Introduction to SDN

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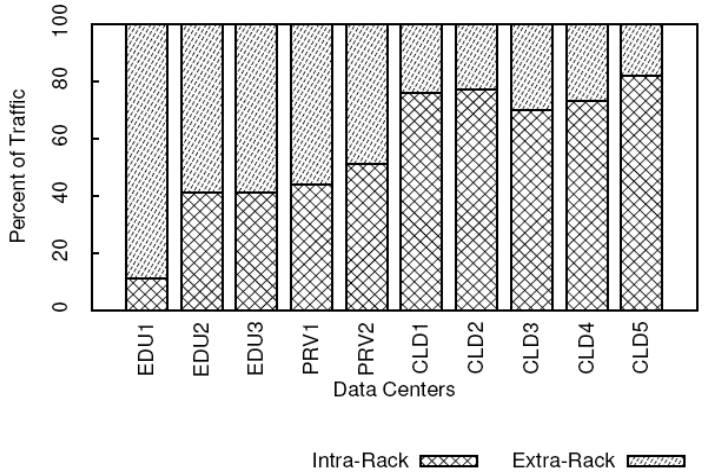
Outline

- W2-1: Introduction to SDN
- W2-2: Introduction to OpenFlow
- W2-3: Flow Table, Group Table and Meter Table
- W2-4: Operations in OpenFlow

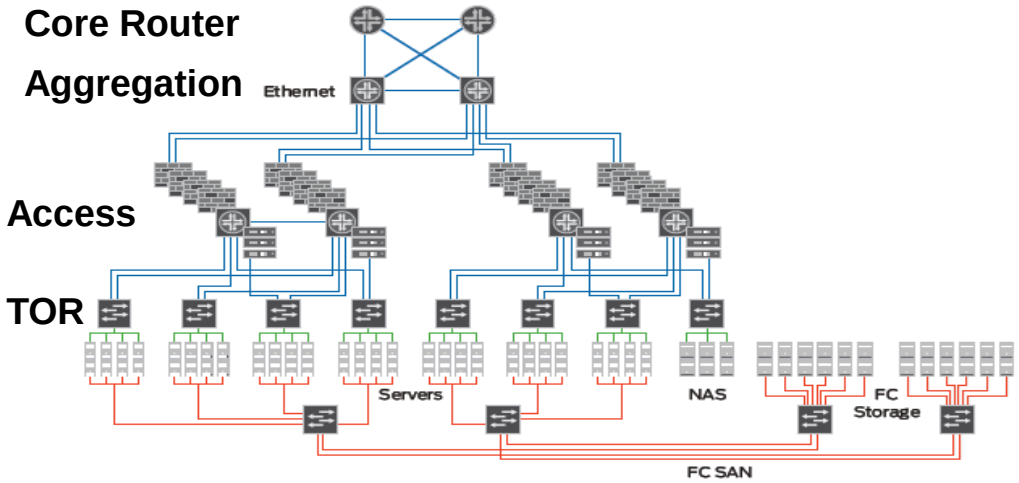
Background (1/3)

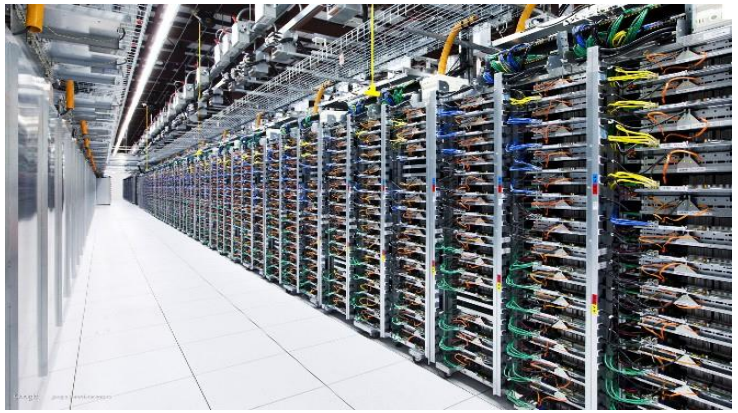
❖ Needs for a New Networking Paradigm

- Changing Traffic Patterns
  - Data Center Traffic
  - North-south: 95% → East-west: 40 ~ 80%



- Data Center Networks
  - Hyper scale network
    - Hundreds and thousands of servers
    - Hundreds and thousands of switches → Tera bit network capacity
    - 3-4 tier architecture → over 50% of network capacity is used to connect switches → inefficient



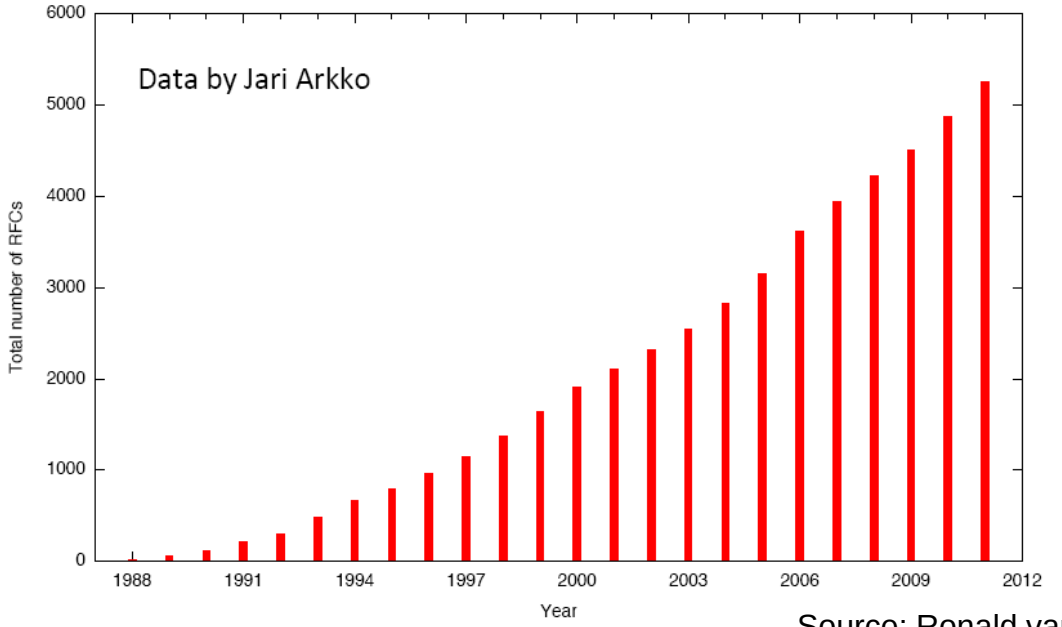


Background (2/3)

❖ Need for a new Networking Paradigm

- Vendor dependency
  - Lack of open I/F and standard API → operators cannot tailor the N/W
  - Biz needs and user demand → standard → Long Time to Market
    - Vendor's equipment product cycle → over 3 years

- Fundamental problems of IP protocols
  - Protocols defined in isolation, each to solve a specific problem and without the benefit of abstractions.

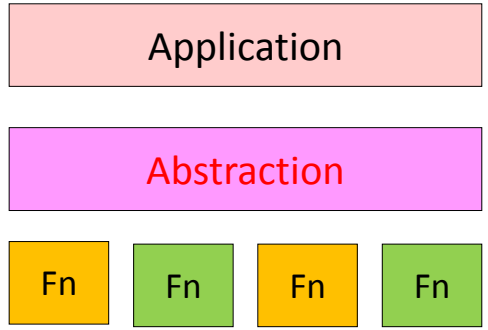


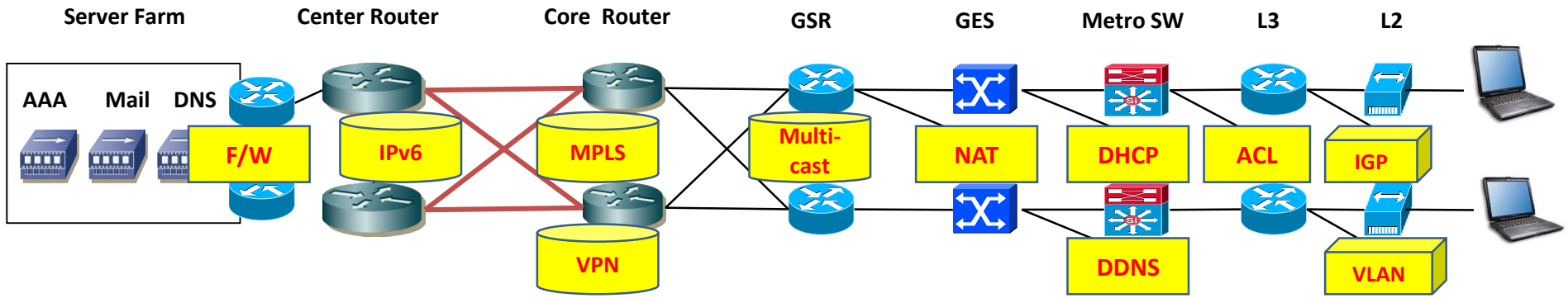
Source: Ronald van der Pol, rvdp@sara.nl

Background (3/3)

❖ Need for a new Networking Paradigm

- Fundamental problems of IP protocols
  - Current Internet needs many new dedicated middleboxes
    - Lack of IPv4 addresses (2^{32}) → NAT, IPv6 (2^{128})
    - Security → IDS/IPS, VLAN, VPN
    - Management → Authentication, QoS, ACL, DPI, etc.
    - Mobile service (EPC) → S-GW, P-GW, MME, etc.
  - Today's Internet is static
    - To add or delete any device, IT must touch multiple devices and configurations.
    - But, human errors are common

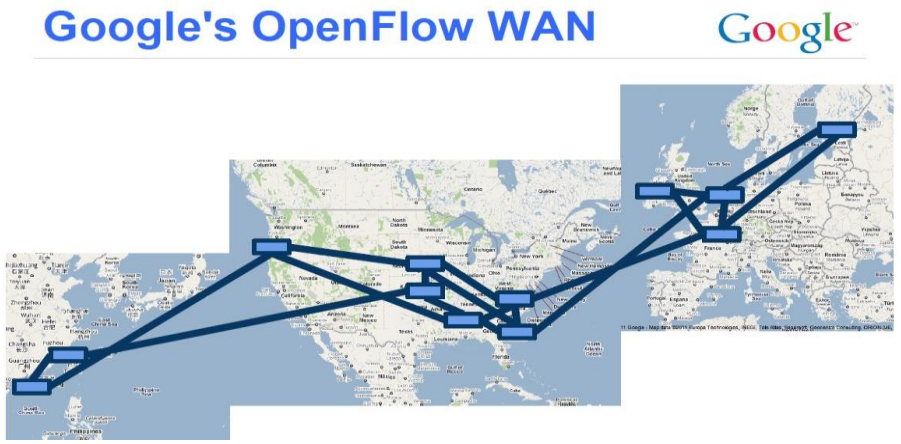




SDN Background

❖ Rapid Development of OpenFlow Technologies

- 2012 ONF meeting, Google announced that…
  - Google's G-Scale network is operating using OpenFlow
  - Developed for 2 years (2010~2012.1)
  - Saved CAPEX and OPEX

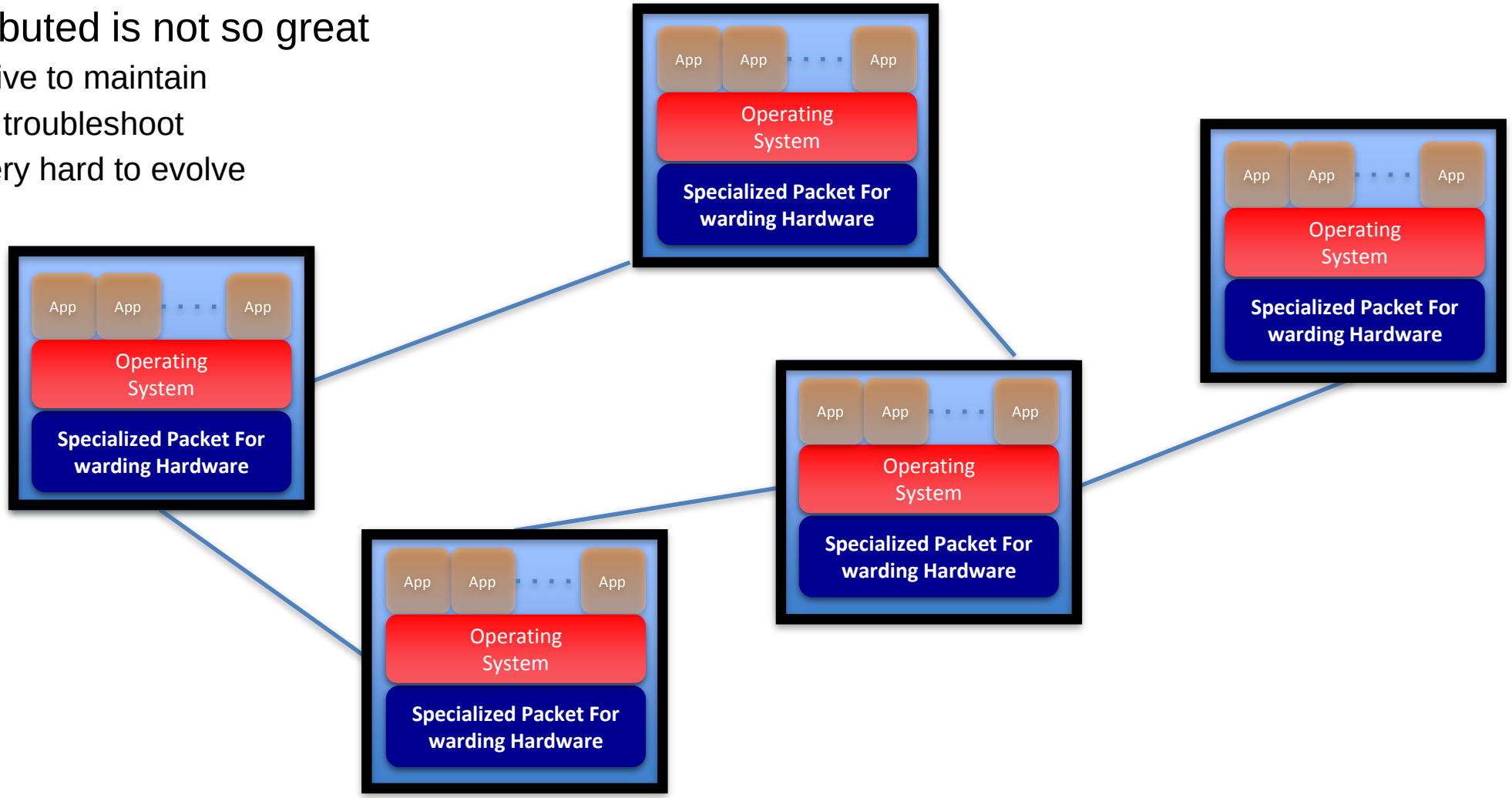


- OpenFlow was known as an open standard to test experimental protocols in the campus networks
- OpenFlow → now evolving to Enterprise and Carrier grade SDN technologies
  - Commercial OpenFlow switches and controllers
  - NEC, NTT Data, Nicira , HP, IBM, BigSwitch, Brocade……

Traditional Network

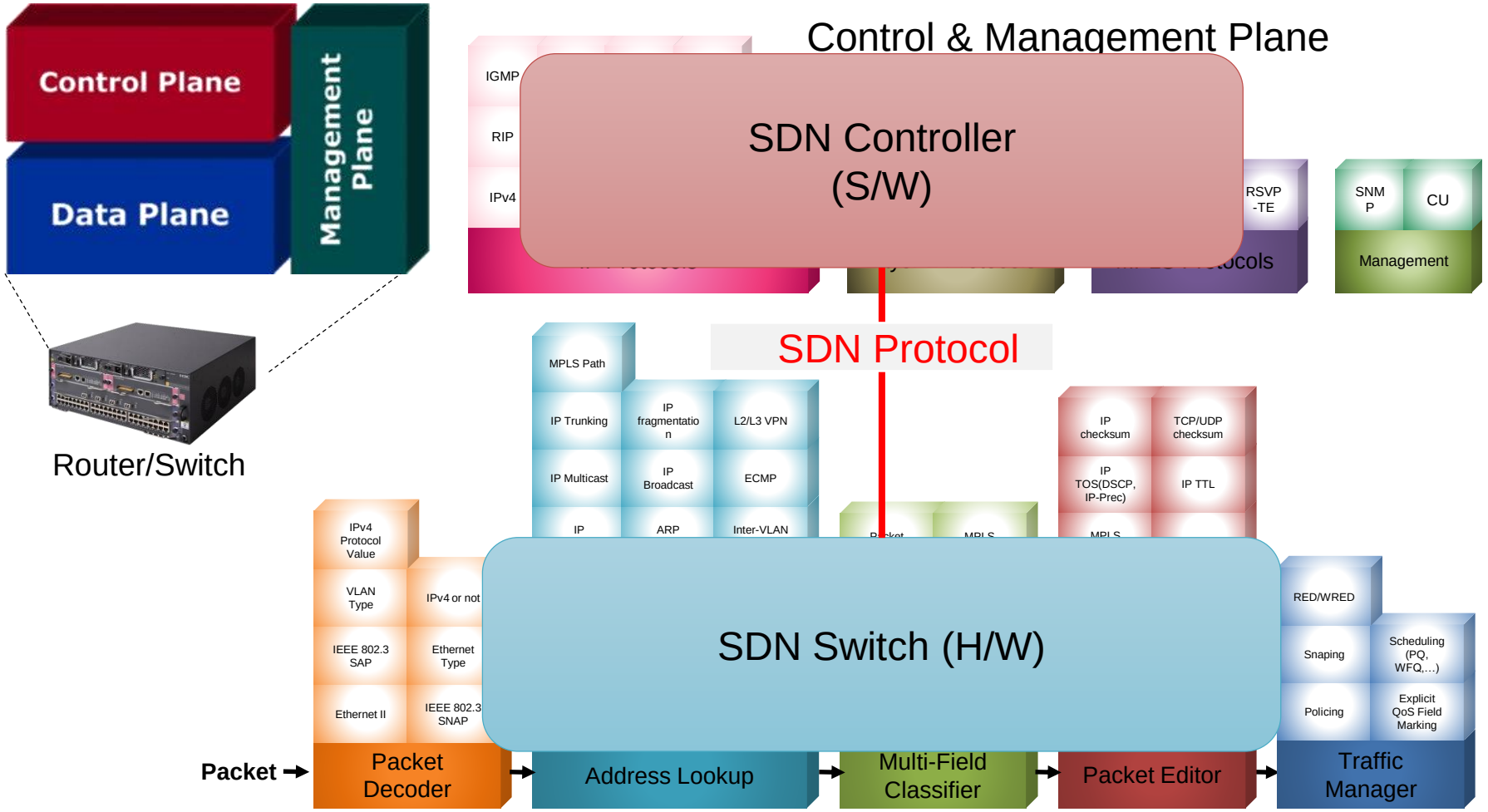
❖ Distributed Protocols

- Fully distributed is not so great
  - Expensive to maintain
  - Hard to troubleshoot
  - Very, very hard to evolve



SDN Concept

❖ SDN Separates Control and Data Plane Functions



SDN Concept

❖ SDN Concept

- Separate control plane and data plane entities
  - Network intelligence and state are logically centralized
  - The underlying network infrastructure is abstracted from the applications
- Execute or run control plane software on general purpose hardware
  - De-couple from specific networking hardware
  - Use commodity computers
- Have programmable data planes
  - Maintain, control and program data plane state from a central entity
- An architecture to control not only a networking device but an entire network
  - Similar to existing Network Management System (NMS), but more powerful

❖ Control Software (SW)

- Control SW operates on view of network
- Control SW is not a distributed system
  - Abstraction hides details of distributed states

SDN with Key Abstraction in the Control Plane