Ninux.org

Saverio Proto (ZioPRoTo)

Linux Day 2008 Viterbo

Traditional Network Infrastructure: commercial wireless access

CUSTOMERS

OPERATOR WISP

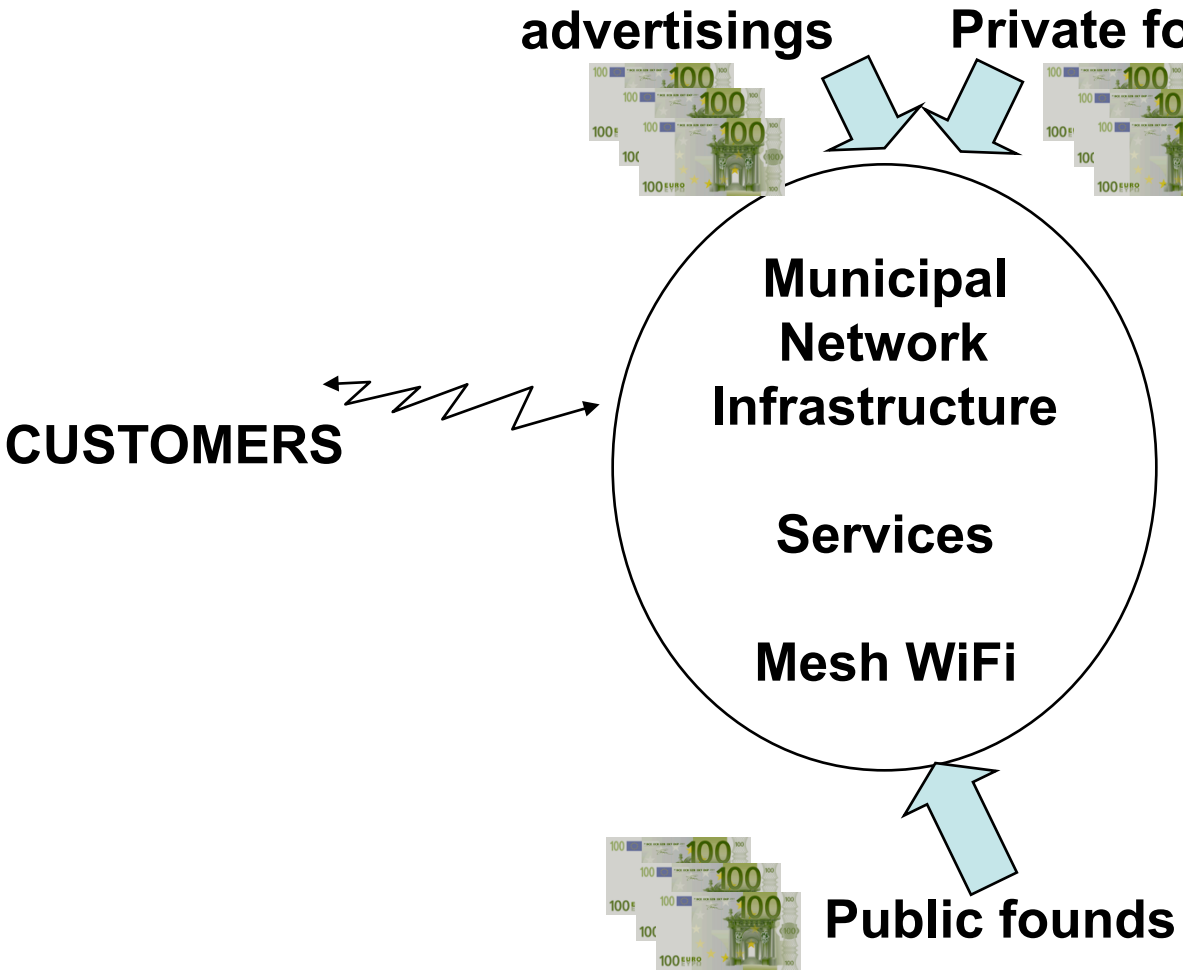
Services Infrastructure

WISP

- Big operators
  - GPRS→UMTS→HSDPA
- "small" WISP (wi-fi):
  - Not good business models
  - High costs, little profit

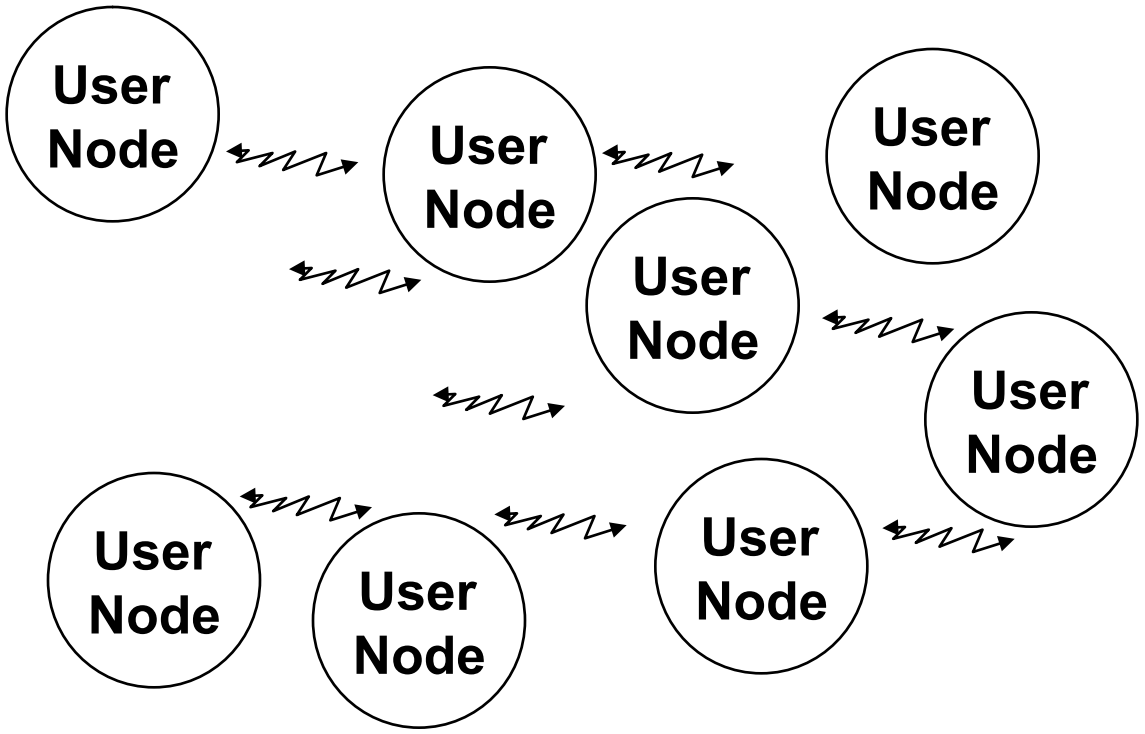
Roaming;
WISP federations;
…

Traditional Network Infrastructure: free wireless access



- Of course better for citizens
  - Free access
- Little (none?) change in the network model
  - Centralized infrastructure
  - Centralized services

Wireless Community Network: the new way!



- Users do not “access” the network, they “are” the network
- Users(= network nodes):
  - Volunteers
  - Citizens
  - Communities
  - Business
  - Municipality
- No“operator”
- Technology:
  - Today Mesh WiFi
  - Tomorrow?

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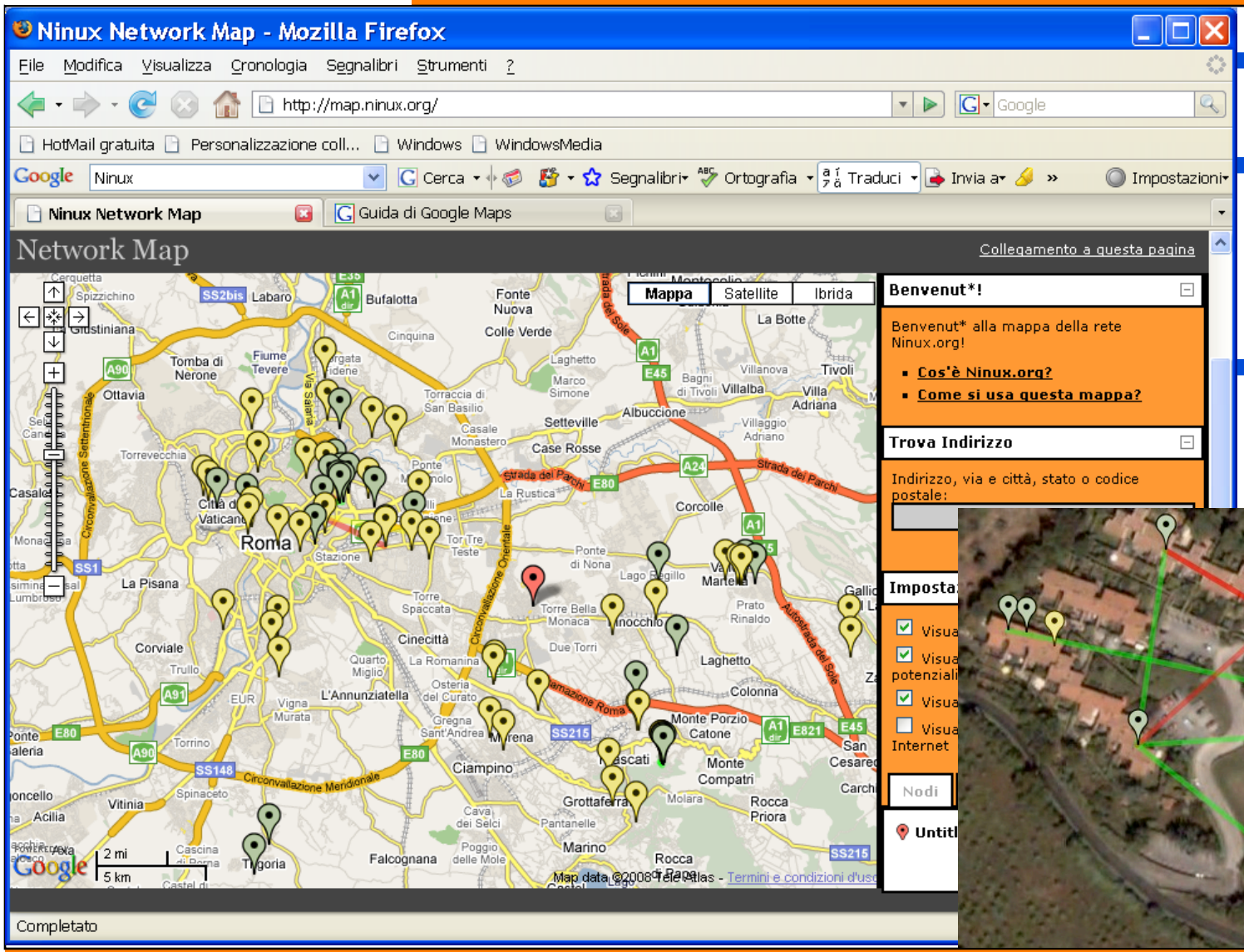
Network Neutrality

- The Network is a common good
  - Open: anyone can join
  - Free access
  - No third parties in the communication (operators)
  - Multi owned
  - New business models in a free market
  - Gives more value to a geographical area
- Looks like the beginning of the Internet !

Roma: Ninux; TuscoloMesh



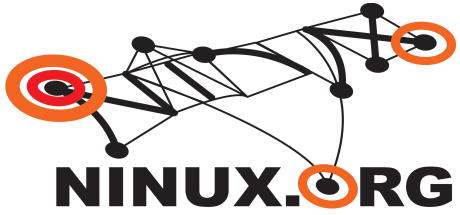
- ~30 nodi ninux + ~10 nodi tuscolo
- Appassionati, studenti, forte collegamento con università
- sperimentazione tecnologie e soluzioni

Ninux: snapshot

Approccio:
Tutto o quasi
“fatto in casa”
(antenne, etc)

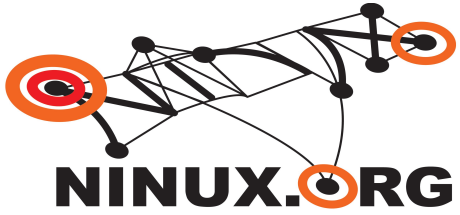
Layer 8 - People

- Is not easy to explain to people what is a Wireless Community
  - People are confused about Internet
  - People are confused about Free Software
  - What is Wiki RSS Jabber torrent ... ??
  - If you are not selling something there is something wrong with you!
- Most people are willing to pay but now willing to learn
  - At least at the beginning
  - Not everyone is like this!
  - Cultural problem, not technological



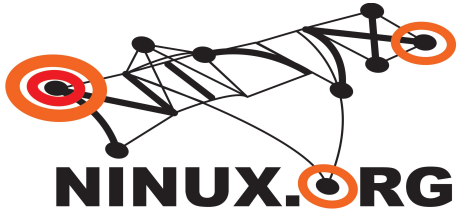
Layer 3 – Network Addressing

- What we want ? Goals:
  - Fully routable Network (No NAT)
  - Scalable (up to 1000 nodes)
- IPv4
  - Manual configuration
    - Need clear understading of IP to configure
  - DHCP not possible in MANET (limited broadcast domain)
- IPv6
  - Automatic stateless configuration
    - Not experts can try to install nodes
  - Address space is big enough to avoid NAT
  - With global addresses we are in one network: The Internet!



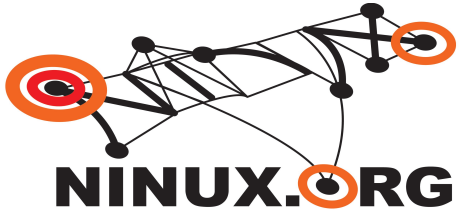
Layer 3 – IPv6

- RFC 2460 – RFC 3513 – RFC 4193
  - December 1998 !!
  - RFC 3363 and 3364 for DNS support (AAAA records)
- More Addresses
  - 128 bit IP addresses
- Stateless autoconfiguration
- No checksums
- No fragmentation
- Multicast / Anycast



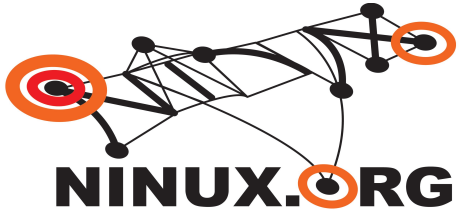
Layer 3 – IPv6 in the Kernel

- Check **`/proc/net/if_inet6`**
- **`modprobe ipv6`**
- **`Networking - > Networking Options -> the IPv6 Protocol`**
- Forget **`ifconfig !`**
- Use **`ip`**
- Compile your applications for IPv6



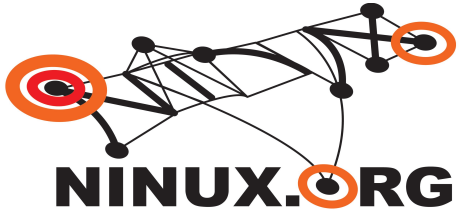
Layer 3 – IPv6 Address Types

- Link Local
  - Automatic (stateless) IP connectivity on same link
  - fe80::/10
    - `ip addr show`
  - Very good in combination with mDNS (Avahi, Bonjour)
- Site Local
  - Just like the old private IPv4
  - fec0::/10
- Global
  - You can request addresses (many) at a Tunnel Broker
  - 2001::/10



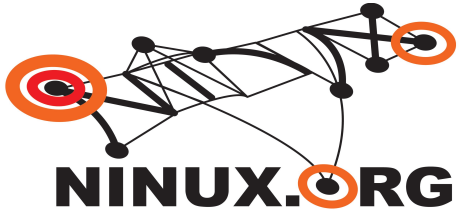
Layer 3 – IPv6 Address Types

- With Global IP addresses for every one
  - Network Address Traslation (NAT) is not necessary anymore
  - End user routers are faster because they do not mantain a state
    - NAT tables
  - Most application problems are NAT problems
- We can finally use IPSec !
  - Without tunneling over UDP
  - With better security and performances!



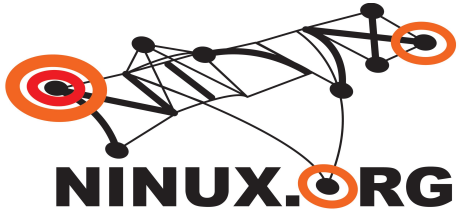
Layer 3 – IPv6 Address Assignment

- Manual Configuration
  - Usually on routers
- Statefull Autoconfiguration
  - Basically DHCPv6
- Stateless Autoconfiguration
  - Routers Advertise prefix of current attached subnet
  - Hosts are able to set up their IP addresses without communication exchange with other peers
  - There is not 1 node that holds the state of the all network
  - Note that DNS server IP address is not provided with router advertisements, but anycast shuold do the job



Layer 3 – IPv6 Packets are simpler

- No checksum
  - Avoid not necessary processing
  - Avoid checksum recalculation when changing options
- No fragmentation
  - VERY big benefit where a state is needed
  - Think of firewalls
    - Need to wait for all fragments before forwarding adding latency
  - Not all fragment are expected to flight on the same path



Layer 3 – IPv6 and IPv4

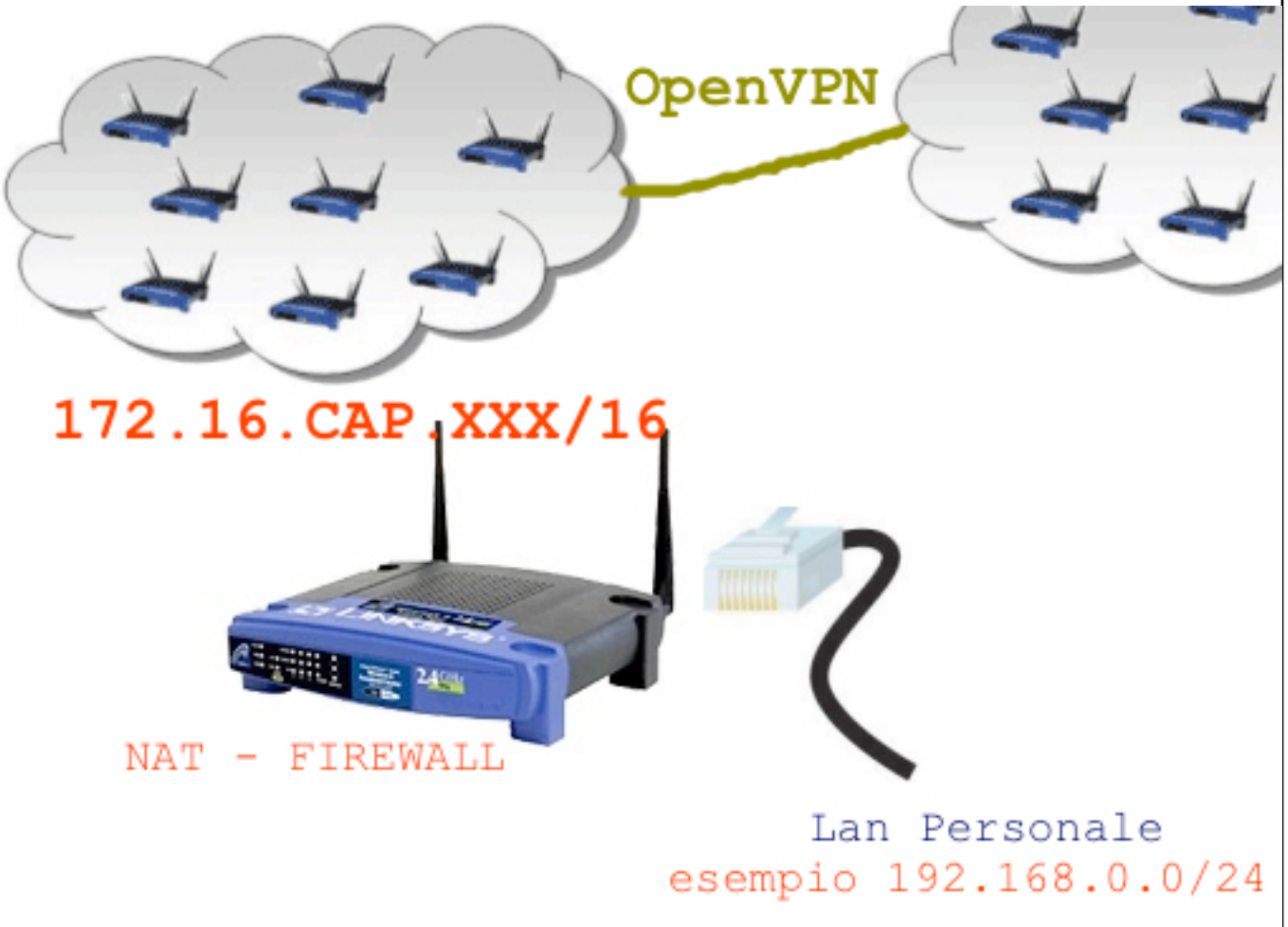
- 6to4
  - Let's you speak IPv6 wheneven you have a public IPv4
  - It is _NOT_ a way to make a IPv4 only host speak with a IPv6 only host
  - 2002:IPv4:IPv4:/48
  - Route towards IPv6 Backbone with anycast address 192.88.99.1
  - Route backwards to IPv4 host wth original IPv4 address
- 6in4
  - It is simply a tunneling
- This is your sit0 interface on Linux
  - Needs tun/tap drivers support in the Kernel

Layer 3 – IPv6 and IPv4

- IPv6 only host to IPv4 world
  - Special DNS resolver
    - If the AAAA record does not exist provide a special A record with a site local prefix and the original IPv4
  - Special Gateway dual stack that keeps state of connections
    - Smart Gateway intercepts the site local prefix and threats packets in a NAT fashion

Layer 3 – Network Architecture

- IPv4
  - Manual configuration
  - Private IP addresses
  - Extreme Subnetting



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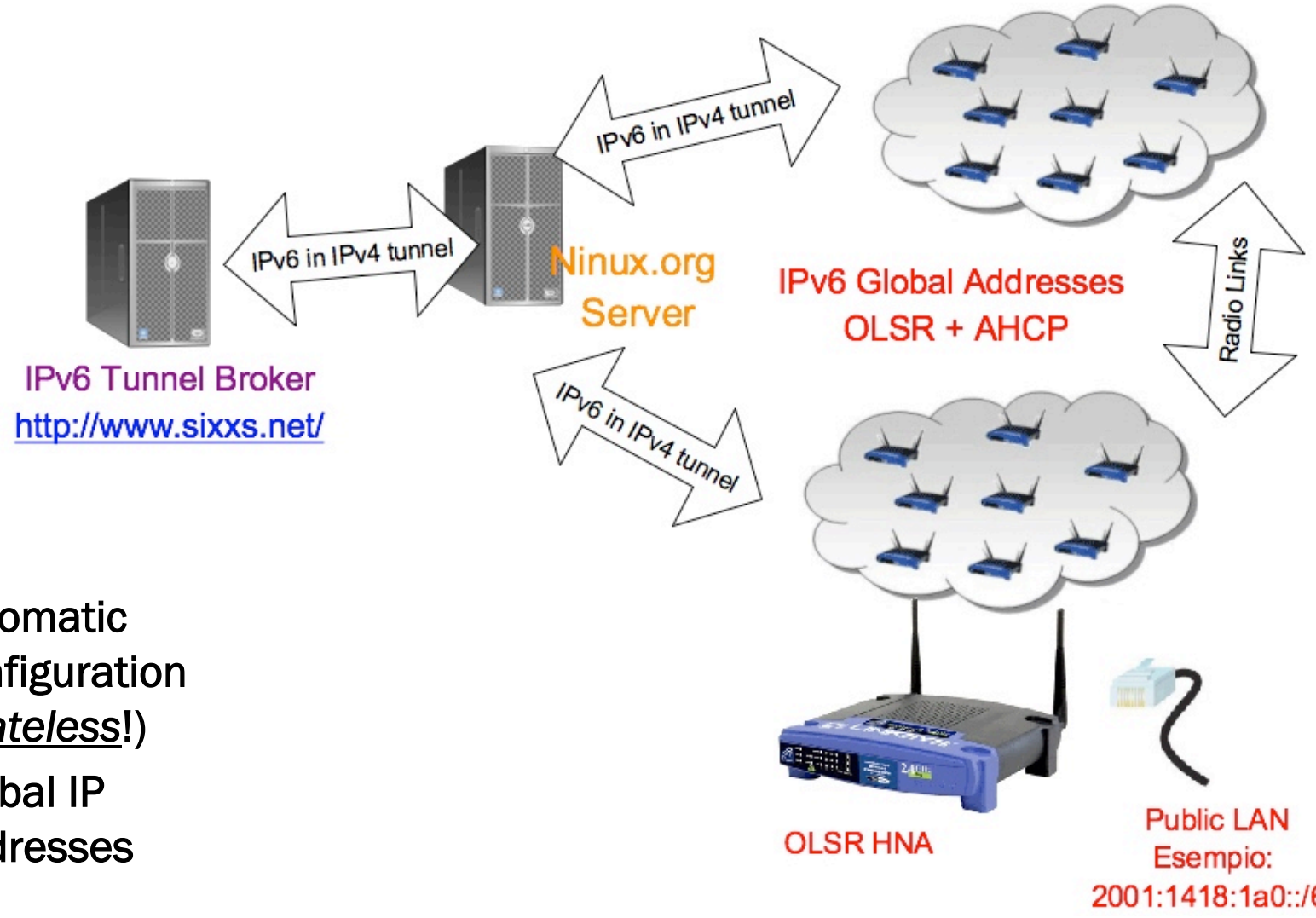


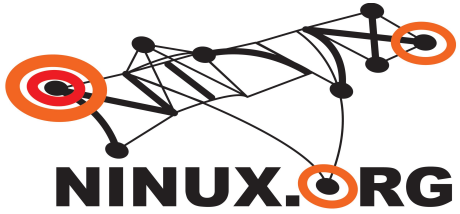
- IPv6
  - Automatic configuration (*stateless*!)
  - Global IP addresses

Layer 3 – Network Architecture

- Each node is capable to select a unique subnet.
- N=2^16=65535 K=1000
- 1.2sqrt(n) = 300 circa

$$P_k = \prod_{i=0}^{k-1} \frac{n-i}{n}$$

GGGG:GGGG:GGGG:ZXXX:MMMM:MMMM:MMMM:MMMM



Questions ?

- Thanks for coming
- Questions ?