Customizable Scientific Web-Portal for DIII-D Nuclear Fusion Experiment

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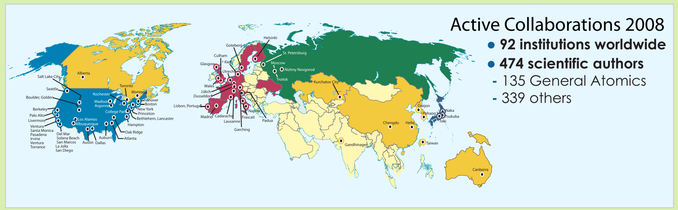
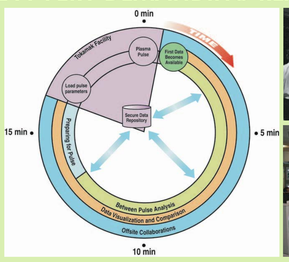
Introduction and Motivation

THE DIII-D TOKAMAK IS THE LARGEST EXPERIMENTAL NUCLEAR FUSION RESEARCH FACILITY IN THE US



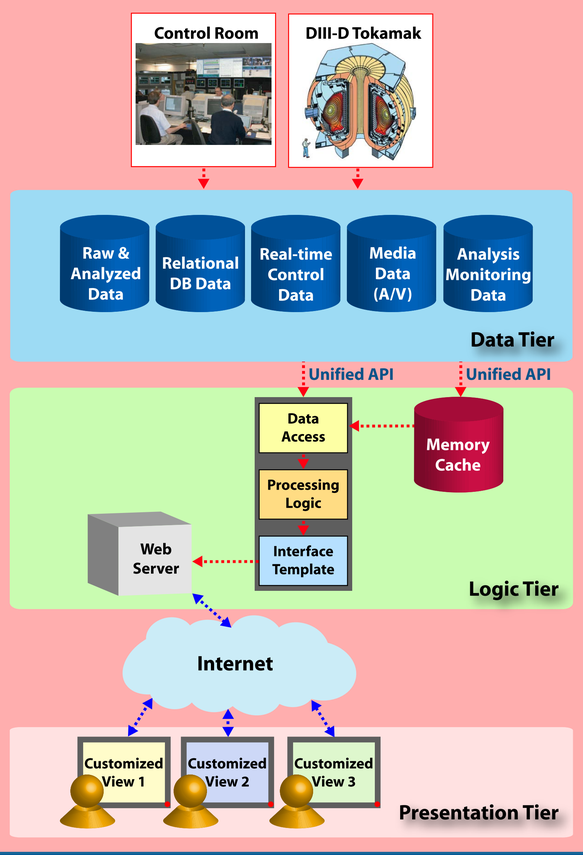
EXPERIMENTAL FUSION SCIENCE IS AND WILL CONTINUE TO BE A VERY DEMANDING REAL-TIME ACTIVITY



INCREASING UTILIZATION OF THE INTERNET AND CONVENIENT WEB TECHNOLOGIES MADE IT POSSIBLE TO CREATE A HIGHLY INTERACTIVE WEB-BASED APPLICATION

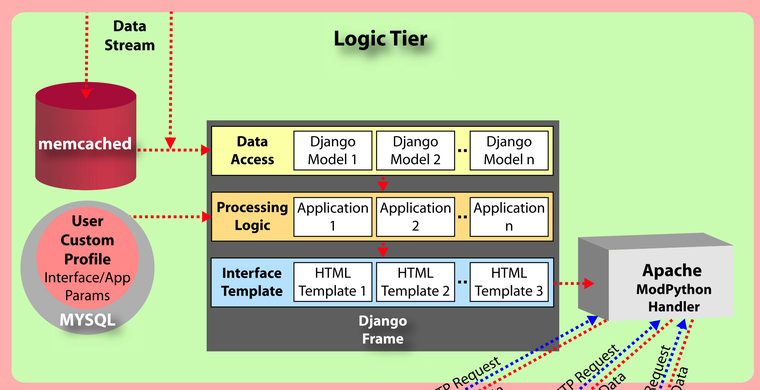
Software Architecture

THE DIII-D WEB PORTAL DESIGN UTILIZES MULTI-TIER SOFTWARE ARCHITECTURE WHICH IS MAINLY COMPOSED OF THREE TIERS: DATA TIER, LOGIC TIER, AND PRESENTATION TIER

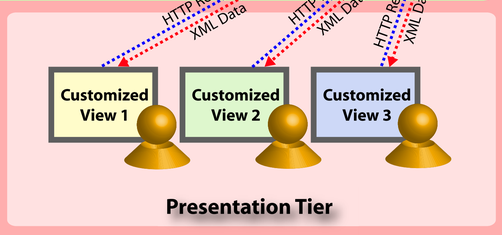


- The Data Tier provides multiple data sources generated by the DIII-D tokamak and research activities of scientists.
- The Logic Tier is responsible for receiving data from the Data Tier, processing it and generating the web interface for the Presentation Tier.

The python-based Django framework is used for the Logic Tier which consists of three major parts: Model, Template and View.



- The Presentation Tier generates requests to the Logic Tier and receives corresponding presentation information.
  The types of requests are:
  1) Data viewing and visualization requests
  2) Control requests
  3) Web-portal customization requests



Applications

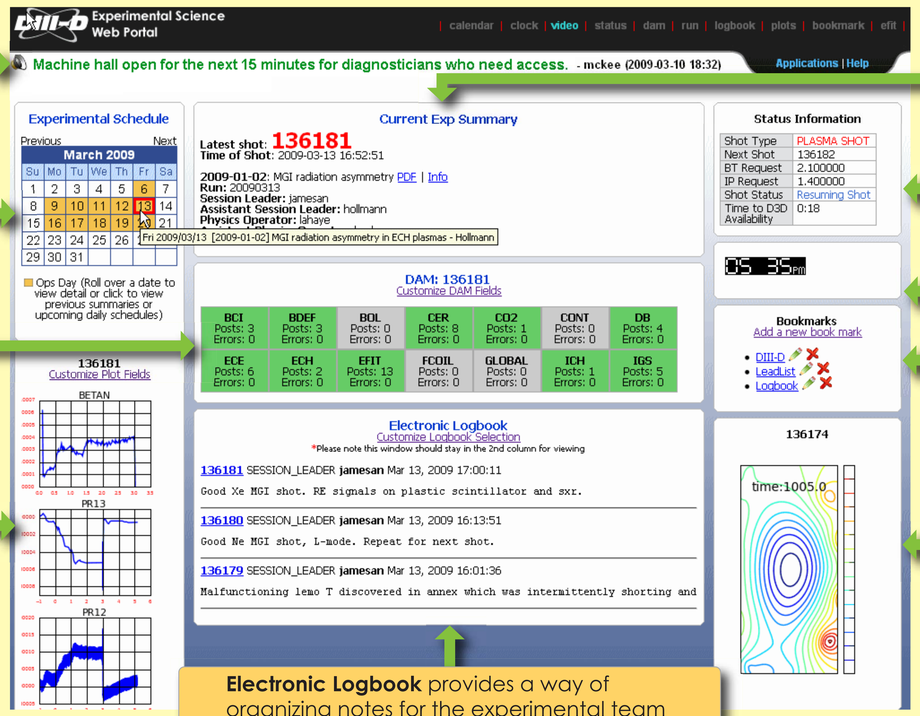
THE WEB PORTAL IS A LIBRARY OF APPLICATIONS AND SERVICES WHICH COVER A WIDE VARIETY OF ASPECTS TO THE DIII-D RESEARCH PROGRAM.

Instant Global Announcement makes announcements available to all web-portal users

Experimental Schedule provides a detailed overview of all scheduled experiments

Data Analysis Monitoring outputs results of analysis codes in real-time

Signal Plots outputs the latest plots of various measured and analyzed data



Current Experiment Information gives a summary of the experiment such as experimental team and details of the proposed experiment

Tokamak Status Information displays pulse information such as the configurations for the pulse as well as the status and the type

Clock displays the current time

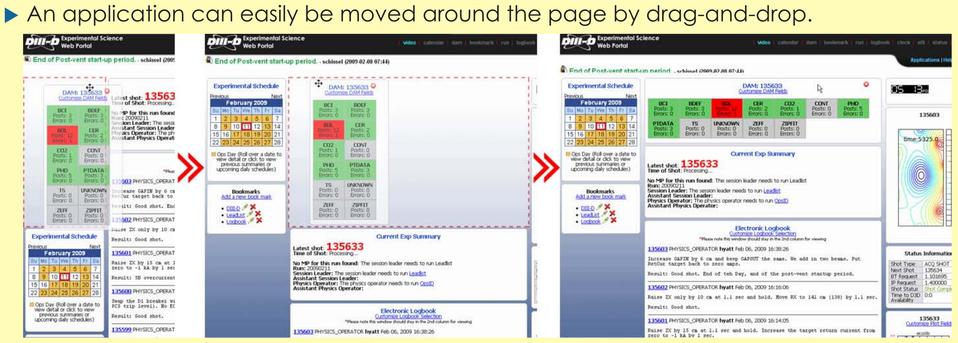
Bookmarks provides a way for users to save websites

EFIT Animation displays an animation of the most recently calculated plasma shape data.

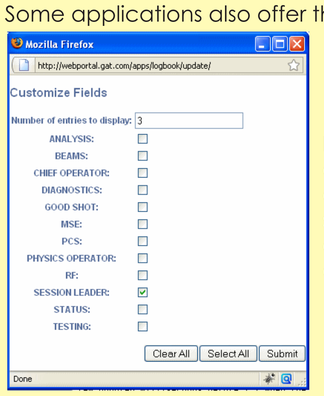
Electronic Logbook provides a way of organizing notes for the experimental team

TO SATISFY THE MANY DIFFERENT NEEDS AND INTERESTS OF ITS USERS, THE WEB-PORTAL PROVIDES A CUSTOMIZATION FOR EACH USER.

- A list of all available applications and services are provided as links to independently turn them on or off.
- An application can easily be moved around the page by drag-and-drop.



- Some applications also offer their own customization



For example, the Electronic Logbook application provides a list of all available entry categories for users to select from. It also allows users to change the number of entries to display on their web-portal page.

Deployment Status & Future Work

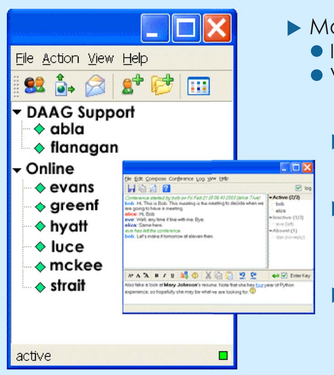
DEPLOYMENT STATISTICS

- The DIII-D web-portal has been deployed during the year 2009 experimental campaign and used for two months.
  - 60 scientists have viewed with ~25 regular users
  - Remote users exceed those in the control room

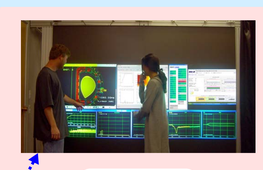
THE WEB-PORTAL INTERFACE PROVED TO INCLUDE BENEFITS OVER REGULAR DESKTOP APPLICATIONS

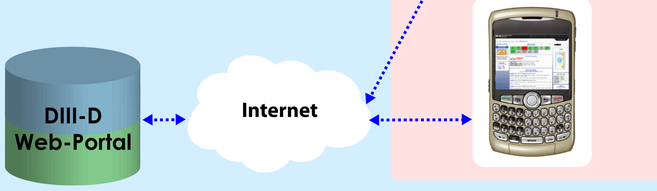
- No client software installation is required.
- New versions instantly available since no client install.

FUTURE WORK INCLUDES MORE APPLICATIONS AND IMPROVEMENTS ON EFFICIENCY AND SCALABILITY



- More applications and features
  - Instant Messaging
  - Visualization Sharing
- Finer grained layout customization
- "Server push" to minimize the network and server CPU load.
- Examination of distributed Logic Tier.
- Improve template management to serve more clients.
  - Smart phones
  - Large display walls





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