

Introduction to the challenges of VR

ARM

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VR Use-cases – Driving System Demand

VR technology =
Truly Immersive Experience



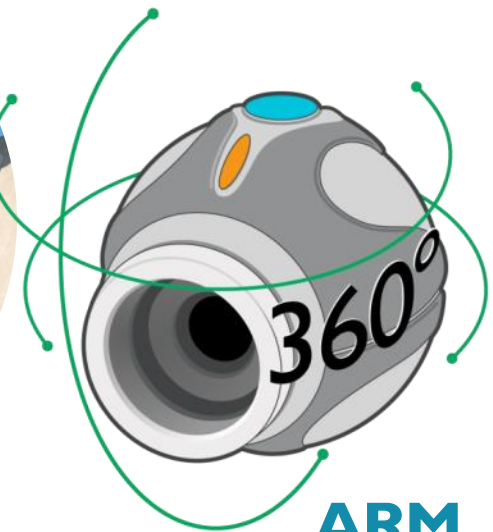
Virtual Reality Gaming

- Interactive high-end graphics



Virtual Reality Video/360 Video playback

- Immersive video content



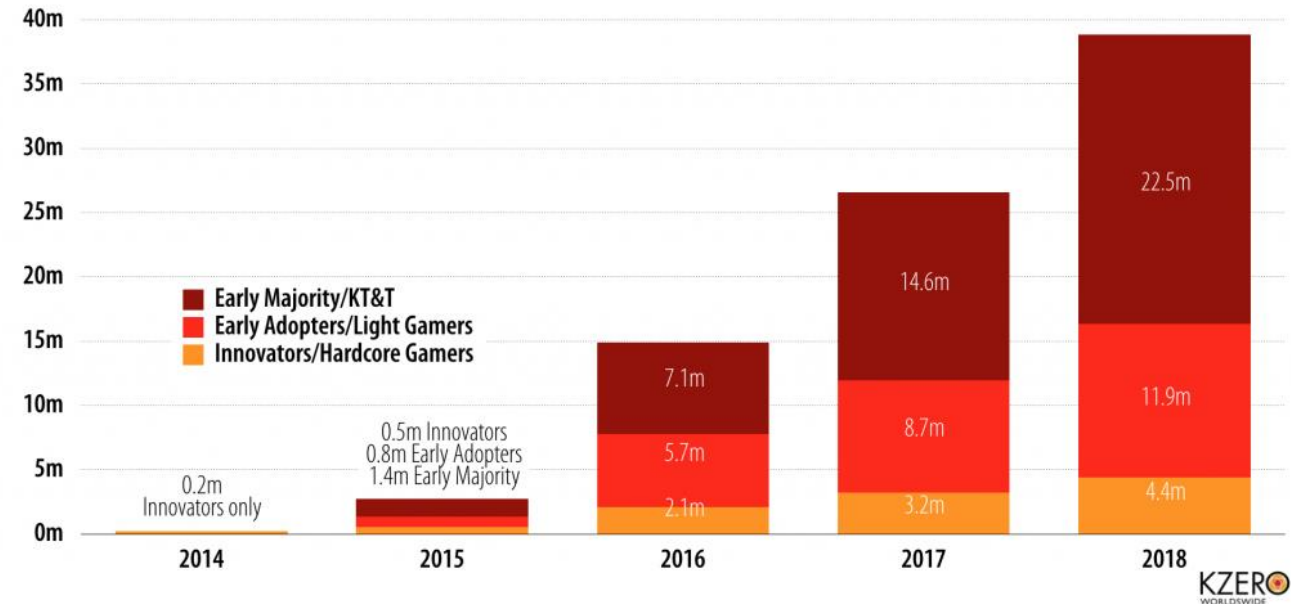
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Virtual reality landscape

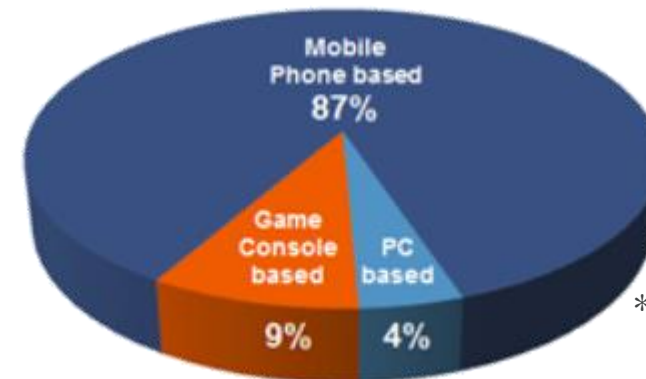
- Multiple vendors including high-end console, mobile OEMs and game publishers coming to market with VR
- KT&T – Kids, Tweens and Teenagers are driving demand
- Mobile VR drives VR into the mainstream market

HMD Unit Sales

*Source KZero



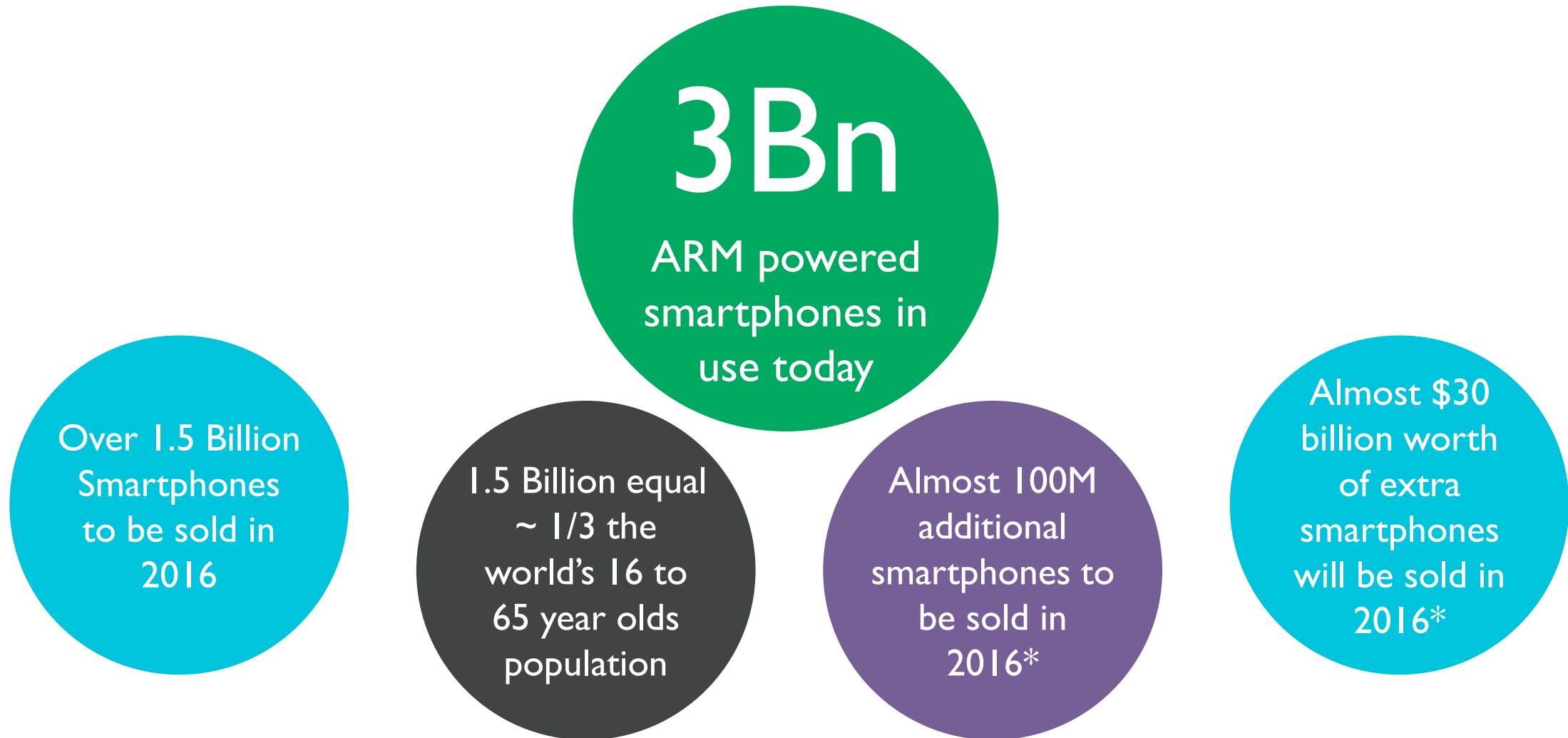
Volume market share forecast for 2016



*Source Strategy Analytics

Mobile technology: Bringing VR to the mainstream market

Mobile is everywhere



Why VR on mobile?

Tethered VR



3Bn
ARM powered
smartphones in
use today

- Accessible through your smartphone
- Lower cost systems
- Untethered – no need for a ‘cable servant’
- No need for mains power
- VR on the go
- VR while you travel

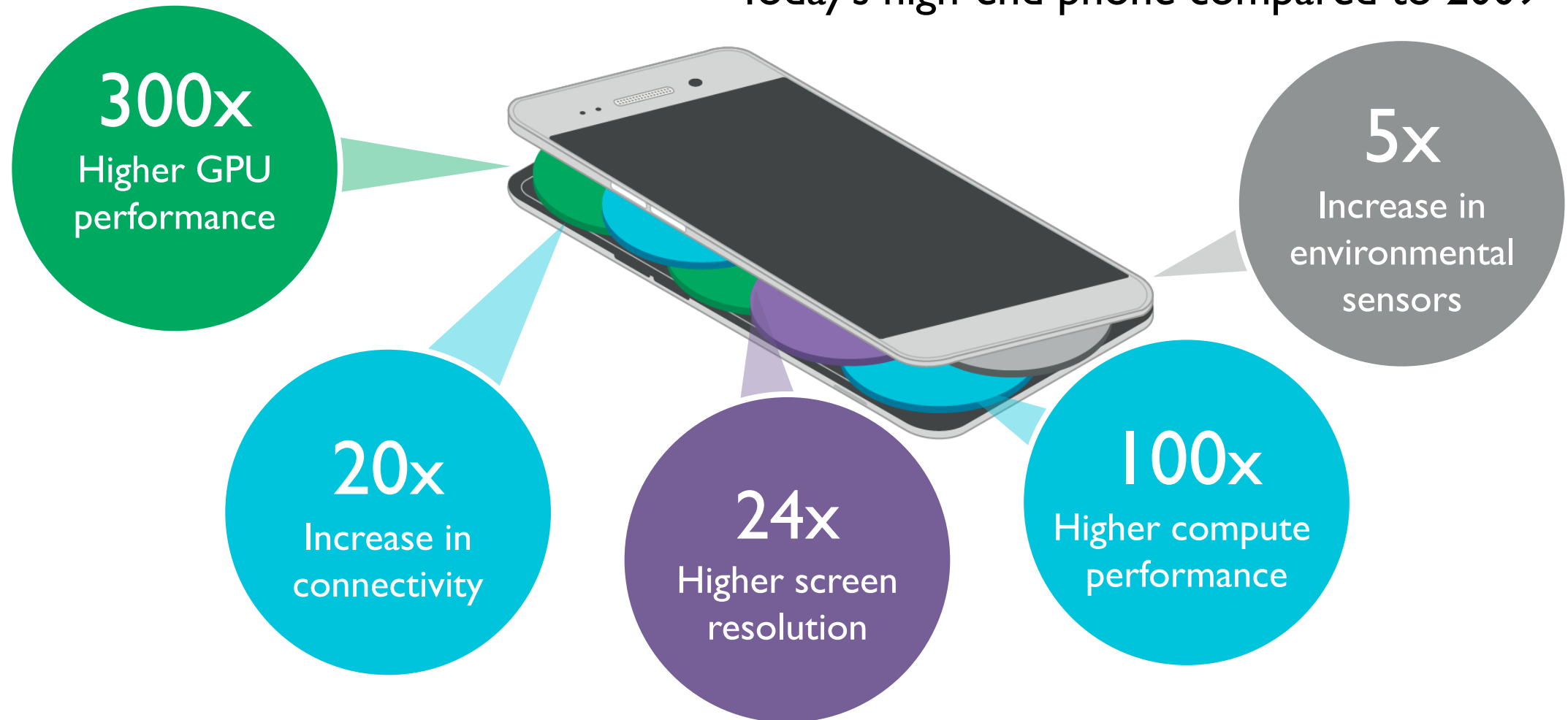
Mobile VR



VR challenges mobile devices

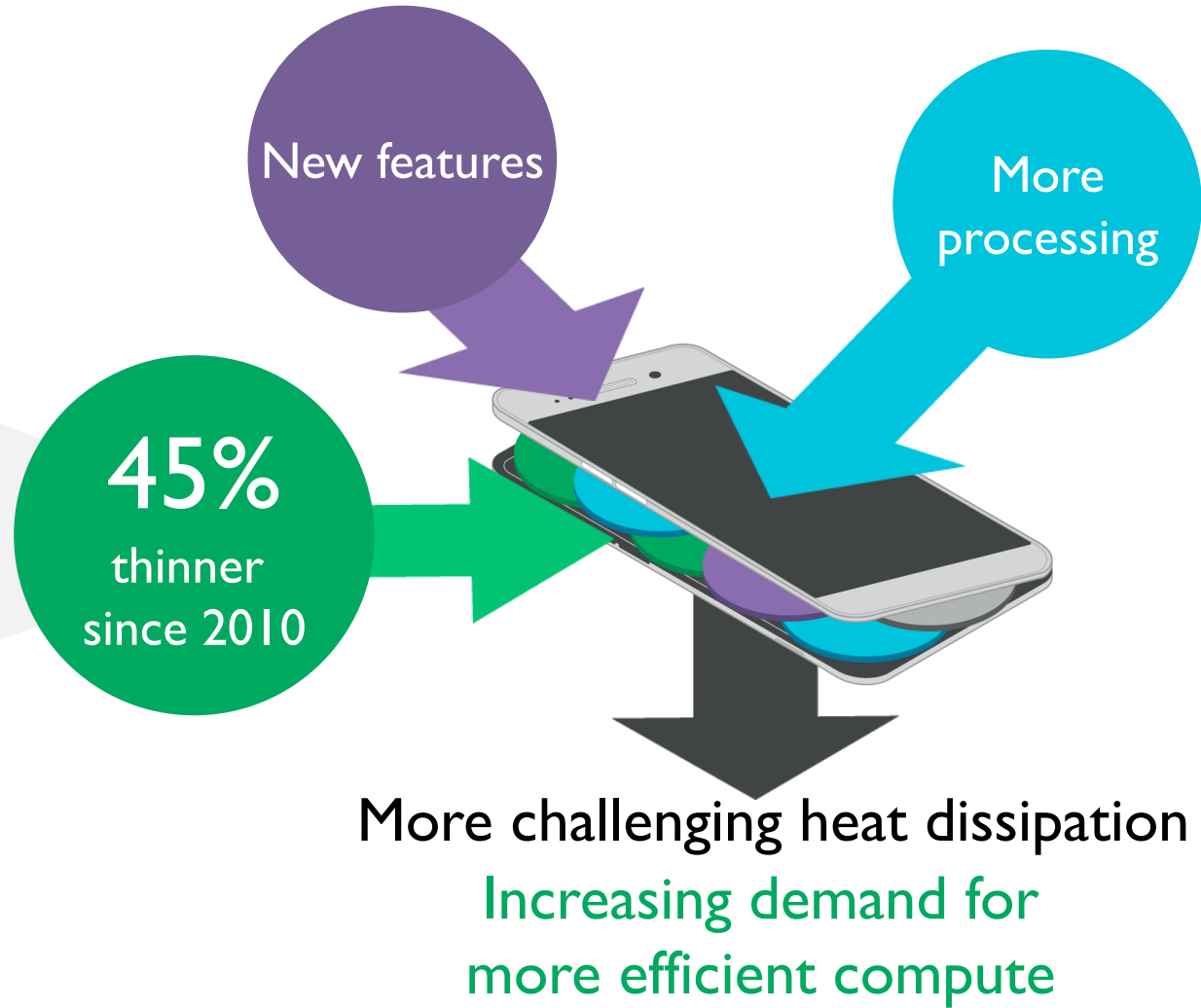
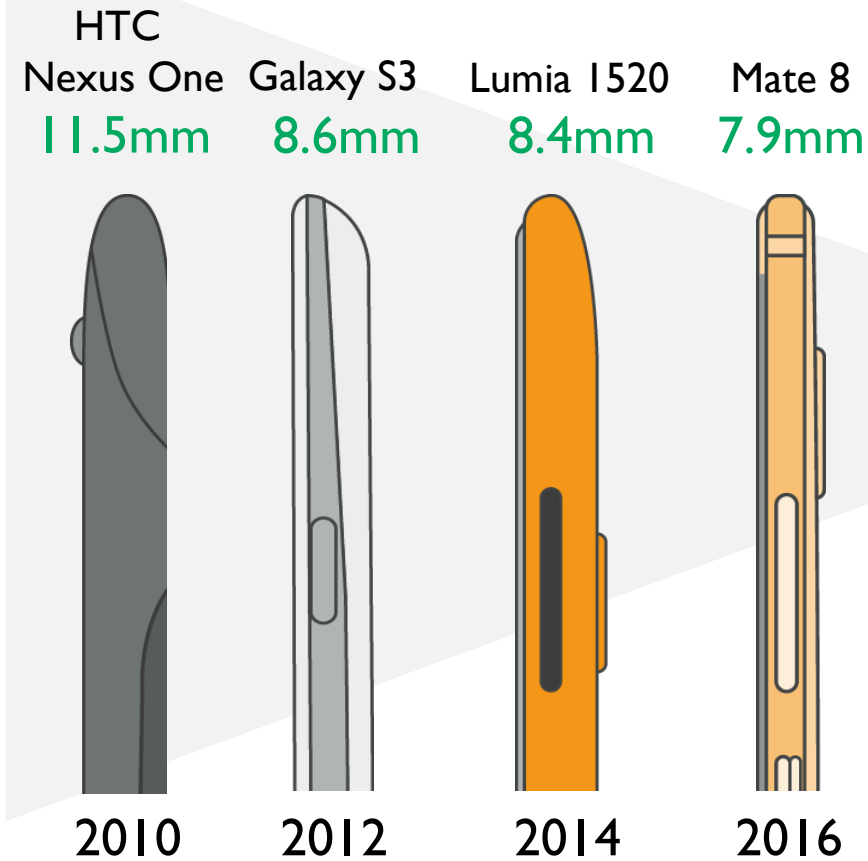
System demands continue to grow...

Today's high-end phone compared to 2009



...while thermal and power budgets shrink

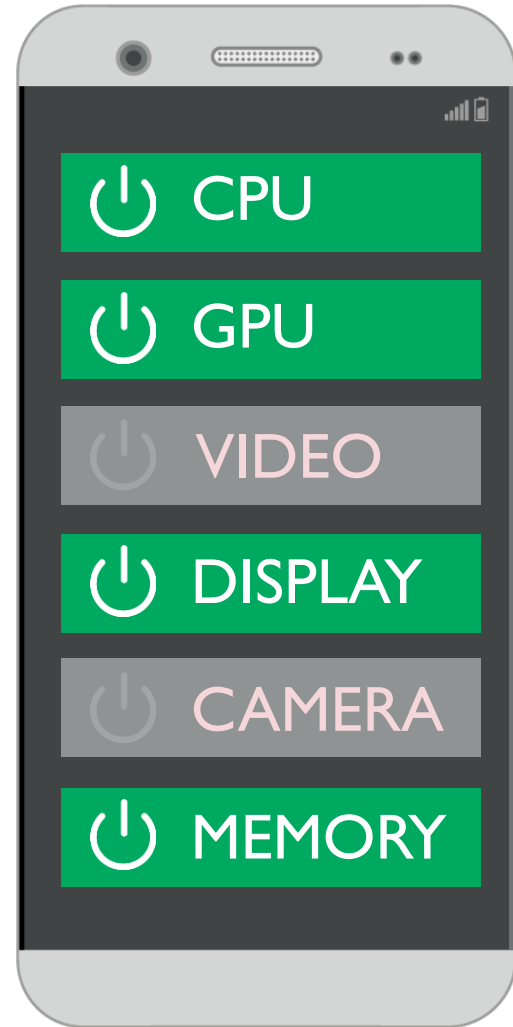
Shrinking form factors



VR content stretches the mobile form factor



Continuous demand on CPU, GPU, display and memory



High frame rate
>60FPS

120 FPS
Next generation target

High resolution
>2K

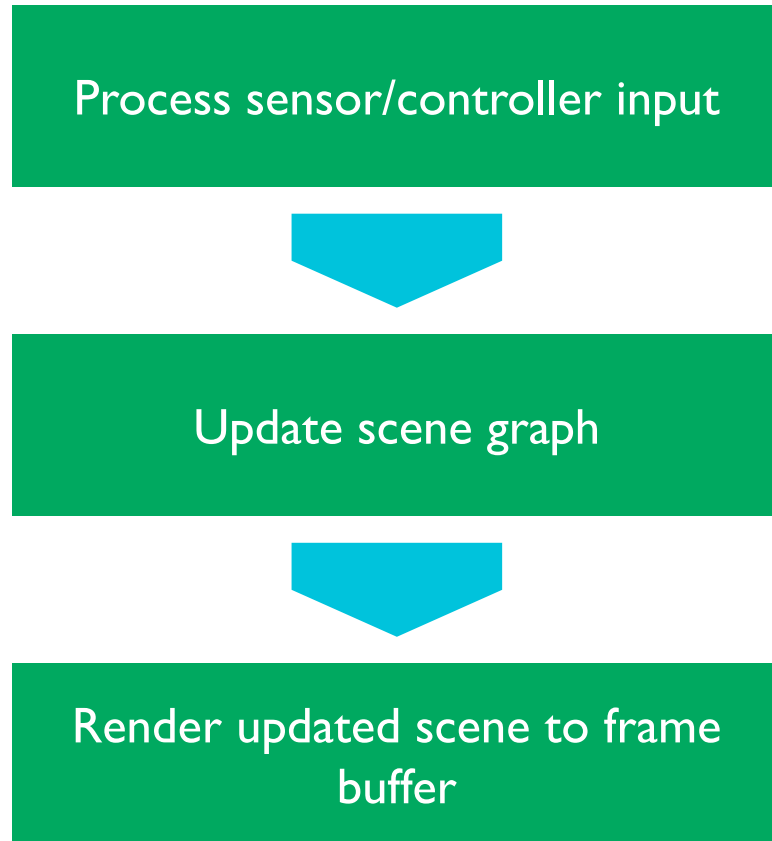
4K
Next generation target

Low Latency

<10ms
Sensor to Glass
Next generation

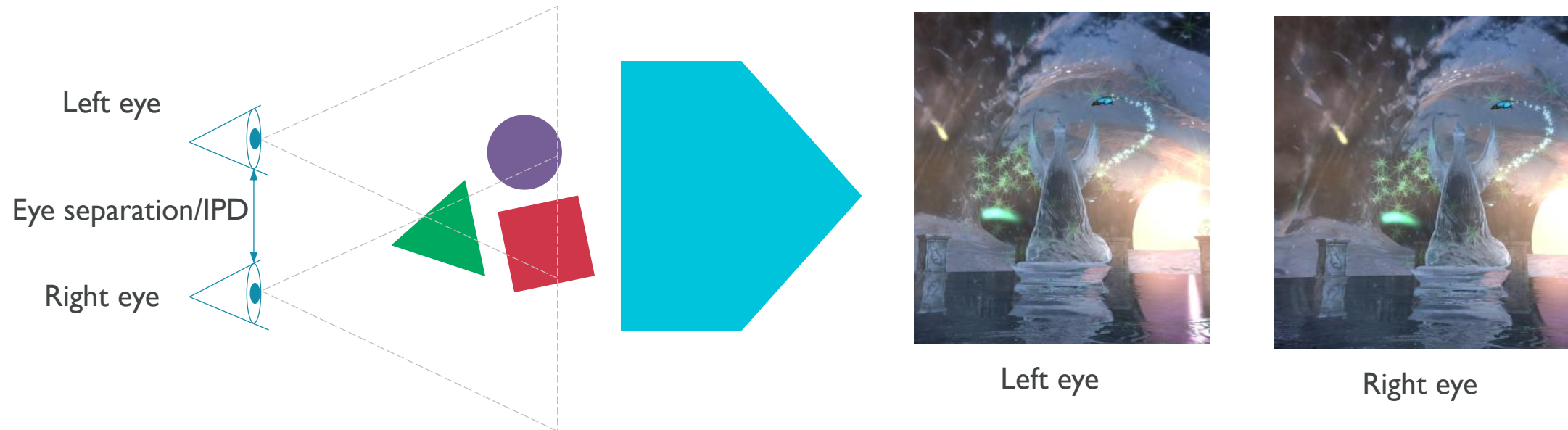
Making VR a reality with Khronos

Regular scene rendering



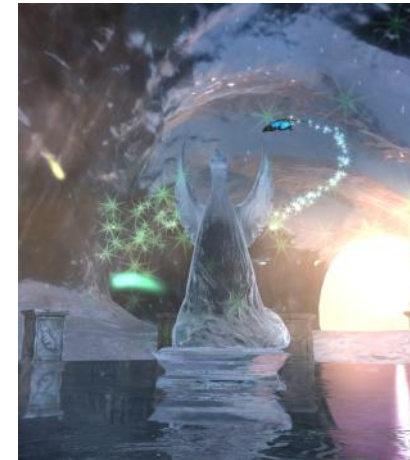
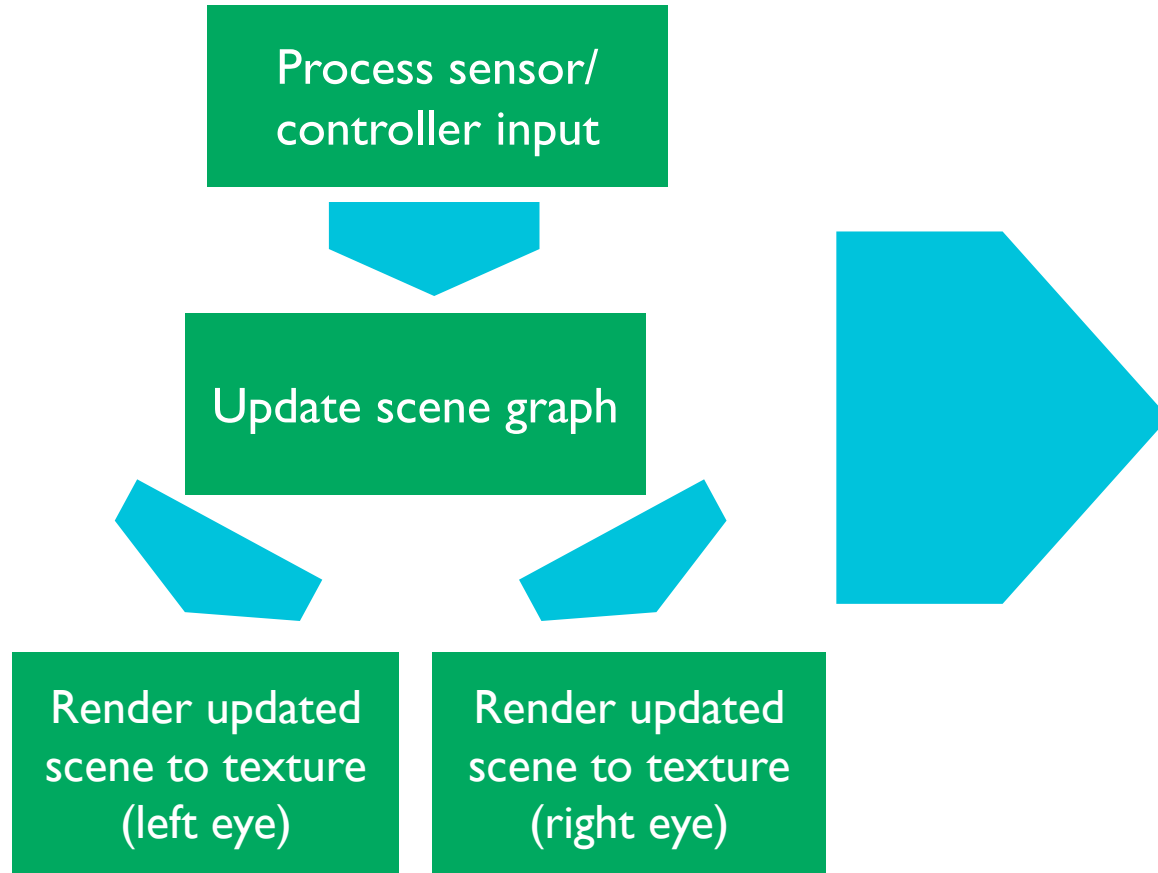
Stereoscopic scene rendering

- Render scene twice into two viewports for left and right eye
- Adjust camera(s) in the scene according to left and right eye with interpupillary distance (IPD)

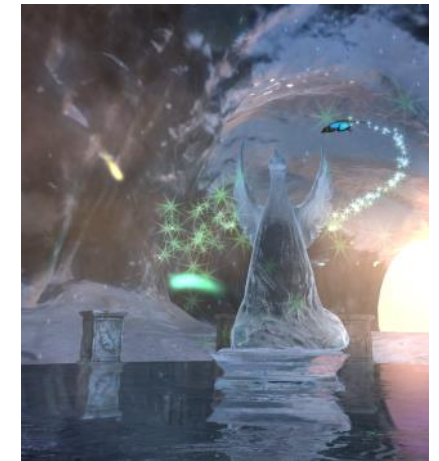


Stereoscopic scene rendering

Render left eye and right eye independently



Left eye



Right eye

Delivering a smooth VR experience

Minimal latency

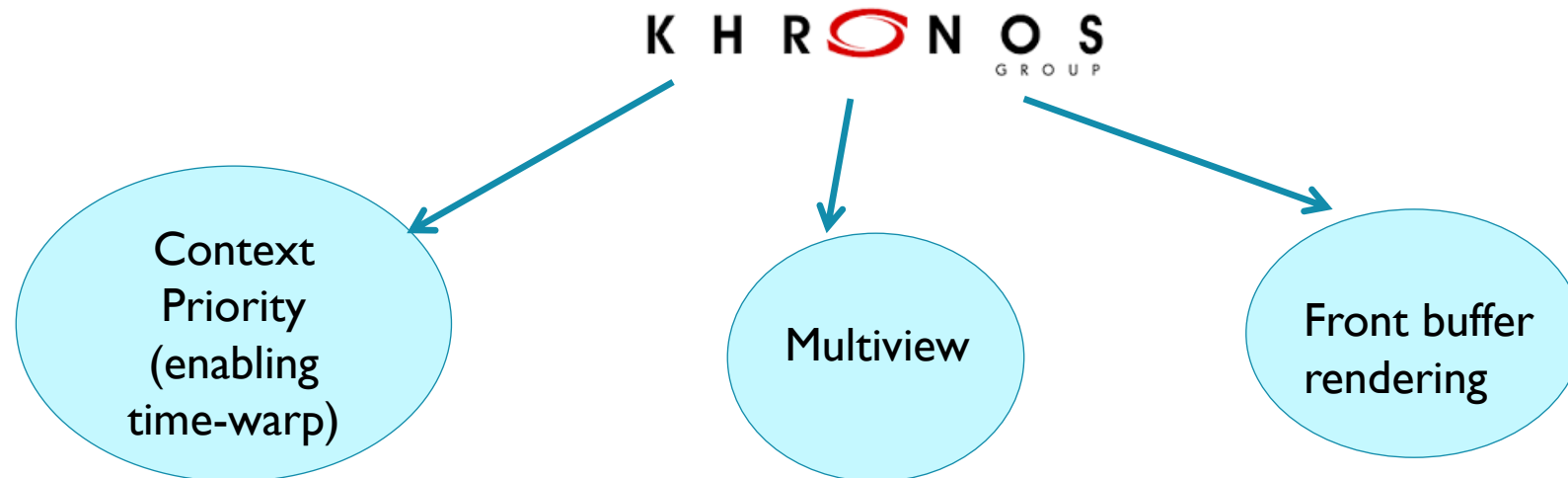
- Components in graphics pipeline add latency
- Reducing latency key to delivering a smooth experience

Higher frame-rate

- Real-time update without introducing motion blur, avoiding motion sickness

Higher Resolution

- Proximity of user to screen requires higher pixel density to maintain visual quality



Thank you

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