

Body of European Regulators
for Electronic Communications

BEREC

The logo graphic consists of two horizontal lines, one blue and one red, that curve downwards in the center. A blue arc starts under the 'B' and ends under the 'E', while a red arc starts under the 'E' and ends under the 'C'.

An assessment of IP interconnection in the context of net neutrality

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Context I

- 3 BEREC Documents consulted until 31 July 2012 in the scope of Net Neutrality
 - **NGN “IP interconnection & NN”** is an assessment of IP interconnection markets and economic relationships between operators in the context of Net Neutrality.
 - **CEA “Competition issues & NN”** is an economic analysis about which practices may cause harm to the end users, and under which conditions.
 - **QoS Guidelines** are about assessing "degradation of service" and the conditions and ways to use the new art. 22.3 USD, i.e. how to intervene when deemed necessary.

Context II

- Previous ERG/BEREC Documents on IP interconnection
 - ERG (07) 09: **Report on IP interconnection**
 - ERG (08) 26 **Common Statement on Regulatory Principles of IP-IC/ NGN Core**
 - BEREC (10) 24 rev1: **Common Statement on Next Generation Networks Future Charging Mechanisms / Long Term Termination Issues**

- ERG/BEREC worked quite extensively on the role of IP-interconnection in the context of transition from PSTN to NGNs emphasising
 - Separation of network and application layer
 - Importance of charging principles
 - CS 2010: BEREC considers BAK more promising than CPNP for (voice) termination in the long term.

Scope and outline (I)

- Focus of the paper is on the wholesale level of interconnection between ISPs
- Interconnection arrangements between networks are not directly related to net neutrality as long as all traffic flows are treated equally (BEREC NN-Response to COM)
- A violation of net neutrality is therefore considered unlikely if all traffic is treated according to the best effort principle.

Scope and outline (II)

- The best effort principle is reflected in today's interconnection agreements across IP-networks taking the form of transit and peering agreements.
- 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 any significant regulatory intervention – also due to competitive pressure of end-users at the retail level.

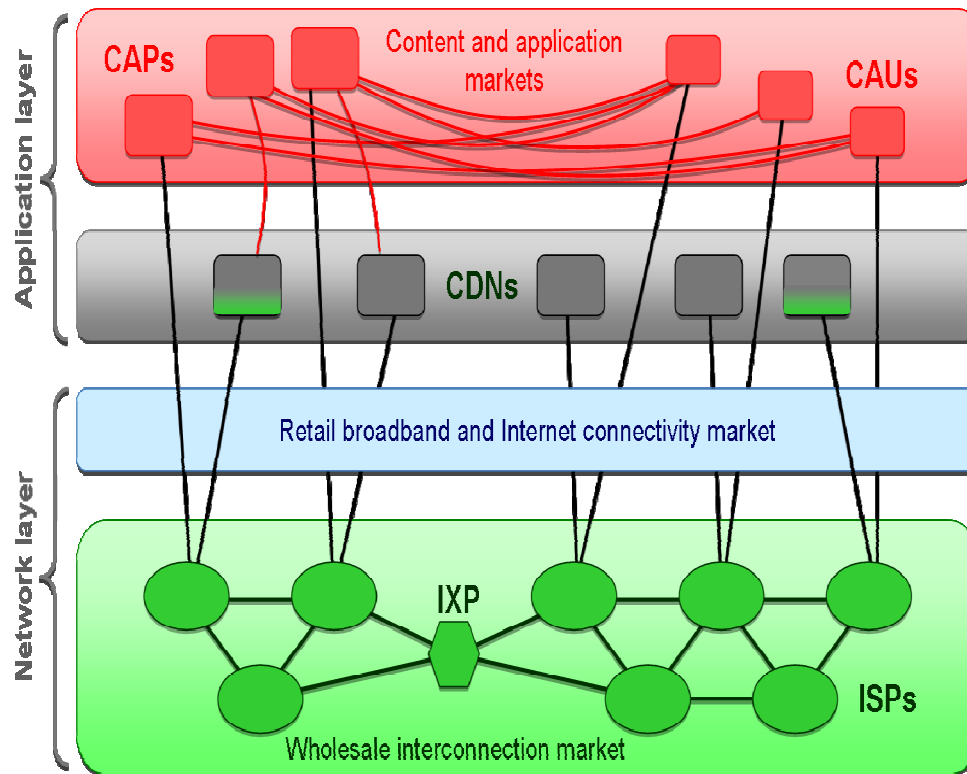
Structure

- Chapter 1: Introduction (scope and outline)
- Chapter 2: describes the different players across the value chain (end-users, Content and application providers as well as Content and application users, Internet Service Providers and Content Distribution Networks) and relating them to definitions used in the Framework.
- Chapter 3: describes different types of interconnection such as peering and transit
- Chapter 4: describes recent changes along the value chain (traffic evolution, pricing and costing, revenue flows, players etc.)
- Chapter 5: Regulatory context
- Chapter 6: Hypotheses / Conclusions

The paper contains 24 questions for the public consultation

Categories of electronic communications services in the value chain

Main functionalities performed by different players:



Content and application providers (CAPs) and Content and application users (CAUs) act as producers and consumers on “content and applications markets” (red lines)

Content and distribution networks (CDNs) sell their services to CAPs (red line) and usually buy wholesale services from Internet Service Providers (ISPs) (black lines).

ISPs as network providers sell connectivity to CAPs and CAUs (indicated by the black lines) through “retail broadband and Internet connectivity markets” (blue area)

ISPs interact with each other on “wholesale interconnection markets” (green area, black lines)

Separation of network and application layers

- ... is a characteristic feature of the best effort Internet having enabled innovation and growth:
 - Over the top provision implies that CAPs and CAUs can interact at the application layer including interconnecting their applications without involvement of the network providers.
 - At the network layer incoming and outgoing packets are treated equally, therefore direction of traffic flow is of no importance.
 - No need to distinguish origination and termination at the network layer, i.e. for transit and peering
 - Direction however relevant for interconnection at the application layer

Transit and Peering

- Costs and revenues
- Peering requirements
- Decision to peer or to buy transit
- Secondary/donut/regional peering
- Internet Exchange Points
- Default traffic transfer strategy: the best-effort principle

QoS Interconnection across networks?

- QoS traffic classes across interconnected networks enabling end-to-end IP services hardly exist in practice.
- In best effort networks alternative mechanisms - compared to the strategies followed in networks offering enhanced quality - for improving end-to-end network performance have been developed. Examples are
 - Endpoint based congestion control for reduction of the traffic load,
 - Internet Exchange Points and
 - increased use of peering.
 - Also CDNs are used to improve the CAUs perception of an application's quality (QoE) – storing data more locally contributing to a reduction of latency.
- QoS differentiation potentially leading to deviations from net neutrality mostly occurs within the ISP's network providing connectivity to the end users.

QoS Interconnection for specialised services

- Closed IP networks relying on admission control
- Integration of network and application required
- Typically for services like business VPN and IP-TV
- No interconnection across networks if the specialised service is provided by the access provider
- Future interconnection regime for voice?
 - Dedicated resources instead of internet connectivity?
 - No agreements on binding quality performance objectives in sight
 - Some operators intend to establish Calling Network Party Pays?

Trends along the value chain I

- A number of observations with regard to traffic evolution, traffic type, development of IXs, costs, price trends are made
- The emergence of hyper giants (Google etc....), the emergence of CDNs, the increasing role of regional peering related to the decreasing role of IP transit providers contributed to the flattening of the Internet topology.
- Increasingly large Eyeball ISPs acquire Tier 1 status

Trends along the value chain II

- The Internet ecosystem has managed to adapt IP interconnection arrangements to reflect (inter alia) changes in technology, changes in (relative) market power of players, demand patterns and business models. This happened without a need for regulation.
- Both sides of the market, namely CAPs and CAUs contribute to pay for connectivity to the Internet. No free riding but everything covered in the Internet value chain.
- Whether an ISP can exploit the physical bottleneck for traffic exchange depends on
 - whether the charging mechanisms entitles the ISP to a payment at the wholesale level out of its monopoly position and
 - the degree of competition at the retail level.

Regulatory Issues I

- The current Regulatory Framework foresees an obligation to negotiate interconnection on a non-discriminatory basis (Art. 5 AD). However it does not provide a legal basis for mandating free peering.
- The market has developed very well so far without any significant regulatory intervention.
- Disruptions in IP-interconnection due to disputes between ISPs potentially lead to a situation where not all destination of the Internet may be reached. However such instances have been few and have to date been solved in a relatively short time without any significant regulatory intervention – also due to competitive pressure of end-users at the retail level.

Regulatory Issues II

- Since the early days of the Internet there have been constant changes in the respective markets along the value chain - involving new types of players as well as new types of interconnection arrangements. NRAs need to better understand these markets.
- Depending on MSs' respective situations, NRAs may take different approaches: At this point in time some countries consider data gathering exercises useful whereas most others do not consider them appropriate unless concrete problems or requests occur.
- Any measure could potentially be harmful, so that it should be carefully considered.

Next Steps

- Public Consultation ongoing with the other NN-related documents until 31 July 2012
 - Important questions
 - Role of imbalance of traffic flows
 - Empirical evidence of paid peering?
 - Will traffic classes develop across networks?
 - Role of CDNs for improving QoE, backward integration
 - Interconnection for specialised services across networks??
- We are looking forward to receive your comments!
- Adoption of the final report at 4th BEREC Plenary in December 2012