EUC Score

DEX4DaaS – Measuring and comparing perceived remote desktop user experience in a Cloud PC era

E2EVC 2024, Montreal

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Benny Tritsch

Dr. Tritsch IT Consulting

EUC Score

Parallels

GO-EUC

TeamRGE
Remoting Graphics Experts

Performance Data Scientist
EUC Documentary Cameraman
MVP | CTP | EUC Expert | NGCA

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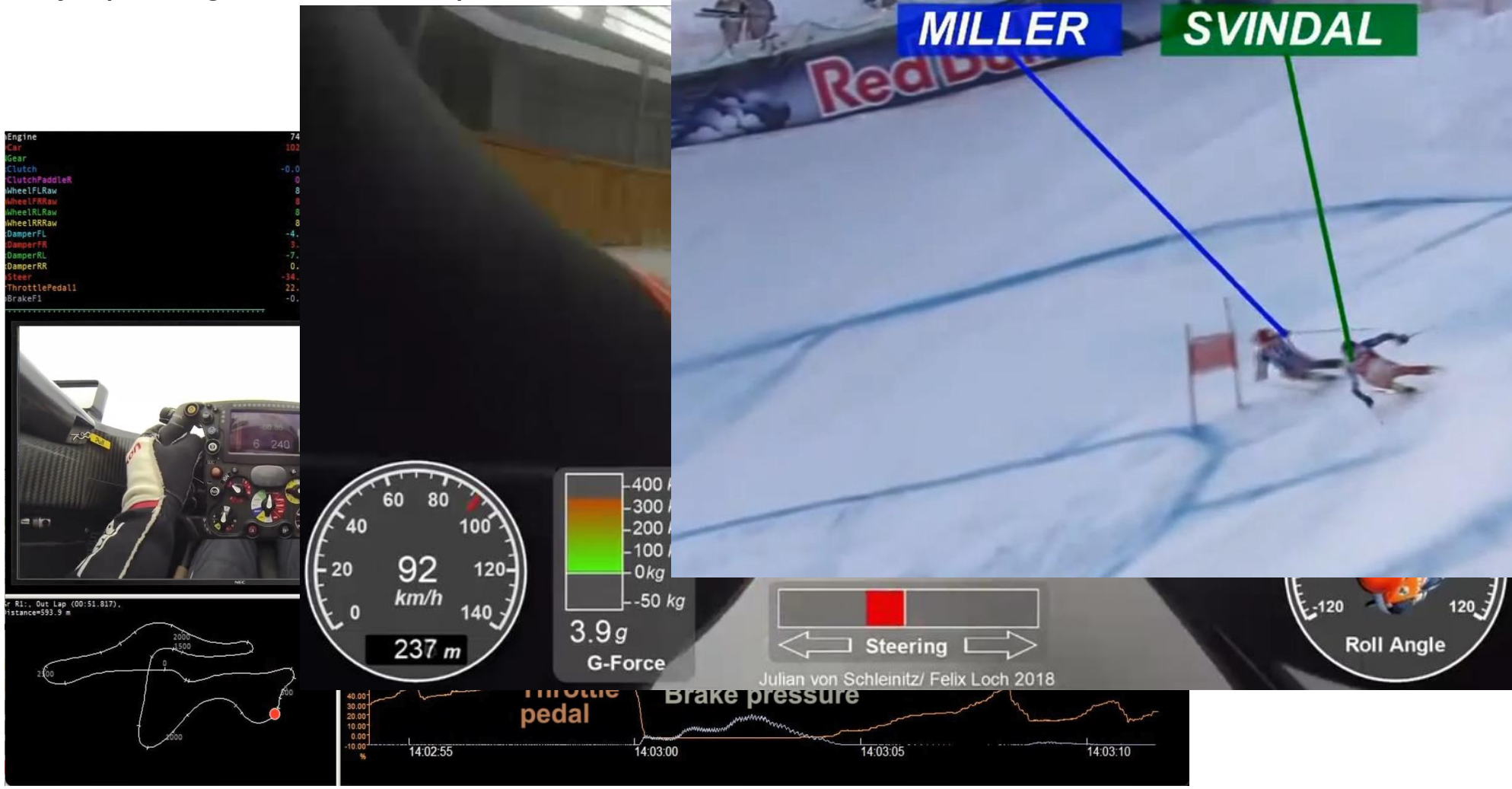
@drtritsch

DE EUC FORUM

EXPERTS 2 EXPERTS Virtualization Conference
www.e2evc.com

Dartfish Video Analysis Alpine Skiing

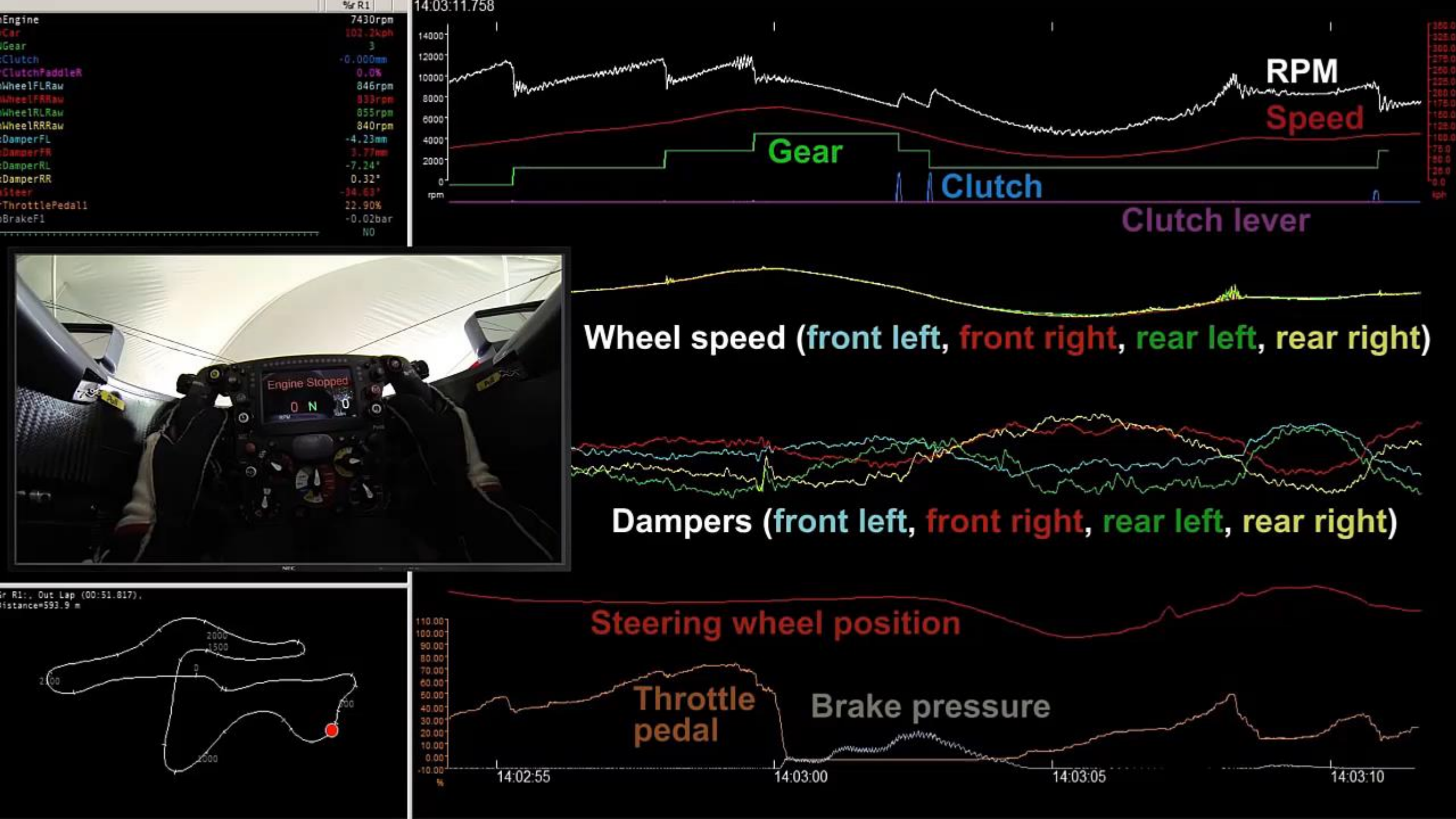
Olympic Luge Track – first-person view



Formula 1 Telemetry and Driver Experience


Kitzbühel
Hahnenkamm-Rennen
Audi
Audi quattro
LONGINES
Kitzbühel
LONGINES


0:00.000
Official Time
60
80
40
100
20
120
5
km/h
0
140
0 m
400 kg
300 kg
200 kg
100 kg
0kg
-50 kg
1.0g
G-Force
Steering
Julian von Schleinitz/ Felix Loch 2018
-30
0
30
-60
60
-90
90
-120
120
Roll Angle


%r R1
Engine 7430rpm
Car 102.2kph
Gear 3
Clutch -0.000mm
ClutchPaddleR 0.0%
WheelFLRaw 846rpm
WheelFRRaw 833rpm
WheelRLRaw 855rpm
WheelRRRaw 840rpm
DamperFL -4.23mm
DamperFR 3.77mm
DamperRL -7.24°
DamperRR 0.32°
Steer -34.63°
ThrottlePedal1 22.90%
BrakeF1 -0.02bar
NO
14:03:11.758
14000
12000
10000
8000
6000
4000
2000
0
rpm
RPM
Speed
Gear
Clutch
Clutch lever
Engine Stopped
0 N 0
Wheel speed (front left, front right, rear left, rear right)
Dampers (front left, front right, rear left, rear right)
Gr R1:, Out Lap (00:51.817),
Distance=593.9 m
2000
1500
1000
500
0
Steering wheel position
110.00
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
-10.00
%
Throttle pedal
Brake pressure
14:02:55
14:03:00
14:03:05
14:03:10

HAMILTON - VETTEL
STIRIA Q3 BEST LAP COMPARISON

Provided by
Federico **ALBANO**

FP

SPEED [km/h]

SECTOR 1
HAMILTON : -0.669

SECTOR 2
HAMILTON : -0.878

TOP SPEED
HAMILTON 295 KM/H
VETTEL 288 KM/H

SECTOR 3
HAMILTON : -0.831

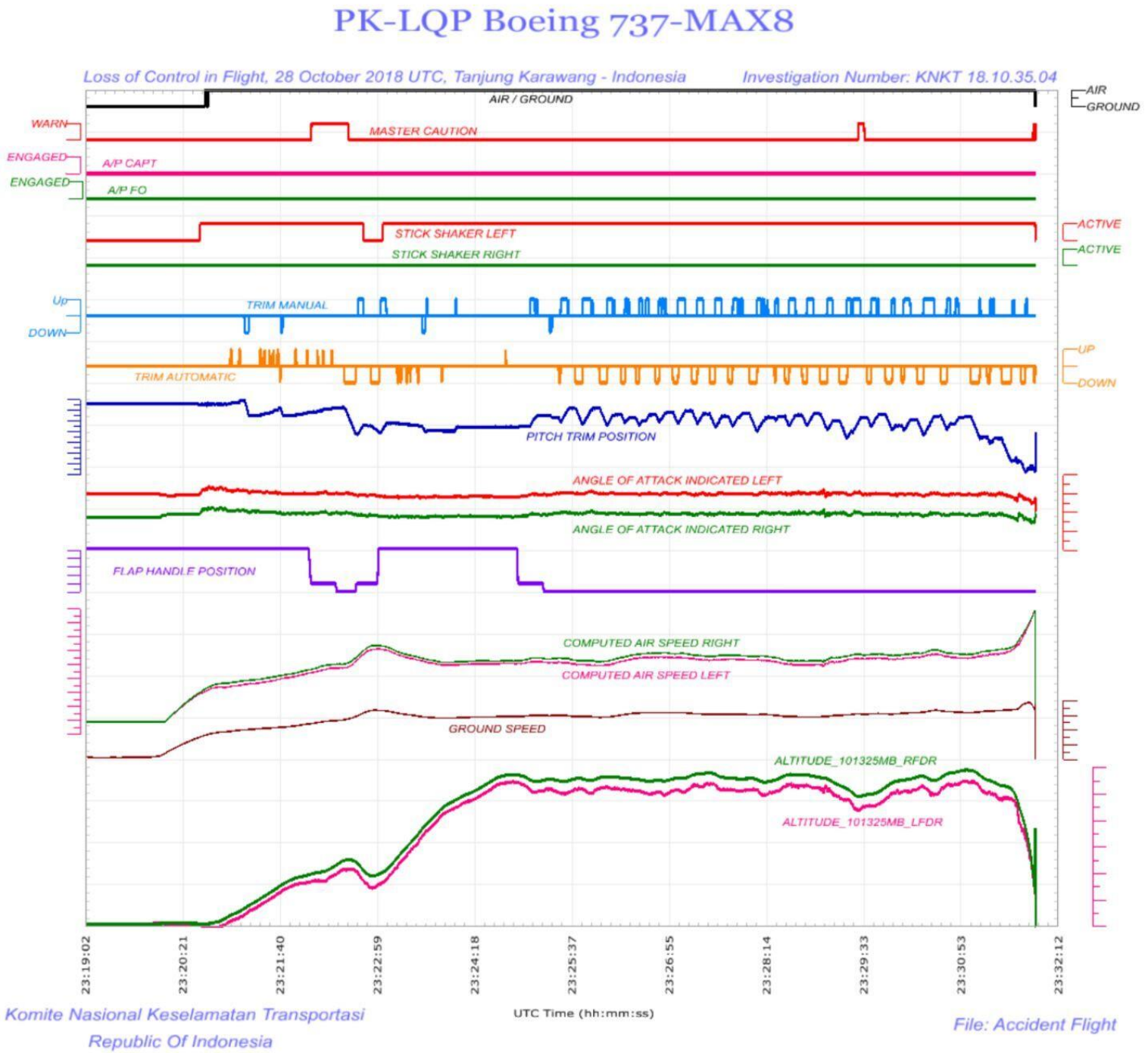
LAP TIME:
HAMILTON : 1:19.273
VETTEL : 1:21.651

HAM +6
HAM +11
HAM +6
PARI
HAM +5
HAM +10
HAM +11
HAM +9
HAM +16
HAM +10
VET +1
HAM +7
VET +2

THR [%]

1 2 3 4 5 6 7 8 9 10

Flight Data Recorder

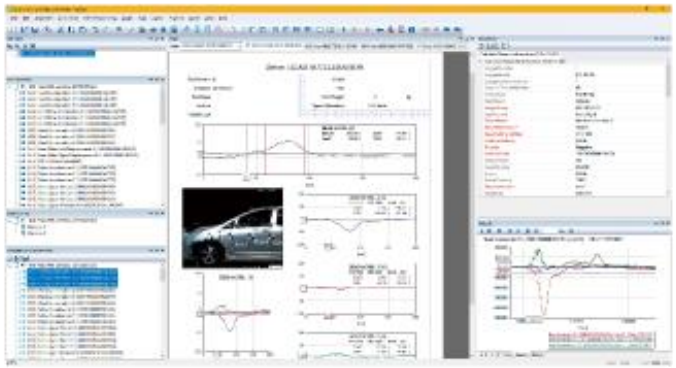


Automobile Safety Rating

- **US NHTSA** - Department of Transportation
- **US IIHS** - Insurance-industry-backed nonprofit organization
- **Euro NCAP**

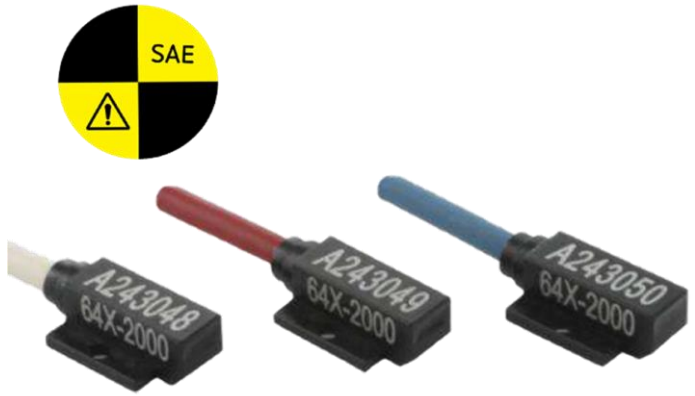
Test Scenario Examples

- Frontal crash test
- Side barrier crash test
- Side pole crash test
- Rollover resistance test



Crash Test Analysis Software

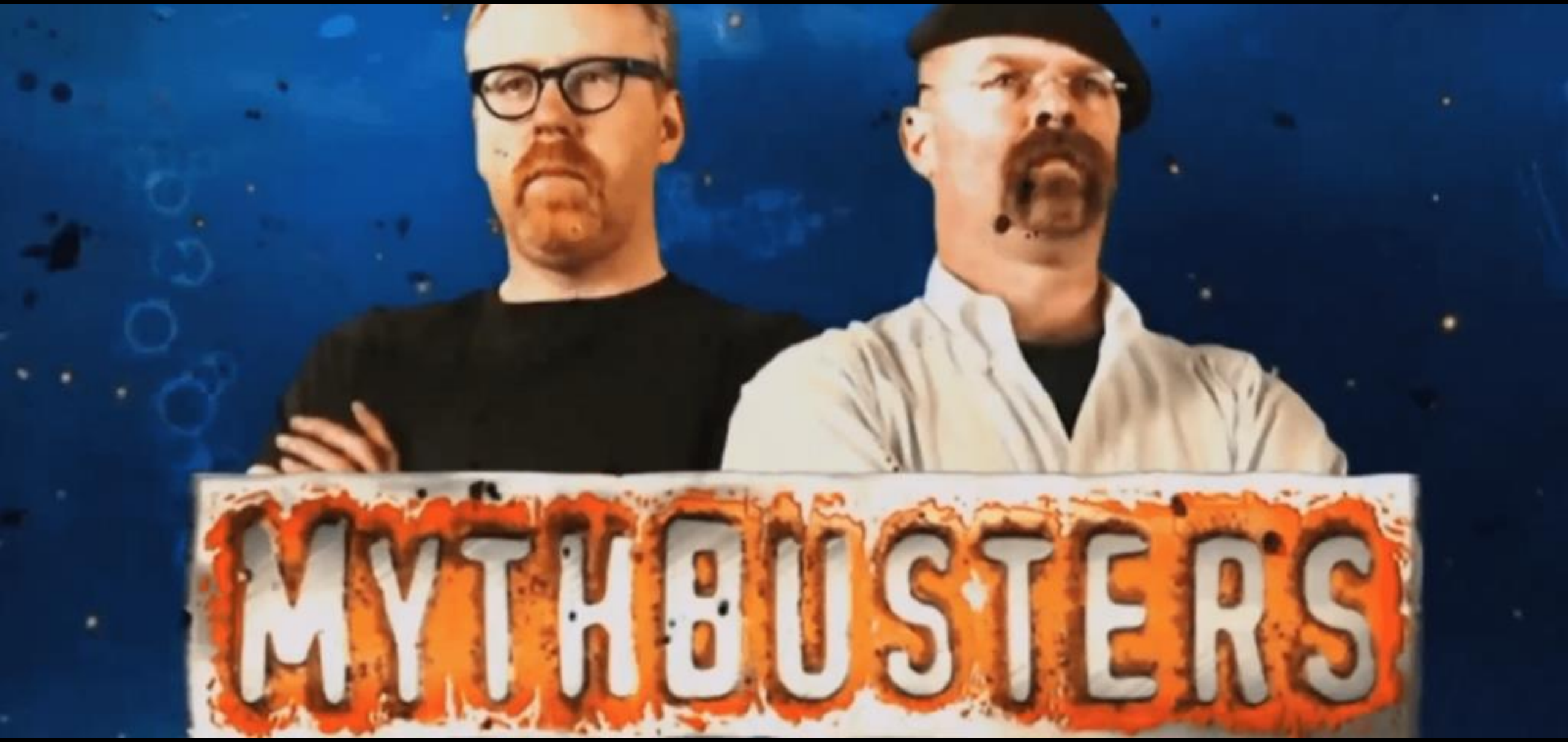
High-Speed Camera

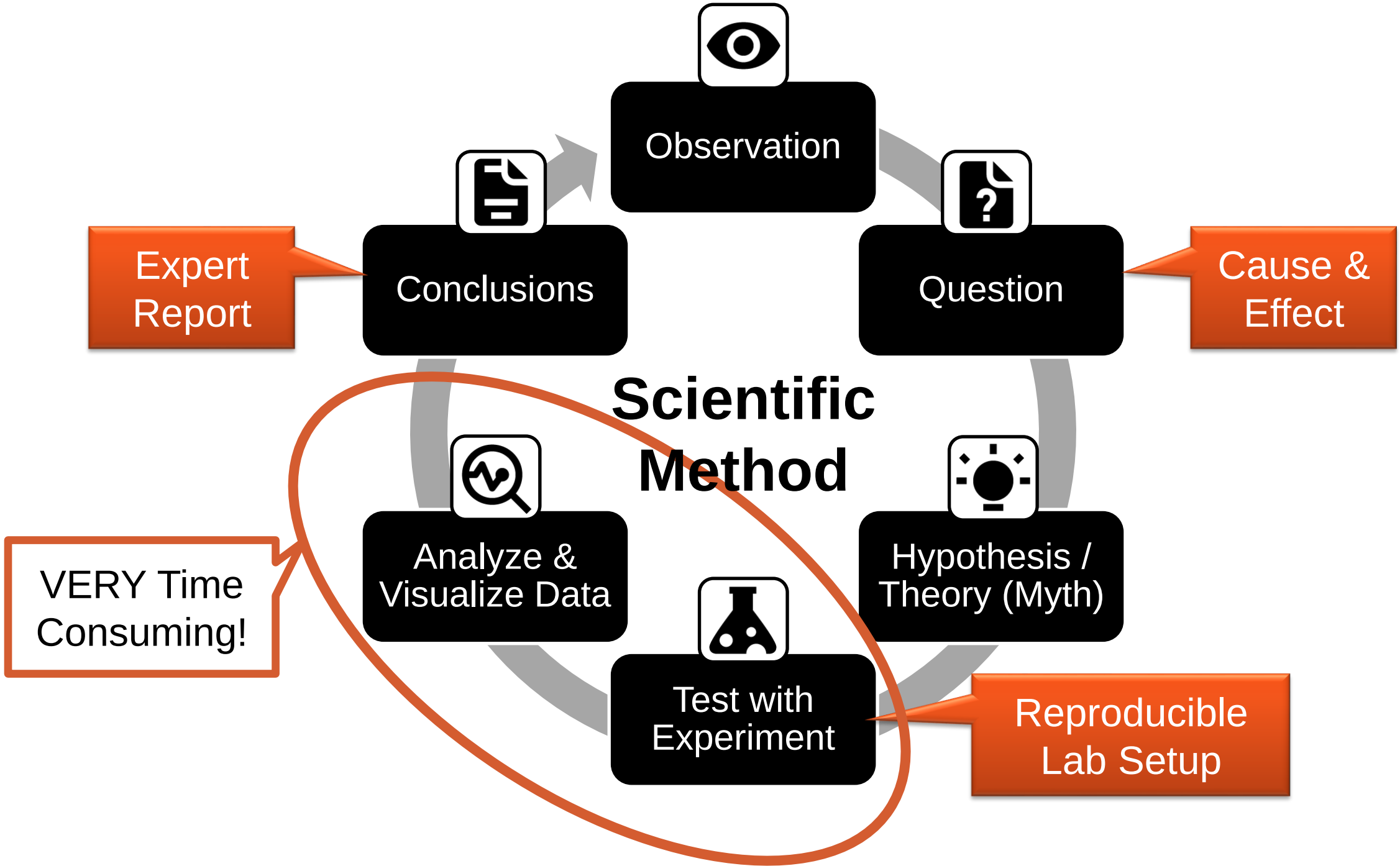


Crash Test Sensors
> 200 sensors/ATD

Anthropomorphic Test Device = ATD
“Crash Test Dummy”, $200k each

Catapult – Crash Test Sled
Repeatable and reliable impact conditions


MYTHBUSTERS


Observation
Question
Cause & Effect
Hypothesis / Theory (Myth)
Test with Experiment
Reproducible Lab Setup
Analyze & Visualize Data
VERY Time Consuming!
Conclusions
Expert Report
Scientific Method

Some of my recent DEX4DaaS projects

1. Comparison of local workstation, Citrix HDX and Microsoft RDP under LAN and WAN conditions for urban planners in public city administrations
2. Reference measurement for the use of CAD/CAM applications in a manufacturing environment over LAN and from the home office
3. Testing and comparing the perceived user experience when using different GPU-accelerated Azure Windows 365 instances
4. Analysis of randomly disconnected user sessions on RDSH VMs running on a Hyper-V host with NIC Teaming
5. Comparison of standard RDP and RDP-SxS when connected to Azure VMs (Parallels project)

And now let’s talk about Windows

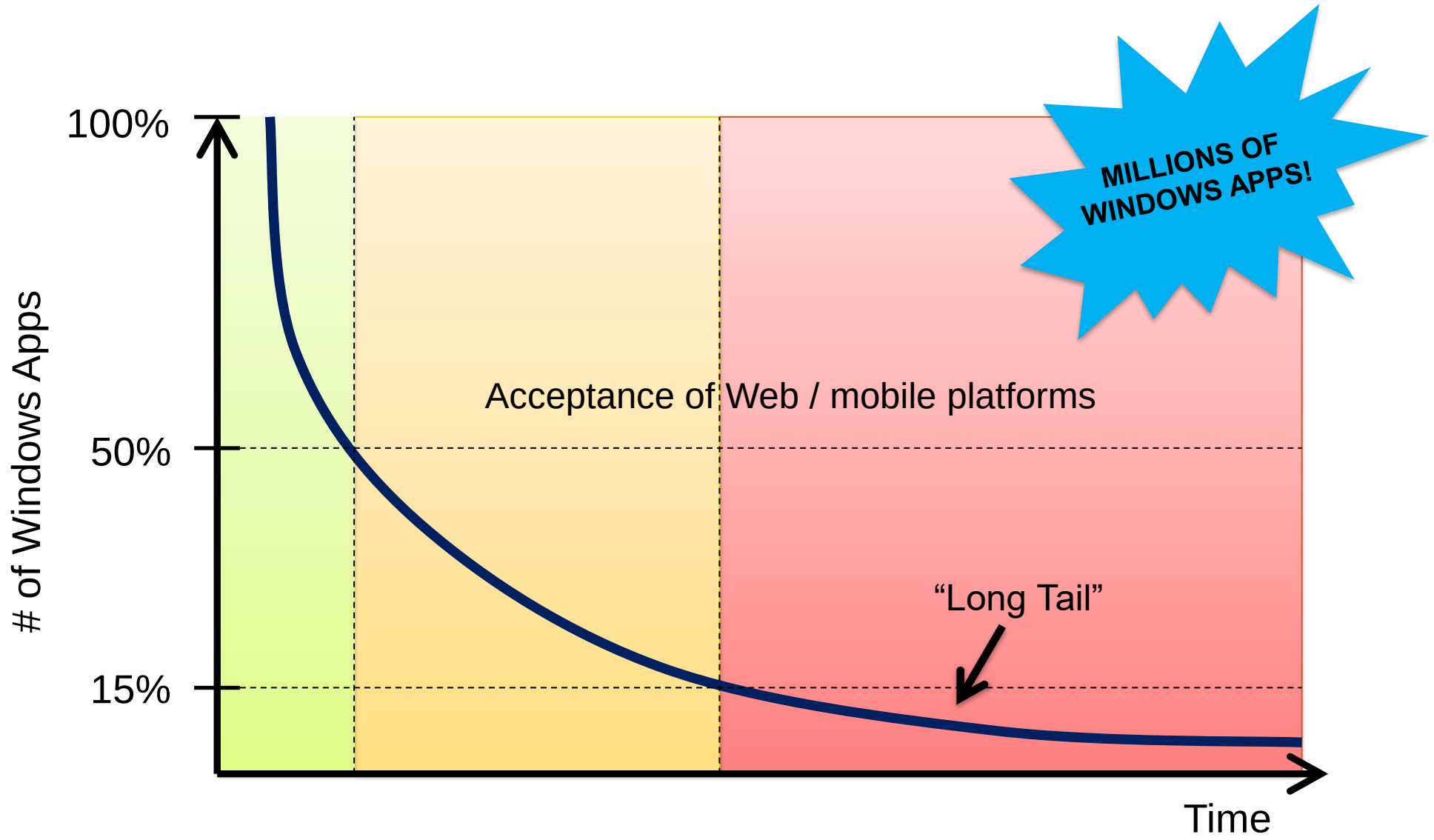
Gaming platform

Media and entertainment center

Information search and storage hub

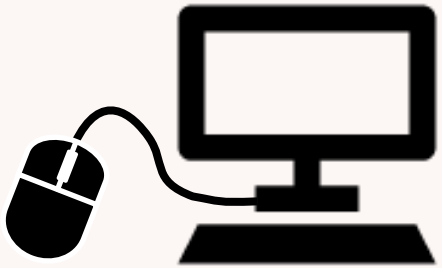
Digital workspace for business apps

Cloud Adoption Rate and the “Long Tail”

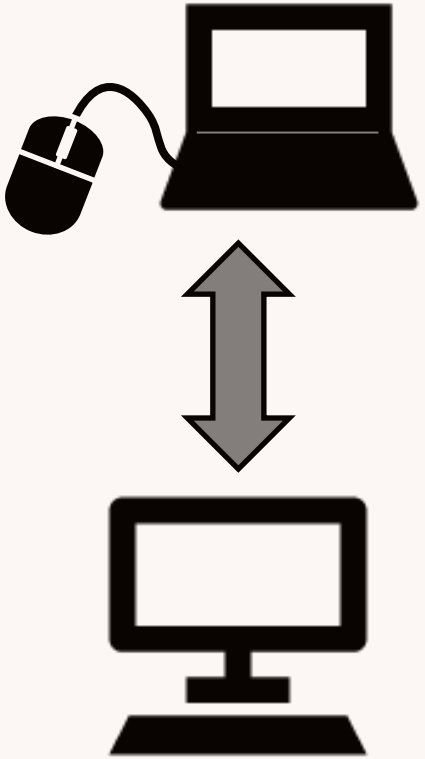


End User Computing

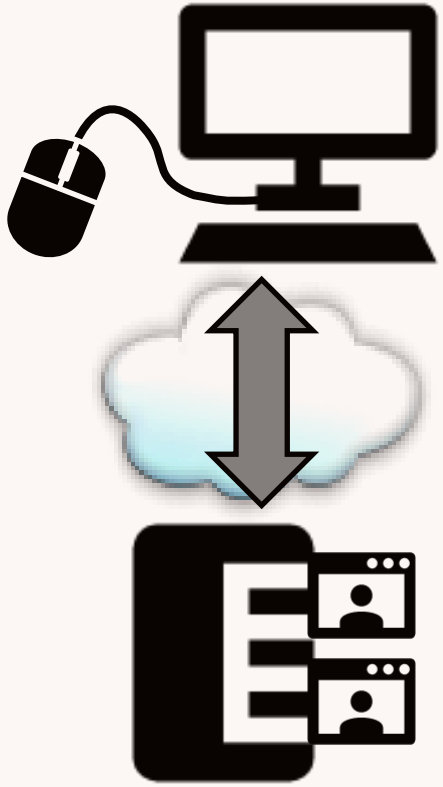
On-Prem Windows

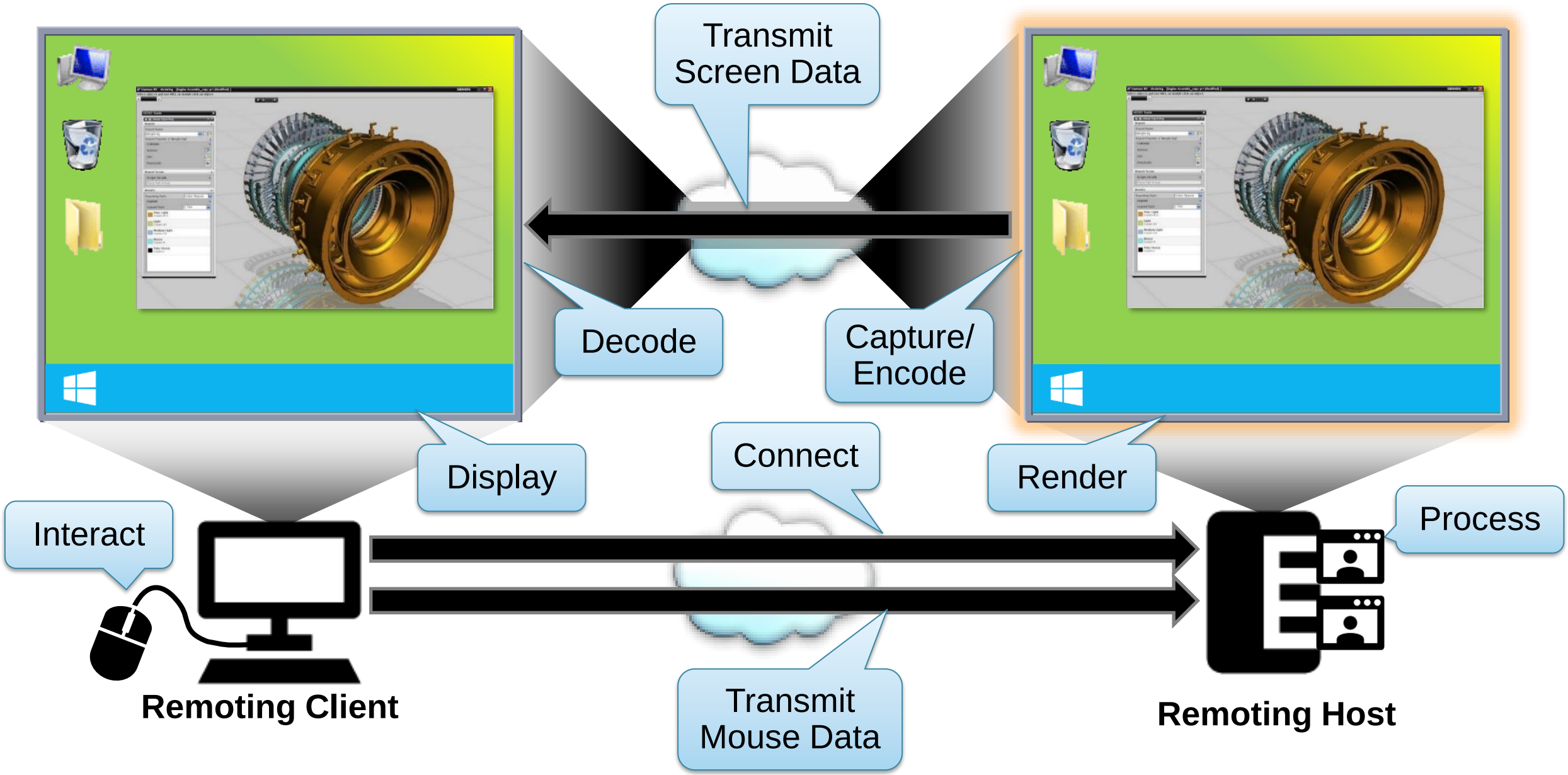


VDI / RDSH on LAN



AVD / Win365

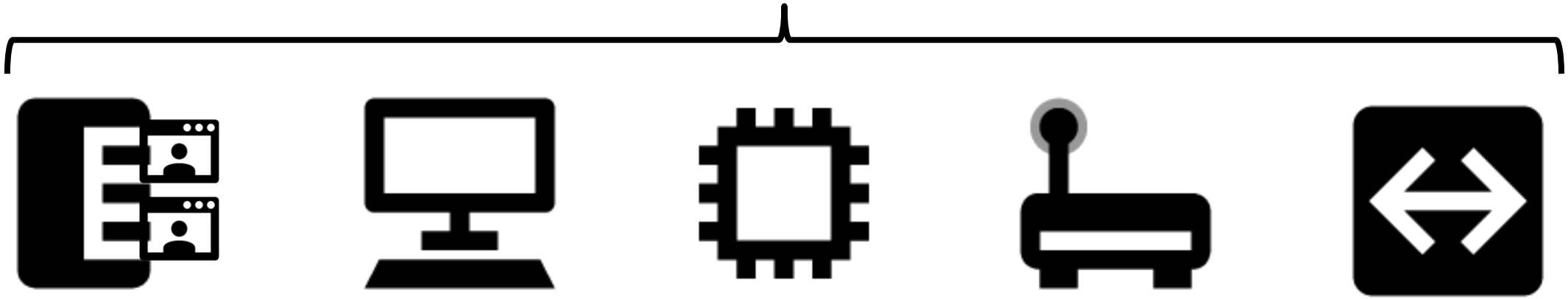



Transmit
Screen Data
Decode
Capture/
Encode
Display
Connect
Render
Interact
Process
Transmit
Mouse Data
Remoting Client
Remoting Host

From a User's Perspective: Quality Criteria

Boot and logon duration	Measure boot time + logon time + user session load time until it is ready for user interaction. Includes identity management and authentication methods.
Application and content load time	Measure time from user starting an application until the content appears and the application is ready for user input, including access to the storage system.
User input delay ("Lag")	Measures responsiveness of graphical elements after user-initiated triggers = "time from mouse click to screen update" (lag, latency, system response time).
Graphics APIs supported	Detect incompatibilities when running graphics applications using the DirectX, OpenGL, Vulkan and WebGL APIs.
Media formats supported	Detect incompatibilities when opening and playing media files, such as MP4, MPEG, MOV, WMV or AVI.
Distortion of media	Measure media and screen output quality. Detect image, animation, and audio/video compression and decompression artifacts and anomalies.
Screen refresh rate	Measure the number of times per second that the desktop or application can draw consecutive images on the screen and in the host frame buffer (frames per sec = fps).
Endpoint specs and quality	Determine the screens' number of pixels, density, and visual dimensions – frame buffer requirements grow with resolution and screen number. Detect periphery incompatibilities.
Application reliability and stability	Detect application hangs, freezes, crashes or unhandled exceptions. Measure consistency, dependability and robustness of applications.
Session consistency and resilience	Check if user state is preserved across subsequent sessions. Measure session disruptions, hangs, disconnects/reconnects, availability, timeouts and redundancy.

User Experience Influencers



Host System “VM Type”

Client Device “Endpoint”

GPUs

Network

Remoting Protocol

Science of EUC: Network Factors

The richer the graphics, the more bandwidth it will take

Bandwidth

Data transfer rate of a network connection

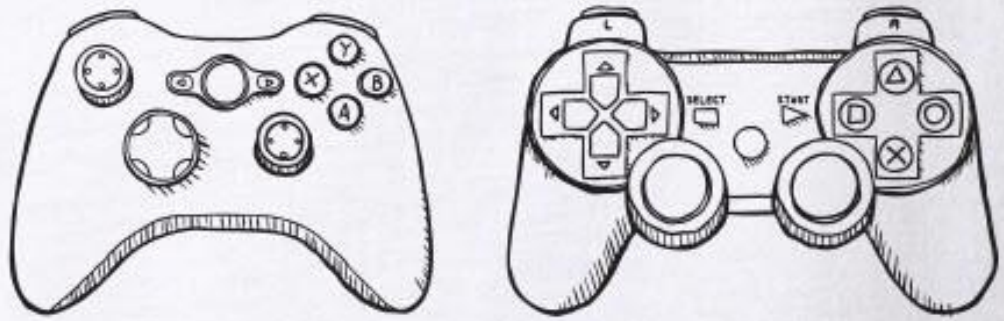
Latency

Delay; amount of time to traverse a system (+ Jitter)

Packet Loss

Discarding of data packets (in percent)

VIDEO GAMES DON'T MAKE US VIOLENT



LAG DOES

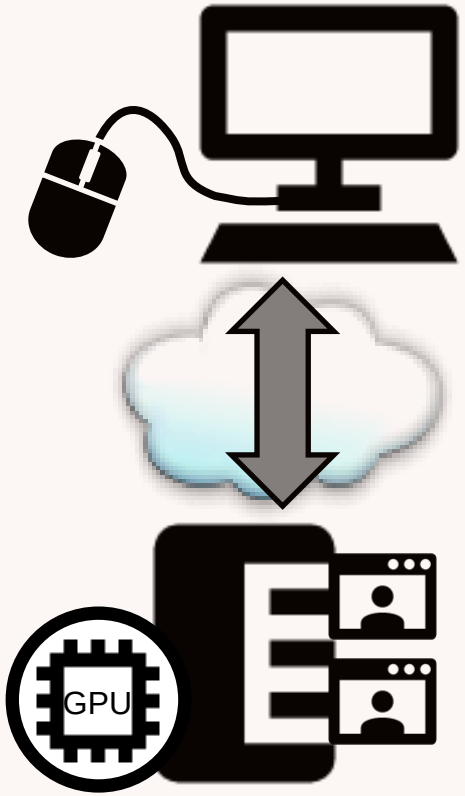
Different Personas – Different Requirements

	Persona Name	Rendering	IT Workforce	Description
	**Task Worker**	CPU	25-80%	Well-defined, repetitive, and delineated tasks, using a limited number of applications
	**Information Worker**	CPU or shared GPU	25-80%	Find facts quickly, create documents, edit, write & process information
	**Knowledge Worker**	High-end CPU or shared GPU	10-50% ~400m	Tasks include accessing the Internet, using email, and creating complex documents, presentations, and spreadsheets
	**Power User**	Shared GPU or dedicated GPU	5-50% ~200m	People who use multiple compute, network and graphics-intensive applications
	**CAD/CAM Professional Designer**	Dedicated GPU	5-25% ~25m	People who use graphically-intense applications for computer-aided design (CAD) and computer-aided manufacturing (CAM)

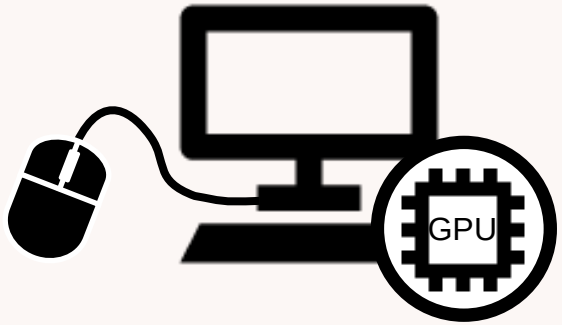
Potential Trend

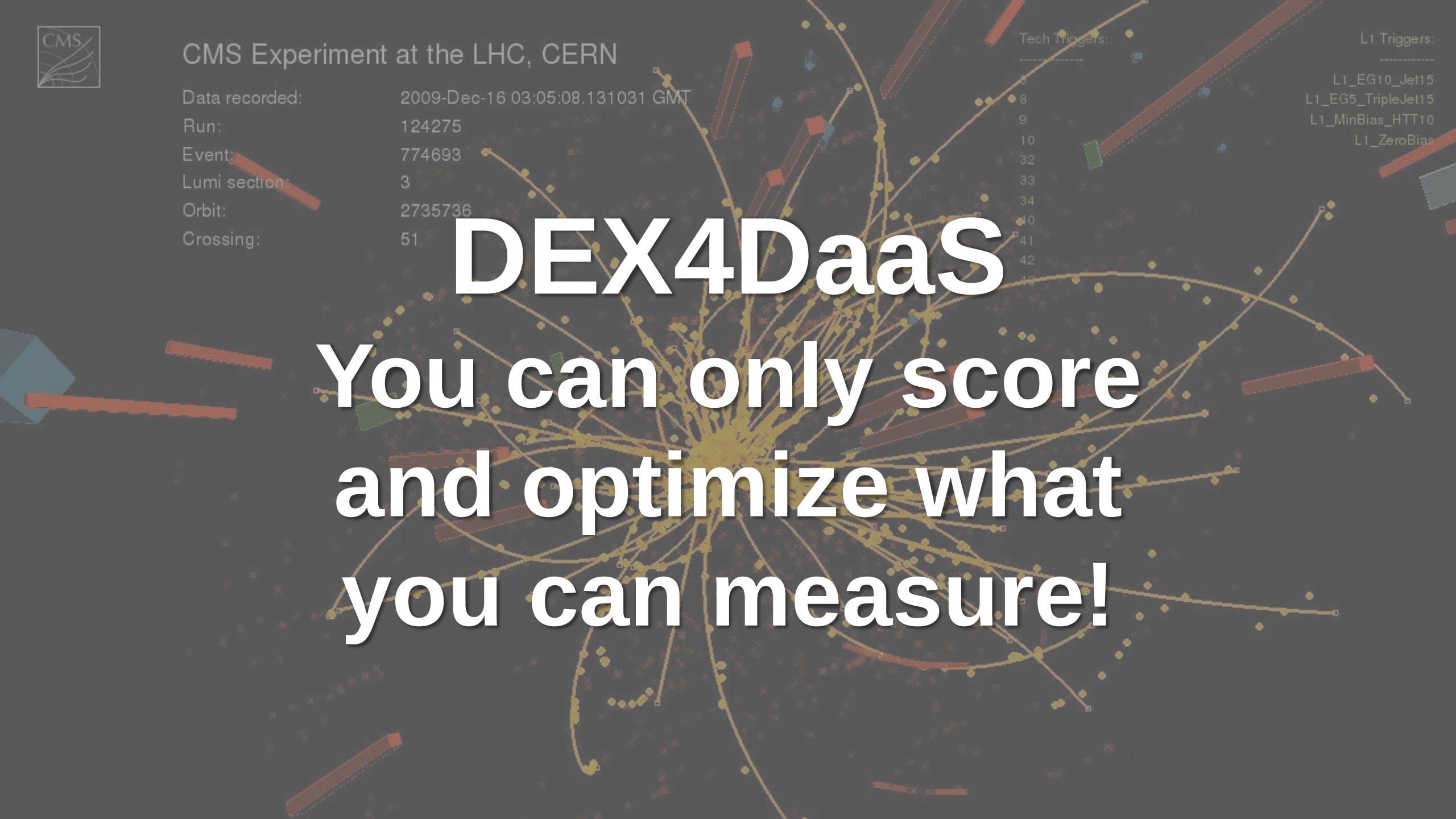
The Pendulum May Swing Back to Physical PCs

AVD / Win365



Physical Machines with Access to Cloud Services

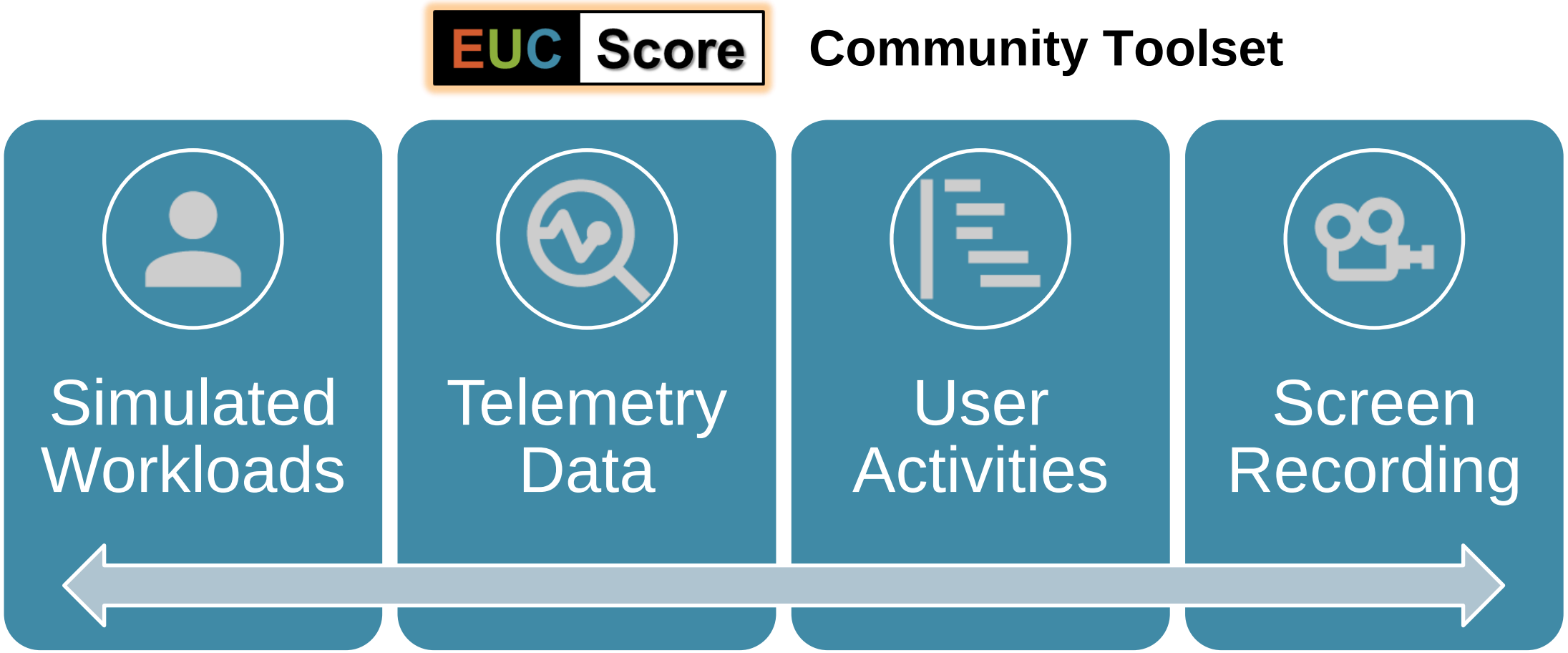




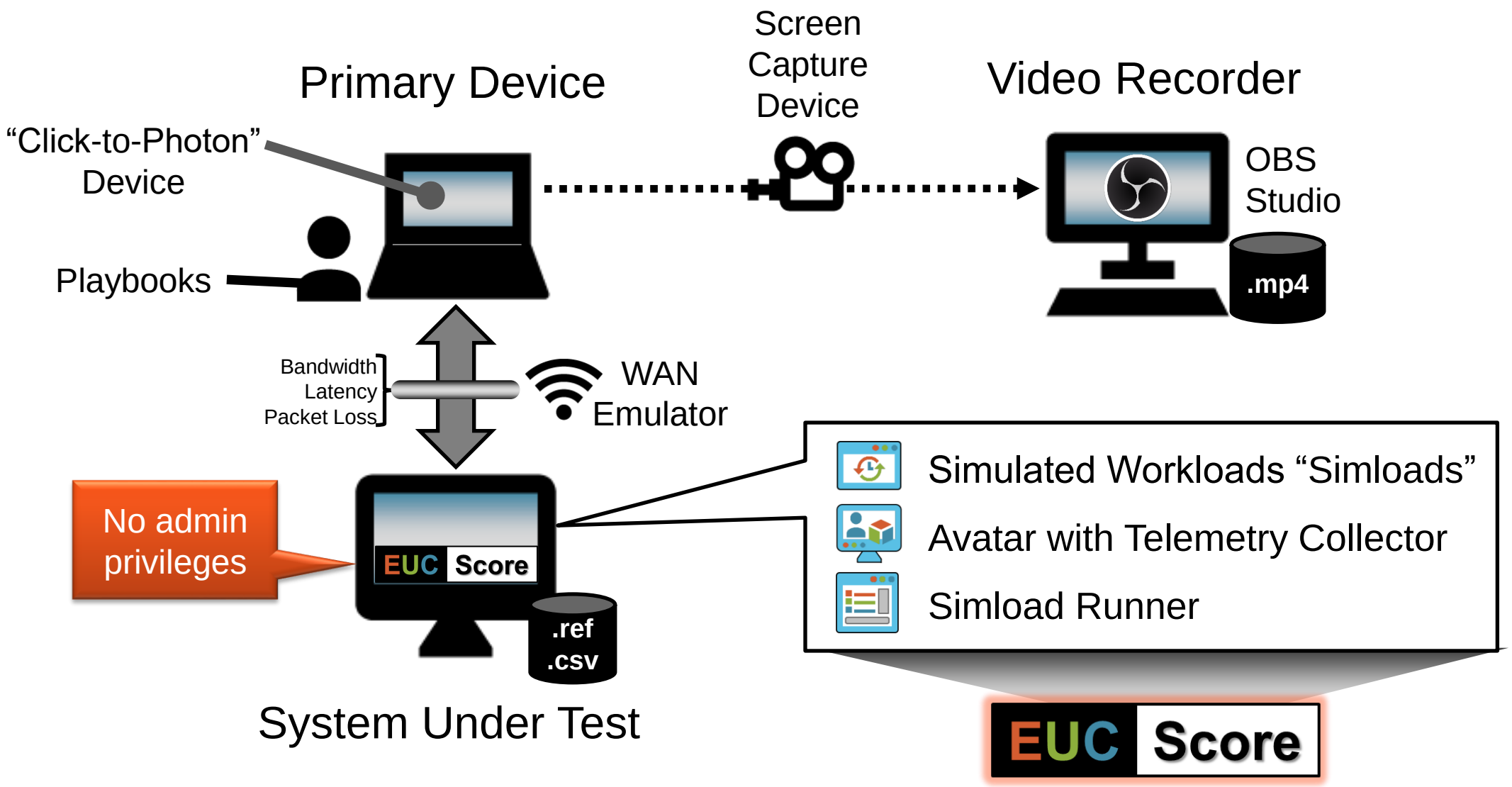
DEX4DaaS

You can only score and optimize what you can measure!

User Experience Benchmarking

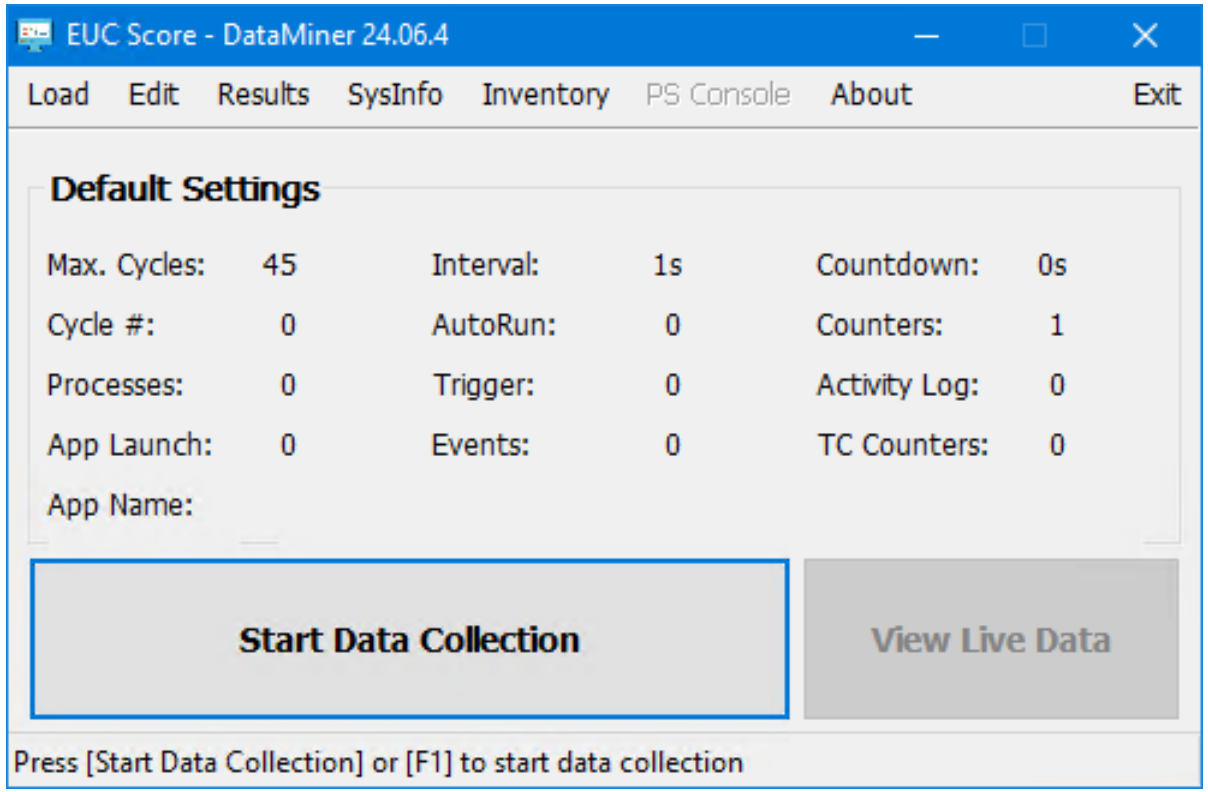


Build a DEX Test Lab with EUC Score



EUC Score Data Miner

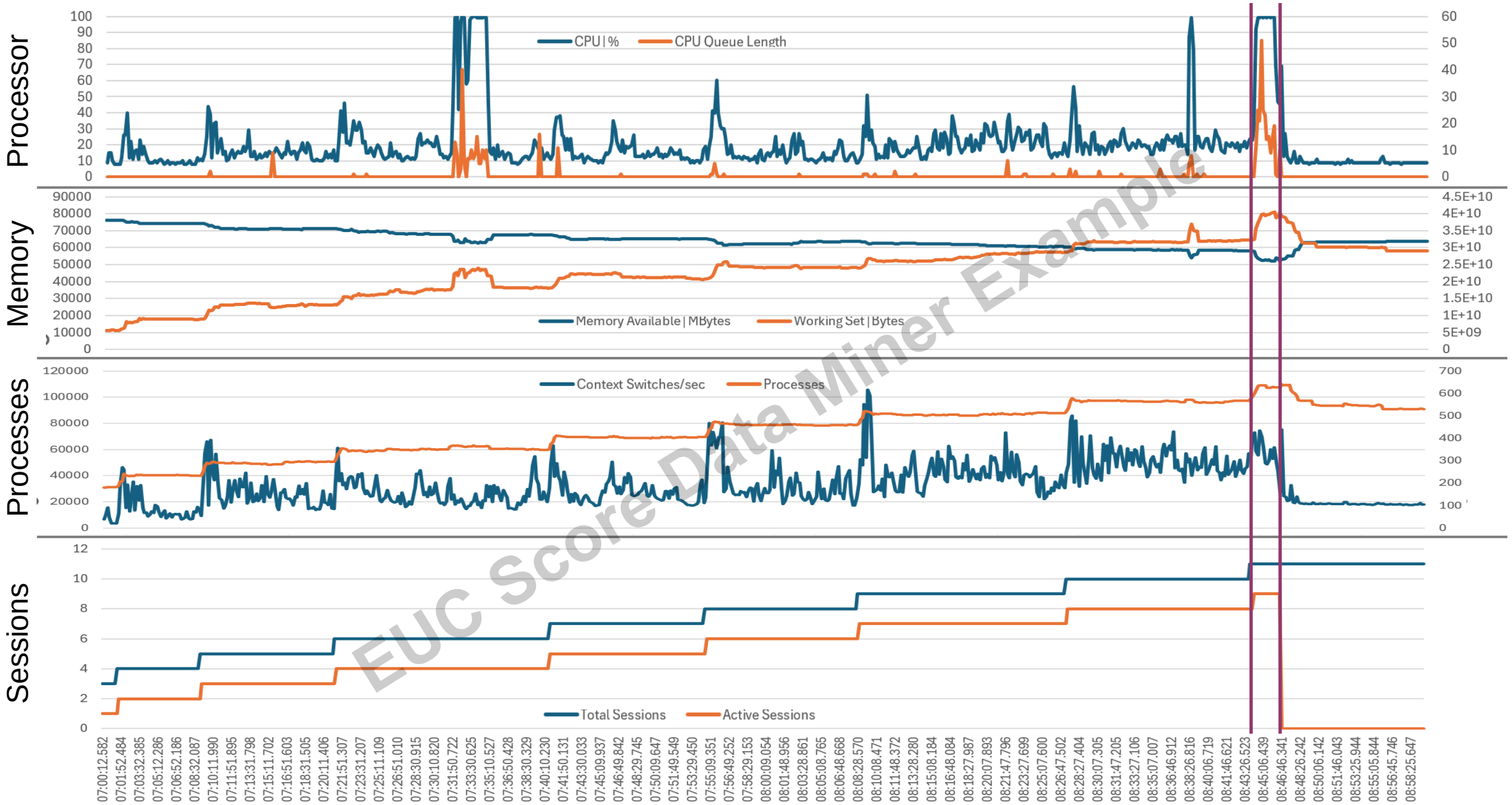
- Data Miner integrates several supplementary tools
  - Collects performance counters independently of Simloads
  - Writes system information to a text file in the results folder
  - Writes multiple CSV files with inventory data in the results folder
  - Collects process information
  - Launches applications
- Data Miner can be used stand-alone by copy & paste deployment



Data Miner runs both with a GUI and from the command line

Windows Telemetry Data (Core Set)

Components	Performance Counters
CPU	\Processor(_Total)\% Processor Time \System\Processor Queue Length
Memory	\Memory\Available Mbytes \Process(_Total)\Working Set
Storage	\PhysicalDisk(_Total)\Disk Read Bytes/sec \PhysicalDisk(_Total)\Disk Write Bytes/sec \PhysicalDisk(_Total)\Disk Transfers/sec (IOPS) \PhysicalDisk(_Total)\Current Disk Queue Length
System	\System\Context Switches/sec \System\Processes
Network	TC::network received(_Total) TC::network sent(_Total)
GPU	TC::GPU load(_Total)\3D TC::GPU load(_Total)\Video Decode TC::GPU load(_Total)\Video Processing TC::GPU frame buffer(_Total)


Processor
CPU | %
CPU Queue Length
Memory
Memory Available | MBytes
Working Set | Bytes
Processes
Context Switches/sec
Processes
Sessions
Total Sessions
Active Sessions
EUC Score Data Miner Example

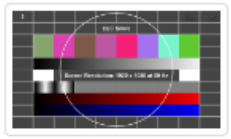
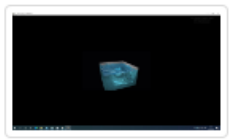
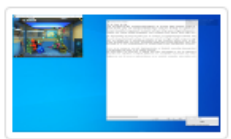
Simulated Workloads – “Simloads”

	Type	Description
	**Type 1 Primary**	Test run with an application that highlights a specific graphic or multimedia format (GDI, DirectX, OpenGL or video) – may require a pre-installed application.
	**Type 2 Persona**	Sequence of chained or overlayed user activities, orchestrated in such a way they generate the characteristic behavior and consistent load pattern of a predefined interactive user type.
	**Type 3 Score**	Measures predefined system metrics used to produce a number (=score) that represents the performance. Typically, each score Simload is associated with a specific theme.

https://eucscore.com/gallery.html

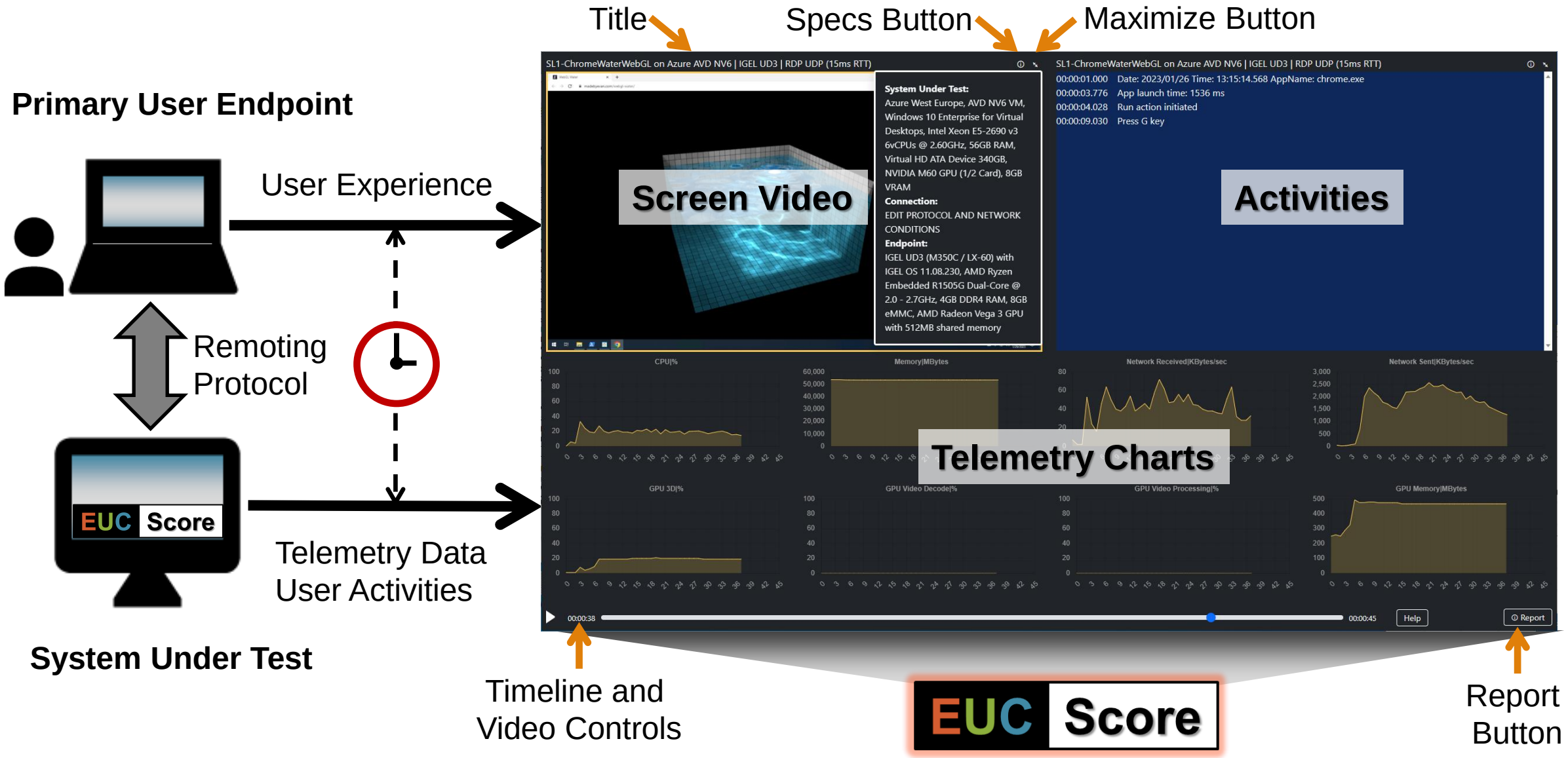
EUC Score Simload Gallery: https://eucscore.com/gallery.html

https://eucscore.com/gallery.html

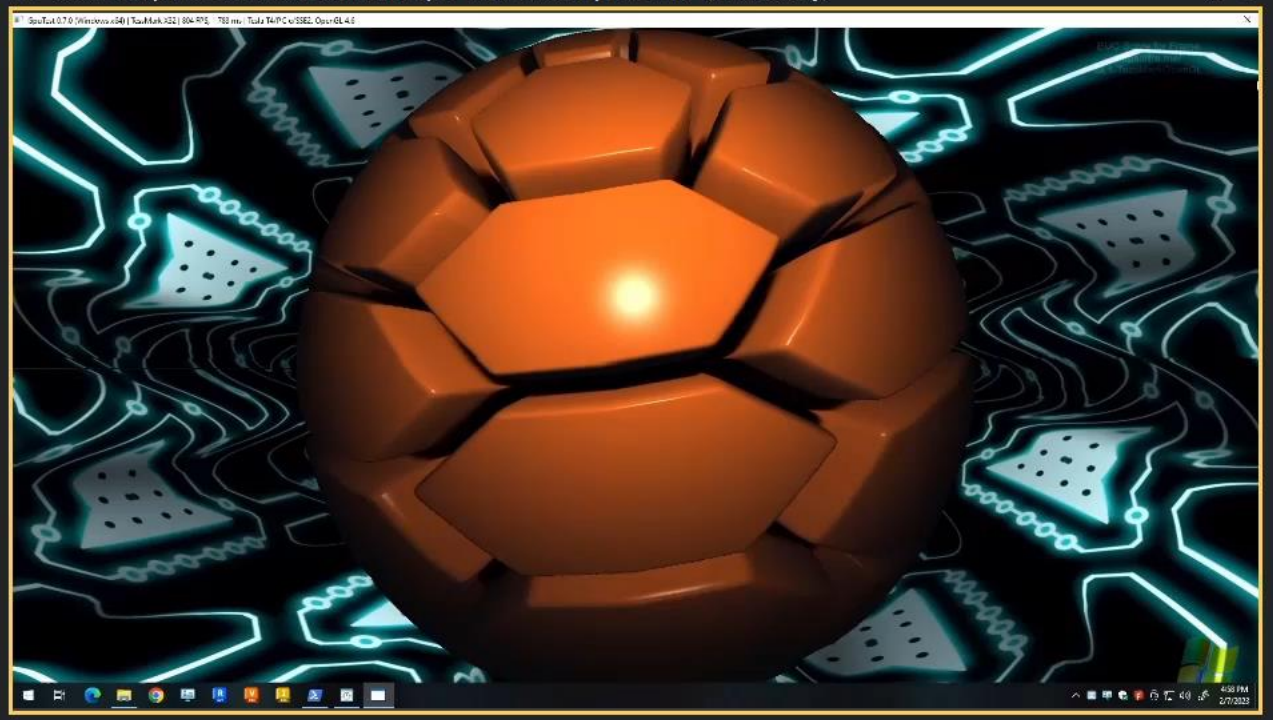
Thumbnail	Simload Type	Description
	**System**	**SL0-TestScreen** Open a test pattern screen and save system information.
	**Primary** Base	**SL1-NotepadEdit** Open Microsoft Notepad and start writing a novel with random type speed.
	**Primary** Base	**SL1-WordpadScroll** Open local DOCX file with PNG images in Wordpad and randomly move pages up and down every second.
	**Primary** JPEGView	**SL1-JPEGViewStatic** Open JEPG image in JEPG View. **NOTE**: This is the most basic Simload as it includes neither animations nor user interactions.
	**Primary** JPEGView	**SL1-JPEGViewAnim** Open animated GIF image in JEPG View.
	**Primary** WMPlayer	**SL1-WMPlayer480pWMV** Open local 480p WMV video in Windows Media Player, switch from windowed to fullscreen mode.
	**Persona** Base	**SL2-Base** **Foreground**: SL3-AppDialog **Background**: SL1-JPEGViewAnim

+ custom or manual Simloads with real user playbooks

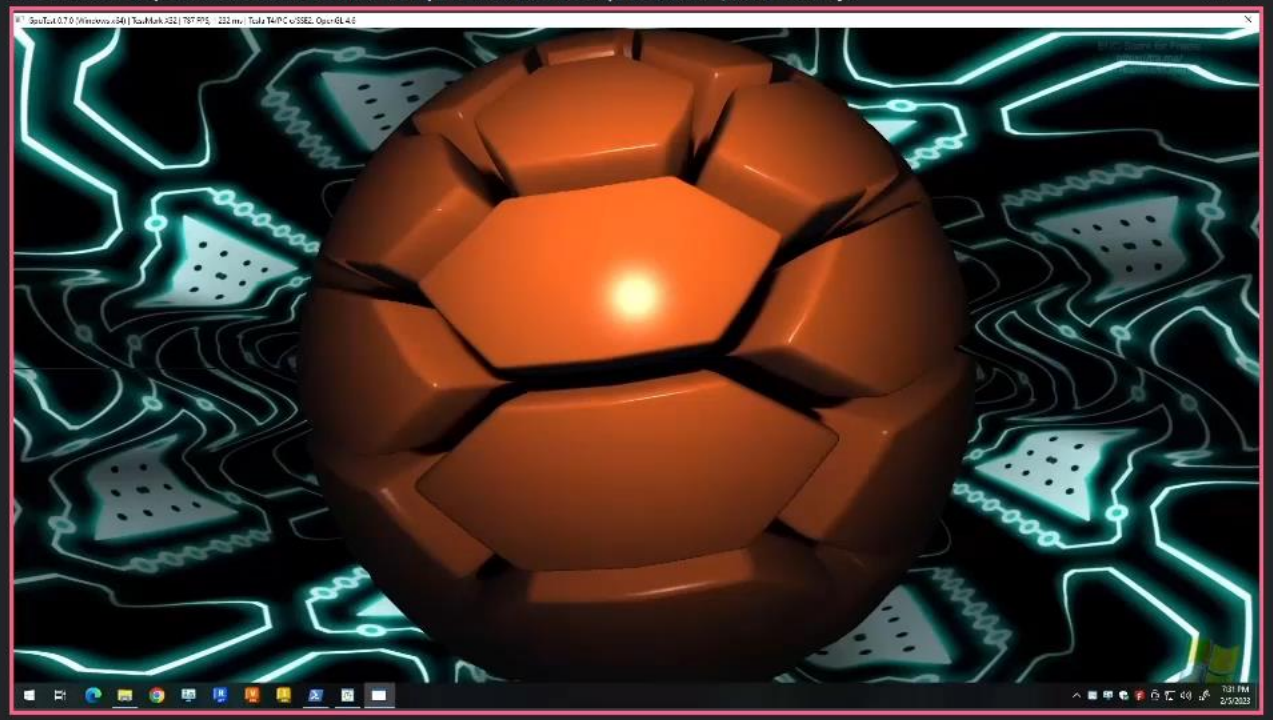
Visual Data Analytics – Sync Player

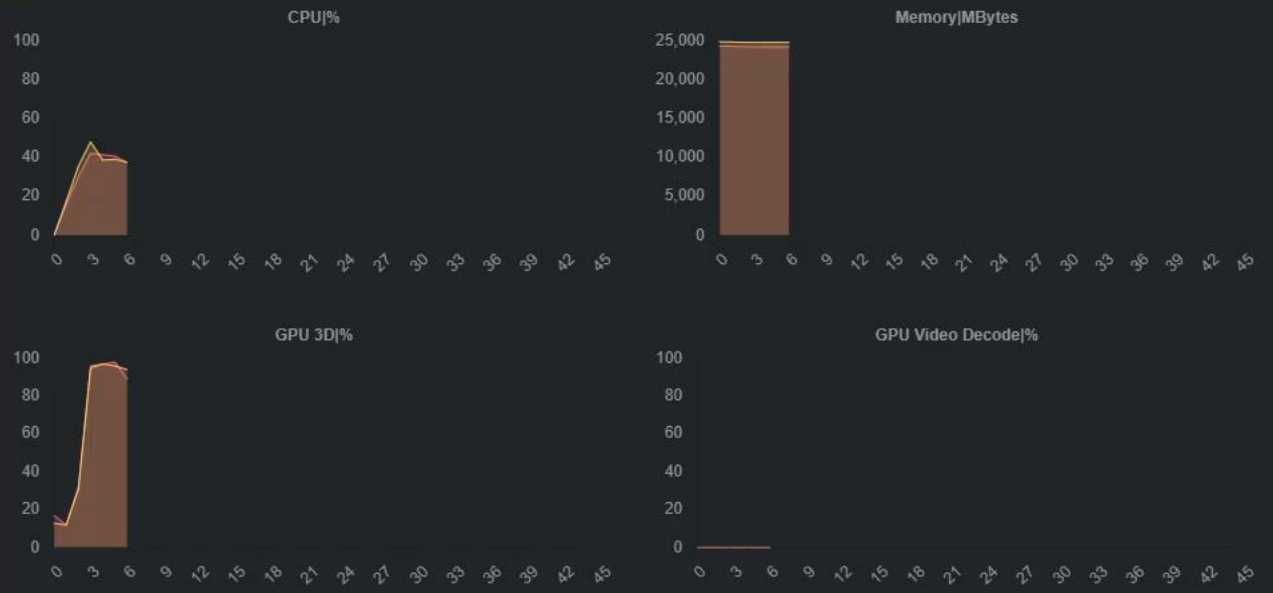


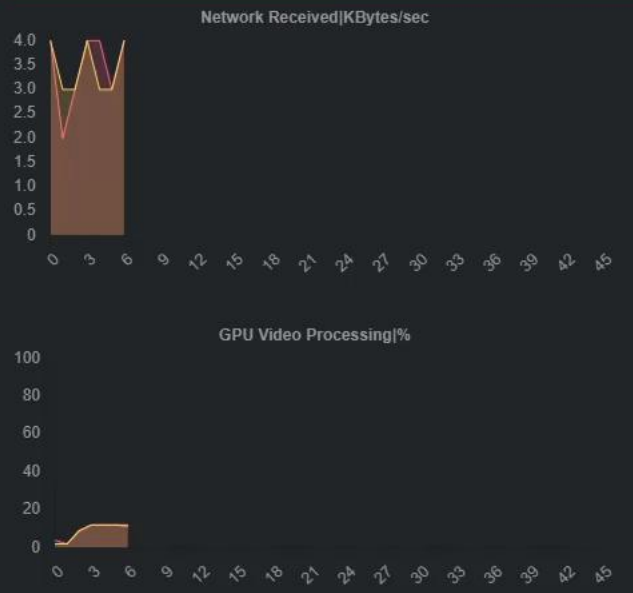
SL1-TessMarkOpenGL on Azure NC4asT4 v3 | HP t640 w/ GPU | FRP8 UDP (7ms latency)

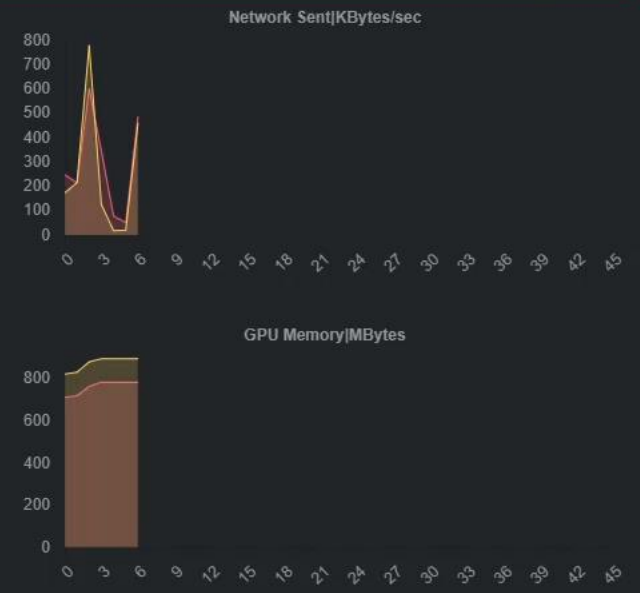


SL1-TessMarkOpenGL on Azure NC4asT4 v3 | HP t640 w/o GPU | FRP8 UDP (10ms latency)

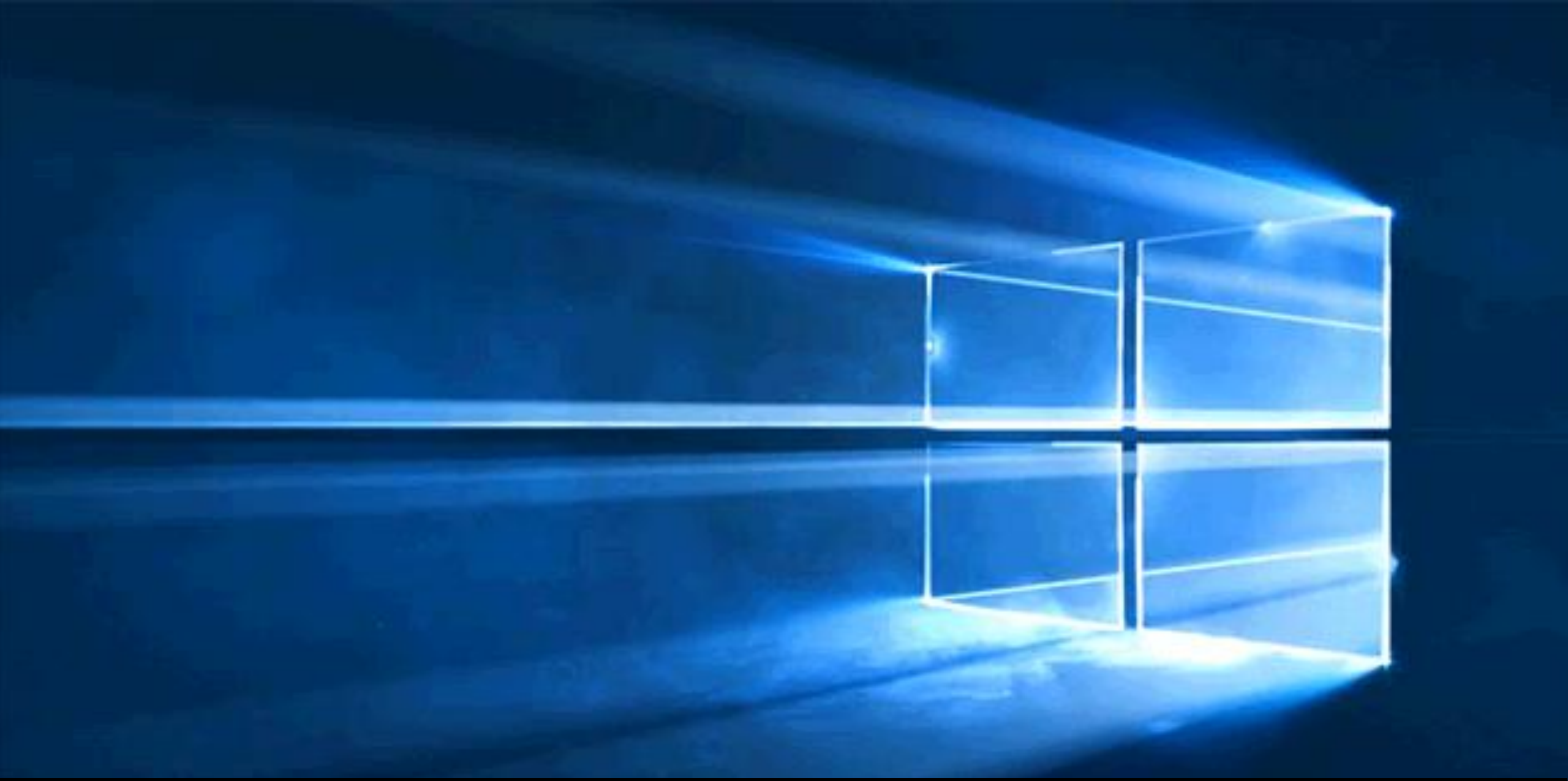








00:00:07 00:00:45 Help Report



Show Time

Why would you want to use EUC Score?

Diagnose end-user pain symptoms and solve IT support sorrows with proactive synthetic testing

Identify potential pain
Pre-production capabilities, performance and load testing

Examine existing pain
Ad-hoc diagnostics in production environments

Prevent new pain
What-if analysis and comparison of system designs and migration scenarios = “Guided POCs”

Quantify pain relief success
Before-after analysis of system optimizations and software updates

Measure chronic pain
DaaS and VDI service level agreement management

Deliver less pain by design
EUC software quality assurance and quality control

EUC Score Components	Freeware Edition Free Download	Community Edition Requires Free License	Professional Individual Edition Requires License	Enterprise Edition Requires License
Base Simloads (single app)	✓	✓	✓	✓
Simple Personas (multiple apps)	✓	✓	✓	✓
Score Simloads	✓	✓	✓	✓
Simload Runner	✓	✓	✓	✓
Core Telemetry	✓	✓	✓	✓
Command-Line Automation	✓	✓	✓	✓
Data Miner	✓	✓	✓	✓
Shared Results	(✓)	✓	—	—
For Community Usage	(✓)	✓	—	—
Advanced Simloads (single app)		✓	✓	✓
Advanced Personas (multiple apps)		✓	✓	✓
Avatar (tray app)		✓	✓	✓
Telemetry Collector (CSV file & GUI)		✓	✓	✓
PowerShell Object & Automation		✓	✓	✓
Sync Player		✓	✓	✓
Protected Results			✓	✓
For Individual Commercial Usage			✓	✓
Simload SDK				✓
Online Training (2h/quarter)				✓
For Enterprise Commercial Usage				✓
Support	Community	Community	Email	Email
Subscription Fee	Free	Free	€495/year €149/quarter	€5,000/year €1,500/quarter

Call to Action

If you want to learn more about EUC Score, send me an email

info@eucscore.com

EUC Score

https://eucscore.com
https://eucscore.com/results

NOTE: The EUC Score toolset is free for community benchmarking tests when the results are made freely available to the public

EUC Score Links

Home Page

Freeware Download

- Toolset documentation: https://docs.eucscore.com
- Test Methodology: https://eucscore.com/methodology.html
- Simload Gallery: https://eucscore.com/gallery.html
- Test Results (Sync Player): https://eucscore.com/results
- Terminology (Glossary): https://eucscore.com/terminology.html
- Lab Equipment: https://eucscore.com/equipment.html

Thank You

Benny Tritsch | info@eucscore.com | @drtritsch