



GEN6 RoadShow event  
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# Transition of a municipal data centre to IPv6



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Citkomm

This project has  
received funding  
from the European  
Union's



European  
Commission

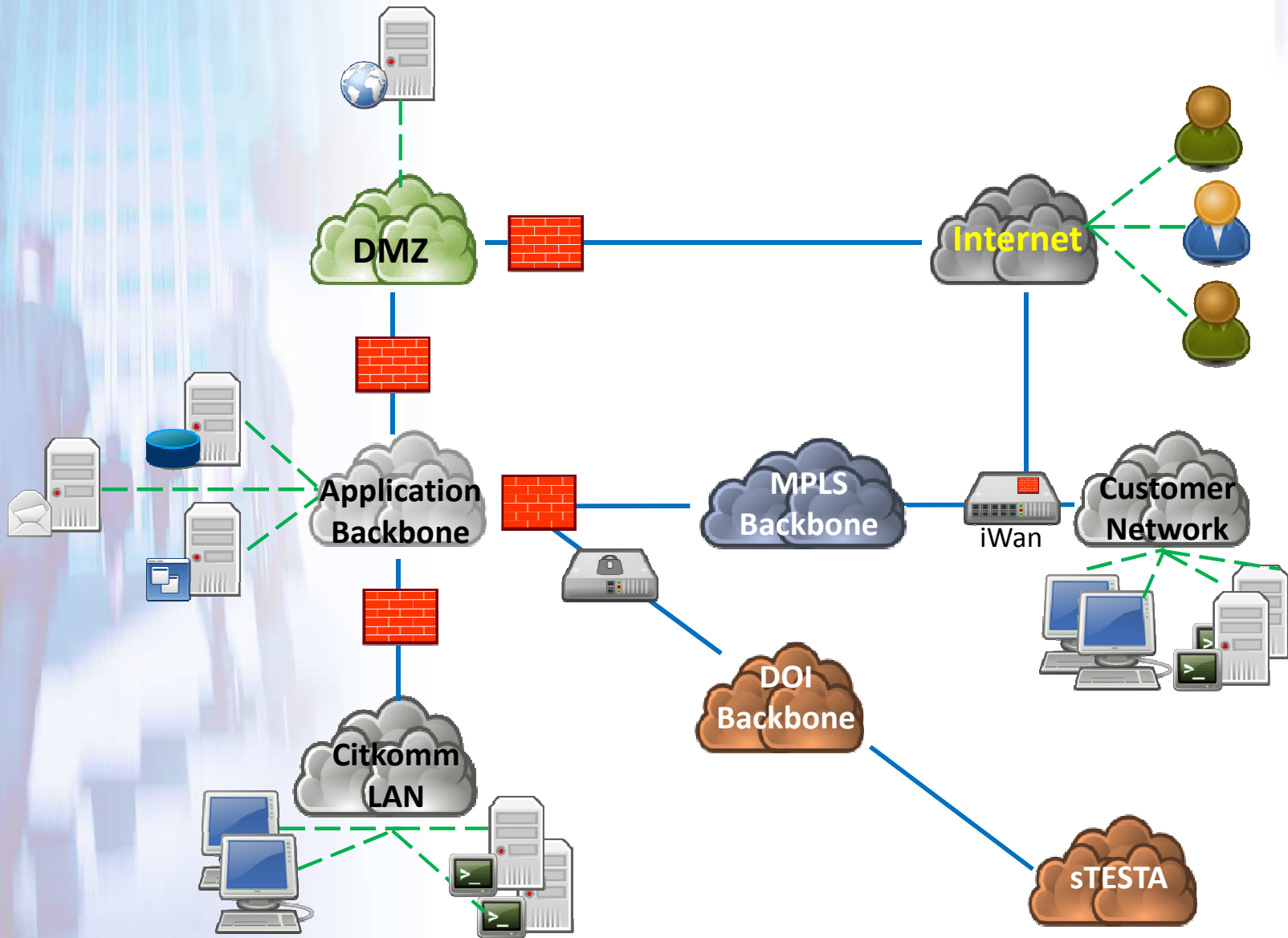
## Agenda

- Citkomm
- Starting point
- Approach
  - Addresses
  - Internet access network
  - Internet applications
  - VPN Network
  - Business applications
  - Application security
  - Local network
- Summary

## Citkomm - who we are ...

- Over 40 years of company history
- One of the major municipal IT service providers in North Rhine-Westfalia
- 195 employees
- appr. 22 Mio. € business volume (2013)
- Founded as central data centre
- Evolution to system integrator





## Starting point

- Motivation
  - IPv6 showing up in Internet communication
  - IPv6 gets mandatory in internal networks (driven by vendors)
  - No existing productive IPv6 implementation in heterogeneous infrastructures
- IPv6 addresses available by national governmental LIR de.government
- Guidelines for IPv6 transition planning by a R&D project of the national government, available also in English at [www.lir.bva.bund.de](http://www.lir.bva.bund.de) – best practices

## Global approach

- Dual stack
- From the edges to the core
- “Project marketing” by broad basic training

# Address Structuring, local parts

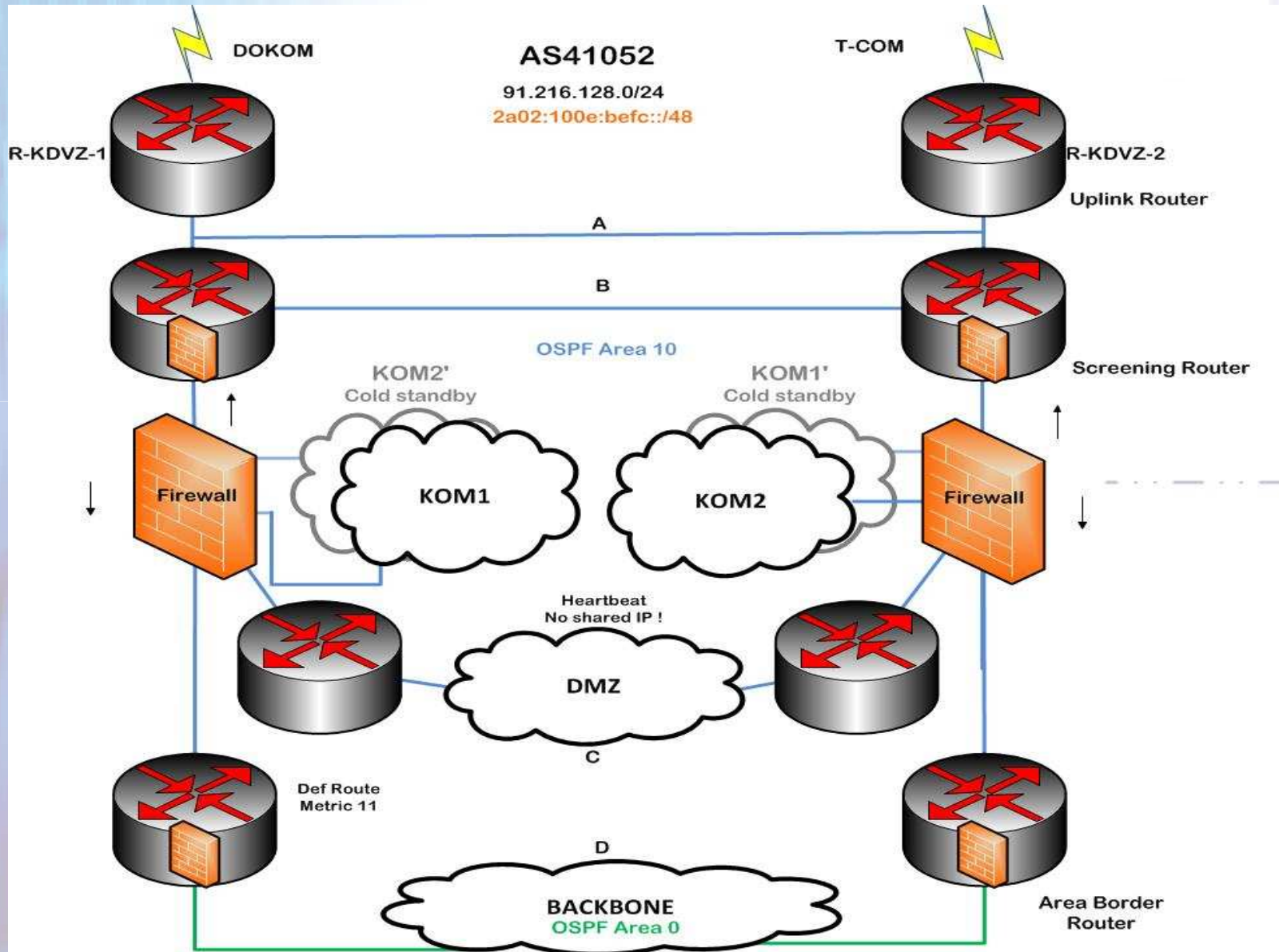
| Base: /48   |                        |                        |                         | last network address word |                           | interface identifier      |                      |
|---|------------------------|------------------------|-------------------------|---------------------------|---------------------------|---------------------------|----------------------|
| Basic concept (two nibbles type + two nibbles number = 16 bits) |                        |                        |                         | 1 <sup>st</sup> Word      | 2 <sup>nd</sup> Word      | 3 <sup>rd</sup> Word      | 4 <sup>th</sup> Word |
| 1 <sup>st</sup> nibble  | 2 <sup>nd</sup> nibble | 3 <sup>rd</sup> nibble | 4 <sup>th</sup> nibble  | Device Class              | 3 <sup>rd</sup> Byte IPv4 | 4 <sup>th</sup> Byte IPv4 |                      |
| 0   | Data Centre 1          | 0                      | Infrastructure/Transfer | Server                    | 0000                      |                           | Private              |
| 1   |                        | 1                      |                         |                           | 0010                      |                           | Address              |
| 2   |                        | 2                      |                         | Storage                   | 0020                      |                           | Range                |
| 3   |                        | 3                      |                         |                           | 0030                      |                           |                      |
| 4   | Data Centre 2          | 4                      |                         | Router                    | 0040                      |                           |                      |
| 5   |                        | 5                      |                         |                           | 0050                      |                           |                      |
| 6   |                        | 6                      |                         |                           | 0060                      |                           |                      |
| 7   |                        | 7                      |                         |                           | 0070                      |                           |                      |
| 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                      |                           |                      |

## Internet access network

- Enable the access network of Citkomm (own Autonomous System) with IPv6, transfer it into production state
- DNS and Mail were made accessible via IPv6 quite easily
- More than the half of the hosted web servers have been transferred and therefore made accessible with IPv6
- DOI (national government backbone) access enabled for IPv6
- Backbone access routers enabled for IPv6
- Set up of parallel monitoring for IPv6 connectivity for the public services provided by Citkomm
- Stability problems in OSPF, ongoing investigations/improvements



municipal data centre goes IPv6



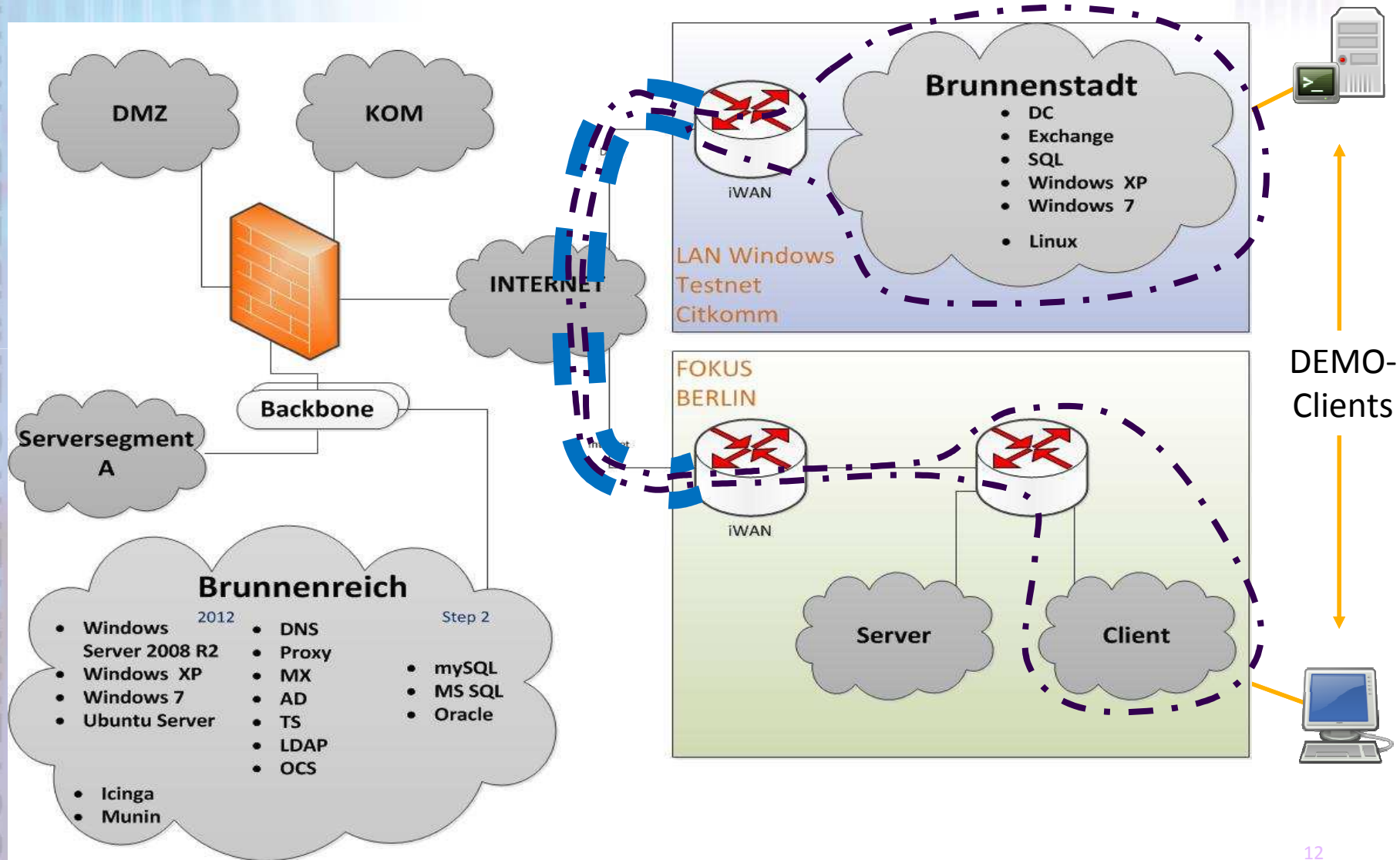
## Internet applications (citizen services)

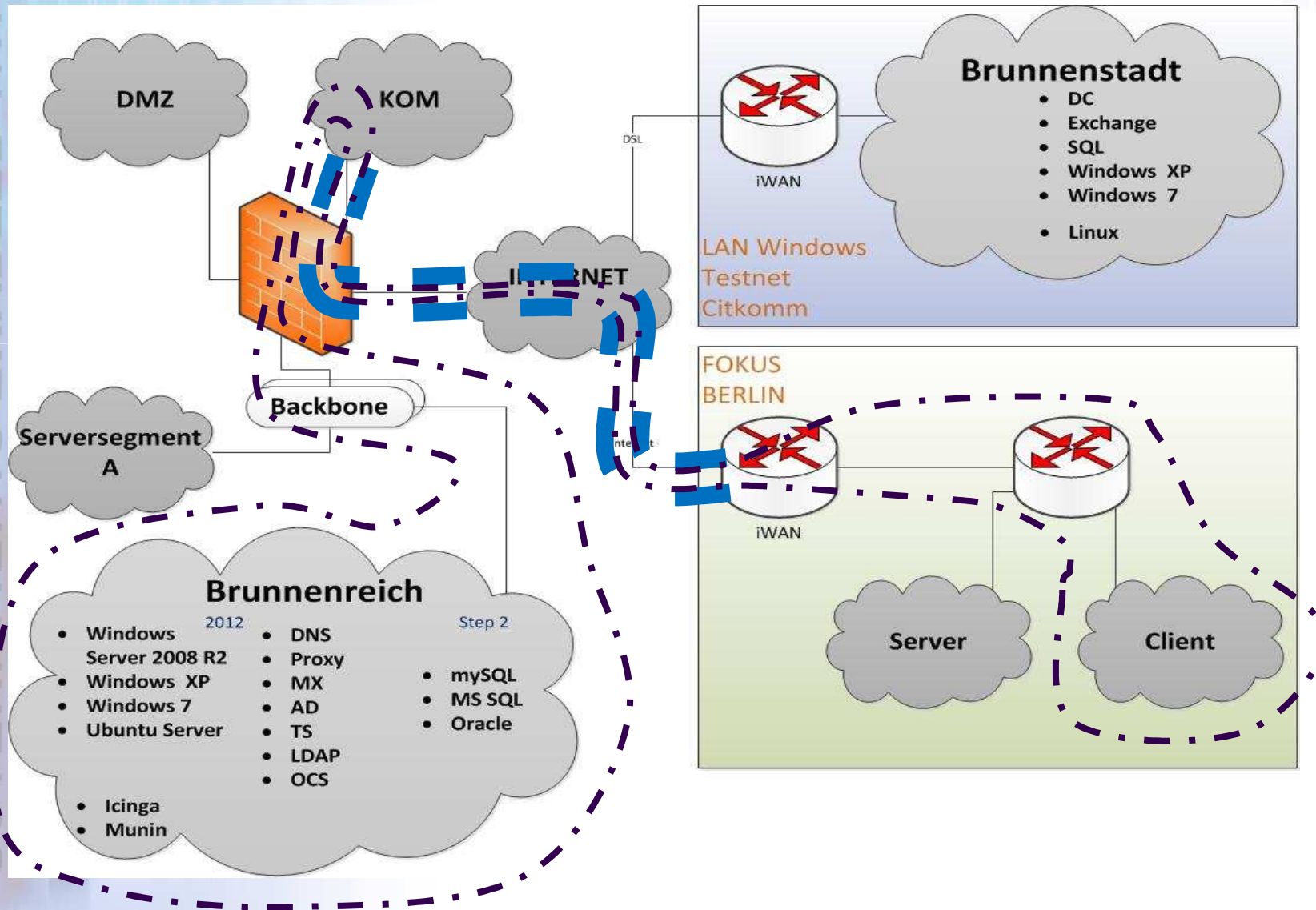
- Setup of a structured process for web site transition to IPv6, internally and with customer involvement
  - Receive permissions of customers for IPv6 transition of web sites
  - Establish a test infrastructure for customer approval of IPv6 usability for web sites
  - Start process with friendly customers (local governments)
- Release to the public of first web sites in February 2013
- Ongoing transition process

## 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 lab
- VPN tunnel start scripts made IPv6 aware
- Implementation concept for next generation VPN Network appliances for all Citkomm WAN routers
- Closely related to addressing concept
- IPv6 connectivity from the ISP is no "must have" in the beginning

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## Business applications

- Set up of a separated test network for application testing
  - Basic service infrastructure equivalent to production
  - Separated network segment connected to the Citkomm production backbone
  - Interconnection between the testbeds FOKUS, BRUNNENSTADT and BRUNNENREICH with a set of basic services (e.g. DNS, mail)
  - Monitoring server for all servers in the application testbed
  - Basic infrastructure for Microsoft terminal server based applications
- Test of several business applications in testbed to confirm IPv6 operations

## Business applications

- Outcome: Two application classes
  1. No or minor IPv6 problems
    - Some applications work without any difference regarding the chosen IP version
    - Well known bug on IP data field (database column width)
  2. Essential problems
    - Drivers (Database access)
    - In-deep of the application / used framework

## Application security

- Idea: Improve security for legacy applications by means of IPsec
- Investigation on IPsec implementations in well known, current operating systems
  - 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
- Central experience: IPv6 offers new opportunities for use of IPsec in transport mode, as there is no NAT as barrier any more



## Local Network

- Testbed
  - Finalisation of test network (Windows) for LAN with IPv6 support “BRUNNENSTADT”
  - Structured tests of function and services based on IPv6 connectivity
- Citkomm internal
  - Strategic stop of Linux LAN. Therefore all Linux test for LAN were aborted
  - Setup of Windows LAN in Citkomm started in January 2014
  - IPv6 transition prepared with extensive tests and checklists
  - Final implementation silently

## Local Network

- Customer network / Windows LAN
  - Project planning with customer local government of city of Brilon
  - IPv6 setup based on existing checklists was performed within one day for 10 servers and ca. 150 clients



Brilon town hall



Brilon market place

## Summary - global experiences

- IPv6 is necessary
  - in the Internet to provide access for citizens
  - in local networks due to vendor requirements
- IPv6 transition is possible
  - in heterogonous infrastructures
  - in governmental infrastructures
- IPv6 implementation is an ICT project like any other
  - Act serious
    - Plan - Build – Test – Run
  - Act in time – and before the pain

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## Questions ?

Contact

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