NOG.HR #3

NETCONF & YANG Industry Insights

With detours to RESTCONF and sysrepo

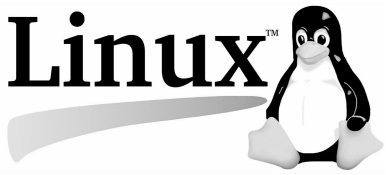
sartura

October 19th, 2023

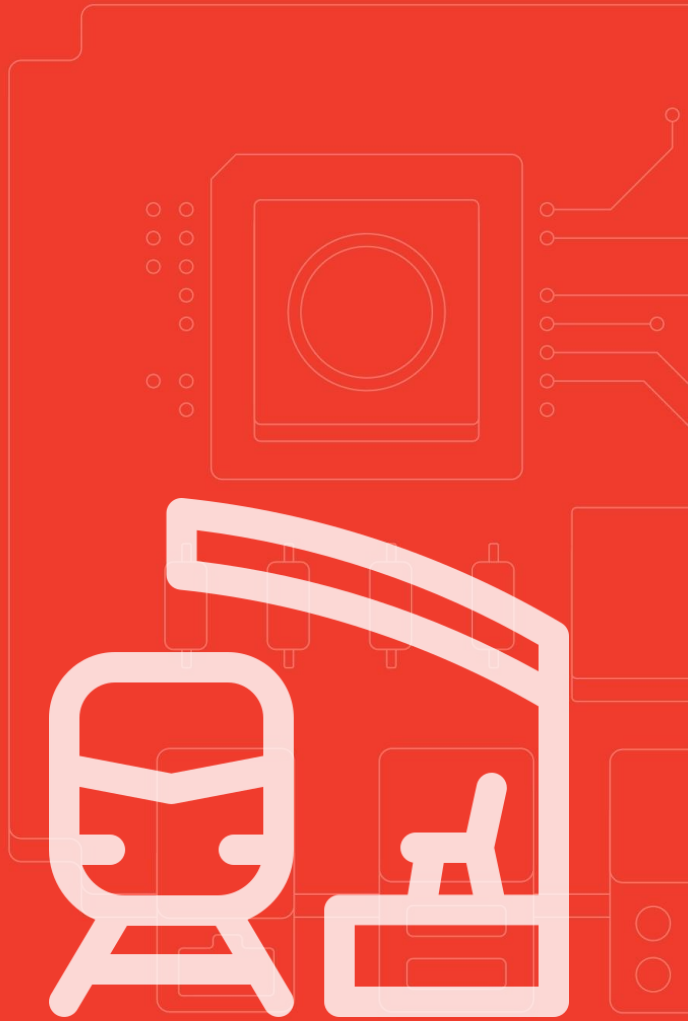
About Sartura

- We offer a range of high-tech engineering services
  - Concierge software development including kernel and user-space
  - Open Source project contributions
  - Delivering network products and solutions (including CPE and switches)
- Our mission is to bridge the gap between Open Source and Enterprise

Open Source Contributions



Central station



Railway station logo source: flaticon.com

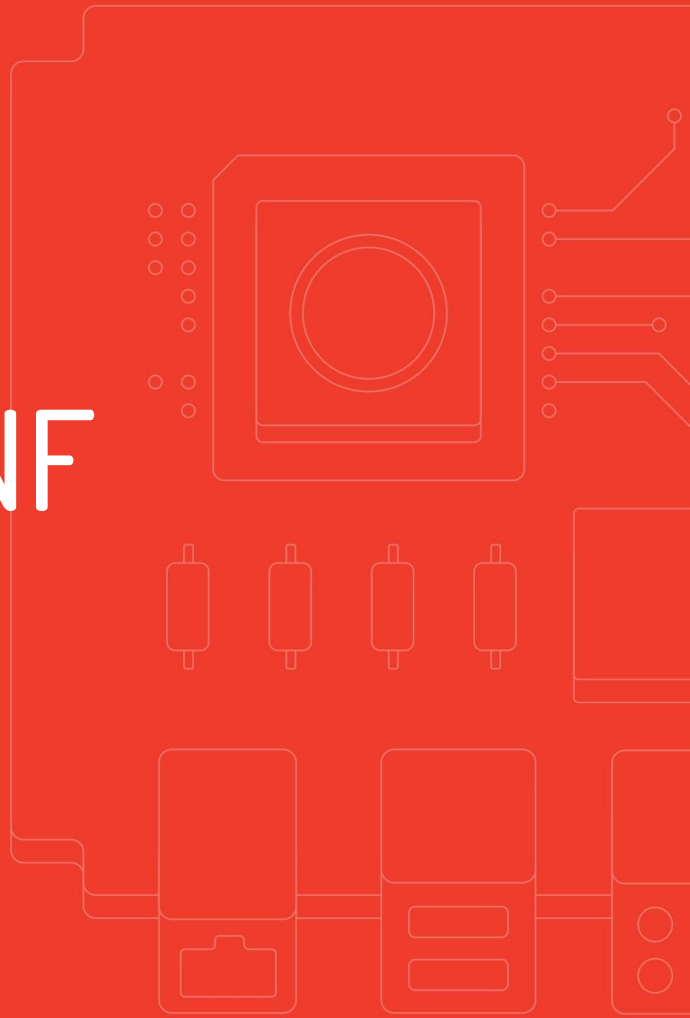
Upcoming stations

- NETCONF & RESTCONF
- YANG
- sysrepo & libyang
- Industry Insights

...all aboard!

NETCONF & RESTCONF

First stop



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First stop: NETCONF & RESTCONF

NETCONF

- Developed and standardized by the IETF in RFC 4741, revised in RFC 6241
- Build upon the knowledge and real world experience gathered with SNMP
- Supported by major vendors like: Cisco, Juniper, Nokia, Huawei, Arista, ...

RESTCONF

- HTTP based protocol that uses the datastore concept of NETCONF for configuration manipulation

gNMI

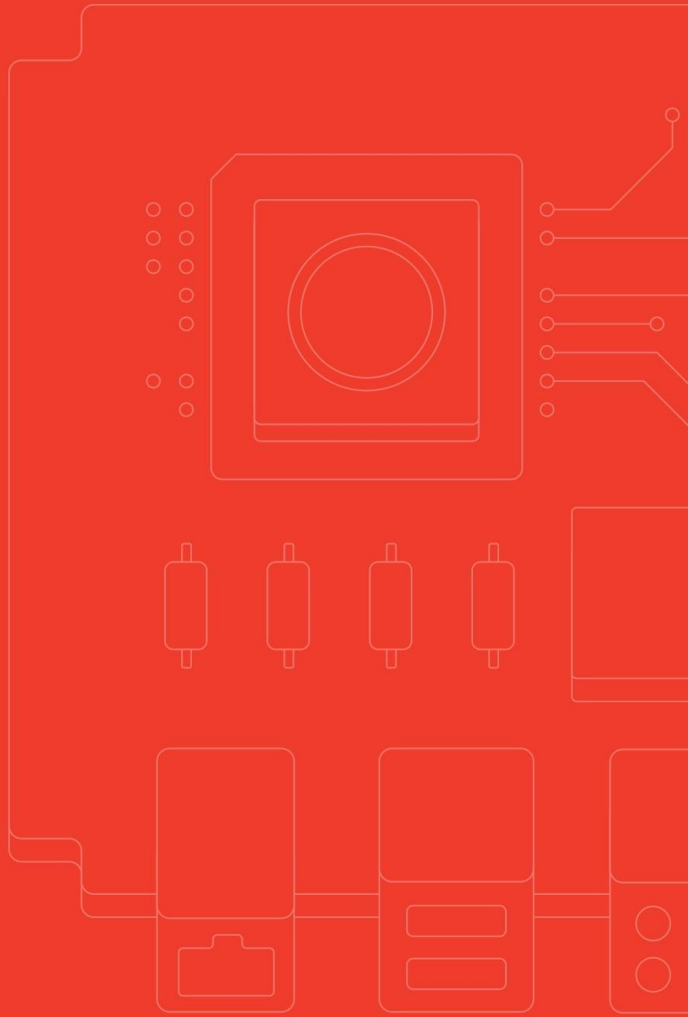
- gNMIc -> https://youtu.be/v3CL2vrGD_8 (presentation from the North American NOG 2023)

First stop: NETCONF & RESTCONF

	NETCONF (RFC 6241)	RESTCONF (RFC 8040)
transfer protocols	SSH, TLS	HTTP/HTTPS
data encoding	XML	XML, JSON
operations	RPC	HTTP methods (GET, POST, ...)
data modeling	YANG	YANG, XSD

YANG

Second stop



Second stop: YANG

- Data modeling language
- Developed by the NETMOD (Network modeling) group of IETF
- Introduced with RFC 6020, updated to YANG 1.1 with RFC 7950
- YANG 1.1 goes together with “Common YANG Data Types” RFC 6991
- Upcoming YANG version (work in progress): https://github.com/netmod-wg/yang-next

Second stop: YANG

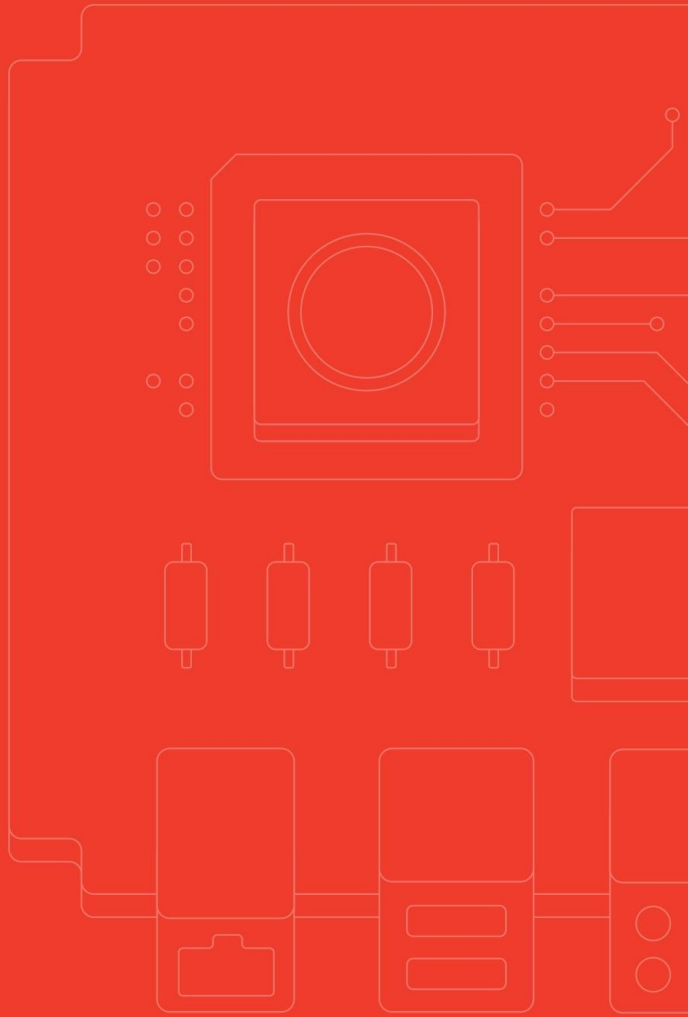
Brief example of a YANG model (right) and its XML representation with data in the datastore (below). JSON is also possible. Source: ietf-system@2014-08-06.yang

```
<system xmlns="urn:ietf:params:xml:ns:yang:ietf-system">
  <dns-resolver>
       <search>wikipedia.org</search>
       <search>archlinux.org</search>
       <server>
         <name>cloudflare dns</name>
         <udp-and-tcp>
           <address>1.1.1.1</address>
           <port>53</port>
         </udp-and-tcp>
       </server>
       <server>
         <name>cloudflare ipv6 dns</name>
         <udp-and-tcp>
           <address>2606:4700:4700::1001</address>
         </udp-and-tcp>
       </server>
  </dns-resolver>
</system>
```

```
container dns-resolver {
  description
  "Configuration of the DNS resolver.";
  leaf-list search {
    type inet:domain-name;
    ordered-by user;
  }
  list server {
    key name;
    ordered-by user;
    leaf name {
      type string;
      description
      "An arbitrary name for the DNS server.";
    }
    choice transport {
      mandatory true;
      case udp-and-tcp {
        container udp-and-tcp {
          leaf address {
            type inet:ip-address;
            mandatory true;
          }
          leaf port {
            if-feature dns-udp-tcp-port;
            type inet:port-number;
            default 53;
          }
        }
      }
    }
  }
}
```

sysrepo & libyang

Third stop



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Third stop: sysrepo & libyang

sysrepo - https://github.com/sysrepo/sysrepo/

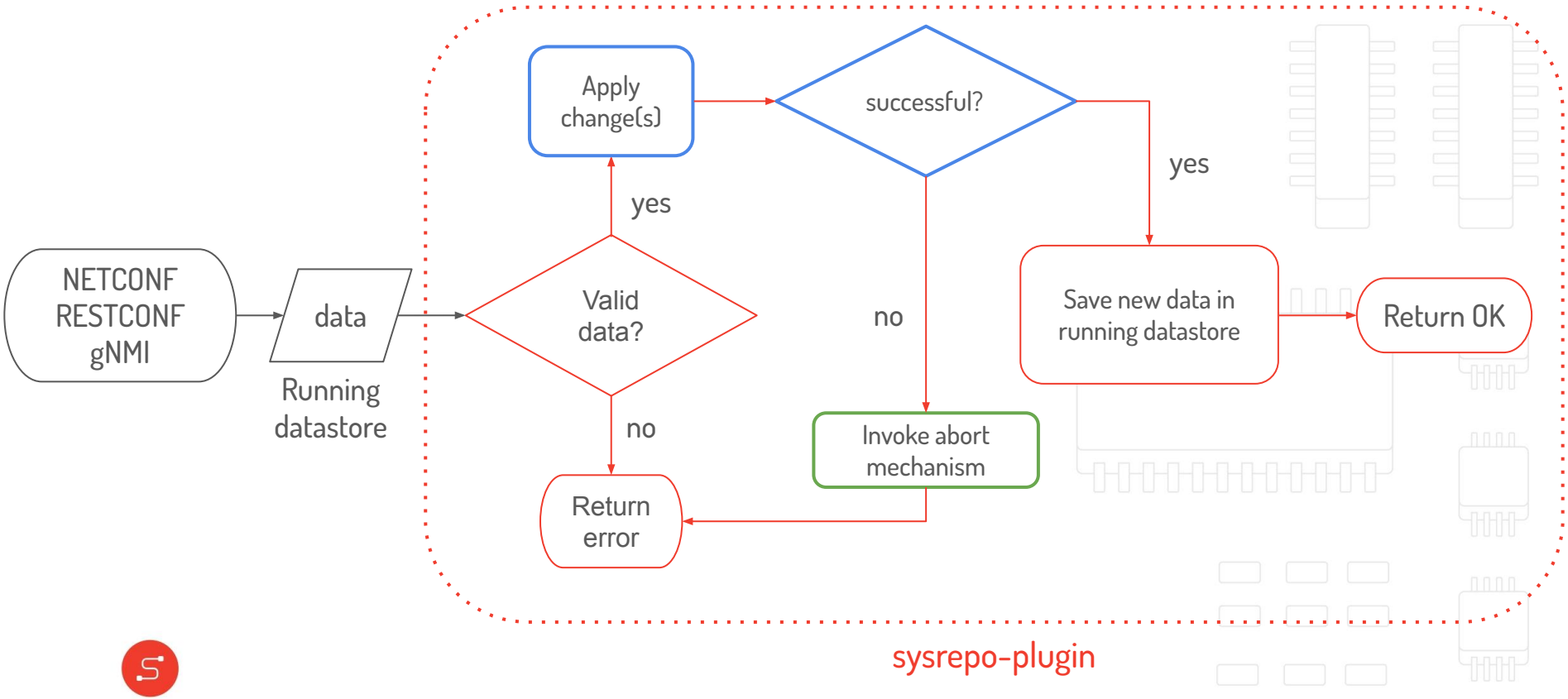
- Open-source YANG configuration and operational datastore for UNIX/Linux applications
- Provides a C language API
- Official Python and C++ bindings available
- Integrated within Netopeer2 NETCONF server
- Used for plugin development

libyang - https://github.com/CESNET/libyang

- Open-source YANG data parser and toolkit

Sysrepo, libyang and Netopeer2 are maintained and developed by CESNET (Czech Education and Scientific NETwork).

Third stop: sysrepo & libyang



Industry Insights

Fourth stop

What we have created, learned, broken,
learned more, invented.

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Fourth stop: industry insights

- So far based on our experience there are different applications for sysrepo
  - Telcos, Industrial automation, router & switch vendors
- Our experience is mostly based on sysrepo plugin development - mostly Linux C based, with recent usage of C++
  - OpenWrt
  - Common models from IETF (system, interfaces) and IEEE (802.11q bridge)
  - Some openconfig models
- Several utilities, testing tools and projects exist, but opportunities for more exist too
  - Pyang
  - Ncclient
  - OSS-Fuzz integration
- Lately interest in gNMI seems to be increasing as an alternative to NETCONF

Fourth stop: industry insights

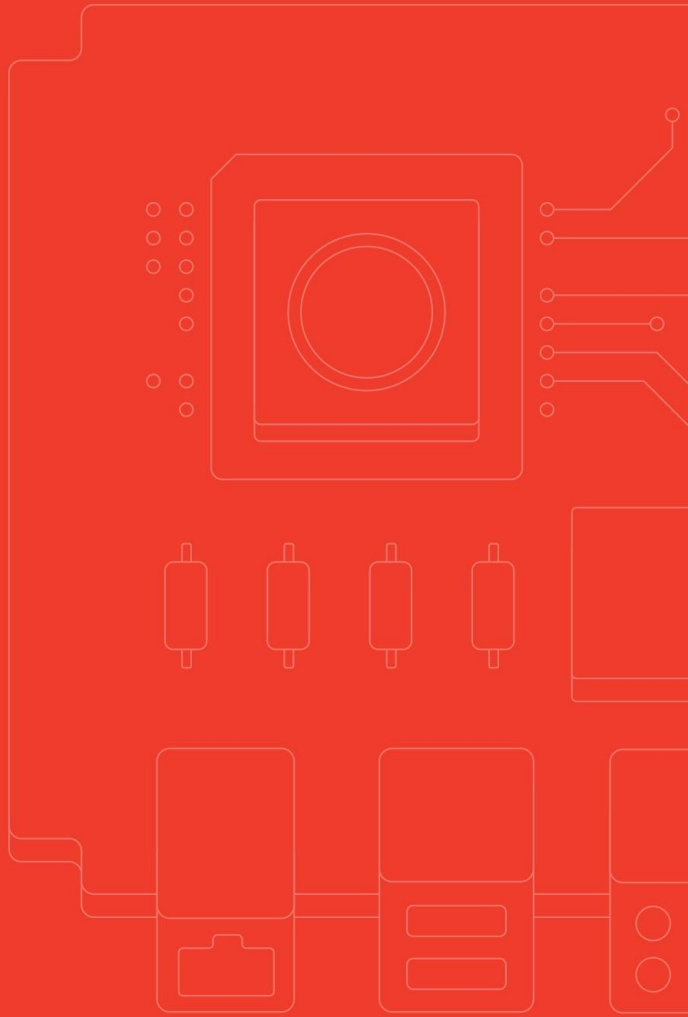
- Custom YANG model design is a common requirement
  - Can be a tedious and long process due to YANG complexity
- Often requested NETCONF features are already available in the Netopeer2 implementation
- CI/CD is often more complex than for other user space software
- Partial Windows support hasn't been an issue so far
- Our contributions:
  - sysrepo plugin generator to speed up the creation of sysrepo plugins (available on github)
    - Can generate C and C++ code
  - robotframework-sysrepolibrary for testing (available on pypi.org)

Fourth stop: industry insights

- Sysrepo community event 2023
  - Virtual event on November 15th 2023
  - **Users** and **contributors** of Sysrepo will join
  - We'll be sharing use-cases, implementation, and application experiences, and help shape the Sysrepo roadmap. And you can be a part of that!
  - More information: https://www.sysrepo.org/#event

Questions

Last stop



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NETCONF & YANG Industry Insights

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