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Motivation



- SpoVNet Services

- Built as **overlay** networks upon **heterogeneous** underlays
- **Spontaneously** created – no underlay support needed
- **Adapt** to changing network conditions

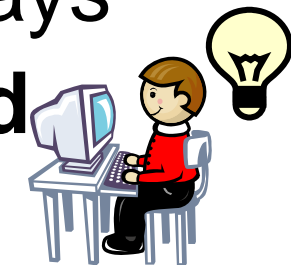
→ How can those overlays be

- created **comfortably**? 
- **secured**? 
- optimized with **cross-layer-information**?

Our Architectural Contribution



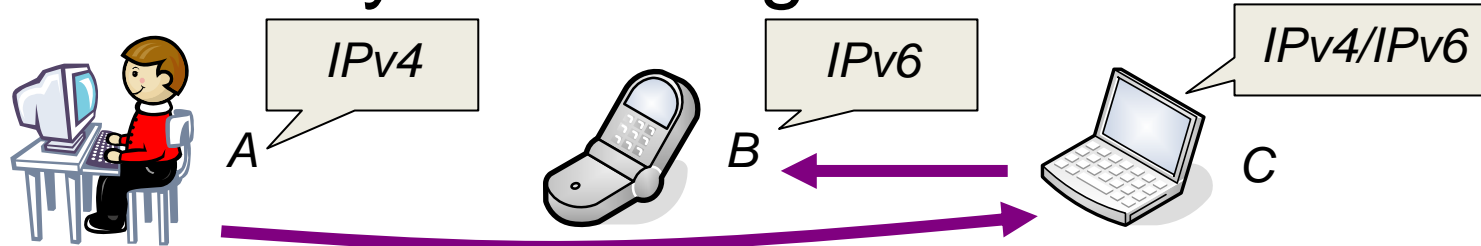
- Divide overlay construction into two parts
 - Provide abstract transport connectivity with Base Communication
 - Provide location independent identifier addressing using the Base Overlay
- Consider security right from the start
 - Integrated security!
- Provide X-layer information for overlays
 - **Support comfortable creation and deployment of new services**



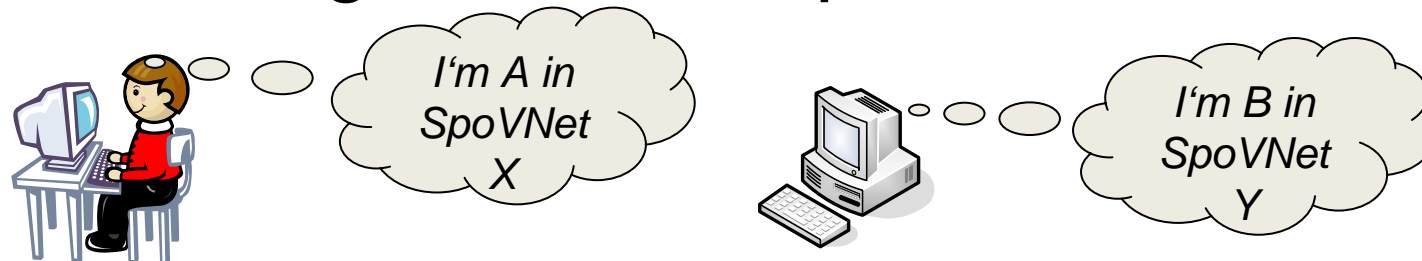
Selected Contributions



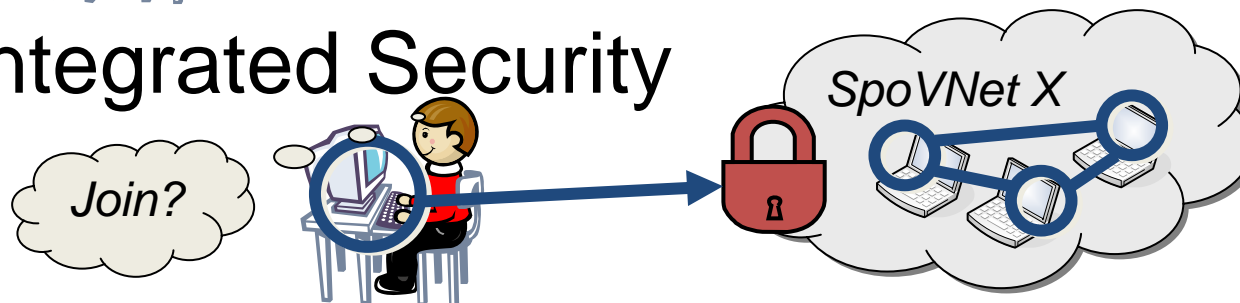
1. Connectivity in heterogeneous networks



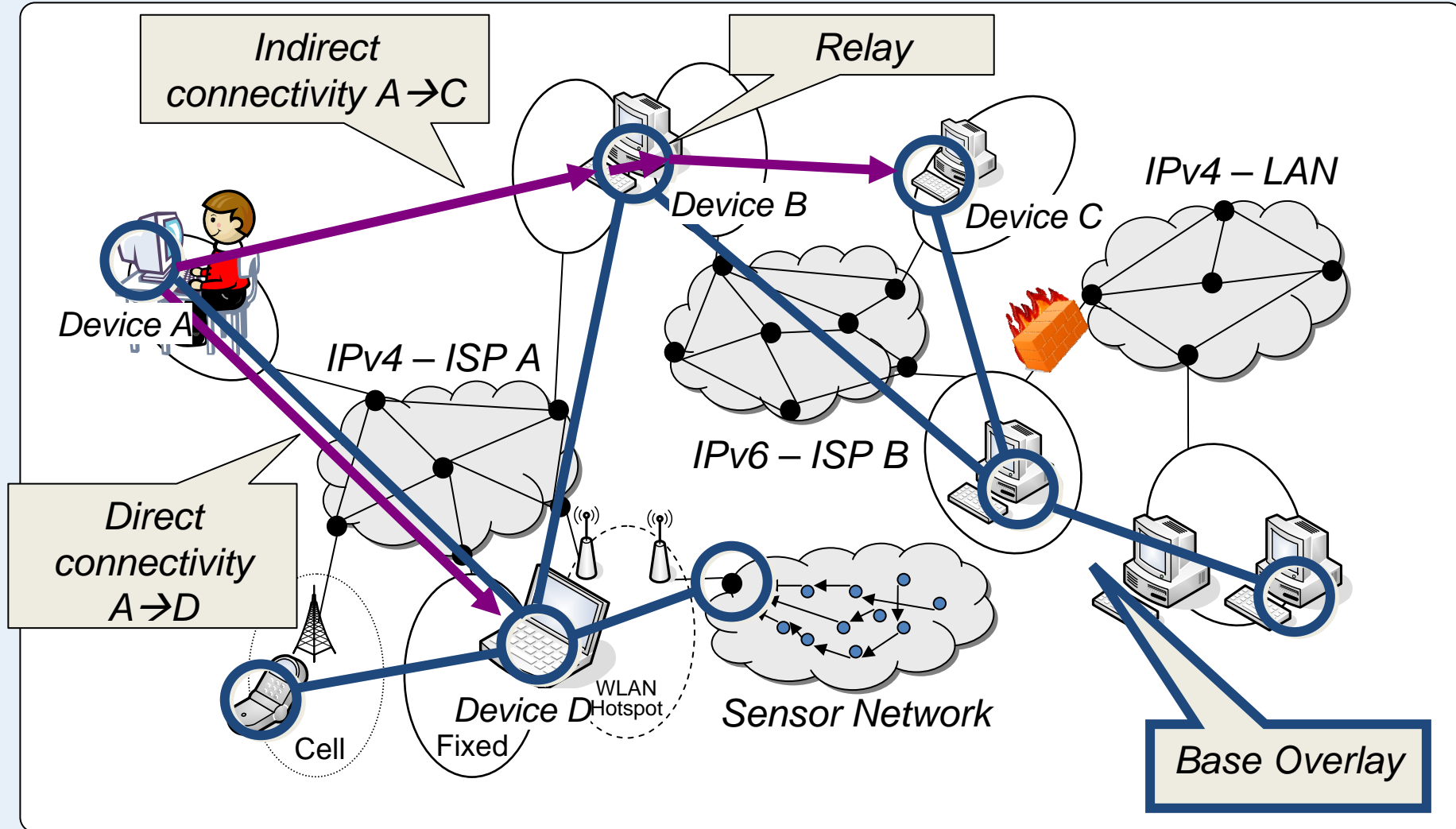
2. Addressing and namespaces



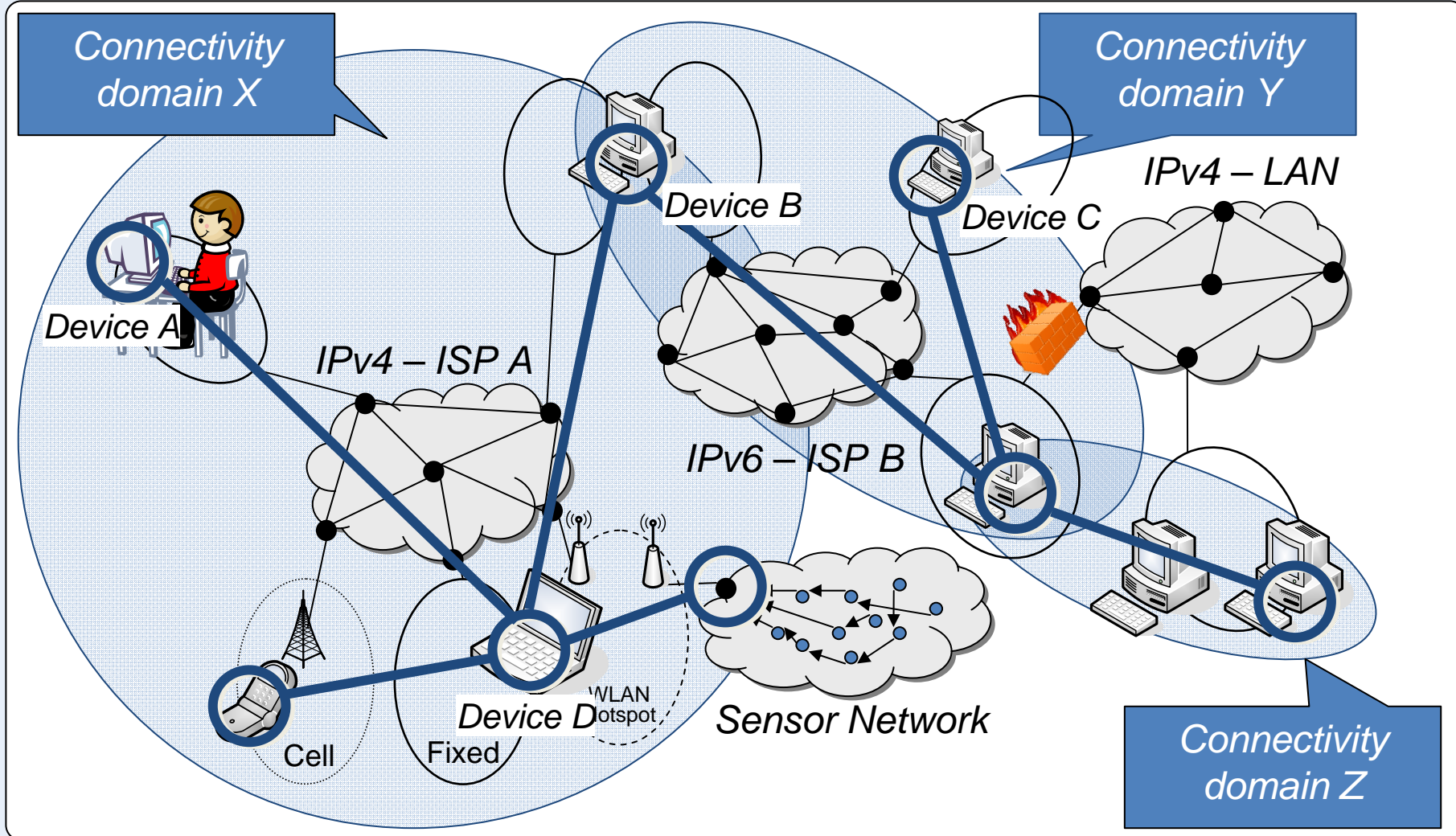
3. Integrated Security



Connectivity



Connectivity Domains

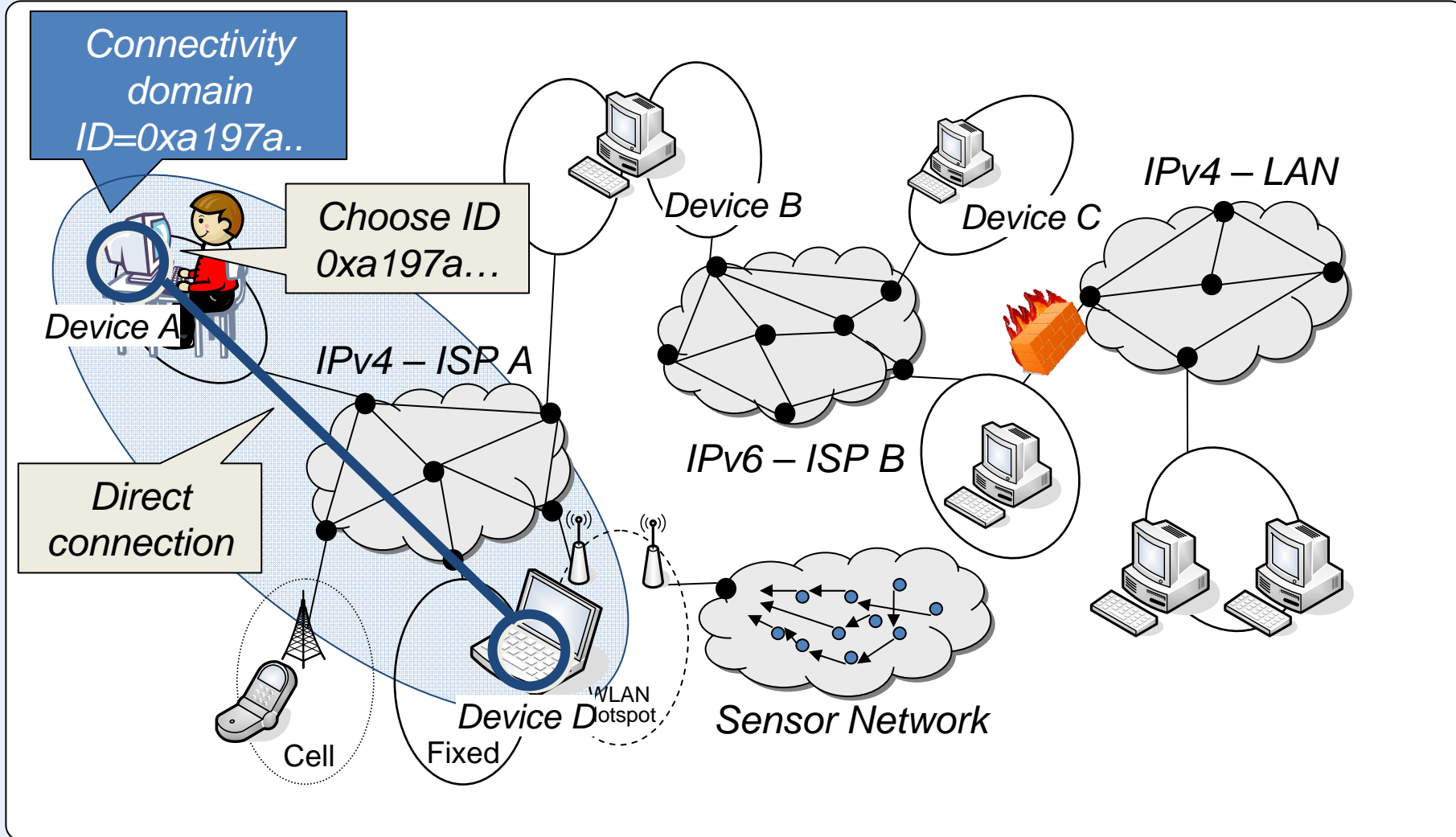


Connectivity Domains

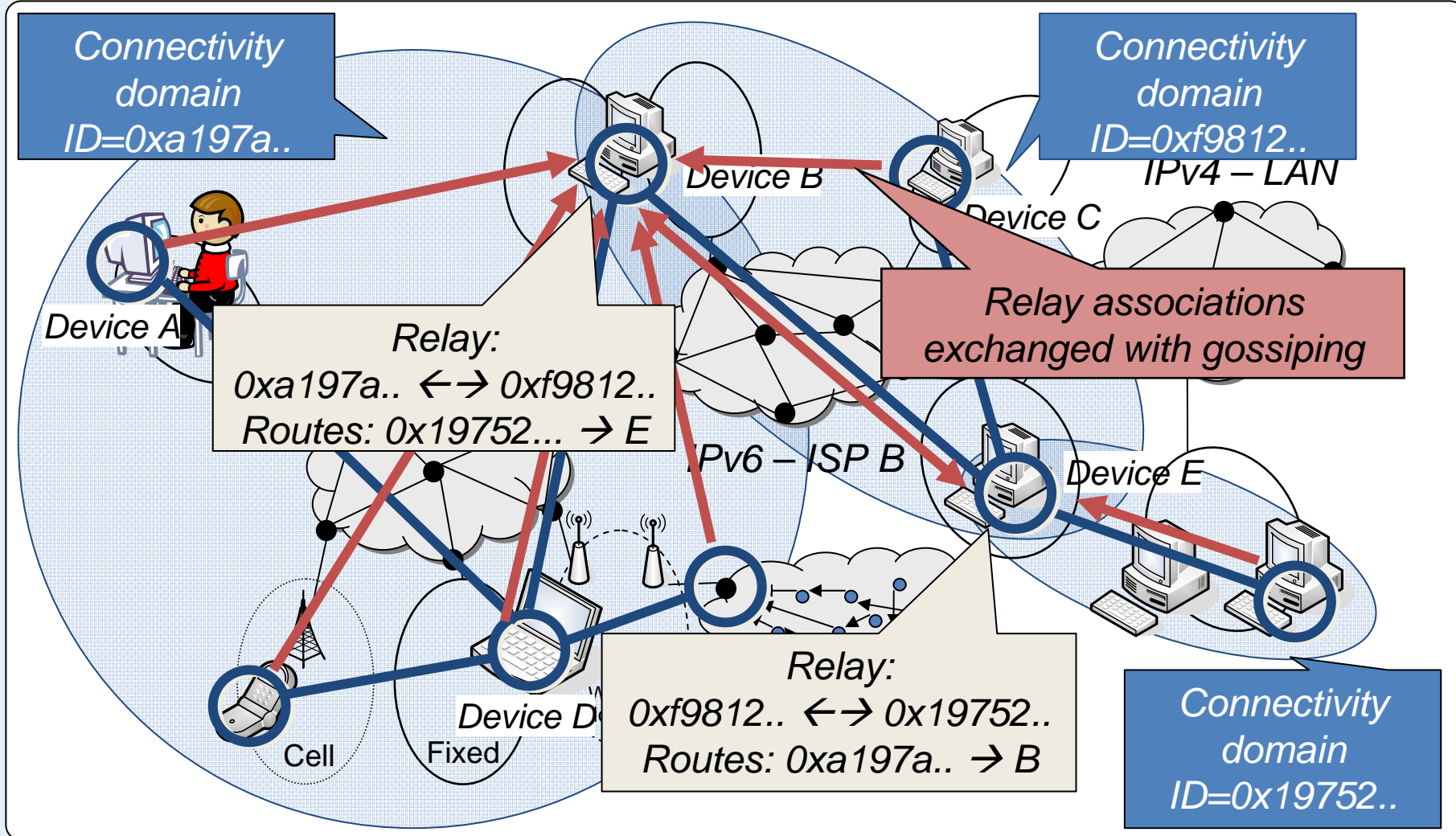


- Problem outline
 - Detect connectivity domains and relays
 - Establish links across connectivity domains
 - Consider partitioning and merging
- Our first solution
 - Identification of connectivity domains with probabilistically unique identifiers
 - Detection of relays
 - Simple link state protocol finds relay paths

Detection Example



Detection Example



Connectivity Domains: Summary



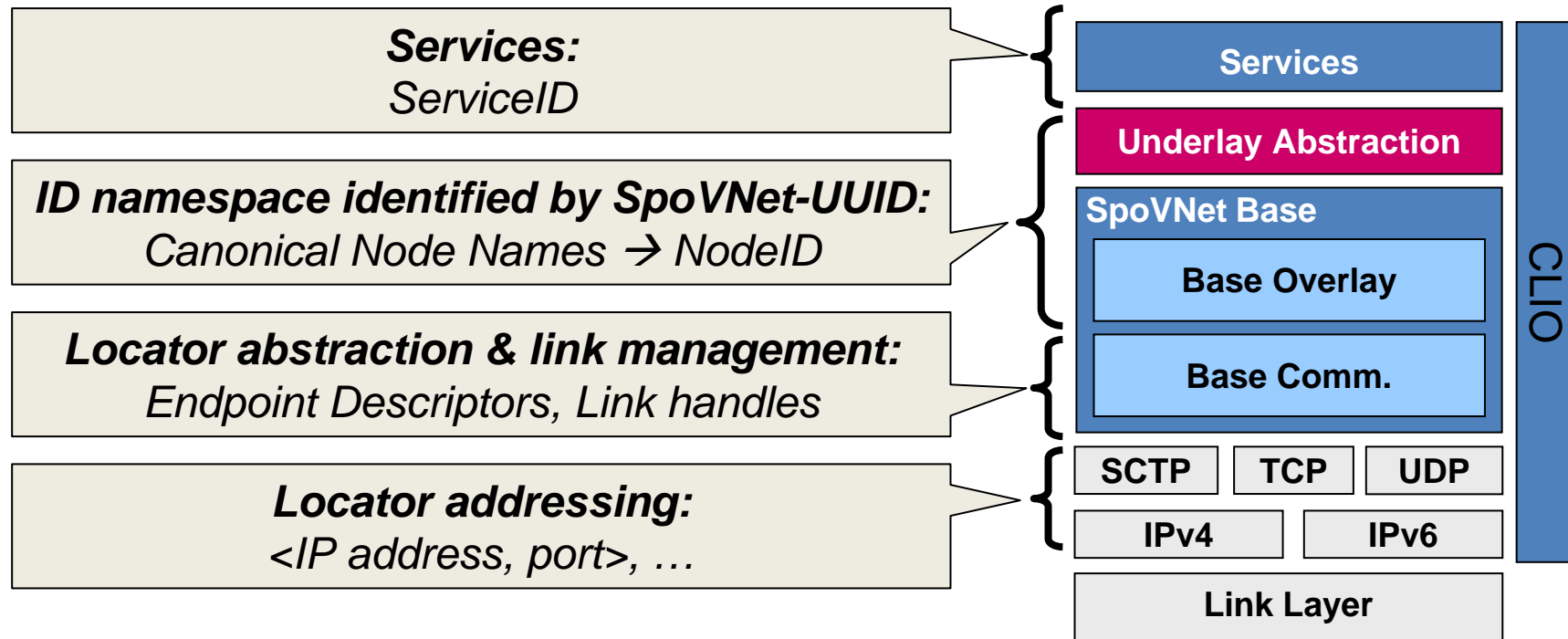
- First **pragmatic** approach allows
 - Distributed **detection** of connectivity domains
 - Provides **relay paths** to each domain
 - ➔ **Provides end-to-end connectivity across heterogeneous networks!**
- Further work
 - Algorithms to handle **partitioning** and **merging**
 - Optimization of relay paths with **virtual coordinates**

Namespaces and Addressing

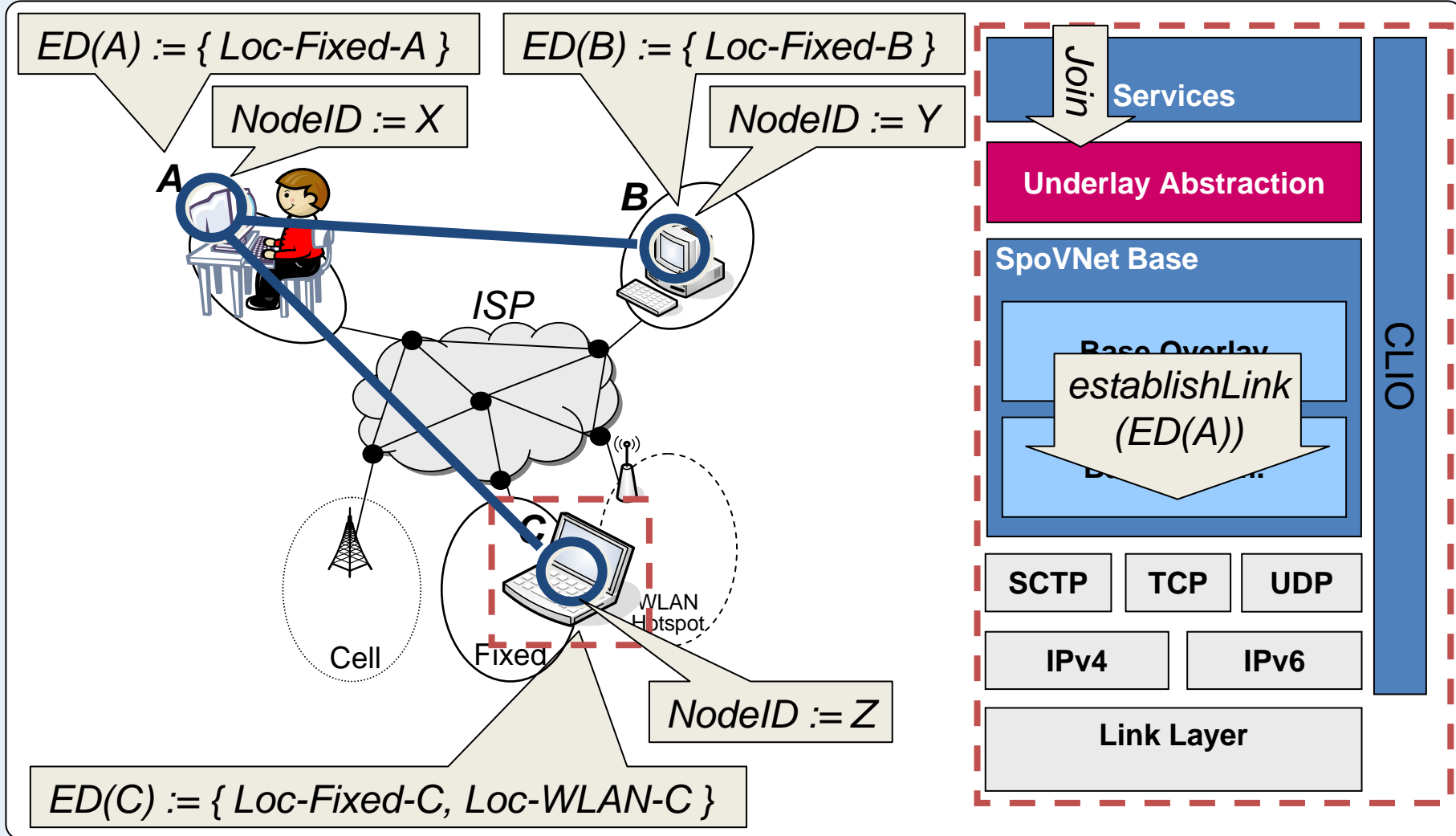


- Base Communication
 - Maintains all links between SpoVNet-Devices
 - Addressing with Endpoint Descriptors
 - Hides underlay addressing from higher layers
- Base Overlay
 - Forms SpoVNet-Instance with its own namespace identified by a SpoVNet-UUID
 - Nodes have Canonical Node Names (CNN)
 - CNNs are hashed to a routable node identifier (NodeID)
- ServiceID
 - Similar to the ports scheme in TCP/UDP
 - Identifies a service in a given node instance

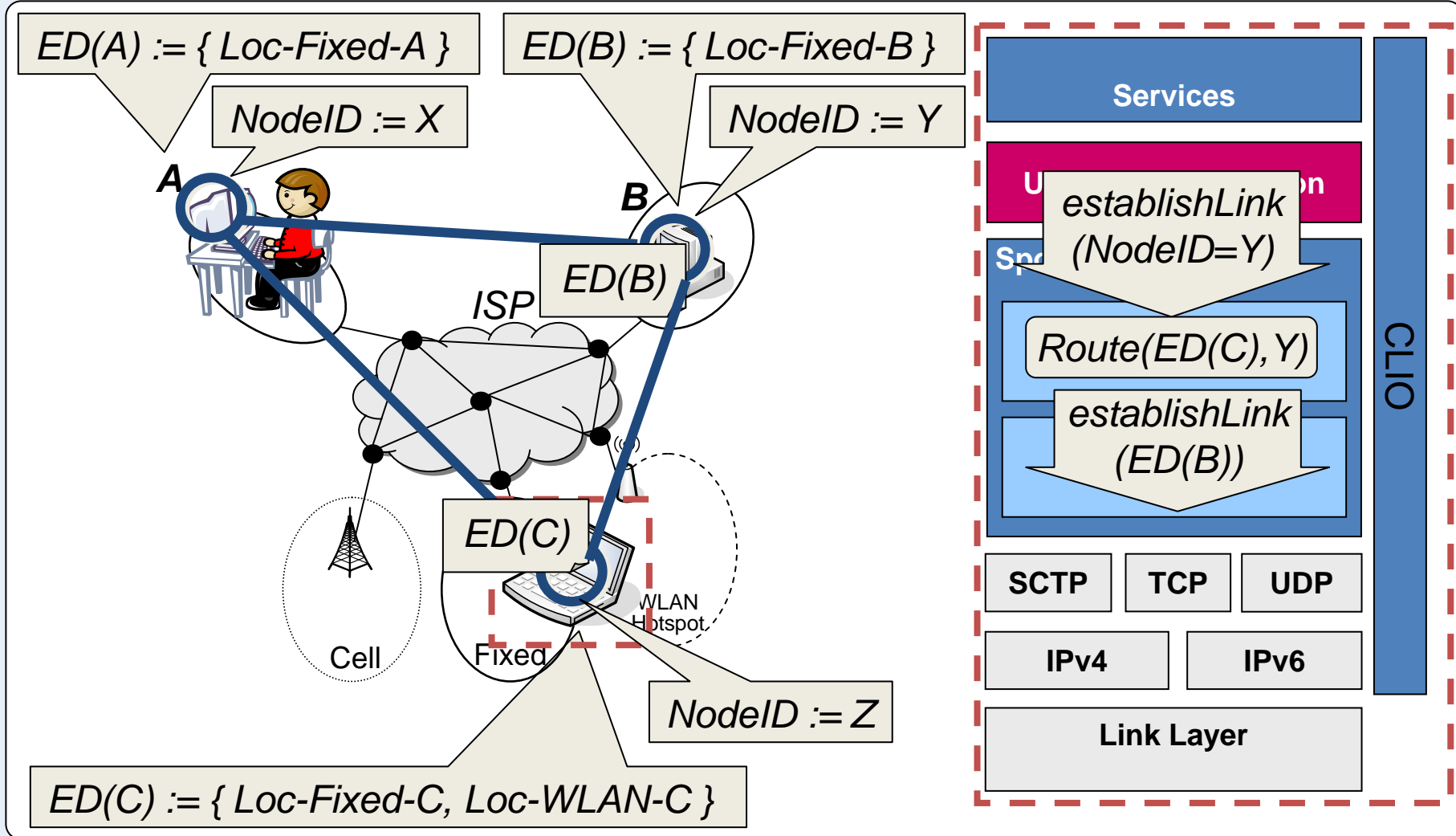
Namespaces and Addressing



Link establishment



Link establishment

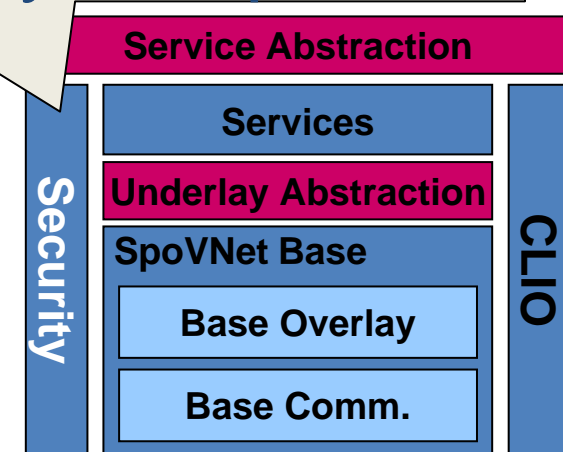


Integrated Security Strategy

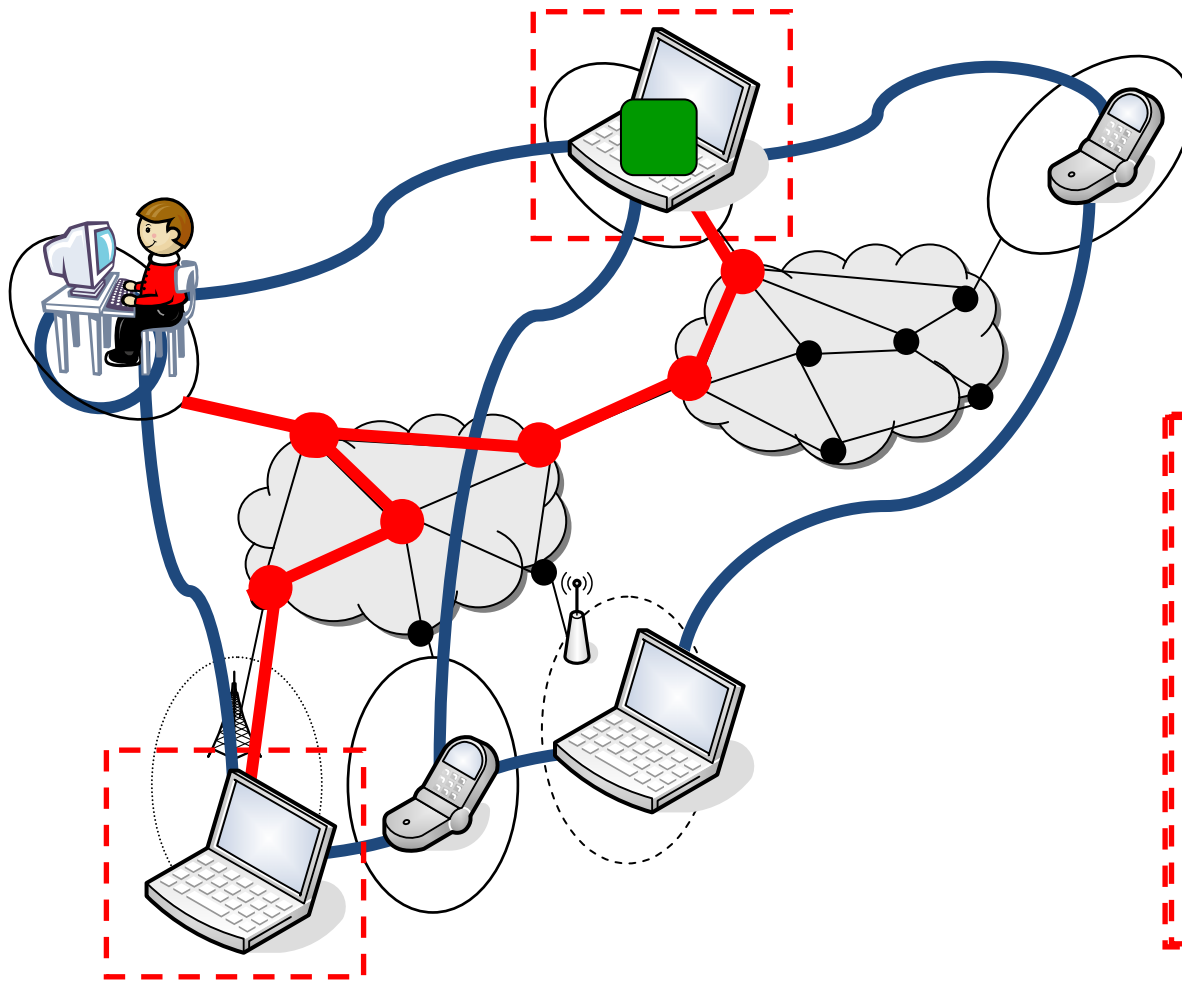


- Consider security as an **integral part** of the SpoVNet architecture
- Identify security sensitive operations **once** for each **service overlay**
- Check operations with **security component**
→ Enforcement of **policies**

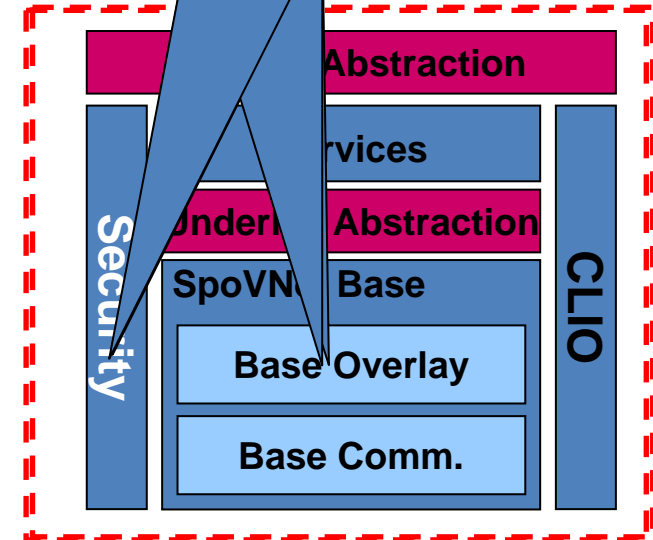
→ **Integrated Security**



Exemplary Policy: Control Access



Verify the signed credential



Summary



- SpoVNet's Communication Layers feature
 - Abstraction layer to many different underlays
 - Integrated security
 - Cross-Layer information
- Introduced here
 - Distributed connectivity domain detection
 - Unified location independent addressing and namespaces
 - Integrated Security: Authorization in SpoVNets
- Implementation
 - Currently under heavy development
 - ➔ **First preliminary open-source release end of 2008. Check <http://www.spovnet.de>!**



Thank you!

Questions?