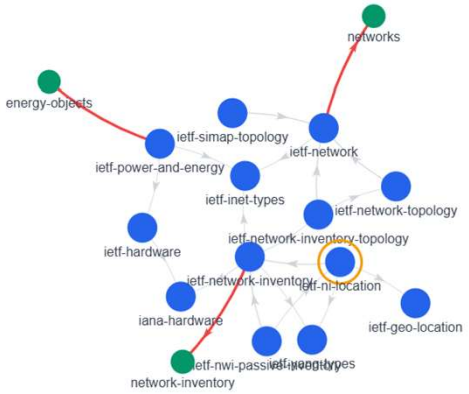
Knowledge Graph based on SIMAP Connected with IVY

Michael Mackey michael.mackey@huawei.com
Olga Havel olga.havel@huawei.com
Brad Peters bradpeters@nbnco.com.au



IETF

125 Shenzhen

What Were We Trying To Do ?

Show how the SIMAP (NMOP) and Active/Passive Inventory (IVY) can be aligned using Knowledge Graphs

This is what the YANG looks like

draft-havel-nmop-simap-yang-01

```
module: ietf-simap-topology
  +--ro networks-history
     +--ro network-history* [live-network-ref timestamp]
        +--ro live-network-ref    -> /nw:networks/network/network-id
        +--ro timestamp           yang:date-and-time
        +--ro file-id?            inet:uri

  augment /nw:networks/nw:network:
    +--rw name?          string
    +--rw label*         string
    +--rw description?   string
    +--ro extension?     <anydata>
  augment /nw:networks/nw:network/nw:node:
    +--rw name?          string
    +--rw label*         string
    +--rw description?   string
    +--ro extension?     <anydata>
  augment /nw:networks/nw:network/nw:node/nt:termination-poi
    +--rw name?          string
    +--rw label*         string
    +--rw description?   string
    +--ro extension?     <anydata>
  augment /nw:networks/nw:network/nt:link:
    +--rw name?          string
    +--rw label*         string
    +--rw description?   string
    +--ro extension?     <anydata>
  augment /nw:networks/nw:network:
    +--rw network-category?   identityref
    +--rw live-network-ref?   -> /nw:networks/network/network-id
    +--rw timestamp?          yang:date-and-time
  augment /nw:networks/nw:network/nt:link:
    +--rw link-type?        identityref
    +--rw link-direction?   identityref
    +--rw tp* [network-ref node-ref tp-ref]
       +--rw tp-ref          -> /nw:networks/
network[nw:network-id=current()/../network-ref]/
node[nw:node-id=current()/../node-ref]/nt:termination-point/tp-id
       +--rw node-ref        -> /nw:networks/
network[nw:network-id=current()/../network-ref]/node/node-id
       +--rw network-ref     -> /nw:networks/network/network-id
       +--rw tp-role?        identityref
       +--rw tp-direction?   identityref
  augment /nw:networks/nw:network:
    +--rw subnetwork* [network-ref]
       +--rw network-ref     -> /nw:networks/network/network-id
```

Figure 13: The Structure of the SIMAP Data Model

rfc8345

```
module: ietf-network
  +--rw networks
     +--rw network* [network-id]
        +--rw network-id              network-id
        +--rw network-types
        +--rw supporting-network* [network-ref]
        |  +--rw network-ref      -> /networks/network/network-id
        +--rw node* [node-id]
           +--rw node-id              node-id
           +--rw supporting-node* [network-ref node-ref]
              +--rw network-ref
              |       -> ../../../supporting-network/network-ref
              +--rw node-ref         -> /networks/network/node/node-id
```

Figure 4: The Structure of the Abstract (Base) Network Data Model

Added in ontology

draft-ietf-ivy-network-inventory-topology

```
module: ietf-network-inventory-topology
  augment /nw:networks/nw:network/nw:node:
    +--rw inventory-mapping-attributes
       +--rw ne-ref?    nwi:ne-ref
  augment /nw:networks/nw:network/nt:link:
    +--rw inventory-mapping-attributes
       +--rw link-type?    string
  augment /nw:networks/nw:network/nw:node/nt:termination-point:
    +--rw inventory-mapping-attributes
       +--rw ne-ref?           nwi:ne-ref
       +--rw port-ref?         leafref
       +--ro port-breakout!
          +--ro breakout-channel* [channel-id]
             +--ro channel-id    uint16
```

draft-ygb-ivy-passive-network-inventory

```
module: ietf-nwi-passive-inventory

  augment /nwi:network-inventory:
    +--rw cable* [id]
       ..........
       ..........
|      +--rw component-ref?   leafref
    +--rw passive-device* [id]
       +--rw id             string
       +--ro uuid?          yang:uuid
       +--rw name?          string
       +--rw description?   string
       +--rw alias?         string
       +--rw device-type?   identityref
       +--rw custom-tags*   string
       +--rw location-ref?  nil:ni-location-ref
       +--rw passive-port* [id]
          +--rw id             string
          +--ro uuid?          yang:uuid
          +--rw name?          string
          +--rw description?   string
          +--rw alias?         string
          +--rw port-type?     identityref
          +--rw fiber-core-num?  uint32
```

Figure 3: Tree diagram for passive network inventory

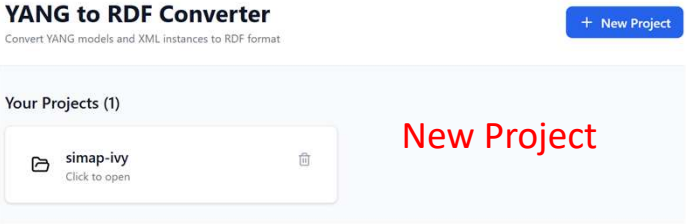
draft-ietf-ivy-network-inventory-yang

```
module: ietf-network-inventory
  +--ro network-inventory
     +--ro network-elements
        +--ro network-element* [ne-id]
           +--ro ne-id            string
           +--ro ne-type?         identityref
           +--ro uuid?            yang:uuid
           +--ro name?            string
           +--ro alias?           string
           +--ro description?     string
           +--ro software-rev* [name]
           |  +--ro name          string
           |  +--ro revision?     string
           |  +--ro patch* [revision]
           |     +--ro revision    string
           +--ro mfg-name?        string
           +--ro product-name?    string
           +--ro product-rev?     string
           +--ro components
              +--ro component* [component-id]
                 +--ro component-id      string
                 +--ro class             union
                 +--ro uuid?             yang:uuid
                 +--ro name?             string
                 +--ro alias?            string
                 +--ro description?      string
                 +--ro software-rev* [name]
                 |  +--ro name          string
                 |  +--ro revision?     string
                 |  +--ro patch* [revision]
                 |     +--ro revision    string
                 +--ro mfg-name?         string
                 +--ro product-name?     string
                 +--ro hardware-rev?     string
                 +--ro mfg-date?         yang:date-and-time
                 +--ro part-number?      string
                 +--ro serial-number?    string
                 +--ro asset-id?         string
                 +--ro is-fru?           boolean
                 +--ro uri*              inet:uri
                 +--ro parent*
                 |       -> ../../component/component-id
                 +--ro parent-rel-pos?   string
                 +--ro is-main?          boolean
```

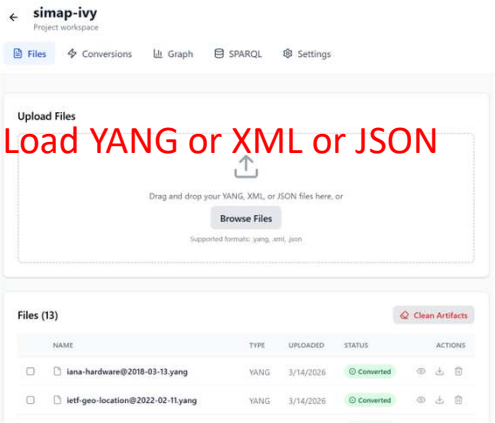
Figure 2: Network inventory tree diagram

SIMAP and Active and Passive Inventory

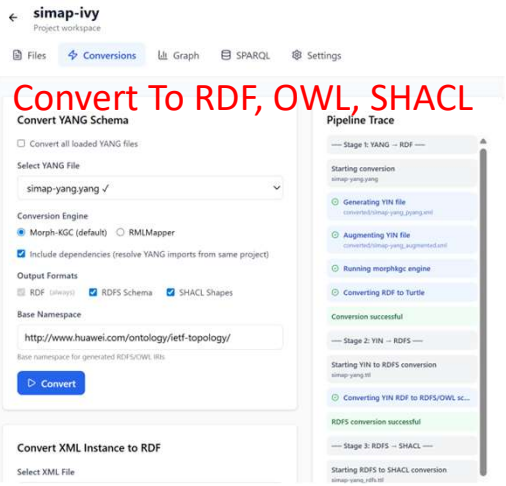
How Can We Quickly Add The Missing Semantic Knowledge ?



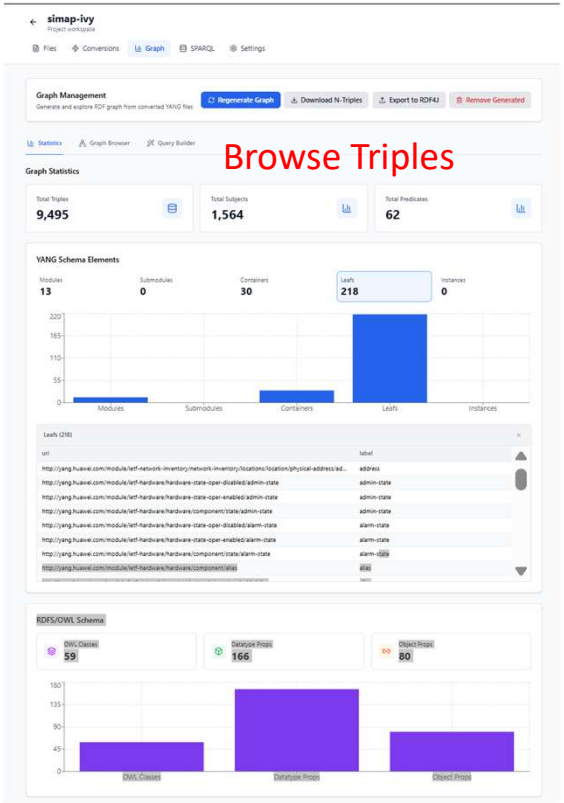
New Project



Load YANG or XML or JSON

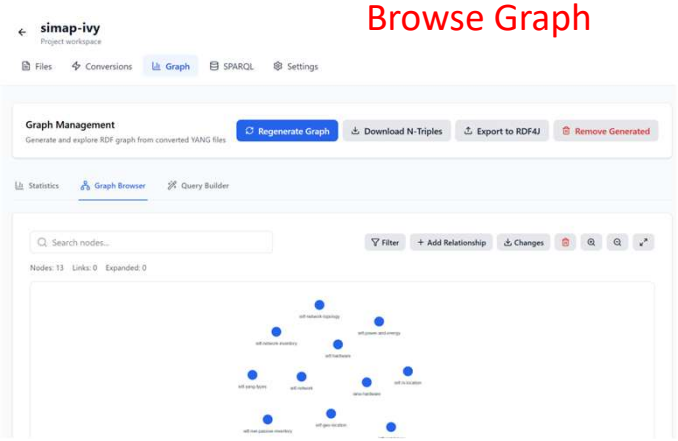


Convert To RDF, OWL, SHACL

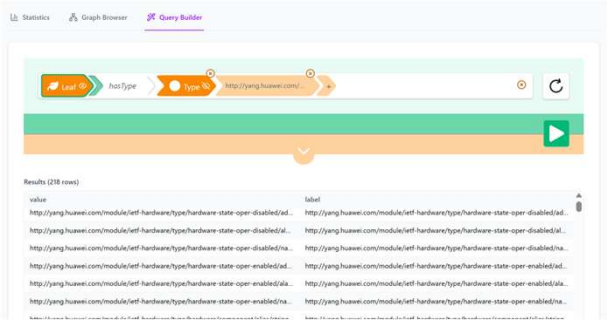


Browse Triples

Browse Graph

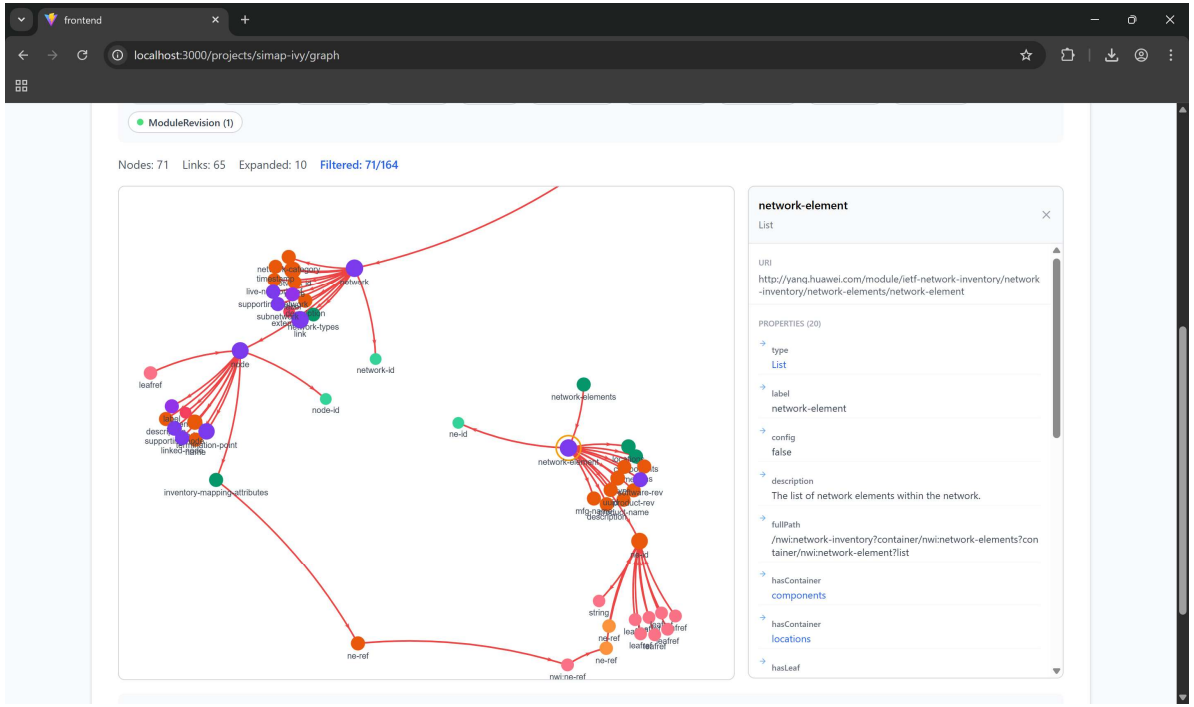


Graphical Model Driven Query



We Built A New App To Help

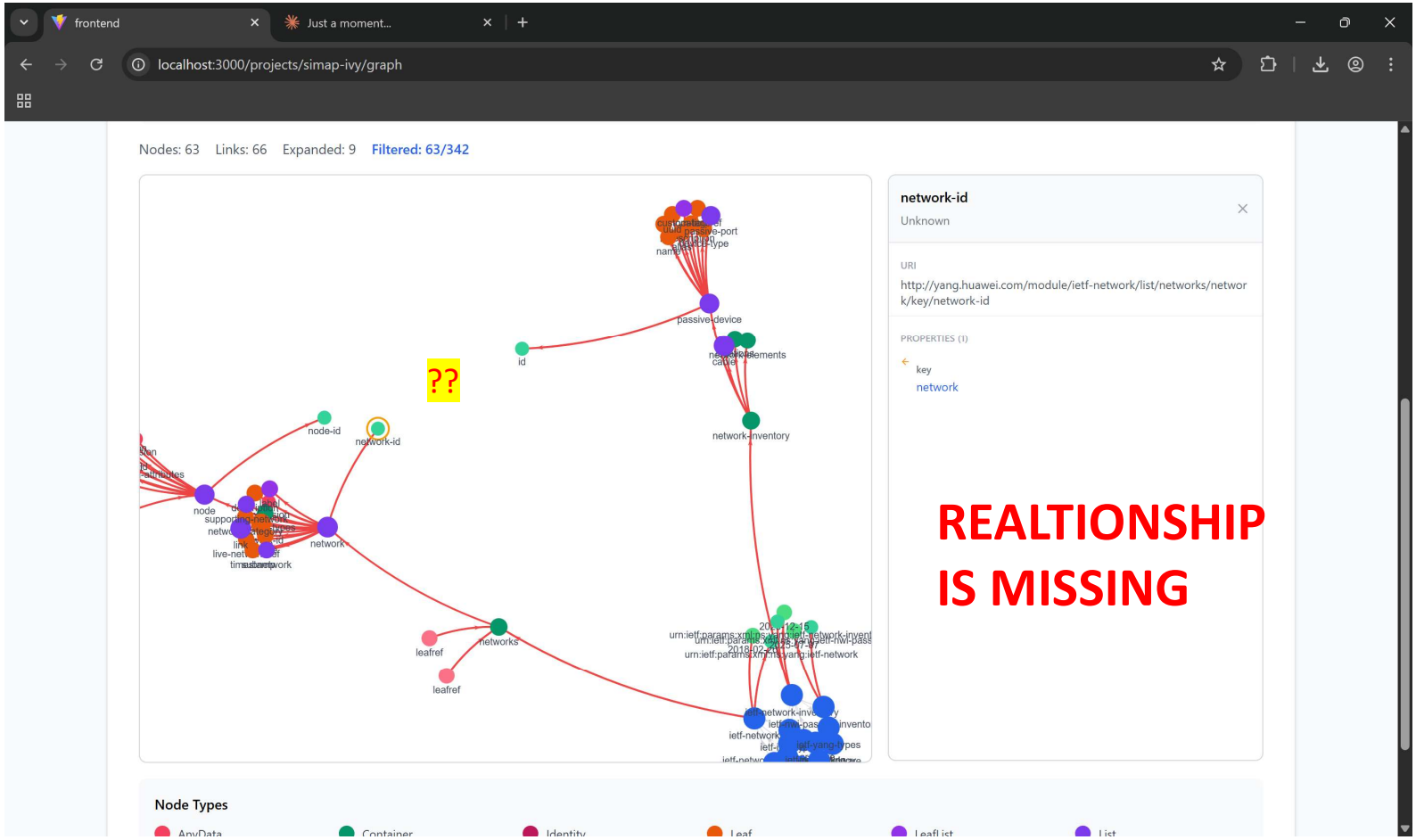
SIMAP To Ivy Active Inventory:



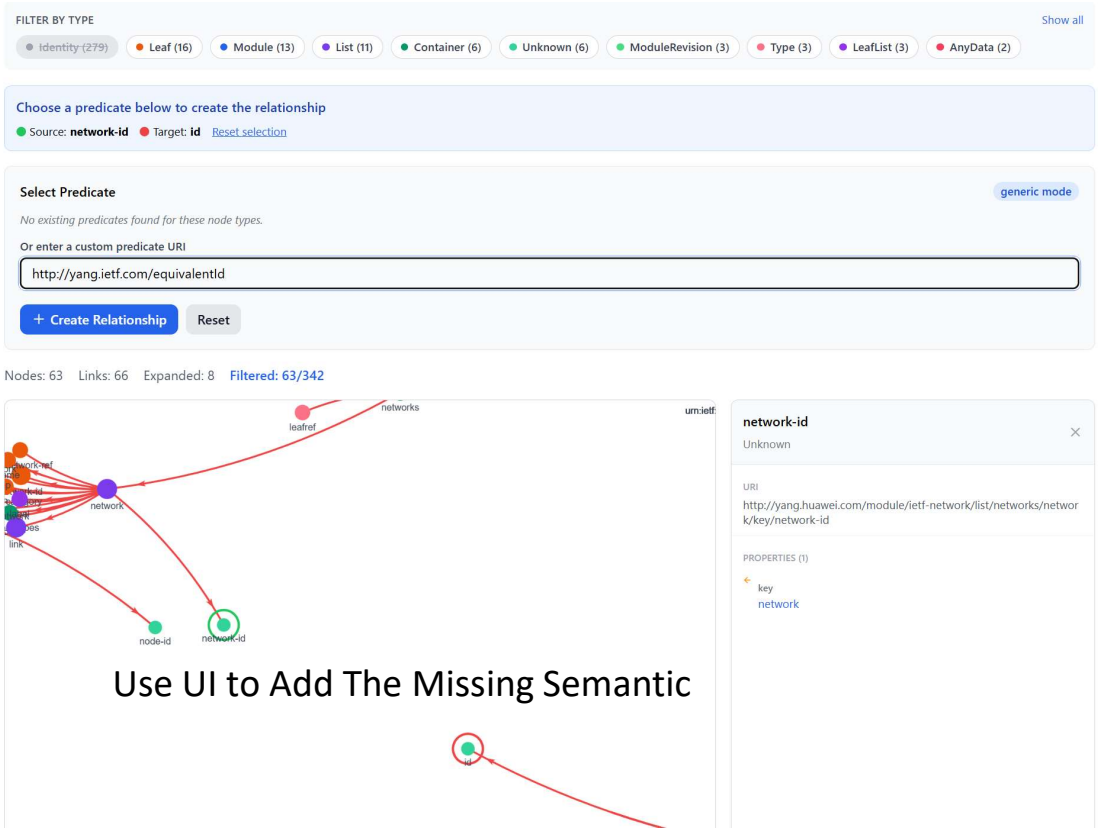
This what it looks like in the Graph

ACTIVE INVENTORY HAS A REALATIONSHIP

SIMAP To Ivy Passive Inventory:



Simply Add The Missing Relationship



Use UI to Add The Missing Semantic

You Can Export Or Download The New Triples

```
@prefix ietf125: <http://yang.ietf.com/> .
@prefix yang: <http://yang.huawei.com/> .

<yang:module/ietf-nwi-passive-inventory/list/network-inventory/passive-device/key/id>
ietf125:equivalentId
<yang:module/ietf-network/list/networks/network/node/key/node-id>
```

Create a simple triple to add the relationship with some semantic

Next Steps:

- Adding instances to show how we can query and link between SIMAP and Inventory.
- Use the App to quickly evaluate usability and completeness of different candidate SIMAP YANG approaches

In the meantime, please check out our drafts

https://datatracker.ietf.org/doc/draft-mackey-nmop-kg-for-netops/
https://datatracker.ietf.org/doc/draft-ietf-nmop-simap-concept/
https://datatracker.ietf.org/doc/draft-havel-nmop-simap-yang/

IETF

125 Shenzhen