SDN and ForCES based optimal network topology discovery[1]

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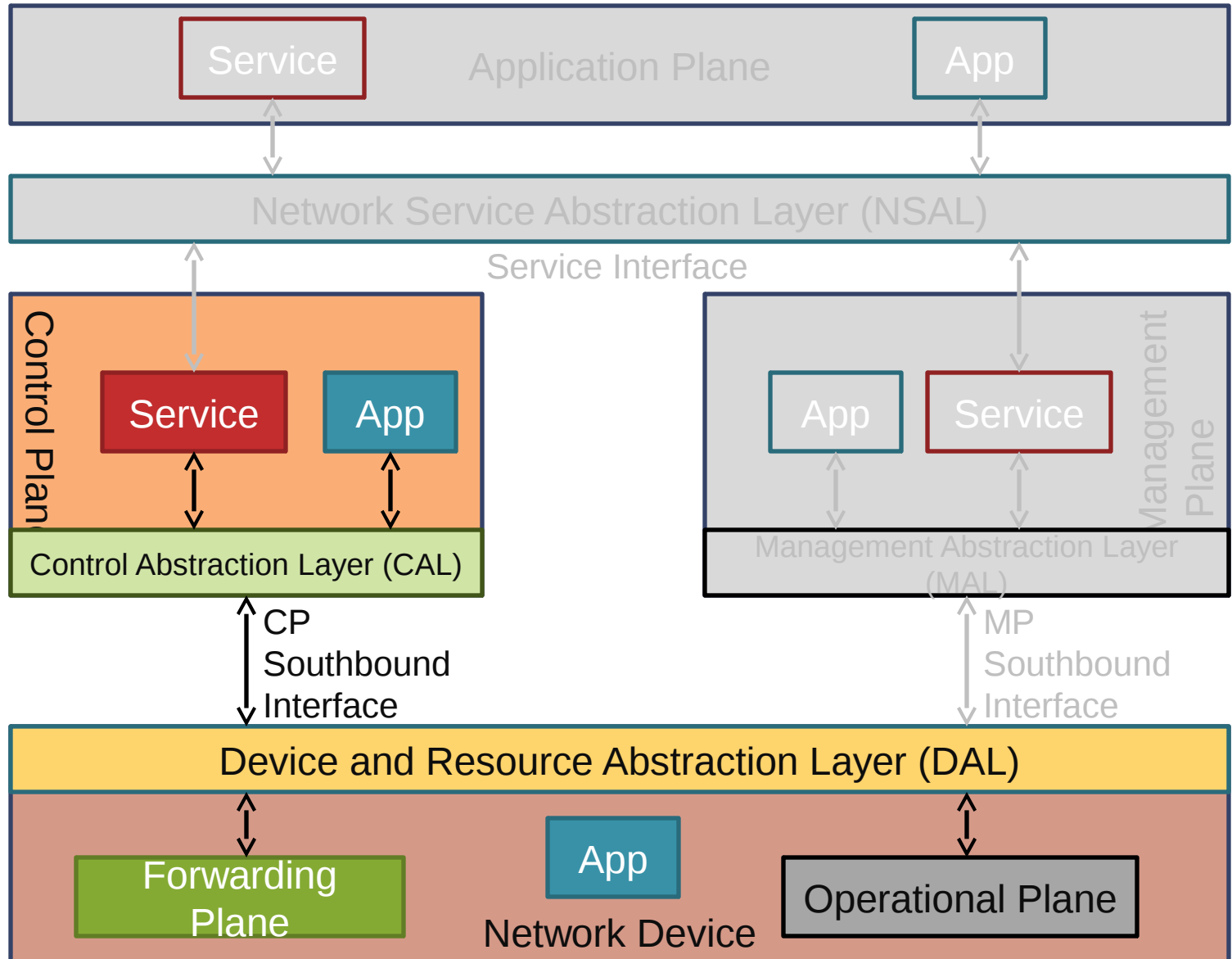
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Motivation

- Efficient topology discovery for SDN
  - What more can you ask?
- Need:
  - Immediate notification upon a change
  - Low overhead
- Example Distributed solutions:
  - **LLDP**
  - ARP
  - NDP

Where in SDN does this fits?

Service | Application Plane | App

Network Service Abstraction Layer (NSAL)

Service Interface

Control Plane

Service | App

Control Abstraction Layer (CAL)

CP Southbound Interface

Management Plane

App | Service

Management Abstraction Layer (MAL)

MP Southbound Interface

Device and Resource Abstraction Layer (DAL)

Forwarding Plane

App

Operational Plane

Network Device

So(lution)

- Leverage normal LLDP operation
  - Devices already know how, why replicate?
- Abstract (DAL) info and collect on controller
- ForCES as the glue
  - Model
    - Topology Information
    - LLDP Control parameters
  - Protocol
    - Extract topology information on demand per device
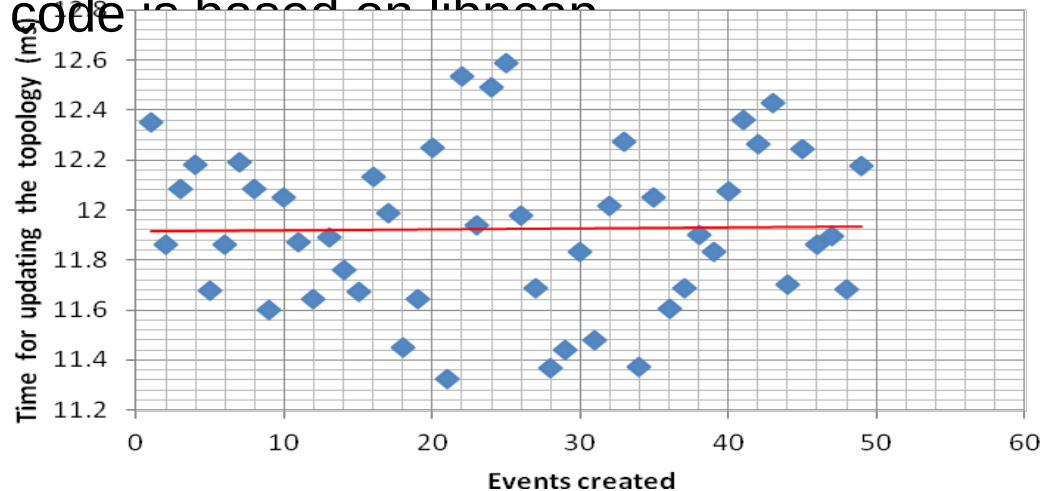   - Events for local topology change

Benefits

- No overhead (primarily on CPSI)
  - No need for an LLDP packets to run around in circles (e.g. in OpenFlow topology discovery)
- Immediate response
  - Each LLDP update immediately creates an event
- No change to reinvent the wheel
  - Device already knows LLDP
  - Although the software will need to know ForCES!
- Not limited to LLDP
  - Can use same concept for other discovery protocols

Results

- Average time to discover new switch (from LLDP packet) and recompute topology: **12ms**
  - 90% less than OpenFlow-based solution (~100ms)1

- Experiment Caveats:
  - Performed on 3 virtual machines on a x86 Intel Celeron B830
  - Packet capture code is based on libpcap
  - Few switches

1Ixia, NEC Controller Testing: Part1, http://www.necam.com/docs/?id=2709888a-ecfd-4157-8849-1d18144a6dda

Backup Slide

```xml
<dataTypeDef>
    <name>LLDP_Info</name>
    <synopsis>Struct containing all usable info for
discovery
    process</synopsis>
    <struct>
    <component componentID="1">
        <name>Neighbors</name>
        <synopsis>neighbors info</synopsis>
        <typeRef>Neighbors_entry</typeRef>
    </component>
    </struct>
</dataTypeDef>
```

```xml
<dataTypeDef>
    <name>Neighbors_entry</name>
    <synopsis>info for neighbors </synopsis>
    <struct>
    <component componentID="1">
        <name>Source</name>
        <synopsis>Local machine's 48bit IEEE mac
        address</synopsis>
        <typeRef>byte[6]</typeRef>
    </component>
    <component componentID="2">
        <name>Remote</name>
        <synopsis>Neighbor's 48bit IEEE mac addresses from
        discovery process</synopsis>
        <typeRef>byte[6]</typeRef>
    </component>
    <component componentID="3">
        <name>Devport</name>
        <synopsis>The port from which capture is
         done from FE</synopsis>
        <typeRef>uint16</typeRef>
    </component>
    </struct>
</dataTypeDef>
```

```xml
<event eventID="2">
    <name>UpdateMap</name>
    <synopsis>Inform that new nodes are available for the
    datapath</synopsis>
    <eventTarget>
        <eventField>Map</eventField>
    </eventTarget>
    <eventChanged/>
    <eventReport>
        <eventReport>
         <eventField>Map</eventField>
         <eventSubscript>Neighbors</eventSubscript>
        </eventReport>
    </eventReport>
</event>
```