The Spontaneous Virtual Networks Architecture for Supporting Future Internet Services and Applications

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GI/ITG KuVS Fachgespräch Future Internet

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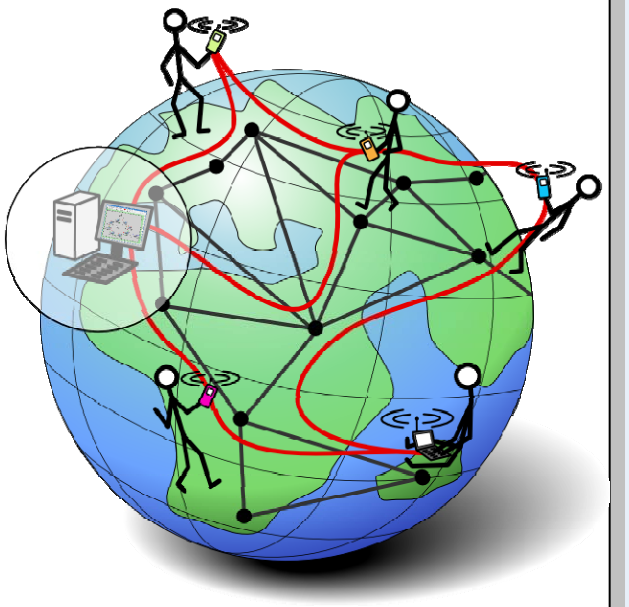
Future Internet

- Internet has evolved from 4-node network to ubiquitous, global communication network
  - → But … is it flexible enough for the future?



- Patchwork design and deployment problems
  - "Half" layers: IPsec, MPLS (2.5); TLS (3.5) …
  - TCP adaptations to wireless, mobile etc.
  - Multicast, MobileIP → Deployment?
- How to improve flexibility?
  - → Calls for new architectures !?
  - Clean slate … time horizon of 10 years and more?
  - Overlay-based architecture … the way SpoVNet goes!

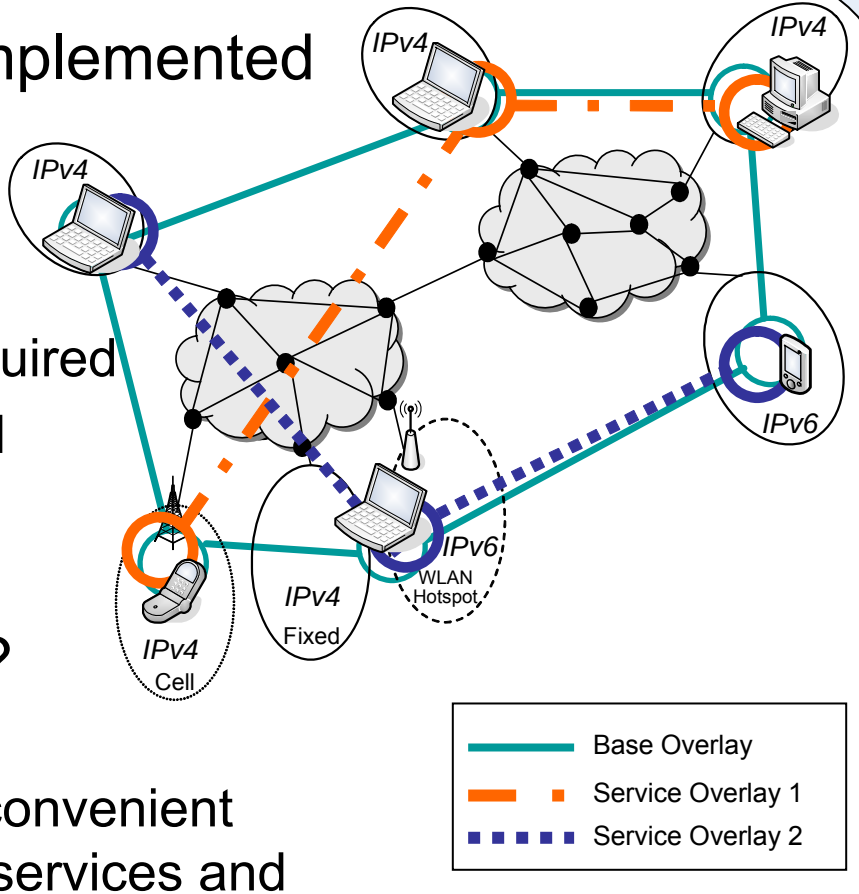
Spontaneous Virtual Networks - Objectives

1) Provide communication services flexibly, adaptively and spontaneously on top of heterogeneous networks

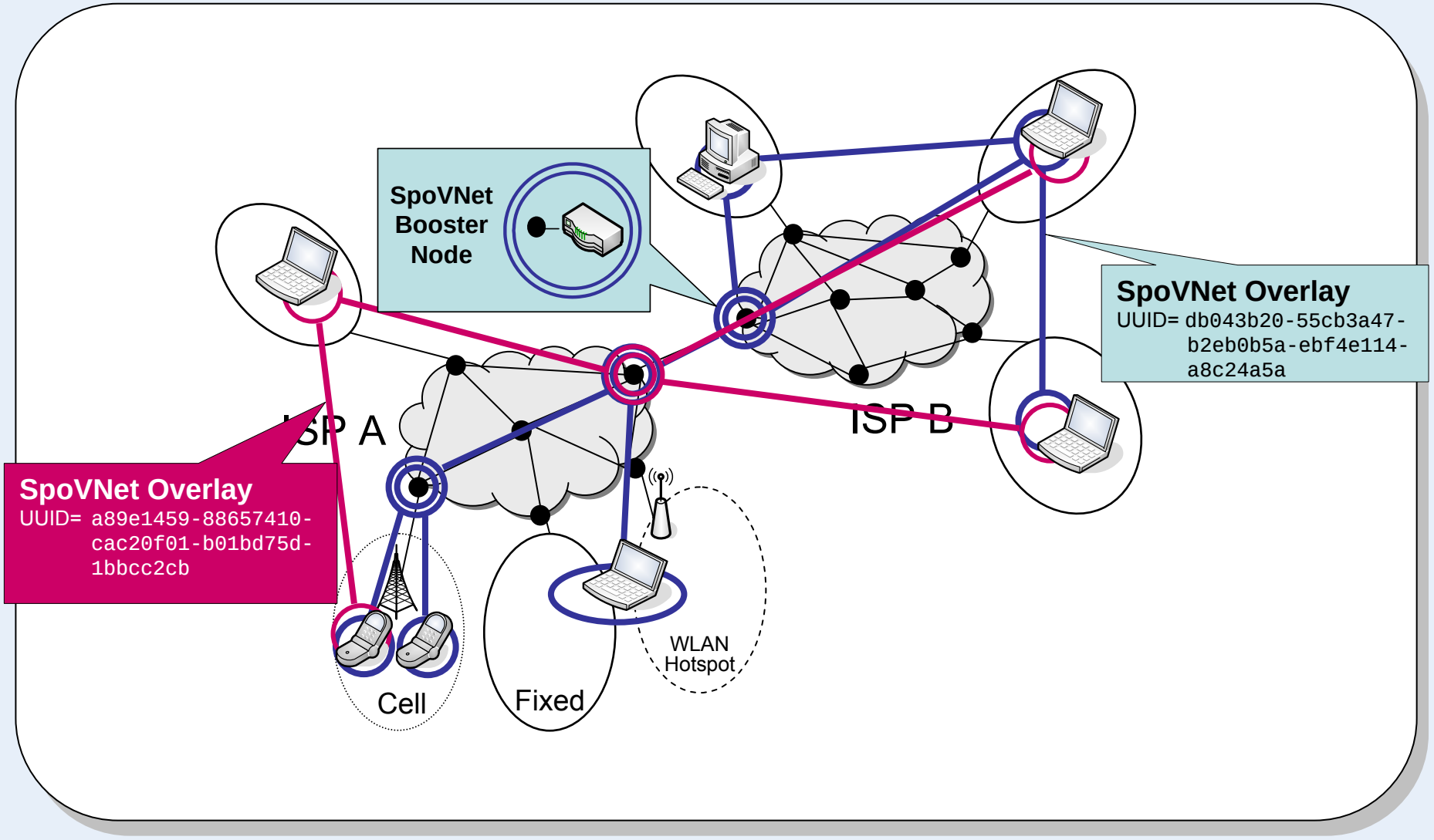
2) Enable seamless transition from current to future networks

SpoVNet in a Nutshell

- Extensible set of services implemented by overlays
  - Spontaneous and flexible per application
  - No infrastructure support required
  - Self-organizing, scalable and robust
- Differences to other Overlay-based approaches?
  - Framework provides generic (transport-)mechanisms for convenient realization of overlay-based services and innovative applications
  - Optimization and adaptivity using Cross-Layer Information



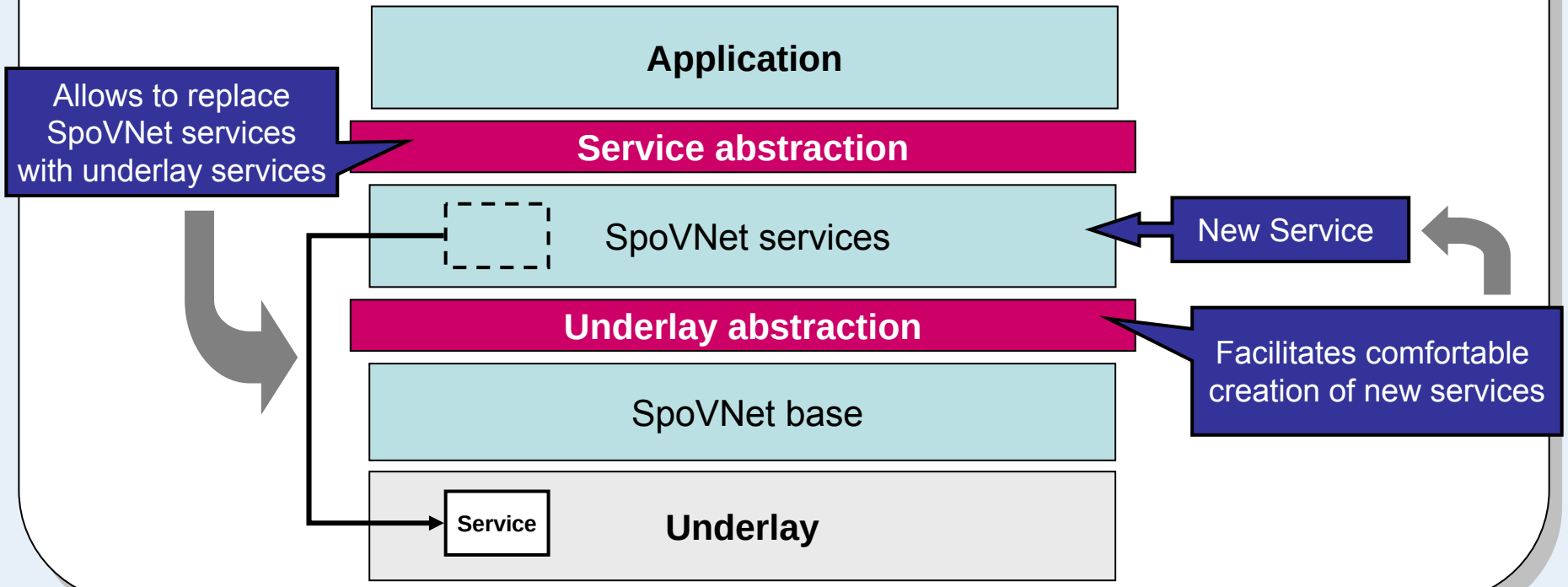
Optional Performance Boost – Booster Nodes



SpoVNet Architecture

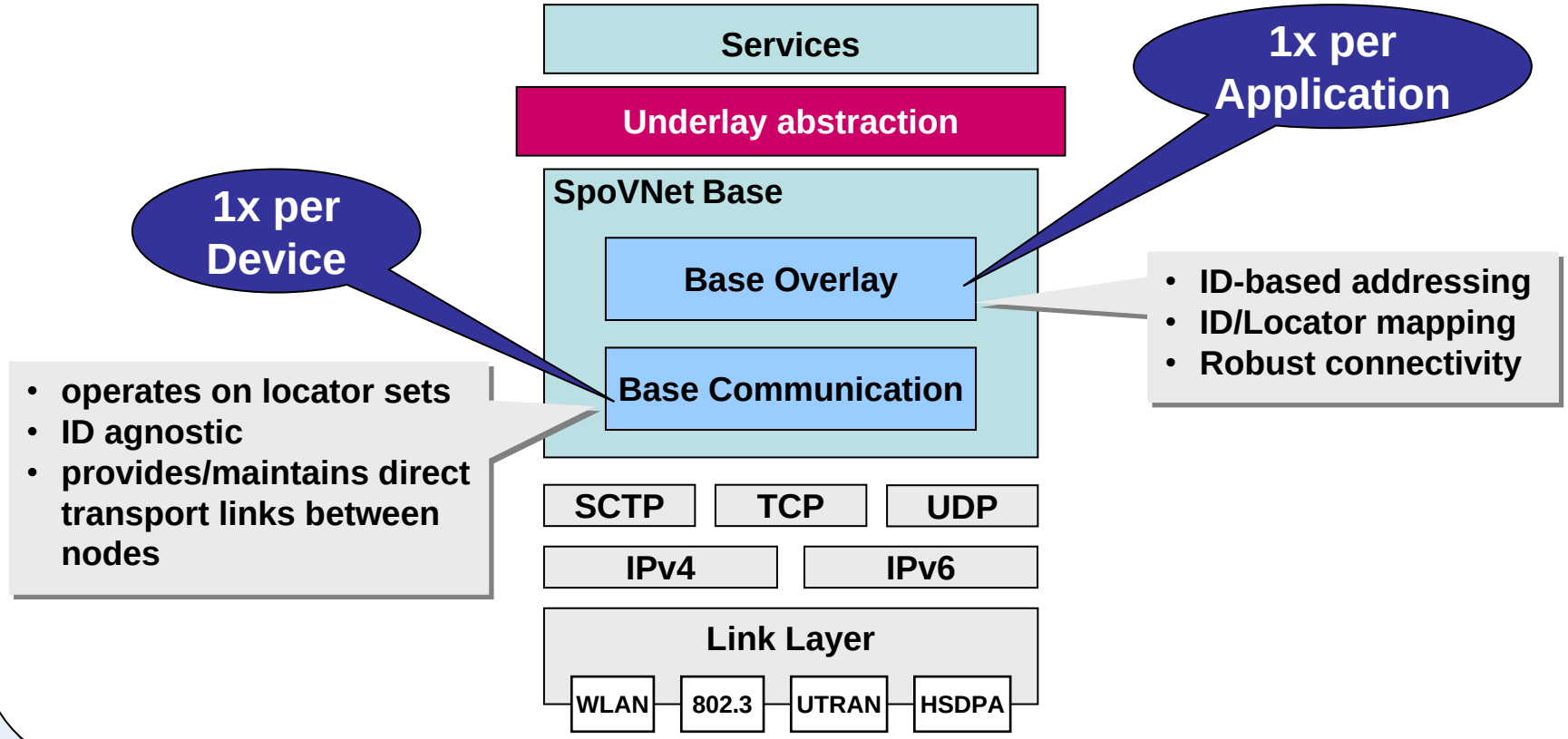
provides a framework that

1) allows comfortable creation of application supporting (overlay-)services in heterogeneous networks (e.g., multicast)
2) assures that these services can be incrementally replaced by evolving underlay services (e.g., IP multicast, QoS support)

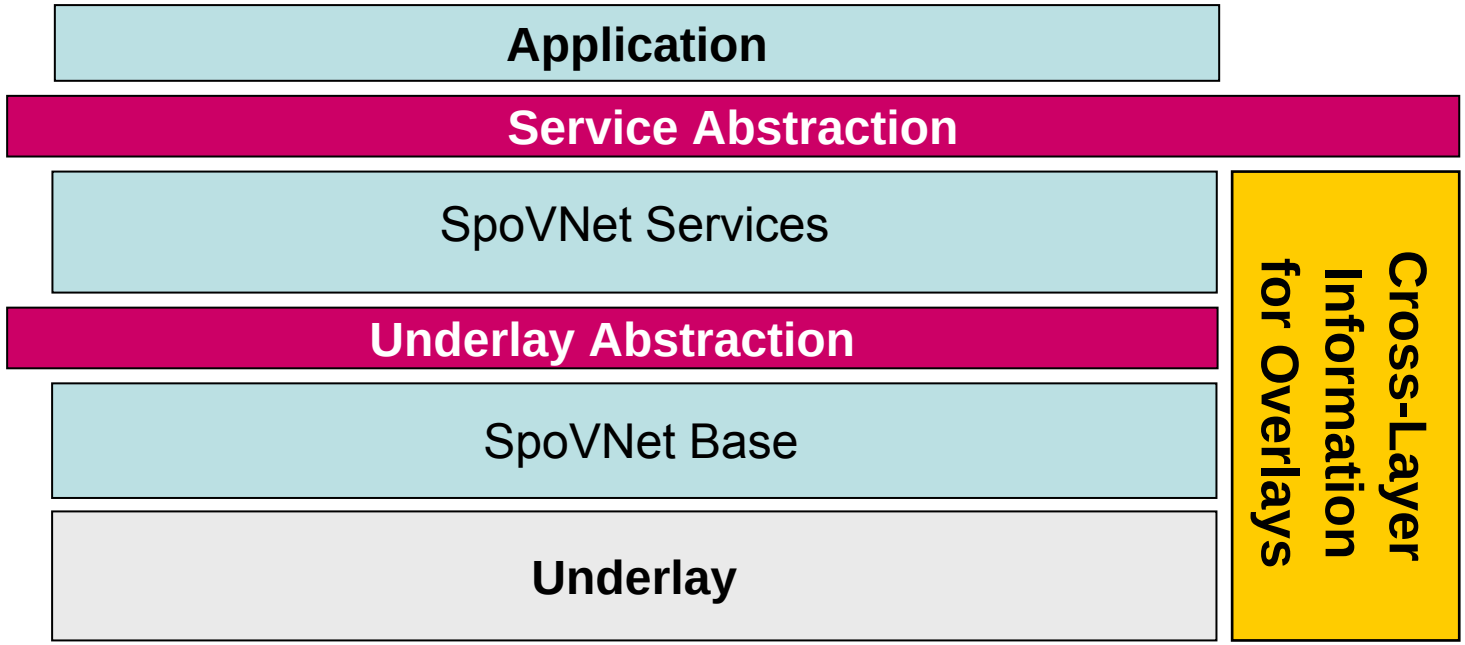


SpoVNet Underlay Abstraction

- Provides generic transport mechanisms hiding mobility, multi-homing and heterogeneity



Cross-Layer Abstraction



- The Cross-Layer Information for Overlays (CLIO) provides abstract cross-layer information

  →Services and applications can now adapt autonomously to changing network conditions

Further Features

- Base Communication
  - Sending one-shot (datagram) messages
  - Handling of mobility, multi-homing, heterogeneity (relaying)
  - Allows for hidden SpovNets and secured bootstrapping
- Base Overlay
  - Creating a SpoVNet instance
    - Initiator fixes properties (ID, cryptographic functions, authentication policy)
  - Joining a SpoVNet instance
    - Requires authorization and integration into Base Overlay
  - Integrated Security
    - Overlay (control) traffic is encrypted and integrity protected
    - Authentication Mechanisms – Cryptographic node and SpoVNet identifiers
    - Authorization Mechanisms: Centralized/Decentralized
- Services
  - Multicast-Multipeer
  - Event Observation and Notification
  - Legacy Application Service

Conclusion & Future Work

- SpoVNet …
  - … enables flexible, adaptive, and spontaneous provisioning of application-oriented and network-oriented services
  - approach between pure end-to-end overlay and virtual network architectures (virtualization down to the underlay)
- SpoVNet Underlay Abstraction
  - Supports easy creation of overlay-based services
  - Identifier-based addressing scheme
  - Generic transport mechanisms to deal with underlay characteristics (mobility, multihoming, heterogeneity, …)
  - Transparent selection of transport- and network-layer protocols to provide persistent transport links
- Current work
  - Evaluation by simulation models
  - Prototypical implementation → will be published as Open Source