CBOR Support in libyang

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IETF

Adding CBOR Support in libyang

Why are we trying to do this?

1. While implementing An HTTPS-based Transport for YANG Notifications (by Mahesh Jethanandani and Kent Watsen) and CBOR Encoding for HTTPS-based Transport for YANG Notifications (written by our team), we noticed a lack of CBOR support in popular YANG tooling libraries like libyang (in C) and yangson (in Python).

2. Similar lack of support was noticed by Thomas Graaf and Team during their work on implementations of YANG Push publishers.

We hence felt the need to fill this critical gap within YANG tooling.

Join us at netconf : https://datatracker.ietf.org/doc/draft-chittapragada-netconf-https-notif-cbor/

Goal of the project

Our goal was to extend libyang, the widely used YANG data-modeling library written in C, by implementing full CBOR (Concise Binary Object Representation) support, both serialization and parsing, for YANG-modeled data

- libyang is a YANG data modeling language parser and toolkit supporting XML and JSON.

https://github.com/CESNET/libyang/issues/2130 - feature request for CBOR support in data

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What we worked on

- Understood libyang's data parsers lyd_parse_xml() and lyd_parse_json() and implemented a lyd_parse_cbor() *function.*
- Understanding how to serialize CBOR data into appropriate structures.
- Worked on 2 different implementations,
  - Using libcbor as the low level CBOR parser, https://github.com/MeherRushi/libyang/tree/cbor
  - Writing a CBOR parser from scratch (while referring to the JSON parser), https://github.com/MeherRushi/libyang/tree/sid_cbor

Progress - Development

- Working on 2 different implementations :
  - Leveraged libcbor for decoding; ensured schema-aware parsing and type mapping.
    - Implemented parser_cbor.c and parser_cbor.h to parse raw CBOR into lyd_node trees.
    - Introduced new high level API lyd_parse_data_mem_len() to propagate the data length parameter to internal parsing functions, enabling precise handling of bounded memory buffers during data parsing
  - Trying to write a low level cbor parser from scratch following the pattern of the low level JSON parser in json.c in libyang, implemented parser_cbor.c, parser_cbor.h, cborr.c and cborr.h files for the same
- Modified CMakeLists.txt to include new files and link libcbor as a dependency.
- Integrated CBOR parser into libyang's parsing dispatch logic and Introduced new data encoding format LYD_CBOR in libyang.
  - Consequently introduced respective structures (lycbor_ctx, lyd_cbor_ctx, etc) and functions (lyd_parse_cbor, lyd_parse_cbor_init, etc) and tried to keep it consistent with the json parser

What we learned

Understanding libyang:

- Familiarized with libyang’s modular architecture and parser/printer structure.
- Analyzed existing XML/JSON parsing flows, validation mechanisms, and lyd_node tree construction.
- Traced call stacks and internal context management (ly_ctx, lyd_ctx, etc) during data parsing and validation.

CBOR Standards:

- Studied CBOR (RFC 8949) encoding rules – major types, tags, maps, arrays, and semantic structures.
- Mapped CBOR elements to YANG-modeled structures (containers, lists, leafs).

Future Work

1. *Finalize CBOR integration*
   a. Implement remaining validation and printing logic for CBOR data
2. *Add CBOR SID support*
   a. Extend parser to handle CBOR SIDs, after discussion with libyang maintainers on implementation specifics.
3. *Complete the development of the Low Level Parser*
   a. Implement a custom CBOR parser to remove *libcbor* dependency.

Wrap Up

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