# IPv6

Content

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Why do we need IPv6
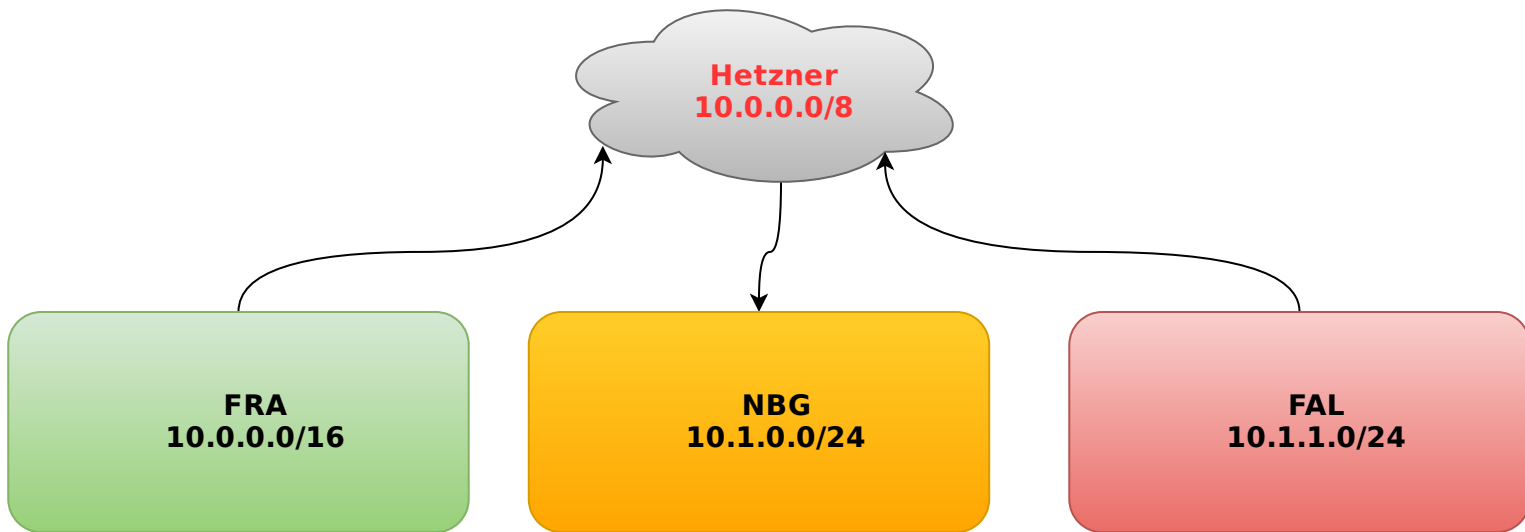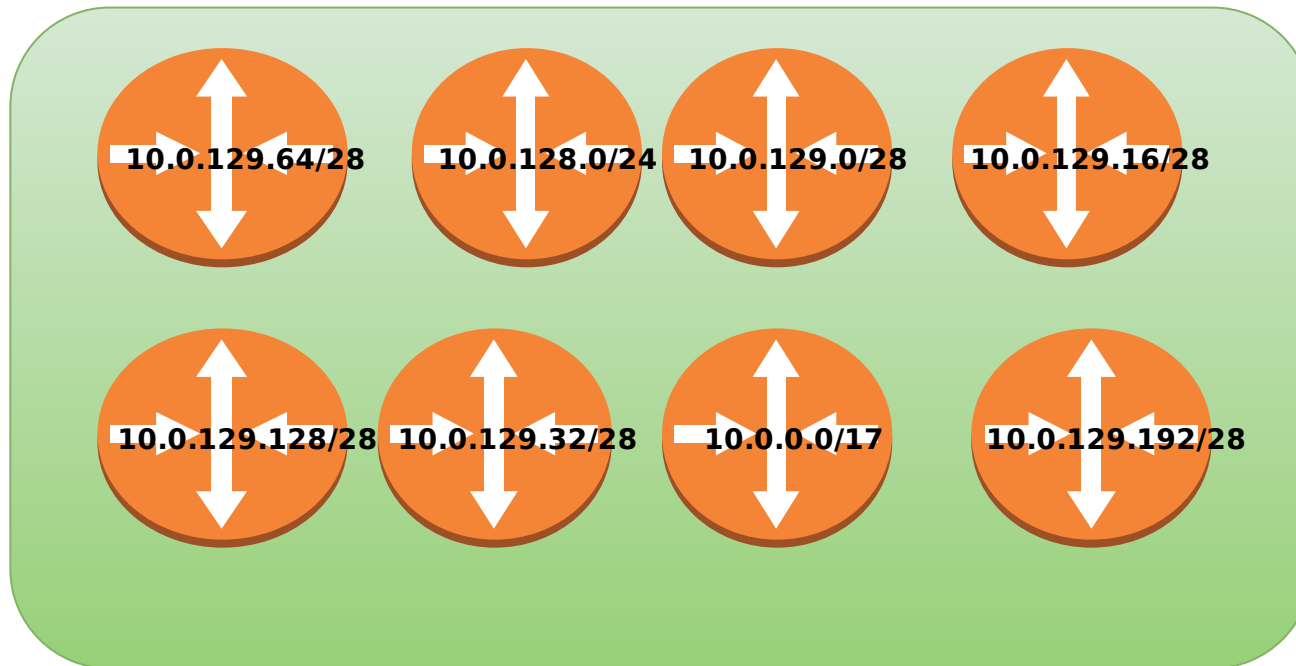
Why we need IPv6

- IPv4 Basics

- 32-bit address range

- 2^32 addresses => 4 billion

- 1.2 billion active devices

- 10 years ago everybody got a class C or B net

- Less available nets => smaller allocation

- 595,385 BGP entries in full table

- Several router fail at 524288 entries (512 * 1024)
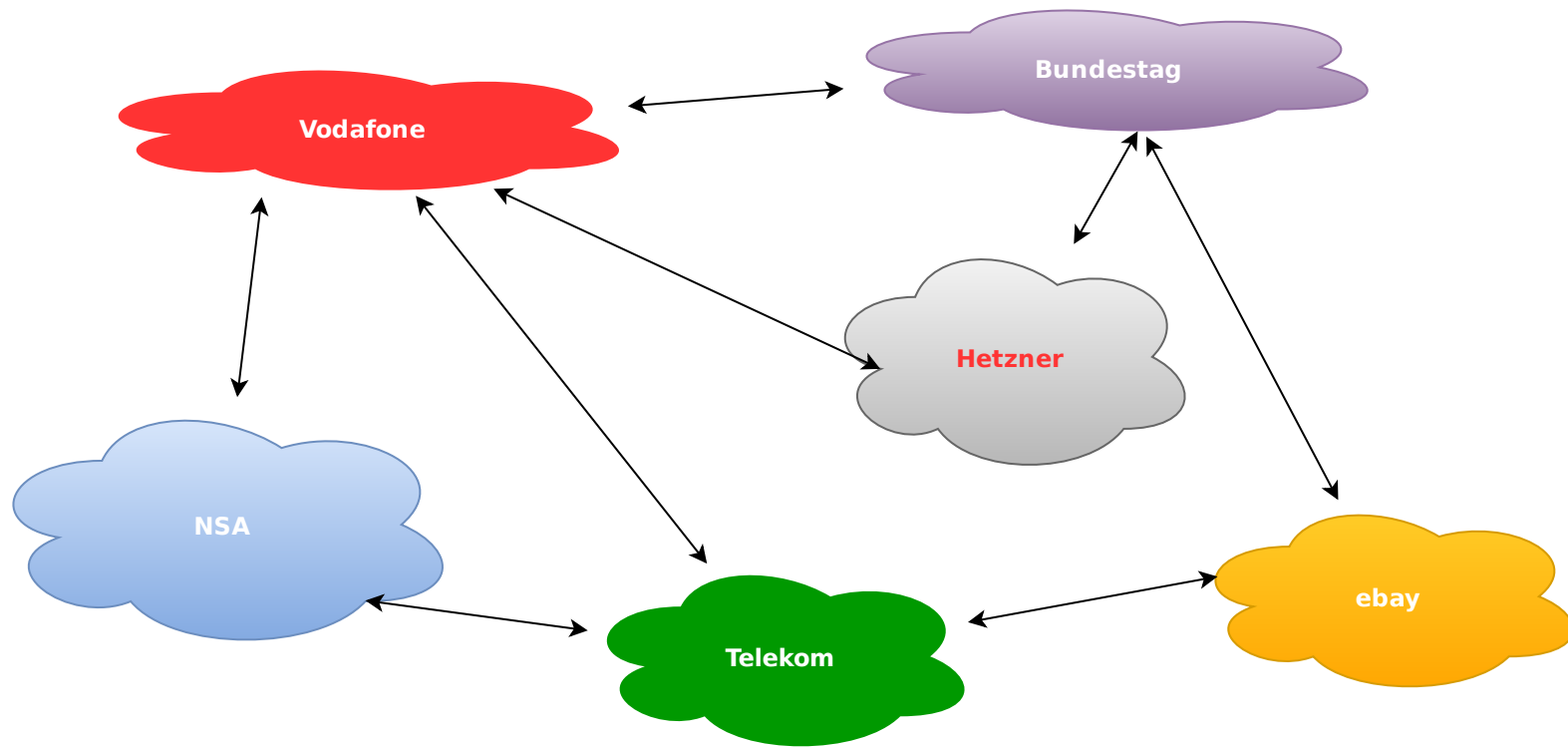
Every cloud = One AS (Autonomous

Hetzner
10.0.0.0/8

FRA
10.0.0.0/16

NBG
10.1.0.0/24

FAL
10.1.1.0/24

Features

Features

- Moar!! Addresses

- 128-bit length

- 2^128 addresses

- 7.9*10^28 times bigger than IPv4 space

- 29-bit prefix for each LIR (Local Internet Registry)

- LIR can get even one per location

- Even 19-bit prefix if you blame the RIR (Regional Internet Registry)

- For example DTAG got 2003::/19

- Every site should get their own 64-bit prefix

- 48-bit minimal PI space

- 2a00::/12 for RIPE

- IANA currently uses 2000::/3

Features

- Moar!!
Addresses

- New notation

- New hex notation: 2a01:4f8:11a:b1f::4/64

- Full notation: 2a01:04f8:011a:0b1f:0000:0000:0000:0004

- 8 groups of 16-bit in hex

- Ignore leading 0s in groups

- Replace the biggest successive group of zeros with ::

- /64 indicates the prefix length

- 64-bit is default, can be omitted

Features

- Moar!!
Addresses

- New notation

- **Improvement**

- No broadcast

- Multicast is mandatory

- Neighbor Discovery Protocol (NDP) as ARP replacement

- Always assign 64bit prefixes to devices, no single IP-Addresses

- Privacy extension for host part of addresses

Features

- Moar!!
  Addresses

- New notation

- Improvement

- **Multicast**

Excursion about Multicast

- Own address space, prefix is ff::/8

- used for communication in groups

- different groups and scopes available

- Simply assign an address from a group to you to be part of the group

- ff0X::1 : every device with IPv6 (like IPv4 broadcast)

- ff0X::2 : all router

- ff0X::f : UPnP devices

- ff0X::101 : NTP server

- ff0X::1:2 : DHCPv6 server

- Where X is: 1 = Interface-Local; 2 Link-Local, 8 Organization-Local

Features

- Moar!!
Addresses

- New notation

- Improvement

- Multicast

- **Useless stuff**

- Mobile IPv6

- SLAAC - StateLess Address AutoConfiguration

- DAD - Duplicate Address Detection

- Fake RA - Router Advertisment

- RA Flooding

- Fake DAD

Features

- Moar!!
Addresses

- New notation

- Improvement

- Multicast

- Useless stuff

- **Good to know**

- IPv6 is always prefered over IPv4

- IPv4 and IPv6 are seperate networks, awesome for breaking stuff

- BIOS PXE boot will never support IPv6

- UEFI PXE boot supports IPv6 + IPv4

- Link local address now contains MAC address fe80::52e5:49ff:fe41:c204

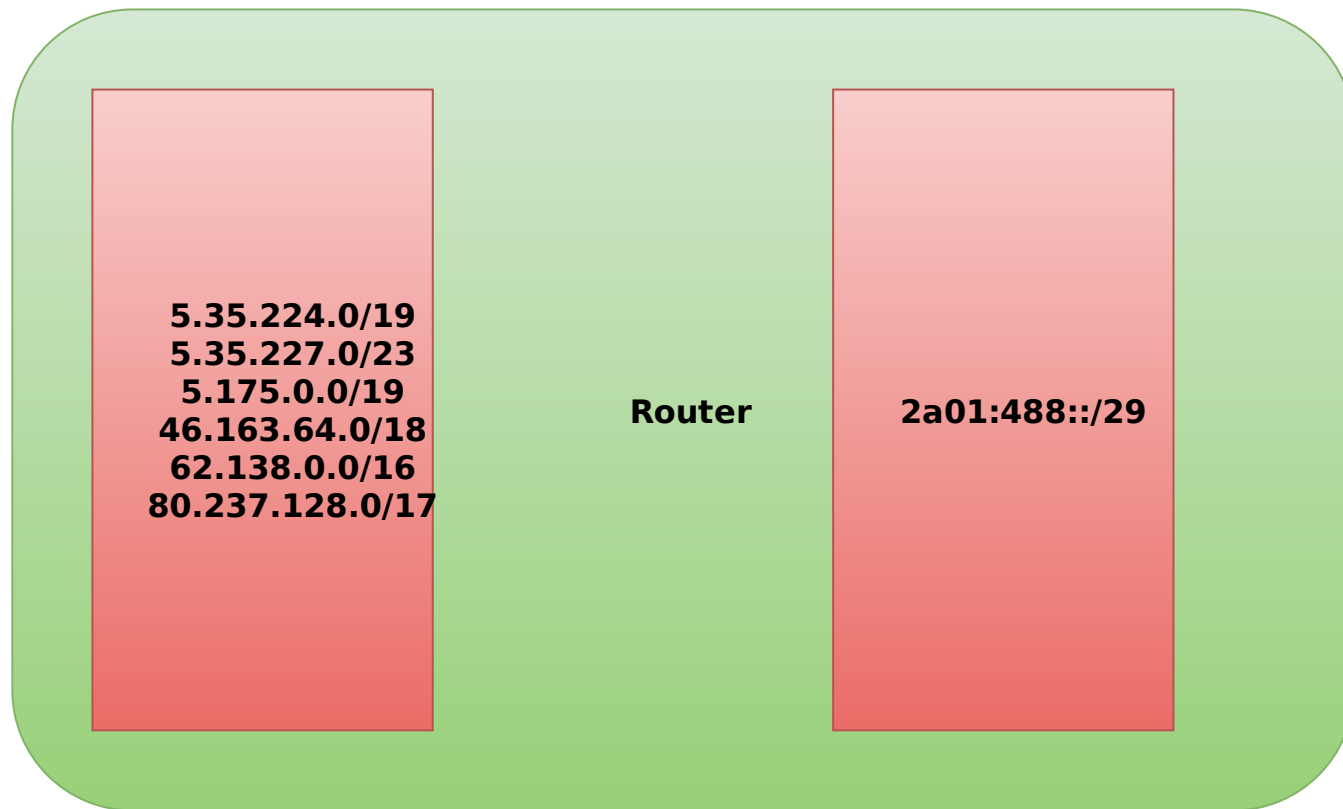- Route your prefix to server, no bridging

- STOP SHITTY NAT!

Implementation

Implementation

- Global Routing

- IPv6 addresses are 4 times bigger than IPv4

- Requires 4 times more space for each BGP entry

- Routers are already full ...

- Bigger prefixes for each AS -> less prefixes -> less BGP entries

- Hierarchical routing

- Renumber a server if he changes the location, don't route his prefix

- DO NOT ROUTE A 64bit PREFIX

SERIOUSLY, DO NOT ROUTE A SINGLE PREFIX

5.35.224.0/19
5.35.227.0/23
5.175.0.0/19
46.163.64.0/18
62.138.0.0/16
80.237.128.0/17

Router

2a01:488::/29

Implementation

- Global Routing

- System configuration

- Static for servers

- Always try to use link local gateway fe80::1

- SLAAC for clients in trusted networks

- DHCP6 or static for clients in untrusted networks

Implementation

- Global Routing

- System configuration

- **Debugging**

- Do you run a firewall? Does it care about IPv6?

- You killed IPv4/IPv6 Routing/Firewalling? The other protocol will still work

- Never forget that IPv6 is always preferred over IPv4

- Local issues? Check the cache size of your switch

- Routing issues? Check the cache size of your routers

- Initial connection is slow? Src + Dest have IPv6 configured but it is broken => fallback to IPv4

Summary

Plan your hierarchy wisely

Honor your hierarchy

Be careful with SLAAC