

ulm university universität
uulm



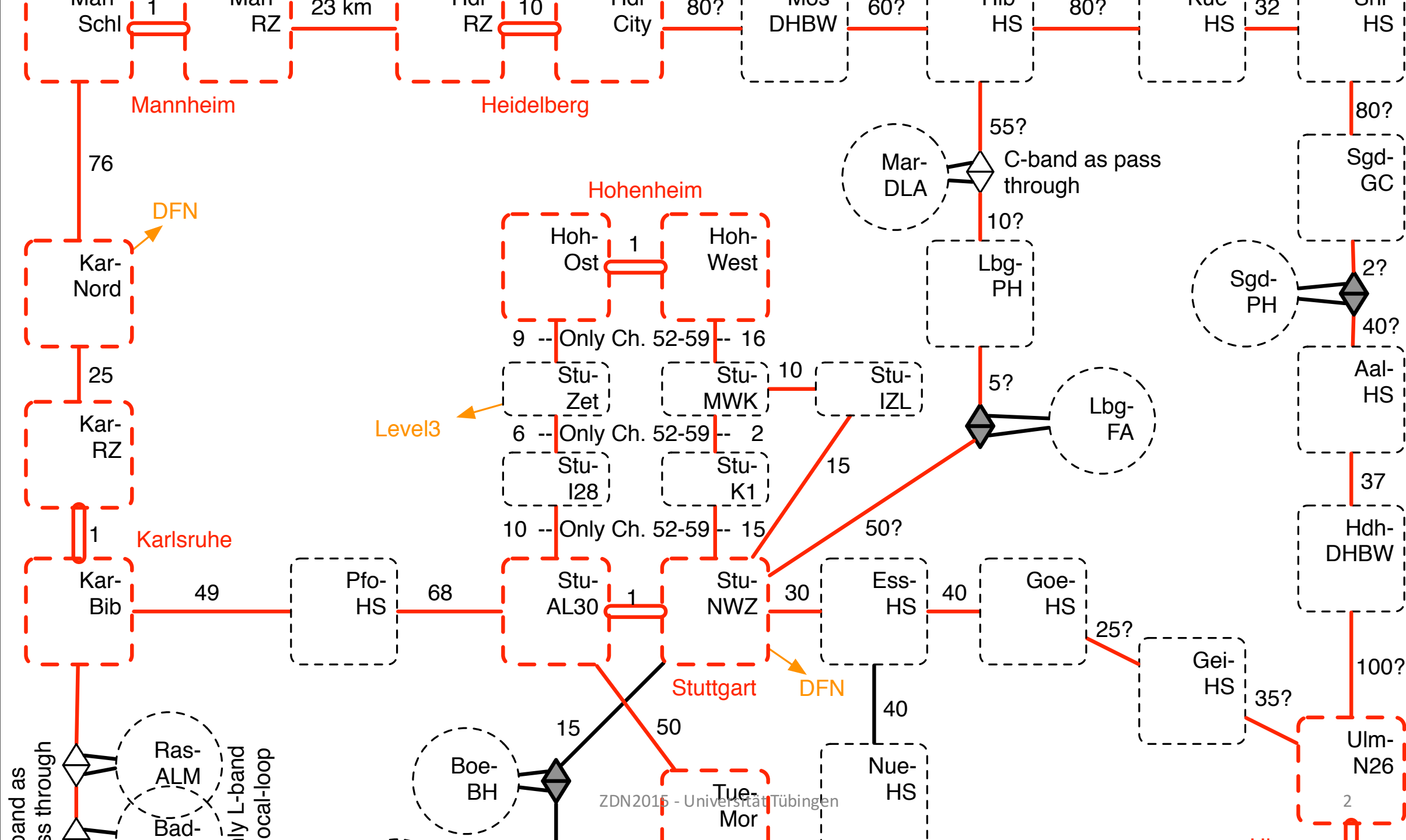
bwNET100G+ – Integrated Innovation for Evolving the BelWü Network

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BelWü facts

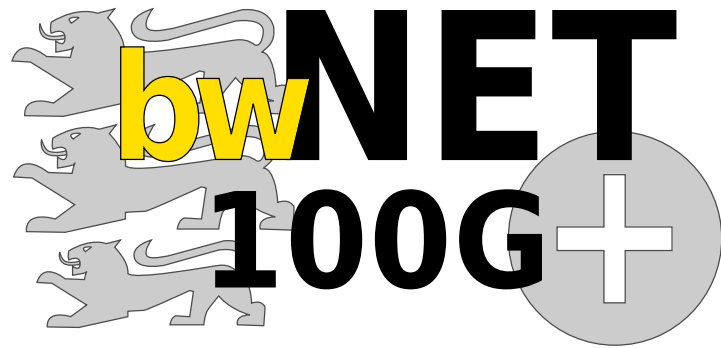
- Internet Service Provider in the region of Baden-Württemberg for
 - 9 universities
 - 23 universities of applied sciences
 - 8 locations of the DHBW
 - 6 universities for education (Pädagogische Hochschulen)
 - 8 universities for music and art
 - Other scientific organisations, schools, libraries and others
- Additionally
 - Webhosting and moodle based e-learning services
 - “Jugendschutzproxy” for schools
 - E-Mail services, SPAM detection
 - Basic network services (DNS, NTP, ...)
- Organizational home of BelWü is University Stuttgart

BelWü facts – for engineers

- >2.000 km dark fiber, >1.000 km rented bandwidth
- 50 Backbone POPs, 50 optical amplifiers
- >80x10G and 10x100G bandwidth
- Customer Ports: Layer 3: 60 * 10GE, 260 * GE, 140 * FE
Layer 2: 11*100GE
~200 Backbone-Router
- ~3.000 CPEs for schools and smaller institutions
- Operated with 8 FTE permanent staff, 3 commercial customer income based positions, 8 teachers, students...

BelWü facts – for ~~politicians~~ historians

Year	Highlight
1987	Inauguration of BelWü, partially bridged IP and IP over X.25
1989	All universities in Baden-Württemberg connected to BelWü
1994	Full Mesh Network between universities with 2-34 Mbit/s
1998	Next technology step with 155 Mbit/s ATM connection
2001	Extension of the network to 1 Gbit/s (Cisco 12410/GSR), SRP/DPT rings with 2.4 Gbit/s und 622 Mbit/s
2006	First 10 Gbit/s connections
2010	Preparation of backbone network for 100Gbit/s-fähigen-Netz with Cisco ASR 9000. Self-operated passive DWDM, connectivity between major sites with multiple 10Gbit/s Ethernet connections
2013	First 100 Gbit/s connection
2014	100 Gbit/s connection for all universities in BaWü
2016/ 2017	Full optical dark fibre based backbone, ROADM based?, 100Gbit IP routers?



Does BelWü need
a new innovation
process?

Innovation process so far



So why can't we just go on?

Operation staff from the universities, paid to be conservative

Scientific Chairman

Vision, Flexible Network supporting the wide range of different regional collaborations, provide sufficient bandwidth, optimise for different traffic types, adopt emerging and new technologies, ...

BelWü TA

BelWü 2017+

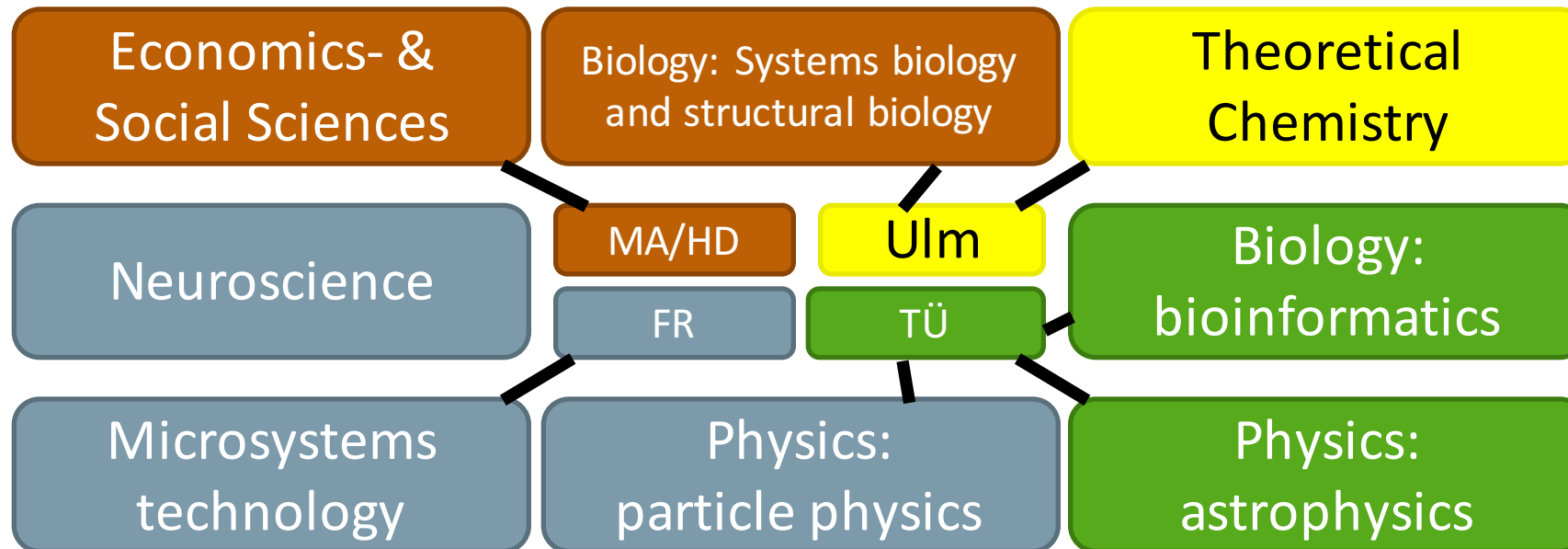
Push their specific solution as world best option 😊

Vendors

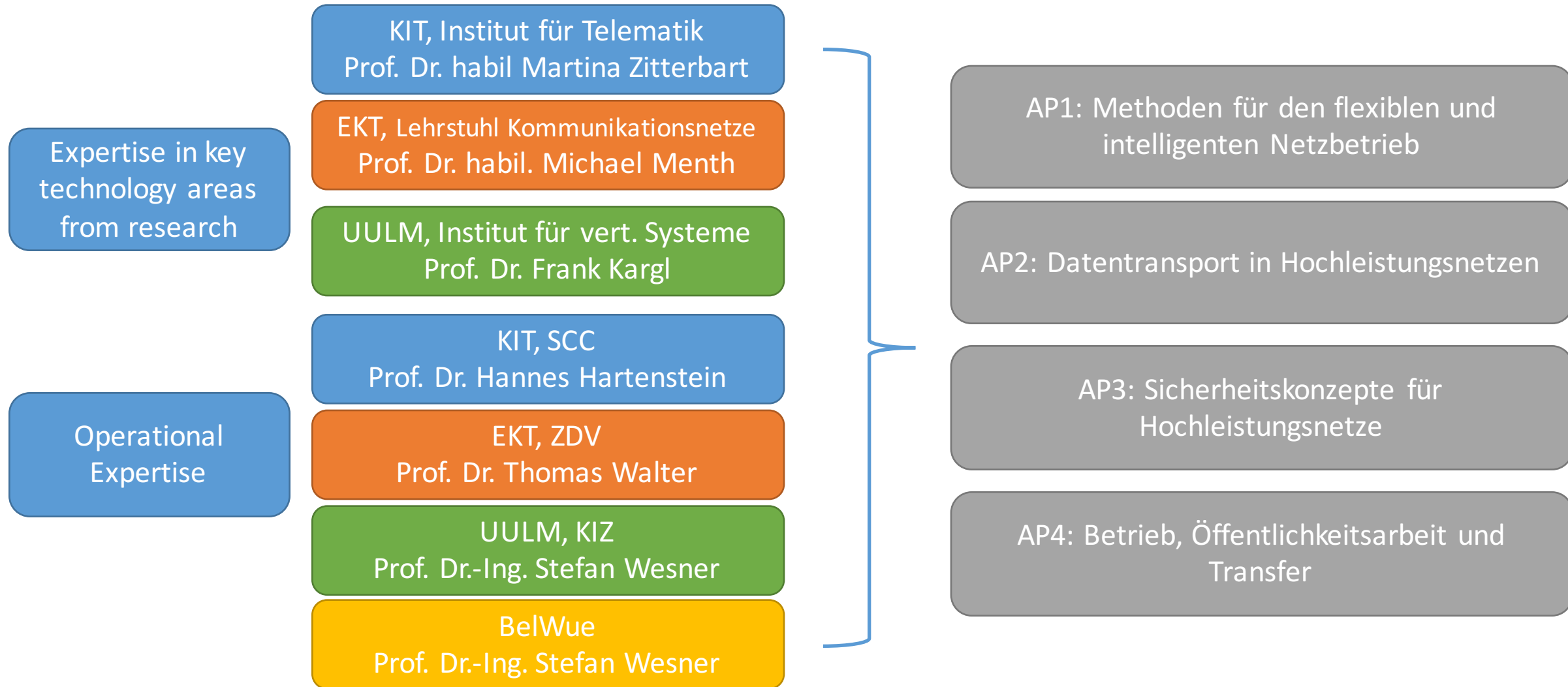
BelWü NOC

Ever increasing complexity with fixed number of staff, Emerging (immature?) technology versus 24/7 availability

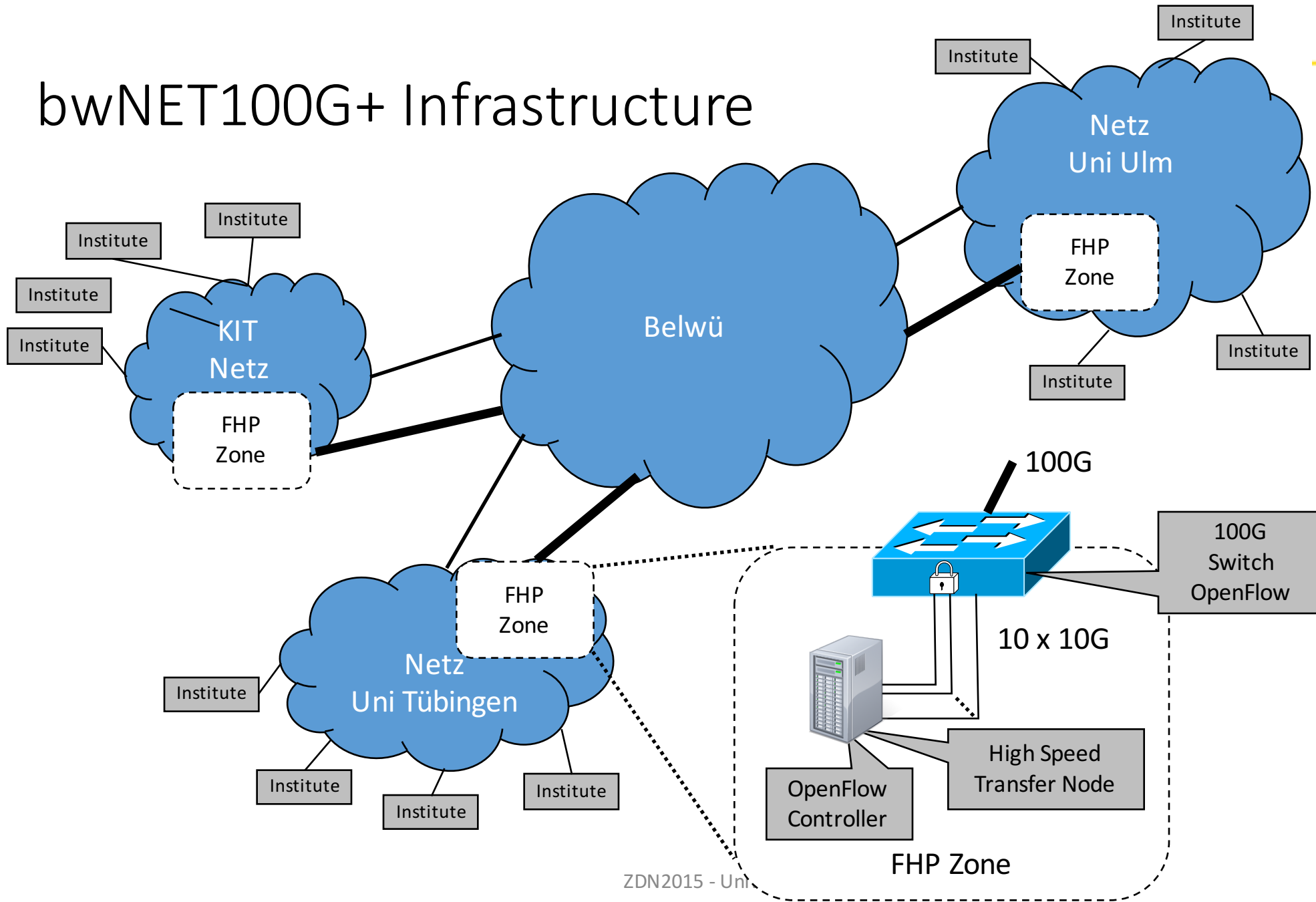
Example bwHPC Services



bwNET100G+ solution approach → team up



bwNET100G+ Infrastructure



WP1: Methods for a flexible and intelligent network operation

AP1: Methoden für den flexiblen und intelligenten Netzbetrieb

Application Scenarios of SDN within a Campus Network

SDN Technology and products "robustness" analysis

Methods for realizing "flexible high performance zones"

Scalability, Application beyond 100Gbps?

AP4: Betrieb, Öffentlichkeitsarbeit und Transfer

- Scenarios & Challenges
- Deployment costs (considering infrastructure in the field)
- Operational impact/costs
- Security and regulatory impact

WP2: Data Transport in High-Speed networks

AP2 Datentransport in Hochleistungsnetzen

Analysis of
protocol
performance for
the use cases

Protocol
optimisation

SDN based traffic
engineering &
traffic mix control

Data Transport
solutions beyond
100Gbps?



AP4: Betrieb, Öffentlichkeitsarbeit und Transfer

- Scenarios & Challenges
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WP3: Security concepts for High-Speed Networks

AP3 Sicherheitskonzepte für Hochleistungsnetze

Set-up of high-speed security testbed

FPGA based prototype implementation and evaluation

Methods for SDN based security

Scalability, Application beyond 100Gbps?

AP4: Betrieb, Öffentlichkeitsarbeit und Transfer

- Scenarios & Challenges
- Deployment costs (considering infrastructure in the field)
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Conclusions

- It is no longer enough for a research network to deliver just competitive bandwidth
- Adoption of new technological trends and solutions in a 24/7 operational infrastructure is complex and a conflict area
- bwNET100G+ solution approach
 - Dedicated network infrastructure and test server with direct WAN access as playground
 - Requirements and challenges from the practitioners
 - Integrated teams with researchers and operational staff
 - Validation will be based on technology capabilities but also on operational and economic impact
 - Proposed concepts from bwNET100G+ might not make it into production (“veto” position of operation)

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1. /Users/wesner (bash)
Last login: Thu Sep 24 22:33:34 on console
[wesner@eduroam043:~]$ traceroute www.uni-ulm.de
traceroute to www.uni-ulm.de (134.60.1.22), 64 hops max, 52 byte packets
 1 * * *
 2 134.2.252.65 (134.2.252.65) 4.117 ms 1.025 ms 0.938 ms
 3 tuebingen-wae-1-10ge-0-1-0-3.belwue.net (129.143.135.33) 1.569 ms 1.584 ms 1.379 ms
 4 stuttgart-al30-1-10ge-0-2-0-2.belwue.net (129.143.57.85) 2.811 ms 2.212 ms 2.324 ms
 5 ulm-n25-1-10ge-0-1-0-0.belwue.net (129.143.57.70) 3.261 ms 3.245 ms 3.161 ms
 6 cdrip.uni-ulm.de (129.143.87.114) 3.173 ms 3.118 ms 3.215 ms
 7 lindt-core-int.rz.uni-ulm.de (134.60.112.242) 3.007 ms 3.182 ms 2.982 ms
 8 www-ssl.rz.uni-ulm.de (134.60.1.22) 3.420 ms 3.238 ms 2.931 ms
[wesner@eduroam043:~]$

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Thanks for your attention and for using BelWü today...

Get in touch: stefan.wesner@uni-ulm.de, stefan.wesner@belwue.de

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BelWü facts – practical view

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