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February 15 - 19, 2016 • Berlin, Germany

We're ready. Are you?



Christian Huber, Network Technology, February 2016

BMW GROUP – AN ENTERPRISE INTRODUCING IPv6.

**CISCO LIVE 2016.
BERLIN.**

**BMW
GROUP**



Rolls-Royce
Motor Cars Limited

BMW GROUP – AN ENTERPRISE INTRODUCING IPv6. WHAT IS THIS PRESENTATION ABOUT?

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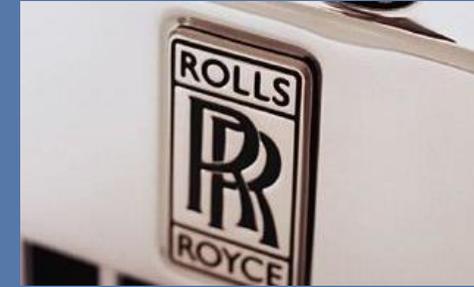
BMW GROUP – AN ENTERPRISE INTRODUCING IPv6. AGENDA.

Agenda.

- Motivation
- Approach
- Network Architecture
- Network Rollout
- Status
- Outlook

BMW GROUP – AN ENTERPRISE INTRODUCING IPv6. BMW, MINI AND ROLLS-ROYCE.

Brands



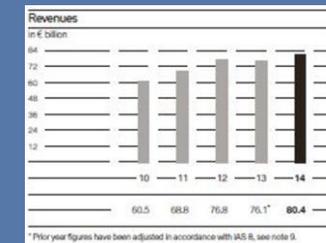
Figures



116.000 employees



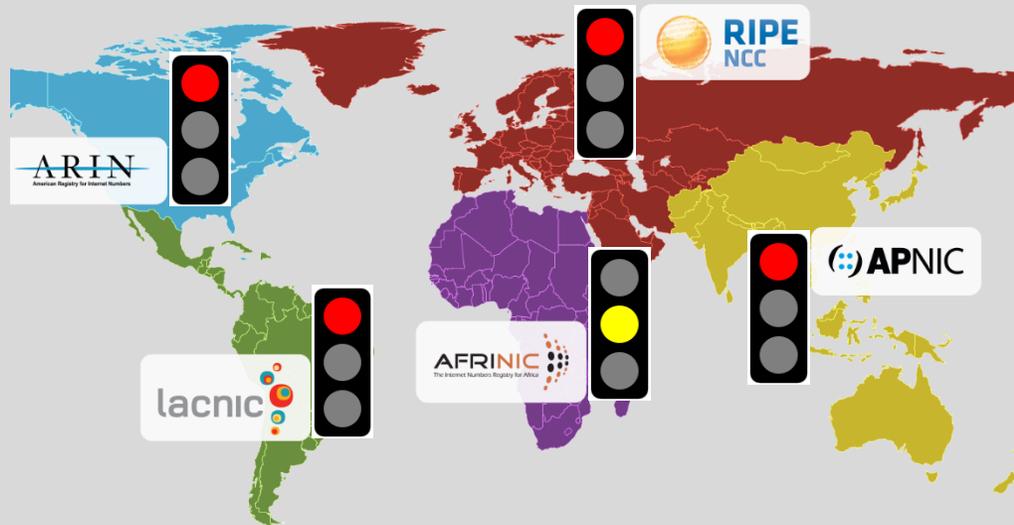
2.1 million cars



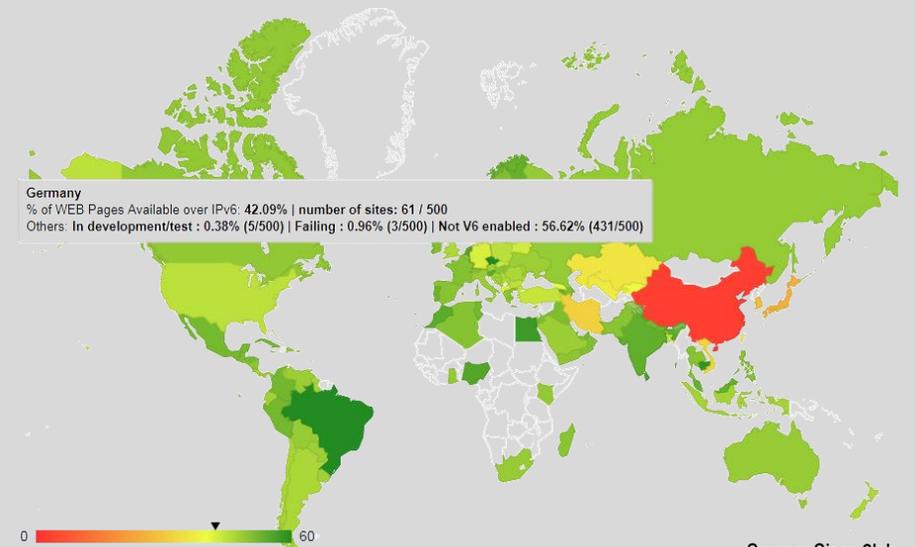
80.4 billion revenue

MOTIVATION. IPv4 ADDRESS DEPLETION AND MOVE TOWARDS IPv6.

Worldwide IPv4 Depletion.



Web Content available via IPv6.

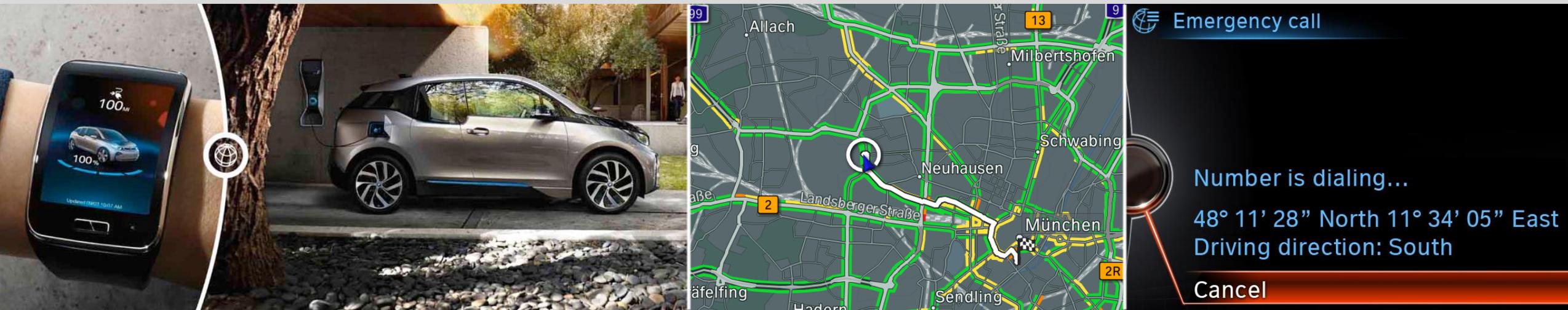


Source: Cisco 6lab

IPv4 resources are depleted worldwide – The Internet is moving towards IPv6.

Services and resources available via the Internet have to be IPv6 enabled in order to ensure connectivity.

MOTIVATION. CONNECTEDDRIVE.



ConnectedDrive – A service for BMW customers, provided and hosted by BMW, running on an end device built by BMW.

Every BMW built (2,000,000+/- anno) requires IP connectivity to our Data Centre – Scalability provided by IPv6 is key!

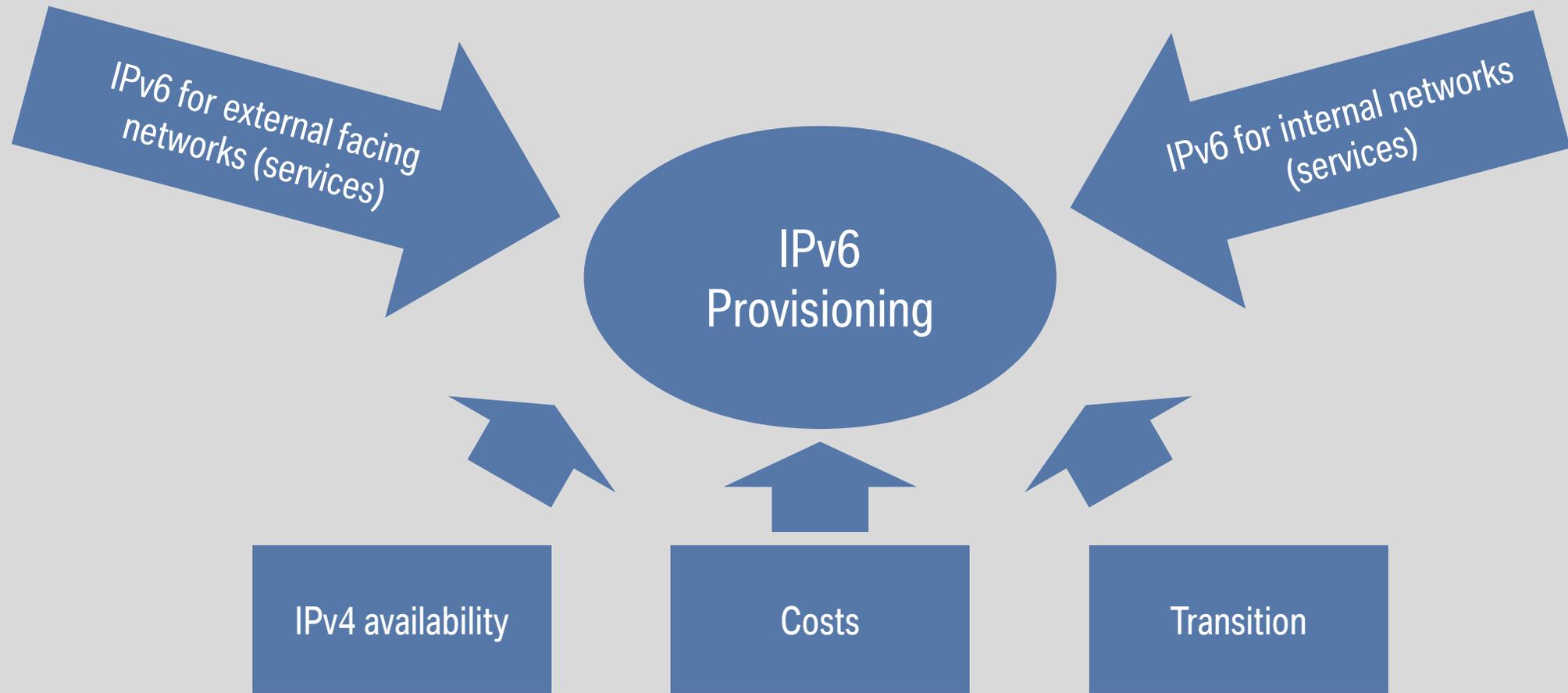
MOTIVATION. INDUSTRIE 4.0.



Industrie 4.0 (Internet of Things) brings thousands of additional end devices to manufacturing environments.

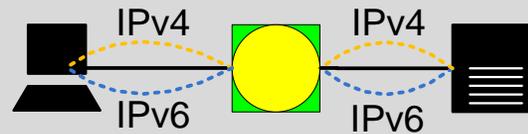
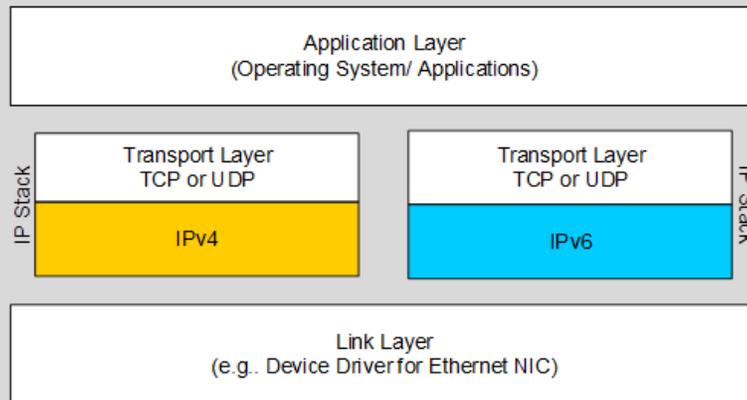
Scalability, end-to-end communication and ease of use are required – Features only provided by IPv6!

APPROACH. REQUIREMENTS.

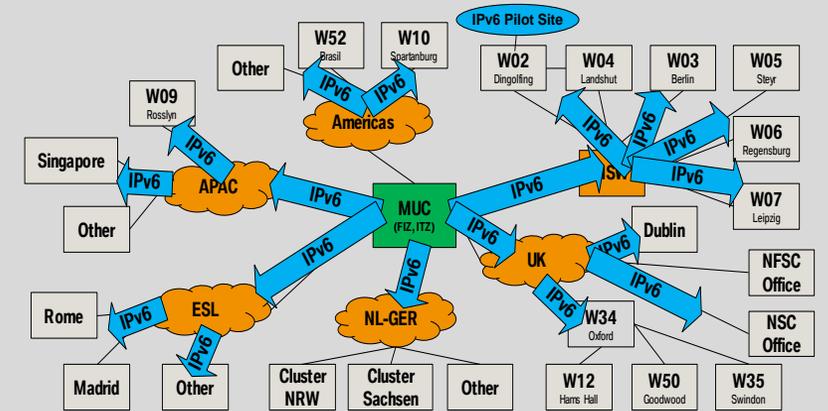


APPROACH. DUAL STACK AS TRANSITION METHOD.

Dual Stack.



Core to Edge Rollout.



Dual Stack is the only transition method that enables a scalable, long-term, cost efficient and riskless transition towards IPv6.

APPROACH. INFRASTRUCTURE FIRST – APPLICATIONS FOLLOW (I).

Network Solutions & Rollout.

- Architectural and design decision
- Requirements on interfaces partners
- Network solution build
- Network rollout

„The road for IPv6 is built.“

Infrastructure Solutions & Rollout.

- Infrastructure solution build
- Infrastructure services and deployments used by all applications are IPv6 enabled

„IPv6 services are provided along the road.“

Application Transition.

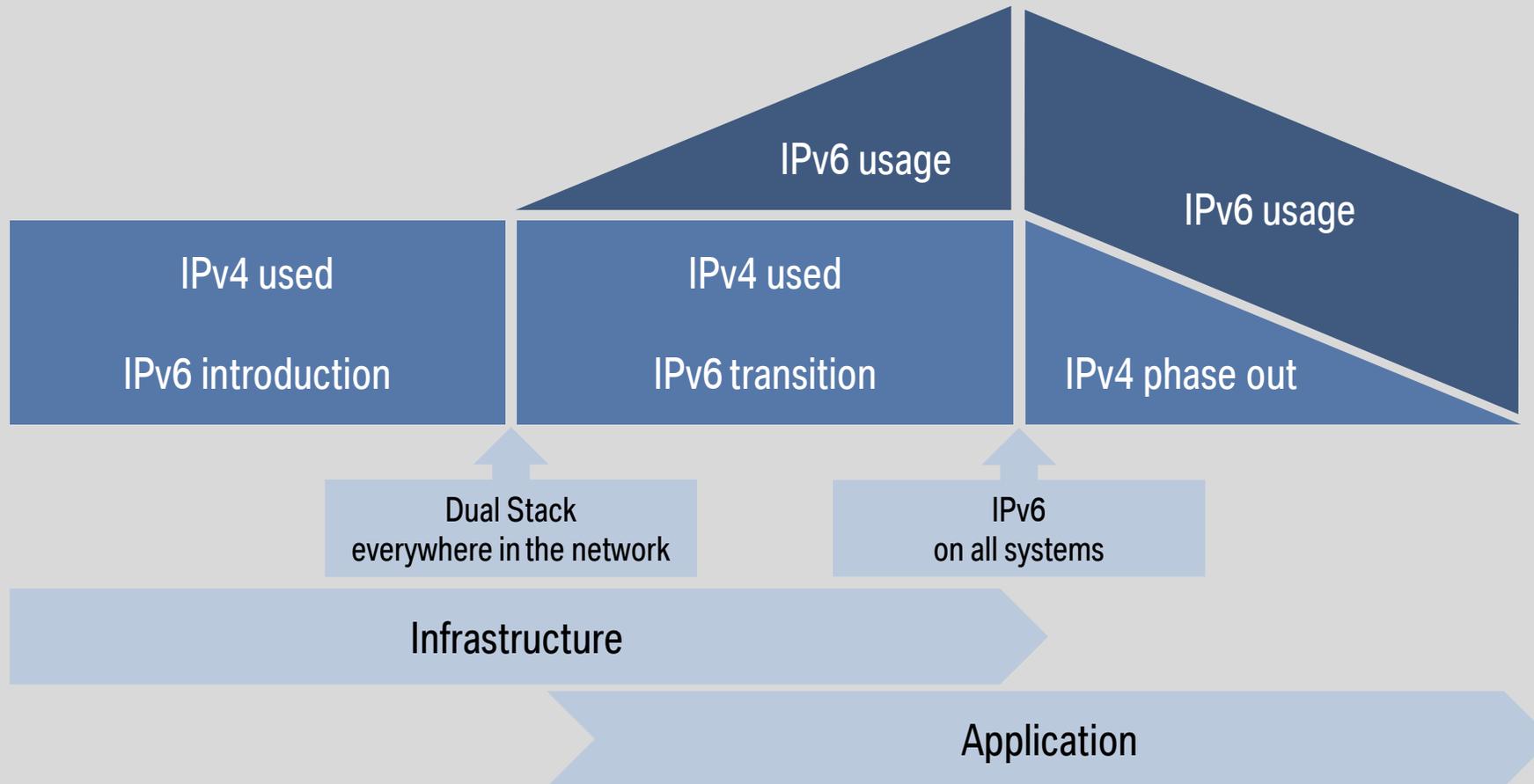
- Application build
- Migration of applications incl. their dedicated infrastructure

„IPv6 is used to transport data.“

IPv6 Project

Lifecycle Management

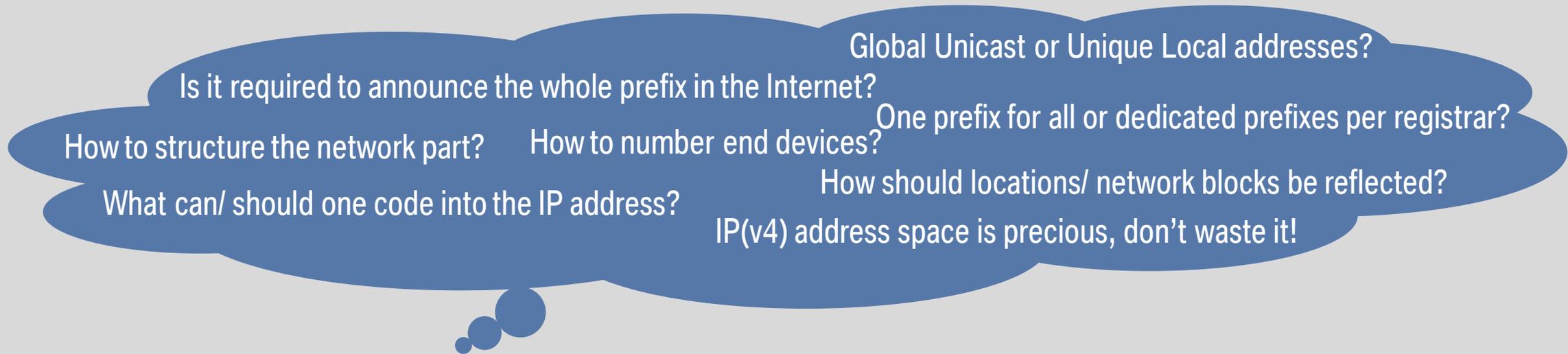
APPROACH. INFRASTRUCTURE FIRST – APPLICATIONS FOLLOW (II).



NETWORK ARCHITECTURE. DESIGN PREMISE.

Build a network architecture and design that lasts
and is at least as available and reliable as IPv4!

NETWORK ARCHITECTURE. NETWORK DESIGN – ADDRESS PLAN.



Plan reserves.

You only do an IP address design once a lifetime.

Keep it simple.

An IP address is just a number. Code only things into the address plan, people can remember and require for daily operations.

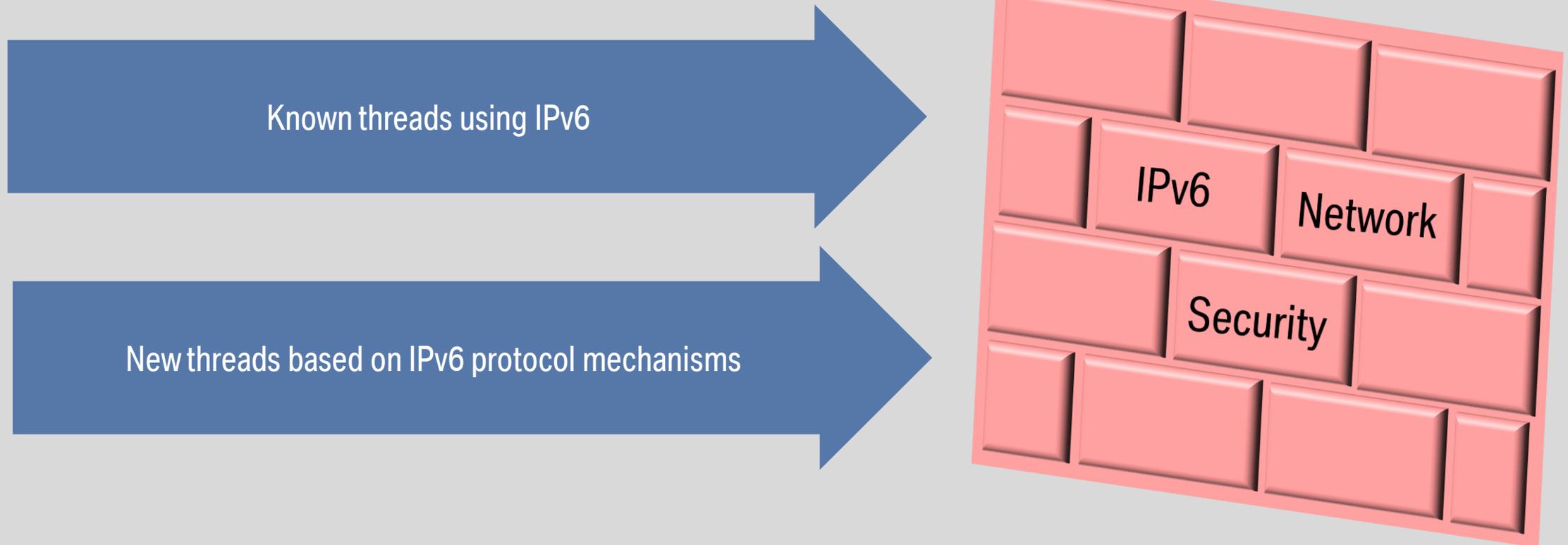
Follow Best Practices.

What everybody does will be supported for good.

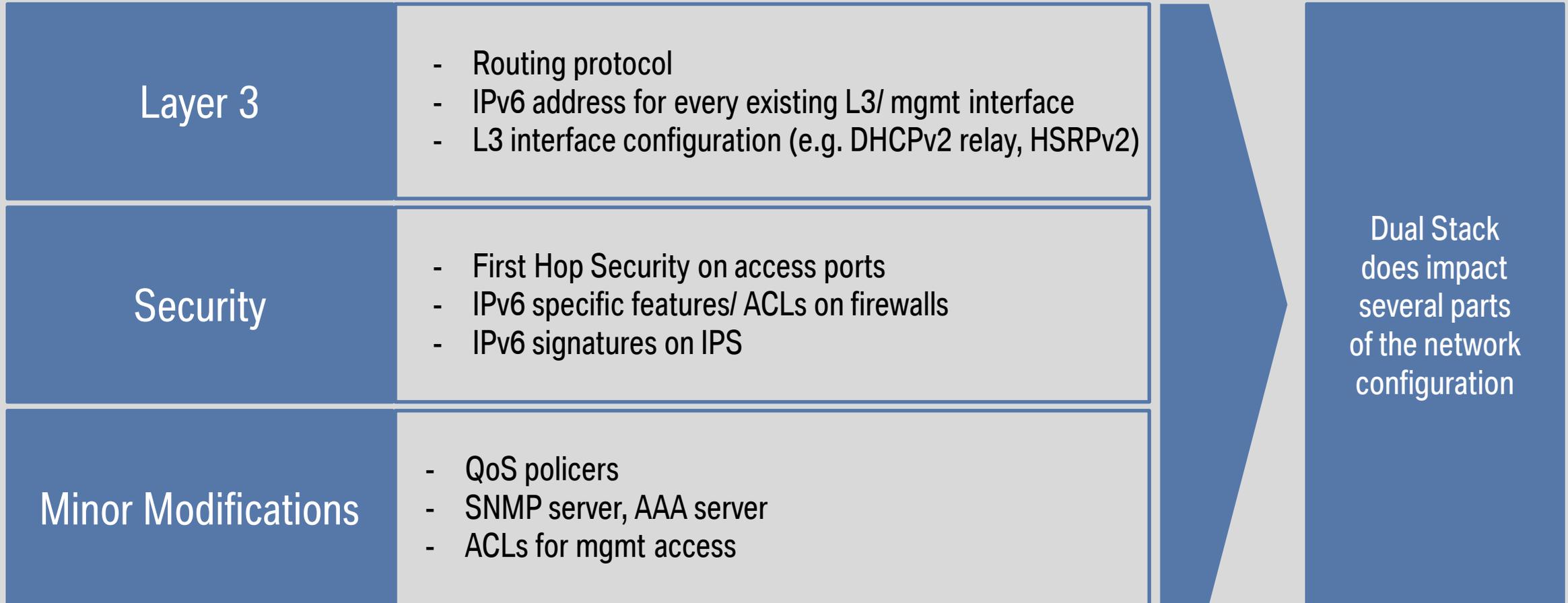
NETWORK ARCHITECTURE. NETWORK DESIGN – ROUTING DESIGN.



NETWORK ARCHITECTURE. NETWORK DESIGN – SECURITY.



NETWORK ARCHITECTURE. NETWORK DESIGN – FEATURES/ CONFIGURATION.



NETWORK ARCHITECTURE. OPERATION SOLUTIONS/ TOOLS.

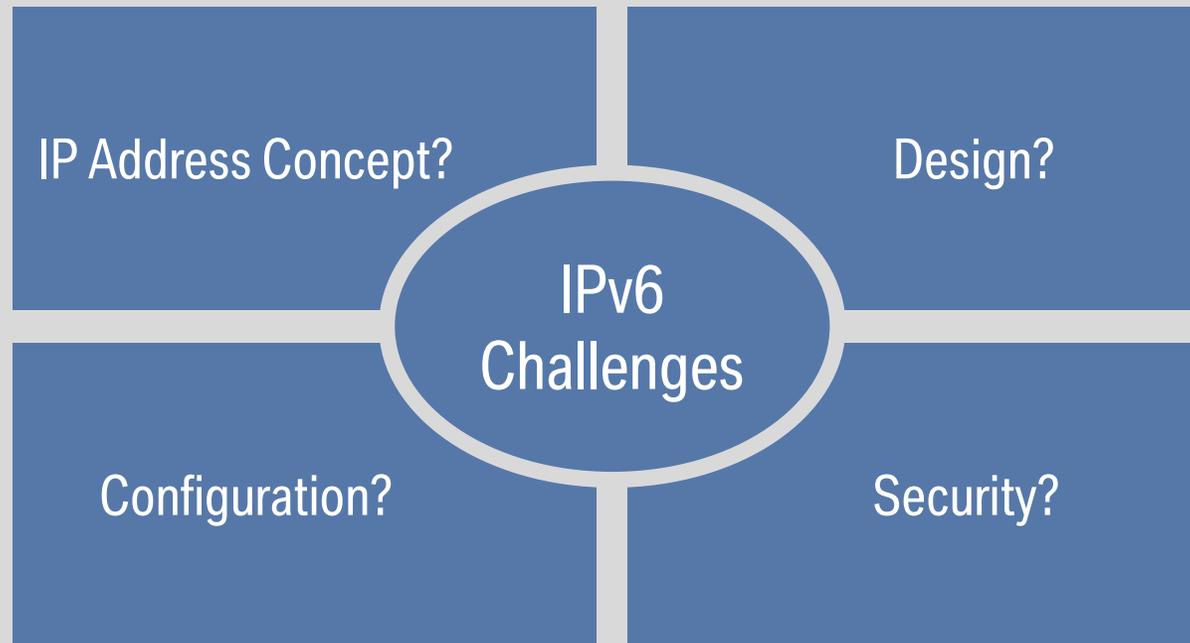
IPv6 is used to communicate

The screenshot displays a web-based network management interface. The top navigation bar includes 'Suche' and 'Sucheinschränkung - Netz'. The main content area is divided into a left sidebar with a tree view containing 'IPv6' and 'Netz' sections, and a central configuration panel for 'Sucheinschränkung - Netz'. This panel includes fields for 'Netz ID', 'Netzmandant', 'Netz-Name', 'Gateway', 'Domain', 'VLAN ID', 'VLAN Pool', and 'VLAN Gruppe'. To the right of these fields are dropdown menus for 'Funktion', 'Netzbereichname', 'DHCP aktiv', 'Reverse Lookup', 'Gespart', 'Operator', and 'Primärer Bereich'. Below the configuration fields is a table titled 'Suchergebnis - Netz' with the following columns: 'Netz ID', 'Netzmandant', 'Netz-Name', 'Gateway', 'Netzbereichname', 'Domain', and 'VLAN ID'. The table currently shows 'Keine Datensätze'. At the bottom of the interface, a network diagram is visible, showing a central node labeled 'NETZ280411' connected to several other nodes, including 'ALW0280037', 'ALW0280038', and 'ALW0280166'. A list of IP addresses is also visible on the left side of the diagram.

IPv6 is processed as data/ information

IPv6 support in operation solutions/ tools is key to success!

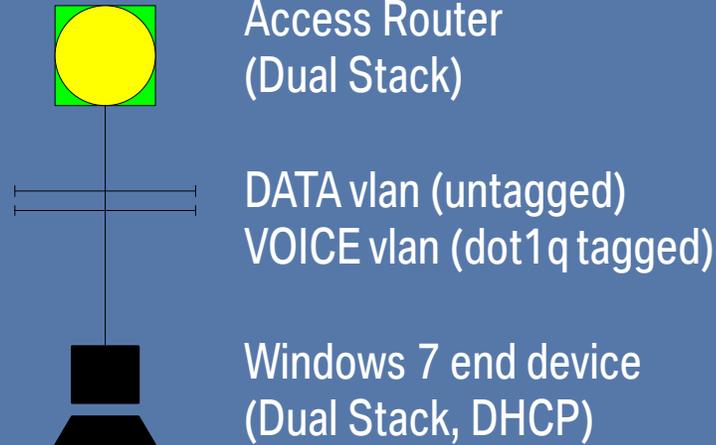
NETWORK ARCHITECTURE. CHALLENGES.



The challenges in an IPv6 project are the differences between IPv4 and IPv6 and those can be mainly seen at the interface to other IT systems.

NETWORK ARCHITECTURE. CHALLENGES - EXAMPLE.

Setup.



Challenge.

- NIC runs on “auto-tagging” (depending on NIC driver version)
→ Client sees IPv6 RA’s from both subnets
- Client has two default gateways (DATA and VOICE vlan)
- Only DATA default gateway is reachable

```
C:\Users\Q345055>ipconfig
Windows-IP-Konfiguration

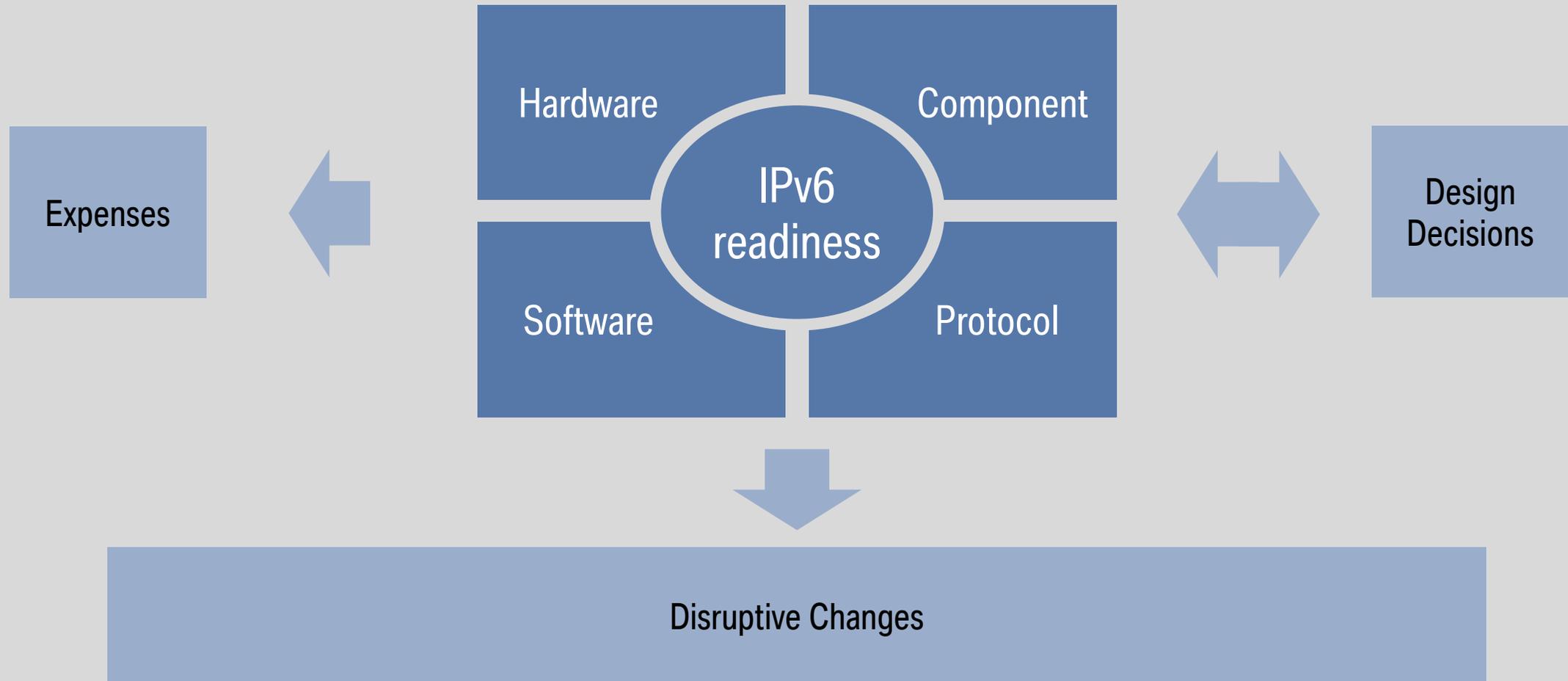
Drahtlos-LAN-Adapter Drahtlosnetzwerkverbindung:
Medienstatus . . . . . : Medium getrennt
Verbindungsspezifisches DNS-Suffix: nuc
Ethernet-Adapter LAN-Verbindung:
Verbindungsspezifisches DNS-Suffix: nuc
IPv6-Adresse . . . . . : 2a03:1e80:f003:506::10:ac60
Verbindungslokale IPv6-Adresse . . : fe80::58dc:40d7:d26d:1391::11
IPv4-Adresse . . . . . : 10.145.6.64
Subnetzmaske . . . . . : 255.255.255.0
Standardgateway . . . . . : fe80::1e80:f003:1:3::11
                          fe80::fe80::11
                          10.145.6.1
```

```
C:\Users\Q345055>netsh interface ipv6 show route
Veröff. Typ Met Präfix Idx Gateway/Schnittstelle
-----
Nein Manuell 16 ::/0 11 fe80::1e80:f003:1:3
Nein Manuell 256 ::/0 11 fe80::fe80
Nein Manuell 256 ::1/128 1 Loopback Pseudo-Interface 1
Nein Manuell 8 2a03:1e80:f003:506::/64 11 LAN-Verbindung
Nein Manuell 256 2a03:1e80:f003:506::10:ac60/128 11 LAN-Verbindung
Nein Manuell 8 2a03:1e80:f003:507::/64 11 LAN-Verbindung
Nein Manuell 256 fe80::/64 11 LAN-Verbindung
Nein Manuell 256 fe80::/64 12 Drahtlosnetzwerkverbindung
Nein Manuell 256 fe80::58dc:40d7:d26d:1391/128 11 LAN-Verbindung
Nein Manuell 256 fe80::84de:3eb6:1101:7643/128 12 Drahtlosnetzwerkverbindung
Nein Manuell 256 ff00::/8 1 Loopback Pseudo-Interface 1
Nein Manuell 256 ff00::/8 11 LAN-Verbindung
Nein Manuell 256 ff00::/8 12 Drahtlosnetzwerkverbindung
```

Solution.

Neighbor Discovery Router-Preference “High” is activated for all DATA vlans
→ End device prefers DATA vlan

NETWORK ROLLOUT. IPv6 READINESS.



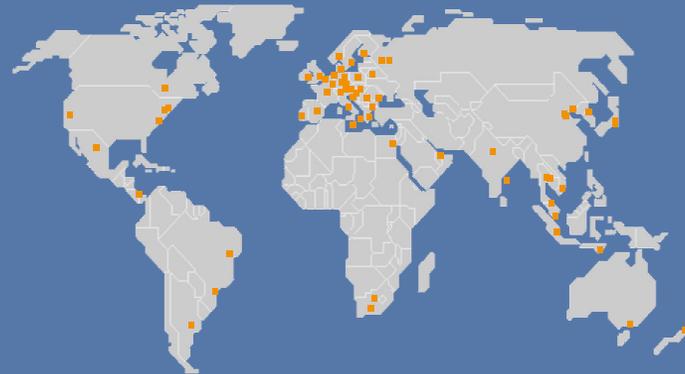
NETWORK ROLLOUT. SCALE.

Network Infrastructure



20,000+ components

Locations



250+ locations

Individual Parameters

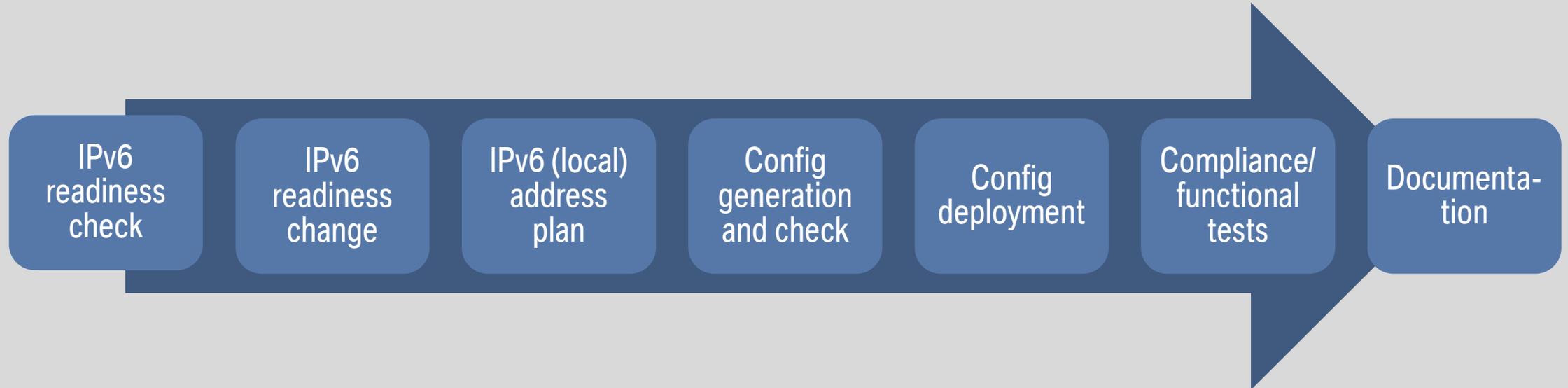
```
DISTRIBUTION# sh ipv6 interface brief
TenGigabitEthernet2/1 [up/up]
FE80::1E80:10:1:1
2A03:1E80:10:27::3
TenGigabitEthernet2/2 [up/up]
FE80::1E80:10:1:1
2A03:1E80:10:2::2
TenGigabitEthernet2/3 [up/up]
FE80::1E80:10:1:1
2A03:1E80:10:3::2
TenGigabitEthernet2/4 [up/up]
FE80::1E80:10:1:1
2A03:1E80:10:4::2
TenGigabitEthernet2/5 [up/up]
FE80::1E80:10:1:1
2A03:1E80:10:5::2
TenGigabitEthernet2/6 [up/up]
```

```
ACCESS# sh run int vlan 1
Te:
!
interface Vlan1
description Data
ip address 10.255.111.1 255.255.255.0
ip helper-address 160.50.1.1
ipv6 address FE80::1E80:10:1:1 link-local
ipv6 address 2A03:1E80:10:51C::1/64
ipv6 dhcp relay destination 2A03:1E80::1
end
```

55,000+ subnets

An IPv6 rollout is all about scale!

NETWORK ROLLOUT. WHAT IS AN IPv6 ROLLOUT LIKE?



Automation

Processes

An IPv6 rollout means to handle tons of data and configuration.

BMW GROUP – AN ENTERPRISE INTRODUCING IPv6. STATUS.

ConnectedDrive R&D



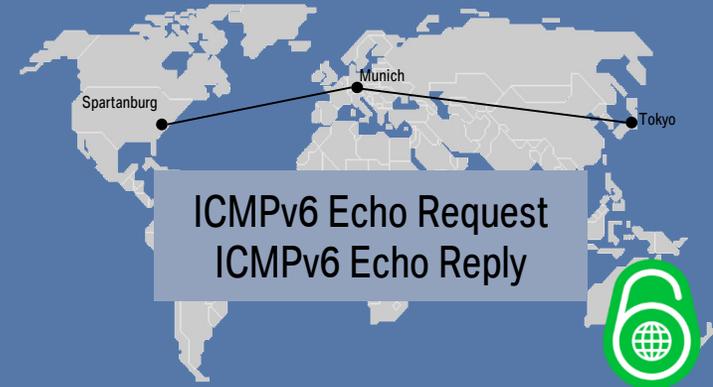
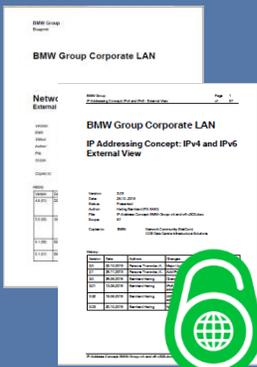
1st Services



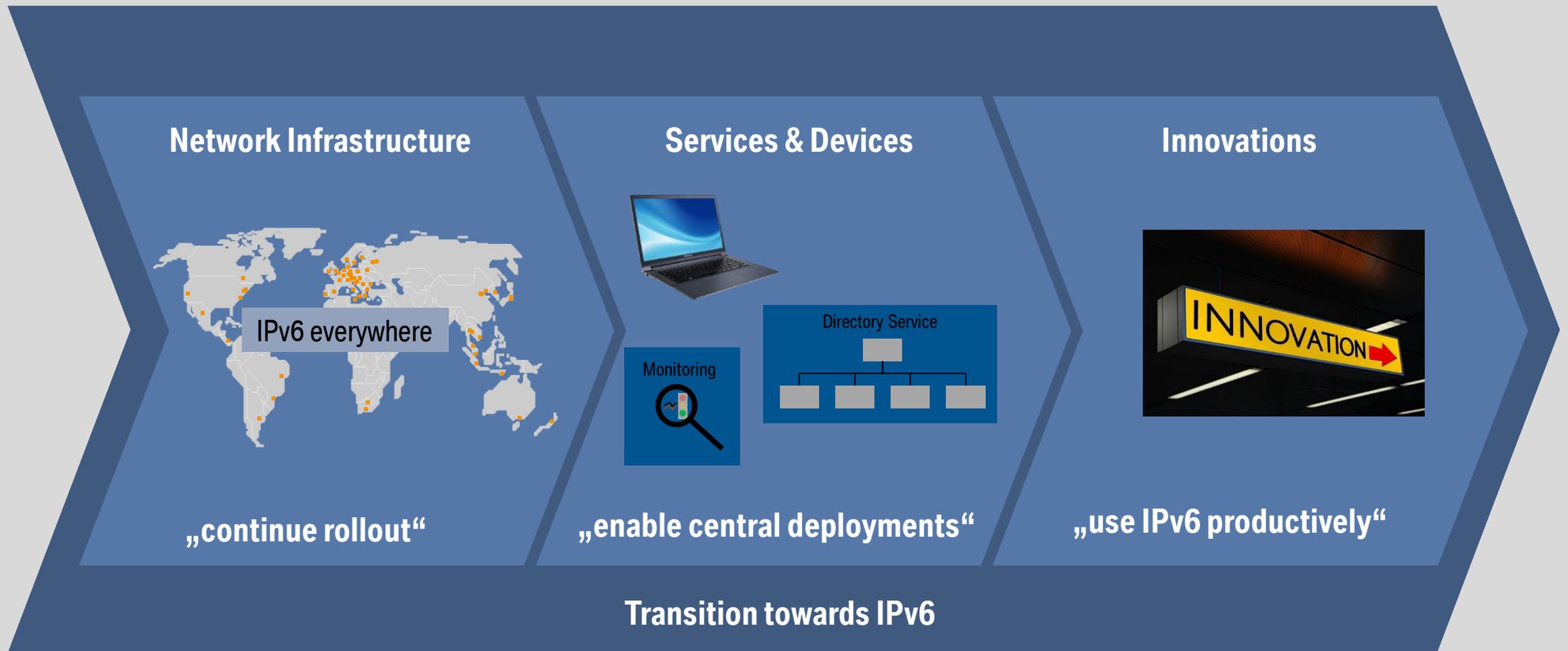
Infrastructure Solutions



Network Solutions and Rollout



BMW GROUP – AN ENTERPRISE INTRODUCING IPv6. OUTLOOK.



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- All surveys can be completed via the Cisco Live Mobile App or the Communication Stations

