

Carrier-grade VoIP platform with Kamailio[®] at 1&1



Kamailio World, 17.04.2013

Henning Westerholt

Head of IT Operations Internet Access & Communications

- Henning Westerholt
- General
 - Linux user since 2001
 - Seriously involved in IT since 2003
- 1&1 Internet AG
 - Since beginning of 2007 as software and system developer
 - Now team lead in IT Operations, responsible for the “Access” IT systems
- Kamailio Open Source project
 - Since 2007 involved in the project
 - Core Developer, member of management board
 - Regularly present on different events
- Part of the much bigger group that design, build and also operate the services I'll present in this talk

- VoIP technologies
 - About 1&1
 - Setting and scope
 - General technology overview
 - 1&1 VoIP backend overview
- History 1&1 VoIP Platform
 - How all started
 - Development and growths
 - Challenges and motivations
 - Redundancy concepts
- Current setup
 - Geographical redundancy
 - Overview current setup
- Summary

- 6250 employees
 - 2,397 billion € revenue in 2012
 - about 232 Million € EBIT
- Offices in several European and international locations
 - Main development office in Karlsruhe
 - VoIP development also in Bucharest
- Five datacenters with over 70.000 Servers in Europe and USA
- Own global redundant WAN with hundreds of Gbit/s external bandwidth
- Second place w/r to customer base in the German DSL market
- Also important for 1&1, but not focus of this talk
 - webhosting, E-Mails, Portal, Advertising
- Biggest driver in 2012 the “1&1 Prinzip”
 - Overnight delivery of new hardware, one day Hardware replacement, one month free testing

IT Operations Access

Access
Backend

Access
Middleware

VoIP

Radius

ACS

*boss

VoIP backend at 1&1



- Operated mainly with Open Source components
- One of the biggest deployments out there
- Data
 - Over three million customers on the platform
 - More than seven Million subscribers
 - Interconnections to Telefonica, Vodafone and QSC and others
 - More then one billion minutes per Month to the PSTN
- Geographical redundant backend in a load-sharing setup
- Focus towards small businesses and home users
- Provides services for ADSL, VDSL, UMTS and LTE customer connections



<http://www.flickr.com/photos/21560098@N06/3831347566>

CPEs & Carrier Endpoints

Kamailio Softswitch

Asterisk PBX

MySQL

PDB

Mail, LI

MySQL

Mail, LI

Debian
Linux

Debian
Linux

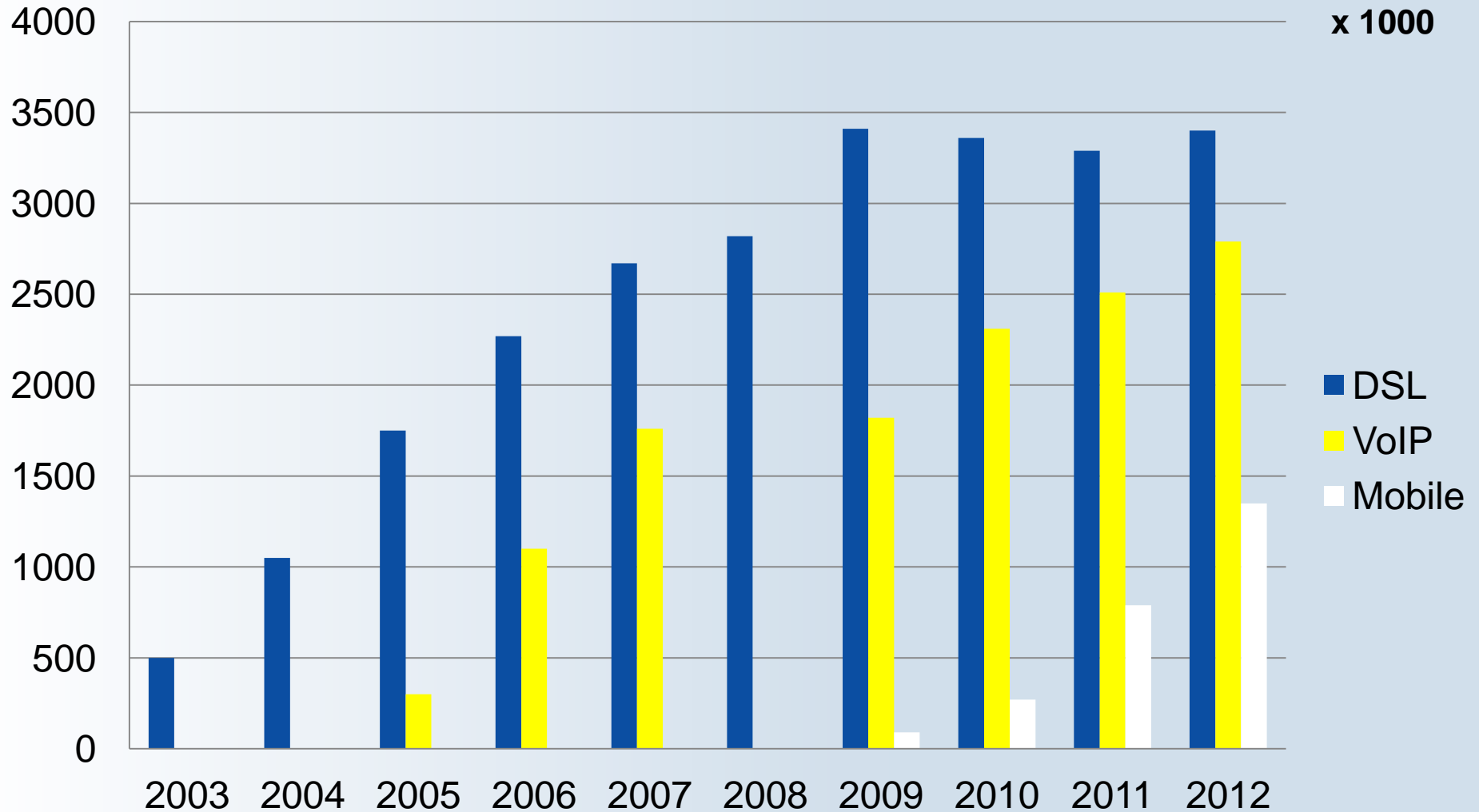
Debian
Linux

Standard
Server

Standard
Server

Standard
Server

Customer development DSL, VoIP and Mobile



How its started, rapid growths



- July 2004
 - First branded DSL resale offering with VoIP
 - SER 0.8.12 in production, later SER 0.8.14
- December 2004 – SER 0.9.0 in production
- July 2005 - OpenSER 0.9.5.1 with small modifications in production
- August 2005 - Backend something like 10-20 machines
- January 2006
 - OpenSER 0.9.5.2 with major extensions in production
 - Biggest change partitioned user location
- December 2006
 - 2.09 million DSL customers, 780.000 VoIP customer, 260 million minutes/month
- February 2007
 - OpenSER 0.9.5.3 in production, with initial carrier route module
 - Backend is something like 20-30 machines

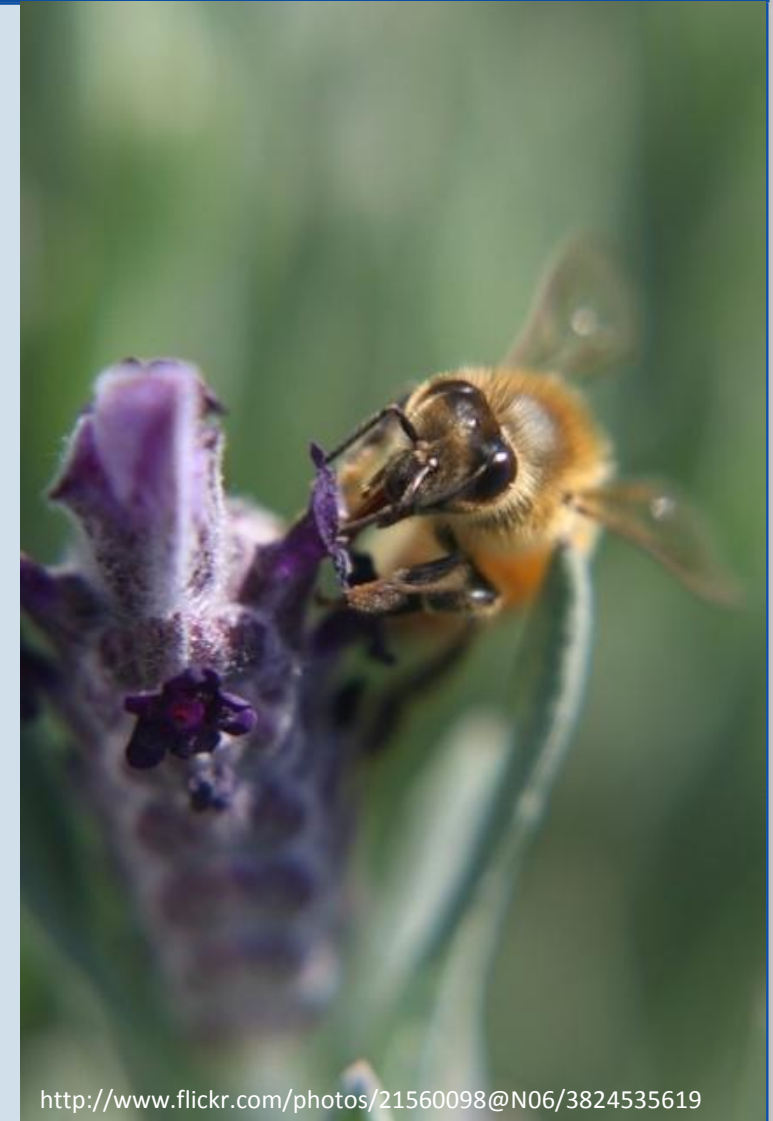
- February 2007
 - decision to change development mode, as we could not keep up with the Open Source project and wasted time in redundant bug fixing and developing
- April 2007 – first contribution to OpenSER project
- May 2007 - Internal patches gets ported or merged upstream
- December 2007
 - 2.54 million DSL customer, 1.6 million VoIP, 800 million minutes/month
- January 2008
 - Porting mostly finished, several major contributions now upstream
- October 2008 - OpenSER 1.3 completely in production
- October 2009 - Kamailio 1.5 in production on balancers
 - Two developers in the Open Source project, upstream first development
- December 2009
 - Kamailio 1.5 in production for presence, Backend something like 50 machines

- External service dependencies
 - other company services but also to the internet
 - external IP routing (IXs or peerings), to external DNS services (.de or provider)
- Scaling issues with SIP VoIP service
 - order of magnitude difference between normal load and emergency situations
 - problem of registration retransmission during outages, exponential traffic increase
 - in general SIP retransmissions with the UDP protocol a potential problem
- Necessary QoS improvements
 - customer expectations for first line telephony
 - growth in customer size and/ or service complexity
- Legal requirements
 - Increasing pressure from regulation authorities, e.g. for lawful interception, emergency calls
 - service and availability

- June 2010
 - Kamailio 1.5 in production on proxies
 - Four developers in the Open Source project
- July 2010
 - Kamailio 1.5 completely in production
 - Further improvements in operation processes and Q/A
- September 2010 – internal tests of Kamailio 3.0
- October 2010
 - 3.38 million DSL customers, 2.21 million have first line VoIP
 - Building of a second backend in another data center
- November 2010 – setup with geographical redundancy finished
- February 2011
 - Setup with geographical redundancy full in production
 - Backend now more than 100 machines, not including support systems

Keeping up with the development

- April 2011
 - Internal tests of Kamailio 3.1, contribution of partitioned user location
- May 2011
 - Kamailio 3.1 in production on balancers
 - Dialog support and CDR based accounting in production
- August 2011
 - Kamailio 3.1 for proxies in test
 - 3.31 million DSL customers, 2.41 have first line VoIP
- Spring 2012
 - Kamailio 3.1 completely in production
 - Migration to a new Asterisk PBX version starts



<http://www.flickr.com/photos/21560098@N06/3824535619>

■ Summer 2012

- Migration work to the Kamailio version 3.3 starts
- New Asterisk version in production, consolidation of internal application services

■ Winter 2012

- Lightweight B2BUA implementation in production for call-forwarding
- New routing implementation developed to provide much more flexibility in routing decisions
- Agile internal software development

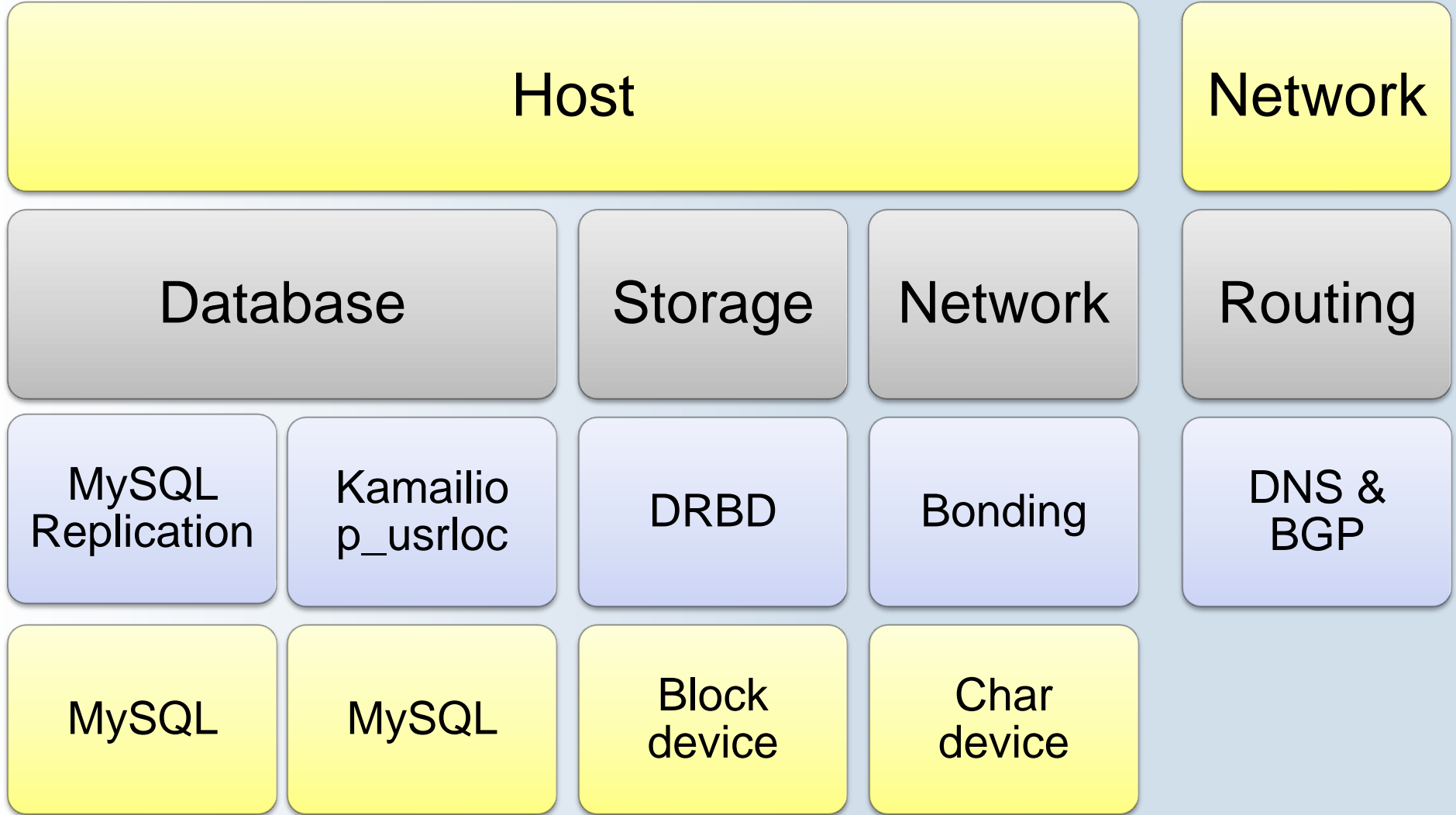
■ Spring 2013

- New routing implementation in production
- Georedundant traffic capturing with homer in production
- New geo-redundant test system
- Automated package building and testing
- Kamailio 3.3 in production

- Complexity
 - debugging of global failure conditions, e.g. interoperability issues
 - maintaining a proper quality of service over datacenters and clusters
 - External dependencies to company services
- Maintenance
 - stable and identical machine setup necessary
 - service changes and coordination
- Shared database state
 - distribution of provisioned subscriber data
 - usually a distributed infrastructure
 - universal availability of user agent location information
- Routing and failover
 - partitioning and distribution of users
 - failover during emergency or for maintenance reasons

- No single best way available, several solutions possible
- Processes and also tools needed
 - ITIL (e.g. Change management, Incident management..)
 - Configuration management (e.g. puppet)
 - System management and monitoring
 - Ticket Systems and workflows
- Quality assurance
 - Internal and external
 - Bug tracking and tracing tools
- Ensure availability of redundant systems
 - Failover tests
 - Load-shared active/active setup
 - Documentation and processes

VoIP stack redundancy mechanism



- Local read-only data for performance and stability
 - DNS caching
 - MySQL replication
- KISS principle
 - Use well-understood mechanism with low complexity
 - DRBD synchronization
 - Layer 2 bonding
 - REGISTER replication
- Layers of redundancy
 - Network, Hosts and Data center
- System stability
 - DNS and BGP versus IP any cast
- Isolation
 - Minimize dependencies to other internal and external services

Overview complete VoIP system



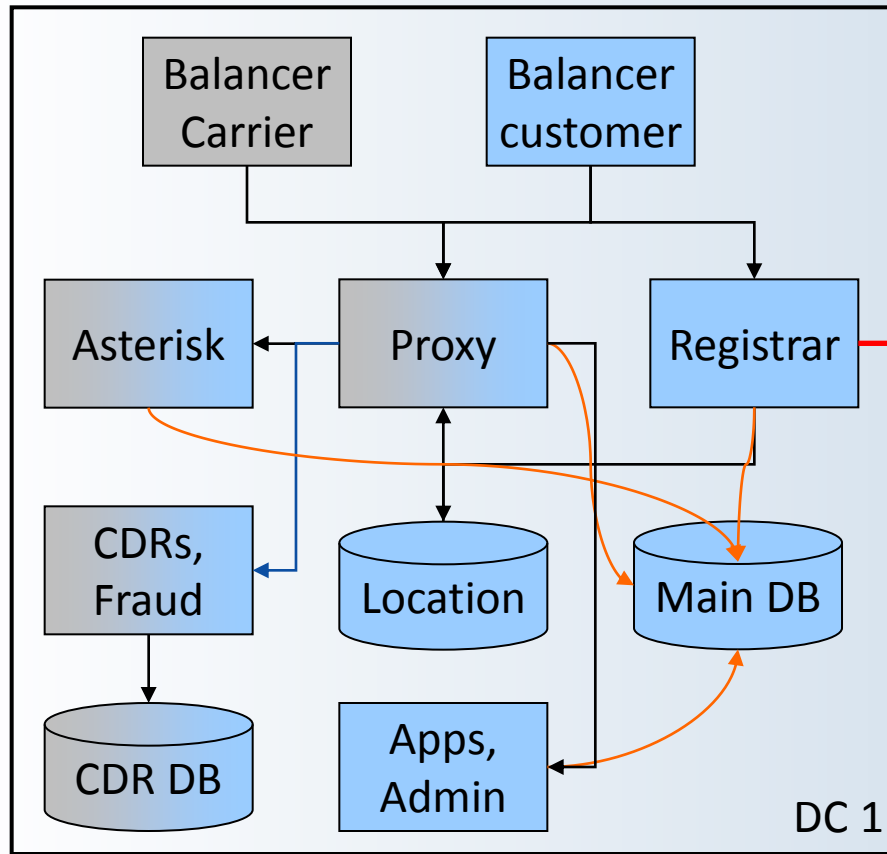
1&1

GMX

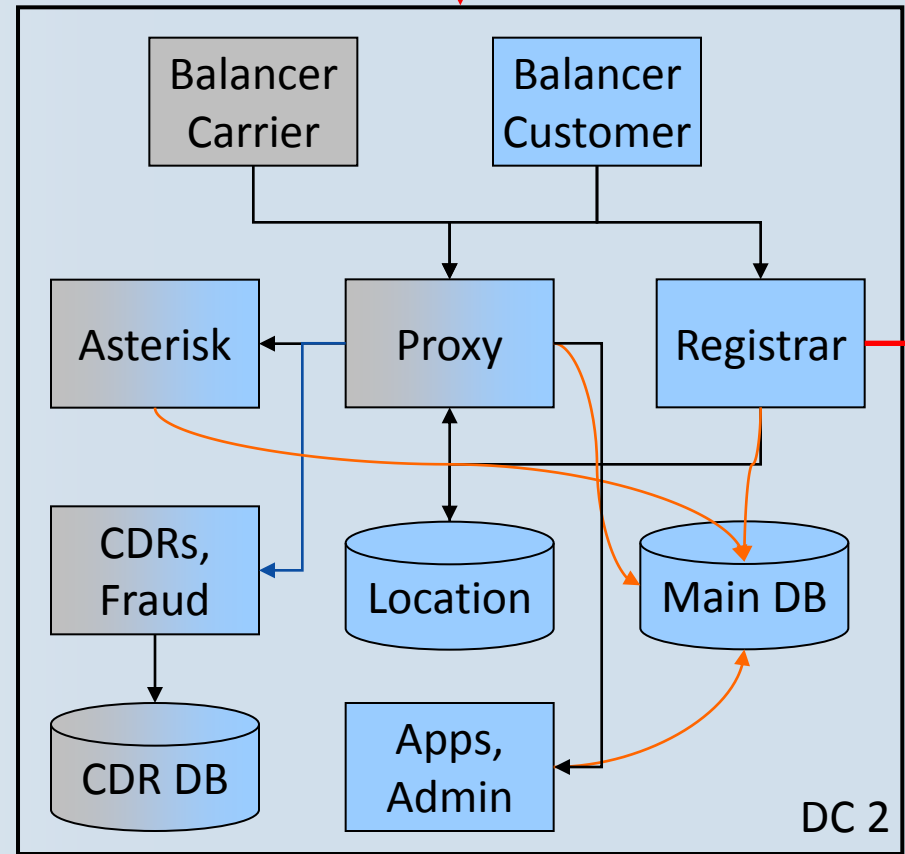
QSC

Telefonica

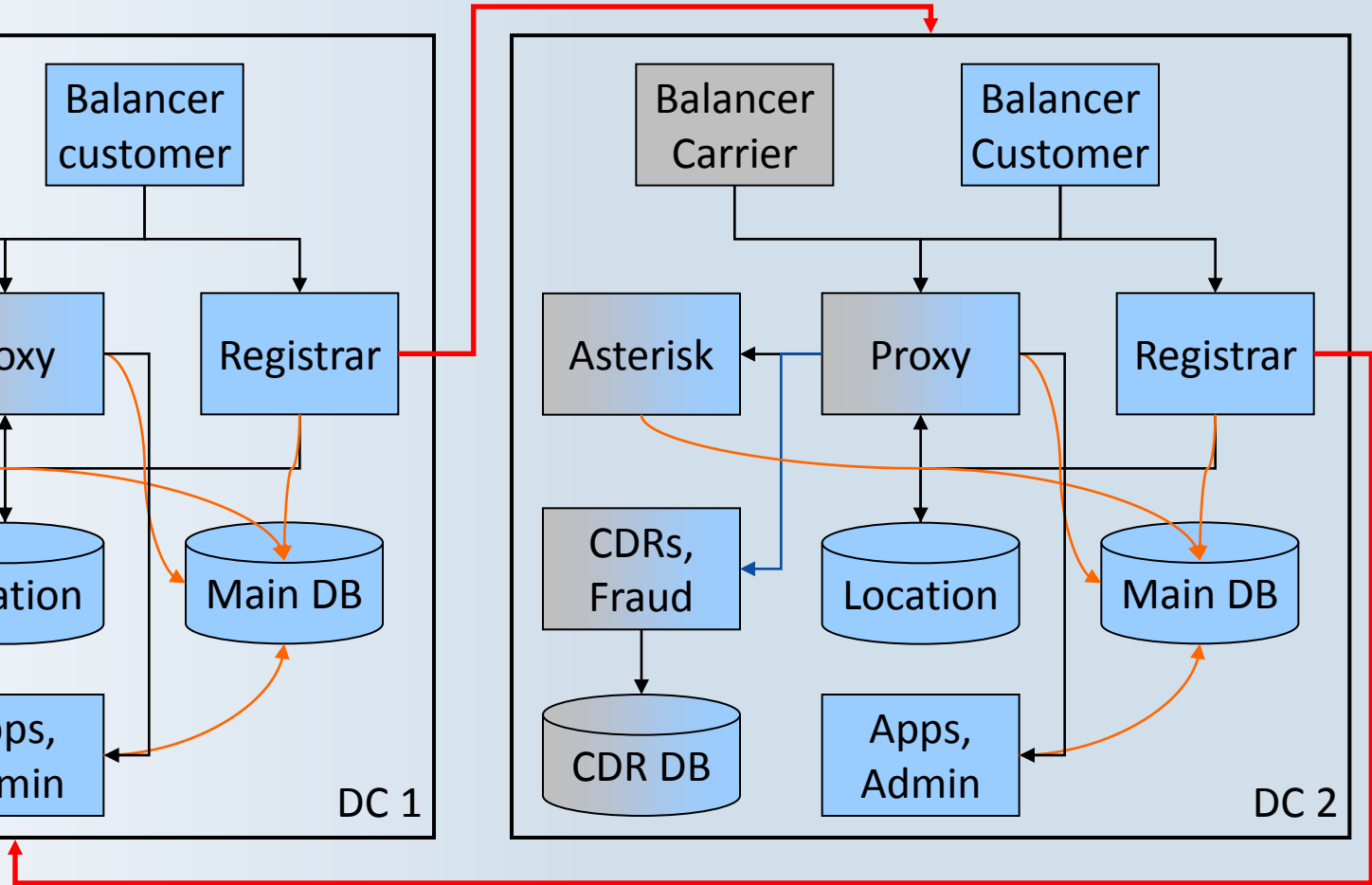
Vodafone



DC 1



DC 2



- Participate in the Kamailio project
- Keep it simple
- Manual processes beats complex automatism
- Build redundant system active/active, if possible
- Use layers of redundancy that complement each others
- Keep your data local
- Try to minimize (external) dependencies
- Over provisioning for stability

Thanks for your attention!



Questions?

- Henning Westerholt
 - hw@kamailio.org
- We're hiring
 - System Administrator for ACS and Java Middleware
 - VoIP Backend Developer for Kamailio and Asterisk
 - More information from me or at <http://jobs.1und1.de/>
- License of this slides

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