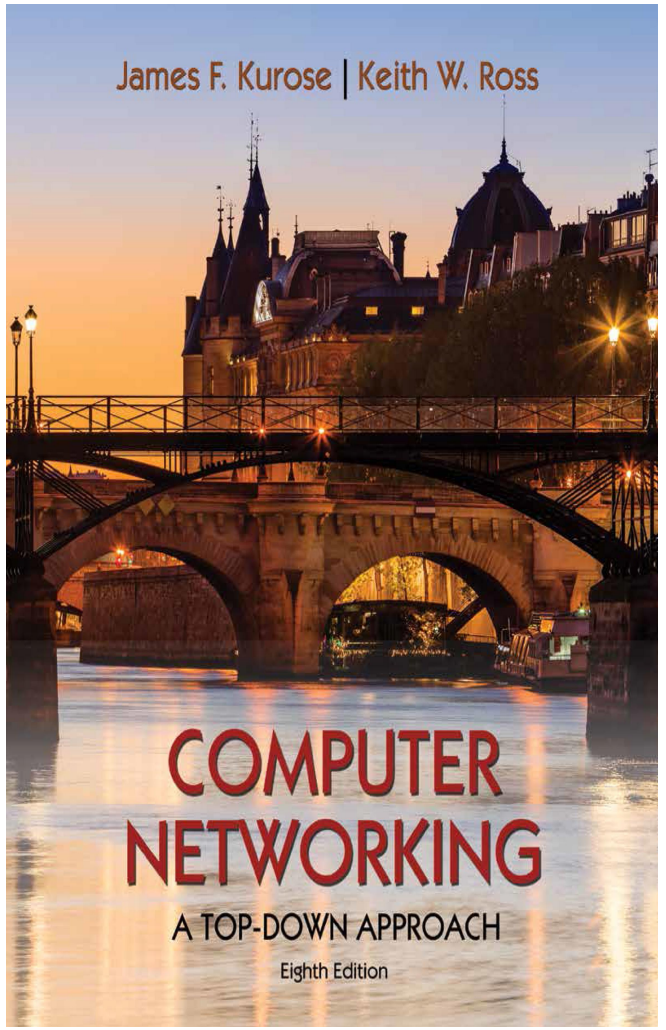
Network Layer: Control Plane

Computer Networks



- Introduction: network-layer control plane
- Routing algorithms
- Intra-ISP routing: OSPF
- routing among ISPs: BGP
- SDN control plane
- Internet Control Message Protocol
- Network management

Network layer control plane: our goals

- understand principles behind network control plane:
  - traditional routing algorithms
  - SDN controllers
  - network management, configuration

Network layer control plane: our goals

- understand principles behind network control plane:
  - traditional routing algorithms
  - SDN controllers
  - network management, configuration
- instantiation, implementation in the Internet:
  - OSPF, BGP
  - OpenFlow, ODL and ONOS controllers
  - Internet Control Message Protocol: ICMP
  - SNMP, YANG/NETCONF

Network layer: “control plane” roadmap

- introduction
- routing algorithms
  - link state
  - distance vector
- intra-ISP routing: OSPF
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Network layer: “control plane” roadmap

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- network management, configuration
  - SNMP
  - NETCONF/YANG

Network-layer functions

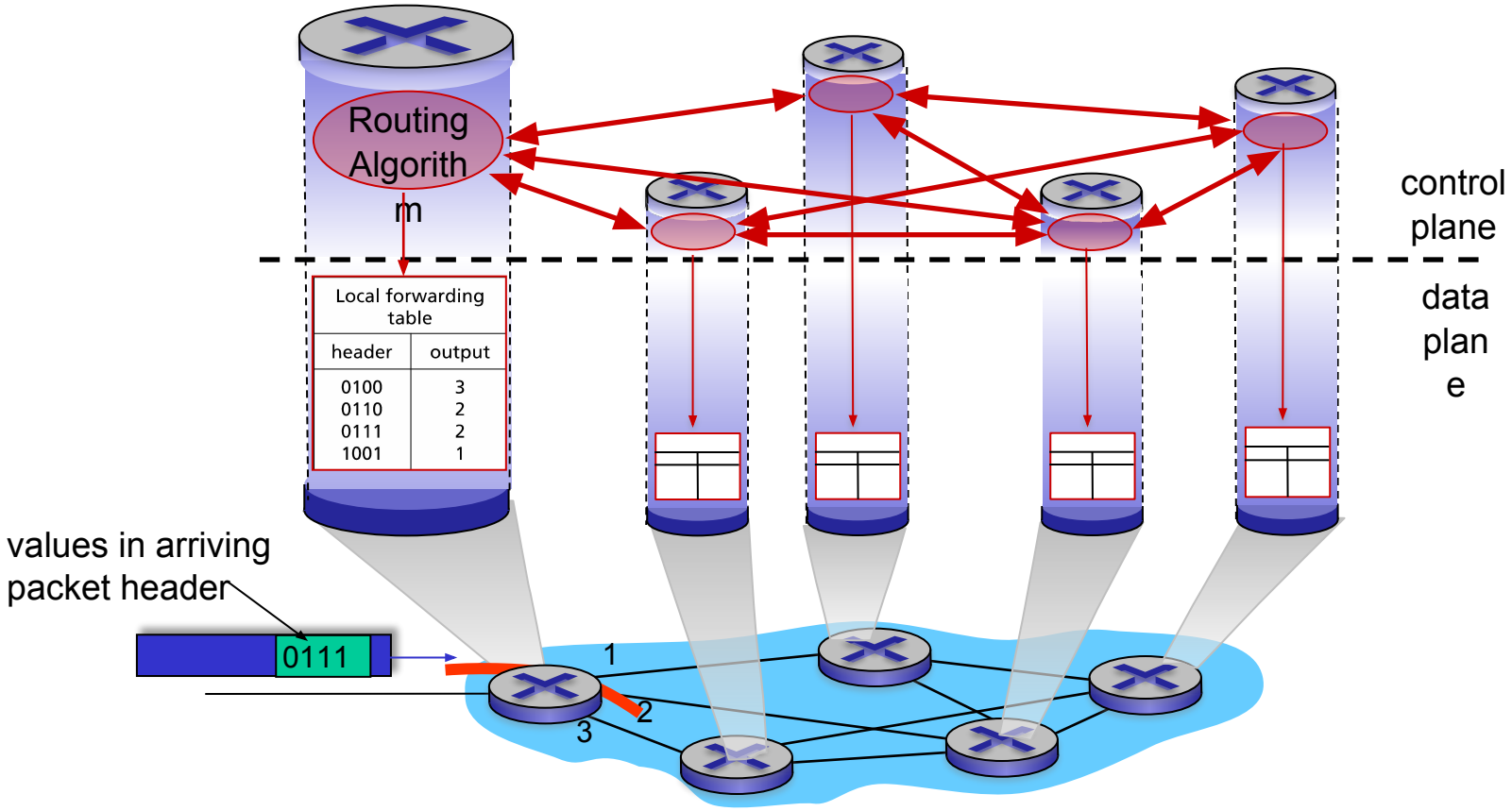
- routing: determine route taken by packets from source to destination — *control plane*
- forwarding: move packets from router's input to appropriate router output — *data plane*

Two approaches to structuring network control plane:

- per-router control (traditional)
- logically centralized control (software defined networking)

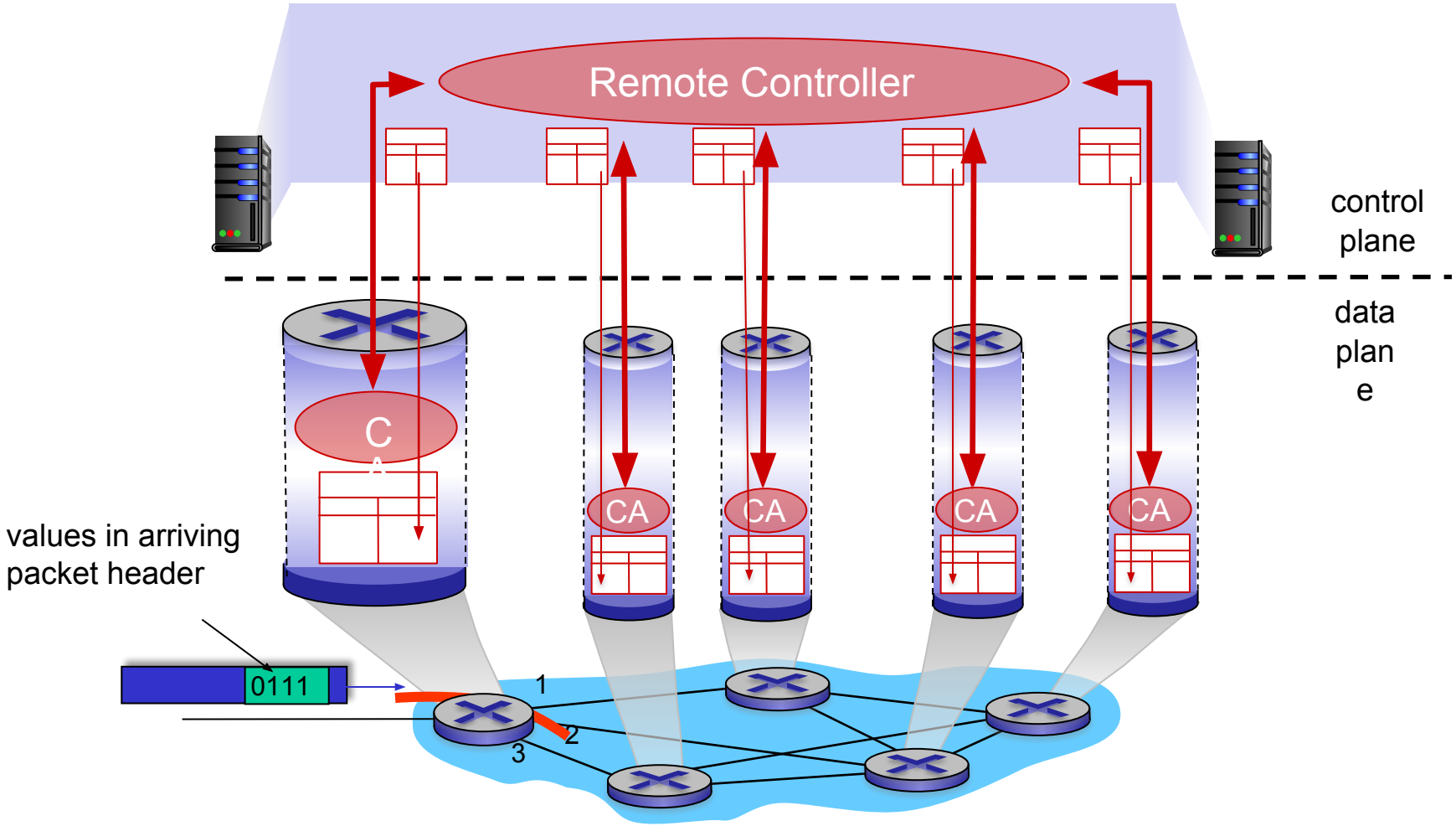
Per-router control plane

Individual routing algorithm components *in each and every router* interact in the control plane

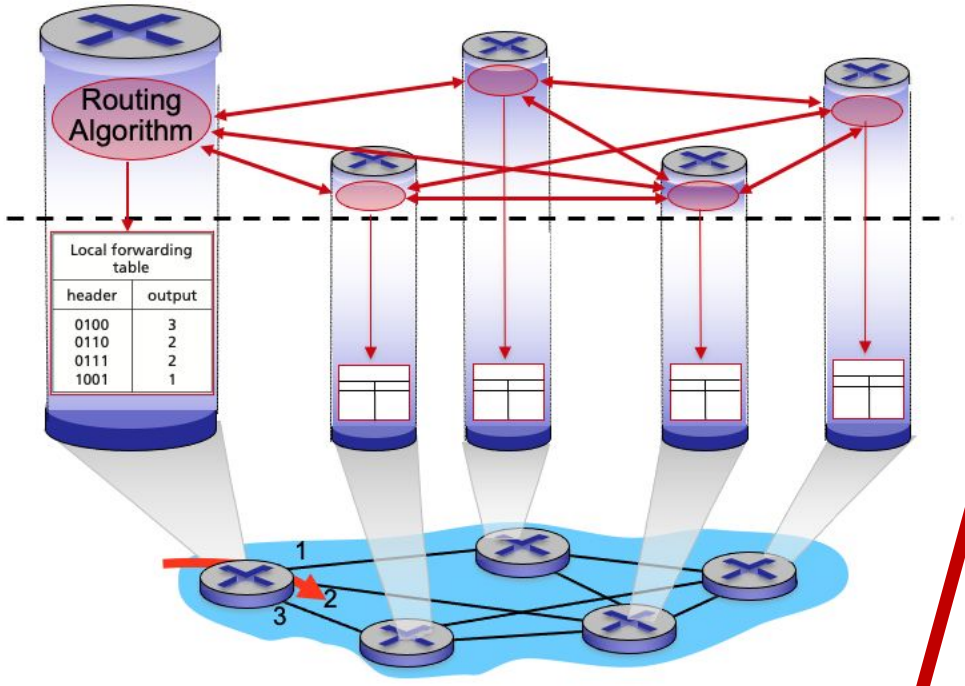


Software-Defined Networking (SDN) control plane

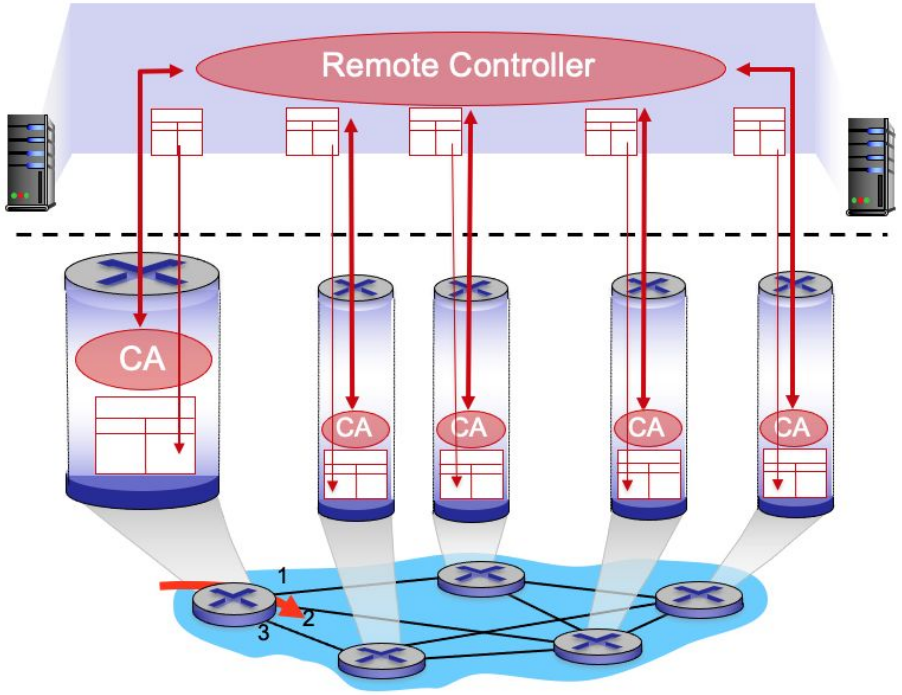
Remote controller computes, installs forwarding tables in routers



Per-router control plane



SDN control plane



Routing Versus Forwarding

Which of the following statements correctly identify the differences between routing and forwarding. Select one or more statements.

- *Forwarding* refers to moving packets from a router's input to appropriate router output, and is implemented in the control plane.
- *Forwarding* refers to determining the route taken by packets from source to destination, and is implemented in the control plane
- *Routing* refers to moving packets from a router's input to appropriate router output, and is implemented in the data plane.
- *Routing* refers to moving packets from a router's input to appropriate router output, and is implemented in the control plane.
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- *Forwarding* refers to determining the route taken by packets from source to destination, and is implemented in the data plane.
- ***Forwarding* refers to moving packets from a router's input to appropriate router output, and is implemented in the data plane.**
- ***Routing* refers to determining the route taken by packets from source to destination, and is implemented in the control plane.**

Control Plan Implementation Approaches

Write the name of the approach towards implementing a control plane considering the given description that how the approach works.

A. A (typically) remote controller gathers information from routers, and then computes and installs the forwarding tables in routers.

✔ Software-defined networking (SDN)

B. Individual routing algorithm components - with a component operating in each and every router - interact with each other in the control plane. The individual routing algorithm component executing in a given router computes the local forwarding table for that router.

✔ Per-router control plane