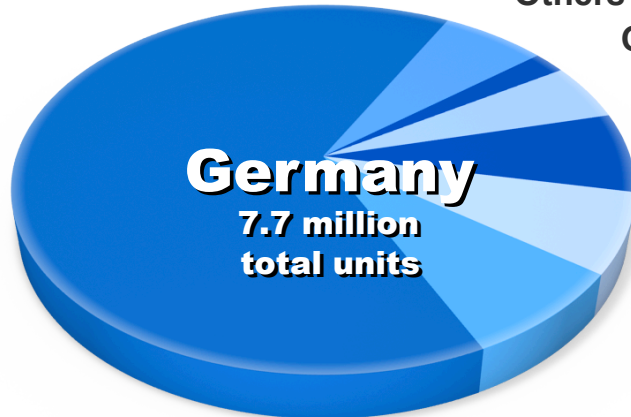




IPv6 in the home network Real life experiences with FRITZ!Box

About AVM

AVM 65%



Others 6%

Gigaset 2%

D-Link 5%

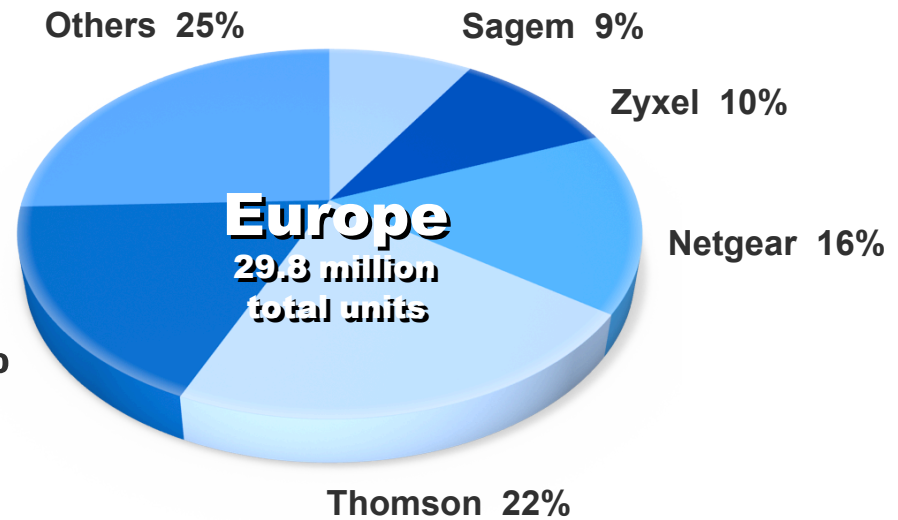
Thomson 7%

Zyxel 7%

Netgear 8%



AVM 18%



Others 25%

Sagem 9%

Zyxel 10%

Netgear 16%

Thomson 22%

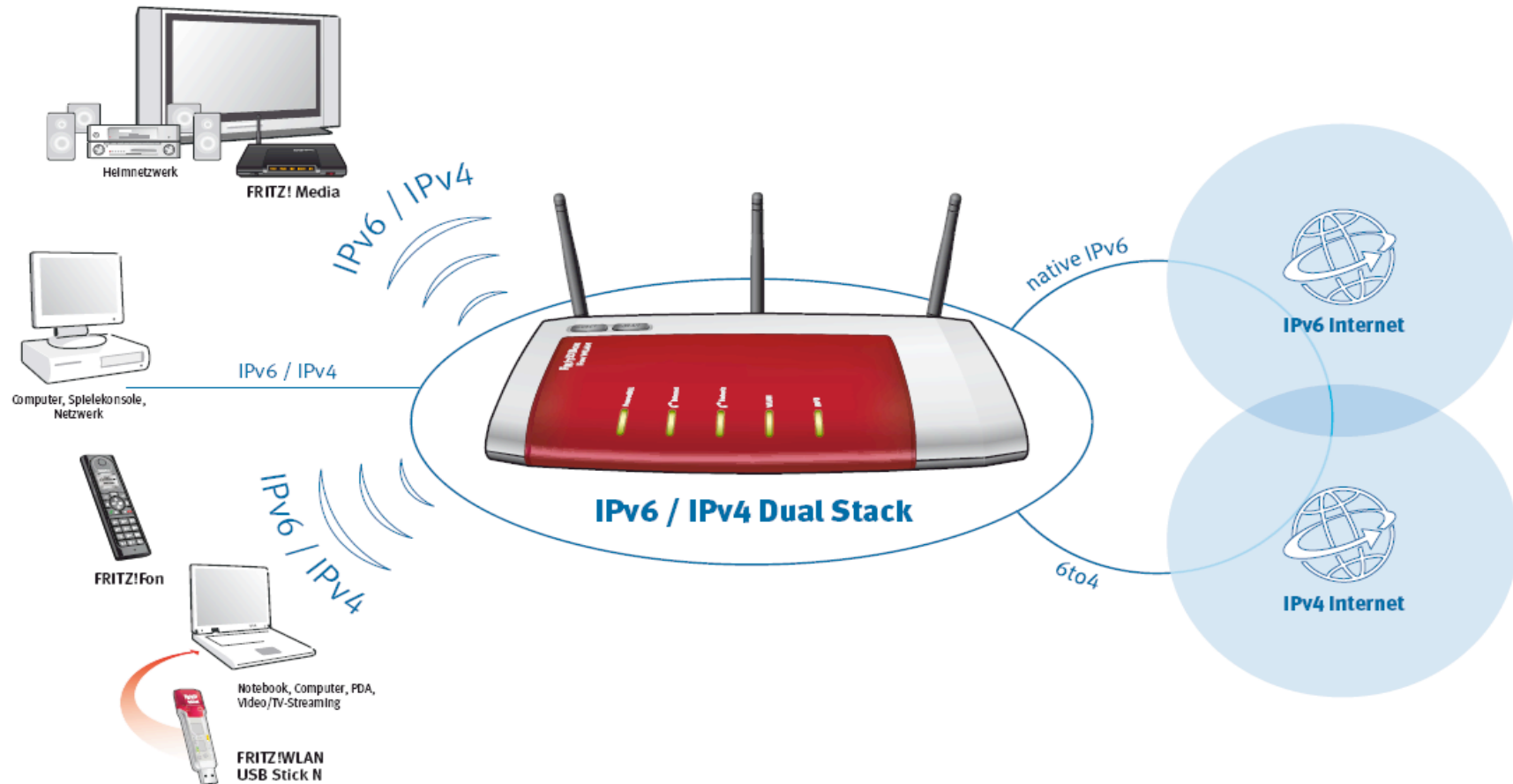


AVM Network Development

- **Own network development department**
- **Complete IP routing stack is developed by AVM**
- **18 years ago: Novell IPX Router for ISDN**
- **15 years ago: Multiprotokoll Router with IPv4 support**
- **8 years ago: first DSL products**
- **6 years ago: FRITZ!Box products for home networks SoHo-applications**
- **12 years ago: PBX for home applications**
- **2008: Start of the IPv6 development**
- **March 2009 (Cebit): Release of the first public IPv6-Firmware for FRITZ!Box 7270**
www.avm.de/en/IPv6



IPv6 with FRITZ!Box



IPv6 Development

~50 RFCs have been implemented

- Complete IPv6/IPv4 dual stack on the WAN and LAN side
- IPv6CP and ND support for native IPv6 over Broadband connections
- DHCPv6 prefix delegation
- DNS AAAA-Support
- DHCPv6 client and server
- Router Advertisement
- 6to4 Support
- Support for SixXS.net Heartbeat-Tunnel
- Release at Cebit 2009, Press Announcement together with Freenet
- One of the first IPv6 enabled IADs worldwide



IPv6 firmware releases

German and international firmware is available here

www.avm.de/en/ipv6

www.avm.de/ipv6

- **FRITZ!Box Fon WLAN 7270**
 - WLAN, ADSL2+, DECT, Ethernet, ISDN/PSTN
- **FRITZ!Box Fon WLAN 7570**
 - WLAN, VDSL/ADSL2+, DECT, Ethernet, ISDN/PSTN



IPv6 WAN Options

Zugangsdaten

Einstellungen IPv6

Status der IPv6-Internetverbindung: nicht aufgebaut Aktualisieren

IPv6-Unterstützung

Unterstützung für IPv6 aktivieren

IPv6 über DSL verwenden (numbered PPP)
Diese Einstellung erfordert, dass Ihr Anbieter IPv6 über numbered PPP unterstützt. Die IPv6-Adresse für die DSL-Schnittstelle wird über PPPv6 zugewiesen.

IPv6 über DSL verwenden (unnumbered PPP)
Diese Einstellung erfordert, dass Ihr Anbieter IPv6 über unnumbered PPP unterstützt. Die IPv6-Adresse für die DSL-Schnittstelle wird anhand der via DHCPv6 zugeteilten Prefixe bestimmt.

IPv6 über eine herkömmliche IPv4-Verbindung verwenden (6to4)
Diese Einstellung kann mit herkömmlichen IPv4-Internetanschlüssen genutzt werden.

IPv6 über einen SixXS-Tunnel nutzen
Diese Einstellung kann mit allen herkömmlichen IPv4-Internetanschlüssen genutzt werden.
Vor der Nutzung ist es notwendig, einen Tunnel mit Heartbeat-Unterstützung unter www.SixXS.net zu beantragen.

SixXS Zugangsdaten

Benutzername:

Kennwort:

Tunnel-ID:



IPv6 FRITZ!Box GUI

The screenshot shows the FRITZ!Box web interface in a browser window. The browser's address bar shows 'http://fritz.box/'. The interface has a blue header with the 'FRITZ!Box' logo and navigation tabs for 'Startmenü' and 'Einstellungen'. A left sidebar contains menu items: 'Übersicht', 'Anrufe', 'Telefonbuch', 'Telefoniegeräte', 'Netzwerk', 'Ereignisse', and 'Energiemonitor'. The main content area is titled 'Übersicht' and displays the following information:

- Produktinformationen:** FRITZ!Box Fon WLAN 7270, Firmware-Version 54.04.70-astockmeier-build_1144-13724. Kennwortschutz nicht aktiv: [Kennwort setzen \(empfohlen\)](#)
- Anschlussinformationen:**
 - DSL: bereit
 - DECT: aus
 - WLAN: aus
 - LAN: verbunden (LAN 1, LAN 2, LAN 3)
 - USB-Geräte: kein Gerät angeschlossen
- Verbindungsinformationen:**
 - Internet: verbunden seit 25.02.2009, 09:53 Uhr. IP-Adresse: 87.234.237.214
 - Internet, IPv6: verbunden seit 25.02.2009, 09:53 Uhr. IPv6-Präfix: 2002:57ea:edd6::/64
 - Internettelefonie: Rufnummer 39976256, registriert
- Komfortfunktionen:**
 - Fernwartung: aktiviert, <https://87.234.237.214>, Benutzername: user

Buttons for 'Aktualisieren' and 'Hilfe' are located at the bottom right of the main content area. The status bar at the bottom left of the browser window shows 'Fertig'.



IPv6 Connected

Einstellungen IPv6

Status der IPv6-Internetverbindung: aufgebaut

Globale IPv6 Adresse:	2002:57ea:edd8:1000:21f:3fff:fe55:3a53/64
Global Address Lifetimes (Valid/Preferred):	3148/1348 s
IPv6-MTU:	1280
Global IPv6-Prefix for LAN:	2002:57ea:edd8::/56
Global Prefix for LAN Lifetimes (Valid/Preferred):	3148/1348 s
Erster IPv6 DNS-Server:	
Zweiter IPv6 DNS-Server:	

Aktualisieren



IPv6 in the LAN – Service migration

- **IPv6 enabled FRITZ!Box services**
 - Webinterface (http and https)
 - SMB/CIFS
 - FTP
- **IPv6 standardization is not complete for some common home network protocols**
 - UPnP AV: based on the assumption that home network addresses are not routed
 - UPnP IGD: firewall control and port forwarding need an extension of the standard



Learning: Unique Local Adresses

- **What happens if the gateway does not know a globally valid prefix? (DSL-sync loss, wrong user credentials, time based rate with inactivity timer, ...)**
- **How should local peers communicate?**
- **Link Locale Addresses should not be used for real data.**



Link Locale Addresses

RFC 3513, Section 2.5.6

Local-Use IPv6 Unicast Addresses

...

Link-Local addresses are designed to be used for addressing on a single link for purposes such as automatic address configuration, neighbor discovery, or when no routers are present.

Routers must not forward any packets with link-local source or destination addresses to other links.



Unique Locale Addresses (ULA)

Solution: assign an ULA-prefix when there is no globally valid prefix

Solvable problem: Windows XP likes the ULA so much that it sends packets with an ULA as source address even when the internet connection has been reestablished and a globally valid prefix has been assigned to Windows.

Unique Local Addresses

Wenn keine IPv6-Internetverbindung aufgebaut ist, kann FRITZ!Box lokalen Netzwerkgeräten Unique Local Addresses (ULA) zuweisen, damit diese untereinander kommunizieren können.

- keine Unique Local Adresses (ULA) zuweisen (nicht empfohlen)
- Unique Local Adresses (ULA) zuweisen, solange keine IPv6-Internetverbindung besteht (empfohlen)
- Unique Local Adresses (ULA) immer zuweisen

ULA-Präfix manuell festlegen:

fd : : : /64

Unique Local Address Ihrer FRITZ!Box: fd00::21f:3fff:fe55:3a51/64



Unnumbered PPP

- **Numbered PPP is not wanted in some cases.**
→ only a link locale address is assigned to the WAN interface
- **How does communication work that comes from the IAD itself (e.g. Voip data, DNS resolver, Remote Management etc.)? Which address should be used in this case?**
- **Solution: the WAN interface gets an address using the DHCPv6-prefix that has been delegated by the ISP**



Home network segmentation

- **FRITZ!Box offers LAN segmentation. People like this feature**
- **It is not allowed to offer prefixes that are smaller than /64 in an Ethernet-like LAN.**
- **Segmentation in the LAN is only possible if the ISP assigned a prefix which is larger than /64**



Firewall

All peers in the LAN have „real IP-Addresses“. This is still unfamiliar to many of us, including application developers. A firewall is necessary.

- **Forget all slogans like „IPv6 simplifies your Remote Desktop connection“.**
- **How should something similar to an IPv4 portforwarding table look?**
- **Dynamic prefixes? Dynamic LAN-addresses**
 - static ACLs do not make sense
 - Configuring ACLs manually is quite complicated for an normal end user
- **Host addresses may also change when hosts regard IPv6 privacy guidelines**



Firewall

Ideas

- Offer a table containing all LAN stations – with friendly names
- Offer a portforwarding table based on the friendly name
- Offer ALG functionality for all
- **Dynamic prefixes? Dynamic LAN-addresses**
 - static ACLs do not make sense
 - Configuring ACLs manually is quite complicated for an normal end user
- **Host addresses may also change when hosts regard IPv6 privacy guidelines**



Summary

- **Some additional specifications for some protocols that FRITZ!Box uses today must be extended to IPv6. But all basic IAD services are ready.**
- **Current situation: IPv6 support can go into a production release in very short time.**
- **Best practices of ISPs which target end customers will be interesting**
 - Dynamic or static prefixes? Dynamic in what timeframe?
 - Typical prefix length?
 - Will the end customer be able to receive multicast streams with global scope?



Feedback

- **IPv6 Firmware for FRITZ!Box is available under www.avm.de/en/ipv6**
- **Please give us your feedback now. Facts are created now.**

