

DTN7

An Open-Source Disruption-tolerant Networking
Implementation of Bundle Protocol 7

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Siebt er

~~AdHoc Now 2019~~

[hsmr]

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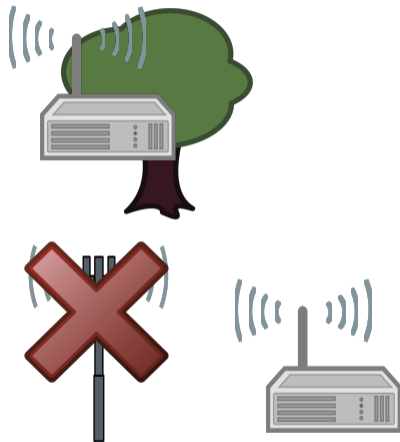
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Delay / Disruption-tolerant Networking (DTN)

- ▶ Situations without a reliable uplink
 - ▶ Environmental monitoring in remote areas
 - ▶ Destroyed telecommunication infrastructure
 - ▶ Internet access is blocked

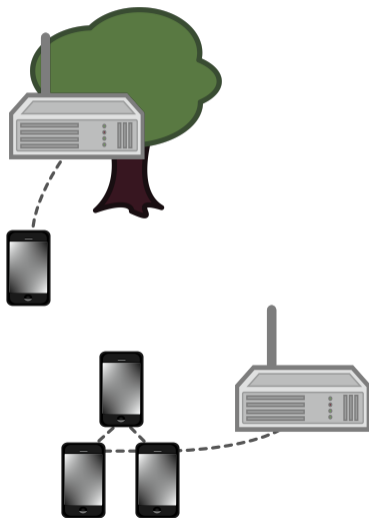
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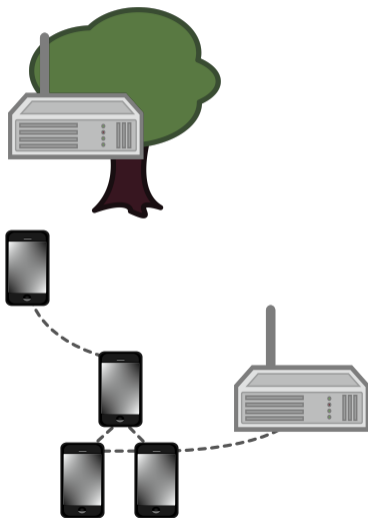
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 - ▶ Hop-by-hop transport
 - ▶ Opportunistic or scheduled contacts to neighbors
 - ▶ Allows large time window between two transmissions



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DTN7

This brings us to DTN7...

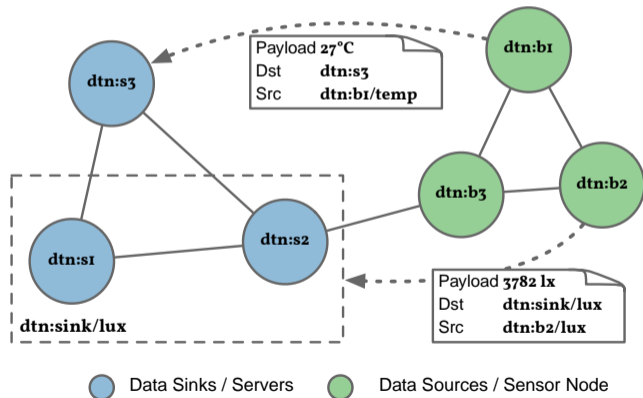
- ▶ Free and open-source DTN software
- ▶ Written in the Go programming language
- ▶ Modularized design, easy to extend
- ▶ Implementation of the recently released Bundle Protocol (BP)

Bundle Protocol Version 7 (BP)

- ▶ Describes both a DTN architecture and protocol
- ▶ Still in development, but nearly finished
- ▶ Latest draft (version 14) was released on 04.08.2019
- ▶ Aims to obsolete Bundle Protocol Version 6, RFC 5050

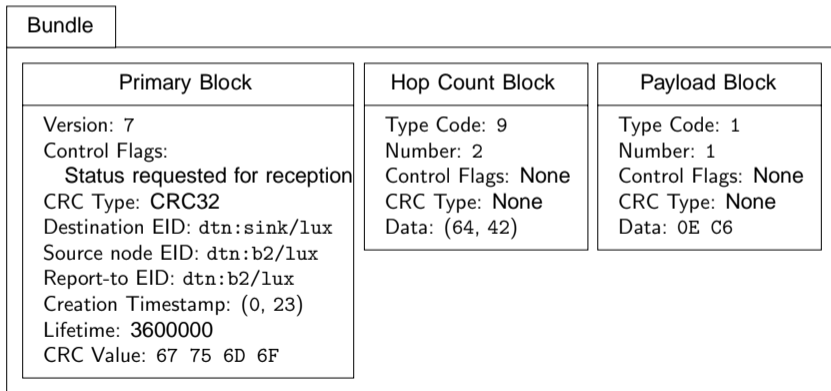
Nodes and Endpoints

- ▶ Nodes are identified by an Endpoint ID (URI), e.g., `dtn:node`
- ▶ A node might be addressed by multiple Endpoint IDs
- ▶ An Endpoint ID might represent multiple nodes



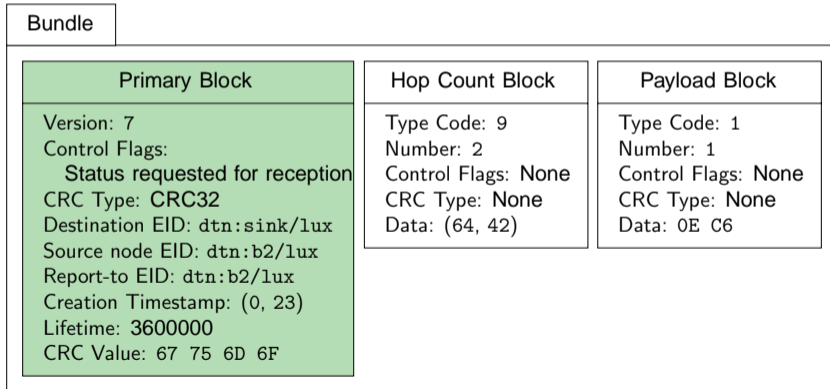
Bundles and Blocks

- ▶ BP packets are called Bundles
- ▶ A Bundle is a sequence of Blocks
- ▶ Binary represented in CBOR, RFC 7049



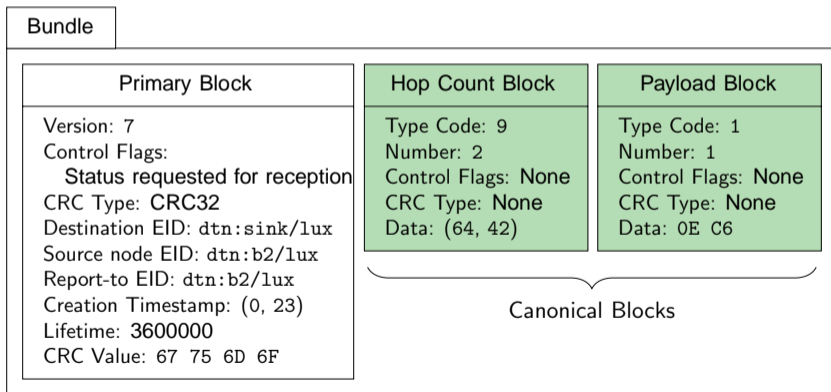
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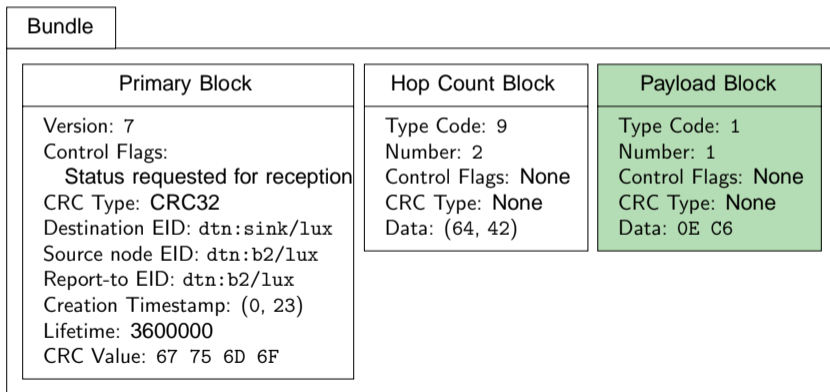
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Bundle Exchange

- ▶ Convergence Layer
 - ▶ Transport technology for Bundles between nodes
 - ▶ Implemented: MTCP, TCP, **LoRa**
 - ▶ Possible: Bluetooth, ~~LoRa~~, Email, QR code, Pigeon, ...
- ▶ Routing
 - ▶ Selection of neighbors for Bundle delivery
 - ▶ Implemented: DTLSR, Spray and Wait, Epidemic Routing, **PROPHET**

Other DTN7 Components

- ▶ Store for Bundles that are waiting for delivery
- ▶ RESTful API to dispatch and fetch Bundles
- ▶ Peer Discovery to detect nearby nodes

DTN7 Programs

- ▶ dtnd: DTN daemon
- ▶ dtncat: command line tool

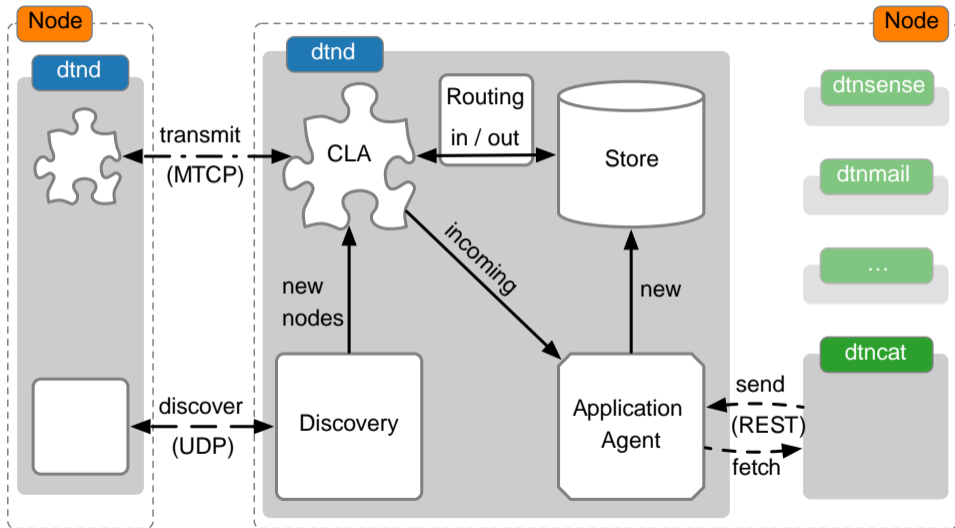
```
# Sending a Bundle
```

```
$ dtncat send http://localhost:8080/ dtn:sink/lux <<< "3782 lx"
```

```
# Retrieving a received Bundle
```

```
$ dtncat fetch http://localhost:8080/
```

DTN7 Architecture

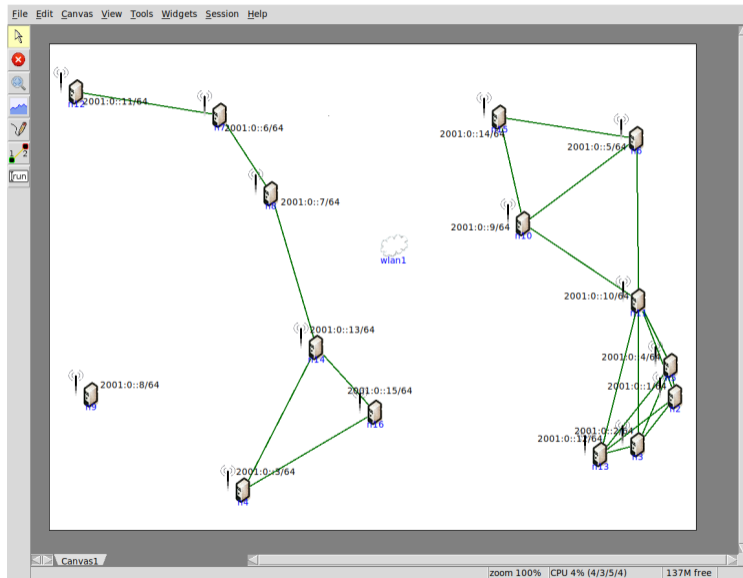


Evaluation

- ▶ Up to 64 nodes emulated in the Common Open Research Emulator (CORE)
- ▶ Nodes are connected pairwise in a chain topology
- ▶ Simulated IEEE 802.11g network, 54 MBit/s



CORE



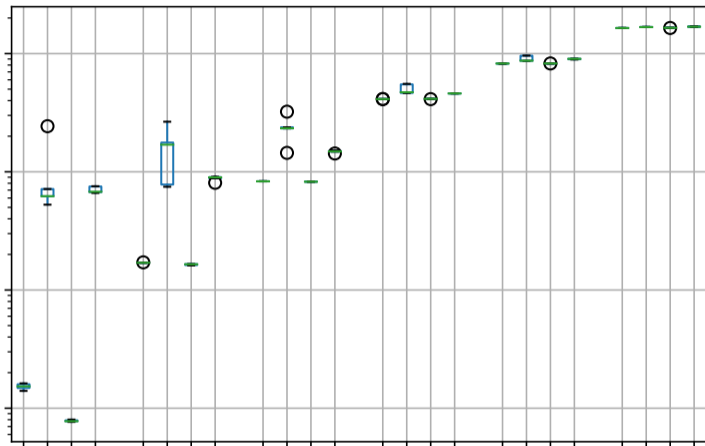
Evaluation

- ▶ Payload Size
 - ▶ 64 KiB: compressed image
 - ▶ 1 MiB: small image / short audio recording
 - ▶ 5 MiB: smartphone image / audio recording
 - ▶ 25 MiB: longer audio recording / short video
 - ▶ 50 MiB: HD video
 - ▶ 100 MiB: 4K smartphone video

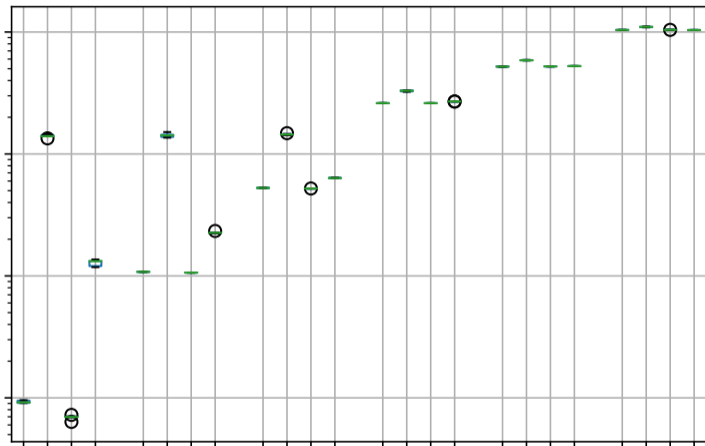
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- ▶ DTN Software
 - ▶ DTN7
 - ▶ Forban
 - ▶ IBR-DTN
 - ▶ Serval

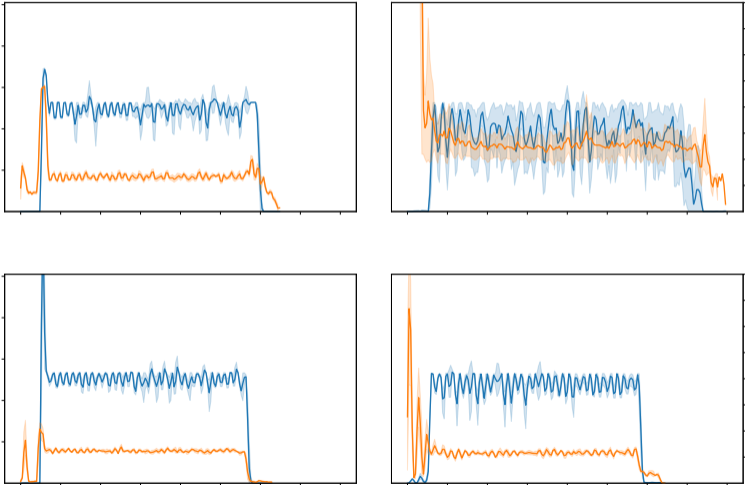
Transmission Time: Two Nodes



Transmission Time: 64 Nodes



CPU and Network Usage: 32 Nodes, 25 MiB



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<https://dtn7.github.io/>