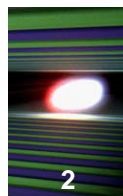




# User IT support and data management challenges at European XFEL

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27.06.2011 Zürich

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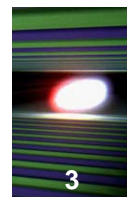
- X-ray free electron laser
- Construction of the facility in progress
- Planned commissioning and start of users operation in 2015
- Forming future European XFEL user communities



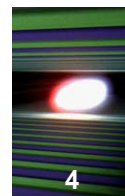
The building pit of the experimental hall, 10 April 2011



5th European XFEL Users' Meeting, Jan 2011



- Needs for common/federated authentication system
  - Users will come from many institutes, not only in Europe
  - We need to support different scientific communities
  - Make it easier for service providers (EuXFEL, DESY)
- Requires trust between users, identity and service providers
  - Lack of trust would soon lead to very limited use of such system
- Traceability and established procedures in case of service misuse, compliance with national regulations
  - Well recognized system will attract more attention from hackers
- Suitable not only for web based services
  - Access to data and computing resources will be needed



## ■ Authorization aspects

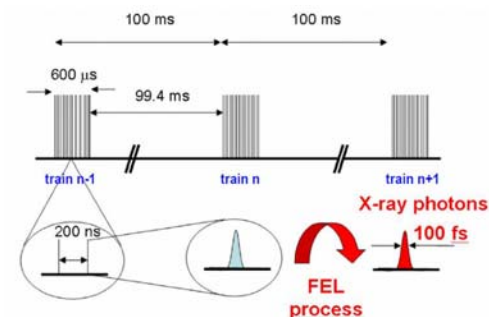
- Overall access control should stay at service provider (facility)
- Scalable structure for authorization delegation
- Different type of services may require different level of trust
  - Proposal submission vs. data analysis
- Time restricted authorization (i.e.: instrument control)

## ■ Open questions

- Is there an agreement between us on the requirements?
- How common should be the “common” system?
- Do we see any project which has the highest chance to be widely accepted by scientists and service providers?
- What about the third “A”? How important is it to know how much resources is used by different groups?

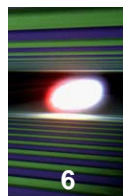
# Enormous data flow

- The challenge comes from:
  - Novel experimental techniques
  - High repetition rate and the bunch structure



- Implications for data acquisition, management and analysis
  - High data rates (initially up to 10GB/s from a single detector)
  - Huge accumulated data volumes
  - Parallel data processing techniques
  - Complex data analysis chain
  
- The highest priority for us is to solve these issues

# Initial XFEL DAQ and DM architecture

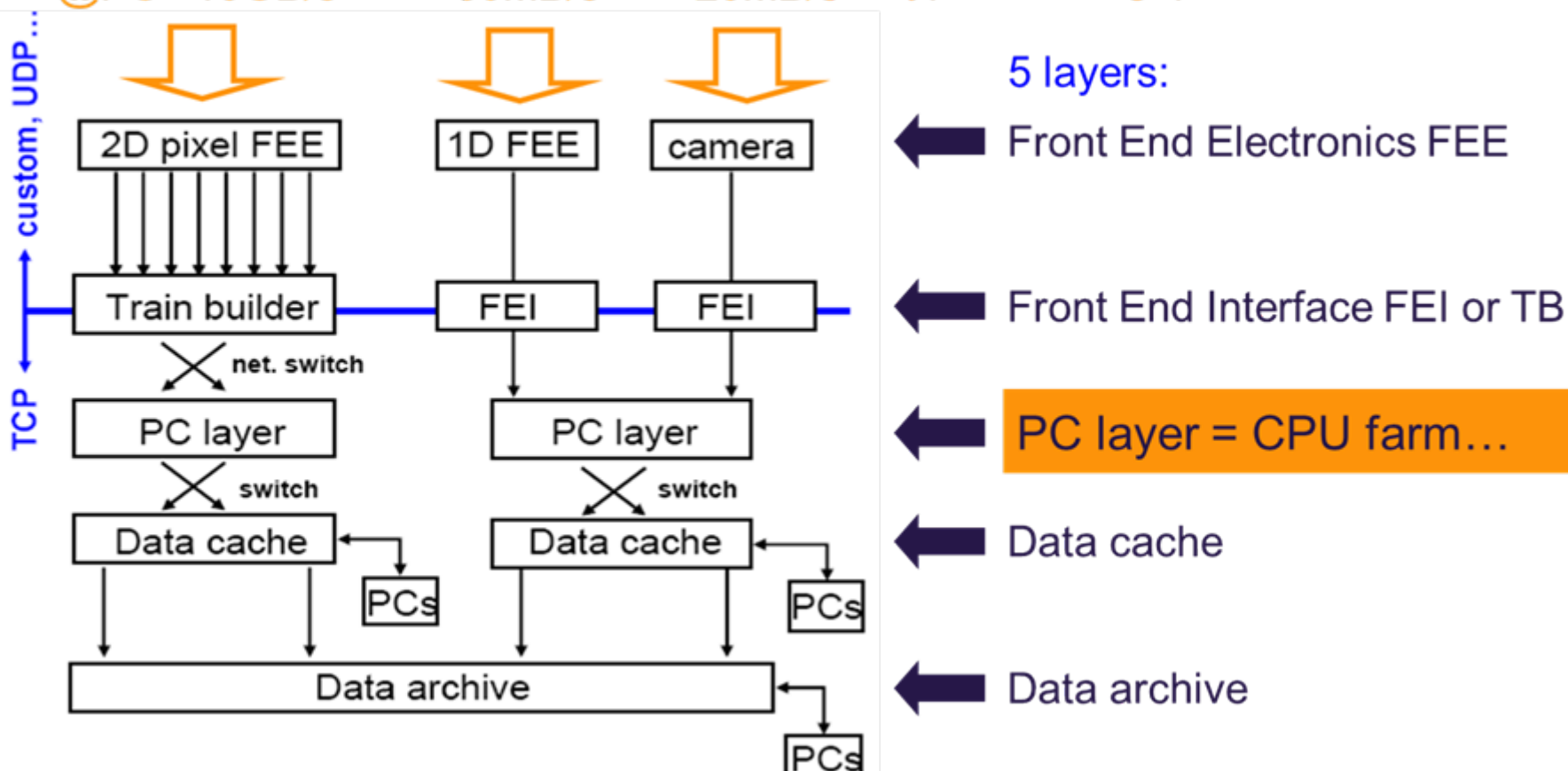


Frame: 2MB  
Train: 1GB  
@PC 10GB/s

2kB  
5MB  
50MB/s

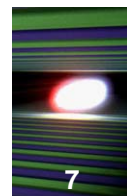
2MB  
2MB  
20MB/s

: Typical throughputs



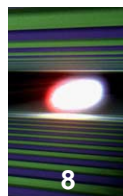
Foresee processing (including rejection and compression) in all layers

# CRISP: High speed data recording and access



- Collect requirements and ideas for high speed data recording
  - Expected data rates and multiplicity of data sources
  - How to deal with parallel data streams
  - How to enable online data processing, reduction and monitoring
  - Data integrity checks
  
- Provide solutions for optimized and secured access to data using standard protocols
  - Find the best technology and architecture for data storage
  - Test standard data access protocols (i.e.NFSv41)
  - Collect requirements for data protection scheme
  - Optimize data access for selected applications
  
- Propose and validate the architecture for data recording and access

# First experience from LCLS

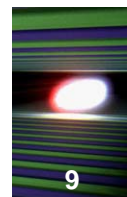


- Order of 100s TB per experiment campaign lasting 2-3 weeks (120Hz operation mode)
- We managed to transfer large data volumes (~200TB) over the network from SLAC to DESY

date	Peak rate [MB/s]	Average rate [MB/s]	Time to transfer 100 TB [day]
2010 May	3	2,5	485 (estimation)
2010 Nov	45	24	50 (estimation)
2011 Mar	148	80	15 (real number)

- Data have been archived to tapes
  - Parallel transfers using standard DESY setup of dCache system (10Gbps network, single client with DDN, 15 dCache servers, not exclusive use)
  - Peak data rate 600MB/s



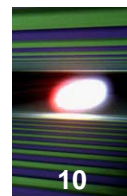


## ■ Observed difficulties:

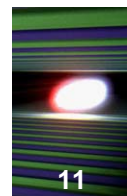
- Transfer stability was not satisfactory
- Sporadic data corruption seen, required retransfer
- Difficulties when dealing with both small (<500MB) and large files (>50GB)
- Problems with checksum calculations for large files (>50GB)

## ■ Despite of:

- Good connectivity between SLAC and DESY
- Long lasting experience in dealing with large datasets
- Usage of specialized tools (bbcp) optimized for WAN transfer
- Cooperation and help from many experts on both sites
- Adjustment of firewall and special server tuning



- From the user point of view
  - Difficult to manage and analyze large datasets
  - Automatic procedures for good quality data selection needed
    - Bad data rejection as soon as possible
  - Automatic, scalable, parallel analysis pipelines desirable
  - Data analysis using GPUs
  
- This supports the model where data is analyzed or heavily preprocessed close to the experiment or it is transferred only over well optimized connections



- Seeking appropriate authentication and authorization concept as a base for all services
- Solving issues related to the expected enormous data flow is the highest priority
- Need to validate and improve initial concepts for high speed data recording and access
- The challenge is a combination of:
  - scientific and technical complexities
  - required flexibility and ease of use