Dynamic Classification in a Silicon-Based Forwarding Engine

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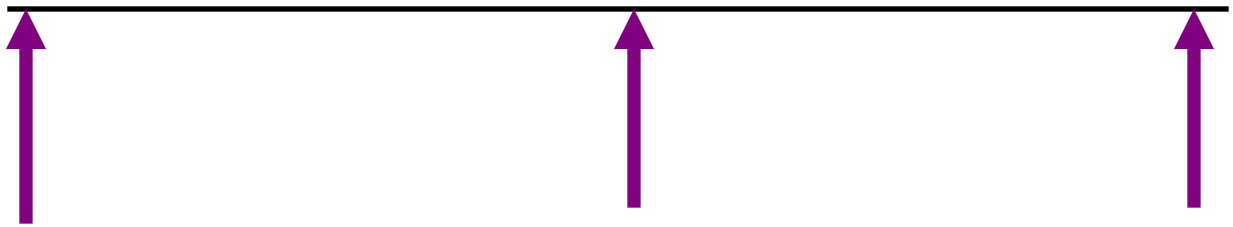
The Network Paradigm Spectrum



Traditional Networks

- end-to-end connectivity
- well defined protocols
- increasingly perform forwarding in hardware

?

Active Networks

- on-the-fly service introduction
- per-flow granularity possible
- inject software in data path

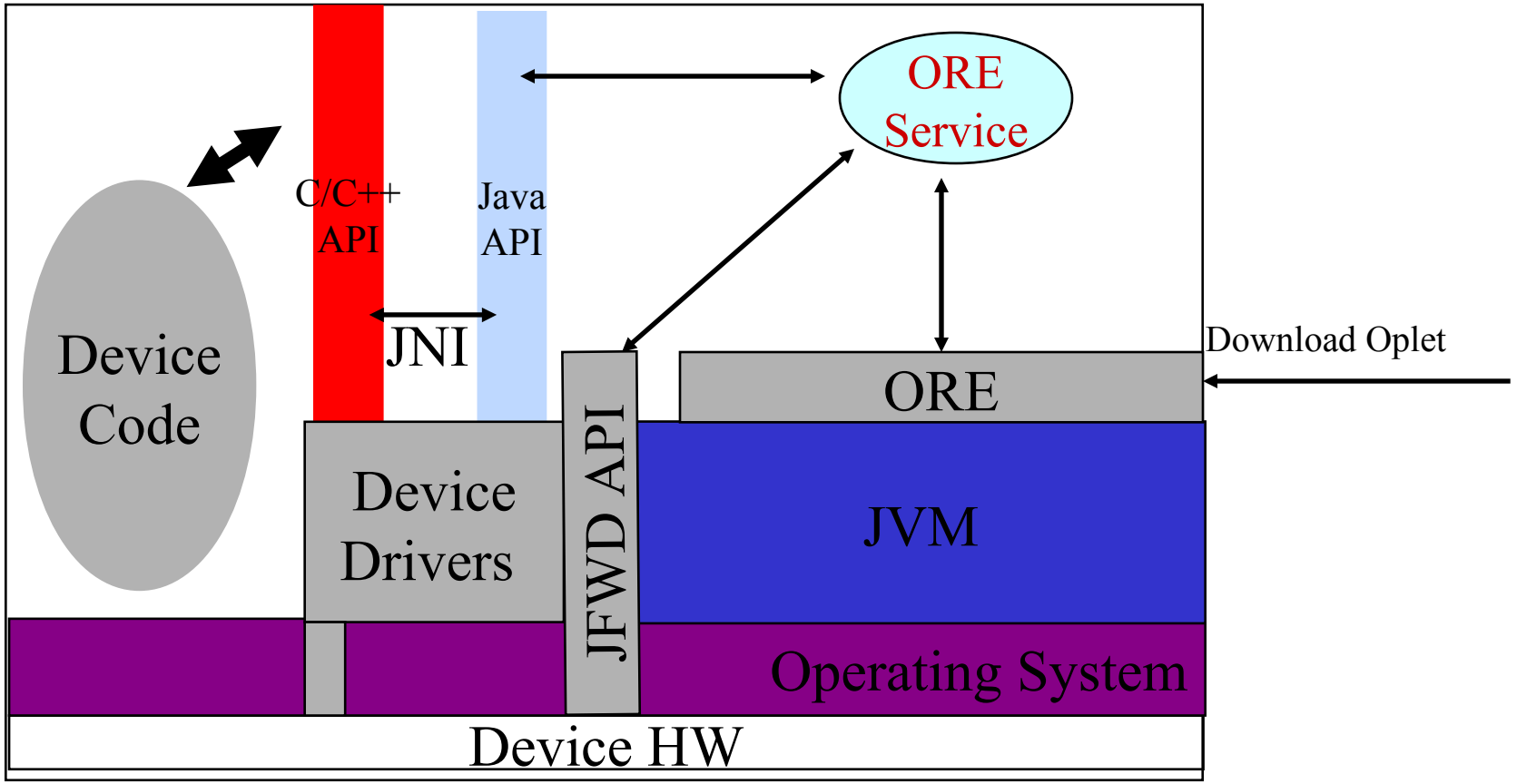
Objectives

- Implement flow performance enhancement mechanisms **without** introducing software into data forwarding path
  - **Service defined packet processing in a silicon-based forwarding engine**
  - **Policy-based Dynamic packet classifier**
- Create OPEN platform for introduction of new services
  - **Specify OPEN interfaces for Java applications to control a generic, platform-neutral forwarding plane**
  - **Enable downloading of services to network node**
  - **Allow object sharing and inter-service communication**

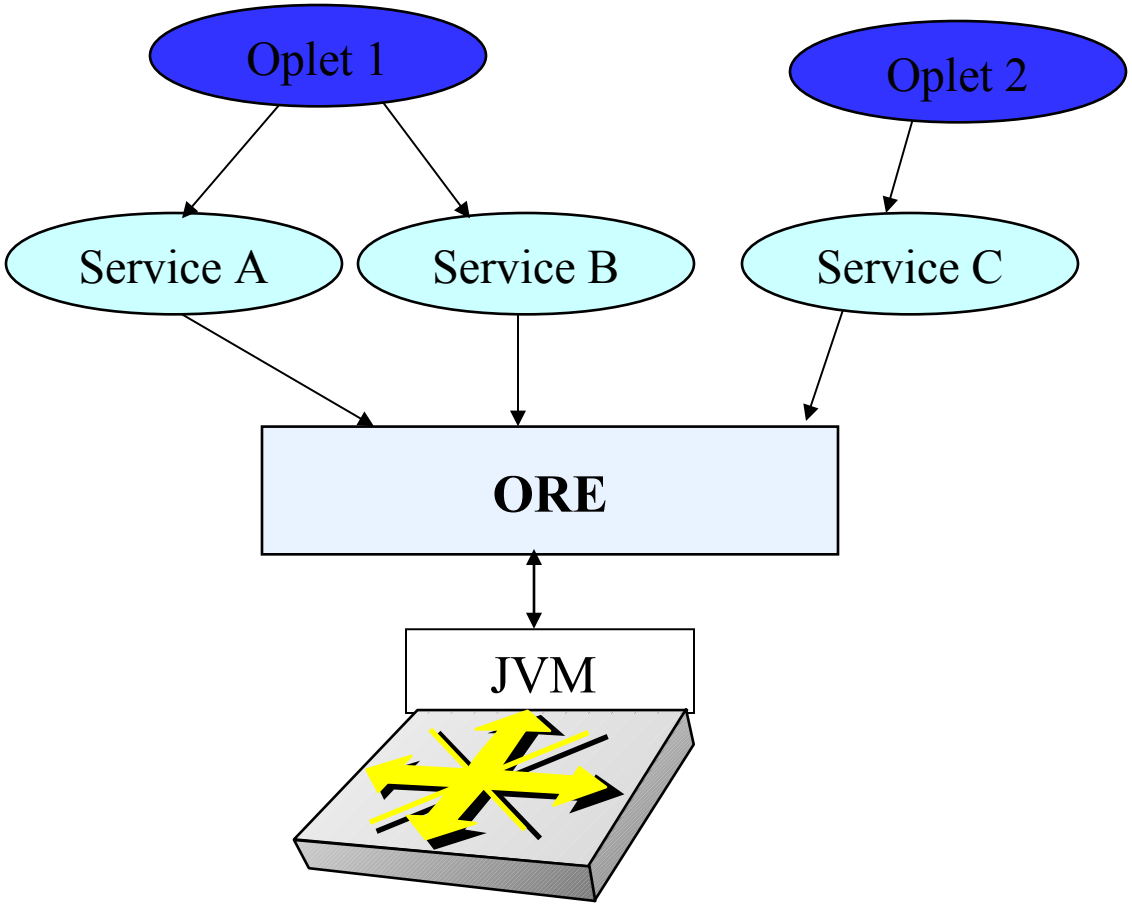
Accomplishments

- JVM on a Silicon-Based Routing Switch
- ORE - Oplet Run-time Environment
  - Java-enabled platform for secure downloading and safe execution of services
  - Ensures required services are installed for a downloaded Oplet
- Java SNMP MIB API (proxy mode for non Java devices)
- Implementation of Network Forwarding API (JFWD)
- RESULT: **Dynamic** Classification in Silicon-Based forwarding engine on a Gigabit Routing Switch

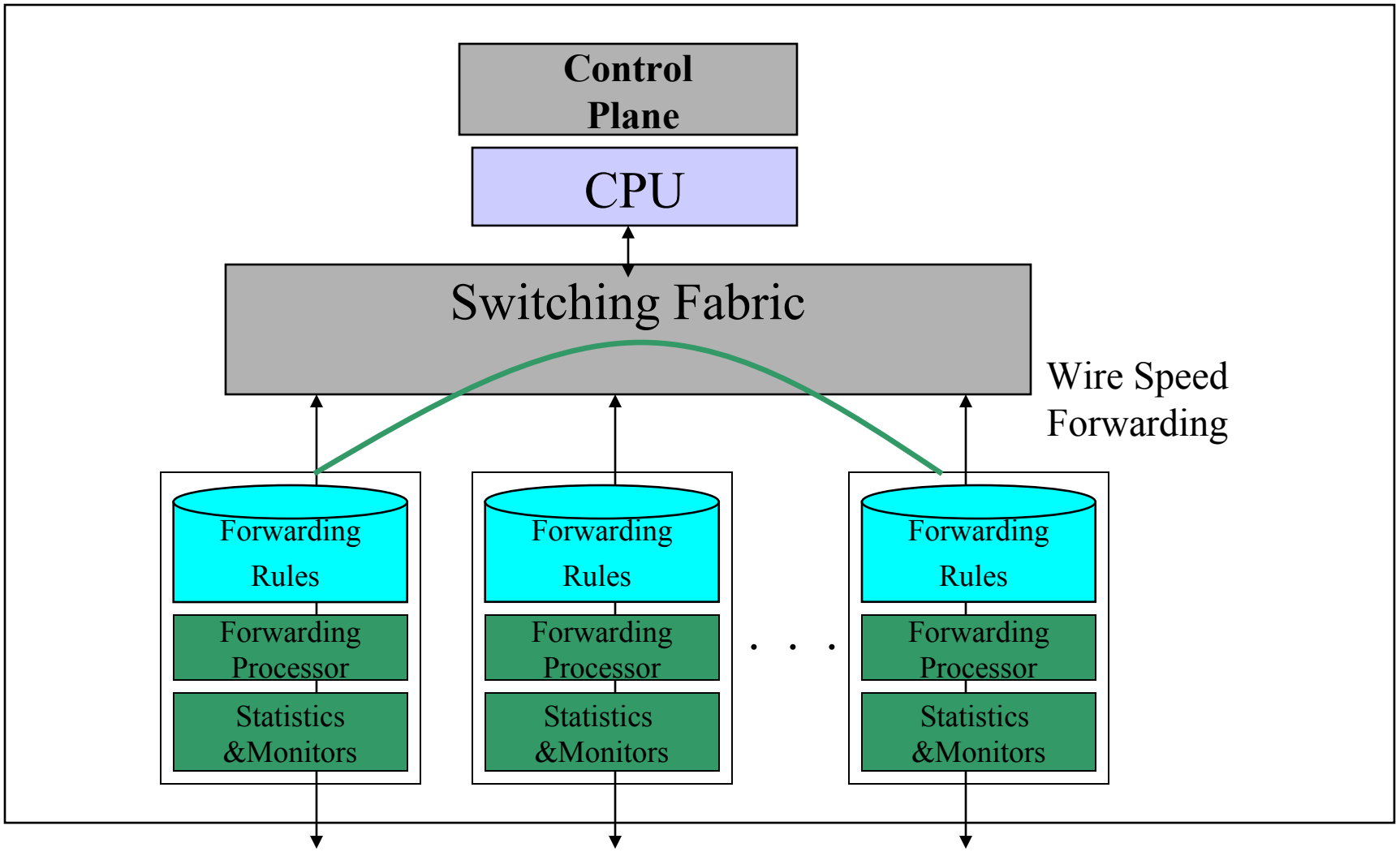
Open Device Architecture



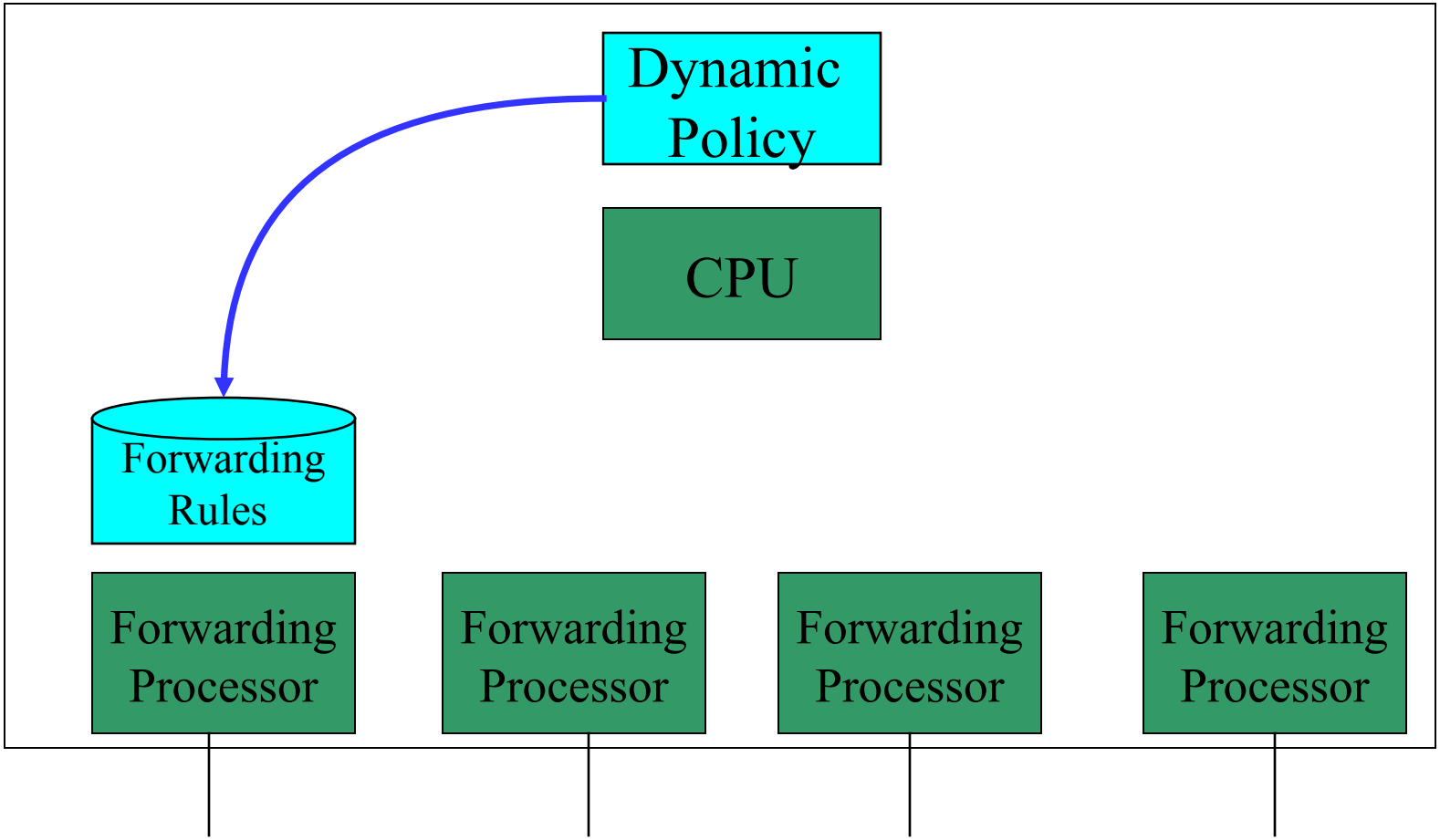
ORE - Oplet Run-time Environment



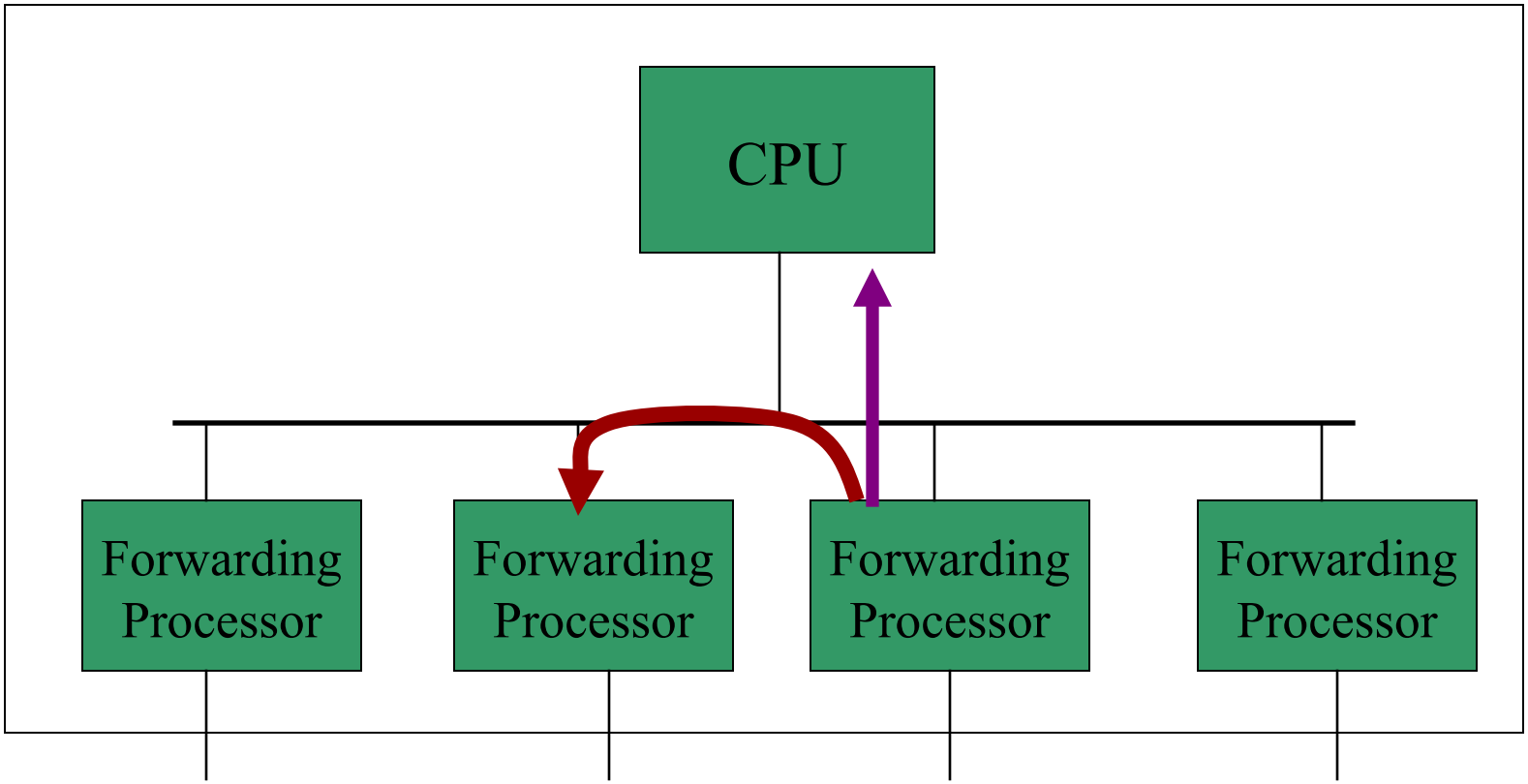
Silicon-based Forwarding Engines



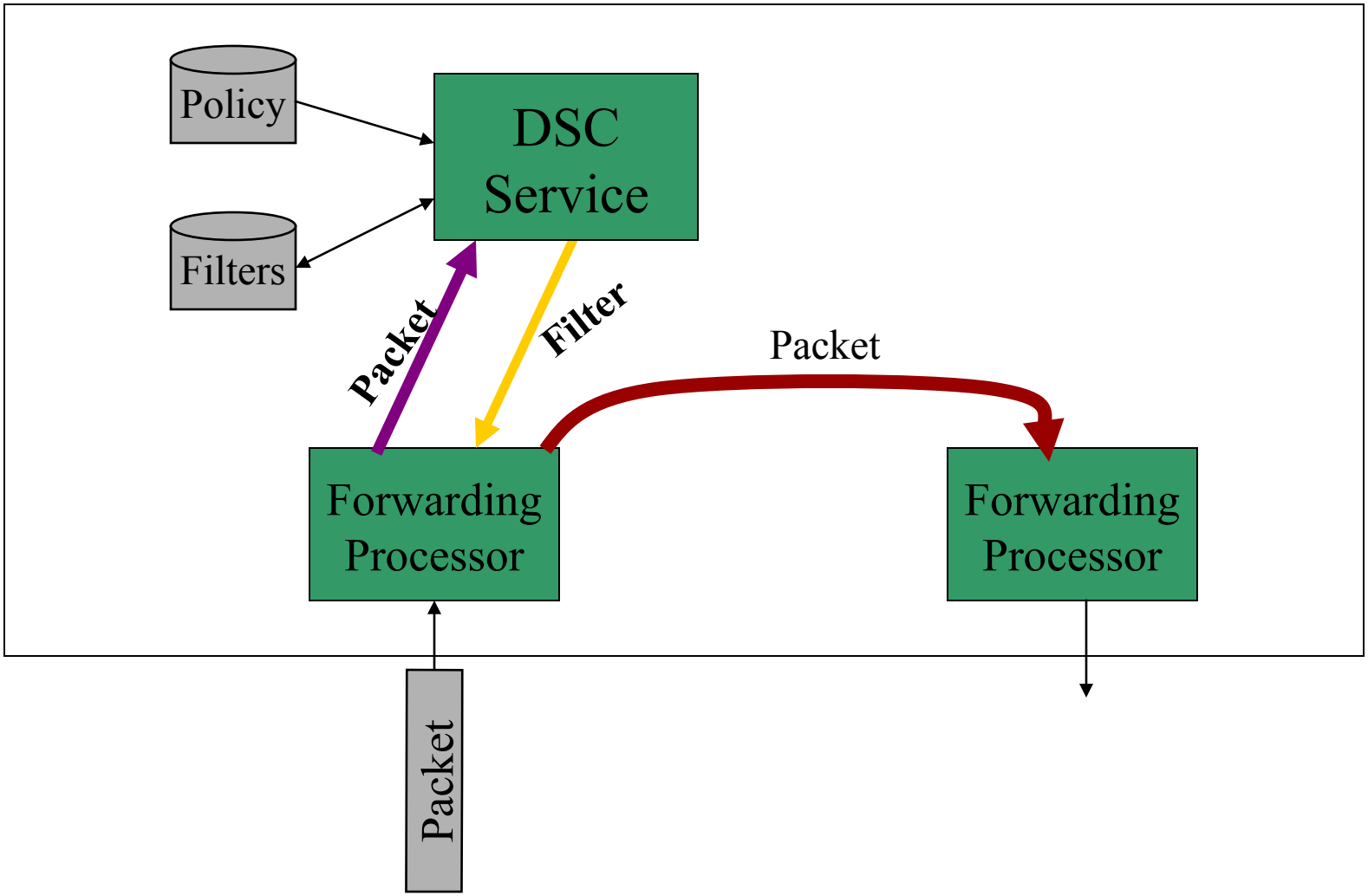
Dynamic Configuration of Forwarding Rules



CarbonCopy Capability



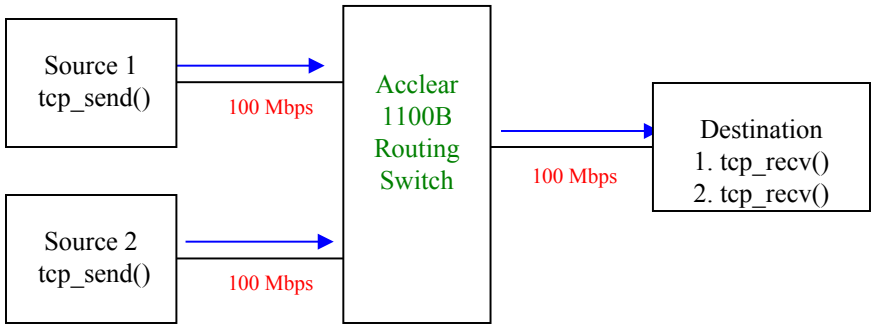
Dynamic Packet Configuration

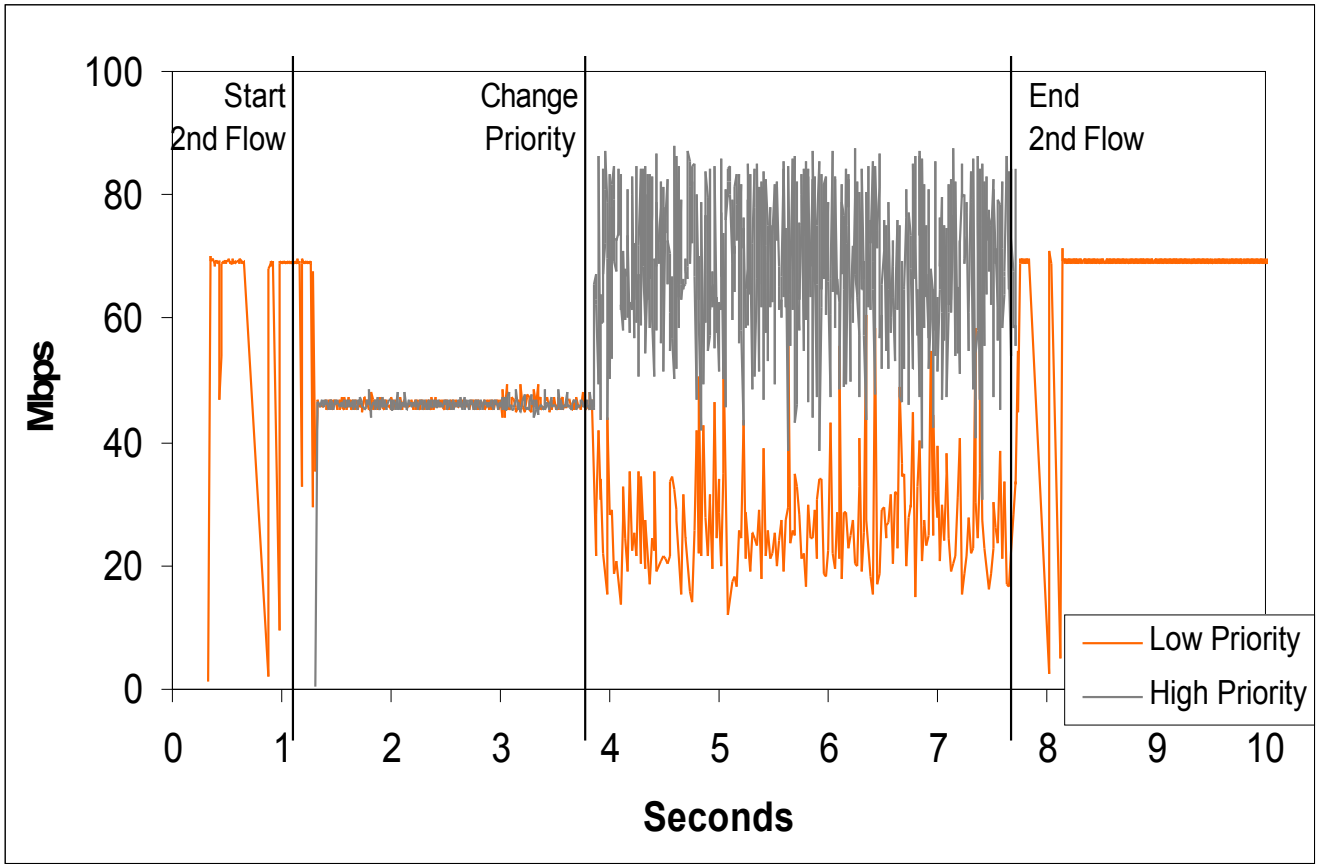


Dynamic Classification

- Identify real-time flows (e.g. packet signature/flowId)
  1. Use CarbonCopy filters to deliver multimedia control protocols to control plane
     - e.g. SIP, H.323. RTSP
     - Determine dynamically assigned ports from control msgs
  2. Use CarbonCopy filters to sample a number of packets from the physical port and identify RTP packets/signature
- Set a packet processing filter for packet signature to:
  - adjust DS-byte OR
  - adjust priority queue

Experimental Setup




100
80
60
40
20
0
Mbps
Start
2nd Flow
Change
Priority
End
2nd Flow
0
1
2
3
4
5
6
7
8
9
10
Seconds
Low Priority
High Priority

Summary

- Developed the ORE for downloading and safely running services onto network devices
- **Without** introducing software into data path we performed **Dynamic Classification of flows in a Silicon-Based Gigabit Routing Switch**
  - **Introduced a new service to a Gigabit Routing Switch**
  - **Identified real-time flows**
  - **Performed policy-based flow behavior classification**
  - **Adjusted DS-byte value**
  - **Showed that flow performance can be improved**

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