Maple in OpenDaylight

github.com/maplesdn

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Problems with SDN Programming Practice

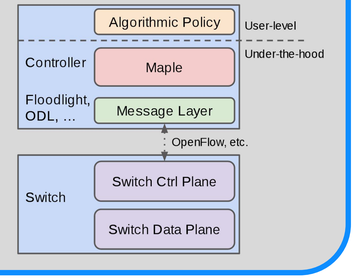
- **Declarative**: specify *what*, but not *how*
- **Low-level**: manage flow rule patterns, priorities, timeouts
- **Restrictive**: must use special programming language

To realize full benefits of SDN (for example, in cloud settings), we need better SDN programming abstractions and mechanisms.

Maple Overview

Maple is an SDN programming system that:

1. allows programmers to use standard languages to write **centralized algorithms** to determine network behavior
2. provides **simplifying abstraction** that alg. runs per packet
3. includes **efficient mechanisms** for computing flow tables, multicore scheduling, offloading work to switches



Algorithmic Policies

Algorithmic policies describe how a packet should be forwarded; not flow table rules!

$$f\text{: } (packet \times env) \longrightarrow route$$

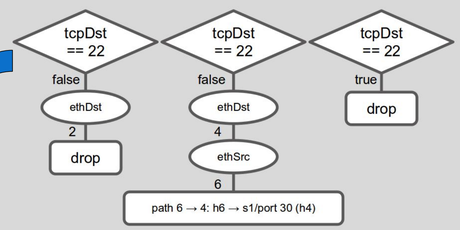
```
MapleMap<MacAddr, Location> location;

Route f(Packet p) {
 location.put(p.ethSrc(), p.ingressPort());
 if (p.tcpDstIs(22)) {
   return NULL_ROUTE;
 } else {
   Location dst = location.get(p.ethDst());
   Path path = myShortestPath(links(), p.ingressPort(),
dst);
   return path;
 }
}
```

Maple provides the abstraction that every packet is **logically** run through the algorithmic policy.

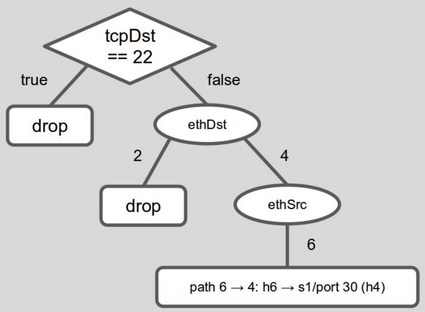
Need to be careful in terms of **latency**, **bandwidth**, and **computational capacity**.

Flow Table Compilation

Maple observes dependency of f on packet data



Maple builds a partial decision tree for f



Maple compiles flow tables from trace trees

Priority	Match	Action
1	tcpDst == 22	drop
0	ethDst == 2	drop
0	ethDst == 4	port 30

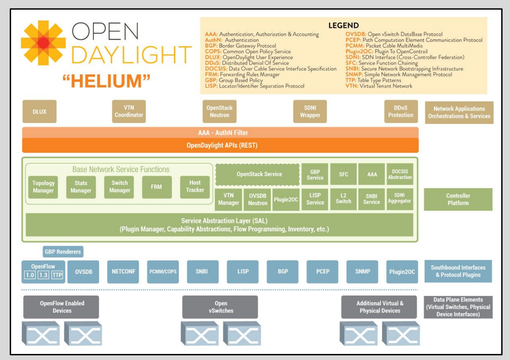
Implementing Maple in ODL

As part of a course on cloud computing, we built:

- a Java library for Maple
- a Java adapter for OpenDaylight

github.com/maplesdn

With these tools, SDN programmers can now use Maple to write centralized algorithmic policies efficiently using OpenDaylight.



Adapters for other OpenFlow controller implementations can now also be written (Floodlight, OpenStack, …).