Topology Exchange and Path Finding

Ralph Koning, Miroslav Živković, and Paola Grosso (UvA)
Farabi Iqbal, Niels van Adrichem, and Fernando Kuipers (TUD)
General remarks

We present the topology exchange solution that supports:

- **different topology representations** (NML example)
- different (optimal) **path-finding** algorithms are supported for given topology
- (finding of) **disjoint paths**
- security (not discussed here)
- **topology provisioning** based on on
  - requesting party
  - bilateral peering agreement
  - other policies
Components

We distinguish three main components, they can be combined into services.

- **Topology Index** tells you the location of the served topologies
- **Topology Provider** serves the topology files.
- **Topology Consumer** processes the topology information
  - Examples: Lookup service, Path finder service, Monitoring service, Validation service
Considerations

- the **topology index** is never the true source of information, those are the topology providers
- the **topology provider** deals directly with the consumer and decides what to show or what exceptions to make based on local policy
- the **topology consumer** decides what to do with the given information and what is relevant for it to work
- (signed topology updates and encrypted connections)
1. Topology provider sends an update to the index
2. Topology index notifies the subscribed topology consumers (clients)
1. The topology consumer (client) fetches the summary information from the topology index
2. TC obtains the topologies from respective providers
Path finding

- The multi-domain routing algorithm
  - needs to accept more path requirement details
  - provides an *inter-domain path* that satisfies the given requirements
  - Inter-domain links may be described using many attributes
  - Multi-constrained (optimal) path problem
  - May or may not support loops
Path requirements

1. Certain domains must (or must not) belong to the ID path
2. Certain domains or ID links must be in a predefined sequence
3. Certain ID links must (or must not) belong to the ID path
Example

Find the shortest inter-domain path from domain 1 to domain 11, “not-via” inter-domain links (3,4) and (6,7), and “in-order” domains 2,10. (1-5-2-3-6-9-10-7-11)
Questions?

We want to thank to the following people for their feedback and support

- Freek Dijkstra, Diederik Vandevenne (SURFsara)
- Hans Trompert, Gerben van Malenstein (SURFnet)
Thank you!
Index format

<table>
<thead>
<tr>
<th>domain</th>
<th>version</th>
<th>location</th>
<th>neighbours</th>
<th>foreign</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>01</td>
<td><a href="http://d1.net/topo/">http://d1.net/topo/</a></td>
<td>D2</td>
<td>D4</td>
</tr>
<tr>
<td>D2</td>
<td>01</td>
<td><a href="http://d2.net/topo/">http://d2.net/topo/</a></td>
<td>D1</td>
<td>D4, D5</td>
</tr>
<tr>
<td>D3</td>
<td>01</td>
<td><a href="http://d2.net/topo/">http://d2.net/topo/</a></td>
<td></td>
<td>D5</td>
</tr>
</tbody>
</table>
Security concerns

We use public key techniques to validate topology information

- Topologies and topology updates are signed by the TP
- Index information is signed by the TI

Public keys have to be known by all parties we can do this by:

- Distributing public keys via a PKI
- Managing the topology index, adding domains and keys manually
- Use DNS to distribute keys and DNNSec to sign