Ryuo
Using High Level Northbound API for Control Messages in SDN

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Issues of OpenFlow

- Control latency
- Applications couple with OpenFlow at some degree
- All control logic centralized
Ryuo: Architecture

- Ryuo App: Focus on business logic
- Local Service: Provides high level API, ensures compatibility
- Domain specific control message
Example: Topology Discovery and Routing

- Ryu Controller
- OF Switch
- Topo Service
- Routing Service
- OpenFlow

Flow diagram showing the interactions between Topology App, Routing App, Ryu Controller, and OF Switches.
Evaluations

- Control Traffic
- Control Latency
- Throughput of handling local events
Evaluation Environment

- Pica8 P-3295 OpenFlow switch
  - CPU: 825MHz PowerPC
  - Memory: 512MB

- PC: For host, Ryu controller, Ryuo
  Application
  - CPU: Intel Core i5-3470, 3.2 GHz
  - Memory: 4GB
Control Traffic Evaluation

Figure: OpenFlow vs Local Controller Approach (approx.) vs Ryuo
Evaluation: Fast Failover with OpenFlow 1.0

- H1: 1K packets/s.
- H2: Wireshark.
- S1-S2 → S1-S3-S2
- Count packets lost
Evaluation: Fast Failover with OpenFlow 1.0

- Local Service: ~0.1s slower.
Throughput Evaluation: Setup

- Throughput: Number of events handled in one second.
- Send UDP packets, record responses.
Switch can only handle about 40 packets per second.

Not a problem on a virtualized server.

New switches with more powerful CPUs.\textsuperscript{[1]}
Ryuo: Implementation

- Ryuo Apps and Local Services based on Ryu.
- Global Local Communication: Pyro4\(^2\)
- Available Online: https://github.com/epcc-networking/ryuo
Two ways to deploy:

- Directly on OpenFlow switches.
- On servers with multiple VMs and Open vSwitch.
Related Work

- Kandoo\textsuperscript{[3]}: Local and Root Controller
- Beehive Netctrl\textsuperscript{[4]}: Distributed Network Controller
- Orion\textsuperscript{[5]}: Hierarchical Control Plane
Conclusion

- **Advantages:**
  - Reusable Local Services provide high level API.
  - Easy to extend southbound API.
  - Less control traffic.

- **Disadvantages:**
  - Limited by resources on the switch.
  - Local Service deployment.
Questions?
Thank you!

