Flexible Candidate Path Selection of SR Policy

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Background

Per [RFC9256], as long as there is a valid segment list in the active candidate path, the active candidate path is valid.

But the paths of remaining segment lists may not meet the SR policy forwarding performance requirements, such as:

- Insufficient bandwidth.
- Excessive delay
- Too high packet loss rate
- ……

Scenario 1： Two segment lists under the Path are down, leading to insufficient total bandwidth for the Path.

```
SR Policy POL1
    Candidate Path CP1
      Bandwidth Requirement: Bandwidth > 150Mbps
      Preference 200
      Segment List 1 <SID11...SID1i>, Weight 1   //100M
      Segment List 2 <SID21...SID2j>, Weight 1  //100M
      Segment List 3 <SID31...SID3k>, Weight 1  //100M
    Candidate Path CP2
     Preference 100
      Bandwidth Requirement: Bandwidth > 150Mbps
      Segment List 4 <SID41...SID4i>, Weight 1 //100M
      Segment List 5 <SID51...SID5j>, Weight 1 //100M
      Segment List 6 <SID61...SID6k>, Weight 1 //100M
```

Scenario 2: The state of the segment list is up but the delay does not meet the requirements of the path.

```
SR Policy POL1
  Candidate Path CP1
      Preference 200
      Delay threshold 200 //  Delay<=200ms
      Segment List 1 <SID11...SID1i>, Weight 1 //Delay>1
      Segment List 2 <SID21...SID2j>, Weight 1 //Delay>2
  Candidate Path CP2
      Preference 100
      Delay threshold 200  //  Delay<=200ms
      Segment List 3 <SID41...SID4i>, Weight 1 //Delay<100ms
      Segment List 4 <SID51...SID5j>, Weight 1 //Delay<100ms
      Segment List 5 <SID61...SID6k>, Weight 1 //Delay<100m
```

Validity of a Candidate Path

Based on the real-time resource usage and forwarding quality of candidate paths, the head node can perform dynamic path switching among multiple candidate paths in the SR policy.

- When the forwarding quality check is not configured, perform the check according to Section 5 of RFC9256.
- When the forwarding quality check is configured, in addition to following Section 5 of RFC9256, add a new quality check for forwarding.

  - ✓ Set the threshold parameters for forwarding quality and resources for candidate paths.
  - ✓ A SR Policy candidate path or A SR Policy segment list is considered valid only if its validity control parameters are satisfied.

SR Policy POL1
Candidate Path CP1----------→ 1. Set the threshold parameters for forwarding quality and resource
Preference 200
Segment List 1 <SID11...SID1i>---------→2. Validate the forwarding quality and resources of the segment list to determine if they meet the requirements. If they do
Segment List 2 <SID21...SID2j> not meet the requirements, set the status of the segment list to "invalid. "
Segment List 3 <SID31...SID3k>

----------→3. Validate the forwarding quality and resources of the SR Policy candidate path to determine if they meet the requirements.
If they do not meet the requirements, set the status of the SR candidate path to **invalid**.

Threshold Parameters of Candidate Paths

The threshold of segment list :

- **Jitter**
- **Latency**
- **Packet loss**

  When the jitter, delay, or packet loss of a valid segment list cannot meet the specified threshold requirement, the segment list will be treated as an invalid segment list and will no longer load share traffic.

The threshold of candidate path:

- **Available bandwidth**
- **Actual bandwidth**

  The sum of preset bandwidth or actual remaining bandwidth of all valid segment lists in the candidate path that meet the threshold requirements for latency, jitter, or packet loss.
- **Precision Availability Metrics (PAM)**
- ……

Use case for bandwidth and delay

Select the Best Path Based on Available bandwidth
Requirement: The transmission available bandwidth >= 150Mbps

If segment list 1 and segment list 2 fail, only segment 3 in CP1 remains valid. Since CP1 requires 150M bandwidth but only 100M is available, it does not meet the requirements, so CP1 is set to Invalid status. CP2 is then selected as the new active candidate path for POL1, and the traffic forwarded by POL1 is switched to the path of CP2 for forwarding.

SR Policy POL1
Candidate Path CP1
Bandwidth Requirement: Bandwidth > 150Mbps
Preference 200
Segment List 1 <SID11...SID1i>, Weight 1 //100M
Segment List 2 <SID21...SID2j>, Weight 1 //100M

Segment List 3 <SID31...SID3k>, Weight 1 //100M
Candidate Path CP2
Preference 100
Bandwidth Requirement: Bandwidth > 150Mbps
Segment List 4 <SID41...SID4i>, Weight 1 //100M
Segment List 5 <SID51...SID5j>, Weight 1 //100M
Segment List 6 <SID61...SID6k>, Weight 1 //100M

Select the Best Path Based on End-to-End Delay
Requirement: The transmission delay <= 200ms.

If the delay of segment list 1 exceeds the threshold, CP2 is selected as the new active candidate path of POL1. The traffic forwarded by POL1 is switched to the path of CP2 for forwarding.

SR Policy POL1
Candidate Path CP1
Preference 200
Delay threshold 200 // Delay<=200ms
Segment List 1 <SID11...SID1i>, Weight 1 //Delay>1s
Candidate Path CP2
Preference 100
Delay threshold 200 // Delay<=200ms
Segment List 2 <SID41...SID4i>, Weight 1 //Delay<100ms

History of version change

- According to the comments of IETF-117 meeting, the following contents have been updated:
  - ✓The principles for using thresholds at the segment list level and candidate path level have been clarified.
  - ✓Added description, using PAM defined by IPPM WG [I-D.ietf-ippm-pam] as a threshold parameter for candidate paths.
  - ✓Added use case based on E2E delay
- After IETF-119 meeting, in accordance with the comments, this document clarifies only to add checks for the validity of the Candidate Path status and does not alter the Candidate Path selection rules as defined in RFC9256.

Next Steps

- Welcome more feedback from WG
- Ready for Adoption Call