Software-Defined Multicast Network Overlay Framework
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Outline

- Problem Statement
- Requirements
- Proposed Framework – SDN Multicast Framework
- Next Steps
Problem Statement – Today’s Multicast Solutions

- **P1:** Network scalability, stability and impact on unicast with limited operator control
  - Distributed (on-router) multicast control plane shares compute resources with unicast
    - Multicast receiver Joins & Leaves
    - Periodic Multicast state refresh

- **P2:** lack of uniform multicast admission control mechanisms and path computation constrain support across implementations
  - Based on entitlement of receivers and senders
  - Based on bandwidth in path computation, when it applies, and at nodal level
    - With IP multicast data plane or non-TE signaled paths, there is no bandwidth control capability
  - Based on operator network design policies on resource usage
  - Based on QoS constraints (e.g., latency, jitter) – often not accounted for

- **P3:** Restrictions and constrains that limit the ability to carry multicast traffic across “network domains” with different multicast capabilities
  - Network domains may be part of same or different ASs and/or operators
Problem Statement – Today’s Multicast Solutions

- **P4**: Inability of operator(s) to flexibly design multicast (inter-) networks coping with operations’ requirements and underlying network capabilities

- **P5**: Lack of uniform security policies and mechanisms to protect against various DoS attacks in control or data plane

- **P6**: Lack of multicast telemetry data
Multicast SDN Overlay Framework

- Objective: Define a reference architecture and framework that ease the development of interoperable solutions that address today’s problems

- Genesis: SDN Paradigm
  - Provides for the decoupling of the multicast control plane from the routing forwarding elements and unicast control
  - Unified control plane across the various forwarding element implementations
    - Uniform admission control (entitlement and bandwidth)
    - Multicast tree computation algorithms that can take into account various constraints
  - Multicast SDN Domain controllers for scale and extending multicast control across domain boundaries with different capabilities and administrative responsibilities
  - Management Applications that can control the additions of receivers, senders, and steering of traffic
Multicast SDN Overlay Framework – Key Requirements Addressed (1 of 2)

- No network topology constraints, but unicast and multicast topology aware (resources, capabilities)
- Decouple unicast and multicast topologies - select replication nodes and types
- Agnostic to other services in network (unicast and multicast)
- Support existing multicast applications – no modifications required
- Support for multi-tenancy (implications to both control plane and data plane)
- Support for edge replication over underlay unicast data plane transport. Underlay unicast transport:
  - IPv4 and IPv6
  - MPLS
  - Segment routing
- Support for edge replication over underlay multicast data plane transport. Underlay unicast transport:
  - IPv4 and IPv6
  - MPLS
  - BIER
Multicast SDN Overlay Framework – Key Requirements Addressed (2 of 2)

- Admission Control (entitlement and bandwidth)
- Path (re-) computation based on various constraints
- Programmability of network elements – policies and multicast forwarding entries
- Stitching of multicast traffic across different multicast domain boundaries with different capabilities
Multicast SDN Overlay Framework Reference Architecture (2 of 3) – terminology and functionalities

- **MSD (Multicast SDN Domain):** under the control of one multicast SDN controller in the admin domain

- **MSE (Multicast Service Edge):**
  - Multicast on LAN ports (control and data plane replication)
  - Proxies multicast joins/leaves to SDN controller
  - Receives/sends multicast packets, unicast-encapsulated from/to designated MSNs

- **MSN (Multicast Service Node):** Designated multicast replicator for MSEs with senders and/or receivers for a multicast group. Replicates and receives multicast packets from other MSNs and MBGs.

- **MBG (Multicast Border Gateway):** Interconnects MSDs

- **CN (Core node):** provides transit underlay transport
Multicast SDN Overlay Framework Reference Architecture (3 of 3) – Models

- Full: SDN Controller performs all control plane functions and programs the data path all nodes in an MSD – Draft provides an operations overview

- Hybrid:
  - Admission control and programmability of MSE-MSN data path and multicast group membership on MSN by SDN controller
  - Distributed control plane on MSNs and MBGs (BGP-MVPN) in an MSD

- Cut-Through:
  - MSE to MSE direct replication
Next Steps

- Solicit feedback on mailing list – input is appreciated
- Expand on Control Plane and multi-Multicast SDN Domain section
- Add fault tolerance
- Add use cases
- Call out what can be leveraged from existing protocols and the needed new work
Questions/Discussion

Thanks!