

# CORE NETWORKS UTILIZING SOFTWARE DEFINED NETWORKING

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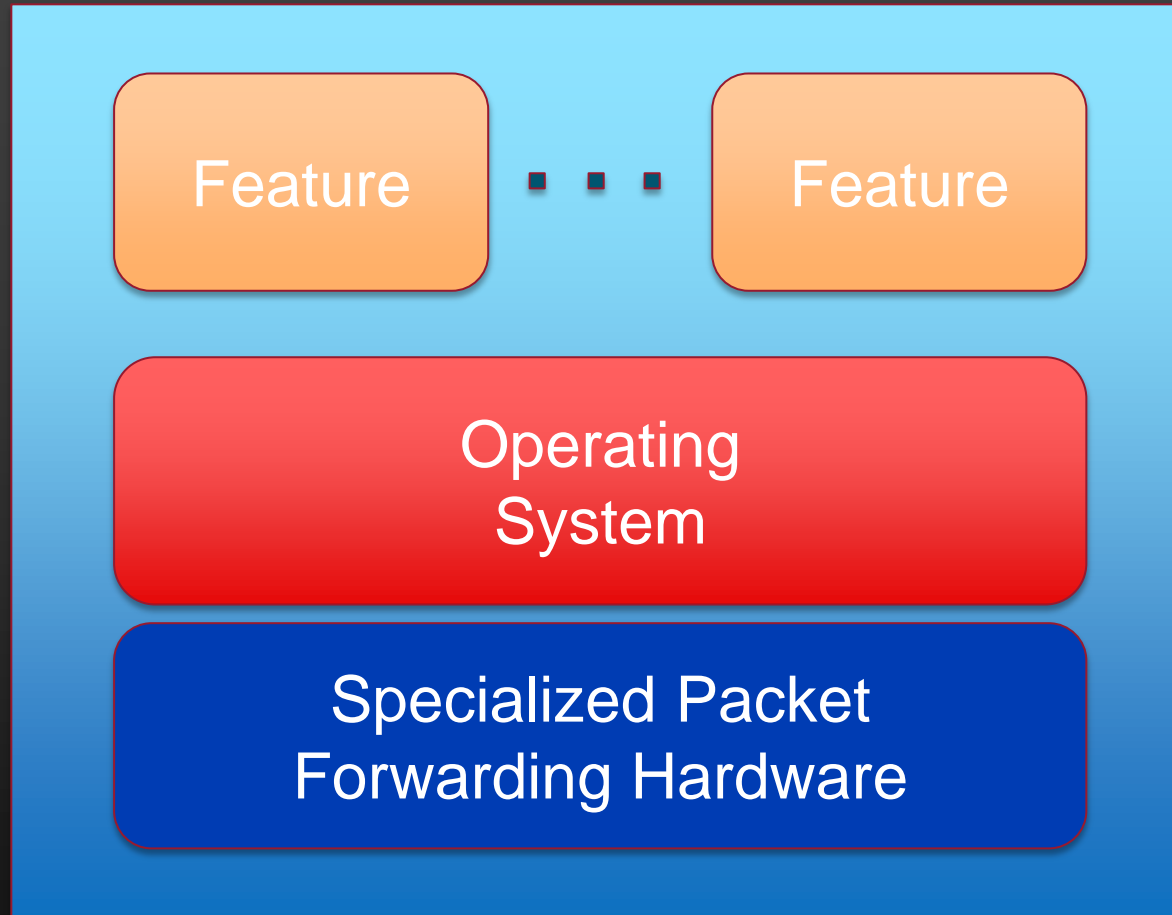
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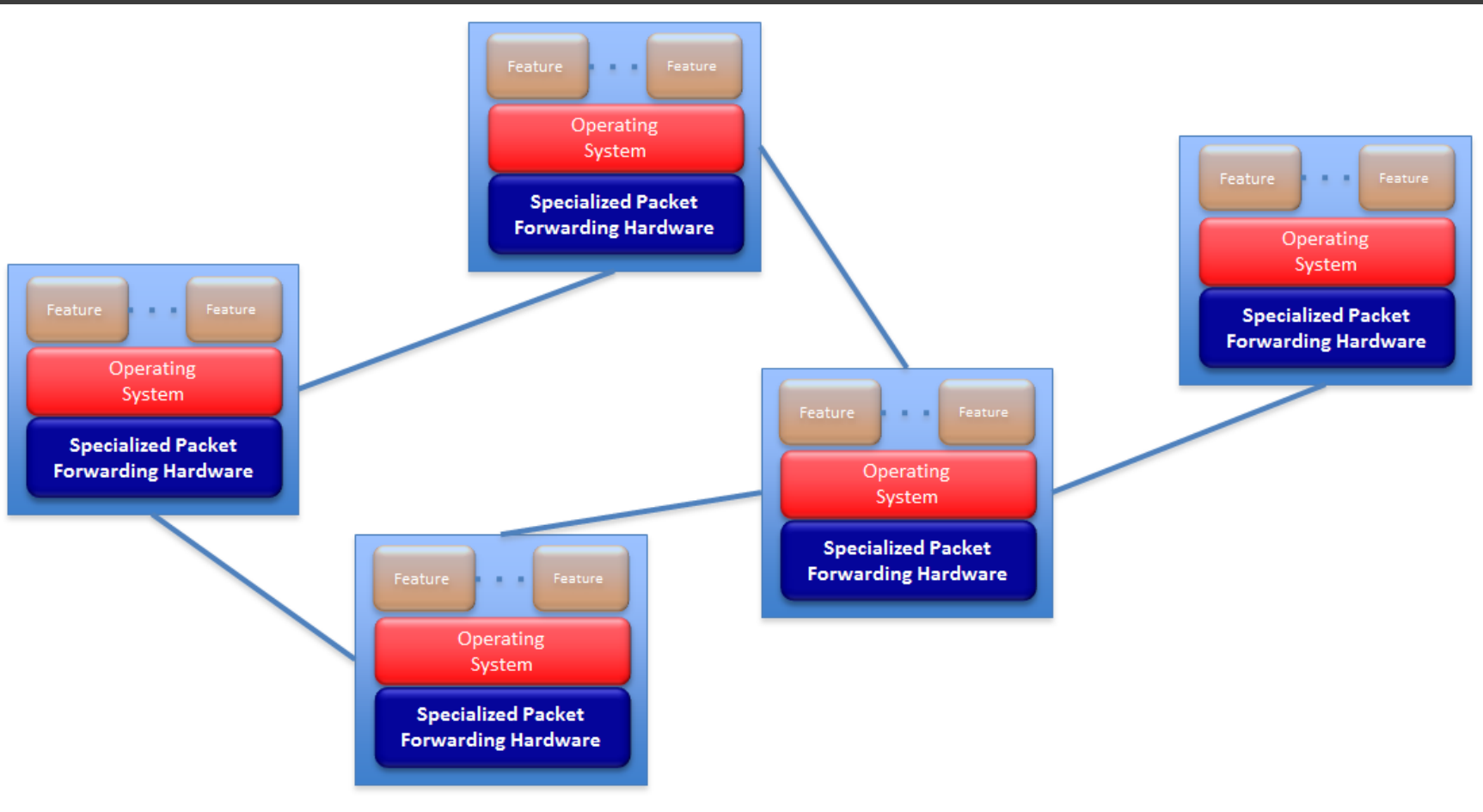
# Software Defined Networking

- Separation of Control and Forwarding Plane
- Control Plane
  - High level processing and routing decisions
  - Slow and “Intelligent” software implementation
  - Simplified network management
  - Greater network flexibility
- Forwarding Plane
  - Packet forwarding
  - Fast and “Simple” hardware implementation

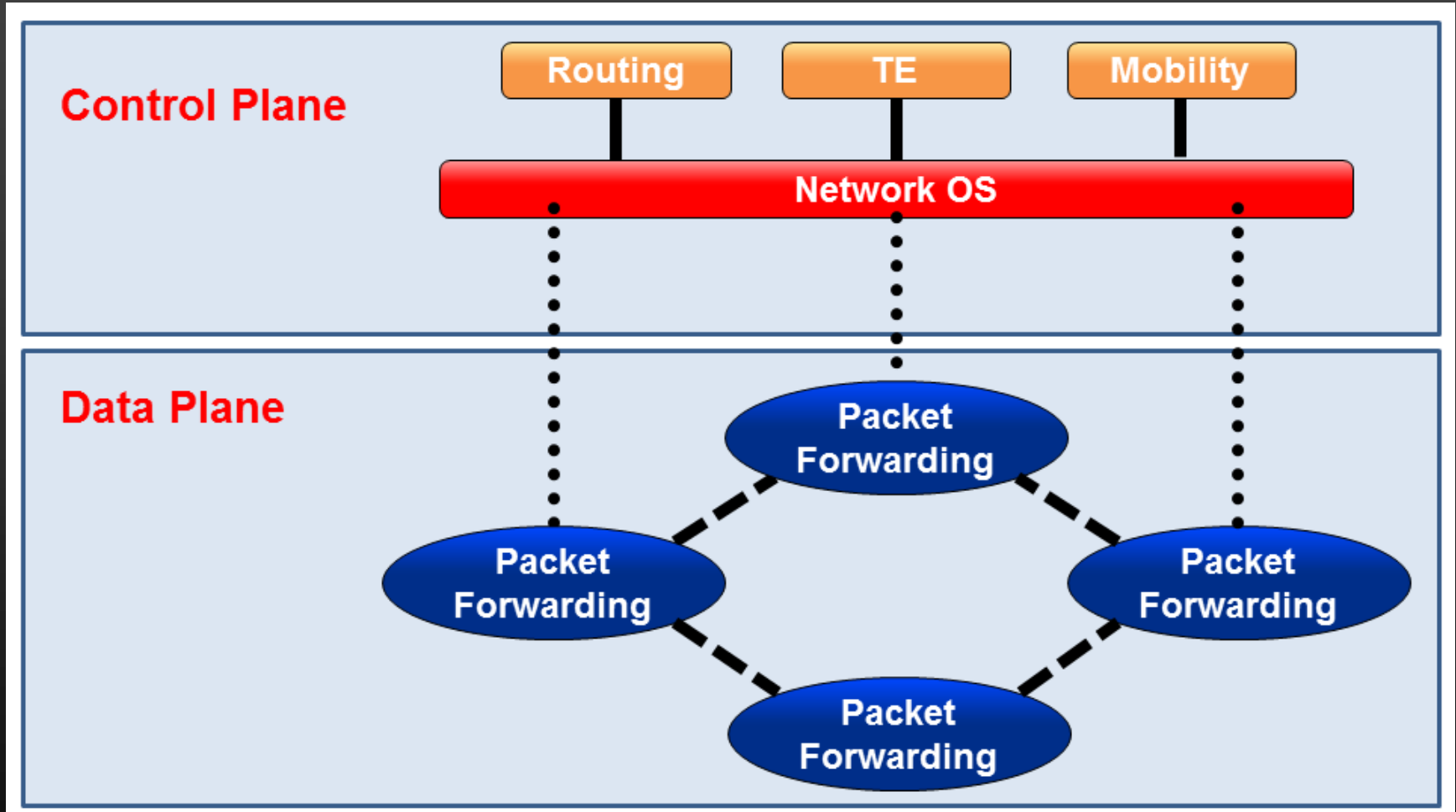
# Software Defined Networking



# Software Defined Networking



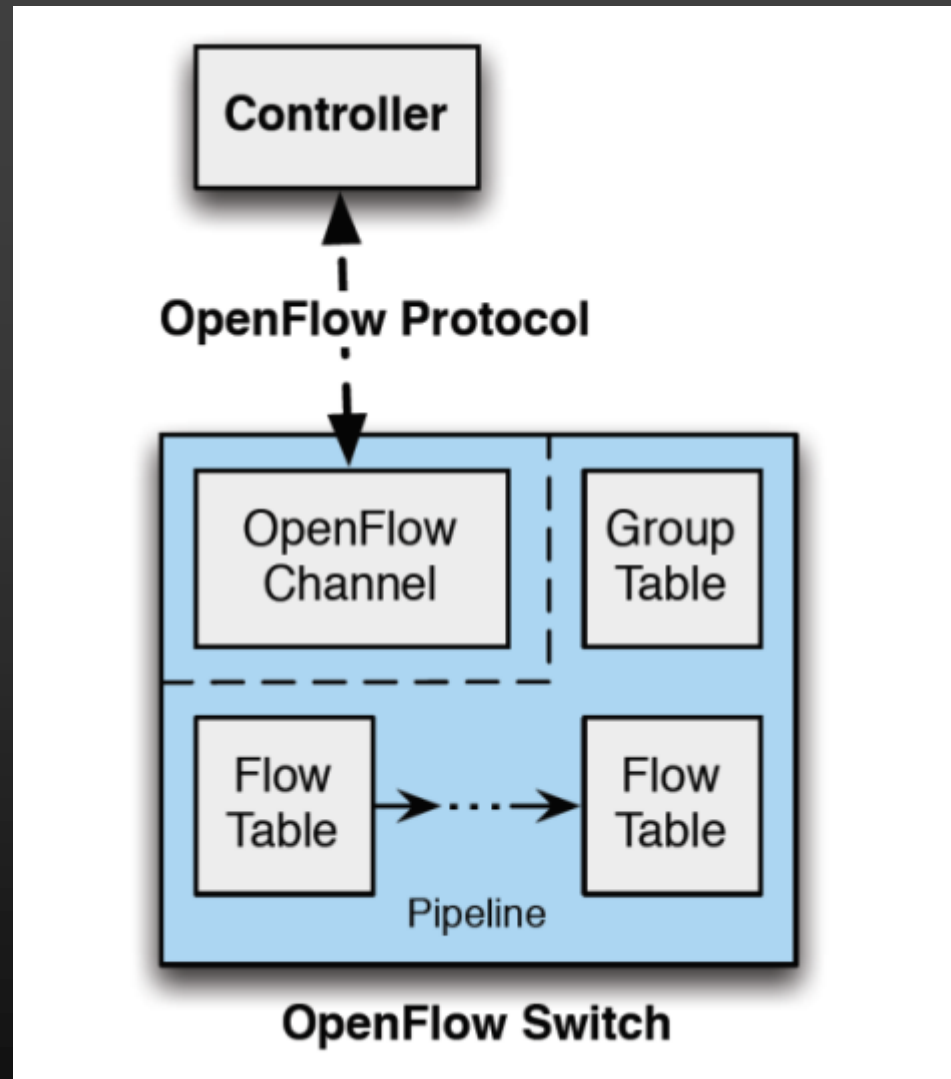
# Software Defined Networking



# OpenFlow

- Open Networking Foundation
- Developed for experiments and prototyping on production network - slicing
- Enables the network to react to topology, application or user changes in real-time
- Early commercial adoption in data centres
- Misunderstood to be the only SDN solution

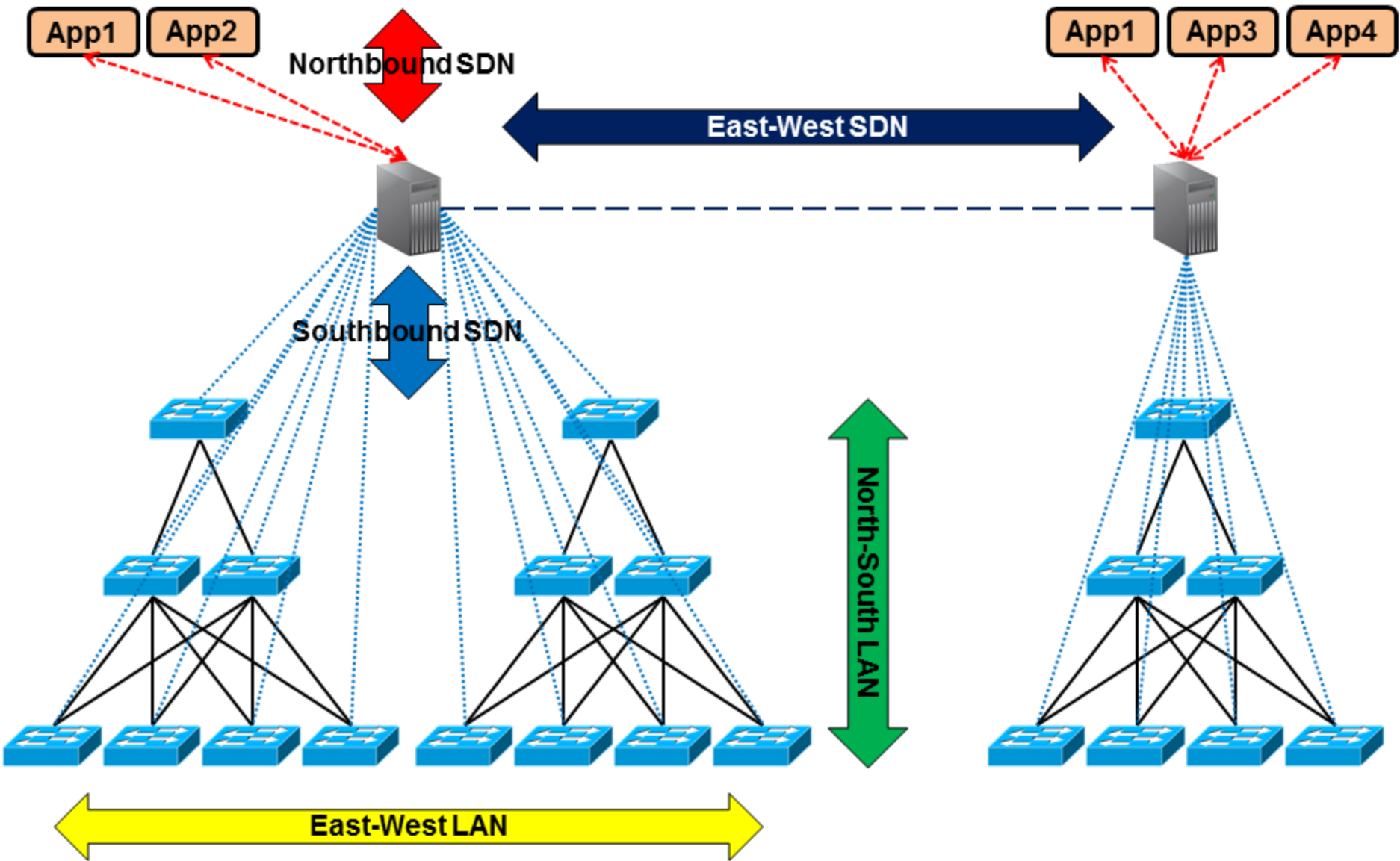
# OpenFlow





# Related Technologies

- Interface to Routing System (I2RS)
- Forwarding and Control Element Separation (ForCES)
- Network Configuration Protocol (NETCONF)
- Path Computational Element (PCE)
- Network Function Virtualization (NFV)



# Scaling SDN Controller

- Scaling conventional SDN controllers
- Distributed SDN controllers
- Inter-controller communication
  - SDNi
  - EWBridge

# Scaling SDN Controller

- SDNi
- Defined only basics
- Coordinate flow setup requests from applications
- Exchange reachability information for routing
- Abandoned in 2012

# Scaling SDN Controller

- EWBridge
  - SDN AS Peers
  - SDN intra-domain sub-network peers in same administrative domain
  - Data centres of a company located in different places
  - Enterprise networks connected by WAN
- Currently focused on last three with inter-domain connection as possible future work
- Using same controller, not heterogeneous

# Conclusions

- Rapid development of SDN
  - Academic
  - Commercial
- Focus on extension of functionality
- Until recently only little research into scaling SDN controller

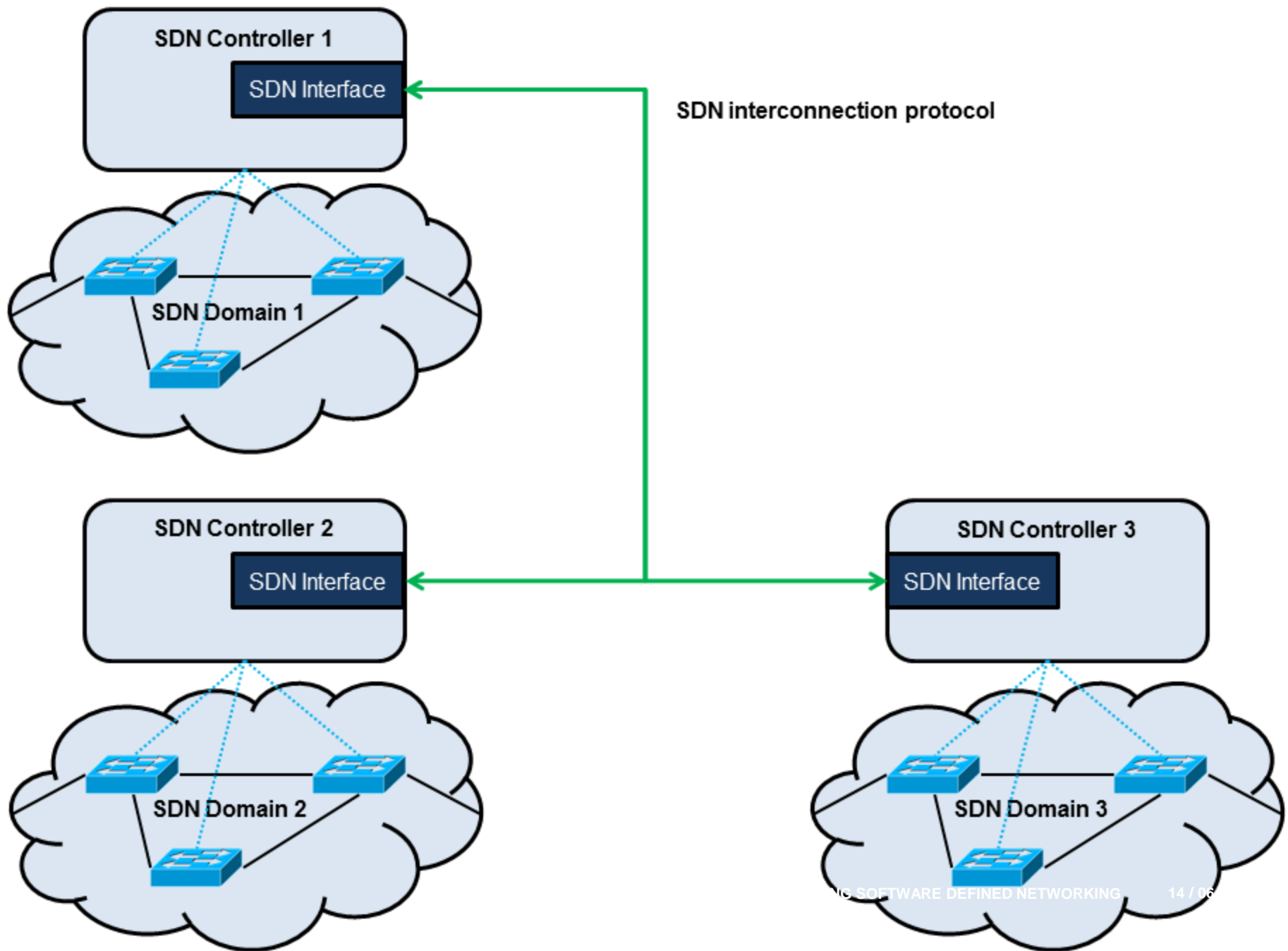
# Motivation

- Separation of control and forwarding plane stimulates faster innovation in networks
- New networking paradigm of SDN likely to be globally deployed
- Insufficient provisioning for very large scale ISP core networks
- No support for inter-domain controller communication

# Problem Statement

- Design inter-controller communication system in heterogeneous SDN domains
  - Improve SDN architecture to benefit from east-west interface between controllers
  - Design new universal east-west communication protocol for interconnection of heterogeneous SDN networks
  - Define a communication interface in SDN controller for the interconnection protocol
  - Verify the functionality of the designed protocol and methods by comparing it with unmodified network and alternative existing methods





# Q&A