Simple to Program

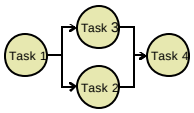
```
public class COG implements StatusListener{
   public void create() { … }
   public void submit () { … }
   public void statusChanged (StatusEvent e)  { … }
   public static void main (String arg[]){
                                    try {
          COG cog = new COG();
          cog.create();
          cog.submit();
       catch (Exception e) {
          logger.error("Something went wrong:", e);
   }
}
```

```
public void statusChanged (StatusEvent event) {

   Status status  = event.getStatus( );

   logger.debug(``Status changed to " +  status.getStatusCode());

   if (status.getStatusCode ( ) == Status.COMPLETED) {
      logger.info(``Task Done");
   elsif (status.getStatusCode ( ) == Status.FAILED) {
      logger.info(``Task Failed");
       System.exit(1);
   }
}
```




```
TaskGraph tg = new TaskGraphImpl();

public void create () {
  // define tasks
   …..
  /* Add the tasks to the TaskGraph */
  tg.add(task1);
  tg.add(task2);
  tg.add(task3);
  tg.add(task4);
  tg.addDependency(task1, task2);
  tg.addDependency(task1, task3);
  tg.addDependency(task2, task4);
  tg.addDependency(task3, task4);
}

public void submit() {
  TaskGraphHandler handler =  new
                          TaskGraphHandlerImpl ();
      try {
        handler.submit(tg);
      } catch (Exception e) {
        logger.error(``Some Error occured", e);
        System.exit(1);
      }
}
```

```
try {
    handler.submit (cog);
  } catch (InvalidSecurityContextException  ise) {
    logger.error(``Security Exception", ise);
    System.exit(1);
  } catch (TaskSubmissionException tse) {
    logger.error(``TaskSubmission Exception", tse);
    System.exit(1);
  } catch (IllegalSpecException ispe) {
    logger.error(``Specification Exception", ispe);
    System.exit(1);
  } catch (InvalidServiceContactException isce){
    logger.error(``Service Contact Exception", isce);
    System.exit(1);
  }
```

CoG Kit Patterns

The philosophy behind the Java CoG Kit is based on object-oriented programming patterns. One of these patterns is the "task" pattern to help conducting a workflow in the Grid. An implementation can be achieved by reusing the interfaces and implementations provided by the Java CoG Kit.

A simple COG

We show an example of a class named COG that is based on our task pattern. The task pattern always contains a method to create and submit tasks, and a method that reports on status changes.

Completing the COG

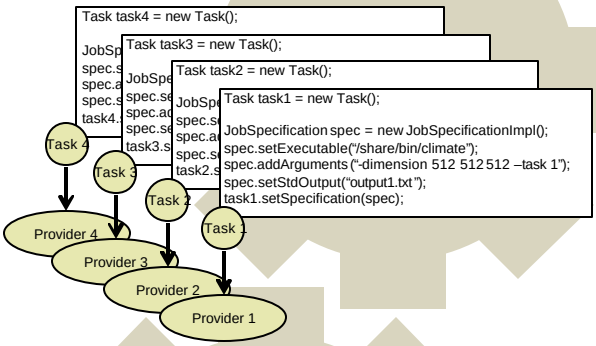
The Java CoG Kit contains interfaces and methods that simplify the definition and use of task graphs and tasks based on our abstraction model. Defining a handler that deals with the submission of the job becomes as simple as our example demonstrates. A comparable C program would consume many more lines.

More sophisticated handlers can be custom designed.

Tasks are specified through a simple task specification.

Providers & Binding

Providers for various Grid toolkits can be seamlessly integrated and a task can be bound to a particular Grid resource. Through this process late binding is possible.



Even simpler

The same example can be formulated even simpler through our Java CoG Kit workflow language. Karajan, our workflow engine, will take care of the rest.

```
<project>
    <include file="sysdefaults.xml"/>
    <sequential>
        <gridExecute executable="/share/bin/climate"
            arguments="-dimension 512 512 512 -task 1"
            host="hot.mcs.anl.gov'
            provider="gt3.2.1"
            stdout="output1.txt"/>
        <parallel>
            <gridExecute executable="/share/bin/climate"
                arguments="-dimension 512 512 512 -task 2"
                host="cold.mcs.anl.gov'
                provider="gt2"
                stdout="output2.txt"/>
            <gridExecute executable="/share/bin/climate"
                arguments="-dimension 512 512 512 -task 3"
                host="hot.mcs.anl.gov'
                provider="gt3.2.1"
                stdout="output3.txt"/>
        </parallel>
        <gridExecute executable="/share/bin/climate"
            arguments="-dimension 512 512 512 -task 4"
            host="blue.mcs.anl.gov'
            provider="gt4"
            stdout="output4.txt"/>
    </sequential>
</project>
```

```
Service service = new ServiceImpl(Service.JOB_SUBMISSION);
Service service = new ServiceImpl(Service.JOB_SUBMISSION);
Service service = new ServiceImpl(Service.JOB_SUBMISSION);
Service service = new ServiceImpl(Service.JOB_SUBMISSION);

service.setProvider(``GT3_2_1");

// Set Security Context – e.g. certificates and such
SecurityContext  securityContext  = CoreFactory.newSecurityContext(``GT3_2_1");
securityContext.setCredentials(null ); // e.g. set it to default in ./globus
service.setSecurityContext(securityContext );
// Set Contact – e.g. where to go to
ServiceContact serviceContact =
    new ServiceContactImpl ( http://hot.mcs.anl.gov:8080/ogsa/services/base/gram/,
    MasterForkManagedJobFactoryService");
service.setServiceContact(serviceContact);

task1.setService(Service.JOB_SUBMISSION_SERVICE, service);
```