



ST. PETERSBURG NATIONAL RESEARCH UNIVERSITY
OF INFORMATION TECHNOLOGIES, MECHANICS AND OPTICS

Laboratory of the
Network Technologies in Distributed Computing Systems

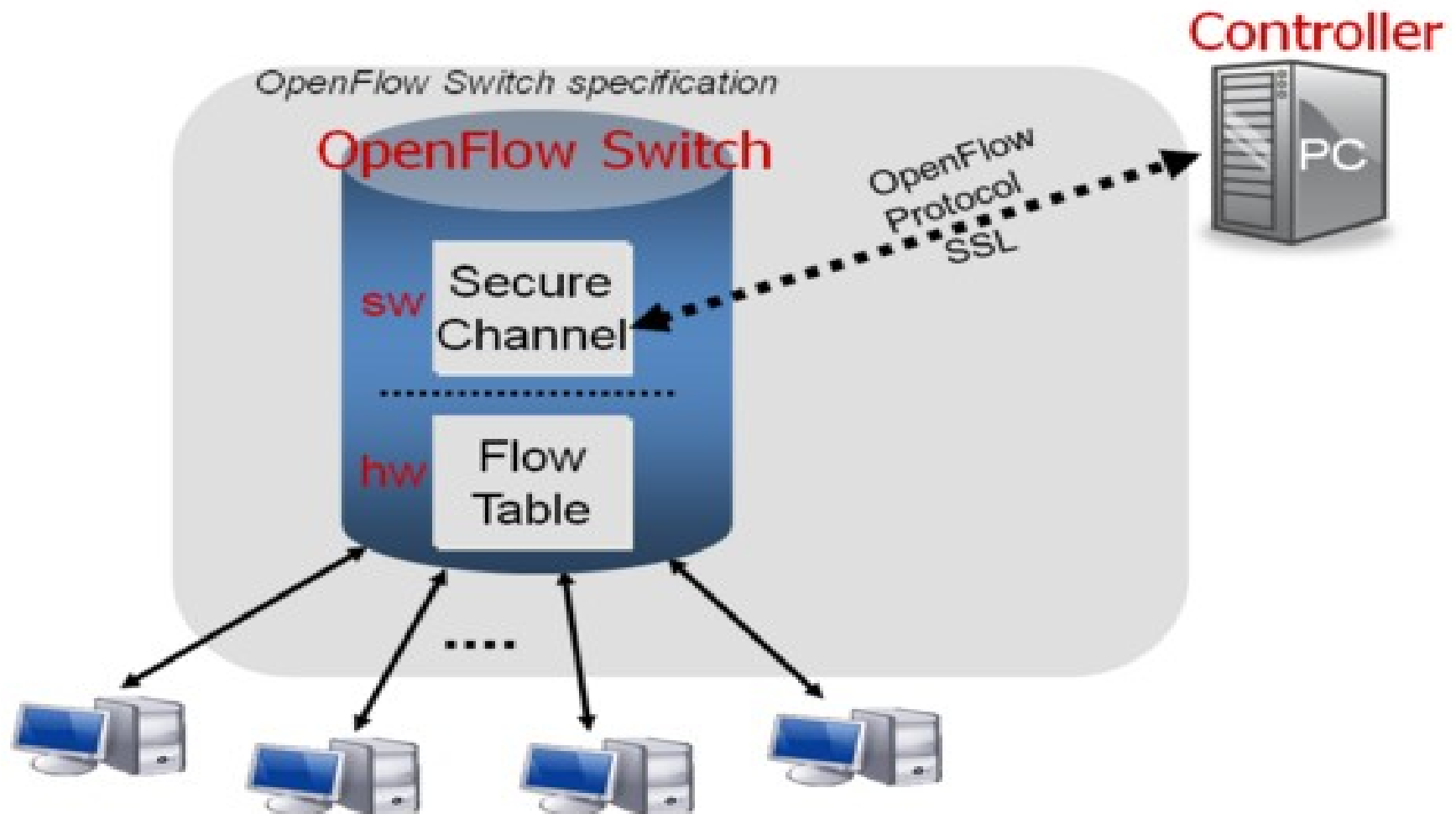
Use cases for OpenFlow SDN technology

Oleg Sadov

sadov@mail.ifmo.ru

<http://sdn.ifmo.ru>

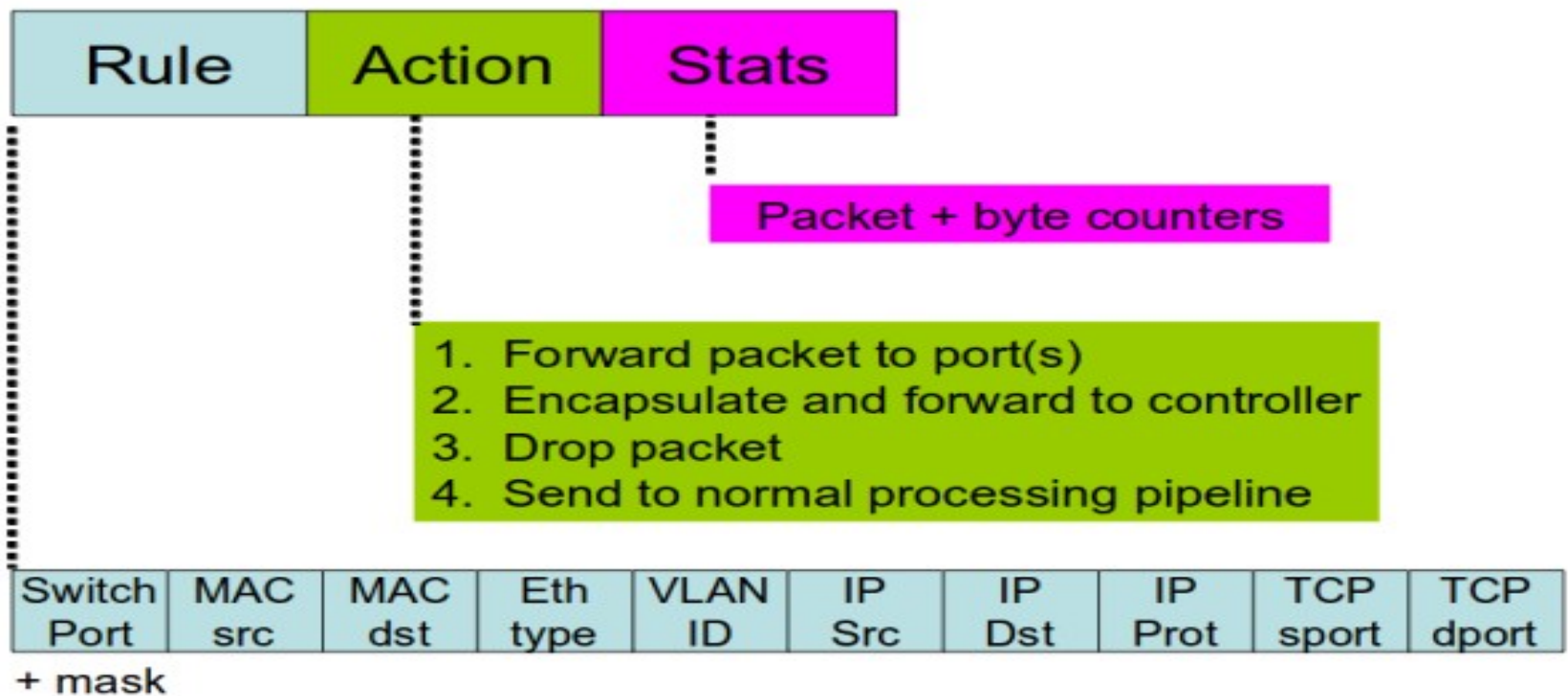
OpenFlow Architecture





Flow Table Entry

“Type 0” OpenFlow Switch





Examples

Switching

Switch Port	MAC src	MAC dst	Eth type	VLAN ID	IP Src	IP Dst	IP Prot	TCP sport	TCP dport	Action
*	*	00:1f:...	*	*	*	*	*	*	*	port6

Flow Switching

Switch Port	MAC src	MAC dst	Eth type	VLAN ID	IP Src	IP Dst	IP Prot	TCP sport	TCP dport	Action
port3	00:2e:..	00:1f:..	0800	vlan1	1.2.3.45.6.7.8		4	17264	80	port6

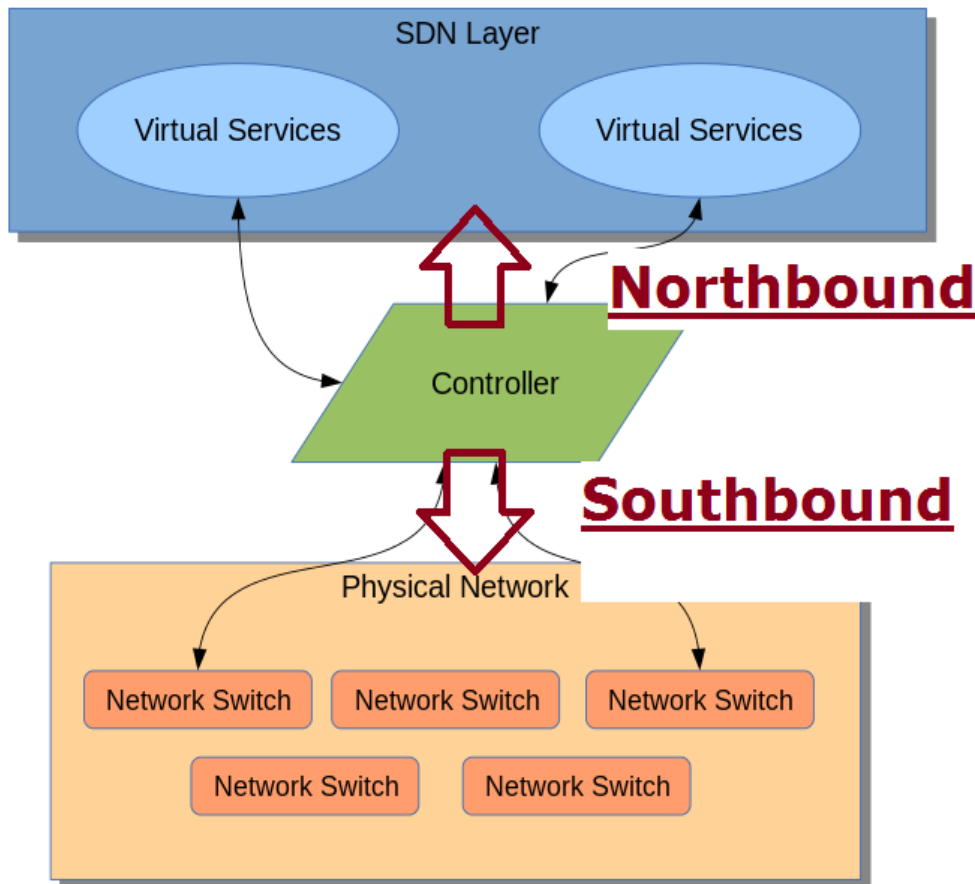
Firewall

Switch Port	MAC src	MAC dst	Eth type	VLAN ID	IP Src	IP Dst	IP Prot	TCP sport	TCP dport	Action
*	*	*	*	*	*	*	*	*	22	drop



OpenFlow programming infrastructure

North



NFV

REST-API

NOX, Ryu, OpenDaylight,
FlowVisor...

OpenFlow

SW: OVS, CPqD...

HW: HP, IBM, Cisco, Huawei,
BigSwitch, Pica8...

South



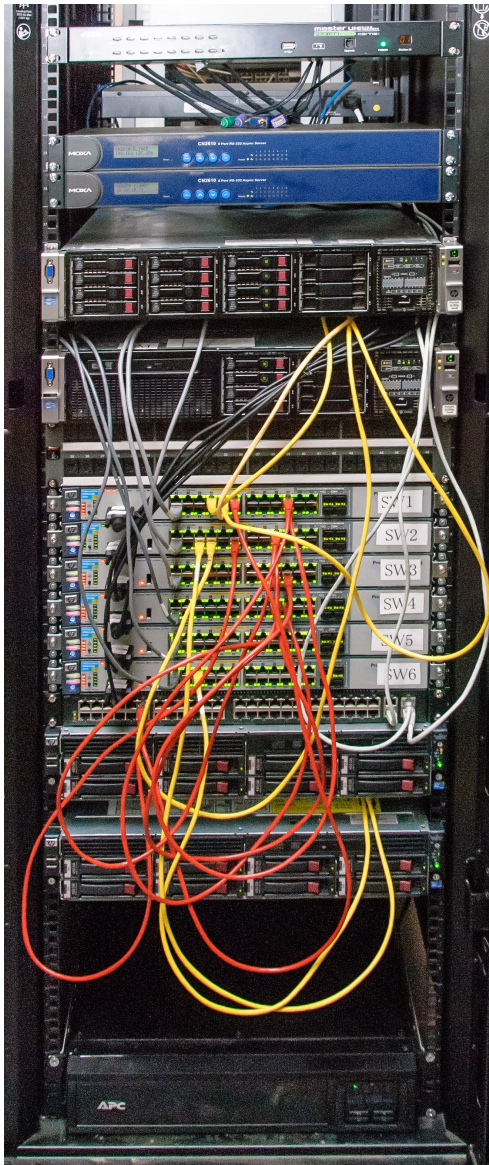
Testbed

Hardware:

- OpenFlow switches – Pica8 3290 and 7 HP 3500-24G-PoE yl
- iSCSI SAN — 2 HP P4300 G2 7.2TB SAS Starter SAN BK716A
- Servers — 2 DL380p Gen8

Software:

- OpenFlow software switch based on CPqD/of12softswitch and Open vSwitch
- OpenFlow controllers based on CPqD/nox12oflib, NOX classic and NOX
- OpenFlow network emulator Mininet
- VirtualBOX and KVM Virtual Machines with NauLinux 6.3/6.4 distributions and Ubuntu 11.10 pre-configured CPqD OpenFlow-1.2 Virtual Machine

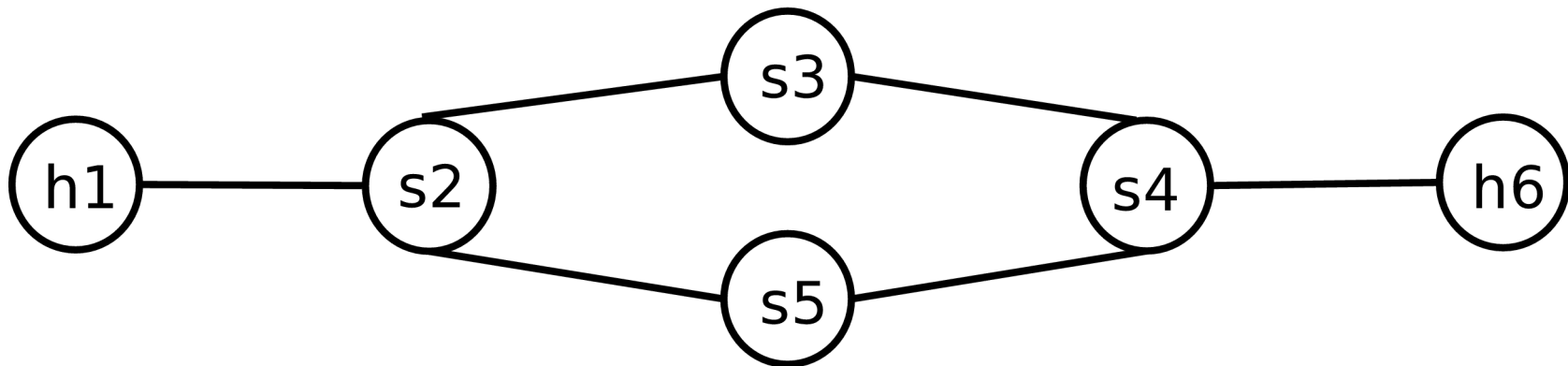




Network resources and data flows management

Testing:

- SAN response time
- Topology changing





Testing tools

- NOX applications and modified CPqD/of12softswitch
- Python management scripts for different HW/SW switches (HP, Pica8, CPqD/of12softswitch and Open vSwitch)
- iSCSI test programs (performance, latency, jitter)
- Test scripts (with using of Mininet-API)



SAN performance measurements

```
# ./rd_test /dev/sdb 2 100
```

```
Result: 130124 requests/sec (260248/2)
```

```
# ./rtt_iscsi_read /dev/raw/raw1 1000 \  
512 1024
```

```
Size=512 Packets=1000 Latency=0.000844
```

```
Jitter=0.000084
```

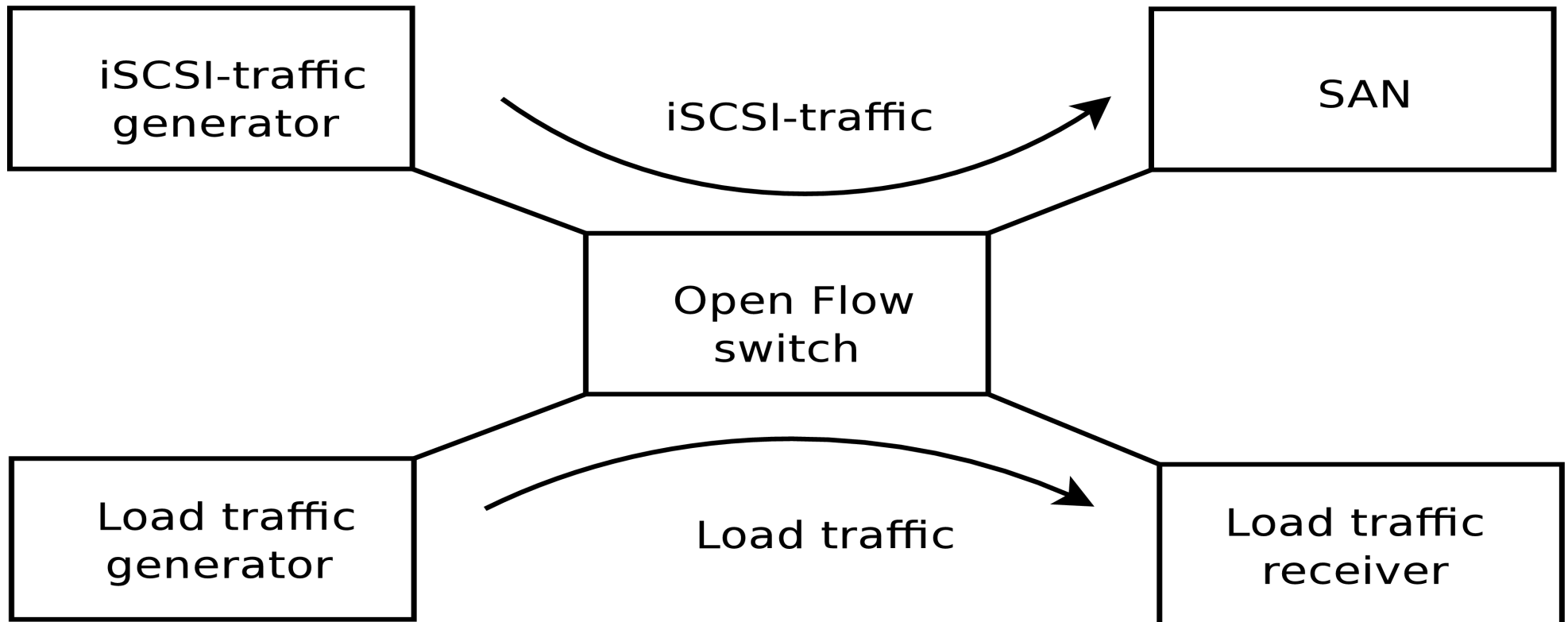
```
Size=1024 Packets=1000 Latency=0.000860
```

```
Jitter=0.000104
```



QOS assurance methods

- ToS/PCP priorities
- OpenFlow queues





Testing tools

- NOX applications and modified CPqD/of12softswitch
- Python management scripts for different HW/SW switches (HP, Pica8, CPqD/of12softswitch and Open vSwitch)
- iSCSI traffic generator
- Iperf, SIP traffic generator
- Test scripts (with using of Mininet-API)



QoS measurements

Hardware switch

ISCSI traffic (%)	Load traffic (%)	SAN I/O speed (Kb/s)
100	0	10.0
80	20	8.4
20	80	2.1
0	100	0

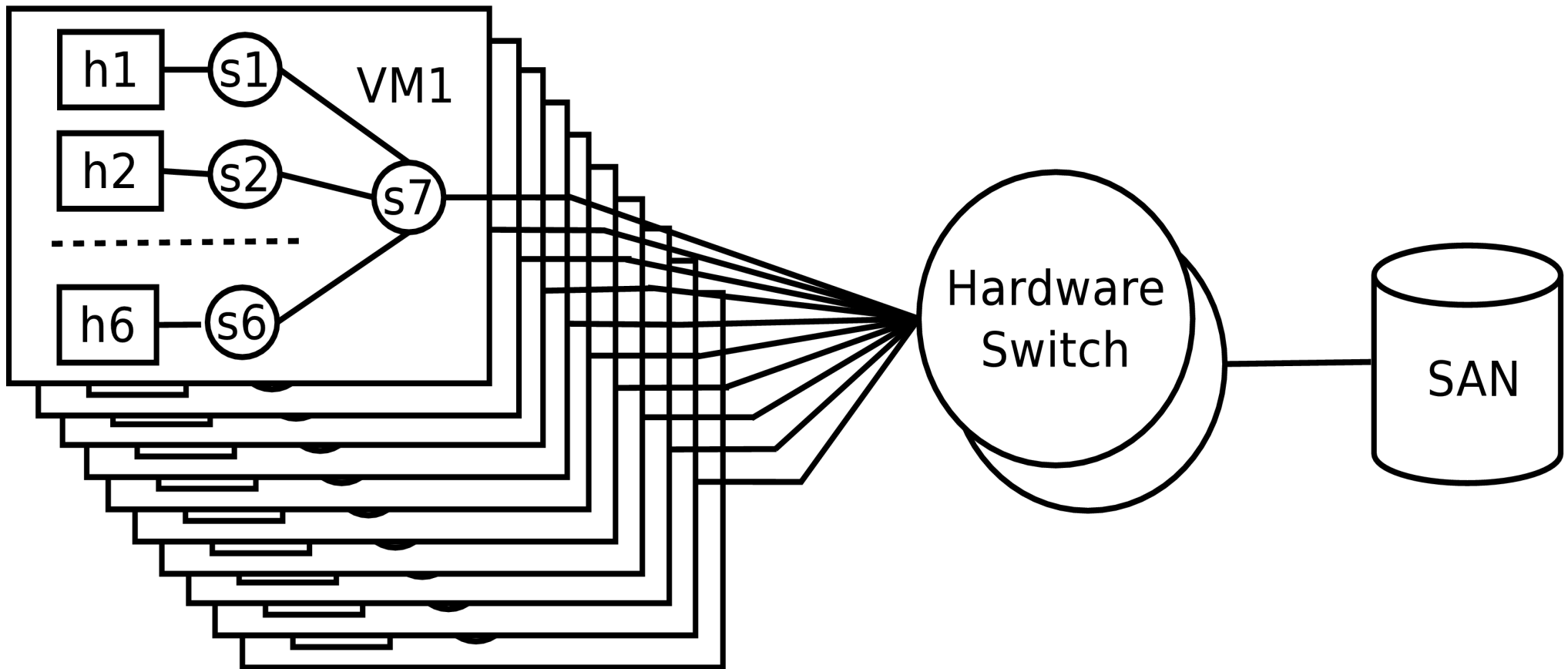
Software switch

ISCSI traffic (%)	Load traffic (%)	SAN I/O speed (Kb/s)
100	0	35.1
100	0.1	31.6
100	100	8.3
0.1	100	5.4
0.1	0.1	9.2



Data Center modelling

100 000 requests to SAN





Testing tools

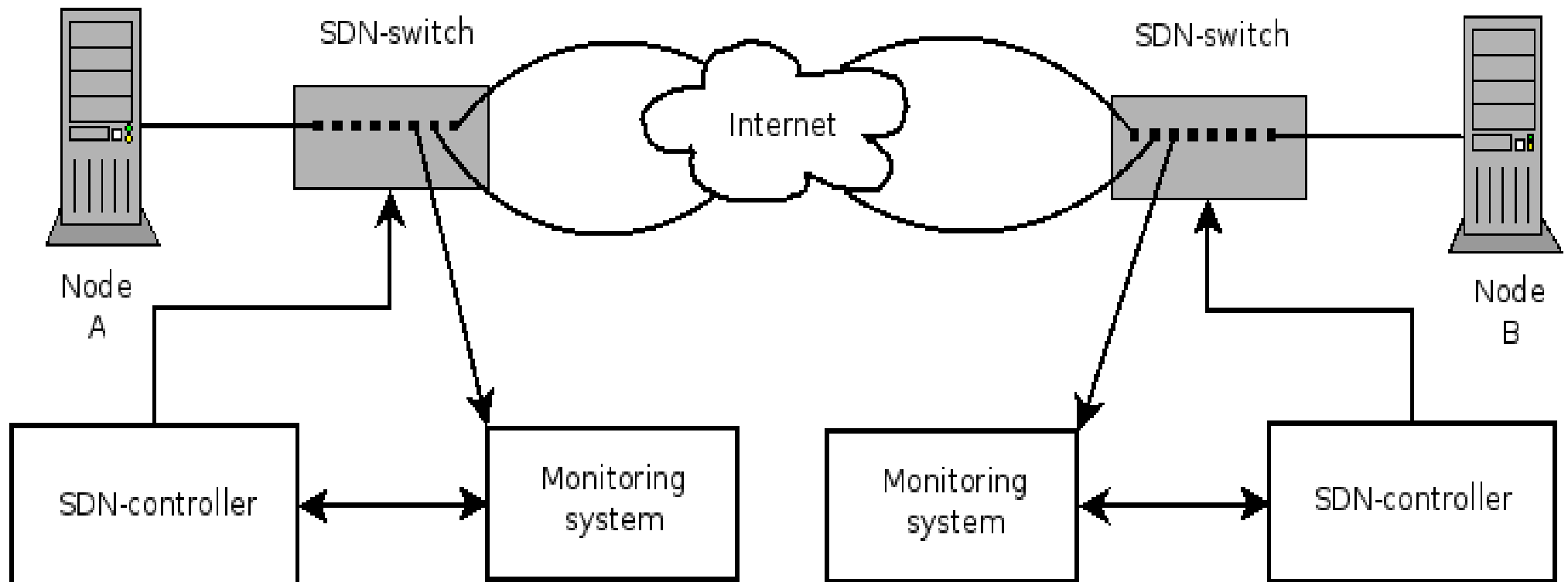
- 10 VMs (every VM – 6 virtual hosts, 7 OVS switches, local NOX controller in Mininet-based virtual network + xinetd service for MACs setting in MN VN)
- Central host – NOX and lot of testing program for remote running MN VMs with different MACs diapasons and measurements of different MACs in NOX flow-table.



Current directions for investigations

- OF 1.4 hardware switch development
- Researching of possibility of OF using for BigData remote transfers
- IoT
- Quantum cryptography and calculations

BigData transferring





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Laboratory of the
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Chandra Satriana

Master Thesis

“Development of an Ecology-Oriented
Software-Defined Networking Framework”