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escola superior de tecnologia e gestão

IPv6@IPLeiria
IPLeiria's Network IPv6 Migration

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Final Project, Computer Engineering course, 26 July 2011

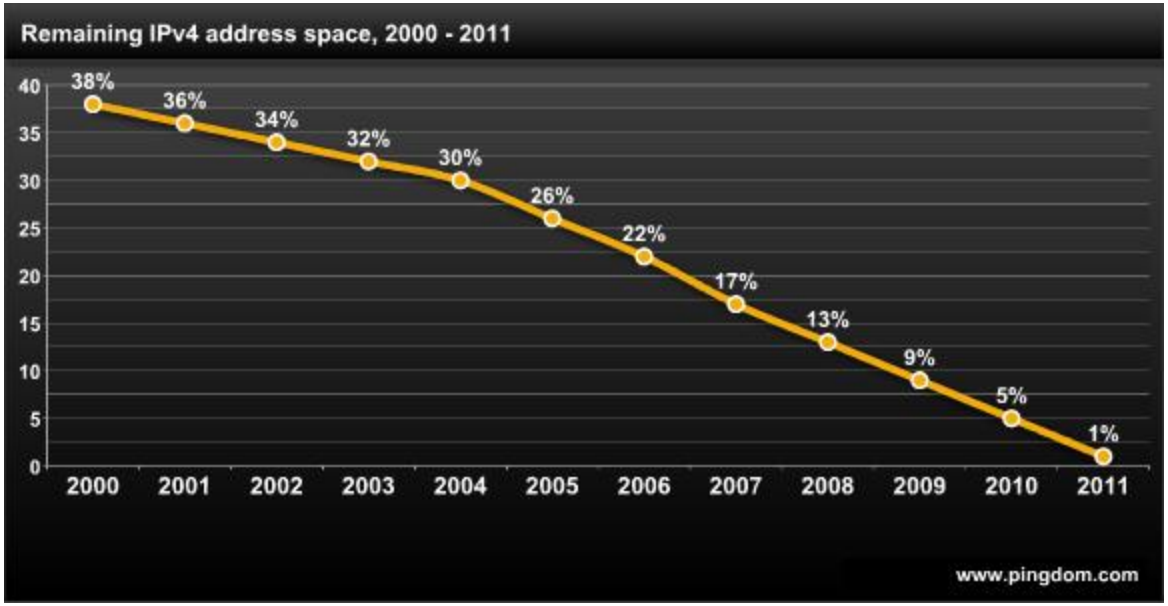
Summary

- Introduction – Need for IPv6
- Project Objectives
- IPv6 Addressing
- Transition Mechanisms
- Tunneling tests
- IP Transmission comparison test
- Addressing Plan
- Dual Stack VoIP server
- Conclusions

Introduction – Need for IPv6

- Growth of the Internet user base
- Increased number of always on equipment
- Unavoidable exhaustion of the IPv4 addressing space

IPv4 addresses exhaustion chart



IPv6 features

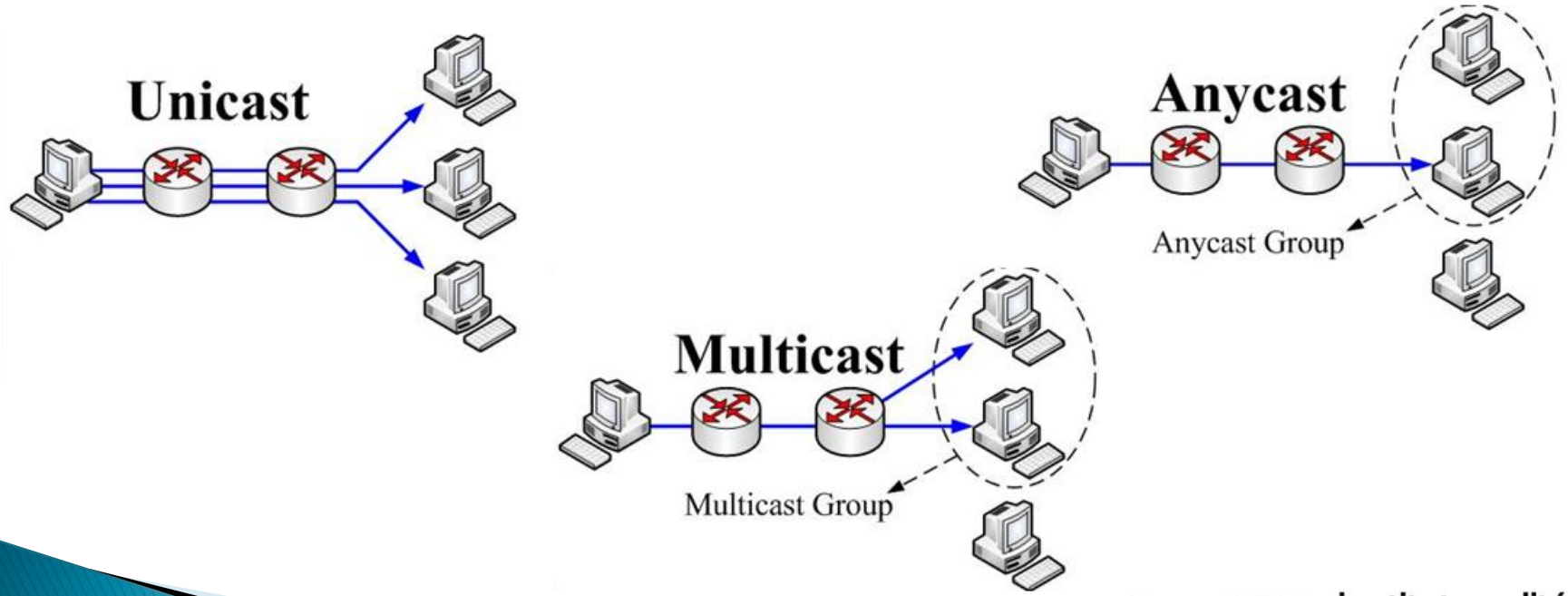
- 128 bit addresses translates to a huge addressing space
- Fixed header length
- Extension headers for extra options
- Source node responsible for Fragmentation
- QoS applied to the stream

Project Objectives

- Study different IPv6 transition solutions
- Develop various tunneling tests
- Create a structured IPv6 addressing plan
- Implement an IPv6 VoIP Server

IPv6 Addressing

- Link-local, Site-local (deprecated) and Global Scopes
- Unicast, Multicast and Anycast address types

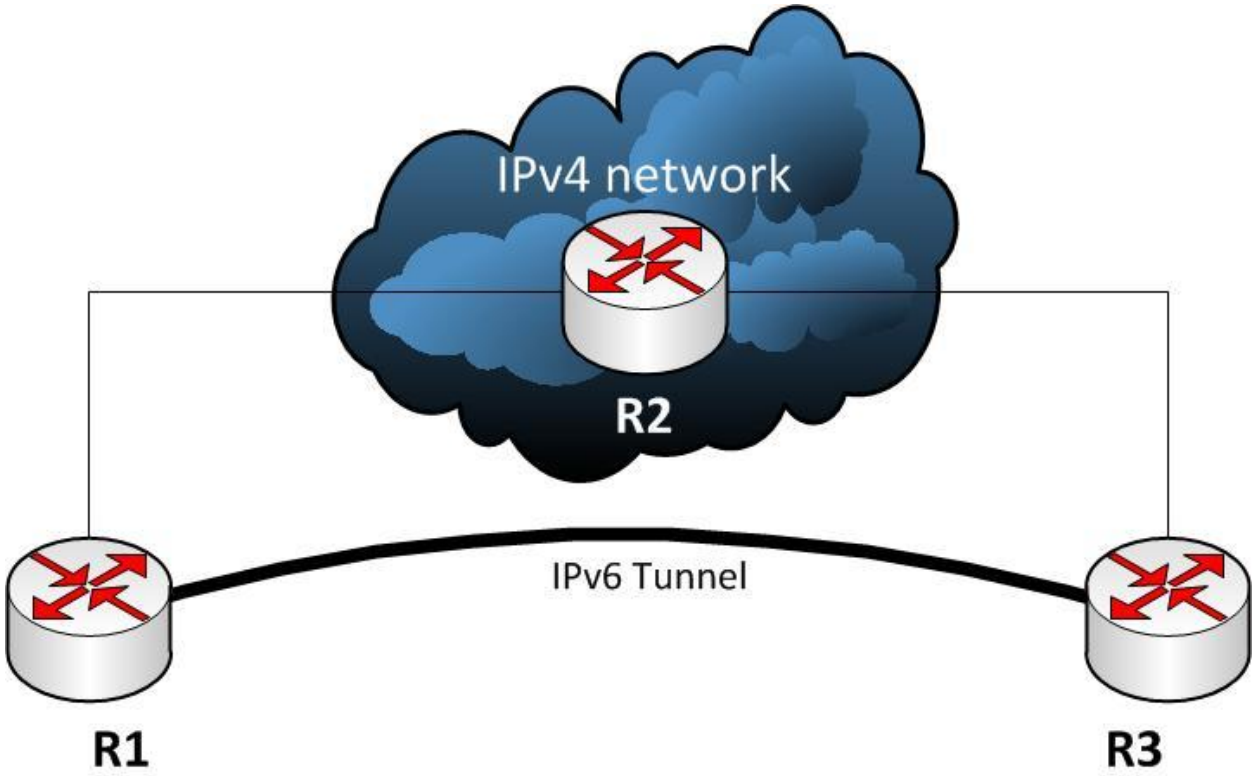


Transition Mechanisms

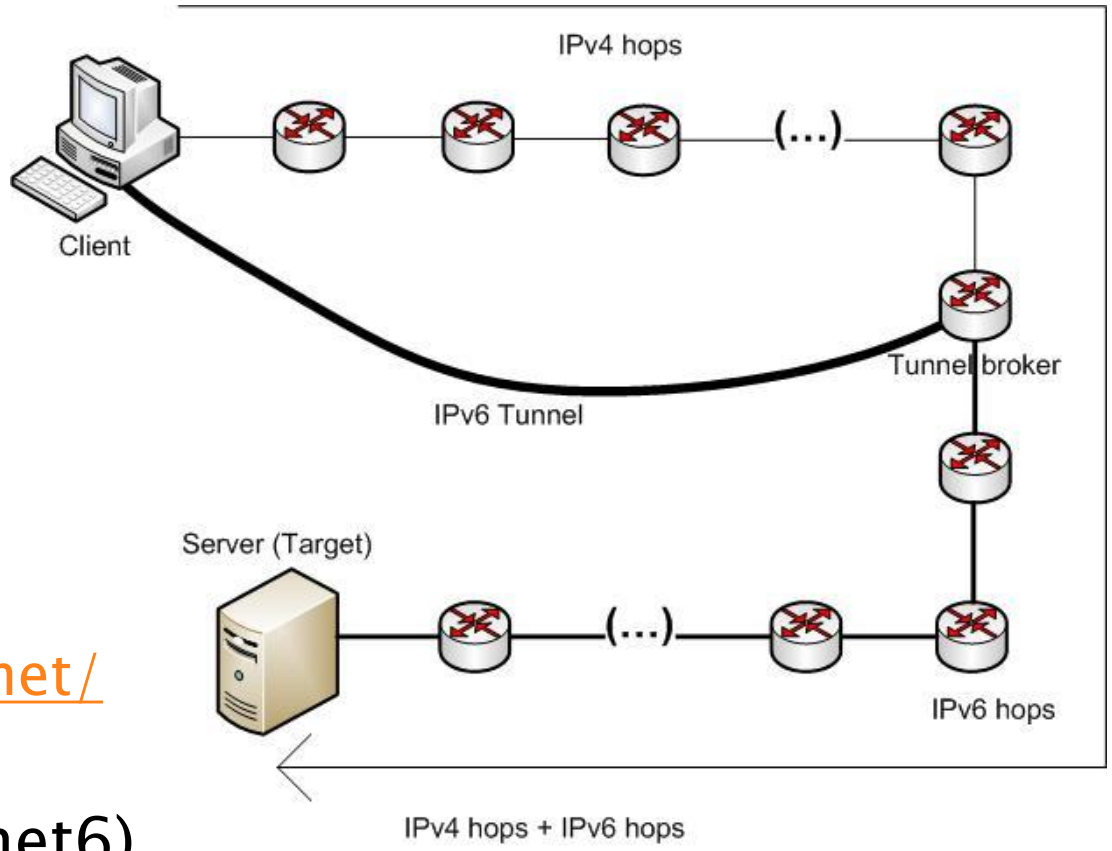
- Tunneling
  - IPv6 encapsulated in IPv4
  - Manual, Automatic and Semi-Automatic
- Dual Stack
  - Node running both IPv4 and IPv6 stacks

Tunneling Tests

- IPv6 Testbed
  - 6to4 Tunnel
  - Manual tunnel
  - ISATAP



Tunneling Tests



- Tunnel Brokers
  - Hurricane Electric
    http://tunnelbroker.net/
  - Gogo6 Client (Freenet6)
    http://gogonet.gogo6.com/page/freenet6-services

Tunneling Comparison

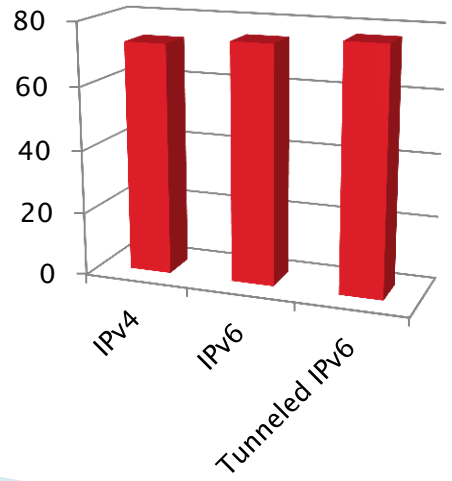
	6to4	Manual	ISATAP	Tunnel Broker
Type	Point-to-multipoint	Point-to-point	Point-to-point	Point-to-point
Properties		Not Auto-configurable	Site only	Autoconfiguration depends on implementation
Use	To connect more than two IPv6 islands	To connect two IPv6 islands	To allow single nodes to achieve IPv6 connectivity	To provide IPv6 Internet connectivity to a single node through the IPv4 Internet

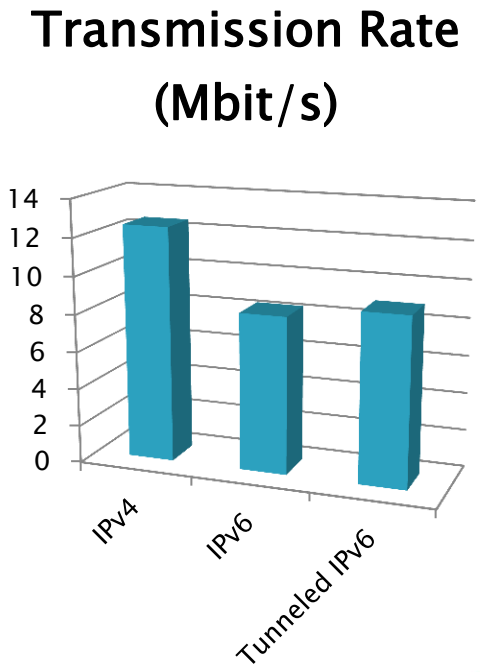
Tunneling tests Conclusions

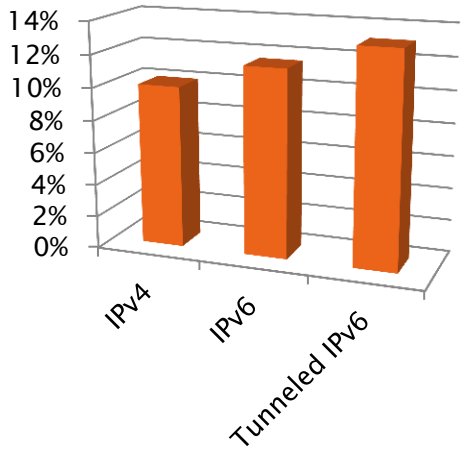
- Tunneling is an acceptable alternative when native IPv6 is unavailable
- Different tunnel solutions solve different needs
- Tunnel broker solutions are a good option for isolated nodes

IP transmission comparison test

- IPv4 vs Native IPv6 vs tunneled IPv6 file transmission
- Latency, Transmission rate, Header Overhead







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IP transmission comparison test
Conclusions

- Native IPv6 is theoretically capable of better performance than IPv4
- In reality IPv4 usually pulls ahead due to lack of native IPv6 support
- ISPs will embrace native IPv6 instead of tunneled IPv6 in order to bring the numbers around and raise IPv6 performance

IPv6 Addressing Plan

- Use type based Addressing Plan
- Easier security policies configuration
- Larger routing tables
- Use of VLANs for extra security layer
- Point to Point links use /64 prefix

- IPLeiria's prefix attributed by FCCN: 2001:690:2060::/48

IPv6 Addressing Plan

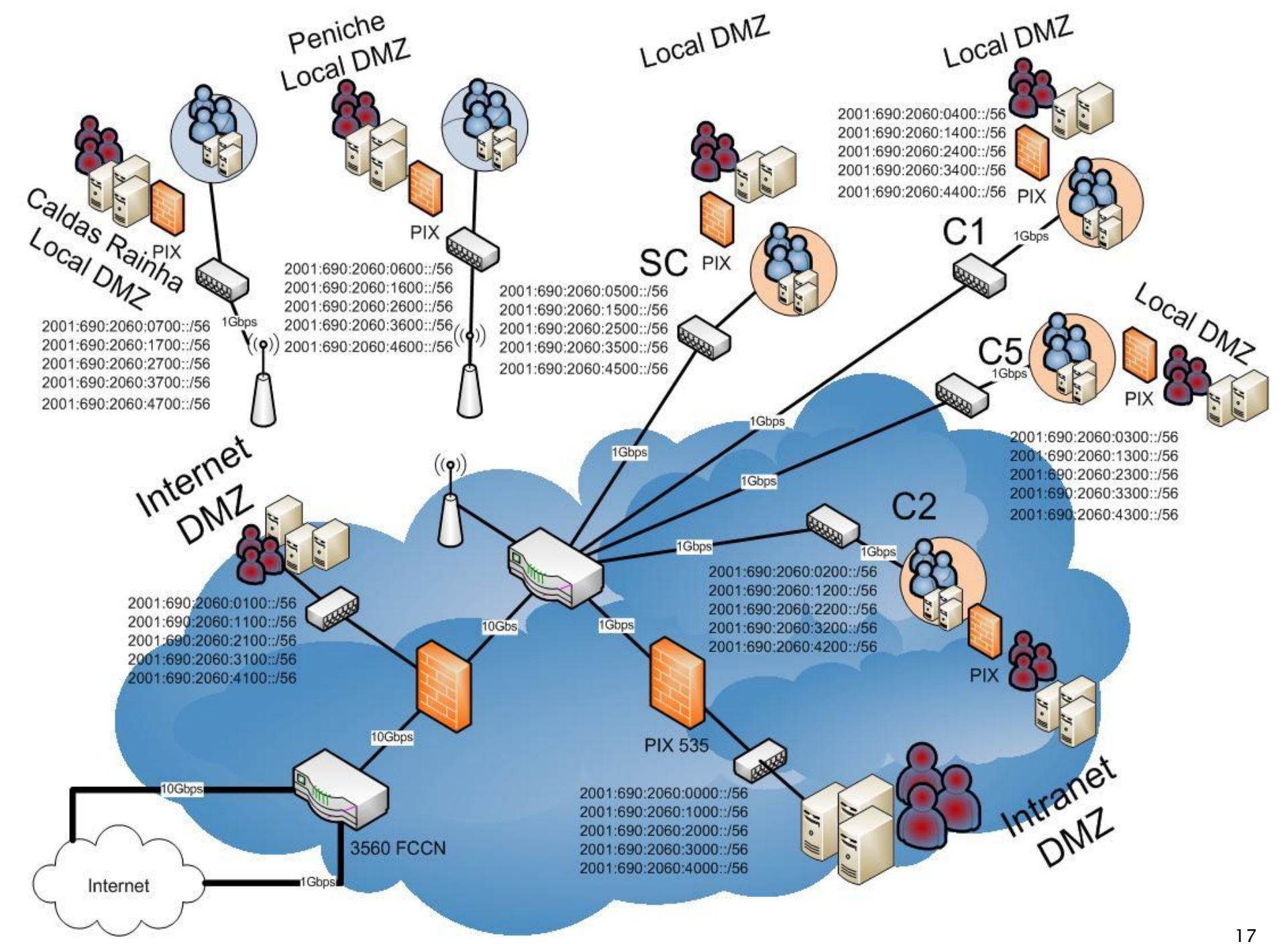
2001:690:2060:XXXX::/64

Yellow digit represents the use type
Red digit represents the location
Green digit represents the extra options

Addressing Plan example

2001:690:2060:0201::/64

Yellow digit (use type): Student
Red digit (location): IPLeiria's Campus 2
Green digit(extra options): IT class room

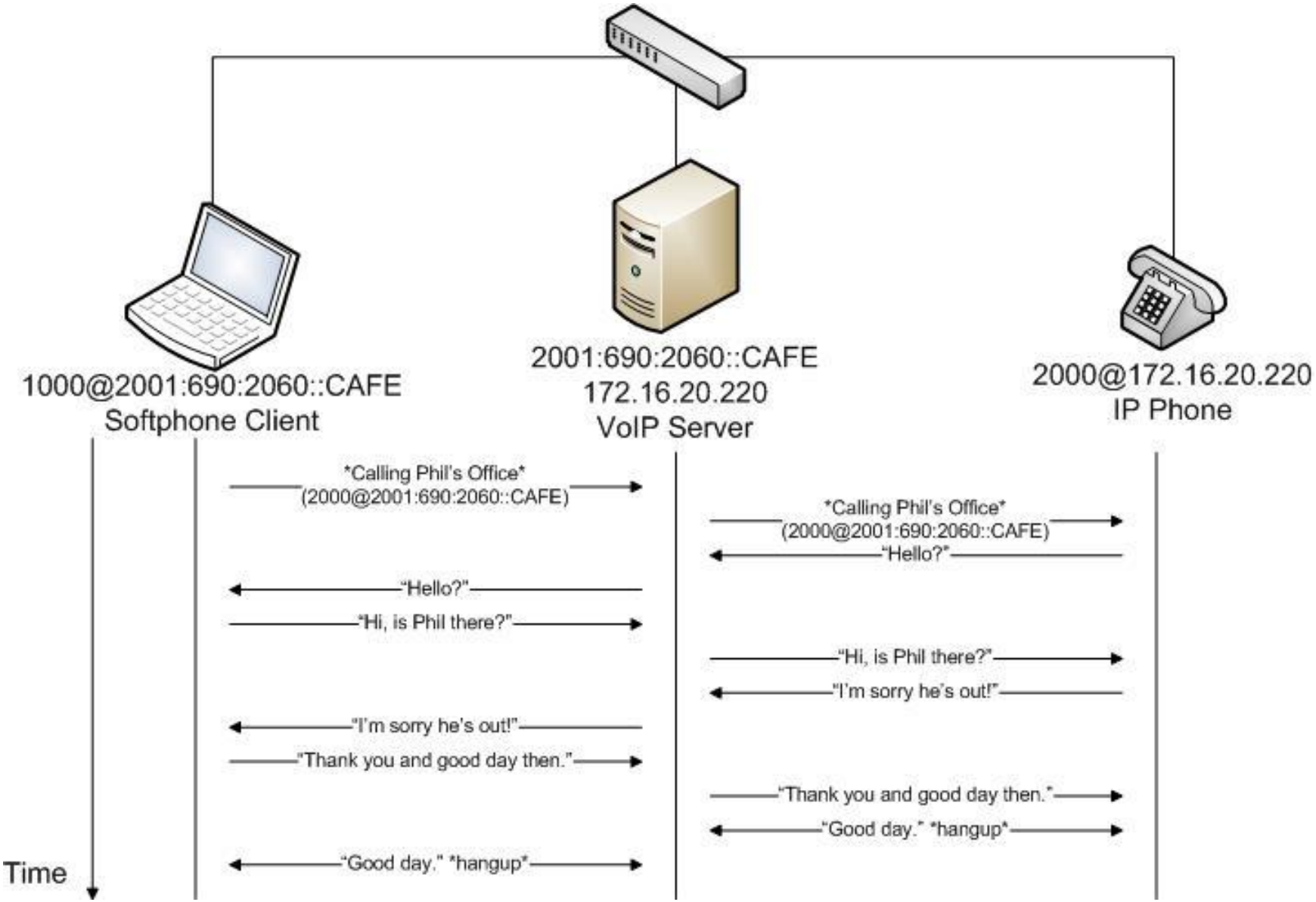

Peniche
Local DMZ
Local DMZ
Local DMZ
Caldas Rainha
Local DMZ
PIX
PIX
SC
PIX
C1
1Gbps
2001:690:2060:0400::/56
2001:690:2060:1400::/56
2001:690:2060:2400::/56
2001:690:2060:3400::/56
2001:690:2060:4400::/56
2001:690:2060:0700::/56
2001:690:2060:1700::/56
2001:690:2060:2700::/56
2001:690:2060:3700::/56
2001:690:2060:4700::/56
1Gbps
2001:690:2060:0600::/56
2001:690:2060:1600::/56
2001:690:2060:2600::/56
2001:690:2060:3600::/56
2001:690:2060:4600::/56
2001:690:2060:0500::/56
2001:690:2060:1500::/56
2001:690:2060:2500::/56
2001:690:2060:3500::/56
2001:690:2060:4500::/56
C5
1Gbps
Local DMZ
PIX
1Gbps
1Gbps
1Gbps
2001:690:2060:0300::/56
2001:690:2060:1300::/56
2001:690:2060:2300::/56
2001:690:2060:3300::/56
2001:690:2060:4300::/56
Internet
DMZ
C2
1Gbps
1Gbps
2001:690:2060:0200::/56
2001:690:2060:1200::/56
2001:690:2060:2200::/56
2001:690:2060:3200::/56
2001:690:2060:4200::/56
2001:690:2060:0100::/56
2001:690:2060:1100::/56
2001:690:2060:2100::/56
2001:690:2060:3100::/56
2001:690:2060:4100::/56
10Gbs
1Gbps
PIX
10Gbps
PIX 535
10Gbps
2001:690:2060:0000::/56
2001:690:2060:1000::/56
2001:690:2060:2000::/56
2001:690:2060:3000::/56
2001:690:2060:4000::/56
Intranet
DMZ
3560 FCCN
Internet
1Gbps

VoIP

- Driven by the Internet boom of the 1990s and consequent exponential growth of the user base
- Transmission of audio and video through the IP network
- Lower costs when compared with legacy phone services
- Possible to aggregate with the POTS

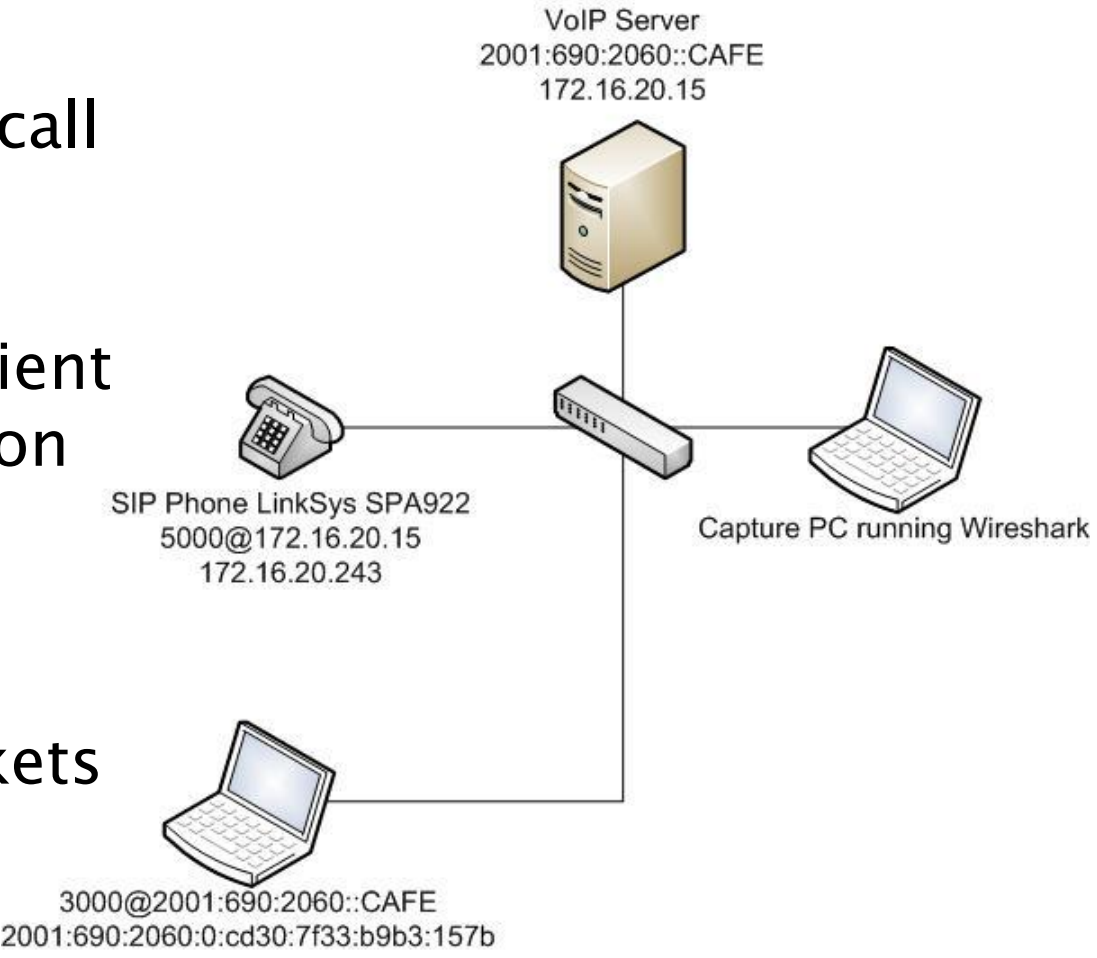
- IPLeiria uses a Trixbox OS running an Elastix SIP server with PBX extensions

Dual Stack VoIP server



Dual Stack VoIP test

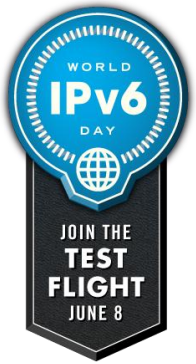
- VoIP server used as a call switchboard
- Only client to server communication. No client to client communication takes place.
- Server keeps track of registered extensions and redirects the packets to the destination address.



Dual Stack VoIP server test Conclusions

- IPv4 and IPv6 support for intra and inter protocol communication
- Easy Implementation and Migration of the current IPLeiria's VoIP server.
- Very desirable solution for a Migration Scenario

World IPv6 Day Participation



- Re-enabling of the IPLeiria's native IPv6 connection with the FCCN.
- Enabling Access to the IPLeiria's IPv6 network through a Wifi connection.
- Implementation of an access counter on the ESTG's IPv6 webpage.
- Registration on the World IPv6 Day Website with IPLeiria being the only Portuguese Education Institution on there.

Conclusions

- Tunneled IPv6 is an acceptable solution if native IPv6 is unavailable
- Use of the provided Structured Addressing Plan brings good benefits to an IPv6 network
- A Dual Stack VoIP server is an amazingly interesting and desirable tool in a migration scenario
- IPLeiria's IPv6 network migration should'nt bring any big hardships since all equipment should be IPv6 capable
- IPv6 has come and its adoption is mandatory. The study and implementation of transition mechanisms must continue

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