Yang model for requesting Path Computation

draft-busibel-teas-yang-path-computation-02
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Summary of changes from IETF 97

• Added detailed connectivity matrix dimensioning consideration (section 3.1)
• Added new chapter 5 regarding «Path computation for multiple LSPs»
• Added section for security consideration
• Added Yang model for stateless RPC
Detailed connectivity matrix dimensioning

We have analyzed the set of constraints, and their cardinality, that impact the size of the detailed connectivity matrix.

<table>
<thead>
<tr>
<th>Constraints</th>
<th>Cardinality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endpoints</td>
<td>N(N-1) unidir</td>
</tr>
<tr>
<td>Bandwidth</td>
<td>Technology specific:</td>
</tr>
<tr>
<td></td>
<td>• in theory 200 bandwidth values/ranges for ODU/ODUflex [may be reduced in practice]</td>
</tr>
<tr>
<td></td>
<td>• in practice 4-7 (5 on average) bandwidth ranges for IP</td>
</tr>
<tr>
<td>Metrics</td>
<td>8: IGP, TE, hop, MLP, MBP, Delay, Delay Variation, Loss</td>
</tr>
<tr>
<td>Bounds</td>
<td>practice 30: 6 metrics (IGP, TE, hop, Delay, Delay Variation, Loss) x 5 ranges</td>
</tr>
<tr>
<td>Priority</td>
<td>8 values for setup priority</td>
</tr>
<tr>
<td>Local protection</td>
<td>2: true/false flag</td>
</tr>
<tr>
<td>Administrative Color</td>
<td>Theoretical: 3x2^{32} (include, exclude-any, exclude-all and 32bits)</td>
</tr>
<tr>
<td></td>
<td>Practical: few values are used</td>
</tr>
<tr>
<td>SRLG</td>
<td>High number [not estimated]</td>
</tr>
</tbody>
</table>
Feedback from the analysis

An approach based only on detailed connectivity matrix is hardly feasible with limited applications

Example: IP Networks

• Endpoints = N*(N-1), Bandwidth = 5, Metrics = 6, Bounds = 20, Priority = 8, Local protection = 2 (no SRLG and no affinities)
• Number of paths: 24.960 * N(N-1) = 300,000 for N=4
• 1K for each path json description: 300 Mbytes for each domain
• 20% of paths change when a new deployment of traffic occurs: 60 Mbytes of change notifications for each domains traversed by the new e2e LSP
Path Computation for multiple LSPs

Domain A
- 3 RPC Requests
  - >= 1 Path(s)/RPC
  - 1 ingress port
  - 3 egress ports
  - >= 3 Paths

Domain B
- 9 RPC Requests
  - >= 1 Path(s)/RPC
  - 3 ingress ports
  - 3 egress ports
  - >= 9 Paths

Domain C
- 3 RPC Requests
  - >= 1 Path(s)/RPC
  - 3 ingress ports
  - 1 egress port
  - >= 3 Paths

VERSUS

1 RPC Request
- 1 ingress port
- 3 egress ports
- >= 3 Paths

1 RPC Request
- 3 ingress ports
- 3 egress ports
- >= 9 Paths

1 RPC Request
- 3 ingress ports
- 1 egress port
- >= 3 Paths

Same number of computed paths but less RPC Requests!
Yang model

• Yang model is provided based on RPC stateless
  – Aligned with the TE-Tunnel YANG model to ensure consistency
  – Working in close relationship with TE-Tunnel YANG model authors to address common open issues

• Statefull Path computation can be achieved with pre-computed tunnels as defined in TE-Tunnel YANG model
GitHub Support

• GitHub Repository

• GitHub support used for
  – Developing and tracking YANG model for stateless RPC
  – Tracking Open Issues, discussions and resolutions
Open Issues

• How to reduce the number of path computation requests in networks with many domains
  – In principle: use the detailed connectivity matrix information together with path computation requests
  – Is this a standardization issue or only an implementation issue, provided that IETF standard provides all the required tools?

• Residual BW [#30]
  – New metric for the minimum unreserved bandwidth over all the links traversed by the computed path

• Topology-id in path constraints [#27]
  – The avoidTopology allows constraining which topologies shall be avoided by path computation, includeTopology list to constraints which topologies shall be considered by path computation.
  – To be agreed the need

• Missing local protection [#24]
  – Use of L flag in the SESSION/ATTRIBUTE object.
Open Issues (2)

• Support of Delay metric [#21]
  – Is it needed to align with draft-ietf-pce-pcep-service-aware-13?
  – Currently te-tunnel uses metric-type TE (min delay) + cost-limit = X ms
    ec (if smaller than x msec)

• Multiple metric for path computation [#20]
  – In RFC 5440 a path computation request can include an arbitrary num
    ber of METRIC objects.
  – Currently TE-tunnel does not support this

• Optional or mandatory constrains [#19]
  – In PCEP it is possible to specify if a constraint is mandatory, optional, if
    the path computation must fail if the constraint is not met or to relax t
    he constraint.
  – It should be possible to have the same behavior for path computation
    RPC and tunnel setup.
Open Issues (3)

• Clarification/discussions with TE-Tunnel authors
  – Representation of IRO and XRO using the explicit route object in TE-tunnel [#29]
  – Usage of Affinities mask [#26]
  – Tiebraker associated behavior [#22]
  – How to know the layer of the tunnel to be setup and/or the path to be computed [#18]
  – Source&Destination reference: not clear the usage of double syntax (ip-address and tp-id) in te-tunnel [#15]

• Capacity units [#28]
  – to be aligned with TE-topology

• How to use a subset of tunnel-params_config grouping for a Path Computation RPC
Next Steps

• Resolve current open issues
  – Continue cooperation with TE Tunnel model authors

• Path computation for multiple LSP
  – Yang has to be updated to support this

• Describe solution for the case where RPC response takes too long time

• Seeking comments and feedbacks from interested WGs to improve document

• Yang solution integration into TE-tunnel draft or in this draft?

• Ready to become WG document?