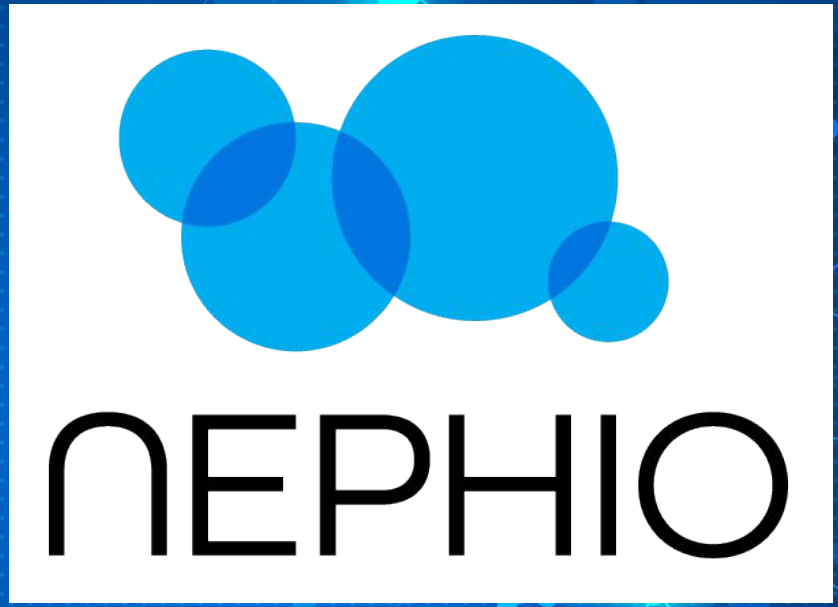
Why Nephio?

Nephio R1 Concepts and Tutorials
Episode 2
July 2023

Prerequisites:

- Episode 1 - Series Introduction



https://nephio.org/learn

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Nephio SIG Automation Chair
Kubernetes SIG Architecture Co-chair

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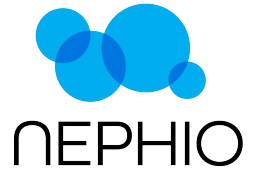
Stepping Back

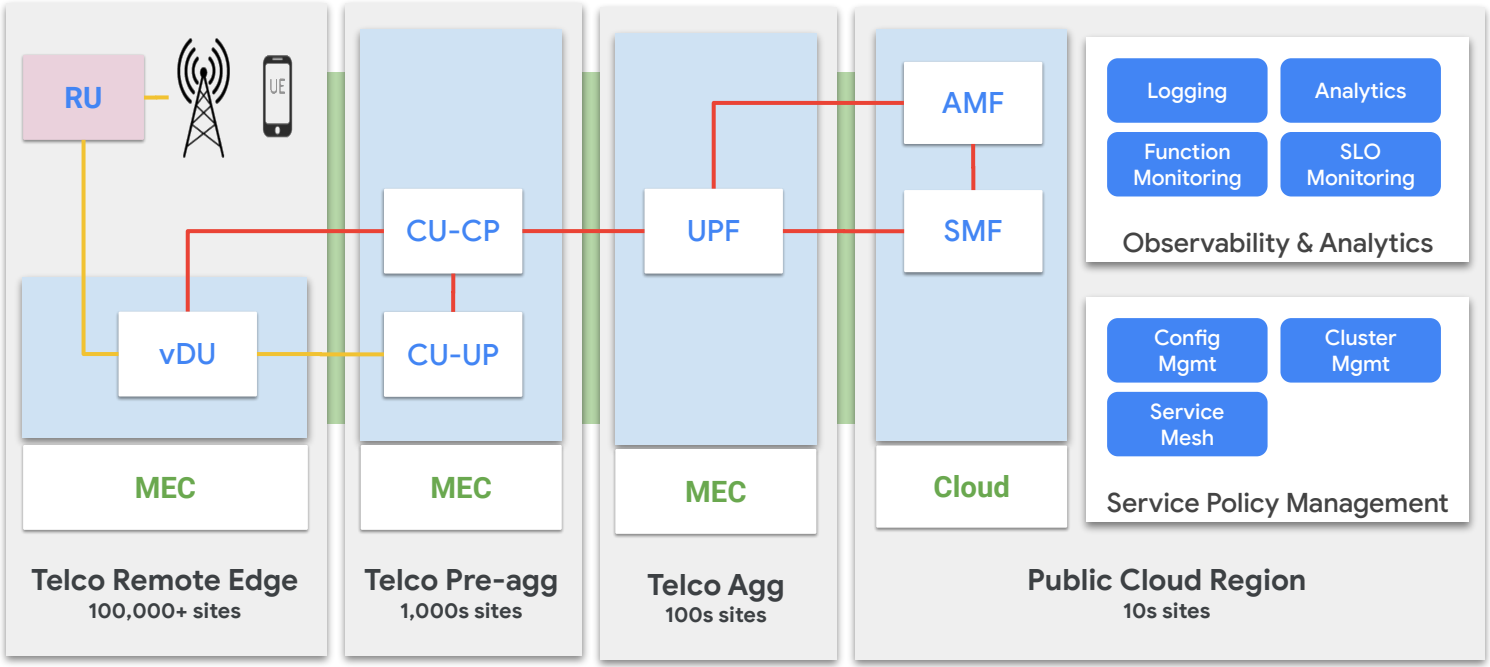


- Why cloud?
  - On-demand, API-driven consumption of data center resources
- Why MEC / Distributed Cloud?
  - On-demand, API-driven consumption of edge resources
- Managing workloads on cloud is hard
  - Many projects for this in areas like gitOps, App Delivery, Workflows, Platform Engineering
  - Not really a solved problem
- Managing workloads on thousands - or tens of thousands - of little clouds is much, much harder

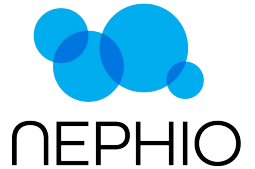
Imagine deploying complex, interconnected workloads across many geographically distributed sites.

cloud.google.com/about/locations

Simplified / Minimal 5G Network



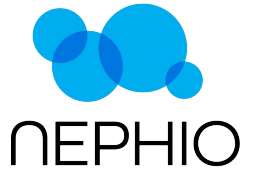
Planning, Planning, Planning



What does it take to roll this out? ***Some*** of it, for **Day 1**:

- Identify available, applicable sites - edge and cloud regions
- Determine which workloads should run where how they interconnect
- Determine the infrastructure needed - clusters, nodes, special hardware
- Configure cross-site networking: allocate subnets, IPs, VLANs, VRFs, etc.
- Configure the underlying nodes for specialized telco requirements
- Configure the workload specifications - their Kubernetes manifests
- Configure the workloads themselves to know about each other

Complexity, Complexity, Complexity



Day 2 adds more complexity:

- Monitor that the stated intent is still expressed
  - Workloads are up and running
  - Configuration hasn't drifted
- Handle changes to topology
  - Spin up a new aggregation site, adding a UPF
  - UPF needs to talk to an SMF
  - Each of these needs to be configured to see each other
- Resize workloads as topology changes
  - As we add UPFs, we need to vertically scale the SMF.
- Enable upgrade of workloads and infrastructure with progressive rollout

It Gets Worse…

Each layer is managed by different systems!

- Topology: Manually encoded in powerpoint slides and spreadsheets
  - Maybe end-to-end orchestration workflows
- Cloud infrastructure: Cloud Provider APIs
  - Maybe Terraform, scripts, or e2e orchestration
- Networking within and between sites: manual router configuration
  - Maybe some vendor or other proprietary automation
- Nodes: K8s extensions, manual or scripted kernel and other configs
- Workload specifications: stored in Kubernetes manifests, maybe in Git or scripts
- Workloads configs: proprietary, vendor-specific network element managers

And Worse…

Different systems means different ***teams***.

- Each layer and system has a different team, probably even broken up by region
- Existing methods such as Helm charts *assume you have already figured out all the inputs*
- Teams must negotiate all these values ahead of time on a per-site, per-workload basis
- Imagine…
  - 100 inputs per workload
  - 20 workloads per site
  - 10,000 sites
- That is 20,000,000 values!

What do we do? Where do we start?

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Reduce Complexity

- Consolidate on a **single, unified platform for automation**
  - Across infrastructure, workloads, workload configs, vendors and deployment tiers.
- **Declarative configuration with active reconciliation** to support days one and two.
  - And distribute state (intent) across geography for resilience
- Configuration that can be **cooperatively managed** by machines and humans.
  - Machine-manipulable configuration is fundamental to automation.