Technische Universität Braunschweig

µDTN: Unifying DTNs and WSNs

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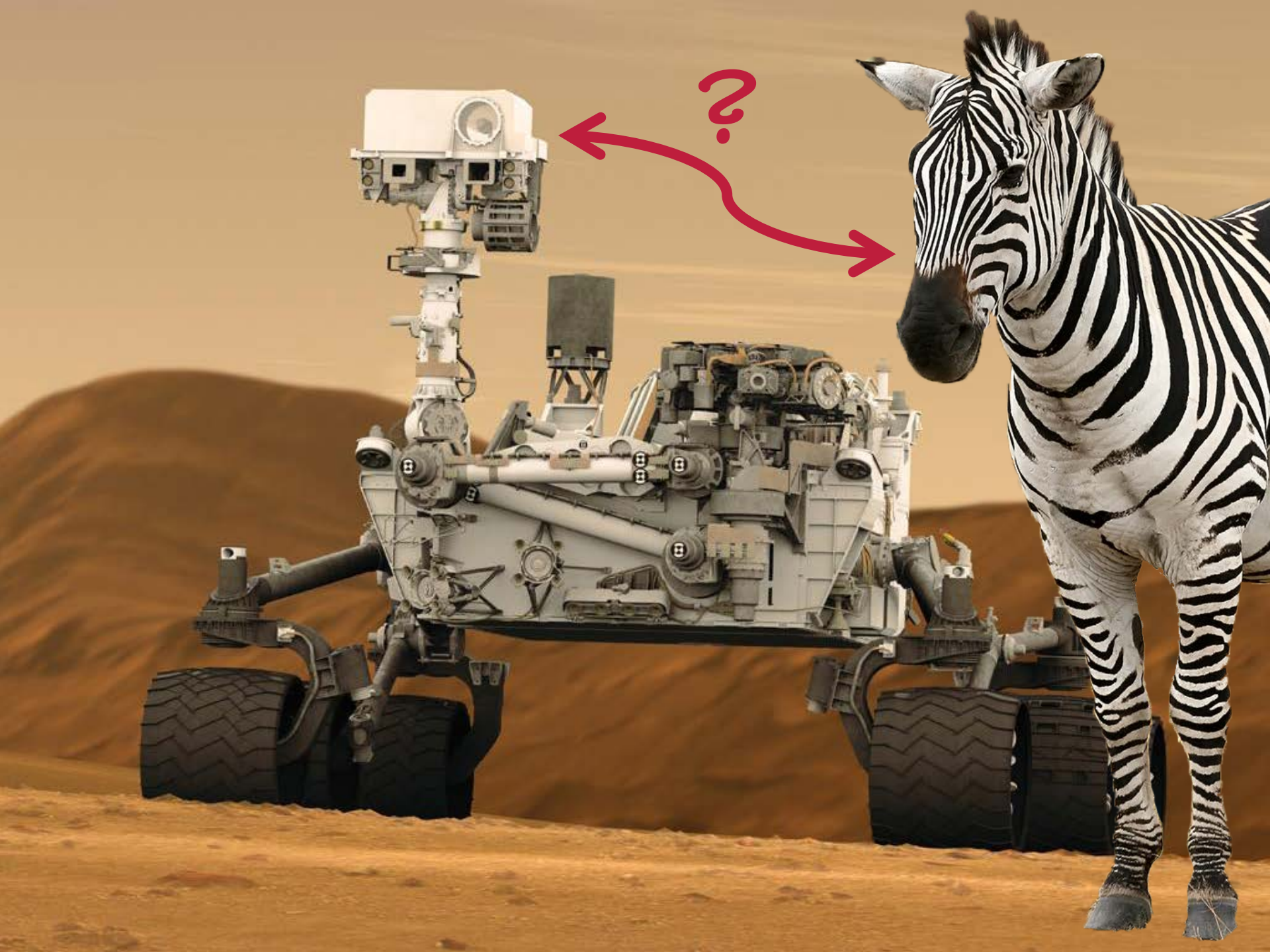
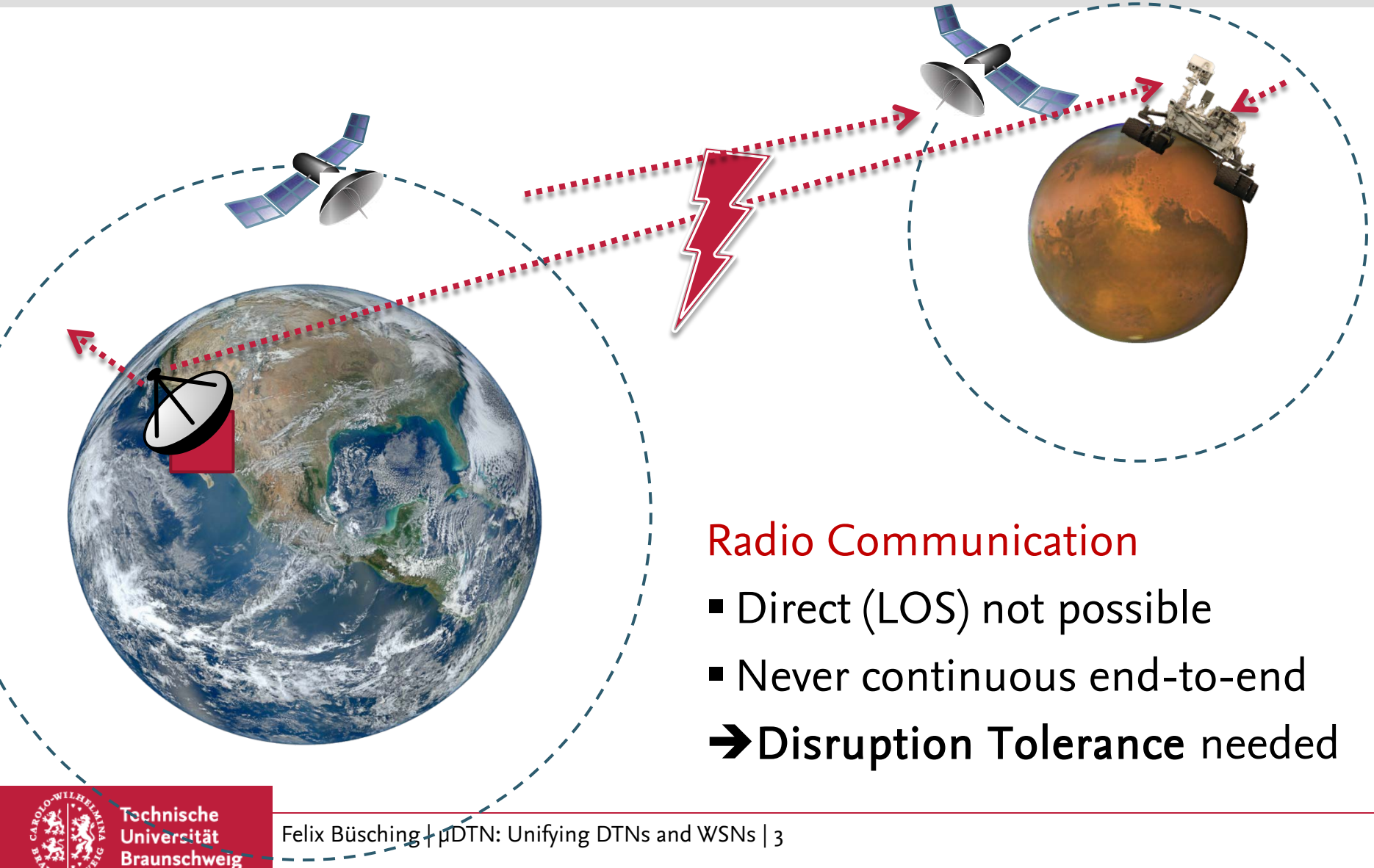


Interstellar Communication

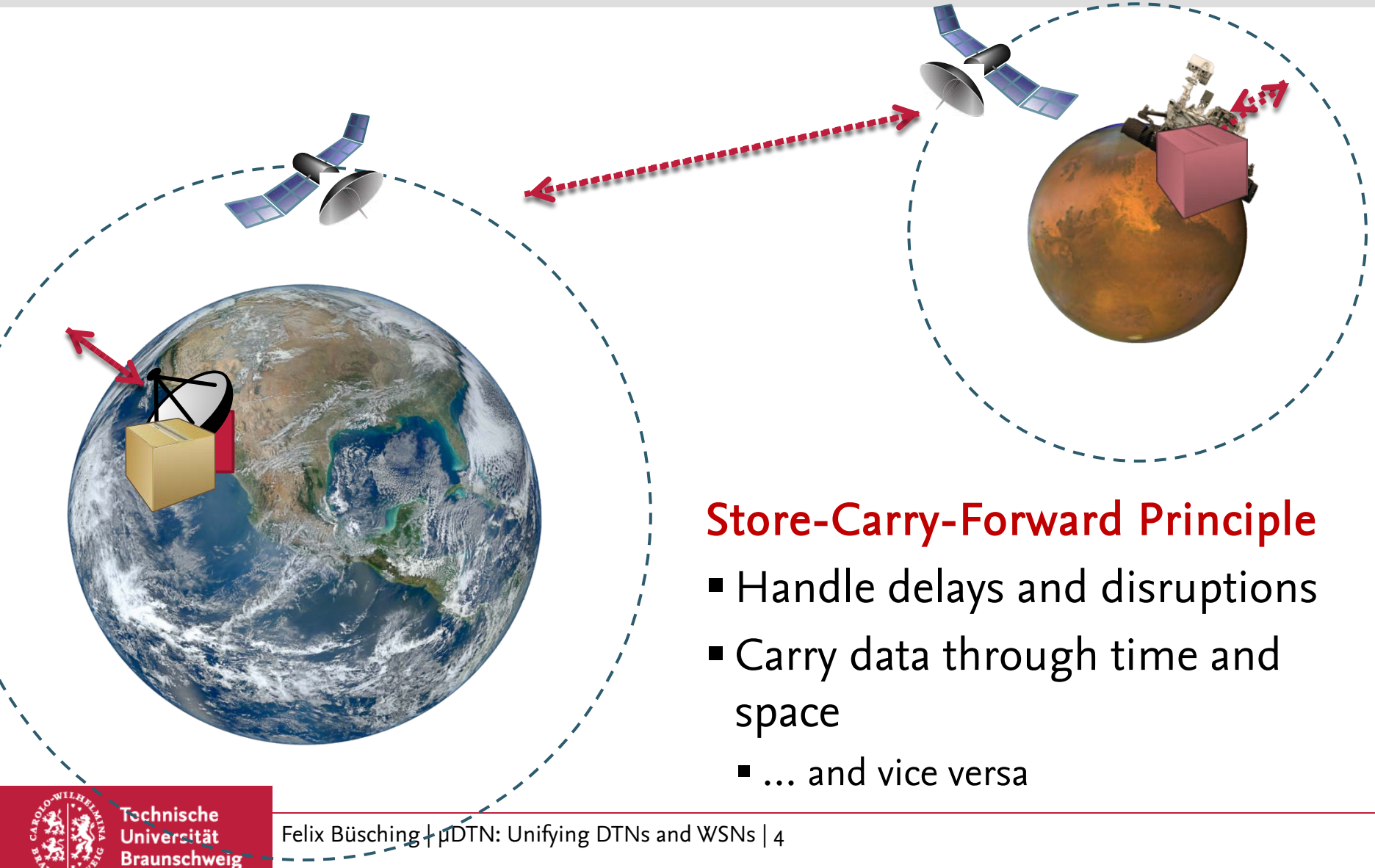


Radio Communication

- Direct (LOS) not possible
- Never continuous end-to-end

➔**Disruption Tolerance** needed

Disruption Tolerant Networks (DTN)



Store-Carry-Forward Principle

- Handle delays and disruptions
- Carry data through time and space
  - ... and vice versa

CURIOSITY

Summary: Interstellar Communication – e.g. Mars Rover "Curiosity"

Aim

- Collect data, transfer it to earth

Challenges

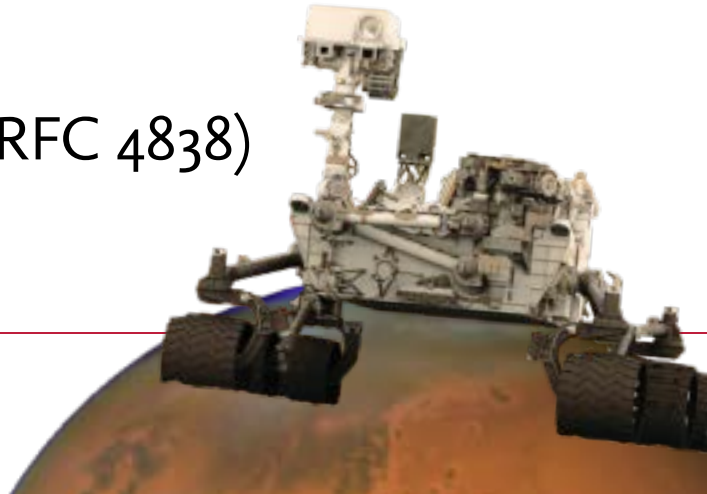
- Harsh environment
- Huge delays
- No continuous end-to-end connection

Approach

- Store, carry, forward principle

Solutions / Standards

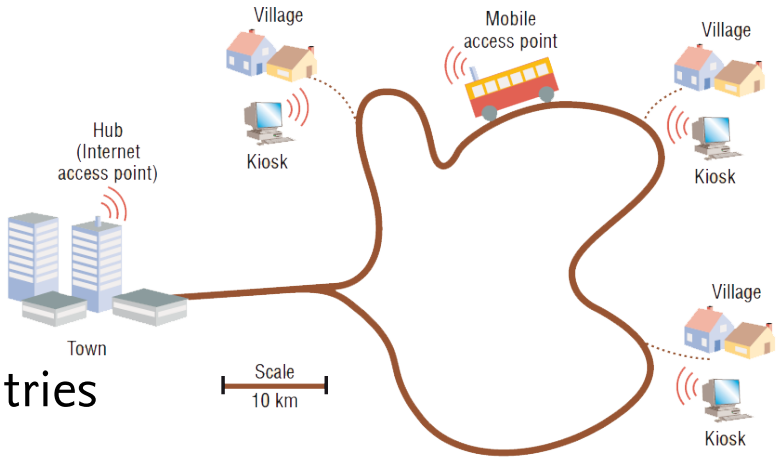
- Delay-Tolerant Networking Architecture (RFC 4838)
- Bundle Protocol Specification (RFC 5050)

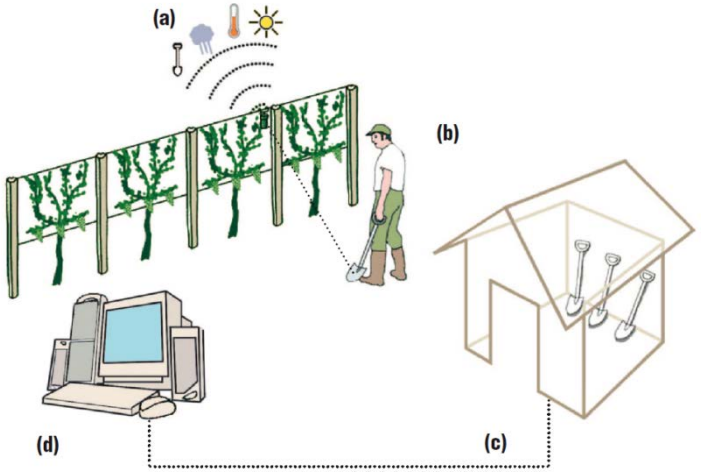


Delay Tolerant Networks (DTNs) in WSNs

Many different projects

- Zebranet
  - Zebras in Kenya
- DakNet
  - Internet/E-Mail access for developing countries
- Vineyard Computing
  - Vineyards in USA
- …





Summary: DTNs in WSN

Aim

- Collect data, transfer it to base station(s)

Approach

- Store, carry, forward principle

Challenges

- Harsh environment
- Huge delays
- Often disrupted connection

Solutions

- Many individual!

Standards

- None!

Recommendation

- Look above!

Concept: Use Standard Protocols in DT-WSNs

"Standards"

- Delay-Tolerant Networking Architecture (RFC 4838)
- Bundle Protocol Specification (RFC 5050)

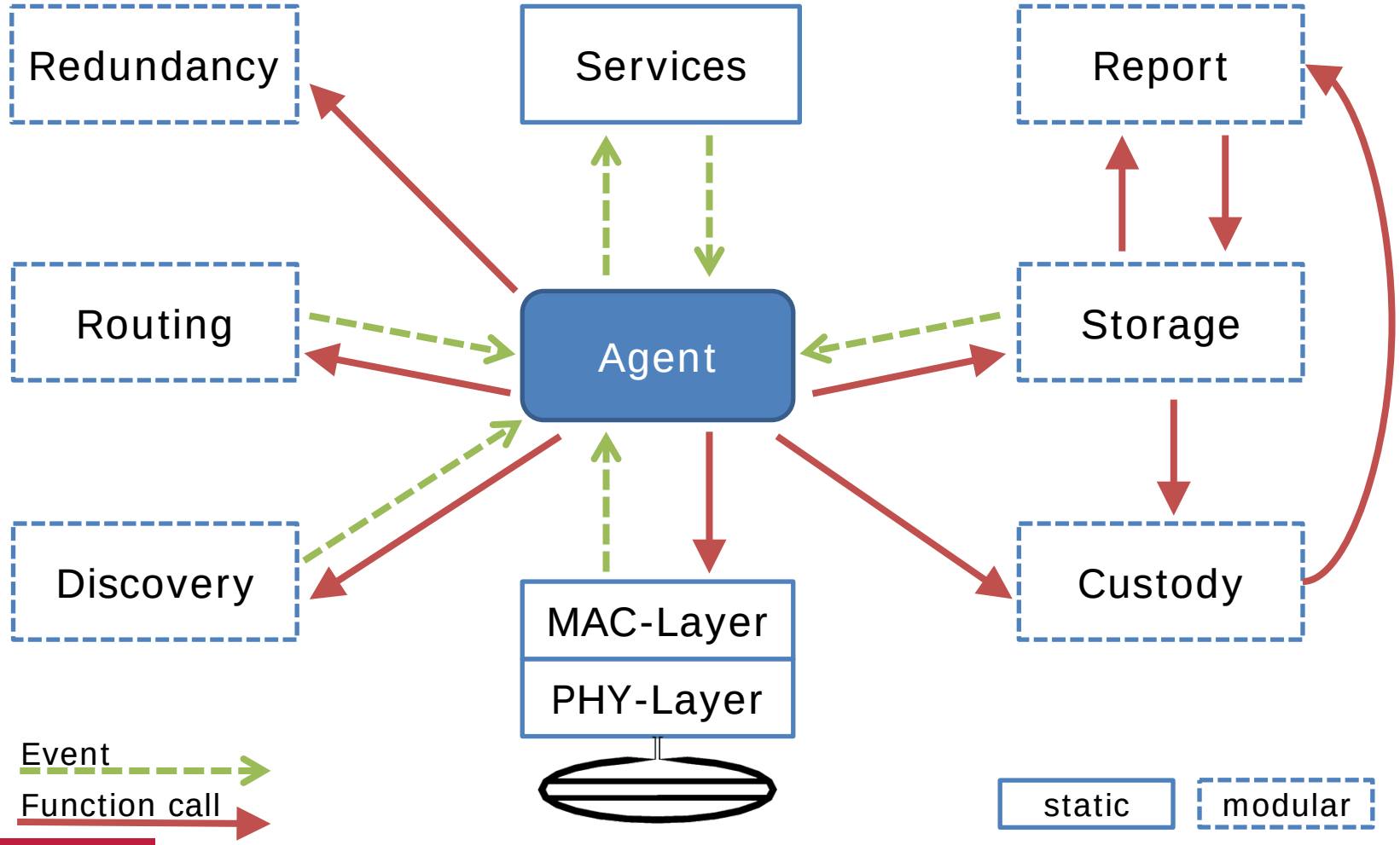
Pros

- It's existent and works
  - People are using it in space!
- It's an RFC

Cons

- Not very lightweight
  - Specialized solution more efficient
- RFC is not a standard

Implementation: µDTN



Details: µDTN – Bundle Protocol (BP) Implementation for Contiki

Implementation for Contiki

- Should be easy portable

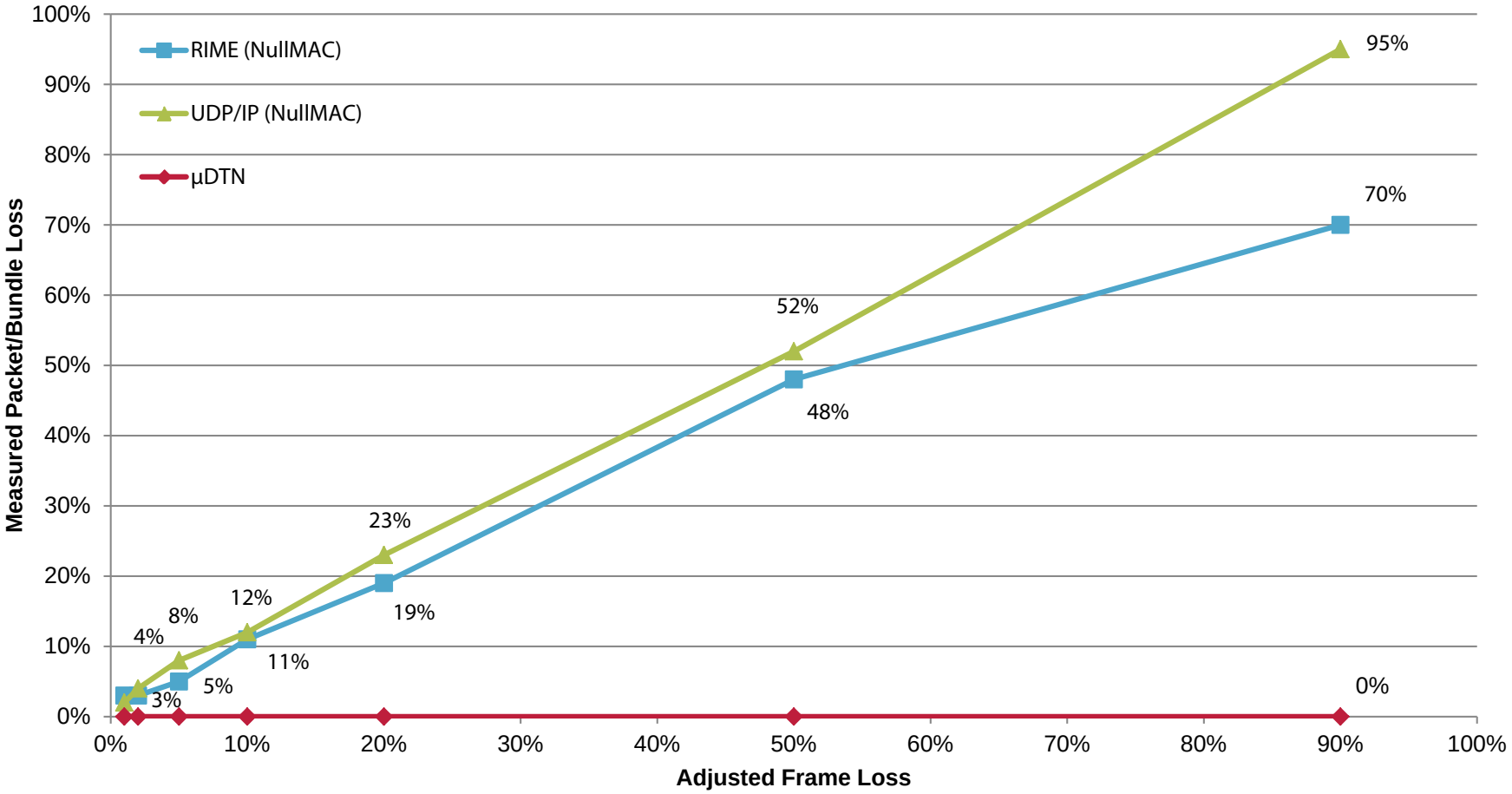
Compatible to RFC 5050

- Only Compressed Bundle Header Encoding (CBHE) supported
  - Bundle Protocol: Addressing by strings
  - dtn://node/service → 42:23

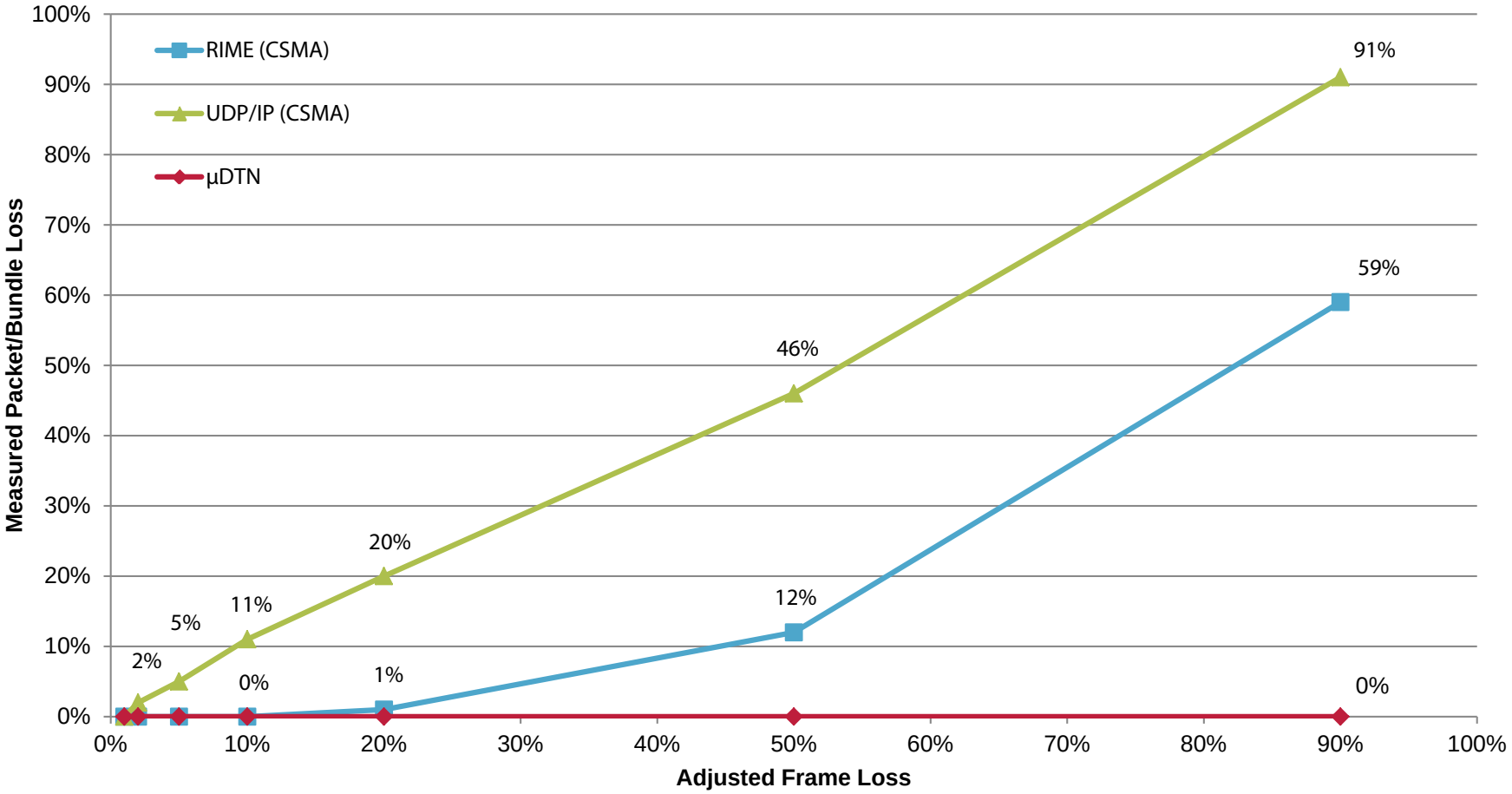
Located above MAC-Layer

- Contrast to most other implementations
- Reduced overhead

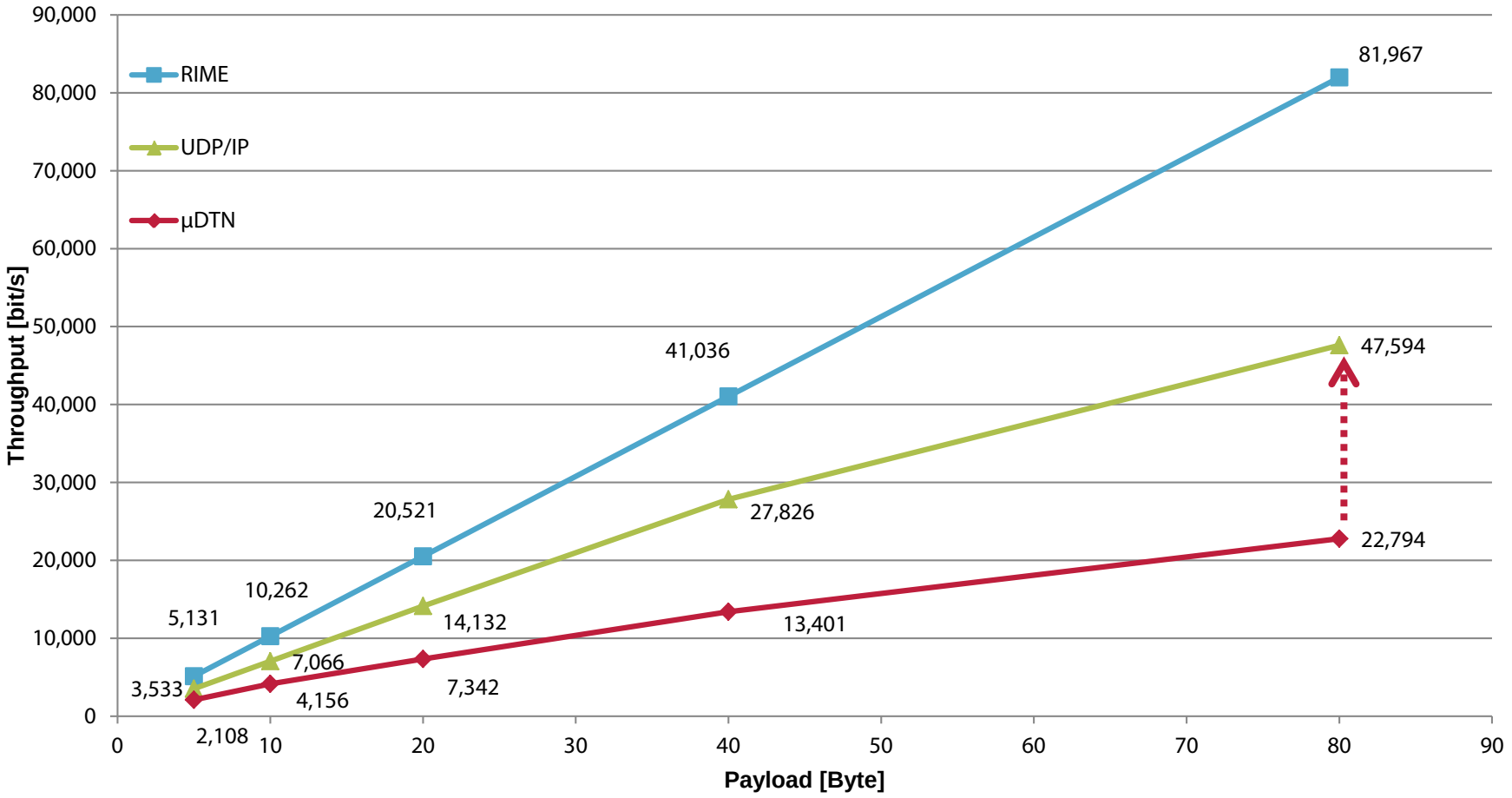
Evaluation: Frame Loss (Cooja, NullMac)



Evaluation: Frame Loss (Cooja, CSMA)



Evaluation: Throughput (TMote Sky)



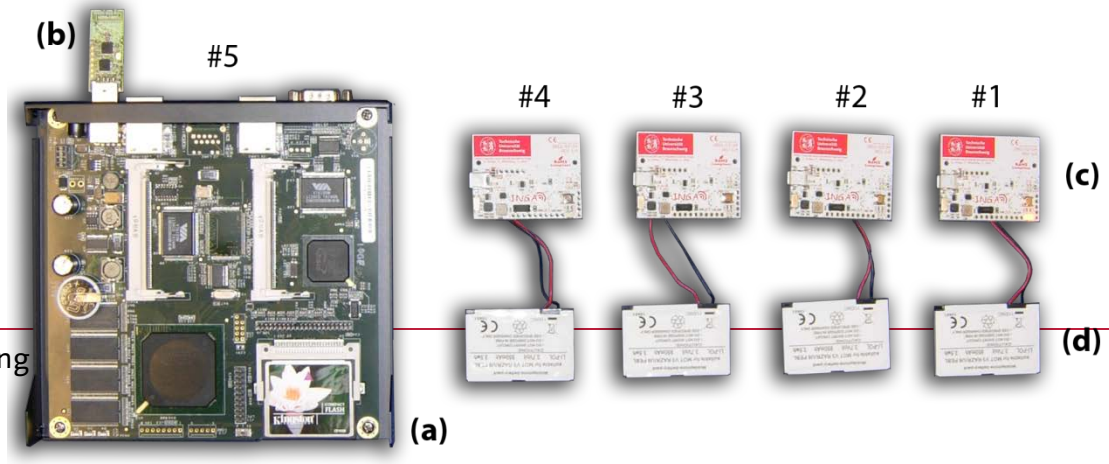
Current State

µDTN successfully tested

- Cooja simulator
- Tmote Sky
- INGA

Heterogeneous Communication

- Tmote <-> INGA
- INGA <-> USB-Gateyway
- Interoperable with other standard BP implementations



Conclusion

Similar requirements for DTNs in space and WSNs

- Demand of robust and reliable communication
- Use standards, wherever applicable

µDTN is RFC 5050 conform Bundle Protocol implementation

Use it!

- http://www.ibr.cs.tu-bs.de/projects/mudtn

Thanks for your attention!

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