Open IT Infrastructure to Drive Innovations at SKT

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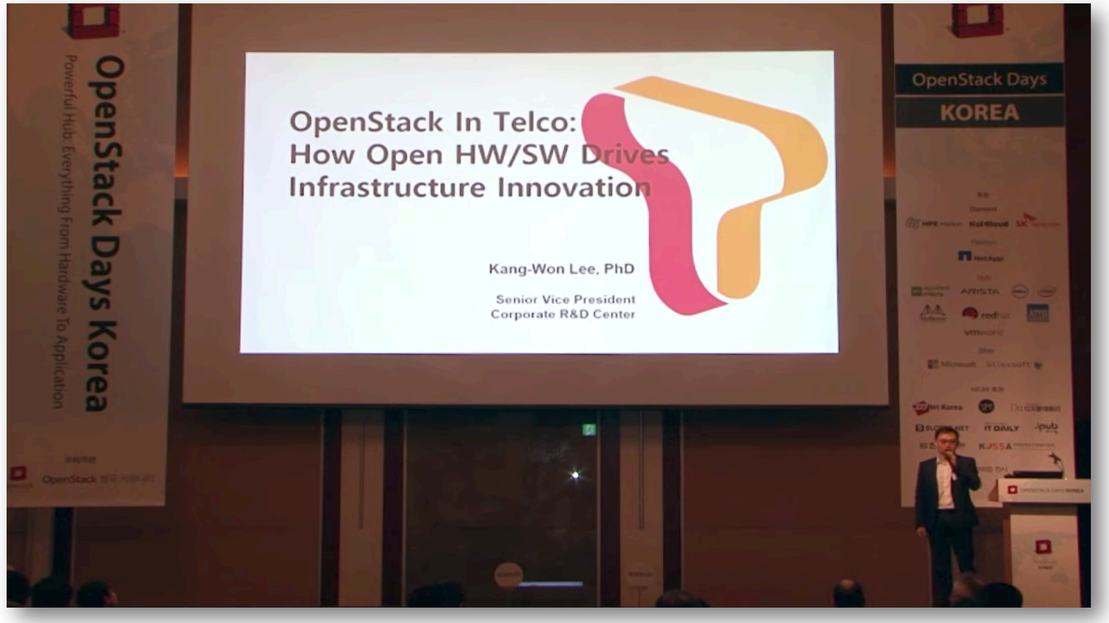
Senior Vice President
Corporate R&D Center

SKT in Past OpenStack Days



2015: All-IT Network Vision

SDDC Vision & Architecture

SKT Commitment on OpenStack

2016: Open HW/SW Development

Open HW Development

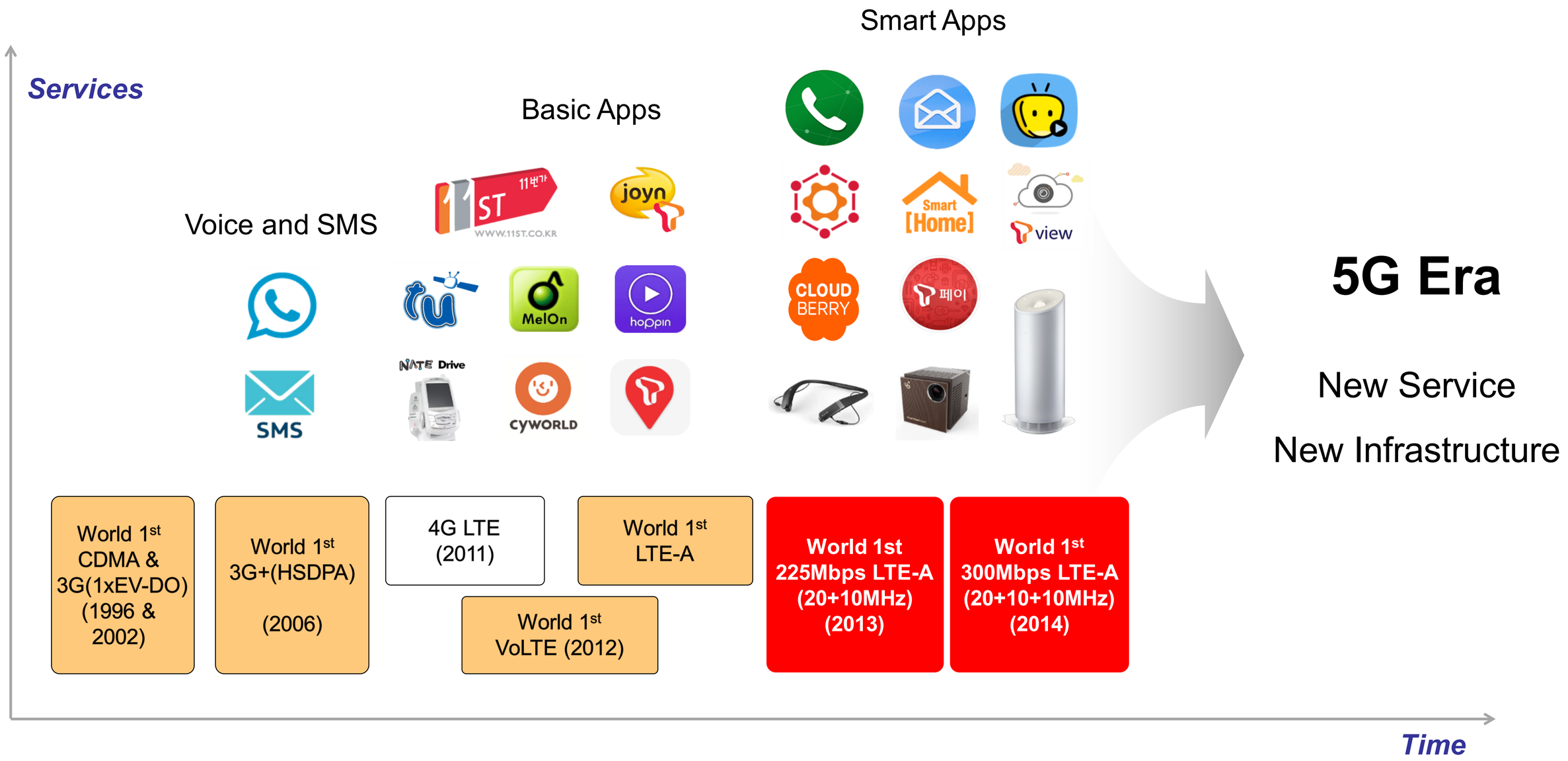
SDDC Operation/Analytics SW Development

2017: OpenStack with Agility

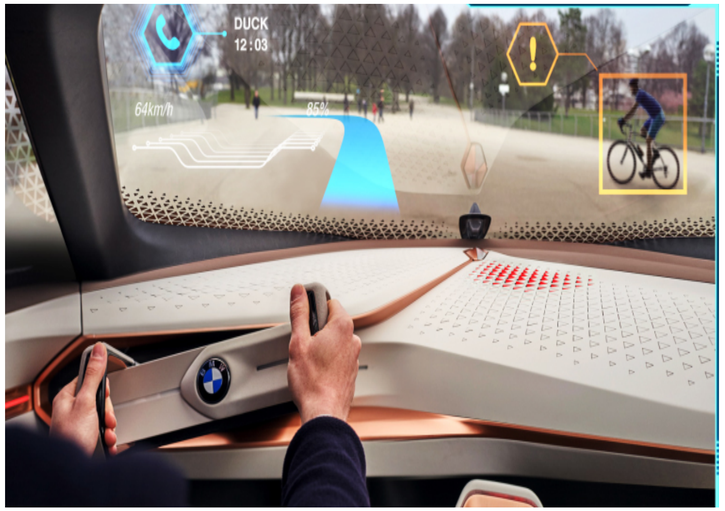
Containerized OpenStack Deploy and Manage

Open Infrastructure for AI

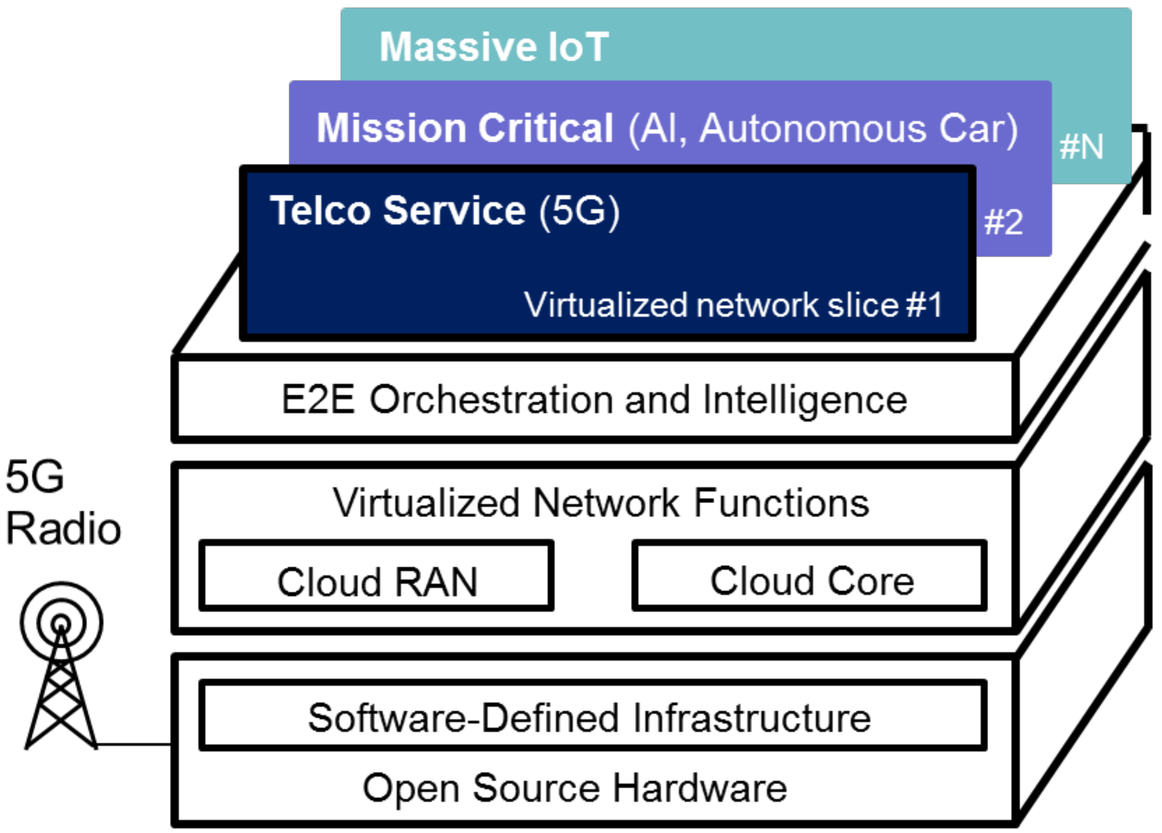
SKT over years



Innovative Services of 5G



5G Evolution to Open Infrastructure



SKT Services

- Ultra High Data Rate
- Mission Critical Service
- Massive Connectivity

ATSCALE

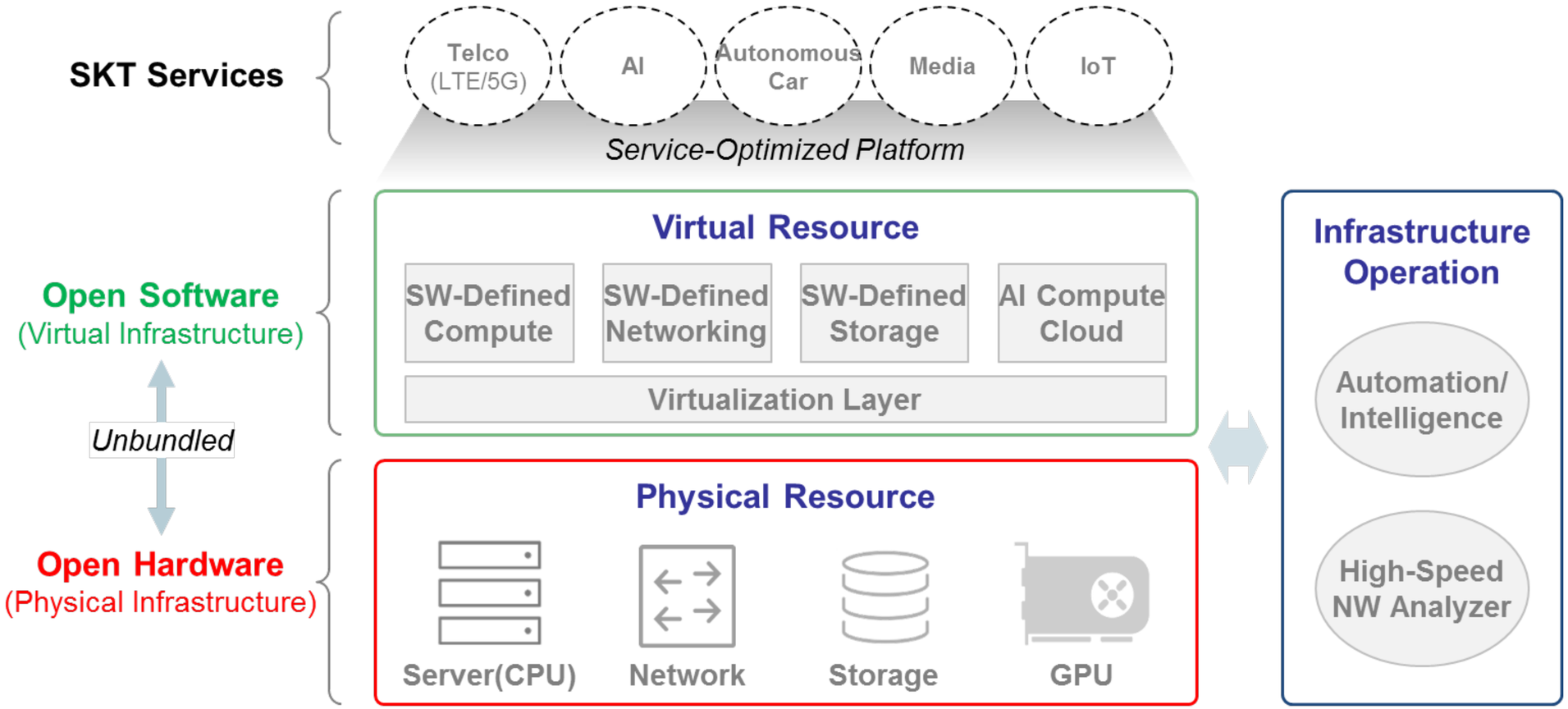
- Virtualized Network Functions
- Network & Service Slicing
- Next-Generation OSS (TANGO)

COSMOS

- Software-Defined Infrastructure
- Open Hardware and Software
- Telco & Mission Critical Services

COSMOS Vision

- **Composable, Open, Scalable with Open Software and Hardware**
- **Mission Critical Services (5G, AI, Autonomous Car, etc.)**

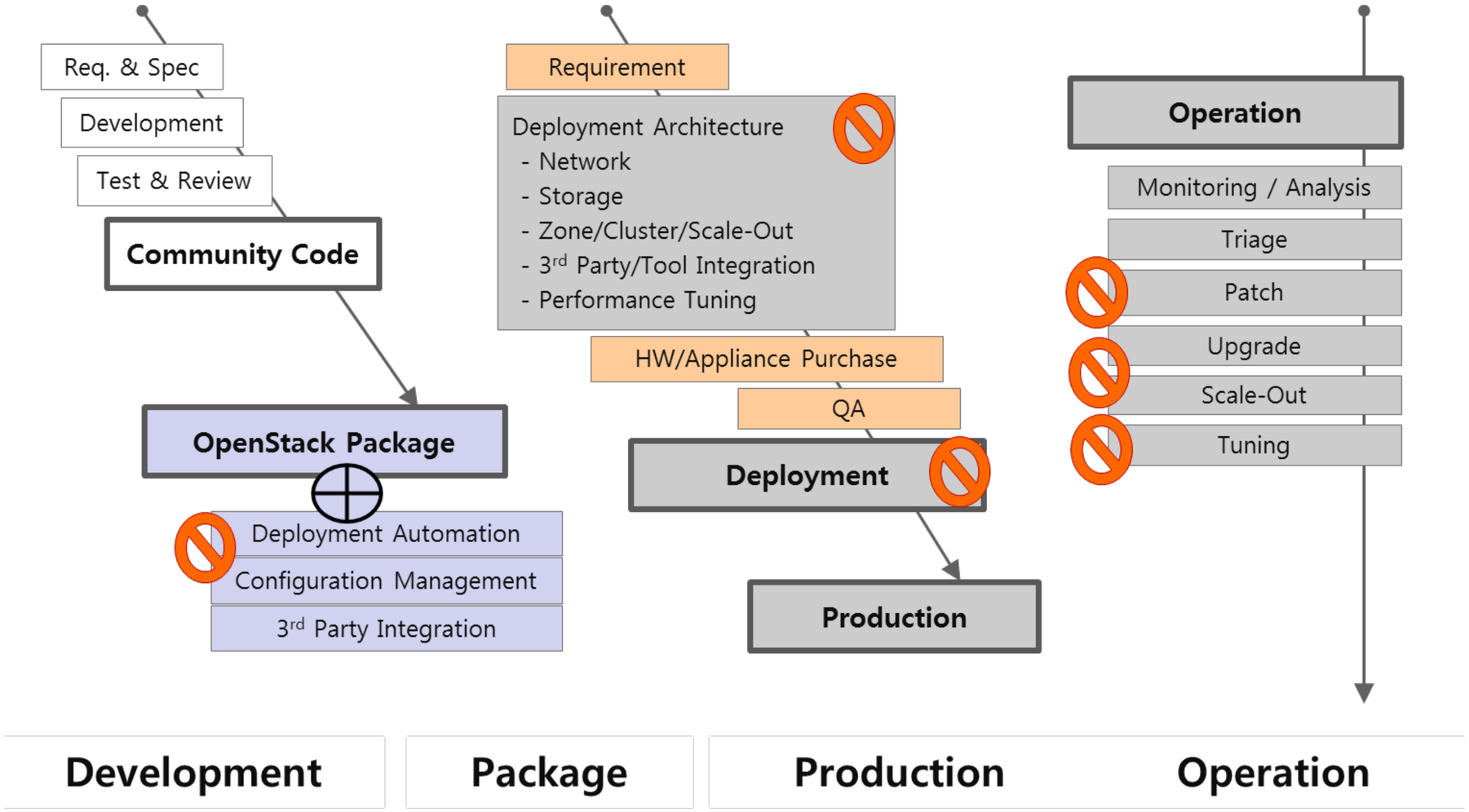


Open Infrastructure for Virtual Resources

- **OpenStack for Virtual Infrastructure Management**
- **Telco (5G), Media, IoT Applications**

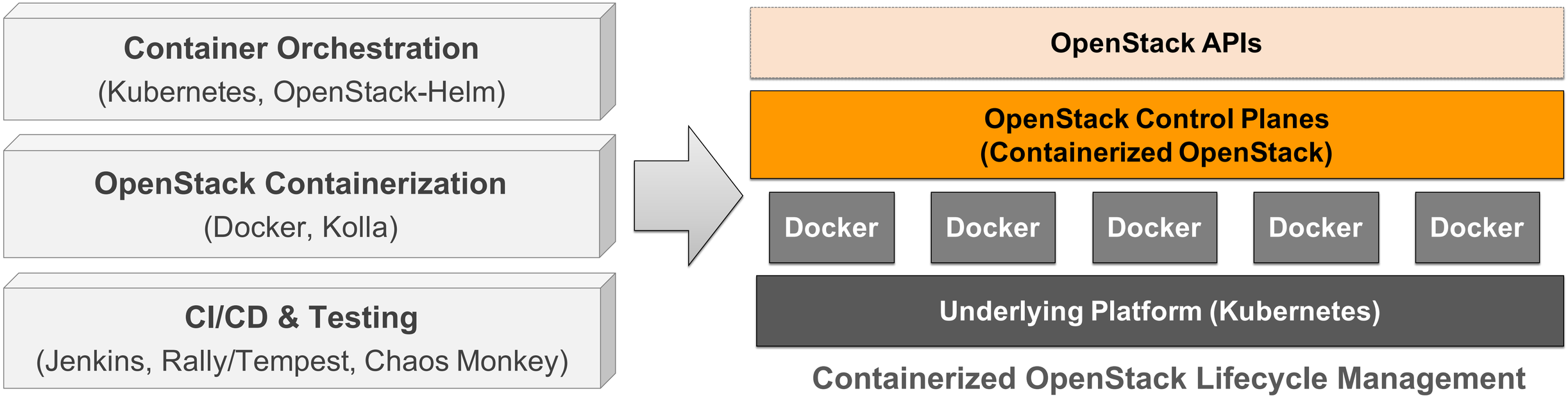
Challenges

- OpenStack is still very **complicated system to deploy and manage**
- Current way of **automating** OpenStack still has **challenges**



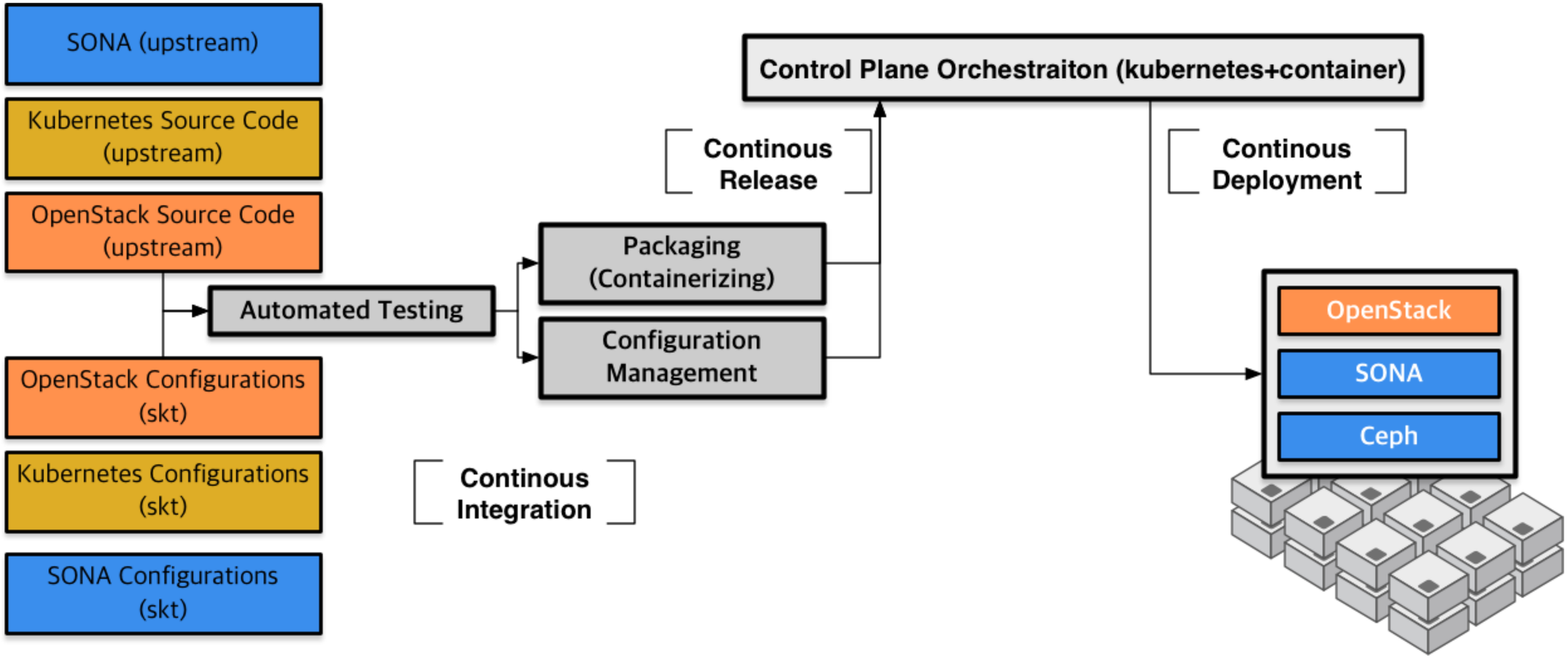
TACO (SKT All Container OpenStack)

- Developed by **SK Telecom**, leveraging **Container and Kubernetes**
- **Community Version** with **Continuous Integration / Delivery** System
- Enhanced OpenStack Lifecycle Management: **Self-Healing, Upgrade w/o Service Interruption, Simple and Easy Deployment, Highly Flexible Customization**



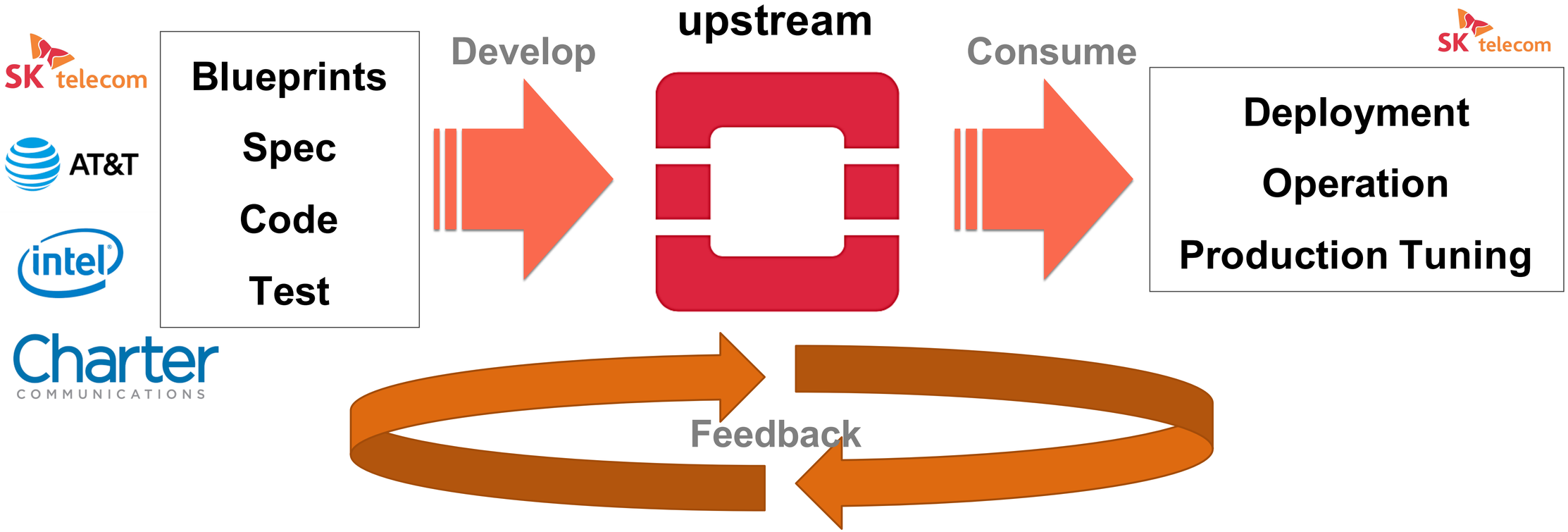
TACO SW Delivery

- **Automated Continuous Integration** Pipeline w/ Various Tests (100% sync to Upstream Code)
- Standardized **Packaging, Versioning, Release** Process and Tool Sets



Upstream First Philosophy

- **Upstream First**: Develop on upstream; Consume directly from the upstream
- **Benefits:** Zero Silo Code, Strong ecosystem (Your code are used everywhere), Efficient Development Effort (Loosely Coupled Co-Development with Various Community Partners)



TACO Roadmap

2016 Q3

Initial Ideation
on
OpenStack
Control Plane
Containerization

2017 Q1

OpenStack-Helm
Based
Development
Project Launch

Collaboration
- LCOO
- OpenStack-Helm

2017 Q3

CI/CD Pipeline
. Containerization
. Unit/Feature Test
. HA-Enabled
. Resiliency Test

TACO V1.0
Beta Release

2017 Q4

Production-Ready
OpenStack
. Self-Testing
. Full-
Containerization
. Operation Tool

TACO V1.0
Official Release

2018

Production
Deployment
. E2E Automation
&
Expand to
NFV Control Plane
& Orchestration

Open Infrastructure for AI

- **Cloud Infrastructure of AI Training**
- **Large GPU Cluster for Diverse AI Applications**

AI Infra R&D Overview

Deep Learning Infrastructure with Increased Performance and Utilization for SKT's AI Services

SKT AI Services

NUGU

T-map

T-view

Autonomous Driving

⋮

1 AI Compute Cloud

- Cloudification of Large-Scale GPU Cluster
- GPU Virtualization by Container
- Dynamic Job Scheduler for Better Utilization

2 AI Compute Appliance

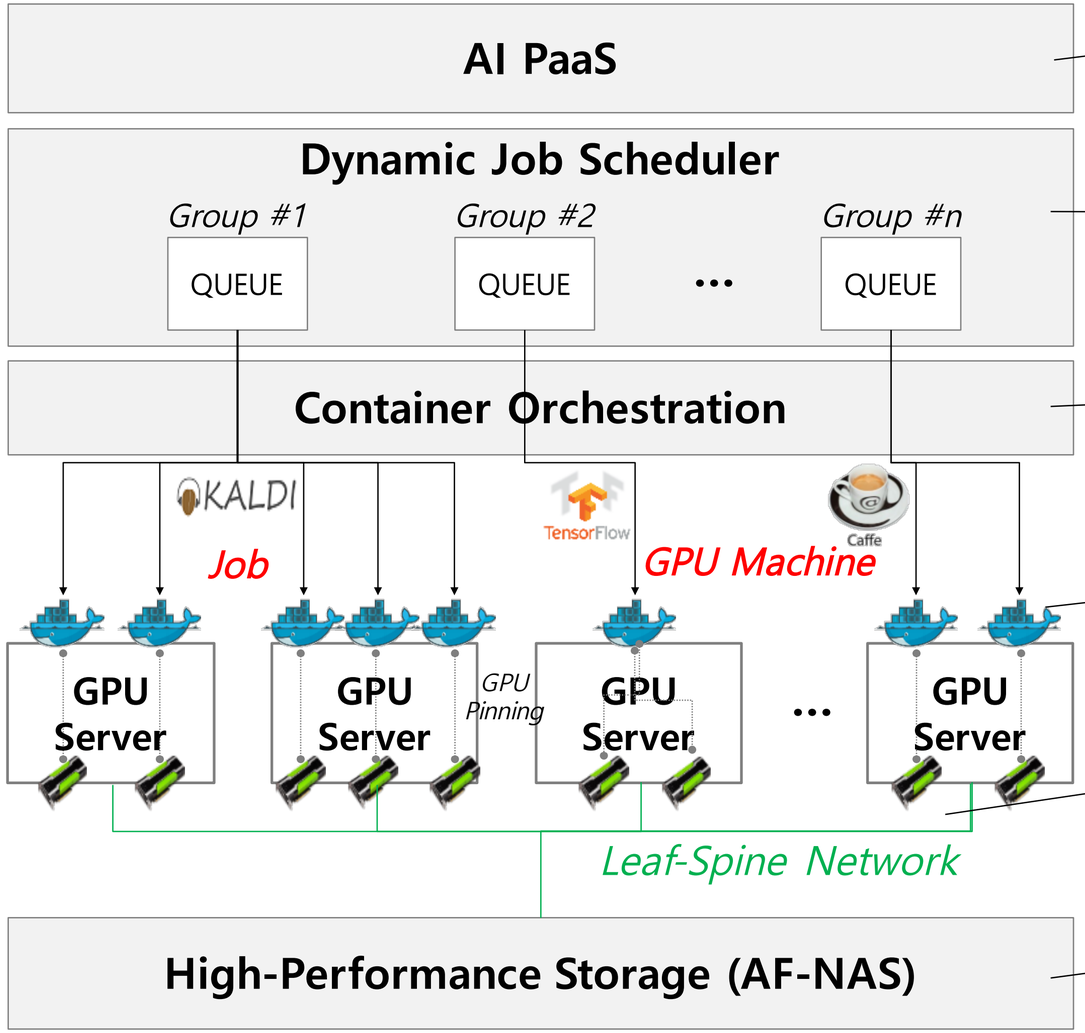
- High-Density GPU-based HPC Appliance
- Deep Learning SW Framework Optimization
- Rack-Scale Design by Dynamic Configuration of CPU-GPU-Storage

3 AI Inference Accelerator

- FPGA Optimized for Diverse ML Framework
- Lower Cost, Higher Performance, Lower Power Consumption than CPU/GPU

AI Infra R&D: AI Compute Cloud

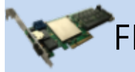
Highly Efficient Multi-User Multi-Node GPU Cloud Using Container & Job Scheduler



- Job Creation for Data Parallelism
- Dynamic GPU Resource Allocation
- Container Life Cycle Management
- GPU Containerization for Diverse ML Frameworks
- SONA Fabric Network
- All-Flash NAS Storage for Large Model and Data

AI Infra R&D: AI Compute Appliance

HPC Appliance with Optimized Deep Learning S/W on High-Density GPU Server

BI Tool (GUI)	Jupyter	etc.	
Job Scheduler	AI Compute Cloud		
Deep Learning Framework	Tensorflow	Kaldi	Caffe
S/W Accel. Module	Comp. Graph Optimization (JIT Compile)		
Library	CuDNN	NCCL	NV Docker
Accelerator Direct I/O Layer	NVMe-GPU-XeonPhi-FPGA Direct		
H/W Accelerator	 GPU  XeonPhi	 FPGA  NVMe SSD	
Compute H/W	  GPU Server	 JBOG	

BI Tool for High Usability

Highly Efficient PaaS Platform

- Cluster, Dynamic Scheduling
- Support for Diverse ML Framework

Computation & Memory Optimization

H/W Acceleration Methods

Accelerator	Target
XeonPhi	Seq. Processing, CODEC
FPGA	Reduce Operation
NVMe SSD	Near Data Processing, ISP

Direct Communication b/w Accelerators

- NVMe-GPU Direct I/O

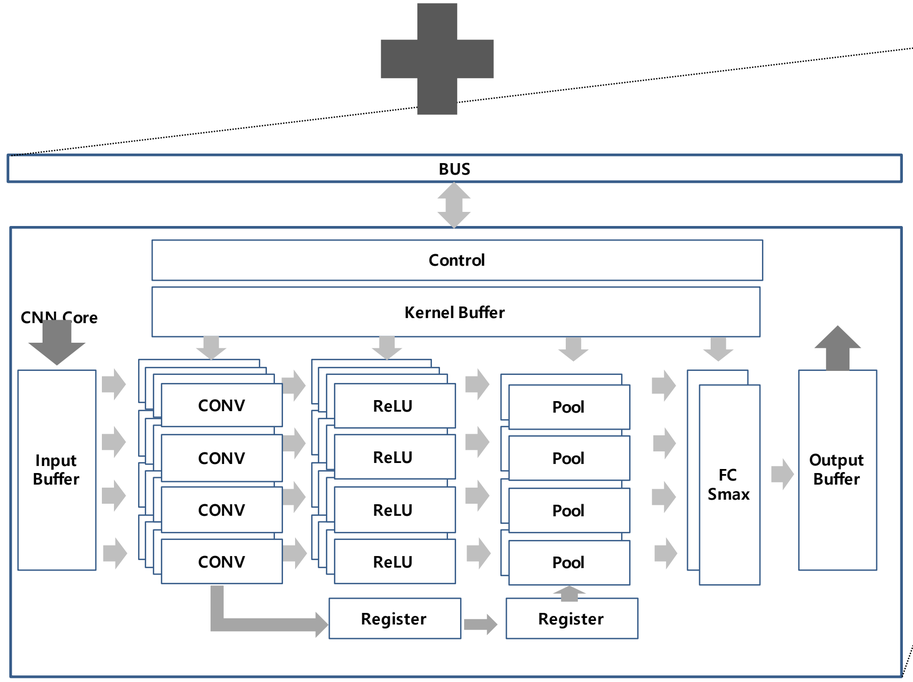
ISP(In-Storage Processing)

- Deep Learning Acceleration in NVMe SSD Core

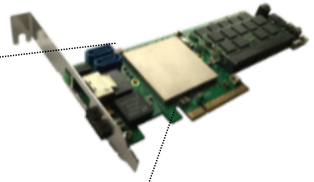
AI Infra R&D: AI Inference Accelerator

Inference Acceleration to Improve Performance and Power Efficiency

Deep Learning Framework (S/W)



Deep Learning Inference Core (H/W)



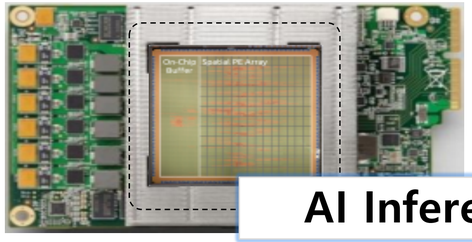
FPGA Accelerator

PCIe Slot

PCIe Card Based Server in AI Service Cloud

Xeon+FPGA

Xeon+FPGA Server for AI Service Cloud



AI Inference ASIC

Let’s Journey Together

Community Collaboration

- **OpenStack-Helm Project**
- **Large Contributing OpenStack Operator WG (LCOO)**

- **Kubernetes**
- **Helm**
- **Prometheus**

- **Docker**
- **Linuxkit**

Summary

TACO (SKT All Container OpenStack)

- **Kubernetes/Container based Life Cycle Management**
- **Container-centric SW Delivery Pipeline (CI)**
- **Community Collaboration (Call for Action)**

Open Infrastructure for AI

- **DL Training & Application Development**

To Learn More…

OpenStack의 컨테이너화 및 Kubernetes를 통한 Lifecycle 관리 기술

Track I
13:00 ~ 13:30

Kolla를 이용한 Production-Ready OpenStack Container 생성 및 CI파이프라인

Track I
17:20 ~ 17:50

Kubernetes/OpenStack-Helm 튜토리얼

7월 14일 A-1 10:50~14:50

Advanced Features for Ceph: Deduplication and QoS

7월 14일 Ceph Day 14:00~14:50

Thank You!