Designing the future interconnection ecosystem

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A universal story of the Internet community – how it all started for (many of) us...

Frankfurt
The architecture shifted – more innovation

Internet infrastructure in Europe

Easy scale-out for global CDNs

Foundation for clouds
First revolution in digital infrastructure has enabled today’s success stories.
What’s the next one?

2019

2020+
How will the future Internet architecture look?
Let’s get some hints from our daily lives

*Smartphones:*

An assistant, companion, tool… in everybody’s daily life

A symbolic object and embodiment of the connection between the physical and digital world

Everything, right now, anywhere, anytime
And some hints from enterprises’ R&D labs

Upcoming technologies:

- **Virtual Reality**: 20 ms
- **Read Screen**: 80 ms
- **Augmented Reality / Car**: 100 ms
- **Eye Blink**: 150 ms
- **4K (TV)**: 1500 ms

The image shows a graph with various technologies and their corresponding latencies. The graph illustrates the bandwidth and latency (speed) for different technologies such as Video, Things, System Control, and VR/AR. The latencies range from 10us to 10ms for different applications.
What are the implications for the architecture of the Internet?

Dynamic networks... with seemingly infinite capacity... anywhere in no time!
The abstract challenge we are facing
How to fulfil the vision & tackle the challenges? – Guiding principles

**Mission:** to better *Build, Operate, Scale & Optimize* networks

**Design principles:**

- **Simplified architecture**
  - Less protocols
  - Less network abstraction

- **Insight-driven**
  - Real-time (tele)metrics
  - Integrate AI-based analytics software

- **Highly programmable**
  - Software systems
  - Network components programmable

- **Highly automated**
  - Reconfiguration of networks via codified workflows
**How to fulfil the vision & tackle the challenges? – Key building blocks of the future interconnection ecosystems**

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<td>• Specialized networking hardware replaced by software on general purpose servers</td>
<td>• Software defines the flow of traffic, decoupling control from packet forwarding: dynamic routing based on prices</td>
<td>• Bringing workloads closer to the user and exploiting the advantages of NFV and SDN</td>
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<td>• Dynamic tasks</td>
<td>• Flexible bandwidth</td>
<td>• Lower latency</td>
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<td>• Scalable</td>
<td>• Price/cost reduction</td>
<td>• Integrated security</td>
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<td>• Short innovation cycles</td>
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And other master components to integrate...

5G Faster access technologies with integrated software

**Access Innovation**
- mmWave Spectrum
- New Air Interface
- Massive MIMO

**Architectural Innovation**
- Software defined core
- Software controlled traffic steering
- Integrated in (former) backbone technologies
And other master components to integrate...
And other master components to integrate...

Integrated Security

Services, Protocols, Hardware

• New network protocols feature end-to-end encryption by default
• Next generation routing enables resource and path validation
• DDoS mitigation
• Quantum cryptography
Key take-away

The future Internet architecture...

- Personalized & contextualized services & processes
- Virtualized & “softwarized” networks
- Connecting anyone, to anything, anywhere, on demand, and in no time