Developer Summit
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Kandan Kathirvel

Group Product Manager, Google Cloud

TSC Chair, Nephio

Sana Tariq

Principal Technical Architect, Telus

TSC Vice-Chair, Nephio

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Goals of this Development summit - II

Discover Nephio

- Overview of Nephio, concepts and objectives for newcomers

Plan for R1

- Focused community discussion to make progress towards R1

Build a Community

- TSC get together: Plan for R1 and beyond

Telco challenges to Cloud native evolution

Telecom under several transitions

VNF to CNF

Private to Public Cloud

Centralized to highly distributed network

Telecom in need of transformation

Zero-touch automation with human-free control-loop

Reduce Opex and optimize scarce edge resources

Addressing limitations of legacy out-of-band network automation

Lack of right technology: Challenges

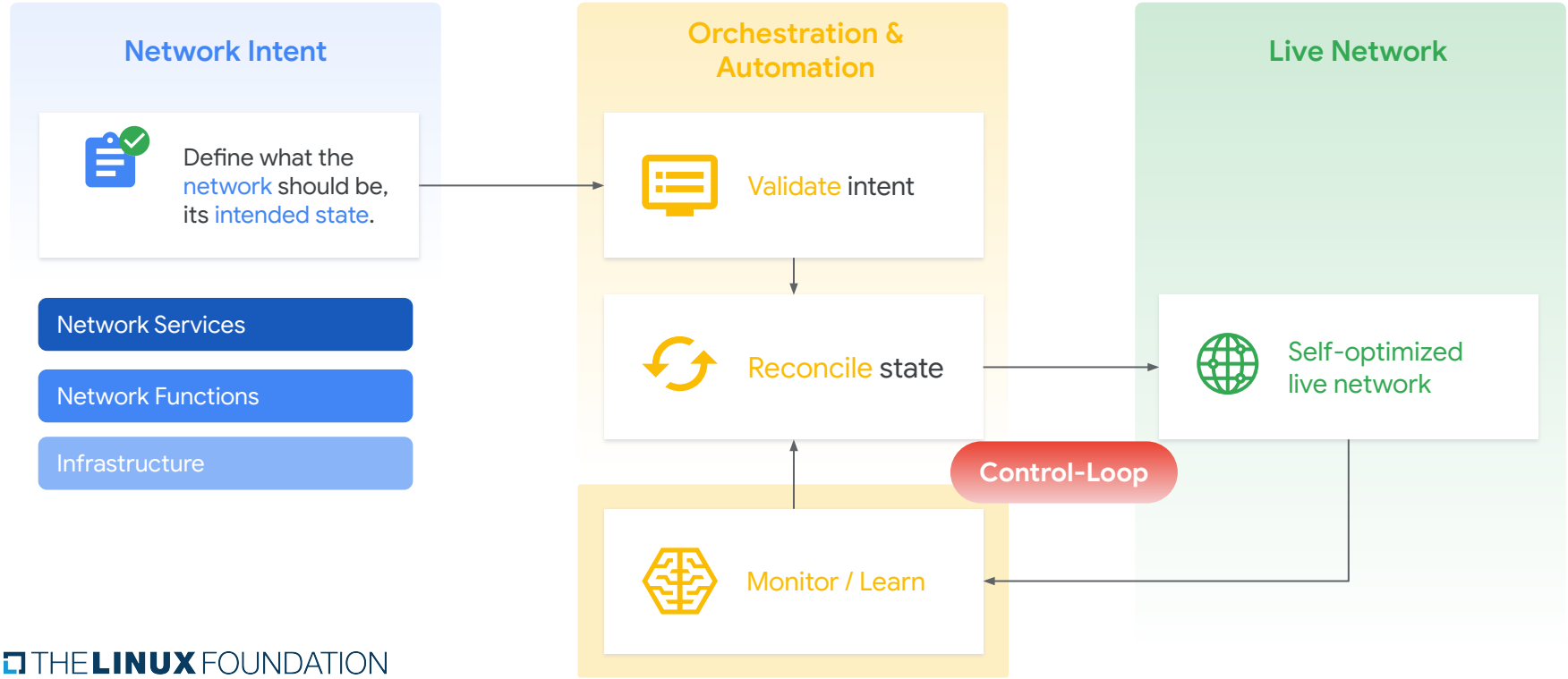
Kubernetes is not enhanced enough to support Network Function automation:

- **Kubernetes only manages basic compute/network/storage whereas NFs have demands beyond standard Kubernetes** such as existing Pod extensions: Multus, SR-IOV support, DPDK, etc.
- In addition NFs and cloud-infra have more complex lifecycle management requirements.
- **Enterprises rely on Kubernetes based automation for workload but Telcos rely on traditional management functions** (e.g NFVO) outside of Kubernetes to manage workloads, which is not optimal for workload reconciliation.

Infrastructure-as-Code falls short at many ends:

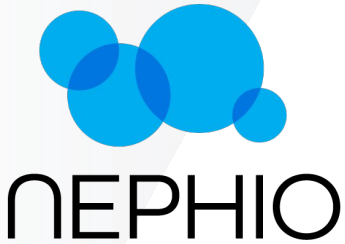
- The existing automation to deploy network functions on top of K8s mostly uses **Infrastructure-as-Code (e.g Helm), which has many limitations**, e.g.
  - Complex templates
  - Difficult to read and test
  - Limited re-use, end up with huge lists of values that need setting
  - Not composeable - cannot handle complex sets of applications built from reusable components
  - **Non-declarative and lacking vendor neutral templates**

Nephio: An intent driven network architecture



Towards the Autonomous Network: Cloud Native Automation

Cloud Native Network automation along with Cloud Infrastructure will be a fundamental building block to achieve the 5G network vision.



Three aspects for optimizing automation

Declarative configuration

Simplified configuration to user e.g. Deploy 5G UPF with X capacity at Y location and do Z when this event occurs

Intent-based automation

To address day 0, 1 and 2 configurations, rainy day scenarios, intelligent auto scaling control-loops, and full life-cycle support

Simplified Cloud -Native automation

Simplified and consistent cloud-native management (Kubernetes) in every tier

Extend base Kubernetes with Infrastructure CRDs and Operators

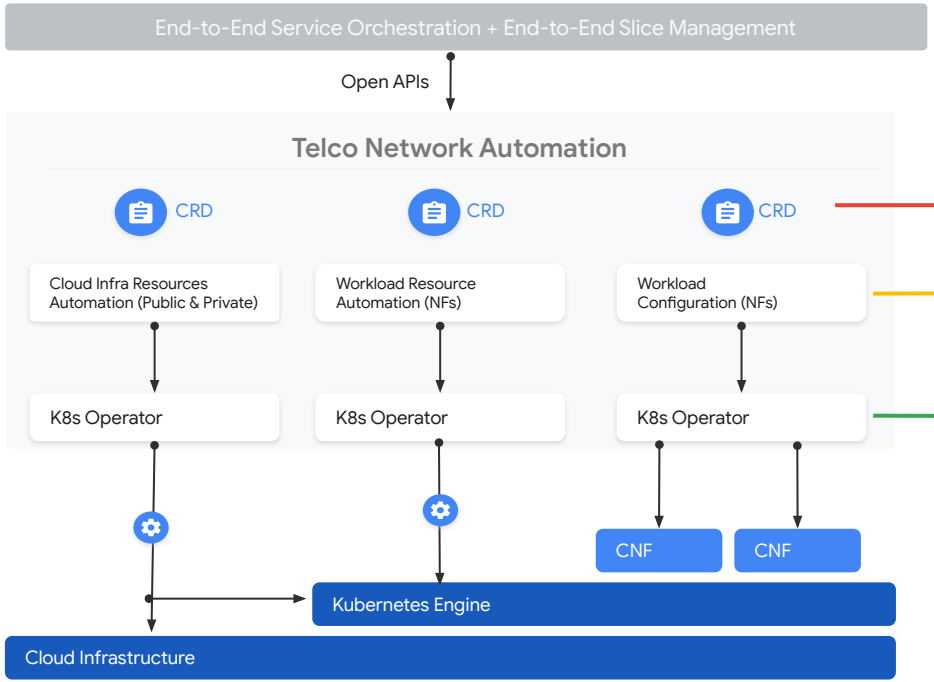
- Declarative expression of ALL infrastructure requirements for NFs
- Beyond the Pod, to Node
- Beyond the Node, to ToR

Deploy a function anywhere

- No out-of-band infrastructure configuration

Nephio Architecture

Infrastructure and Network Function Configuration



Applying Kubernetes Resource Model principles

K8S Customer Resource Definitions (CRD) driven API

Configuration blueprints for network functions (multiple vendors/multiple domains) and corresponding infrastructure

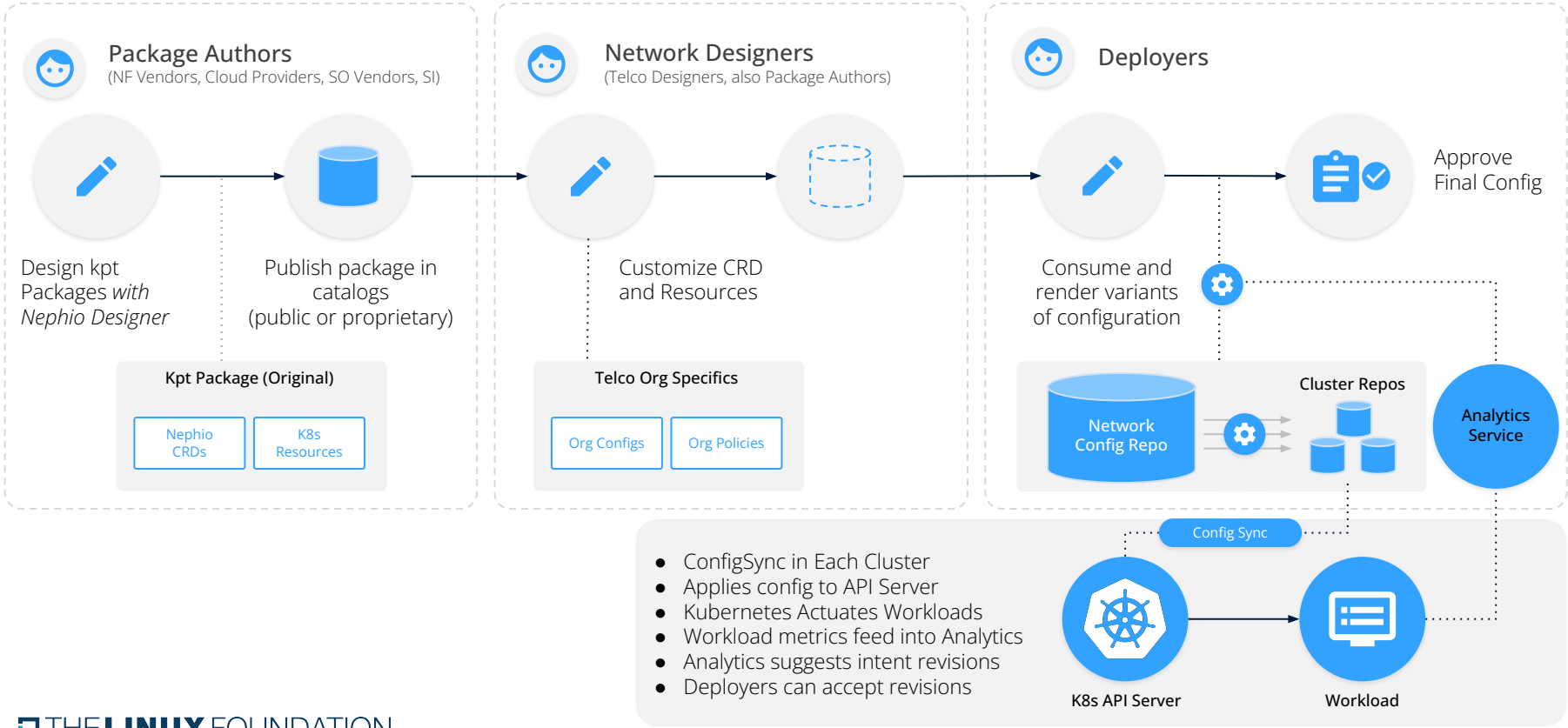
Operator implementation translating intent to actual configuration, continuous observation and reconciliation on deviations

This unified approach allows for the use of CI/CD principles and common tooling across all layers.

CRDs & Operators: Principles

1. CRD needs to be open - Community baseline
2. Vendor extension to the CRDs should be pluggable to Nephio framework
3. Community to establish a set of baseline requirements for pluggable CRD and Operators configurations within the Nephio framework
4. As community progress, community to establish a compliance certification for the CRDs/Operators to encourage openness

Nephio End-to-End Journey



Nephio: Progress report

Journey started here

Launched on April 22nd, 2022

Make Cloud-Native automation as a reality:

- 25+ founding members
- Seed code from Google
- Linux Foundation community
- Foster Kubernetes benefits

Today

Fully established community

Broader participation from Telco, Vendors and Cloud Providers:

- 70+ participating members, and growing
- TSC and SIGs fully established and operational
- 100+ developers & architects actively participating
- Release 1 targeted in 1H2023

NEPHIO

Make automation **faster, simpler, easier,** and work towards **achieving agility** and **optimization** in cloud based deployments

Roadmap towards Release 1

April
Nephio Launch

June
Dev Summit

June
Google seed Code 1

Sep
Community established

Oct
R1 Scope Finalized

Nov
R1 Stories Completed

Nov
Dev Summit 2

Dec/Jan
Google seed code 2

Feb
MWC'23 PR

April
R1 dev complete

May
Nephio R1 Release

May
Development R2+

Q2 · Q3 · Q4 · Q1 · Q2

2022 · 2023

Nephio Release 1

R1

Scope & Goals

Deliver K8/KRM-based automation for Infra & NF deployment

NF configuration (free5GC to start with)

Model NF to Infrastructure dependencies

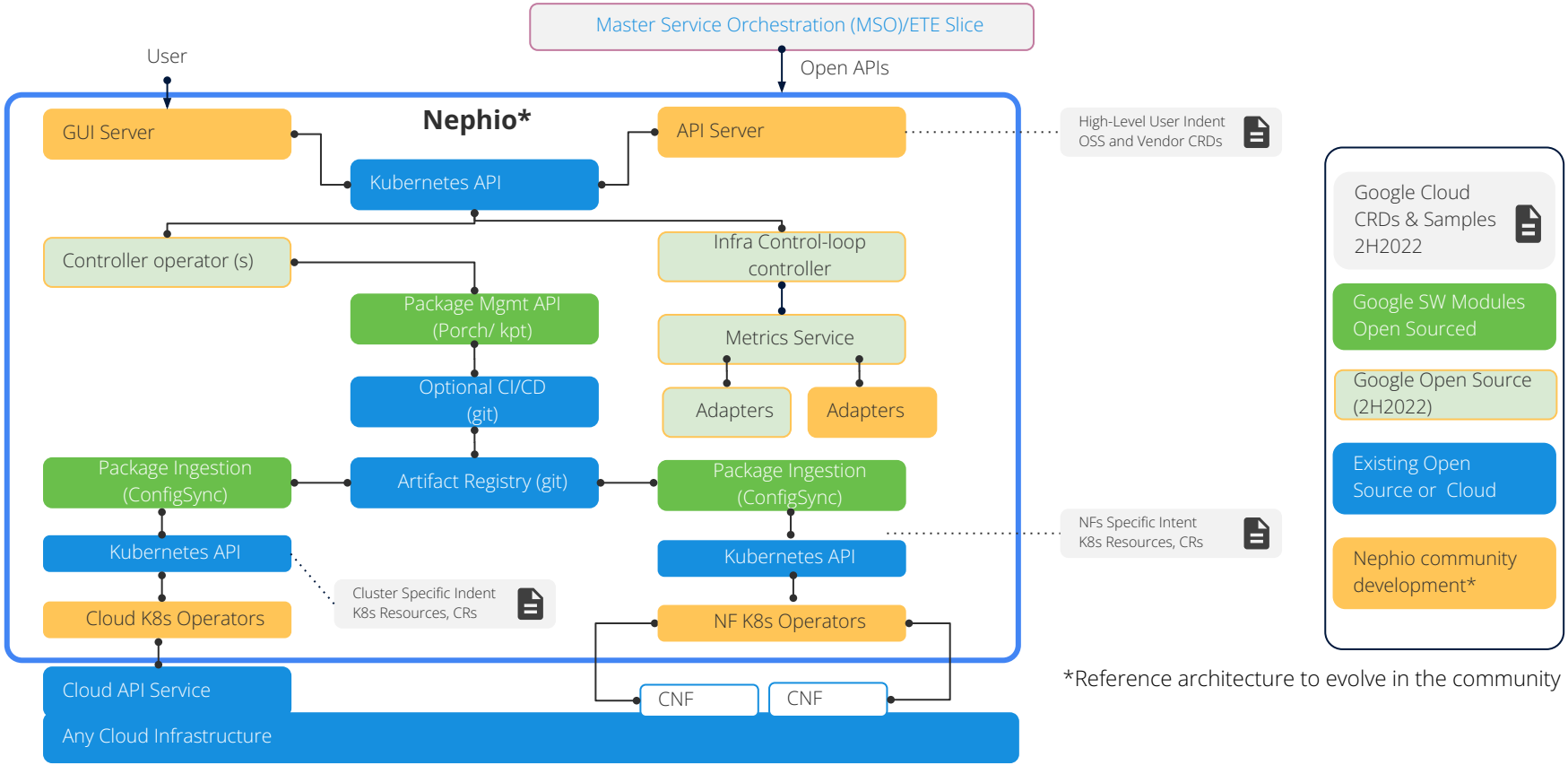
Building Blocks

- Kubernetes based control-plane
- CRD schema
- Operators of Operators interworking
- CRD & Operators for Cloud-infrastructure deployment
- CRD & Operators for open network functions
- Automation of end-to-end deployment
- Test suite

Success Criteria

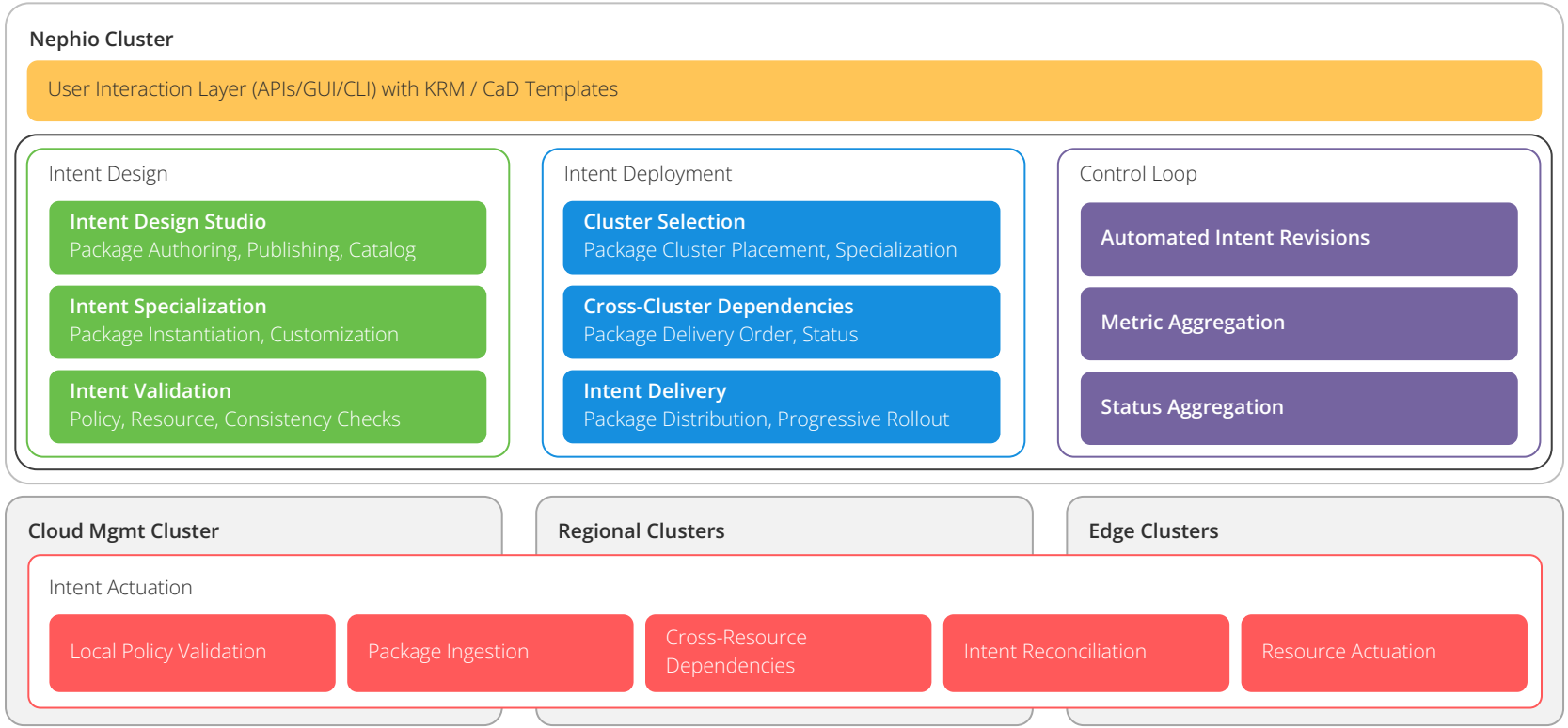
- Establish the Nephio framework
- Enables the community and industry to use K8 based Cloud-native automation of Telco infrastructure and workloads
- Instantiate the Free5GC as a sample NF with the full configuration

Google's software contribution view from 1st Dev summit



*Reference architecture to evolve in the community

Nephio Functional Building blocks



KRM - Kubernetes Resource model
CaD - Configuration as Data

Google and community contributions to Nephio

Google contributions

H1-2022

- Porch
- Configsync
- Free5GC CRD
- Contribution to v0.1 code (used in this workshop)

H2-2022

- NF deploy CRDs (to deploy Free5GC NFs)
- Selective Google Cloud Infrastructure deploy CRDs and Operators
- NF deploy Operator: K8s operators for deploy NFs

Community towards R1

In Progress

- CRD schema
- Operators interworking
- CRD & Operators for Cloud-infrastructure deployment
- CRD & Operators for Free5GC network functions
- Automation of end-to-end deployment
- Test suite

Looking beyond R1

User Stories

- Multi-cloud
- Multi-NF
- Multiple use cases i.e Beyond Mobility; Wireline, Transport, SD-WAN, etc.,
- Large scale deployments

CRD/Operators

- Establish CRD schema
- Operators SDK
- Helm & Yang to Nephio CRD converter
- Compliance and certification program

Control-Plane

- SDK for building Operators
- Operators of operators
- UI: GUI & APIs
- UI: Design Studio
- Integration APIs to MSO, Inventory systems, BSS

Proposals to scale

Establish the board at the end of 1st year. April 2023

SIG 1: Network Architecture

Specifications and Requirements

SIG 2: Automation Machinery

CRDs, Operators, and Related Tooling,Reference Implementation, Packaging, Installation

SIG 3: Release

CI/CD, Test Grids, Builds, Release Machinery, Project Administration

\+ **SIG 1 to plan for additional use cases**

\+ **New projects**

Speed up the community innovation and support new sub-groups/projects under SIG 2 to develop backlog

Establish Board in 2023

- Google sponsored funding until April 2023
- Community based funding and board from May 2023
- LF to coordinate with the process
- Form a Sub-committee with TSC members to help with the LF process
- Community decision scope of work and the membership fee
- Establish the process document by Feb
- Members recruitment from April 2023

TSC Proposals to add new projects

- TSC to establish and augment the process to accept new sub-projects focused in delivery Nephio v1 ++
- Any community members can bring in projects
- TSC to vote and direct the project either to SIG 1 or SIG 2 or SIG 3 depending on the nature of the project
- Governance provided by the main SIG
- Sub-SIG operates

Nephio:
Let’s join hands to make Cloud Native Automation vision a reality

CSPs

Commitment in changing to Cloud native networks

Cloud Providers

Commitment to support open standards

NF vendors

Commitment to support Cloud native NF and open standards

Cloud-native automation and Nephio operator survey by Analysys Mason

https://docs.google.com/forms/d/1KX2Rn_OnMGprBwobYH-wuMJc1Y8xVeoAIlKys4iwlPs/edit

If you are Telecom Operator, Please take this survey.

Survey results will be shared via a study in combination with Analysys Mason - around MWC

Q&A

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Thank you!
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