

# Voice.

How to forge the path that makes sense for your real world.

# Video.

# Data.

There is no single route to a multi-service network. A clear direction for one business could be jammed with roadblocks for another. Converging voice, video and data must start with an understanding of where you are right now—and where you want to be down the road.

**This guide can help.**

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# This guidebook will help you to:

**Get up-to-speed** on the terms, technologies and trends surrounding the convergence of voice, video and data

**Understand** what a multi-service network really is, and how convergence applications can deliver competitive advantages

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**Make more informed decisions** regarding technology investments for your WAN and LAN

**Learn** how breakthrough convergence applications can deliver competitive advantages

**Recognize** the essential nature of policy-based management for multi-service networks

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**All aboard.** The communications revolution is in full motion.

**But watch your step. For while there's no time to waste in planning your network for the 21st century, don't accept without question that you must abandon your existing infrastructure. And don't accept that you must wait until things settle down to make any move at all. The way we see it, sometimes an evolutionary approach makes the most sense, and sometimes nothing short of a revolution will do. The choice should be yours.**

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## What's the reality of your world?

Chances are the communications revolution is already at work changing the way you do business. e-business has become everyday business. In the last year of the 20th century, consider that more than 2.7 trillion email messages have been sent and more than 70 million new voice mail boxes created. e-commerce generated about \$40 billion – and some predict the Web will generate more than \$1 trillion over the next five years.

The communications revolution is in full motion. And you know there's no time to waste in planning your network for the 21st century. But before you rush into decisions – and investments – that will cost your business more than they can possibly return, think about what you really need to grow your business this year, next year and well into this new millennium.

Already, your employees are communicating via email and voice mail, using remote access laptops or hand-held PDAs, and calling with wireless phones from home or on the road. Your customers want to see your products on the Web from their home PCs at midnight – or right in the middle of a very busy network traffic day.

No one wants to wait for anything anymore. And when it comes to technology investments for next-generation networks, there's no need to wait. But you do need to plan. Voice. Video. Data. You need it all. You want it now. But you have to forge the path that makes the most sense for your business for the long-term. Sometimes an evolutionary approach makes the most sense. Sometimes nothing short of a revolution will do. The choice should be yours.

*Don't accept  
that you must  
abandon your  
existing infra-  
structure to join  
the communica-  
tions revolution.*

So don't accept that you must abandon your existing infrastructure to join the communications revolution. And don't be coaxed into believing that you need to wait it out and see how things settle down before you invest in your future – or that there is only one route to the multi-service network of tomorrow.

One thing is certain. To compete in the 21st century, your business needs must drive your networking investments. Regardless of size or market, from start-up ventures to major corporations, higher education to manufacturing, business models may be changing – but the need for a solid bottom line remains.

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## **Build your network to build your business.**

Before you invest in a networking technology, question its real world value. Will this investment help your business to:

**Manage customer relationships for a competitive edge?**

**Speed time-to-market?**

**Share information with customers, employees, partners and suppliers worldwide?**

**Bring the right service to the right customer through the right medium at the right time?**

**Provide any customer or employee with easy access to real-time information anytime, anywhere?**

**Deliver interactive, personalized services?**

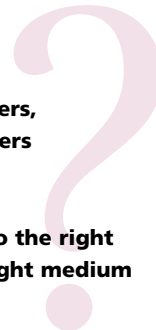
**Improve employee productivity?**

**Position for long-term growth?**

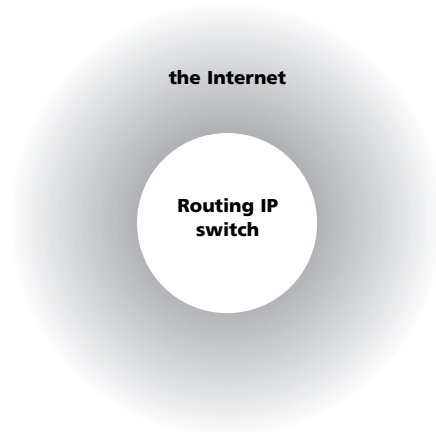
**Protect current investments?**

**Predict the best call center agent to handle each call, for ultimate customer satisfaction?**

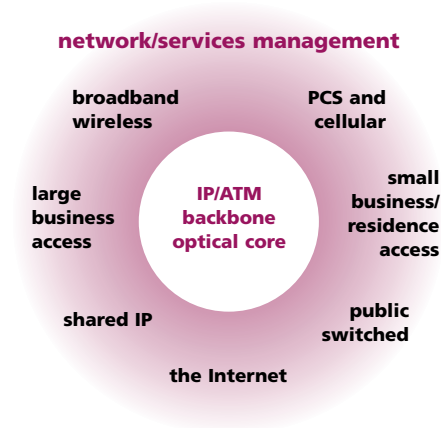
**Reduce labor and/or equipment costs?**



# What does multi-service really mean?



**One way to think of the communications revolution.**



**The real world way to revolutionize business performance.**

The world is changing at a record pace. Changes that are fueled in large part by the technology that's enabling the communications revolution. And with all the options to consider, opportunities to explore, new terms to understand, and technologies to investigate, it can seem that even the planet beneath us is spinning faster than before.

Whenever things move so quickly, it's easy to get caught up in confusion. And there is a lot of confusion around the future of communications networking.

*"The Internet is everything."*

*"Voice over IP is the only way to go."*

*"There will be no place for legacy systems when networks converge."*

*"Plan for one colossal superhighway that will support all your traffic."*

*"All you need is more bandwidth."*

## Now for the real world view.

**Reality.** The Internet is important, and the pervasive nature of the Web has opened our eyes (and ears) to a new way of accessing and processing information, but it's only part of the story.

**Reality.** Voice over IP is the right solution for some business needs – but too often vendors ask you to compromise, accepting a lesser feature set than traditional telephony delivers. Don't lower your performance expectations. The communications revolution is about moving your business forward – not moving back in time.

**Reality.** There's no way to justify the universal abandonment of legacy systems that can be useful for many years to come.

**Reality.** Network convergence is not about starting from scratch to build a single super network. It's about effectively managing a multi-service network of networks to support a multitude of users on any number of devices.

Local and long distance voice networks.

Enterprise data networks.

Cellular, PCS and broadband wireless networks.

Cable networks.

Copper and optical.

ATM, Frame Relay, IP and time division multiplexing (TDM).

Office phones. Home phones.

Laptops. Desktops. PDAs. Pagers.

A multi-service network of networks requires a common currency that links networks, protocols and user devices while supporting applications such as multimedia messaging and collaboration, customer care, tele-work solutions, wireless communications and data solutions.

# How will multi-service networking revolutionize your business performance?

When it comes to deciding which technologies to invest in to support a multi-service network for your business, be sure the discussion goes beyond hubs and routers, protocols and switches. Because the infrastructure you build is only as powerful as the applications and services it enables – and the ease with which it can be managed.

*Any media.*

*Any network.*

*Any endpoint.*

*Anytime.*

## **Start with business needs.**

Ask questions and expect answers that will help you to adapt your business to thrive (not just survive) in a changing world. Traditional boundaries are gone. The global village is open for business 24 hours a day, and the communications revolution is changing the rules of the game so that almost anyone can compete. But only the truly prepared can win. So what's it going to take for you to compete – and win – in the years ahead? Do you know how your business will:

**Connect with your partners and suppliers?**

**Find the right talent to bring into your organization?**

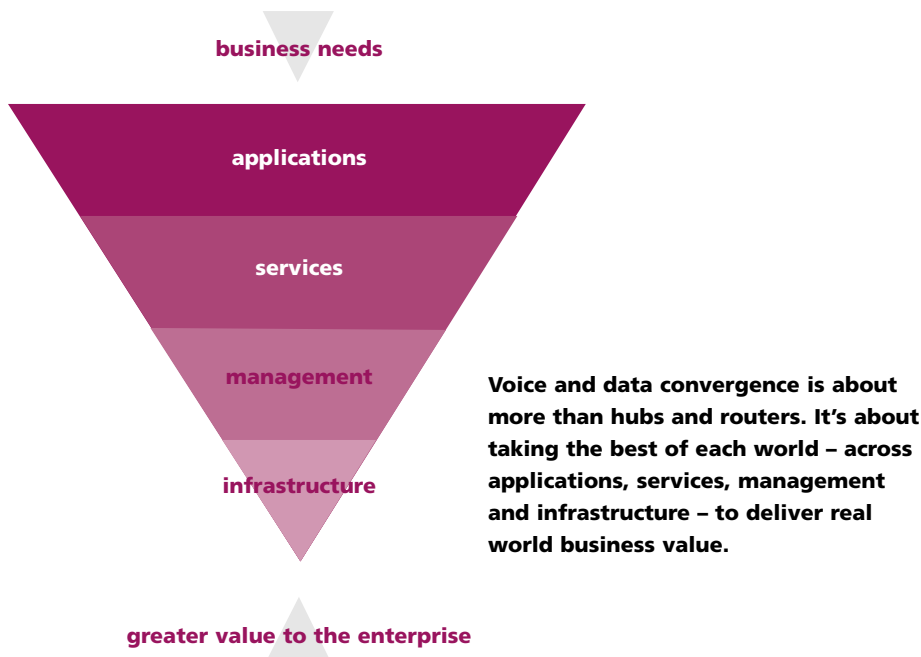
**Manage relationships with partners, suppliers and employees to keep your business moving forward?**

**Communicate with your customers?**

**Sell your goods or services?**

**Lower the cost of doing business without compromising your partners, suppliers, employees or customers?**





The promise of multi-service networking lies in the applications that answer these real world business questions. New communications technologies are removing time and distance barriers to make the 24-hour day a productive one for your business. Mobility and remote access applications let your employees work anytime and

anywhere, improving productivity and job satisfaction. Customer care applications can go so far as to unite a specific customer representative with a specific customer (or supplier or partner) every time they need attention.

## Merging the best of voice telephony and data networks.

Traditional telephony and data networks each have their advantages. Voice networks are always on – 99.999 percent reliability is the undisputed standard. They're rich with features and applications, scalable, and easy to manage and use. But they can't operate at speeds needed to deliver future multi-service applications.

Innovation and data networks go hand in hand, with products and services being developed and delivered at a whirlwind pace. They are also cost-effective. And IP-based networks deliver an array of applications and can provide universal connectivity. However, problems exist with product interoperability, reliability and cumbersome adds, moves and changes.

The key to successful convergence for any business is to tap into these strengths and minimize the weaknesses by investing in a partner whose solutions result in a highly reliable, scaleable, multi-service network.

*Many vendors will focus on your making the infrastructure decisions first. We suggest an alternative approach:*

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**Applications.** Most visible to your users and relevant for your business are the applications that enable new ways of doing business and achieving competitive advantage, and new ways to reach and sell to customers. Beyond the familiar voice messaging, email and fax, emerging applications will unify multimedia messaging, real-time calling and information access to help you to:

- **Generate new revenue**
- **Save time**
- **Improve productivity**
- **Increase employee and customer satisfaction.**

**Services.** To keep your break-through applications up and running for your business, you need end-to-end support you can rely on – design, integration, installation and around-the-clock service.

**Management.** The management tools provided must transcend the underlying technologies of your network of networks and must support the multiple applications. Enabling a multi-service network with Quality of Service capabilities through policy management (See Section 5) is key.

**Infrastructure.** There is no one technology that can do it all for your business right now. And you don't want to abandon existing systems that are adding value. So, for the foreseeable future, multiple transport technologies (IP, ATM and TDM) will work together. Keeping these multi-service networks simple is the key to survival.

*A well-planned and implemented multi-service network will help you to:*

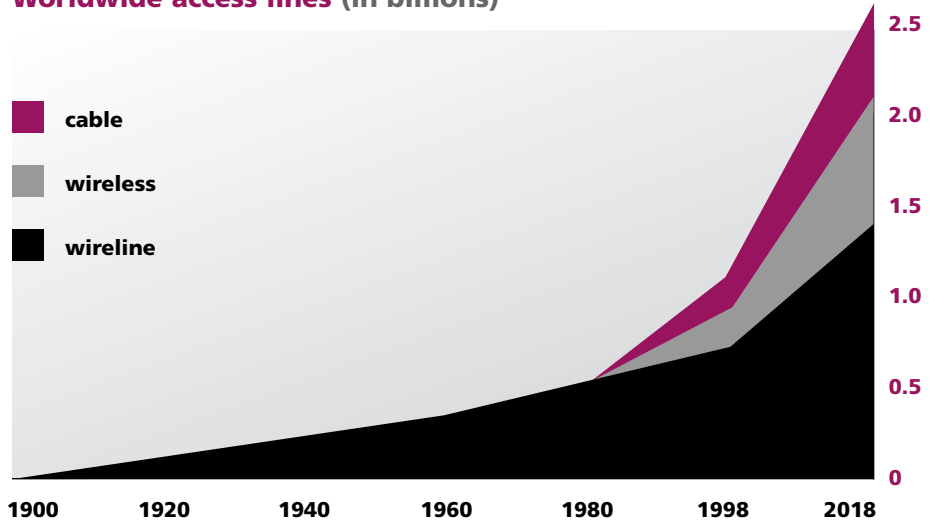
- **Attract and retain a top-notch workforce**
  - **Focus on business imperatives not network infrastructure**
  - **Reduce capital expenses and operating costs**
  - **Lower total cost of ownership**
  - **Deploy reliable, manageable, cost-effective business applications**
-

## Section 2

# What are the technological and business forces driving the communications revolution?

These days, it's hard to tell what is moving faster – customer demand for revolutionary communications services or technological breakthroughs that are enabling the revolution.

**Worldwide access lines (in billions)**



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It was 100 years before customer demand reached the one billion mark for phone service. In just the next ten years – or less – this demand will nearly triple to 2.8 billion.

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*Someday soon communications networks will handle a trillion bits (a terabit) of information at once. That's equivalent to allowing a user to surf 100,000 TV channels simultaneously or respond to computer clicks from 10 million Internet users at the same time. It's in the works at Lucent. Using an experimental fiber-optic technology, Bell Labs researchers have already demonstrated the world's first long-distance, error-free transmission of a terabit of information per second over a single strand of optical fiber.*

*terabit  
per second*

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Today, there are 200 million wireless phone subscribers. By 2008 there will be over one billion wireless communications appliances in use – a 500 percent increase.

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*At the current rate of progress in photonics, ten years from now a single fiber will carry 1,000 wavelengths with gigabits per wavelength for a total capacity of a quadrillion bits (a petabit) per second.*

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In a typical day, 35 million voice mail messages are sent.

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*The best thing that can happen for the enterprise is for more competition at the service provider level. And Lucent is making that a reality in many ways. For one, the recent introduction of a point-to-point, optical networking system that transmits up to 40 gigabits (billion bits) of information per second (Gb/s), while saving carriers up to 60 percent in start-up costs.*

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Every minute, 500 million e-mail messages are transmitted to and from the 130-million-plus email subscribers worldwide.

*petabit  
per second*

**Photonics.** Photonics is the technology that uses light particles, or photons, to transport information over hair-thin glass fibers. It is optical technology, which one Lucent guru envisions will be as important to the 21st century as electricity was to the 20th century.

Today, service providers use fiber-optic lines to transport the pulses of light that represent electronic data and voice signals – and increasing demand is pushing those lines to the capacity limit. Instead of adding more lines, service providers are looking to add capacity in a more effective manner – through dense wave division multiplexing or DWDM. With DWDM, different wavelengths, or colors, of light are transmitted on the same fiber strand.

Up to 80-100 wavelengths of light can be combined on a fiber when DWDM is utilized, giving service providers hundreds of times more bandwidth. And that translates into more services for the enterprise. Even more promising is that photons are moving ever closer to the desktop. Called the next phase of the digital revolution, photonics is well on its way to making network communications easier, faster and less expensive than ever before.

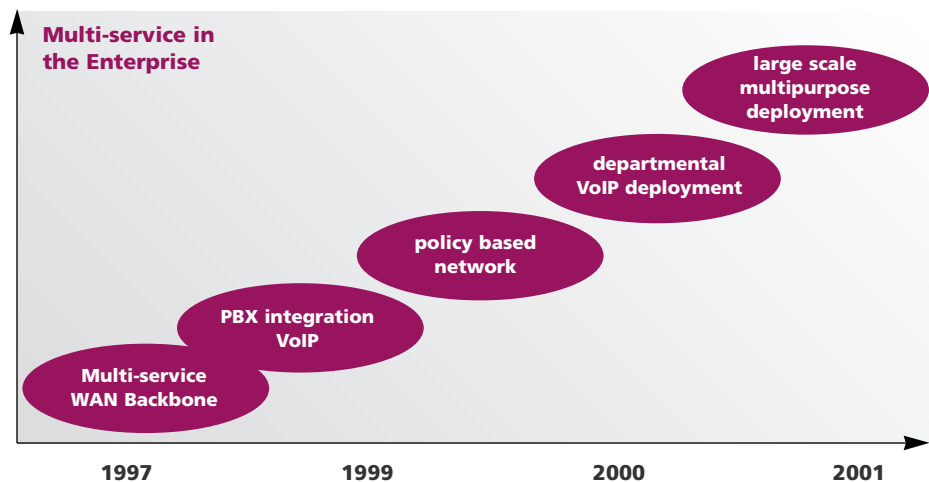
**Wireless.** The data-carrying capacity of wireless radio transmission is rapidly expanding, with the potential to extend the performance levels of high-bandwidth fiber optic networks to where the cables can't reach. Think of it as the ultimate roaming service. Next-generation wireless networks will be built on standards and will interoperate to deliver seamless roaming and transparent services.

## Technology considerations for the wide-area network.

Chances are, no one networking solution in a multi-service world will meet all your needs all the time. Once again, we're back to business needs. If you understand the advantages and benefits of each technology, you can map your information access needs to the solution that delivers the speed, reliability and scalability you need.

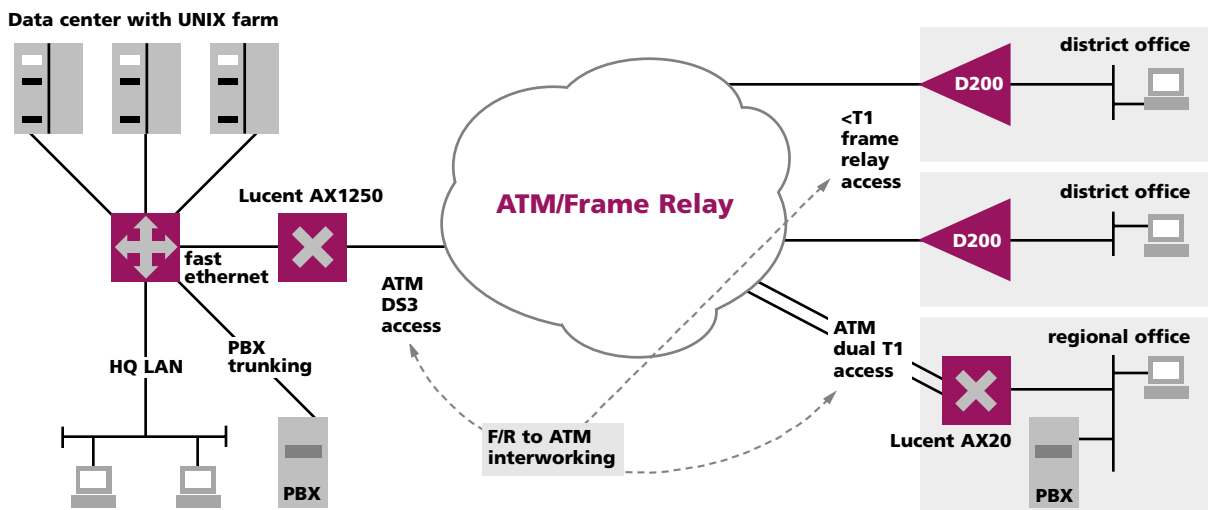
When it comes to the wide-area network, ATM, Frame Relay and IP each bring multi-service capabilities. But your best bet may be some combination of two or all three protocols based on the priorities of your business, including the requirements for Quality of Service and ease of management.

Regardless of the technology you choose, your number one priority should be its "future-readiness." Few organizations can afford to invest in solutions that meet only today's needs well.



WAN protocols	Your best bet when...	Typically used by
<b>ATM</b>	<p>Guaranteed Quality of Service (QoS) is essential.</p> <p>Scalability is key. ATM can carry traffic of various speeds, scaling from low to high-speed video and multimedia applications.</p>	<ul style="list-style-type: none"> <li>• Service providers</li> <li>• Large financial companies</li> <li>• Fortune 500 companies</li> <li>• Universities</li> <li>• Large hospitals</li> </ul>
<b>Frame Relay</b>	<p>High-speed and flexibility are important but you don't want to invest heavily in the cost and management of private network lines.</p>	<ul style="list-style-type: none"> <li>• Retail</li> <li>• Fast growing small companies (that may need to connect new groups or partners quickly and affordably)</li> </ul>
<b>IP</b>	<p>There's a business need to significantly reduce the costs associated with long distance voice and data communications.</p>	<ul style="list-style-type: none"> <li>• Multinational companies</li> </ul>

## Multi-service WAN



**ATM.** That ATM can discriminate between the differing need and tolerance of voice and data makes it a powerful solution for a converged voice and data network. ATM provides the Quality of Service (QoS) necessary to deliver voice and video applications to end users with speed and clarity – without letting traditional, lower-priority data slow it down.

*Critical success factors:*

- **Congestion management**
- **Priority queuing**
- **Low delay variance for voice and video**
- **Multiple interface types**

**Frame Relay.** Used for LAN to LAN communication, access to the Internet and remote access, Frame Relay is an economical alternative for converging voice and data. Widely accepted and installed, Frame Relay is used frequently when organizations add new applications or build new networks. Investing in Frame Relay removes the need to invest in individual private lines, purchase multiplexing equipment and reduces the time and resources required to design and maintain a network.

*Critical success factors:*

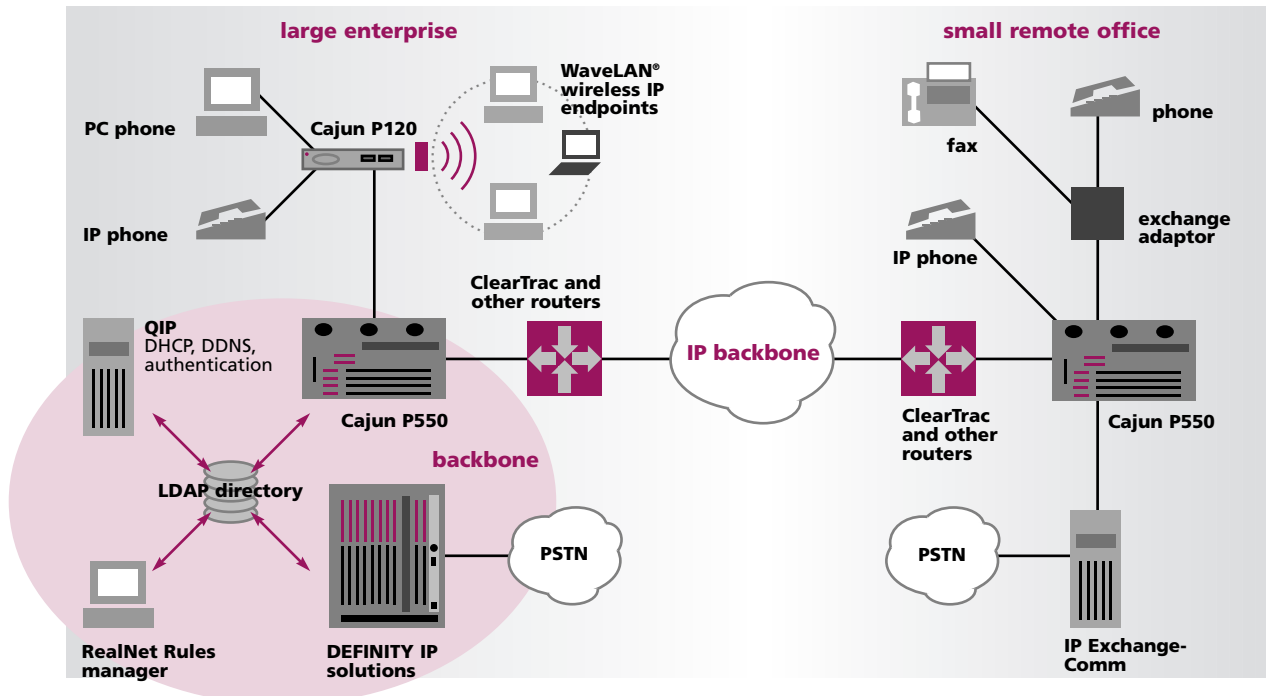
- **Congestion management**
- **High voice quality with compression enabled**
- **Required maximum simultaneous voice and fax channels**
- **Frame Relay switching capability**
- **Digital and analog support**
- **Application prioritization (voice, SNA, IP, IPX)**

**IP.** Perhaps nothing is garnering more excitement than the potential of IP applications, but issues remain before packetized voice is very prevalent – and be wary of Voice over IP solutions that don't deliver the features your users expect and need: multi-party conferencing, add/drop, call forwarding, and message waiting indicator. For while the cost savings is a prime motivator, end users are sophisticated and demanding – and not keen on compromise.

*Critical success factors:*

- **Standard usage (phone to phone, fax to fax, PC to phone, phone to PC)**
- **No special dialing sequences or phone equipment required**
- **Retains traditional call handling features**
- **Automatic quality monitoring**

### Multi-service networking – IP



## Technology considerations for the local-area network. Enabling a future-ready campus.

**Gigabit Ethernet. Gigabit Switching.** Campus LANs are being pushed to the limit, and to meet the increasing demands for improved performance, availability, security and simplicity, you need to investigate new technologies. A few reasons why Gigabit Ethernet is the way to go:

- **Unparalleled speed and throughput**
- **Minimal network disruption**
- **Low cost of ownership**
- **Ability to take advantage of new features with minimal risk**

**It's fast.** With the demands on today's campus LANs, it's imperative to move each packet through the network at a faster rate to free the network to handle other communications.

**It's straightforward.** Migrating to Gigabit Ethernet in your LAN delivers dramatic performance improvements with little disruption to business-as-usual. Of course, the standards for "business-as-usual" may be raised as your users get more productive.

**It's cost-effective.** Gigabit Ethernet provides tens of gigabits of bandwidth for campus networks with the simplicity of Ethernet and at a lower cost than other technologies of comparable speed.

**It's future ready.** Gigabit Ethernet is designed to be easy to install and support at the start – and to ensure a smooth upgrade path to the future.

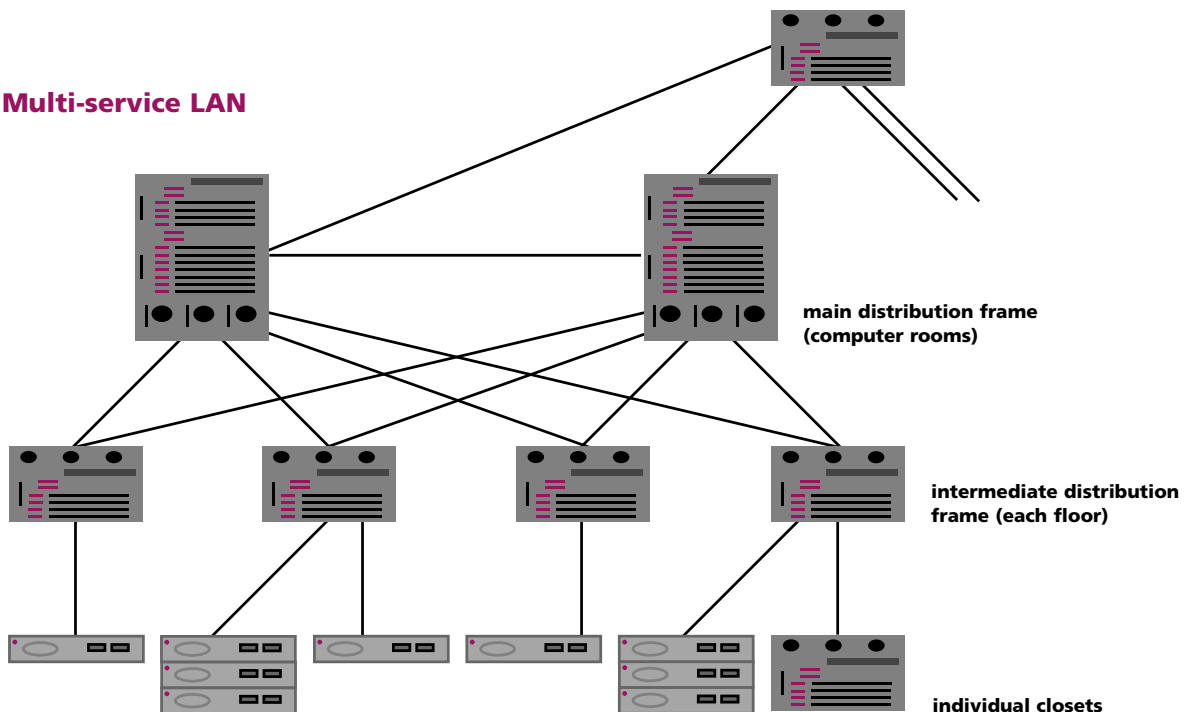
## Don't settle for less than a Campus LAN that:

Not all Gigabit Ethernet solutions are the same, however, and you should consider the following before making an investment:

- Will your network support integrated voice and data applications from day one?
- Will your network guarantee application-specific Quality of Service?
- Will you be able to achieve 45.76 Gbps backplane switching capacity?
- Will you be able to depend on your network as you depend on your telephone (99.999% reliable)?

- Is ready from day one to support integrated voice and data applications
- Delivers the highest levels of bandwidth to support your new applications
- Guarantees application-specific Quality of Service
- Is reliable without exception (like your telephone network)

## Multi-service LAN



## What's it going to take to manage this network of networks?

Just as business needs drive your networking investments, the demands of day-to-day business should be what drive your network's performance. Such is the basis of policy-based networking – a new and increasingly valuable approach to managing the access to and the response of a network that needs to support voice, data and video applications.

Using an enterprise policy manager, you define the high-level rules – or policies – that determine how network resources are used, by whom and at what times. With business priorities as a starting point, policy-based networking lets you map business operations to network capabilities. This can be achieved in a variety and any combination of ways – controlling access based on user, device, application, time, location. For example, business applications essential to business hours (8-5, Monday through Friday) would

get priority status at those times while e-commerce applications would get priority all the time. And the same user has different needs in terms of connectivity when he or she is working remotely versus working in the office (a coupling of user and location to assign network resources).

Expect an enterprise policy manager to:

- **Improve reliability and network consistency by automating the manual and therefore error-prone processes for assigning network resources**
- **Synchronize the priorities for network information (voice, data or video) flow with business priorities**
- **Reduce the cost of networking and computing maintenance**
- **Enhance productivity for you and your users**

**Security.** Policy-enabled networking must be synonymous with secure networking, and allow you to define rules to fit multiple security domains.

**Resource allocation.** Look for the ability to define and apply rules for IP addresses associated with specific subnets and the users associated with those subnets whose needs are similar.

Consider the benefit of IP Address management, which allows for the dynamic assignment of addresses to users as they logon to the network, and the return of those addresses to a "pool" as each user logs off.

**Quality of Service.** Essential for the ability to set and deliver priority performance to the users and applications that need it.

### *Critical policy domains*

- *security*
- *resource allocation*
- *Quality of Service*

## Real world business scenarios

**Learn** how the Seattle Mariners will work with Lucent to enable a multi-service network to build perhaps the most technologically advanced stadium in the country – just one of the many diverse enterprises choosing Lucent as a partner in r/evolution.

**Plus** this section explores three business cases – Voice over Frame Relay, Voice over ATM, and Voice over IP – with details in each case on existing conditions and costs, converged network costs and resultant savings.

## Wire it – and they will come

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When the Seattle Mariners' new ballpark – SAFECO Field – opens in the summer of 2000, it will be one of the most technologically advanced stadiums in the country. Lucent-based data and voice networks will be at the center of the facility's day-to-day operations, providing the infrastructure to support ticket, merchandise and refreshment sales and up-to-the-minute team and game information via direct Internet access in the park's luxury suites.

**Applications.** “Our ability to serve our fans extremely well is critical to making SAFECO Field a first-rate leisure destination for the entire family,” said Larry Witherspoon, director of information systems for the Mariners. Essential to good customer service are the applications that the club will deploy through its multi-service network of networks:

*Unified Messaging* – Remote workers, including Mariners' scouts, will be able to access their voice and fax messages from a single source – either a phone or a PC.

*Internet Call Center* – Fan will be able to purchase tickets and merchandise. The goal is for season ticket holders and others with Mariners' accounts to order food and beverages before or during the game, specifying the inning when they want the order delivered to their seats.

*Interactive Voice Response* – The Mariners' toll-free fan information line will let callers select from a menu of pre-and post-game reports, SAFECO Field homestand updates and other information. And the plan the following season is for this line to feature a fax-back capability to deliver game notes, box scores and other information directly to Mariners fans throughout the region.

**Services.** Through Lucent's NetCare portfolio of services, the SAFECO Field networks will be covered for around the clock maintenance seven days a week to ensure maximum system reliability and availability.

**The infrastructure.** The park's data network features four of the award-winning Lucent Cajun™ P550™ and 39 of Cajun P220™ Gigabit Switches, over which 100 Mbps Fast Ethernet and 1000 Mbps Gigabit Ethernet traffic will run. This network will support SAFECO Field's IP-based Micros point-of-sale food service application across the park and administrative office applications. Vendors will use digital cash registers and credit card scanners linked to the backbone. And fans in the 69 luxury suites will have the option for direct Internet access (via their own laptops) to obtain real-time statistics and other information.

The modular Cajun P550 Switches will provide all backbone data network connectivity and seamlessly interoperate with the standalone Cajun P220 Switches, which will be deployed in wiring closets throughout the stadium. Two Lucent Managed Firewall servers will provide the security, prohibiting unauthorized access.

"Having highly reliable switches was paramount in our choosing Lucent over its data networking competitors," explained Witherspoon.

The voice network includes Lucent's DEFINITY® Enterprise Communications Server switching system with digital and analog station ports and ISDN trunks for access to local and long-distance services, a 50-agent call center with automatic call distribution and the CentreVu® Internet voice response system. The network also includes INTUITY® voice and fax messaging for 500 users.

## Business Case One:

# Voice Over Frame Relay

### Assumptions - Business Office

#Branch offices	10
#People/branch	50
#Onnet calls/day	250
Avg holding time (min)	6
#Onnet mins/day	1500
#Business days/month	22
P-grade of service	0.01
Busy hour loading factor	0.17
Busy hour traffic (Erlangs)	4.25
# Voice Channels needed	10
Bandwidth needed (kbps) to access V-VPN	640
Bandwidth applied to access V-VPN – # access lines	10
Compression rate (kbps)	8
Overhead (kbps)	3
Voice bandwidth needed (kbps) on converged net	110
Voice bandwidth applied (kbps) on converged net	128
Access lines backup&overflow of 1% of calls to V-VPN	2

### WAN Pricing

V-VPN charges each branch	
V-VPN rate/min	\$0.05
V-VPN access line	\$60

### Frame Relay

56k local loop/month	\$250
56k frame port/month	\$300
32k PVC/month	\$60
256k local loop/month	\$500
256k frame port/month	\$850
128k PVC/month	\$200
Frame installation	\$800
Local loop installation	\$400

### T1 frame relay

T1 local loop/month	\$1,100
T1 frame port/month	\$2,500
Frame installation	\$1,000
Local loop installation	\$600

### Existing Network Recurring Costs

Total BO: 10 voice access lines plus V-VPN charges each	\$22,500
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Total BO: 1 56k access, 56k FR port, 32k PVC each	\$6,100
Total RHQ:5 T1 access	\$5,500
Total RHQ: 1 T1 access, FR port	\$3,600
Total voice/data charges/month	\$37,700
Total voice/data charges/year	\$452,400

### Converged Network Costs

One-time charges	
Total V-FRAD at BO's/RHQ (1 each) @ \$5000 each	\$55,000
Total BO: 1 PBX 8 port interface to V-FRAD @ 2500 each	\$25,000
Total RHQ: 1 PBX 2-port T1 interface to V-FRAD @ \$5000	\$5,000
Total Capital costs	\$85,000
Total installation BO transmission services	
1 256k local loop/frame port @ \$1200 each	\$12,000
1 128k additional PVC @ \$25 each	\$250
Total installation RHQ frame relay	\$0
Staff Labor (.5 FTE at 1 mo at \$100k/year)	\$4,167
Total Installation	\$12,250
Total One-time costs	\$97,250

### New Recurring Costs

Total BO: overflow: 2 access lines @ \$60 plus V-VPN usage ea.	\$4,500
Total BO: 1 256k local; 1 256k FR port; 1 128k PVC; 1 32k PVC	\$16,100
Total RHQ overflow: T1 access @ \$1100	\$1,100
Total RHQ: T1 local; T1 FR port	\$3,600
Total Depreciation (3year/straight line)	\$2,361
Monthly maintenance	8%
Monthly Maintenance Charges	\$567
Total voice/data charges/month	\$28,228
Total voice/data charges/year	\$338,733

<b>Monthly Savings</b>	<b>\$9,472</b>
<b>Monthly Savings Percentage</b>	<b>25.13%</b>
<b>Annual Savings</b>	<b>\$113,667</b>
<b>Payback Period (months)</b>	<b>10.27</b>

## Business Case Two:

# Voice Over ATM

### Assumptions - Regional Office

# Branch offices	7
# People/branch	150
# Onnet calls/day	1500
Avg holding time (min)	6
# Onnet mins/day	9000
# Business days/month	22
P-grade of service	0.01
Busy hour loading factor	0.17
Busy hour traffic (Erlangs)	25.5
# Voice channels needed	36
Bandwidth applied (kbps) to access V-VPN	2 T1s
Compression rate (kbps)	32
Overhead (kbps)	3
Voice bandwidth needed (kbps) on converged net	1260
Voice bandwidth applied (kbps) on converged net	T1
Bandwidth for backup&overflow 1% to V-VPN (access lines)	3

### WAN Pricing

V-VPN charges	
V-VPN rate/min	\$0.05
V-VPN access line	\$60
T3 local loop	
T3 local loop/month	\$9,900
T3 local loop installation	\$700
T1 frame relay or ATM VBR	
T1 local loop/month	\$1,100
T1 frame relay or ATM port/month	\$2,500
768k PVC/month	\$1,700
T1 PVC/month	\$2,500
Frame/ATM installation	\$1,000
Local loop installation	\$600
T3 ATM port/month	\$10,000

### Existing Network Recurring Costs

Total RO: 2 T1 access plus V-VPN charges each	\$84,700
Total RO: 1 T1 access, T1 FR port, 768k PVC ea	\$37,100
Total CHQ: 11 T1 access	\$12,100
Total CHQ: 4 T1 access, T1 FR ports	\$14,400
Total voice/data charges/month	\$148,300
Total voice/data charges/year	\$1,779,600

### Converged Network Costs

One Time Charges		
Total RO: ATM concentrators at \$18,000 each	\$126,000	
Total CHQ: ATM concentrator at \$35,000	\$35,000	
Total RO: 1 PBX 8-port interface to V-VPN at \$2500 each	\$17,500	
Total CHQ: 1 2-port T1 PBX interface to ATM at \$5000	\$5000	
Total Capital costs	\$143,500	
Total Installations RO transmission services		
1 T1 local loop each @ \$600	\$4,200	
2 T1 ATM port each @ \$1000	\$14,000	
2 ATM VBR PVCs @ \$25 each	\$350	
3 overflow voice access lines @ \$100	\$2,100	
Total installation CHQ: 1 T3 access, 1 T3 ATM port	\$3,100	
Enterprise Staff Labor (1 FTE at 3 mo at \$100k/year)		\$25,000
Total Installation	\$43,550	
Total One-time costs	\$187,050	

### New Recurring Costs

Total RO overflow: 3 access lines @ 60 plus V-VPN usage each	\$15,120
Total RO: 2 T1 links; 2 T1 ATM ports; 768k & T1 VBR PVC's each	\$79,800
Total CHQ overflow: T1 access @ \$1,100	\$1,100
Total CHQ: T3 link; T3 ATM port	\$19,900
Total Depreciation (3 year/straight line)	\$3,986
Monthly Maintenance	8%
Monthly Maintenance Charges	\$957
Total voice/data charges/month	\$120,863
Total voice/data charges/year	\$1,450,353

<b>Monthly Savings</b>	<b>\$27,437</b>
<b>Monthly Savings Percentage</b>	<b>18.5%</b>
<b>Annual Savings</b>	<b>\$329,247</b>
<b>Payback Period (months)</b>	<b>6.82</b>

## Business Case Three:

# Voice Over IP

### Assumptions - Business Office

# Branch offices	5
# People/site	10
# Onnet calls/day/site (BO-RHQ)	100
Avg holding time (min)	6
# Onnet mins/day (BO-RHQ)	600
# Business days/month	22
P-grade of service	0.01
Busy hour loading factor	0.17
Busy hour traffic (Erlangs)	1.7
# Voice channels needed	6
Bandwidth applied to access PSTN – # access lines	6
Compression (kbps)	8
Overhead (kbps)	3
Voice bandwidth needed (kbps) on converged net	66
Voice bandwidth applied (kbps) on converged net	66
Bandwidth needed for 1% overflow to access PSTN	2

### WAN Pricing

PSTN charges each branch	
PSTN rate/min	\$0.15
PSTN access line	\$60
I-VPN dedicated services	
56kbps local loop	\$250
56kbps I-VPN service	\$350
128kbps local loop	\$350
128 kbps I-VPN service	\$800
256kbps local loop	\$500
256kbps I-VPN service	\$1,000
T1 local loop	\$1,100
T1 I-VPN service	\$1,800
I-VPN installation	\$1,000
128k local loop installation	\$400

### Existing Network Recurring Costs

Total BO: 6 PSTN access lines plus usage each	\$11,700
Total BO: 1 56k local loop plus I-VPN service each	\$3,000
Total RHQ: 1 T1 and 6 PSTN access lines	\$1,460
Total RHQ: 1 T1 local loop plus I-VPN service	\$2,900
Total voice/data charges/month	\$19,060
Total voice/data charges/year	\$228,720

### Converged Network Costs

One-time charges	
Total BO: V-IP gateway @ \$5,000 ea.	\$25,000
Total RHQ: V-IP gateway @\$63,000	\$63,000
Total BO: 2 key system interfaces to V/IP gateway @ \$100 each	\$1,000
Total RHQ: 1 PBX 16-port interface to V/IP gateway @ \$3500	\$3,500
Total BO: router interfaces (V.35 cable) @ \$150 each	\$750
Total RHQ: router interfaces (V.35 cable) @ \$150 each	\$150
Total Capital costs	\$93,400
Total Installations BO transmission services	
Total BO: 1 128k local loop/I-VPN service @ \$1400 each	\$7,000
Total Installations RHQ transmission services	
Total RHQ: I-VPN services – no upgrade needed	\$0
Total RHQ: 4 overflow voice access lines @ \$100\$400	\$1,600
Enterprise staff labor (5 FTE at 1 mo at \$100k/year)	
	\$4,167
Total Installation:	\$11,567
Total One-time costs:	\$104,967

### New Recurring Costs

Total BO: overflow: 2 PSTN access lines plus usage	\$604.50
Total BO: 1 128k local loop/I-VPN service	\$5,750
Total RHQ: overflow: 10 PSTN access lines @ \$60	\$600
Total RHQ: T1 local loop/I-VPN service	\$2,900
Total Depreciation (3 year/straight line)	\$2,594
Monthly Maintenance	8%
Monthly Maintenance charges	\$623
Total charges/month	\$13,072
Total charges/year	\$156,859

<b>Monthly Savings</b>	<b>\$5,988</b>
<b>Monthly Savings Percentage</b>	<b>31.42%</b>
<b>Annual Savings</b>	<b>\$71,861</b>
<b>Payback Period (months)</b>	<b>17.53</b>

## A multi-service solution from Lucent

