

Software Defined Networking

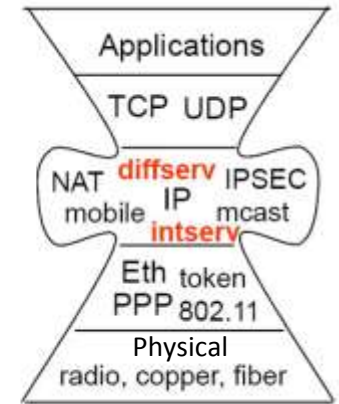
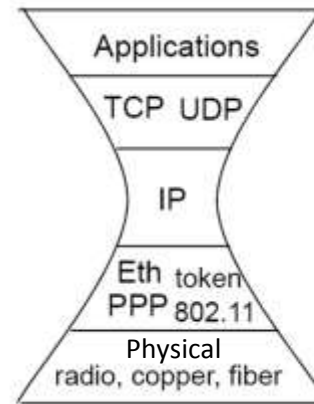
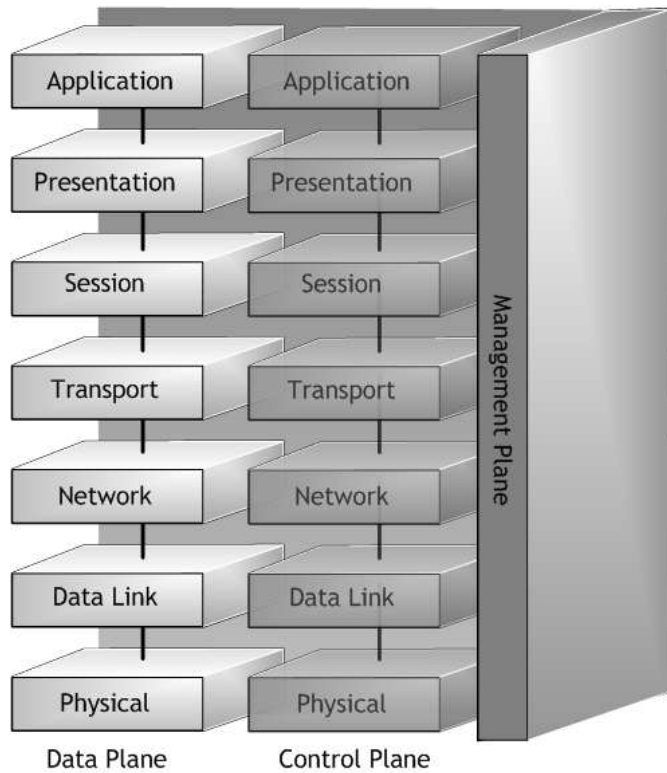
Stefano Giordano

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Università di Pisa*

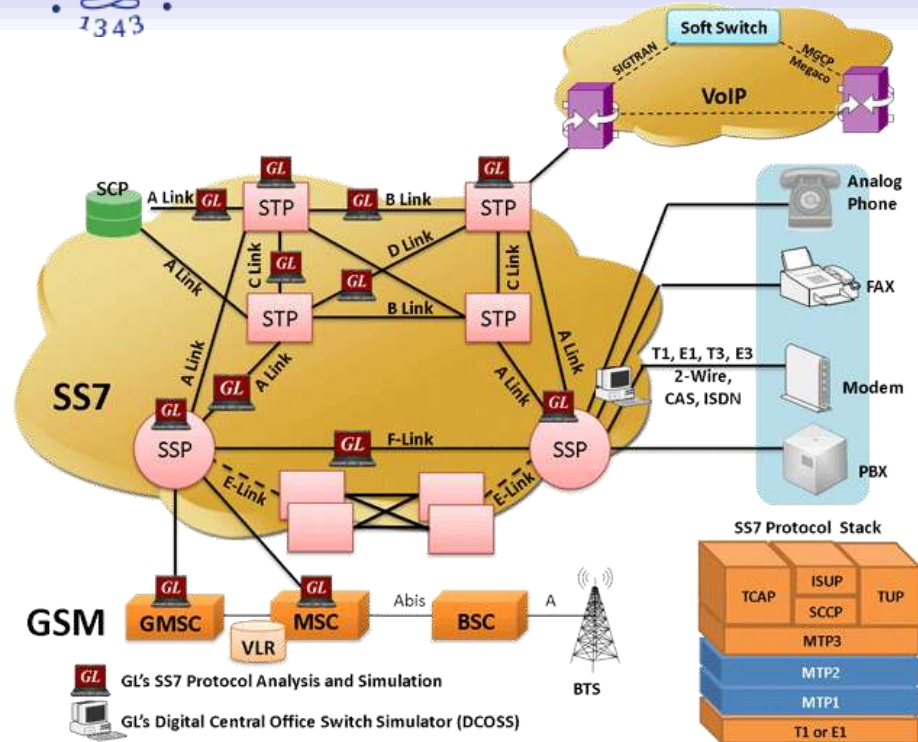


3D Reference model of ISDN

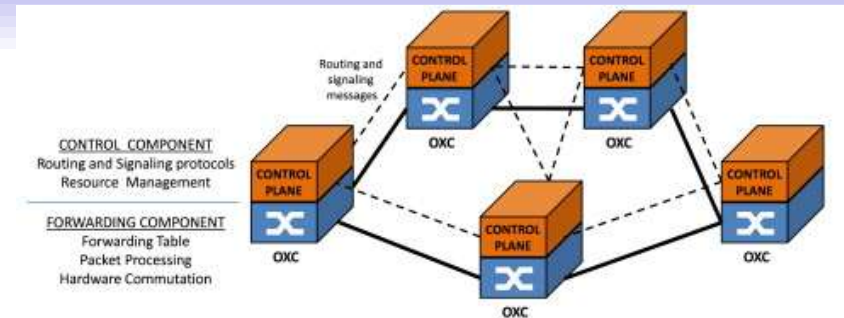
Hourglass reference model of a TCP/IP network



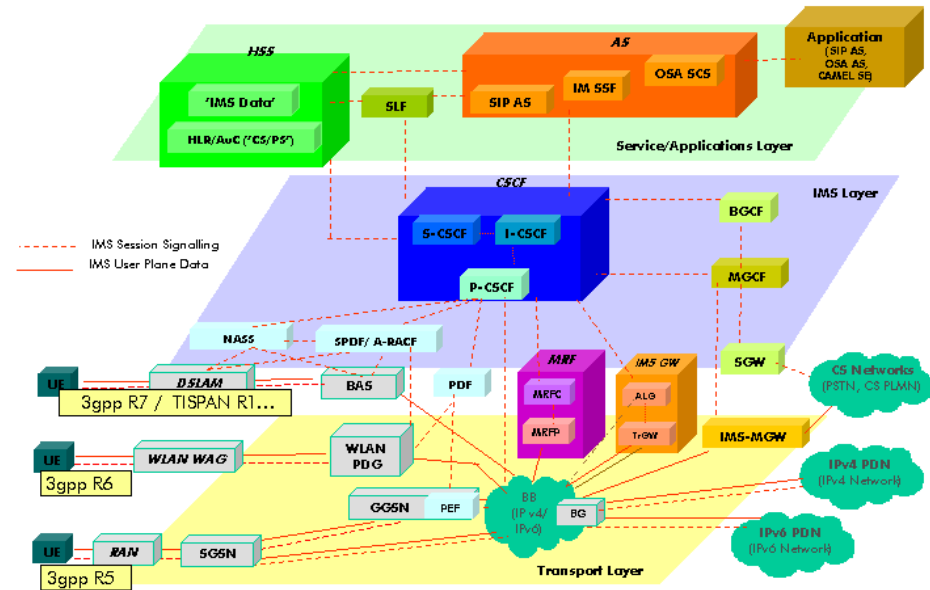
Signaling Systems (Control Plane)



Mobile Cellular Network



Optical Transport Networks (GMPLS)



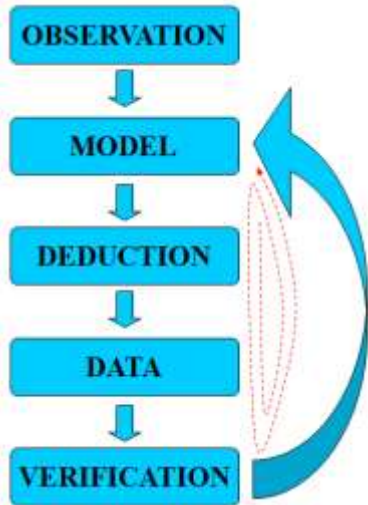
IP Multimedia Subsystem

Network Management





Our methodology – Our tools

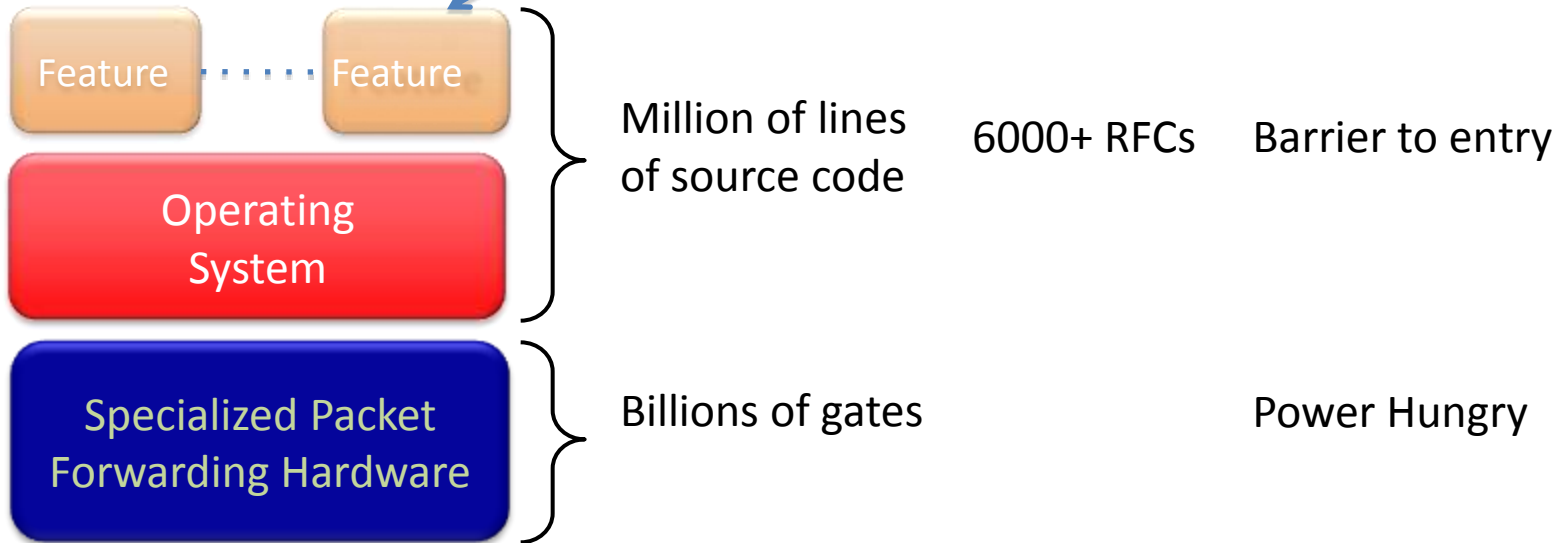


	Performance Fidelity	Scale	Real User Traffic?	Complexity	Open
Simulation	medium	medium	no	medium	yes
Emulation	medium	low	no	medium	yes
Software Switches	poor	low	yes	medium	yes
NetFPGA	high	low	yes	high	yes
Network Processors	high	medium	yes	high	yes
Vendor Switches	high	high	yes	low	no



Network Ossification

Routing, management, mobility management, access control, VPNs, ...



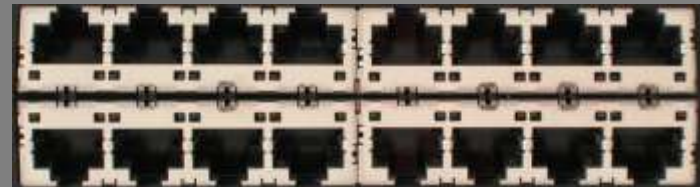
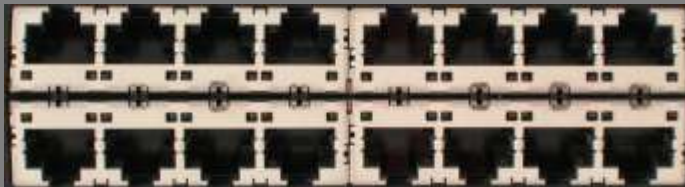
Many complex functions hidden into the infrastructure

*OSPF, BGP, multicast, differentiated services,
Traffic Engineering, NAT, firewalls, MPLS, redundant layers, ...*

An industry with a “mainframe-mentality”, reluctant to change

Legacy network device

Ethernet Switch





Legacy network device

Control Path (Software)

Data Path (Hardware)



Openflow a first step towards SDN

OpenFlow Controller

OpenFlow Protocol (SSL/TCP)

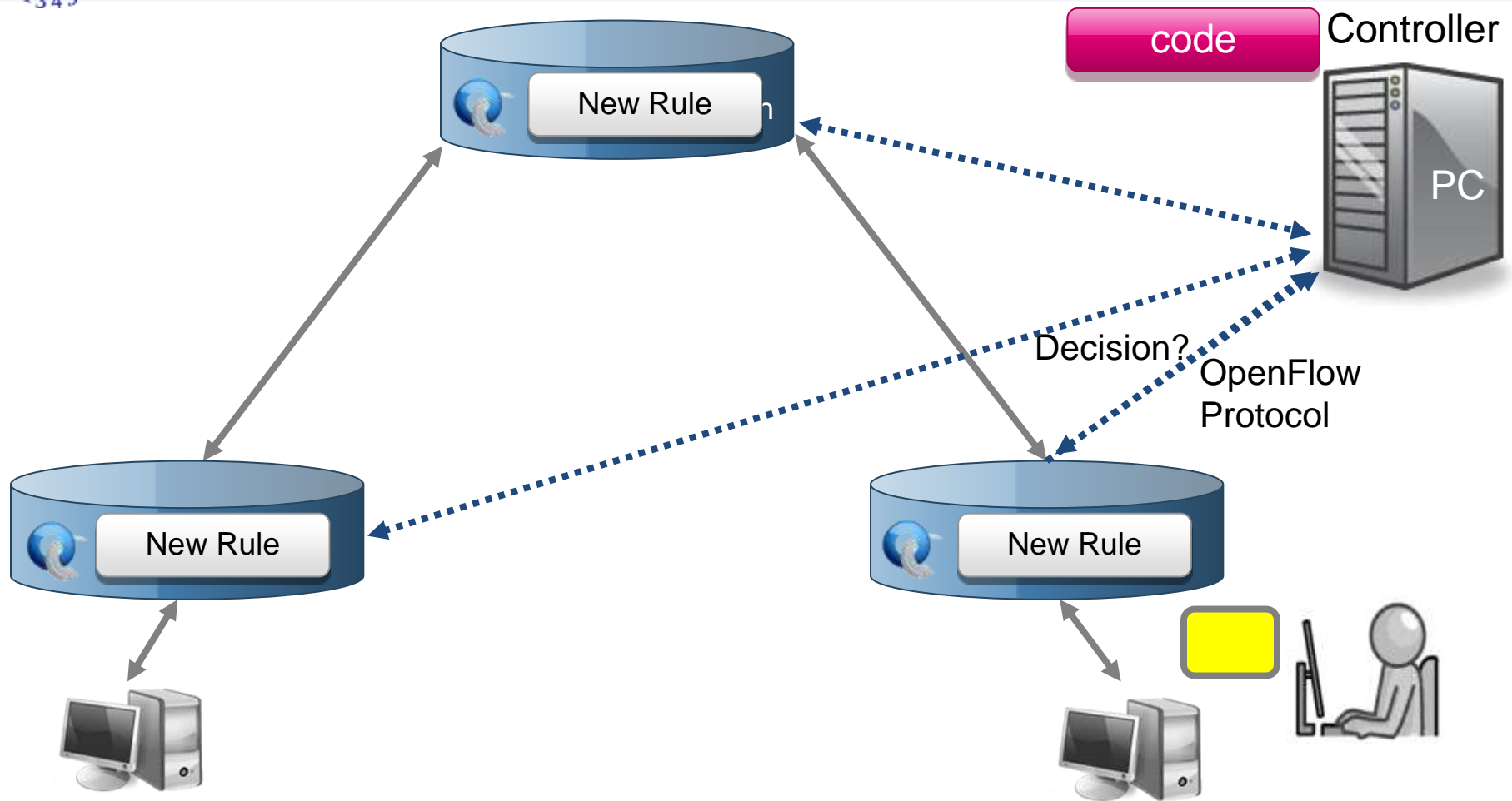


Control Path

OpenFlow

Data Path (Hardware)

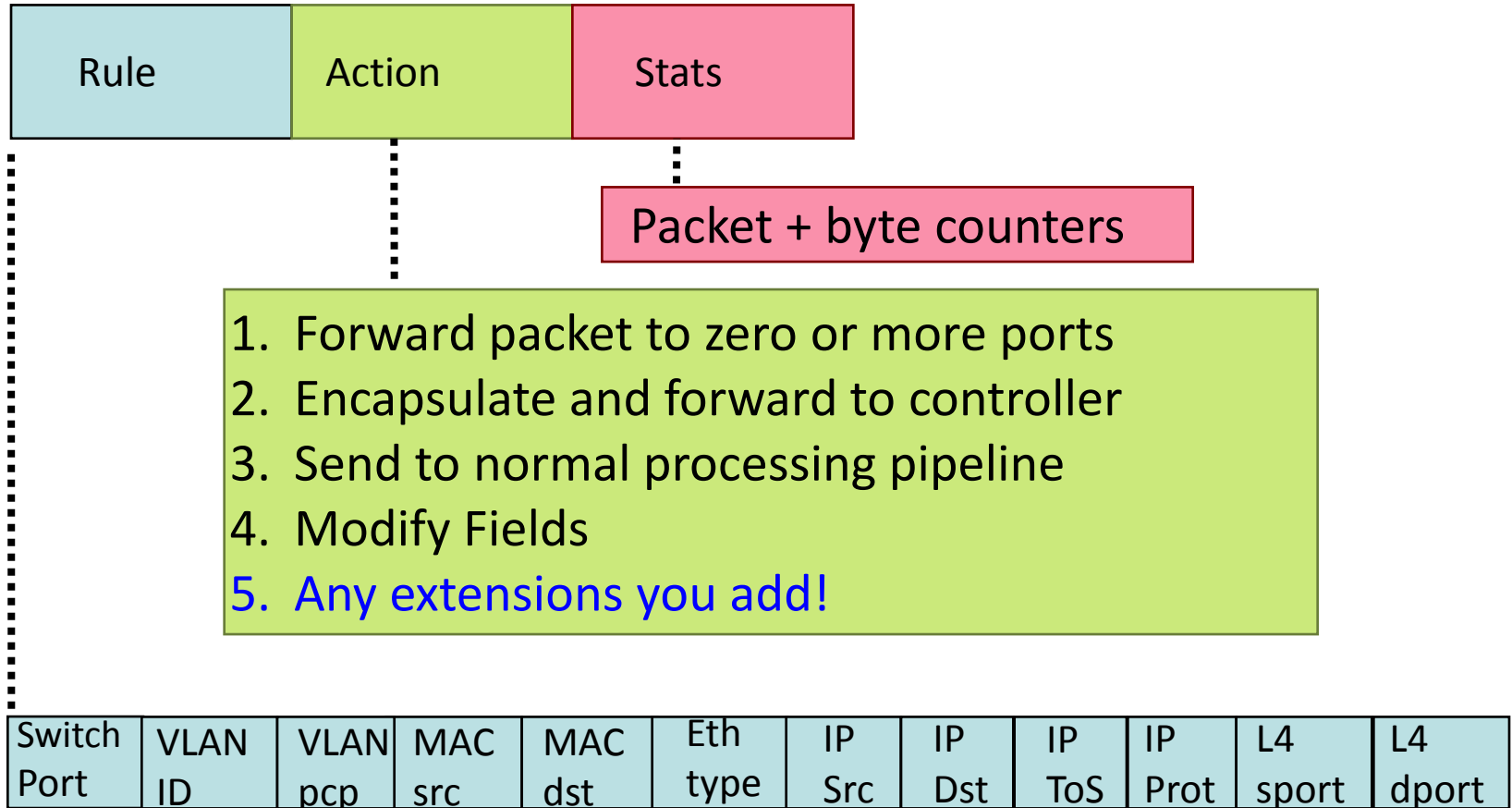
OpenFlow usage



OpenFlow offloads control intelligence to a remote software



OpenFlow 1.0 Basics Flow Table Entries



+ mask what fields to match

Crosslayering!

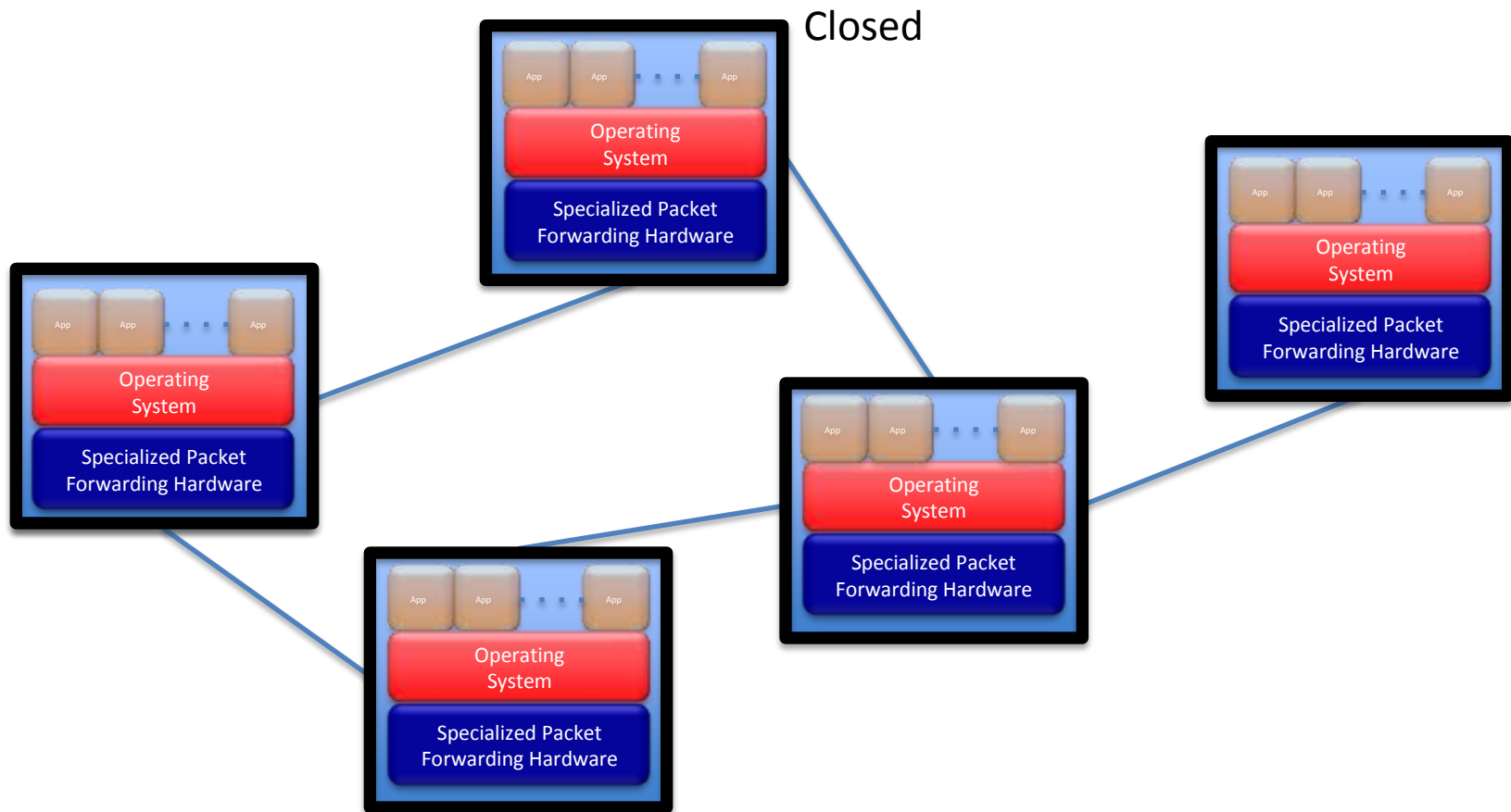


Possible uses: write your code!

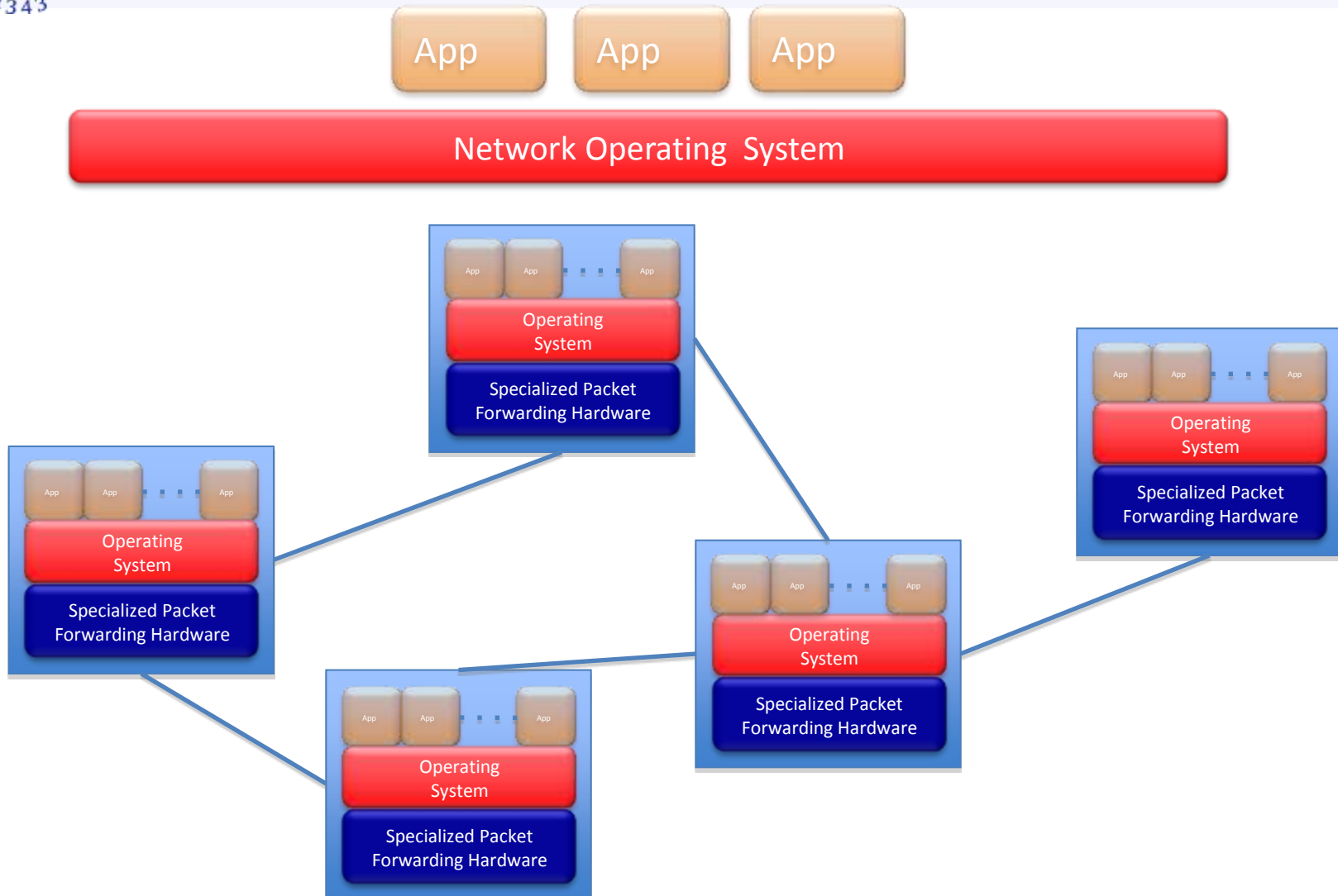
- Simple learning switch
 - Per Flow switching
 - Network access control/firewall
 - VLANs
 - Her own new routing protocol:
unicast, multicast, multipath
 - Home network manager
 - IPv x
- VM migration
 - Server Load balancing
 - Mobility manager
 - Power management
 - Network monitoring and
visualization
 - Network debugging
 - Network slicing

Current Internet

Closed to Innovations in the Infrastructure



Software Defined Networking

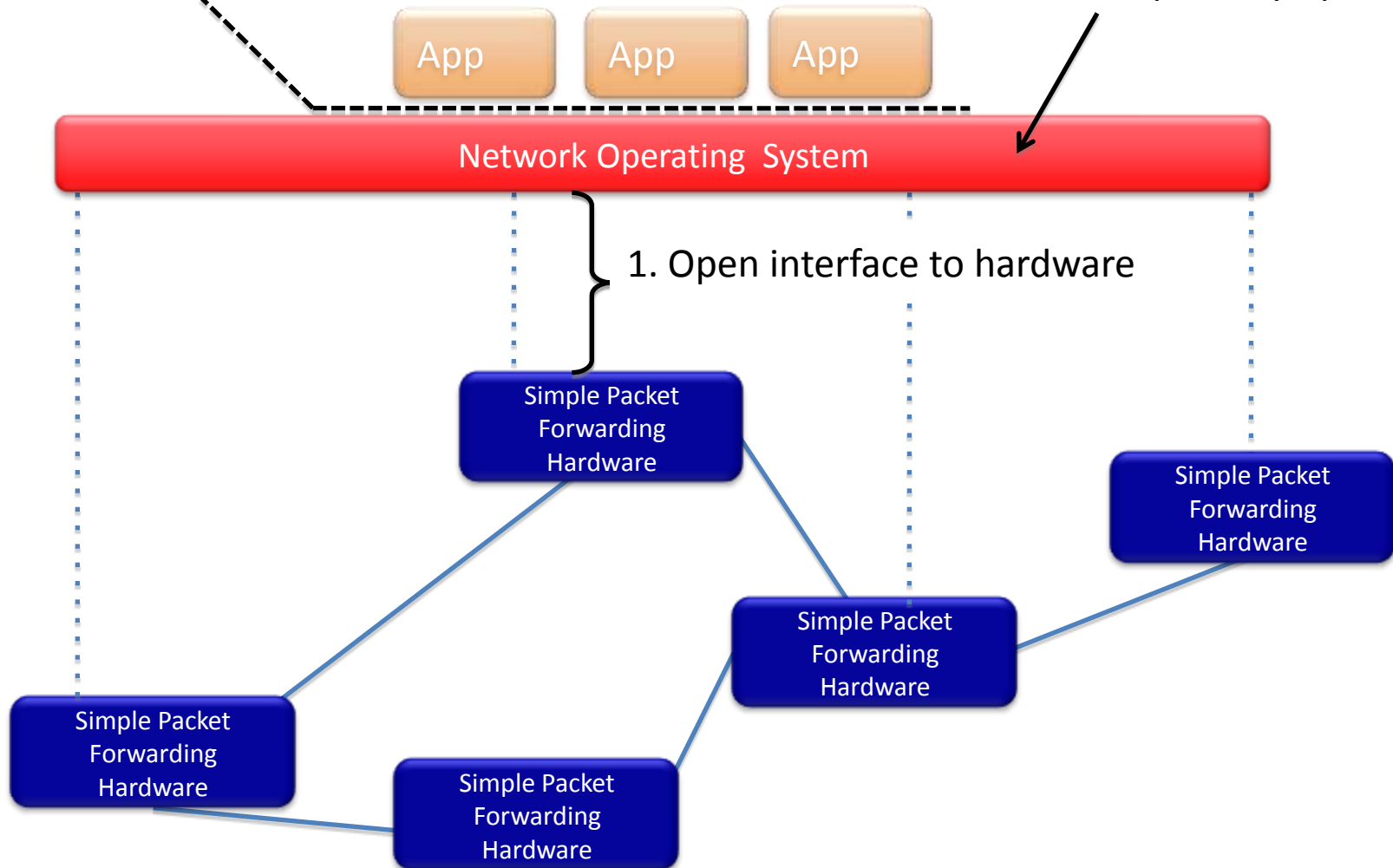




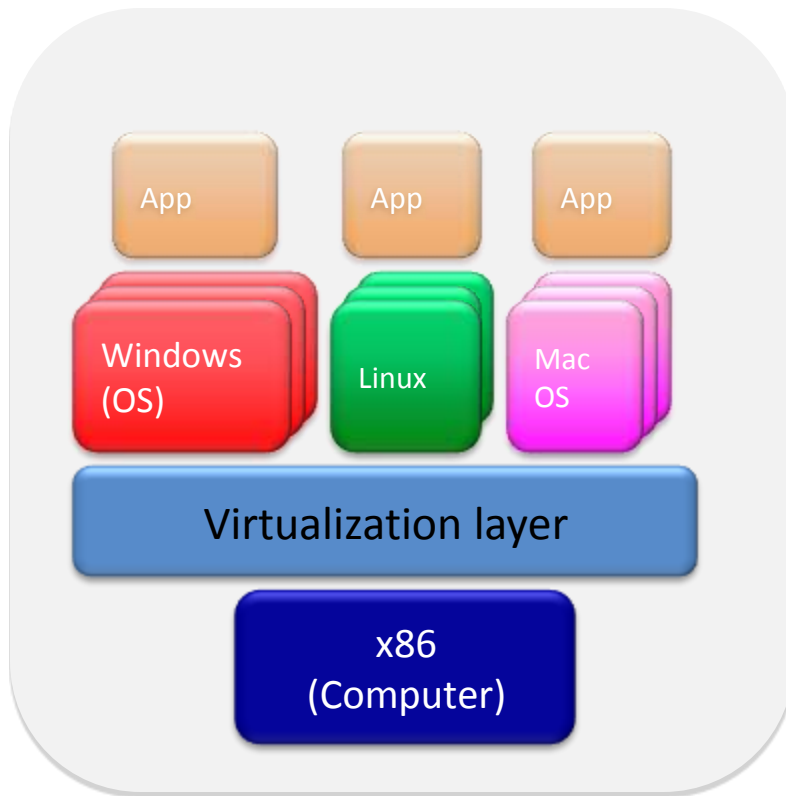
Software Defined Networking

3. Well-defined open API

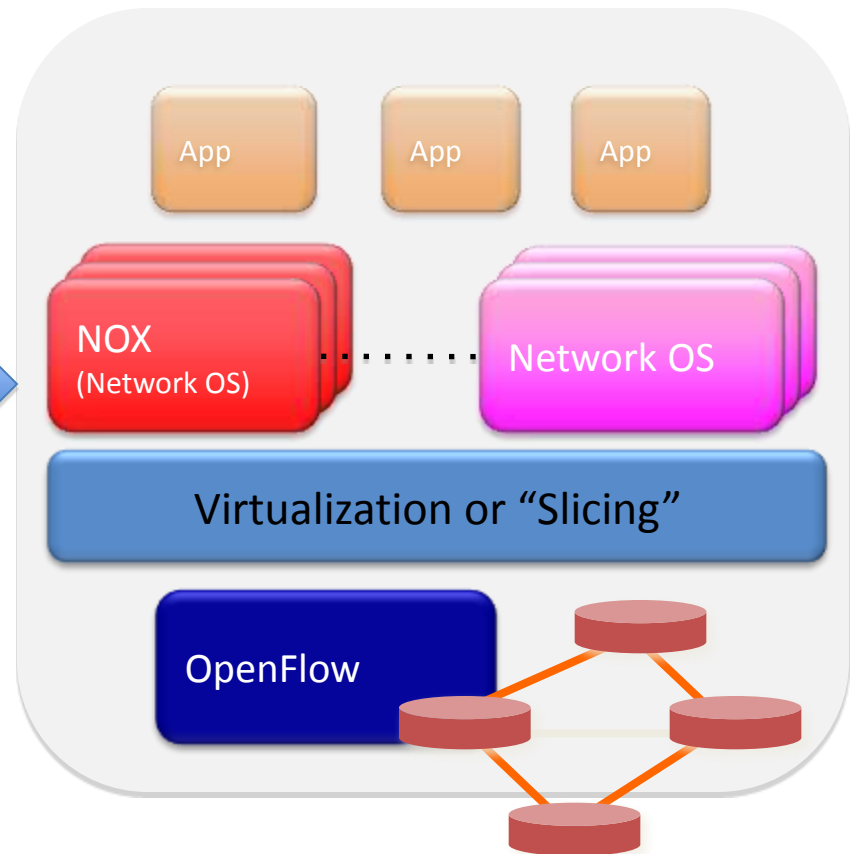
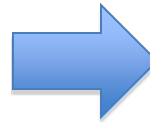
2. At least one good operating system
Extensible, possibly open-source



Trends



Computer Industry

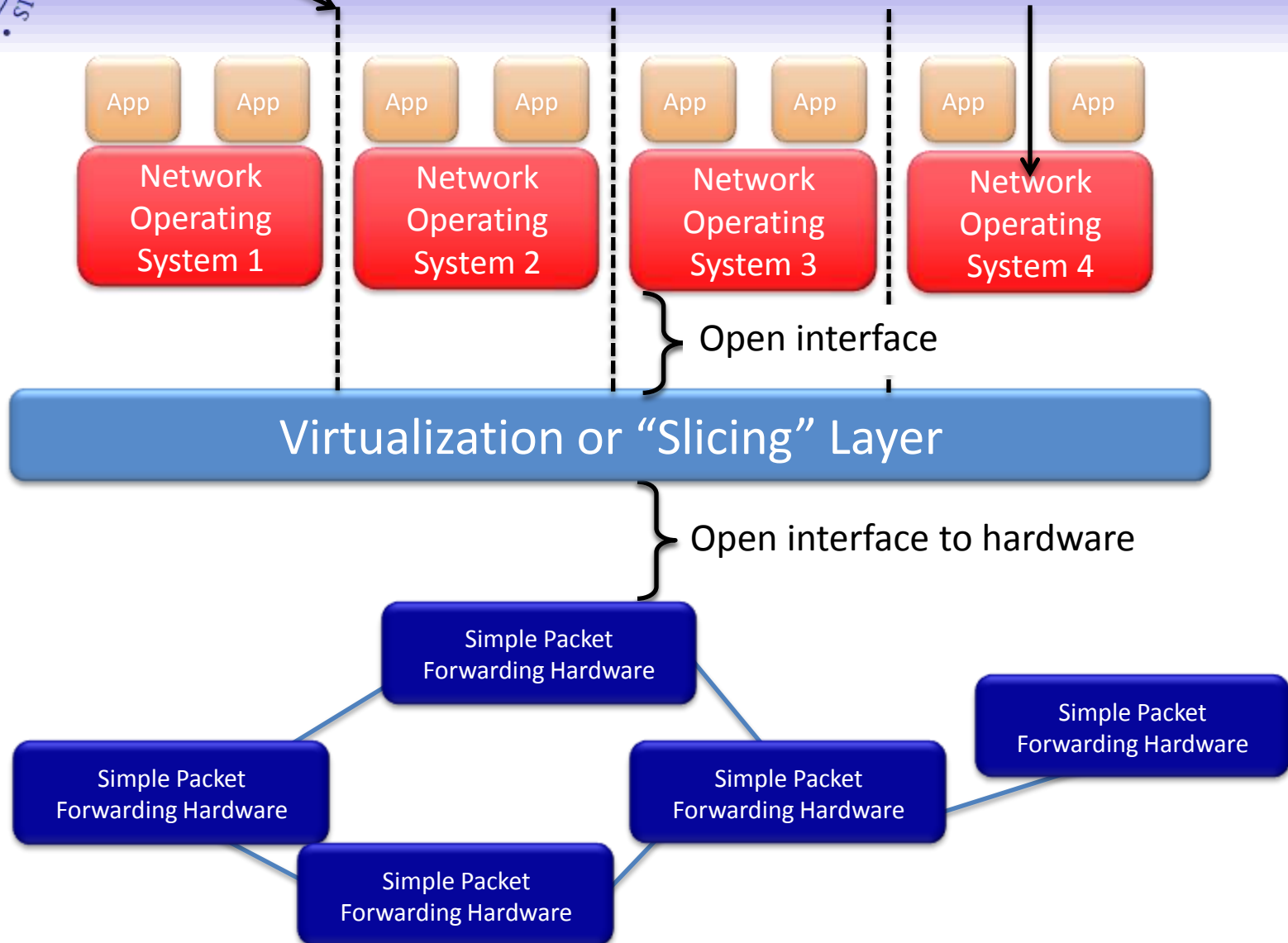


Network Industry



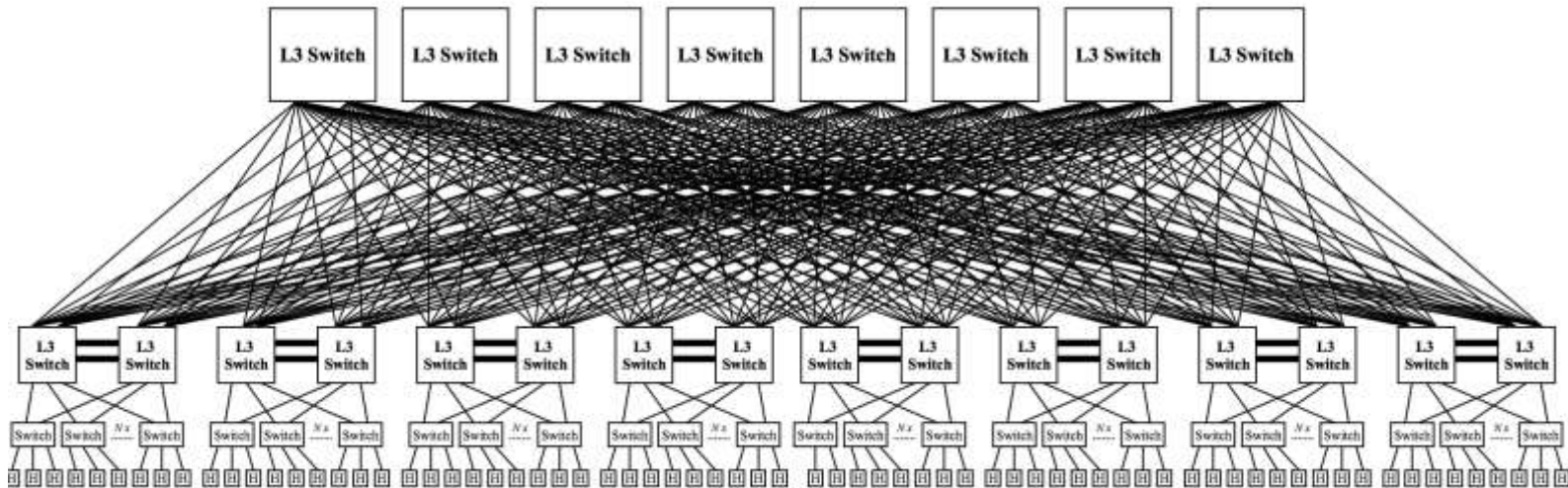
Isolated “slices”

Many operating systems, or
Many versions



SDN and DC intradomain management

Integrating Systems and Network Management using SDN



Problem: 20.000 server -> 400.000 VM.

Keeping 20.000 devices in sync with 400.000 entities.

SDN can help programming the switches with a central DB.



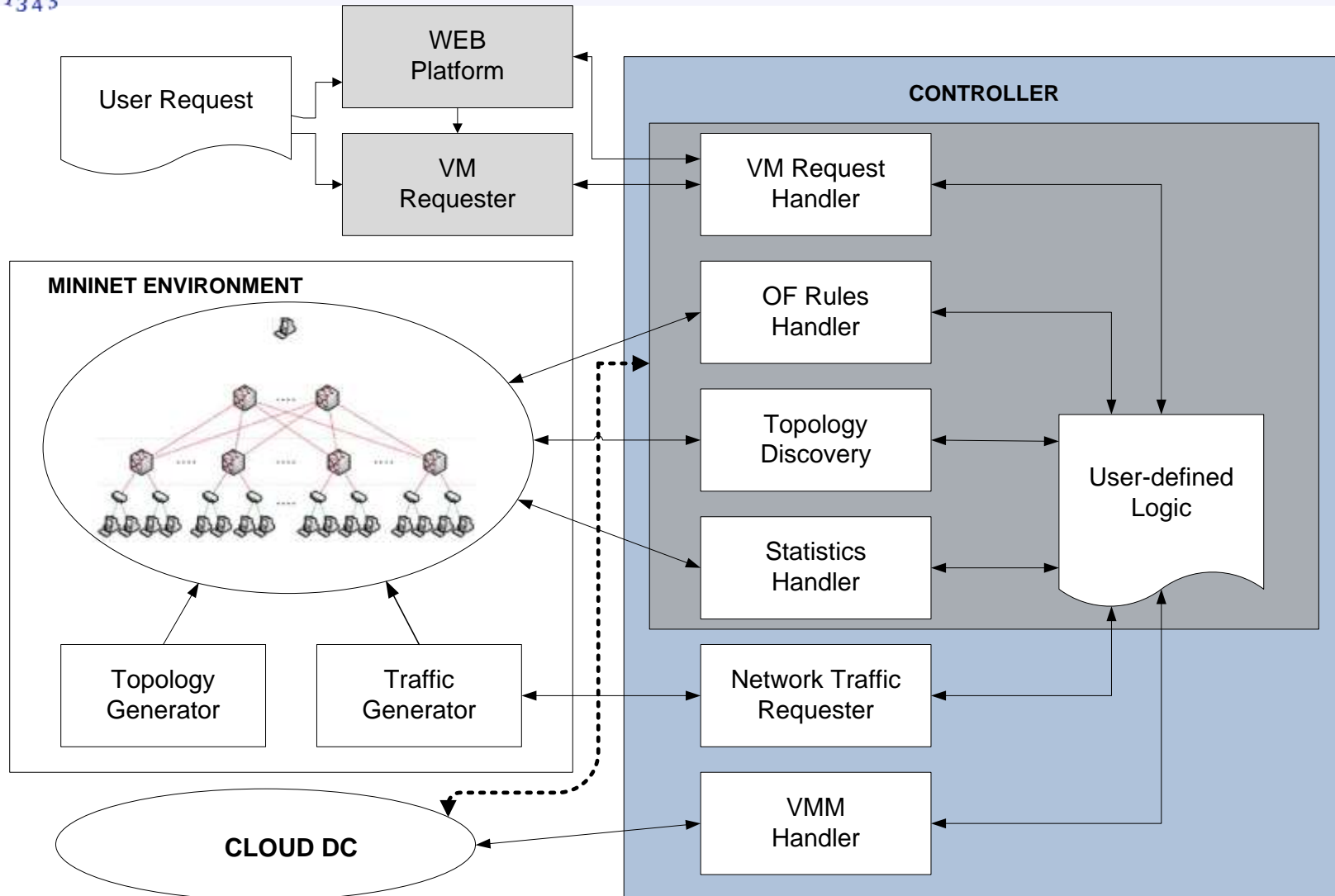
Datacenter in a Box

We decided to realize a platform in order to carry out some SDN Cloud-DC experiments and also let other researchers to perform their own.

Our Emulator is composed by:

- A VM requester
- A Web Platform
- A DC controller (called OFVN controller)
- A slightly modified mininet Virtualization environment.

Platform Architecture



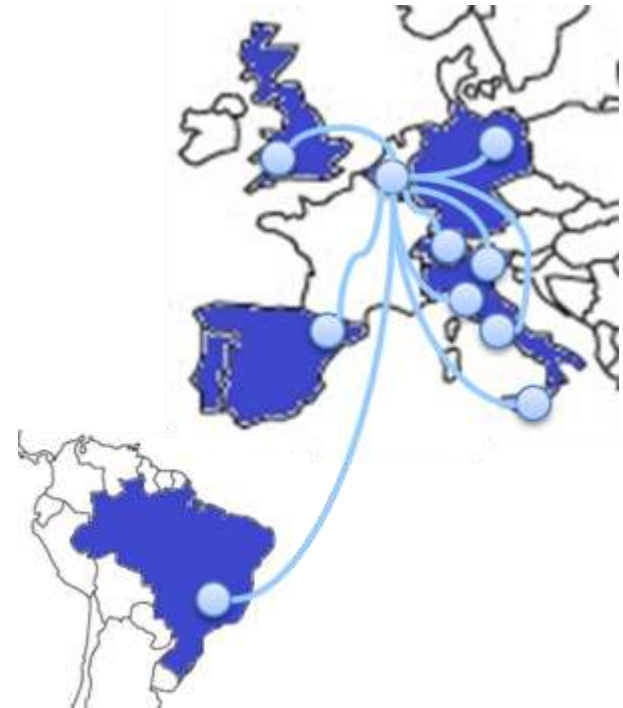
Ofelia Activity



Another activity is the one concerning the European Project OFELIA.

In this project we deployed an SDN Framework composed by several switches and Xen server to allow users to deploy their own network applications.

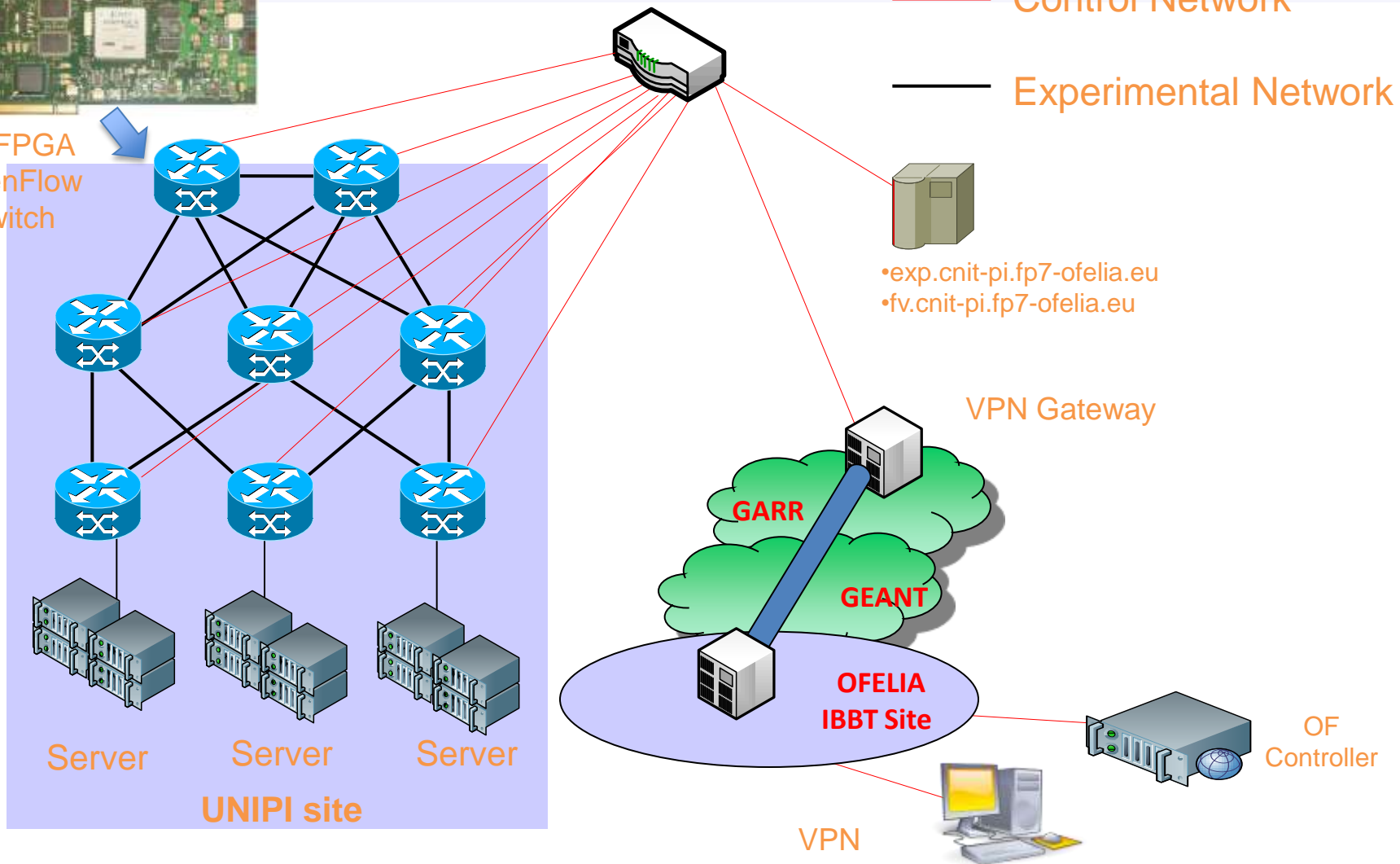
Our contribution is related to a network control application that allows to the allocate virtual machines deciding from a network perspective.



Ofelia UNIPI island



netFPGA
OpenFlow
switch



SDN & NFV



Sessione su SDN & NFV

11 Ottobre 2013

Orario 16-18

Aula **PS1**

Piano terra **Edificio E**

Polo Fibonacci



Parteciperanno

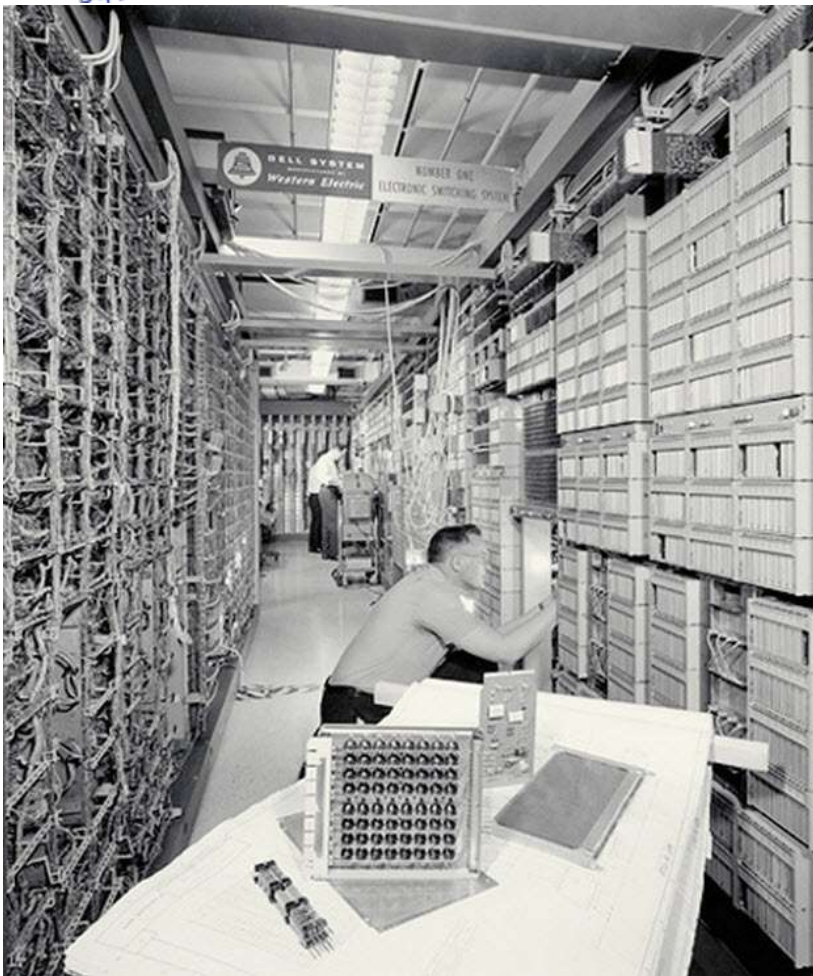
- DELL
- CISCO
- ERICSSON
- INTECS
- ISCOM
- JUNIPER NETWORKS
- NEXTWORK
- ...



Centrali telefoniche con “controllo a programma archiviato”

Grazie

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1 ESS – Storage Program Control 1965