Network Topology Models
draft-clemm-i2rs-yang-network-topo-04*
draft-clemm-i2rs-yang-l3-topo-00^

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Purpose

- " Provide YANG data models to represent topology
    - . Represent horizontal and vertical layering
    - . Extract commonalities between different topology types
    - . Allow for easy extension, derivation of additional topology types
- " Applications
    - . draft-ietf-i2rs-architecture-09 (Topology Management, section 5.1)
    - . Data nodes capture and reconcile their understanding of network topology, propagate topology info
    - . Network controllers represent controller network topology
- " Changes since -02
    - . Minor model updates
        - " Split between "network" (with node inventory) and "network-topology" (adding links + termination points)
    - . Minor editorial updates
        - " Section on how to extend and "use" the model
        - " Section on how to represent the same device in multiple networks
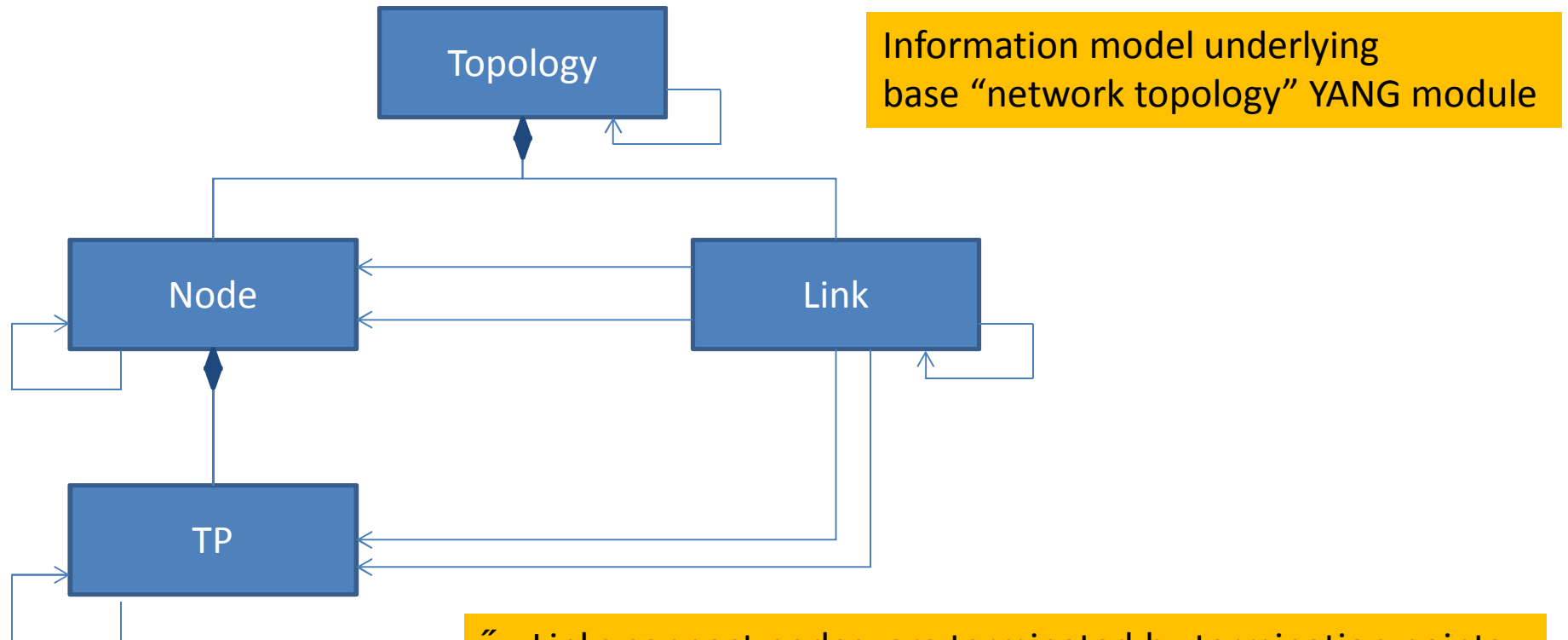   - " Other minor updates

Data model architecture
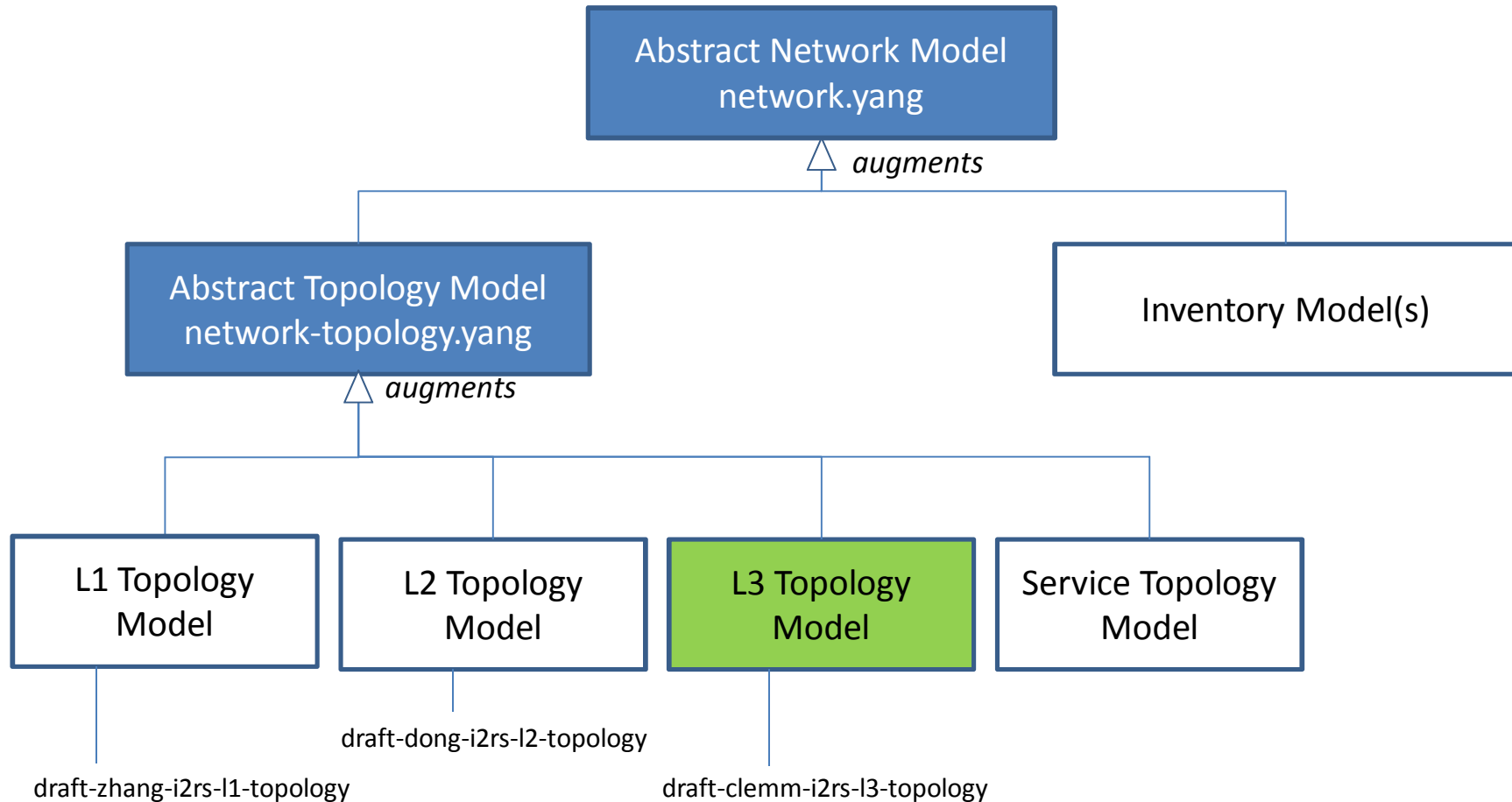
Horizontal and vertical layering

Data model structure

Topology

Node

Link

TP
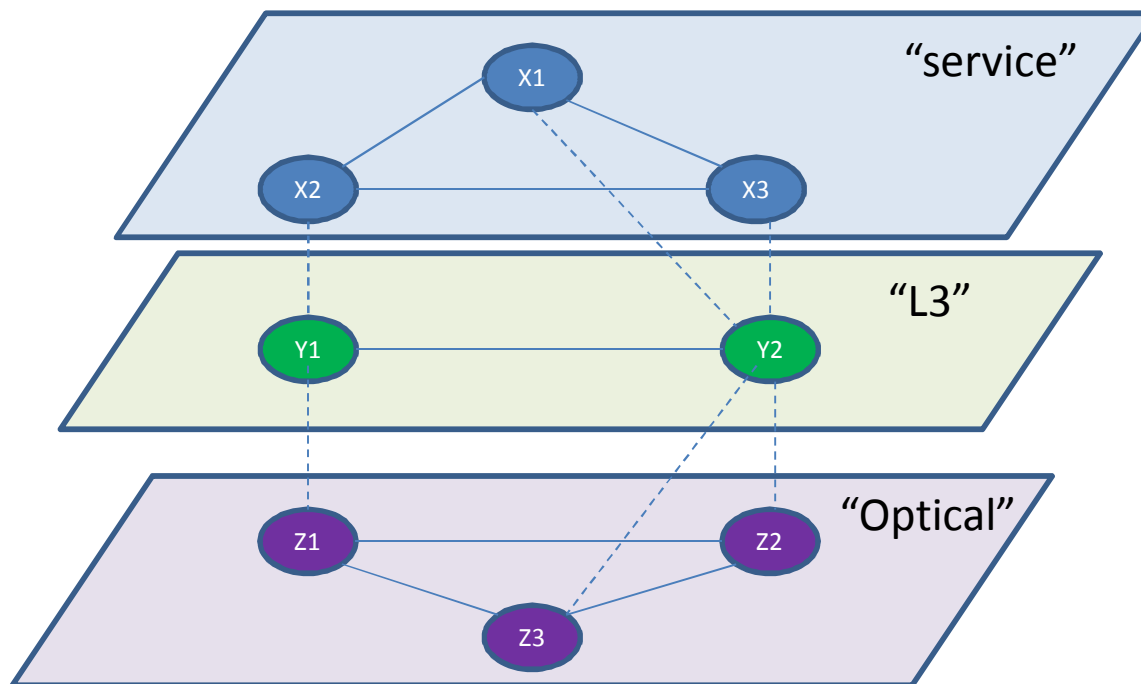
Information model underlying
base "network topology" YANG module

- Links connect nodes, are terminated by termination points
- Topologies can refer to underlay topologies
- Links can refer to underlay links
- Nodes can refer to underlay nodes
- Unidirectional, point-to-point links
  represent non-ptp through hierarchies of nodes, links

```
module: network
    +--rw network* [network-id]
        +--rw network-id           network-id
        +--ro server-provided?     boolean
        +--rw network-types
        +--rw supporting-network* [network-ref]
        |  +--rw network-ref    leafref
        +--rw node* [node-id]
        |  +--rw node-id                  node-id
        |  +--rw supporting-node* [network-ref node-ref]
        |  |  +--rw network-ref    leafref
        |  |  +--rw node-ref       leafref
        |  +--rw lnk:termination-point* [tp-id]
        |     +--rw lnk:tp-id                        tp-id
        |     +--rw lnk:supporting-termination-point*
        |                        [network-ref node-ref tp-ref]
        |        +--rw lnk:network-ref    leafref
        |        +--rw lnk:node-ref       leafref
        |        +--rw lnk:tp-ref         leafref
        +--rw lnk:link* [link-id]
            +--rw lnk:link-id           link-id
            +--rw lnk:source
            |  +--rw lnk:source-node    leafref
            |  +--rw lnk:source-tp?     leafref
            +--rw lnk:destination
            |  +--rw lnk:dest-node    leafref
            |  +--rw lnk:dest-tp?     leafref
            +--rw lnk:supporting-link* [network-ref link-ref]
                +--rw lnk:network-ref    leafref
                +--rw lnk:link-ref       leafref
```
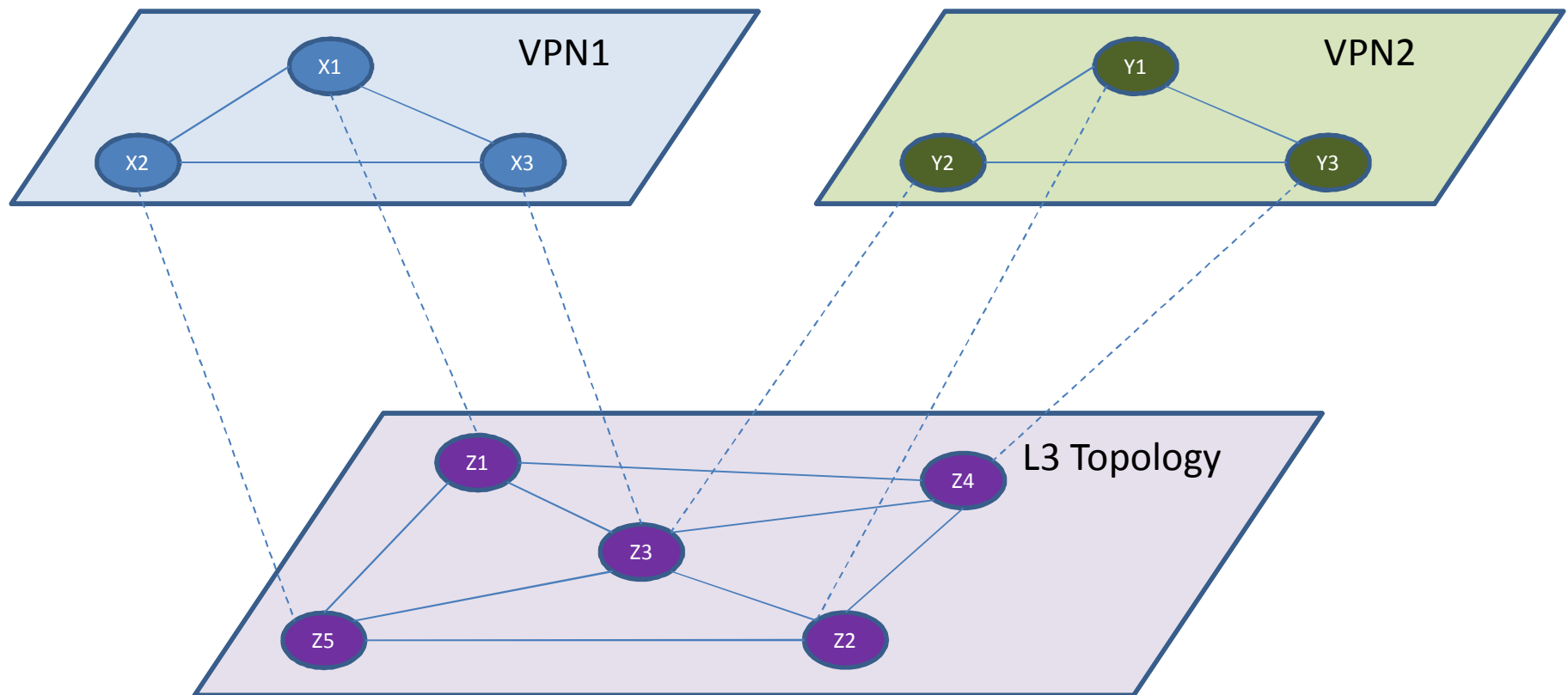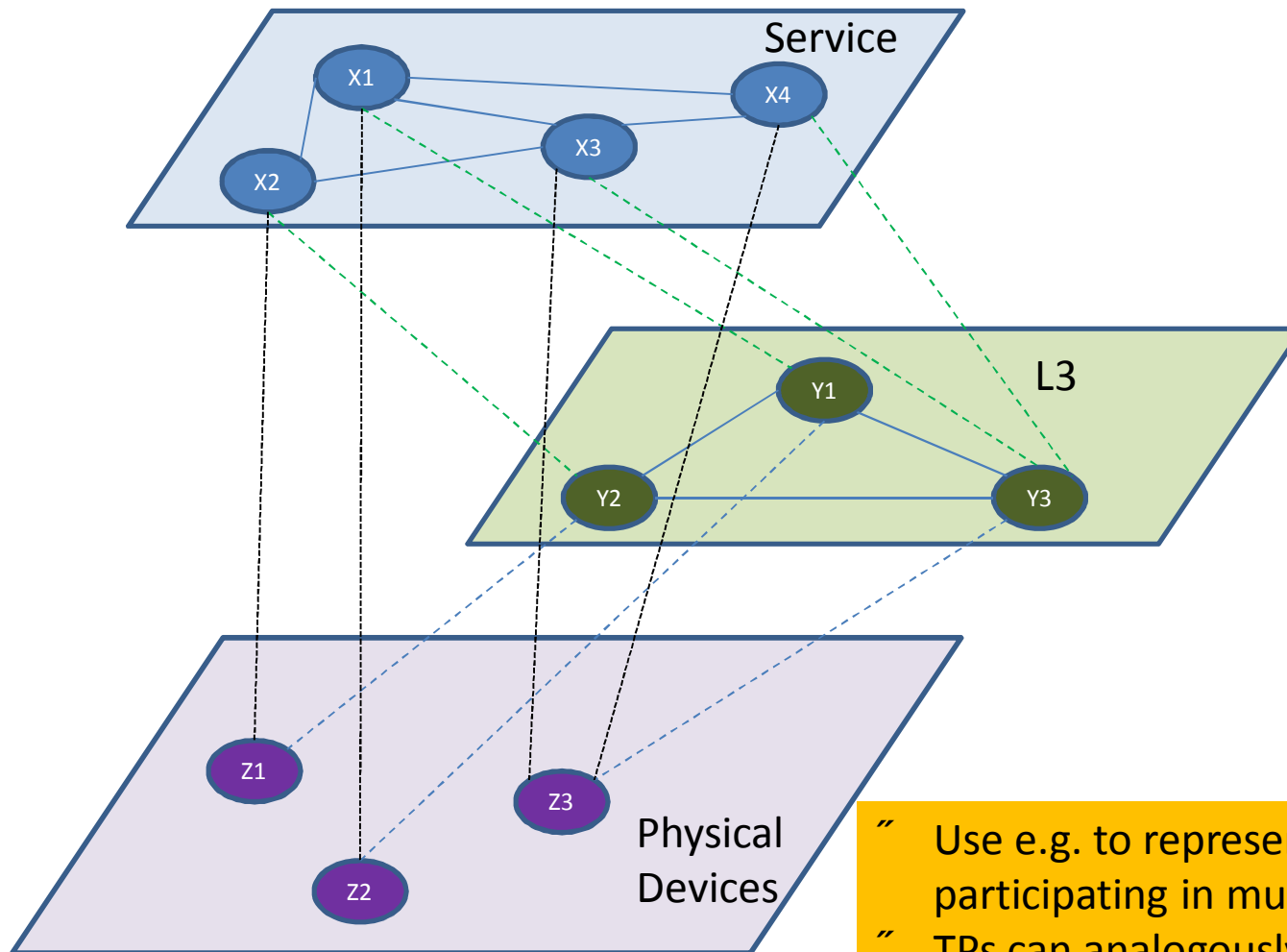
network.yang

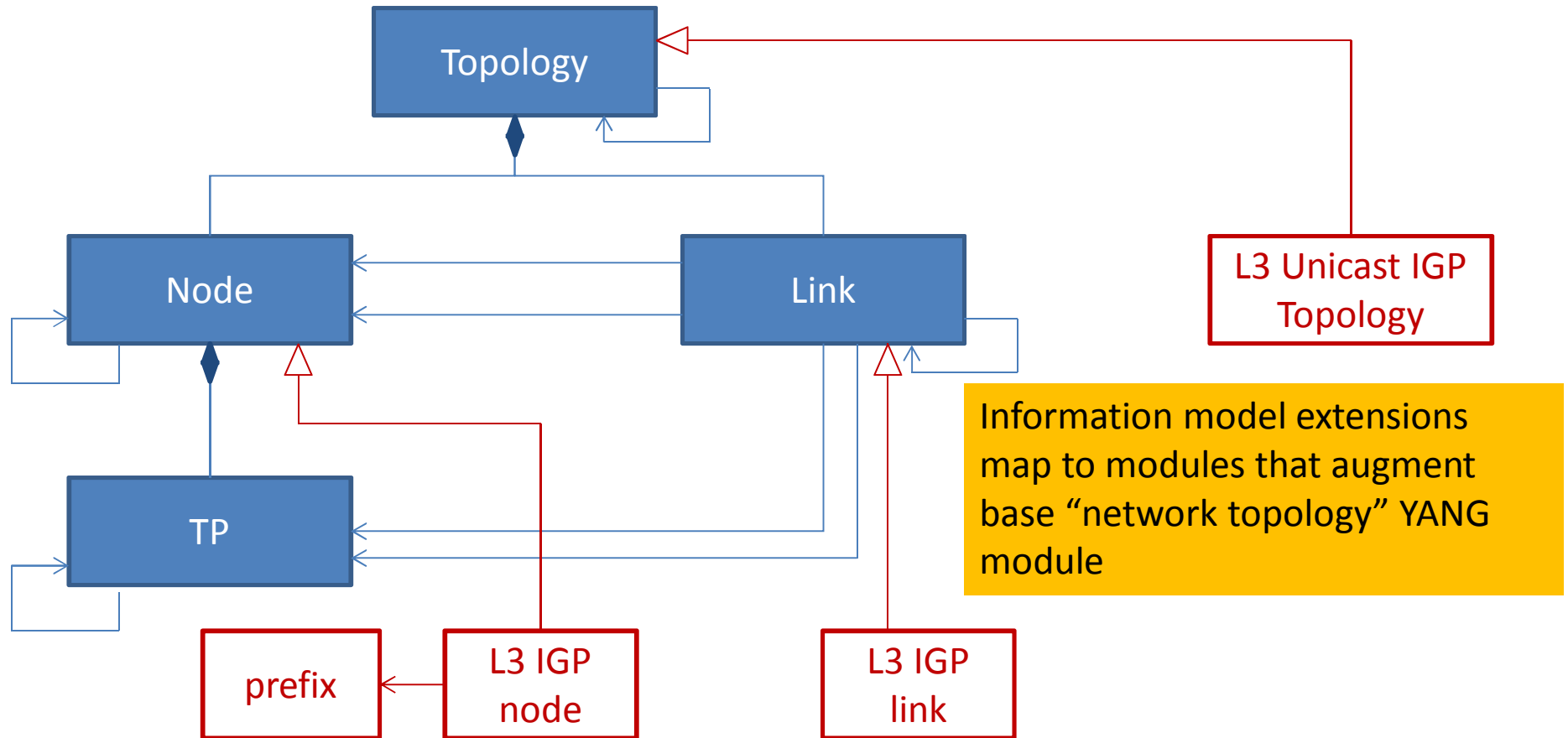network-topology.yang

Topology hierarchies
Multiple overlays

Topology hierarchies
Multiple underlays

Service

L3

Physical Devices

˝ Use e.g. to represent same devices participating in multiple topologies
˝ TPs can analogously refer to interfaces/ports

Extending the model – e.g. L3
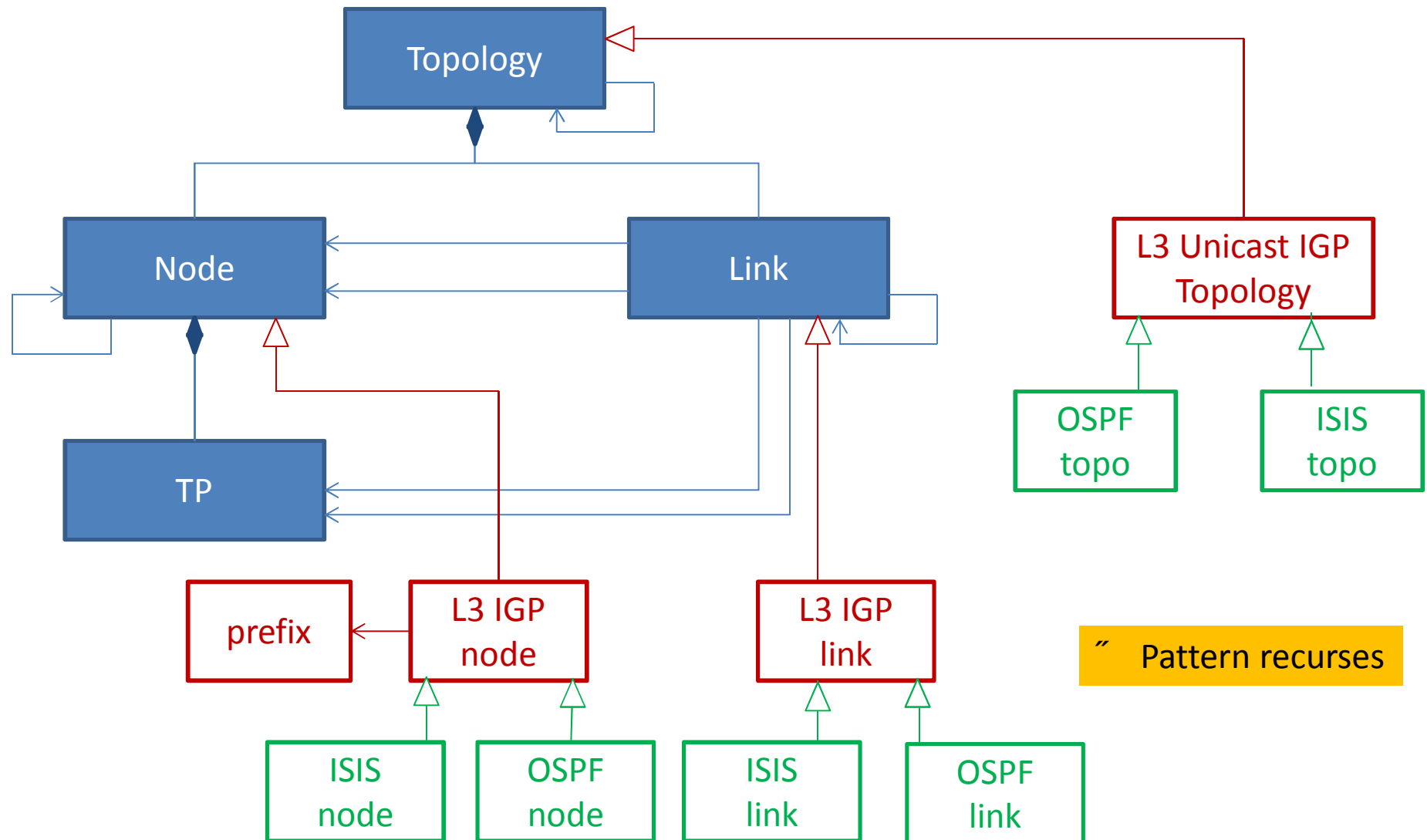

Topology

Node

Link

TP

prefix

L3 Unicast IGP Topology

L3 IGP node

L3 IGP link

Information model extensions map to modules that augment base "network topology" YANG module

˝ Derive Layer 3 Unicast IGP topology object classes
˝ Integrity rules ensure links, nodes, topology of matching type

Extending the model – e.g. L3 (contd.)

```
module: l3-unicast-igp-topology
  augment /nw:network/nw:network-types:
    +--rw l3-unicast-igp-topology!
  augment /nw:network:
    +--rw igp-topology-attributes
      +--rw name?    string
      +--rw flag*    flag-type
  augment /nw:network/nw:node:
    +--rw igp-node-attributes
      +--rw name?        inet:domain-name
      +--rw flag*        flag-type
      +--rw router-id*   inet:ip-address
      +--rw prefix* [prefix]
        +--rw prefix    inet:ip-prefix
        +--rw metric?   uint32
        +--rw flag*     flag-type
  augment /nw:network/nt:link:
    +--rw igp-link-attributes
      +--rw name?     string
      +--rw flag*     flag-type
      +--rw metric?   uint32
  augment /nw:network/nw:node/nt:termination-point:
    +--rw igp-termination-point-attributes
      +--rw (termination-point-type)?
        +--:(ip)
        |  +--rw ip-address*       inet:ip-address
        +--:(unnumbered)
          +--rw unnumbered-id?   uint32
```

Note: L3 model draft needs to be updated shortly to reflect generic model updates

Discussion

˝ Network topology focuses on what's truly common

- . Generic, optional features:
  augment separately
  (e.g. connectivity matrix, schedule info)
- . Topology specifics: augment separately

˝ Read-only vs read-write topology

- . Server-provided flag as opposed to "read-only" vs "configured" state"

˝ Model has considerable traction, multi-vendor support

˝ Implementations exist

˝ Ask: Adopt as WG document