Regional Seminar on Costs and Tariffs for Member Countries of the Regional Group for Asia and Oceania (SG3RG-AO) (former TAS Group)

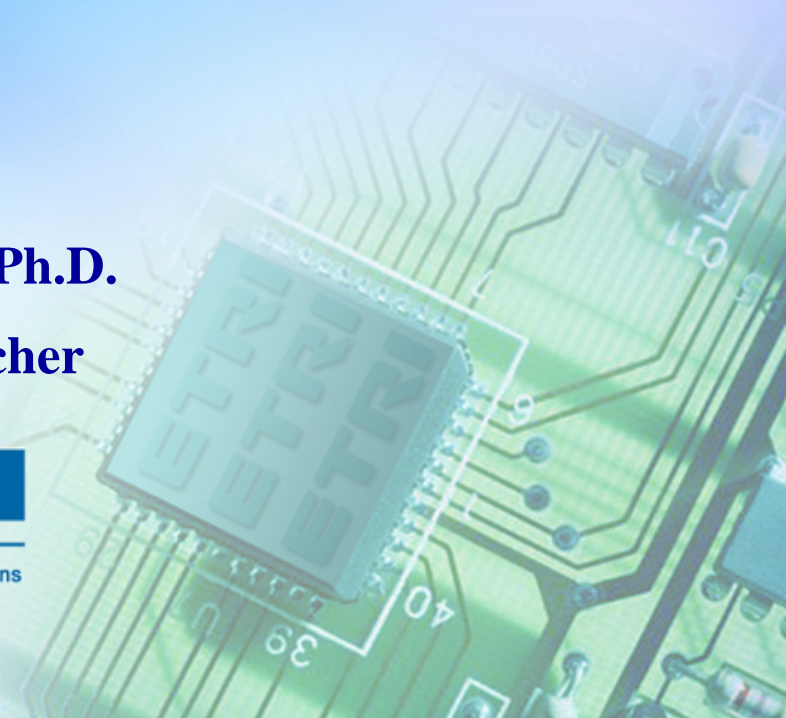*Hanoi, Vietnam, March 4-6, 2009*

Document 4

IT R&D Global Leader

Interconnection Models and Practices

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1. **Interconnection Issues under PSTN Environment**

2. **Interconnection Issues under VoIP Environment**

3. **Interconnection Issues under All-IP Environment**

PSTN Interconnection : Korea Case

- **Korean Interconnection regime was established in 1992 and has been implemented since 1994**

- **Under the Telecom Business Act, the Korean NRA(KCC) require all operators (fixed and mobile, Dominant and non-dominant) to provide interconnection service to other operators on request on a transparent and non-discriminatory basis**

- **Fixed and mobile termination (interconnection) charges have been reviewed by the KCC biannually and the basis for the rates is the LRIC model (detailed information will be provided in the fourth section)**

PSTN Interconnection : Korea Case(2)

- **The structure of the interconnection rate is per minute, which is the same irrespectively of time of day or day of week**

- **As the fixed incumbent, KT has been designated as SMP (Significant market power) operator and as the mobile incumbent, SKT as SMP operator**

Unit : person

Fixed			Mobile		
operator	Subscriber	Market share	Operator	Subscriber	Market share
KT	20,620,605	90.0%	SKT	22,875,785	50.5%
SK Broadband	1,978,409	8.6%	KTF	14,258,546	31.5%
LG Dacom	301,266	1.3%	LGT	8,140,180	18.0%
Total	22,900,280	100.0%	Total	45,274,511	100.0%

PSTN Interconnection : Korea Case(3)

- **Until 2003, the methodology for setting up fixed and mobile termination (Interconnection) rates were based on HCA (Historical cost accounting), which moved to LRIC in 2004 to set up more efficient and market oriented termination charge**

- **Since 2007, KCC has been reviewed the fixed and mobile termination charge for 2008 and 2009**

- **It is expected that termination charges for fixed and mobile networks are finally determined in November of 2008**

PSTN Interconnection : Korea Case(4)

- **In mobile termination charge review for 2006 and 2007, the KCC (Former MIC) reduced the mobile termination rate differential between the dominant and non-dominant player**

- **It means that asymmetric regulation of interconnection has been weakened between dominant and other mobile operators**

- **As a result, the dominant player (SK Telecom)'s mobile termination charge was increased by around 6%, while other operators (KTF and LG Telecom) experienced 14% decrease on average**

PSTN Interconnection : Korea Case(5)

- **The main reason for the increase in dominant player (SK Telecom)'s mobile termination rate was because KCC (former MIC) decided that 3G network cost should be included in interconnection cost**

- **Meanwhile, the decrease in other players' (KTF and LG Telecom) mobile termination rates was due to drastic increase of traffic on both operators' network**

- **In case of review of mobile termination rate for 2008 and 2009, where the main issue is to still what extent mobile termination rates should reflect 3G network costs**

PSTN Interconnection : Korea Case(6)

- **Fixed and mobile interconnection rates have been set on a cost basis, but at the same level as KT's rates based on the 'reciprocal compensation principle'**

- **Mobile termination rate wasn't until 2000 year that mobile operators faced regulation of mobile termination rates on a cost basis**

- **Currently all mobile operators are designated as having significant market status following the recognition of a monopoly in call termination to individual mobile networks**

Interconnection Models and Practices

1. Interconnection Issues under PSTN Environment

2. Interconnection Issues under VoIP Environment

3. Interconnection Issues under All-IP Environment

Definition

- ## What is Voice over IP?
  - Carrying voice traffic on networks designed for data
  - Most data networks, e.g. the internet, are unmetered
    - VoIP may therefore appear to be free
  - Not a new concept
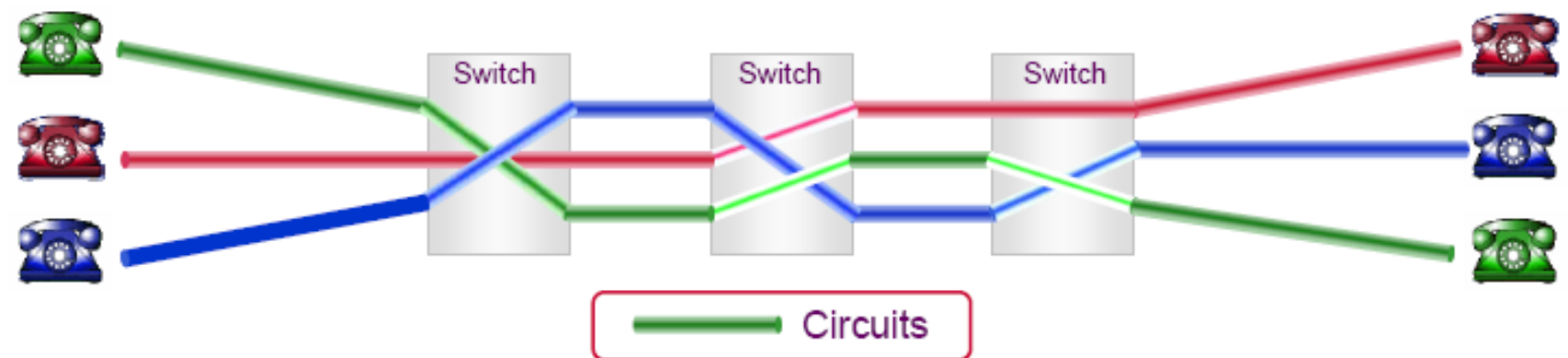 - Technology now in place which may finally encourage mass adoption
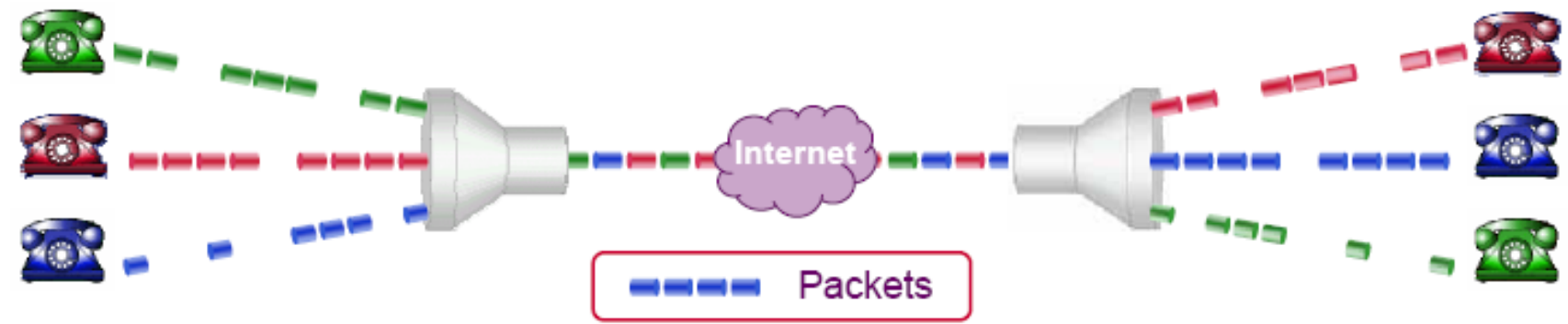
A wide range of "interfaces"

From high tech... ———————————————————▶ ...to traditional

Circuits vs. Packets

Traditional Voice

Switch   Switch   Switch

Circuits

Voice over IP

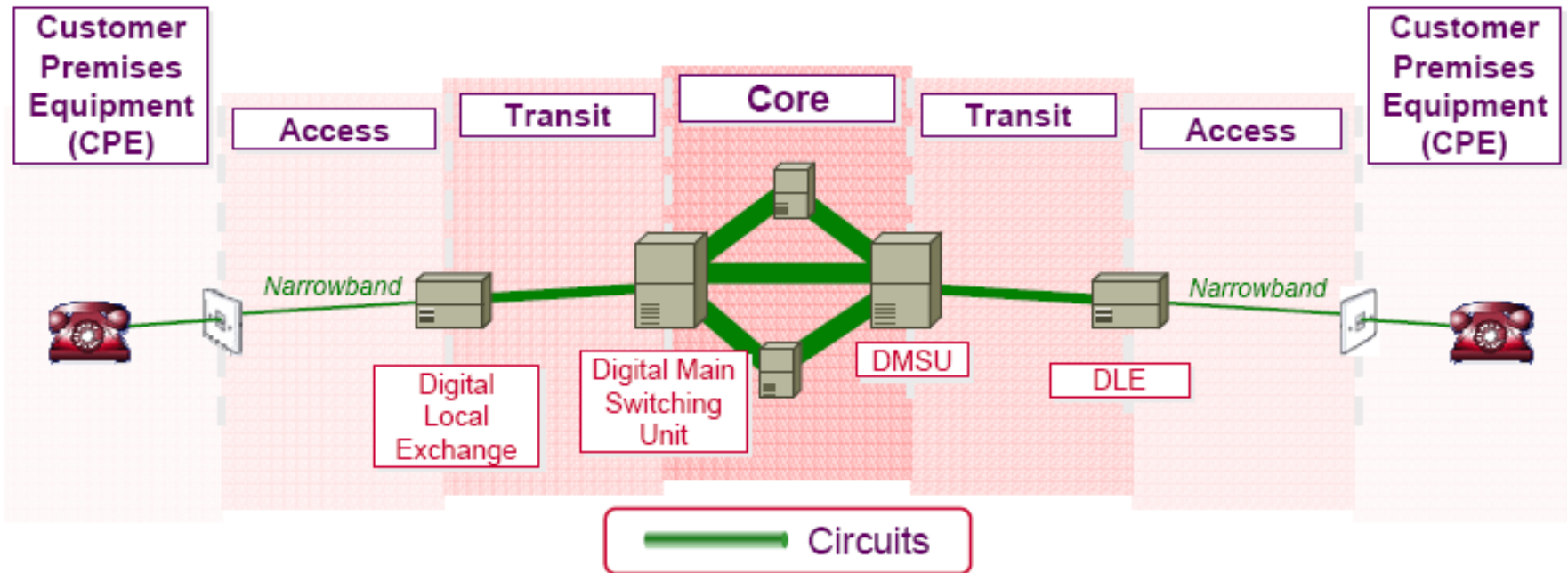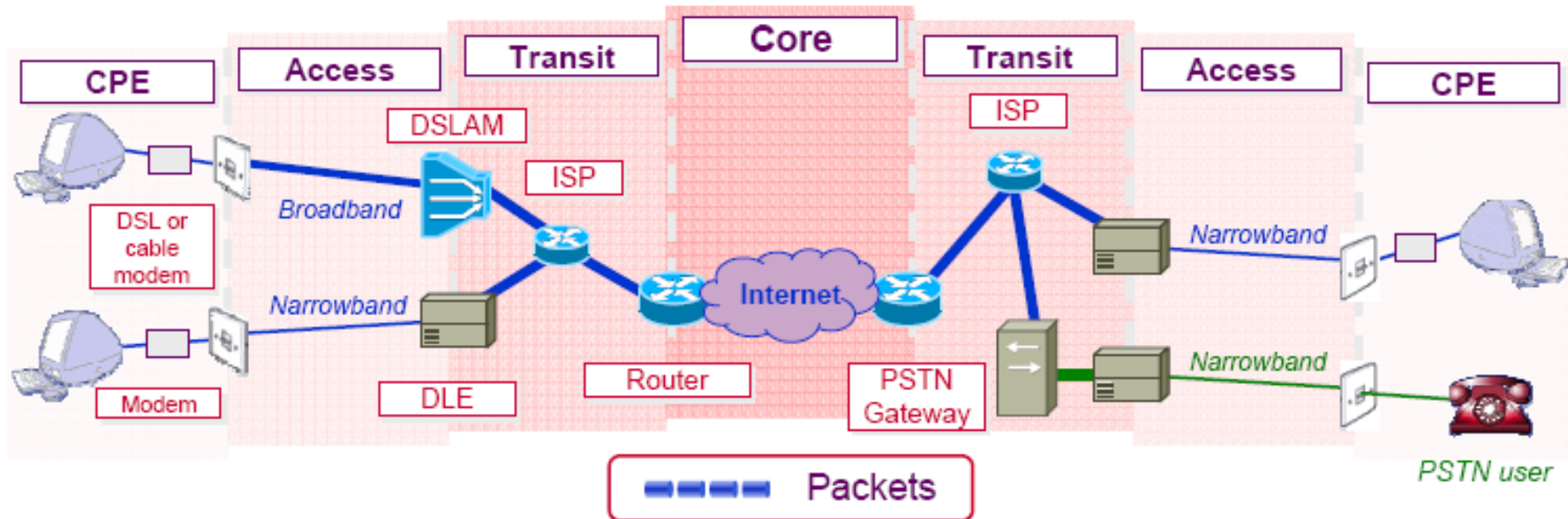Internet

Packets

PSTN – Traditional Voice

- High levels of redundancy
- Spare capacity to deal with peaks → High reliability
- Inflexible for non-voice
- Relatively high cost

PC-to-PC VoIP

- – **Software allows voice "calls" from one PC to another**
- – **Different brands of software do not usually interwork**
- – **Voice is converted to IP packets at PC**
- – **Works best on broadband**
  - ▪ **Speed, always on – incoming calls**
- – **Carried like normal data traffic by ISP, usually across public internet**

PC-to-PC VoIP – e.g. Skype

- **The most popular PC-PC VoIP software**
  - **Download more than 50m times**
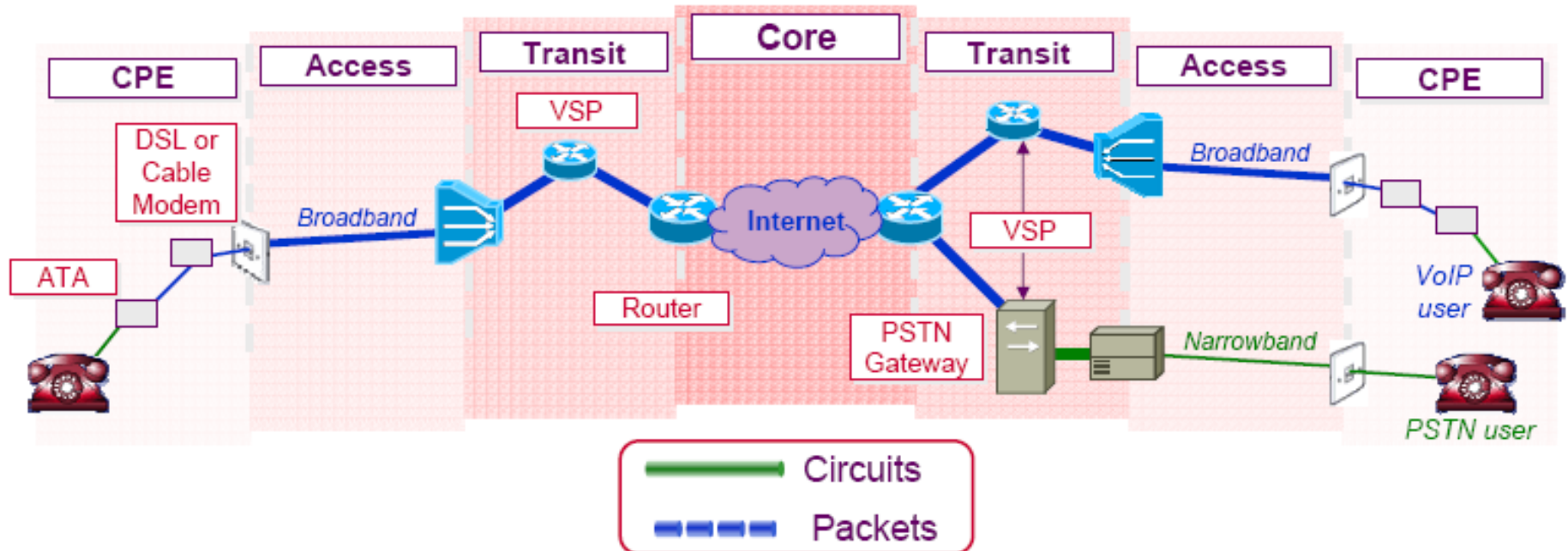 - **Over 8m regular users**

Free PC-PC calling

SkypeOut
Call PSTN
phones for a fee

Supports
Conference
Calling
& Chat

skype™

Phone-to-Phone VoIP

- Use existing telephone with an Analogue Telephone Adapter (ATA)
- Or use an IP phone
- Both connect to Broadband modem
- Called party may be another VoIP user
- Or, via a gateway, a traditional PSTN customer

Phone-to-Phone VoIP – e.g. Vonage

- **One of the most popular hardware VoIP products in the US**
  - **400,000 customers**

- **Launched a UK service on Jan. 2007**
  - **£9.99/month – residential, unlimited UK calls to "normal" numbers**

Analogue Telephone Adapter
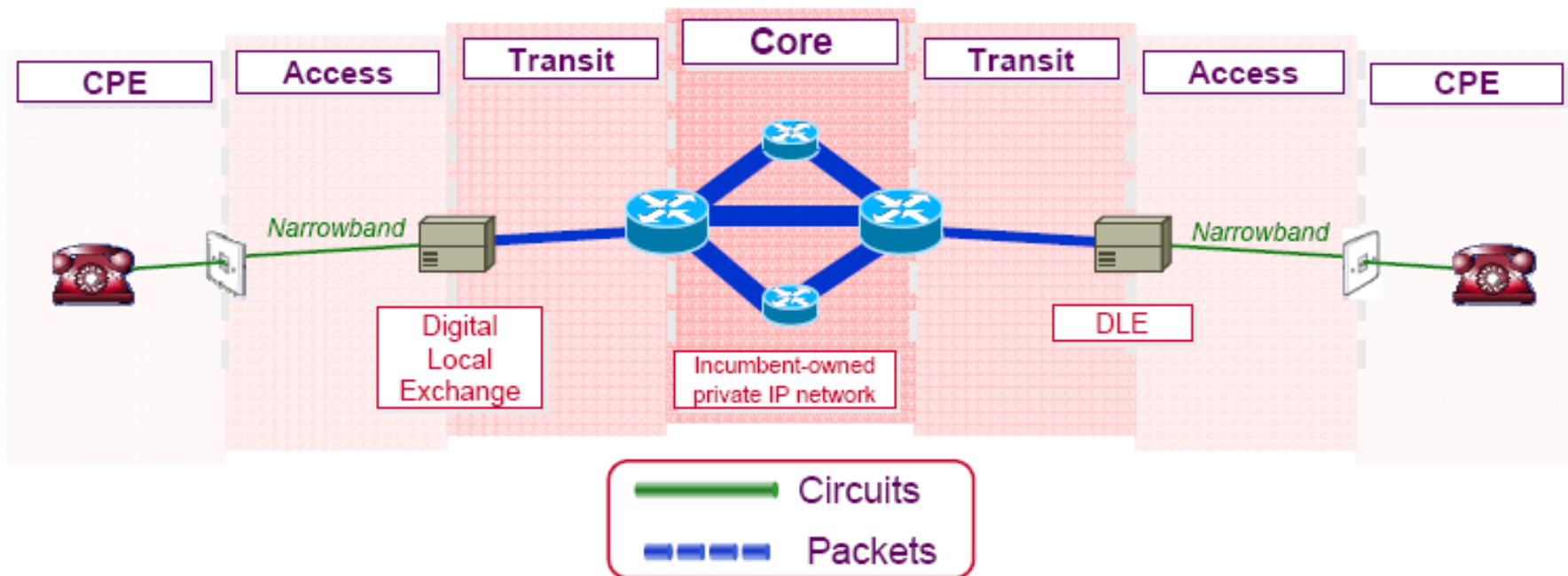
Online Account Management

Feature Set-up

Billing

VoIP in the PSTN

- – **Many traditional PSTN calls are carried as VoIP in part**
- – **For efficiency reasons they may travel with other IP traffic**
- – **Different from over VoIP**
  - ■ **Invisible to end customer; Private IP network, not internet; Controlled quality**

VoIP in the Corporate Network
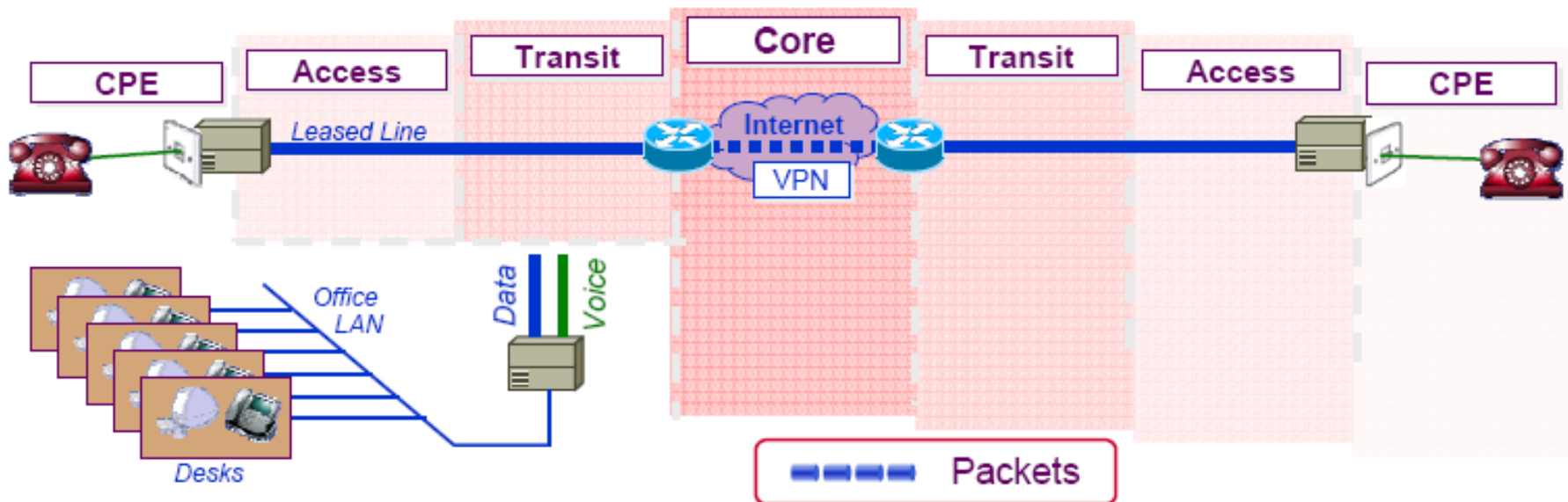
- – **Increasingly common application of VoIP**
- – **Company may carry their site-site voice as IP over existing leased line of VPN**
- – **Additionally, a single desk wiring infrastructure (LAN) may carry both data and voice (as VoIP)**
- – **Voice may stay as IP or be converted to PSTN**

Interconnection Pricing for VoIP

- **Comparison of Telecommunications and Internet Cost Recovery**
- **Models for Internet Interconnection**
- **Implications of VoIP for Interconnection Pricing**
- **Pricing Mechanisms for VoIP Interconnection**
- **Criteria for a New Interconnection Regime**

Comparison of Telecommunications and Internet Cost Recovery

Telecommunications	Internet
-Cost recovery subject to significant regulation and government oversight.	-Little or no regulatory oversight.
-Settlements are transparency.	-ISP contracts are subject to non-disclosure agreements.
-Settlements based on traffic flow and charged on minutes of use.	-ISPs combine transmission and content.
-"Half-circuit" approach to sharing the costs of the international link.	-Cost recovery based on link capacity.
-Settlements operate on a destination specific basis.	-Charged on bandwidth and derived throughput of the link.
-Under the accounting rate settlement model, the same system applies for all network operators.	-ISP network access provides onward transit to many other networks and destinations.
	-ISPs use different charging models, depending on the characteristics of the ISPs involved.

Models for Internet Interconnection

- **Enter into "peering" arrangements**

- **Enter into a transit arrangements**

- **Peering**
  - **"Sender Keep All" or "Bill and Keep"**
  - **A zero compensation arrangements by which two ISPs agree to exchange traffic at no charge**
  - **The process, terms, and conditions remain private**

Models of Internet Interconnection

- **Transit**
  - An agreement in which larger ISPs sell access to their networks, their customers, and other ISP networks with which they had negotiated access agreements
  - The sender pays the full cost of interconnection
  - Transit charges are set by commercial negotiation, and are generally not disclosed
  - Much greater geographical access than telecommunications transit arrangements
  - One Internet transit payment arrangement with one major Tier-1 ISP can provide a small, remote SIP with access to the Rest of the World

Implications of VoIP for Interconnection Pricing

- **The opportunities VoIP creates for arbitrage create pressures to**
  - Move toward cost-based pricing for interconnection
  - Adopt uniform charges for access, regardless of the type of call, type of service providers, or other call characteristics

- **Cost-based Pricing**
  - Traditionally, telecommunications prices keep basic local service low at the expense of long-distance users.
  - High long-distance prices have created numerous opportunities for arbitrage.
  - Traditional model is unsustainable and inefficiency
  - Moving towards a more cost-based model

Implications of VoIP for Interconnection Pricing

- **Uniform Access Charges**
  - **Different access prices depending on the type of call, the type of service providers, or the distance involved → Opportunities for arbitrage → Uniform charging regime**
  - **Standard for Internet access in many countries**
  - **Charges should not differ based on distance**
  - **To move to the uniform access charges, regulators will need to**
    - **Eliminate regulatory asymmetries**
    - **Decide whether VoIP providers should pay the same charges and regulatory fees as other network operators**
  - **Per minute pricing becomes an inefficient cost recovery mechanism**
  - **Calling Party Pays approach to call pricing may no longer reflect actual cost causation**

Pricing Mechanisms for VoIP Interconnection

- **Application of Origination and Termination Payments to VoIP**
  - **A VoIP operator's gateway – PSTN operator's Tandem Switch**
  - **VoIP operators should pay PSTN operators for call switching and routing**
  - **Originating VoIP traffic parallels a calling party pays**

- **Cost Drivers for VoIP**
  - **Per minute cost recovery and call duration have no meaningful relationship to the costs of a VoIP call.**
  - **Interconnection charges based on bandwidth used would be better reflect underlying cost drivers.**

Pricing Mechanisms for VoIP Interconnection

- **Setting Cost-Based Charges for VoIP Interconnection**
  - **Interconnection pricing mechanism should reflect the costs of the local network assets used to provide VoIP**
  - **Treating VoIP providers in the same way as conventional service providers will remove arbitrage opportunities**
  - **Cost reflective interconnection pricing for VoIP**
    - **End user payments**
    - **Unbundling**
    - **Cost based VoIP origination and termination charges**

Pricing Mechanisms for VoIP Interconnection

- **Reciprocal Payment Obligations**
  - VoIP operators should have the same rights to compensation
    - Reciprocal compensation for terminating calls that originate on the PSTN

- **Effect of Convergence**
  - "All you can eat" calling packages at a flat monthly rate
  - TPS offerings are using the type of flat rate pricing for the voice component of the service.
  - Lead to create additional pressure for interconnection pricing for VoIP services to conform to the retail pricing structure and to undermine the traditional system of charging for interconnection on a per minute basis

Criteria for a New Interconnection Regime

- **New approach to interconnection pricing should**
  - Encourage efficient competition and the efficient use of, and investment in, telecommunications networks
  - Preserve the financial viability of universal service mechanisms
  - Treat technologies and competitors neutrally
  - Allow innovation
  - Minimize regulatory intervention and enforcement

- **Treating VoIP providers in the same way as other service providers**
  - Interconnection charges
  - Regulatory fees
  - Other regulatory requirements

Criteria for a New Interconnection Regime

- **NGN Challenges to Regulators**
  - **NGNs will present both recurring and new challenges to regulators**
  - **Whether and how to resolve issues relating to interconnection terms and conditions**
  - **Regulators may not have lawful authority to mandate interconnection and to regulate rates, because VoIP and other Internet-mediated services do not fit within a telecommunications services classification**

- **VoIP Impact on Universal Service Funding**
  - **VoIP may have an adverse impact on universal service funding**
  - **Users of conventional services may have to bear a higher financial subsidy burden**

Interconnection Models and Practices
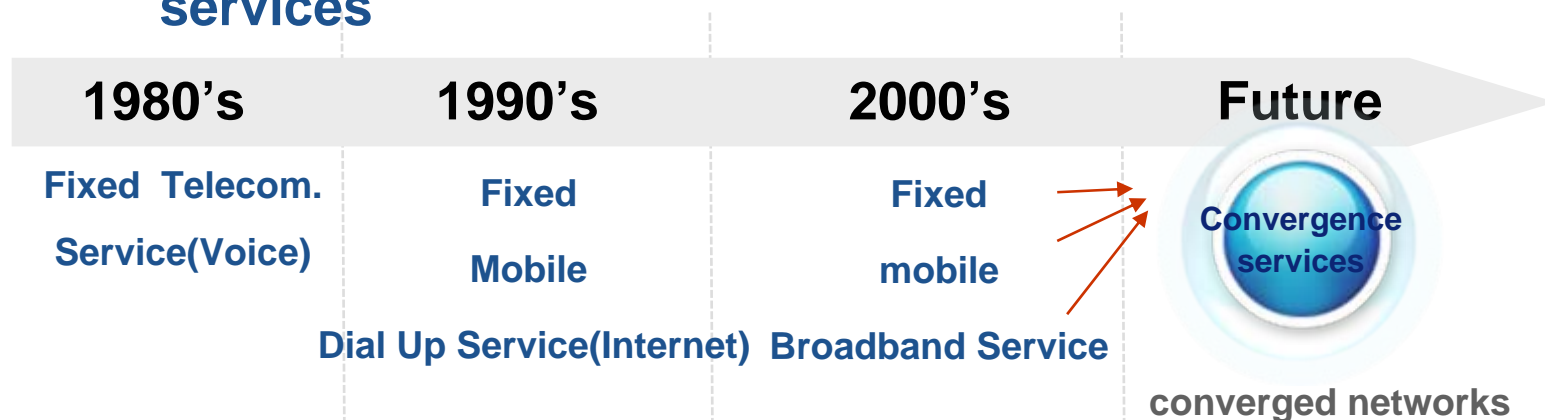
1. Interconnection Issues under PSTN Environment

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New Telecom Environment(1)

■ **Service Development**
 – **If Telecommunication service evolves to convergence, relationship between service and cost driver becomes ambiguous**
 – **New costing methodology is needed for new convergence services**

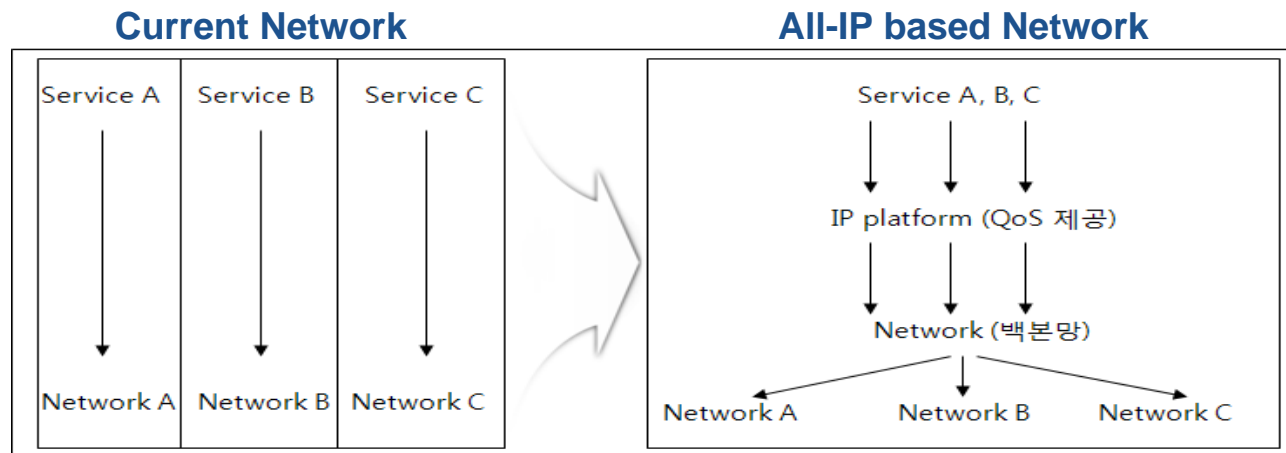| 1980's	1990's	2000's	Future
Fixed Telecom. Service(Voice)	Fixed Mobile	Fixed mobile	Convergence services
	Dial Up Service(Internet)	Broadband Service	converged networks

■ **bundled services subscriber will be increased**

■ **Internet application (ex: Gmail, Skype) will be provided by various access network**

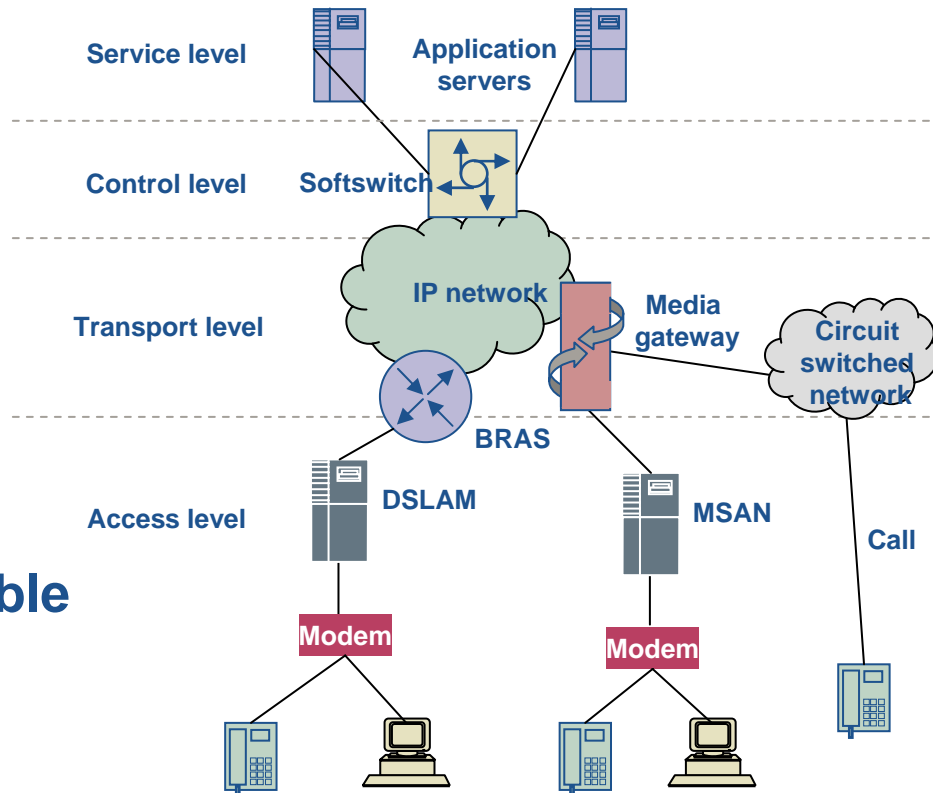# New Telecom Environment(2)

- ## Network Development
  - ### Converged network based IP network will be introduced and popular network → Various services are provided by one backbone network → New cost allocation problems arise

Current Network　　　　　　　　　**All-IP based Network**

Service A	Service B	Service C
↓	↓	↓
Network A	Network B	Network C

All-IP based Network:

Service A, B, C
↓ ↓ ↓
IP platform (QoS 제공)
↓ ↓ ↓
Network (백본망)
↙ ↓ ↘
Network A　　Network B　　Network C

- Until now, fixed services have been provided by overlay network

- As network converged, voice and data traffic will be transmitted by one network,

- It is expected that converged network leads to cost reduction

A Generic NgN architecture

- **A multi-layer architecture**
  - services
  - Control
  - transport
  - access

- **Session controls and switching functions are separated**
  - Traditional switches are replaced by:
    media gateway - responsible for adapting services to different physical underlying networks
    softswitches - doing the NGN intelligence and switching functions

Service level — Application servers

Control level — Softswitch

Transport level — IP network — Media gateway — Circuit switched network

BRAS

Access level — DSLAM — MSAN — Call

Modem — Modem

NgN Migration Drivers(1)

- **Cost savings**
  - NGNs can bring savings between 30-70% in cumulated capex and opex compared to a traditional TDM solution

- **TDM networks increasingly obsolete**
  - opex constantly growing
  - NGNs are more efficient, require less infrastructure, space, manpower, electricity
  - opportunity-cost to migrate towards NGNs lowers

- **Increased revenues and profitability**
  - NGN reduces opex
  - enables development of value-added services that can bring in new revenues
  - is more flexible to develop new services
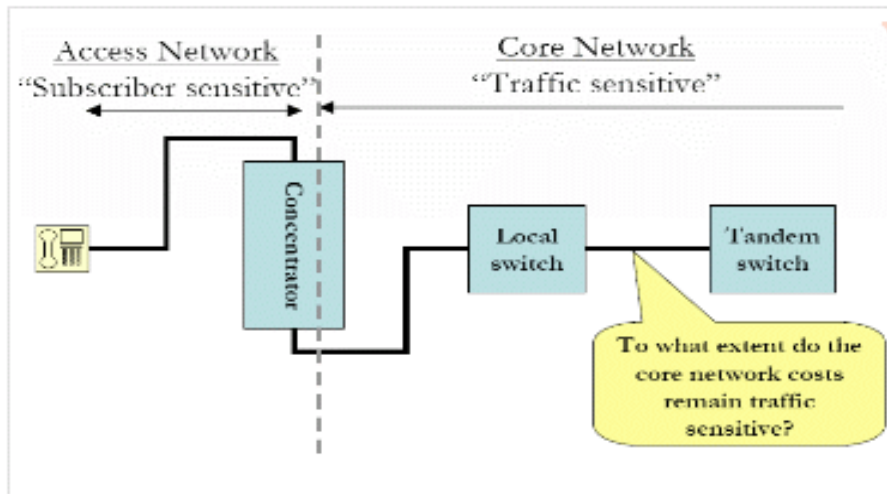
NgN Migration Drivers(2)

- **Reduce long-distance transit costs**
  - replace IP lines, rather than leased lines, from the historical operator; IP lines usually much cheaper

- **Compete in the domestic market**
  - deploy a NGN class five solution to develop innovative services mixing voice, video, audio TV etc. using one single IP technology
  - compete against alternative operators who rely on the incumbent TDM networks
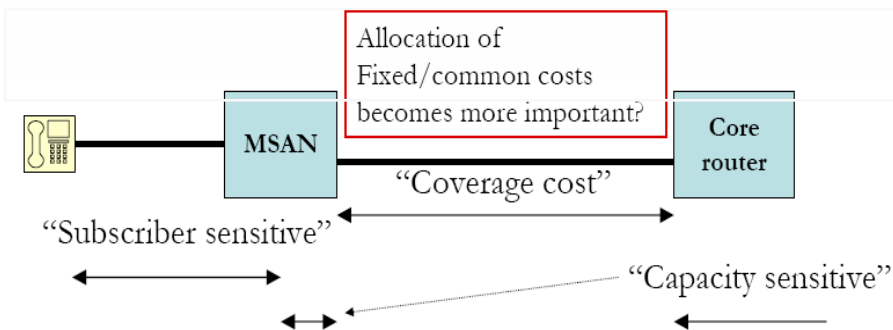
Characteristics of All-IP based Network(1)

- **Characteristics of All-IP based network**
  - **Traditional PSTN is Circuit switching but NgN(All-IP based network) is Packet switching**

    - **Voice and data traffic is transformed as a series of packets and transmit**
    - **A serious of packet is transmitted on various routes and reassemble on final destination**

  - **Classification between access and core network is very clear in traditional telecomm. Network and most cost is in proportion to traffic volume and distance**

Characteristics of All-IP based Network(2)

Access Network "Subscriber sensitive"   Core Network "Traffic sensitive"

Concentrator

Local switch

Tandem switch

To what extent do the core network costs remain traffic sensitive?

Allocation of Fixed/common costs becomes more important?

MSAN

Core router

"Coverage cost"

"Subscriber sensitive"

"Capacity sensitive"

— **Classification between access and core network in All-IP based network will become ambiguous   and it is expected that transmission network is mostly not dependent on traffic volume**

- **NGN network is made up of IP network and Node**
- **Duct and fibre are capacity insensitive facilities in core network**
- **Coverage will be major cost driver**

Cost Characteristics in All-IP based Network

- Hierarchy of NgN network is horizontal and IP-based services will be provided by one converged network, so cost calculation of network will be more simple if cost allocation principle is clear

- As fixed, mobile and other network converged fixed cost will be increased

- Especially, it is expected that local loop will be displace by fiber, so proportion of fixed cost will be increased in access network → rational and objective cost allocation principle will be more important

- Capex and Opex will be reduced in NgN network environment → it lead to reduce the price of telecommunication service

The New telecoms world created by NgNs

- **How will NGNs alter the regulatory regime?**
  - There is an argument that says: not at all (only in detail: concepts and services remain as before). But:
- **The access/core network boundary is 'blurred'**
- **Access costs are increasing as percentage of the whole**
  - For example, concept of access becoming long access network link (bitstream); however, 'access copper' may become smaller
- **Architectures are developing in different ways and at different speeds**
- **Centralised processing simplifies call routing and reduces differentiation between services, but 'routing tables' for service processing elements and allocation of IT systems is a problem**
- **FCJC increasing: to encompass virtually the entire core network?**

Regulating NgNs

- **It is about regulating existing (and new) services on a new infrastructure**

- **Two main viewpoints on how to regulate NGNs:**
  - **technology neutrality: regulate**
    - **same services imply same regulation no matter what the technology is behind it**

  - **need for investment: don't regulate**
    - **incumbents are about to invest in new infrastructure and this will generate welfare gains**
    - **demand and technology risk**
    - **regulation will limit pricing freedom and returns**

**But real problem is still 'non-replicable' access**

The regulatory Challenges(1) - the transition

- **Falling volumes imply a 'hump' in the short term for interconnect rates if current LRIC models are used, but using MEA costs (which might be NGN) means that past investments will not be recovered and would lead to regulatory uncertainty**

- **Migration costs and arrangements to provide OLO operations need to be taken into account**

- **With NGN and VoIP, traditional retail (and wholesale?) rates will fade. Q is speed of movement (legacies live on, but world could 'flip' quickly)**

The regulatory Challenges(2) – the Access

- **Access-related costs rise as fraction of total. These are fixed and are mostly not capacity-dependent and service-independent. Implication is not to charge by capacity (it is not a driver)**
- **Access is still (and even more now) a non-replicable asset (not economic sense for duplication of cables in the same street)**
- **Commercial deals will ensure value-based pricing and deals that destroy minute and bit pricing. Voice can easily become a 'free' add-on**

cost

PSTN

traffic (volume)

cost

NGN

traffic (volume)
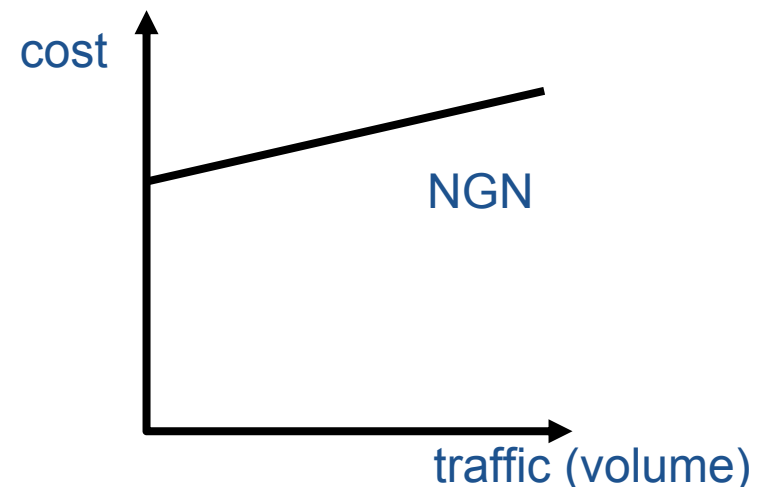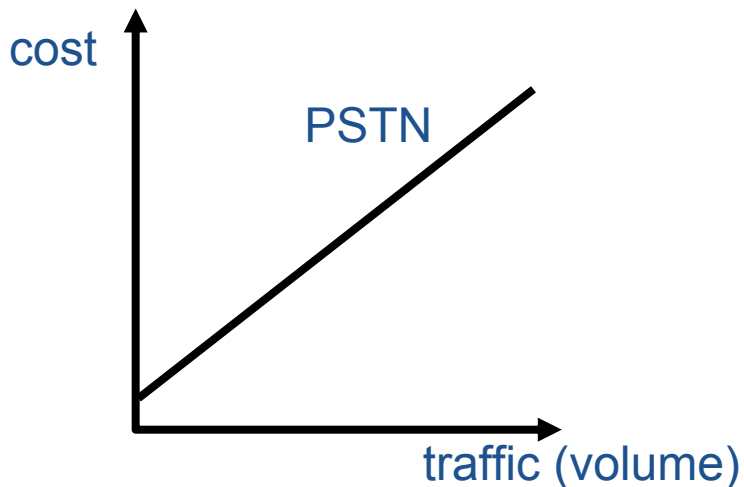
The regulatory Challenges(2) — the Access

- **Regulate access and ensure other operators have access to non-replicable assets**

- **Incumbents have SMP by means of their size and because they are the only ones with the ability to create true national NGNs. Also, they have the unique ability to vertically integrate services and have customer data/control**

- **Need to ensure inter-working is allowed - standards or open interfaces - if SMP operator attempts to restrict others**

- **Need peering of applications to allow inter-working and not simply network interconnection. This means access to higher-level functionality (IT peering) and access to customer information**

The regulatory Challenges(3) — Settlement Method

- **PSTN**
  - Co-existence of CPNP (calling party's network pays) and Bill&Keep]
  - In Korea, CPNP is adopted

- **Internet network**
  - Two types of interconnection for internet : peering and transit
    - Peering : It is very similar to Bill and Keep
    - Transit : bill your customer & pay your upstream providers
    - No regulation in Korea

- **Alternative for settlement method - Dual Regime**
  - Types of Network, Types of Service, Network Hierarchy, Distance Compensation

Interconnection Models and Practices

Thank You!!!