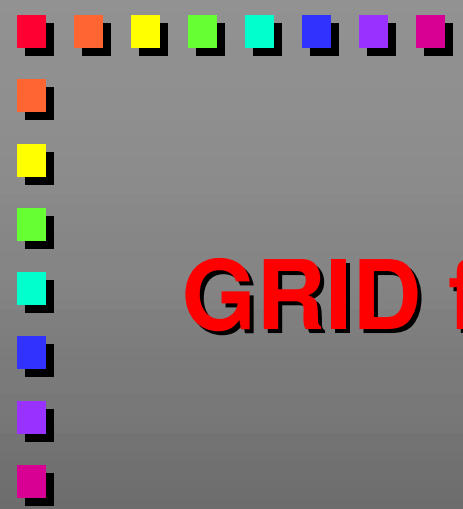
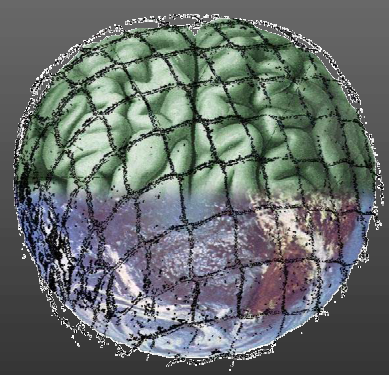


“Ruđer Bošković” Institute  
Electronic department  
and Computing centre



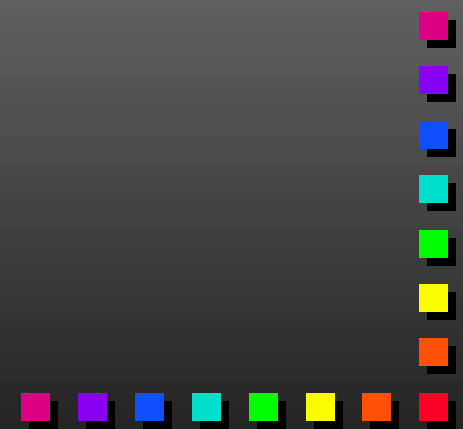
# GRID for Scientific and Economic development of Croatia

*Our aspiration*



Grid logo  
Celebrum/globus

*Karolj Skala*



# Evolution time base

- 1980s: Internet (e-Mail)
- 1990s: Web (e-Information)
- 2000s: **GRID** (e-Science)
- 2010s: SGRID (e-Society)

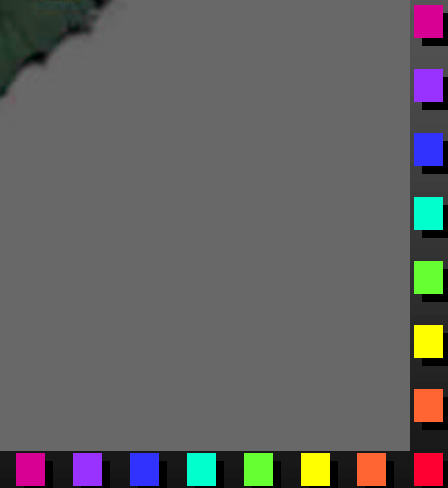
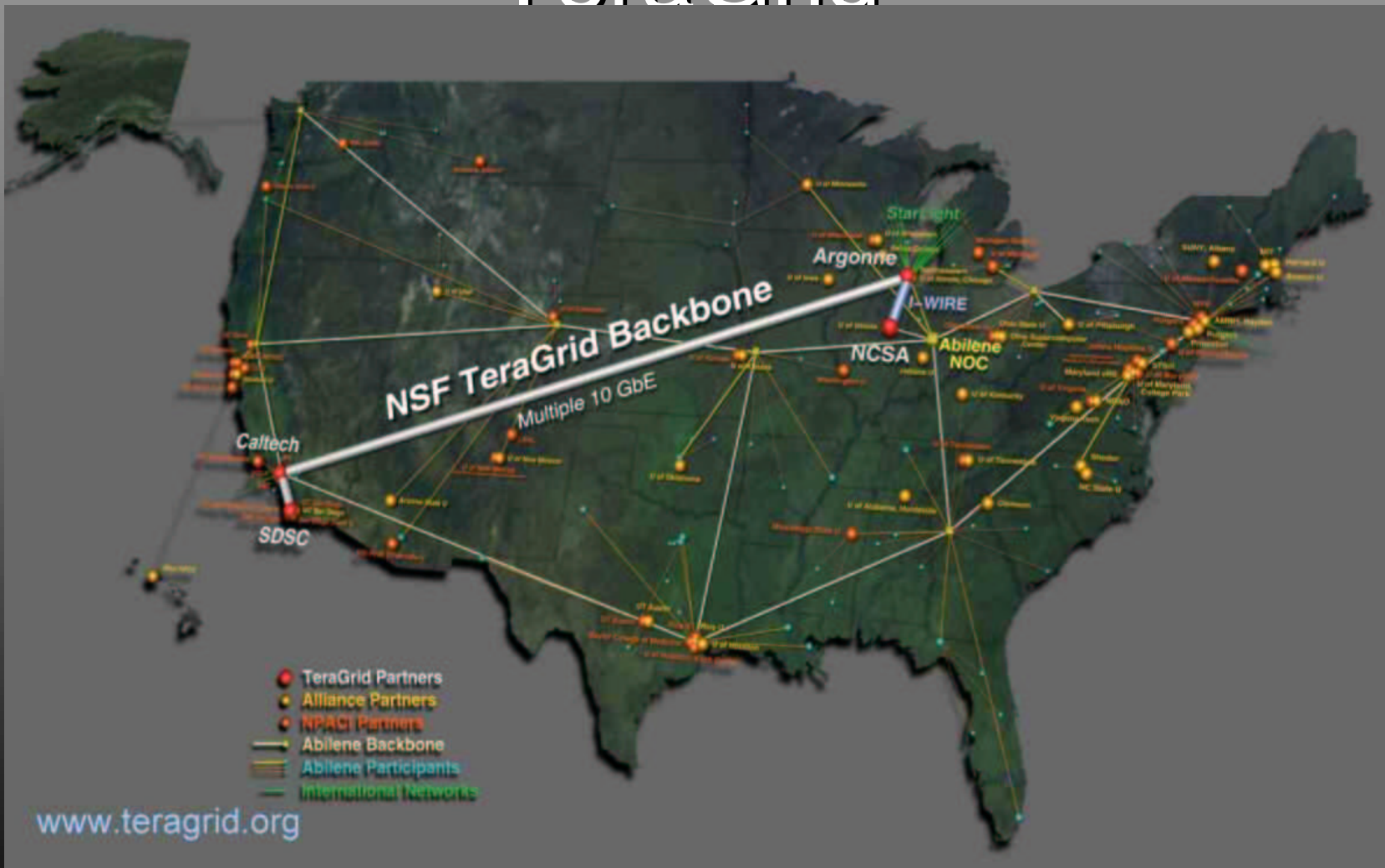


# GRID?

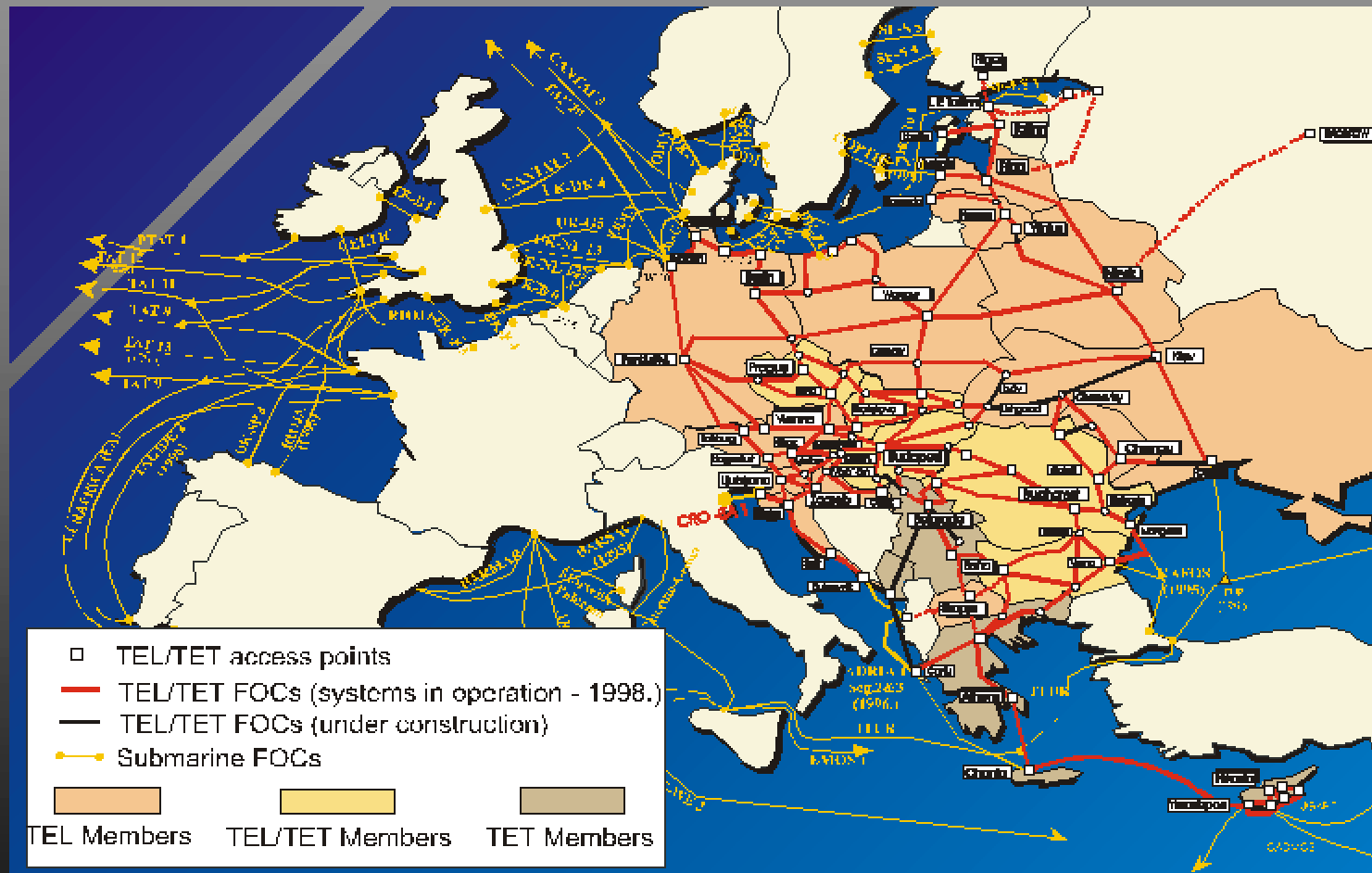
Grids are "super Internets" for high-performance computing: worldwide collections of high-end resources - such as supercomputers, storage, advanced instruments and immersive environments. These resources and their users are often separated by great distances and connected by high-speed networks.



# TeraGrid

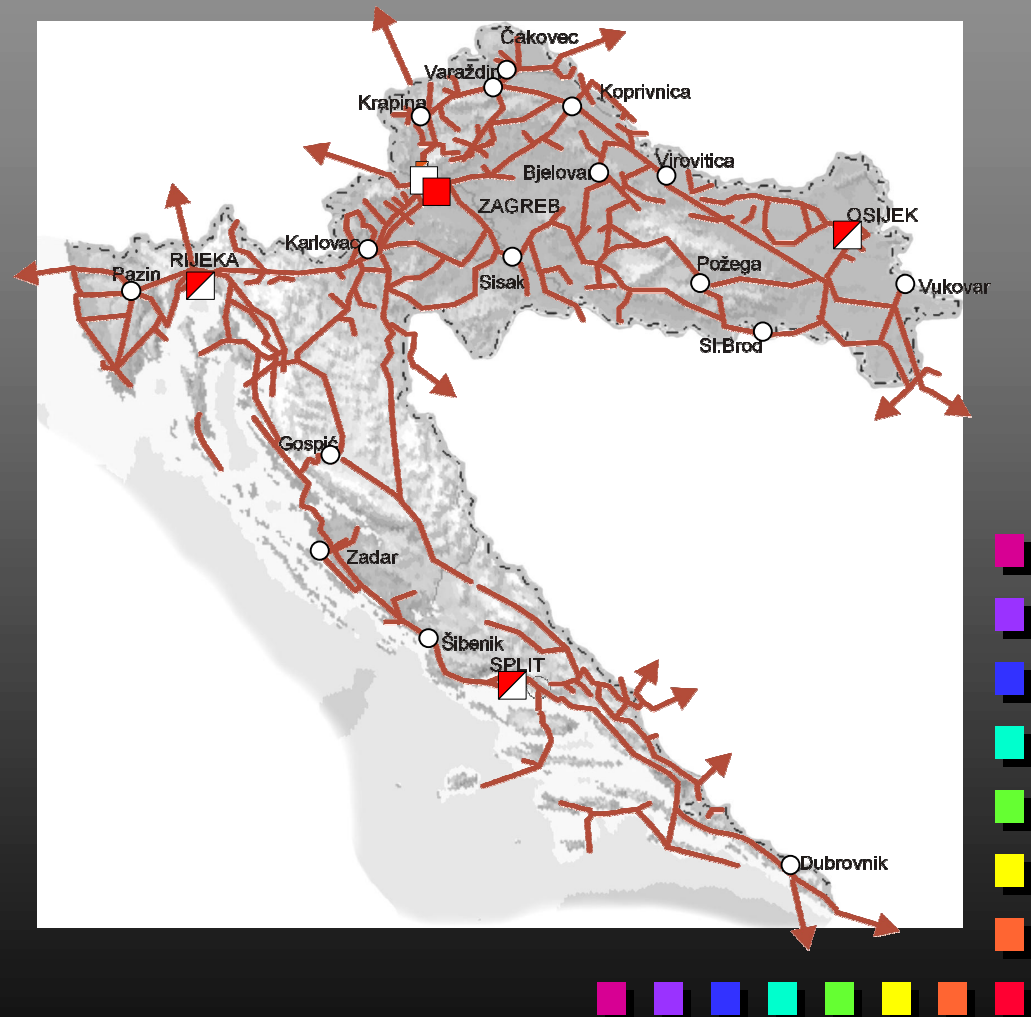


# Croatian infrastructure as a part of European telecommunications



# Communication infrastructure

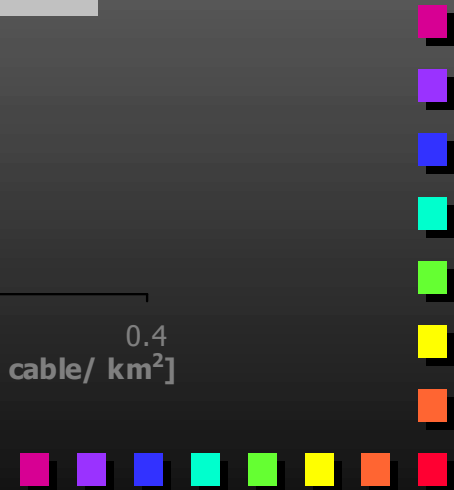
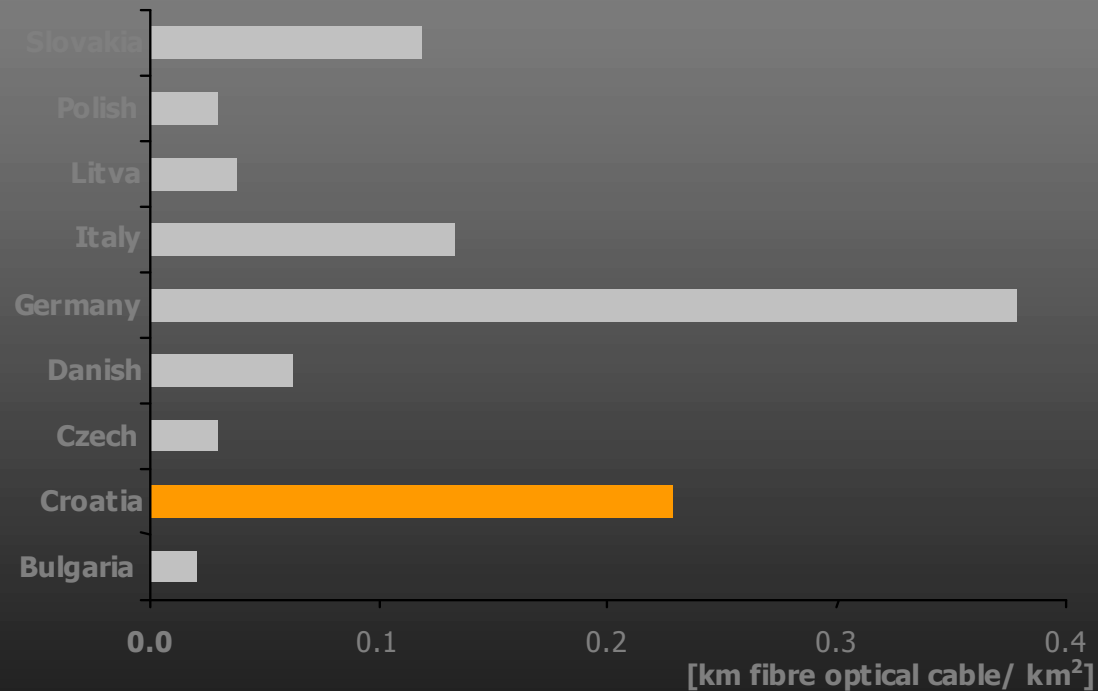
- From 1991 to 2001 realised fiber optical infrastructure across the Croatia
- Total length 18 000 km  
(In plastic pipe)
- monomodal optical fibre  
(1300 i 1550 nm).



# Optical cable diversity

Optical cable length per surface unit km/km<sup>2</sup>

(source: Telecom Operators Companies Annual Reports)



# The possible CRO GRID optical backbone

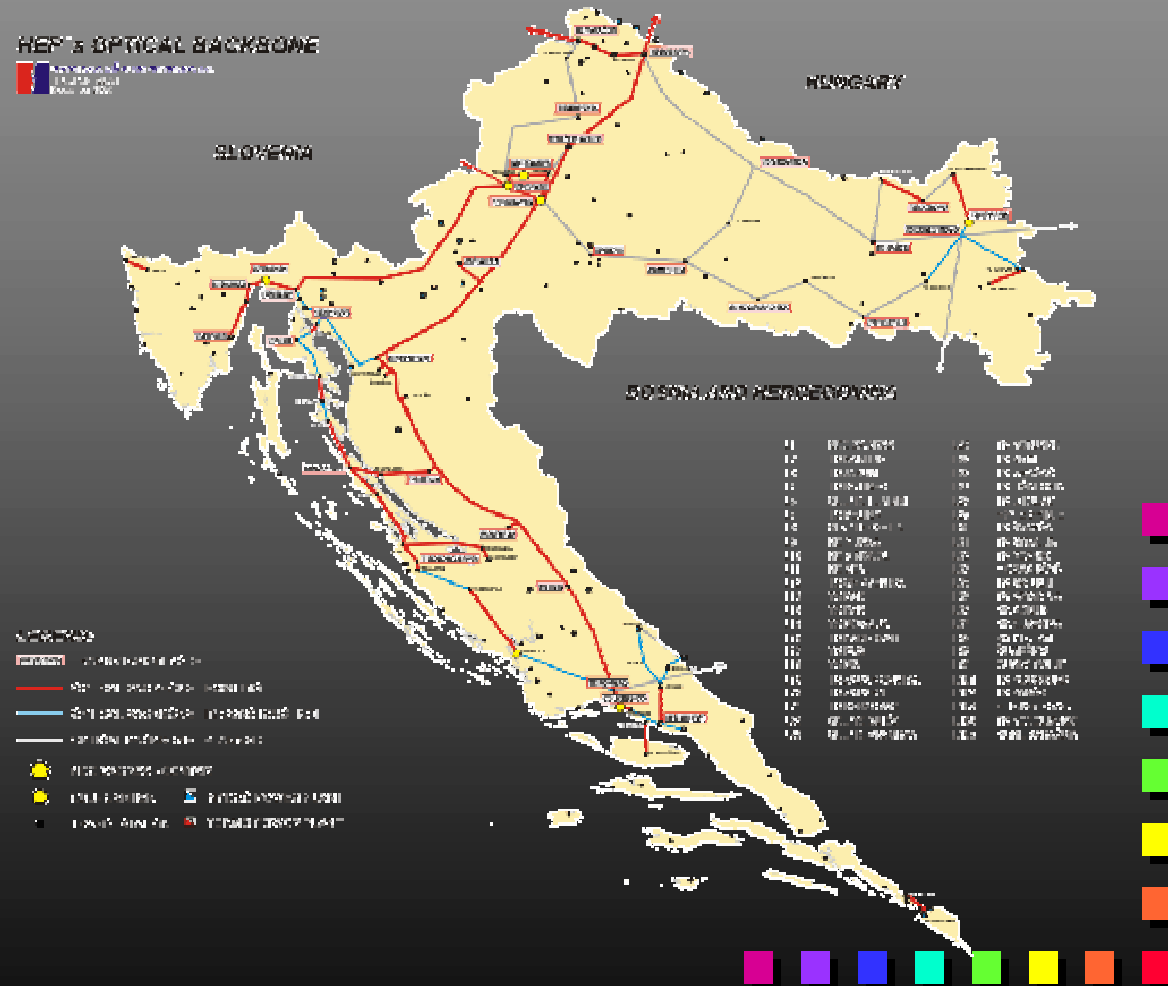
New Grid WAN

University centers:

Zagreb, Split, Rijeka,  
Osijek, Varaždin

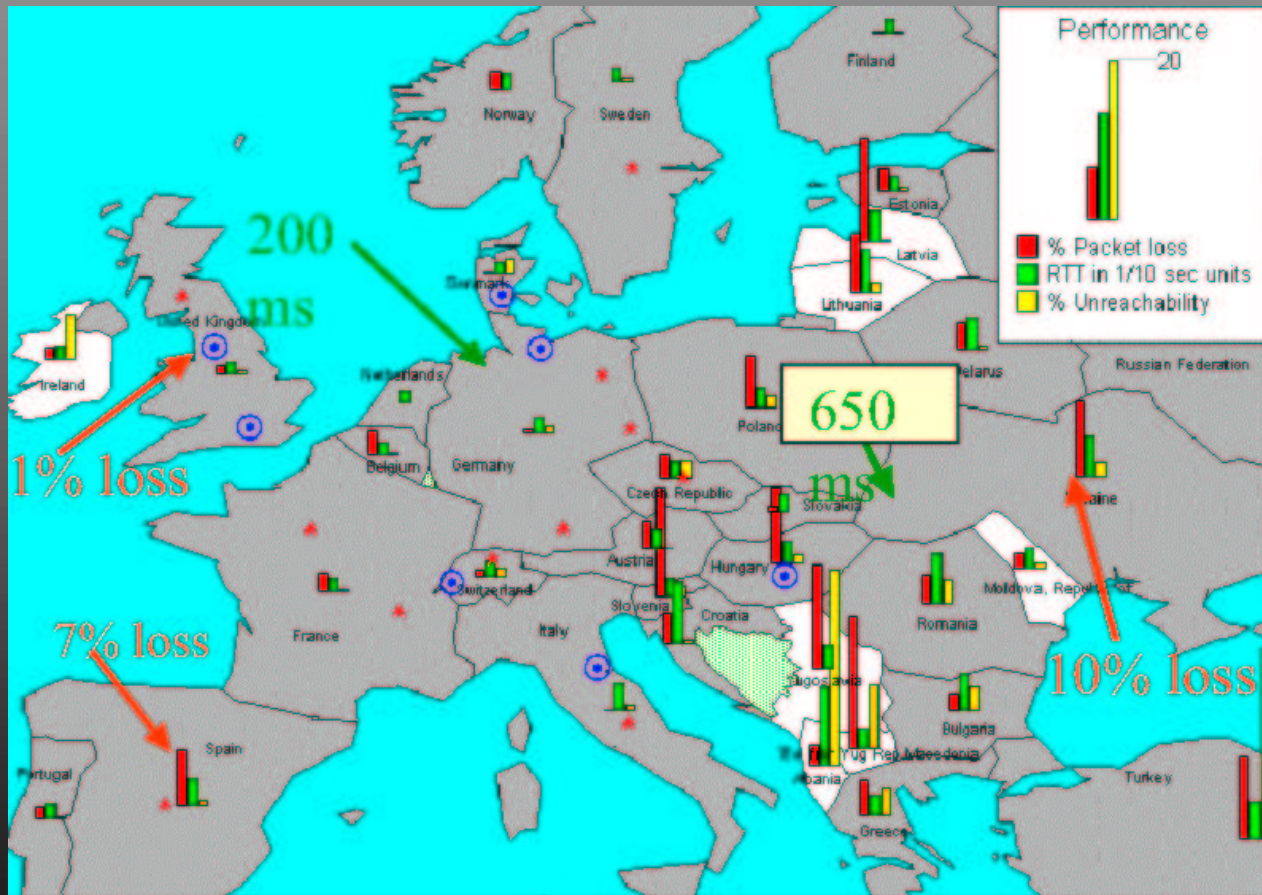
- Realised
- In realisation
- In plane 2002

(fiber: ITU.T G.652)

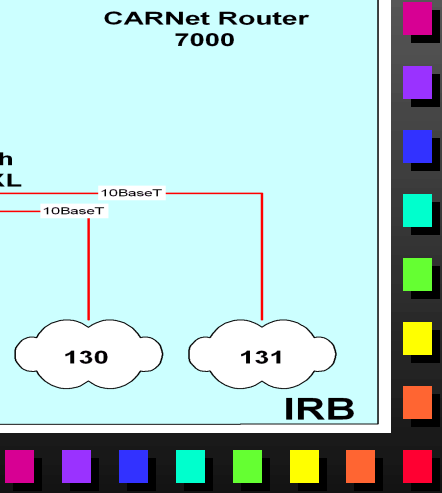
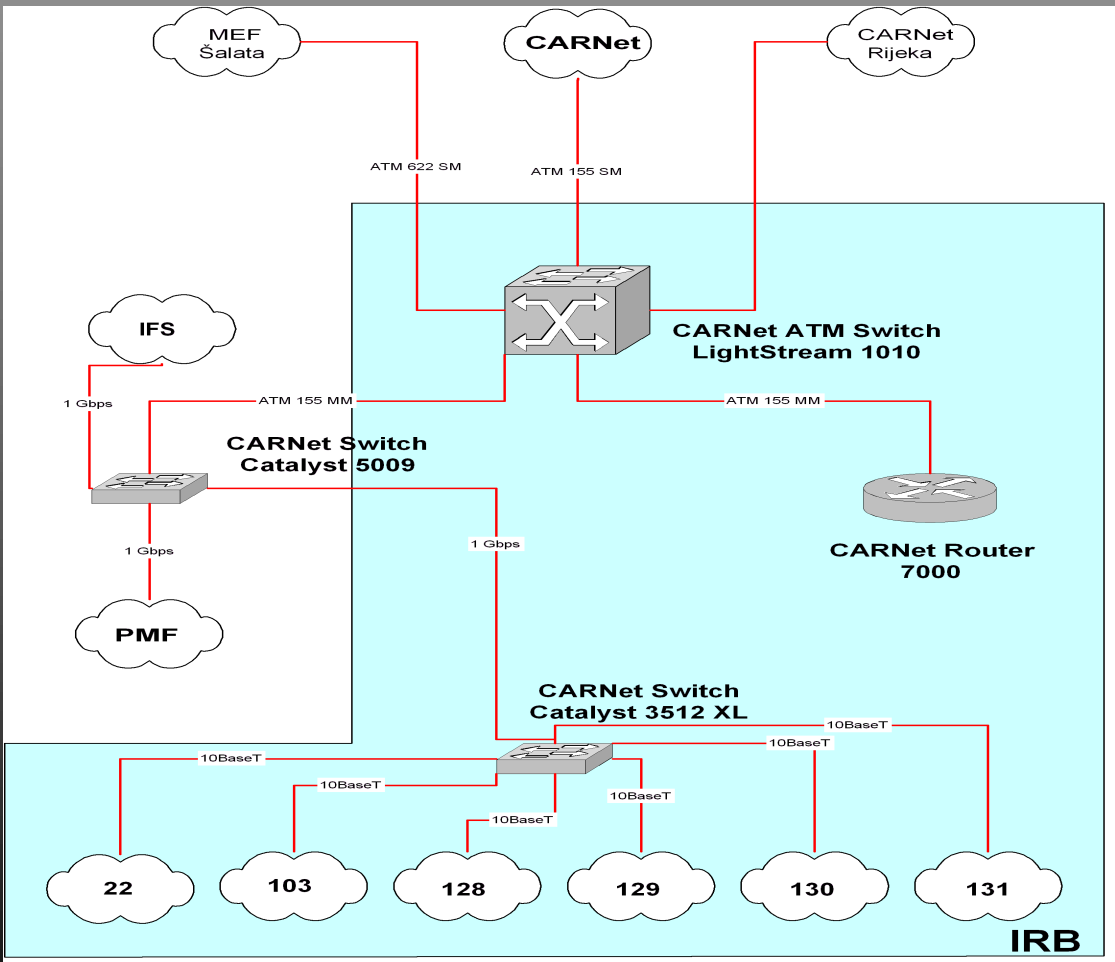
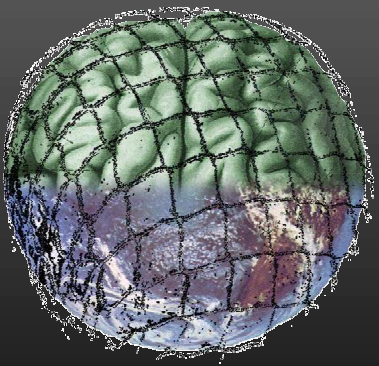




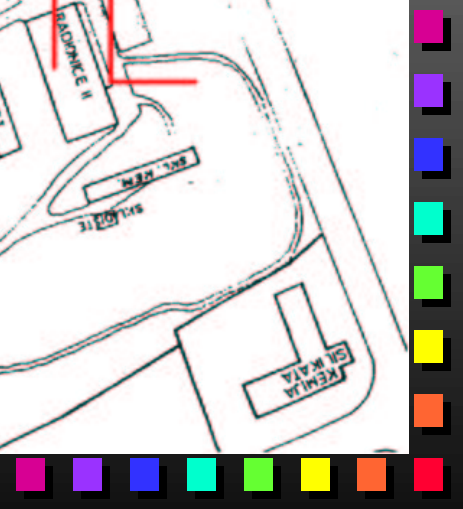
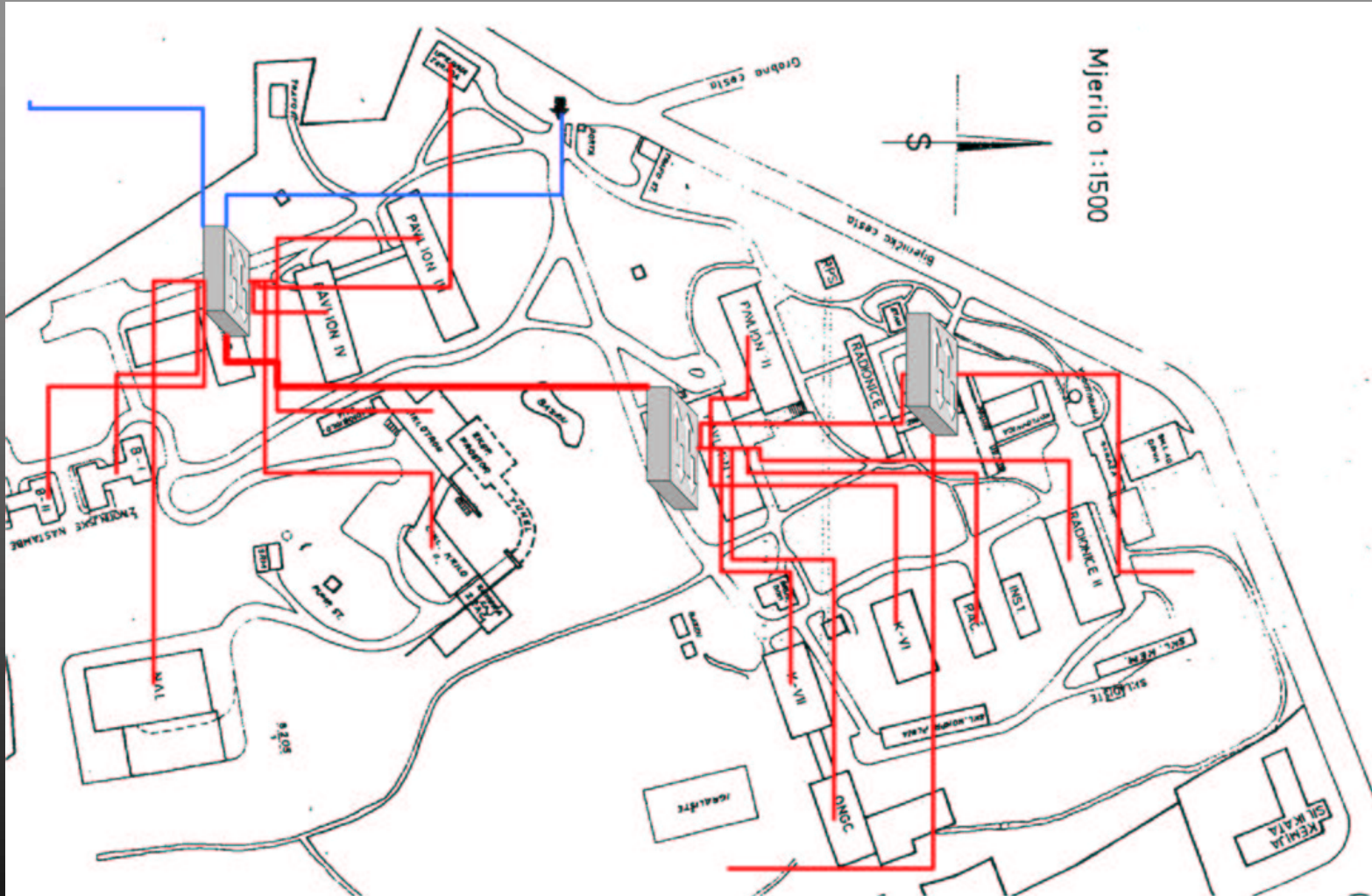
# QoS paradox



# Gb Campus Horvatovac



# IRB optical LAN



# Cluster computing

- 3 clusters: IRB and 2 extensions GF and Cibona
  - IRB
    - Computing nodes: 18 with dual P4 1 and 1.8 GHz
    - Operating systems: linux 7.2
    - Networks: Gigabith Ethernet, IP networks
  - GF
    - Computing nodes: 15 with P3 933 MHz
    - Operating systems: linux 7.2
    - Networks: Gigabith Ethernet, IP networks
  - CIBONA
    - Computing nodes: 45 with P4 1.5 GHz
    - Operating systems: linux 7.2
    - Networks: Gigabith Ethernet, IP networks
    - 10 Mb atmosferic laser link
    - 6 Mb microwave links



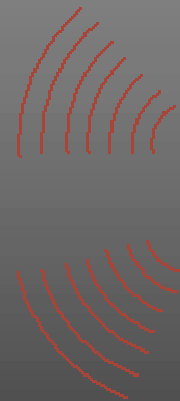
# Cluster grozd.irb.hr



# Cluster farm integration



Grafički fakultet



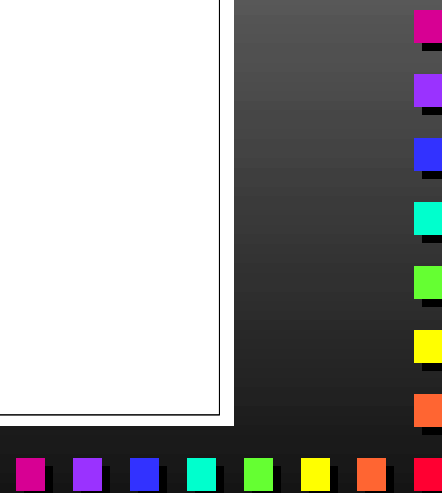
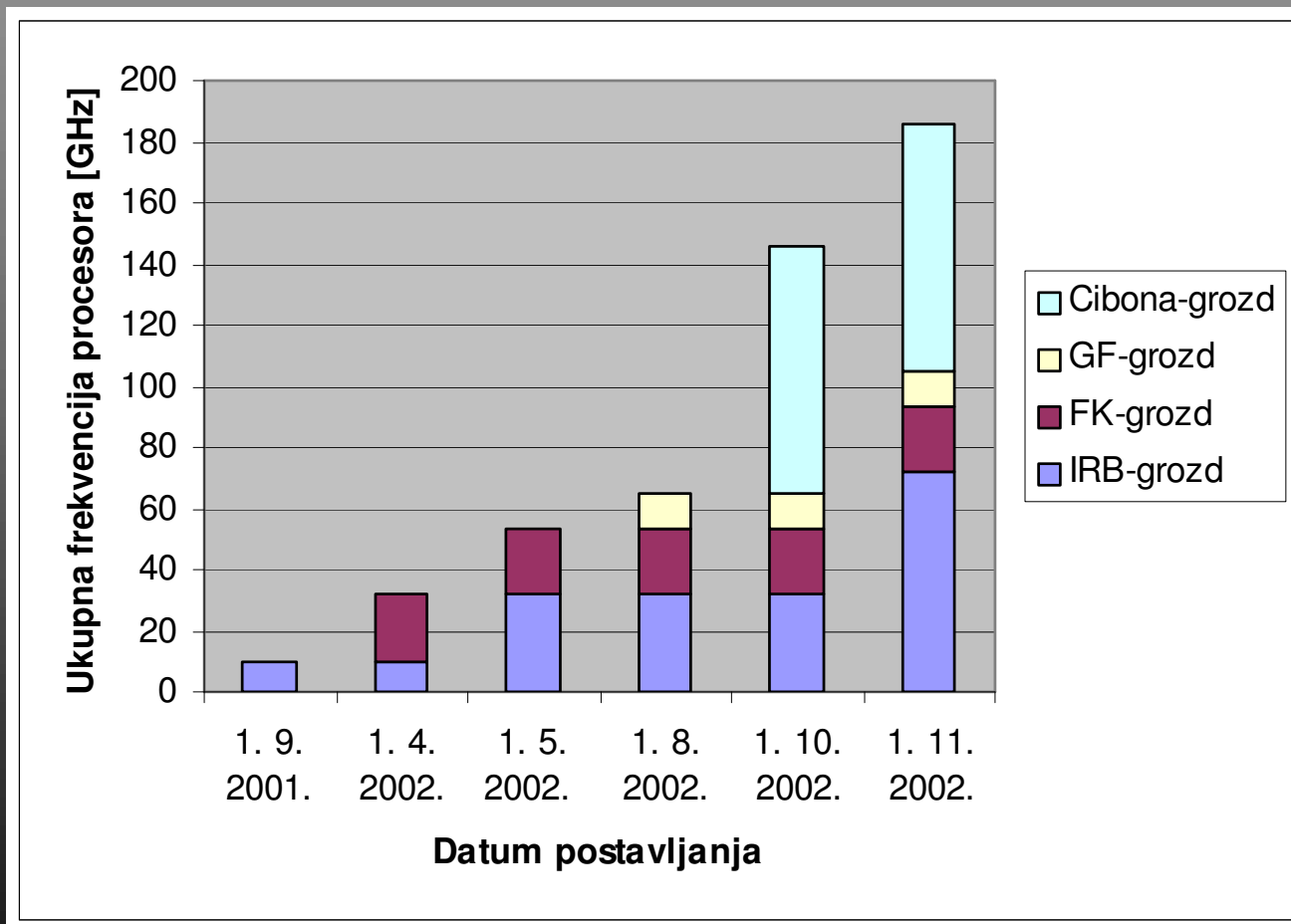
Institut  
Ruđer  
Bošković



# Wireless LAN extension



# Cluster grow

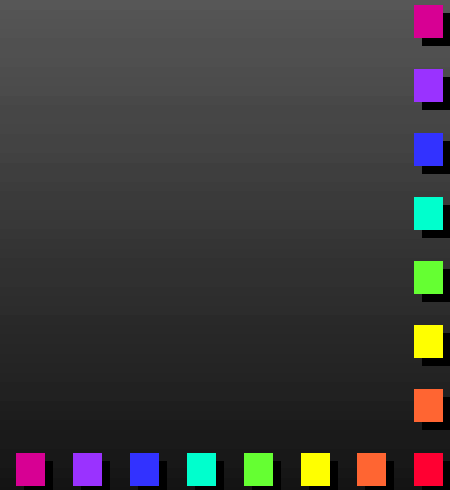




# Scientific Campus Horvatorovac

Great aspiration to scientific grid applications in Campus

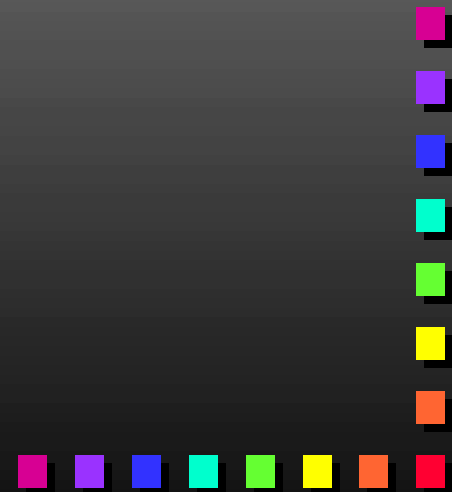
- Ruđer Bošković Institute
- Faculty of science
  - Physics
  - Mathematics
  - Biology
- Institute of Physics
- Medical school University of Zagreb



# Scientific projects in Campus

■ 260 projects in the Campus Horvatovac in field of:

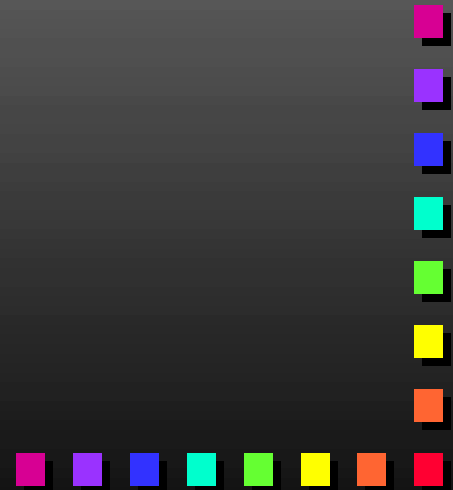
- Physics
- Chemistry
- Mathematics
- Molecular-biology
- Medicine
- Electronics
- Computer science



# Main Grid applications

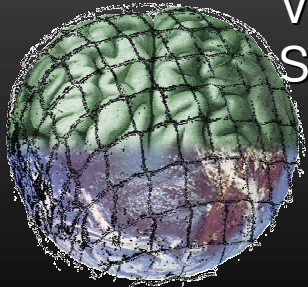
(Campus Grid & Cro Grid)

- Scientific cluster computing
- Scientific instruments in grid (NMR,..)
- Scientific databases
- Distributed Data Aquisition (Marine ecology..)
- Scientific visualisation



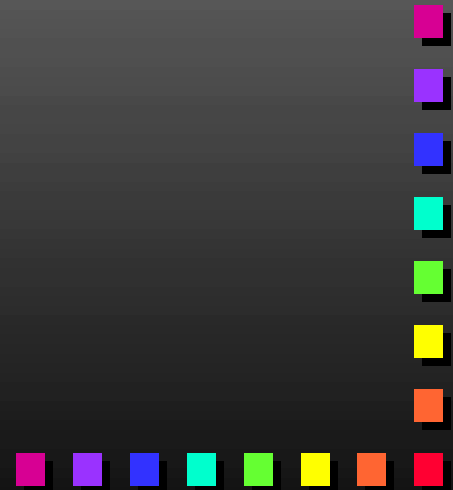
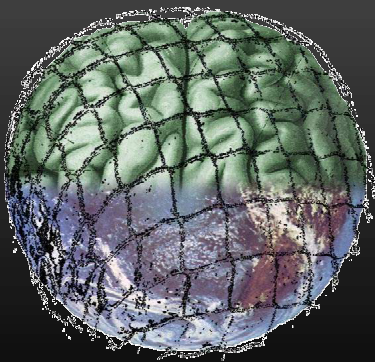
# Grid Reasearch Directions

- Computational Grid – natural extension of cluster computing (CAMPUS GRID)
- Data Grid – large computational task on large volumes of data (CRO GRID)
- Knowladge Grid – knowladge discovery in large data sets (Grid Miner)
  - Joint project with Institute for Software Science University of Vienna “Development of New Grid Technologies for Advanced Scientific and Engineering Application”

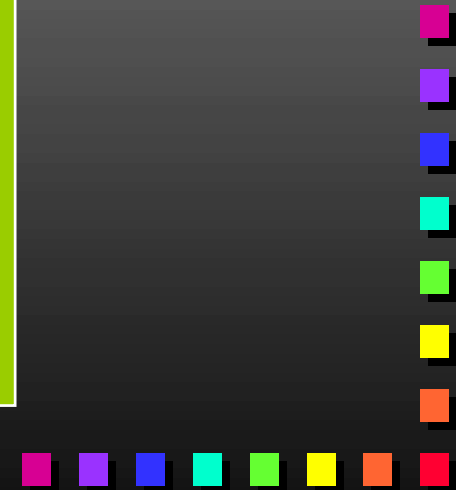
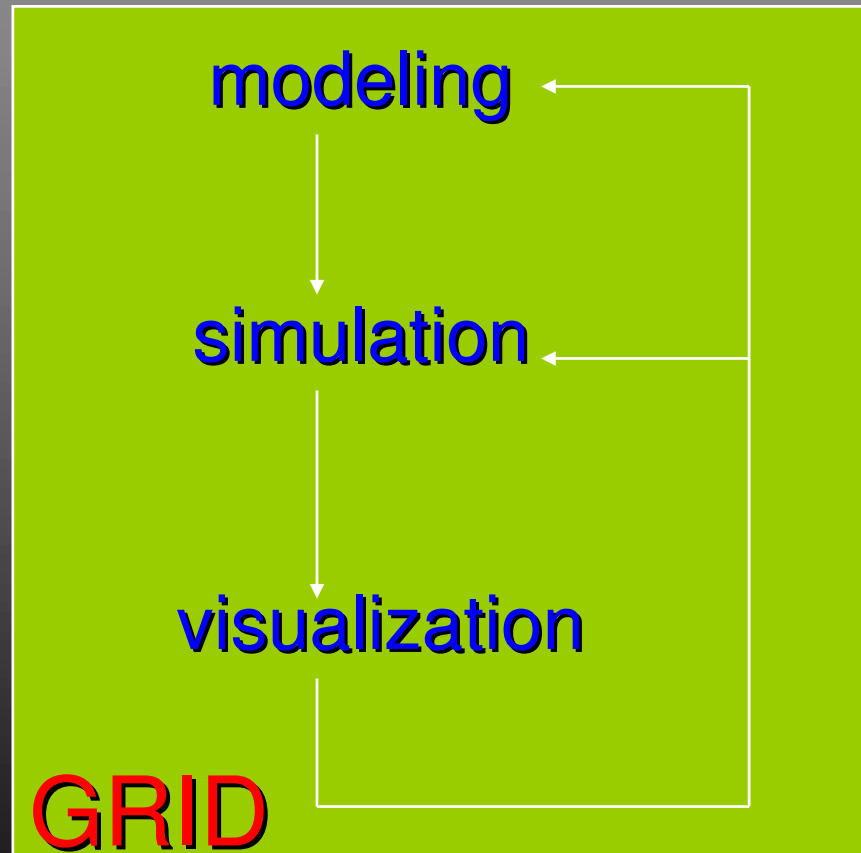


# Scientific Campus Grid goals

- Metacomputing technology
- Distributed computing test bed (3C)
- High-speed computing (Globus)
- High throughput computing (Condor)
- Virtual laboratory (teleimmersion)
- **e-Science centre**

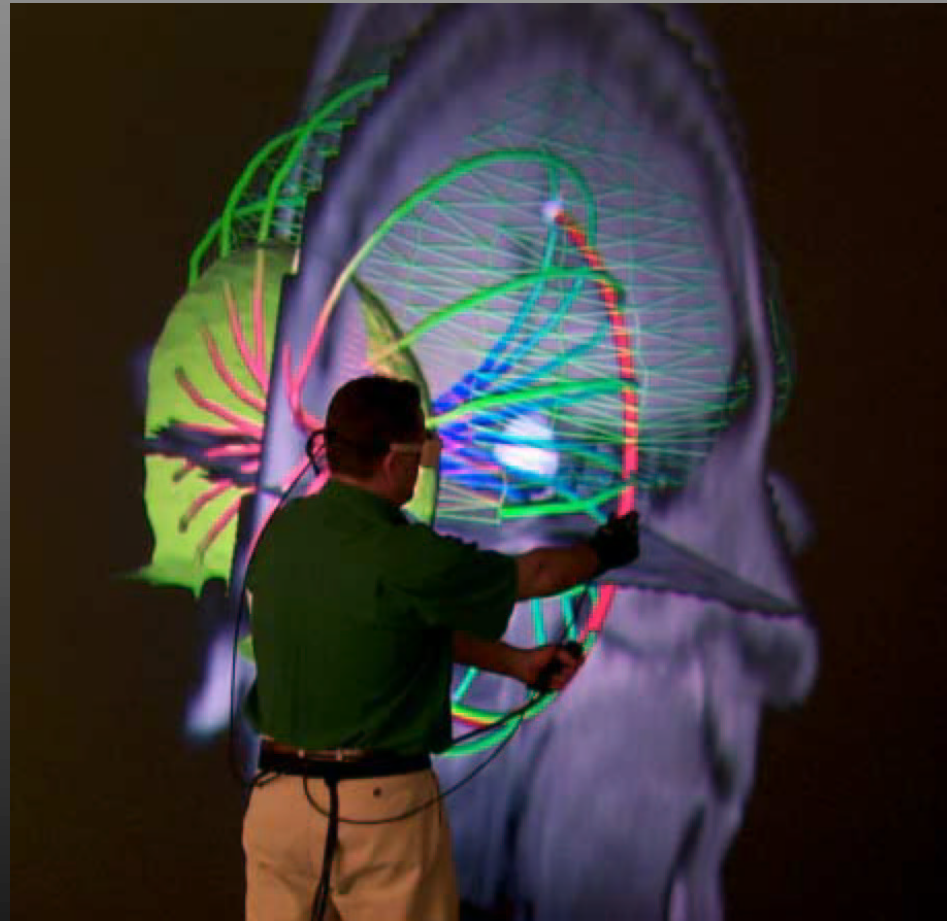
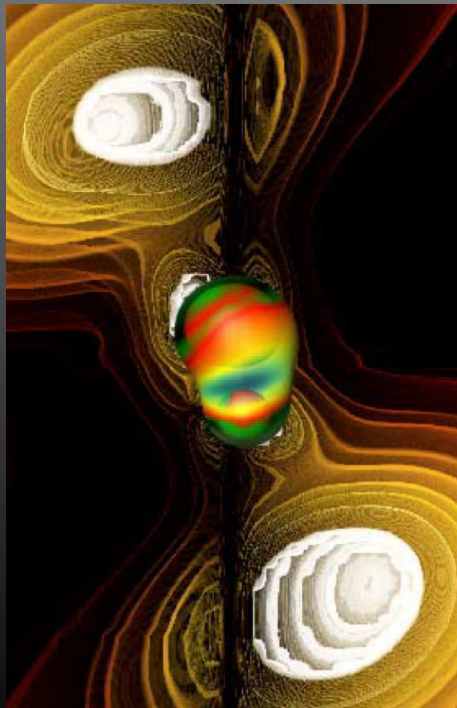


# e-Science Pipeline



# Scientific visualisation

- 2D/3D visualisation
- Dinamic grid visualisation
- Teleimersion visualisation



# Generic IT development timeline

- **Infrastruktura**

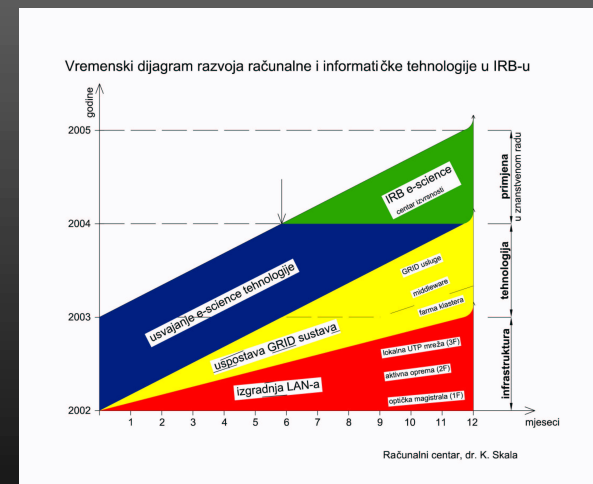
IRB LAN/optical backbone/active equipment/local UTP  
2001/2002

- **Tehnologija**

Grid tehnology clusters, farms of clusters, middleware, grid services  
2003/2004

- **Applications**

e-Science center /scientific applications  
2005-...

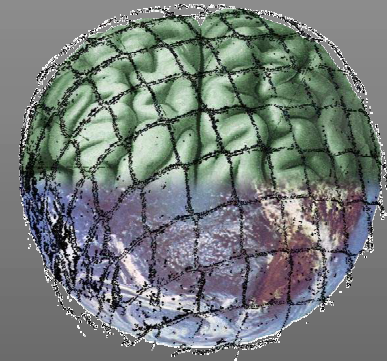




# Orientation and collaboration

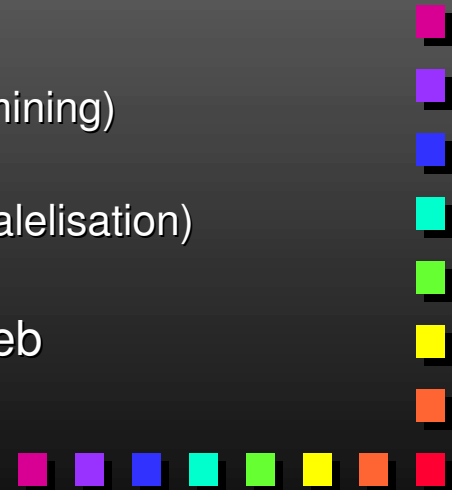
## Orientation to Grid projects:

- Campus Grid Horvatovac (2002-2005)
  - GridMiner
- Cro Grid (start from 2003?)



## Existing cooperations:

- Cern Data Grid,
- Austro-Croatian grid project (grid testbed and data mining)
  - GridMiner
- Collaboration with projects in Hungary (program paralelisation)
  - P-Grade ([www.sztaki.hu](http://www.sztaki.hu))
- Southaphton University - AccessGrid node in Zagreb





# More Information

<http://grid.irb.hr>

<http://cluster.irb.hr>

