A introdução do IPV6 na Administração Pública
Centro de Congressos do IST
Lisbon 2015

IPv6 in Public Safety

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Supported by EC,
Grant nr. 261584

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Faculty of Electrical Engineering

ICT Innovations for Life and Business

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GEN6 – Governments ENabled with IPv6

- **Project time frame**
  - 1.1.2012 – 31.3.2015
- **19 EU partners**
  - 7 national pilots
  - 2 cross-border pilots
- **EC reference**
  - http://ec.europa.eu/information_society/apps/projects/factsheet/index.cfm?project_ref=297239
  - http://www.gen6-project.eu/

Slovenian pilot – A-ERCS

- **Advanced Emergency Response Communication Solution**
  - http://www.gen6-project.eu/A-ERCS.html
- **A-ERCS System deployment name 6inACTION**
  - http://6inaction.net/

GOVERNMENTS ENABLED WITH IPv6
GEN6

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Smart and compact mobile solution designed to provide first responders with reliable communications and IoT-driven situation surveillance and intervention management services in emergency situations
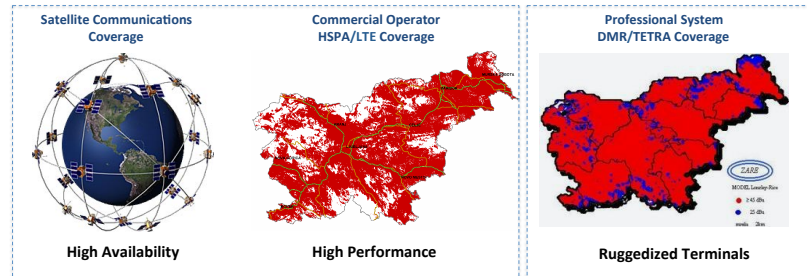
6onCORE
DISTRIBUTED AND ROBUST OVERLAY NETWORK

6onDASHBOARD
IoT-DRIVEN INTERVENTION MANAGEMENT

6onFIRE
ON-SITE SENSOR SYSTEM

6onMOBILE
TRIAGE APPLICATION
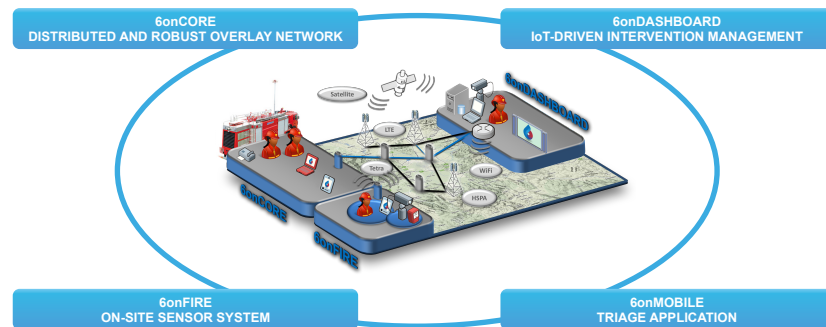
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6inACTION Vision

- **Converged communications in emergency situations**
  - **a distributed and robust overlay communication solution for data transport and rich multimedia service built across professional (e.g. DMR, TETRA, Satellite) and commercial networks (e.g. UMTS/HSPA, LTE)**

Non-mission critical (e.g. video, maps, chat, mail)   Mission critical e.g. voice

Satellite Communications Coverage   **Commercial Operator HSPA/LTE Coverage**   **Professional System DMR/TETRA Coverage**

High Availability   **High Performance**   **Ruggedized Terminals**

IPv6 convergence layer and smart network enabler

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6inACTION Vision – Technology

- **COTS terminals and equipment**

IP67, Mil, Water Proof, Crush Proof, Drop Proof, Dust Proof,

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Public Safety Regulation and Standardization

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Regulation and standardization

- **BB PPDR – BB Public Protection and Disaster Relief**
  - **ITU-T - Report ITU-R M.2033**
    - **Radiocommunication objectives and requirements for public protection and disaster relief**
  - **US FCC mandates LTE for public safety network (Februar 2012)**
    - **700 MHz, D Block (Block 14)**
      - „President Barack Obama yesterday signed into law the payroll-tax-cut extension legislation, which reallocates the 700 MHz D Block spectrum to public safety and provides $7 billion in federal funding to help pay for the buildout of a nationwide LTE network for first responders."
      - http://urgentcomm.com/policy_and_law/news/obama-signs-dblock-law-20120223
    - **Congressional Research Service**
      - Substantial radio coverage is targeted, and the act instructs leveraging existing infrastructure by establishing agreements to use commercial or other communications infrastructure already in place. (e.g., federal, state, tribal,)
  - **EU Regulation - CEPT ECC Report 199 (May 2013)**
    - **User requirements and spectrum needs for future European broadband PPDR systems (Wide Area Networks)**
    - **Frequency blocks**
      - **400MHz, 700 MHz, 2GHz?**
    - **Defined operational environments/category for BB PPDR**
      - **PP1: Day-to-day operations**
      - **PP2: Large emergency and/or public events**
      - **DR: Disaster Relief**
  - **Standardization - 3GPP Release 12**
    - **http://www.3gpp.org/Public-Safety**

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First BB PPDR System by „CEPT ECC Report 199"

Slide 1

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Defined groups of services and environment

- **Mission critical services**
  - e.g. voice, p2t
  - supported by TETRA and DMR
- **Non-mission critical services**
  - e.g. rt video, mail, interactive maps, pictures, files, chat…
  - supported by LTE, HSPA, Satellite, WiFi,…
- **Defined operational environments/category**
  - Day-to-day operations
  - Large emergency and/or public events
  - Disaster Relief

Every day operations
- Fire
- Flood
- Water rescue
- Car accidents
- …

Source: Dalymail

Source: Dalymail   Source: Wikipedia

Extreme natural disasters
- Earthquake in Italy (2012)
- Earthquake&Tsunami in Japan (2011)
- Hurrican Katrina (2005)

Source: CBS

Source: A. Kwasinski   Source: Kimberly K.

Professional and commercial communication systems are 100% operational

Professional and commercial communication systems are down!

Slide 2

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SYSTEM TODAY
Backhaul
- DMR
- Telco UMTS/HSPA

On-site
- DMR radio

SYSTEM TOMORROW
Backhaul
- DMR, TETRA, satellite
- Telco UMTS/HSPA, LTE, WiFi
- xDSL/FTTH

On-site
- DMR radio, WiFi mesh, sensors

IPv6, NEMO, DSMIPv6, IPsec…

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Fire
Flood
Earthquake
Alerts

SERVICES TODAY
- Voice – 1. priority
- Messages – 2. priority

SERVICES TOMORROW
- Voice – 1. priority
- Messages – 2. priority
- Pictures – 3. priority
- File – 4. priority
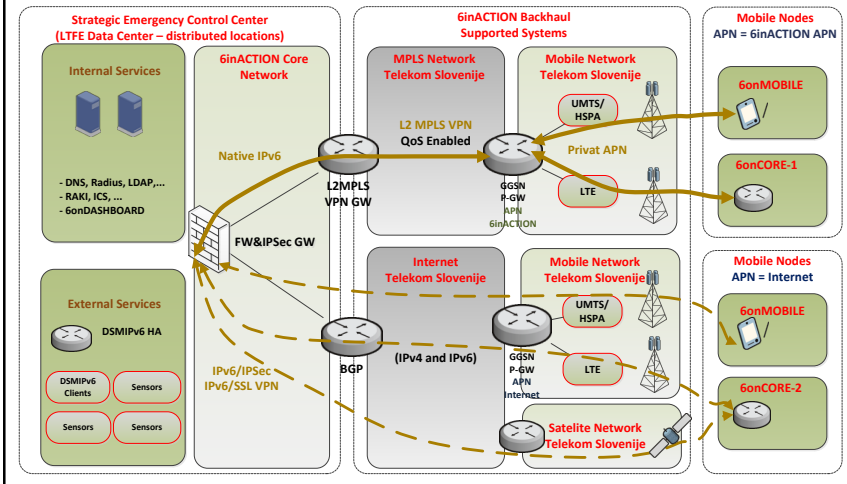- Video – 5. priority
- Sensor & M2M services

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6inACTION System – High level system architecture

TACTICAL LEVEL

STRATEGIC LEVEL

USER/MISSION LEVEL

TACTICAL LEVEL

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6inACTION Deployment Architecture @ Telekom Slovenije

**Strategic Emergency Control Center
(LTFE Data Center – distributed locations)**

Internal Services

6inACTION Core Network

- DNS, Radius, LDAP,...
- RAKI, ICS, ...
- 6onDASHBOARD

Native IPv6

L2MPLS VPN GW

FW&IPSec GW

External Services

DSMIPv6 HA

DSMIPv6 Clients   Sensors

Sensors   Sensors

IPv6/IPSec IPv6/SSL VPN

6inACTION Backhaul Supported Systems

MPLS Network Telekom Slovenije

Mobile Network Telekom Slovenije

L2 MPLS VPN
QoS Enabled

UMTS/ HSPA

Privat APN

GGSN P-GW APN 6inACTION

LTE

Internet Telekom Slovenije

Mobile Network Telekom Slovenije

UMTS/ HSPA

BGP   (IPv4 and IPv6)

GGSN P-GW APN Internet

LTE

Satelite Network Telekom Slovenije

**Mobile Nodes
APN = 6inACTION APN**

6onMOBILE

6onCORE-1

**Mobile Nodes
APN = Internet**

6onMOBILE

6onCORE-2

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Mobile node/user provisioning – private APN

- **AAA and security process**
  - Phase 1.: LTE/UMTS AKA – mobile provider
    - USIM Authentication and Key Agreement in HSS/HLR server — **Mobile operator**
  - Phase 2.: Extended node/user authentication and authorization – 6inACTION system
    - CHAP/PAP in Radius server
  - Phase 3.: Additional encryption for the most critical services – 6inACTION system
    - IPSec for networking devices (6onCORE)
    - SSL VPN for end user devices (6onMOBILE)
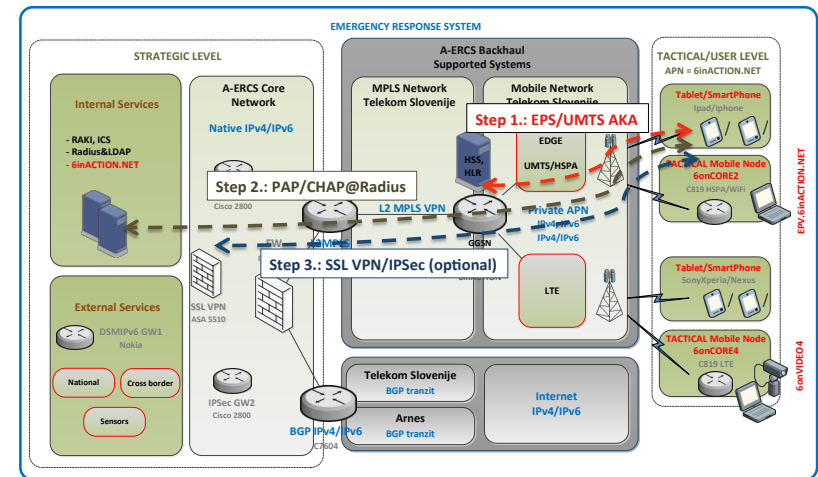   - DSMIPv6 for sensor gateway (6onFIRE) — **Public safety agency**

- **Network parameter assignment**
  - RADIUS assigned and P-GW/GGSN enforced IPv4&IPv6 parameters - 6inACTION system
  - LTE option
    - IPv6 EPS bearer
    - IPv4 EPS bearer
    - IPv4/IPv6 EPS bearer
  - HSPA/EDGE option
    - IPv6 PDP context
    - IPv4 PDP context
  - SSL/TLS VPN option
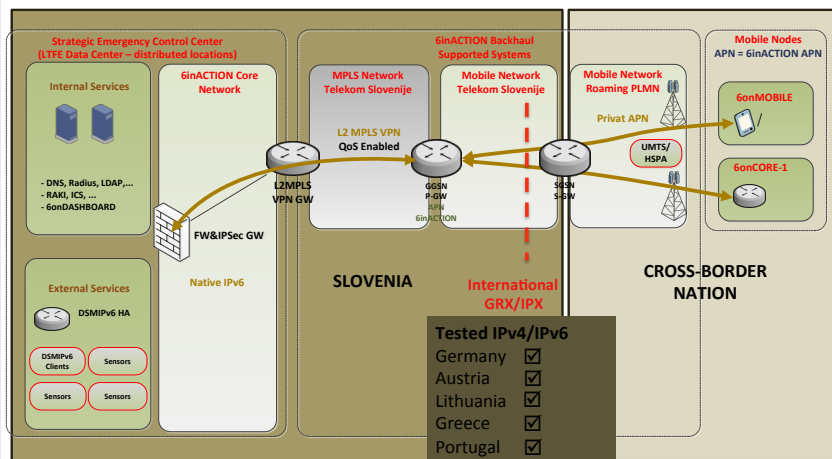   - IPv4/IPv6
    - IPv6
    - IPv4 — **Public safety agency**

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6inACTION System – Detailed deployment architecture (mobile part)

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6inACTION – Architecture for Cross-border Operations over 3G/4G

Strategic Emergency Control Center
(LTFE Data Center – distributed locations)

Internal Services

6inACTION Core Network

- DNS, Radius, LDAP,...
- RAKI, ICS, ...
- 6onDASHBOARD

FW&IPSec GW

Native IPv6

External Services

DSMIPv6 HA

DSMIPv6 Clients

Sensors

Sensors

Sensors

MPLS Network Telekom Slovenije

L2 MPLS VPN
QoS Enabled

L2MPLS VPN GW

Mobile Network Telekom Slovenije

GGSN P-GW APN 6inACTION

SLOVENIA

International GRX/IPX

6inACTION Backhaul Supported Systems

Mobile Network Roaming PLMN

Privat APN

SGSN S-GW

UMTS/HSPA

CROSS-BORDER NATION

Mobile Nodes
APN = 6inACTION APN

6onMOBILE

6onCORE-1

Tested IPv4/IPv6

Germany	☑
Austria	☑
Lithuania	☑
Greece	☑
Portugal	☑

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6onCORE
IPv6 INTELLIGENT NETWORK ENABLER

1. Set up on-site intervention command center using 6onCORE

- Compact mobile network node
- Installed in first responder vehicle or fully portable
- Provides communication services for intervention management by selecting best available networks for the required services
- Connects to 6onFIRE sensor deployments on site

IPv6 network intelligence
- NEMO with MCoA and IPSec
  - secure and transparent 6onCORE node mobility
- SLAAC and DHCPv6
  - host and network nodes auto configuration

Technical design
- Cisco ISR819 M2M router

- Multicast with MLD, PIM-SM and scope options support
  - flexible live multimedia streaming on-site and globally
- IPv6 hierarchical addressing
  - fast unit, user and sensor provisioning
- BGP and OSPFv3

PA addressing
- IPv6 PA and IPv4 PA addressing

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Tactical Smart Devices

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TACTICAL&MISSION SMART DEVICES AND APPS

- **COTS TERMINALS + IP67/MIL enclosure**
  - Dust proof, water proof, drop/crash proof
- **INTEGRATING CUSTOM TACTICAL AND IT APPS**
  - Tracking, contextualized on-site triage, live video streaming
  - Mail, file share, video, picture, cloud apps
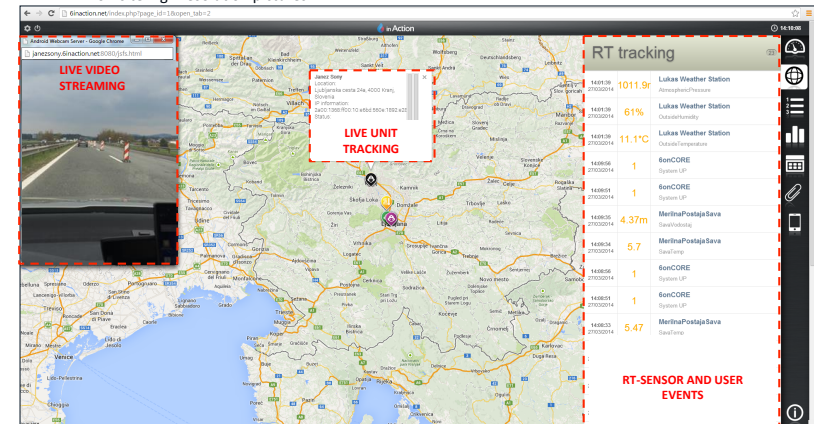- **IPv6 PDP Context / EPS bearer support?**
  - Android: ☑☑✖✖
  - iOS: ✖✖✖✖

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IoT-Driven Intervention Management

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IoT-DRIVEN INTERVENTION MANAGEMENT

- **Real-time common operational picture**
  - Mash up of sensor and user events, live unit tracking, live video streaming and remotely captured on-site high resolution pictures
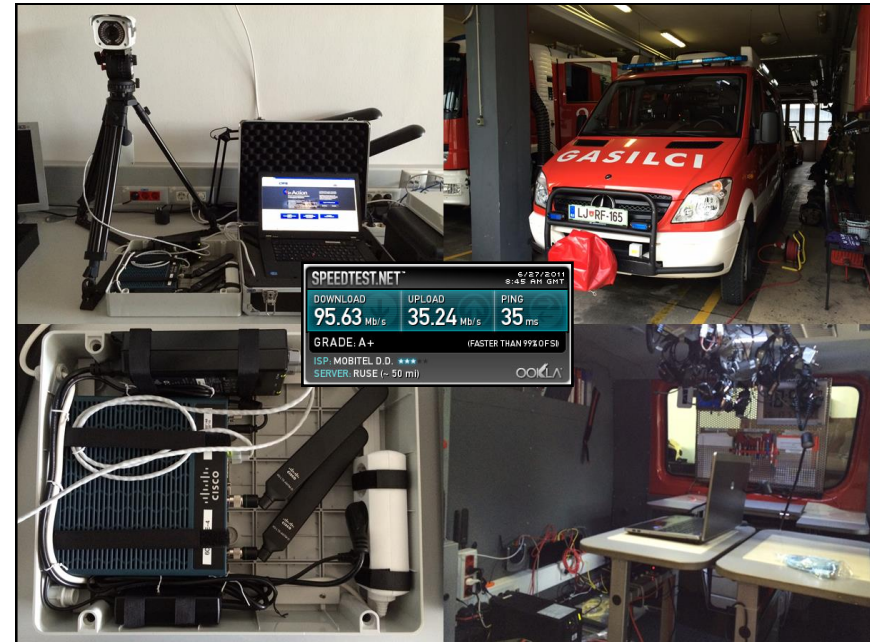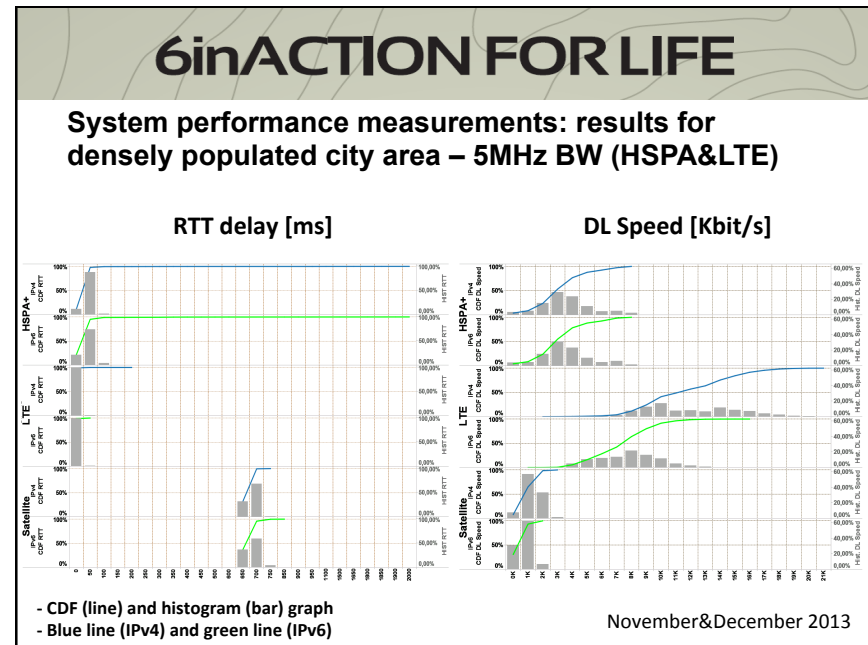
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IoT-DRIVEN INTERVENTION MANAGEMENT

- **Contextualized real-time triage reporting**
  - User notes + site map + on-site captured high resolution picture + unit track

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System piloting and testing

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Conclusion – IPv6&LTE for public safety?

- **Pros: "All IP" proven commercial technologies – IPv6 inherited by default!**
  - **High mobile performance**
    - **up to 150 Mbps and 10 ms data plane (RTT delay using LTE)**
  - **3G/4G bullet proof system integrated security**
    - **AKA authentication, AES/3G SNOW user and control plane encryption**
    - **Extended authentication (i.e. RADIUS) for central user control and provisioning**
    - **For the most critical services, additional IPSec, SSL VPN and HTTPS security services**
  - **Standardized QoS support**
  - **Deployment options and system virtualization: business APNs, MVNO, national roaming**
  - **Standardized interfaces: various networking and handheld equipment vendors/providers**
  - **Open and powerful ecosystem for service (multimedia, sensors, M2M) development**
    - **Easy integration between custom services and existent IT services**
  - **Easy cross-border and international on-site cooperation**
    - **based on international roaming (GRX/IPX)**
- **Cons: immature technologies in mission critical situations**
  - **3GPP public safety standardization not finished, missing "TETRA like" features**
  - **BB PPDR frequency band is in a process of EU allocation**
  - **Missing IPv6 support on "some" mobiles/tablets**
  - **Missing added value features on routing gear (i.e. NEMOv6 McA) ?**
  - **Millions invested in TETRA**

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Lead by ULFE, official GEN6 partner

Powered by partners
- Go6 Institute – federating and consultancy role,
- Ministry of Education, Science and Sport – integration of project in Slovenian government,
- Water Institute - Pilot system requirements and pilot testing,
- Municipality of Ljubljana (MOL), Department for Protection, Rescue and Civil Defense (OZRCO) – pilot system requirements and pilot testing, live emergency response environment & infrastructure,
- Telekom Slovenije, d. d. – fixed and mobile network provider
- Cisco System Slovenia&Global – networking equipment support.
- Academic and Research Network of Slovenia (ARNES)