

# MiG – A Complete Grid Middleware (mostly) in Python

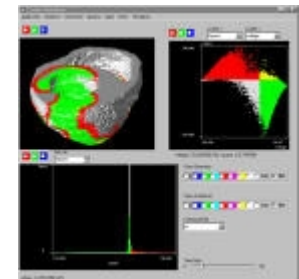


M I N I M U M I N T R U S I O N G R I D

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University of Copenhagen  
E-Science

# The Grid

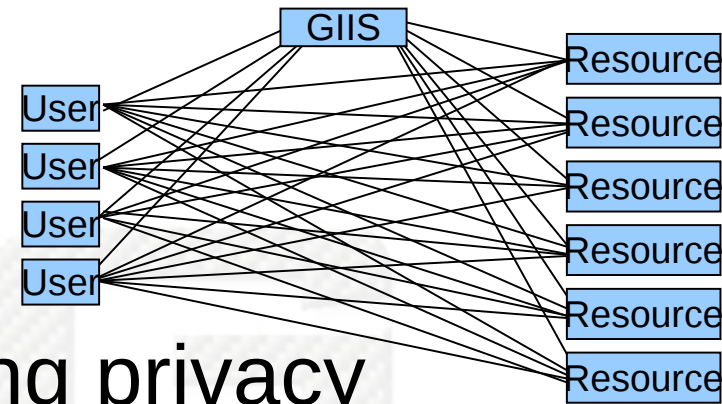
- 'Internet' mainly allows access to separate information, resources
- The Grid should provide unified access to **any** desired resource
  - Processing
  - Storage
  - Applications
  - People
- Sharing, collaboration
  - Virtual organizations



# Problems in Classic Grid Models?

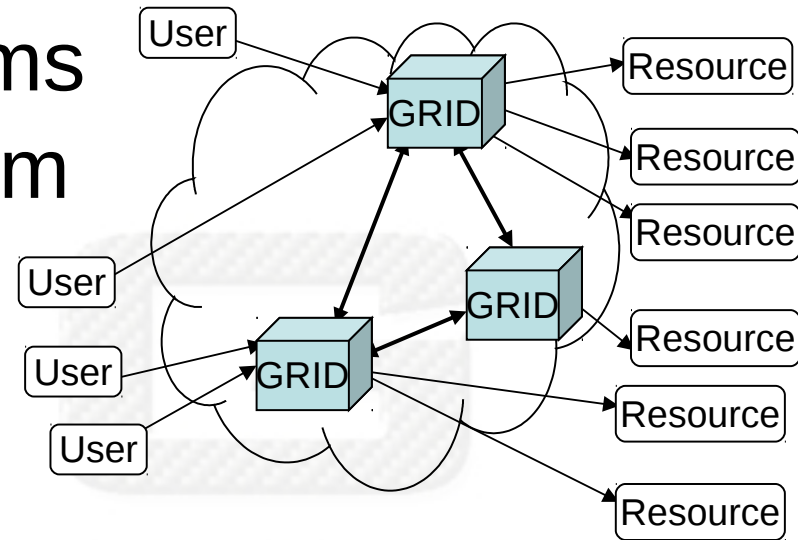
(not every problem in every middleware)

- Single point of failure
- Lack of scheduling
- Poor scalability
- No means of implementing privacy
- No means of utilizing 'cycle-scavenging'
- Firewall dependencies
- Highly bloated middleware
- Cumbersome user collaboration
- Steep learning curve
- Ad-hoc application access



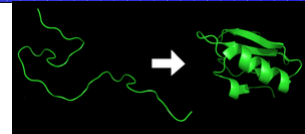
# Minimum intrusion Grid - Idea

- Address 1<sup>st</sup> gen. problems
- GRID should be a system
  - not just a protocol
  - servers that **are** GRID
  - coordinated upgrade
- Users and resources do not have to maintain anything
- Appears as big virtual computer to users
- Appears as group of users to resources



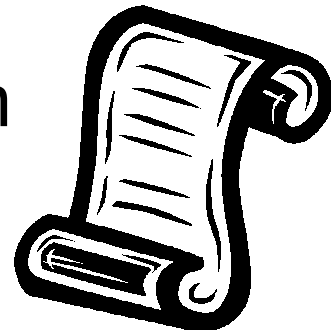
# Why is GRID Needed?

- Science & business go virtual
  - A lot of areas turn to computer simulations
  - More, bigger and cheaper experiments
  - Data mining
- Computer power is consolidated in data centres
  - Avoid user maintenance
  - Better utilization → cheaper
  - Users need easy access
  - Providers need access control



# 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 **don't need** to install Grid software
  - A web-browser is enough
  - X.509 certificate for identification/access
- **Optional** advanced interfaces
  - User scripts
  - Client APIs
  - Remote file system
  - Native clients



# User view of MiG

The screenshot shows a web browser window titled "Dashboard - Mozilla Firefox" with the address bar displaying "https://dk.migrid.org/". The page header features the "MiG Minimum intrusion Grid" logo. A left-hand navigation menu includes links for Dashboard, Submit Job, Files, Jobs, VGrids, Resources, Downloads, Runtime Envs, People, Settings, Shell, and Docs. The main content area is titled "Dashboard" and contains a welcome message for "Hi Jonas Bardino", a "Your Status" section with job and resource counts, a "Certificate expires in:" timer showing 340 days, 23 hours, 55 minutes, and 46 seconds, and a "Documentation and Help" section.

Dashboard - Mozilla Firefox

File Edit View History Bookmarks Tools Help ← → ↻ 🏠 MiG migrid.org https://dk.migrid.org/ Google DA

## MiG Minimum intrusion Grid

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

### Dashboard

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 277210 jobs: 0 parse, 0 queued, 1 frozen, 0 executing, 267026 finished, 0 retry, 9608 canceled, 0 expired and 575 failed.

3921 resources providing 4260 execution units in total allow execution of your jobs.

☀ Loading disk stats...

Your user certificate expires on Wed May 16 2012 11:48:26 GMT+0200 (CEST).

### Certificate expires in:

340 23 55 46  
Days Hours Minutes Seconds

### Documentation and Help

Minimum intrusion Grid includes some built-in documentation like the



# MiG Requirements - Resource

- Resources **don't need** to install Grid software
  - Only create MiG user(s)
  - Provide limited remote access
    - ssh inbound
    - https outbound
- System administrators use ordinary X.509 user certificates to manage resources
- Sandboxed systems have even fewer requirements



# Resource Owner View of MiG

Resource Management - Mozilla Firefox

File Edit View History Bookmarks Tools Help migrid.org https://dk.migrid.org/ Google DA

Settings  
Shell  
Docs

Fri Jun 10 2011 13:38:43 GMT+0200 (CEST)

**Certificate expires in:**  
**340 22 9 43**  
Days Hours Minutes Seconds

Use the editing interface or make any changes manually in the text box below.  
[Resource configuration docs](#)

```
::HOSTURL::  
klynge.ekstranet.diku.dk  
  
::HOSTIDENTIFIER::  
0  
  
::ANONYMOUS::  
False  
  
::HOSTKEY::  
klynge.ekstranet.diku.dk,192.38.115.205 ssh-rsa AAAAB3NzaC1yc2EAAAABIWAAAQEaUc1ob5cm3dwedlvj1GInd4UC  
  
::SSHPORT::  
22  
  
::MIGUSER::  
mig  
  
::RESOURCEHOME::  
/home/mig/mighome/MiG/mig_frontend/klynge.ekstranet.diku.dk.0  
  
::FRONTENDNODE::  
klynge.ekstranet.diku.dk  
  
::SCRIPTLANGUAGE::  
  
 ----- 
```

**Front End**  
klynge.ekstranet.diku.dk

# Files

- Private user home on MiG
- All file refs are relative to user home

File Manager - Mozilla Firefox

File Edit View History Bookmarks Tools Help

migrid.org https://dk.migrid.org/ Google DA

## MiG Minimum intrusion Grid

Dashboard

Submit Job

Files

Jobs

VGrids

Resources

Downloads

Runtime Envs

People

Settings

Shell

Docs

### File Manager

/

/				
.ssh				
BINF				
BIRC				
CT-Toolbox				
CellBlade				
DCSC				
DEMO				
DIKU				
DistNumPy				
Dock_working_dir				
ESS				
Farma-BR				
vinavl	4.00 KB	dir		2010-21-10 17:28
VirtualDesktop	4.00 KB	dir		2010-28-10 12:24
.default.css		css		2011-17-05 11:47
.default.mrsl		mrsl		2010-15-07 06:23
base1.txt		txt		2009-23-09 11:28
cacert.pem		pem		2009-30-07 08:50
catch-linux-s		KB		2009-30-07 08:50
catch-sandb				
catch.mRSL		mRSL		2009-26-08 13:14
codegrep.py	1.80 KB	py		2009-30-07 08:50
CSPBuilder.tar.gz	158.60 KB	gz		2009-08-09 11:36
CT.bmp	1.17 MB	bmp		2010-30-07 17:01
				2009-18-09 16:24

# File Editor

File Manager - Mozilla Firefox

File Edit View History Bookmarks Tools Help

migrd.org https://dk.migrd.org/ Google DA

**MIG** Mir

Editor

Edit contents:

H1 H2 H3 H4 H5 H6 | B I S | [List Icons]

```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN">
<html>
<head>
<title>Private portal for Online-CT</title>
<link rel="stylesheet" type="text/css" href="/images/site.css" media="screen"/>
<link rel="stylesheet" type="text/css" href="/vgrid/Online-CT/path/style.css" media="screen"/>

<script type="text/javascript" src="/images/js/jquery-1.3.2.min.js"></script>
<script type="text/javascript" src="/images/js/jquery.prettyprint.js"></script>
<script type="text/javascript" src="/images/js/jquery.form.js"></script>

<script type="text/javascript">
function sourceInputSelected() {
    var form = document.forms["submitform"];
    var source_selected = "";
    var i;
    for(i=0;i<form["sourceinput"].length; i++) {
```

Save Changes Close Download

Certificate expires in:  
340 23 47 46  
Days Hours Minutes Seconds

IGGKU  
MDGrid  
MIG LT

# Jobs

- The Grid work unit is jobs
  - Typically batch command(s)
  - Including resource specs
  - User input/output files
- Users send jobs to MiG queue
  - Replication (if enabled)
  - Execution when a suitable resource is ready
  - All job handling is done by MiG
  - User may override jobs: hold, cancel, resubmit
- Grid apps typically wrap jobs to create flow



# Submit Job

Submit Job - Mozilla Firefox

File Edit View History Bookmarks Tools Help migrid.org https://dk.migrid.org/ Google DA

## MIG Minimum intrusion Grid

- Dashboard
- Submit Job**
- Files
- Jobs
- VGrids
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### 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](#)

Fri Jun 10 2011 13:58:48 GMT+0200 (CEST)

**Certificate expires in:**  
**340 21 49 37**  
Days Hours Minutes Seconds

# Job Status

Job Manager - Mozilla Firefox

File Edit View History Bookmarks Tools Help migrid.org https://dk.migrid.org/ Google DA

**MIG** Minimum intrusion Grid

Dashboard  
Submit Job  
Files  
Jobs  
VGrids  
Resources

**Job Manager**

1/5 15 jobs per page load 100 last jobs matching \*\_2011\_\*

<input type="checkbox"/> Job ID	Status	Date
<input type="checkbox"/> 339146_6_10_2011__12_0_6_dk.migrid.org.0	EXECUTING	Fri Jun 10 12:00:06 2011
<input type="checkbox"/> 339137_5_3_2011__7_34_48_dk.migrid.org.0	FROZEN	Tue May 3 07:34:48 2011

Job Manager - Mozilla Firefox

File Edit View History Bookmarks Tools Help migrid.org https://dk.migrid.org/ Google DA

**MIG** Minimum intrusion Grid

Dashboard  
Submit Job  
Files  
Jobs  
VGrids  
Resources

**Job Manager**

1/5 15 jobs per page load 100 last jobs matching \*\_2011\_\*

<input type="checkbox"/> Job ID	Status	Date
<input type="checkbox"/> 339146_6_10_2011__12_0_6_dk.migrid.org.0	FINISHED	Fri Jun 10 12:00:06 2011
<input type="checkbox"/> 339137_5_3_2011__7_34_48_dk.migrid.org.0	FROZEN	Tue May 3 07:34:48 2011

# Job Result

File Manager - Mozilla Firefox

File Edit View History Bookmarks Tools Help

migrid.org https://dk.migrid.org/ Google DA

**MIG** Minimum intrusion Grid

Dashboard  
Submit Job  
Files  
Jobs  
VGrids  
Resources  
Downloads  
Runtime Envs  
People

File Manager

/job\_output/339146\_6\_10\_2011\_12\_0\_6\_dk.migrid.org.0/

Name	Size	Type	Date Modified
.ssh			
BINF			
BIRC			
CT-Toolbox			
CellBlade			
DCSC			
DEMO			
DIKU			
DistNusD			
339146_6_10_2011_12_0_6_dk.migrid.org.0.io-status	121.00 B	io-status	2011-10-06 14:00
339146_6_10_2011_12_0_6_dk.migrid.org.0.status	21.00 B	status	2011-10-06 14:00
339146_6_10_2011_12_0_6_dk.migrid.org.0.stderr	0.00 B	stderr	2011-10-06 14:00
339146_6_10_2011_12_0_6_dk.migrid.org.0.stdout	12.00 B	stdout	2011-10-06 14:00

Mozilla Firefox

File Edit View History Bookmarks Tools Help

migrid.org

File Manager x https://dk.mi...org.0.stdout x +

hello grid!



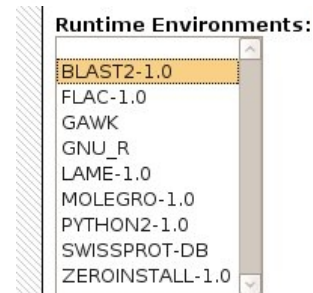
# Runtime Environments

- 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
- Local files, devices or markers



- Managed by resource owners (users)

# Viewing Runtime Environments

Runtime Environments - Mozilla Firefox

File Edit View History Bookmarks Tools Help  migrd.org <https://dk.migrd.org/>  Google DA 

## MIG Minimum intrusion Grid

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### Runtime Environments

Runtime environments specify software/data available on resources.

[Documentation on runtime environments](#)

#### Existing runtime environments

← 2/3 → 20 runtime envs per page ▼

Name			Description	Resources	Created
PYTHON-DEV-2			Development headers and static libraries for any Python in the 2.X series. For most distributions these components are not included in the standard Python package but rather have their own -dev package.	4	Tue May 25 16:55:35 2010
PYTHON-DEV-2.6			Development headers and static libraries for any Python in the 2.6 series. For most distributions these components are not included in the standard Python package but rather have their own -dev package.	4	Thu Jun 3 09:20:28 2010
SCIPY-0.1			Scientific Tools for Python	2	Tue May 25 16:40:59 2010
TESTRE			test description	1	Fri May 19 09:51:12 2006
			The Zero Install Injector makes it easy for users to install software without needing root privileges. It takes the RPM of a		Thu Jun 3

Fri Jun 10 2011 14:51:42 GMT+0200 (CEST)

**Certificate expires in:**  
**340 20 56 44**  
Days Hours Minutes Seconds

# Inspect Runtime Environment

Runtime environment details - Mozilla Firefox

File Edit View History Bookmarks Tools Help  <https://dk.migrid.org/cgi-bin/sho> 

## MIG Minimum intrusion Grid

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### Show runtime environment details

Name	PYTHON-2
Description	Any Python in the 2.X series
Needed software	 <p>Name: Python Url: <a href="http://www.python.org">http://www.python.org</a> Description: Python 2.X Version: 2.X</p>
Environment variables	<p>Name: PYTHON (use with \$PYTHON) Example: /usr/bin/python Description: Path to the python interpreter</p>
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	klynge.ekstranet.diku.dk.1, klynge.ekstranet.diku.dk.0, fyrgrid.grid.aau.dk.0, fyrgrid.grid.aau.dk.1,

Fri Jun 10 2011 14:52:57 GMT+0200 (CEST)

**Certificate expires in:**  
**340 20 55 29**  
Days Hours Minutes Seconds



# VGrids

- VGrids are Virtual Organizations in MiG
- Straight forward collaboration
  - Share files
  - Share resources
  - Private web page / portal
  - Public web page / portal
  - Private Wikis
  - Private SCM repositories
  - Private Forum
- Completely user managed



MoinMoin



# View VGrids

VGrid administration - Mozilla Firefox

File Edit View History Bookmarks Tools Help [migrid.org https://dk.migrid.org/](https://dk.migrid.org/) Google DA

## MIG Minimum intrusion Grid

- Dashboard
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- VGrids**
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### VGrids

VGrids share files, a number of collaboration tools and resources. Members can access web pages, files, tools and resources. Owners can additionally edit pages, as well as add and remove members or resources.

#### VGrids managed on this server

1/4 25 VGrids per page

Name	Files	Web Pages	Wiki	SCM	Forum	Monito
Generic	---	---	---	---	---	<a href="#">View</a>
BINF	<a href="#">Open</a>	<a href="#">View</a> <a href="#">Edit</a>	<a href="#">View</a> <a href="#">Edit</a>	<a href="#">Open</a> <a href="#">Open</a>	<a href="#">View</a> <a href="#">View</a>	<a href="#">Open</a> <a href="#">View</a>
BiRC	<a href="#">Open</a>	<a href="#">View</a> <a href="#">Edit</a>	<a href="#">View</a> <a href="#">Edit</a>	<a href="#">Open</a> <a href="#">Open</a>	<a href="#">View</a> <a href="#">View</a>	<a href="#">Open</a> <a href="#">View</a>
CellBlade	<a href="#">Open</a>	<a href="#">View</a> <a href="#">Edit</a>	<a href="#">View</a> <a href="#">Edit</a>	<a href="#">Open</a> <a href="#">Open</a>	<a href="#">View</a> <a href="#">View</a>	<a href="#">Open</a> <a href="#">View</a>
CT-Toolbox	<a href="#">Open</a>	<a href="#">View</a> <a href="#">Edit</a>	<a href="#">View</a> <a href="#">Edit</a>	<a href="#">Open</a> <a href="#">Open</a>	<a href="#">View</a> <a href="#">View</a>	<a href="#">Open</a> <a href="#">View</a>
DCSC	<a href="#">Open</a>	<a href="#">View</a> <a href="#">Edit</a>	<a href="#">View</a> <a href="#">Edit</a>	<a href="#">Open</a> <a href="#">Open</a>	<a href="#">View</a> <a href="#">View</a>	<a href="#">Open</a> <a href="#">View</a>
DEMO	<a href="#">Open</a>	<a href="#">View</a> <a href="#">Edit</a>	<a href="#">View</a> <a href="#">Edit</a>	<a href="#">Open</a> <a href="#">Open</a>	<a href="#">View</a> <a href="#">View</a>	<a href="#">Open</a> <a href="#">View</a>

...List continues...


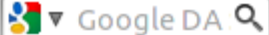
### Additional VGrids

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 sub-VGrid called DEF by entering ABC/DEF below.

Create VGrid

# Manage VGrids

Administrare VGrid: Online-CT - Mozilla Firefox

File Edit View History Bookmarks Tools Help  migr grid.org https://dk.migr grid.org/ 

## MIG Minimum intrusion Grid

Dashboard

Submit Job

Files

Jobs

VGrids

Resources

Downloads

Runtime Envs

People

Settings

Shell

Docs

Thu Jun 16 2011 12:01:07 GMT+0200 (CEST)

**Certificate expires in:**  
**334 23 47 19**  
Days Hours Minutes Seconds

### Administrare 'Online-CT'

#### Owners

[Hide Owners](#)

Current owners of Online-CT:

Remove	Owner
<input type="radio"/>	/C=DK/ST=NA/L=NA/O=DIKU/OU=NA/CN=Jonas Bardino/emailAddress=bardino@diku.dk
<input type="radio"/>	/C=DK/ST=Denmark/L=NA/O=DIKU/OU=NA/CN=Brian Vinter/emailAddress=vinter@diku.dk

#### Members

[Hide Members](#)

Current members of Online-CT:

Remove	Owner
<input type="radio"/>	/C=DK/ST=Denmark/L=NA/O=DIKU/OU=NA/CN=Kenneth Skovhede/emailAddress=skovhede@diku.dk
<input type="radio"/>	/C=DK/ST=Denmark/L=NA/O=DIKU/OU=NA/CN=Martin Charles Florents Djurnoe/emailAddress=djurnoe@diku.dk
<input type="radio"/>	/C=DK/ST=NA/L=NA/O=DIKU/OU=NA/CN=Finn Krog/emailAddress=finnkrog@diku.dk

# VGrid Private Homepage

## 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

sample1.png ▾

Projection data

▾

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

20 ▾

Filter

▾

Result notification

▾

Extra simulation arguments (only for experts!)

▾

Run

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

Job ID	Status	Date
339146_6_10_2011__12_0_6_dk.migrid.org.0	FINISHED	Fri Jun 10 12:00:06 2011



# VGrid Public Homepage

Public page for Online-CT - Mozilla Firefox

File Edit View History Bookmarks Tools Help <http://dk.migrid.org/vgrid/Online> Google DA

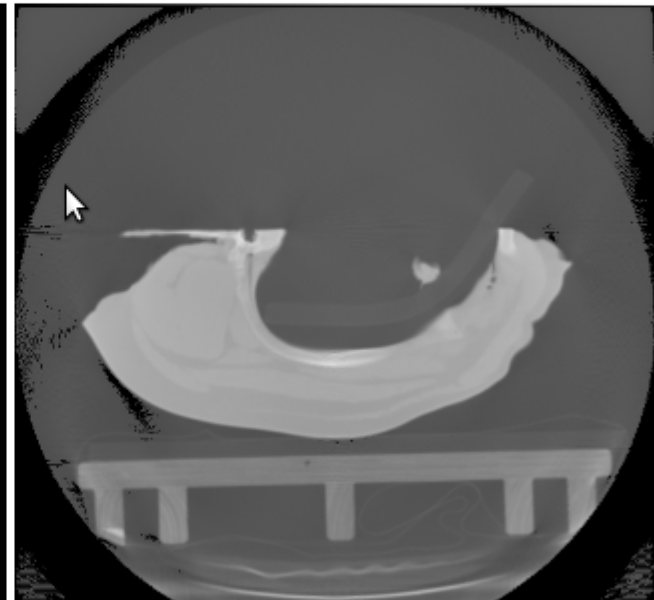
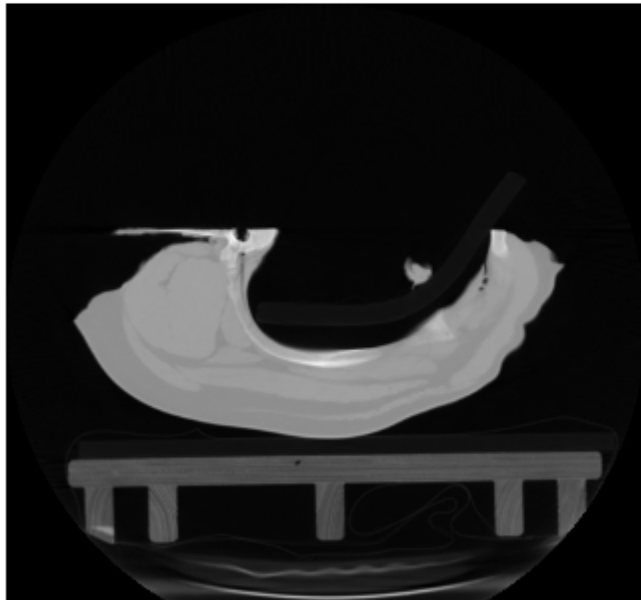


## Online CT

### 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.



# VGrid Private Wiki

FrontPage - Online-CT - Mozilla Firefox

File Edit View History Bookmarks Tools Help ← → ↻ 🏠  migrid.org https://dk.migrid.org/ ☆ Google DA 🔍

 Login

**FrontPage** RecentChanges FindPage HelpContents

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

## Online CT Owners Wiki

Shared space only for owners of the Online-CT VGrid.

We will most likely primarily use the [Members Wiki](#) for project information.

Please feel free to add relevant contents.

Interesting starting points:

- [RecentChanges](#): see where people are currently working
- [WikiSandBox](#): feel free to change this page and experiment with editing
- [FindPage](#): search or browse the database in various ways
- [HelpOnMoinWikiSyntax](#): quick access to wiki markup
- [SiteNavigation](#): get an overview over this site and what it contains

## How to use this site

# VGrid Private SCM Repository

Online-CT member SCM repository: files for changeset 3ca4c0f56ec0 - Mozilla Firefox

File Edit View History Bookmarks Tools Help migrd.org https://dk.migrd.org/ Google DA

[changelog](#) [shortlog](#) [tags](#) [changeset](#) [zip](#) [gz](#)

## files for changeset 3ca4c0f56ec0: /xrayengine/

drwxr-xr-x						<a href="#">[up]</a>
drwxr-xr-x						<a href="#">html/</a>
drwxr-xr-x						<a href="#">image-icons/</a>
drwxr-xr-x						<a href="#">image-input/</a>
drwxr-xr-x						<a href="#">mrs/</a>
drwxr-xr-x						<a href="#">projection-input/</a>
drwxr-xr-x						<a href="#">src/</a>
-rw-r--r--	2011-05-31	14:27	+0200	1392		<a href="#">README</a>
-rw-r--r--	2011-05-31	14:27	+0200	6037		<a href="#">README.cuda</a>
-rwxr-xr-x	2011-05-31	14:27	+0200	2756		<a href="#">cbreconclient.py</a>
-rwxr-xr-x	2011-05-31	14:27	+0200	16195		<a href="#">cbreconserver.py</a>
-rw-r--r--	2011-05-31	14:27	+0200	844		<a href="#">configure-phantom-katsevich.xml</a>
-rw-r--r--	2011-05-31	14:27	+0200	837		<a href="#">configure-pig-fdk.xml</a>
-rw-r--r--	2011-05-31	14:27	+0200	843		<a href="#">configure-skull-fdk.xml</a>
-rwxr-xr-x	2011-05-31	14:27	+0200	9930		<a href="#">dynrange.py</a>
-rw-r--r--	2011-05-31	14:27	+0200	48384		<a href="#">fdk.py</a>
-rw-r--r--	2011-05-31	14:27	+0200	1631		<a href="#">geometry.c</a>
-rw-r--r--	2011-05-31	14:27	+0200	1276		<a href="#">geometry.h</a>
-rw-r--r--	2011-05-31	14:27	+0200	52941		<a href="#">geometry.py</a>
-rw-r--r--	2011-05-31	14:27	+0200	198880		<a href="#">input-dump.png</a>
-rw-r--r--	2011-05-31	14:27	+0200	90846		<a href="#">input-image.png</a>

# VGrid Private Forum

VGrid Forum - Mozilla Firefox

File Edit View History Bookmarks Tools Help migrid.org https://dk.migrid.org/

**General CT Tools?**

Date	Author	Message
<small>NEW</small> 10 Jun 2011 15:41:31	/C=DK/ST=NA/L=NA/O=DIKU/OU=NA /CN=Martin Rehr/emailAddress=rehr@diku.dk	<p>This sounds like a very good idea.</p> <p>I've created a VGrid named 'CT-Toolbox' for the purpose. I think we should keep the different development projects in the VGrids in which they are located now, and then use CT-Toolbox for generic release versions, which can be used as templates for future projects.</p> <p>Cheers, Martin</p>
10 Jun 2011 15:36:38	/C=DK/ST=NA/L=NA/O=DIKU/OU=NA /CN=Jonas Bardino/emailAddress=bardino@diku.dk	<p>Hi Online-CT'ers</p> <p>We have a number of different CT projects running, but the implementations are developed in different vgrids and local repos. Should we try to collect a generic version of the implementations a kind of toolbox? Maybe a new VGrid?</p> <p>Cheers, Jonas</p>

[Reply to this thread](#)

[Reload thread](#)

[Return to forum index](#)

[Subscribe/unsubscribe to thread updates](#)

Fri Jun 10 2011 15:51:01 GMT+0200 (CEST)

**Certificate expires in:**  
**340 19 57 25**  
Days Hours MinutesSeconds

# VGrid Monitor

MiG Monitor - Mozilla Firefox

File Edit View History Bookmarks Tools Help migrid.org https://dk.migrid.org/

## Resource job request

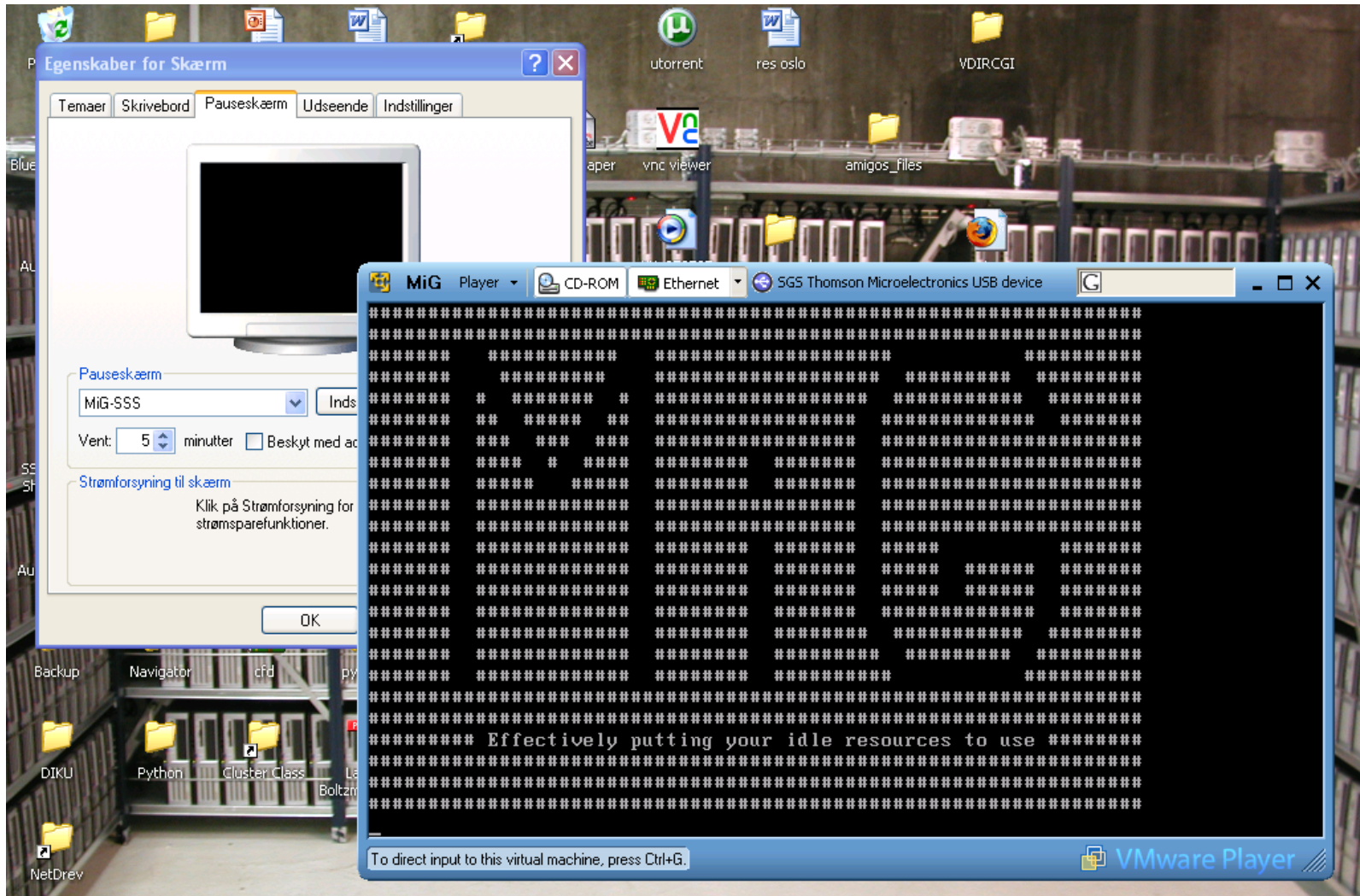
Listing the last request from each resource

◆	◆ Resource ID with exe unit	◆ Last seen	◆ VGrid	◆ CPU time (s)	◆ Node count	▲ CPU count	◆ Disk (GB)	◆ Memory (MB)	◆ Arch	◆ Status	◆ Job (s)	◆ Remain
✓	amigos50.diku.dk.0 (alias EightByEight) localhost	Fri Jun 10 15:35:40 2011 (0d 0h 2m 25s ago)	DIKU	900	1	8	10	8192	AMD64	No jobs in queue can be executed by resource	360	0d, 0h, 3m,
✓	escience2.ekstranet.diku.dk.0 (alias Sun T2) localhost	Fri Jun 10 15:34:42 2011 (0d 0h 3m 23s ago)	DIKU	43200	1	8	10	32640	SPARC-T2	No jobs in queue can be executed by resource	360	0d, 0h, 2m,
✓	klynge.ekstranet.diku.dk.0 (alias Klynge) klynge	Fri Jun 10 15:33:59 2011 (0d 0h 4m 6s ago)	DIKU	14400	8	4	1	8192	AMD64	No jobs in queue can be executed by resource	360	0d, 0h, 1m,
✓	pig01.ekstranet.diku.dk.0 (alias Porky 1) localhost	Fri Jun 10 15:37:28 2011 (0d 0h 0m 37s ago)	DIKU	3600	1	4	100	8192	AMD64	No jobs in queue can be executed by resource	360	0d, 0h, 5m,
✓	cuda.bardinosen.dk.0 (alias EEE Box) localhost	Fri Jun 10 15:36:45 2011 (0d 0h 1m 20s ago)	DIKU	3600	1	2	10	2048	X86	No jobs in queue can be executed by resource	360	0d, 0h, 4m,
✓	amigos50.diku.dk.2 (alias PlayStation3 Cluster) PS3-02	Fri Jun 10 15:36:54 2011 (0d 0h 1m 11s ago)	DIKU	1000000	1	1	10	196	PS3	No jobs in queue can be executed by resource	360	0d, 0h, 4m,

# Resource Models

- **Conventional resources**
  - Like all other Grid systems, only easier
  - Basic user accounts with (restricted) ssh access from MiG servers
  - Compute and external storage nodes
- **MiG-SSS**
  - A very powerful screensaver
  - Virtualised minimal Linux distro
- **PS3-live**
  - Minimal Linux Live CD for PlayStation3
- **One-Click**
  - The simplest possible way to contribute
  - Web page with java applet

# MiG-SSS



# PlayStation 3

- The Cell CPU
  - 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
- Linux Live CD puts PS3's on MiG





# Managing Resources

## Minimum intrusion Grid

Dashboard

Submit Job

Files

Jobs

VGrids

Resources

Downloads

Runtime Envs

People

Settings

Shell

Docs

Fri Jun 10 2011 15:58:24  
GMT+0200 (CEST)

Certificate expires in:

340 19 50 2

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.

1/4 10 resources per page

Resource ID			Runtime envs	Alias	Nodes	CPUs	Mem (MB)	Disk (GB)	Arch
1615b4b4008492287aa8bd6848a85930			0		1	52	53248	10	SUN4U
amigos24.diku.dk.0			0		11	14	2048	10	X86
fyrgrid.grid.aau.dk.0			7	Fyrkat	17	8	16384	10	AMD64
fyrgrid.grid.aau.dk.1			9		2	8	16384	10	AMD64
amigos50.diku.dk.0			17	EightByEight	1	8	8192	10	AMD64
escience2.ekstranet.diku.dk.0			2	Sun T2	2	8	32640	10	SPARC-T
klynge.ekstranet.diku.dk.1			2	Klynge_grid	65	4	8192	1	AMD64
klynge.ekstranet.diku.dk.0			9	Klynge	9	4	8192	1	AMD64
pig01.ekstranet.diku.dk.0			14	Porky 1	1	4	8192	100	AMD64
d3c374876deccef6cfb6df3095891167			1		41	4	8000	80	AMD64

[Include sandbox resources](#)

#### Resource Status

# Resource Administration

Resource Management - Mozilla Firefox

File Edit View History Bookmarks Tools Help ← → ↶ ↷

migrid.org https://dk.migrid.org/ Google DA

Settings  
Shell  
Docs

Fri Jun 10 2011 13:38:43 GMT+0200 (CEST)

**Certificate expires in:**  
**340 22 9 43**  
Days Hours Minutes Seconds

Use the [editing interface](#) or make any changes manually in the text box below.  
[Resource configuration docs](#)

```
::HOSTURL::  
klynge.ekstranet.diku.dk  
  
::HOSTIDENTIFIER::  
0  
  
::ANONYMOUS::  
False  
  
::HOSTKEY::  
klynge.ekstranet.diku.dk,192.38.115.205 ssh-rsa AAAAB3NzaC1yc2EAAAABIWAAAQEaUc10b5cm3dwedlvj1GInd4UC  
  
::SSHPORT::  
22  
  
::MIGUSER::  
mig  
  
::RESOURCEHOME::  
/home/mig/mighome/MiG/mig_frontend/klynge.ekstranet.diku.dk.0  
  
::FRONTENDNODE::  
klynge.ekstranet.diku.dk  
  
::SCRIPTLANGUAGE::  

```

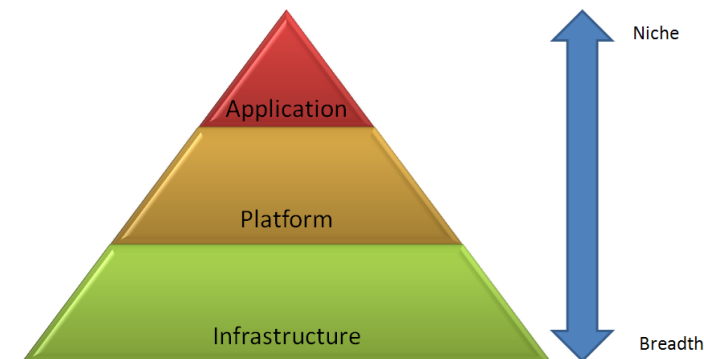
Save ----- Forget changes

**Front End**  
klynge.ekstranet.diku.dk

(F) Start Status Stop Clean

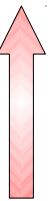
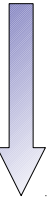
# The Cloud

- Multiple cloudy 'Cloud' definitions
  - Software as a Service
    - Web services/apps
      - Salesforce, Google/Apple/Microsoft/... web apps, ...
  - Platform as a Service
    - Software stack
      - Google App Engine, Microsoft Azure, ...
  - Infrastructure as a Service
    - Virtualized hosting:
      - Amazon EC2, RackSpace, ...



# GRID vs. Cloud Computing

- The fall of Grid computing in general
  - Started out with grand unified top-down vision
  - Gradually lowered ambitions for reliability and ease of management: 'job shop'
  - Still requires expertise to use: few 'elite' users
- The rise of Cloud computing (IaaS)
  - Bottom up solutions to different isolated problems
  - Subsets of Grid vision: no collaboration!
  - Isolated resource sharing at best
  - Self service solutions require expertise to use



# Reviving Grid Ambitions

- We **can** deliver original Grid promises
  - Share compute, storage, ... resources
    - Including PRC resources
  - Preserving transparency and ease of use
  - Collaboration platform
    - Communication, share files, work flow
- Cloud inspiration?
  - Better software sharing
  - Application platform (Saas/PaaS)
  - Virtual machines (IaaS)



# Better Software Sharing

- Use runtime envs
  - Native apps controlled by admins
  - On-demand apps controlled by users
- Central software repository
- ZeroInstall for on-demand apps
  - Dynamic deployment
  - Dependency handling
  - Isolation and secure sharing
  - User controlled use



# Software Repository

SWRepo - Mozilla Firefox

File Edit View History Bookmarks Tools Help ← → ↻ 🏠 migrid.org https://dk.migrid.org/ ☆ Google DA 🔍

## SWRepo - Software Repository for grid.dk

---

### Address

</software-repository/package>

### Description

Welcome to the grid.dk software repository management system: Here you can browse available packages and edit any packages that you administrate.

### Search Status

Searching for packages matching pattern 'openssl\*'

### Available Packages

The list below contains references to all matching packages.

Package
<a href="#">openssl</a>

# Application Platforms (VGrids)

File Edit View Go Bookmarks Tools Window Help

Back Forward Reload Stop [https://portal.grid.dk/cgi-bin/showvgridprivatefile.py?vgrid\\_name=Matlab-Compiler&path=index.htr](https://portal.grid.dk/cgi-bin/showvgridprivatefile.py?vgrid_name=Matlab-Compiler&path=index.htr) Search Print

## Matlab-Compiler MatLab Grid Service Pages

**MatLab Compilation**

Main MatLab File:  Main MatLab file on the server ([browse files](#) or [upload one](#))

Other components (MatLab or C files):  Other MatLab or C components to be used in the compilation. Specify paths to ([or choose](#)) files in your home directory, each on a

Output name:

Target Architecture: X86

**Compile Jobs submitted** [clear](#)

See the [Job monitor](#) page for previous jobs.

**Existing Applications**

Name	Source file (main)	Arch.	Refresh	Comments
aaa	aaa.m	X86	<input type="button" value="Delete"/>	Pending Job: 868_1_19_2011__13_58_16_portal.grid.dk.0
helloo	Matlab-Compiler/hello.m	AMD64	<input type="button" value="Delete"/>	<input type="button" value="Submit job"/> <input type="button" value="Do a parameter sweep"/>
mrank_test1	Matlab-Compiler/main.m (and mrank.m)	AMD64	<input type="button" value="Delete"/>	<input type="button" value="Submit job"/> <input type="button" value="Do a parameter sweep"/>
scalarprod	scalarprod.m	AMD64	<input type="button" value="Delete"/>	Compilation 870_1_25_2011__12_21_2_portal.grid.dk.0 failed

**Run a Matlab job**

Run the compiled application mrank\_test1(on AMD64 architecture):

Arguments:

Input files (choose)

[Back to the Top](#)

[Compile MatLab to Executable](#)

[Compiled MatLab Application](#)

[Output files from running applications](#)

[Information](#)

[Back to the Dashboard](#)

[Automatic page refresh](#)



# Virtual Machines

## MINIMUM INTRUSION GRID

Dashboard

Submit Job

Files

Jobs

VGrids

VMachines

Resources

Downloads

Runtime Envs

Settings

Shell

### MiG Virtual Machines

Request Virtual Machine

#### Welcome to MiG virtual machine management!

In this part of MiG you can:

- Request Virtual Machines, by clicking on the button above
- See your virtual machines in the list below.
- Start, and connect to your Virtual Machine by clicking on it.

#### Your machines:

VirtualDesktopsRock



Specs:

- Memory: 1024
- Cpu's: 1
- Arch: i386
- Password: UNKNOWN

MyFavouriteDesktop



Specs:

- Memory: 1024
- Cpu's: 1
- Arch: i386
- Password: UNKNOWN

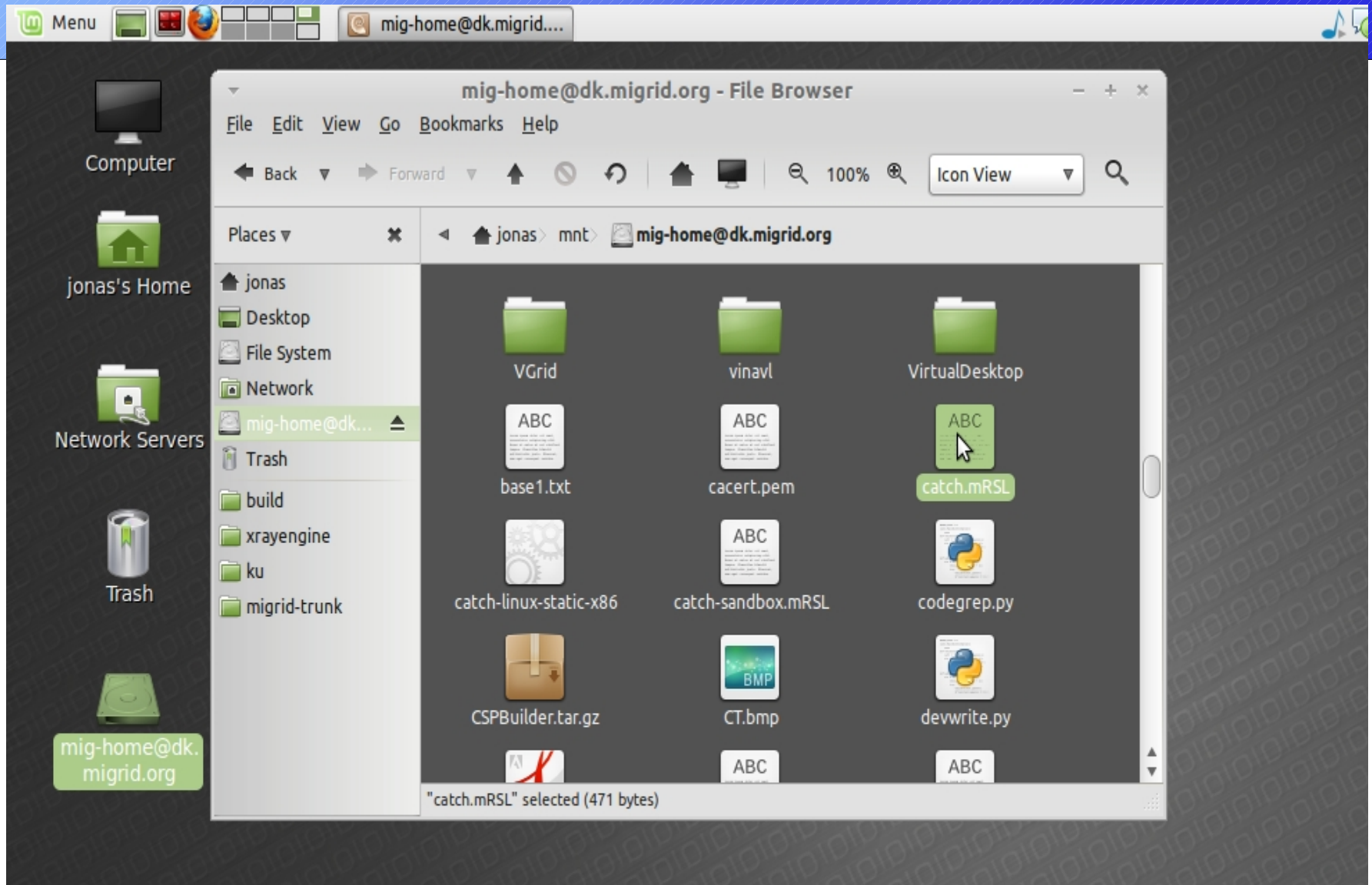
Scilab



Specs:

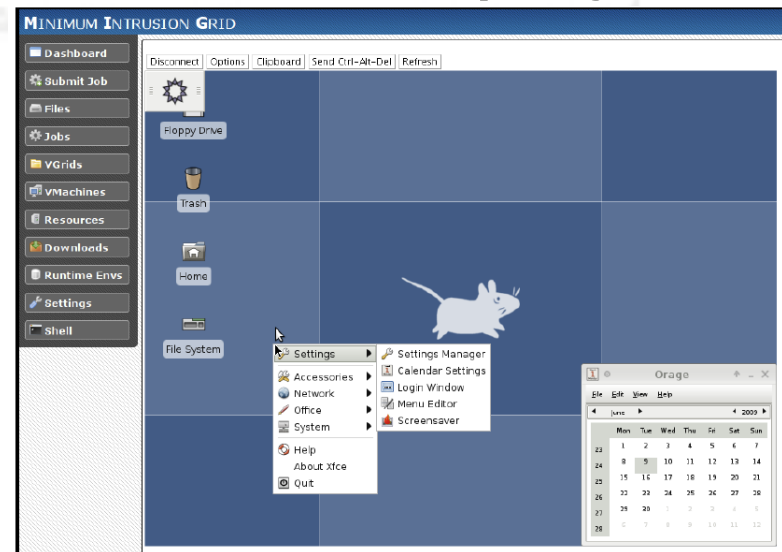
- Memory:
- Cpu's: 1
- Arch: i386
- Password:

# SSHFS Remote File Access



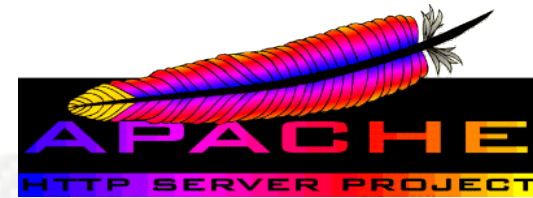
# Graphical Access

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



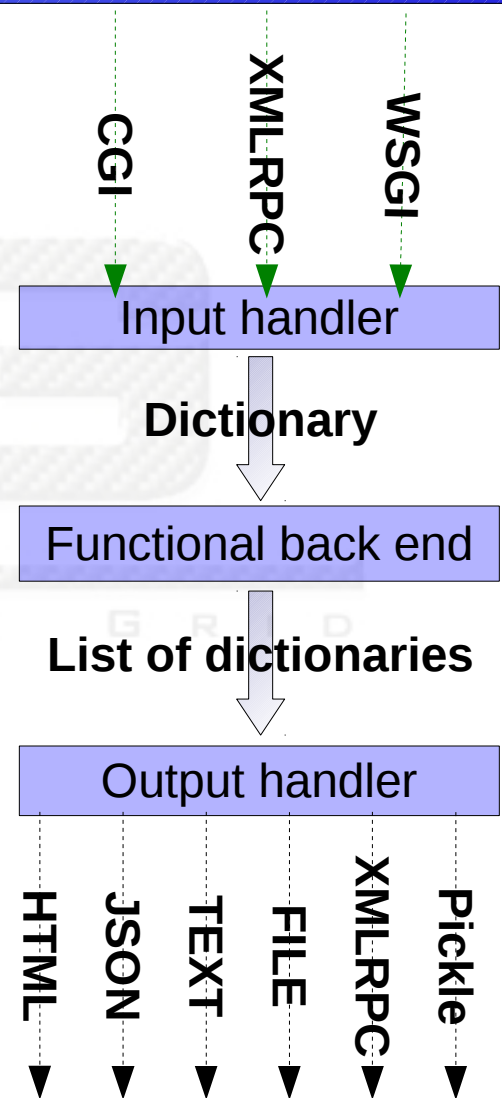
# MiG Core Components

- Web server
  - WSGI
  - CGI
  - XMLRPC
- MiG Daemons
  - Job manager
  - Monitor
  - IM notifier
  - SFTP daemon
  - SSH multiplexing



# Web Server

- Multiple front ends to functional backends
  - Input handler parses/validates request to dictionary
  - Backend called with input dictionary, and it interacts file system (pickle) and daemons
  - Backend return list of nested dictionaries
  - Requested output handler translates it to string



# External Components

- MoinMoin WikiWiki
  - CGI based isolated installation in VGrid dir
- Mercurial SCM
  - CGI based isolated installation in VGrid dir
  - Client access with user certificate
- (Extended) Forest Board Forum
  - Messages and status files in VGrid dir
- Enchant, JSON and Paramiko
  - Integrated module calls
- ZeroInstall software deployment

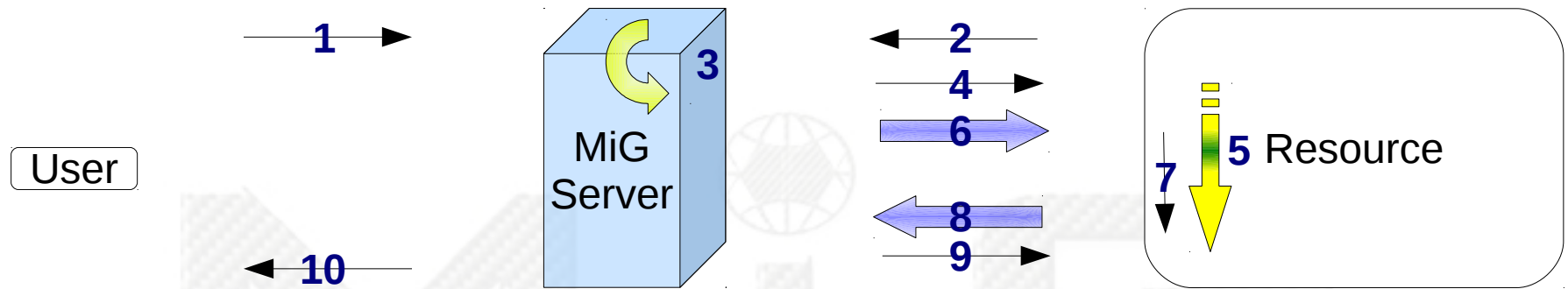


# SFTP Server

- Extended Paramiko SFTP example
  - Validate SSH public key
  - Map key to MiG user for user home
  - Filter requests
    - 'chroot' to user home, except vgrid shares
    - Restricted files
    - No symlinks
    - No access changes (chmod)
- Users can use sftp client to access MiG home
- Users can use sshfs to locally mount MiG home



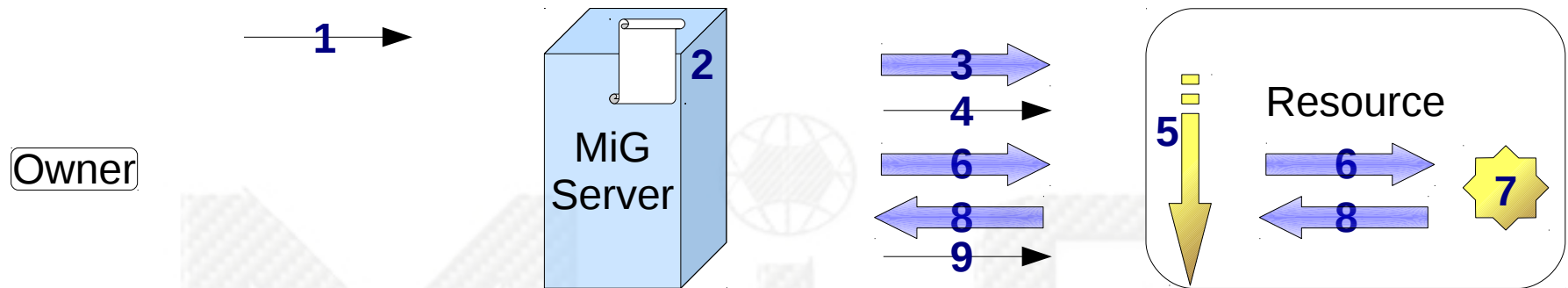
# Under the Hood: Job Flow



1. User submits job to the MiG server (HTTPS and certificate)
2. Resource requests a new job to execute (HTTPS)
3. The MiG server schedules a job and 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 actual job commands are executed
8. Resource sends outputfiles to the MiG server (HTTPS)
9. MiG server cleans up the resource using SSH
10. User retrieves job results eventually (HTTPS and certificate)




# Under the Hood: Resource Run



- 1.Resource owner starts resource through MiG server (HTTPS)
- 2.MiG server creates resource scripts from conf (w. Session ID)
- 3.MiG server copies FE and EXE scripts to resource using SCP
- 4.MiG server launches both scripts on resource using SSH
- 5.FE script loops: gateway to MiG server (HTTPS+Session ID)
- 6.Exe script pulls job with input/executable files through FE
- 7.Exe script executes job
- 8.Exe script sends result with output files through FE
- 9.Result or timeout on MiG server triggers clean up and launch of new EXE script on resource ... repeat from (6) ...

# Security and Access Control

- MiG daemons run as one unprivileged user
  - User homes are in same account
    - prevent illegal directory traversal
- Symlinks from VGrid shares to user homes
  - Prevent symlink creation/modification
- Resource access without certificate 
  - Random Session IDs
- Cross Site Scripting / Request Forgery
  - Strictly validate all input and output
  - Require HTTP POST in modifying interfaces

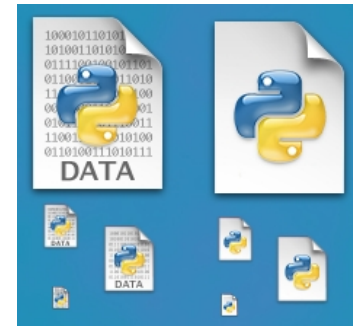
# Python Advantages

- Extremely fast development
- Standard library and extensions for everything
- More functionality in fewer lines of code
  - 50K lines (SLOC) in MiG
  - 1M+ lines in comparable middlewares
- Quality of code / Maintenance
- Dictionaries, pickle for lightweight DB's
- Flexible output formatting



# Pure Python?

- Apache: HTTPSServer, Django, Zope, ...
- OpenSSH ssh/scp to resource: Paramiko
- cURL with client certs: urllib, pyopenssl, pycurl
- IRC Notify: libpurple or dbus+pidgin
- HTML formatting: Mako, Clearsilver, ...
- Manual JQuery javascripting: pyjamas
- Bash scripts: python equivs
- Daemons: TCPSocketServer, ...



# Python Problems / Limitations

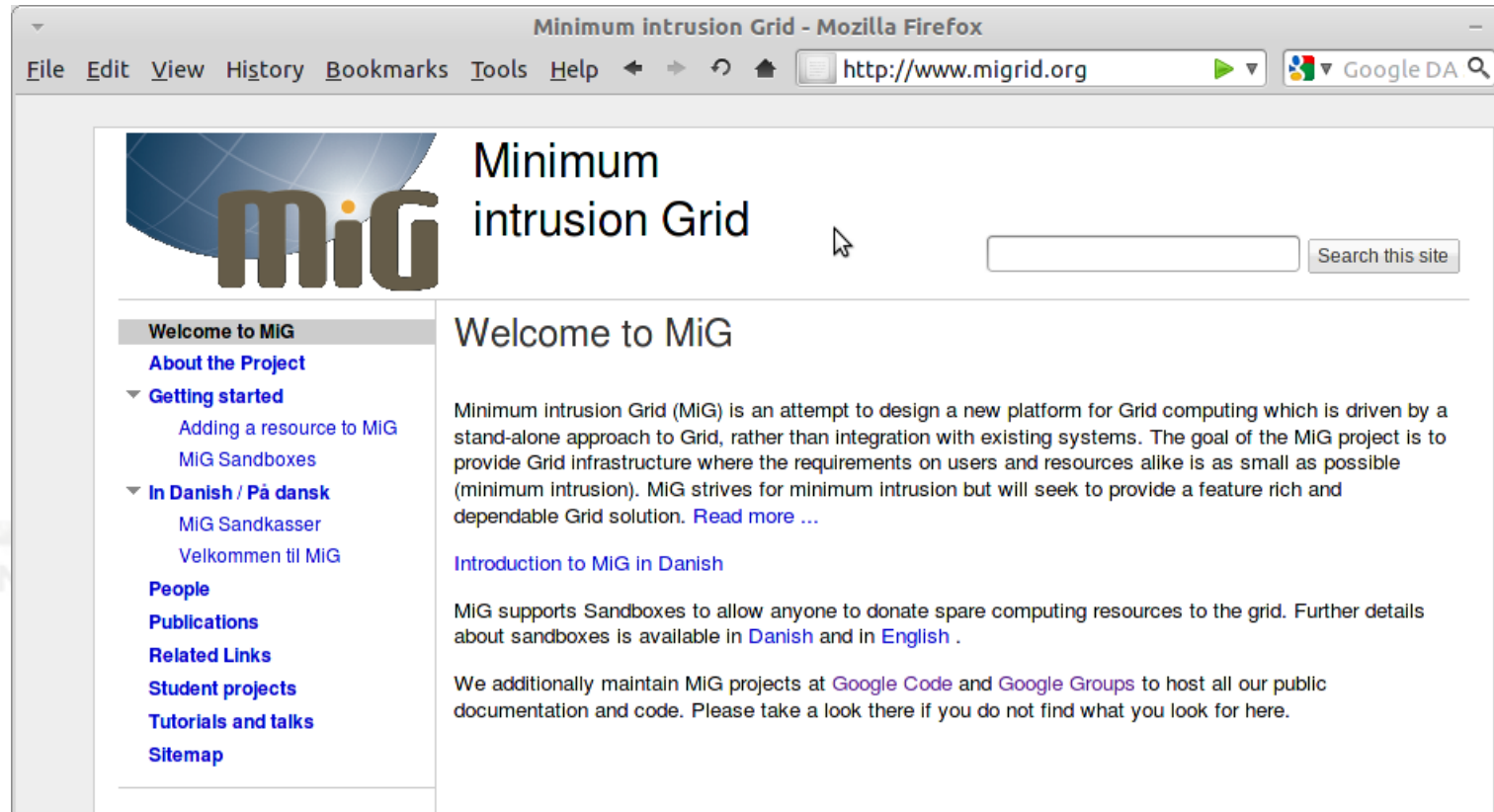
- Apache
  - Scalability, TLS/SSL, URL rewrite
- cURL
  - Limited native SSL client certificate support
- IRC Notify
  - python-purple has rough edges
- Manual JQuery javascripting
  - Pyjamas is still experimental
- Bash resource scripts
  - Python world domination still getting closer :o)

# MiG Conclusions

- MiG is 'feature complete'
- Easy to use, transparency
  - users / resource owners
- Flexible resource sharing
  - Dedicated, PRC and IaaS style
- Dynamic collaboration tools
- Application platform
- Dynamic software deployment
- Outstanding issues
  - Beyond 'research' project
  - server distribution performance



# Further Information



The screenshot shows a Mozilla Firefox browser window displaying the website <http://www.migrid.org>. The page features the MiG logo (a stylized 'miG' with a globe background) and the title 'Minimum intrusion Grid'. A search bar is located to the right of the title. The main content area is titled 'Welcome to MiG' and contains the following text:

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.

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

- 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

# www.migrid.org