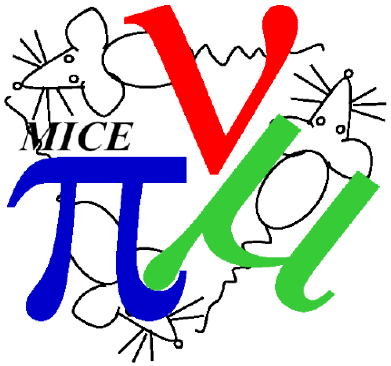
MICE Computing and Infrastructure



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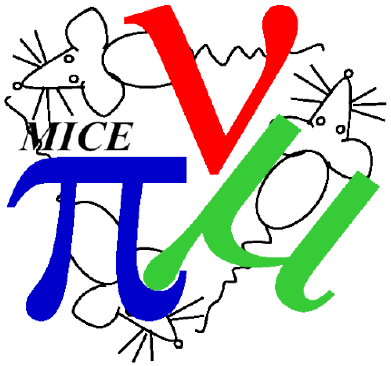
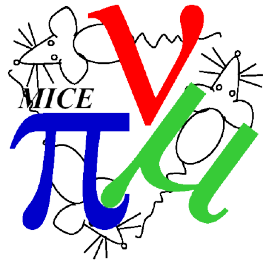
Overview

- Software and Computing
  - Aims
  - Requirements
  - Process Overview
  - Top Level Organisation
- Computing Infrastructure
  - GRID services
  - Configuration Management
  - Infrastructure WBS
  - Infrastructure Plans
- Conclusions

Software and Computing



Computing and Software aims

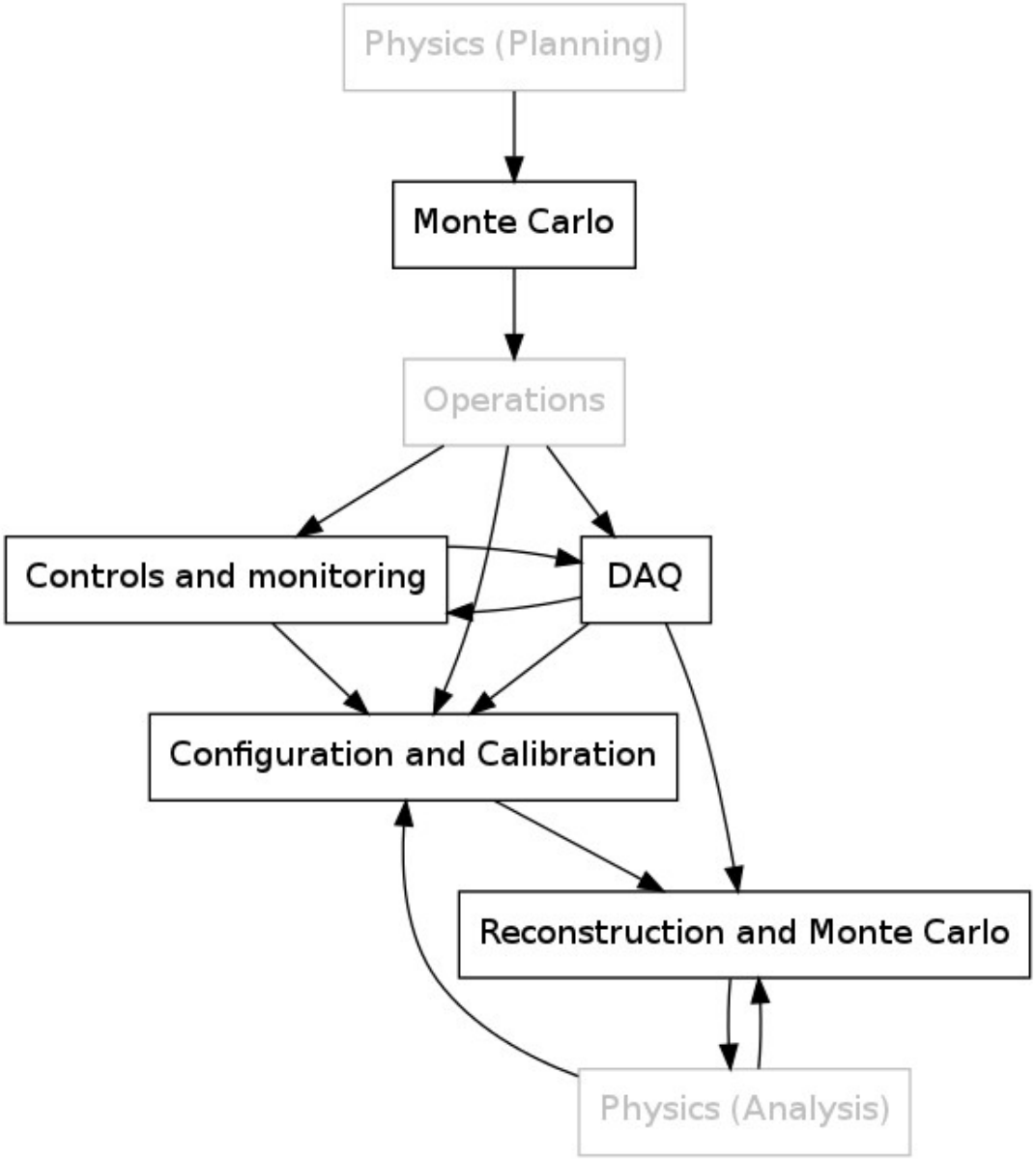


- MICE software and computing project aims to
  - Readout the detectors
    - Data Acquisition - DAQ
  - Convert electronics signals to physics parameters
    - reconstruction
  - Provide monte carlo model
  - Provide online physics outputs
    - Online monitoring
    - Online reconstruction
    - Online event display
  - Provide controls interfaces to, and monitoring of, hardware
    - Controls and Monitoring
  - Provide some support services e.g. web services, data curation
- Provide online feedback with physics data
  - e.g. phase space distributions at each detector in real time
- Provide reconstructed data for analysis within 24 hours of data taking

Requirements

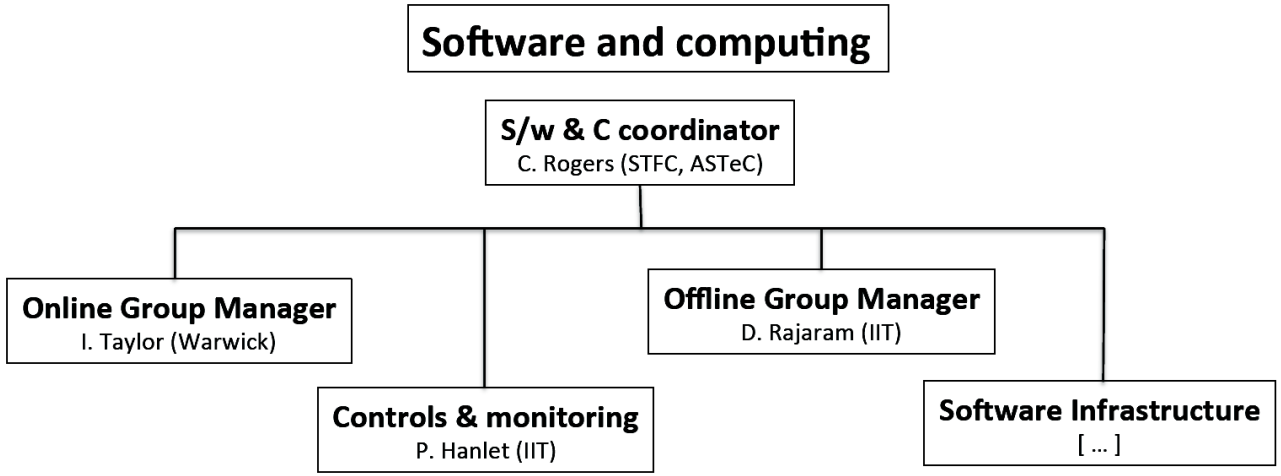
- Complex particle physics style detectors
  - Calibrations need to be performed weekly – monthly
  - Fiddly pattern recognition algorithms
  - Fiddly matching between different detectors
- Precision modelling requirements
  - Field model accuracy ~ O(1e-3) relative precision
  - Alignment precisions O(0.1) mm – O(1) mm
  - Tracking to O(100) micron (<< tracker resolution) over 10 m
- Tricky configuration management requirements
  - Currents change ~ hourly
  - Geometry changes ~ weekly-monthly
- Share the worst bits of accelerator and particle physics requirements

Process Diagram



S/w & Computing Organisation

Version date: 9th April 2014; revision C



- Online responsible for MICE local control room (MLCR) systems
  - Controls, DAQ, reconstruction servers
  - DAQ electronics
  - DAQ control software
  - Online monitoring (of DAQ)
- Infrastructure responsible for computing "glue"
  - Configuration management
  - GRID services
  - Web services
  - Rogers acting as interim manager

S/w & Computing Organisation

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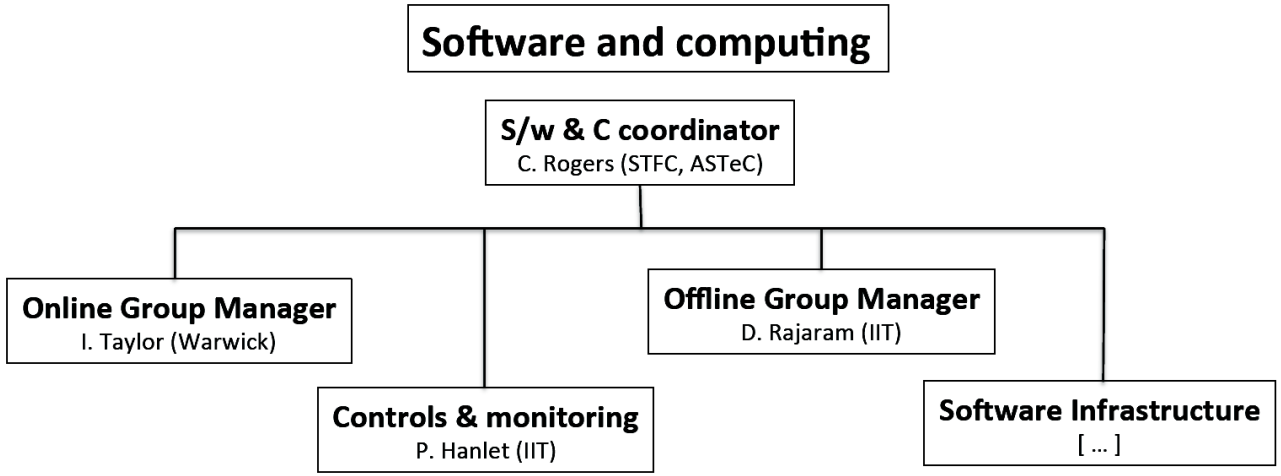
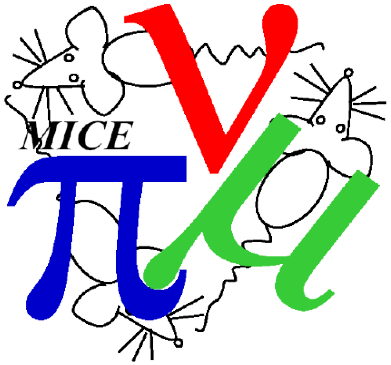
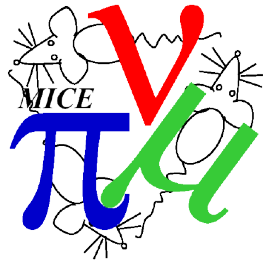


- Offline responsible for developing physics tools
  - Reconstruction of detectors
  - Monte carlo modelling of the experiment
- Controls and monitoring responsible for slow control of hardware
  - Interface to control electronics for each subsystem
  - Storage of monitored variables
  - User interfaces

Infrastructure

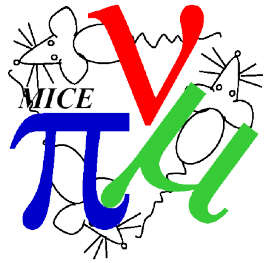


Infrastructure



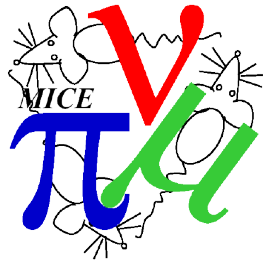
- Infrastructure project provides “glue” for offline computing tasks
  - GRID services
  - Configuration Management
  - Web services
- Infrastructure project owns mechanics of the glue
  - We do not fill databases
  - We do not determine physics parameters

Infrastructure - GRID



- GRID services
  - Data movement
    - Take data from the control room to permanent storage
  - Data curation
    - Long term storage of MICE raw data and ancillary data
  - Execution of offline reconstruction
    - 24 hour turnaround for detector reconstruction
    - Includes a monte carlo of the data set
  - Batch reprocessing
    - Redo reconstruction and monte carlo following e.g. new calibration
  - MC production
    - Pure monte carlo jobs for e.g. experimental planning, systematics studies, etc
  - Data movement between GRID sites (GRID Download Agent)
  - Management of storage area (Metadata DB)
- Infrastructure project owns mechanics of executing the code
  - We do not plan the physics needs (physics group)
  - We do not develop mc/recon code (offline group)

Infrastructure - Configuration



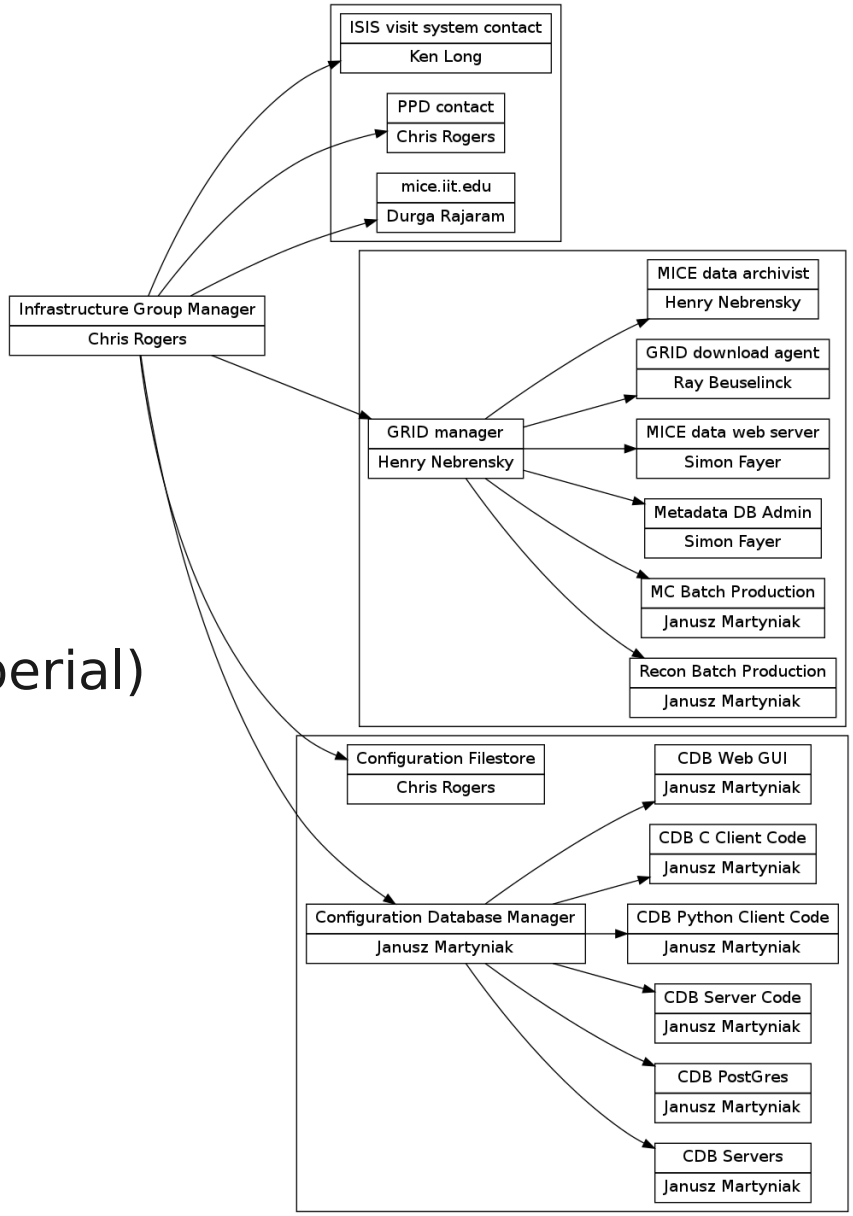
- Configuration Filestore
  - Store for pre-configuration data e.g. raw calibration data
  - Aim to provide full audit trail for reconstruction
- Configuration Database
  - Storage and interface for configuration data
    - Calibrations
    - Geometries, field maps
    - Magnet currents
    - Etc
  - Read/Write interface for access from MLCR only
    - Hosted in MLCR
  - Read interface for access from internet
    - Hosted in RAL PPD rack room
  - Postgres DB
  - Web service layer
    - Server side is in Java
    - Client side principally in python
    - Developing interfaces in C for Controls and Monitoring interface
    - Web based GUI for physics analysis users

Infrastructure – Web Services

- MICE also manages a number of web services
  - Main MICE web site – mice.iit.edu
  - MICE wiki micewww.pp.rl.ac.uk
  - MICE bastion: Remote access to MICE local control room
  - EPICS gateway: Remote access to controls and monitoring
  - Remote access to CDB
  - Jenkins: MAUS test servers

WBS

- Janusz Martyniak (Imperial)
  - At 50 % FTE
- Henry Nebrensky (Brunel)
  - At 20 % FTE
- Chris Rogers (RAL)
  - At 20 % FTE
- Durga Rajaram (IIT)
  - At 10 % FTE
- Simon Fayer, Ray Beuselinck (Imperial)
  - At 10 % FTE



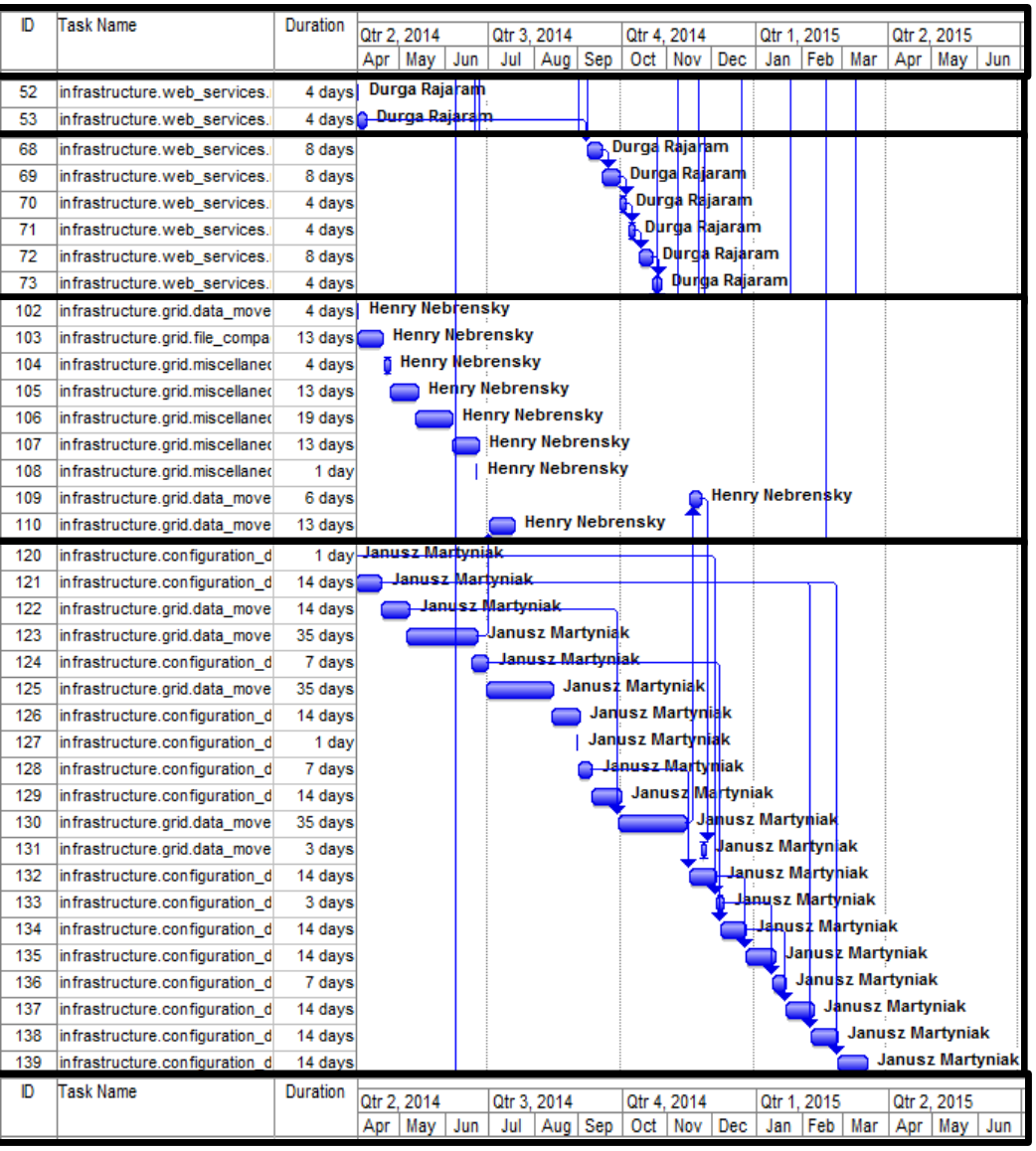
Pacakge status

- GRID
  - Data movement of production experimental data from the control room to CASTOR grid storage has been implemented
  - Dissemination of data to other GRID sites is implemented
  - Dissemination of software to GRID sites is automatic
  - Production runs have been performed for offline reconstruction and batch reprocessing
- Configuration Database tables are in production for
  - Muon beamline and cooling channel magnet currents
  - EPICS alarm handler and state machine
  - Detector cabling, detector calibration
  - Target operation
  - PID detector status
  - Geometry
- MICE web services have typical uptimes > 99 %

Ongoing work

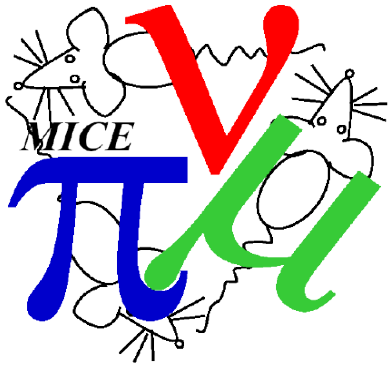
- GRID
  - Upgrade data mover to SL6
  - Automate data movement to GRID
  - Storage of “miscellaneous” data
  - Execution of batch reprocessing
- Configuration Database
  - Tables for controlling batch/GRID jobs
  - Store metadata information e.g. systems failures during data taking
  - C API for EPICS interface
  - Replacement of main storage node in RAL PPD
  - Tables for managing tracker controls
- Web services
  - Replacement of main storage node in RAL PPD
  - Update/refactor of mice.iit.edu (main MICE website)
  - Migrate EPICS, MICE bastion to more resilient virtualisation server
  - Add SL6 server to MAUS test servers

Work plan



- First iteration
  - Developing experience in running to a project plan
  - Errors ~ 50%
  - No proper assessment of risk
- Initial analysis shows we are stressed at Martyniak

Conclusions



Conclusions

- Complexity in the computing project is driven by
  - Difficult diagnostics compared to e.g. conventional accelerator diagnostics
  - High precision requirements
  - Complexities of the configuration
- Seek to provide a robust framework to support physics analysis
  - The aim is that no one notices our work!