RADEON

TECHNOLOGIES GROUP

Raja Koduri

Senior Vice President And Chief Architect

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Imagine a world where only the **top 16% of PC users** purchase graphics cards that provide premium VR and gaming experiences…

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Where millions of gamers have been relegated to using **outdated technology…**

Where **notebook gamers** are often forced to compromise...

Where tens of millions more can only read about incredible **PC VR experiences** they can't enjoy for themselves...

And they're worried that if they upgrade now, their investment will be short lived…

That's the world we live in **today.**

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Gamers and consumers are being **left behind**
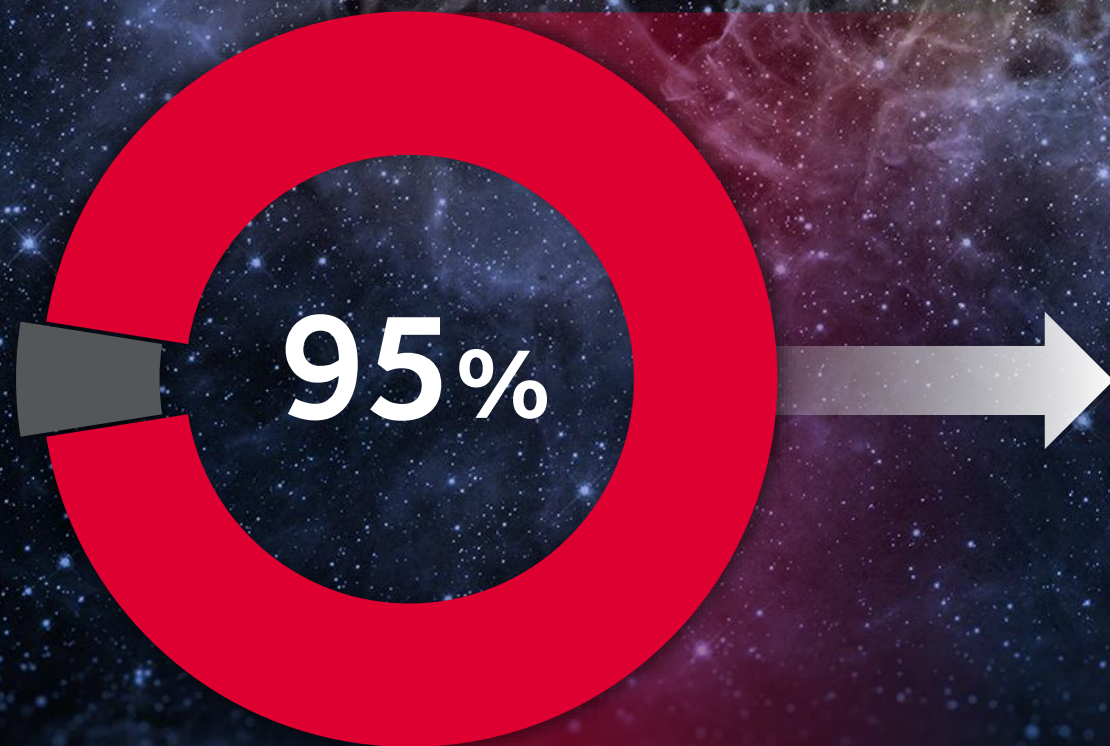
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Incredible gaming technology should be within the reach of **everyone**

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CHALLENGE 1
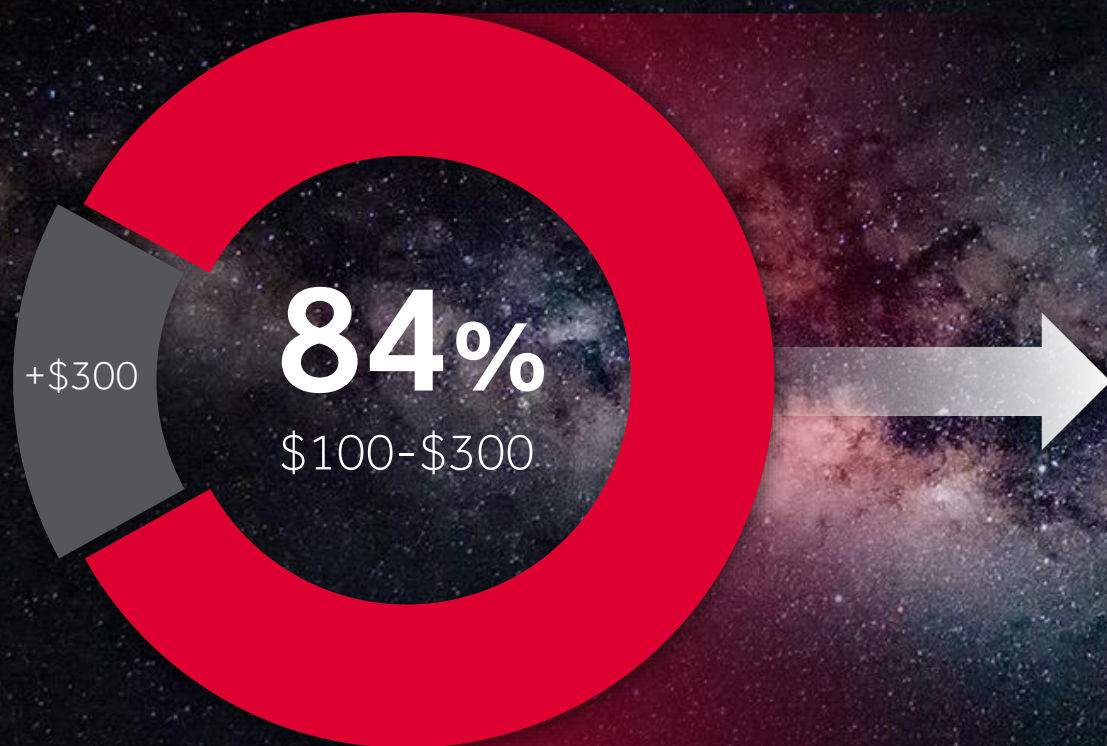
How do we make the next generation of gamers PC gamers?

95%

Single monitor gamers are **gaming at 1080p or below** according to Steam™

*See Endnotes for details.

84%
$100-$300
+$300

The overwhelming majority of gamers buy **$100-300 graphics cards**

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5 million gaming notebooks are sold every year

Why isn't it **100 million?**

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Flagship technology that effectively gives GPU performance that rivals that of consoles

Engineered to deliver unprecedented performance

Exceptionally low power with low-z height to drive notebook design wins

Making the GPU accessible with close-to-the-metal DirectX® 12 API

Flagship technology that effectively gives mobile users GPU performance that rivals that of consoles

CHALLENGE 2

How do we bring real VR to millions of consumers?

VR is amazing, but relatively few can enjoy it

1.6 B
1.4 B
1.2 B
1.0 B
0.8 B
0.6 B
0.4 B
0.2 B
0.0 B

1.43 billion PCs

▸ Just **13 million PCs worldwide** this year will have the graphics capabilities needed to run VR

▸ Only 1% of the 1.43 billion PCs used globally

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*See Endnotes for details.

VR User Adoption Survey

Category	Percentage
Equipment too expensive	68%
Headset too bulky	41%
Situations wanting to use VR would be limited	37%
Not enough diff. btwn VR and seeing things normally	26%

0% 10% 20% 30% 40% 50% 60% 70%
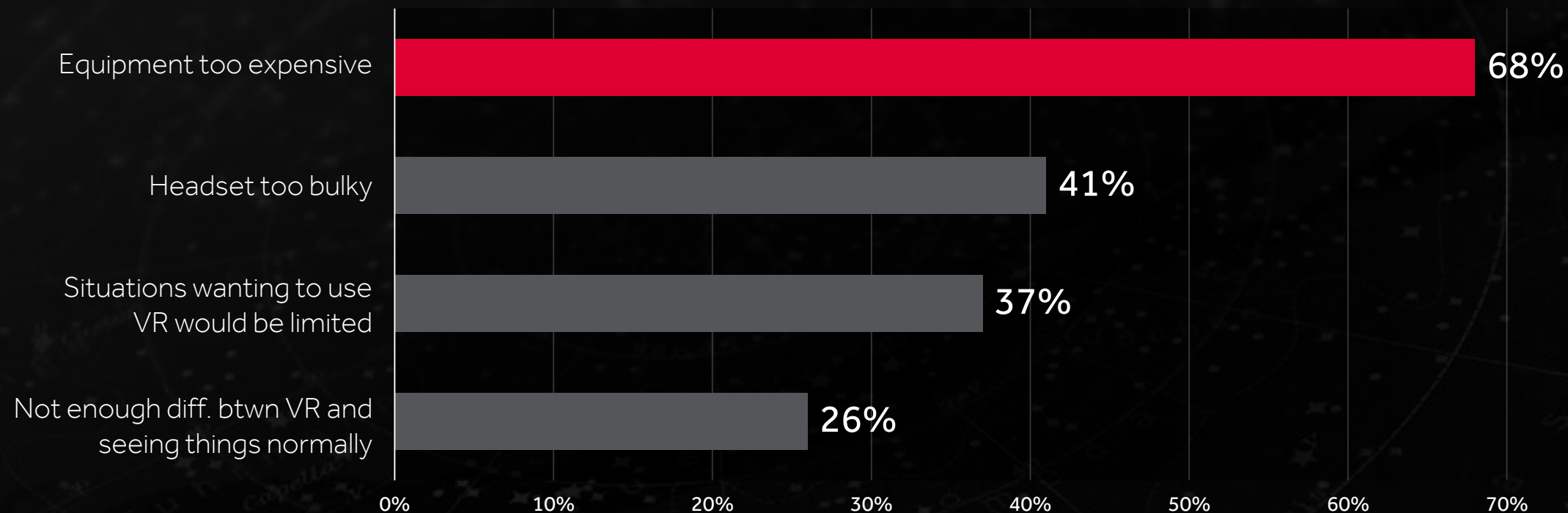
One of the biggest deterrents
to widespread adoption of VR is **cost**

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Opportunity to drive the install base of VR-ready PCs to **100 million** in the next few years

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Opportunity to drive VR into retail **in volume**

Making VR game and application development viable on a **large scale**

Reducing the cost of entry to VR:

Dramatically accelerating the pace of the VR ecosystem growth to ultimately help make HMDs more affordable

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Makes VR possible
for anyone who
wants it

Grows the addressable market
for PC VR

Further Drives
VR into retail

Helps make HMDs
more affordable

A high-performance, low-power solution
to democratize VR, delivering extraordinary
VR experiences

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CHALLENGE 3

How can we get the best and widest range of content to PC gamers as fast as possible?

How do we cut port times for console games to **next to nothing** and ensure the **highest quality, highest performance** experiences?

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We very intentionally selected these two chip sizes for the Polaris architecture because we believe gaming content will be built around these two levels of capability.
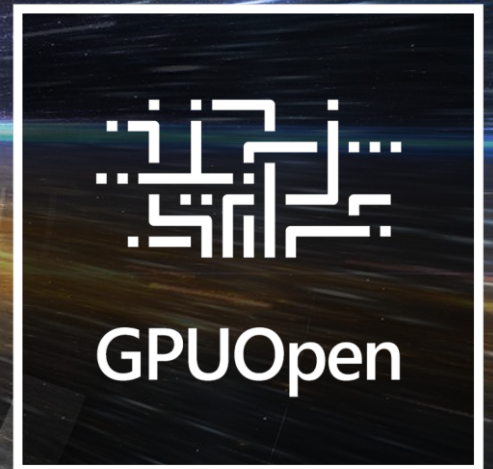

5+ TFLOPS OR 2+ TFLOPS + GPUOpen
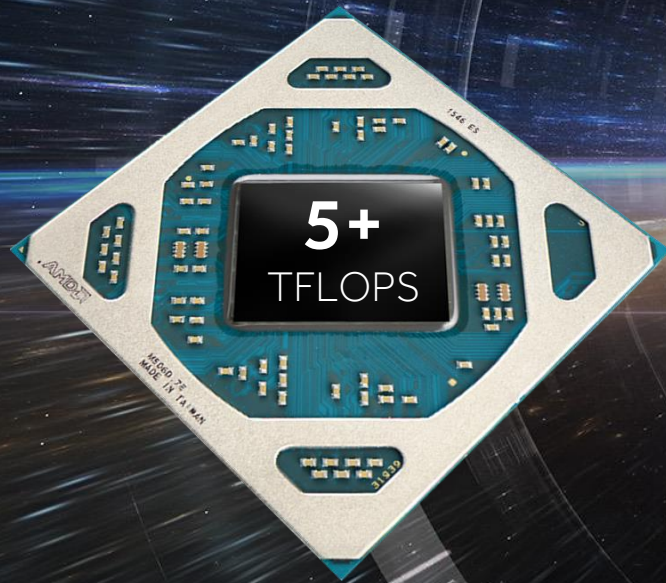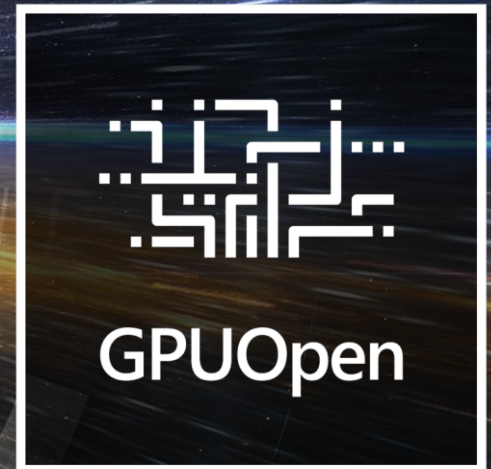
The acceleration of more affordable content development

5+ TFLOPS + 5+ TFLOPS + GPUOpen
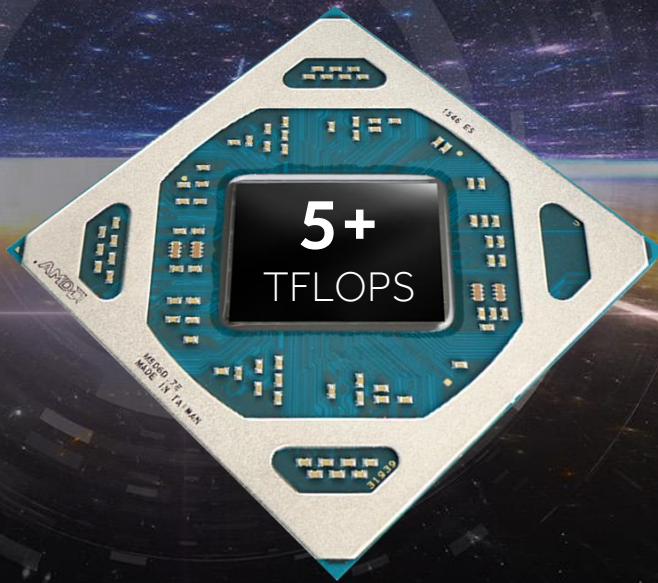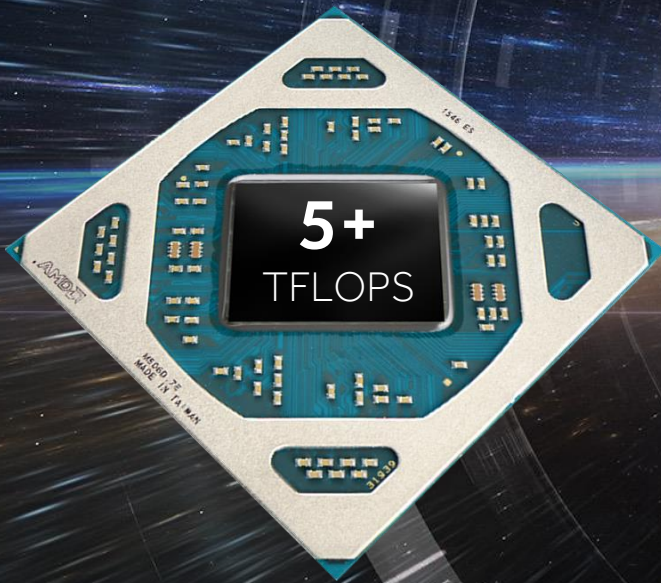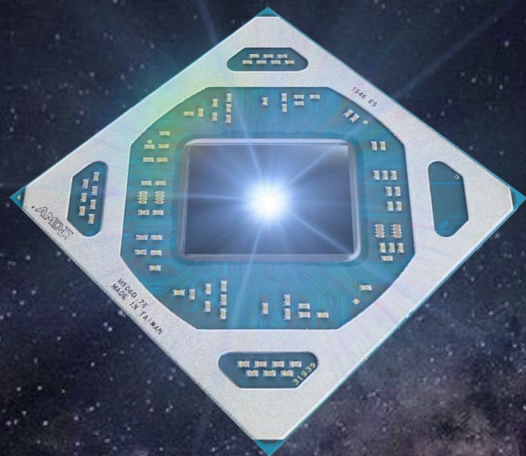
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POLARIS 10

36 CUs

\> 5 TFLOPS

256-bit

4th Gen GCN

4K Encode/Decode

DP 1.3/1.4 HDR
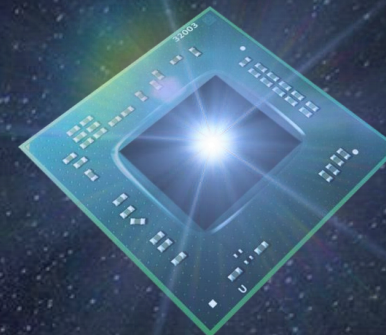
Up to 2.8X Perf/Watt

POLARIS 11

16 CUs

\> 2 TFLOPS

128-bit

4th Gen GCN

4K Encode/Decode

DP 1.3/1.4 HDR

Up to 2.8X Perf/Watt

*See Endnotes for details.

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Introducing the Polaris architecture-based RADEON RX Series,

that delivers on the promise of gaming and VR for everyone with three "entitlements" for all.

Console-class GPU performance for thin and light notebooks

Extraordinary VR experiences at price points never offered before

Great game content delivered to PC gamers in real time.

AMD | RADEON

RADEON RX 460

TFLOPS	> 2
CUs	14
Mem Size	2 GB GDDR5
Mem Bus Size	128-bit
Power connector	none
Encode / Decode	4K H.264 / HEVC
Display Port	1.3/1.4 HDR

Cool and Efficient Solution
For eSports Gaming

AMD | RADEON

RADEON RX 470

TFLOPS	> 4
CUs	32
Memory Size	4GB GDDR5
Memory Bus Size	256-bit
Power connector	1x6-pin
GCN	4th Gen
AMD FreeSync™	YES
Display Port	1.3/1.4 HDR

Brilliant HD Gaming

AMD | RADEON

RADEON RX 480

TFLOPS	> 5
CUs	36
Memory Bandwidth	224/256* GB/s
Memory Size	4/8 GB GDDR5
Memory Bus Size	256-bit
Power	150 W
VR Premium	YES
AMD FreeSync™	YES
Display Port	1.3/1.4 HDR

Beyond HD Gaming

Premium VR Experiences

AMD | RADEON

RADEON RX 480

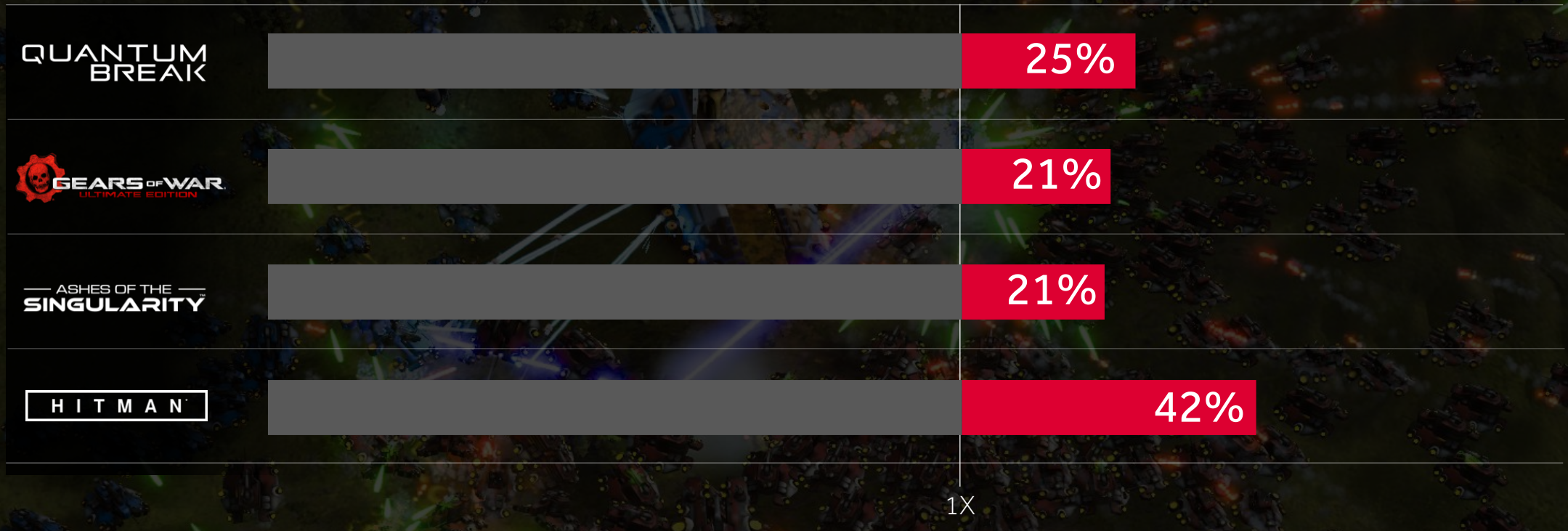## 1440p Premium Gaming

Percentage values are up to, see endnotes for details

■ Radeon RX 480 8GB   VS   ■ NV GTX 970 4GB

QUANTUM BREAK — 25%

GEARS OF WAR ULTIMATE EDITION — 21%

ASHES OF THE SINGULARITY — 21%

HITMAN — 42%

1X

Premium HD Gaming

Smooth Frame-rates
With AMD FreeSync™ Technology

DirectX™ 12 Gaming Featuring
Asynchronous Compute

mGPU Scaling
with AMD CrossFire™ Technology

33

Enabling Premium VR Experiences at Low Power

Performance Test

Radeon RX 480 8GB   VS   R9 380

6.3

3.6

6
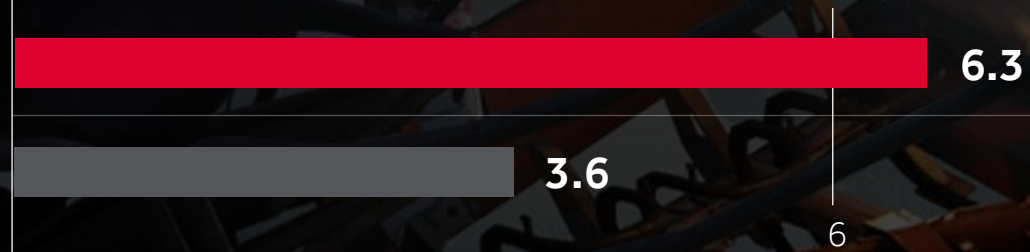
Ready for Oculus™ Rift and Steam® VR

Polaris Platform for Gamers

Premium Gaming

Immersive VR Experiences

Future-Proof Technologies*

Game-Changing Control

DirectX 12 · Vulkan™

HDMI™ · HEVC · FreeSync Enabled · DisplayPort

RADEON SOFTWARE CRIMSON

Gamers Deserve the Latest Game Technologies

DirectX 12

Single	DX 12 mGPU

+ 63%

TOTAL WAR WARHAMMER

Radeon™ R9 390X

Vulkan™

OpenGL	Vulkan

+ 45%

DOOM
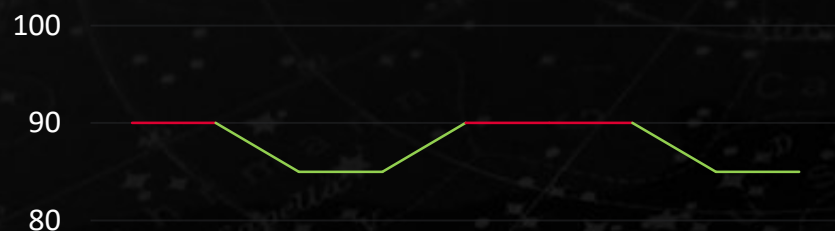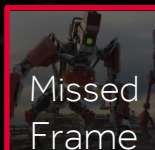
Radeon™ RX 480

Gamers Deserve the Chance for Better Upgrades

DisplayPort

- 1.3 HBR3 Ready
- 1.4 HDR Ready

HDMI™
HIGH-DEFINITION MULTIMEDIA INTERFACE

- 2.0b Enabled

AMD FREESYNC™ TECHNOLOGY

- Synchronous panel refresh
- Elimination of video tearing

*See Endnotes for details.
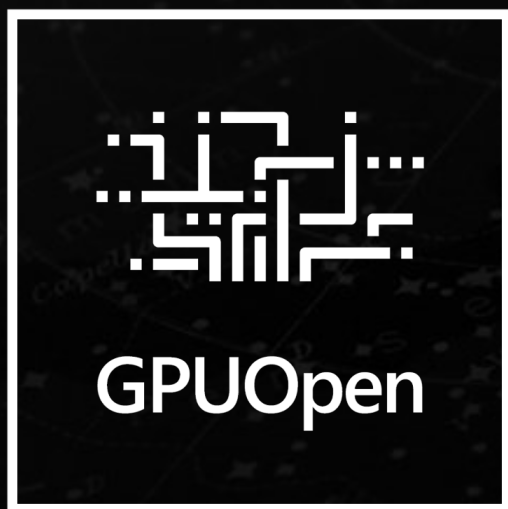
Gamers Want Great Streaming

Game at Max Settings	Record With Your Favorite Software	Encode With High Quality Codecs	Share
	Open Broadcaster Software	HEVC **NEW**	twitch
	raptr	H.264	YouTube GAMING
			PLAYS.TV
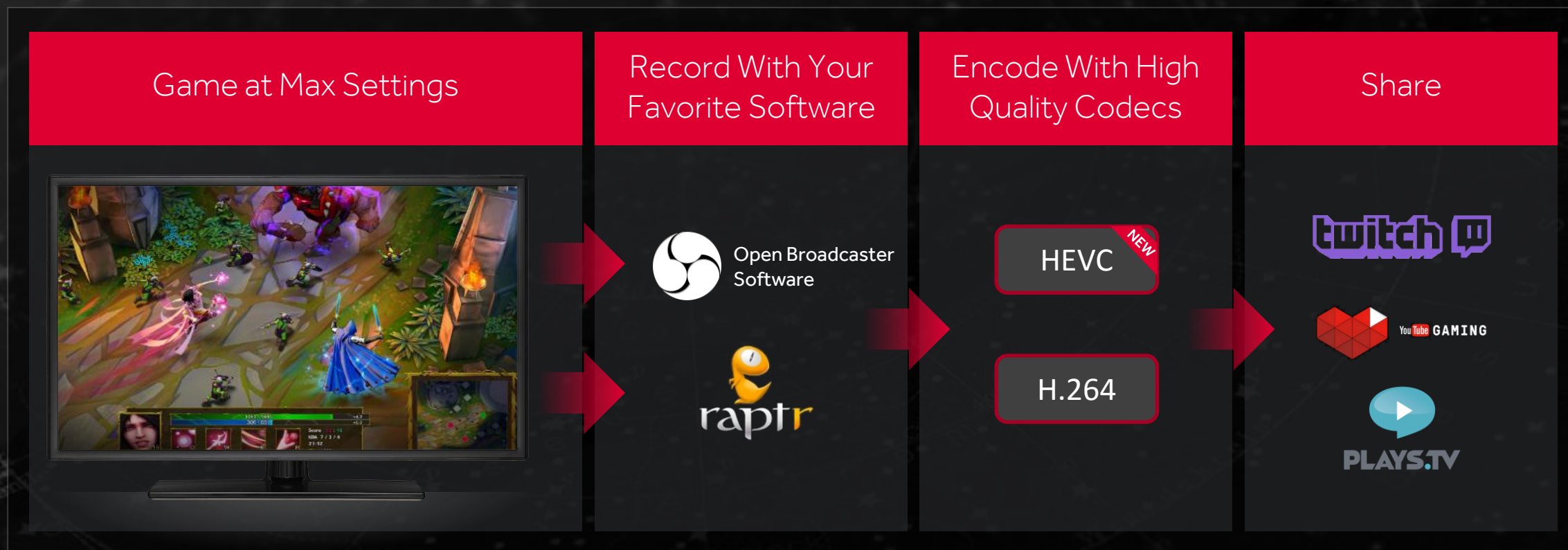
High Quality Game Streaming for Gamers With Radeon™ RX Graphics

*See Endnotes for details.

The First in a Family of Solutions
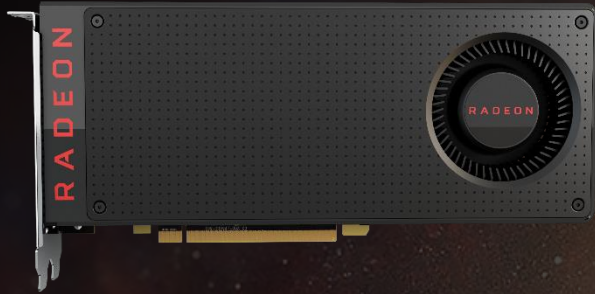
RADEON RX 480
Beyond HD Gaming & VR Premium

RADEON RX 470
Brilliant HD Gaming

RADEON RX 460
Cool & Efficient E-Sports Gaming

AMD | RADEON

Endnotes

Slide 11: http://store.steampowered.com/hwsurvey

Slide 16: 13 million PCs worldwide next year will have the graphics capabilities needed to run VR according to Gartner as cited in http://www.bloomberg.com/news/articles/2015-12-30/few-computers-are-powerful-enough-to-support-virtual-reality

Slide 28: Polaris 11 2.8x performance per watt: Testing conducted by AMD Performance Labs as of May 10, 2016 on 3DMark 11 and 3DMark Firestrike using a test system comprising of an i7-4600M, 8GB, AMD Radeon driver 16.20. AMD Radeon R9 M280X (14CUs) scored 5700 and 3500 with a board power of 82W. AMD Radeon RX 480M (16CUs) scored 7200 and 4070 with a board power of 35W. Using Performance/Board power, the resulting average across the 2 different titles was a perf per watt of 2.8X vs the Radeon R9 M280X . RX-5

Polaris 10 2.8x performance per watt: Testing conducted by AMD Performance Labs as of May 10, 2016 on the AMD Radeon™ RX 470 (110w) and AMD Radeon™ R9 270X (180w), on a test system comprising i7 5960X @ 3.0 GHz 16GB memory, AMD Radeon Software driver 16.20 and Windows 10.. Using 3DMark Fire Strike preset 1080p the scores were 9090 and 5787 respectively. Using Ashes of the Singularity 1080P High, the scores were 46 fps and 28.1 fps respectively. Using Hitman 1080p High, the scores were 60 fps and 27.6 fps respectively. Using Overwatch 1080p Max settings, the scores were 121 fps and 76 fps respectively. Using Performance/Board power, the resulting average across the 4 different titles was a perf per watt of 2.8X vs the Radeon R9 270X. Test results are not average and may vary. RX-6

Slide 33: Testing conducted by AMD Performance Labs as of June 10, 2016 on the AMD Radeon™ RX 480 8GB and NV GTX 970 4GB, on a test system comprising i7 5960X @ 3.0 GHz 16GB DDR4-2666 memory, Gigabyte X99-UD4, AMD Radeon Software Crimson Edition driver 16.5, NV driver 365.10 and Windows 10. Using Ashes of the Singularity High 1440p 2xMSAA, Gears of War High 1440p 4xAF, Hitman Max 1440p 16xAF, Quantum Break 1440p Medium AA ON, Radeon™ RX 480 scored 45.23 fps, 57.26 fps, 52.53 fps, 50.45 fps respectively. NV GTX 970 scored 37.47 fps, 47.19 fps, 36.85 fps, and 40.43 respectively. Performance may vary based on use of latest driver versions. Test results are not average and may vary. RX-16

Slide 34: Testing conducted by AMD Performance Labs as of May 19, 2016 on the Radeon™ RX 480 and Radeon™ R9 380 on a test system comprising Intel i7-6700K, 2x4GB DDR4-2666 RAM, Z170 motherboard, Radeon Software Crimson Edition 16.1.1 and Win10 64-bit. Using the Steam VR Performance test, Radeon RX 480 scored 6.3 and Radeon R9 380 scored 3.6. RX-2

Slide 35: Statement of "future-proof" refers to support of current and upcoming technology standards including 14nm FinFET process technology, DirectX 12 and Vulkan API support, new display technology, and experiences such as VR. "Future-proof" statement is not meant to serve as a warranty or indicate that users will never have to upgrade their graphics technology again. Support of current and upcoming technology standards described above has the potential to reduce frequency of graphics upgrades for some users.

Slide 36: DX12 Testing conducted by AMD Performance Labs as of May 10, 2016 on the AMD Radeon™ R9 390X and Warhammer DX12 at 1440p. Single card scored 60 fps, CrossFire™ configuration scored 97.8 fps. Test results are not average and may vary. Vulkan testing conducted by AMD Performance Labs as of May 10, 2016 on Doom at High Settings, tested at 1080P with an Intel Core i7 5960X with 16GB DDR4, Radeon™ RX 480 scored 55 fps in OpenGL and 80 fps in Vulkan. Test results are not average and may vary. RX-10

FreeSync is an AMD technology designed to eliminate stuttering and/or tearing in games and videos by locking a display's refresh rate to the framerate of the graphics card. Requires Monitor, AMD Radeon™ graphics and/or AMD A-Series APU compliant with DisplayPort™ Adaptive-Sync 1.2 (or newer). AMD Catalyst™ driver 15.2 Beta (or newer) required. Adaptive refresh rates vary by display; check with your monitor manufacturer for specific capabilities. Only select AMD Radeon GPUs and A-Series APUs supported; see www.amd.com/freesync for full details. GD-67

Slide 40: HEVC acceleration is subject to inclusion/installation of compatible HEVC players.

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