“Softwarization: RD & Innovation status of activities and next steps”

ANTONIO MANZALINI, Chair of the IEEE SDN initiative

ITU-T Focus Group on IMT-2020
Pre-meeting workshop on network softwarization
Turin, 21st September, 2015
IEEE SDN is a cross-societies initiative aiming at developing a worldwide RD&I cooperation on Software Defined Network (SDN) and Network Function Virtualization (NFV) by creating the conditions for a pre-industrial impact in Telecommunications and ICT.

A main challenge will be overcoming current “fragmentation” by reaching a critical mass of leading technical experts (both from Industry and Academia), business managers of LE and SME, Entrepreneurs, Open Source communities, early adopters, Regulators, Policy makers, real Users, etc;

IEEE SDN core team is composed of about 50 Experts actively involved in 7 Committees:

- Conference, Education, Publicity, Publication, Standards, Pre-Industrial and Out Reach;

Initiative is currently followed by the a Technical Community of about 2500 people.
What’s today understanding?

- The two basic principles of SDN – NFV are not new:
  - the former is about the separation between s/w and h/w has been around for a long time (e.g., active and programmable networks);
  - the later leverages on virtualization of network and IT resources which was demonstrated and exploited in IT systems after in the ‘60ties;
- What’s new is the techno-economic context, making SDN-NFV sustainable
- At the beginning SDN – NFV have been mainly considered as technologies for the evolution of current core Telecommunications networks (e.g., routers, switches, transmission nodes, and middle-boxes);
- IEEE SDN has argued that said paradigms are part of a broader systemic trend called «softwarization» which will impact all Telecommunications and ICT areas (from terminals, to the edge network, to the core network to the Data Centers).
What’s today understanding?

- SDN and NFV are not only concerning Networks. SDN and NFV are facets of a systemic trend, called Softwarization which is aiming at «integrating» Cloud, Networks and Terminals.

- In fact, Softwarization can be seen as a crossing point of key technological trajectories, such as: pervasive diffusion of ultra-broadband; IT HW performance increase (at lower and lower costs); growing availability of Open Source SW; more and more advanced terminals.

A SYSTEMIC GAME CHANGER FOR TELECOMMUNICATIONS AND ICT: FROM NETWORKS TO SERVICE PLATFORMS TO THE NEW TERMINALS
Drivers

Softwarization = technology + business + regulations

Centralization
- Cloud - Computing
- Legacy Telecom Networks

Distribution
(i.e., both global and local)
- Cloud - Edge - Computing
- SDN
- NFV

• Ultra – broadband
• IT performance/costs
• Open Source S/W
• Virtualization
• Powerful terminals

Today

Softwarization

Tomorrow

Digital society
Industry 4.0

• X-as-a-Service
Automated Processes

systemic
Softwarization

IEEE
Advancing Technology
for Humanity
The landscape

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>Significant venture capital funding begins for companies SDN and network virtualization (e.g., Nicira Networks)</td>
</tr>
<tr>
<td>2007</td>
<td>Concept of SDN emerges from research on active and programmable networks</td>
</tr>
<tr>
<td>2008</td>
<td>ONF founded by DTAG, Facebook, Google, Microsoft, Verizon, and Yahoo! to improve networking through SDN and standardizing the OpenFlow protocol</td>
</tr>
<tr>
<td>2009</td>
<td>First open source code of OpenFlow protocol for Campus networking announced</td>
</tr>
<tr>
<td>2010</td>
<td>First open source code for vSwitch announced</td>
</tr>
<tr>
<td>2011</td>
<td>ETSI NFV white paper backed by 13 operators</td>
</tr>
<tr>
<td>2012</td>
<td>Formal Discussions on NFV</td>
</tr>
<tr>
<td>2013</td>
<td>The Linux Foundation found the project OpenDaylight, an open source framework to accelerate SDN NFV adoption</td>
</tr>
<tr>
<td>2014</td>
<td>ETSI-ONF collaboration formalized on SDN support of NFV</td>
</tr>
<tr>
<td>Feb 2014</td>
<td>First release OpenDaylight code «Hydrogen»</td>
</tr>
<tr>
<td>Jul 2013</td>
<td>AT&amp;T Domain 2.0</td>
</tr>
<tr>
<td>Jul 2012</td>
<td>Acquisition of Nicira networks by VMWare</td>
</tr>
<tr>
<td>Jan 2012</td>
<td>DTAG Basic European Network</td>
</tr>
<tr>
<td>Apr 2012</td>
<td>Google publicises use of OpenFlow</td>
</tr>
</tbody>
</table>

Source: ETSI, ONF, OpenDaylight and press articles
Several reference architectures...too many!

SDN reference architecture
(Open Networking Foundation)

NFV reference architecture
(ETSI)

ODL reference architecture
(OpenDayLight – Linux)
Several reference architectures...too many!

Management and Control are becoming part of the dynamic design of the software architecture

Open Source Software tools and platforms

- OpenStack
- OpenDaylight
- ONOS
  Open Network Operating System
Which way?

Which way?

Source: J. Doyle «Universal laws and architectures»

Source: L. Peterson, «Central Office Re-architected as a Datacenter (CORD) Open Networking Lab» in collaboration with AT&T (ONS2015)"
Service unification

- A Slice is made of a set of VMs + set of VNs
  - Constraint-based VM allocation
  - VMs added and deleted over time
  - VNs provide service isolation and composition
- A VN is like a “switch” that fully connects all VMs in Slice
  - Private or Public (routable)
  - Closed or Open (available for multiple slices to join)
- Services are executed in one (or more) Slices
- Services will become “units of orchestration”
IEEE SDN: Challenges

- Standardization of a reference functional model/architecture (levels, abstractions, interfaces)
- Automation of Operations processes (current OSS/BSS cannot easily scale)
- Interoperability between “softwarized domains” and with the legacy infrastructures
- Best practice and Specs for testing the «open source» software (network and service functions, tools and platforms being adopted for «softwarization»);
- Reliability and performances
- Security “by design”
- The new value chain and the regulation rules
- Educating Industry managers, technical experts and, in general, students, common people about this change of paradigms in Telecommunications (Digital Society and Digital Economy)
- Contributing to creating the new required skill (subjected to Softwarization)
- Anticipating the needs and creating the conditions for a pre-industrial exploitation of “Softwarization” through experiments, PoCs..., but also creating of ecosystems.
An Overarching Operating System for orchestrating and managing multiple SDN-NFV test-beds/field-trials: Specs, Validation Methods and Best Practices, PoCs.
An Overarching Operating System for orchestrating and managing multiple SDN-NFV test-beds/field-trials: Specs, Validation Methods and Best Practices, PoCs.
SDN and NFV are not only concerning Networks. SDN and NFV are facets of a systemic trend, called Softwarization which is aiming at «integrating» Cloud, Networks and Terminals. This will enable new service models (x-as-a-service)

- Softwarization = technology + business + regulations

- Challenges includes:
  - Standardization of a reference functional model/architecture (levels, abstractions, interfaces)
  - Automation of Operations processes (current OSS/BSS cannot easily scale)
  - Interoperability between “softwarized domains” and with the legacy infrastructures
  - Best practice, Specs and Methods for testing S/W (network and service functions platforms);
  - Reliability and performances
  - Security “by design”
  - The new value chain and the regulation rules
  - Educating for the change of culture
  - Anticipating the needs and creating the conditions for a pre-industrial adoption of “Softwarization of Telecommunications” through experiments, PoCs...
Thank You!

“YOU NEVER CHANGE SOMETHING BY FIGHTING THE EXISTING REALITY. TO CHANGE SOMETHING BUILD A NEW MODEL THAT MAKES THE EXISTING MODEL OBSOLETE.”

-R. Buckminster Fuller

antonio.manzalini@telecomitalia.it
http://sdn.ieee.org/
http://ieee-sdn.blogspot.it/