I2RS Interim Group #7: Topology

Presenter:

Group Members: Jan Medved, Shane Amante, Alex Clemm, Lisa Huang, Joel Halpern, Adrian Farrell

Use Case Description

- Topology of the network
  - And how it relates to I2RS
- Standardized information model
  - Representing multiple layer networks
  - In support of PCE, Capacity Planning, and Traffic Engineering, ad ALTO
  - Represent multiple layers
    - With relationships between and within layers

Scope and Scale

- Representing service layers
  - Within the administrative scope
- The graph elements represent
  - Devices, Ports, links (unidirectional)
  - Abstractions thereof
    - LAG, ECMP Groups, logical nodes
  - Graph elements have properties
    - Reachable addresses, Customers, bandwidth
    - Tagging for which “kind” of operation to use this in
      - For example, which layer path computation should use this
      - Or for filtering

Operational Scope

- The primary focus here is information abstraction
- At each layer, needs information at the same dynamics as the modeled network changes
  - May be notifications or polling
  - Depth and breadth depend upon use case
- This needs also to be usable for handling requests for changes to the topology
  - Not all topology elements are equally mutable
  - Don't know write rate? Seems to be use case dependent
  - Computations support planning for protection switching
    - Protection Switching is in the network
    - Writes have to be damped
- Need filtering and recursion

I2RS Differences

- Standard API / Protocol for
  - Active and passive elements
  - Representing relationships between elements in distinct layers
  - Dependencies vertically and horizontally
  - Across vendors
  - Agreed Information about network elements
  - Consolidation of detail and abstract models
    - Including device and network models
  - Have to be able to talk about service abstraction
    - Including application specific or customer specific
  - Integration of information gathering, abstraction, and control

Specific Uses Cases to Solve

- Provide a Topology Abstraction that can be used for network oriented decisions
  - These may be actuated through other mechanisms
    - Which may be a higher layer application
  - Failure implications analysis (can also be problem troubleshooting tool)
    - Implications of node failure on
    - Multi-Layer, e.g. horizontal and vertical propagation
    - Plan is to use identities to correlate with physical devices
  - VPN Service Provisioning
    - Including customer attachment capability
  - Capacity Planning and Traffic Engineering
    - Demands may be expressed in terms of observed pairs (e.g. city pair) or reservation requests
    - Capacity may be in terms of measured utilization or bandwidth reservations
- Populate this Topology Abstraction

Target

- To be useful, this model has to be exposed via protocol
- To be realizable, we have to be able to collect the needed information from the network
- No one thing can project the entire internet

Graph element properties

- Relationships to other elements
  - All are one to many unidirectional
  - Connected to
  - Used by
  - Uses
  - Service tags
  - Need to indicate direction of failure propagation
    - Containment may be a subcase of this
  - Minimum requirements (like number of LAG elements) are additional properties
- Extensible kinds of elements
- Extensible properties of defined elements

Kinds of Graph Elements

- Network Links
- Network Nodes
  - Router – Logical or physical
  - Switches?
  - Route Reflector
  - Service delivery node – needs subtype
  - Not about Chassis
- Network Ports
  - Physical
  - Logical
  - Nested
  - Tunnel
- Containers?
- Customer?

General Graph Element properties

- Identity
  - With sufficient clarity to correlate to other models
  - May need multiple
- Network Location?
  - Geography?, Pop?, IX?
- Administrative and Operational State
- Shared Fate tagging
  - separate from failure propagation