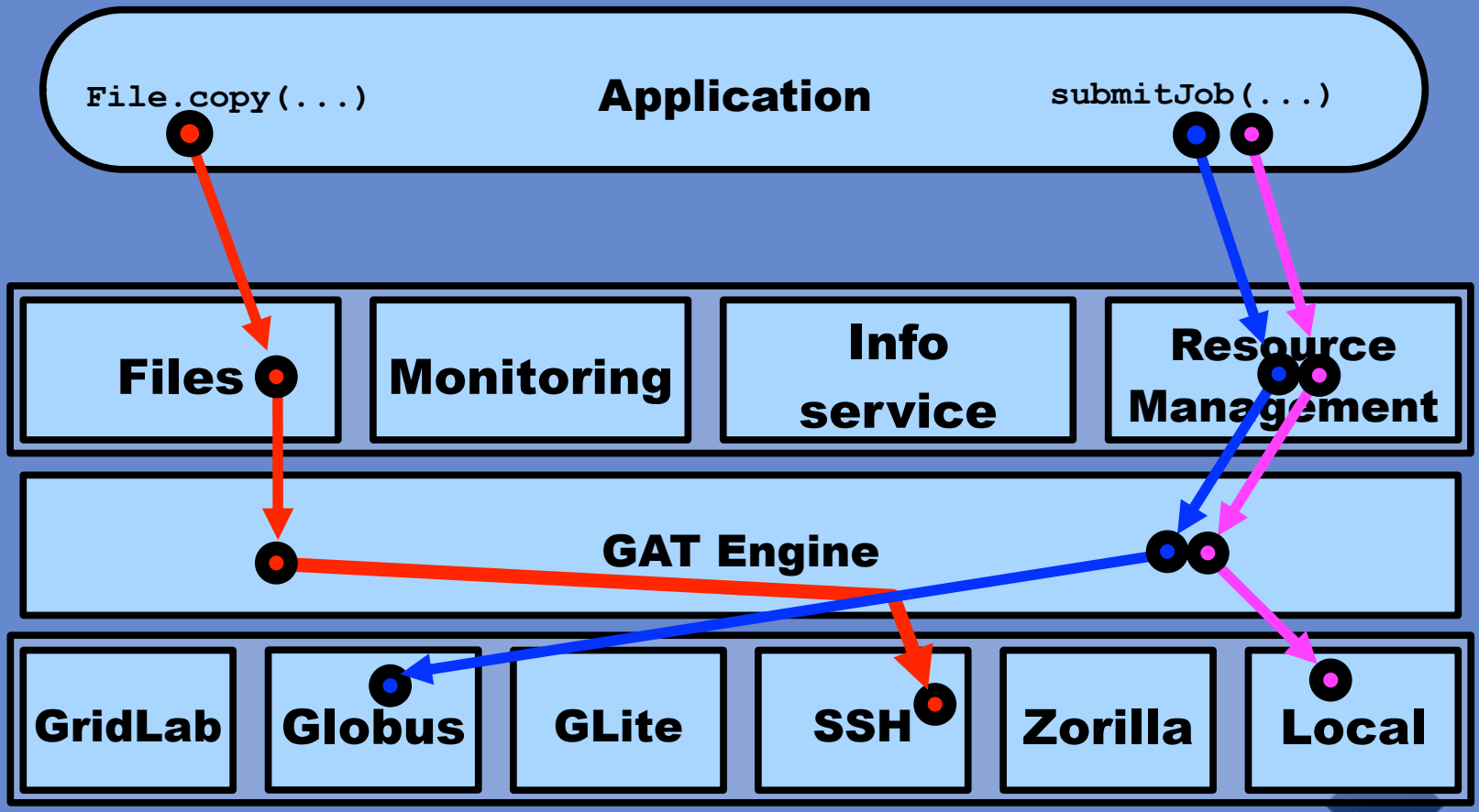
Ibis as Master Key

Hands-on

Niels Drost

Computer Systems Group
Department of Computer Science
VU University, Amsterdam, The Netherlands

JavaGAT Design



Prerequisites

- These slides: www.cs.vu.nl/ibis/tutorial.html
- Sun/Oracle Java (1.6 or 1.7 both fine) http://www.oracle.com/technetwork/java/javase/downloads/index.html
- Apache ANT: http://ant.apache.org/bindownload.cgi
- Eclipse (optional): http://www.eclipse.org/
- Login using ssh without a password

Getting started with the Examples

- From tutorial page www.cs.vu.nl/ibis/tutorial.html
  - Download JavaGAT release
  - Download masterkey-examples.zip
- Unzip both files
- Set “javagat” property in “masterkey-examples/build.xml” to proper JavaGAT location
- Build using “ant”

1) File Copy

- Class: masterkey.basic.Copy
- Run using scripts/run(.bat) CLASS ….
- See masterkey.examples
- 1a. Try to copy to/from:
  - Local machine
  - DAS-3/4
  - Your own machine!
- 1b. Try to edit source to rename/delete/etc
  - See JavaGAT Javadoc on tutorial site

1) File Copy

```
import org.gridlab.gat.GAT;
import org.gridlab.gat.URI;

public class Copy {

    public static void main(String[] args) throws Exception {
        GAT.createFile(args[0]).copy(new URI(args[1]));
        GAT.end();
    }
}
```

- URI's used as file location

2) Running jobs

- Class: masterkey.basic.RunJob
- 2) run some commands on
  - Localhost (local://localhost)
  - The DAS-4 VU frontend (ssh://fs0.das4.cs.vu.nl)
  - The DAS-4 nodes (sshsge://fs0.das4.cs.vu.nl)
  - Your own machine!

```java
public class RunJob {

    public static void main(String[] args) throws Exception {
        ResourceBroker broker = GAT.createResourceBroker(new URI(args[0]));

        SoftwareDescription sd = new SoftwareDescription();

        sd.setExecutable(args[1]);

        sd.setStdout(GAT.createFile("stdout.txt"));
        sd.setStderr(GAT.createFile("stderr.txt"));

        Job job = broker.submitJob(new JobDescription(sd));

        do {
            System.out.println("Current state: " + job.getState());
            Thread.sleep(1000);
        } while ((job.getState() != JobState.STOPPED)
                && (job.getState() != JobState.SUBMISSION_ERROR));

        GAT.end();
    }
}
```

3) Pre/Post-staging

- Class: masterkey.basic.RunJobWithStaging
- Run without arguments for usage!
- 3) Run some jobs with files. E.g.
  - /usr/bin/sort (see numbers.txt)
  - /usr/bin/convert (see images dir for some input)
  - …

```java
public class RunJobWithStaging {
    // USAGE: machine executable input [arguments…] output
    public static void main(String[] args) throws Exception {
        ResourceBroker broker = GAT.createResourceBroker(new URI(args[0]));

        SoftwareDescription sd = new SoftwareDescription();
        sd.setExecutable(args[1]);
        sd.setStdout(GAT.createFile("stdout.txt"));
        sd.setStderr(GAT.createFile("stderr.txt"));

        sd.addPreStagedFile(GAT.createFile(args[2]));
        sd.addPostStagedFile(GAT.createFile(args[args.length - 1]));

        sd.setArguments(getArguments(args));
        Job job = broker.submitJob(new JobDescription(sd));

        do {
            System.out.println("Current state: " + job.getState());
            Thread.sleep(1000);
        } while ((job.getState() != JobState.STOPPED)
                && (job.getState() != JobState.SUBMISSION_ERROR));

        GAT.end();
    }
```

4) Jobs with extra Settings

- 4a) Certificates
  - Class: masterkey.basic.RunJobWithCertificate
  - Requires globus certificate, and local setup
- 4b) Environment
  - Class: masterkey.basic.RunJobWithEnvironment
  - Not all adaptors support this

Using a Certificate

```
public static void main(String[] args) throws Exception {
    CertificateSecurityContext securityContext = new CertificateSecurityContext(
            new URI(System.getProperty("user.home") + "/.globus/userkey.pem"),
            new URI(System.getProperty("user.home") + "/.globus/usercert.pem"),
            getPassphrase());

    GATContext context = new GATContext();

    context.addSecurityContext(securityContext);

    ResourceBroker broker = GAT.createResourceBroker(context, new URI(
            args[0]));

    ...
```

Environment variables

```
// Create a software description containing the executable name, and
// two files for any output that is generated on stdout or stderr.
SoftwareDescription sd = new SoftwareDescription();
sd.setExecutable(args[1]);
sd.setStdout(GAT.createFile("stdout.txt"));
sd.setStderr(GAT.createFile("stderr.txt"));

Map<String, Object> environment = new HashMap<String, Object>();
environment.put("SOME_SETTING", "some-value");
sd.setEnvironment(environment);
```

5) Preferences

- Arbitrary additional settings not in API directly
- Simple key-value pairs
- Possible in almost all JavaGAT types (e.g. Files)
- See javagat.properties for a list per adaptor
- Specified using GATContext

5) Preferences

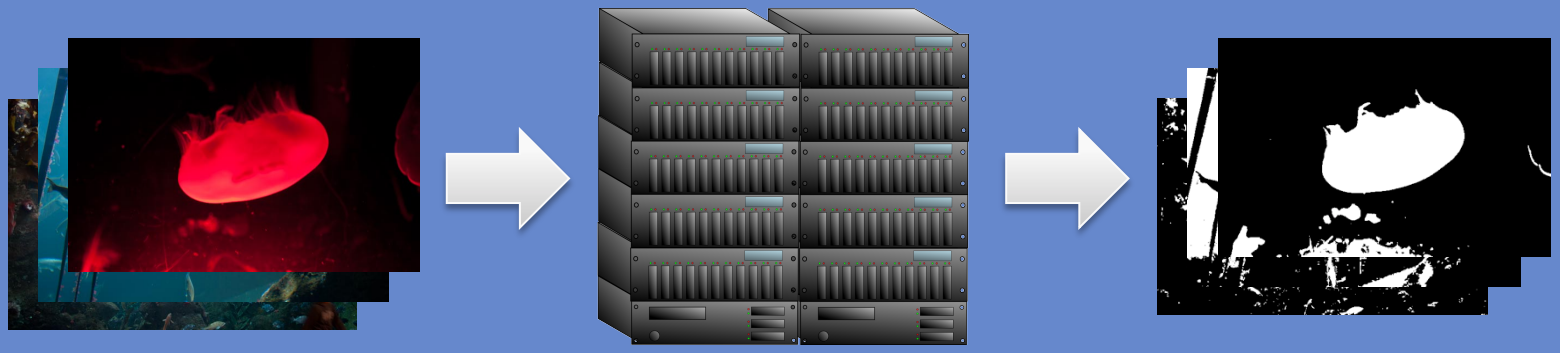
```
GATContext context = new GATContext();
context.addPreference("sshpbs.native.flags", "-l num_gpu=1");

ResourceBroker broker = GAT.createResourceBroker(context, new URI(args[0]));
```

- Class: masterkey.basic.RunJobWithPreferences
- Submit to the DAS-4 to get a GPU node!

Task Farming: Running Example

- Scientist needs to process a large number of independent data files using some application
- Offload to compute resource using Task Farming
- Today
  - Tool: ImageMagic “convert”
  - Data: Pictures



6) Task Farming

- Class
  - masterkey.basic.SimpleTaskFarming
  - masterkey.basic.MultiSiteTaskFarming
- Directory with Input files
- Directory with output files
- Executable, arguments, resource to use

```
public class SimpleTaskFarming {
    //USAGE: MACHINE EXECUTABLE INPUT_DIR [ARGUMENTS ...] OUTPUT_DIR
    public static void main(String[] args) throws Exception {
        ResourceBroker broker = GAT.createResourceBroker(new URI(args[0]));

        String executable = args[1];
        String inputdir = args[2];
        String outputdir = args[args.length - 1];

        String[] inputs = listInputs(inputdir, ".jpg");

        Job[] jobs = new Job[inputs.length];

        for (int i = 0; i < inputs.length; i++) {
            SoftwareDescription sd = new SoftwareDescription();
            sd.setExecutable(executable);

            File input = GAT.createFile(inputdir + File.separator + inputs[i]);
            sd.addPreStagedFile(input);
            File output = GAT.createFile(outputdir + File.separator + "out-" + input.getName());
            sd.addPostStagedFile(GAT.createFile(output.getName()), output);

            sd.setStdout(GAT.createFile("stdout-" + i + ".txt"));
            sd.setStderr(GAT.createFile("stderr-" + i + ".txt"));

            // Set the arguments and submit the job.
            sd.setArguments(prepareArguments(input.getName(), getArguments(args),
                    output.getName()));

            jobs[i] = broker.submitJob(new JobDescription(sd));
        }

        waitUntilFinished(jobs);
        GAT.end();
    }
```

```
public class SimpleTaskFarming {
    //USAGE: MACHINE EXECUTABLE INPUT_DIR [ARGUMENTS ...] OUTPUT_DIR
    public static void main(String[] args) throws Exception {
        ResourceBroker broker = GAT.createResourceBroker(new URI(args[0]));

        String executable = args[1];
        String inputdir = args[2];
        String outputdir = args[args.length - 1];

        String[] inputs = listInputs(inputdir, ".jpg");

        Job[] jobs = new Job[inputs.length];

        for (int i = 0; i < inputs.length; i++) {
            File output = GAT.createFile(outputdir + File.separator + "out-" + input.getName());
            sd.addPostStagedFile(GAT.createFile(output.getName()), output);

            sd.setStdout(GAT.createFile("stdout-" + i + ".txt"));
            sd.setStderr(GAT.createFile("stderr-" + i + ".txt"));

            // Set the arguments and submit the job.
            sd.setArguments(prepareArguments(input.getName(), getArguments(args),
                    output.getName()));

            jobs[i] = broker.submitJob(new JobDescription(sd));
        }

        waitUntilFinished(jobs);
        GAT.end();
    }
```

```
public class SimpleTaskFarming {
    //USAGE: MACHINE EXECUTABLE INPUT_DIR [ARGUMENTS ...] OUTPUT_DIR
    public static void main(String[] args) throws Exception {

    for (int i = 0; i < inputs.length; i++) {
        SoftwareDescription sd = new SoftwareDescription();
        sd.setExecutable(executable);

        File input = GAT.createFile(inputdir + File.separator + inputs[i]);
        sd.addPreStagedFile(input);
        File output = GAT.createFile(outputdir + File.separator
                                                + "out-" + input.getName());
        sd.addPostStagedFile(GAT.createFile(output.getName()), output);

        sd.setStdout(GAT.createFile("stdout-" + i + ".txt"));
        sd.setStderr(GAT.createFile("stderr-" + i + ".txt"));

        // Set the arguments and submit the job.
        sd.setArguments(prepareArguments(input.getName(), getArguments(args),
                output.getName()));

        jobs[i] = broker.submitJob(new JobDescription(sd));
    }

    waitUntilFinished(jobs);
    GAT.end();
}
```

```java
public class MultiSiteTaskFarming {
    // USAGE: MACHINE[,MACHINE, ...] EXECUTABLE INPUT_DIR [ARGUMENTS ...] OUTPUT_DIR
    public static void main(String[] args) throws Exception {
        String[] brokerURIs = args[0].split(",");

        ResourceBroker[] brokers = new ResourceBroker[brokerURIs.length];
        for (int i = 0; i < brokers.length; i++) {
            brokers[i] = GAT.createResourceBroker(new URI(brokerURIs[i]));
        }

        // ...

        for (int i = 0; i < inputs.length; i++) {

            ResourceBroker broker = brokers[i % brokers.length];

            jobs[i] = broker.submitJob(jobDescription);
        }

        waitUntilFinished(jobs);
        GAT.end();
    }
```