Plugins in JANA

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…some stuff you probably already know…

- Programs are collections of smaller, self-contained instruction sequences
  - Routines
  - Subroutines
  - Functions
  - Methods
  - …*choose a name …*
- Linking these together can be done either *a priori* or dynamically at the time the program is run
- Routines that are dynamically linked are kept in separate files from the main program
  - Shared libraries
  - Shared objects
  - Dynamically Linked Libraries (DLL)
  - …*choose a name …*
- Shared libraries can be linked by the system at program startup or their routines can be accessed programmatically via the ***dl*** (“D-L”) library.

Using libdl

- Open a shared object
  - `void *handle dlopen("file.so", RTLD_GLOBAL);`
- Look for symbol (routine) by name
  - `InitPlugin_t *plugin = (InitPlugin_t*)dlsym(handle, "InitPlugin");`
- Call routine (if symbol is found)
  - `(*plugin)(this);`
- No way to check argument list. Have to assume it.
  - For JANA plugins, the routine name is "InitPlugin" and the argument is a *JApplication*.*
- With the JApplication pointer, the plugin can:
  - Register event processors (*JEventProcessor)*
  - Register factories (*JFactoryGenerator)*
  - Register event sources (*JEventSource*)
  - …etc, etc, ….

Uses for plugins

- Make and fill histograms/trees
- Add or replace factories
  - factories from plugins take precedence
  - *hdparsim*
- Add capability to read in different file formats or events/objects from different network protocols
- Add capability to read in calibration constants from a different source
  - *jcalibws (web services interface)*
- Activate additional monitoring or controls
  - *janadot*
  - *janarate*
  - *janactl*
  - *rootspy*

Making a plugin

- Use the *mkplugin* script in the Hall-D scripts directory
  - https://halldsvn.jlab.org/repos/trunk/scripts/mkplugin
  - *mkplugin myPlugin*
    - *`DEventProcessor_myPlugin.h`*
    - *`DEventProcessor_myPlugin.cc`*
    - *`Makefile`*

DEventProcessor.cc

```
1  // $Id$
2  //
3  //    File: DEventProcessor_myPlugin.cc
4  // Created: Fri Jul  2 16:19:43 EDT 2010
5  // Creator: davidl (on Darwin eleanor.jlab.org 10.2.0 i386)
6  //
7
8  #include "DEventProcessor_myPlugin.h"
9  using namespace jana;
10
11
12 // Routine used to create our DEventProcessor
13 #include <JANA/JApplication.h>
14 extern "C"{
15 void InitPlugin(JApplication *app){
16     InitJANAPlugin(app);
17     app->AddProcessor(new DEventProcessor_myPlugin());
18 }
19 } // "C"
20
21
22 //------------------
23 // DEventProcessor_myPlugin (Constructor)
```

The *DEventProcessor,cc* file contains skeletal code for an event processor that can be used to make and fill histograms.

Also contains the “magic” code that makes it a plugin and adds one instance of the event processor.

Gotchas

- Global variables with the same name
- Libraries statically linked into both plugin and executable
  - Potential version mismatch
- Library statically linked to executable but not plugin and plugin needs something from it that executable doesn't
  - Link failure at time *dlopen* is called

Existing GlueX plugins

- *hdparsim - semi-parametric simulation*
- *mcthrown_hists - generated particle hists*
- *radlen_hists - radiation lengths*
- *phys_tree - tree with reconstructed part.*
- *eta_ntuple - hbook Ntuple for PrimEx*
- *…several more, but many out of date*

Multiple plugins may be used by a single process. Because of this a convention has been adopted to create a TDirectory and place histograms/trees within to avoid naming conflicts with other plugins.

Specifying plugins to JANA programs

- Use “PLUGINS” configuration parameter to specify plugins as a comma separated list.
  - Example:

    hd_root –PPLUGINS=phys_tree,janarate …

- Specify with --plugin command line option
  - Example:

    hd_root --plugin=phys_tree –plugin=janarate

Summary

- Plugins are fully supported in *JANA*
- Several plugins exist in repository
  - *src/programs/Analysis/plugins*
  - *src/programs/Simulation/plugins*
- *scripts/mkplugin* script makes it easy to get started