

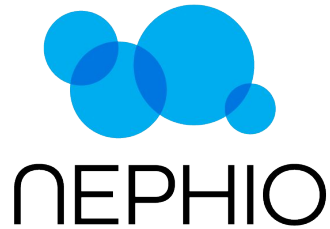


Nephio Presentation

Sep 20th, 2022

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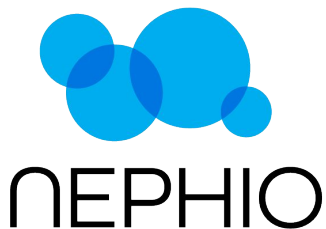
The Linux Foundation and Google Cloud Launch Nephio to Enable and Simplify Cloud Native Automation of Telecom Network Functions

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

- 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



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 THE **LINUX** FOUNDATION



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

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.

Lack of right technology: Challenges

Kubernetes is not enhanced enough to support Network Function automation:

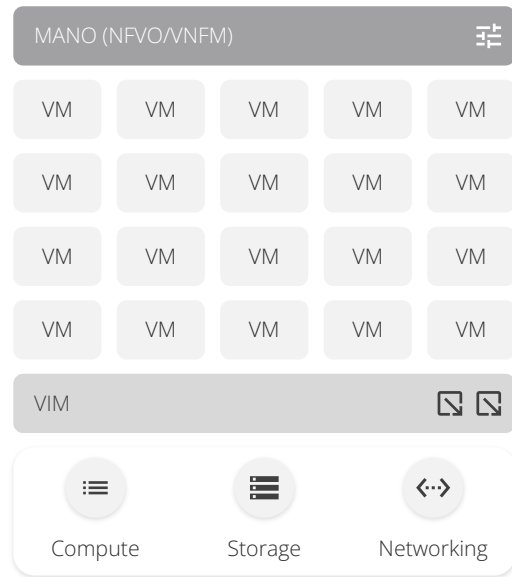
- Kubernetes enables the telecom to run network functions (NFs) as containers.
- **Kubernetes only manages basic compute/network/storage whereas NFs have demands beyond standard Kubernetes** such as existing Pod extensions: Multus, SR-IOV support, DPDK, and Node configuration: such as VLAN membership, 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**

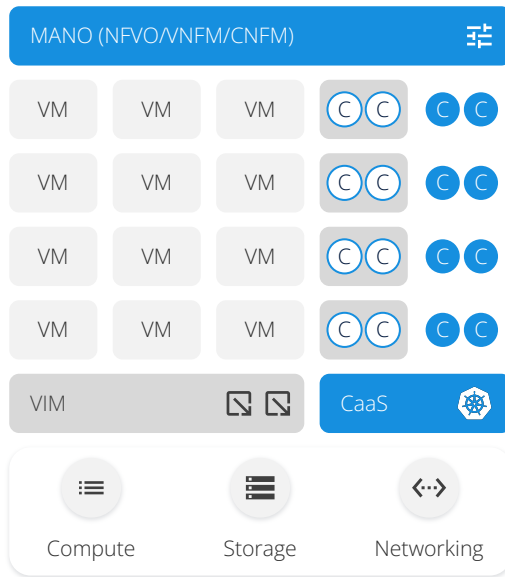
Transition to Cloud Native Automation

Past 4 years



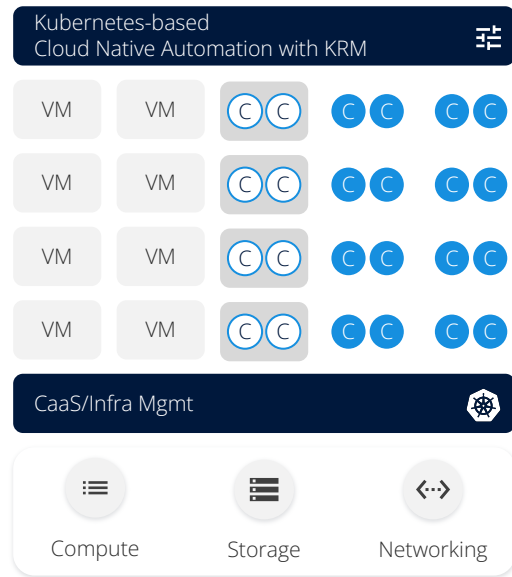
Non-Container Era

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

Three aspects for optimizing automation



Intent-based automation

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



Declarative configuration

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



Non-complex: Cloud -Native automation

Simplified, unified cloud native management (Kubernetes) in every tier

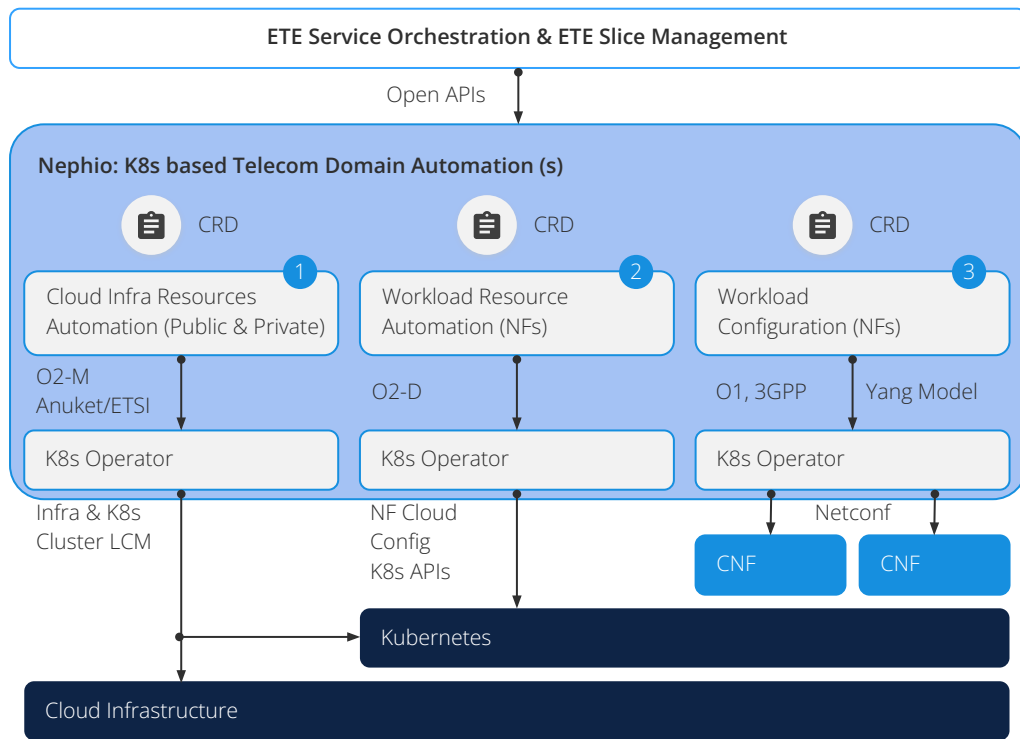
Extend base Kubernetes with Infrastructure CRDs and Operators

- 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

Different layers of configuration & existing standards & Nephio Focus



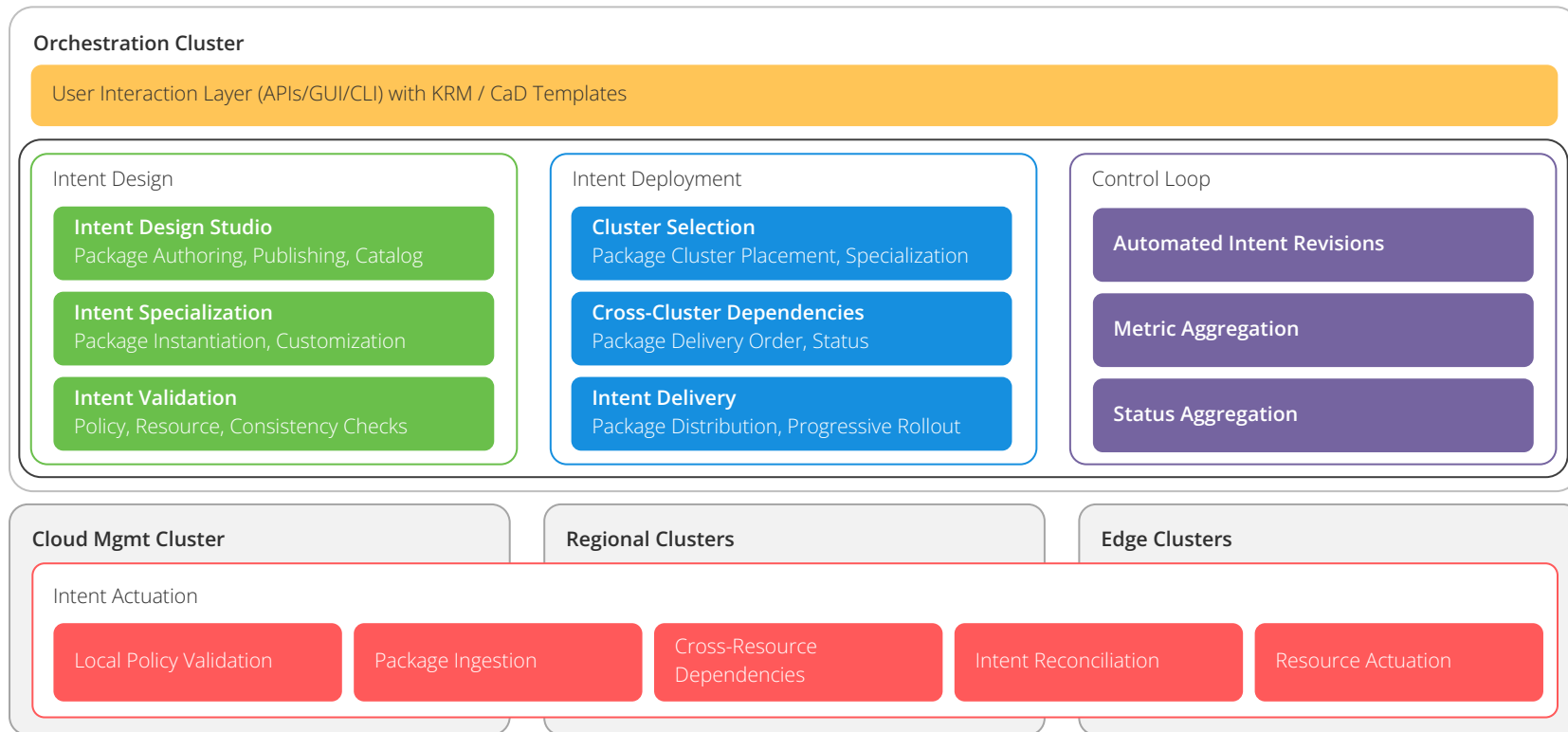
Scope of Nephio community

Nephio focuses on extending K8s to support unified automation with

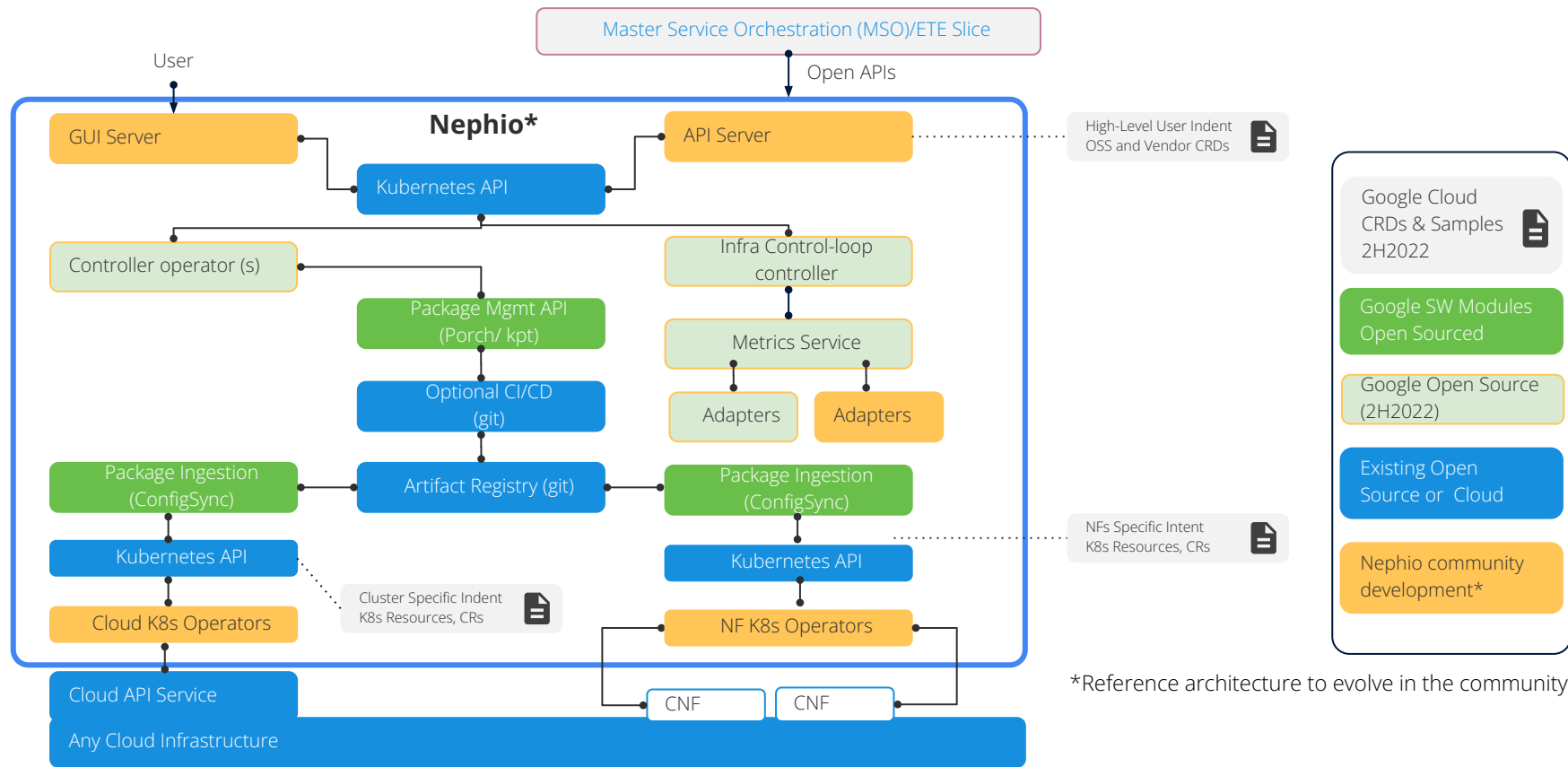
- K8s based CRDs and operators for each Public and private cloud Infrastructure automation.
- The workload cloud resource automation (i.e CRUD operations of K8 Cluster, Network Functions deployment on top of the cloud, and NF infrastructure configuration such as SR-IOV)
- Workload configuration (ie. NF level configuration)

Service Orchestration layer is not in scope for this community

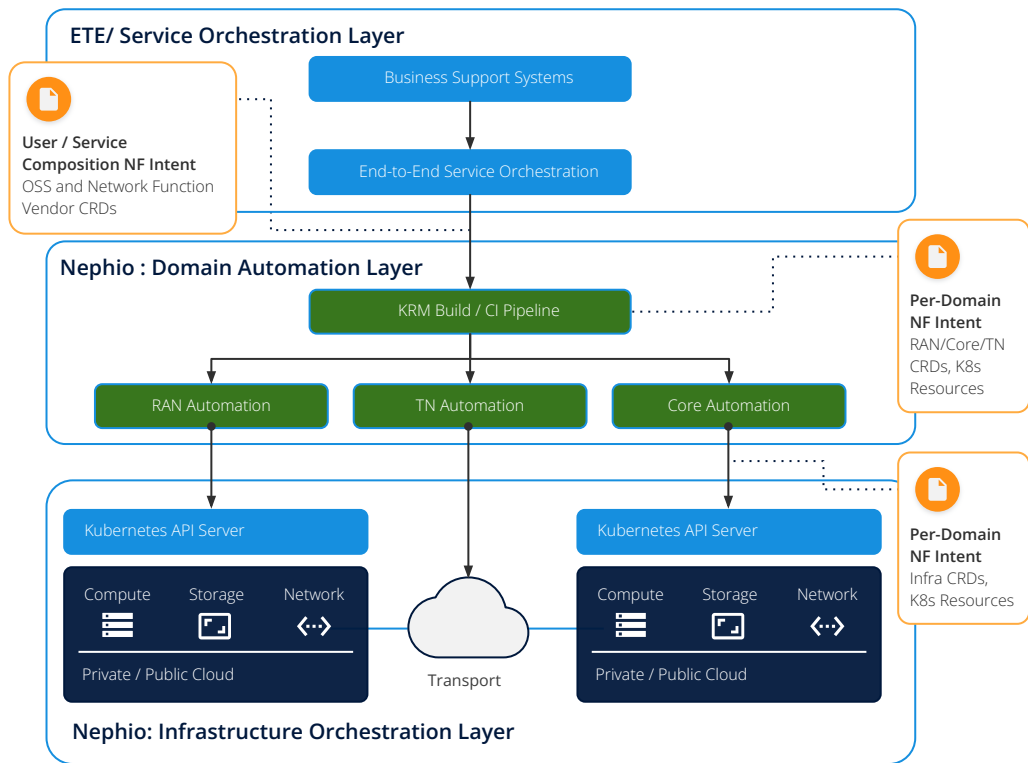
Nephio Functional Building blocks



Google's software contribution to Nephio



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

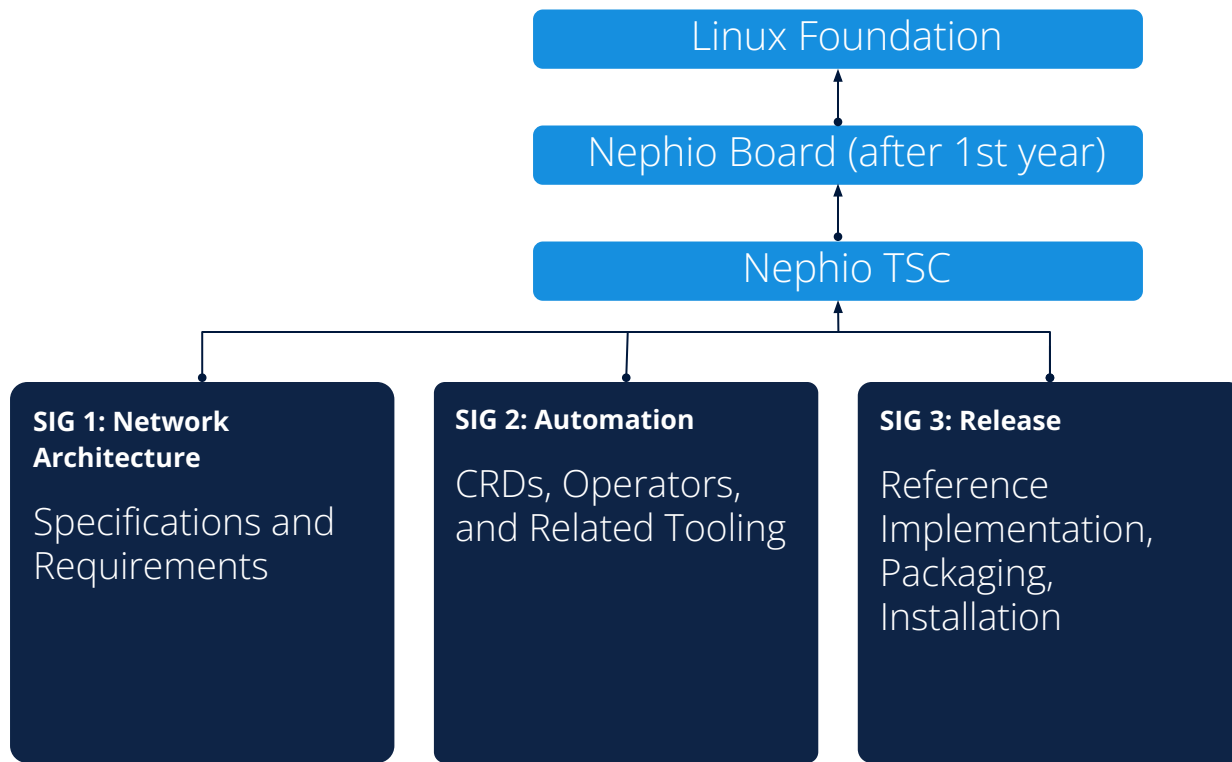
Nephio: Domain orchestration layer

- 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

Nephio: Proposed working structure



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 (for TSC members)
 - 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 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 for more information

Thank you!