Shasta 5000 Broadband Service Node in the Wireless IP Space

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Introduction

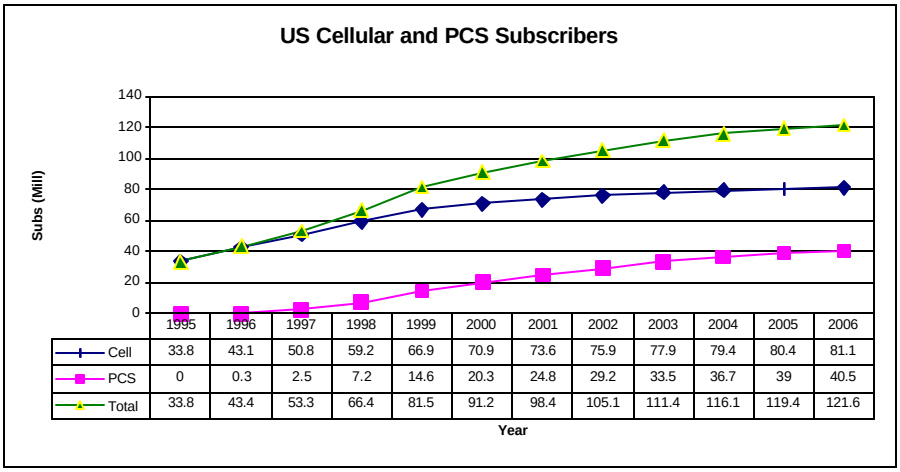
It is estimated that by 2002 there will be over 1-billion wireless subscribers worldwide (ref. Cahners In-Stat). This figure will be driven, in part, by the convergence of Wireless and the Internet. The Internet is used for information gathering, education, shopping and entertainment, as well as everyday communication among people. The Internet also provides new opportunities for service providers. It has ushered in a host of new traffic and a new set of services to be offered, such as web hosting, e-mail service, and IP-based virtual private networking for corporations. All of these factors are driving growth in data traffic and are fundamentally changing telecommunication networks. Established carriers and service providers are faced with the challenge of reconfiguring their voice networks to handle the explosive growth of data, while at the same time looking for new ways to leverage the investment in their installed base.

The wireless Internet brings the convenience and advantages of mobility to Internet consumers by providing quality and reliability. By delivering the full power of the Internet to a host of mobile devices, the wireless Internet will bring together the islands of communications: home, office, mobile.

Wireless Market

The number of wireless subscribers is expected to grow substantially over the next few years. Strategis Group forecasts a 19% compound annual growth rate (CAGR) across the industry. Many regions will continue to experience even higher growth. The network build outs of today's 2G digital networks are bringing new subscribers to the wireless market for the first time. As wireless networks begin upgrading to 2.5G, off loading data traffic from the switch backbone to edge routers, this growth should accelerate even more.

Analysts project almost half a billion global wireless subscribers between 2000 and 2001, representing about 40% of the developed world. The US Wireless market (Figure 1) will surpass 100 million subscribers by mid 2001. To think that in 1983 the industry predicted 1 million subscribers by 2000!



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Cell	33.8	43.1	50.8	59.2	66.9	70.9	73.6	75.9	77.9	79.4	80.4	81.1
PCS	0	0.3	2.5	7.2	14.6	20.3	24.8	29.2	33.5	36.7	39	40.5
Total	33.8	43.4	53.3	66.4	81.5	91.2	98.4	105.1	111.4	116.1	119.4	121.6

Figure 1 US Wireless Market (IDC 1999)

The convergence of wireless and Internet markets will create new revenue and marketing opportunities for wireless operators, service providers and content providers. New partnerships will need to be formed in order to provide services such as Wireless Access Protocol (WAP), location based services, device based services, and personalized mobile web sites. These new partnerships will help operators retain their current subscribers and add new ones.

Revenue estimates for the wireless Internet market predicted growth at a rate of over 30% from 1999 to 2004 (Figure 2). During this same period, the number of wireless Internet subscribers will increase from just under 5 million in 2000, to over 50 million by 2004. This will mean enormous opportunity for wireless operators. New revenue opportunities will be in mobile commerce, advertising and content.

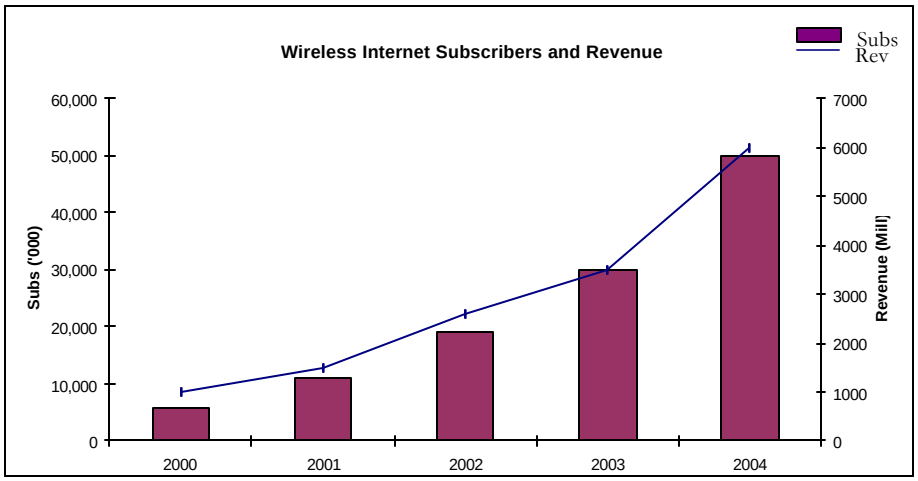


Figure 2 US Wireless Internet Market Forecast (Strategies 1999)

Value Chain

Wireless operators face increased competition for mobile voice services, increasing the pressure on margins. Major factors influencing the dynamics of the wireless industry today include decreasing prices, continued subscriber growth, and stable minutes of use (Figure 3).

Date	Bill ($ per month)	Call time (min)
12/1987	$96.83	2.33
12/1999	$41.24	2.38

Figure 3 US Historical Revenue and Call Time Data (CTIA '00)

Competition has lowered per-minute pricing from 30 cents just a couple of years ago, to 15-18 cents or less, depending on the bundled service plan offered. This has resulted in reduced revenue per subscriber. This decline could continue to as low as 4-6 cents per minute on a global average basis.

Subscriber growth, though still quite strong, is slowing somewhat. The need to attract and retain high quality/high revenue subscribers remains critical as churn continues to erode margins.

To ensure successful deployment of a wireless Internet strategy, a new business model needs to be developed. Historically, the operator "owned" the value chain because they owned and maintained the network and acted as the service provider to offer the only available service – voice. With the Internet revolution, users now demand more numerous and more powerful services and content. To meet these changing expectations, the wireless Internet value chain must expand and evolve (Figure 4). Revenue generation will move from an access only based model, to a service/content subscription based one.

The new wireless Internet value chain will incorporate new players (i.e., service providers, content portals, etc.) who have expertise needed to implement wireless Internet services. The operator no longer owns the entire value chain and will now partner with other content and service providers to deliver maximum value to the subscriber base. The right combination of network elements, services, applications and professional services will ensure the successful implementation of a wireless Internet solution.

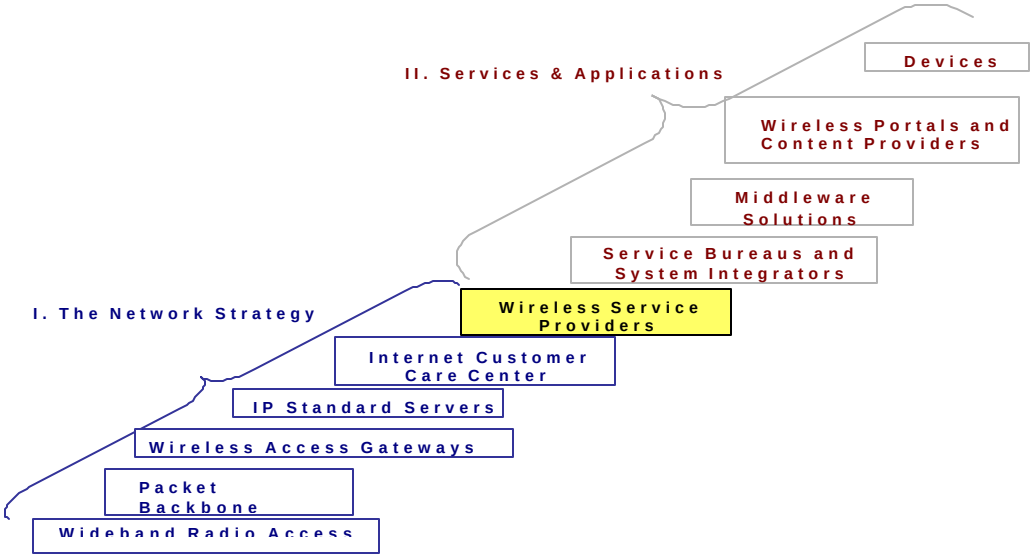


Figure 4 Value Chain

Combining the value and usefulness of the Internet with wireless access will create even greater opportunity for service providers and operators. Many of today's wireless voice subscribers want to extend mobility to their data applications. In fact, 38% of voice subscribers rank wireless Internet access as their most desired service (Yankee Group).

A tremendous opportunity exists to combine wireless networks and the Internet into a more powerful application. Integrating the value of mobility with the richness of content available on the Internet will meet the pent-up demand.

One such example of the new Internet value chain is the emerging Business to Employee (B2E) market. The focus of this market strategy is for service providers and corporate intranets to team up, to provide employees with discount products and services. The employees gain from the benefit of volume discounts, while employers can strengthen retention by offering these discounts. Operators will benefit from the increased traffic from a large captive group. A look at the 'Fortune-100' corporate roster will show the potential number of new subscribers list (Figure 5).

Company	# Employees
Boeing	190,000
Delphi	213,000
Ford	345,000
GM	388,000
Pepsi	151,000

Figure 5 Select Fortune 500 Companies (Info World '00)

Shasta's Role and Advantages

The Shasta 5000 Broadband Service Node (BSN) will be implemented in support of next generation 2.5G and 3G wireless systems. With the Shasta 5000 BSN deployed in conjunction with next generation wireless systems, operators can achieve security and scalability, offering subscribers customized service level agreements (SLAs) with services such as Virtual Private Networks (VPNs), all through open interfaces and self-provisioning (Figure 6).

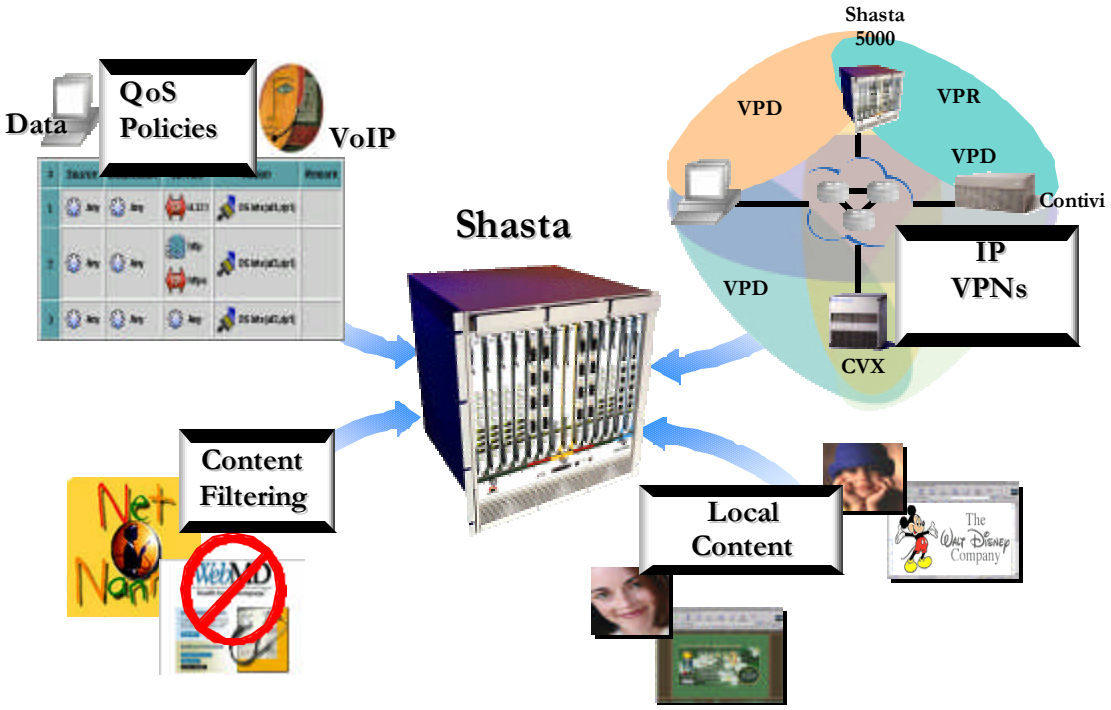


Figure 6 Shasta 5000 High Touch Services

The Service Creation System (SCS) is at the heart of Shasta's high-touch services. The SCS integrates with the Shasta 5000 BSN hardware platform and operating system, enabling a very powerful service definition system that is designed to allow rapid creation of customized IP service policies. Some of these high touch services are:

- Security (firewalls, anti-spoofing)
- Virtual Private Networks (VPNs)
- Queing (defining burst sizes, as in frame relay)
- DiffServ (for setting grade of services)
- Accounting
- Policing
- Support for Content Filtering Services (for example, Net Nanny)
- Captive Portals

The SCS allows operators to create system-wide service policies and service profiles that can be applied to individual subscribers or groups of subscribers.

Tailored SLAs based on the subscriber and traffic – allow the service provider to offer tailored services to individual subscribers based on the subscriber and their applications. With Shasta 5000 BSN, the network is able to recognize each specific mobile user irrespective of where the subscriber is connecting to the network, and apply the SLA to their traffic. The Shasta 5000 BSN is able to distinguish between the different traffic streams, such as Internet file downloads or voice calls, and will be able to give higher priority to voice traffic via DiffServ (Differentiated Services) priority levels. With DiffServ, operators can set priorities ranging from the highest priority level 4 to the lowest priority level 1.

Fast provisioning of new subscribers – is made possible through templates which enable the operator to add new users to the network quickly.

Fast authentication – allows thousands of subscribers simultaneous authentication, which is ideal for mobile wireless. The Shasta 5000 BSN supports the industry standard Remote Authentication Dial-In User Services (RADIUS) client software, which can interface to the network operator's chosen RADIUS server.

Scalable – the Shasta 5000 BSN is able to handle thousands of users and scale to meet the future growth of mobile networks.

VPN support – the Shasta 5000 BSN supports multiple IP-VPNs, which will allow the support of multiple Service Provider contexts. This will allow the carrier to offer their network to a range of service providers who will, in turn, be able to offer value-added services.

Security and encryption – the built-in state aware inspection firewall is supported.

Accounting and billing – the Shasta 5000 BSN provides the raw data of the subscriber sessions to the Radius server to enable billing and accounting per subscriber as specified in the Radius standards.

Open interfaces – the Shasta 5000 BSN supports both the Common Object Request Broker Architecture (CORBA) interface for network management, and Lightweight Directory Access Protocol (LDAP) for directory services. The CORBA interface will allow the Shasta 5000 BSN system to be integrated into the operator's existing umbrella standards-based Telecommunications Management Network (TMN) management system using industry standard interfaces. LDAP support will allow the integration into industry standard directory services. LDAP will maintain the external subscriber databases that could be integrated with applications such as loyalty card schemes, and structured to keep records of what type of web sites the user accesses to allow targeted marketing.

Next Generation Wireless Networks

Next generation Internet Protocol (IP) networks, will provide wireless Internet access for 2.5G/3G, based on Code Division Multiple Access (CDMA), Time Division Multiple Access (TDMA) or Global System for Mobile Communication (GSM) interfaces. Current mobile networks will evolve to next generation networks capable of supporting data rates from 144Kbps to 384Kbps, and eventually, to 2Mbps (Figure 7).

Technology	2G	2.5G / 3G
CDMA	Circuit, 14.4Kbps	1x - 3x ,144 – 384Kbps
TDMA	Circuit, 9.6Kbps	GPRS/EDGE, upto 384Kbps and UMTS
GSM	Circuit, 9.6Kbps	GPRS/EDGE, upto 384Kbps and UMTS

Figure 7 Wireless Technology Road-Map

CDMA/GSM/TDMA, today's current wireless networks, are based on the traditional 'Telco' voice switching platforms. The switch is the focal point for most network controls, such as call flows (voice or data) and signaling (Figure 8). As a result, data and voice are treated no differently, despite the fact that each have very distinctive characteristics.

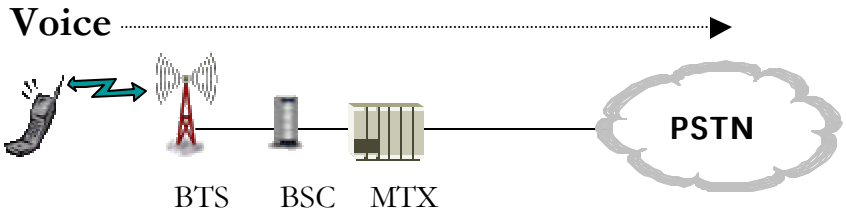


Figure 8 Standard Voice Network

Wireline Internet access is based on IP centric networks, optimized for data traffic. The convergence of wireless and the Internet will be the result of an IP network extension to the pre-existing voice network, taking full advantage of the existing wireless network investments and providing IP access. The IP based architecture will redirect data traffic at the Base Transceiver Station (BTS), or Base Station Controller (BSC), to the IP gateway, or broadband service node (i.e. Shasta 5000 BSN) (Figure 9). This architecture allows the switch to handle all the voice services without the added congestion of data traffic.

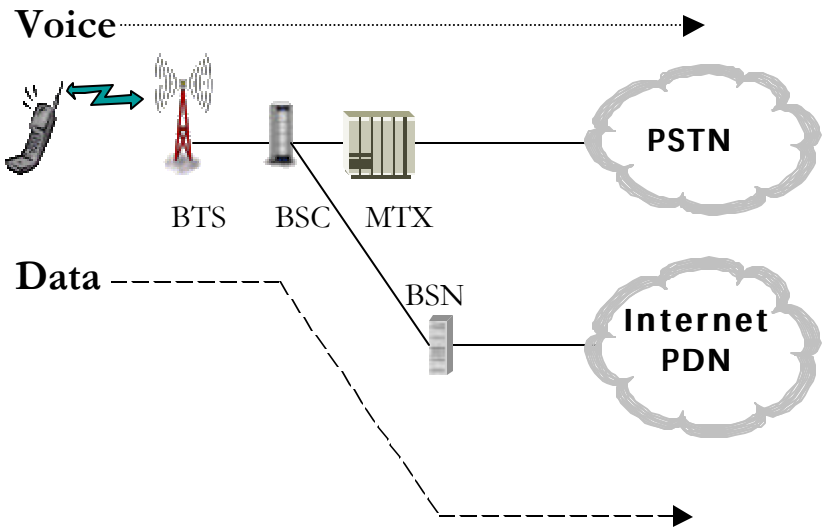


Figure 9 Voice / Data Network Overlay

CDMA

For Nortel's 2.5G CDMA 1xRTT (1 x 1.25MHz Radio Transceiver Technology) network, the Shasta 5000 will provide the functionality for the Packet Data Services Node (PDSN). As data traffic enters the BSC, it is routed to the PDSN (Figure 10).

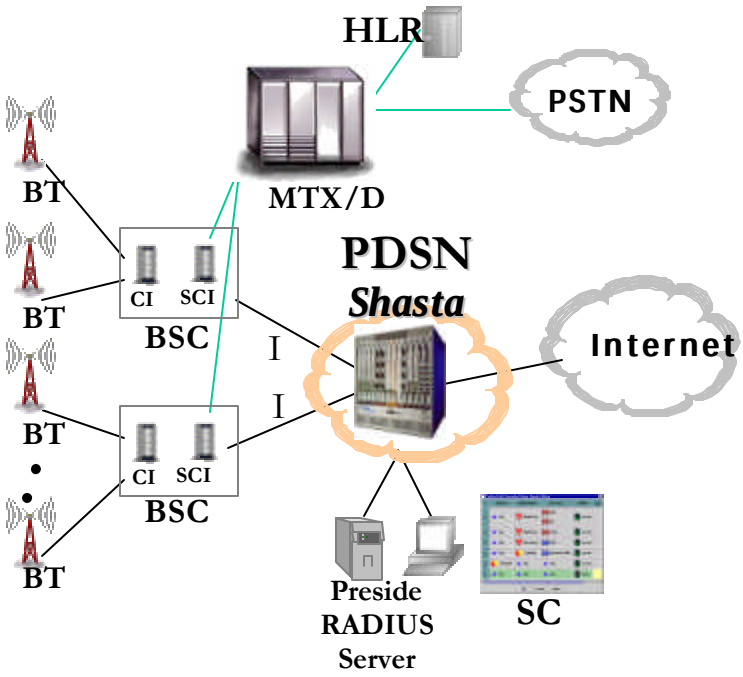


Figure 10 CDMA 1xRTT Network

At the PDSN, the Shasta 5000 BSN goes beyond providing basic router aggregation functionality at the subscriber edge. At the subscriber edge, it is important to have the ability to identify each individual subscriber. Without knowing "who" the subscriber is, value-added services cannot be targeted to a specific user or users. At that point, the network would only be aggregating IP pipes.

GSM/TDMA

The Shasta 5000 BSN is access technology agnostic, making it the perfect solution for multiple applications, such as DSL, Cable, CDMA, GSM or TDMA. For this reason, Nortel has selected the Shasta 5000 BSN as the IP gateway for the GSM and TDMA 2.5G network evolution.

Although GSM and TDMA are deployed as different and separate networks for voice, they in fact share a common architecture. The primary differences are in the access technology, or radio hardware, that sits in the BTS. Due to the high level commonality in the network, it was decided to migrate these two technologies to a common 2.5G network.

This new data network standard is called General Packet Radio Service (GPRS). Initially developed for GSM, GPRS defines the network backbone. As with 1xRTT, GPRS will overlay the existing GSM/TDMA voice networks. Two new pieces of hardware will be introduced, the Serving GPRS Support Node (SGSN) and the Gateway GPRS Support Node (GGSN) (Figure 11). The SGSN handles all mobility management functions, such as detecting new mobiles and packet routing. The SGSN will utilize Nortel's Passport product. The GGSN (similar in functionality to the CDMA PDSN) will provide IP gateway functionality, routing and aggregation, as well as high touch services offered by the Shasta 5000 BSN via the SCS.

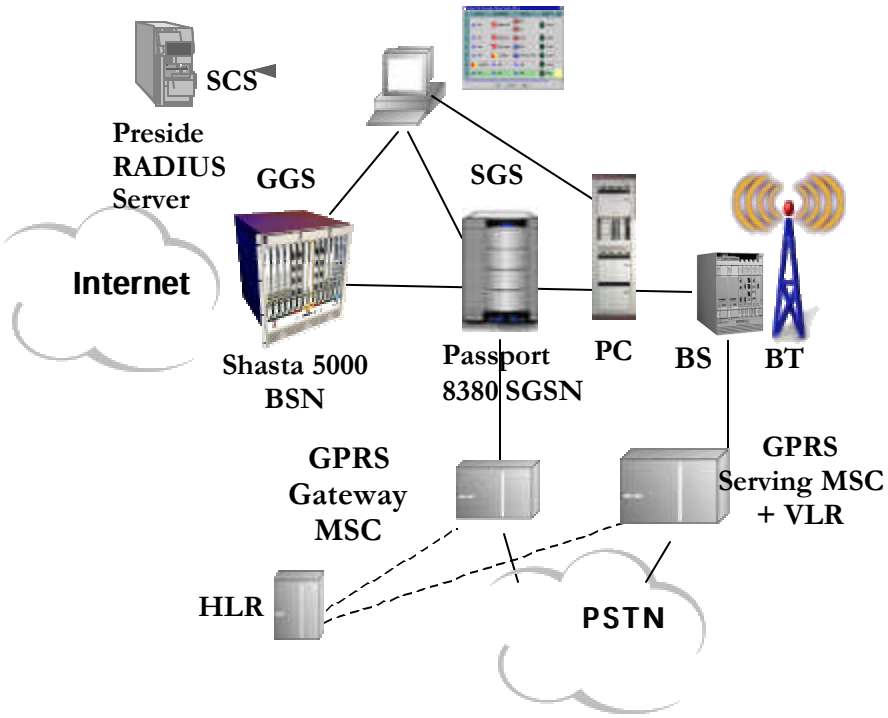


Figure 11 GSM/TDMA GPRS Network

As mentioned previously, TDMA will also be migrating to the GPRS architecture. GSM and TDMA networks are similar; the differences lie within the radio access technology. Enhanced Data for a GSM Environment (EDGE) architecture is being introduced for access portion of the data capable network. GSM has standardized the use of 200KHz of bandwidth for voice and data traffic. TDMA will introduce a wideband 200KHz radio for data. Both technologies will also make use of new modulation schemes. When deployed, the GPRS network elements will be combined with the EDGE radio access, completing the EDGE-GPRS solution, enabling data rates of 384Kbps.

Content Portal

Internet portals today are launch sites for a person's Internet web-based experience. Portals are becoming more "Global Internet Media" companies than simple search engines. They provide many services, such as personalization, e-mail, searching, content filtering and traffic re-direction. With the emergence of each new access component, such as standard dial-in, cable, DSL, etc., the opportunity exists for the branding of new portals. Wireless Internet provides such an opportunity.

- Yahoo!, a service portal, experienced net revenues of $203 million in 1998, almost exclusively from advertising, promotion, and sponsorship.

A wireless portal is not just a branded HTML-based web site; rather, a wireless portal must provide proxy based services to address the wide range of devices/screen sizes (form factor) and to address the lower bandwidth. The Shasta 5000 is unique in this space, providing more than just the functionality of an edge router. The Shasta 5000 is capable of providing a suite of high touch services that can be packaged and marketed to subscribers, in addition to providing the content mediation of a wireless portal (Figure 12).

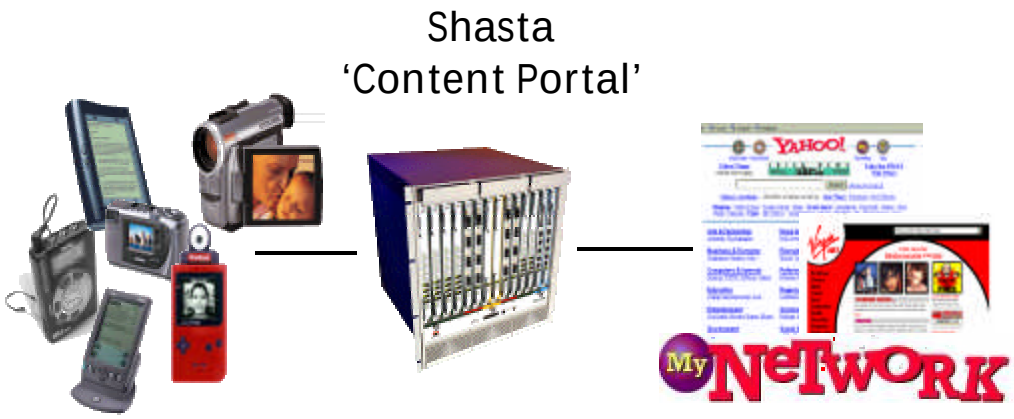


Figure 12 Content Portal

Portal services will continue to evolve from basic wireless messaging. Push services such as stock quotes, sports scores and headlines, as well as e-mail and pages, are just the beginning. The next generation of services will focus on wireless computing. As new PDAs come to market, screen sizes and form factor will make full Internet access with graphics feasible. Future services will migrate to wireless multimedia with the advent of 3G networks; video messaging, real-time data, high speed file transfers will all be possible.

Next Generation Devices

The way people access the Internet has evolved in parallel with the services and content that it provides. There was a time when people would only access the Internet from their PCs for e-mails and information searches. Today, people are accessing the Internet to download music/voice for MP3 players, play video games from various remote sites, and to make purchases or access their information from the TV. These new Internet applications have influenced a whole new market for Internet access devices.

- Bill Gates has been quoted as saying that information appliances will outnumber PCs in 4 to 10 years; IDC anticipates this will occur in 2000 – 2001 (Figure 13).

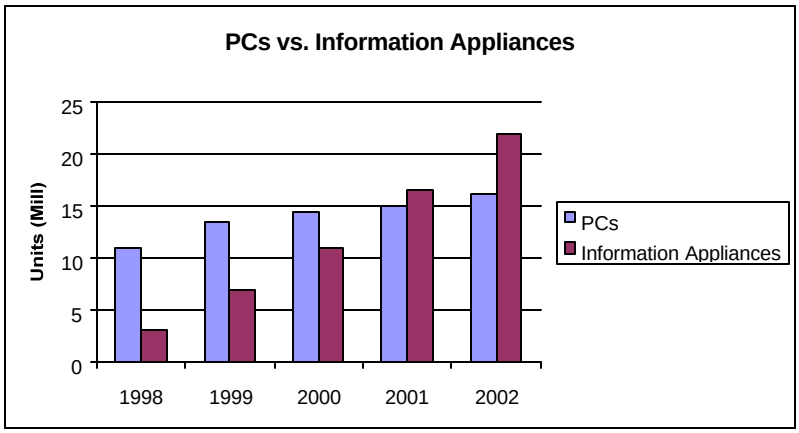


Figure 13 Internet Access Devices (IDC '98)

So the question remains. Will there be more than one device type to access the Internet? Will these new devices outnumber PCs? The answers to both is – YES. The Internet has taken on a multi-faceted purpose for people. Accessing the Internet by wireless phone will be just another facet of access to the Internet anywhere, anytime or anyplace.

Conclusion

Nortel Networks' "Unified Network" will leverage current and emerging technologies – routing, optical, wireline, wireless, switching and IP – into a high-quality, robust, scalable, controllable, secure network solution. The Shasta 5000 BSN is well positioned to fill these needs in the wireless space, ensuring that content and services are delivered transparently across technologies and platforms to end users.

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IDC, Yankee Group, Strategis – where cited
Dave Ginsburg – various Shasta White Papers

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