

Beyond the Core: Enabling Software-defined Control at the Network Edge

13.03.2017

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Motivation

- Internet is an important part of our daily life
- There are many use-cases:
 - Mobile Browsing
 - Video Streaming
 - Cloud Computing
 - IOT
 - ...



Motivation

1

Network Protocols which...

- Fit the different use-cases
- Ensure good and cost efficient performance

2

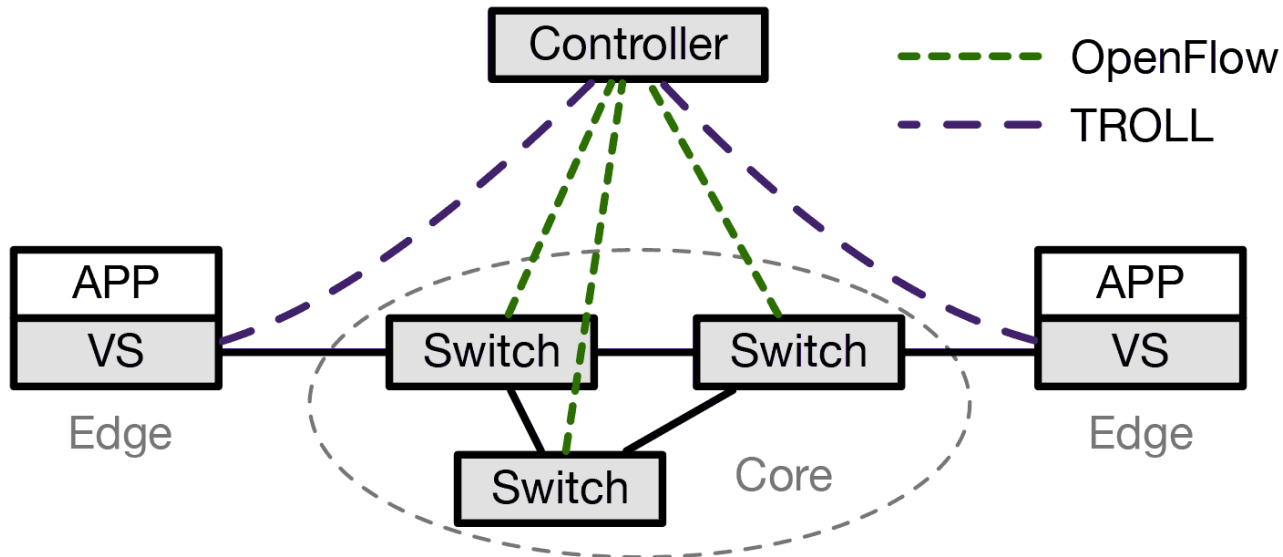
Concepts to change between protocols when use-case or network environment changes

→ SDN is a chance to solve both



Motivation

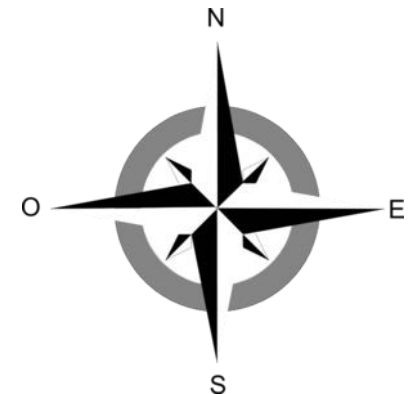
- De facto standard for SDN control is OpenFlow
 - OpenFlow is designed for the core
 - Offers no functionality for edge devices
- We introduce TROLL as edge device control protocol





Agenda

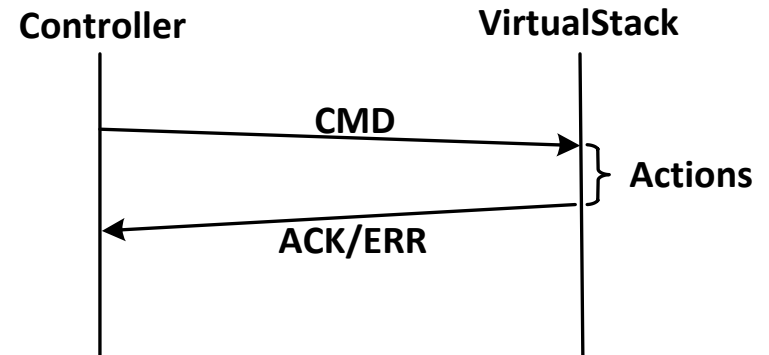
- Motivation
- **Communication Patterns**
- Capabilities
- Reference Implementation
- Conclusion



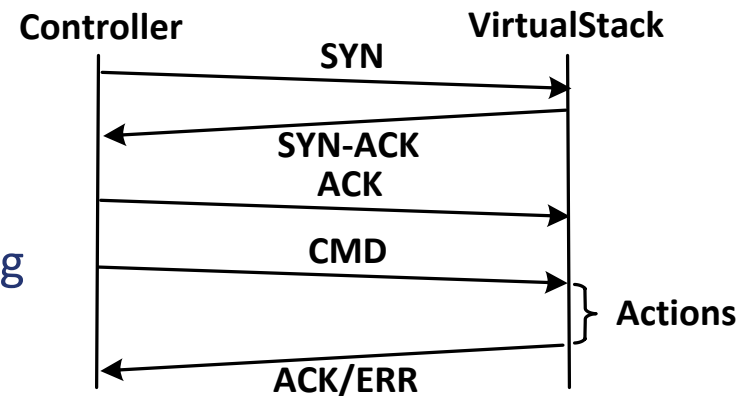


Communication Patterns

- Low overhead communication
 - No reliable channel needed
 - Low latency actions
 - Useful for recovery while congestion



- Advance communication
 - Reliable channel needed
 - Enable more data than one packet
 - Useful for installing rules and monitoring





Capabilities – Reporting

```
RegisterHost(  
af310516-0688,  
TCP, SCTP, UDP, IPv4)
```



```
NewLink(  
af310516-0688,  
ww0,  
TYPE:LTE,  
IP_VERSION:IPv4,  
IP:10.0.0.1,  
MAC:EA-D7-6D-BB-B9-9C)
```





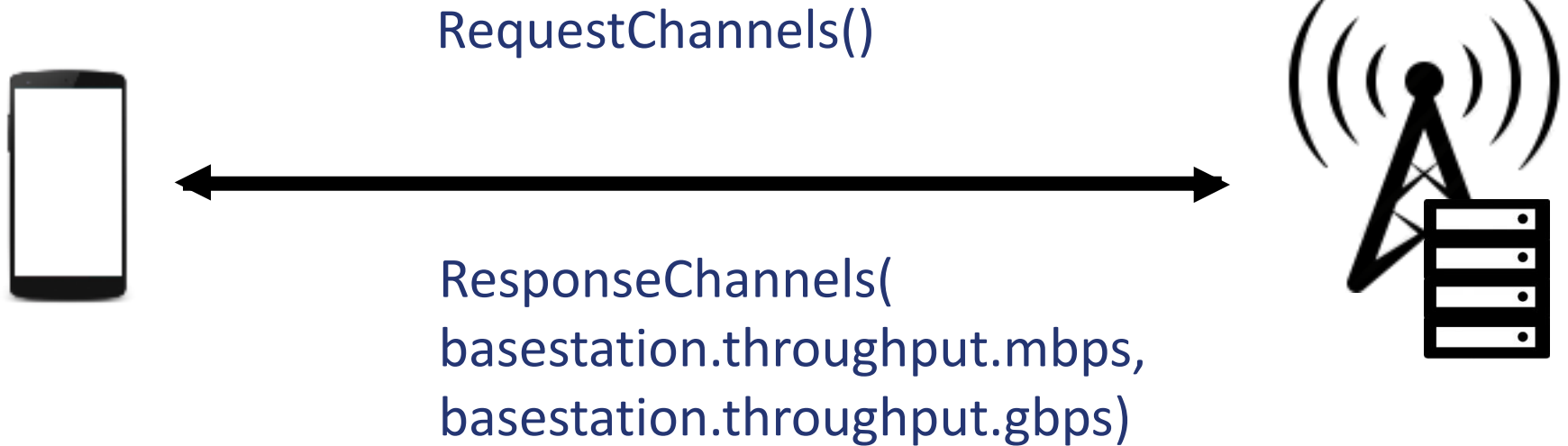
Capabilities – Advanced Action

```
InstallLinkRule(  
  ww0,  
  IF  
    baseStation.throughput > 10 Gbps  
  THEN  
    link.throughput.limit = 500 kbps)
```





Capabilities – Monitoring





Capabilities – Monitoring



SubscribeChannel(
basestation.throughput.mbps)



DataUpdate(
uint64,
1,
basestation.throughput.mbps)



Capabilities – Advanced Action

```
InstallLinkRule(  
  ww0,  
  IF  
    baseStation.throughput > 10 Gbps  
  THEN  
    link.throughput.limit = 500 kbps)
```



RuleInstalled(awsmRule0)





Capabilities – LO Action





Capabilities – Reporting

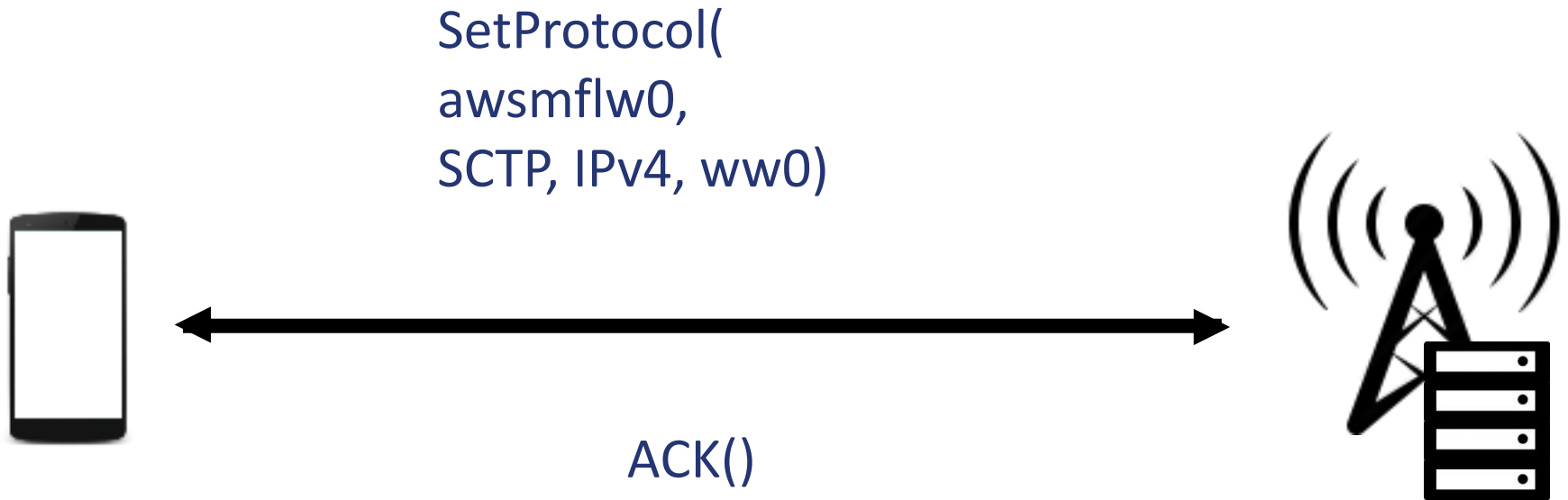


NewFlow(
af310516-0688,
awsmflw0,
TCP, IPv4, ww0)





Capabilities – LO Action

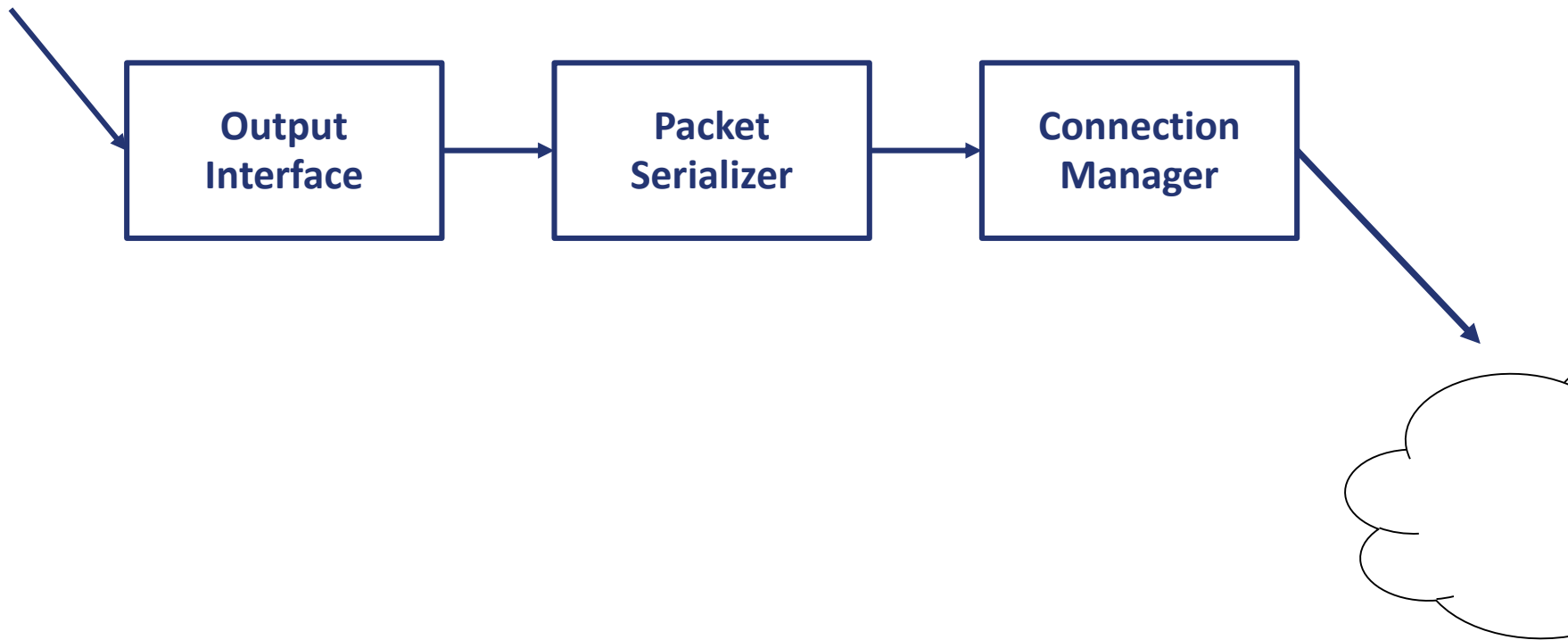




Reference Implementation*

- Sending packets

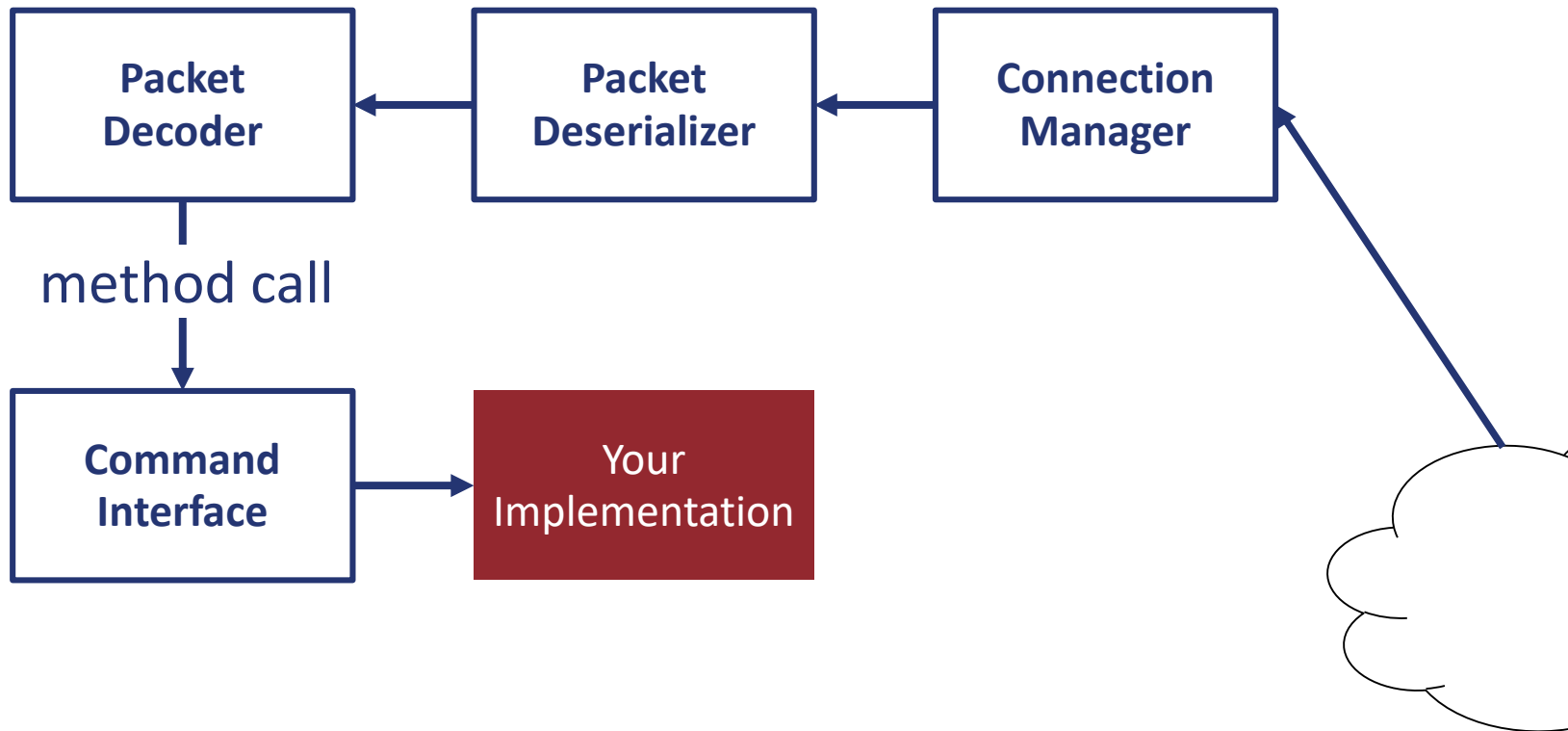
method call





Reference Implementation*

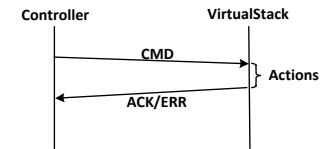
- Receiving packets





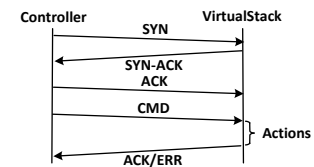
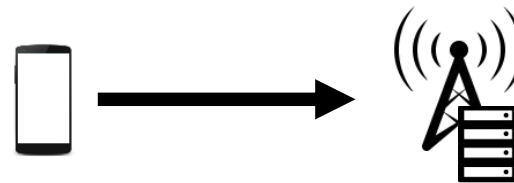
Conclusion

- TROLL - a SDN control protocol for network edge
- Communication Pattern:
 - Low overhead - for low latency actions
 - Advanced - for highly flexible information exchange



- Capabilities:

- Reporting
- Monitoring
- Actions



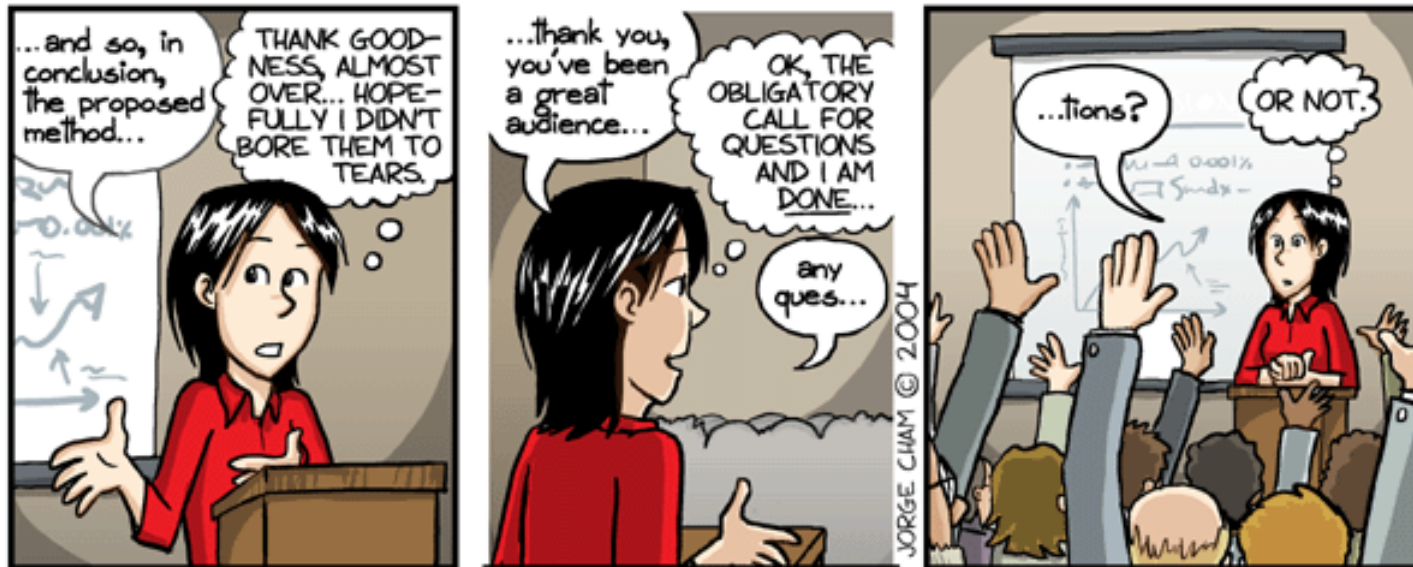
- Reference Implementation

- Available soon on GitHub





Thank You!



And now ... let's discuss!