Open ContEnt Aware Networks

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Workshop "Optimization of Network Resources for Content Access and Delivery"
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www.ict-ocean.eu

Agenda

- Introduction (/ reminder) about OCEAN project
- Business models
- OCEAN Architecture for FTTx and xDSL access networks
- Conclusion
  - Key take-aways. Questions/answers

Introduction to OCEAN
OCEAN Project

- European project FP7 OCEAN (2010/2013), coordinated by Orange Labs, Concentrates on the future of audiovisual content delivery

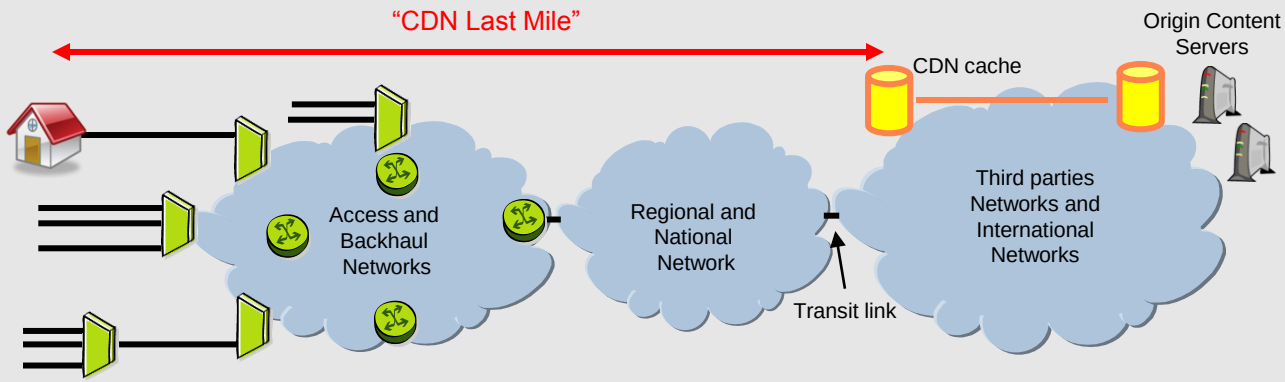
- Consortium members

Alcatel-Lucent	Belgium	Industry
European Broadcasting Union (EBU)	Switzerland	Content providers
France Telecom (Coordinator)	France	Telco
Fraunhofer HHI	Germany	Research institute
IBBT	Belgium	Research institute
IDATE	France	Market Intelligence, SME
N2NSoft	France	Research SME
PRISM	France	University
Telekomunikacja Polska (TP)	Poland	Telco and CDN provider

Introduction to OCEAN
Context and Challenges

- Tremendous evolution of online multimedia content delivery
  + 50 to 60% traffic volume growth per year the last 5 years
- Key role of CDN players in the Internet
  1/3 of all Internet traffic delivered through a CDN
- ... And shortcomings
  - QoS and network cost in the "CDN last mile"
  - Lack of Openness in Content Delivery Systems
  - Current state of the art leaves large space for innovation, traffic reduction and QoS improvement
  - Business challenges (network & CDN intercos, services & regulation evolution)

Typical CDN deployment for online content delivery



Introduction to OCEAN
Objectives

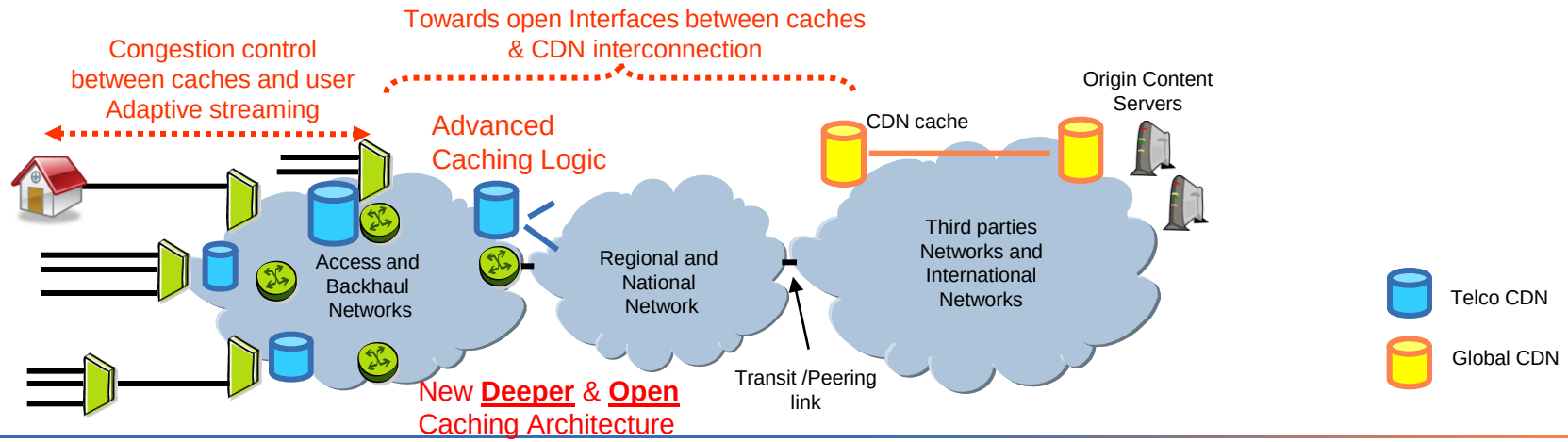
1) Technical framework for Open ContEnt Aware Networks
- Allowing to cache content closer to the terminal client than the traditional CDNs do
- Enabling CDN interconnection between Telco CDNs and Global CDN

2) Technical innovations on key CDN building blocks
- Popularity tracking and caching logics, content aware congestion control

Focus of today's presentation

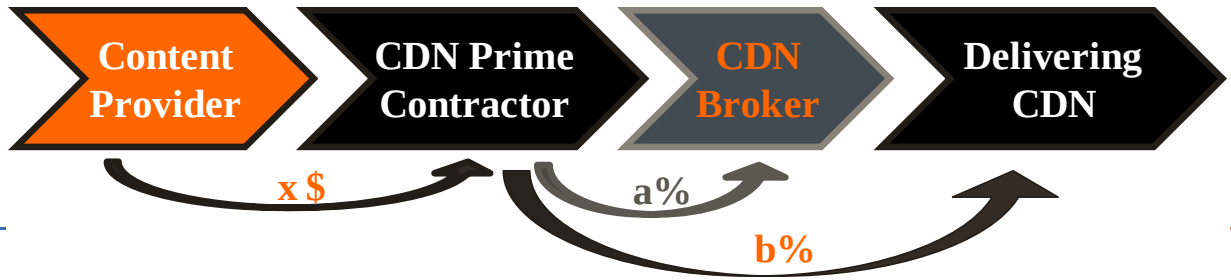
3) Organic instantiations over existing access networks
- Cost models and analysis to study how to best position and dimension CDN nodes

4) Business models and go-to-market strategy
- Enabling the different types of players to migrate to OCEAN target and get better investment incentives



OCEAN Business Models
Challenges

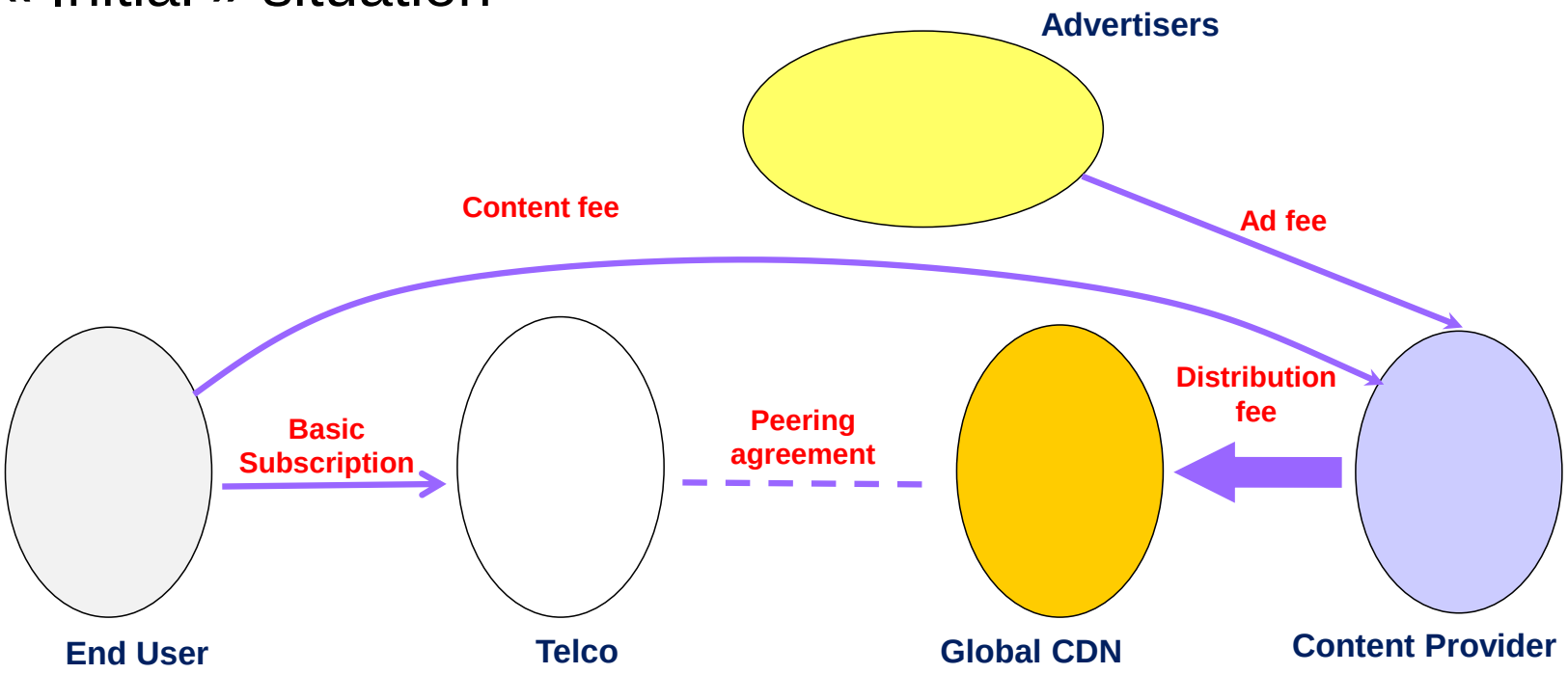
- **Many players involved, with different incentives and requirements**
  - **Pure CDN players and Telcos**
    - Need to federate CDNs deployed in different countries and/or for different purposes
    - Need to scale up CDN capacity and service portfolio
    - Need to lower the pressure of third parties traffics and reduce network cost
    - While providing a better alternative to transparent caching
    - … and preserving the business of content providers
  - **Content providers**
    - Trend for adopting multi-CDN delivery strategies
    - To secure distribution of content (load balancing, offload, failover, QoS/QoE proof CDN)
    - To take advantage of CDN market competition, both on Price and Quality of Service
- **Multi-CDN systems are totally new from business perspective**
  - **Existing interconnection practices and business models probably not appropriate**
    - E.g. Voice or IP interconnection models
  - **Multiple factors will impact on the business models to emerge**
    - The CDN Market structure (Strong ambitions from Telco's while market still led so far by pure OTT players)
    - The distribution and weights of the key assets (incl. footprint, service portfolio, CRM, Customer base)
    - The content rights, content licensing and content revenue models



OCEAN Business Models

Business Models investigated in OCEAN

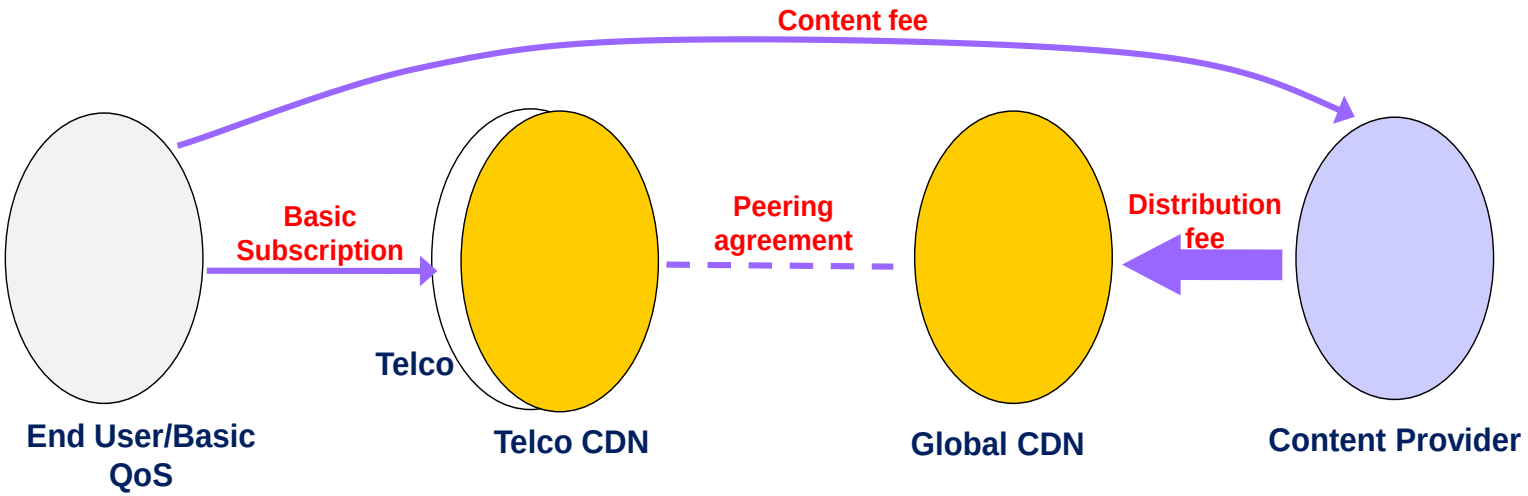
« Initial » situation



OCEAN Business Models

Business Models investigated in OCEAN

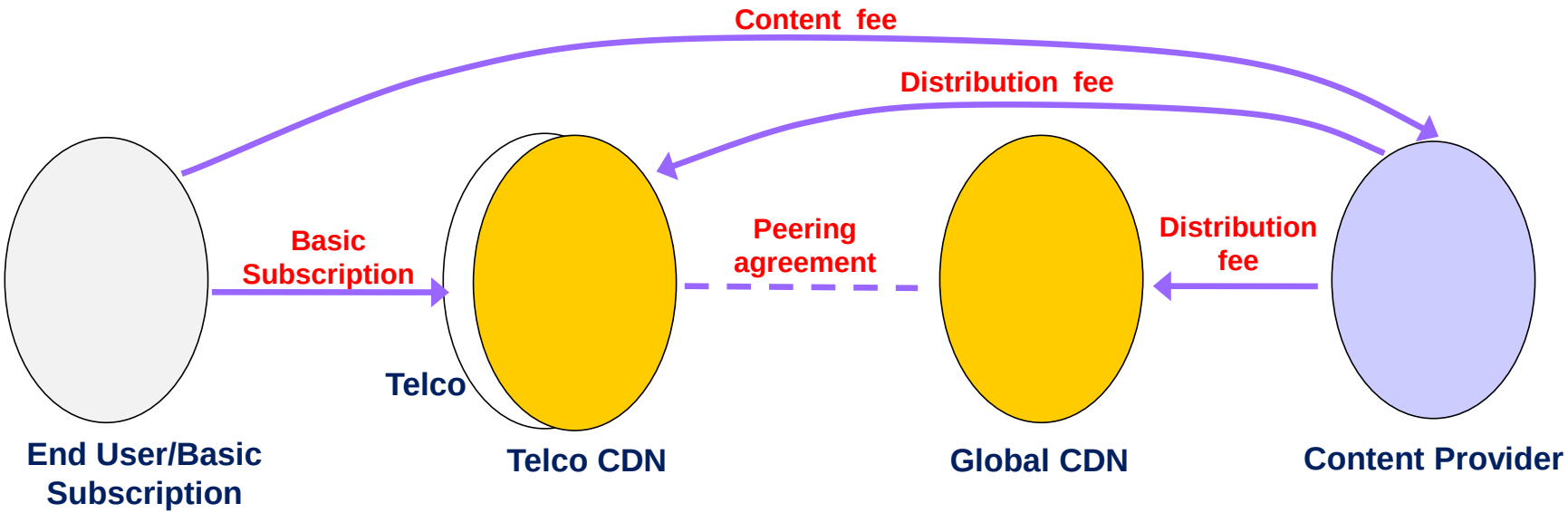
Status quo



OCEAN Business Models

Business Models investigated in OCEAN

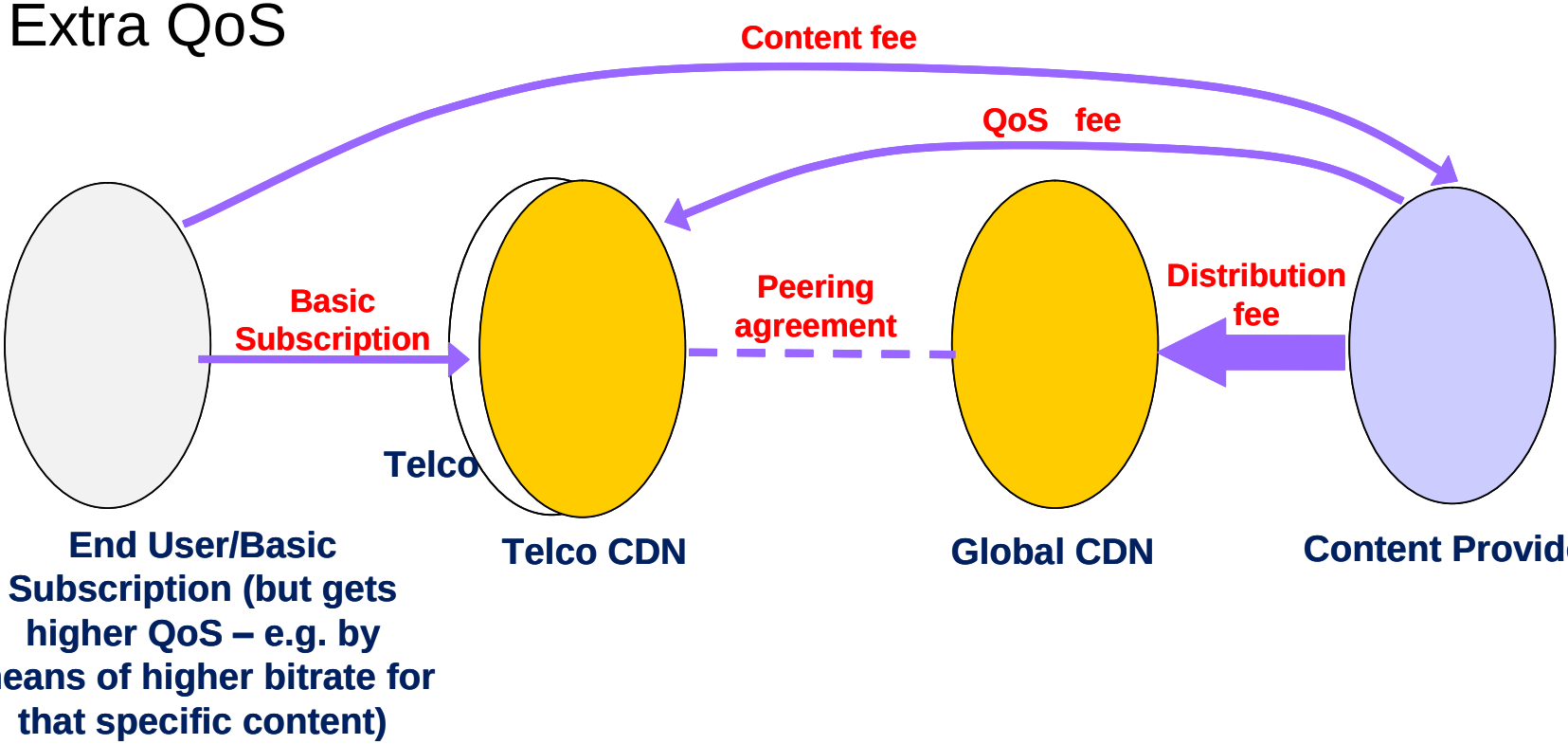
Pay Per Cache



OCEAN Business Models

Business Models investigated in OCEAN

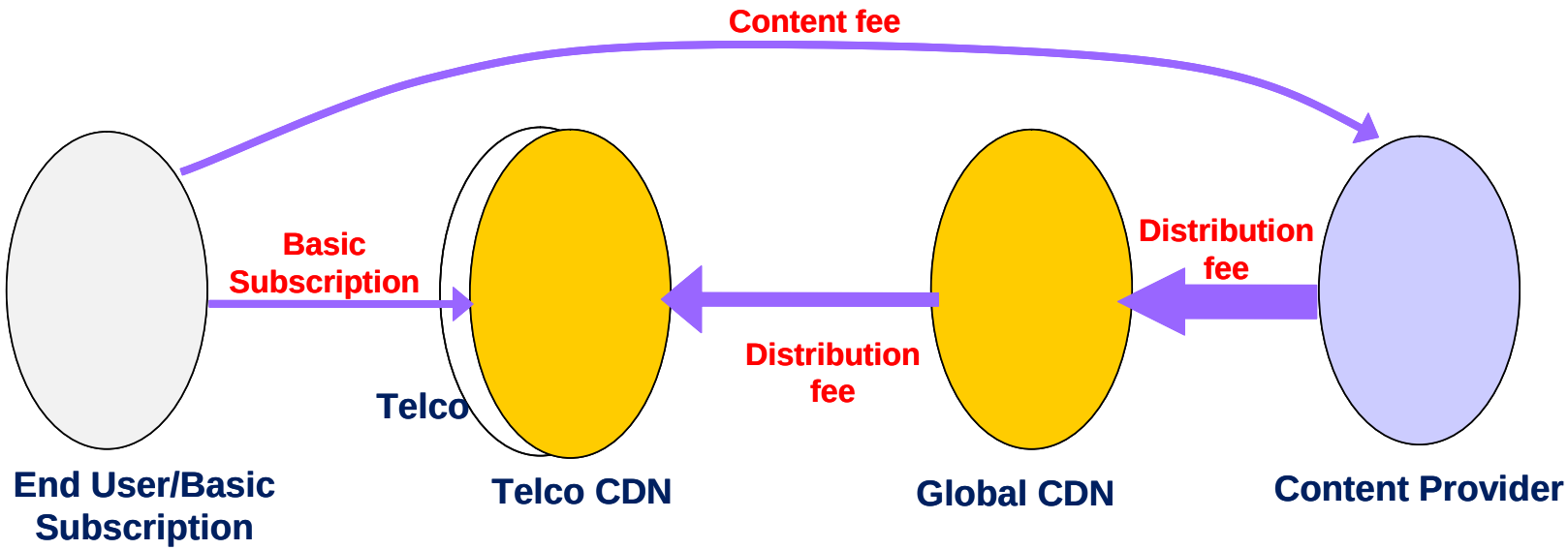
Extra QoS



OCEAN Business Models

Business Models investigated in OCEAN

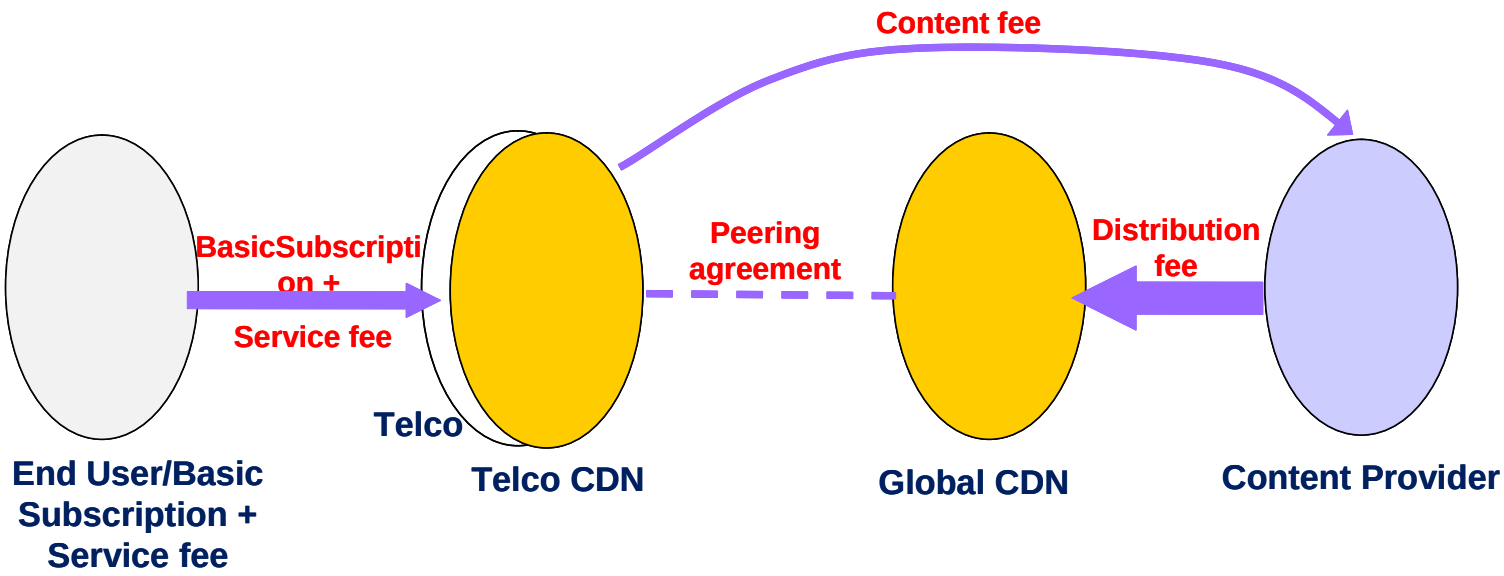
Cascading CDN



OCEAN Business Models

Business Models investigated in OCEAN

Content Bundle



OCEAN Business Models

Studies on-going

Telco CDN impacts on Business Models

Player	Potential advantages offered by Telco CDN	Potential drawbacks
End user	Better QoS due to caching closer to the user	Higher cost (case of Premium Subscription)
Telco	**Transport cost savings** Reduced churn Better ARPU QoS contribution from Content Provider Distribution fee from Global CDN	**Telco CDN cache server costs**
Global CDN	**Reduced traffic and server costs** Increased overall content deliveries	Less revenues from Content Provider Distribution fee to Telco
Content Provider	**Cost savings due to reduced server capacity** Higher footprint Better QoS delivery to end users	QoS contribution to Telco

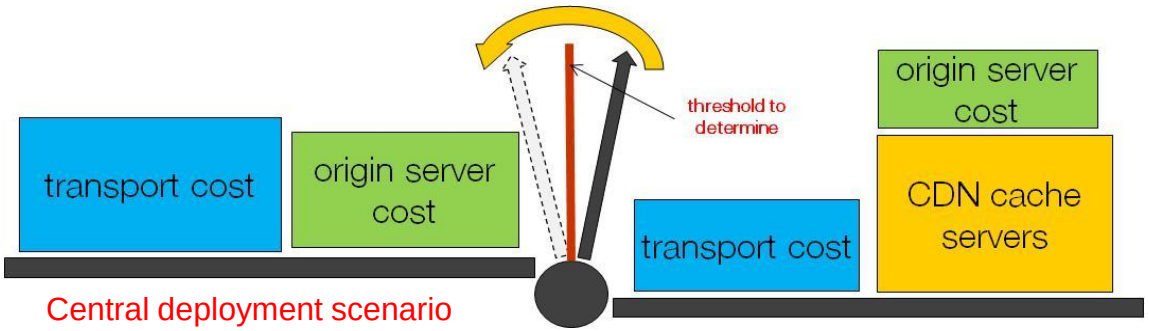
OCEAN architecture for FTTx and xDSL access networks
Introduction

- Objective
  - Investigate how OCEAN's general functional framework can be applied in the **Telco** network environment

    i.e. over legacy core and access networks based on DSL and fibre access technologies.

⇒Cost models and analysis to study how to best position and dimension CDN nodes

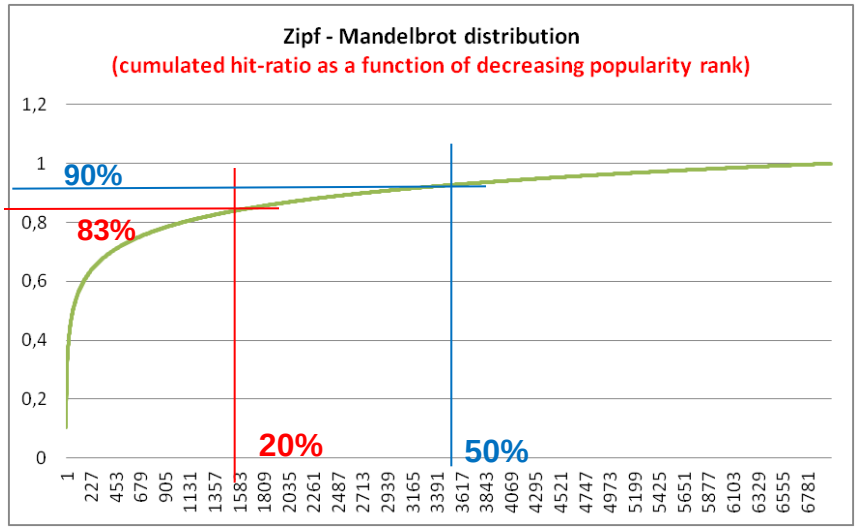
- With a projection up to 2015,
- On current Telco networks (Orange France & Poland)
- Focusing on Catch-up TV and VoD content delivery services.



OCEAN architecture for FTTx and xDSL access networks

Assumptions

- Storage capacity of cache servers based on variable range of contiguously decreasing popularities (hit probabilities) and on average size per content.
- The byte hit-ratio of a cache server that would store all of the x% most popular contents is approximated by a cumulative probability distribution function



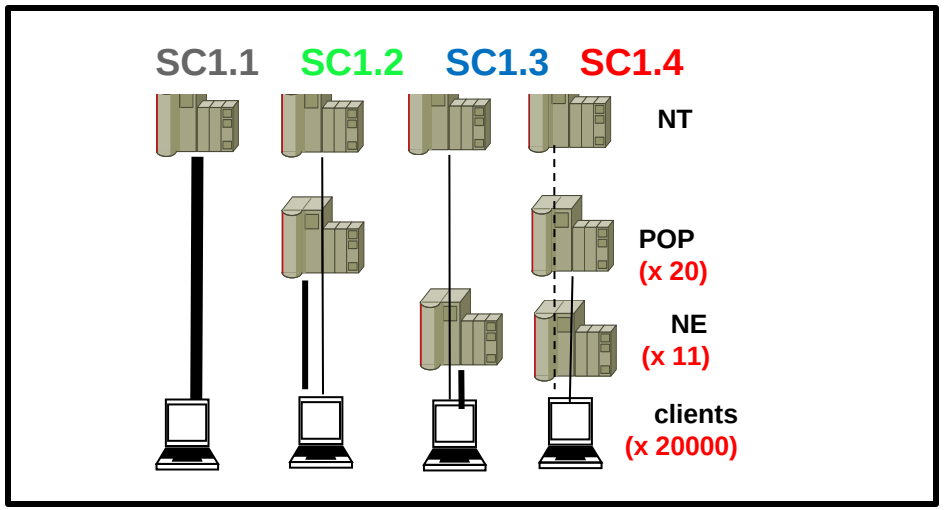
Example:

Among 7000 contents (accessed by the clients), and sorted by decreasing popularity rank (in abscise), the graph presents the cumulated probability to access to the contents with ranks < x: x=20%, => 83% of « hit » (near 80%) will concern the range between 0 and 20...

- Simulations performed along the OCEAN project **for VoD services** are in-line with these assumptions
  - Including during peak traffic periods, which drive actual provisioning of transport and delivery resources

OCEAN architecture for FTTx and xDSL access networks
Deployment scenarios

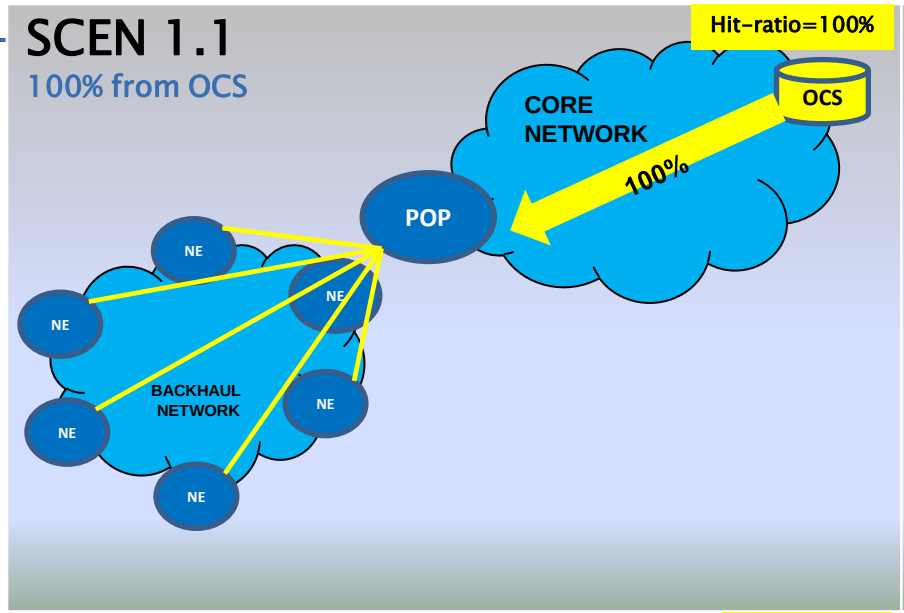
Scenario	Description
SCEN 1.1	Reference scenario with no cache server. All the contents are only in the origin server.
SCEN 1.2	Scenario with one level of regional caches (Intermediate cache Servers) located at all regional POPs . The most popular contents (20% of the contents) are fetched from the closest regional caches/servers.
SCEN 1.3	Scenario with one level of local caches located at all NE nodes (leaf Cache Servers). The most popular contents (20% of the contents) are fetched from the closest local caches/servers.
SCEN 1.4	Scenario with two levels of caches, regional and local, combining scenarios SCEN 1.2 and 1.3. The most popular contents (20% of the contents) are fetched from the closest local caches/servers and the next 30% (ranking from 20% to 50%) are fetched from the relevant regional caches/servers.

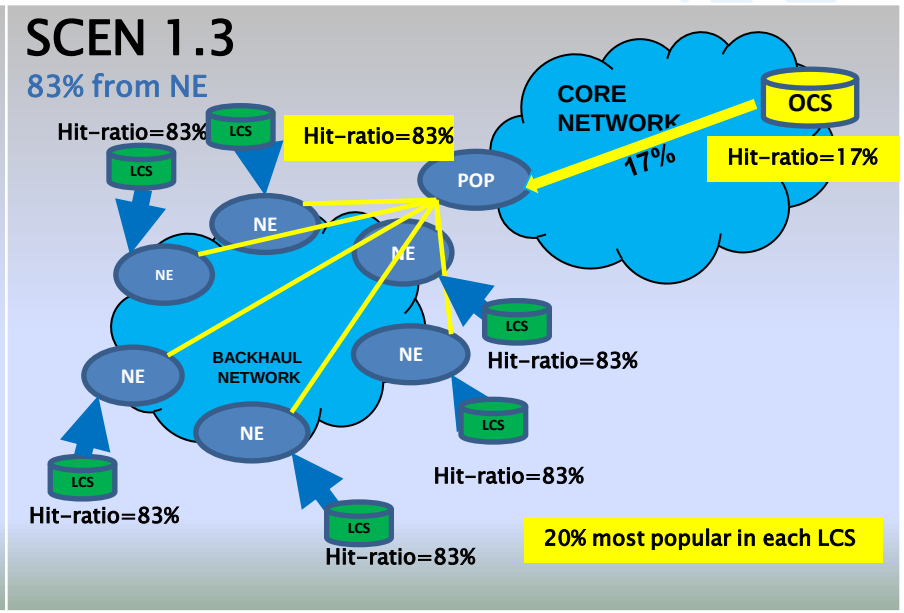


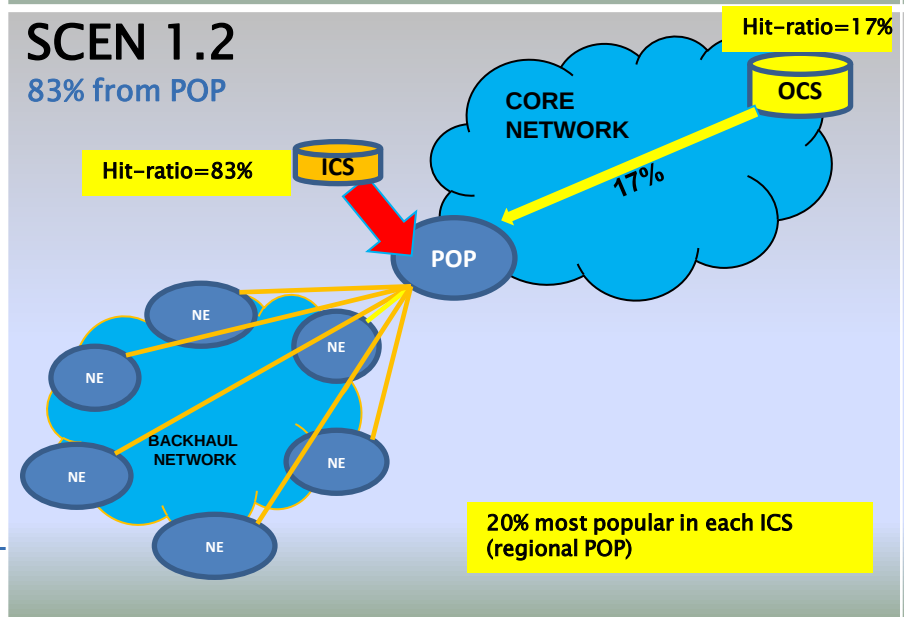
NT: Network Transit → OCS: Origin Content Server
POP: (regional) Point of Presence → ICS : Intermediate Cache Server
NE: Network Edge → LCS : Leaf Cache Server

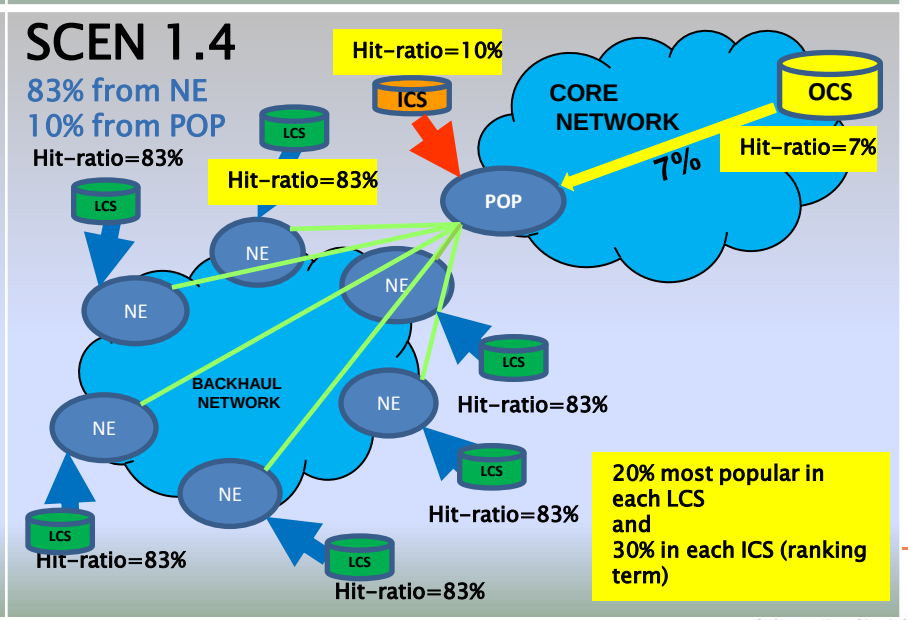
OCEAN architecture for FTTx and xDSL access networks

Deployment scenarios (con't)





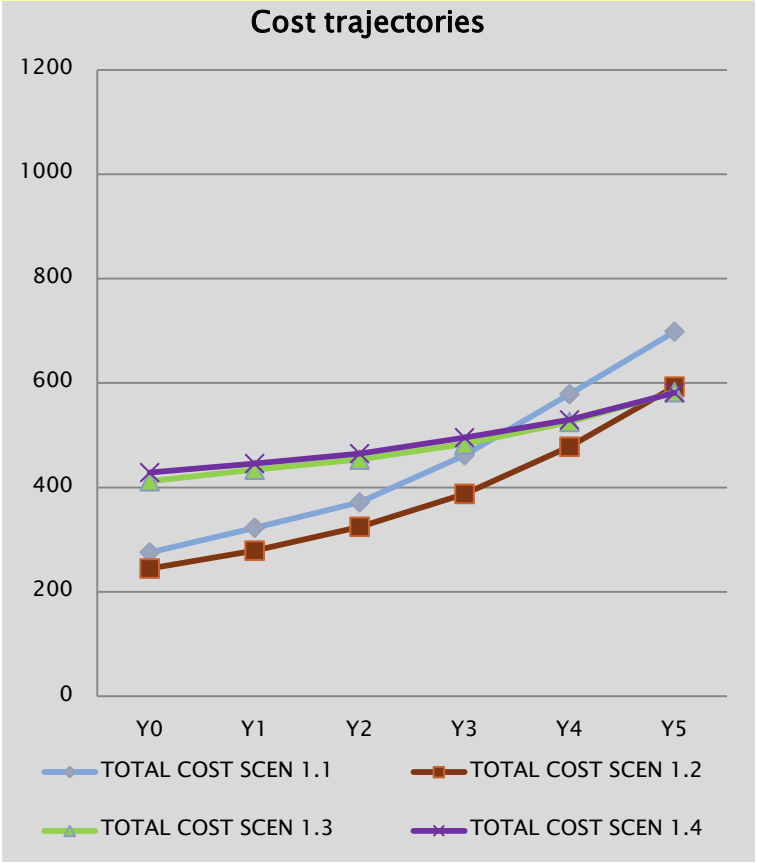




OCEAN architecture for FTTx and xDSL access networks

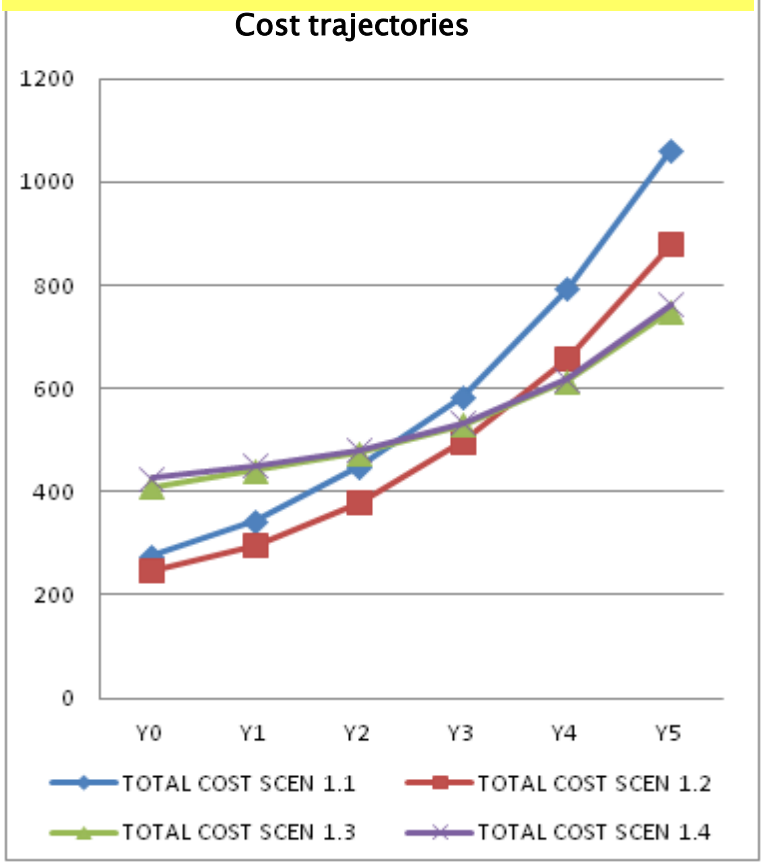
Evaluations / Impact of usage growth and session bitrate

A. Simultaneous connection rate from 2% to 7,5%



Clear advantage to deploy cache nodes on all PoP nodes from Day 1
Advantage to deploy cache nodes on NE nodes reached after 5 years

A. Simultaneous connection rate from 2% to 7,5% +
B. Session bitrate from 2,2 Mbps to 3,5 Mbps

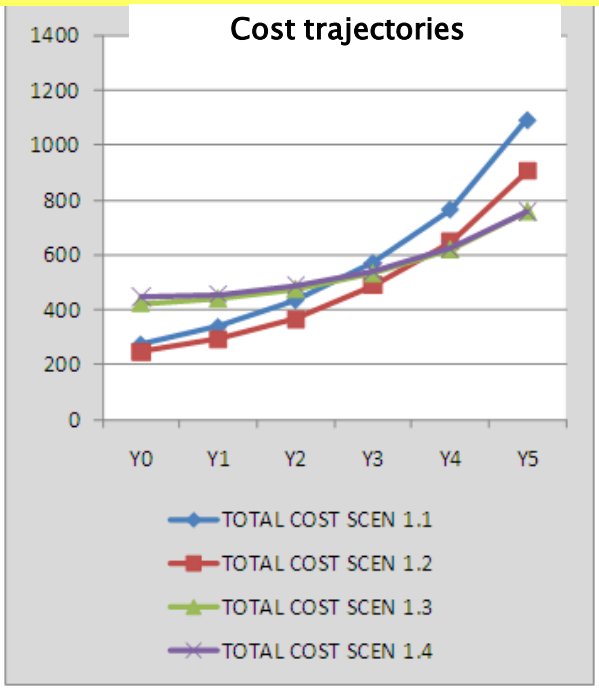


Advantage to deploy cache nodes
on NE nodes reached after 3,5 years

OCEAN architecture for FTTx and xDSL access networks

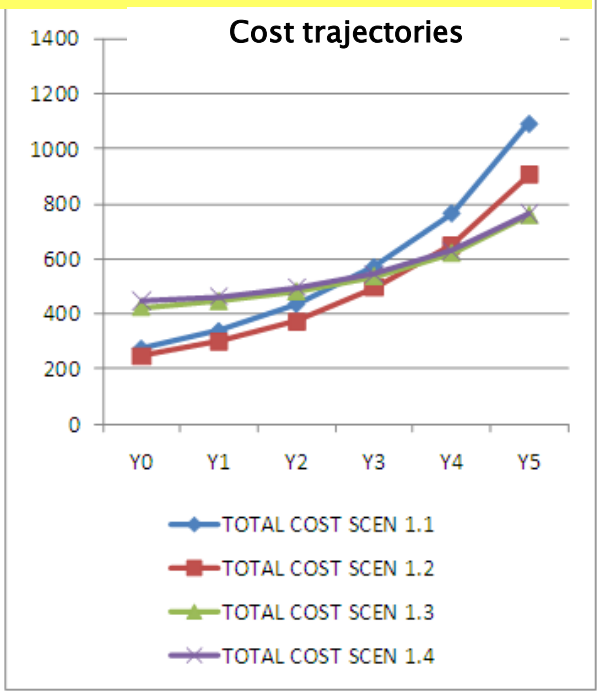
Scenarios evaluation / Impact of catalog size

A. + B. +
C. Increasing server capacities (+20%/year)
- Max storage capacity: from 5 TB to 12 TB
- Max streaming bitrate: from 7 Gb/s to 17 Gb/s
- Max simultaneous sessions: from 3000 to 7400

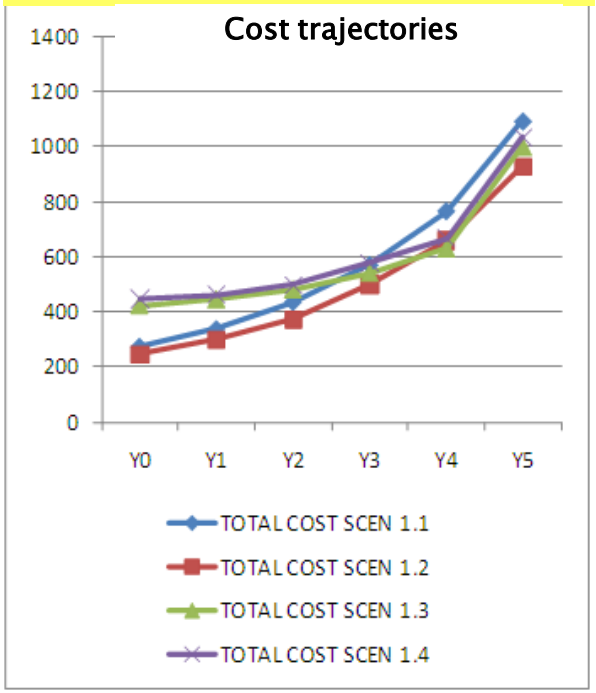


Limited impact of increasing server capabilities (as compared to case A + B)

A. + B. + C. +
D. Increasing catalog size (+10%/yr – Medium)



A. + B. + C. +
D'. Increasing catalog size (+30%/yr – High)



Increasing stronlgy the catalogue size, while keeping the same byte hit ratio assumptions, negatively impacts on the gains provided by distributed deployment scenarios

Conclusion

- Key take-aways (for VoD like services)
  - Implementing Intermediate Cache Servers in key regional nodes (SCEN1.1 -> SCEN1.2) already proves to be technically and economically viable
  - Getting caches gradually down to the last segment of the transport network (SCEN1.2 -> SCEN1.3, SCEN1.4) would be quite justified by a moderate growth of demand intensity at peak hour
  - Optimizating the migration path decentralized architectures may allow to reach up to a temporary "10%" gain (as compared to non-optimized migration path).
  - Evolving towards decentralized architectures would be globally profitable, on condition that savings at origin servers (and/or revenues from CDN interconnections) are included in total cost estimations.
  - These results open attractive perspectives for solutions based on the architecture proposed in OCEAN.
  - Warning: keep in mind that VoD like services have particular consumption patterns enabling satisfying caching performance levels ("20/80 : the 20% most popular contents are approx. the 80% most accessed ones"). This may be quite different with other content services.
- Works on-going
  - OCEAN works continue in 2012 and beg. 2013. More detailed recommendations will be then presented.
  - A survey with our EBU partner, to collect data about content providers' expectations on CDN service providers, is currently on going.

Thank you

The research leading to these results has received funding from the European Union's Seventh Framework Programme ([FP7/2007-2013]) under grant agreement n° 248775.