Working Group
Draft for TCPCLv4

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Motivations for Updates to TCPCL

1. During implementation of TCPCLv3, Scott Burleigh found an ambiguity in bundle acknowledgment and refusal.

2. For use in a terrestrial WAN, author has a need for TLS-based authentication and integrity. TCPCLv3 mentions TLS but does not specify its use. IETF strongly in favor of TLS for new general-use protocols.

3. Reduced sequencing variability from TCPCLv3

4. Adding extension capability for TCPCL sessions and transfers.
Goals for TCPCLv4

• Do not change scope or workflow of TCPCL.
  ◦ As much as possible, keep existing requirements and behaviors. The baseline spec was a copy-paste of TCPCLv3.
  ◦ Still using single-phase contact negotiation, re-using existing headers and message type codes.
  ◦ Allow existing implementations to be adapted for TCPCLv4.
Last Draft Edits

- Changes are in draft-ietf-dtn-tcpclv4-11.
- Removed separate XFER_INIT message and moved transfer extension items into first XFER_SEGMENT message (when START bit is set).
  - This avoids overhead of extra message and simplifies message sequencing logic.
  - The transfer Total Length has been moved into an extension item (further discussion in later slides).
- Reduced total extension list length from 64-bit to 32-bit.
  - Strong guidance provided in spec to limit the size of extension items.
  - This still allows “large” extensions (for some relative amount of largeness).
- Clarified default and minimum session timeout behaviors.
  - Restored recommended default from TCPCLv3.
- Added a “reply” marking to SESS_TERM message to avoid trivial feedback loop.
  - Now a termination initiation is distinguishable from its acknowledgement.
- Removed encoding variability in SESS_TERM reason code.
  - An “unknown” code is used where previously there was no encoded value.
Minimal TCPCLv4 Implementation

• In the case where a user wants to achieve least-overhead on a reliable private network:
  ◦ No TLS use, no EID exchange, no extensions
  ◦ Always single-segment transfers

• Sequence:
  ◦ Contact header (each direction): 6 octets
  ◦ SESS_INIT (each direction): 25 octets
  ◦ XFER_SEGMENT out: 22 octets + bundle size
  ◦ XFER_ACK in: 18 octets
  ◦ SESS_TERM (each direction): 2 octets

• Overhead for session: 33 octets
• Overhead for each transfer: 40 octets
Transfer Length Extension

• The total length of a segmented transfer is now included in an extension item.

• Moving this data from (removed) XFER_INIT message to extension item saved 2 octets.
  ◦ XFER_INIT+XFER_SEGMENT overhead was 37 octets, now 35 octets when the Transfer Length extension is used.
Demo CL Agent Changes

• The python example agent has been updated to follow new -11 message sequencing.

• New behaviors:
  ◦ Agents are not fully bidirectional and D-Bus controlled to allow multiple sessions both incoming and outgoing.
  ◦ Performs graceful SESS_TERM sequencing on KeyboardInterrupt (Ctrl+C) or D-Bus command.
  ◦ Implemented segment-scaling algorithm to target a desired time-to-acknowledge as a proof of concept.

• Also implemented random message generator to exercise demo agent and wireshark plugin.
New Wireshark Dissectors

• For TCPCLv4:
  ◦ Decodes Contact Header and all defined Message types.
  ◦ Handles TLS in sessions.
  ◦ Decodes session and transfer extension items.
  ◦ Performs several sequence checks with warnings.
  ◦ Performs SEGMENT--ACK cross-linking and timing.
  ◦ Reassembles segments of a transfer into a single data block.
  ◦ Validates CBOR decoding of the bundle content.

• For BPv7:
  ◦ Verifies proper bundle header/footer.
  ◦ Decodes primary and canonical blocks.
  ◦ Decodes type-specific data defined in the core spec.
  ◦ Ran into issues with CRC use, may need to clarify in BP spec.
### Wireshark Screenshot

<table>
<thead>
<tr>
<th>Time</th>
<th>Sequence</th>
<th>Source IP</th>
<th>Destination IP</th>
<th>Protocol</th>
<th>Length</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.001473487</td>
<td>localhost.localdomain localhost.localdomain TCP</td>
<td>66 dtn-bundle</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.002315871</td>
<td>localhost.localdomain localhost.localdomain TCP</td>
<td>72 Contact He</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.002321587</td>
<td>localhost.localdomain localhost.localdomain TCP</td>
<td>66 41856 → dst</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.003273943</td>
<td>localhost.localdomain localhost.localdomain TCP</td>
<td>97 SESS_INIT</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.004121492</td>
<td>localhost.localdomain localhost.localdomain TCP</td>
<td>97 SESS_INIT</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.045463400</td>
<td>localhost.localdomain localhost.localdomain TCP</td>
<td>66 41856 → dst</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Transmission Control Protocol, Src Port: 41856 (41856), Dst Port: dtn-bundle (4556), Seq: 3985000

- **TCP Convergence Layer Version 4**
  - **TCPCLV4 Message, Type: XFER_SEGMENT (0x1), Xfer ID: 1, Flags: START|END**
    - Message Type: 0x01
    - Transfer Flags: 0x03
    - **Transfer ID: 0x0000000000000001**
    - Extension Items Length (octets): 15
    - Transfer Extension Item (0x1)
      - Data Length (octets): 91
      - Data: 9f890700016b64657374696e6174696f6e66736f75726365...
      - [Seen Length: 91]
      - [Expected Total Length: 91]
      - [Related XFER_ACK: 12]
      - [Acknowledgment Time: 0.007989159 seconds]

#### Bundle Protocol Version 7

Frame (194 bytes)  Bundle Payload (7 bytes)
Open Issues from Feedback

• Concern about allowed extension item encodings.
  ◦ Currently the Extension Item data Length field is 32-bit.
  ◦ This is oversized from minimum expected use.
  ◦ This also avoids any possible issue with large extension items.
  ◦ Is it worth shaving octets to possibly run into size-overflow issues?
    ◦ An Extension Item Length of 16-bits could be used with more complex multiple-item sequencing to implement larger data payloads.
  ◦ Are we concerned with two octets in an optional mechanism?
Way Forward for TCPCLv4

• Further set of editorial changes to fix some typos and to include type/reason codes in the spec body tables (not just in the IANA tables).

• Working implementation is available for interoperability testing
  ◦ Implemented in scapy/python for ease of understanding.
  ◦ Handles concurrent sessions and asynchronous socket events.
  ◦ Does not implement BP agent behavior, only CL behavior.

• Working Wireshark protocols for troubleshooting implementations and analyzing traffic.
  ◦ These supersede the “Bundle” protocols in stock Wireshark 2.6