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Bell Labs

VR/AR in the 5G Era

NEM Summit
November 23, 2016

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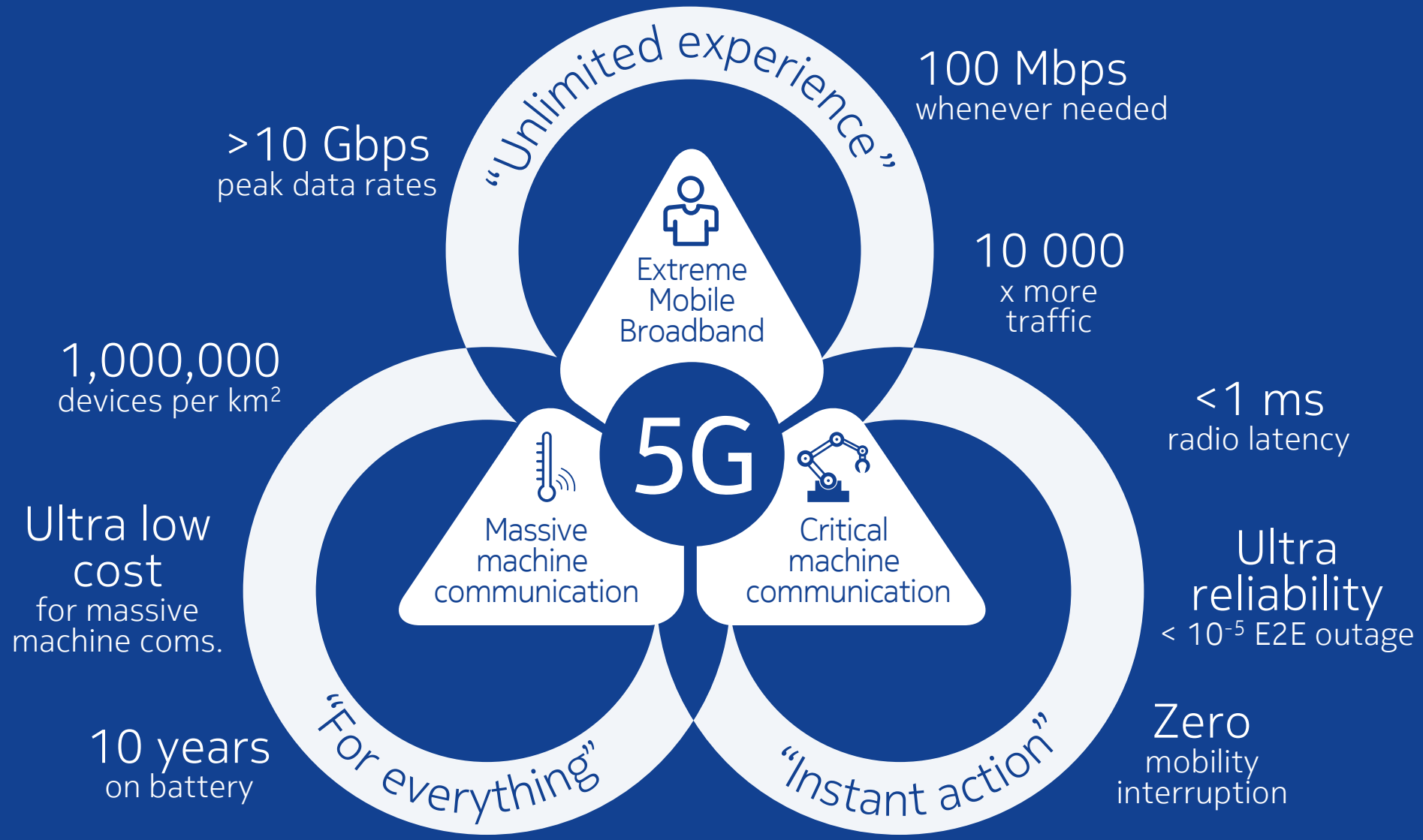
5G will change the world



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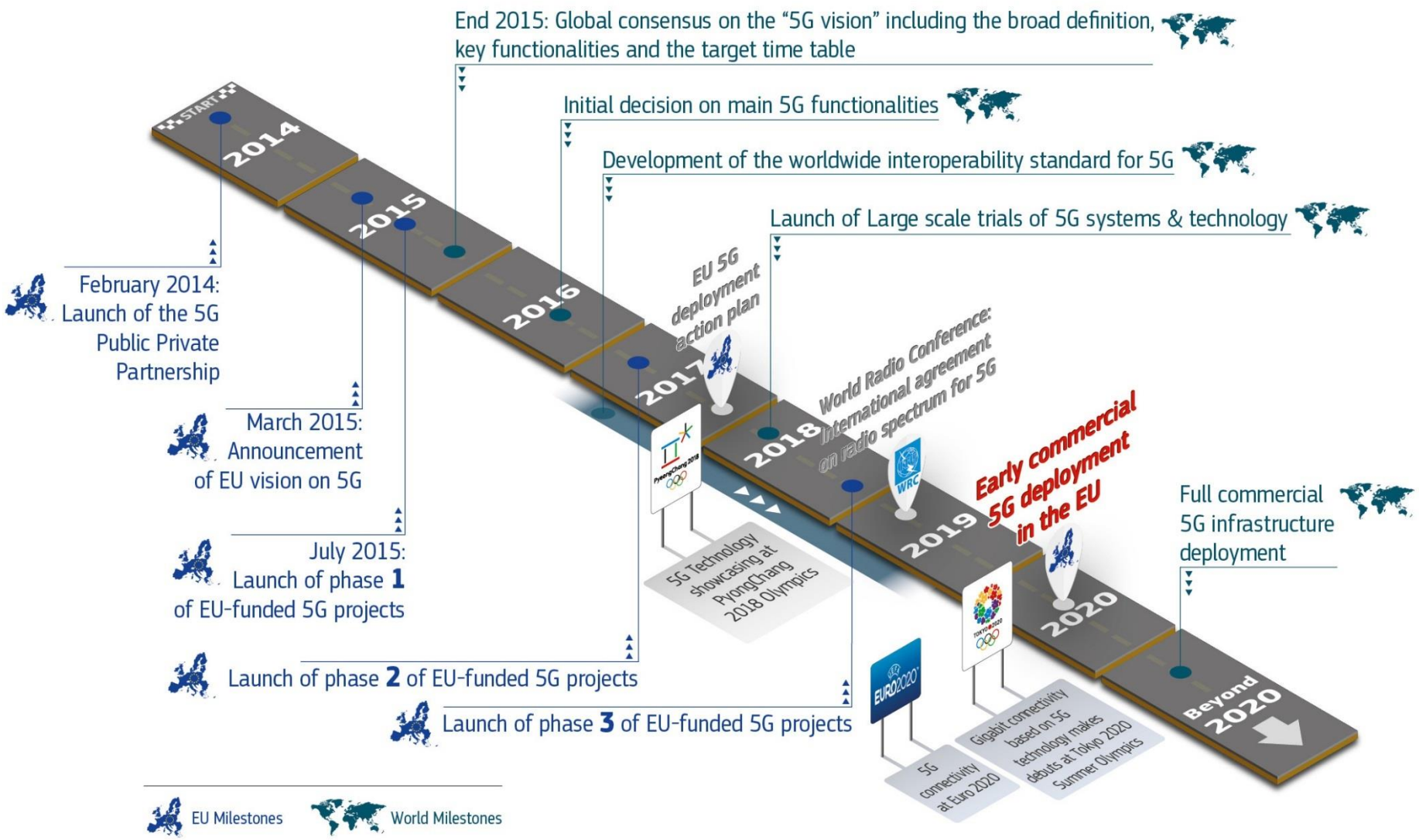
5G PPP Roadmap



Phase 1: 2014-2016

Design phase, proof of concepts, standardization

Phase 2: 2016-2018

Prototypes, technology demos, pilots with vertical industries

Phase 3: 2018-2020

Large scale trials on integrated end to end 5G experimental network infrastructure

The Mixed Reality spectrum
References from popular culture

Virtual Reality | Augmented Reality

Virtuality

Immersion in remote or synthetic environment

Interaction with virtual objects & people in **real environment**

Reality

The Lawnmower Man VR

Star Trek Holodeck

Star Wars holograms

The Terminator view

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The Mixed Reality spectrum and 5G

Virtual Reality

PC-tethered
(Facebook Oculus)

Smartphone-based
(Samsung Gear VR)

NOW

Isolating immersion of VR implies individual, dedicated viewing sessions in private and secure environments.

- Primordially in-home usage over broadband access + WiFi
- Some usage during car & train travel

Augmented Reality

Microsoft Hololens

ODG R7 glasses

2018+

Performance, price, form factor, comfort

Anchored in reality, AR is compatible with interactions in public environments and social settings.

- **Potential for continuous indoor and outdoor usage**
- **Relevant 5G application scenario**

Augmented Reality main consumer media classes

Gaming

Gaming experiences integrated into player's real-world environment.

1 Mbps

Contextual Info

Contextual information tuned to user's situation, activity and intent.

5 Mbps

2D Video

Ubiquitous hands-free video consumption and creation greatly boosts usage.

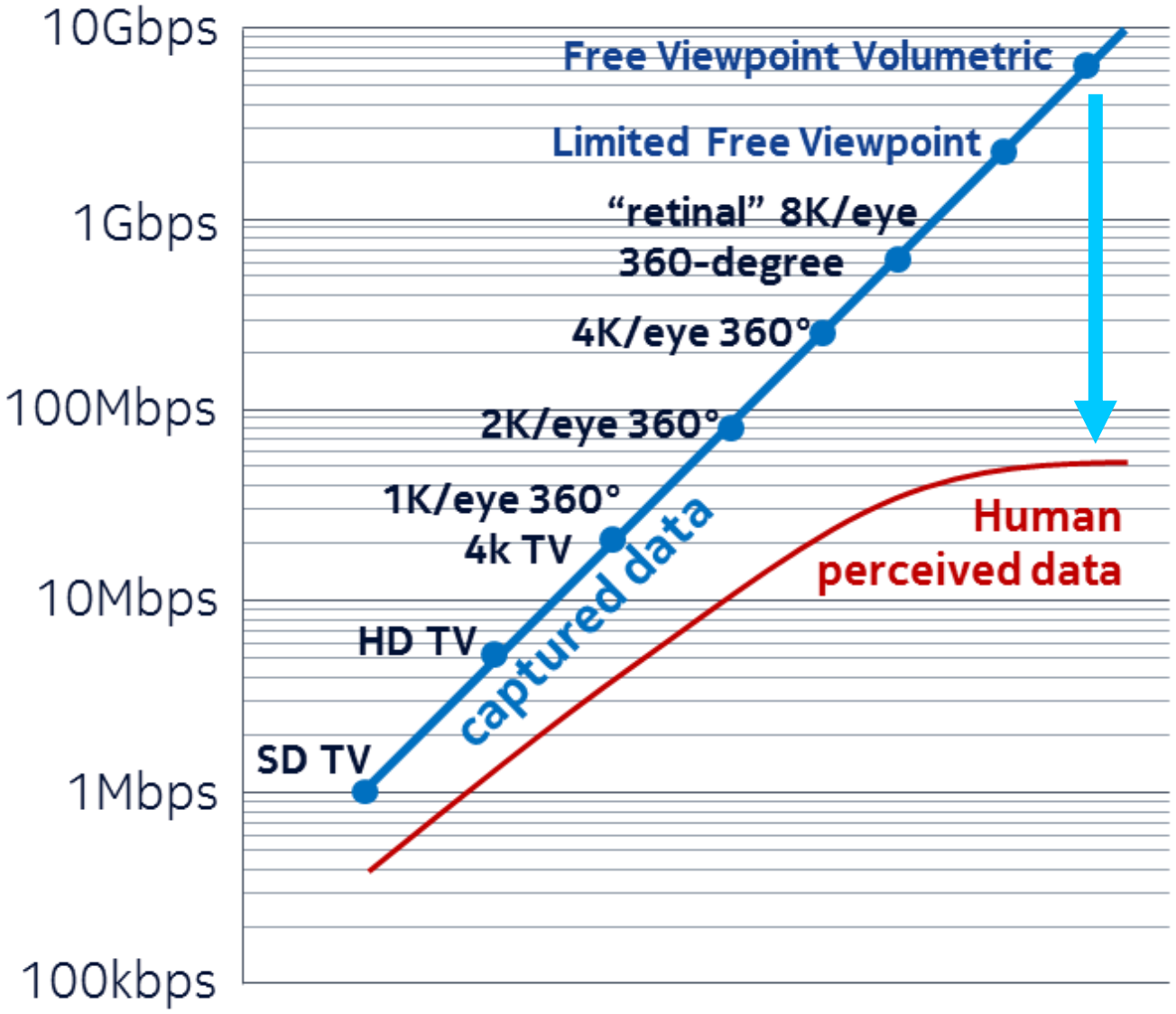
15 Mbps

Volumetric Video

Free Viewpoint volumetric video, a new medium for entertainment, information and communication.

100 Mbps

Volumetric video bandwidth



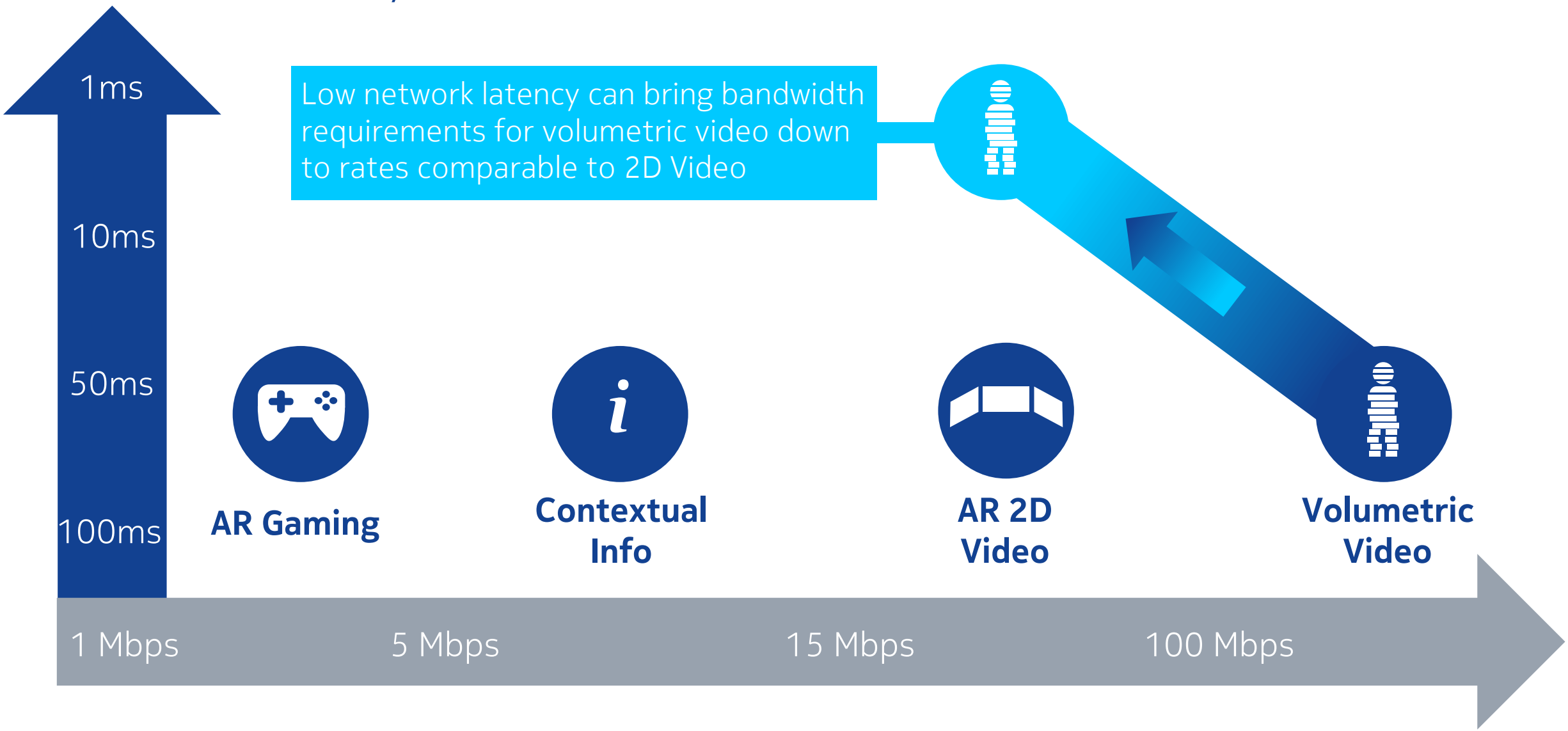
Bandwidth requirements explode for high-quality volumetric video

Bandwidth requirements can be greatly reduced by **rapid adaptation** of delivered video data to user's position, head orientation and eye gaze direction

Viewers can only perceive a fraction of the captured video data:

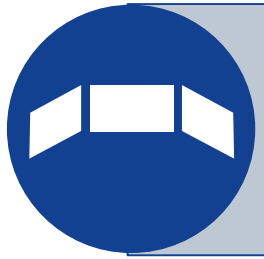
- Single position in space
- Human Field of View
- Non-uniform resolution distribution of human eye

Bandwidth-latency

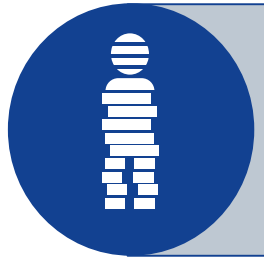


Summary

AR Video = prime 5G consumer media service



Ubiquitous hands-free consumption and creation of video will greatly boost usage.



New medium of AR volumetric video demands 5G bandwidth/latency playfield.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