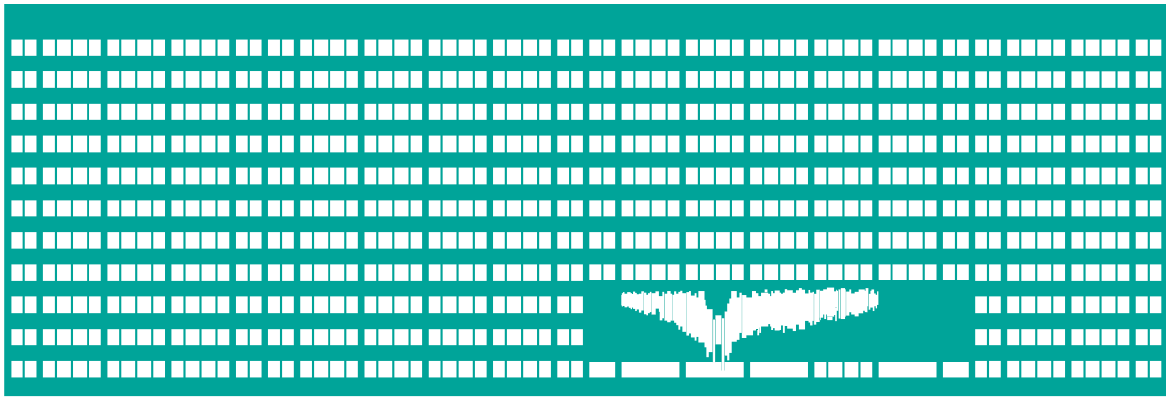
VSB TECHNICAL UNIVERSITY OF OSTRAVA | FACULTY OF ELECTRICAL ENGINEERING AND COMPUTER SCIENCE | DEPARTMENT OF COMPUTER SCIENCE

IPv6



Computer networks
Seminar 6

IPv6 address space

- IPv6 address size is 128 bits (RFC 4291)
  - space: 2^128 addresses
- Like IPv4 is divided to the network address and host address
  - Usually with mask /64
- IANA address ranges released
  - 2000::/3 Global Unicast [RFC4291]
  - FC00::/7 Unique Local Unicast [RFC4193]
  - FE80::/10 Link Local Unicast [RFC4291]
  - FF00::/8 Multicast [RFC4291]

IPv6 address notation

- Full notation
  - eight groups of four hexadecimal digits separated by colon „:“
    - 2001:0000:0db8:0000:0000:0000:1428:57ab
- Short notation
  - Four zeros in a group can be written as one zero
    - 2001:0:0db8:0:0:0:1428:57ab
  - One or any number of consecutive groups of 0 value may be replaced with two colons
    - 2001:0:0db8::1428:57ab
    - **It is not possible:** 2001::0db8::1428:57ab

IPv6 address assignment methods

- Manually configured
- IPv6 autoconfiguration based on known network prefix and MAC address of NIC (ICMPv6)
- using DHCPv6

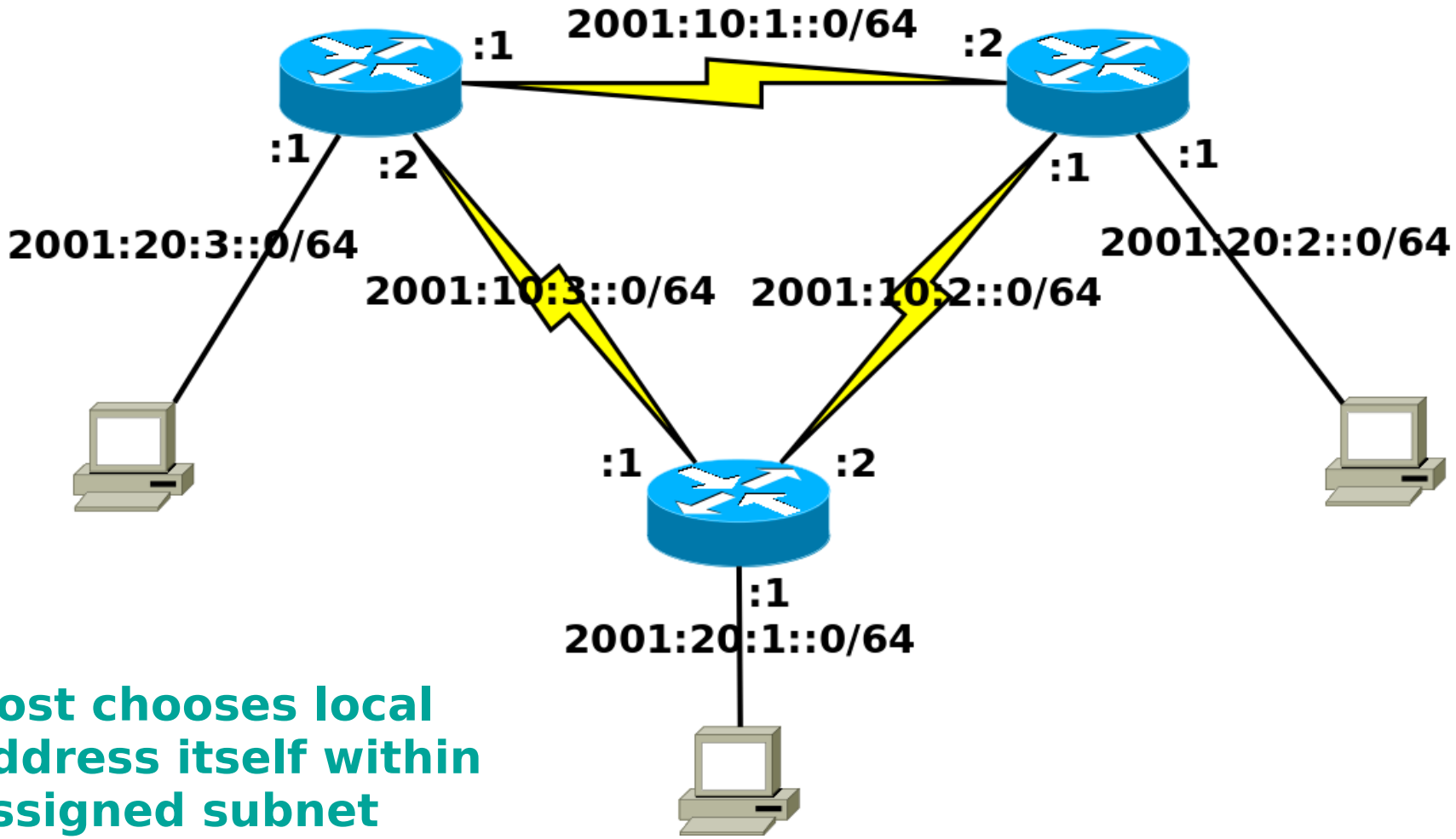
- Manual configuration
  - administratively difficult
  - long addresses are mistake-prone

IPv6 Autoconfiguration

- Easier configuration of IPv6 on local network
- Address derived from advertised network prefix and from NIC MAC address
- Required the presence of the device which is able to provide necessary ICMPv6 messages
  - ICMPv6 server
  - stateless configuration
  - Potentially dangerous
    - Every connected client is able to derived the address

Address plan and network topology

It is required to ensure appropriate routing in the network



Host chooses local address itself within assigned subnet

IPv6 configuration on Cisco router

- Enabling routing process
  - (config)#**ipv6 unicast-routing**
- IPv6 configuration on interface
  - (config)#**interface <type><num>**
  - (config-if)#**ipv6 address <ipv6>/<mask>**
  - (config-if)#**no shutdown**

Switched module for routers

The module provides more (typically 4 or 8) Ethernet switched ports (fast or gig. Ethernet)

- We need to use VLANs to configure these ports
  - (config)# **interface** gi0/1/0
  - (config-if)# **switchport mode access**
  - (config-if)# **switchport access vlan** 123
  - (config-if)# **no shutdown**
- The created virtual interfaces for VLANs are then configured as normal interfaces
  - (config)# **interface vlan** 123
  - (config-if)# **ip/ipv6 address** ...
- We can check the interfaces in normal way:
  - # **show ip interface brief**
  - # **show interface vlan** 123

IPv6 configuration in Linux

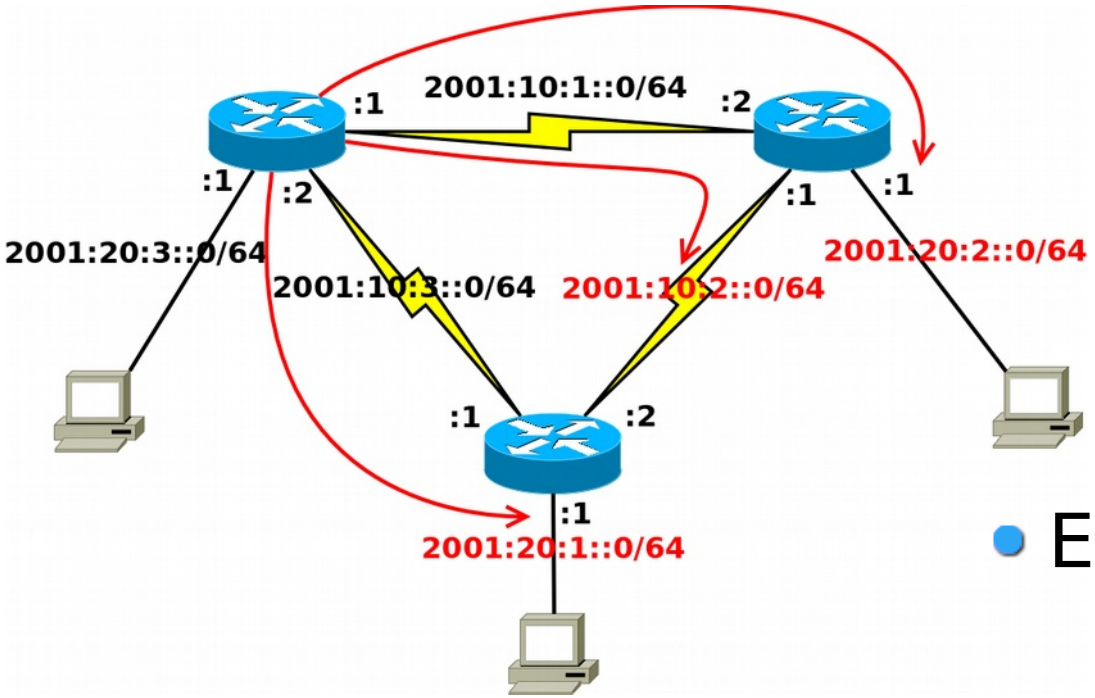
- Iproute2 usage
  - Assigning IPv6 address to interface
    - **ip addr add <ipv6>/<mask> dev <dev>**
  - Removing IPv6 address from interface
    - **ip addr del <ipv6>/<mask> dev <dev>**
  - Removing all configured IP addresses from interface
    - **ip addr flush <dev>**
  - Default gateway configuration
    - **ip route add default via <ipv6_gw>**

Configuration example in Linux

- Removing addresses from int. eth0
  - **ip addr flush eth0**
    - ip a f eth0
- Setting the address 2001:2345::0120/64 on eth0
  - **ip addr add 2001:2345::0120/64 dev eth0**
    - ip a a 2001:2345::0120/64 dev eth0
- IPv6 default gateway configuration
  - **ip route add default via 2001:2345::0001**
    - ip r a default via 2001:2345::0001

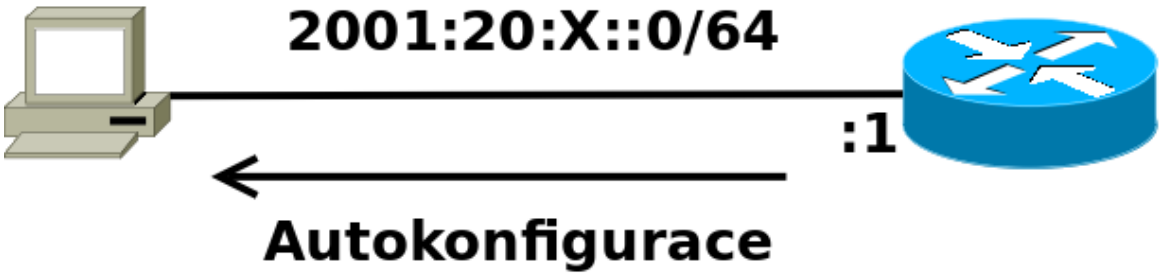
Static routing

- IPv6 static routing
  - (config)#**ipv6 route <ipv6_net>/<mask> <next_hop>**



- It is necessary to add routes leading to not connected parts of network topology on routers
- Every router has 3 static routes

IPv6 autoconfiguration



- Configuration of Ipv6 network prefix propagation from router
  - (config)#**interface <type><num>**
  - (config-if)#**ipv6 nd prefix <IPv6_pref>/<mask>**
- Setting sending interval of router advertisements
  - (config-if)#**ipv6 nd ra-interval <num_sec>**
- Generating IPv6 address on computer
  - **ip link set <dev> down**
  - **ip link set <dev> up**

Configuration checking

- Device accessibility
  - **ping6** <IPv6_addr>
- Path to the device from L3 view
  - **traceroute6** <IPv6_addr>
  - **tracepath6** <IPv6_addr>