Εισαγωγή στον Προγραμματισμό

Εισαγωγική ενότητα (25%) :
Βασικές έννοιες και τομείς
της Επιστήμης Υπολογιστών
5^η και 6^η ομιλία

Παναγιώτης Τζουνάκης

Άνοιξη 2025

World Wide Web: Παρασκήνιο & Θεμέλια

Αντικείμενα παρουσίασης :

- Κέντρα Λειτουργίας Δικτύων (Network Operation Centers – NOCs)

- Οργανισμοί (Organizations)

- Σύλλογοι / Κοινότητες (Societies / Communities)

- Υποδομές (Infrastructures)

- Υπηρεσίες (Services)

- Δραστηριότητες (Activities)

World Wide Web: Παρασκήνιο & Θεμέλια

Στόχοι παρουσίασης:

- Present the most important real artificial network.

- Identify the infrastructures that make the web function.

- Identify the different interconnected networks. These networks are different, but there are harmonious correspondences which guarantee the overall functionality.

Σύντομο ιστορικό

http://en.wikipedia.org/wiki/History_of_the_Internet

Government-built Internet or private-sector-build?

NEITHER & BOTH! Nowadays,

Internet = "commons-based peer production."

Build by a human open, decentralized, peer network

+

Web is built on Top of the Internet

http://www.internethalloffame.org/

INTERNET HALL of FAME®

Celebrating people who bring the Internet to life

HOME | **INDUCTEES** | NOMINATIONS | INTERNET HISTORY | SPEAKERS | PRESS | BLOG | ABOUT

INDUCTEES

HOME / INDUCTEES / 2017 INDUCTEES

2017 INTERNET HALL OF FAME INDUCTEES

In this section:
- ▶ **Inductees Alphabetically**
- ▶ 2012 Inductees
- ▶ 2013 Inductees
- ▶ 2014 Inductees
- ▶ 2017 Inductees

GLOBAL CONNECTORS

Nabil Bukhalid

Ira Fuchs

Shigeki Goto

Mike Jensen

Ermanno Pietrosemoli

Tadao Takahashi

Florencio Utreras

Jianping Wu

INNOVATORS

Jaap Akkerhuis

Yvonne Marie Andrés

Alan Emtage

Ed Krol

Tracy LaQuey Parker

Craig Partridge

http://www.internethalloffame.org/

World Wide Web Hall of Fame @ First International Conference on the World-Wide Web (1994)

- Tim Berners-Lee, CERN
- Marc Andreessen, Netscape Communications Co., formerly at NCSA
- Eric Bina, Netscape Communications Co., formerly at NCSA
- Kevin Hughes, Honolulu C.C., now at Enterprise Information Technologies
- Rob Hartill, Los Alamos National Lab, formerly at U. Wales College at Cardiff
- Lou Montulli, Netscape Communications Co., formerly at U. Kansas

Πιθανό μέλλον

Operations Concept for a Solar System Internetwork (SSI)

IOAG.T.RC.001.V1
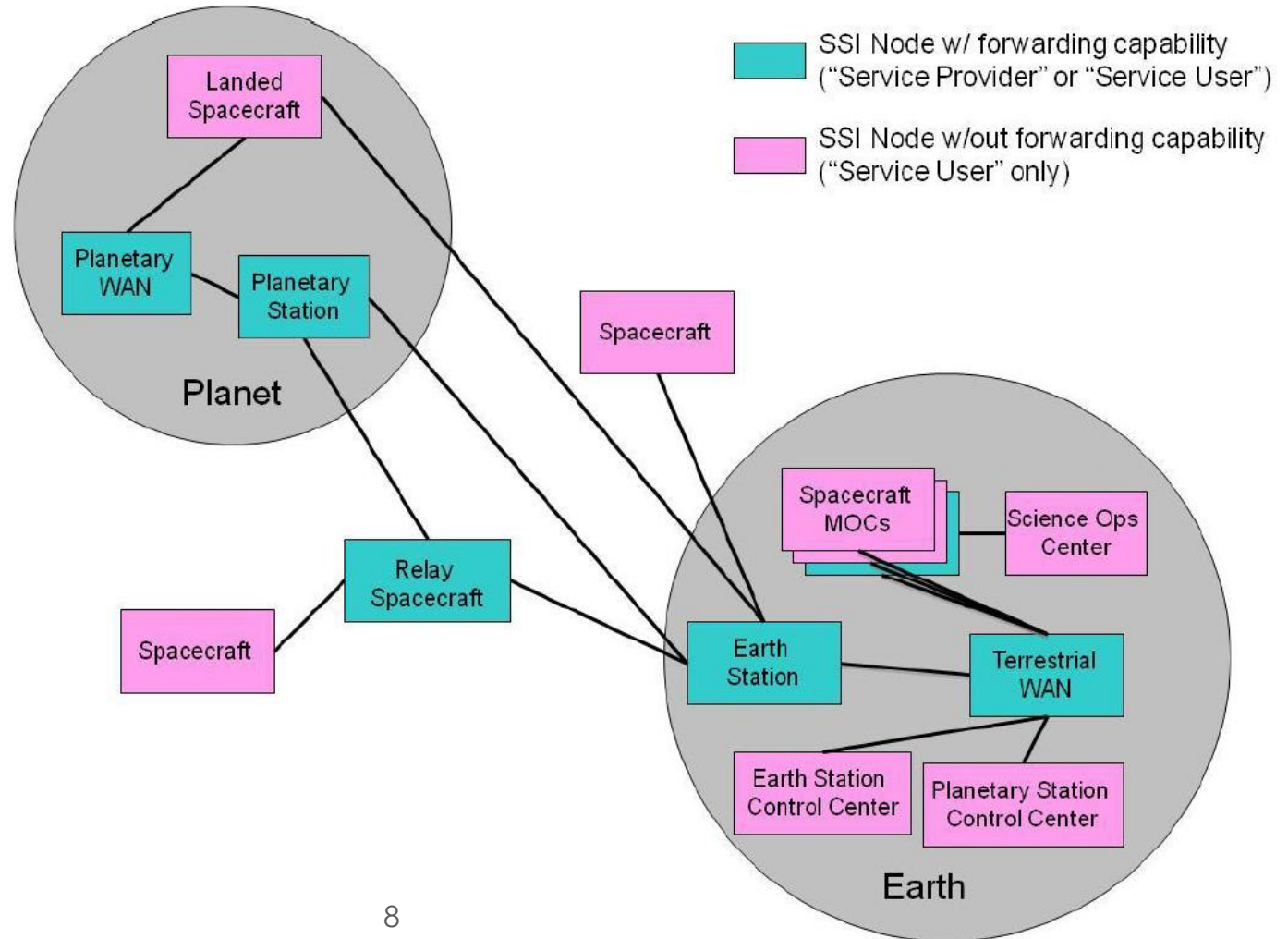
Πιθανό μέλλον
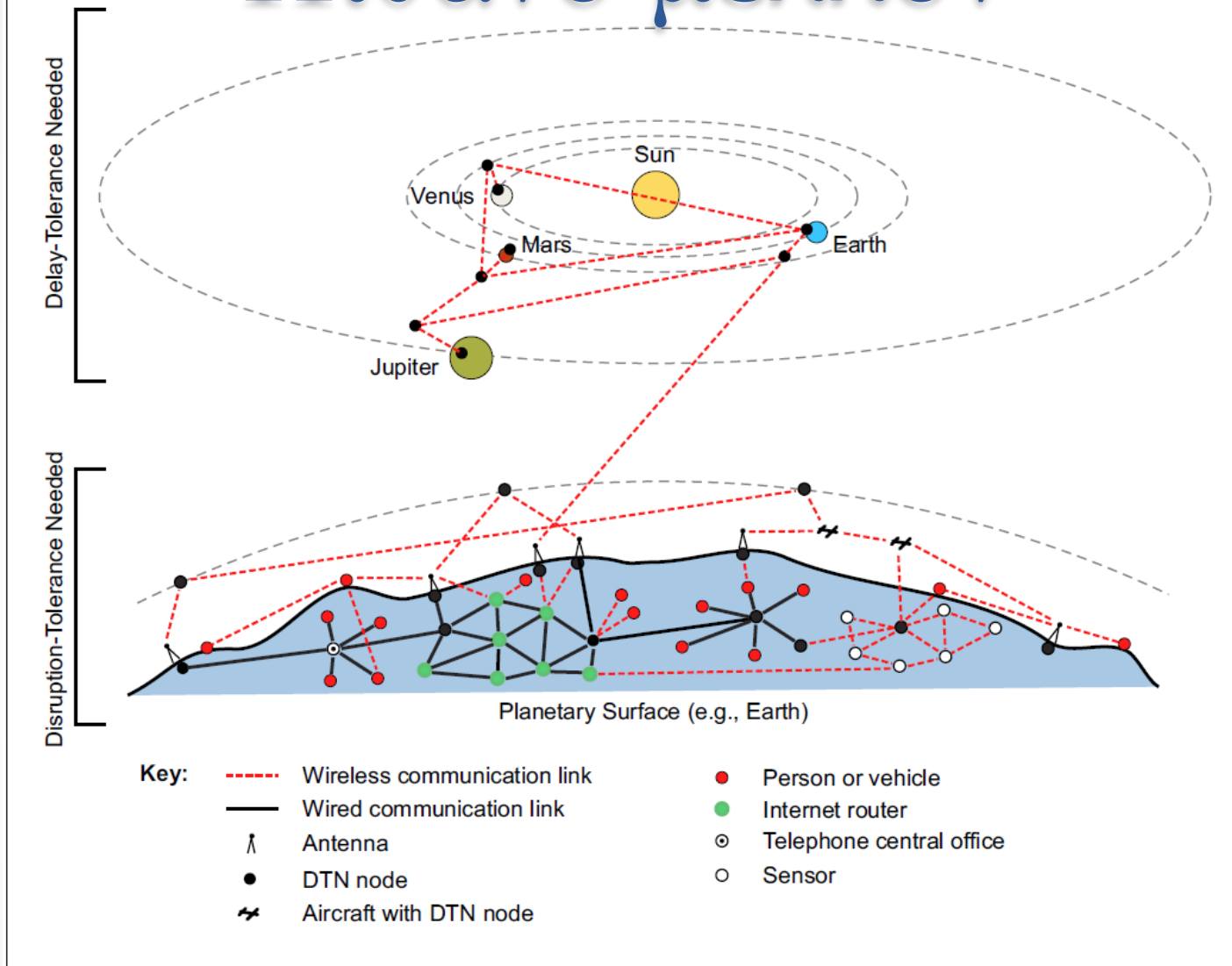
Delay- and Disruption-Tolerant Networks (DTNs): A Tutorial
http://ipnsig.org/wp-content/uploads/2012/07/DTN_Tutorial_v2.04.pdf

Τμήμα Μαθηματικών
Αριστοτέλειο Πανεπιστήμιο Θεσσαλονίκης

NASA Disruption Tolerant Networking

Τμήμα Μαθηματικών

Αριστοτέλειο Πανεπιστήμιο Θεσσαλονίκης
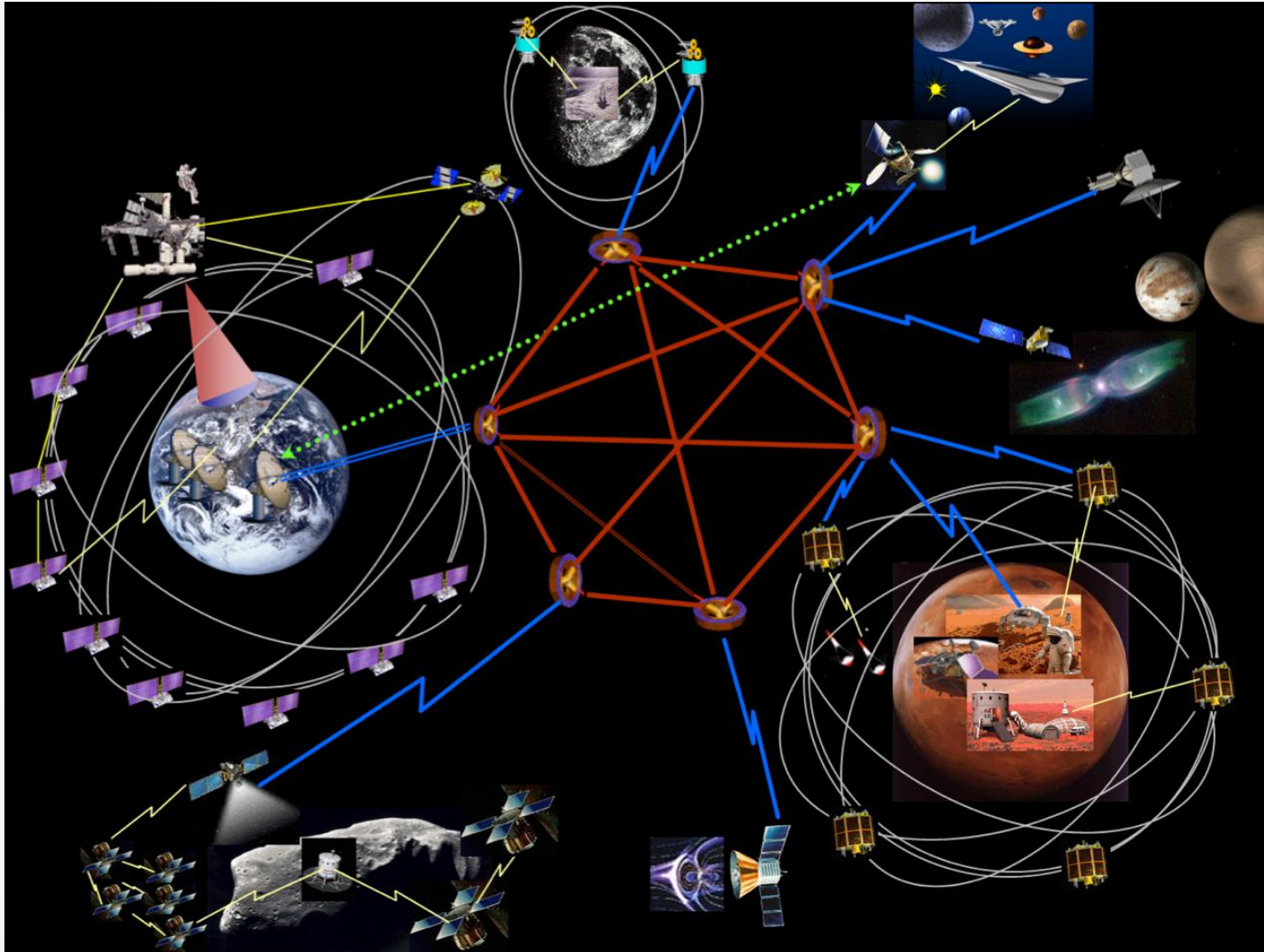
Network Layer Interaction
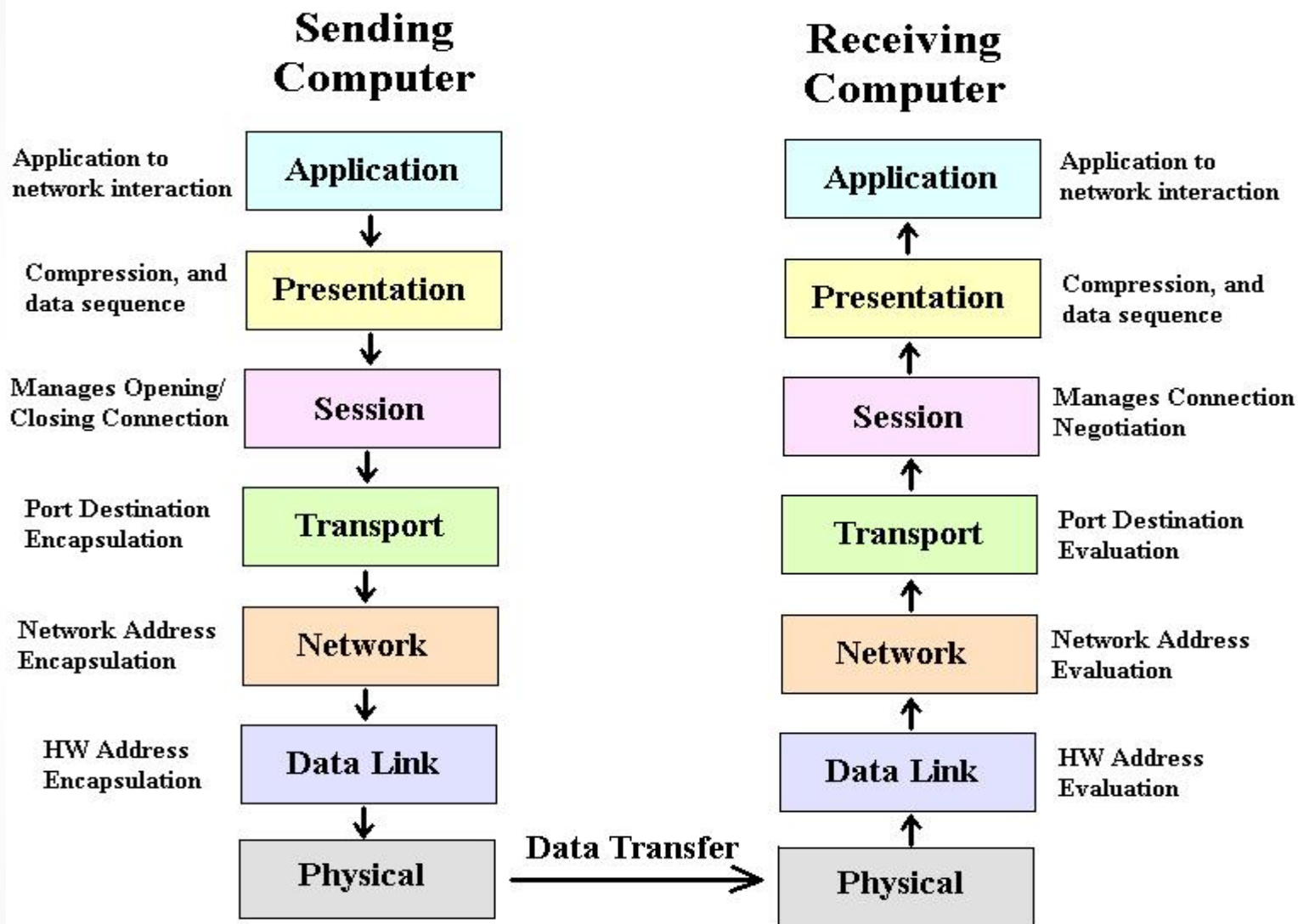
Ad hoc Internet protocol stack

Τμήμα Μαθηματικών
Αριστοτέλειο Πανεπιστήμιο Θεσσαλονίκης
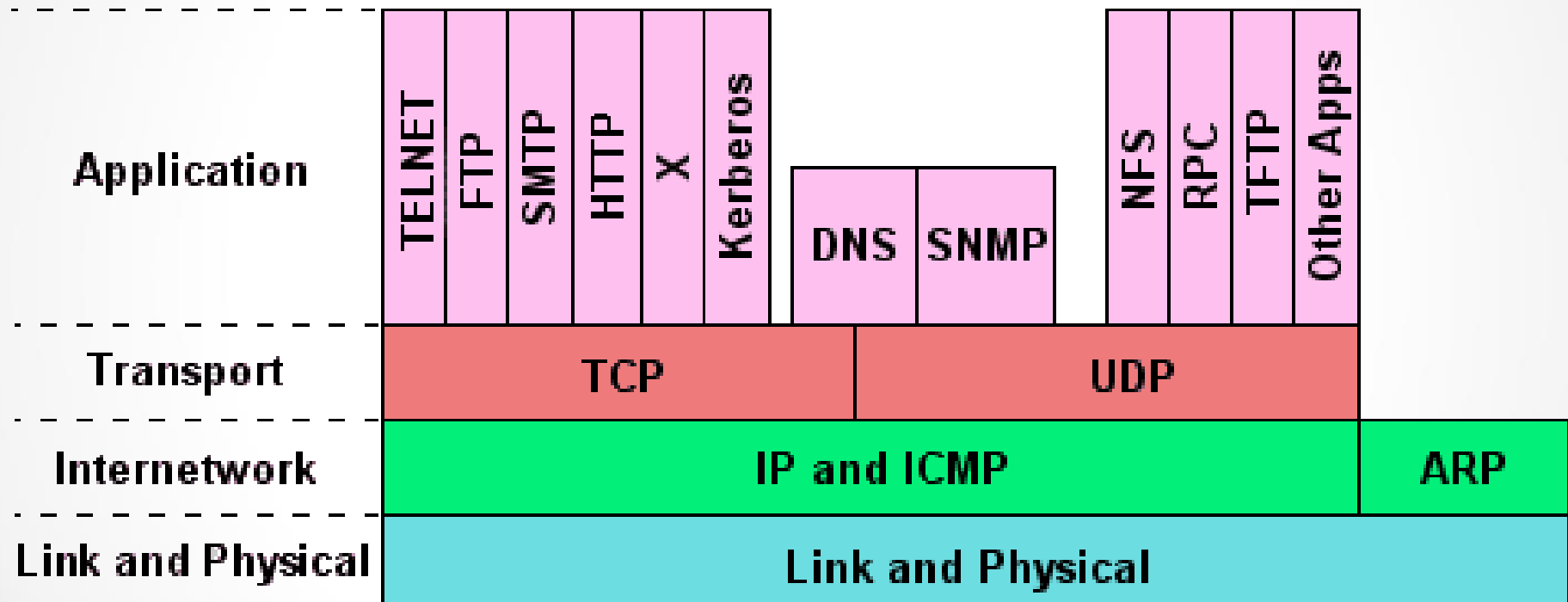
OSI Model

Layer #	Name	Mnemonic	Encapsulation Units	Devices or Components	Keywords/Description
7	Application	All	data	PC	Network services for application processes, such as file, print, messaging, database services
6	Presentation	People	data		Standard interface to data for the application layer. MIME encoding, data encryption, conversion, formatting, compression
5	Session	Seem	data		Interhost communication. Establishes, manages and terminates connection between applications
4	Transport	To	segments		End-to-end connections and reliability. Segmentation/desegmentation of data in proper sequence. Flow control
3	Network	Need	packets	router	Logical addressing and path determination. Routing. Reporting delivery errors
2	Data Link	Data	frames	bridge, switch, NIC	Physical addressing and access to media. Two sublayers: Logical Link Control (LLC) and Media Access Control (MAC)
1	Physical	Processing	bits	repeater, hub, transciever	Binary transmission signals and encoding. Layout of pins, voltages, cable specifications, modulation

OSI comparision with TCP/IP Protocol Stack

OSI #	OSI Layer Name	TCP/IP #	TCP/IP Layer Name	Encapsulation Units	TCP/IP Protocols
7	Application			data	FTP, HTTP, POP3, IMAP, telnet, SMTP, DNS, TFTP
6	Presentation	4	Application	data	
5	Session			data	
4	Transport	3	Transport	segments	TCP, UDP
3	Network	2	Internet	packets	IP
2	Data Link	1	Network Access	frames	
1	Physical			bits	

Hosted at Novgorod State University

http://www.vlsm-calc.net/models.php

Εξέλιξη του Internet

1. Simplification of lower network layers, after the "Protocol Wars" (OSI, SNA, DECNET, appletalk, etc., ….. and TCP/IP) of the 1980s, and early 1990s.

"We reject kings, presidents and voting. We believe in rough consensus and running code." : *David Clark at a 1992 talk describing the Internet Engineering Task Force*

Εξέλιξη του Internet

2. Convergence of applications, technologies and networks

Voice   Video   Data   Storage

||
\/

Broadband IP network

Εξέλιξη του Internet

TECHNOLOGY ROADMAP: THE INTERNET OF THINGS

Technology Reach

Software agents and advanced sensor fusion

Miniaturization, power-efficient electronics, and available spectrum

Teleoperation and telepresence: Ability to monitor and control distant objects

Physical-World Web

Ability of devices located indoors to receive geolocation signals

Locating people and everyday objects

Ubiquitous Positioning

Cost reduction leading to diffusion into 2nd wave of applications

Surveillance, security, healthcare, transport, food safety, document management

Vertical-Market Applications

Demand for expedited logistics

RFID tags for facilitating routing, inventorying, and loss prevention

Supply-Chain Helpers

2000   2010   2020   Time

???

Quantum Internet

Τμήμα Μαθηματικών
Αριστοτέλειο Πανεπιστήμιο Θεσσαλονίκης

Βλέπε https://datatracker.ietf.org/doc/draft-irtf-qirg-principles/

2023-25: Τεχνολογίες και υποδομές κβαντικής επικοινωνίας στην Ευρώπη και στην Ελλάδα

DECLARATION ON A
QUANTUM COMMUNICATION INFRASTRUCTURE
FOR THE EU

All 27 EU Member States
have signed a declaration agreeing to **work together** to explore how to **build a quantum communication infrastructure** (QCI) across Europe, boosting European capabilities in quantum technologies, cybersecurity and industrial competitiveness.

@FutureTechEU #EuroQCI

https://qt.eu/ecosystem/quantum-communication-infrastructure

Quantum communication networks

HQCi — HellasQCI - Quantum Communication Infrastructure for Greece

HellasQCI North — Holomontas

Helmos

HellasQCI Central

Skinakas — HellasQCI South

grnet

— Terrestrial Fiber link
-- Satellite-to-earth link
Telescope OGS
Trusted Node
Metropolitan area

https://hellasqci.eu/

A vision for the future space-based quantum network

Monetary transfers between financial institutions secured by Quantum Comm

$$$

Image credit: NASA TDRS

New Materials
Image credit: NASA/Marshall Space Flight Center

Researchers access the research power of centralized quantum computers and maintain confidentiality

Quantum Network

30 mL

15 mL

Breakthroughs in Medicine

Image Credit: NASA Ames / John Hardman

Quantum Sensor arrays may be used to monitor local aquifers

Image credit: NASA TDRS

$$$
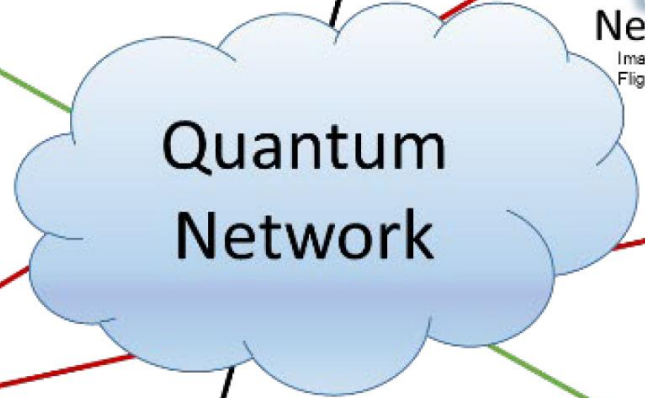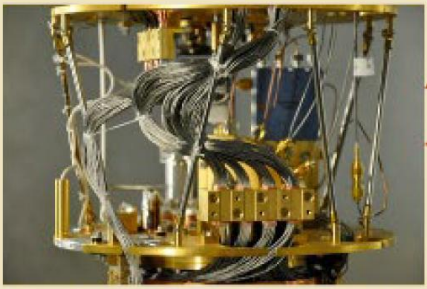
Quantum Communication 101
Henry Semenenko, Sherilyn Wright, Michelle Lollie, Jefferson Flórez, Matty Hoban, Florian Curchod

Final Report
Workshop on Space Quantum Communications and Networks
Developing a Roadmap to Quantum Communications in Space
January 30 – 31, 2020
University of California, Berkeley
Berkeley, California 94720
30 September 2020

NIST National Institute of Standards and Technology U.S. Department of Commerce

Τμήμα Μαθηματικών

Αριστοτέλειο Πανεπιστήμιο Θεσσαλονίκης

Εισαγωγή ευρυζωνικών υπηρεσιών (broadband services)

- High Return On Investment per user, leading to sustainable and (in long term) profitability

- Cut costs & increase productivity in public sector

- Sectors for immediate application: health, education, lift of social / geographical exclusions

Broadband services

- Basic network services are prerequisite
  o DNS, directory services, e-mail, web, ftp, etc.

- Value added network services
  o Application & document sharing, video/audio only conference, video e-mail, online gaming, streamed video, digital music, VoIP, sync/async distance learning, etc.

Προσφορά ευρωζωνικών υπηρεσιών

There is no single "killer application"!!!

SOLUTION: services 'bouquets':
o High speed
o "always on" characteristic
o flat fee

Τμήμα Μαθηματικών
Αριστοτέλειο Πανεπιστήμιο Θεσσαλονίκης

Ταξινόμηση υπηρεσιών

- security & data services
  - VPN, firewalls, parental controls

- entertainment
  - Video on Demand, Music on Demand, Internet Radio

- Advanced telecommunications
  - VoIP, Video telephony, mobility

- Tele-control / smart buildings
  - security, surveillance, utility management

Οργάνωση

- Networks (Classes A – E, + CIDR, IPv4/IPv6)
- Autonomous Systems (AS)
- Network Operations Centers (NOCs)
- Internet Operation =

"Collaboration, Collaboration, Collaboration"!!!

Since 9/2010 the Task Force on Network Operation Centers (TF-NOC) brings together NOC managers, engineers, developers, operators, controllers and project managers interested in NOC functions ...

See http://www.geant.org/activities/tf-noc/

https://wiki.geant.org/display/SIGNOC/SIG-NOC+Special+Interest+Group+-+Network+Operations+Centre

http://www.geant.org

GÉANT

Τμήμα Μαθηματ.

Αριστοτέλειο Πανεπιστήμιο Θεσσαλονίκης

23

Οργάνωση

- Staff:
  - roles (request routing, specialized addressing of requests)
  - coverage (place – time of response / address of issues),
  - Jurisdiction – responsibilities (administrative boundaries, obligations)
- NOC organization (centralized hierarchy, distributed structures, external assignments)
- Integration of tools and methodology of work

Οργάνωση

- Profile of network users and NOC services

- A framework of NOC obligations against users (Service Level Agreements - SLAs, Service usage Regulations)

- Methods – Tools to communicate with users and manage them

Οργάνωση : Documentation at NOC

- What kind of information is documented at NOC?

- Internal / external documentation

- Tools to create, maintain, promote documentation

- Best Practices

Τμήμα Μαθηματικών
Αριστοτέλειο Πανεπιστήμιο Θεσσαλονίκης

Διοίκηση

Internet governance : shape the evolution and use of the Internet

<u>Who?</u> Governments, private sector, civil society

<u>How?</u> Develop and apply

<u>What?</u> norms, rules, decision-making procedures, and programs

Διοίκηση: Όργανα διακυβέρνησης

- Internet Assigned Numbers Authority (IANA) ==>> Internet Corporation for Assigned Names and Numbers (ICANN)
- Regional Internet Registries (RIRs)
  - ARIN, RIPE NCC, APNIC, LACNIC, AfriNIC
- Internet Society (ISOC)
- Internet Architecture Board -->> ISOC
- Internet Engineering Task Force (IETF) -->> ISOC
- Internet Engineering Steering Group (IESG)
- Internet Research Task Force
- Internet Research Steering Group
- Internet Governance Forum

Internet bodies

- Internet Engineering Task Force (IETF)
- Internet Assigned Numbers Authority (IANA)
- ICANN - the Internet Corporation for Assigned Names and Numbers
- Internet Society (ISOC)
- Number Resource Organization
- Regional Internet Registry (RIR)
- Internet Research Task Force (IRTF)
- Internet Architecture Board (IAB)

United Nations bodies

- Internet Governance Forum
- World Summit on the Information Society
- Working Group on Internet Governance

Τμήμα Μαθηματικών
Αριστοτέλειο Πανεπιστήμιο Θεσσαλονίκης

Internet & Web standards

- Recommendations published by the World Wide Web Consortium (W3C)
- Internet standard (STD) documents published by the Internet Engineering Task Force (IETF)
- Request for Comments (RFC) documents published by the Internet Engineering Task Force

    Internet Draft -> Proposed Standard (RFC) -> Internet Standard

- Standards published by the International Organization for Standardization (ISO)
- Standards published by Ecma International (formerly ECMA)
- The Unicode Standard and various Unicode Technical Reports (UTRs) published by the Unicode Consortium
- Name and number registries maintained by the Internet Assigned Numbers Authority (IANA)

Τμήμα Μαθηματικών
Αριστοτέλειο Πανεπιστήμιο Θεσσαλονίκης

Διοίκηση:
Χρηματοδότηση

- ## Sources
  - o AUTh annual budget
  - o AUTh Research Committee
  - o Competitive Research projects

- ## Indicative Expenditure categories
  - o Hardware, software, equipment
  - o Other / maintenance support
  - o disposables
  - o Personnel salaries
  - o Travel expenses

Αντικείμενα εργασίας στα NOC

1) Monitoring:

- Traffic monitoring
  - Observation and measurement of the evolution of the traffic on an interface or line.
- Fault monitoring
  - Checking and tracing of failures and errors in network equipment and lines.
- Physical Infrastructure monitoring
  - Observation of physical parameters like temperature, humidity, open doors, etc.
- Flow monitoring
  - Observation of the sets of packets passing a point in the network during a certain time interval.
- Routing monitoring
  - Viewing of the IP routes from/to an AS and the routing protocols employed.
- Multicast monitoring
  - Observation of multicast topology and availability.
- Logging
  - Storage of the records of events from devices.

Τμήμα Μαθηματικών
Αριστοτέλειο Πανεπιστήμιο Θεσσαλονίκης

Αντικείμενα εργασίας στα NOC

2) Problem management:

- Alarming
  - Getting warnings about problems or incidents.
- Diagnostic
  - Following a procedure in order to identify the source of a problem.
- Sniffing/analyzing
  - Investigating inside the packets of data to find the origin of a problem or malfunction.

3) Performance management

- Passive or active measurement of the throughput of a connection to analyze its efficiency.

4) Multi-domain management

- Management of connections that traverse several management domains.

5) Reporting and statistics

- Querying of data sources for reference and statistics.

Αντικείμενα εργασίας στα NOC

6) Ticketing
- Process for the tracking of incidents, problems or tasks

7) Change management
- Controlling and recording of changes in values, technologies, etc.

8) Configuration management and backup
- Control and backup of the configuration for the routers, switches and other pieces of equipment.

9) Chat/communication/coordination
- Communication with people, either in the same institution or in other institutions.

10) Knowledge management/documentation
- Storing and sharing knowledge information to improve the efficiency in an organization.

11) Security management
- Control of physical and logical resources to avoid third parts from attacking the resources of an institution.

Αντικείμενα εργασίας στα NOC

12) Inventory management

- Organization and control of information about an institution's devices, materials and products.

13) Resources management

- Organization and control of logical resources such as IP addresses, AS numbers, circuits numbers, topology documentation, etc.
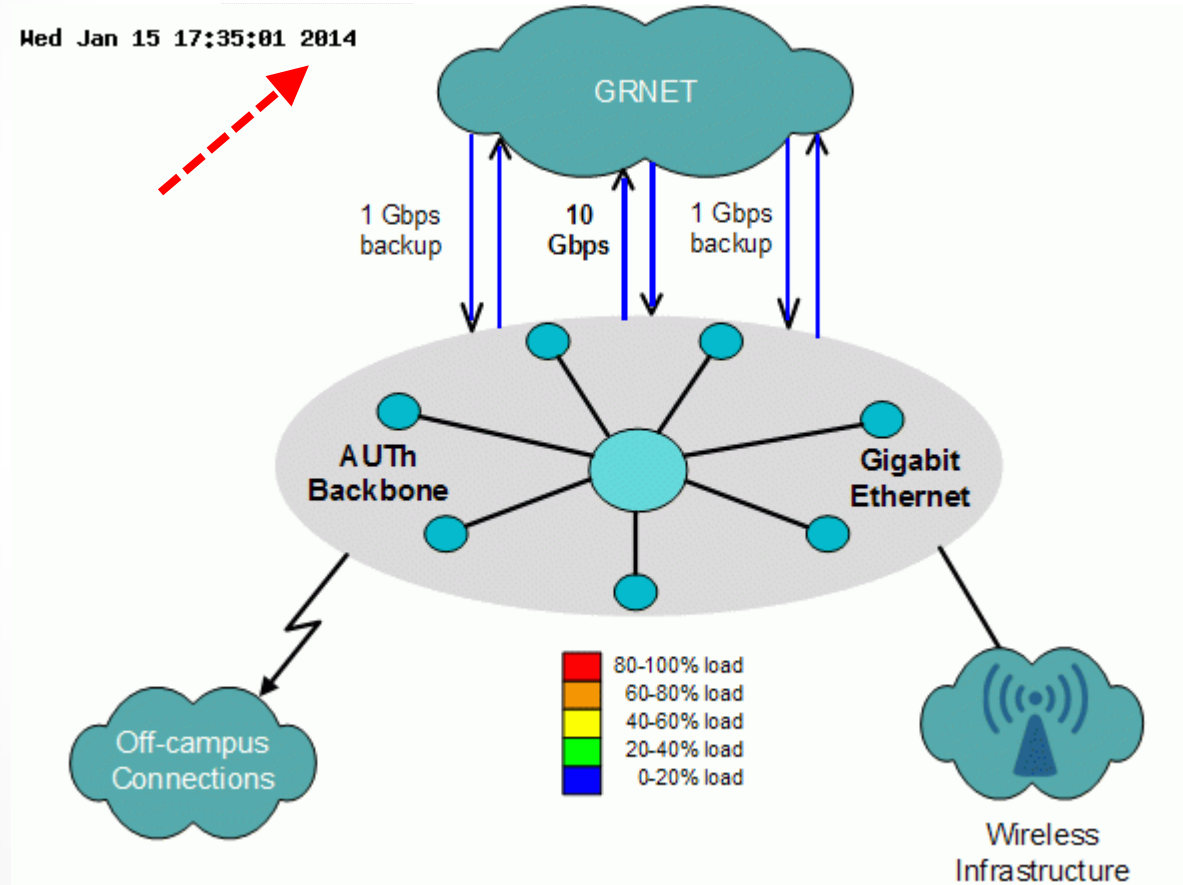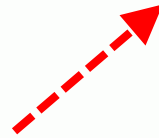
14) Out-of-band access

- Access to the network devices of an institution from an external network

Internet infrastructures at A.U.Th.

Τμήμα Μαθηματικών
Αριστοτέλειο Πανεπιστήμιο Θεσσαλονίκης

The Network

- Intranet:
  - Networking for secretariats, datacenters, etc.
  - 10.0.0.0 , 192.168.0.0
- Internet (IPv4):
  - 155.207.0.0 (AUTH-NET)
  - 192.104.147.0 (AUTH-TO-OTHERS)
  - Autonomous System: AS-5470
  - auth.gr, απθ.gr
- Internet (IPv6 enabled):
  - ID: W1-GR-00002188

The Network

- Infrastructures at AUTh (fiber optic cabling, wireless links, switches, routers, servers, etc.)

- Services maintained and offered at AUTh (e-mail, voice, video, web services, etc.)

- E-infrastructures/"middleware": LDAP, PKI, AAI)

- Tools for administration and monitoring of the network (netcop, nagios, etc.)

Cabling: Activities

- Study and supervision of new installations and expansions of network cabling infrastructure
- Location and repair of faults and maintenance of network cabling structure
- Maintenance and cleaning of network node locations
- Operation of the Cabling Management System (CMS) and data entry to it

Τμήμα Μαθηματικών
Αριστοτέλειο Πανεπιστήμιο Θεσσαλονίκης

Cabling: Activities

- Monitoring and administration of Uninterruptible Power Supplies (UPS) for NOC

- Study, supervision and maintenance of electrical power facilities in NOC and network premises

- Study and supervision of air conditioning facilities (NOC premises, data centers and network node locations)

Τμήμα Μαθηματικών
Αριστοτέλειο Πανεπιστήμιο Θεσσαλονίκης

Network Documentation

- Floor plans including network outlet positions (in Visio)
- Imprinting of copper distribution boxes in .doc format
- Imprinting of fiber optic distribution boxes in .xls format
- Data structures for network outlets per building, per floor in MySQL DB. Web based management application (NOCWeb).
- Files of measurement data and respective viewers for outlet certification

Floor plan with network outlets

Αριστοτέλειο Πανεπιστήμιο Θεσσαλονίκης
Τμήμα Μηχανικών Χωροταξίας και Ανάπτυξης
Βέροια- Κτίριο Α (γραμματεία)

Web/DB based outlet

Outlet measurement &

Outlet measurement & certification
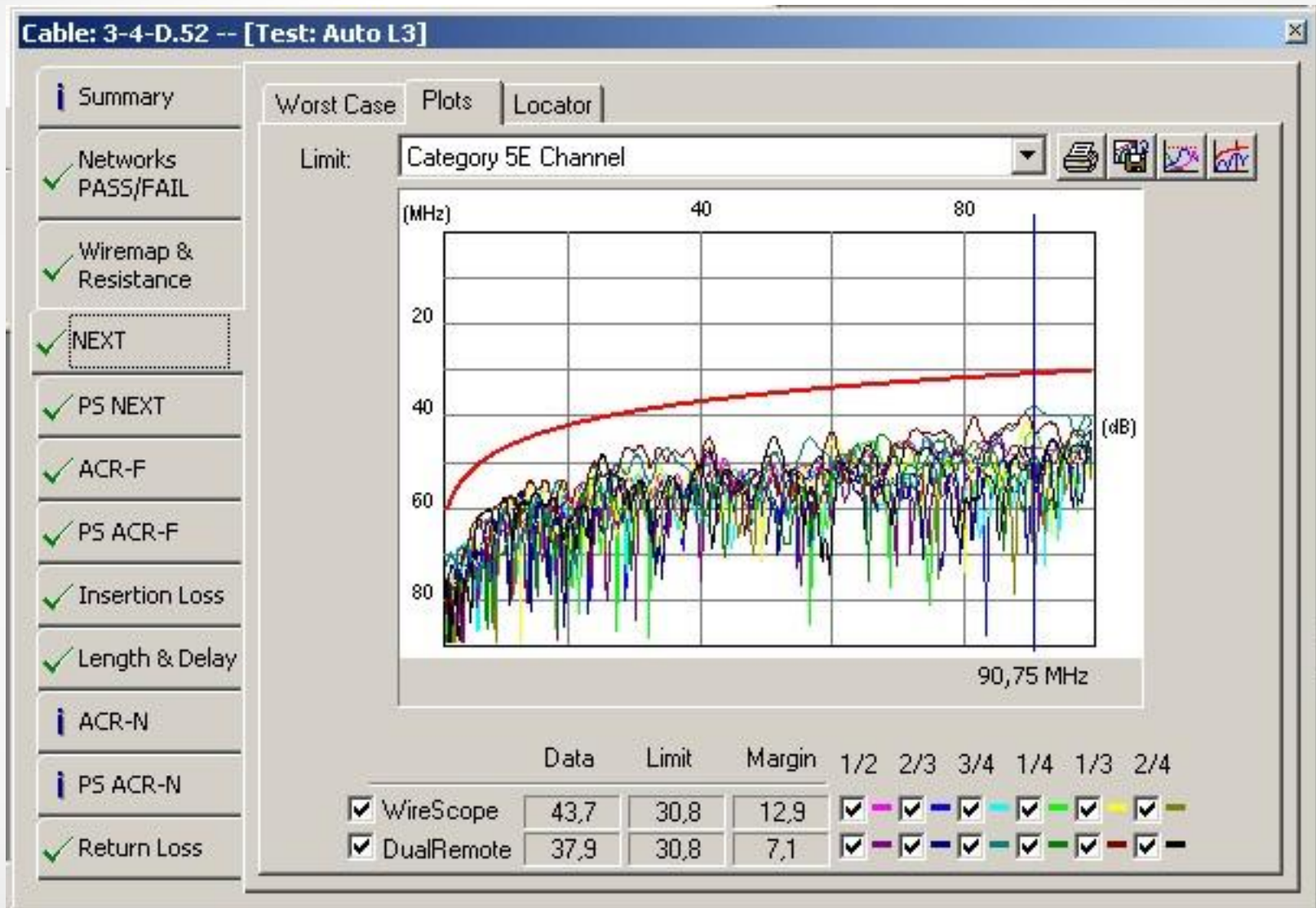
Cabling: Problem solving

- Registration of user problems through ticket opening from helpdesk.
- Locating faulty network outlets by checking data bases, floor plans, distribution boxes files and certification measurements
- Technician on site call
- Check of cabling and outlet
- Damage repair

Cabling: Tools

- Fiber and copper cabling control instrument (cable tester).
- Network function control instrument (network tester).
- Tools to terminate copper (UTP) outlets
- Tools to terminate cables at patch panels in network nodes.
- Various small tools for UTP and power cabling (stripper, screw drivers, multimeters, etc).

@2014 Fiber optics network at AUTh

Active components @ AUTh

Activities

- Routers and ethernet switches
- Connections to remote units
- Connections to the Internet through GRNET
- Detection and resolution of security and network abuse incidents ("in-house" software development)
- Installation and configuration of firewalls
- Network traffic and usage statistics (MRTG, IP accounting)

Activities

- IP telephony and Voice over IP
  - o Call switching to other academic institutions
  - o Telephony provision to 4 remote units
  - o IP telephony for NOC
- "Contact Center" for NOC helpdesk (serving AUTh and **Greek School Network** users)
- Wireless LANs   (hundreds of access points under NOC administration)
- Dial-up service (through PSTN)
- 2nd level support for the GSN

Platforms for management & services

- Network Monitoring:
  - NMIS (freeware)
  - Scripts developed "in-house"
- Statistics:
  - MRTG, Cacti, RRDtool, nfdump (freeware)
  - Scripts and sw application developed "in-house"
- Telephony & telephone user helpdesk system
  - Cisco Unified Communications Manager
  - Contact Center Express (Cisco)
- Access points Management
  - Wireless LAN Controller (Cisco)
  - Wireless Control System (Cisco)

NMIS

NMIS Dashboard - Mozilla Firefox

File Edit View History Bookmarks Tools Help

auth.gr https://nnms.ccf.auth.gr/nmis

Google

NMIS Das...   Μενού Επιλογών   AUTH - NOC, C...   Number of activ...   Leased address...   AUTH - NOC, O...   AUTH - NOC, O...   AUTH - NOC, A...   AUTH - NOC, O...   APC Environme...

NMIS Dashboard

Mon Nov 7 14:56:29 2011 EET | Dash | Large Dash | Doc | Help | Statistics Type [▼] Node [▼] Group [▼] Find [ ] GO NMIS 4.2.12

Find Current Event Event Log Event Sum syslog Syslog Sum Reports Tools Outages DNS Map IP Logs NMIS Logs Plugins
Tables -> Locations Contacts Event Policy Logs List Escalation Thresholds Users Nodes Links Interfaces sysNodes sysInterface ifTypes Services Enterprise Model Master Slave Slaves Toolset

NMIS Plugin Help Apache Docs Mail Queue Disk Usage Node Detail Report NMIS Config Looking Glass
Capacity Planning View Event Protocol Discovery RTTMON/SAA NMIS Runtime

Network Metrics

99.350 ▲	was: 98.730 diff: 0.620
Reachablility	99.416 ▲
Interface Availablility	99.758 ▼
Health	99.082 ▲
Response Time	12 ms ▲

Current Network Status

Group	Status	NodeUp	NodeDn	Metric	Reach	IntAvail	Health	RT
All Groups Status	Warning	228	1	99.350 ▲	99.416 ▲	99.758 ▼	99.082 ▲	12 ms ▲
AUTH-SERVERS	Normal	2	0	100.000 ▲	100.000 ▲	100.000 ▲	100.000 ▲	0 ms ▼
Access-Servers	Normal	1	0	100.000 ▲	100.000 ▲	100.000 ▲	100.000 ▲	0 ms ▼
Aggreg-Switches	Normal	10	0	99.806 ▼	100.000 ▲	100.000 ▲	99.352 ▼	1 ms ▼
Backbone-Routers	Normal	4	0	98.858 ▼	100.000 ▲	99.404 ▼	96.391 ▼	1 ms ▼
EDUNET	Normal	8	0	100.000 ▲	100.000 ▲	100.000 ▲	100.000 ▲	18 ms ▼
GRNET	Normal	2	0	100.000 ▲	100.000 ▲	100.000 ▲	100.000 ▲	9 ms ▼
Ippokratio	Normal	1	0	100.000 ▲	100.000 ▲	100.000 ▲	100.000 ▲	1 ms ▼
Offcampus-Routers	Normal	5	0	99.976 ▼	100.000 ▲	100.000 ▲	99.920 ▼	31 ms ▲
Other-Routers	Normal	2	0	100.000 ▲	100.000 ▲	100.000 ▲	100.000 ▲	0 ms ▼
SW-bld01	Normal	3	0	100.000 ▲	100.000 ▲	100.000 ▲	100.000 ▲	2 ms ▼
SW-bld02	Normal	4	0	100.000 ▲	100.000 ▲	100.000 ▲	100.000 ▲	2 ms ▼
SW-bld03	Normal	2	0	100.000 ▲	100.000 ▲	100.000 ▲	100.000 ▲	2 ms ▼
SW-bld04	Normal	4	0	100.000 ▲	100.000 ▲	100.000 ▲	100.000 ▲	2 ms ▼
SW-bld06	Normal	5	0	100.000 ▲	100.000 ▲	100.000 ▲	100.000 ▲	2 ms ▼
SW-bld07	Normal	1	0	100.000 ▲	100.000 ▲	100.000 ▲	100.000 ▲	2 ms ▼
SW-bld08	Normal	3	0	100.000 ▲	100.000 ▲	100.000 ▲	100.000 ▲	2 ms ▼
SW-bld09	Normal	7	0	100.000 ▲	100.000 ▲	100.000 ▲	100.000 ▲	2 ms ▼
SW-bld10	Normal	3	0	100.000 ▲	100.000 ▲	100.000 ▲	100.000 ▲	2 ms ▼
SW-bld11	Normal	3	0	100.000 ▲	100.000 ▲	100.000 ▲	100.000 ▲	1 ms ▼
SW-bld12	Normal	9	0	100.000 ▲	100.000 ▲	100.000 ▲	100.000 ▲	2 ms ▼
SW-bld13	Normal	1	0	100.000 ▲	100.000 ▲	100.000 ▲	100.000 ▲	2 ms ▼
SW-bld14	Normal	2	0	100.000 ▲	100.000 ▲	100.000 ▲	100.000 ▲	1 ms ▼
SW-bld15	Normal	3	0	100.000 ▲	100.000 ▲	100.000 ▲	100.000 ▲	2 ms ▼
SW-bld16	Normal	4	0	100.000 ▲	100.000 ▲	100.000 ▲	100.000 ▲	2 ms ▼
SW-bld17	Normal	3	0	100.000 ▲	100.000 ▲	100.000 ▲	100.000 ▲	2 ms ▼
SW-bld18	Normal	4	0	100.000 ▲	100.000 ▲	100.000 ▲	100.000 ▲	2 ms ▼

Google 115.000 m² Datacenter @ Iowa

Τμήμα Μαθηματικών
Αριστοτέλειο Πανεπιστήμιο Θεσσαλονίκης
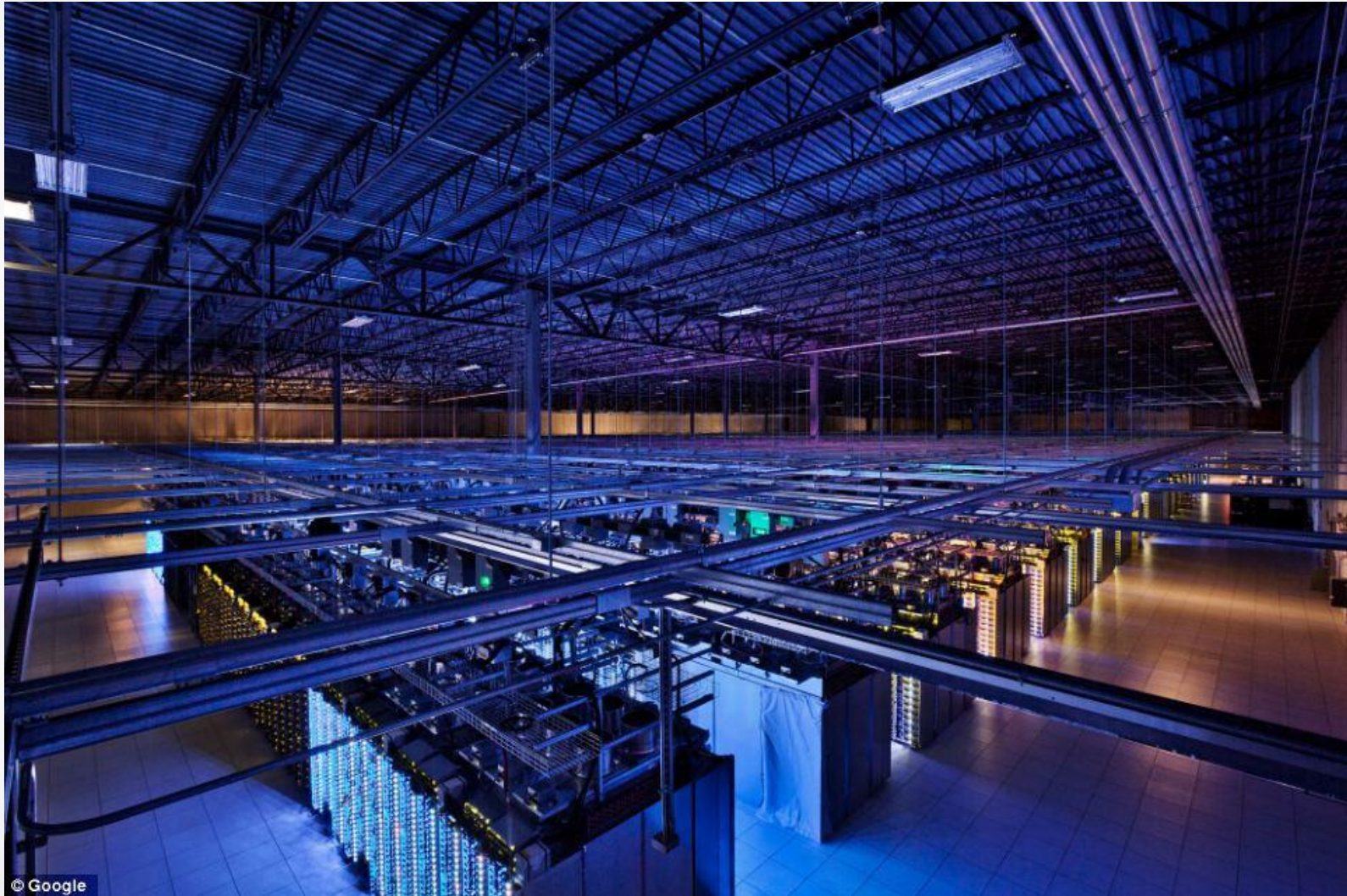
Datacenter @ Ministry of Education

AUThs' Central Datacenters at NOC: economies of scale at the University level

- Strategy
- Infrastructures
- Blade servers
- Network Attached Storage (NAS)
- Virtualization

Strategic issues

- Data protection
  - Central repository (storage consolidation)
  - Synchronization between two points (replication)
- Protection from hardware failures
  - Protection from faults in HW (servers + disks)
  - Live virtual machine migration
- Optimum resource exploitation
  - processor, memory, storage, network
  - Dynamic management
  - Easy allocation
- Economies of scale

Landscape of services

Personal

User authentication is required in order to access services:

NOC, ITC, University Library, Secretariats, other Service Providers

Web services

Website development

AUTh and NOC

Infrastructure for website hosting

Other AUTh units

Interfaces development

Press news, tele-education

Directory services, e-university

Network Access

Connection to AUThnet

- Wired
- Wireless
- Through a secure channel

Voice and Video

Cooperative activities

- telephony
- Video transmissions
- teleconference

The Greek School Network (GSN)

- Largest public network in Greece
- Connects more than **14.300 schools**, **3.400** educational units and libraries
- Closed educational intranet – **1.300.000** students' **160.000** teachers' **safety** is a primary target.
- Value added network services for the education
- Based on open source development
- User support and training for the services GSN provides
- Network infrastructure complementary to GRNET
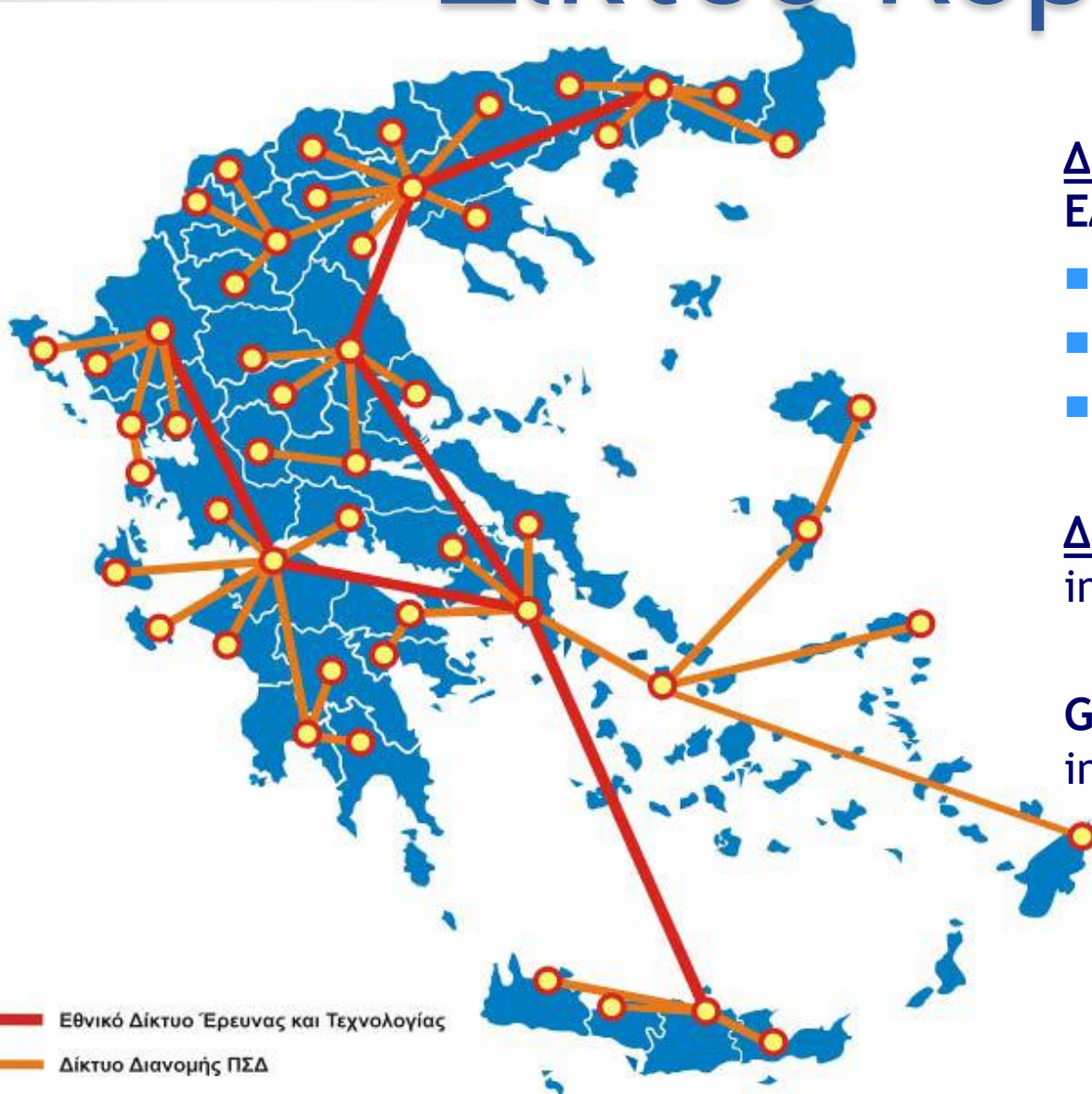- **Broadband** access GSN is a central target

GSN operations

- **Part of ministry's strategic planning to introduce and utilize ICT in education**

- **Implemented by a cooperating human network:**
  - Ministry of education
  - 2 Research Centers, 9 Universities, 2 TEI
  - AUTH participates through NOC which is responsible for:
    - User helpdesk (at Thessaloniki, Pella, Serres)
    - Service Level Agreement (SLA) framework for ICT services
    - Computer Security Incident Response Team - CSIRT for the GSN

- **Best Practice at a national and international level**

Δίκτυο Κορμού

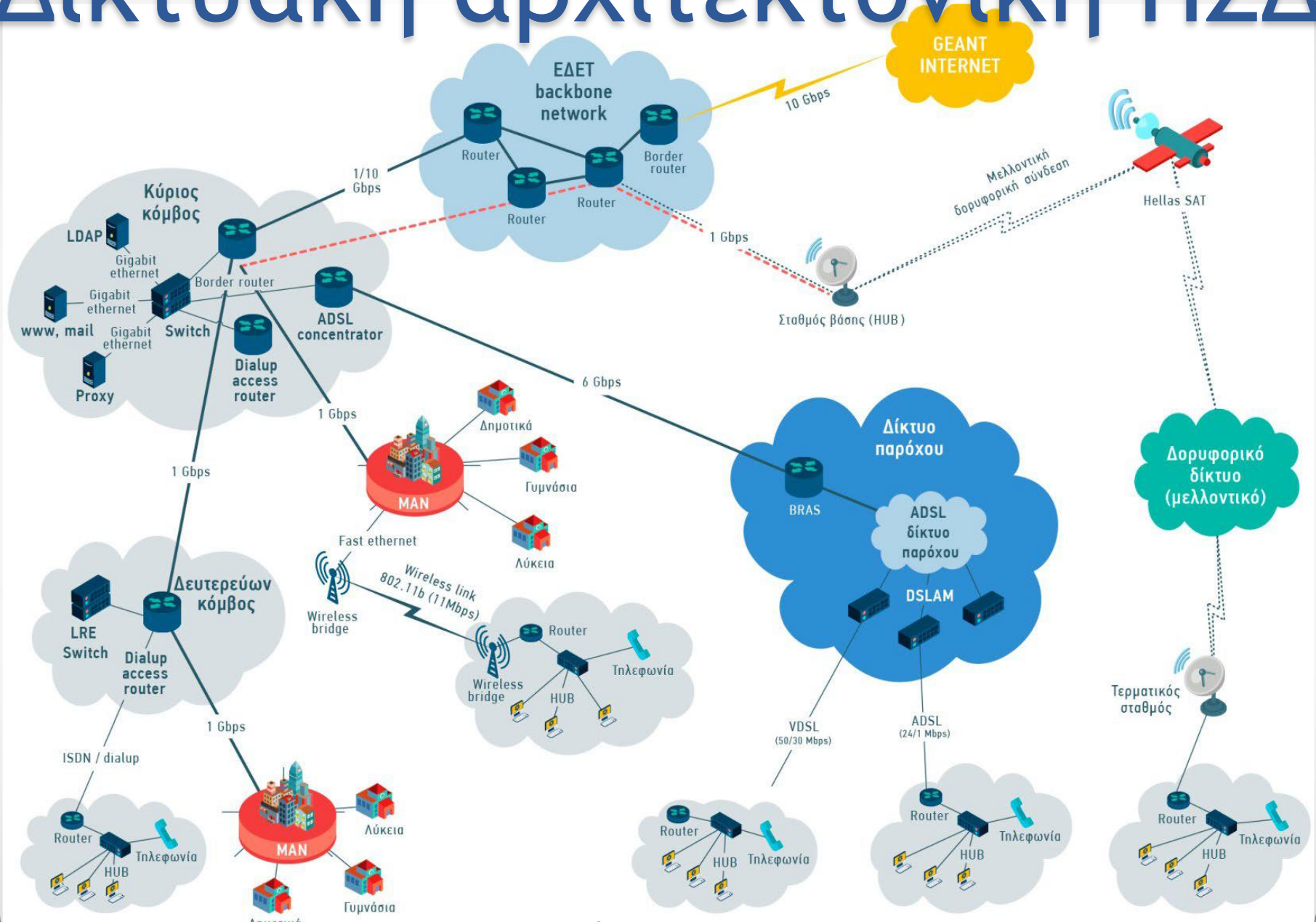**Δίκτυο Κορμού: παρέχεται από το ΕΔΕΤ**

- very good collaboration
- complimentary operations
- minimizing OPEX

Δίκτυο Διανομής: 51 nodes installed inside OTE premises

Gigabit interconnections to GRNET in more than 10 major cities

Εθνικό Δίκτυο Έρευνας και Τεχνολογίας

Δίκτυο Διανομής ΠΣΔ

Δικτυακή αρχιτεκτονική ΠΣΔ

Αριστοτέλειο Πανεπιστήμιο Θεσσαλονίκης Πηγή:https://www.sch.gr/wp-content/uploads/2020/01/GSN_Detailed_Memo_EN_February_2020-1.pdf

User helpdesk

- **Provides assistance to AUTh and GSN users**
  - o Handles user requests and provides help to solve technical problems
  - o Organizes briefings, collects, organizes and presents statistics for NOC services
  - o Coordinates training activities and edits training material
  - o Creates user manuals and provides information for NOC services (telephone and on counter at AUTh campus)

Relevant Movies!

Lo and Behold, Reveries of the Connected World (2016)
http://www.imdb.com/title/tt5275828/

The Circle (2017) http://www.imdb.com/title/tt4287320/

Zero Days (2016) http://www.imdb.com/title/tt5446858/

Banking on Bitcoin (2016) http://www.imdb.com/title/tt5033790/

Deep Web (2015) http://www.imdb.com/title/tt3312868/

Trust Machine: The Story of Blockchain (2018)
https://www.imdb.com/title/tt7407496/

Ερωτήσεις & Απαντήσεις