IEC Type 4 Blueprint: AR/VR at Edge

ARM, HTC, IBM, MobiledgeX, Visby, Orange, PSU
**Integrated Edge Cloud Reference Stack**

- **Heterogeneous Architecture**
  - VM, container, bare metal
  - Servers and customized Edge platforms
  - Virtualized NFs and Physical NFs
  - Accelerator interface

- **Resource constraints**
  - Kubernetes
  - SDN Controller for K8s

- **HW Accelerations**
  - Integrated accelerators
  - PCIe/CCIX attached accelerator (Smart NICs...)

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**Infra Orchestration and Installer**
- Kubernetes
- Containerized Compass

**Networking Software**
- Linux System Networking
- VPP, OVS

**Control**
- Calico, xConnect, NSM
- Contiv/VPP
- OVN-K8s

**Lightweight App orchestration**
- Knative (serverless)

**Apps**
- Bare metal
- Container

**Network Equipment**
- Switch/GW

**Edge Servers or Networking Edge Platform**
- Integration Accelerators
  - Smart NICs
  - FPGA/GPU

**Real Time Linux distribution**
- SR-IOV, DPDK

**Apps**
- Knative (serverless)
- KubeFlow (ML)
- EdgeX (IoT)
Scope of Type 4 AR/VR Edge Cloud

**APP cluster Orchestrator (MEX/VIVE)**

- Edge Controllers
  - Physical Provisioning (Ansible?)
  - Application Provisioning (K8S or KubeEdge)
  - Orchestrator (K8S or KubeEdge)
- Servers
  - High speed networking
  - Servers with SW acceleration (DPDK, SR-I0V)
  - Servers with SmartNICs
- VMs
  - Orchestrator (K8S or KubeEdge)
- PODs
  - SDN (OVN or Contiv/VPP)
  - Monitoring/Alerting (Prometheus/Grafana)
- CI/CD Framework
  - APP cluster Orchestrator (MEX/VIVE)
  - CI/CD Framework (ONAP)
  - VNFs
  - Application Provisioning (K8S or KubeEdge)
  - VMs
  - PODs
  - Orchestration Framework (ONAP)
  - CI/CD Framework (MEX/VIVE)
  - CI/CD Framework (ONAP)

**Servers**

- VR/AR
  - Servers with GPU
- Storage
  - Storage Servers

**Container/Compute Nodes**

- High speed networking
- Servers with SW acceleration (DPDK, SR-I0V)
- Servers with SmartNICs
Proposed Generic/Baseline AR/VR Blueprint

GUI
- Dashboard
- Admin GUI
- User GUI (content portal)
- Prometheus

Declarative Configuration

Performance Benchmarking Tools box

Documentation

ETE Security tools

ETE Operations tools

App Launch Workflows
- Community TFD
- Akraino TFD

Proposed Generic/Baseline AR/VR Blueprint

Edge Application and APIs
- Applications
- VR/AR apps
- Developer VR App
- Developer AR App
- Adaptive Remote Rendering Runtime

Lightweight Edge App Orchestration
- Kubernetes
- CRM

ETE Application - TBD

GUI
- Admin GUI
- User GUI (content portal)
- Prometheus

APIs

Documentation

VR/AR - new
- Generic/baseline
- Future release

VR/AR optional Add-ons

Network Edge
- Multi-node Single cluster
- Multi-node Multi-Cluster

Optional MEX application centric Components

Developer APIs
- Eication, network conditions

Edge Platform Software Components
- Isolation framework
- Infra Orchestration
- Storage
- Network Control Plane
- Network Data Plane
- Operation System
- Docker
- Kubernetes
- Calico
- Ubuntu
- Flannel
- OVS
- Windows Server

Network Edge
- NC – Multi-node Multi-Cluster
- Windows Server
- Flannel
- OVS
- Kubernetes
- Docker

APPLICATION FRAMEWORK LAYER
- CRM
- Optional MEX application centric Components

DATAPLANE LAYER
- FPGA
- ASIC
- GPU

VIRTUALIZATION LAYER
- HW Abstraction LAYER

Adaptive Remote Rendering Runtime
## Cloud VR/AR Blueprint Spec

<table>
<thead>
<tr>
<th>Case Attributes</th>
<th>Description</th>
<th>Informational</th>
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</thead>
<tbody>
<tr>
<td>Type</td>
<td>New Blueprint for VR/AR on the Network Edge</td>
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<tr>
<td>Blueprint Family</td>
<td>Proposed Name Integrated Edge Cloud (IEC) Type 4</td>
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<tr>
<td>Use Case</td>
<td>Deployment of generic edge end and cloud environment for VR/AR cloud streaming ref to use case supplementary material</td>
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<tr>
<td>Initial POD Cost</td>
<td>Leverage IEC Type 1 Blueprint - less than $120k (3 nodes)</td>
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<td></td>
<td><strong>Scale &amp; Type</strong></td>
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|                      | Generic blueprint PoC:  
- One master node and up to 5 worker nodes with mixed Linux and optional Windows OS  
- Each server, x86/ARM server with nVidia RTX GPUs (Titan or GeForce TBD)  
Large scale deployment:  
- Number of servers, x86/ARM server or deep edge class, is site dependent (footprint)  
- vGPU and federation supported class, e.g. NVIDIA Tesla K80 GPUs;  
- Chelsio T580-CR NIC                                                                                                                                                  |              |
|                      | **Applications**                                                                                                                                                                                         |              |
|                      | Generic blueprint PoC: Small scale cloud AR/VR rendering farm with generic SO  
1. High performance premium gaming, 3D/Light-field video for movies, live concerts, events, LBE, etc.  
2. Enterprise applications, including training/education, product design collaboration, manufacturing, maintenance, data analytical etc, |              |
|                      | **Power Restrictions**                                                                                                                                                                                   | N/A          |
|                      | **Infrastructure orchestration**                                                                                                                                                                        |              |
|                      | Docker 18.09.4 or above (19.03 may be needed to run optional windows container with nVidia GPU support) and K8s 1.14.1 or above- Container Orchestration, VMWare VM  
OS - Ubuntu 18.04.2, windows server 2019                                                                                                                                 |              |
|                      | **SDN**                                                                                                                                                                                                  | Calico and K8s, or or SR-IOV, OVS-DPDK |
|                      | **Workload Type**                                                                                                                                                                                         | VR and AR applications with adaptive remote/split rendering runtime running inside Containers or VM |
|                      | **Additional Details**                                                                                                                                                                                  | The test configuration consists of 3 machines connected using ethernet switch: a master and 2 worker nodes, each with TBD processor clocked at TBD GHz, with TBD GB of RAM and Ubuntu operating system for master, windows server 2019 or later for worker. MTU of 1450B is configured (to compensate for GTP tunnel header). Each windows server preconfigures with 2-3 VMs with fixed GPU allocation per VM. |
Contact Us

The Linux Foundation
1 Letterman Drive
Building D, Suite D4700
San Francisco CA 94129
Phone/Fax: +1 415 7239709
www.linuxfoundation.org

General Inquiries
info@linuxfoundation.org

Membership
membership@linuxfoundation.org

Corporate Training
training@linuxfoundation.org

Event Sponsorship
sponsorships@linuxfoundation.org

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