



Innovations in Clouds,
Internet and Networks

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CONVINcE: Towards Power- Optimized Video Distribution Networks

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CONVINcE



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**Why a collaborative project
to optimize the consumption
of Video
Distribution Networks ?**

ICT Sector Accounts for 2 Percent of Global Carbon Emissions: Study

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By Sarah Miller

Jan 07, 2013 04:00 AM EST

NATURE WORLD NEWS



Scientists from the University of Southampton claim to have found a possible **solution** to the ever-increasing threat of carbon dioxide in the atmosphere: store it in particular locations far beneath the ocean. Global carbon emissions are expected rise to a record high this year of 36 billion metric tons, according to new figures from the Global Carbon Project. (Photo : Reuters)

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Is the internet on the brink of collapse? The web could reach its limit in just eight years and use all of Britain's power supply by 2035, warn scientists

- Internet speeds have increased by 50-fold in the last decade alone
- Optical fibres have reached capacity and cannot transfer any more light
- Laying down more cables may solve problem but this will increase costs
- 'It is harder and harder to keep ahead,' said Professor Andrew Ellis

By BEN SPENCER SCIENCE REPORTER FOR THE DAILY MAIL

PUBLISHED: 00:28 GMT, 2 May 2015 | UPDATED: 14:57 GMT, 3 May 2015



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The internet is heading towards a 'capacity crunch' as it fails to keep up with our demand for ever faster data, scientists have warned.

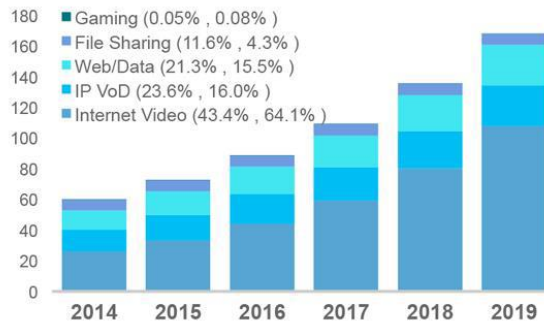
Leading engineers, physicists and telecoms firms have been summoned to a meeting at London's Royal Society later this month, to discuss what can be done to avert a web crisis.

The boom of internet television, streaming services and ever-more powerful computers has increased the strain on our communications infrastructure.

Cisco Visual Networking Index: Forecast and Methodology, 2014–2019



May 27, 2015



Video Highlights

It would take an individual over 5 million years to watch the amount of video that will cross global IP networks each month in 2019....

The sum of all forms of video (TV, video on demand [VoD], Internet, and P2P) will be in the range of 80 to 90 percent of global consumer traffic by 2019.

Internet video to TV doubled in 2014. Internet video to TV will continue to grow at a rapid pace, increasing fourfold by 2019. Internet video to TV traffic **will be 17 percent of consumer Internet video traffic by 2019**, up from 16 percent in 2014.

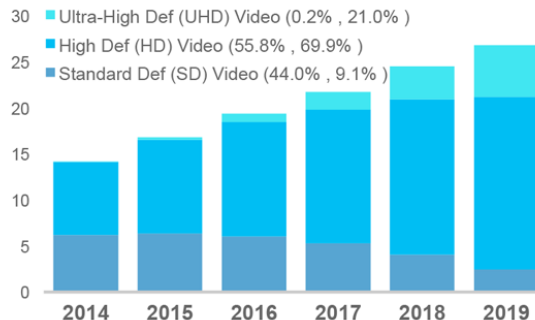
Consumer VoD traffic will double by 2019. HD will be 70 percent of IP VOD traffic in 2019, up from 59 percent in 2014.

Content delivery network traffic will deliver over half of all internet video traffic by 2019. **By 2019, 72 percent of all Internet video traffic will cross content delivery networks**, up from 57 percent in 2014.

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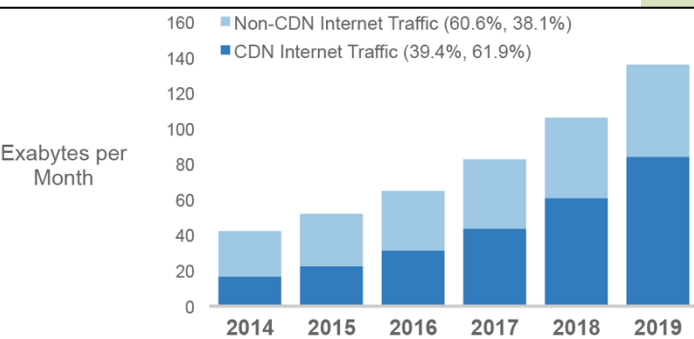
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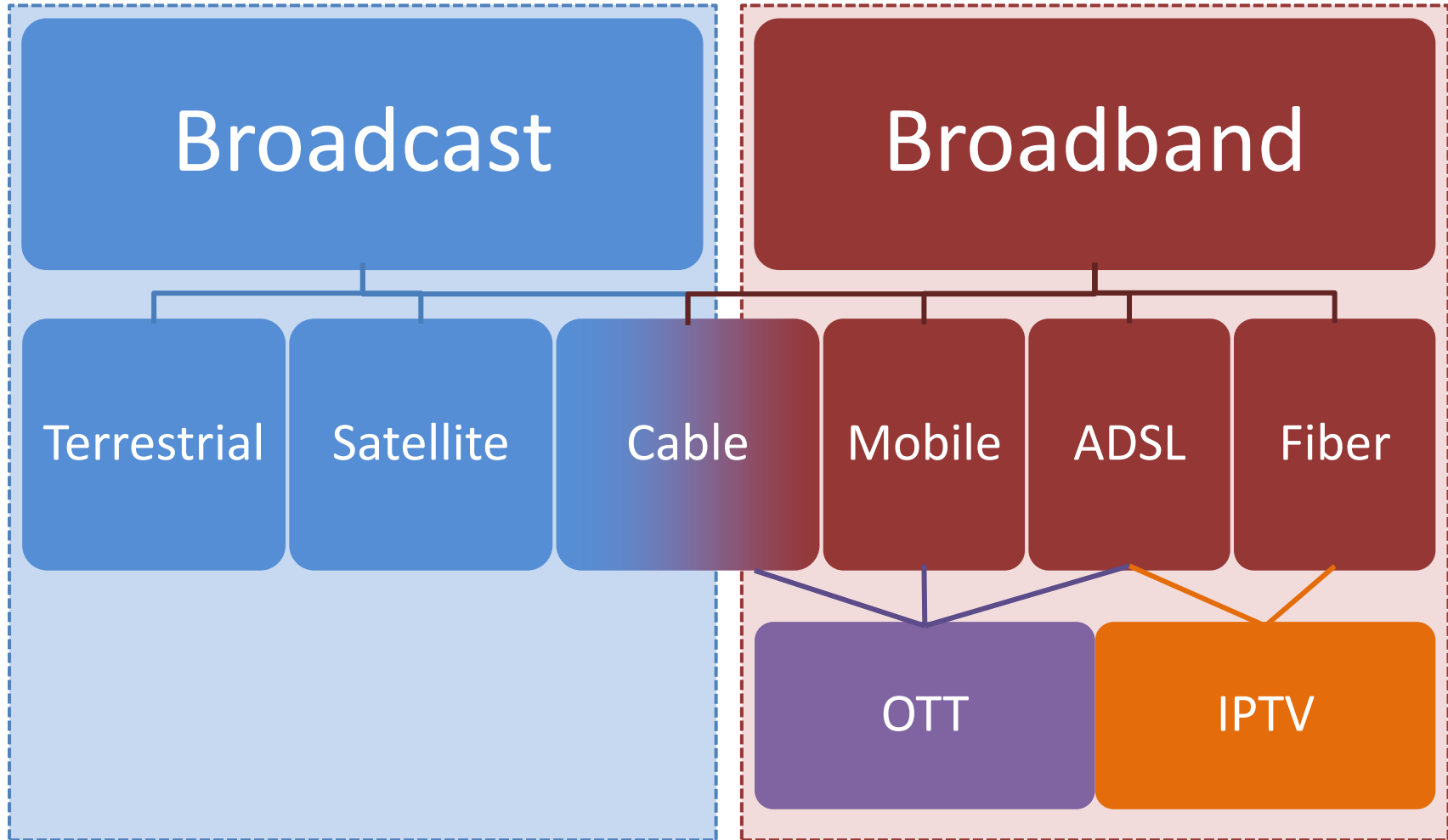
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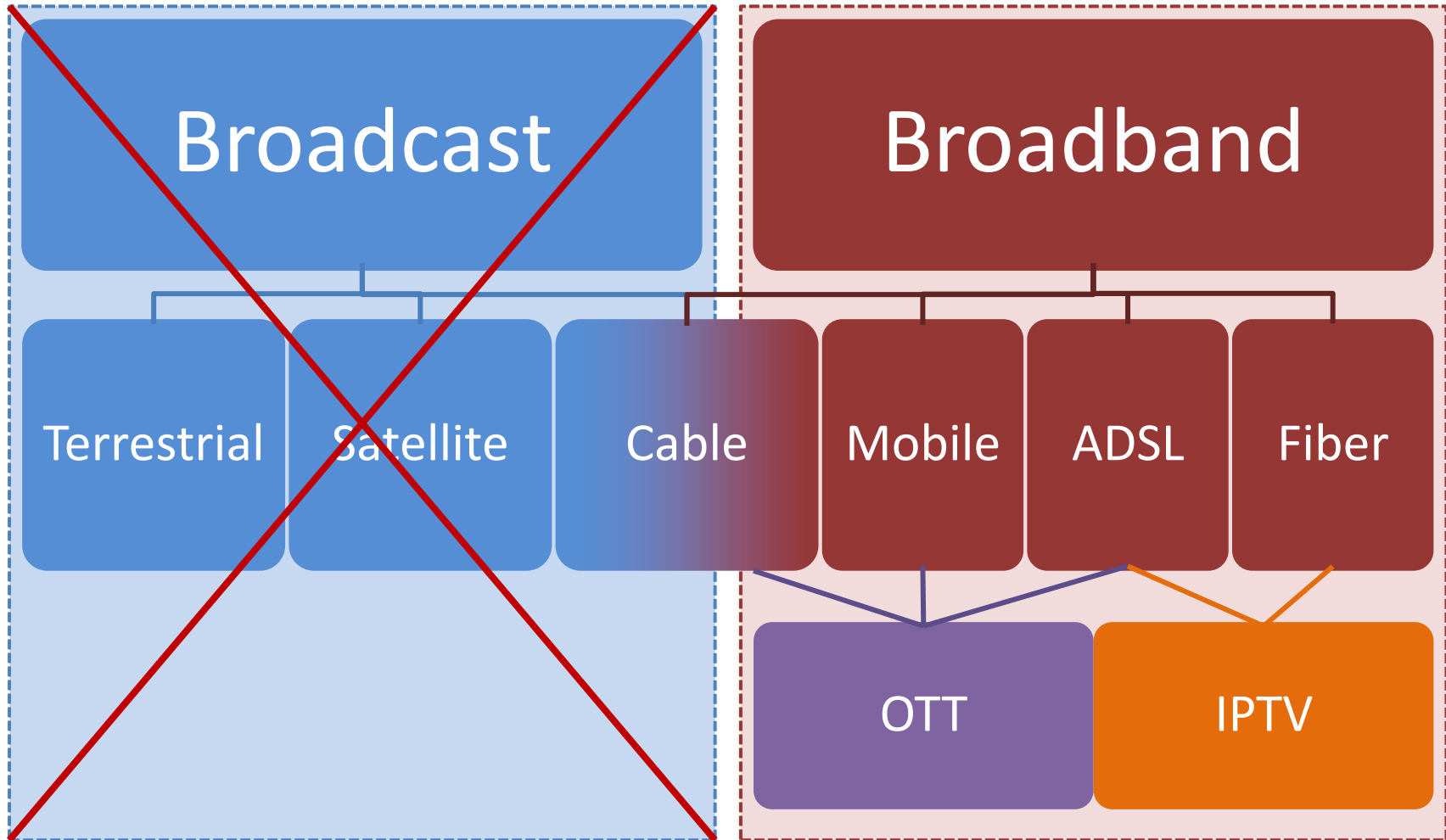
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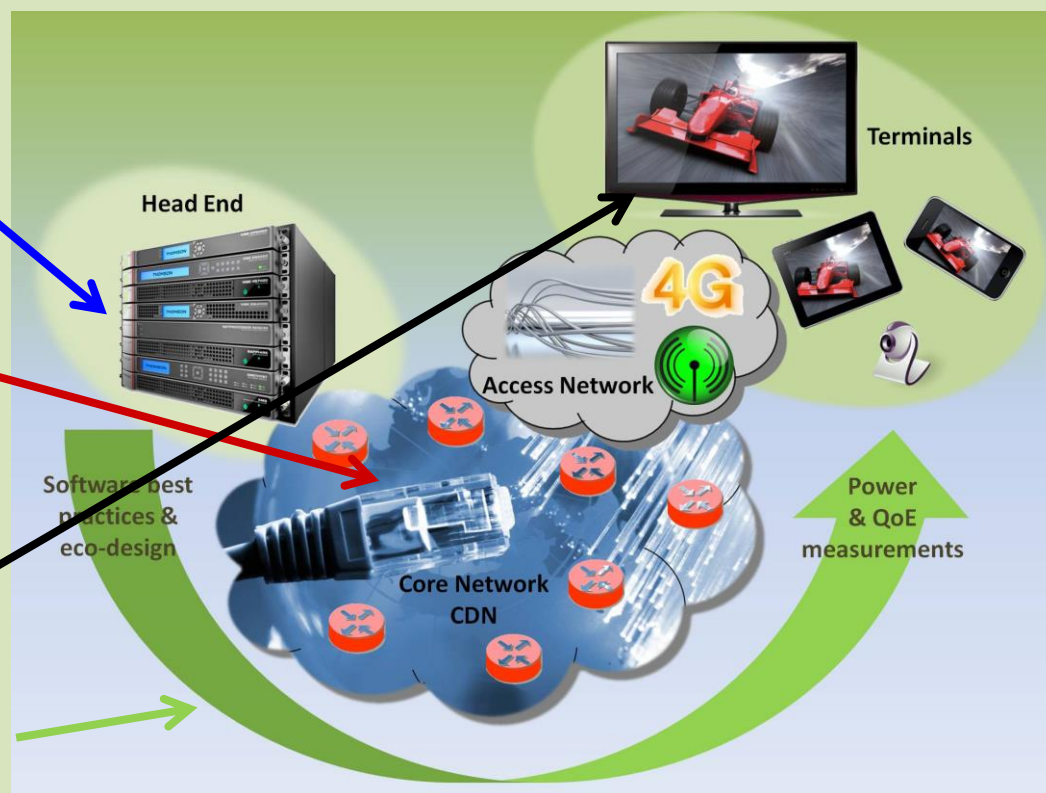
Consumption Optimization in Video Networks

<http://convince.wp.tem-tsp.eu/>

Contact : raoul.monnier@thomson-networks.com

CONVINcE

- Main focus: To optimize the end to end power consumption in IP-based video distribution networks
- The project addresses:
 - Video encoding/transcoding
 - Adaptive bit streaming
 - Core/metro networks
 - Access networks, 4G
 - CDN
 - Routing protocols, SDN
 - Fixed & mobile terminals
 - Displays
- With transversal activities



Eureka/Celtic + project

Started in September 2014
End in September 2017

15 Partners, 4 countries



SONY



TELESTE



EXFO



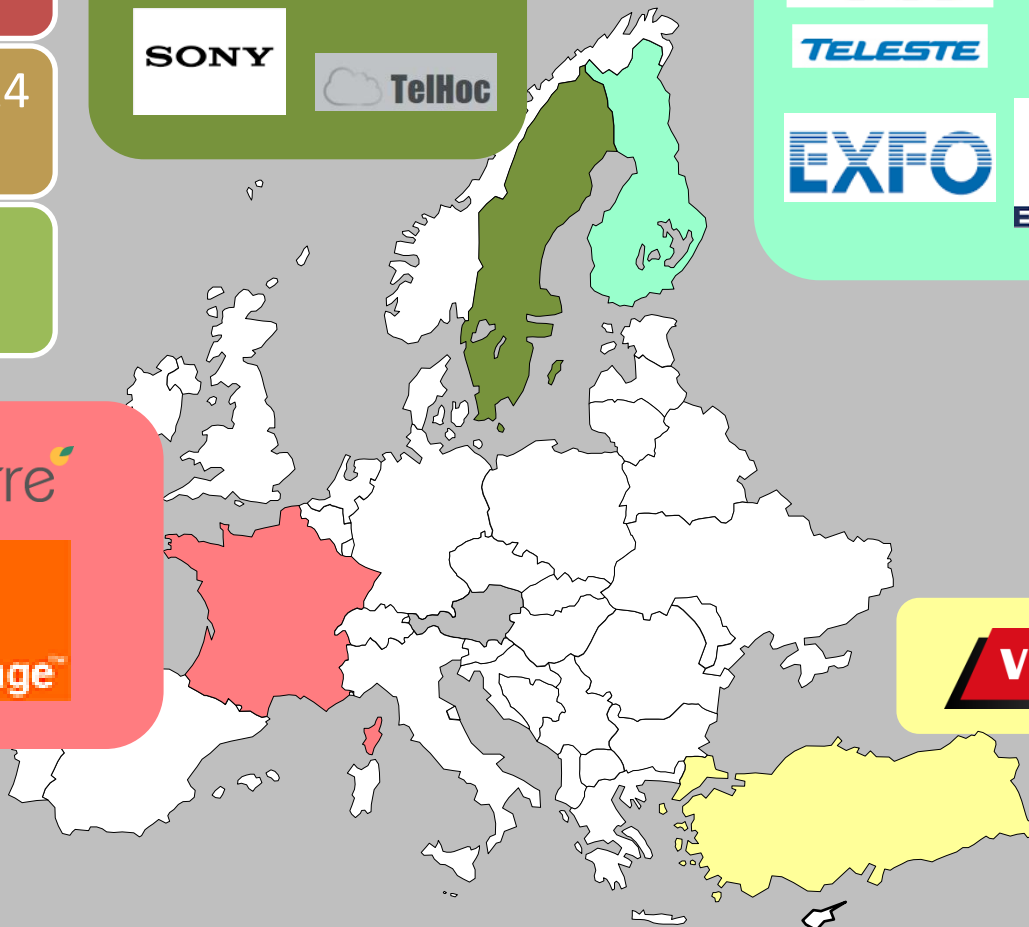
THOMSON

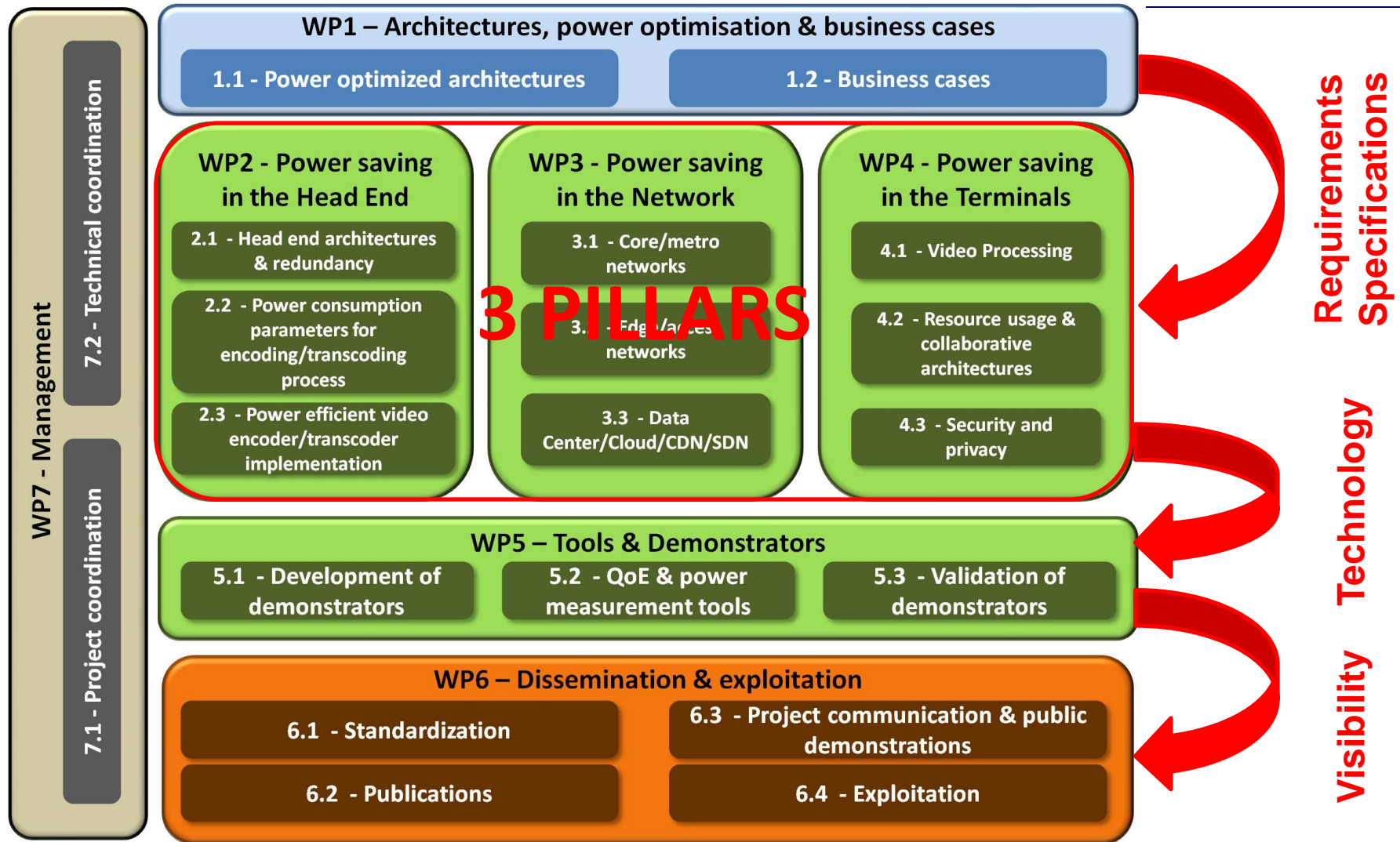
VIDEO NETWORKS

Kaliterre



VESTEL





Main characteristic: diversity and complexity!

3 layers HLA

- Low-Layer Network
- Content Distribution Network
- Video Distribution Network

3 categories of architectural solutions

- Non-cloud based (State of the Art)
- Edge-cloud
- SDN/NFV

CDN

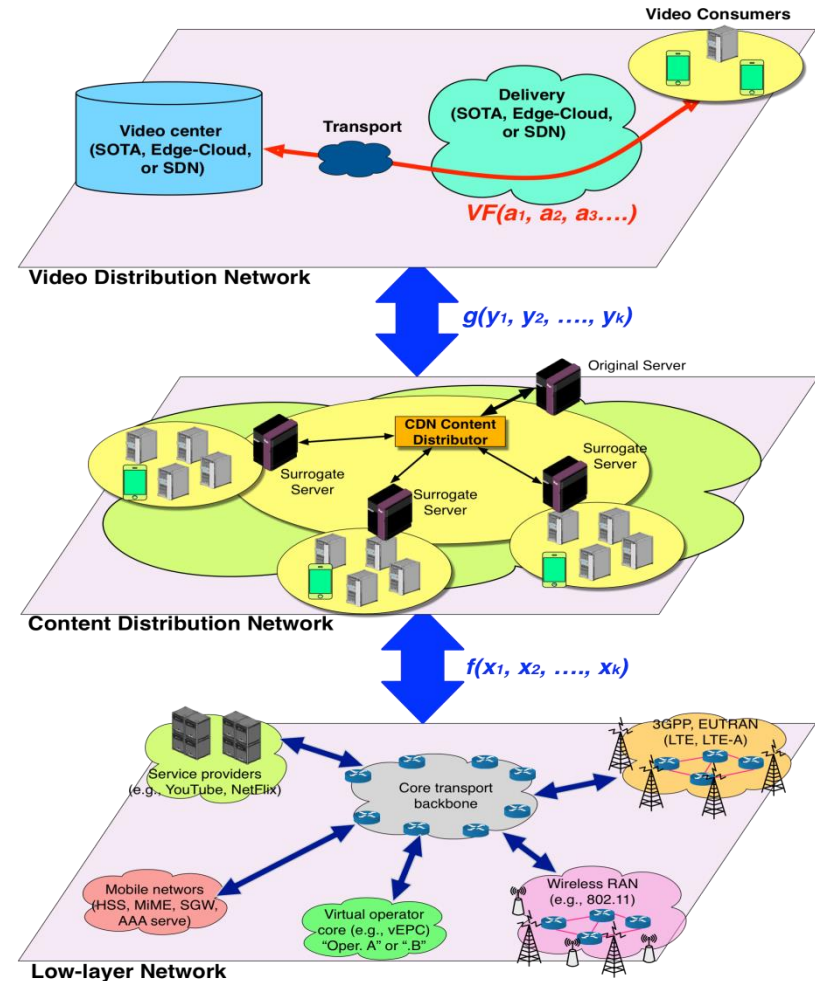
- Request routing
- Content routing
- Content processing
- Security

4 application scenarios

- On-Demand Video Streaming
- Live Video Streaming; Cloud Gaming
- Camera-Based Sensor Network (Video surveillance)

Formal representation of the video flow in VDN

$VF_{xyz} = f(\text{network solution; video flow element; application})$





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Performance optimization

CONVIN^{ce}E

VDN performance optimization refers to

- End-user performance (QoE) and
- System performance (e.g., energy consumption, QoS)

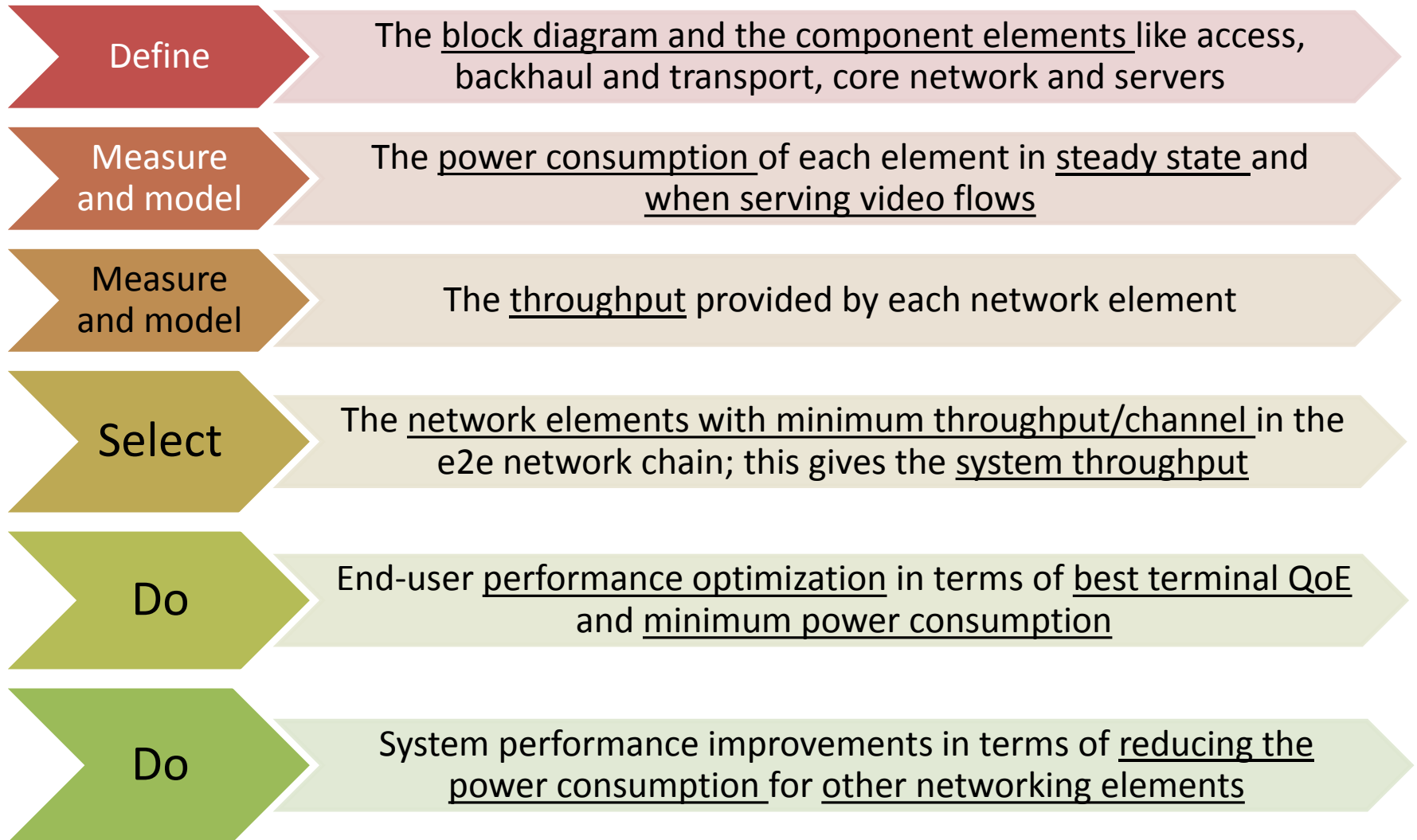
Performance optimization ends up in a trade-off

- Where the e2e power consumption is optimized for a given set of
 - QoS parameters and
 - QoE metrics

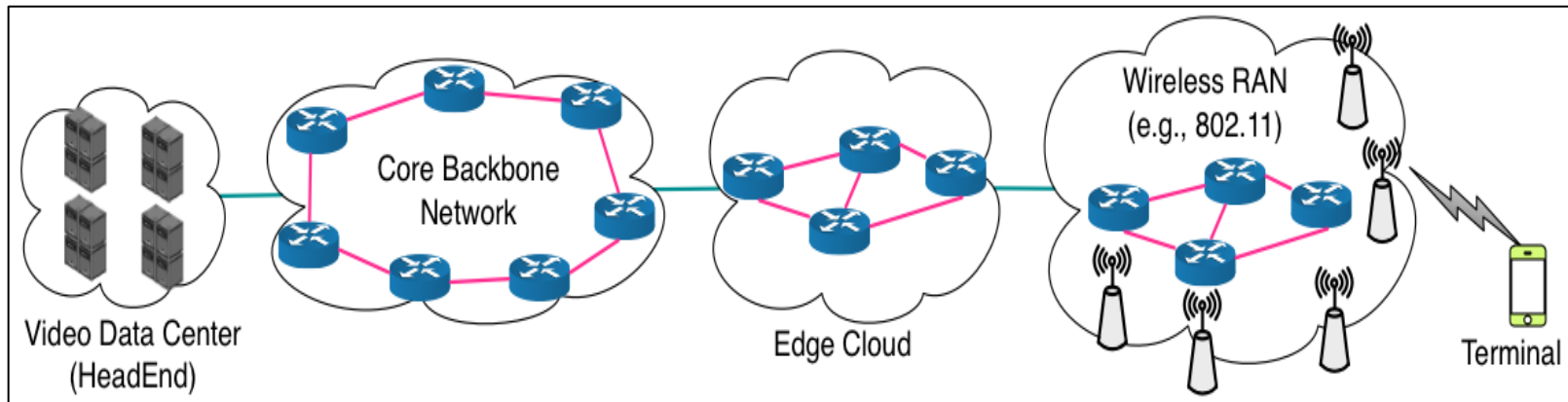
Important observation

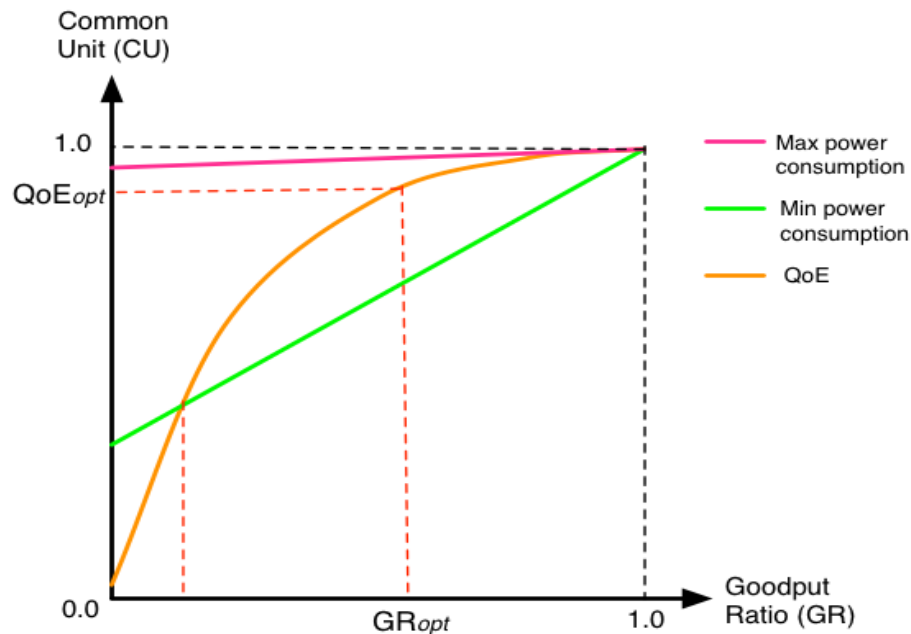
- Most performance limiting networking segment in an e2e chain is the wireless LAN - terminal, because of
 - Minimum e2e throughput and
 - Largest power consumption

General procedure



A networking scenario is considered to show the optimization concept





Goodput Ratio (GR) is defined to be the ratio of measured throughput to optimal throughput wrt best performance

Plot the function $CU = f(GR)$

- CU refers to both QoE and power consumption; for both of them, $CU \in (0, 1)$
- Given that the best QoE is towards $GR = 1$ and the minimum power consumption is towards $GR = \text{minimum}$

Do performance optimization: find the optimal value for $CU = f(GR)$ corresponding to GR_{opt}

Given

- CONVINCe edge-cloud architecture

Do

- Power minimization for individual entities

Also

- Measure the e2e throughput/channel for every individual entity in the e2e network chain; measure QoE at terminal
- Select the individual entity with minimal e2e throughput/channel and denominate this throughput as being the system throughput
- Plot the function $CU = f(GR)$
- Select the optimal value for this function; select accordingly the values for QoE_{opt} and optimal power consumption wrt GR_{opt}

Subject to

- Specific requirements for power minimization of other entities in terms of (e.g.)
 - Minimum power consumption for headend \cap
 - Minimum power consumption in Edge Cloud \cap
 - Best route with reference to minimum power consumption (Internet) \cap
 - Minimum power consumption in RAN

CONVINcE is a 3 year project addressing the E2E consumption optimization of video distribution networks

At mid-term, good results are available

Among others, basics for system and end-user performance optimization are laid

Future work is about further developing the system and to setup the CONVINcE demonstrators

See more : <http://convince.wp.tem-tsp.eu/>



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Thank you!

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