Flexible Candidate Path Selection of SR Policy

draft-liu-spring-sr-policy-flexible-path-selection-11

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IETF-124

Backgroud Review

- Problem statement
  - ✓ An active candidate path is considered valid as long as it has at least one valid segment list
  - ✓ Not guarantee that the remaining segment lists meet performance requirements
  - ✓ Consequence: Switch to back-up segment list will be sub-standard, and load-sharing across segment lists is inadequate.
- Performance shortfall examples
  - ✓ Insufficient bandwidth
  - ✓ Excessive delay
  - ✓ High packet loss rate
  - ✓ ……
- Key focus areas
  - ✓ RFC9256 Protocol Compliance Preservation
  - ✓ Additional CP States Extension for QoS-Aware Path Selection
  - ✓ Eligibility Draft Implementation Framework

Revision History : Key Updates

- Updates after IETF-117
  - ✓ Clarified threshold application principles at segment list level and candidate path level
  - ✓ Added PAM (Performance Aggregate Metrics) as threshold parameter for candidate paths
  - ✓ Added latency-based use case
- Updates after IETF-119
  - ✓ Added validity checks for candidate path status
  - ✓ Clarified to maintain existing candidate path selection rules per RFC 9256
- Updates after IETF-122
  - ✓ Adopted candidate path eligibility state for dynamic path switchover and changed the concept "validity of candidate path" to "eligibility state"
  - ✓ Eligibility state determined by real-time resource usage and forwarding quality

Summary of Updates v9 to v10

- Eligibility Attribute Concept
  - ✓ Introduced in [I-D.karboubi-spring-sr-policy-eligibility] at candidate path level
  - ✓ Influences path selection
- Dynamic Path Control
  - ✓ Head node adjusts eligibility based on: Real-time resource usage/Forwarding quality (e.g., bandwidth, delay)
  - ✓ Enables dynamic switching within SR policy
- Key Mechanisms
  - ✓ Threshold Configuration: Set forwarding quality and resource thresholds
  - ✓ Continuous Monitoring: Check thresholds against path performance
  - ✓ Adaptive Action: If thresholds violated → Set eligibility to False. Prioritize eligible paths

SR Policy POL1
Candidate Path CP1----------→ 1. Set the threshold parameters for forwarding quality and resource
Preference 200
Segment List 1 <SID111…SID11i>
Segment List 2 <SID121…SID12j>
----------→2. 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 eligibility attribute of this CP to false

Candidate Path CP2----------→3 Set the threshold parameters for forwarding quality and resource
Preference 100
Segment List 1 <SID211…SID21k>
Segment List 2 <SID221…SID22n>
----------→4. Validate the forwarding quality and resources of the SR Policy candidate path to determine if they meet the requirements.
If they meet the requirements, set the eligibility attribute of this CP to True

5. When multiple eligible candidate paths coexist in an SR policy:
* Only paths with eligibility=true participate in active path selection--------CP1→Inactive, CP2→Active

Practical Examples

Available bandwidth based path selection

- Requirement: The available bandwidth of the forwarding path ≥ 150 Mbps
- Scenario
  - ✓ Segment List 1 and Segment List 2 fail
  - ✓ Only Segment List 3 in CP1 remains valid
  - ✓ CP1 requires 150 Mbps but only 100 Mbps is available
- Decision Process
  - ✓ CP1 fails to meet bandwidth requirement
  - ✓ CP1's eligibility attribute = False
  - ✓ CP2 is selected as new active candidate path for POL1
- Result : Traffic forwarded by POL1 is switched to CP2 for transmission

```
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
```

End-to-End delay based path selection

- Requirement: The end-to-end delay of the forwarding path < 200 ms
- Scenario
  - ✓ Segment List 1 delay (1s) exceeds threshold (≥ 200 ms)
  - ✓ CP1 no longer meets delay requirement
- Decision Process
  - ✓ CP1 fails to satisfy delay constraint
  - ✓ CP1's eligibility attribute = False
  - ✓ CP2 is selected as new active candidate path for POL1
- Result: Traffic originally forwarded by CP1 is switched to CP2 for transmission

```
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
```

Running Code

- Interoperability Test: China Mobile Lab in 2025
- Verified Hardware & Software
  - ✓ H3C CR16010H-FA | CR19000-8
  - ✓ ZTE M6000-8S Plus | M6000-3S
  - ✓ China UnitechsUnified Controller
- Validation Scope
  - ✓ Demonstrated solution to an observable problem
  - ✓ Multi-vendor interoperability
  - ✓ Standards compliance
  - ✓ Path selection performance

Next Steps

- Seeking broader review and feedback from WG
  - ✓Is this a problem that other people think is real?
  - ✓Is this solution taking the right approach?
- Ask for adotpion call

Thanks!