The mc_runjob package

An Overview

Dave Evans

evansde@fnal.gov

Lancaster University
Introduction

- Intro to mc_runjob
- mc_runjob at DØ and MC farms
- Components of mc_runjob
- MC Processing
- Data and Analysis processing
- Integration with SAM and JIM
- Runjob Server
- Future Plans
Intro to mc_runjob

mc_runjob is an Object Oriented Workflow planner and metadata manager written in Python which converts metadata into executable jobs

Three main pieces
- PreProcessor ⇒ Customises Metadata
- Linker ⇒ Organises metadata into tasks
- Configurator ⇒ Performs task

Metadata ⇒ Jobs + More Metadata
What does mc_runjob do?

- Uniform interface for varying software.
- Tame complex production processing environments with hundreds of input parameters.
- Handles complex multi-application workflow topologies.
- Resolve Dependencies and relationships among the metadata easily.
- Produce metadata description of workflow.
- ⇒ Removes need to understand DØ software details.
Components: PreProcessor

- Adapts metadata to local environment.
- Starts any required services.
- Parallellises job for local resource.
- Sends final macro(s) to Linker
Components: Linker

- Resolves Dependencies
- Builds Configurator structure
- Distributes metadata to configurator
- Runs the Configurators to make a single job
Components: Configurator

- Each configurator does a specific task: Eg:
  - Generates an Executable script
  - Manages files
  - Interfaces to a batch system

- Very Flexible inheritance based design that can do virtually any task.

- Configurators use the metadata to configure themselves for a particular task.
Use At DØ

- Used for all off site MC production.
- Used to define keyword structure for metadata and request system.
- Used by casual users on central systems: CAB, Clued0.
- Automates use of DØ framework and provides a simple way to tailor a processing job via cardfiles, rcps etc.
Use At DØ Farms
Use with SAM

- Produces keyword based metadata.
- Interface with SAM for processing involving SAM.
  - Store/Declare
  - Processing Datasets
  - Request Management
- Mostly working, but will re-implement most functionality to use the new SamUserApi.
- Working with SAM team to use SAM for file caching/transport within a farm.
mc_runjob can be used to process data and analysis jobs with minimal effort. Using mc_runjob an MC Farm can also do analysis and data jobs.

- Only difference for data is an rcp file
- Analysis needs more work on a common analysis framework.
- Essentially just processing a dataset through some configurators.
- Data and Analysis requests can use the MC Request system.
Data Processing Scenario

n file processing job

SAM Dataset
N MC/Data Files

n = \frac{N}{Farm\ Capability}

Trigsim

d0reco

tmb_ana

Trigsim

d0reco

tmb_ana

...

Trigsim

d0reco

tmb_ana

Merge processing outputs for N file Analysis job

ROOT Analysis

Analysis Output
Analysis Scenario

n file processing job

SAM Dataset
N TMB Files

n = N
Farm Capability

TMB Stream

Stream A

tmb_ana

Stream B

tmb_ana

Merge processing outputs for N file Analysis job

ROOT Analysis

Analysis Output

Stream A Analysis

Stream B Analysis

TMB Stream

Stream A

tmb_ana

Stream B

tmb_ana

Merge processing outputs for N file Analysis job

ROOT Analysis

Analysis Output

SAR Workshop - April 18, 2003 – p. 13/27
mc_runjob produces executable jobs, tailored to the local resources and handles all of the details of the executables.

- Allows a Grid job to be defined as a simple set of metadata
- Manufactures the job based on the resources available
- When an exe is supported by runjob, it can be run in a standard way on a Grid. Can be used to provide a common interface for any executable for use at a grid site.
SAM/JIM Integration

Step 1: Submission of MCRequests via JIM

- JIM sends request id to site with MC software Preinstalled
- PreProcessor at site takes request details from SAM and creates macro
- PreProcessor tailors macro to the local site
- Linker creates jobs and submits them to the local BS
- Results are stored into SAM

Next step: Jobs broadcast to JIM monitors

Expand to send complete macro via JIM
Runjob Server Design

Goal: Provide central services for all jobs running at a site, in a flexible multifORMAT way

- Provide a way for jobs to query each other.
- Provide default handlers for common tasks.
- Make Job information available in a common format.
- Allow a framework that will support customisations for any location.
- Focus on providing a common interface to the job.
Jobs periodically produce XML representation of their state

Job information is made available via an XML-RPC service

An XML based system for requesting actions from a central server

Server hands requests off to handlers which are adapters for various tools.

Eg: SAM Store, Merge job, SAM projects, Job dependencies
Runjob Server Schematic

All Information Exchange via Serialisable Python objects which can be converted to or from XML to provide a universal interface format.

Default Services like Sam Store file relocation and job monitoring are provided, but can easily be swapped for a custom service handler that repackages the XML in the format required by the Service.
Future Plans: DØ

- Finish up JIM MCRequest system
- Use SAM for file Xfers within a farm
- Improve Job Error handling and rescue
- Implement Runjob Server
- Fully implement all features for Data processing.
- Use mc_runjob as an interface to samg submit to submit grid jobs.
- Expand Analysis Configurators
CMS Also uses mc_runjob as its official production tool.

Create Common project: ShahKar

Will allow Tevatron and LHC computing tasks to run on the same facilities

ShahKar should become a FNAL CD Project

ShahKar is Urdu for Great Work
mc_runjob Documentation

- Webpage: http://www-clued0.fnal.gov/runjob/
- DØ mailing list: d0_mc_runjob_users@fnal.gov
- DØ CMS mailing list: mcrunjob-design@fnal.gov
Organisation

- DØ
  - Dave Evans - Primary Developer
  - Rod Walker - SAM/JIM Integration
  - Peter Love - Grid Integration
  - Iain Bertram - Farms and Requests

- CMS
  - Greg Graham - Primary Developer
  - Anzar Afaq - Integration with CMS tools
  - +New Postdoc - Development of core services
CMS Plans

- milestones for CMS:
  - 1.5 M Geant3 events full chain on IGT from Nov-Dec. 2002
  - 10M Geant4 events for PCP June-December on IGT/LCG-1 Grid

- Required Functionality
  - Works with MOP Condor-G system (Done)
  - Works with EDG Resource Broker (June)

Runjob used to create/submit jobs to USCMS Integration Grid Testbed and soon also for EDG
mc_runjob and d0tools

- d0tools runs a single exe
- mc_runjob runs a set of exes in order
- Plan to use d0tools to generate the scripts within mc_runjob
mc_runjob and MCFarm

MCFarm has lots of experience controlling Farm jobs. Many points at which mc_runjob could meet MCFarm

- MCFarm Preprocessor - Customise macros for MCFarm
- MCFarm Monitor format - Jobs produce MCFarm format monitoring info
- MCFarm Services implemented for Runjob Server.
- Implement MCFarm diagnostics for mc_runjob
mc_runjob and d0rte

- In future use run time environment instead of minitar files
- Use to sandbox custom executables
- Build in d0rte interface in runjob for transport and management of d0rte tarfiles