

Minimum intrusion Grid Introduction



MINIMUM INTRUSION GRID

Jonas Bardino
University of Copenhagen
E-Science

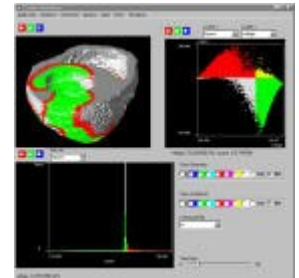
The Grid

- Named after the power-grid
- Sometimes referred to as the information power grid
- Like the power-grid GRID should be powered by large installations
 - not individual generators



Philosophy

- Current 'Internet' mainly allows access to information
- The Grid should provide access to **any** desired resource
 - CPU/SuperComputers
 - Storage
 - Applications



Why is GRID needed

- Science goes virtual
 - A lot of areas turn to computer simulations
 - A wider range of experiments, and cheap!
- Computer power is consolidated in data centres
 - User maintenance can not be expected
 - Better utilization -> cheaper
 - Users still need easy access
 - Resource owners need access control

Problems found in the existing models?

(not every problem in every middleware)

- Single point of failure
- Lack of scheduling
- Poor scalability
- No means of implementing privacy
- No means of utilizing 'cycle-scavenging'
- Firewall dependency
- Highly bloated middleware

MiG Idea

- MiG should address all the previous concerns
- GRID should be a system
 - not just a protocol between sites
- By having a set of servers that **are** GRID we get full control of GRID
 - we upgrade all machines at the same time
- Users and resources do not have to maintain anything

The desired user view of MiG

- MiG should be a virtual computer to the user
- Files are stored within MiG – each user has his own home-directory
 - In job descriptions files are relative to the users home-directory
- We even support interactive applications
- Economically MiG should be fair

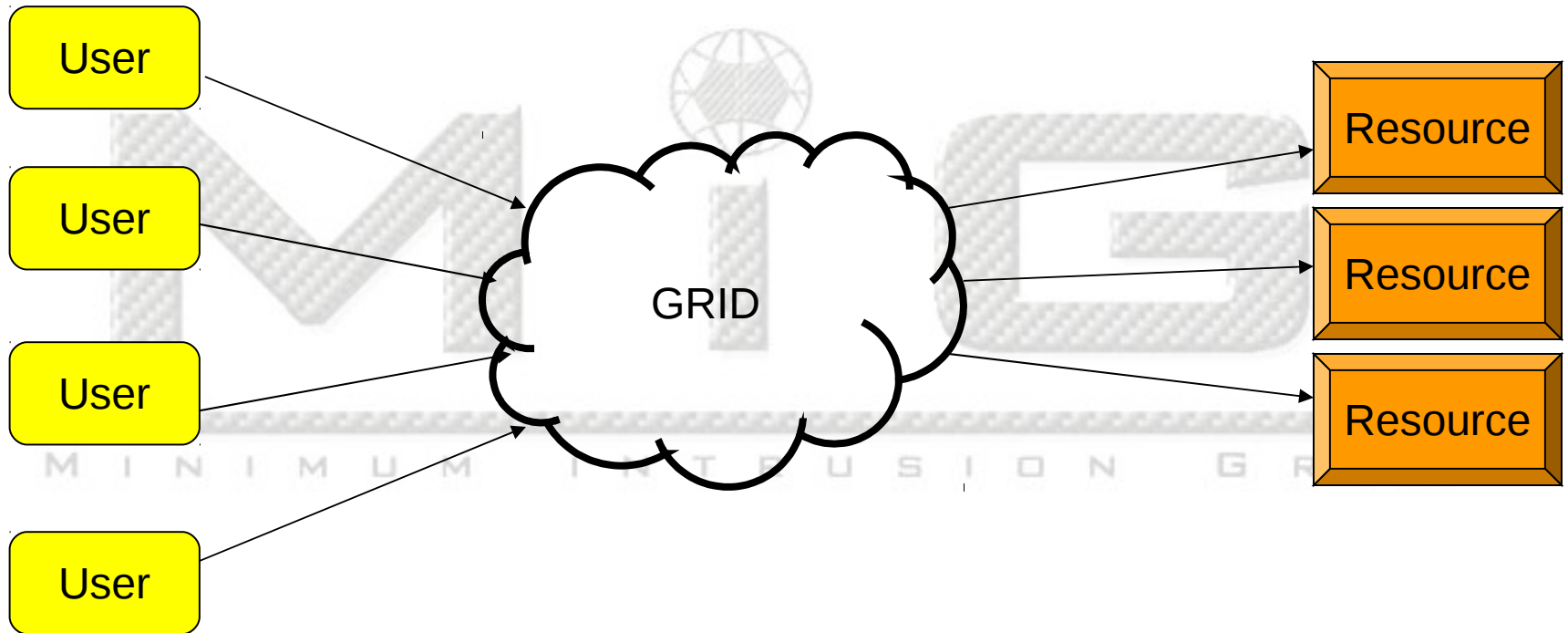
The desired resource view of MiG

- MiG is just another user
 - or set of users
- Economically MiG should be fair

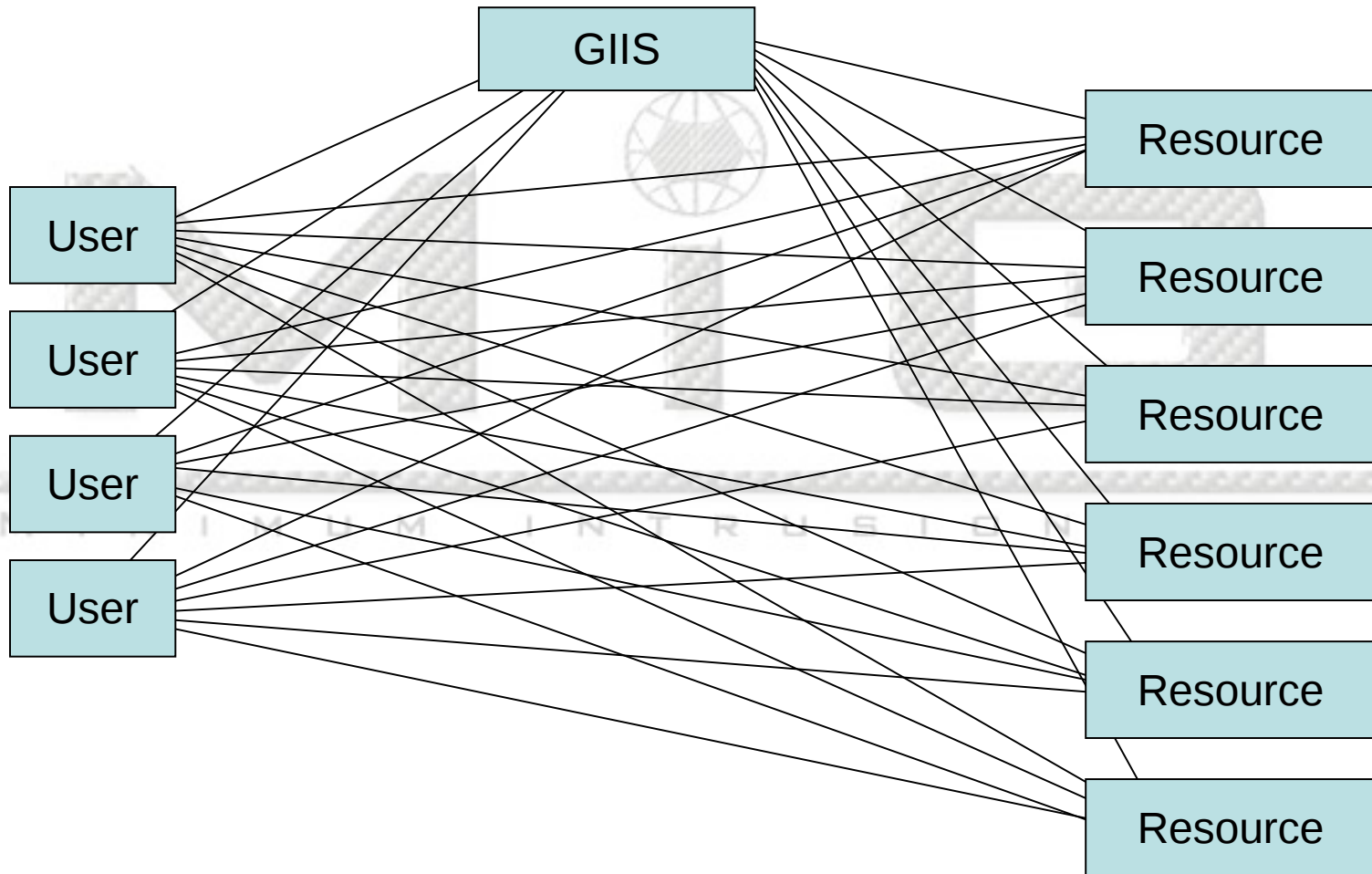
MiG

MINIMUM INTRUSION GRID

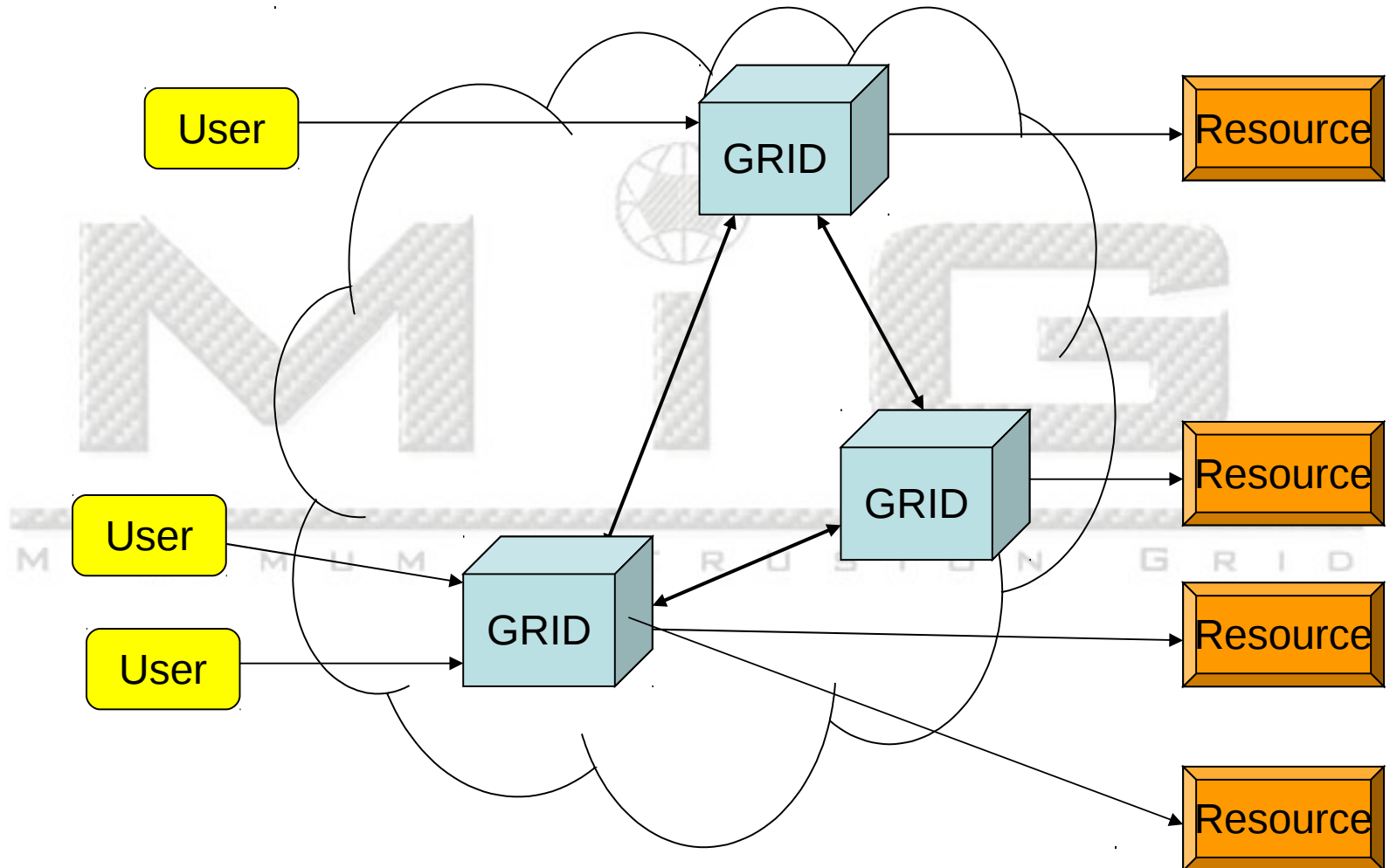
The abstract MiG model



Classic Grid



Minimum intrusion Grid



MiG Rules

- i. **Nothing** produced by MiG can be **required** to be installed on either the resource or client end
- ii. Everything within MiG must be implemented in Python unless another language is absolutely required
- iii. Any design and implementation decision must optimize towards transparency for the users
- iv. Anything that is not right must be thrown away

MiG requirements - User

- Users should depend on **no** installed SW
 - A web-browser should be enough
- In addition to a browser the users need only a certificate
 - A scriptable user-interface is also available – but not required

M I N I M U M I N T R U S I O N G R I D

User view of MiG

The screenshot shows a web browser window titled "Dashboard - Mozilla Firefox". The address bar displays the URL "https://dk.migrid.org/cgi-bin/dashboard.py". The page features a blue header with the "MiG" logo and the text "Minimum intrusion Grid".

Left Sidebar:

- Dashboard
- Submit Job
- Files
- Jobs
- VGrids
- Resources
- Downloads
- Runtime Envs
- Settings
- Shell
- Docs

Main Content Area:

Dashboard

Welcome to the Minimum intrusion Grid

Hi Jonas Bardino

This is your private entry page or your dashboard where you can get a quick status overview and find pointers to help and documentation. When you are logged in with your user certificate, as you are now, you can navigate your pages using the menu on the left.

Your Status

This is a general status overview for your Grid activities. Please note that some of the numbers are cached for a while to keep server load down.

You have submitted a total of 277141 jobs: 0 parse, 0 queued, 0 executing, 266970 finished, 0 retry, 9604 canceled, 0 expired and 567 failed.

3837 resources providing 4185 execution units in total allow execution of your jobs.

Loading disk stats...

Your user certificate expires on May 24 07:52:44 2011 GMT.

Documentation and Help

Minimum intrusion Grid includes some built-in documentation like the

- [Docs page](#)

but additional help, background information and tutorials are available in the

- [external Minimum Intrusion Grid documentation](#)

Personal Settings

Bottom Left: A box shows the current time as "Fri Jan 28 2011 11:02:25 GMT+0100 (CET)". Below it, a "Certificate expires in:" section displays a countdown timer: "115 22 50 18" (Days Hours Minutes Seconds).

Bottom Bar: The word "Done" is visible on the left, and a system tray with icons is on the right.

MiG requirements - Resource

- Resources should only create a MiG user
- As few requirements to the resource as possible
 - support ssh inbound
 - support https outbound
- The system administrator also needs a certificate to register the resource
- Sandboxed systems have different requirements

The desired user view of MiG

- MiG should be a virtual computer to the user
- Files are stored within MiG – each user has his own home-directory
 - In job descriptions files are relative to the users home-directory
- Interactive application support

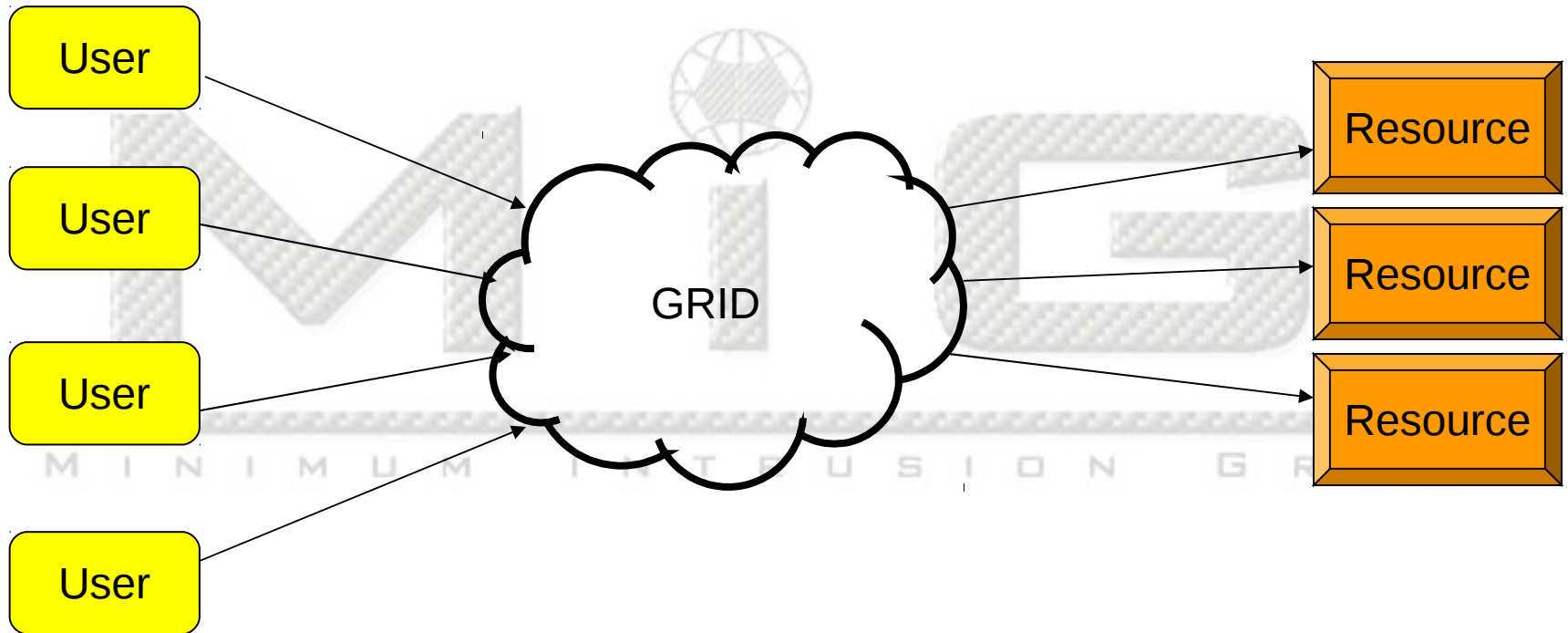
The desired resource view of MiG

- MiG is just another user
 - or set of users
- Economically MiG should be fair

MiG

MINIMUM INTRUSION GRID

The abstract MiG model



Project page


Minimum intrusion Grid - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://www.migrid.org/

Google

Dashboard Minimum intrusion Grid



Minimum intrusion Grid

Welcome to MiG

Welcome to MiG

- About the Project
- Getting started
 - Adding a resource to MiG
 - MiG Sandboxes
- In Danish / På dansk
 - MiG Sandkasser
 - Velkommen til MiG
- People
- Publications
- Related Links
- Student projects
- Tutorials and talks
- Sitemap

Minimum intrusion Grid (MiG) is an attempt to design a new platform for Grid computing which is driven by a stand-alone approach to Grid, rather than integration with existing systems. The goal of the MiG project is to provide Grid infrastructure where the requirements on users and resources alike is as small as possible (minimum intrusion). MiG strives for minimum intrusion but will seek to provide a feature rich and dependable Grid solution.

[Read more ...](#)

[Introduction to MiG in Danish](#)

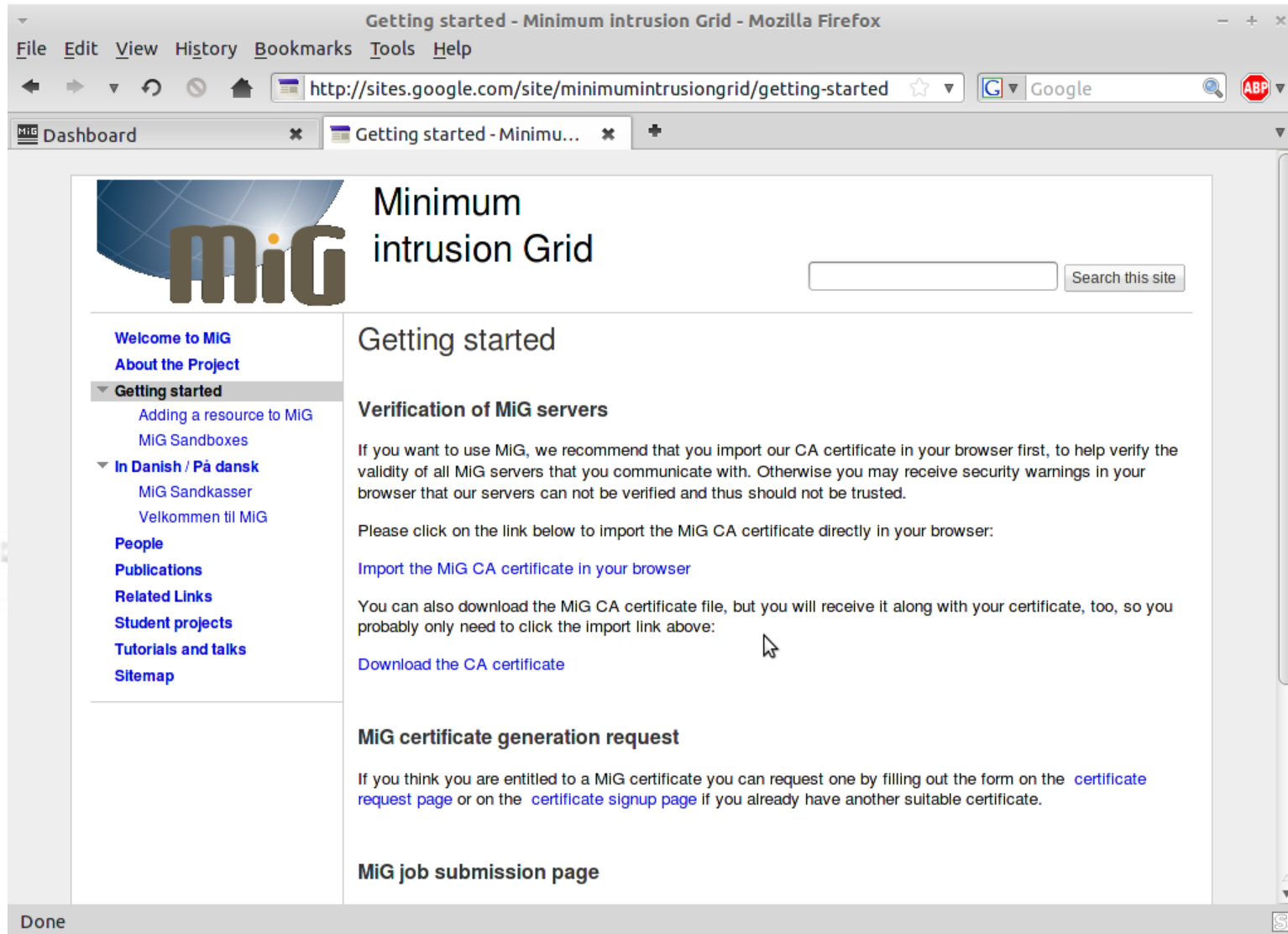
MiG supports Sandboxes to allow anyone to donate spare computing resources to the grid. Further details about sandboxes is available in [Danish](#) and in [English](#).

We additionally maintain MiG projects at [Google Code](#) and [Google Groups](#) to host all our public documentation and code. Please take a look there if you do not find what you look for here.

[Sign in](#) [Recent Site Activity](#) [Terms](#) [Report Abuse](#) [Print page](#) | **Powered by Google Sites**

Done

Getting started



The screenshot shows a Mozilla Firefox browser window with the title "Getting started - Minimum intrusion Grid". The address bar displays the URL "http://sites.google.com/site/minimumintrusiongrid/getting-started". The browser's tab bar shows two tabs: "Dashboard" and "Getting started - Minimu...".

The website content includes a header with the "miG" logo and the text "Minimum intrusion Grid". A search bar is located in the top right corner with the placeholder text "Search this site".

The left sidebar contains a navigation menu with the following links:

- Welcome to MiG
- About the Project
- Getting started (selected)
- Adding a resource to MiG
- MiG Sandboxes
- In Danish / På dansk
 - MiG Sandkasser
 - Velkommen til MiG
- People
- Publications
- Related Links
- Student projects
- Tutorials and talks
- Sitemap

The main content area is titled "Getting started" and contains the following sections:

Verification of MiG servers

If you want to use MiG, we recommend that you import our CA certificate in your browser first, to help verify the validity of all MiG servers that you communicate with. Otherwise you may receive security warnings in your browser that our servers can not be verified and thus should not be trusted.

Please click on the link below to import the MiG CA certificate directly in your browser:

[Import the MiG CA certificate in your browser](#)

You can also download the MiG CA certificate file, but you will receive it along with your certificate, too, so you probably only need to click the import link above:

[Download the CA certificate](#)

MiG certificate generation request

If you think you are entitled to a MiG certificate you can request one by filling out the form on the [certificate request page](#) or on the [certificate signup page](#) if you already have another suitable certificate.



MiG job submission page



The browser's status bar at the bottom shows "Done".

Obtaining a certificate

MiG certificate request - Mozilla Firefox

File Edit View History Bookmarks Tools Help

← → ↺ ↻ 🏠  migrid.org https://dk-sid.migrid.org/cgi-sid/reqcert.py ☆ Google 🔍 

 Dashboard × Getting started - Minimu... ×  MiG certificate request × +

MiG Minimum intrusion Grid

Welcome to the MiG certificate request page

Please enter your information in at least the **mandatory** fields below and press the Send button to submit the certificate request to the MiG administrators.

IMPORTANT: Please help us verify your identity by providing Organization and Email data that we can easily validate!
That is, if You're a student/employee at DIKU, please type DIKU in the Organization field and use your USER@diku.dk address in the Email field.

Full name	<input type="text"/>	1
Organization	<input type="text"/>	2
Email address	<input type="text"/>	3
State	<input type="text"/>	4
Two letter country-code	<input type="text"/>	5
Password	<input type="text"/>	6, 7
Verify password	<input type="text"/>	6, 7
Comment or reason why you should be granted a MiG certificate:	<input type="text"/>	8

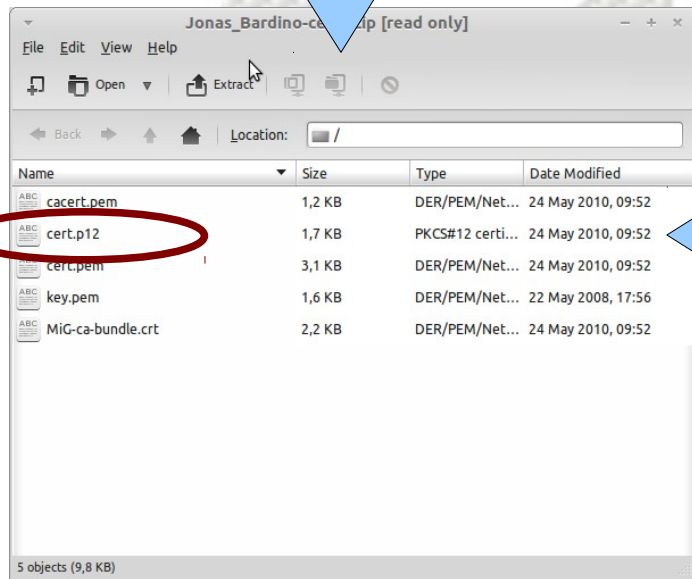
Please note that passwords will be visible to the MiG administrators!

¹ restricted to the characters in 'abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 -@.'
² name or acronym

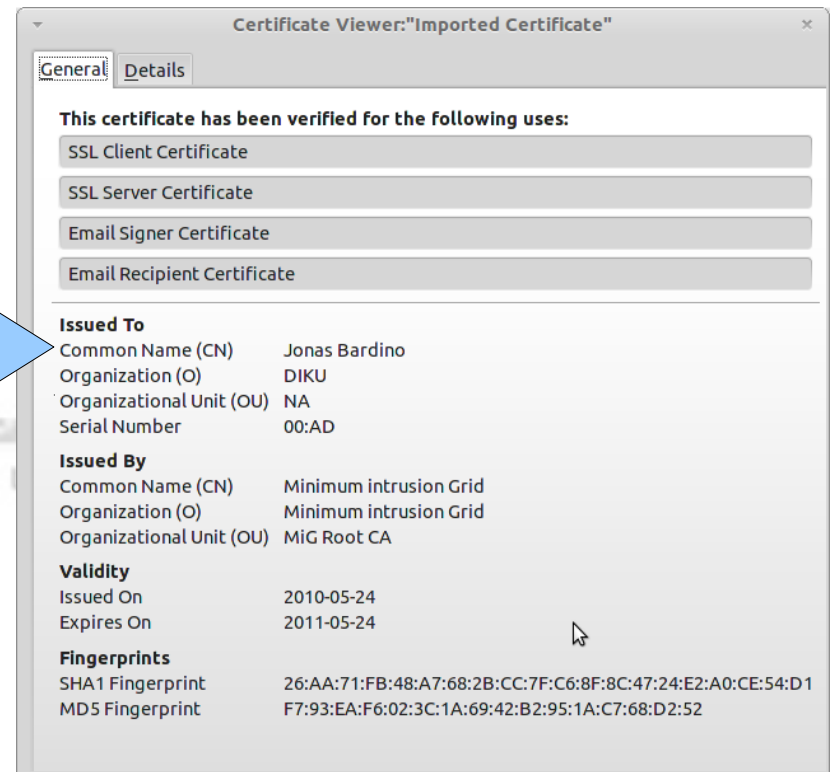
Done

Certificate

Certificate mail



Import
.p12 in
browser



Files

- Each user has a private home on MiG
- Works as a standard UNIX home dir
- GUI file manager and command line access
- Includes shared dirs from virtual org's
- All file refs in MiG are relative to user home

M I N I M U M I N T R U S I O N G R I D

File management

File Manager - Mozilla Firefox

File Edit View History Bookmarks Tools Help

Submit Job File Manager

Dashboard

Submit Job

Files

Jobs

VGrids

Resources

Downloads

Runtime Envs

Settings

Shell

Docs

Sun Jan 30 2011 20:58:43 GMT+0100 (CET)

Certificate expires in:
113 12 54 1
Days Hours Minutes Seconds

MIGMinimum intrusion Grid

File Manager

/

.ssh

BINF

BIRC

CellBlade

DCSC

DEMO

DIKU

DemoGrid

Dock_working_dir

ESS

Farma-BR

GRSfs

GTA-2006

HP-NumPy

ICSUT

IGGKU

MDGrid

MIG-Middleware

MIG-UT

fib.mRSL

fib.out

fib.py

fib.sh

fibdyr

fibon

gridjo

gridjo

gridjo

gridjo

gridjo

cat

head

tail

hello

infile

input.txt

inputfile

io.mRSL

lilhanack sn n

Show

Download

Edit

Copy

Paste

Delete

Rename

Zip

Unzip

submit

228.0 B	mRSL	2009-04-11 15:05
13.00 B	out	2009-30-07 08:50
448.00 B	py	2009-30-07 08:50
588.00 B	sh	2009-30-07 08:50
310.00 B	sh	2009-30-07 08:50
129.00 B	mRSL	2010-27-09 10:45
172.00 B	mRSL	2010-27-09 10:47
172.00 B	mRSL	2010-27-09 10:47
172.00 B	mRSL	2010-27-09 10:47
172.00 B	mRSL	2010-27-09 10:47
172.00 B	mRSL	2010-27-09 10:47
21.00 B	mRSL	2010-30-07 17:22
34.81 KB		2009-30-07 08:50
15.00 B	txt	2011-28-01 16:51
19.00 B		2009-30-07 08:50
159.00 B	mRSL	2011-28-01 16:53
3.39 MR	n	2009-08-09 12:40

172 files in current folder of total 34.24 MB in size.

Subversion commits to project migrid on Google Code

Revision 1418: a few fixes and more information in readme
2011-01-28 11:05:04
Changed Paths: Modify /branches/grid.dk/mig/resource/ll-scripts/MIGllquery.sh ...

Revision 1417: Added subprocess functionality for obtaining sufficient rights when creating a
2011-01-28 10:33:01
Changed Paths: Modify /branches/grid.dk/mig/shared/arcwrapper.py Added subprocess functionality for obtaining ...

Revision 1416: Added first version of resource scripts for LoadLeveler.
2011-01-27 17:47:41
Changed Paths: Add /branches/grid.dk/mig/resource/ll-scripts ...

COPENHAGEN
-4°
Fair
High: 1° Low: -3°
Wind: SSW 4.83km/h

FREDERICIA
-5°
Fog
High: 1° Low: -4°
Wind: SSW 12.87km/h

January 2011

Su	Mo	Tu	We	Th	Fr	Sa
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

Read full forecast

Read full forecast

Test code: 0 Description: OK

https://dk.migrid.org/cgi-bin/fileman.py#edit

File editor

File Manager - Mozilla Firefox

File Edit View History Bookmarks Tools Help

https://dk.migrid.org/cgi-bin/fileman.py

Submit Job File Manager

Minimum intrusion Grid

Dashboard

Submit Job

Files

Jobs

VGrids

Resources

Downloads

Runtime Envs

Settings

Shell

Docs

Sun Jan 30 2011 20:59:03 GMT+0100 (CET)

Certificate expires in:
113 12 53 41
Days Hours Minutes Seconds

File Manager

/

fib.mRSL

228.00 B

mRSL

2009-04-11 15:05

fib.out

13.00 B

out

2009-30-07 08:50

462.00 B

py

2009-30-07 08:50

448.00 B

sh

2009-30-07 08:50

588.00 B

py

2009-30-07 08:50

310.00 B

sh

2009-30-07 08:50

129.00 B

mRSL

2010-27-09 10:45

172.00 B

mRSL

2010-27-09 10:47

172.00 B

mRSL

2010-27-09 10:47

172.00 B

mRSL

2010-27-09 10:47

172.00 B

mRSL

2010-27-09 10:47

21.00 B

mRSL

2010-30-07 17:22

34.81 KB

2009-30-07 08:50

15.00 B

txt

2011-28-01 16:51

19.00 B

2009-30-07 08:50

159.00 B

mRSL

2011-28-01 16:53

3.39 MB

0

2009-08-09 12:40

172 files in current folder of total 34.24 MB in size.

Editor

Select file:
/fib.py

Edit contents:

```
#!usr/bin/python
#
"""Simple recursive Fibonacci"""

import sys

def fib(arg):
    if arg < 2:
        return arg
    return fib(arg-1) + fib(arg-2)

if len(sys.argv) < 2:
    print "Usage: %s VALUE" % sys.argv[0]
    sys.exit(1)

val = 1
```

HTML Editor Txt2Tags Editor Raw text field

Submit file as job after saving ☐

Save Changes Close Download

Subversion commits to project migrid on Google Code

Revision 1418: a few fixes and more information
2011-01-29 11:05:04
Changed Paths: Modify /branches/grid.dk/mig/reso

Revision 1417: Added subprocess functionality
2011-01-29 10:33:01
Changed Paths: Modify /branches/grid.dk/mig/shared/arcwrapper.py Added subprocess functionality for obtaining ...

Revision 1416: Added first version of resource scripts for LoadLeveler.
2011-01-27 17:47:41
Changed Paths: Add /branches/grid.dk/mig/resource/ll-scripts ...

OPENHAGEN
-4°
Fair
High: 1° Low: -3°
SSW 4.83km/h

FREDERICIA
-5°
Fog
High: 1° Low: -4°
Wind: SSW 12.87km/h

January 2011

Su	Mo	Tu	We	Th	Fr	Sa
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

Jobs

- The core of grid applications is jobs
- Typically execution of batch command(s)
- Optionally working on user files
- Jobs are sent to MiG queue
 - Execution when a suitable resource is ready
 - Job handling is done by MiG
 - User may override jobs: hold, cancel, resubmit
- Advanced apps can wrap jobs

Your first job (mRSL)

- Jobs are executed in a standard UNIX shell environment.

The MIG logo is centered in the background. It features the letters 'M', 'I', and 'G' in a large, bold, sans-serif font. The 'I' is replaced by a stylized globe icon. The letters have a light gray, textured fill.

`::EXECUTE::`
`echo 'hello grid!'`

`::CPUTIME::`
`30`

Your first job (submit text)

The screenshot shows a web browser window titled "Submit Job - Mozilla Firefox" with the address bar displaying `https://dk.migrid.org/cgi-bin/submitjob.py`. The page header features the MIG logo and the text "Minimum intrusion Grid". A left sidebar contains navigation links: Dashboard, Submit Job (highlighted), Files, Jobs, VGrids, Resources, Downloads, Runtime Envs, Settings, Shell, and Docs. Below the sidebar, a status box shows the date and time: "Fri Jan 28 2011 11:27:07 GMT+0100 (CET)". A "Certificate expires in:" section displays a countdown: "115 22 25 37" with labels "Days Hours Minutes Seconds".

The main content area is titled "Submit Job" and contains the following text:

This page is used to submit jobs to the grid.

There are 3 interface styles available that you can choose among: [fields style](#), [textarea style](#), [files style](#)

Please note that changes to the job description are *not* automatically transferred if you switch style.

Please enter your mRSL job description below:

Job descriptions can use a wide range of keywords to specify job requirements and actions. Each keyword accepts one or more values of a particular type. The full list of keywords with their default values and format is available in the on-demand [mRSL Documentation](#).

Actual examples for inspiration: [CPU Info](#), [Basic I/O](#), [Job Notification](#), [Povray](#) and [VCR](#)

A large text area for the job description contains the following mRSL script:

```
::EXECUTE::  
echo 'hello grid!'  
  
::CPUTIMETIME::  
30
```

The browser's status bar at the bottom shows "Done".

Alternative (submit fields)

Submit Job - Mozilla Firefox

File Edit View History Bookmarks Tools Help

https://dk.migrid.org/cgi-bin/submitjob.py

MIG Minimum intrusion Grid

- Dashboard
- Submit Job**
- Files
- Jobs
- VGrids
- Resources
- Downloads
- Runtime Envs
- Settings
- Shell
- Docs

Fri Jan 28 2011 11:28:29 GMT+0100 (CET)

Certificate expires in:

115 22 24 16
Days Hours Minutes Seconds

Submit Job

This page is used to submit jobs to the grid.

There are 3 interface styles available that you can choose among: [fields style](#), [textarea style](#), [files style](#)

Please note that changes to the job description are *not* automatically transferred if you switch style.

Please fill in your job description in the fields below:

Please fill in one or more fields below to define your job before hitting Submit Job at the bottom of the page. Empty fields will simply result in the default value being used and each field is accompanied by a help link providing further details about the field.

Execute Commands: [help](#)

echo 'hello grid!'

Input Files: [help](#)

Output Files: [help](#)

Done

Your first job (status)

Job Manager - Mozilla Firefox

File Edit View History Bookmarks Tools Help

https://dk.migrid.org/cgi-bin/jobman.py

textarea Job Manager

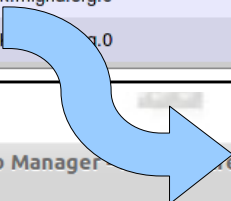
MIG Minimum intrusion Grid

Dashboard
Submit Job
Files
Jobs
VGrids
Resources
Downloads
Runtime Envs

Job Manager

1/1 15 jobs per page load 100 last jobs matching *_2011_*

<input type="checkbox"/> Job ID	Status	Date
<input type="checkbox"/> 334851_1_28_2011__10_34_36_dk.migrid.org.0	QUEUED	Fri Jan 28 10:34:36 2011
<input type="checkbox"/> 334850_1_28_2011__10_33_35_dk.migrid.org.0	FINISHED	Fri Jan 28 10:33:35 2011
<input type="checkbox"/> 334849_1_28_2011__10_31_14_dk.migrid.org.0	FINISHED	Fri Jan 28 10:31:15 2011



Job Manager - Mozilla Firefox

File Edit View History Bookmarks Tools Help

https://dk.migrid.org/cgi-bin/jobman.py

textarea Job Manager

MIG Minimum intrusion Grid

Dashboard
Submit Job
Files
Jobs
VGrids
Resources
Downloads
Runtime Envs

Job Manager

1/1 15 jobs per page load 100 last jobs matching *_2011_*

<input type="checkbox"/> Job ID	Status	Date
<input type="checkbox"/> 334851_1_28_2011__10_34_36_dk.migrid.org.0	FINISHED	Fri Jan 28 10:34:36 2011
<input type="checkbox"/> 334850_1_28_2011__10_33_35_dk.migrid.org.0	FINISHED	Fri Jan 28 10:33:35 2011
<input type="checkbox"/> 334849_1_28_2011__10_31_14_dk.migrid.org.0	FINISHED	Fri Jan 28 10:31:15 2011

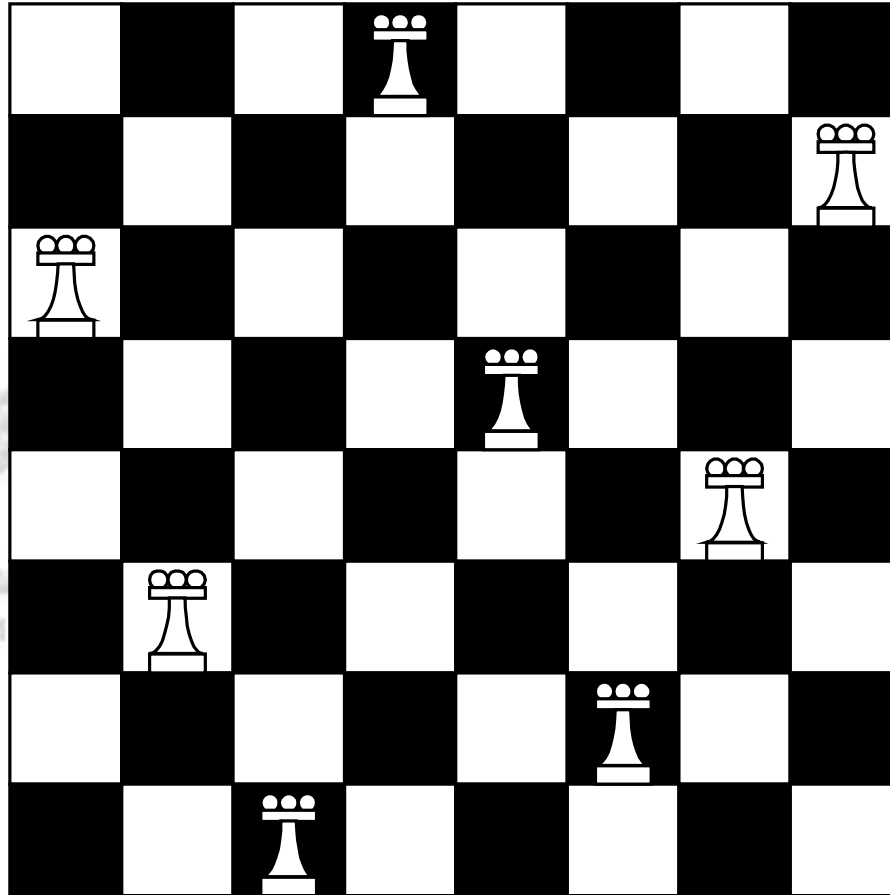
Your first job (result)

The screenshot displays the Minimum Intrusion Grid (MIG) File Manager interface within a Mozilla Firefox browser. The main window shows the file manager for the path `/job_output/334851_1_28_2011__10_34_36_dk.migrid.org/`. A table lists the output files for job 334851_1:

Name	Size	Type	Date Modified
334851_1_28_2011__10_34_36_dk.migrid.org.0.io-status	121.00 B	io-status	2011-28-01 11:37
334851_1_28_2011__10_34_36_dk.migrid.org.0.status	21.00 B	status	2011-28-01 11:37
334851_1_28_2011__10_34_36_dk.migrid.org.0.stderr	0.00 B	stderr	2011-28-01 11:37
334851_1_28_2011__10_34_36_dk.migrid.org.0.stdout	12.00 B	stdout	2011-28-01 11:37

Below the file manager, a terminal window is open, showing the command `echo` and the output `hello grid!`. The terminal window is titled "MIG Submit Job" and has a red circle around the output text. The browser's address bar shows the URL `https://dk.migrid.org/cgi-bin/resm`.

Your first real job (Problem)



<http://dk.migrid.org/public/examples/NQueens.zip>

Your first real job (code)

```
class Queens {  
  
    public int n=8;  
    public int count = 0;  
    int [] all;  
  
    boolean legal(int i){  
        for(int x=0;x<i;x++) {  
            if(all[i]==all[x]) return(false);  
            if(all[x]-(i-x)==all[i]) return(false);  
            if(all[x]+(i-x)==all[i]) return(false);  
        }  
        return(true);  
    }  
  
    void make_boards(int i){  
        for(int y=0;y<n;y++){  
            all[i]=y;  
            if(legal(i)){  
                if(i+1==n) count++;  
                else make_boards(i+1);  
            }  
        }  
    }  
}  
// ...continued on the right
```

```
Queens(int n){  
    this.n=n;  
    all=new int[n];  
    make_boards(0);  
}  
  
public class Nqueens_seq {  
    public static void main(String args[]){  
        int n=8;  
        if(args.length>0) n=new Integer(args[0]).intValue();  
        System.out.println(new Queens(n).count+" with "+n+" queens");  
    }  
}
```

Your first real job (job)

::EXECUTE::

java Nqueens_seq 15

::NOTIFY::

bardino@diku.dk

jabber: jonasbardino@jabber.dk

Please modify to your own
preferred notification type(s)
and address(es) :-)

::INPUTFILES::

NQueens/Nqueens_seq.class Nqueens_seq.class

NQueens/Queens.class Queens.class

::CPUTIME::

100

Your first real job (submit)

The screenshot shows a Mozilla Firefox browser window titled "Submit Job - Mozilla Firefox". The address bar displays the URL `https://dk.magrid.org/cgi-bin/submitjob.py`. The browser has two tabs: "Submit Job" and "Job Manager".

The "Submit Job" page features a left sidebar with navigation links: Dashboard, Submit Job (highlighted), Files, Jobs, VGrids, Resources, Downloads, Runtime Envs, Settings, Shell, and Docs. Below these links, a status bar shows the date and time: "Fri Jan 28 2011 16:03:35 GMT+0100 (CET)". A certificate expiration timer is also present, showing "115 17 49 10" for Days, Hours, Minutes, and Seconds respectively.

The main content area is titled "Submit Job" and contains the following text:

This page is used to submit jobs to the grid.

There are 3 interface styles available that you can choose among: [fields style](#), [textarea style](#), [files style](#)

Please note that changes to the job description are *not* automatically transferred if you switch style.

Please enter your mRSL job description below:

Job descriptions can use a wide range of keywords to specify job requirements and actions. Each keyword accepts one or more values of a particular type. The full list of keywords with their default values and format is available in the on-demand [mRSL Documentation](#).

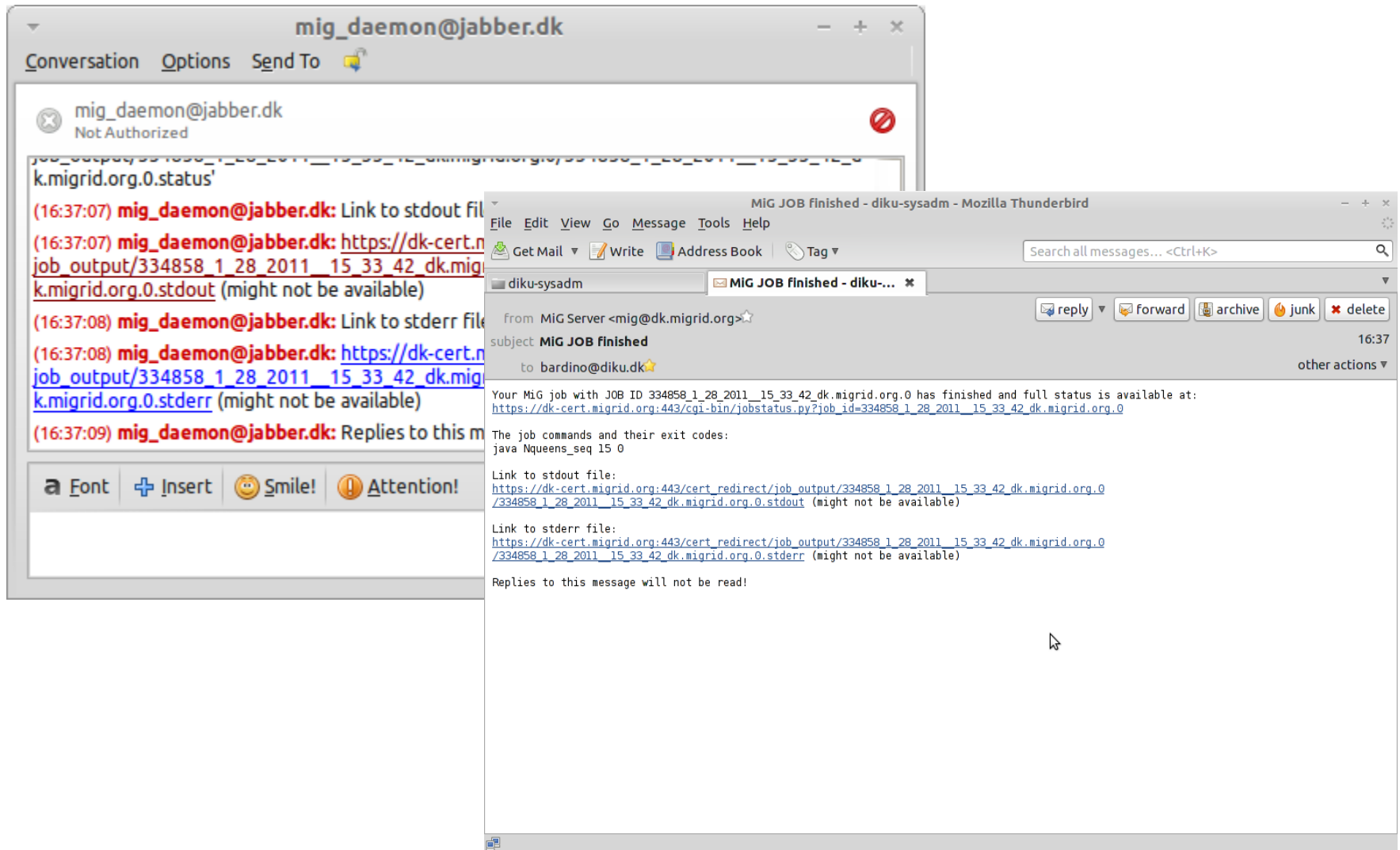
Actual examples for inspiration: [CPU Info](#), [Basic I/O](#), [Job Notification](#), [Povray](#) and [VCR](#)

The job description text area contains the following mRSL script:

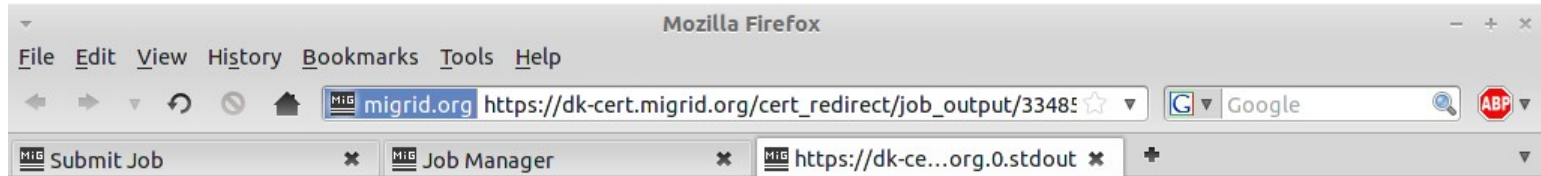
```
::EXECUTE::  
java Nqueens_seq 15  
  
::NOTIFY::  
bardino@diku.dk  
jabber: jonasbardino@jabber.dk  
  
::INPUTFILES::  
NQueens/Nqueens_seq.class Nqueens_seq.class  
NQueens/Queens.class Queens.class  
  
::CPUTIME::  
100
```

The browser status bar at the bottom shows "Done".

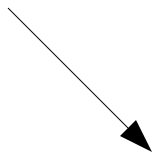
Your first real job (completed)



Your first real job (result)



2279184 with 15 queens



2279184 solutions with 15 queens



Your first real job (assumptions)

- implicit resource assumptions
 - Java VM
 - CPU speed vs CPU time
 - memory, disk requirements
 - ...
- more on runtime environments later

Your first real job (optimizations)

- What did we do
 - Create all possible boards
 - Test each one sequentially
 - $N=15$ takes a while and run times grow fast
- How could we improve run time on Grid?
 - Symmetry?
 - Parallel jobs?
- With optimizations and Grid we may be able to break the current world record!

Jobs with specific requirements

- Architecture
 - In mRSL description
::ARCHITECTURE::
<architecture>
 - or by selecting in drop down box in fields interface
 - x86, AMD64, PS3, ...
- No. of cluster nodes (NODECOUNT)
- No. of CPU's per node (CPUCOUNT)
- MB of memory (MEMORY)
- GB of disk space (DISK)
- VGrid order (VGRID)
- ...

Suitable cluster job (fields)

Submit Job - Mozilla Firefox

File Edit View History Bookmarks Tools Help

https://dk.migrid.org/cgi-bin/submitjob.py

Submit Job Job Manager File Manager

Target Resources: [help](#)

- ☐ fyrgrid.grid.aau.dk.0_*
- ☐ fyrgrid.grid.aau.dk.1_*
- ☐ fyrkat.grid.aau.dk.0_*
- ☐ klynge.ekstranet.diku.dk.0_*
- ☐ pig01.ekstranet.diku.dk.0_*
- ☐ pig02.ekstranet.diku.dk.0_*

VGrid Order: [help](#)

- ☒ ANY
- ☐ BINF
- ☐ BIRC
- ☐ CellBlade
- ☐ DCSC

Number of Nodes: [help](#)

8

Number of CPU Cores: [help](#)

4

CPU/Wall Time (s): [help](#)

300

Memory (MB): [help](#)

1024

Disk (GB): [help](#)

Done

Specific cluster job (fields)

Submit Job - Mozilla Firefox

File Edit View History Bookmarks Tools Help

https://dk.migrid.org/cgi-bin/submitjob.py

Submit Job Job Manager File Manager

Target Resources: [help](#)

- ☐ fyrgnd.grid.aau.dk.0_*
- ☐ fyrgnd.grid.aau.dk.1_*
- ☐ fyrgnd.grid.aau.dk.0_*
- ☒ klynge.ekstranet.diku.dk.0_*
- ☐ pig01.ekstranet.diku.dk.0_*
- ☐ pig02.ekstranet.diku.dk.0_*

VGrid Order: [help](#)

- ☒ ANY
- ☐ BINP
- ☐ BIRC
- ☐ CellBlade
- ☐ DCSC

Number of Nodes: [help](#)

8

Number of CPU Cores: [help](#)

4

CPU/Wall Time (s): [help](#)

300

Memory (MB): [help](#)

1024

Disk (GB): [help](#)

Done

Runtime Environments

- Resource and User contract

- without them almost nothing is guaranteed
- used to negotiate apps and libs in a generic fashion
- anyone can define them, but only resource owners can specify which ones they implement and how
- no spec update is possible, always create new

- Examples

- PYTHON-2 (any Python 2.X interpreter)
 - resource owner specifies PYTHON=/path/to/python
 - user knows that \$PYTHON contains actual path in job
- Java support
- Local files, devices or markers

Runtime environments (Task)

Fibonacci number - Wikipedia, the free encyclopedia - Iceweasel

File Edit View History Bookmarks Tools Help

W http://en.wikipedia.org/wiki/Fibonacci_number

Tartu In... Welcom... Estonia... Tallinn ... Basic E... Comm... Tux Trai... Tux Trai... fibonac... W Fib...

Your **continued donations** keep Wikipedia running! Log in / create account

article discussion edit this page history

Have questions? Find out how to ask questions and get answers.

Fibonacci number

From Wikipedia, the free encyclopedia

In **mathematics**, the **Fibonacci numbers** are a **sequence** of numbers named after **Leonardo of Pisa**, known as Fibonacci. Fibonacci's 1202 book *Liber Abaci* introduced the sequence to Western European mathematics, although the sequence had been previously described in **Indian mathematics**.^{[1][2]}

The first number of the sequence is 0, the second number is 1, and each subsequent number is equal to the sum of the previous two numbers of the sequence itself. In mathematical terms, it is defined by the following **recurrence relation**:

$$F(n) = \begin{cases} 0 & \text{if } n = 0; \\ 1 & \text{if } n = 1; \\ F(n-1) + F(n-2) & \text{if } n > 1. \end{cases}$$

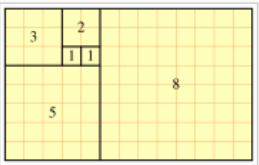
That is, after two starting values, each number is the sum of the two preceding numbers. The first Fibonacci numbers (sequence A000045 in OEIS), also denoted as F_n , for $n = 0, 1, 2, \dots, 20$ are:^{[3][4]}

F_0	F_1	F_2	F_3	F_4	F_5	F_6	F_7	F_8	F_9	F_{10}	F_{11}	F_{12}	F_{13}	F_{14}	F_{15}	F_{16}	F_{17}	F_{18}	F_{19}	F_{20}
0	1	1	2	3	5	8	13	21	34	55	89	144	233	377	610	987	1597	2584	4181	6765

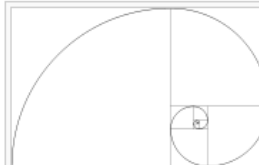
Every 3rd number of the sequence is odd and more generally, every k th number of the sequence is a multiple of F_k .

The sequence extended to negative index n satisfies $F_n = F_{n-1} + F_{n-2}$ for all integers n , and $F_{-n} = (-1)^{n+1} F_n$.

..., -8, 5, -3, 2, -1, 1, followed by the sequence above.



A tiling with squares whose sides are successive Fibonacci numbers in length



<http://dk.migrid.org/public/examples/SimpleJobs.zip>

Runtime Environments (job)

```
::EXECUTE::  
$PYTHON fib.py 26
```

```
::EXECUTABLES::  
fib.py
```

```
::MEMORY::  
256
```

```
::CPUTIME::  
300
```

```
::RUNTIMEENVIRONMENT::  
PYTHON-2
```



Runtime Environments (submit)

Dashboard

Submit Job

Files

Jobs

VGrids

Resources

Downloads

Runtime Envs

Settings

Shell

Docs

Sun Jan 30 2011 21:00:53
GMT+0100 (CET)

Certificate expires in:
113 12 51 52
Days Hours MinutesSeconds

Submit Job - Mozilla Firefox

https://dk.migrid.org/cgi-bin/submitjob.py

Google

Minimum Intrusion Grid

Submit Job

This page is used to submit jobs to the grid.

There are 3 interface styles available that you can choose among: [fields style](#), [textarea style](#), [files style](#)

Please note that changes to the job description are "not" automatically transferred if you switch style.

Please enter your mRSL job description below:

Job descriptions can use a wide range of keywords to specify job requirements and actions.
Each keyword accepts one or more values of a particular type.
The full list of keywords with their default values and format is available in the on-demand [mRSL Documentation](#).

Actual examples for inspiration: [CPU Info](#), [Basic I/O](#), [Job Notification](#), [Povray](#) and [VCR](#)

```
::EXECUTE::  
$PYTHON fib.py 26  
  
::EXECUTABLES::  
fib.py  
  
::MEMORY::  
256  
  
::CPU::  
300  
  
::RUNTIMEENVIRONMENT::  
PYTHON-2  
  
::VGRID::  
ANY
```


☐ Save as default job template

Submit Job

Subversion commits to project migrid on Google Code

Revision 1418: a few fixes and more information in readme
2011-01-28 11:05:04
Changed Paths: Modify /branches/grid.dk/mig/resource/ll-scripts/MIGlquery.sh ...

Revision 1417: Added subprocess functionality for obtaining sufficient rights when creating a
2011-01-28 10:33:01
Changed Paths: Modify /branches/grid.dk/mig/shared/arcwrapper.py Added subprocess functionality for obtaining ...


Read full forecast

COPENHAGEN
-4°
Fair
High: 1° Low: -3°
Wind: SSW 4.83km/h

FREDERICIA

January 2011

Su	Mo	Tu	We	Th	Fr	Sa
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15

https://dk.migrid.org/cgi-bin/fileman.py

Runtime Environments (result)



Fibonacci number 26 is 121393

Runtime Environments (optimizations)

- Horrible performance due to repeated calls
 - recursion calls exact same function many times
- Dynamic programming greatly improves it
 - save result and reuse instead of calling again
- Can we split up in parallel jobs?

MINIMUM INTRUSION GRID

Viewing Runtime Environments

Runtime Environments - Mozilla Firefox

File Edit View History Bookmarks Tools Help

https://dk.migrid.org/cgi-bin/redb.py

Runtime Environments Runtime environment det...

MIG Minimum intrusion Grid

- Dashboard
- Submit Job
- Files
- Jobs
- VGrids
- Resources
- Downloads
- Runtime Envs**
- Settings
- Shell
- Docs

Sat Jan 29 2011 14:56:45 GMT+0100 (CET)

Certificate expires in:

114 18 56 0
Days Hours Minutes Seconds

Runtime Environments

Runtime environments specify software/data available on resources.

[Documentation on runtime environments](#)

Existing runtime environments

1/3 25 runtime envs per page

Name	Description	Resources	Created
AMBER10	Assisted Model Building with Energy Refinement or AMBER is a molecular simulation suite.	3	Fri Jan 23 12:25:07 2009
BASH-ANY-1	Bash is a common UNIX shell	10	Mon Aug 23 14:01:35 2010
GAWK-ANY-1	'awk', a program that you can use to select particular records in a file and perform operations upon them. Gawk is the GNU Project's implementation of the AWK programming language. It conforms to the definition of the language in the POSIX 1003.2 Command Language And Utilities Standard. This version in turn is based on the description in The AWK Programming Language, by Aho, Kernighan, and Weinberger, with the additional features defined in the System V Release 4 version of UNIX awk. Gawk also provides more recent Bell Labs awk extensions, and some GNU-specific extensions.	3	Mon Aug 23 13:21:25 2010

https://dk.migrid.org/cgi-bin/showre.py?re_name=PYTHON-2

Inspect Runtime Environment

Runtime environment details - Mozilla Firefox

File Edit View History Bookmarks Tools Help

https://dk.migrid.org/cgi-bin/showre.py?re_name=PYTHON-2

Google

MIG Runtime Environments x MIG Runtime environment det... x

MIG Minimum intrusion Grid


- Dashboard
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- Runtime Envs
- Settings
- Shell
- Docs

Sat Jan 29 2011 14:57:08 GMT+0100 (CET)

Certificate expires in:

114 18 55 37
Days Hours Minutes Seconds

Show runtime environment details

Name	PYTHON-2
Description	Any Python in the 2.X series
Needed software	
Name:	Python
Url:	http://www.python.org
Description:	Python 2.X
Version:	2.X
Environment variables	Name: PYTHON (use with \$PYTHON)
	Example: /usr/bin/python
	Description: Path to the python interpreter
Created	Wed Mar 12 16:20:27 2008
Creator	/C=DK/ST=NA/L=NA/O=DIKU/OU=NA/CN=Jonas Bardino/emailAddress=bardino@diku.dk
Job count	(not implemented yet)
Resources	fyrgrid.grid.aau.dk.0, fyrgrid.grid.aau.dk.1, d3c374876deccef6cfb6df3095891167, 97e31517734ca6e80c376cdae1d5697e, pig01.ekstranet.diku.dk.0, pig02.ekstranet.diku.dk.0, ...

Done

Adding Runtime Environments

adminre - Mozilla Firefox

File Edit View History Bookmarks Tools Help

https://dk.migrid.org/cgi-bin/adminre.py

MIG Minimum Intrusion Grid

- Dashboard
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- Docs

Sun Jan 30 2011 21:17:02 GMT+0100 (CET)

Certificate expires in:
113 12 35 42
Days Hours Minutes Seconds

Create runtime environment

Use existing RE as template

Note that a runtime environment can not be changed or removed when it has been created, so please be careful when filling in the details

Changing the number of software and environment entries removes all data in the form, so please enter the correct values before entering any information.

Number of needed software entries

Number of environment entries

Runtime environment has a testprocedure

RE Name
(eg. DALTON-3.0, must be unique):


Description:

Needed Software:
name= # required
version= # required
url= # required
description= # required
icon= # required

Environments:
name= # required
example= # required
description= # required

Subversion commits to project migrid on Google Code

Revision 1418: a few fixes and more information in readme
2011-01-28 11:05:04
Changed Paths: Modify /branches/grid.dk/mig/resource/ll-scripts/MiGllquery.sh ...

 **COPENHAGEN**
-3°
Fair
High: 1° Low: -3°
Wind: SSE 9.66km/h

January 2011

Su	Mo	Tu	We	Th	Fr	Sa
						1

Done

VGrids

- Best thing since sliced bread ☺
- VGrids are Virtual Organizations in MiG
- They are a dead easy way to create collaborations
 - Share files
 - Share resources
 - Private web page / portal
 - Public web page / portal
 - Private Wikis
- Private repository with revision control (Mercurial)



N G R I D

View VGrids

Dashboard

Submit Job

Files

Jobs

VGrids

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Runtime Envs

Settings

Shell

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Sun Jan 30 2011 21:22:56 GMT+0100 (CET)

Certificate expires in:
113 12 29 48
Days Hours Minutes Seconds

VGrid administration - Mozilla Firefox

File Edit View History Bookmarks Tools Help

https://dk.migrid.org/cgi-bin/vgridadmin.py

Google

MIG

Minimum intrusion Grid

VGrids

VGrids share files and resources. Members can access web pages, files and resources, owners can also edit pages, as well as add and remove members or resources.

VGrids managed on this server

1/4 25 VGrids per page

Name	Private web pages	Public web pages	Owner Wiki	Member Wiki	Owner SCM	Member SCM	Monitor
Generic	View
GINF	Edit View	Edit View	Open	Open	View	View	View
BiRC	Edit View	Edit View	Open	Open	View	View	View
CellBlade	Edit View	Edit View	Open	Open	View	View	View
DCSC	Edit View	Edit View	Open	Open	View	View	View
DEMO	Edit View	Edit View	Open	Open	View	View	View
Demovgrid	Edit View	Edit View	Open	Open	View	View	View
Demovgrid/test	Edit View	Edit View	Open	Open	View	View	View
DIKU	Edit View	Edit View	Open	Open	View	View	View
ESS	Edit View	Edit View	Open	Open	View	View	View
ESS/Controls	Edit View	Edit View	Open	Open	View	View	View
Farma-BR	Edit View	Edit View	Open	Open	View	View	View
GRSIs	Edit View	Edit View	Open	Open	View	View	View
GTA-2006	Edit View	Edit View	Open	Open	View	View	View
HP-NumPy	Edit View	Edit View	Open	Open	View	View	View
ICSUT	Edit View	Edit View	Open	Open	View	View	View
IGGKU	Edit View	Edit View	Open	Open	View	View	View
MDGrid	Edit View	Edit View	Open	Open	View	View	View
MIG-developers	Edit View	Edit View	Open	Open	View	View	View
MIG-Middleware	Edit View	Edit View	Open	Open	View	View	View
NBIroengten	Edit View	Edit View	Open	Open	View	View	View
Online-CT	Edit View	Edit View	Open	Open	View	View	View
Papers	Edit View	Edit View	Open	Open	View	View	View
povray	Edit View	Edit View	Open	Open	View	View	View
ratalosk	Edit View	Edit View	Open	Open	View	View	View

VGrid Totals

View a monitor page with all VGrids/resources you can access

Additional VGrids

Please enter a name for the new VGrid to add, using slashes to specify nesting. I.e. if you own a VGrid called ABC, you can create a sub-VGrid called DEF by entering ABC/DEF below.

Create VGrid

Done

VGrid creation

VGrid administration - Mozilla Firefox

File Edit View History Bookmarks Tools Help

https://dk.migrid.org/cgi-bin/vgridadmin.py

MIG Minimum intrusion Grid

Dashboard
Submit Job
Files
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Downloads
Runtime Envs
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Docs

Sun Jan 30 2011 21:22:56 GMT+0100 (CET)

Certificate expires in:
113 12 29 48
Days Hours Minutes Seconds

VGrids

VGrids share files and resources. Members can access web pages, files and resources, owners can also edit pages, as well as add and remove members or resources.

VGrids managed on this server

1/4 25 VGrids per page

Name	Private web pages	Public web pages	Owner Wiki	Member Wiki	Owner SCM	Member SCM	Monitor
Generic	---	---	---	---	---	---	View
BINF	Edit	View	Open	Open	View	View	View
BIRC	Edit	View	Open	Open	View	View	View
CellBlade	Edit	View	Open	Open	View	View	View
DCSC	Edit	View	Open	Open	View	View	View
DEMO	Edit	View	Open	Open	View	View	View
DemoVgrid	Edit	View	Open	Open	View	View	View
DemoVgrid/test	Edit	View	Open	Open	View	View	View
DIKU	Edit	View	Open	Open	View	View	View
ESS	Edit	View	Open	Open	View	View	View
ESS/Controls	Edit	View	Open	Open	View	View	View
Farma-BR	Edit	View	Open	Open	View	View	View
GRSIs	Edit	View	Open	Open	View	View	View
GTA-2006	Edit	View	Open	Open	View	View	View
HP-NumPy	Edit	View	Open	Open	View	View	View
ICSUT	Edit	View	Open	Open	View	View	View
IGGKU	Edit	View	Open	Open	View	View	View
MDGrid	Edit	View	Open	Open	View	View	View
MIG-developers	Edit	View	Open	Open	View	View	View
MIG-Middleware	Edit	View	Open	Open	View	View	View
NBlroengten	Edit	View	Open	Open	View	View	View
Online-CT	Edit	View	Open	Open	View	View	View
Papers	Edit	View	Open	Open	View	View	View
povray	Edit	View	Open	Open	View	View	View
ratafosk	Edit	View	Open	Open	View	View	View

VGrid Totals

[View a monitor page with all VGrids/resources you can](#)

Additional VGrids

Please enter a name for the new VGrid to add, using slashes to specify nesting. I.e. if you own a VGrid called ABC, you can create a sub-VGrid called DEF by entering ABC/DEF below.

Create VGrid

Type VGrid name and press Create VGrid

VGrid creation

VGrid administration - Mozilla Firefox

File Edit View History Bookmarks Tools Help

https://dk.migrid.org/cgi-bin/vgridadmin.py

MIG Minimum intrusion Grid

VGrids

VGrids share files and resources. Members can access web pages, files and resources, owners can also edit pages, as well as add members.

VGrids managed on this server

1/4 25 VGrids per page

Name	Private web pages	Owner SCM	Member SCM	Monitor
Generic	---	---	---	View
BINF	Edit	View	View	View
BIRC	Edit	View	View	View
CellBlade	Edit	View	View	View
DCSC	Edit	View	View	View
DEMO	Edit	View	View	View
DemoVgrid	Edit	View	View	View
DemoVgrid/test	Edit	View	View	View
DIKU	Edit	View	View	View
ESS	Edit	View	View	View
ESS/Controls	Edit	View	View	View
Farma-BR	Edit	View	View	View
GRSIs	Edit	View	View	View
GTA-2006	Edit	View	View	View
HP-NumPy	Edit	View	View	View
ICSUT	Edit	View	View	View
IGGKU	Edit	View	View	View
MDGrid	Edit	View	View	View
MIG-developers	Edit	View	View	View
MIG-Middleware	Edit	View	View	View
NBlroengten	Edit	View	View	View
Online-CT	Edit	View	View	View
Papers	Edit	View	View	View
povray	Edit	View	View	View
ratafosk	Edit	View	View	View

VGrid Totals

[View a monitor page with all VGrids/resources you can](#)

Additional VGrids

Please enter a name for the new VGrid to add, using slashes to specify nesting. I.e. if you own a VGrid called ABC, you can create a sub-VGrid called DEF by entering ABC/DEF below.

[Create VGrid](#)

You can even create VGrids within VGrids – just name the VGrid as a subdirectory

Type VGrid name and press Create VGrid

VGrids appear as subdirectories

File Manager - Mozilla Firefox

File Edit View History Bookmarks Tools Help

https://dk.migrid.org/cgi-bin/fileman.py

MIG Minimum intrusion Grid

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Submit Job
Files
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Sun Jan 30 2011 21:28:13 GMT+0100 (CET)

Certificate expires in:
113 12 24 31
Days Hours Minutes Seconds

File Manager

/DIKU/

/

- .ssh
- BINF
- BIRC
- CellBlade
- DCSC
- DEMO
- DIKU** (selected) - DIKU - VGrid shared files directory
- DemoGrid
- Dock_working_dir
- ESS
- Farma-BR
- GRSIs
- GTA-2006
- HP-NumPy
- ICSUT
- IGGKU
- MDGrid
- MIG-Middleware
- MIG-UT

Name	Size	Type	Date Modified
Radiation	4.00 KB	dir	2010-25-02 23:57
successful_scale	4.00 KB	dir	2010-15-04 16:34
test	4.00 KB	dir	2011-05-01 13:15
ct.png	262.51 KB	png	2010-11-04 19:45
fail	178.01 MB		2010-20-05 18:46
Nqueens_seq.class	946.00 B	class	2010-11-04 20:04
Queens.class	842.00 B	class	2010-11-04 20:04
radiation_Dynamic_Orchestration.py	8.01 KB	py	2010-11-04 20:55
radiation_Dynamic_Orchestration.pyc	5.55 KB	pyc	2010-11-04 20:55
radiation_Sequential.py	2.64 KB	py	2010-11-04 19:46
radiation_v6.pyc	5.47 KB	pyc	2010-11-04 20:12
radiationgraphics.py	1.61 KB	py	2010-11-04 19:46
radiationgraphics.pyc	2.09 KB	pyc	2010-11-04 20:12
test.py	987.00 B	py	2010-11-04 21:42
test.pyc	806.00 B	pyc	2010-11-04 21:42
timer.py	1.34 KB	py	2010-11-04 19:46
timer.pyc	3.08 KB	pyc	2010-11-04 20:13

17 files in current folder of total 178.31 MB in size.

Subversion commits to project migrid on Google Code

Revision 1418: a few fixes and more information in readme
2011-01-28 11:05:04
Changed Paths: Modify /branches/grid.dk/mig/resource/ll-scripts/MIGQuery.sh ...

Revision 1417: Added subprocess functionality for obtaining sufficient rights when creating a
2011-01-28 10:33:01
Changed Paths: Modify /branches/grid.dk/mig/shared/arcwrapper.py Added subprocess functionality for obtaining ...

Revision 1416: Added first version of resource scripts for LoadLeveler.
2011-01-27 17:47:41
Changed Paths: Add /branches/grid.dk/mig/resource/ll-scripts ...

COPENHAGEN
-3°
Fair
High: 1° Low: -3°
Wind: SSE 9.66km/h
Read full forecast

FREDERICIA
-5°
Fog
High: 1° Low: -4°
Wind: SSW 8.05km/h
Read full forecast

January 2011

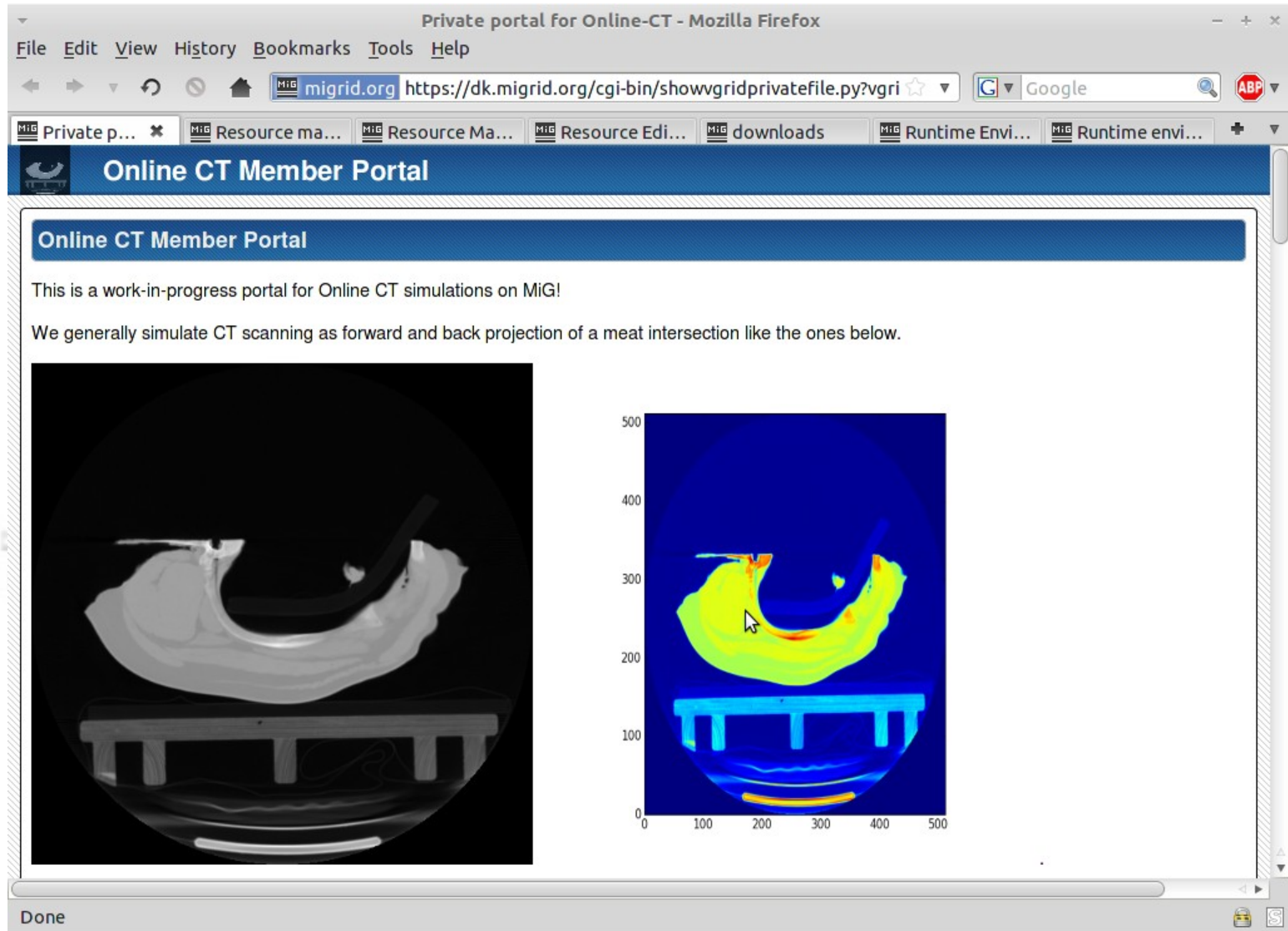
Su	Mo	Tu	We	Th	Fr	Sa
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

Exit code: 0 Description: OK

Done

© 2003-2010 The MIG Project



VGrid private homepage I










VGrid private homepage II

Private portal for Online-CT - Mozilla Firefox

File Edit View History Bookmarks Tools Help

← → ↺ ↻ 🏠  migrid.org <https://dk.migrid.org/cgi-bin/showvgridprivatefile.py?vgri> ☆ 🔍 Google 

 Private p... ✕  Resource ma...  Resource Ma...  Resource Edi...  downloads  Runtime Envi...  Runtime envi... +

Live Results

It is now possible to run the entire simulation on the Grid without touching any code or command lines. Just select number/position of sources below and click 'Run' to start a simulation. You can select an input image and no projection to run a full simulation, or select projection data to load saved projection results and only run the reconstruction part of the simulation using those projection data. The optional filter is applied to the projection data before the reconstruction in order to enhance certain features like edges on the reconstructed image. Notification is optional, too, and uses the addresses you have set on your MiG Settings page.

Input image

Projection data

Sources ☒ equidistant ☐ random ☐ bit string ☐ colon-separated list of angles (degrees)

Filter

Result notification

Extra simulation arguments (only for experts!)

Your latest jobs are monitored below with updates every two minutes:

Done

VGrid public homepage

Public page for Online-CT - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://dk.migrid.org/vgrid/Online-CT/index.html

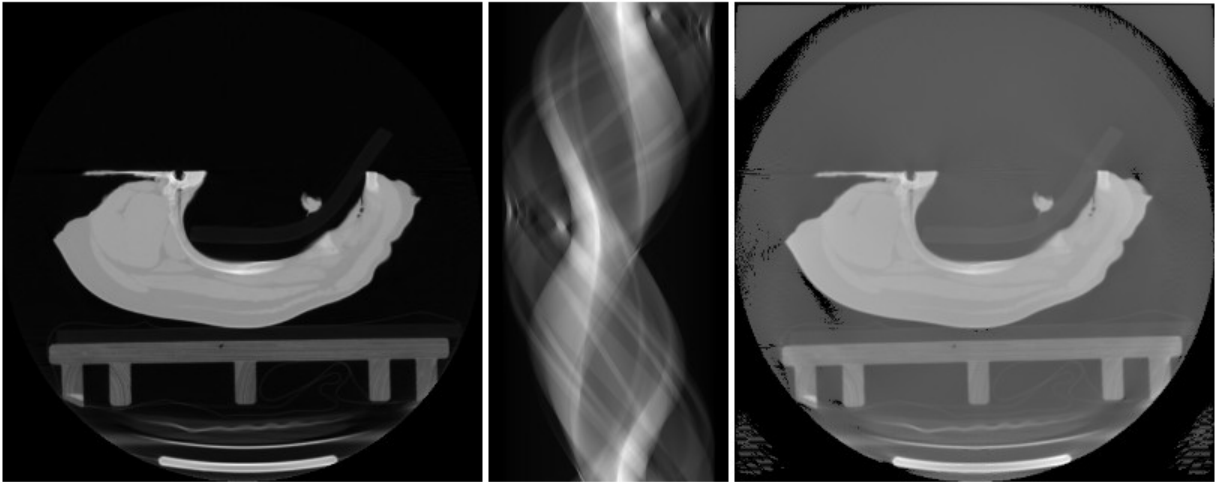
Google

Online CT

Online CT Scanning

Welcome to the public Online-CT page!

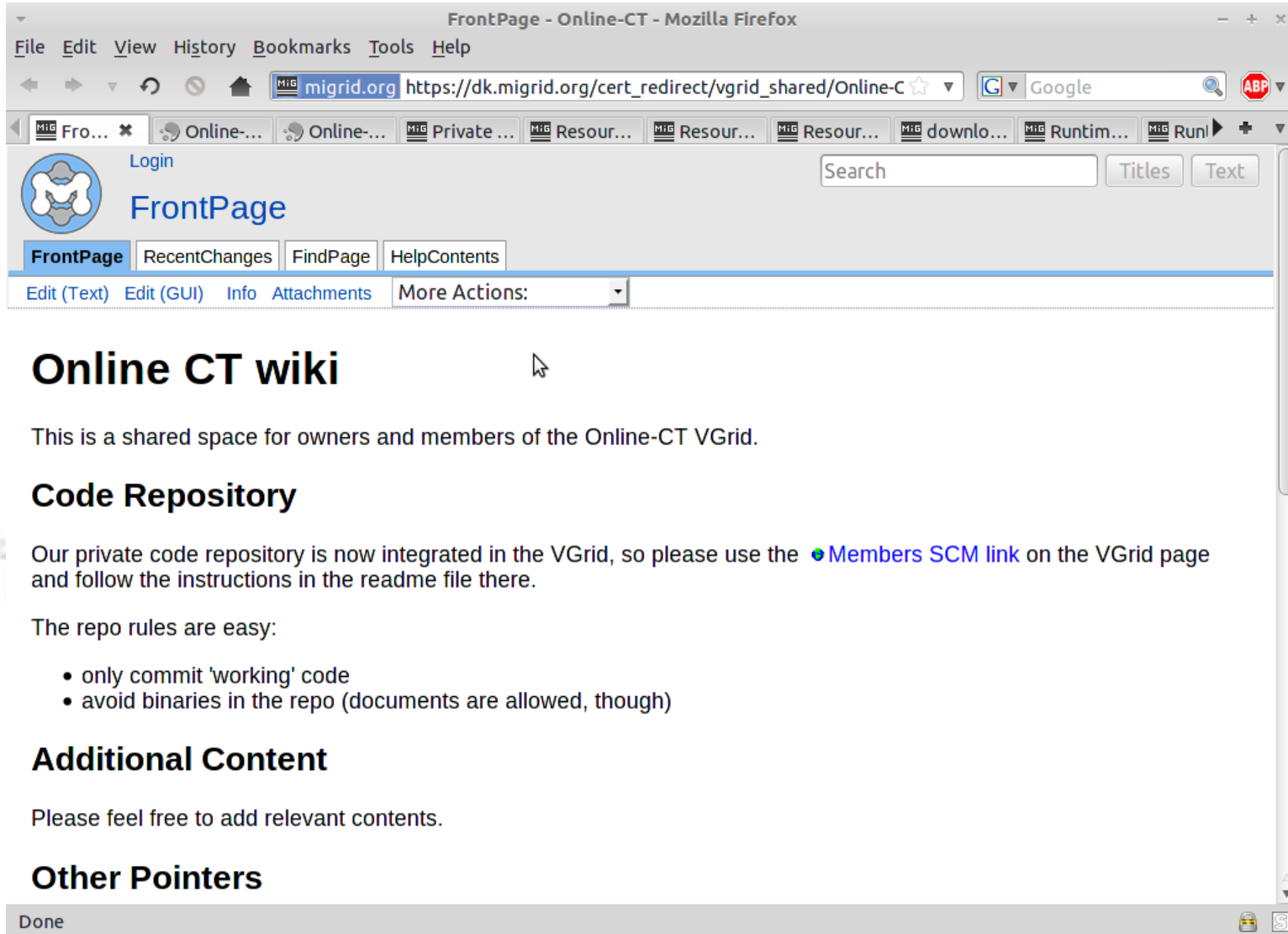
Online-CT is a project focused on developing and building a solution for efficient analysis and cutting of pork carcasses in slaughterhouses. The analysis is based on CT scanning and online reconstruction of the intersection images in the actual production line, so the results must be available within seconds in order to keep up with the flow. As an example the intersection image below could result in detector readings as visualized in the sinogram, and we can then use e.g. filtered back projection to obtain an estimate of the actual intersection. This sinogram was obtained through a forward projection with the target image, but in the real setup we will only have the detector readings from the CT scan.



The sinogram and reconstructed image above are from a high resolution scan, so the reconstruction yields a result quite close to the real image.

Done

VGrid private wiki



FrontPage - Online-CT - Mozilla Firefox

File Edit View History Bookmarks Tools Help

migrid.org https://dk.migrid.org/cert_redirect/vgrid_shared/Online-C

Google

Search Titles Text

Login

FrontPage

RecentChanges FindPage HelpContents

Edit (Text) Edit (GUI) Info Attachments More Actions:

Online CT wiki

This is a shared space for owners and members of the Online-CT VGrid.

Code Repository

Our private code repository is now integrated in the VGrid, so please use the [Members SCM link](#) on the VGrid page and follow the instructions in the readme file there.

The repo rules are easy:

- only commit 'working' code
- avoid binaries in the repo (documents are allowed, though)

Additional Content

Please feel free to add relevant contents.

Other Pointers

Done

VGrid private SCM I

Online-CT member SCM repository: shortlog - Mozilla Firefox

File Edit View History Bookmarks Tools Help

migrid.org https://dk.migrid.org/cert_redirect/vgrid_shared/Online

Google

changelog tags files zip gz rss atom

shortlog for Online-CT member SCM repository

search: navigate: (0) -100 -60 tip

31 hours	Jonas Bardino	minimal cb reconstruction network server and client
47 hours	Jonas Bardino	move core actions into a separate function in preparation for mile stone with reconstruction daemon
5 days	Jonas Bardino	update rotation figure for more clear asymmetry
8 days	Jonas Bardino	pdf version
8 days	Jonas Bardino	missing figures
8 days	Jonas Bardino	added parallel notes
8 days	Jonas Bardino	final
8 days	Jonas Bardino	nearly done
8 days	Jonas Bardino	updates
9 days	Jonas Bardino	presentation for the seminar
2 weeks	Jonas Bardino	implemented preprocessing of TIFF projections in OSCaR-like way
8 weeks	Jonas Bardino	partial projections generator support
8 weeks	Jonas Bardino	add slices option and simplify some operations
8 weeks	Jonas Bardino	command line support for number of plot slices
8 weeks	Jonas Bardino	add plotting of virtual cuts along the axis of rotation as needed

https://dk.migrid.org/+C=DK+ST=NA+L=NA+O=DIKU+OU=NA+CN=Jonas_Bardino+emailAddress=bardino@diku.dk/vgrid_shared/Online-C...

VGrid private SCM II

Online-CT member SCM repository: files for changeset c9442852745f - Mozilla Firefox

File Edit View History Bookmarks Tools Help

migrid.org https://dk.migrid.org/+C=DK+ST=NA+L=NA+O=DIKU+OU=... Google

Online... Private po... Resource ... Resource ... Resource E... downloads Runtime E... Runtime e...

changelog shortlog tags changeset zip gz

files for changeset c9442852745f: /xrayengine/

drwxr-xr-x						[up]
drwxr-xr-x						html/
drwxr-xr-x						image-icons/
drwxr-xr-x						image-input/
drwxr-xr-x						mrsl/
drwxr-xr-x						projection-input/
drwxr-xr-x						src/
-rw-r--r--	2011-01-28	06:43	+0100	1392		README
-rw-r--r--	2011-01-28	06:43	+0100	6037		README.cuda
-rwxr-xr-x	2011-01-28	06:43	+0100	2416		cbreconclient.py
-rw-r--r--	2011-01-28	06:43	+0100	3641		cbreconserver.py
-rw-r--r--	2011-01-28	06:43	+0100	57890		fdk.py
-rw-r--r--	2011-01-28	06:43	+0100	1631		geometry.c
-rw-r--r--	2011-01-28	06:43	+0100	1276		geometry.h
-rw-r--r--	2011-01-28	06:43	+0100	52941		geometry.py
-rw-r--r--	2011-01-28	06:43	+0100	198880		input-dump.png
-rw-r--r--	2011-01-28	06:43	+0100	90846		input-image.png
-rw-r--r--	2011-01-28	06:43	+0100	4556		meshgrid.py
-rw-r--r--	2011-01-28	06:43	+0100	237106		output-dump.png
-rw-r--r--	2011-01-28	06:43	+0100	95108		output-image.png
-rw-r--r--	2011-01-28	06:43	+0100	2679		projfilter.py
-rw-r--r--	2011-01-28	06:43	+0100	90846		raw-image.png
-rw-r--r--	2011-01-28	06:43	+0100	90846		raygeomodule.c

Done

VGrid Monitor

Dashboard

Submit Job

Files

Jobs

VGrids

Resources

Downloads

Runtime Envs

Settings

Shell

Docs

Sun Jan 30 2011 21:33:16 GMT+0100 (CET)

Certificate expires in:
113 12 19 27
Days Hours Minutes Seconds

MIG Minimum intrusion Grid

Statistics/monitor for the Online-CT VGrid

This page was generated Sun Jan 30 21:31:49 2011
Automatic refresh every 120 secs.

State	Number of jobs	Item	Requested	Done	Runtimeenvironment	
Parse	0	Cpucount	1115	1066	NUMPY-0.1	214
Queued	1	Nodecount	1080	1031	PYTHON-2.6	840
Executing	0	Cputime	782790	748950	GNU_TAR	93
Failed	6	GB Disk	800	780	PYTHON-DEV-2	10
Retry	0	MB Memory	751055	746430	PYTHON-2	127
Canceled	42	Used Walltime	5 days, 00:14:44		SCIPY-0.1	21
Expired	0				PYTHON-DEV-2.6	9
Finished	1031				GAWK-ANY-1	1
Total	1080					

Resource job request

Listing the last request from each resource


Resource ID with exe unit	Last seen	VGrid	CPU time (s)	Node count	CPU count	Disk (GB)	Memory (MB)	Arch	Status	Job (s)	Remaining
✓ pig01.ekstranet.dku.dk.0 (alias Porky 1) localhost	Sun Jan 30 21:30:51 2011 (0d 0h 0m 58s ago)	Online-CT	3600	1	8	100	8192	AMD64	No jobs in queue can be executed by resource	360	0d, 0h, 5m, 1s
✓ pig02.ekstranet.dku.dk.0 (alias Porky 2) 127.0.0.1	Sun Jan 30 21:31:47 2011 (0d 0h 0m 2s ago)	Online-CT	3600	1	1	100	8192	AMD64	No jobs in queue can be executed by resource	360	0d, 0h, 5m, 57s
✓ pig02.ekstranet.dku.dk.0 (alias Porky 2) localhost	Sun Jan 30 21:28:03 2011 (0d 0h 3m 45s ago)	Online-CT	3600	1	1	100	8192	AMD64	No jobs in queue can be executed by resource	360	0d, 0h, 2m, 14s

VGrid Totals

A total of 3 resources (10 cpu's) joined this VGrid (3 up, 0 down?, 0 slack)
0 resources (0 cpu's) appear to be executing a job

Subversion commits to project migrid on Google Code

Revision 1418: a few fixes and more information in readme
2011-01-28 11:05:04

COPENHAGEN
-1°
Clear

January 2011
Su Mo Tu We Th Fr Sa

Done

MiG from the users POV

- Browser
 - x.509 certificate and HTTPS
- Manage files in grid home directory
- Submit jobs, view jobstatus etc.
- MiGscripts. Wrappers around “curl”.
- File handling:
 - migput, migget, migmkdir, migls, migrm, migcat, ...
- Job handling:
 - migsubmit, migstatus, migcancel

Using the scripts

Generate and download scripts from MiG

Download or write job specification (mRSL):

<http://dk.migruid.org/public/examples/io.mRSL>

This example creates and uploads 'input.txt' which is sent to output.txt

Run the job:

```
echo "test job" > input.txt
```

```
migput.sh input.txt input.txt
```

```
migsubmit.sh io.mRSL
```

returns a JOB_ID that is used for further treatment of the job

the job creates a file (outputfile)

```
migstatus.sh JOB_ID
```

to get the status of the job

```
migcat.sh output.txt
```

to show the job output when job is done

Further examples in tutorial at <http://www.migruid.org>

Resource models

- For now there are 3 types of resources
- One-Click
 - The simplest possible way to contribute
- MiG-SSS
 - A very powerful screensaver
- Conventional resources
 - Like all other Grid systems, only easier



The One-Click resource

- The web-browser as a Grid resource
 - Uses java applet plugin
 - No installation required
 - No administrative work required
 - All devices capable of running a JVM can be addressed
- Security
 - Secure communication through https
 - Sandboxed through the java applet security model
 - No local file access
 - No local process execution

One Click

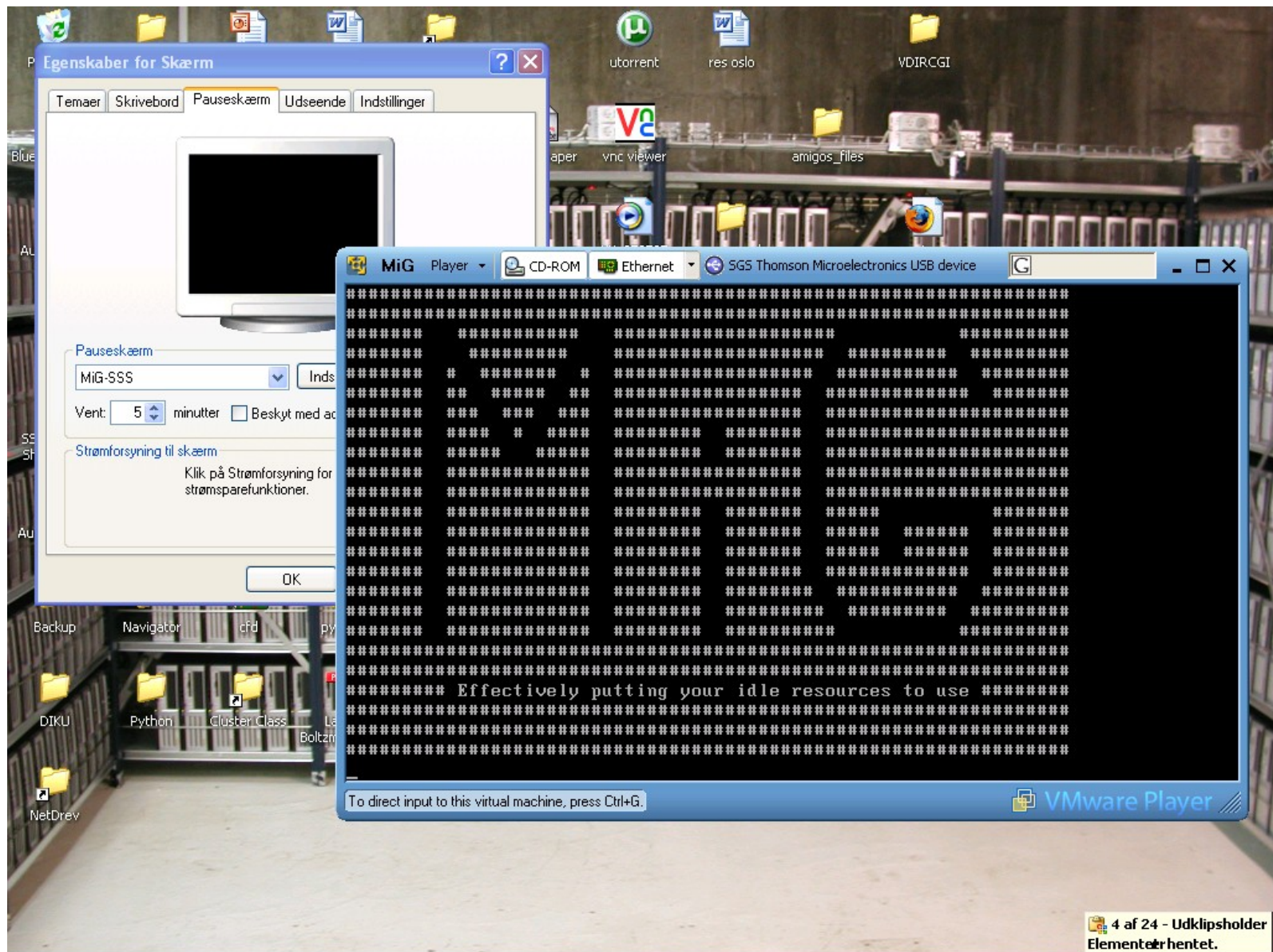


<http://dk.migrid.org/public/examples/Prototeins.zip>

MiG-SSS

- The goal is to combine Screen Saver Science and Public Resource Computing:
 - Harvest idle compute cycles from computers in screen saver mode
 - Put them on tap for grid jobs!
- Implemented as a virtual machine that is controlled by the screen-saver component
- Got a migration feature
 - But this requires high bandwidth and is currently not suited for ADSL lines

MiG-SSS



PS3 on MiG

- The Cell CPU is a multi-core microprocessor (9 cores)
 - Basically a (1 master)/(8 node) cluster on a chip
 - PS3 version only enables 6 of the nodes (SPE's)
- 200+ GFlops (SP) @ 3.2 GHz
- 20+ Gflops (DP) @ 3.2 Ghz
- A lot of PS3's are available
- A live Linux CD puts PS3's on MiG

MINIMUM INTRUSION GRID

Adding conventional resources

- Conventional resources include
 - Workstations
 - Clusters
 - Supercomputers
- You may choose to execute with low priority on a resource
- You may specify a execution pre-condition command to e.g. stop taking jobs when the CPU load is high
- No Windows native resources

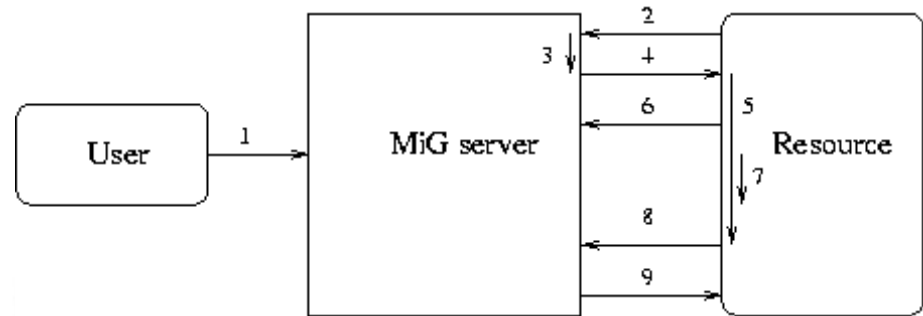
Requirements

- You must know your resource ☺
- Requires ssh in
- Requires https out



MINIMUM INTRUSION GRID

Under the hood: job flow



1. User communicates with the MiG server using HTTPS and certificates.
2. Resource requests a new job to execute (HTTPS)
3. The MiG server creates the job script.
4. MiG server sends the job to the resource using SCP.
5. The resource starts the job script.
6. Resource pulls the inputfiles from the MiG server (HTTPS)
7. The job is being executed
8. Resource sends outputfiles to the MiG server (HTTPS)
9. MiG server cleans up the resource using SSH (files and processes).

Viewing resources

Resource management - Mozilla Firefox

File Edit View History Bookmarks Tools Help

https://dk.migrid.org/cgi-bin/resman.py

Resource ma... Resource Ma... Resource Edi... downloads Runtime Envi... Runtime envi...

MIG Minimum intrusion Grid

Dashboard

Submit Job

Files

Jobs

VGrids

Resources

Downloads

Runtime Envs

Settings

Shell

Docs

Sat Jan 29 2011 14:54:38 GMT+0100 (CET)

Certificate expires in:
114 18 58 6
Days Hours Minutes Seconds

Available Resources

Resources available on this server

All available resources are listed below with overall hardware specifications. Any resources that you own will have a administration icon that you can click to open resource management.

2/2 25 resources per page

Name	Runtime envs	Alias	Nodes	CPUs	Mem (MB)	Disk (GB)	Arch
klynge.ekstranet.diku.dk.0	6	Klynge	9	4	8192	1	AMD64
pig01.ekstranet.diku.dk.0	11	Porky 1	2	8	8192	100	AMD64
pig02.ekstranet.diku.dk.0	9	Porky 2	5	1	8192	100	AMD64
00eba7f3ae02d4d6a3e2a4b71df172ae	2		26	1	256	10	X86
056580c42b81d810811ae52277492cc0	3		1	1	256	10	X86
3a0530a9839aaf573521e2d25080bfb8	0		1	1	128	1	X86
5684f5b8e00cb30908650e7c576227f1	0		1	1	128	10	PS3
5da65cd862046a87c9740aedfb632db3	1		1	1	512	10	X86
73fdb7af568e1590acdcd98cb9a2c07	0		1	1	1024	1	CELL
aeeb9d6d50754dc3ae273836e950fd93	3		25	1	256	100	X86
c26346f56745714c8ea388437c1106e8	4		1	1	256	10	X86
fyrkat.grid.aau.dk.0	6	Fyrkat	17	8	16384	10	AMD64

[Include sandbox resources](#)

https://dk.migrid.org/cgi-bin/resadmin.py?unique_resource_name=klynge.ekstranet.diku.dk.0

Adding/editing a resource

The screenshot shows a Mozilla Firefox browser window titled "Resource Editor - Mozilla Firefox". The address bar displays the URL `https://dk.migrid.org/cgi-bin/resedit.py?hosturl=klynge.ekstranet.dik`. The browser has several tabs open: "Resource Editor", "downloads", "Runtime Environments", and "Runtime environment de...".

The web application is the "Minimum intrusion Grid" (MiG) Resource Editor. It features a left sidebar with navigation links: Dashboard, Submit Job, Files, Jobs, VGrids, Resources, Downloads, Runtime Envs, Settings, Shell, and Docs. Below these links, a status bar shows the date and time: "Sat Jan 29 2011 14:56:13 GMT+0100 (CET)".

The main content area is titled "Resource Editor" and "MiG Resource Editor". It contains a paragraph of instructions: "Please fill in or edit the fields below to fit your MiG resource reservation. Most fields will work with their default values. So if you are still in doubt after reading the help description, you can likely just leave the field alone."

The "Main Resource Settings" section includes the following fields:

- Host FQDN:** `klynge.ekstranet.diku.dk` (with a help link)
- Host identifier:** `0` (with a help link)
- Frontend Home Path:** `/home/mig/mighome` (with a help link)
- Anonymize ID in grid:** `False` (with a help link and a dropdown arrow)

At the bottom left, a "Certificate expires in:" section shows a countdown timer: "114 18 56 31" (Days Hours Minutes Seconds). The bottom status bar shows "Done" and a small red icon.

Managing your resources I

The screenshot shows the Mozilla Firefox browser window displaying the MiG Resource Management interface. The address bar shows the URL `https://dk.migrid.org/cgi-bin/resadmin.py?unique_resource_name=kly`. The browser has several tabs open, including "Resource Manager", "Resource Editor", "downloads", "Runtime Environ...", and "Runtime environ...".

The MiG interface has a blue header with the "MiG" logo and the text "Minimum intrusion Grid". On the left is a sidebar with navigation links: Dashboard, Submit Job, Files, Jobs, VGrids, Resources, Downloads, Runtime Envs, Settings, Shell, and Docs. Below the sidebar, a status bar shows the date and time: "Sat Jan 29 2011 14:55:03 GMT+0100 (CET)".

The main content area is titled "Resource Management" and contains the following sections:

- MiG Resources Owned**: A section with the text "Quick links to all your resources and individual management" and a link "Show quick links".
- Configuration**: A section with the text "Use the [editing interface](#) or make any changes manually in the text box below." and a link "Resource configuration docs".
- Configuration Details**: A text box containing the following configuration parameters:

```
::HOSTURL::  
klynge.ekstranet.diku.dk  
  
::HOSTIDENTIFIER::  
0  
  
::ANONYMOUS::  
False  
  
::HOSTKEY::  
klynge.ekstranet.diku.dk,192.38.115.205 ssh-rsa AAAAB3NzaC1yc2EAAAABIwAAAQEAuCl0b5cm3dwedlvj1GInd4UC
```

The status bar at the bottom of the browser shows the URL `https://dk.migrid.org/cgi-bin/resedit.py?hosturl=klynge.ekstranet.diku.dk;hostidentifier=0`.

Managing your resources II

Resource Management - Mozilla Firefox

File Edit View History Bookmarks Tools Help

https://dk.migrid.org/cgi-bin/resadmin.py?unique_resource_name=kly

Google

Resource Manag... Resource Editor downloads Runtime Environ... Runtime environ...

```
::HOSTKEY::  
klynge.ekstranet.diku.dk,192.38.115.205 ssh-rsa AAAAB3NzaC1yc2EAAAABIwAAAQEAuCl0b5cm3dwedlvj1GInd4UC  
  
::SSHPORT::  
22  
  
::MIGUSER::  
mig  
  
::RESOURCEHOME::  
/home/mig/mighome/MiG/mig_frontend/klynge.ekstranet.diku.dk.0  
  
::FRONTENDNODE::  
klynge.ekstranet.diku.dk  
  
::SCRIPTLANGUAGE::
```

Save ----- Forget changes

Front End				
klynge.ekstranet.diku.dk	(Re)Start	Status	Stop	Clean
Execution Units				
ALL UNITS	(Re)Start	Status	Stop	Clean
klynge	(Re)Start	Status	Stop	Clean
Storage Units				
ALL UNITS	(Re)Start	Status	Stop	Clean
	(Re)Start	Status	Stop	Clean

https://dk.migrid.org/cgi-bin/resedit.py?hosturl=klynge.ekstranet.diku.dk;hostidentifier=0

Screen Saver Science

PRC with deadlines

- Screen Saver Science is hard to merge with strong scheduling
 - Once a resource accepts a job – just how much time is it offering?
- We create an exponential averaged statistic prediction
 - 24x7 resolution

	Mon	Tue	Wed	Thu	Fri	Sat	Sun
0	4,281289	0,609102	4,370668	6,52596	3,298105	5,535493	5,512131
1	0,140011	4,552117	2,280195	6,468878	6,98397	4,135618	6,896847
2	6,214814	2,297592	5,894947	2,217671	5,421552	5,990491	6,273165
3	0,909552	3,254109	5,488454	2,996888	7,434242	2,463183	2,790015
...
21	1,102019	5,191171	4,97769	3,163451	2,796037	2,292304	2,448104
22	5,448806	6,861695	6,110104	3,13554	0,411362	0,778049	0,470441
23	4,257551	2,140985	0,800296	5,465861	1,4688	6,577736	7,138229

Live job I/O

- Job input/output *during* execution
- Open job status and request live I/O
 - an update request is sent to the resource
 - it uploads/downloads the current specified files
 - From/to MiG home directory
 - Message queue support

Live job I/O example

Minimum intrusion Grid

Request live communication with jobs

Fill in the live I/O details below to request communication with a running job. Job ID can be a full ID or a wild card pattern using "*" and "?" to match one or more of your job IDs. Use send output without source and destination paths to request upload of the default stdio files from the job on the resource to the associated job_output directory in your MIG home. Destination is always handled as a directory path to put source files into. Source and destination paths are always taken relative to the job execution directory on the resource and your MIG home respectively.

Action:
☒ send output ☐ get input

Job ID:
334671_11_4_2010_16_19_52_dk.migrid.org.0

Source path(s):
[Empty field] [Add another source field]

Destination path:
[Empty field]

[Send request]

Further live job control is available through your personal message queues. They provide a basic interface for centrally storing messages under your grid account and can be used to pass messages between jobs or for orchestrating jobs before and during execution.

[Message queue interface](#)

Subversion commits to project migrid on Google Code

Revision 1392: Merge in revisions 1331 : 1391 from trunk, resolving all conflicts.
2010-11-04 16:51:14
Changed Paths: Modify /branches/grid.dk Modify /branches/grid.dk/NEWS ...

Revision 1391: delay job variable expansion until actual job handout in order to properly suppo
2010-11-02 14:04:51
Changed Paths: Modify /trunk/mig/server/jobscriptgenerator.py ...

Revision 1390: Code validation notes
2010-11-02 13:58:55
Changed Paths: Modify /wiki/MIGCodingStyle.wiki Code validation notes

COPENHAGEN
9°
Mostly Cloudy
High: 9° Low: 8°
Wind: WSW 19.3km/h

FREDERICIA
9°
Mostly Cloudy
High: 9° Low: 8°
Wind: SW 12.8km/h

November 2010

Su	Mo	Tu	We	Th	Fr	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

Done

Graphical Access

- Interactive jobs
- VNC display on server
 - anonymous display at MiG servers
- User: https+cert+java client
- Resource: X forwarding to server display
- CGI script
 - start VNC display
 - redirect user to display

Developer Accounts

- UNIX account on amigos18.diku.dk
- private apache server on high ports
 - only my-apache stop/start (not conf access)
- snapshot or svn checkout of MiG code
- run MiG daemon(s) from home dir
- simply use `https://amigos18.diku.dk:PORT/`
- allows most features

Transparent Remote File Access

- Huge input files incur a number of problems:
 - Download time vs. total execution time
 - Job execution on the resource is delayed
 - Storage requirements on resources
 - Often only small scattered fragments of input files are needed
- We seek to fix this using automatic on-demand download

Transparent remote file access

- Download time of input files is eliminated; the job is started immediately
- Only needed data is transferred
 - Or as little extra as possible
- Jobs previously impeded from grid submission due to huge input files are now ready for the grid
- The model outperforms a standard copy-model
- The library is entirely user-level
- Not in production!

Additional topics

- Automatic job variables
- Grid enabling apps with xmlrpc or json
- MiG Shell
- Sshfs mount MiG home
- Storage resources
- Custom page layout
- Widgets
- Android access (certificate proxy)

MiG Conclusions

- MiG is 'feature complete'
- easy to use: user / resource owner
- flexible resource models
- nearly full featured developer accounts
- outstanding issues
 - server distribution performance
 - execution model efficiency
 - cluster transparency
 - better interactive job support
 - more users/resources

How to join

And more information in general



www.migrid.org