TCP YANG Model – Update

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With contributions from Simon Bauer and Martin Mager

TCPM @ IETF 111
**Scope and status**

- **YANG model** for TCP configuration with narrow scope
  1. TCP basic statistics (optional)
  2. TCP connection list
  3. TCP-AO and TCP MD5 with TCP-AO being strongly RECOMMENDED

- Keepalives from draft-ietf-netconf-tcp-client-server

- Use in BGP YANG model
  - **draft-ietf-idr-bgp-model-11** import of TCP-AO definitions

  ```
  import ietf-tcp {
  prefix tcp;
  reference
  "I-D.scharf-tcpm-yang-tcp: Transmission Control Protocol (TCP)
  YANG Model.";
  }
  ``

  ```
  draft-ietf-idr-bgp-model-11
  ```

  ```
  choice option {
  case ao {
  uses tcp:ao;
  leaf ao-keychain {
  type key-chain:key-chain-ref;
  ...
  }
  description
  "Uses TCP-AO to secure the session. Parameters for those are defined as a grouping in the TCP YANG model.";
  reference
  "RFC 5925 - The TCP Authentication Option.";
  }
  draft-ietf-idr-bgp-model-11
  ```

- Stable TCP-AO YANG model needed by **end of 2021**
Compete tree diagram

module: ietf-tcp
  +--rw tcp!
    +--rw connections
      | +--rw connection*
      |    | [local-address remote-address local-port remote-port]
      |    | +--rw local-address     inet:ip-address
      |    | +--rw remote-address    inet:ip-address
      |    | +--rw local-port        inet:port-number
      |    | +--rw remote-port       inet:port-number
      | +--rw common
      |   | +--rw keepalives!
      |   |   | +--rw idle-time       uint16
      |   |   | +--rw max-probes      uint16
      |   |   | +--rw probe-interval  uint16
      |   | +--rw (authentication)?
      |   |   | +--:(ao)
      |   |   |   | +--rw enable-ao?   boolean
      |   |   |   | +--rw send-id?       uint8
      |   |   |   | +--rw recv-id?       uint8
      |   |   |   | +--rw include-tcp-options? boolean
      |   |   |   | +--rw accept-key-mismatch? boolean
      |   |   | +--:(md5)
      |   |   |   | +--rw enable-md5?    boolean
      | +--ro statistics {statistics}?  
      |   | +--ro active-opens?     yang:counter32
      |   | +--ro passive-opens?    yang:counter32
      |   | +--ro attempt-fails?    yang:counter32
      |   | +--ro establish-resets? yang:counter32
      |   | +--ro currently-established? yang:gauge32
      |   | +--ro in-segments?      yang:counter64
      |   | +--ro out-segments?     yang:counter64
      |   | +--ro retransmitted-segments? yang:counter32
      |   | +--ro in-errors?        yang:counter32
      |   | +--ro out-resets?       yang:counter32
      |   | +--x reset
      |   |   | +--w input
      |   |   |   | +--w reset-at?  yang:date-and-time
      |   |   | +--ro output
      |   |   |   | +--ro reset-finished-at? yang:date-and-time

→ Relatively straightforward model
Diff between -02 and -01

- **Write access to connection list:** List must be writeable due to YANG semantics
  - Expanded description: “List of TCP connections with their parameters. The list is modelled as writeable, but implementations may not allow creation of new TCP connections by adding entries to the list. Furthermore, the behavior upon removal is implementation-specific. Implementations may support closing or resetting a TCP connection upon an operation that removes the entry from the list.”
  - Issue reported by Simon Bauer and Martin Mager

- **Client/server imports:** Removed from model
  - Discussed during last meeting
  - Issue reported by Simon Bauer and Martin Mager

- **Reset RPC for statistics:** No change as compared to -01, but additional explanation
  - New text: “Note that the TCP MIB does not include means to reset statistics, which are defined in this document. This is not a major addition, as a reset can simply be implemented by storing offset values for the counters.”
  - Suggestion by Richard Scheffenegger and Michael Tuexen

- **TCP-AO modeling:** Clear description of how to set send-id and recv-id
  - Expanded description: “The SendID is inserted as the KeyID of the TCP-AO option of outgoing segments. The SendID must match the RecvID at the other endpoint.”
  - Feedback from Melchior Aelmans and Greg Hankins

→ Only minor changes between -02 and -01
Prototype

- **Software prototype** for draft-ietf-tcpm-yang-tcp
  - Student research project at Hochschule Esslingen – University of Applied Sciences
  - Developers: Simon Bauer and Martin Mager

- NETCONF server based on open-source software “clixon”
  - Clixon source code at https://github.com/clicon/clixon
  - Clixon supports NETCONF, RESTCONF, and CLI interfaces
  - No builtin NMDA support (so far)

- **Initially supported functions** in draft-ietf-tcpm-yang-tcp
  - Connection list
  - Stats

- Used operating systems
  - **Ubuntu Linux** as example for desktop/server
  - **QNX** as example for embedded networking hardware

- No further issues in YANG model identified
  - Network stack can be accessed by OS-specific APIs (netstat, /proc, etc.)
  - Most development work elsewhere (e.g., chunked framing support by clixon)

- Open-source release TBD
Prototype
NETCONF Server Architecture with clixon

Source: Simon Bauer, Martin Mager, Evaluation eines modellbasierten Managements in verschiedenen Systemumgebungen, Hochschule Esslingen – University of Applied Sciences, 2021
Prototype Plugin for IETF TCP YANG model

Source: Simon Bauer, Martin Mager, Evaluation eines modellbasierten Managements in verschiedenen Systemumgebungen, Hochschule Esslingen – University of Applied Sciences, 2021