

Einführung von VoIP am DESY



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IT

Overview



- DESY
- The IP Network @ DESY
- Telephony @ DESY
- VoIP Installation, Design and Experience
- Summary

Deutsches Elektronen-Synchrotron – DESY



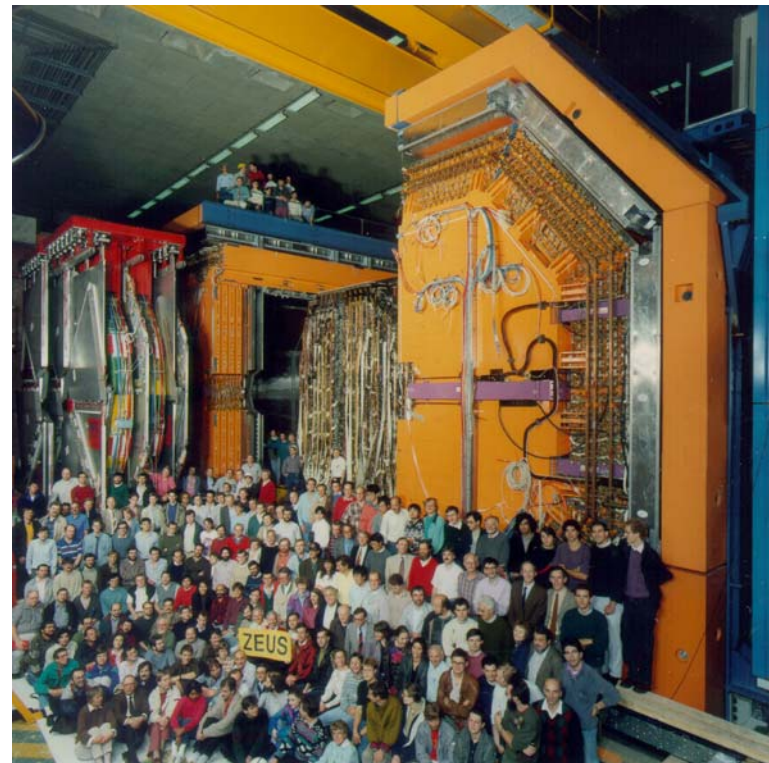
- National Research Center with special emphasis upon
 - Development, construction and operation of particle accelerator facilities
 - Particle physics
 - Research with photons
- Member of the Helmholtz Association
- 2 Locations: Hamburg and Zeuthen (Berlin)
 - Similar Institutes: CERN (Geneva) SLAC (Stanford), FNAL (Chicago), KEK (Tokyo)



Deutsches Elektronen-Synchrotron – DESY



- People @ DESY
 - ~ 1900 permanent staff members
 - ~ 3000 scientists from 45 countries are using the DESY facilities
- Budget: 183 M€ per Year
- Actual Projects:
 - XFEL
 - PETRA III
 - ILC



PETRA III



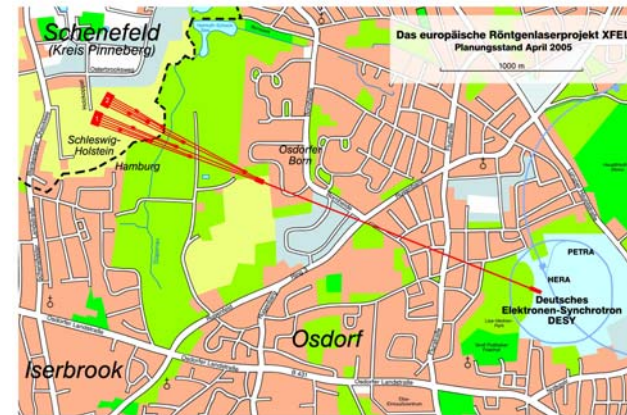
- Conversion of existing storage ring PETRA into one of the most brilliant x-ray sources worldwide
- Construction started July 2007
- User operation starting 2009
- Total investment: 225 M€
- 280 m long experimental hall



XFEL



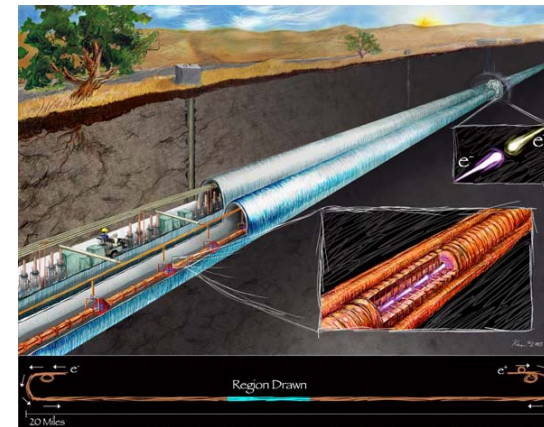
- The world's longest artificial light source, a 3.4-km-long facility
- XFEL X-ray laser is being planned as a project with European participation
- Project costs: 908 M€
 - Construction is due to begin in 2009
 - Commissioning will start in 2012
- An all-new research centre will be built on the outskirts of the town of Schenefeld in Schleswig-Holstein



ILC



- The next big challenge in particle physics is the International Linear Collider (ILC)
- ~ 33 km Length, ~ 6 G€
- At DESY, the international TESLA Technology Collaboration developed the superconducting accelerator technology which will be used for the ILC
 - FLASH Accelerator at DESY
- No site has yet been selected
- Operation could start 2015



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IT @ DESY



- IT Department delivers central IT Services to employees and guests
 - Mail, Web, Windows Domain, SAP,
 - Mass storage for physics data
 - 300 – 500 TBytes/year (CERN is going for 10 PBytes/year)
 - PC farms for data analysis (>1000 hosts in the Computing Center)
 - Tier-2 for the LHC Computing Grid (LCG)
- ~ 80 people within 7 sections

IT Section Communication Networks

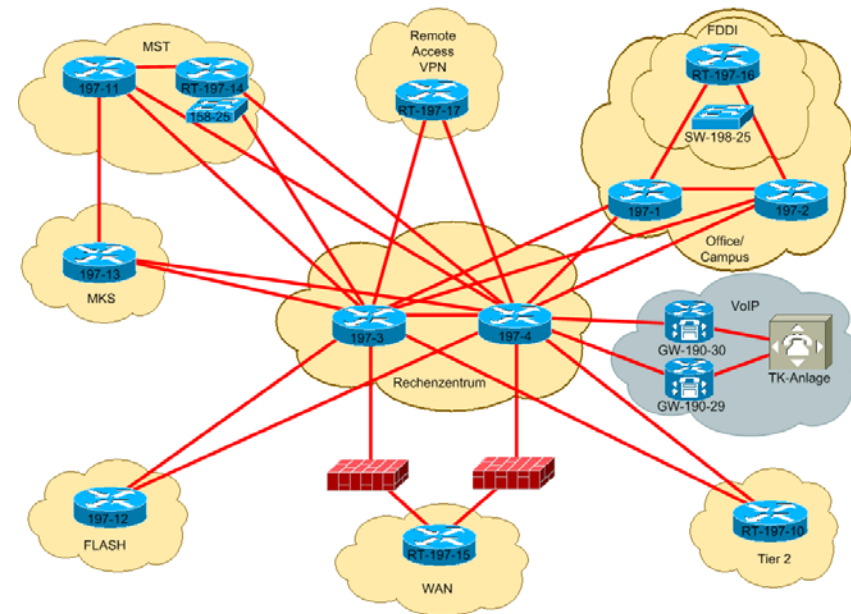


- Responsible for basic communication services
 - LAN, WAN, WLAN
 - Telephony, Mobiles
 - Firewalls, IDS
 - Remote Access, VPN
 - Videoconferencing
 - DNS, DHCP, Radius, ...
- Currently 12,5 FTEs

Network Layout, Data Rates



- Several layer 3 networks
 - Campus
 - Computing Center
 - Accelerator Control
 - ...
- OSPF as routing protocol
- Some data rates:
 - Data C. ~ 120 TBytes/d
 - Backbone ~ 20 TBytes/d
 - Office ~ 30 TBytes/d



LAN



- 10 GBit/s Backbone, OSPF routed
- At least Switched Fast Ethernet available on the entire campus, newer installations are Gigabit capable
- 13 Routers, ~ 240 Switches
 - Homogeneous environment:
 - Catalyst 6000 (~80 %), 3750, 2948/2980 and 3500 XL
 - ~ 12.800 10/100 Ports
 - ~ 6.300 10/100/1000 Ports (800 LWL, 5.500 Copper)
 - ~ 140 10-GE Ports
 - ~ 21.700 DNS Entries

WAN

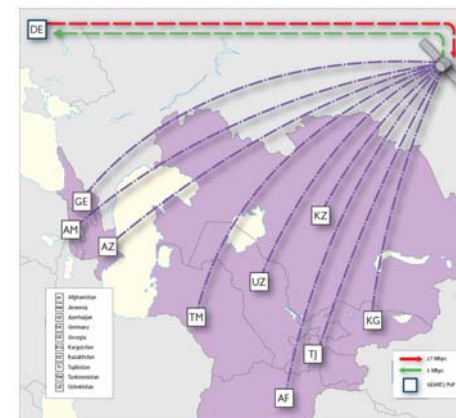


- 10 GBit/s via the German NREN DFN
 - Connected to XR-DES and GR-HAM (HHR III)
- Site-to-Site VPN Hamburg–Zeuthen (DFN)
 - 10 GE Optical VPN
 - Protected optical path via WDM equipment
 - 1 GE Ethernet over MPLS (EoMPLS) VPN
 - DFN-NOC doesn't like this very much but it was the only solution for a fully redundant path between Hamburg and Zeuthen

WAN Projects



- **SILK**
 - Connecting the Caucasian and Central Asian NRENs to European NRENs
 - Satellite connections from DESY Hamburg
 - Financed by NATO Science Program and EU
- **OCCASION**
 - Videoconferencing via SILK Infrastructure
 - Financed by EU



How stable is the network?



- We are very pleased with the network stability
 - Uptimes of more than 500 Days seen several times, the SNMP uptime counter warps around !
 - One switch in the Accelerator Control System reached 4 year, 38 week uptime !
- Between 1.1.2000 and 31.12.2006 we have seen ~400 years of operation with 2165 hours of downtime
 - ~ 99.94 % availability
 - ~ 10 % Maintenance
 - < 1 % Unplanned (Crashes, etc.)
 - ~ 90 % Unplanned with external events (power outage, ...)

Device Management



- Maintenance Contract
 - all active devices covered
 - Next business day hardware replacement
- One 'Spare' component of any device on site
 - Allows immediate replacement, failed component finally replace via maintenance contract
 - Normally uses as lab equipment
- One Device of any type in the production network serves as a reference installation

Out-of-Band Management



- An entire independent network for central access to serial console lines
- Serial Console connected to Terminalserver
- Network is build out of old and reused equipment
- A Software (MO from KiNetworks) manages the access to the console lines
 - Access Control
 - Logging of all events on System Console -> extremely useful for troubleshooting (Crashes !)



LAN Experience

- Bandwidth Usage is growing by a factor of 2-5 per year
- Only minor downtimes due to failed hardware or malfunctioning software or configuration errors
- Major problems are power outages
 - We are trying to buy only equipment with redundant power supplies and try to connect them to different power lines
- It is getting more and more difficult to get maintenance windows as more and more business critical applications require a non stop running network
 - SW Upgrades are nevertheless necessary
 - In Service System Upgrade!

Telephony



- DESY runs ~ 4600 phones,
~ 4100 phones at Hamburg, ~ phones at Zeuthen
 - 2 PBX Systems in Hamburg
 - Avaya/Tenovis I55 (~ 2300 phones, ~ 25 % digital phones)
 - Avaya/Tenovis I333, very old! (~ 1100 phones, analog only)
 - 1 PBX System in Zeuthen
 - Avaya/Tenovis I33 (~ 700 phones, ~ 25 % digital phones)
 - 1 IPT System in Hamburg
 - Cisco Communication Manager (~ 700 phones), some IP phones are located in Zeuthen
- 120 Lines for external phone calls (4 x S2M)
- Voice-Mail/Fax/SMS Server
 - Cycos MRS



Why IP Telephony?

- Easy handling of user movements
 - About 20 – 30 movements per week
- Only one infrastructure to maintain
- Integration of remote sites (Zeuthen) and traveling scientists
- CTI options (Outlook Integration, ...)
- XML Services via phone integrated Web-Browser
 - e.g. Phone Book, News Ticker,

Goal



- Smooth migration, no fork lift installation
- Integration into existing numbering plan
 - Replacing traditional telephones with IP phones without changing the phone number
- One PBX will coexist for redundancy purpose
- Replacement of analog phones by IP phones
 - enhanced functionality
- Stopping PBX investments



VoIP @ DESY

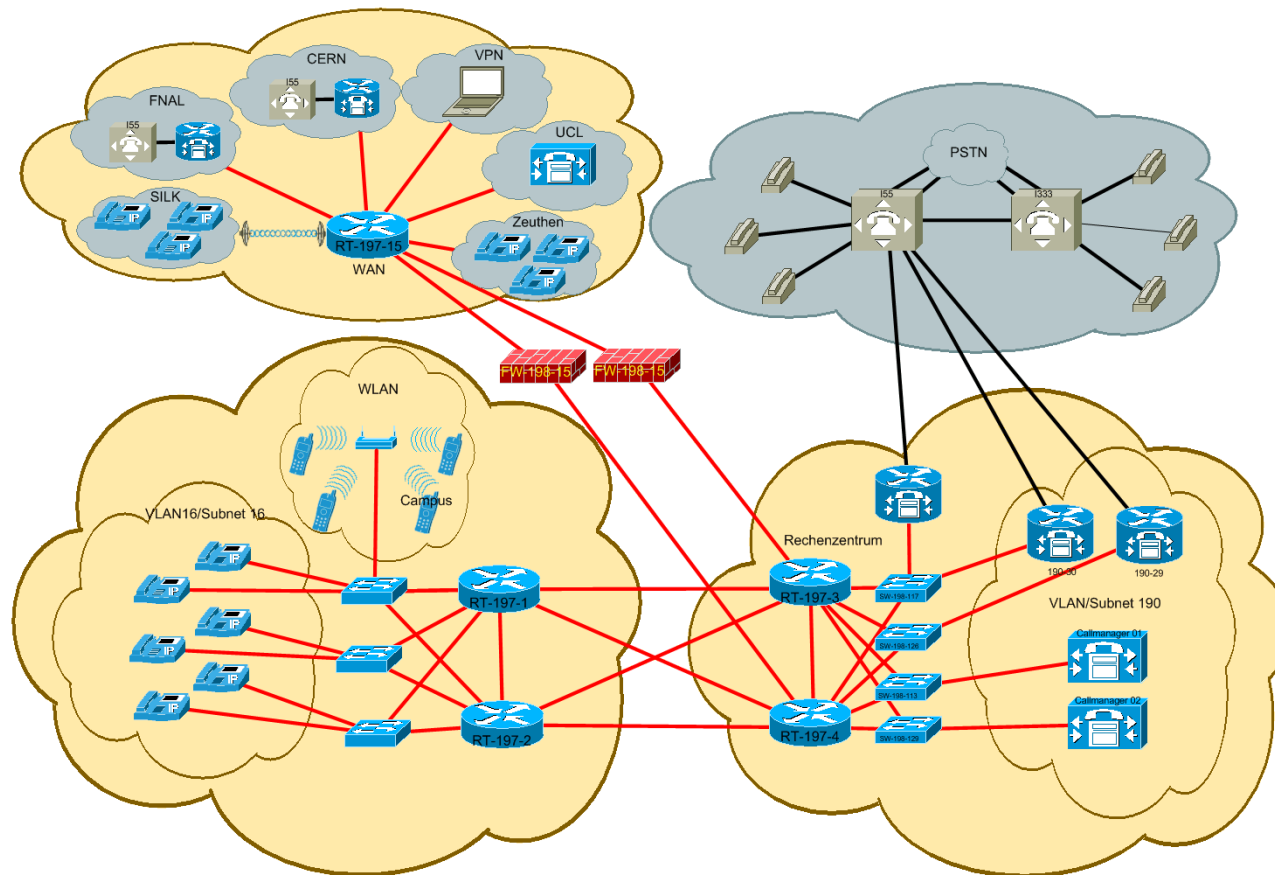
- First Cisco Callmanager on site in July 2000
 - Voice quality was bad, but idea was convincing
 - PBX integration was missing
 - Mayor step with Callmanager Version 3 and QSIG-Support
- Actually running a Cisco Communication Manager Cluster (6.1.2)
 - Production Status since February 2005 with Version 4.1.3
- Various Telephones in Operation (~ 700 Phones)
 - Hardphones
 - Softphones (IP Communicator, X-Lite, ...)
 - WLAN-Phones
 - Video Phones, (e.g. Cisco VT Advantage)

IP Telephony Network



- Operated in 3 dedicated VLANs (phones, servers, WLAN phones)
 - All VLANs have very restrictive Firewall rules
 - Phone VLAN is brought to the phones via AUX-VLAN feature and thus no additional Network Plugs are needed
- PBX Gateway
 - CCM is operated as subsystem of the PBX
 - Two Cisco 3825 with 30 lines (PRI) each
- Nearly all phones are operated via PoE and PoE extension on switches has been enlarged and will proceed the next years
- No QoS configuration in the network yet!

VoIP Network Design



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Experience



- No unexpected outage of CCM yet, very stable operation
- Most work was going into the PBX/IPT interface
 - Small pieces were missing (Leading zeros from external calls, Calling Line ID, Call-Back on Busy, Billing of Private Calls, etc.) and were added step by step
- Interesting Selling Points ;-)
 - People love the quality of the 'Hands Free' operation
 - Online Phone Book as XML Service
- IPT is still missing some well known functionalities
 - 'Partnerschaltungen', phone lock, ...
- Increasing Demand for IPT functionalities (e.g. Outlook Integration)

Next Steps



- Video Telephony
- Management improvements
 - MOS Value, Jitter, Delays, etc.
- More IP Phones @ Zeuthen
- More Site-to-Site VoIP connections
 - Lot of communication and agreements necessary as every institute has its own policy
 - Telecommunication Laws !
- Do we need Authentication/Encryption for Voice Data?
- Additional Phone Services
- Looking for the WLAN + GSM Phones to better support mobile user

Third Party Integration



- Cisco Callmanger > 5.x allows integration of third party SIP phones
 - Hardphones
 - Softphones, e.g. X-Lite
 - even with Video option
- Cisco Callmanger is capable of routing H.323 calls and handle H.323 devices
 - H.323 GDS Integration (any GDS device could be called from any DESY IP phone and vice versa)



Conference Systems

- Increasing number of audio and video conferences
- Various 'Systems' in use
 - native H.323
 - Cisco MeetingPlace
 - EVO (<http://evo.caltech.edu>)
- Audio via MeetingPlace
- Video primarily via H.323 and EVO
 - Building the bridge between all these systems is very difficult ...

Summary



- The Network is reliable enough to support Voice and Video Applications
 - But keep the power supplies up and running ;-)
 - In Service System Upgrade needed on all systems
- It is a tremendous advantage to have the PBX team and the IP team within one group
- Smooth migration is working pretty well
- We stopped PBX investments
- Is IPT cheap?
 - Yes and no! You're investing the money on other items like PoE, etc.