

The role of video QoE in the Future X Network

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Video and QoE in Nokia

Presentation Outline

- Nokia Spain is one of the hotspots of Video technology within Nokia
 - Product development
 - Research (Bell Labs)
- Vision: Future X Network for the era of automation (5G and beyond)
- Public funded research projects
 - Create new Future X Network subsystems
 - QoE impact
 - Engage Nokia video experts with QoE community

Our vision:
The future of the network

IDEAS



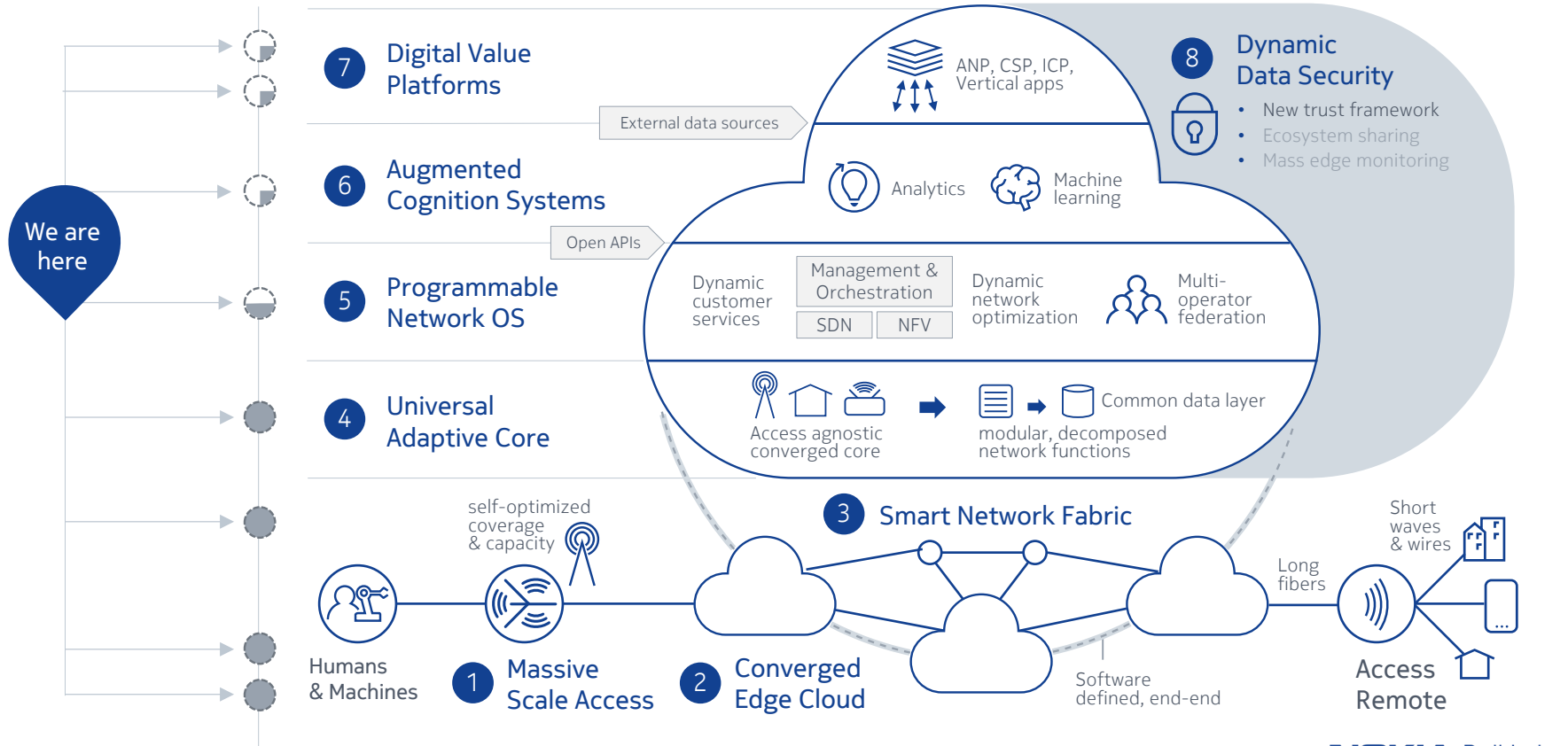
The revolution

Technological Revolution (def):

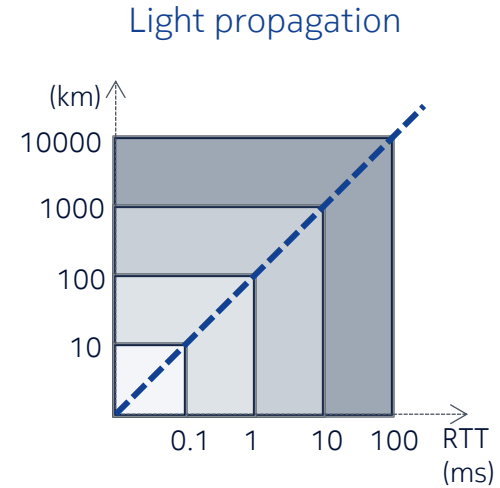
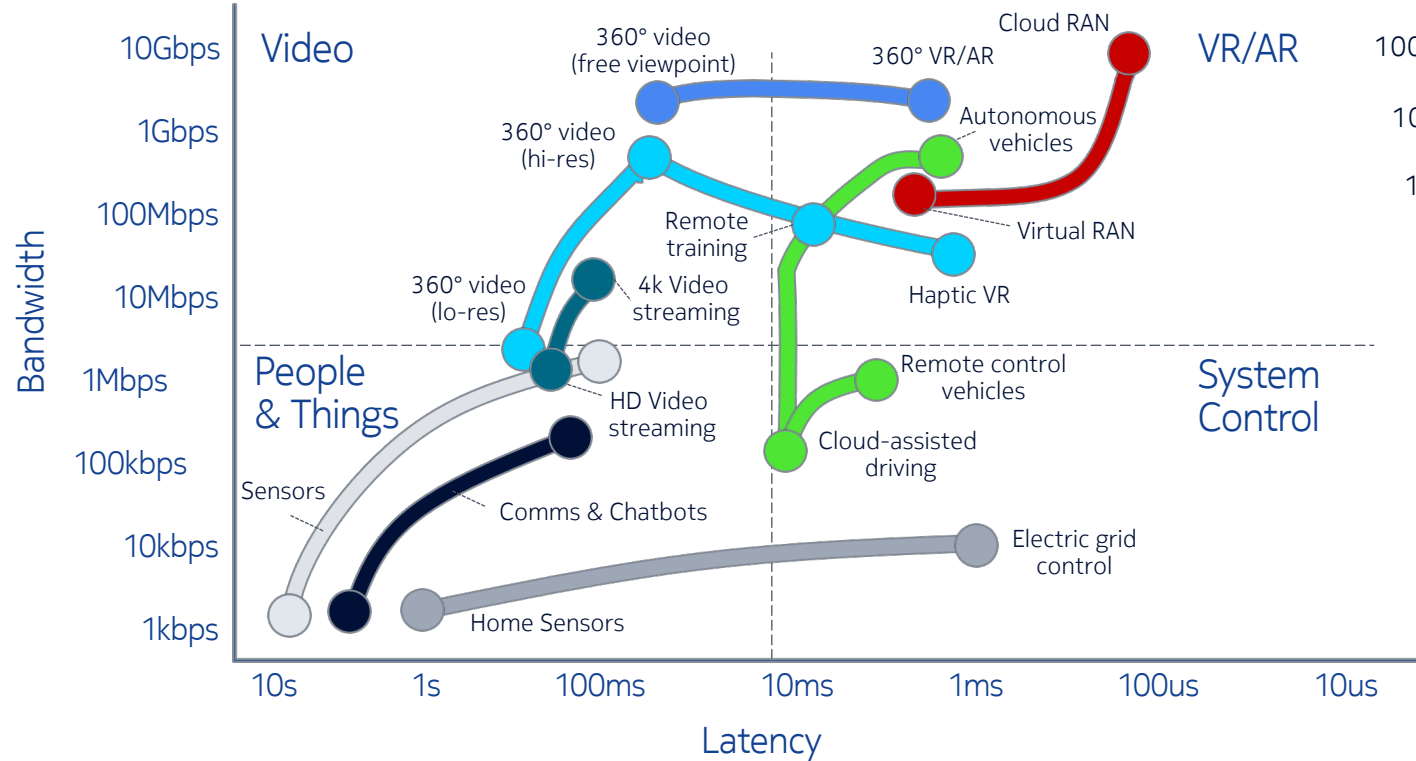
Interconnection of new systems and technologies + capacity to profoundly transform economies & society

Tech. Revolution	Enabling Technology	Connectivity
Financial (1600 – 1740)	Stocks & Bonds	Banking & Stock Market Infrastructure
1 st Industrial (1780 – 1840)	Steam Engine & Iron Production	Rail and Shipping Networks
2 nd Industrial (1880 – 1920)	Steel & Chemicals	Extended Transportation Networks Electricity & Telecom Networks
Scientific-Technical (1940 – 1970)	Analog & Digital Signal processing	Digital Communications Networks
Information (1985 – 2015)	The Web, Cloud computing & Mobile devices	Internet & Broadband Access
Automation of Everything (2015 –)	Digital interfaces & Data analysis	Future X Network

The Future X architecture for the digital future of everything



Latency & bandwidth matter ...



What about Video Quality?



Visual information is (still) relevant

- New formats (e.g. omnidirectional)
- New ways of experience (immersion, interactivity, augmentation, etc).

Entertainment is not the only use case

- Domain-specific QoE:
 - Training, design, communication...
- Video Quality for Machine Learning

Latency is critical

- Quality of interactivity
- Response time of quality metrics

Quality as a Service

- Optimize resources in terms of QoE
- Standard and interoperable metrics



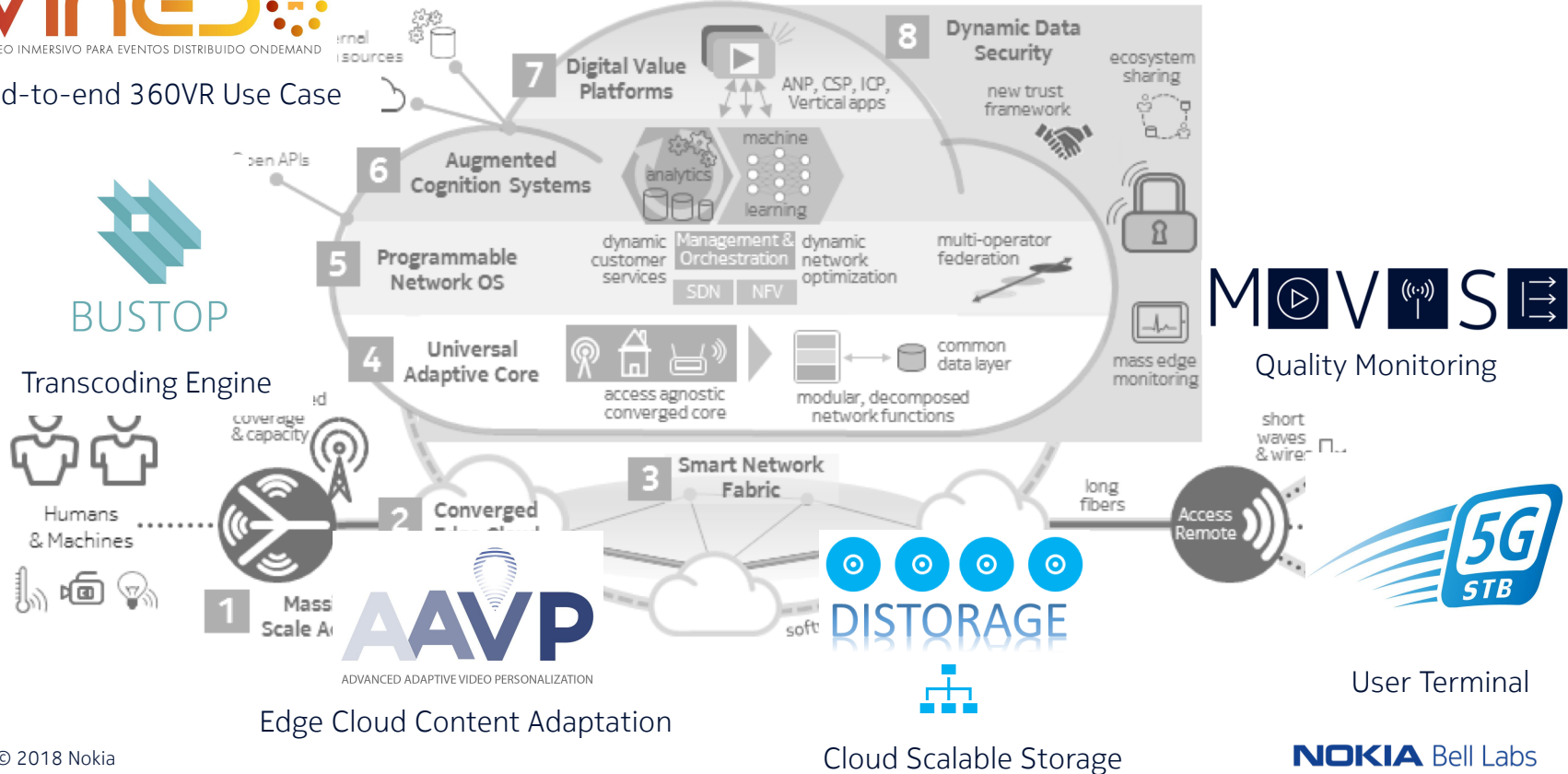
Video research & innovation projects

And how video quality is important for them

Creating new video pieces for the Future X Network



End-to-end 360VR Use Case



Monitoring segmented video

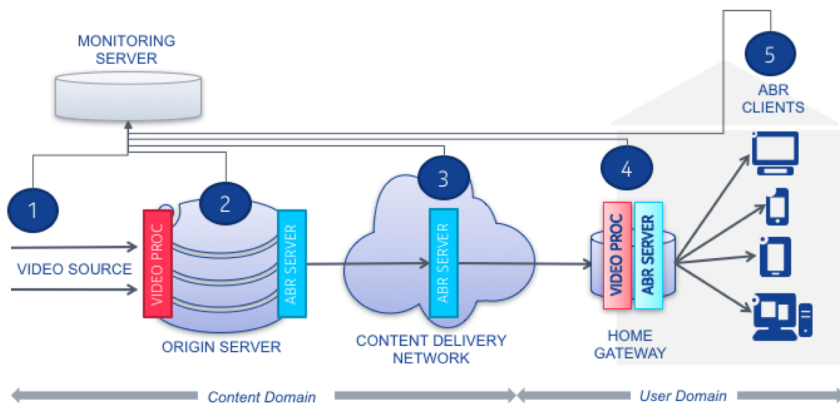
- Architecture to monitor QoE
- Identify key NR metrics
 - Cause -> objective effect -> subjective impact
- Create monitoring / assessment tools

NORM: NR metrics for monitoring (KQIs)

- Scalable, real-time
- Significant (understandable) for operators
- Repeatable (can be forced)

IMG/AVHD: develop test tools

VQEG: host this meeting :-)



BUSTOP

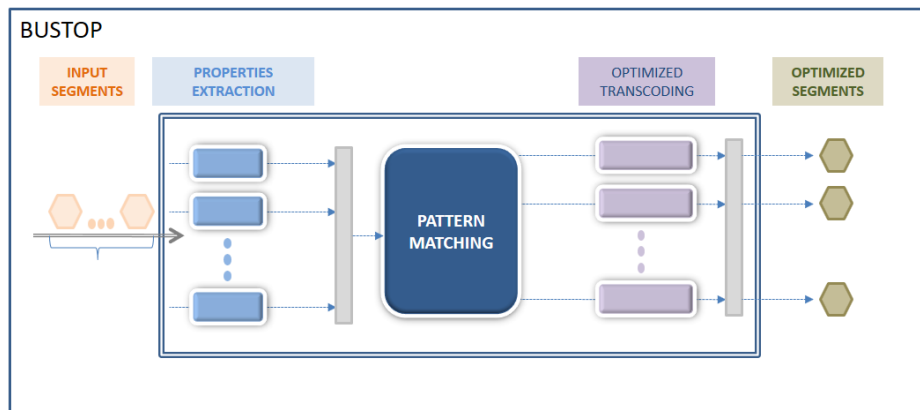
Terminal-oriented video transcoding platform

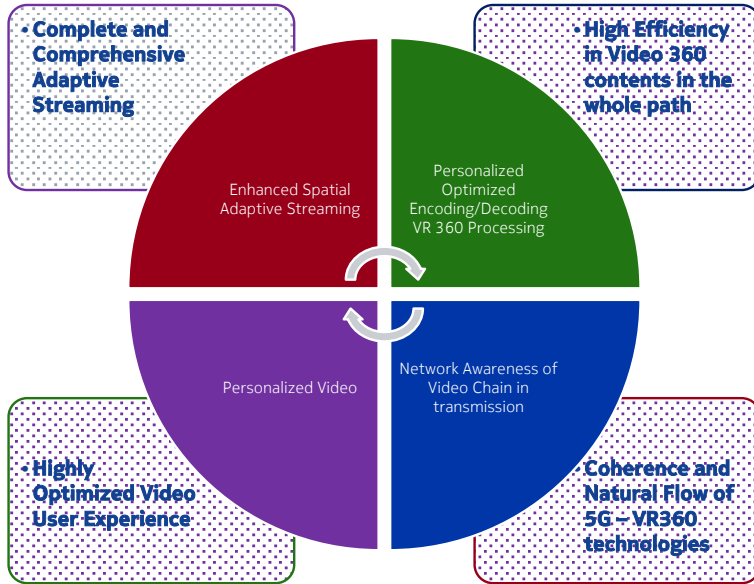


- Optimize content:
 - Network restrictions
 - User terminals / screens
- Scalable decision process & transcoding
 - Edge cloud, per-user

SAM/AVHD/UHD:

- Device characterization (presentation #28)
- Accuracy/efficiency trade-offs for coding quality metrics





- Optimization of ABR video content for
 - 4.5G/5G topologies &
 - 360VR video content
- Edge cloud content personalization

IMG:

- Quality of viewport-optimized video coding (e.g. based on tiling)
 - Low-latency FR metrics

DISTORAGE

Highly scalable video storage platform



- Scalable storage for massive recording and streaming of video
- Distributed: redundancy and throughput
- Real-time analysis and labeling of video segments
- Ingest may be not reliable (e.g. user-generated)

NORM:

- Content quality thresholding (accept/reject)
- Key Quality Indicators that may be added as meta-information to video storage
 - (e.g. "find me all the contents whose quality is excellent")

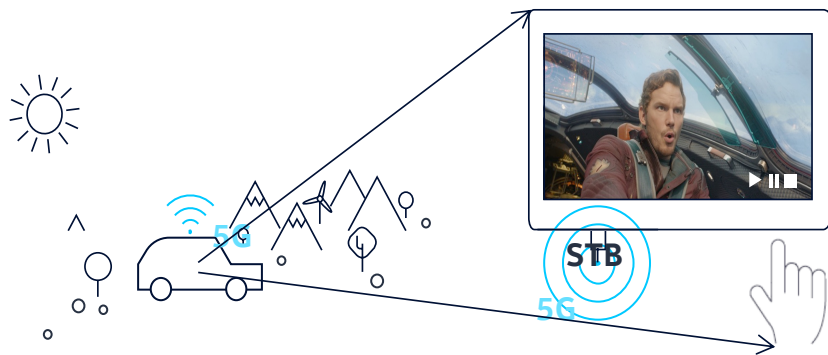


5GSTB

User terminals for the future network



- HW/SW implementation of client device (“set-top-box”) for 5G mobility environments
- Adaptive streaming policies
 - Optimized for mobility (network changes)
 - Adding info from network status



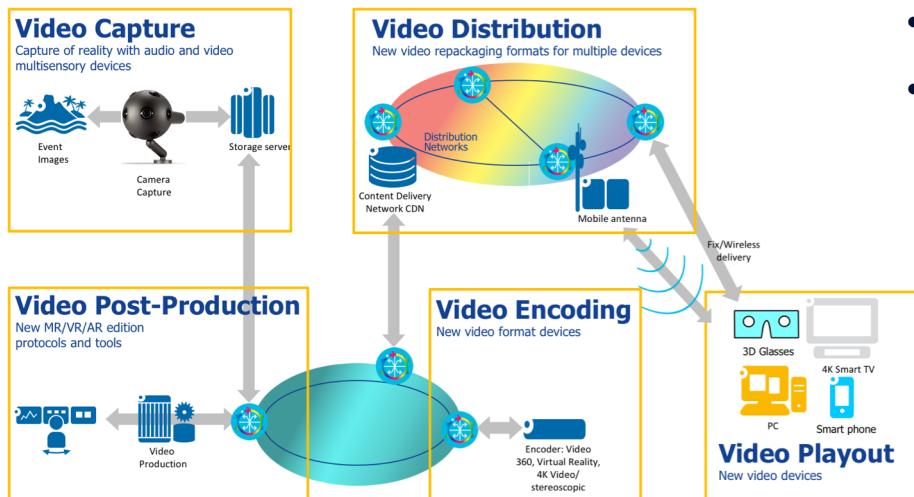
AVHD:

- Metrics to model adaptive streaming quality
 - Can they be used as input to optimize client algorithm?
- Subjective assessment methodologies:
 - Adaptive streaming sessions
 - Mobility environments (car/train/...)

- Professional capture and production of 360VR content
- Requirements for e2e service
- Use cases: education, telemedicine...

IMG:

- Quality of capture & production:
 - Quality of the 360VR shots
 - Stitching, projections, e
- Task-oriented evaluation for use cases
- Interaction between real and virtual world (augmented virtuality)



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