Introducción a IPv6
Mecanismos de transición

Alejandro Teixeira Gomez
MikroTik Certified Trainer# 163
ateixeira@mikrotikxperts.cl

Agenda

- ¿QUIÉNES SOMOS?
- ESTADISTICAS DE IPV4 / IPV6
- IPV6 EN CHILE
- INTRODUCCION A IPV6
- AUTOCONFIGURACION IPV6
- COEXISTENCIA Y TRANSICION
- MIKROTIK IPV6
- LABORATORIO DUALSTACK

¿QUIÉNES SOMOS?

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¿Quiénes somos?

- **MikroTik Xperts / Academy Xperts**
  - Fundada en 2006
  - Presencia en 7 países
  - Mas de 700 certificaciones dictadas
  - Certificador número 1 en Latinoamérica
  - Cuenta con 4 trainer certificados
    - Alejandro Teixeira
    - Mauro Escalante
    - Miguel Ojeda
    - Gustavo Angulo

Academy Xperts

Mikrotik Xperts

MikroTik CERTIFIED Training Center

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¿Quiénes somos?

- **Alejandro Teixeira Gómez**
  - Ingeniero de Telecomunicaciones (Venezuela)
  - Magister en Ingeniería de Negocios con TI (Chile)
  - Trainer certificado MikroTik: ID TR0163
  - Fundador y Gerente General de TF Consulting
  - Fundador y CTO de Wisper Comunications
  - Fundador y CEO de Corporación Widuit C.A.
  - Co-fundador y CTO de Mikrotik Xperts Chile
  - CTO de Austro Internet S.A.

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ESTADISTICAS DE IPV4 / IPV6

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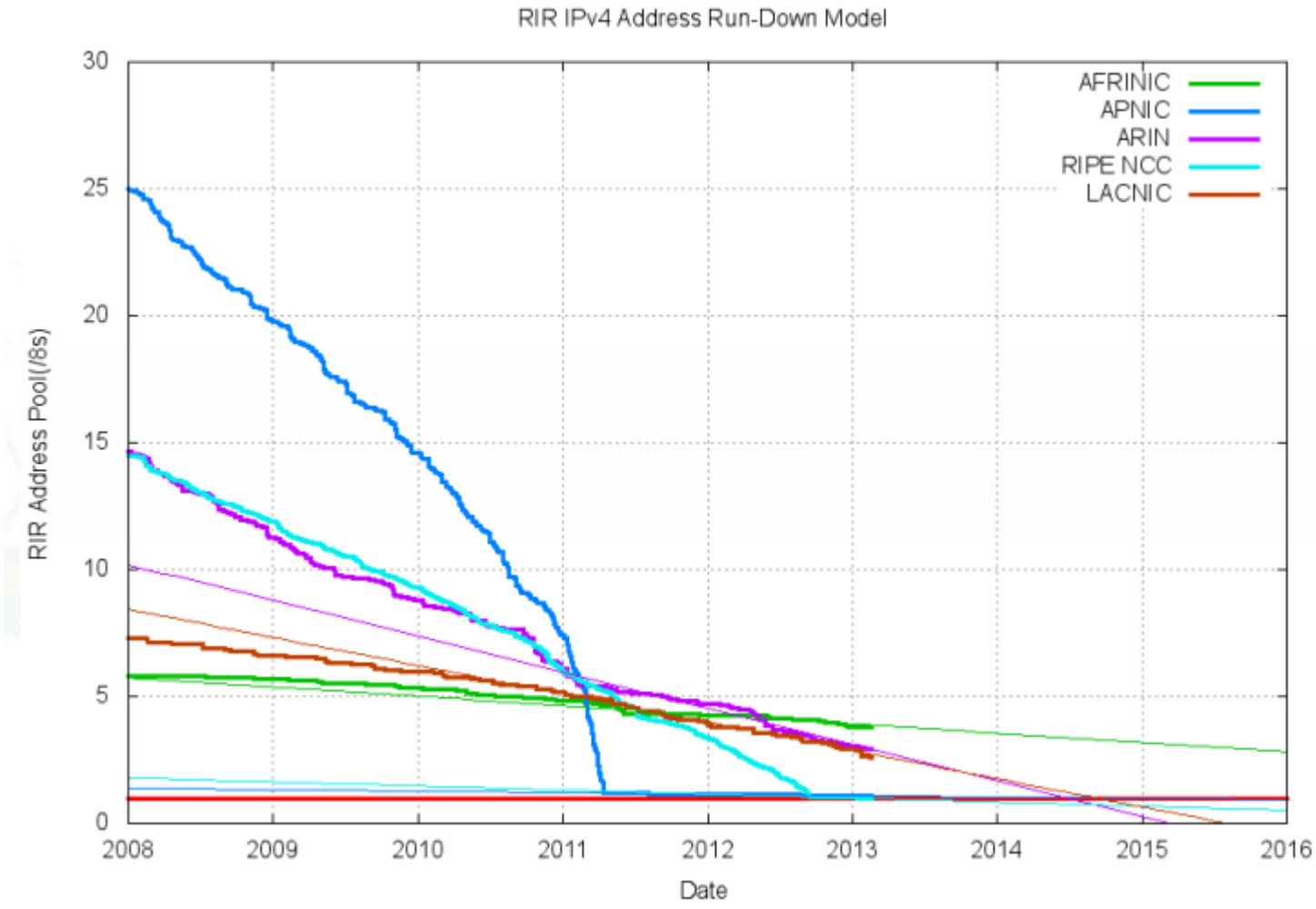
IANA

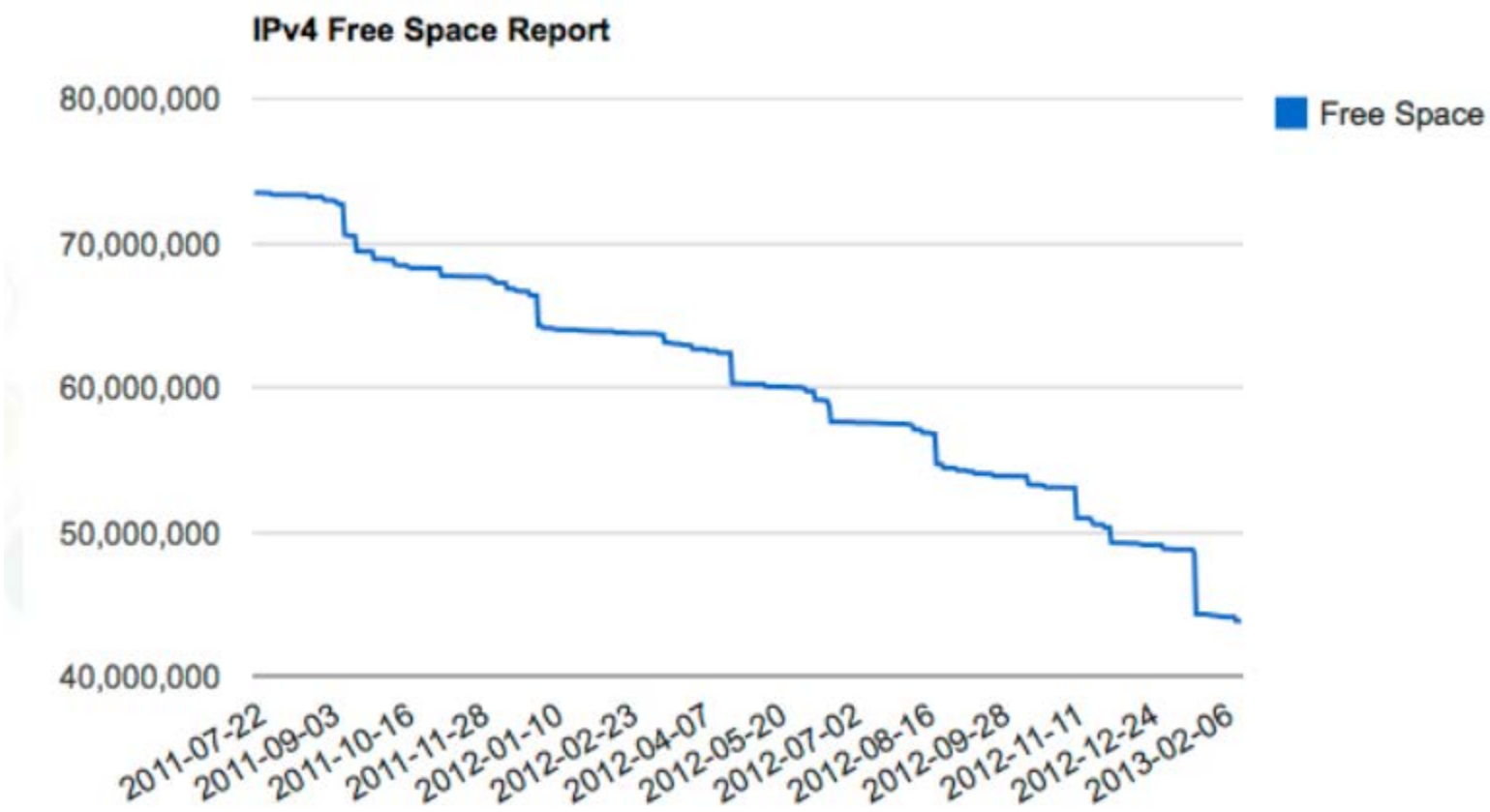
¿Qué ocurrirá al agotarse las direcciones IPv4?

- **Internet seguirá**
- **IPv4 e IPv6 coexistirán** durante mucho tiempo
- Se seguirán teniendo **direcciones IPv4 durante muchos años** (de distintas maneras)
- **Incremento del uso de NAT en IPv4**

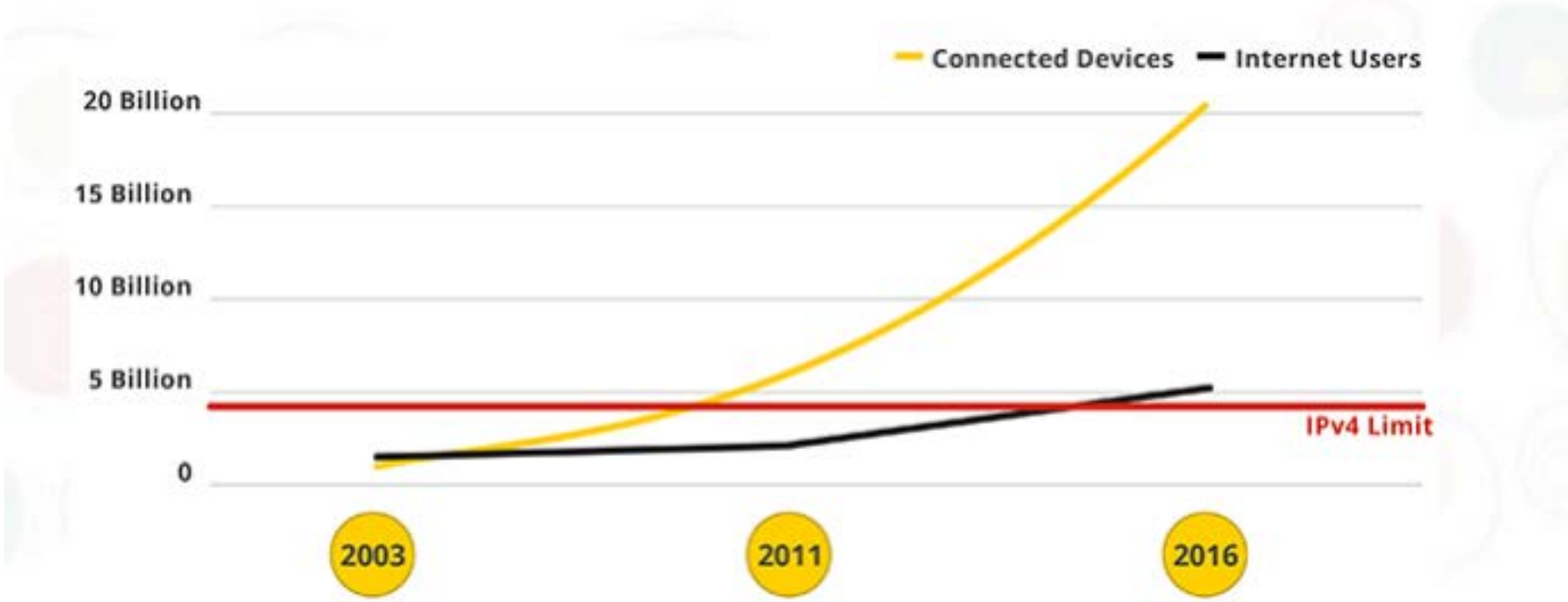
Proyecciones de agotamiento IPv4



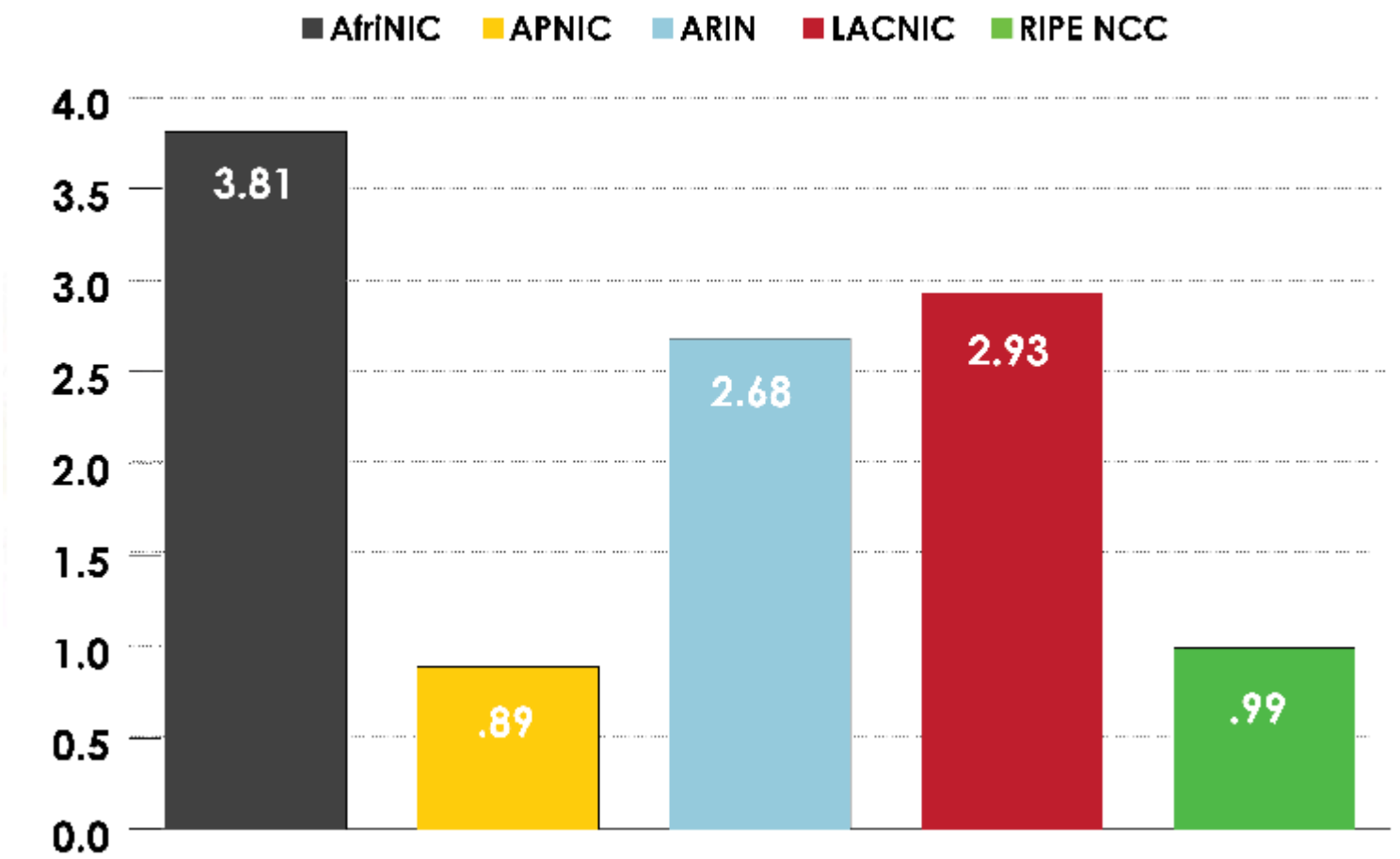
Espacio disponible en LANIC



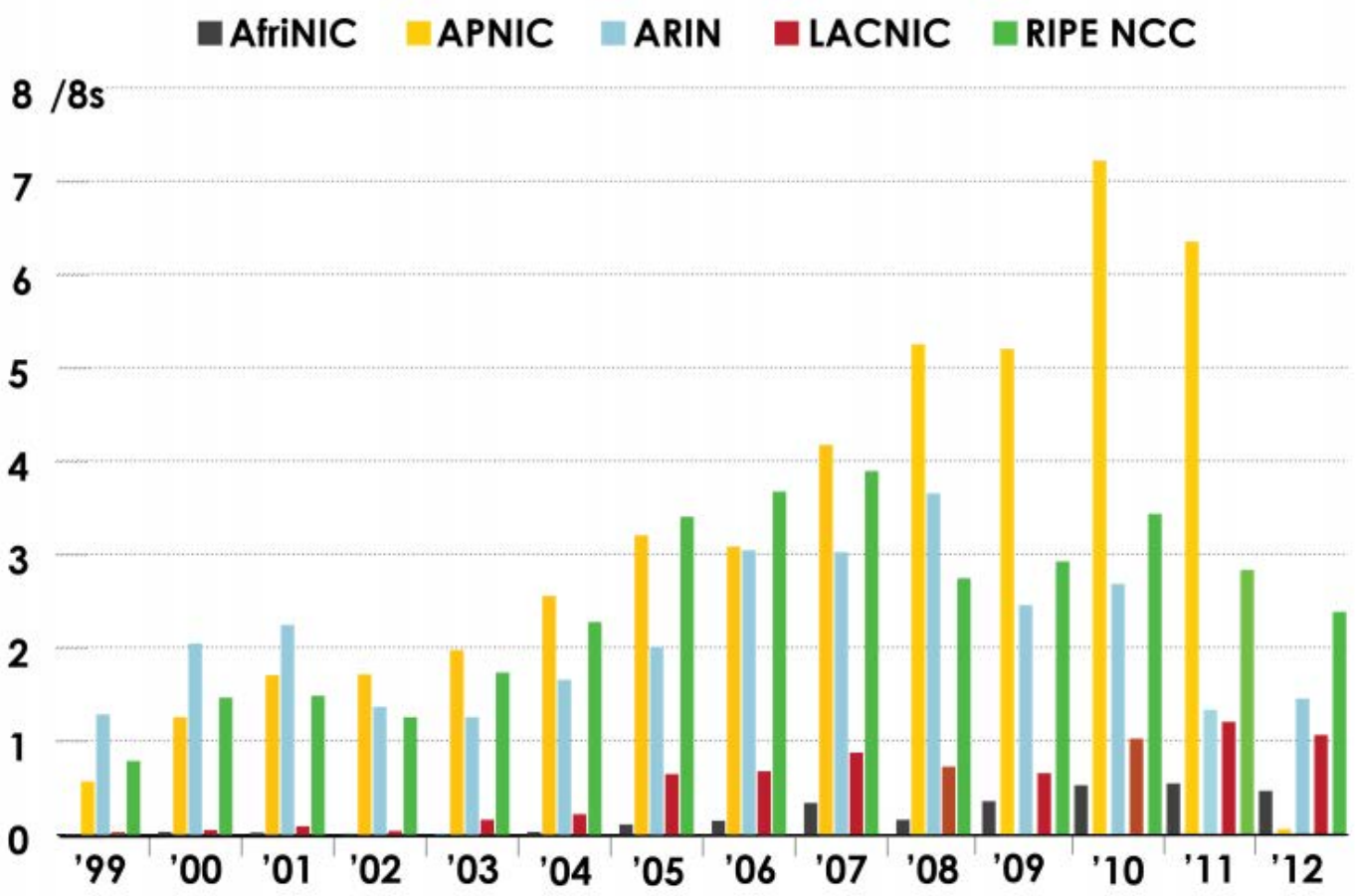
Crecimiento de usuarios conectados



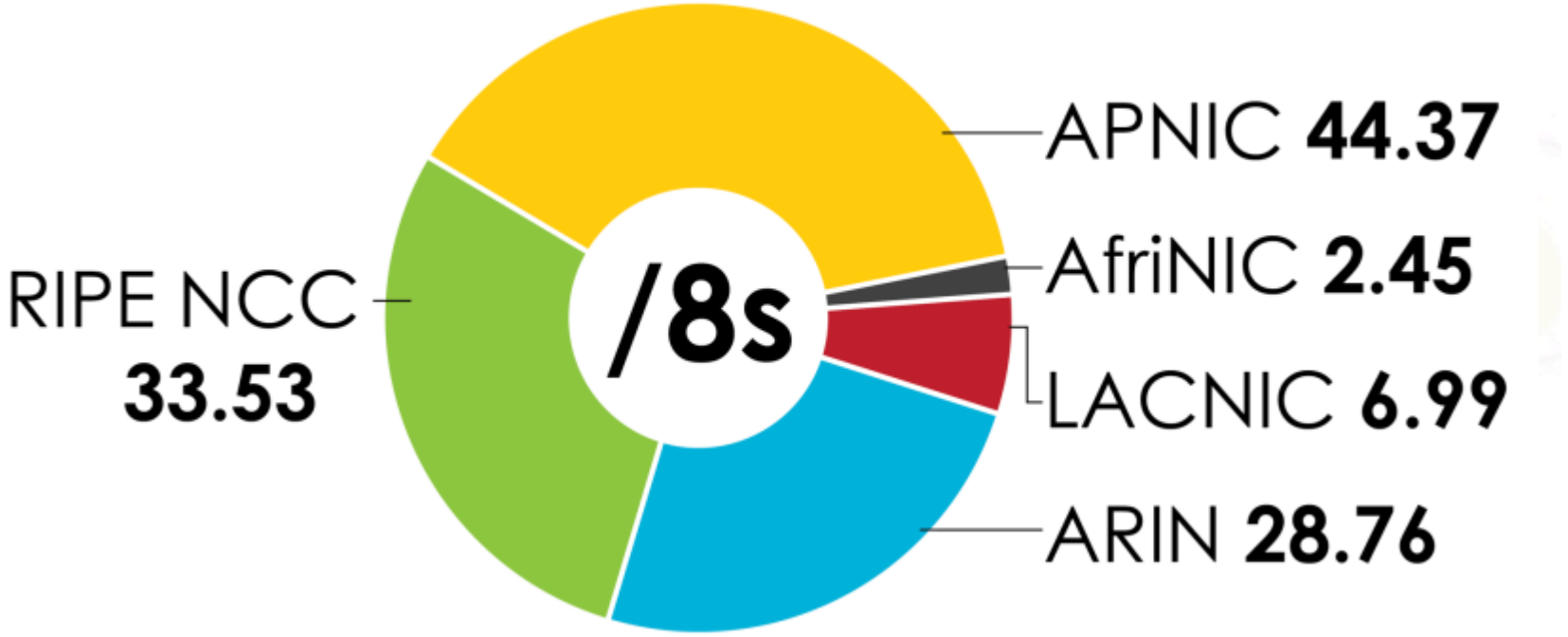
Espacio disponible por cada RIR (/8)



Bloques IPv4 asignados (RIR a Organizaciones)



Bloques IPv4 asignados (RIR a Organizaciones)



IPV6 EN CHILE

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IPv6 en Chile

- 06 de Junio de 2012
  - **Lanzamiento oficial** de IPv6 en Chile
  - Empresas de telecomunicaciones ya poseen IPv6

Aproximadamente **un 0,7 % del trafico mundial es IPv6 en la actualidad**. En **Chile**, esta cifra oscila entre **0,01 % y 0,02 %** del trafico

Empresa	Estado de IPv6	Condiciones
Movistar	Implementado	Entrega solo a empresas
Entel	Implementado	No ofrece
VTR	Implementado	No ofrece
GTD	Implementado	Entrega solo a empresas

INTRODUCCION A IPV6

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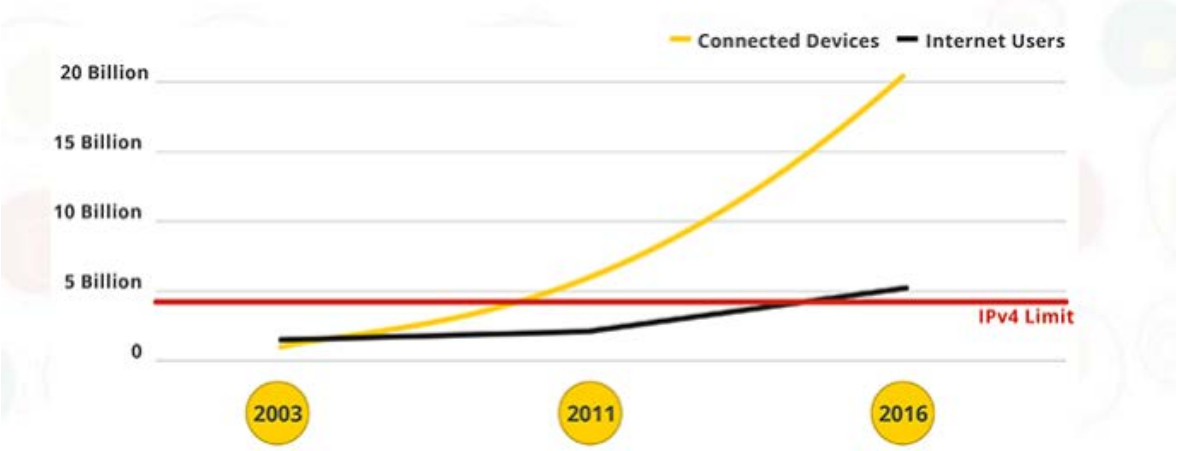
Futuro de IPv4

- **IPv4 está prácticamente agotado**
- **IPv6 no será adoptado masivamente** hasta que se terminen las direcciones IPv4 o hasta que haya adecuados incentivos (económicos, políticos, regulatorios)
- IPv6 no es un problema, es una oportunidad de desarrollo para las TICs en la región



Características de IPv6

- Un **amplio pool de direcciones**, el cual se dice que será **útil por al menos unos 30 años**
- **Estructura de direccionamiento jerárquica basada en prefijos** en vez de clases, cuyo fin es mantener tablas de enrutamiento mas pequeñas y eficientes.
- Incorporación de **mecanismos de auto-configuración** para IPv6
- **Soporte nativo de encapsulamiento y encriptación**
- **Métodos de transición** desde IPv4
- **Mecanismos de interoperabilidad** para comunicación con redes IPv4

Nuevos conceptos

- **Packet versus datagram:** IPv6 usa el termino de packet en vez de datagram. El significado es el mismo pero bajo formatos distintos.
- **En IPv6 se usa el termino de nodo** para cualquier sistema que ejecute IPv6, ya sea un host o un router.
  - Un host es un nodo IPv6 que no hace forward de paquetes que no son explícitamente dirigidos a él
  - Un router es un hots que hace forward de paquetes que no son destinados a él

Direccionamiento

IPv4

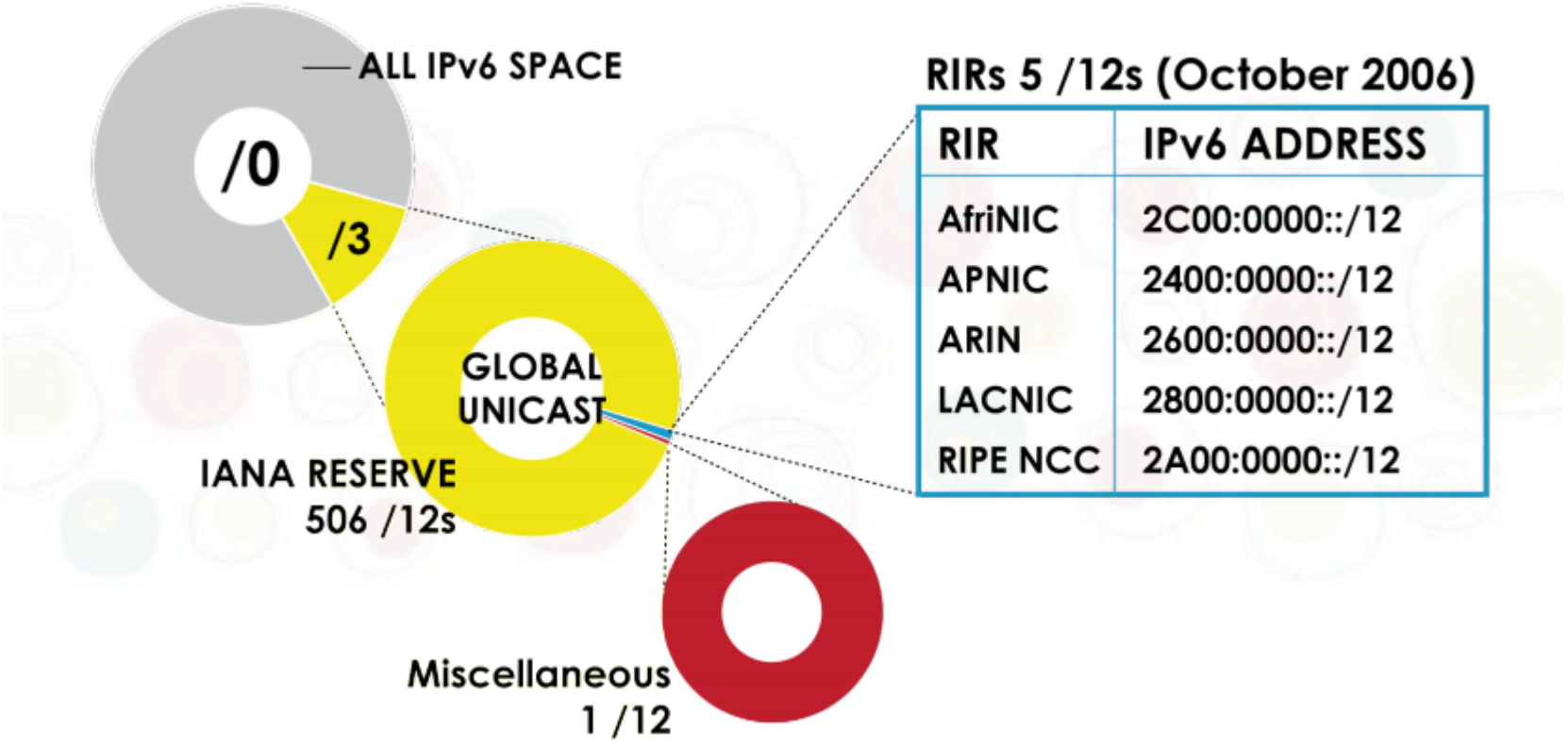
- 2^{32} = **4.294.967.296**

IPv6:

- 2^{128} = **340.282.366.920.938.463.463.374.607.431.768.211.456**

50.000 direcciones por metro cuadrado en la tierra

¿Cuánto espacio IPv6 hay disponible?

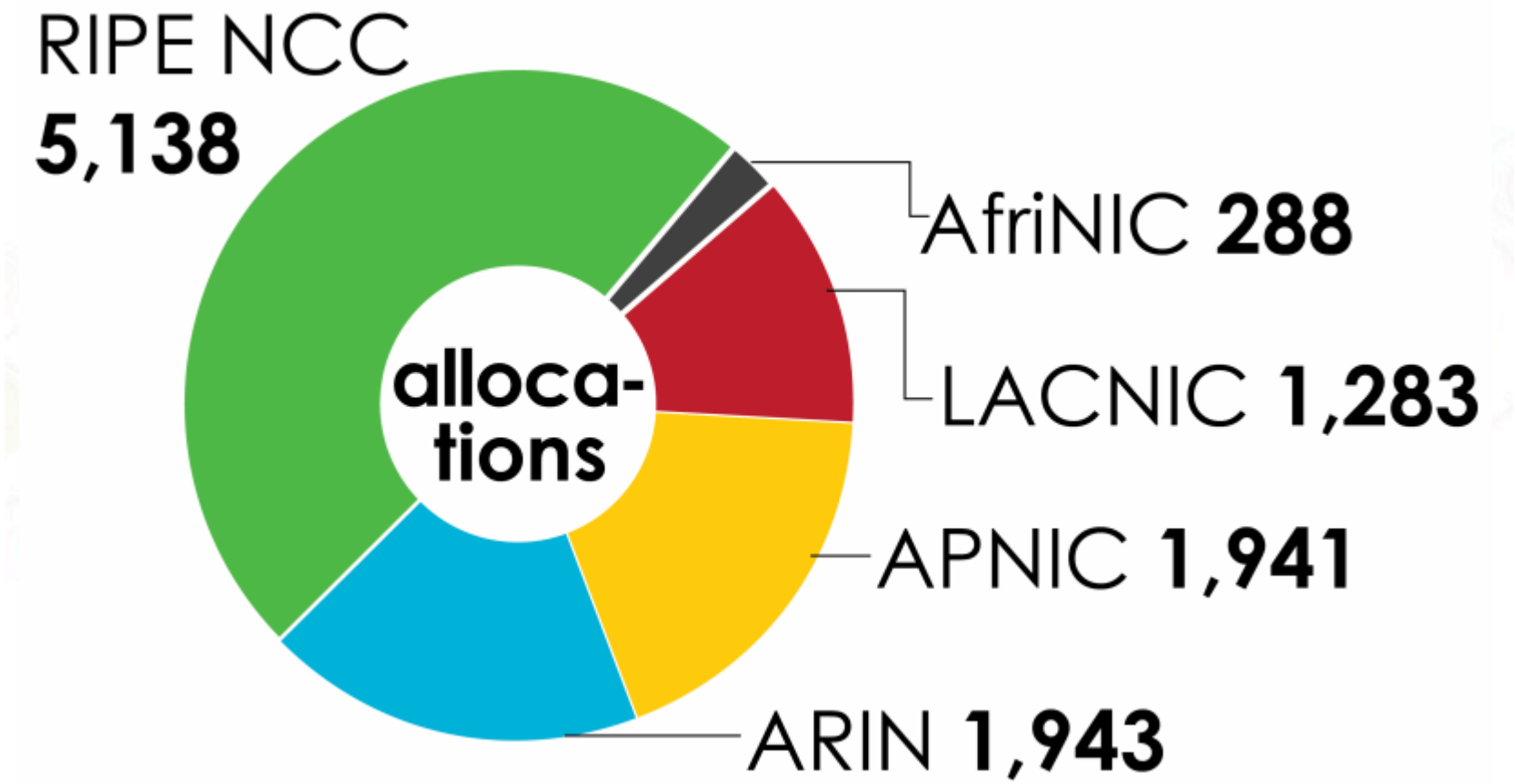


RIRs 5 /12s (October 2006)

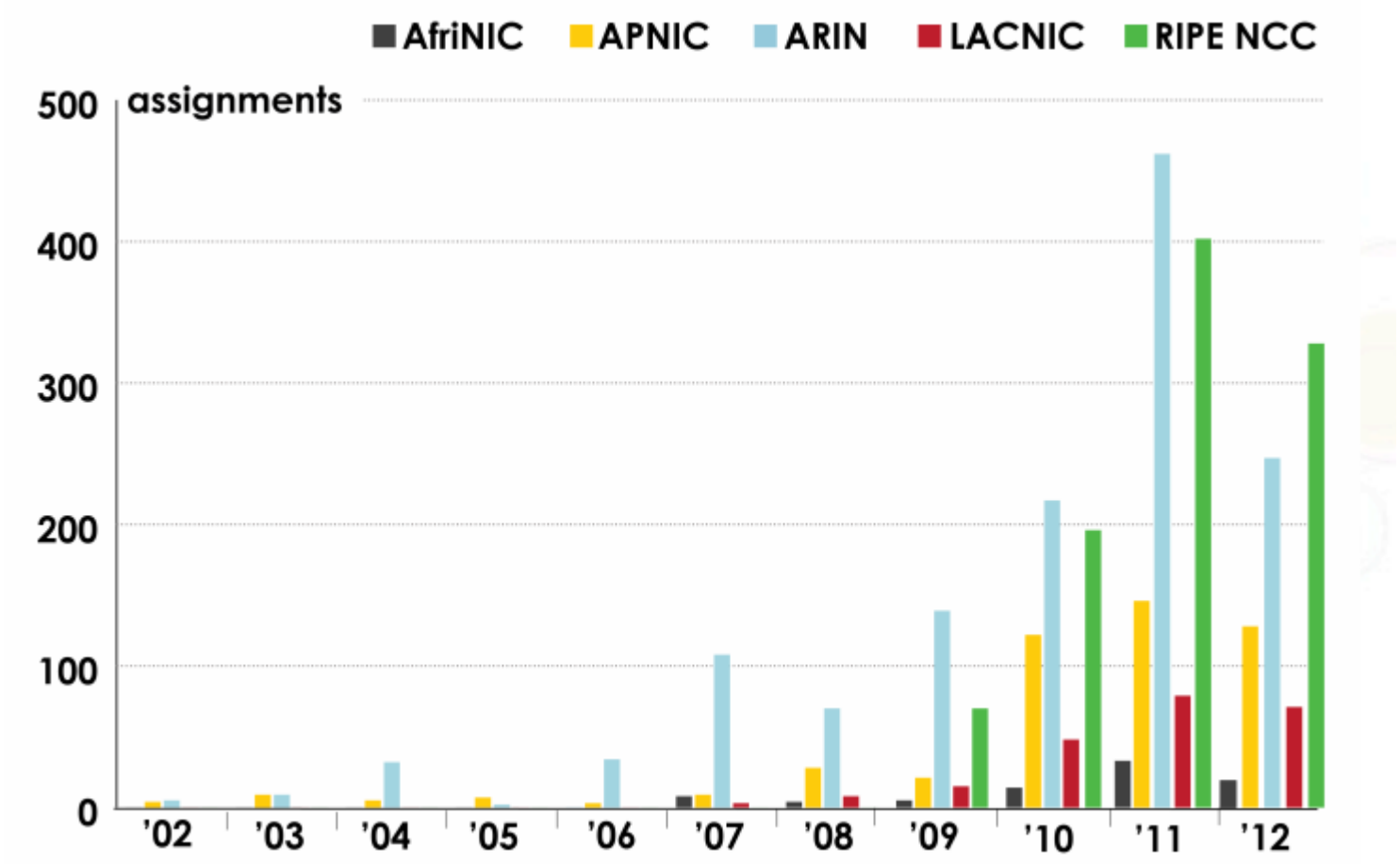
RIR	IPv6 ADDRESS
AfriNIC	2C00:0000::/12
APNIC	2400:0000::/12
ARIN	2600:0000::/12
LACNIC	2800:0000::/12
RIPE NCC	2A00:0000::/12

83.076.749.736.557.200.000.000.000.000.000.000

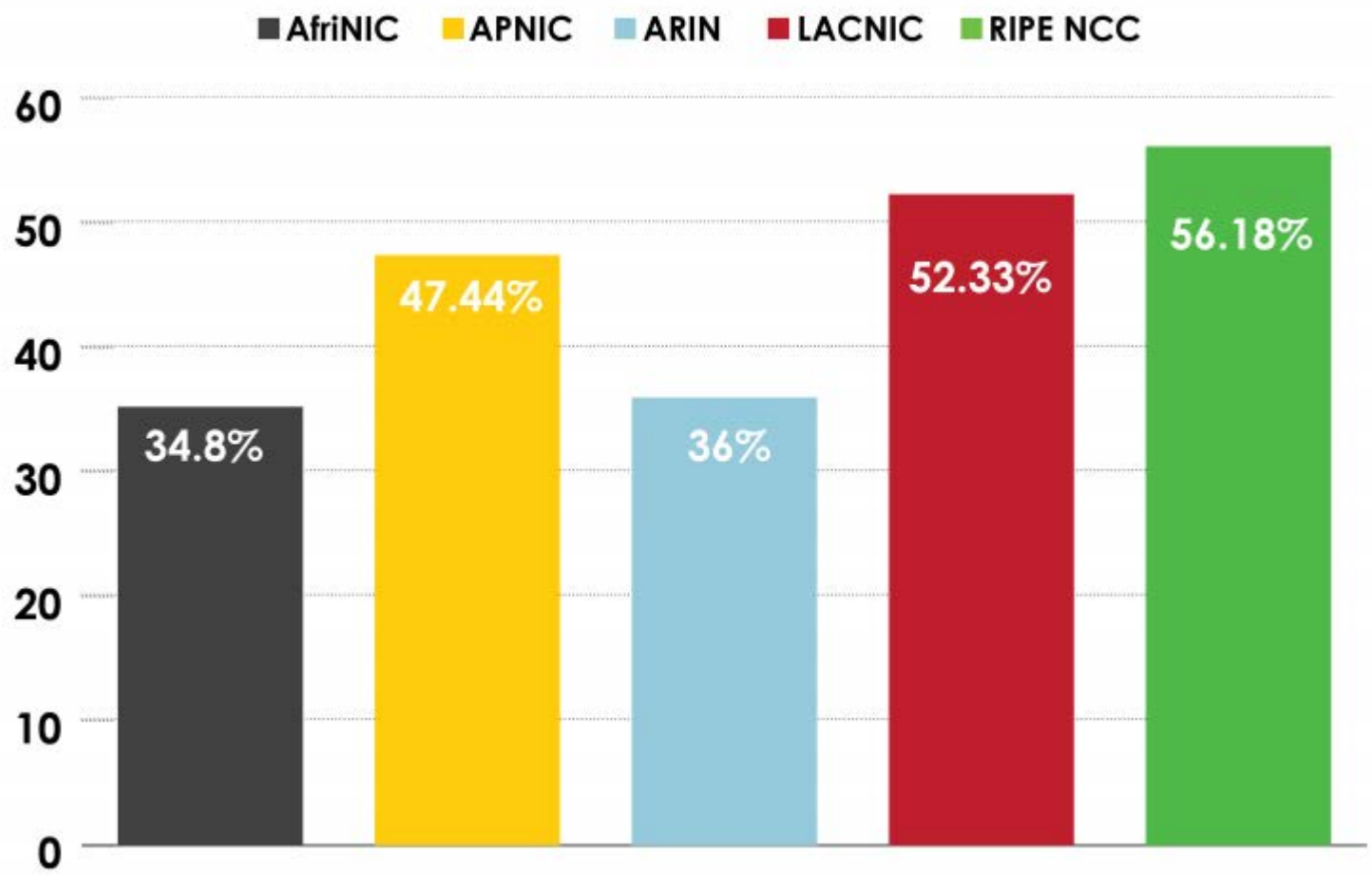
Asignaciones IPv6 totales



Asignaciones IPv6 totales

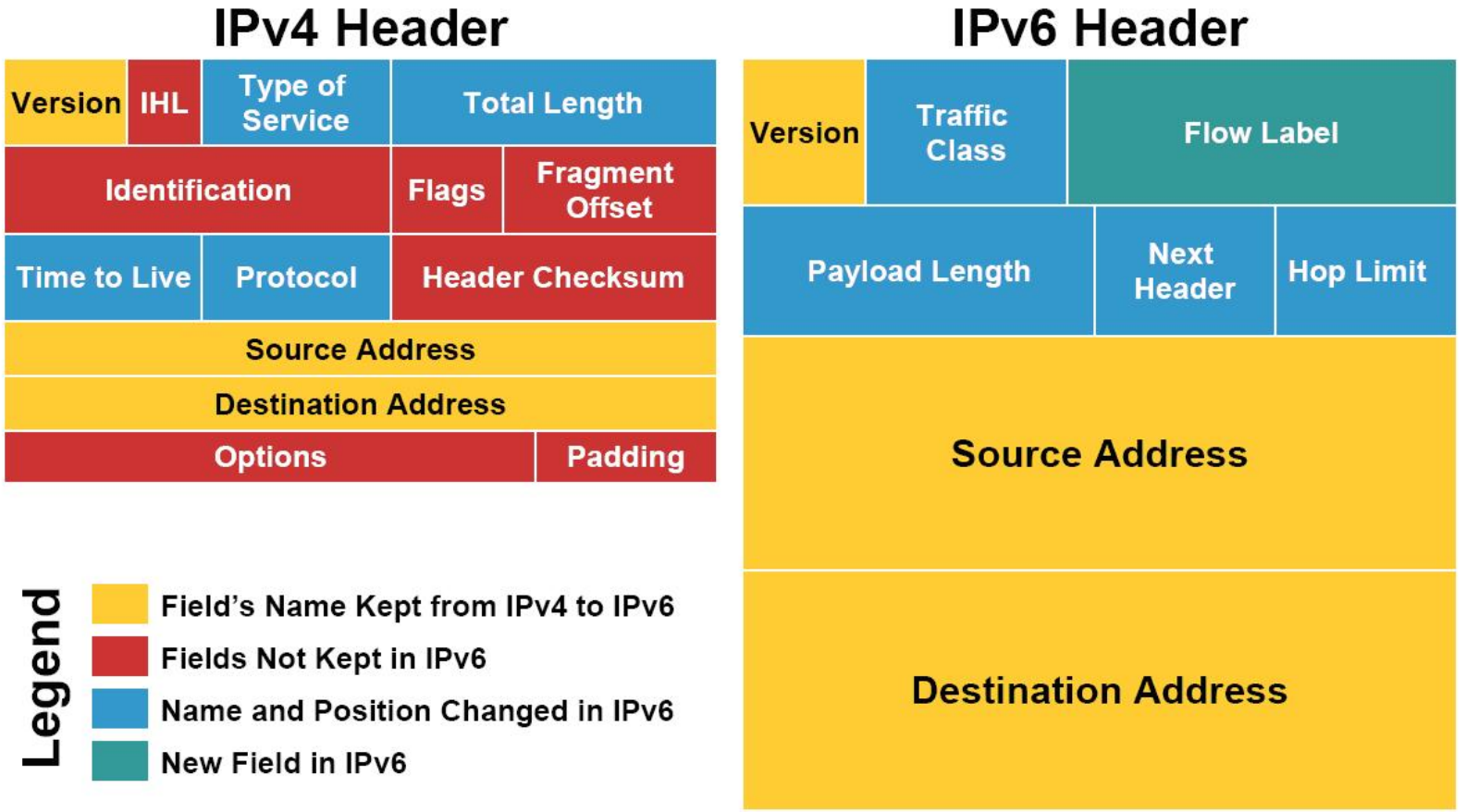


Porcentaje de miembros con IPv6



Cabecera IPv6

- Mas simple que el usado en IPv4
- Mas fácil de procesar por enrutadores
- Elimina campos innecesarios (opcionales)
- Introduce el concepto "Cabeceras de extensión“
- Tamaño fijo: 40 octetos

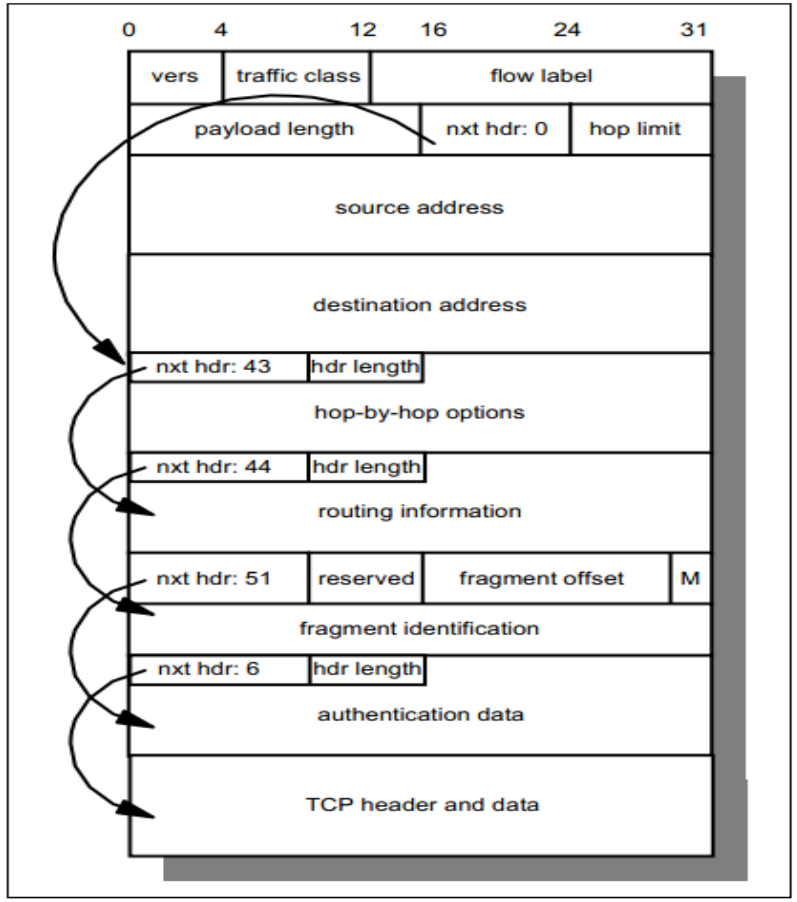


Campos: cabecera IPv6

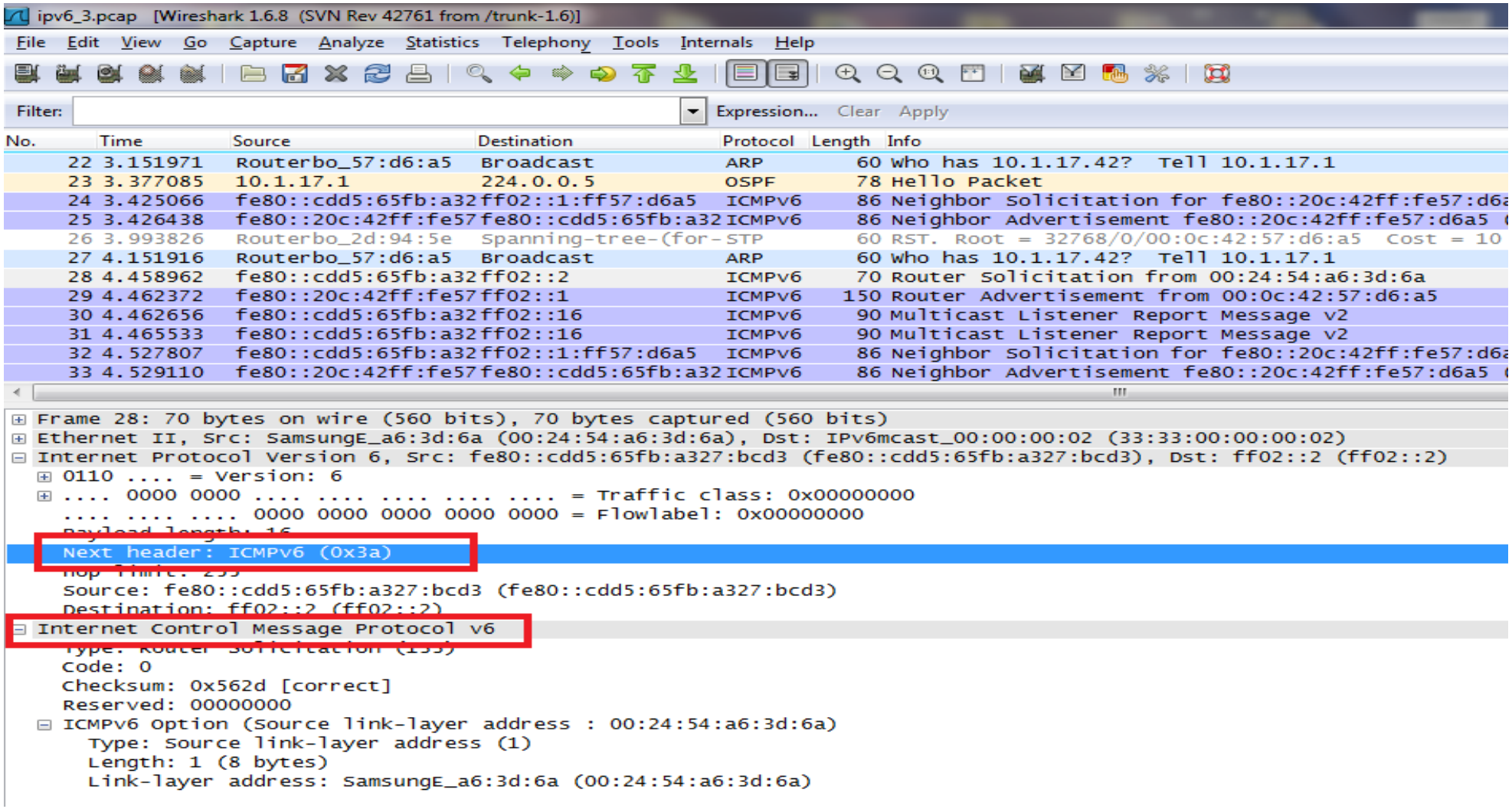
- Direcciones de origen (128 bits)
- Direcciones de destino (128 bits)
- Versión del protocolo IP (4 bits)
- Clase de tráfico (8 bits, Prioridad del Paquete)
- Etiqueta de flujo (20 bits, manejo de la Calidad de Servicio),
- Longitud del campo de datos (16 bits)
- Cabecera siguiente (8 bits)
- Límite de saltos (8 bits, Tiempo de Vida)

IPv6 Extension Headers

- En IPv6, **la información opcional es codificada en cabeceras diferentes** que pueden ser colocadas entre la cabecera IPv6 y las cabeceras de los protocolos de capas superiores.
- La **longitud de cada header es variable**
- Siempre son múltiplo de 8 bytes
- **Extension Headers:**
  - Extension Header Order
  - Options
  - Hop-by-Hop Options Header
  - Routing Header
  - Fragment Header
  - Destination Options Header
  - No Next Header



IPv6 Extension Headers



Representación en texto de direcciones IPv6

- Hay tres formas
- **FORMATO 1:** La forma **x:x:x:x:x:x:x:x**, donde las x son valores hexadecimales de ocho campos, cada uno con 16 bits.
- Por ejemplo:

  FEDC:BA98:7654:3210:FEDC:BA98:7654:3210

  1080:0:0:0:8:800:200C:417Aa

Representación en texto de direcciones IPv6

- **FORMATO 2:** El uso de **"::" indica uno o más grupos de 16 bits cuyo valor es cero**. "::" solamente **puede aparecer una vez en la dirección**. Por ejemplo:
  - 1080:0:0:0:8:800:200C:417A (dirección unicast)
  - FF01:0:0:0:0:0:0:101 (dirección multicast)
  - 0:0:0:0:0:0:0:1 (la equivalente en IPv4 a 127.0.0.1)
  - 0:0:0:0:0:0:0:0 la dirección “unspecified”

  pueden representarse como:
  - 1080::8:800:200C:417A,
  - FF01::101,
  - ::1
  - ::

Identificación del tipo de dirección

Allocation	Prefix (bin)	Start of address range (hex)	Mask length (bits)	Fraction of address space
Reserved	0000 0000	0:: /8	8	1/256
Reserved for NSAP	0000 001	200:: /7	7	1/128
Reserved for IPX	0000 010	400:: /7	7	1/128
Aggregatable global unicast addresses	001	2000:: /3	3	1/8
Link-local unicast	1111 1110 10	FE80:: /10	10	1/1024
Site-local unicast	1111 1110 11	FEC0:: /10	10	1/1024
Multicast	1111 1111	FF00:: /8	8	1/256
Total allocation				15%

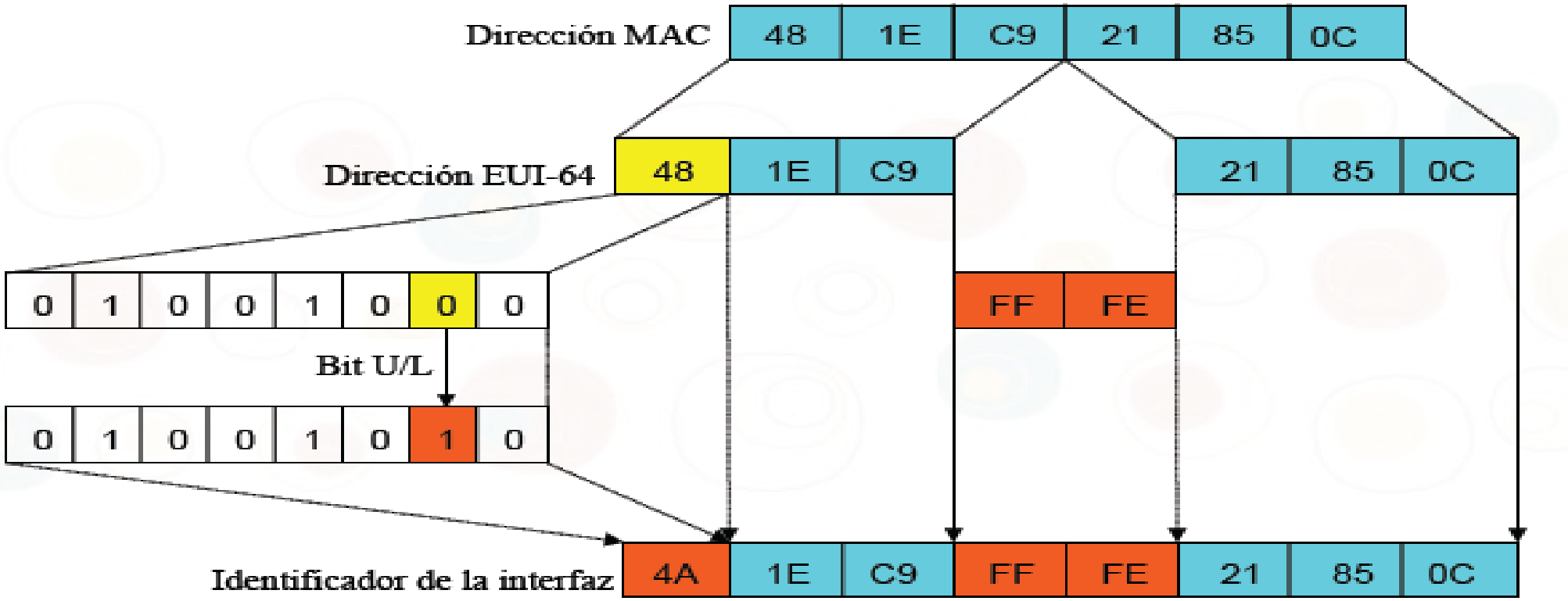
Link Local: Interface Identifier

- The last 64 bits of an IPv6 address are the interface identifier that is unique to the 64-bit prefix of the IPv6 address. There are several ways how to determine interface identifier:
  - EUI-64
  - Randomly generated to provide a level of anonymity
  - Manually configured

Link Local: EUI-64

- Traditional interface identifiers for network adapters are 48-bit MAC address. This address consists of a 24-bit manufacturer ID and a 24-bit board ID.
- IEEE EUI-64 is a new standard for network interface addressing. The company ID is still 24-bits in length, but the extension ID is 40 bits, creating a much larger address space for a network adapters.
- To create an EUI-64 address from the interface MAC address:
  - 0xFFFE is inserted into the MAC address between the manufacturer ID and the board ID.
  - seventh bit of the first byte is reversed.

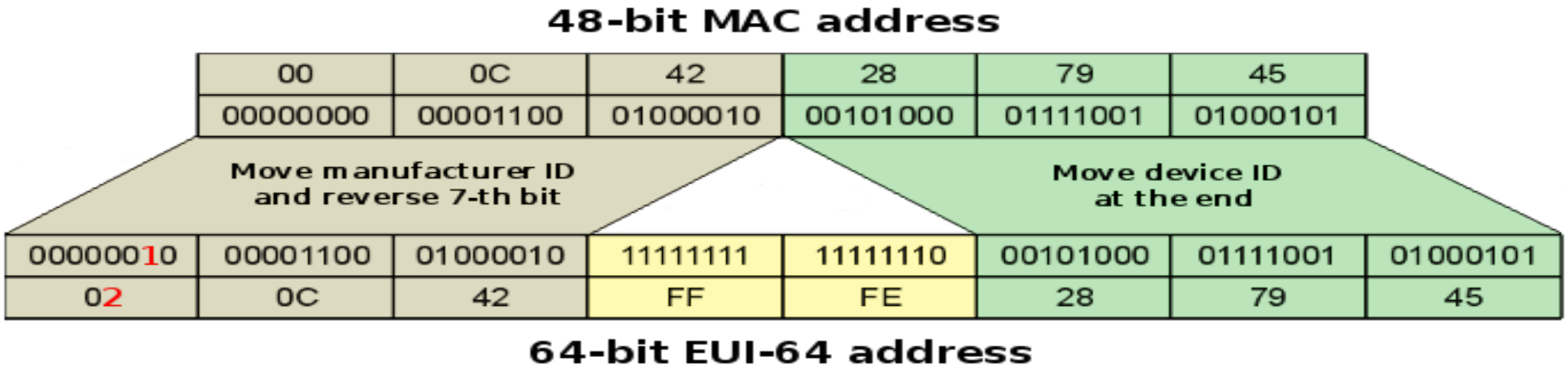
EUI-64: Link Local Address



Dirección Link Local: **FE80::4A1E:C9FF:FE21:850C**

EUI-64: Link Local Address

- Image above illustrates conversation process. When the result is converted to colon-hexadecimal notation, we get the interface identifier 20C:42FF:FE28:7945. As the result, corresponds link-local address is
  - **FE80::20C:42FF:FE28:7945/64**



AUTOCONFIGURACION IPV6

Autoconfiguración

- Autoconfiguración Stateless
- Autoconfiguración Stateful (DHCPv6)

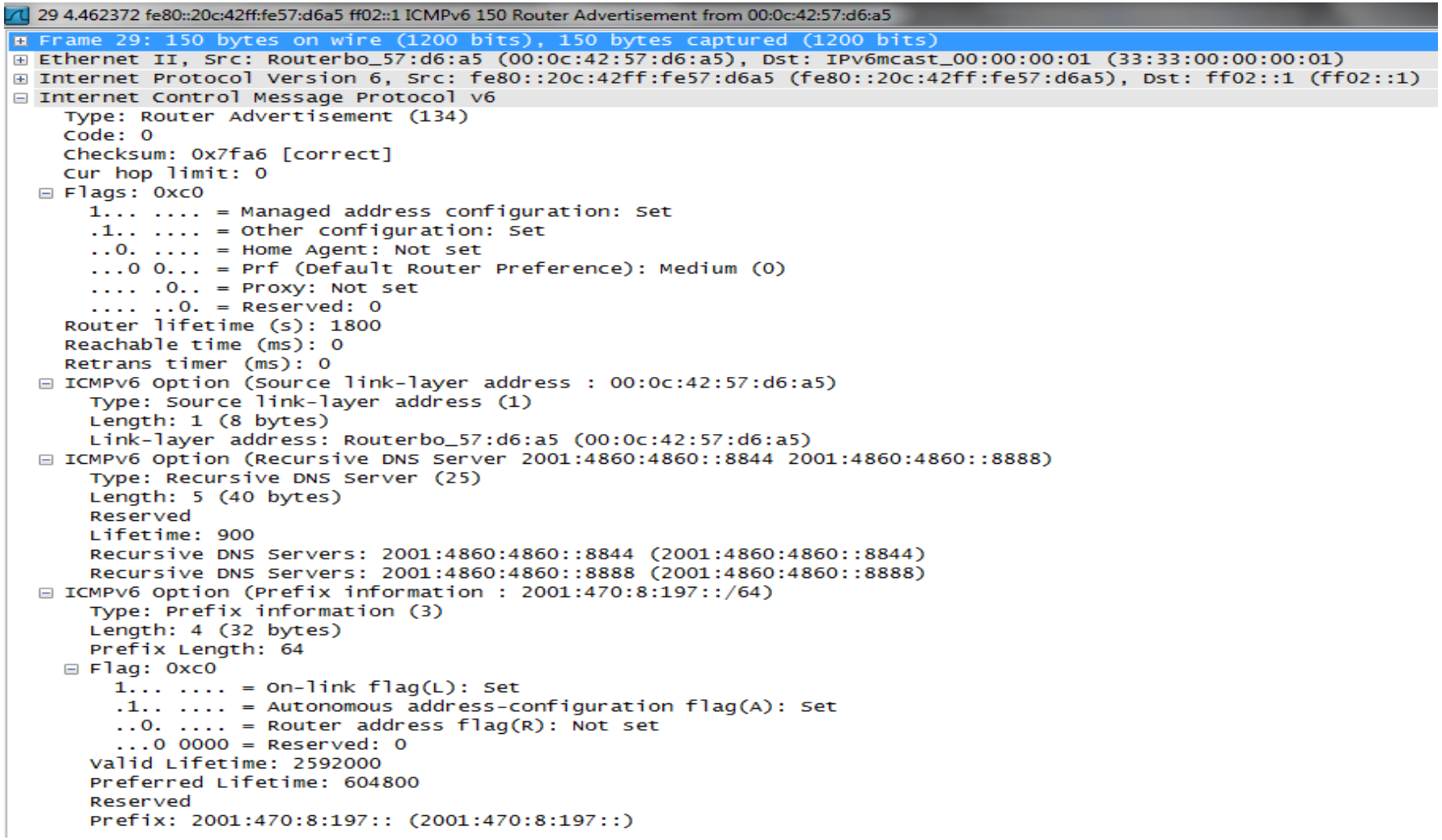
Autoconfiguración Stateless

- Configuración **plug & play para los hosts**
- En la inicialización de la red nodo obtiene:
  - **Prefijo IPv6**
  - **La dirección de la ruta por defecto**
  - **Hop limit**
- La dirección del **DNS normalmente no es entregada**
  - Hay una extensión experimental para ello (RFC5006)
  - Aun no esta disponible en los sistemas operativos

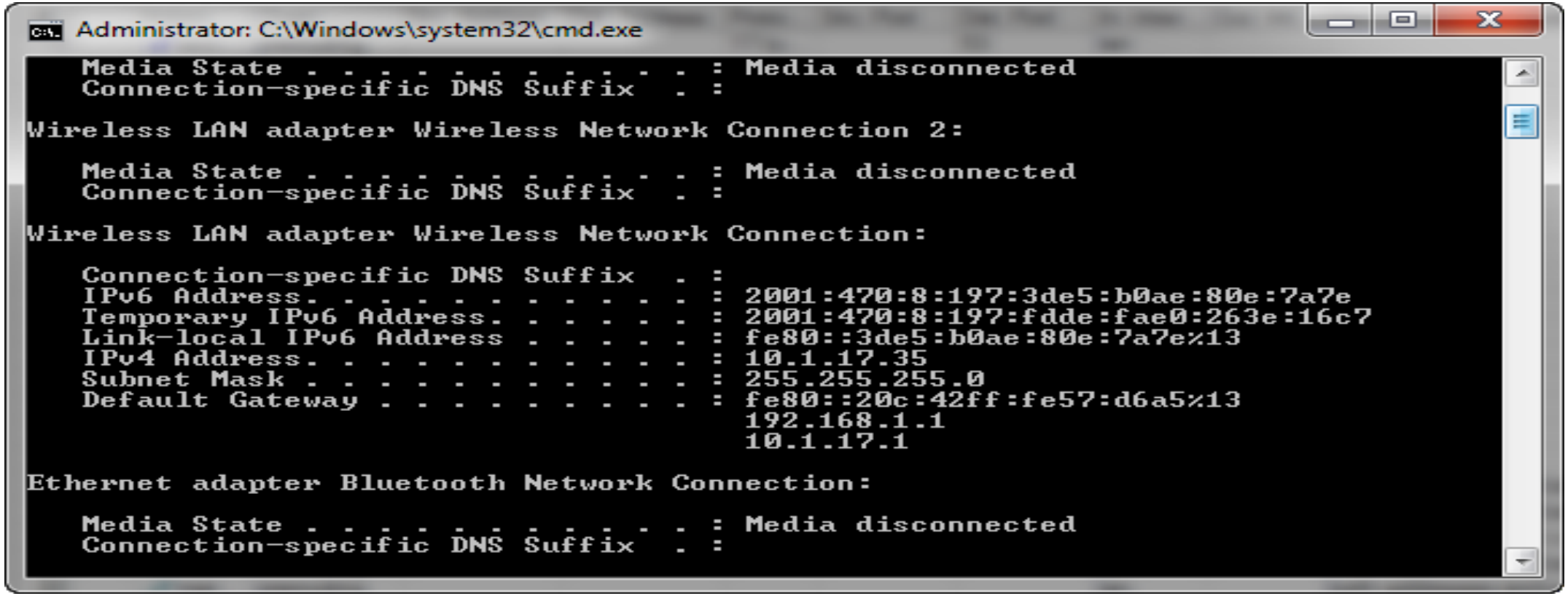
Autoconfiguración Stateless

- IPv6 Stateless Address Autoconfiguration
  - Definido en el RFC 4862
- Los **Hosts escuchan por mensajes Router Advertisement (RA)**
  - Enviados periódicamente por los routers en el link local, o solicitados por el host enviando un mensaje de solicitud
  - **Los mensaje RA proveen información que permiten la configuración automática de los hosts**
- Los Hosts pueden crear direcciones IPv6 Global unicast combinando:
  - Su dirección de interfaz EUI-64 (basada en la MAC) o un ID randomico
  - El prefijo de red (obtenido vía el anuncio del Router)
- **Global Address = Link Prefix + EUI-64 address**

Router Advertisement packet (RA)



Autoconfiguración Stateless



Autoconfiguracion Stateful DHCPv6

- Server
  - Responde a los requerimientos de clientes
  - Opcionalmente provee al cliente con:
    - Una dirección IPv6
    - Otros parámetros de configuración (DNS servers…)
  - Escucha en la siguientes direcciones multicast:
    - All_DHCP_Relay_Agents_and_Servers (FF02::1:2)
    - All_DHCP_Servers (FF05::1:3)
  - Provee medios para asegurar el control de acceso a los recursos de la red
  - Usualmente almacenando el estado de los clientes (el método usual utilizado hoy por IPv4)

COEXISTENCIA Y TRANSICION

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Coexistencia y transición

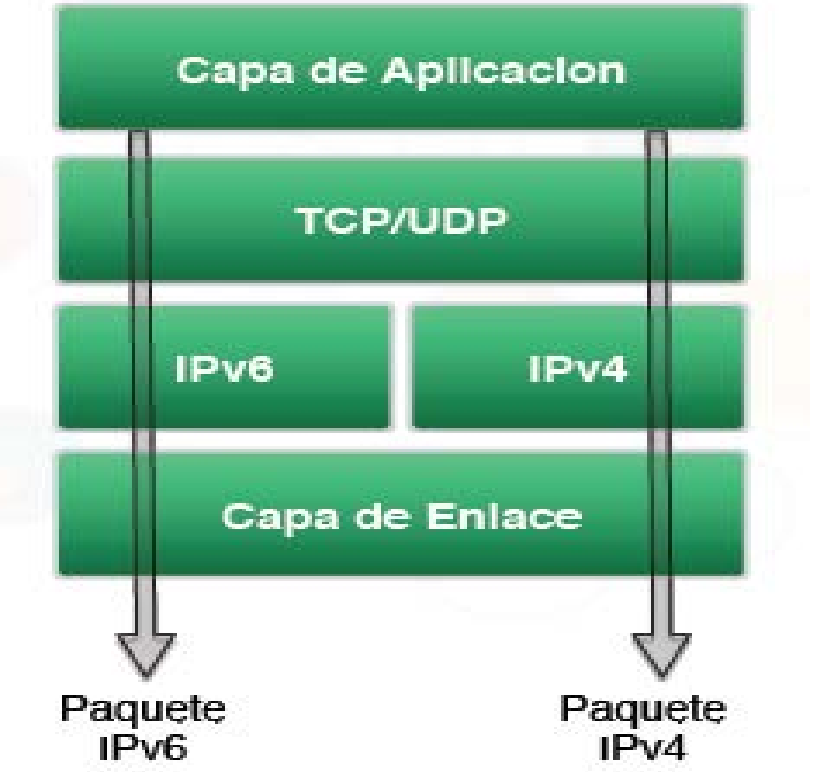
- Toda **la estructura de Internet esta basada en el protocolo IPv4**
- **Un cambio inmediato de protocolo es inviable** debido al tamaño y proporción que posee la red
- **La adopción de IPv6 debe ser realizada de forma gradual**
- Habrá un **periodo de transición y coexistencia** entre los dos protocolos
- Las redes IPv4 necesitaran comunicarse con la redes IPv6 y viceversa
- Para facilitar este proceso, se desarrollaron algunas **técnicas** que buscan **mantener la compatibilidad** de las redes que están desplegadas en IPv4 con el nuevo protocolo IPv6

Técnicas de transición

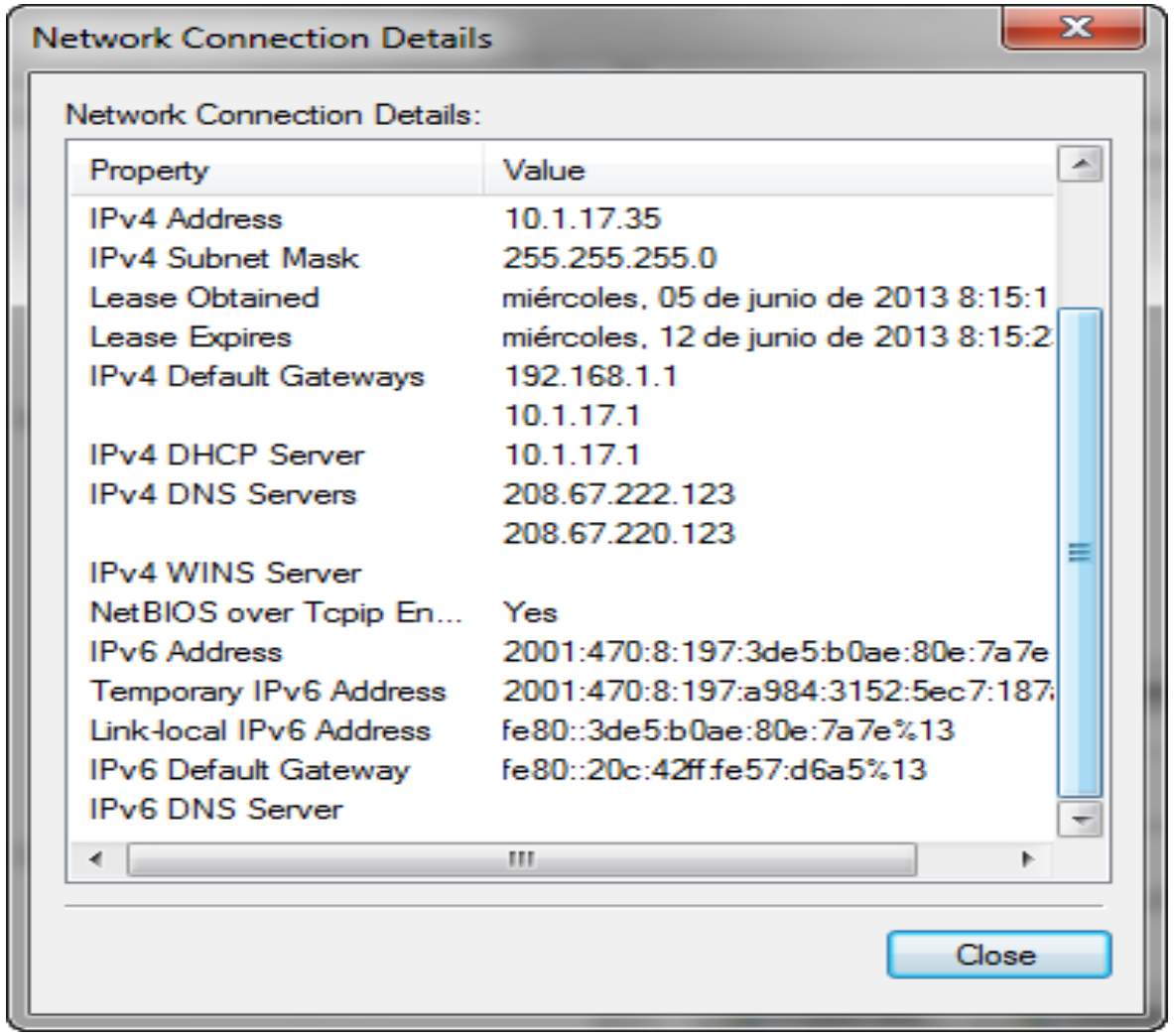
- **Doble pila (dual stack)**
  - Provee soporte a ambos protocolos en el mismo dispositivo
- **Túneles**
  - Permite el trafico de paquetes IPv6 sobre la estructura de la red IPv4 ya existente
- **Traducción**
  - Permite la comunicación entre nodos con soporte IPv6 con los nodos que soportan solamente IPv4

Doble Pila

- Los nodos se tornan **capaces de enviar/recibir paquetes tanto IPv4 como IPv6**
- Un nodo IPv6/IPv4 cuando se comunica con un nodo IPv6, se comporta como un nodo IPv6 y en la comunicación con uno IPv4, como un nodo IPv4
- El nodo precisa al menos una dirección de cada una de las pilas
- Utiliza mecanismos IPv4, como por ejemplo DHCP, para tomar direcciones IPv4, y mecanismos IPv6 para direcciones IPv6

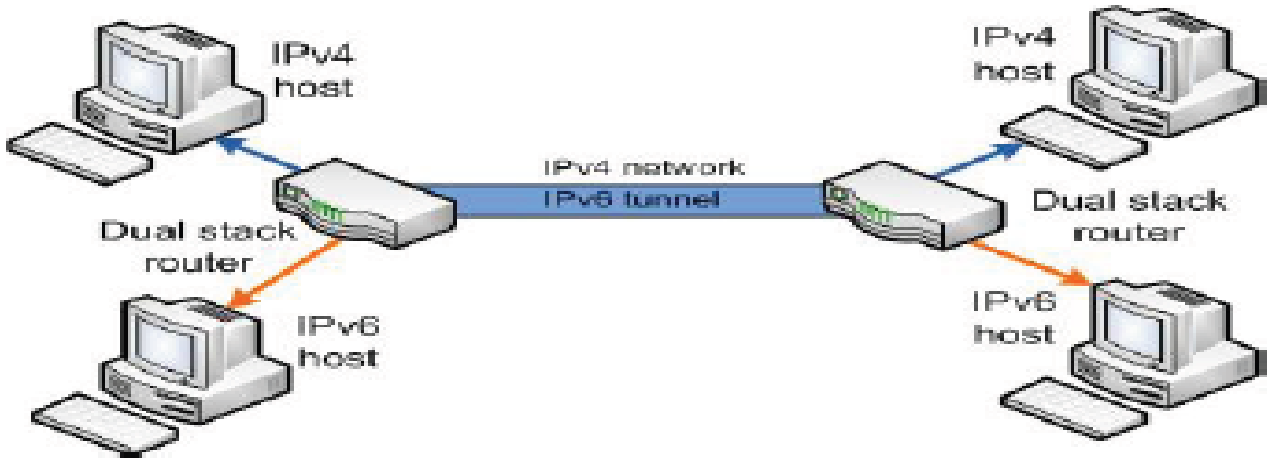


Doble Pila


Network Connection Details
Network Connection Details:
Property
Value
IPv4 Address
10.1.17.35
IPv4 Subnet Mask
255.255.255.0
Lease Obtained
miércoles, 05 de junio de 2013 8:15:1
Lease Expires
miércoles, 12 de junio de 2013 8:15:2
IPv4 Default Gateways
192.168.1.1
10.1.17.1
IPv4 DHCP Server
10.1.17.1
IPv4 DNS Servers
208.67.222.123
208.67.220.123
IPv4 WINS Server
NetBIOS over Tcpip En...
Yes
IPv6 Address
2001:470:8:197:3de5:b0ae:80e:7a7e
Temporary IPv6 Address
2001:470:8:197:a984:3152:5ec7:187
Link-local IPv6 Address
fe80::3de5:b0ae:80e:7a7e%13
IPv6 Default Gateway
fe80::20c:42ff:fe57:d6a5%13
IPv6 DNS Server
Close

Túneles

- El contenido del **paquete IPv6 es encapsulado en un paquete IPv4**
- Puede ser clasificados en los siguientes modos:
  - Router-a-Router
  - Host-a-Router
  - Router-a-Host
  - Host-a-Host

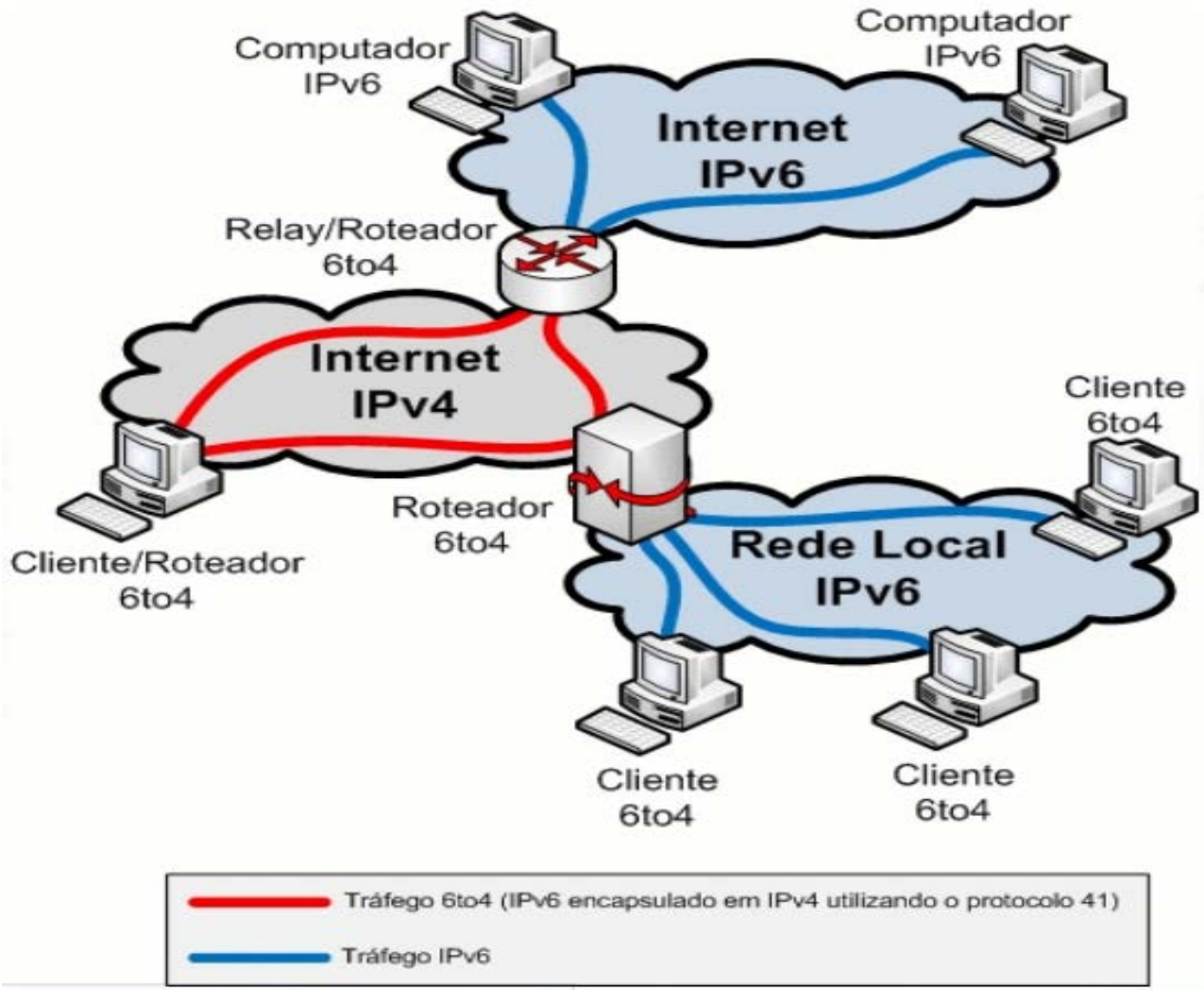


Tipos de túneles

- Existen diferentes formas de encapsulamiento:
  - Paquetes **IPv6 encapsulados en paquetes IPv4**
    - Protocolo 41
    - **6to4**, ISATAP y Tunnel Brokers
  - Paquetes **IPv6 encapsulados en paquetes GRE**
    - Protocolo GRE
  - Paquetes **IPv6 encapsulados en paquetes UDP**
    - TEREDO

6to4

- Proporcionando una **dirección IPv6 única al host**
- Puede ser utilizado con Relays públicos, cuando no hay conectividad v6 nativa.
- Cuando hay conectividad nativa y servicios, debe ser implementada para facilitar la comunicación con clientes 6to4



MIKROTIK IPV6

MikroTik IPv6 support

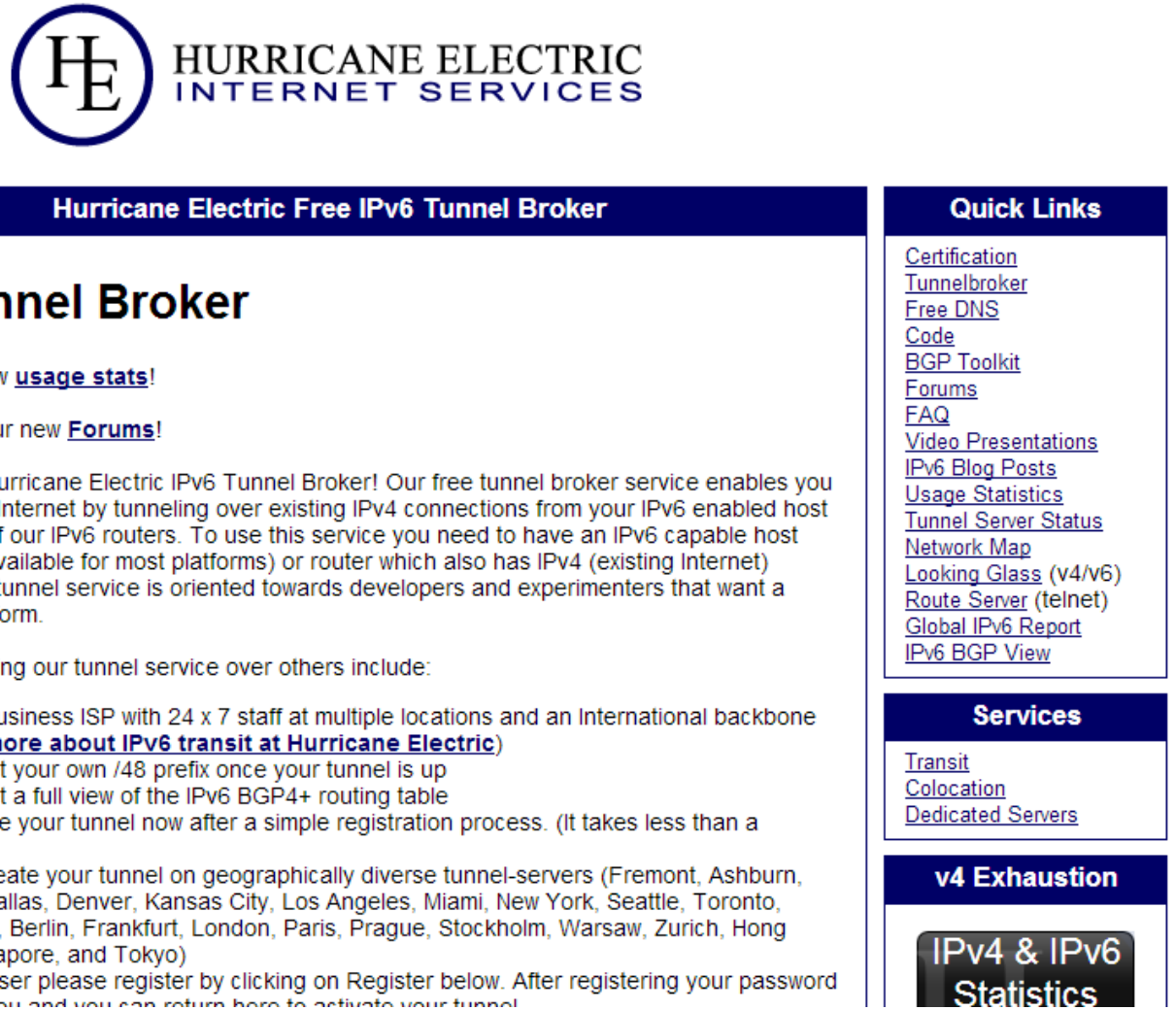
- DHCPv6 prefix delegation for DHCP server.
- DHCPv6-PD client.
- IPv6 Prefix Delegation over PPP interfaces.
- static addressing and routing
- router advertisement daemon (for address autoconfiguration)
- dynamic routing: BGP+, OSPFv3, and RIPng protocols;
- firewall (filter, mangle, address lists, connection table);
- queue tree, simple queue, pcq
- DNS name servers

MikroTik IPv6 support

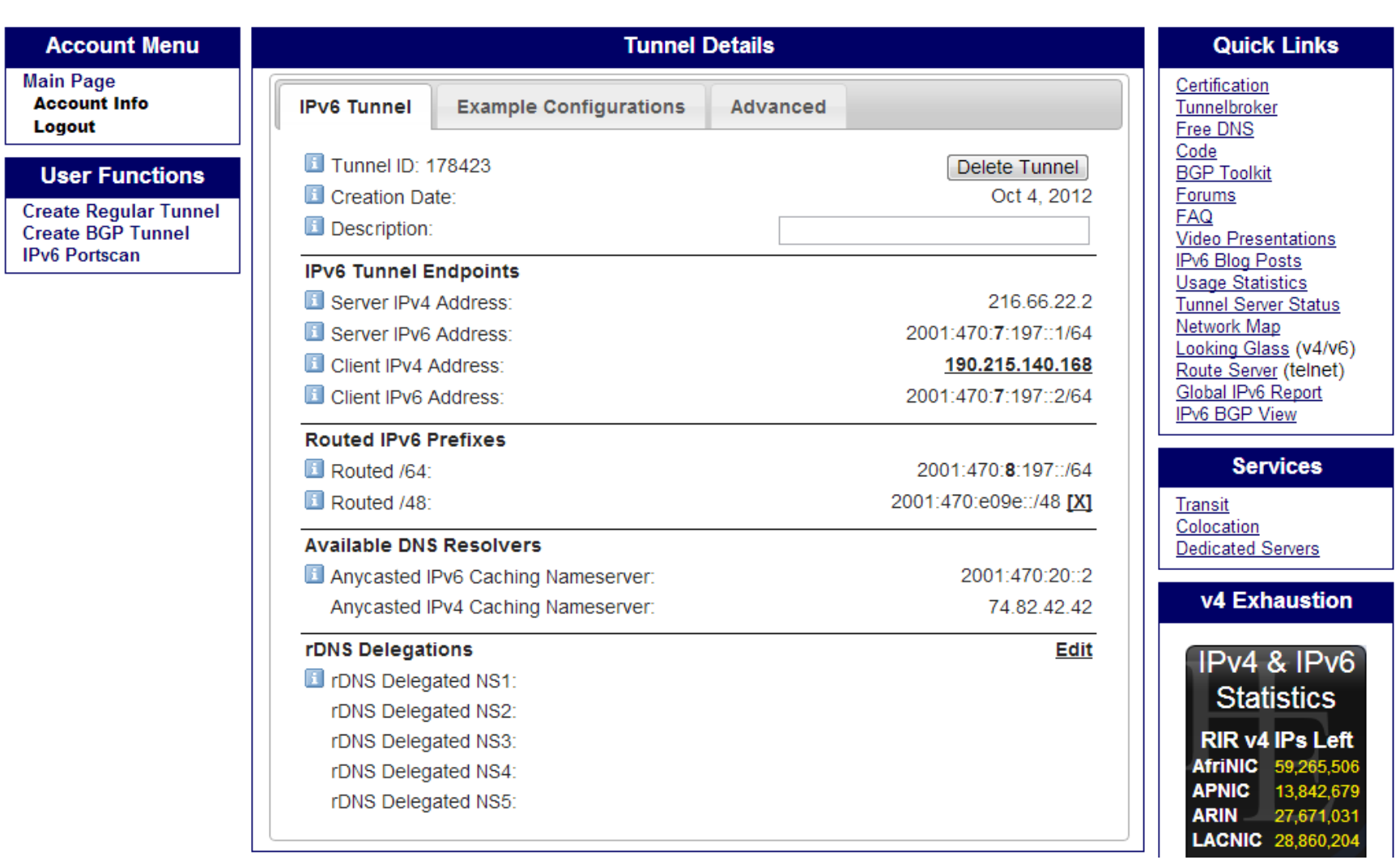
- 6in4 (SIT) tunnels
- EoIPv6, ip/ipv6 over ipv6 (IPIPv6) tunnel interface (starting from v5RC6)
- IPSEC
- VRRPv3
- all PPP (Point-to-point protocols)
- SSH, telnet, FTP, WWW access, Winbox, API
- ping
- traceroute
- web proxy
- sniffer and fetch tools
- IP services and User allowed IPv6 address support
- torch, bandwidth test and other tools

LABORATORIO DUALSTACK

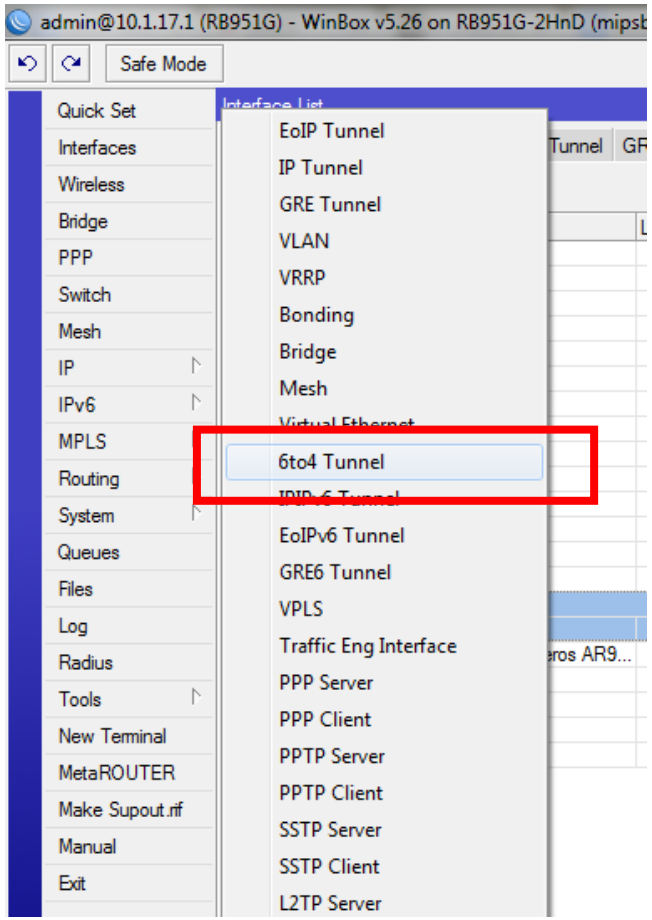
HURRICANE ELECTRIC / TUNNEL BROKER

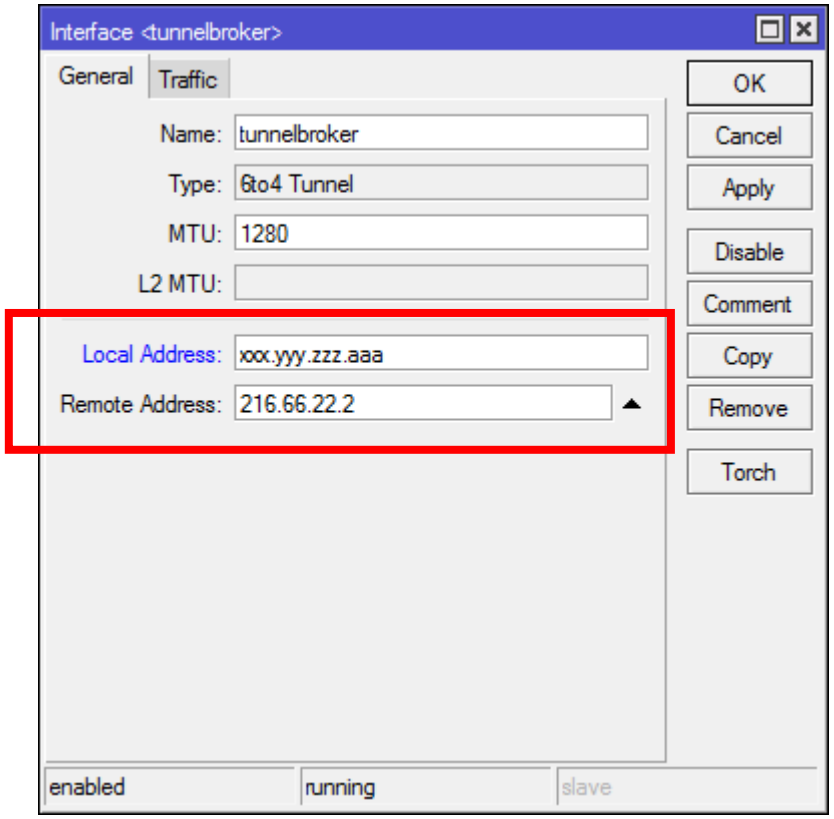


HURRICANE ELECTRIC / TUNNEL BROKER

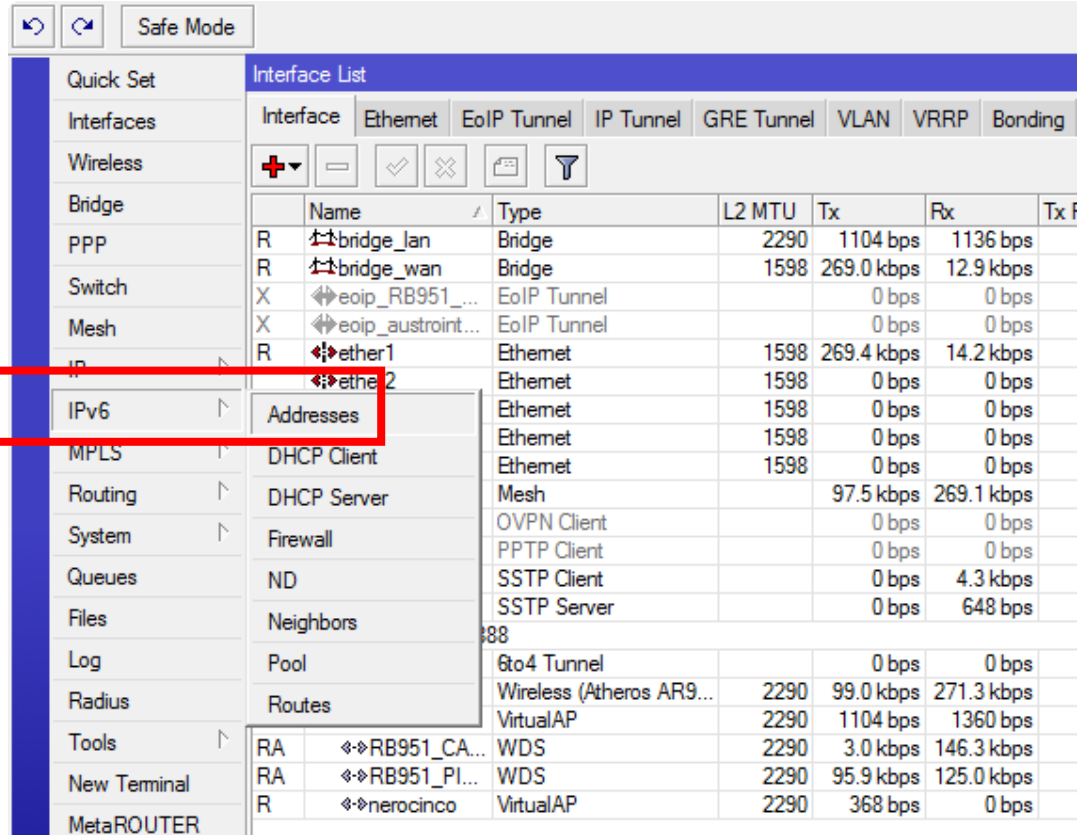


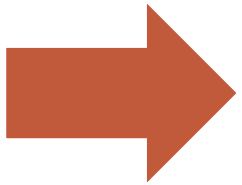
6to4 Tunnel

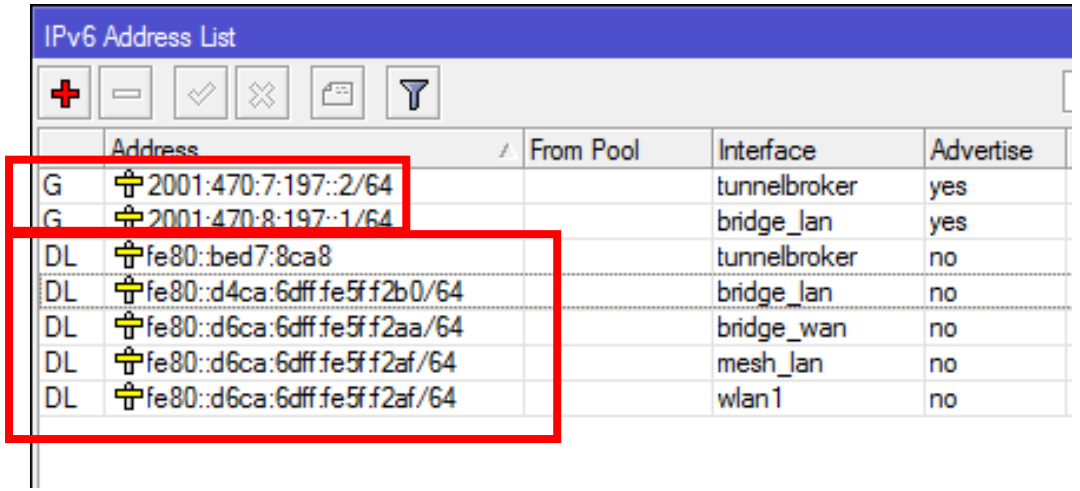

admin@10.1.17.1 (RB951G) - WinBox v5.26 on RB951G-2HnD (mipsb
Safe Mode
Quick Set
Interfaces
Wireless
Bridge
PPP
Switch
Mesh
IP
IPv6
MPLS
Routing
System
Queues
Files
Log
Radius
Tools
New Terminal
MetaROUTER
Make Supout.rif
Manual
Exit
EoIP Tunnel
IP Tunnel
GRE Tunnel
VLAN
VRRP
Bonding
Bridge
Mesh
6to4 Tunnel
EoIPv6 Tunnel
GRE6 Tunnel
VPLS
Traffic Eng Interface
PPP Server
PPP Client
PPTP Server
PPTP Client
SSTP Server
SSTP Client
L2TP Server


Interface <tunnelbroker>
General
Traffic
Name: tunnelbroker
Type: 6to4 Tunnel
MTU: 1280
L2 MTU:
Local Address: xxx.yyy.zzz.aaa
Remote Address: 216.66.22.2
OK
Cancel
Apply
Disable
Comment
Copy
Remove
Torch
enabled
running
slave

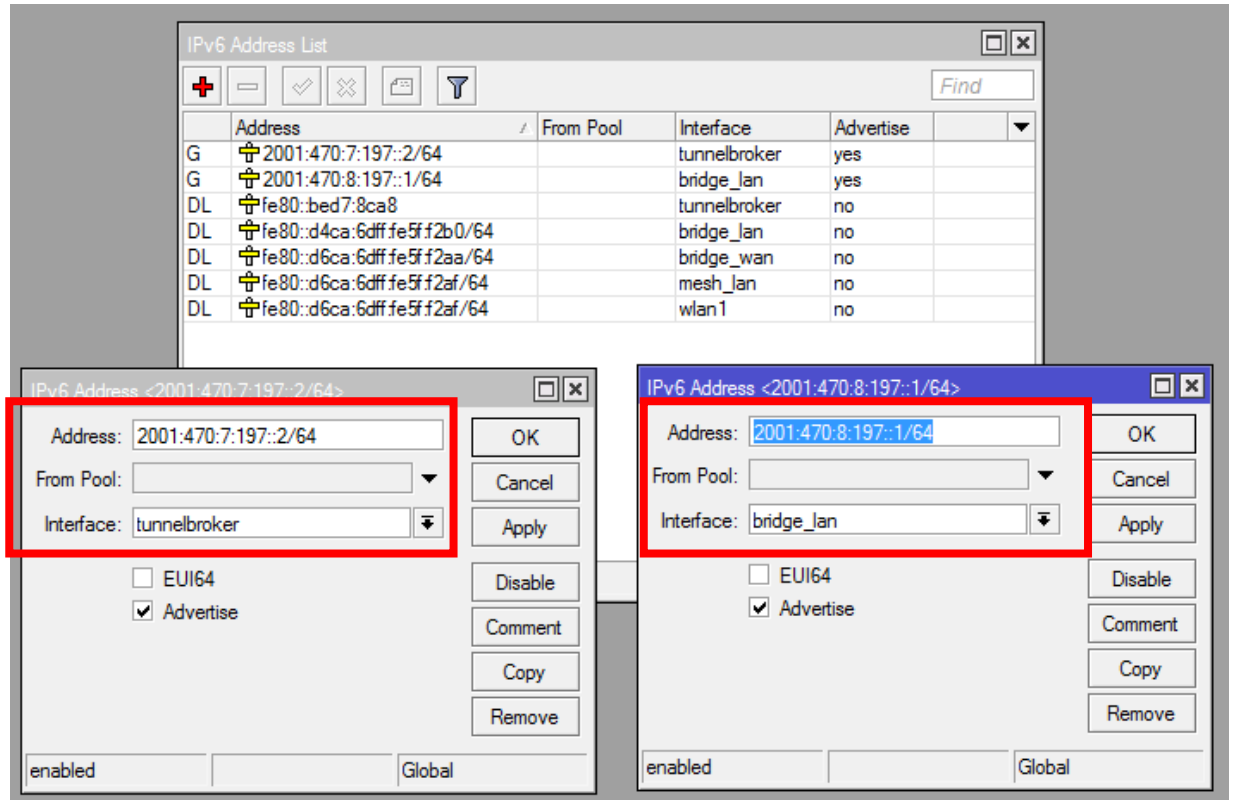
6to4 Tunnel

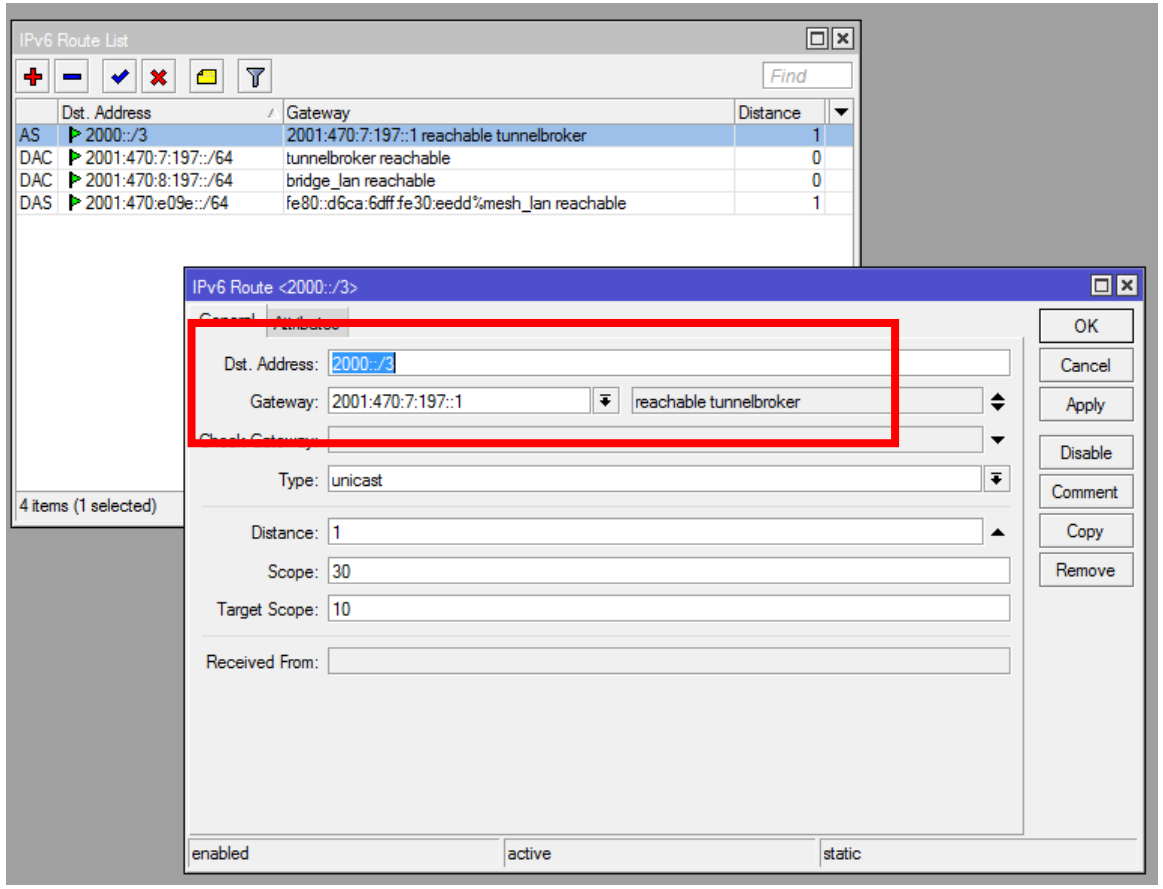

Safe Mode
Quick Set
Interfaces
Wireless
Bridge
PPP
Switch
Mesh
IP
IPv6
MPLS
Routing
System
Queues
Files
Log
Radius
Tools
New Terminal
MetaROUTER
Addresses
DHCP Client
DHCP Server
Firewall
ND
Neighbors
Pool
Routes
Interface List
Interface
Ethernet
EoIP Tunnel
IP Tunnel
GRE Tunnel
VLAN
VRRP
Bonding
Name
Type
L2 MTU
Tx
Rx
R bridge_lan Bridge 2290 1104 bps 1136 bps
R bridge_wan Bridge 1598 269.0 kbps 12.9 kbps
X eoip_RB951_... EoIP Tunnel 0 bps 0 bps
X eoip_austroint... EoIP Tunnel 0 bps 0 bps
R ether1 Ethernet 1598 269.4 kbps 14.2 kbps
ether2 Ethernet 1598 0 bps 0 bps
Ethernet 1598 0 bps 0 bps
Ethernet 1598 0 bps 0 bps
Ethernet 1598 0 bps 0 bps
Mesh 97.5 kbps 269.1 kbps
OVPN Client 0 bps 0 bps
PPTP Client 0 bps 0 bps
SSTP Client 0 bps 4.3 kbps
SSTP Server 0 bps 648 bps
6to4 Tunnel 0 bps 0 bps
Wireless (Atheros AR9... 2290 99.0 kbps 271.3 kbps
VirtualAP 2290 1104 bps 1360 bps
RA RB951_CA... WDS 2290 3.0 kbps 146.3 kbps
RA RB951_PI... WDS 2290 95.9 kbps 125.0 kbps
R nerocinco VirtualAP 2290 368 bps 0 bps



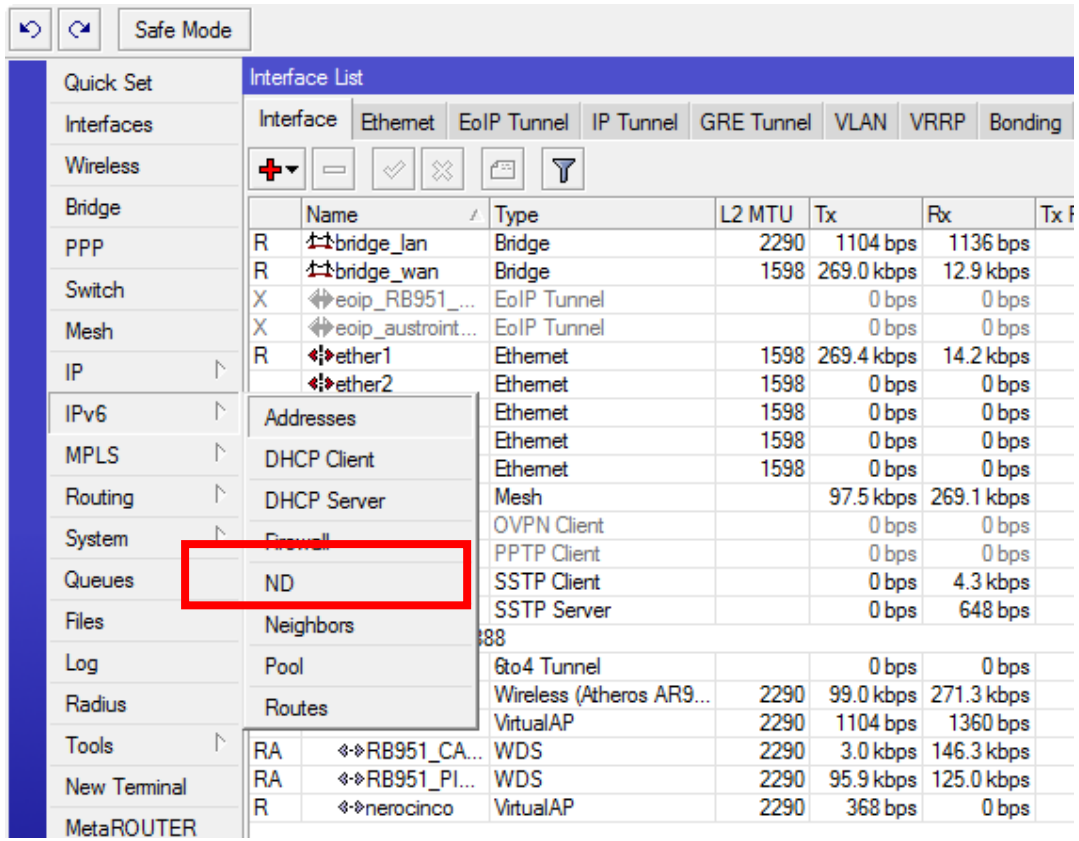

IPv6 Address List
Address
From Pool
Interface
Advertise
G 2001:470:7:197::2/64 tunnelbroker yes
G 2001:470:8:197::1/64 bridge_lan yes
DL fe80::bed7:8ca8 tunnelbroker no
DL fe80::d4ca:6dff:fe5f:f2b0/64 bridge_lan no
DL fe80::d6ca:6dff:fe5f:f2aa/64 bridge_wan no
DL fe80::d6ca:6dff:fe5f:f2af/64 mesh_lan no
DL fe80::d6ca:6dff:fe5f:f2af/64 wlan1 no

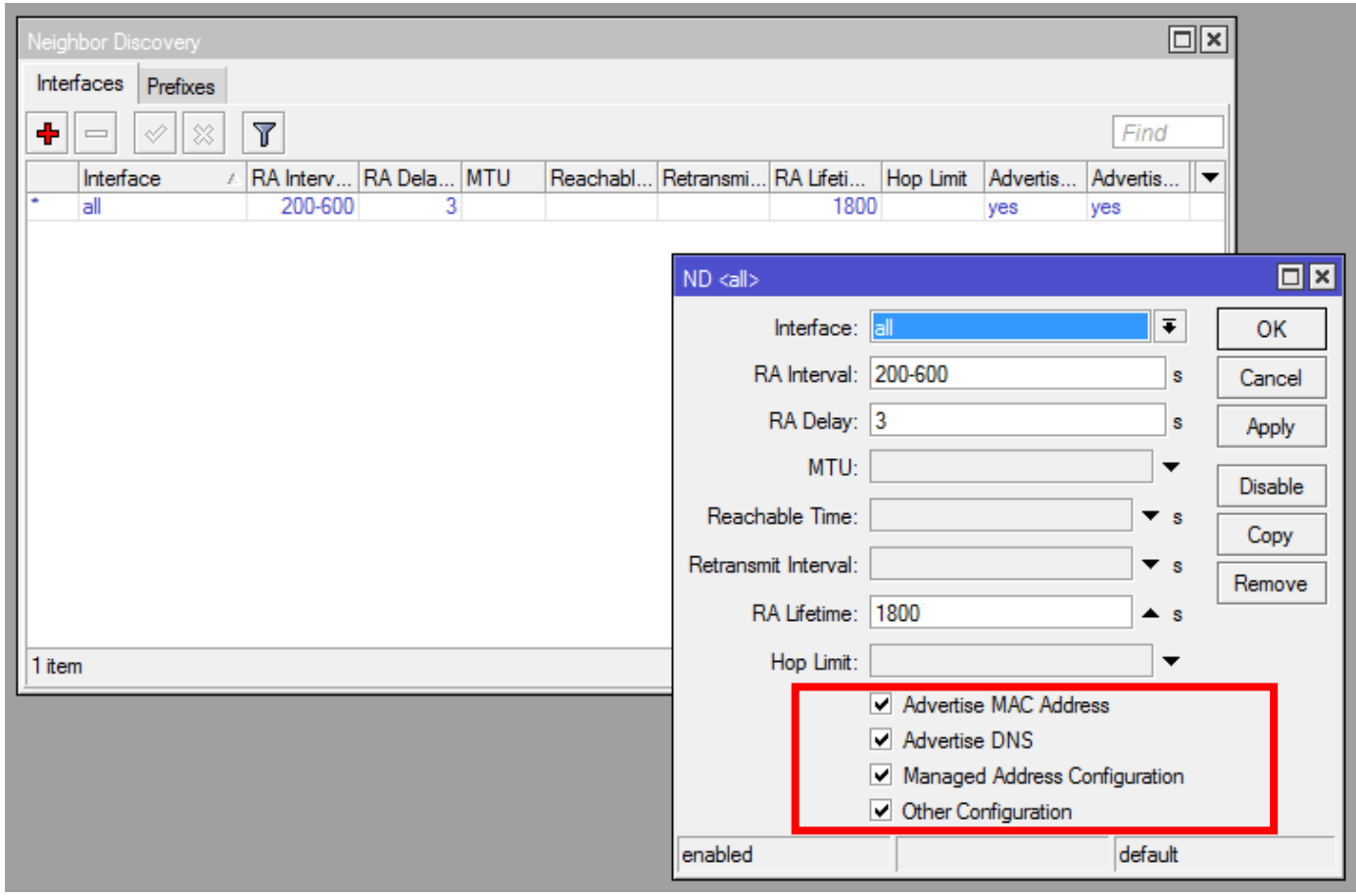
6to4 Tunnel


IPv6 Address List
Find
Address
From Pool
Interface
Advertise
G 2001:470:7:197::2/64 tunnelbroker yes
G 2001:470:8:197::1/64 bridge_lan yes
DL fe80::bed7:8ca8 tunnelbroker no
DL fe80::d4ca:6dff:fe5f:f2b0/64 bridge_lan no
DL fe80::d6ca:6dff:fe5f:f2aa/64 bridge_wan no
DL fe80::d6ca:6dff:fe5f:f2af/64 mesh_lan no
DL fe80::d6ca:6dff:fe5f:f2af/64 wlan1 no
IPv6 Address <2001:470:7:197::2/64>
Address: 2001:470:7:197::2/64
From Pool:
Interface: tunnelbroker
EUI64
Advertise
OK
Cancel
Apply
Disable
Comment
Copy
Remove
enabled
Global
IPv6 Address <2001:470:8:197::1/64>
Address: 2001:470:8:197::1/64
From Pool:
Interface: bridge_lan
EUI64
Advertise
OK
Cancel
Apply
Disable
Comment
Copy
Remove
enabled
Global

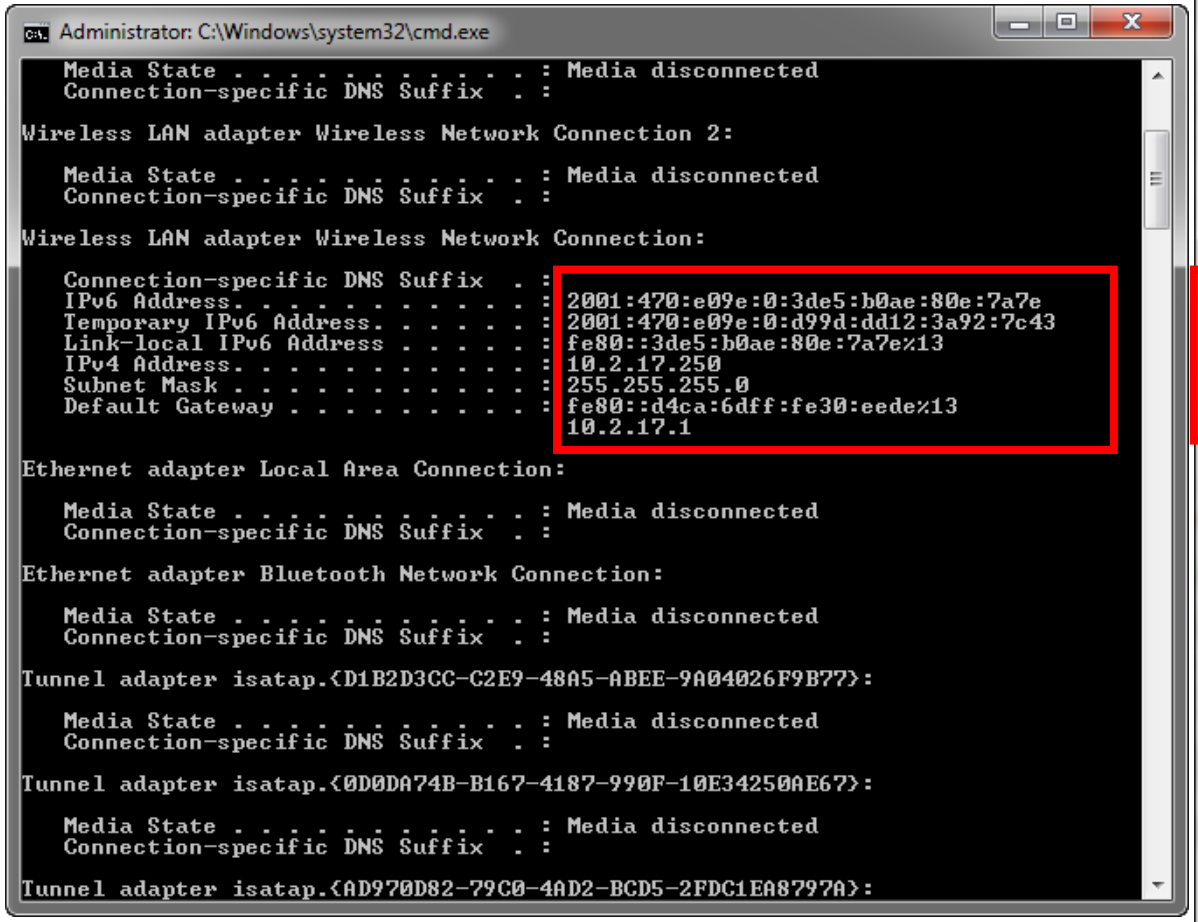

IPv6 Route List
Find
Dst. Address
Gateway
Distance
AS 2000::/3 2001:470:7:197::1 reachable tunnelbroker 1
DAC 2001:470:7:197::/64 tunnelbroker reachable 0
DAC 2001:470:8:197::/64 bridge_lan reachable 0
DAS 2001:470:e09e::/64 fe80::d6ca:6dff:fe30:eedd%mesh_lan reachable 1
4 items (1 selected)
IPv6 Route <2000::/3>
Dst. Address: 2000::/3
Gateway: 2001:470:7:197::1 reachable tunnelbroker
Type: unicast
Distance: 1
Scope: 30
Target Scope: 10
Received From:
OK
Cancel
Apply
Disable
Comment
Copy
Remove
enabled
active
static

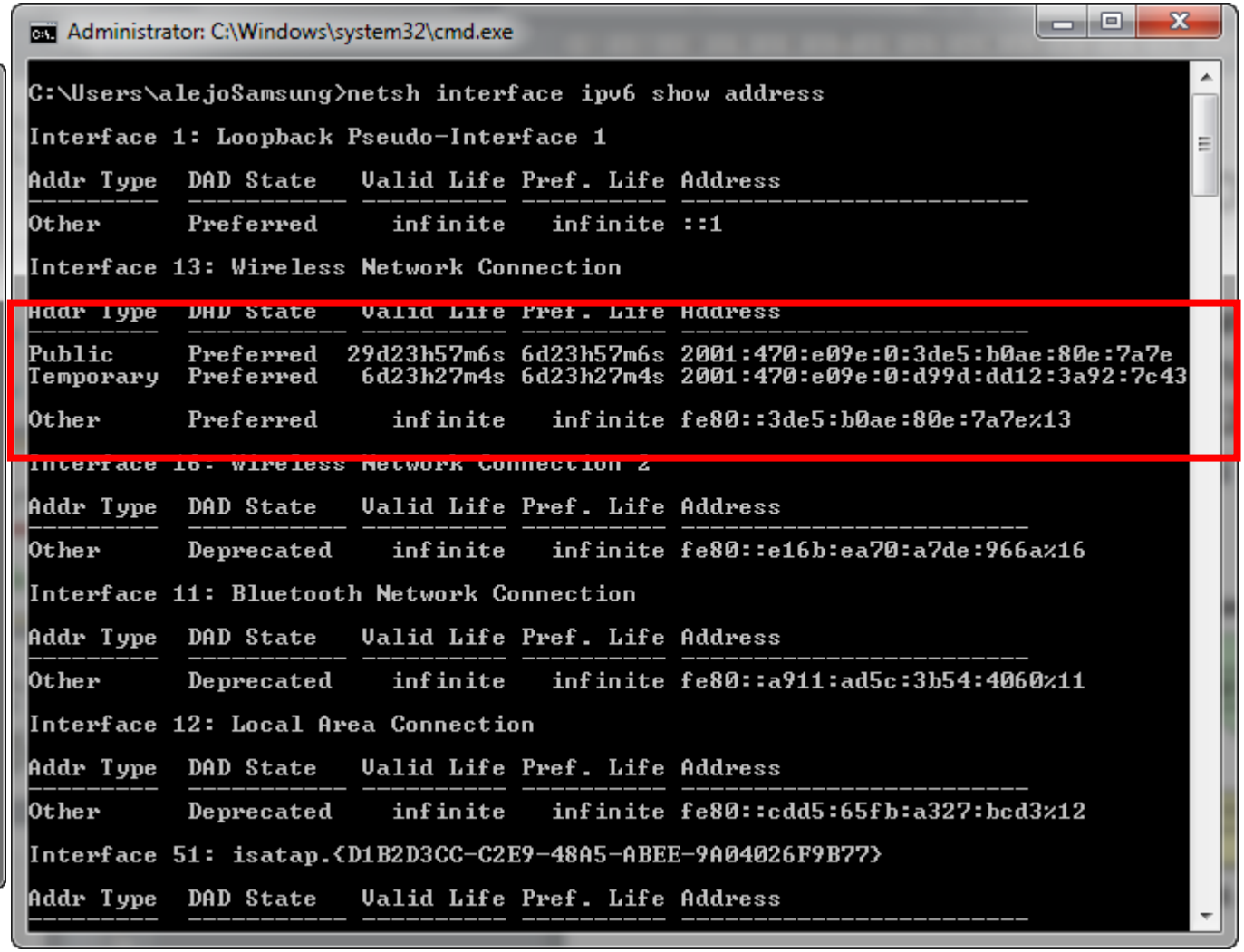
6to4 Tunnel


Safe Mode
Quick Set
Interfaces
Wireless
Bridge
PPP
Switch
Mesh
IP
IPv6
MPLS
Routing
System
Queues
Files
Log
Radius
Tools
New Terminal
MetaROUTER
Interface List
Interface
Ethernet
EoIP Tunnel
IP Tunnel
GRE Tunnel
VLAN
VRRP
Bonding
Name
Type
L2 MTU
Tx
Rx
R bridge_lan Bridge 2290 1104 bps 1136 bps
R bridge_wan Bridge 1598 269.0 kbps 12.9 kbps
X eoip_RB951_... EoIP Tunnel 0 bps 0 bps
X eoip_austroint... EoIP Tunnel 0 bps 0 bps
R ether1 Ethernet 1598 269.4 kbps 14.2 kbps
ether2 Ethernet 1598 0 bps 0 bps
Ethernet 1598 0 bps 0 bps
Ethernet 1598 0 bps 0 bps
Ethernet 1598 0 bps 0 bps
Mesh 97.5 kbps 269.1 kbps
OVPN Client 0 bps 0 bps
PPTP Client 0 bps 0 bps
SSTP Client 0 bps 4.3 kbps
SSTP Server 0 bps 648 bps
6to4 Tunnel 0 bps 0 bps
Wireless (Atheros AR9... 2290 99.0 kbps 271.3 kbps
VirtualAP 2290 1104 bps 1360 bps
RA RB951_CA... WDS 2290 3.0 kbps 146.3 kbps
RA RB951_PI... WDS 2290 95.9 kbps 125.0 kbps
R nerocinco VirtualAP 2290 368 bps 0 bps
Addresses
DHCP Client
DHCP Server
Firewall
ND
Neighbors
Pool
Routes

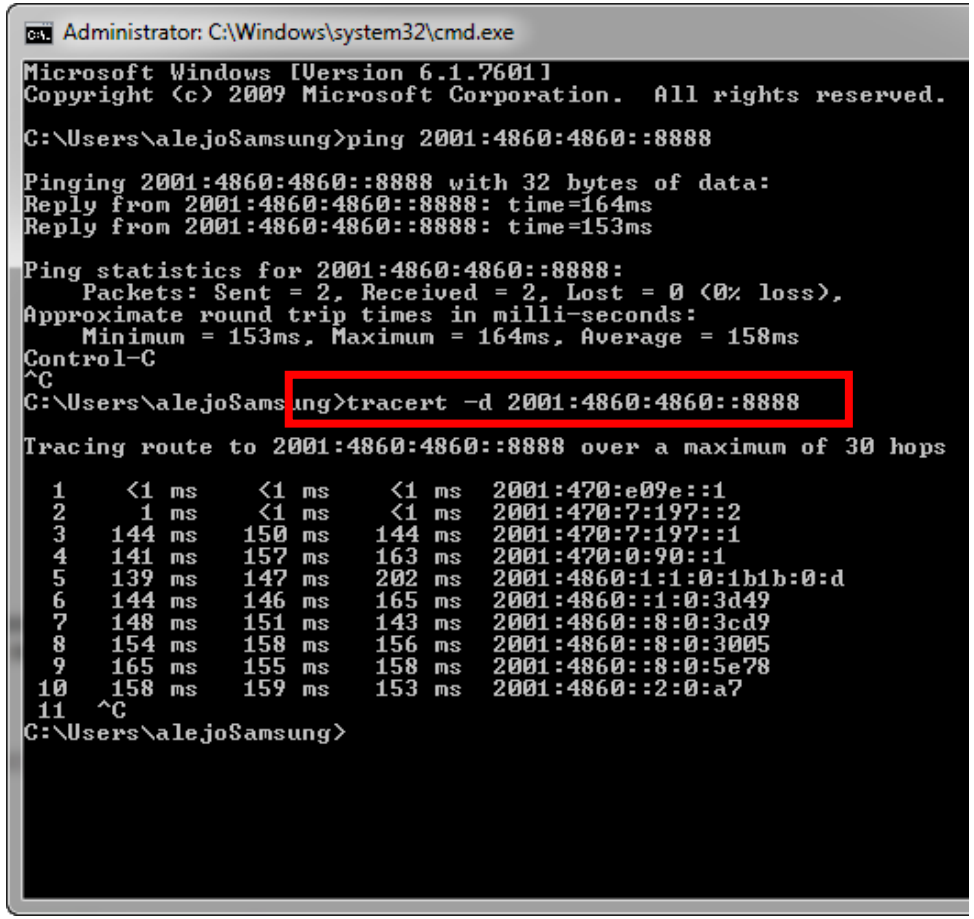

Neighbor Discovery
Interfaces
Prefixes
Find
Interface
RA Interv...
RA Dela...
MTU
Reachabl...
Retransmi...
RA Lifeti...
Hop Limit
Advertis...
Advertis...
all 200-600 3 1800 yes yes
1 item
ND <all>
Interface: all
RA Interval: 200-600 s
RA Delay: 3 s
MTU:
Reachable Time: s
Retransmit Interval: s
RA Lifetime: 1800 s
Hop Limit:
Advertise MAC Address
Advertise DNS
Managed Address Configuration
Other Configuration
OK
Cancel
Apply
Disable
Copy
Remove
enabled
default

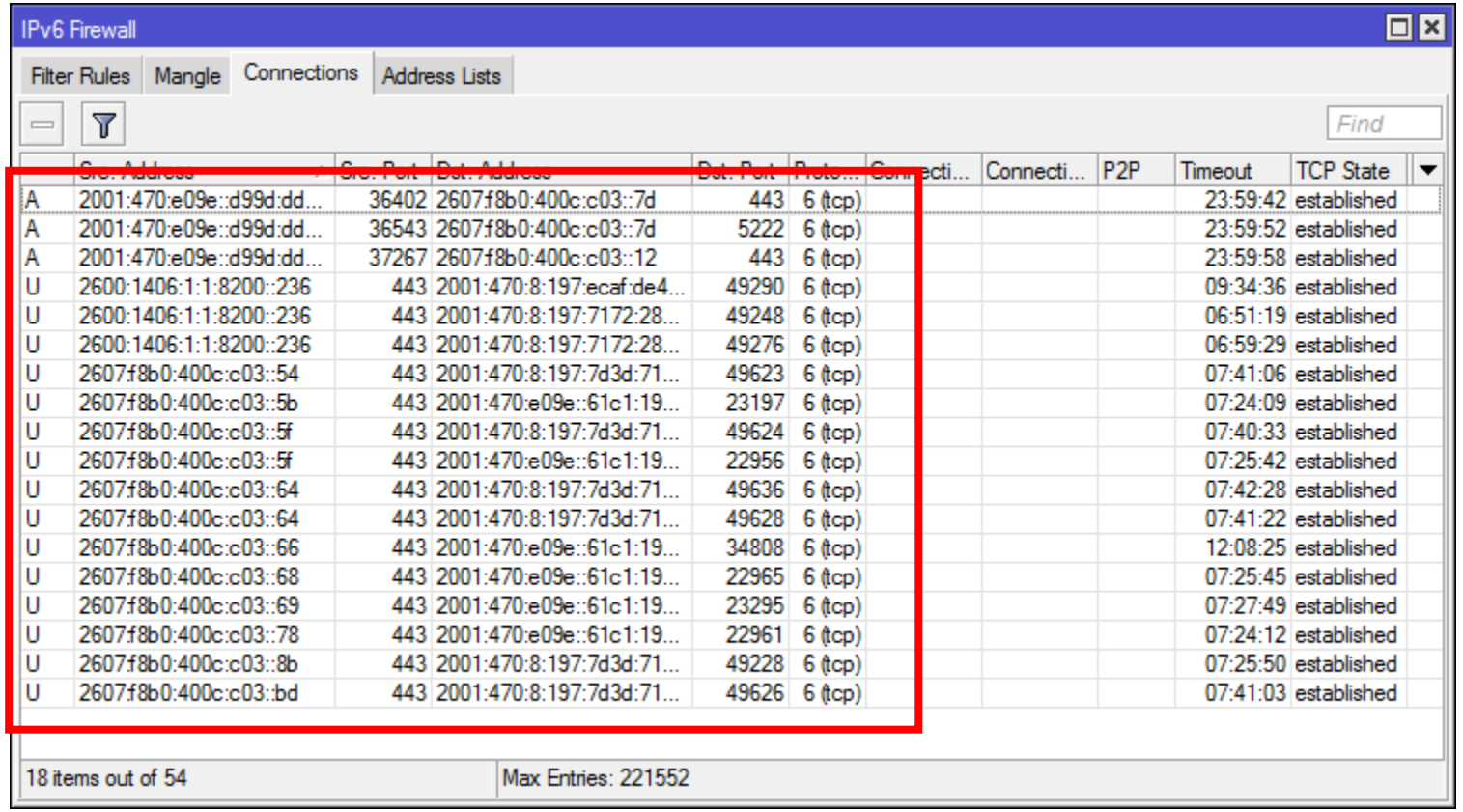
6to4 Tunnel


Administrator: C:\Windows\system32\cmd.exe
Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . :
Wireless LAN adapter Wireless Network Connection 2:
Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . :
Wireless LAN adapter Wireless Network Connection:
Connection-specific DNS Suffix . :
IPv6 Address. . . . . : 2001:470:e09e:0:3de5:b0ae:80e:7a7e
Temporary IPv6 Address. . . . . : 2001:470:e09e:0:d99d:dd12:3a92:7c43
Link-local IPv6 Address . . . . . : fe80::3de5:b0ae:80e:7a7e%13
IPv4 Address. . . . . : 10.2.17.250
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : fe80::d4ca:6dff:fe30:eede%13
10.2.17.1
Ethernet adapter Local Area Connection:
Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . :
Ethernet adapter Bluetooth Network Connection:
Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . :
Tunnel adapter isatap.{D1B2D3CC-C2E9-48A5-ABEE-9A04026F9B77}:
Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . :
Tunnel adapter isatap.{0D0DA74B-B167-4187-990F-10E34250AE67}:
Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . :
Tunnel adapter isatap.{AD970D82-79C0-4AD2-BCD5-2FDC1EA8797A}:

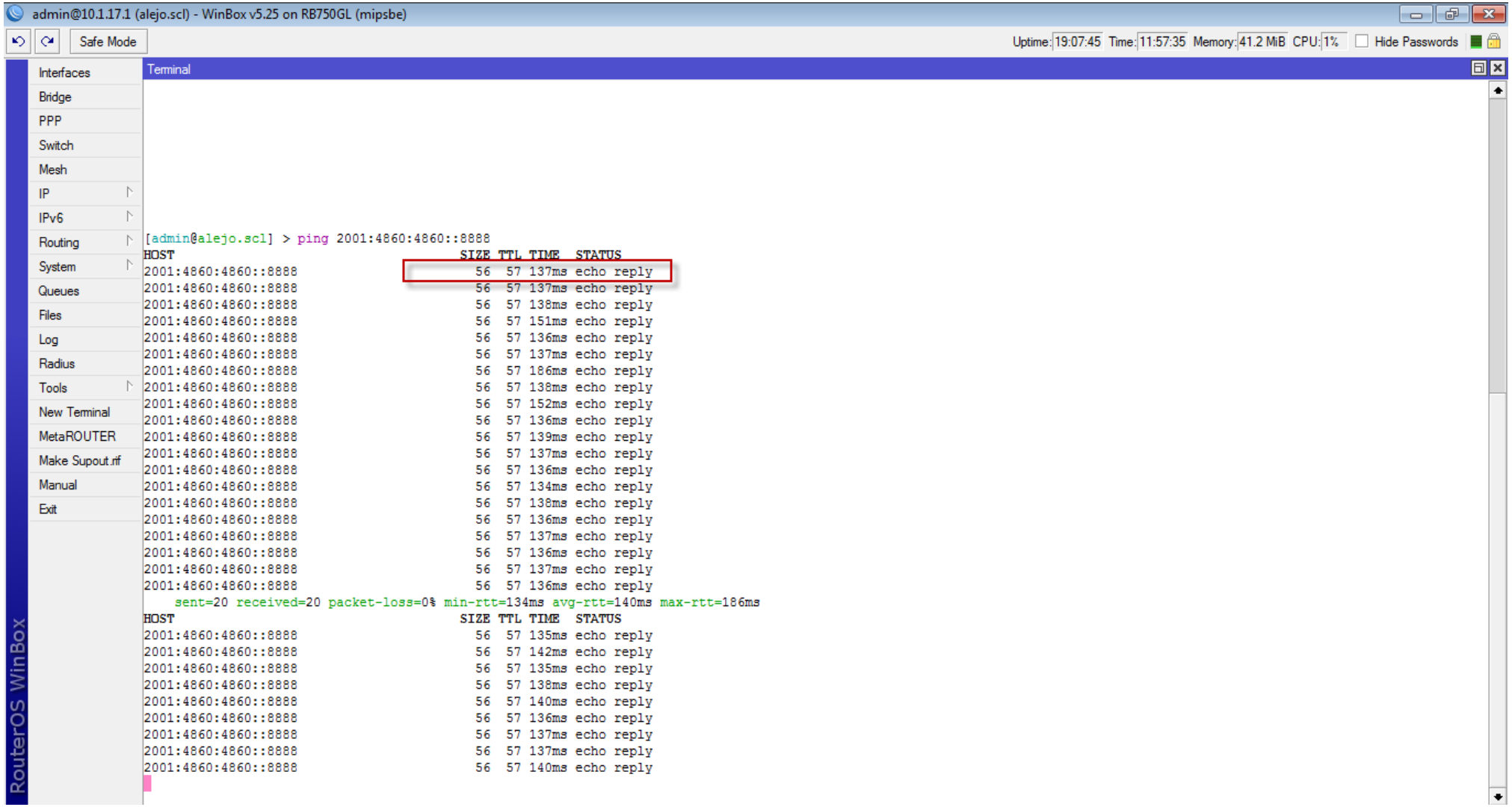

Administrator: C:\Windows\system32\cmd.exe
C:\Users\alejoSamsung>netsh interface ipv6 show address
Interface 1: Loopback Pseudo-Interface 1
Addr Type DAD State Valid Life Pref. Life Address
Other Preferred infinite infinite ::1
Interface 13: Wireless Network Connection
Addr Type DAD State Valid Life Pref. Life Address
Public Preferred 29d23h57m6s 6d23h57m6s 2001:470:e09e:0:3de5:b0ae:80e:7a7e
Temporary Preferred 6d23h27m4s 6d23h27m4s 2001:470:e09e:0:d99d:dd12:3a92:7c43
Other Preferred infinite infinite fe80::3de5:b0ae:80e:7a7e%13
Addr Type DAD State Valid Life Pref. Life Address
Other Deprecated infinite infinite fe80::e16b:ea70:a7de:966a%16
Interface 11: Bluetooth Network Connection
Addr Type DAD State Valid Life Pref. Life Address
Other Deprecated infinite infinite fe80::a911:ad5c:3b54:4060%11
Interface 12: Local Area Connection
Addr Type DAD State Valid Life Pref. Life Address
Other Deprecated infinite infinite fe80::cdd5:65fb:a327:bcd3%12
Interface 51: isatap.{D1B2D3CC-C2E9-48A5-ABEE-9A04026F9B77}
Addr Type DAD State Valid Life Pref. Life Address

6to4 Tunnel

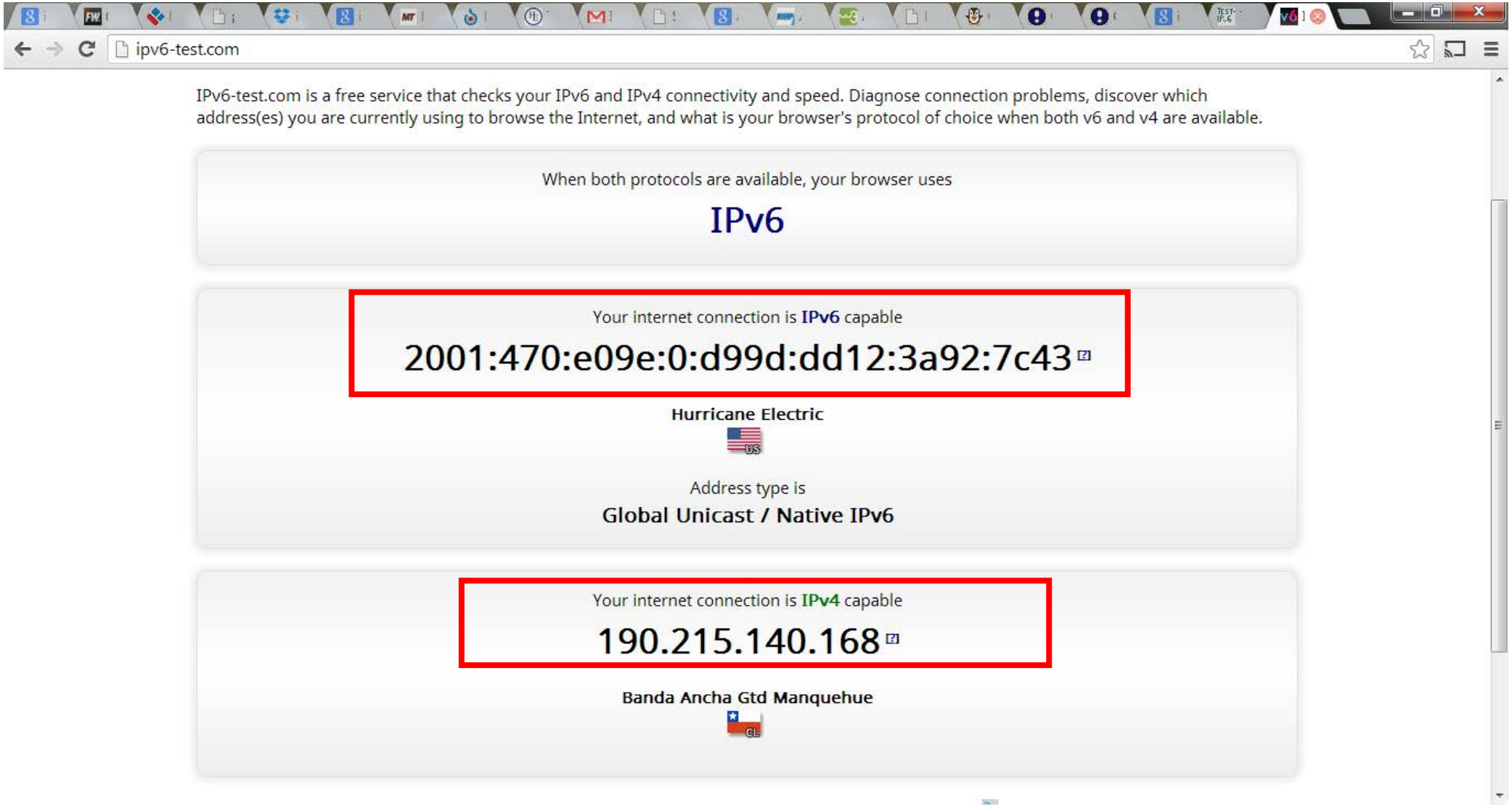

Administrator: C:\Windows\system32\cmd.exe
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation. All rights reserved.
C:\Users\alejoSamsung>ping 2001:4860:4860::8888
Pinging 2001:4860:4860::8888 with 32 bytes of data:
Reply from 2001:4860:4860::8888: time=164ms
Reply from 2001:4860:4860::8888: time=153ms
Ping statistics for 2001:4860:4860::8888:
Packets: Sent = 2, Received = 2, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 153ms, Maximum = 164ms, Average = 158ms
Control-C
^C
C:\Users\alejoSamsung>tracert -d 2001:4860:4860::8888
Tracing route to 2001:4860:4860::8888 over a maximum of 30 hops
1 <1 ms <1 ms <1 ms 2001:470:e09e::1
2 1 ms <1 ms <1 ms 2001:470:7:197::2
3 144 ms 150 ms 144 ms 2001:470:7:197::1
4 141 ms 157 ms 163 ms 2001:470:0:90::1
5 139 ms 147 ms 202 ms 2001:4860:1:1:0:1b1b:0:d
6 144 ms 146 ms 165 ms 2001:4860::1:0:3d49
7 148 ms 151 ms 143 ms 2001:4860::8:0:3cd9
8 154 ms 158 ms 156 ms 2001:4860::8:0:3005
9 165 ms 155 ms 158 ms 2001:4860::8:0:5e78
10 158 ms 159 ms 153 ms 2001:4860::2:0:a7
11 ^C
C:\Users\alejoSamsung>


IPv6 Firewall
Filter Rules
Mangle
Connections
Address Lists
Find
Src. Address
Src. Port
Dst. Address
Dst. Port
Proto...
Connecti...
Connecti...
P2P
Timeout
TCP State
A 2001:470:e09e::d99d:dd... 36402 2607f8b0:400c:c03::7d 443 6 (tcp) 23:59:42 established
A 2001:470:e09e::d99d:dd... 36543 2607f8b0:400c:c03::7d 5222 6 (tcp) 23:59:52 established
A 2001:470:e09e::d99d:dd... 37267 2607f8b0:400c:c03::12 443 6 (tcp) 23:59:58 established
U 2600:1406:1:1:8200::236 443 2001:470:8:197:ecaf:de4... 49290 6 (tcp) 09:34:36 established
U 2600:1406:1:1:8200::236 443 2001:470:8:197:7172:28... 49248 6 (tcp) 06:51:19 established
U 2600:1406:1:1:8200::236 443 2001:470:8:197:7172:28... 49276 6 (tcp) 06:59:29 established
U 2607f8b0:400c:c03::54 443 2001:470:8:197:7d3d:71... 49623 6 (tcp) 07:41:06 established
U 2607f8b0:400c:c03::5b 443 2001:470:e09e::61c1:19... 23197 6 (tcp) 07:24:09 established
U 2607f8b0:400c:c03::5f 443 2001:470:8:197:7d3d:71... 49624 6 (tcp) 07:40:33 established
U 2607f8b0:400c:c03::5f 443 2001:470:e09e::61c1:19... 22956 6 (tcp) 07:25:42 established
U 2607f8b0:400c:c03::64 443 2001:470:8:197:7d3d:71... 49636 6 (tcp) 07:42:28 established
U 2607f8b0:400c:c03::64 443 2001:470:8:197:7d3d:71... 49628 6 (tcp) 07:41:22 established
U 2607f8b0:400c:c03::66 443 2001:470:e09e::61c1:19... 34808 6 (tcp) 12:08:25 established
U 2607f8b0:400c:c03::68 443 2001:470:e09e::61c1:19... 22965 6 (tcp) 07:25:45 established
U 2607f8b0:400c:c03::69 443 2001:470:e09e::61c1:19... 23295 6 (tcp) 07:27:49 established
U 2607f8b0:400c:c03::78 443 2001:470:e09e::61c1:19... 22961 6 (tcp) 07:24:12 established
U 2607f8b0:400c:c03::8b 443 2001:470:8:197:7d3d:71... 49228 6 (tcp) 07:25:50 established
U 2607f8b0:400c:c03::bd 443 2001:470:8:197:7d3d:71... 49626 6 (tcp) 07:41:03 established
18 items out of 54
Max Entries: 221552

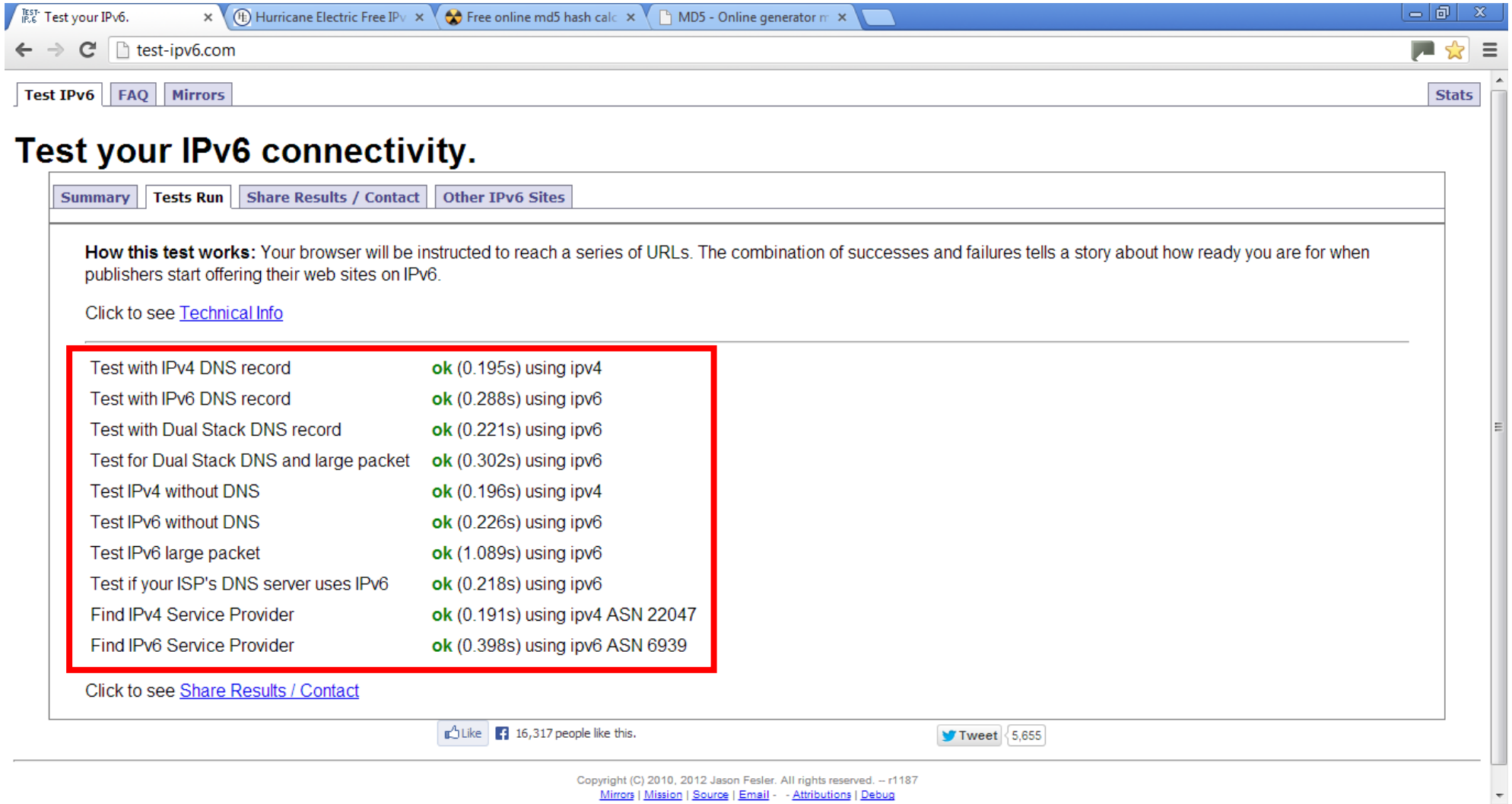
6to4 Tunnel


admin@10.1.17.1 (alejo.scl) - WinBox v5.25 on RB750GL (mipsbe)
Safe Mode
Uptime: 19:07:45 Time: 11:57:35 Memory: 41.2 MiB CPU: 1% Hide Passwords
Interfaces
Bridge
PPP
Switch
Mesh
IP
IPv6
Routing
System
Queues
Files
Log
Radius
Tools
New Terminal
MetaROUTER
Make Supout.rif
Manual
Exit
RouterOS WinBox
Terminal
[admin@alejo.scl] > ping 2001:4860:4860::8888
HOST SIZE TTL TIME STATUS
2001:4860:4860::8888 56 57 137ms echo reply
2001:4860:4860::8888 56 57 137ms echo reply
2001:4860:4860::8888 56 57 138ms echo reply
2001:4860:4860::8888 56 57 151ms echo reply
2001:4860:4860::8888 56 57 136ms echo reply
2001:4860:4860::8888 56 57 137ms echo reply
2001:4860:4860::8888 56 57 186ms echo reply
2001:4860:4860::8888 56 57 138ms echo reply
2001:4860:4860::8888 56 57 152ms echo reply
2001:4860:4860::8888 56 57 136ms echo reply
2001:4860:4860::8888 56 57 139ms echo reply
2001:4860:4860::8888 56 57 137ms echo reply
2001:4860:4860::8888 56 57 136ms echo reply
2001:4860:4860::8888 56 57 134ms echo reply
2001:4860:4860::8888 56 57 138ms echo reply
2001:4860:4860::8888 56 57 136ms echo reply
2001:4860:4860::8888 56 57 137ms echo reply
2001:4860:4860::8888 56 57 136ms echo reply
2001:4860:4860::8888 56 57 137ms echo reply
2001:4860:4860::8888 56 57 136ms echo reply
sent=20 received=20 packet-loss=0% min-rtt=134ms avg-rtt=140ms max-rtt=186ms
HOST SIZE TTL TIME STATUS
2001:4860:4860::8888 56 57 135ms echo reply
2001:4860:4860::8888 56 57 142ms echo reply
2001:4860:4860::8888 56 57 135ms echo reply
2001:4860:4860::8888 56 57 138ms echo reply
2001:4860:4860::8888 56 57 140ms echo reply
2001:4860:4860::8888 56 57 136ms echo reply
2001:4860:4860::8888 56 57 137ms echo reply
2001:4860:4860::8888 56 57 137ms echo reply
2001:4860:4860::8888 56 57 140ms echo reply

6to4 Tunnel


ipv6-test.com
IPv6-test.com is a free service that checks your IPv6 and IPv4 connectivity and speed. Diagnose connection problems, discover which address(es) you are currently using to browse the Internet, and what is your browser's protocol of choice when both v6 and v4 are available.
When both protocols are available, your browser uses
IPv6
Your internet connection is IPv6 capable
2001:470:e09e:0:d99d:dd12:3a92:7c43
Hurricane Electric
US
Address type is
Global Unicast / Native IPv6
Your internet connection is IPv4 capable
190.215.140.168
Banda Ancha Gtd Manquehue
CL

6to4 Tunnel


Test your IPv6.
Hurricane Electric Free IPv
Free online md5 hash calc
MD5 - Online generator
test-ipv6.com
Test IPv6
FAQ
Mirrors
Stats
Test your IPv6 connectivity.
Summary
Tests Run
Share Results / Contact
Other IPv6 Sites
How this test works: Your browser will be instructed to reach a series of URLs. The combination of successes and failures tells a story about how ready you are for when publishers start offering their web sites on IPv6.
Click to see Technical Info
Test with IPv4 DNS record ok (0.195s) using ipv4
Test with IPv6 DNS record ok (0.288s) using ipv6
Test with Dual Stack DNS record ok (0.221s) using ipv6
Test for Dual Stack DNS and large packet ok (0.302s) using ipv6
Test IPv4 without DNS ok (0.196s) using ipv4
Test IPv6 without DNS ok (0.226s) using ipv6
Test IPv6 large packet ok (1.089s) using ipv6
Test if your ISP's DNS server uses IPv6 ok (0.218s) using ipv6
Find IPv4 Service Provider ok (0.191s) using ipv4 ASN 22047
Find IPv6 Service Provider ok (0.398s) using ipv6 ASN 6939
Click to see Share Results / Contact
Like
16,317 people like this.
Tweet
5,655
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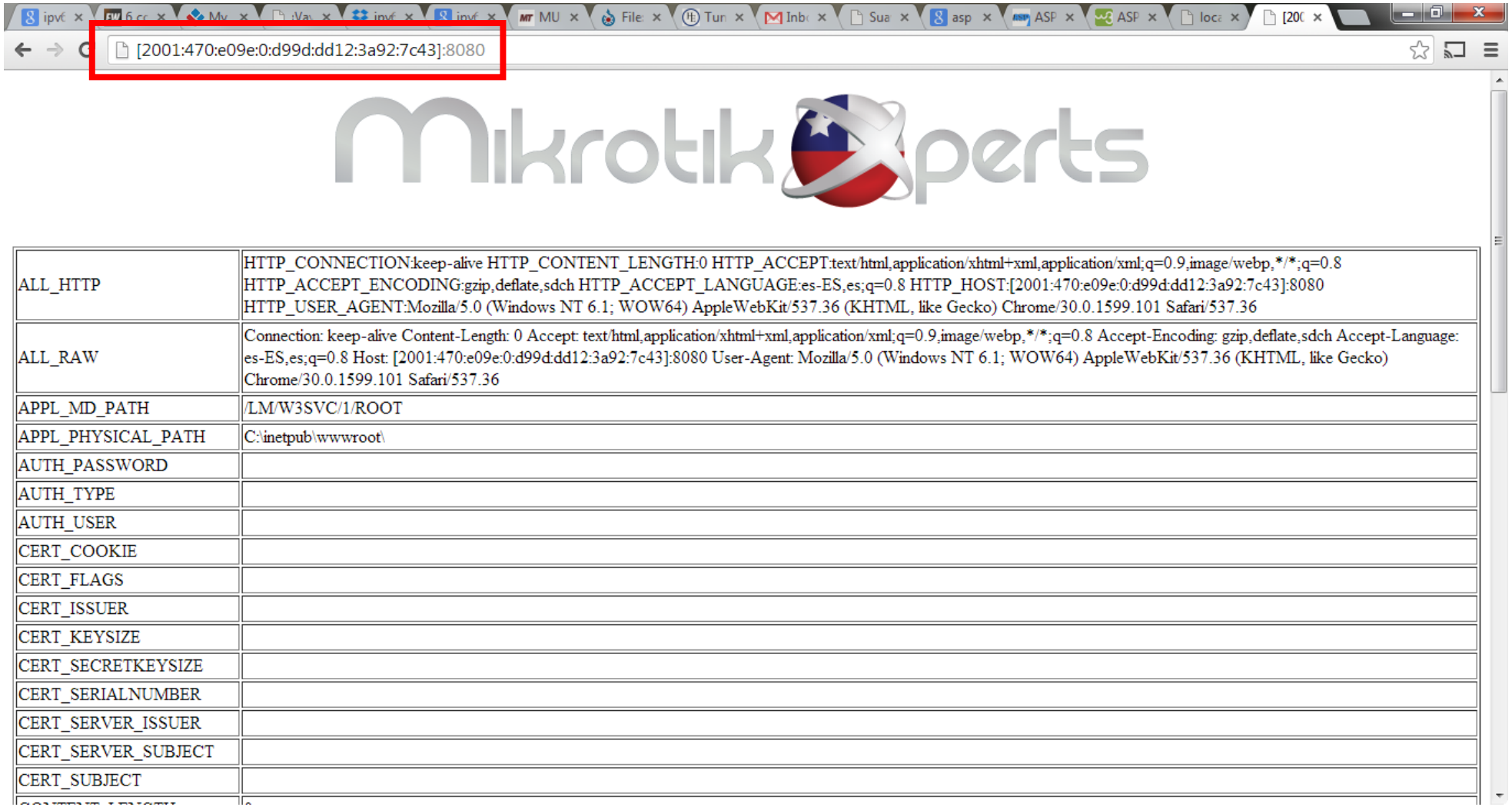
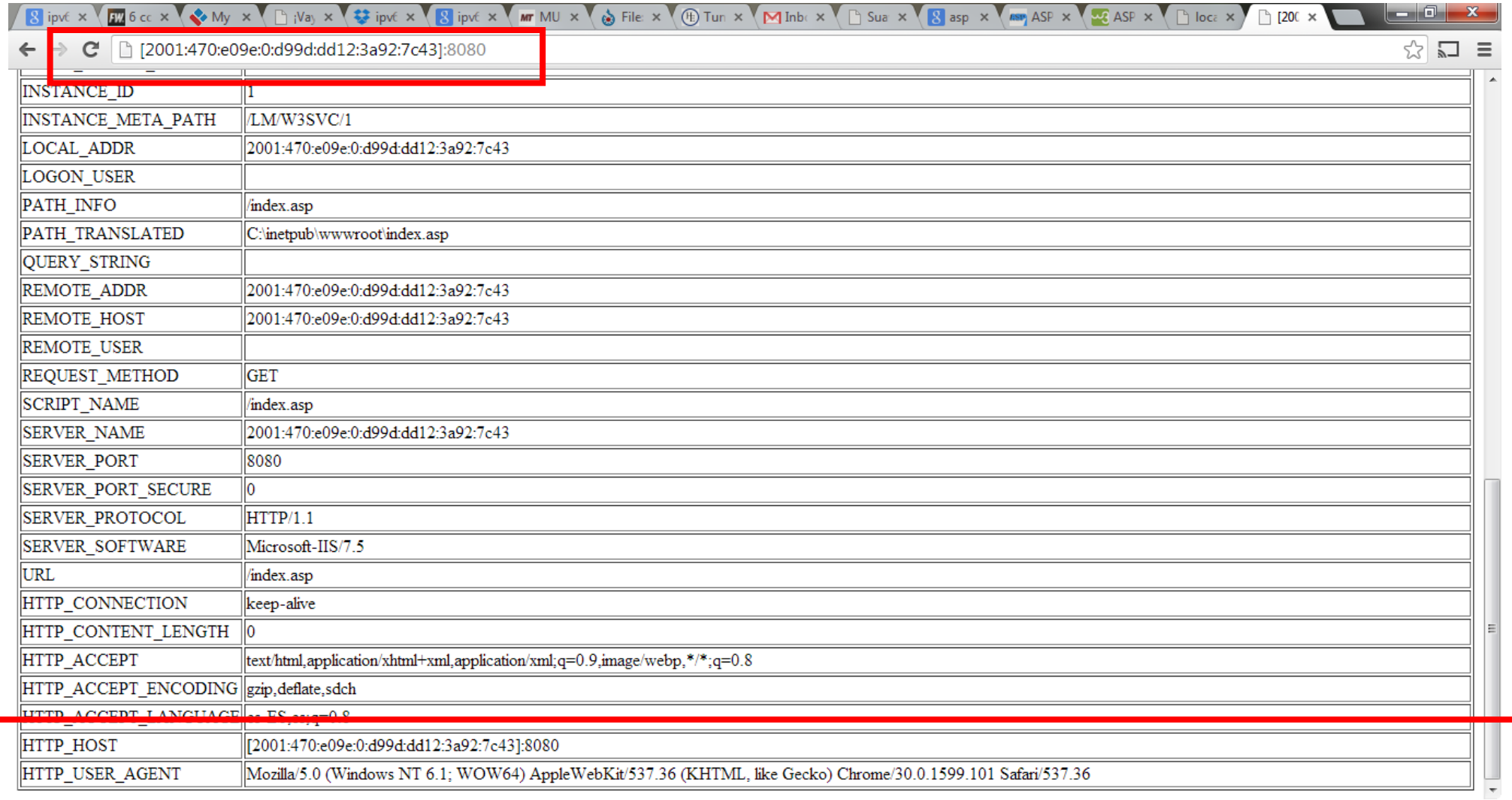
Mirrors | Mission | Source | Email - - Attributions | Debug

6to4 Tunnel



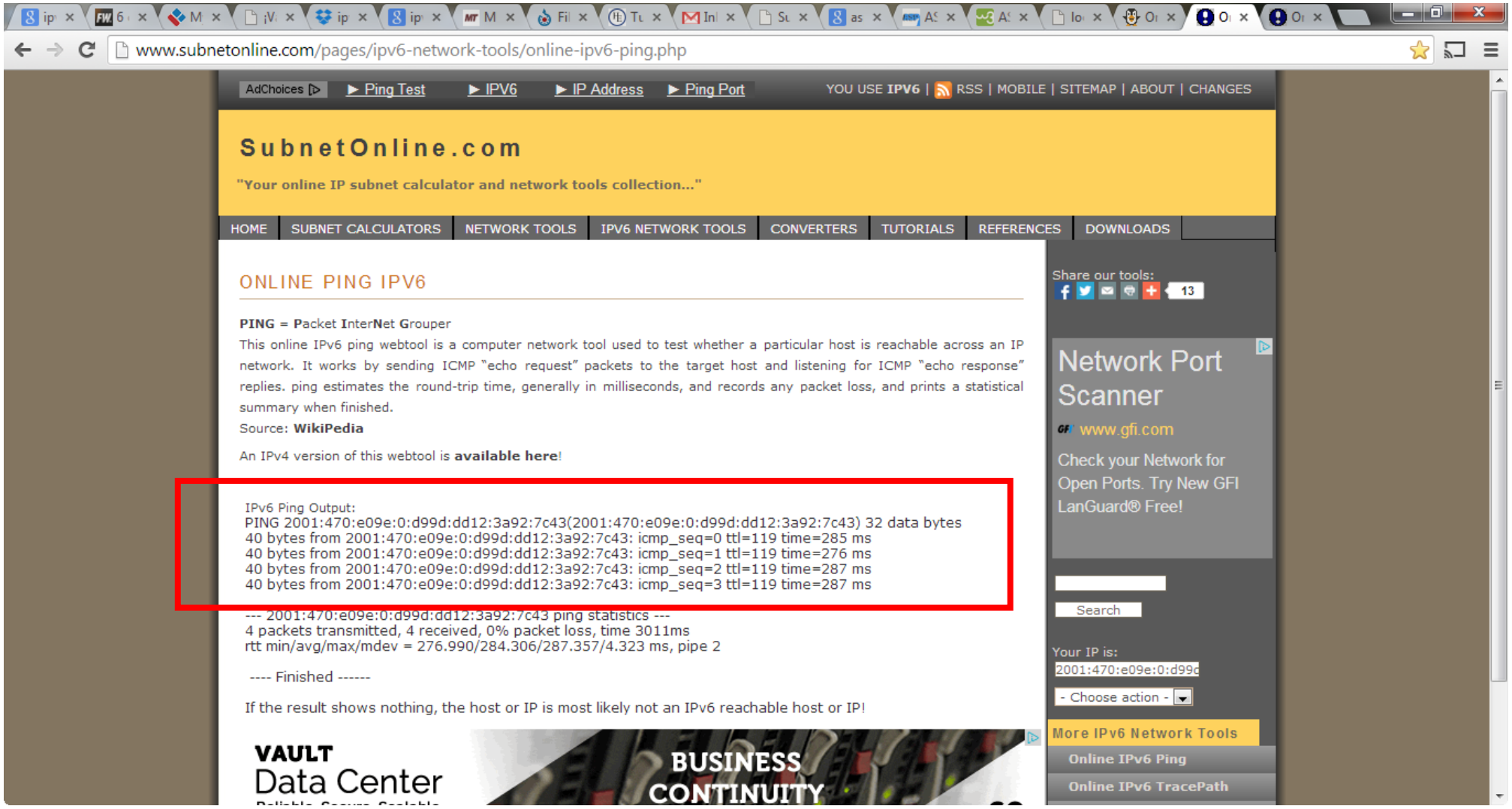
ALL_HTTP	HTTP_CONNECTION:keep-alive HTTP_CONTENT_LENGTH:0 HTTP_ACCEPT:text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,*/*;q=0.8 HTTP_ACCEPT_ENCODING:gzip,deflate,sdch HTTP_ACCEPT_LANGUAGE:es-ES,es;q=0.8 HTTP_HOST:[2001:470:e09e:0:d99d:dd12:3a92:7c43]:8080 HTTP_USER_AGENT:Mozilla/5.0 (Windows NT 6.1; WOW64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/30.0.1599.101 Safari/537.36
ALL_RAW	Connection: keep-alive Content-Length: 0 Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,*/*;q=0.8 Accept-Encoding: gzip,deflate,sdch Accept-Language: es-ES,es;q=0.8 Host: [2001:470:e09e:0:d99d:dd12:3a92:7c43]:8080 User-Agent: Mozilla/5.0 (Windows NT 6.1; WOW64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/30.0.1599.101 Safari/537.36
APPL_MD_PATH	/LM/W3SVC/1/ROOT
APPL_PHYSICAL_PATH	C:\inetpub\wwwroot\
AUTH_PASSWORD	
AUTH_TYPE	
AUTH_USER	
CERT_COOKIE	
CERT_FLAGS	
CERT_ISSUER	
CERT_KEYSIZE	
CERT_SECRETKEYSIZE	
CERT_SERIALNUMBER	
CERT_SERVER_ISSUER	
CERT_SERVER_SUBJECT	
CERT_SUBJECT	

6to4 Tunnel

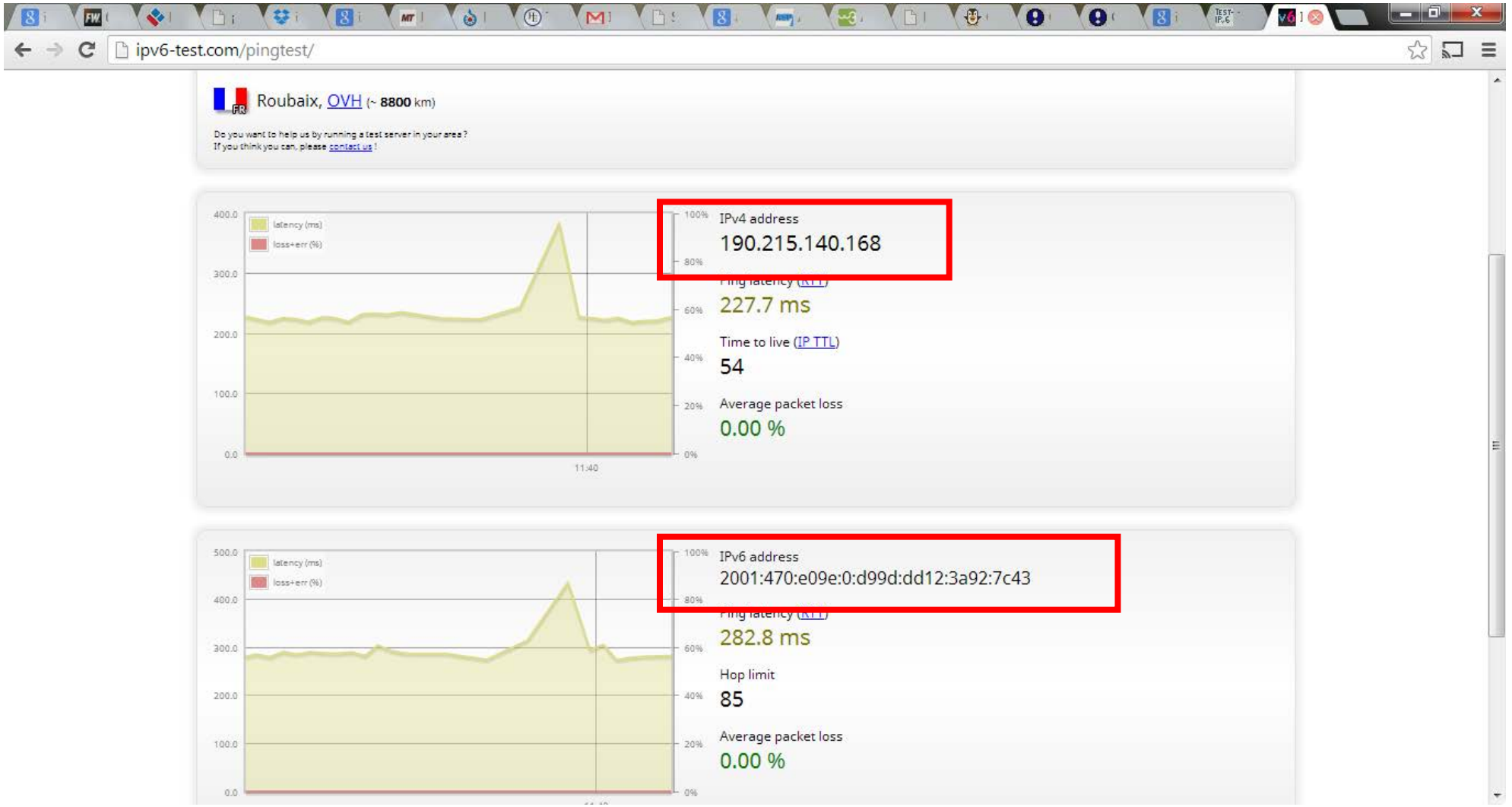


INSTANCE_ID	1
INSTANCE_META_PATH	/LM/W3SVC/1
LOCAL_ADDR	2001:470:e09e:0:d99d:dd12:3a92:7c43
LOGON_USER	
PATH_INFO	/index.asp
PATH_TRANSLATED	C:\inetpub\wwwroot\index.asp
QUERY_STRING	
REMOTE_ADDR	2001:470:e09e:0:d99d:dd12:3a92:7c43
REMOTE_HOST	2001:470:e09e:0:d99d:dd12:3a92:7c43
REMOTE_USER	
REQUEST_METHOD	GET
SCRIPT_NAME	/index.asp
SERVER_NAME	2001:470:e09e:0:d99d:dd12:3a92:7c43
SERVER_PORT	8080
SERVER_PORT_SECURE	0
SERVER_PROTOCOL	HTTP/1.1
SERVER_SOFTWARE	Microsoft-IIS/7.5
URL	/index.asp
HTTP_CONNECTION	keep-alive
HTTP_CONTENT_LENGTH	0
HTTP_ACCEPT	text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,*/*;q=0.8
HTTP_ACCEPT_ENCODING	gzip,deflate,sdch
HTTP_ACCEPT_LANGUAGE	es-ES,es;q=0.8
HTTP_HOST	[2001:470:e09e:0:d99d:dd12:3a92:7c43]:8080
HTTP_USER_AGENT	Mozilla/5.0 (Windows NT 6.1; WOW64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/30.0.1599.101 Safari/537.36

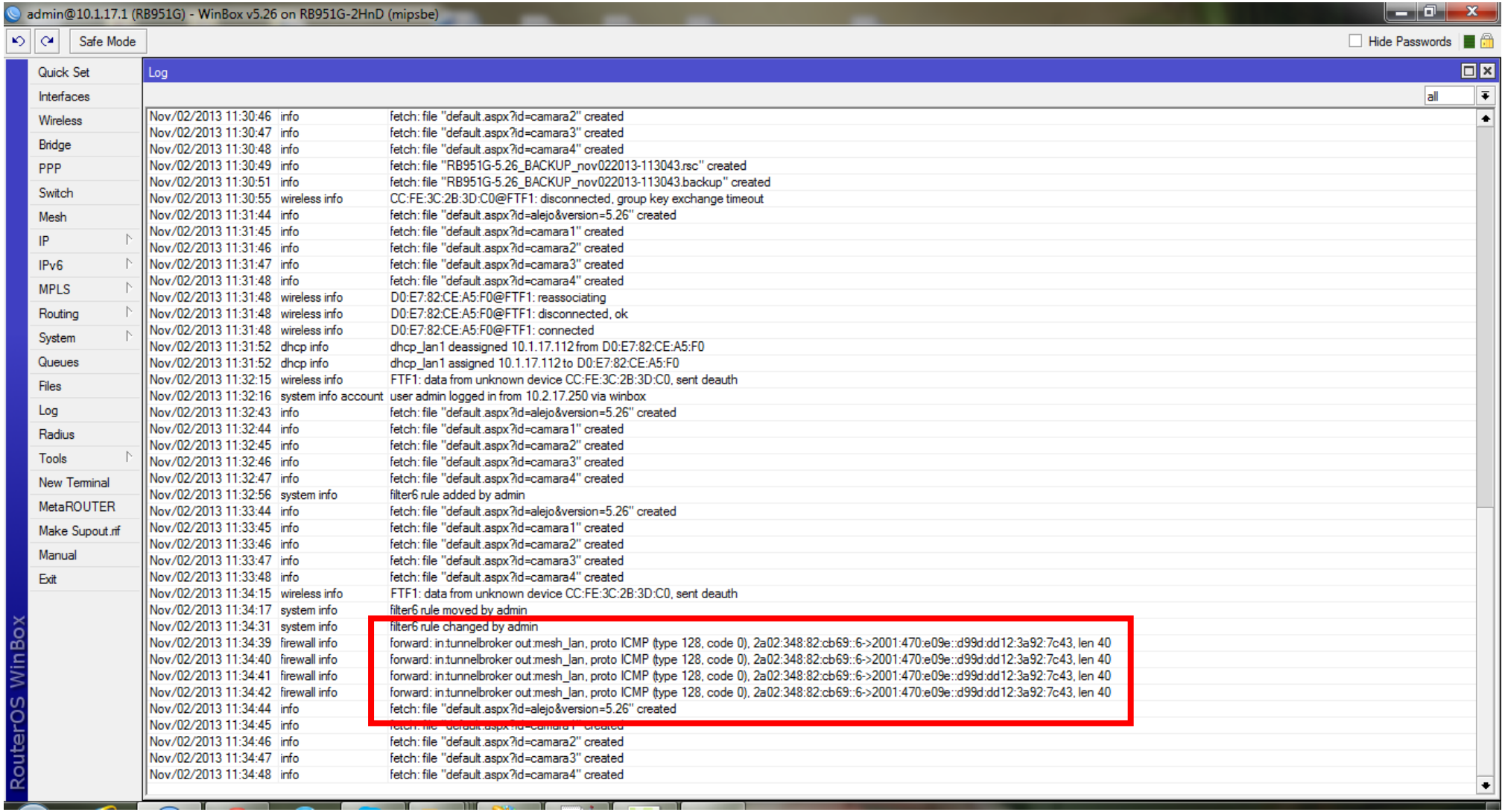
6to4 Tunnel


www.subnetonline.com/pages/ipv6-network-tools/online-ipv6-ping.php
AdChoices
Ping Test
IPV6
IP Address
Ping Port
YOU USE IPV6 | RSS | MOBILE | SITEMAP | ABOUT | CHANGES
SubnetOnline.com
"Your online IP subnet calculator and network tools collection..."
HOME
SUBNET CALCULATORS
NETWORK TOOLS
IPV6 NETWORK TOOLS
CONVERTERS
TUTORIALS
REFERENCES
DOWNLOADS
ONLINE PING IPV6
PING = Packet InterNet Grouper
This online IPv6 ping webtool is a computer network tool used to test whether a particular host is reachable across an IP network. It works by sending ICMP "echo request" packets to the target host and listening for ICMP "echo response" replies. ping estimates the round-trip time, generally in milliseconds, and records any packet loss, and prints a statistical summary when finished.
Source: WikiPedia
An IPv4 version of this webtool is available here!
IPv6 Ping Output:
PING 2001:470:e09e:0:d99d:dd12:3a92:7c43(2001:470:e09e:0:d99d:dd12:3a92:7c43) 32 data bytes
40 bytes from 2001:470:e09e:0:d99d:dd12:3a92:7c43: icmp_seq=0 ttl=119 time=285 ms
40 bytes from 2001:470:e09e:0:d99d:dd12:3a92:7c43: icmp_seq=1 ttl=119 time=276 ms
40 bytes from 2001:470:e09e:0:d99d:dd12:3a92:7c43: icmp_seq=2 ttl=119 time=287 ms
40 bytes from 2001:470:e09e:0:d99d:dd12:3a92:7c43: icmp_seq=3 ttl=119 time=287 ms
--- 2001:470:e09e:0:d99d:dd12:3a92:7c43 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3011ms
rtt min/avg/max/mdev = 276.990/284.306/287.357/4.323 ms, pipe 2
---- Finished ------
If the result shows nothing, the host or IP is most likely not an IPv6 reachable host or IP!
Share our tools:
13
Network Port Scanner
www.gfi.com
Check your Network for Open Ports. Try New GFI LanGuard® Free!
Search
Your IP is:
2001:470:e09e:0:d99d
- Choose action -
More IPv6 Network Tools
Online IPv6 Ping
Online IPv6 TracePath
VAULT
Data Center
BUSINESS CONTINUITY

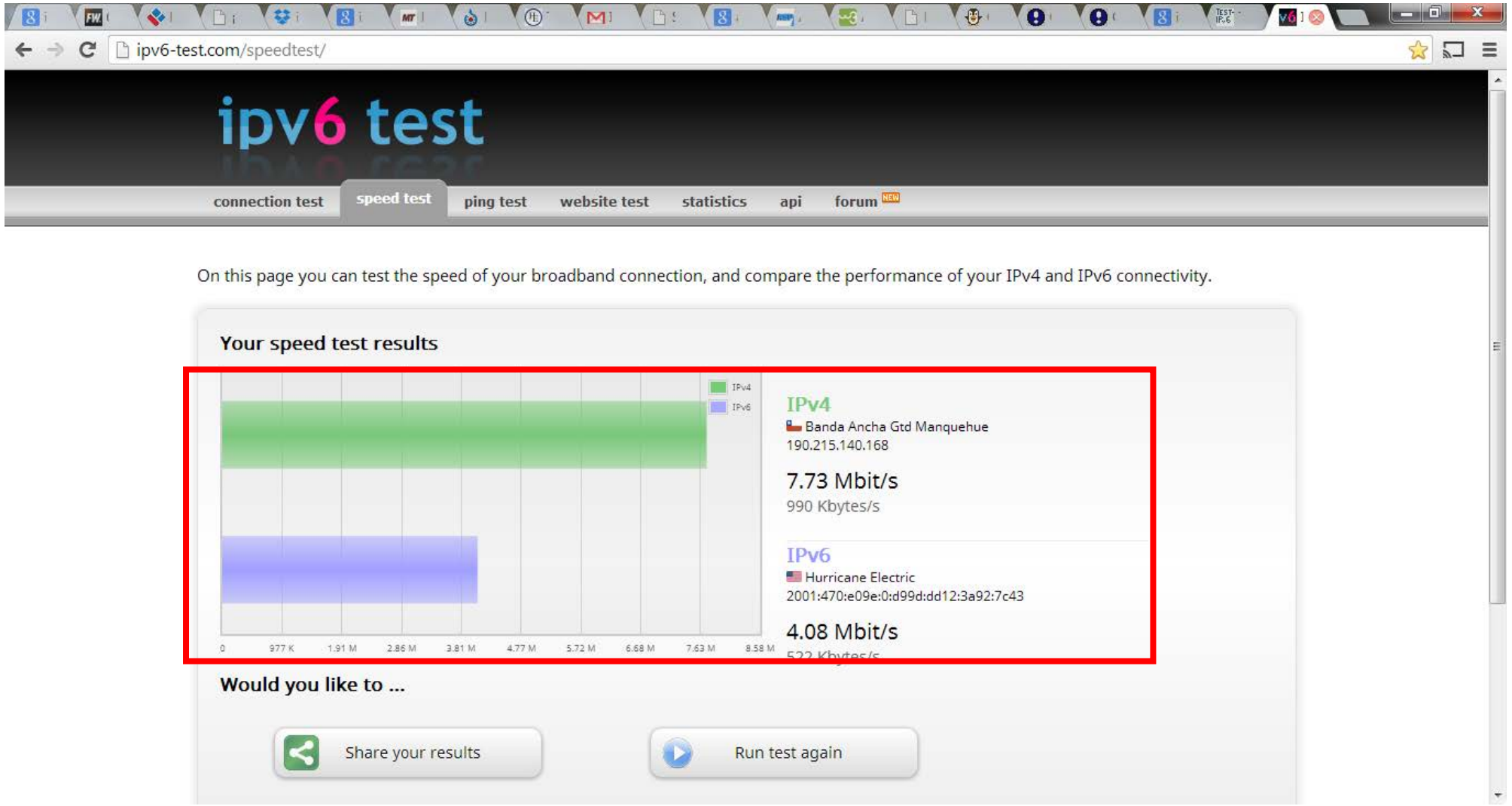
6to4 Tunnel


ipv6-test.com/pingtest/
Roubaix, OVH (~ 8800 km)
Do you want to help us by running a test server in your area?
If you think you can, please contact us !
IPv4 address
190.215.140.168
227.7 ms
Time to live (IP TTL)
54
Average packet loss
0.00 %
IPv6 address
2001:470:e09e:0:d99d:dd12:3a92:7c43
282.8 ms
Hop limit
85
Average packet loss
0.00 %

6to4 Tunnel


admin@10.1.17.1 (RB951G) - WinBox v5.26 on RB951G-2HnD (mipsbe)
Safe Mode
Hide Passwords
Quick Set
Interfaces
Wireless
Bridge
PPP
Switch
Mesh
IP
IPv6
MPLS
Routing
System
Queues
Files
Log
Radius
Tools
New Terminal
MetaROUTER
Make Supout.rif
Manual
Exit
RouterOS WinBox
Log
all
Nov/02/2013 11:30:46 info fetch: file "default.aspx?id=camara2" created
Nov/02/2013 11:30:47 info fetch: file "default.aspx?id=camara3" created
Nov/02/2013 11:30:48 info fetch: file "default.aspx?id=camara4" created
Nov/02/2013 11:30:49 info fetch: file "RB951G-5.26_BACKUP_nov022013-113043.rsc" created
Nov/02/2013 11:30:51 info fetch: file "RB951G-5.26_BACKUP_nov022013-113043.backup" created
Nov/02/2013 11:30:55 wireless info CC:FE:3C:2B:3D:C0@FTF1: disconnected, group key exchange timeout
Nov/02/2013 11:31:44 info fetch: file "default.aspx?id=alejo&version=5.26" created
Nov/02/2013 11:31:45 info fetch: file "default.aspx?id=camara1" created
Nov/02/2013 11:31:46 info fetch: file "default.aspx?id=camara2" created
Nov/02/2013 11:31:47 info fetch: file "default.aspx?id=camara3" created
Nov/02/2013 11:31:48 info fetch: file "default.aspx?id=camara4" created
Nov/02/2013 11:31:48 wireless info D0:E7:82:CE:A5:F0@FTF1: reassociating
Nov/02/2013 11:31:48 wireless info D0:E7:82:CE:A5:F0@FTF1: disconnected, ok
Nov/02/2013 11:31:48 wireless info D0:E7:82:CE:A5:F0@FTF1: connected
Nov/02/2013 11:31:52 dhcp info dhcp_lan1 deassigned 10.1.17.112 from D0:E7:82:CE:A5:F0
Nov/02/2013 11:31:52 dhcp info dhcp_lan1 assigned 10.1.17.112 to D0:E7:82:CE:A5:F0
Nov/02/2013 11:32:15 wireless info FTF1: data from unknown device CC:FE:3C:2B:3D:C0, sent deauth
Nov/02/2013 11:32:16 system info account user admin logged in from 10.2.17.250 via winbox
Nov/02/2013 11:32:43 info fetch: file "default.aspx?id=alejo&version=5.26" created
Nov/02/2013 11:32:44 info fetch: file "default.aspx?id=camara1" created
Nov/02/2013 11:32:45 info fetch: file "default.aspx?id=camara2" created
Nov/02/2013 11:32:46 info fetch: file "default.aspx?id=camara3" created
Nov/02/2013 11:32:47 info fetch: file "default.aspx?id=camara4" created
Nov/02/2013 11:32:56 system info filter6 rule added by admin
Nov/02/2013 11:33:44 info fetch: file "default.aspx?id=alejo&version=5.26" created
Nov/02/2013 11:33:45 info fetch: file "default.aspx?id=camara1" created
Nov/02/2013 11:33:46 info fetch: file "default.aspx?id=camara2" created
Nov/02/2013 11:33:47 info fetch: file "default.aspx?id=camara3" created
Nov/02/2013 11:33:48 info fetch: file "default.aspx?id=camara4" created
Nov/02/2013 11:34:15 wireless info FTF1: data from unknown device CC:FE:3C:2B:3D:C0, sent deauth
Nov/02/2013 11:34:17 system info filter6 rule moved by admin
Nov/02/2013 11:34:31 system info filter6 rule changed by admin
Nov/02/2013 11:34:39 firewall info forward: in:tunnelbroker out:mesh_lan, proto ICMP (type 128, code 0), 2a02:348:82:cb69::6->2001:470:e09e::d99d:dd12:3a92:7c43, len 40
Nov/02/2013 11:34:40 firewall info forward: in:tunnelbroker out:mesh_lan, proto ICMP (type 128, code 0), 2a02:348:82:cb69::6->2001:470:e09e::d99d:dd12:3a92:7c43, len 40
Nov/02/2013 11:34:41 firewall info forward: in:tunnelbroker out:mesh_lan, proto ICMP (type 128, code 0), 2a02:348:82:cb69::6->2001:470:e09e::d99d:dd12:3a92:7c43, len 40
Nov/02/2013 11:34:42 firewall info forward: in:tunnelbroker out:mesh_lan, proto ICMP (type 128, code 0), 2a02:348:82:cb69::6->2001:470:e09e::d99d:dd12:3a92:7c43, len 40
Nov/02/2013 11:34:44 info fetch: file "default.aspx?id=alejo&version=5.26" created
Nov/02/2013 11:34:45 info
Nov/02/2013 11:34:46 info fetch: file "default.aspx?id=camara2" created
Nov/02/2013 11:34:47 info fetch: file "default.aspx?id=camara3" created
Nov/02/2013 11:34:48 info fetch: file "default.aspx?id=camara4" created

6to4 Tunnel


ipv6-test.com/speedtest/
ipv6 test
connection test
speed test
ping test
website test
statistics
api
forum
On this page you can test the speed of your broadband connection, and compare the performance of your IPv4 and IPv6 connectivity.
Your speed test results
IPv4
IPv6
0
977 K
1.91 M
2.86 M
3.81 M
4.77 M
5.72 M
6.68 M
7.63 M
8.58 M
IPv4
Banda Ancha Gtd Manquehue
190.215.140.168
7.73 Mbit/s
990 Kbytes/s
IPv6
Hurricane Electric
2001:470:e09e:0:d99d:dd12:3a92:7c43
4.08 Mbit/s
Would you like to ...
Share your results
Run test again

GRACIAS POR SU ATENCIÓN

Alejandro Teixeira Gomez
MikroTik Certified Trainer# 163
ateixeira@mikrotikxperts.cl