Path Computation API

draft-busibel-ccamp-path-computation-api

IETF 96 – Berlin

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Scope

- Controllers/Orchestrators operate based on Traffic Engineering Database (TED) data
- YANG topology models provide access to TED
  - YANG enables use of NETCONF or RESTCONF
  - Complements existing TED distribution mechanisms
- A path computation API may be needed as well
  - YANG enables use of NETCONF or RESTCONF
  - Complements existing mechanisms (e.g. PCEP)
- -00 of the draft presents use cases for a path computation API
Examples for Use Cases

IP-Optical Integration
– An optical domain is providing connectivity between IP routers

Multi-domain Optical Network
– Optical domains interconnected by multiple inter-domain links

Data Center interconnection
– Optical domain is providing connectivity among data centers
IP-Optical Integration

- ORCHESTRATOR
  - Request a Path
  - Yang based interface
  - TE Topology: Abstract node

- IP NW CONTROLLER

- Optical NW CONTROLLER

- IP NW
  - OPTICAL NW
Why Path Computation API in YANG?

- Path computation is only a subset of controller functionality
  - Service setup/modification/deletion $\rightarrow$ YANG
  - Notifications and telemetry information $\rightarrow$ YANG
  - YANG is a standard to define controller northbound interfaces
- Reduce complexity by leveraging protocol communality (by using NETCONF, RESTCONF, …)
  - Avoid per-protocol mechanisms for authentication, authorization, etc.
  - Load balancers can simpler deal with a single protocol
- Leverage the YANG eco-system
  - Fastly growing tools for YANG-based APIs, e.g., in open source
  - Cloud orchestrators and other systems (only) use RESTful APIs
Multi-domain Optical Networks

ORCHESTRATOR

Yang based interfaces

Optical NW CONTROLLER 1

Optical NW CONTROLLER 2

A B C D E F G H
Data center interconnections

Yang based interface
Conclusions

• Tradeoffs when abstracting topology information
  – Accuracy versus Scalability
  – Accuracy versus Up-to-date information
• Path Computation APIs allows the orchestrator to request some of the possible paths
  – Possibly without requiring accurate abstract topology
  – Abstract topology information can be used to reduce the number of path computation requests
• Path computation API and TE topology model are complementary tools
Next Steps

• Seeking guidance on whether the draft should be addressed to TEAS or CCAMP
  – Current use cases for optical networks (CCAMP scope)
  – Issues and solution seems applicable also to packet networks (i.e., TEAS)

• Start analyzing solutions to address the use cases
  – Definition of a YANG model, e.g., with stateless RPC
  – Pre-computed TE Tunnel approach (statefull)

• Seeking comments and feedback from interested WGs
Appendix
IP+Optical: Path Computation Example
Multi-domain Optical Networks (many domains)

• **Combining 2 approaches**
  – Abstract topology information provided by domain controllers limiting the number of potential optimal e2e paths
  – Path computation API to find optimal path within limited set.
Data center interconnections (2)

- Virtual machine in DC1 needs to transfer data to another virtual machine (in DC2 or DC3)
- Optimal decision based on optical cost (DC1-DC2 or DC1-DC3) and computing power
- Cloud orchestrator uses API to request Optical domain to compute the cost of possible optical paths and to DC controller to compute the cost of computing power, and then take the decision.