IETF Hackathon:

YANG Data Model for Network Interconnect Tester

- IETF 104
- 23-24 March, 2019
- Prague

Background

- Problem:
  - MDN enabled tester
    - “Model Defined Networking”
  - Interoperable tester
  - Simulatable MDN network

```
                  +----------------+
      e0.egress   |                | e1.ingress
   +--------------| TG  tester  TA |←-------------+
   |              |                |              |
   |              +----------------+              |
   |                                              |
   |                +------------+                |
   |                |            |                |
   +--------------->|    DUT     |----------------+
                    |            |
                    +------------+
```

```
+------------+          +------------+          +------------+
|            | e0    e0 |            | e1    e0 |            |
| tester0  TG|>-------->|    dut0    |>-------->|TA  tester1 |
|            |          |            |          |            |
+------------+          +------------+          +------------+
```

- New draft:

  draft-vassilev-bmwg-network-interconnect-tester-00

Details

```
module: ietf-traffic-generator
  augment /if:interfaces/if:interface:
    +--rw traffic-generator {egress-direction}?
    |  +--rw (type)?
    |  |  +--:(single-stream)
    |  |  |  +--rw frame-size          uint32
    |  |  |  +--rw (frame-data-type)?
    |  |  |  |  +--:(raw-frame-data)
    |  |  |  |     +--rw frame-data?   string
    |  |  |  +--rw interframe-gap      uint32
    |  |  |  +--rw interburst-gap?     uint32
    |  |  |  +--rw frames-per-burst?   uint32
    |  |  |  +--rw src-mac-address?    yang:mac-address {ethernet}?
    |  |  |  +--rw dst-mac-address?    yang:mac-address {ethernet}?
    |  |  |  +--rw ether-type?         uint16 {ethernet}?
    |  |  +--:(multi-stream)

        ...   ...   ...
```

```
#Connect to network
net=tntapi.connect("topology.xml")

# Start traffic
net.node("tester0").edit(
  "create /interfaces/interface[name='e0']/traffic-generator -- frame-size=64 interframe-gap=20")


net.commit()
```

Details 2

Automated self-test script for devices implementing the network-interconnect-tester draft:

Usage:

```
./test-network-interconnect-tester.py --config=../topology.xml --interface=analyzer.ge0 --interface=analyzer.xe0 \
  --interface=local.ge15 --interface=local.xe2 --interface=local.xe3 --test-internal-loopback=true --test-analyzer=true
```

Output:

```
+------------------------------------------------------------------------------------------------+
| Port \ Run    |    1    |    2    |    3    |    4    |    5    |    6    |    7    |    8    |    9    |
+------------------------------------------------------------------------------------------------+
| NORM          |  98.70 |  76.19 |  50.00 |  50.00 |   5.00 |  50.00 |   5.00 |  10.00 |  76.19 |
|------------------------------------------------------------------------------------------------|
| analyzer.ge0  | 101.40 |  76.45 |  50.18 |  51.34 |   5.02 |  50.94 |   5.02 |  10.02 |  76.62 |
|------------------------------------------------------------------------------------------------|
| local.ge15    | 101.37 |  76.41 |  50.16 |  51.33 |   5.01 |  50.98 |   5.02 |  10.05 |  76.66 |
|------------------------------------------------------------------------------------------------|
| local.xe3     |  97.85 |  55.10 |  76.91 |  56.40 |  12.65 |  72.83 |  12.52 |  13.32 |  55.27 |
|------------------------------------------------------------------------------------------------|
| local.xe2     |  97.91 |  55.12 |  76.96 |  56.43 |  12.65 |  72.88 |  12.53 |  13.33 |  55.30 |
|------------------------------------------------------------------------------------------------|
| analyzer.xe0  | 101.37 |  76.41 |  50.16 |  51.32 |   5.01 |  50.92 |   5.02 |  10.02 |  76.59 |
+------------------------------------------------------------------------------------------------+
```

Simulation

- Another implementation of the drafts
  - Using open source simulation tool
- With a small translator script
- Input in XML format, conforming to YANG models:
  - ietf-network, ietf-network-topology
  - ietf-interfaces, ietf-interfaces-ethernet-like
  - Ietf-network-bridge-flows*, ietf-network-bridge-scheduler*
  - Ietf-traffic-generator*, ietf-traffic-analyzer*, ietf-loopback*

    *: DRAFT
- Output is a NED file, with the same config
  - The own DSL of the simulation tool

Simulation

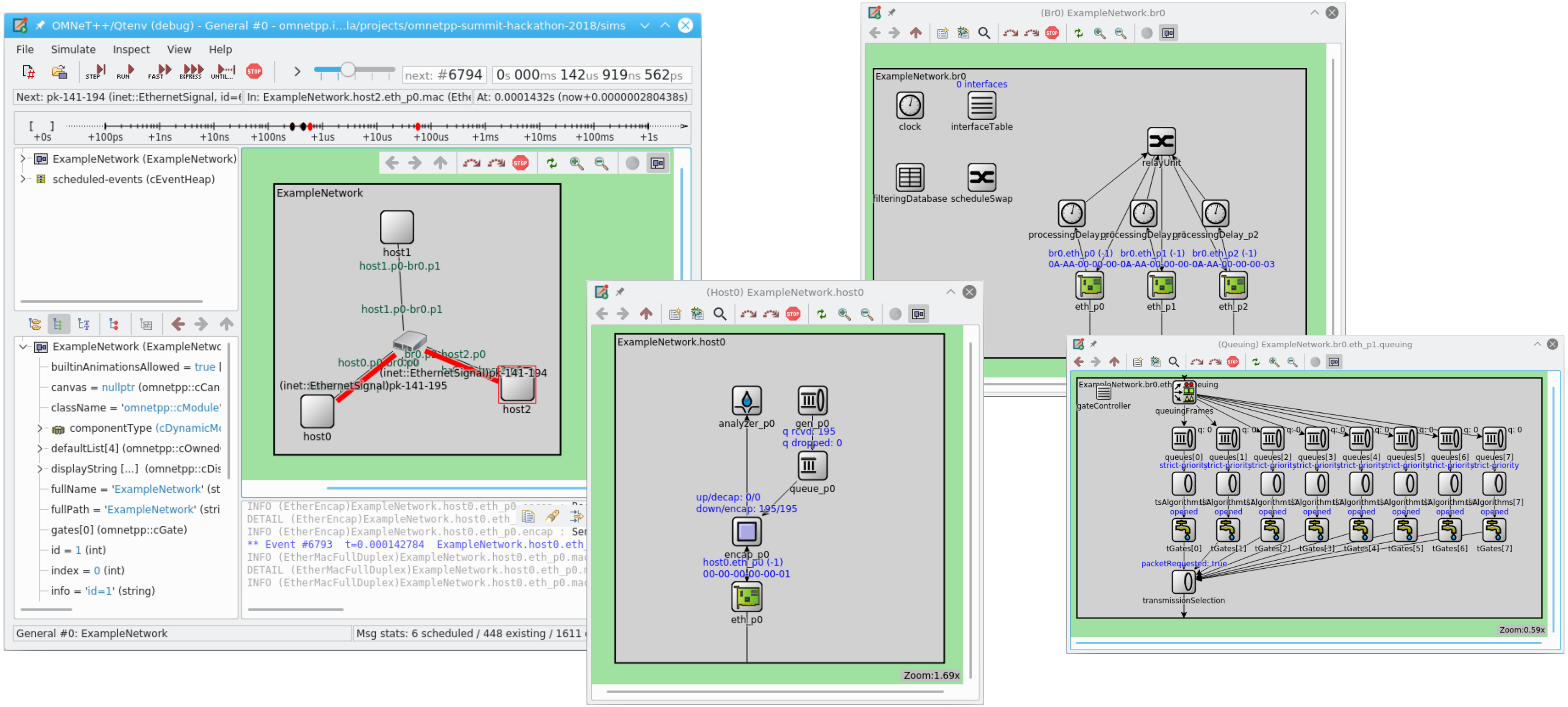
```
topology-with-config.xml:

  <networks xmlns="urn:ietf:params:xml:ns:yang:ietf-network">
      <node>
        <node-id>host0</node-id>
        <termination-point
           xmlns="urn:ietf:params:xml:ns:yang:ietf-network-topology">
          <tp-id>p0</tp-id>
        </termination-point>
        <config xmlns="urn:tntapi:netconf-node">
          <interfaces xmlns="urn:ietf:params:xml:ns:yang:ietf-interfaces">
              <traffic-generator
                  xmlns="urn:ietf:params:xml:ns:yang:ietf-traffic-generator">
                <frame-size>64</frame-size>
                <interframe-gap>20</interframe-gap>
                <dst-mac-address>00:00:00:00:00:03</dst-mac-address>
```

Simulation

topology-with-config.ned:

```
module Host0 {
    parameters:
        eth_p0.address = "00:00:00:00:00:01";
    gates:
        inout p0;
    submodules:
        eth_p0: VLANEthernetInterfaceHost;
        analyzer_p0: TrafficAnalyzer;
        gen_p0: TrafficGenerator {
            frameSize = 64B;
            interFrameGap = 20B;
            destAddress = "00:00:00:00:00:03";
        }
    connections:
        encap_p0.upperLayerOut --> analyzer_p0.in;
        queue_p0.in++ <-- gen_p0.out;
        encap_p0.upperLayerIn <-- queue_p0.out;
        eth_p0.upperLayerOut --> encap_p0.lowerLayerIn;
        eth_p0.upperLayerIn <-- encap_p0.lowerLayerOut;
        P0 <--> eth_p0.phys;
}
```

Simulation



OMNeT++/Qtenv (debug) - General #0 - omnetpp.i...la/projects/omnetpp-summit-hackathon-2018/sims

next: #6794 | 0s 000ms 142us 919ns 562ps

Next: pk-141-194 (inet::EthernetSignal, id=(| In: ExampleNetwork.host2.eth_p0.mac (Ethe | At: 0.0001432s (now+0.000000280438s)

- ExampleNetwork (ExampleNetwork)
- scheduled-events (cEventHeap)

- ExampleNetwork (ExampleNetwc
  - builtinAnimationsAllowed = true |
  - canvas = nullptr (omnetpp::cCan
  - className = 'omnetpp::cModule'
  - componentType (cDynamicM
  - defaultList[4] (omnetpp::cOwned
  - displayString [...] (omnetpp::cDis
  - fullName = 'ExampleNetwork' (st
  - fullPath = 'ExampleNetwork' (stri
  - gates[0] (omnetpp::cGate)
  - id = 1 (int)
  - index = 0 (int)
  - info = 'id=1' (string)

```
INFO (EtherEncap)ExampleNetwork.host0.eth_p0.encap : Re
DETAIL (EtherEncap)ExampleNetwork.host0.eth_
INFO (EtherEncap)ExampleNetwork.host0.eth_p0.encap : Ser
** Event #6793  t=0.000142784  ExampleNetwork.host0.eth_
INFO (EtherMacFullDuplex)ExampleNetwork.host0.eth_p0.mac
DETAIL (EtherMacFullDuplex)ExampleNetwork.host0.eth_p0.m
INFO (EtherMacFullDuplex)ExampleNetwork.host0.eth_p0.mac
```

General #0: ExampleNetwork | Msg stats: 6 scheduled / 448 existing / 1611

Simulation

- Advantages:
  - No special or expensive equipment needed
  - Deterministic and reproducible
  - Easier to modify, experiment with, and optimize
- New YANG model:
  - To model propagation delay in the medium

Wrap Up

Team members:

Vladimir Vassilev
Transpacket AS

Attila Török
OpenSim Kft.

First timers @ IETF/Hackathon:

Attila Török

References

- https://www.ietf.org/id/draft-vassilev-bmwg-network-interconnect-tester-00.txt
- https://www.ietf.org/id/draft-vassilev-netmod-network-bridge-01.txt
- https://github.com/torokati44/ietf-hackathon104
- https://github.com/vlvassilev/litenc/tree/master/tntapi/example/ietf-network-interconnect-tester