



# The Mobile Future of eXtended Reality (XR)

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Hugo Swart  
Senior Director, Product Management  
Qualcomm Technologies, Inc.  
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# XR is the future

Industrial & manufacturing



Engineering



Healthcare



Retail



Education



Marketing & advertising



Military



Emergency response



Entertainment



VR  
XR  
AR

Will the smartphone become an XR headset?



# XR is here today, but it is still in its infancy

Analogy to smartphones: XR evolution will take years...opportunity will be immense

**Technology Phase:** Infancy

**Market:** Mostly early adopter "Prosumers"

**Technology Phase:** Rapid evolution

**Market:** Surging consumer adoption

XR is here today

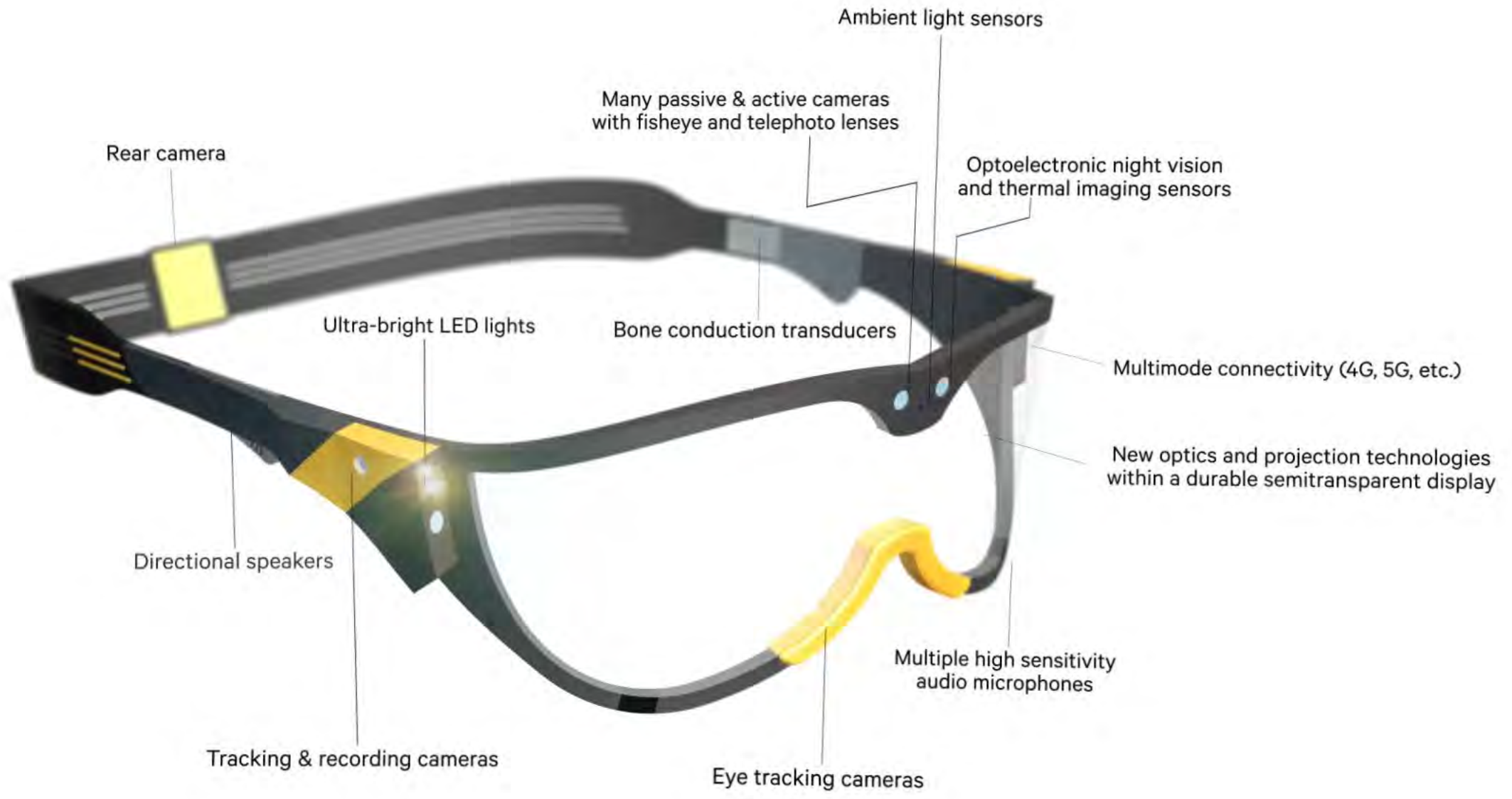
XR by ~2020

**Technology Phase:** Maturity

**Market:** Worldwide, ubiquitous use

XR will follow a similar ~30 year cycle of sleeker designs, with tremendously increasing functionality





Rear camera

Ultra-bright LED lights

Directional speakers

Tracking & recording cameras

Eye tracking cameras

Many passive & active cameras with fisheye and telephoto lenses

Ambient light sensors

Optoelectronic night vision and thermal imaging sensors

Bone conduction transducers

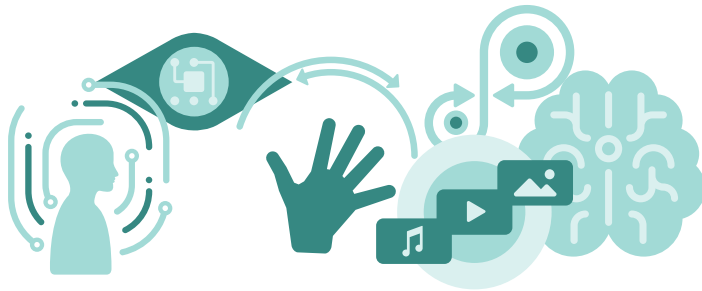
Multimode connectivity (4G, 5G, etc.)

New optics and projection technologies within a durable semitransparent display

Multiple high sensitivity audio microphones

# Power and thermal efficiency is essential for XR

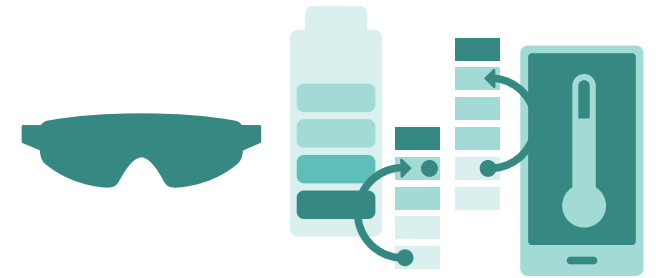
The XR headset needs to be appropriate to wear and use all day



## The challenge of XR workloads

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Very compute intensive  
Complex concurrencies  
Always-on  
Real-time



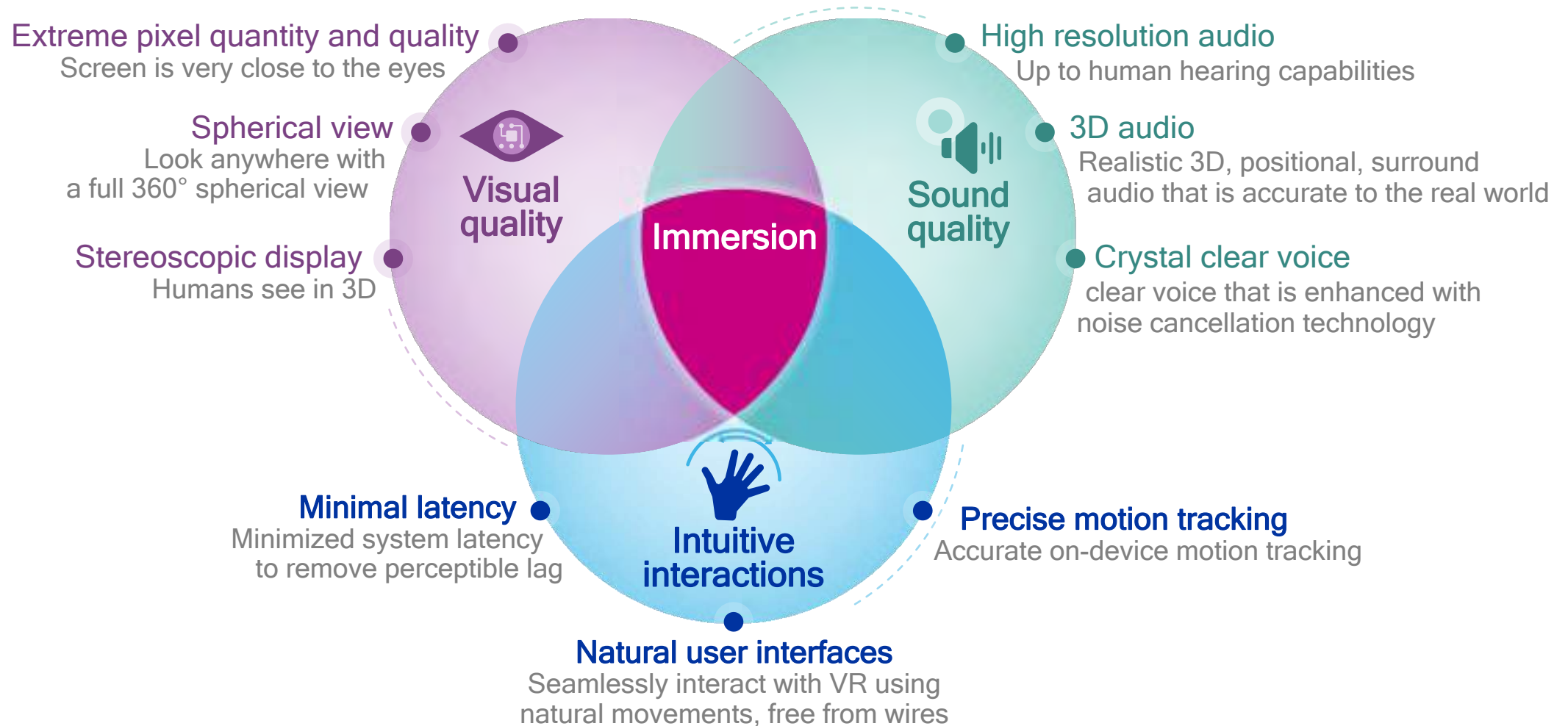
## Constrained mobile, wearable environment

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Must be thermally efficient for sleek, ultra-light designs  
Requires long battery life for all-day use  
Able to be quickly recharged at least 1,000 times

# Immersive virtual reality has extreme requirements

Achieving full immersion at low power to enable a comfortable, sleek form factor







# Immersive visuals with Snapdragon 835

**25%**

faster  
graphics  
rendering

Up to

**60x**

more display  
colors



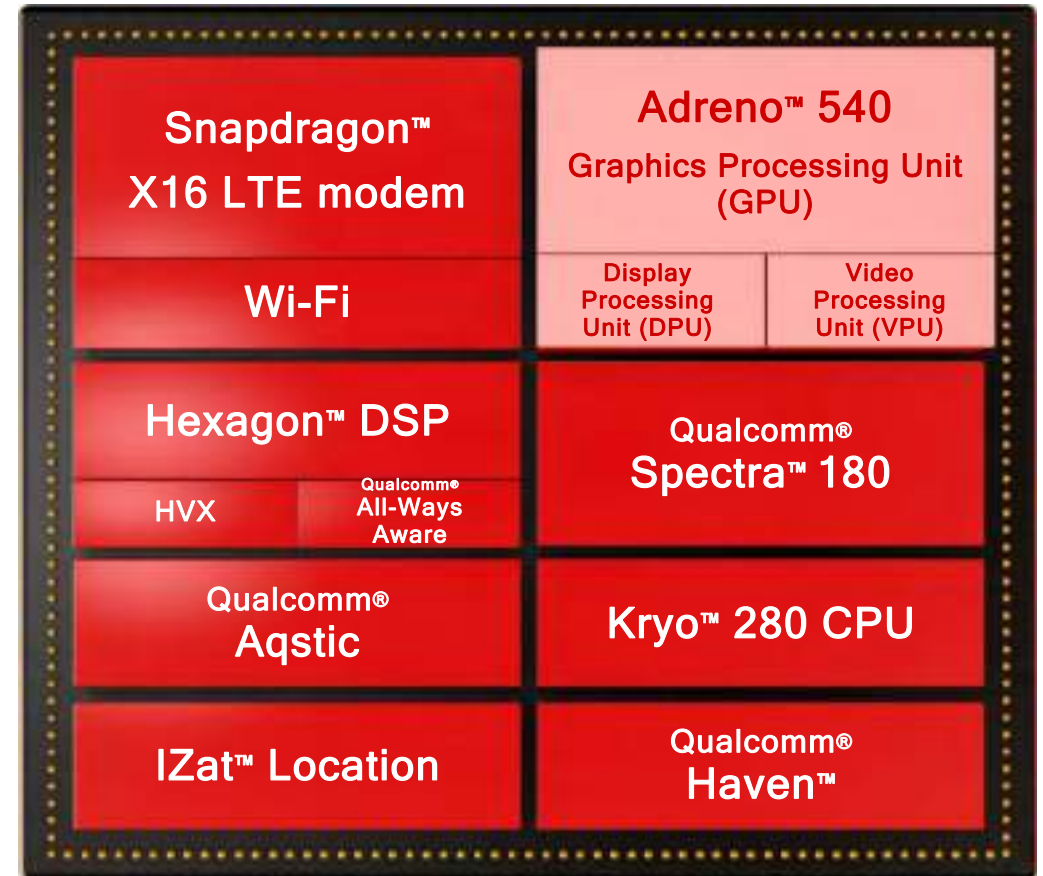
# A heterogeneous computing approach for immersive visuals

Efficient processing by running the appropriate task on the appropriate engine

## Immersive visuals

- **GPU** - Efficient rendering of advanced 3D visuals for DX12, OpenGL ES & Vulkan applications
- **DPU** - 10-bit 4K@60fps display, Q-Sync, and wide color gamut
- **VPU** - 4K HEVC 10-bit playback, foveated video support

## Qualcomm® Snapdragon™ 835



\* Not to scale



## Snapdragon 835 immersive audio experiences



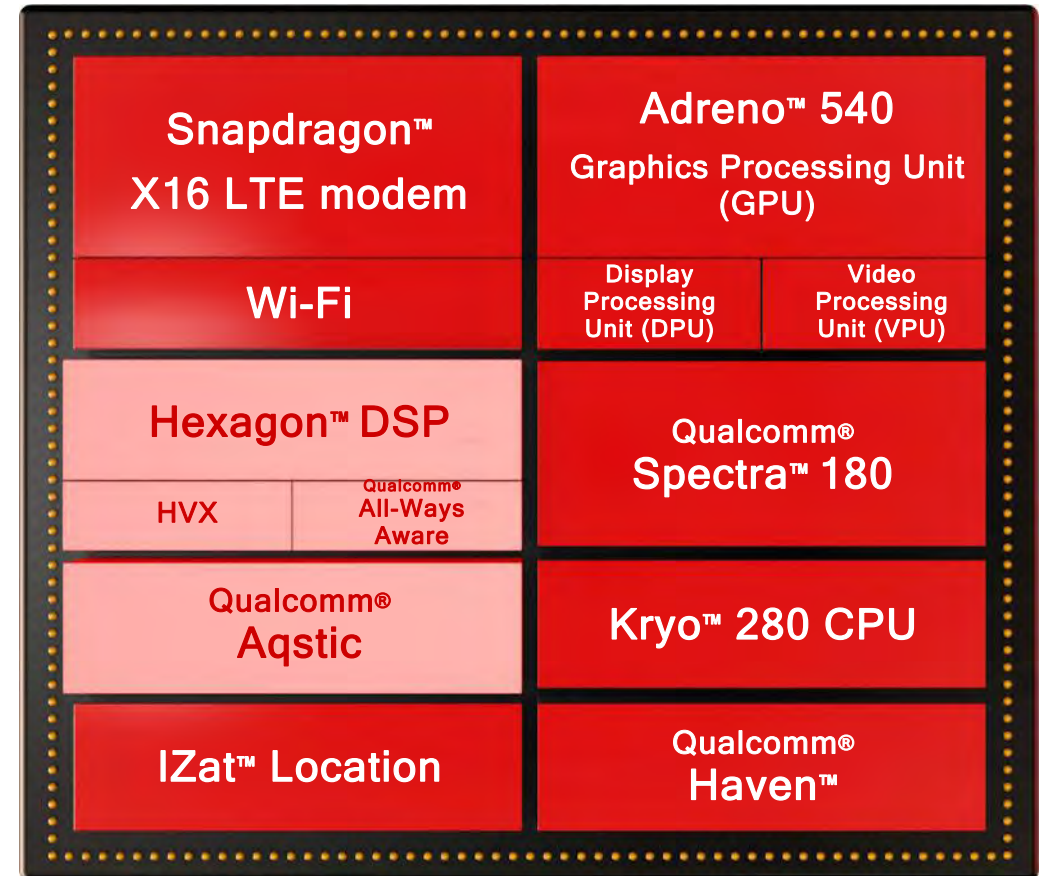
# A heterogeneous computing approach for immersive audio

Efficient processing by running the appropriate task on the appropriate engine

## Heightened sounds

- Support for object and scene-based audio
- Hi-Fi grade DSD format and SNR & THD+N
- Crystal Clear voice

## Qualcomm® Snapdragon™ 835



\* Not to scale



# Computer vision for XR

- 6 DoF head tracking
- Eye tracking
- Hand tracking
- Object detection and recognition



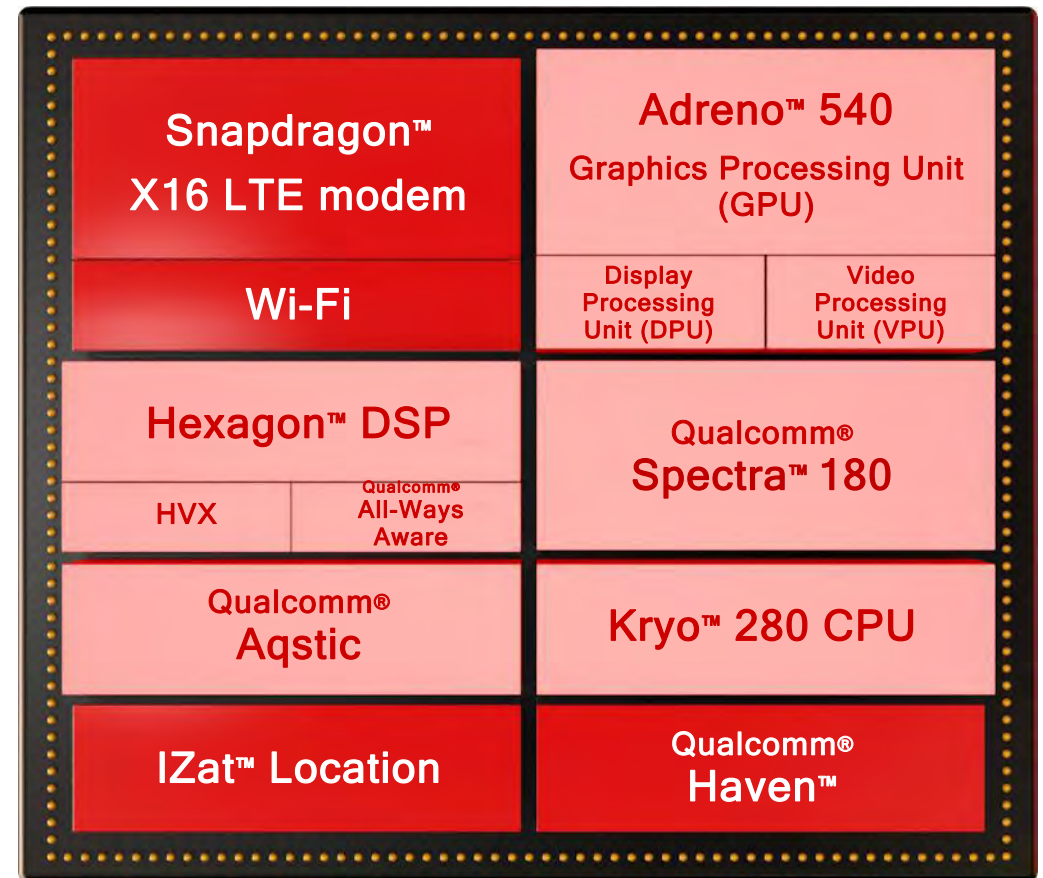
# A heterogeneous computing approach for immersive interactions



Qualcomm® Snapdragon™ 835

## Immersive Interactions

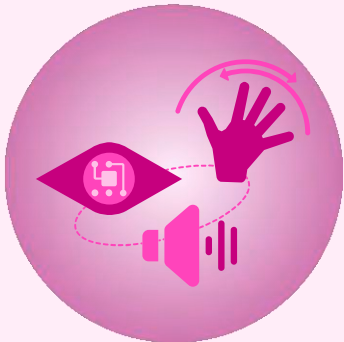
- VIO for precise, low latency 6-DOF
- Computer vision for gesture recognition and eye tracking
- Machine learning for eye movement prediction and gesture recognition
- Hexagon DSP is a crucial differentiator for real-time and low power experiences



\* Not to scale

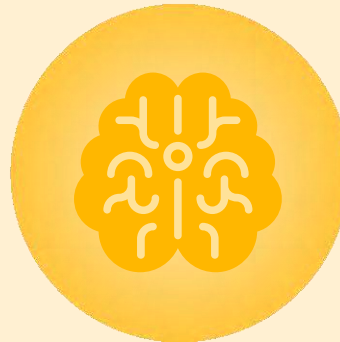
# AR has additional requirements beyond immersion

Providing an always-on experience that intelligently enhances our lives



## Immersive

The visuals, sounds, and interactions are so realistic that they are true to life



## Cognitive

It understands the real world, learns personal preferences, and provides security & privacy



## Connected

An always-on, low power wearable with fast wireless cloud connectivity anywhere

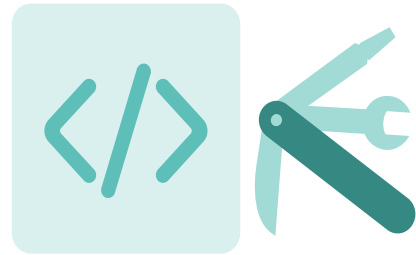
# Significant progress in VR and AR this year

## Improving experiences with Snapdragon 835



### Snapdragon 835

Purpose built silicon for superior mobile VR & AR



### Snapdragon VR SDK

Easy developer access to Snapdragon accelerated VR libraries that simplify application development



### HMD Accelerator Program

Commercialize VR HMDs quickly with fewer resource restraints



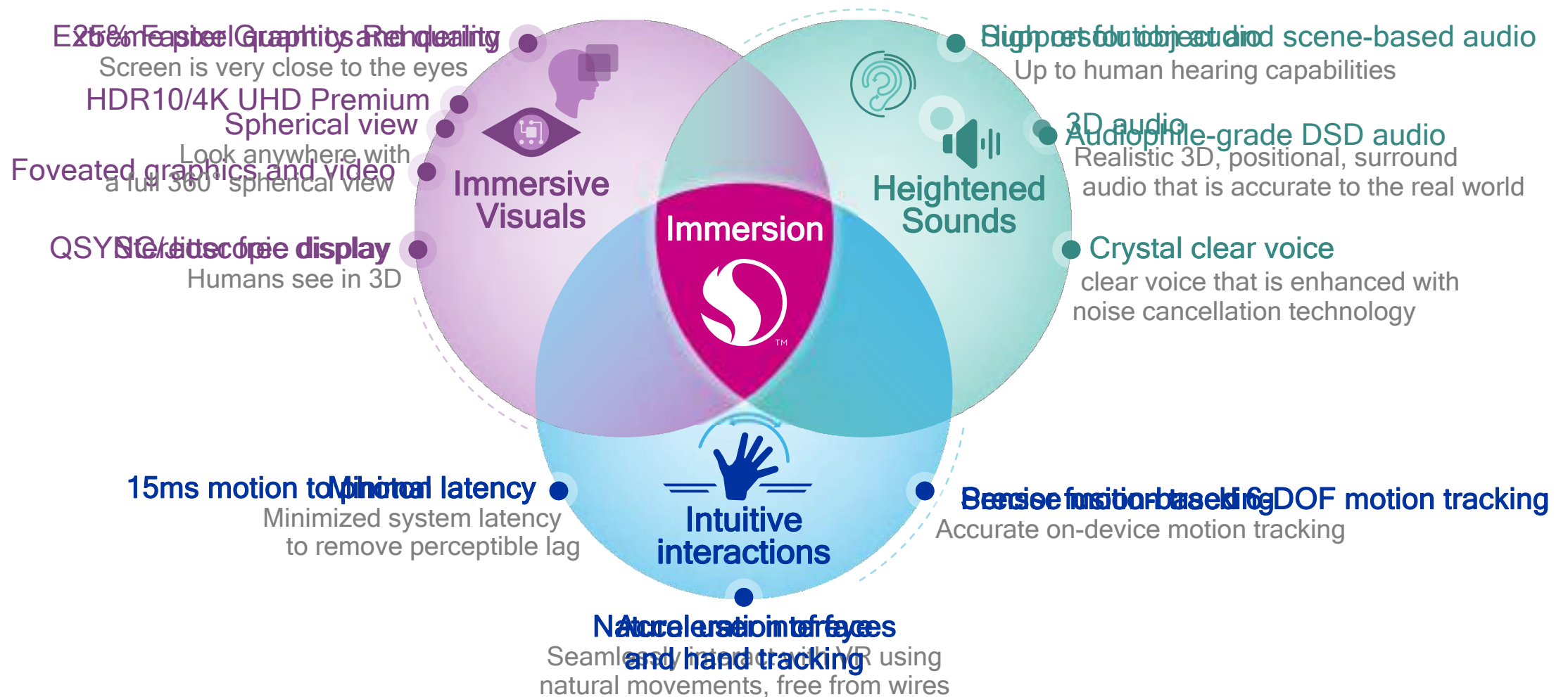
### Ecosystem support

Collaboration with multiple content, technology, and platform companies



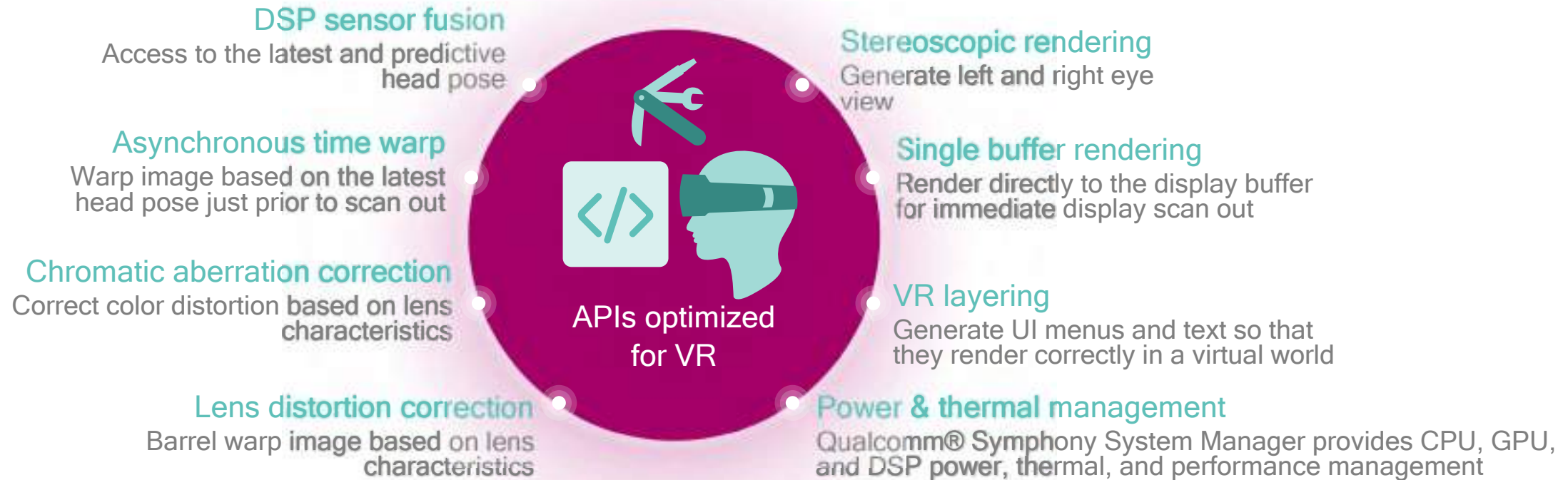
# Snapdragon 835 processor is taking us closer to the vision

Designed to meet the VR processing demands within the thermal and power constraints



# Qualcomm® Snapdragon™ VR SDK

Access to advanced VR features to optimize applications and simplify development



## Benefits

Simplified development

Optimized VR performance

Power and thermal efficiency

# A comprehensive, robust VR reference design

Reference design based on the Snapdragon 835 SoC



**Snapdragon 835**



## Key components selection

(camera, sensors, display)



## Product/HW Design Files

(schematics, BOM, layout files, thermal design guidelines)



## VR SW Services and SDK

(6DoF, Sensor Fusion, ATW, Single-Buffer Rendering, Unity plug-in, etc.)



## VR HMD Sample Units

(availability in July)

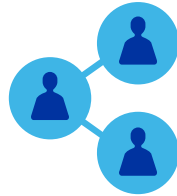
# HMD Accelerator Program - Pillars

Commercialize VR HMDs quickly with fewer resource restraints



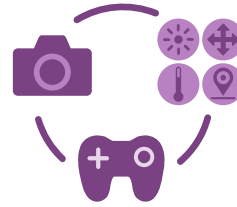
1

Product  
Reference  
Design



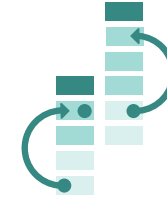
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ODM  
Partners



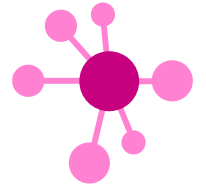
3

Component/  
Peripherals/  
Technology  
Partners



4

Performance  
and Quality  
Metrics/Testing



5

Marketing  
Support

# Accelerating the development of standalone HMDs

HMD Accelerator Program cutting edge components



**Sensors**

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**Eye  
Tracking**

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**Controllers**

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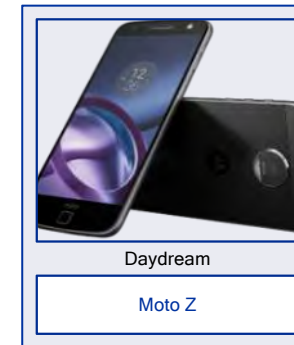
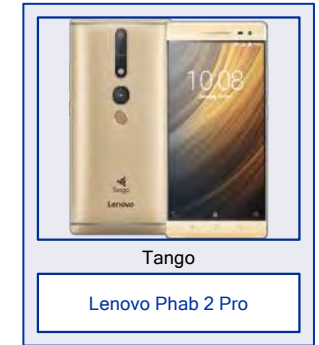
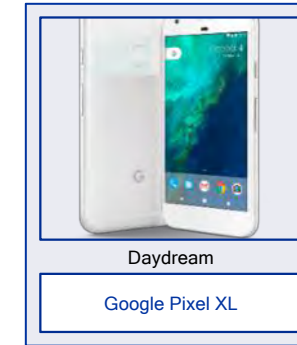
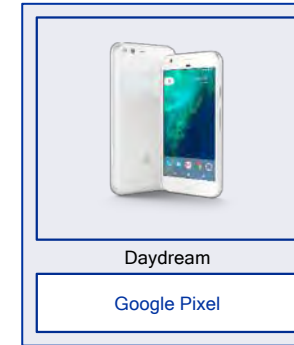
**BOSCH**

Omni  Vision.

**XIMMERSE**

# Actively working with XR device manufacturers

## XR products based on Snapdragon Mobile VR Platform



20+ 20+  
Devices launched In development



# Google Daydream and Qualcomm collaboration

- Jointly fostering the ecosystem of standalone mobile VR
- Google IO accountment: 835 standalone reference design



# Jointly fostering the ecosystem of standalone mobile VR



Daydream

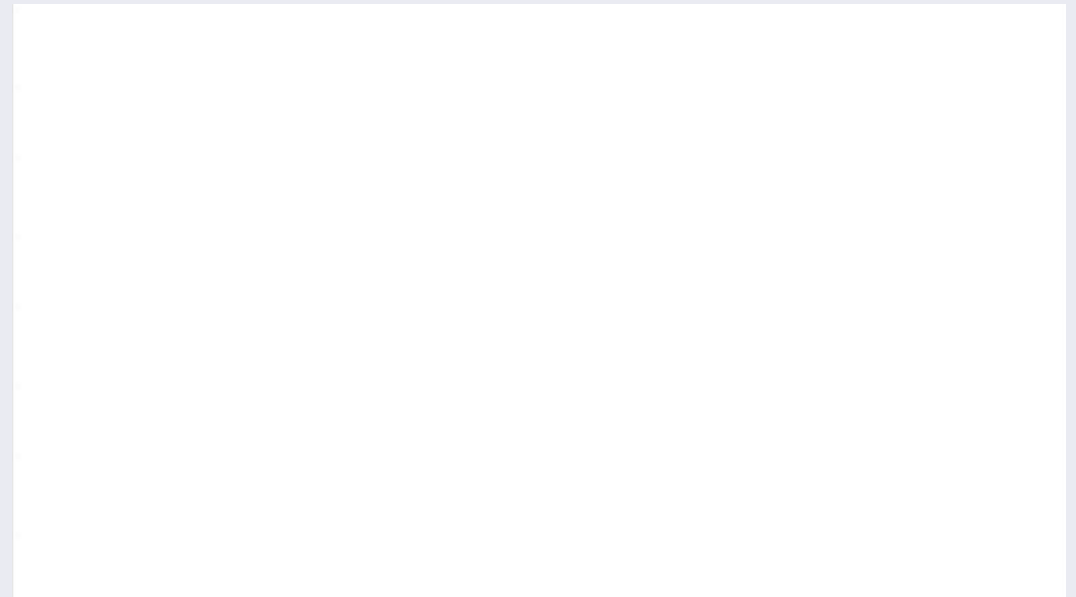


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# Snapdragon Mobile VR Development Kit



- ❖ Snapdragon VR SDK
- ❖ Snapdragon VR HMD

[developer.qualcomm.com](http://developer.qualcomm.com)

# Thank you

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