Use-cases for Traffic Steering in Operator Networks

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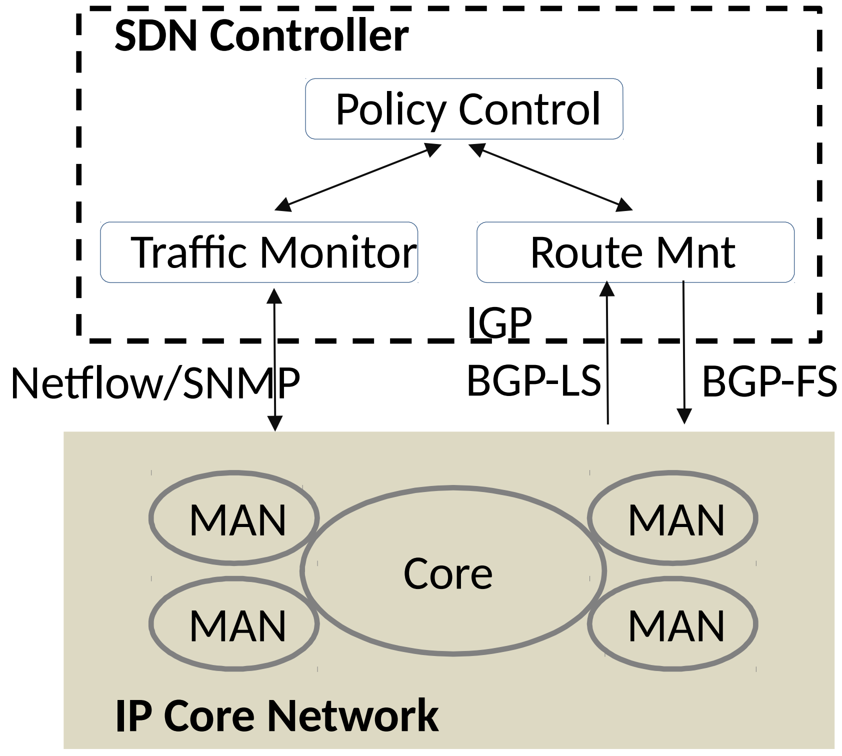
Background

- Topic involves to a traditional technology used in MPLS network
- But how to implement TE in large scale native IP network is still a challenge
  - Locally
  - Limited Flows
  - SDN
- In SDN context, Traffic Steering means locally scheduling selected traffics from whole network in terms of operator's dedicated task or requirement



Motivation

- Traffic steering needs do exist in operators’ networks
- It is becoming a challenge today in IP network
  - Comparing to requirements, network resources are always limited
  - Differentiated requirements and SLA co-exist at the same time
  - How to configure forwarding route/path automatically
- Try to demonstrate typical use-cases to facilitate traffic steering solution in future
  - Temporary case
  - Persistent case

Use-cases for ISP(1)

EoS-oriented Steering

```
                                                   Some latency
                       +----------+                Some loss
                       | HongKong |
 Less latency        --+----------+--
 Some congestion
                  ---        |        ---
                ---          |          ---
              --             |             --
          +----------+       |       +----------+
          |Singapore |       |       |    LA    |
          +----------+       |       +----------+
              --             |Path1        --
                ---          |          ---
            Path2 ---        |        ---  Path3
                     --+----------+--
                       |  Sydney  |
                       +----------+
           Less latency      |
           Less loss         |
                 +-----------+-----------+
                 |           |           |
             +-------+   +-------+   +-------+
             |Silver |   |Gold   |   |Bronze |
             |Users  |   |Users  |   |Users  |
             +-------+   +-------+   +-------+
```

- Three prioritized users in Sydney, saying Gold, Silver and Bronze, wish to visit website located in HongKong.
- Three different paths with different experiences according to users' priority.
- Gold users/services: Less latency and less loss
- Silver users/services: Less latency and some congestion.
- Bronze users/services: Some latency and loss.

Use-cases for ISP(2)

❑ Load Balancing Oriented Steering

```
      Aggregation C   *     Core      *   Aggregation D
                      *               *
                      *               *
                      *  +----------+ *
                      *  | Core A   | *
+------+              --+----------+--                  +------+
|MAN C1|-+         ---*               *---            +-|MAN D1|
+------+ |      ---   *               *   ---         | +------+
         |    --      *               *      --       |
         | +----------+*              * +----------+  |
         +-| AGG C    |*              * |  AGG D   |-+
         | +----------+*              * +----------+  |
         |    --      *               *      --       |
+------+ |      ---   *               *   ---         | +------+
|MAN C2|-+         ---*               *---            +-|MAN D2|
+------+              --+----------+--                  +------+
                      *  | Core B   | *
                      *  +----------+ *
```

Secondary Path
for load balance

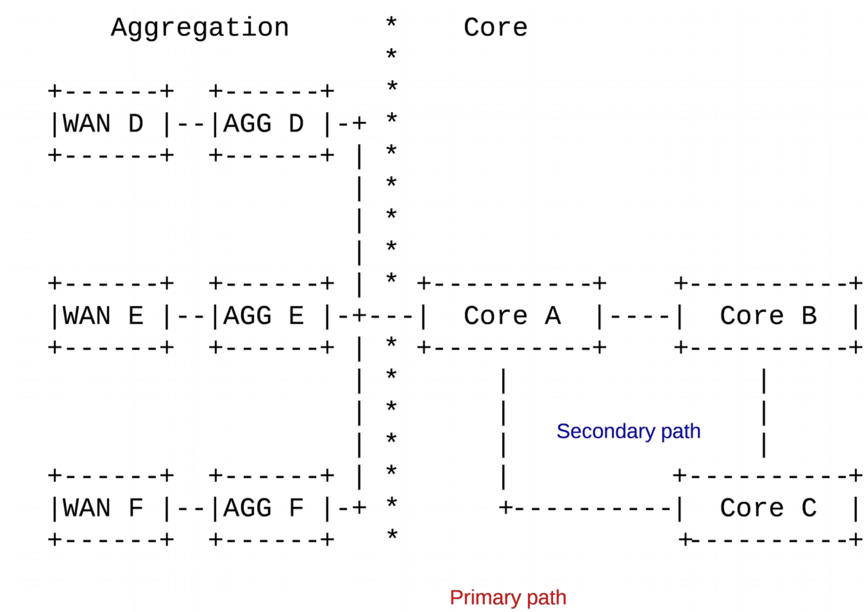
Primary Path
with congestion

Load balancing between Aggregation and Core

- Traffic from Aggregation C to Aggregation D follows the path AGG C->Core B->AGG D as the primary path.
- Some traffic will be reload to less utilized path AGG C->Core A->AGG D when the primary path CBD has congestion.

Use-cases for ISP(3)

Load Balancing Oriented Steering



Load balancing in Core

- Traffic from Core C to WAN area usually passes through link CA in Core area.
- Part of traffic should be transferred to link CBA when link CA congested

Use-cases for ISP(4)

Load Balancing Oriented Steering

```
              *            *
      City A  *   City B   *  City C
              *            *
    +-------+ *  +-------+ * +-------+
    |IXP A1 |----| IXP B1|---|IXP C1 |
    +-------+ *  +-------+ * +-------+  ISP 1
       |      *      |     *   |  |
*******|*************|*********|**|**********
       |  +----------|---------+  |
       |  |   *      |     *      |     ISP 2
       |  |   *      |     *      |
     +------+ *  +------+  * +------+
     |IXP A2|----|IXP B2|----|IXP C2|
     +------+ *  +------+  * +------+
       |      *      |     *      |
       |      *      |     *      |
    +-------+ *  +-------+ * +-------+
    |Core A |----|Core B |---|Core C |
    +-------+ *  +-------+ * +-------+
```

Load balancing among ISPs

- A long distance inter-ISP link existed between City C and City A from IXP C1 to IXP A2.

- Usually traffic from IXP C1 to Core A passes through the long distance link IXP C1->IXP A2-> Core A.

- Part of traffic should be transferred to link IXP C1->IXP B1->IXP A1->IXP A2->A when primary link congested

Use-cases for ISP(4)

Load Balancing Oriented Steering

Load balancing among Transits

Secondary path

```
********************************
*                              *
*        AS C1                 *
*                              *    AS Y1
*                              *
*         +---+         +---+  *  +-----------+
*        /| B |---------| C |-----| Transit A |        AS Z1
*       / +---+\        +---+  *  +-----------+--
*      /    |   \\    //  |    *                   --  +-----------+
*+---+/     |     \\//    |    *                     --|           |
*| A |      |     //\\    |    *                       |Destination|
*+---+\     |   //    \\  |    *                     --|           |
*      \    |  /        \ |    *                   --  +-----------+
*       \ +---+         +---+  *  +-----------+--
*        \| D |---------| E |-----| Transit B |
*         +---+         +---+  *  +-----------+
*                              *
*      IP Core                 *    AS X1
*                              *
********************************
```

Primary path
before QoS worse

- Traffic to destination in AS Z1 from ISP IP core network (AS C1) has two choices on transit, saying Transit A and Transit B.

- Transit A will be preferred when the QoS of Transit B gets worse. As a result, the same traffic will go through Transit A instead.

Use-cases for OTTSP

QoS-Oriented Steering

- An OTTSP has 3 exits with its ISP in City A, City B and City C. Based on network conditions, this OTTSP may choose different exits to steer its traffic into ISP's networks.

Business-Oriented Steering

- An OTTSP may make its steering strategy based on different business.

Inbound Traffic Steering

- An OTTSP may wish to have choices on entrances for inbound traffic.
- An ISP may choose to ignore or even prohibit an OTTSP's attempt to affect traffic paths.
- A negotiation mechanism is needed here.

```
           *           *
    City A *  City B   * City C
           *           *
           *  +-----+  *
           *  |Users|  *
           *  +-----+  *
           *     |     *
     +-----------+-----------+
     |     *     |     *     |
  +-----+  *  +-----+  *  +-----+
  | R11 |-----| R12 |-----| R13 |
  +-----+  *  +-----+  *  +-----+  OTT
     |     *     |     *     |
*****|***********|***********|*********
     |     *     |     *     |
     |     *     |     *     |     ISP
  +-----+  *  +-----+  *  +-----+
  | R21 |-----| R22 |-----| R23 |
  +-----+  *  +-----+  *  +-----+
     |     *     |     *     |
     +-----------+-----------+
           *     |     *
           *  +-----+  *     +-------+
           *  | AR  |--------|Content|
           *  +-----+  *     |Server |
                             +-------+
```

Derived Requirements for a Solution

- REQ01: A classification mechanism/system is REQUIRED to exist to identify users' traffic and the correspond priority respectively.
- REQ02: A decision procedure/mechanism for path selection is REQUIRED to exist to decide traffic forwarding strategy based on the input from a classification mechanism.
- REQ03: A resource monitoring mechanism/system is REQUIRED to exist for dynamically report the resource usage of target subnets.
- REQ04: A decision procedure/mechanism for path selection is REQUIRED to exist to decide traffic forwarding strategy based on the input from a resource monitoring mechanism.
- REQ05: A QoS monitoring mechanism/system is REQUIRED to exist for dynamically report the QoS conditions of those transits.
- REQ06: A decision procedure/mechanism for path selection is REQUIRED to exist to decide traffic forwarding strategy based on the input from a QoS monitoring mechanism.
- REQ07: A decision distribution mechanism/system is REQUIRED to exist to populate the adjustment behavior accordingly.
- REQ08: The three mechanisms above are RECOMMENDED to be automatic ones.
- REQ09: A mechanism/system exists to identify different businesses from traffic flow.
- REQ10: An interactive mechanism/system is REQUIRED to exist for negotiation between OTT and ISP to solve the scenario of inbound traffic steering.

Summary

- What we need is to schedule flows automatically with fine granularity
- We need a new policy control plane and related policy for end-to-end traffic scheduling is very complex in IP network
- Details in requirement continue to be collected

Question