



GIORNATA DI INCONTRO BORSE DI STUDIO GARR "ORIO CARLINI"
MARTEDI' 12 DICEMBRE 2017 - ROMA



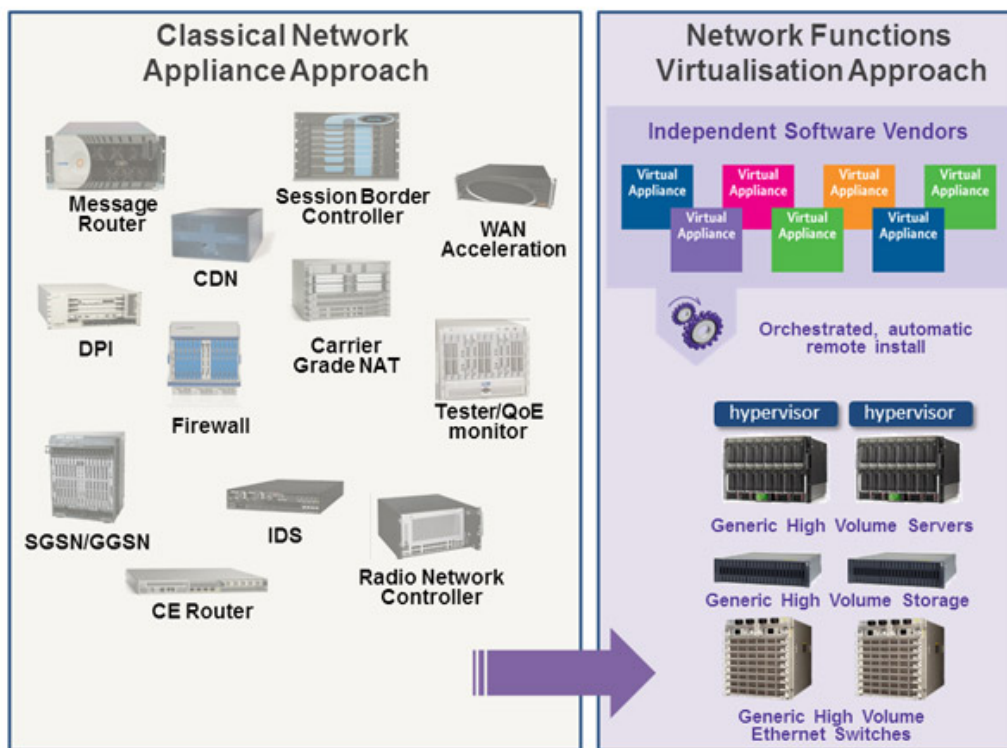
EXPOSE

EXPerimenting on Open Source
sdn/nfv service dELivery platform



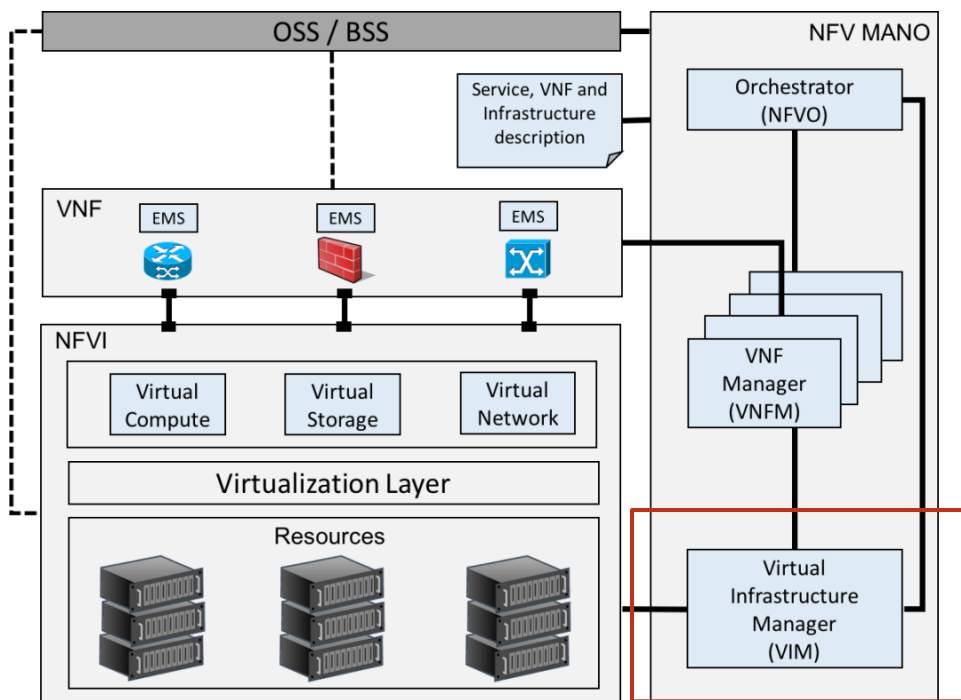
**UNIVERSITÀ DEGLI STUDI DI ROMA
TOR VERGATA**
Dipartimento di Ingegneria Elettronica

Network Function Virtualization scenario

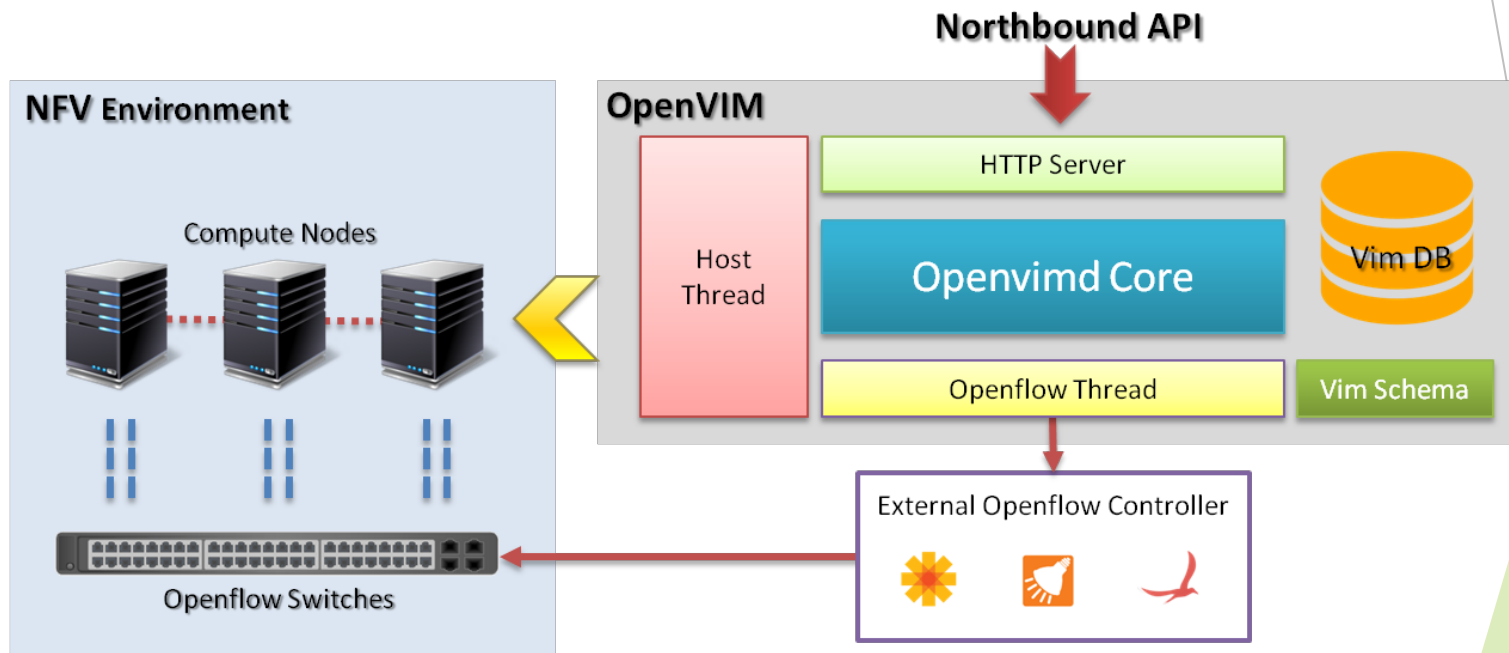


Fonte: British Telecom Website.

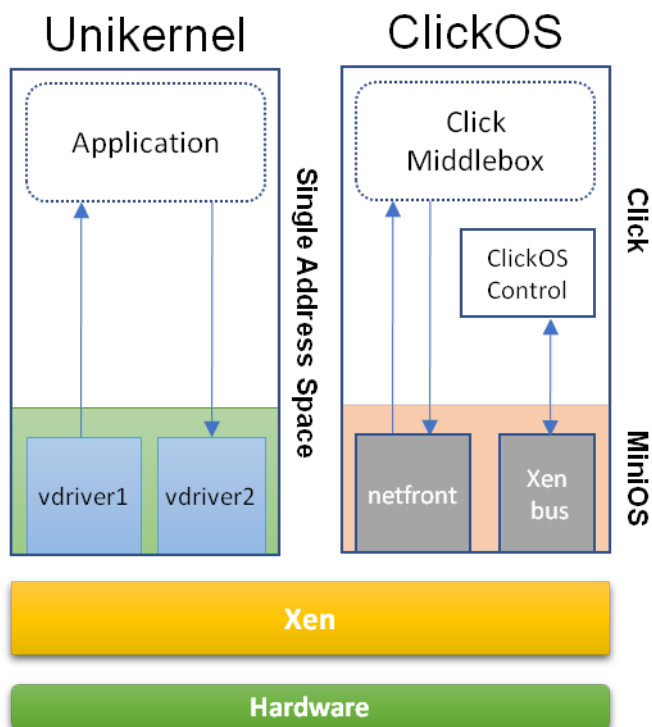
Virtual Infrastructure Manager



OpenVIM



Unikernels - ClickOS



► Unikernels:

- Macchina specializzata: singola applicazione + OS minimale
- Singolo spazio di indirizzi, co-operative scheduling con basso overhead
- La virtualizzazione di Unikernels è realizzata estendendo gli attuali hypervisor (Xen)

► ClickOS

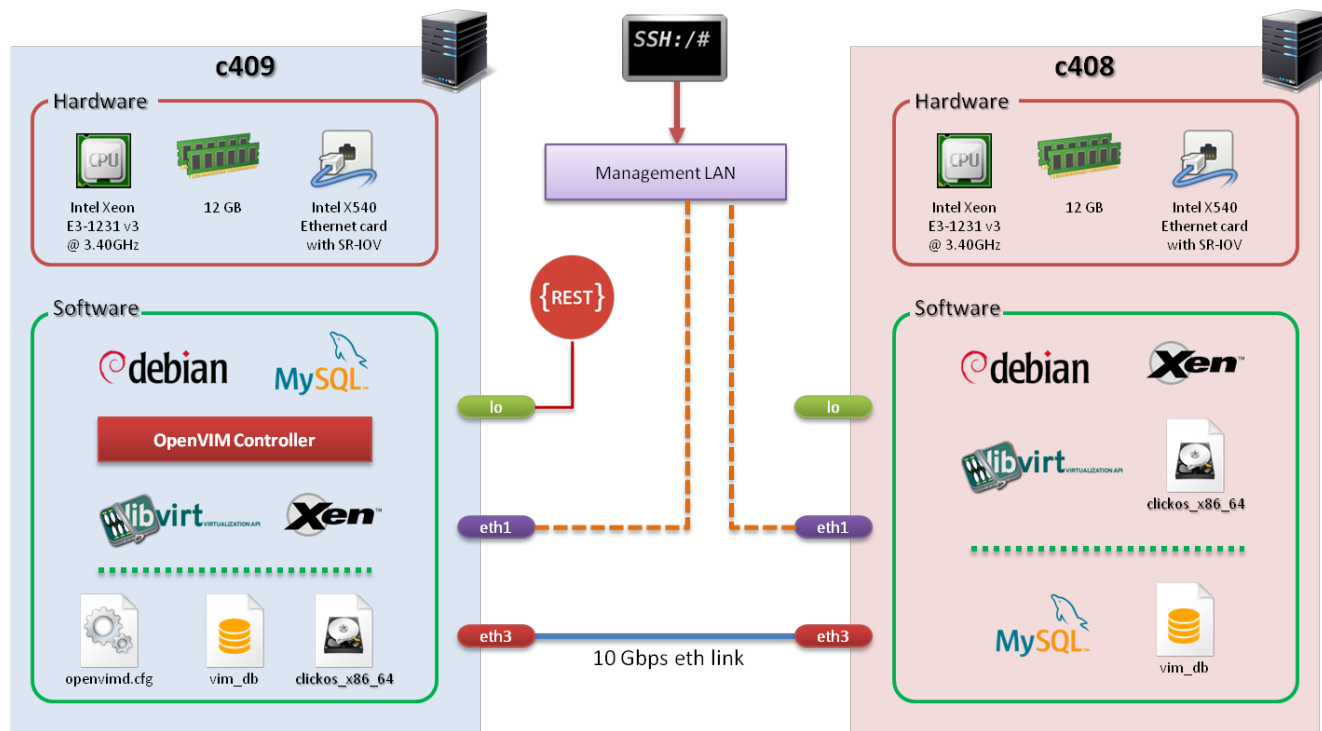
- OS minimalistico basato su MiniOS
- Piccolo (< 4 Mbytes)
- Leggero (1 VCPU, 8 MB RAM, 1 VIF)
- Flessibile (può svolgere diverse funzioni NFV a seconda della configurazione attivata dopo il boot)

Unikernels start up

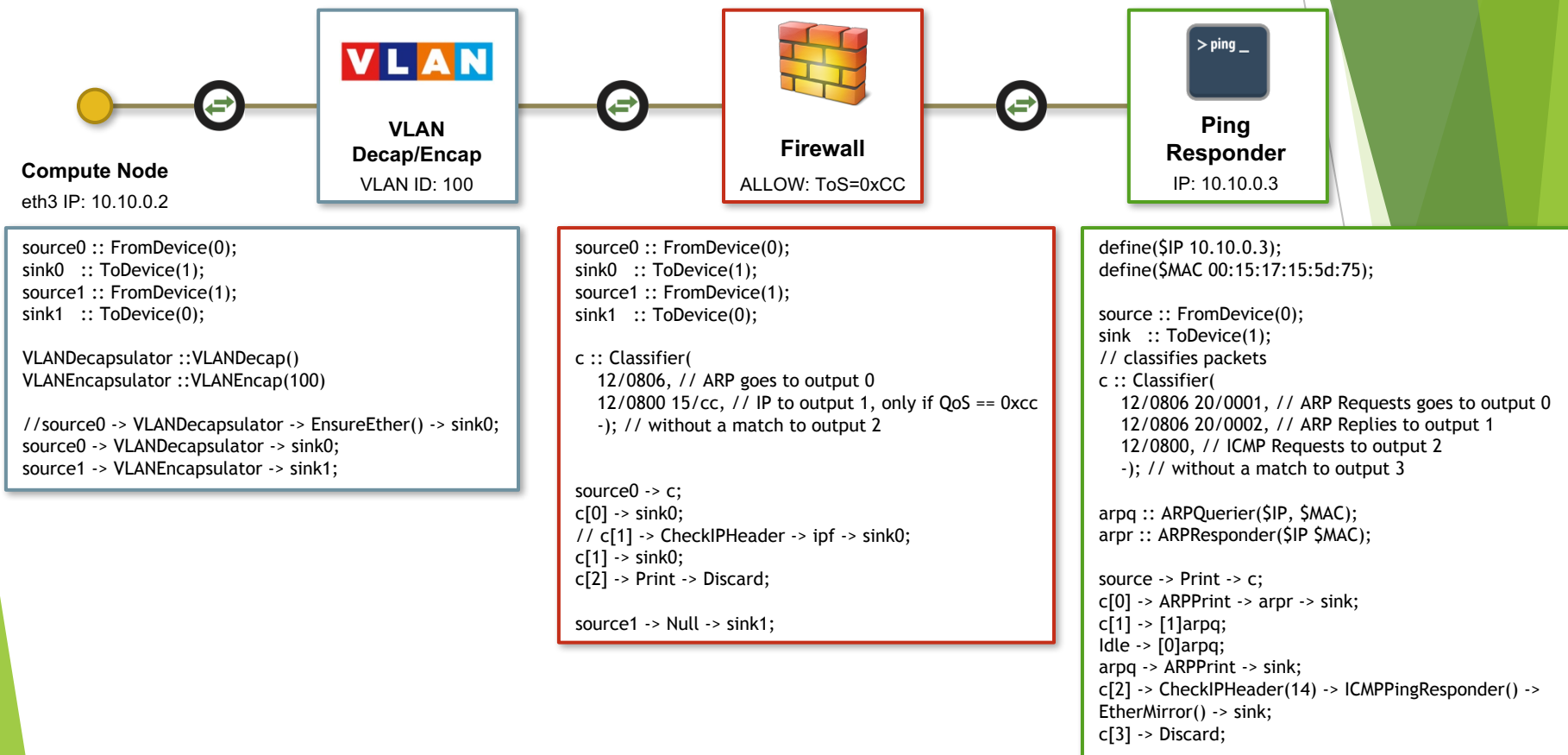
Per avviare Unikernels come ClickOS è stato necessario adattare OpenVIM:

- ▶ Cambio di hypervisor da KVM a XEN
- ▶ Mantenere la compatibilità con KVM
- ▶ Implementare le configurazione per gli unikernel
- ▶ Implementare la configurazione per il boot delle full VM con XEN
- ▶ Implementare un diverso modello di networking
- ▶ Valutare le prestazioni del sistema

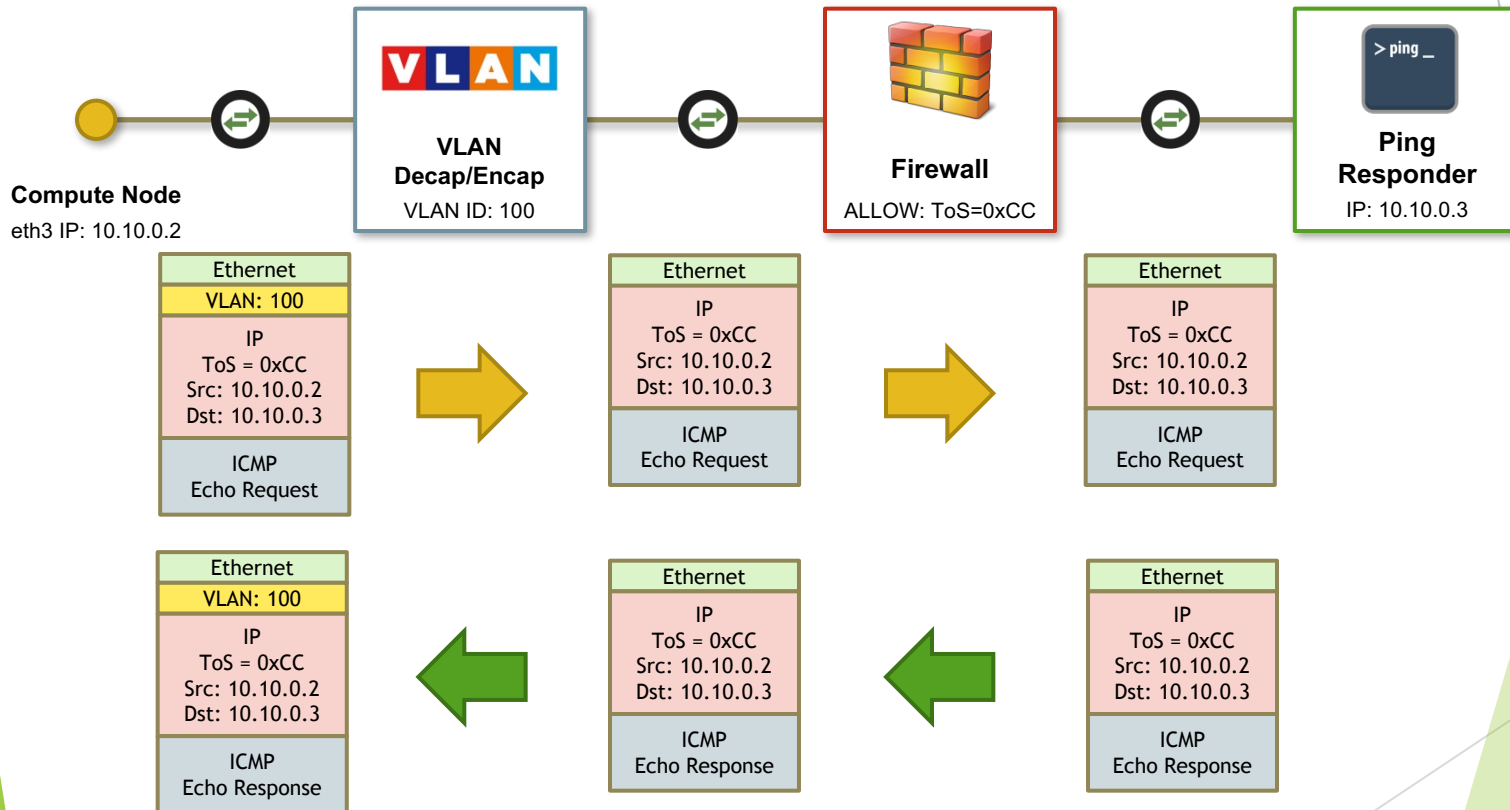
Testbed



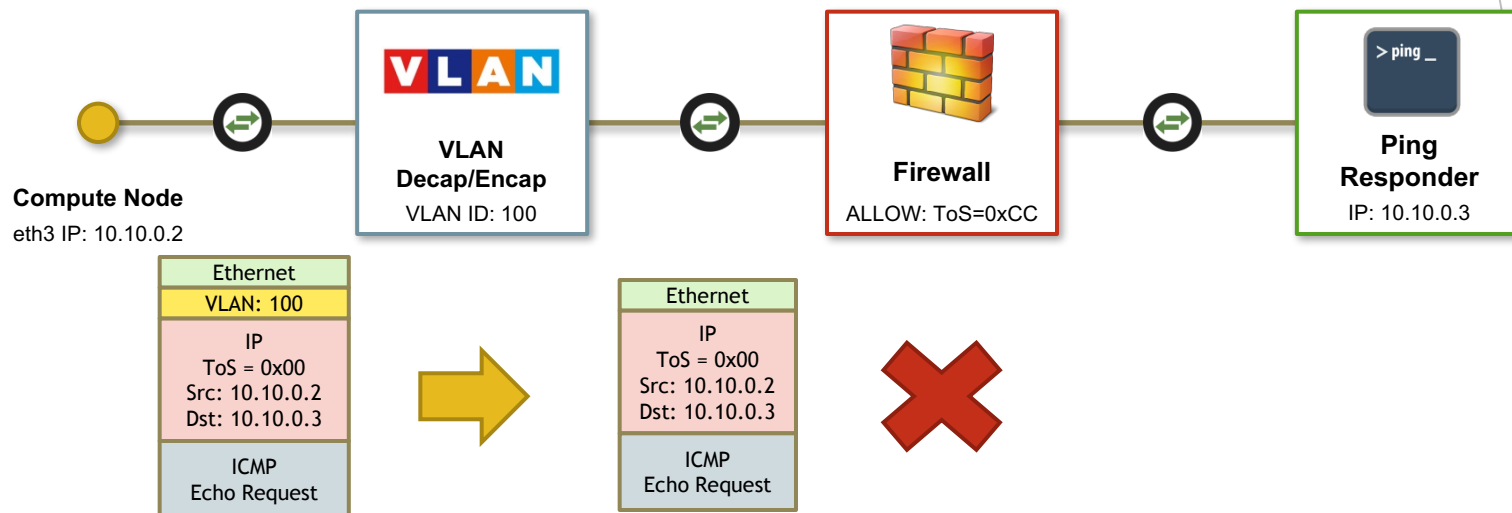
Use case: ClickOS chain



Use case: ClickOS chain



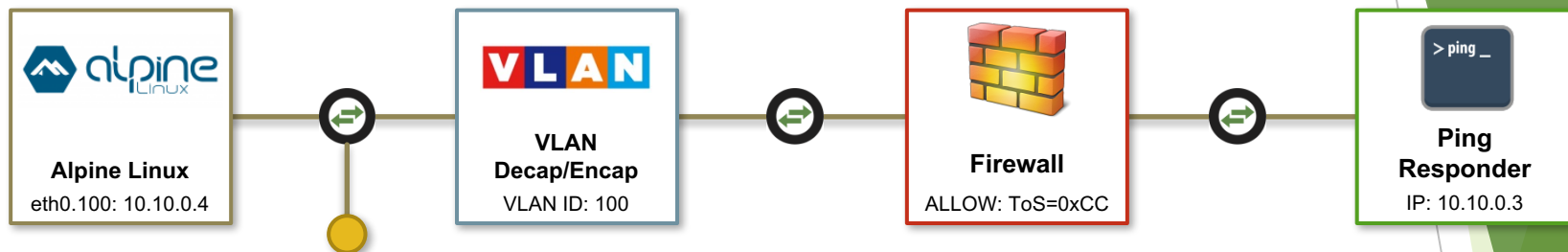
Use case: ClickOS chain



```
ping -c 2 10.10.0.3
PING 10.10.0.3 (10.10.0.3) 56(84) bytes of data.
```

```
--- 10.10.0.3 ping statistics ---
2 packets transmitted, 0 received, 100% packet loss, time 1008ms
```

Use case: avanzato



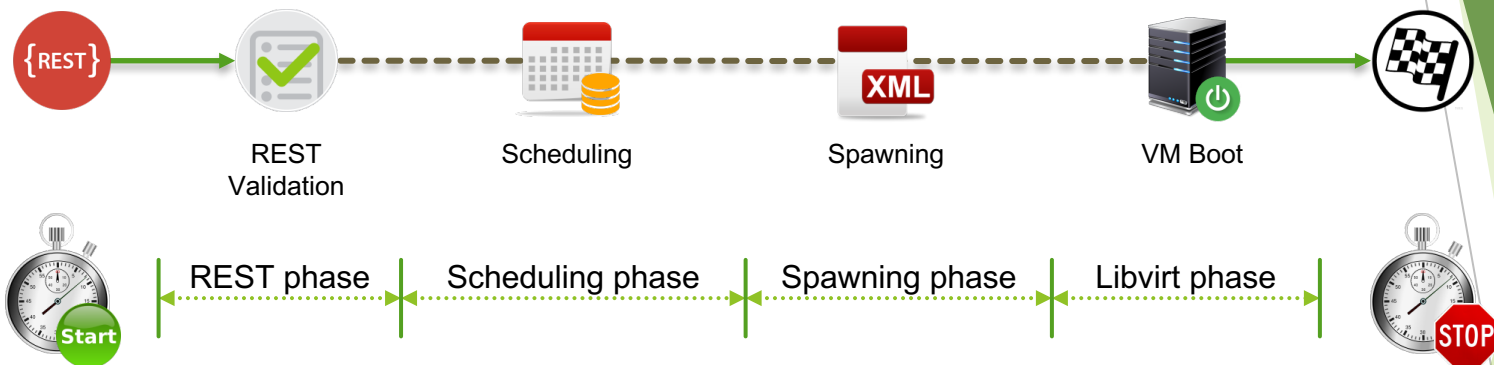
Compute Node
eth3 IP: 10.10.0.2

```
openvim@debian: ~  
Welcome to Alpine Linux 3.4  
Kernel 4.4.30-0-grsec on an x86_64 (/dev/ttyS0)  
  
alpine14 login: root  
Password:  
Welcome to Alpine!  
  
The Alpine Wiki contains a large amount of how-to guides and general  
information about administrating Alpine systems.  
See <http://wiki.alpinelinux.org>.  
  
You can setup the system with the command: setup-alpine  
  
You may change this message by editing /etc/motd.  
  
alpine14:~# ping -c 2 -Q 0xCC 10.10.0.3  
PING 10.10.0.3 (10.10.0.3) 56(84) bytes of data:  
64 bytes from 10.10.0.3: icmp_seq=1 ttl=255 time=1.68 ms  
64 bytes from 10.10.0.3: icmp_seq=2 ttl=255 time=0.369 ms  
  
--- 10.10.0.3 ping statistics ---  
2 packets transmitted, 2 received, 0% packet loss, time 1001ms  
rtt min/avg/max/mdev = 0.369/1.026/1.683/0.657 ms  
alpine14:~#
```

OpenVIM Release

- ▶ Telefónica Investigación y Desarrollo
 - ▶ OpenVIM release "ZERO" ([github](#) - obsoleta)
- ▶ ETSI Comunità OSM (Open Source MANO)
 - ▶ OpenVIM release ONE
 - ▶ OpenVIM release TWO
 - ▶ **OpenVIM release THREE** (ultima rilasciata)
 - ▶ OpenVIM release FOUR ([attualmente in definizione](#))

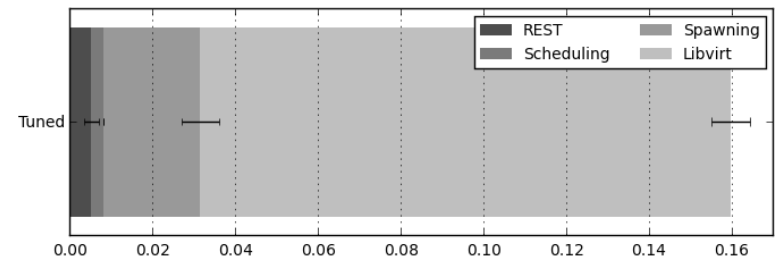
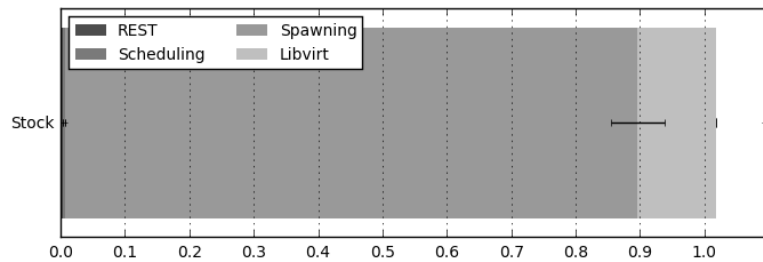
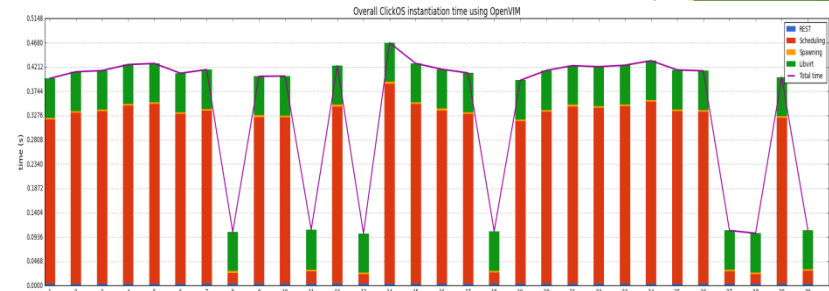
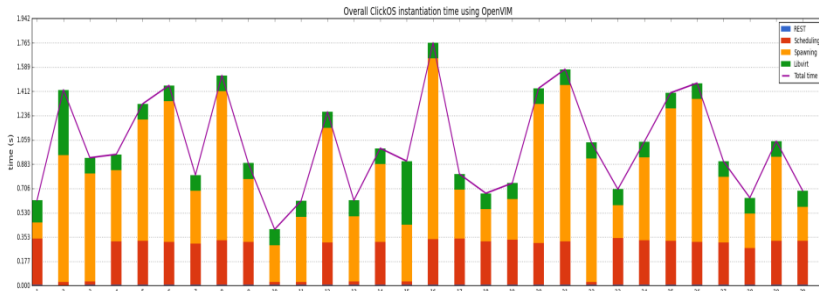
Performance Evaluation



OpenVIM tuned version:

- ▶ Ottimizzazione del descrittore XML
- ▶ Ottimizzazione della gestione dei task.
- ▶ libvirt over TCP (invece di SSH)

Performance Evaluation



Performance: Stress test

Condizioni del test (OpenVIM versione tuned):

- ▶ Avvio da 10 a 300 VNFs ClickOS di background.
- ▶ Istanziamento della N + 1 VNFs e misurazione del tempo di boot
- ▶ Deallocazione delle VNFs istanziate

Load	REST	Scheduling	Spawning	Libvirt
10 VMs	0.004	0.004	0.185	0.157
20 VMs	0.007	0.004	0.216	0.161
50 VMs	0.007	0.004	0.192	0.181
100 VMs	0.007	0.004	0.205	0.216
150 VMs	0.007	0.005	0.207	0.254
200 VMs	0.007	0.005	0.206	0.297
250 VMs	0.007	0.005	0.195	0.346
300 VMs	0.008	0.006	0.195	0.401



Performance: Batch tests

Condizioni del test (OpenVIM versione tuned):

- ▶ Avvio da 0 a 200 VNFs ClickOS di background
- ▶ Simulazione di una chain di VNF da 5 a 10 ClickOS
- ▶ Deallocazione delle VNFs istanziate

Load - Batch	5 VMs	6 VMs	7 VMs	8 VMs	9 VMs	10 VMs
0 VMs	0.319	0.337	0.342	0.371	0.374	0.391
10 VMs	0.447	0.467	0.461	0.455	0.454	0.463
50 VMs	0.535	0.539	0.526	0.545	0.551	0.543
100 VMs	0.622	0.594	0.624	0.616	0.622	0.632
200 VMs	0.814	0.829	0.841	0.862	0.851	0.863

Conclusioni

- ▶ Esplorato il mondo NFV concentrandomi sui VIM
- ▶ Valutato OpenStack come VIM
- ▶ Esplorato le capacità degli Unikernels (ClickOS)
- ▶ Studiato attentamente OpenVIM
- ▶ Modificato OpenVIM per adattarlo agli Unikernels e XEN
- ▶ Costruito uno use case per testare il sistema
- ▶ Valutato le prestazioni di OpenVIM nel boot di Unikernels



Dissemination activities

► Pubblicazioni:

- P. L. Ventre, C. Pisa, S. Salsano, G. Siracusano, F. Schmidt, P. Lungaroni, N. Blefari-Melazzi, “Performance Evaluation and Tuning of Virtual Infrastructure Managers for (Micro) Virtual Network Functions”, IEEE NFV-SDN Conference, Palo Alto, USA, 7-9 November 2016
- P.L. Ventre, P. Lungaroni, G. Siracusano, C. Pisa, F. Lombardo, F. Schmidt, S. Salsano, “On the Fly Orchestration of Unikernels: Tuning and Performance Evaluation of Virtual Infrastructure Managers” (non pubblicato)

► Presentazioni:

- S. Salsano, F. Huici, “Superfluid NFV: VMs and Virtual Infrastructure Managers speed-up for instantaneous service instantiation”, October 10th 2016 - EWSDN @ SDN & OpenFlow World Congress
- S. Salsano, “Performance Evaluation and Tuning of Virtual Infrastructure Managers for (Micro) Virtual Network Functions”, November 8th 2016 - IEEE NFV-SDN conference, Palo Alto, USA, 7-9 Nov. 2016
- C. Pisa “VIMs extensions to deal with Unikernels/Unikernel support in VIM : performance evaluation”, Bucarest, Romania 28 March 2017
- S. Salsano, “Extending ETSI VNF descriptors and OpenVIM to support Unikernels”, ETSI OSM-Mid-Release#3 meeting, July 13th, Sophia Antipolis, France
- S. Salsano “Deploying of Unikernels in the NFV Infrastructure”, EuCNC 2017, Oulu, Finland, June 11th 2017
- S. Salsano, “RDCL 3D, a Model Agnostic Web Framework for the Design and Composition of NFV Services”, O4SDI - 3rd IEEE International Workshop on Orchestration for Software Defined Infrastructures @ IEEE NFV-SDN 2017 Berlin Germany 6th November, 2017



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Grazie per l'attenzione



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Dipartimento di Ingegneria Elettronica



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