

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**

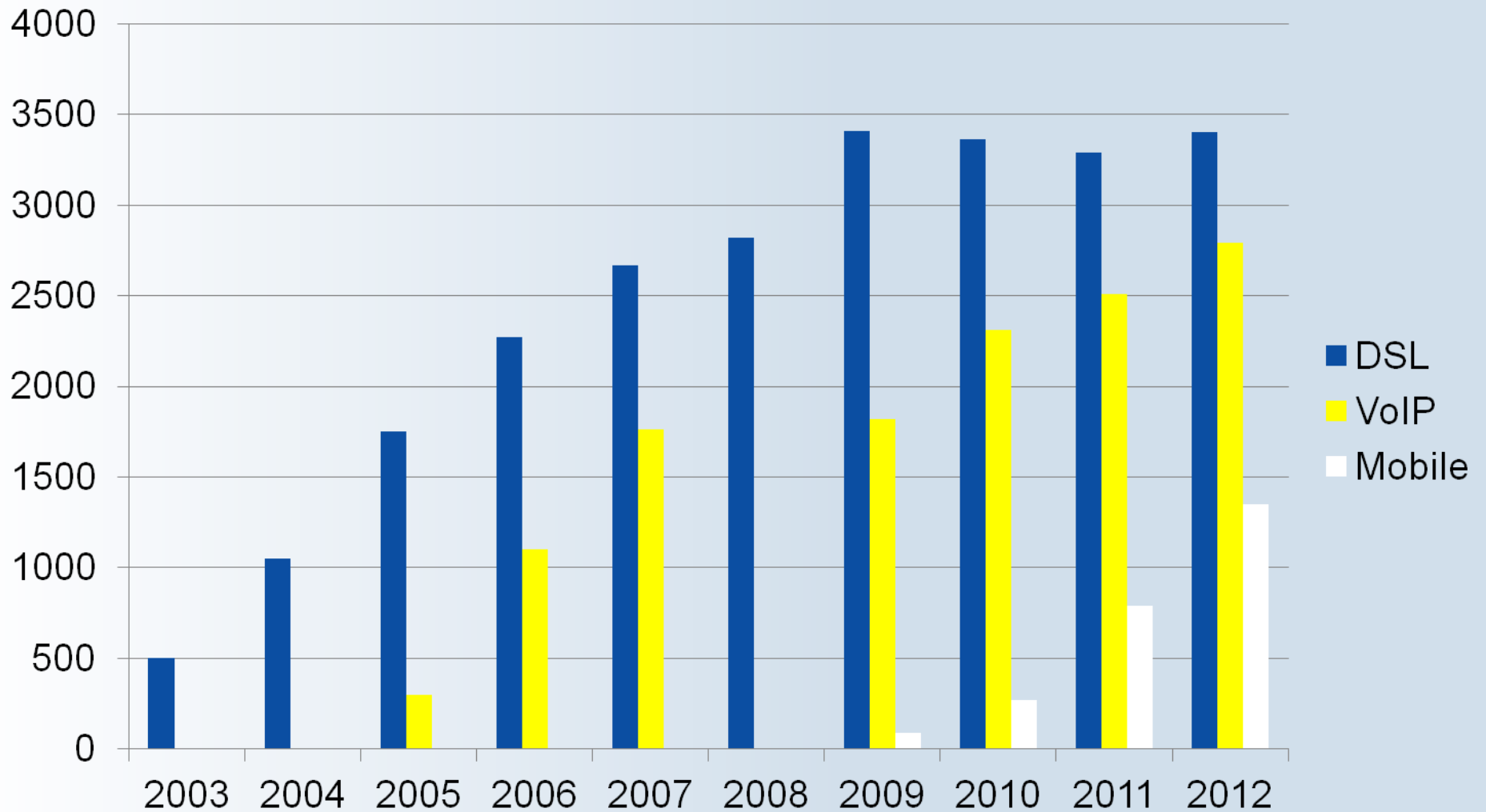
**Debian
Linux**

**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

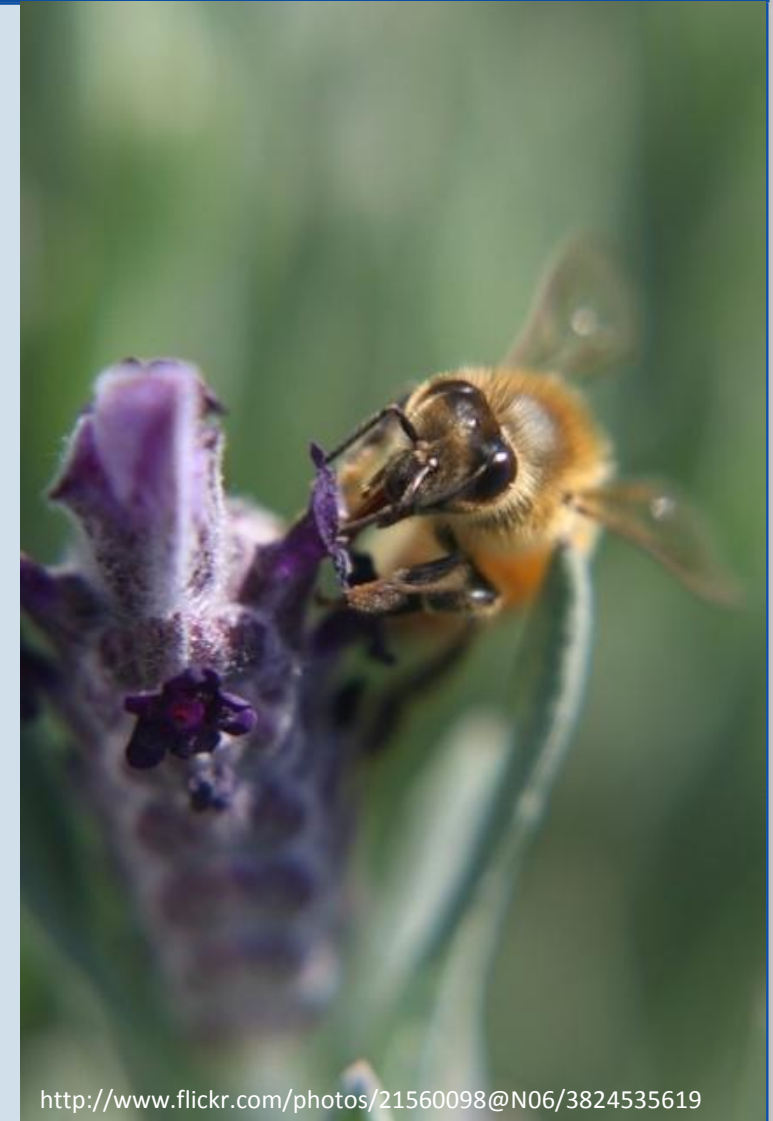
- February 2007
 - decision to change development mode, as we could not keep up with the Open Source project and wasted time in redundant bug fixing and developing
- April 2007 – first contribution to OpenSER project
- May 2007 - Internal patches gets ported or merged upstream
- December 2007
 - 2.54 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

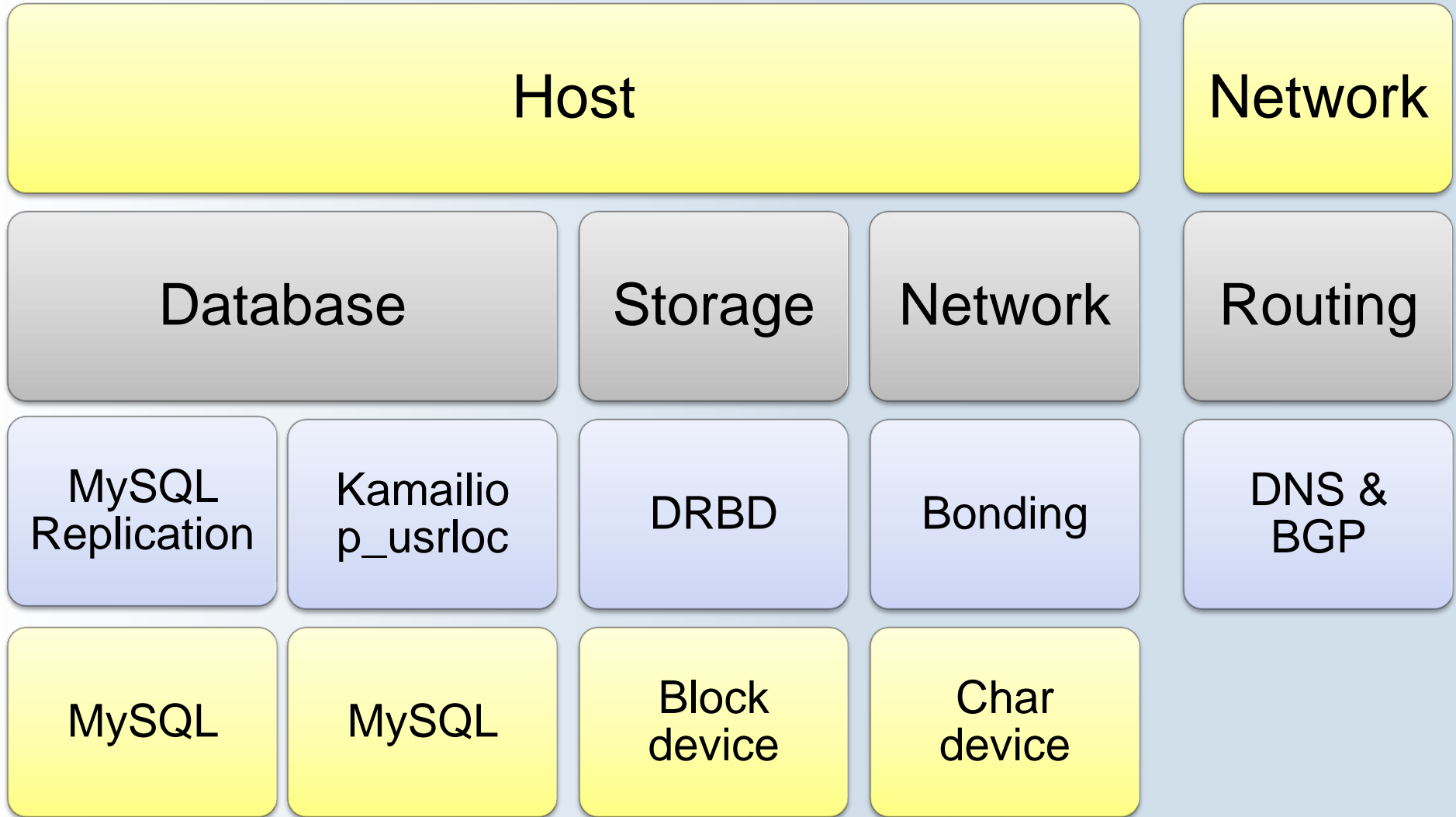
■ Spring 2013

- 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



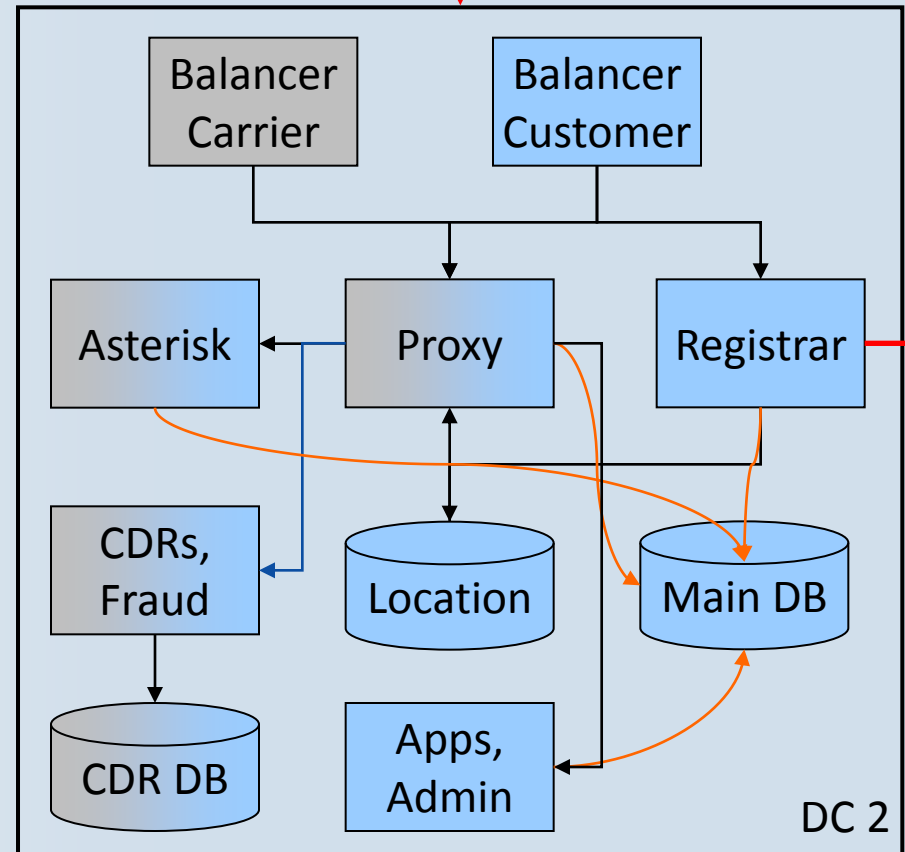
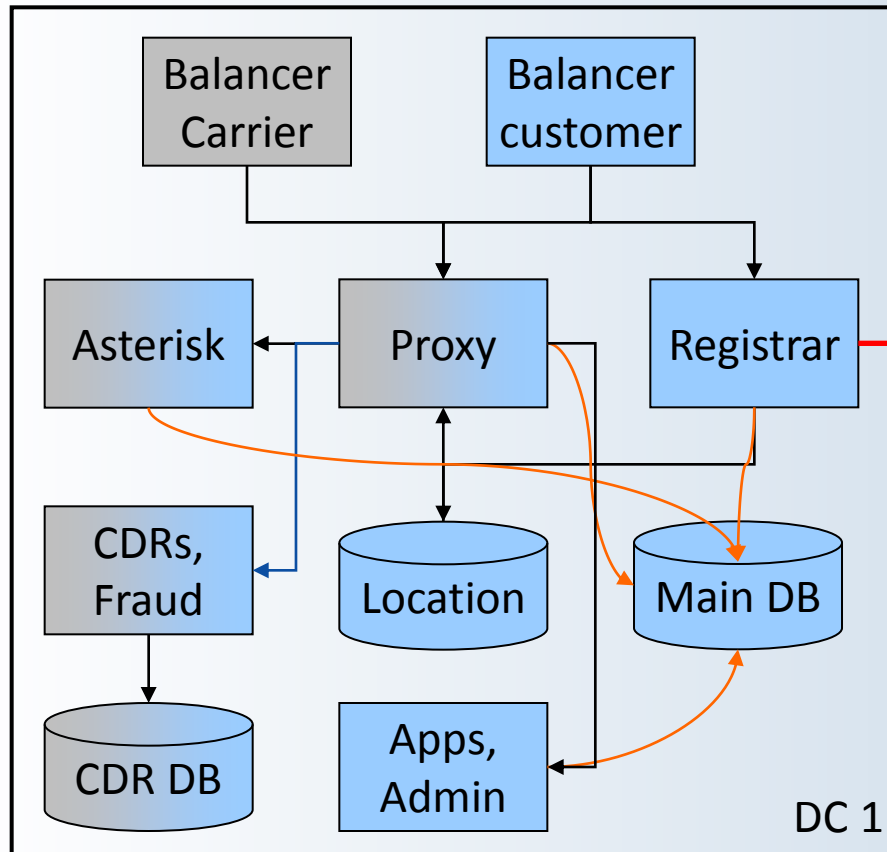
1&1

GMX

QSC

Telefonica

Vodafone



- 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
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- We're hiring
 - System Administrator for ACS and Java Middleware
 - VoIP Developer
 - More information from me or at <http://jobs.1und1.de/>
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