An outlook of the user support model to educate the users community at the CMS Experiment

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On behalf of the CMS collaboration

DPF 2011, Brown University – 8-13 August 2011
The CMS Experiment

- **CMS** – Compact **Muon** Solenoid detector at
- **LHC** – Large **Hadron** Collider accelerator at
- **CERN** - Organisation Européenne pour la Recherche Nucléaire

Highlights of CMS –
- 3.8 Tesla Magnetic Field
- 14000 tonnes
- Studies proton-proton and heavy ion collisions
- Search for Higgs Boson
- Extra dimensions
- Dark Matter
- Discover the Unexpected
The CMS Collaboration

• The sun never sets on CMS
• 40 countries
• 183 institutes
• 3500 people
New Paradigm for Users

- Huge collaboration – 3 times the Tevatron experiments
  - Requires huge resources, money, manpower
  - Long life span of the experiment ~ 30 years
  - Enormous data rate - 10,000 copies/sec of *Encyclopaedia Britannica*

- Users located worldwide
  - Significant numbers of scientists are no longer co-located at CERN, but instead are at individual institutions or grouped regionally
  - Possible financial and logistic constraints to not to be at CERN
  - Larger distances and large time differences

- Highly distributed environment for
  - Computing (Grid)
  - Physics analysis

- Physics and Computing Support
  - Should reach every user wherever they may be
  - Be taken up in organized and central way

**Need for an organized User Support**
The Challenge for User(Support)

• Engage the collaboration discovery potential and maximize physics output
• How to quickly come up to a level to contribute to physics
  • CMS has a complex computing environment
  • The tools to do physics are non-trivial
  • Most of time the problem is not lack of information but to find and access it
• Users come from different backgrounds
  • Language and culture
  • Physics and computing skills
  • Know-how facilities

Need for an ordered and centrally managed knowledge base and this is where the User Support takes its role
The CMS and User Support

- CMS Experiment organized into several coordination tasks
- One of them is Computing - further subdivided:
  - Data Operation – gets data out, processes it
  - Analysis Operation – operational aspects of data
    - provides support to CMS users using CRAB (CMS Remote Analysis Builder) to submit jobs over Grid
  - Facility Operation – working, distributed fabric with consistent computing environment for users
  - User Support – general computing and physics support for users to accelerate physics analysis
The User Support

- CMS User Support (led by two co-conveners) is
  - Of the Users
  - By the Users
  - For the Users
- Almost no dedicated personnel, clear manifestation of a big collaborative spirit
- Expert in different physics analysis tools
  - Help other users
  - Users become expert and provide feedback
  - Get recruited for further help
  - And so on the cycle goes
Meeting the Challenge

• To bring all users up to speed quickly to contribute to physics analyses
• Engage the collaboration in meeting the pre-requisites to perform physics analyses
• Make use of all the possible and available collaborative tools
• Distribute the expertise besides CERN to other centers/institutes
What do we do

• The User Support focuses on
  • Maintaining, supervising and improving CMS documentation, hundreds of web wikis
  • Organizing of tutorials and workshops on tools for physics analyses
• In addition, answers general computing and physics questions
  • Email, in person, EVO chat sessions
  • Specific questions go to the respective discussion forums (hypernews), answered in a collaborative manner by experts
Usage of Collaborative Tools

• We do not develop collaborative tools but are a very big community using them 24/7

• Use collaborative tools supported at CERN
  • EVO – video/audio meetings and recordings
  • Indico – presentations
  • Twikis
  • e-learning (espace) – sharepoint technology
  • Hypernews – email forum
CMS widely uses twikis for documentation
- Allows users to edit directly from the browser
- ~17000 twikis

The User Support manages and periodically reviews a structured documentation suite
- WorkBook (public domain)
  - Quick start to analysis for beginner
  - ~100 twikis total
  - Each topic has a responsible person
- SWGuide (Viewable by CMS members only)
  - Details on each domain belonging to CMS software
    - data formats, framework, physics analyses software etc.
  - ~1350 twikis
  - Each topic has a responsible person
- Software reference documentation (doxygen)
  - Customize, generate and maintain
  - For every CMSSW release from sources in CVS
Documentation - Snapshots

SWGuide

Doxygen

WorkBook
Tutorials

• Given by experts, relying on the collaborative spirit
• Happen periodically
• Topics pre-requisite for physics analyses
  • CMS Software and Python tutorials
  • PAT (Physics Analysis Toolkit)
    • high-level analysis layer
    • enables common analysis efforts across Physics Groups
  • Statistical Tools, RooStat, RooFit
  • Grid Computing Tools
  • Using Event (proton-proton collision) Display
• Analysis Examples workshops
• Use EVO, wikis and collaborative web area (espace)
  • can be followed remotely
• Frequent tutorials ensure that the documentation is up to date
In two years tutorials on
• 3 CMS orientation for newcomers
• 11 PAT( Physics Analysis Toolkit* )
  • 1-week training- CERN
  • 25-30 participants/tutorial
• 2 Statistical Tools - CERN
• 5 Grid Usage - CERN
• 3 Event Display - CERN
• Tutorials at Analysis Workshops-100 participants each
• The material and EVO recordings exist, respectively, in documentation and Indico for reference and self study
CMS User Feedback Survey

- A CMS wide survey has shown that
  - Tutorials very useful for newcomers
  - Demand to add more topics to tutorials
  - For self study users prefer twikis
  - Questions are directed to hypernews
  - SWGuide and WorkBook useful
The new paradigm in scientific collaboration has not only lead to the organized and central User Support but also growth of LHC Physics Centers worldwide.

- LPC @ FNAL, LPCC @ CERN (hostlab) and Terascale @ DESY

For University group to be plugged in several paths work:

1. Place team @ CERN
2. Base team @ home institute
3. Place team at a LHC Physics Center (regional center)

Most groups employ more than one option and in this way a significant numbers of scientists no longer co-located at the host lab can contribute being at individual institutions or grouped regionally.

- LHC Physics Centers serve as venues for the tutorials and analysis workshops
- The role and efficacy of a remote regional center is vital for CMS
LHC Physics Centers

Physics at the Terascale

The Helmholtz Alliance "Physics at the Terascale" bundles German activities in the field of high-energy collider physics. It is a network comprising all German research institutes working on LHC experiments, a future linear collider or the related phenomenology - 18 universities, two Helmholtz Centres and one Max Planck Institute. The Alliance includes the following topics: development of new accelerator and detector technologies, methods of data analysis, development of theoretical models and methods and development of the relevant computing infrastructure. More...

Implications of LHC results for TeV-scale physics

The workshop, which takes place during the last week of the 2011 TH/LPCC Institute on LHC physics, will be the first in a series of meetings devoted to

Status of LHC ops

Latest news

LHC status

Current fill:

CERN site:

CMS data analysis school

In January 2011, more than 100 participants (from the US, Korea, India, France, Germany, Belgium, and Brazil) participated in the highly successful hands-on school, where eighty percent of the time was devoted to a series of hands-on exercises. First introducing participants to the tools of data analysis and then later devoted to performing detailed physics measurements with real

LHC Physics Centers
LPC @ Fermilab

LPC is a CMS physics analysis & detector upgrade regional center
• ~100 resident CMS scientists
• Enables CMS physicists to participate directly in CMS remotely, economically and transparently.
• The LPC is the local (FNAL) center of excellence for CMS physics

A physics collaboration with 3,000 members from all over the world working on a variety of questions can seem chaotic, but physicist Jason St. John knows, everything has an underlying order.

http://www.fnal.gov/lpc/

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LPC @ Fermilab

• A Regional Center: Easier to Contribute CMS
• Proximity to a broad range of object expertise under one roof
• Access to outstanding computing resources
• Access to expert software support
• A vibrant intellectual community
• For smaller university groups a way to attain critical mass
• Lots of office space for post docs and students
• Visiting scientists & seminars weekly
• Schools and conferences on site
LPC - Engaging the CMS community

- CMS physics & object activities with LPC involvement span the complete range of the CMS program with many CMS conveners based at LPC

- Supporting young CMS leaders
- LPC fellows Program
- LPC Guest & Visitor Program
  - short and long stays
  - support students, postdocs & faculties
Theorists & experimentalists visit:
  • from CMS & larger community
  • Experts stay ~ week
  • give several lectures/seminars
  • hold “office hours”
  • chat with locals & by EVO with CMS.

• One week long hands on physics analysis tutorials
• preceded by month long pre-exercises on software and computing
• More Analysis Schools planned worldwide – Europe, Asia
LPC – Engaging Theory and Experiments

- Workshops: Partnering with sister “LPCs”
- Engaging theory: CTEQ Collaboration
- Engaging other experiments: ATLAS & Tevatron

The next workshop: @ an ATLAS Analysis Center early autumn ‘11
CMS and Data Preservation

• CMS is currently working on
  • general policy document on data preservation
  • CMS-specific resource-loaded implementation plan
  • goal:
    • maximum realization of CMS scientific potential
    • use of data by HEP scientists who were not members of the collaboration, educational and outreach initiatives, and citizen scientists in the general public
  • Implies open access to CMS software, analysis code and techniques, raw and reconstructed data etc in a phased manner
User Support and Data Preservation

• A very first step towards data preservation is having a robust and up-to-date documentation
• User Support activities – a step towards preservation
  • Documentation – WorkBook and SWGuide
  • Software reference documentation
  • Tutorials, analysis schools - trained over ~500 CMS users over 2 years, effort will multiply every year
    • Tutorials planned at other LPC centers worldwide
• Techniques and technology used to train CMS users for analysis can easily be extended to activities to train non-CMS users
Summary

• CMS has put systematic and organized effort in training CMS users
• User Support is making an impact in
  • Usability of structured documentation suite
  • Facilitating the usage of common physics tools
  • Collaborative effort in maintaining and improving documentation
  • Awareness of using and contributing to it
  • data preservation
• Growth of LPC centers has proved vital to CMS success
• Collaborative effort is the key to the success