



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



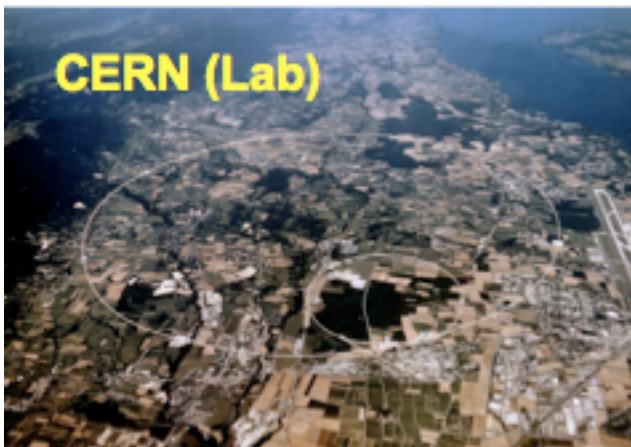
The CMS Experiment



- **CMS** – **C**ompact **M**uon **S**olenoid detector at
- **LHC** – **L**arge **H**adron **C**ollider 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



CERN (Lab)



LHC (Collider)



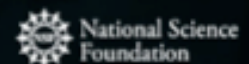
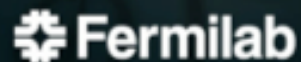
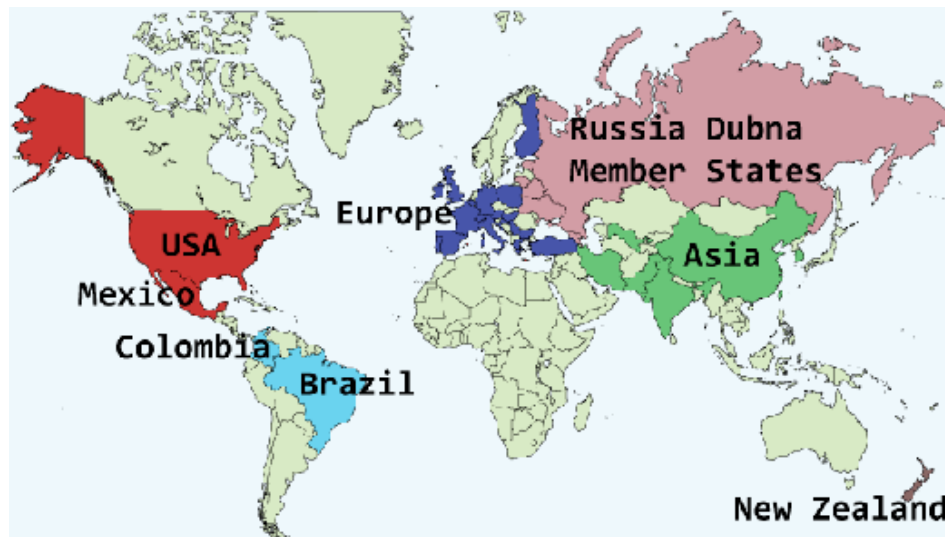
CMS (Detector)



The CMS Collaboration



- The sun never sets on CMS
- 40 countries
- 183 institutes
- 3500 people



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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



Documentation



- 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



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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



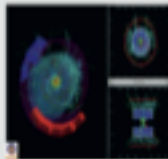
Tutorials stats



German LHC Physics Workshop 2010

27 September - 1 October 2010
DESY, Hamburg

The annual German LHC Physics Workshop brings together Ph.D. students, postdocs and senior physicists for a week of lectures, tutorials and discussions.



In two years tutorials on

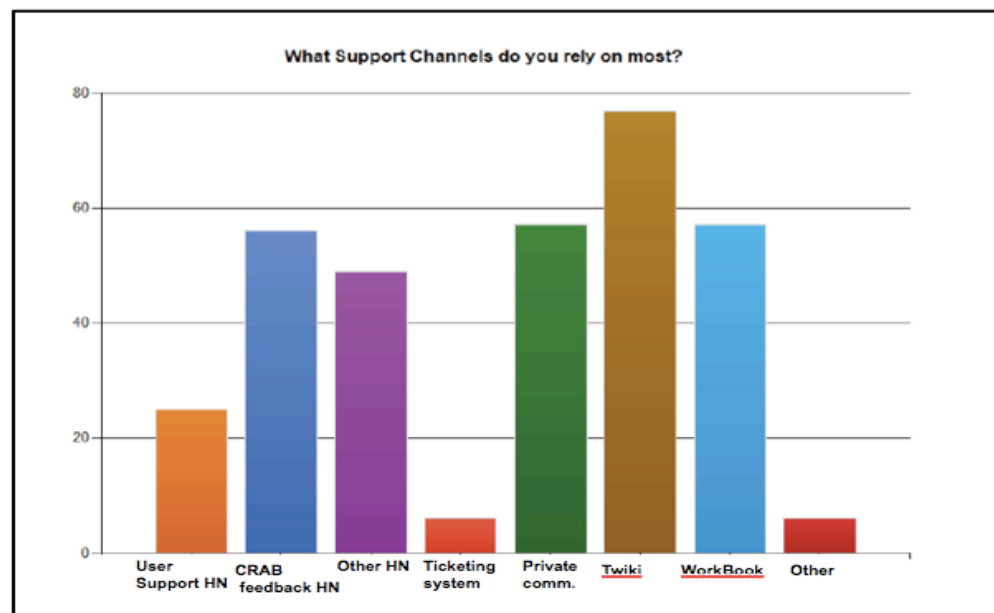
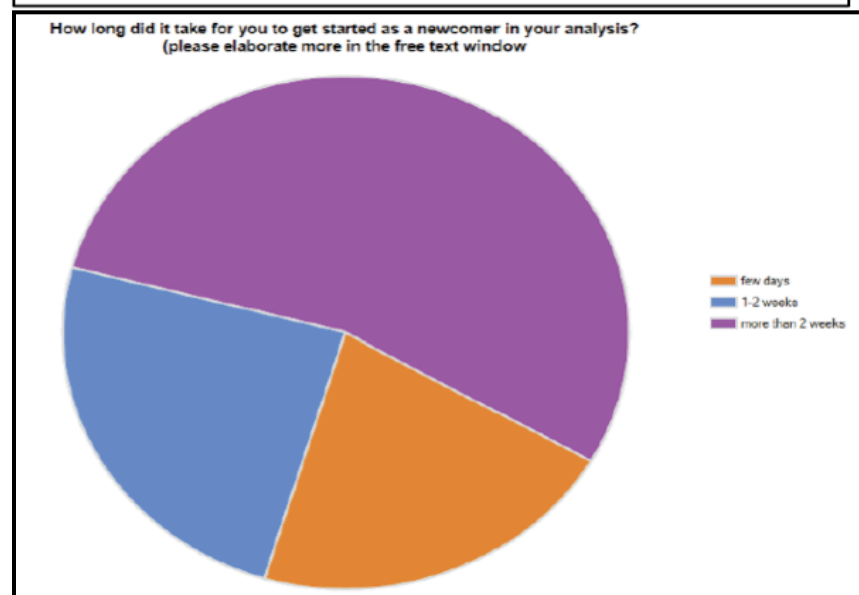
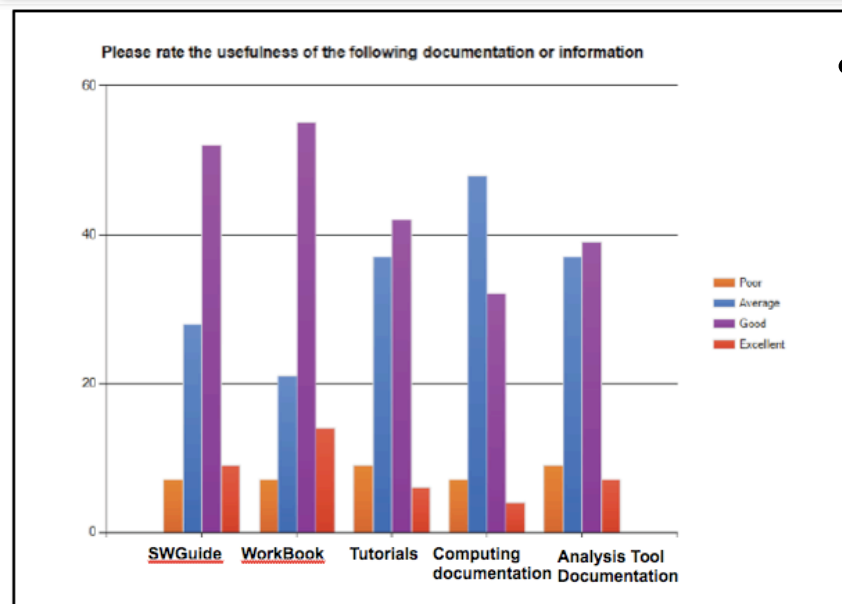
- 3 CMS orientation for newcomers
- 11 PAT(Physics Analysis Toolkit*)
 - 1-week training- CERN
 - 25-30 participants/tutorial
- 2 Statistical Tools - CERN
- 5 Grid Usage - CERN
- 3 Event Display -CERN
- Tutorials at Analysis Workshops-100 participants each
- The material and EVO recordings exist, respectively, 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





Growth of LHC Physics Centers



- 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



[HOME](#) | [VISITING THE LPC](#) | [PHYSICS](#) | [PROGRAMS](#) | [FELLOWS](#) | [COMMUNITY](#) | [CALENDARS](#)

LPCC links

WELCOME

- About the LPCC
- Visit the LPCC
- Subscribe to LPCC News

LHC WORKING GROUPS

- MB & UE WG
- Rate normalization WG
- Electroweak WG

EVENTS

- Forthcoming events
- Past events

LHC PUBLICATIONS

THEORY CONTACTS

STUDENTS RESOURCES

MISC

News

RIVET tutorial
07/02/2011
Rivet is a software toolkit for data analysis of MC event generator simulation, including analysis tools and a large (and growing) library of experimental analyses. Experimentalists and phenomenologists have found Rivet analyses to be a good way to prototype experimental analyses, validate and compare event generators (cf. <http://mcplots.cern.ch>). This tutorial will cover the essentials of using Rivet, from browsing and running existing analyses to writing new ones. The tutorial will be hands-on and laptop-based.
More details and registration:
<https://indico.cern.ch/conferenceDisplay.py?confid=145745>
[Read More...](#)

Implications of LHC results for TeV-scale physics
06/20/2011
This 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, ["page 1"](#)

Current fill [luminosity](#)

["Page-1", tutorial](#)

Exp's status, ["page 3"](#)

[LHC weekly plan](#)

[LHC programme coordination](#)

[LHC integrated luminosity charts](#)

PHYSICS AT THE TERASCALE
Helmholtz Alliance

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[Physics at the Terascale](#)

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...](#)

Current News

- 2011/07/04: Open Leading Scientist Position at DESY
- 2011/07/04: Open Postdoc position in Karlsruhe
- 2011/07/04: New posters online
- 2011/06/14: Alliance

Physics Links

- [LHC Status](#)
- [ATLAS](#)
- [CMS](#)
- [LHCb](#)
- [ALICE](#)



LPC @ Fermilab



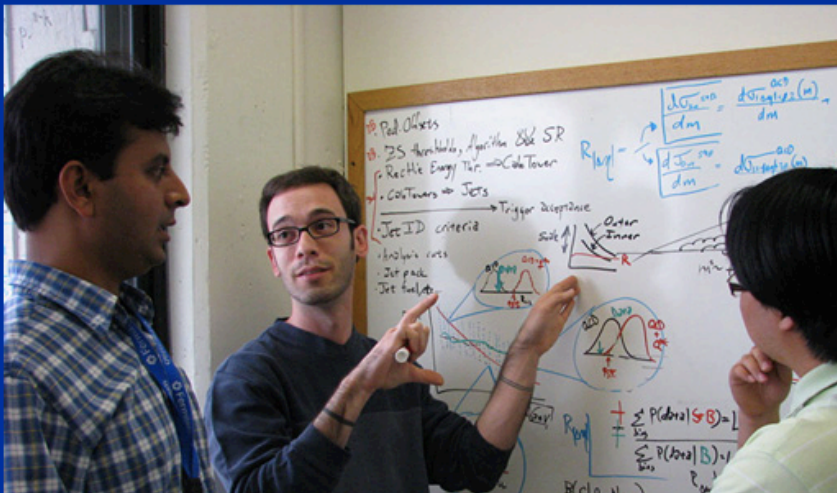
UNIVERSITY OF
Nebraska
Lincoln

LPC
LHC PHYSICS CENTER

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



[HOME](#) | [VISITING THE LPC](#) | [PHYSICS](#) | [PROGRAMS](#) | [FELLOWS](#) | [TOPIC OF THE WEEK](#) | [CALENDARS](#)



FEATURE

LHC PHYSICS CENTER CONNECTS PHYSICISTS TO CMS

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.

- 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



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





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

 <p>MICHELE DE Gruttola</p> <p>...Higgs search, which will be a topic of great interest in 2011, when LHC Integrated luminosity will start...</p>	 <p>ALEXEY Drazdetskiy</p> <p>...to continue working on ZZ, H→ZZ in particular in 4 and 2 lepton modes. This includes many aspect of the analyses...</p>
 <p>ADAM Everett</p> <p>...the opportunity to continue the study of muon object selection. This research is an especially important cross-group project...</p>	 <p>CECILIA Gerber</p> <p>...extend my studies of events containing muons + MET + jets + b-jets in the final state to obtain a well understood top quark pair sample...</p>
 <p>KRISTIAN Hahn</p> <p>...focus on searches for physics beyond the standard model. I am specifically interested in final states that include substantial missing...</p>	 <p>ANDREW Ivanov</p> <p>...My goal is to study data samples dominant by top quarks, and search for a possible admixture due to new physics processes...</p>
 <p>JACOBO Konigsberg</p> <p>...working on Higgs searches at CMS. Specifically on channels that include associated production of vector-bosons and the Higgs decaying to pairs of b-quarks...</p>	 <p>GENA Kukartsev</p> <p>...searches for exotic phenomena beyond the standard model with particular interest in dilepton and quasi-two-body topologies...</p>

- Supporting young CMS leaders
- LPC fellows Program
- LPC Guest & Visitor Program
 - short and long stays
 - support students, postdocs & faculties



LPC Education - Engaging HEP experts



CMS Data Analysis School

CMS DATA ANALYSIS SCHOOL
Jan 25-29 2011 at LPC, FNAL

From Benchmarks of the Standard Model to First Discoveries

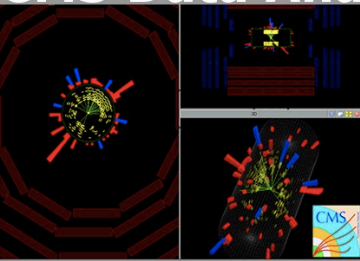
Registration for the School and the agenda are at:
<http://indico.cern.ch/conferenceDisplay.py?confid=112319>
(Please note: to register, a CERN e-mail (NICE) account is required.)

Course Area at CERN for the CMS Data Analysis School Jan 2011
<https://espace.cern.ch/learn/cms/AnalysisSchoolJan11/default.aspx>

Speakers for opening session

- JoAnne Hewett (SLAC) - The Big Picture
- Eric Prebys (FNAL) - The LHC
- Joel Butler (FNAL) - The CMS Detector
- Gigi Rolandi (CERN) - CMS Results and the Next Two Years

This school was formerly known as EJTERM. A link to the EJTERM 2010 site can be found [here](#).

 [View Full Size](#)



- <http://www.physics.purdue.edu/hep/cms-data-analysis-school/>
- 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
- Theorists & experimentalists visit:
 - from CMS & larger community
 - Experts stay ~ week
 - give several lectures/seminars
 - hold “office hours”
 - chat with locals & by EVO with CMS.





LPC – Engaging Theory and Experiments



Standard Model Benchmarks at the Tevatron and LHC

November 19 - 20, 2010

Fermilab

11/24/2010: [Fermilab Today](#) article about the Benchmarks Workshop

A link to the workshop poster is here



Hosted by: The CTEQ Collaboration, the LHC Physics Centers @ CERN, DESY,

FERMILAB and the ATLAS Physics Analysis Center @ ANL



Some photos from the workshop.

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



Standard Model Benchmarks at High-Energy Hadron Colliders

15-17 June 2011 *DESY (Zeuthen)*
Europe/Berlin timezone



FNAL November 2010



DESY June 2011

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