



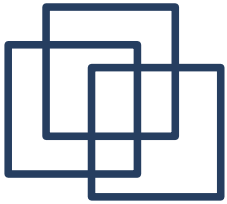
# IPv6 Internet Reloaded

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Thomas Schäfer  
(Systemadministration)

LMU Munich

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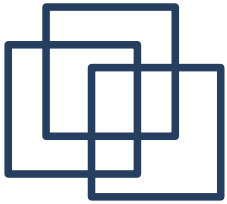
# Who am I?

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```
inet6num:      2001:4ca0:4f01::/48
netname:       DE-MWN-LMU-CIS
descr:         Ludwig-Maximilians-Universitaet Muenchen
descr:         Zentrum fuer Informations- und Sprachverarbeitung
descr:         Oettingenstr. 67
descr:         80538 Muenchen
country:       DE
admin-c:       TS3160-RIPE
tech-c:        TS3160-RIPE
status:        ASSIGNED
mnt-by:        LRZ-MNT
created:       2005-07-07T13:40:29Z
last-modified: 2005-07-07T13:40:29Z
source:        RIPE

person:        Thomas Schaefer
address:       Ludwig-Maximilians-Universitaet Muenchen
address:       Zentrum fuer Informations- und Sprachverarbeitung
address:       Oettingenstr. 67
address:       80538 Muenchen
address:       Germany
phone:         +49 89
phone:         +49 89
fax-no:        +49 89
nic-hdl:       TS3160-RIPE
mnt-by:        LRZ-MNT
created:       2005-07-07T13:40:28Z
last-modified: 2005-07-07T13:40:28Z
source:        RIPE # Filtered
```

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[www.cis.uni-muenchen.de](http://www.cis.uni-muenchen.de)

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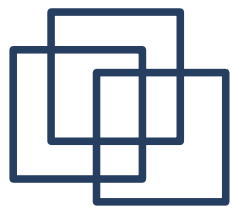
- a small unit of the Ludwig-Maximilians-University
  - IPv6 since 2005 in use
  - 20 servers(linux), 25 workstations(linux, win, mac)
  - 20 staff members, a lot of students with mobile computers
  - part of Munich Scientific Network(MWN) by Leibniz Supercomputing Centre (LRZ)
-



# Operating Systems

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- Linux – Opensuse, Ubuntu, qemu/kvm
  - Mac OS X
  - Windows 10
  - some ipv4-only devices: troubling printers
  - some IPv6-only devices: file servers  
(nfs, cifs, isp, ntp)
-

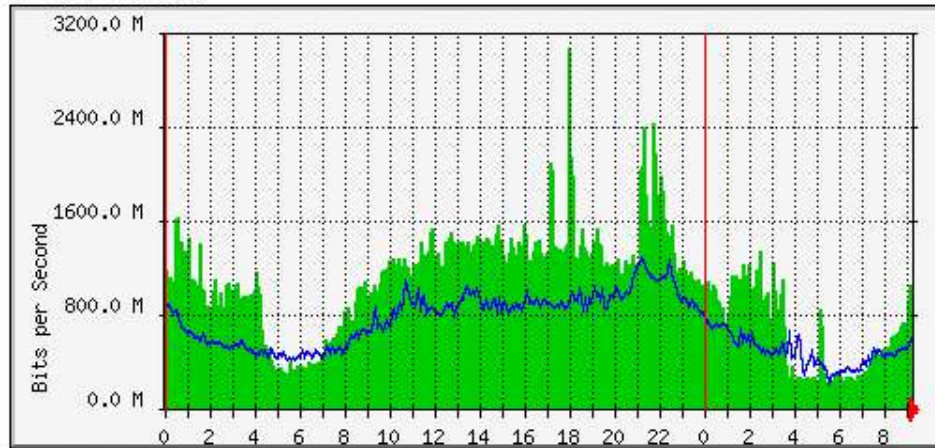


# Traffic 2010 vs 2020 LRZ

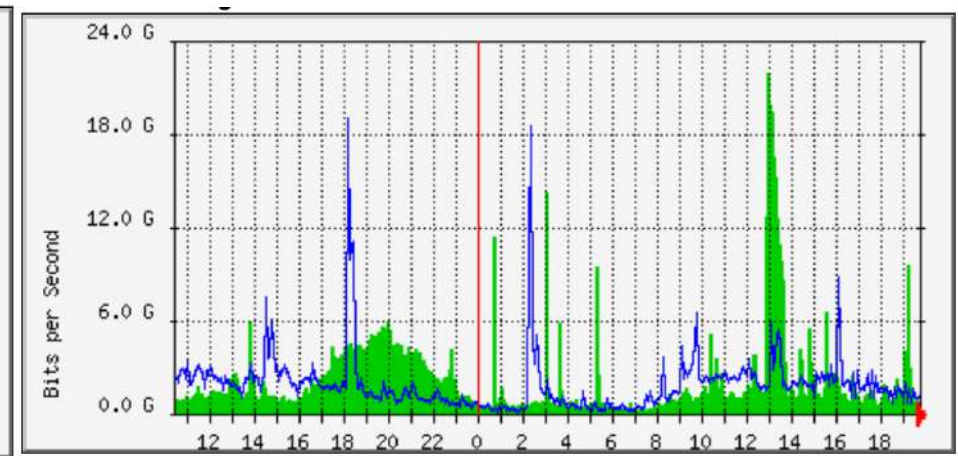
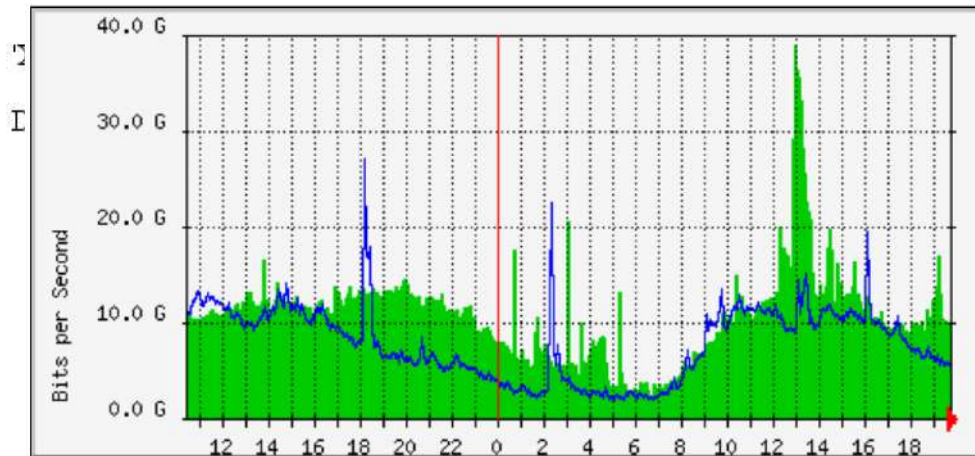
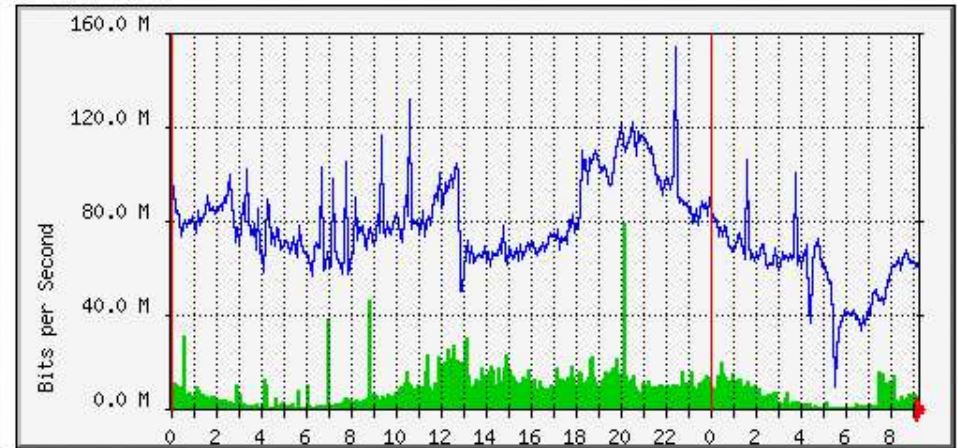
X-WiN

2010

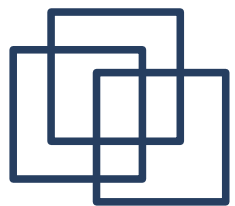
X-WiN Gesamt



X-WiN IPv6

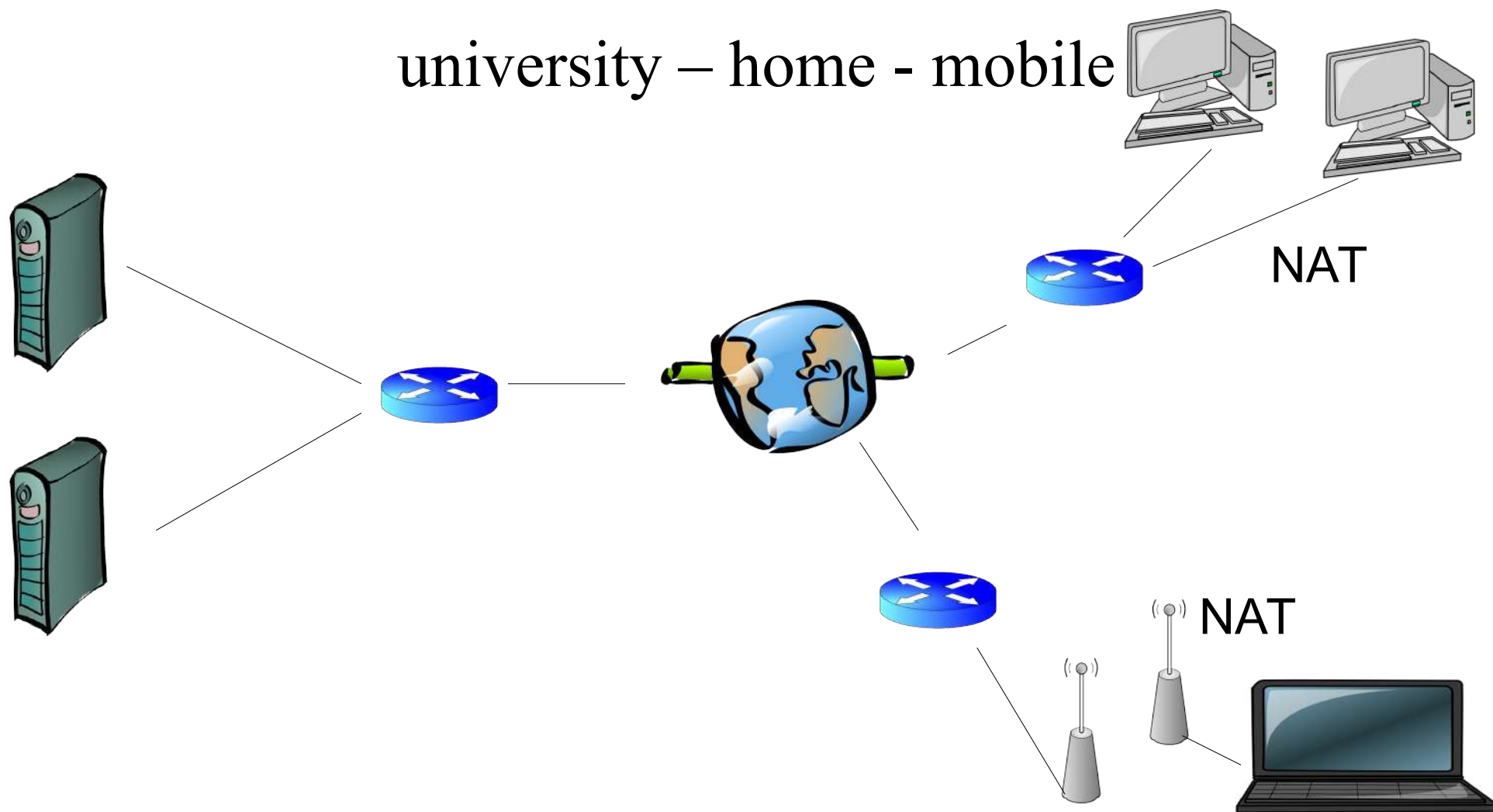


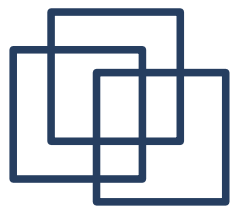
2020



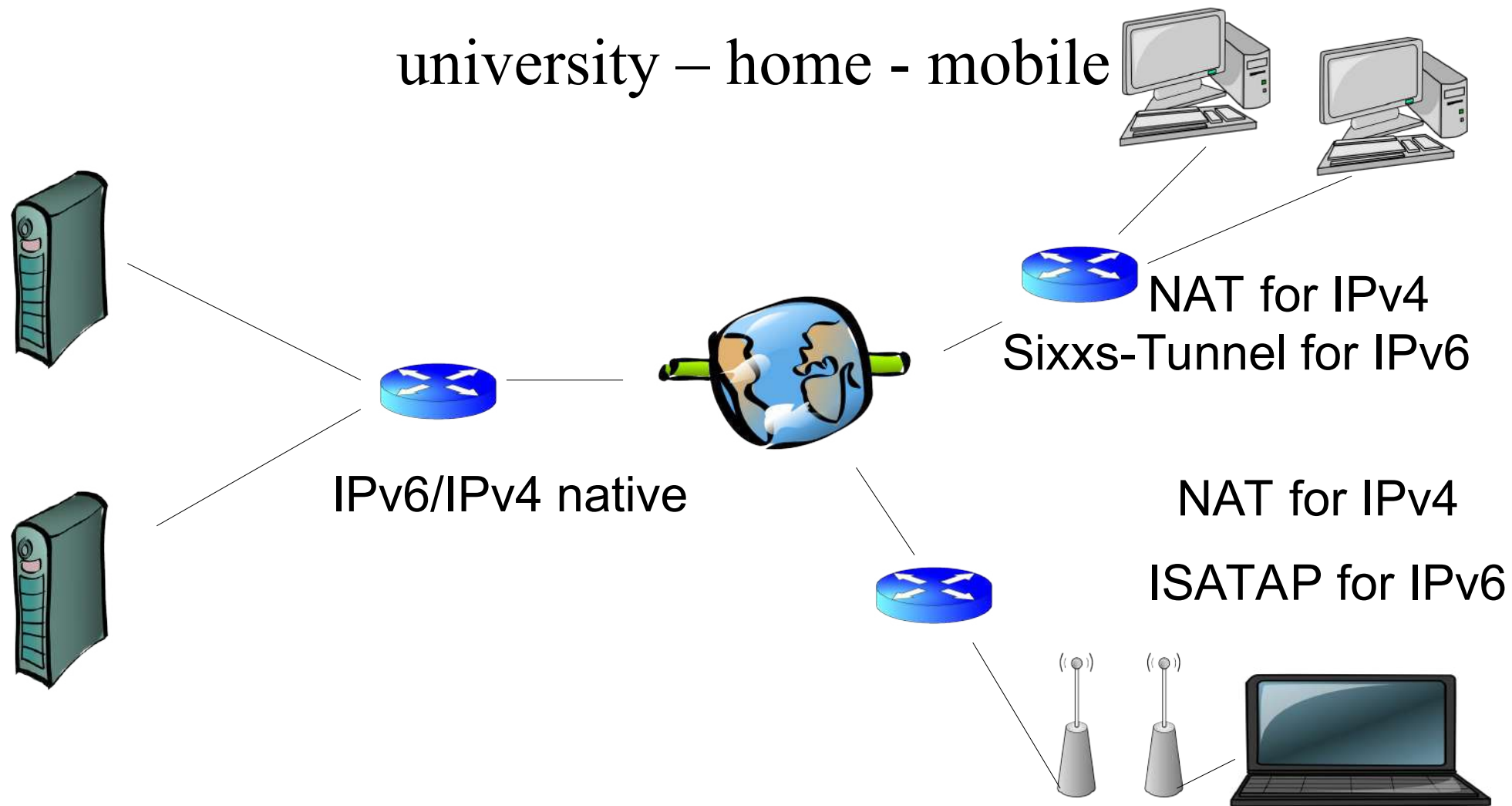
# The magic triangle – 2006

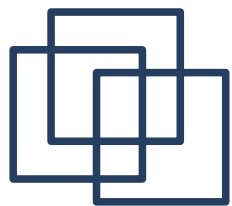
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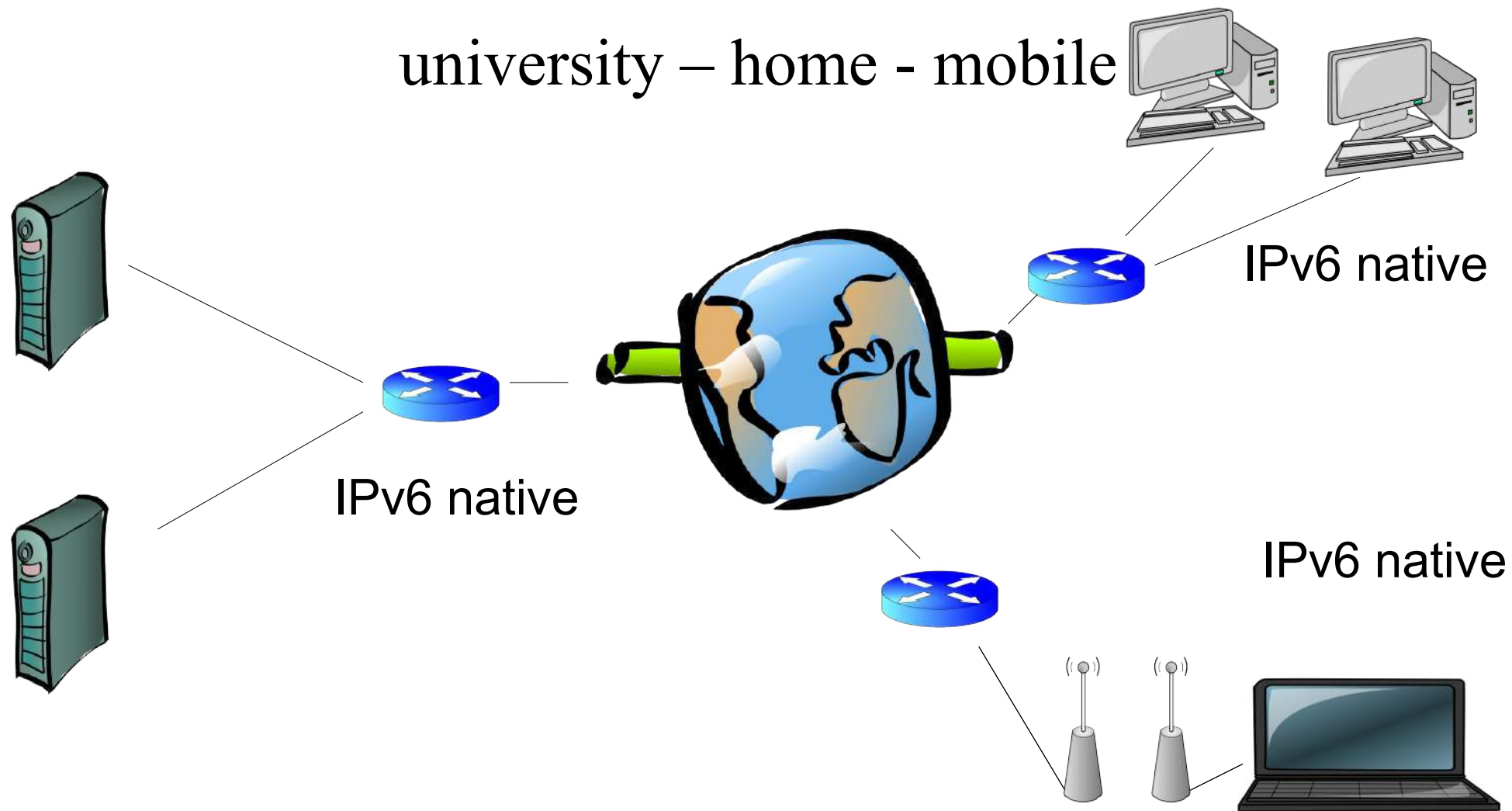
# The magic triangle - 2010



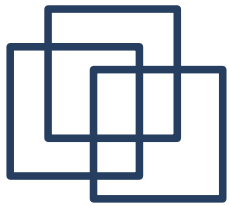


# The magic triangle – 2020

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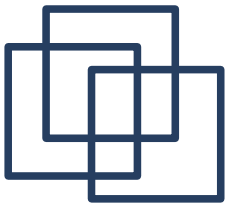




# Services via IPv6 extern

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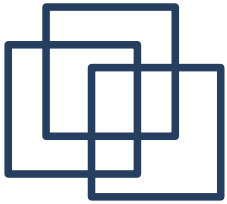
- port 25, 465, 587 email via smtp(s)
  - port 993, 995 email via imaps and pop3s
  - port 53 - DNS
  - port 80/443 – http(s) (gitlab)
  - port 22 – ssh (gitlab)
  - port 3690 - subversion
  - port 3389 xrdp
  - port 5901 vnc
  - ...
-



# Services via IPv6 intern

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- port 123 - Network Time Protocol
  - port 631 - Internet Printing Protocol (cups)
  - port 445 - cifs/SaMBa
  - port 5432 - database PostgreSQL
  - port 2049 - nfsv4
  - port 3306 - mariadb
  - port 27017- mongodb
  - ....
  - ip6tables for packet filtering
-



## in the meantime...1/3

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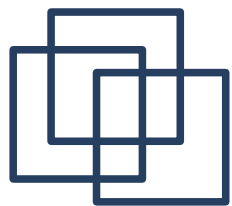
What happened to my DSL at home?

- 2004-2014: IPv4-only DSL, IPv6 via sixxs-tunnel
- 2014: Deutsche Telekom switched me to dualstack
- 2018: I moved to M-Net, a regional ISP, DS-lite

Good Bye IPv4! Welcome FTTB!

Welcome fast IPv6!

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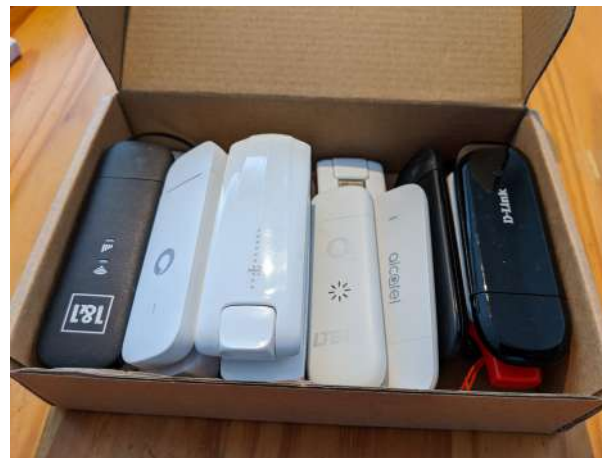
## in the meantime ...2/3

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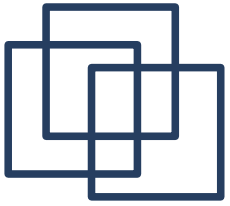
Development of IPv6 – mobile (Vodafone)  
starting with sixxs-tunnel ...

- 2012 – 2015: I got access to an early IPv6-test

collection of my  
LTE-dongles – (the winners)



- end of 2019: Vodafone provides dualstack
-



## in the meantime ...3/3

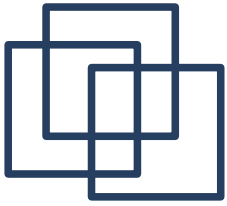
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Development of IPv6 – mobile (Telekom)  
starting with sixxs-tunnel ...

- 2014: I got access to an early IPv6-dualstack test
- 2015: Telekom provides dualstack for all
- 2018: I got access to an IPv6-only test
- 2020: Telekom provides IPv6-only for all

Good Bye IPv4!





# Smartphones? Of course!



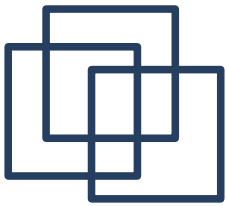
dualstack by  
Vodafone



IPv6-only and  
dualstack by  
Deutsche  
Telekom



IPv6-only and  
dualstack WIFI by  
LRZ  
(service provider  
of the universities  
in Munich)

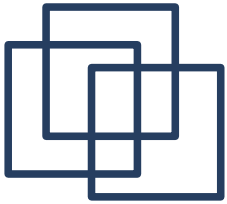


# special use cases

VPN Statistics	
<b>CONNECTION INFORMATION</b>	
Time Connected	00:00:23
Status	Connected
Tunneling Mode	Tunnel All Traffic
Tunneling Mode (IPv6)	Tunnel All Traffic
<b>ADDRESS INFORMATION</b>	
Client	141.84.15.188
Server	2001:4CA0:0:119:0:500...
Client (IPv6)	2001:4CA0:4FFF:11:0:0...
<b>BYTES</b>	
Sent	2296
Received	5518
<b>FRAMES</b>	
Sent	20
Received	15
<b>CONTROL FRAMES</b>	
Sent	2
Received	1

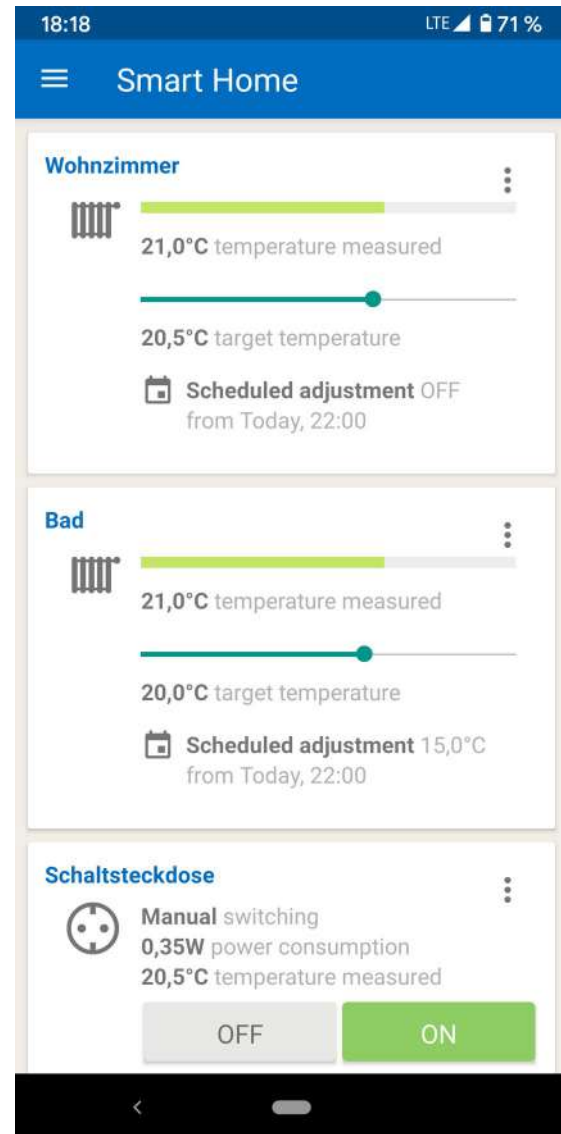
- VPN from home/mobile to the university(cisco)
- VPN from university/mobile to home(openvpn)
- ssh and other remote tools work also without VPN via IPv6 in both directions

Profiles	
<b>CONNECTED</b>	
<input checked="" type="checkbox"/>	OpenVPN Profile tschaefer.dynv6.net
<b>DISCONNECTED</b> ▾	
<b>CONNECTION STATS</b>	
7.3KB/s	
0B/s	0B/s
BYTES IN 3 B/S ↓	BYTES OUT 4 B/S ↑
DURATION 00:04:44	PACKET RECEIVED 5 sec ago
YOU	
YOUR PRIVATE IP (IPv4) 192.168.178.134	
YOUR PRIVATE IP (IPv6) 2001:a61:4e8:9001::1:1001	
SERVER tschaefer.dynv6.net	
SERVER PUBLIC IP 2001:a61:4e8:9001:ba27:ebff:feb6:f293	
PORT 1194	VPN PROTOCOL UDPv6 +

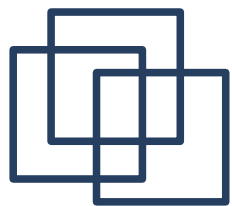


# Smart home...

beside some personal services, like the vpn, access to my storage, remote desktop I also use a commercial application for smart home – via IPv6







# Last but not least – corona..

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like a lot of other people I installed jitsi-meet

peer to peer works

Connection: Good

Bitrate: ↓ 1822 Kbps ↑ 2610 Kbps

Packet loss: ↓ 0% ↑ 0%

Resolution: 1280x720

Frame rate: 30

Server count: 1

[Show less](#)

Estimated bandwidth: ↓ N/A ↑ 4580 Kbps

Remote address: [2a00:20:a003:61ef:699c:9bd7:f8b2:2692] (p2p)

Remote port: 40447

Local address: [2a01:598:b970:4ca7:44bf:4365:18b3:241c]

Local port: 38072

Transport: udp

Connection: Good

Bitrate: ↓ 2604 Kbps ↑ 1628 Kbps

Packet loss: ↓ 0% ↑ 0%

Resolution: 640x360

Frame rate: 30

Server count: 1

[Show less](#)

Estimated bandwidth: ↓ N/A ↑ 3318 Kbps

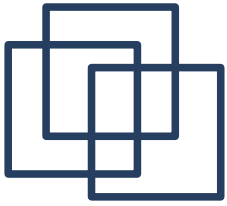
Remote address: [2a01:598:b970:4ca7:44bf:4365:18b3:241c] (p2p)

Remote port: 38072

Local address: [2a00:20:a003:61ef:699c:9bd7:f8b2:2692]

Local port: 40447

Transport: udp

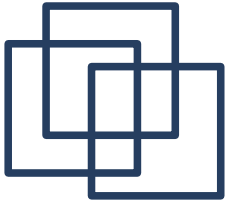


Not the end..

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Enjoy IPv6!

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The end.

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Thank You!

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