

# Akraino TSC F2F Meeting Material

## Network Cloud Blueprint & Project Proposals

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December 6-7, 2018



# Agenda

- Network Cloud Blueprint Proposals
  - Unicycle
  - Rover
  - SEBA
  - Serverless
- Akraino Edge Stack Feature Project
  - CHOMP

# AT&T initiated Blueprints (Akraino seed code)

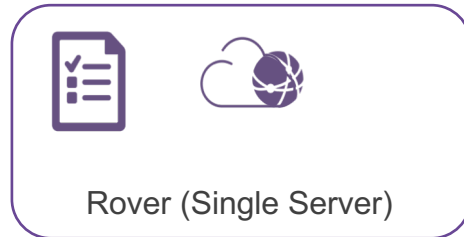
Use Case

Telecom ( 5G -Core, Voice, ...)

Blueprint Family

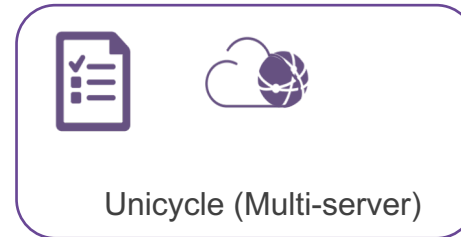
Network Cloud Blueprint

Blueprint



Rover (Single Server)











The icon for the Rover blueprint consists of a document icon with a checkmark and a list, and a cloud icon with a globe inside.



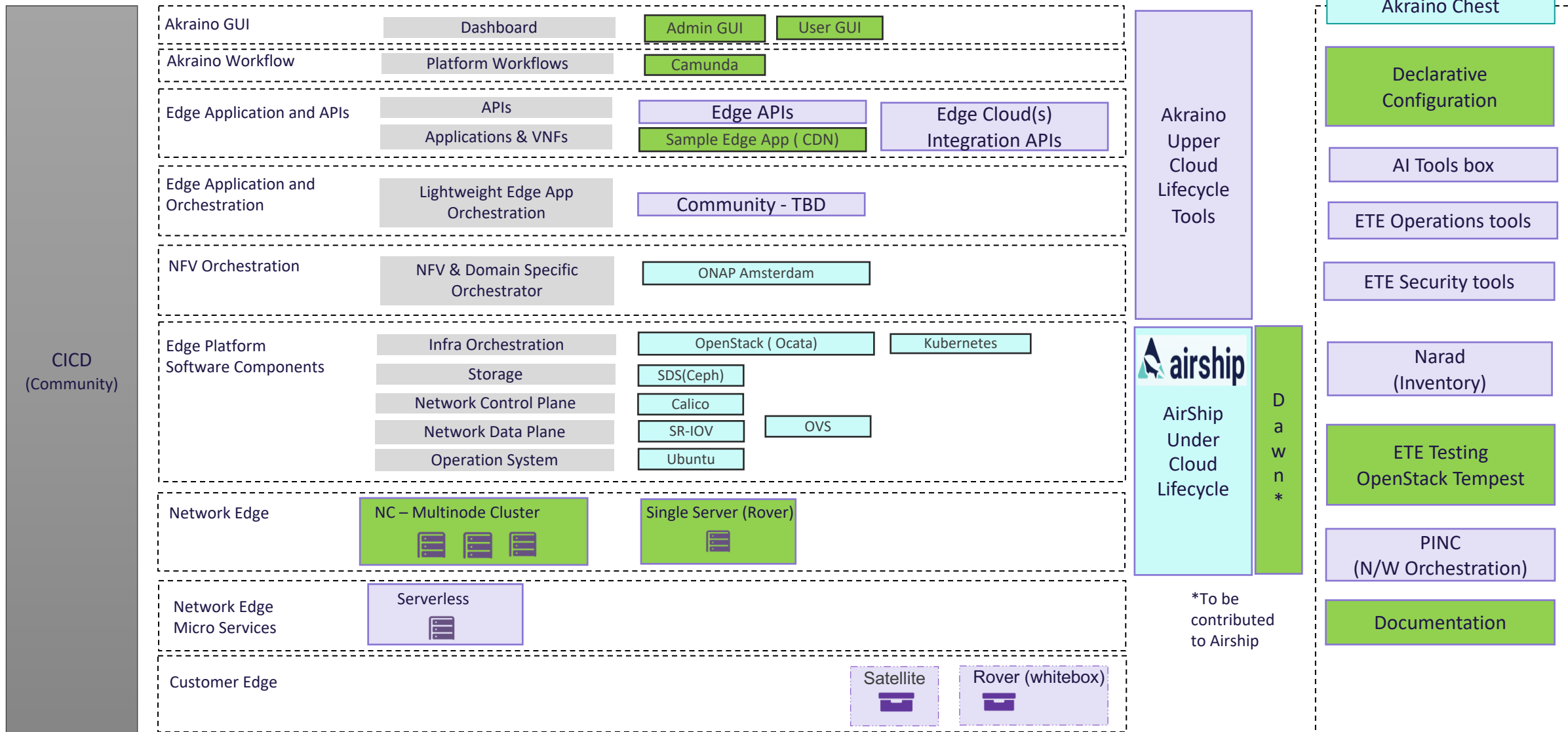
Unicycle (Multi-server)

The icon for the Unicycle blueprint consists of a document icon with a checkmark and a list, and a cloud icon with a globe inside.

# Other AT&T's Blueprint Proposals

	RI Targets				
Blueprints	 <b>SEBA</b> (In collaboration with ONF)	 <b>Serverless</b>	 <b>Real Time</b>	 <b>3rd Party Cloud</b>	 <b>Customer-premises / Far Edge</b>
	 Single Rack (NC Family)	 (NC Family)	 Multiple Servers (All Container workloads)	 3rd Party Cloud Edge Stack – <b>Standard Interfaces</b>	 All-in-one White boxes
Use Cases	vAccess (XGSPON)	Microservices	Realtime RAN , vRAN	Multiple Edge Applications	Universal CPE

# Akraino Network Cloud Blueprint (November, 2018)



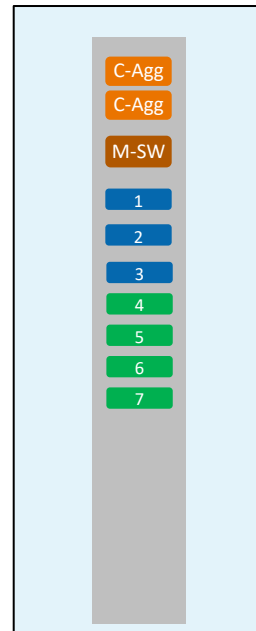
# Akraino Blueprint Proposal - Unicycle

Case Attributes	Description	Informational
Type	Seed Code (Code already in Akraino)	
Blueprint Family - Proposed Name	Network Cloud Family	
Use Case	Network Cloud – carrier edge use case	
Blueprint proposed Name	Unicycle (Single Rack)	
Initial POD Cost (capex)	Unicycle less than \$250K	
Scale & Type	Up to 7 servers X86 server	
Applications	5G Core or vRAN (RIC)	
Power Restrictions	Example Only: • Less than 10Kw	
Infrastructure orchestration	OpenStack Pike or above - VM orchestration Docker 1.13.1 or above / K8 1.10.2 or above- Container Orchestration OS - Ubuntu 16.x VNF Orchestration - ONAP Beijing Under Cloud Orchestration - Airship v1.0	
SDN	SR-IOV & OVS-DPDK	
Workload Type	VMs and Containers	
Additional Details	See next slide	

# Akraino Blueprint Proposal - Unicycle

Hosted @ Telco or Provider ( e.g., Network Cloud)

## Unicycle POD



<b>Characteristics</b>	<ul style="list-style-type: none"><li>- 1 Rack POD</li><li>- Containerized Control plane</li><li>- K8 based resiliency</li><li>- Possible - Data plane/Control Plane mixed</li></ul>
<b>Use Cases (e.g.)</b>	<ul style="list-style-type: none"><li>- IoT, Wireline (PON), Store</li><li>- Remote Edge (Analytics etc.)</li></ul>

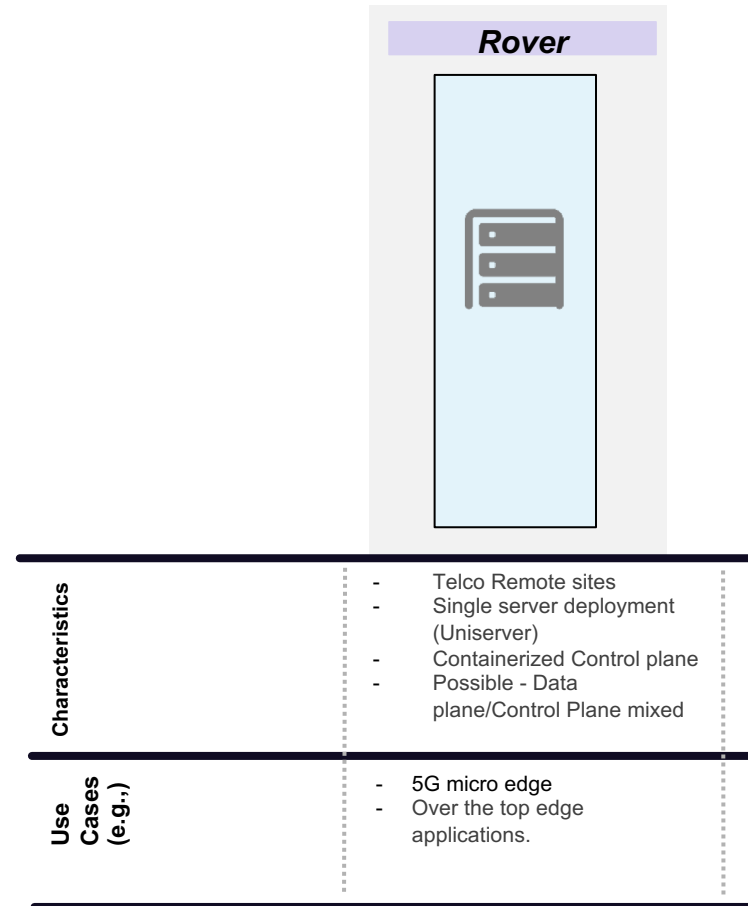
# Akraino Blueprint Proposal - Rover

Case Attributes	Description	Informational
Type	Seed Code (Code already in Akraino)	
Blueprint Family - Proposed Name	Network Cloud Family	
Use Case	Network Cloud	
Blueprint proposed Name	Rover	
Initial POD Cost (capex)	Rover less than \$20k	
Scale & Type	1 server x86/ARM server or deep edge class	
Applications	5G micro edge Over the top edge applications. Remote @ Central Offices	
Power Restrictions	Less than 10Kw	
Infrastructure orchestration	OpenStack Pike or above - VM orchestration Docker 1.13.1 or above / K8 1.10.2 or above- Container Orchestration OS - Ubuntu 16.x Under Cloud Orchestration - Airship – in a Bottle	
SDN	SR-IOV & OVS-DPDK or VPP-DPDK	
Workload Type	VMs and Containers	
Additional Details	See next slide	



# Akraino Blueprint Proposal - Rover

## Customer's Premises



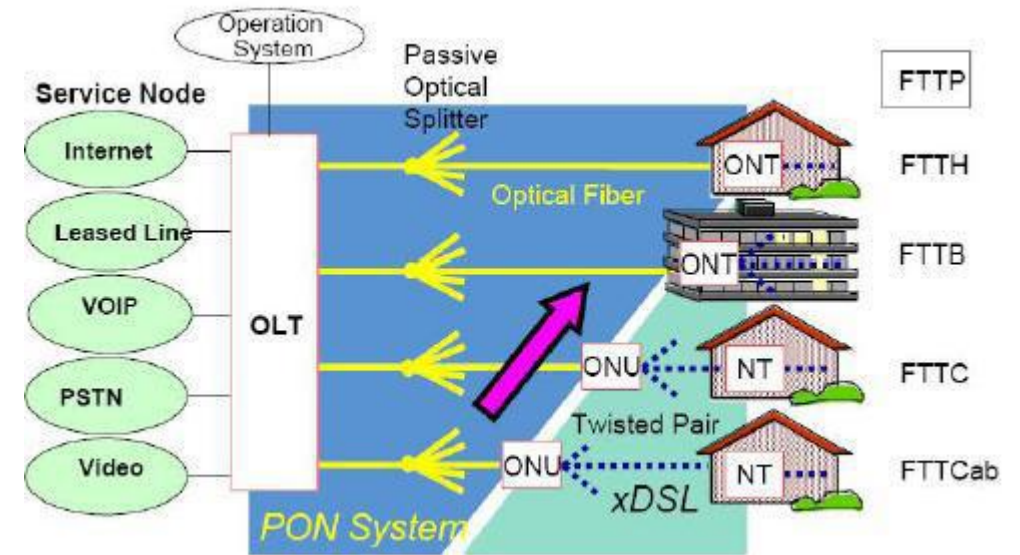
# Assessment Criteria – Data Points

Criteria	Network Cloud Blueprint
Each initial blueprint is encouraged to take on at least two Committers from different companies	AT&T, Ericsson, ARM, Intel, Juniper, Radisys, Dell, HP
Complete all templates outlined in this document	Detailed in this slide
A lab with exact configuration required by the blueprint to connect with Akraino CI and demonstrate CD. User should demonstrate either an existing lab or the funding and commitment to build the needed configuration.	Validation Lab hosted by AT&T <a href="https://wiki.akraino.org/pages/viewpage.action?pageId=1147237">https://wiki.akraino.org/pages/viewpage.action?pageId=1147237</a>
Blueprint is aligned with the Akraino Edge Stack Charter	All Opensource, Edge use case, Aligned with the Akraino Charter
Blueprint code that will be developed and used with Akraino repository should use only Open Source software components either from upstream or Akraino projects.	Yes, all Opensource
For new blueprints submission, the submitter should review existing blueprints and ensure it is not a duplicate blueprint and explain how the submission differs. The functional fit of an existing blueprint for a use case does not prevent an additional blueprint being submitted.	Multiple blueprints under this NC family to support Telco use cases

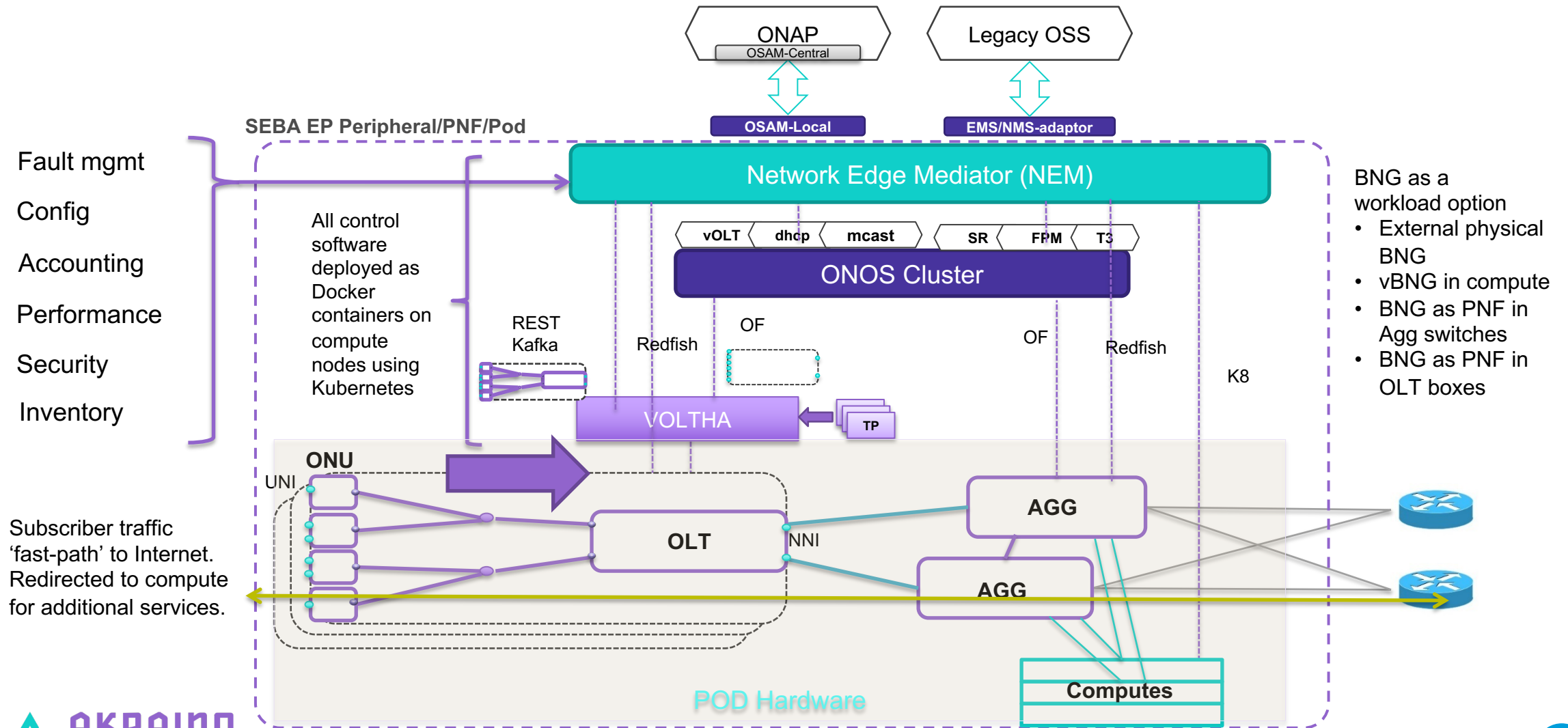
Criteria	NC Blueprint
Name of the project is appropriate (no trademark issues etc.); Proposed repository name is all lower-case without any special characters	NC Unicycle and Rover
Project contact name, company and email are defined and documented	Kandan Kathirvel, AT&T <a href="mailto:kk0563@att.com">kk0563@att.com</a>
Description of the project goal and its purpose are defined	Multiple blueprints under this NC family to support Telco use cases
Scope and project plan are well defined	Targeted for release 1
Resources committed and available	There is a team, resources and lab in place
Contributors identified	AT&T, Ericsson, ARM, Intel, Juniper, Radisys, Dell, HP
Initial list of committers identified (elected/proposed by initial contributors)	AT&T, Dell, HP, Ericsson, ARM, Juniper
Meets Akraino TSC Policies	The Project will operate in a transparent, open, collaborative, and ethical manner at all times
Proposal has been socialized with potentially interested or affected projects and/or parties	Proposal has been reviewed by the TSC
Cross Project Dependencies (XPDs). In the case where a project will require changes in other projects, those projects are listed in the proposal, and a sponsoring developer in the project has been identified	Airship, OpenStack, K8, Docker, OS
Tools have been identified and discussed with relevant partners (Linux Foundation, IT). Once the project passes the review, the tools chain must be created within one week. Tools encompass Configuration Management, CI/CD, Code Review, Testing, Team Wiki, End Users documentation (not exhaustive)	Initial Code already exist in the Akraino CI

# SEBA POD Overview

- › Deployment model is self contained, pre-integrated solution
  - › Scale to 1000s of central office locations
  - › Lowest Cost Solution Required
- › Current SEBA POD contains network elements, compute nodes, and software components
  - › Aggregation and management switches
  - › Three compute nodes required for K8 redundancy
  - › About twenty containers running VOLTHA, ONOS, NEM, etc
  - › Supports up to 16 OLT
  - › **All container based**



# SEBA Logical View



# SEBA – Key Software Components

- **VOLTHA**

- The Virtual OLT Hardware Abstraction provides an abstraction for the PON by modeling it as an quasi-Ethernet switch with UNI and NNI ports, to the SDN controller, while hiding internal details about the OLT and ONUs.

- **NEM**

- The Network Edge Mediator serves as the mediation layer between the edge/access system and the service provider backend and global automation frameworks.
- XOS will continue to be a core component of NEM. NEM will have additional components to support FCAPS. A variety of operator OSS/BSS and global orchestration frameworks can be integrated northbound for specific deployment needs

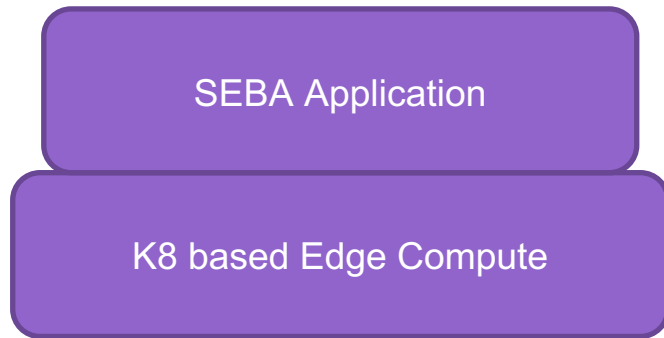
- **New Container Orchestration System - Kubernetes**

- Kubernetes is being used as the container orchestration system and through the use of Helm charts, all control components (VOLTHA, ONOS, NEM etc.) for the access system will be deployed on the compute nodes.

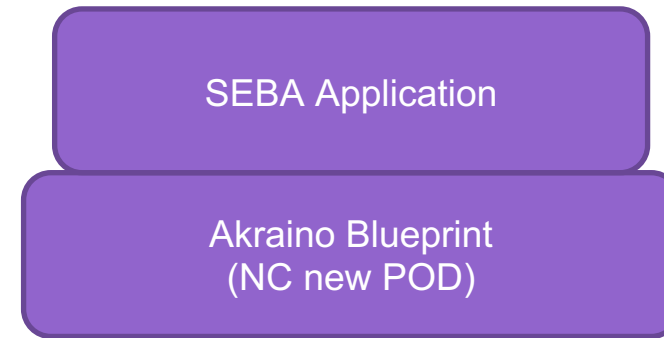
- **ONOS**

- ONOS clusters will be used to host
  - control Apps providing VOLTHA functionality such as subscriber authentication, vlan assignment, DHCP, and multicast.
  - control Apps providing AGG switch/router functionality such as vlan-termination or forwarding, multicast, failover etc.

# SEBA POD after Akraino Integration



- Monolithic design
- Manual steps involved
- Cloud layer not hardened for production

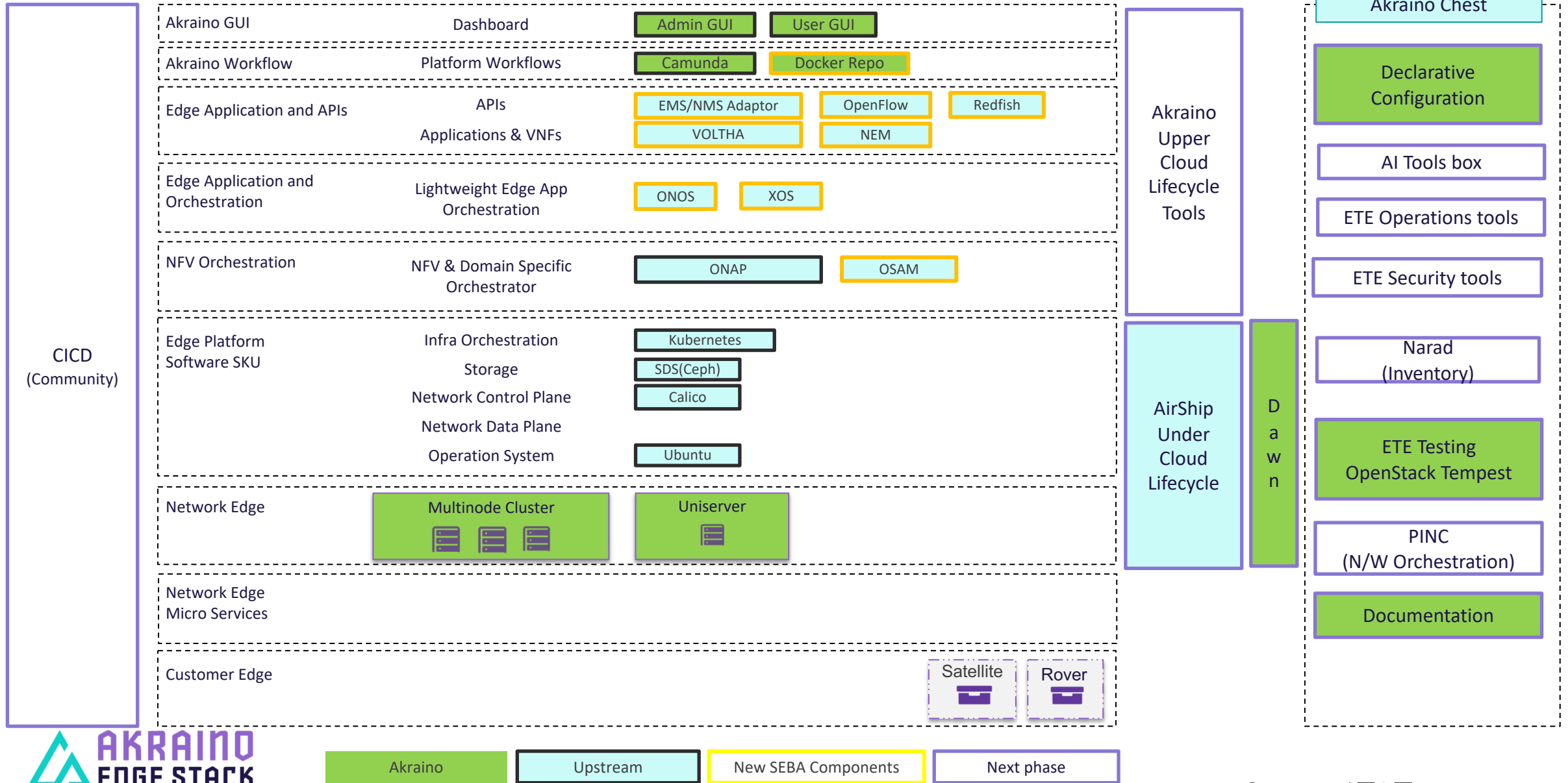


- Akraino based community blueprint
- Full Automation (Airship based + Tenant Container support)
- Cloud layer hardened for production

# Blueprint Proposal: SEBA

Case Attributes	Description	Informational
Type	New blueprint for fixed wireline access within Network Cloud Blueprint family	
Blueprint Family - Proposed Name	Network Cloud	
Use Case	Virtual broadband access (XGS-PON - Higher bandwidth, symmetric version of GPON)	
Blueprint proposed Name	SDN Enabled Broadband Access (SEBA)	
Scale & Type	3 servers per POD x86 and ARM (with 8-16 cores each)	
Applications	Virtual broadband access – vOLT access & aggregation (5000 edge locations)	
Power Restrictions	Less than 1 kW. NEBS and 48V DC	
Infrastructure orchestration	OS - Ubuntu 16.x Docker 1.13.1 or above / K8 1.10.2 or above- Container Orchestration Under Cloud Orchestration - Airship v1.0 Open Network Operating System (ONOS) and XOS VOLTHA (Virtual Optical Line Terminal Hardware Abstraction – CORD project) Network Edge Mediator (NEM) ONAP and OSAM EMS/NMS Adaptor	
SDN	ONOS OF & Redfish	
Workload Type	Containers	
Additional Details	Akraino based community blueprint, Full Automation (Airship based + Tenant Container support) Cloud layer hardened for production Current SEBA POD contains network elements, compute nodes, and software components. Aggregation and management switches Three compute nodes required for K8 redundancy About twenty containers running ONOS, XOS, VOLTHA, NEM, etc Supports up to 16 OLTs.	See next slide for additional details

# Akraino SEBA Blueprint SW Stack



Source: AT&T



# Assessment Criteria – Data Points

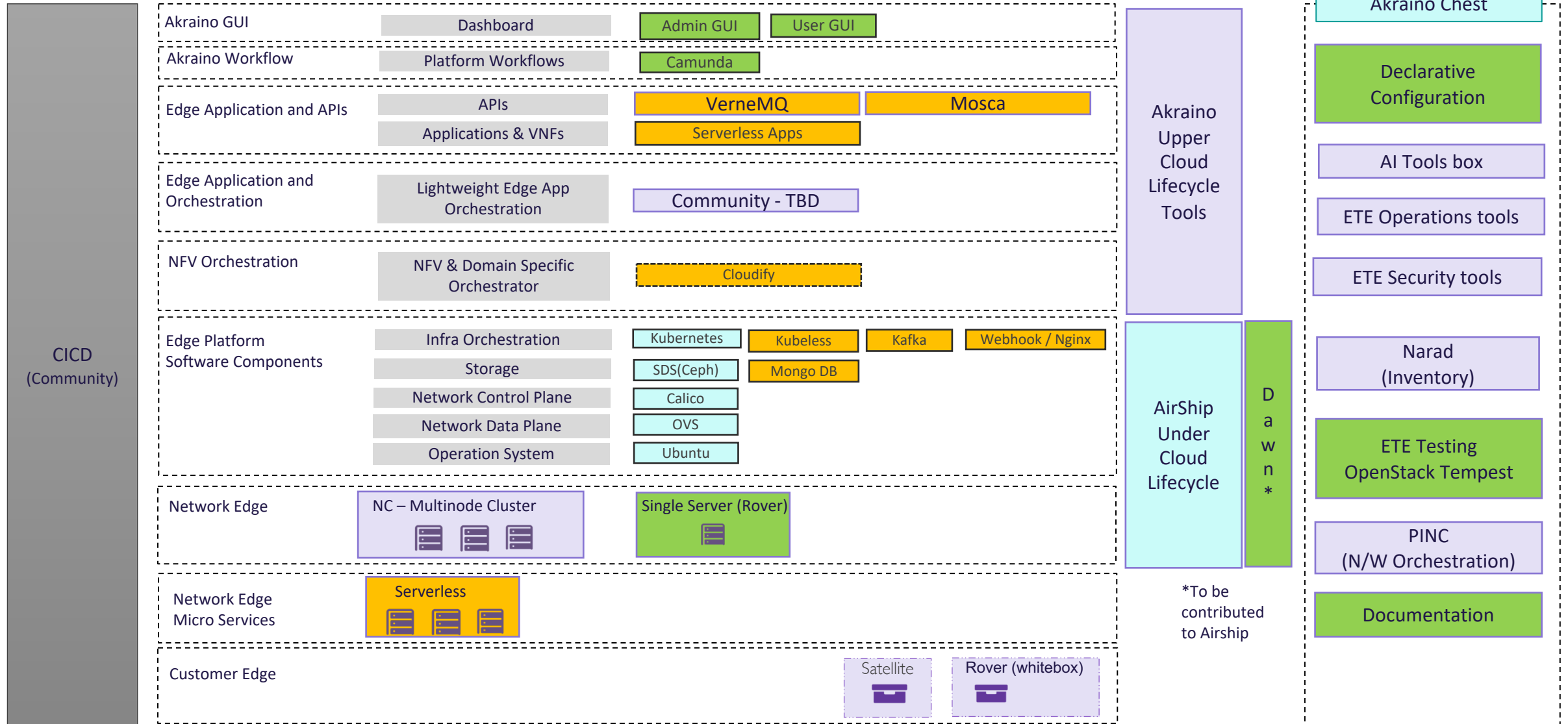
Criteria	SEBA Blueprint
Each initial blueprint is encouraged to take on at least two Committers from different companies	AT&T, ONF, Radisys, Netsia, ARM
Complete all templates outlined in this document	Detailed in this slide
A lab with exact configuration required by the blueprint to connect with Akraino CI and demonstrate CD. User should demonstrate either an existing lab or the funding and commitment to build the needed configuration.	Validation Lab hosted by AT&T <a href="https://wiki.akraino.org/pages/viewpage.action?pageId=1147237">https://wiki.akraino.org/pages/viewpage.action?pageId=1147237</a>  Plus, Community lab, once it is ready.
Blueprint is aligned with the Akraino Edge Stack Charter	All Opensource, Edge use case, Aligned with the Akraino Charter
Blueprint code that will be developed and used with Akraino repository should use only Open Source software components either from upstream or Akraino projects.	Yes, all Opensource
For new blueprints submission, the submitter should review existing blueprints and ensure it is not a duplicate blueprint and explain how the submission differs . The functional fit of an existing blueprint for a use case does not prevent an additional blueprint being submitted.	This blueprint introduces fixed wireline access based on XGS-PON (higher bandwidth, symmetric version of GPON) within the Network Cloud Blueprint family.

Criteria	SEBA Blueprint
Name of the project is appropriate (no trademark issues etc.); Proposed repository name is all lower-case without any special characters	Updated NC Unicycle (3 servers)
Project contact name, company and email are defined and documented	Kandan Kathirvel, AT&T <a href="mailto:kk0563@att.com">kk0563@att.com</a>
Description of the project goal and its purpose are defined	Multiple blueprints under this NC family to support Telco use cases
Scope and project plan are well defined	Targeted for release 1
Resources committed and available	There is a team, resources and lab in place
Contributors identified	AT&T, ONF, Radisys, Netsia, ARM
Initial list of committers identified (elected/proposed by initial contributors)	AT&T, ONF, Radisys, Netsia, ARM
Meets Akraino TSC Policies	The Project will operate in a transparent, open, collaborative, and ethical manner at all times
Proposal has been socialized with potentially interested or affected projects and/or parties	Proposal has been reviewed by the TSC
Cross Project Dependencies (XPDs). In the case where a project will require changes in other projects, those projects are listed in the proposal, and a sponsoring developer in the project has been identified	Airship, K8, Docker, OS, additional tools to be identified
Tools have been identified and discussed with relevant partners (Linux Foundation, IT). Once the project passes the review, the tools chain must be created within one week. Tools encompass Configuration Management, CI/CD, Code Review, Testing, Team Wiki, End Users documentation (not exhaustive)	New validation project need to be created

# Blueprint Proposal: Serverless

Case Attributes	Description	Informational
Type	New Blueprint for Serverless capability at the Edge	
Blueprint Family - Proposed Name	Network Cloud	
Use Case	Provide FaaS (Function as a Service) for Serverless Applications	
Blueprint proposed Name	Serverless	
Initial POD Cost (capex)	Leverage Unicycle POD - less than \$150k	
Scale & Type	Up to 7 servers x86/ARM server or deep edge class	
Applications	Ephemeral event driven transactions for IoT gateway. For example, applications for autonomous cars.	
Power Restrictions	Less than 10Kw	
Infrastructure orchestration	Kubeless Docker 1.13.1 or above and K8s 1.10.2 or above- Container Orchestration OS - Ubuntu 16.x Under Cloud Orchestration - Airship v1.0	
SDN	OVS	
Workload Type	Containers	
Additional Details	VerneMQ MQTT Gateway and/or Mosca MQTT Broker Kafka message bus and Webhook/Nginx middleware Kubeless function management engine over Kubernetes Helm chart for platform infrastructure installation integrated with Airship Regional controller based installer for Functions	See next slide for additional details

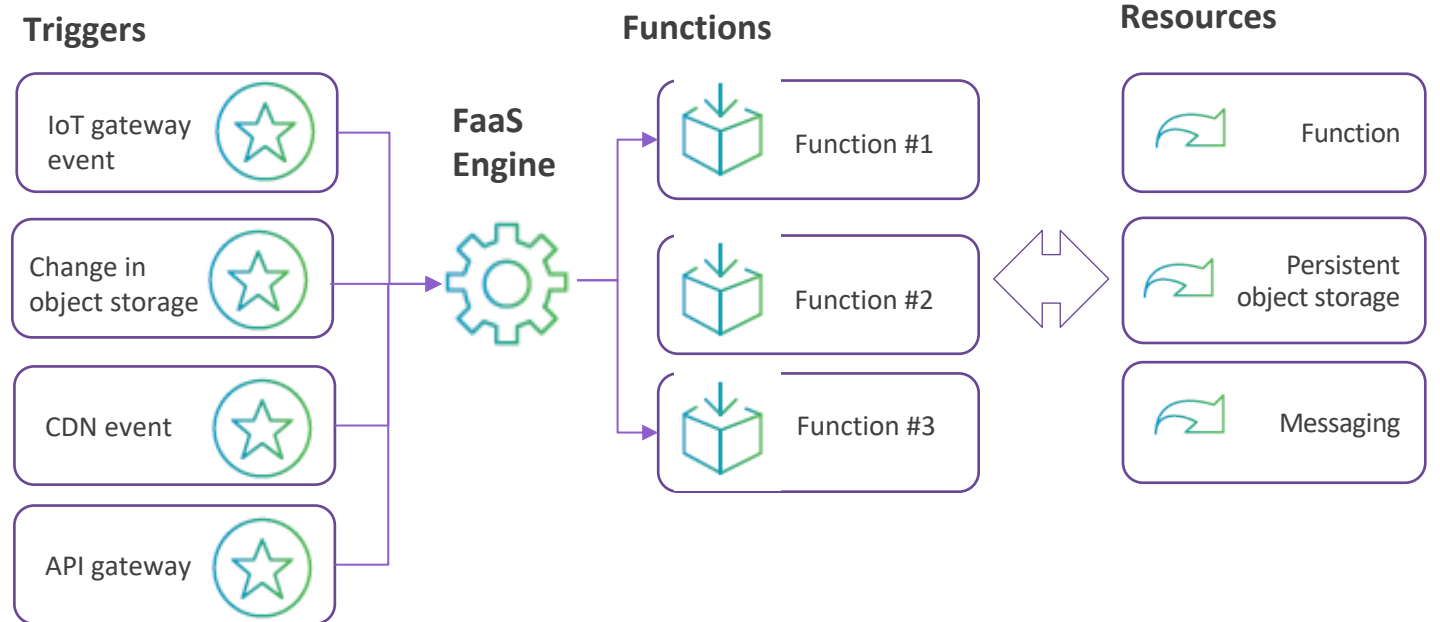
# Serverless Blueprint



\*To be contributed to Airship

# Motivation and Benefits for “Serverless” Edge

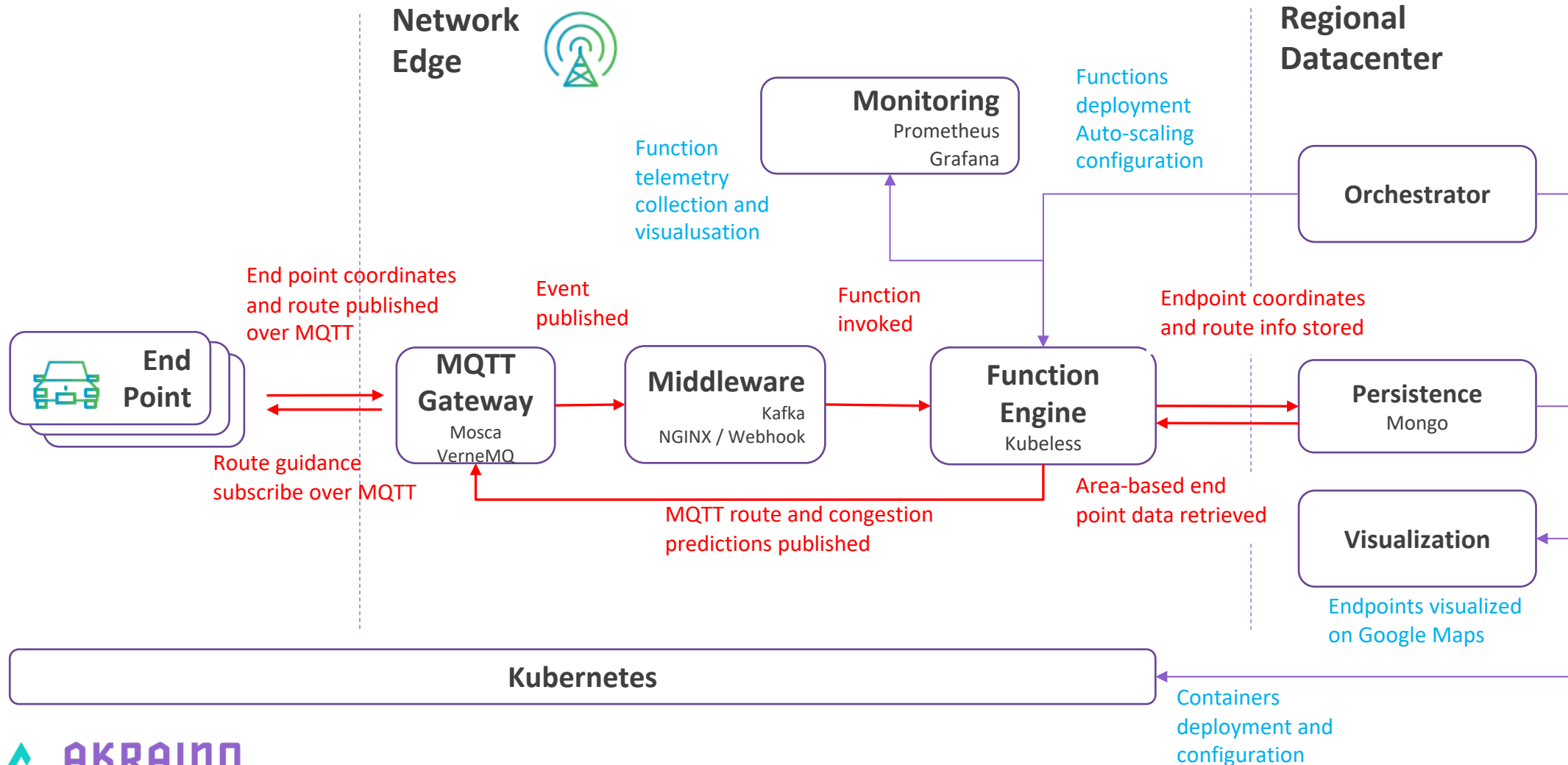
- Function-as-a-service (FAAS) or serverless architecture improves edge capacity utilization via automatic release of unused resources
- Functions accelerate development and integration cycles by high-level abstraction of application runtime
- Edge FaaS users do not have to deal with availability, capacity scaling and planning across large number of edge nodes, removing 3<sup>rd</sup> party adoption barriers for edge cloud
- Complementing Akraino with AWS Lambda-like and open-source AWS Greengrass equivalent, with focus on IoT enablement



# What Workloads Are Great Match for Serverless

	Good	Bad
<b>Workload Characteristics</b>	Transactional – “do and die”	Always on
	Stateless	Stateful
	Working with external data	
	Event-driven	
<b>Workload Examples</b>	IoT back-end	IoT gateway
	Video transcoding	Data plane element (firewall, router, switch)
	Web application services	Database
	Control plane (DNS, AAA, mobile packet core)	
	In-memory caching (memcached, live streaming)	
	Stream and file processing	

# Serverless Software Architecture - Autonomous Vehicle Use Case



# Lifecycle Management

## Configuration and Deployment

- Kubernetes YAML used to configure persistent containers: access control, back-end service discovery (e.g. MQTT gateway to Kafka or Webhook)
- The K8s containers can be deployed using Helm or external orchestrator
- Kubeless CLI/API used to deploy functions and pass deployment-specific parameters (persistent Mongo DB URL, MQTT gateway for end point communications etc.)

## Monitoring

- Kubeless supports native Kubernetes monitoring solution Prometheus, which collects key function KPIs (function invocation duration, invocation rate and success rate) per function
- Grafana visualizes the metrics collected by Prometheus data source
- Currently implemented per edge node, centralized metrics aggregation is feasible

## Scaling

- The Kubeless engine launches docker container per function
- Additional containers are added using built-in auto-scaling Kubeless function

# Serverless Blueprint Proposal Details for TSC

Criteria	Serverless Blueprint
Each initial blueprint is encouraged to take on at least two Committers from different companies	AT&T, Cloudify  Others - TBD
Complete all templates outlined in this document	Yes
A lab with exact configuration required by the blueprint to connect with Akraino CI and demonstrate CD. User should demonstrate either an existing lab or the funding and commitment to build the needed configuration.	The 'CD Environment for Akraino Network Cloud Family Seed Code' will be used. <a href="https://wiki.akraino.org/pages/viewpage.action?pageId=1147237">https://wiki.akraino.org/pages/viewpage.action?pageId=1147237</a>
Blueprint is aligned with the Akraino Edge Stack Charter	This is part of the network cloud blueprint family which is aligned with the Akraino Charter
Blueprint code that will be developed and used with Akraino repository should use only Open Source software components either from upstream or Akraino projects.	This is addressed on slide 15 where upstream components and open source components are identified
For new blueprints submission, the submitter should review existing blueprints and ensure it is not a duplicate blueprint and explain how the submission differs. The functional fit of an existing blueprint for a use case does not prevent an additional blueprint being submitted.	This blueprint introduces serverless compute capability with functions in the network cloud blueprint family

Criteria	Serverless Blueprint
Name of the project is appropriate (no trademark issues etc.); Proposed repository name is all lower-case without any special characters	Proposed projects in LF Geritt: <ul style="list-style-type: none"> <li>• edgility-mosca - the Mosca broker</li> <li>• edgility-web - the visualization component</li> <li>• edgility-generator – to run the demo for Serverless</li> </ul>
Project contact name, company and email are defined and documented	Kandan Kathirvel, AT&T <a href="mailto:kk0563@att.com">kk0563@att.com</a>
Description of the project goal and its purpose are defined	Yes
Scope and project plan are well defined	Targeted for release 1 to support microservices use cases
Resources committed and available	There is a team, resources and lab in place
Contributors identified	
Initial list of committers identified (elected/proposed by initial contributors)	AT&T, Cloudify Others - TBD
Meets Akraino TSC Policies	The Project will operate in a transparent, open, collaborative, and ethical manner at all times
Proposal has been socialized with potentially interested or affected projects and/or parties	Proposal has been reviewed by the TSC
Cross Project Dependencies (XPDs). In the case where a project will require changes in other projects, those projects are listed in the proposal, and a sponsoring developer in the project has been identified	Leverages Unicycle POD as referenced on slide 14
Tools have been identified and discussed with relevant partners (Linux Foundation, IT). Once the project passes the review, the tools chain must be created within one week. Tools encompass Configuration Management, CI/CD, Code Review, Testing, Team Wiki, End Users documentation (not exhaustive)	No additional tools will be needed from the Linux Foundation. Existing CI tools can be used.

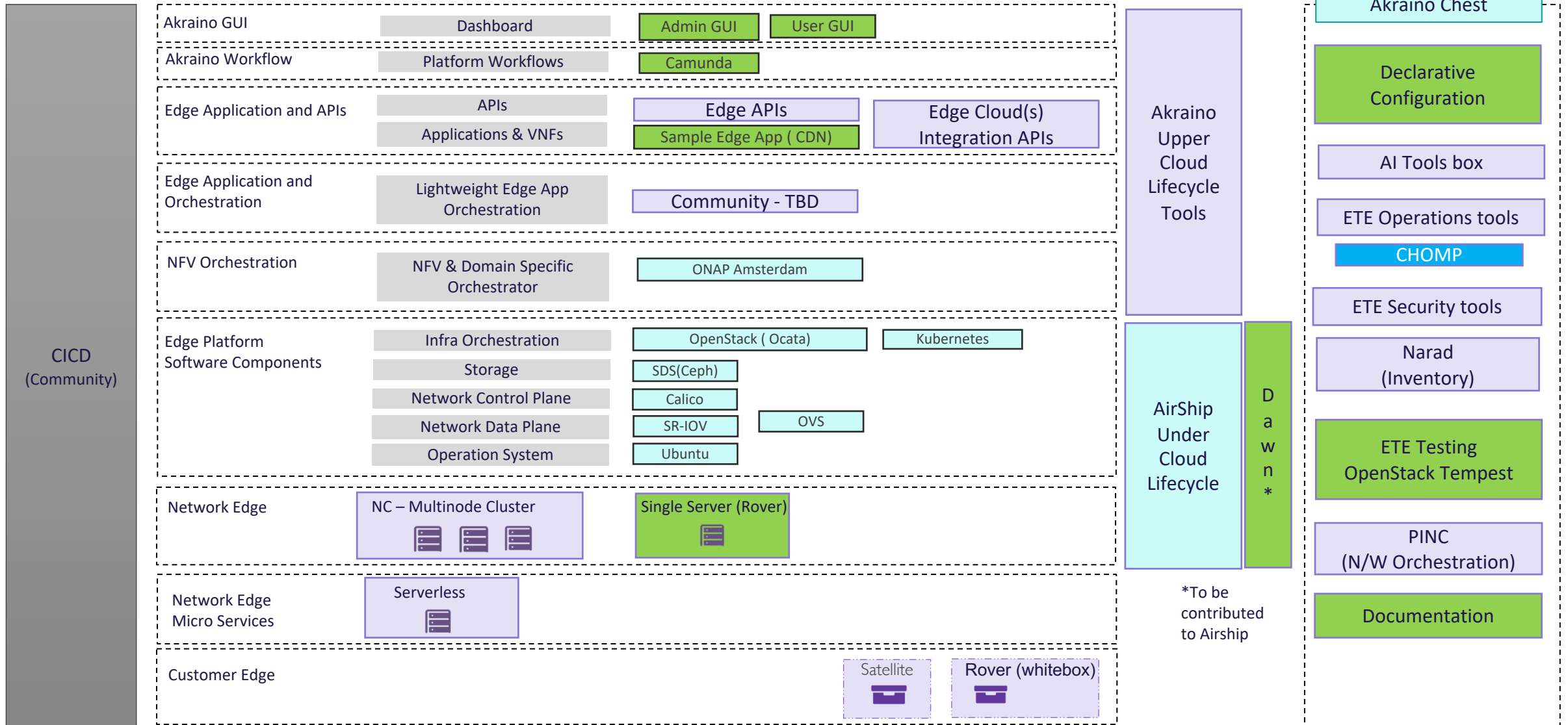




# Akraino Feature Project - CHOMP

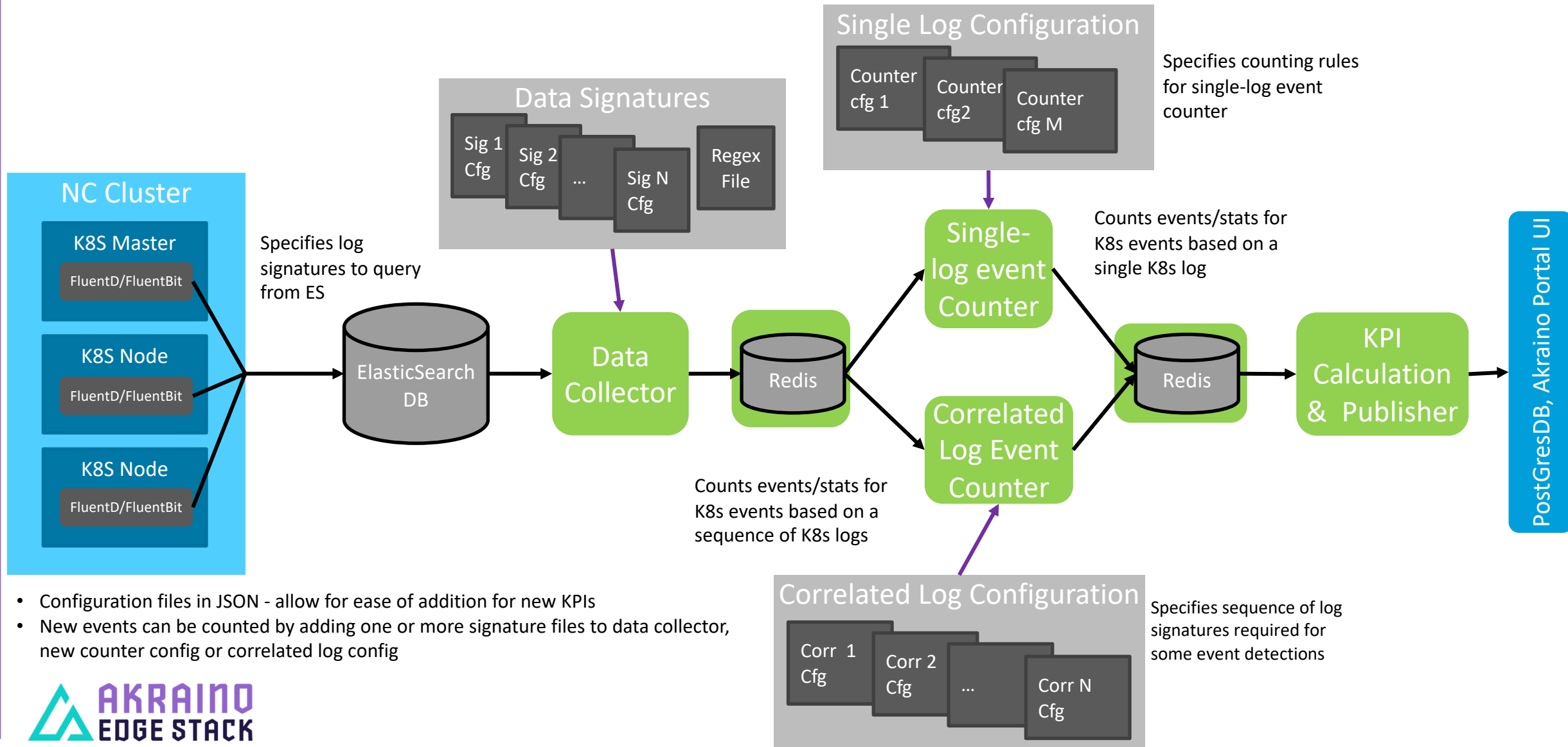
Feature	Description	Companies Participating / Committers	Requested Release / Timeline	Informational
Operational Tools Augmentation	<p>CHOMP (Cluster Health and Overload Monitoring Platform) will do log correlation for Akraino lifecycle management</p> <ol style="list-style-type: none"><li>1. Log-based metrics in CHOMP provide key visibility for operations teams beyond the existing traditional monitoring tools such as Prometheus</li><li>2. These KPIs could become the beginning of troubleshooting and root cause identification as NC becomes ready for production deployments</li><li>3. Broad categories include:<ol style="list-style-type: none"><li>a. Latencies for common Kubernetes procedures</li><li>b. Failure details - insufficient memory or computing capacity</li><li>c. Procedure details - restart backoffs, pod evictions prior to restarts</li><li>d. Kubernetes Component Availability</li></ol></li><li>4. Modular design and Configurable for easy addition of new log-based metrics as NC platform matures</li></ol>	AT&T	RI	<p>Impacted Blueprint Family - Network Cloud</p> <p>See next slide for additional details</p>

# Akraino Feature Project - CHOMP



Akraino - new    Upstream    Future release    CHOMP

# CHOMP Containerized Architecture



- Configuration files in JSON - allow for ease of addition for new KPIs
- New events can be counted by adding one or more signature files to data collector, new counter config or correlated log config

For More Information, Please  
Visit [www.akraino.org](http://www.akraino.org)

