Flex Community Lab for Open19 & Akraino

Rob Neff

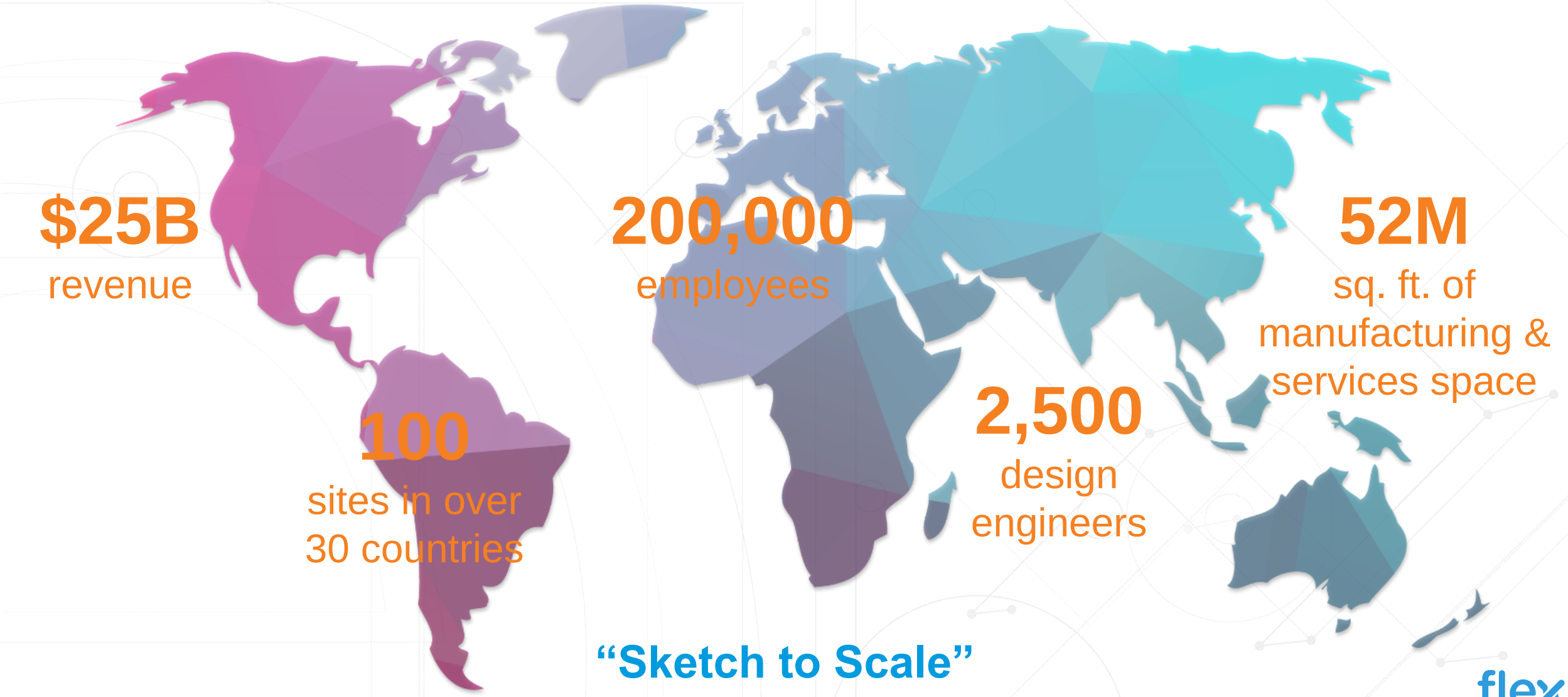
Cloud Solutions Architect

Open19 + Akraino for the Edge

Agenda

1. Flex Overview
2. Edge Datacenter Use Cases, Requirements & Issues
3. Akraino Overview
4. Open19 Overview
5. Flex CloudLabs Akraino Community Lab

Flex – Manufacturing & Design



$25B
revenue

200,000
employees

52M
sq. ft. of manufacturing & services space

100
sites in over 30 countries

2,500
design engineers

“Sketch to Scale”

Flex has access to unique insights

Flex Lab-as-a-Service Overview

Labs to host open source community labs to cultivate partnership, engage in industry consortium, build ecosystem & provide solution trials, demos, validation and certification.

Physical

- Lab space consisting of 1200+ sq.ft. area in Silicon Valley
- Power and Cooling capacity for up to 30 racks
- Work benches and hardware staging area

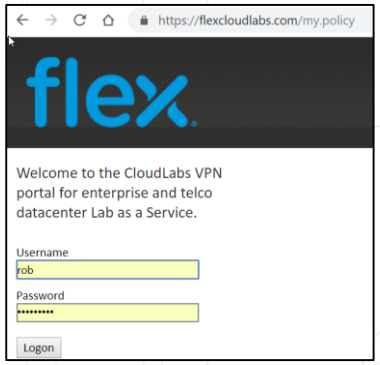
Network

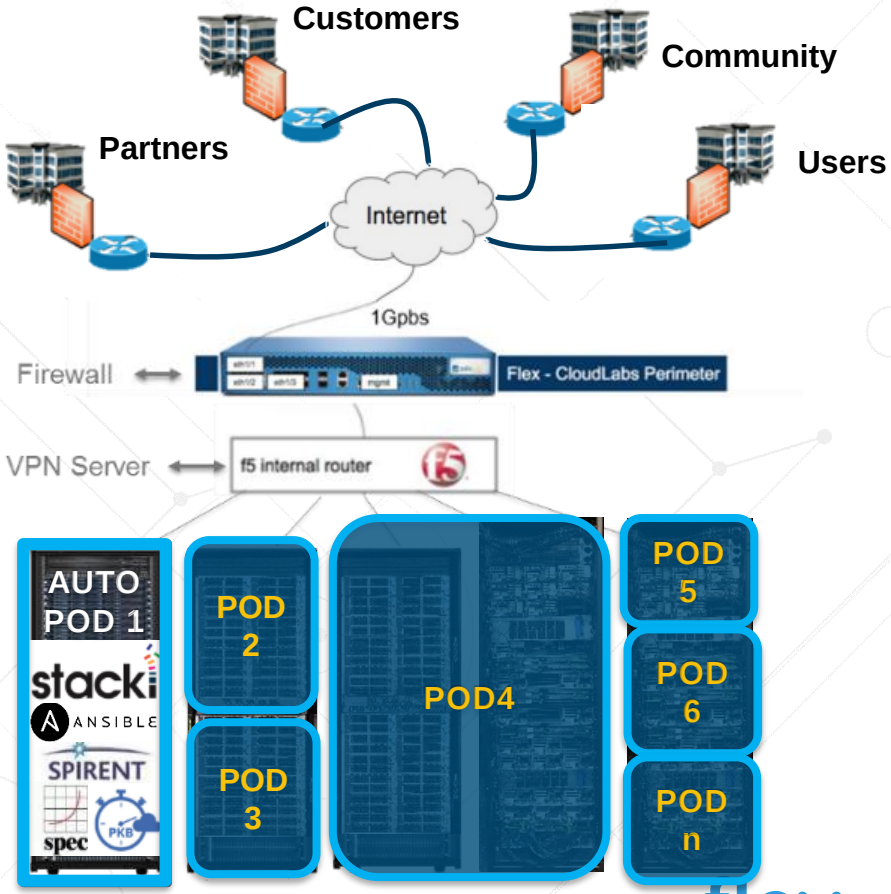
- Isolated from Flex corporate network
- Supports up to 60 secured project PODS
- 1G dedicated network with remote access

CloudLabs support

- Range of white box and reference platforms
- Partner and vendor hardware staging
- Automation and test tool integration capabilities

https://flexcloudlabs.com





Lab-as-a-Service Initiative Objective

Promote Open Hardware Platforms

» The On-demand labs are intended to help companies evaluate open source options for hardware and software stacks across North America.

Collaborate across Opensource Consortiums

OPNFV

ONF Open Networking Foundation

openstack

» LaaS helps by providing disaggregated hardware and software stacks. ONF is testing their software using the On-demand labs to grow the CORD and ONOS communities.

Validate and Certify Tools and Software on Platform Solutions

Integrate

CORD

openstack.

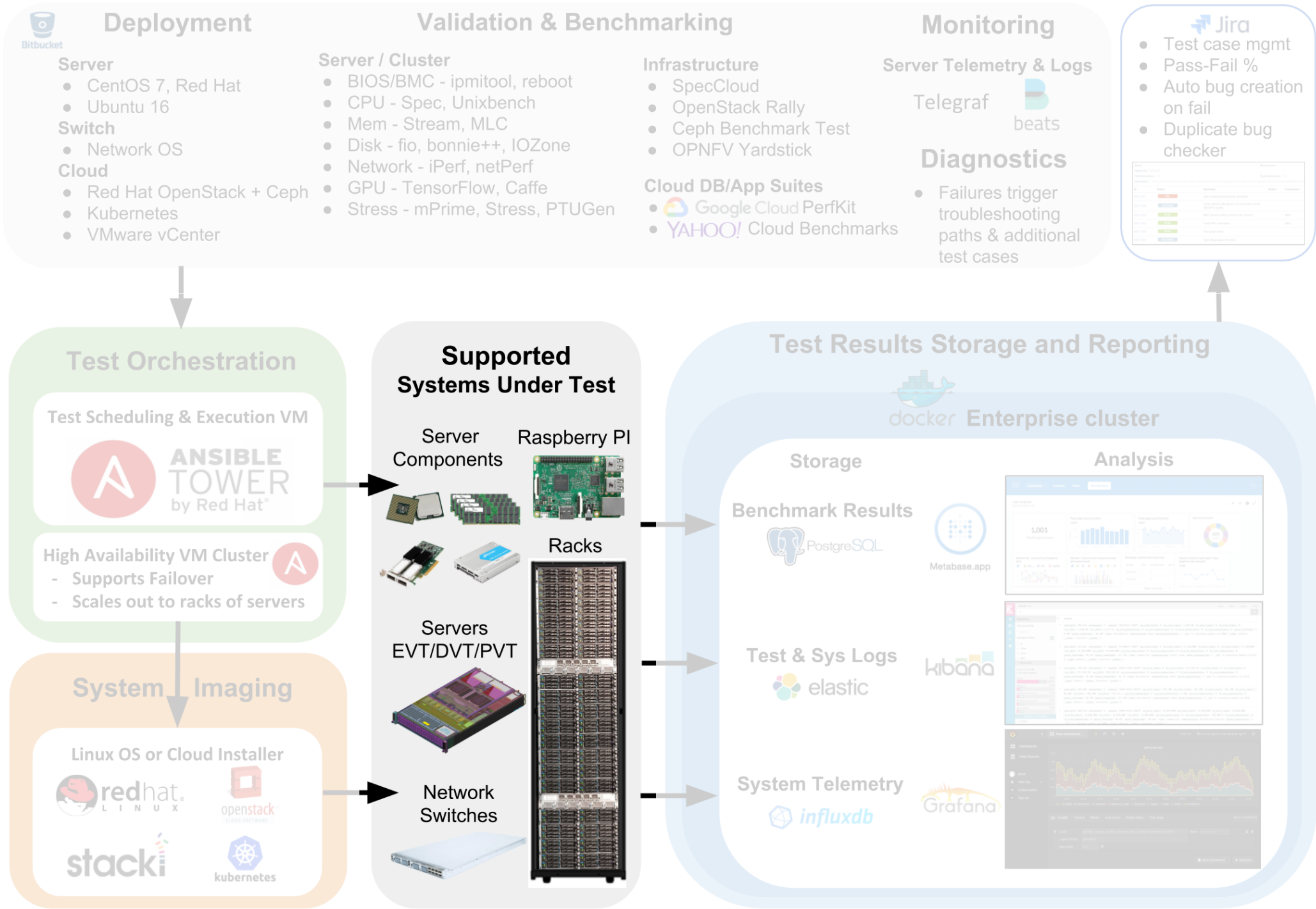
Validate

» Flex works with ecosystem to integrate OCP, OPEN19 and software solutions like CORD, OPNFV & soon Akraino. We see a growing interest from Telco to use LaaS for trials before migration to field deployments.

flex

Automata Framework

1. Supports from Raspberry PI up to many racks (300+ sut)
2. Industry standard open source benchmarks, tools & stress tests
3. Imaging & tests orchestrated by Ansible Tower
4. Stacki & Red Hat deployment tools enable light OS or datacenter stacks
5. Results, telemetry, & logs indexed stored in Enterprise Docker cluster with GlusterFS backend
6. JIRA for reporting



Automata Use Cases

Server Diagnostics

- Inventory Check
  - CPU, Mem, Drive check
  - LSPCI checks
  - Sensor check
- BIOS / BMC Diags
  - DMIDecode (BIOS)
  - BMC FRU / fields
  - IPMITool Checks
- Logs
  - Var/log/messages
  - BMC SEL
  - DMESG

Server Performance & Stress

Captures Result, Telemetry, Logs

- Benchmarking
  - SpecCPU
  - GPU tests
  - Drive (fio)
  - Network (iPerf)
- Stress
  - CPU (PTUGen)
  - Memory (StressApp)
  - Drive (bonnie++/fio)
  - Network (iPerf)
  - Soft Reboot
  - Hard reboot (PDU control)

Test Sequencing

- Workflows
- Example Sol Sea

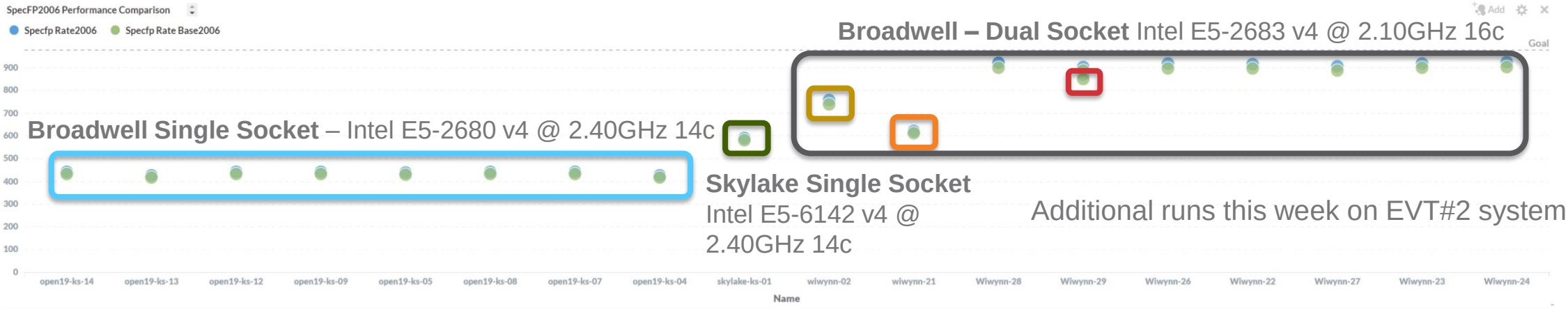
(Log/tel check after each)

1. 8 hr mPrime Stress,
2. Fio suite
   1. Individual drives
   2. Combined drives
3. Repeated soft reboots
4. Inventory check
5. Fio suite
6. 10x Repeated hard reboots
7. Inventory check
8. Fio suite
9. 8 hr Stress app

Synchronous System Testing

- Remote block storage bandwidth tests from many 200 client VM's each with its own RBD
- Coordinated Network Bandwidth test across 24 pairs of bricks
- Coordinated uplink bandwidth tests across racks
  - Test 800Gbps aggregate uplink on Bolt?)

Example: Performance Benchmark - Spec 2006 Results



Broadwell – Dual Socket Intel E5-2683 v4 @ 2.10GHz 16c

Broadwell Single Socket – Intel E5-2680 v4 @ 2.40GHz 14c

Skylake Single Socket
Intel E5-6142 v4 @ 2.40GHz 14c

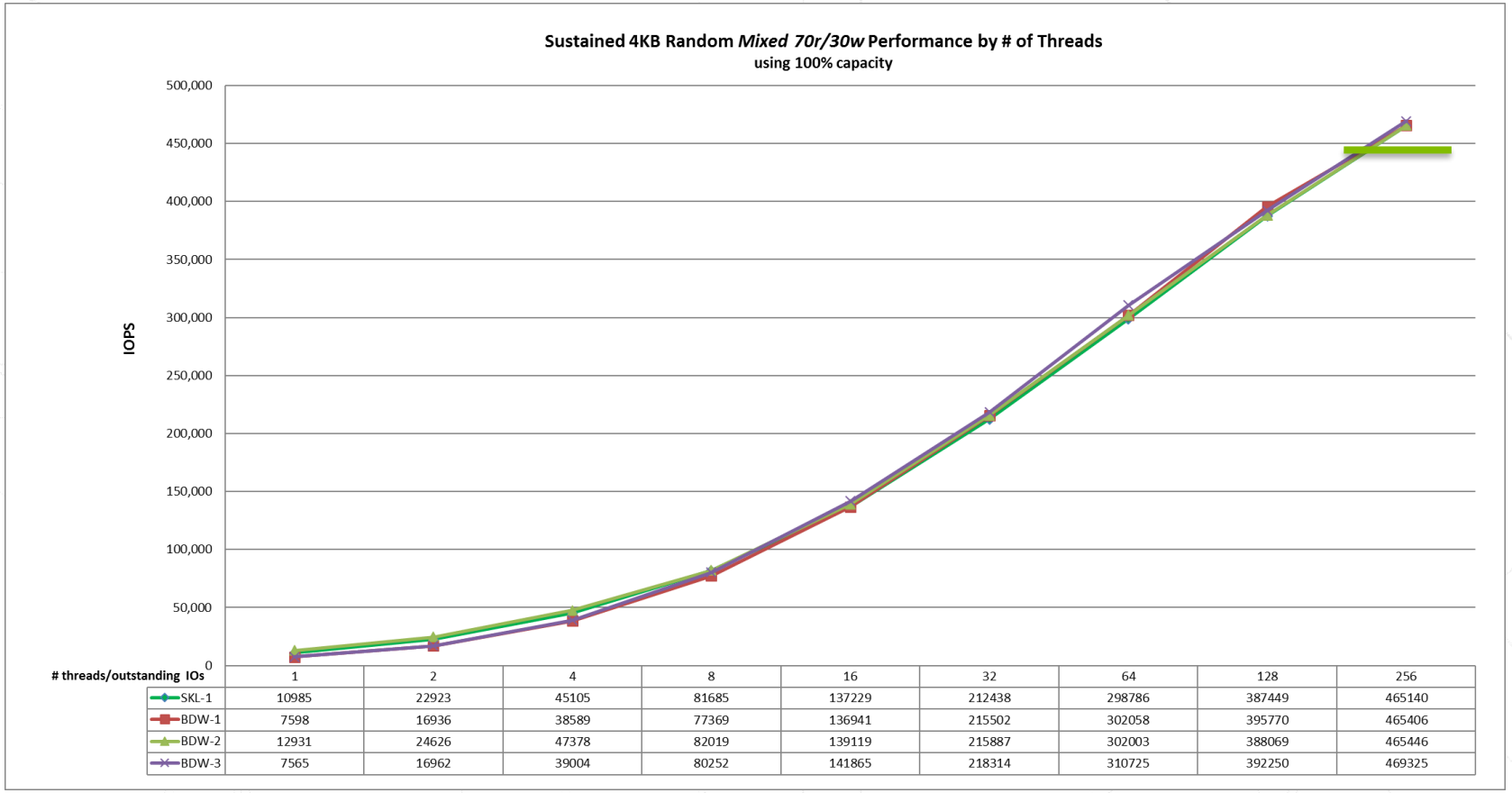
Additional runs this week on EVT#2 system

Speccpu2006 Resources

ID	Name	Rack	Unit	Bios Version	Processor	Processor Cores	Processor Count	Processor Threads Per Core	Mem Total	Distribution	Distribution Release	Distribution Version	Kernel
2,305	open19-ks-14	0	0	L2.22H	GenuineIntel	14	1	2	128662	CentOS	Core	7.3.1611	3.10.0-514.26.2.el7.x86_64
2,304	open19-ks-13	0	0	L2.22H	GenuineIntel	14	1	2	128662	CentOS	Core	7.3.1611	3.10.0-514.26.2.el7.x86_64
2,303	open19-ks-12	0	0	L2.22H	GenuineIntel	14	1	2	128662	CentOS	Core	7.3.1611	3.10.0-514.26.2.el7.x86_64
2,302	open19-ks-09	0	0	L2.22H	GenuineIntel	14	1	2	128662	CentOS	Core	7.3.1611	3.10.0-514.26.2.el7.x86_64
2,301	open19-ks-05	0	0	L2.22H	GenuineIntel	14	1	2	128662	CentOS	Core	7.3.1611	3.10.0-514.26.2.el7.x86_64
2,300	open19-ks-08	0	0	L2.22H	GenuineIntel	14	1	2	128662	CentOS	Core	7.3.1611	3.10.0-514.26.2.el7.x86_64
2,299	open19-ks-07	0	0	L2.22H	GenuineIntel	14	1	2	128662	CentOS	Core	7.3.1611	3.10.0-514.26.2.el7.x86_64
2,298	open19-ks-04	0	0	L2.22H	GenuineIntel	14	1	2	128662	CentOS	Core	7.3.1611	3.10.0-514.26.2.el7.x86_64
2,297	skylake-ks-01	0	0	L1.01A	GenuineIntel	16	1	2	127366	CentOS	Core	7.4.1708	3.10.0-693.el7.x86_64
1,306	wiwynn-02	11	2M	LB4_M04	Intel(R) Xeon(R) CPU E5-2683 v4 @ 2.10GHz	16	2	2	257673	CentOS	Core	7.3.1611	3.10.0-514.26.2.el7.x86_64
1,304	wiwynn-21	11	34L	LB4_M04	Intel(R) Xeon(R) CPU E5-2683 v4 @ 2.10GHz	16	2	2	128657	CentOS	Core	7.3.1611	3.10.0-514.26.2.el7.x86_64
1,303	Wiwynn-28	0	0	LB4_M04	Intel(R) Xeon(R) CPU E5-2683 v4 @ 2.10GHz	16	2	2	257673	CentOS	Core	7.3.1611	3.10.0-514.26.2.el7.x86_64
1,302	Wiwynn-29	0	0	LB4_M04	Intel(R) Xeon(R) CPU E5-2683 v4 @ 2.10GHz	16	2	1	257673	CentOS	Core	7.3.1611	3.10.0-514.26.2.el7.x86_64
1,298	Wiwynn-26	0	0	LB4_M04	Intel(R) Xeon(R) CPU E5-2683 v4 @ 2.10GHz	16	2	2	257673	CentOS	Core	7.3.1611	3.10.0-514.26.2.el7.x86_64
1,297	Wiwynn-22	0	0	LB4_M04	Intel(R) Xeon(R) CPU E5-2683 v4 @ 2.10GHz	16	2	2	257673	CentOS	Core	7.3.1611	3.10.0-514.26.2.el7.x86_64
1,296	Wiwynn-28	0	0	LB4_M04	Intel(R) Xeon(R) CPU E5-2683 v4 @ 2.10GHz	16	2	2	257673	CentOS	Core	7.3.1611	3.10.0-514.26.2.el7.x86_64
1,295	Wiwynn-27	0	0	LB4_M04	Intel(R) Xeon(R) CPU E5-2683 v4 @ 2.10GHz	16	2	2	257673	CentOS	Core	7.3.1611	3.10.0-514.26.2.el7.x86_64
1,294	Wiwynn-23	0	0	LB4_M04	Intel(R) Xeon(R) CPU E5-2683 v4 @ 2.10GHz	16	2	2	257673	CentOS	Core	7.3.1611	3.10.0-514.26.2.el7.x86_64

Attached NVMe storage

Example: Storage Performance, by Threads



# threads/outstanding IOs	1	2	4	8	16	32	64	128	256
SKL-1	10985	22923	45105	81685	137229	212438	298786	387449	465140
BDW-1	7598	16936	38589	77369	136941	215502	302058	395770	465406
BDW-2	12931	24626	47378	82019	139119	215887	302003	388069	465446
BDW-3	7565	16962	39004	80252	141865	218314	310725	392250	469325

- **70/30 Micron datasheet 445k IOPS**
- **70/30 tests pass 465k IOPS at 256 threads**

Akraino, The Edge Project

Akraino is the Edge Project for the Linux Foundation

This project will bring the extensive work AT&T and Intel have already done to create edge technology that is hardened to address critical infrastructure requirements.

*These include the **high availability**, **fault management**, and **performance management** needed for continuous 24/7 operation, as well as the **low latency, high performance, scalability, and security** needed for edge and IoT workloads.*

We're pleased to welcome it to The Linux Foundation and invite the participation of others as we work together to form Akraino Edge Stack.

- Jim Zemlin

Executive Director, The Linux Foundation

Source: https://www.akraino.org/

Akraino Goals & Scope

Goals

- Development of an Edge solution to meet the needs of Telco, Enterprise, and Industrial IoT use cases
- Develop an Edge API and framework for interoperability with 3rd party Edge providers & hybrid cloud models
- Collaborate with upstream community (CI/CD & upstream process support).
- Edge IaaS/ PaaS - Wide variety of Edge applications.
- Development of Edge Middleware, SDKs, applications and create an app/VNF ecosystem
- Creation of blueprints for PODs (Point of Delivery)

Features

- Single Pane of Glass Control - Single view management of edge resources across 10,000 + sites.
- Thin local Control Plane - Develop multiple ways to reduce local box or data center control plane footprint. For example, run control/data plane mixed with security measures, run in network switches, etc.
- Edge user/ Developer APIs - Provide agnostic Edge APIs.
- Edge IaaS/ PaaS - Wide variety of Edge applications.
- Central/Regional VIM - Alternative to Thin local Control Plane. Remote orchestration of edge compute resources (thin control, agent only at the edge).
- Edge capabilities like analytics etc.
- Low Latency Provisioning - Dynamic Micro services enablement.

Source: https://www.akraino.org/

Akraino Principles

Design Principles

- Finite set of configurations – In order to reduce the complexity, the design will follow a finite set of configurations.
- Cloud native applications – The design will also include the native applications.
- Simplified security – The design will provide a secure platform and services while not being a burden for the platform.
- Autonomous, turn-key solution for service enablement to enable rapid introduction.
- Platform, VNF and application assessment and gating – assess whether the application is fit to run at the edge. (E.g. latency sensitiveness, code quality).

Build Principle

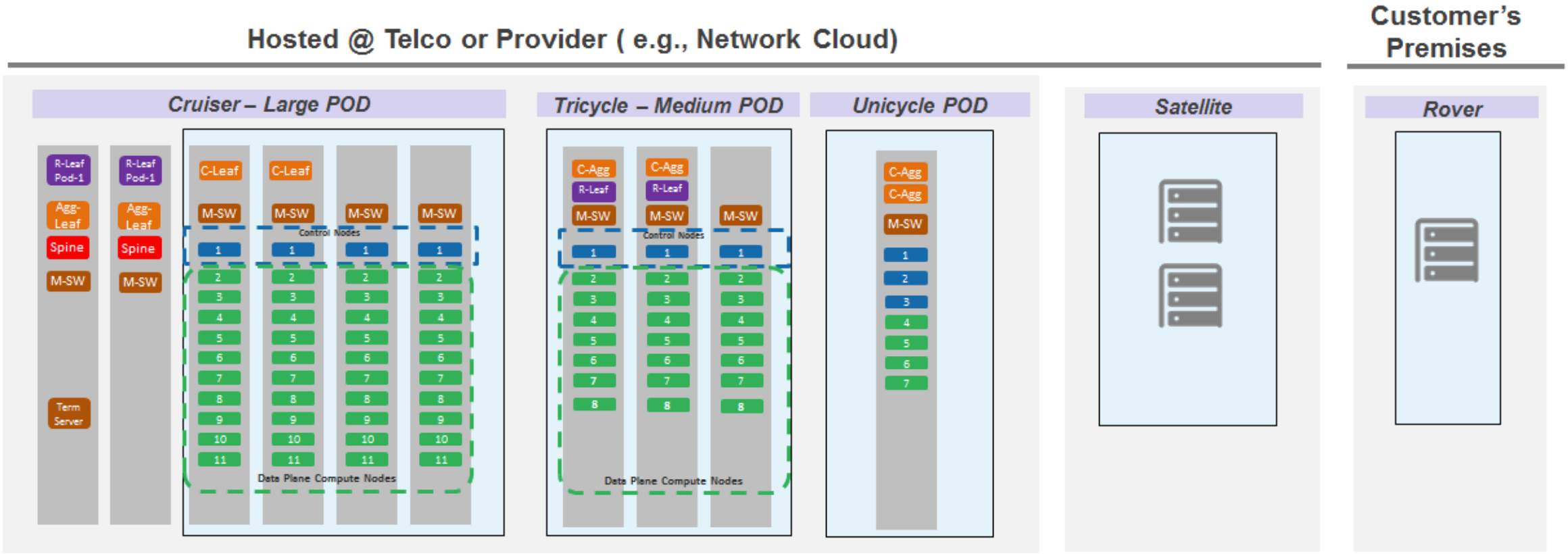
- Low latency placement and processing to support edge drivers.
- Plug & play Modular architecture – building blocks using multiple cloud management technologies.

Run Principles

- Zero-touch provisioning, operations, and lifecycle – reduce OpEx
- Automated maturity measurement – operations, designs, and services.
- Software abstraction based homogeneity – hide any hardware differences via software.
- Common platform and service orchestration – ONAP.

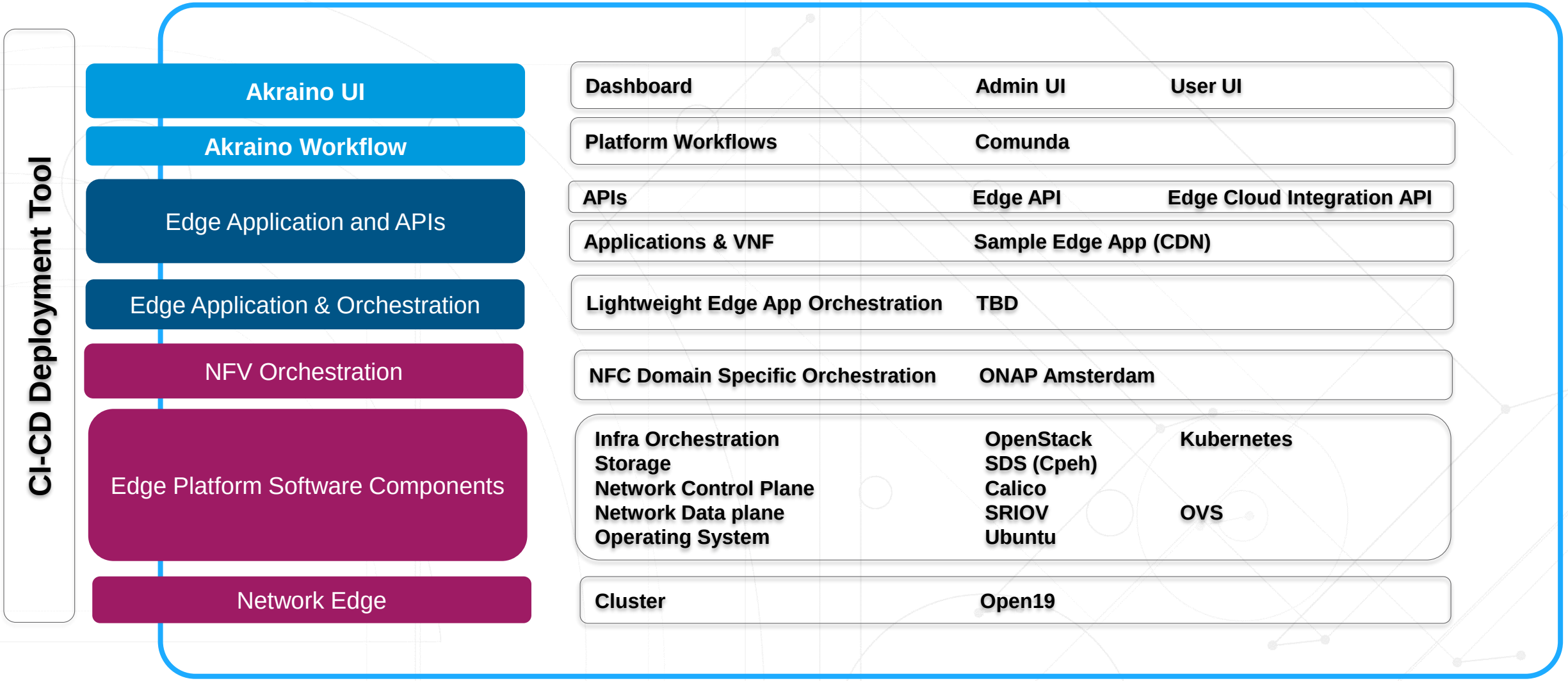
Source: https://www.akraino.org/

Akraino POD (Point of Delivery) blueprints



	Cruiser – Large POD	Tricycle – Medium POD	Unicycle POD	Satellite	Rover
Characteristics	- 6 Racks POD - Containerized Control plane (OpenStack, Ceph, etc.,) - K8 based resiliency	- 3 Racks POD - Containerized Control plane - K8 based resiliency	- 1 Rack POD - Containerized Control plane - K8 based resiliency - Possible - Data plane/Control Plane mixed	- Remote Edge – 1 or 2 servers - Containerized Control plane - No K8 based resiliency - Data plane/Control Plane mixed	- Remote @ customer or public buildings - DANOS based - White boxes
Use Cases (e.g.,)	- 5G Core - 5G Access	- IP Services - 5G Access	- IoT, Wireline (PON), Store - Remote Edge (Analytics etc.)	- Over the top edge applications.	- Over the top edge applications. - SD-WAN

Akraino Edge Cloud Stack

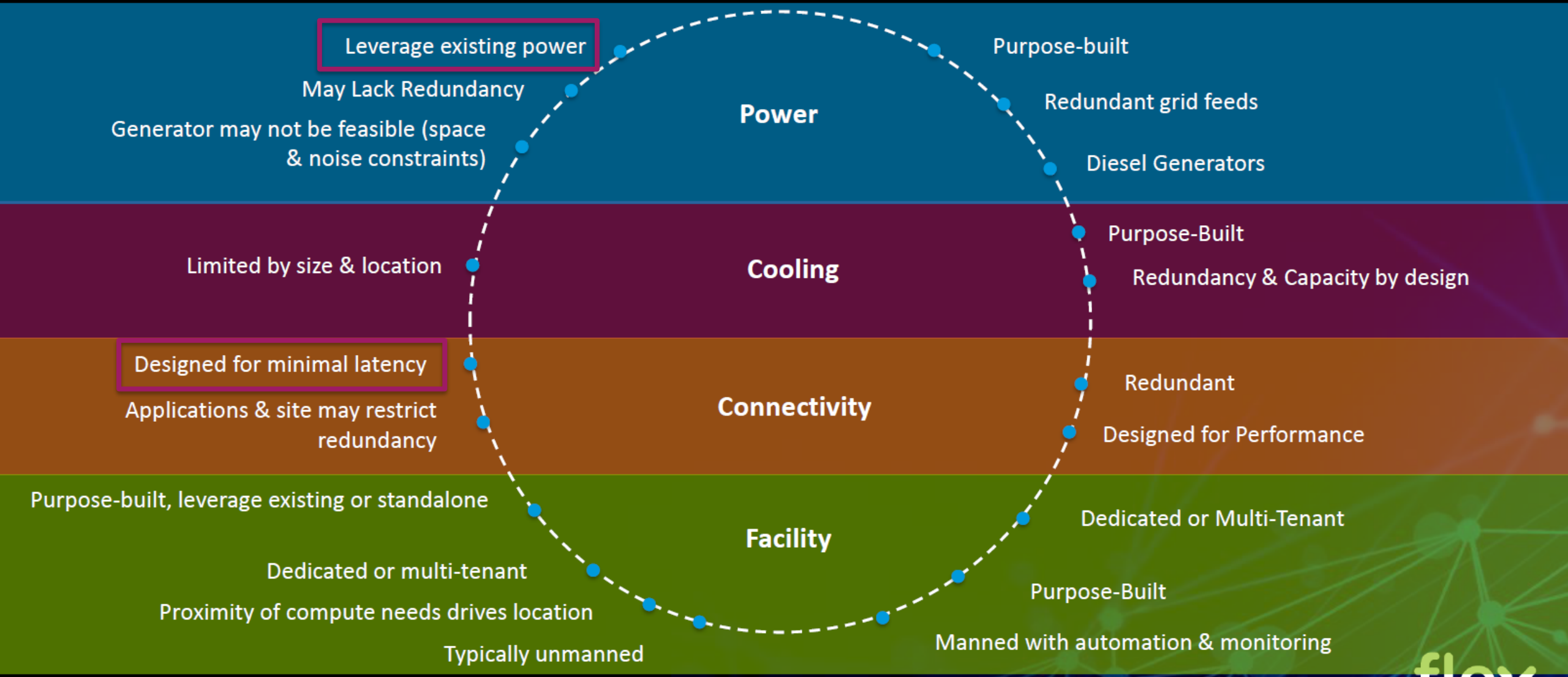


source: THE LINUX FOUNDATION

flex

Open19 Hardware Platform

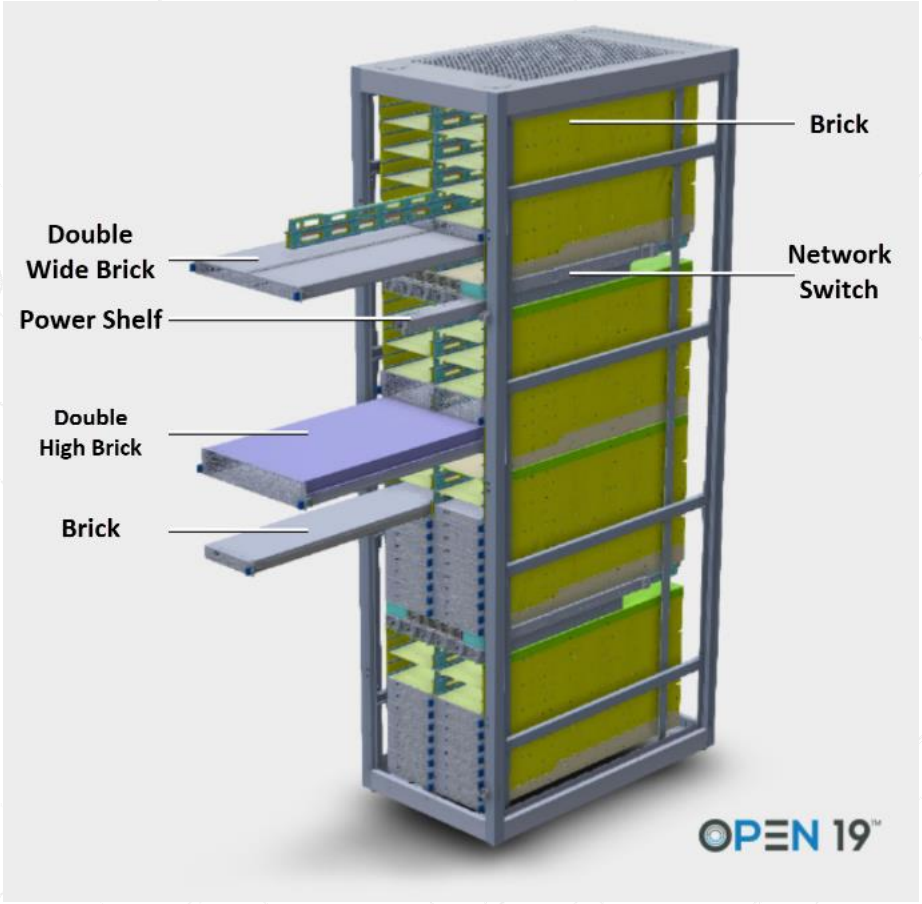
Edge Data Center Comparison



Introduction to Open19

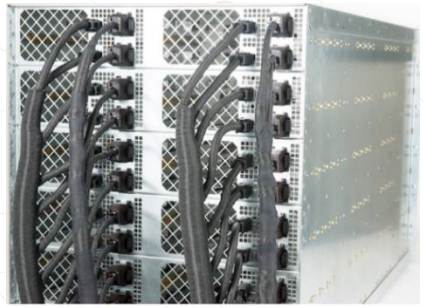
Key Benefits of Open19

- 5x gain in speed of full rack integration
- Low latency, high speed 50-100G networking per server brick to take advantage of NVMe bandwidth
- Standard server form factors, power & connectors to seamlessly integrate all Open19 gear while allowing vendors to protect their unique internal server IP



Open19 Building Blocks for Akraino Unicycle POD

Brick Cage



- Cages come in 8U & 12U form factors supporting between 16 & 24 bricks.
- Snap-on power cables provide 250-400w per brick
- Snap-on data cables provide 50-100G per brick

Network Switch

- Broadcom iCOS certified
- 3.2Tbps switching capacity
- Supports 48 server bricks at 50Gbps per brick with 8x100Gbps uplink ports

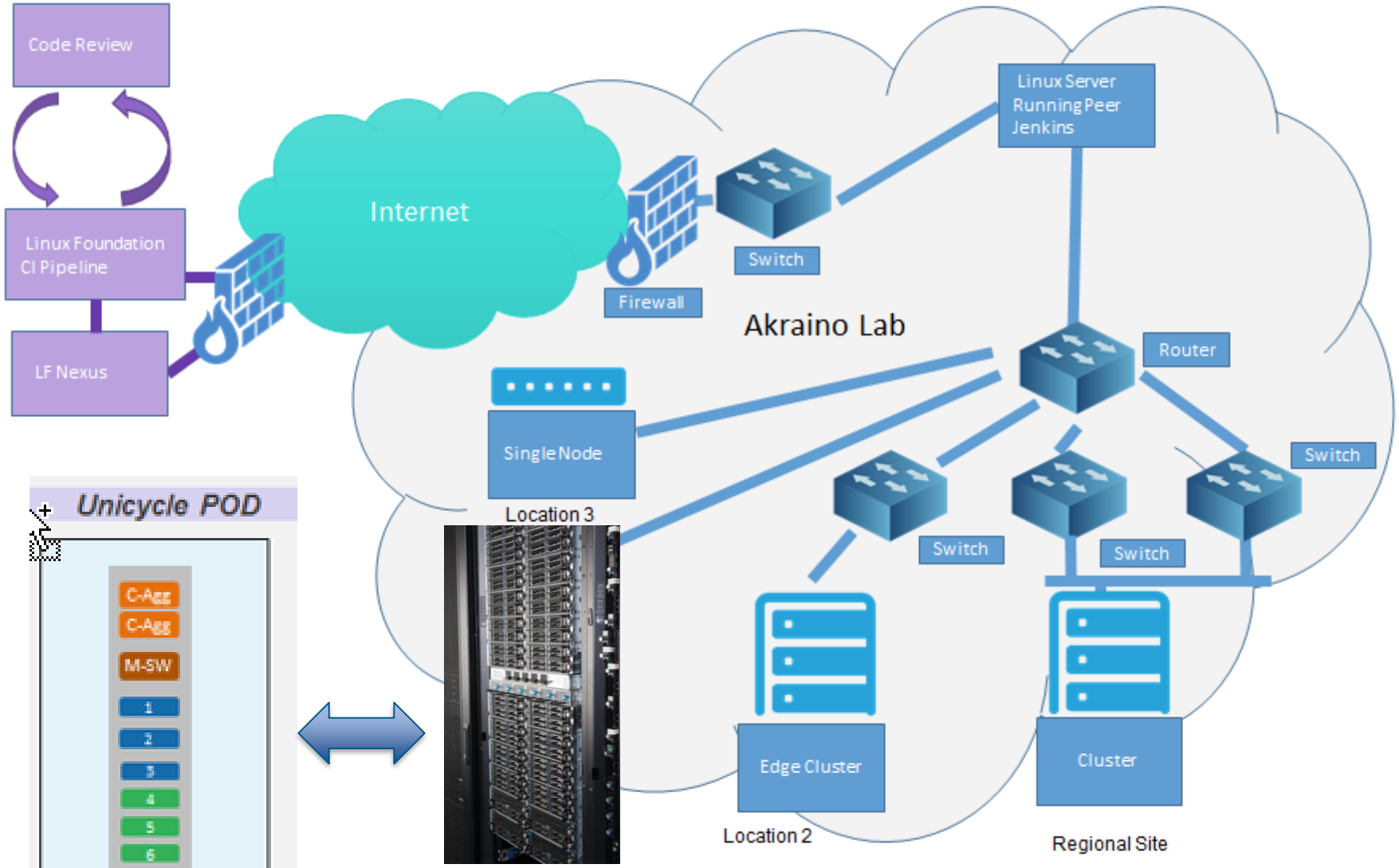
Power Shelf

- 9.6kW 1U, 19.2kW 2U
- 12v output to bricks
- 48 bricks at an average of 250W per brick
- 6 OTS power modules

Brick

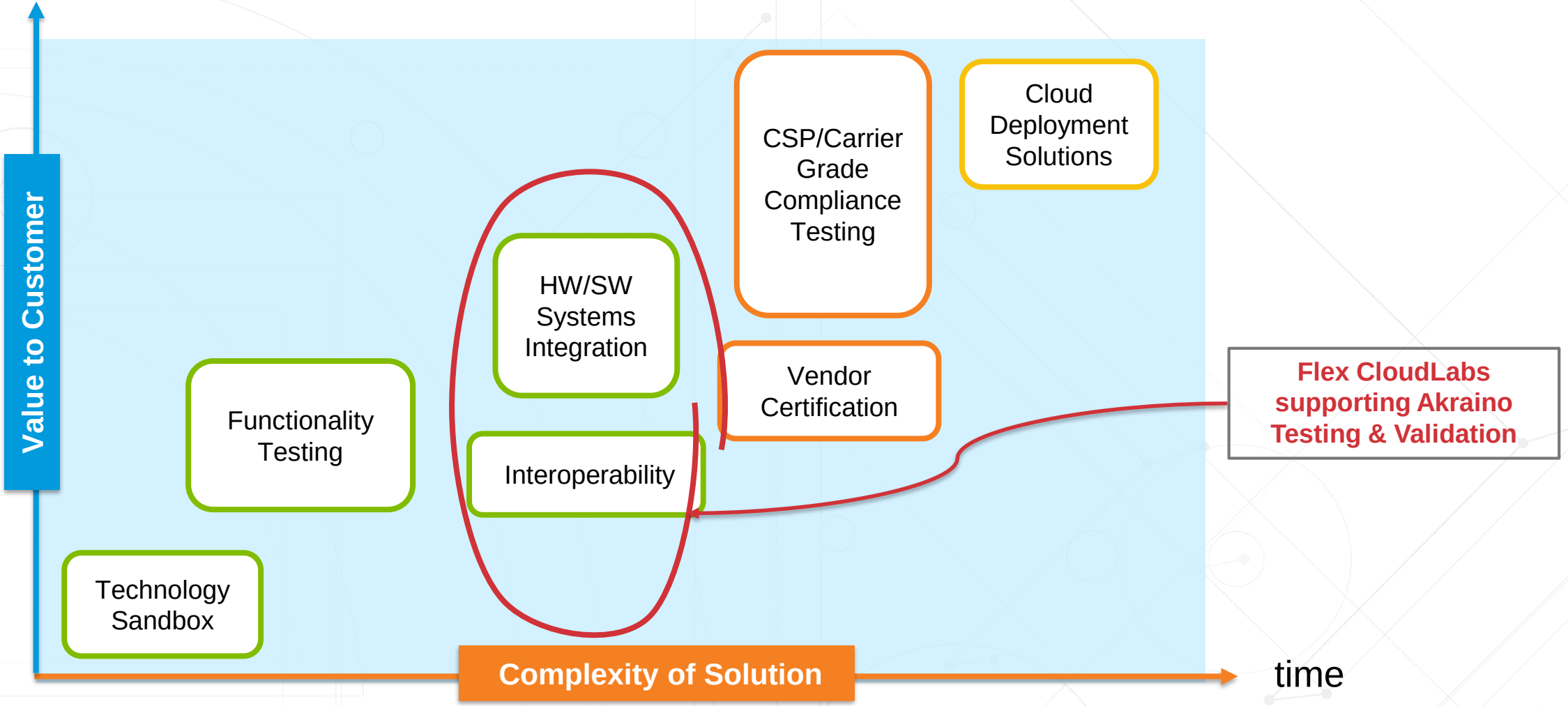
- Skylake E5 CPU
- Up to 100Gbps bw
- Up to 400W

Akraino Unicycle POD Setup@ Flex



Flex Silicon Valley Design Center

Open19+Akraino Program



Flex Akraino Community Lab on Open19

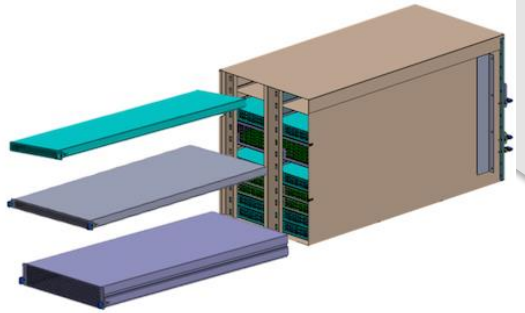
Open19 “Get Started” Option for Akraino Community Lab

Validate Akraino Reference Blueprints

Flex is working towards Customization Opportunities in collaboration with Akraino Community to meet specific requirements and use cases using Open19 reference platform

- Dual socket Skylake Server Bricks
- 3.2T ICOS certified switch Broadwell DE CPU and BMC
- 12U and 8U brick cages
- Power shelf and cables

We will make Open19™ hardware available to the Akraino community for testing and integration in Spring 2019



Open
Modular
Serviceable
Flexible
Dense
Scalable

Akraino Edge Stack on Open19 Summary

AKRAINO EDGE STACK

- Open19 Available to the Akraino community for Test and Integration
- Akraino is an Open Source High-Availability Software Stack Optimized for the Edge
- Linux Foundation Project
- AT&T is a key contributor defining reliability and performance requirements
- Promise is to deliver new levels of flexibility, scalability and reliability at the edge

flex