ATLAS Computing at SLAC

1. Tier 2 Computing Center
2. Parameterized Shower Simulation
Tier 2 Computing Center

• LHC tiered computing architecture.
• Specific roles and challenges for Tier 2.
• SLAC’s core competence.
• Proposal timeline.
• Western Tier 2 proposal.
• Connection to Analysis Support Center.
Typical LHC Tiered Structure

- **Tier 0**: Offline Farm, CERN Computer Ctr, ~25 TIPS
- **Tier 1**: IN2P3 Center, RAL Center, INFN Center
- **Tier 2**: Tier 2 Center
- **Tier 3**: Institute, ~0.25TIPS, 100 - 1000 Mbits/sec
- **Tier 4**: Workstations, Physics data cache

Physicists work on analysis “channels”
Each institute has ~10 physicists working on one or more channels
Tier 0

- Located at CERN.
- Archiving and distribution of RAW data.
- Prompt reconstruction of calibration and express streams.
- First pass processing of primary event stream.
- Access granted only to central production group and those providing first-pass calibration.
Tier 1

• Approximately 10 world-wide.
  - One in U.S. at BNL.
• Host and provide access to subset of RAW.
• Reprocess, provide ATLAS-wide access to derived datasets, as well as simulated data samples from Tier 2’s.
• Part of calibration processing capacity.
• Access restricted to production managers of working groups and reprocessing group.
Tier 2

- Hosting of datasets.
  - Physics samples in accordance with local interest.
  - Special datasets for code development.
- Access to Tier 2 available to all ATLAS members. In practice, heightened access according to local policy.
- Analysis capacity for physics working groups.
- Significant calibration role following local interests.
- Simulation capacity for the experiment.
Tier 3

• Typically a university group.
• Store user ntuples of local interest.
• Should be Grid-enabled but can work off Grid.
• Neither centrally planned nor centrally controlled.
User analyses requiring access to ATLAS-wide datasets (such as RAW, AOD and TAG) rely almost exclusively on Tier 2 centers.
Simulation Production

• Very CPU intensive.
• Modest storage needs.
• Managed activity.
• Understood, controlled and optimized data movement.
• Relatively easy to deal with.
Calibration

• Expect to perform Inner Detector calibration and alignment.

• Matches detector involvement and common interest of traditional SLAC user groups, e.g.
  - Pixel detector - LBNL and SLAC.
  - Semiconductor Tracker - UCSC.

• More challenging than simulation production.
  - Workload often more variable.
  - Access patterns less predictable.
Physics Analysis

• Analysis capacity concentrated in Tier 2’s.
  - Tiers 0 and 1 primarily production sites.

• “Chaotic” data access patterns.
  - Data intensive.
  - Many users and jobs in parallel.
  - Data movement difficult/impossible to predict and optimize.

• Major challenge in scaling.

A truly functional Tier 2 requires much more than just keeping a bunch of boxes running.
Why Tier 2 at SLAC?

• Support the user community.
  - Function of a national lab.

• Strong track record in BaBar.
  - Dealt with similar data-intensive analysis issues.
  - Real-life network utilization.
  - Long-time participant and leader in Grid.
  - Cooperative operation with many other sites.

• Continue to innovate (e.g. PetaCache project).
Network Utilization

6 months

0.5 Gbps
**Middleware Security Group Meeting**

**Date/Time:** from Monday 05 June 2006 (09:00) to Tuesday 06 June 2006 (16:00)

**Location:** SLAC

**Chairperson:** Bob Cowles, Ake Edlund

**Description:** Goal with meeting: Update on current global security architecture work. Discuss future global security architecture work.

The meeting is in the Research Office Building (ROB) - building number 48 on the North side of the campus (30-B) on the map.

http://www2.slac.stanford.edu/maps/slacarea.html#gridMap

The meeting room is Redwood A-B on the south side of the building.

**Material:** list of attendees

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**Monday 05 June 2006**

**Kick-off** (2006-06-05 09:00->09:15)

Chairperson: Bob Cowles and Ake Edlund

**glexec / managing dynamic change of users at runtime** (2006-06-05 09:15->10:30)

09:15 glexec - update (45') (transparencies)

Gerben Venekamp

(NUKEF, NL)
US ATLAS Tier-2 Timeline

• Three sites chosen in 2005.
  - Northeast (Boston & Harvard).
  - Midwest (Chicago & Indiana).
  - Southwest.

• Two sites to be chosen in 2006.
  - February – Call for Proposals.
  - May – Proposals due.
  - June – Evaluation Committee.

• Decision in July by US ATLAS Managers.
  - Evaluation report.
  - Input from funding agencies.
Western Tier 2 Proposal

• Proposal by SLAC with strong user support.
• Most of Tier 2 funds for dedicated H/W by leveraging existing infrastructure & support.
  - “Lights out” operations for ~10 years.
  - H/W commonality with other projects.
  - Grid experience and expertise.
  - Dedicated and experienced staff in SCCS!
• Scavenge idle resources from other projects.
  - Tier 2 ~15% of BaBar implies significant leveraging potential.
“Western” Tier 2 Community
Western Tier 2 Community

- Participated in proposal writing.
- Members of proposed Advisory Board.

*Enthusiastic support of many user groups.*

- Other institutions are welcome!
Analysis Support Center (ASC)

• US ATLAS designated three ASC’s.
  - BNL.
  - Argonne.
  - LBNL.

• Committed to supporting LBNL in particular.
  - LBNL, SLAC and UCSC form a natural cluster.
  - Overlapping working hours with many institutions.
  - Office and meeting space if needed.
  - Proximity to Western Tier 2 and therefore more responsiveness.
Parameterized Shower Simulation

- Why parameterized showers?
- Why SLAC?
- What are the goals and plans?
Simulation in ATLAS

• Simulation code ~2x to ~10x times slower than planned.
  - Originally planned sample ~20% of real data.
  - Now correspondingly smaller.

• Multiple ways to improve.
  - Code optimization.
  - Shower library.
  - Parameterized shower.

SLAC can contribute in many ways. We can make unique contributions to parameterized shower.
SLAC and GEANT4

• SLAC is a member of GEANT4 Collaboration that provides core code and support.
  - Largest team outside of CERN.

• Extensive core expertise.
  - Deputy Spokesperson and chief architect.
  - Hadronics package coordinator.

• Extensive user expertise at SLAC.
  - BaBar was first major user of GEANT4.
  - Also used by GLAST, LCD, etc.
Parameterized Showers

• Unique capability at SLAC.
  - Core code to enable parameterized showers developed by SLAC GEANT4 member.
  - Relatively new feature.
  - Little user experience in implementation.

• New proposal to ATLAS management.
  - Not in original proposal to join.
  - SLAC expert to mentor and support ATLAS specific implementation effort.
  - Enthusiastic response from ATLAS management.
Plans and Goals

• **Short term plan.**
  - Manpower found from a US ATLAS group.
  - Engage experts in ATLAS simulation.
  - Engage experts in ATLAS calorimeters.
  - Meeting in early July to kick off the effort.

• **Longer term.**
  - Develop validation suite.
    • Detector metrics.
    • Physics metrics.
  - Implement and tune parameterization.

• **Goal is to converge within a year.**
Summary

Tier 2 Computing Center
Parameterized Shower Simulation

• Utilize core competence in the Lab.
• Leverage past investments.
• Support the LHC/ATLAS program.
• Support the user community.