Interconnection, Two-Sided Markets, and BEREC's consultation on IP Interconnection in the Context of Net Neutrality

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Presentation to ANACOM

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Note (1) that I do not speak for BEREC, and (2) that some of the enclosed analysis was done on behalf of various clients.

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Interconnection and Two-Sided Markets

- Introduction
  - Interconnection in an evolving world
  - Two-sided markets
  - Applications of two-sided markets to interconnection
- Voice call termination as a two-sided market
- BEREC's consultation on IP interconnection in the context of Net Neutrality
  - IP interconnection and differentiated QoS
  - A debate over content versus network transmission
- Concluding remarks

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Interconnection in an evolving world

- Global attention over interconnection as networks evolve from traditional switched networks to IP-based networks.
- How this change is viewed, and the degree to which it is disruptive, can vary greatly from one regulatory system to the next.

Interconnection in an evolving world

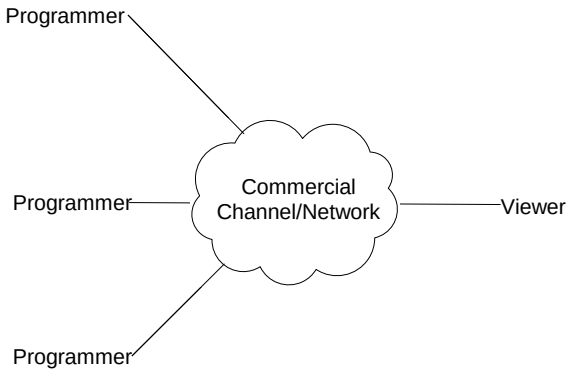
- Switched fixed and mobile networks.
  - Regulation to address market power.
  - Termination fees in the absence of regulation will tend to be very high, for both large and small operators.
- Internet.
  - Peering: two providers exchange traffic only for their respective customers, often (but not always) with no explicit charges.
  - Transit: Payment to deliver traffic to third parties.
  - Historically, little or no regulation of peering.
  - Peering arrangements are typically “Coasean”.
- What happens “when worlds collide”?

Two-Sided Markets

- A relatively new branch of economics deals with two-sided markets.
- In a two-sided market, a platform provider somehow benefits by bringing the sides of the market together.
- Payment could come from either side of the market; thus, relationships between price and cost that would be irrational in a conventional market might be reasonable in a two-sided market.
- Examples include broadcast television, and singles bars.
- Rochet, Jean-Charles/ Tirole, Jean (2004): Two Sided Markets : An Overview, March 200

Two-Sided Markets

- Broadcast television is a common and pertinent example.
- Payment comes from programmers/broadcasters, and ultimately from advertisers.
- The consumer typically pays little or nothing.
- In a conventional market, it would be strange for consumers to pay less than the cost of the service, but in a two-sided market it can be rational.



Two-Sided Markets

- Cable television provides a more complex demonstration of the dynamics of two-sided (or multi-sided) markets.
  - High value content providers such as premium sports can typically demand high payments from the cable operator, i.e. the provider of the two-sided platform
  - Providers of content that is valued less, or that is valued by fewer end-users, may not be able to command high payments, or for that matter may need to pay the cable operator to have their content transmitted.
  - The results of the negotiation are heavily dependent on the relative bargaining power of the parties.
  - Payment may flow in some cases from the end-user to the content provider, typically through the cable operator.

Two-Sided Markets

- From an economic perspective, the fact that a bargaining game is involved is not necessarily a problem, nor is the relevance of bargaining power.
- The negotiated outcomes can be economically rational and efficient.

Two-Sided Markets and interconnection

- Every electronic communications market is in some sense a two-sided market.
- HOWEVER, in not every case will a two-sided market analysis provide information that was not available in a conventional analysis.
- If the *structure* of prices matters, and not just the *level*, then a two-sided analysis may matter. (Tirole and Rochet (2004))
- Areas where two-sided markets have been considered:
  - Voice call termination payments
  - Arrangements between network operators and content providers, especially as regards Quality of Service

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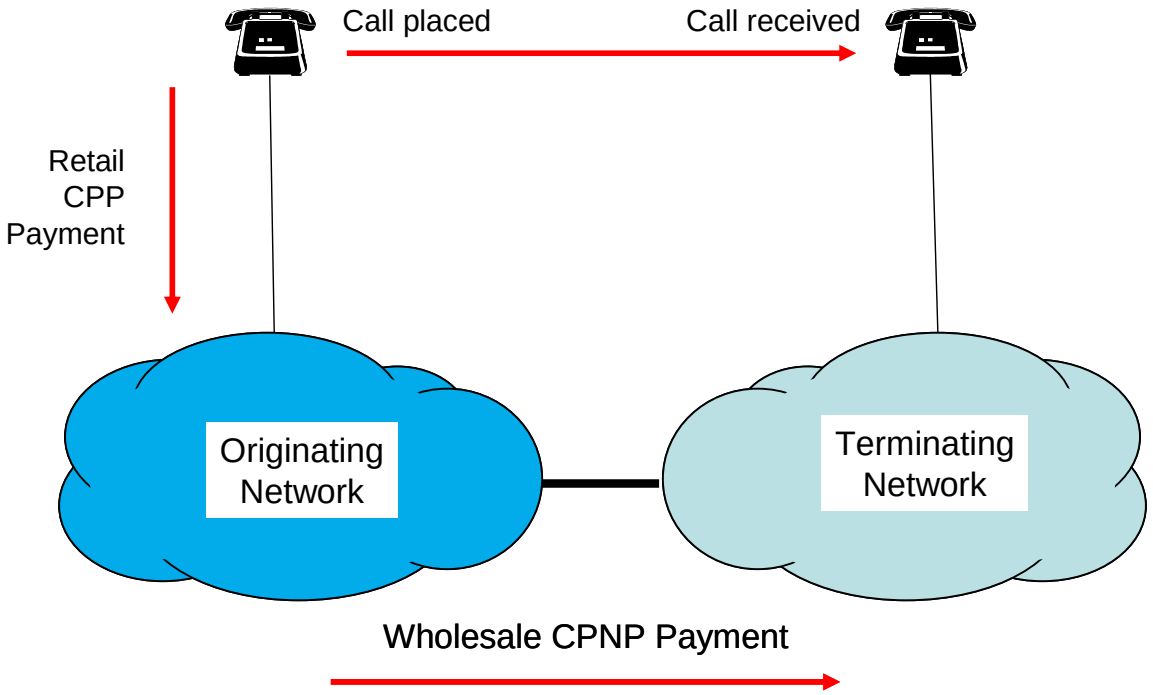
Voice call
termination is a
tough problem!

Economic background: Traditional Fixed and Mobile Interconnection Models

- Calling Party's Network Pays (CPNP) wholesale arrangements



- An alternative (US, Canada, Hong Kong, Singapore) is to have negotiated arrangements under obligations of reciprocity, often resulting in no wholesale charges (Bill and Keep).

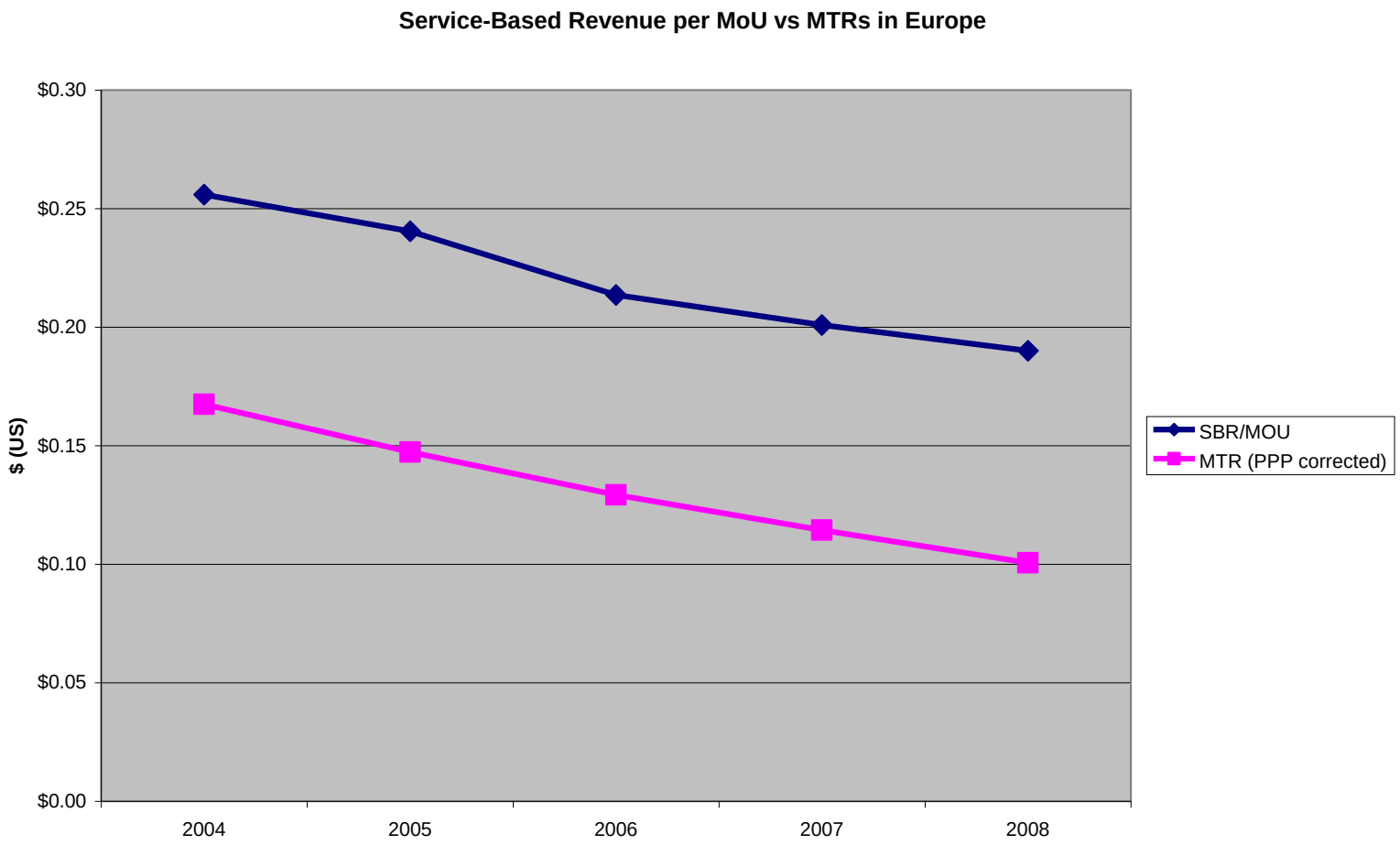
Voice call termination as a two-sided market

- The originating and terminating networks can collectively be viewed as a two-sided platform. Each can play either role.
- In this case, the called party is not very different from the party that placed the call, but the model is still valid.
- The terminating network possesses terminating monopoly power to the extent that no other network can complete calls to that number.
- *Calling Party Pays (CPP)* retail arrangements – where the receiving party nothing for the call – can be viewed as a two-sided market arrangement favouring call recipients over those who place calls.
- In reality, both parties benefit from the call. (Tirole and Jeon)

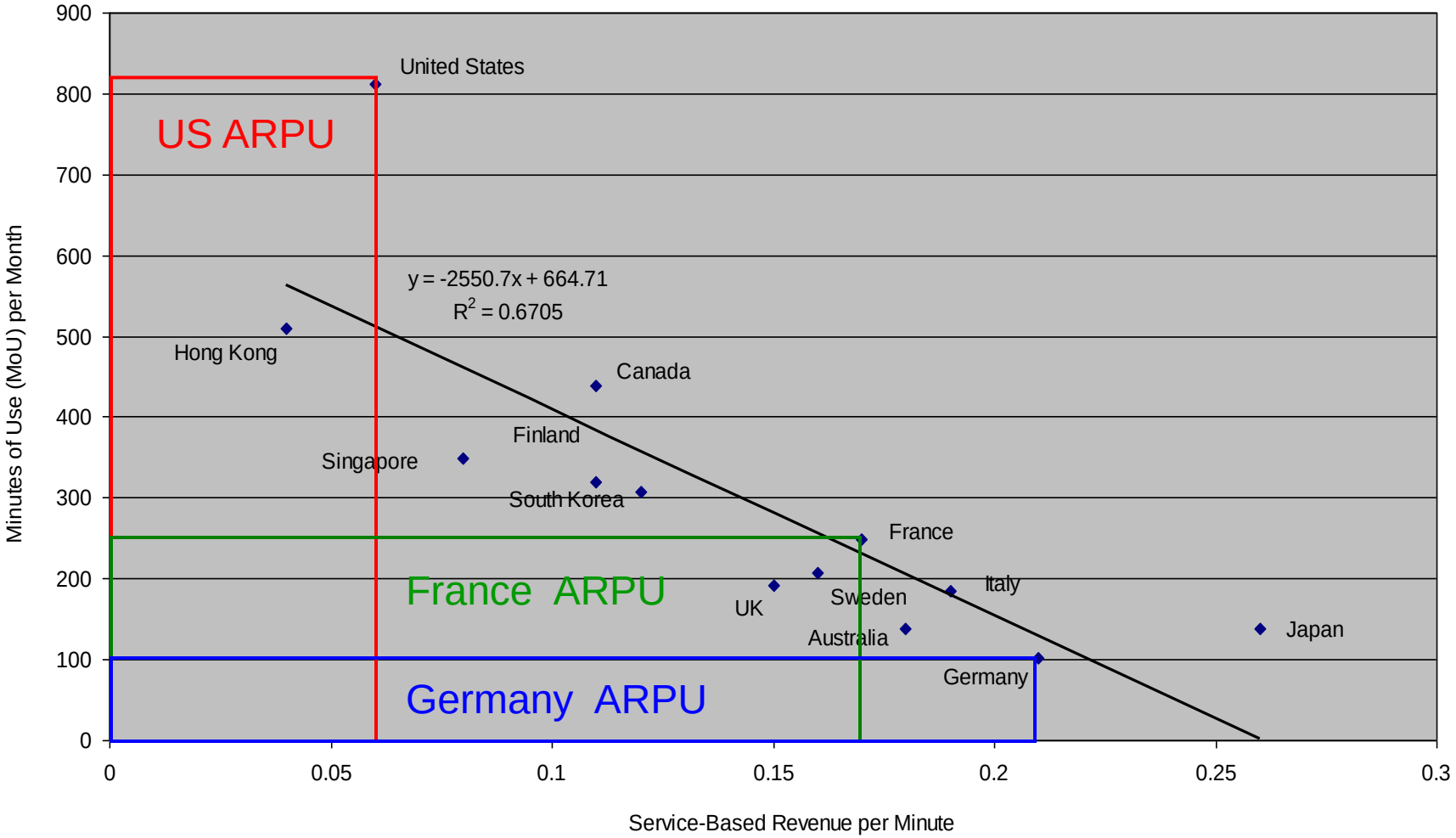
Voice call termination as a two-sided market

- *Calling Party Network Pays (CPNP)* wholesale arrangements – where the calling party‘s network make a payment to the receiving party‘s network – enable the two-sided market to work by funding the subsidy to the receiving party.
- What happens when the wholesale payment is reduced?
  - If the wholesale payment becomes less than the marginal cost of receiving the call, there would be a tendency to introduce charges for calls received (or equivalents such as flat rate fees).
  - One might expect firms to raise prices on the originating side to make up for lost termination revenues.
- Is this happening?

Voice call termination as a two-sided market



Voice call termination as a two-sided market

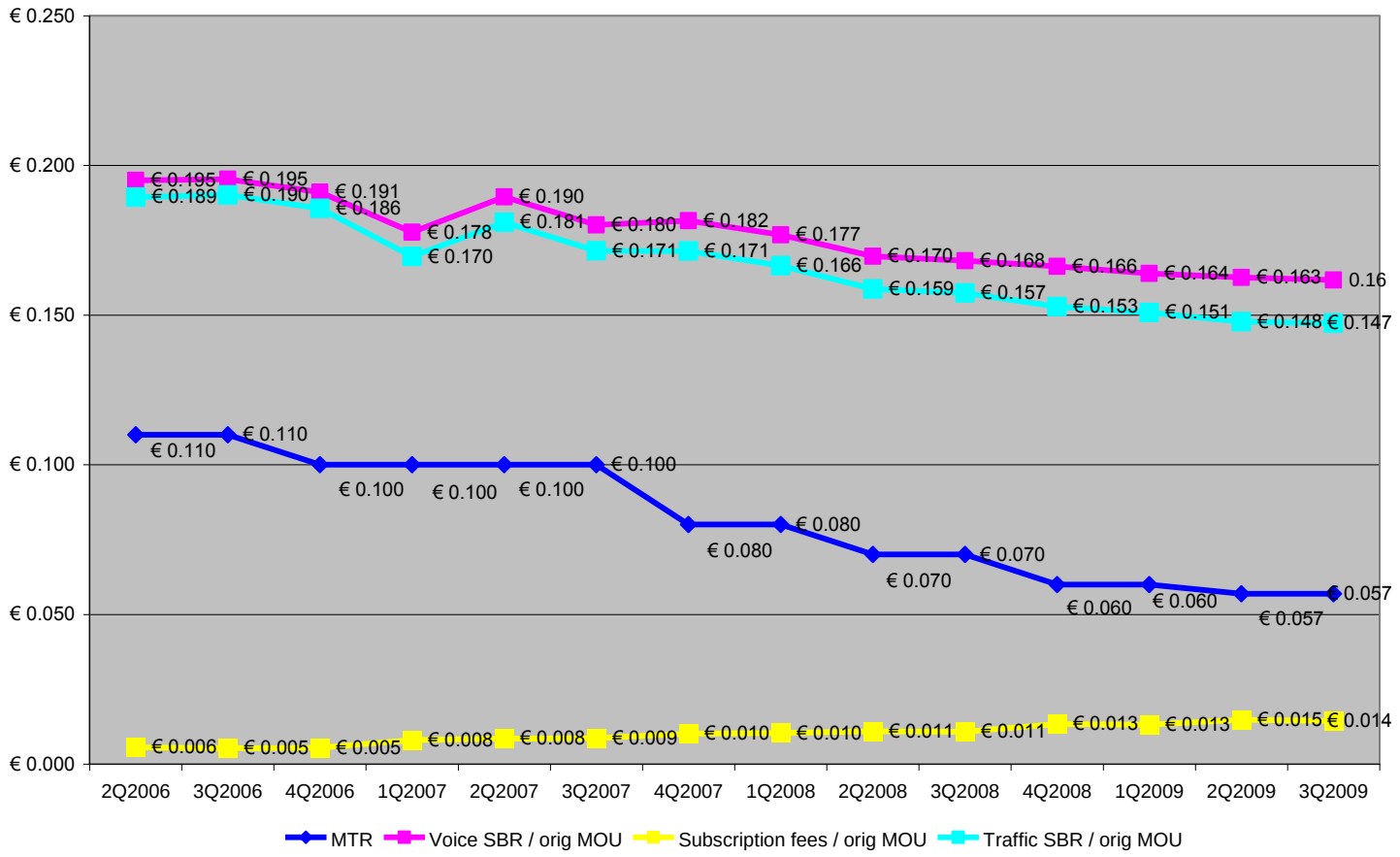


MoU and service based revenue per minute from Merrill Lynch Quarterly Wireless Matrix, as cited by the US FCC in 2008.
Merrill Lynch does not count on-net mobile terminated in CPNP countries, thus under-counting by not more than 20%.

Economic background; Wholesale and retail

Region	Arrangements	Results
US	No fixed MTR, but obligations of symmetry and reciprocity	MTRs are zero, and FTRs are low.
Europe before 2003	No regulation at all for mobile	MTRs averaged €0.20
Europe today	Cost based MTRs on an accelerated glide path	MTRs dropping, heading toward perhaps € 0.005.

Voice call termination as a two-sided market



Voice call termination as a two-sided market

- Results are a bit mixed, but a 2009 TERA study for the Commission concluded that the relationship between MTRs and retail price is positive (the opposite from what one would expect based solely on two-sided market considerations).

	Panel data	Data Sources	Years	Results
Andersen and Hansen (2007)	9 European Countries	Ovum Wireless Intelligence	2003 - 2006	Cannot reject profit neutrality
Genakos and Valletti (2008)	OECD countries	Cullen International Teligen	2002 - 2006	Negative impact of MTRs on retail prices (stronger with competition and penetration)
Veronese and Pesendorfer (2009)	39 European and other OECD countries	Oftel Teligen Merrill Lynch European Commission	2002 - 2007	Small positive impact of MTRs on retail prices (insignificant with debiased data)
Growitsch, Marcus and Wernick (2010)	16 European countries	ERG Merrill Lynch CMT	2003-2008	Positive impact of MTRs on retail prices
Littlechild (2006)	44 countries	Merrill Lynch	2005	Insignificant impact of MTRs regime on retail prices

Voice call termination as a two-sided market

- Two-sided market considerations are surely relevant here, but many factors interact in complex ways.
- Wholesale revenues represent only 15% of total mobile revenues, so the direct impact is relatively small. This limits the magnitude of two-sided market effects.
- For *Mobile-to-Mobile (M2M)* calls, the termination rate is a *cost*. Lowering the *cost* of calls in a competitive market tends to reduce the *price*.
- The fraction of calls that are M2M is increasing.
- Lowering MTRs limits the ability of large MNOs to prevent small ones from competing on price through on-net off-net price discrimination, thus enhancing competition.

On-net Off-net price discrimination

- Most MNOs outside the US charge less at retail for calls to their own customers (on-net calls) than for calls to other MNOs.
- For on-net calls, the MNO faces the real marginal cost of termination, not the (possibly inflated) MTR.
- On-net off-net price discrimination favours MNOs with large shares of subscribers.
  - For a “large” MNO, many calls remain on-net.
  - For a “small” MNO, most calls must go off-net, and therefore face the high MTR as an incremental cost.
- For any MNO, it is challenging to price below the MTR. The more you sell, the more you lose.
- A low or zero MTR enables competitors to price aggressively, and constrains on-net off-net price discrimination.
- Largely absent in the US, and disappearing in Europe.

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BEREC consultation on IP interconnection in the context of network neutrality

- “The present paper will … focus on the wholesale level of interconnection between ISPs and other intermediaries in the Internet value chain and analyse how deviations from Net Neutrality may or may not be reflected at the interconnection level governing transmission of packets across the Internet as a collection of different networks (Autonomous Systems).”

  - BEREC consultation

BEREC consultation on IP interconnection in the context of network neutrality

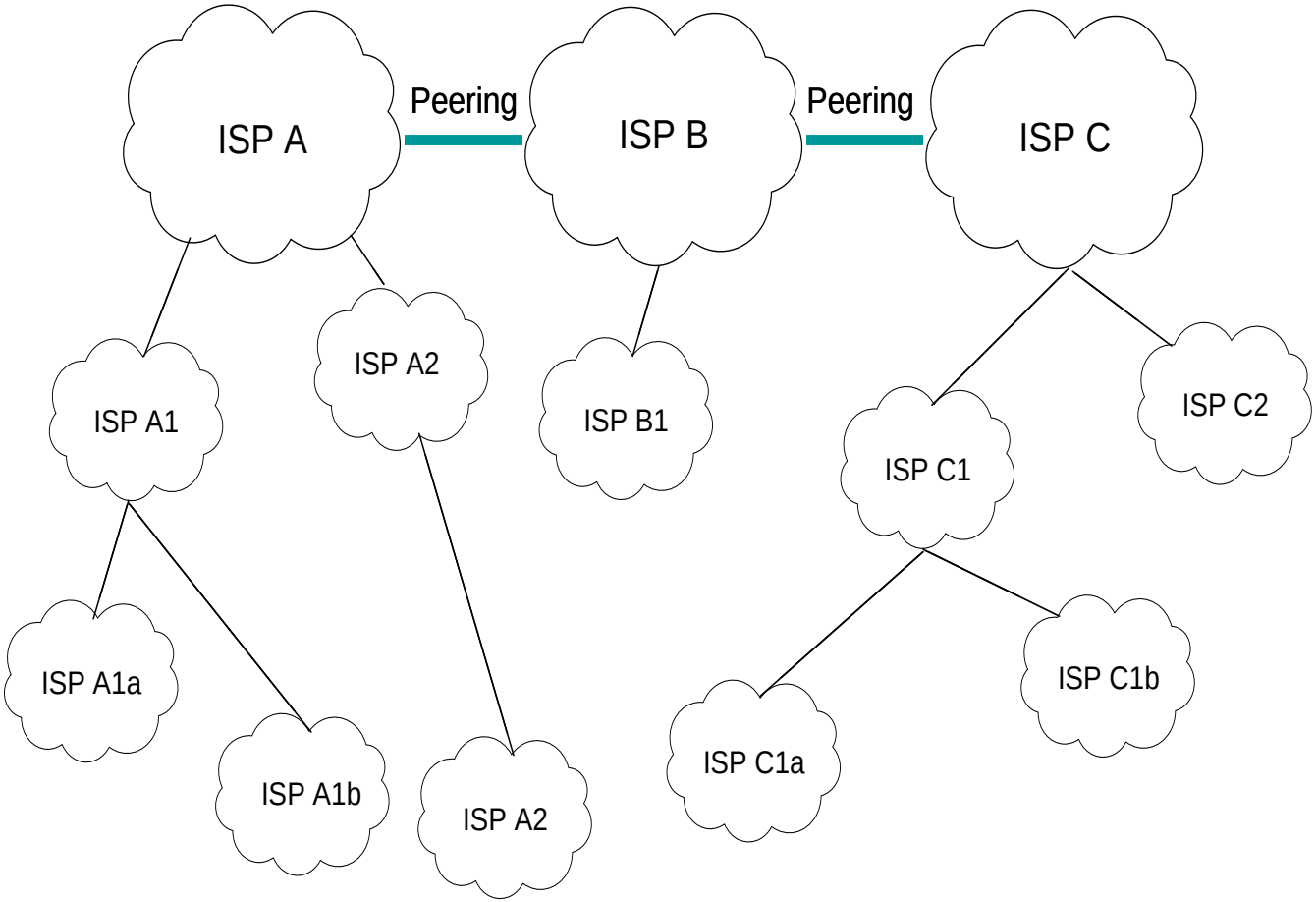
- “A violation of the Net Neutrality principle is … considered unlikely if all traffic is treated in a best effort manner. The best effort principle is reflected in today’s interconnection agreements across IP-networks taking the form of transit and peering agreements.
- However a disruption of interconnection at the wholesale level could still occur in a best effort world leading to a situation where end-users cannot reach all destinations on the Internet and, thereby potentially impacting Net Neutrality. However such instances have been few and have to date been solved in a relatively short time without regulatory intervention – also due to competitive pressure of end-users at the retail level.”

- BEREC consultation

Peering, transit, and Internet access

- Transit
  - The customer pays the transit provider to provide connectivity to substantially all of the Internet.
  - Essentially the same service is provided to consumers, enterprises, ISPs, content provider or application service providers.
- Peering
  - Two ISPs exchange traffic of their customers (and customers of their customers).
  - Often, but not always, done without charge.
- Variants of both exist.

Peering, transit, and Internet access



Possibly becoming less hierarchical over time

BEREC consultation on IP interconnection in the context of network neutrality

- “[Peering and transit] interconnection arrangements developed without any regulatory intervention, although the obligation to negotiate for interconnection applies to IP networks as well. These agreements have been largely outside the scope of activity of NRAs. This appeared justified in particular due to the competitiveness of the transit market on IP backbones.”

  - BEREC response to Commission

- “NRAs powers are thus currently limited to non-SMP instruments unless a 3-criteria test is run and a market subject to ex-ante regulation outside the recommendation list is established. These instruments include a general obligation to interconnect on a non-discriminatory basis codified in Art 5 AD.”

  - BEREC consultation

BEREC consultation on IP interconnection in the context of network neutrality

- "A literal interpretation of Network Neutrality, for working purposes, is the principle that *all electronic communication passing through a network is treated equally.* That all communication is treated equally means that it is treated independent of (i) content, (ii) application, (iii) service, (iv) device, (v) sender address, and (vi) receiver address. … There have been and will continue to be deviations from this strict principle. Some of these deviations may well be justified and in the end-user's interest but other forms cause concern for competition and society. To assess this, NRAs will need to consider a wider set of principles and regulatory objectives."

- BEREC's 'Response to the European Commission's consultation on the open Internet and Net Neutrality in Europe'

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What is QoS in an IP-based NGN?

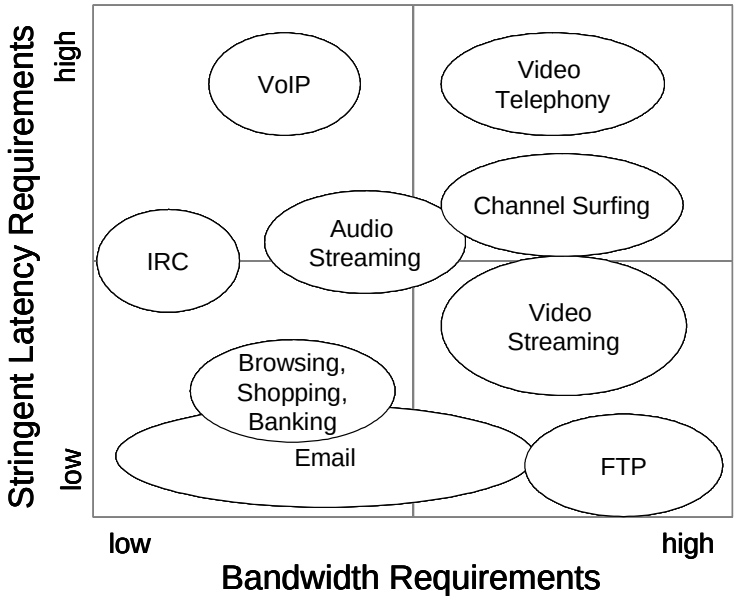
- In traditional fixed telephone networks, there tended to be a great deal of concern about blocking probability, much less about voice quality once the call was allowed to complete.
- In an IP-based system under load, packets can routinely be queued for transmission, or dropped if the queue is too long.
- These delays are not a failure mode – they are a normal aspect of Internet Protocol operation.
- What factors are most critical to the Quality of User Experience in such an environment?

What is QoS in an IP-based NGN?

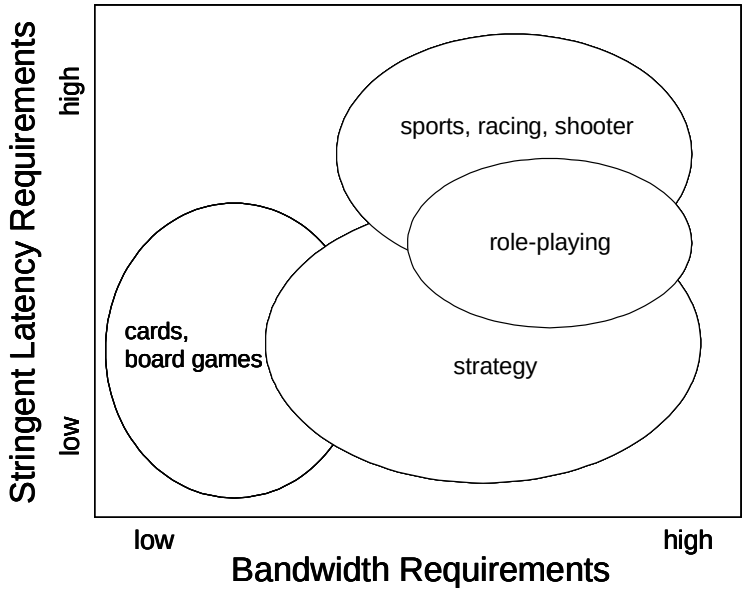
- **Bandwidth:** the maximum number of bits that a transmission path can carry.
- **Propagation delay:** The time that a packet requires, as a function of the length of all transmission path and the speed of light through that particular transmission path.
- **Queuing delay:** The time that a packet waits before being transmitted. Both the average delay and variability of delay (jitter) matter, since the two together establish a confidence interval for the time within which a packet can be expected to arrive at its destination.
- **Packet loss:** The probability that a packet never reaches its destination. This could be due to transmission errors, but errors are quite rare in modern fibre-based fixed networks. More often, packets are lost because the number of packets waiting for transmission is greater than the available storage capacity (buffers).

Differentiated Quality of Service (QoS): Application Needs

General Applications



Gaming Applications

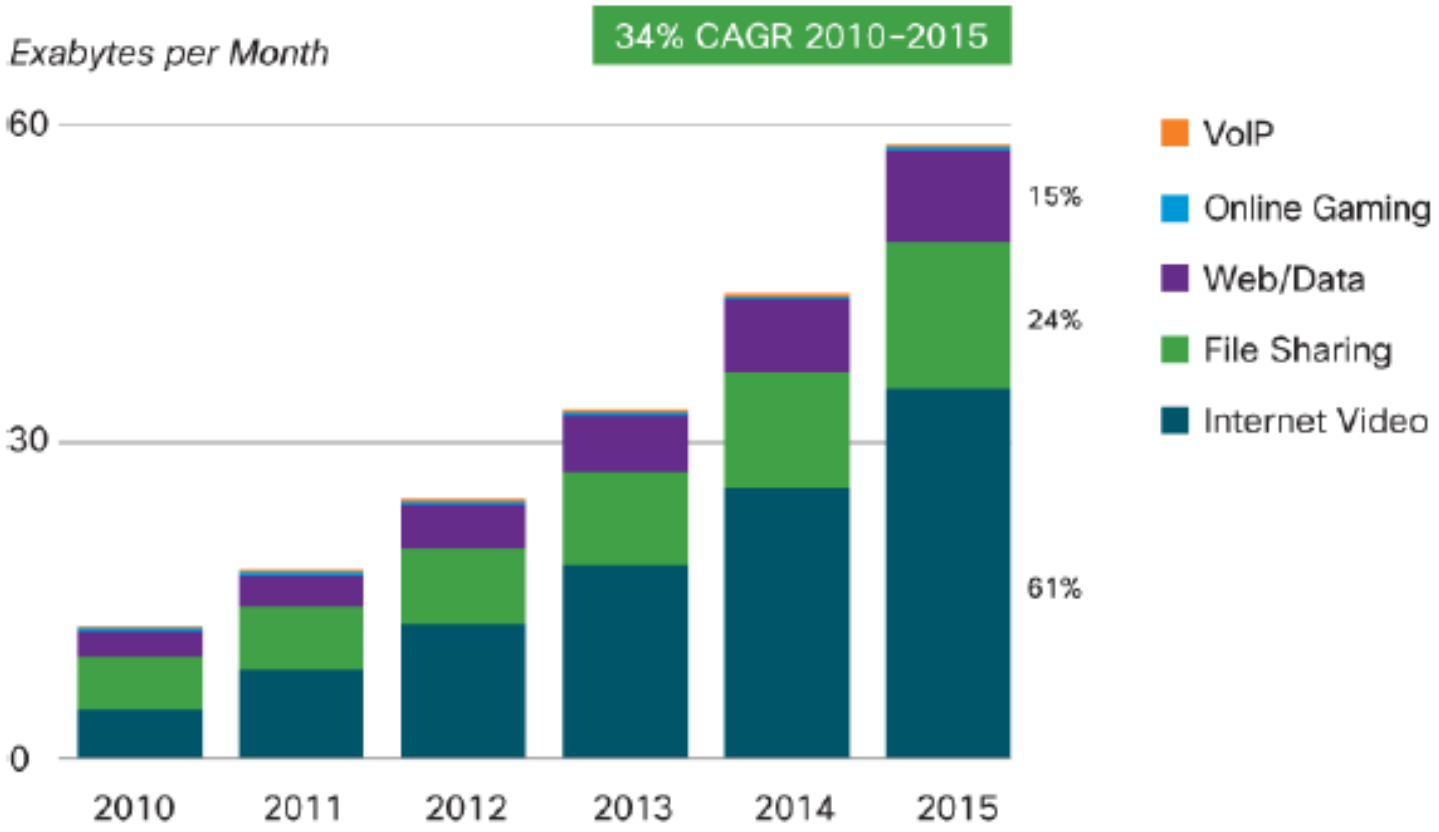


- Real time bidirectional audio: stringent requirements
- Email: liberal requirements
- Streamed audio and video: fairly liberal requirements. (Channel surfing?)

Differentiated Quality of Service (QoS): Application Needs

- For voice, if delay exceeds about 150 milliseconds, both sides may begin to speak at once.
- Not all video is delay-sensitive.
  - For real-time videoconferencing, similar considerations apply to delay; however, bandwidth requirements are far greater.
  - For streamed video, if it is permissible to wait a second or two at the outset, a jitter buffer can accommodate typical delays.
  - Interconnection is not relevant to all video. Much video is originated close to the end-user (within the end-user's own network, in order to save transmission costs.
- Certain interactive games may be highly delay-sensitive.
- Data applications tend to be less sensitive, but some (e.g. web-browsing) are more delay-sensitive than others (e.g. e-mail).

The relative weight of VoIP and Internet video



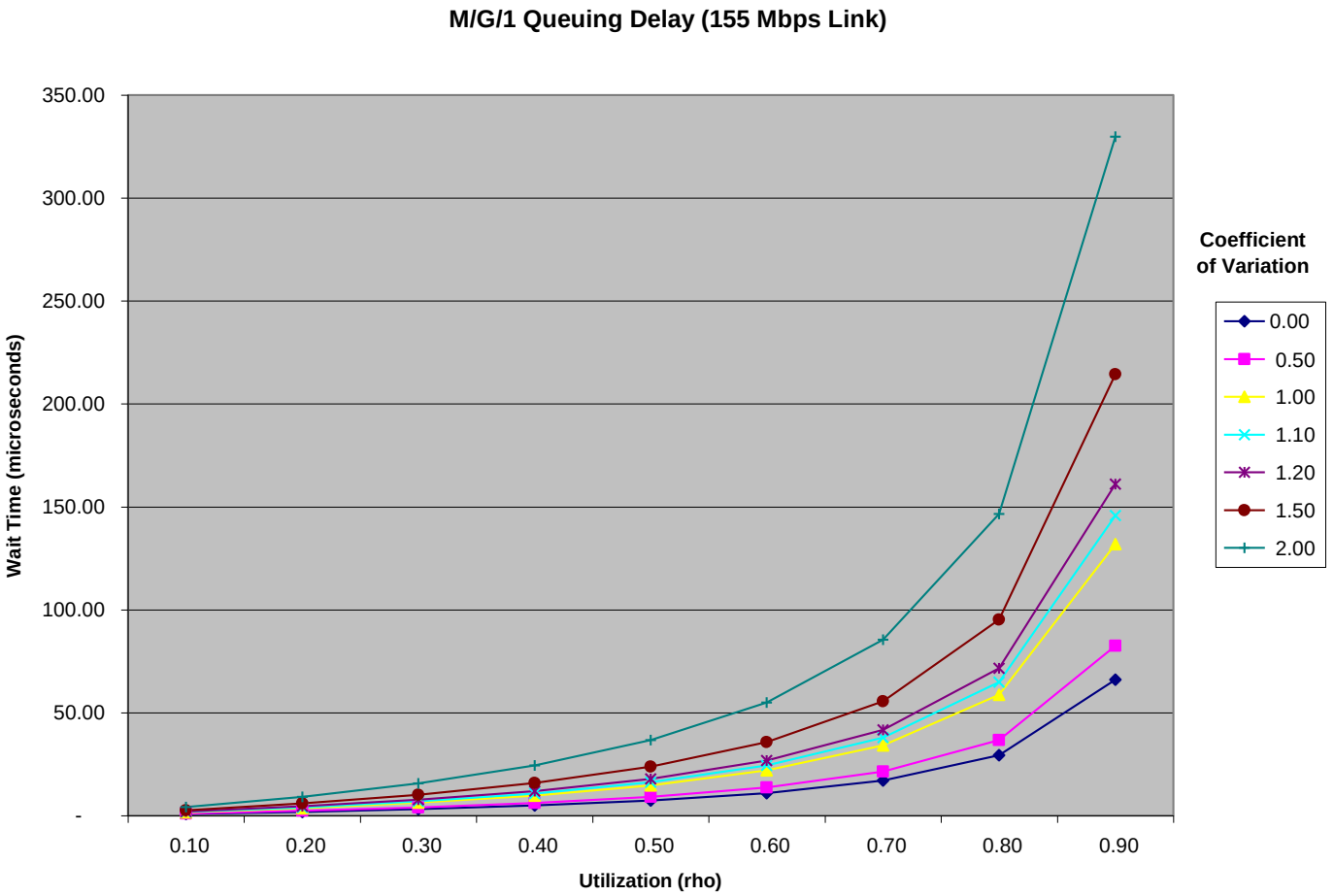
Source: Cisco (2011).

Differentiated Quality of Service (QoS)

- At a technical level, QoS is not fundamentally hard.
  - DiffServ is technically trivial.
  - MPLS in a single network is technically trivial.
  - Cross-provider MPLS is only marginally harder.
  - Even RSVP is not that hard. My former company, BBN, had working production RSVP-compliant networks in 1995!
- In terms of the basic economics, QoS is not fundamentally hard.
- Differentiated QoS *within* a network is, in fact, commonplace.
- Nonetheless, there is no significant roll-out of differentiated QoS *between* networks.

➢ ***WHY NOT?***

Economic theory and QoS issues: Differentiated Quality of Service (QoS)



M/G/1 queueing analysis of the performance ***of a single link***

(with clocking delay of 50 µsecs (284 byte packets) and a 155 Mbps link)

Implementing inter-provider QoS

- Although the technology is reasonably straightforward, little practical experience in enforcing QoS across IP-based networks.
- It is not due to a lack of standards – there are too many standards, not too few.
- Classic problem of introducing change into a technological environment:
  - Network effects – no value until enough of the market has switched.
  - Long, complex value chains.
  - Costs and complexity of transition.
- Analogous problems have slowed IPv6 and DNSSEC.

Implementing inter-provider QoS

- Efforts to extend Quality of Service (QoS) across network operators have failed to catch fire for many reasons:
  - **Scale:** Bilateral peering arrangements will tend to be acceptable to both network operators only when the networks are of similar scale, or more precisely when both networks can be expected to be subject to similar cost drivers for carrying their respective traffic.
  - **Traffic balance:** Where traffic is significantly asymmetric, cost drivers are likely to also be asymmetric.
  - **Monitoring and management:** There are many practical challenges in determining whether each network operator has in fact delivered the QoS that it committed to deliver.
  - **Financial arrangements:** There has been no agreement as to how financial arrangements should work. In particular, there has been enormous reluctance on the part of network operators to accept financial penalties for failing to meet quality standards.

Implementing inter-provider QoS

- Many efforts over the years to define inter-provider QoS standards.
- One of the best and most practical was organised by MIT, with substantial industry participation.
- The following values from the MIT white paper would appear to be resonable for IP interconnection suitable for real time bidirectional voice:

Delay:	100 msec
Delay Variance:	50 msec
IPPM Loss Ratio:	1 x 10-3 (One Way Packet Loss)

- The MIT WG white paper also explains how to measure these, and how to allocate end-to-end requirements to multiple networks. IPPM probes could be suitable.
- A challenge: No network operator will want another to operate probes within its network.

Economic considerations: network neutrality

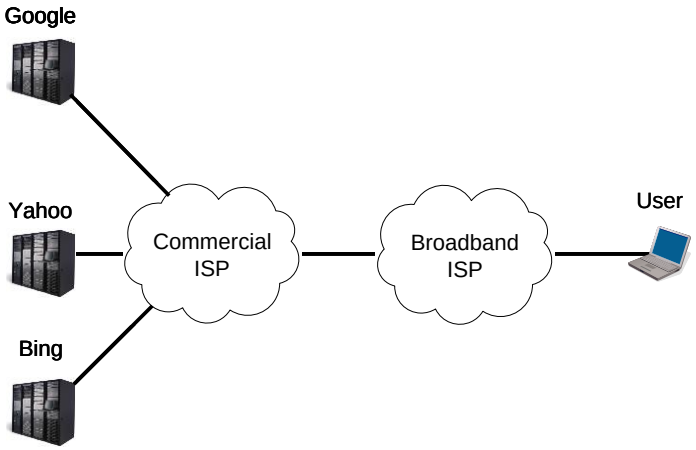
- Quality differentiation
- Economic foreclosure
- Two-sided (or multi-sided) markets

Quality differentiation

- Quality differentiation and price differentiation are well understood practices.
- In the absence of anticompetitive discrimination, differentiation generally benefits both producers and consumers.
- We typically do not consider it problematic if an airline or rail service offers us a choice between first class and second class seats.

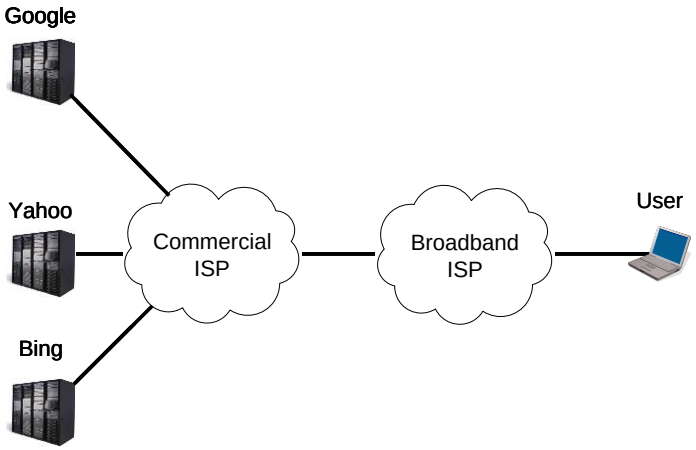
Economic foreclosure

- When a producer with market power in one market segment attempts to project that market power into upstream or downstream segments that would otherwise be competitive, that constitutes economic foreclosure.
- Foreclosure harms consumers, and imposes an overall socio-economic deadweight loss on society.



Two-sided markets

- The Internet can be thought of as a two-sided market, with network operators collectively serving as a platform connecting providers of content (e.g. web sites) with consumers.
- The ISPs *collectively* are the two-sided platform. Their interests are not aligned.
- Each side of the market pays its own ISP (or makes equivalent investments).



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Through the Looking Glass, and what Scott found there

… with apologies to John Tenniel and Charles Lutwidge Dodgson (Lewis Carroll).

A debate over content versus network transmission

- A.T. Kearney, “A Viable Future Model for the Internet” (2010):
  - “[T]hose who benefit from higher traffic volumes are those who generate traffic (typically content sites) and those who consume it (typically end users).
  - Those who have to build and operate the networks required to carry these traffic volumes earn almost no revenue from the former group and are often locked into flat rate price schemes with the latter group, continually decreasing because of retail competition.”

A debate over content versus network transmission

- In a recent white paper (asking the WCIT in Dubai to alter the ITU's International Telecoms Regulations (ITRs)), the European incumbents (ETNO) said:
  - "ETNO is not asking for increased regulatory intervention but aims to establish a reference for commercial negotiations."
  - "ETNO [seeks a new model for interconnection that would] acknowledge the challenges of the new Internet economy and the principles that fair compensation is received for carried traffic and operators' revenues should not be disconnected from the investment needs caused by rapid Internet traffic growth."
  - "The goals for the new interconnection models are: enable incremental revenues by end-to-end QoS pricing and content value pricing; …"

Network Operators and Content Providers: Who Should Bear the Cost?)

- This debate has deep roots:

  "The chief executive of AT&T, Edward Whitacre, told *Business Week* last year that his company (then called SBC Communications) wanted some way to charge major Internet concerns like Google and Vonage for the bandwidth they use. "What they would like to do is use my pipes free, but I ain't going to let them do that because we have spent this capital and we have to have a return on it," he said."

  NY Times, March 8, 2006

A debate over content versus network transmission

- How rapid is Internet traffic growth?
- How are costs growing over time?
- Do flat rate price schemes for those who consume content imply that prices necessarily decrease over time?

The perils of rapid growth in Internet traffic

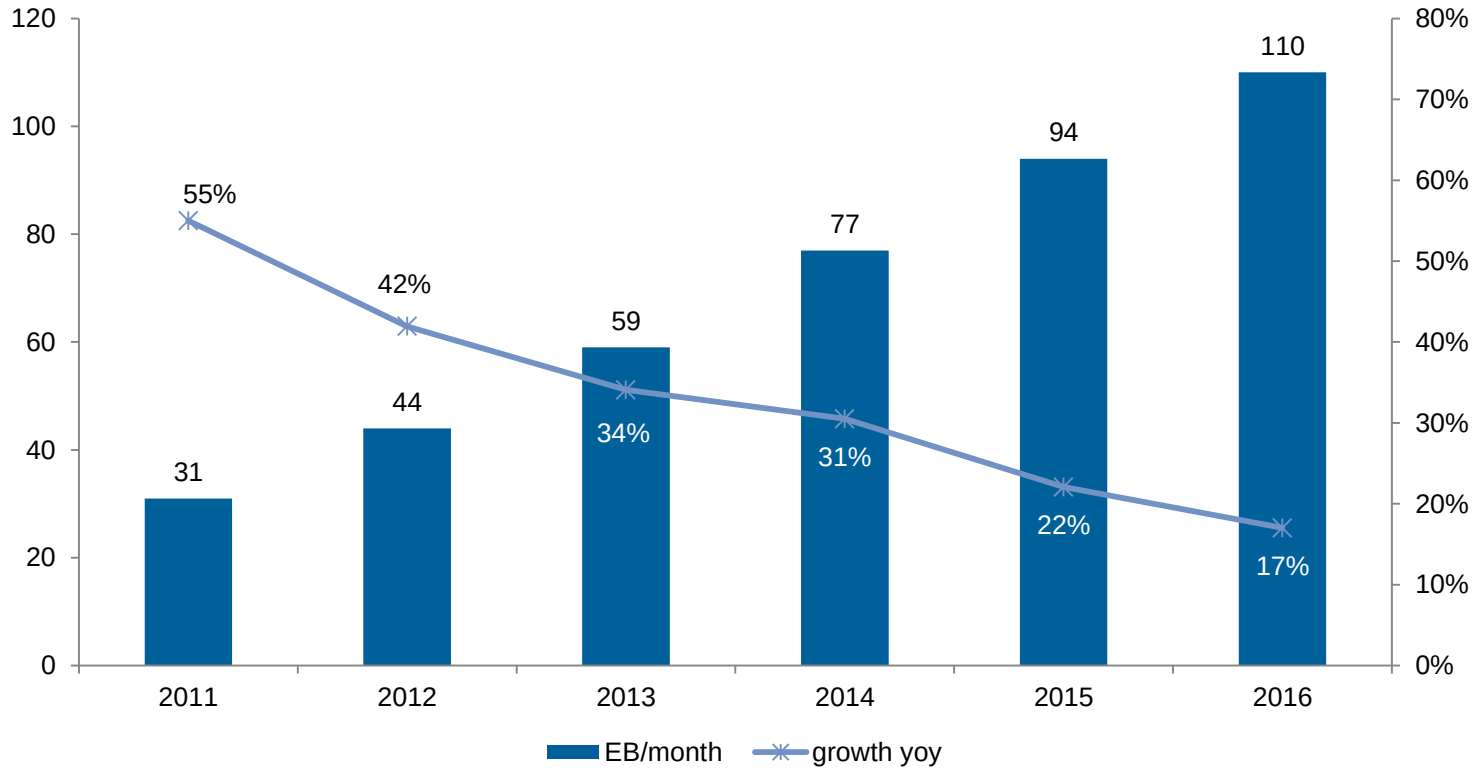
… with apologies to John Tenniel and Charles Lutwidge Dodgson.

Rapid growth in Internet traffic?

- Traffic volumes for Internet Protocol (IP) traffic are increasing, both for fixed and for mobile networks, but the percentage rate of increase is declining over time.
- The number of fixed broadband subscribers continues to increase, as does the number of mobile users who use data services.
- Traffic growth is largely a function of:
  - an increase in the number of subscribers, and
  - an increase in traffic per subscriber.
- Some costs are largely driven by the number of subscribers, and are largely independent of usage per subscriber.

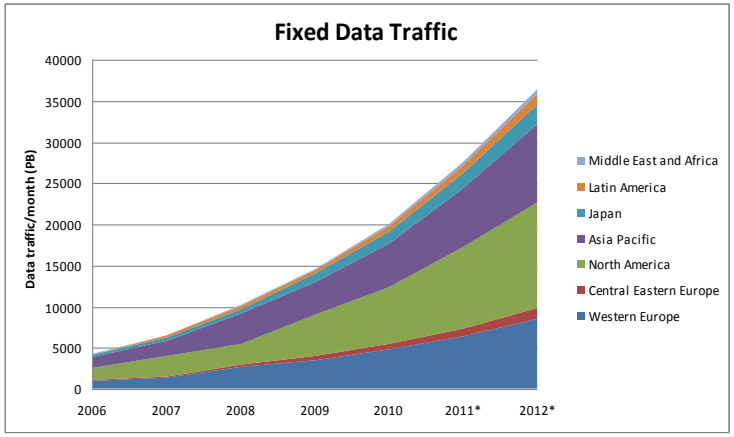
Rapid growth in Internet traffic?

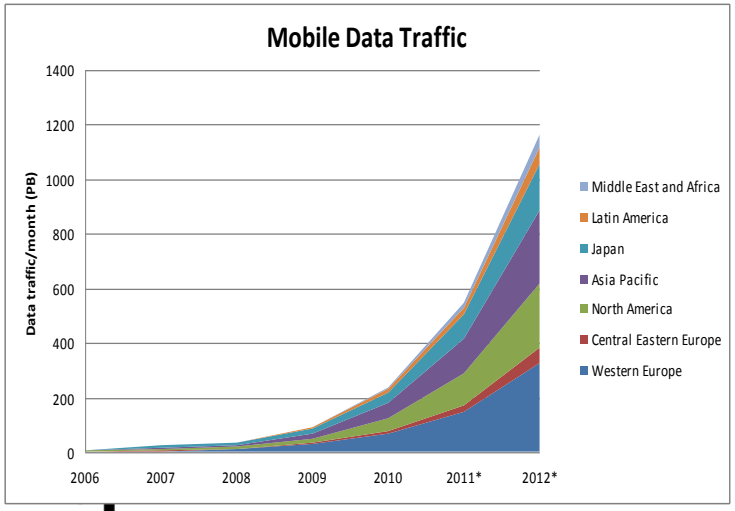
- Traffic continues to grow, but the global rate of growth in percentage terms is declining over time.



Source: Cisco (2012), WIK calculations.

Rapid growth in Internet traffic?





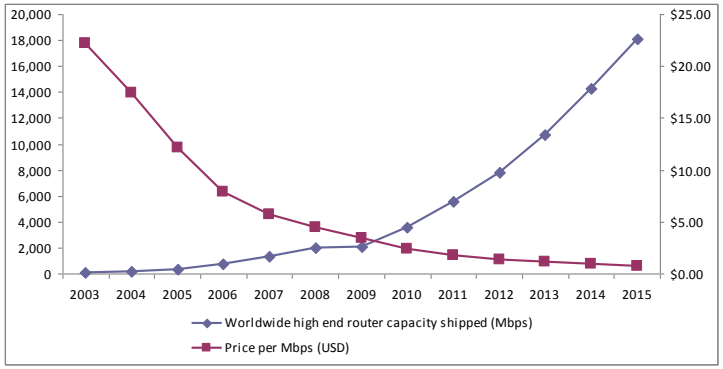
Traffic is indeed increasing in both the fixed and the mobile networks.

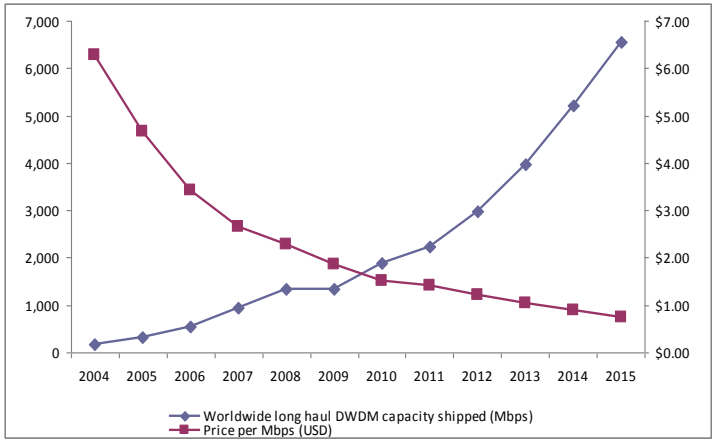
Source: Cisco (2011), WIK calculations.

Internet traffic growth drives increased investment needs

… with apologies to John Tenniel and Charles Lutwidge Dodgson.

Rapid Internet traffic growth drives investment needs





Here we have the shipment quantities in Mbps and the price per Mbps (USD) for high end routers and for long haul DWDM optoelectronic equipment.

These are among the key cost drivers for Internet core and aggregation networks.

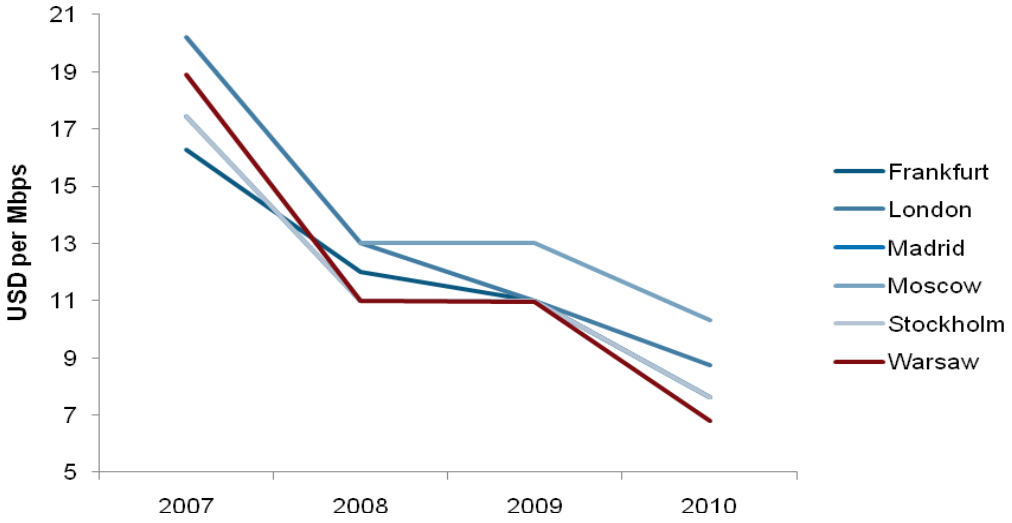
The growth in shipments generally tracks the Cisco projections.

The growth in *shipment volume* does not equate to a growth in *costs*, because the decline in unit costs is nearly in balance with it.

Source: Dell'Oro (2011), WIK calculations.

Rapid Internet traffic growth drives investment needs

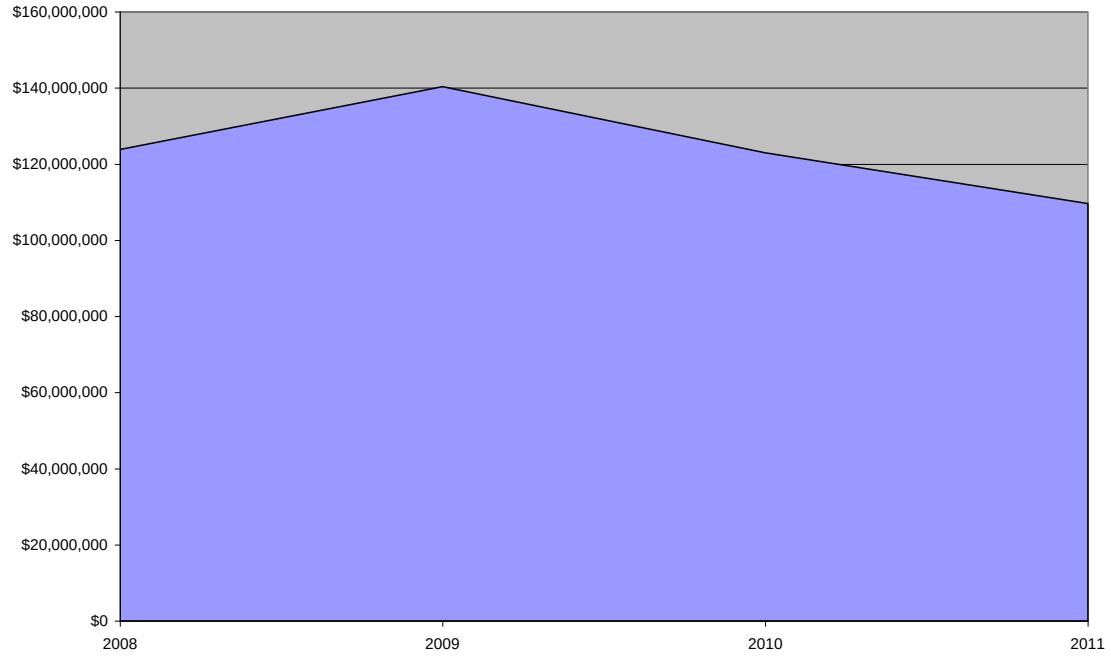
- Meanwhile, unit prices for global transit are declining rapidly.
- This decline reflects not only equipment costs but also circuits (over land and under water).
- Labour and other OPEX elements play only a small role, since they depend mostly on the number of subscribers.



Source: Telegeography (2011), WIK calculations.

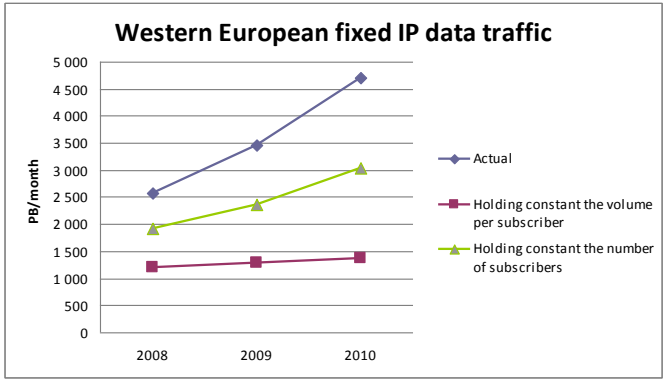
Rapid growth in investment needs driven by Internet traffic growth

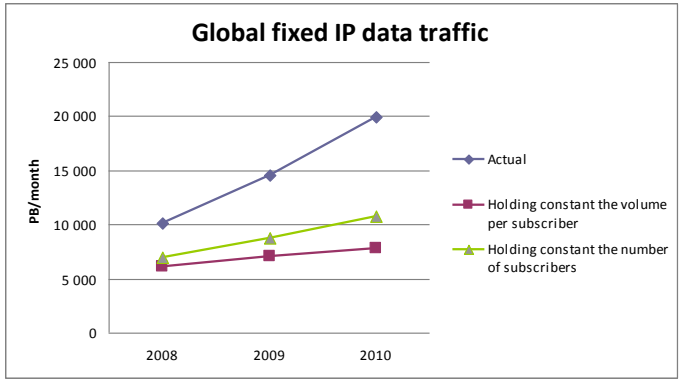
- The monthly cost of carrying every bit of Western European Internet traffic, including growth, is flat or declining (and small in any case).
- Any self-supply is presumably cheaper than buying transit.



Source: Cisco (2011), Telegeography (2011), WIK calculations.

Rapid Internet traffic growth drives investment needs





Internet traffic growth is partly a response to increased use of Internet applications and content, and partly a result of increase in the number of subscribers.

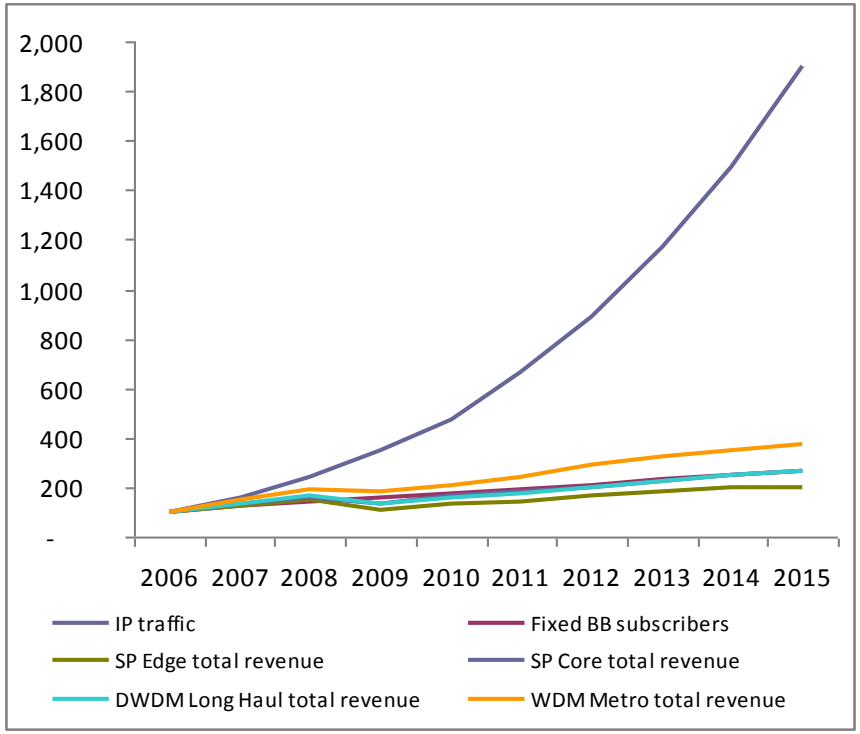
It is possible to distinguish between these two effects.

The effects on network operator profitability can be quite different. Increases in the number of subscribers equate to increased revenues.

Source: Cisco (2011), OECD (2011) WIK calculations.

Rapid Internet traffic growth drives investment needs

- This is consistent with the trend in underlying equipment costs, which tracks with subscribership and revenue, not with the volume of traffic.

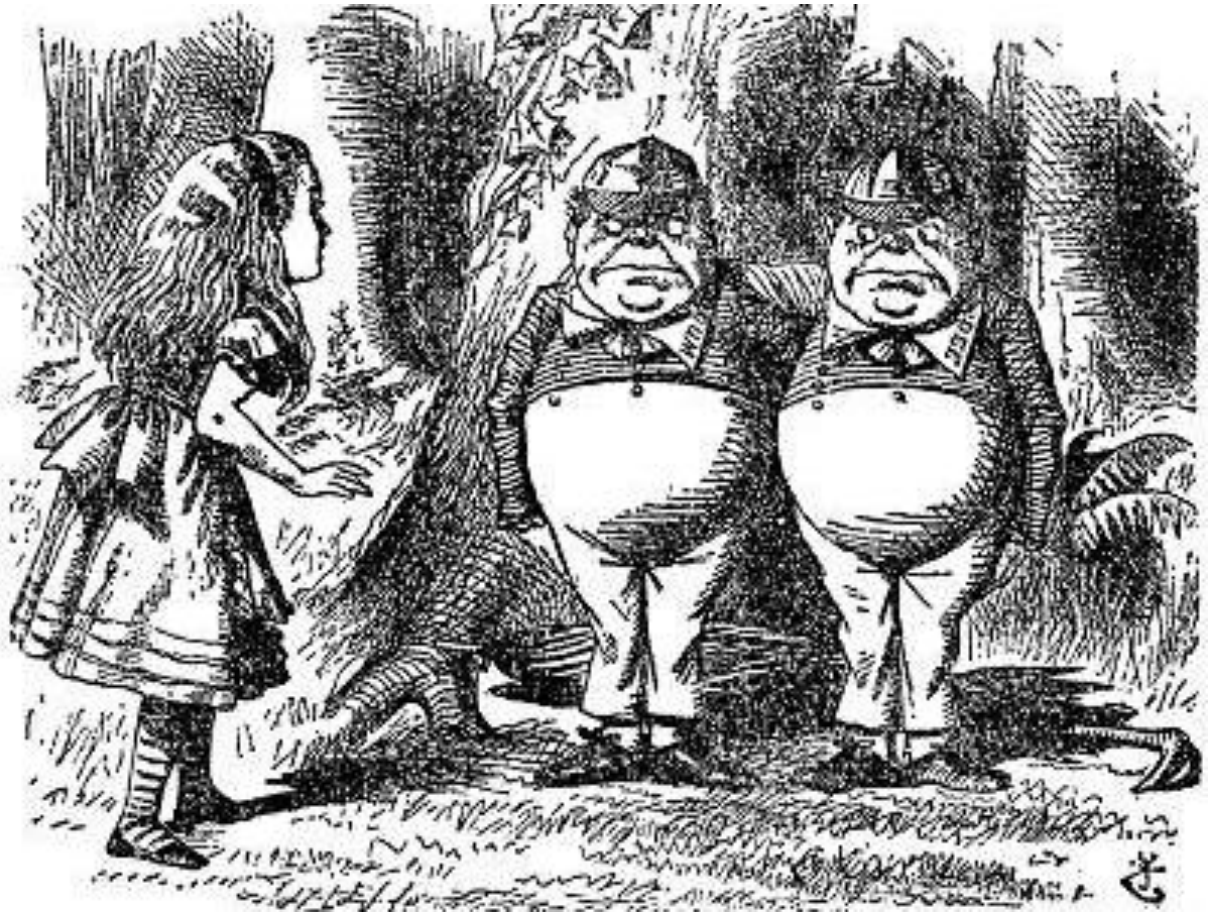


Source: Dell'Oro (2011), Cisco (2011), WIK calculations.

BEREC findings

- “[Content and application providers] make substantial payments for hosting and connectivity. Furthermore they pay for CDN services that bring content closer to the [consumer]. Therefore different from what is sometimes alleged by some telcos in the Net Neutrality debate there seems to be no free-riding problem. This holds even for those [content providers] that stick to their core activity which is the provision of content and/or applications without further vertically integrating along the value chain. Therefore BEREC conjectures that everything is covered and paid for in the Internet value chain (from content providers to the [users]).”

  - BEREC consultation

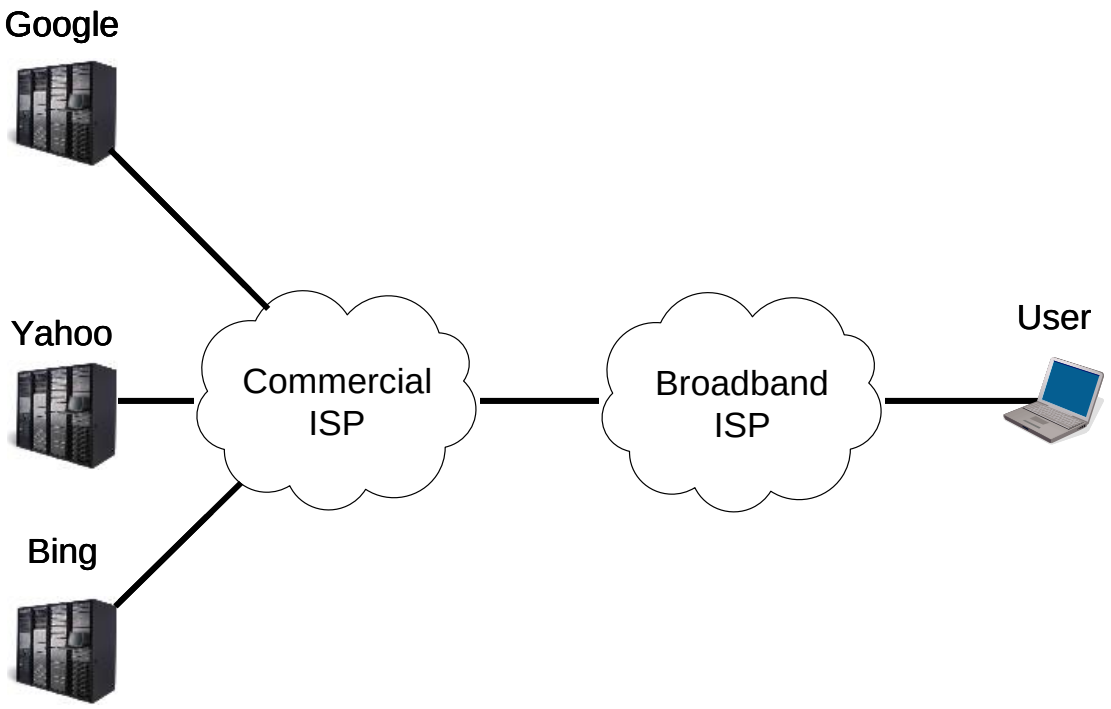


Two-sided markets

… with apologies to John Tenniel and Charles Lutwidge Dodgson.

Two-sided markets

- Recall that the objective in a two-sided market is to enhance societal welfare by maximizing participation and usage externalities.



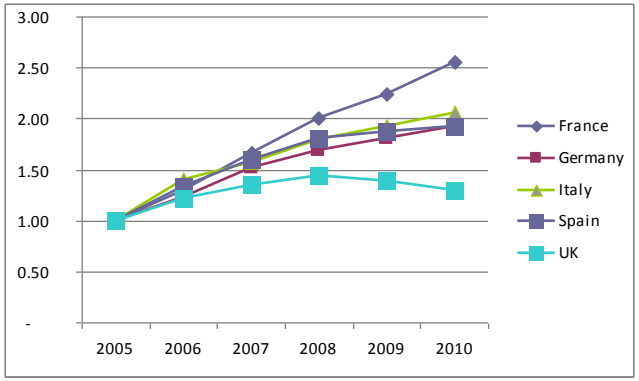
Two-sided markets: Price signals

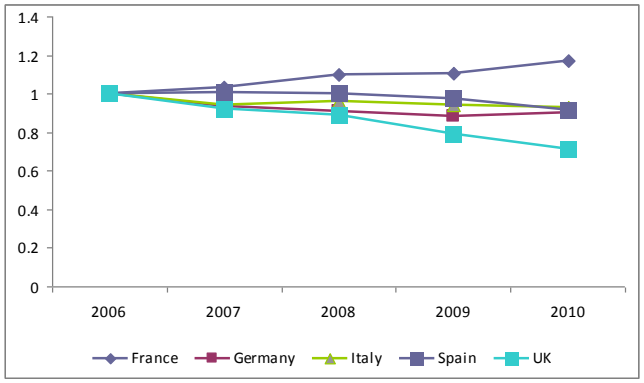
- For many reasons, prices signals *should* be stronger to consumers than to content producers.
- Cost causation in the Internet is far more complex than in the traditional telephone network, but most decisions to consume content are made by the consumer.
- It is the consumer who decides to download a video – the content provider merely makes the content available.
- It is therefore entirely appropriate that the consumer be subject to stronger price signals than the content provider.

Two-sided markets: Price signals

- A large fraction of the cost of data transmission and receipt is associated with last mile access.
- The consumer decides how fast a broadband access is desired, and pays accordingly.
- The same is true of the content provider, but access benefits from huge economies of scale. Large content providers benefit from economies of scale in nearly all aspects of their operation.
- Once the access facility is in place, costs are largely independent of the volume of data. Truly usage-dependent costs typically represent a small fraction of the total costs of data transmission and receipt.
- For consumers to pay higher unit prices for data transmission than large content providers is not an anomaly. It is an expected and desirable result.

Two-sided markets and consumer WTP





Total fixed broadband subscriber revenue is increasing at a rate that reflects the growth in subscribership.

Fixed broadband subscriber revenue per subscriber (ARPU) is fairly steady.

The retail unit price is stable because underlying costs are stable.

Prices seem to move in both directions.

The end of unlimited mobile flat rates in the US demonstrates that prices can increase, even under a flat rate.

Source: IDATE data (2011), WIK calculations.

Two-sided markets and NGA

- Through the EU 2020 strategy, Europe seeks to achieve availability of 30 Mbps broadband to all Europeans by 2020, with half of all broadband consumers served at speeds of 100 Mbps or more.
- Consumers have only limited interest in NGA at present – incremental willingness to pay for ultra-fast broadband is only about € 5 per month, which is nowhere near enough to fund the initial investment needed in most parts of the national territory.
- Most estimates of the investment needed are in the neighbourhood of € 200 – 300 billion.

Network Type	Cost per home accessed [in €]					
	DE	FR	SE	PT	ES	**IT**
VDSL	457	n.v.	352	218	254	**433**
PON	2,039	1,580	1,238	1,411	1,771	**1,110**
P2P	**2,111**	**2,025**	**1,333**	**1,548**	**1,882**	**1,160**

Source: WIK (2008).

Two-sided markets and NGA

- Determining the right balance of payments in a two-sided market is complex. Many factors would need to be considered, including externalities and demand elasticities.
- The focus for NGA deployment and adoption to date has been on the *supply* side, not on the *demand* side.
- If one were going to take a two-sided market approach to NGA deployment, the optimal flow of payments could just as well be from network operators to content providers (i.e. in the opposite direction from that which has been suggested).
- If consumers are not convinced that ultra-fast connectivity is worth what it would cost, there is a clear need for more high value high bandwidth content.
- Without rigorous analysis, the answer is indeterminate.

Interconnection and Two-Sided Markets

- Introduction
  - Interconnection in an evolving world
  - Two-sided markets
  - Applications of two-sided markets to interconnection
- Voice call termination as a two-sided market
- BEREC's consultation on IP interconnection in the context of Net Neutrality
  - IP interconnection and differentiated QoS
  - A debate over content versus network transmission
- Concluding remarks

Concluding Remarks: Voice interconnection

- Bloated wholesale termination charges lead to bloated retail charges.
- By bringing termination rates in line with real costs, Europe is moving in a direction that is likely to enhance consumer benefits and overall societal welfare.

Concluding Remarks: Network Operators and Content Providers

- Total fixed network costs are increasing, as usual.
- The rate of total fixed network costs appears to be in balance with the rate of increase in subscribers, for at least some network operators. This means that the cost per user is relatively stable.
- Total retail revenue for fixed broadband has increased in proportion to the number of subscribers. Traffic growth driven by an increase in the number of subscribers should therefore raise no concerns.
- If costs had increased markedly, prices would have increased. Retail prices tend to move up or down in response to underlying costs, in this market as in most healthy competitive markets.

Concluding Remarks: Network Operators and Content Providers

- The growth in mobile Internet traffic is quite stunning.
- Costs will likely increase near term (e.g. fibre to cell sites).
- All indications are that mobile network operators can and will find ways to adjust their retail prices to keep them in balance with their costs, provided that regulators do not prevent them from doing so.
- Price increases for mobile data should not necessarily be viewed as indicating market failure.
- In both the fixed and mobile networks, it is important that regulation not interfere with non-discriminatory QoS-aware commercial arrangements among willing parties.
- “Generally, QoS classes at the network layer can be welfare enhancing as long as [consumers] can make an informed decision. This requires transparency.” - BEREC consultation

Concluding Remarks: Two-Sided Markets

- The two-sided market analysis, as synthesised by Tirole and Rochet (2004 et seq.), is a useful way of looking at a number of topics in the regulation of electronic communications.
- The goal is to maximise participation and use of services.
- These systems are complex! Two-sided considerations are not necessarily all that is going on, and may not be the most important thing that is going on.
- Serious analysis would require serious work!
  - It would depend on a very full understanding of interactions and elasticities.
  - Full analysis is rarely feasible.
- Avoid jumping to hasty conclusions!

References

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