

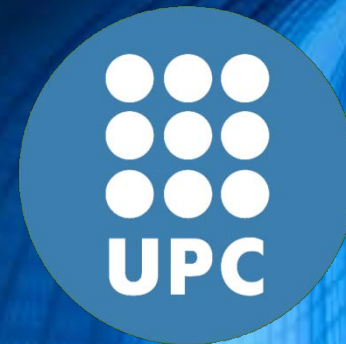
# LISP-ROAM: Network-based Host Mobility with LISP

ANDREA GALVANI

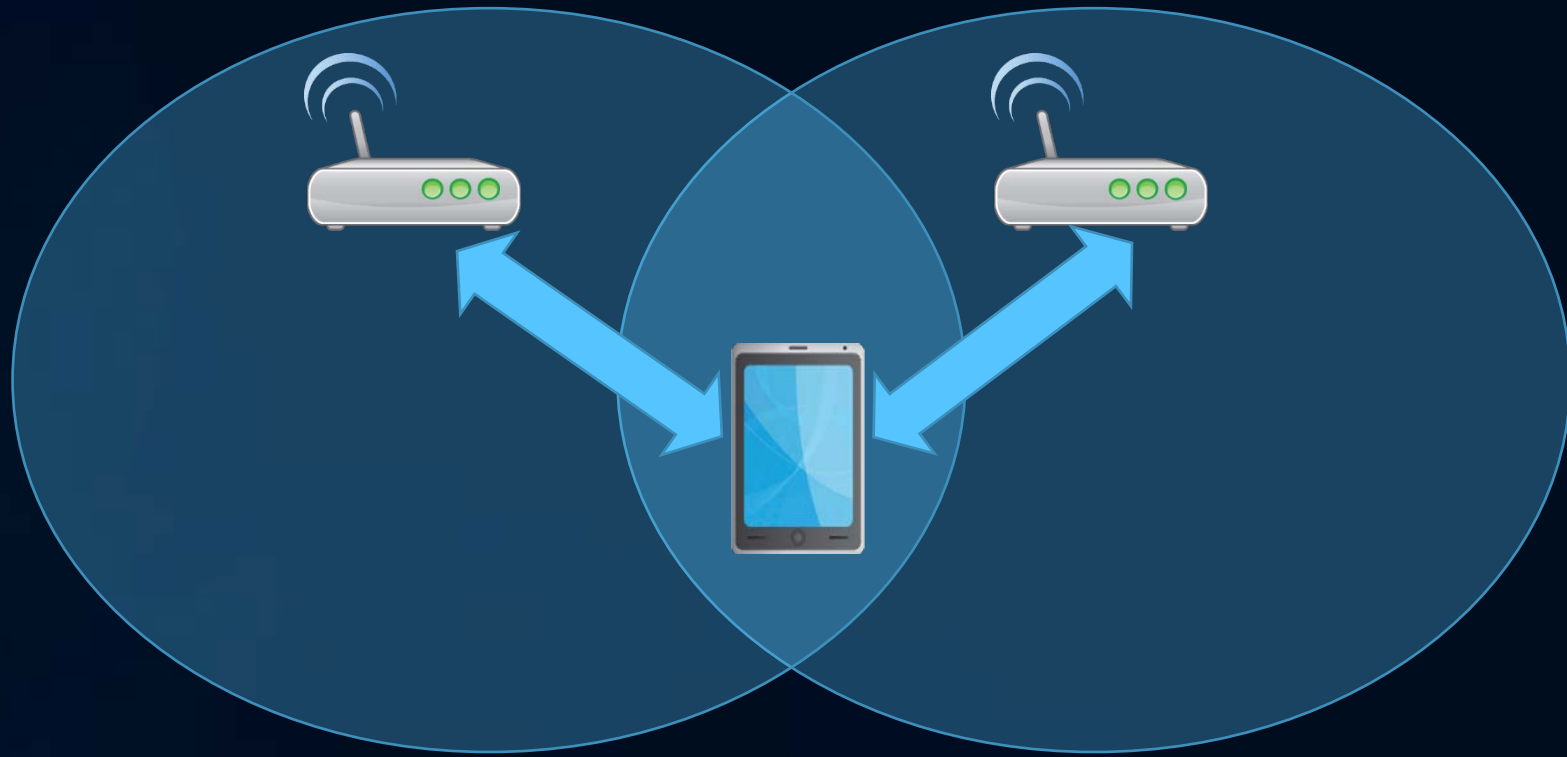
ALBERTO RODRIGUEZ-NATAL

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FULVIO RISSO

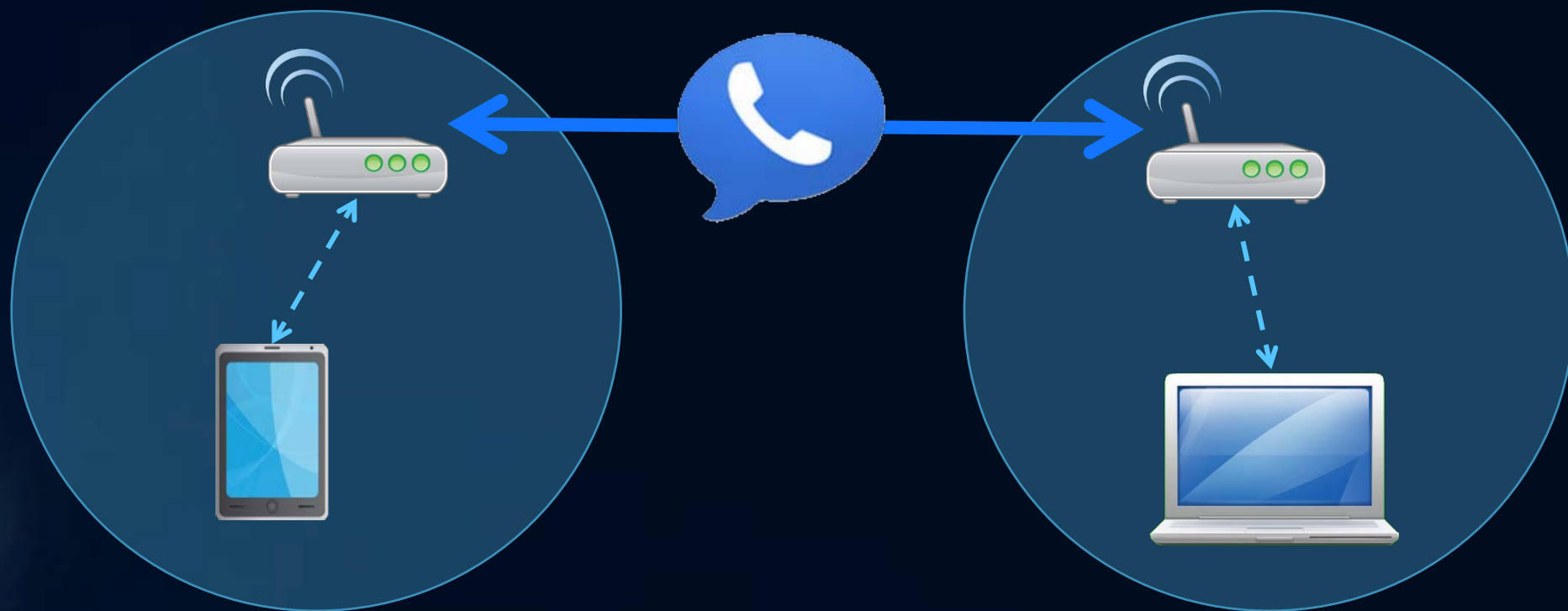


# Wi-Fi Mobility



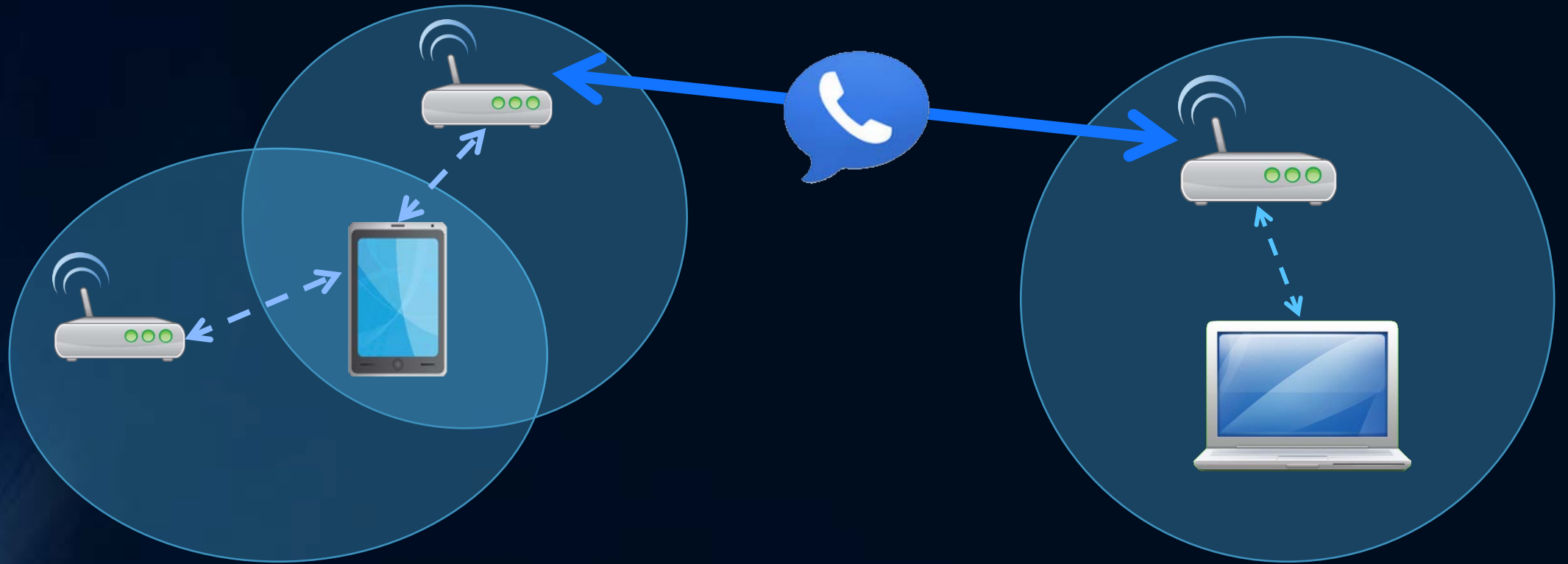
Users switching between Wi-Fi networks  
(Handover)

# Scenario



A user is doing a VoIP call,  
or exchanging a file, ...

# Scenario



The user decides to **change** Wi-Fi network  
The connection is **dropped** and has to be reinitialized

# Problem

A TCP connection is represented by a 4-tuple:

<source IP, source Port, destination IP, destination port>

- When the user moves, his IP changes
- The TCP connection is released

# “Network-based”

“Host-based”: *additional software needs to be installed on the user's host...*

“Network-based”:

- *No modifications to users' devices required*
- *The network components take care of the mobile hosts' mobility*

# Goals

- ❑ Connection **continuity** when roaming across Wi-Fi networks
- ❑ Users' devices use **standard** TCP/IP stack
- ❑ Network components are in charge of managing users' mobility
- ❑ **Minimize** modifications to other components
- ❑ Keep a high level of **abstraction** for future developments

# State of the art

IETF standards

- Mobile IP v4 / v6
- Proxy Mobile IP v6

Adopted in 3G networks

...No standards for Wi-Fi networks



# IP address constraint

The IP address represents **two properties** at the same time

- User's **identity**
- User's **location**

User's location changes → **User's IP changes**

# LISP

## Locator/ID Separation Protocol

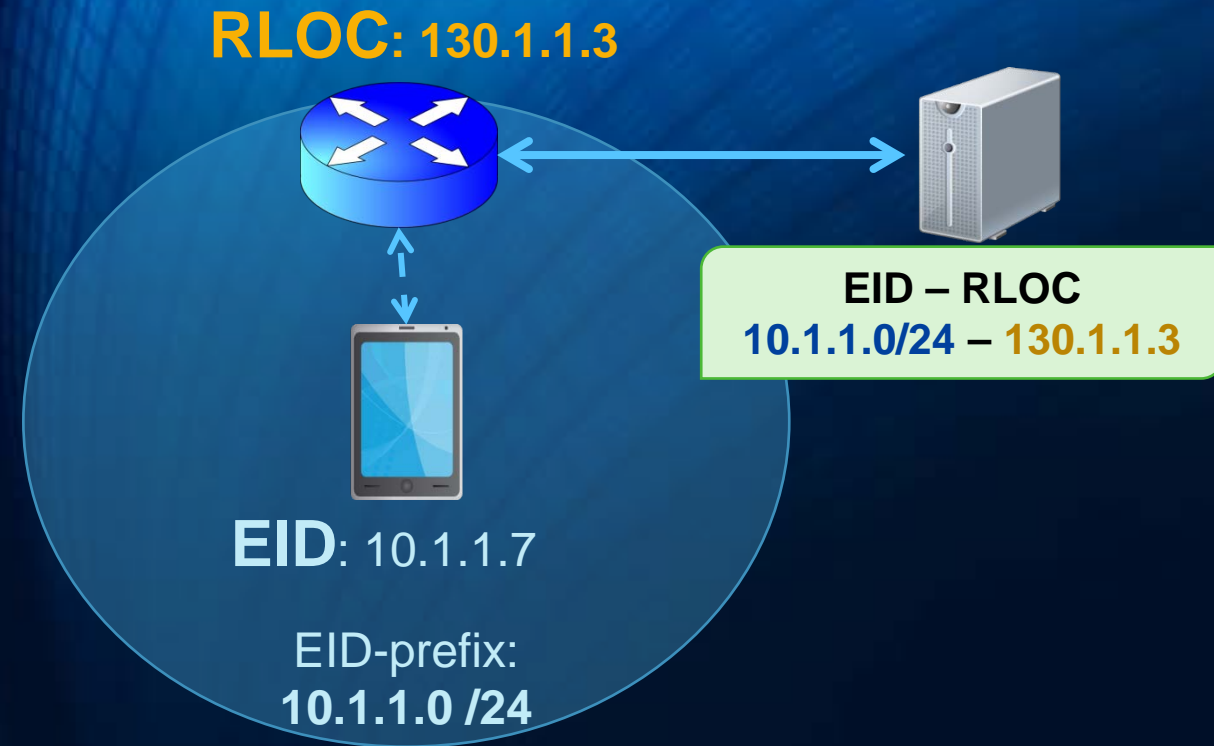
### Loc/ID split

- One address space for user's identity
  - (EID – Endpoint Identifier)
- One address space for user's location
  - (RLOC – Routing LOCator)

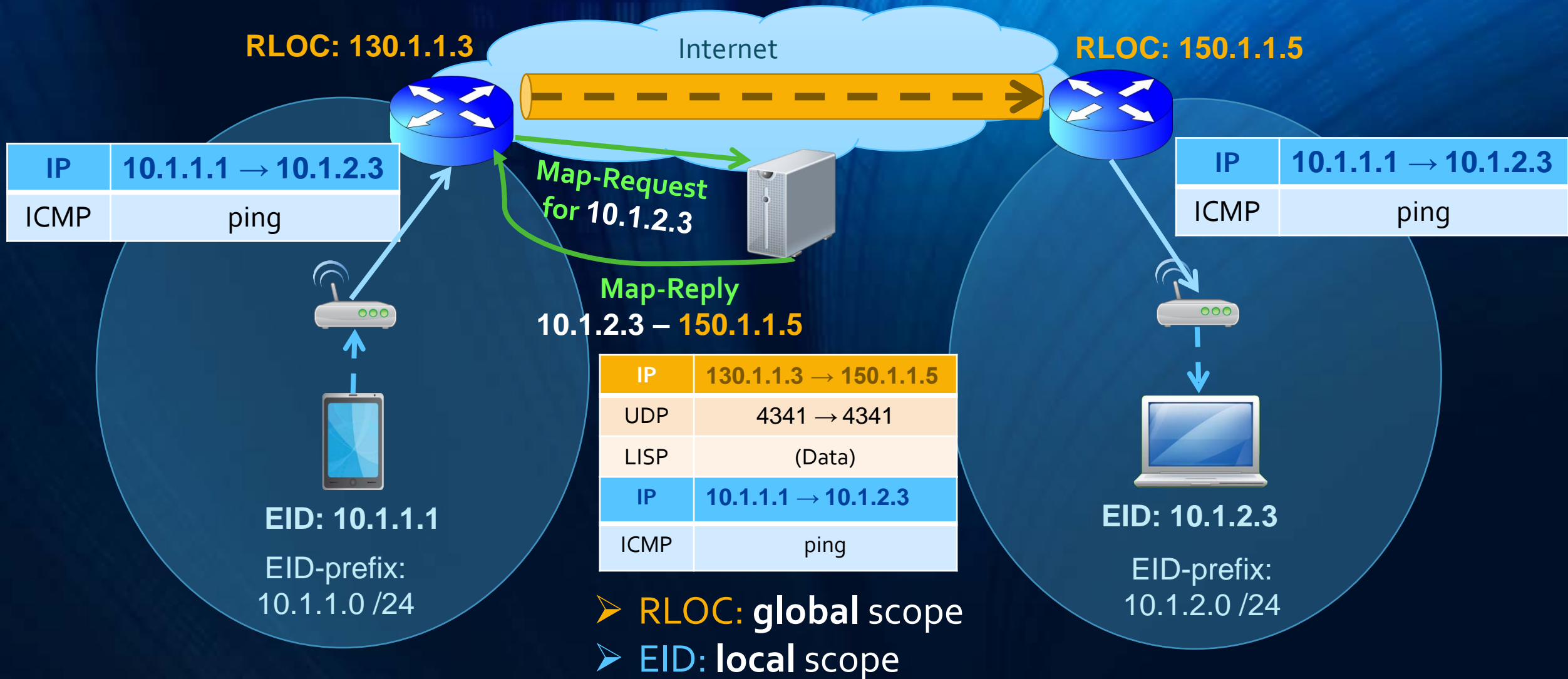
User's location changes → User's RLOC changes

# LISP overview

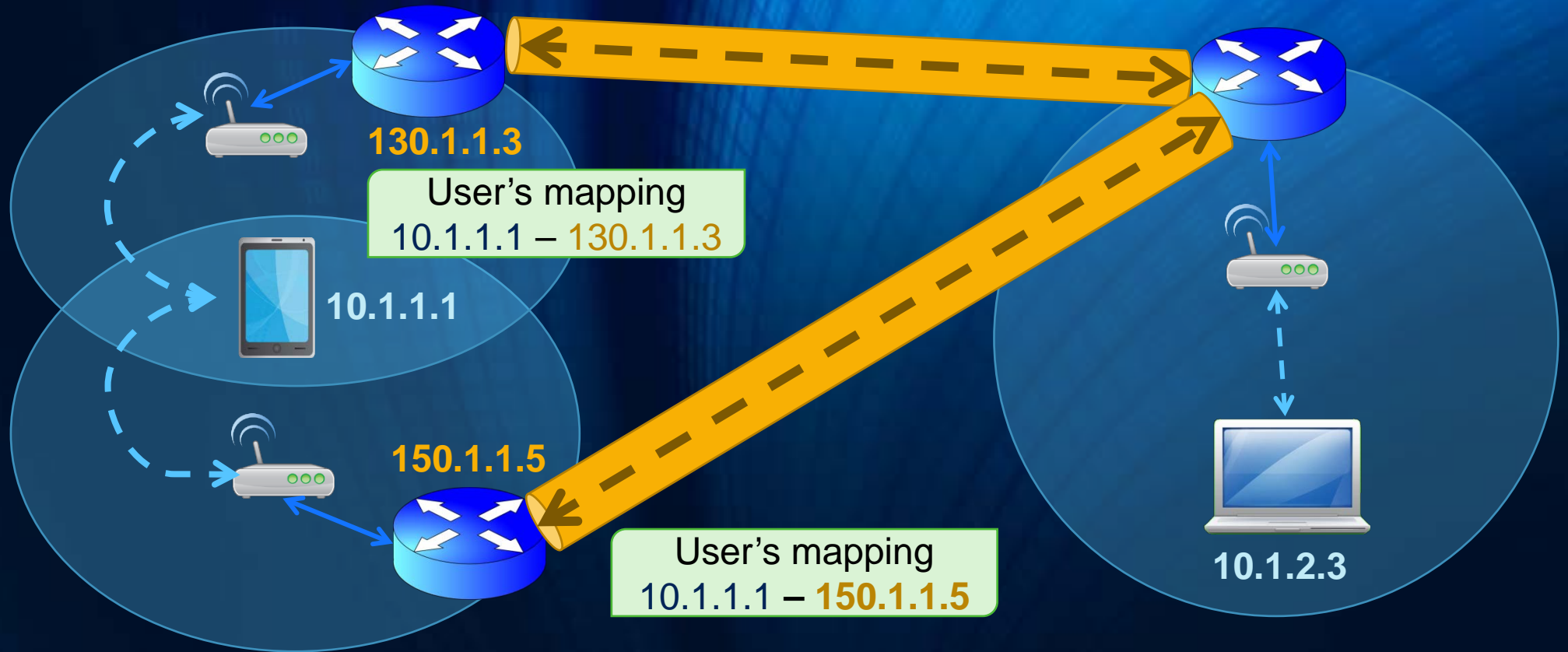
- **xTR** (Edge Router)
- Subnetwork with **EID-prefix**
- Users in the network are given an **EID** from the prefix
- A **Map-Server** is used for storing mappings
- A **Map-Resolver** for retrieving mappings



# LISP in a nutshell



# Idea



Update user's **RLOC** when he moves

- Establish TCP connections using **EIDs**

# Solution Design – LISP-ROAM

A solution to be implemented by Internet Service Providers

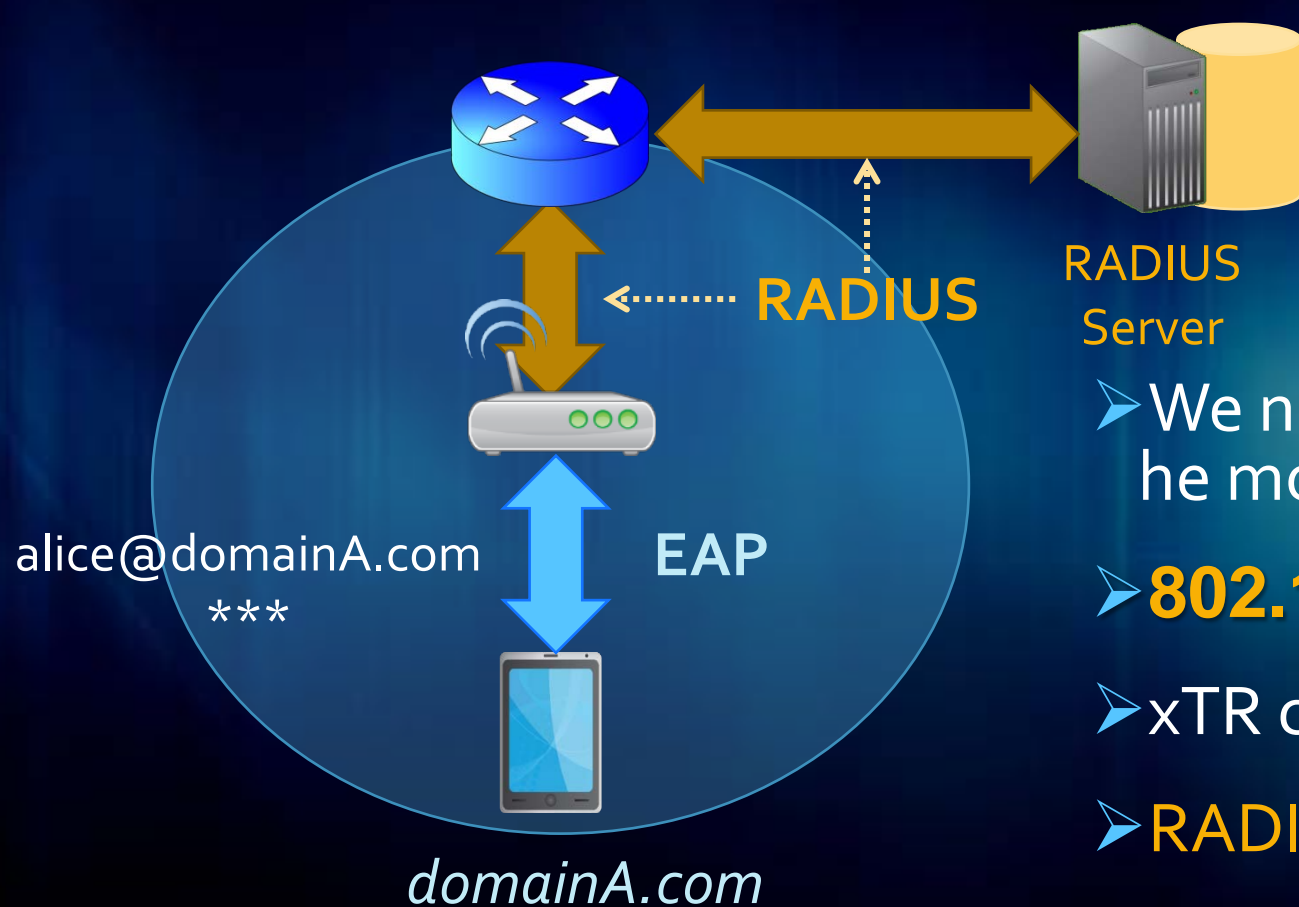
- New mobility service
- Full trust agreement
- Possibility to roam across every network
- User is assigned a fixed EID

# Five Steps

Everytime a user connects to a network...

1. User authentication
2. User's EID retrieval
3. User's local configuration
4. User's home Map-Server retrieval
5. User's location update

# 1. User authentication

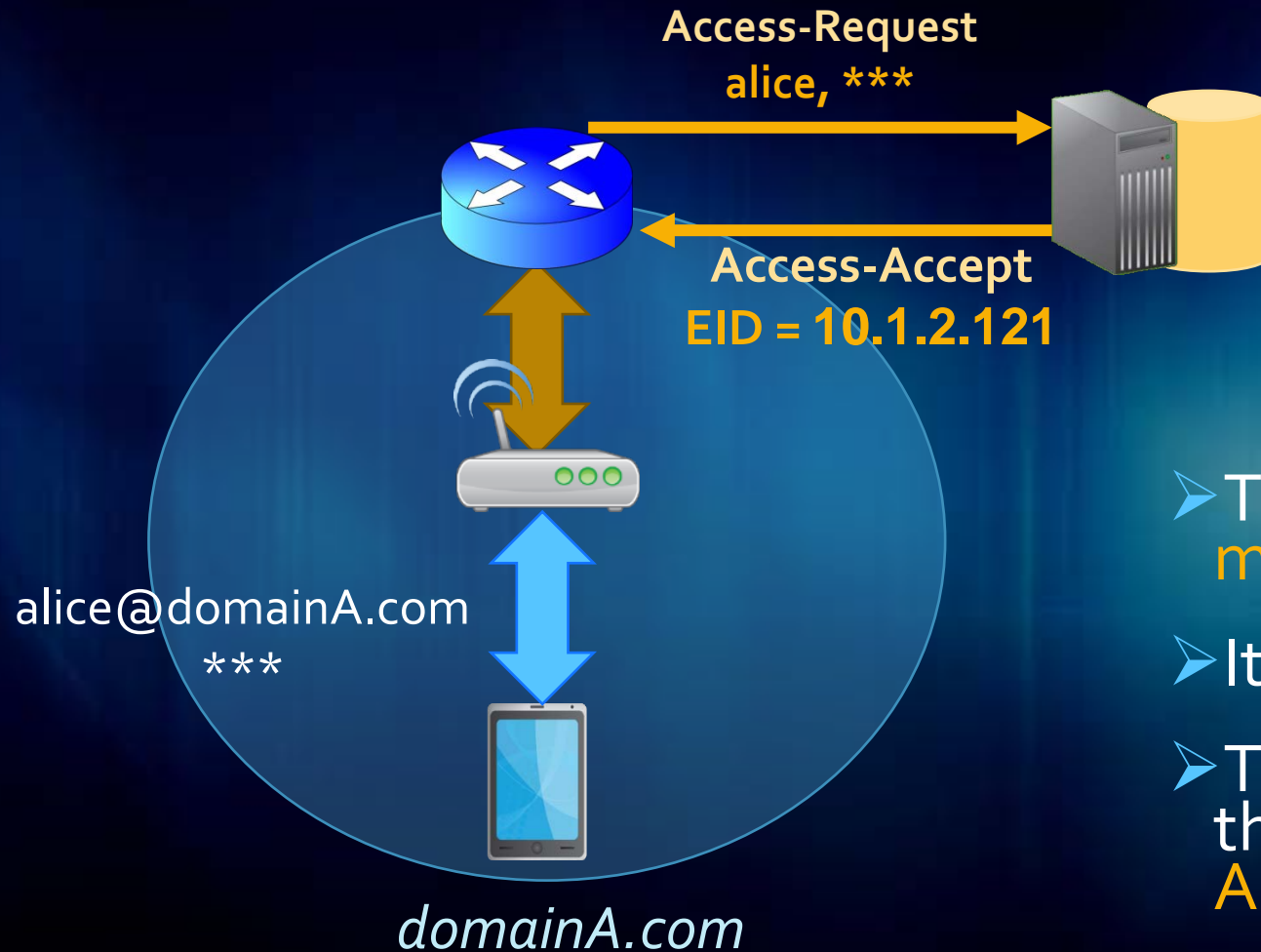


Username	Password
alice	***
bob	***

- We need to keep track of the user while he moves
- **802.1x** standard
- xTR checks credentials with **RADIUS**
- **RADIUS Server** stores users' credentials



## 2. User's EID retrieval



Username	Password	EID
alice	***	10.1.2.121
bob	***	10.1.2.137

- The RADIUS Server can store **multiple** attributes
- It's possible to store user's **EID**
- The RADIUS Server returns the EID embedded in the **Access-Accept**

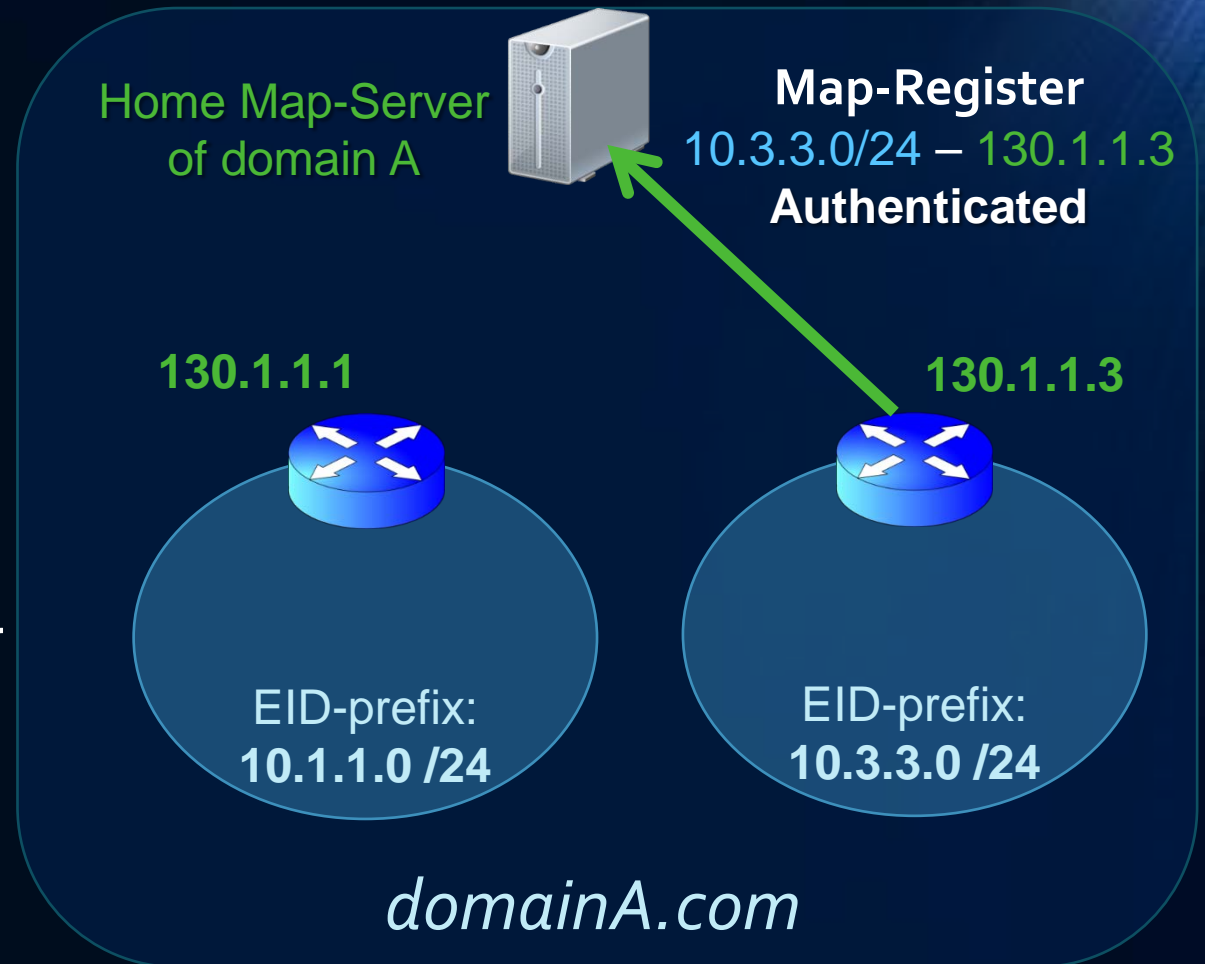
# 3. User's local configuration

- A local virtual interface is created for every user
- The xTR has an alias IP for every user
- The xTR is the default gateway for the user



# 4. User's home Map-Server

- One Map-Server per domain
  - All Map-Servers form a Distributed Mapping System
- Home Map-Server
  - Home domain's Map-Server
- Every xTR knows the **key** related to its EID-prefix



# 4. User's home Map-Server

When a **foreign** user connects to a network  
the xTR has to retrieve user's home **Map-Server's...**

## 1. Address

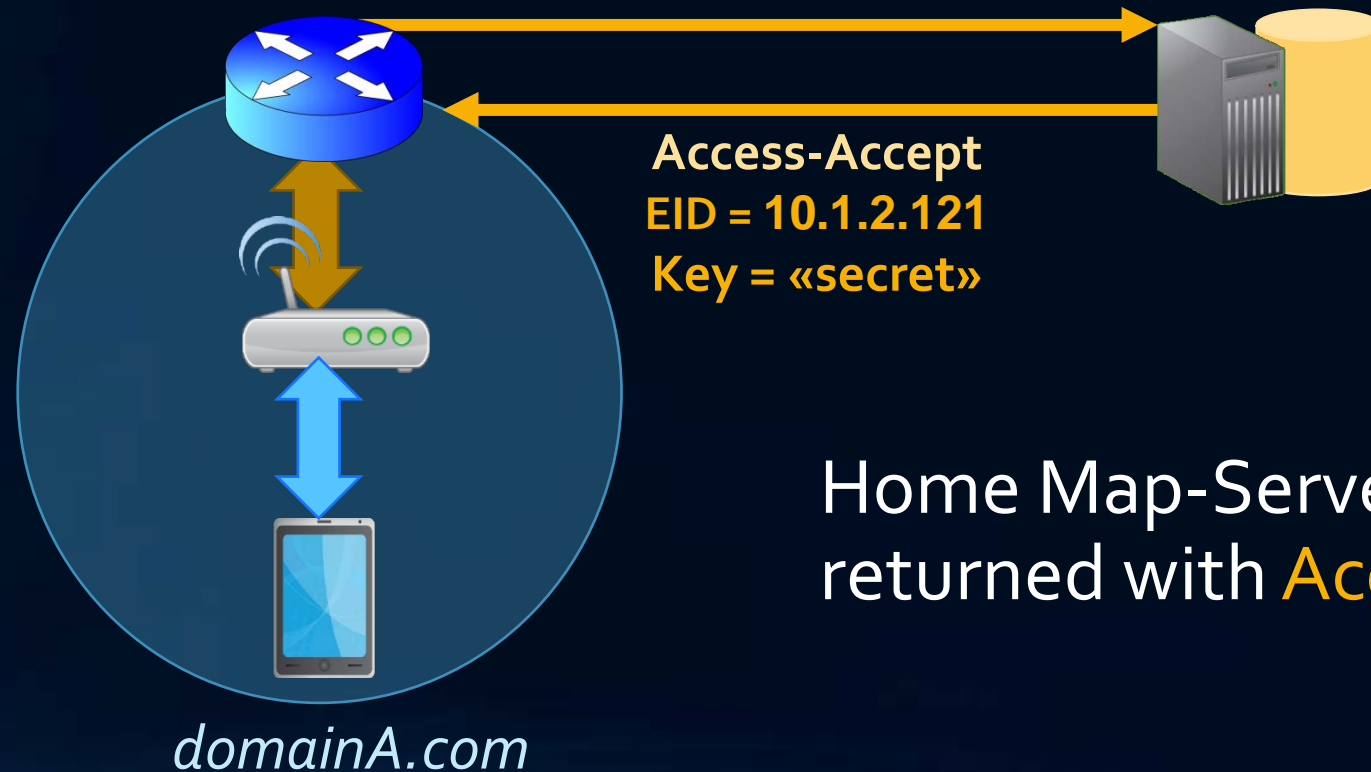
- Can be done using the LISP infrastructure
- ...or through other systems (DNS)

## 2. Key

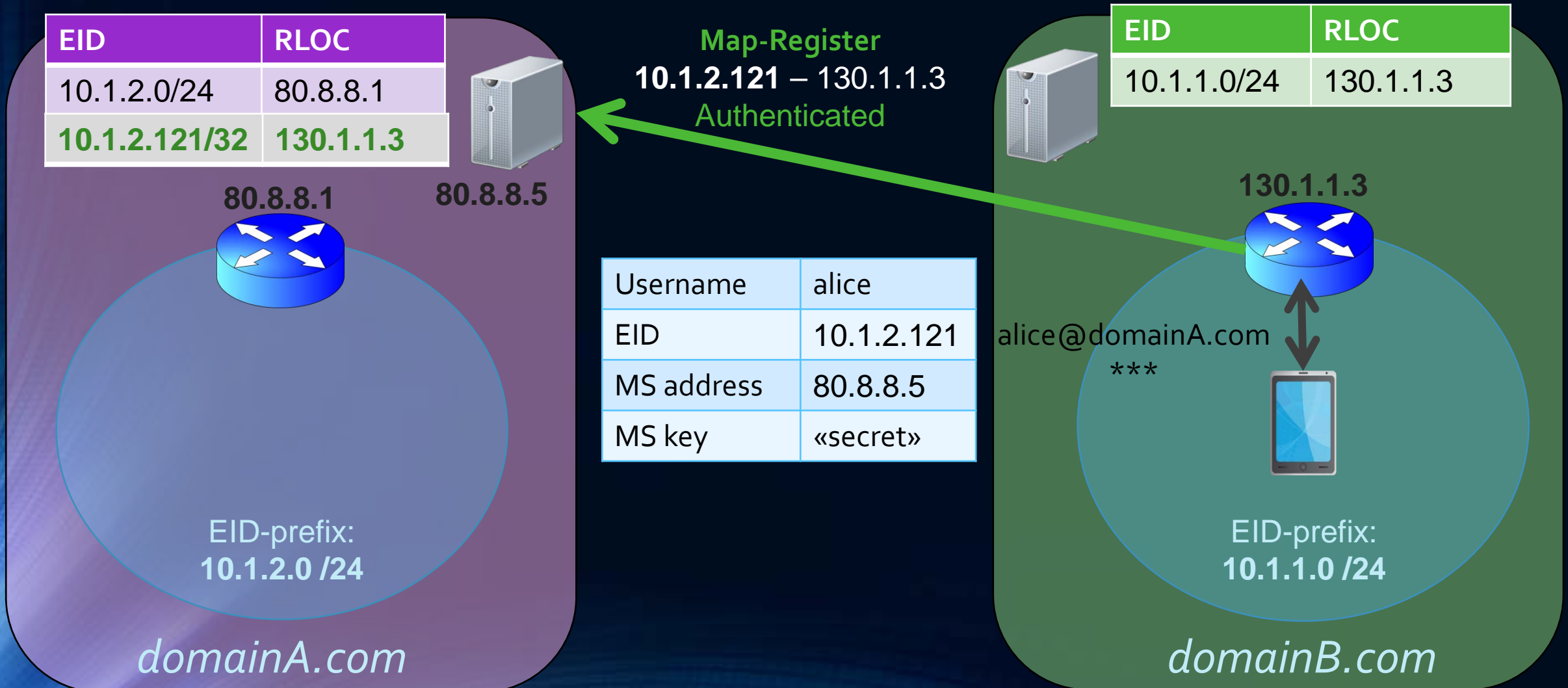
- ...use RADIUS attributes

# 4. User's home Map-Server **key**

Username	Password	EID	Map-Server key
alice	***	10.1.2.121	«secret»
bob	***	10.1.2.137	«secret»

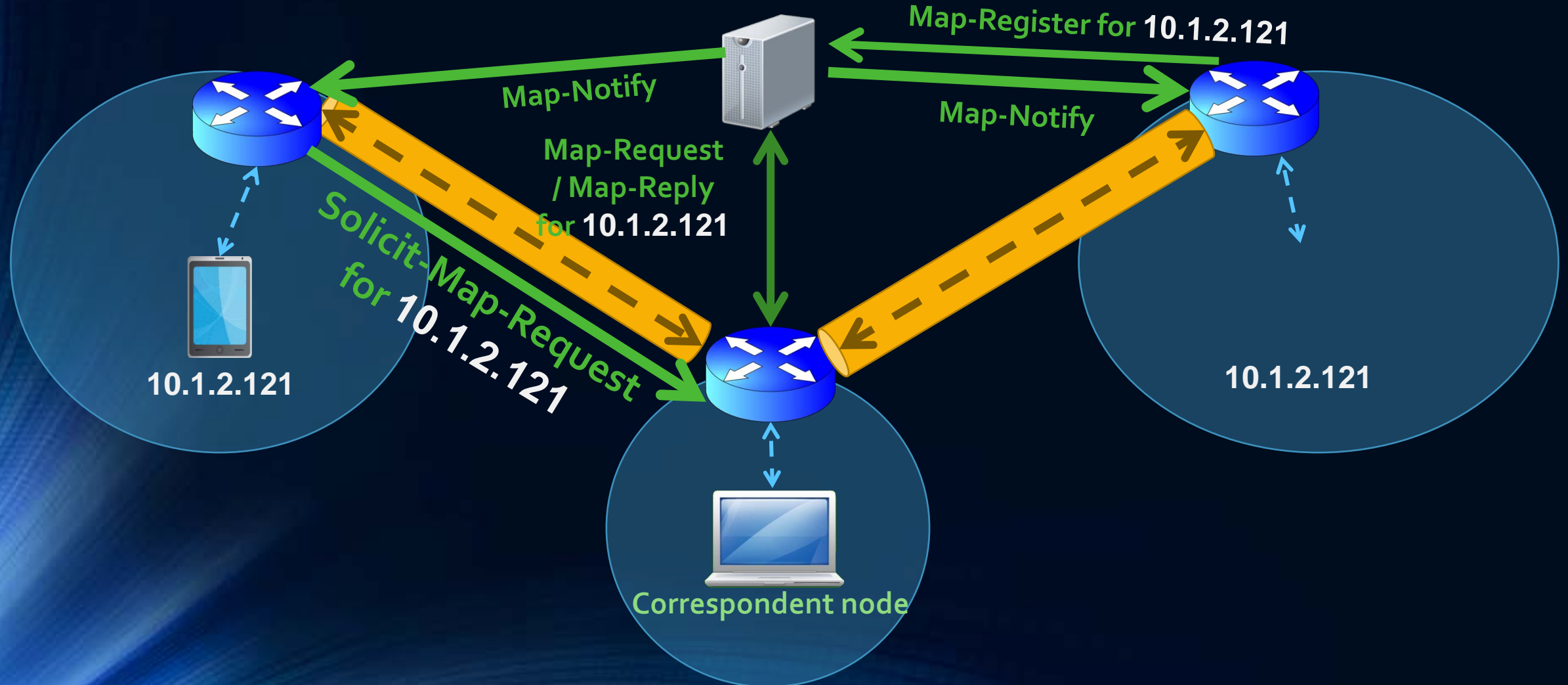


# 5. User's location update

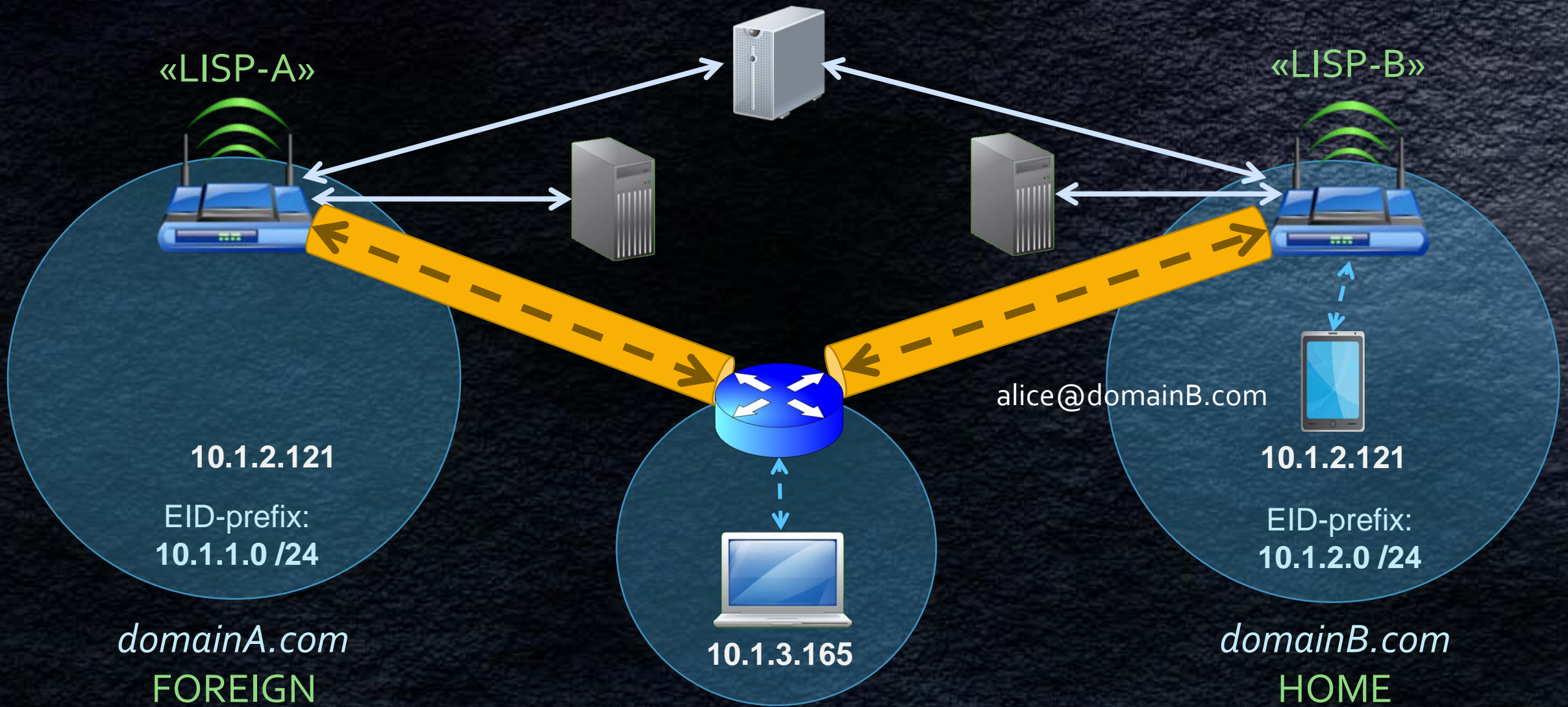


# Update correspondent nodes

LISP Map-Server / Map-Resolver



# Test bed



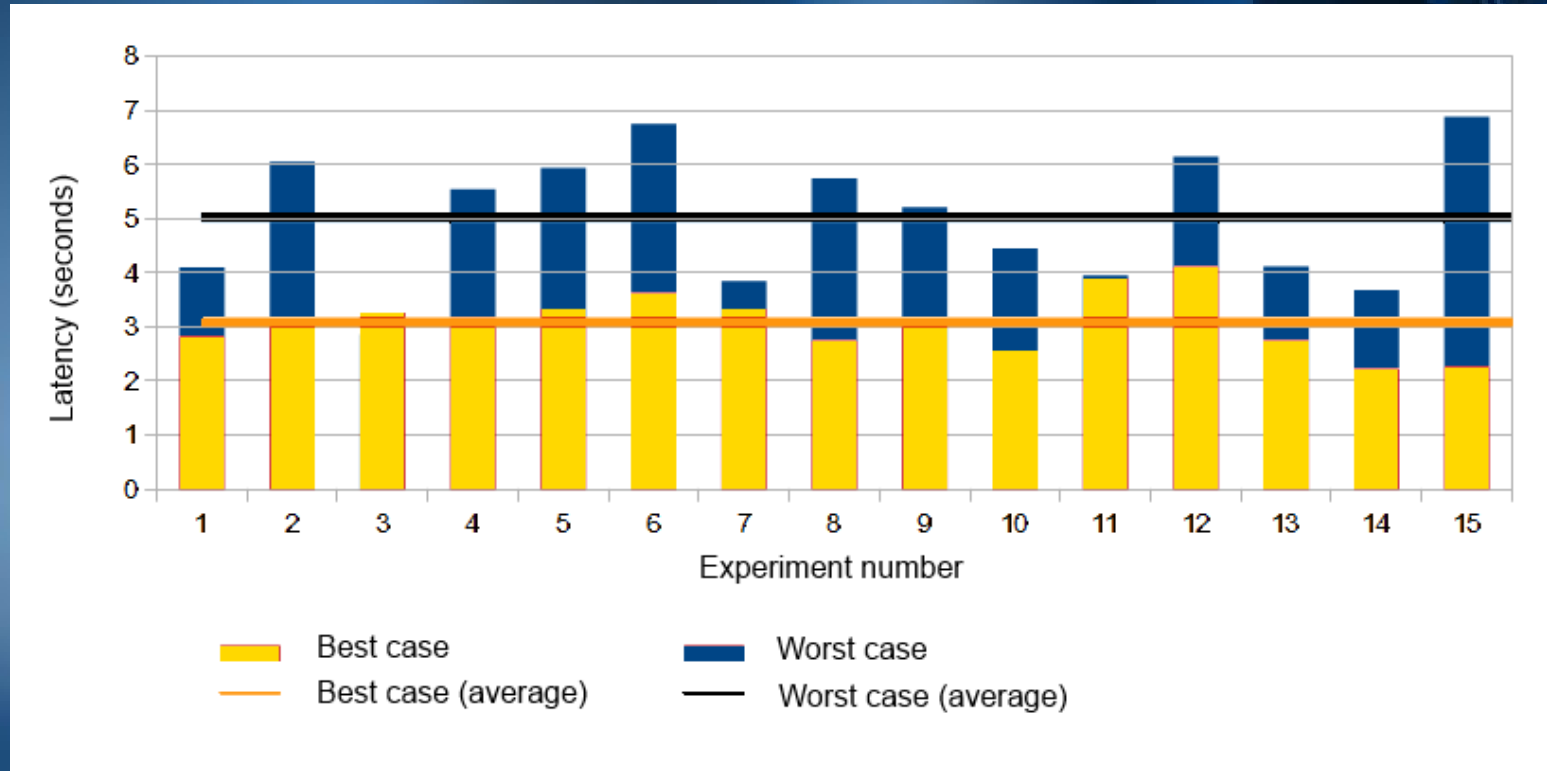


# Handover test

## Latency and packet loss

1. User home / foreign
  - User connects to home / foreign network
2. User known / unknown
  - User has connected before to the network

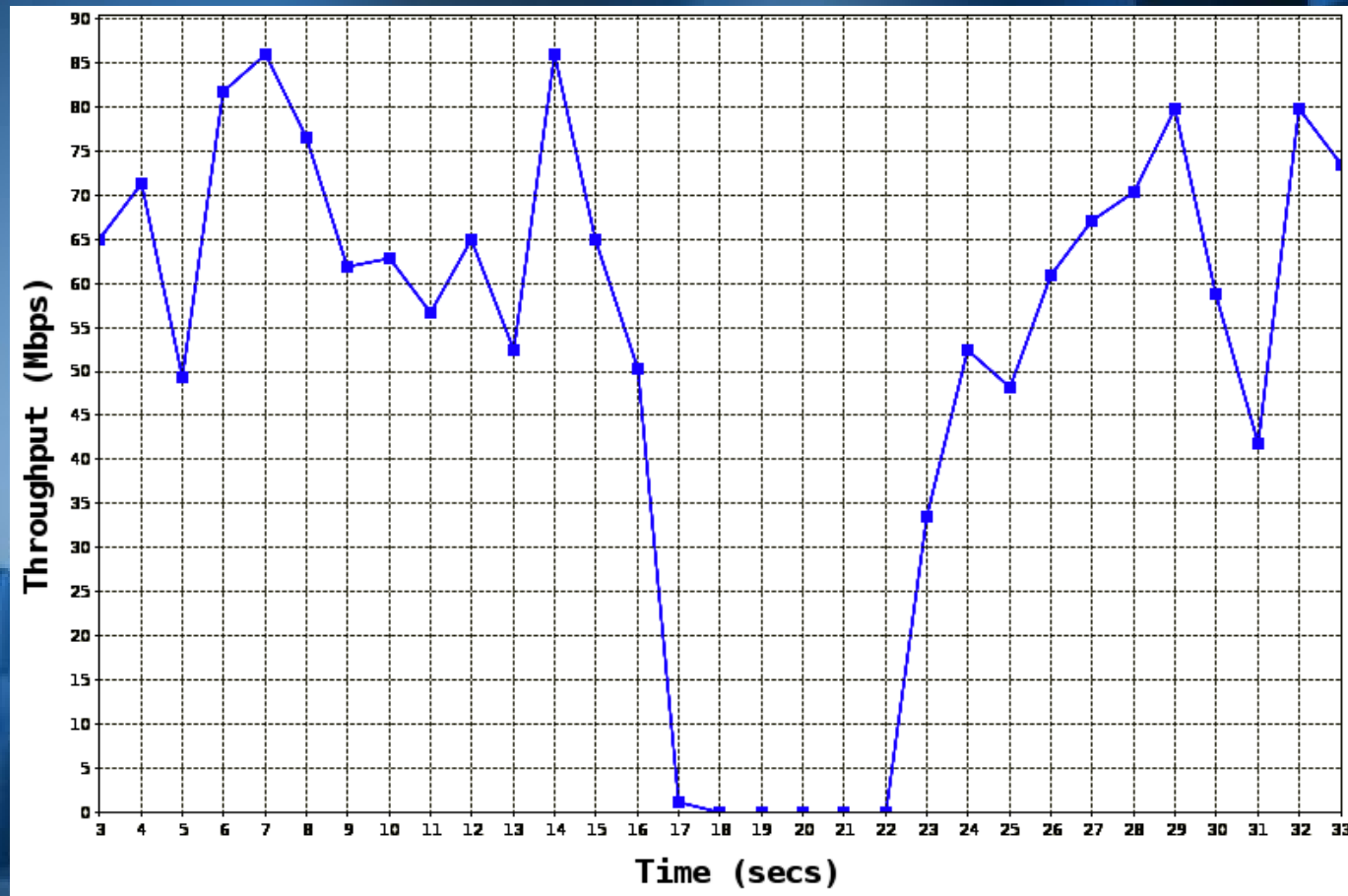
# Latency



**Best case:** Known user connecting to home network

**Worst case:** Unknown user connecting to foreign network

# Packet loss



The throughput is decreased to ~0 Mbps during the Handover

# Conclusions

- ✓ **LISP-ROAM actually achieves connection continuity in user mobility**
- ✓ It can be considered a suitable solution for realistic scenarios (buildings, campuses, ...)
- ✓ The solution has been tested in a small scope but can be considered being implemented in wider scenarios (ISP level)
- ✓ The assumptions made allow future extension / interoperability with 3G operators

# Thanks for your attention

[bit.ly/lisp-roam](http://bit.ly/lisp-roam)

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