Next Generation VR with Large FoV and High Resolution with StarVR and NVIDIA VRWorks

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Hardware and software challenges
(and why we love VRWorks)

What’s next
(hint: it starts with an S)

Current state of VR
(and why it’s not so great)
CURRENT STATE OF VR
Let’s talk HMDs

3 platforms: Oculus, HTC, Windows Mixed Reality

- Same field of view
- Similar resolution*
MAJOR LIMITATIONS

What about the immersion?

Screen door effect

Diving goggles

Tethered*
WHAT’S NEXT

Screen door effect
Higher Resolution

Diving goggles
Large Field of View

Tethered*
Backpack PC
WHAT’S NEXT
Welcome to the StarVR One
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2011  2013  2015  2016
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CHALLENGES
Let’s talk hardware
NATURAL PANORAMIC FIELD OF VIEW

STAR VR
210° x 130°

OTHER VR
110° x 130°

210° FOV  110° FOV
SLANTED FRUSTUM

- Stereoscopic overlap FOV
- Peripheral vision FOV Left
- Peripheral vision FOV Right
- Field of view when looking straight forward
Angle/Pixel extreme variation with large FOV
TO MAKE THINGS WORSE, PERSPECTIVE PROJECTION
LARGE FOV PERFORMANCE IMPACT?

- Need more pixels to cover area
- Higher resolution screens

- More objects are in the FOV

Larger FOV exponential harder
\[ \rightarrow 16 \times \text{calculation wasted} \]

Existing SDKs don’t work well for large FOV

Quadro RTX Picture

CPU
TWO PROJECTIONS PER EYE (QUAD VIEW)
LITTLE BIT OF OVERLAP AND BLENDING

1/3 SCREEN COVERS 1/2 FIELD OF VIEW
CAN REDUCE SIGNIFICANTLY RESOLUTION FOR SAME IMAGE QUALITY
TWO PROJECTIONS PER EYE (QUAD VIEW)

Multi-View Rendering
VR SLI
VR SLI
Mono-Input-HMD

GPU 1  VS  FS  CP

GPU 0  VS  FS

Time

Courtesy of Robert Menzel
VR SLI
Dual-Input-HMD

GPU 1: VS | FS | CP
GPU 0: VS | FS

Time

Courtesy of Robert Menzel
VR SLI
Dual-Input-HMD

GPU 1
VS  FS

GPU 0
VS  FS

„Time-Warp“ also done in parallel too!

Courtesy of Robert Menzel
VR SLI

Benchmark WIP (Curtesy of VRED)

Bonus: Perfect Scalability
Great gain when using heavy textures

2 x GV100
100M Triangles Model
FOVEATED RENDERING

STARVR COMES STANDARD WITH EYE TRACKING
2 VIEWPORT PER EYE FOVEATED RENDERING

- HIGH QUALITY & GOOD PERFORMANCE: RENDER 2 VIEWPORTS
- ONE LARGE FOV, COVER ENTIRE SCREEN, VERY LOW RES
- ONE SMALL FOV, EYE TRACKED, VERY HIGH RES
FOVEATED RENDERING

Image quality and performance

Up to 2 times performance gain with the same perceived image quality

Fully customizable parameters (MSAA in foveated viewport, low AA in the background)
2 VIEWPORT PER EYE FOVEATED RENDERING

Variable Rate Shading
STARVR ONE
DESIGNED FOR LARGE FOV
OPTIMAL PERFORMANCE WITH NVIDIA VRWORKS

Thank you!