Some Controversial Opinions on Software-Defined Data Plane Services

Fulvio Risso, Politecnico di Torino, Italy
Antonio Manzalini, Telecom Italia, Italy
Mario Nemirovsky, Barcelona Supercomputing Center, Spain
Some Controversial Opinions on Software-Defined Data Plane Services

Definitions (view limited to a single router)

Software Defined Networks

Network Functions Virtualization

Network Service Chaining (today)

NFV/NSC (future?)

Fulvio Risso, SDN4FNS13, November 2013
The First Controversial Opinion

On the Relevance of Data vs. Control Plane
The actors

• Current research focuses on network operators
  – How to optimize the network
  – How to reduce costs
  – How to introduce new services
  – How to increase revenues

• What about end users?
  – Corporate networks
  – Domestic users
  – May they benefit from SDN/NFV/NSC?
# The Control vs. Data plane grid (part 1)

<table>
<thead>
<tr>
<th><strong>Network operators</strong></th>
<th><strong>SDN</strong> is about customizing network paths</th>
<th><strong>NFV/NSC</strong> is about introducing more flexibility in data plane services</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Enables network optimization, traffic engineering</td>
<td>Simplifies the deployment of data plane middleboxes</td>
</tr>
<tr>
<td></td>
<td>Reduces costs</td>
<td>Enables the fast introduction of new data-plane services</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reduces costs May increase revenues</td>
</tr>
<tr>
<td><strong>End users</strong></td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>
About users and services

• Why should users care about how their data is transported in the network?
  – It’s the operator job
  – Users simply expect that data is delivered at best

• What about the possibility to relocate some of the data plane services, currently under the control of the users and located at the edge, in the operator’s network?
  – Personal firewall, parental control software
  – Corporate security middleboes
  – …
  – Users may be still in charge or controlling and operating theirs services, without having to deal with the low-level details
    • Hardware, deployment issues, etc.
## About users and services (Italy)

<table>
<thead>
<tr>
<th>Market description</th>
<th>Potential users</th>
<th>Pricing</th>
<th>Potential revenues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Families interested in parental control software</td>
<td>1.38M</td>
<td>30€/year</td>
<td>41.5M€</td>
</tr>
<tr>
<td>Customers interested in personal security software</td>
<td>18.28M</td>
<td>15€/year</td>
<td>274.2M€</td>
</tr>
<tr>
<td>Corporate mobile users interested in mobile protection software</td>
<td>0.79M</td>
<td>50€/year</td>
<td>39.4M€</td>
</tr>
<tr>
<td>Corporate users interested in mobile protection software (BYOD case)</td>
<td>2.41M</td>
<td>50€/year</td>
<td>120.6M€</td>
</tr>
<tr>
<td>Companies interested in operator-based protection software</td>
<td>52K</td>
<td>1000€/year</td>
<td>52.4M€</td>
</tr>
</tbody>
</table>

**Total**                                                  | **528.1M€**     |          |                    |

Total market for TLC operators in Italy: about 60B€/year
Some Controversial Opinions on Software-Defined Data Plane Services

The Control vs. Data plane grid (part 2)

<table>
<thead>
<tr>
<th>Network operators</th>
<th>SDN is about customizing network paths</th>
<th>NFV/NSC is about introducing more flexibility in data plane services</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Enables network optimization, traffic engineering</td>
<td>Simplifies the deployment of data plane middleboxes</td>
</tr>
<tr>
<td></td>
<td>Reduces costs</td>
<td>Enables the fast introduction of new data-plane services</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reduces costs, May increase revenues</td>
</tr>
<tr>
<td>End users</td>
<td></td>
<td>Enables relocating data plane services in the network</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reduces costs, increases flexibility</td>
</tr>
</tbody>
</table>
Our first controversial opinion is about the relevance of the control vs. data plane.

Guess what our answer is...
The Second Controversial Opinion

On the Importance of the Hardware in Future Data Plane Services
What about the hardware for future data plane service? (part 1)

The network hardware will be a simple, dumb switch.

*(by the OpenFlow community)*

The network hardware will integrate many network dedicated components (e.g., TCAMs, etc).

*(By the network manufacturers)*

The network hardware will be made from standard, high-volume components.

*(By the general purpose computing manufacturers)*
A parallel with general purpose computing

| 20MHz CPU | 1MB RAM |
| 100MHz CPU | 16MB RAM |
| 500MHz CPU | 512MB RAM |
| 3GHz CPU | 2GB RAM |
| 3GHz CPU (multicore) | 16GB RAM |

Floating point units
Hardware coprocessors (e.g., GPUs)
Integrated GPU functions
Virtualization functions

64 bit operands
Vector instructions (MMX, AVX)
64 bit addressing
Security (encryption) functions

The simplistic view
The actual view

Fulvio Risso, SDN4FNS13, November 2013
What about the hardware for future data plane service? (part 2)

The network hardware will be a simple, dumb switch.
(by the OpenFlow community)

We are not so good to predict the future but...

The network hardware will integrate many network dedicated components (e.g., TCAMs, etc).
(By the network manufacturers)

And this is our second controversial opinion.

The network hardware will be made from standard, high-volume components.
(By the general purpose computing manufacturers)
The Third Controversial Opinion

On the Standardization of the Northbound and Southbound Interfaces in Future Data Plane Services
Northbound and Southbound API

Northbound API

Southbound API

Simple packet forwarding hardware

SDN Controller

Traffic optimizer

WAN load balancer

“Routing” protocol

Simple packet forwarding hardware

Simple packet forwarding hardware
The parallel with general purpose computing

Also general computing has northbound and southbound interfaces, and no standards exist.
Some Controversial Opinions on Software-Defined Data Plane Services

Hard to define a suitable Southbound API

Router

<table>
<thead>
<tr>
<th>Destination</th>
<th>Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network 1</td>
<td>port1</td>
</tr>
<tr>
<td>Network 2</td>
<td>port3</td>
</tr>
<tr>
<td>Network 3</td>
<td>port1</td>
</tr>
<tr>
<td>Network 4</td>
<td>port2</td>
</tr>
</tbody>
</table>

Lookup table

The view of a router from a **Network** perspective

Router

- L2 bridging
- L3 routing
- Memory (TCAM, SRAM, DRAM)
- Deep Packet Inspection
- Dedicated ASICs
- Hardware accelerators
- QoS
- NAT
- Network processors
- Bus, crossbar

The view of a router from a **Computing** perspective
Standard interfaces may be useful. However they may also limit the innovation.

Whatever your opinion is, consider that:
1. standards for northbound and southbound interfaces may never appear, (or)
2. if they appear, there is the chance that they may not be used.

And this is our third controversial opinion.
Thanks for your attention!