Virtual Reality
Kilian Knoll, Siemens PLM
Agenda

- AR-VR Background
- Market Environment
- Use Cases
- Teamcenter Visualization Capabilities
- Data Privacy … a reminder
- Demo
Augmented / Virtual Reality – AR/VR

**Virtual Reality (VR)** is a computer generated simulation of a real life environment; immersing the user to experience the simulated reality first hand.

+ VR guarantees the user’s focus on the content
+ Most immersive way to tell a story/review virtual content
- Hinders users from interacting with the real world

**Augmented Reality (AR)** merges computer generated graphics on top of real world, to digitally enhance what we see. **Mixed Reality** when the virtual and physical can interact.

+ Leverages the real world visuals for seamless blending of virtual and real elements
- So far AR headsets had implementation issues, but promising solutions ahead

Powerwalls, CAVE, Headsets

Tablets/Mobile, Headsets
What is available today?
Previous generation of AR/VR experience

- NX, Process Simulate, Teamcenter Visualization
- Mockup, Jack work with CAVEs and Powerwalls

- Jack and Process Simulate Human support various motion capture devices
Augmented / Virtual Reality – Siemens PL Customers Are Investing

Why Now?

Cost and Availability
Competition in the gaming industry has driven down the cost and raised availability of the devices.
$100k for CAVE+real estate vs $1k for headset+cubicle

CPU/GPU/RAM
Cost and size of compute (in device and cloud) improving all the time, making mobile AR/VR a reality.

Computervision
Scanning and recognition algorithms rapidly improving:
Register, insert and enable virtual/real to interact

Data/Analytics
Cost and wealth of cloud based analytics and network driving realtime data into operational activities
AR-VR – Market Environment
Accelerating VR/ AR product introduction


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Augmented / Virtual Reality - Technology Names
Challenge of a Rapidly Changing Technology Landscape

THE VR FUND Q1 2017 VR INDUSTRY LANDSCAPE

THE VR FUND Q2 2017 AR INDUSTRY LANDSCAPE

SIEMENS
When will AR/VR be adopted in industry?

Technology
- Rapidly maturing, cost dropping → driven by gaming
- Low cost form factor to replace powerwall/cave envs
- Existing 3D content/workflow easily adapted to VR

Business
- Moving to commodity feature → Cost of doing business
- Investment → VR product development in existing 3D apps
  - Establish shared framework for VR/AR technology

Risks
- Lack of standards for graphics, HMI and UI/UX

Technology
- Complex SW&HW challenges → driven by industry
- Mobile form factor with high compute, low power and high fidelity situational awareness
- New AR applications to be developed

Business
- Opportunity for new AR applications leveraging IOT/Big Data Analytics
- Investment → Research AR technology and use cases

Risks
- Delivering on the hype cycle before technology/SW ready
VR/AR Use Cases
Virtual and Augmented Reality applies across the lifecycle and for all industries:

<table>
<thead>
<tr>
<th>Industry</th>
<th>Concept</th>
<th>Design</th>
<th>Engineering</th>
<th>Planning</th>
<th>Assembly</th>
<th>Marketing</th>
<th>Sales</th>
<th>Maintenance</th>
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<tbody>
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<td>Aerospace &amp; Defense</td>
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Many of the VR use cases are geared towards upfront definition & inspection whereas AR use cases are more predominant in Assembly, Manufacturing & Service.
**Why Virtual Reality?**  
*Where does industry expect value from VR – Sample Cases*

<table>
<thead>
<tr>
<th>Immersive Study</th>
<th>Today</th>
<th>With VR</th>
<th>Improvement/Value</th>
</tr>
</thead>
</table>
| Designers / Planning analyze and inspect virtual definition of product | Inspect 3D / PLM data on 2D displays. Using 2D display techniques and modes to understand the design | Inspect 3D data within immersive virtual environment. Using walk and fly-through navigation techniques | • Better understanding of 3D  
• Fewer analysis cycles  
• Right first time  
• Improved product/plan accuracy and usability |

| Design Review | Face-Face/Web meetings, visualizing 3D content on shared 2D screens | Team meet in virtual immersive 3D environment to review, discuss and provide feedback | • Better understanding of 3D  
• Quicker resolution of issues  
• Fewer meetings  
• Less travel |

| Sales Configurator | Configure and view 3D product on 2D displays with limited navigation tools | Configure and walk/fly through 3D product in immersive environment | • Better understanding of configured product  
• Improved user experience for sales |
### Why Augmented Reality?

**Where does industry expect value from AR – Sample Cases**

<table>
<thead>
<tr>
<th>Augmented Work Instruction</th>
<th>Shopfloor augmentation with graphical instructions and step validation</th>
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<tbody>
<tr>
<td><strong>Today</strong></td>
<td>Document based instructions for assembly. Validation through manual checklists or secondary steps</td>
</tr>
<tr>
<td><strong>With AR</strong></td>
<td>In-scene stepwise instruction and tasks – including safety instructions and automated task validation</td>
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</table>
| **Improvement/Value**      | • First time accuracy with validated instructions  
                             • Better understanding, improved quality and efficiency |

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<tr>
<th>Remote Service Expert</th>
<th>Field servicing supported by virtual technical expert</th>
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<td><strong>Today</strong></td>
<td>Remote expert assistance via phone or expert has to travel to site</td>
</tr>
<tr>
<td><strong>With AR</strong></td>
<td>Remote expert ‘sees’ and guides through augmented reality to assist on-site technician</td>
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</table>
| **Improvement/Value**      | • Knowledge multiplier for expert  
                             • Less travel for key staff  
                             • First trip success for support |

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<tr>
<th>Virtual Training</th>
<th>Trainee is guided through procedures on real equipment</th>
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<td><strong>Today</strong></td>
<td>On-site training on equipment with physical presence of trainer. Trainee navigates book-based manuals</td>
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<tr>
<td><strong>With AR</strong></td>
<td>Virtual presence of trainer. Virtual guidance of trainee via 3D instructions overlaid on real world equipment</td>
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</table>
| **Improvement/Value**      | • Remote training – less travel  
                             • Improved trainee productivity with in-situ instruction  
                             • Improved understanding for trainee – translating manuals to real world |
Teamcenter Visualization VR Capabilities
Virtual Reality in PL Applications

Teamcenter Visualization

- Focus on Design Review use cases
- Leverage existing
  - Review with session, snapshots, sectioning...
  - Powerwall capability/UI
- Initial Release: Teamcenter 11.4
Targeted Support for new low cost VR devices
Extending Teamcenter Visualization Professional – and Mockup

- Native support for the following devices as part of new product offering
  - HTC Vive
  - Oculus Rift
  - zSpace
- Allows the user to immerse themselves
  - Tracking – users can poke „inside“ camera movement sync’d with device signals
- Navigate within virtual environment
- Richness of Visualization and DMU functions exposed through immersive menu
  - Navigation
  - Analysis
  - Collaboration
- PLM integrated VR at a keypress
  - Data can be loaded directly from Teamcenter
  - Issues found during an immersive session can be stored and managed in Teamcenter
User Interaction & Tracking

- Camera Position Tracking
  - Synchronization of headset / glasses with stereoscopic display

- Controller Tracking & Assignment can be used for many different purposes
  - Selection and Actions
  - Reachability
  - User Configurable assignment of functions to „buttons“

- User Interaction
  - Immersive Menu with rich set of relevant DMU functions
  - Customizable UI capabilities to allow for casual – as well as expert users
Richness of Visualization and DMU functions in Immersive

• No additional training required
• All Functions identical to traditional Teamcenter Visualization interaction behavior on Desktop environments
• Relevant base functions accessible in Immersive Environment
• Use of Snapshots with their associated assets (e.g. behaviors) to quickly „get to the point“
• Selection, Pre-highlighting to interact with the model
Richness of Visualization and DMU functions in Immersive

- Major analysis functions directly accessible
- Section to cut through the mist
- Measure to understand impact
- Move parts to disassemble
- Check Collisions to understand form & fit
- Automatically disassemble to understand maintainability
PLM integrated VR at a Keypress

- Information readily available to the users
- Teamcenter Visualization with VR capabilities directly connected to Teamcenter
  - Access to bulk data without any additional conversion process requirements
  - Rich set of configuration and persistence mechanisms
  - Integrated DMU functions
- Analysis & Issues found in VR managed in Teamcenter leveraging existing Teamcenter Visualization Sessions, Snapshots, Markups etc.
Data Privacy

• What is the concern
  • *What if screenshots of your top secret project would be pushed out to the internet 4 years before SOP?*

• Background
  • To support the low cost devices, applications Siemens PL builds rely on SDK’s & API’s from the hardware / software vendors
  • Some of these vendors may collect data that may be sensitive to you
  • Some providers understand the issue and are working it

https://www.vrheads.com/vr-and-your-privacy-how-are-these-companies-treating-your-data

VIVE BUSINESS EDITION

Industry Benchmark for VR HMDs.
High precision tracking.
Integrated accessories, professional services and support required by enterprise customers.

SIMPLER IT ROLL-OUT

HTC has worked with the largest enterprises in automotive, construction and aerospace sectors to develop a simplified installation process that is currently in its last stages of preparation.

This software for VIVE Business Edition, greatly optimizes IT roll-out, as it does not require setting up accounts and an internet connection is not required during installation or operation.

Your models and data are safe as the SteamVR runtime is not sharing any user content through the internet.
Thank You!

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