



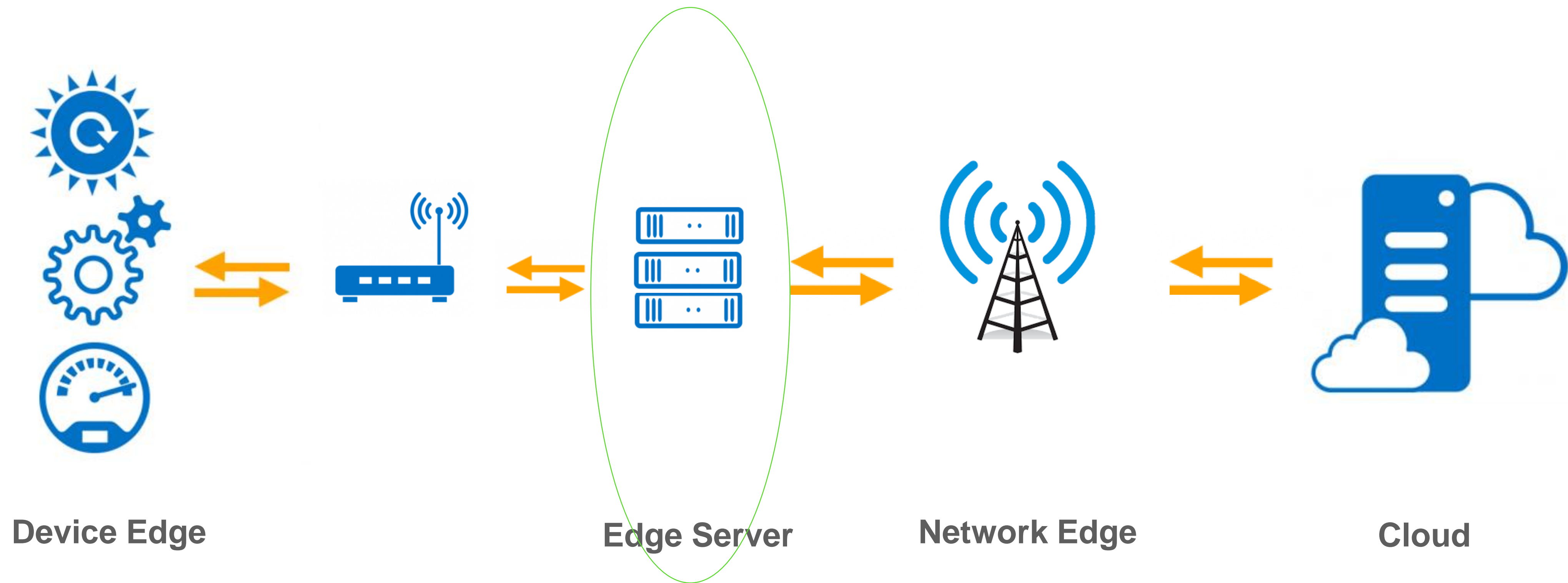
EDGE COMPUTING AND EVOLUTION OF AR/VR

Dijam Panigrahi,
Co-founder/COO, GridRaster Inc.

What is Edge Computing?

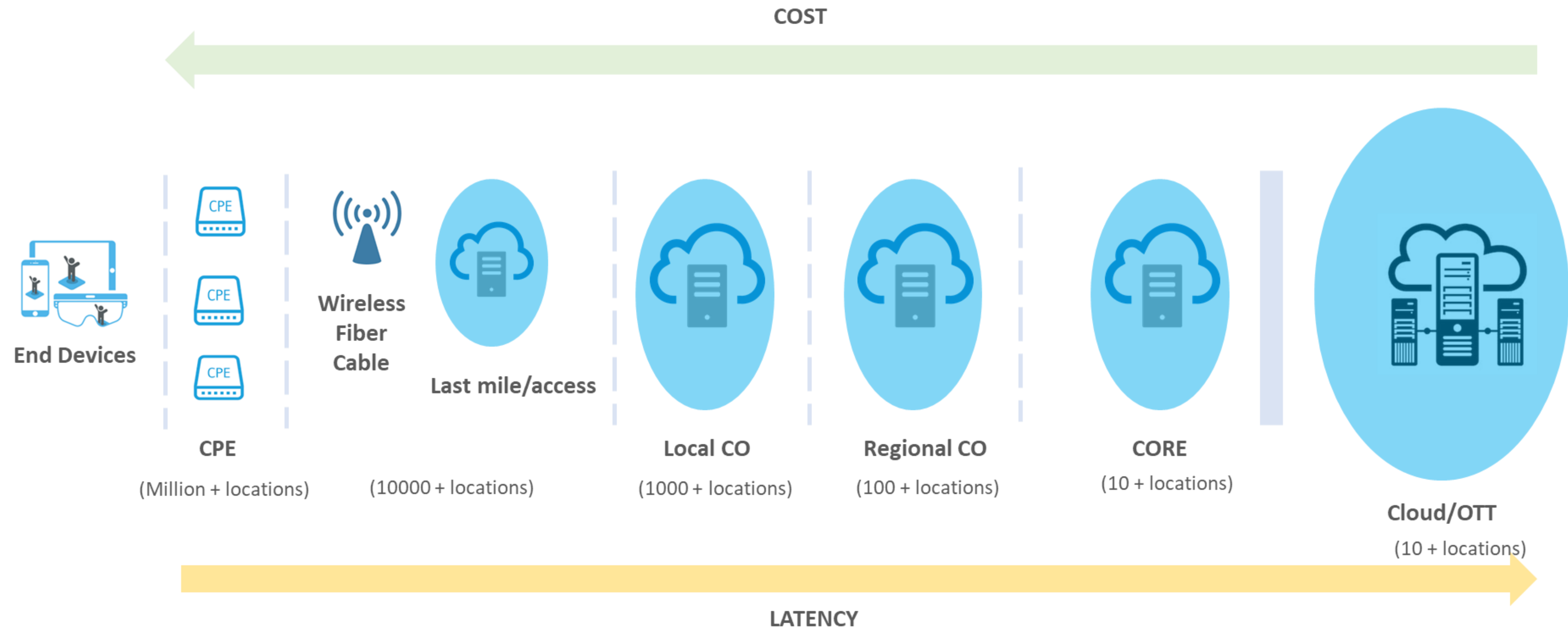
Moving the compute function closer to the user

Edge computing is defined as any compute functions that occurs between the endpoint and the cloud



Evolving Cloud and Network Architecture

Hierarchy of computing over a network



Key Benefits of Edge Computing

Better, faster and cheaper for real-time processing of data

- Faster response time
- Reduced data haul over the core network
- Reduced transport cost
- Improved Data Security & Compliance
- Better quality of service



GRIDRASTER - A CLOUD PLATFORM FOR IMMERSIVE AR/VR

Leveraging **edge compute** and **3D vision-based** AI to deliver high-quality immersive experiences at scale

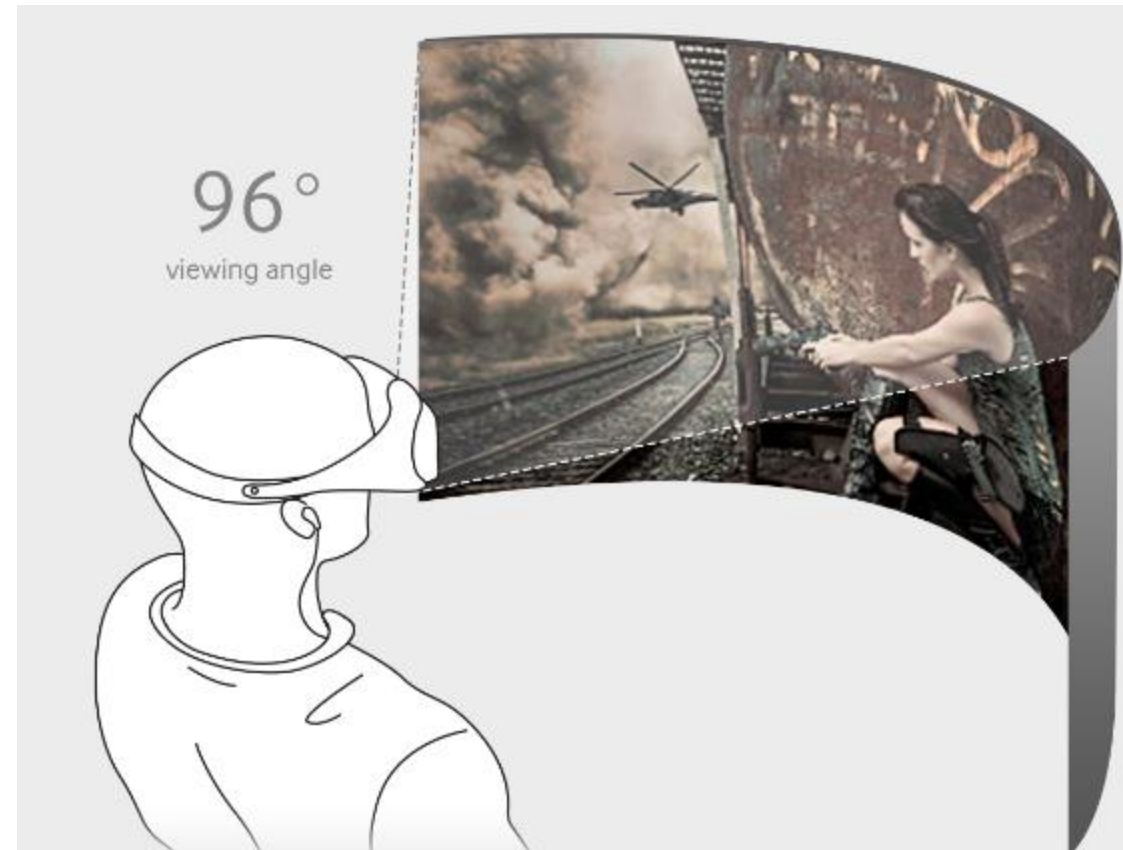


AR/VR is set to **Transform** the way we
LIVE and **WORK**

Evolution of Mixed Reality

Mixed Reality is evolving from simple 3D visuals to fully immersive experience

Beginning



- Low Resolution, Small Field of View
- Information Overlay, Rudimentary Games/Apps
(e.g. Pokémon Go, IKEA AR App, etc.)

Now



- 3D virtual world with better sense of “presence”, “immersive” yet distinct real and virtual worlds, require dedicated and expensive equipment
- 3D games, Simple visualizations and holograms

Future

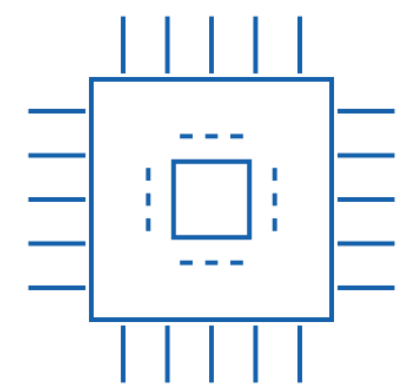
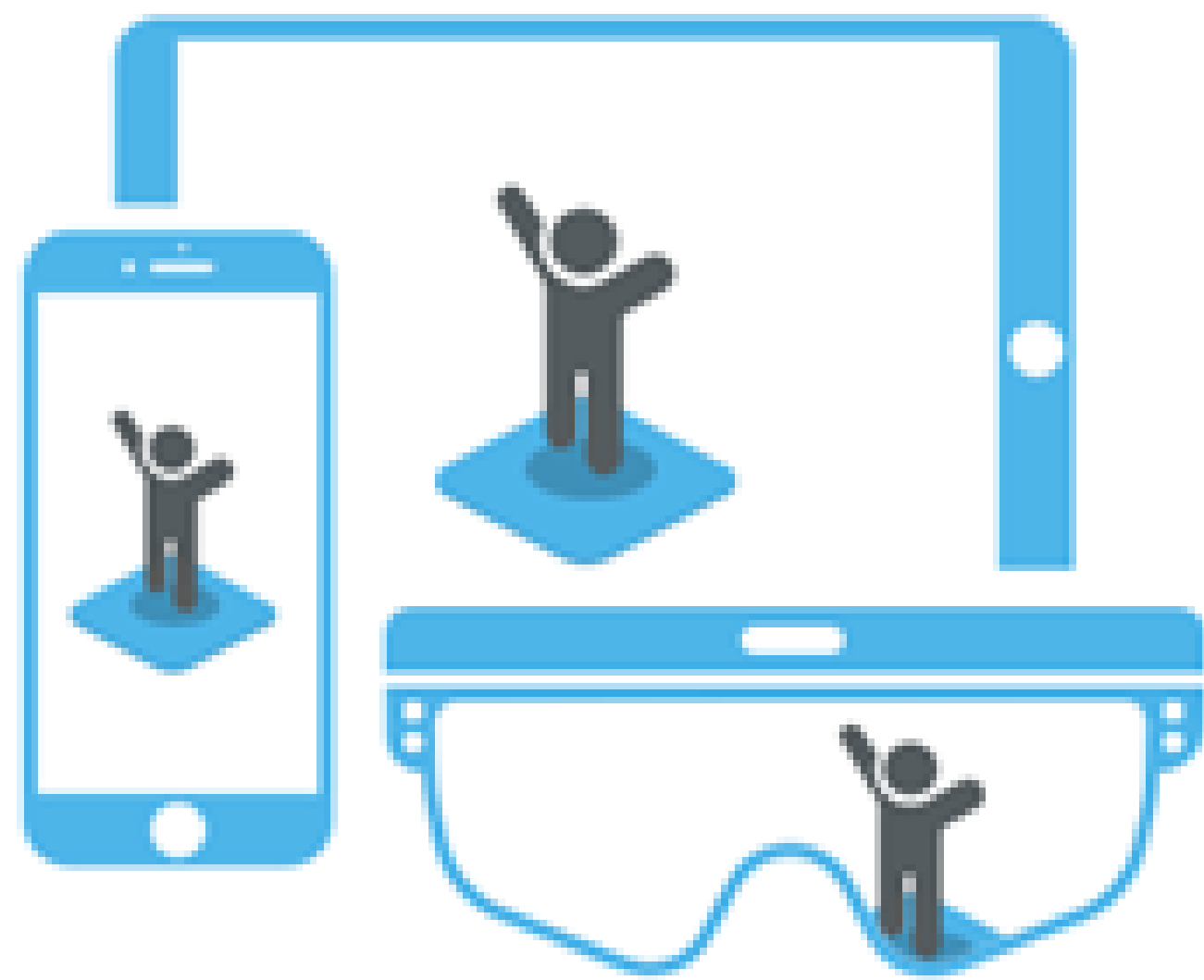


- Totally Immersive “Mixed Reality” experience, accessible on mobile AR devices, fusion of real and virtual worlds, powered by cloud.
- Immersive games, concerts, entertainment; 3D rendering of complex worlds

Mobile is the opportunity

But limitations of the mobile devices severely restricts immersive experiences

DEVICE LIMITATIONS



Limited Compute



Limited Battery

MR CHALLENGES



Low quality visual rendering



Restricted persistence and precision of spatial data



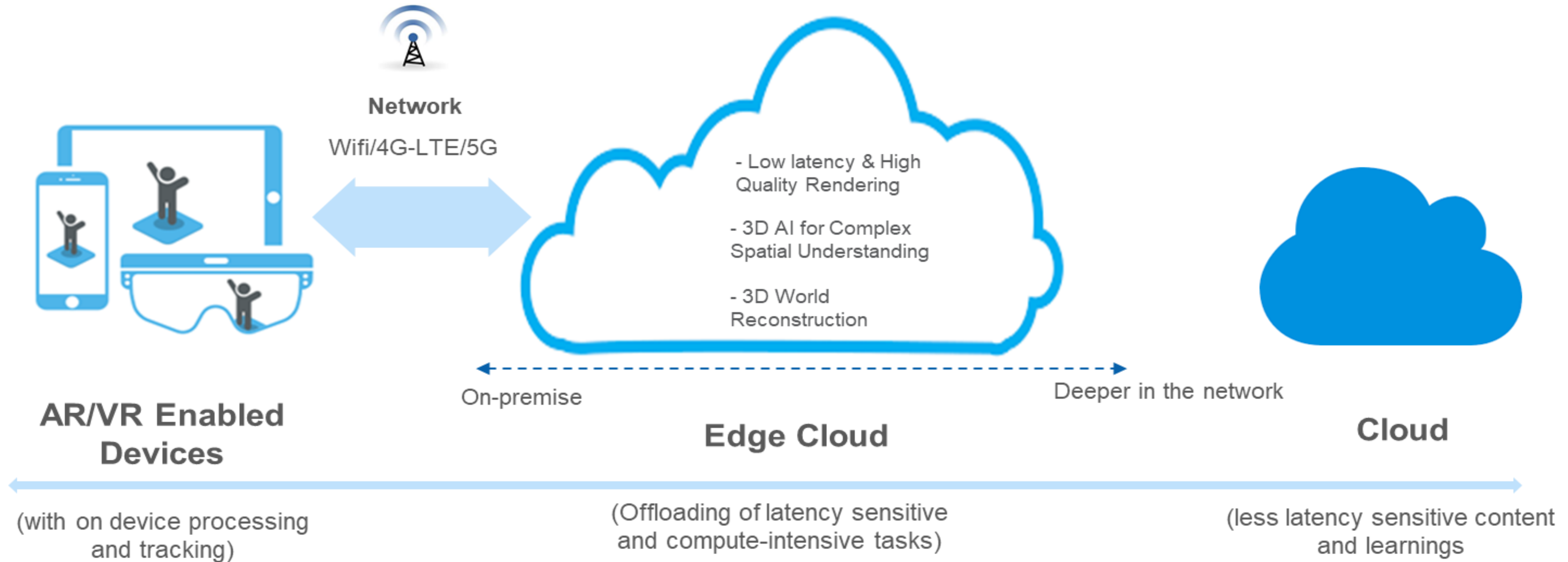
Limited 3D spatial and contextual understanding

A bright blue sky with scattered white, fluffy clouds. The clouds are of various sizes and are distributed across the frame, with a larger, more prominent cloud on the right side. The overall scene is clear and bright.

NO high quality immersive system exists today
that can provide both **performance** and **scale**

Solution: Intelligent Cloud based Augmentation

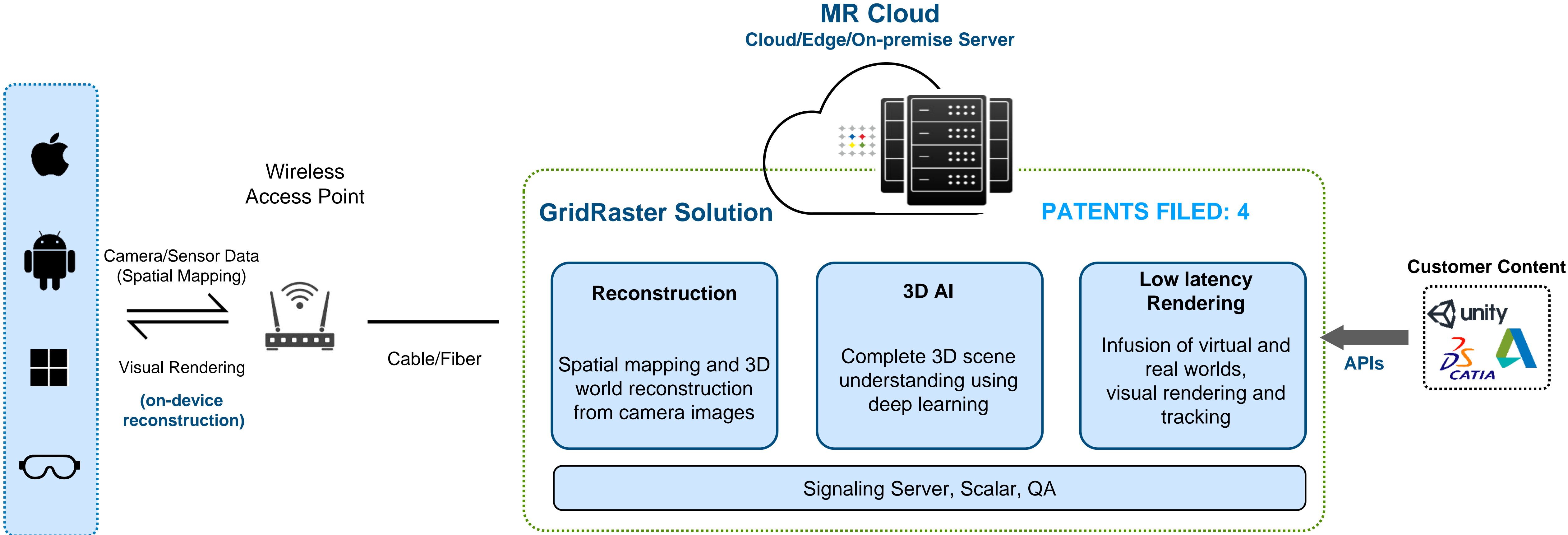
Offloading compute-intensive rendering, 3D world Reconstruction and 3D AI to remote server



GridRaster: Cloud Platform for Immersive Mixed Reality

True Immersive MR: Powered by Edge Compute and Vision Based 3D AI

← Mobile Client → ← Cloud/On-Premise Server →



Complete end-to-end solution: Leveraging Hybrid Computation, Integrating with Standard APIs.

Performance Summary

Delivering high-quality low latency rendering and accurate merging of virtual and physical world

Metric	Standalone HMD	HMD with GridRaster Solution
Polygon count of virtual objects rendered	~ 100K (heavily decimated models)	50 Million¹ (with no decimation)
Frame-Rate	60 FPS	60 FPS²
Motion-to-Photon Latency	20 ms	< 20 ms (with network RTT < 80 ms)³
3D Spatial Mapping	< 1 FPS	60 FPS
Rendering Precision	1 inch ⁴	1 mm
Industry vertical-specific 3D Vision based AI	No	Yes

¹With single GPU. Number of Polygons can be increased using multiple GPUs in parallel.

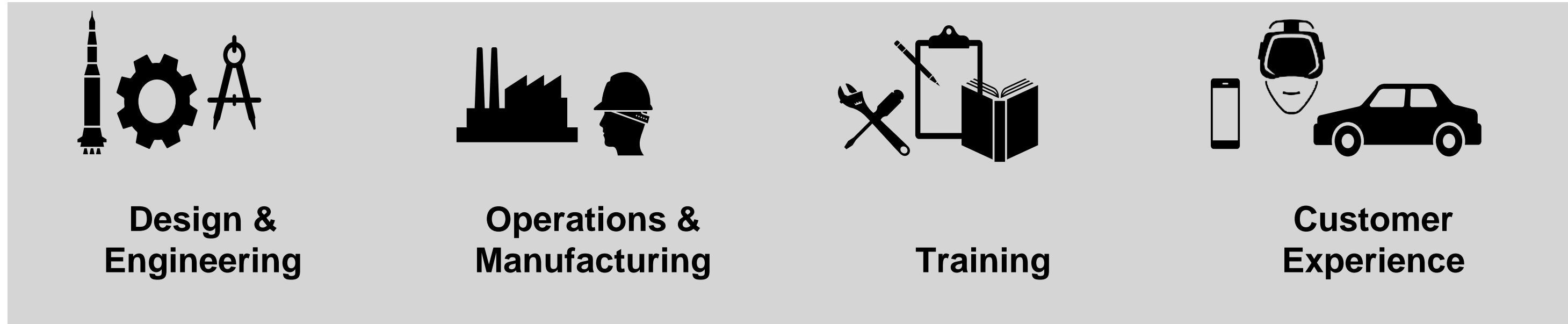
²Frame-rate is limited by the hardware of the HMD. GridRaster solution can support higher frame rates.

³On-device visual reconstruction to compensate for network delay.

⁴Rendering Precision can be improved by using finer mesh, which would limit the object size.

Enterprise first and proven verticals

MR serves broad spectrum use case in Enterprise, focused on high ROI applications



Augmented Interface:
Fuse virtual and real
worlds

Improved Safety: Failure
Predictions &
Preventative
Maintenance

Knowledge Transfer:
“Know What I Know”

Higher win rates:
customers can better
visualize products

Collaborative Design
Review

Operator & Assembly
Work Instructions

Minimized Time to Build
Work Instruction in 3D

Shorter sales cycles:
easy access to all
products -
anywhere/anytime

Quick Iterations through
multiple steps/teams

Benefits of Planning:
more predictable time to
complete tasks

Reduced Cognitive
Load: Workers can
operate at higher levels

Augmented Brand
Experience



INDUSTRIAL

\$6.5B



AUTOMOTIVE

\$3.3B



AEROSPACE

\$1.5B

(By 2024, CAGR of 65% from 2017-2024)
Source: <https://www.gminsights.com/industry-analysis/augmented-reality-ar-market>

Future Trends

The world is going to be painted with data

- 5G to further accelerate the adoption of AR/VR
 - Ultra low latency
 - 3-4x better throughput
 - Better use of the spectrum
- Enterprise AR/VR deployments to help propel the adoption of consumer AR/VR
- Utilization of the peer-to-peer network to share data locally and reduce the load on the core network



Thank You

Join us as we shape the future.

DIJAM PANIGRAHI



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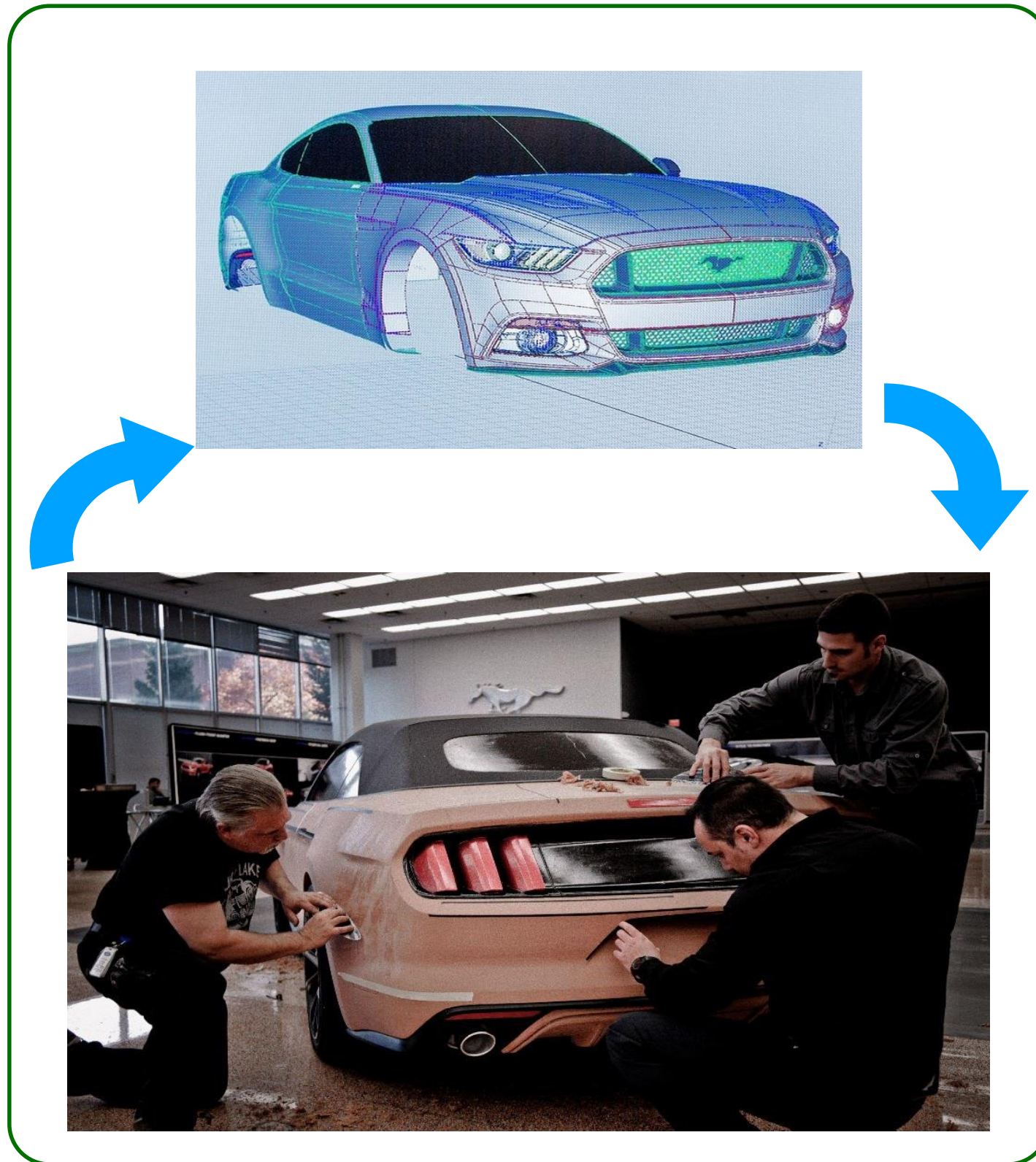
A bright blue sky with scattered white cumulus clouds. The clouds are of various sizes and are distributed across the frame, with a larger, more prominent cloud on the right side. The overall scene is clear and sunny.

Some **examples...**

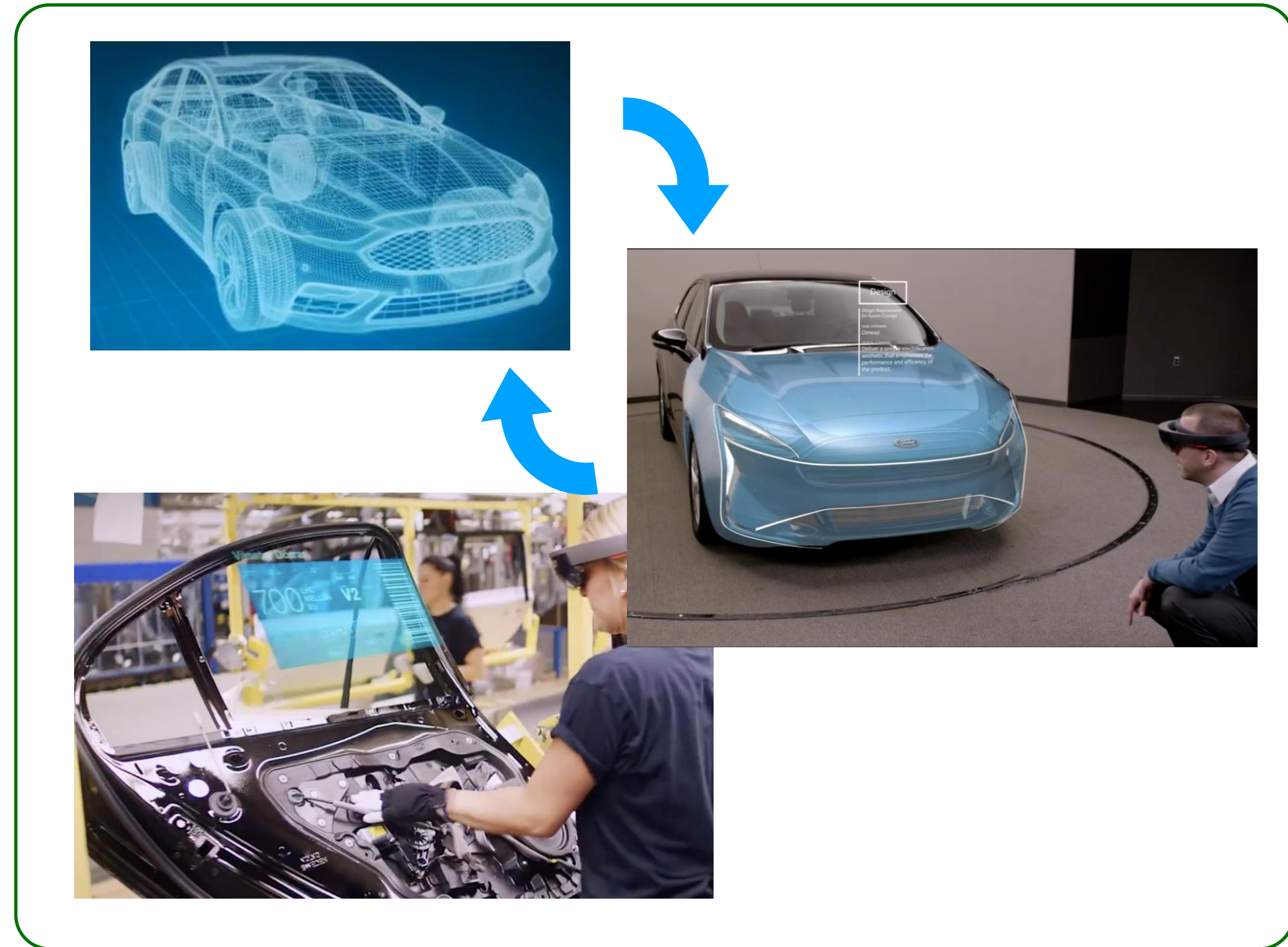
Automotive: Car Design Process

Rapid Iteration, Clearer Communication, Quick Decision

Now



Impact of Mixed Reality

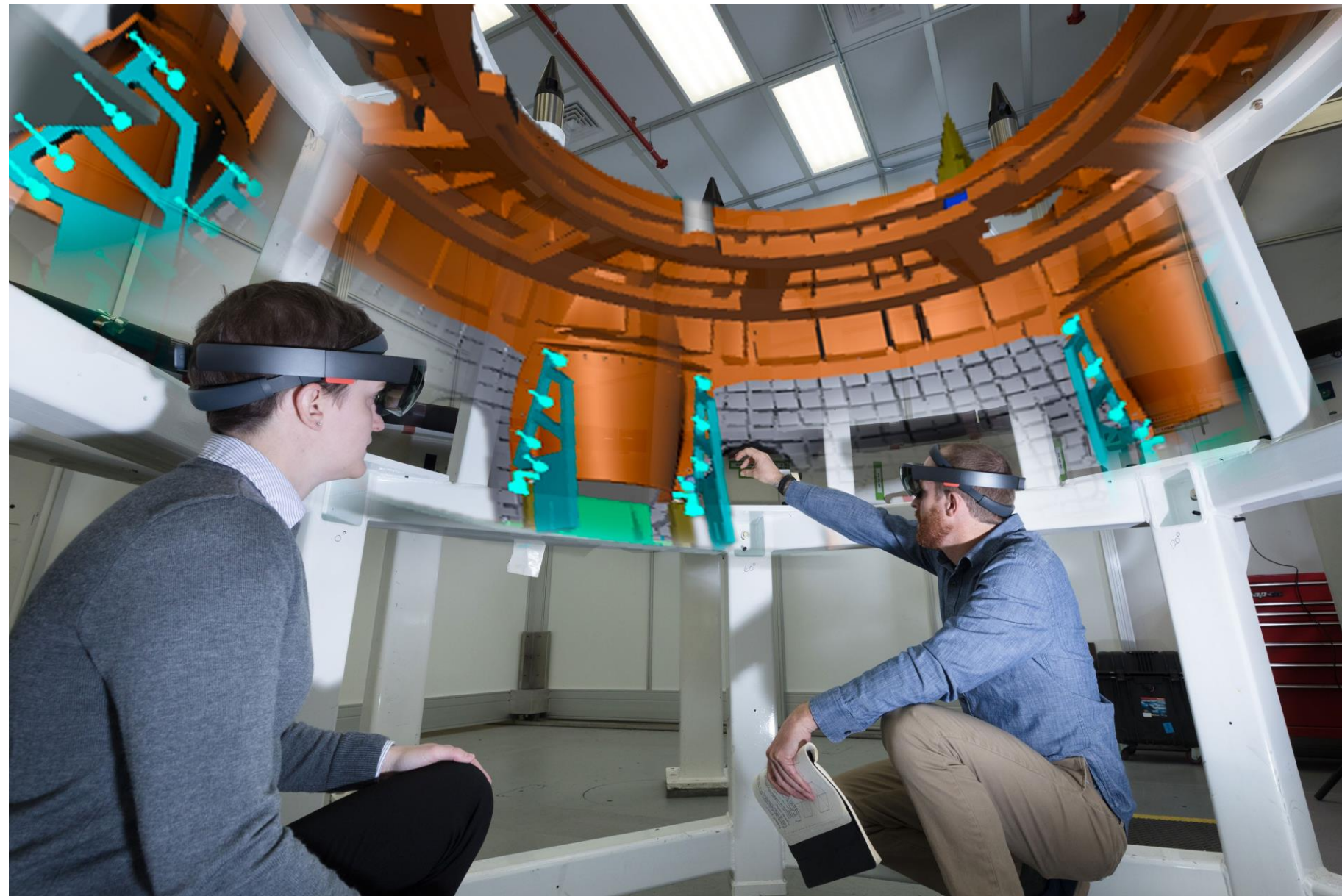


Speeds up design process from months to days

Aerospace: Design/Manufacturing Process/Maintenance

Minimize errors using MR: Instructions overlay, remote assistance, better planning and visualization

Design



Manufacturing/Maintenance



More than 40 percent increase in productivity

AR/MR Technologies provide Significant Time Savings to the Manufacturing Build Process through Optimized Decision Process, positively impacting the entire OODA Loop (Observe, Orient, Decide, Act).

- Shelley Peterson, Emerging Technologies Lead, Lockheed Martin

Industrial Manufacturing: Training/Maintenance

Reduce skill gap, enhance employee proficiency level, predictive maintenance improving safety

Training/Enhance Knowledge



Maintenance



Up to 85 percent reduction in training time

“AR lets users learn at their individual speed, and lessons can be repeated again and again without needing to involve the trainer or interrupt other trainees.”

- Frank Voßnacker, Innovation Manager, Siemens Power Generation Services