

KPN's perspective on future communication & 5G

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16 April 2019

The Power of KPN is our network



Communication

- <https://www.youtube.com/watch?v=B4viRavtwQg>

Virtual & Augmented Reality

Top 10 innovation trend (2017)



Dance Dance Dance VR

5G Field trials

Top 10 innovation trend (2018)

- <https://www.youtube.com/watch?v=1u7cXcAU9M>

1 billion People in VR

A lot is missing for widespread VR: Communication & Privacy



© <https://venturebeat.com/2017/10/11/mark-zuckerberg-we-want-to-get-1-billion-people-in-virtual-reality/>

Social AR/VR/XR Communication

Future Services



**VR Communication
(TNO)**



**AR Communication
(Mimesys / Intel)**



**Holoportation
(Microsoft)**

Why is this important for KPN

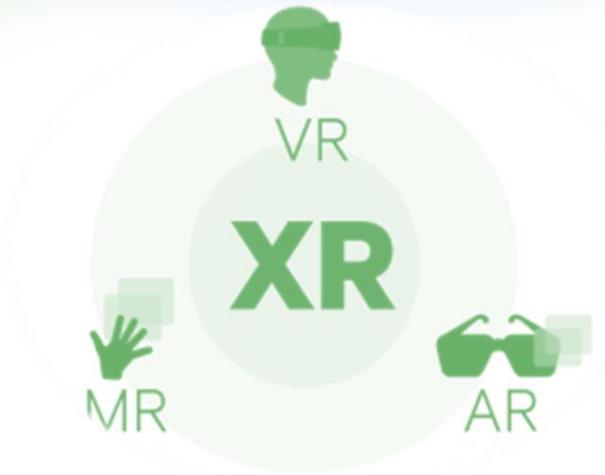
Why do people use Mobile Communication?



**Communication
on the go**



**Reliable
Services**



**Mobile as the
dominant platform**

Why is this important for KPN

5G & B2B Opportunities



- 99.999% reliability
- 1-10 ms delay
- High bandwidth



**high bandwidth for
production
companies**



**high-demand
storage solutions**



hosting solutions

Global Interop: KPN API Marketplace (LINK)

Opening Operator Services to 3rd parties



Get things done!

Develop faster with easy-to-use and flexible building blocks

Global Interop: KPNs added value

We do not monetize privacy



Convenience



Privacy



Security

Social VR

Example End to end chain



RGB+D camera



Depth-based background removal



HMD Replacement

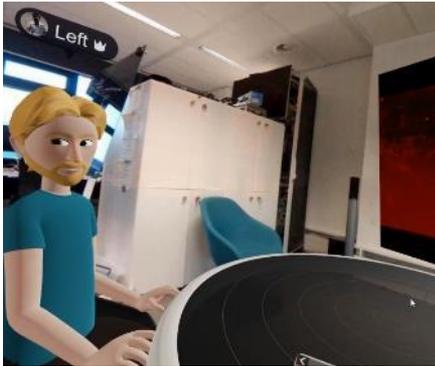


Scalability



User Study: Shared experience – 16 pairs

Social VR vs FB Spaces vs Face-to-Face



- interaction as well as social connectedness, Social VR is comparable to face-to-face
- avatars limited the perceived quality of interaction
- in-line with existing studies in literature that correlate avatar's realism to the quality of the communication in mediated communications
- *Paper: De Simone, F, Li, J, Galvan Debarba, H, El Ali, A, Gunkel, S.N.B, & Cesar Garcia, P.S. (2019). Watching videos together in social Virtual Reality: An experimental study on user's QoE. In Proceedings of 2019 IEEE Virtual Reality (VR) Proceedings.*

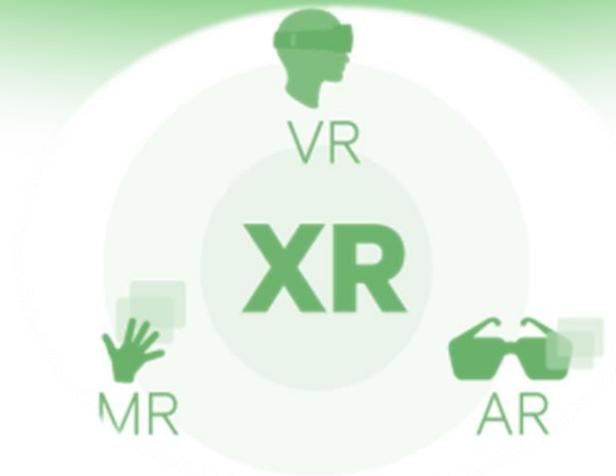
User Study: Negotiation task – 9 groups of 4

Social VR vs Skype vs Face-to-Face



- Initial Results:
 - Face-to-Face is best
 - No significant differences between Skype and Social VR
- Priority wish list:
 - Optical HMD removal: 24
 - Note-taking: 19
 - Interaction with VE: 4
 - More natural placement of self in VE: 1
 - Self-view: 0

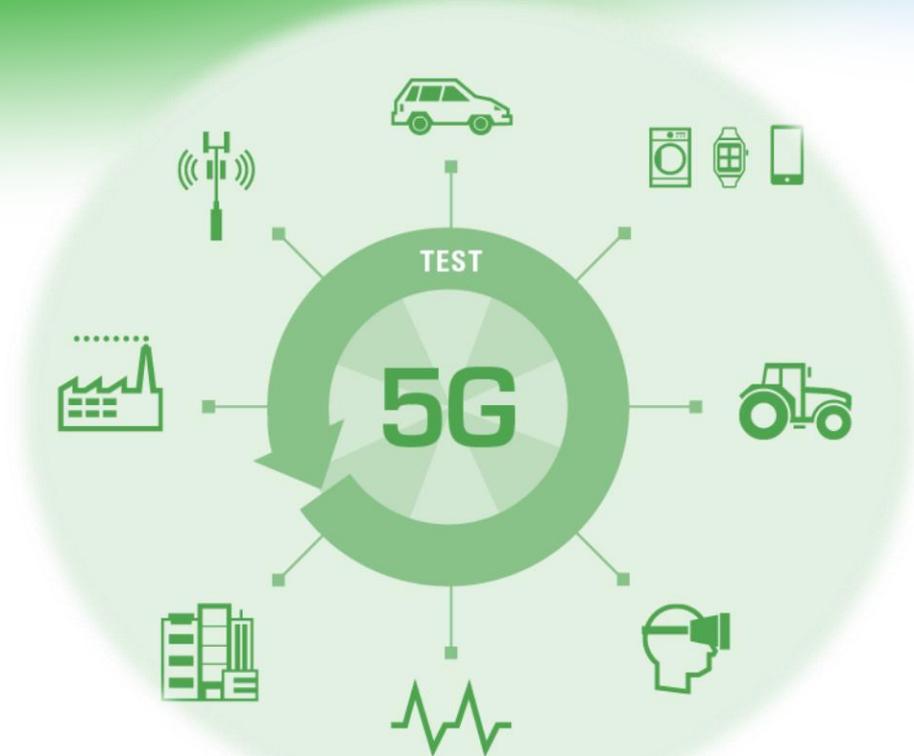
Social VR/AR/XR Requirements



- (Managed) bandwidth for video streams: uplink & downlink
 - More important than for regular video conferencing
- In-network video processing
- Central communication bridge
- End-user devices:
 - VR headset
 - headphones
 - (depth) webcam

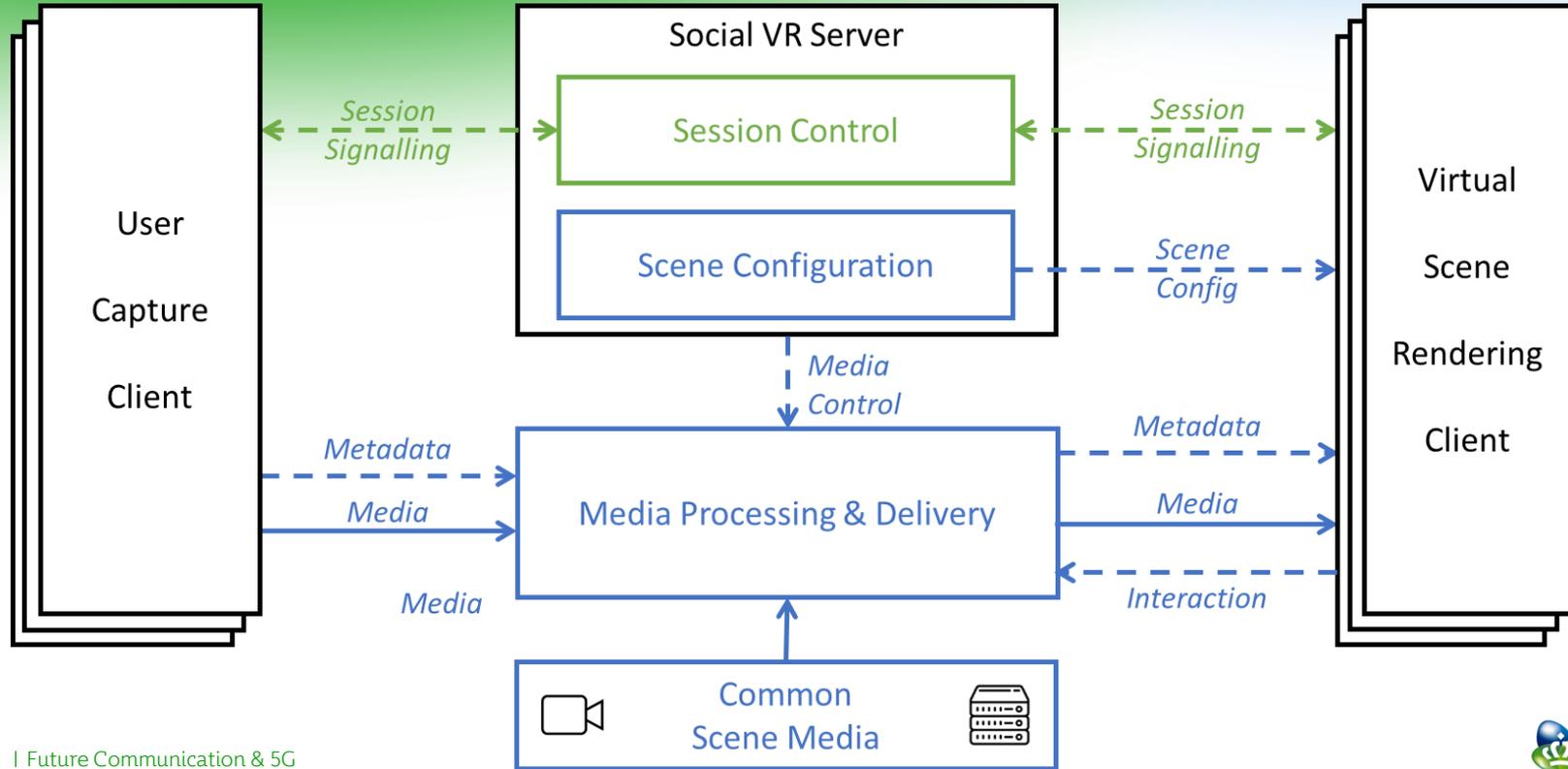
5G & Social VR

We need good requirements to build a good network.



Path to Success Standardisation

Generic Social VR Architecture (MPEG-I)



Path to Success

Current Steps



**Active Customer
Requests**



**Workplace Trials
@TNO & @KPN**



Industry Activity

Thanks!

Questions & Discussion

