Accelerating Innovation with LEANNFV

SCOTT SHENKER

SYLVIA RATNASAMY

CONSTANTINE POLYCHRONOPOULOS

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Six Years After the NFV White Paper…

- PROGRESS:
  - A detailed architecture and large open-source codebases
- PROBLEMS:
  - Adoption and innovation much slower than expected
- PARADOX:
  - Why has this been so hard?

NFV Involves Three Basic Components

- Infrastructure Manager (VIM++):
  - Oversees the computational infrastructure
- Virtual Network Functions (VNFs):
  - Largely based on existing implementations
- NFV Manager (VNFM+NFV-O):
  - Oversees lifecycle management

Integration is the Problem

- Connected these components in complicated ways
  - Embedded NFV management in compute infrastructure
  - New features often require modifying pairwise APIs
- Makes deployment hard
  - Must change existing computational infrastructure
- Makes onboarding even harder
  - No useful guidance for how to easily integrate VNFs
- Makes innovation almost impossible
  - Because these pieces are so tightly interwoven

How Do We Fix This?

- Focus exclusively on integration
  - Provide universal integration mechanism (key-value store)
  - Do not require NFV-specific features in the VIM
  - Recognize that this is all we need to specify!
- Leave the rest of the design open for innovation
  - Components can evolve independently
  - Deployment barriers are greatly reduced
- This creates a lean, extensible, multi-vendor NFV ecosystem

Accelerating Innovation with Lean NFV

SYLVIA
RATNASAMY

The Lean NFV Approach

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Impact on the Ecosystem

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Next Steps for Lean NFV

NFV Involves FOUR Basic Components

- Infrastructure Manager (VIM++):
  - Overseeing the computational infrastructure
- Virtual Network Functions (VNFs):
  - Existing code moved into a VM
- NFV Manager (VNFM+NFV-O):
  - Overseeing lifecycle management
- Key-Value (KV) Store
  - Universal point of integration

Key-Value (KV) Store

- Simple and general abstraction

Key	Value
K1	AAA,BBB,CCC
K2	AAA,BBB
K3	AAA,DDD
K4	AAA,2,01/01/2015
K5	3,ZZZ,5623

```
put(key,value)
value=get(key)
notification=watch(keys)
```

Key-Value (KV) Store

- Simple and general abstraction
- Many open source implementations & extensive deployment experience

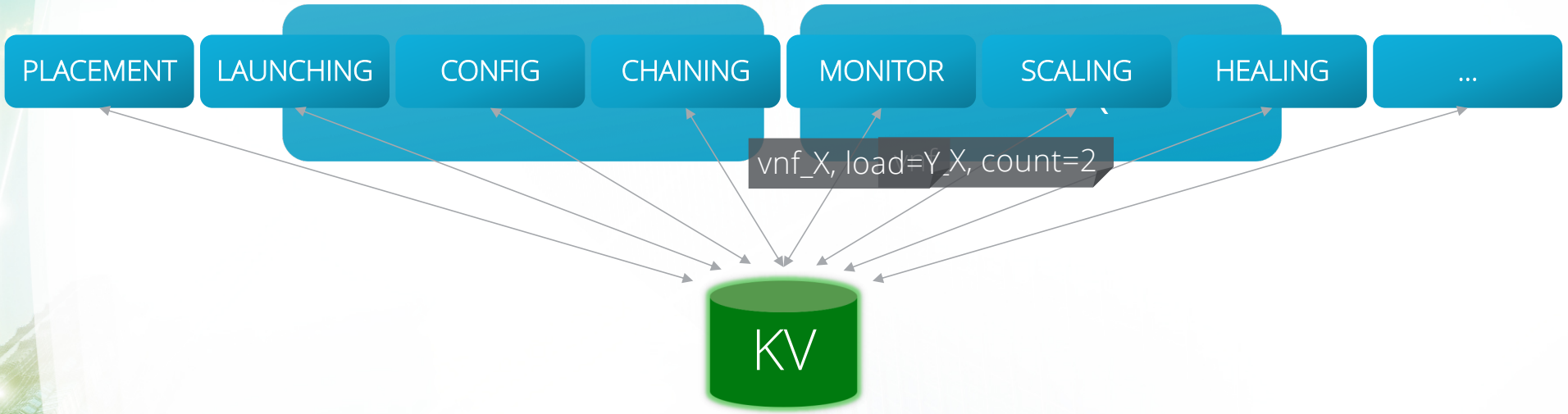
Why a KV Store?

Crux of integration is allowing components to discover/exchange state

- VNF status
- configuration
- chain definition
- service load
- resource map
- events

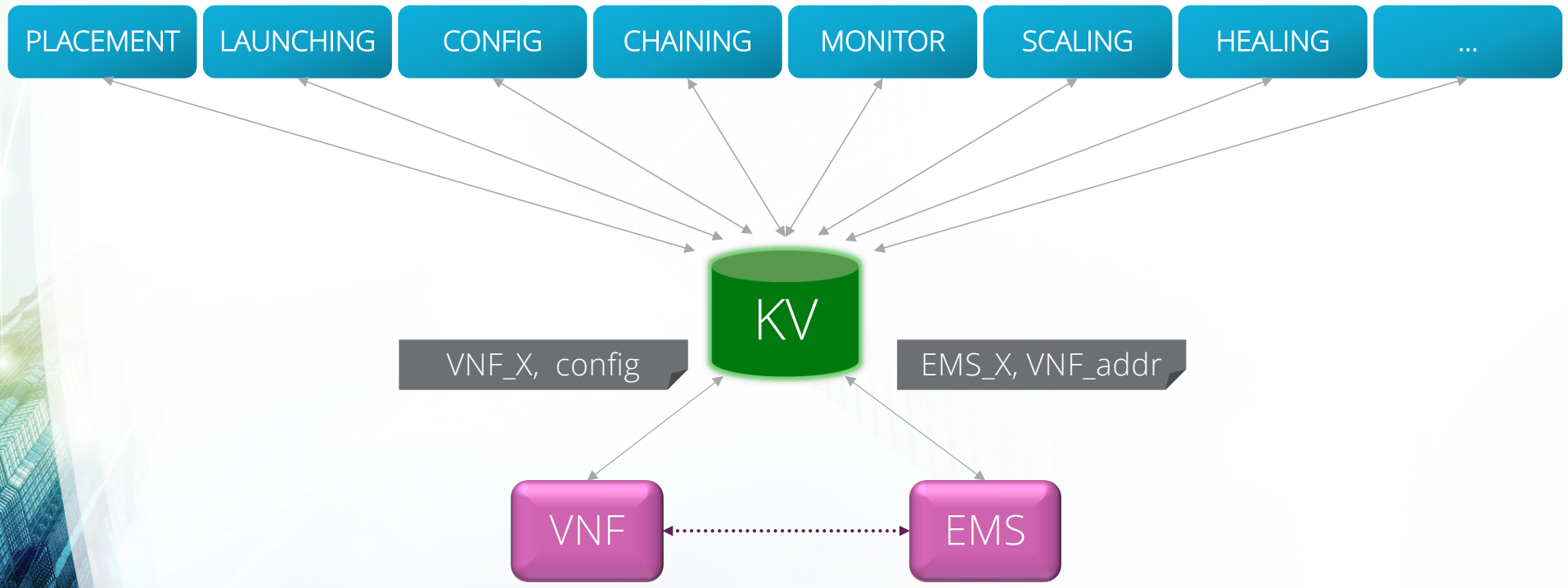
KV store enables this in a manner that is lean and extensible

Integration with the NFV Manager

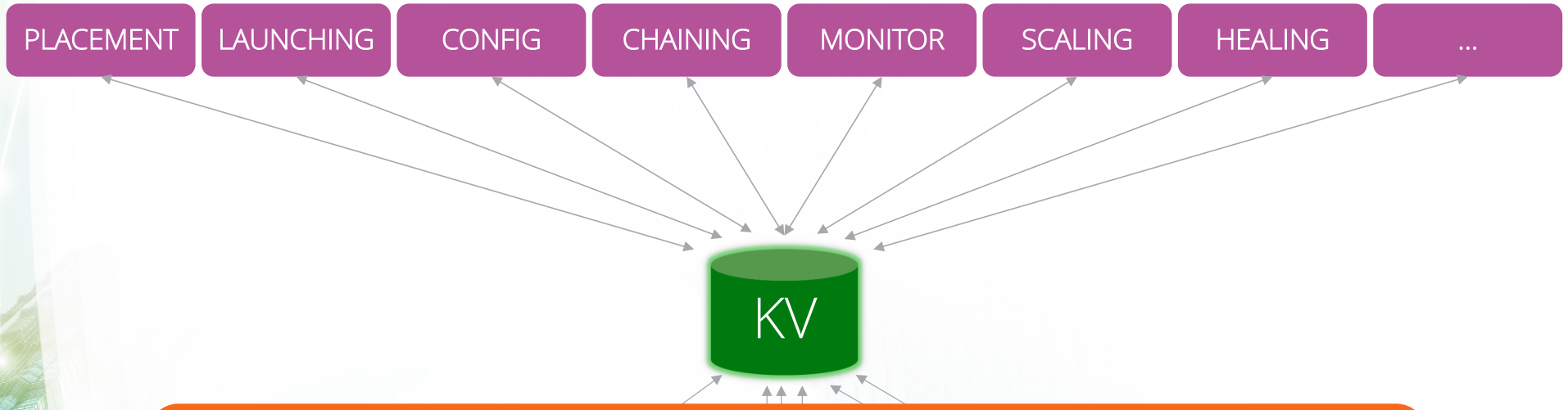


KV-based integration enables NFV MANO that is lean, extensible, and multi-vendor

Integration with the VNFs

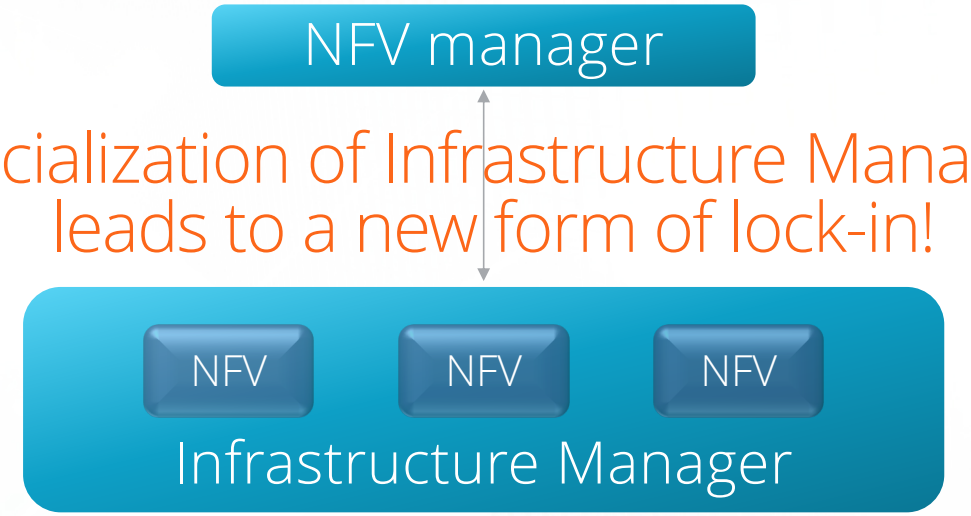


Integration with the VNFs



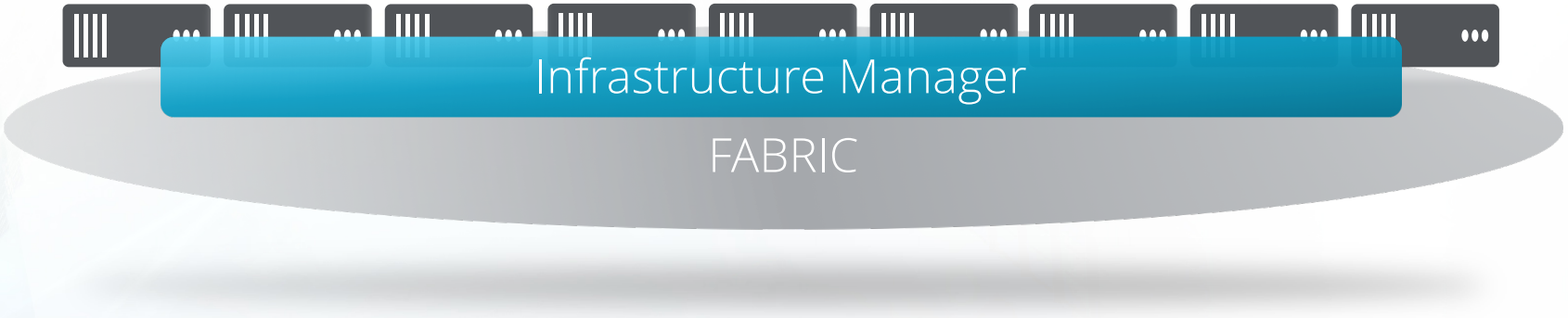
KV-based integration allows VNFs to evolve *incrementally and independently*

Integration with Infrastructure Managers

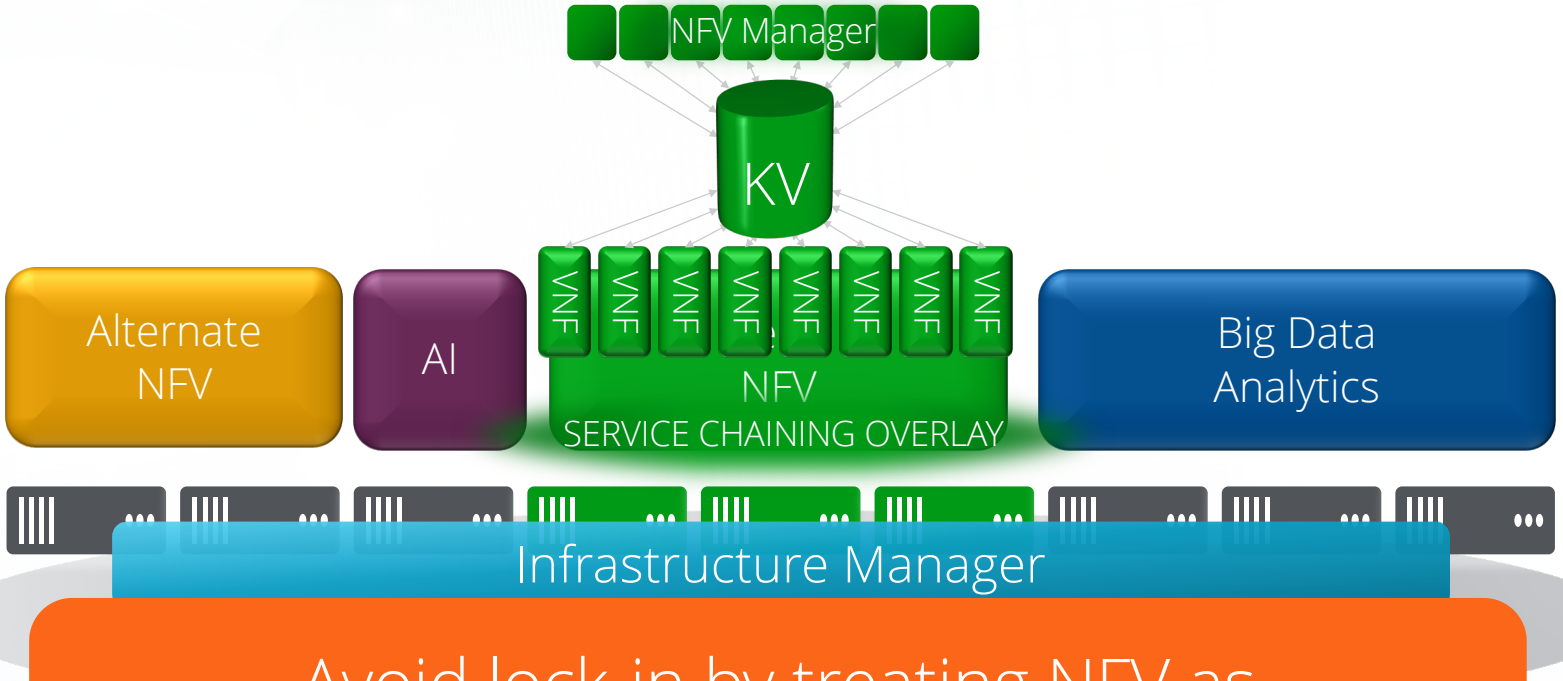


NFV should rely on COMMON
infrastructure management features

Integration with Infrastructure Managers



Integration with Infrastructure Managers



Avoid lock-in by treating NFV as just another workload

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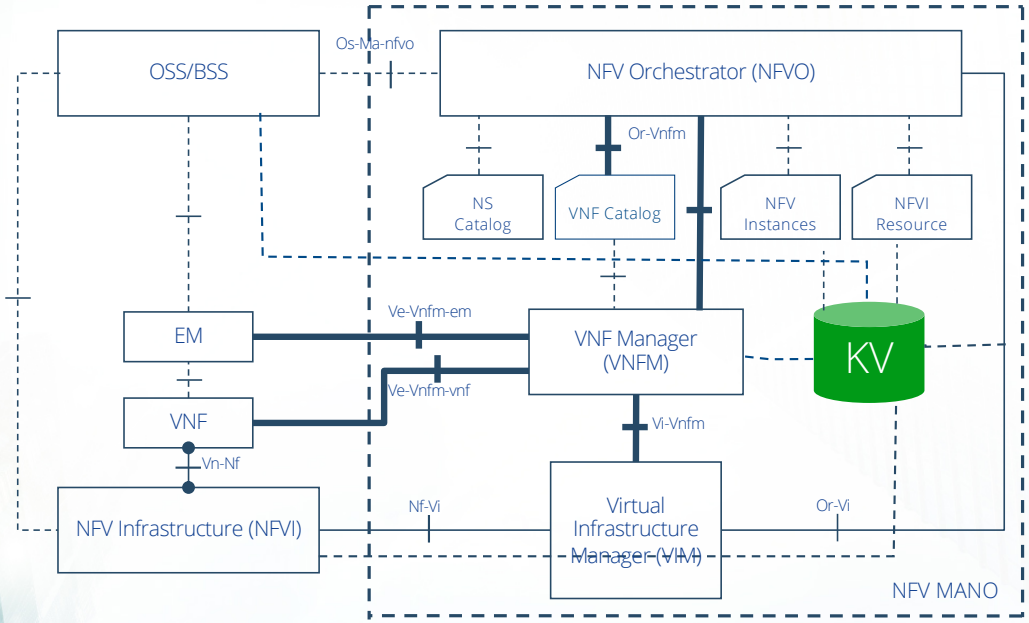
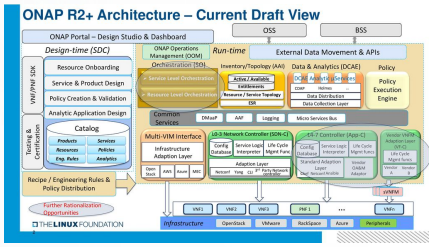
Next Steps for Lean NFV

Lean NFV is Synergistic to ETSI MANO & ONAP



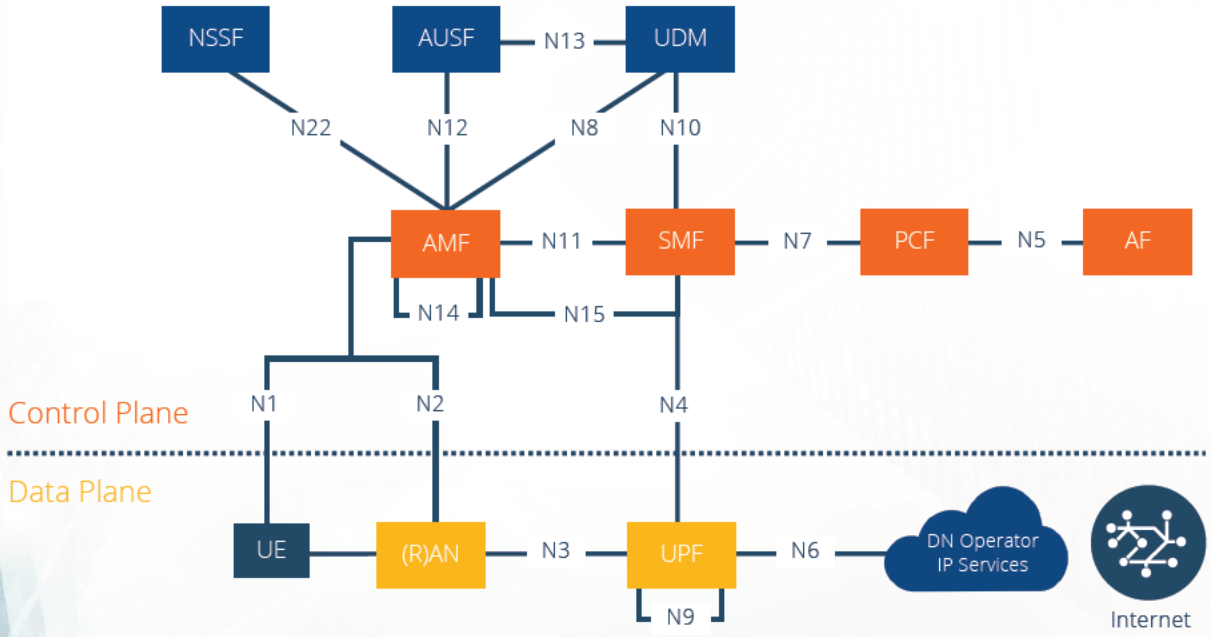
Open Source MANO

- Existing NFVI and VNF deployments can co-exist with Lean NFV based NFs and higher-level functions (O/M)
- Incremental integration into a Lean NFV framework
- Enabling value-add service creation around KV Store that can be instantaneously available to all VNFs and NFV infrastructure



Lean NFV: Enhanced flexibility for 5G

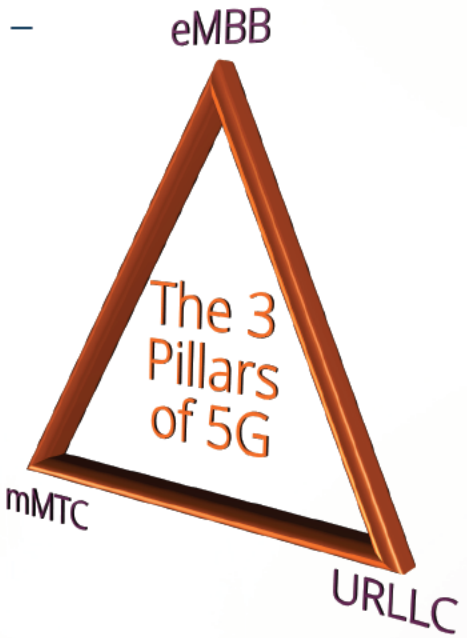
Core NFs and Reference Points TS 23.501



- Aligned with SBA req/repl & subscribe/notify architecture
- Support for microservices
- Highly distributed, vendor-independent framework
- Asynchronous architecture supports faster integration, less constrained NF development and new innovations (callback framework in KV Store?)
- Aligned with DevOps and cloud native strategy

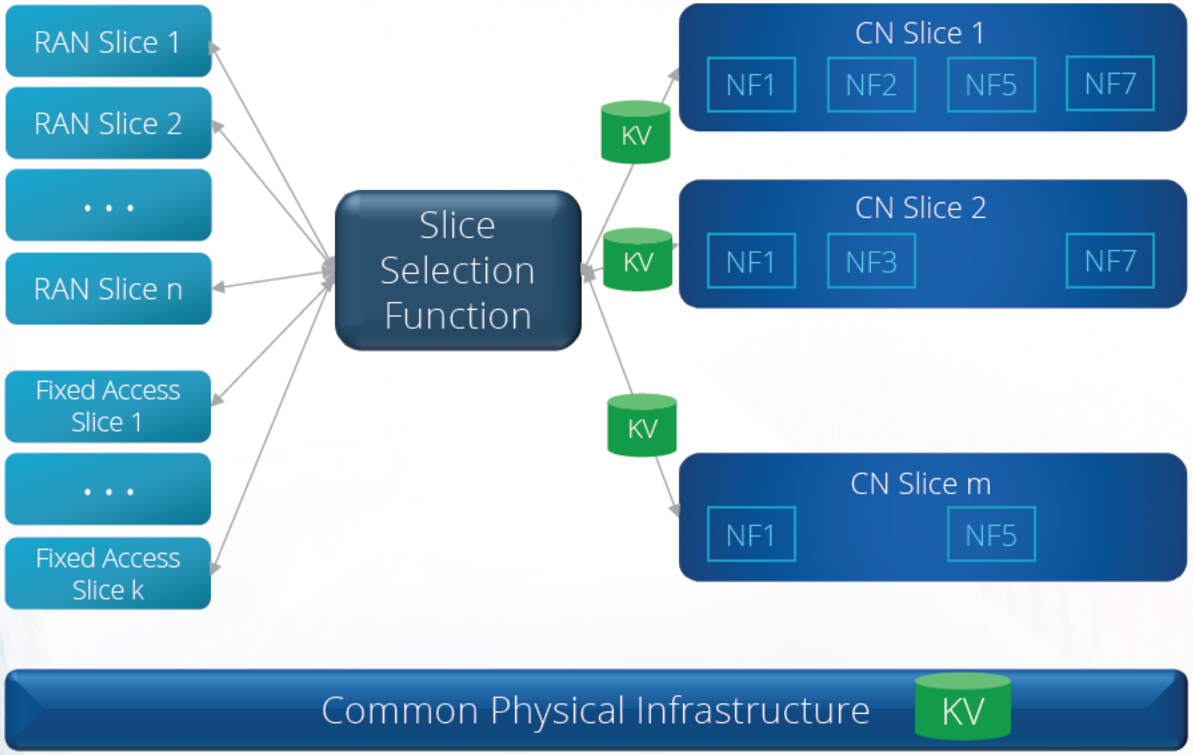
Network Slicing & MEC Support in Lean NFV

- Decisive move toward distributed networks/infrastructure – key requirement for 5G
- NFV facilitates access aggregation, which in turn accelerates adoption of MEC
- By design, Lean NFV is suitable for highly distributed networks and infrastructure (MEC and Network Slicing)
  - Distributed KV Store for autonomous edge NFVI operations
  - Hierarchical organization of Keys and Values for distributed environments
  - KV store reads/updates on a need-to-know basis



Enhanced Segmentation in Network Slicing

Isolation of KV Store per slice greatly improves security



- SP KV Store: Part of common infrastructure and provisioning framework
- Tenant (Slice) KV Store: Private/shared options depending on security requirements

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Summarizing Lean NFV

- Main technical points
  - Use key-value store as universal point of integration
  - Remove need for specialized VIMs
- Lean NFV is an open architecture
  - Lean, extensible, multi-vendor
- We expect many realizations of this architecture
  - Commercial, open-source, and combinations of both

Advantages of this Approach

- The minimal design that enables easy integration
  - Leaving the rest open for innovation
- Allows us to solve the problems of today…
  - Complementary to today's codebases and VNFs
- …and the problems of tomorrow
  - Compatible with cloud-native, 5G, and beyond
- This is the path to increasing adoption and innovation

Next Steps…

- Learn the basics:
  - Read white paper at LeanNFV.org (endorsed by ten experts)
  - Visit demo in booth #605
- Explore more deeply:
  - Read more detailed technical documents (forthcoming)
  - Inspect demonstration code (forthcoming)
  - Attend future workshops (sign up at web site)


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