

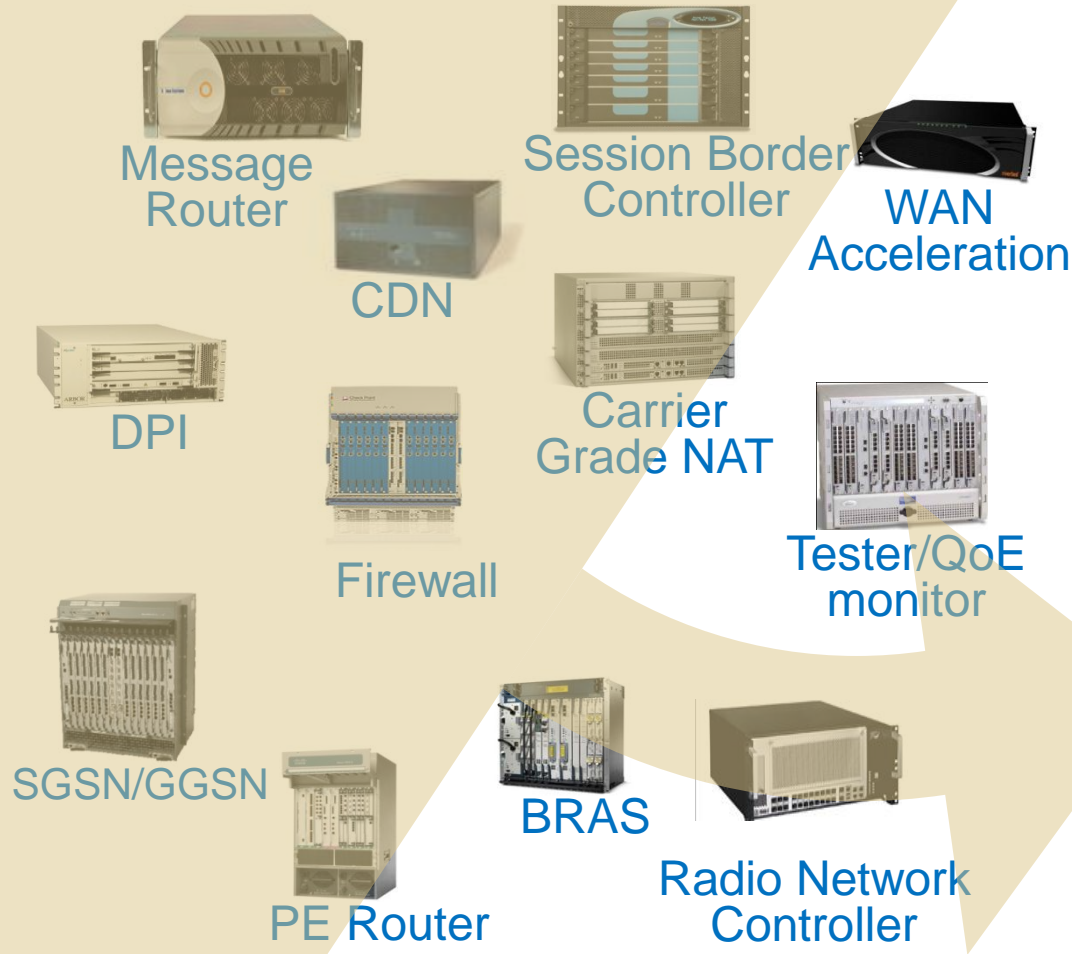


# Network Functions Virtualisation

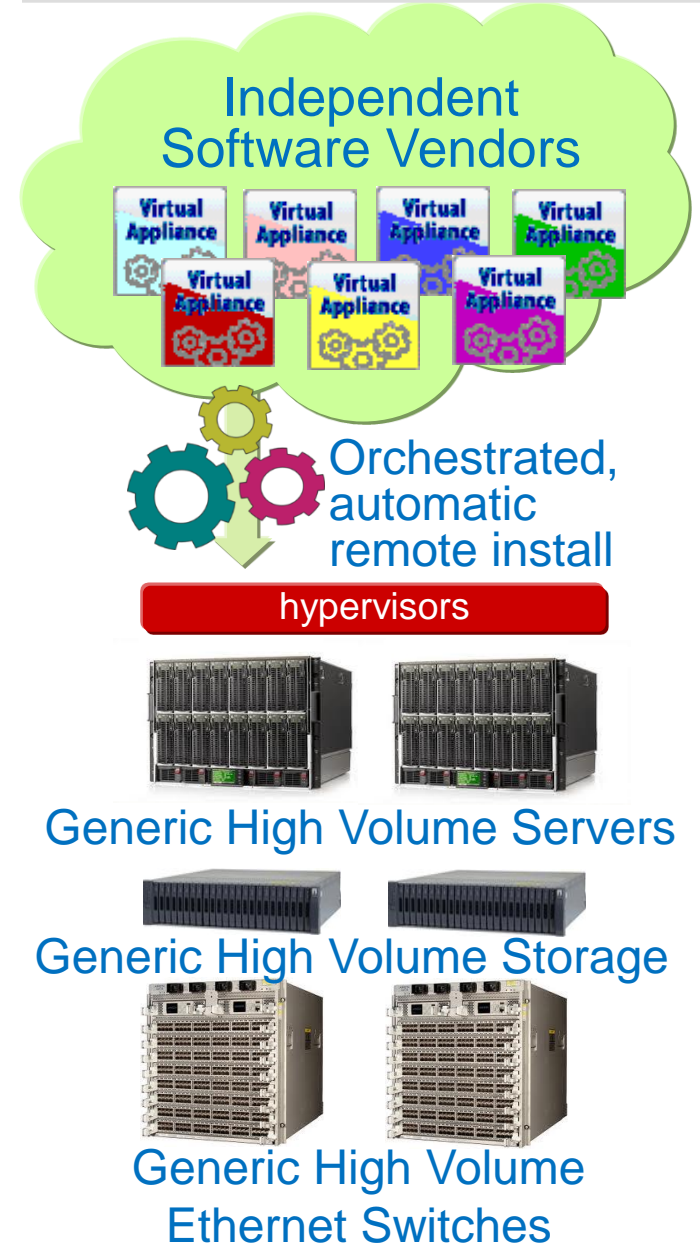
Bob Briscoe  
Chief Researcher  
BT

+ Don Clarke, Pete Willis, Andy Reid, Paul Veitch (BT)  
+ further acknowledgements within slides

# Network Functions Virtualisation Approach



## Classical Network Appliance Approach



# If price-performance is good enough, rapid deployment gains come free

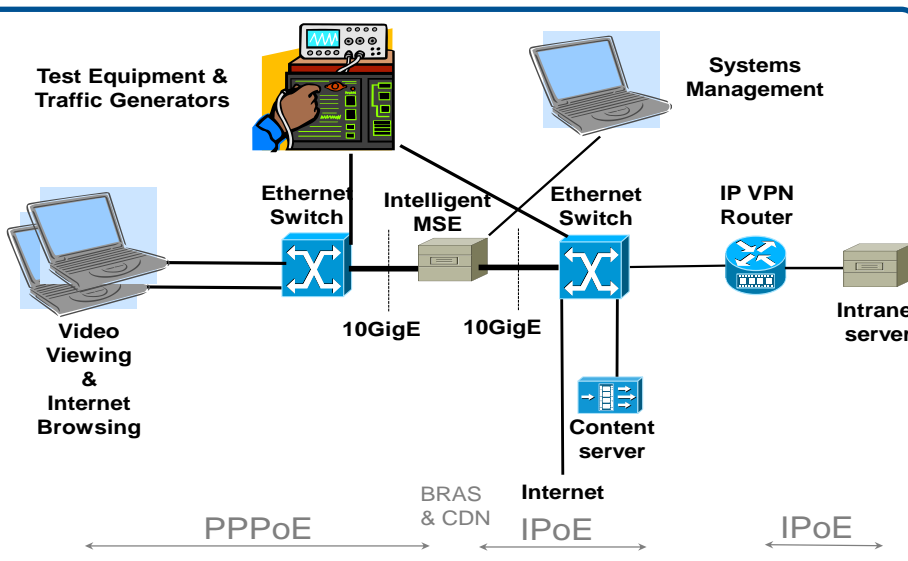
## Mar'12: Proof of Concept testing

- Combined BRAS & CDN functions on Intel® Xeon® Processor 5600 Series HP c7000 BladeSystem using Intel® 82599 10 Gigabit Ethernet Controller sidecars
  - BRAS chosen as an “acid test”
  - CDN chosen as architecturally complements BRAS
- BRAS created from scratch so minimal functionality:
  - PPPoE; only PTA, priority queuing; no RADIUS, VRFs
- CDN COTS – fully functioning commercial product

acknowledge:



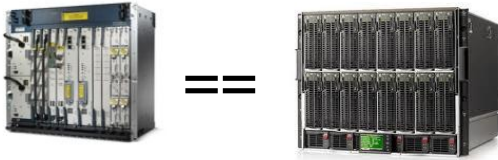
WIND RIVER



Significant management stack :

1. Instantiation of BRAS & CDN modules on bare server
2. Configuration of BRAS & Ethernet switches via Tail-F
3. Configuration of CDN via VVue mgt. sys.
4. Trouble2Resolve via HP mgmt system

# Mar'12: Proof of Concept Performance Test Results

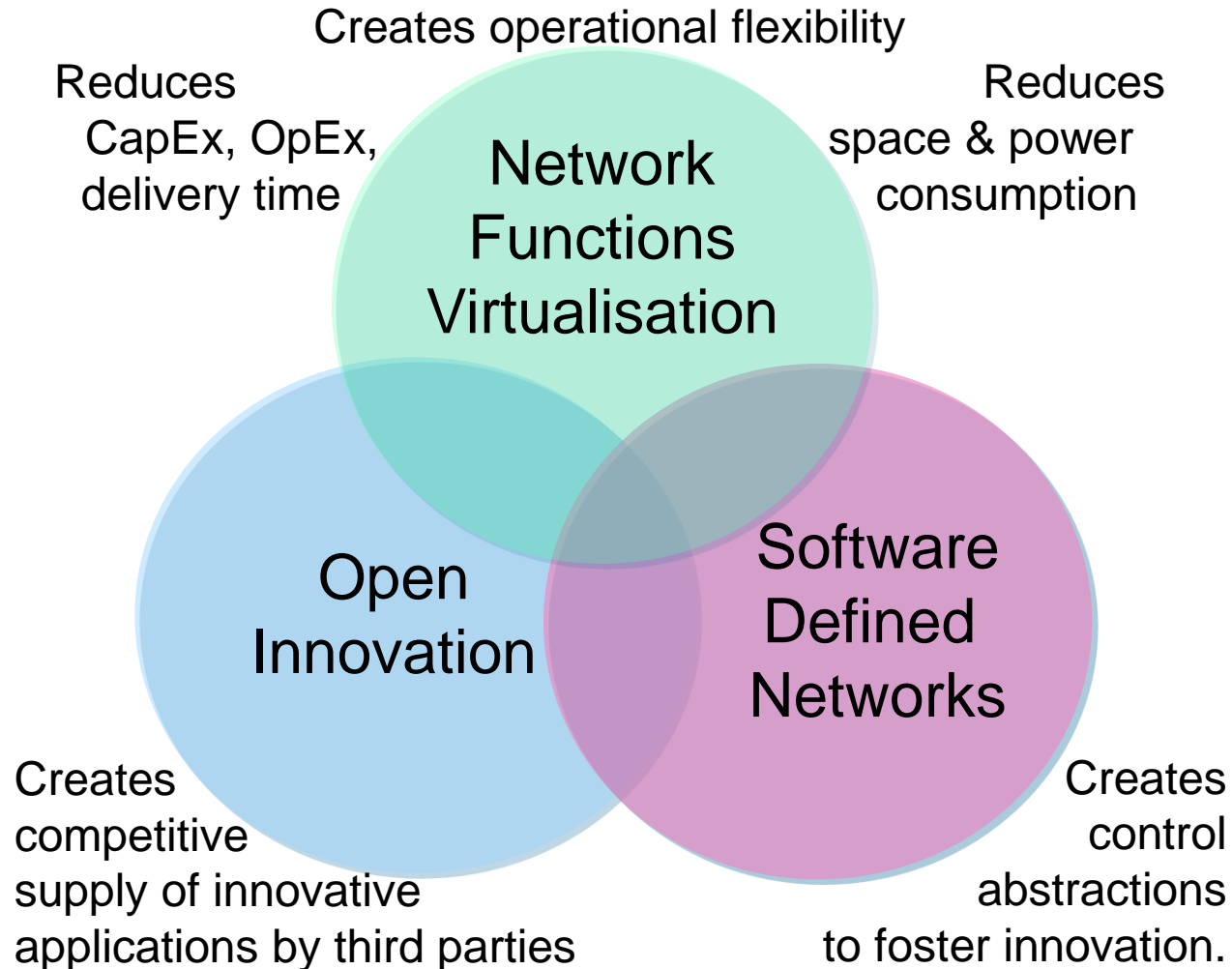


- Average 3 Million Packets Per Second per Logical Core for PPPoE processing.
  - Equivalent to 94 M PPS/97 Gbps per Blade = 1.5 G PPS/1.5 Tbps per 10 U chassis<sup>1</sup>.
  - Test used 1024 PPP sessions & strict priority QoS
  - Test used an Intel® Xeon® E5655 @ 3.0 GHz, 8 physical cores, 16 logical cores (not all used).
- Scaled to 9K PPPoE sessions per vBRAS.
  - Can support 3 vBRAS per server.
- Subsequent research:
  - implemented & testing software Hierarchical QoS
  - results so far show processing is still not the bottleneck
  - (also tested vCDN performance & video quality)

Test Id	Description	Result
1.1.1	Management access	Pass
1.2.1	Command line configuration: add_sp_small	Pass
1.2.2	Command line configuration: add_sub_small	Pass
1.2.3	Command line configuration: del_sub_small	Pass
1.2.4	Command line configuration: del_sp_small	Pass
1.3.1	Establish PPPoE session	Pass
1.4.1	Block unauthorized access attempt: invalid password	Pass
1.4.2	Block unauthorized access attempt: invalid user	Pass
1.4.3	Block unauthorized access attempt: invalid VLAN	Pass
1.5.1	Time to restore 1 PPPoE session after BRAS reboot	Pass
1.6.1	Basic Forwarding	Pass
1.7.1	Basic QoS - Premium subscriber	Pass
1.7.2	Basic QoS - Economy subscriber	Pass
2.1.1	Command line configuration: add_sp_medium	Pass
2.1.2	Command line configuration: add_sub_medium	Pass
2.2.1	Establish 288 PPPoE sessions	Pass
2.3.1	Performance forwarding: downstream to 288 PPPoE clients	Pass
2.3.2	Performance forwarding: upstream from 288 PPPoE clients	Pass
2.3.3	Performance forwarding: upstream and downstream from/to 288 PPPoE clients	Pass
2.4.1	Time to restore 288 PPPoE sessions after BRAS reboot	Pass
2.5.1	Dynamic configuration: add a subscriber	Pass
2.5.2	Dynamic configuration: connect new subscribers to BRAS	Pass
2.5.3	Dynamic configuration: delete a subscriber	Pass
2.5.4	Dynamic configuration: delete service provider	Pass
2.6.1	QoS performance - medium configuration	Pass
3.1.1	Command line configuration: add_sp_large	Pass
3.1.2	Command line configuration: add_sub_large	Pass
3.2.1	Establish 1024 PPPoE sessions	Pass
3.3.1	Performance forwarding: downstream to 1024 PPPoE clients	Pass
3.3.2	Performance forwarding: upstream from 1024	Pass

**very useful performance potential to match the performance per footprint of existing BRAS equipment**

### 3 Complementary but Independent Networking Developments



# New NfV Industry Specification Group (ISG)

- First meeting mid-Jan 2013
  - > 150 participants
  - > 100 attendees from > 50 firms
- Engagement terms
  - under ETSI, but open to non-members
  - non-members sign participation agreement
    - essentially, must declare relevant IPR and offer it under fair & reasonable terms
  - only per-meeting fees to cover costs
- Deliverables
  - White papers identifying gaps and challenges
  - **as input to relevant standardisation bodies**
- ETSI NfV collaboration portal
  - white paper, published deliverables
  - how to sign up, join mail lists, etc

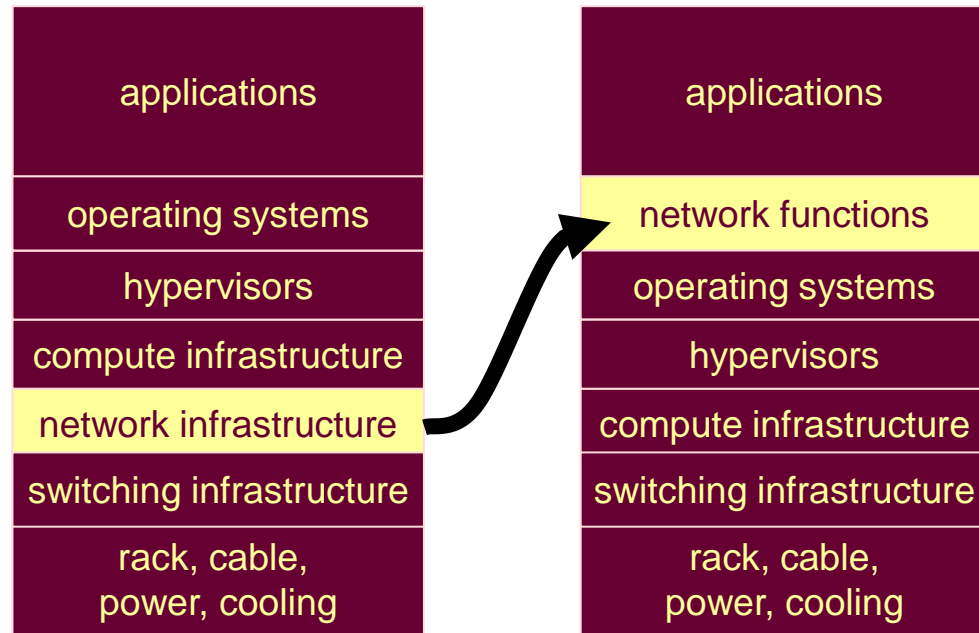
- Network-operator-driven ISG
  - Initiated by 13 carriers shown
  - Consensus in white paper
  - Network Operator Council offers requirements
  - grown to 23 members so far



# gaps & challenges

## examples

- management & orchestration
  - infrastructure management standards
  - multi-level identity standard
  - resource description language



- security
  - Topology Validation & Enforcement
  - Availability of Management Support Infrastructure
  - Secure Boot
  - Secure Crash
  - Performance Isolation
  - Tenant Service Accounting

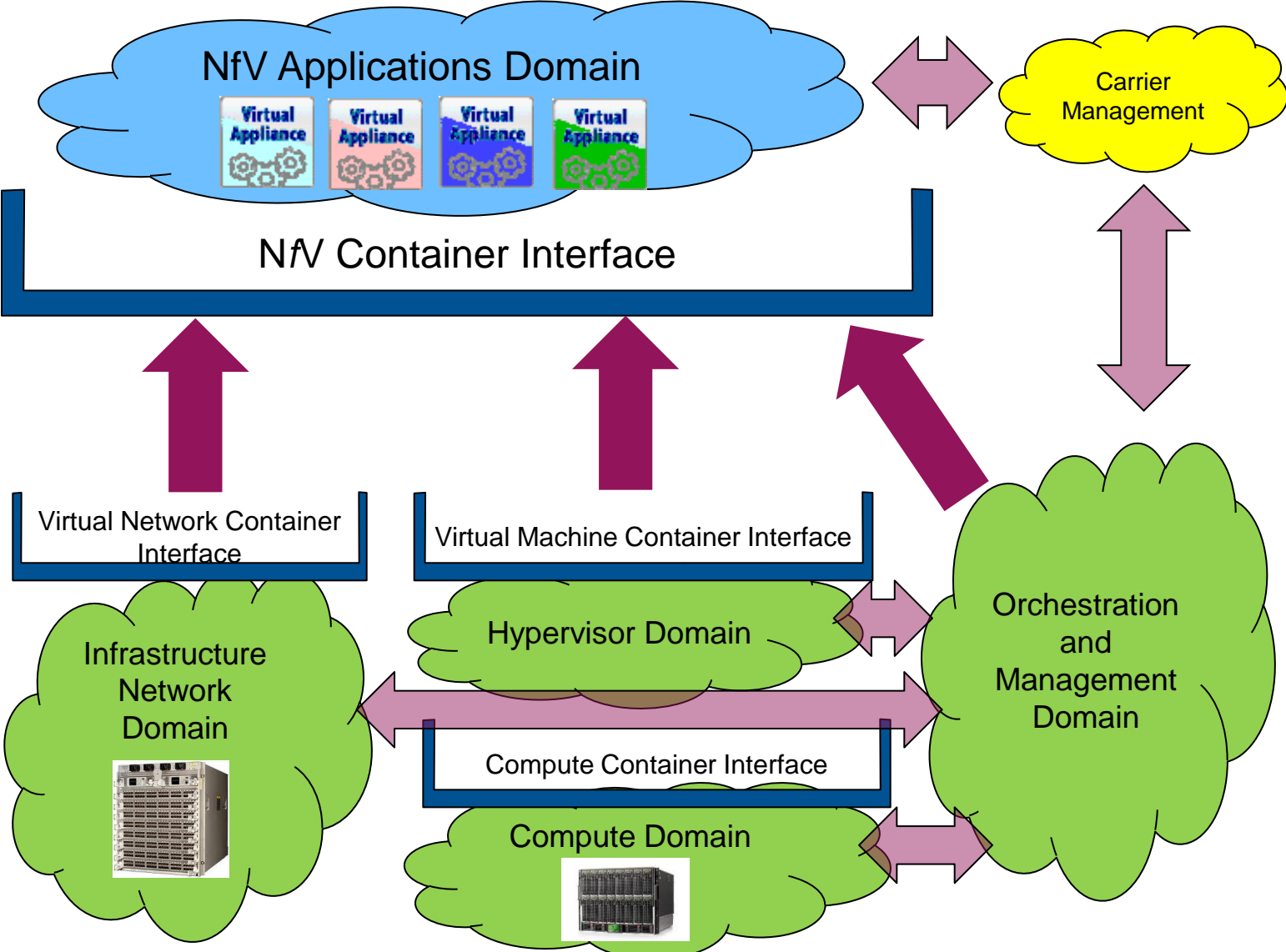


## Q&A

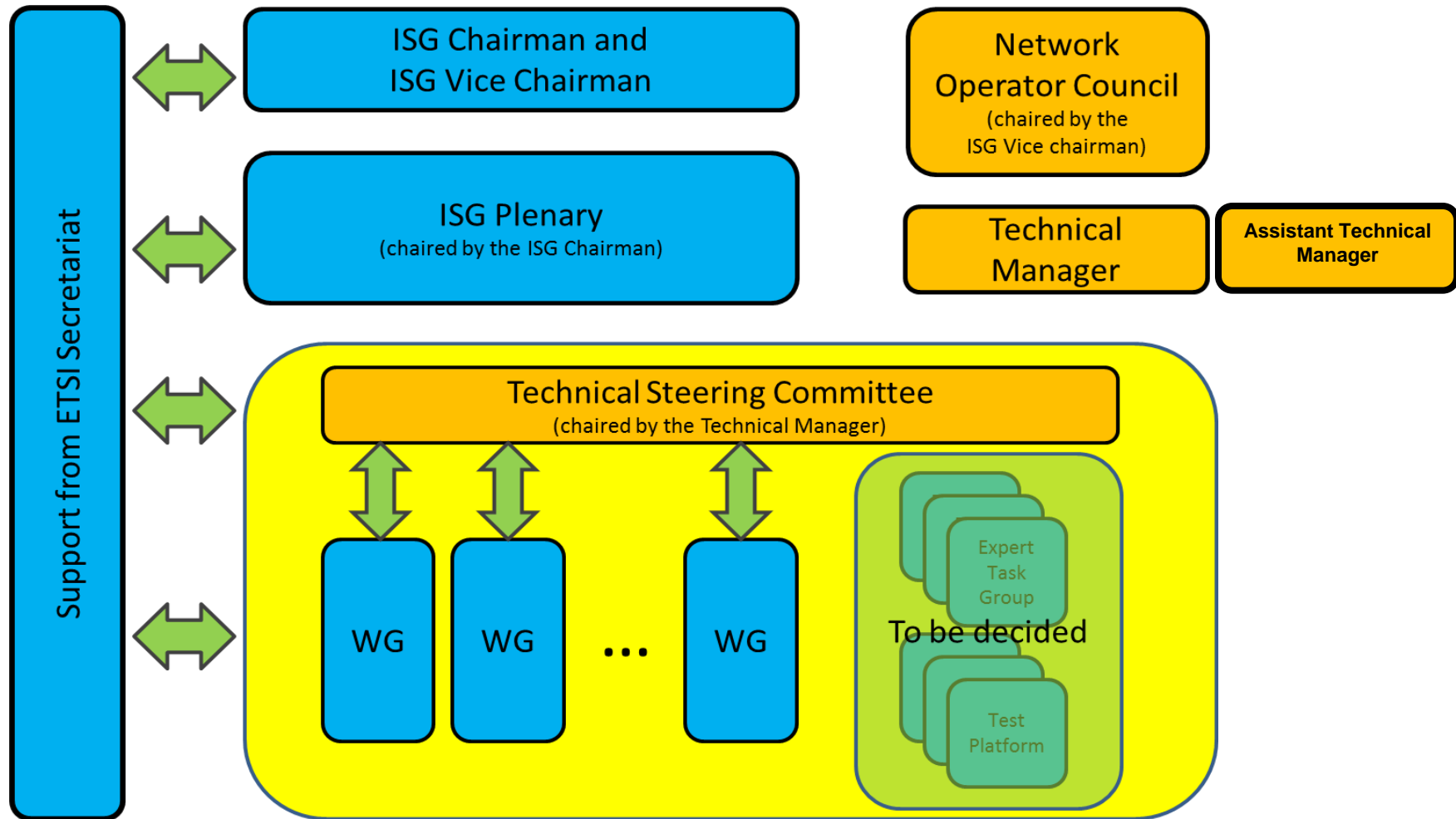
and spare slides



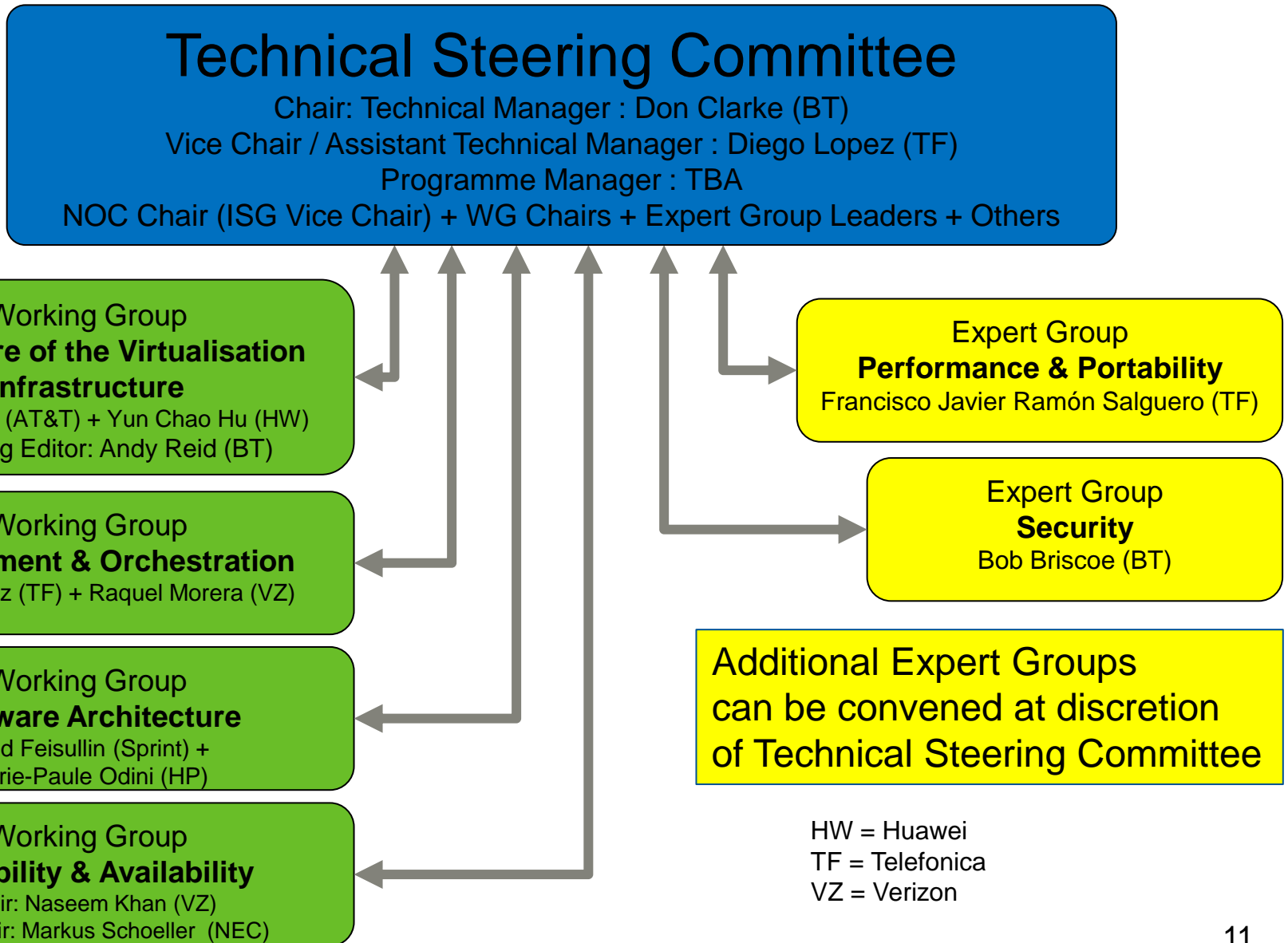
# Domain Architecture



# NVF ISG Organisation Structure...

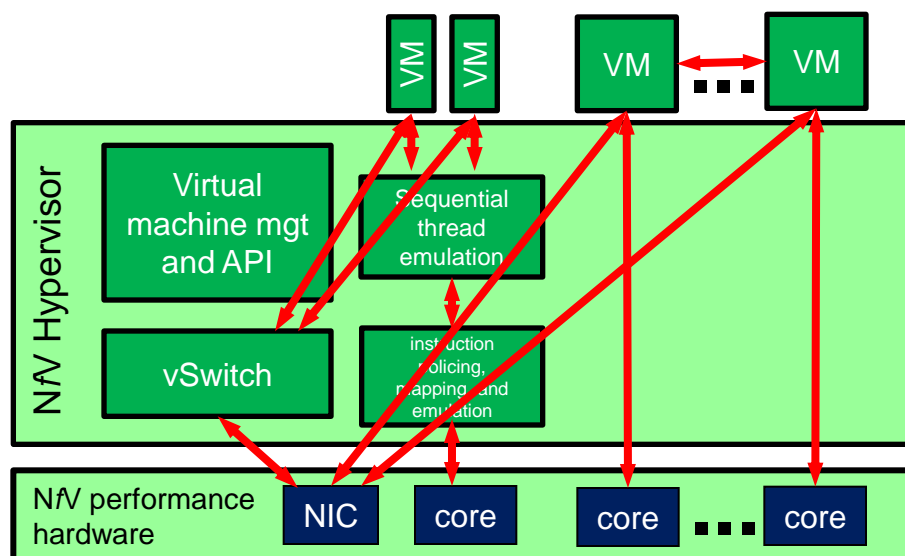
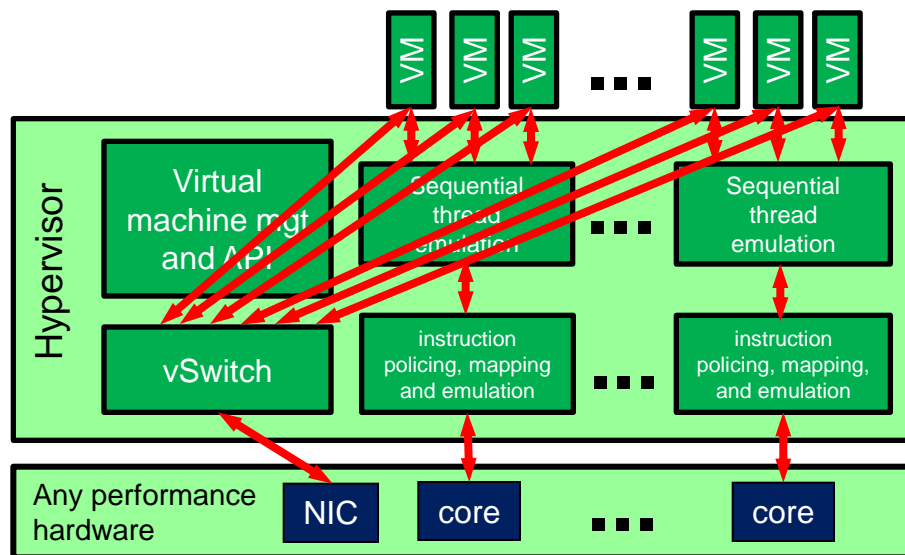


# ISG Working Group Structure



# Hypervisor Domain

- General cloud hypervisor is designed for maximum application portability
  - Hypervisor creates
    - Virtual CPUs
    - Virtual NICs
  - Hypervisor provides
    - Virtual Ethernet switch
  - Hypervisor fully hides real CPUs and NICs
- NFV Hypervisor is aimed at removing packet bottlenecks
  - Direct binding of VM to core
  - Direct communication between VMs and between VMs and NIC
    - User mode polled drivers
    - DMA remapping
    - SR-IOV
- Many features already emerging in hypervisors



# Orchestration and Infrastructure Ops Domain

- Automated deployment of NfV applications
  - Orchestration console
  - Higher level carrier OSS
- Tools exist for automated cloud deployment
  - vSphere
  - Openstack
  - Cloudstack
- NfV infrastructure profile for NfV application to
  - Select host
  - Configure host
  - Start VM(s)
- Application profile to specify
  - Service address assignment (mechanism)
  - Location specific configuration

