth between the customer and the agent.
- Interactive gaming – Offers consumers a way to meet online and establish interactive gaming sessions (e.g., video games).
- Distributed Virtual Reality – Refers to technologically generated representations of real-world events, people, places, experiences, etc., in which the participants in and providers of the virtual experience are physically distributed. These services require sophisticated coordination of multiple, diverse resources.
- Home Manager – With the advent of in-home networking and intelligent appliances, these services could monitor and control home security systems, energy systems, home entertainment systems, and other home appliances. Imagine you're watching television and the doorbell rings – no problem – you just use the TV's remote to get a view of your front entrance to see who's there. Or imagine monitoring your house while you're away on a trip, or your in-house nanny watching your children while you're at work.

4.0 Next Generation Service Architecture

Many existing applications were developed in a "stovepipe" fashion, hard-coded for a specific type of transport. For carriers wishing to support a limited set of applications over a limited number of transport mechanisms, this strategy is adequate. This "stovepipe" approach might even provide better performance, reliability, etc. since the platform is tailored for each specific application/transport combination. However, as the number of applications and types of transport increases, the "stovepipe" approach can become quite inefficient. For example, looking across a larger sample of applications over a larger number of transport types, there are more similarities than differences in the types of support required (e.g., billing, security, setting up connections, signaling protocols, etc.). Thus, as the number of supported applications increases, it becomes quite inefficient to provide specialized mechanisms for session control, connectivity control, middleware, signaling, interworking, etc.

As Figure 4 illustrates, one of the primary goals of NGNs is to provide a common, unified, and flexible control environment that can support multiple types of services and management applications over multiple types of transport. This section describes three critical characteristics of this Next Generation control environment.

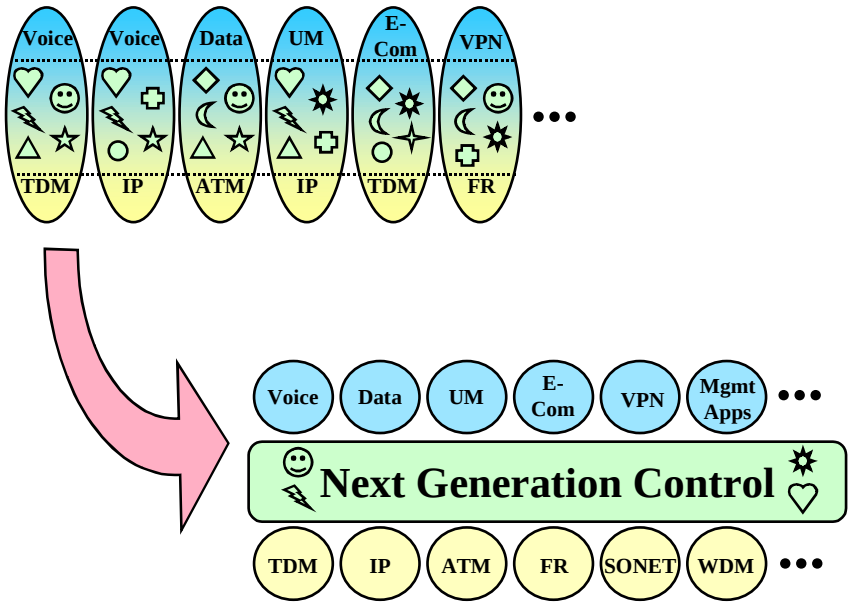

Figure 4: Next Generation Control

4.1 Architectural Layering

The concept of architectural layering is central to NGN environments. First and foremost, NGNs cleanly separate service/session control from the underlying transport elements. This allows carriers to choose (for their particular situations) the "best-in-breed" transport elements independent from the "best-in-breed" control software. As Figure 5 shows, NGN control can then be decomposed into feature control, service/session control, and connectivity control. The

clean separation between access, service, and communications session control within the Service Layer allows each type of session to be treated independently from the others. Thus, multiple service sessions can be started from a single access session. Likewise, communications sessions can be treated separately from the overall service session they are part of (i.e., thereby allowing for separated call and connectivity control). Most importantly, these separations allow for services to be developed independently from underlying transport and connectivity considerations. Thus, service developers will no longer need to know anything about the type of transport used for the services they are developing.

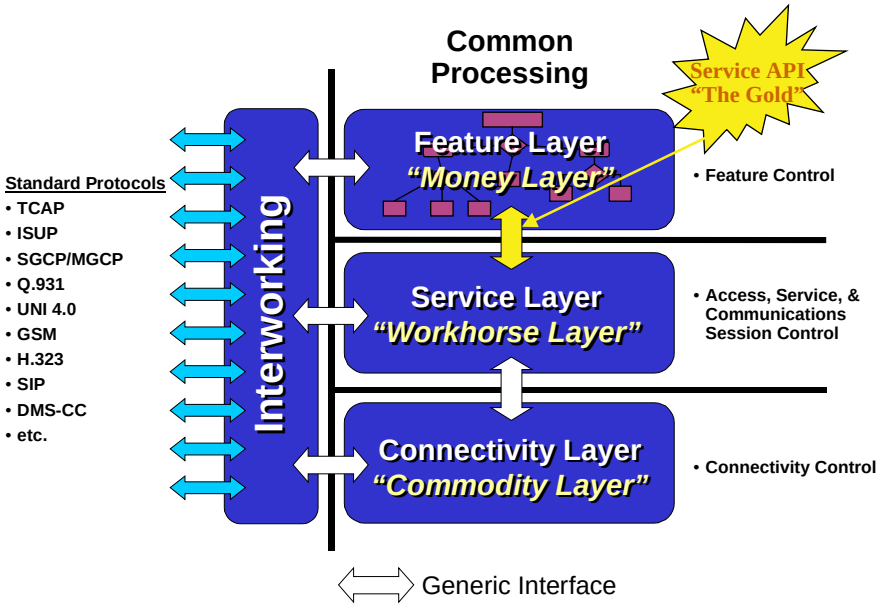

Figure 5: Architecture Layering/Open Service Interfaces

4.2 Open Services Interface/API

Figure 5 also shows another essential attribute of the Next Generation Service Architecture (i.e., its reliance on open architecture and interfaces). In particular, an open development environment based on an Application Programming Interface (API) will enable service providers, third party application developers, and potentially end users to create and introduce applications quickly and seamlessly. This will speed the introduction of new services by giving service providers more control over the service introduction process and allow for the reuse of existing application components. It will also open the opportunities for creating and delivering services to a broader audience. Our ability to offer new and creative services will only be limited by our imaginations.

4.3 Distributed Network Intelligence

In an NGN services environment, the scope of marketable services can be greatly extended to include a much richer variety of services and associated network intelligence. The NGN Distributed Processing Environment (DPE) will uncouple this network intelligence from physical network elements. Thus, network intelligence can be distributed to the most suitable locations in the network or, if appropriate, to the CPE. For example, network intelligence could reside on

general purpose servers running the components needed for a particular service, on servers that perform specific functions (e.g., Service Control Points [SCPs], Intelligent Peripherals, and Services Nodes in an AIN environment), or on edge devices close to the consumer. Functional capabilities will no longer be coupled with the physical network elements.

5.0 Conclusions

From a user's perspective, today's networks have come a long way in fulfilling their purpose of enabling people and their machines to communicate at a distance. However, a key critical success factor (among many) is focused telecommunications industry attention on NGN service concepts and how these concepts can be realized in an NGN environment, from the edges to the core of the network. This focus is lacking today, with most of the attention on specific NGN technology issues. However, we believe the most important issues to be addressed relate to NGN services and how they can be realized in an NGN environment. Common industry understanding of a Next Generation Service Architecture will help crystallize the requirements for each of the other NGN technology issues, as well as identify areas where industry cooperation is needed.

This White Paper addressed three critical questions related to NGN services:

- Why are NGNs important for service providers? - Public network carriers should (and must) pursue NGNs to offer value-added services. This will be their new strategic differentiator!
- What are the most important trends, characteristics, and specific services in an NGN environment? – Although it is difficult to predict what the next killer applications will be, this paper lists service characteristics and capabilities that will be important in the NGN environment based on service-related industry trends. It also describes a number of services we currently believe will be important drivers in the NGN environment.
- What attributes should a Next Generation Service Architecture possess? - One of the primary goals of NGNs is to provide a common, unified, and flexible service architecture that can support multiple types of services and management applications over multiple types of transport. This paper described three critical attributes of this Next Generation Service Architecture (i.e., architectural layering, an open services interface/API, and distributed network intelligence).

About the Author:

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