



# Nephio Kickoff Meeting

May 17, 2022

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# Meeting Information



Google Meet joining info

Video call link: <https://meet.google.com/vnk-ngqb-pvg>

Or dial: (US) +1 252-825-7051 PIN: 633 815 219#

More phone numbers: <https://tel.meet/vnk-ngqb-pvg?pin=1278385490147>

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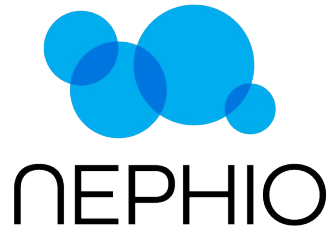
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# Agenda

- Welcome and Introductions
- Nephio Overview (30 Minutes)
- Details about in-person Nephio's TSC and Developer Summit
- Q&A

# Welcome and Introductions



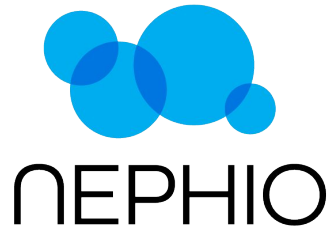
**The Linux Foundation and Google Cloud Launch Nephio to Enable and Simplify Cloud Native Automation of Telecom Network Functions**

*New Open Source Project at the LF brings Cloud, Telecom and Network functions providers together in a Kubernetes world*

**San Francisco—April 12, 2021** Today, the [Linux Foundation](https://www.linuxfoundation.org/), the nonprofit organization enabling mass innovation through open source, announced the formation of project Nephio in partnership with Google Cloud and leaders across the telecommunications industry. The Linux Foundation provides a venue for continued ecosystem, developer growth and diversity, as well as collaboration across the open source ecosystems.

[www.nephio.org](https://www.nephio.org)

- New Open Source Technical Project at the Linux Foundation
- Ecosystem aligning to simplify automation of Telecom Network Functions - the kubernetes way
- 25+ Major Service Providers, Services, Infrastructure & Network Function Vendors behind this global initiative.
- Complementary to major initiatives and projects in LF Networking, LF Edge and CNCF built on Kubernetes



**The Linux Foundation and Google Cloud Launch  
Nephio to Enable and Simplify Cloud Native  
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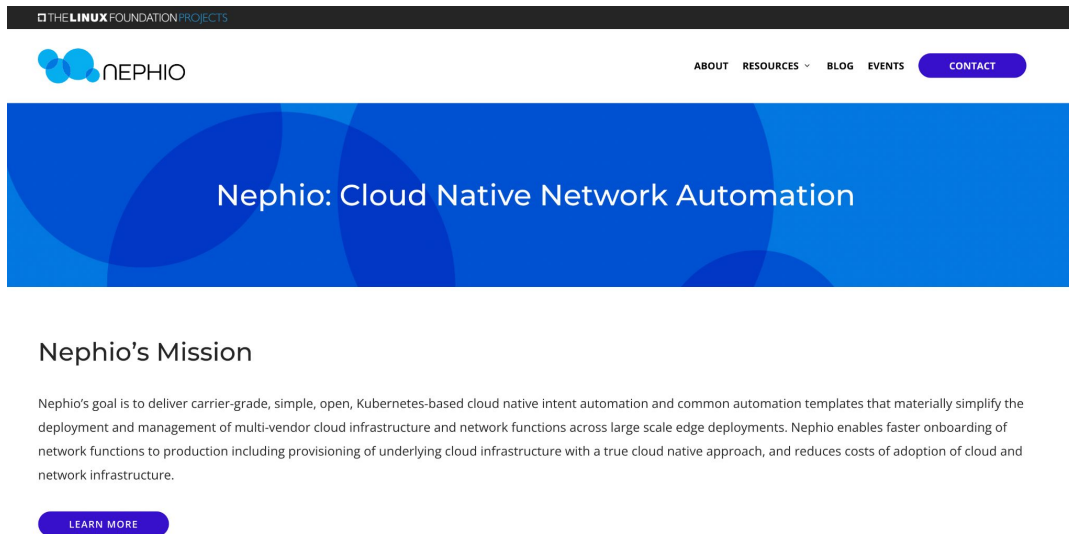
**San Francisco—April 12, 2021** Today, the [Linux Foundation](#), the nonprofit organization enabling mass innovation through open source, announced the formation of project Nephio in partnership with Google Cloud and leaders across the telecommunications industry. The Linux Foundation provides a venue for continued ecosystem, developer growth and diversity, as well as collaboration across the open source ecosystems.

**At Launch**



# Nephio Quick Status update

- Significant Interest since launch
- Over 150 asks to join dev forums
- 25+ new logos to support
- LF hosted meetings and websites being set up
- First blog published (<https://nephio.org/on-the-road-to-public-cloud-5g-networks/>)



The screenshot shows the Nephio website homepage. At the top, there is a dark navigation bar with the text "THE LINUX FOUNDATION PROJECTS" on the left and navigation links "ABOUT", "RESOURCES", "BLOG", "EVENTS", and "CONTACT" on the right. Below this is a blue header section with the Nephio logo and the text "Nephio: Cloud Native Network Automation". The main content area features the heading "Nephio's Mission" followed by a paragraph describing the project's goal: "Nephio's goal is to deliver carrier-grade, simple, open, Kubernetes-based cloud native intent automation and common automation templates that materially simplify the deployment and management of multi-vendor cloud infrastructure and network functions across large scale edge deployments. Nephio enables faster onboarding of network functions to production including provisioning of underlying cloud infrastructure with a true cloud native approach, and reduces costs of adoption of cloud and network infrastructure." At the bottom of this section is a blue button labeled "LEARN MORE".

Please join the community  
<https://nephio.org/>



# Nephio Overview

Nepho - comes from the Greek word néphos, meaning "a cloud, mass of clouds."

Nephio is reflection of word Nepho to support *Cloud Native Network Automation*

Pronounced as "**neh**-fee-ow"

# Mission Statement

Nephio's goal is to deliver carrier-grade, simple, open, Kubernetes-based cloud-native intent automation and common automation templates that materially simplify the deployment and management of multi-vendor cloud infrastructure and network functions across large scale edge deployments. Nephio enables faster onboarding of network functions to production including provisioning of underlying cloud infrastructure with a true cloud native approach, and reduces costs of adoption of cloud and network infrastructure.

## Problem: Complexity

Telcos are in need of a) Zero-touch provisioning of network; b) Lower operational costs; and c) Operational agility

Building a scalable 5G network across multiple edge locations is complex.

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

## Making it even harder for Telco:

- Transition from VNF to CNF
  - Existing automation tools are stuck in the pre-CNF era and not able to truly transition to a simplified true Cloud native automation.
- Transition to public clouds and large numbers of edge locations
  - Multiple standards/specifications exist (e.g O-RAN O2) but industry needs more work to accomplish implementation of open & vendor-neutral cloud-based automation.
- Zero-touch automation requirements with human-free control-loop
  - Industry is lacking vendor neutral cookie-cutter automation configurations (a.k.a Automation to speed the implementation of use cases.)
- Need to optimize scarce edge and constrained device edge resources
  - Smart and cloud-native automation is required with a) Intent based automation b) Active reconciliation c) Control-loop to effectively manage large scale far-edge resources.
- Addressing limitations of legacy out-of-band network automation
  - Full potential of containers & Kubernetes automation is not realized

# Lack of right technology: Challenges

## Kubernetes is not enhanced enough to support Network Function automation:

- Kubernetes enables the telecom to run network functions (NFs) as containers.
- **Kubernetes only manages basic compute/network/storage whereas NFs have demands beyond standard Kubernetes** such as existing Pod extensions: Multus, SR-IOV support, DPDK, and Node configuration: such as VLAN membership, CPU isolation, hugepages, RT kernel.
- 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 composable - cannot handle complex sets of applications built from reusable components
  - **Non-declarative and lacking vendor neutral templates**

Nephio's solution to industry problem

# Cloud Native Automation - How do we get there?

01

## Simplify the automation and its logic

- Deploy cloud infrastructure and Network Functions on top of it without out-of-band configuration management; let Kubernetes manage the configuration of Infrastructure & CNFs instead of external orchestrators.
- **Extend Kubernetes to manage all the way down to meet NF infrastructure demands from cloud infrastructure.** I.e Kubernetes not just to manage compute/network/storage but also NFs cloud infrastructure demands such as
  - Existing Pod extensions: Multus, SR-IOV support, DPDK
  - Node configuration: such as VLAN membership, CPU isolation, hugepages, RT kernel
  - ToR configuration: such as VLAN, VRF, VRF-lite configuration.
- For example, recently there are many discussions within the O-RAN community to standardize configuration CRDs but there is no industry wide initiative in open source to make it happen. Nephio is launched to address this technology gap.

02

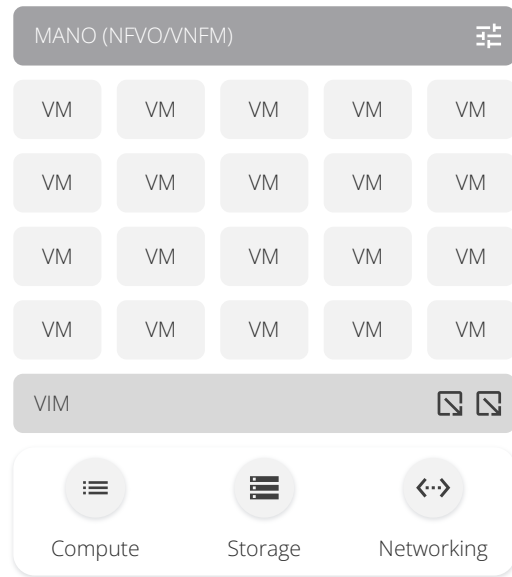
## Make the configuration machine-manageable

Enabling automation of configuration specialization, delivery, and policy enforcement by treating Configuration-as-Data and keeping it in KRM format.

- **Intent-based automation in which user express higher level intent and automation is smart enough to expand the configuration and manage the state for the user without user intervention.**
- This is possible if the configuration is declarative and machine-readable without embedded logic (no templates).
- **Reusable, composable configuration** without embedded bespoke, deployment-specific logic.
- Tools operate on configuration rather than configuration being code itself.

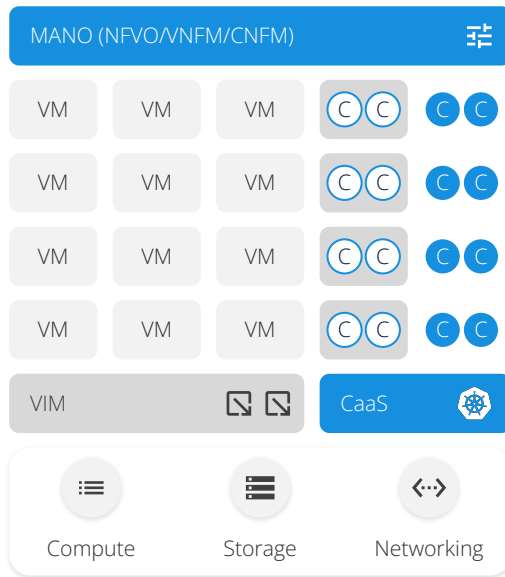
# Transition to Cloud Native Automation

## Past 4 years



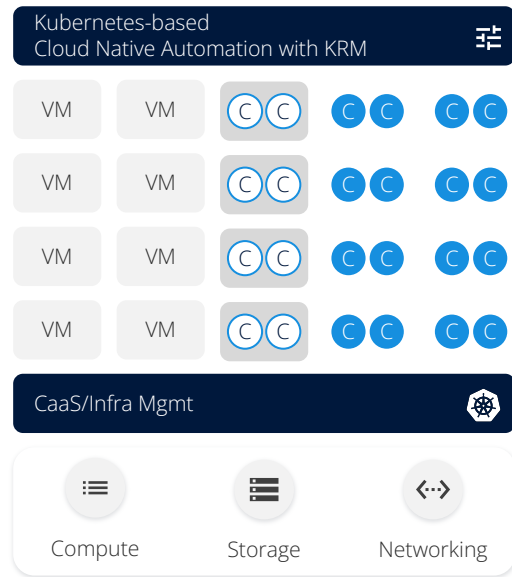
Non-Container Era

## Today



**Traditional methods:** K8s with out-of-band automation

## Nephio



**True Cloud-Native:** K8s automation all the way down to Cloud infrastructure & NFs



# Benefits of using K8s & KRM/CaD

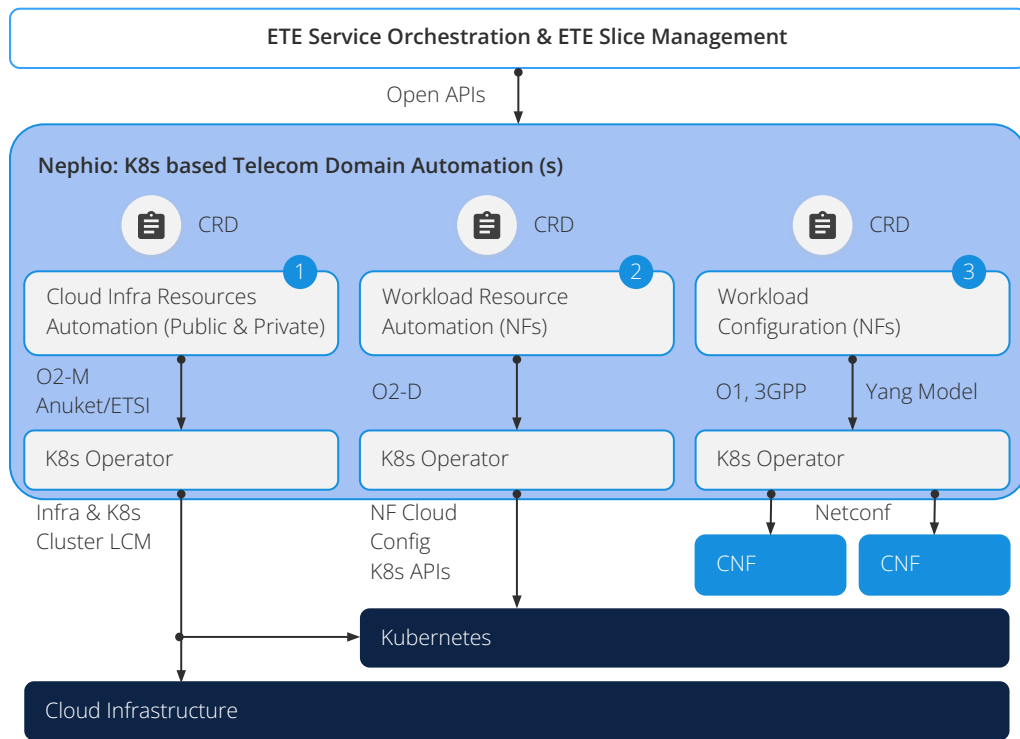
## Benefits of Kubernetes based automation

- **Kubernetes is a strong, proven framework for declarative management.** Operational team better understands the Kubernetes based automation than proprietary out-of-band automation.
- **Kubernetes has existing methodology such as CRDs to define fully declarative configuration and operators to support lifecycle of the workloads.**
- Kubernetes inherently provides a) clear declarative intent of the workload b) not fire and forget instead active reconciliation (continuously cares and manages the state) c) self-healing d) actively fixes configuration drift

## Benefits of Kubernetes Resource Model (KRM) and Configuration as Data (CaD)

- Widely adopted in the enterprise world and telecom community can largely benefit from the same principles
- Replacement for Helm, reducing the complexity with declarative intent based schema
- Reusable, well-tested functions operate on configuration rather than embedding code inside the configuration
- **Automated changes, bulk operations, and human-initiated modifications co-exist peacefully**
- Automatic system validation of configuration before CRUD operations
- Not just API-driven, but API-centric

# Different layers of configuration & existing standards & Nephio Focus



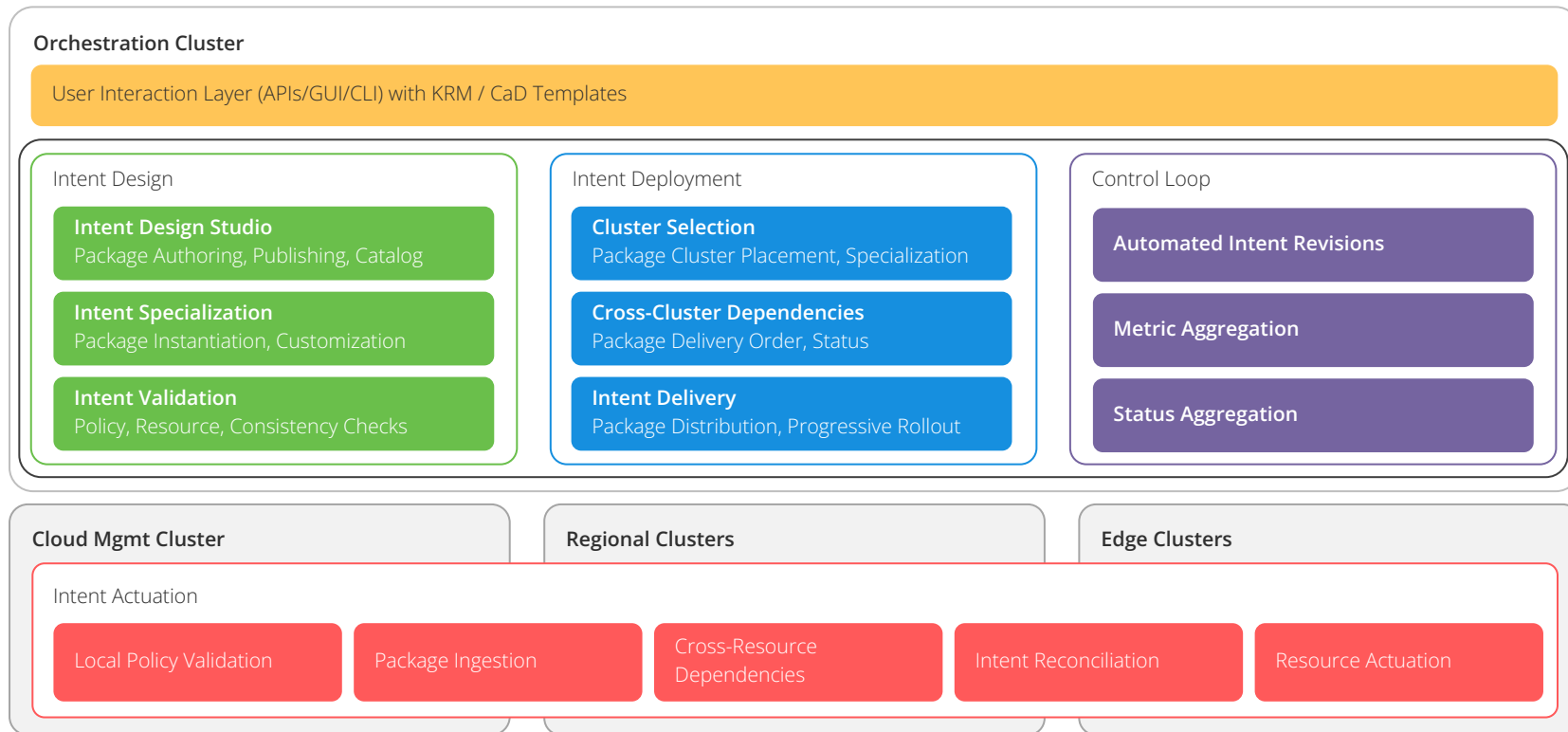
## Scope of Nephio community

Nephio focuses on extending K8s to support unified automation with

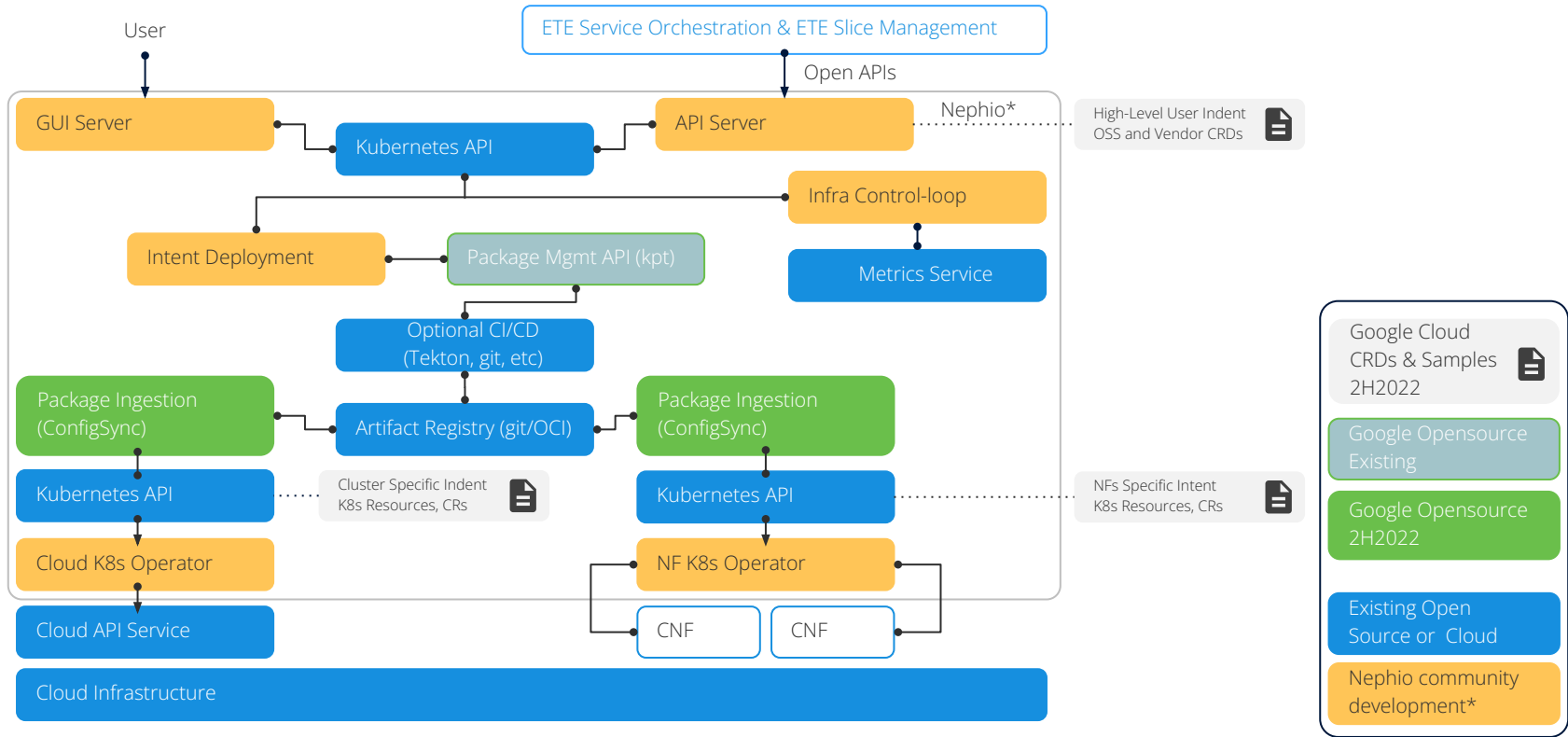
- K8s based CRDs and operators for each Public and private cloud Infrastructure automation. This implementation will be done in conformance to the standards. (e.g 3gPP, O-RAN O2, etc.,)
- The workload cloud resource automation (i.e CRUD operations of K8 Cluster, Network Functions deployment on top of the cloud, and NF infrastructure configuration such as SR-IOV)
- Workload configuration (ie. NF level configuration), initially this will be a wrapper to the Yang or industry standard models. In conformance to the standards e.g O1, 3gpp interfaces specs. Community to work towards making this interface more cloud-native.

Service Orchestration layer is not in scope for this community

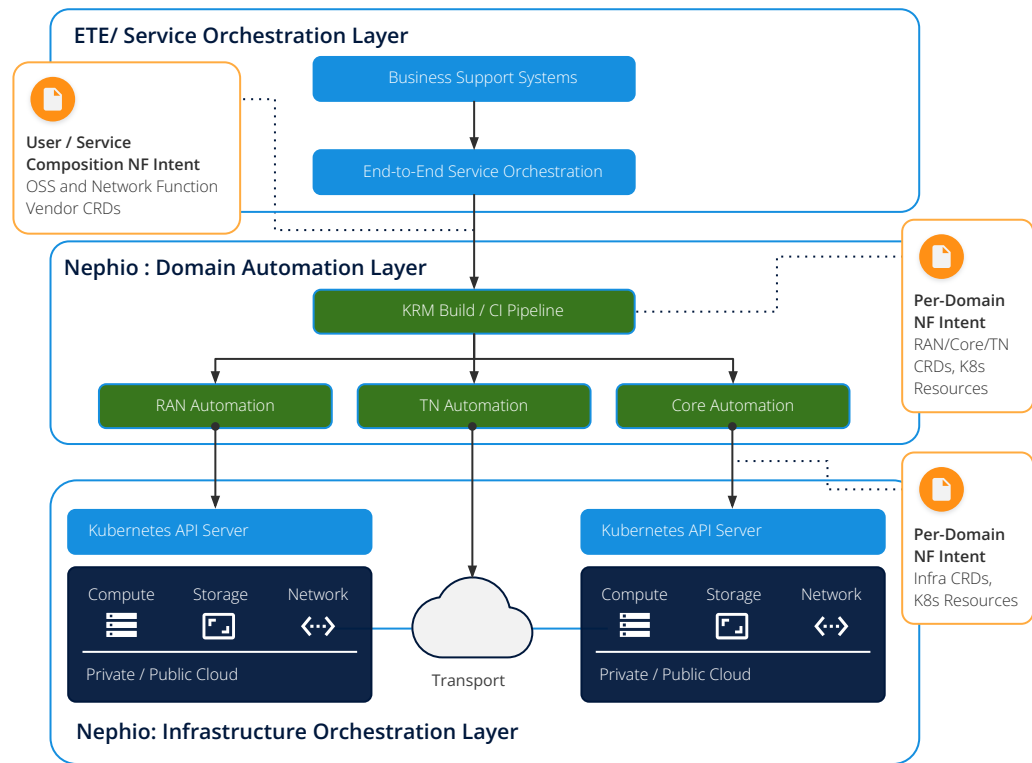
# Nephio Functional Building blocks



# Software elements of Nephio reference architecture & Google open source



# Telecom Automation layers & Nephio Scope



## External: Service orchestration layer

- Accepts user requirements
- Composes functions and supports end-to-end n/w slicing configuration
- Pushes intent to domain orchestration layer
- PNF orchestration

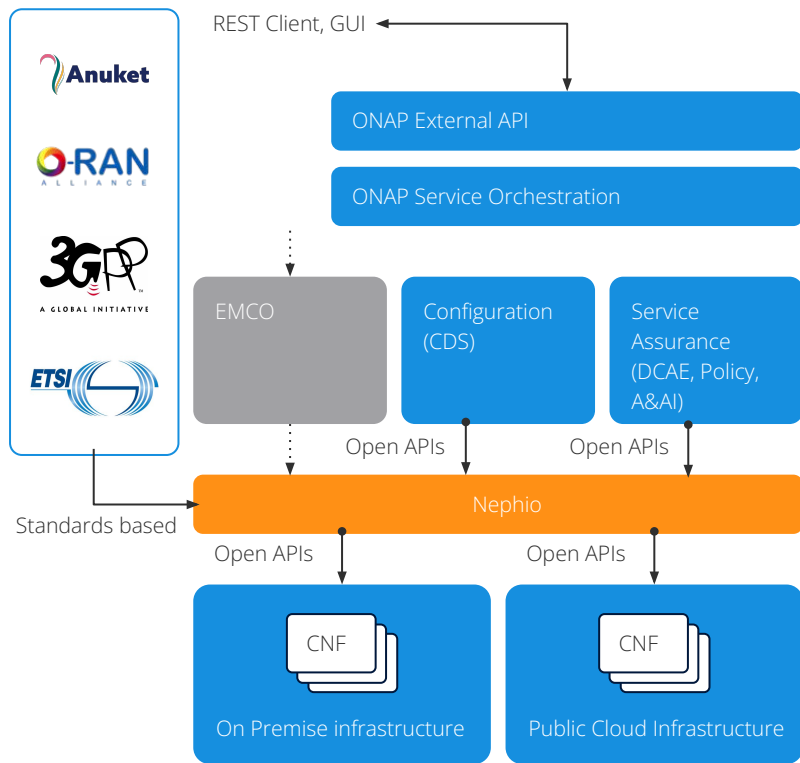
## Nephio: Domain orchestration layer

- Accepts service composition
- Calculates domain and cluster-specifics
- Pushes Kubernetes manifests

## Nephio: Infrastructure orchestration layer

- Applies per-cluster Kubernetes manifests
- Actuates infrastructure resources
- Results in running network functions

# Synergy with other OSS/SDO projects



- ONAP end-to-end service orchestration layer can interface with Nephio using open APIs for domain automation for a) cloud infrastructure b) Network function automation using Kubernetes Resource model (KRM) /Configuration-as-Data based automation.
- EMCO is another opensource in LFN, that can interface with Nephio for KRM/CaD based automation of a) cloud infrastructure b) Network function automation but it is optional.
- Kubernetes is part of CNCF and fundamental to Nephio. Nephio further expands k8s CRDs/Operators for telecom automation use cases.
- Nephio CRDs are in conformance with O-RAN and 3GPP specifications.

Nephio

ONAP Component (Module Name)

EMCO

# Summary

## Telcos

An open, simple, widely adopted **Kubernetes based cloud-native automation** that enables **multi-vendor support**, faster onboarding, easier life-cycle management, embedded control-loop, active reconciliation and service assurance - **reducing cost by efficiency and agility.**

## Cloud providers

**A common cloud-based automation framework** based on well-proven **Kubernetes technology minimizes the levels of custom automation solutions** needed for each application. Kubernetes based automation enables faster development with known technology and assures network functions will deploy and run reliably on top of the Cloud.

## Network function vendor

**A Kubernetes based cloud native automation enables easier multi-vendor integration with cloud providers**, makes Network Function onboarding to cloud easier and improves the overall customer experience with simple and reliably integrated cloud-native automation.

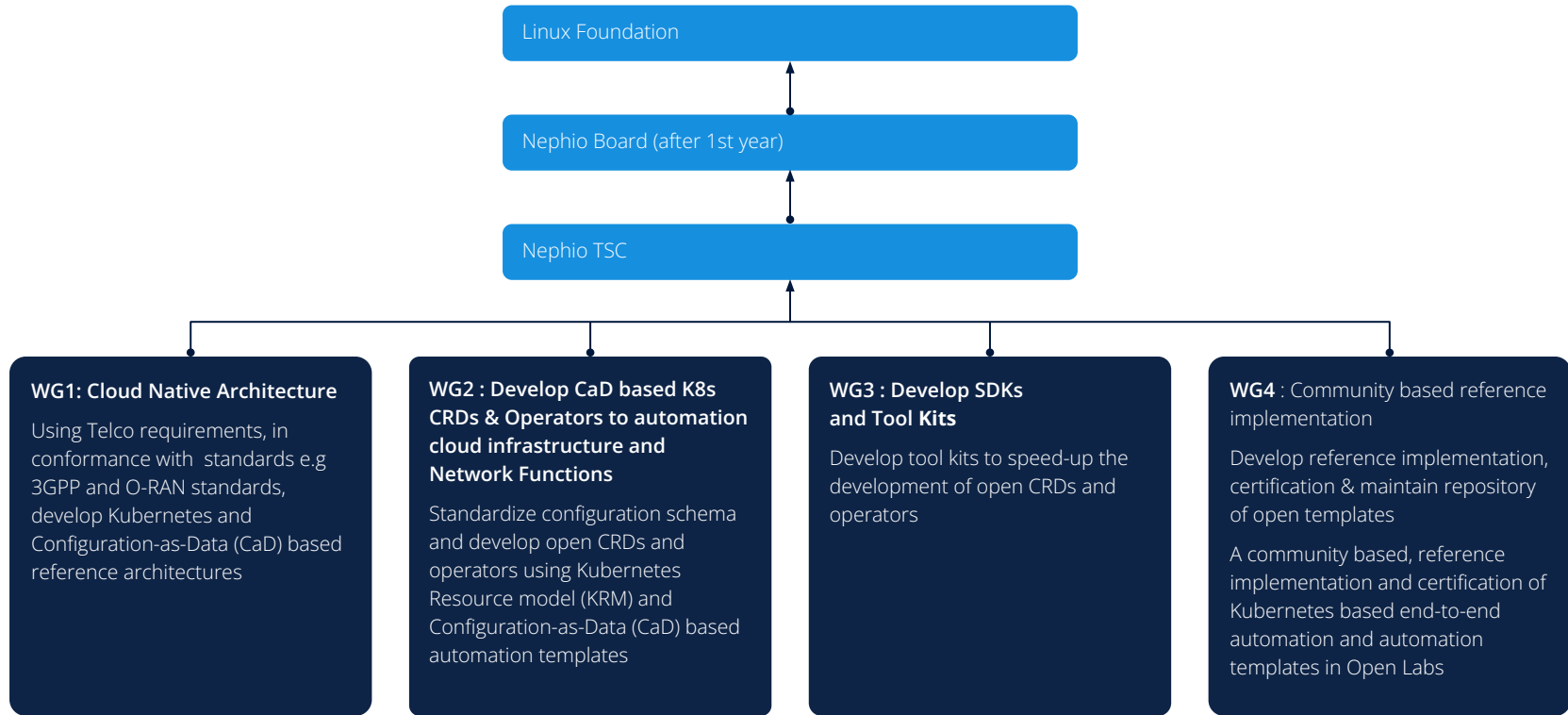
**Join and be part of this industry effort to make the world a better place with Cloud native automation!**

# Community TSC Charter



# Nephio Scope

K8s automation all the way down to Cloud infrastructure & NFs



## Participation in Technical Project (Membership)



Google is covering the 1st year launch & community run expenses



Telcos, Network Equipment vendors, Cloud operators, enterprises and startups are welcome to join.



No membership fee to join the project



Authorize LF to use your company logo in the Nephio website and provide a PR quote to join the community.



Commit to at least one active resource participation and contribution to working groups (WGs) to take part in the TSC.



Commit at least 2 active resources participation and contribution in the working groups (WGs) to be a TSC voting member for 1st six months.



After six months TSC election will be conducted or TSC to decide the election criteria. At that point, the selection to TSC is based on merit basis as articulated in the charter.

## TSC Nominations

<https://github.com/nephio-project>

We are now starting the initial technical meetings of the Nephio Project. As you know, the technical oversight body for the Nephio Project is the Technical Steering Committee (TSC). Of the voting members of the TSC during the start-up phase of the Project, **9 seats** have been set aside for organizations that commit **at least two technical developer resources** (individuals that will actively contribute to the Nephio Project code base and technical discussions) to the project by submitting a pull request to the [CONTRIBUTORS.md](#) file with the following information:

- The name of your organization;
- The names and GitHub IDs of at least two employees of the organization that intend to actively contribute to the Project; and
- Which of the two+ active contributors you would like to participate as a voting member of the TSC during the start-up phase on behalf of your organization.

Interested organizations should submit pull requests to the [CONTRIBUTORS.md](#) ([governance/CONTRIBUTORS.md](#)) file by May 31, 2022

# Technical Steering Committee and Developer Summit



## Location:

Google Cloud Building - MP3  
1170 Bordeaux Drive , Building 3  
Sunnyvale, CA 94089

[Google Building MP3](#)

## Dates & Schedule:

- Jun 22, 2022 (Wednesday)
  - Breakfast - 7:30 AM PT to 8 AM PT
  - Sessions: 8 AM PT to 5 PM PT
  - Social 5:30 PM PT to 7 PM PT
- Jun 23, 2022 (Thursday)
  - Breakfast - 7:30 AM PT to 8 AM PT
  - Sessions: 8 AM PT to 3 PM PT

## Nearest Airport:

- San Jose (SJC)
- San Francisco (SFO)

## Nearest Hotels:

AC Hotel by Marriott Sunnyvale Moffett Park  
1235 Bordeaux Dr, Sunnyvale, CA 94089

**Please register here before June 5th:**

<https://nephio.org/events/>

# Technical Steering Committee and Developer Summit



## Proposed agenda:

### Day 1:

- Breakfast
- Executive keynotes
- Executive Panel
- Lunch
- Nephio Technical deep dives
- Community operations (logistics, TSC meetings, Voting, How to guide, etc...)
- Social hour

### Day 2:

- Breakfast
- Executive keynotes
- Working group deep-dives, roadmap and future asks
- Lunch
- Collaboration with other communities (Logistics, technology, etc.,)
- Community next steps

# Project resources

- Website - <https://nephio.org/> , <https://nephio.org/about/>
- Blog Postings - <https://nephio.org/blog/>
- Project Github - <https://github.com/nephio-project> (Please note “nephio-project is right one”)
- Project email distro
  - [nephio-tsc@lists.nephio.org](mailto:nephio-tsc@lists.nephio.org) (for TSC members)
  - [nephio-dev@lists.nephio.org](mailto:nephio-dev@lists.nephio.org) (for all)

## Create an Account:

Follow LF Documentation at: <https://docs.linuxfoundation.org/lfx/sso/create-an-account>

Please subscribe to the Nephio developers mailing list. You can do that by sending an email to this address: [nephio-dev+subscribe@lists.nephio.org](mailto:nephio-dev+subscribe@lists.nephio.org) You will receive an auto reply requesting subscription validation. The email content is not important.

## To join as Supporter:

Again, there are no documents to sign or fees to join, just the form needs to be filled out with the requested information. You can fill out this Linux Foundation's [simple form](https://forms.gle/Q4pXJdTykYfgziax9) (<https://forms.gle/Q4pXJdTykYfgziax9>) - Contact [mwoster@linuxfoundation.org](mailto:mwoster@linuxfoundation.org) for more information

## Q&A

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Thank you!