Services over Internet Protocol: Voice is Just the Beginning

AT&T

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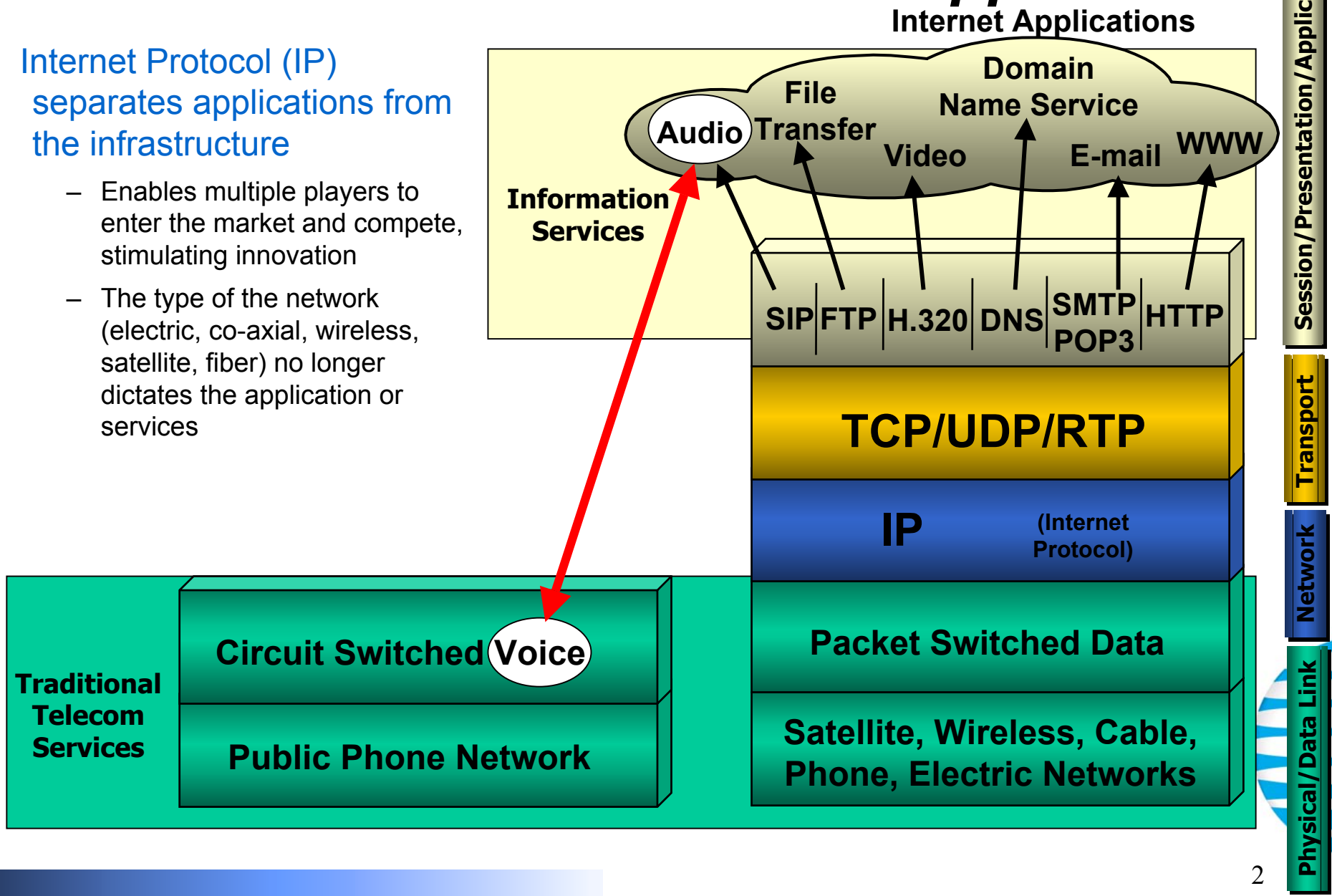
IP Enables New Generation of Applications

Internet Protocol (IP) separates applications from the infrastructure

- Enables multiple players to enter the market and compete, stimulating innovation
- The type of the network (electric, co-axial, wireless, satellite, fiber) no longer dictates the application or services

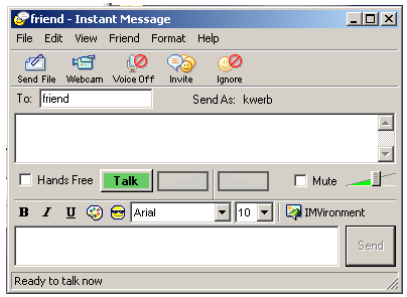


VoIP:

An information service that delivers voice communications and enables voice convergence with other data applications and devices.

WHAT THE FUTURE HOLDS:

- Presence (Instant Messenger, Follow me)
- One Number / “Follow Me” Services
- IP Call Centers
- Universal Messaging
- Virtual Meetings / Collaboration (like NetMeeting)
- Real time language translation
- IP Centrex
- Multi-Point Videoconferencing
- Desktop Multimedia
- Push to Talk Cellular
- Voice Chat

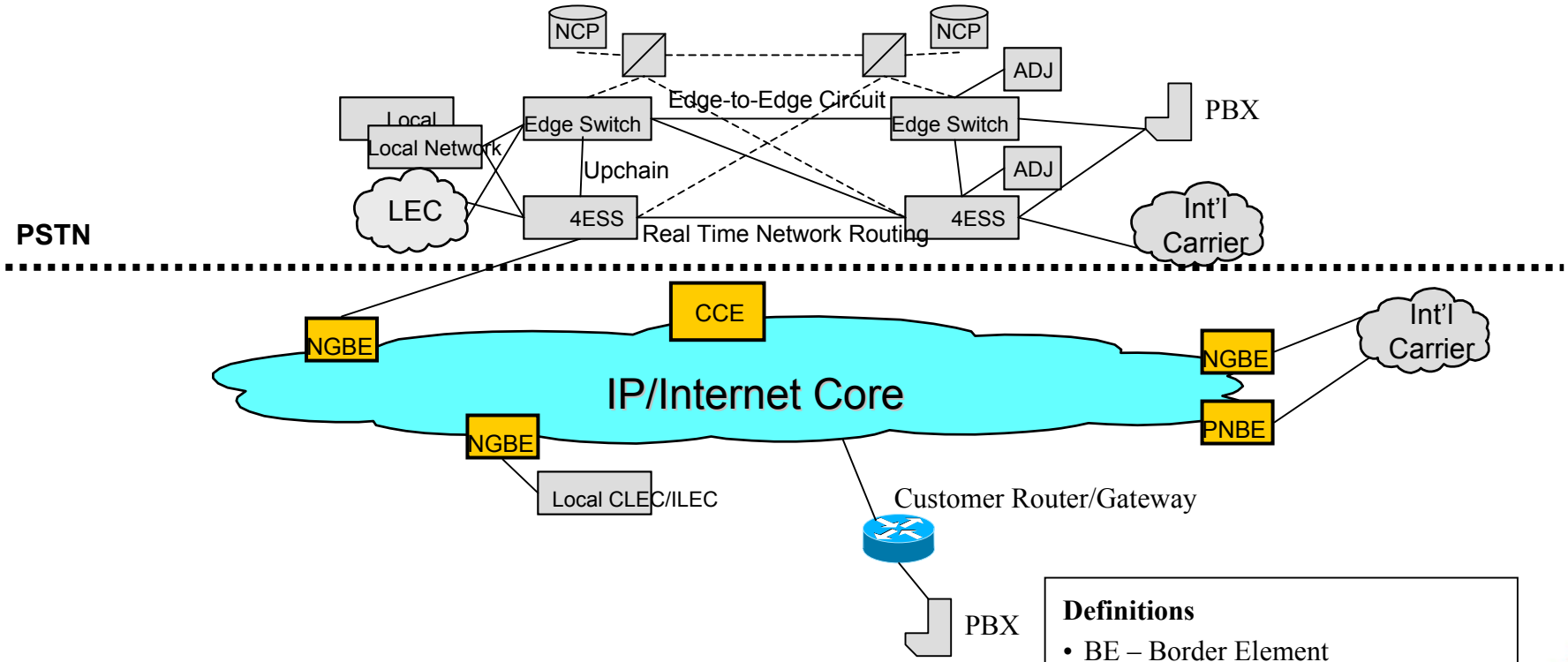


Some Industry Trends

- Data / voice distinction is blurring
  - The Internet is increasingly being used for voice and data (e.g., AT&T's phone-to-phone IP telephony)
  - Many corporate packet networks run VoIP and TDM combinations
  - Long distance and local service providers run VoIP for an increasing portion of total traffic
  - Cable operators are offering VoIP and cable telephony services
- Voice is becoming an application over IP networks
  - The industry architecture for VoIP is to treat the voice packets and the signaling as applications on an IP network
  - Innovative IP-based applications (e.g., call routing, integrated messaging) are written for the IP network
  - Phone numbers can be location independent
  - Phone calls are going to be distance independent
- Device functionality is converging
  - Emergence of devices such as cell phones that are PDAs, SIP telephones that are also Java computing devices, WiFi handsets that are SIP endpoints
  - Protocol conversion is happening directly in many CPE devices, not just "computers"

It is quickly becoming difficult to discern what is a "phone call" in the traditional sense.

VoIP – The Early Days

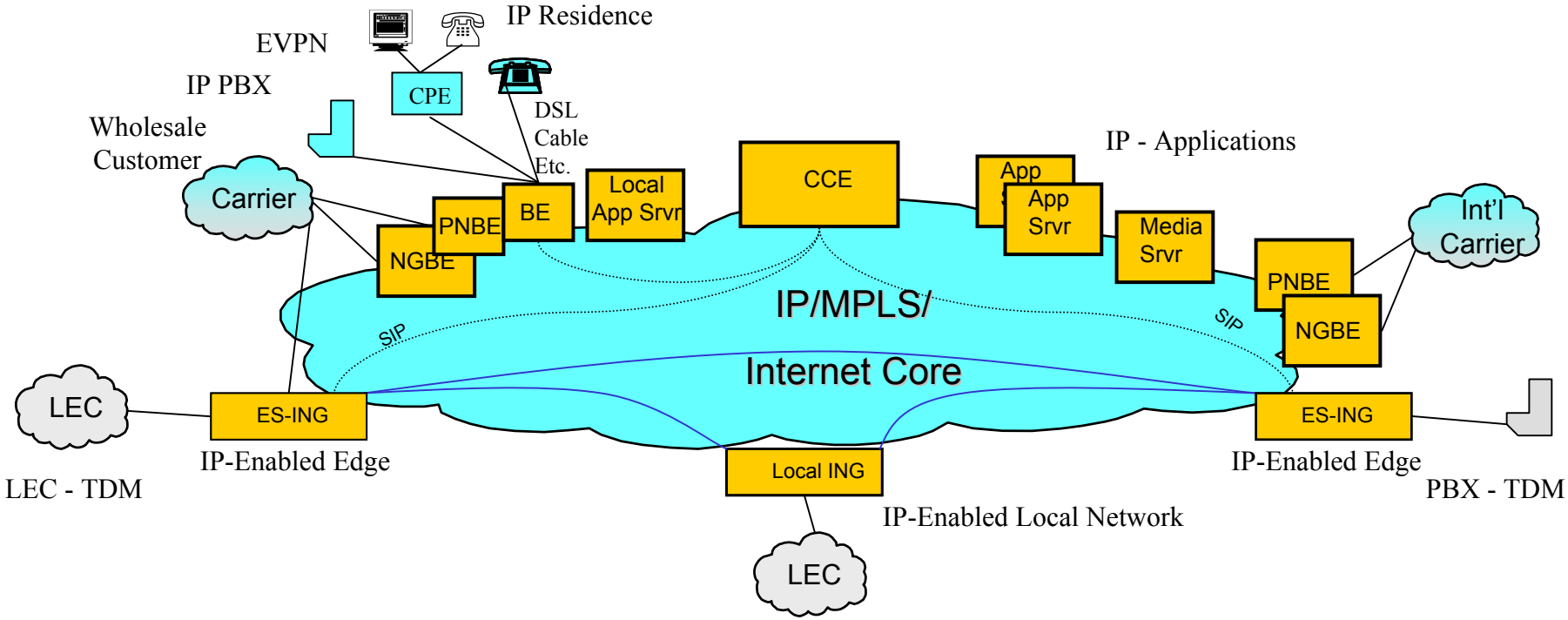


Advanced Voice Features Across TDM
VoIP transport with hop-on/hop-off

Definitions

- BE – Border Element
- CCE – Call Control Element
- ING – Integrated Network Gateway
- NCP – Network Control Point
- NGBE – Network Gateway Border Element
- PNBE – Peer Network Border Element

VoIP – Today's Build-out



Interconnect local, toll & international switches with IP.
Replace Adjuncts with Media Servers to reduce capex.
Interconnect private VPNs with public VoIP services.

Definitions
- BE – Border Element
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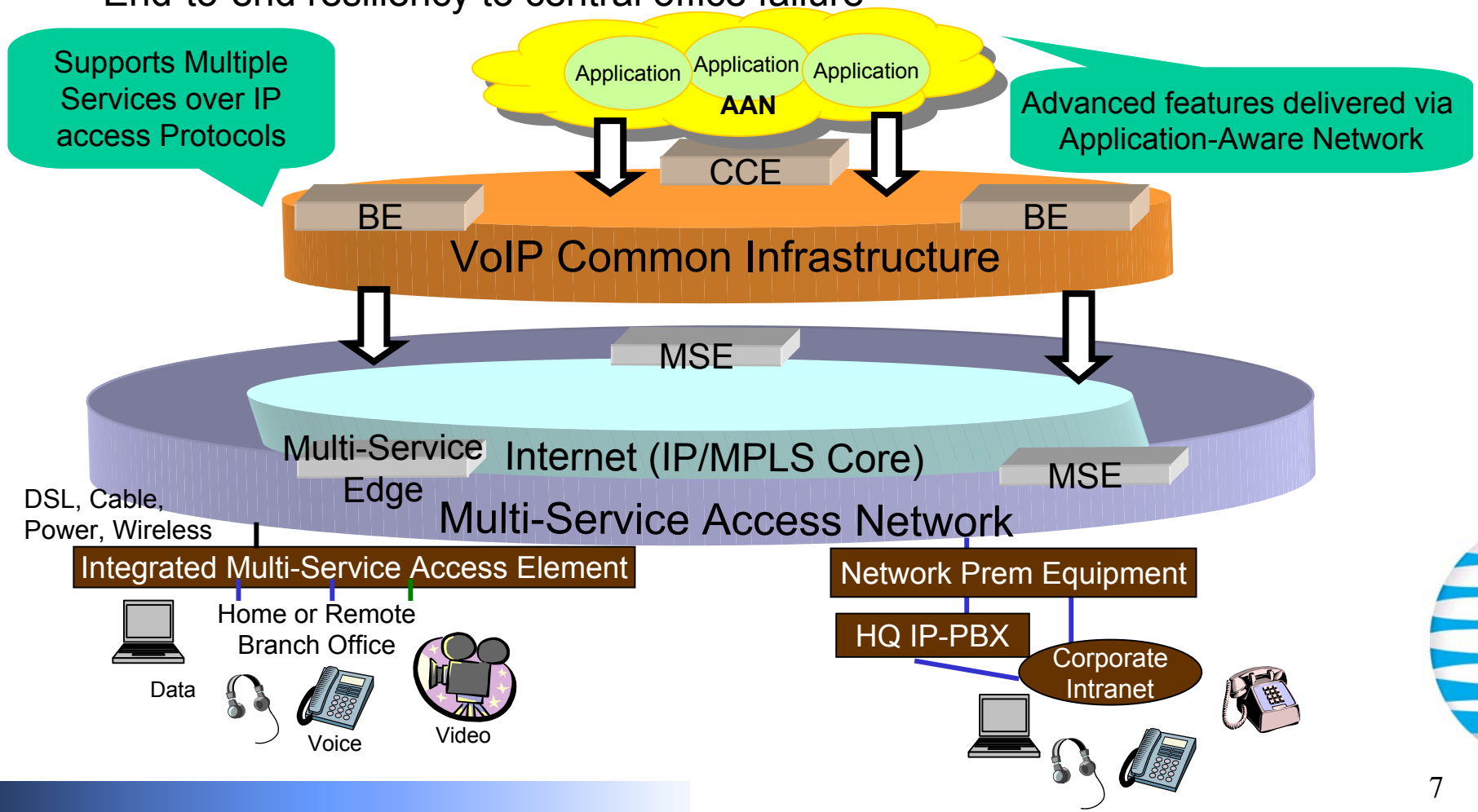
- ING – Integrated Network Gateway
- NGBE – Network Gateway Border Element
- PNBE – Peer Network Border Element
- BS - Business

Services over IP – The Goal

- Secure, integrated voice/data/video access
- Extension of premise intelligence to reduce operations cycle time
- Innovative applications in the network based on standard protocols and service creation environment
- End-to-end resiliency to central office failure



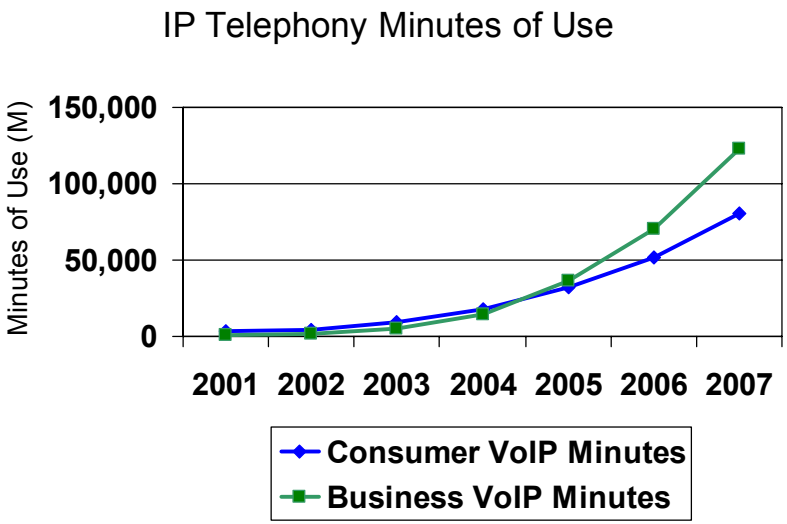
Voice Begins Its Transformation to IP

- The AT&T Voice Network – Big shoes to fill
  - 350M calls/day
  - <100 Defects per Million
  - 10^{-5} blocking
  - 200 Toll switches; over 130 Local switches; 15 International gateways
- Magnitude of Migration
  - Approximately 525K T1s connected to the LD network
  - Even more complicated than the industry shift to all-fiber networks and the digital conversion (due to VoIP protocol explosion)
  - Huge investment required in VoIP network, systems and migration tools
- Industry perspective
  - Little investment being made in circuit switching technology (other than maintenance)
  - Investment in VoIP technologies and real-time, IP-based applications
  - Intelligent endpoints (not just black telephones) are emerging
  - Significant customer (consumer and business) benefits are emerging

AT&T Leads the Industry in IP Networking

Contribution to U.S. Economic Growth will be Driven by Business Uses of VoIP

(even though Consumer minutes lead today)



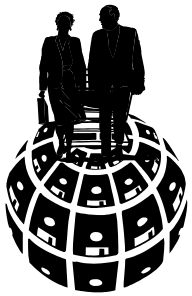
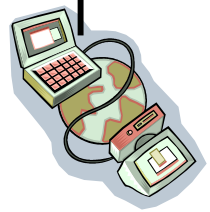
Source: IDC, 2003

BUSINESS DRIVERS

- Emergence of Native IP Environments
  - IP Centrex, IP PBX, IP Phones, Soft Phones, Multimedia on the LAN
  - 3G Wireless, Broadband Networks
- Enterprises seeking to save money on intra-company telephone calls and faxes
- Companies want web-based call centers/web callback/e-commerce
- New IP based features and services
  - Mobility, Presence
  - Unified Messaging, Multimedia Conferencing
  - Follow Me, Portals
- Technology maturing with open standards for easier, faster innovation
- Convergence to a single IP network for all applications
  - No local and LD distinction

Who Benefits from Selling IP Applications?

The IP Value Chain Encompasses Much More Than Telco Carriers*

User	IP Appliance	IP Interface	Local Network	Packet Gear	App Provider/ ISP	Network Wholesaler	IP Apps
							
• Consumers • Small Businesses • Corporations • Government Agencies • Religious organizations, libraries, schools • Non-profits	• Dell • Compaq • Apple • Motorola • Intel • Dallas Semiconductor • IBM • Hewlett Packard • Sony Electronics • Gateway • Panasonic • Nokia • Ericsson • Palm • Audiovox • Kyocera • Samsung • LG Electronics • Sanyo • Philips	• Cisco • Lucent • Siemens AG • Nortel • 3 Com • Alcatel • Avaya •Net2phone • Clarent Corp. • 8 X 8 • Super Technologies	• Verizon • SBC • Bell South • Qwest • AOL-TW • AT&T • Comcast • Cox • Hughes • Echostar • Worldcom • Sprint • Nextel • US Cellular • Cablevision • Adelphia	• Cisco • Sun Microsystems • Nortel • Lucent • Oracle • Silicon Graphics • Novell • Siemens • Storage Tek • Corning • Akamai • Avaya	• Net2Phone • Deltathree • Iscom • Super Technologies • Dialpad • TalkingNets •ComEase.com • 8 X 8 • Vonage • Startec • ILink./World Exchange • Earthlink	• ITXC • iBasis • Global Crossing • NetVoice • Level 3 • AT&T • InfoNet • GoBeam • Exario	• Microsoft • Yahoo! • AT&T • Cisco • 8x8

*Does not include many broadband wireless providers beginning to provide services in the local network and home/business LAN

Economic Boost to the Economy from VoIP

- VoIP will be a broadband driver.
- VoIP, and its integrated voice and data features, will revolutionize the way companies do business and how consumers use communications.
- VoIP allows workers to be more productive from home, and more productive at work.
- August 2003 Business Week analysis stated that productivity-improving technology investments, like VoIP, could yield $140 billion in annual costs savings in the next five years to businesses in six industries alone.
- These are the kinds of productivity gains that can, in turn, drive broader economic growth and raise standards of living.

IP Networks Pay Their Way Today

- When an ILEC terminates VoIP services today it receives either reciprocal compensation or local end-user business line rates.
  - State commissions have generally based reciprocal compensation on TELRIC-based transport and termination charges, which ensure that the ILEC recovers its costs plus a reasonable profit.
  - The FCC found in ISP exemption order that local business lines fully compensate ILECs for the cost of providing service.
  - ILECS have provided no evidence that the charges they receive to terminate VoIP services are insufficient.

VoIP: A Catalyst for Regulatory Reform

- Despite the great promise of VoIP, concerns have been raised about its effect on the legacy access charge regime and its potential impact on universal service.
  - However, issues of regulatory reform for access, intercarrier compensation and universal service existed before the arrival of VoIP.

- VoIP itself is not the real cause for concern here – ILECs are fully compensated for the cost of terminating traffic. VoIP only highlights the urgent need for regulatory reform.

- The FCC must address these issues head-on in proceedings designed to implement the comprehensive reforms of intercarrier compensation and USF.

VoIP: A Catalyst for Regulatory Reform
Intercarrier Compensation

Burdening VoIP with access charges will stifle innovation and advancement of this technology.

- VoIP traffic should not be subject to above-cost access charges.
  - VoIP is in its infancy and represents less than 5% of interexchange traffic.
  - The FCC's policy should be to encourage the transition from circuit switched to IP services. Refraining from imposing access charges on initial VoIP services is critical to allow this transition to occur.
- The adoption of a rational intercarrier compensation regime is necessary to ensure the continued development of IP networks and innovative services.
  - Cost-based termination rates create a level playing field for all types of technologies and encourage the development of competitive services.

VoIP: A Catalyst for Regulatory Reform
Intercarrier Compensation

- The FCC must not make artificial regulatory distinctions between various types of VoIP traffic by imposing discriminatory access charges on a particular "flavor" of VoIP.
  - All types of VoIP providers compete with one another through IP technologies and there are no material distinctions in the uses of local facilities by any of the various forms of VoIP services.
  - Premature determinations of the applicability of access charges risk severe discrimination that will distort competition among different services that use the same technologies and have more in common with one another than they do with circuit switched long distance services.
  - A free and competitive market is one in which providers are free to subscribe to services that are efficient and are not artificially required by regulation to use services that have rate structures that are above-cost and inefficient.
  - Applying traditional access charges to phone-to-phone IP telephony would dis-incent IP network upgrades and enhancements, favor legacy circuit switched networks, and diminish RBOC interest in overall intercarrier compensation reform.

VoIP: A Catalyst for Regulatory Reform
Universal Service Fund

- There is broad agreement that the universal service funding mechanism is broken.
  - The current revenues-based system remains unsustainable and discriminatory. The fund size continues to increase as interstate revenues continue to decrease, leading to higher contribution factors.
  - "Safe harbor" discrimination favors wireless carriers over wireline carriers and international carriers over interstate carriers.
- Expanded revenue-based system that includes intrastate revenues is not a viable solution.
  - Does not address "leakage" from information services.
  - Determining USF assessable revenues from bundled offers is problematic.
- The adoption of a technology-neutral funding mechanism is the solution.
  - If the FCC adopts a permanent USF funding mechanism based on working telephone numbers, all providers of working telephone numbers would contribute to the federal Universal Service Fund.
  - Under a telephone numbers-based funding mechanism, contributor assessments would no longer vary by type of technology or industry segment.

VoIP Technology and Policy Challenges

- Accessibility
- Law Enforcement
- 911
- Quality of Service and Security

VoIP Technology and Policy Challenges: Accessibility

- In keeping with its commitment to accessibility, AT&T Consumer launched Internet Relay in 2001/2002. Internet Relay allows hearing impaired individuals to use a website to place text calls to an AT&T relay center which are then verbally conveyed by the relay center Communications Assistant. It can be used in conjunction with two line Voice Carry Over and Hearing Carry Over services. It does not require broadband.
  - AT&T also offers AT&T Video Relay Service over the Internet for hearing impaired individuals with a web cam and high speed internet connection.
  - There are no charges to customers for AT&T Internet Relay or Video Relay calls placed to US destinations.
  - Residential end users of AT&T VoIP services should be able to receive incoming voice relay calls and non-hearing impaired individuals should be able to place outgoing voice calls to relay centers.
  - VoIP packet loss compensation methods do not permit TTY users to currently use VoIP services to place or receive text relay calls.
  - Additional information on AT&T Relay can be found at http://www.att.com/relay

AT&T is committed to the accessibility, where readily achievable, of its information and communications products and services.

VoIP Technology and Policy Challenges: Lawful Interception Requirements

- AT&T understands policy makers' concerns that VoIP may pose difficult technical, legal and policy issues with respect to lawful interception activities and related requirements.
- AT&T believes that VoIP constitutes an "information service" that is expressly exempted from CALEA, and in any event, VoIP is presently not a "replacement for a substantial portion of the local exchange service" as required under the statute.
- Law enforcement has a wide array of means at its disposal, such as the Electronic Communications Privacy Act and Title III, to ensure that its lawful interception requirements are satisfied in the context of VoIP services being provided today.
- In addition to existing legal requirements, industry efforts are underway to find technical solutions to support lawful intercepts.
  - For example, Committee T1 (ATIS) is working on an industry standard that supports "lawfully authorized electronic surveillance" (LAES) of VoIP services.
- As VoIP evolves, AT&T will continue to work with industry participants to ensure that appropriate technical responses are developed to address legitimate law enforcement needs for interception.

VoIP Technology and Policy Challenges: 911

The VoIP industry is working with the public safety community to develop 911 solutions.

- The National Emergency Number Association (NENA) and VoIP leaders, including AT&T Consumer, reached an agreement on key principles for providing 911 services to VoIP users.
- The agreement provides that VoIP service providers will:
  - Provide 911 emergency service (at least routing to a Public Safety Access Point (PSAP)10-digit number) for customers using phones that have the functionality and appearance of conventional phones, within a reasonable time (three to six months).
  - Discuss approaches for providing 911 with the local PSAPs or coordinator when launching service in a particular area.
  - Support current NENA and industry efforts to reach an interim solution that includes the delivery of 911 calls through the existing 911 network, providing a callback number to the PSAP, and in some cases, initial location information.
  - Support current NENA and industry efforts to reach long-term solutions that include the delivery of 911 calls to the proper PSAP, providing callback number/recontact information to the PSAP, providing location of caller; and extending direct IP connectivity to PSAPs.
  - Develop consumer education programs to ensure that consumers are fully aware of VoIP 911 service capabilities and issues.
  - Support an administrative approach to maintain funding of 911 resources at a level equivalent to those generated by current/evolving funding processes.

VoIP Technology and Policy Challenges: Quality of Service, Security

- QoS is difficult to attain in a “best effort” connectionless packet network (packet loss, jitter, echo)
- Reducing latency requires managed IP backbones, native IP switching, and routing protocols that give preference to real time traffic
- Call setup delay is higher in a distributed call control architecture than in an integrated one
- Bandwidth
  - Overhead is higher in a packet switched network than in a circuit switched network
  - Features such as 3-way calling require more allocated bandwidth for the duration of the call
  - Must balance need for compression to reduce bandwidth with need for voice quality
- Security
  - Many IP PBX systems are based on Windows NT and can be hacked; firewall problems remain a concern in the SIP environment (IDC, 2003)
  - Network monitoring, intrusion detection and prevention and recovery are critical security processes to ensure quality of service

Innovation and Investment Drive IP Solutions

- Industry efforts to find technical solutions are dependent on continued research, development and investment in IP technologies.
- Innovation in the IP backbone is equally important as innovation at the edge of the network.
- VoIP services require large investments to upgrade Internet backbone facilities and to enable them to carry high quality voice as well as other data. These investments are essential preconditions to future offerings of the integrated voice, data and multimedia services that IP allows.
- For these future services to be realized, providers first must develop the capability to offer high quality voice services over Internet backbone facilities or other IP networks – and that requires that there be an initial economic reason to make the necessary investments.
- Few things would be potentially more destructive to the development of the Internet than imposing above-cost and inefficient access charges on VoIP services.

Realizing the Promise of IP

- The FCC's deregulatory policies towards VoIP have ensured that capital has been available to begin the enormous task of integrating VoIP technology into carrier networks.
- To unleash the full potential of VoIP, the FCC should:
  - Treat all VoIP services as information services
  - Support intercarrier compensation reform external to any VoIP proceeding and make fast track
  - Refrain from applying today's access regime to any form of VoIP in the interim
  - Reform and stabilize USF
  - Support industry leadership in addressing public interest concerns such as

    E-911, lawful interception activities and consumer accessibility
  - Ensure VoIP providers continued access to bottleneck facilities
  - Be vigilant against anti-competitive and/or discriminatory behavior by RBOC and cable companies seeking to capitalize on offering both underlying network high speed Internet access service and the vertical market VoIP services

VoIP has the potential to revolutionize communications and to speed the delivery of advanced services to all Americans.