Key Note, ISCC 2000,
Antibes-Juan les Pins, France, July 5, 2000

The Next Generation Networks/Services and IP

Koichi Asatani

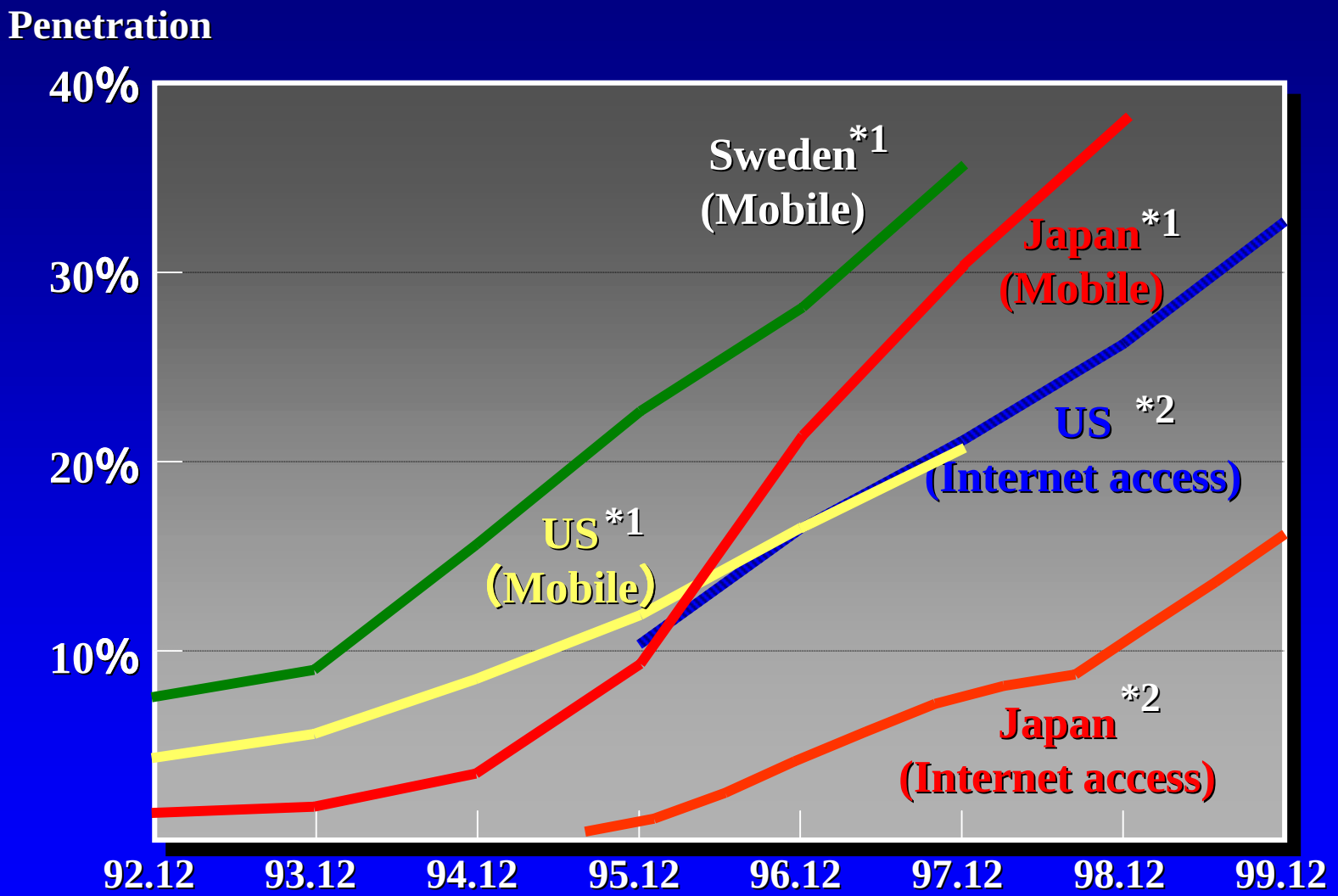
Kogakuin University/Waseda University
asatani@sin.cc.kogakuin.ac.jp, asatani@tom.comm.waseda.ac.jp
URL: http://asatani.cc.kogakuin.ac.jp

What I learned from Euro 2000

Outline

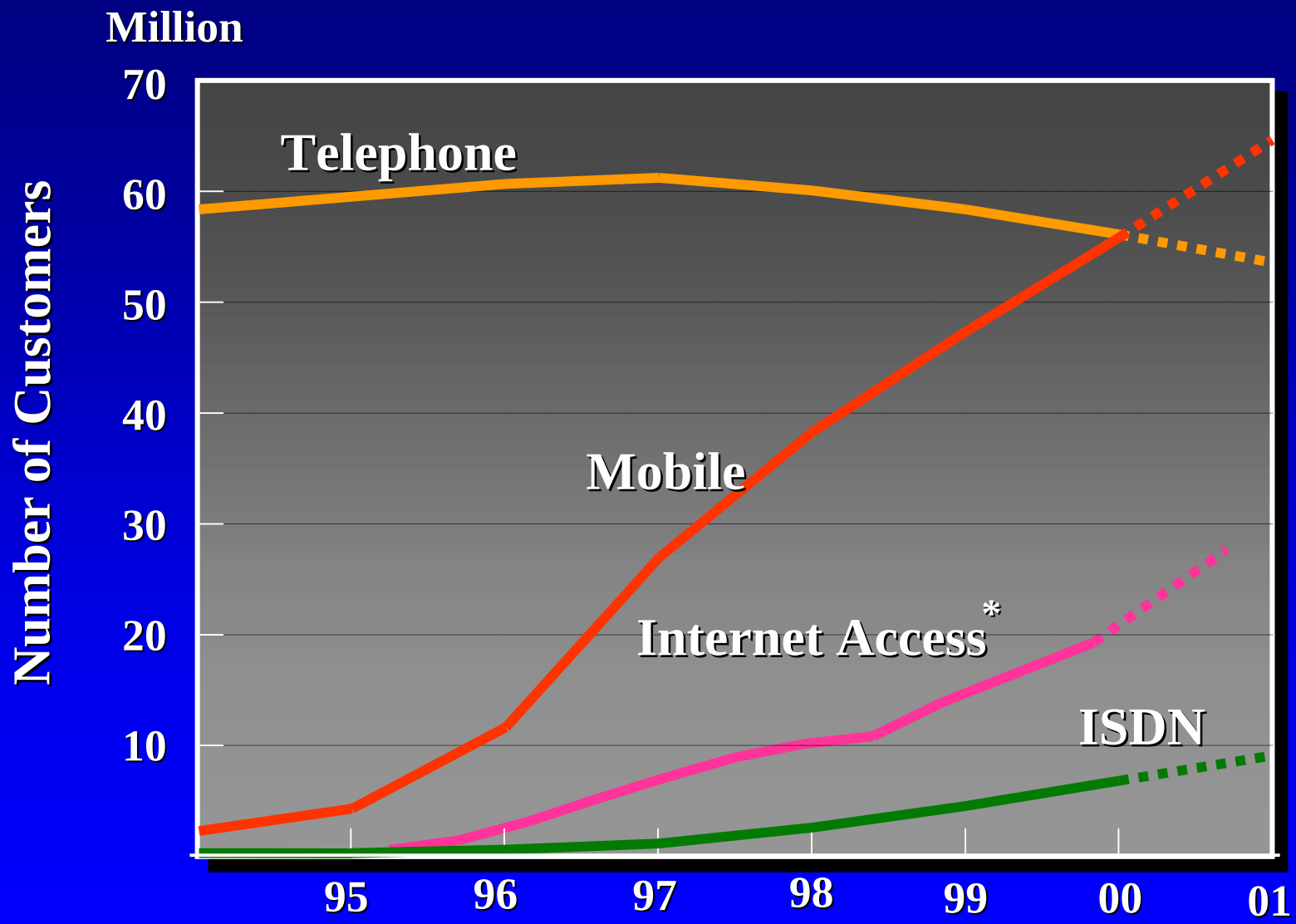
- Trends in Services
- Trends in Technologies
- Telecom Networks & Internet
- Requirements to NGN
- Network Strategies for NGN
- QoS Strategies for NGN
- Issues & Challenges

Trends in New Telecommunication Services



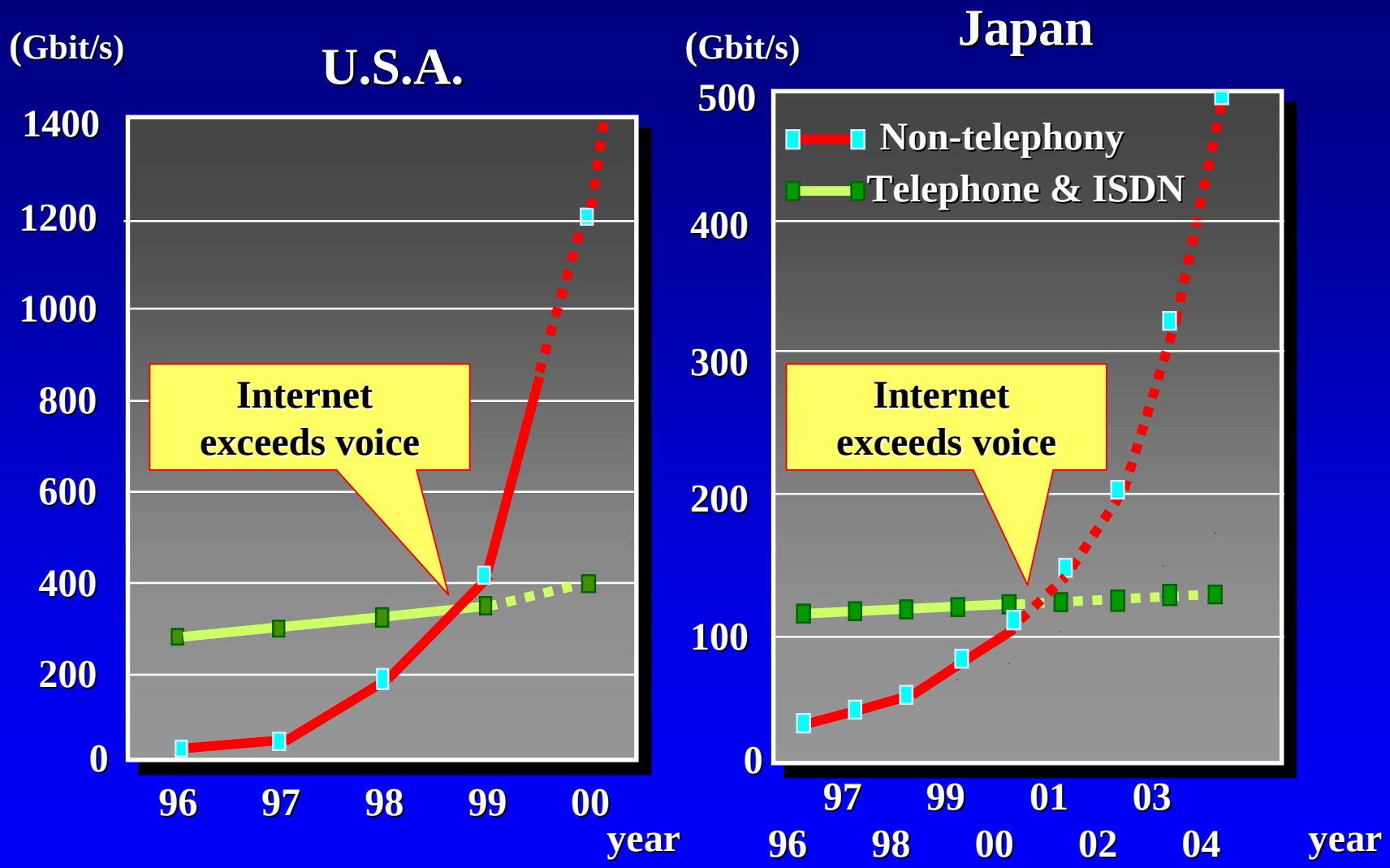
Source: *1 – OECD, *2 - IDC

Number of Telecom Customers in Japan



* : Estimation by IDC (International Data Corporation)

Growth of Internet Traffic



Source : IGI Consultation

Source: Modified NTT data

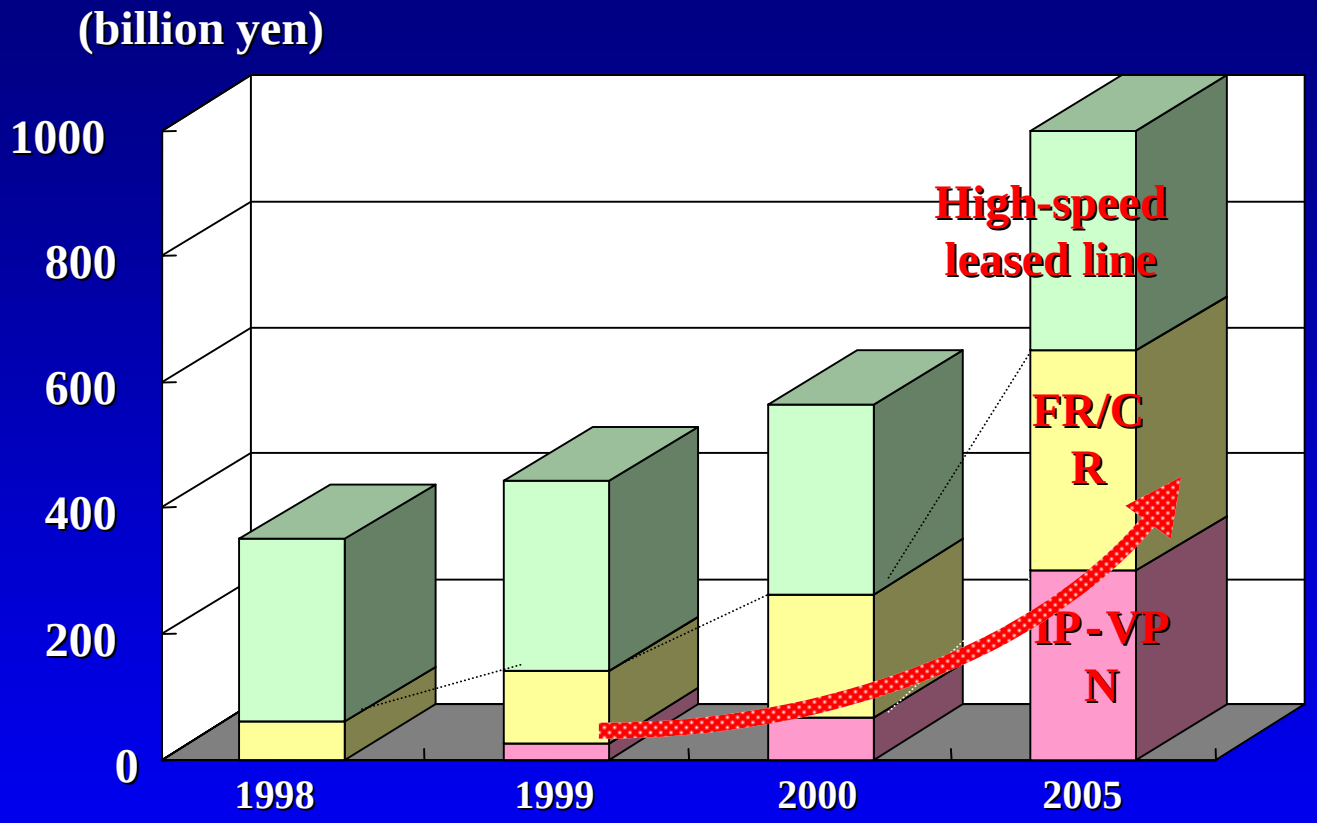
Key Events

- 1960's Nationwide Network
- 1970's Dial Connection
- 1980's Global Dial Connection, Digital Integration
- 1990's Internet Explosion

  (1998 Internet traffic exceeds telephone traffic.)
- 2000 Mobile phones exceeded fixed telephones

  Mobile Internet (i-Mode) : 8M users in 1.5 yrs
- -2010 IT & Home Electronics, Digital Migration ? ?

Estimated VPN Market in Japan



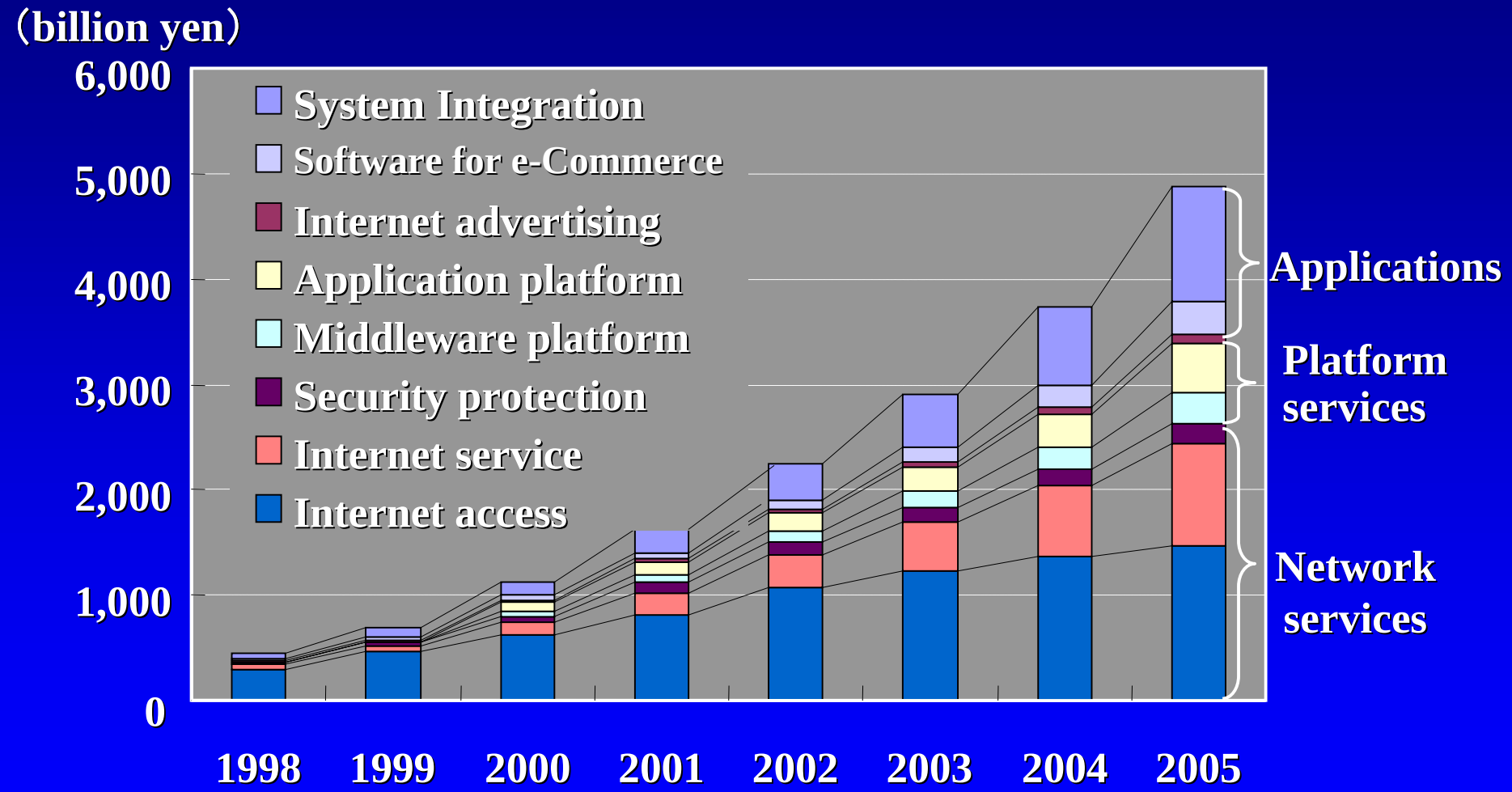
FR: Frame Relay
CR: Cell Relay

IP VPN Market

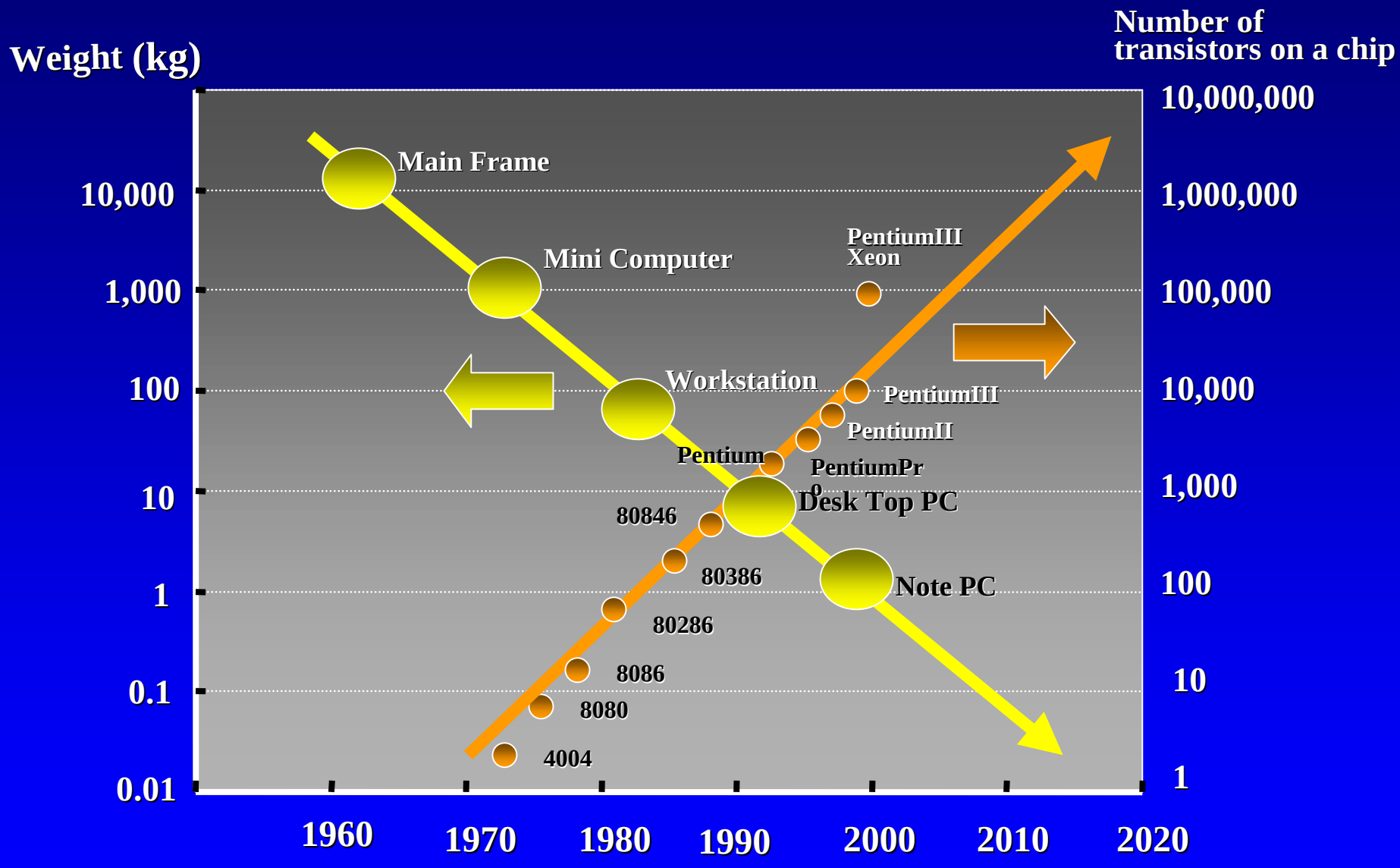
Year	1998	1999	2000	2005
Yen	-	26 billion	68 billion	300 billion

- 90% of FR/CR uses TCP/IP.
-Assumption: 30% of high-speed leased line and FR/CR customers will use IP-VPN in 2005.

Market for Multimedia IT Services in Japan

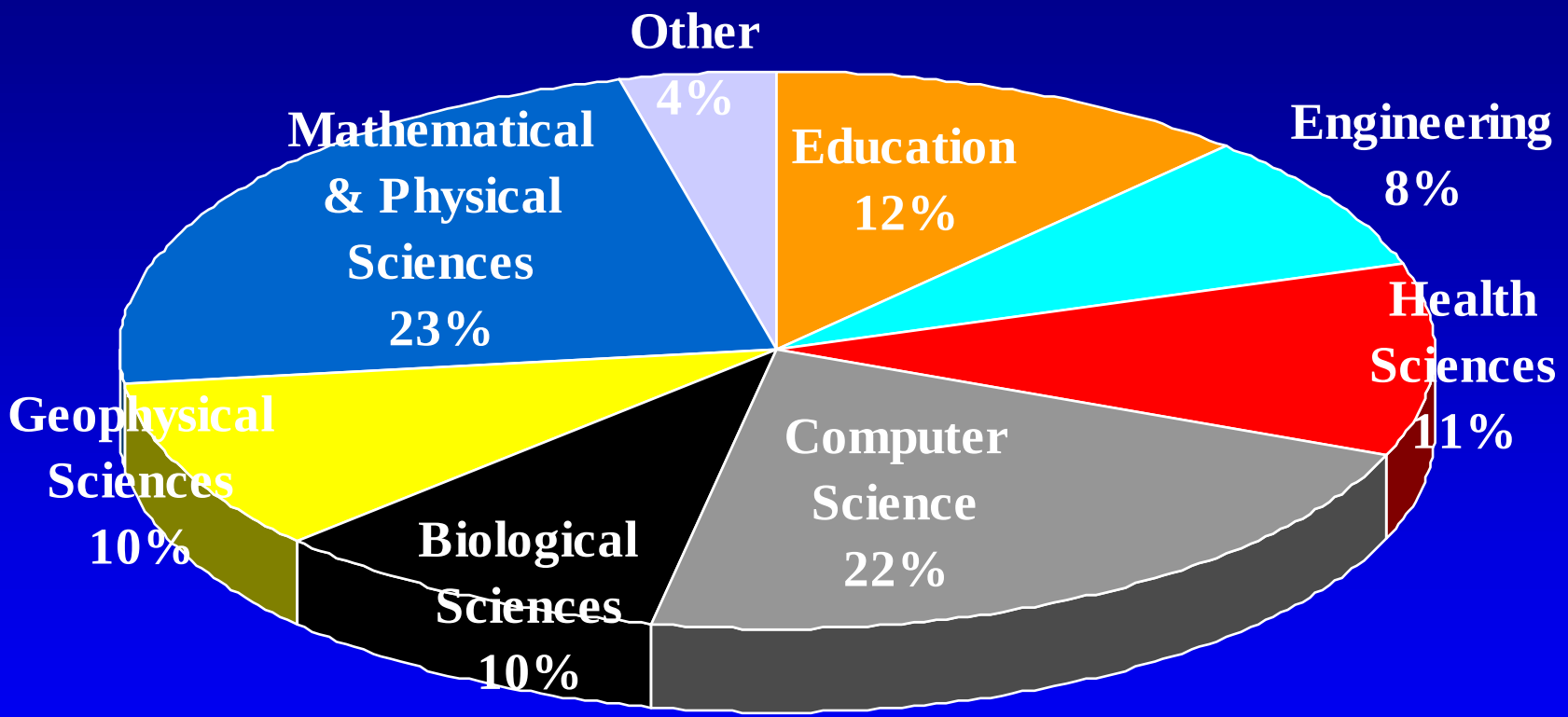


Technology Trends



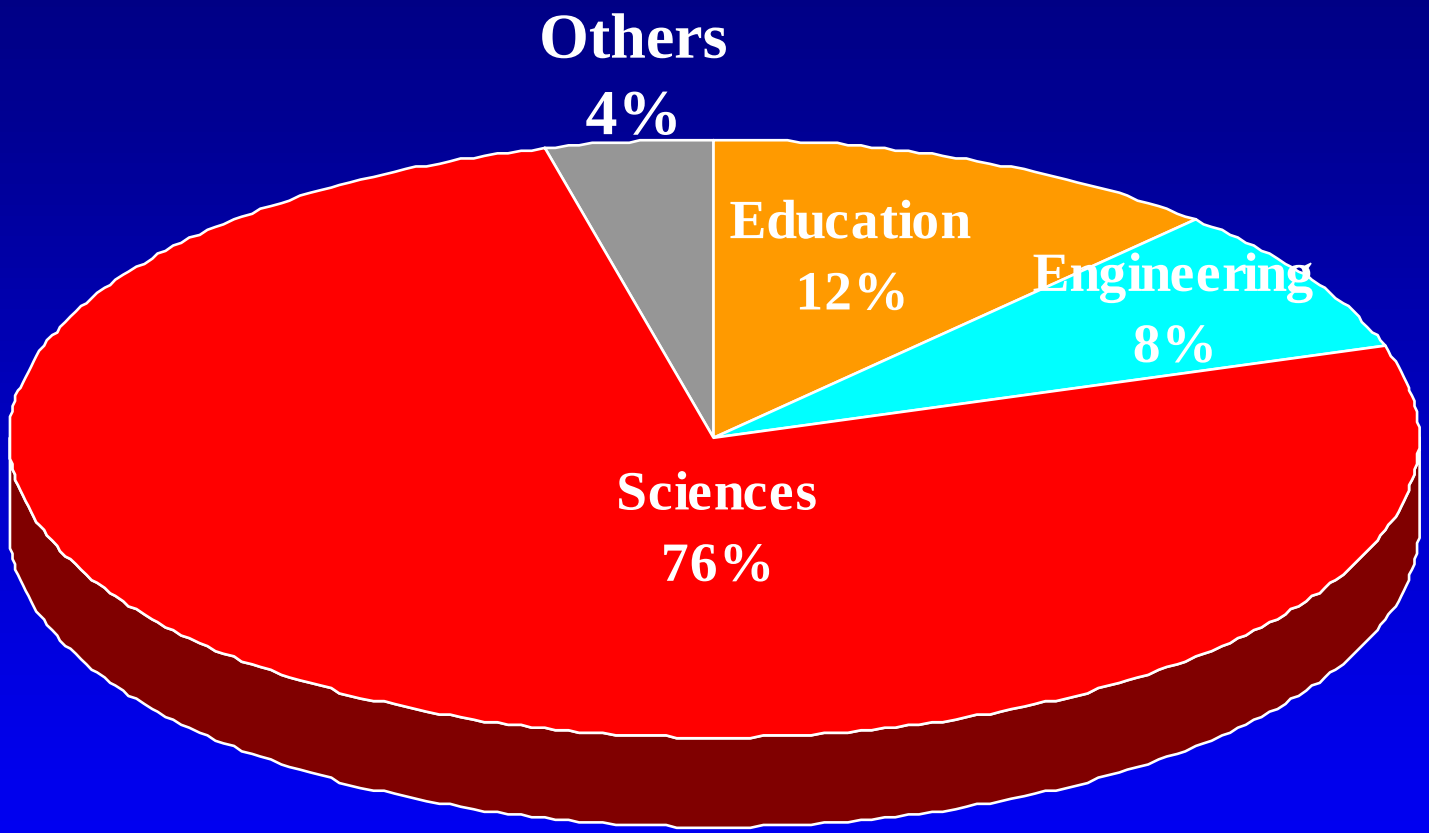
Source: TIME,July 3,2000

Distribution of Internet2 Projects



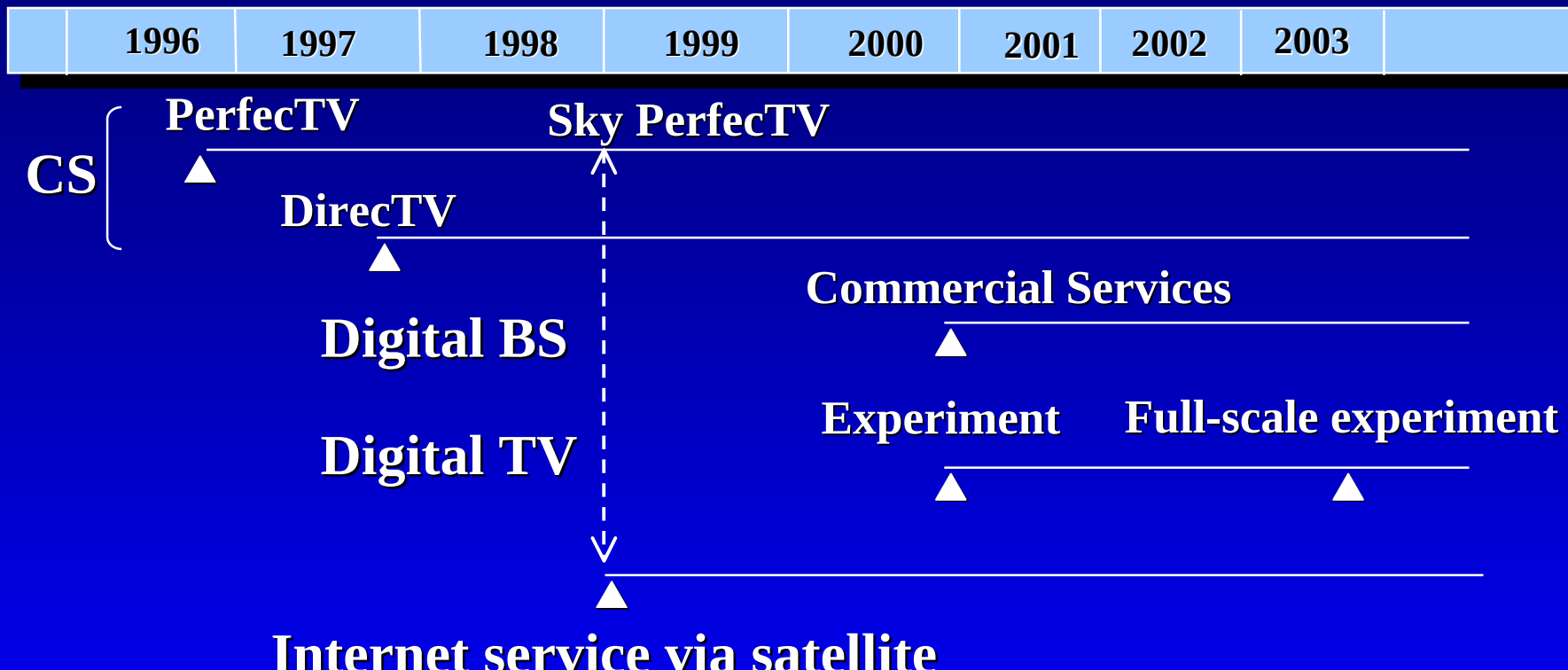
Source：
http://www.ncsa.uiuc.edu/SCD/DAST?clearing/graphics/disc.htm

Distribution of Internet2 Projects



Source：
http://www.ncsa.uiuc.edu/SCD/DAST?clearing/graphics/disc.htm

Digital TV Broadcasting in Japan



Number of TV customers
TV: 27 million
BS: 13 million
CS: 1 million

Telecom at a glance

- Global telephone services with guaranteed quality (233 countries/regions)
- High scalability
- Advanced capability (e.g. IP over ATM)
- Matured traffic engineering
  Predictable/measurable traffic
- Quick recovery from network failure
- Easy E-E network operation
- Stable growth (e.g., 8%/year in USA traffic, 4B subscribers in Y2K)

Internet at a glance

- Non-guaranteed QoS :Best Effort
- Global connectivity:
  IP: 96countries, UUCP:144 countries,
  e-mail:173 countries
- Low scalability
- Enhancing new services: CO emulation
- Premature traffic engineering
  Hard to predict/measure traffic
- Hard to recover from network failures
- Complicated E-E network operation
- High growth (e.g. 100%/year in USA traffic)

Characterizations of Internet & Telecom

	Internet	Telecom
QoS	non-guaranteed best effort	guaranteed
Primary Objective	reachiability	real time
Connection	connectionless	connection
Security	low	high
Dependability	?/low	high
E-to-E operability	low	high
Cost/bit	low	high
Charging	flat/on usage	on usage

Network Management for NGN

- Connectionless type network
  → controls at transport layer (TCP)
  → controls by host servers (end systems)
  - limited capability by end system control
  - user demands for cheap but unreliable services
- Connection-type
  → controls at network layer
  → controls by network nodes
  - real time voice, moving picture(streaming signals)
  - user demands for reliable services
- Likely Solution
  - connectionless + connection emulation
  - end system control + network node control

Some requirements to NGI

- **Reliable**
  - proven technology
  - self healing
- **Bandwidth Management**
  - limited bandwidth need management
- **Quality of Service**
  - some flows need timeliness or constant bit rate

Source: Based on R. Goode, Global IPv6 Summit, Paris,1999.10

Some Requirements to NGI

- **Priority Levels**
  - **some messages outrank other ones**
- **Simple to Manage**
  - **infrastructure must not be too complex to manage**
- **Low Protocol Overhead**
  - **limited bandwidth must be used efficiently (header compression, multicasting)**

Source: Based on R. Goode, Global IPv6 Summit, Paris,1999.10

IPv6の技術的特徴

- １．拡張されたIPアドレス空間 128ビット (32ビット：IPv4）
- ２．自立的な構成技術　低管理コスト
- ３．モバイルIP
- ４．マルチキャスト、エニーキャストのサポート
- ５．セキュリティの組み込みによるセキュリティ向上
- ６．フローラベルによるQoS制御
- ７．既存のインターネットアプリケーションへの後方一貫性
- ８．IPv4よりも優れたパフォーマンス
- ９．コンパクトで単純なヘッダ構成
- １０．将来への拡張性（拡張ヘッダ）

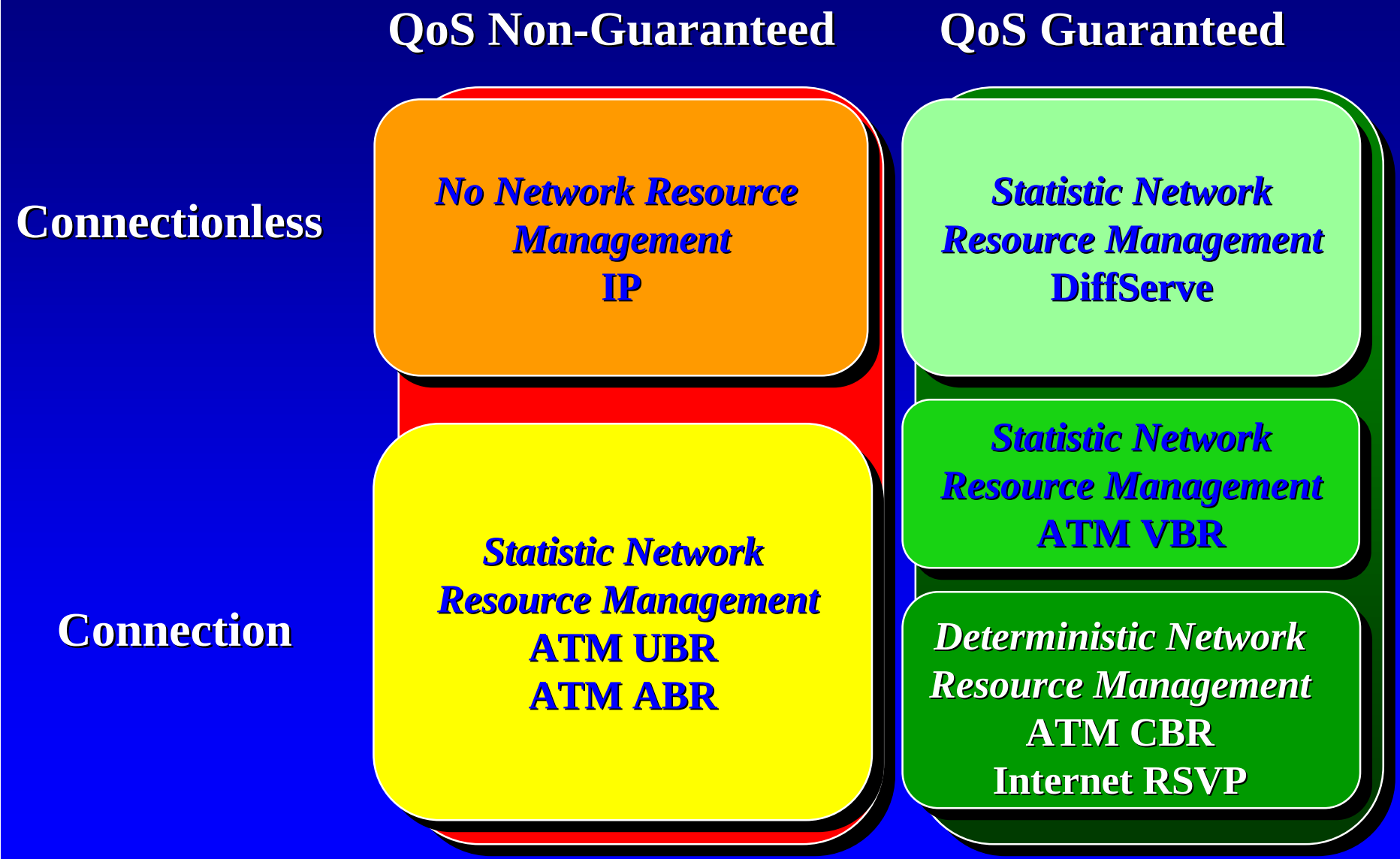
IPv6 Features

- 1 Extended IP Address Space **128bit (32bit：IPv4)**
- 2 Auto-configuration
- 3 Mobility
- 4 Multicast, Anycast
- 5 IPSec
- 6 Flow label
- 7 Backward compatibility
- 8 Better performance
- 9 Compact & simple header
- 10 Future extension (extended header)

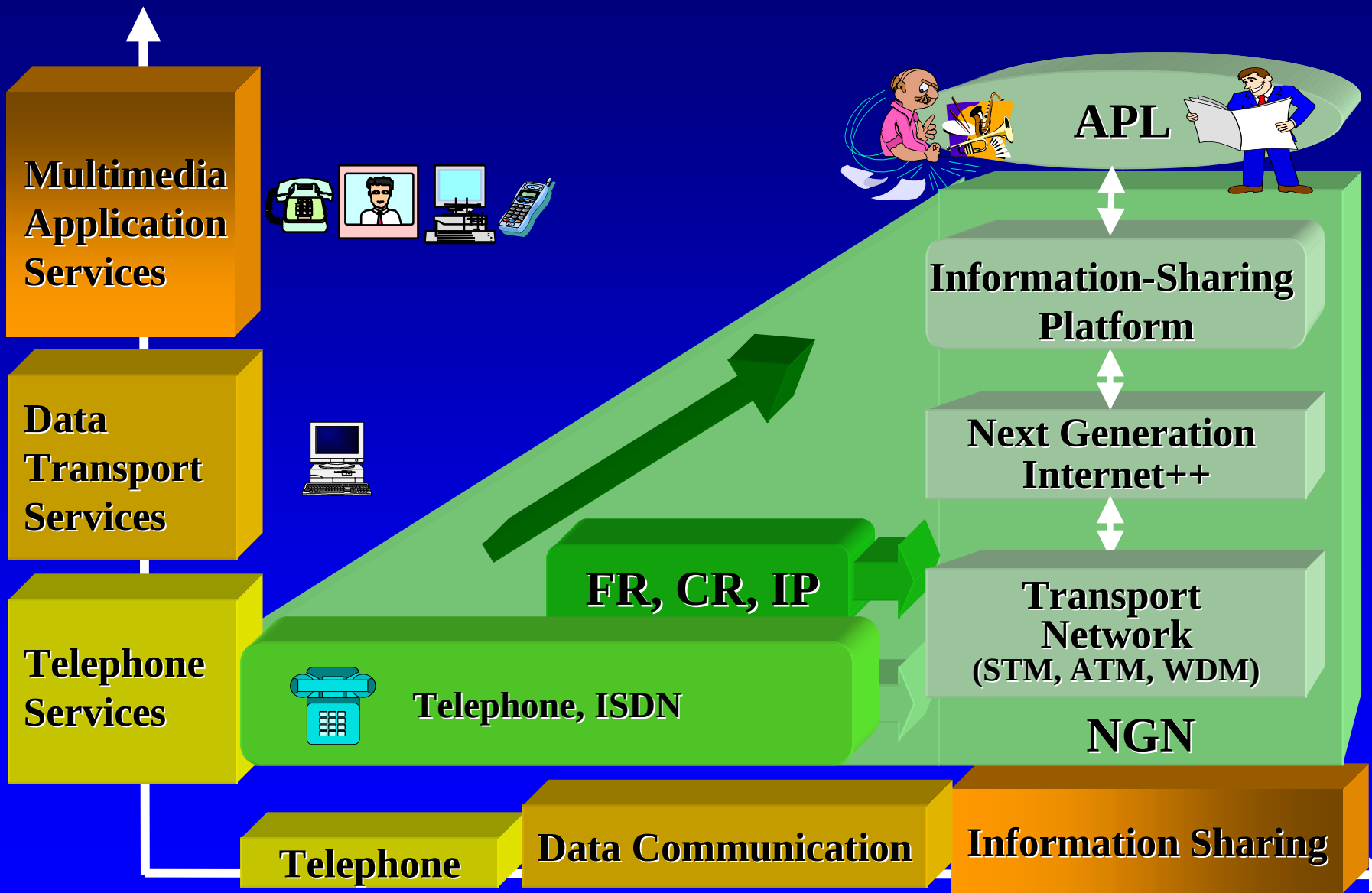
Requirements for NGN

attribute	values
QoS	non-guaranteed QoS with less price & guaranteed QoS
Primary Objective	reachiability & real time
Connection	do not care
Security	low with less price & high
Dependability	low with less price & high
E-to-E operability	high
Cost/bit	low
Charging	flat/on usage

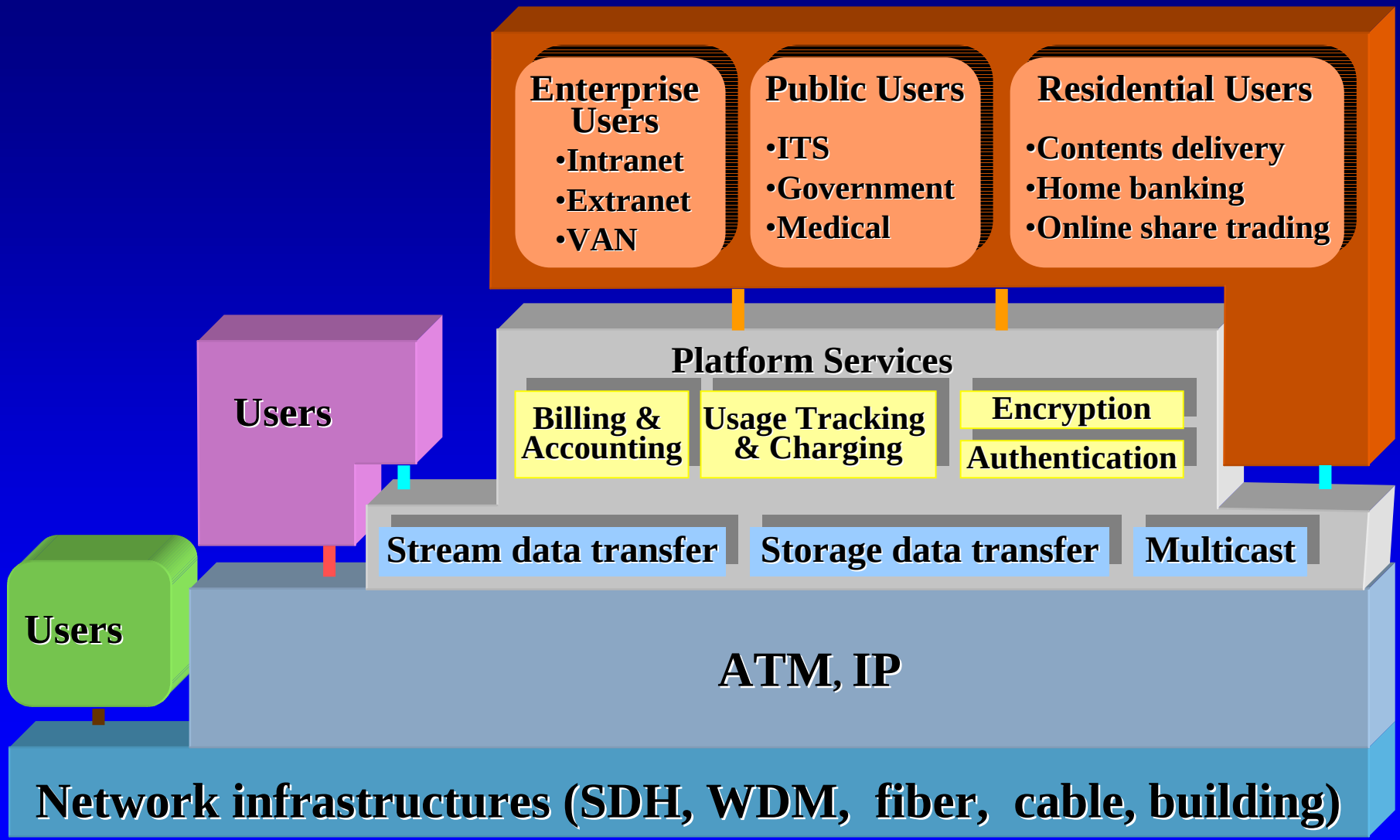
Network Resource Management Overview



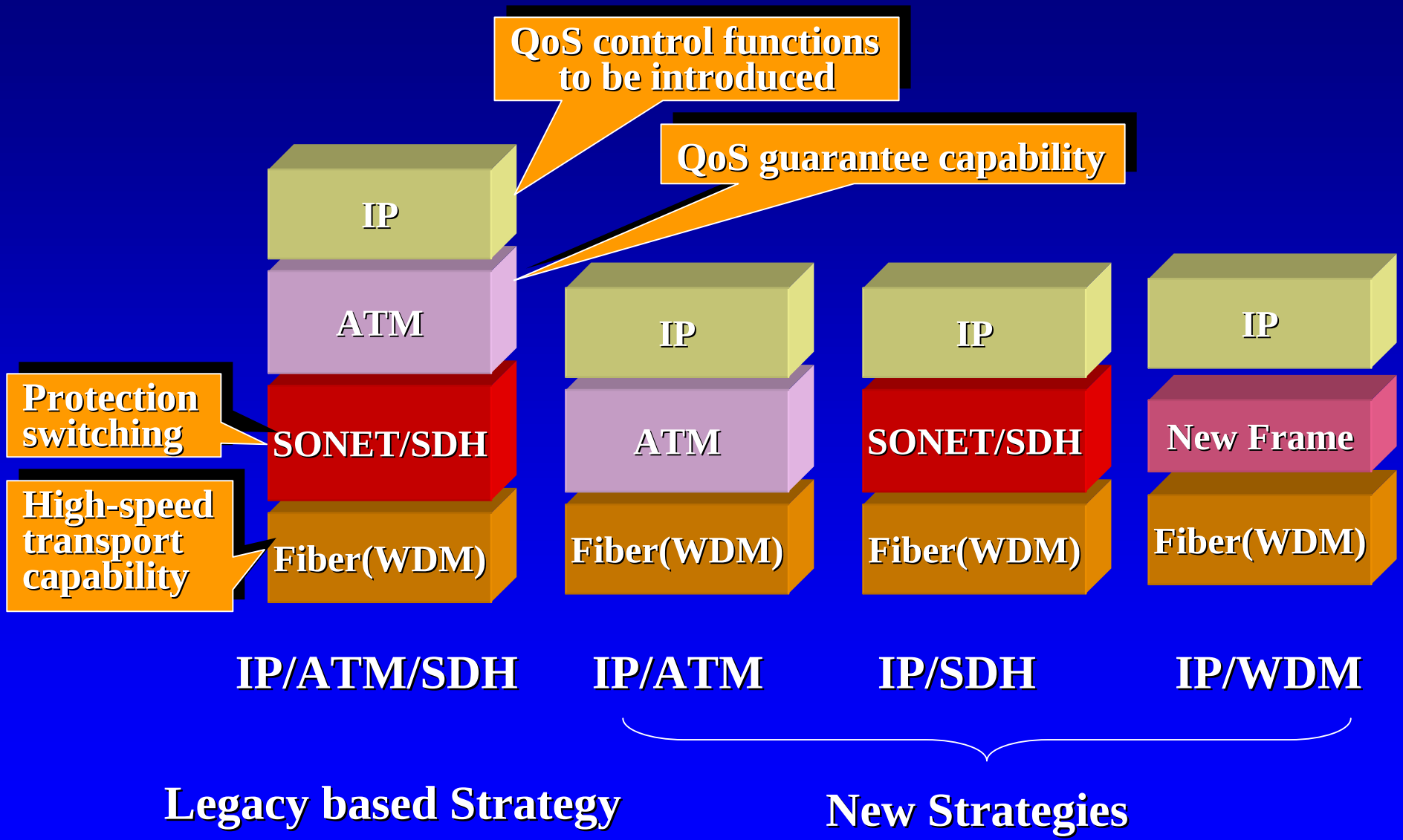
New Paradigms in Communication Networks



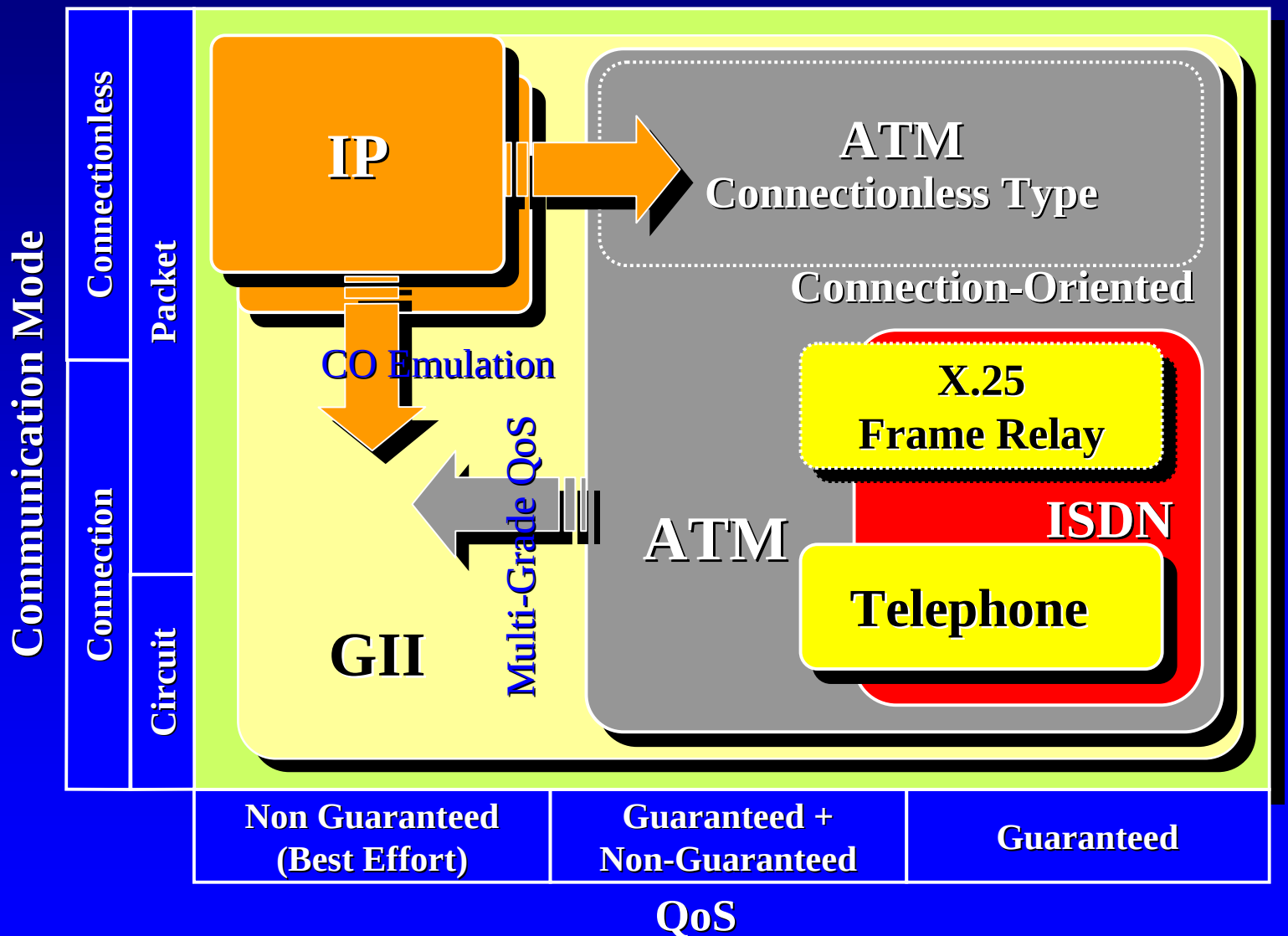
Platform Services for Information Sharing



Backbone Transport Network Strategies



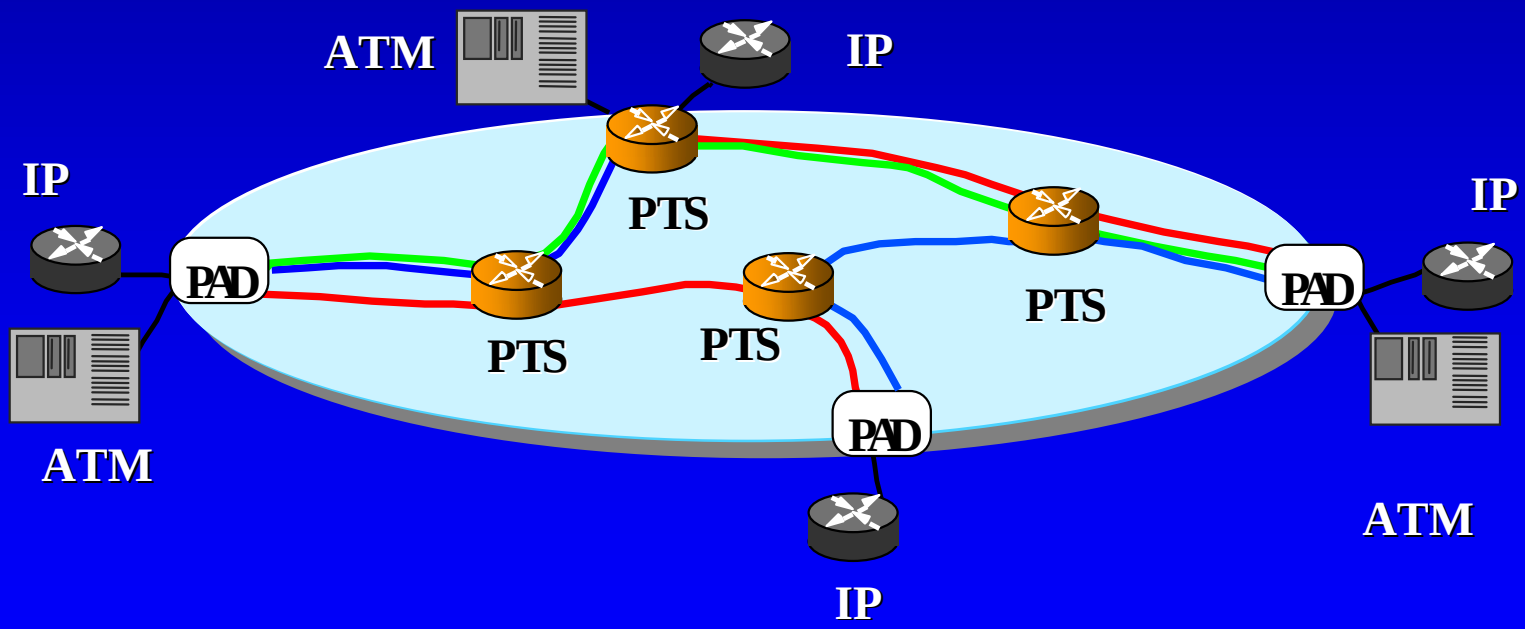
Multimedia Communications and QoS



Simple and High-Speed Photonic Networks

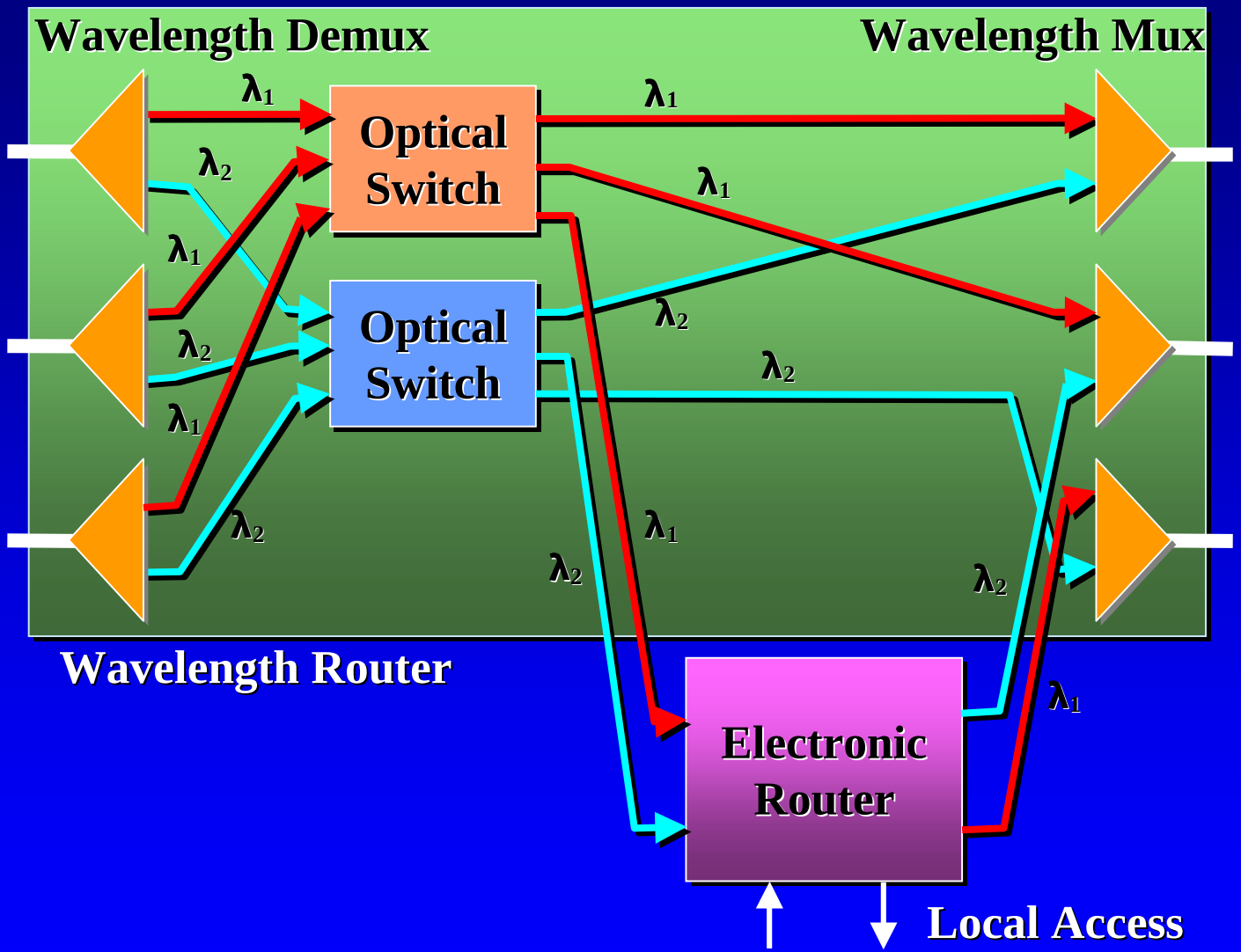
Wavelength Path

- **Tera bit/s Network**
- **Small Delay Backbone**
- **Cost-Effective Network**



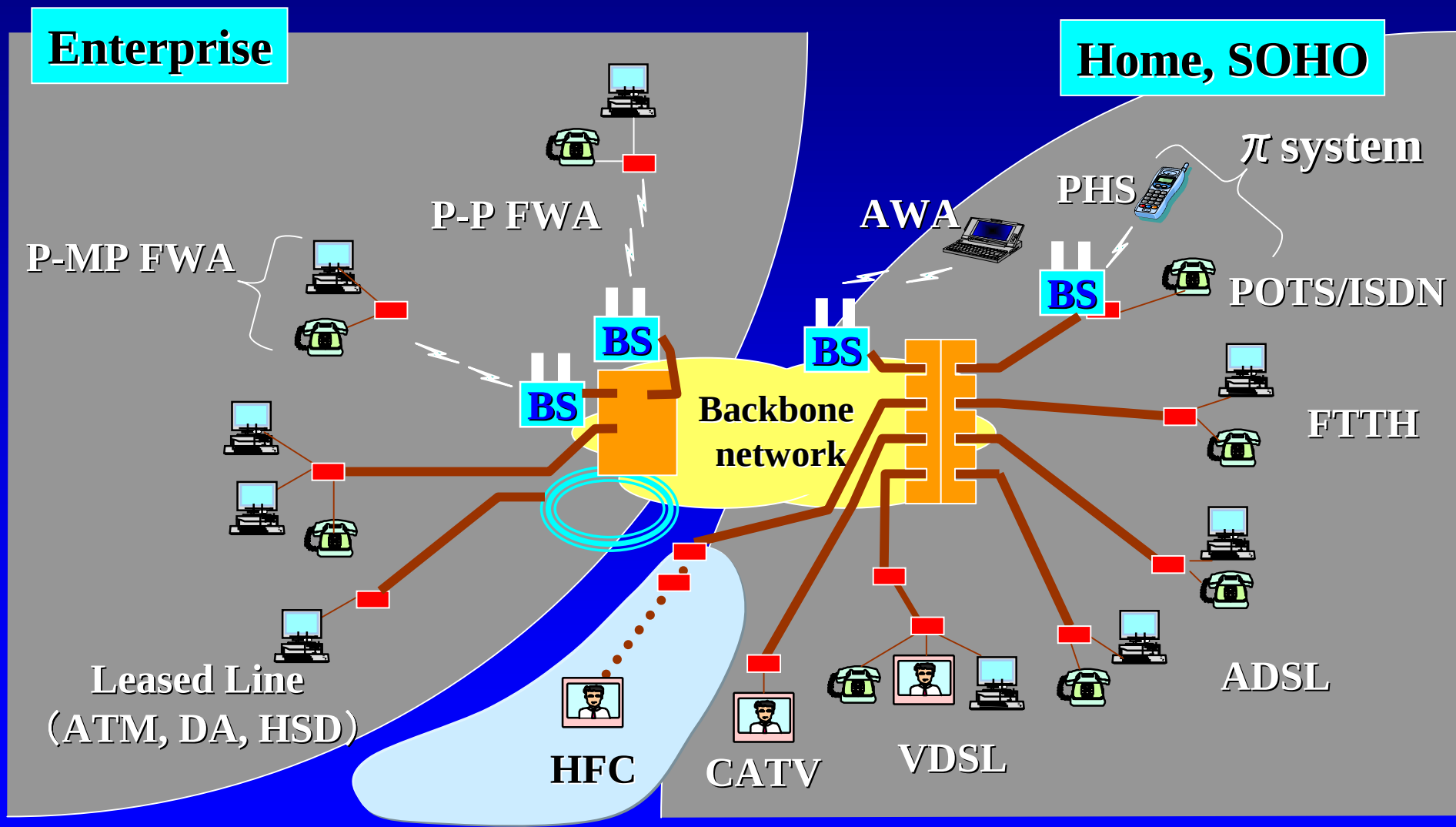
PTS:Photonic Transport System
PAD:Payload Assembler-Disassembler

Wavelength Router

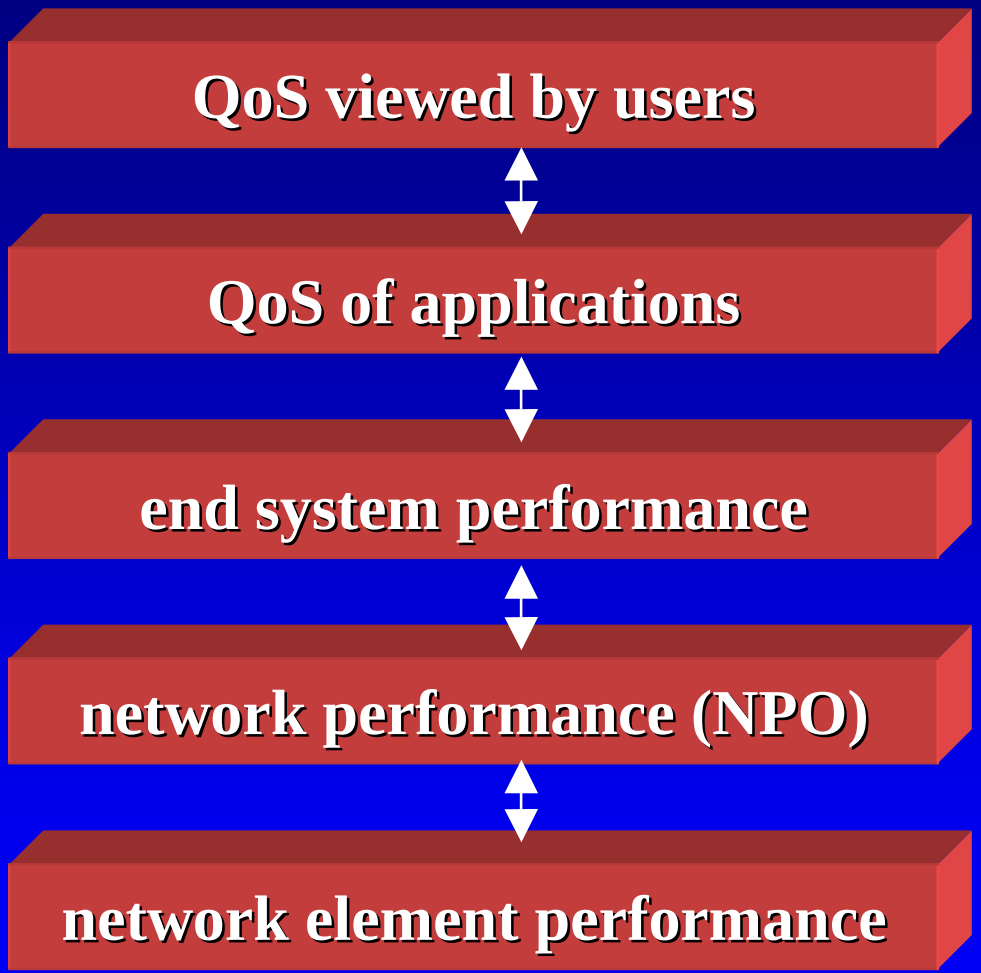


Source: M. Murata, K. Kitayama & H. Miyahara

Access Service Lineup



QoS Architecture



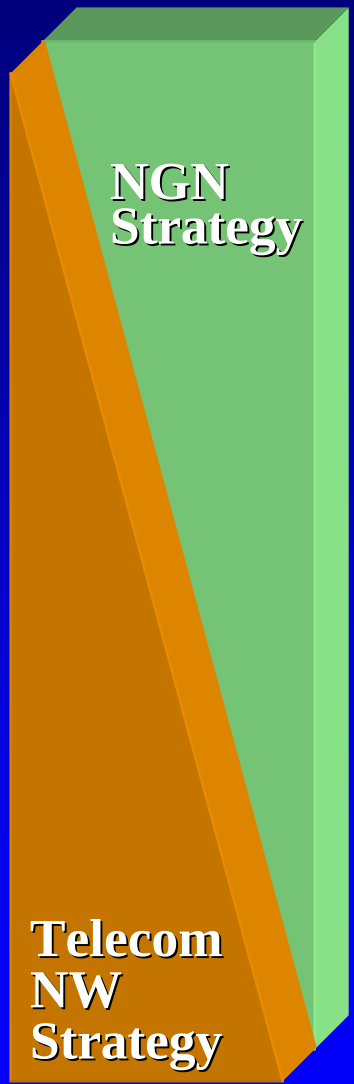
user evaluation

intra-media quality
(e.g. e-e delay)
inter-media quality
(e.g. sync)

system process
delay (speed)

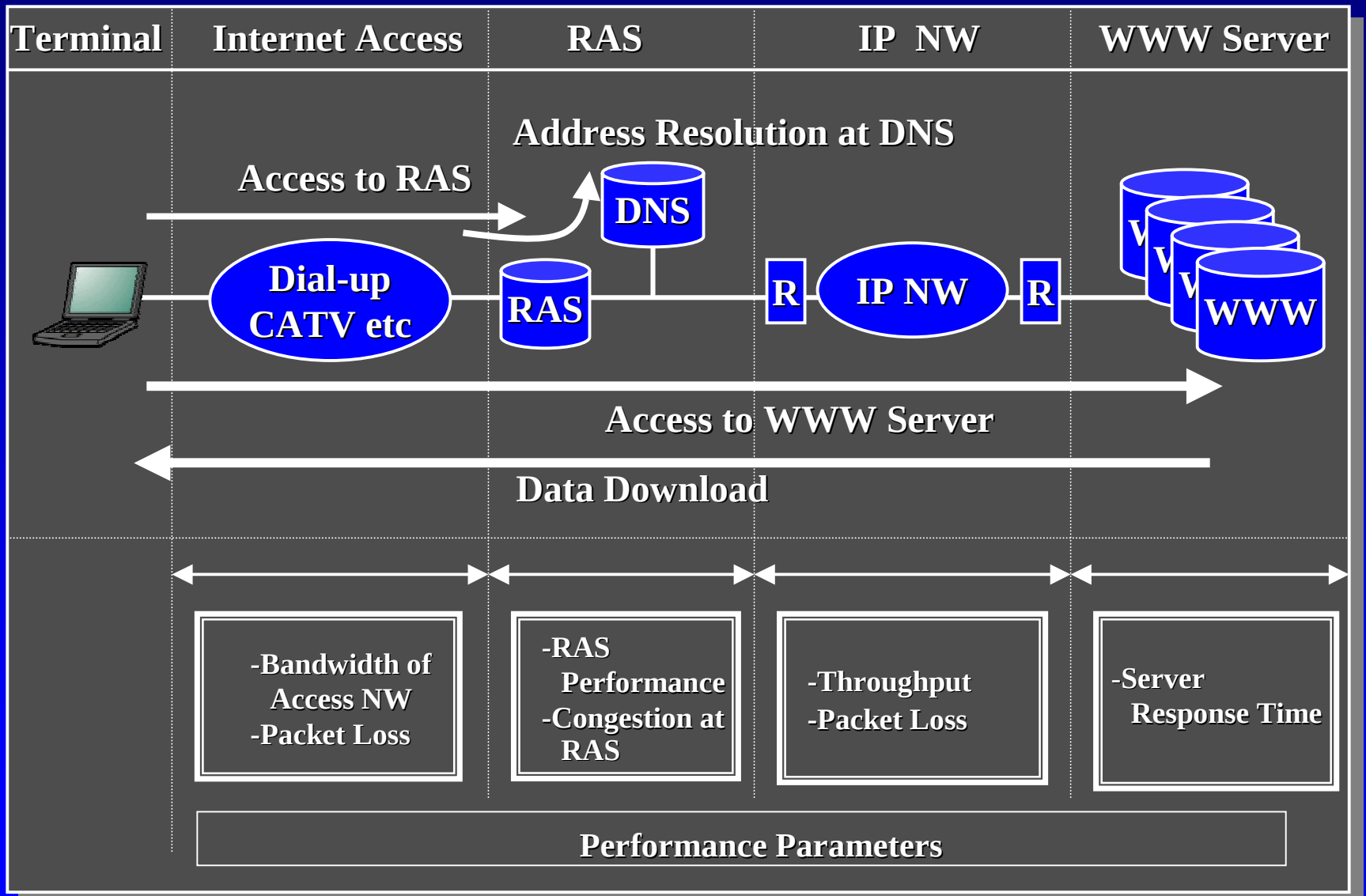
throughput
delay, latency

throughput
delay

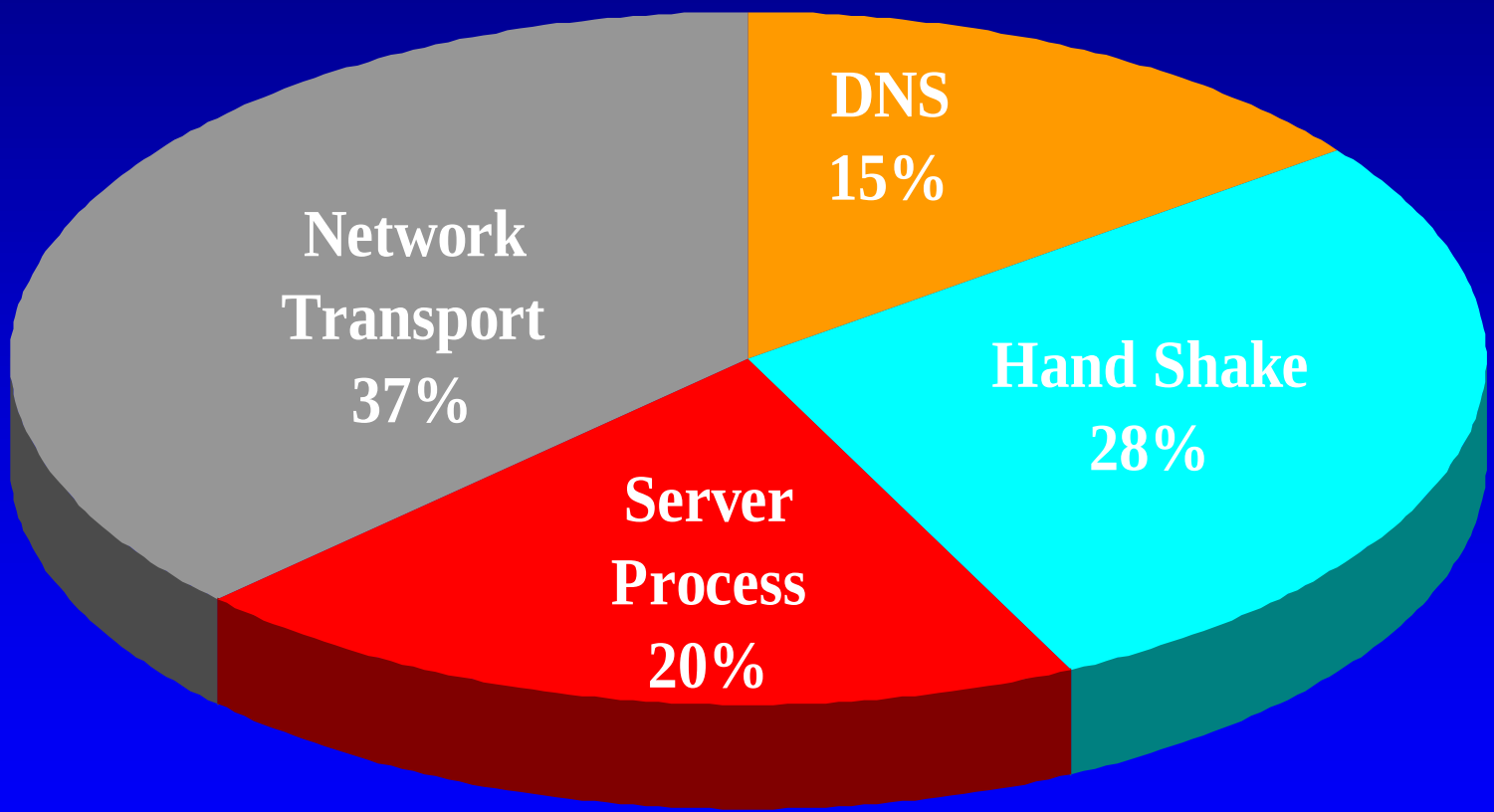


NPO : Network Performance Objectives
EDO : Equipment Design Objectives

QoS for WWW Server Access



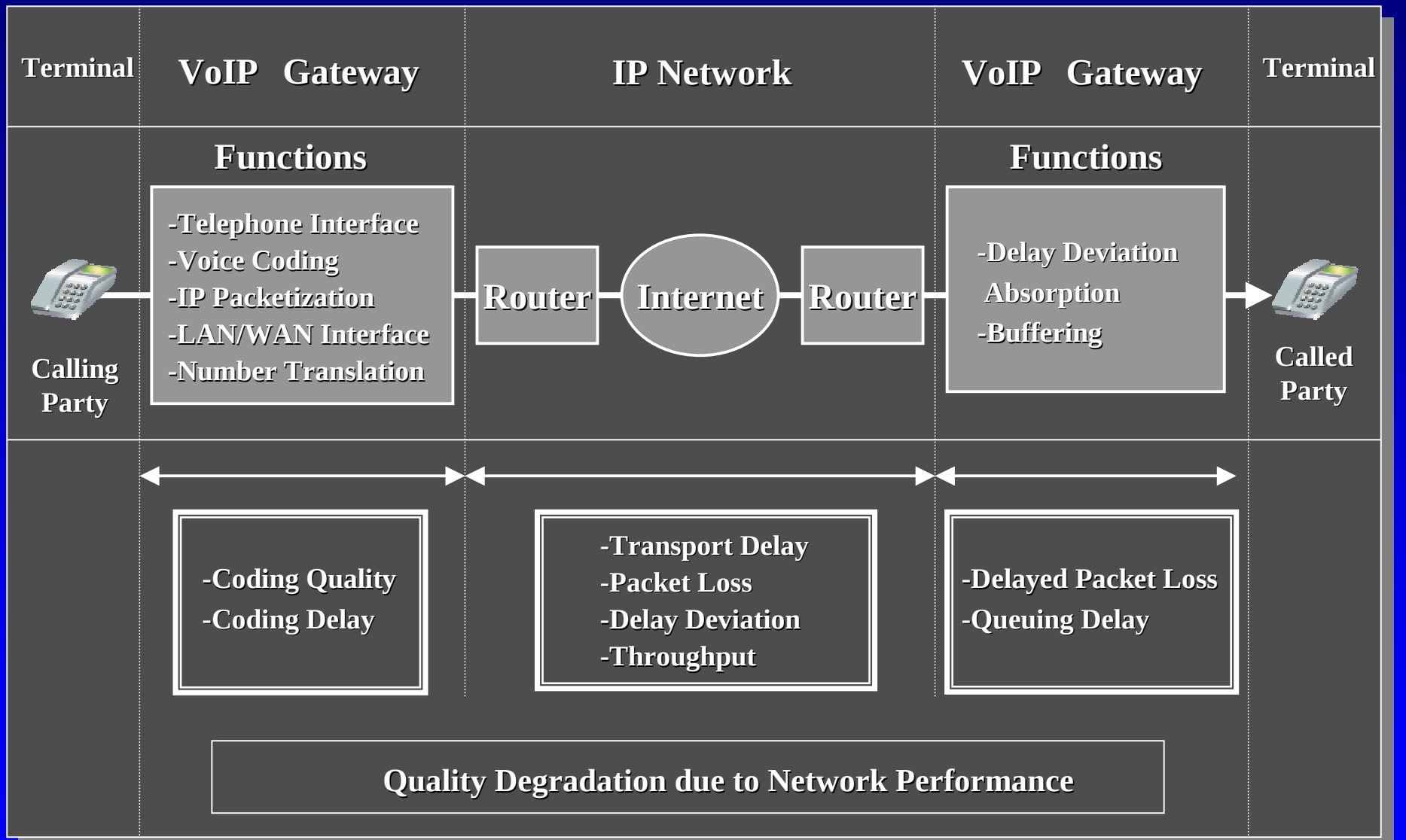
Delay Distribution in Web Downloading



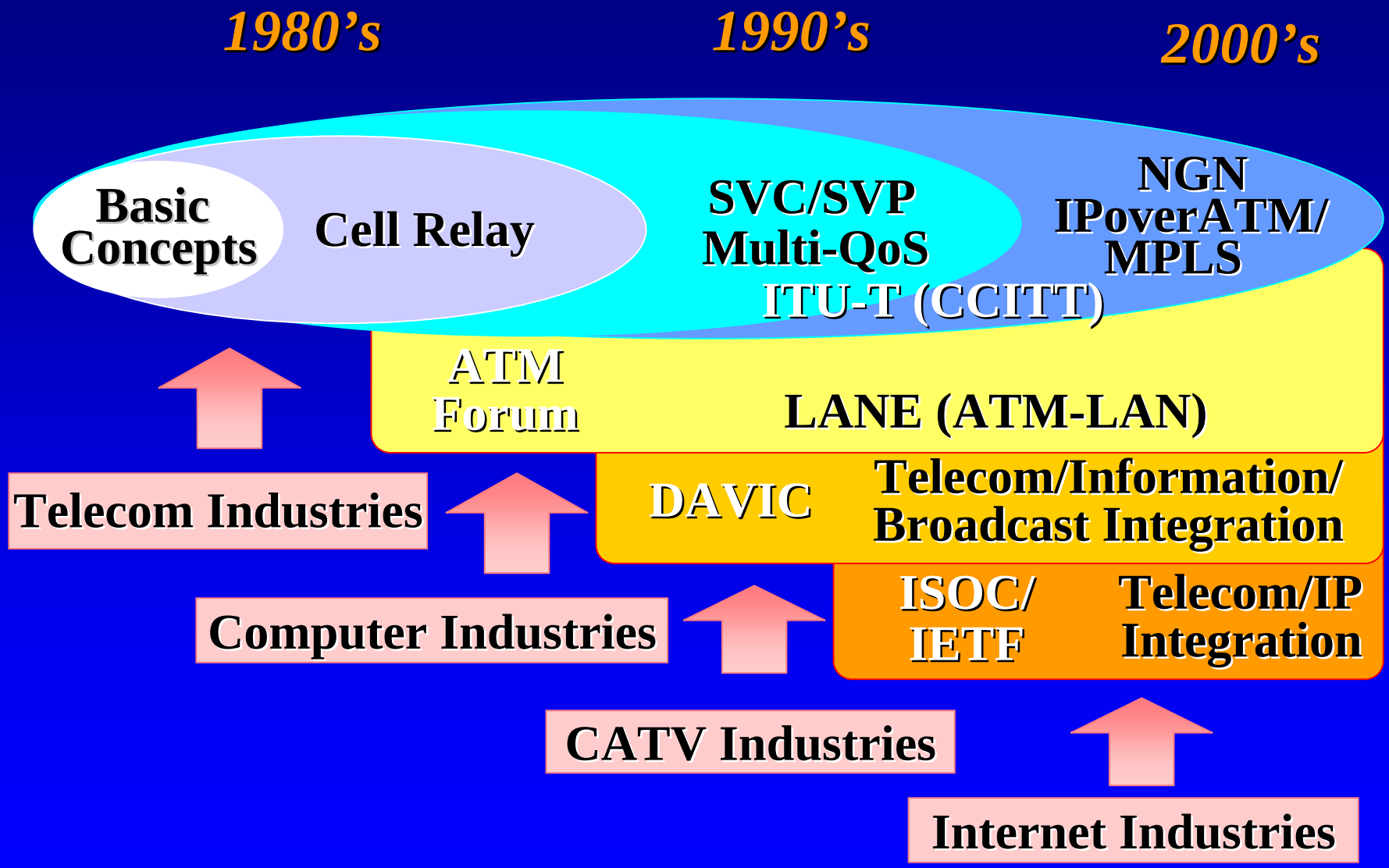
Source: Y.Fujita, M. Murata & H.Miyahara,Trans.IEICE, 1998.
Based on the data at ftp://www.telcordia.com/pub/huitema/stats

QoS Role is Growing

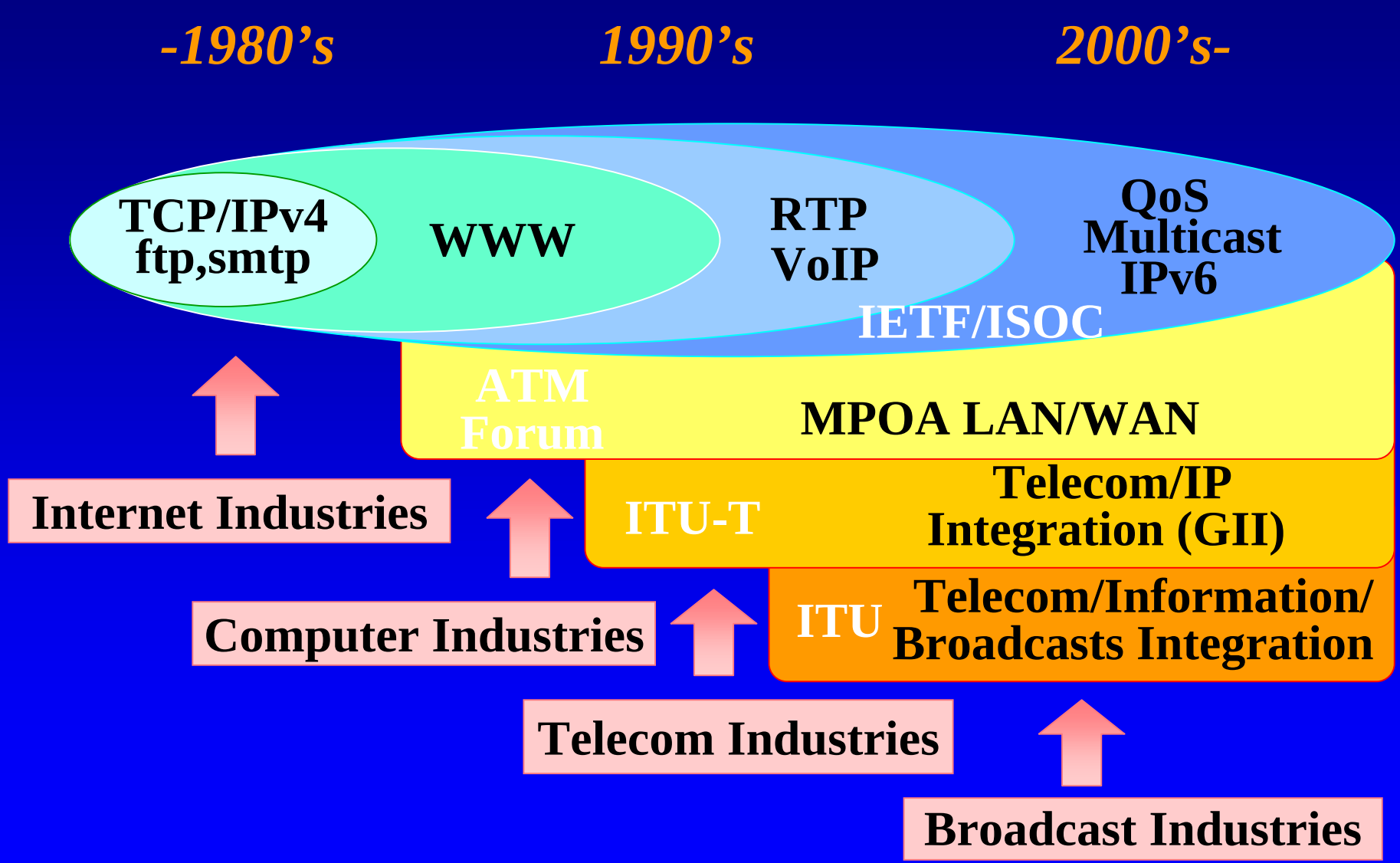
VoIP QoS & Performances



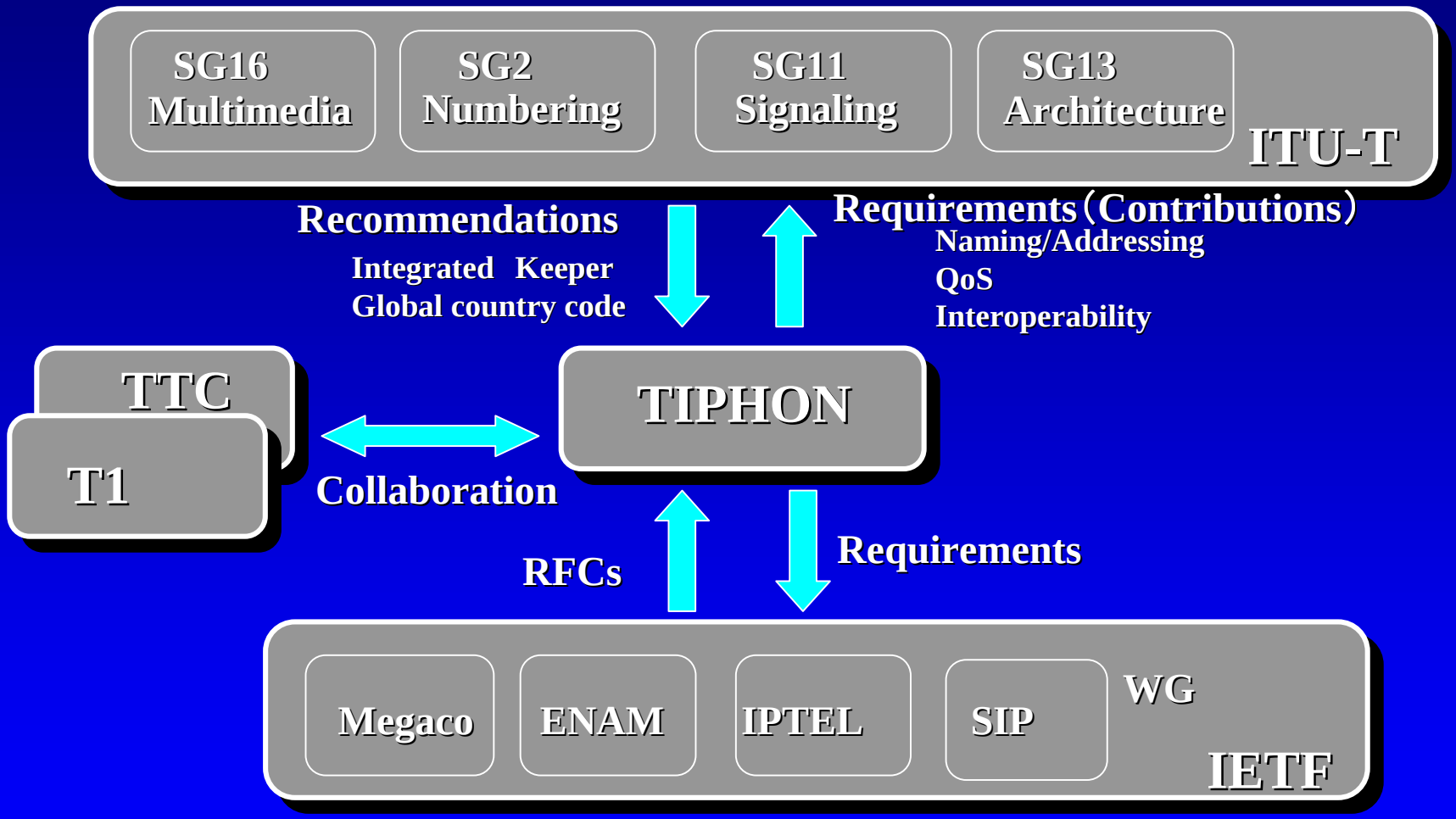
Scope & Involvement of ATM Standards



Scope & Involvement of IP Standards

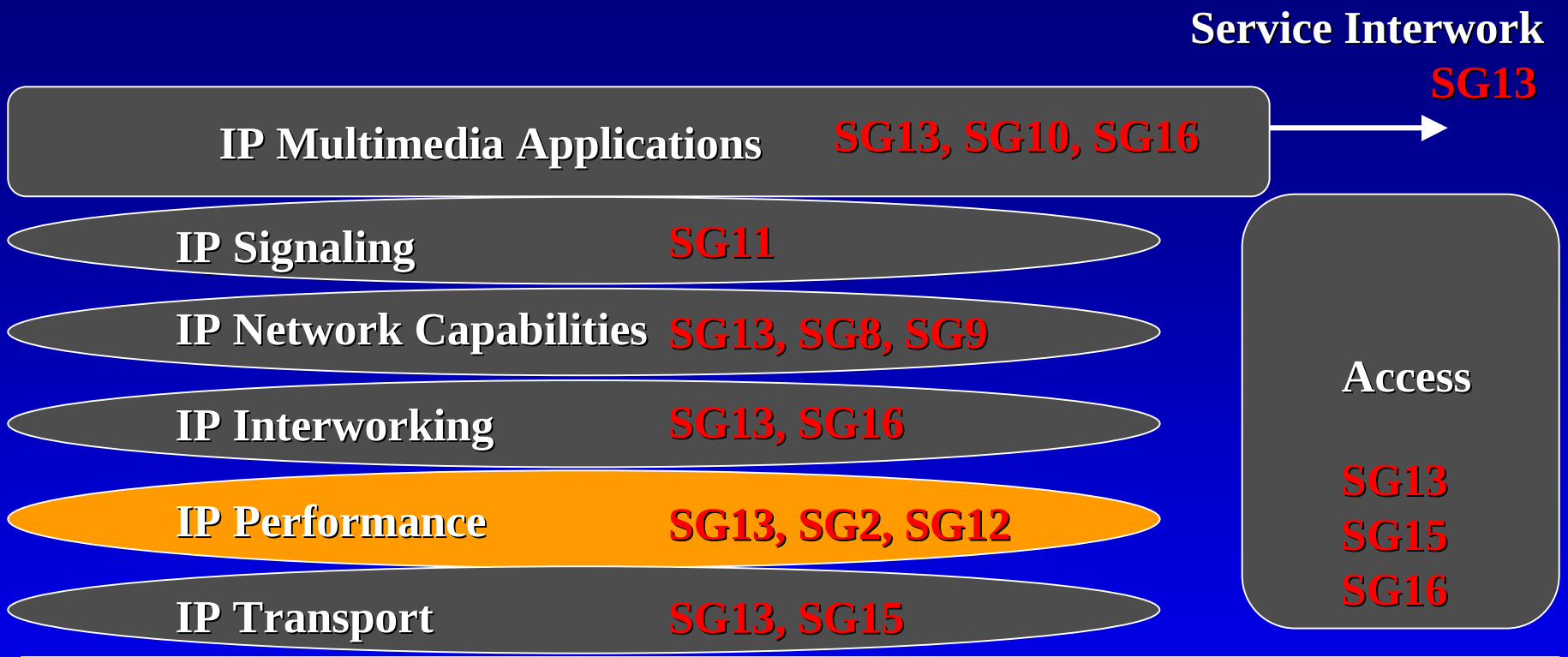


ITU-T, TIPHON & IETF

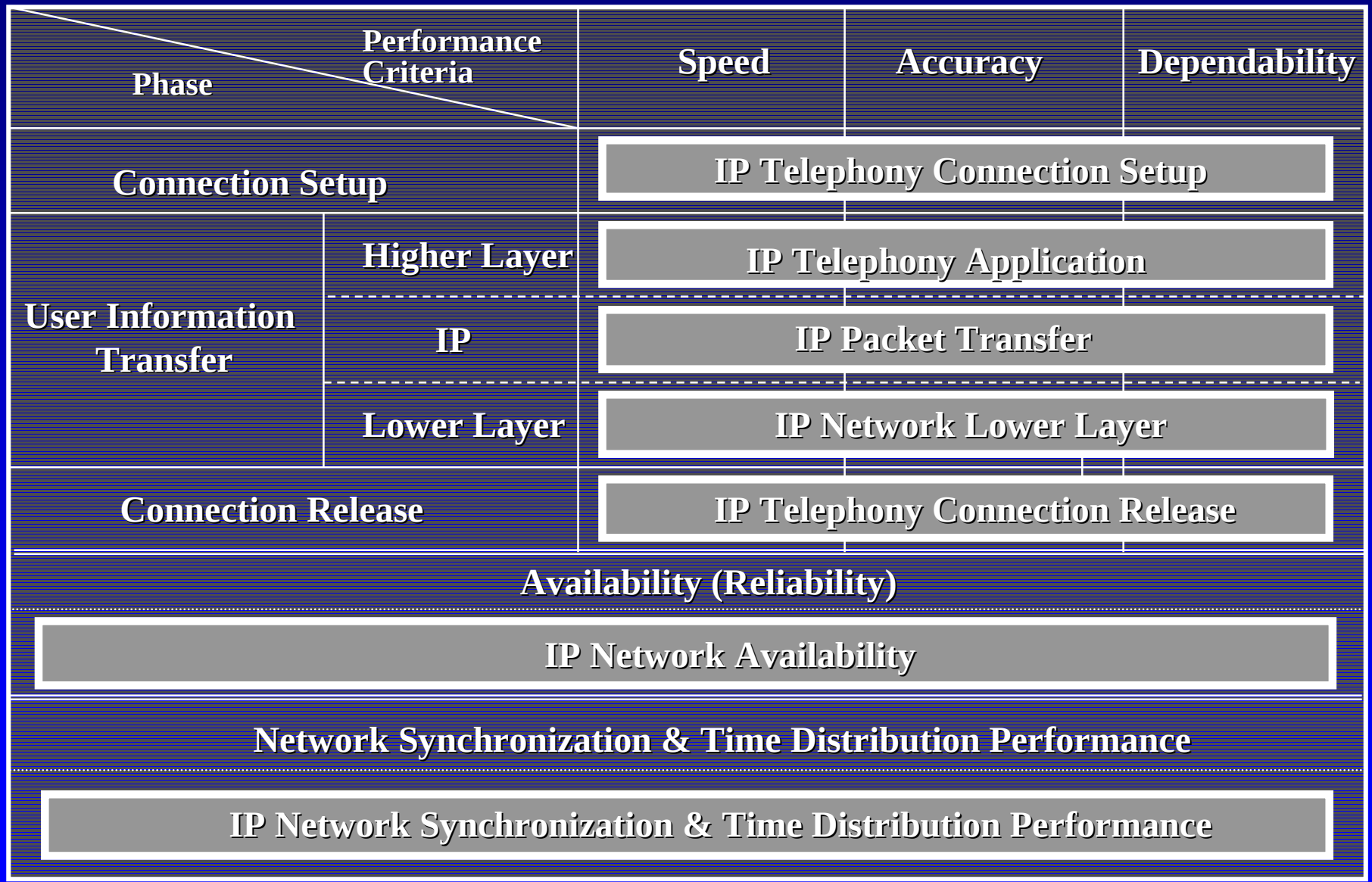


enam: new numbering
iptel: IP Telephony
sip: Session Initiation Protocol

ITU-T IP-Project & Study Items



IP Network Performance Framework



Availability Parameters

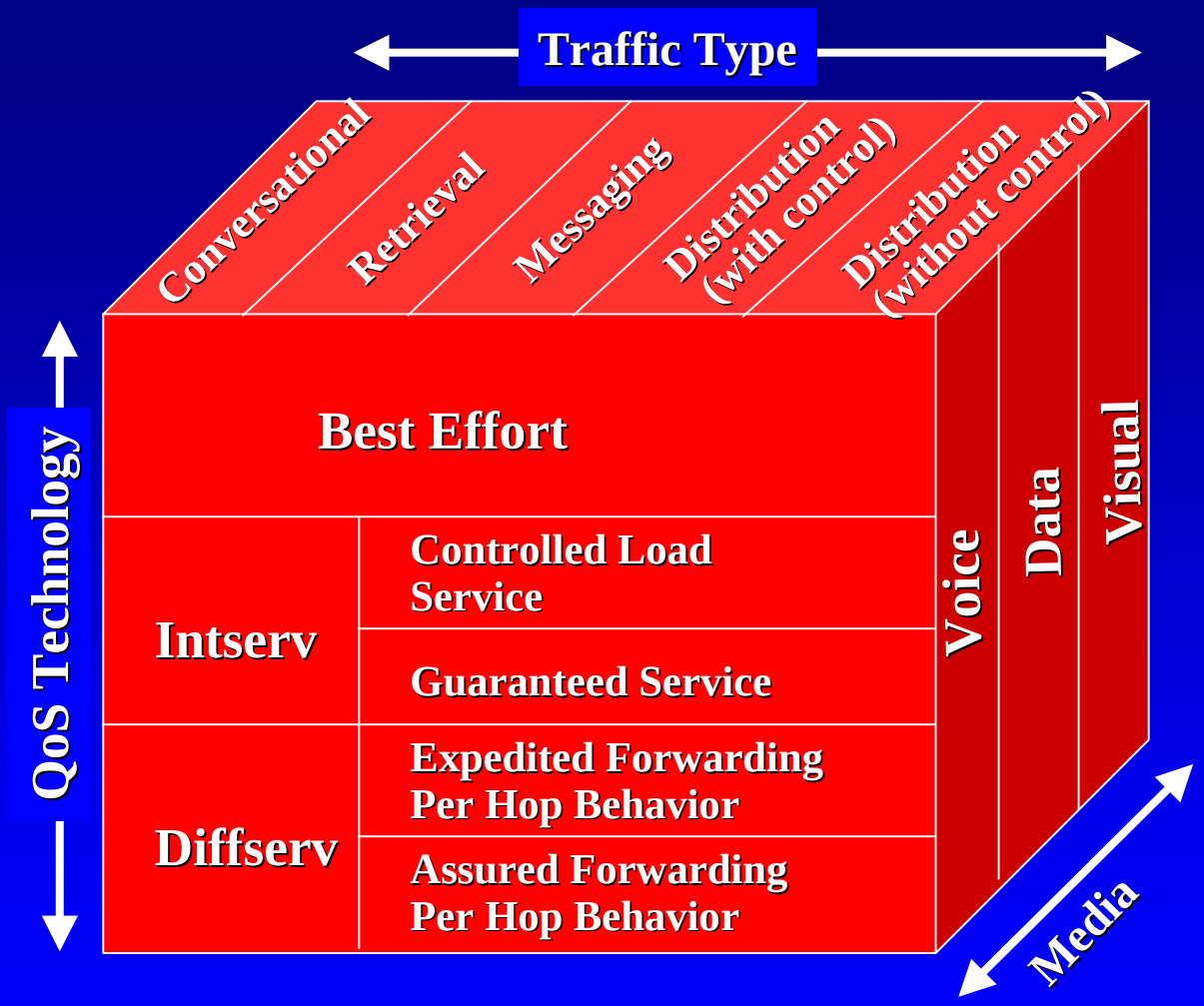
Unavailability: IP Packet Loss Ratio(IPLR) > C1

- **C1 = 0.75 (Other candidates: 0.9 and 0.99)**
- **Measurement duration: 5 minutes**

Metrics:

- **Percent IP service unavailability (PIU)**
- **Percent IP service availability (PIA)**
- **Unit = % Time Ratio**

QoS Technology in IP Networks



ITU-T Draft Rec. Y.1001 " IP Framework"

GS:Guaranteed Service
CLS:Controlled Load Service
AF:Assured Forwarding
EF:Expedited Forwarding

TIPHON QoS Class

QoS Class	BEST	HIGH	MEDIUM	Best Effort
Total QoS	> PSTN/ISDN	PSTN/ISDN	Cellular(GSM)	Usable
Voice Transmission Quality(G.109)	Under study	> 85	> 70	> 50
Voice Quality	>G.711	>G.726(32kbps)	>GSM-Full Rate	Not Specified
E-E Delay				
TIPHON-05001	< 150ms	< 250ms	< 450ms	<Not Specified
TIPHON-05006	< 150ms	< 250ms	< 350ms	< 450ms
TIPHON-05009	< 100ms	< 100ms	< 150ms	< 250ms

TIPHON :Telecommunications and Internet Protocol Harmonization Over Networks

95 % Values

IP QoS & Performance Studies in IETF

Subject	IETF WGs
Measurement	
IP Packet Transfer Performance	IP Performance Metrics WG(ippm)
AP Flow Performance	Real-time Traffic Flow Measurement WG (rtfm)
NW Elements Benchmarking	Benchmarking Methodology WG (bmwg)
Operation & Management	
Monitoring	SNMP Version 3 WG (snmpv3) xxx MIB WG xxx = Ethernet, Physical Topology,rmon
Management	Distributed Management WG (disman) Policy Framework WG (policy) Internet Traffic Engineering WG (tewg)
QoS Control	Integrated Services WG (intserv) Differentiated Services WG (diffserv) Multiprotocol Label Switching WG (mpls)

Other Organizations (1)

The ATM Forum

IP over ATM & Traffic Management

- FAST (Framed ATM over SONET/SDH transport)
- Mapping Diffserv into ATM Service Class
- GFR(Guaranteed frame rate)

T1 Committee

- T1A1.2 Network Survivability performance
- T1A1.3 Performance of Digital Networks and Services

  T1A1-14 Active Specification and Allocation of Internet Service Performance
- T1A1.5 Multimedia Communications Coding and Performance
- T1A1.7 Signal Processing and Network Performance for Voiceband Services

Other Organizations (2)

IOPS.ORG (INTERNET OPERATORS GROUP)

Objective: IP Operations & Performances

fire drills and smurf

NIMI (National Internet Measurement Infrastructure)

Project in NSF (National Science Foundation)

Objective: IP Quality Metrics and Measurement

VoIP-QoS-Forum

Objective: VoIP QoS Management

QoS Forum

Objective: QoS Control

Issues in Next Generation Networks/Services

- Maintaining or even Improving Telecom QoS levels
- More QoS Guarantee other than the Best Effort
- More Secure
- More Reliable:
  Servers/Routers' recoveries take longer time.
- More Mobile
- Charging/Accounting Capabilities
- Next Generation Networks penetration?
  Applications Driven or Network Driven?
  What is(are) the killer application(s)?
  Interoperability with legacy telecom applications

Challenges

- Killer Technology
- Killer Applications:
  Telephone & Internet, what else?
- Standards
- Implementation
- Collaborations among Service Venders, Equipment Venders & Users
- Users' Demands & Support
- Quality and Reliability is "MUST" even for Best Effort Services.

Thank you!
Merci!
感謝!