

BcN Control and Management

2005. 11. 24

최태상
BcN Research Division
ETRI

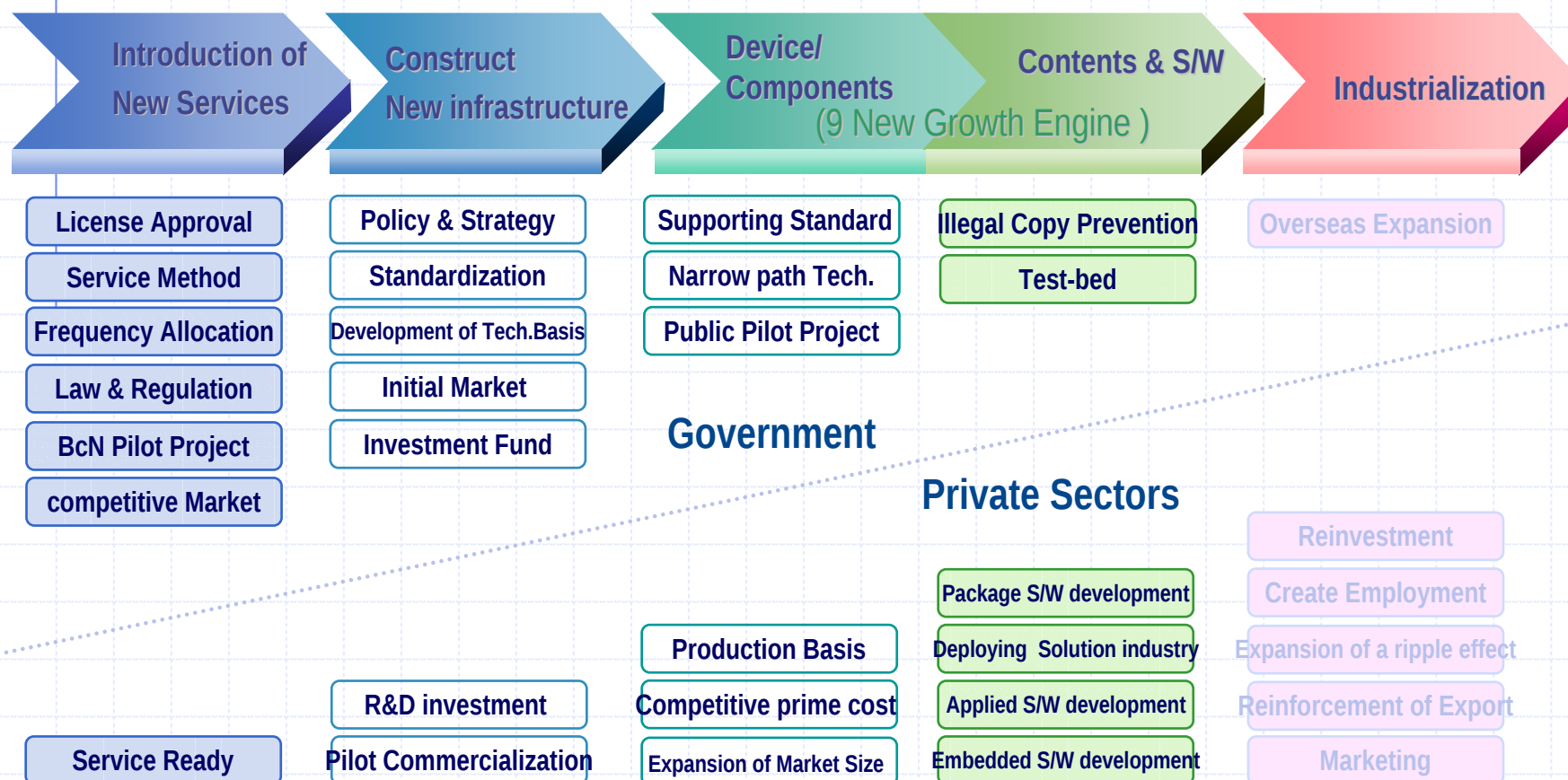
Topics

- BcN Overview – Government View
- NGN – Other World's BcN
- Rationale for a New Network Architecture toward BcN
- ETRI's BcN Vision: A New Network Architecture
- NCP: Control and Management Platform for BcN

BcN Overview – Government View

Value Chain in IT Industry

Value Chain & Role of Government•Private Sectors



IT839 Strategy

Triggering positive feedback mechanism in the value chain

8 New Services

WiBro
(2.3GHz Portable Internet)
DMB
Home Network
Telematics
RFID-based Service
W-CDMA
Terrestrial DTV
IP Telephony (VoIP)

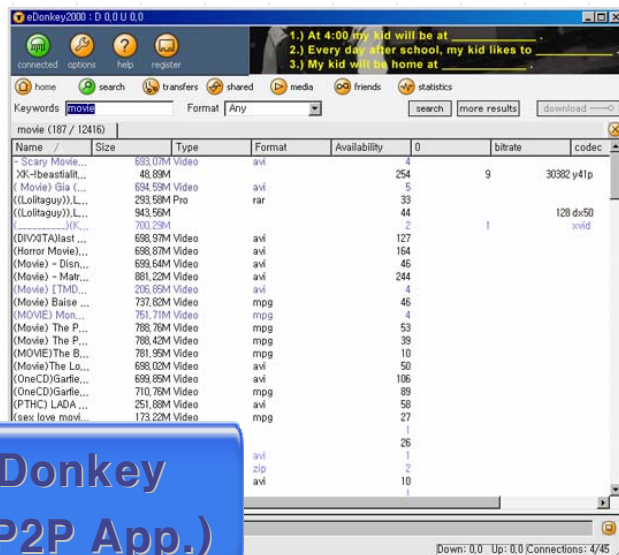
3 Infrastructures

Broadband Convergence
Network (BcN)
U-Sensor Network
(USN)
IPv6

9 Growth Engines

NG Mobile Comm.
Digital TV
Home Network
IT SoC
NG PC
Embedded SW
Digital Contents
& SW Solutions
Telematics
Intelligent Service Robot

But the traffic is still growing fast !



**eDonkey
(P2P App.)**

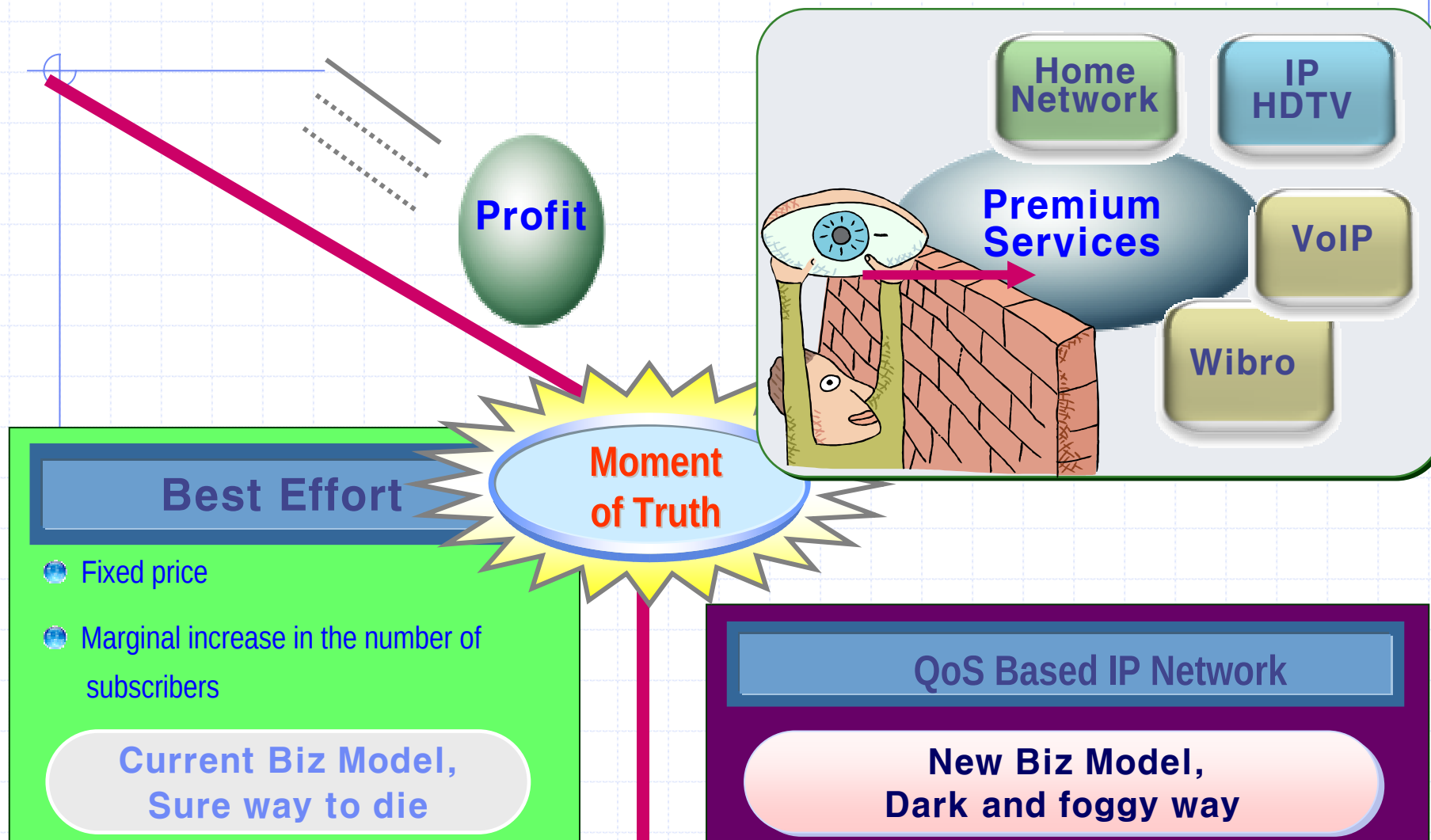


**Cyworld
(Mini Homepage)**



**Online
Games**

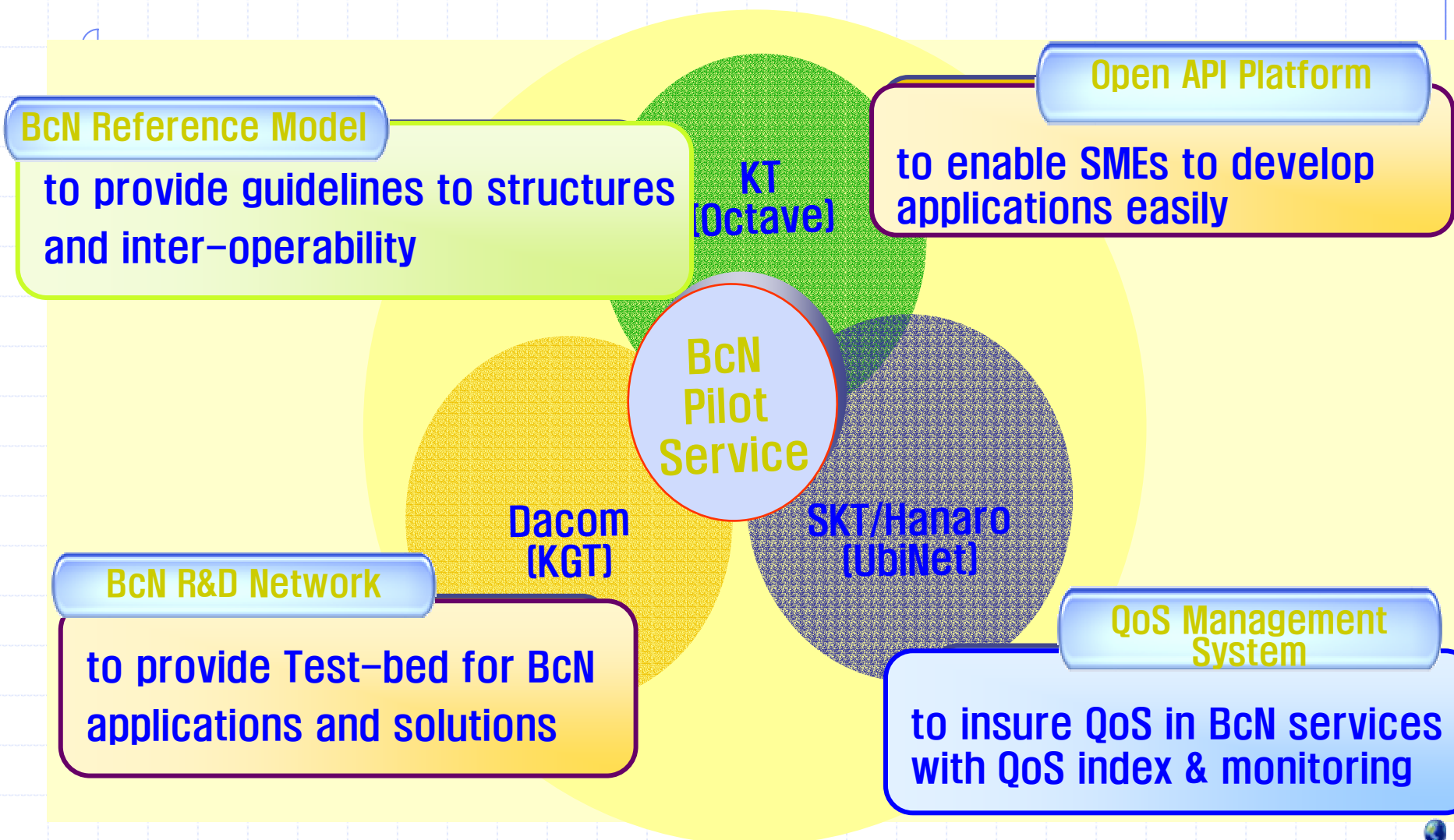
Moment of Truth : stagnate or face the challenge



BcN: the way to face challenge

**It is really a Moment of Truth,
but the decision is very clear.
Face the challenge,
and BcN is the way to do it.**

Summary of BcN Deployment Strategies



BcN Pilot Service Project – 3 consortia

KT Group

KT, KTF

Samsung Elec., Corecess,
Core Communications,
iCrossTech,
CNS, Wooksung, Herit, Uangel

KBS, MBC, SBS, EBS
Direct media, Singy,
Carrot Korea, SON Korea

KTI



SKT/Hanaro Group

SKT, Hanaro

Samsung Elec., Herit, Xener,
Telcaware, Mirinet, Wooksung,
Samwoo, Uangel
Hulim interactive, SK C&C,
Secure soft, Entels, IDC Tech.

SBS, SK communications, MBN,
Skylife, Choongchung Broacasting

Daehan cable, SK construction

Dacom Group

Dacom, LGT, Powercom

Wooksung, Acromate,
LG CNS, CD Networks,
Alticast, Uangel

MBC, BSI, Dreamcity
Daum Communications, Inotive

KIST





What makes BcN based e-Learning a killer application ?

- tens of billions \$USD in private education : big potential market
- QoS Management : Ensuring high quality in streaming services
- Channel Selection point in BcN could be at Curbs, not at STBs
Overcome the physical limitation of access lines
- Time shifting (Uni-casting based)

Example

- **Highly customized e-learning programs**
 - High quality, HD
 - divided into 10 lecturers with different style
 - divided into 10 levels by difficulties
 - divided into 10 programs by progress
 - Time-Shifting → any time, pause & repeat
 - Interactive → pose questions and answered in real time

This is just one example.

Many more to be developed during BcN pilot projects

Vision & Goals of BcN

Vision

To provide seamless, broadband, integrated multimedia services anytime, anywhere by the year 2010

Goals

To reach 20 million BcN subscribers by 2010 in Korea



Conclusion

BcN is not something to come in the future.

It is a reality we are facing now in Korea.

NGN – Other World's BcN

ITU-T Key NGN QoS 표준 분야

- Performance objectives and classes: SG12, 16
 - Application performance
 - Network performance: Y.1540, Y.1541(IP)/Y.1561(MPLS)/I.356(ATM)
- Dynamic QoS controls: SG11, 13, FGNGN
 - Signaling of performance requirements
 - Dynamic activation of QoS controls
 - Inter-provider QoS
 - Interworking of QoS mechanisms
 - Framework and guidelines
- Performance measurement and monitoring: SG4, 13, FGNGN
 - M.2301, M.3341
- Performance assessment: SG12
- Other key SDOs involved in NGN QoS standardization include: 3GPP, 3GPP2, ATIS, IETF, ETSI TISPAN, MFA

A major goal is to define a standard toolkit for providing session QoS end to end independent of access technology

ITU-T NGN QoS 표준 현황



■ FGNGN의 Framework & Architecture 관련 현재 진행 분야

- TR-FRA: 2005년 11월 완료 목표 (o)
 - NGN Framework, 전체구조, 및 주요 기능 명세 표준

■ FGNGN의 QoS 관련 현재 진행 중인 분야

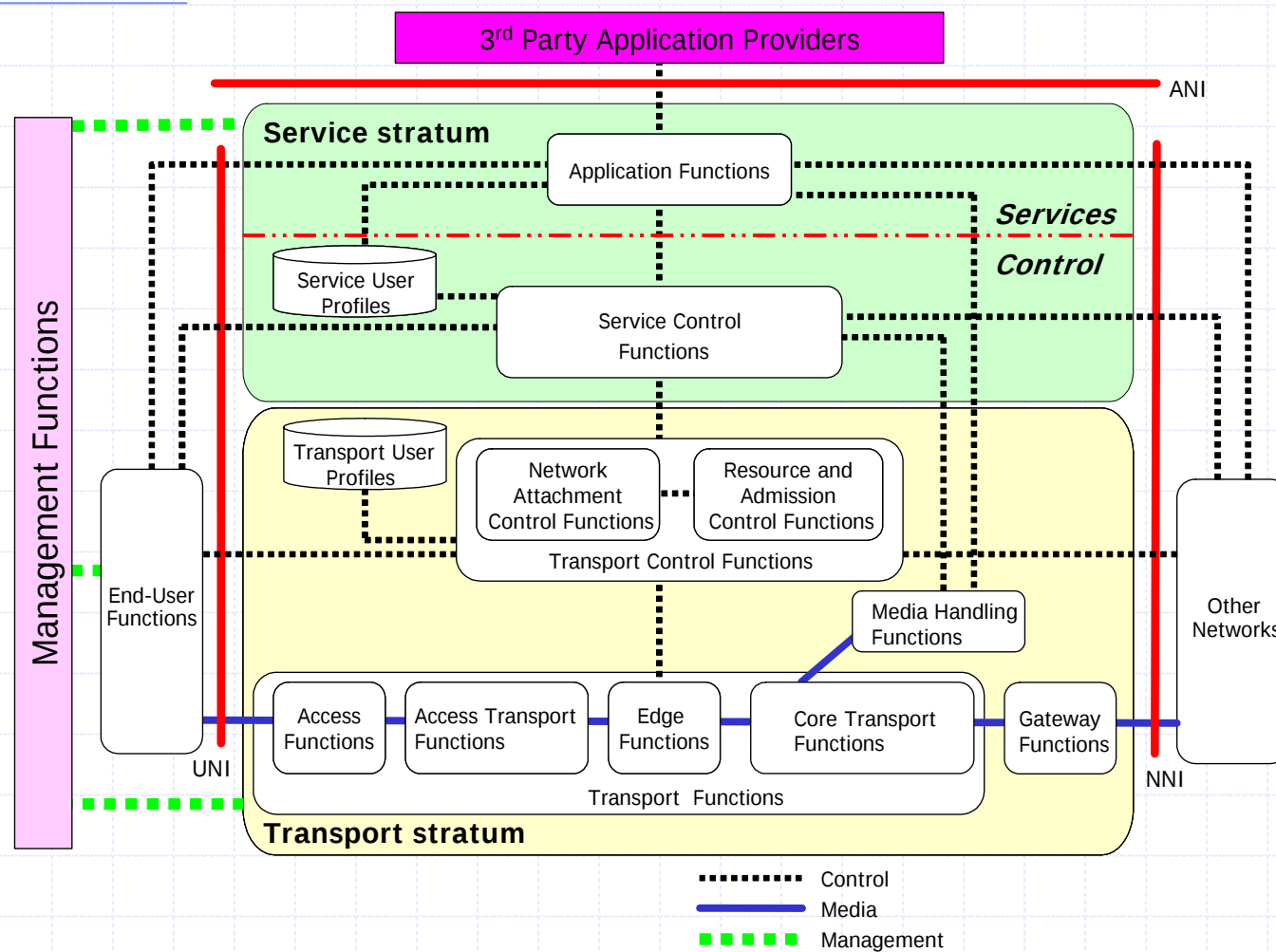
- TR-RACF: 2005년 11월 완료 목표 (△)
 - NGN 자원 및 수락 제어 표준
- TR-ngn.qos: 2005년 9월 완료 목표 (o)
 - NGN 종단간 서비스 품질 개요 표준
- TR-ngn.NHNperf: 2005년 9월 완료 목표 (o)
 - FR, ATM, IP 기술간 품질 등급 매핑 표준
- TR-PMM: 2005년 11월 완료 목표 (△)
 - NGN 성능/품질 측정 표준
- TR-apo: 2005년 11월 완료 목표(△)
 - 이종 사업자 종단간 성능 측정을 위한 알고리즘 표준
- TR-enet: 2005년 11월 완료 목표 (△)
 - NGN 백본망의 이더넷 활용 표준
- TR-e2e-qos: 2005년 11월 완료 목표 (x)
 - NGN 종단간 QoS 제어 및 관리 표준

■ ITU-T SG13 관련 현재 진행 분야

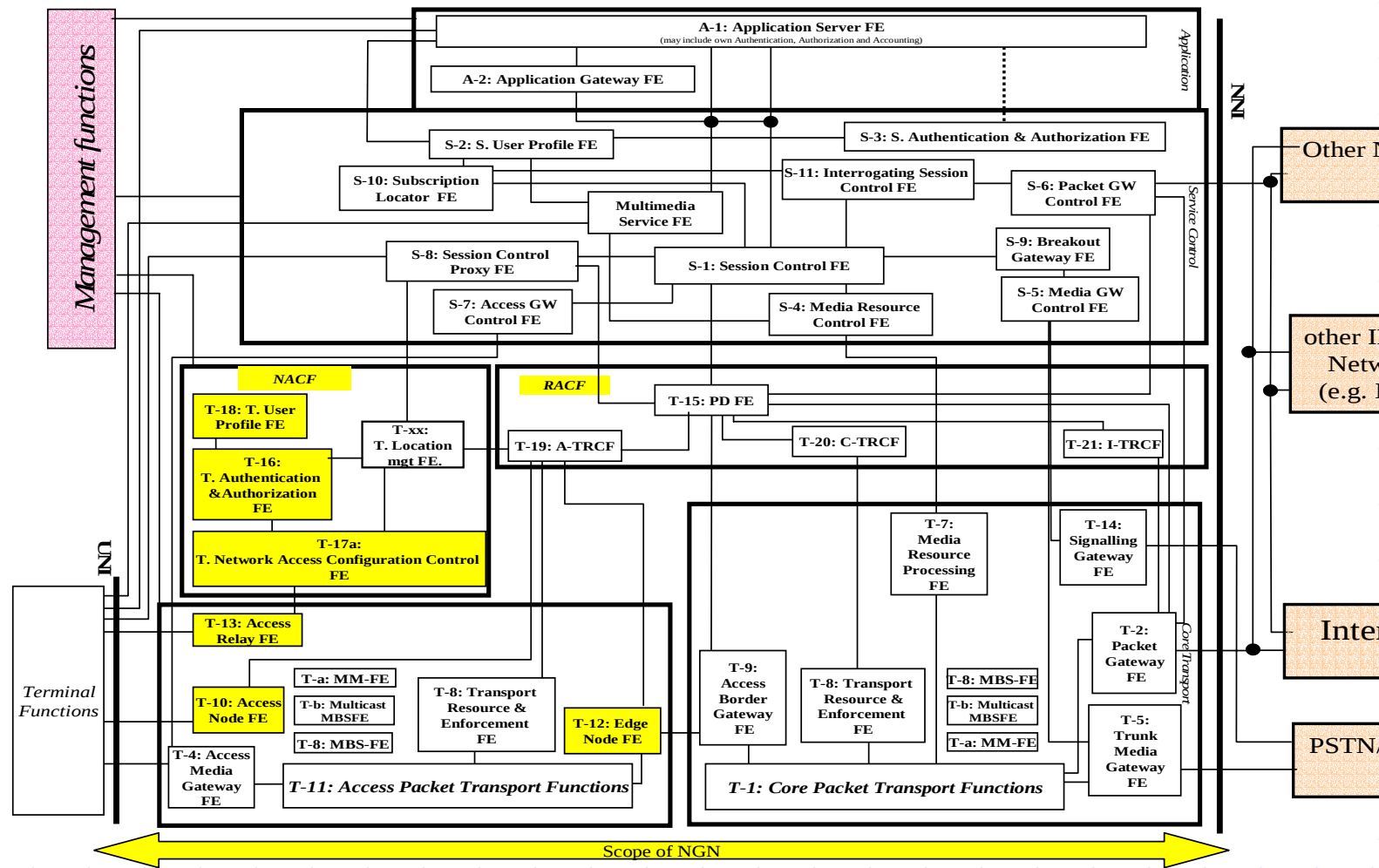
- Y.ngn-account: 2006년 9월로 완료 목표 (△)
 - NGN 과금 표준
- Y.17ethoam
 - NGN 이더넷 OAM 표준

(NOTE: 완성도: o - 높음, △ - 중간, x - 낮음)

NGN Architecture Overview



NGN Generalized Functional Architecture



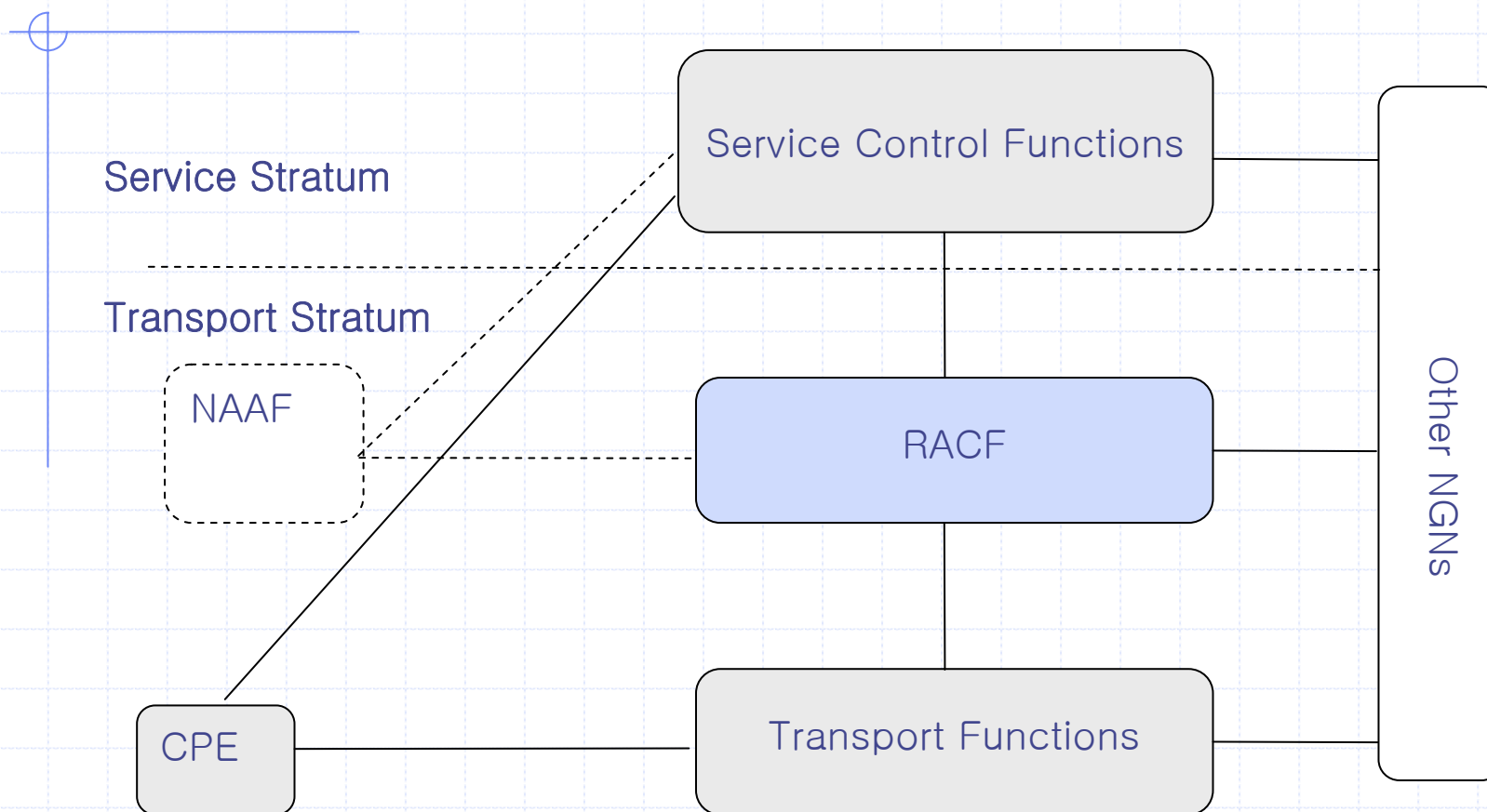
RACF Functionality: TR.racf

QoS control

- resource reservation
- admission control
 - ▶ checking authorisation based on user profiles, SLAs, operator specific policy rules, and resource availability within access and core transport
- gate control

NAPT and/or FW traversal control Functions over access and core transport networks

RACF Position in NGN



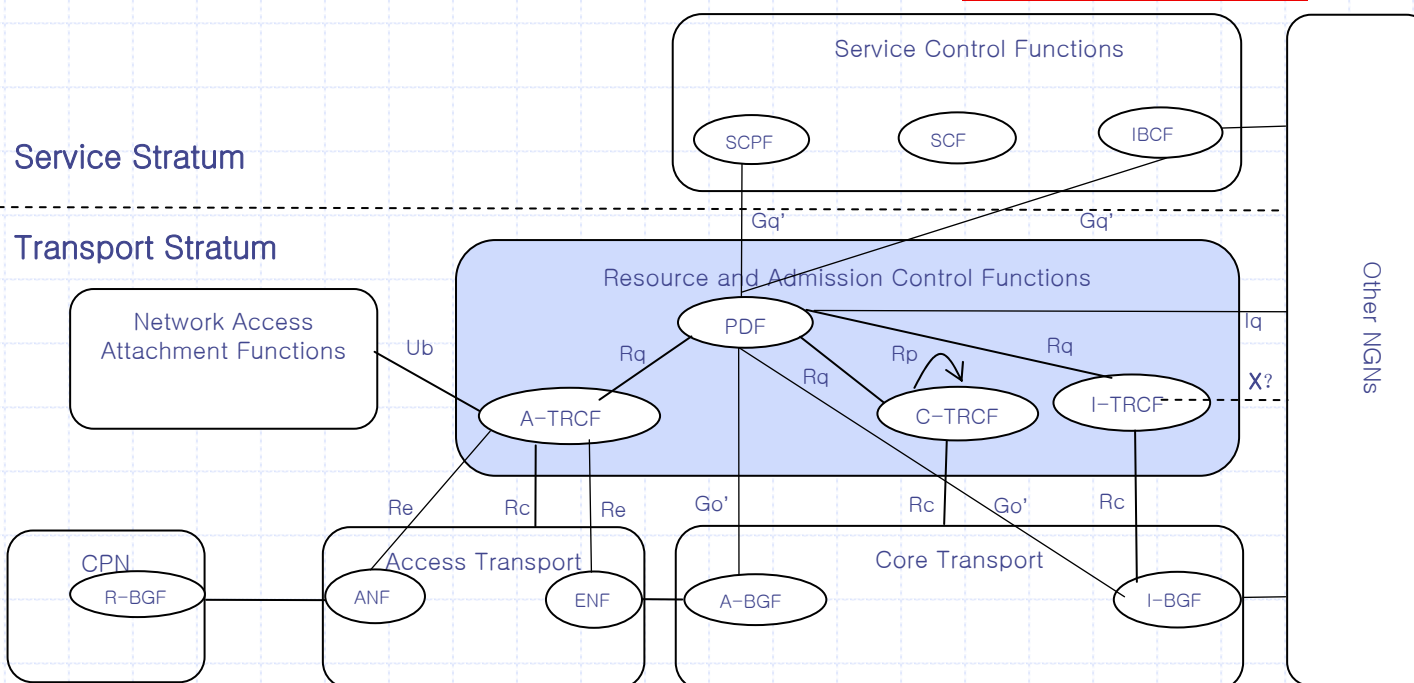
NAAF: Network Access Attachment Functions

RACF Architecture

(Cf. FGNGN-OD-00165, May. '05)

Work in progress

AT&T
KT
FT
NTT
Cisco
Lucent
Huawei
Nortel
ZTE



ANF — Access Node Function

ENF — Edge Node Function

A-BGF — Access Border Gateway Function

I-BGF — Interconnection Border Gateway Function

R-BGF — Residential Border Gateway Function

IBCF — Interconnection Border Control Function

PDF — Policy Decision Function

SCF — Service Control Function

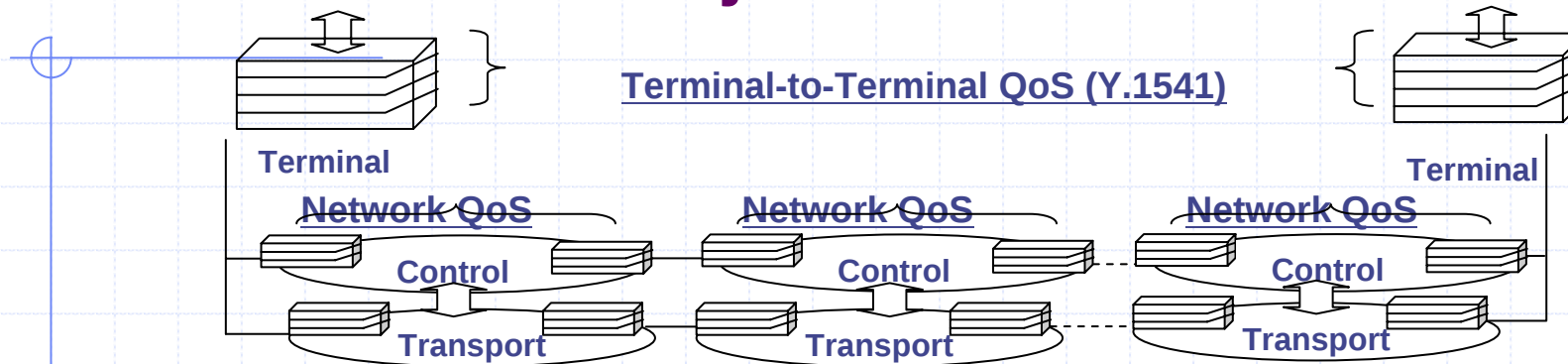
SCPF — Service Control Proxy Function

A-TRCF — Access Transport Resource Control Function

C-TRCF — Core Transport Resource Control Function

I-TRCF — Interconnection TRCF

IP QoS Classes and Network Performance Objectives: Y.1541

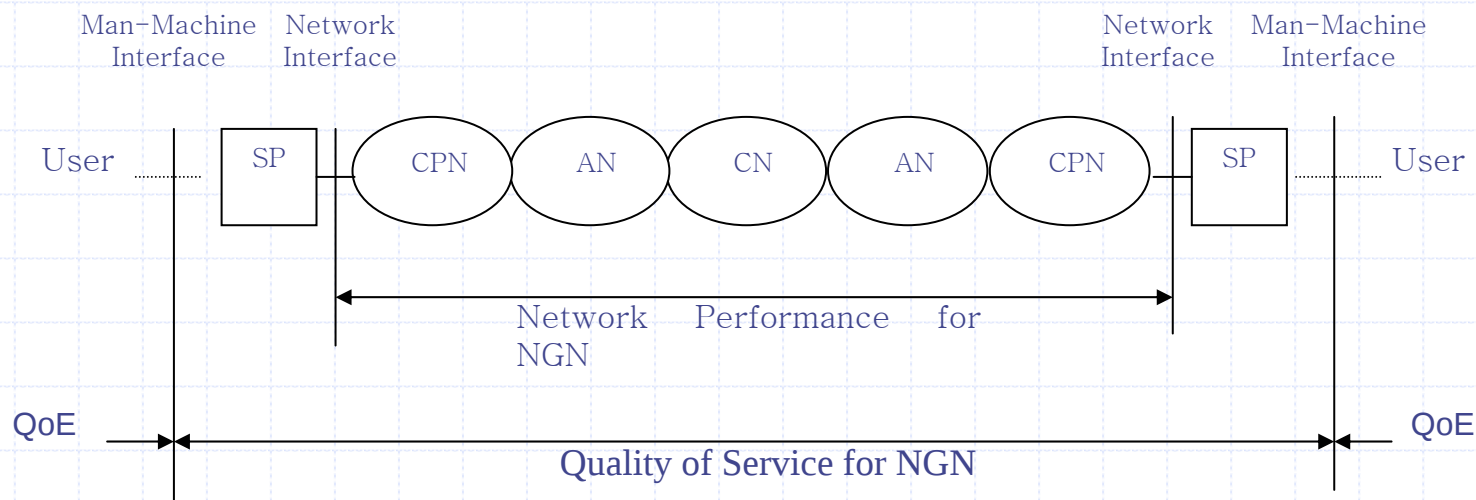


Network performance parameter	<u>IPTD</u>	<u>IPDV</u>	<u>IPLR</u>	<u>IPER</u>
<u>QoS Class 0</u>	<u>100 ms</u>	<u>50 ms</u>	<u>1×10^{-3}</u>	<u>1×10^{-4}</u>
<u>QoS Class 1</u>	<u>400 ms</u>	<u>50 ms</u>	<u>1×10^{-3}</u>	
<u>QoS Class 2</u>	<u>100 ms</u>	<u>U*</u>	<u>1×10^{-3}</u>	
<u>QoS Class 3</u>	<u>400 ms</u>	<u>U*</u>	<u>1×10^{-3}</u>	
<u>QoS Class 4</u>	<u>1 s</u>	<u>U*</u>	<u>1×10^{-3}</u>	
<u>QoS Class 5 (Unspecified)</u>	<u>U*</u>	<u>U*</u>	<u>U*</u>	<u>U*</u>
<u>QoS Class 6</u>	<u>100 ms</u>	<u>U*</u>	<u>1×10^{-5}</u>	<u>1×10^{-6}</u>
<u>QoS Class 7</u>	<u>400 ms</u>	<u>U*</u>	<u>1×10^{-5}</u>	<u>1×10^{-6}</u>

- Encompass key IP application categories
- Are relatable to practical IP network QoS mechanisms
- Can be achieved in realistic network implementations
- Are verifiable at network boundaries
- Are readily applicable to NGN
- Are being enhanced in ITU-T SG 12

Description of QoS, NP & QoE: TR.ngn.qos

- provide descriptions of NGN Quality of Service, Network Performance and Quality of Experience;
- illustrate how the QoS, NP & QOE concepts are applied in NGN environment;
- describe performance aspects of the NGN including performance of service and transport stratum;
- provide a basis for common understanding of performance concepts useful to users and to the industries that compose the NGN (e.g., Fixed & mobile telecommunications, broadcasting, etc.).
- define the application QoS classes of the NGN



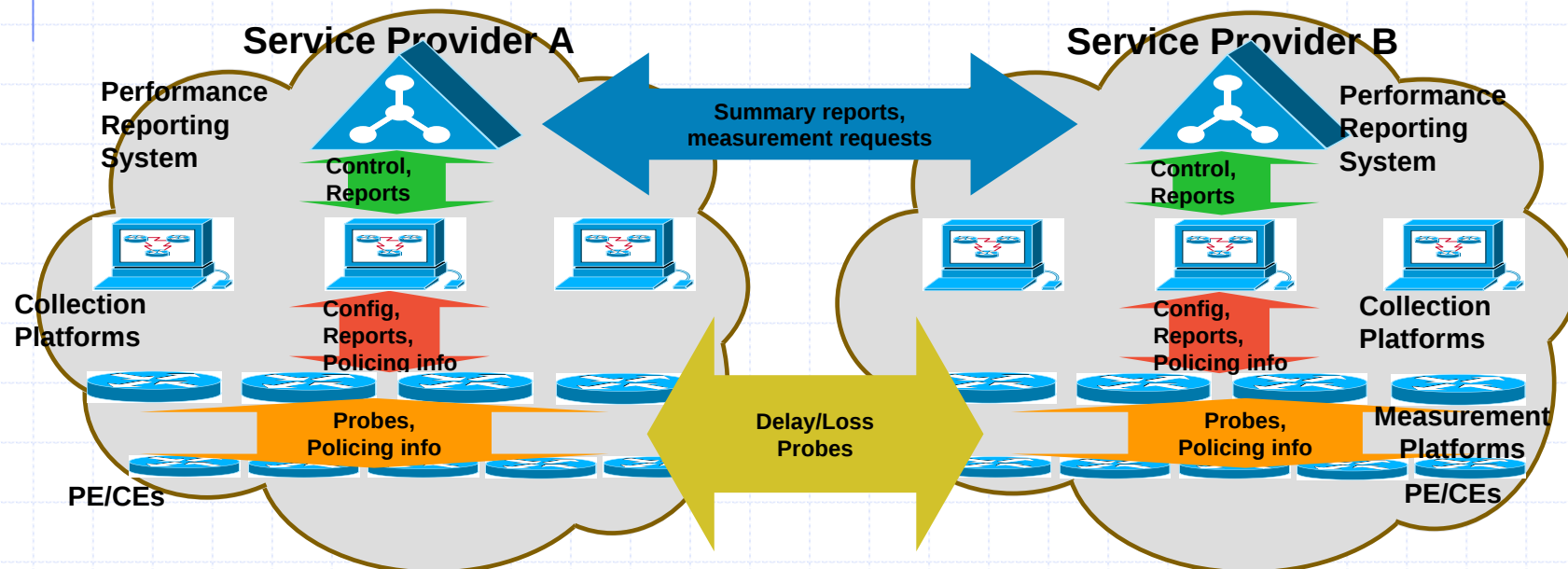
Mapping among IP, ATM and Frame Relay QoS classes: Y.ngn.NHNperf

IP QoS Class	ATM QoS Class	FR QoS Class
0		
1		
2		
3		
4		
5	4	0
6	1	3
7	1	2

Performance Measurements and Management for NGN: TR-pmm

- Unspecified options, parameters
- Concatenation of performance over multiple network segments
- Accuracy
- Data Handling
- Define attributes to be measured
 - Mean delay, delay variation, packet loss, unavailability

- Specify how attributes are measured
 - Proposed default rollup period 1 hour
 - Active probes tailored to service classes (telephony, multimedia streaming, low latency data)
 - Default probe transmission period 1 sec.
 - Clock synchronization to Coordinated Universal Time through GPS
 - Algorithms for computing performance
- Specify the inter-PRS interface



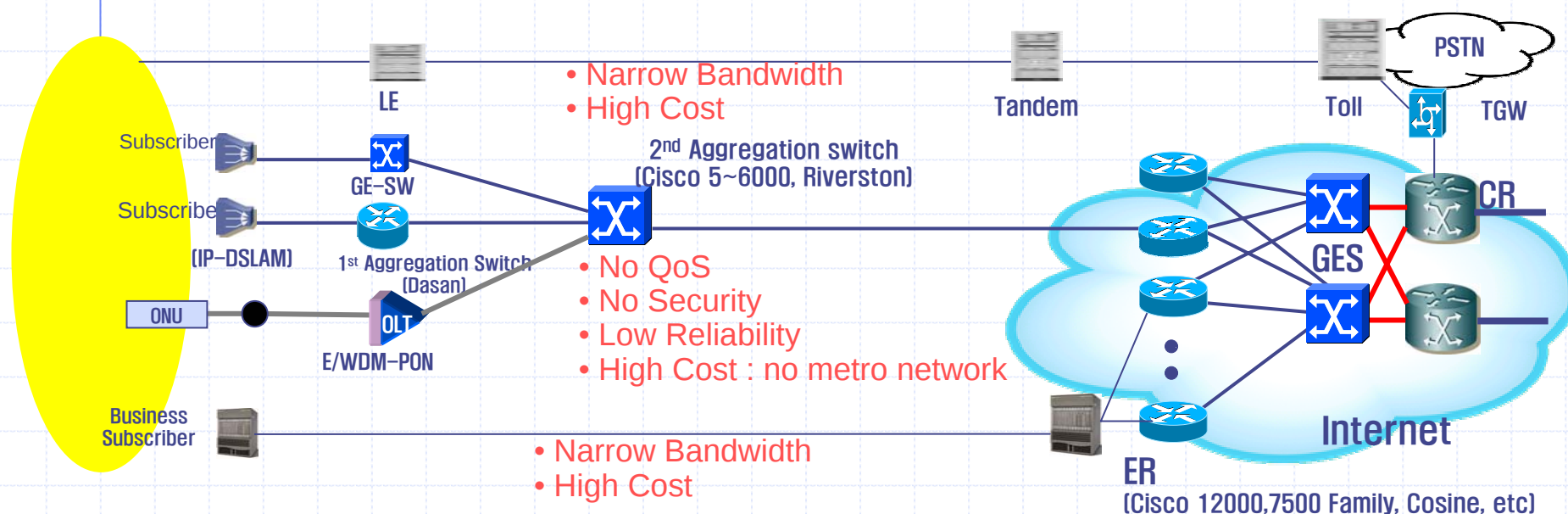
NGN Accounting, Charging, & Billing: Y.ngn.account

- Work in progress since Dec. 2004
- Service and functional requirements
- Generic and functional architectures for accounting, charging, and billing
- Accounting and metering capabilities of various levels of information
 - Duration only
 - Volume only
 - Flow-aware volume
 - Contents level
- Service specific charging data info model vs service independent generic model
 - Charging data info model for customer
 - Charging data info model for inter-SP settlement
- Charging data export functional capabilities and protocol
- Inter-SP settlement functional capabilities and protocol
- Applicability scenarios of these capabilities
- Management and security of accounting, charging and billing elements

Rationale for a New Network Architecture toward BcN

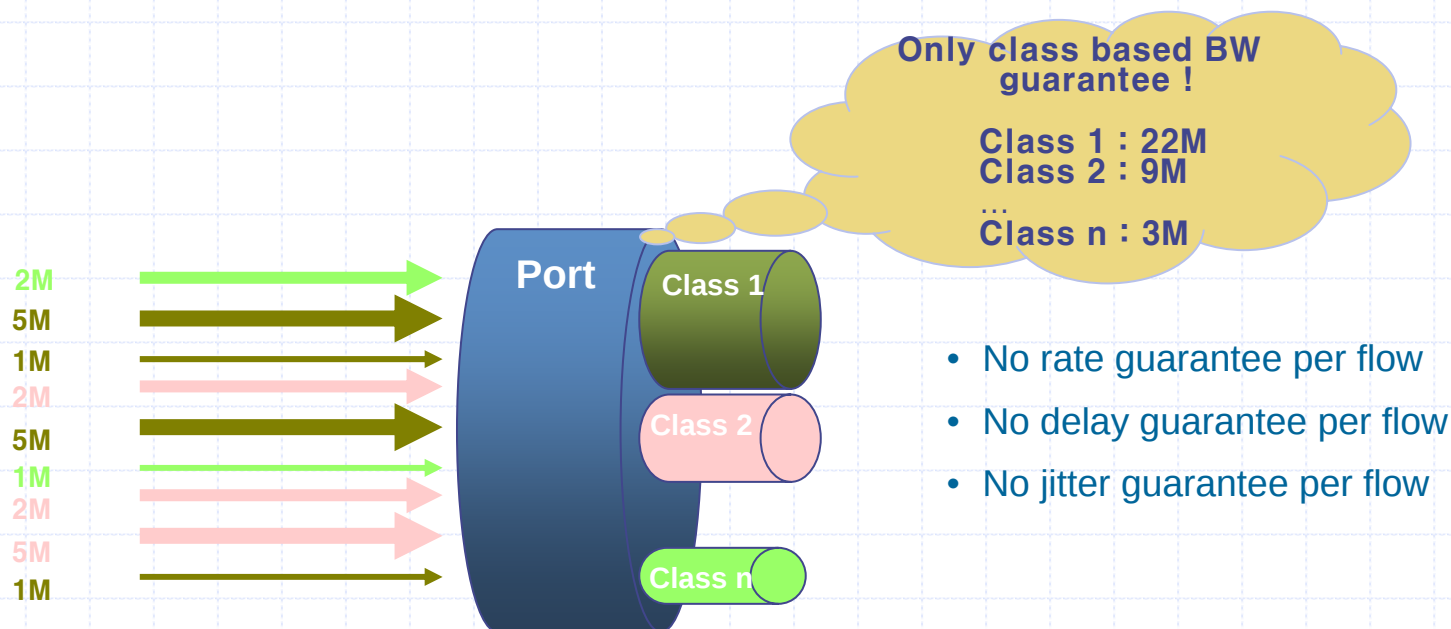
Problems in Current Networks

- No QoS Guarantee – Only CoS
- No Security Guarantee – MAC Spoofing, IP Spoofing
- No SLA Guarantee – No Performance Monitoring
- No IP Billing – No Real Packet Statistics
- Low Reliability – No UNI OAM, Protection/Restoration
- High Cost



Tech. Analysis (1) - QoS

- No Admission control
- No QoS Guaranteeing Traffic Control
 - CoS : Low Latency Queueing + Class-based WRR



Tech. Analysis (2) – SLA, IP Billing

Not Supported Real QoS Info

- No Performance monitoring
- No real-time TE

► **Flow:** Def'n is flexible, but generally any unique combination of 5 tuples:

- Source Address
- Destination Address
- Source Port
- Destination Port
- Protocol

Netflow

Cisco CEF/Riverstone

► **State:** Managing and maintaining the following information for each flow:

- Switch Fabric Route
- Nexthop

Forwarding Info

- Class
- Rate
- Delay Variation
- Byte Count
- Flow Duration

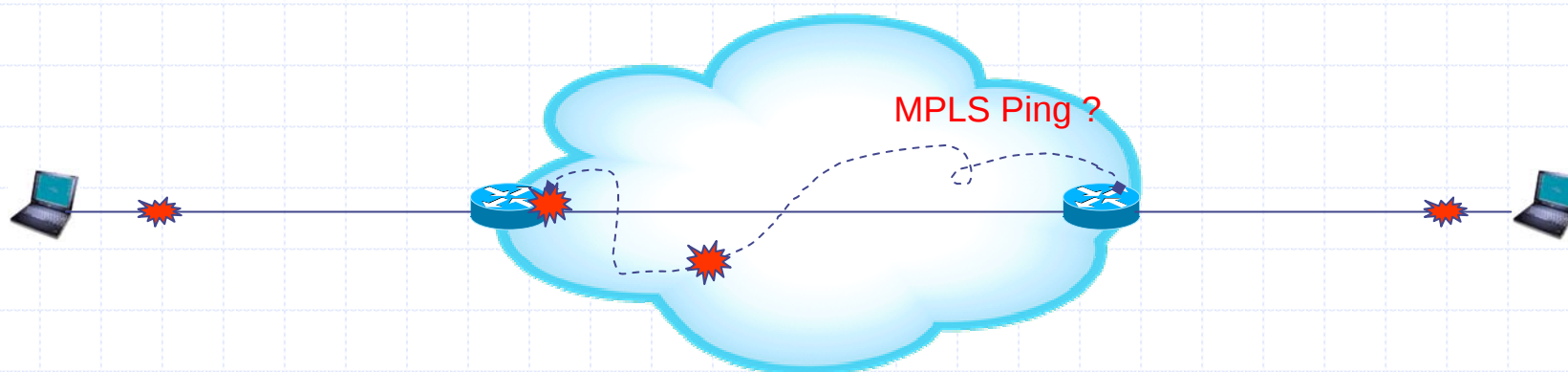
QoS Info

- Packets Received/Dropped, Bytes Received/Dropped, etc.

Statistics Info

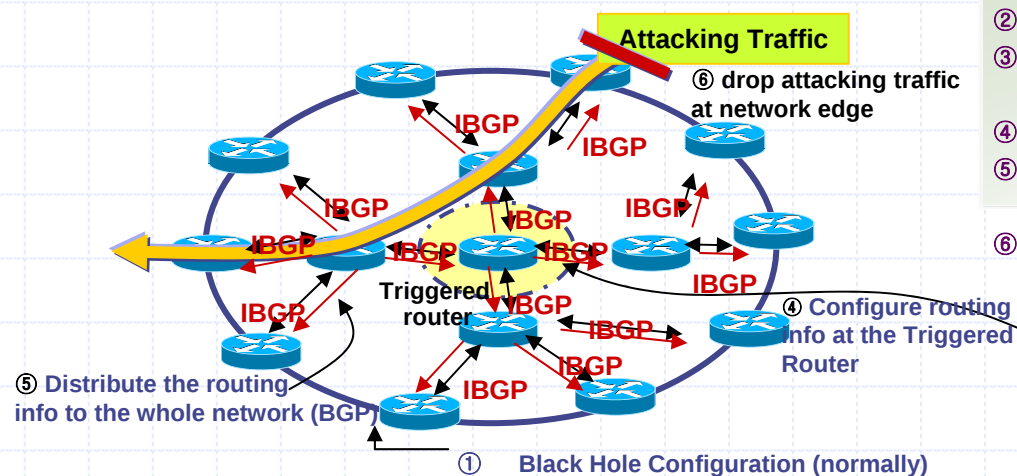
Tech. Analysis (3) - Reliability

- No UNI OAM
- No Secured Return Path for MPLS
 - No Guarantee for Restoration time
- No Scalability for MPLS TE
 - No scalability for CV



Tech. Analysis (4) - Security

- Only Protection for MAC Spoofing, IP snipping
- No Mechanism of Real-time Protection for Attack
 - Black hole, Sink Hole
 - ▶ No mechanism of Real-time detection
 - ▶ Slow action using Routing protocol
 - ▶ More complex of Routing protocol
 - ▶ No QoS guarantee for Normal Traffic



- ① Normally configure Black Hole mode
- ② Detect attacking traffic
- ③ Analyse IP Source / Destination address of attacking traffic
- ④ Configure routing info at the Triggered Router
- ⑤ Distribute the routing info to the whole network (BGP)
- ⑥ Drop the attacking traffic at the network edge



Operator

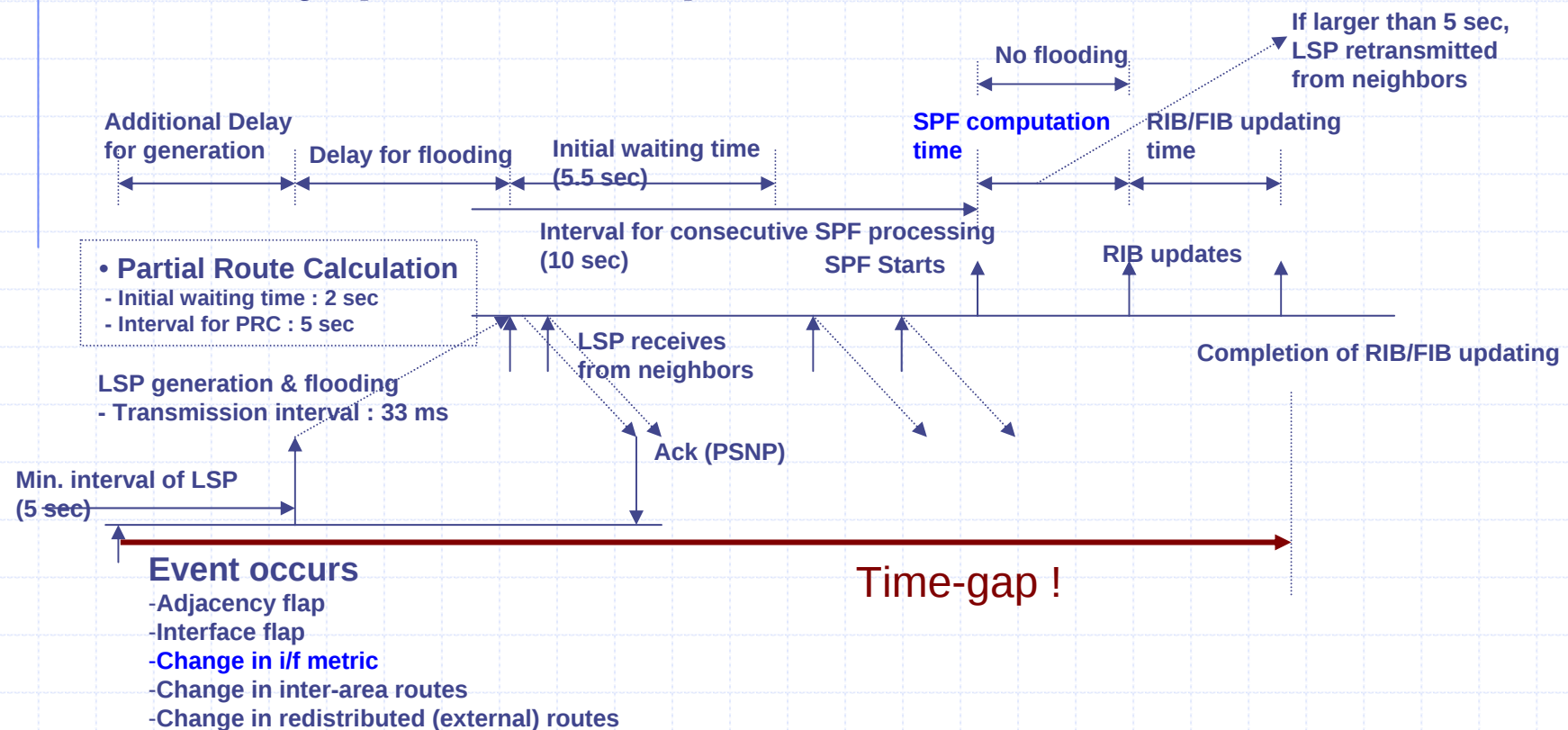
- ②, ③ Detect attacking traffic and analyse IP Source / Destination address of attacking traffic

Net flow
3rd party Analyser Tool
- TAPS
- Arbor Networks, etc

Tech. Analysis (5) - Controllability

No Guarantee for Real-time controllability

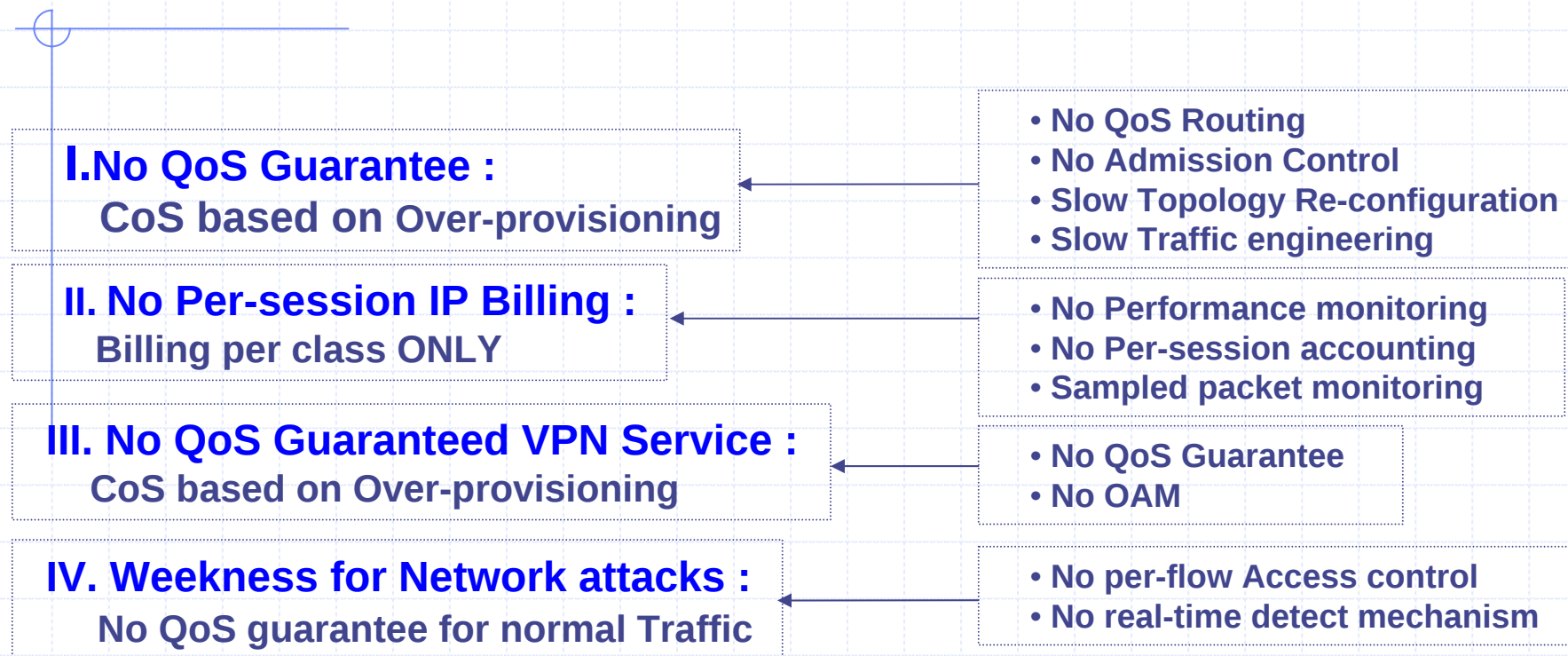
- Slow Network Convergence
- Routing loop, black hole routes, suboptimal routes



Tech. Analysis (5) - Instability

- Different Routing Table for each class -> No Scalability !
- Instability of routing architecture if the link cost depends on traffic
 - E.g.) Delay, available bandwidth, packet loss
- Simple Cut-through <- Diffserv over MPLS, DS-aware TE
 - No scalability of Protection/Restoration in IP/MPLS

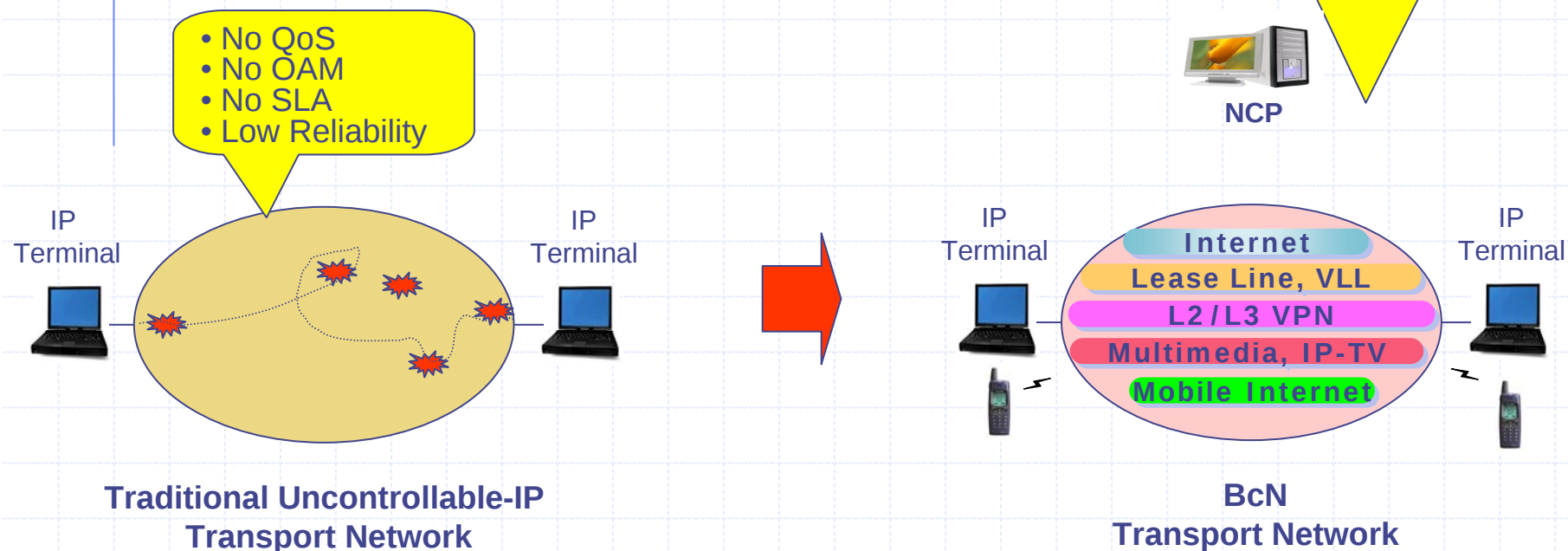
No New BM in IP Transport



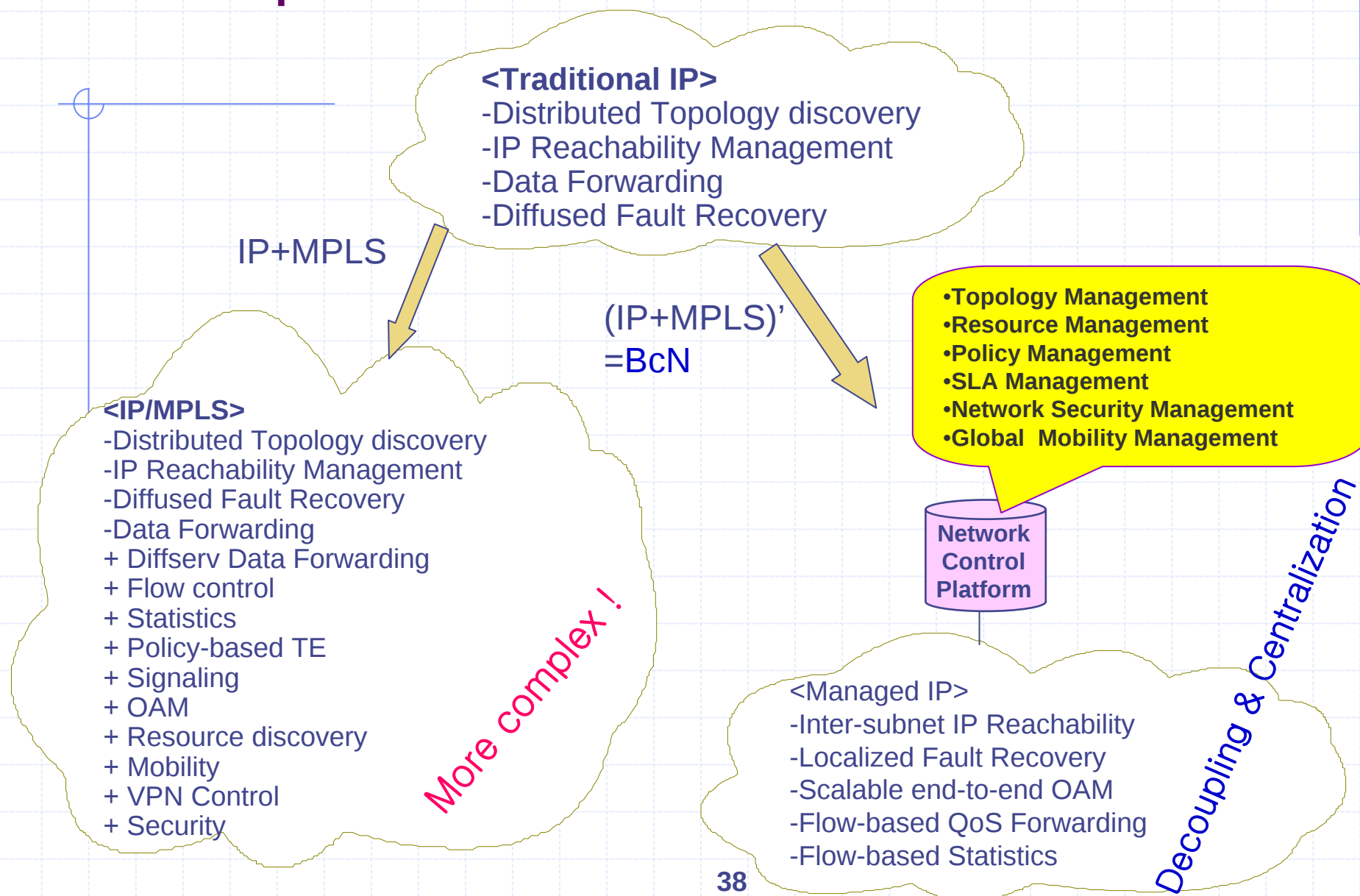
ETRI's BcN Vision: A New Network Architecture

Concept of New Architecture

- Paradigm Shift
- BcN = QoS-based Manageable NGN
= Profitable Ng-IP Transport Network

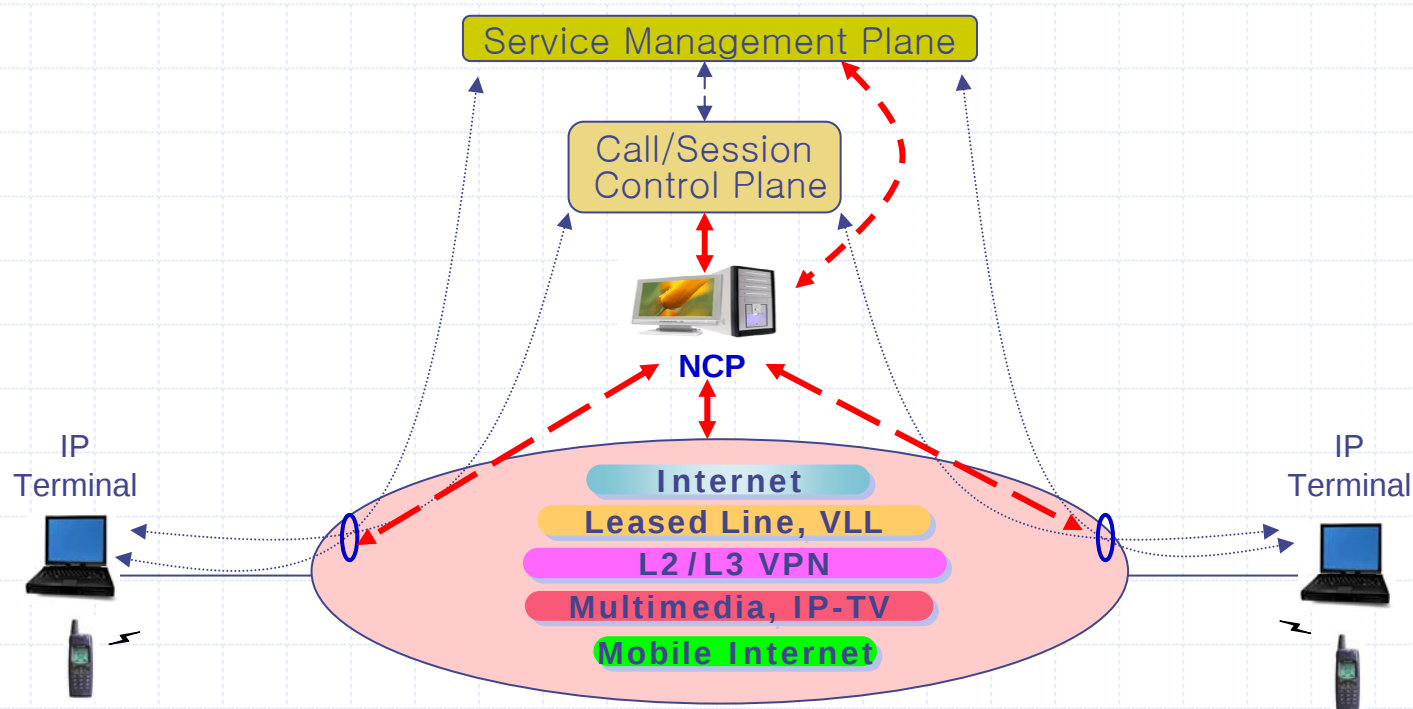


Concept of BcN



BcN Control Architecture

Layered Open Architecture



Multi-service Managed IP Transport Network

-
- The diagram illustrates a network architecture with the following components and interfaces:
- Components:**
 - SMS** (Service Management System)
 - Session Initiation System**
 - NCP** (Network Control Point)
 - CPE** (Customer Premises Equipment)
 - Edge (Service) Node** (Left)
 - Core Node**
 - Edge (Service) Node** (Right)
 - Other Access or Core Networks**
 - Interfaces:**
 - I/F-1** (Green solid line): CPE to Session Initiation System.
 - I/F-2** (Green solid line): Session Initiation System to NCP.
 - I/F-3** (Red dotted line): Edge (Service) Node (Left) to NCP.
 - I/F-4** (Blue dashed line): Core Node to NCP.
 - I/F-5** (Teal dashed line): NCP to Edge (Service) Node (Right).
 - I/F-6** (Black dotted line): Session Initiation System to Peer Call Agent.
 - I/F-7** (Purple dashed line): NCP to SMS.
 - I/F-8** (Red solid line): SMS to Session Initiation System.
 - I/F-9** (Yellow dashed line): SMS to Peer Carrier.

NCP: Control and Management Platform for BcN

Basic Philosophy



Introducing centralized control concept

- ❖ Hierarchical Structure for Scalability and Availability

I. Centralized Resource/Policy Management

- Managed QoS Routing
- Admission/Access Control
- Policy-based Provisioning

II. Integrated OAM

- Fast Topology Re-configuration
- Fast Fault Recovery
- Scalable Real-time PM

III. Real-time Monitoring

- Real-time Traffic Engineering
- Flow-based Network Emergency Control

IV. Per-session Accounting

- Usage based IP Billing

V. Centralized Multicast Control

- Nation-wide IP multicasting

+

Flow-based TE



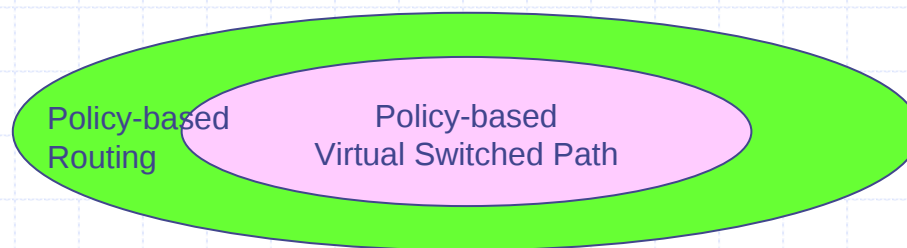
- End-to-end QoS/SLA
- QoS guaranteed VPN
- Network reliability
- Network Security
- IP Billing



Profitable NGN

Policy-based QoS Routing

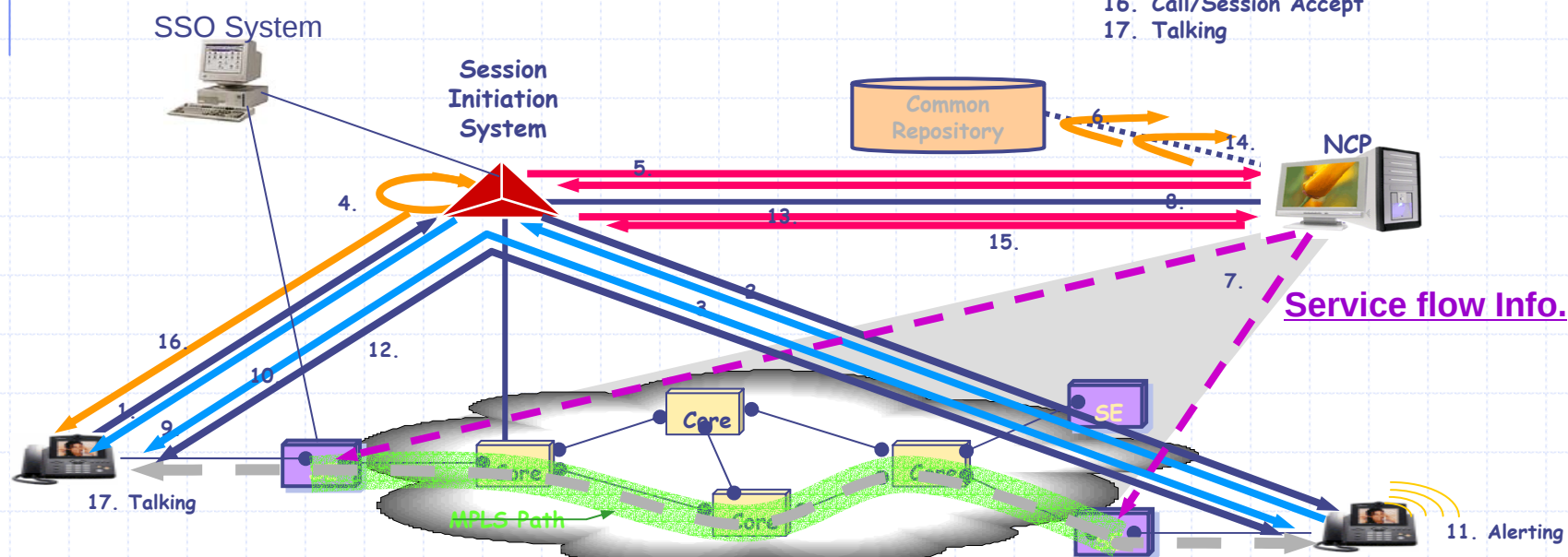
- QoS guaranteed Managed Routing
 - Policy routing + policy-based VSP + real-time TE
 - Based on
 - ▶ Centralized resource management
 - ▶ OAM-based fast topology re-configuration
 - ▶ OAM-based fast fault recovery
 - ▶ Real-time Path monitoring



Admission & Authentication-based Access Control

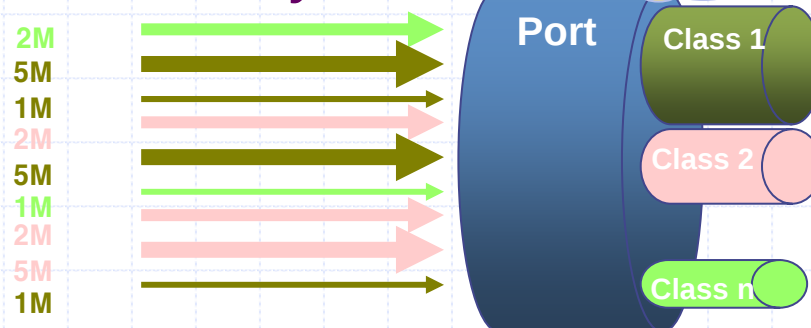
- Admission Control
 - both Control Plane and Data Plane
- Authentication-based Access Control

1. INVITE (w/ SDP)
2. INVITE (w/ SDP)
3. 183 Session Progress
4. Decide Resource Spec.
5. Resource Reservation Request
6. Search Path & Decide Resource Availability
7. Service Flow Information Delivery
8. Resource Reservation Accept
9. 183 Session Progress
10. PRACK/ 200 OK (PRACK) / UPDATE / 200 OK (UPDATE)
11. User Alerting
12. 180 Ringing
13. Resource Commit Request
14. Update Resource Information
15. Resource Commit Accept
16. Call/Session Accept
17. Talking



Flow-based Traffic Control

QoS based only on class

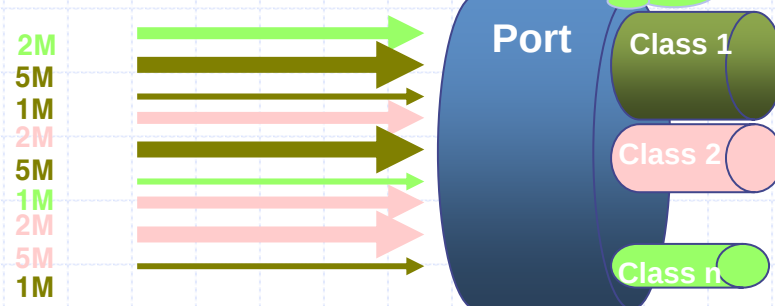


Only class based QoS !

Class 1 : 22M
Class 2 : 9M
...
Class n : 3M

- No rate guarantee per flow
- No delay guarantee per flow
- No jitter guarantee per flow

QoS based on flow and class



Class and flow based QoS !

Flow 1 : 1M
Flow 2 : 2M
...
Flow n : 5M

Class 1 : 22M
Class 2 : 9M
...
Class n : 3M

- Guaranteed rate per flow
- Guaranteed delay per flow
- Guaranteed jitter per flow

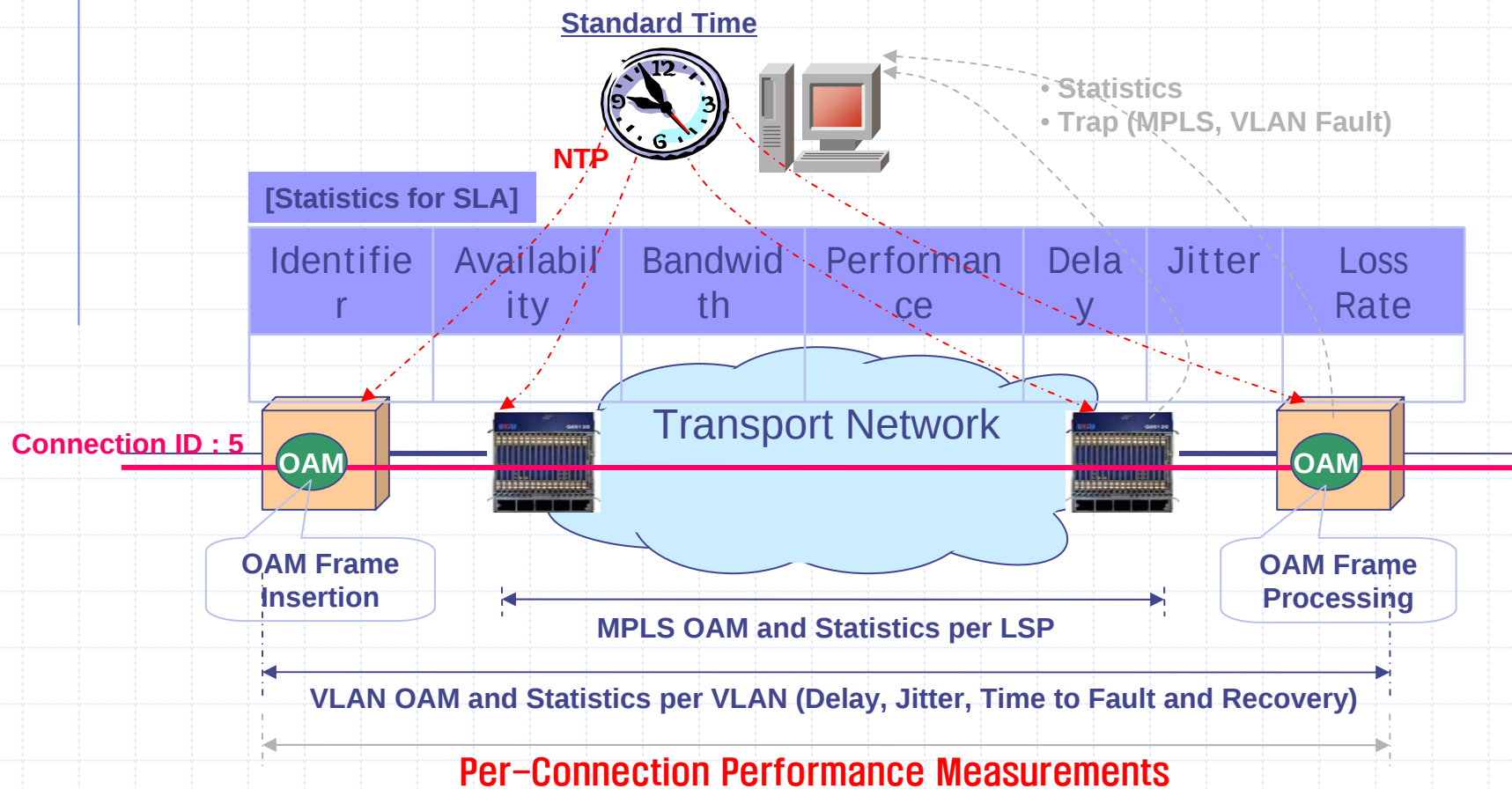
OAM-based MPLS : SMPLS

■ IP/MPLS vs. SMPLS

		IP/MPLS	SMPLS
TD/RD		Distributed	Centralized
QoS/SLA		CoS	Guaranteed QoS (w/ Statistical multiplexing)
CV		RSVP Refresh	OAM packet
Return path for OAM		IP Packet	Pre-determined return path
Path Protection time	LSP fail	3 x refresh + restoration	3 x (20 ms ~ 1 sec) + restoration
	Link fail	FRR (No return Path)	OAM-based FRR

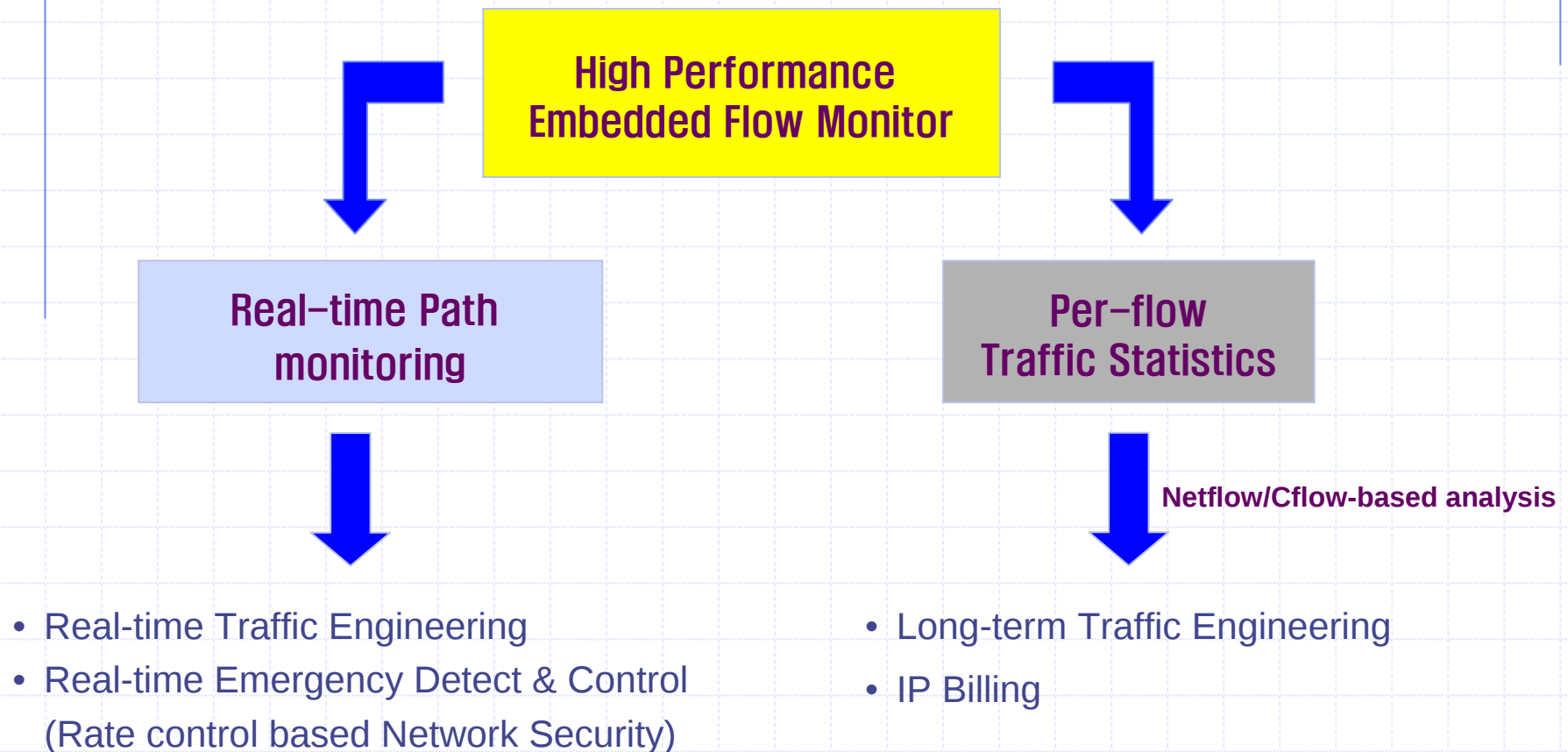
QoS Monitoring

SLA based QoS Guaranteed Service



Real-time TE & Flow-based Network Security

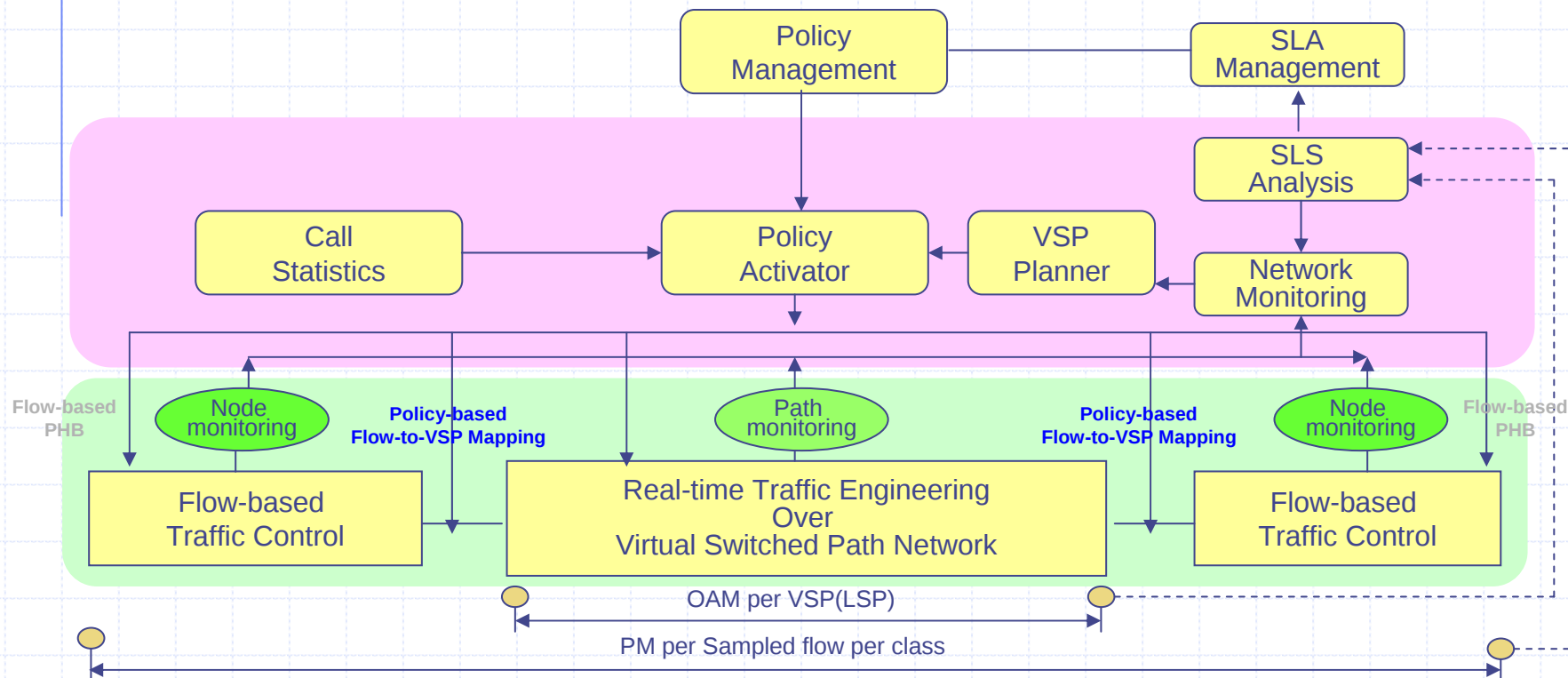
- Real-time per-flow monitoring



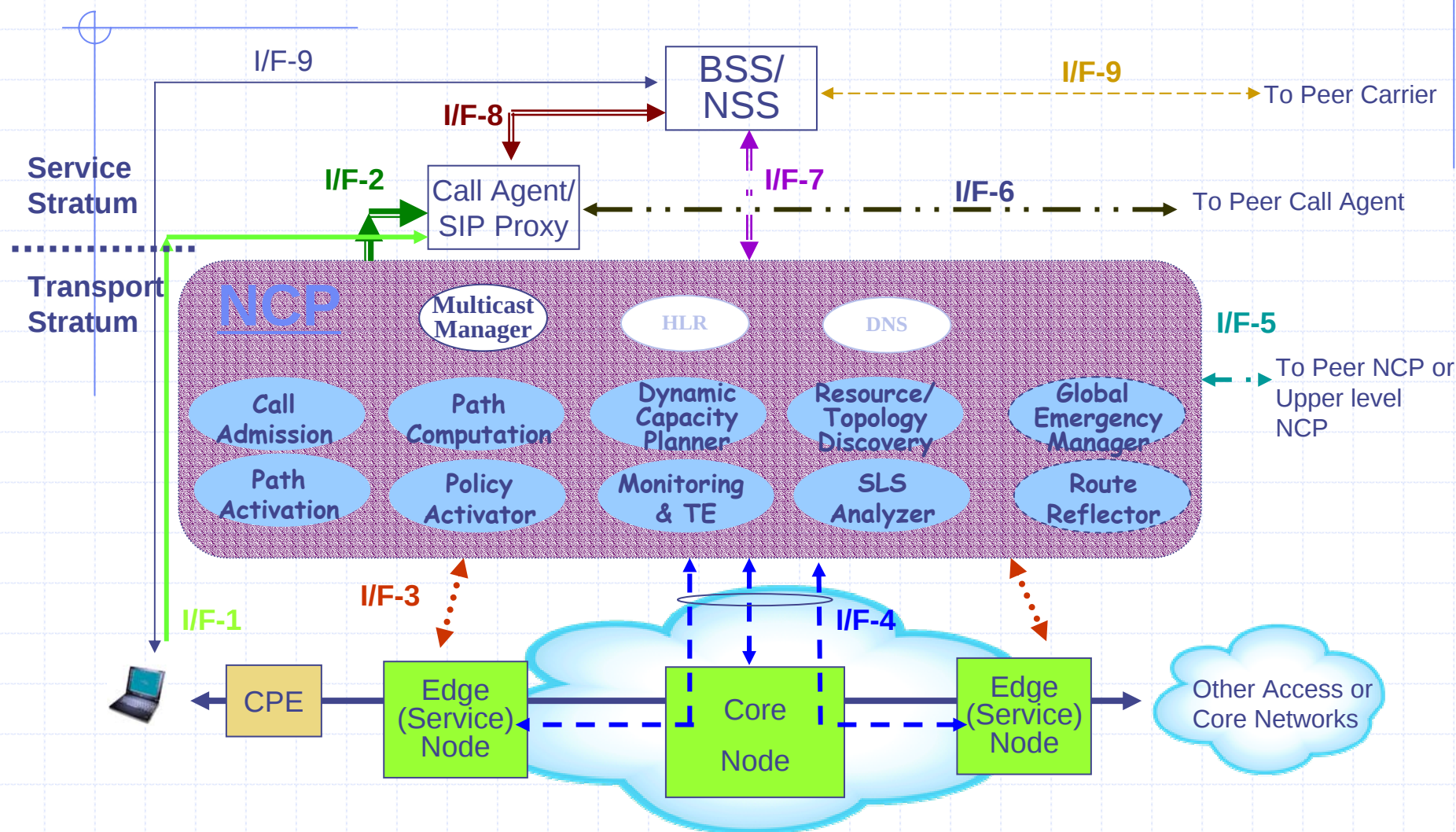
Flow-based TE (Policy-based Provisioning)

■ Flow-based QoS Guarantee

- Per-flow admission control
- Real-time TE

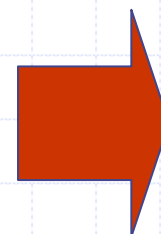


NCP's Functional Framework

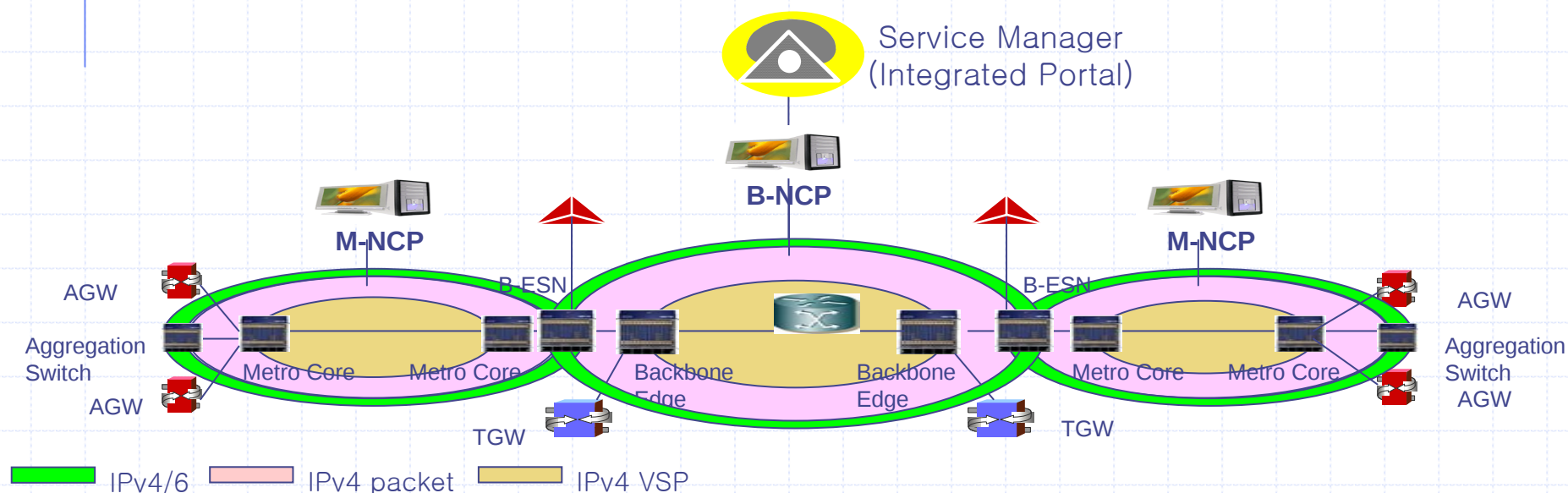


Profitability of BcN and NCP

- Managed QoS Routing
- OAM-based Fast Topology Re-configuration
- Managed VPN Provisioning
- Admission Control
- Real-time Performance Reporting
- Real-time Traffic Engineering
- Flow-based Network Emergency Control
- Per-session Accounting



**Real Profitable
Ng-IP Network**



Thank you !

choits@etri.re.kr