Exercise Telecenter to Bridge the Digital Divide –

rom the ICT Point of View

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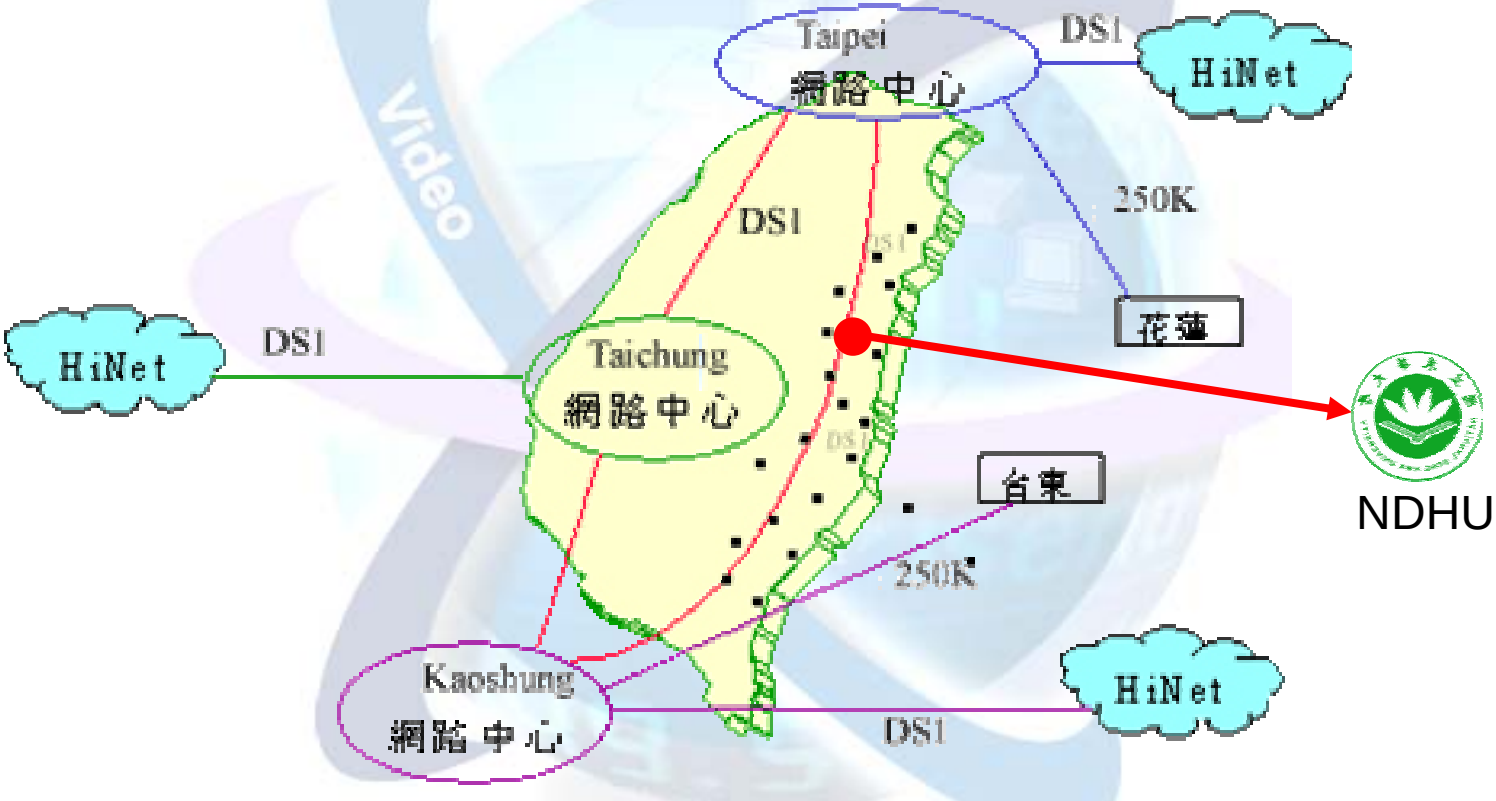
ELECTRICAL ENGINEERING
NATIONAL DONG HWA UNIVERSITY

Past Trend…

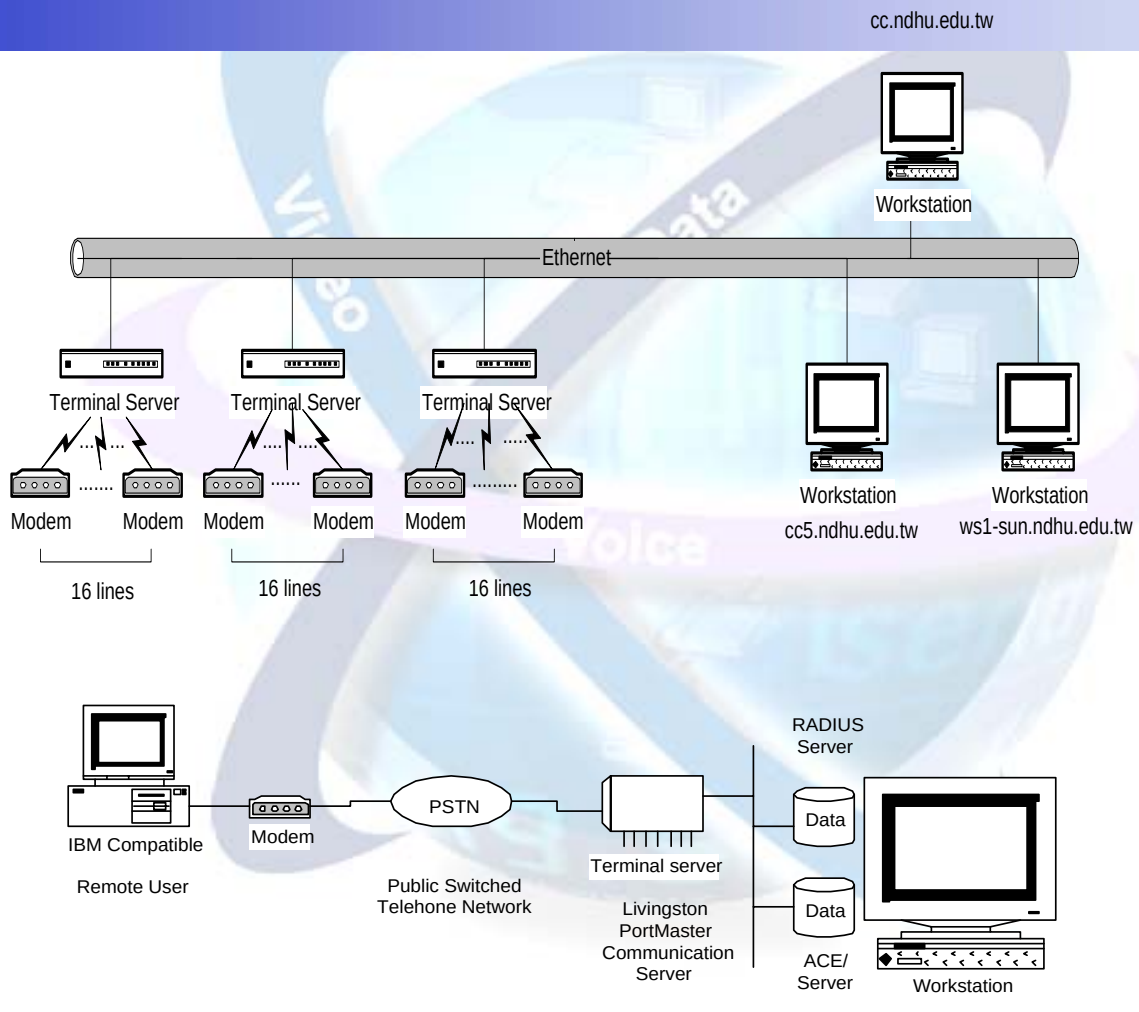
1. H. B. Chen, H. C. Chao and David Lin “An Alternative Method for Connection Between TANet,” TANet’95 Proceedings, Chungli , Taiwan , F18-F25, Oct. 23-24
   - A way to provide NAT through Modem Dialup
2. C. Y. Lin, H. B. Chen, H. C. Chao, Su Chang, and Michelle T. Kao, "*An Authentication Method for Securing the Consistency between Remote Access Servers and E-mail Servers Accounts*," 1997 International Conference on Computer Systems Technology for Industrial Applications -- Internet and Multimedia (CSIA’97), Hsinchu, Taiwan, pp. 234-238, April 23-25, 1997.
   - Radius Appliations
3. Han C. Chao, Wei-Ming Chen, H. B. Chen and Michelle Kao, “*The Economical Multi-link Internet (Intranet) Access Solutions for Medium-Small Business, Rural Educational Institutes and Native Taiwanese Communities in Taiwan*” Proceedings of the 14th International Conference on Advanced Science and Technology (ICAST’98), Chicago, USA, pp. 273-280, April 3-5, 1998.
   - NT based Modem “Trunk Mode”

Deployment Example

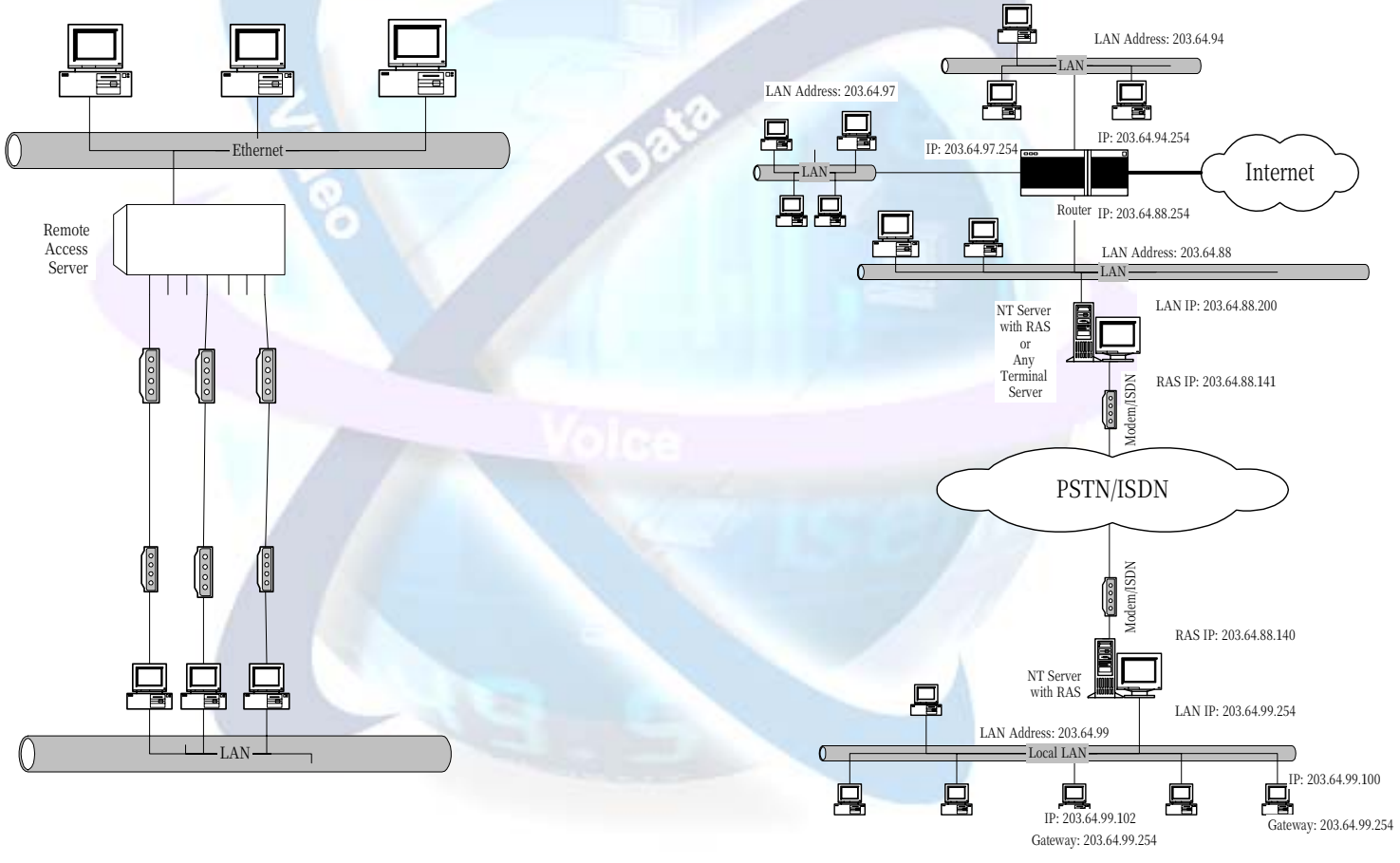


1998

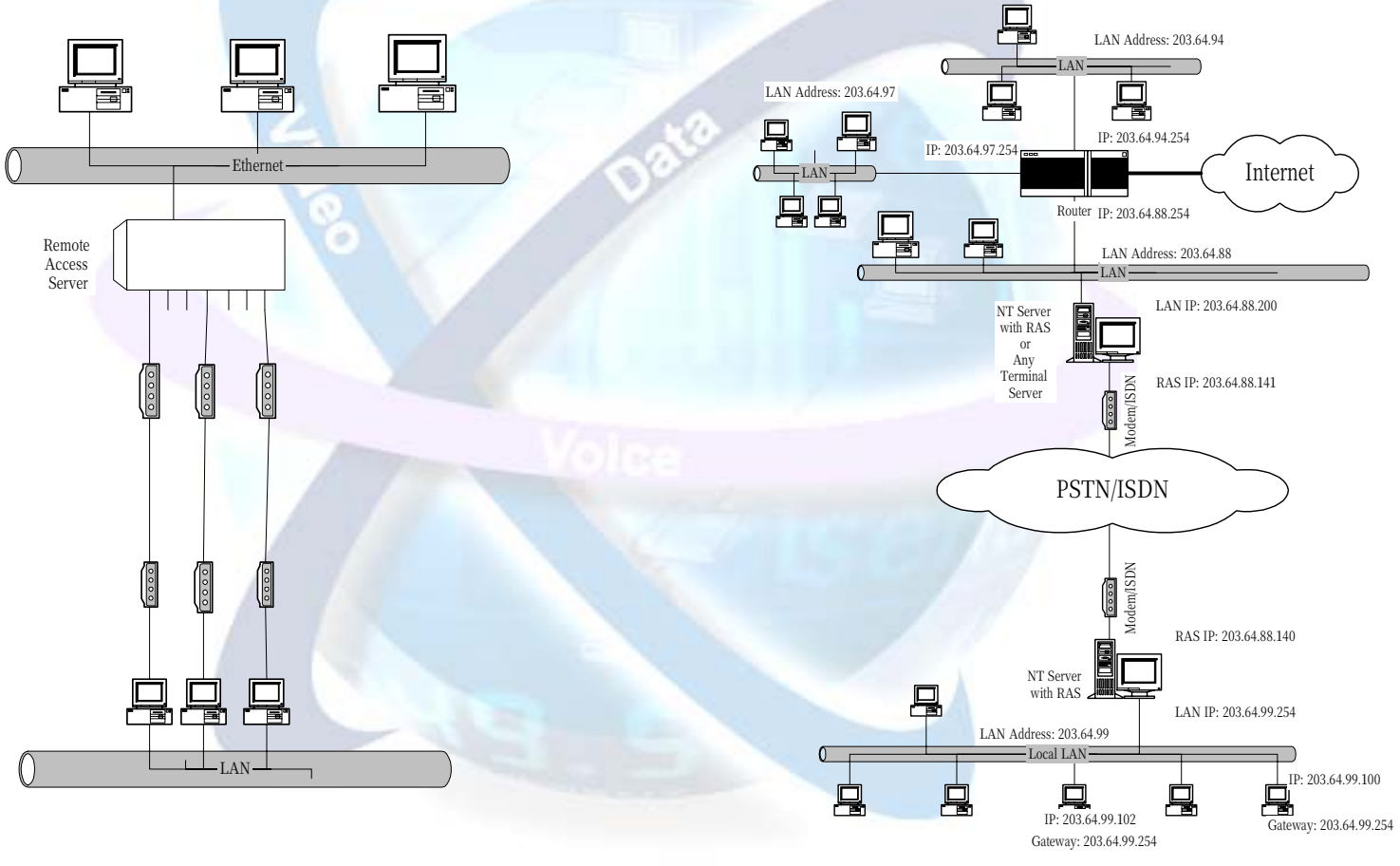
Technical Diagram(I)



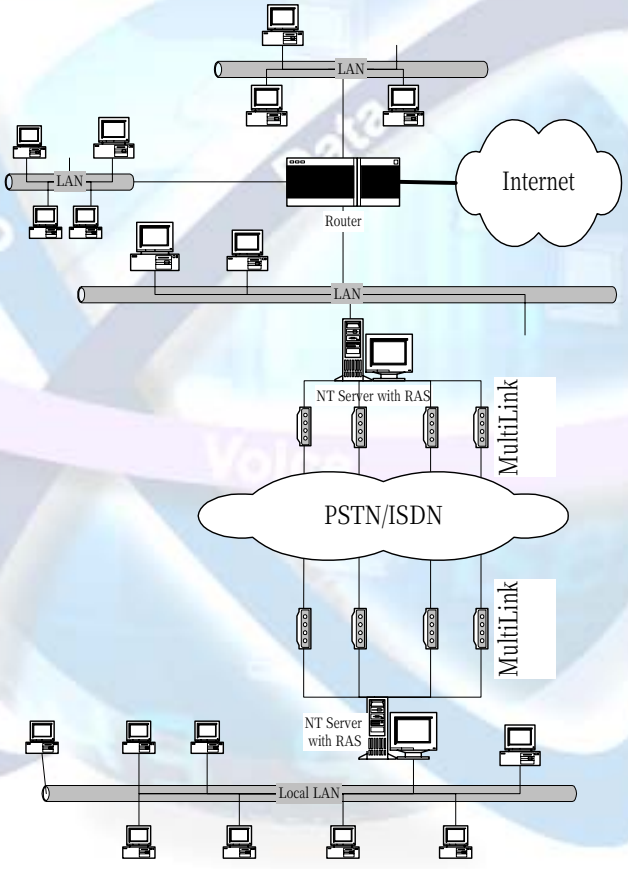
Technical Diagram(II)



Technical Diagram(II)



Technical Diagram(III)



Photos of Activities (I)

Photos of Activities (II)

Photos of Activities (III)

Photos of Activities (IV)

45

聯合報

分類廣告

八十八年四月二十五日 星期日

資訊

綠島上網夢實現了

東華大學師生把「移動教室」帶上綠島 用租來的筆記型電腦領著老小鄉民遊遊

Photos of Activities (V)

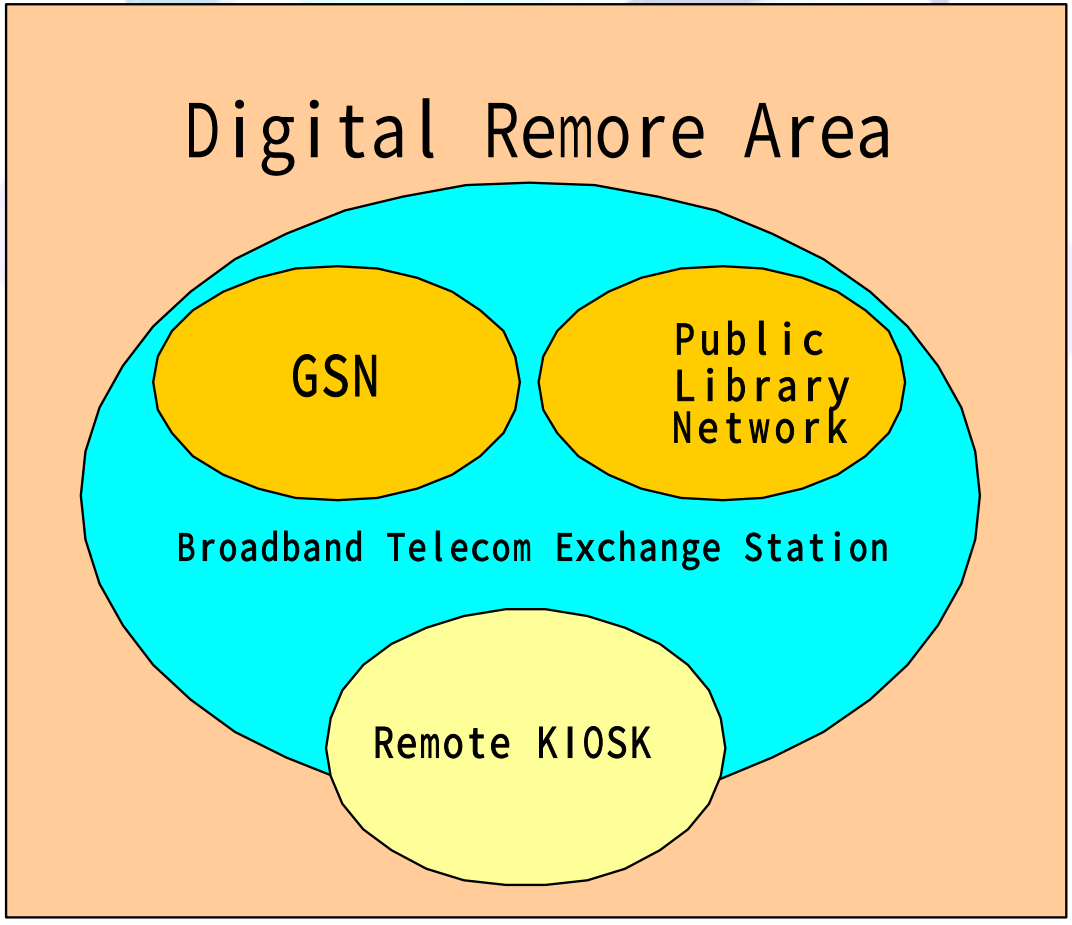
KIOSK


TISNet

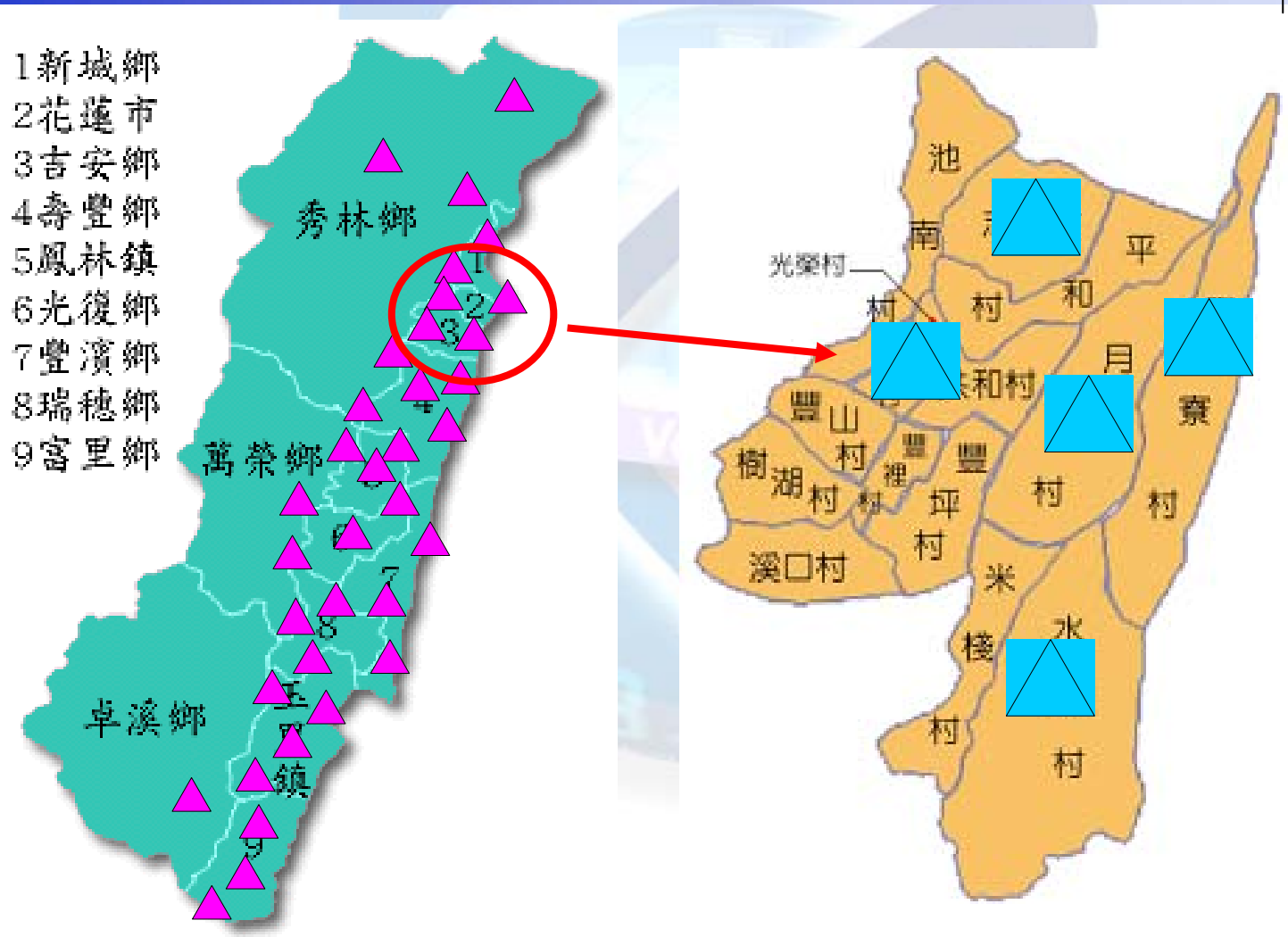
公用資訊站
公用資訊站
Public
Information
Booth
中華電信


台北市公共資訊服務站

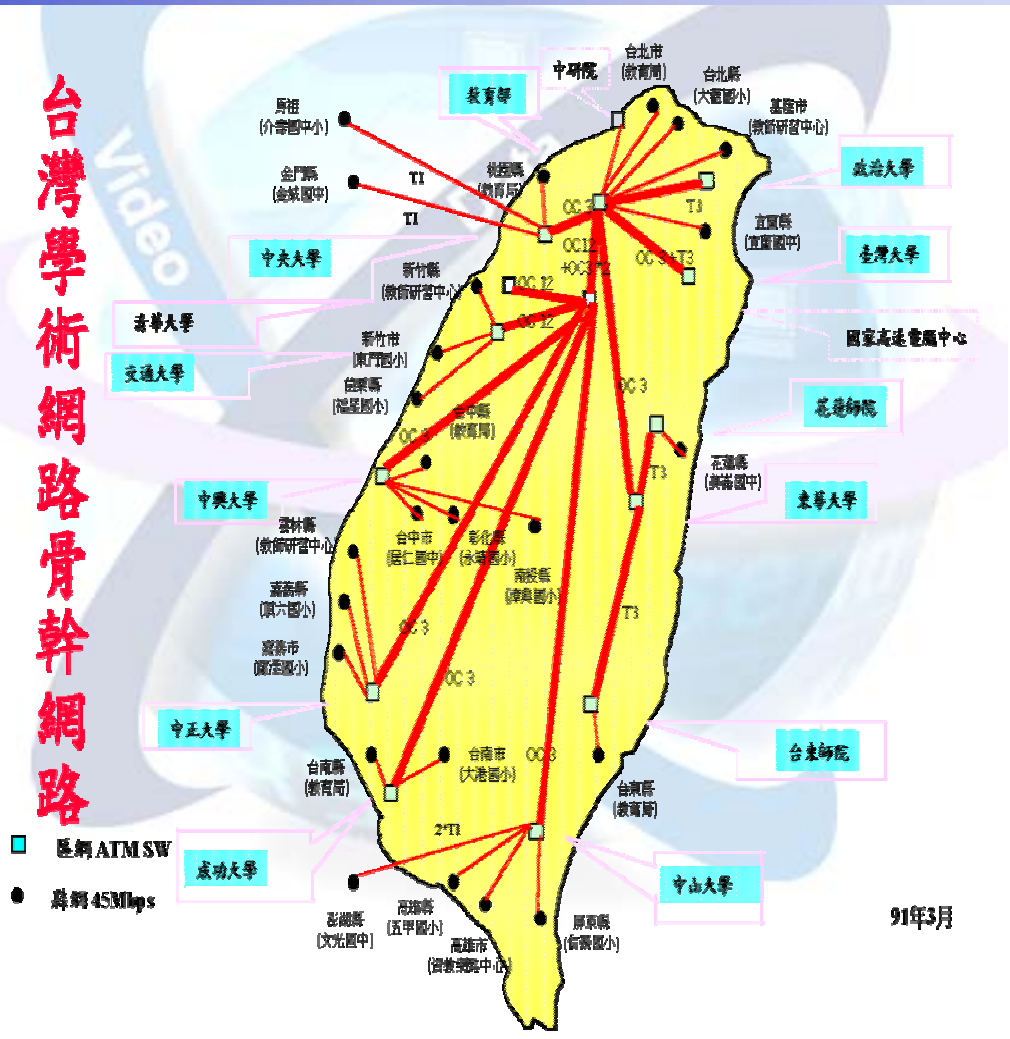
Digital Remote Scope



Telecom Exchange Stations in Hualien



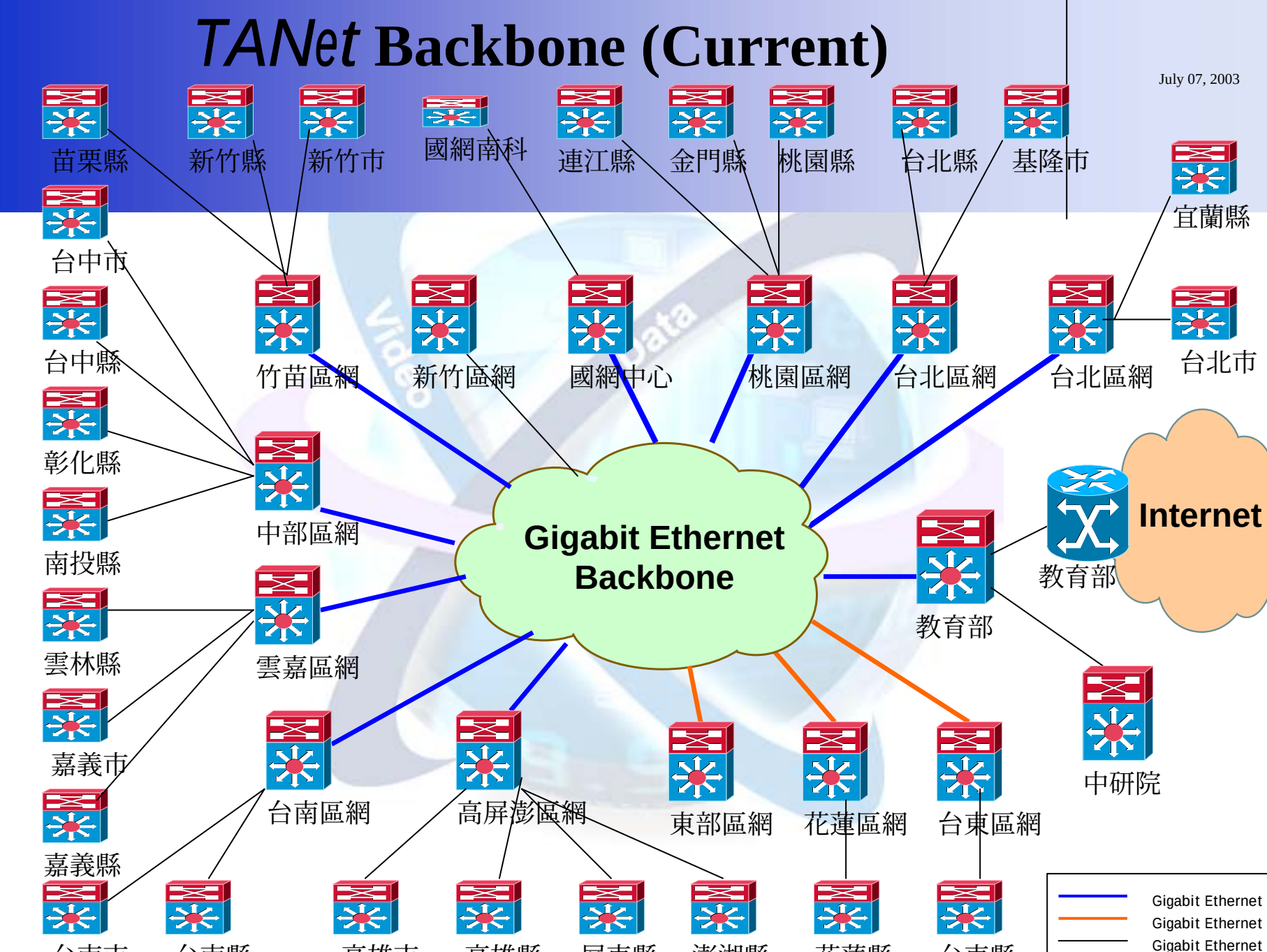
Current TANet Status



2002

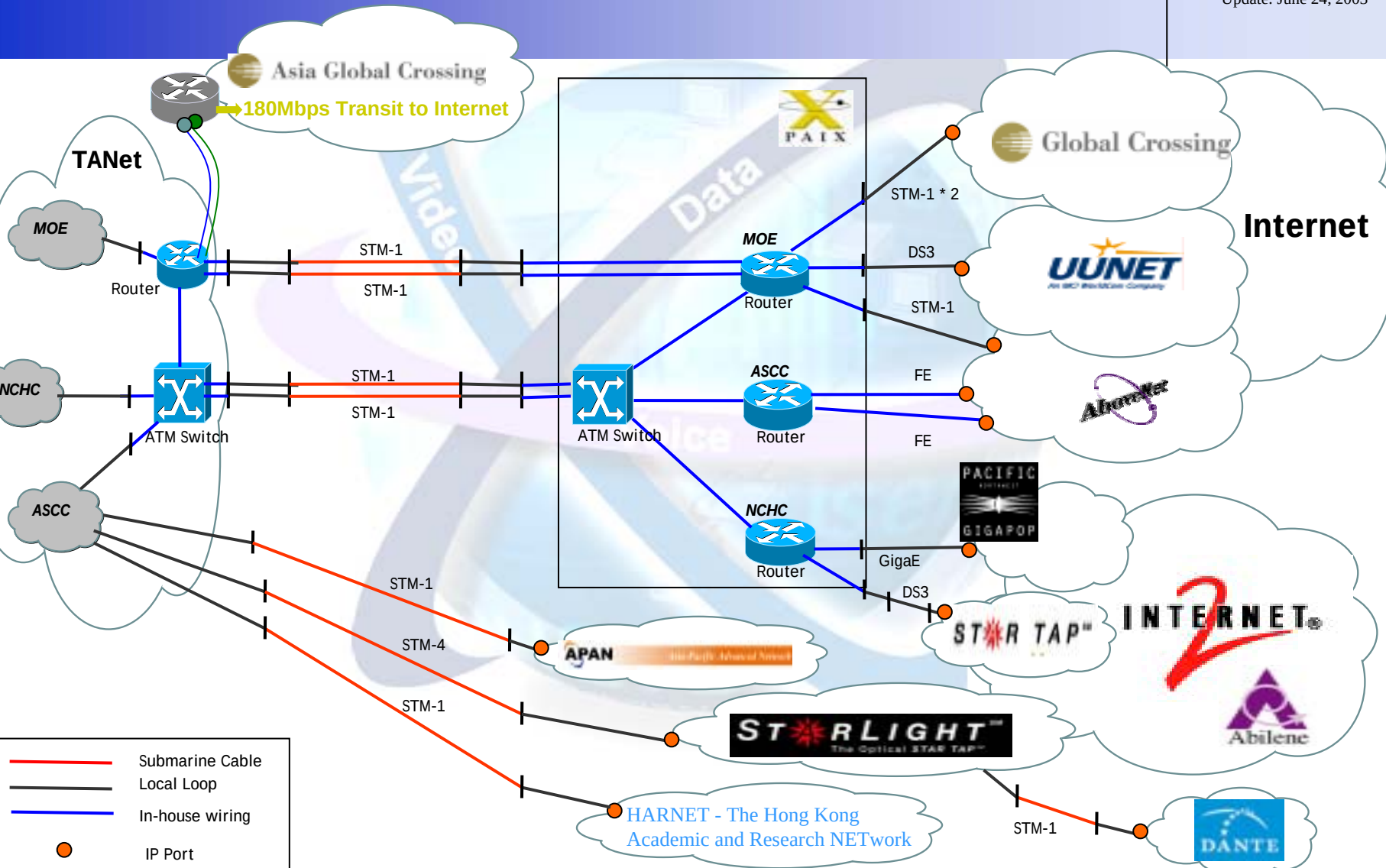
TANet Backbone (Current)

July 07, 2003

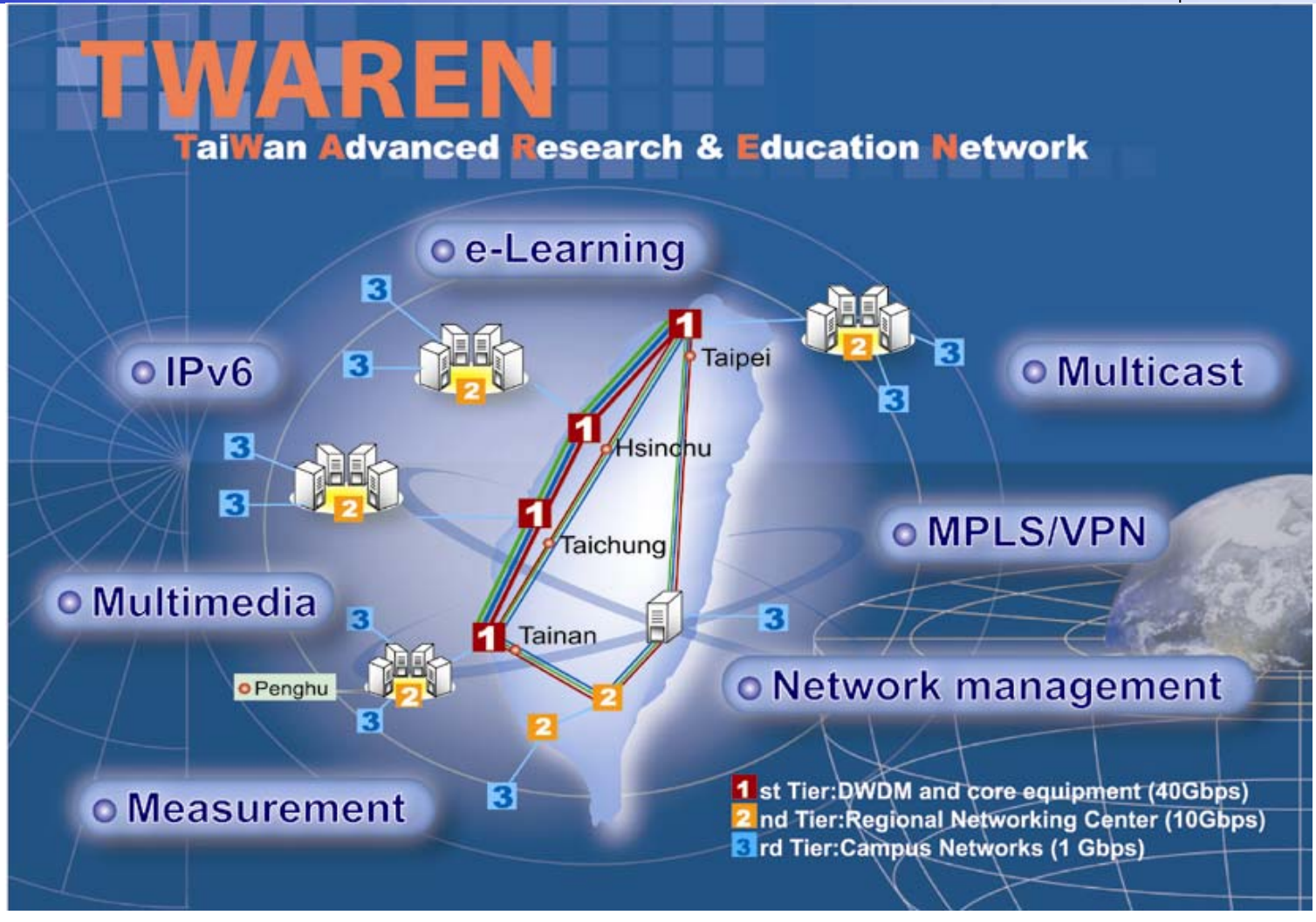


TANet International Backbone

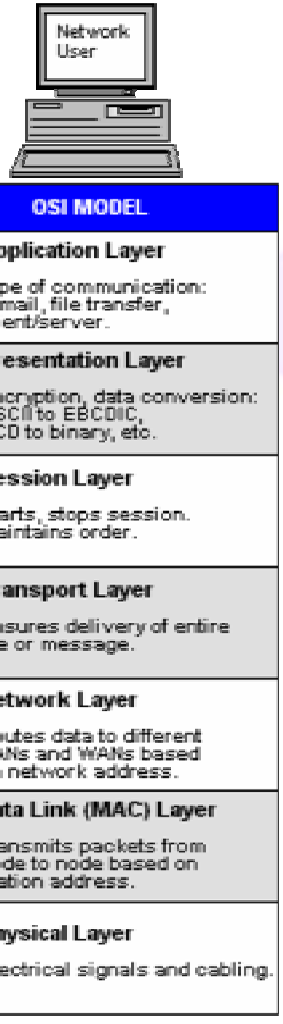
Update: June 24, 2003



TWAREN Project (December 2003)

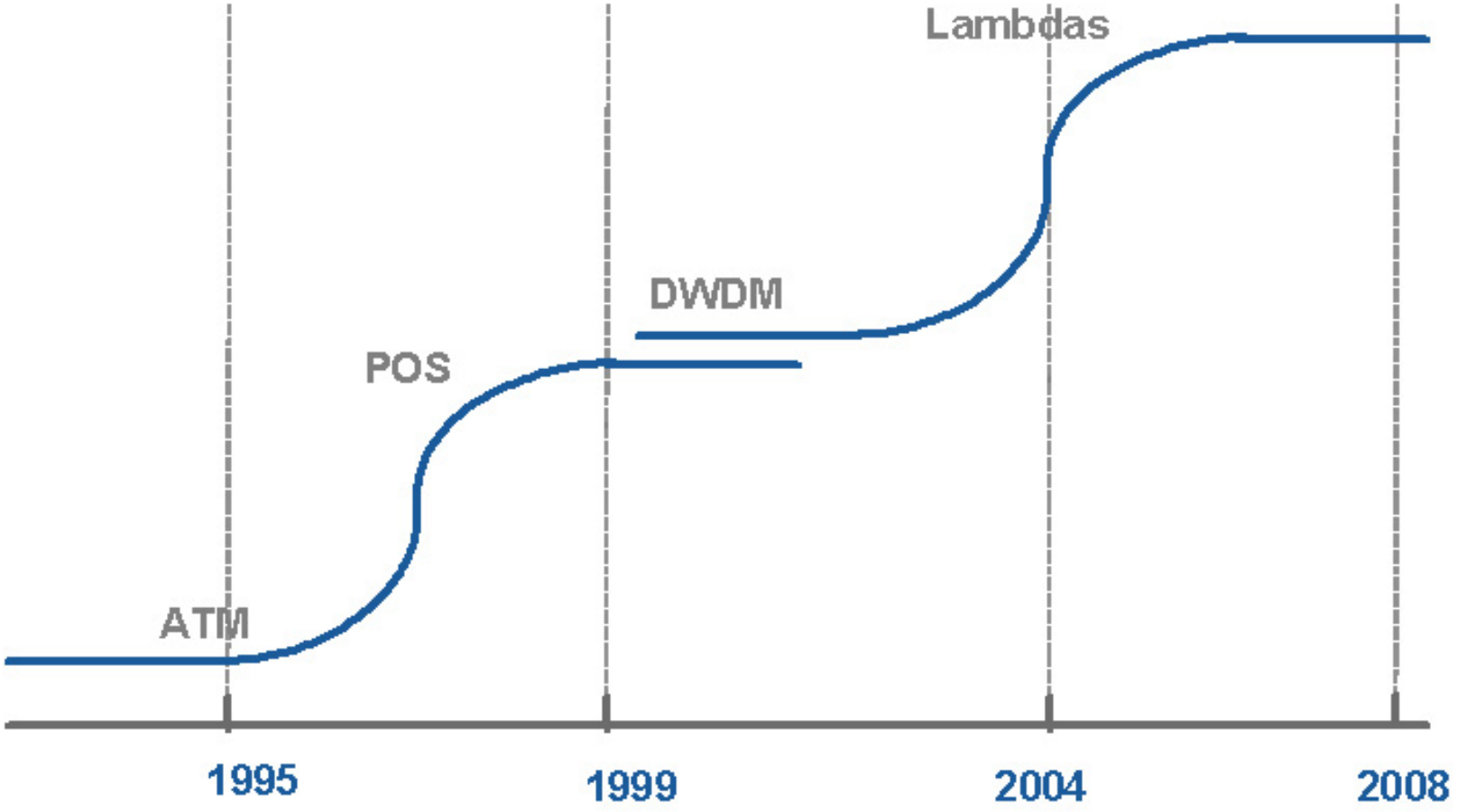


Future Trend…



- Higher Speed
- Fixed -> Portable
  - Mobility and Plug-and-Play
- Client Server System
  - Return to peer-to-peer, but different scale
- Monopoly
  - Layer1/2 -> Layer3(IP) -> Service Aggregation
- Firewall Operation
  - End-to-end Security
  - Collaborating with network

High Speed Network Trend



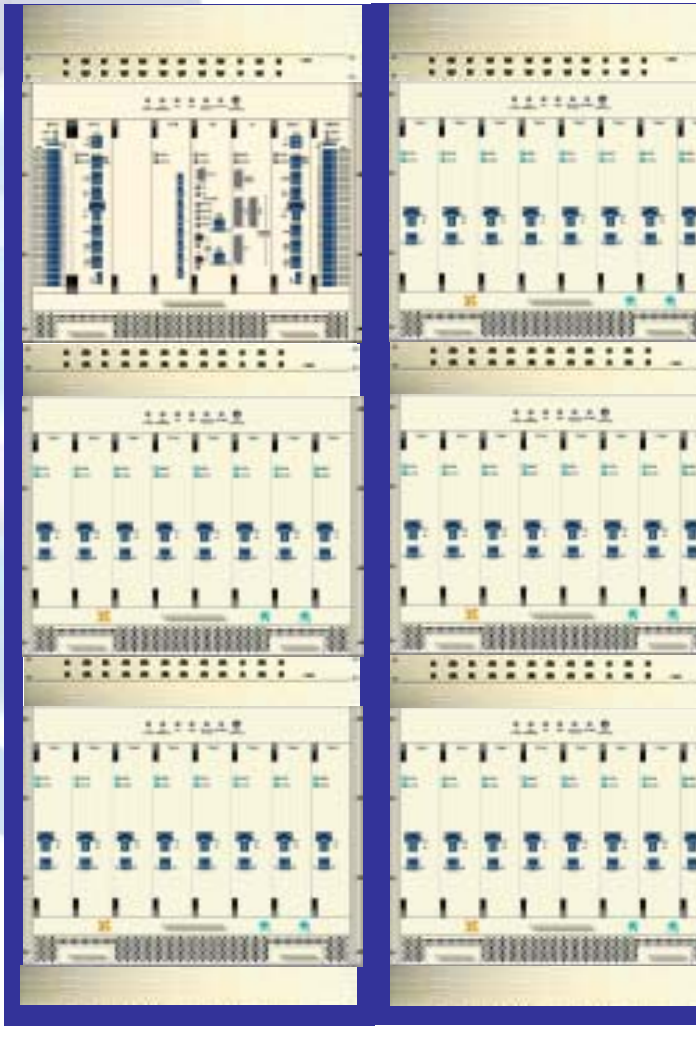
Next Generation Fiber

- Target bit rate x distance (20 Pbs x km)
  - Short Fat 20 Tbs x 1000 km
  - Long Thin 7 Tbs x 3000 km or longer
- Bit rates
  - 40 Gbs, 80 Gbs,
    160 Gbs, 320 Gbs
- 160 to 240 Wavelengths
- Current bit rate x distance
  (5 Pbs x km)

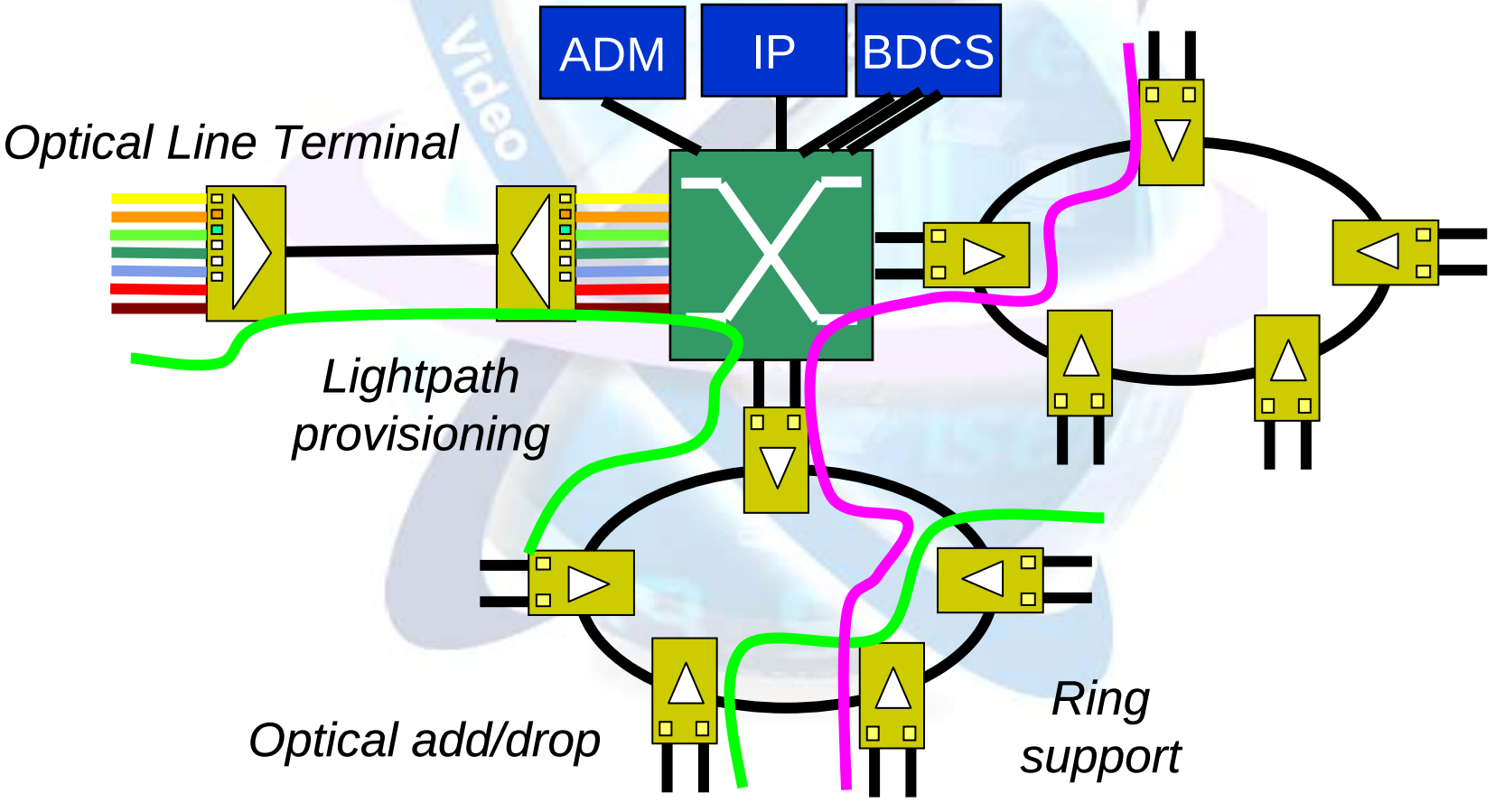
TeraLight™ Ultra Fiber

Ultra Long Reach Transmission

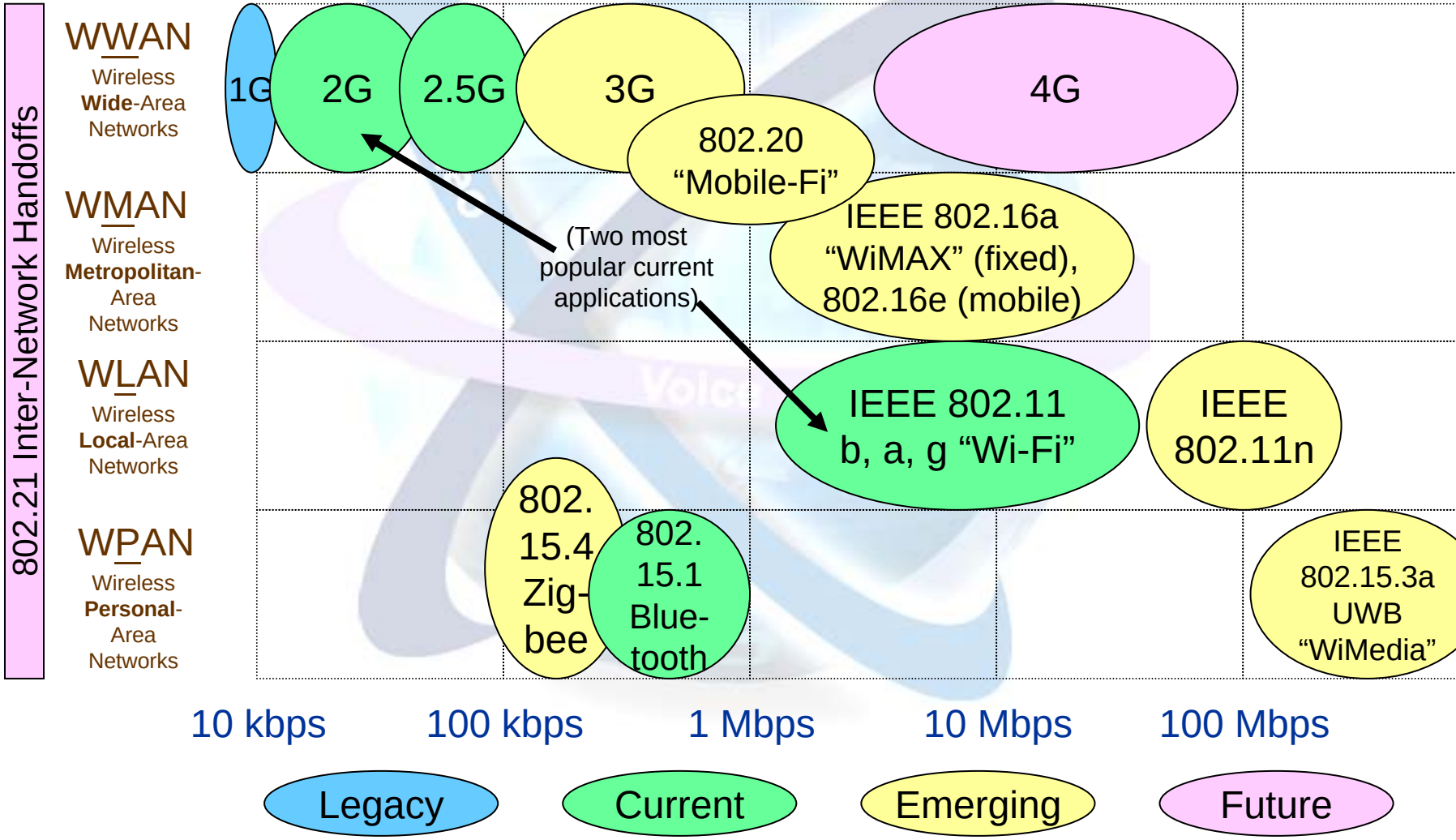
- Extend Transmission Reach from 500 km to > 4000 km
- New Modulation Format (1Bit/Hz)
  - > 3dB Improvement in Signal to Noise
- Better Handle Current Fiber Impairments
- Increase Capacity ex. 40Gbps X 80λ = 3.2 Tbps
- 40Gb/s and beyond



OCCS (Optical Cross Connect System) Switching



The Wireless World

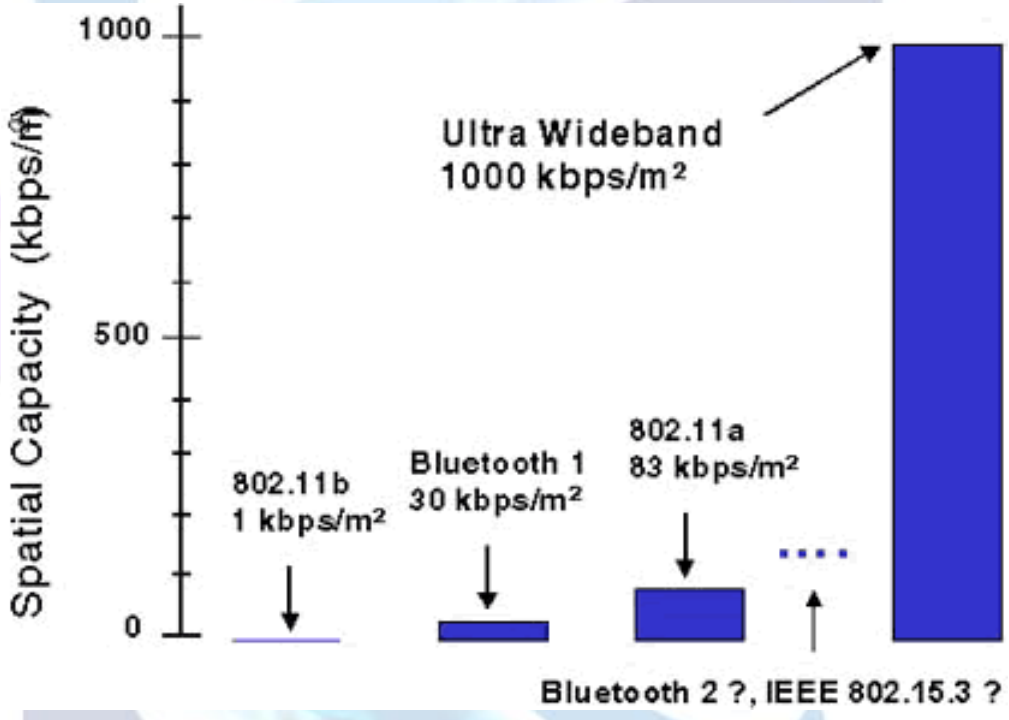


Wireless PAN

- Personal Area Network
  - IEEE 802.15, Bluetooth, 1Mbits/sec
  - IEEE 802.15.3, Ultra Wideband, 1 Gbits/sec

(Picture: Compaq / 3Com

Capacity



Spatial capacity comparison between IEEE 802.11, Bluetooth, and UWB

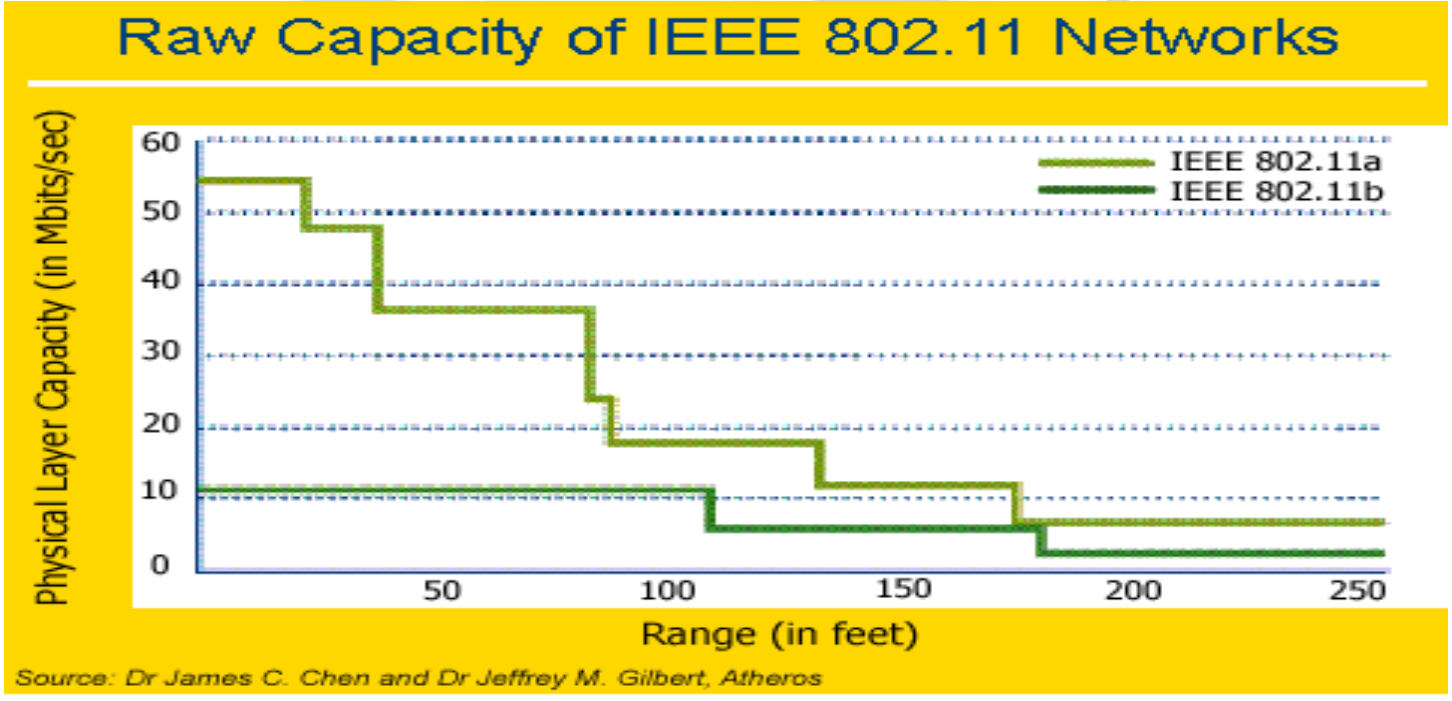
(Source: intel)

Wireless LAN

- Local Area Network
  - 802.11a
    - 5 GHz band, 54 Mbits/sec, OFDM
  - 802.11b
    - 2.4 GHz band, 11 Mbits/sec, DSSS
  - 802.11g
    - 2.4 GHz band, 54 Mbits/sec, OFDM/DSSS

(Picture: D-Link / 3Com)

Data rate & Distance



The Death of Distance. As distance increases, both major types of IEEE 802.11 network drop down to lower data rates. However, 802.11a is always faster than 802.11b. Note that these are Physical-layer data rates. Real throughput is at least 30 percent lower, thanks to protocol overhead and errors.

(Source: Network Magazine)

Wireless MAN

- Metropolitan Area Network
  - IEEE 802.16
    - 802.16.1 (10-66 GHz, line-of-sight, up to 134Mbit/s)
    - 802.16.2 (minimizing interference between coexisting WMANs.)
    - 802.16a (2-11 Ghz, Mesh, non-line-of-sigth)
    - 802.16b (5-6 Ghz)
    - 802.16c (detailed system profiles)
    - 802.16e (Mobile Wireless MAN)

Wireless WAN

- Wide Area Network
  - 3G, 2Mbits above
    - UMTS/CDMA…

TECHNOLOGY			FEATURES
3G	W - CDMA	Wide-band Code Division Multiple Access	- Super voice quality - Up to 2M bit/sec. Always-on data - Broadband data services like video and multimedia - Enhanced roaming
	CDMA - 2000	Based on the Interim Standard-95 CDMA standard	
	TD - SCDMA	Time-division synchronous code-division multiple-access	

(Source: 3gnewsroom)

(Picture: Samsung / Siemens / Alcatel)

4G

Enhanced multimedia, smooth streaming video, universal access, & portability across all types of devices

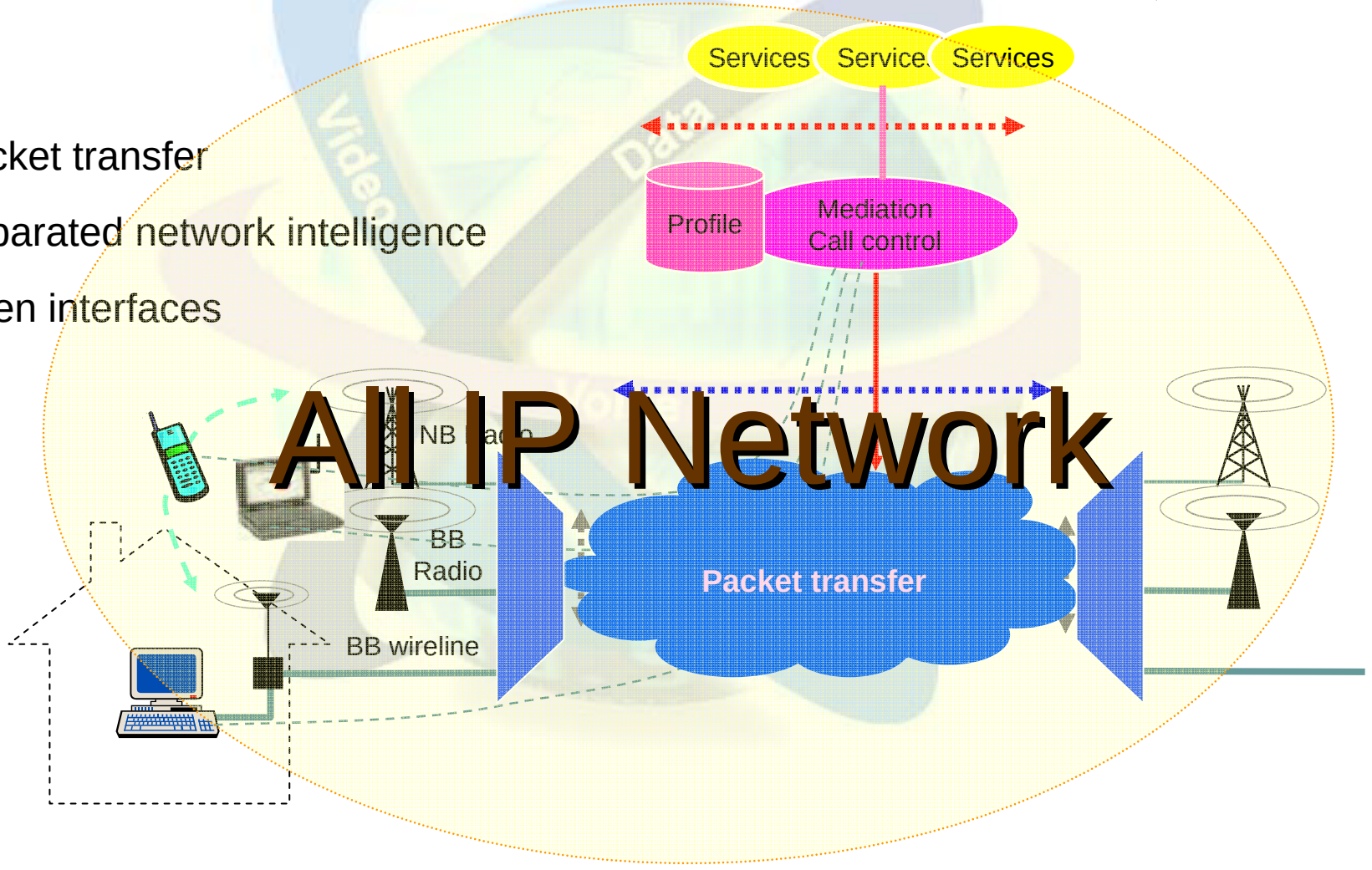
Comparison of 3G and 4G

3G	4G
Back compatible to 2G	Extend 3G capacity by one order of magnitude
Circuit & Packet switched networks	Entirely packet switched networks
Combination of existing & evolved equipment	All network elements are digital
Data rate up to 2Mbps	Higher bandwidth up to 100Mbps

(Source: ece.gatech.edu)

An effective response to heterogeneous future needs

- Packet transfer
- Separated network intelligence
- Open interfaces



IP Is the New Public UNI (Network Connection)

- Public IP Networks Require
  - Routing functions on the edge
    - Consistent interface to subscriber applications
  - Application-Aware Dynamic Service Delivery
    - End-End Across The Network
      - *Network Changes Behavior As Necessary*
- Public IP Networks *Must Provide*
  - Application-aware priority for IP flows
  - Application specific behavior for different IP Flows
    - Deliver bandwidth, and access privileges as required
      - *Per application*
  - Dynamic signaling to support application requirements
    - Deliver services where and when they are needed
      - *By requesting them from smart network elements*
- Public IP Networks *Cannot Use* a Hop-by-Hop Internet Architecture
  - Routers alone won't support what needs to be done

IP Services Vision

	Service Intelligent infrastructure from edge to core to edge	**Benefit**: Provides a network platform for service delivery tailored to the needs to the subscriber/application
+	**Intelligent dynamic signaling in and between the network layers**	**Benefit**: Provides a rich framework for deploying service intelligence between the layers of the network
+	**Scalable, end-to-end network management from single console**	**Benefit**: Allows for efficient network operations and leverage of network investment
+	**Full lifecycle professional services from planning to operations**	**Benefit**: Allows for service providers to outsource to save engineering/operations costs

= **Profitable, Value-added services**

Source: Lucent Technologies

IPv6 will dominate

IPv4

limited size and structure of the current Internet address space

lack of end-to-end security

IPv6

QoS

huge address space

security (IPSec)

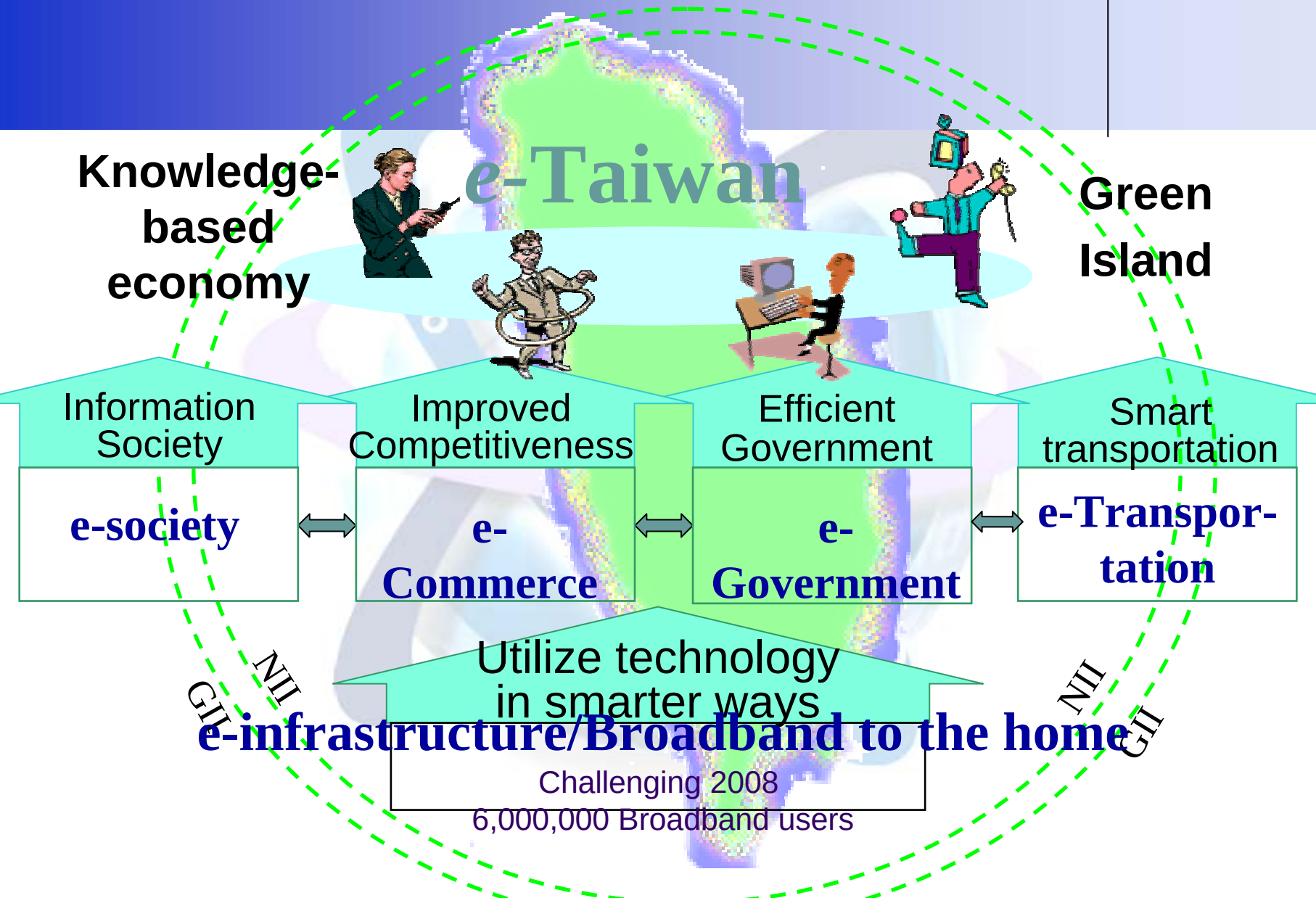
Trends make IPv6 success

- Convergence - Next-Gen Networks
  - Data, audio & video on one wire
    - IPv6: Quality of Service
- Mobility – Massive increase in mobility
  - Dynamic access from various locations
    - IPv6: Mobile IP.
    - IPv6: Quality of Service
- Scalability & Reliability – Computing is mission critical
  - Reliability
    - IPv6: Design of the protocol.
    - IPv6: Hierarchical addressing, Multiple Gateways
    - IPv6: Elimination of NAT.

Trends make IPv6 success

- Security – Convergence to one Network
  - Software is mission critical
    - IPv6: IPSec - Dynamically secure connections
    - IPv6: Multicast and anycast addresses
- Management – Auto-configuration, self managed.
  - Improving IS productivity
    - IPv6: Auto-detection and autoconfiguration
    - IPv6: IP Address Management
- Utility/Grid computing
  - Resources as and when you need.
    - IPv6: Many more addresses, autoconfiguration & management
    - IPv6: Better scalability, path MTU
    - IPv6: QOS

e-Taiwan Project (us$1 billion)

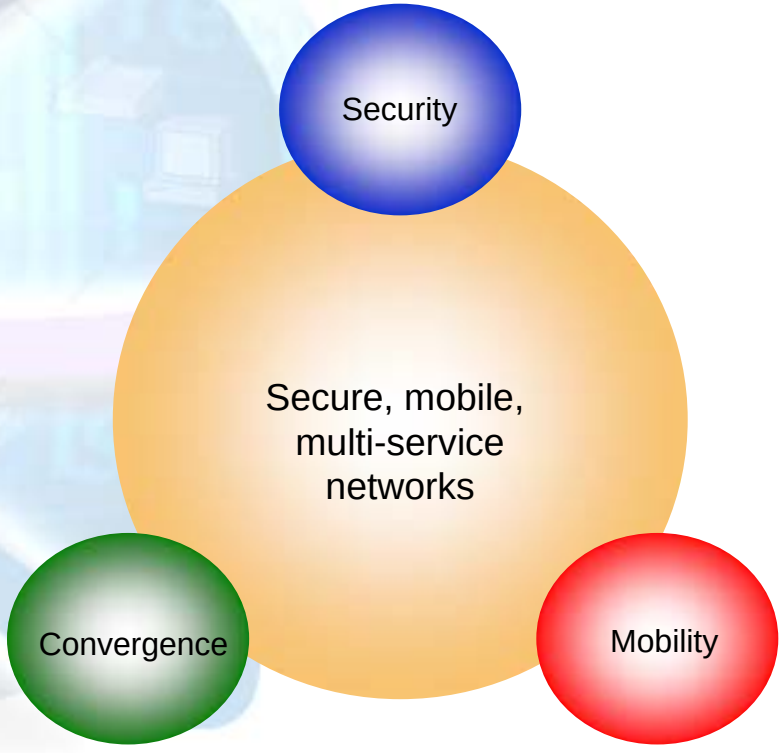


Users Driven

Top Down

User/Host is stupid

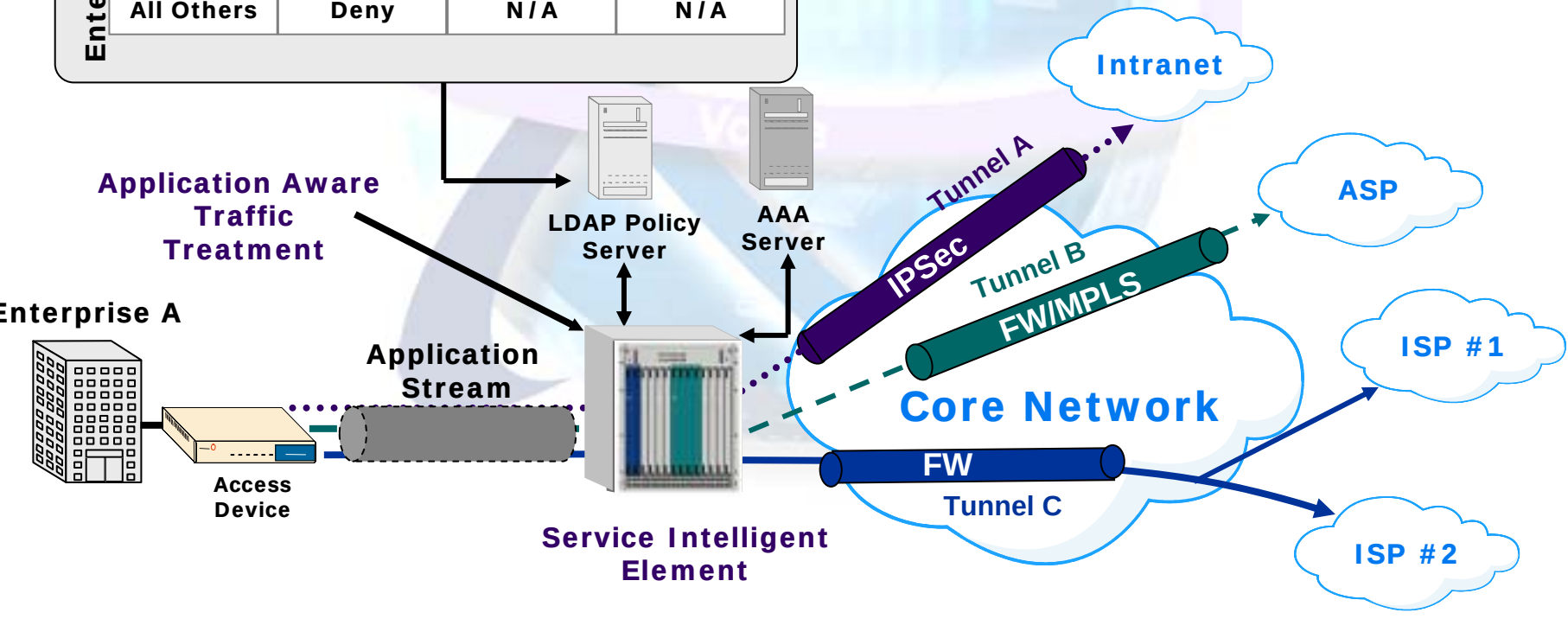
- Unaware of
  - Network structure
  - Protocols
- Interesting about
  - Everything connectivity
  - Ubiquitous/Mobility
  - Security
  - Always Online
  - Hi-Speed
  - Hi-Quality



Personalized Services

Enterprise A Policy

Packet Criteria	Action	Class of Service	Billing Class
Intranet	IPsec	VPN Service	$$$
ASP	FW / MPLS	Sales Automation	$$
WEB	FW	Secure Internet	$
All Others	Deny	N / A	N / A



New Applications

- Grid computing
- Data mining
- Data visualization
- Virtual reality
- Remote cooperation
- VoIP/VVoIP

Application-Driven

- Database access
  - Large-scale simulations produce tens of terabytes per day
  - Earth-orbiting satellites will transmit petabytes of data
  - Matching algorithms for genome databases
  - Image and pattern databases
- Audio and video
  - Different qualities of audio and video require very different bandwidths
    - Compressed speech uses less than one KB/second
    - Uncompressed CD-quality music uses around 200 KB/second
    - Highly compressed, small-screen video can be transmitted at two KB/second
    - High-definition television requires several MB/second

Application-Driven

- Real-time collaboration
  - Groups want to interact across time and space
    - Virtual enterprises
    - Desktop videoconferencing
    - Distance-independent learning
  - Control and synchronization of audio and video streams
  - Shared access to information
  - Managed interactions
  - Maintenance of history and audit trails
  - Support of distributed protocols to provide consistency

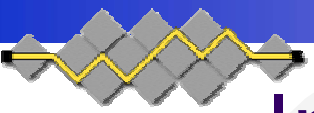
Application-Driven

- Distributed computing
  - Now
    - Tight interconnection of processing elements on a backplane of a single high-performance computer or in a physically connected cluster
  - Future
    - Geographically separated elements
- Tele-Immersion
  - Users in a different locations will collaborate in a shared, virtual or simulated environment as if they are in the same room
  - Must combine audio, video, virtual worlds, and simulations
  - Requires huge bandwidth, very fast responses, and guarantees of delivery

Application-Driven

- Scenarios
  - Remote instrument control
  - Distributed simulation
  - Environmental crises management
  - Public information access
  - Collaborative R&D

Application-Driven



Internet

IETF

Internet Evolution

IPTEL - IP Telephon

SIP - Call

MEC

S

E

MMUS

AVT - Audio/

DIFFSERV, ***INTSERV***, ***RSV***

SIP-H323 BoF

Telephony

ITU-T

Telecommunication Standardisation

ment,

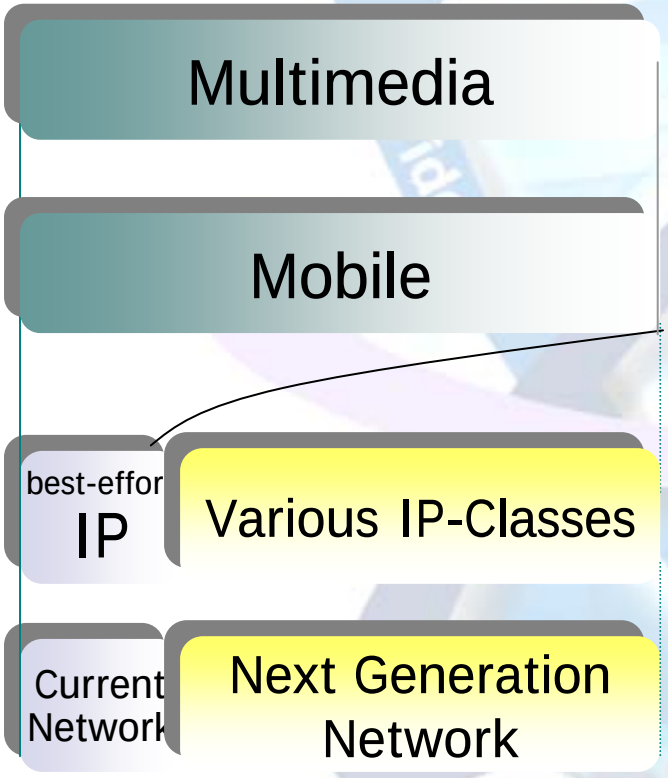
Services

248),

G.7xx), T.* ...

Integrated Video and Voice over IP Service

Middle Layer Improvement



- various QoS

- mobility

- best-effort ⟹
  - guaranteed
  - controlled

- Guaranteeing/ Maintaining / Provisioning QoS

Heterogeneous Network which Guarantees / Maintaining / Provisioning QoS for various IP-Class

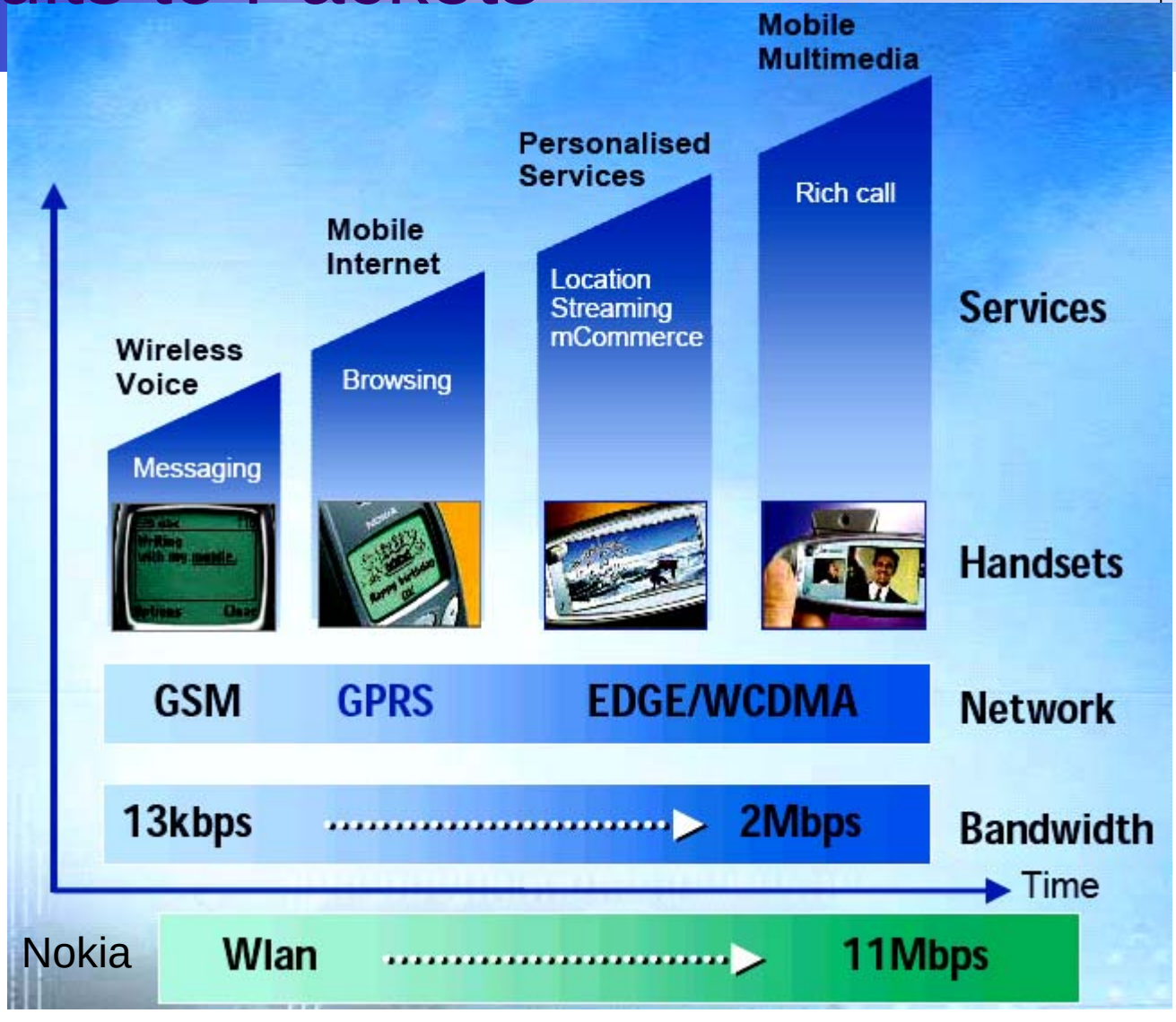
QoS

- Intserv/Diffserv integrated network
  - QoS refers to delay (latency), jitter (variance), and availability
  - Need for reliable and timely delivery of control signals, telemetry, and human-oriented data streams (audio, video, tactile)

IP Mobility

- Hierarchical MobileIPv6
- AAA interactions
- Fast/Smooth/Seamless Handoffs
- Header Compression
- Enable MobileIPv6 to act as mobility technology within and between cellular networks – All-IP Cellular Networks

Technology Evolution from Circuits to Packets



GPRS and WLAN Card

Nokia D311/D211

SONY

- Multimode PC card (GPRS, GSM, WLAN)
- GPRS high speed data connectivity (up to 40.2 Kbit/s)
- WLAN data connectivity where available (up to 11Mbit/s)

Nokia launches new Communicator mobile phone

- Tri-band GSM
- E-GPRS (EDGE)
- Wi-Fi 802.11b
- Symbian OS 7.0
- JAVA MIDP2.0

Nokia 9500
Pic. from www.cellular-news.com

Hitachi G1000 with SD wifi

- Pocket PC 2002 Phone Edition
- CDMA
- SD/MMC Expansion Slot (Upgradeable to SDIO)
- 2.5 hours talk time
- 7 days of stand-by time.

CDMA / WLAN Solution

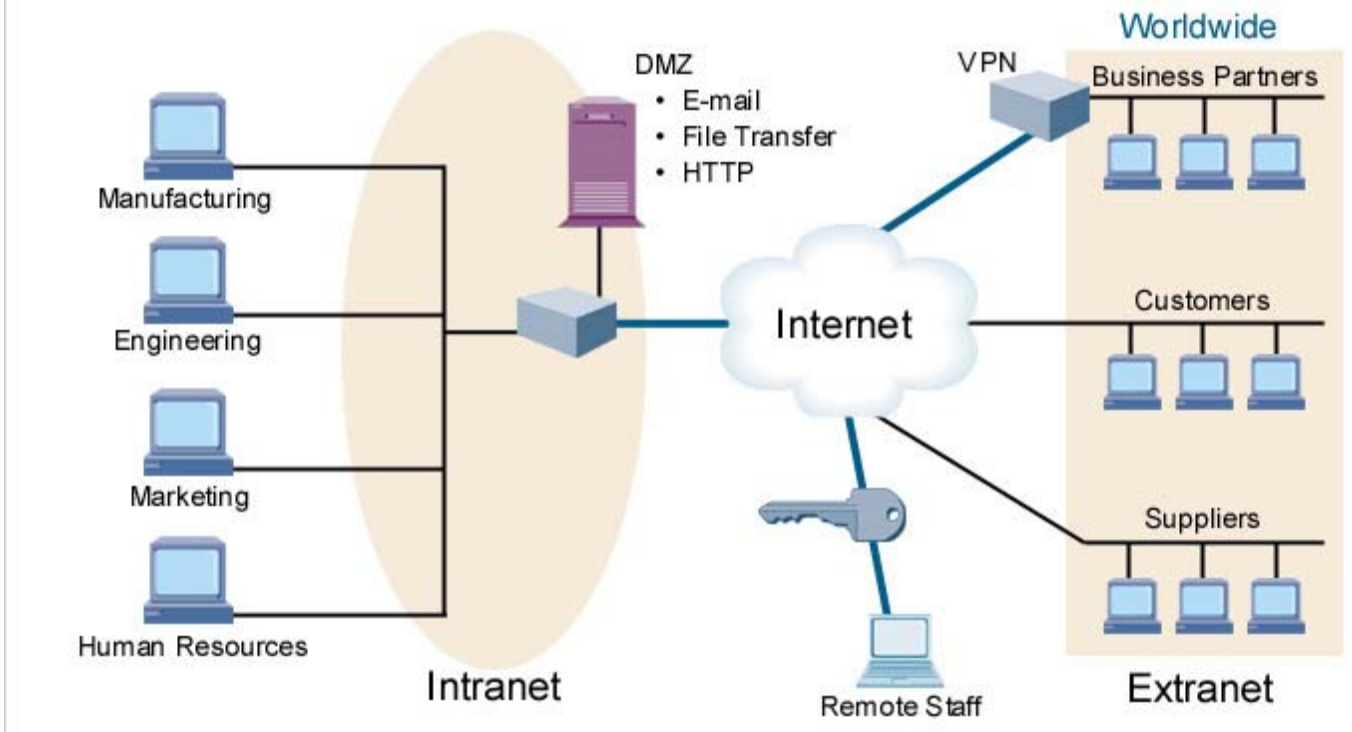
http://www.sprint.com/pcsbusiness/devices/pda/hitachig1000.html

NTT DoCoMo, NEC plan dual 3G/WLAN handset

- W-CDMA / IEEE802.11b
- User will be able to use VOIP when in range of a WLAN access point. Once out of range, it will use the standard 3G network.
- No indication has been made yet whether the handset will be able to seamless transfer voice calls between WLAN and 3G.

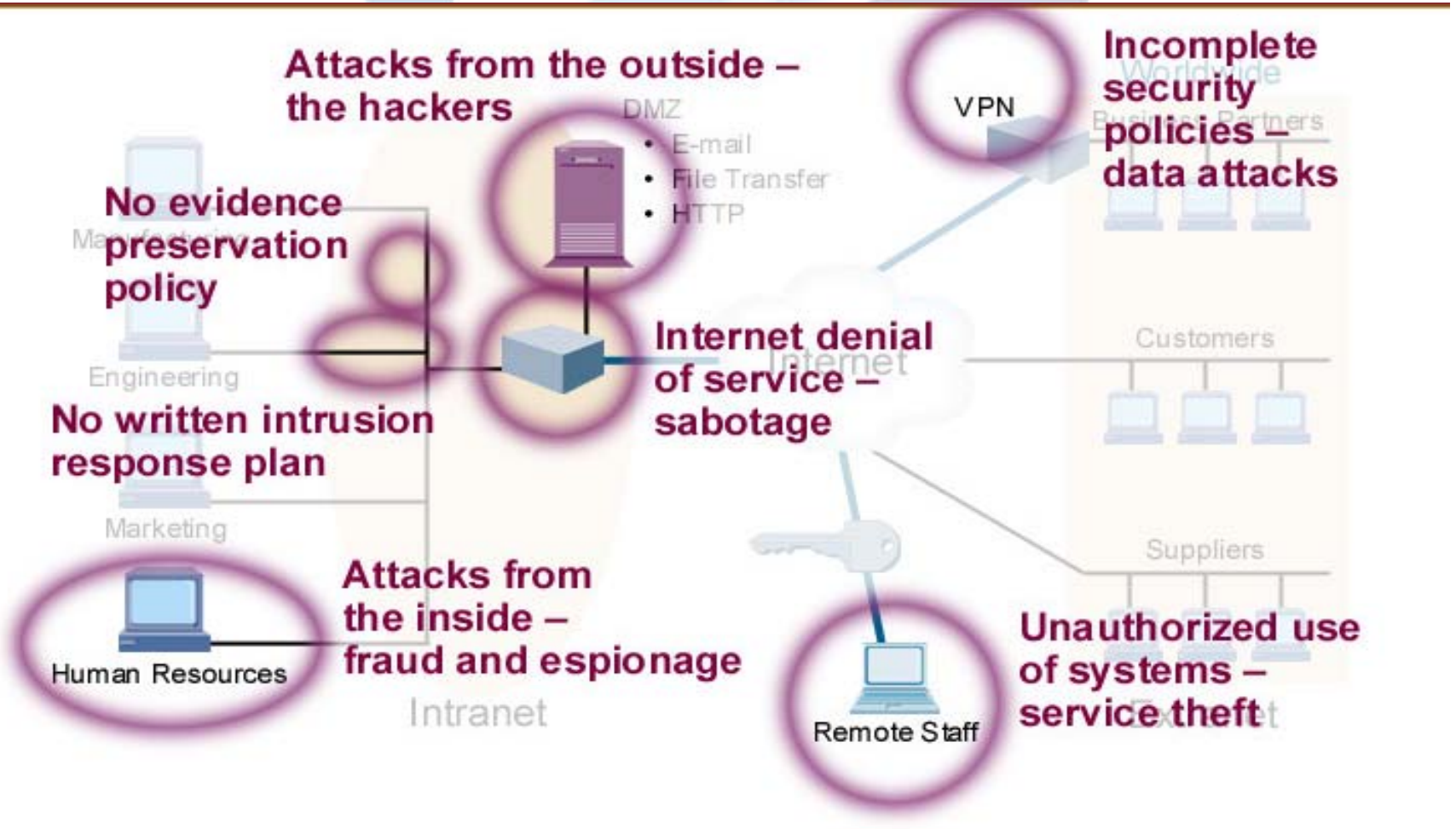
- http://www.mobileburn.com/news.jsp?Id=559
- http://www.infoworld.com/article/03/12/03/HN3gwlanhandset_1.html
- http://www.computerweekly.com/Article126993.htm

Cybersecurity

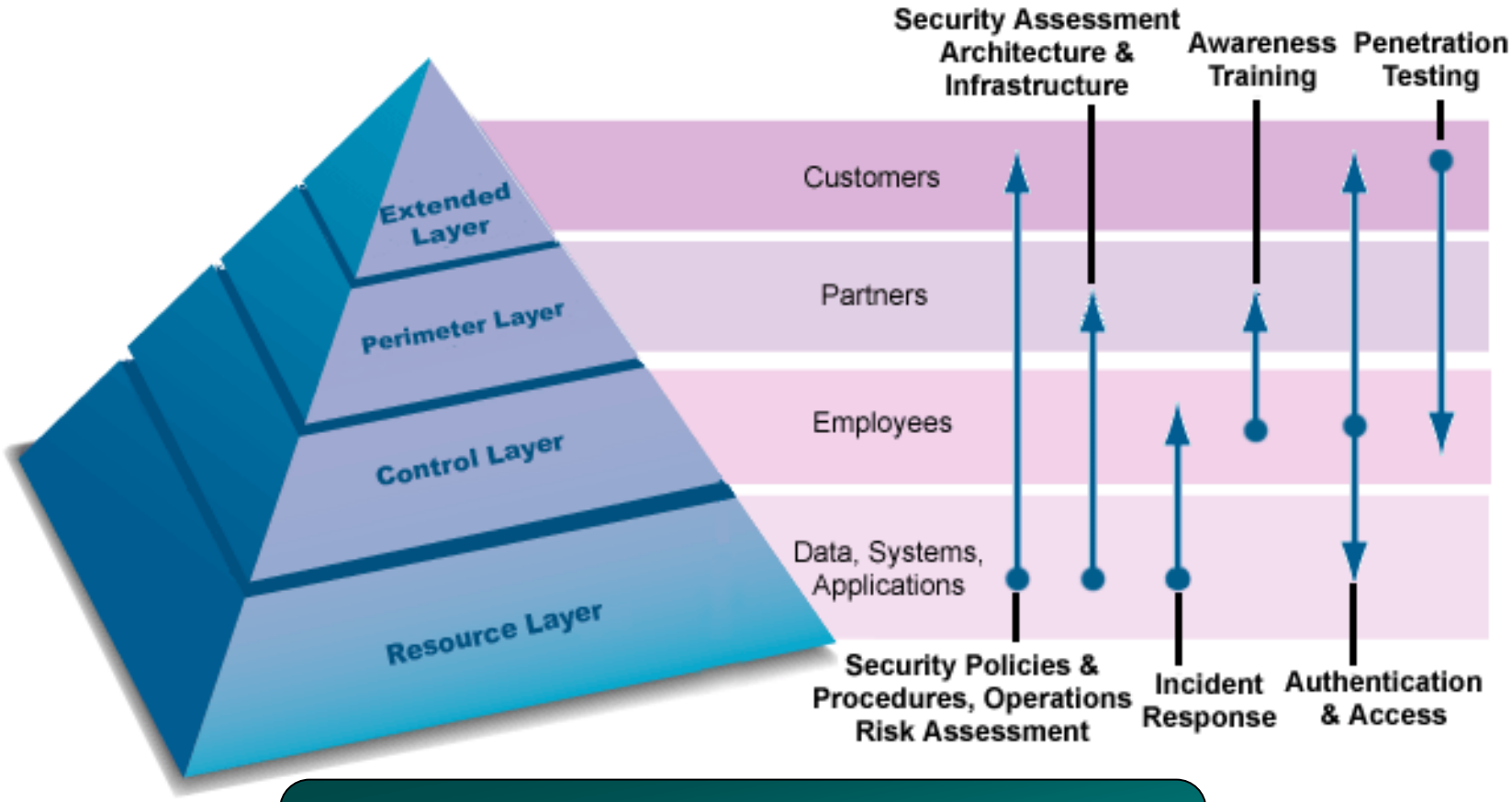


Risks are high, even *before* adding wireless, converged, or network-enabled components

Cybersecurity



The Service of Security



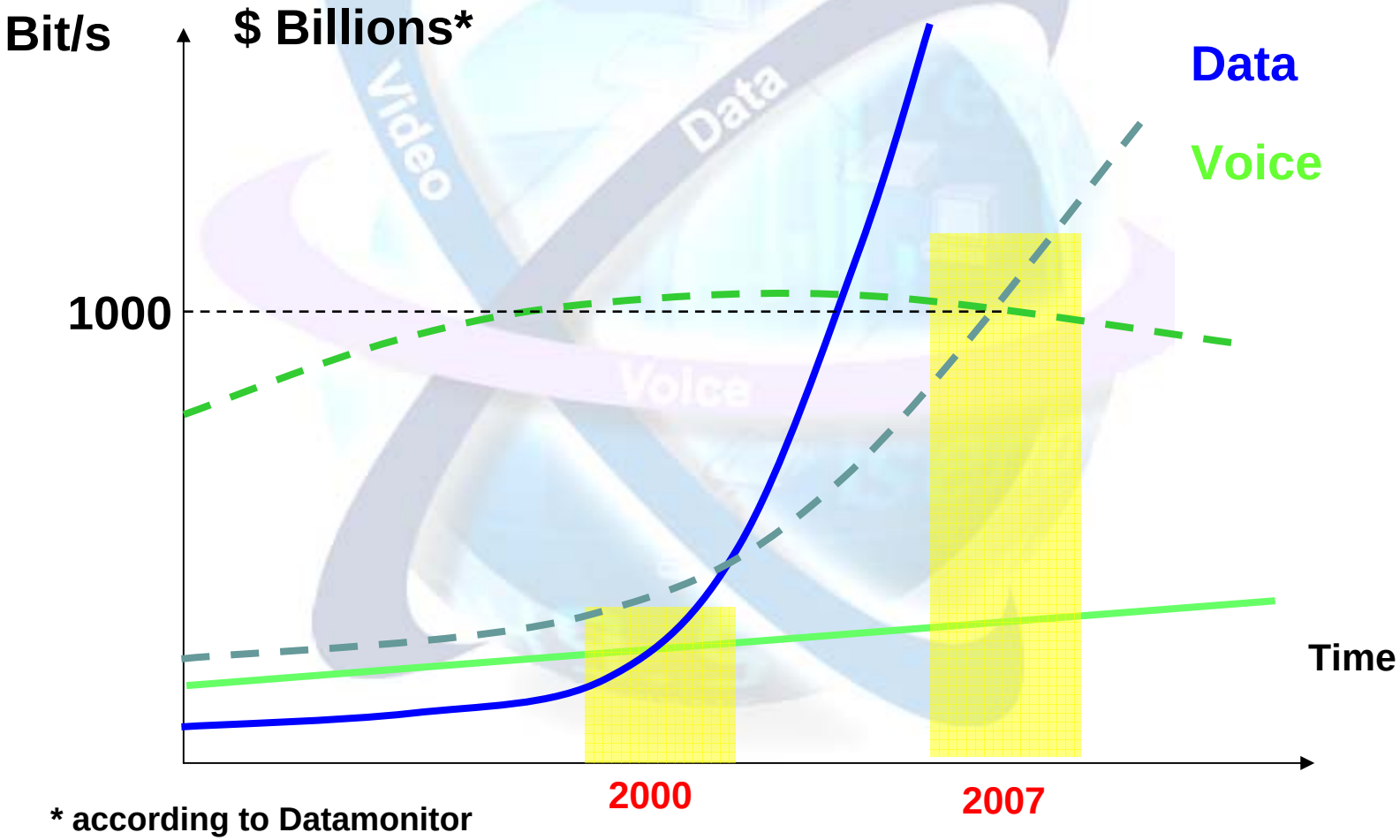
Each element can affect your overall security posture & risk level

Other Technologies

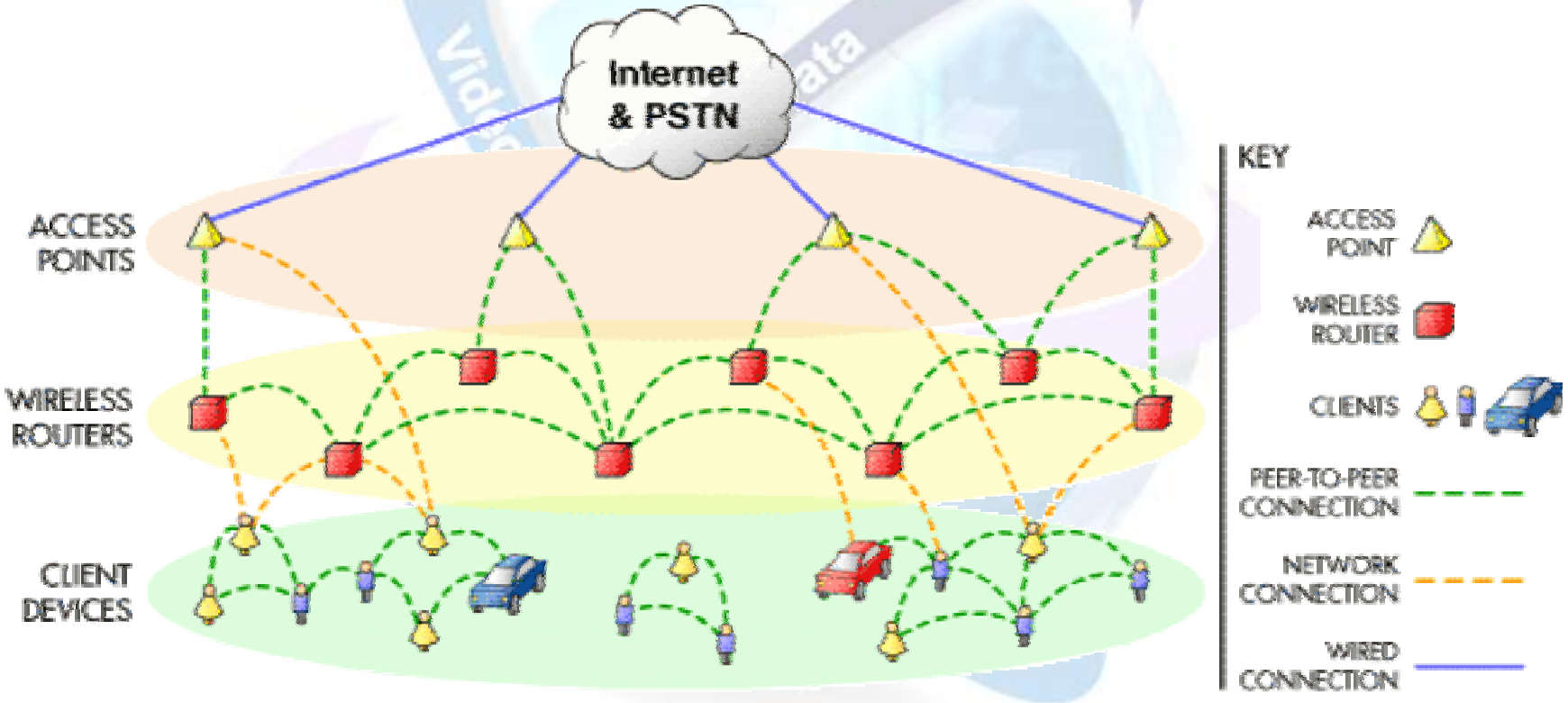
- Multicasting
  - Application-to-application multicast rather than host-to-host
- Adaptive resource management
  - Internet Traffic Engineering
- Virtual networking
  - Construction of multiple networks on a common infrastructure, allowing organizations to easily set up private networking domains governed by organization-specific policies

Conclusion

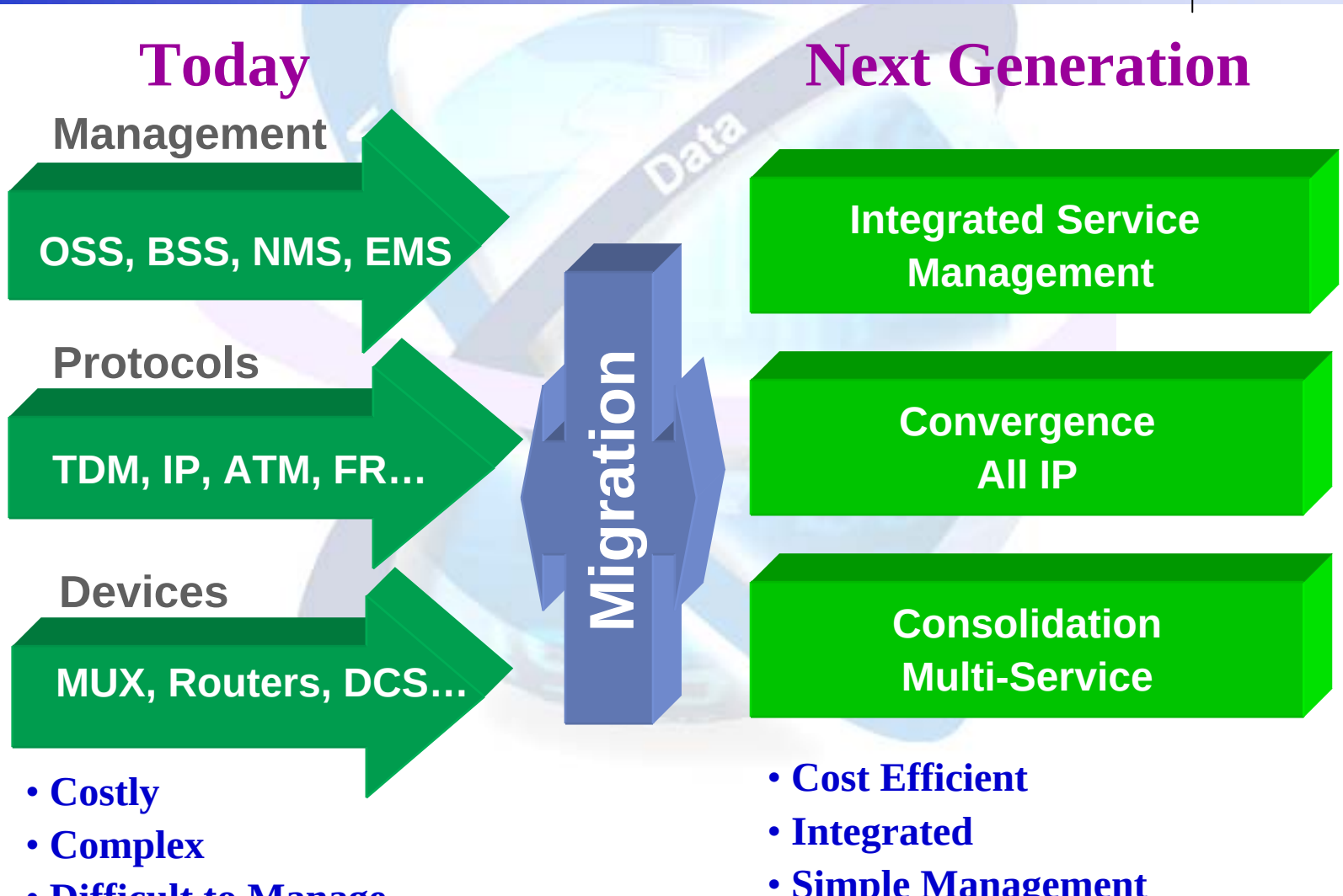
Future uses: quantitative aspects



Mobile Mesh Network



Network Migration



Next Generation Network Drivers

- Technology innovation
  - Establishing a competitive advantage
  - Increasing productivity and revenue opportunities
- Operational efficiency
  - Improving overall network infrastructure performance and scalability
  - Improving manageability by standardizing on network infrastructure and operating systems
  - Reducing long-term operating expenses
  - Improve overall IT infrastructure resiliency
  - Simplify network administration, management and control
- User Requirement and Applications

How to help to mitigate the Digital Divide?

- Government Determination & Capital Investment
  - Bitnet (later 80th)
  - ADSL (middle of 90th)
  - Dual Mode Handset (Early 20th)
- Chose the Right ICT
- Applications based on ICT

If it's green, it's biology, If it stinks, it's chemistry,
If it has numbers it's math,
If it doesn't work, it's technology

Thank you!
Comments?