

Onboarding real-world complex VNFs with WhiteNFV



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OSM VNF Onboarding TF Chair

Agenda

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- **Why is VNF Onboarding important?**
- Dissecting a complex onboarding process
- Conclusions & Announcement

Back to basics: The Original White Paper

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Network Functions Virtualisation – Introductory White Paper Issue 1

Executive Summary

Network Operators' networks are populated with a large and increasing variety of proprietary hardware appliances. To launch a new network service often requires yet another variety and finding the space and power to accommodate these boxes is becoming increasingly difficult; compounded by the increasing costs of energy, capital investment challenges and the rarity of skills necessary to design, integrate and operate increasingly complex hardware-based appliances. Moreover, hardware-based appliances rapidly reach end of life, requiring much of the procure-design-integrate-deploy cycle to be repeated with little or no revenue benefit. Worse, hardware lifecycles are becoming shorter as technology and services innovation accelerates, inhibiting the roll out of new revenue earning network services and constraining innovation in an increasingly network-centric connected world.

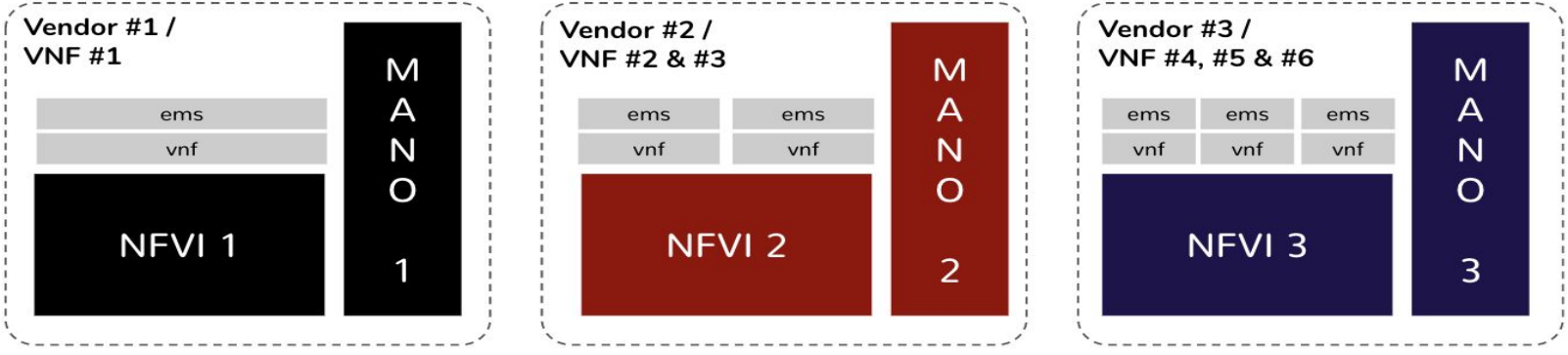
Network Functions Virtualisation aims to address these problems by leveraging standard IT virtualisation technology to consolidate many network equipment types onto industry standard high volume servers, switches and storage, which could be located in Datacentres, Network Nodes and in the end user premises. We believe Network Functions Virtualisation is applicable to any data plane packet processing and control plane function in fixed and mobile network infrastructures.

AT&T BT orange CenturyLink 中国移动 China Mobile colt Deutsche Telekom KDDI NTT TIM Telefónica Telstra verizon

Initial “NFV” was viewed as expensive!

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Have you ever wondered why typical virtualization efforts are more expensive?



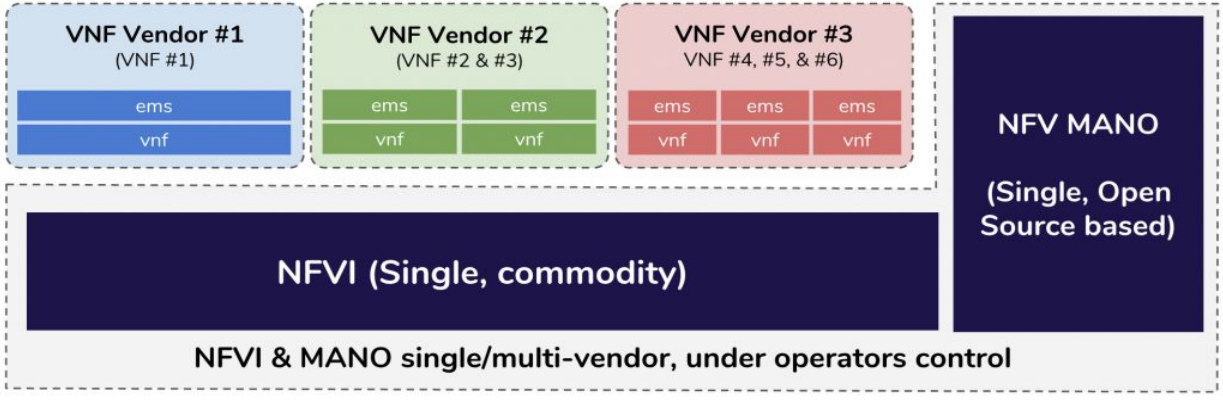
→ **Because they are generally vertical!**

- **CapEx:** You are paying for multiple, full, closed NFV stacks
- **OpEx:** technology is both…
  - **new** to a networking department
  - **Proprietary / Captive**

A Single Telco Cloud

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Operators need a single Telco Cloud, under their control, to leverage the efficiencies!



A single Telco Cloud:

- **Reduces CapEx,** you only **invest once** for the NFVI & MANO stacks, minimizing overhead.
- **Reduces OpEx,** if you build it with the NFV vision, using well-known technologies:
  - **commodity hardware**
  - **open-source-based software solutions**

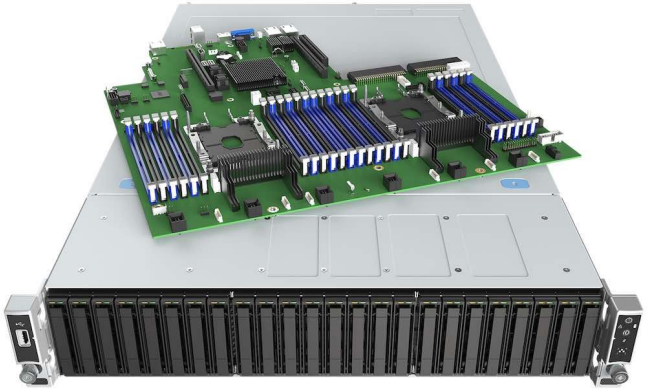
Commodity Hardware

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Building a network (NFVI) from commodity hardware means:

- **Whitebox, bare-metal switches** (with a disaggregated software)
- **COTS servers** (common components available in a number of brands)

...that leverage the work from community projects looking to **build the most efficient hardware specifications.**





100G Whitebox



400G Whitebox

~~Commodity~~ Hyper Scalable Hardware

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The next level is to adopt a more efficient compute form factor, that has proven to be:

- More Space Efficient
- More Energy Efficient
- More Serviceable



OPEN Compute Project

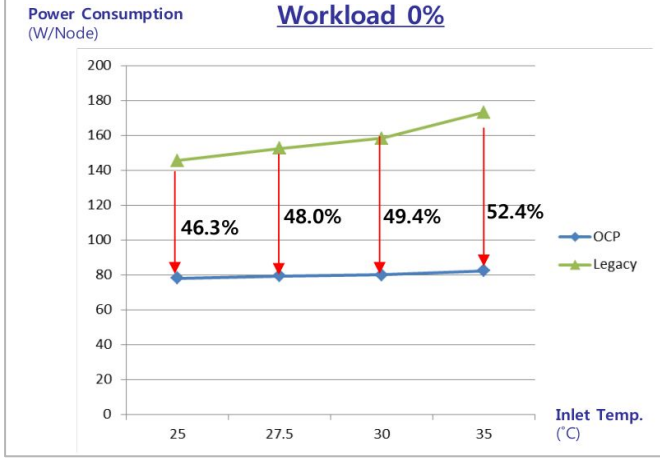
Facebook Server
Intel Motherboard V4.0

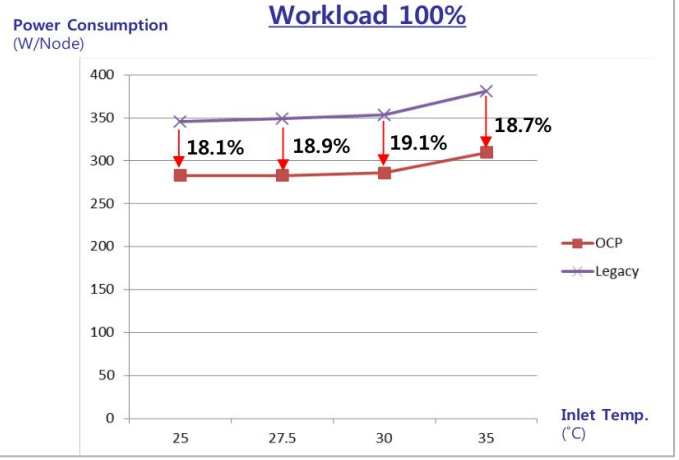
Project Tioga Pass

Rev 0.30

Author:
Whitney Zhao, Hardware Engineer, Facebook
Jia Ning, Hardware Engineer, Facebook

According to SK Telecom, **OCP servers save 18-52% of Energy**



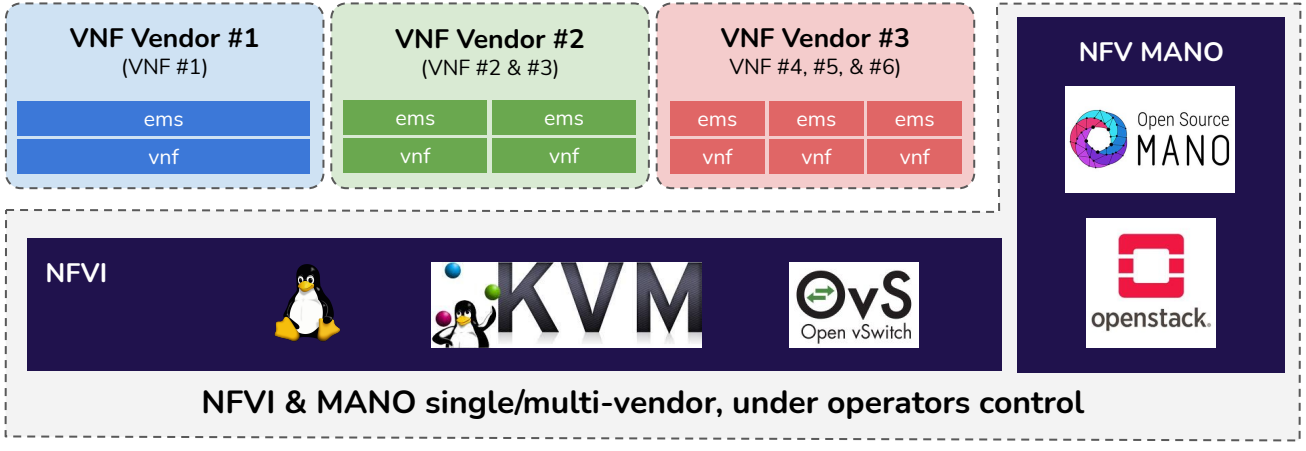


Open Source Software

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Q: Ok, but how to ensure that VNF Vendors will plug to my common, commodity-based Cloud?

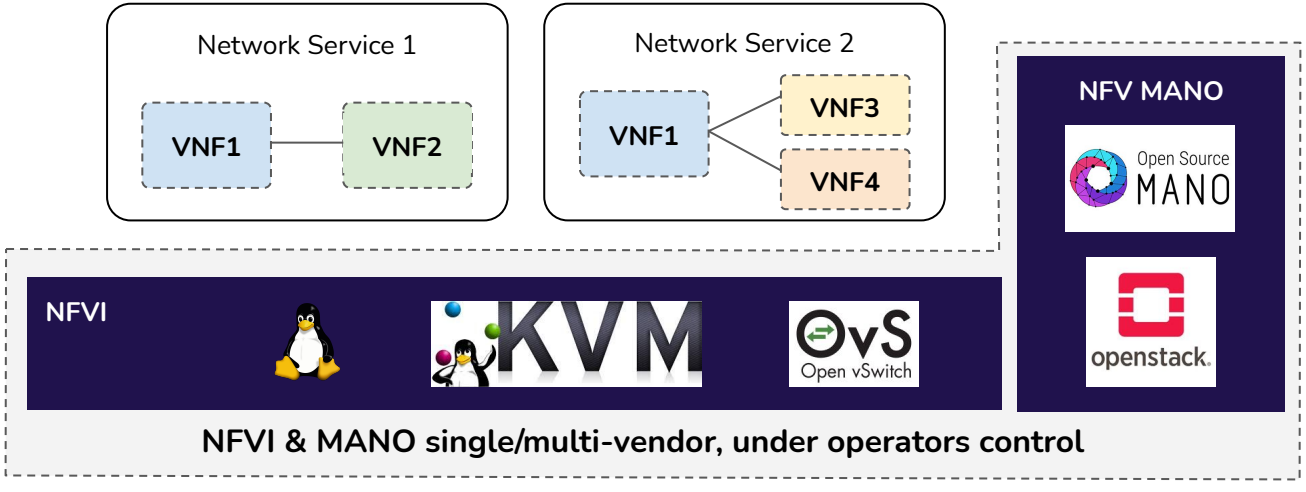
A: Get closer to standards and widely adopted technologies with open-source!



Multi-vendor Network Services

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Finally, operators can enjoy the power of building their own virtualized Network Services, using the best components for every function.



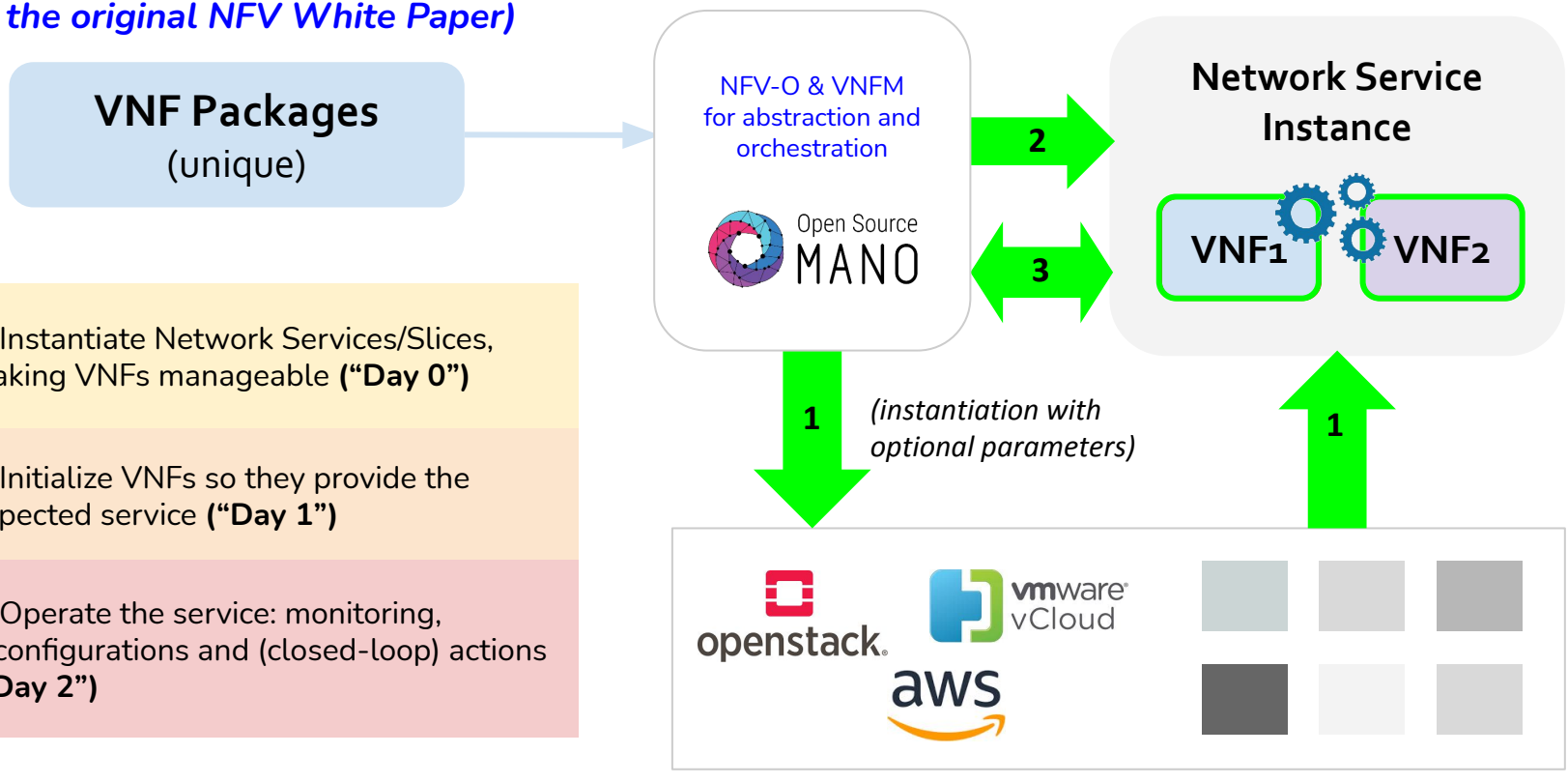
How simple and replicable is to build and deploy these Network Services?
→ that depends on the level of onboarding of the selected VNFs…

VNF Onboarding?

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- Network Functions Virtualisation will only scale if all of the functions can be automated.

(from the original NFV White Paper)



1. Instantiate Network Services/Slices, making VNFs manageable **("Day 0")**
2. Initialize VNFs so they provide the expected service **("Day 1")**
3. Operate the service: monitoring, reconfigurations and (closed-loop) actions **("Day 2")**

Automating Day-0, 1 & 2 operations

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Open Source MANO

Day 0:
Instantiate & Manage

openstack. cloud-init

Isolated VNFs

- vMME
- vS&PGW
- vPCRF
- vHSS

Open Source MANO

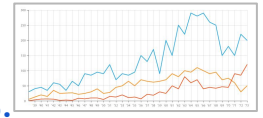
Day 1:
Build Service
(automated)

juju

Evolved Packet Core

- vMME
- vS&PGW
- vPCRF
- vHSS

Open Source MANO



Day 2:
Operate
(on demand)

juju

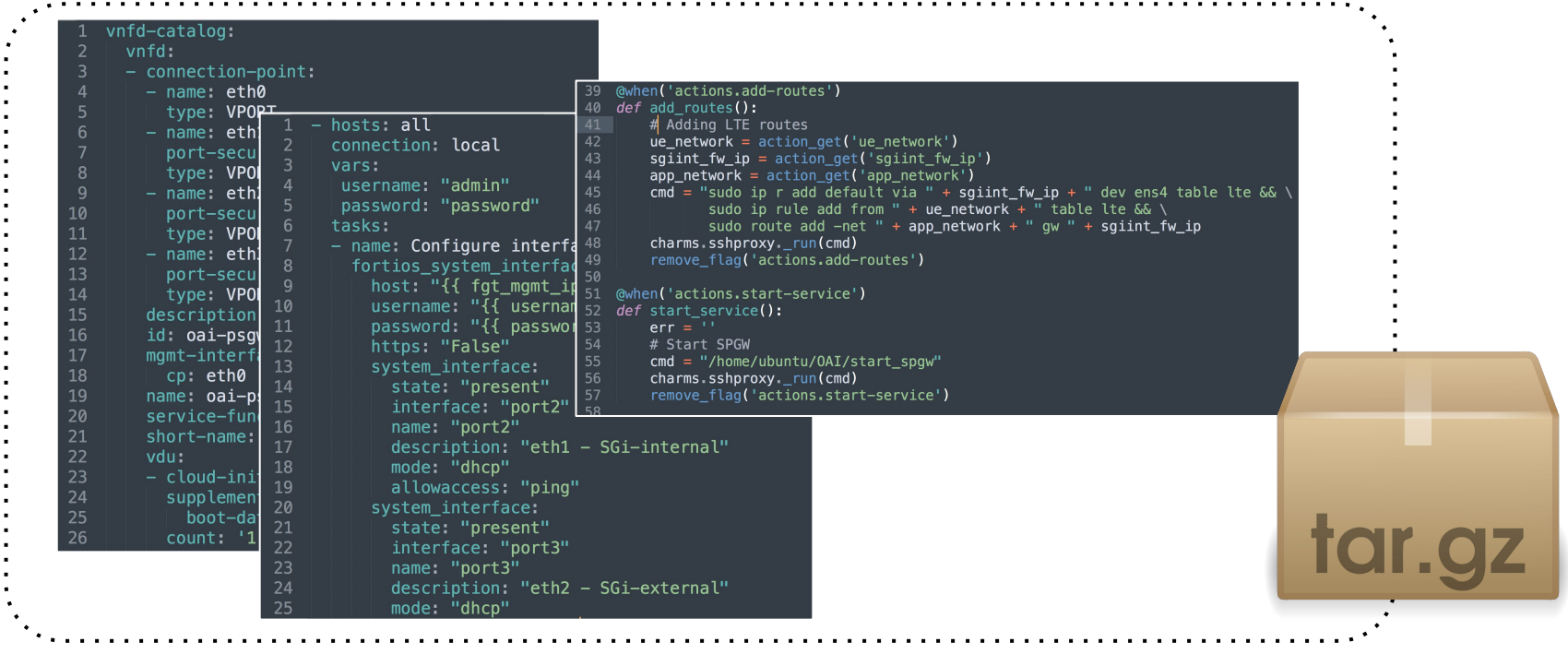
Operated Evolved Packet Core

- vMME
- vS&PGW
- vPCRF
- vHSS

The result: a real VNF Package!

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A **complete VNF Onboarding** process concludes when we have **a package that models the automation of VNF's Day-0 to Day-2 operations**



But, can any Network Function be modelled this way?

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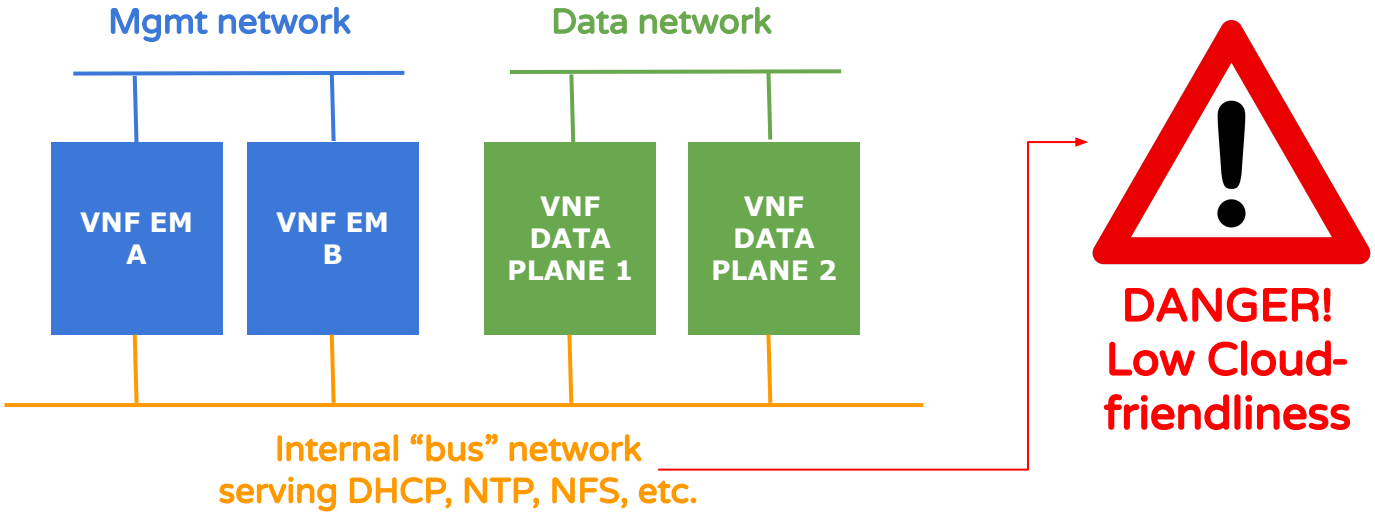
- Why is VNF Onboarding important?
- **Dissecting a complex onboarding process**
- Conclusions & Announcement

Traditional NF Onboarding

Let's explore a real-world example of a Virtual Call Session Control Function (CSCF), recently onboarded with WhiteNFV, Whitestack's OSM distribution.

In this virtual CSCF, the former appliance architecture has been virtualized in this way:

- Virtual Machines emulate linecards
- Internal virtual network that emulate appliance's internal bus between "linecards"
- Services that are redundant with what the Cloud provides run between "linecards" (DHCP, NTP, Storage, etc)

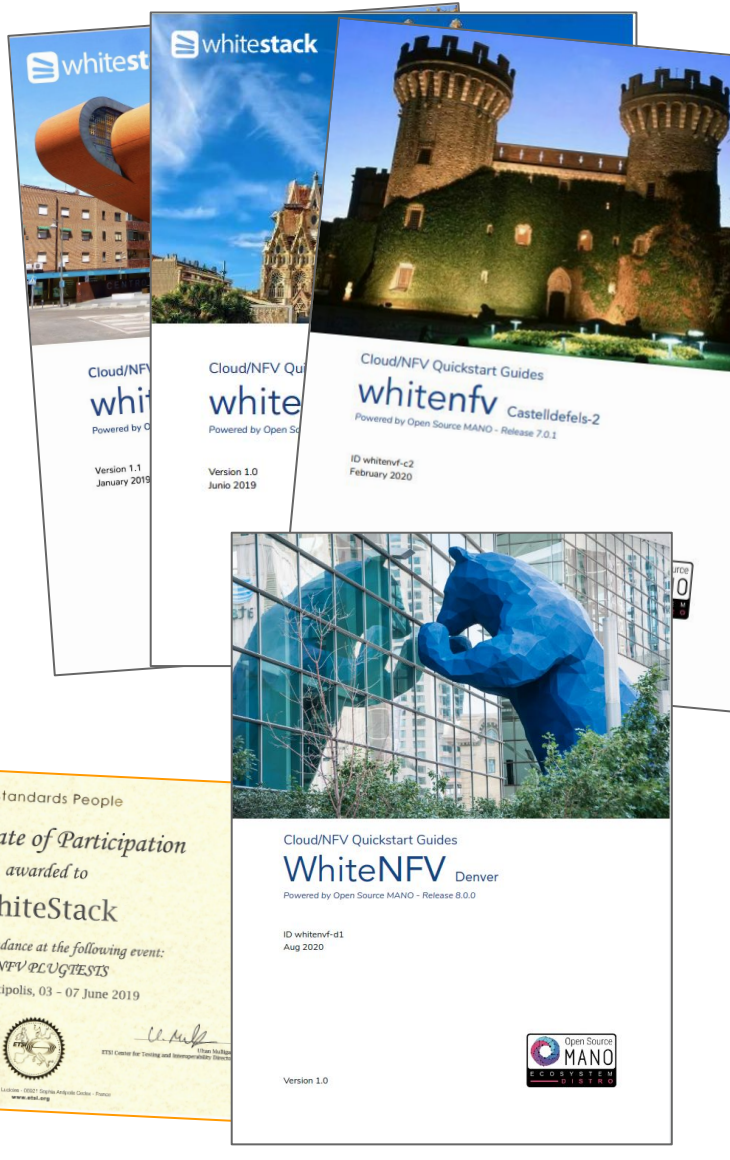


About WhiteNFV

WhiteNFV was the first 100%-aligned OSM distribution available, and accrues an important number of POCs and interoperation tests

- Deployed on top of Kubernetes
- Fast deployment and upgrades
- Implement HA principles
- Additional features oriented to production environments (distributed storage, unified DB engines, security, and more!)

It has been validated in ETSI Plugtests with several VNFs and VIMs (since Jan/2018)





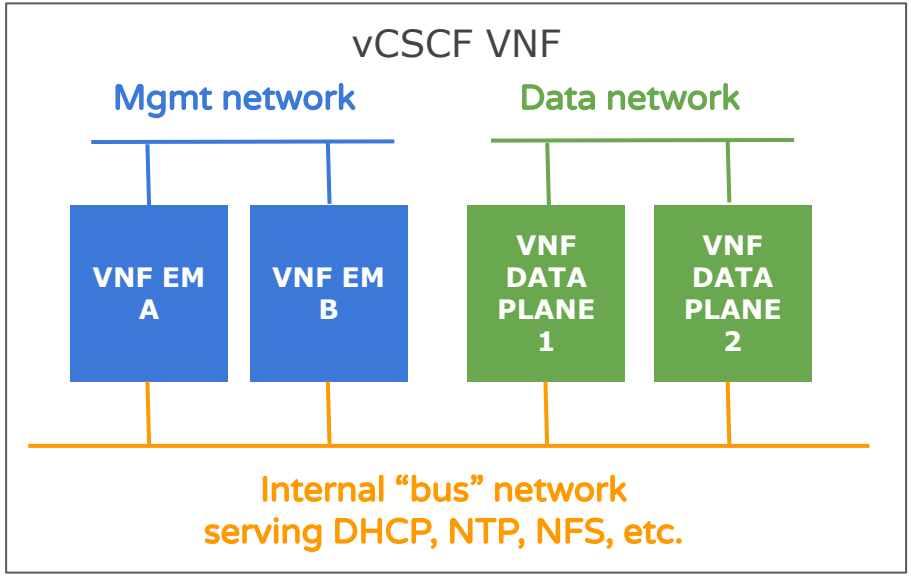
Onboarding real-world complex VNFs with WhiteNFV

What should we aim to automate?

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Things that are available in VIM-specific orchestrators (i.e. Heat)

- ✓ Injection of parameters via user-data
- ✓ Control of HW resources assignment via EPA techniques
- ✓ Network security control



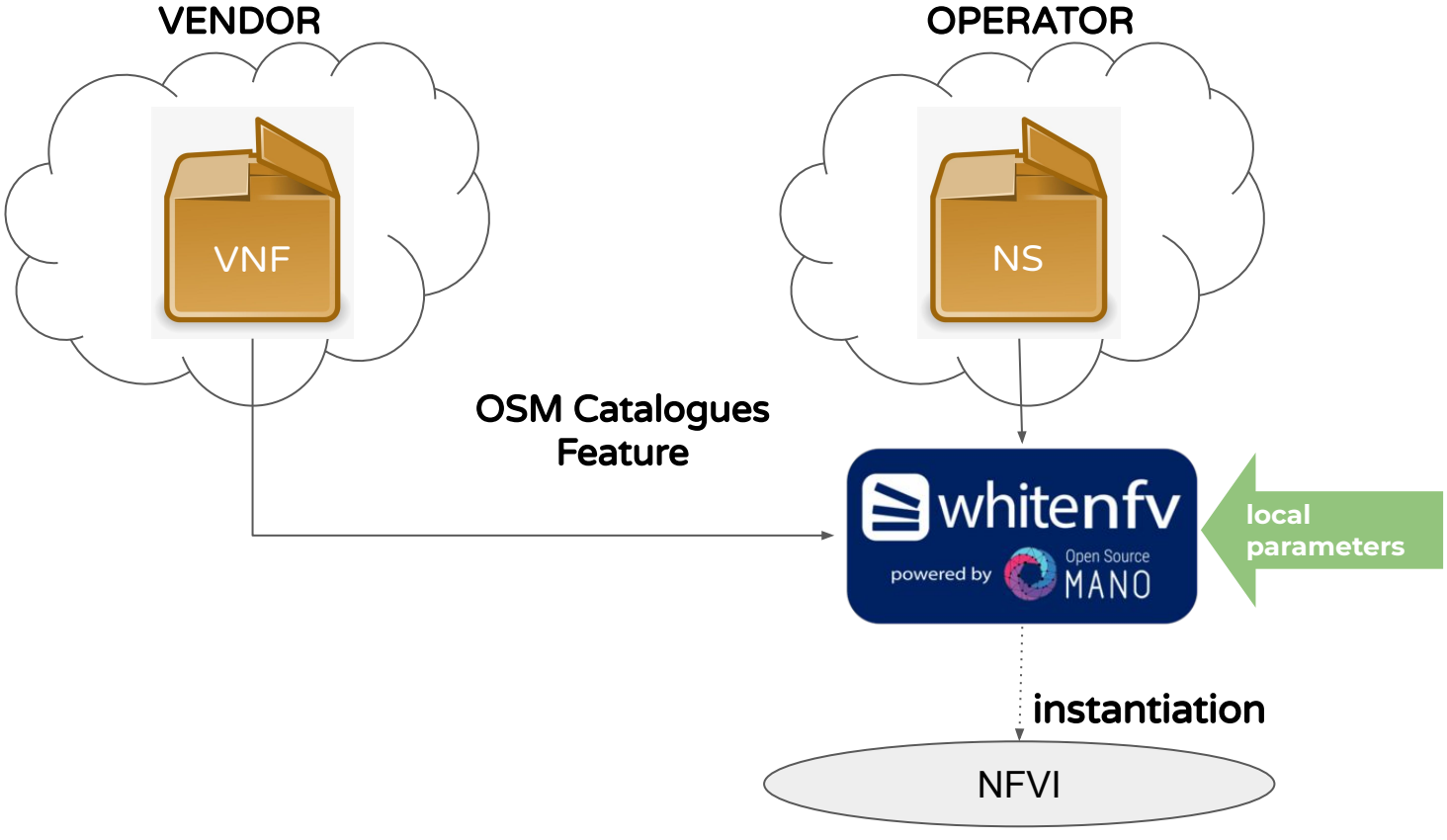
Things that are unique to NFV orchestration

- ✓ NFVI and VNF-level Monitoring
- ✓ (Re)configuration via SSH/Ansible and NETCONF
- ✓ Manual or automatic Scaling

✓ PLUS: we get a reusable VNF package (reusable in any infrastructure)

VNF Package is served online!

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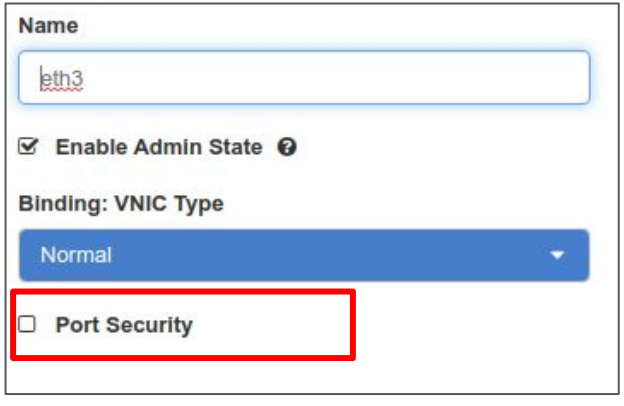
Network Security & EPA Techniques are automatically set at the infrastructure

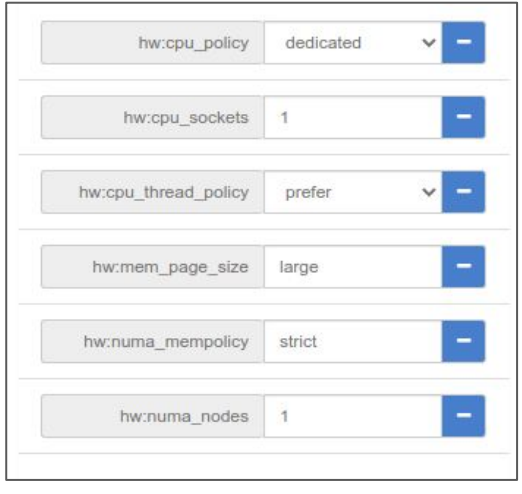
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whitenfv powered by Open Source MANO

```
connection-point:
-   name: sc-gestion1
    port-security-enabled: false
```

```
guest-epa:
    cpu-pinning-policy: DEDICATED
    mempage-size: LARGE
```





...together with static IP/MAC modelling, overriding security settings is KEY for legacy NFs!

VMs are initialized with parametrized user data

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instantiation-time parameters

```
additionalParamsForVnf:
-  member-vnf-index: 'vTCSCF'
   additionalParams:
      OM_IPv4_address: '172.21.7.220'
      OM_IPv6_address: '2001:1b70:8294:3db1::10'
      OM_subnet_IPv4_address: '172.21.7.128/25'
      OM_subnet_IPv6_address: '2001:1b70:8294:3db1::0/64'
      OM_gateway_IPv4_address: '172.21.7.129'
      OM_gateway_IPv6_address: '2001:1b70:8294:3db1::1'
      SC_1_IPv4_address: '172.21.7.221'
      SC_1_IPv6_address: '2001:1b70:8294:3db1::20'
      SC_2_IPv4_address: '172.21.7.222'
      SC_2_IPv6_address: '2001:1b70:8294:3db1::30'
      NTP_server_1_address: 'pool.ntp.org'
```

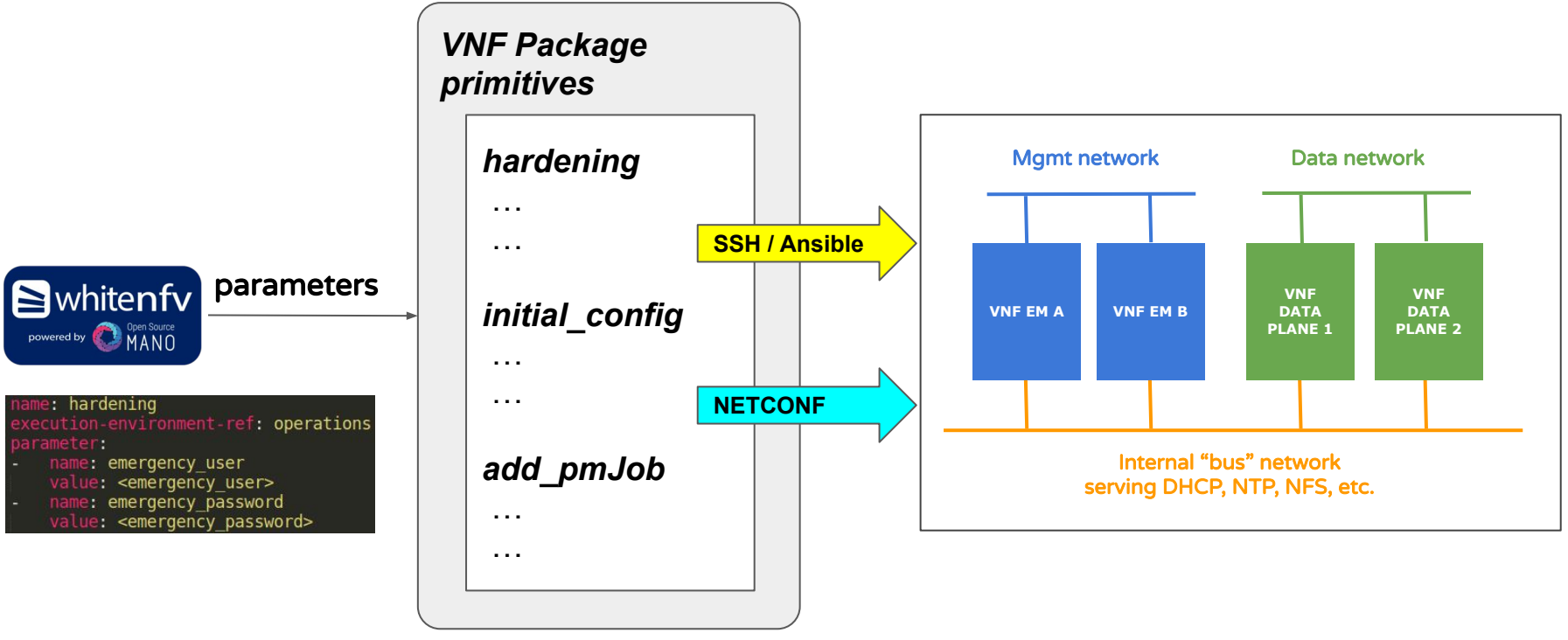
parametrized user data file

```
<Environment xmlns="http://schemas.dmtf.org/ovf/envelope/1"
             xmlns:ovfenv="http://schemas.dmtf.org/ovf/environment/1"
             ovfenv:id="SC-{{ OSM.count_index + 1 }}">
             <PropertySection>
             <Property ovfenv:key="OM_IPv4_address"          ovfenv:value="{{ OM_IPv4_address }}"/>
              <Property ovfenv:key="OM_IPv6_address"          ovfenv:value="{{ OM_IPv6_address }}"/>
              <Property ovfenv:key="OM_subnet_IPv4_address"   ovfenv:value="{{ OM_subnet_IPv4_address }}"/>
              <Property ovfenv:key="OM_subnet_IPv6_address"   ovfenv:value="{{ OM_subnet_IPv6_address }}"/>
              <Property ovfenv:key="OM_gateway_IPv4_address"  ovfenv:value="{{ OM_gateway_IPv4_address }}"/>
              <Property ovfenv:key="OM_gateway_IPv6_address"  ovfenv:value="{{ OM_gateway_IPv6_address }}"/>
```



Network Functions are automatically configured to provide services!

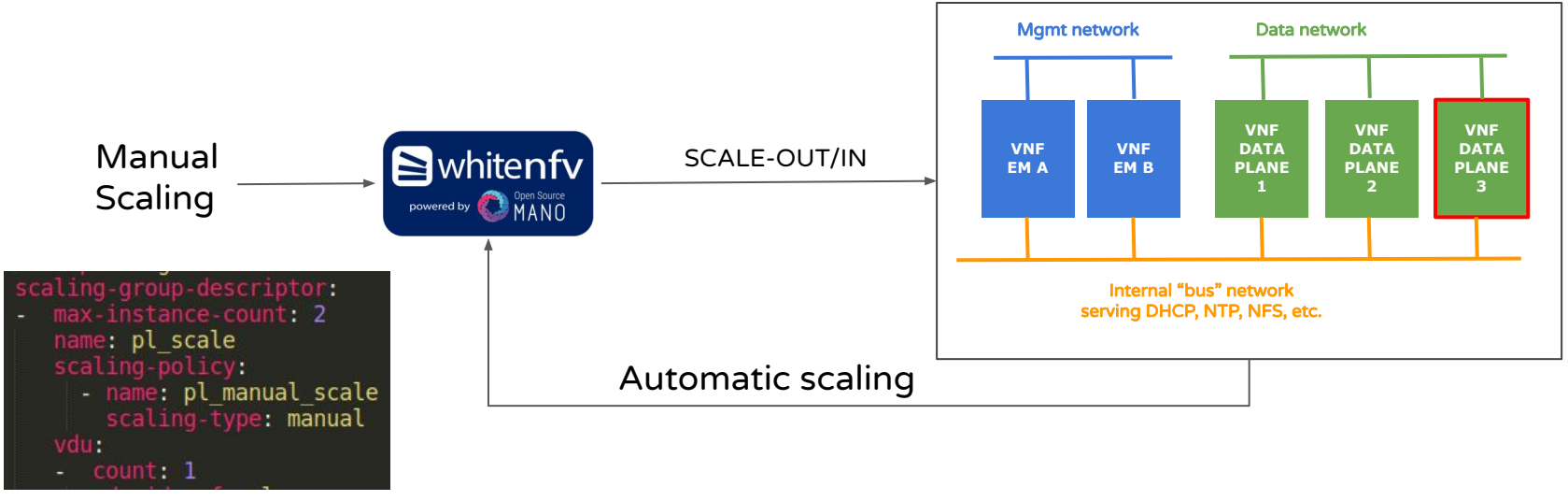
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...together with SDN Assist for underlay automation, this is a KEY value of OSM's NFV Orchestration!

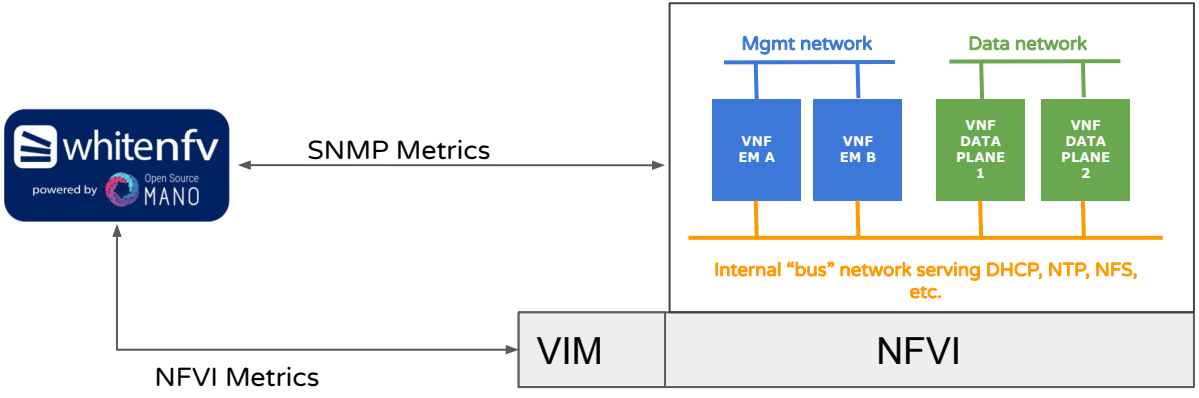
Network Functions can scale manually or automatically based on metrics

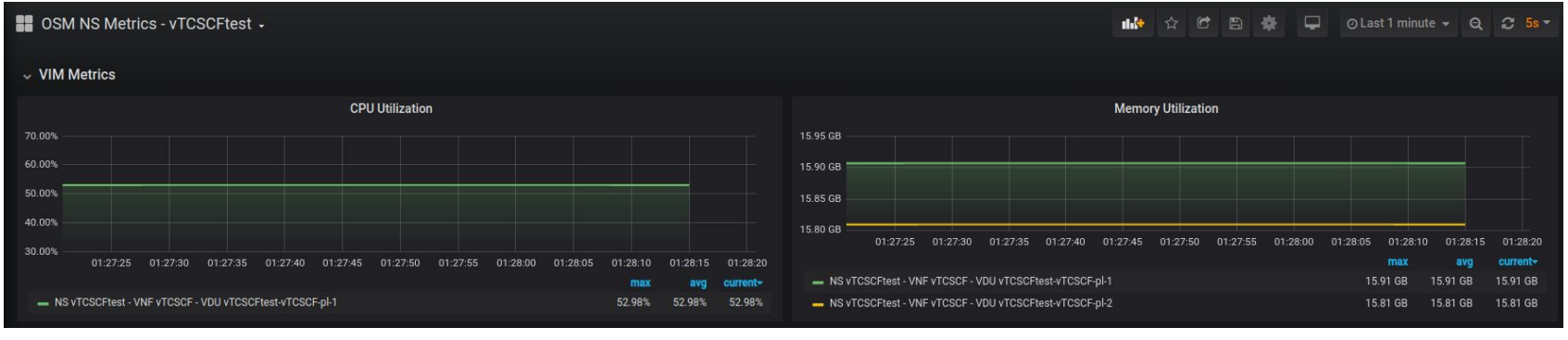
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Metrics can be gathered either from the VIM or directly from the VNF through SNMP

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- Why is VNF Onboarding important?
- Dissecting a complex onboarding process
- **Conclusions & Announcement**

Conclusions

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- **Any VNF can be fully orchestrated, even if it was not originally built for today's cloud.**
- **As far as operators start implementing more distributed and modular network functions, operation will become so complex that orchestration will become the only way forward.**
- **OSM is the only orchestrator in the industry that completely fulfills the NFV vision.**

Announcement!

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We would like to announce a Deployment of Open Source MANO in a Telco production network through WhiteNFV!





Open Source MANO ECOSYSTEM DISTRO

And some other deployments will come soon....

Thanks!



Transforming the telecom industry,
with open technologies.