Hierarchy of IP Controllers (HIC)
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Introduction

• This I-D describes how multiple IP controllers work in a hierarchical fashion
  • How the ACTN framework is applied to IP controllers
  • Interactions between TE and non-TE components
  • Control Plane and Management Plane considerations

• IP Services Realization
  • Seamless MPLS
  • L3VPN
  • L2VPN/EVPN

• Scope for possible new extensions
Hierarchy of IP controllers (HIC)

• The Super Controller receives request from the network/service orchestrator to setup dynamic services spanning multiple domains.

• The Super Controller breaks down and assigns tasks to the domain controllers, responsible for communicating to network devices in the domain. It further coordinates between the controller to provide a unified view of the multi-domain network.
Mapping to ACTN

Main Functions in ACTN

- Multi-domain Coordination
- Virtualization/Abstraction
- Customer mapping/translation
- Virtual Service Coordination

- Interface b/w controllers
  - TE & non-TE
  - Control Plane Protocol
    - PCEP, BGP
  - Management Protocol
    - RESTCONF/NETCONF/gRPC
Topology

Domain Controller / PNC
- Learn Domain Topology
- IGP, BGP-LS, PCEP-LS, Yang based

Super Controller / MDSC
- Learn abstract topology from Domain Controller
- Level of abstraction
- BGP-LS, PCEP-LS, Yang based interface
- Manage E2E topology
Path Compute/Instantiate

- Domain Controller computes/setup per-domain paths
- Super Controller responsible for E2E inter-domain paths
- PCEP Based
  - Stateful H-PCE framework on how E2E path computation, setup, stitching etc
- YANG Based
  - Path Computation Yang Model (via RPC)
  - TE Tunnel Yang Model
- Same as ACTN framework!
Seamless MPLS

- Extend MPLS to the edge mobile backhaul.
- The super controller is aware of the E2E topology.
- Super Controller is responsible to setup the seamless MPLS service from the service model.
- The super controller selects the right ABR and create corresponding per-domain tunnels.
- Based on the service model, the Super Controller translates to the network configuration model for the domain controller.
- The domain controller further breaks into the device configuration model to the PE/ABR to make E2E services.
- Routes can also be learned via the BGP sessions between Domain Controller and Super Controller for intelligent decisions.
L3VPN

• The Super-controller implements the L3SM model and translate it to network models towards the domain controller, which in turn translate it to the device model.

• Based on QoS/Policy, the Super Controller may -
  • Set the tunnel selection policy at the PE/ASBR routers so that they could select the existing tunnels
  • Select an existing tunnels at the controller level and bind it to the VPN service
  • Initiate the process of creating a new tunnel based on the QoS requirement and bind it the VPN service
  • Initiate the process of creating a new tunnel based on the policy

• Apart from Management Plane, control plane interface between controllers can also be used to setup and maintain the L3VPN service!

* -- applicable to L2VPN/EVPN in similar fashion!
PCE / PCEP

PCE

H-PCE and other inter-domain procedures

Stateful PCE

PCE Initiation

Stateful H-PCE

Applicability to ACTN

PCE / PCEP well positioned to meet the requirements for HIC / ACTN!
YANG Models

Service Models (L3SM, L2SM)

Network Configuration Models (?)

Device Configuration Models

Topology Related

Tunnel related

VN and Service-Mapping related

OAM

?
Possible Features/Extensions

- Initial Configurations between controllers
  - Initial Session Establishments
  - Discovery via other protocols
  - Service Discovery (DNS)

- Relationship / Role of controllers

- Learning the mutual capabilities of controllers

- Handling of multiple instances of controller for reliability

- ?
Next Steps

• Get Feedback
  • What is missing?
  • What else can be added / removed?
  • Is such an informational document useful?

• Identified Gaps
  • Need to add more details about other Yang Models that are useful between controllers
  • Need to add more details about usage of BGP between controllers
  • Need to add more details about OAM
  • If you have expertise in these areas please provide help – Call for collaboration!
Thank you!