IPv6 in the Greek School Network and Energy-related Pilot Applications

Manos Varvarigos (manos@ceid.upatras.gr)

http://nts.cti.gr

CTI "DIOPHANTUS" computer technology institute & press

Outline:

- Vision of pilot
- Objectives
- IPv6 in GSN
- Smart Power Meters and IPv6
- Pilot Results from 10 Schools
- Conclusions

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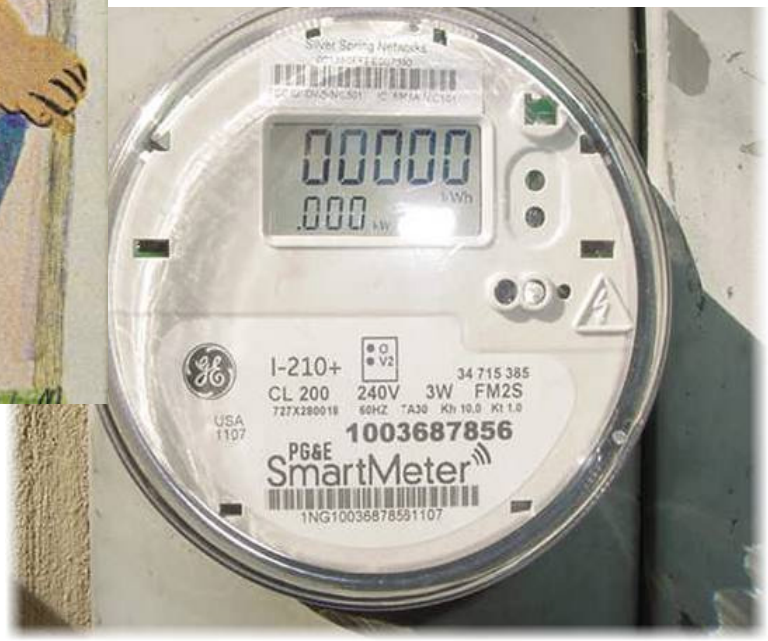
Vision:

- Mobilise school communities for environmental protection.
- Raise energy awareness by interconnecting energy smart meters over IPv6 in selected schools intranets.
- Engaging students on issues of sustainability and empowering in order to make further behavioural energy-saving changes.

3 Basic Components

IPv6



Community (Schools)
Energy Awareness (smart meters)
IPv6 (infrastructure)

Partners:

- **The Computer Technology Institute & Press "Diophantus"** (CTI), is responsible for the administration and the daily operation of the Greek School Network.
- **Greek Research & Technology Network** (GRNET), is responsible for providing networking and cloud computing services to the Greek academic and research communities.
- The **Intelen** Group, a start-up company providing services to the Energy and ICT sector, such as smart metering, meter data management.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GOVERNMENTS ENABLED WITH IPv6
GEN6


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sch.gr


.eu


cip
competitiveness and innovation
framework programme
2007-2013


ICTPSP
ICT POLICY SUPPORT PROGRAMME


intelen


grnet
Networking Research and Education

Objectives:

- Raise energy awareness
  - Mobilise student community
  - Change student behaviour
  - Reduce energy consumption - economical benefit
  - IPv6 as enabler for the provision of a new service
  - Understanding correlations between the energy consumption and usage of different sets of appliances
- Innovative educational methods
  - Self-training and students collaboration
  - Social bonds between communities in diverse geographical areas
  - Interaction among students
  - Promote energy efficiency and sustainability campaigns into school community
- Analyse technical perspective
  - Enhance technical expertise
  - Data Streaming Analysis
  - Enhance IPv6 Service portfolio

Greek School Network (GSN)

Backbone:
Based on 8 PoPs of GRNET

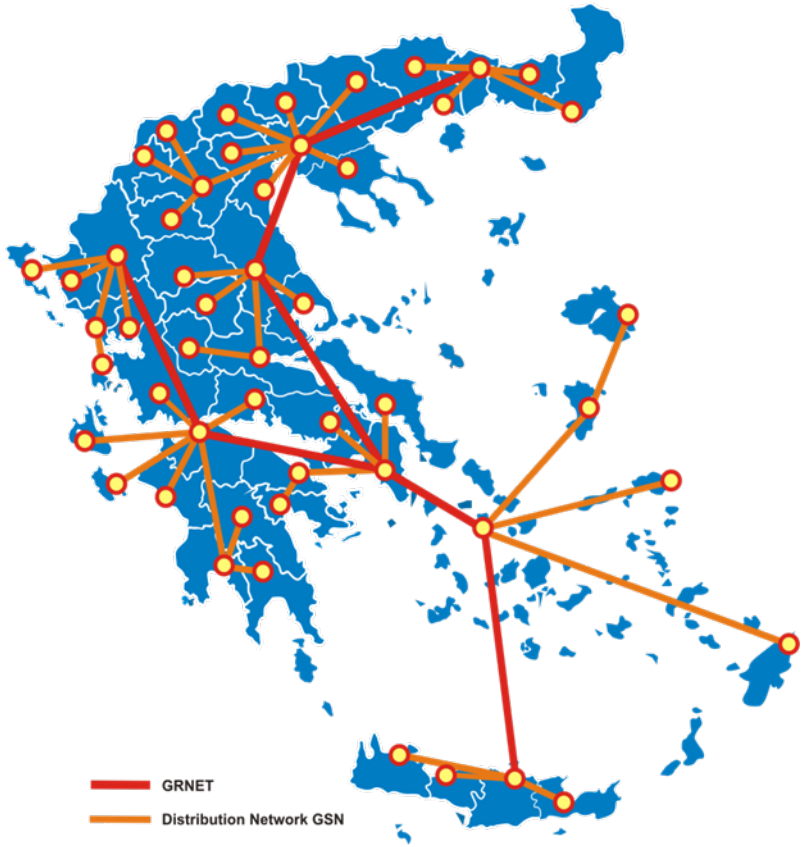
Distribution Network:
51 nodes
(8 main, 43 secondary)

Access Network technology:

- ADSL
- Dialup (ISDN, PSTN)
- Leased Lines (SDSL, VDSL),
- Wireless
- Optical

Number of connected schools:

- 6k primary education
- 4k secondary education
- 0.5k administration offices

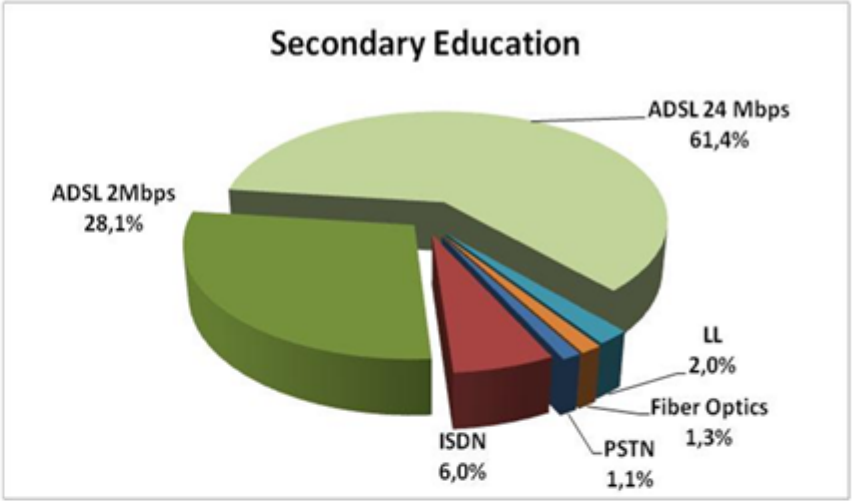


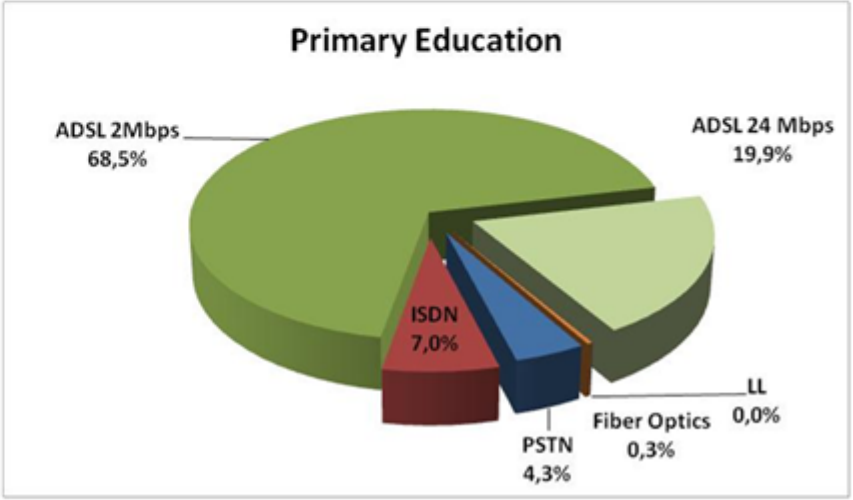
www.sch.gr

Greek School Network (GSN)

Broadband penetration: 90,7%

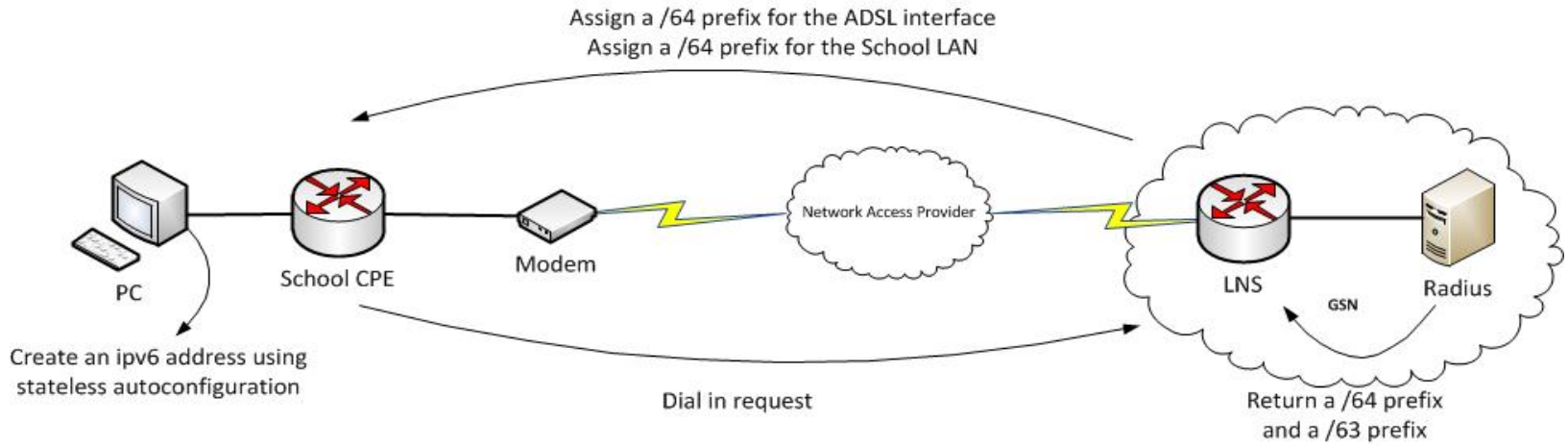
- DSL access 89,0%
  - Secondary Education 89,5%
  - Primary Education 88,4%
- Leased Lines 0,9%
- Fiber Optics:
  - 6% (by end of the year)
- ISDN/analog lines: 9,3%
- # of connections ~17.000





IPv6 in GSN

- The backbone network of GSN is fully IPv6 enabled on all point to point (p2p) links of the primary and secondary nodes of GSN.
- On the access network, IPv6 interconnection has been activated for most ADSL users, namely for about 85% of the schools.



IPv6 in GSN

- GSN has been delegated one /47 and one /48 IPv6 address spaces from GRNET. The /47 assigned to access network and the /48 assigned to backbone network.
- The current address space is not adequate to fulfill the future needs of the school networks and GSN will be delegated a /40 address space.
- OSPFv3 has been selected as a routing protocol for IPv6 interconnection within the GSN
- The backbone network of GSN is dual stack i.e. supports both IPv4 and IPv6.

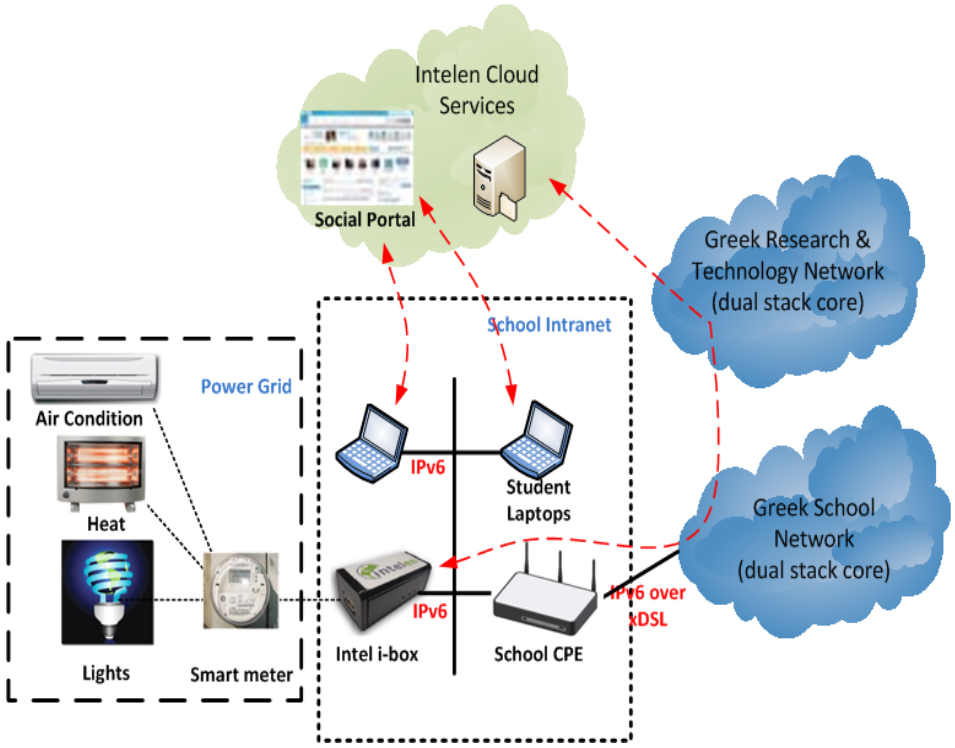
IPv6 security in GSN

- Security rules for incoming and outgoing traffic have been expanded to cover IPv6 traffic.
- Restrictions have been applied to IPv6 traffic in order to prohibit/avoid specific content, e.g. content related to gambling, hate talk, etc, to be delivered to pupils.
- Semi-automatic access control lists on the virtual templates of the ADSL users are applied.

Smart Power Meters and IPv6

- The installed power meters in schools collect energy consumption data that are aggregated through Greek School Network via IPv6 to Intelen's cloud based system.

- The cloud based system feeds the interactive web platform and schools' pages with distributed energy data management and stream analytics



Case Study


Map
Fyli
Petro
Peri
Egale
Nikaia
Piraeus
Google
Map
Φυλή
Αχαρνές
Ζεφύρι
Καματερό
Πετρούπολη
Ίλιον
Περιστέρι
Αιγάλεω
Αθήνα
Νίκαια
Ταύρος
Βύρωνας
Καλλιθέα
Πειραιάς
Νέα Σμύρν
Ηλιούπολη
Παλαιό Φάληρο
Αλίμου
Ροδόπολη
Εκάλη
Διόνυσος
Νέα Ερυθραία
Κηφισιά
Παλλήνη
Πικέρμι
Λεοντάριον
Γλυκά Νερά
Παιανία
Καρελλάς
Κορωπίου
16ο Γυμνάσιο Αθήνας
Address: Λαρίσης 47, Αθήνα , Ελλάς
Daily Consumption: 44.50KWh
Compared to prev. day: 23.53%
©2012 Δεδομένα χάρτη Google, Tele Atlas - Όροι Χρήσης
Google

Energy Analytics

Meter Info

- **Serial :** 772926377031
- **Measurement Type :** Consumption
- **Area Used/Coverage Percentage :** 0m^2
- **Usage Type Meter :** Generic
- **Central Board Amperes :** 0
- **IPv4 :** 10.79.71.128
- **IPv6 link-local :** fe80::2b3:f6ff:fe00:8c47
- **IPv6 global :** 2001:648:2300:37da:2b3:f6ff:fe00:8c47
- **Last Update :** 18-06-2012 14:50:26
- **Activation Date :** 13-06-2012 17:44:01
- **Meter Type :** Current Cost ENVI/ENVIR
- **Central :** Yes

Pilot Results from 10 Schools

- The total energy power savings for 10 school units over a period of 10 weeks was 12.234 KWh.
- The electricity school price for energy unit is 0,12€ per KWh.
- The extrapolated power saving per school year (40 weeks) is 48.936 KWh.

School Name	Power Saving
1st High School Haidariou	21,30%
8th Primary School Vyrona	24,06%
70th Primary School Athens	39,30%
10th Primary school Haidari	33,38%
7th High School Haidari	36,10%
152th Primary School Athens	38,26%
7th High School Peristeri	39,91%
8th Primary School Dafni	33,39%
1/7th Primary School Athens	31,22%
59o High School Peristeri	37,60%

POWER SAVING IN KWH

Pilot Results from 10 Schools

No. of Buildings	10
Av. School Sqm2	~1800 sqm2
Av. Student population	~250 students
Av. Energy / day consumption before smart energy meters	96.1 KWh
Av. Energy / day consumption after smart energy meters	71.7 KWh
Av Energy savings / day	25.39%

School characteristics

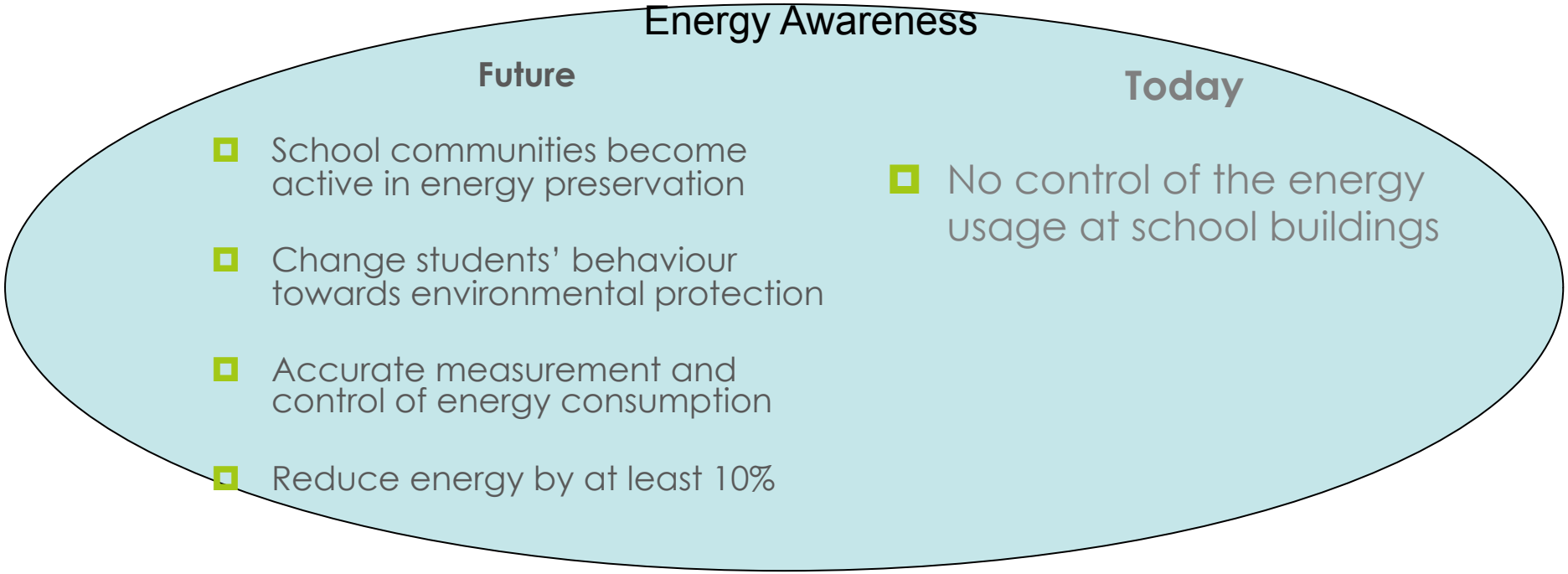
electricity price for schools	0.12€/kWh
Value of savings in 10 weeks	5,872€
Annual consumption at start (280 days)	26,908 KWh
Annual consumption per student	108 KWh/student
Value of annual savings	5,872 €
Value of annual savings per student	23.5€/student

Extrapolated Stats

IPv6 in Greece

- IPv6 adoption according to Google: 0,17% http://www.google.com/ipv6/statistics.html#tab=per-country-ipv6-adoption
- IPv6 support in several universities within Greece (the backbone network is IPv6 enabled)
- IPv6 support is going to be included in the tender of SYZEYXIS-II (i.e., the Greek Public Administration Network)
- Explicit references to IPv6 in the National e-Government Strategy
- Hellenic IPv6 Task Force - http://www.ipv6-taskforce.gr/

Conclusions



- Use technology to create value for the community
- IPv6 can become an enabling technology
  - Energy service not possible in IPv4-only environment
  - Simpler security policies
  - Removes NAT problems

Conclusions

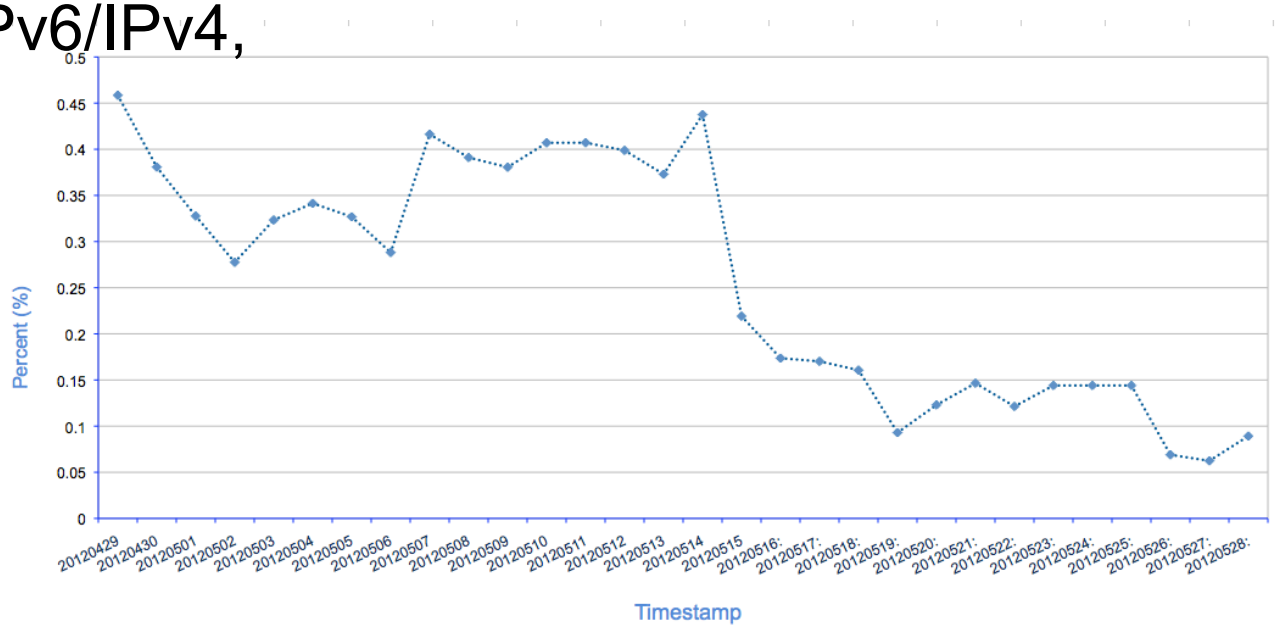
- Advanced services create new challenges for the design teams and operations
- Dissemination plans that will be carried out within the schools and the wider educational community.
  - Self-training of individual students
  - Collaborative efforts between diverse groups within a school

Hellenic IPv6 Task Force Activities

- Participants: Telecom operators, equipment vendors, software development companies, public sector agencies
- Exchange of knowledge and best practices within the members of the team
- Several meeting per year
- Deployment of pilot IPv6 installations. Indicatively:
  - Pilot IPv6 implementations in the networks of the major Telcos in Greece
  - Pilot IPv6 implementation over 3G by Cosmote

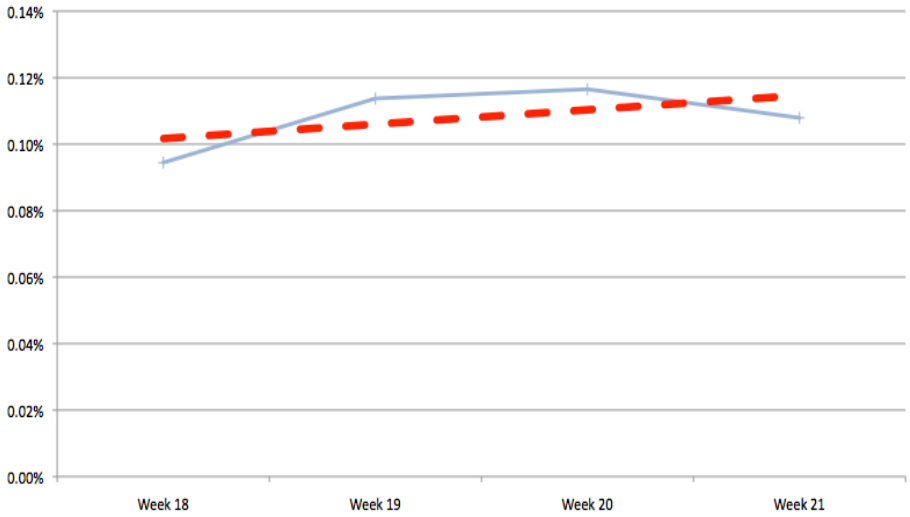
Monitoring the Quality of IPv6 Interconnection of End Users in Greece

- Activity for World IPv6 Launch Day on 6th of June, 2012
- http://v6metrics.grnet.gr/
- IPv6 brokenness», i.e. the percentage of end users that fail to access digital content over HTTP using IPv6/IPv4,

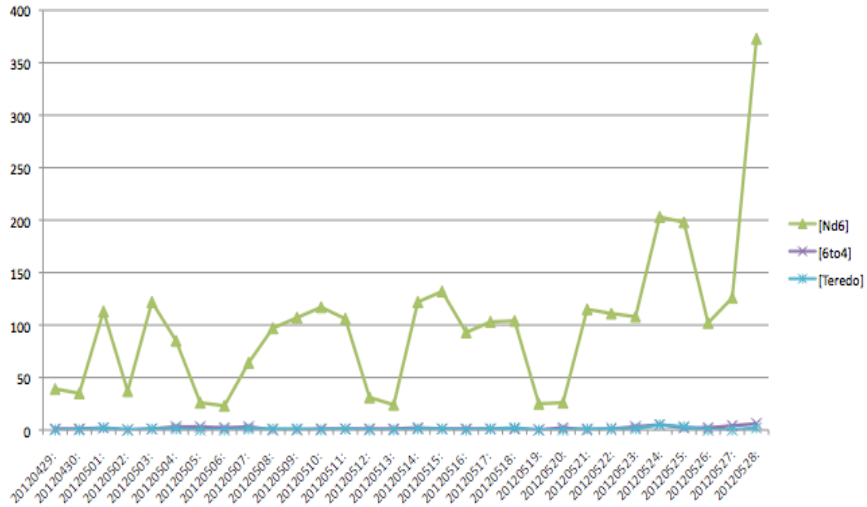


Monitoring the Quality of IPv6 Interconnection of End Users in Greece

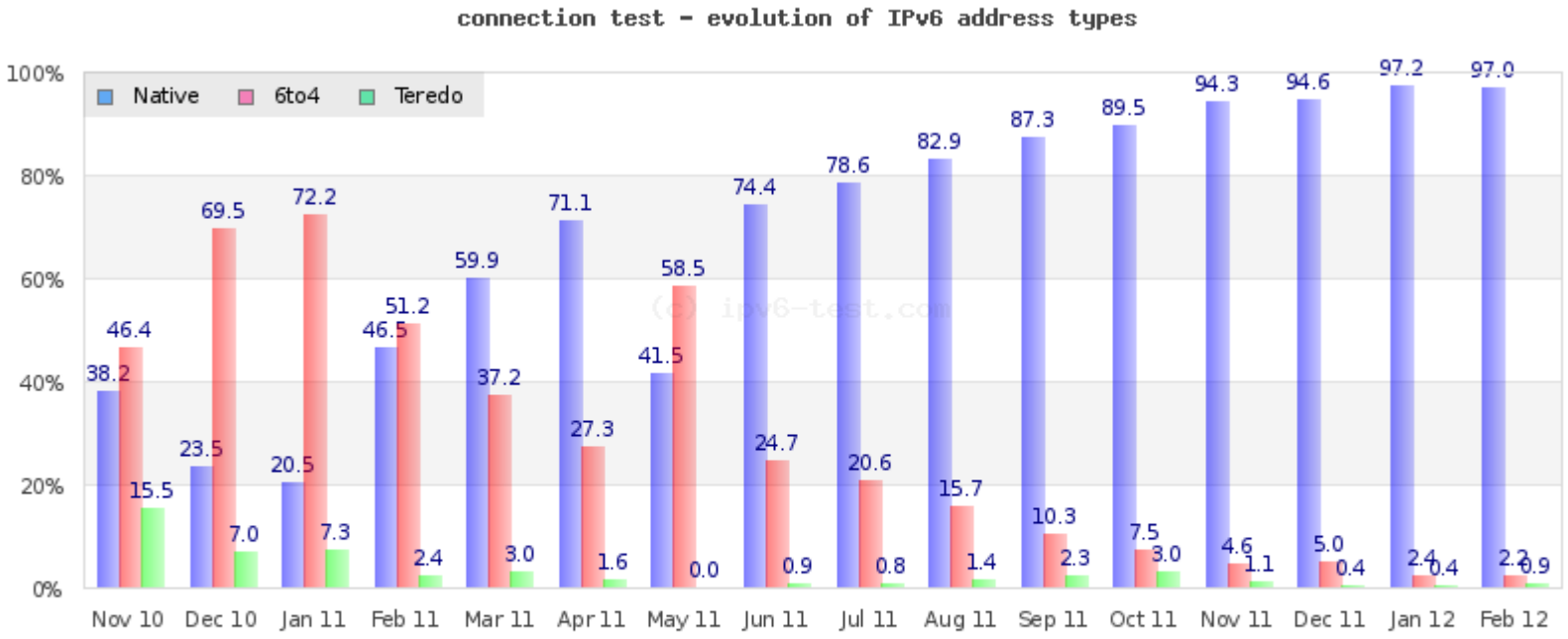
IPv6 penetration", i.e. the percentage of users with IPv6 connectivity.



Absolute number of IPv6 hits

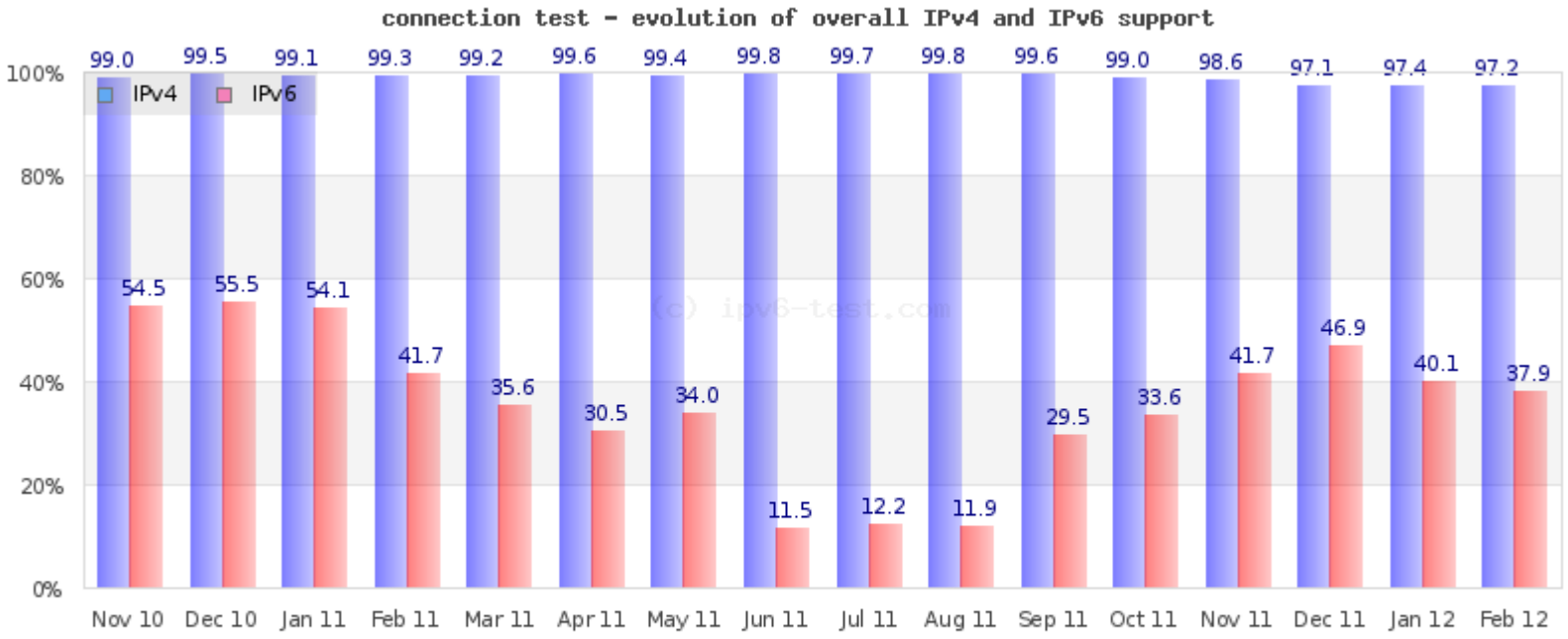


IPv6 address types in Greece



http://ipv6-test.com/stats/country/GR

Overall IPv6 and IPv4 protocol support in Greece



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