IPv6 in cross border applications - GEN6

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GOVERNMENTS ENABLED WITH IPv6
GEN6

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European Commission

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  - Architecture
  - Analysis of current interconnection networks
  - Definition and testing of IPv6 interconnection
- Implementation of a IPv6-enabled cross-border service
  - Authentications Services as an horizontal services

GEN6 IPv6-readiness for cross-border services

1. Design of a network architecture that assures seamless IPv6 interconnection in a transition scenario
2. Analysis of current interconnection networks
3. Definition and testing of the interconnection between German and Spanish access points to get an end-to-end connection via operational IPv6 connectivity
4. Implementation of a Pilot that demonstrates the feasibility of the IPv6 based cross-border service, based on a realistic use case:
   - Cross-border authentication for egov services using STORK

GEN6 Objective on Cross-Border

- Identification of the needed technical arrangements for interoperability of the IPv6 transition for all domestic strategies.
- Prepare different transition scenarios in a mixed environment of IPv4 and IPv6 clouds in the government tiers (national, regional, universities, …),
- Test the interoperability scenarios and compile a troubleshooting manual, roadmap of actions developed and guidelines.
- Define different cross-border scenarios for egov and other services.

Cross-border e-government services

a) Are provided by or on behalf of European public sector entities;
b) At local, regional, national, or supra-national level;
c) By means of interoperable trans-European telematic networks;
d) In order to improve public administration tasks;
e) That are capable of meeting a service demand of public entities, citizens, and/or businesses other than those which are native to the public sector entity's geographic level through nationality, registration or incorporation.

EU's Digital Agenda Study on Analysis of the Needs for Cross-Border Services and Assessment of the Organisational, Legal, Technical and Semantic Barriers (SMART 2011/0074)

Cross-border e-government services

- A2C: Administration to Citizen
  - Register as domicile, driver's license, work permit, electronic prescription
- A2B: Administration to Business
  - Register a legal entity, tax declaration, paying social security
- A2A: Administration to Administration
  - Social security information, criminal records, customs and taxation

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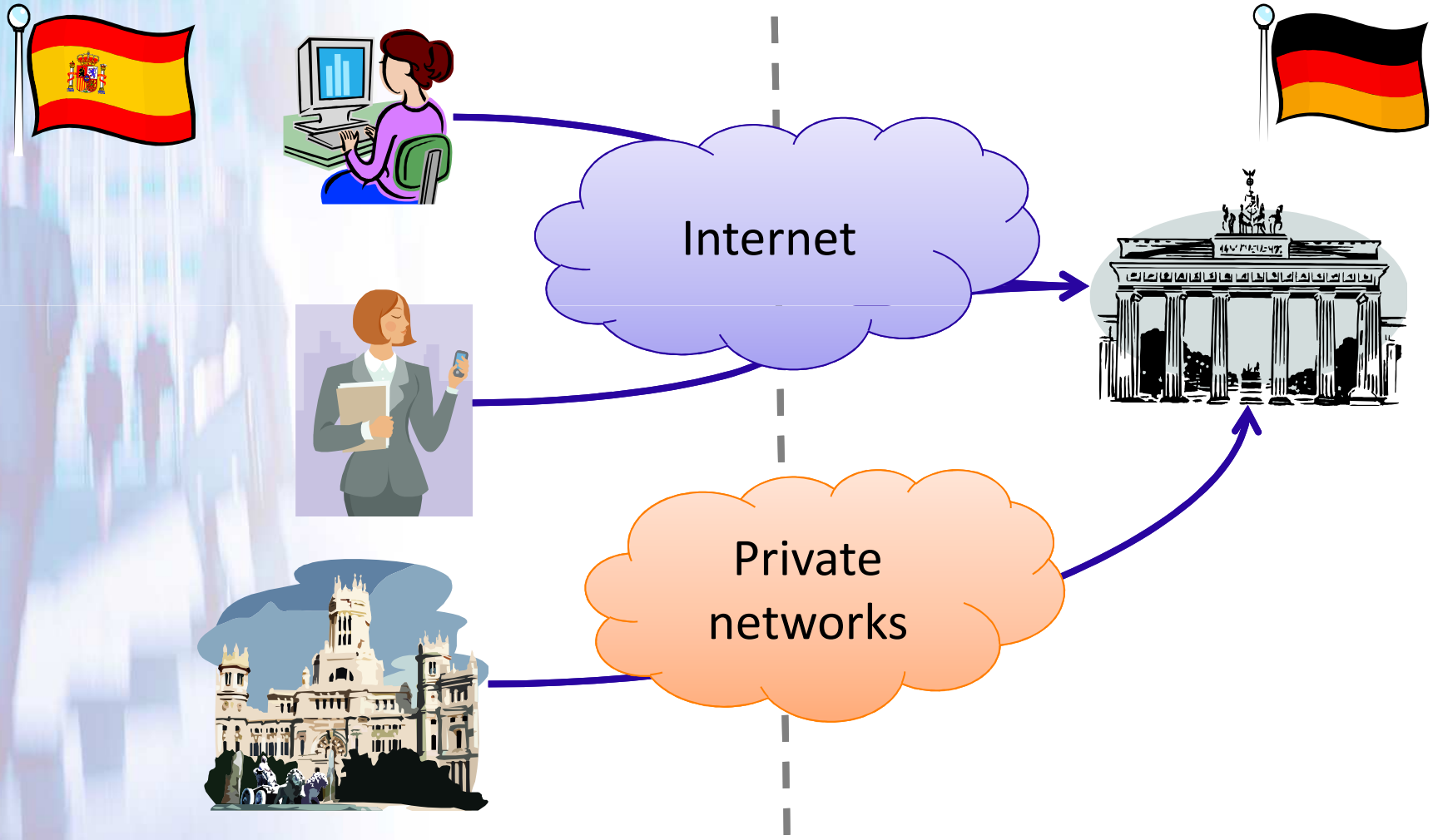
Cross-border e-government services



STORK

- Large Scale Pilot in the CIP program
- Extends eID authentication across Europe
  - eAuthentication is an electronic process that allows the validation of the electronic identification of a person.
- Generic service
  - Used by other e-government services that rely on the STORK platform for identification and authentication
- STORK
  - Executed from 2008 to 2011
  - Deployed a interoperability platform for European eID
  - Citizens can access to foreign e-government services using their national eID
- STORK 2.0
  - From 2012 to 2015
  - Extends eAuthentication to legal persons

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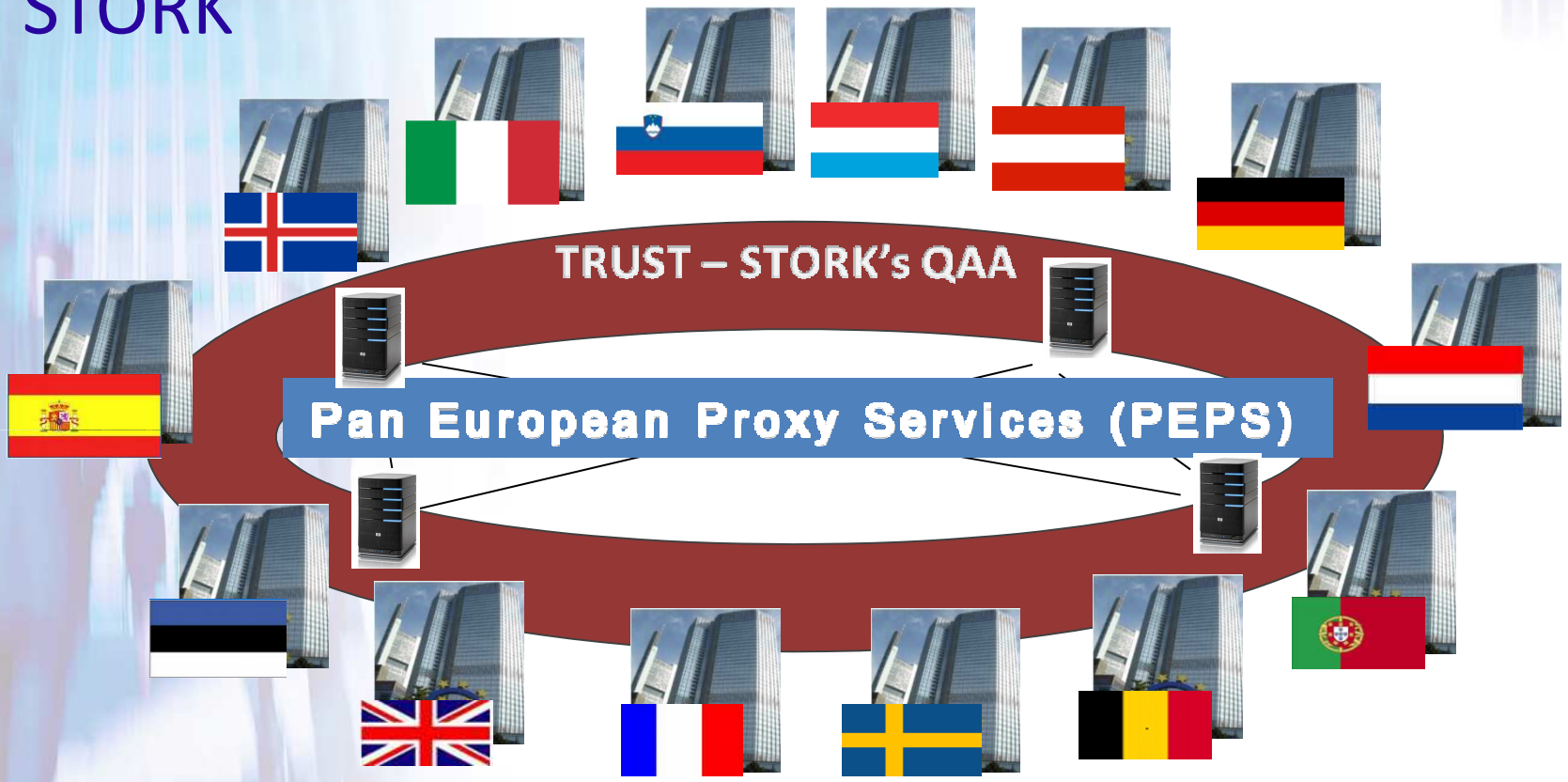
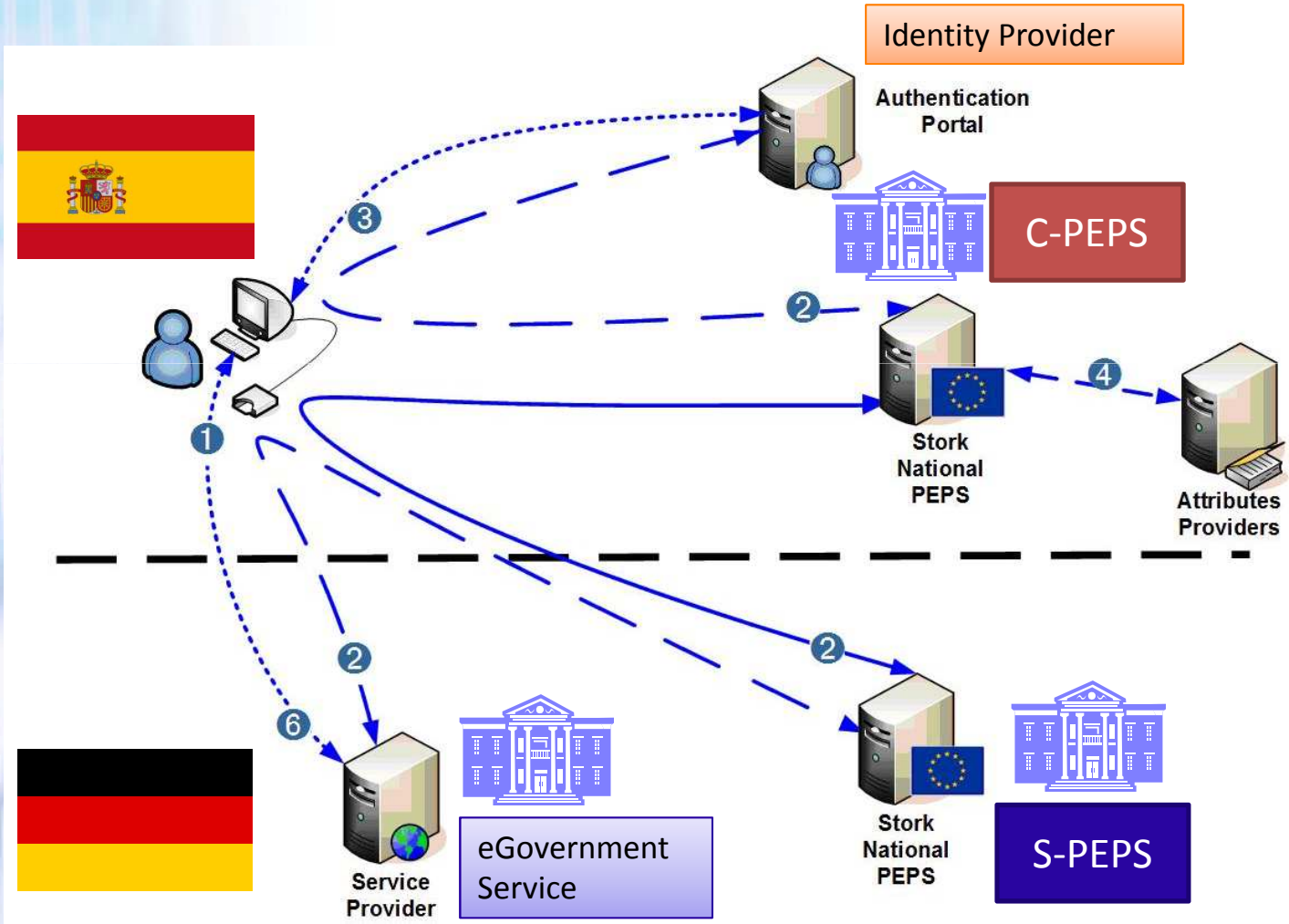
STORK



- Based on the concept of "Circles of trust"
- Service provider -> S-PEPS -> C-PEPS -> Identity provider

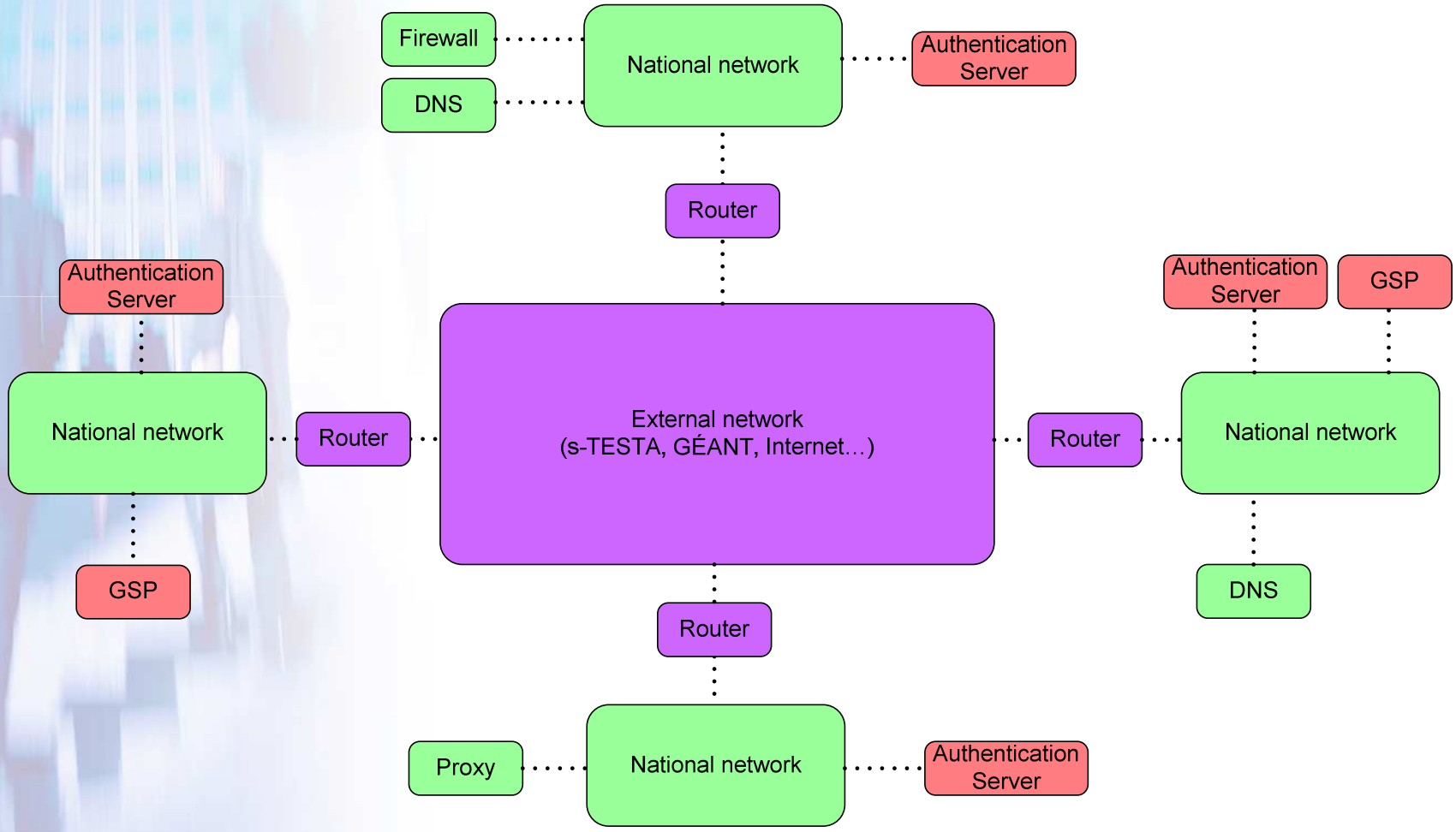
STORK



1. Architecture

- Grounded on existing interconnection infrastructures
- Composed by three elements
  - Government Service Providers (GSPs)
    - The cross-border service (e.g. certificate of address)
    - Also cross-border authentication services (such as STORK)
  - National and regional governmental networks
    - Interconnect different service providers in a regional or national scope (e.g. Red SARA, DOI)
  - External networks
    - Interconnect national networks (e.g. sTESTA)

1. Architecture



2. Analysis of current interconnection networks

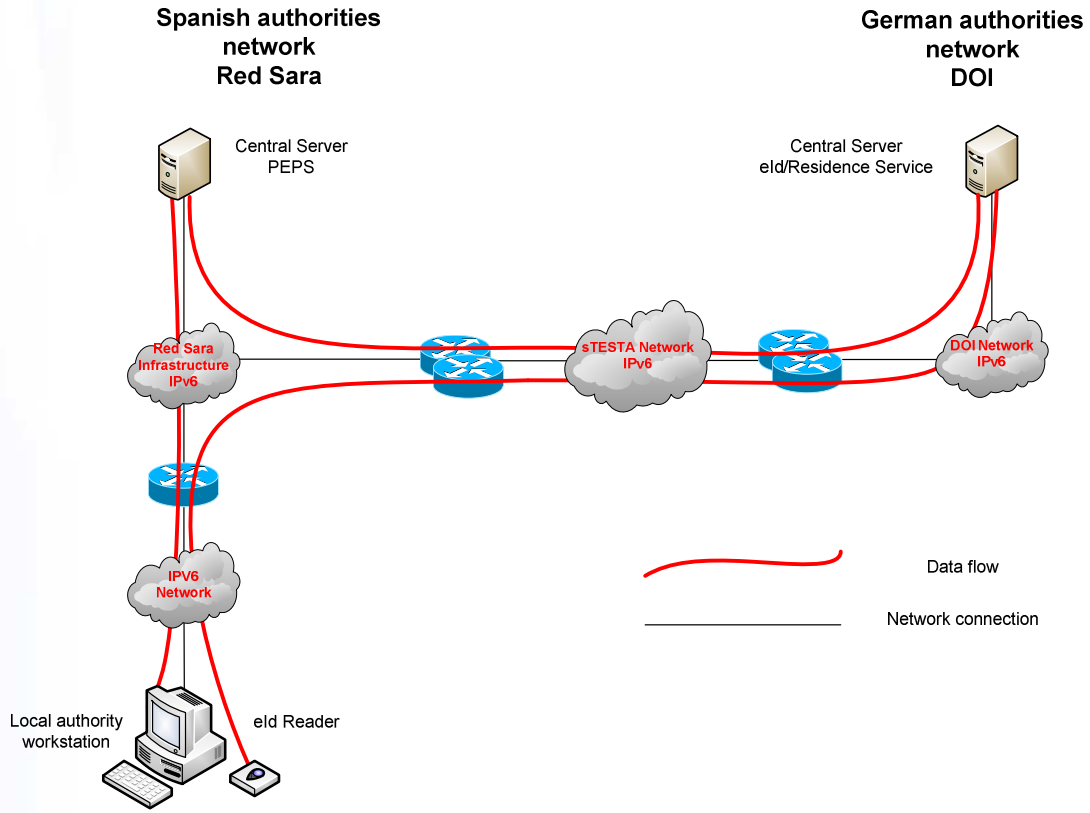
- Cross-border networks: Most relevant are sTESTA and GÉANT
- **GÉANT**
  - Interconnects research and education networks, and some government departments
  - Present on most of Member States
  - Native IPv6 support
- **sTESTA**
  - Interconnects different European networks
  - Preferred solution to exchange information between European administrations
  - Offers integrated security of communications
  - IPv4-only, sTESTA-ng will offer IPv6 but not before than 2015 once transition phase is finished

3. Definition and testing of IPv6 interconnection

- Enabling German and Spanish access points to get end-to-end IPv6 connection
- Two alternatives:
  - Native IPv6 connection
  - Transitional IPv6 connection

3. Definition and testing of IPv6 interconnection

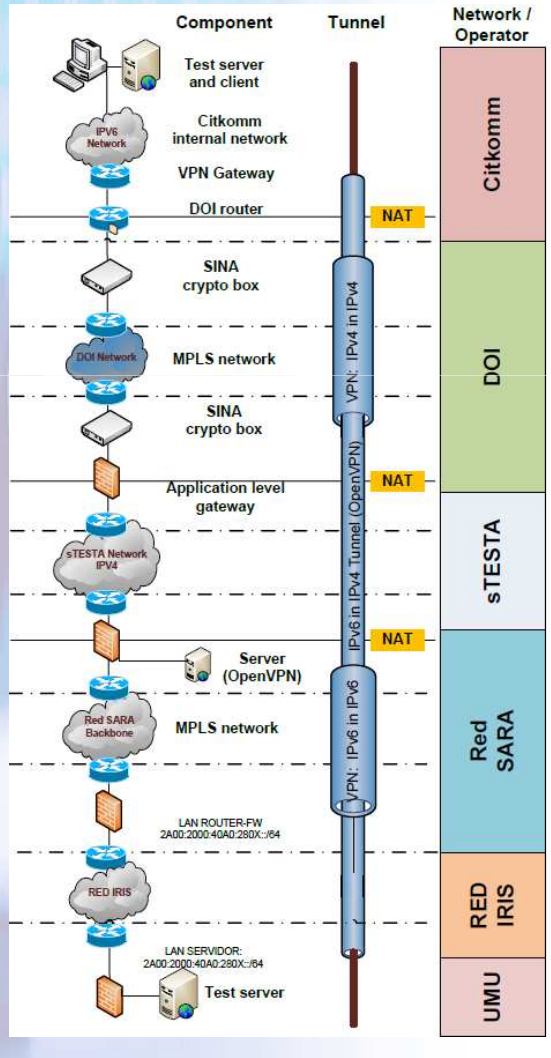
- Native connection:
  - Preferred alternative:
  - Work has been done with DIGIT to provide sTESTA with IPv6 support

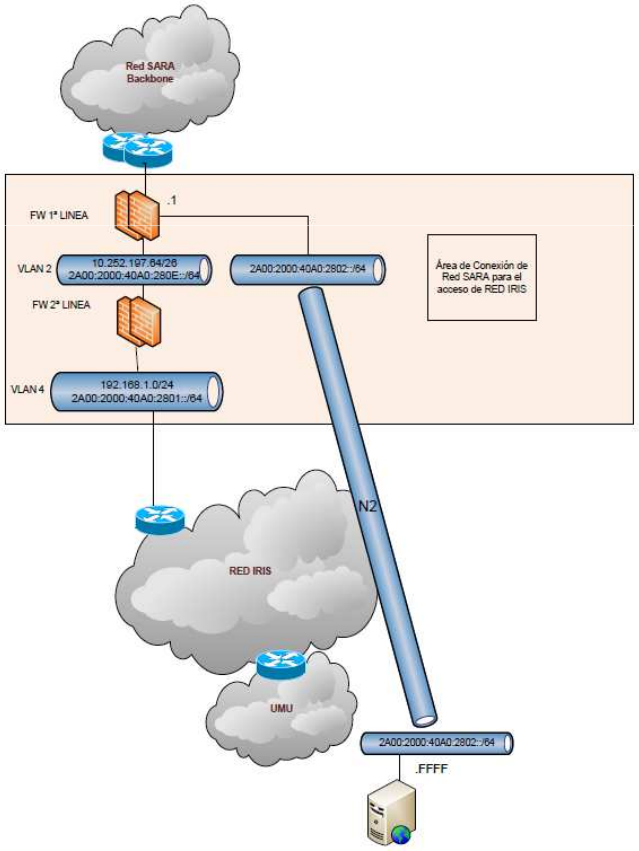


3. Definition and testing of IPv6 interconnection

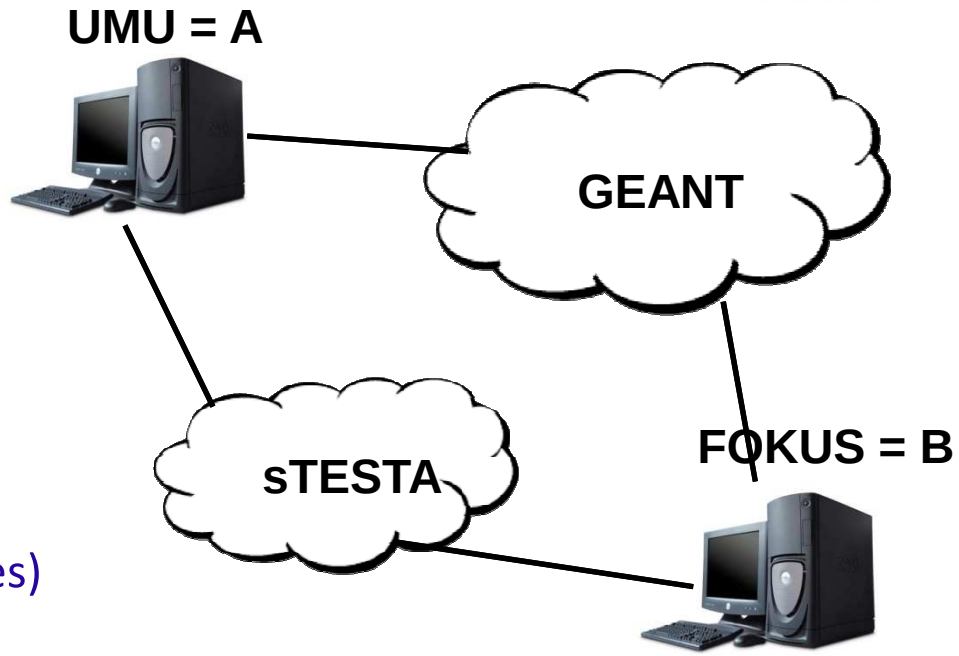
- Native connection:
  - It will not be possible short-term
    - Alternative IPv6-enabled Internet providers, such as GÉANT would be required (not every government department is member)
    - Security and encryption are mandatory when not using sTESTA
- Transitional IPv6 connection
  - Provide a solution based on tunnelling while a native IPv6 network is not available
  - Tested between Germany (Citkomm) and Spain (MINHAP)
  - Two approaches have been tested:
    1. Based on SIT tunnelling
    2. Based on OpenVPN tunnelling

3. Definition and testing of IPv6 interconnection





Testing infrastructure

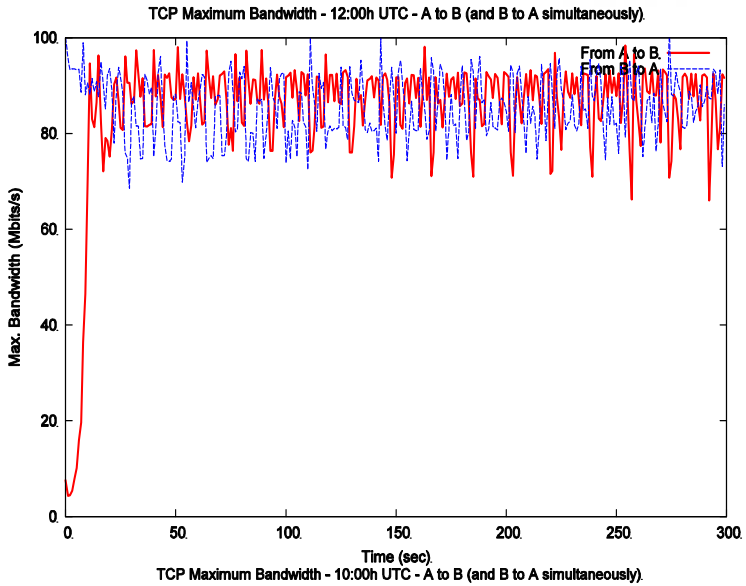


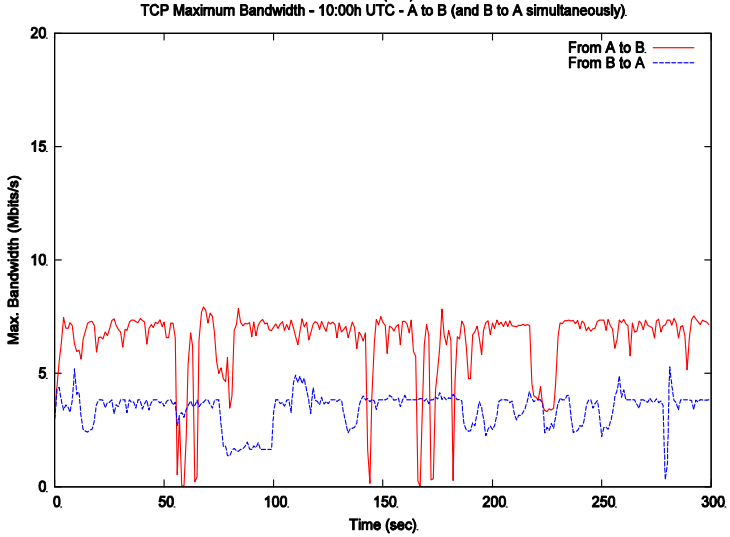
- Test Batch
  - TCP A → B (5 minutes)
  - TCP A ← B (5 minutes)
  - TCP A ←→ B (5 minutes)
  - UDP 1Mbps A → B (5 minutes)
  - UDP 1Mbps A ← B (5 minutes)
  - UDP 1Mbps A ←→ B (5 minutes)
  - ICMPv6 A ←→ B (5 minutes)
- This test batch is launched **every hour** during **a whole day**
- How **the PDR% changes** when the transmission speed is increased
- Results
  - Max. Bandwidth, Packet Delivery Ratio (PDR) and Round-Trip Time (RTT)
  - PDR% behaviour in the limit of the link capacity

TCP results – Max. Bandwidth –

- GEANT
  - 70-95 Mbit/s Max. Bandwidth
  - Full duplex and symmetric bandwidth
  - Appreciable “slow-start”
  - No degradation of the QoS

- sTESTA
  - 6.2 Mbit/s Max. BW from A to B
  - 3.4 Mbit/s Max. BW from B to A
  - Asymmetric bandwidth
  - Some degradation of the QoS at office hours





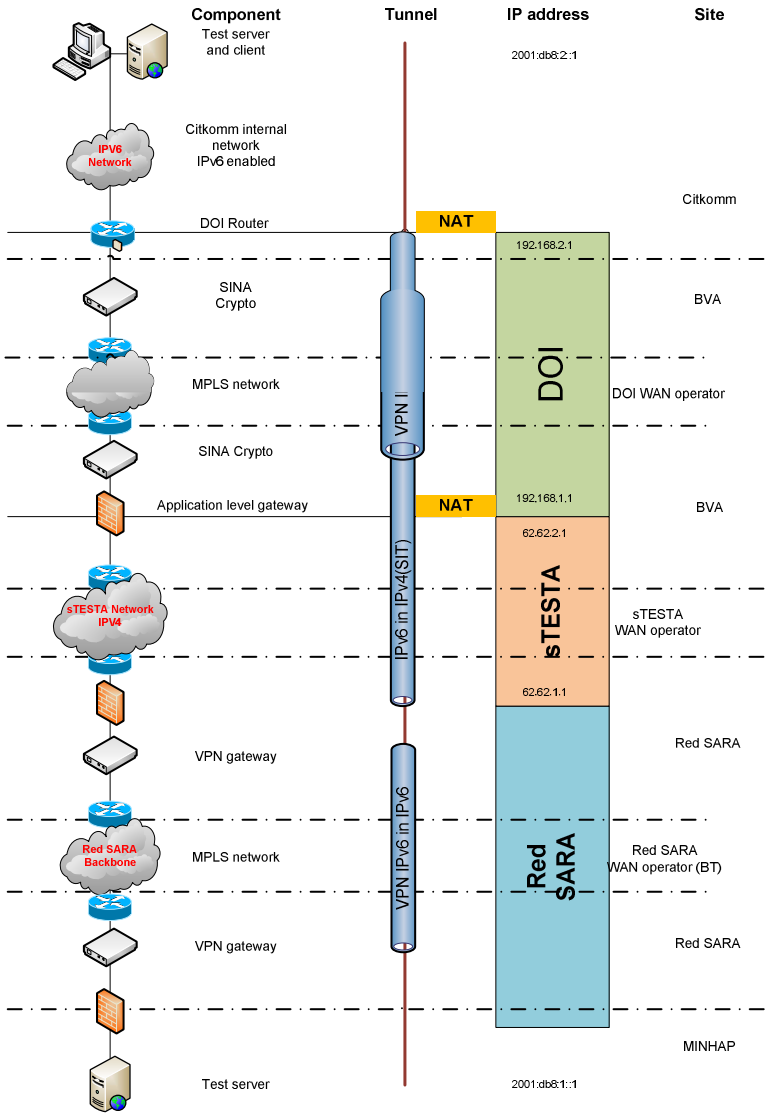
3. Definition and testing of IPv6 interconnection

- Example of Results

Test parts	GEANT (mean)	sTESTA (corrected)	sTESTA (mean)
TCP Max. Bandwidth from A to B	93.141 Mbps	7.72 Mbps	7.11 Mbps
TCP Max. Bandwidth from B to A	93.182 Mbps	5.53 Mbps	5.10 Mbps
TCP Max. Bandwidth from A to B (and B to A)	84.677 Mbps	6.786 Mbps	6.249 Mbps
TCP Max. Bandwidth from B to A (and A to B)	84.676 Mbps	3.735 Mbps	3.440 Mbps
UDP Max. Bandwidth from A to B	~88 Mbps	~9.77 Mbps	~9 Mbps
UDP Max. Bandwidth from B to A	~88 Mbps	~9.77 Mbps	~9 Mbps
UDP PDR% from A to B at 1Mbps	100 %		99.76 %
UDP PDR% from B to A at 1Mbps	100 %		99.96 %
UDP PDR% from A to B (and B to A) at 1Mbps	100 %		99.68 %
UDP PDR% from B to A (and A to B) at 1Mbps	100 %		99.99 %
RTT from A to B	0.122333 sec		0.093963 sec
RTT from B to A	0.155458 sec		0.093710 sec

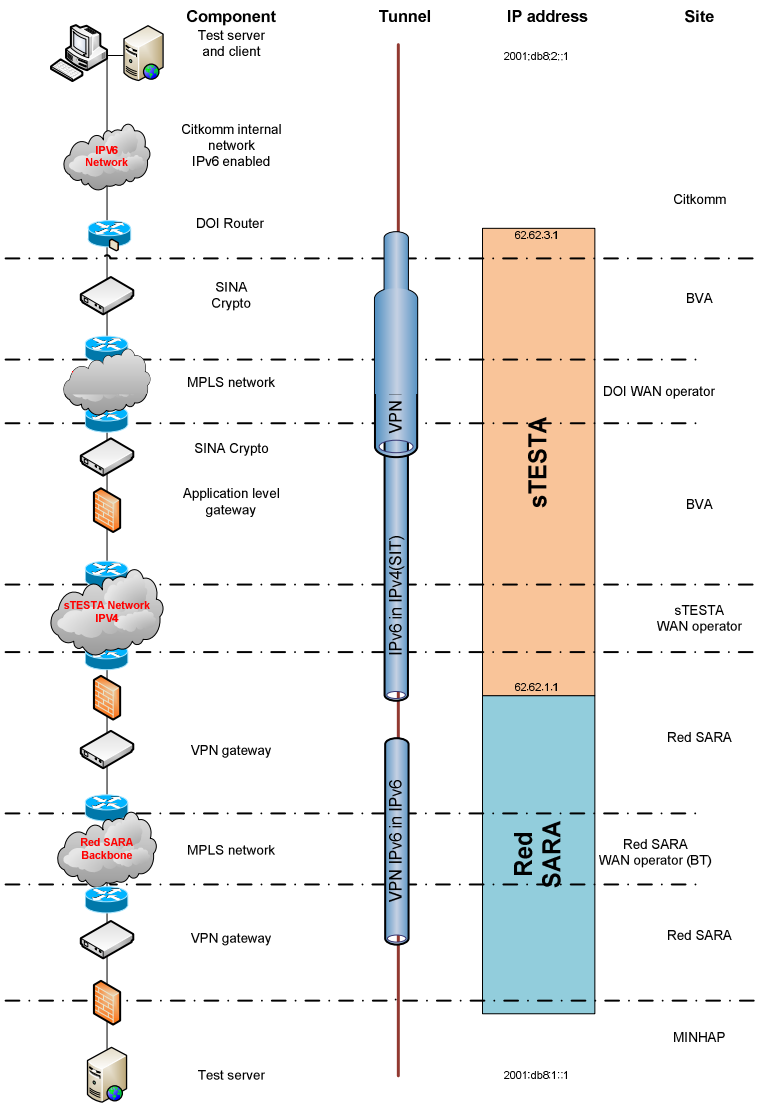
3. Definition and testing of IPv6 interconnection

- Based on SIT tunnelling
  - Pros: Easiness of configuration
  - Cons: Does not offer additional level of security (not really required as sTESTA already provides it)
  - Problem: Application level gateway components in the German side did not work well with NAT



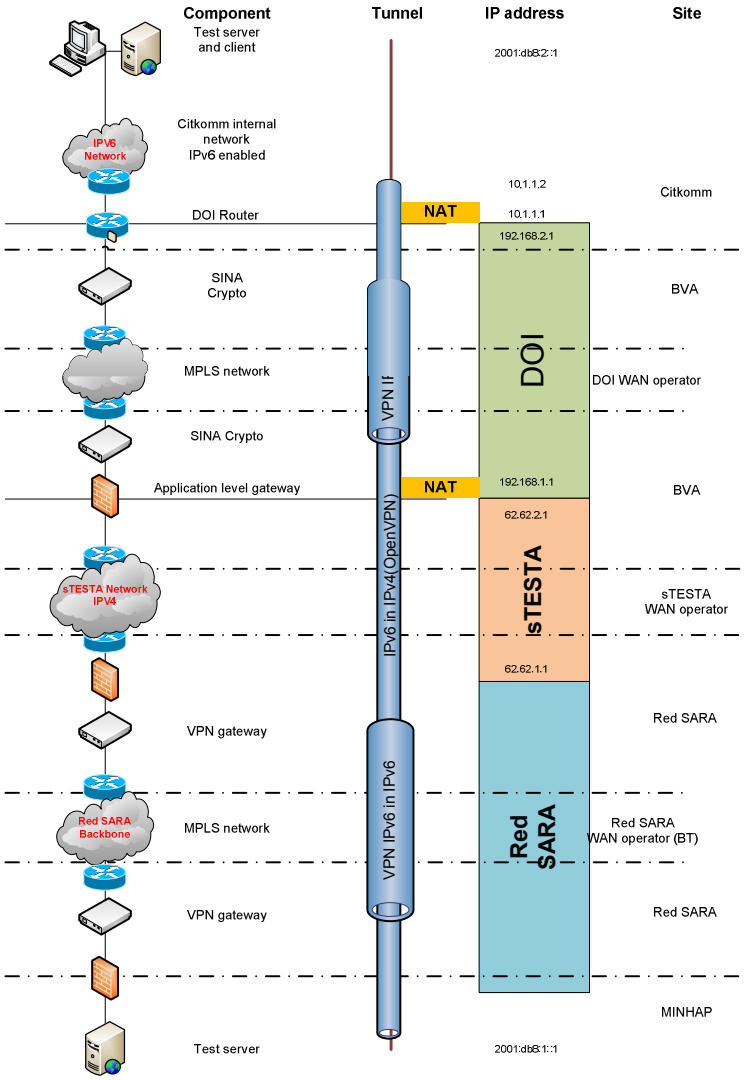
3. Definition and testing of IPv6 interconnection

- Based on SIT tunnelling
  - Solution: Connect Citkomm directly to sTESTA
  - Successful connection



3. Definition and testing of IPv6 interconnection

- Based on OpenVPN tunnelling
  - Pros:
    - Point-to-point security
    - Works well with NAT
  - Cons:
    - More complicated configuration



3. Definition and testing of IPv6 interconnection

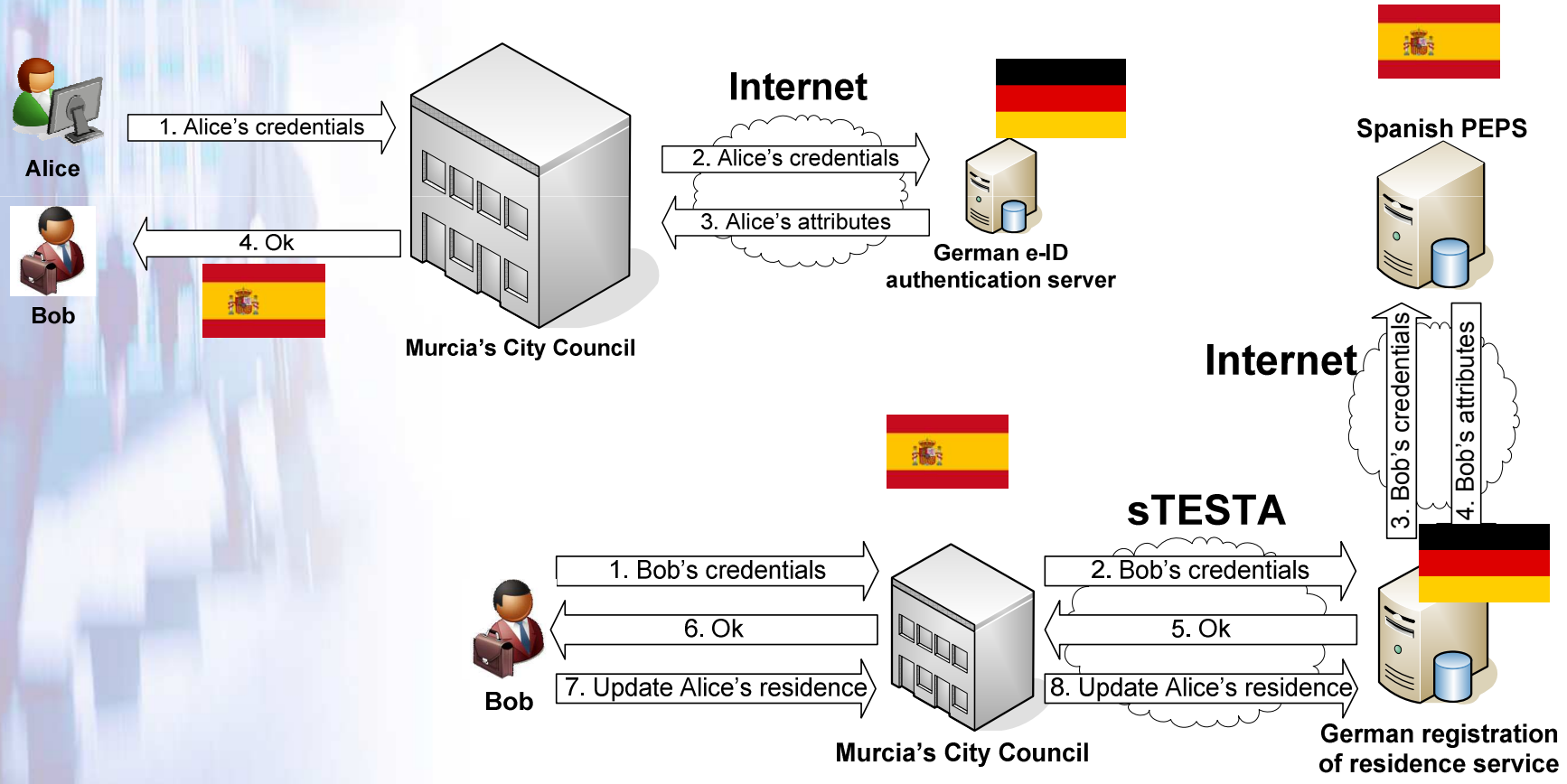
- The connection has been tested with ICMP6 and HTTP traffic
  - Transfer of large files (~ 50MB) over http
  - It delivered the expected performance (~ 2-5Mbit/s) in both directions.
  - DNS not involved in the test, requiring the use of IPv6 literals
- A set of guidelines and good practices is available on the document

4. Implementation of a IPv6-enabled cross-border service

- EID Integration suporting IPv6 in PEPs provided by STORK
- STORK ensures cross-border eID interoperability at European level
- Integrating PEPs in the IPv6 national goverment services provided by GEN6
- Smoothly integration of IPv6 in goverment authenticated services in cross-border
- Support for interconnection with German eID
- Based on a realistic use case
  - Alice is a German citizen who wants to establish her official residence on Murcia. For that she has to apply in the city council premises.
  - After demonstrate her identity (cross-border authentication), the public servant (Bob) updates the Spanish database.
  - Finally, Bob updates the German database, demonstrating he is an authorized Spanish public servant (cross-border authentication)

4. Implementation of a IPv6-enabled cross-border service

- Based on a realistic use case

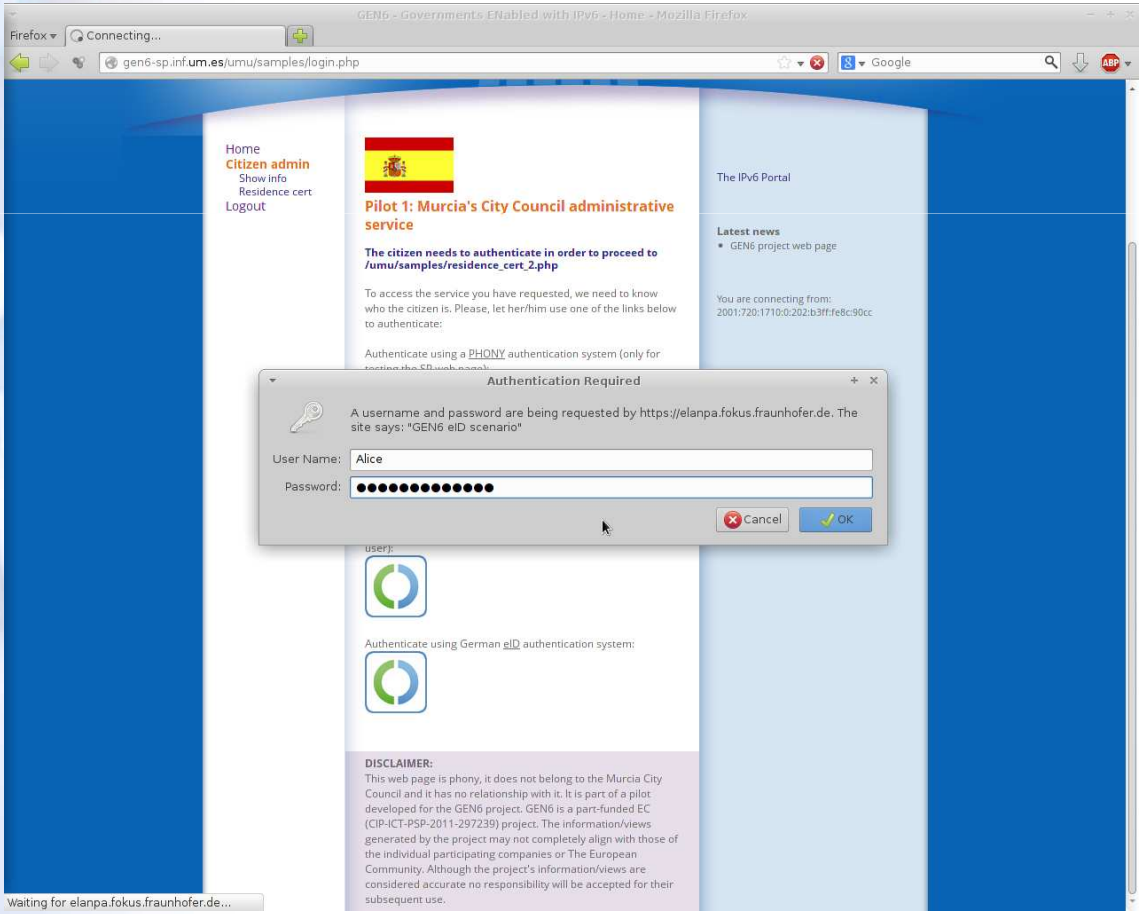


4. Implementation of a IPv6-enabled cross-border service

- We have implemented 4 prototypes cross-border services:
  - City council service (Spain)
  - Registration of address service (Germany)
  - Proxy to German eID system for foreign SPs (Germany)
  - Proxy to STORK for German SPs (Spain)
- We have pushed modifications to 2 in-production cross-border services:
  - Spanish STORK infrastructure (including PEPS, DNS, routes, firewall rules…) to support IPv6
  - German eID system (including firewall rules, DNS, routes…) to support IPv6

4. Implementation of a IPv6-enabled cross-border service

- City council service authenticating Alice (through the proxy to the German eID system)

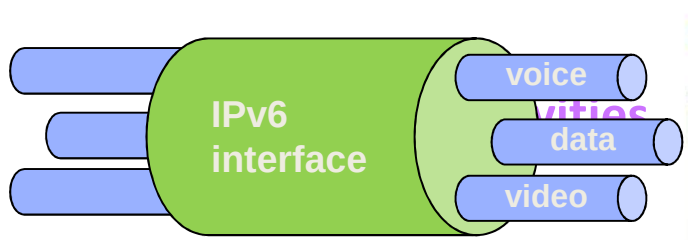


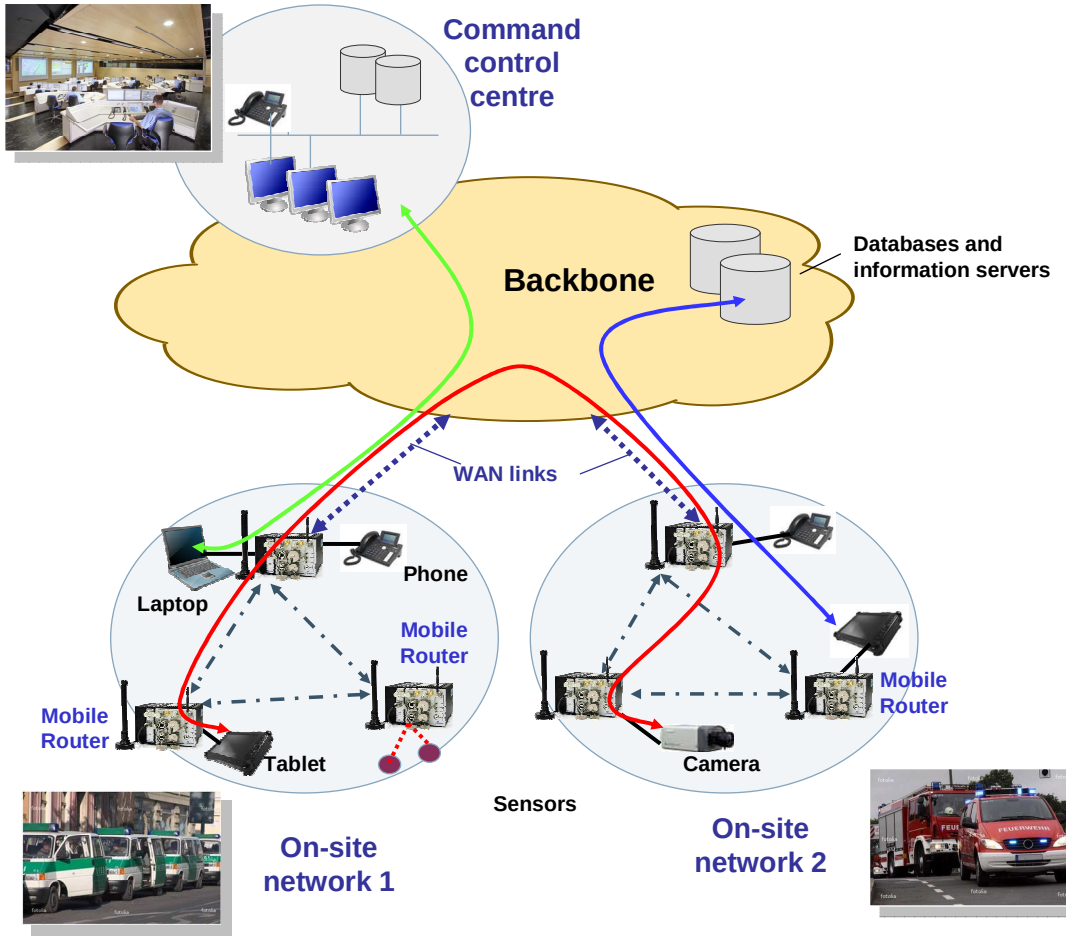
4. Implementation of a IPv6-enabled cross-border service

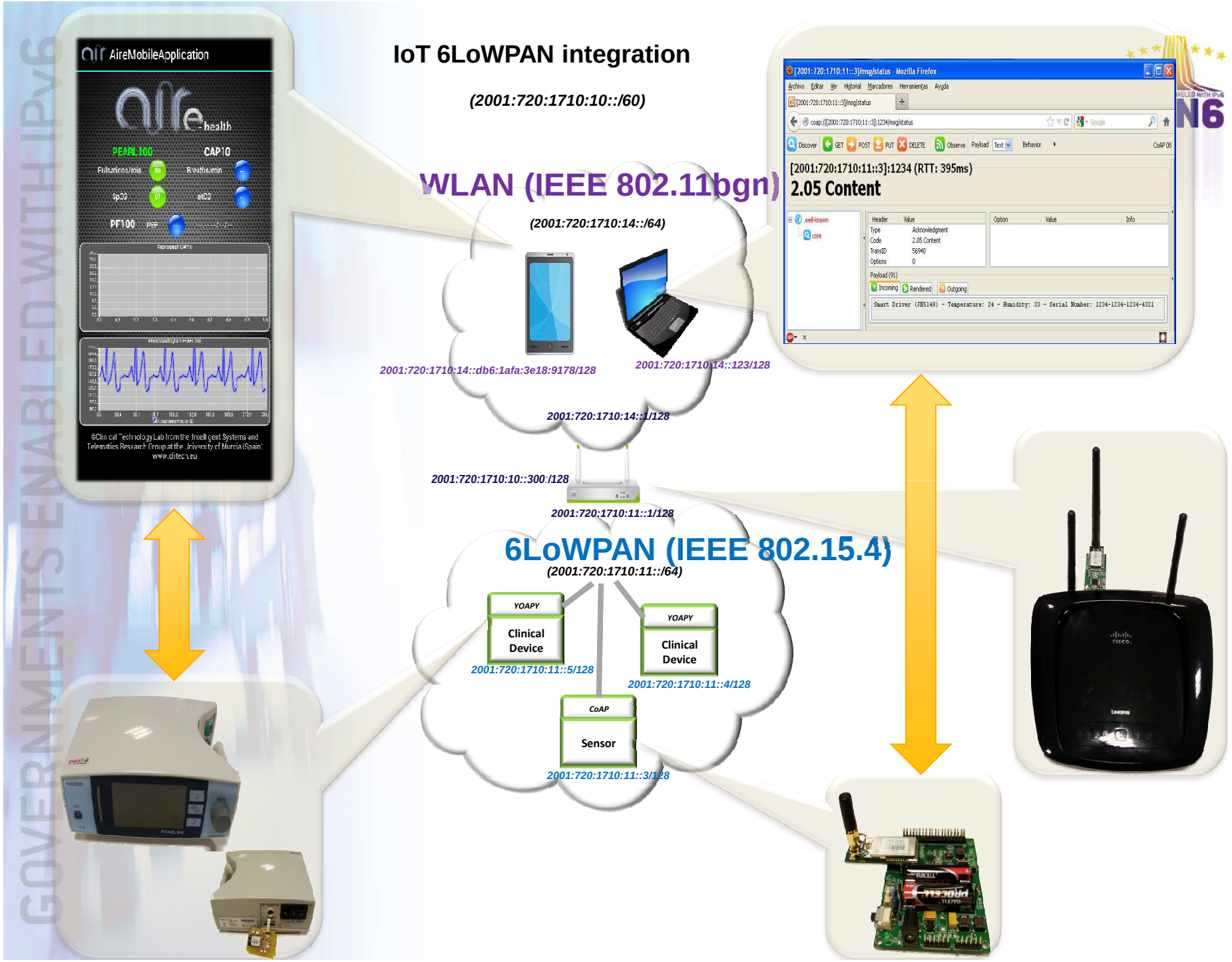
- German registration of address service authenticating Bob (through the proxy to STORK)

Cross-border Safety

- System setup
  - IPv6 as interconnect interface for cross border EU public safety response team collaboration
    - Fixed
    - Mobile/wireless
  - Integration of components for:
    - IPv6 sensor integration within the safety deployment network based on 6LoWPAN for personal and medical sensors
    - NEMO (Network Mobility) components to be integrated with the Mobile routers to allow MIPv6 services and different traffic management MCoA with security based on IKEv2 for IPsec.

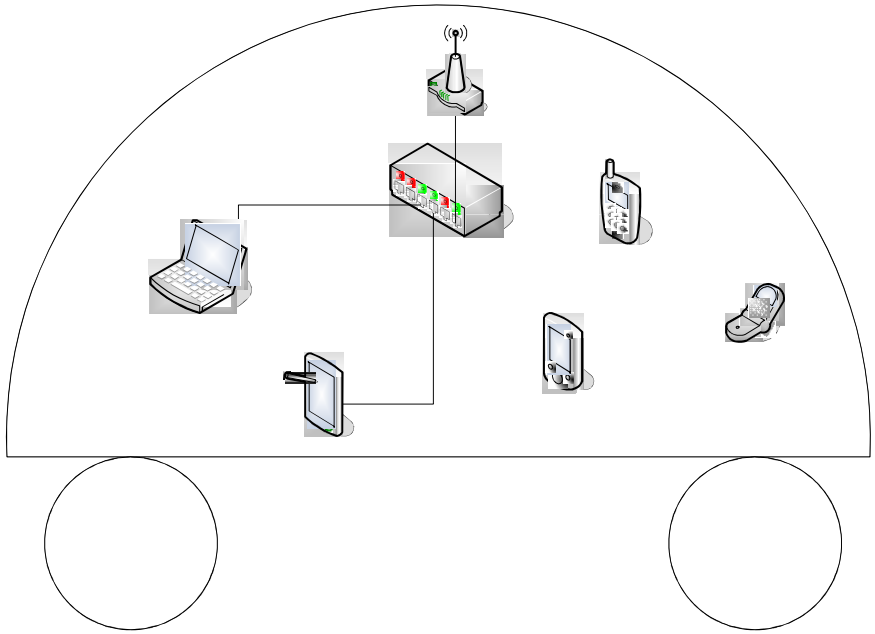




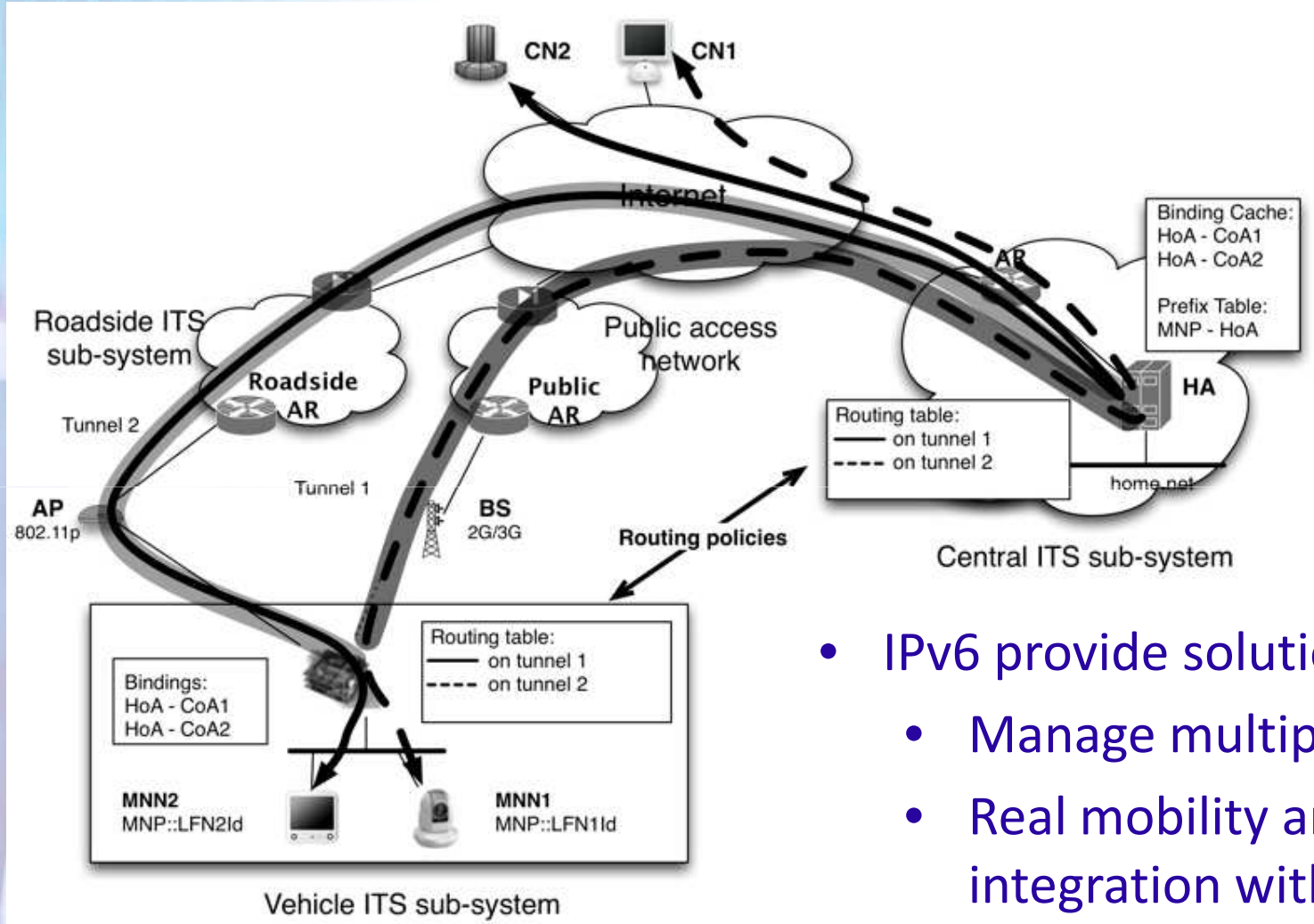

IoT 6LoWPAN integration
(2001:720:1710:10::/60)
AireMobileApplication
PEARL 100
CAP10
PF100
©Clinical Technology Lab from the Intelligent Systems and Telematics Research Group at the University of Murcia (Spain)
www.clitech.eu
WLAN (IEEE 802.11bgn)
(2001:720:1710:14::/64)
2001:720:1710:14::db6:1afa:3e18:9178/128
2001:720:1710:14::123/128
2001:720:1710:14::1/128
2001:720:1710:10::300:/128
2001:720:1710:11::1/128
6LoWPAN (IEEE 802.15.4)
(2001:720:1710:11::/64)
YOAPY
Clinical Device
2001:720:1710:11::5/128
YOAPY
Clinical Device
2001:720:1710:11::4/128
CoAP
Sensor
2001:720:1710:11::3/128
[2001:720:1710:11::3]:1234 (RTT: 395ms)
2.05 Content

IPv6 as a mobile network

- Several IPv6 nodes in a single mobile entity
  - Multiple IP subnets
  - Each node has an IPv6 address
  - Every IPv6 address contains a common IPv6 prefix
  - Different communication media (3G, M5, MM, WiFi, WiMax...) available due to multihoming support
- IPv6 vs IPv4 provide solution for:
  - Security
  - NEMO
  - MCoA

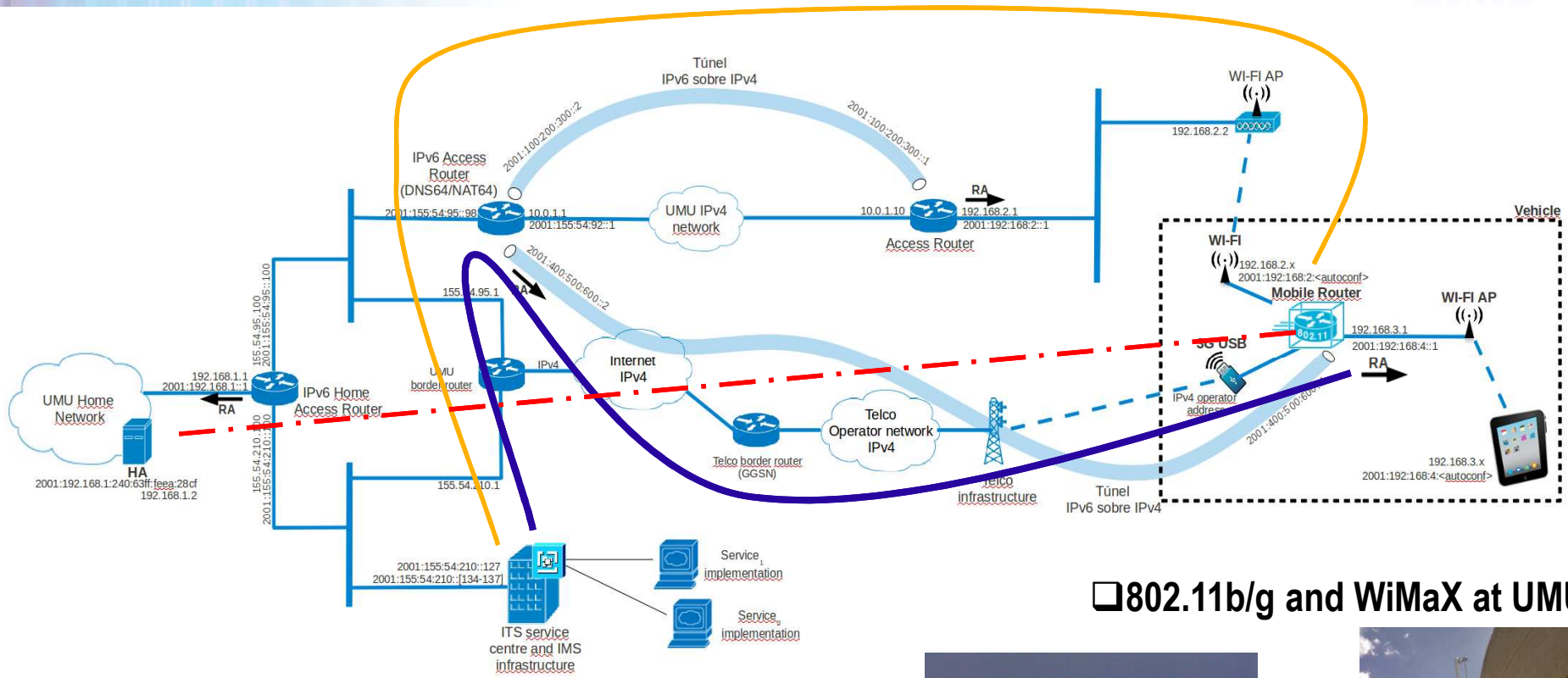


Session continuity architecture

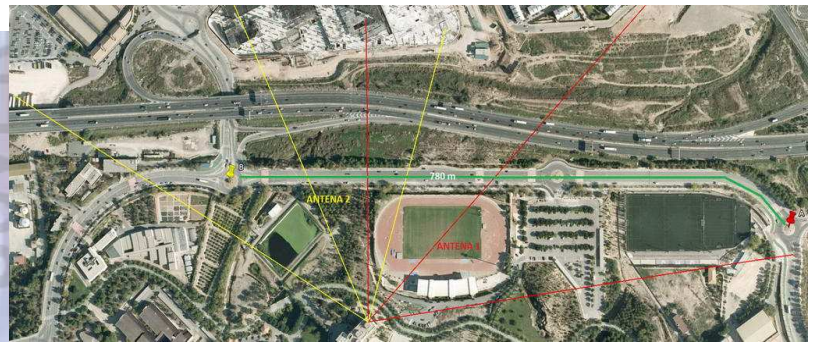


- IPv6 provide solutions to:
  - Manage multiple flows
  - Real mobility and integration with security
  - A complete scenario for ITS

Mobility Support



❑802.11b/g and WiMaX at UMU



- We have presented different challenges and possible IPv6 drivers for having a cross-border authentication for eGov services
- An analysis of STORK2.0 solution and its applicability in GEN6 project for supporting authentication on the cross-border scenario has be described
- An interconnection of the national IPv6 network from Spain and Germany has been presented
- An the usage of the infrastructure of STORK2.0 and German eID using IPv6 for a cross-border authentication for e-goverment has been designed
- IPv6 in ITS and Sensor area represent a good example of the advantages of IPv6