

Networking Trends

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Overview

- Network Convergence
 - » Growth in Network Usage
 - » Application Trends
 - » Bandwidth Requirements
 - » Standardization
 - » Result: Network Convergence
 - » Converged Network Architecture
- Consequences of Convergence
 - » Policy Based Management

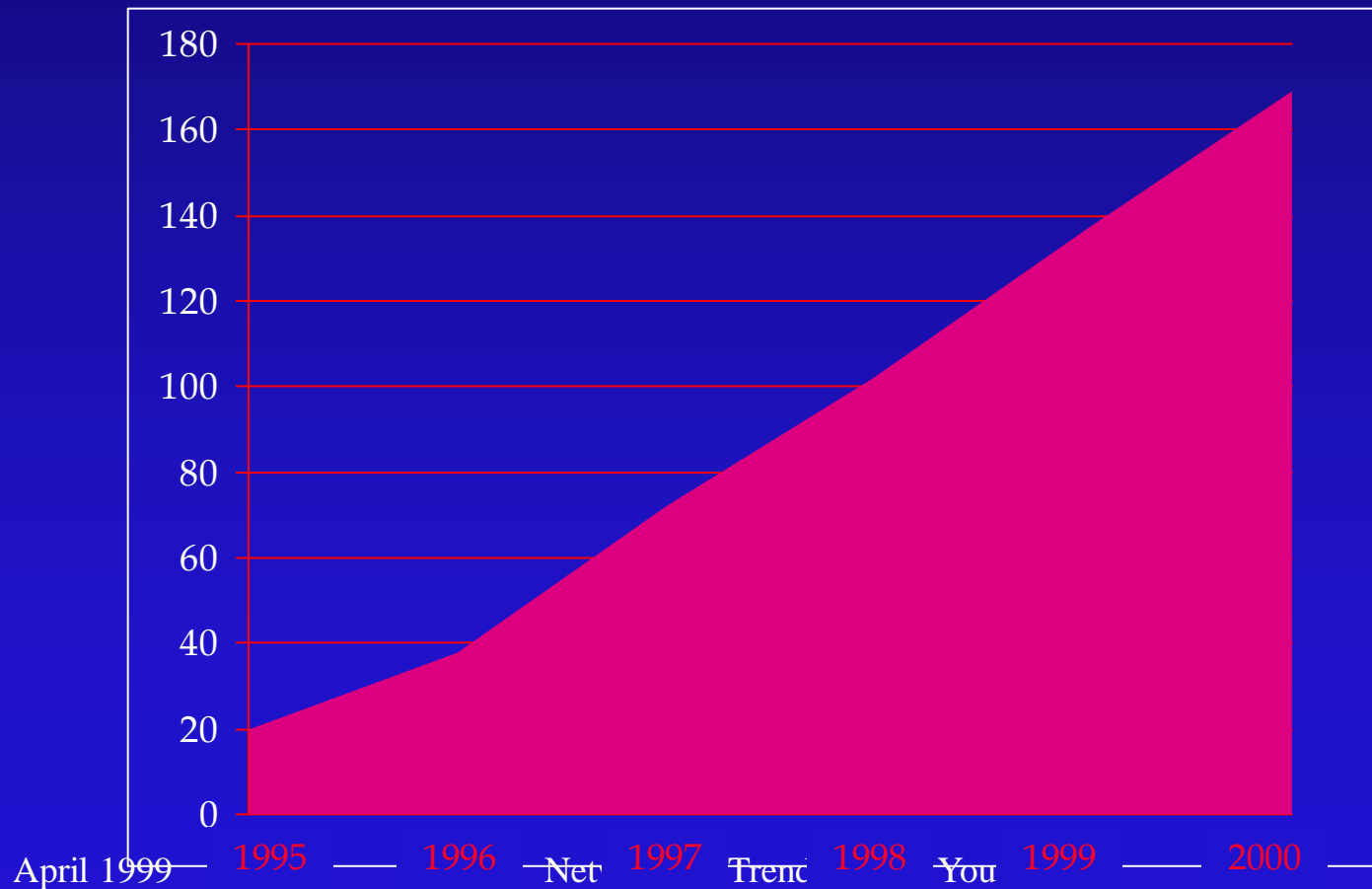
Growth in Network Usage

- World wide web has permanently changed networking.
- Millions of individual users access the internet from home regularly
- Home offices are on the increase
- Businesses are using the Internet for commerce.
- Increasingly, individual organizations are maintaining their own intranets



Internet User Growth

- World Wide Web Users in Millions





Current Trends in Applications

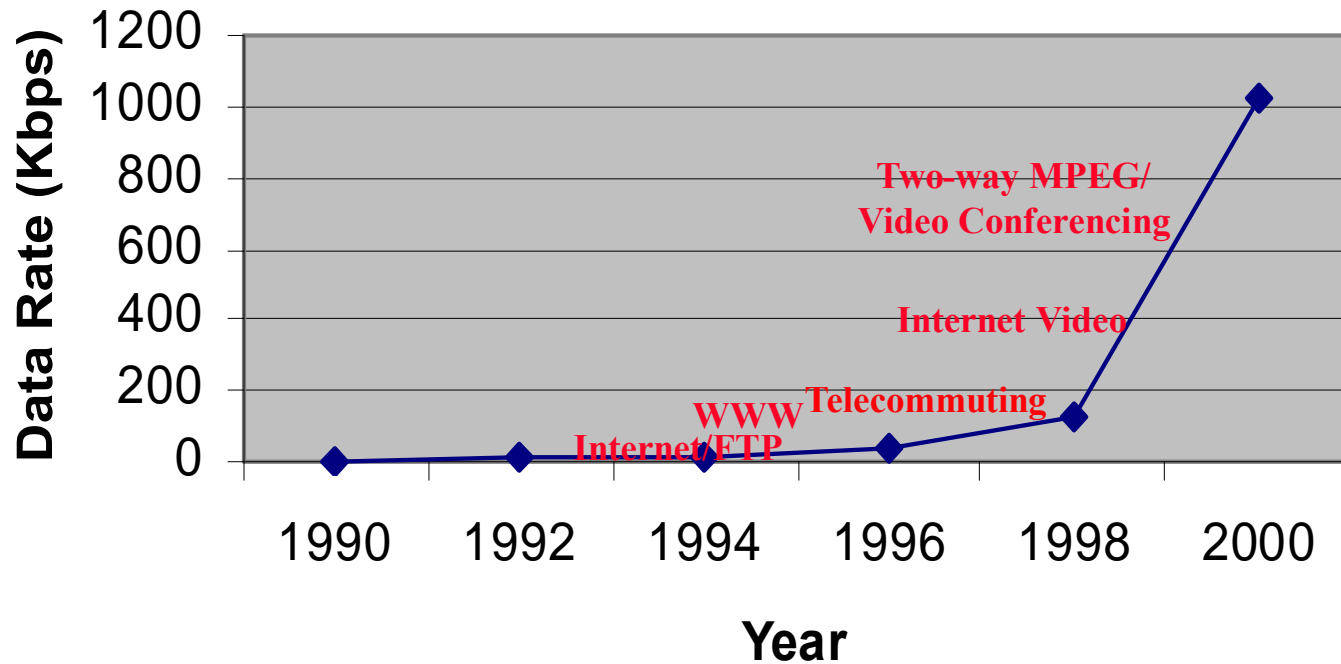
- Web pages now provide animated graphics, audio & video.
- Ease of use is expected of applications.
- Number of functions are expected from a single application (e.g., Web browsing, Mailing, Calendaring etc.).
- Diverse data types are expected to be handled by a single application (e.g., Documents embedding spread sheets, graphics, voice etc.)

Future Trends in Applications

- Entertainment on demand
 - » Movies, TV shows, Sports & . on demand
- Video conferencing
- Online publishing
 - » Majority of books & other publications will be online
- Electronic banking & cash
 - » Electronic banking will displace checks & cash in commerce
- Telecommuting
 - » Employees will perform jobs from remote locations
- Electronic sales
 - » Goods & services will be sold by web
- Distance learning



Predicted Bandwidth Requirements



Technology Trends

- Devices capable of integrating a number of technologies are being designed and produced e.g. a single switch may interface ATM, FDDI, fast Ethernet.
- Layer 2 and Layer 3 (IP switches) are being designed and produced.
- To meet increased bandwidth needs and application sophistication new standards are being proposed.
- Devices capable of prioritizing and filtering are becoming available.



Technology

Essential Technology characteristics to support future applications

- Manageability
 - » Policy responsive network, administrative partitioning
- Scalability
 - » Cost effective growth, bandwidth on demand, Usage & application based prioritization, multi vendor solutions
- Reliability
 - » Utility like uptime, self healing networks, embedded security enforcement
- Next generation features & services
 - » Advanced application functionality, ability to easily create new applications & services



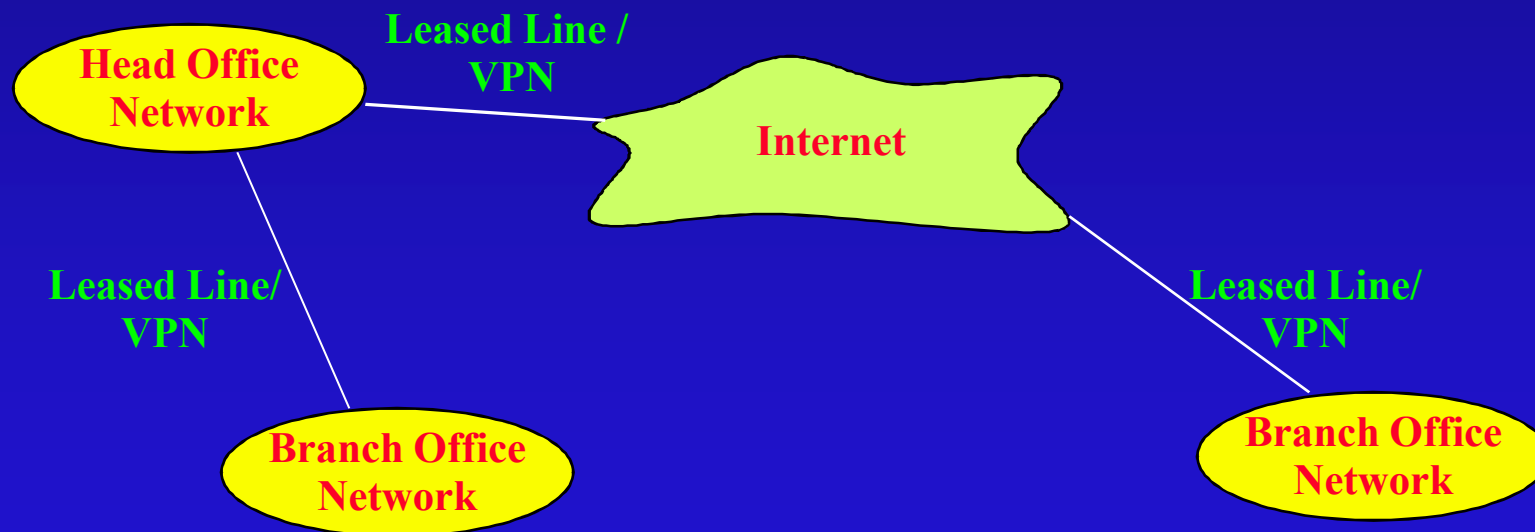
Standardization Efforts

- Standards are necessary to maintain flexibility & to avoid the clutches of proprietary designs. Some forthcoming standards:
- ITU: H323
 - » Supports packet switched networks to carry telephony traffic
- IEEE: 802.1p, 802.1Q
 - » Support prioritization of data traffic at layer 2, this enables QoS
- IETF: RTP, ISLL, RTSP
 - » Real-time Transport Protocol, Integrated Services over Specific Link Layers & Real-Time Streaming Protocol enable IP networks to carry multimedia traffic



Case Example

Why should the company pay for separate inter-branch telephone charges when the VPN could carry voice traffic?



Result : Network Convergence

Converged networking is an emerging technology thrust that integrates voice, video & data traffic over a single network



Network Convergence

Network Convergence entails convergence in various aspects e.g.

- Payload Convergence

- » Different data types are carried in same communications format (e.g., layer 1 audio & video streams as well as layer 3 packets may be carried in layer3 datagrams)

- Protocol Convergence

- » The move is away from multi-protocols to a single protocol namely IP

- Physical Convergence

- » All payloads travel over the same physical network (QoS & CoS may however be used to differentiate service requirements



Network Convergence (Contd..)

- Device Convergence
 - » A single switch may support Ethernet packet forwarding, IP routing, ATM etc.
- Application Convergence
 - » A single application integrates formerly separate functions (e.g., Web pages allow interactive communication)
- Technology Convergence
 - » Same technology (e.g., ATM) is used for both LANs & WANs
- Organizational Convergence
 - » Centralization of networking, telecommunication & computing services under a single authority

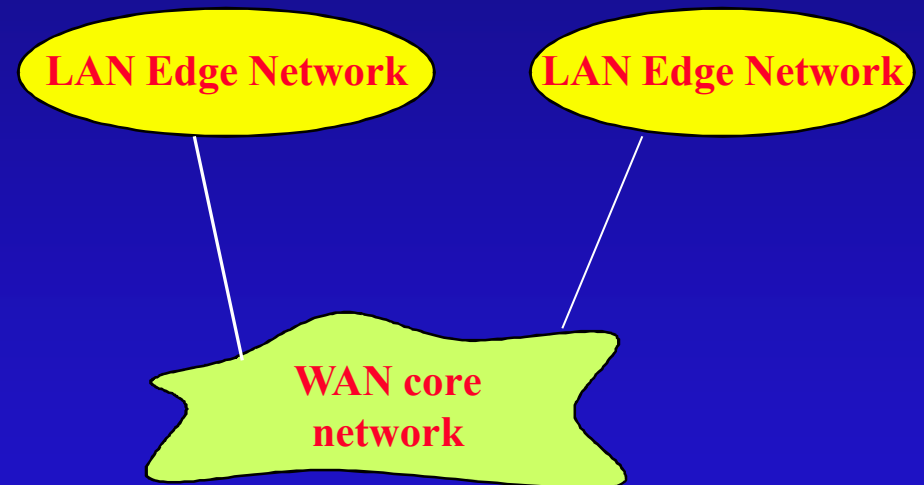
Converged Network Architecture

- A large converged network will probably be composed of LANs and WANs
- They will not be homogenous networks, due to:
 - » Differing economic and performance requirements over LANs and WANs
 - » Differing bandwidth, delay and jitter requirements
- Two possible scenarios are presented.



Converged Network Example 1

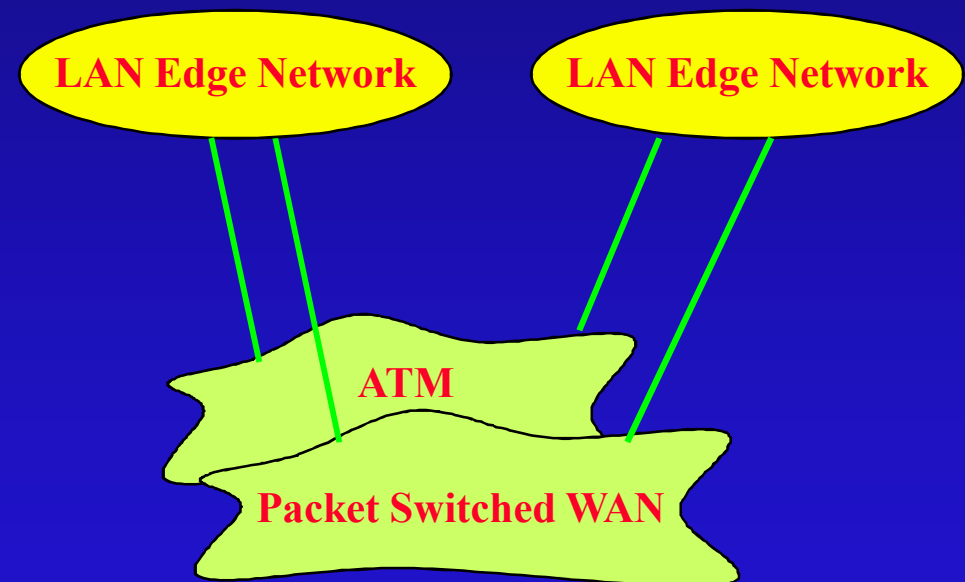
- Edge network: Switched or routed Ethernet
- Core Network: ATM or Frame Relay etc.





Converged Network Example 2

- Parallel core networks
- Traffic is filtered into different service classes at exit from LAN, and routed via different networks:
 - » Connection oriented ATM for multimedia traffic
 - » Packet switched WAN for bursty LAN traffic



Summary

Explosive increase in Transmission Bit Rates And Switching Capacities

Abundant Computing power, DSP, Compression etc.

Distributed operating systems, Middleware, Intelligent agents, Real time database systems.

