

NGN and the last mile

ITU Workshop on Interconnection and Next
Generation Networks

3 May, 2007

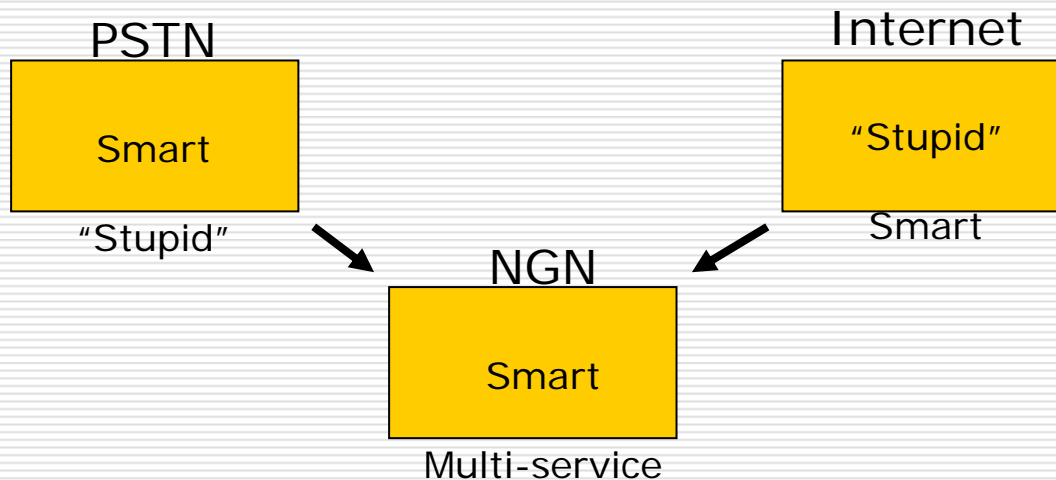
Manama (Bahrain)



Outline of talk

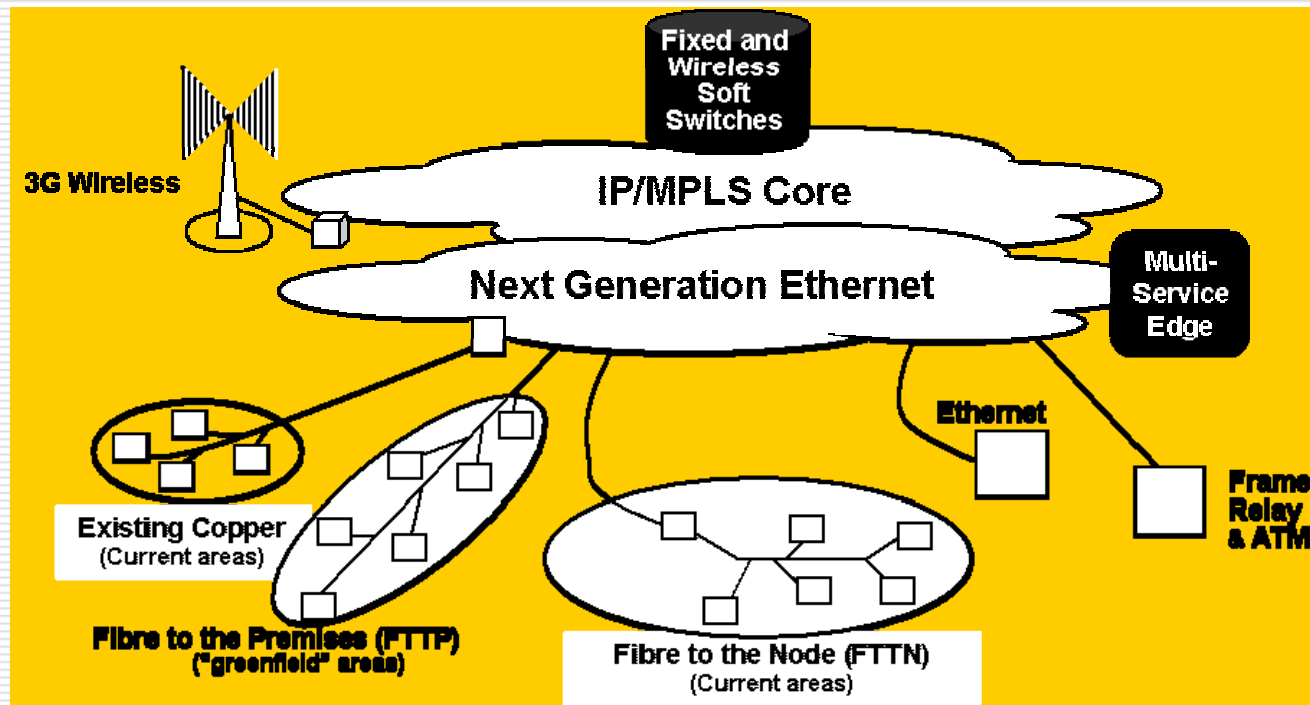
1. NGN interconnection layers
2. PSTN access and interconnection
3. The internet model
4. Pricing
5. Regulation

NGN - convergence



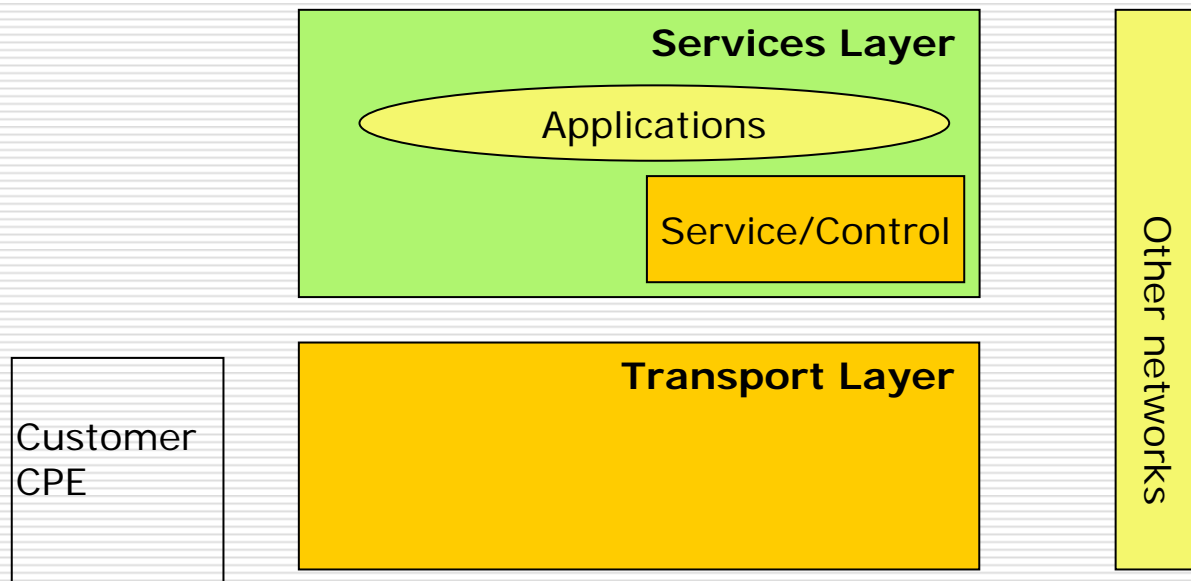
- NGN will replace the PSTN (IP packets vs circuits)
- NGN is carrier-grade internet and more
- Services and platforms converge in the NGN
- We can distinguish between “access” and “core” (next slide)

NGN – “access” and “core”



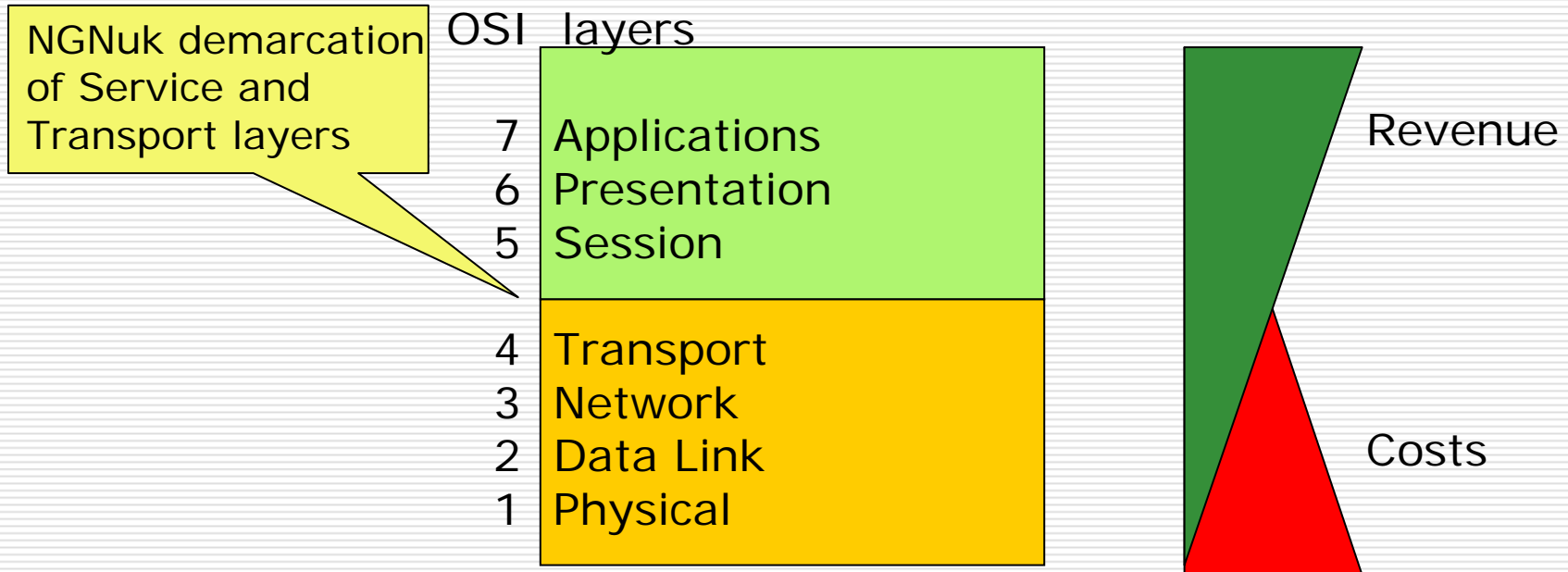
- The “last mile” traditionally concerns “access”
- But, NGN access is more than just “transport”

NGN access and interconnection - 1



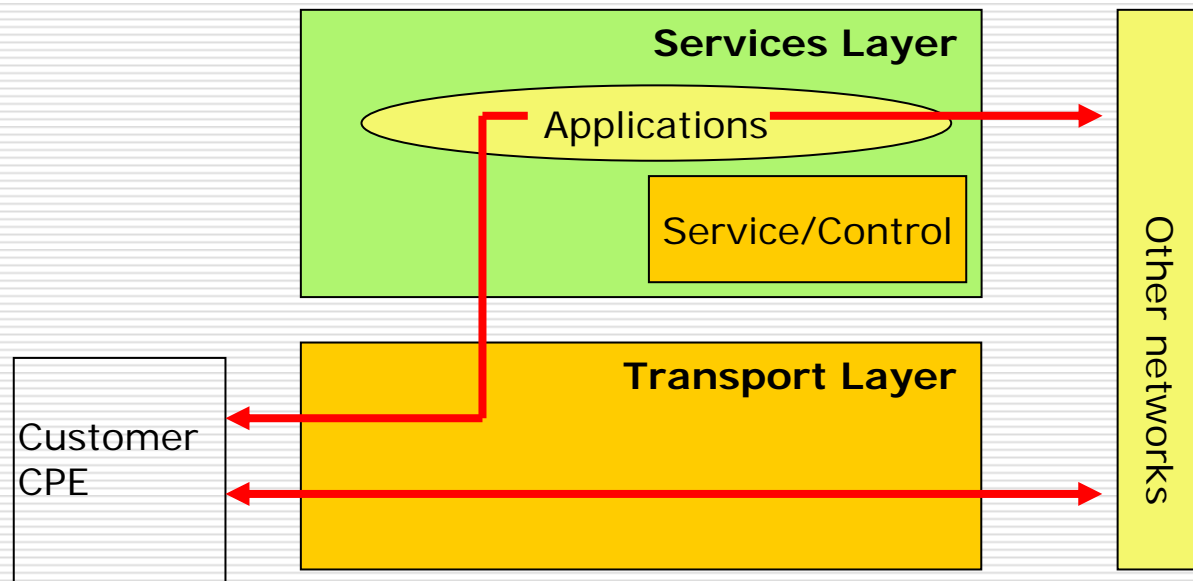
- No international specification yet (?), but NGNuk forum places OSI layers 1-4 in transport and 5-7 in services layer (next slide)

OSI layers



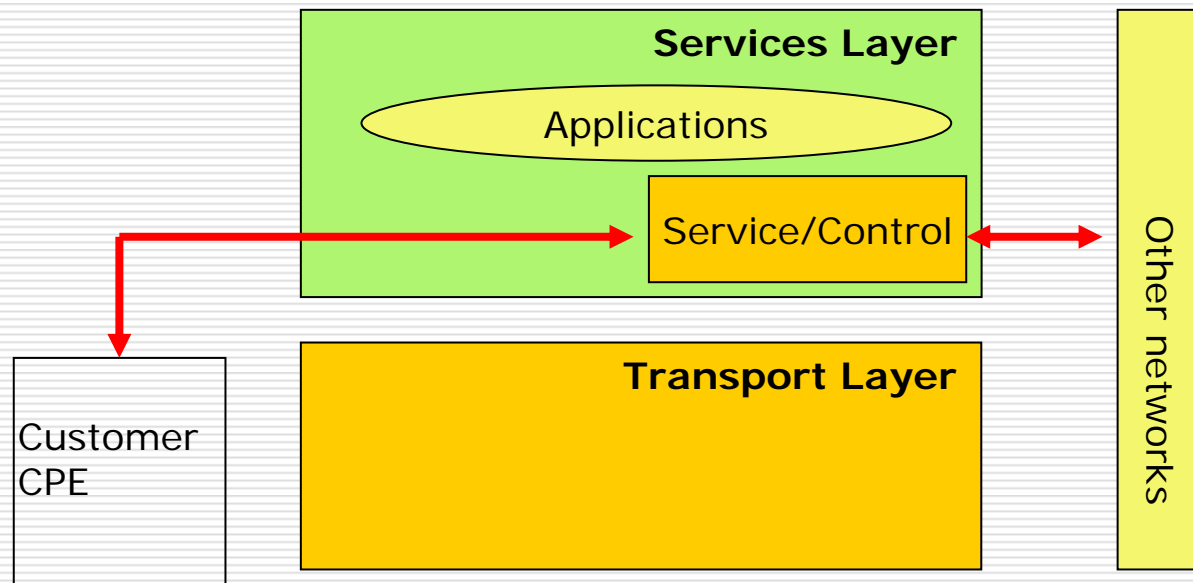
- The open systems interconnection (OSI) reference model specifies the interfaces that allow computers and networks to interact
- Most of the costs fall in the transport layers (Net Neutrality debate)

NGN access and interconnection - 2



- In the transport layer, IP traffic exchanged at layer 2 or 3
- An application like VoD may be provided directly as shown
- A service may require more than one type of interconnection
- And the service may involve different providers too!

NGN access and interconnection - 3



- A key service is VoIP and the service/control module manages the QoS on connecting IP to circuit-switched calls

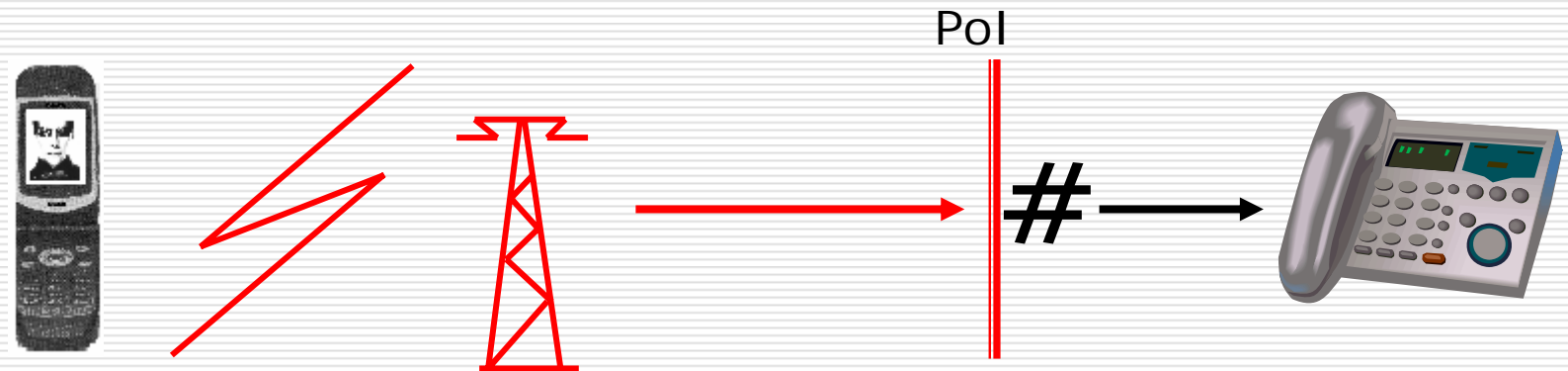
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PSTN access and interconnection

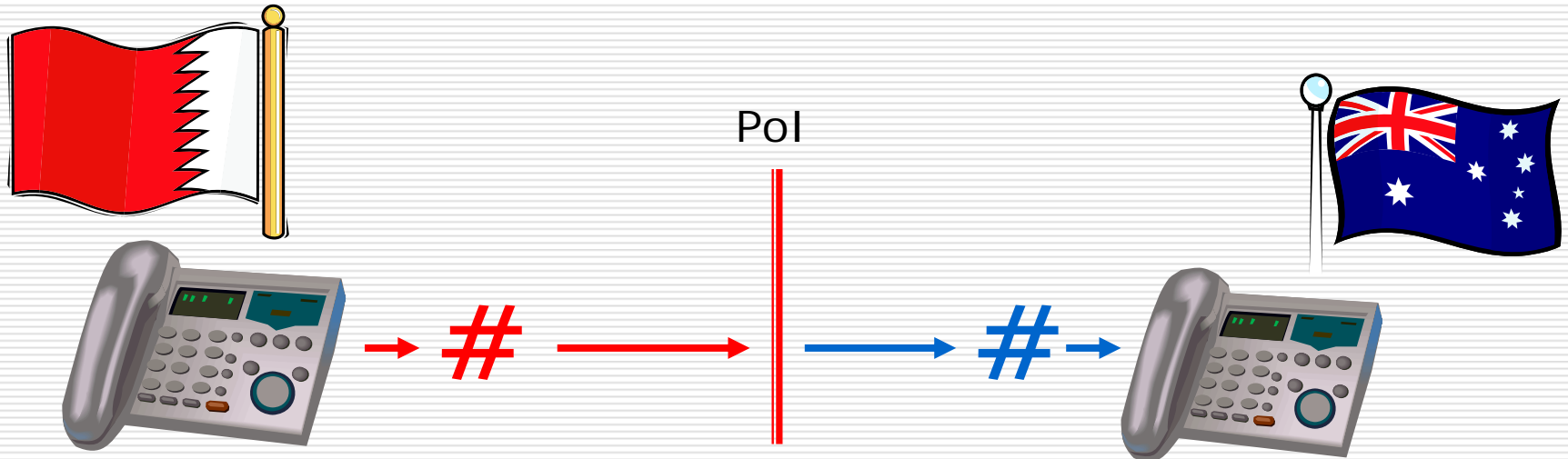
- ❑ Terminating i/c (for “any-to-any”)
 - Mobiles, international and domestic
- ❑ Originating i/c (for “choice”)
 - Indirect access/preselection
- ❑ Bitstream access (for broadband)
- ❑ Unbundled access (for everything)
 - Unbundled local loop

Terminating i/c - Mobile



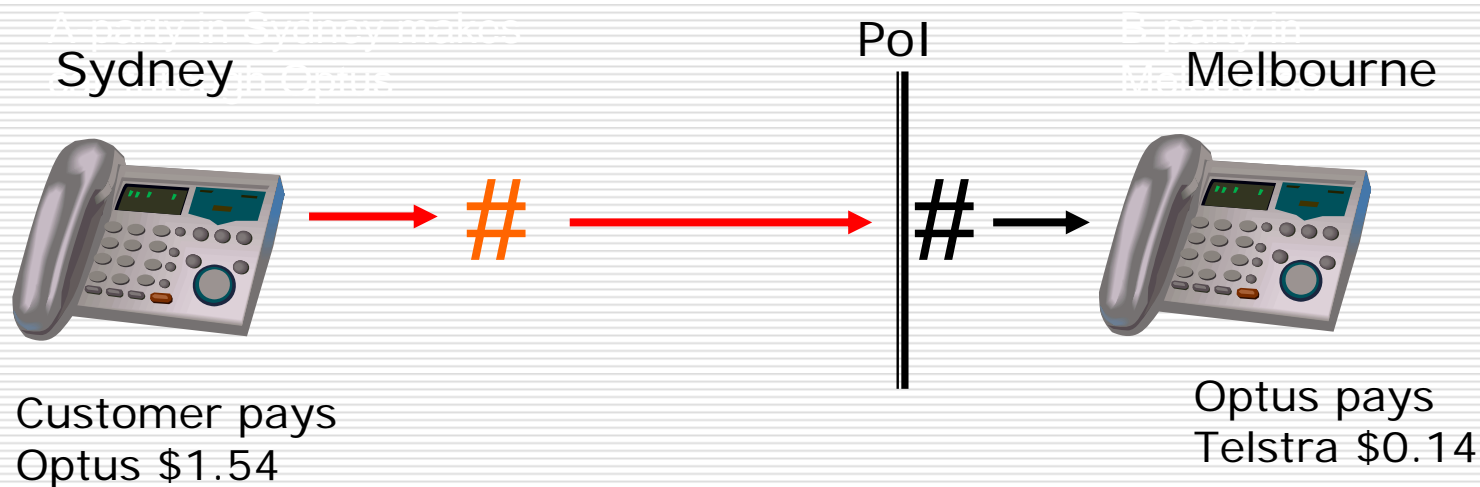
- Mobile operator pays low PSTN termination rate
- In reverse, PSTN operator pays high mobile termination rate
- In both cases, only two carriers and customer revenue kept by originating carrier

Terminating i/c - International



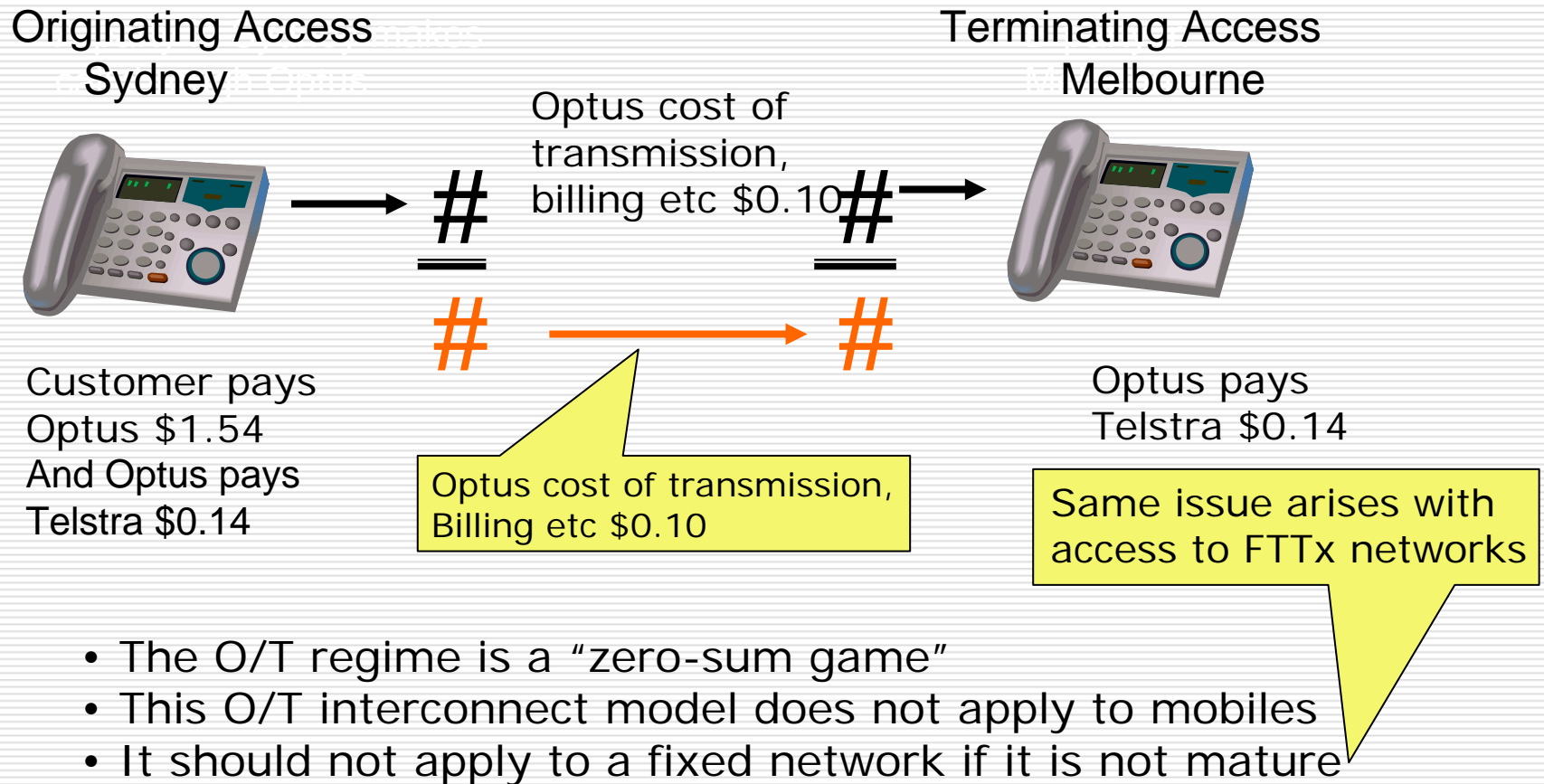
- Carriers split the accounting costs of international transmission
- So, the terminating carrier gets half the accounting rate
- This regime is no longer practicable (VoIP, resale etc)

Terminating i/c - Domestic

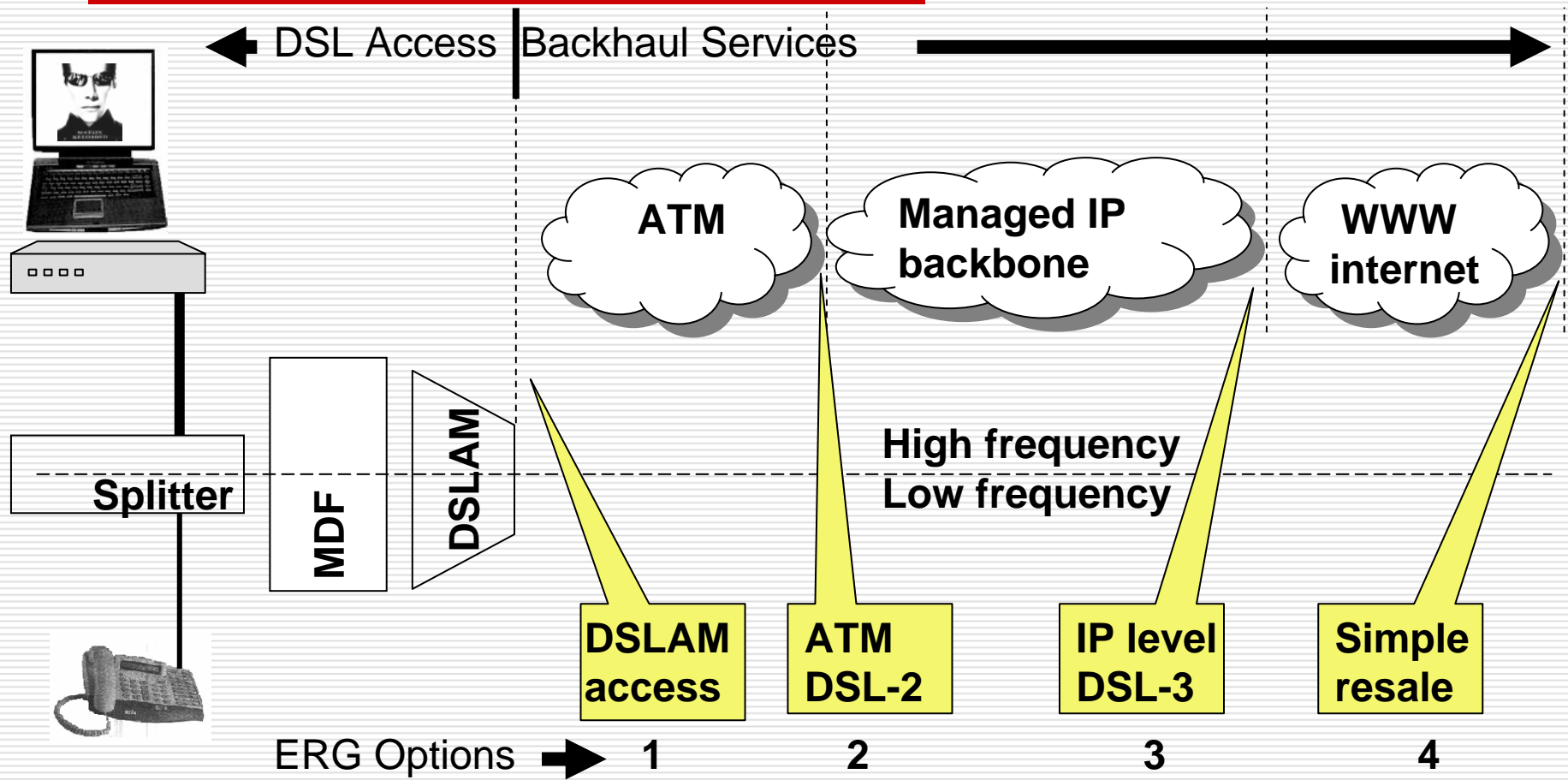


- This is the case for a 5 minute call in Australia in 1995
- In fact, Optus had no directly connected customers
- So, it also obtained originating access (next slide)

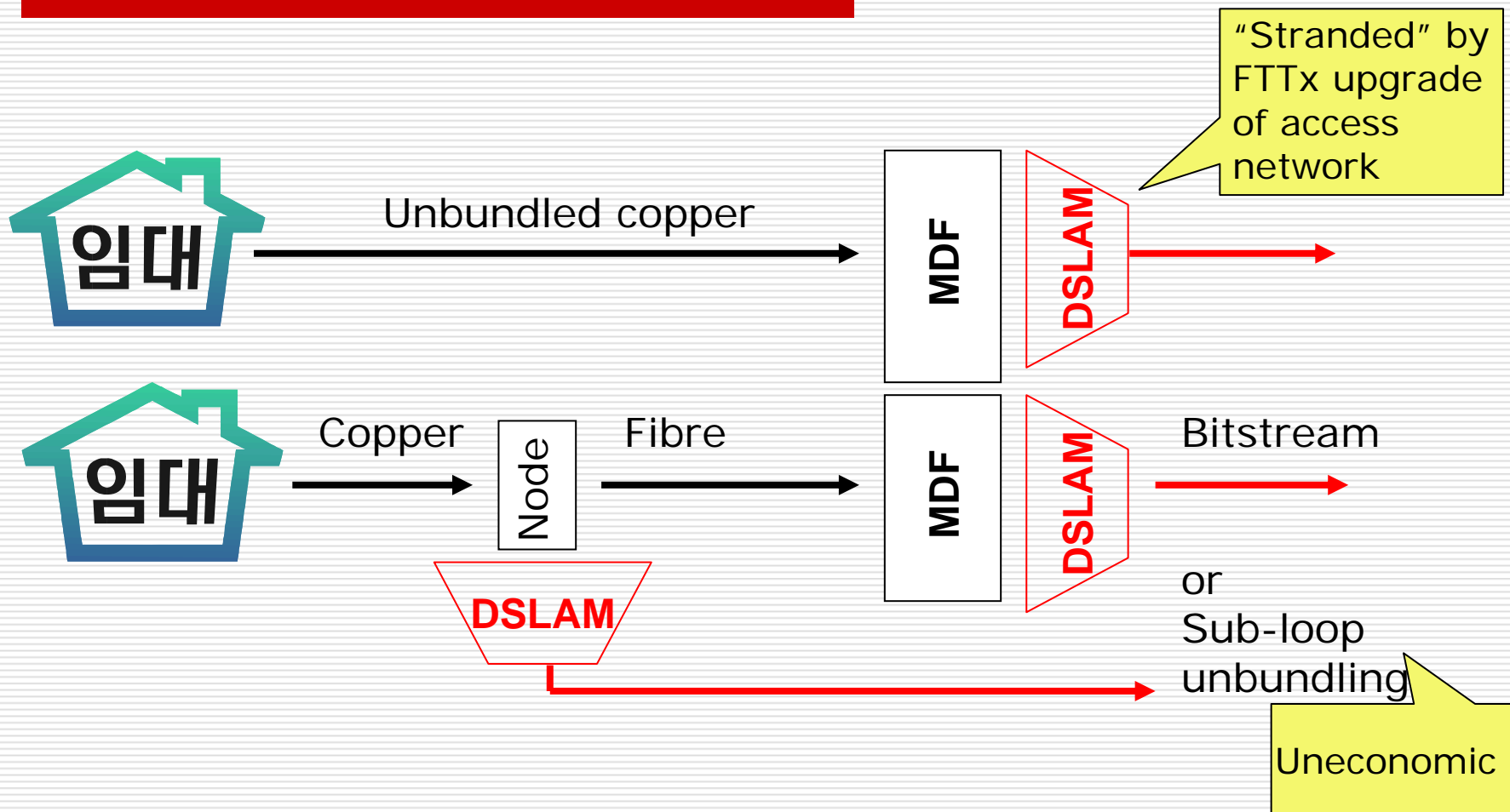
Originating and terminating i/c



Bitstream access options



Unbundled access



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The internet model

- ❑ Customers pay ISPs a monthly subscription to access the Internet cloud and the content “freely” available within the cloud.
- ❑ Traffic streams typically are asymmetrical, i.e., a small upstream request triggers a large cascade of traffic.
- ❑ ISP transiting and peering is connection and bandwidth based.
- ❑ Until recently Internet metering costs exceeded the benefits, and “tunneling” a complete end-to-end link was technologically difficult.
- ❑ As a “network of networks,” Internet connectivity involves interconnection between directly contracting parties, but also access to networks operated by carriers that have no direct contractual arrangement.

Telephony and internet - 1

Telephony

□ Causation

- the caller usually triggers the call and uses facilities provided or paid for by the caller's carrier

□ Traffic measurement

- calls and minutes can be measured

□ Parties

- just **two carriers** at each of circuit established for duration of the call
- model developed by the ITU on a multilateral basis between countries

Internet

□ Causation

- the traffic types are varied and it is **unclear** which party triggered the exchange

□ Traffic measurement

- possible but who should pay?
- Upstream and downstream flows often asymmetrical.

□ Parties

- **many carriers** may be involved in handing-off packets on "best effort"
- model evolved from zero cost peering to a commercial hierarchy of peers and clients

Telephony and internet - 2

Telephony

- ❑ Carriers interconnect at agreed points of interconnection (POI)
- ❑ Calls routed on dialled number
- ❑ Circuit switched with end-end signalling
- ❑ “Intelligent” network elements

Internet

- ❑ Unregulated connection
 - Peering or transit
- ❑ Packets routed on IP header on “best efforts”
- ❑ A connectionless protocol
- ❑ A dumb core technology with intelligence at the edge

Net bias occurs when an ISP deliberately degrades service, drops packets and otherwise tries to punish a specific ISP or content source

Net bias versus reasonable discrimination

Impermissible Net Bias

Deliberate Packet Loss

Targeting Large Volume Content Generators for Punishment or Extortion

Most Types of Port Blocking

Unilaterally Imposing Upstream and Downstream Rules That Violate Existing Service Level Agreements

Affiliate Favoritism That Violates SLAs, Fair Trade and Antitrust Laws

Fees for Overriding Firewalls and Filters

Permissible Network Bias

Variable Bandwidth and Throughput

Bandwidth Partitioning

Metered Service

Better Than Best Efforts Routing

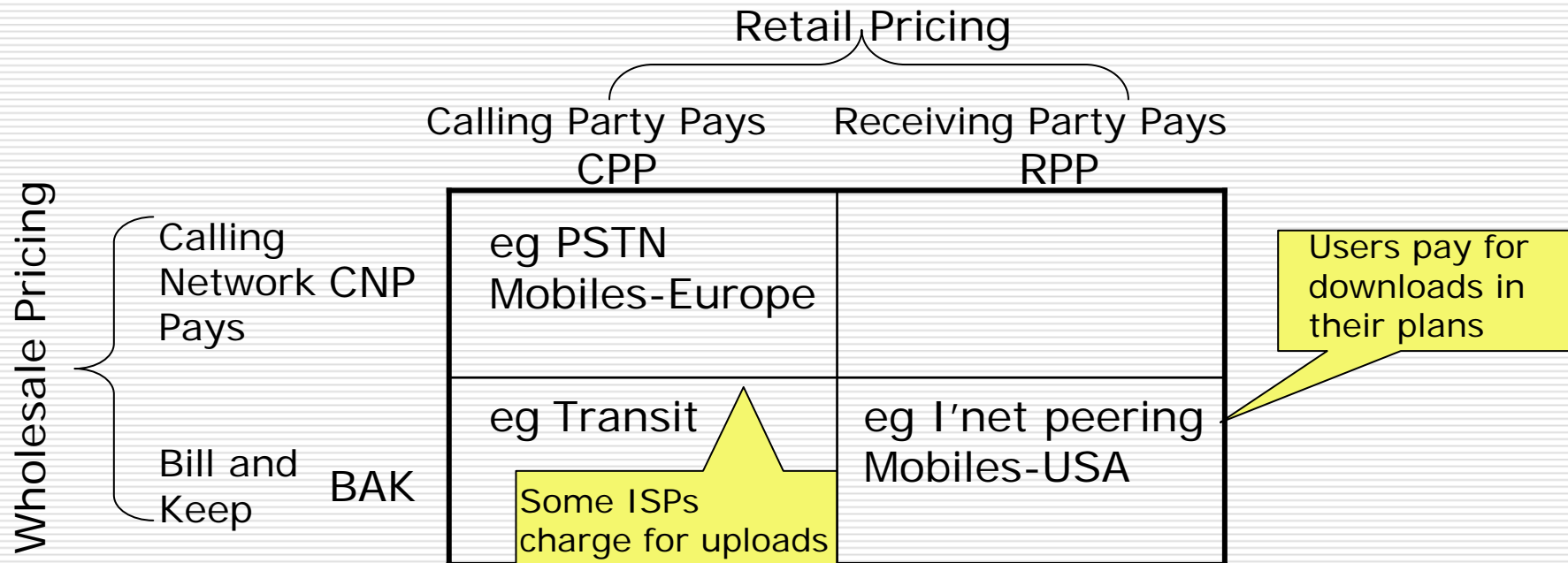
Special or Exclusive Content Deals

Source: Robert Frieden (2006) "Net Neutrality or Net Bias?--Handicapping the Odds for a Tiered and Branded Internet" , 35th Telecommunications Policy Research Conference <http://www.personal.psu.edu/faculty/r/m/rmf5/>

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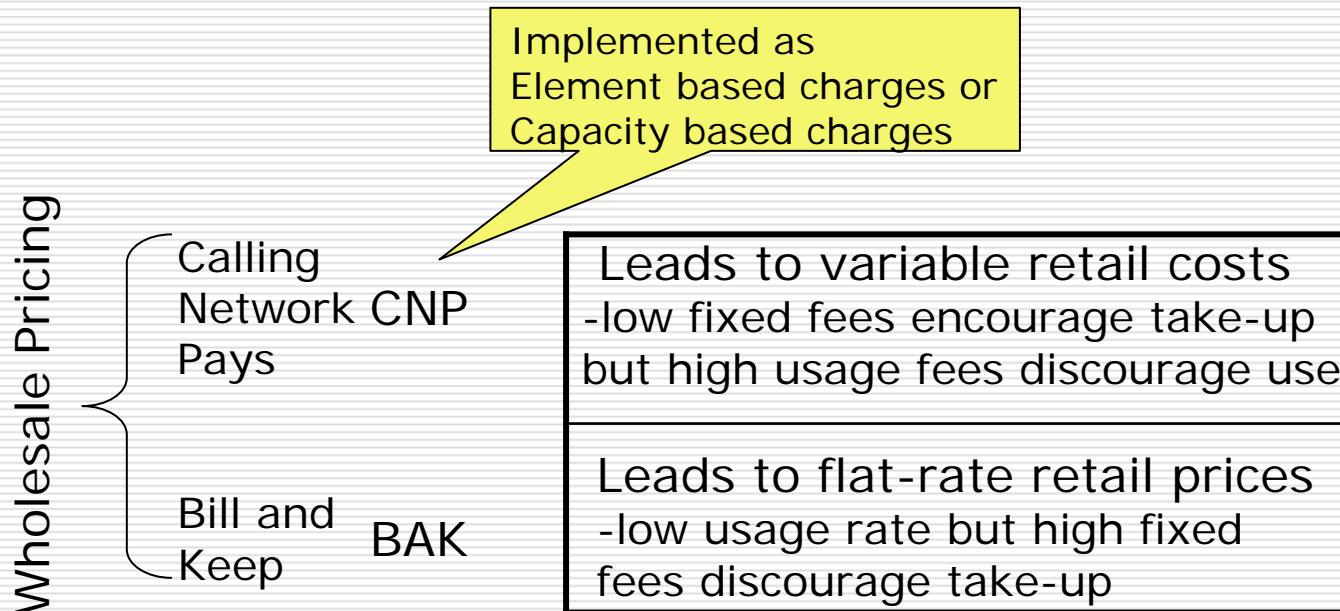
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Charging principles (who pays?)



- transit is provided in a provider-customer relationship
- co-existence of different models will create arbitrage
- retail and wholesale charging are closely related (next slide)

Wholesale and retail



- The European Regulators Group (ERG) favours charging
- Others favour bill and keep – next slide

Wholesale pricing -pros and cons

- ❑ BAK is simple

- ❑ It is unregulated

But

- ❑ It leads to “hot potato” routing

- ❑ It also leads to under-investment

- ❑ It implies retail customers – but they may not exist (eg TNZ?)

- ❑ CNP requires metering

- ❑ It reflects costs (and is not inconsistent with flat rate retail prices)

But

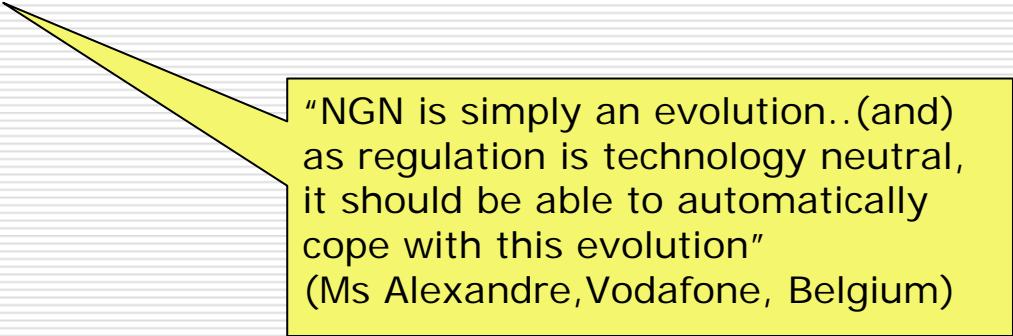
- ❑ Requires regulation of termination monopoly

- ❑ Requires cost models

- ❑ May involve arbitrage

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"NGN is simply an evolution..(and)
as regulation is technology neutral,
it should be able to automatically
cope with this evolution"
(Ms Alexandre, Vodafone, Belgium)

Regulatory considerations

- Need “any-to-any” connectivity
 - Interconnection multi-tiered with NGN
 - New “control” bottlenecks arise in NGN
- Need more choice (increases utility)
 - “walled gardens” from use of IMS
 - Set-top units also create barriers
- Need infrastructure competition
 - Still possible last mile issue remains

Commercial considerations

- ❑ Need “new deal” on access pricing
 - TSLRIC inimical to investment (FTTx)
- ❑ Need “forbearance” on joint supply
 - ie not seen as anti-competitive
 - Bundling and IPsphere
- ❑ Need content providers to pay more
 - Net neutrality debate

More Questions?

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