April 15 2019 martinr@qti.qualcomm.com 5G 3GPP/VRIF/AIS

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How 5G enables new Extended Realities

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How 5G enables new Extended Realities

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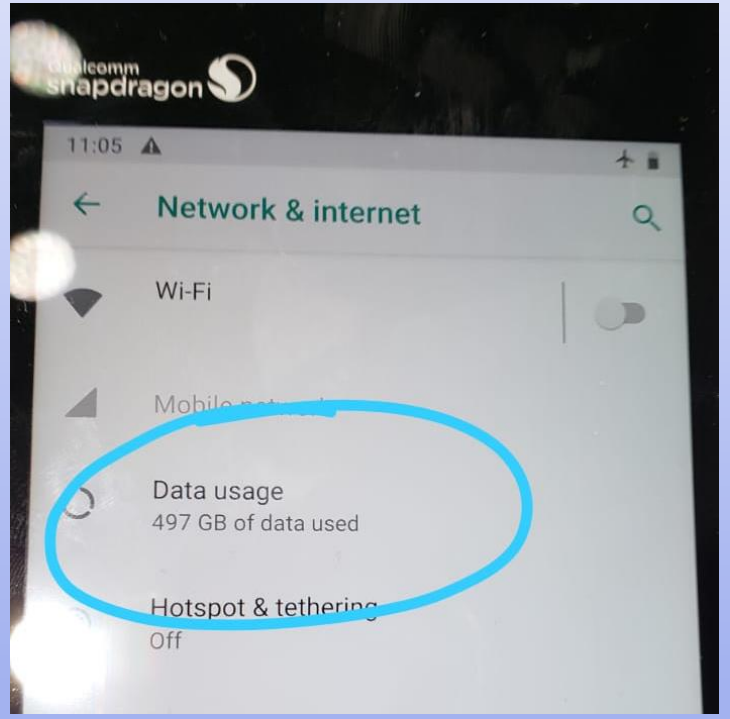


Team's involvement in AR/VR

Working on AR/VR since 2012

2014: 1st Snapdragon AR Prototype

Snapdragon
8060
8074
8084

2015-2017: ODG R7/R8/R9

April 2016: BMW Augmented Vision

2016-2019: Snapdragon VR 820/835/845/855/865

Looking back at 15 Months of XR Improvements

Devices

Hardware / Architecture

- Silicon
  - Snapdragon 820 vs. 855
    Power: 3x savings
- Eye Tracking /
  Foveated Rendering
  - 2x savings for high res
- Computer Vision HW
- AI HW
- Camera See-Through
- Depth Cameras

Connectivity

- Wifi 802.11 AD
  - 60 GHz millimeter wave spectrum
- 5G
  - Sub 6
  - millimeter wave spectrum
- Immersive Media Streaming
  - 6DOF Video
  - Split Rendering

Device Classes

- Mobile Devices
  - Slot-In -> Standalone Viewers
  - Tethered high resolution glasses
- PC
  - Inside-Out Tracking
  - Wireless HDMI
  - Split-Rendering
- Dual Mode Devices
  - Mobile / PC

Looking back at 15 Months of XR Improvements

Software

- ARCore
  - Surface Detection
  - Light Estimation
  - Anchoring Objects
- Khronos OpenXR
  - XR rendering/timing abstraction (Compositor)
  - Tracking abstraction
  - Input abstraction
  - Device abstraction

Controllers

- 3DOF -> 6DOF
- Tracking
  - Optical: Outside-In -> Inside-Out
  - Ultrasound
  - Skeleton model based

Displays

- Higher Resolution
  1k -> 2k -> 4k per eye
- Multiple Viewports
- Multi-Focus
- Wave Guides
- Laser Projectors

AR

VR

Top Individual Use Cases

30% Design

View a room or space with virtual elements to see what it looks like with a new design

35% Travel

Virtually visit any place around the world as if you are physically there

30% Assistance

Enhance your vision to clearly see in dark or poorly lit environments

28% Shopping

Virtually visit a house/apartment, hotel room, vacation spot, or view products before buying

30% How-To

Learn new skills or techniques (e.g. foreign language, making/fixing things)

25% Communication

Communicate with people in different locations as if they are there with you in the same space

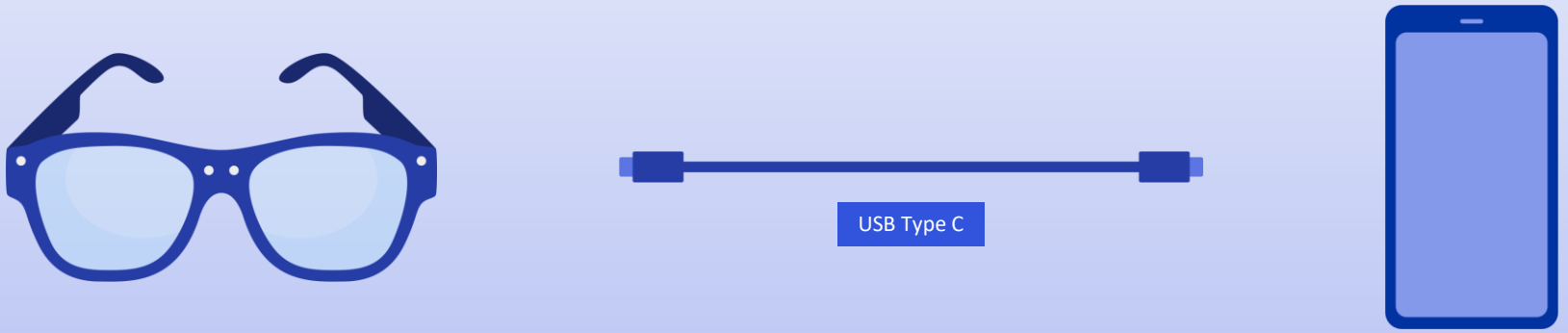
Use cases that help save time and cost

Qualcomm snapdragon 855 mobile platform

- **5G Mobile Platform**
  mmWave & sub-6
- **Immersive Compute**
- **Computer Vision Processing (CV-ISP)**
- Artificial Intelligence Engine
- 7nm Power & Performance

30+ product announcements

Next generation immersive mobile computing with 5G



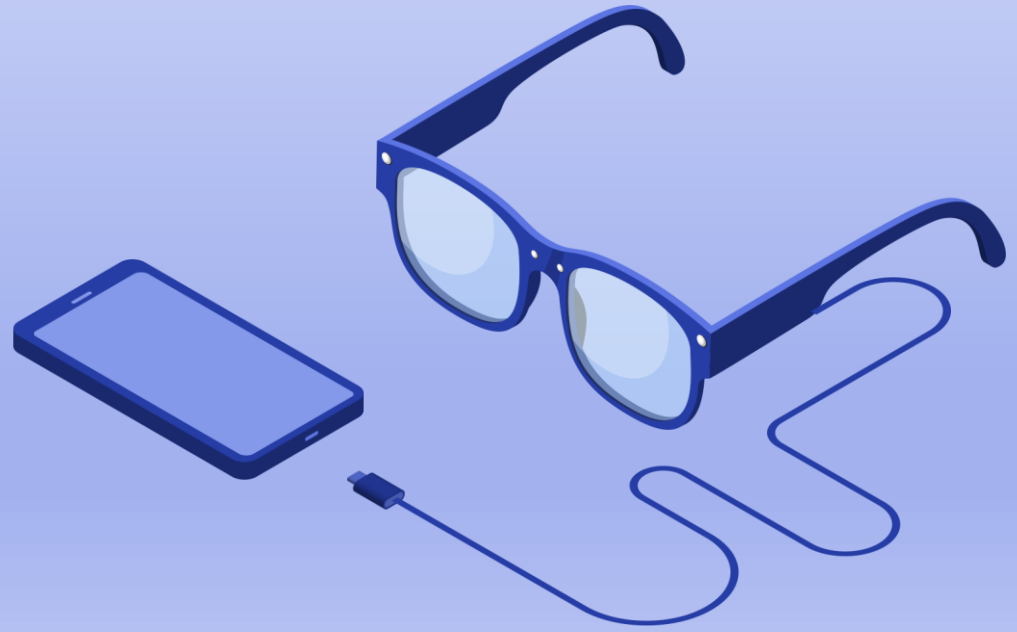
- AR or VR
- Comfortable, light
- High Quality Displays

- Tracking Cameras (head, hand, controller, eye) and sensors

- Snapdragon 855 based Smartphone
- DP out ready (DP+USB enabled)

- Software: Snapdragon 855 SW

XR viewers pave the way



OEM

- Ability to offer different levels of immersive devices

Operator

- Bring new experiences to customers as they unveil 5G
- Ability to bundle offering at point of sale

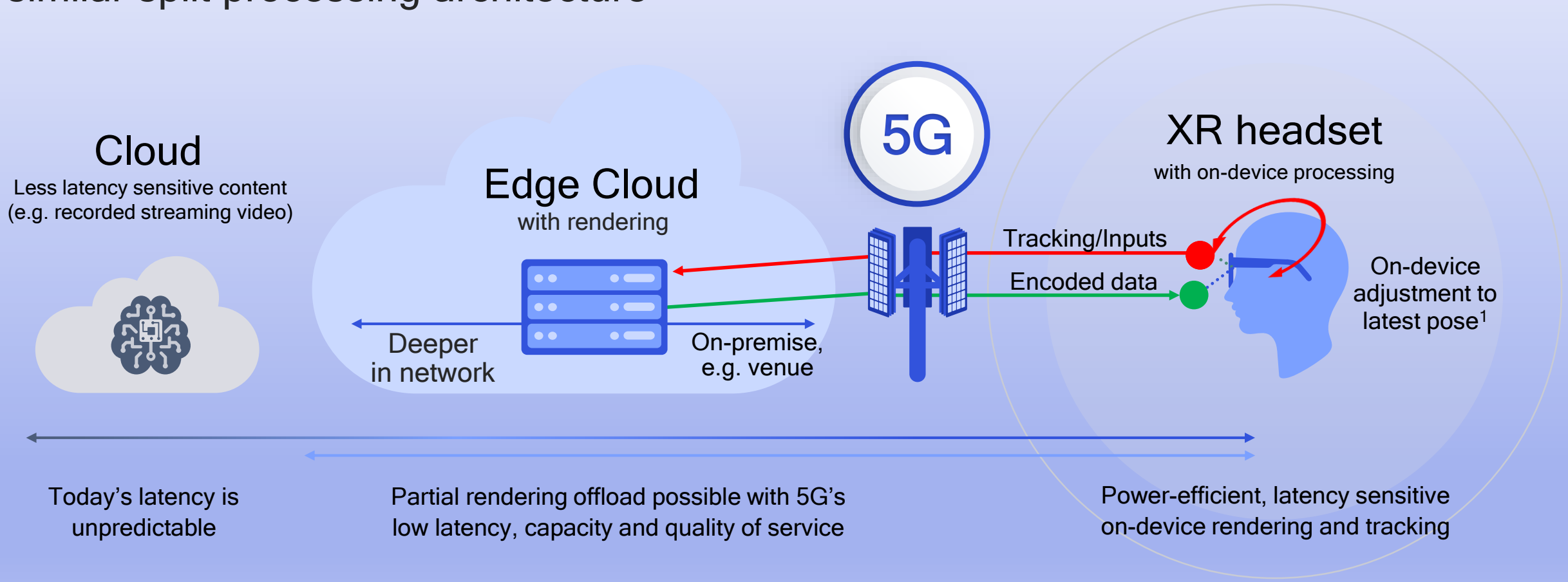
End user

- New and seamless XR experiences

Source: QCT research and analysis

Split Rendering over 5G

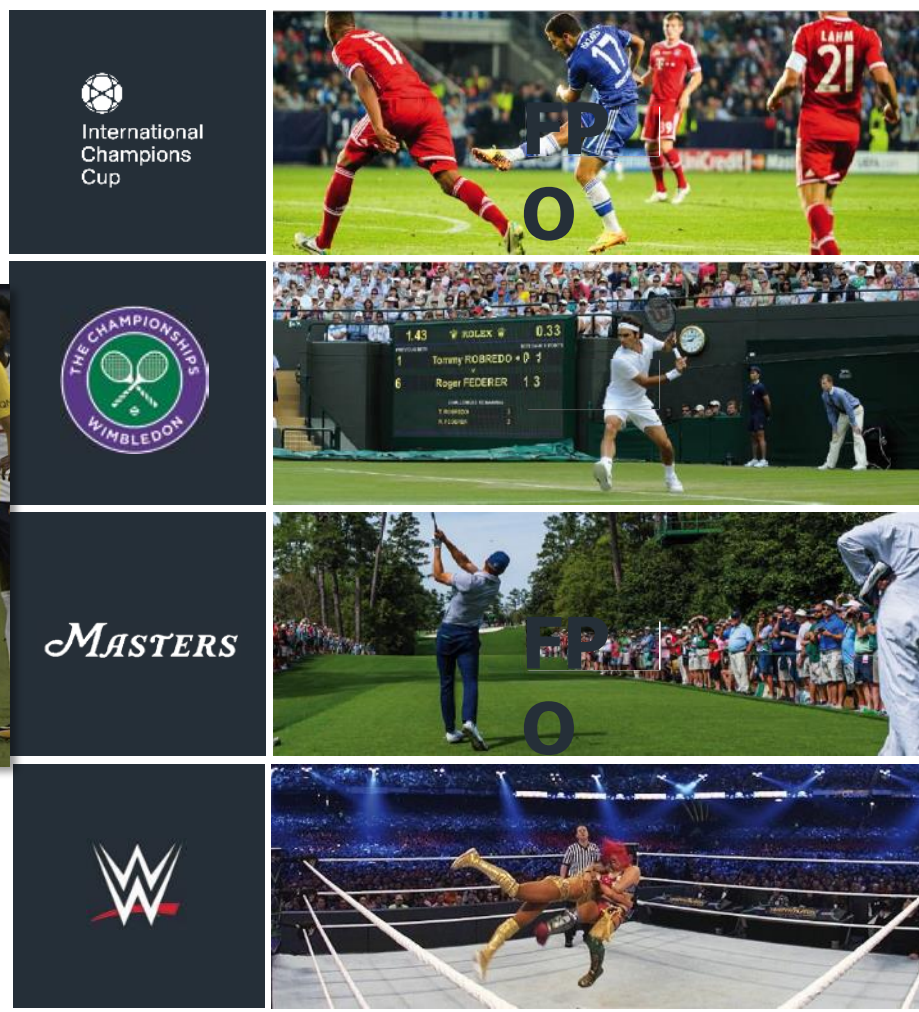
Boundless XR with Edge Cloud will follow similar split processing architecture



Demo

Delivering premium XR experiences anywhere via 5G

NEXTVR



VR: Immersive entertainment over 5G


Transport yourself with XR over real 5G.
Live 5G network demo brought to you by AT&T with Ericsson Radio System
AT&T
ERICSSON
Qualcomm Snapdragon 855 5G Mobile Platform
Exit

Demo

6DOF Video Streaming

Connectivity

- Millimeter wave
  - 5G or 802.11 AD
  - 100-150 Mbps

Software / Content

- NextVR Server and Player application
- Volumetric 180°FOV, 4k60 content (+/- 2 feet)
- Qualcomm Snapdragon VR SDK

Device

- Display: 2160x2160 per eye, 90 fps, demo at 60 fps (content driven)
- 6DOF inside-out tracking
- USB-C to phone

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Thank you

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