

Communications for the new economy: The future of Wireless



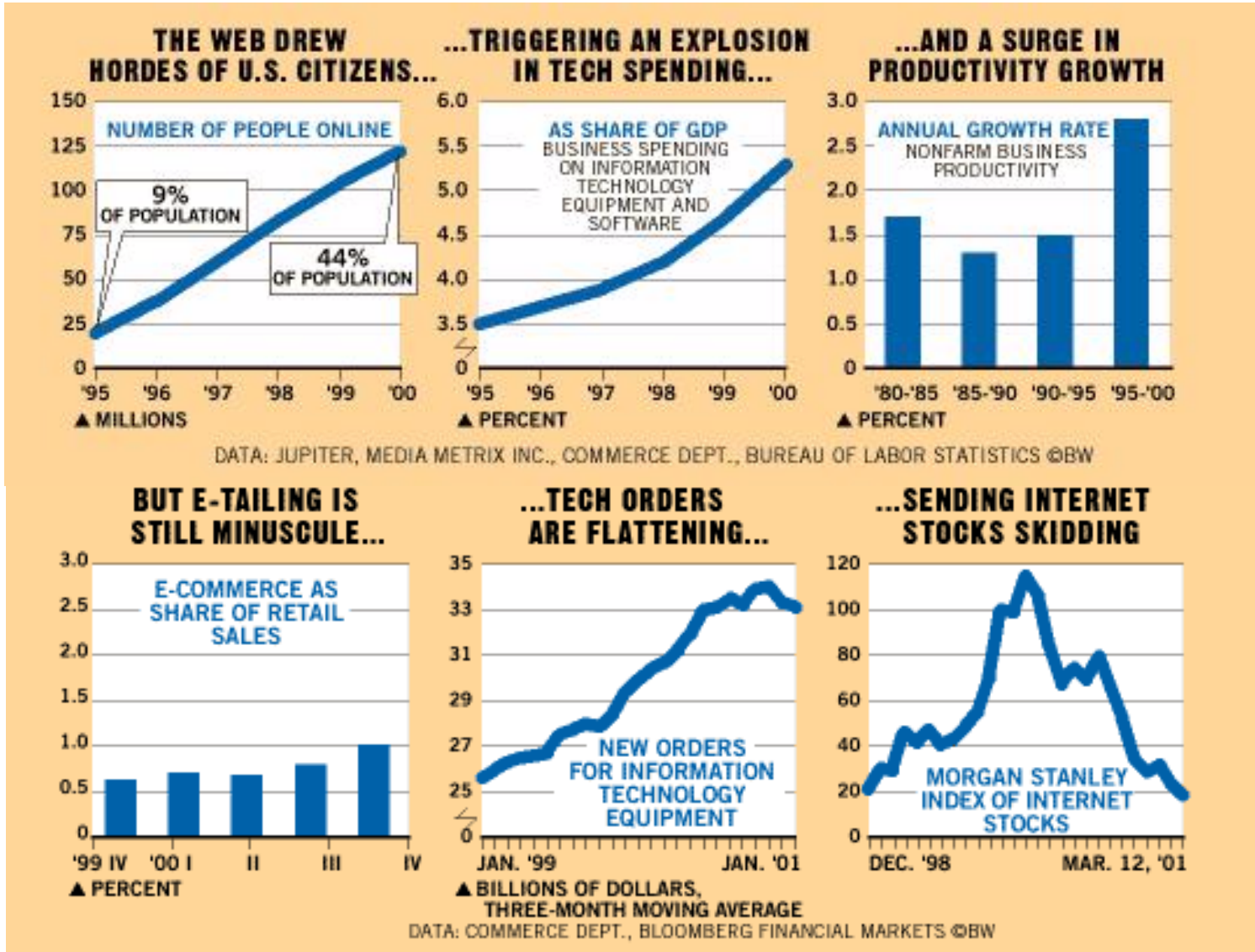
Reinaldo A. Valenzuela

**Director, Wireless Communications Research Department
Bell Laboratories, Lucent Technologies**

Seminar Outline

- **Communications for the new Economy**
- **Wireless Technology Evolution**
- **Broadband Wireless Tutorial**
- **BLAST Overview: The next dimension**
- **BLAST Tutorial:**

The Incredible Internet Roller Coaster



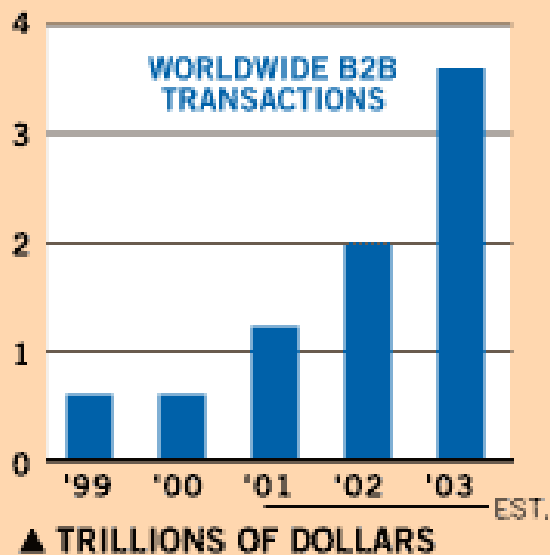
Corporations Expand the Ways They Use the Web...

	Got it already	Starting it now	Considering	No plans yet
Company Intranets	65%	15%	4%	17%
Selling Online	35	30	16	19
Customer Service	21	34	28	18
Capturing Worker Knowledge	15	32	27	27

Data: Forrester Research

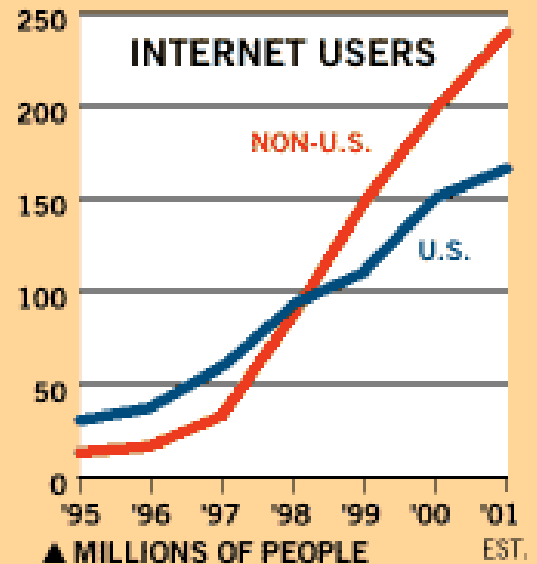
Times are Changing....

B2B E-COMMERCE IS STILL GOING STRONG...



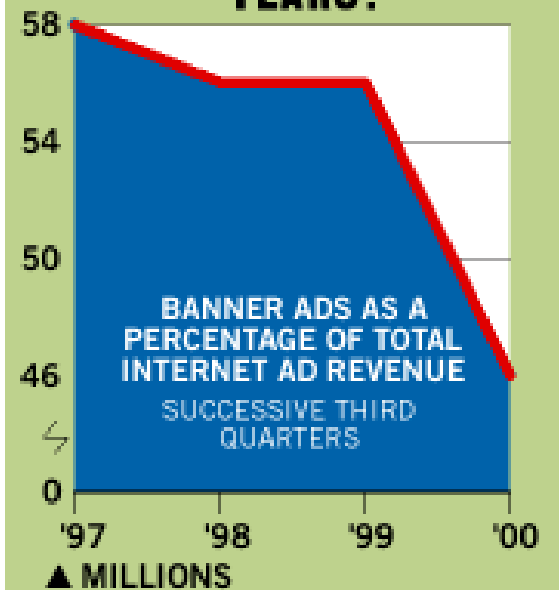
DATA: FORRESTER RESEARCH INC. ©BW

THE CHANGING GLOBAL NET



DATA: COMPUTER INDUSTRY ALMANAC, NUA LTD. ©BW

END OF THE BANNER YEARS?



DATA: PRICEWATERHOUSECOOPERS/INTERNET ADVERTISING BUREAU ©BW

...And E-Biz Projects Remain High Priorities

Percent of companies sticking to key e-business expansion plans:

SALES AND CUSTOMER SERVICE	87%
SUPPLY-CHAIN MANAGEMENT	84
GROUP TRADING EXCHANGES	94

Data: AMR Research

Hitting Pay Dirt in the Virtual World

Even with the crash in Internet stocks, companies are investing heavily in on initiatives Here's a look at where they're putting their money--and the payoff.

- **ELECTRONIC COMMERCE:** Pegged to hit **\$6.8 trillion in 2004**, with 90% of that coming from business-to-business sales, says Forrester Research. About 80% of Cisco Systems' orders are taken online, about \$5 billion last quarter--saving the networking giant \$760 million in annual operating costs.
- **E-MARKETPLACES:** Transactions on e-marketplaces expected to reach **\$2.8 trillion in 2004**, says AMR Research Defense contractor. United Technologies bought \$450 million worth of metals, motors, and other products from an e-marketplace in 2000 and got prices about 15% less than what it usually pays.
- **PROCUREMENT:** Businesses will buy **\$2.8 trillion** in supplies over the Internet in 2004, excluding e-marketplace purchases, says AMR Research. Eastman Chemical is buying 19% of its supplies online now, up from almost nothing two years ago. That has helped boost productivity 9% per year.
- **KNOWLEDGE MANAGEMENT:** Companies will spend **\$10.2 billion** to store and share their employees' knowledge over the Net by 2004, says IDC. Electronics manufacturer Siemens has spent \$7.8 million to create a Web site for employees to share expertise to help win contracts. The result: new sales of \$122 million.
- **CUSTOMER RELATIONS:** Corporations will invest **\$12.2 billion by 2004** on linking customers, sales, and marketing over the Web, says the META Group. Lands' End converts more than 10% of its Web visitors to buyers--compared with the average 4.9%--in part because it offers live chat and other customer-service extras.

What We'll Pay For (According to BW)

- **INTERNET ACCESS:** A few free, plain-vanilla dial-up services may persist, but nearly all will charge for a connection and technical support, especially for high-speed broadband access.
- **ANALYSIS:** Highly valued analyses of information, such as stock market prognostications or a city-by-city list of best doctors, will come with a fee.
- **ENTERTAINMENT:** Just as we pay for all-movie and music-video cable TV, we'll pay for video-on-demand and music on the Web especially now that the courts have outlawed Napster's free file-sharing service.
- **SPECIALIZED SERVICE:** How about an online personal shopper? Or an advance peek at the Armani line for fall? An upscale e-tailer may offer paying club members such online extras.

Where the Internet May Be Revolutionary...

These information-intensive industries are good candidates to be transformed by the Web

- **FINANCIAL SERVICES:** Most financial services can potentially be handled electronically. But so far, banks can't even figure out a good way of letting people pay bills online.
- **ENTERTAINMENT:** Much of entertainment can easily be digitized. But no one knows how to make money yet, and the technology is lagging.
- **HEALTH CARE:** The benefits of shifting health-care transactions to the Web could be enormous. But so are the institutional barriers.
- **EDUCATION:** E-learning could cut the costs of education, but only at the price of making education more impersonal.
- **GOVERNMENT:** Delivering information to citizens electronically has enormous appeal, but requires massive investments.

..And Where the Impact May Be Incremental

Industries where information plays a relatively small role

- **RETAILING:** The glitzy Web sites got all the attention. But dot-com success turned more on who had the best logistics.
- **MANUFACTURING:** Web-enabled supply chains and intranets are important, but ultimately a manufacturer lives or dies on the quality of its goods.
- **TRAVEL:** Online travel sites are popular, but the ultimate constraint on travel is the physical capacity of the air and road systems.
- **POWER:** Online energy exchanges get the publicity, but power generation and transmission capabilities will have the bigger economic impact.

What Will Remain Free:

- **COMMODITY DATA:** Stuff that's widely available everywhere, such as stock quotes, weather, and news, will be Internet giveaways.
- **SHOPPING INFORMATION:** The Web will remain a great place to comparison-shop and gather info on everything from car models to real estate.
- **SEARCH ENGINES:** They may cost a bundle to build, but the incremental cost of additional searches is minuscule, so they'll stay free and rely on advertising and licensing to companies.
- **PURCHASES:** Surcharges would make e-shopping lose its competitive advantage over catalog retailers and in-store purchasing.

With the future of .coms growing dicier, here are bets on business-to-consumer models that work:

- **NICHES ARE NICE:** E-tailers that focus on a niche will far better. Profitable pet supplier Waggin' Tails specializes in high-margin products, unlike the defunct Pets.com, which tried to do it all.
- **INFORMATION BROKERS:** The No. 1 thing Netizens do online is look for information. Those that make it pay will win. Job-listing site Monster.com, which charges employers to post positions, makes money.
- **THE FENCE-STRADDLERS:** Businesses in both the physical and virtual worlds reign. Merck-Medco, the USA's leading provider of prescription-drug care, racking up \$460 million in online sales last year, has clobbered Net upstarts drugstore.com and PlanetRx.
- **A LA CARTE MODELS:** Business models that boast multiple ways of making money have good odds. Real estate listing service Homestore.com, which sells technology and ads, will be profitable this year on projected revenues of \$440 million.

Transcending the WWW: Some promising applications that may give birth to the next generation of Net highfliers

- **WIRELESS NET:** By 2002, some 225 million people will use wireless services that bypass today's Web, up from 40 million last year, says eTForecasts. To be successful, the services must be tailored for small devices that dish up info any place, at any time.
- **PEER-TO-PEER:** Popularized by the Napster music-sharing service, P2P lets PCs communicate with one another directly via the Net. To generate fees, startups are selling P2 software that lets people exchange data and better collaborate on projects.
- **INSTANT MESSAGING:** E-mail is the most popular non-Web use of the Net. Now, instant messaging--e-mail that's like chatting--is the rage. IM is being developed for interactive TV and handhelds. But no one has figured out yet how to make money off of it.
- **MACHINE-TO-MACHINE:** Computers are communicating with less human help. eBay's proxy bidding feature lets users place a maximum offer and the auction site automatically bids for them. Or a company could have a computer order goods when inventories dip.

Networking Technology Leads to “New Economy” Communications

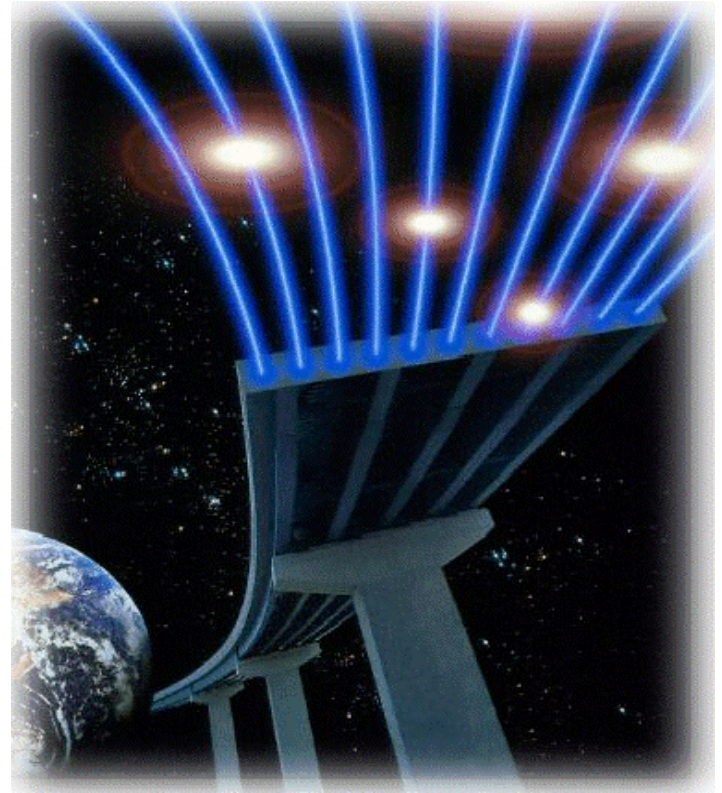
- **Optical networking creates a low-cost, efficient global communications infrastructure**
- **Packet networking, software-mediated, reduces transaction costs**
- **Wireless network access liberates communications from constraints of time and space**

Communications is a “new economy” resource

- **low in cost**
- **accessible as never before**
- **rich in opportunities for new services**

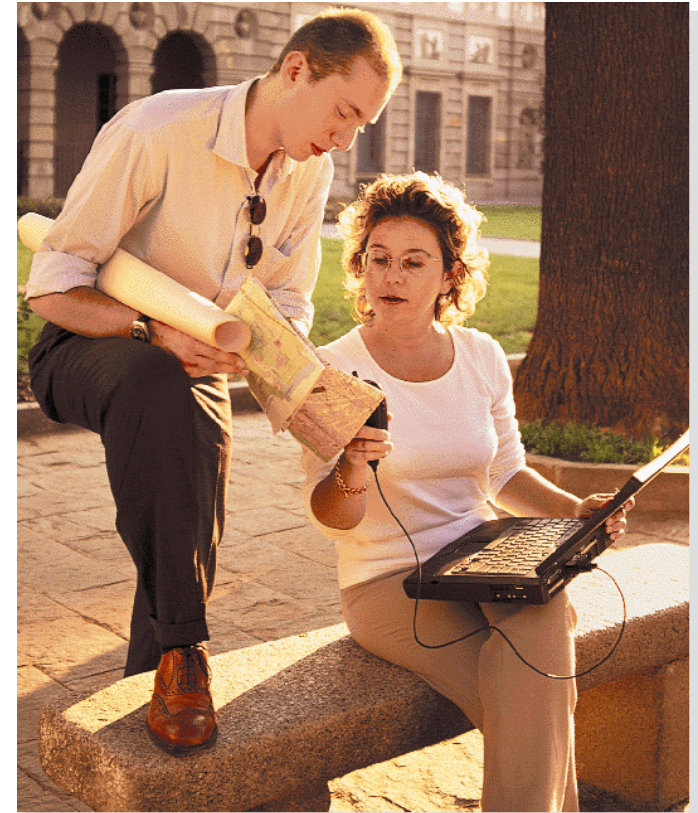
What Can We Expect of Networking in the New Economy?

- Programmable networks
 - “Web-works”
- Ubiquitous wireless connectivity
- An “economy of light”
- People will have access to individualized, customized services -- “Markets of One”



Individualized, Customized Services

- **Services will come from independent software vendors**
- **Applications will be customizable**
- **Individual information environments will be accessible anywhere**
- **You can signal your location, even your movements, to the network**



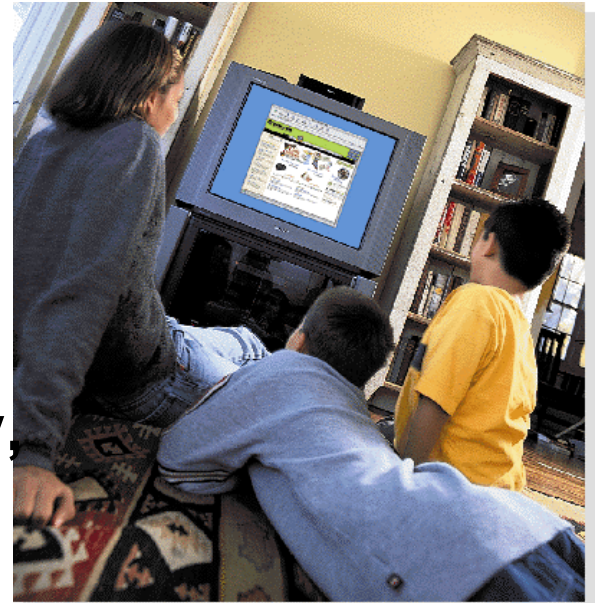
Devices Will Communicate Independently

- **Person-to-person communications as always**
 - in any format: voice, data, video
- **Person to information-source**
 - Internet-like, but broadband
 - mobile, too
- **Machine-to-machine**
 - always-on connectivity
 - unconstrained by wires



Cheap and Abundant Bandwidth

- **Low cost levels will transform the business model**
- **Service, not bandwidth, determines customer charges**
- **Services like movies on demand, interactive TV will be commonplace**
- **Information won't be kept physically, but distributed as needed**



Europe's New Era of Networking

- \$130 billion 1999 market size
- \$210 billion by 2003
- Europe is the 2nd largest global trading block
- Europe is the NOW economy

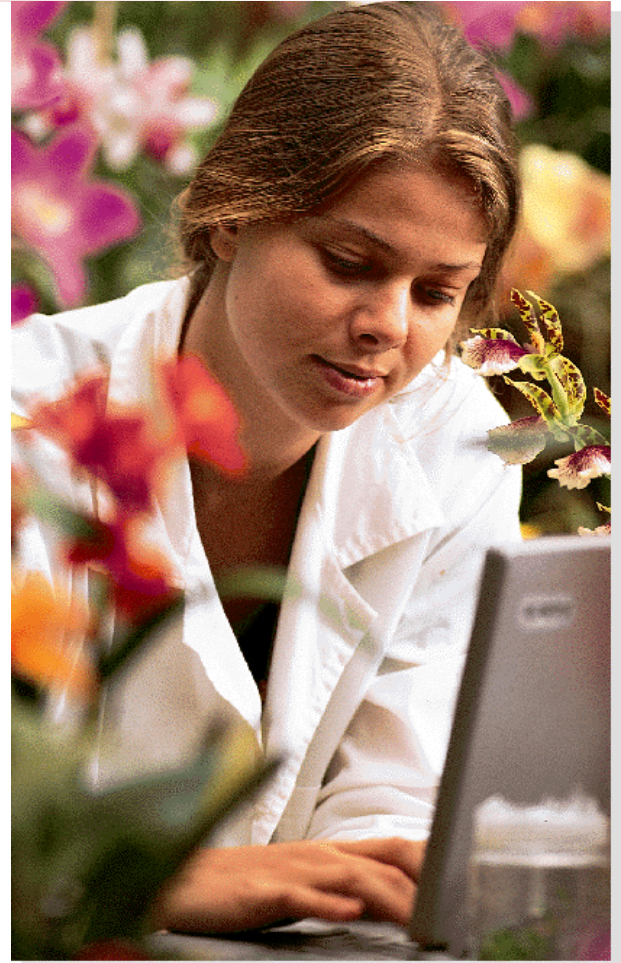


Global Market Drama

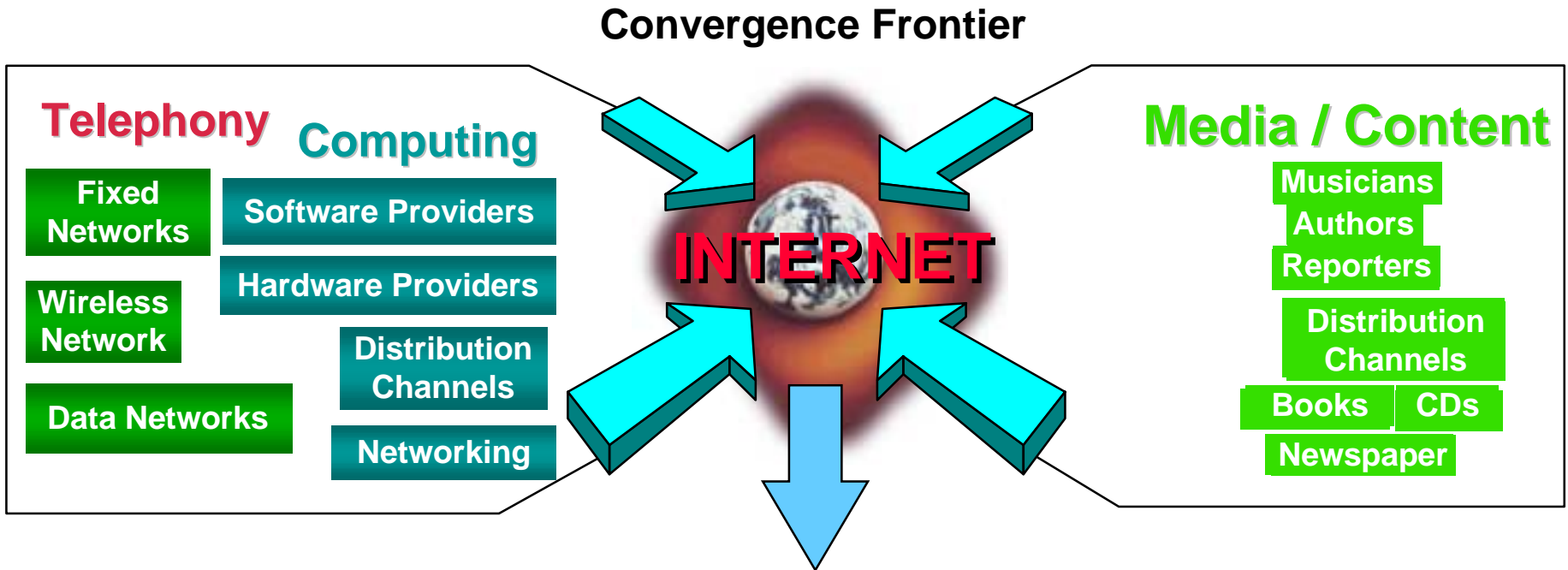
- **5000** players in Europe Middle East and Asia alone
- National borders becoming transparent
- Mergers, partnerships, acquisitions
 - companies are competitors and partners simultaneously
- **B-to-B** transactions to grow **25X by 2003**
- **Internet economy** growing **30x faster** than global economy
- Excitement! Opportunity! Growth!
- Rapid evolution to **3G** - the **Mobile Internet** is here
 - 3G licensing rapidly advancing third party application and service innovation

European Internet Explosion

- **25% of world's internet users**
- **Internet services revenue doubling yearly**
- **On the web -- all day long**
- **Eastern Europe internet use doubles yearly**
- **Huge opportunities for service providers**



The Internet is Driving Technology Convergence and Disrupting Business Models



The Internet is critical and important, but the networking revolution is about more than the next generation of Data Networking (IP/ATM), It's about:

Broadband & Narrowband, Wired & Wireless Access Technologies

- ➔ **Breaking Down Barriers Between Historically Separate Industry Segments**
- ➔ **Networks that will work together to deliver services seamlessly**

Mobility is Major News

- **240 million users expected in 2003**
 - 61% market penetration
- **Mobile e-commerce to primary revenue source for wireless operators**
- **3G License award fees drive network rollout imperatives**



Third Generation: Where The Internet And Mobility Intersect

Today's communications are via multiple devices with the dependence on interfacing with intranets for timely business information

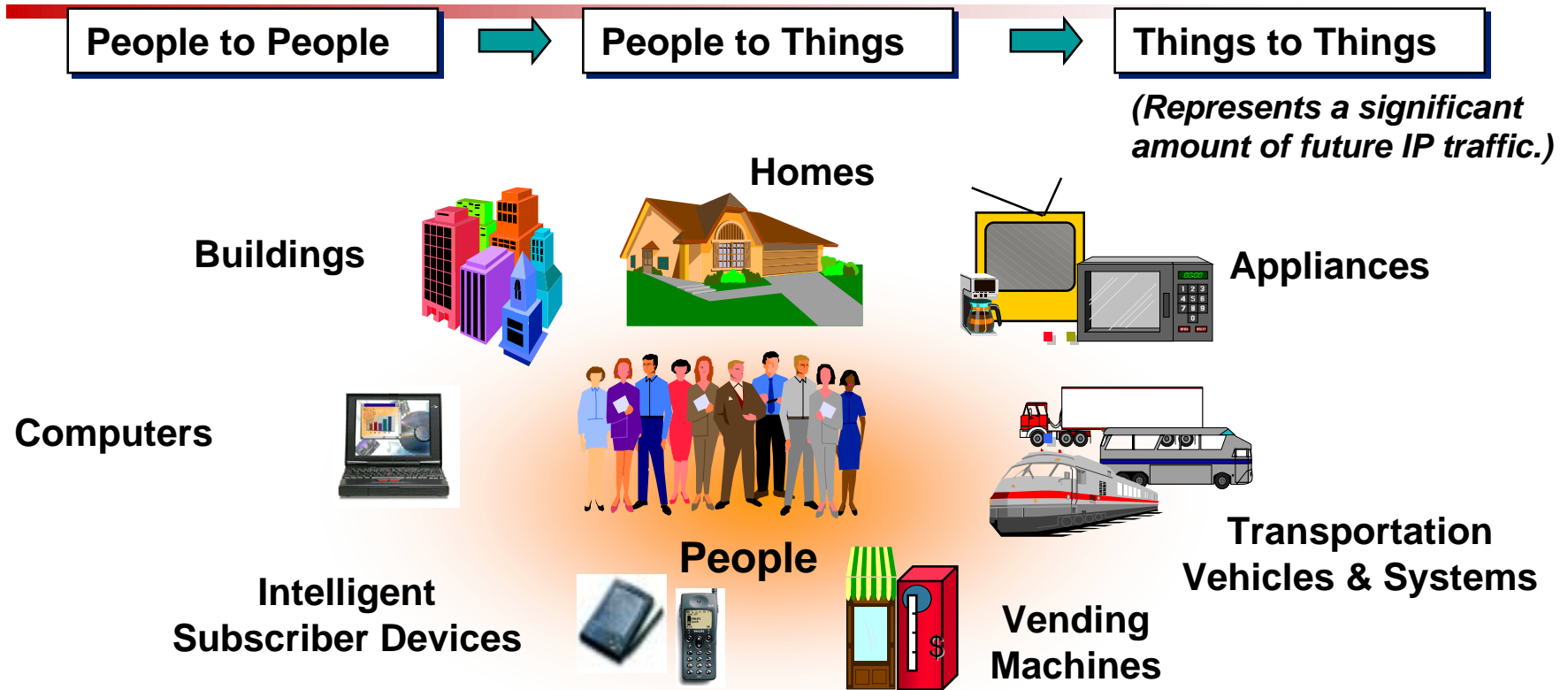


3G enables personalization and integration

- ➔ Individualized services across multiple networks
- ➔ Seamless personal service delivery
- ➔ Always on: anywhere, anytime

Communications Network Transformation

The nature of communications has been changing...

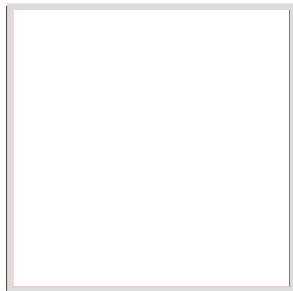
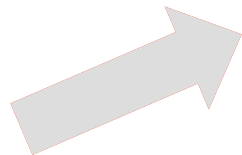
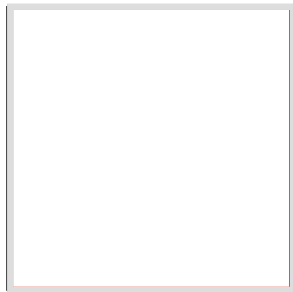
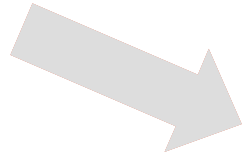
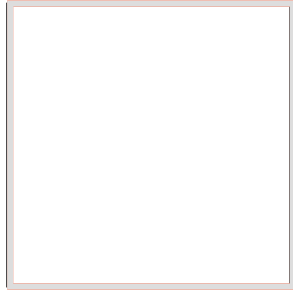


End Users require:

- ➔ “Always On” Connectivity, At Home, At Work, and On the Go
- ➔ Converged Services available via multiple forms of access.
- ➔ Exploding need for ever increasing wireless speed

➔ **BLAST**

BLAST



- **Signals summed**
- **Noise subtracted**

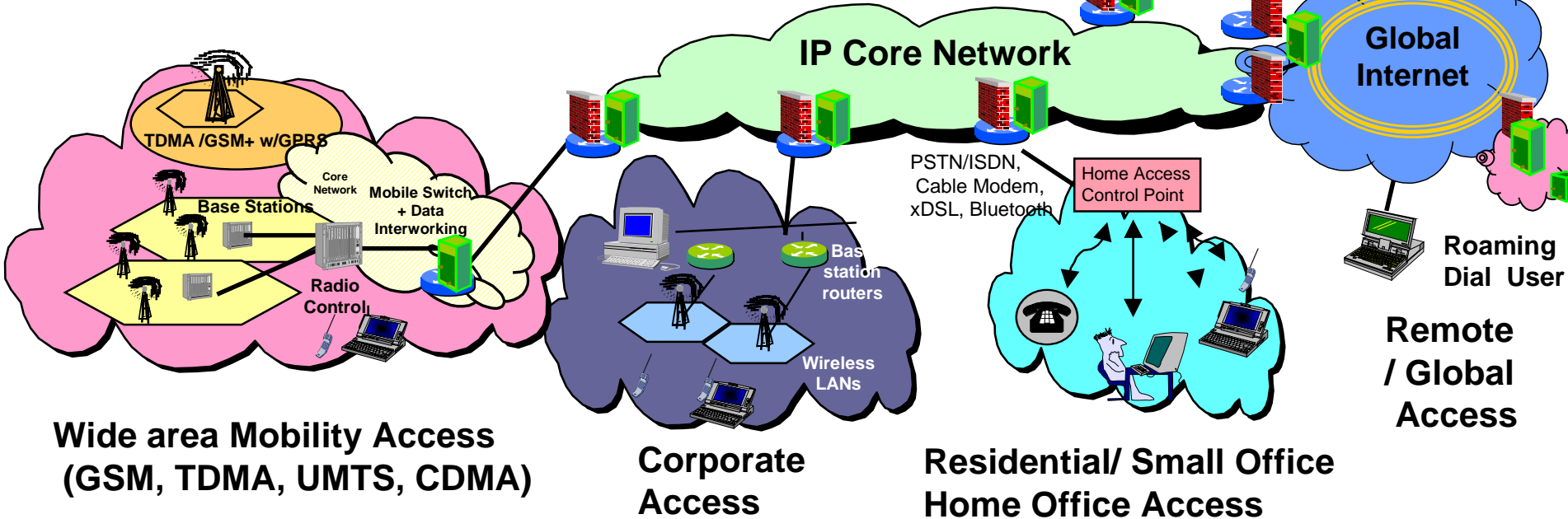
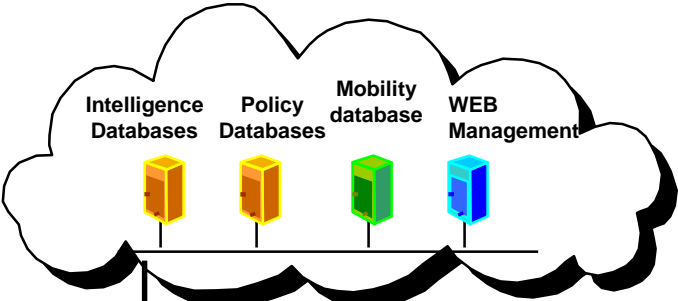
Mobile Internet Growth Strategies

- **Bring to market solutions that retain value in service provider networks**
- **Enable rapid service creation through APIs to Mobile Internet Gateways**
- **Accelerate Mobile Internet through partnerships and alliances**
- **Advances in 3G network technology helps carriers launch new Internet services requiring high data rates**

Next Generation Network Environment

- Multiple Access Networks:**
 - ➔ Fixed and Mobile
 - ➔ Current and Third Generation
- Intelligent Services Layer:**
 - ➔ Provides Inter-Domain Services and Applications
 - ➔ Provides Common Application layer for multiple access networks
 - ➔ Provides single service appearance across residential, corporate and mobile environments.
- IP Core Network**
 - ➔ Provides common transport for Access Networks

Intelligent Services Layer



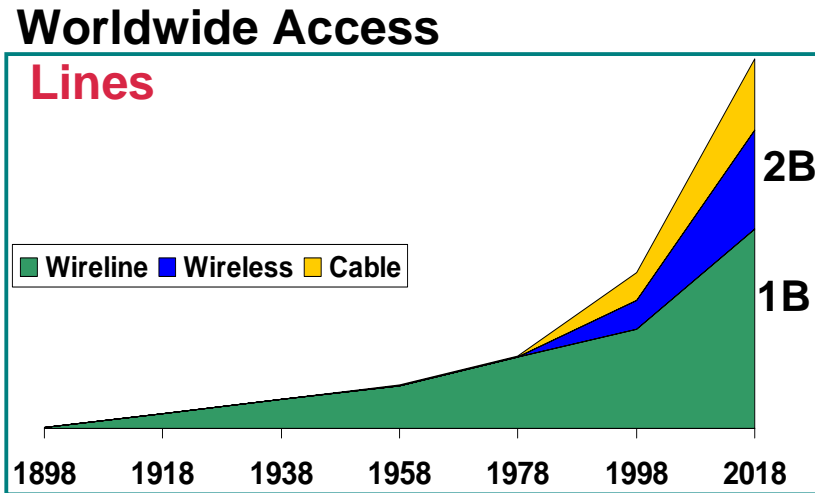
Wide area Mobility Access (GSM, TDMA, UMTS, CDMA)

Corporate Access

Residential/ Small Office Home Office Access

Remote / Global Access

A revolution in information networking is creating unprecedented global change

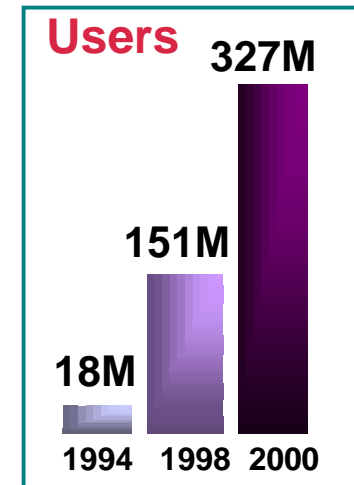


- A century to install the world's first 700 million phone lines; 700 million more lines over the next 15-20 years; 630,000 next week
- More than 400 million wireless subscribers in the world today; 500,000 new subscribers each day; 800 million more over the next 10 years;
- More than 200 million Cable TV subscribers in the world today; 300 million more over the next 15-20 years
- 58 million Km of fiber deployed in '99 - enough to circle the globe 1450 times

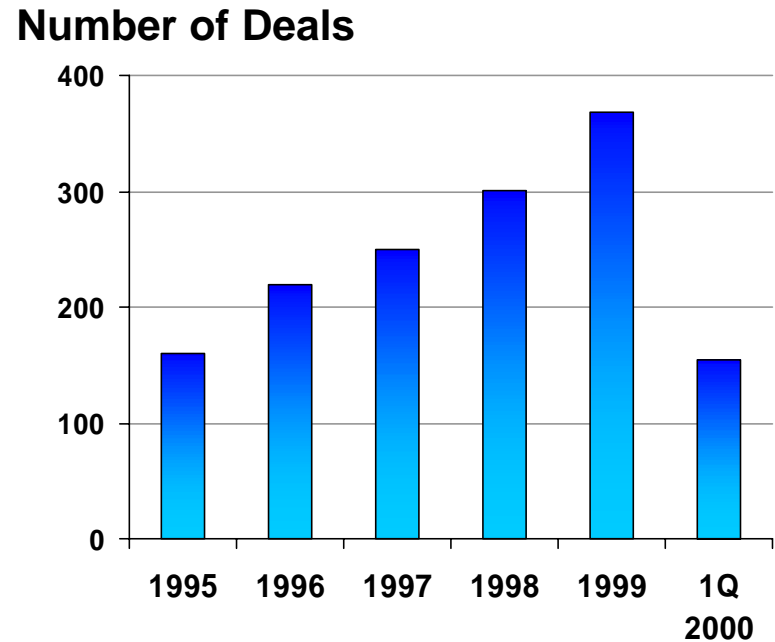
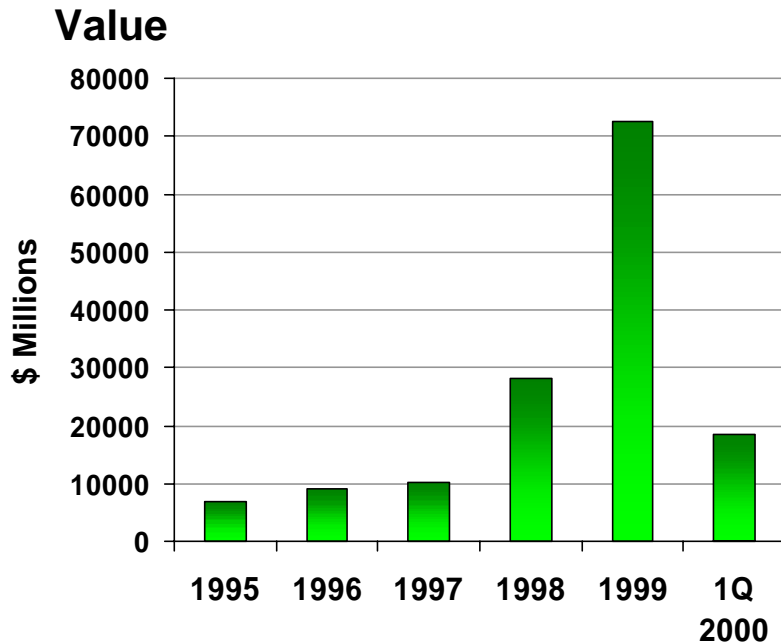
The phenomenal growth of the Internet is driving infrastructure growth

- 12 million e-mail messages in next minute, in addition to 0.5 million voice mail messages
- 37 million people will log on to the net today and choose from 830 million web pages!
- In the next 100 days, Internet traffic will double
- More than 100 million additional Internet users and 25 million websites will come on-line in 2000
- More than 25 million new Web sites will come on-line in the next year
- E-commerce projected to reach \$7 trillion by 2004
- More than 600 million devices connected to cellular networks by 2002

Global Internet

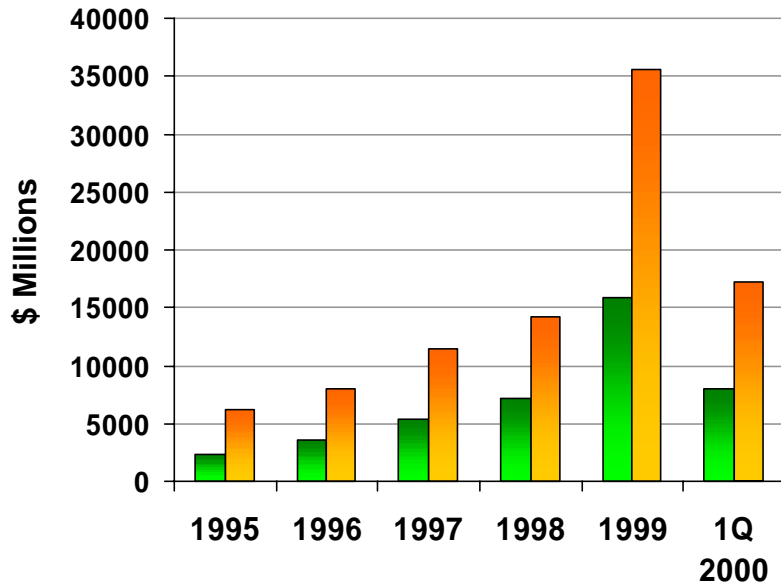


The pace of mergers and acquisitions in Telecom/Networking is exploding

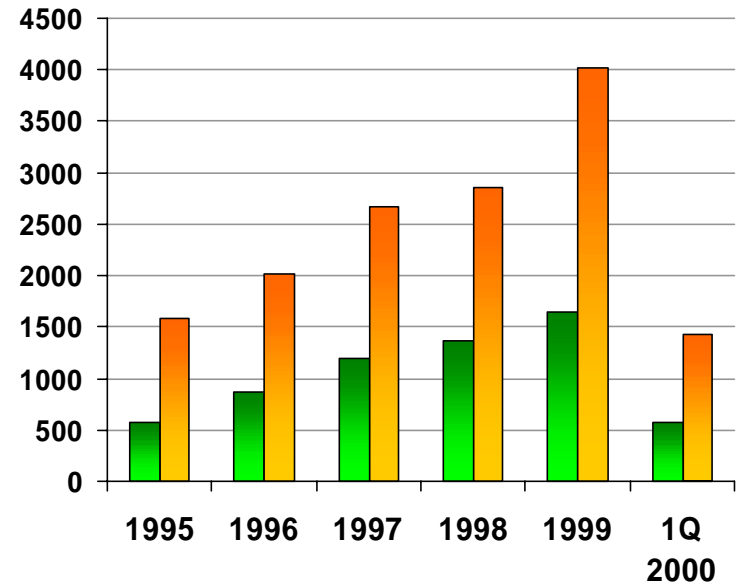


Venture capitalists are participating in the Telecom/Networking Gold Rush

\$ Invested



Number of Companies Funded



 Networking Systems
 All Venture Funding

The market ecology of the communications industry is shifting

- **50+ countries will deregulate telecommunications delivery between 1998 and 2002**
- **Data traffic is becoming dominant but today voice traffic generates 90% of the service revenue**
- **Enterprise data traffic is shifting from 80% internal, 20% external to 20% internal, 80% external due to Internet/web**
- **Communication Services is becoming a supply-side market**
- **Communication platforms are disaggregating and layering**
- **Rapid innovation and de facto standards are the norm**
- **e-everything is demanding a new communications infrastructure**
- **1000 new providers of telephone, Internet and wireless communications services in the next two years**

Threat or Opportunity?

The rapid growth of e-commerce, enabled by global networks, is a global disruption, similar to the printing press, electricity, the telephone, and the computer.

Threat: Companies that are slow to embrace the new technologies may be displaced, damaged or destroyed.

Opportunity: Companies that seize the new technologies to reduce costs, improve customer satisfaction, increase speed of operations, transform business processes, and address new markets can thrive.

Attributes of Survivors

Speed

Customer Focus

Cannibalize/Re-invent

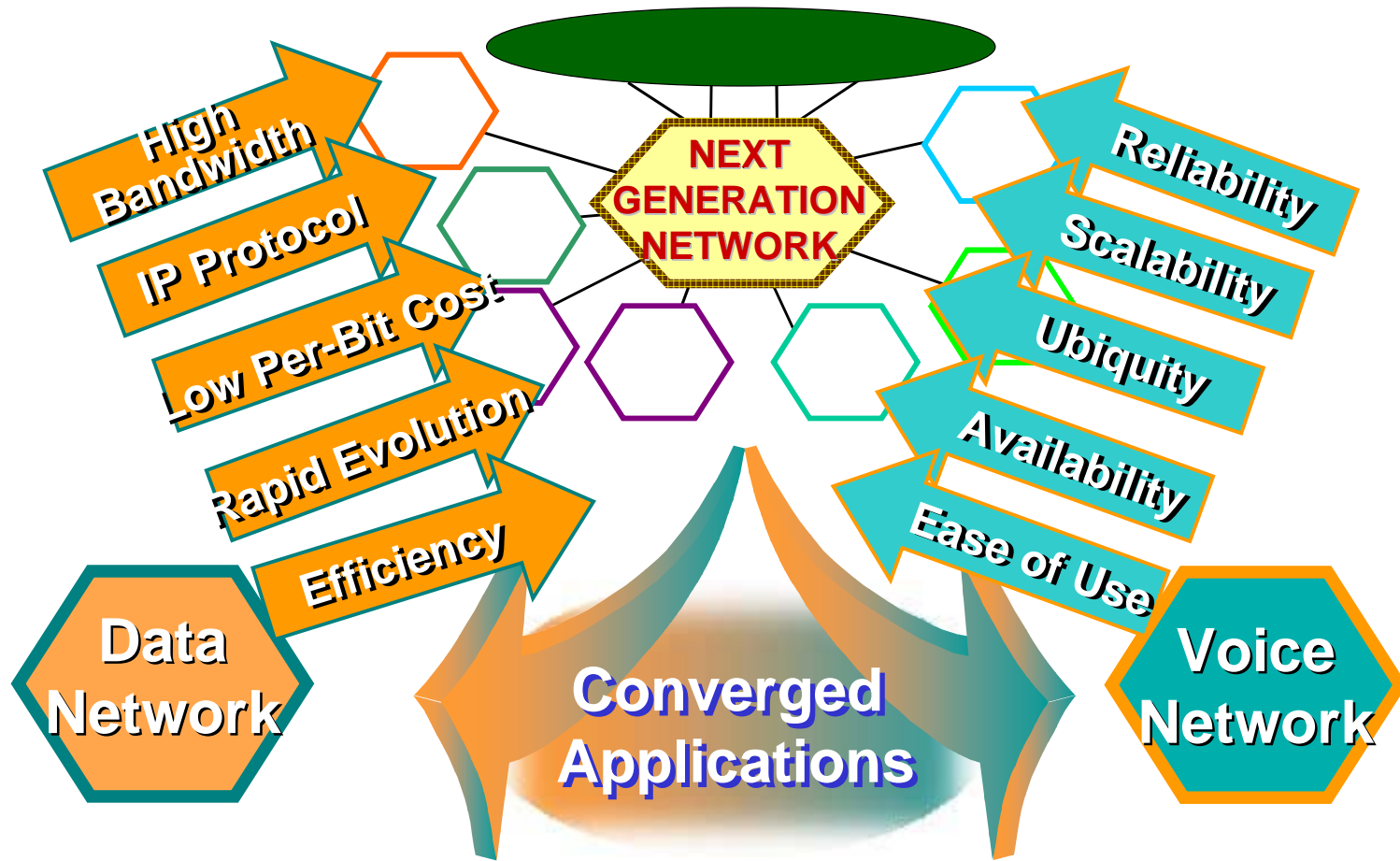
Cost/Simplicity

Global

Digitalization enables beneficial new tools and rules for business transformation

- **Put all operational data on-line**
- **Re-engineer all processes for real-time feedback and speed**
- **Empower employees and customers with on-line tools and access to solve problems themselves**
- **Create virtual teams and organizations across time and place**
- **Reduce hierarchies and eliminate “middlemen”**

Next generation converged networks will incorporate the best features of today's voice and data networks



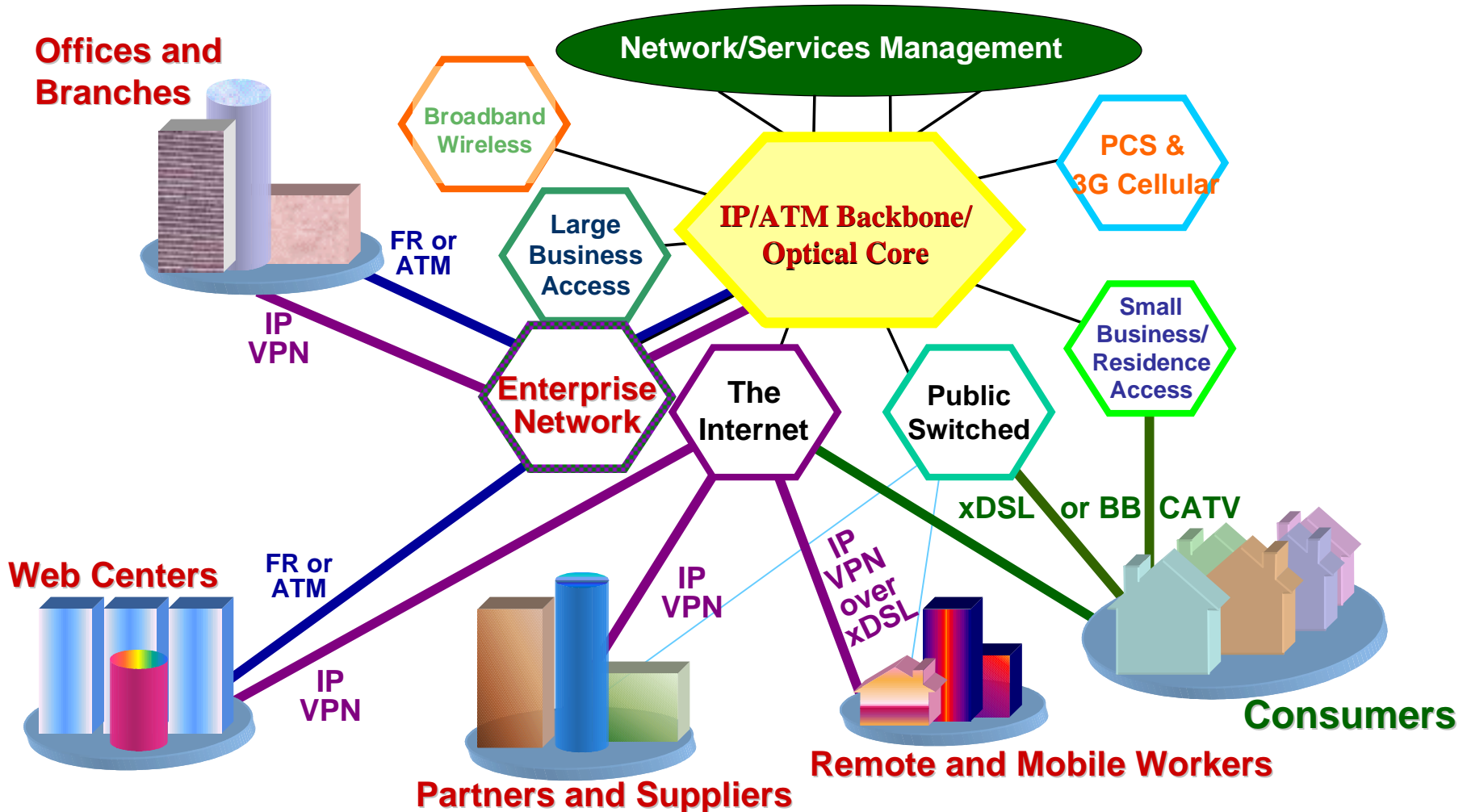
Networks will work together to seamlessly deliver personalized, multiple-media services with a variety of easy-to-use appliances

Optical, switched, packet, wireless, and software technologies will integrate to provide sophisticated communications services

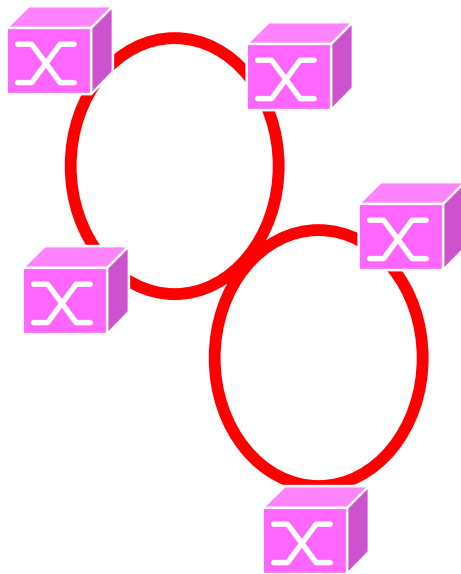
Next generation networks will have:

- **High reliability and ease of use compared to today's switched networks**
- **A multiservice core integrated with optical, ATM/IP and terabit capacity**
- **Broadband access that will cut across wired and wireless, voice, data and video**
- **Service provider-enabled enterprise networks that will change the way businesses operate and create value**
- **Wireless networks will provide a seamless extension of the wired infrastructure**
- **e-business infrastructure capabilities on both public and private networks**
- **Enabling capabilities for the transition to a “virtual enterprise” provided on open platforms**

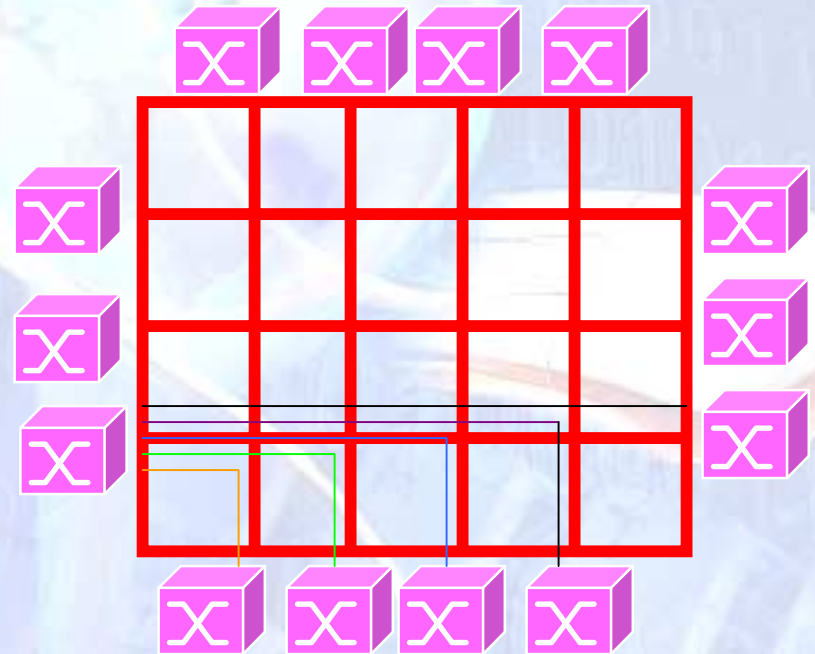
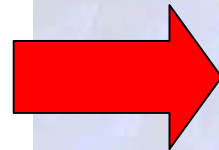
Next generation network will be a seamlessly interconnected Network of Networks with a packet-photonic core



Exploding demand and high capacity optical transport/switching will favor mesh architectures in the core network



Frames Over Rings



λ 's Over Meshes

Scaling Routers is more expensive than scaling optical transport/switching

Gigabit Ethernet and CyberCenters will virtualize the enterprise

