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Integration of LISP and LISP-MN in INET

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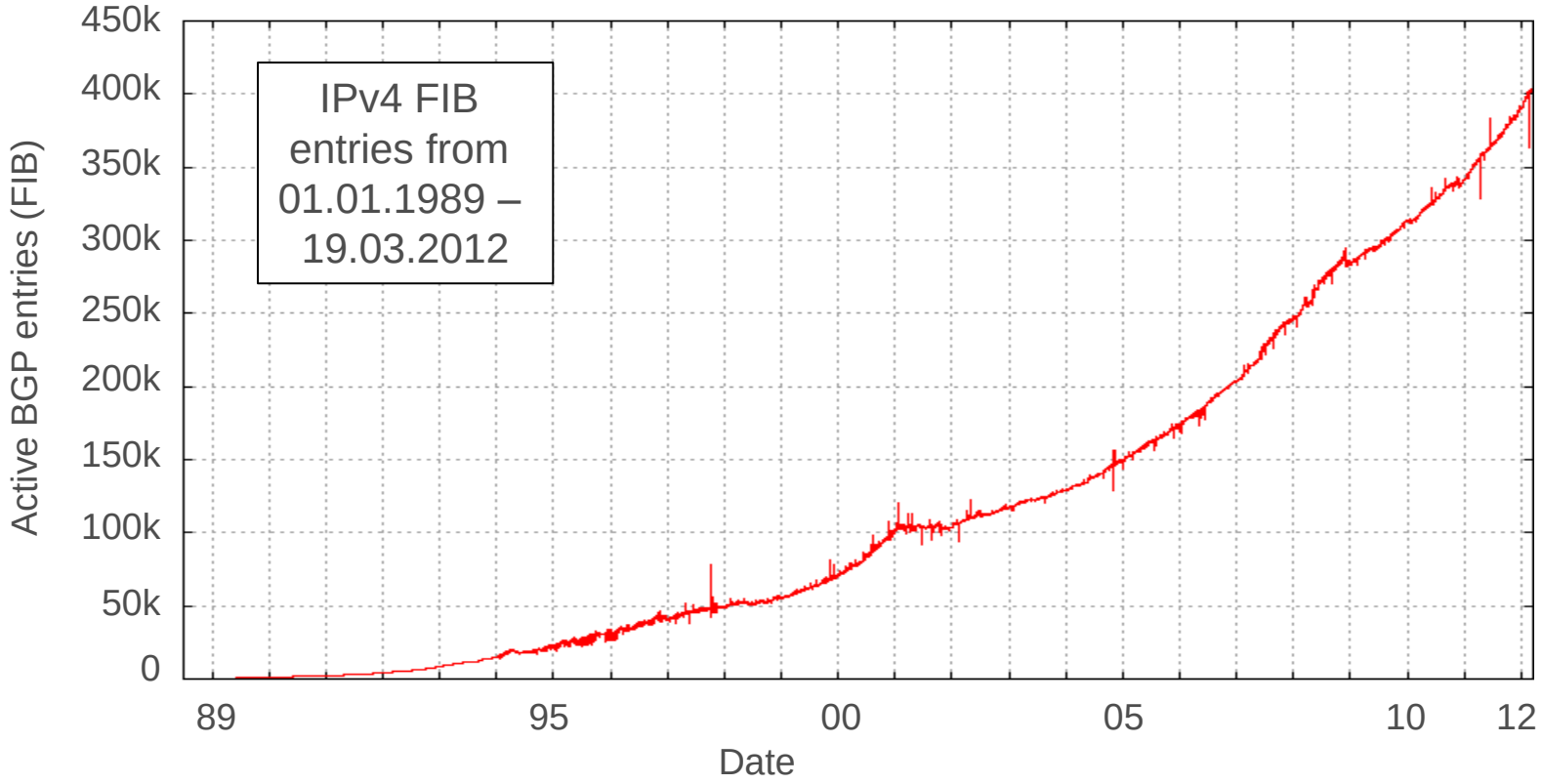
Motivation

- Current naming and addressing architecture is facing scalability problems

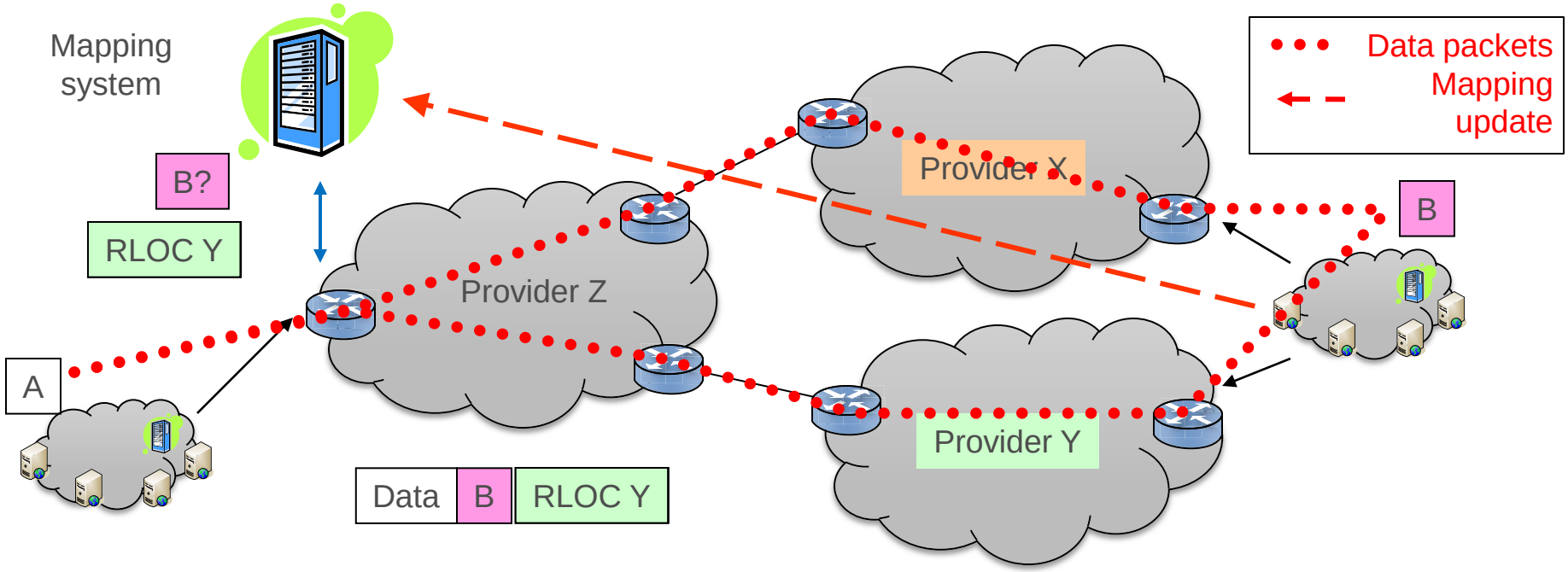


- Overload of IP address semantics with identification & routing information
- Possible solution
  - Locator identifier split
  - Example: **Locator/ID Separation Protocol (LISP) by CISCO**

Outline

- Introduction
  - Locator/identifier split
- LISP background
  - Basic LISP architecture
  - Overview of LISP extensions
- LISP simulation model
  - Implemented nodes and messages
- Evaluation
  - Detailed analysis of handover delay
- Summary and future work

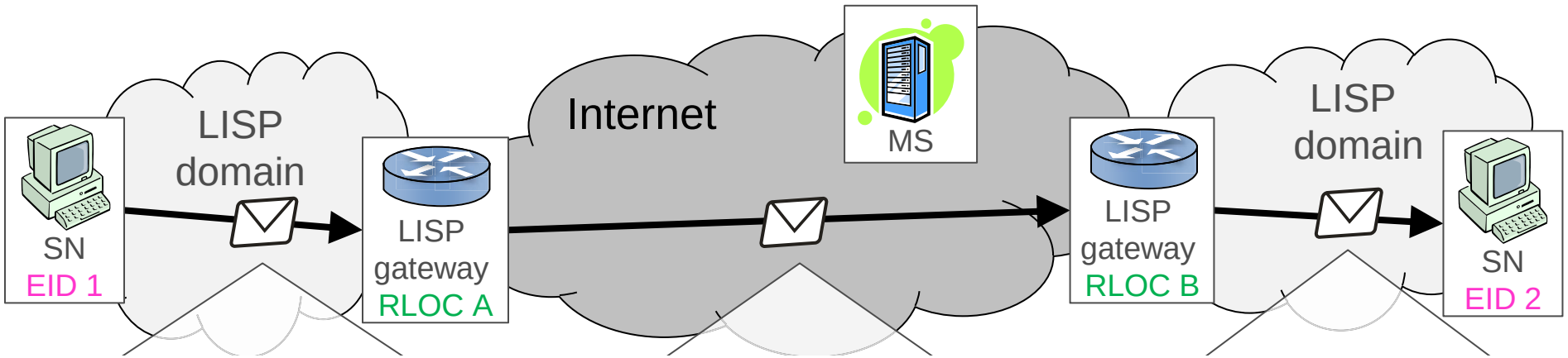
Introduction – Locator/Identifier Split



- Idea
  - Address space divided into identifiers and routing locators
  - Mapping system provides ID-to-Loc information
  - Network layer entities, e.g. gateways, add source and destination Locs to outgoing packets after mapping lookup

Locator/ID Separation Protocol (LISP)

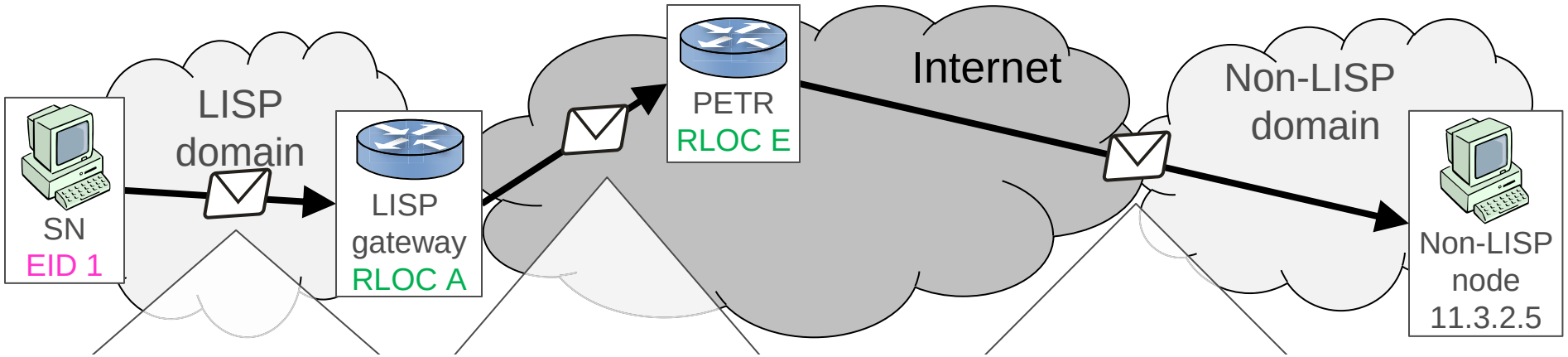
- **Separates local naming and addressing from global routing**
  - EIDs: locally routable and identifier on global scope
  - RLOCs: globally routable IP addresses of LISP gateways
  - LISP gateways add RLOCs to IP packets after mapping lookup
  - Mapping service provides EID-to-RLOC information



LISP Interworking: Outgoing Flow

- **Idea:** send LISP packets without outer header
- **Problem:** upstream provider drops packets due to uRPF

- **Solution:** tunnel packets to proxy ETR (PETR)

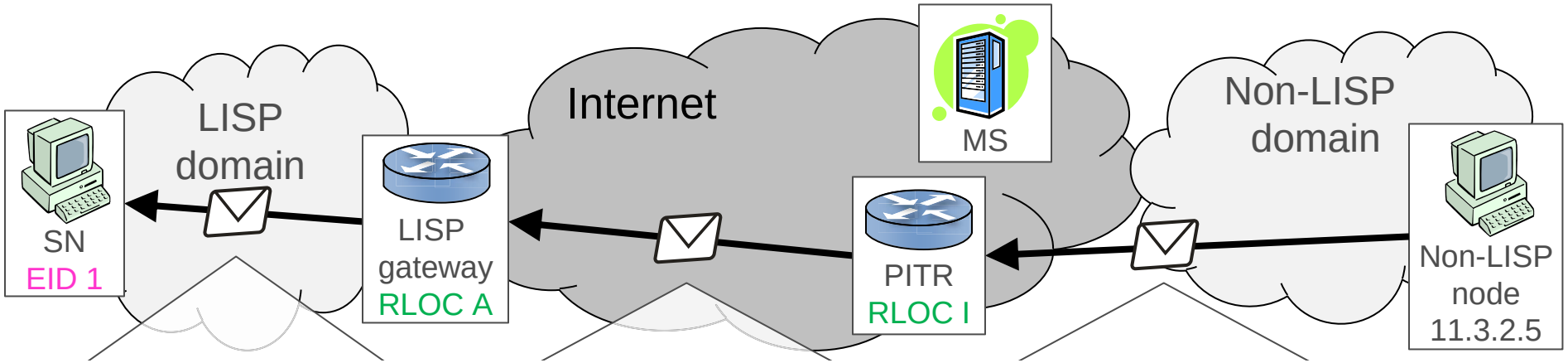


	Src:	Dest:	Src:	Dest:	Src:	Dest:
OH:			RLOC A	RLOC E		
IH:	EID 1	11.3.2.5	EID 1	11.3.2.5	EID 1	11.3.2.5
	DATA		DATA		DATA	

LISP Interworking: Incoming Flow

- **Observation:** non-LISP nodes use EIDs as destination address
- **Problem:** EIDs are not globally routable

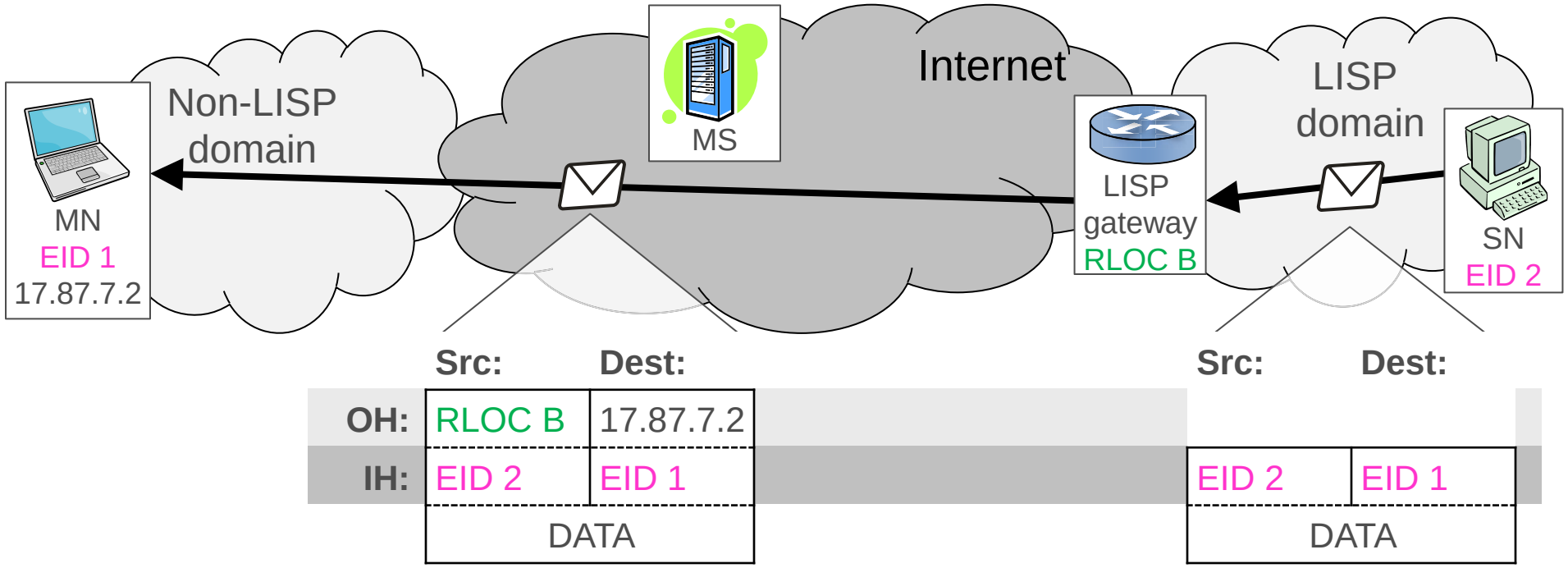
- **Solution:** proxy ITRs announces highly aggregated EID-prefix



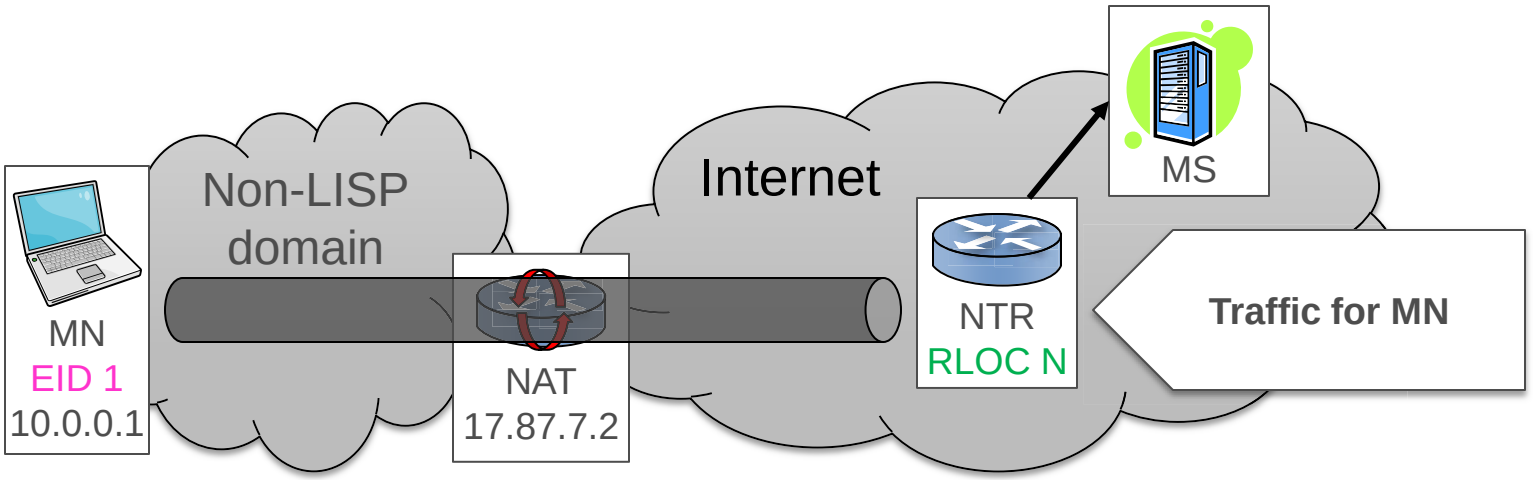
	Src:	Dest:	Src:	Dest:	Src:	Dest:
OH:			RLOC I	RLOC A		
IH:	11.3.2.5	EID 1	11.3.2.5	EID 1	11.3.2.5	EID 1
	DATA		DATA		DATA	

LISP Mobile Node (MN)

- MN acts as whole LISP domain
  - Implements LISP gateway functionality
  - EID used for identification and not for forwarding anymore
  - Care-of-address used for forwarding within local domain
  - MN registers care-of-address as RLOC at mapping service



LISP NAT Traversal



- NAT traversal router (NTR) acts as anchor and relay
  - NTR collocated with PETR
  - MN registers at an NTR
  - NTR adds own RLOC to mapping service
- Tunnel between MN and NTR used to bypass NAT

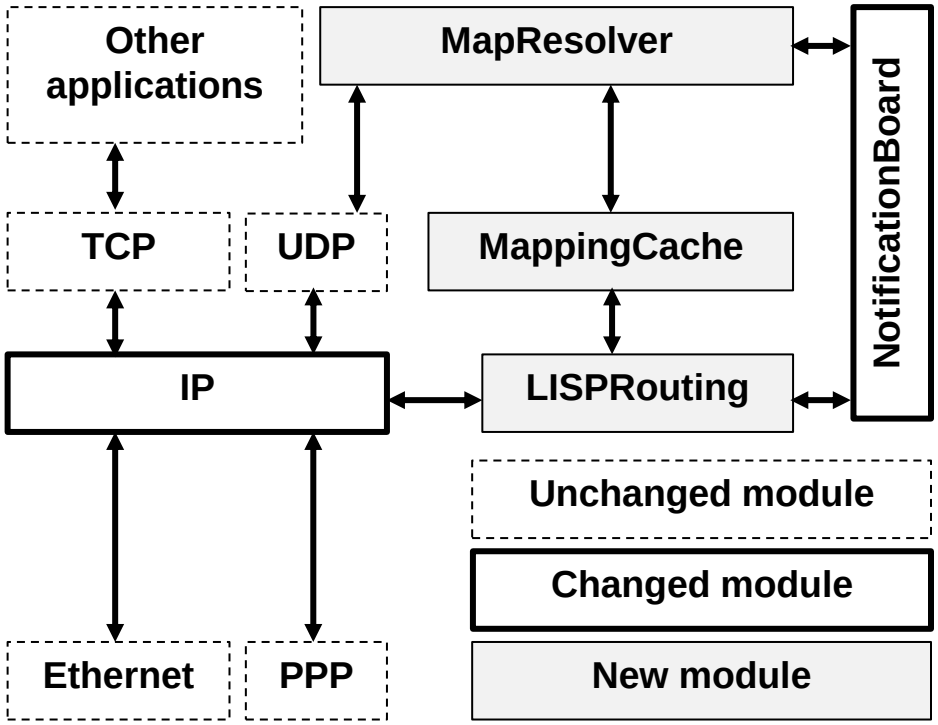
Motivation & Background

- Motivation
  - Test and evaluate improvements to mobile node
  - Proof-of-concept for NAT traversal
  - Check interoperability of LISP-MN and NAT traversal
  - Study handover performance of LISP-MN

- Implementation background
  - Extends INET framework with LISP protocol functionality
  - Based on design ideas of OpenLISP
  - Implementation according to LISP working group drafts
  - Several modifications
    - Integration of DHCP
    - Extension of wireless model → multihoming support
    - Integration of basic NAT functionality

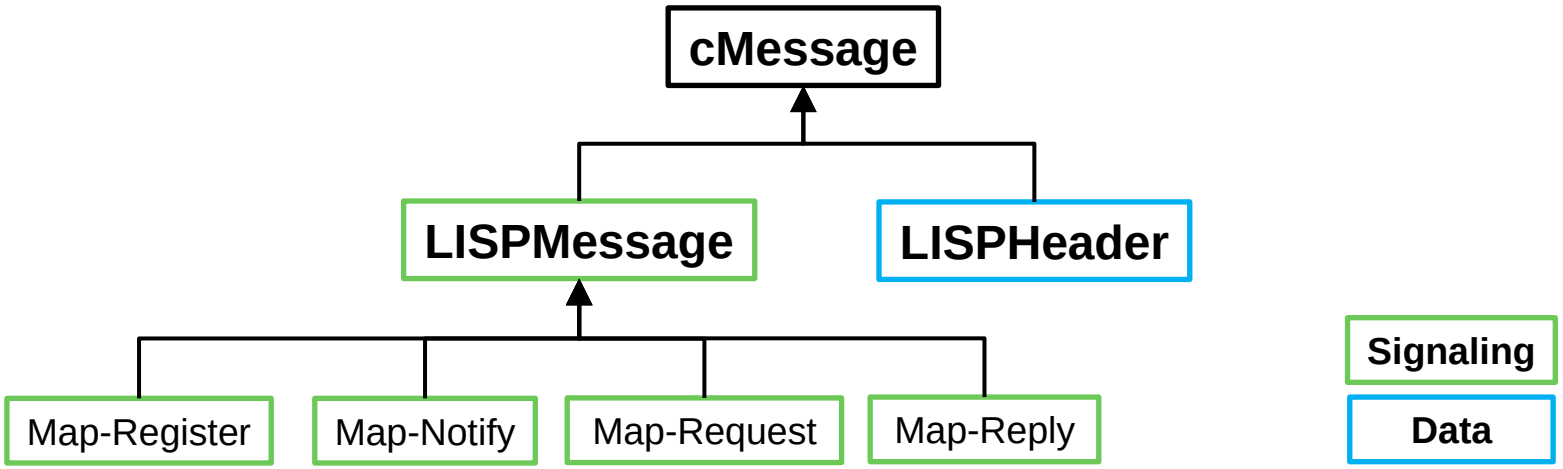
Overview

- Modified IP module
  - Anchor point for LISP modules
- LISP routing module
  - Adds and removes LISP header on data plane
  - Triggers signaling messages
- Map resolver module
  - UDP application
  - Control plane signaling
- LISP mapping cache
  - Stores used mappings
- Inter-module communication
  - Done via Notification Board

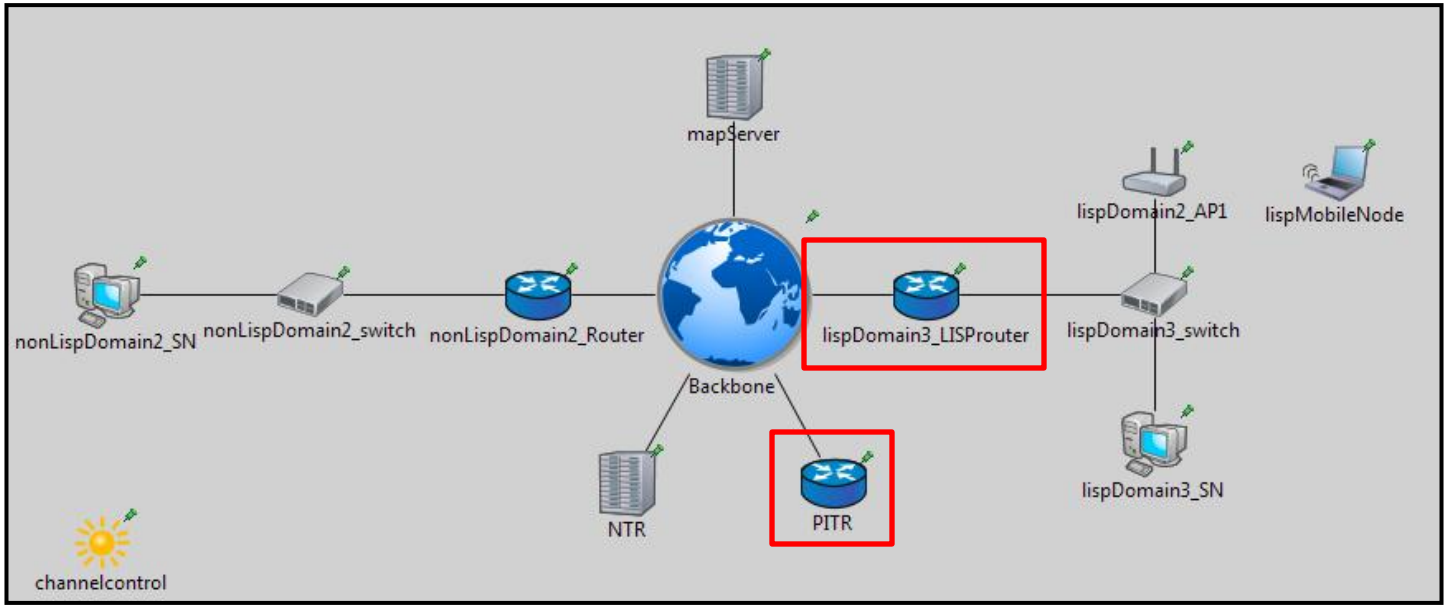


Implemented Messages

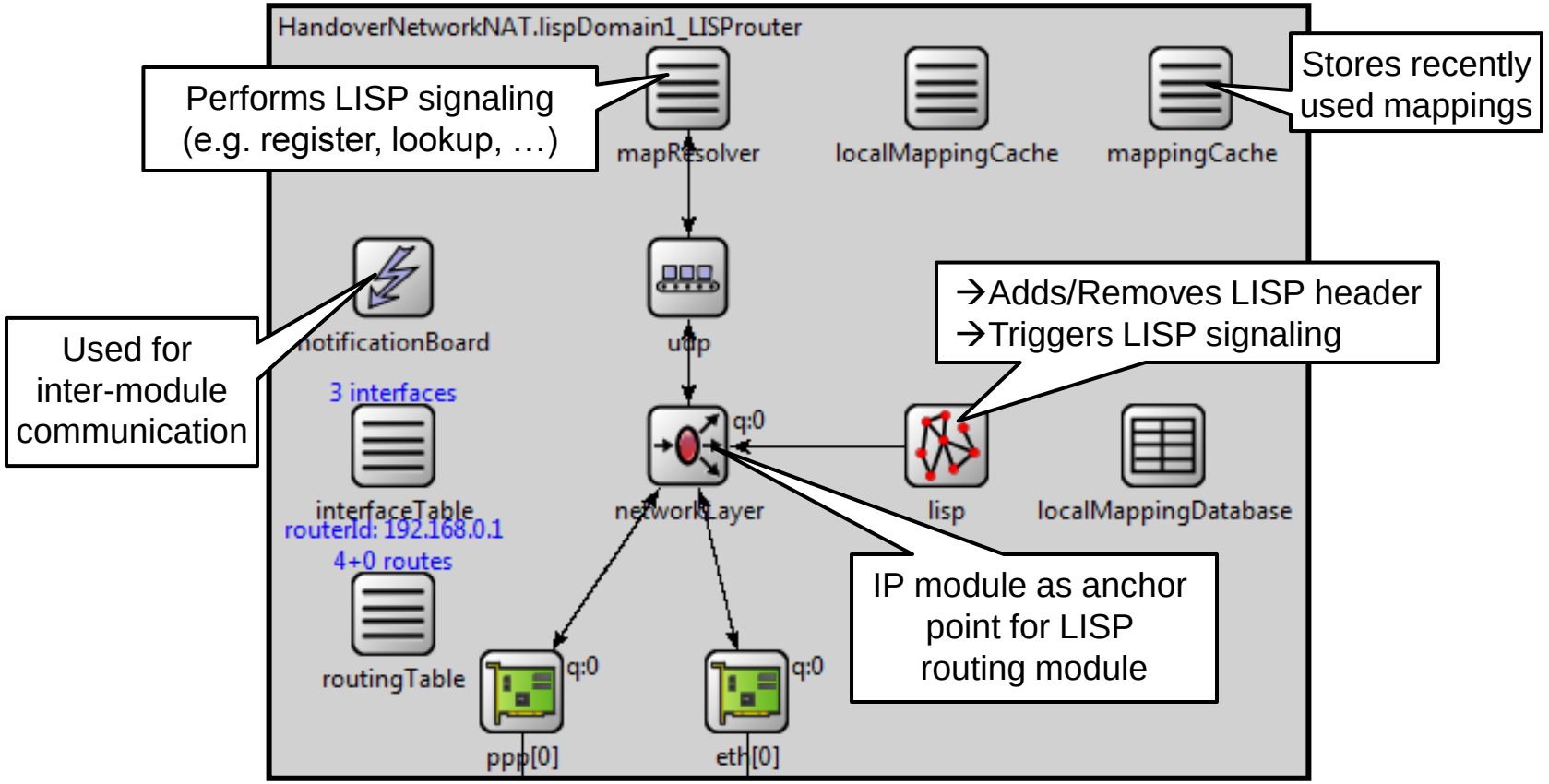
- Message types and message formats implemented according to LISP working group drafts
- LISP header added and removed by lisp routing module
- Signaling messages sent by map resolver module over UDP
  - Registration messages
  - Mapping messages (lookup, probing, …)



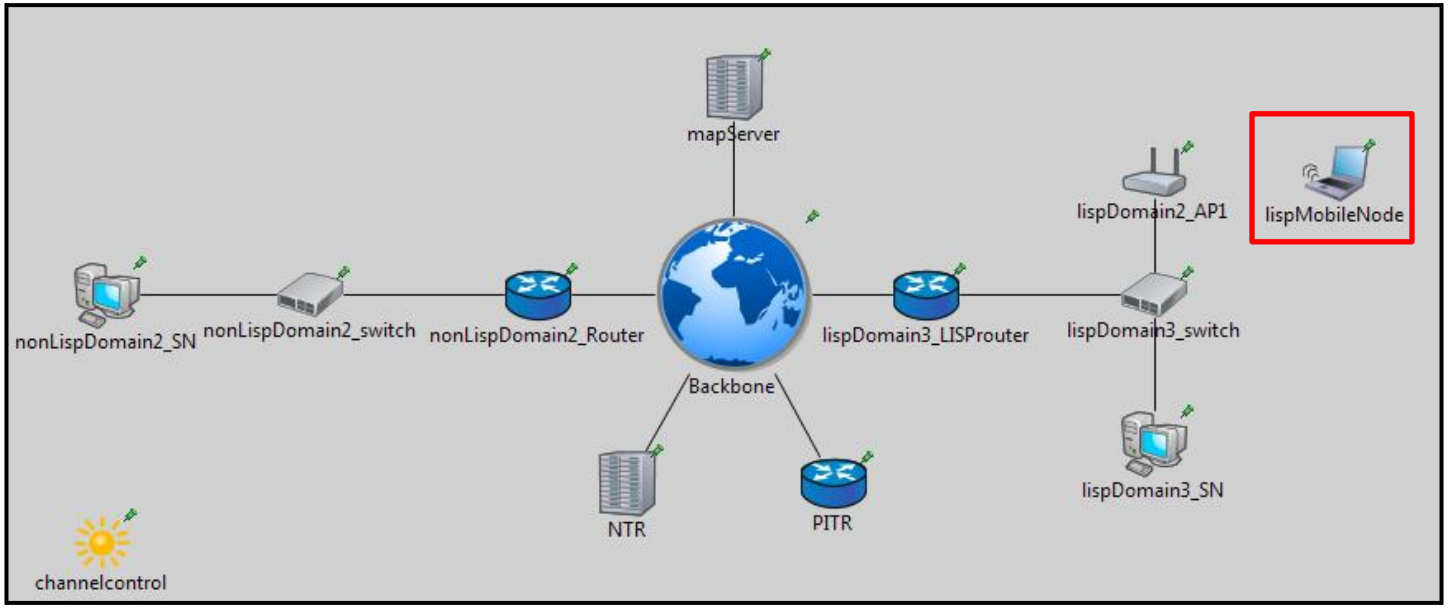
Implemented LISP Nodes



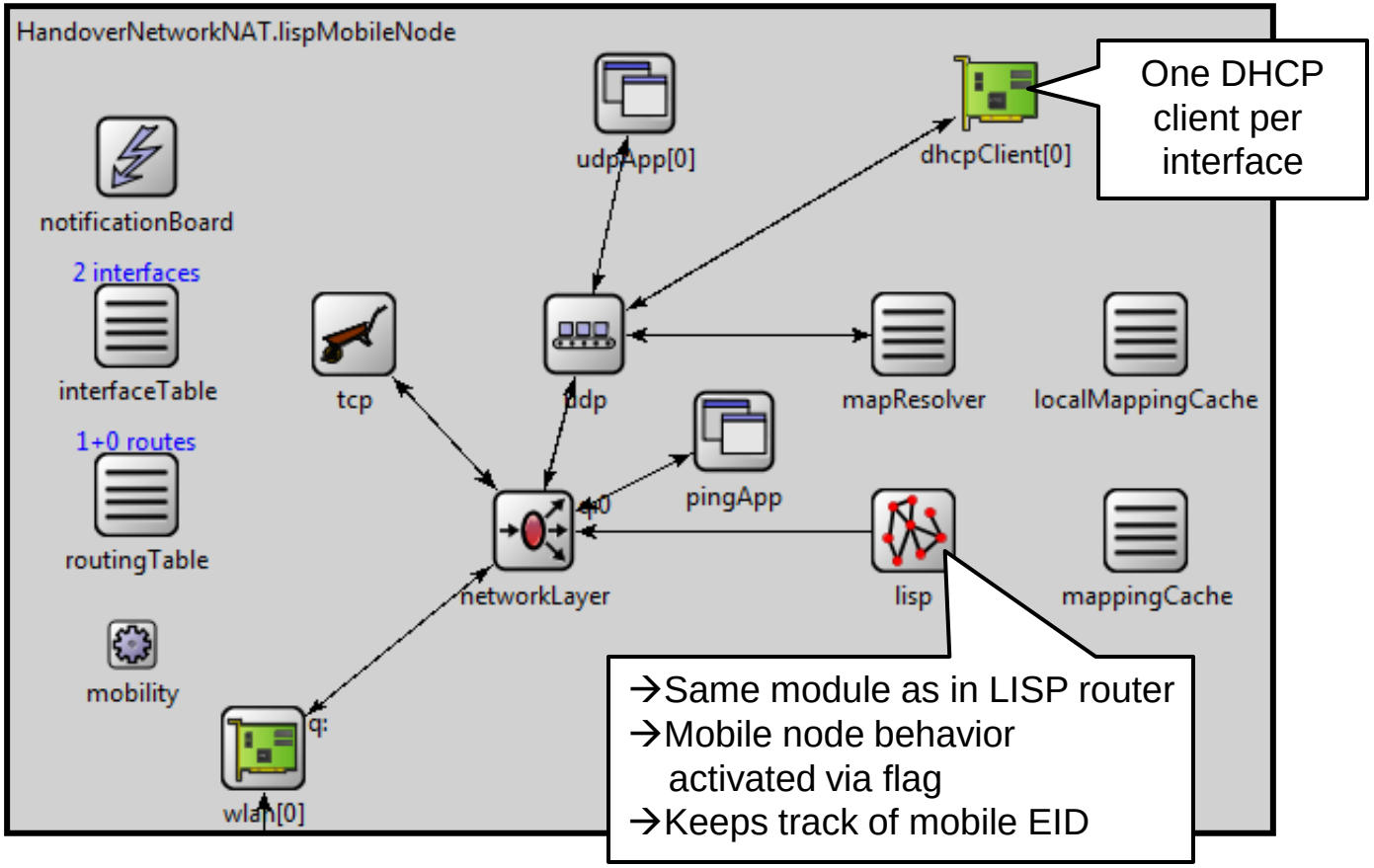
LISP (Proxy) Router Module



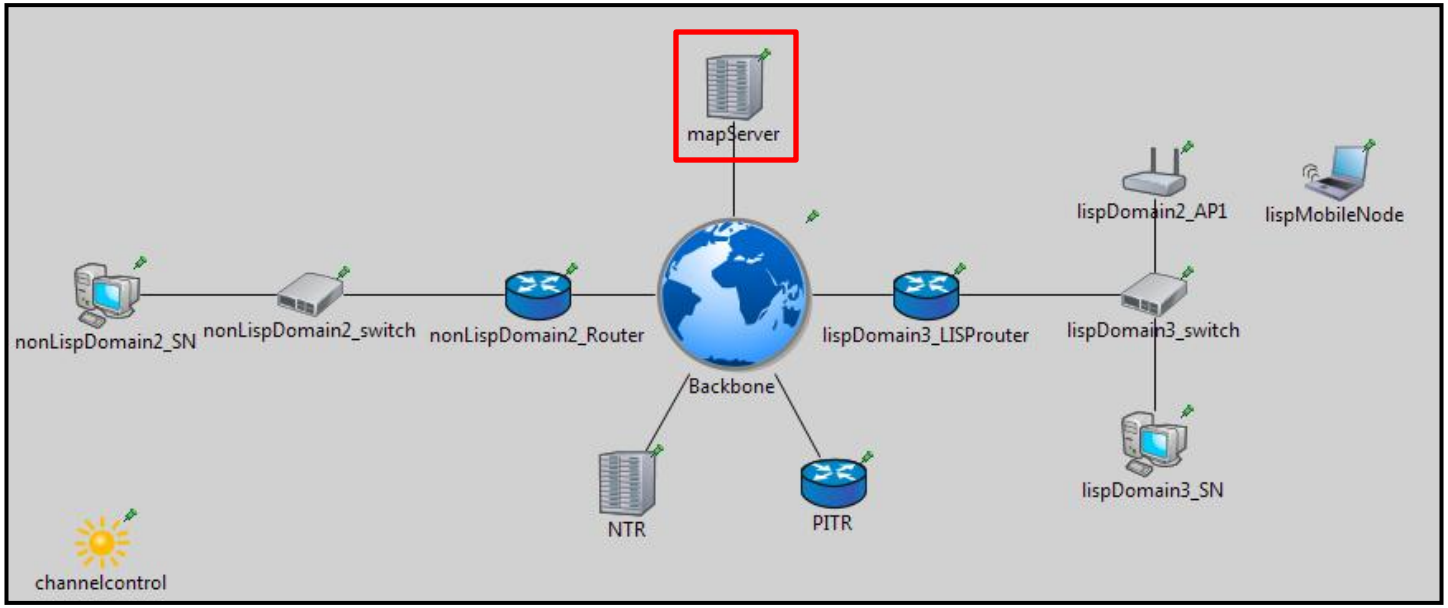
Implemented LISP Nodes



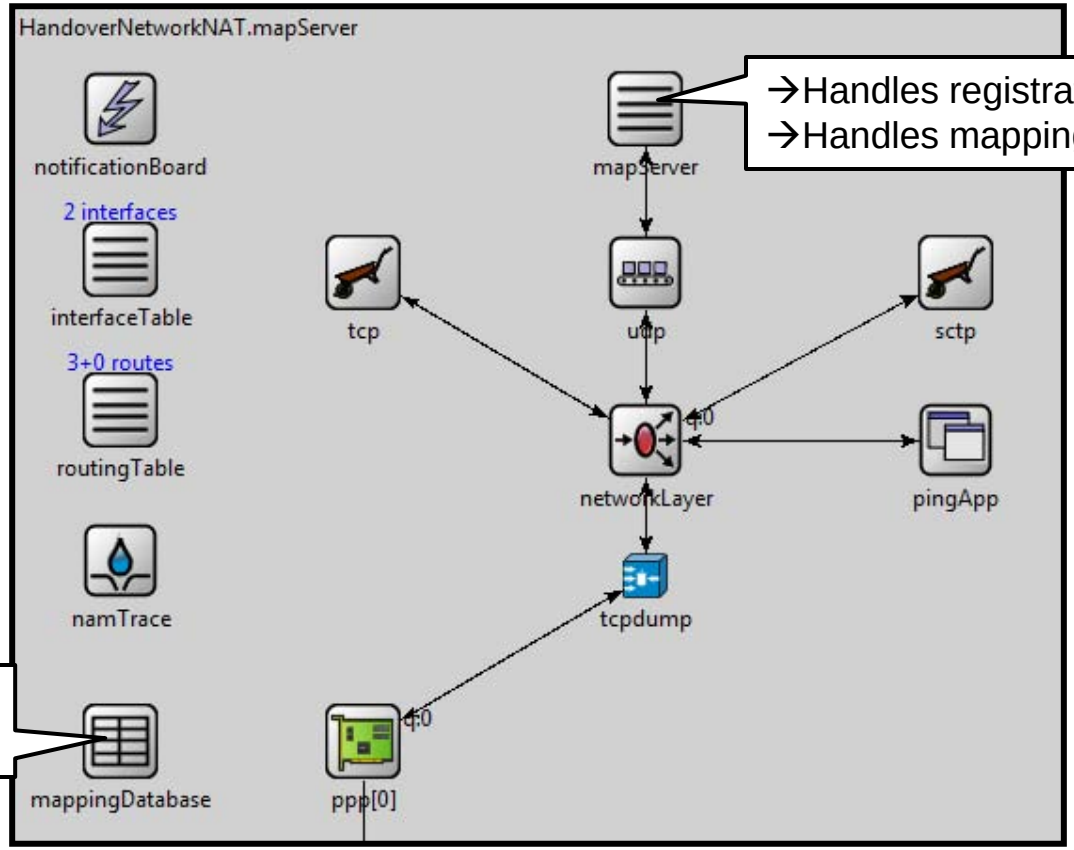
LISP Mobile Node Module



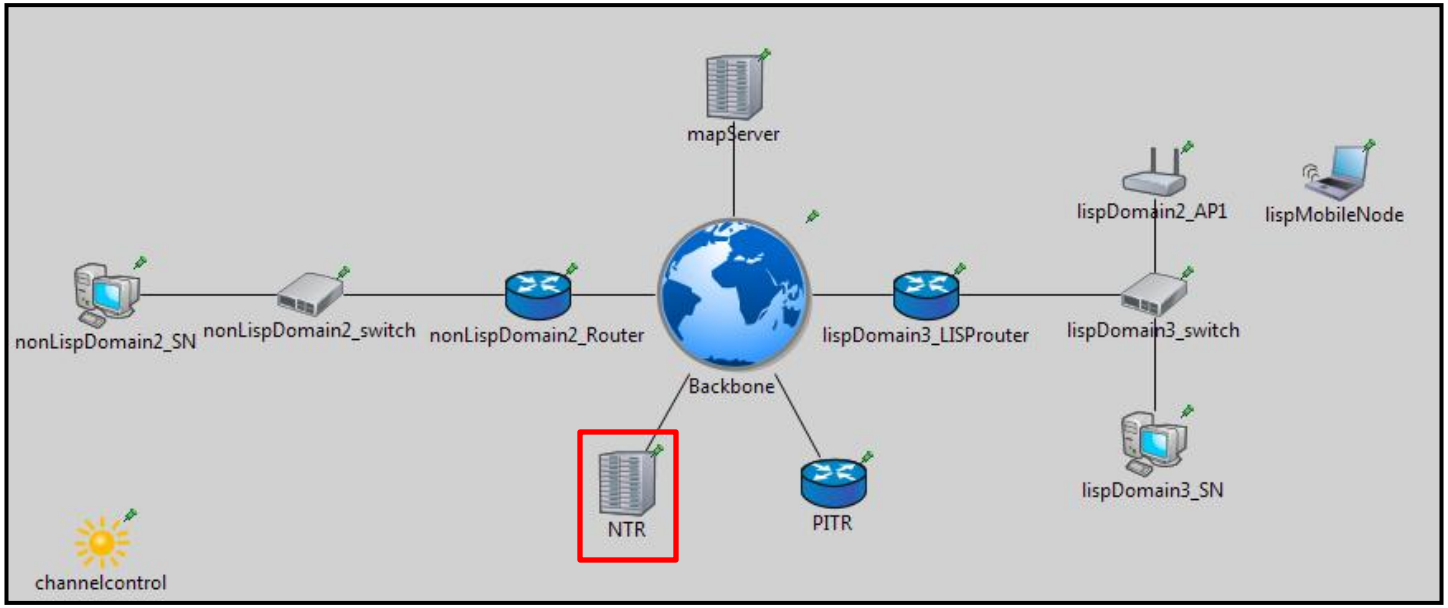
Implemented LISP Nodes



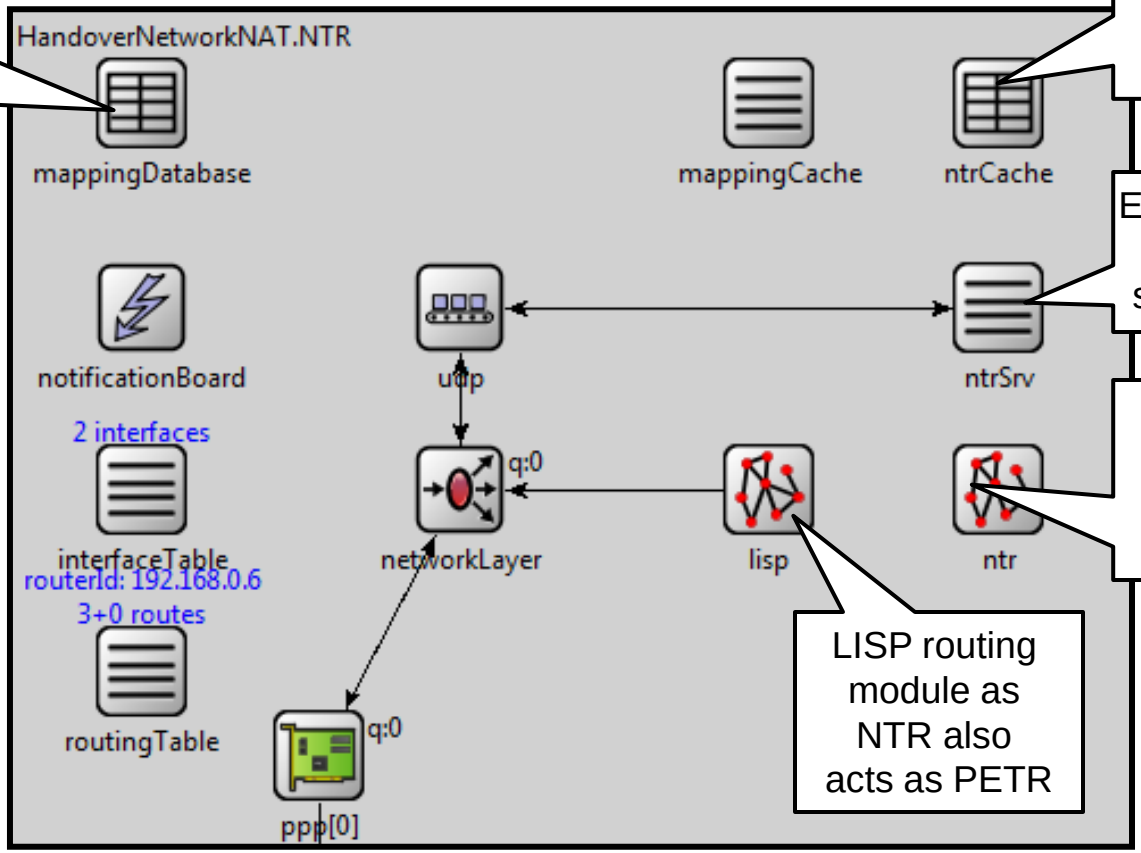
LISP Map Server



Implemented LISP Nodes



NAT Traversal Router



Database for mapping entries of registered mobile nodes

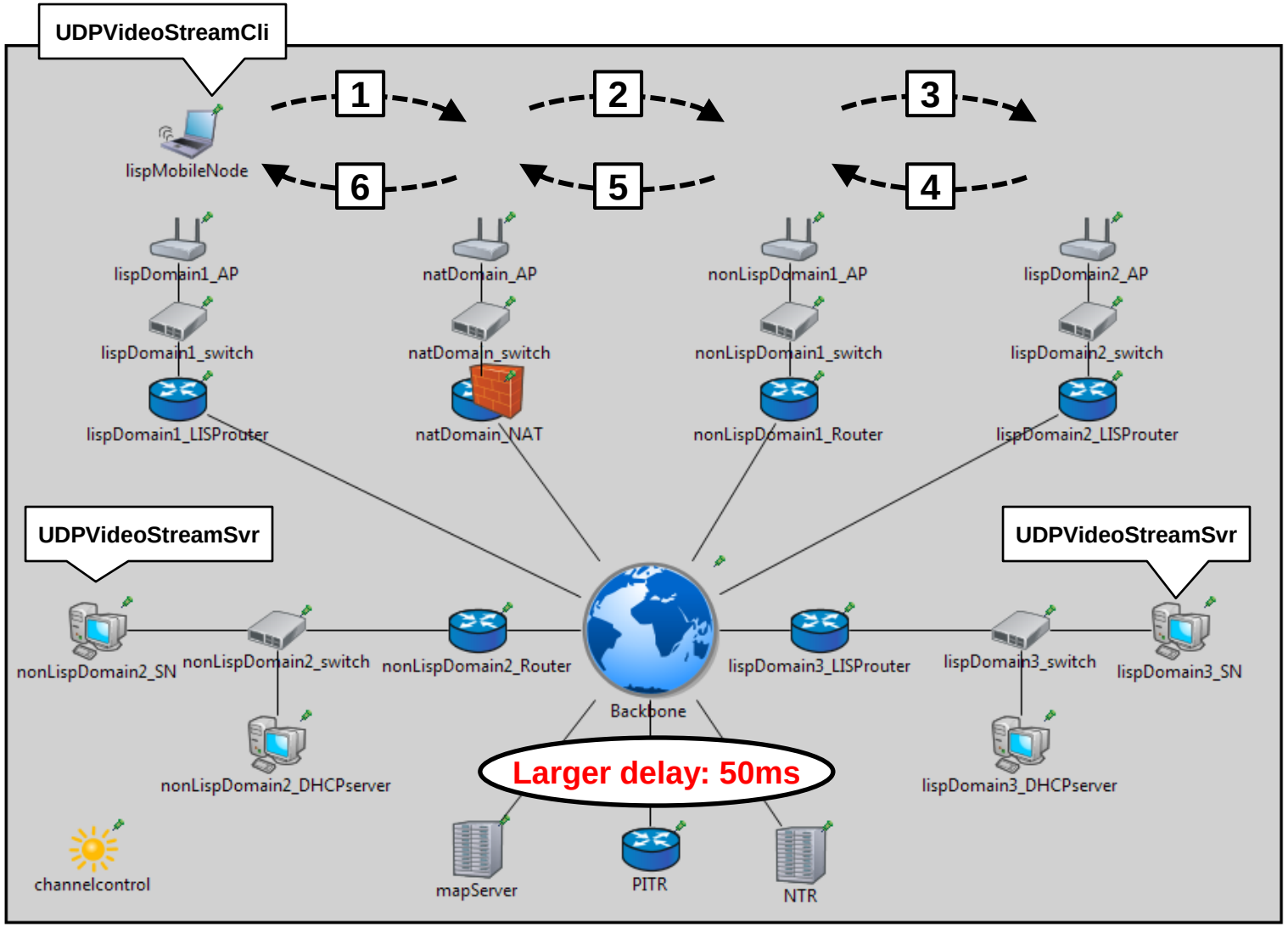
Database for external IP:port of registered mobile nodes

Extended mapServer module with NTR specific functionality

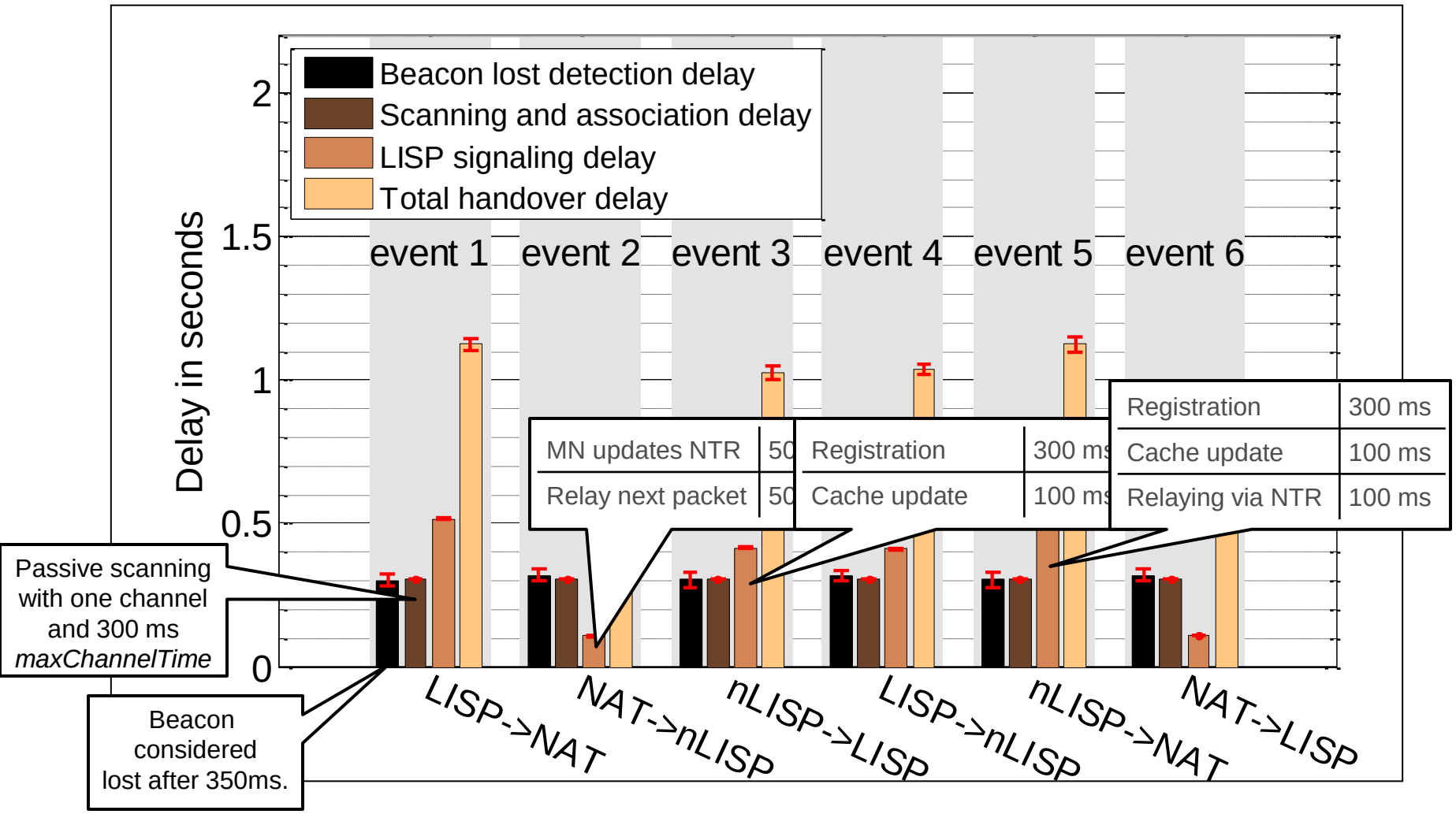
NTR specific forwarding, e.g. (NAT tunneling, packet relay,…)

LISP routing module as NTR also acts as PETR

Handover Scenario



Detailed Delay Analysis



Summary

- Implementation of LISP model in INET
  - Based on OpenLISP design idea and working group drafts
  - Basic LISP architecture with interworking and mapping interface
  - LISP mobility architecture with own NAT traversal
  - Handover delay study as working example

- Future work
  - Extension of existing framework with mapping system
  - Update/upgrade implementation according to the newest drafts
  - Update implementation to the newest INET version
  - Own website with documentation, tutorial, paper, …

Thank You for Your Attention