Welcome to

IPv6 introduction

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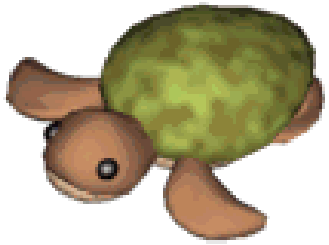
Slides are available as PDF

Goal



Introduce IPv6

IPv6 addressing

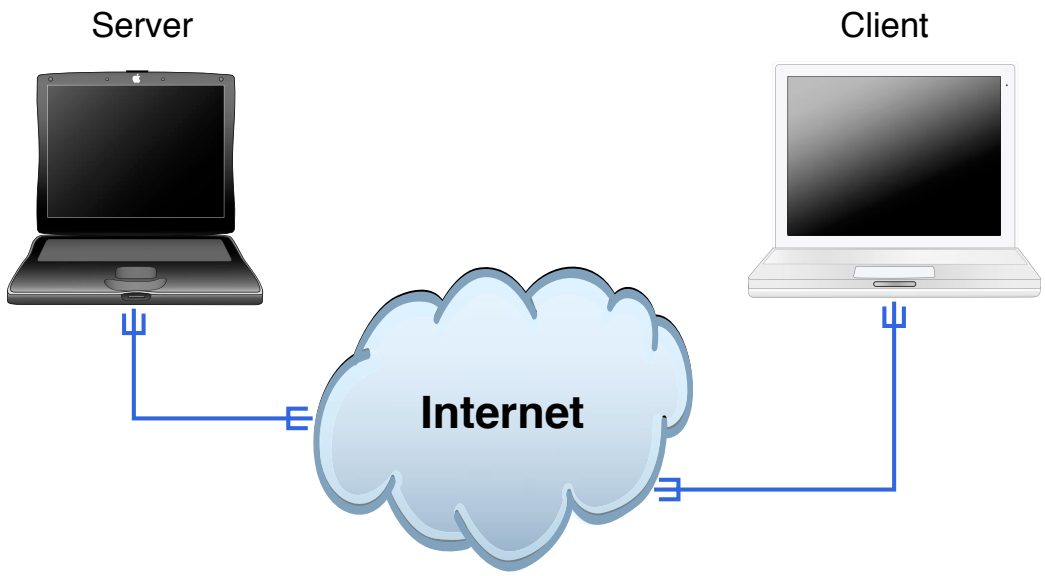
Neighbor Discovery Protocol

IPv4 vs IPv6 - Differences and similarities

Practical examples

Ressources

Internet idag



Clients and servers

Rooted in academic networks

Protocols which are more than 20 years old

Very little encryption and security built into the network

Internet is built on Open Standards

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We reject kings, presidents, and voting.
We believe in rough consensus and running code.
– The IETF credo Dave Clark, 1992.

RFC - Request for comments

RFC, Best Current Practice, FYI, informational

Standards track:
Proposed Standard → Draft Standard → Standard

Internetworking: history

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1961 L. Kleinrock, MIT packet-switching theory

1962 J. C. R. Licklider, MIT - notes

1964 Paul Baran: On Distributed Communications

1969 ARPANET 4 nodes

1971 14 nodes

1973 Design of Internet Protocols started

1973 Email is about 75% of all ARPANET traffic

1974 TCP/IP: Cerf/Kahn: A protocol for Packet Network Interconnection

1983 EUUG → DKUUG/DIKU forbindelse

1988 About 60.000 systems on the internet - The Morris Worm hits about 10%

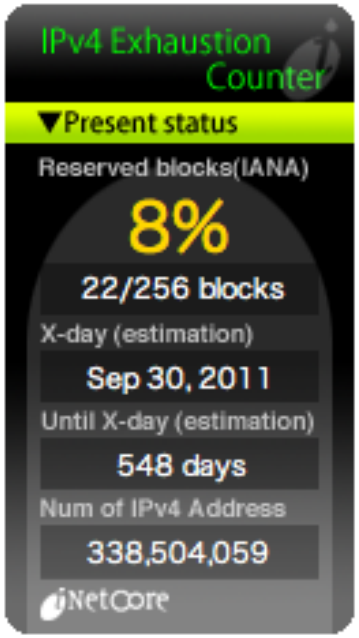
2002 Ialt ca. 130 millioner på Internet

2010 IANA reserved blocks 7% (Maj 2010) - `http://www.potaroo.net/tools/ipv4/`

Why IPv6

Projected IANA Unallocated Address Pool Exhaustion: 30-Sep-2011

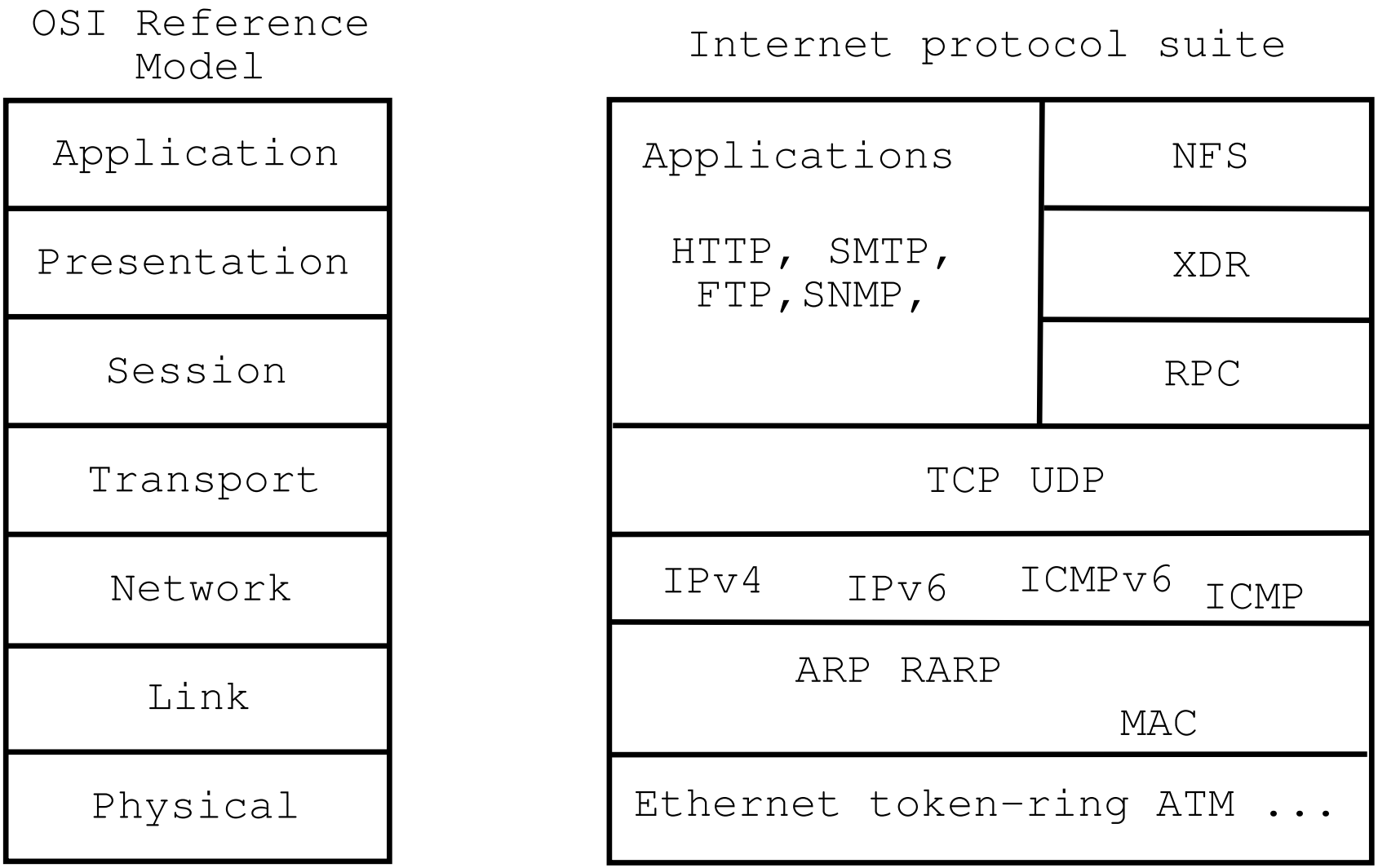
Projected RIR Unallocated Address Pool Exhaustion: 27-Jul-2012



http://www.potaroo.net/tools/ipv4/

No more talk, we need IPv6, get to work - end of discussion

OSI & Internet Protocols



IPv6: Internet redesigned? - no!

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Preserve the good stuff

back to basics, internet as it used to be!

fate sharing - connection rely on end points, not intermediary NAT boxes

end-to-end transparency - you have an address and I have an address

Wants: bandwidth +10G, low latency/predictable latency, Quality of Service, Security

IPv6 is evolution, not revolution

Note: IPv6 was not designed to solve all problems, so don't expect it to!

The Internet has done this before!

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Because all hosts can not be converted to TCP simultaneously, and some will implement only IP/TCP, it will be necessary to provide temporarily for communication between NCP-only hosts and TCP-only hosts. To do this certain hosts which implement both NCP and IP/TCP will be designated as relay hosts. These relay hosts will support Telnet, FTP, and Mail services on both NCP and TCP. These relay services will be provided beginning in November 1981, and will be fully in place in January 1982.

Initially there will be many NCP-only hosts and a few TCP-only hosts, and the load on the relay hosts will be relatively light. As time goes by, and the conversion progresses, there will be more TCP capable hosts, and fewer NCP-only hosts, plus new TCP-only hosts. But, presumably most hosts that are now NCP-only will implement IP/TCP in addition to their NCP and become ”dual protocol” hosts. So, while the load on the relay hosts will rise, it will not be a substantial portion of the total traffic.

NCP/TCP Transition Plan November 1981 RFC-801

How to use IPv6

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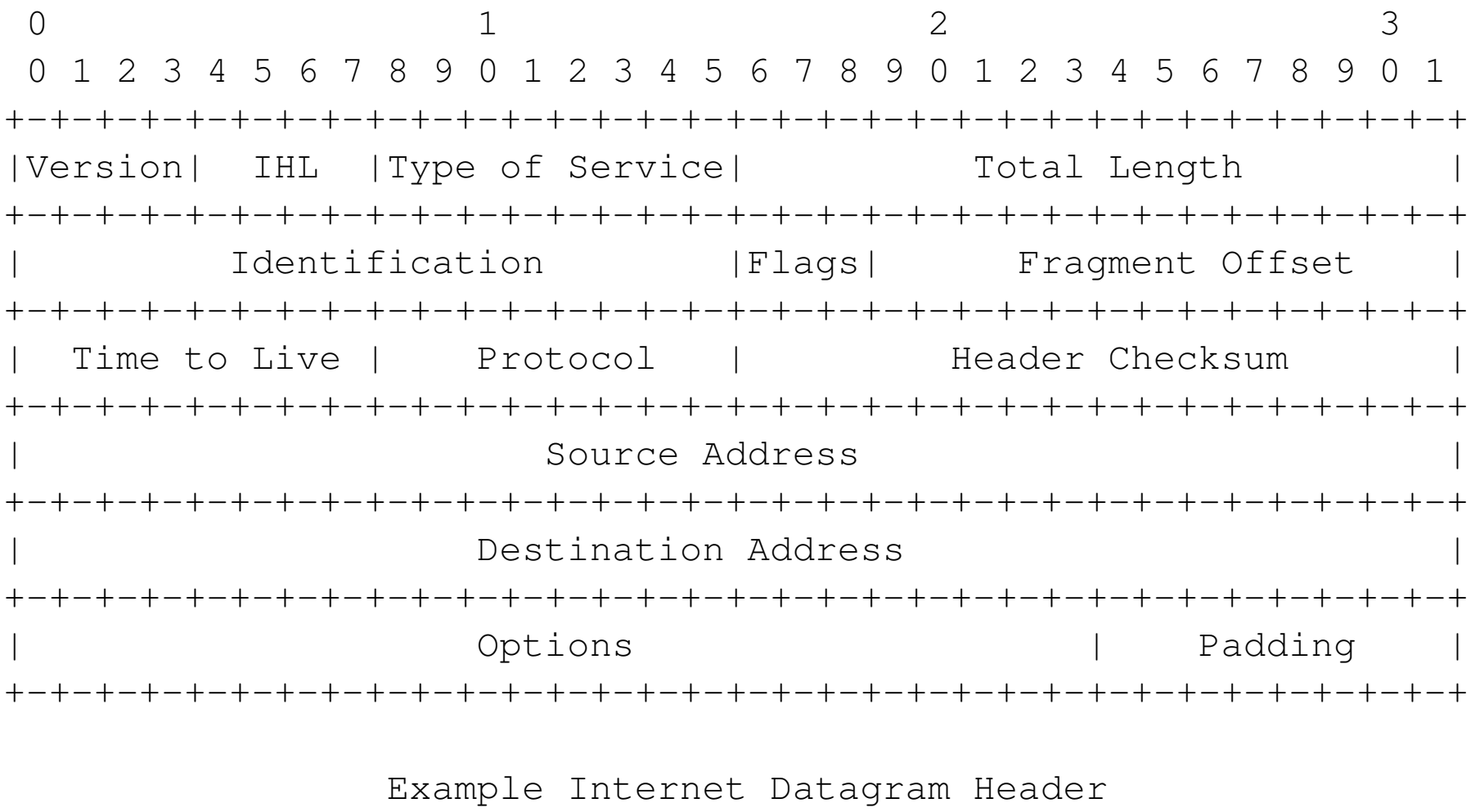
Really how?

- Get IPv6 address and routing
- Add AAAA (quad A) records to your DNS
- Done

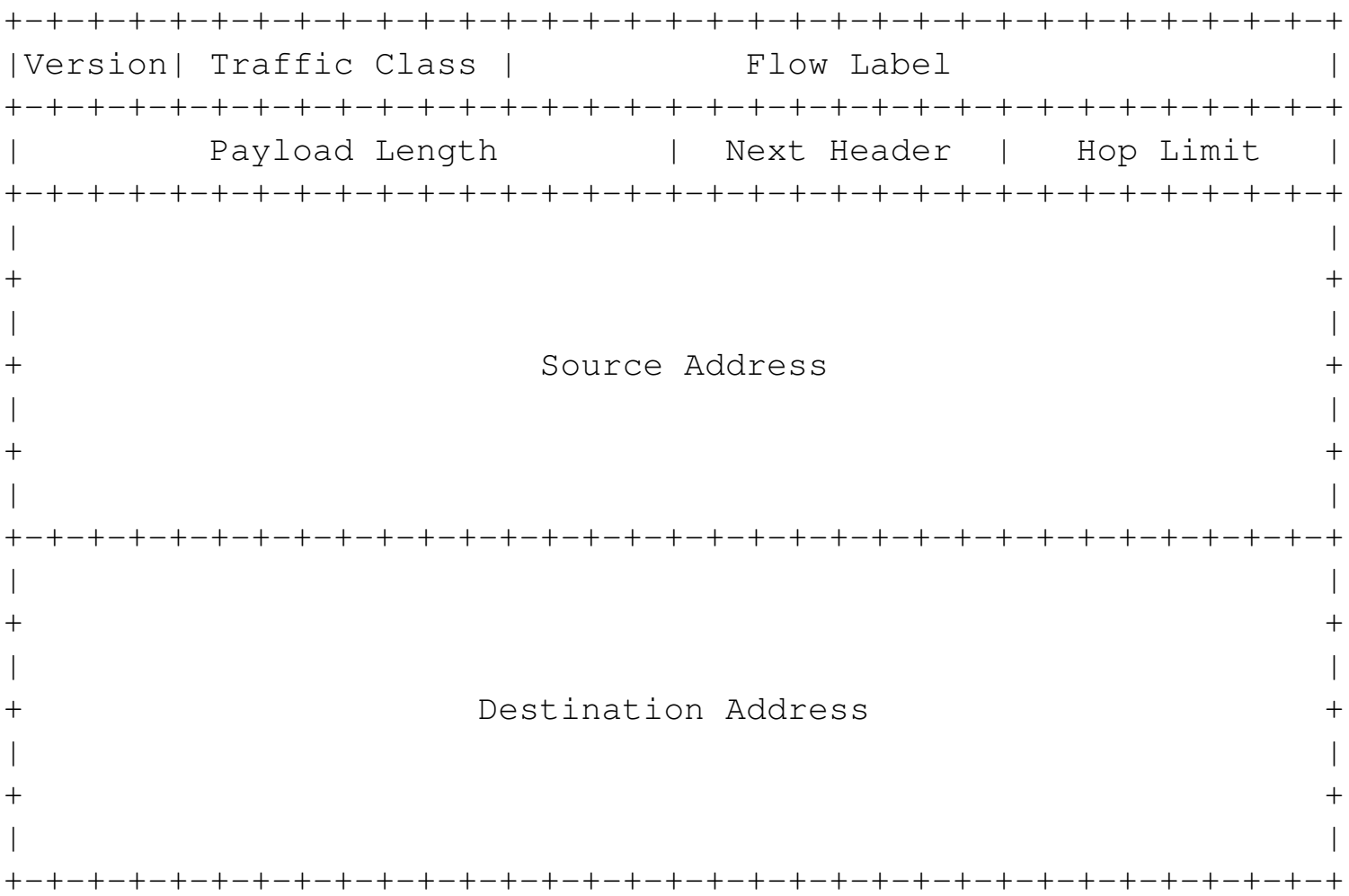
```
www       IN A        91.102.91.17
          IN AAAA     2001:16d8:dd00:19::2
mail      IN A        217.157.63.115
          IN AAAA     2001:16d8:dd0f::200
```

IPv4 header - RFC-791



Example Internet Datagram Header

IPv6 header - RFC-2460



IPv6 - extension headers RFC-2460

- Hop-by-Hop Options
- Routing (Type 0)
- Fragment - fragmentation only at end-points!
- Destination Options
- Authentication
- Encapsulating Security Payload

IPv6 addressing RFC-4291

Addresses are always 128-bit identifiers for interfaces and sets of interfaces

- Unicast: An identifier for a single interface. A packet sent to a unicast address is delivered to the interface identified by that address.
- Anycast: An identifier for a set of interfaces (typically belonging to different nodes). A packet sent to an anycast address is delivered to one of the interfaces identified by that address (the ”nearest” one, according to the routing protocols’ measure of distance).
- Multicast: An identifier for a set of interfaces (typically belonging to different nodes). A packet sent to a multicast address is delivered to all interfaces identified by that address.

There are no broadcast addresses in IPv6, their function being superseded by multicast addresses.

IPv6 addressing RFC-4291, cont.

2001:16d8:ff00:012f:0000:0000:0000:0002
2001:16d8:ff00:12f::2

Eight groups of 4 hex-digits seperated by colon x:x:x:x:x:x:x:x
each x is a 16-bit piece of the address

Prefixes are writting using ipv6-address/prefix-length
Similar to CIDR IPv4 prefixes

Leading zeros within a group can be removed

One or more groups of 16 bits of zeros can be replaced by ::

Note: `http://en.wikipedia.org/wiki/Classless_Inter-Domain_Routing`

Examples:

- ABCD:EF01:2345:6789:ABCD:EF01:2345:6789
- Adddress 2001:DB8:0:0:8:800:200C:417A
- Address of loopback ::1
- IPv6 prefix 2a02:09d0:95::1/64, subnet 2a02:09d0:0095:0000::/64
- Address 2a02:09d0:95::1 or 2a02:09d0:0095:0000:0000:0000:0000:0001

- Danish sites
- Name servers for .dk
  p.nic.dk has IPv6 address 2001:500:14:6036:ad::1
  s.nic.dk has IPv6 address 2a01:3f0:0:303::53
  b.nic.dk has IPv6 address 2a01:630:0:80::53
- ns1.gratisdns.dk has IPv6 address 2a02:9d0:3002:1::2
- www.solidonetworks.com has IPv6 address 2a02:9d0:10::9

IPv6 address - regional prefixes

Aggregatable Global Unicast

2001::/16 RIR subTLA space

- 2001:200::/23 APNIC
- 2001:400::/23 ARIN
- 2001:600::/23 RIPE

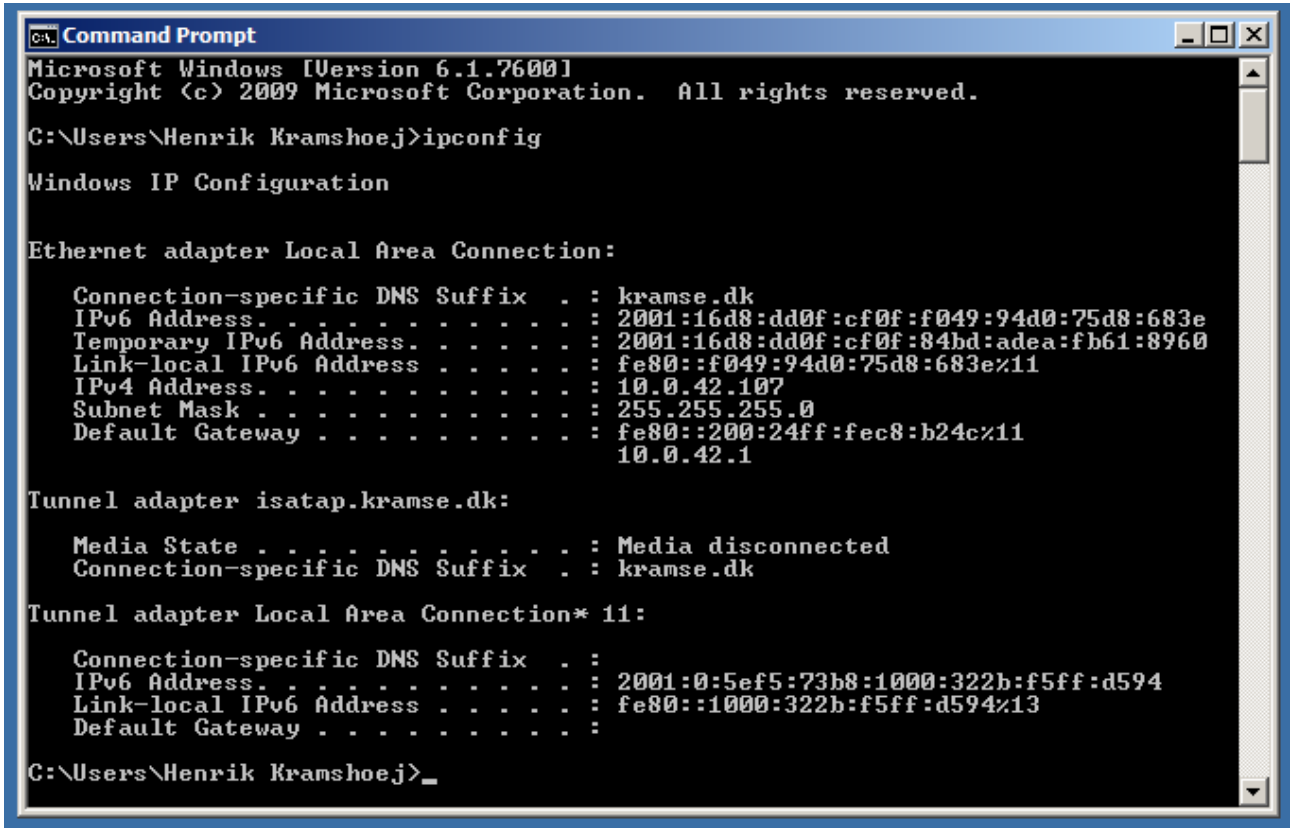
2002::/16 6to4 prefix

3ffe::/16 6bone allocation - old not used anymore

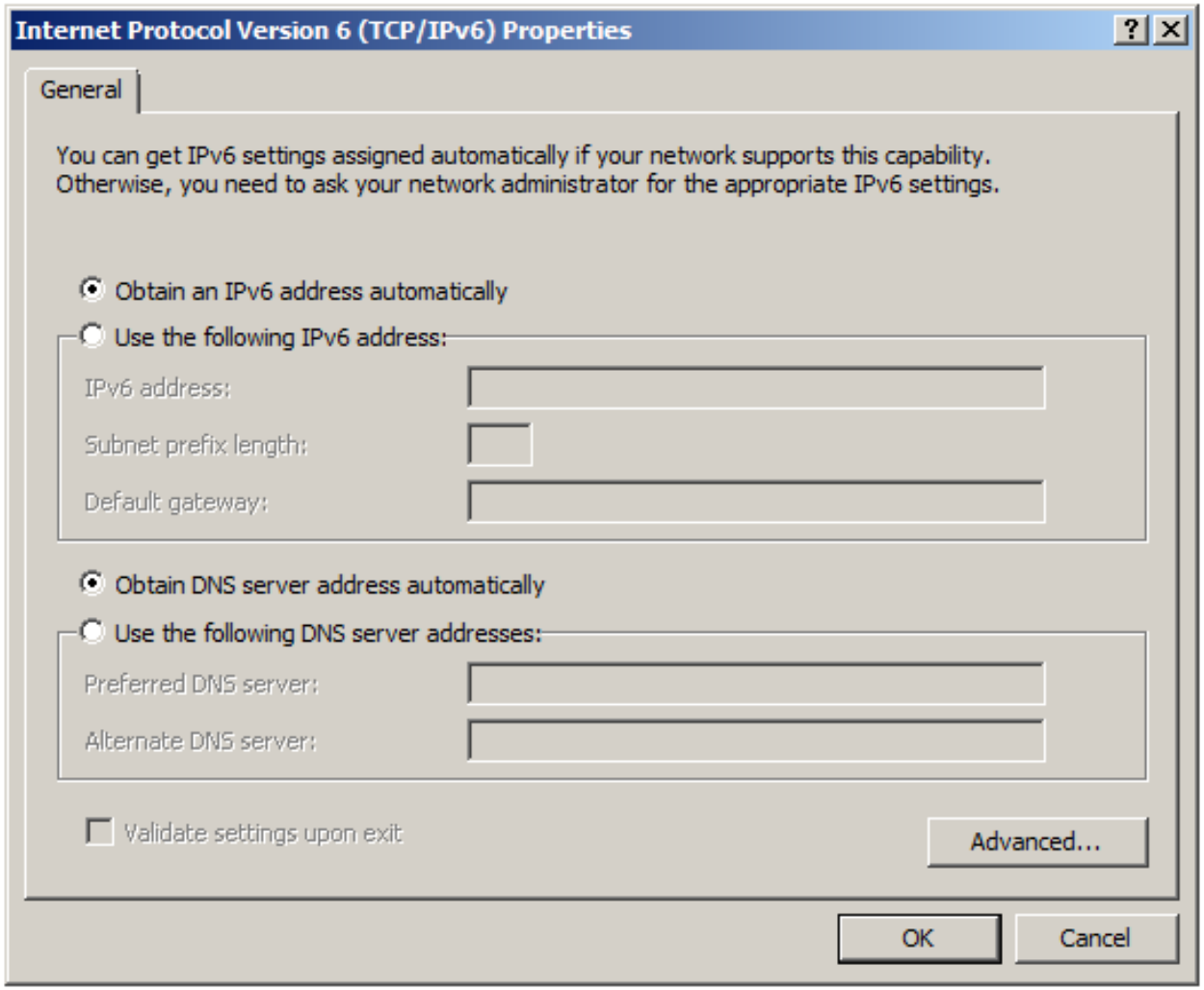
IPv6 address - special prefixes

- link-local unicast addresses
  fe80::/10 generated from the interface MAC address EUI-64
- FEC0::/10 site-local - deprecated in RFC-3879
- FC00::/7 Unique Local IPv6 Unicast Addresses RFC-4193
  `http://www.simpledns.com/private-ipv6.aspx`
- 2001:0DB8::/32 NON-ROUTABLE range to be used for documentation purpose RFC-3849.

Windows - ipconfig



Windows - control panel



Unix - practical examples ifconfig and ping

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```
$ ifconfig en0
en0: flags=8863<UP,BROADCAST,SMART,RUNNING,SIMPLEX,MULTICAST> mtu 1500
inet6 fe80::216:cbff:feac:1d9f%en0 prefixlen 64 scopeid 0x4
inet 10.0.42.15 netmask 0xffffff00 broadcast 10.0.42.255
inet6 2001:16d8:dd0f:cf0f:216:cbff:feac:1d9f prefixlen 64 autoconf
ether 00:16:cb:ac:1d:9f
media: autoselect (1000baseT <full-duplex>) status: active

$ ping6 ::1
PING6(56=40+8+8 bytes) ::1 --> ::1
16 bytes from ::1, icmp_seq=0 hlim=64 time=0.089 ms
16 bytes from ::1, icmp_seq=1 hlim=64 time=0.155 ms

$ traceroute6 2001:16d8:dd0f:cf0f::1
traceroute6 to 2001:16d8:dd0f:cf0f::1 (2001:16d8:dd0f:cf0f::1)
from 2001:16d8:dd0f:cf0f:216:cbff:feac:1d9f, 64 hops max, 12 byte packets
 1  2001:16d8:dd0f:cf0f::1  0.399 ms  0.371 ms  0.294 ms
```

ping6 global unicast address

```
root# ping6 2001:1448:81:beef:20a:95ff:fef5:34df
PING6(56=40+8+8 bytes) 2001:1448:81:beef::1 --> 2001:1448:81:beef:20a:95ff:fef5:34df
16 bytes from 2001:1448:81:beef:20a:95ff:fef5:34df, icmp_seq=0 hlim=64 time=10.639 ms
16 bytes from 2001:1448:81:beef:20a:95ff:fef5:34df, icmp_seq=1 hlim=64 time=1.615 ms
16 bytes from 2001:1448:81:beef:20a:95ff:fef5:34df, icmp_seq=2 hlim=64 time=2.074 ms
^C
--- 2001:1448:81:beef:20a:95ff:fef5:34df ping6 statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max = 1.615/4.776/10.639 ms
```

ping6 link-local address

```
hlk@bigfoot:hlk$ ping6 -I en1 fe80::20d:93ff:fe4d:55fe
PING6(56=40+8+8 bytes) fe80::223:6cff:fe9a:f52c%en1 --> fe80::20d:93ff:fe4d:55fe
16 bytes from fe80::20d:93ff:fe4d:55fe%en1, icmp_seq=0 hlim=64 time=1.557 ms
16 bytes from fe80::20d:93ff:fe4d:55fe%en1, icmp_seq=1 hlim=64 time=1.725 ms
^C
--- fe80::20d:93ff:fe4d:55fe ping6 statistics ---
2 packets transmitted, 2 packets received, 0.0% packet loss
round-trip min/avg/max/std-dev = 1.557/1.641/1.725/0.084 ms
```

Note: -I en1 specifies that this interface is being used.

ping6 til specielle adresser

```
root# ping6 -I en1 ff02::1

PING6(56=40+8+8 bytes) fe80::230:65ff:fe17:94d1 --> ff02::1
16 bytes from fe80::230:65ff:fe17:94d1, icmp_seq=0 hlim=64 time=0.483 ms
16 bytes from fe80::20a:95ff:fef5:34df, icmp_seq=0 hlim=64 time=982.932 ms
16 bytes from fe80::230:65ff:fe17:94d1, icmp_seq=1 hlim=64 time=0.582 ms
16 bytes from fe80::20a:95ff:fef5:34df, icmp_seq=1 hlim=64 time=9.6 ms
16 bytes from fe80::230:65ff:fe17:94d1, icmp_seq=2 hlim=64 time=0.489 ms
16 bytes from fe80::20a:95ff:fef5:34df, icmp_seq=2 hlim=64 time=7.636 ms
^C
--- ff02::1 ping6 statistics ---
4 packets transmitted, 4 packets received, +4 duplicates, 0% packet loss
round-trip min/avg/max = 0.483/126.236/982.932 ms

ff02::1 multicast address of all-hosts on the local link
ff02::2 multicast address of all-routers on the local link
```

Hello neighbors

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```
$ ping6 -w -I en1 ff02::1
PING6(72=40+8+24 bytes) fe80::223:6cff:fe9a:f52c%en1 --> ff02::1
30 bytes from fe80::223:6cff:fe9a:f52c%en1: bigfoot
36 bytes from fe80::216:cbff:feac:1d9f%en1: mike.kramse.dk.
38 bytes from fe80::200:aaff:feab:9f06%en1: xrx0000aaab9f06
34 bytes from fe80::20d:93ff:fe4d:55fe%en1: harry.local
36 bytes from fe80::200:24ff:fec8:b24c%en1: kris.kramse.dk.
31 bytes from fe80::21b:63ff:fef5:38df%en1: airport5
32 bytes from fe80::216:cbff:fec4:403a%en1: main-base
44 bytes from fe80::217:f2ff:fee4:2156%en1: Base Station Koekken
35 bytes from fe80::21e:c2ff:feac:cd17%en1: arnold.local
```

Only Two places need updating the file /etc/sysconfig/network:

```
NETWORKING=yes
NETWORKING_IPV6=yes
HOSTNAME=host1.armadahosting.com
GATEWAY=10.234.123.254
```

From the file: /etc/sysconfig/network-scripts/ifcfg-eth0:

```
DEVICE=eth0
BOOTPROTO=none
ONBOOT=yes
BROADCAST=10.234.123.255
NETWORK=10.234.123.0
NETMASK=255.255.255.0
IPADDR=10.234.123.90
USERCTL=no
IPV6INIT=yes
IPV6ADDR=2a02:9d0:10::10:234:123:90
IPV6_DEFAULTGW=2a02:9d0:10::1
```

IPv6 autoconfiguration

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```
  Modified EUI-64 format-based interface identifiers

ifconfig en1
en1: flags=8863<UP,BROADCAST,SMART,RUNNING,SIMPLEX,MULTICAST> mtu 1500
        ether 00:23:6c:9a:f5:2c
                00-23-6c-ff-fe-9a-f5-2c  48-bit MAC stretched to become EUI-64
                02-23-6c-ff-fe-9a-f5-2c  inverting the "u" bit (universal/local bit)
                fe80::  +  0223:6cff:fe9a:f52c   add link-local prefix
        inet6 fe80::223:6cff:fe9a:f52c%en1 prefixlen 64 scopeid 0x6
```

DHCPv6 is available, but instead autoconfiguration is used mostly

This is based on routers sending router advertisements to the network

Individual nodes then combine this with their EUI64 identifier

Router advertisement daemon

```
root# /usr/sbin/rtadvd -Df en0 en1
```

Startup in debug mode is nice when testing

```
/etc/rtadvd.conf:
en0:
        :addrs#1:addr="2001:1448:81:b00f::":prefixlen#64:
en1:
        :addrs#1:addr="2001:1448:81:beef::":prefixlen#64:
```

Note: forwarding must be enabled!

```
root# sysctl -w net.inet6.ip6.forwarding=1
net.inet6.ip6.forwarding: 0 -> 1
```

IPv6 sockets

```
root# netstat -an | grep -i listen

tcp46  0  0  *.80                 *.*    LISTEN
tcp4   0  0  *.6000               *.*    LISTEN
tcp4   0  0  127.0.0.1.631        *.*    LISTEN
tcp4   0  0  *.25                 *.*    LISTEN
tcp4   0  0  *.20123              *.*    LISTEN
tcp46  0  0  *.20123              *.*    LISTEN
tcp4   0  0  127.0.0.1.1033       *.*    LISTEN
```

Note: some platforms show tcp/tcp6 for IPv4/IPv6 and some show tcp4/tcp6

IPv6 - inet6 family

```
root# netstat -an -f inet6

Active Internet connections (including servers)
Proto Recv Send  Local  Foreign    (state)
tcp46  0    0     *.80     *.*      LISTEN
tcp46  0    0     *.22780  *.*      LISTEN
udp6   0    0     *.5353   *.*
udp6   0    0     *.5353   *.*
udp6   0    0     *.514    *.*
icm6   0    0     *.*      *.*
icm6   0    0     *.*      *.*
icm6   0    0     *.*      *.*
```

Note: this is from a Mac OS X and edited a little

IPv6 is default for a lot of services

```
root# telnet localhost 80

Trying ::1...
Connected to localhost.
Escape character is '^]'.
GET / HTTP/1.0

HTTP/1.1 200 OK
Date: Thu, 19 Feb 2004 09:22:34 GMT
Server: Apache/2.0.43 (Unix)
Content-Location: index.html.en
Vary: negotiate,accept-language,accept-charset
...
```

IPv6 is also default i OpenSSH

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```
hlk$ ssh -v localhost -p 20123

OpenSSH_3.6.1p1+CAN-2003-0693, SSH protocols 1.5/2.0, OpenSSL 0x0090702f
debug1: Reading configuration data /Users/hlk/.ssh/config
debug1: Applying options for *
debug1: Reading configuration data /etc/ssh_config
debug1: Rhosts Authentication disabled, originating port will not be trusted.
debug1: Connecting to localhost [::1] port 20123.
debug1: Connection established.
debug1: identity file /Users/hlk/.ssh/id_rsa type -1
debug1: identity file /Users/hlk/.ssh/id_dsa type 2
debug1: Remote protocol version 2.0, remote software version OpenSSH_3.6.1p1+CA
debug1: match: OpenSSH_3.6.1p1+CAN-2003-0693 pat OpenSSH*
debug1: Enabling compatibility mode for protocol 2.0
debug1: Local version string SSH-2.0-OpenSSH_3.6.1p1+CAN-2003-0693
```

Note: specify -4 or -6 to use specific version

Apache HTTPD server

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The world most popular HTTP server for many years `http://httpd.apache.org`

```
Listen 0.0.0.0:80
Listen [::]:80
...
Allow from 127.0.0.1
Allow from 2001:1448:81:0f:2d:9ff:f86:3f
Allow from 217.157.20.133
```

Apache access log

```
root# tail -f access_log
::1 - - [19/Feb/2004:09:05:33 +0100] "GET /images/IPv6ready.png
HTTP/1.1" 304 0
::1 - - [19/Feb/2004:09:05:33 +0100] "GET /images/valid-html401.png
HTTP/1.1" 304 0
::1 - - [19/Feb/2004:09:05:33 +0100] "GET /images/snowflake1.png
HTTP/1.1" 304 0
::1 - - [19/Feb/2004:09:05:33 +0100] "GET /~hlk/security6.net/images/logo-1.png
HTTP/1.1" 304 0
2001:1448:81:beef:20a:95ff:fef5:34df - - [19/Feb/2004:09:57:35 +0100]
"GET / HTTP/1.1" 200 1456
2001:1448:81:beef:20a:95ff:fef5:34df - - [19/Feb/2004:09:57:35 +0100]
"GET /apache_pb.gif HTTP/1.1" 200 2326
2001:1448:81:beef:20a:95ff:fef5:34df - - [19/Feb/2004:09:57:36 +0100]
"GET /favicon.ico HTTP/1.1" 404 209
2001:1448:81:beef:20a:95ff:fef5:34df - - [19/Feb/2004:09:57:36 +0100]
"GET /favicon.ico HTTP/1.1" 404 209
```

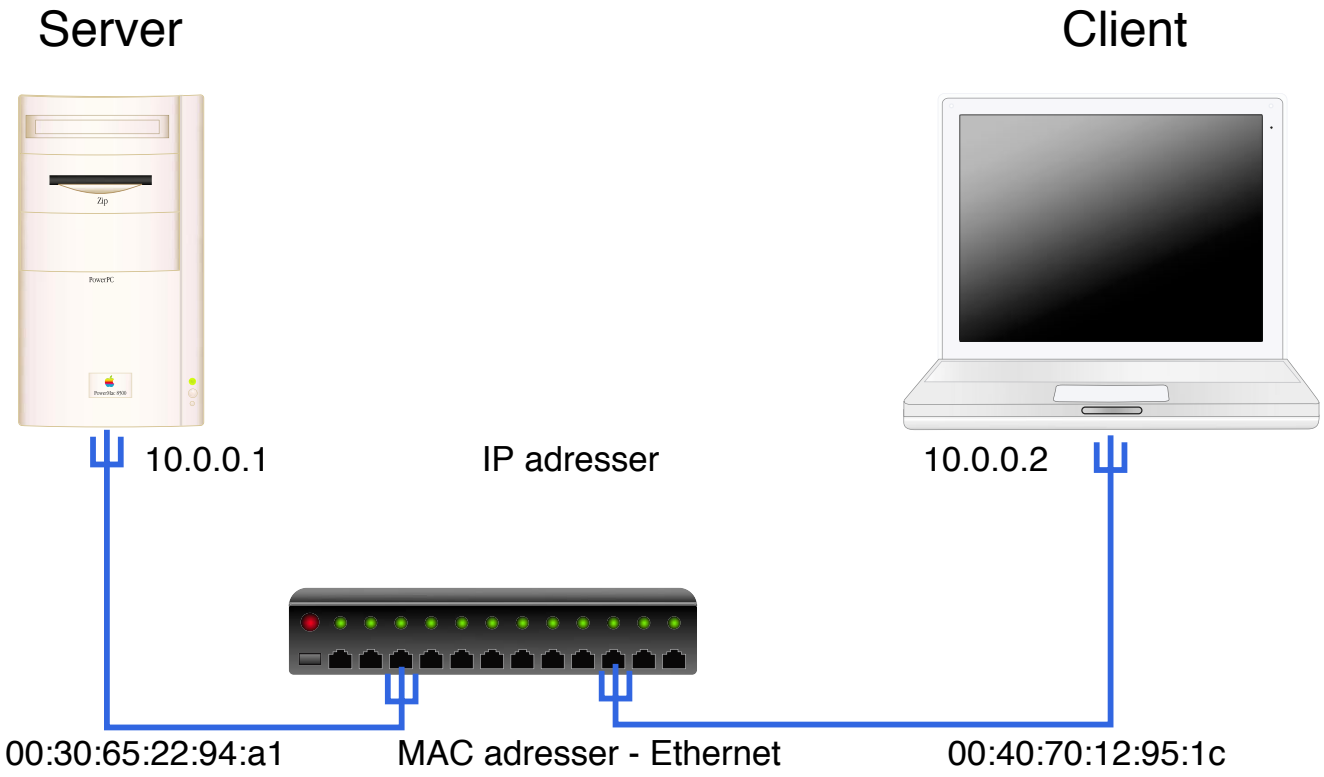
Routing - IPv4

```
$ netstat -rn
Routing tables

Internet:
Destination        Gateway            Flags    Refs      Use   Netif
default            10.0.0.1           UGSc       23        7     en0
10/24              link#4             UCS         1        0     en0
10.0.0.1           0:0:24:c1:58:ac    UHLW       24       18     en0
10.0.0.33          127.0.0.1          UHS         0        1     lo0
10.0.0.63          127.0.0.1          UHS         0        0     lo0
127                127.0.0.1          UCS         0        0     lo0
127.0.0.1          127.0.0.1          UH          4     7581     lo0
169.254            link#4             UCS         0        0     en0
```

Routing - IPv6

```
$ netstat -f inet6 -rn
Routing tables

Internet6:
Destination                 Gateway             Flags      Netif
default             fe80::200:24ff:fec1:58ac    UGc         en0
::1                         ::1                 UH          lo0
2001:1448:81:cf0f::/64      link#4              UC          en0
2001:1448:81:cf0f::1        0:0:24:c1:58:ac     UHLW        en0
fe80::/64                   fe80::1             Uc          lo0
fe80::1                     link#1              UHL         lo0
fe80::/64                   link#4              UC          en0
fe80::20d:93ff:fe28:2812    0:d:93:28:28:12     UHL         lo0
fe80::/64                   link#5              UC          en1
fe80::20d:93ff:fe86:7c3f    0:d:93:86:7c:3f     UHL         lo0
ff01::/32                   ::1                 U           lo0
ff02::/32                   ::1                 UC          lo0
ff02::/32                   link#4              UC          en0
ff02::/32                   link#5              UC          en1
```

ARP in Ipv4



ARP request and reply

ping 10.0.0.2 from server

ARP Address Resolution Protocol request/reply:

- ARP request broadcasted on layer 2 - Who has 10.0.0.2 Tell 10.0.0.1
- ARP reply (from 10.0.0.2) 10.0.0.2 is at 00:40:70:12:95:1c

IP ICMP request/reply:

- Echo (ping) request from 10.0.0.1 to 10.0.0.2
- Echo (ping) reply from 10.0.0.2 to 10.0.0.1
- ...

ARP is performed on Ethernet before IP can be transmitted

IPv6 neighbor discovery protocol (NDP)

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OSI	IPv4	IPv6
Network	IP / ICMP	IPv6 / ICMPv6
Link	ARP	
Physical	Physical	Physical

ARP er væk

NDP erstatter og udvider ARP, Sammenlign `arp -an` med `ndp -an`

Til dels erstatter ICMPv6 således DHCP i IPv6, DHCPv6 findes dog

NB: bemærk at dette har stor betydning for firewallregler!

RFC4861 Neighbor Discovery for IP version 6 (IPv6)

ARP vs NDP

```
hlk@bigfoot:basic-ipv6-new$ arp -an
? (10.0.42.1) at 0:0:24:c8:b2:4c on en1 [ethernet]
? (10.0.42.2) at 0:c0:b7:6c:19:b on en1 [ethernet]

hlk@bigfoot:basic-ipv6-new$ ndp -an
Neighbor                        Linklayer Address  Netif Expire    St Flgs Prbs
::1                             (incomplete)         lo0 permanent R
2001:16d8:ffd2:cf0f:21c:b3ff:fec4:e1b6 0:1c:b3:c4:e1:b6 en1 permanent R
fe80::1%lo0                     (incomplete)         lo0 permanent R
fe80::200:24ff:fec8:b24c%en1  0:0:24:c8:b2:4c       en1 8h54m51s  S  R
fe80::21c:b3ff:fec4:e1b6%en1  0:1c:b3:c4:e1:b6      en1 permanent R
```

IPv6 firewalls

```
# Simple stateful network firewall rules for IPv6
# using IPv4 file for input and inspiration from
# http://www.ipv6style.jp/en/building/20040526/2.shtml
# input from
        $fwcmd6 -f flush
        $fwcmd6 add allow all from any to any via lo0
# Allow ICMPv6 destination unreach
        $fwcmd6 add pass ipv6-icmp from any to any icmptypes 1
# Allow NS/NA/toobig (don't filter it out)
        $fwcmd6 add pass ipv6-icmp from any to any icmptypes 2
# Allow timex Time exceeded
        $fwcmd6 add pass ipv6-icmp from any to any icmptypes 3
# Allow parameter problem
        $fwcmd6 add pass ipv6-icmp from any to any icmptypes 4
# IPv6 ICMP - echo request (128) and echo reply (129)
        $fwcmd6 add pass ipv6-icmp from any to any icmptypes 128,129
# IPv6 ICMP - router solicitation (133) and router advertisement (134)
        $fwcmd6 add pass ipv6-icmp from any to any icmptypes 133,134
# IPv6 ICMP - neighbour discovery solicitation (135) and advertisement (136)
        $fwcmd6 add pass ipv6-icmp from any to any icmptypes 135,136
```

IPv6 firewalls, cont. allowing services

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```
#       Allow all established connections to persist (setup required
#       for new connections).
        $fwcmd6 add allow tcp from any to any established
        $fwcmd6 add allow tcp from any to any out setup
# allow access to my webserver and ssh
#       $fwcmd6 add allow tcp from any to any 80,443  setup
        $fwcmd6 add allow tcp from any to any $ssh  setup

# allow access to X11 forwarding over ::1
        $fwcmd6 add allow tcp from any to ::1 6010  setup

#       Politely rejects AUTH requests (e.g. email and ftp)
        $fwcmd6 add reset tcp from any to any 113

#       Deny everything else ipv6
        $fwcmd6 add 65435 deny log ipv6 from any to any
```

Getting connected

Native IPv6 - available at some hosting providers in DK

Automatic tunnels 6to4, Teredo etc.

- 6to4 benytter IPv4 infrastrukturen
- Teredo sender IPv6 gennem IPv4/UDP pakker

Configured tunnels and tunnelbrokers

- `http://sixxs.net` IPv6 Deployment & Tunnel Broker
- `http://he.net` hurricane electric internet services

Allocating IPv6 addresses

SOLIDO NETWORKS

You have plenty!

Providers will typically get /32

Providers will typically give you /48 or /56

Your /48 can be used for:

- 65536 subnets
- Each subnet has 2^{64} addresses

Danish resources - get involved

Danish IPv6 task force - unofficial `http://www.ipv6tf.dk`

SOLIDO NETWORKS

IPv6 is here already - use it

http://www.ipv6actnow.org/

http://digitaliser.dk/group/374895

http://www.ipv6tf.dk

Questions?

SOLIDO NETWORKS

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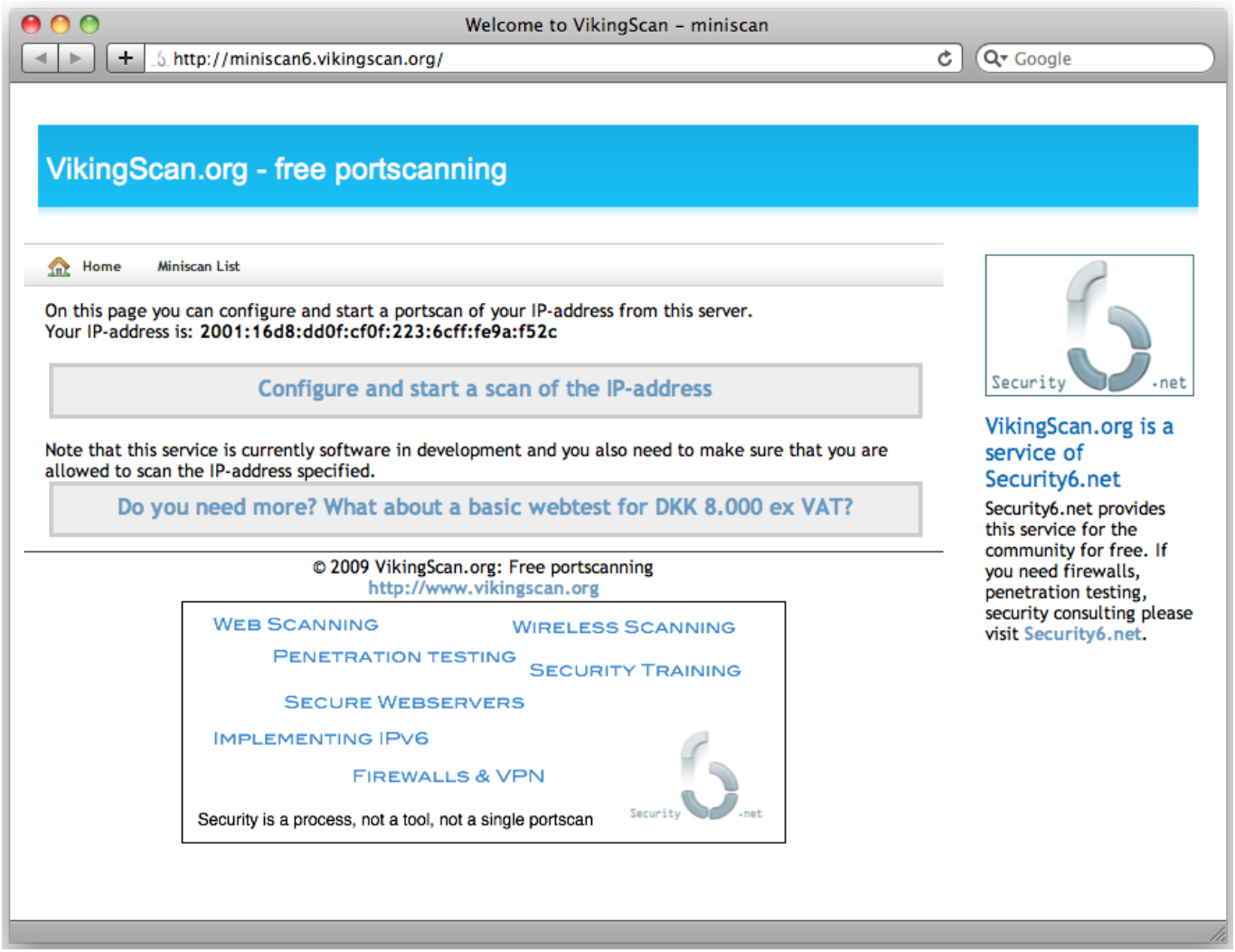
http://www.solidonetworks.com

You are always welcome to send me questions later via email

VikingScan.org - free portscanning



Referencer: netværksbøger

- Stevens, Comer,
- Network Warrior
- TCP/IP bogen på dansk
- KAME bøgerne
- O'Reilly generelt IPv6 Essentials og IPv6 Network Administration
- O'Reilly cookbooks: Cisco, BIND og Apache HTTPD
- Cisco Press og website
- Firewall bøger, Radia Perlman: IPsec,

Bøger om IPv6

IPv6 Network Administration af David Malone og Niall Richard Murphy - god til real-life admins, typisk O'Reilly bog

IPv6 Essentials af Silvia Hagen, O'Reilly 2nd edition (May 17, 2006) god reference om emnet

IPv6 Core Protocols Implementation af Qing Li, Tatuya Jinmei og Keiichi Shima

IPv6 Advanced Protocols Implementation af Qing Li, Jinmei Tatuya og Keiichi Shima

- flere andre

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