



Storage Management on the Grid

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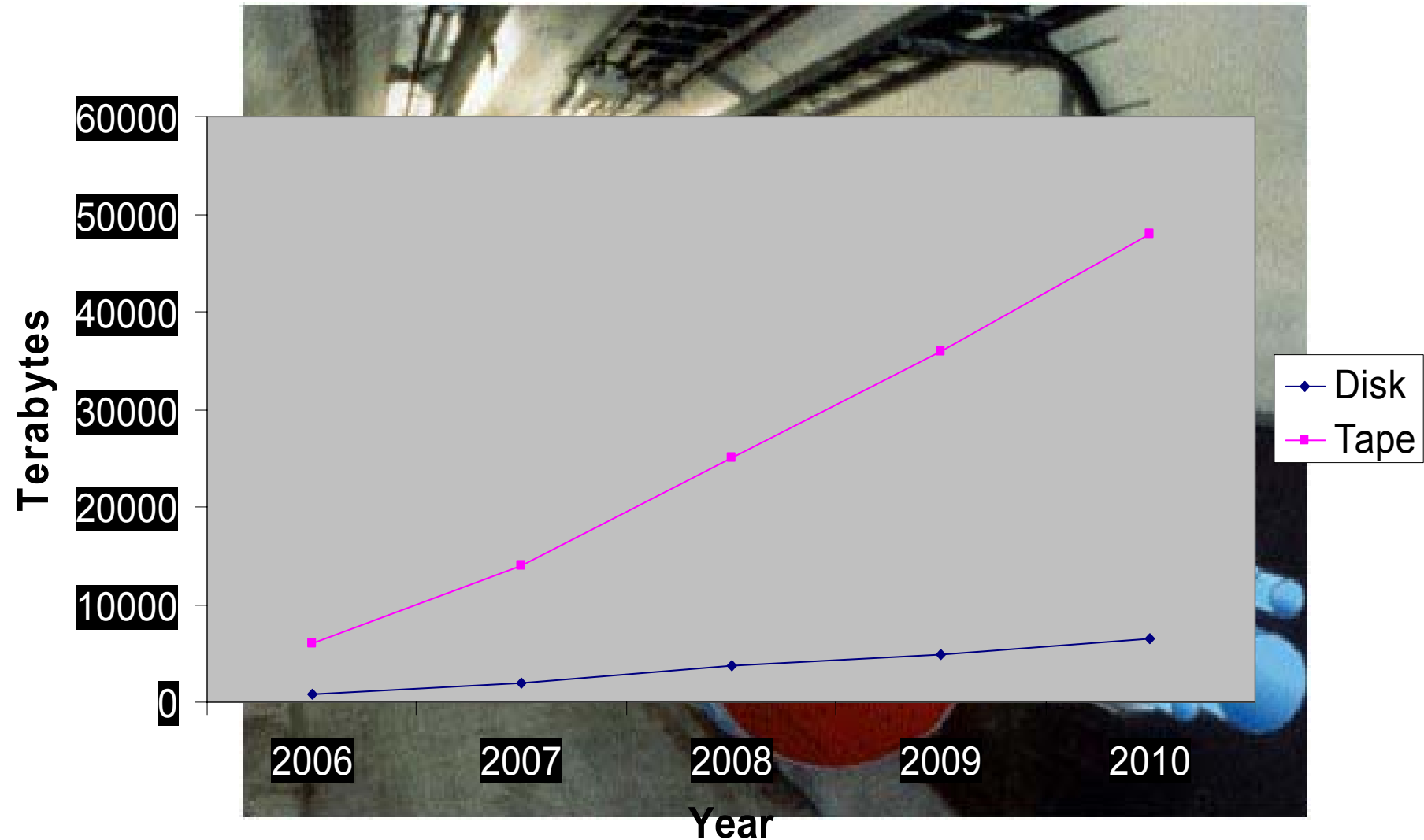
University of Edinburgh



Talk outline

- Motivation
- Storage management issues
- Existing projects
- Current work
- Conclusion

CERN capacity requirements



Cost

cost per gigabyte

performance

- Initially record $\sim 4\text{PB} / \text{year}$

LHC computing

- 1 PB = 1 Tape silo

- 1 silo = £500k

- Media = £600k

- + overhead ...

- Tape is the cheapest option but has issues

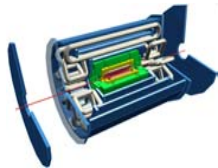
JetStor III IDE 18 bay tower



Grid is the solution

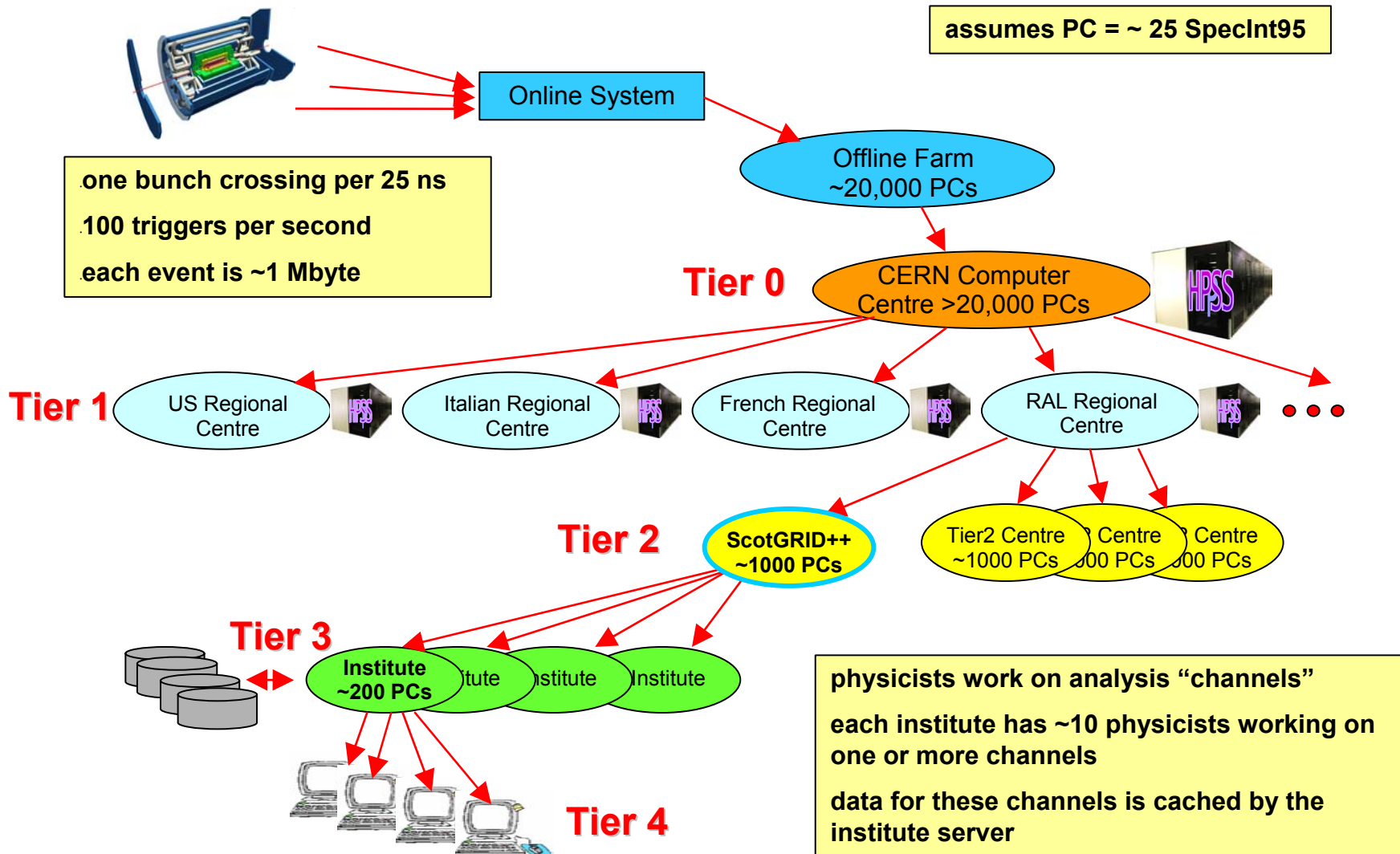
LHC computing challenge

assumes PC = ~ 25 SpecInt95



Online System

one bunch crossing per 25 ns
 100 triggers per second
 each event is ~1 Mbyte



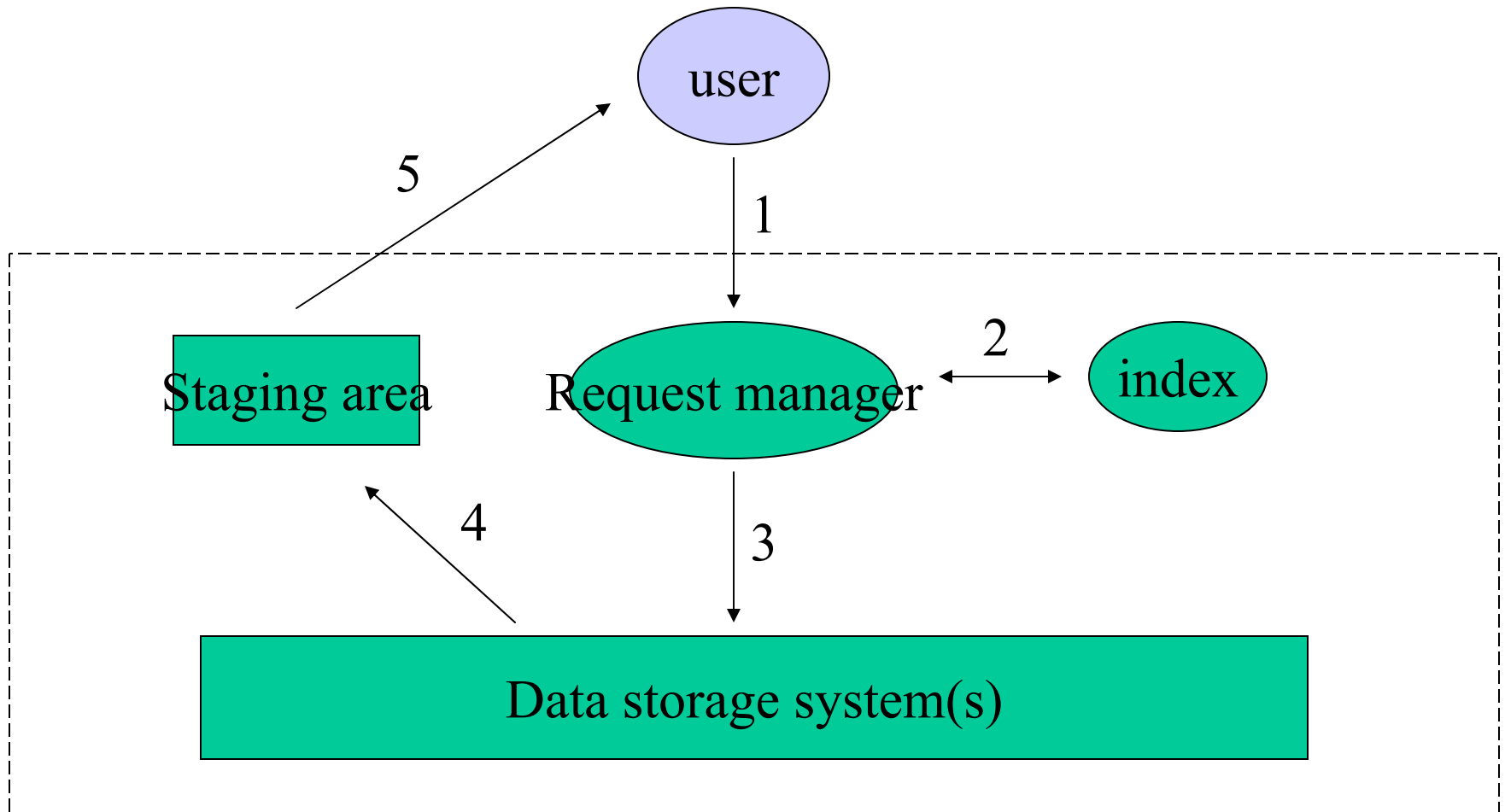
physicists work on analysis “channels”
 each institute has ~10 physicists working on one or more channels
 data for these channels is cached by the institute server



Competing requirements

- A durable, long term store for large amounts of data
 - Very long term data (centuries)
 - Very reliable storage (as good as paper)
- Metadata
 - Overview / administration information
 - Individual file information
- A security mechanism for access and modification
- Online access to data

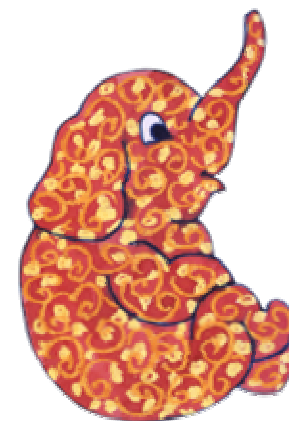
Requesting data from a storage system





Storage Element

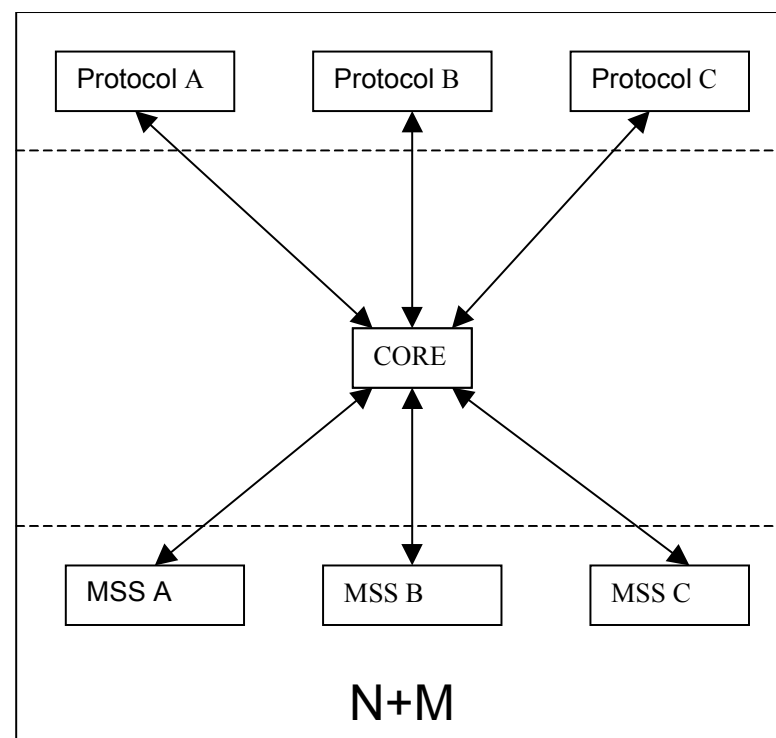
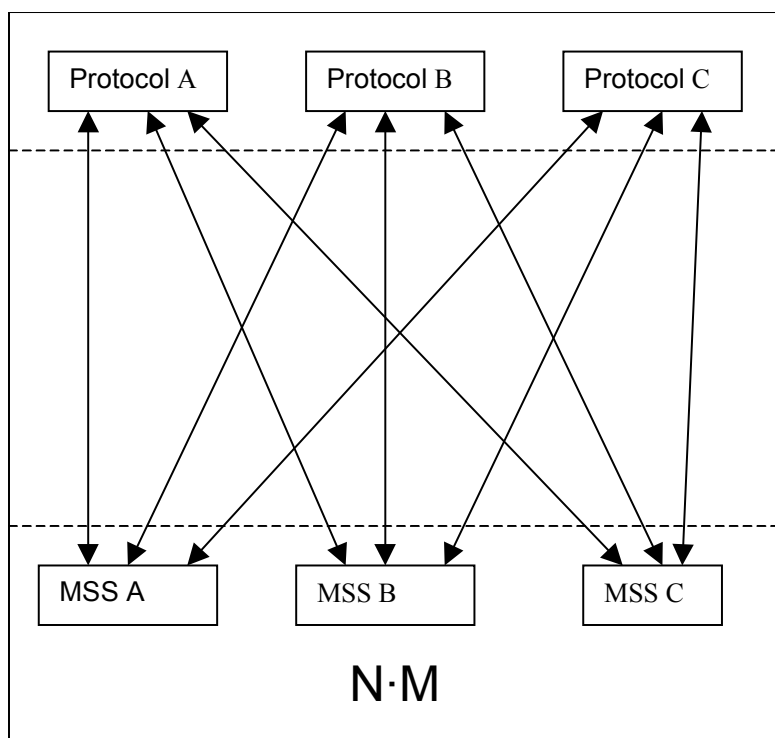
- Storage for European DataGrid
- Developed primarily by RAL under EDG Work Package 5
- Metadata in XML
 - aiming for OGSA compliance
- Used by physics projects



WP5 Logo

Storage Element

Protocols: FTP, HTTP(s), GridFTP, scp ...



MSS: Mass Storage System - disk, tape, hierarchy ...

Old Model

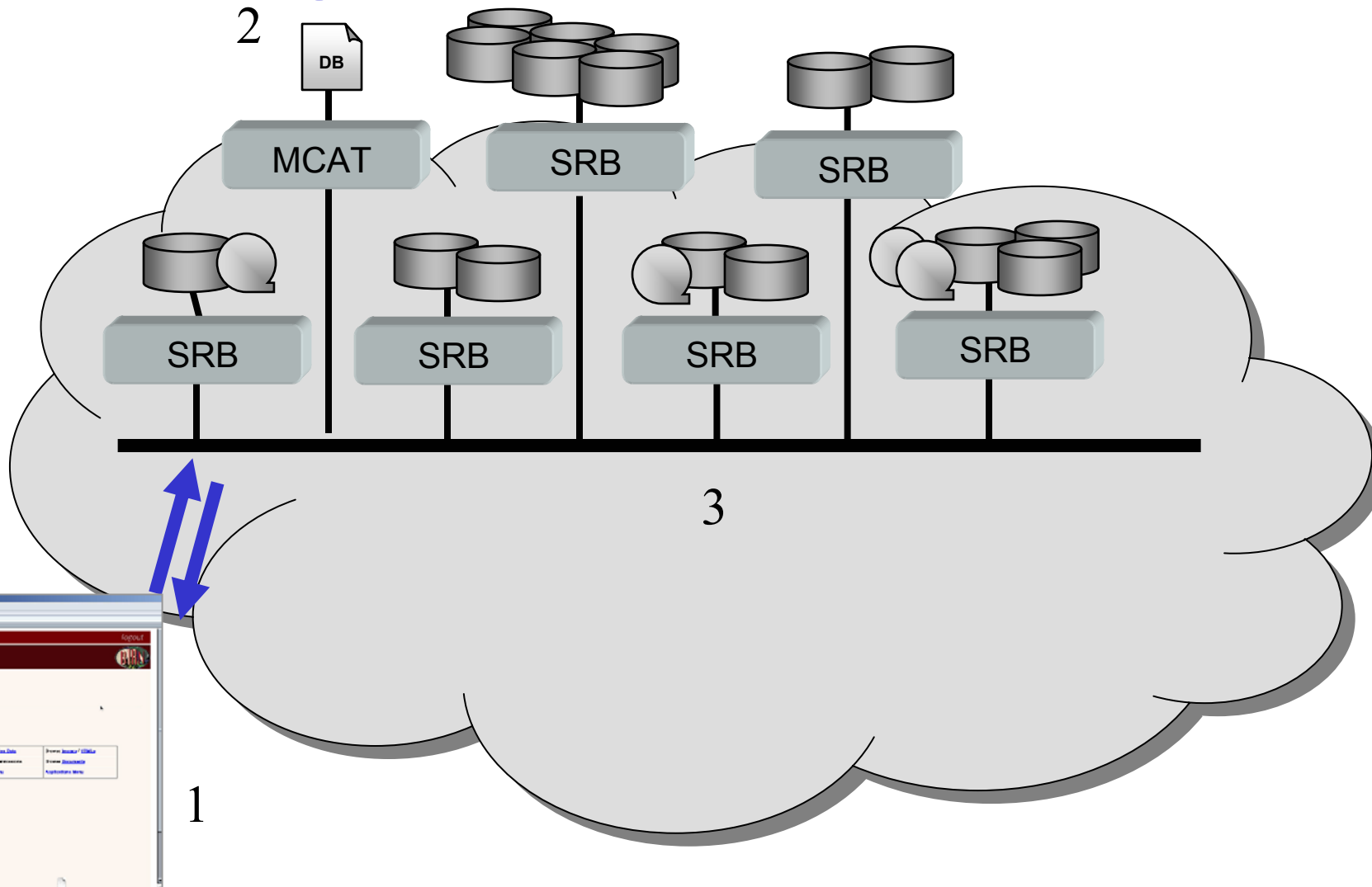
New Model



Storage Resource Broker

- Part of the NSF funded Data Intensive Computing Environments (DICE) project
- San Diego Supercomputing Center
- Centralised metadata system
 - Dublin Core
- In use with CMS and BaBar
- Large following in BioInformatics apps

Storage Resource Broker

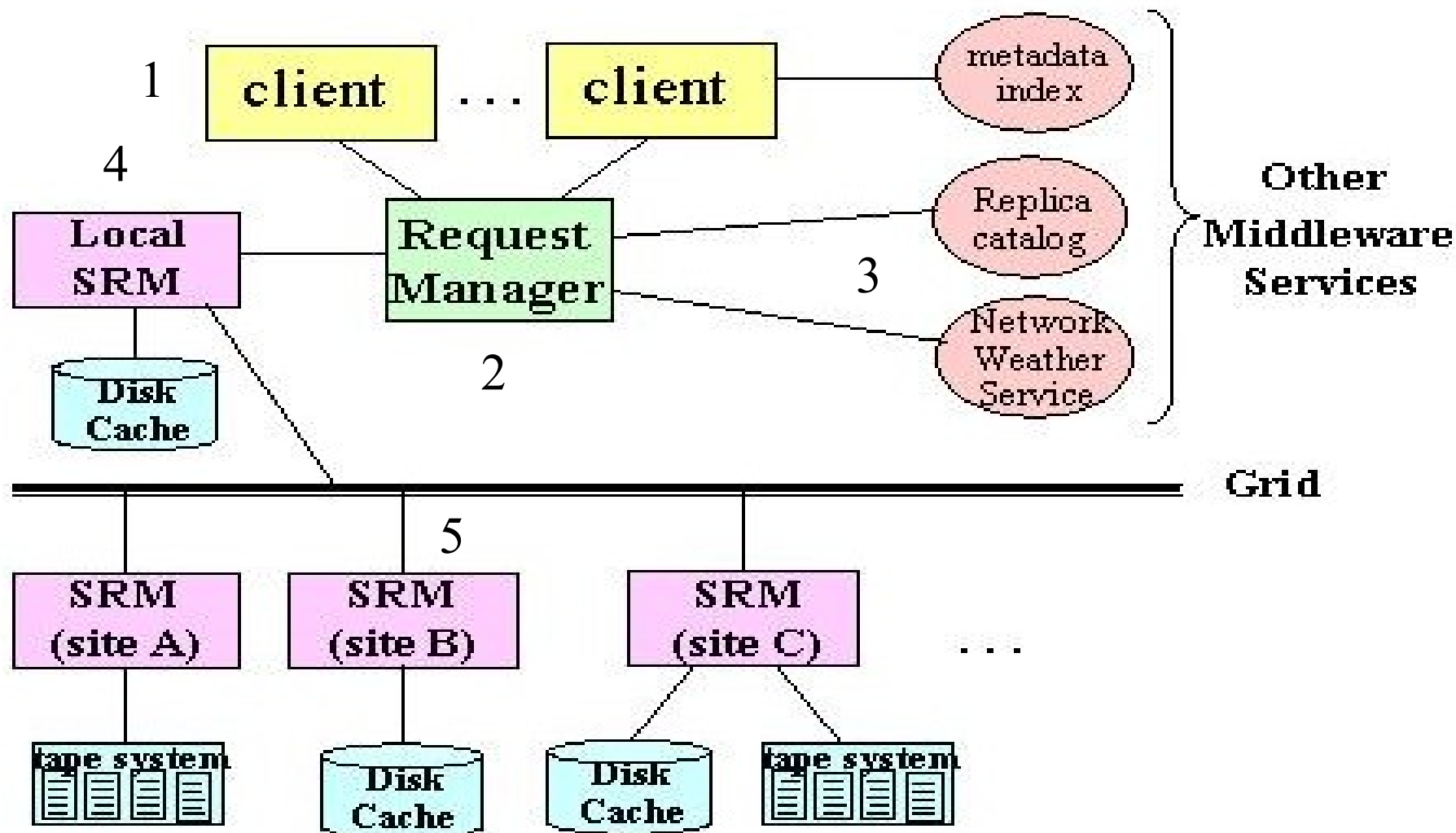




Storage Resource Manager

- Aim: High performance data storage
 - Teragrid
 - Supercomputing apps (high data rate)
- Implemented by LBNL and FNAL
- 2 standards available
 - Process based
 - Web Services

Storage Resource Manager





Current work

- Grid storage is currently specialised
 - Each project has advantages and disadvantages
- Need for interoperation between existing projects
- UK interest
 - Interoperation of existing resources
 - National level
 - Local level



Current Work

- ScotGrid
 - Durham
 - Edinburgh
 - Glasgow
- Rollout of storage management software
- Discussions for joint project
- Strong push to solve interoperation issues

Scottish Tier 2 Centre



Conclusions

- We have presented 3 major projects
- Storage management on the Grid is rapidly advancing
- The existing project teams are working together
- Edinburgh trying to solve some of the interoperation issues