

LVEE Winter

Linux Vacation / Eastern Europe

# Software-Defined Networking СЕГОДНЯ

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# Inception





# Evolution





It always happens

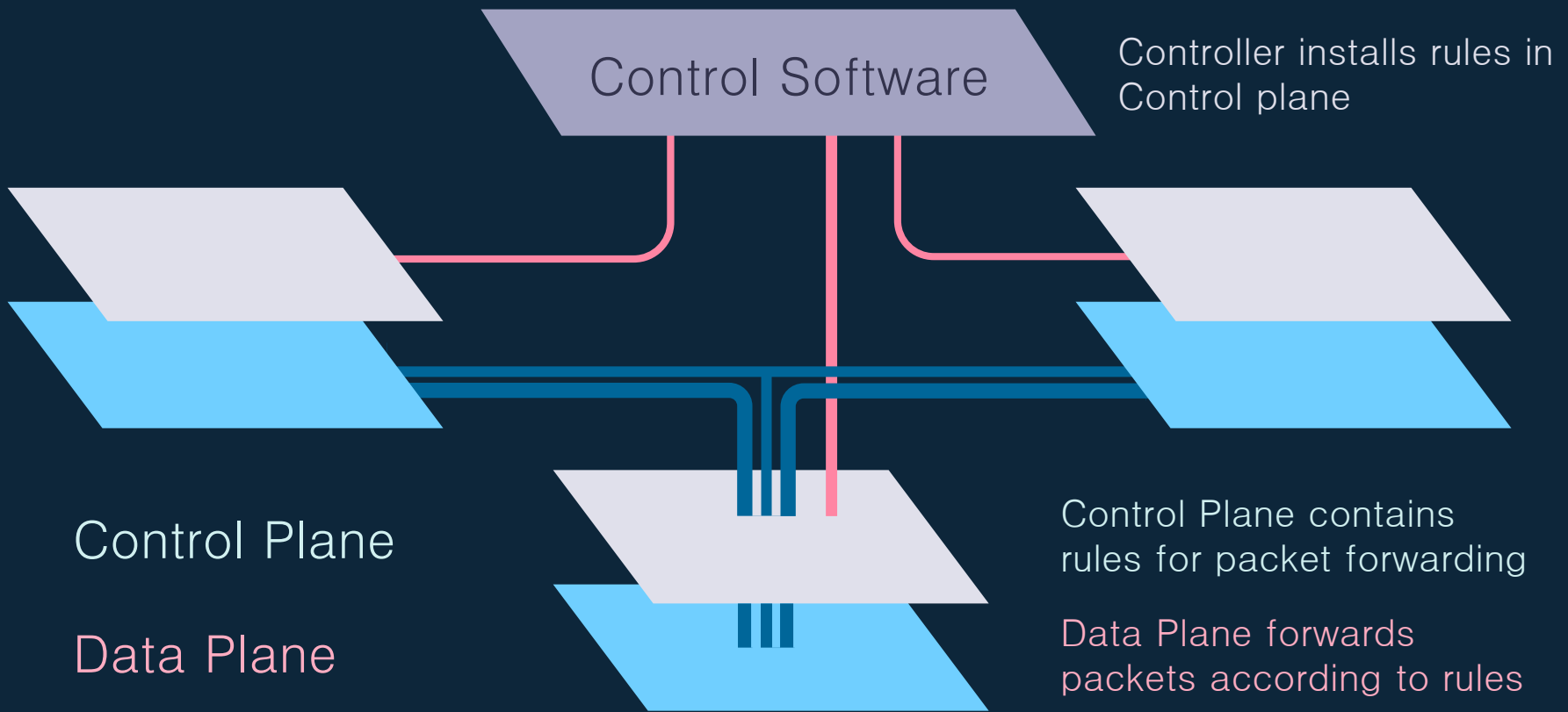




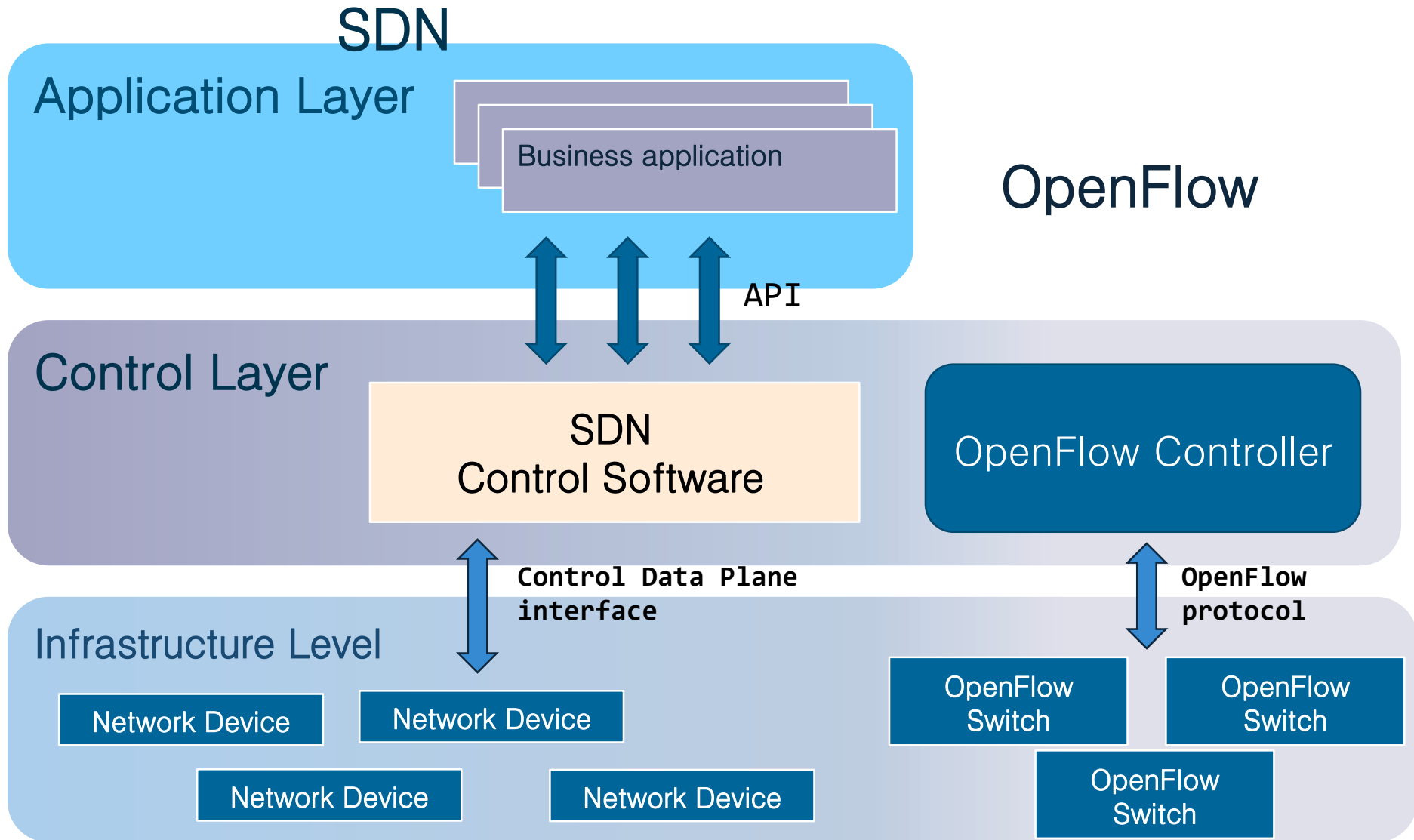
...and even more



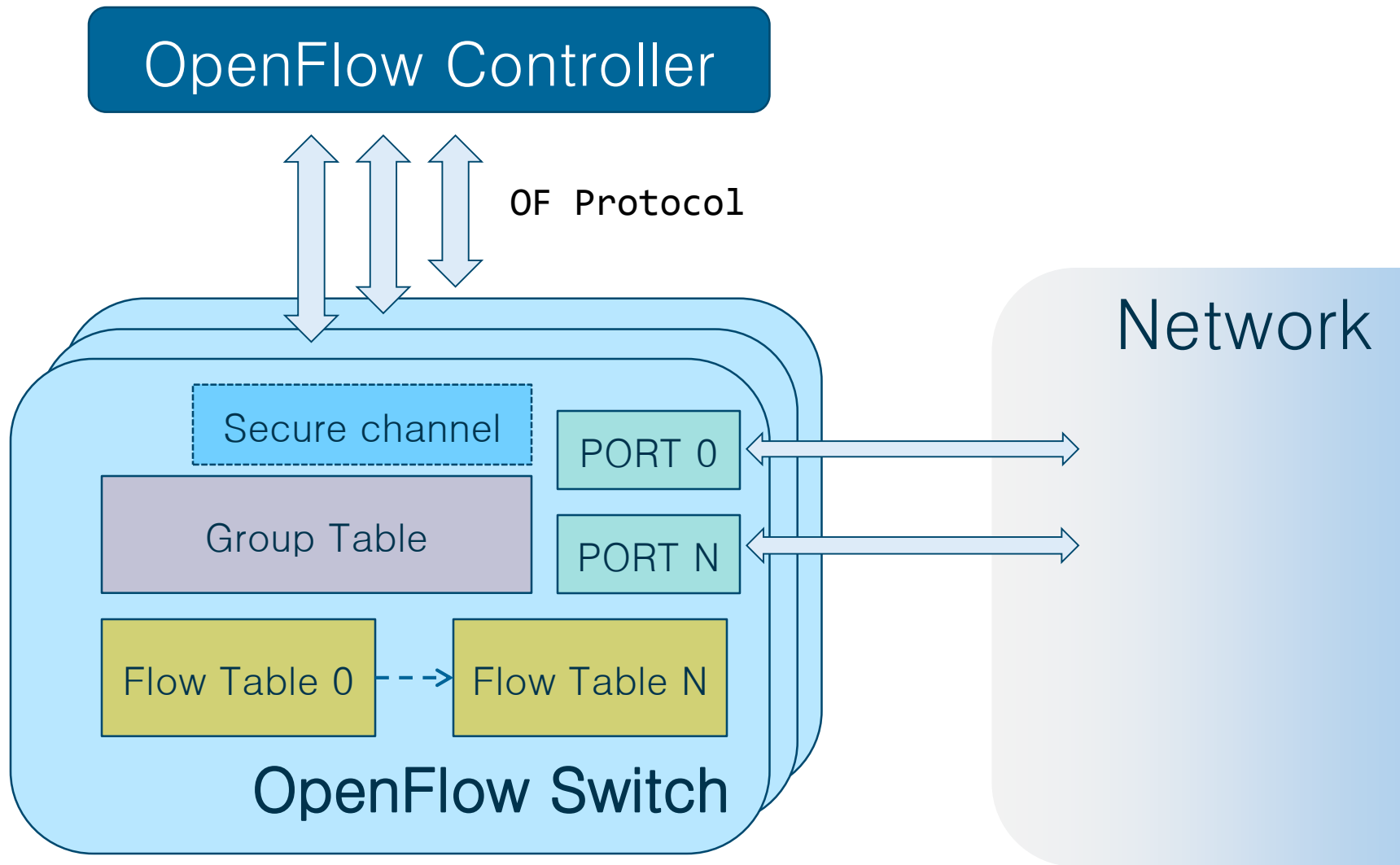
# SDN: Concept



# SDN: Big Picture



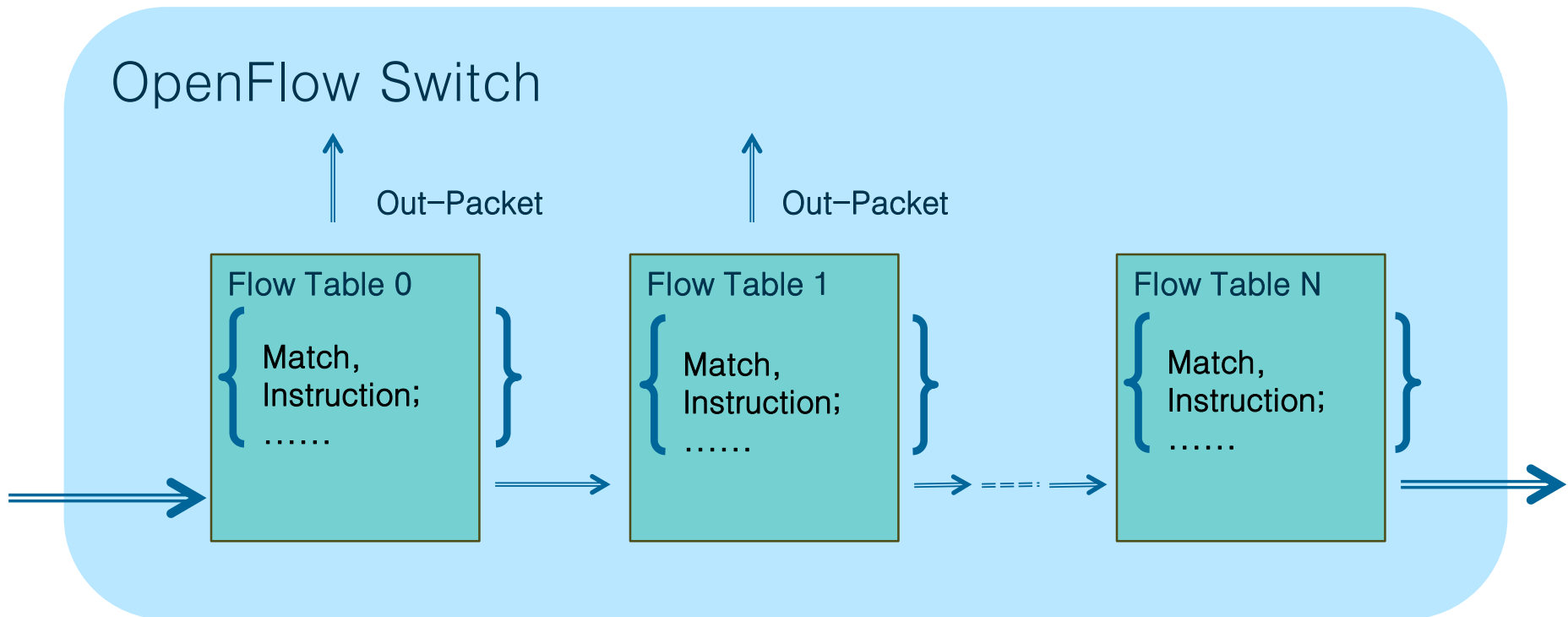
# OpenFlow: Switch





# Switch: Pipeline

- [1] Packet may be transferred to other table;
- [2] Packet header may be modified;
- [3] Packet may be forwarded to given port or just dropped;
- [4] Packet may be applied to given QoS.



# Switch: Table Entry

Match Fields

Priority

Counters

Timeout

Cookies

Instruction set

## Match criteria:

Ingress-port

Ethernet MAC

ARP

IPv4 and IPv6

TCP ports

VLAN, MPLS etc.

## Instruction:

Go-To Table

Modify Metadata

Action Set {forward, apply QoS, drop, Apply to Group}



# OpenFlow programs

	Switch port	MAC src	MAC dst	Eth type	VLAN ID	IP Src	IP Prot	TCP sport	TCP dport	Action
Switching	*	*	00:1f ...	*	*	*	*	*	*	Port6
Flow switching	Port3	00:20..	00:1f..	0800	Vlan1	1.2.3.4	5.6.7.8	4	17264	Port6
Firewall	*	*	*	*	*	*	*	*	22	Drop
Routing	*	*	*	*	*	*	5.6.7.8	*	*	Port6
VLAN switching	*	*	00:1f..	*	Vlan1	*	*	*	*	Port6, port7, port8

OpenFlow can be compared to the instruction set of a CPU

# Aspect-oriented

Group Identifier

Group Type

Counters

Action bucket

**Aspects:**

All

Select

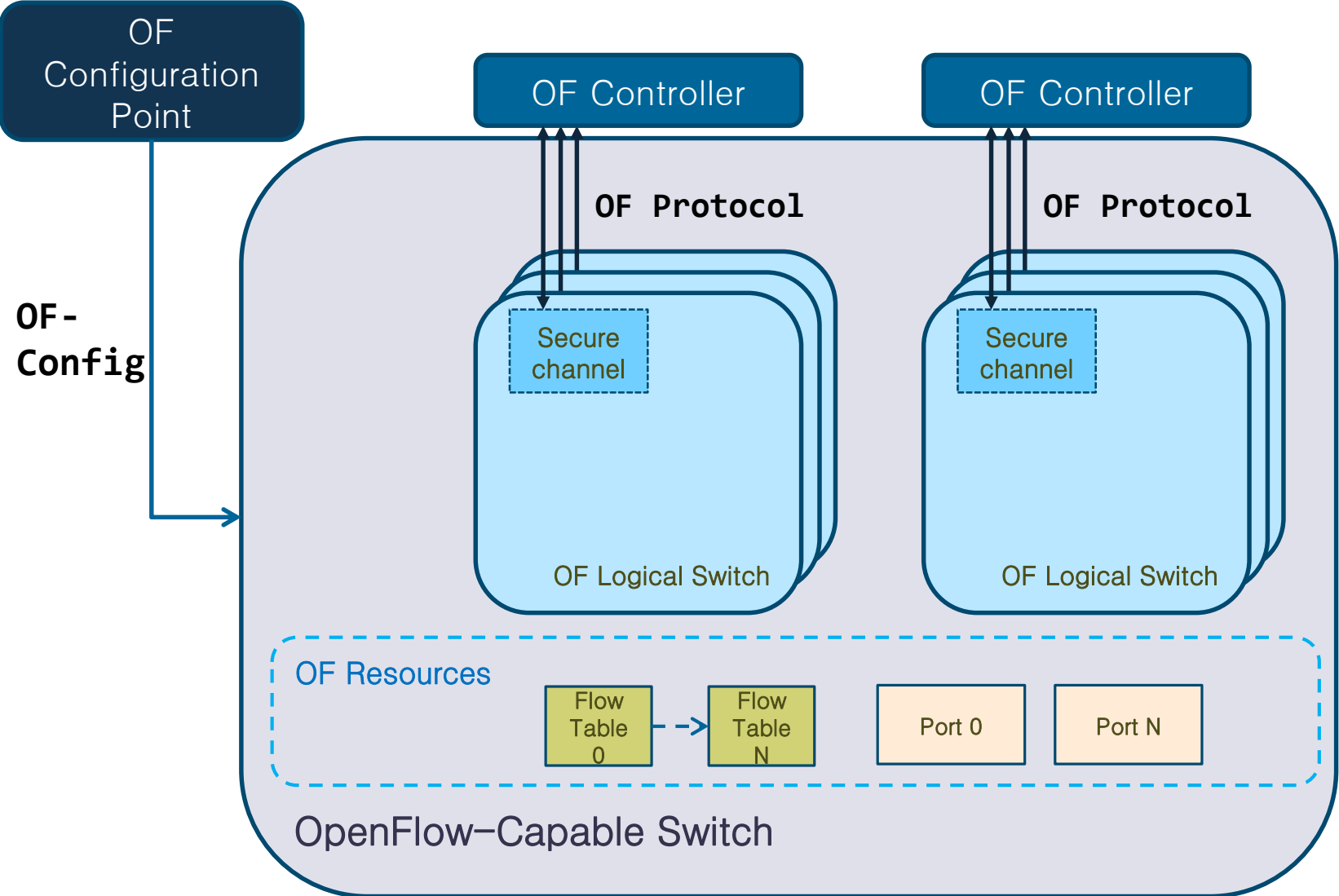
Indirect

Fast Failover





# Metaprogramming



# OpenFlow evolution





# Controller

This slide is intentionally left blank

# CPqD – optimal SDN



CPqD

- OpenFlow Switch on C
- OpenFlow Controller on C++ and Python
- OpenFlow Driver

# FloodLight – SDN platform



## FloodLight Platform

- Flooflight: Java OpenFlow platform, Extensible with Plugins
- Indigo: Create a Firmware
- LoxiGen: Generate OpenFlow driver on the Language you like

# Concurrency be Design



[FlowForwarding.org](http://FlowForwarding.org)

Erlang VM

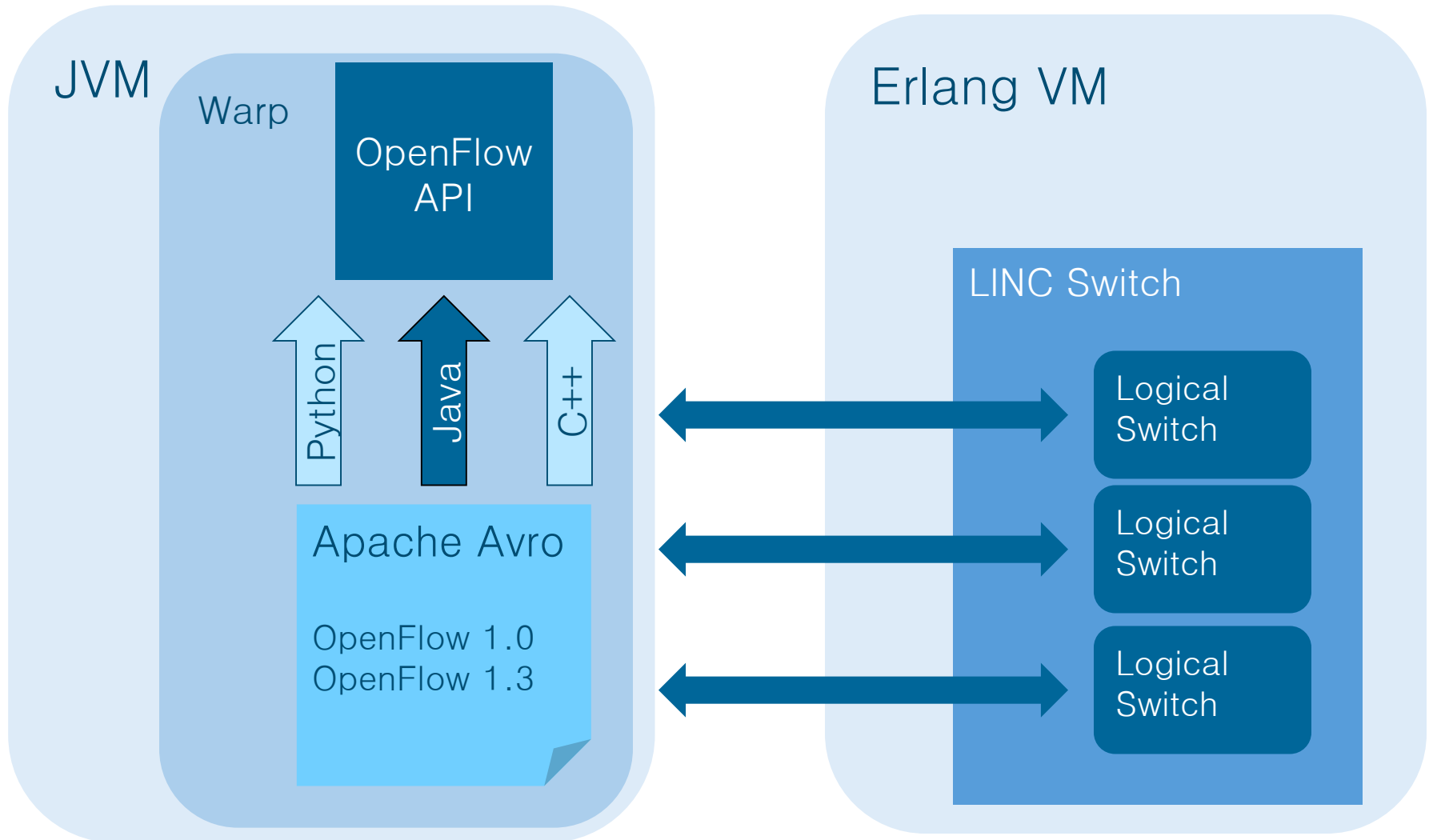
- LINC Software Switch
- Loom Controller
- Tapestry Analyzer

Java VM

- Warp OF Driver
- Akka-based Controller
- Scala actors



# Warp. LINC.



# Our Tapestry

iPad

10.36

100%

## Tapestry: A Network Complexity Analyzer

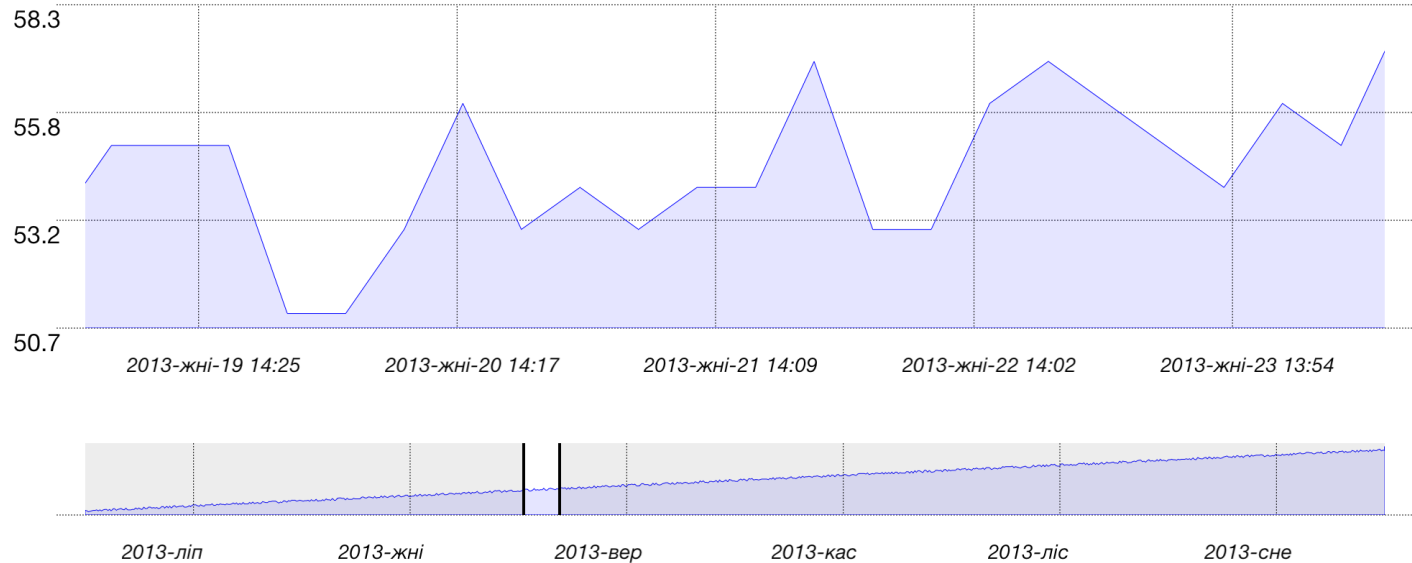
Tapestry Server: ws:// demo

**NCI** <sup>?</sup> **147**  
updated 2013-12-16 10:36:12

**Endpoints** <sup>?</sup> **311**  
updated 2013-12-16 10:36:12

**Queries per Second** <sup>?</sup> **233**  
updated 2013-12-16 10:36:12

1d 5d 1m 3m 6m 1y 5y 10y



# Build SDN Agilely



ryu

Ryu

- Well-defined API
- Integrated in OpenStack
- Tested against 12 Switches
- The main event of Developers track of ONS-2013





# Program Network

## Frenetic and Pyrethic

```
def monitor_noserver_ef():  
    return(Filter((inport_p(2)  
                  & srcport_p(80))-  
                dstip_p("10.0.0.9"))  
           Lift(size) |o|  
           GroupByTime(30) |o|  
           Lift(sum))
```

# OpenDaylight: Free SDN

## Network Orchestration Application and Services

OpenStack Neutron

DDos Protection

OpenDaylight REST API

## Controller Platform

Base Service Networking Functions

Service Abstraction Layer

Southbound Interfaces and Protocol Plugins: OpenFlow, NETCONF, etc

## Data Plan Elements

Network Device

Network Device

OpenFlow Switch

Open vSwitch

# OpenStack

SDN – is a Virtualization

*Thank you!*



