Challenges for a cloud provider

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Deutscher Akademischer Austausch Dienst
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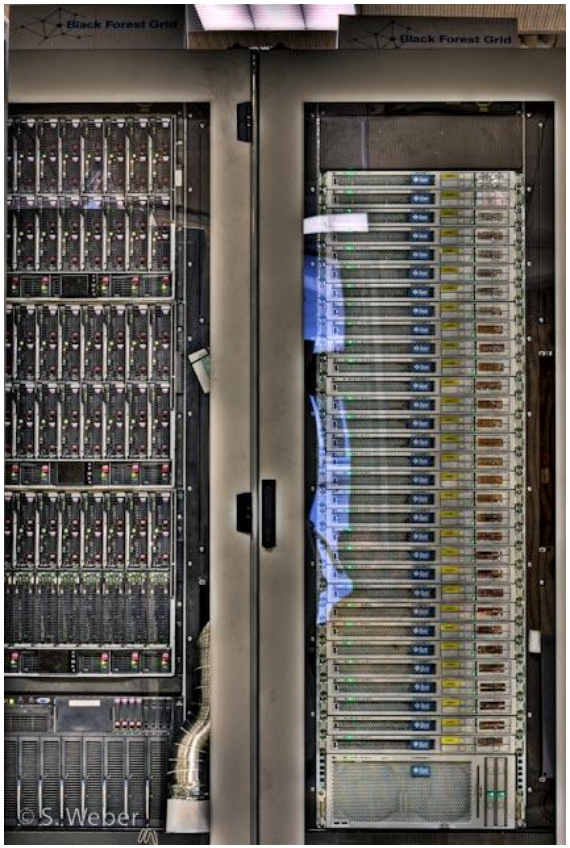
A small cloud infrastructure ☺



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„Unexpected“ technical issues

- Computer center was build in 1974
  - For mainframes – big irons
  - Heavy, water cooling
  - Machine room: 750 kg/m² – max 950 kg/m²
    - With special permission
- But: modern water cooled 19“ racks weigh up to 1400 kg/m² ☹
  - 48 1U computers + cooling + internal air fans + ..
- Modern computers use little energy
  - Just a few hundred watts when fully charged

„Unexpected“ technical issues

- 48 x „a few hundred Watts“ = 35 kW
  - Energy you have to get in and heat you have to get out.
  - At the moment a rack is between 12 and 18 kW
    - Machines are never fully „loaded“
- Scientists have grants, buy machines and bring them to the CC
  - To use the „professional“ infrastructure
  - Rapid growth
  - 300.000€ buys 2-3 racks = 50 kW or more…
- Currently we need 300 – 400 kW
  - Growth announced

„Unexpected“ technical issues

- New power supply – 3 transformer 600 kW each
- New cooling device: 600 kW
  - To produce cold water for the water cooled racks
- Additional supply tunnel to the university cold water ring – 400 kW cooling
- So we could supply 1 MW to machines
  - Continued growth??
  - Well, we pay 0,17€ per kWh, thus 1 MW costs **1,5 Mio € per year**
  - Who pays??
  - Change in funding necessary

„unexpected“ technical issues

- Emergency energy supply
  - Diesel engine with 200 kW
    - Fuel for one day
  - Battery backup for 160 kW for 20 mins
    - Until Diesel takes over
- Change of paradigm:
  the Holy Grail of a computer center – the HPC – cannot be kept in operation during a power failure.
- Define what is mission critical!
  - The Internet !!! And all its servers (DNS, DHCP,..)
  - File servers

„unexpected“ technical issues

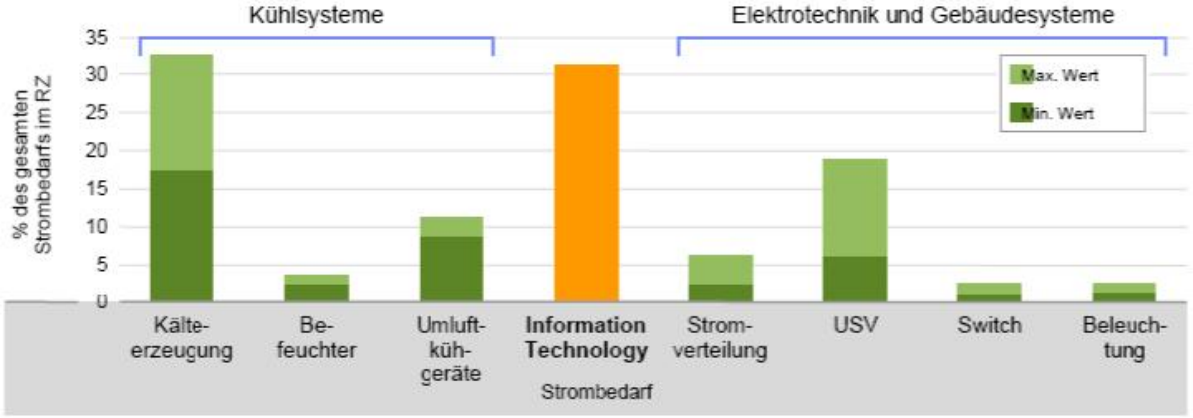
- What if there is a „water failure“?
  - Burst pipes, maintenance by water works …
  - The cooling goes down after 3 hours!
    - And the computer centre overheats…
  - We now asked the water company for an additional supply line.
- We did think about a redundant Internet connection…
  - But not about redundant water supplies….
- Infrastructure discussions dominate over technological issues
  - Like „which hardware is best suited“

Energy…..

- Another summery with some slides from a colleague
- In German – but I will comment them

Wie wird die Energie im RZ verbraucht?

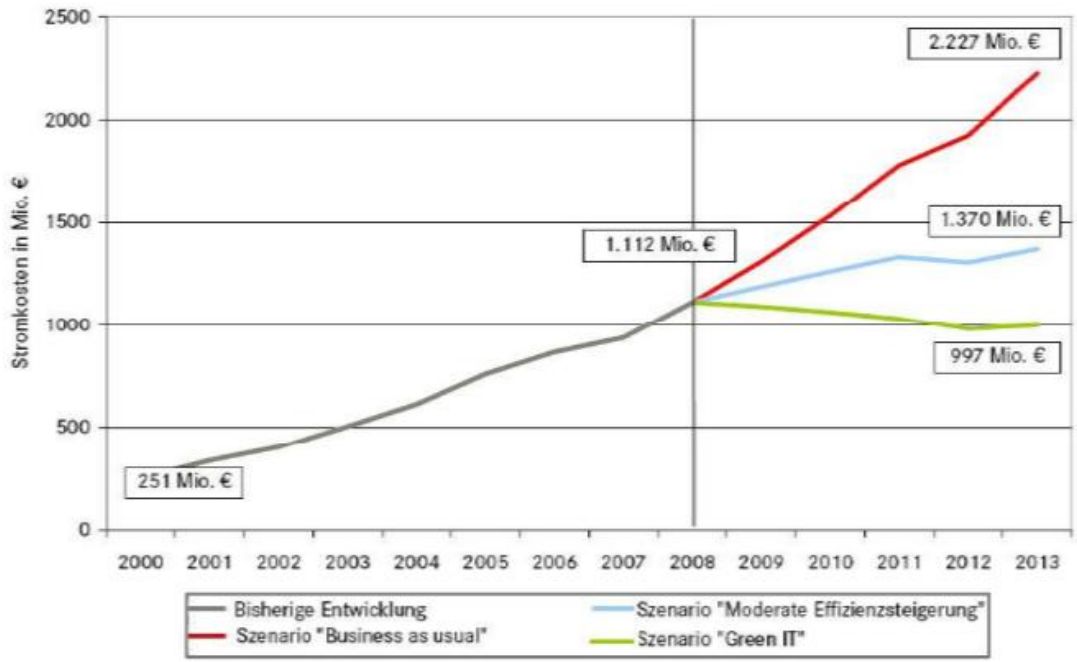
- Herausforderung ist die energetische Optimierung der physischen RZ-Umgebung und der IT-Infrastruktur



In einem typischen DC werden nur etwa 30 – 40 % der Energie für den Betrieb des IT-Equipment aufgewendet

Chart and data source: American Power Conversion Corporation (APC) white paper, Implementing Energy Efficient Data Centers, #114, by Neil Rasmussen, 2006.

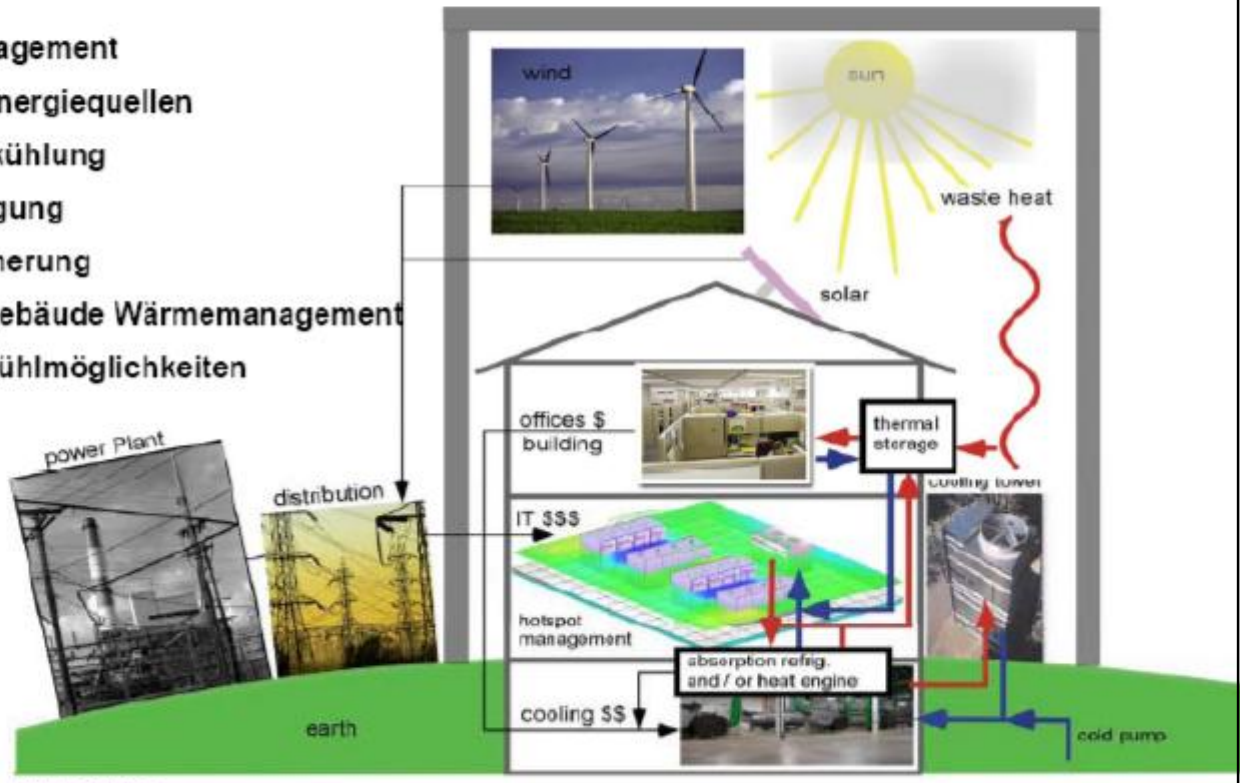
Stromkosten von Servern und RZ's in D'land



Quelle: Borderstep

Zukunft des Green RZ

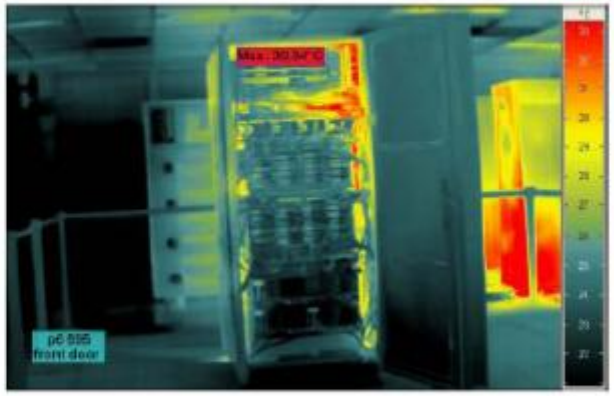
- Hotspot Management
- Alternative Energiequellen
- Absorptionskühlung
- Wärmeerzeugung
- Wärmespeicherung
- Intra & Intergebäude Wärmemanagement
- Alternative Kühlmöglichkeiten

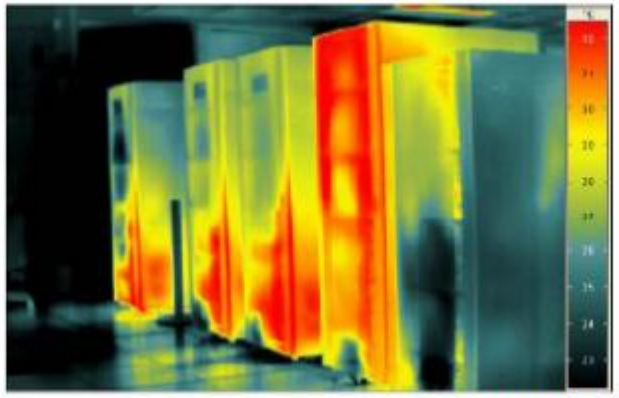


Quelle: Bitkom

Dynamisches Workload Placement

- Aktive Kontrolle der Kühlungsressourcen
  - aktive Kontrolle auf Basis der Rack-Innentemperatur
  - 35 % Energieeinsparung plus gesteigerte Verlässlichkeit
- Dynamisches Workload Placement
  - basierend auf Kühlungseffizienz (Hot Spot Analyse)
- Management & und Controlling auf verschiedenen Ebenen
  - Server, Gehäuse, Rack, Data Center





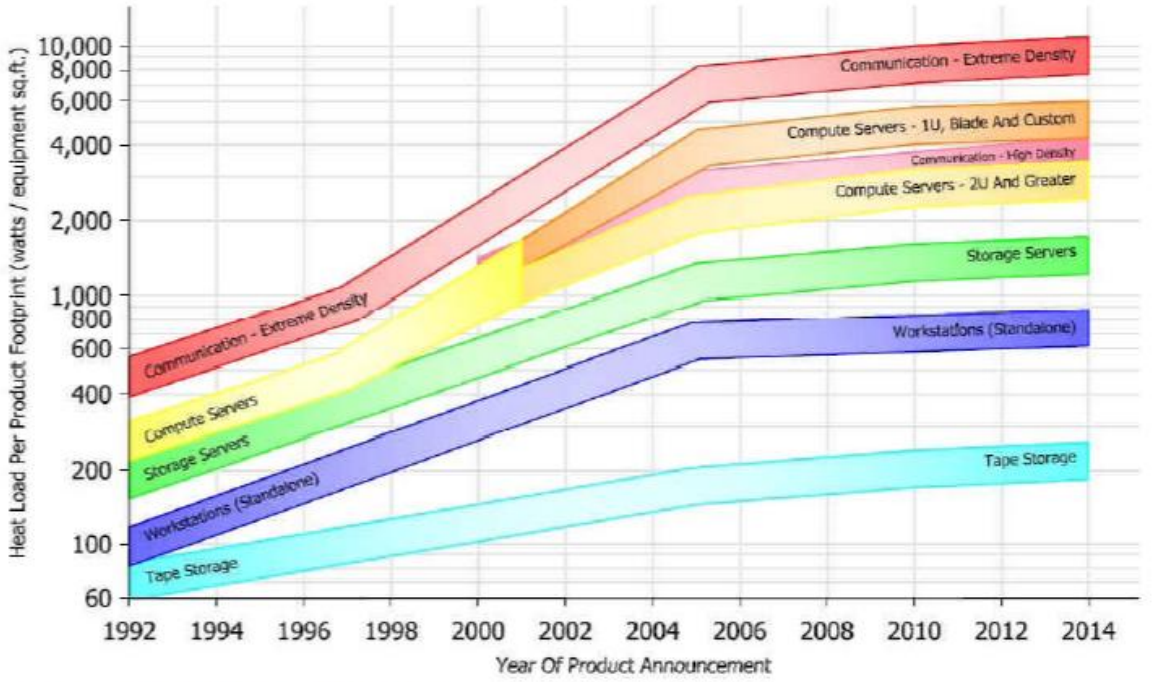
Fotos: IBM / Bitkom

ag-Trendkongress2009-Karlsruhe_20091120.pdf - Adobe Reader

Anzeige Dokument Werkzeuge Fenster Hilfe

12 / 24 71% Suchen

Trend Chart: Product Heat Density



Quelle: Uptime Institute, Footprint - Heat Density Trends

Infinity Web... CC problems Tagesordnu... Posteingang... 3G Watcher status: Disc... Juling-Vortr... Microsoft Po... DE 23:19

So what are the other tasks of a CC?

- Certainly not administrative stuff
  - Printing bills, running SAP, process financial data
- Install and run computers so that scientists can use the resource
  - Using a biologist to install his own machines is a waste of resources
  - How to guarantee the necessary flexibility?
  - Relay new concepts and ideas into the other sciences!
  - Make sure that there is „no shortage“
  - Make sure that scientists get the latest technology
    - What if scientists/grant agencies do not see the need? ☹
  - Large installations generate new research issues from the daily operation

Problems for science

- CPU clock rate is too high (???)
  - 3 GHz = 10 cm travel distance for light
  - Or: does the signal arrive in time
  - If not, how many cycles are lost?
    - Major problem for large clusters
- How do you boot many CPUs efficiently?
  - Whether they are in a cluster or a pool
- Flexible clusters?

Datennetz

Welche Daten werden transportiert?

- Zugriff auf die Server
- Zugriff auf unsere und andere Web-Server
- Zugriff auf Datenbanken von Bibliotheken
- Austausch von großen Mengen wissenschaftlicher Daten
  - (Sternwarte auf La Palma, Cern, Unis)
- Videokonferenzen

Da es keine Vorschriften im Sinne „der Nutzer darf dieses, jenes aber nicht“ gibt, kann man die zukünftige Entwicklung recht gut vorhersagen

- Industrie ist hier oft „blind“

Mail-Daten sind ein verschwindend kleiner Anteil am Datentransport

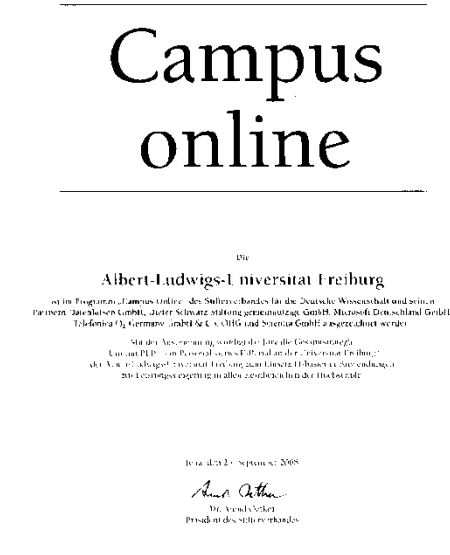
Gesamtvolumen nach draußen pro Monat: ca 100 TB

Backup & Archive – robot system

- Currently som 2500 TB of storage on tape
  - Advantage of tape: no energy consumption, hard to hack
- All machines on campus can backup their data into this system
  - Laptop lost with PhD thesis ??!!?!?
  - User encryption possible
  - Keep several versions
  - User can initiate restore process
- Archive: long term storage of data, move automatically onto new storage technologies

New strategic services for the university

- Multimedia databases
- High quality video conferences
  - Including service
- E-learning activities
  - Part of faculty‘s job – but who runs the workflow?
- Lecture recording
- Podcasting
  - Apple iTunes



Try to make sure that solutions fit

And avoid ….

Mobile user

mobile equipment

IT and management

- Suddenly IT is not only about „managing boxes“
- It is about „managing a university“
- Universities can be seen as companies
  - Not that they „produce“ things…
  - But there are certain similar structural issues
- How can IT contribute towards an improvement
  - The „cloud“ is only a part of this – the „cloud“ is nothing but a tool

Words and terms

- The term *Business IT Alignment* denotes the effort to make IT serve in line with the company targets.
- *IT-Governance* is the responsability of governing board and management

  ... and is a vital part of leading a company. IT-Goverance consists of guidance, organisatorial structures and processes which ensure that the IT supports the company strategies. (*wikipedia*).
- Business targets of a university?
  Business targets of a professorship?
- Can management (=*Rectorate*) tell a professor (=central component of a university‘s reputation) what to do?
  - The professor knows best what his/her IT demands really are
  - Really ??!!?

Nochmals überdenken…

- *Business IT Alignment:* did IT ever work independently of the company‘s target?
- Business target of a university?
  Better: business interest of a university – the infrastructure has to be available and must be working
  - If the network does not work, everybody will complain because they cannot do their day-to-day business.
  - Ok – so there is a thing like „business“ – like in the sentence „mind your own business“

- Reformulate / rethink:
  - Where do we use IT in a university – and for what?
  - Can we gain efficiency by some combination?
  - What is missing – and what did we overlook?
  - Who has to do it?
  - Who coordinates and how drives matters?

Classical situation

- Professor / faculty run their own IT
  - Varying quality, lack of staff and money
  - Reasons can be found in the mainframe area
- Computer centre runs the common resources
  - Data network, email, filespace, www&co, server farms, GRID, printers
  - Sometimes even successful with „inhousing“
- Library runs its own IT-systems
- Administration has her own (and different) systems
  - And in certain parts even nothing
- Information exchange is traditional – via email
  - Reflecting the classical business process
  - Use doodle and telefone to arrange meetings
  - Isn‘t Facebook more modern?
- Some universities do even haven an Identity Management
- But they are not really networked ….
  - Are we wasting resources ??

E-Learning

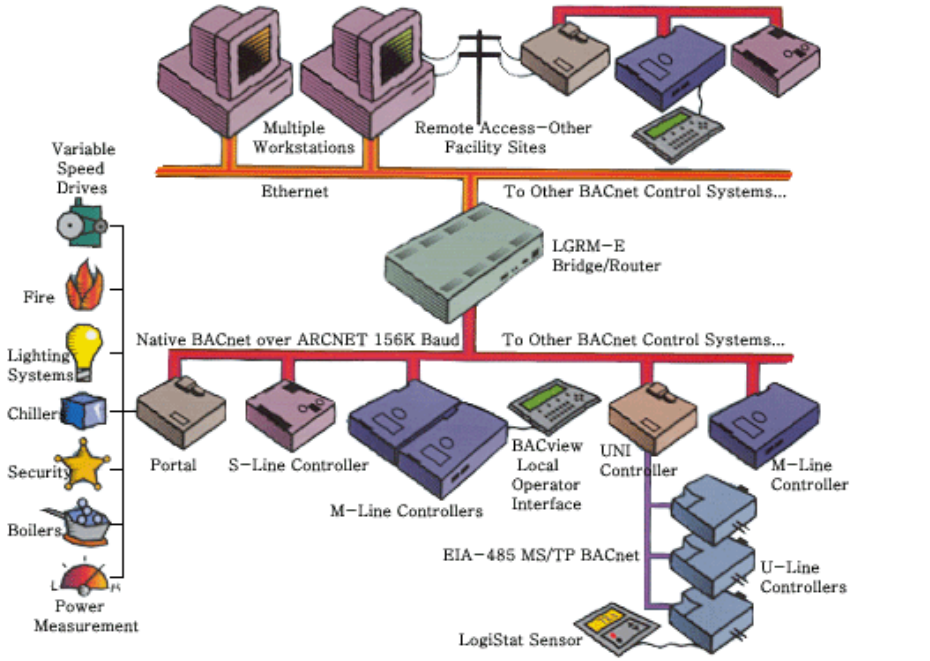
- Everybody talks about it ☺
- Why do we need it?
  - Because it is necessary?
  - Because we got grant money?
  - Online-Repositories to save copying?
  - Record lectures so that people do not have to get up early?
  - Record lectures so that young mothers can continue with their studies?
    - Great idea!! Where are the supporting structures?
    - What if you must be present in the lecture (because the examination rules require it?)
    - Ahhh – a business process is incorrect
- What IT-processes must be established so that e-Learning makes sense?
  - Which administrative processes must be changed?
  - nd welche anderen Verwaltungsakte müssen verändert werden?
  - Not a pure IT issue – but IT can drive the discussion - or be driven by it ☹

Electronic publishing

- Each scientist does it on his/her own?
- What about Open Access
  - Oh yes – this is for free ?!?!?!!?
- Wrong – there is a workflow involved:
  - Production of the publication
  - Alone or with collaboration tools – who offers these
  - Put the final paper into a university database?
    - Not necessary? Well, if there is money involved…
  - Storage in a university repository
    - Open Access only makes sense if you keep the data on your own server – so that the provider cannot simply raise operations costs
    - Unsolved issue of the „publication cloud“
  - How do we measure success?
- Can IT be of any help?
  - Who does it?
  - Is it necessary? Why do we have libraries?
- A core process which is obiously not IT aligned

New customers

- Technical management of buildings:
  - Check meters
  - Remote service
  - Building managment
  - Heating, lighting
  - Intelligent energy management
  - Bacnet
- Known dangers
  - Home office
  - Viruses / stuxnet
  - Attacks from outside
  - Unfriendly takeovers
    - „remotely“ heat rector‘s office
    - Remotely „release animals
  - QoS – reliability of the network
- What to do??
  - Run away? Ignore it?
  - Helf finding solutions / „takeover“ ?



http://www.kjbms.co.kr/Ehomepage/BACnetE.htm

Mobile phones

- Which mobile phone plan?
  - User profile? Usage plan? Who can do consulting? Tariffs abroad?
- Which phone?
  - Freedom of choice – or is functionality and cooperation with IT systems an issue?
    - Classical disaster: new boss with Blackberry arrives in a Blackberry-free institution
- Who configures the smartphones?
  - And re-configures them n times?
  - What should be configured?
  - Who can do the configuration?
- Choice of phones is NOT a decision about phones – it is a decision about system integration
  - Can be a costly enterprise!!
  - What should be the target configuration?
  - Who does error tracing? (phone vs. Groupware)
- System dependency 2.0 !

IT-Alignment – practical views:

- Company A has GroupWise
  - With company phone, data synchronisation, work at home, etc
- Company B uses Exchange
  - With company phone, data synchronisation, work at home, etc
- Company B buys company A
  - Introduction of Exchange into company A
    - Labour costs…
  - Configure company-A-phones for Exchange….
    - Lot of work
  - Offer to all members of staff to exchange their phones to company-B-Standard
    - So that error tracking becomes possible again for all staff members
- So overserved last year ….
- Is that really an IT business alignment?
- Only if company B had already moved all processes to a consistent and supporting IT structure

DFG: rules for good scientific behaviour

- Keep your data for 10 years ….
- Who does it?
- How is this ensured? (enforcement)
  - And how do young scientists learn about this need?
- And where do they store?
  - In the drawer? On a PC?
- Who is responsible in the end?
- And where is the necessary supporting infrastructure?
  - Mehr than jus a „tape robot“!

Student life cyle

- Great advances in the last 10 years
  - No more queues
  - Bachelor/Master-system depends on IT
- Too often it is believed that it suffices to map classical processes into IT processes
  - Registration -> online-registration
  - Application -> online-application
  - And so on
- Thus it is impossible to speed up processing times
  - Checking of forms, setting up orders of preference
- Attempt in Freiburg:
  out-of-order-execution of the admission to law studies.
  - Admit before the official (legally binding) admission process is done !!?!?!
- Improvement of business process: we get the students we want – because we can „use“ them

Speech recognition

- Quite interesting performance now!
  - Lawyers love the software
- Best peripherals? How to connect?
- What is a good workflow?
- Long ago: send the cassettes
- Today : send the recordings as file via email
  - Even when they are big – and the mailer has a 30 MB limit
  - Even when they have to be squeezed through UMTS (which is sometimes only GPRS)
  - User complaints / user problems are the result – user has no idea, only experiences the effect
- Recordings are done on mobile phone and sent directly via email client
  - Really easy…
  - The detection rate is bad – why?? Blame the IT

GroupWare

- „slowly discovered“ by scientists
  - Thanks to smartphones
- Initial success – but then the individual solution does not work across platforms
  - Because they have other smartphones in other places
- Demand for a central solution
  - How is this offered?
  - By the IT centre, not at all, more staff required, outsourcing?
- Including „supersmart“ usage: attach large files (memos,.et) to the date in question
  - Calender database is 2GB or more
- When this data is synchronized via UTMS this will lead to observed „errors“
  - And hefty charges when used in foreign countries
- IT at faultt? Oder user error? Or user misconception?
  - When you argue „you don‘t use your Porsche to harvest bananas“ you get „well Porsche built tractors once“ as a reply

From CIO to CFO

- The more you work on putting IT into university life in a „seamless“ way, the more IT problems you find.
- *„I wish I had not started“* is no alternative as IT is pushed into the business processes from all sides
  - Building management: technology is sold to the maintenance grout
  - E-Learning: suddenly central office administration buys equipment
- Quite similar to the observations made when PCs started to penetrate into the university – but now this penetration happens on a larger scale
- And hits traditional business processes
- Which now turn faulty – since they do not match
  - See the example „GroupWare“
- Everything appeared to be well structured – and now you extinguish new fires everywhere
- CFO = Chief Fire Officer

Solutions…

- More staff
  - Quite unthinkable, given Germany‘s economic situation – or rather „focus“
- Outsourcen
  - A nice word to upset everyone!
  - Why: the fear of becoming useless
  - Why afraid? Because you do something someone else can do just as well
- Avoid typical outsourcing mistakes
  - Like handing over competence and control
  - Example: IT in the ministry: only what has been agreed upon will be done.
  - Who decides if the contract has to be extended?
  - Do you still keep your own IT centre of competence?
  - Or will change only happen if others tell you that you are running behind?
- On the other hand: is it really necessary to do everything yourself?
  - And reinvent the wheel?
  - Especially if your back is against the wall and you have no time for new ideas

Solutions… (?)

- Can you buy services that you did yourself up to now?
  - Without handing over control or losing competence?
  - Example: have your backup (TSM) servers remotely controlled but keep servers and robot in your house
  - Server for the door locks (windows….)
  - Exchange-Server??
  - Ready to run software (SaaS)
- Just the day-to-day operation – not control of contents!
- What about cooperation with other IT-centres?
  - Insist on contracts
  - To get internal backing
- Always the one target: gain time to improve IT processes

Solution: what about using the cloud?

- Amazon has filespace – can we use it and „remarket“ it?
  - To improve the own IT processes
- Can you buy NFS filespace and sell it internally as CIFS ?
- Advantage: clear your own filespace, move it to Amazon and sell your own high-performance filespace (which is now free) internally „with profit“
- Security? encryption!
- Not possible?
  - Counter examples: Dropbox, Teamdrive
- Their workflow functionality appears to be superior to classical fileservers
  - It allows for suitable IT processes for mobile users

fear:

- Others see out data
  - Use suitable (!!!!) contracts – I think we should trust contracts
  - For contract failures there is the legal profession – IT thinks only they can fix things
- Can‘t access the systems in emergencies
  - Prepare with proper contracts
  - Are the own staff members *really* available in an emergency?
- Too expensive
  - Yes – and no
  - Total cost of ownership: direct cost of staff, administrative cost, cost for discussion with staff, group leaders,…
  - Example: The Freiburg CC had its own service to keep the building open on Saturdays
- Fear stops you to put yourself into a better position against other providers
  - Dropbox…

Who should address the questions?

- IT centres always hired professional staff
  - Who can run servers
  - Who are the best programmers
  - Who cannot write applications for money
- Rarely they have a strategic understanding of user behaviour
  - Test: what is a mobile user?
- Staff training is a crucial thing
  - Not promotion – but staying fit
  - Keep up the understanding for IT processes from a bird‘s eye view – plus consulting and analysis
  - Chances are there when you hire new staff: try to rotate and free the position where it is needed and not where it is available

summary

- The problems are „lying on the street“
  - You only have to pick them up
  - Move IT centres from pizza box operator to consultant
- Business-IT-Alignment in a university means that you have to make sure that users can concentrate onto their core business since they have more time thanks to a working IT which fits
  - User problems by lack of knowledge or lack of training
  - User problems through „smart“ use of IT and resulting inconsistencies
- Business-IT-Alignment is a major issue for universities but they are not yet fit
  - Don‘t worry: companies aren‘t either – if you look in such a general context as we have discussed.