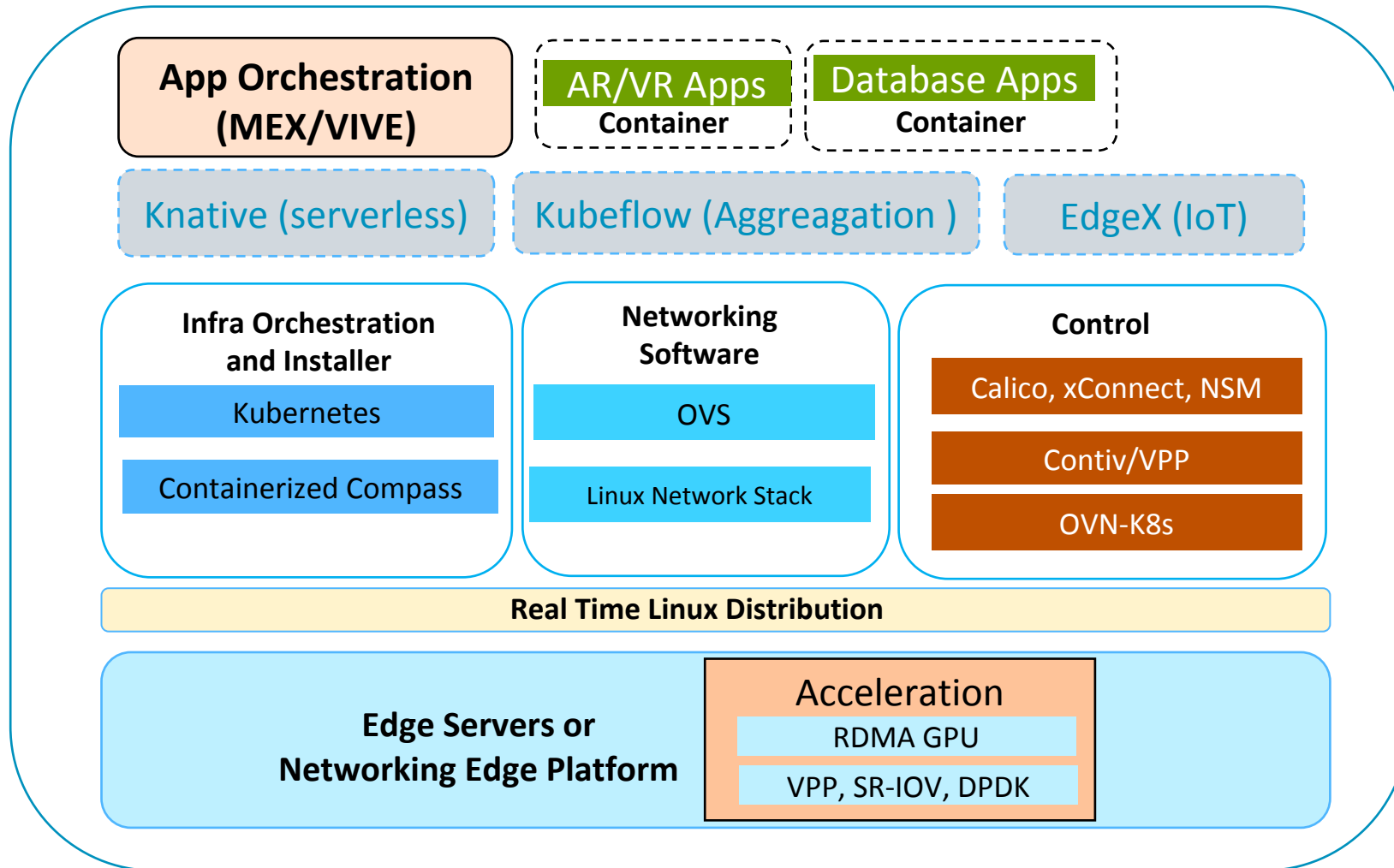# Blueprint: AR/VR at Edge

Arm, HTC, IBM, MobiledgeX, Orange, PSU

THE LINUX FOUNDATION

LF EDGE

Integrated Edge Cloud AR/VR Stack

App Orchestration (MEX/VIVE)

AR/VR Apps — Container

Database Apps — Container

Knative (serverless)

Kubeflow (Aggreagation)

EdgeX (IoT)

Infra Orchestration and Installer

Kubernetes

Containerized Compass

Networking Software

OVS

Linux Network Stack

Control

Calico, xConnect, NSM

Contiv/VPP

OVN-K8s

Real Time Linux Distribution

Edge Servers or Networking Edge Platform

Acceleration

RDMA GPU

VPP, SR-IOV, DPDK

- 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
  - GPU with RDMA
  - PCIe/CCIX attached accelerator (Smart NICs…)

AKRAINO EDGE STACK

Cloud VR/AR Blueprint Spec

Case Attributes	Description	Informational
Type	New Blueprint for VR/AR on the Network Edge	
Blueprint Family - Proposed Name	Integrated Edge Cloud (IEC) Type 4	
Use Case	Deployment of generic edge end and cloud environment for VR/AR cloud streaming	ref to use case supplementary material
Blueprint proposed Name	IEC Type 4: Generic AR/VR oriented Edge Stack for Integrated Edge Cloud (IEC) Blueprint Family	
Initial POD Cost (capex)	Leverage IEC Type 1 Blueprint - less than $120k (3 nodes)	

Scale & Type	Generic blueprint PoC:
	  - One master node and up to 5 worker nodes with mixed Linux and Windows OS
	  - Each server, x86/ARM server with nVidia RTX GPUs (Titan or GeForce TBD), AMD Radeon
	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, AMD Radeon 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 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 windows container with nVidia or AMD 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 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.	

AKRAINO EDGE STACK

Akraino Edge Stack Assisted AR/VR

AR/VR Algorithms that requires GPU

Modeling (i.e. modeling describes the process of forming the shape of an object)

Compositing (e.g. Environmental Mapping, Tone Mapping)

Rendering and Illumination Models

Visualization of Large Volume 3D Models (e.g. **Global Network Operations Center monitoring**)

Registration (e.g. Stitching data from distributed sources)

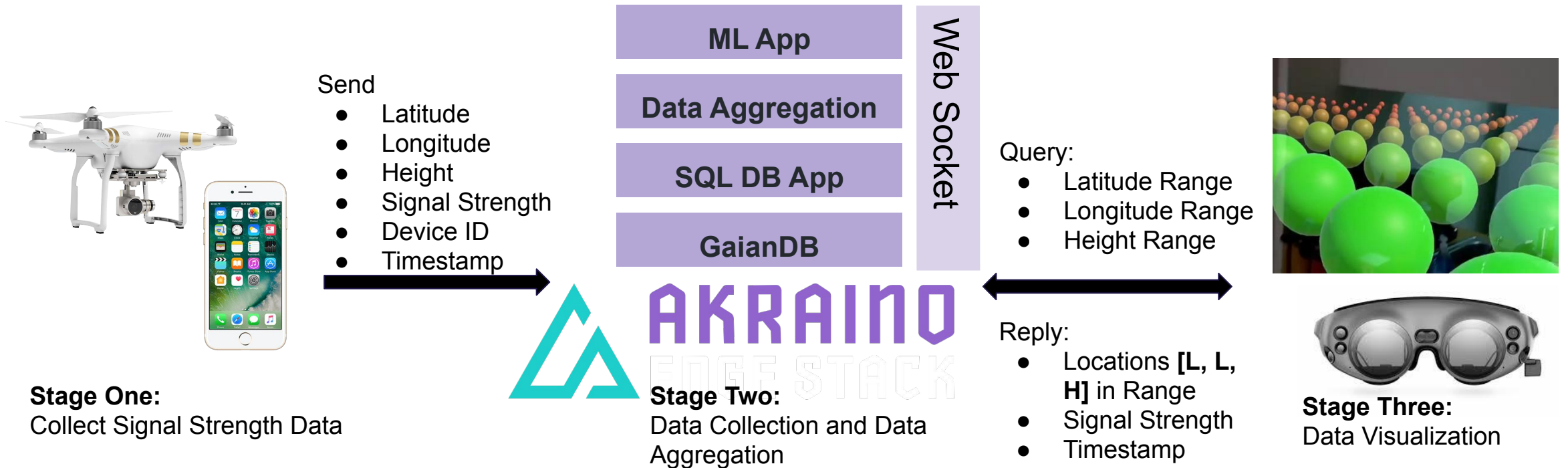Segmentation (e.g. Segmentation and detection for security monitoring)

Use Case
The Future 3D GNOC Monitoring

WIFI/LTE/5G Signal Strength Monitoring

- Previous Network System Performance are targeted on Fiber Networks
- 5G Signals are based on beam forming, which is 3D waveguide analysis
- 3D Data Monitoring for Network System Performance Diagnostics

Send
- Latitude
- Longitude
- Height
- Signal Strength
- Device ID
- Timestamp

ML App

Data Aggregation

SQL DB App

GaianDB

Web Socket

Query:
- Latitude Range
- Longitude Range
- Height Range

Reply:
- Locations **[L, L, H]** in Range
- Signal Strength
- Timestamp

Stage One:
Collect Signal Strength Data

Stage Two:
Data Collection and Data Aggregation

Stage Three:
Data Visualization

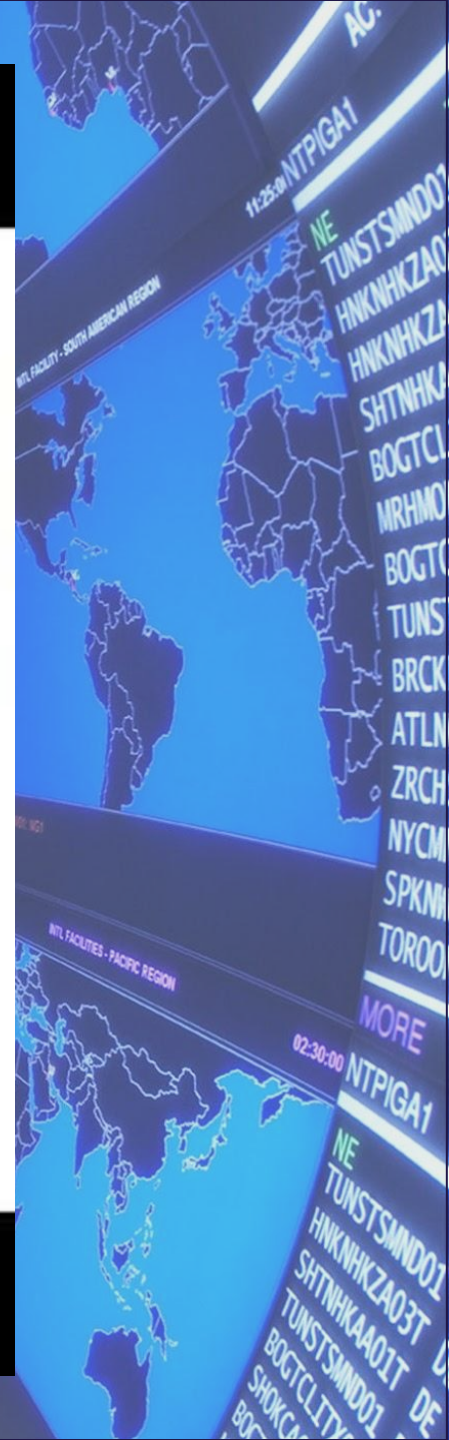Ref: https://dreamtolearn.com/ryan/data_analytics_viz/130/en

Demo Time
The Future 3D GNOC Monitoring

Project Skittles
Augmented Reality Visualization of
WIFI and LTE Signal Strength (POC)

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Backup Slides

Akraino Edge Stack Assisted AR/VR

AR/VR Algorithms that requires GPU:

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› Segmentation (e.g. Segmentation and detection for security monitoring)

Proposed Generic/Baseline AR/VR Blueprint
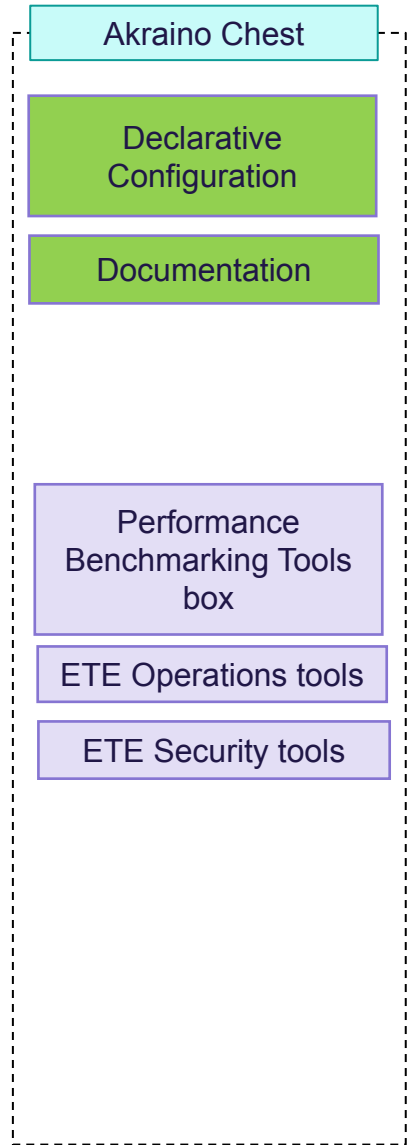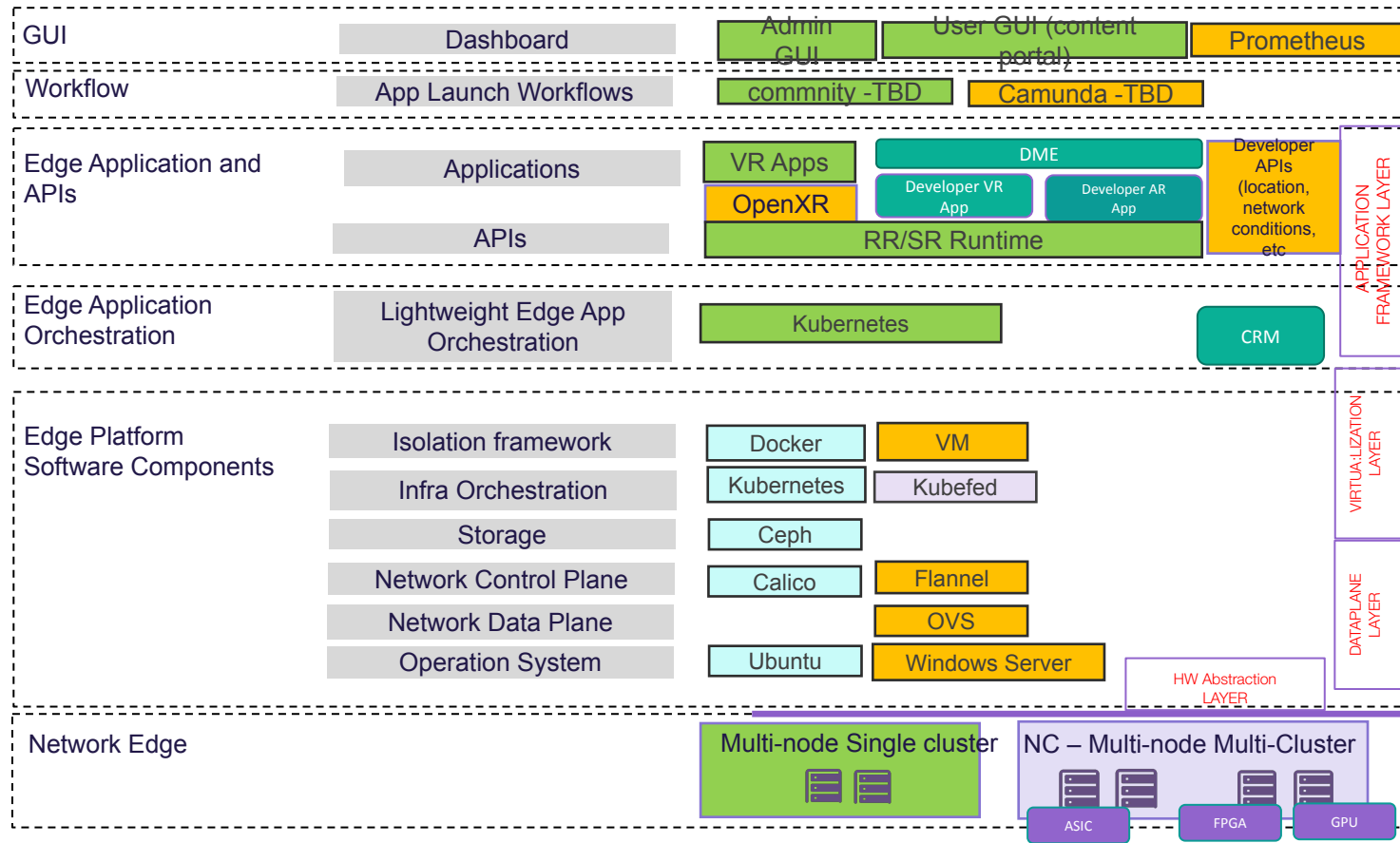
Cloud VR Vertical Deployment Architecture (VIVE)