



# Giga CARNet project

Ivan Marić, Srce

**6th CARNet Users Conference**

FER, Zagreb, September 29, 2004



# Agenda

- Project – overview
- eInfrastructure
- Some principles
- Giga CARNet building
- Future work

# Objective

Main objective of the project is to upgrade the infrastructure of CARNet network to the level that supports:

- advanced Network services and
- demanding multimedia applications

**for the high schools and  
scientific institutions**



# Joint project of CARNet and University Computing Centre

**Ivan Marić/Srce** – Project leader

- 4 sub-projects:
  - o Giga CARNet – building, **Mario Klobučar/Srce**  
Upgrade of the backbone (equipment, telecommunication services) & service implementation
  - o Giga CARNet – traffic, **Igor Velimirović/CARNet**  
Traffic - *real time* monitoring of network and traffic
  - o Giga CARNet – video, **Zlatko Jelačić/CARNet**  
Video - multicast network, MediaOnDemand, video conferencing, VoIP
  - o Giga CARNet – CAR6Net, **Vladimir Rabljenović/Srce**  
CAR6Net - testing and implementing of IPv6 protocol in CARNet network

The logo for CARNet, featuring the word "CARNet" in a bold, blue, italicized sans-serif font.The logo for Srce, featuring a stylized red heart with a white outline inside a black circle, followed by the word "srce" in a black, lowercase sans-serif font.The logo for Giga CARNet, featuring a blue stylized arrow pointing right, followed by the word "giga" in a bold, blue, lowercase sans-serif font and "carnet" in a lighter blue, lowercase sans-serif font.

# Chronology

## *90-ties CARNet traditionally one step ahead*

- Introducing Internet in Croatia (1992)
- Academic community Network (1994)
- Introducing ATM technology (1995)
- First videoconferences (1997)

## *2002. CARNet not at the cutting edge any more*

- CARNet backbone built on 155 Mbit/s ATM connections (WAN) and 622/155 Mbit/s ATM and 100Mbit/s Ethernet connections
- 2Mbit/s access to the institutions
- DSL and Wireless access to the institutions
- CMU service – 1080 dial-in modems



# New circumstances...

- Growing number of users and more demanding applications
- Development of new technologies

## *In Croatia....*

- fast and high quality international link
- upcoming telekom service market deregulation and expected price decrease

## *In the world ...*

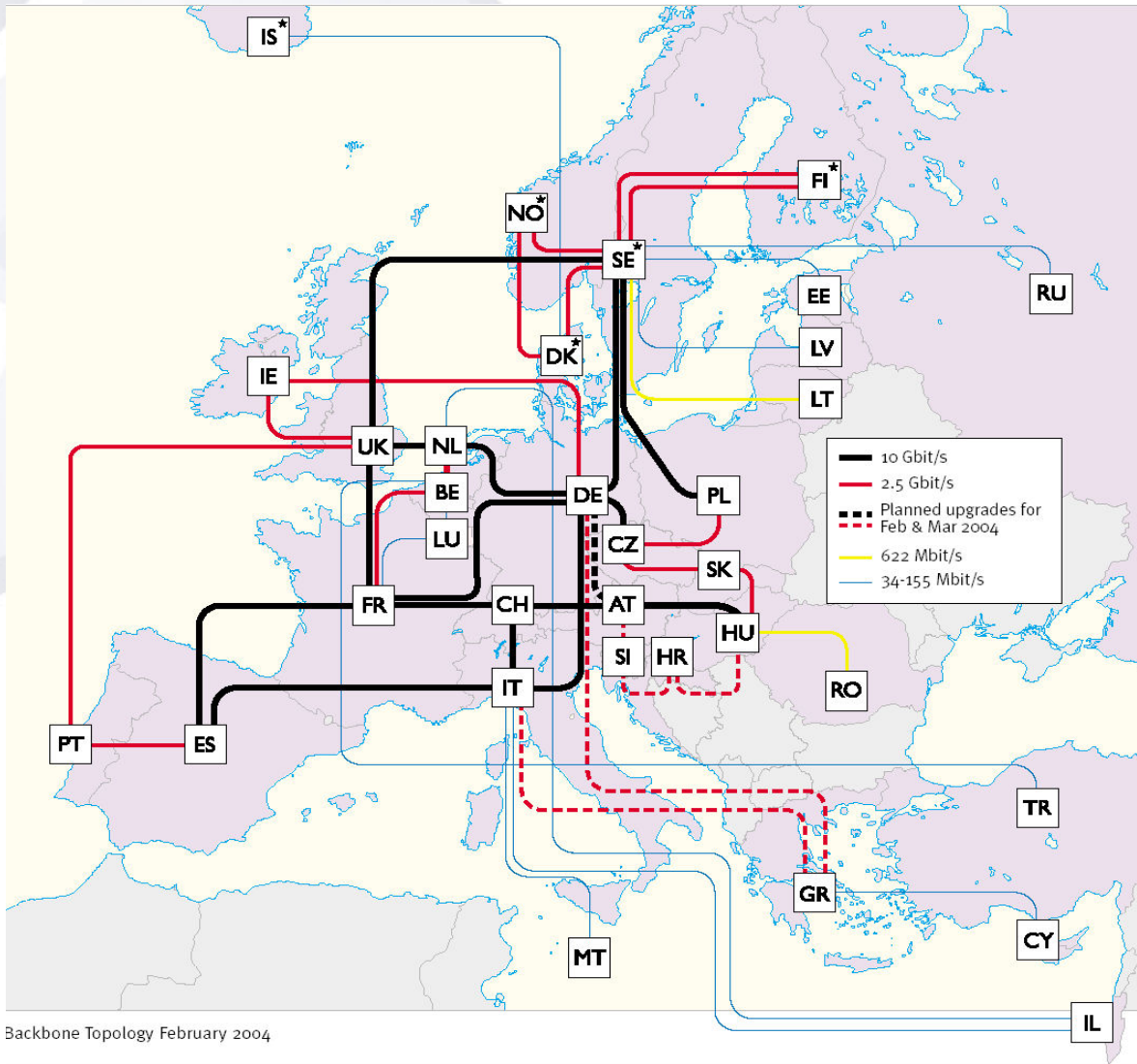
- USA continuously invests in technology development
- EU doubles investments in academic networks
- European Research Area (ERA) as an aspiration to the unified research area and international cooperation
- GEANT network as a basis to the realization of ERA



# ...and new networking trends

- Constant improvement and changes of Network services
- Multimedia and GRID applications
- 'Network of collaboration'





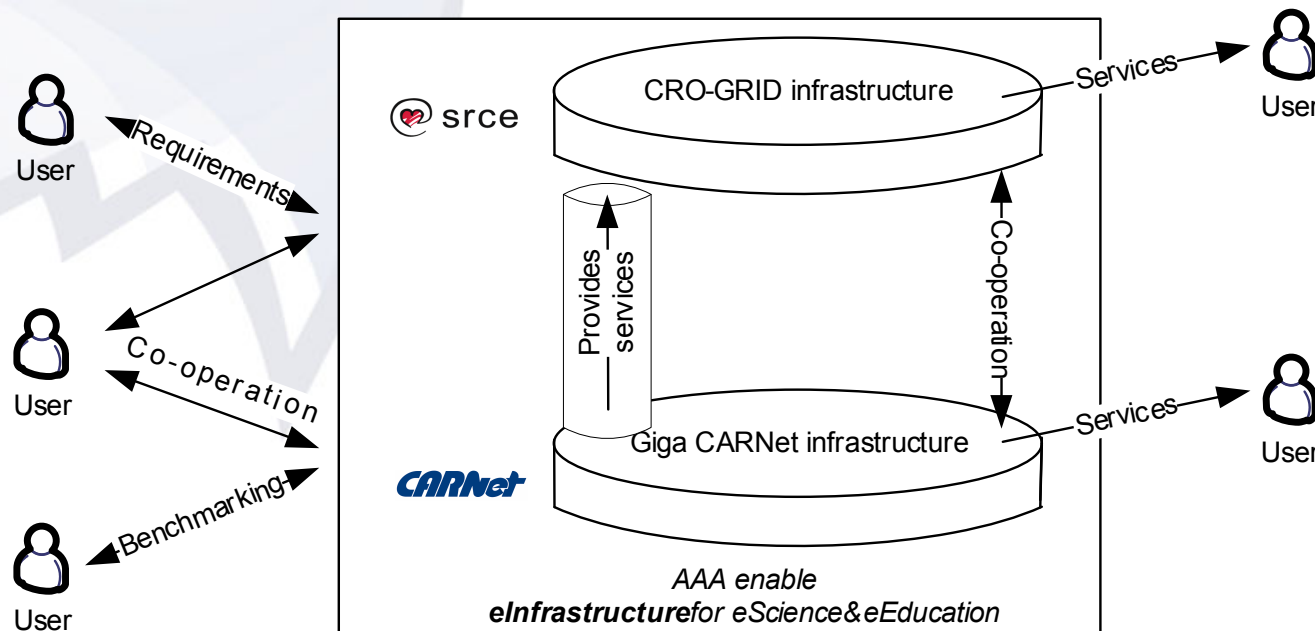
## ...GEANT Network...

GEANT as one of the prepositions of **European Research Area (ERA)** that tends to provide similar conditions to all researchers on the european continent.





# eInfrastructure – *the concept*



# Giga CARNet – How to

- Customer Empowered Fibre (CEF) networks
- Nothing in Line (NIL) concept
- ‘H(R)ome made’



# Customer Empowered Fibre (CEF) networks – general view

- CEF networks is emerging trend, that gradually changes network architecture, topology and services from bottom of hierarchy to top
- Very important advantage is independence on carriers
- Getting access to fibre means controlling the network
- Cost effective in comparison to clasical approach
- Need of new generation transmission and networking equipment



# Nothing in Line (NIL) Concept

- No devices along optical path
- Devices only at the end of data circuits
- No need for complex negotiations about housing and operation (e.g. Access to premises)

***DO IT YOURSELF APPROACH***



# Giga CARNet – network

*broadband and stabile*

## ***Gigabit – broadband and stabile – network***

- Basis to new and improved network services,
- Support for existing and impuls to new acitvities of research and educational community in Croatia,
- Impuls to development of new applications and their usage as a basic tool: MOD, CRO-GRID, ISVU,...
- E2E



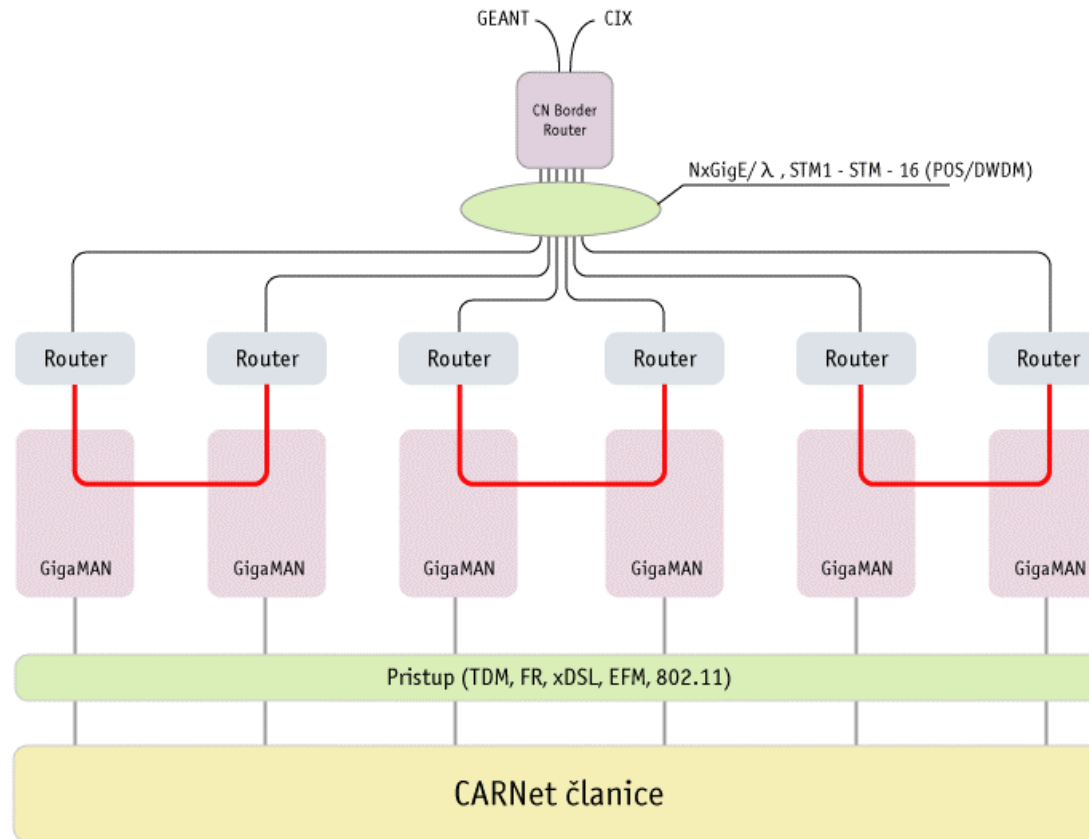
# Giga CARNet – new technologies

*usage of new communication technology*

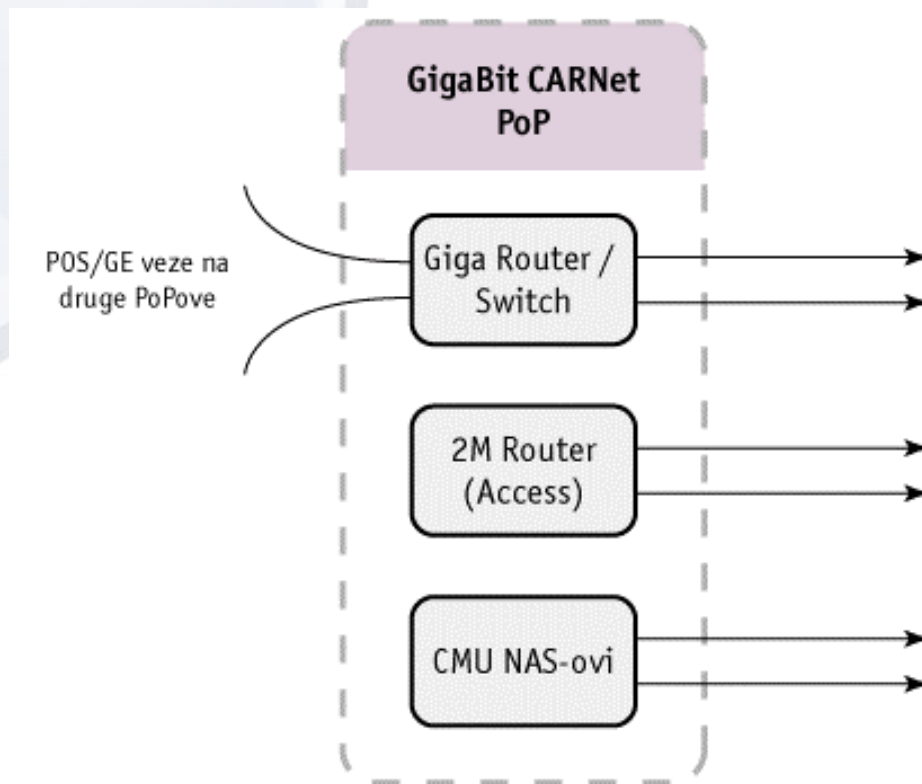
- DWDM vs SDH
- Gigabit Ethernet
- Packet Over SDH
- Ethernet in the ‘first mile’
- IP/MPLS



# Giga CARNet – logical scheme



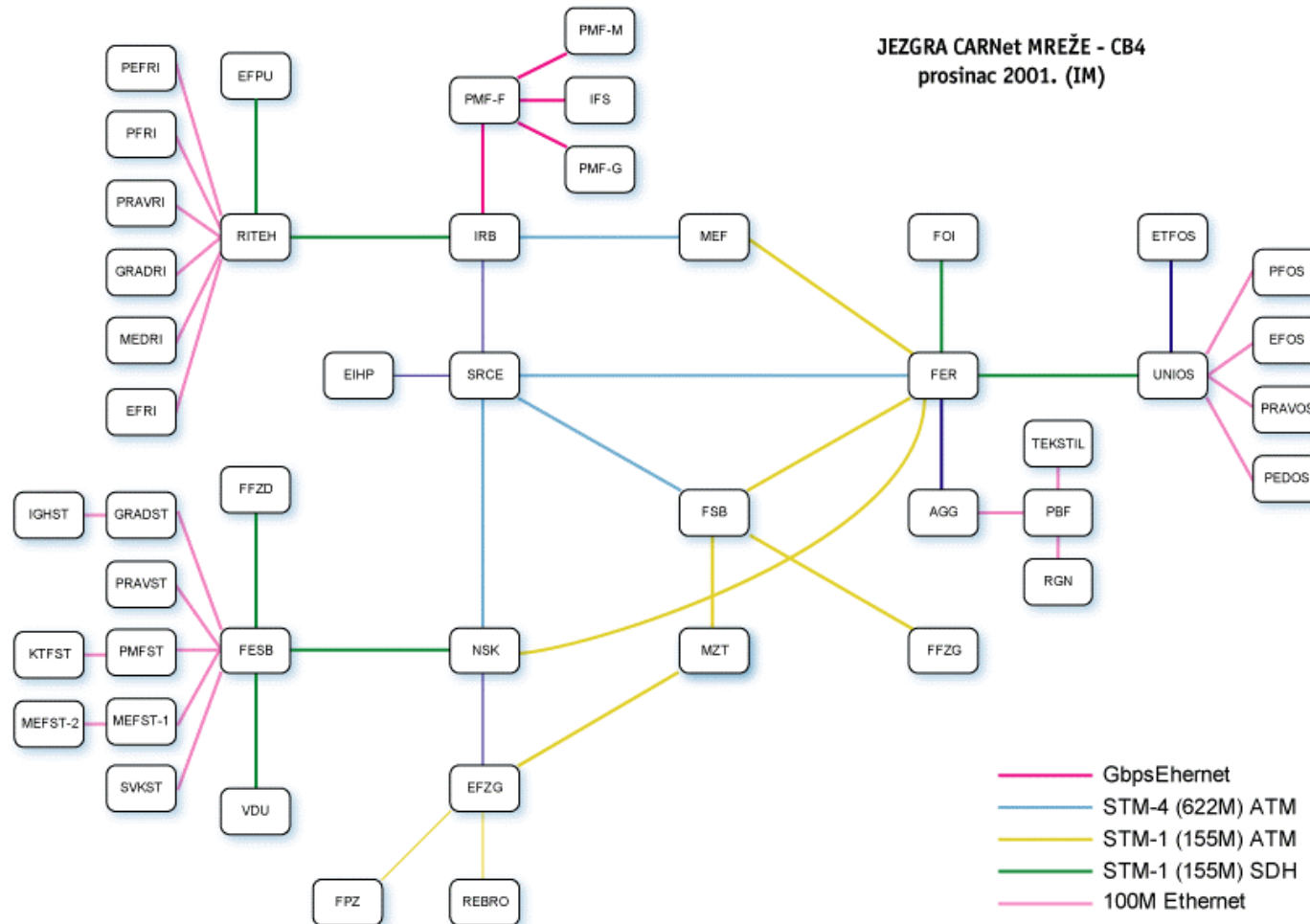
# Giga CARNet – new communication equipment



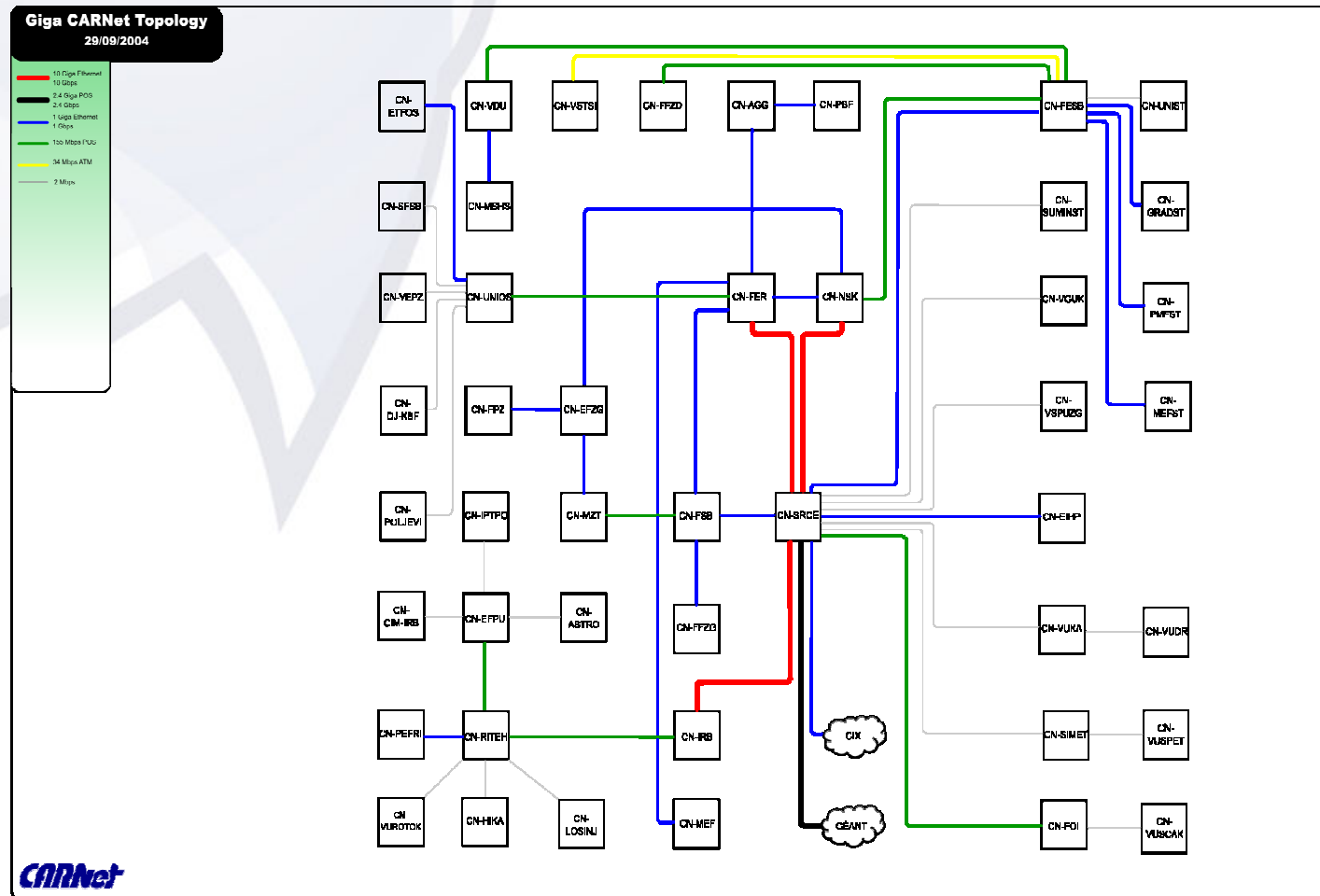
**Cisco GSR 12406/12404 and Cisco 7304 (NPEG100)  
Cisco Catalyst 6509/6506 with SUP720; Cisco Catalyst 3750**



# Change of ATM backbone of CARNet network...



# ...into gigabit network backbone



# Giga CARNet – diversity of services

Regarding connecting possibilities

- Standard IP service
- Premium IP service
- Service of guaranteed capacity

Regarding added value

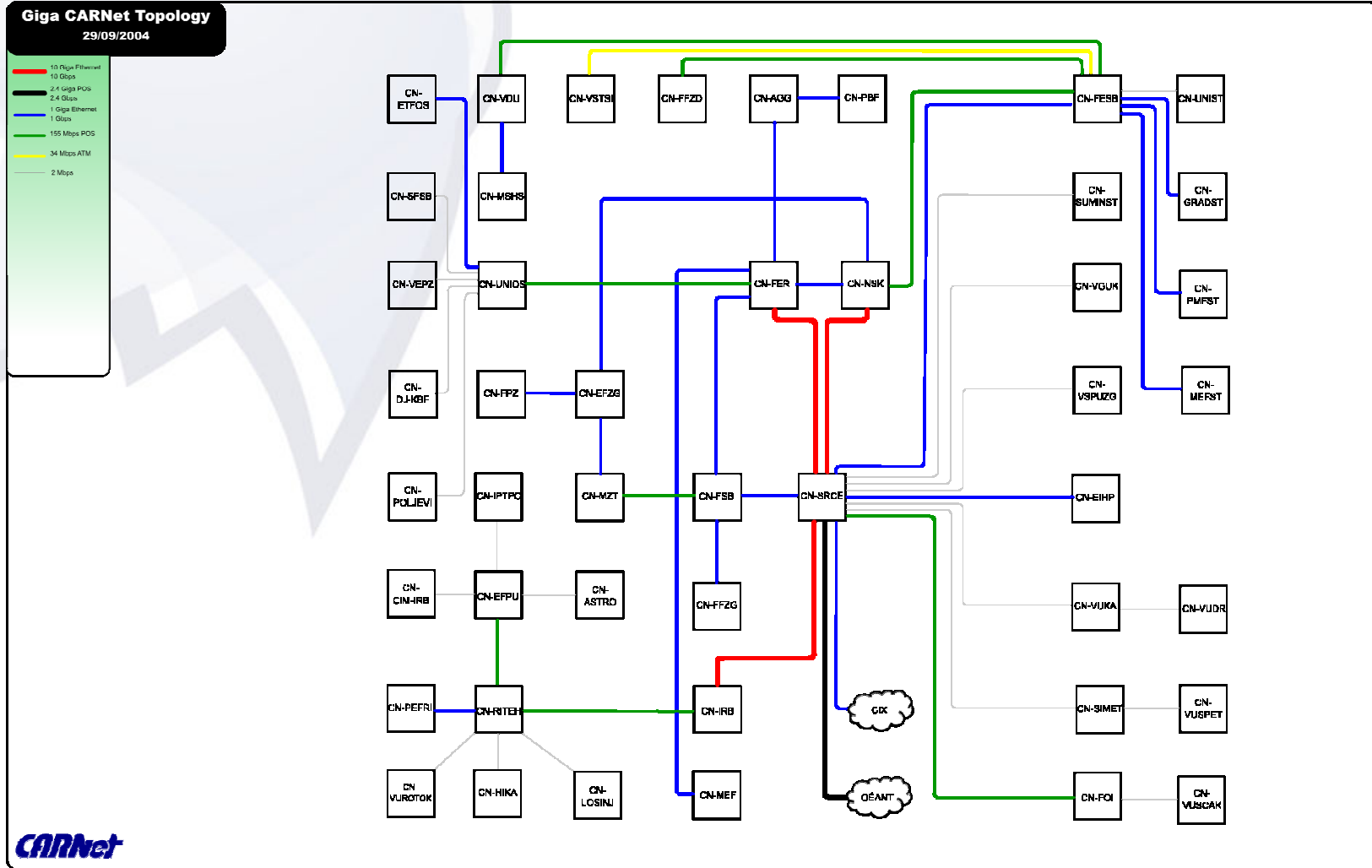
- Service of virtual private networking – VPN
- Multicast service
- New services that demand intelligence network



# Realisation

- Pre-project period (*early phase*)
- Tendering process
  - Quest for lines (*mission impossible*)
  - Active equipment procurement
- Laboratory period (*testing and configuration phase*)
- Implementation period (*building phase*)

# New CARNet topology



# Giga CARNet in numbers

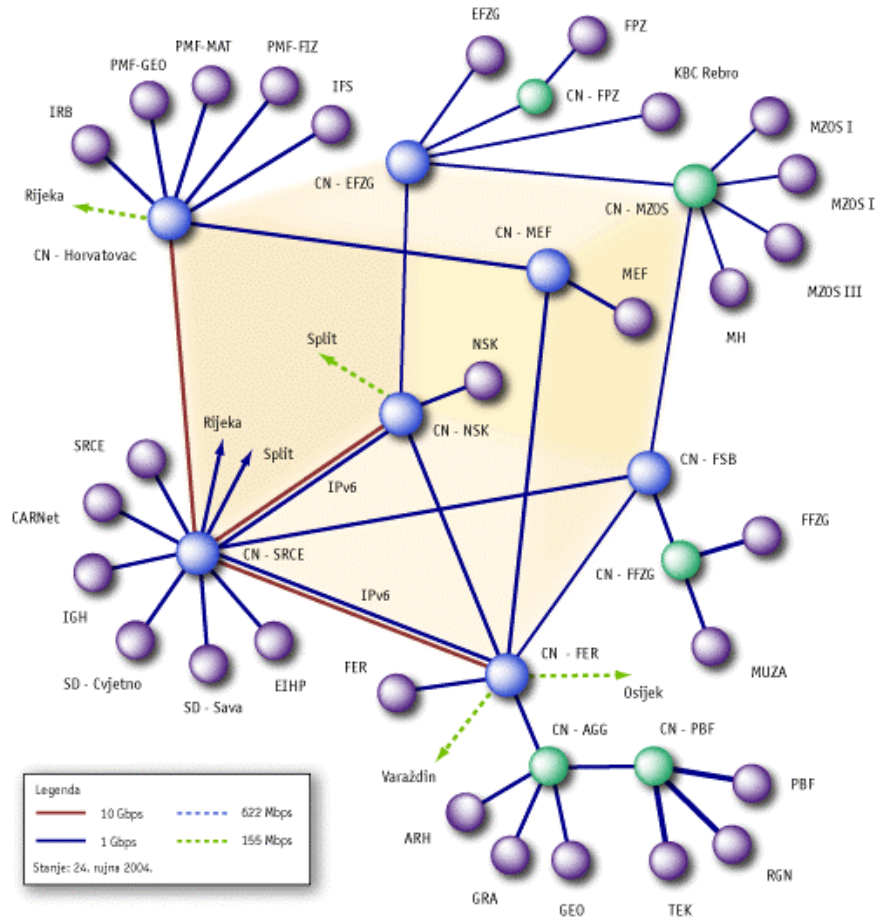
- ✓ Established Giga CARNet PoPs: **25**
  
- ✓ Installed and upgraded equipment: **59**
  - Gigabit router Cisco GSR 12406 (1)
  - Gigabit router Cisco GSR 12404 (3)
  - Router Cisco7304 (6)
  - Gigabit Ethernet Switch Cisco Catalyst 6509 (1)
  - Gigabit Ethernet Switch Cisco Catalyst 6506 (8)
  - Gigabit Ethernet Switch Cisco Catalyst 3750 (15)
  - Router upgrade Cisco7204(6)VXR with NPE-G1 (5)
  - Ethernet Switch upgrade HP2512 with Gb transceiverom (20)
  
- ✓ Established gigabit links: **48**
  - 10Gb links (3)
  - 1Gb links (45)
  
- ✓ Connected CARNet members (institutions): **62**



# Giga CARNet – realized (1)

## Metropolitan Area Network (MAN) in Zagreb

Stanje zagrebačkog dijela CARNet mreže



### CARNet mrežna čvorišta

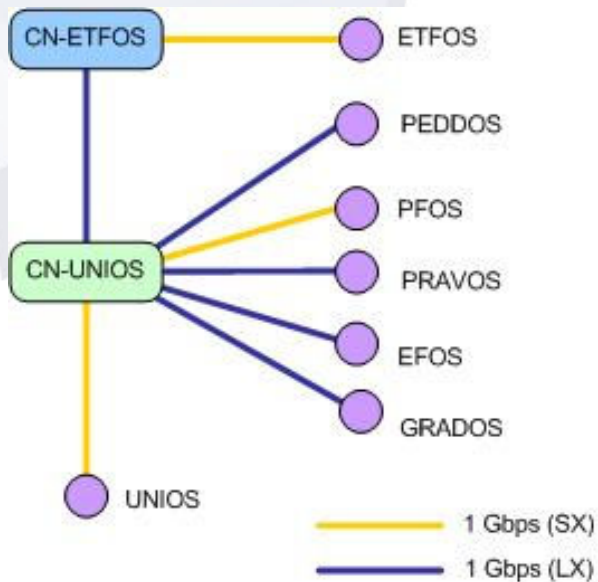
CN - SRCE	Sveučilišni računski centar
CN - FER	Fakultet elektrotehnike i računarstva
CN - AGG	Fakulteti arhitekture, građevine i geodije
CN - PSF	Prehrambeno, biotehnoški fakultet
CN - FFZG	Filozofski fakultet
CN - FSB	Fakultet strojarstva i brodogradnje
CN - MEF	Medicinski fakultet
CN - MZOS	Ministarstvo znanosti, obrazovanja i sporta
CN - EFZG	Ekonomski fakultet
CN - HORVAT.	Horvatovac
CN - NSK	Nacionalna i sveučilišna knjižnica
CN - FPZ	Fakultet prometnih znanost

FPZ	Fakultet prometnih znanosti
Rebro	Kliničko bolnički centar Rebro
EFZG	Ekonomski fakultet
MZOS	Ministarstvo znanosti, obrazovanja i sporta
FSB	Fakultet strojarstva i brodogradnje
FFZG	Filozofski fakultet
FER	fakultet elektrotehnike i računarstva
ARH	Arhitektonski fakultet
GRA	Građevinski fakultet
GEO	Geodetski fakultet
PBF	Prehrambeno-biotehnoški fakultet
RGN	Rudarsko-geološko-naftni fakultet
SRCE	Sveučilišni računski centar
IRB	Institut Ruđer Bošković
IFS	Institut za fiziku Sveučilišta
PMF-GEO	PMF-Geofizički odsjek
PMF-MAT	PMF-Matematički odsjek
PMF-FIZ	PMF-Fizički odsjek
NSK	Nacionalna i sveučilišna knjižnica
MEF	Medicinski fakultet
MUZA	Muzička akademija
IGH	Institut građevinarstva Hrvatske
SD - Cvjetno	Studentski dom - Cvjetno
SD - Sava	Studentski dom - Sava
EIHP	Energetski institut Hrvoje Požar
TEK	Tekstilno tehnološki fakultet
MH	Matica Hrvatska



# Giga CARNet – realized (2)

## OSIJEK Metropolitan Area Network (OS-MAN)



### CARNet mrežna čvorišta

CN-UNIOS Sveučilište u Osijeku  
CN-ETFOS Elektotehnički faklutet u Osijeku

### Članice

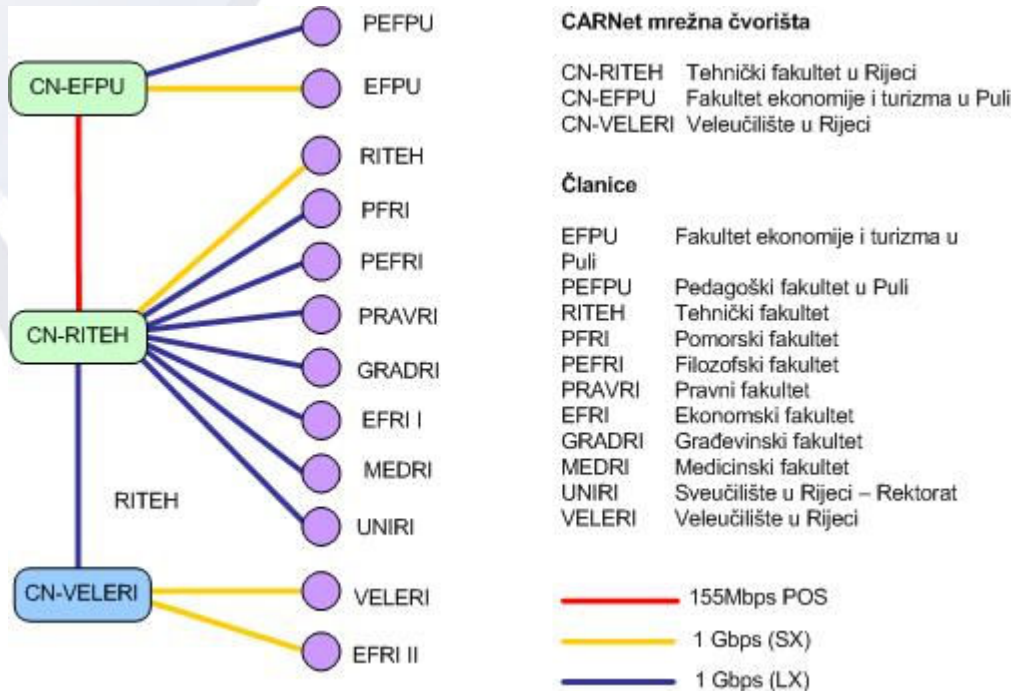
UNIOS Sveučilište u Osijeku - Rektorat  
ETFOS Elektotehnički faklutet u Osijeku  
PEDOS Pedagoški fakultet u Osijeku  
PFOS Poljoprivredni fakultet u Osijeku  
PRAVOS Pravni fakultet u Osijeku  
EFOS Ekonomski fakultet u Osijeku  
GRADOS Građevinski fakultet u Osijeku





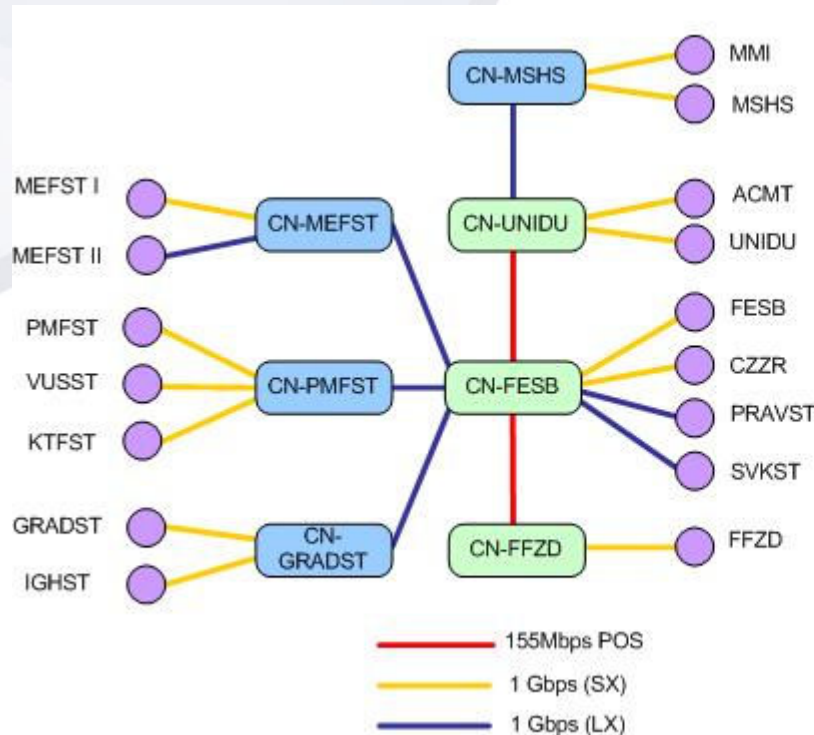
# Giga CARNet – realized (3)

## RIJEKA Metropolitan Area Network (RI-MAN)



# Giga CARNet – realized(4)

## SPLIT-DUBROVNIK-ZADAR Metropolitan Area Network



### CARNet mrežna čvorišta

CN-FESB	FESB, Split
CN-UNIDU	Sveučilište u Dubrovniku
CN-MMHS	Međunarodno središte hrvatskih sveučilišta
CN-FFZD	Filozofski fakultet u Zadru
CN-GRADST	Građevinski fakultet u Splitu
CN-PMFST	PMF Split
CN-MEFST	Medicinski fakultet u Splitu

### Članice

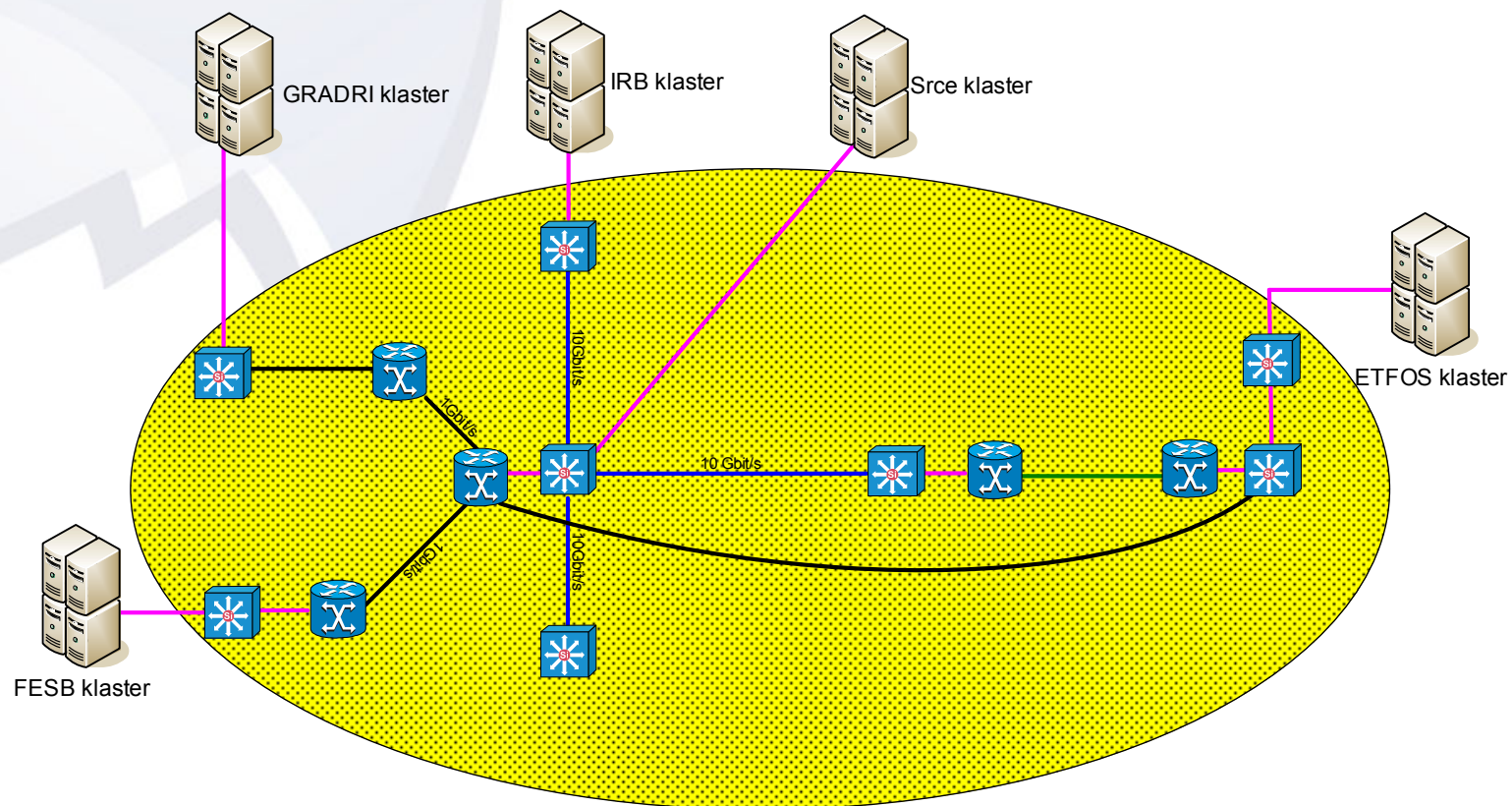
FESB	Fakultet elektr. Rač i brodogradnje
CZZR	Centar za znanstveno računanje
PRAVST	Pravni fakultet u Splitu
SVKST	Sveučilišna knjižnica u Splitu
MEFST	Medicinski fakultet u Splitu
PMFST	Prirodoslovno-matematički fakultet u Splitu
KTFST	Kemijsko-tehnološki fakultet u Splitu
VUSST	Veleučilište u Splitu
GRADST	Građevinsko-arhitektonski fakultet u Splitu
IGH	Institut građevinarstva u Splitu
UNIDU	Sveučilište u Dubrovniku
ACMT	American College of Management and Technology
MSHS	Međunarodno središte hrvatskih sveučilišta
FFZD	Filozofski fakultet u Zadru



# Example 1: Network for video conferences



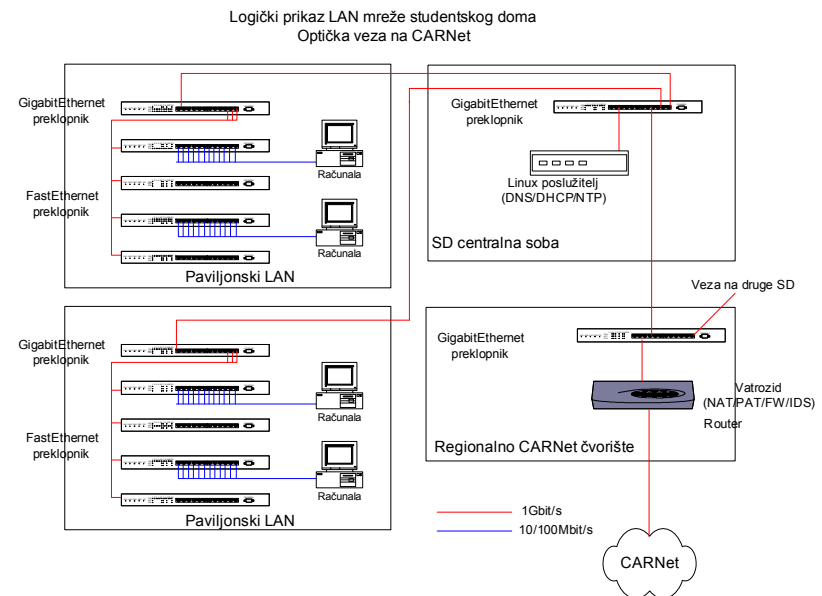
# Example 2: Network for CRO-Grid infrastructure



# Example 3: New dimension off access network

## StuDOM project- LAN of student dormitories

- SC Zagreb, SC Rijeka, SC Split and SC Osijek – 5312 x 802.1x networked student ‘beds’ – 58% of the total amount.
- First gigabit connections in Zagreb



## AAI project – autentification and autorization infrastructure

- establishing unique AAI system of academic community for acces to the CARNet network





# Giga CARNet - ToDo

4th Quarter 2004.

- Realisation of the remain intercity gigabit links:
  - ZG-VŽ, ZG-OS and ST-RI, OS-VŽ
- Finalizing the work on 'native' IPv6 network & CN IPv6 based applications&services
- Implementation of multicast service
- Establishment of monitoring system
- Policies (Video network, Multicast services,..)
- Promotion of Giga CARNet network and services



# Future works (*CN-Light*)

- Evaluate new ways of advanced high speed optical transmission
- Develop and evaluate new control mechanisms for lightpath switching
- Provide basic connectivity service for national (CRO-GRID) and international high demanding users (e.g. CERN, ....?)
- Independent on Giga CARNet infrastructure (?)



***CARNet*** together with ***Srce*** creates first – gigabit technology based – national network incenting this way **development of new services and applications.....**

.....such High quality infrastructure ***provides support to the modern teaching*** and is basis for demanding ***research projects*** and ***international cooperation.....***

.....at the same time ***promotes new Internet technologies*** in Croatia, fullfiling tasks given by Croatian government





# Thanks

## Question & Answer

**Ivan Marić**

University of Zagreb

University computing centre - Srce

[Ivan.Maric@srce.hr](mailto:Ivan.Maric@srce.hr)

