

A new gaming eco-system for Huawei

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Ireland Research Centre

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Introduction: The IRC 3DE Lab

- Team of 3D developers from mostly gaming/visualization related backgrounds
- Focus on four areas: Digital Humans, Global Illumination, Stylization and Cloud Rendering
- Two main task areas: R&D using the Open 3D Engine, support projects of Huawei internally
- Previously affiliated with Unity, Ubisoft, Rare, Dinan Studios and various universities



Thomas



Jiahuan



Santi



Jing



Alberto



T.J.



Roald



Thijs

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Introduction: Tobias Alexander Franke

- Principal Game Engine Architect and team lead at the Ireland Research Centre
- PhD from TU Darmstadt, Germany
 - Major expertise in Global Illumination, Rendering pipeline architectures, Relighting and Augmented Reality
- Formerly Research Scientist at Fraunhofer IGD, Senior Graphics Engineer at Unity Lighting Team
- Technical Advisory Council member of O3DE
 - *The role of the TAC is to facilitate communication and collaboration among the Technical Projects*
- Technical Steering Committee member of O3DE
 - Guidance for technical projects (inside O3DE)



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Introduction: What is O3DE?

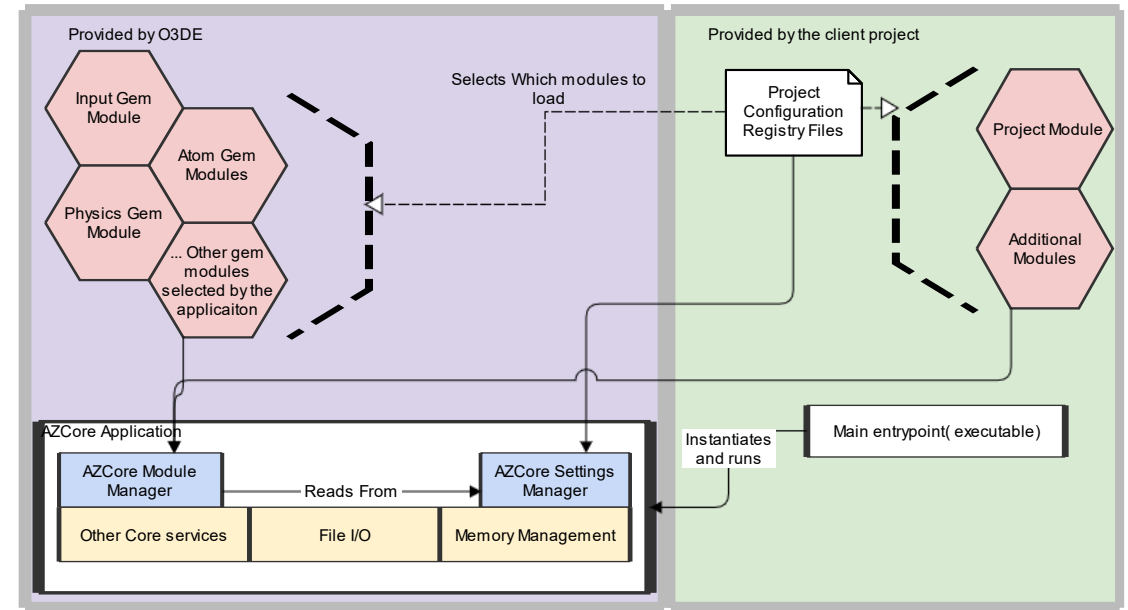
- Fully featured open source 3D engine derived from Amazon Lumberyard
- Controlled by the Linux Foundation
- Sponsored by several partners
 - Huawei is a major stakeholder and premier member
- **Target audience** are game development studios, automotive, movie industry and AR/VR verticals
- High interest for Huawei as it is an independent third competitor to Unity and Unreal



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Introduction: Overview of O3DE architecture

- Why O3DE and not Unity or Unreal?
 - Open source & free
 - Easy to modify/extend
 - “A Clean Slate”
- **Highly flexible, modular system** which allows for custom extensions (*gems*)
 - Similar to a Linux package system
 - Developers can modify **the core**, an **engine module** or a **project module**
- Get code at <https://github.com/o3de/o3de> or the installer at <https://o3de.org/>
- Development is managed publicly via GitHub and Discord



Cool next-gen game! Can I play it on my Smart TV?



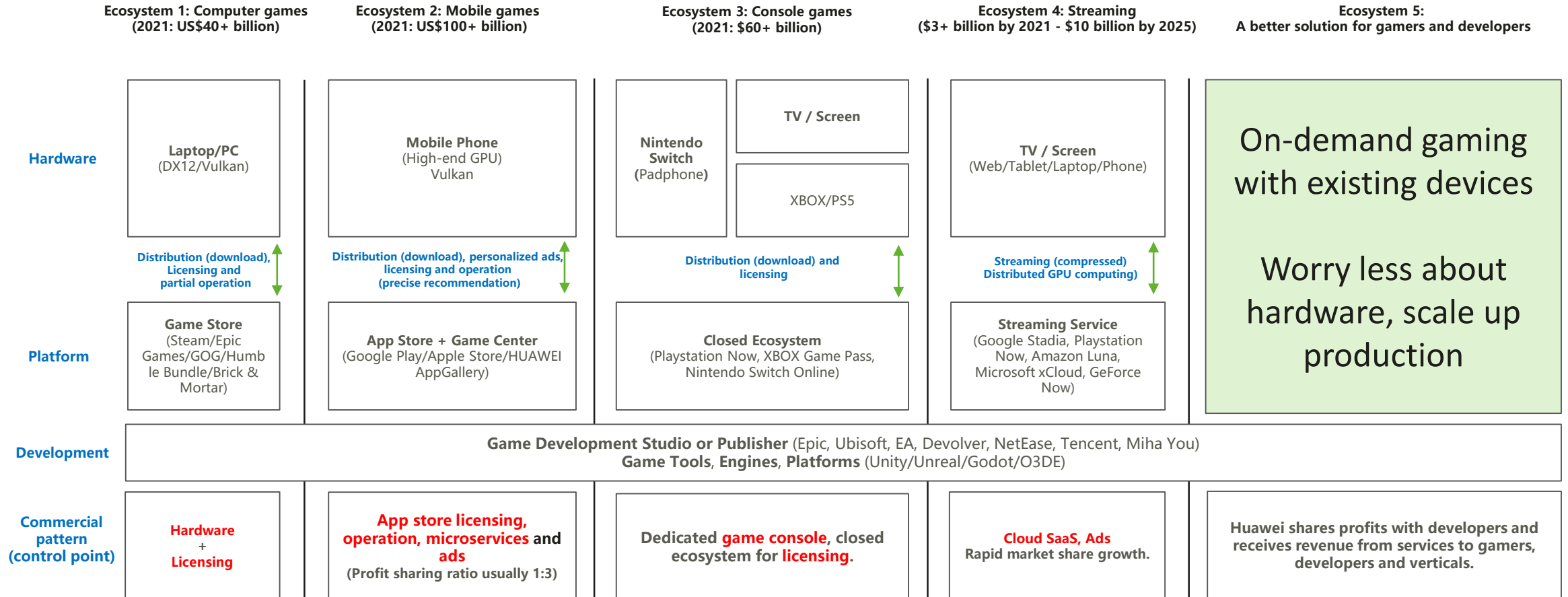
Cool next-gen game! Can I play it on my Smart TV?

- **No**, you need something more! Here are your options:
 - **Buy game, buy** a new PC with a **better graphics card** and connect to TV
 - **Maybe** the game will be released on mobile, so **buy** expensive **new mobile phone**, get the game with **ads**, or buy with **in-game items**, or buy game in **app-store** and stream to TV
 - Buy a **new console** and connect to TV, **buy** or **rent game** from service
 - Get a **streaming service** (Google Stadia, OnLive, Playstation Now...)
- **Most relevant problem for gamers and game developers is hardware**



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Which ecosystems exist right now?



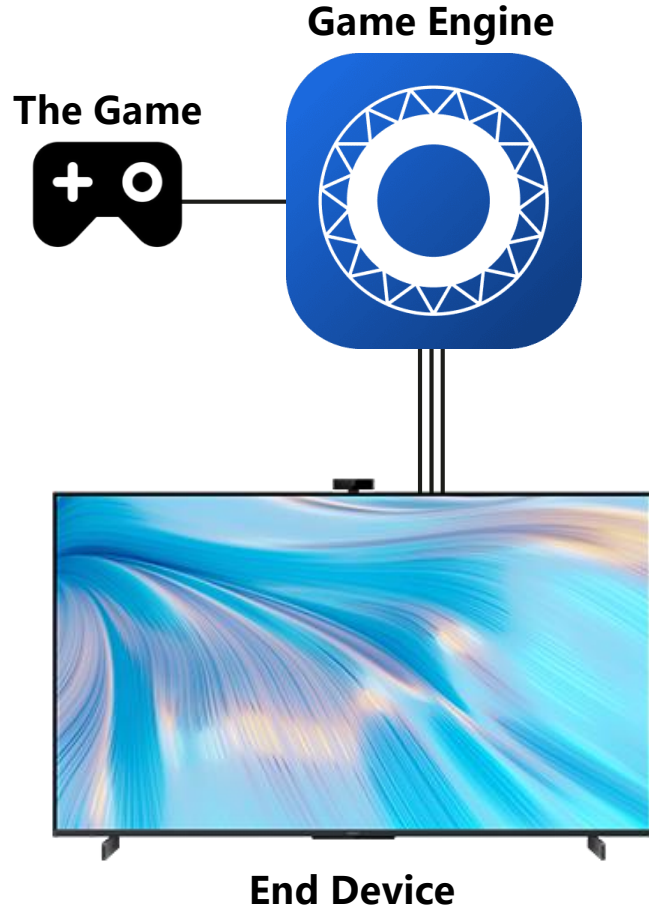
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What is a cloud-native engine?



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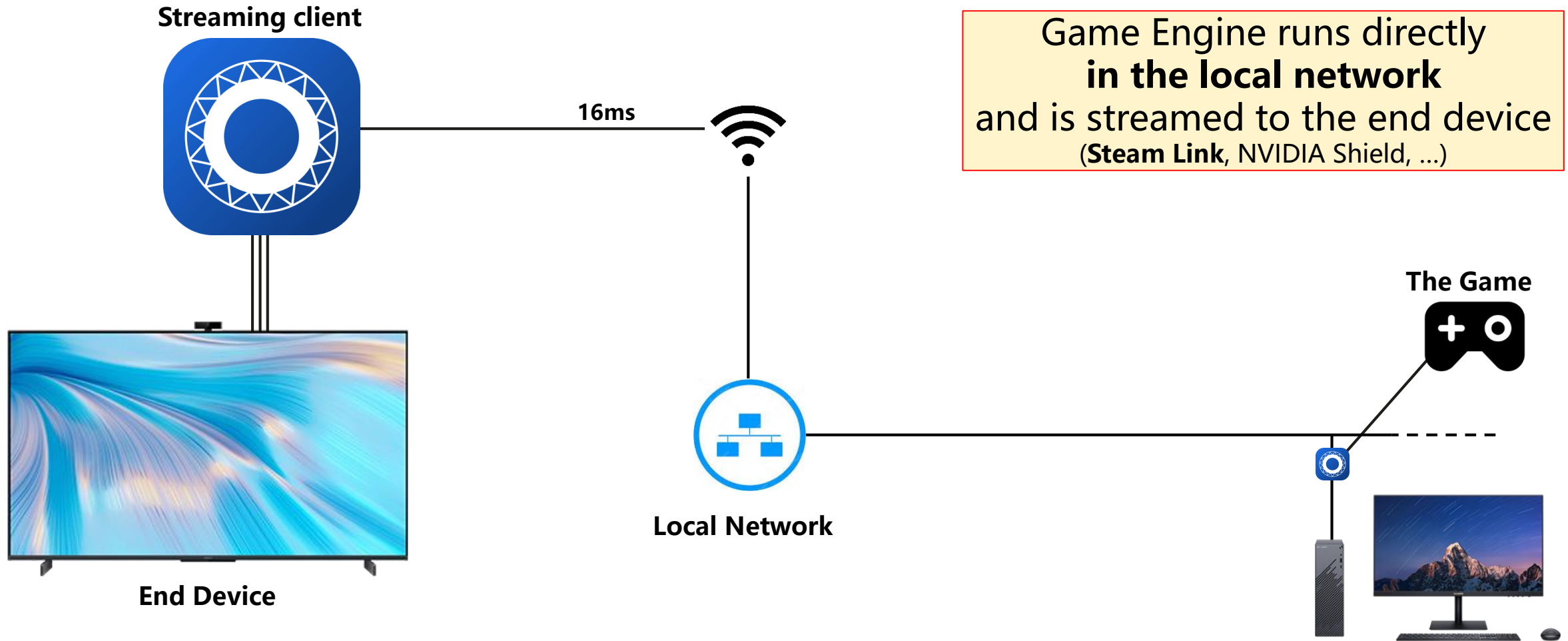
On-Device gaming



Game Engine runs directly
on the end device
(Majority of games today)

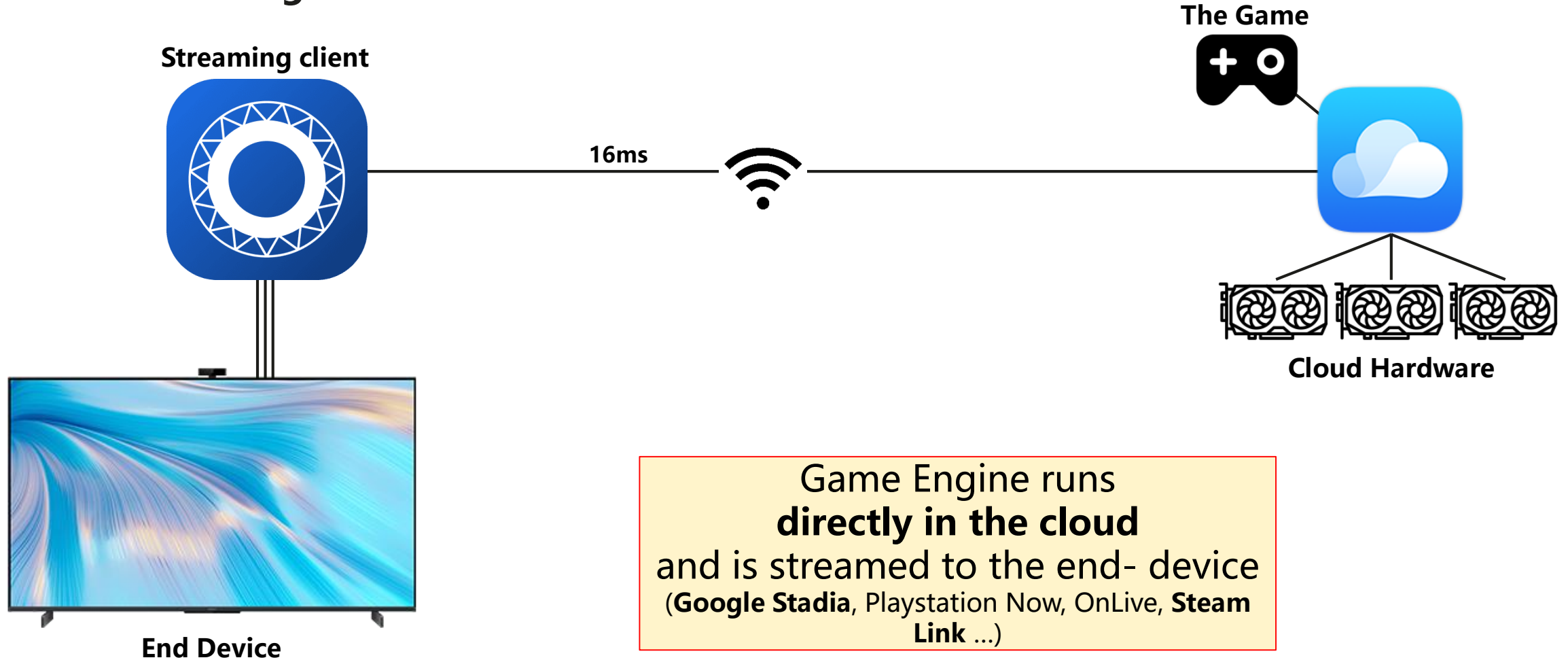
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Full streaming via local network



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Full streaming via cloud

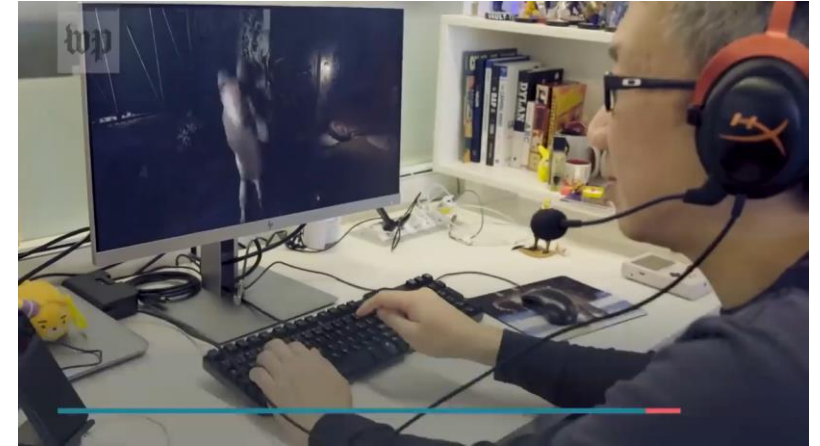


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The failure of Google Stadia & game streaming services

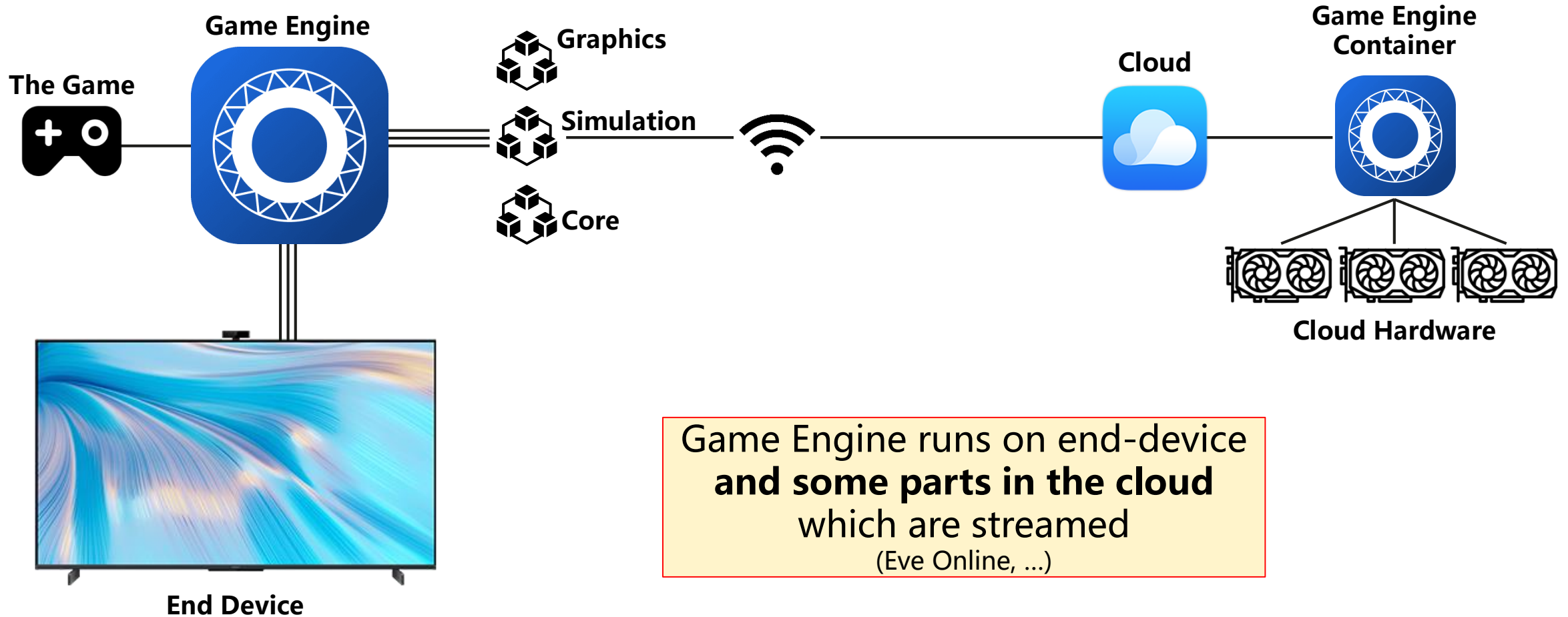
- **Marketing to the wrong crowd**
 - Hardcore movie/music fans watch/listen to a lot of media, hardcore gamers often only play a single game
 - Casual gamers with limited time are mostly parents with steady income who can buy the hardware
 - Overkill solution for most indie and smart phone titles
- **Underestimating technological challenges**
 - Input lag significant, *negative latency* techniques unsuitable
 - Cost and technological limitations have been rolled off to ISPs
- **All or nothing approach**
 - Game engines have many moving parts
 - **Streaming reduces cloud computation to lowest common denominator**

Does this really need
cloud gaming?



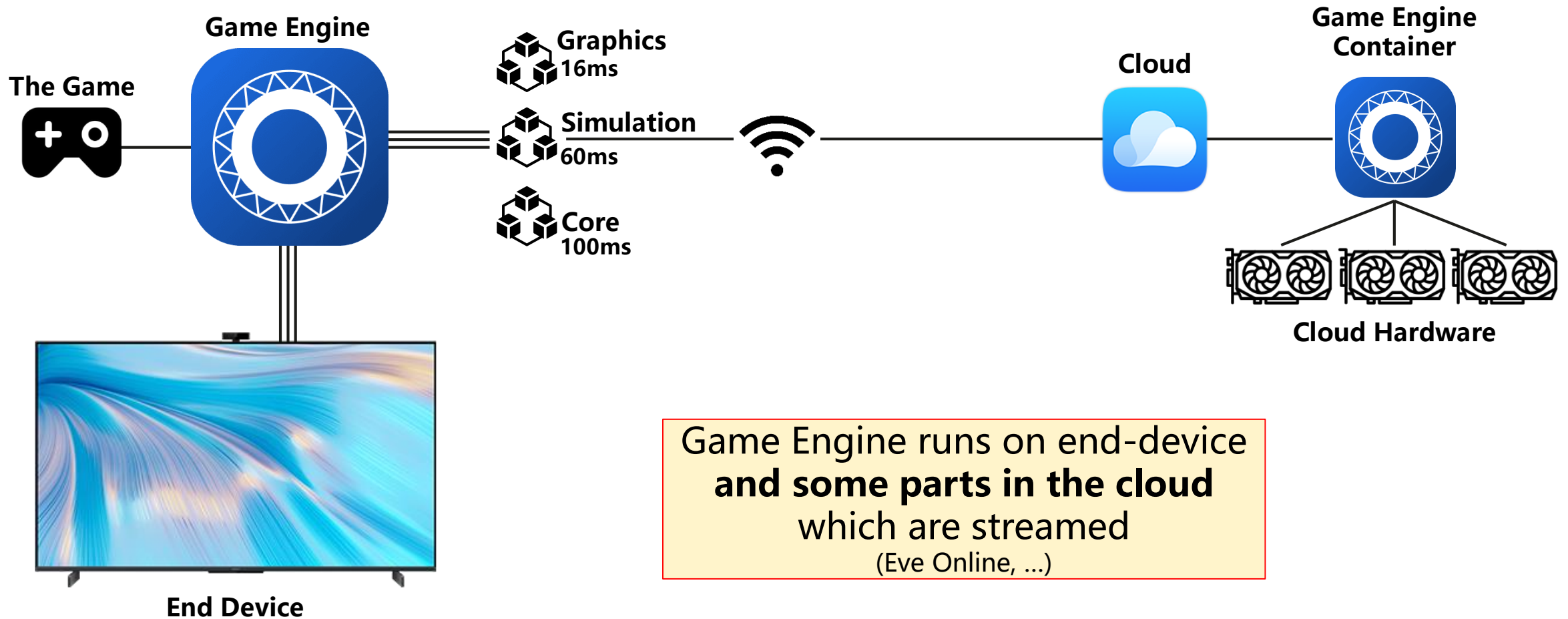
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Partial streaming



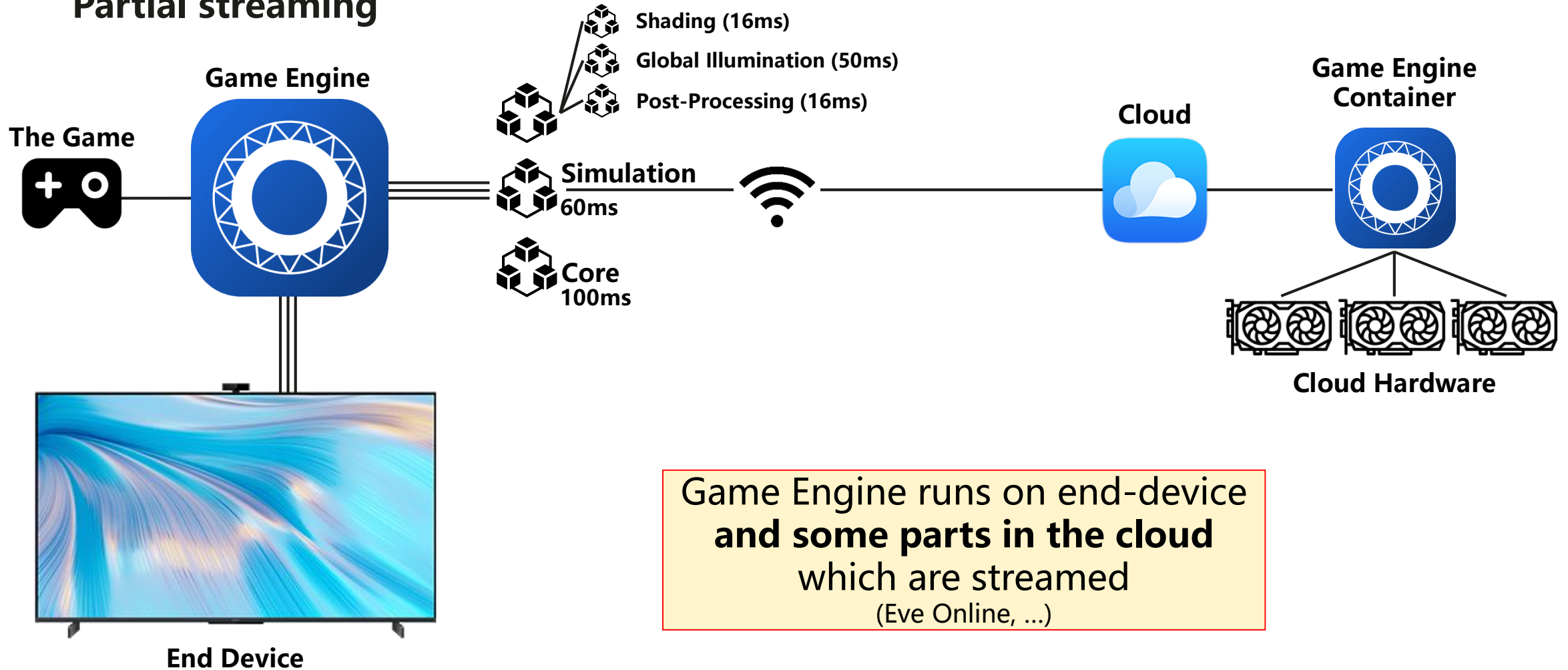
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Partial streaming



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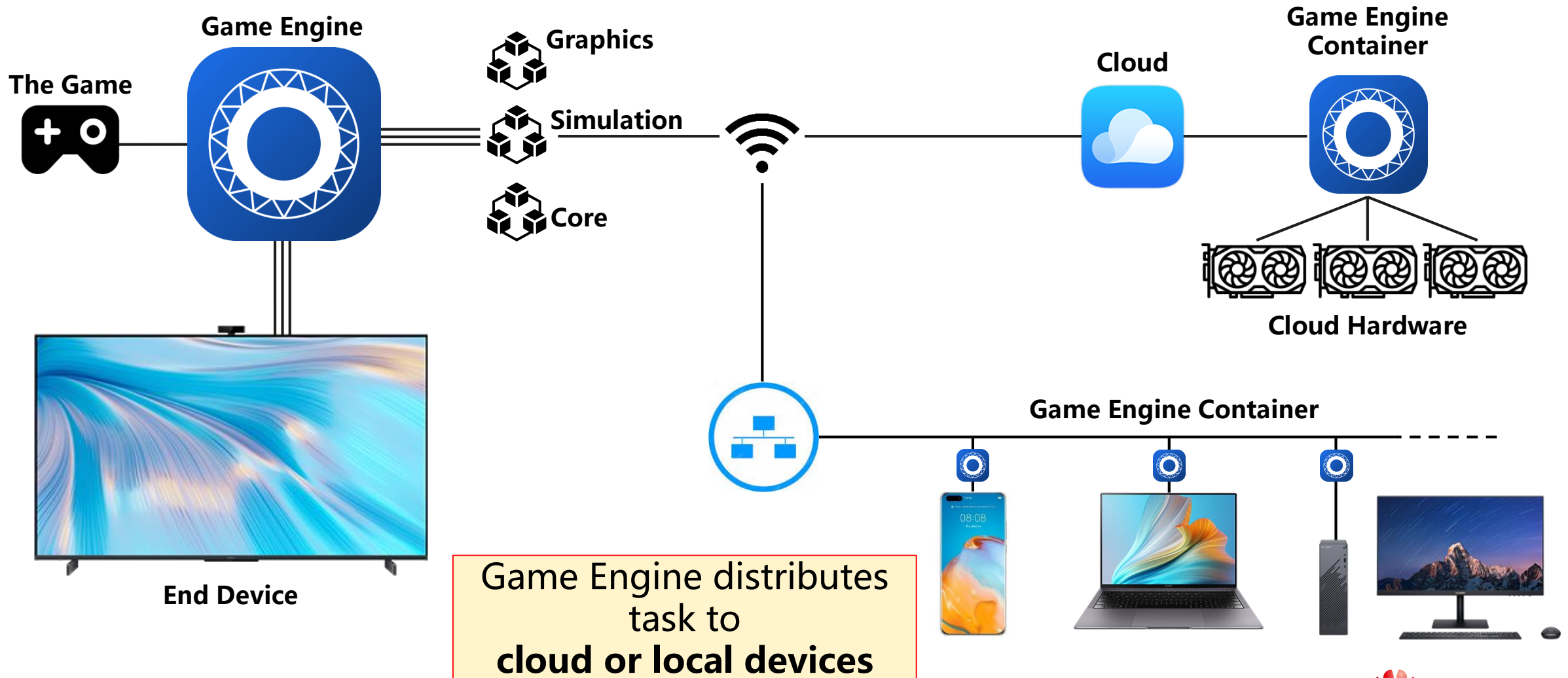
Partial streaming



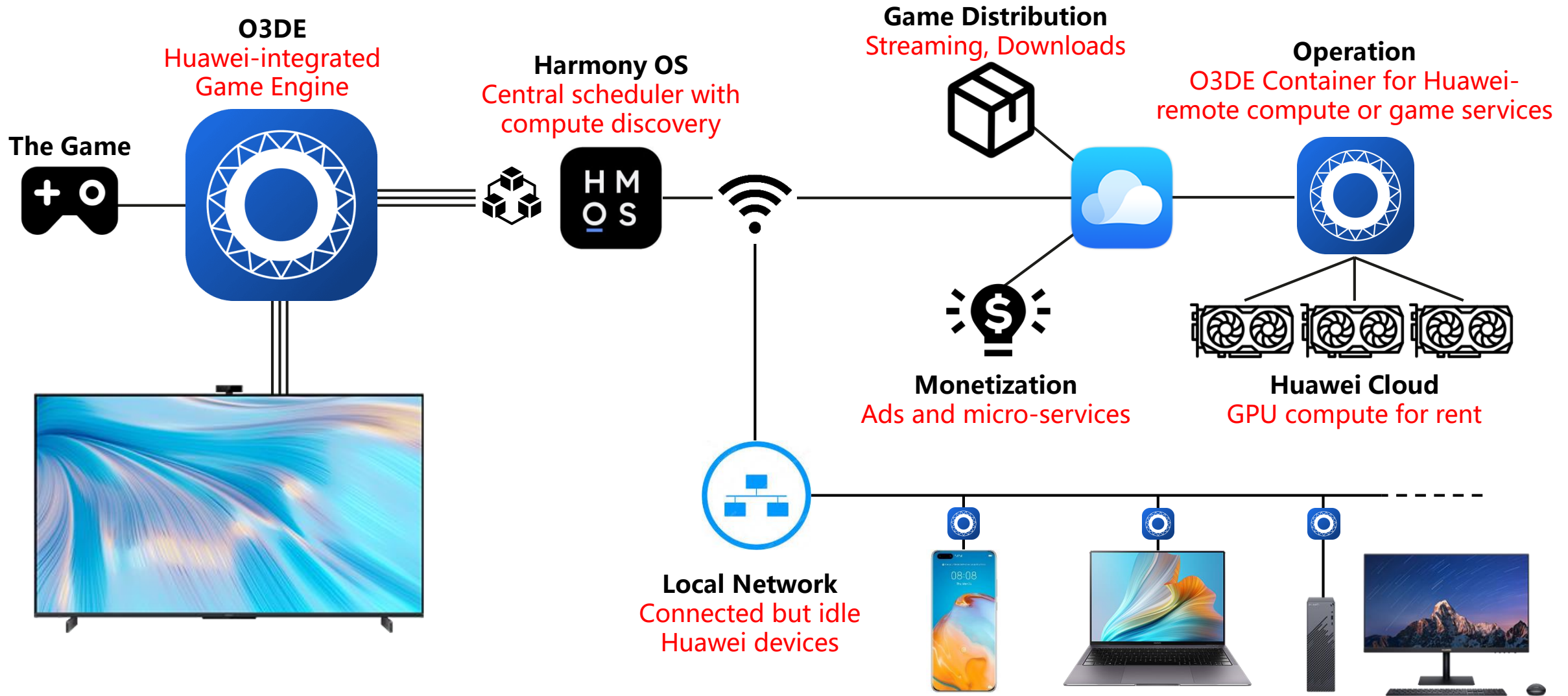
Game Engine runs on end-device
and some parts in the cloud
which are streamed
(Eve Online, ...)

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Distributed streaming

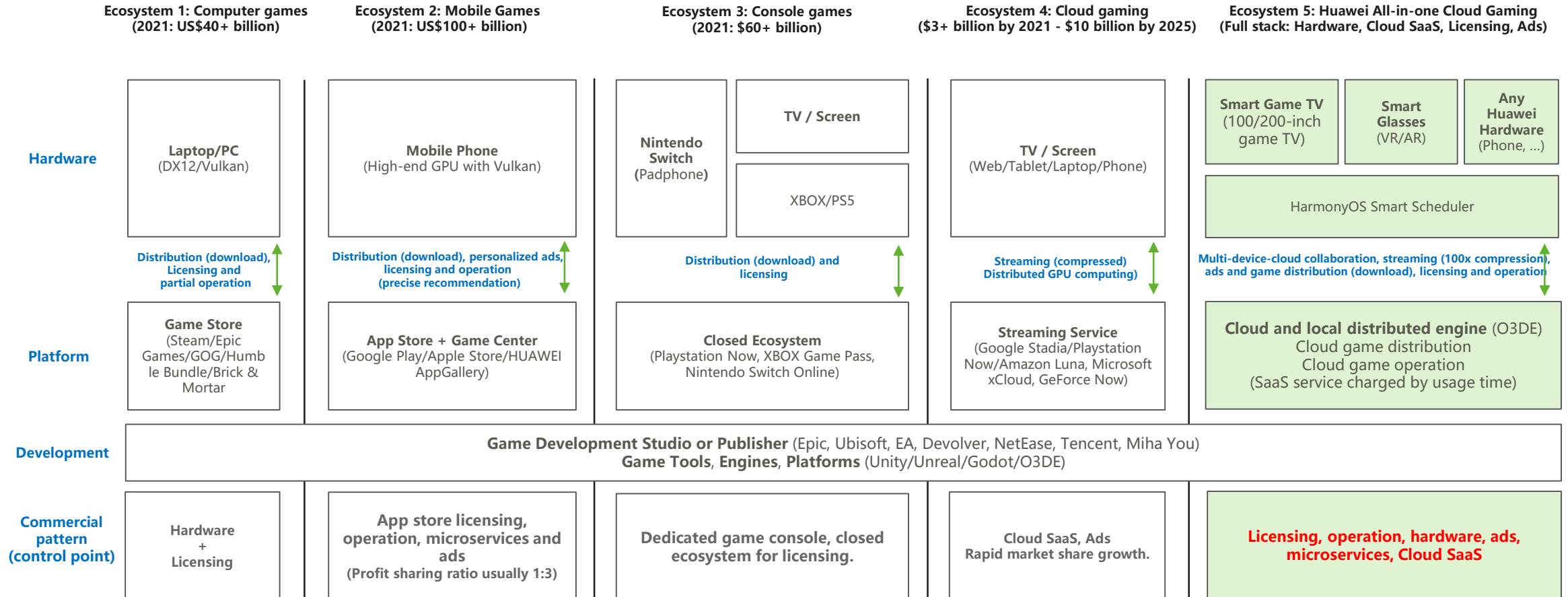


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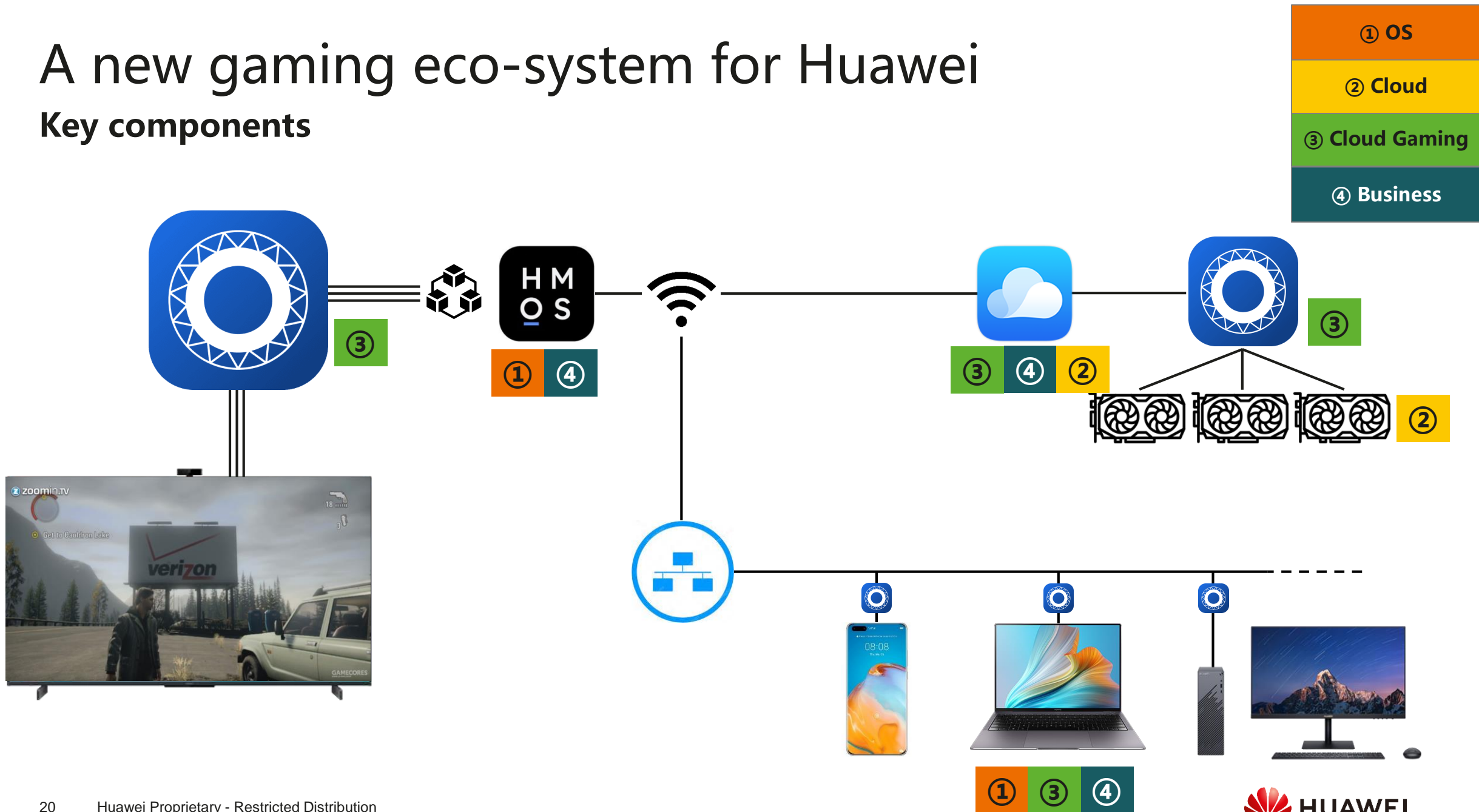
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The Huawei solution



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Key components



OS & Cloud

Requirements

- **Harmony OS Smart Scheduler**
 - Scheduler to find additional compute resources if device is overloaded
 - Search local network for other devices and provide additional GPU/CPU resources for use
 - If network cannot provide sufficient additional resources, try Huawei cloud
 - Automatic instancing/sharing and synchronization support for load distribution (see Hadean/Spatial OS)
 - Discovery within 10ms
- **Other operating systems**
 - Implement daemon to share resources for desktops (Windows, Linux)
 - Similar to Harmony OS scheduler
- **Cloud game distribution**
 - Request initial data chunks from cloud
 - Multiplayer instancing for 10k players
- **On-demand (cloud/edge)-compute**
 - Runs container for O3DE daemon
 - Automatic load-distribution between nodes
 - On-demand service to request daemon(s) ready for compute jobs
 - Can service 10K simultaneous compute jobs
 - Maximum 3ms round-trip time

Cloud Gaming & Business

Three key prototypes from two modes

- Distributed **operation**

- Define new architecture for distributed cloud native engine
- Find generic compute model that is easy to distributed based on latency requirements
- **Distributed Global Illumination**

- Cloud supported **authoring**

- Generate assets from examples (sounds, geometries, textures, ...)
- Learn best sampling distributions for GI
- Support stylized rendering from examples
- **Human Rendering**
- **In-Game 2D/3D Advertisements**

Cloud Gaming

Distributed Global Illumination: Three challenges

- **Distributed Data structures**

- Data structures suitable to distributed rendering
- Controllable scale in both small and large game worlds
- **Hard-but-few or no limits at all for the artist**

- **Authoring**

- Automatic sampling distribution detection using guides
- **One-button-click to set up 95% of a scene using adaptive sample distribution**

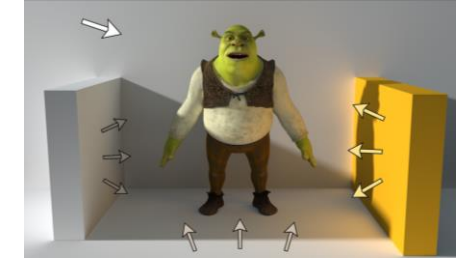
- **Rendering**

- Support for variety of effects such (e.g. interaction with volumetrics)
- Ideally engine should distribute work-items to idle networked machines or request cloud-compute-services
- **Can run scenes at least 30ms per frame on sub-standard devices with little to no dedicated GPU capacities**

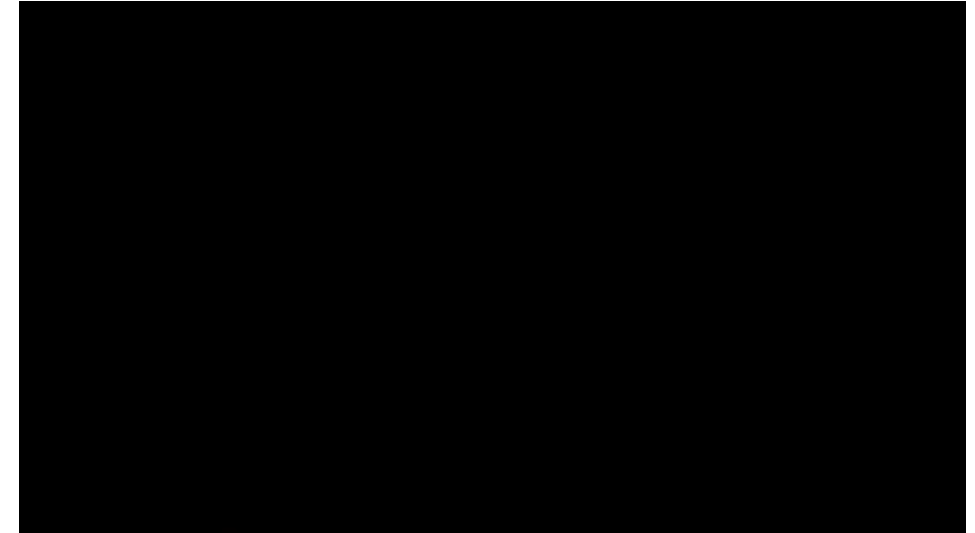
Direct Light only



With Indirect Light



Dreamworks Siggraph Presentation 2010



Probe based GI algorithm using raytracing

Cloud Gaming

Human Rendering Pipeline: Three challenges

- **Photogrammetry**

- Feature extraction from sample images
- Simplified and more cost effective than LightStage
- **More expensive effects to process are distributed to remote instances**

- **Cloud based human generation**

- Tag based modeling, animation remeshing, unguided crowd generation
- Scale from mobile to cloud render farm
- **Any user (professional or not) can request any amount of unique and diverse characters from a remote service**

- **Rendering**

- **Hair:** Wet hair, light transmission, strand based modeling, physics
- **Face:** Skin (wrinkles, physics, pigmentation etc.), eyes, micro-movements, emotions
- **Body:** Cloth rendering and physics
- **A service can be queried and scale the content on the fly for any platform (PC, Smartphone, TV, Smart Watch, ...)**



Digital Carrie Fisher vs Reality
<https://randsinrepose.com/archives/what-we-lost/>

Business

In-Game 2D/3D Advertisements: Three challenges

- **Stylization**

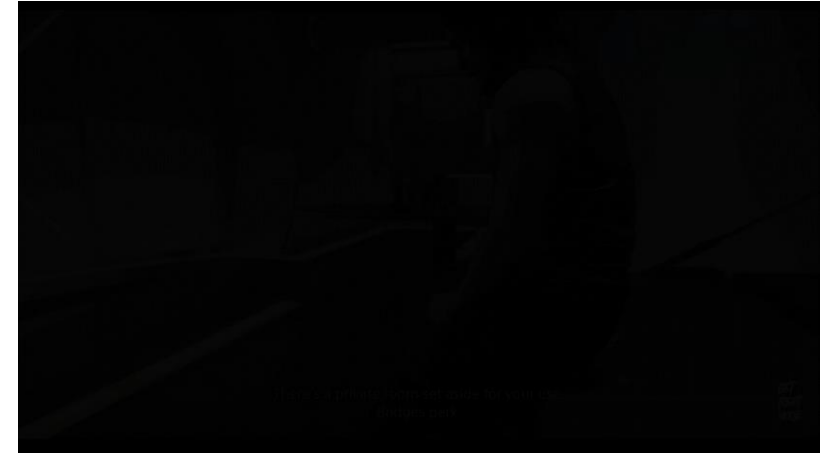
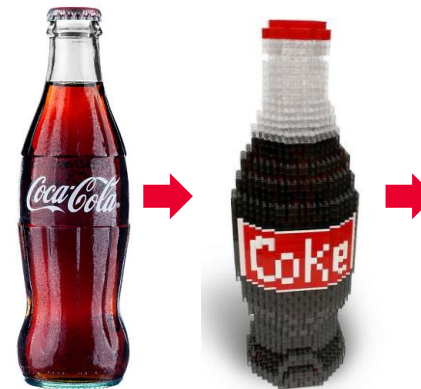
- Adapt content to style of a game for coherency
- Materials, textures, geometry, animation
- **Live (i.e. < 100ms) style-transfer, possibly AI-supported with user-based limits**

- **Context, placement, visibility**

- Automatic discovery of suitable spots in scenes
- Guaranteed minimum visibility
- **AI-guided optimal placement for user-defined visibility**

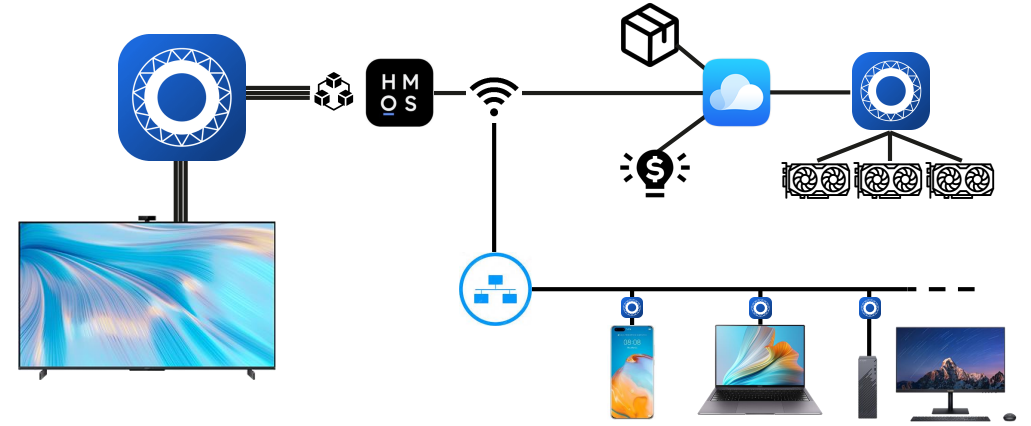
- **Standards**

- Cross-engine toolset to allow developers easy monetization
- **Open standard for ad meshes, materials and shading limits**



Conclusion

- Hardware limitations are the major problem around which all gaming ecosystems orbit
 - For players, artists and developers
- Cloud streaming did not solve the problem
- Distributed computing provides the spectrum without the extremes
 - Need clean slate engine for experiments
 - Need a new engine concept to distribute work items
 - Need built-in discovery of compute nodes for edge-computing
 - Need to validate with prototypes covering user and developer use-cases
- The final goal: Scalability as a Huawei service



Thank you.

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每个组织，构建万物互联的智能世界。

Bring digital to every person, home and
organization for a fully connected,
intelligent world.

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Questions?