



IPv6 Transition in practice



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IPv6 transition in a data centre network – experiences

Workshop on
Addressing the Barriers to IPv6 Deployment

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GEN6 pilot: Brief Description

- Project Kick-Off in January 2012
- Project website www.gen6-project.eu
- Participants with results shown in this presentation
 - Citkomm, Fraunhofer FOKUS (Germany)
 - UMU, MINHAP (Spain)
- Enabling a municipal datacenter's network and infrastructure for IPv6
- Corporate network connects
 - municipalities and local authorities with central services hosted in a data centre,
 - users and institutions within the network
 - offers gateways to networks and services of the federal state NRW and central institutions of the Germany
 - Secure Cross border connections

CITKOMM - STORY

- › Over 40 years of company history
 - › One of the major municipal IT service providers in North Rhine-Westfalia
 - › Founded as central data centre
 - › Evolution to system integrator
 - › 1/1/2018: joined with neighbour data centre to
- Südwestfalen IT (SIT)**
- › ~270 employees

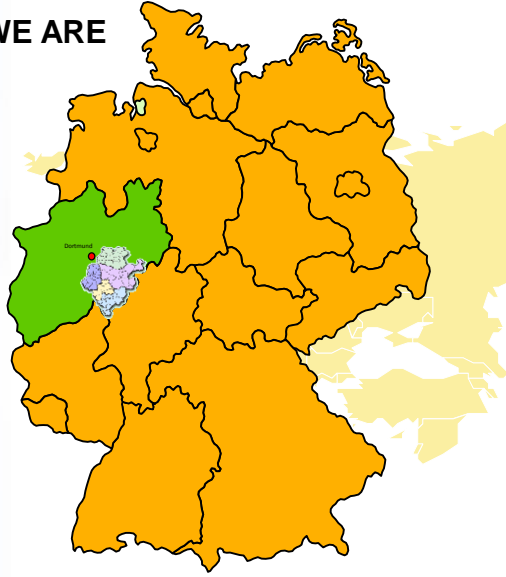
CITKOMM IS NOW PART OF 



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Sit WHERE WE ARE

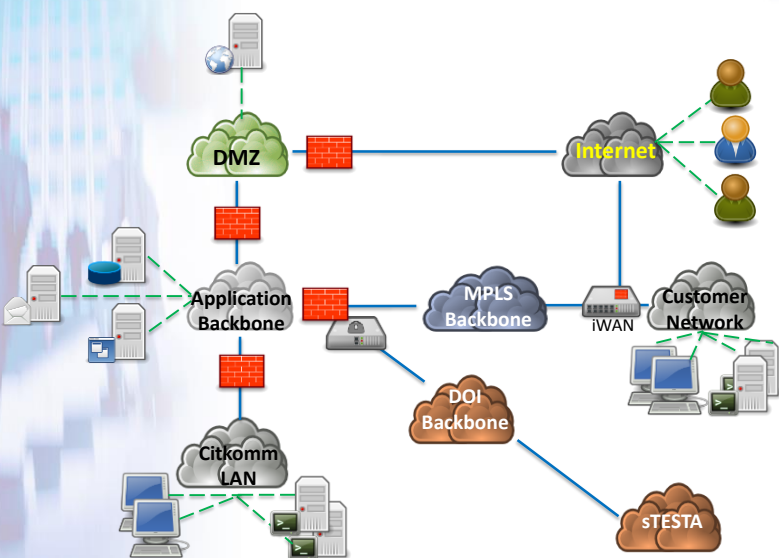
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- Data centre networks



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graph TD; DMZ[DMZ] --- Internet[Internet]; Internet --- CustomerNetwork[Customer Network]; ApplicationBackbone[Application Backbone] --- Internet; ApplicationBackbone --- MPLSBackbone[MPLS Backbone]; MPLSBackbone --- CustomerNetwork; MPLSBackbone --- DOIBackbone[DOI Backbone]; DOIBackbone --- sTESTA[sTESTA]; ApplicationBackbone --- CitkommLAN[Citkomm LAN]; CitkommLAN --- DOIBackbone;
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Preparations I

- General
 - Get Management awareness and support
 - IPv6 cannot be turned off in current Windows networks
 - Future services may be available only on IPv6
 - The never more new protocol is there in the wild
 - You are not alone – others enabled their services before
 - DS lite pains for customers/citizens
 - Networks will grow
 - Training on IPv6 for the whole technical staff
 - Get addresses
 - Thinking with abstract prefixes is hard for most people
 - Select addressing schema

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Address Structuring, local parts, suggestion

Example Prefix: 2001:db8:abcd::/48				interface identifier			
last network address word				interface identifier			
Basic concept (two nibbles type + two nibbles number = 16 bits)				1 st Word	2 nd Word	3 rd Word	4 th Word
1 st nibble	2 nd nibble	3 rd nibble	4 th nibble	Device Class	3 rd Byte IPv4	4 th Byte IPv4	
0	Data Centre 1	0	Infrastructure/Transfer	Server	0000		
1		1			0010		
2		2		Storage	0020	10.11	12 13
3		3			0030		
4	Data Centre 2	4		Router	0040		
5		5			0050		
6		6			0060		
7		7			2001:db8:abcd:8800:0000:0012:0013:0001		
8	Shared	8	Backbone	Switches	0080		
9		9			0090		
a		a	Management		00a0		
b		b			00b0		
c	LAN Site 1	c	DMZ	Clients	00c0		
d		d		Printer	00d0		
e	KOM WAN	e	LAN	Phones	00e0		
f		f			00f0		



Preparations II

- Technical Preparations
 - Check equipment for IPv6 readiness, i.e. security gateways
 - FOKUS profiles with component requirements
http://www.bva.bund.de/EN/Themen/Information_technology_bit/IPv6/node.html (www.lir.bund.de)
 - Be aware of tunnelling protocols
- Testbed
 - Determine goals and steps
- Operations
 - Challenges in monitoring and troubleshooting
 - Inventory software
 - Logfile processing
 - ...



Internet access network

- Enabled the access network of Citkomm (own AS) with IPv6, transferred it to production state
- IPv6 products available on the market
- DNS and Mail are accessible via IPv6
- Proxies forward and reverse IPv6 enabled
- Many of the hosted web servers are accessible with IPv6
- DOI access was finally enabled for IPv6
- Enabling backbone access routers for IPv6
- Set up of monitoring including IPv6 connectivity for the public reachable services of Citkomm

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iWAN VPN Network

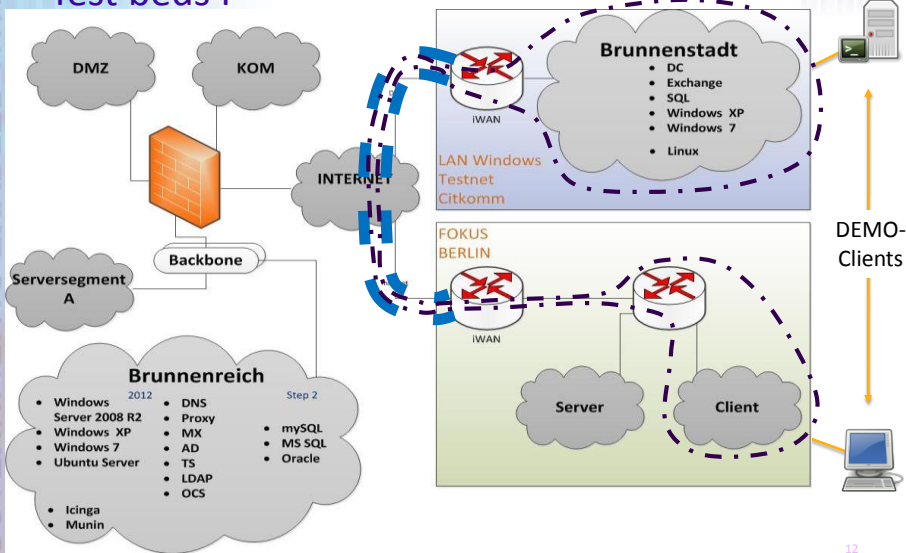
- Core component OpenVPN is IPv6 aware
- First small steps: establish IPv6 tunnel connection with a set of basic services (e.g. DNS) between Citkomm and FOKUS
- VPN tunnel start scripts made IPv6 aware
- Implementation concept for next generation VPN Network appliances for all Citkomm WAN router
- Closely related with addressing concept
- IPv6 connectivity from ISP is no "must have" in the beginning

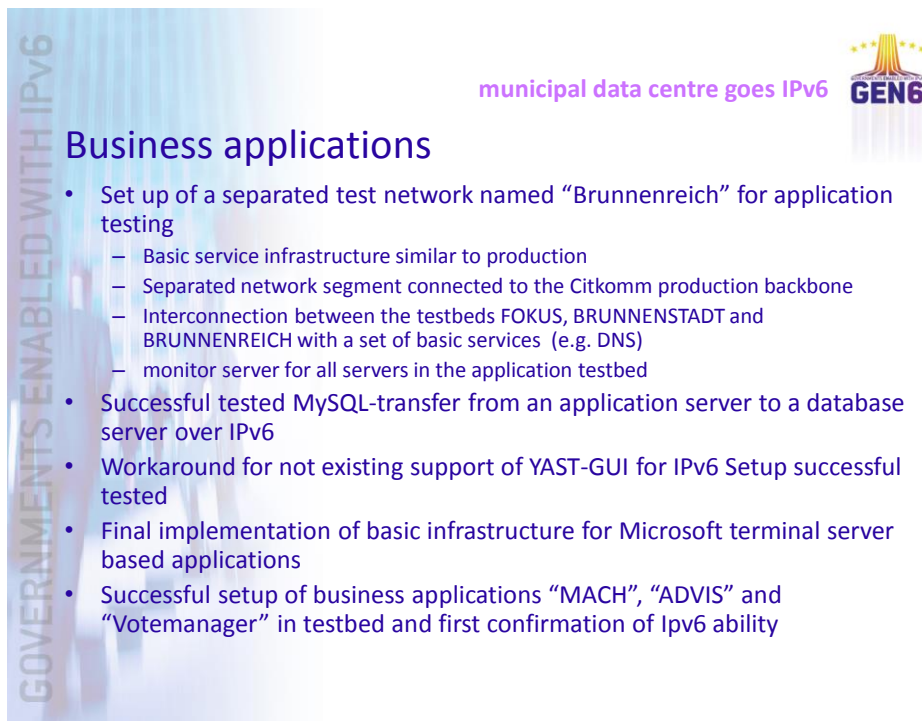
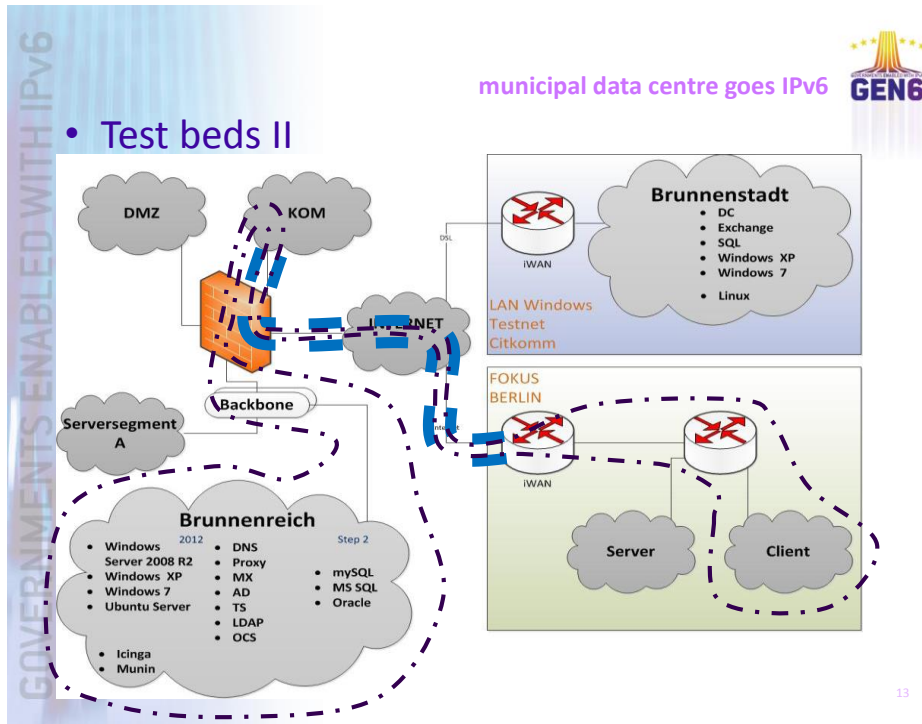
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• Test beds I







Application security

- Idea: Improve security for legacy applications with IPsec
- Investigation on IPsec implementations of current implementations in well known operating systems
 - IPsec support in Windows and Linux since ~2006
- Laboratory evaluation of implementations
- Test bed experience of useful communication scenarios
- Identification of basic limits of actual well known IPsec implementations
 - Common IPsec implementations use tunnel mode
 - Easy application security in LAN not possible
 - No difference between IPsec in IPv4 and IPv6 except with NAT
- IPsec not mandatory in IPv6 since IETF RFC 6434 (11/2011)
- Transport Mode poorly documented



Infrastructure services

- DNS, Mail, Proxy systems work out of the box
- Monitoring (icinga, now check_mk)
 - Get IPv6 enabled checks, dual stack checks
 - Logging and analysis of IPv6 traffic will contain challenges
 - Check external services from the outside
- Inventory software
 - OCS well suitable, but so far no serious IPv6 support
 - Server, Clients for all platforms need addons
- Out of band management network
 - remains on IPv4 only

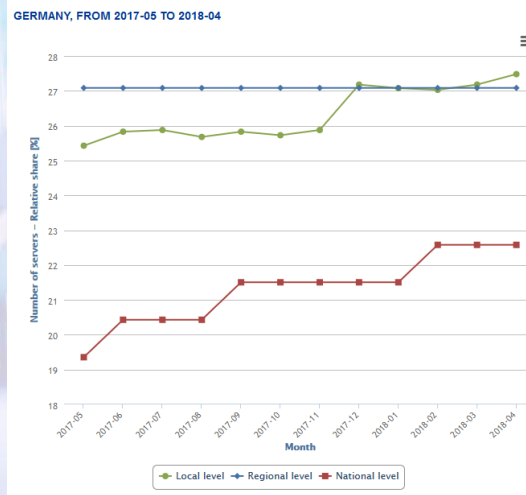


Internet applications (citizen services)

- Setup of a structured process for web site transition to IPv6, internally and with customers
- Receive permissions of customers for IPv6 transition of web sites
- Establish a test infrastructure for customer approval of IPv6 usability for web sites
- Start process with friendly customers (municipalities)
- Final transition of first web sites in February 2013
- Every relaunch brings up new IPv6 enabled sites
- Monitoring and statistics:
 - <http://www.gen6-project.eu/monitoring/government/>
 - https://stats.nic.cz/stats/gen6_by_levels/



Implementation of IPv6 by governments - administrative units





Local Network

- Customer network / Windows LAN
 - Project planning with customer municipality government of Brilon
 - Plan was set up. The resulting main activities were
 - Change of hardware in Q4/13 (new systems on IPv4 only initially)
 - Roll out of new clients with Win7 Q2/14
 - IPv6 deployment in operation



Collaboration with other authorities

- German governmental network DOI
 - (Deutschland Online Infrastruktur)
 - first testbeds with municipalities in 2010
 - most difficulties with crypto devices
 - finally production state since 2013
 - rare applications (DNS, mail, ... and ?)
- Citkomm international
 - Cross border pilot with tunnelled communications over IPv4 only STESTA network
 - possible use cases with eID infrastructure



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Questions ?