

LIGO Data Grid:

A tool for gravitational wave data analysis

Preliminaries

- LIGO Data Grid (LDG) evolves constantly
- These notes detail LDG as it is *today*
- This will denote a planned enhancement



Preliminaries

A “Tip” indicates a suggestion that is not strictly necessary, but will make life easier!



Why the LDG?

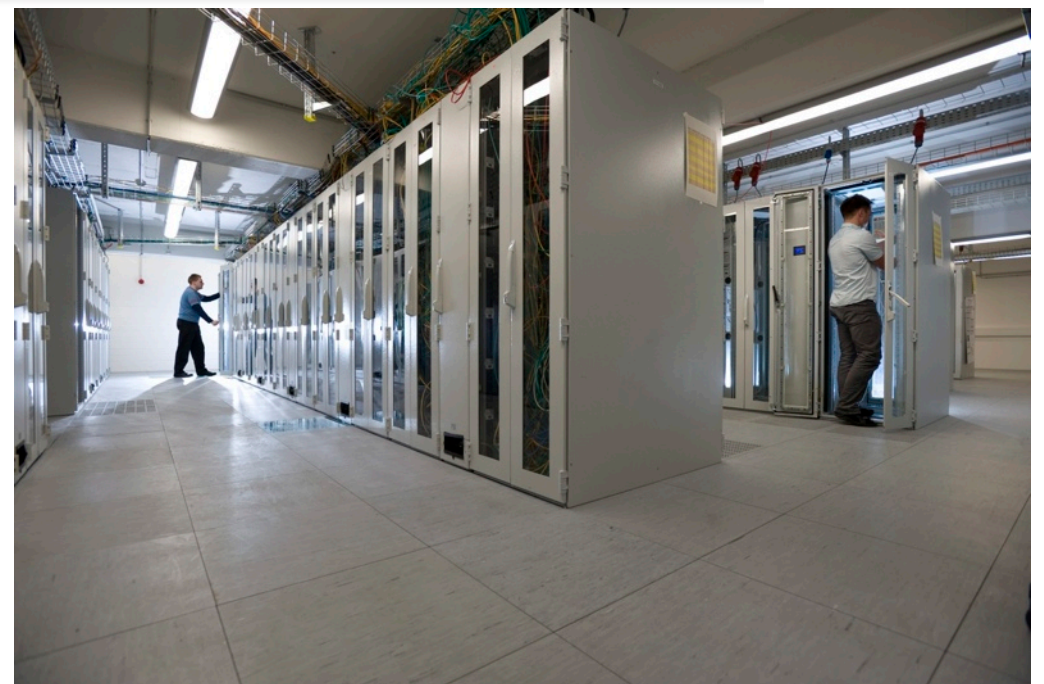
- Petabytes of LIGO, Virgo, GEO data
- 20,000+ computing cores
- Dedicated to GW data analysis
- Software stacks tuned for GW data analysis
- Support by both scientists and admins

LDG Overview

Begin with a global overview of the
LIGO Data Grid...

Linux Clusters

- Maximize computing power for \$
- Flexible platform for scientific computing



Reference Operating Systems

- LDG standardized on two Linux flavors



1. Cent OS 5.3

2. Debian 5 (Lenny)

- Soon upgrade to new references

1. Scientific Linux 6

2. Debian 6 (Squeeze)



debian



Tip

Develop on a LDG reference OS

- Minimize version incompatibilities
- Maximize help from other scientists
- Save you time
- Get more science done



Tip



- Use Linux or Mac OS X for your workstation or laptop
- Do NOT use Microsoft Windows
 - access tools not well supported
 - can be done but will be painful
- No serious LIGO data analysis is done on Windows



“Pleasantly Parallel”

- “Embarrassingly parallel”
- High Throughput Computing (HTC)
- No fast interconnects on clusters
 - (no Infiniband or similar)



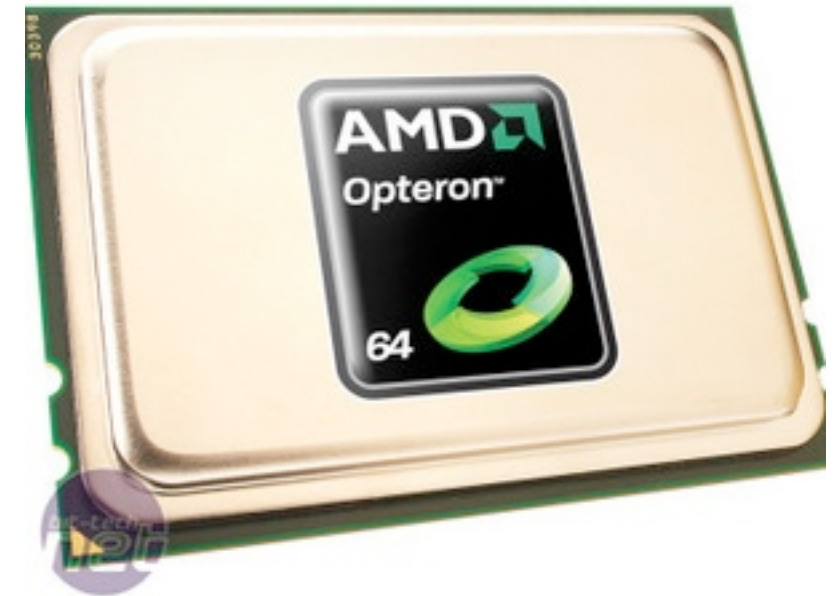
Condor
High Throughput Computing

Single Threaded

- Most codes run single threaded
- Parallelize across data (in time)
- Little MPI or OpenMP
- Some groups using multi-threaded codes
 - all threads within one node

x86-64

- still some 32 bit
- mixture of AMD and Intel hardware



GPU



- very fast FFTs, quite useful for GW analysis
- available on two (2) clusters
- expect GPUs to be standard soon on LDG

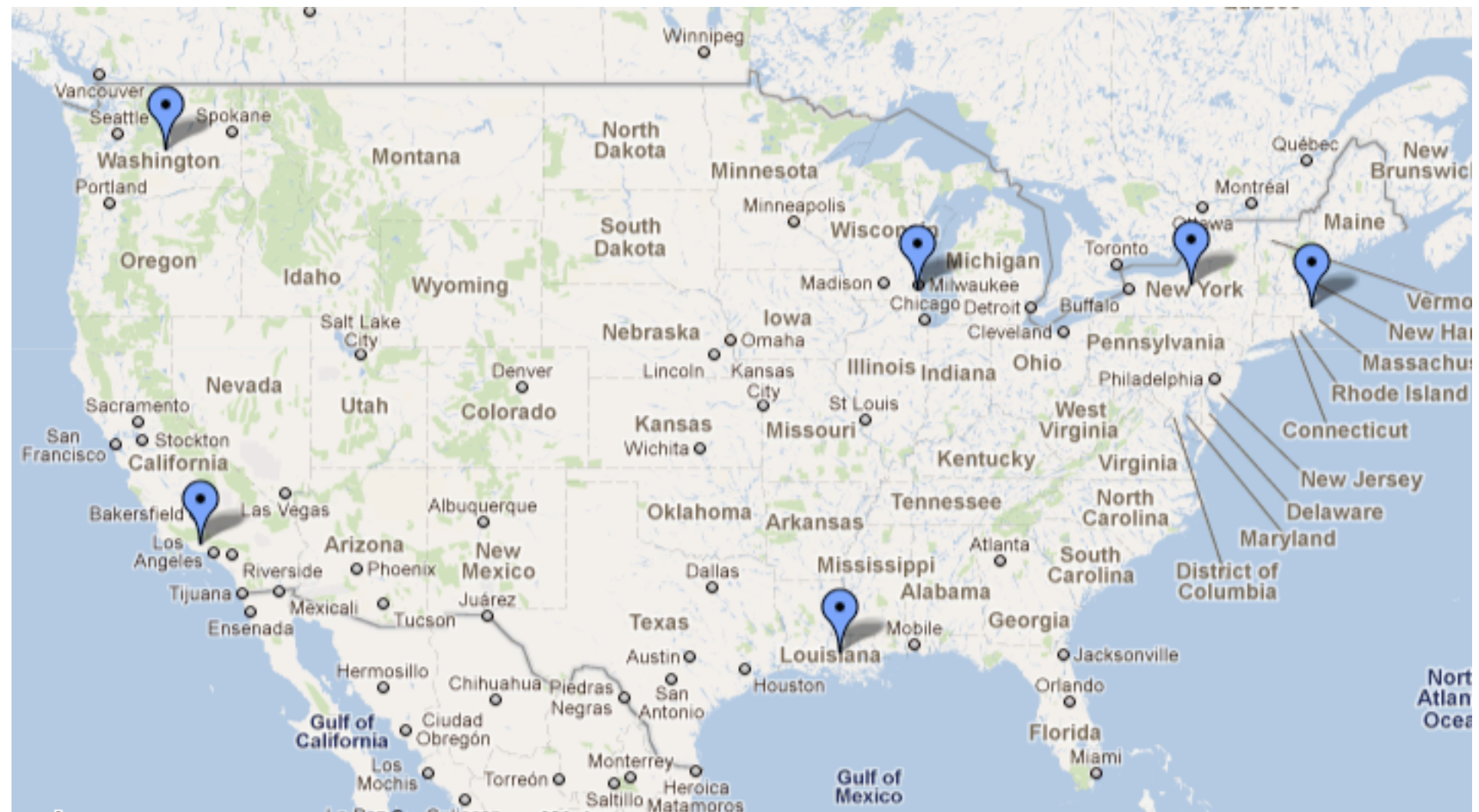




- All LDG clusters use Condor
- Submission and management of data analysis jobs and workflows
- High Throughput Computing environment
- Much more about Condor later

LDG Sites (US)

- Caltech
- LHO
- LLO
- MIT
- SYR
- UWM



LDG Sites (Europe)

- Cardiff
- AEI
- Birmingham



LDG Sites

- Classified by the amount and types of available data...

LIGO Data

- Sampling rate is 16 KHz
- Thousands of “channels” recorded
 - data channels
 - environmental channels monitoring noise
 - control channels
- Many channels sampled at lower rate

LIGO Data

- Channels saved in structure called “frames”
- Frame format is standard for community
- “Frame files” when saved to disk
- T970130-v1 in DCC



LIGO Data

“Raw” or full frame files

- contain ALL channels
- LIGO raw frames usually 32 seconds long
- rarely used for data analysis
- sometimes used for detector characterization

LIGO Data

Level one (1) reduced data sets (RDS)

- about 10% of the channels
- used for data analysis and detector characterization
- LIGO RDS level one usually 64 seconds long

LIGO Data

Gravitational wave strain or $h(t)$ data channel

- calibrated strain
- used for most data analysis
- LIGO $h(t)$ usually 128 seconds long

LDG Sites

- Sites classified into “Tiers”
 1. data available
 2. support level
- Tier One (1)
 - All LIGO data, All GEO data, Virgo $h(t)$
 - Support all LIGO users

LDG Sites

- Tier Two (2)
 - All LIGO, Virgo $h(t)$ data
 - Some level one RDS data
 - Support all LIGO users
- Tier Three (3)
 - Limited sets of LIGO and Virgo $h(t)$ data
 - Support small groups of users
 - usually focus on specific analysis

LDG Sites

- Tier one (1) site: Caltech
- Tier two (2) sites:
 - LHO, LLO, AEI, UWM, SYR
- Tier three (3) sites:
 - MIT, Cardiff, Birmingham
 - MIT transition to Tier 2 for aLIGO



Caltech



- California Institute of Technology
- Tier one (1) site
 - All LIGO data
 - Virgo strain channel $h(t)$ data
 - GEO data (all channels since June 2011)

Caltech



- 2730 cores
- 1.6 PB storage (spinning disks)
- very large tape archive (many PB)

LHO

- LIGO Hanford Observatory
- 2100 cores
- 340 TB disk (spinning)
- large tape archive
- LIGO Tier 2 site



LLO

- LIGO Livingston Observatory
- 2020 cores
- 340 TB storage (spinning)
- large tape archive
- LIGO Tier 2 site



MIT



- ~ 2000 cores
- ~ 300 TB storage
- Currently transitioning from Tier 3 to 2
- Plan to be full Tier 2 site for aLIGO



AEI

- Albert Einstein Institute, Hannover, Germany
- ATLAS cluster
- 7000 cores
- 1.6 PB storage (spinning)
- 264 GPUs (C2050 and C1060)
- GEO Tier 1 site (all GEO data)
- LIGO Tier 2 site



UWM

- University of Wisconsin-Milwaukee
- 3440 cores
- 500 TB storage (spinning)
- LIGO Tier 2 site



SYR

- Syracuse University
- 2380 cores
- 480 TB storage (spinning)
- 170 GPUs
- currently transitioning from Tier 3 to Tier 2



Cardiff



- Cardiff University in Wales, UK
- 180 cores
- 20 TB storage (spinning)
- LIGO Tier 3
- Development of pipelines for binary inspiral and burst analysis

Birmingham



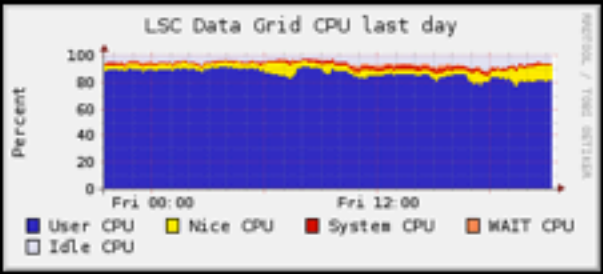
UNIVERSITY OF
BIRMINGHAM

- Birmingham University in UK
- 212 core
- 16 TB storage
- Tier 3 site

LIGO Data Grid: LIGO Data Grid x

https://www.lsc-group.phys.uwm.edu/lscdatagrid/

LIGO Data Grid



DASWG Usage Available Data Services Wiki

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General Information

Welcome to the LSC DataGrid

The LIGO Data Grid is the combination of LIGO Scientific Collaboration computational and data storage resources with grid computing middleware to create a coherent and uniform LIGO data analysis environment. The graph on the top right shows the current CPU usage across the six active centers across the world

Getting started?

If you are new to the LSC DataGrid and need instructions for installing grid tools, getting a certificate, and requesting access to LSC resources then please see [Getting Started on the LSC DataGrid](#) or click on "How to get started" on the navigation bar on the left.

Soon move to wiki.ligo.org/LDG





LIGO Data Grid Report for Fri, 29 Jul 2011 02:22:43 -0500

Get Fresh Data

Last

hour

Sorted

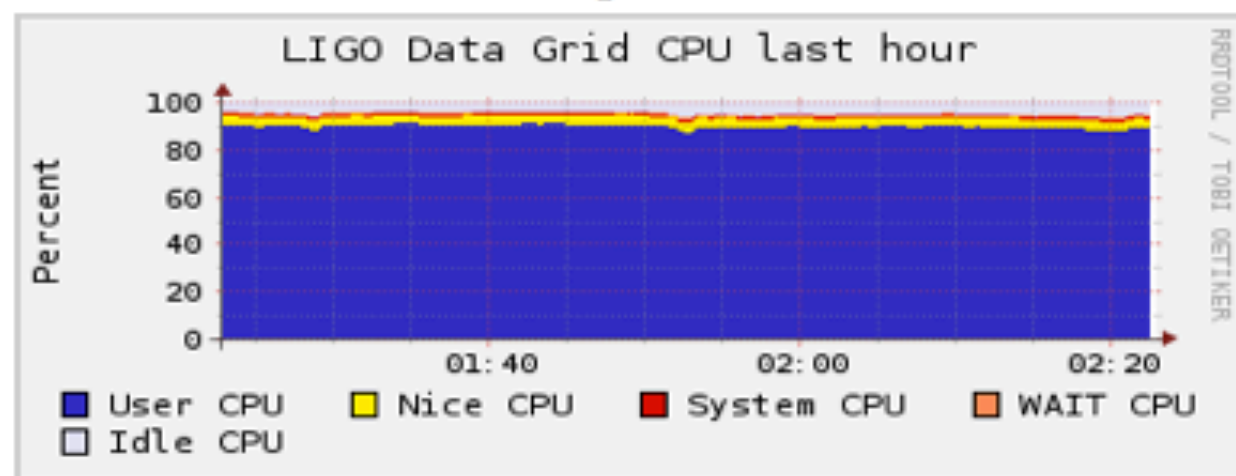
descending

LIGO Data Grid >

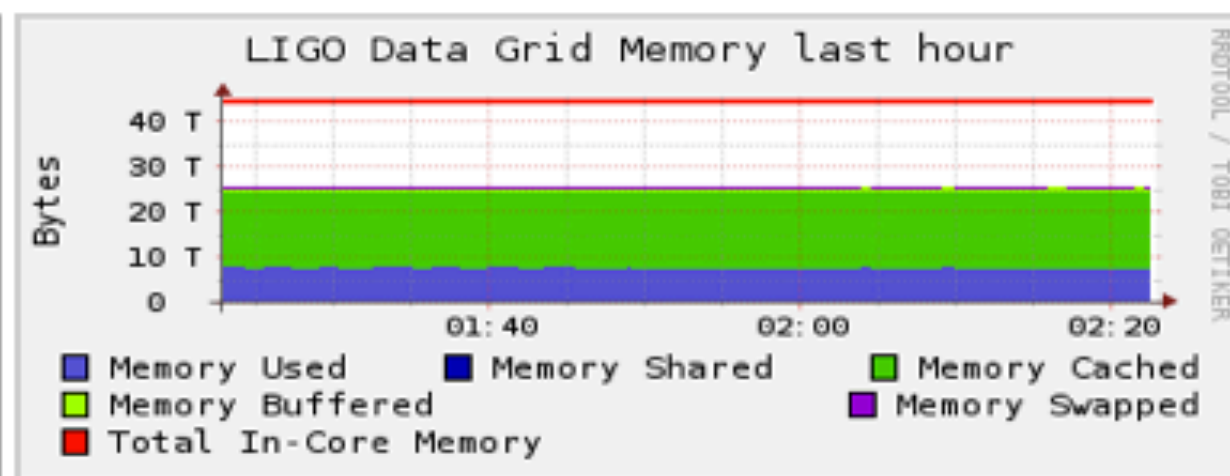
--Choose a Source

LIGO Data Grid (7 sources) (tree view)

CPU's Total: 23524 | Hosts up: 3996 | Hosts down: 9



Avg Load (15, 5, 1m):
 97%, 96%, 96%





Korean LDG Sites

- Ongoing effort to add KISTI and NIMS
- KISTI GSDC:
 - ~ 300 cores (some shared)
 - 100 TB storage (h(t) and level 1 RDS)
 - See presentation by Beobkyun Kim
- NIMS:
 - ~ 200 cores (shared)
 - ~ 40 TB storage



Accessing LDG

How does one actually access the
LDG?

Accessing LDG

- First join LIGO Scientific Collaboration (LSC)
- Groups join LSC, not individuals
- Principal Investigator (PI) manages membership
- Senior members must petition to join LSC
- Post-docs & graduate students managed by PI

LIGO Scientific Collaboration x

https://roster.ligo.org/roster.php?do=roster&search=group&target=57

LIGO Scientific Collaboration | DIRECTORY

● = Principal Investigator ● = Council Member

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****NOTE**** If you are not currently listed in the LSC Directory Services and believe that you should be, please contact your Institution's PI or the LSC Spokesperson.



LIGO Directory Services and Authentication & Authorization Services Infrastructure are supported by the [National Science Foundation](#). Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.



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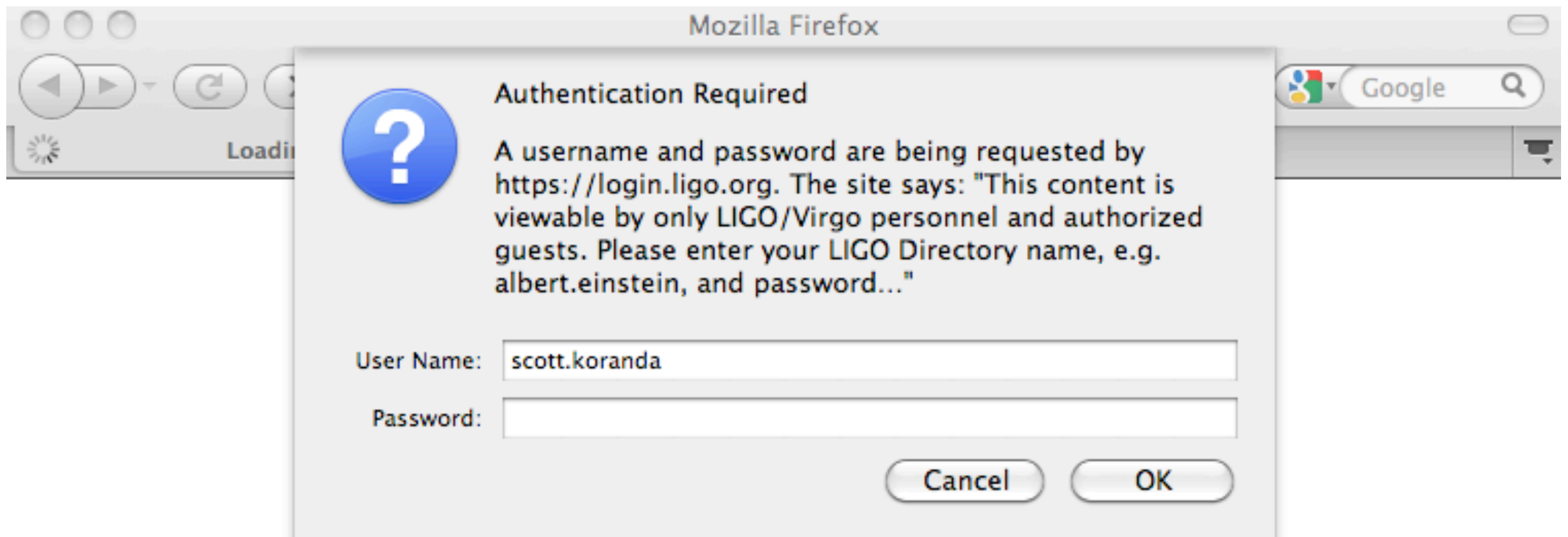


@LIGO.ORG

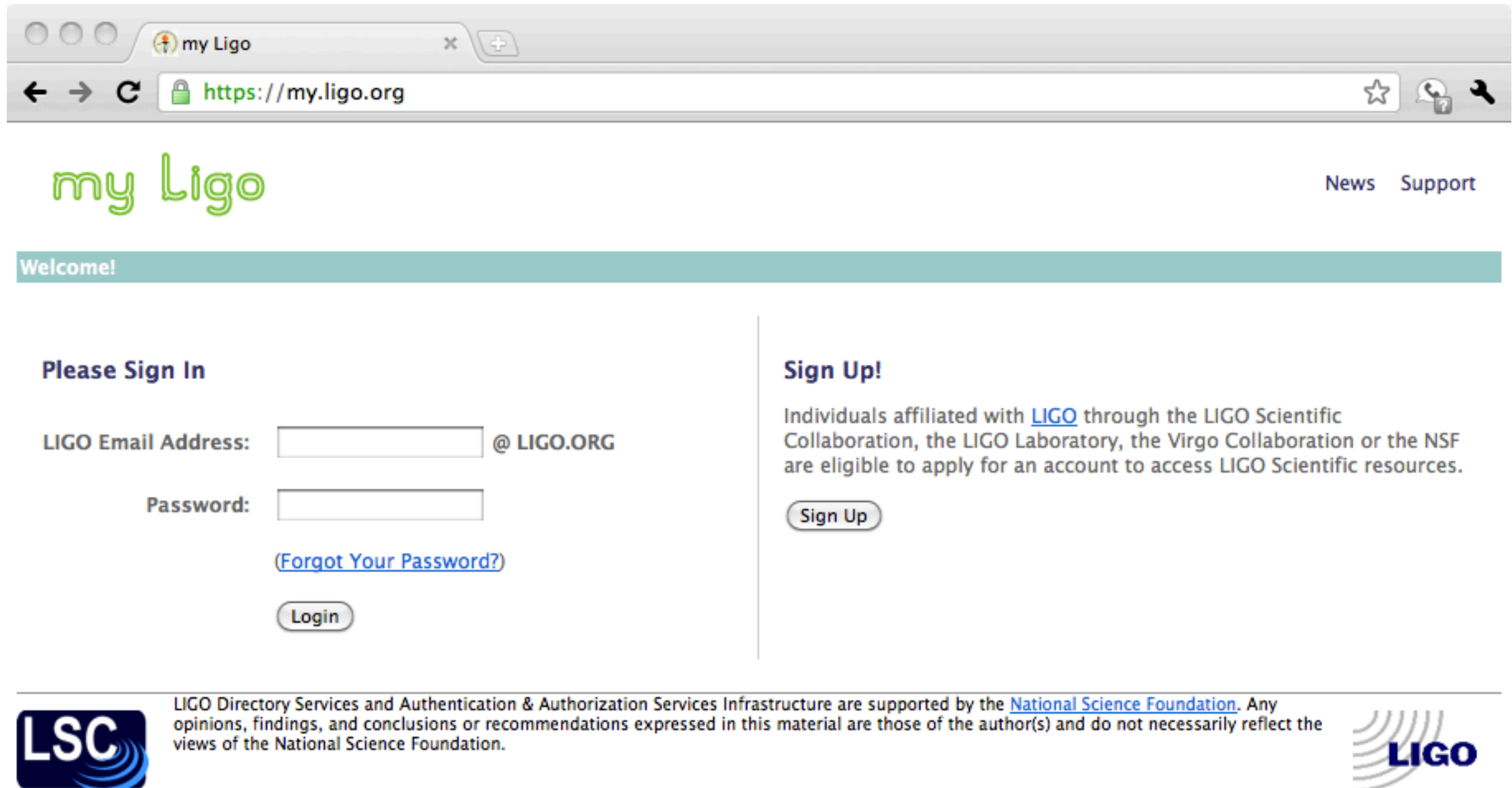
- Each LIGO member receives @LIGO.ORG electronic identity
- Also known as “Albert Einstein identity”
- albert.einstein@LIGO.ORG

@LIGO.ORG

- Used to access all LIGO web pages
- Email address (forwards to other email)



@LIGO.ORG



The screenshot shows a web browser window with the address bar displaying <https://my.ligo.org>. The page features the "my Ligo" logo in green and blue, with "News" and "Support" links in the top right. A teal banner reads "Welcome!". Below this, the page is divided into two columns. The left column, titled "Please Sign In", contains a "LIGO Email Address:" label, a text input field followed by "@ LIGO.ORG", a "Password:" label, another text input field, a "(Forgot Your Password?)" link, and a "Login" button. The right column, titled "Sign Up!", contains a paragraph stating that individuals affiliated with LIGO through the LIGO Scientific Collaboration, the LIGO Laboratory, the Virgo Collaboration, or the NSF are eligible to apply for an account to access LIGO Scientific resources. Below this text is a "Sign Up" button. At the bottom, a horizontal line separates the main content from the footer. The footer includes the LSC logo on the left, a disclaimer stating that LIGO Directory Services and Authentication & Authorization Services Infrastructure are supported by the National Science Foundation and that opinions, findings, and conclusions are those of the author(s), and the LIGO logo on the right.

my Ligo

News Support

Welcome!

Please Sign In

LIGO Email Address: @ LIGO.ORG

Password:

[\(Forgot Your Password?\)](#)

Login

Sign Up!

Individuals affiliated with [LIGO](#) through the LIGO Scientific Collaboration, the LIGO Laboratory, the Virgo Collaboration or the NSF are eligible to apply for an account to access LIGO Scientific resources.

Sign Up

LSC

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LIGO

LIGO Roster

The screenshot shows a web browser window with the address bar displaying `https://roster.ligo.org/roster.php`. The page has a header with the LIGO Scientific Collaboration logo, the word "DIRECTORY", and a "Search the Directory" button. Below the header, there are two main sections: "Search the LSC Directory" and "News & Information".

Search the LSC Directory

Search on any of the following fields:

Member Name:

-- or --

LSC Group:

-- or --

Institution (Federated LSC Groups):

-- or --

Select Views:

☐ Council Members

☐ PIs

☒ View the entire Directory

News & Information

This directory now displays all individuals who have LIGO.ORG accounts used to access LIGO resources. This includes Virgo and LIGO Lab individuals who are not members of the LSC.

Please visit [my Ligo](#) to update your contact information or handle any group management.

Other Directories

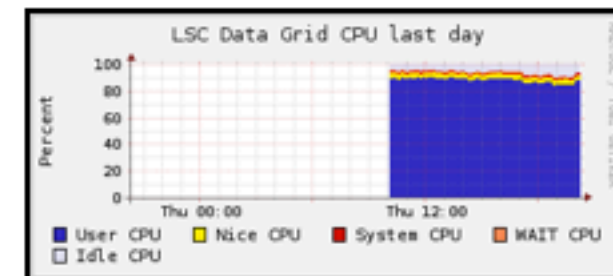
[LSC Committees and Working Groups](#)

[LIGO Laboratory](#) | [Virgo Collaboration](#) | [GEO 600](#)

Electronic Identities

- In future use **existing campus/institute** credential to access LDG
- Leverage “SAML Federated Identities”
 - US: InCommon/Internet2
 - Japan: GakuNin
 - UK: Access Management Federation For Education and Research
 - Germany: DFN-AAI
 - Italy: IDEM
 - France: Fédération Éducation-Recherche
- Is there a Korean SAML federation?





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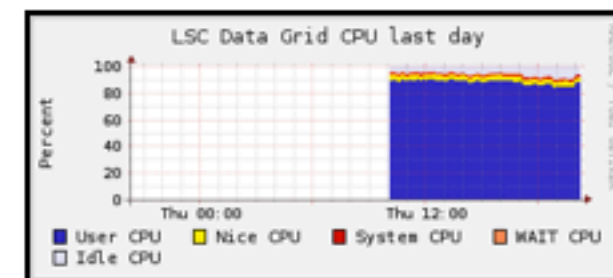
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[Account Request](#)

Getting Started on the LSC DataGrid

The following five steps are the basic steps required in order to "get started", as a user, on the LSC DataGrid.

1. **Install the LSC DataGrid Client package:** In order to connect to the LSC DataGrid clusters the client tools need to be installed. Installation instructions, for various supported platforms, can be found [here](#).
2. **Get a certificate:** To use the tools in the LSC DataGrid Client package to connect to LSC resources you will need a Personal X.509 Grid Certificate, from DOEgrids or another appropriate certificate authority, for authentication. Instructions for obtaining such credentials can be found [here](#). It will take 24 to 48 hours to process your request.
3. **Request accounts:** Accounts on LSC systems can be requested at:

[LIGO Scientific Collaboration Virtual Organization Computer Resource Request Form](#)



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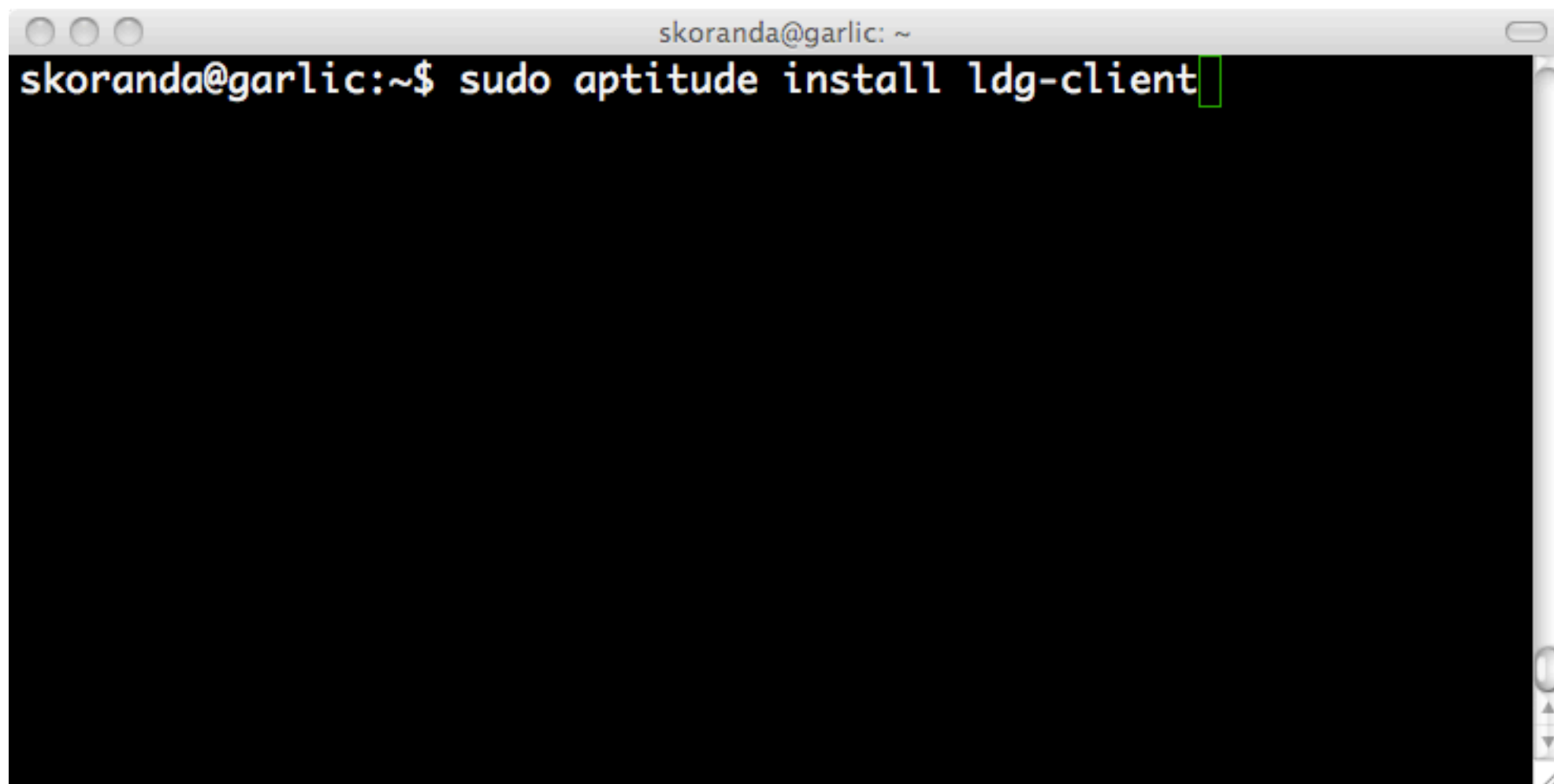
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LDG Client

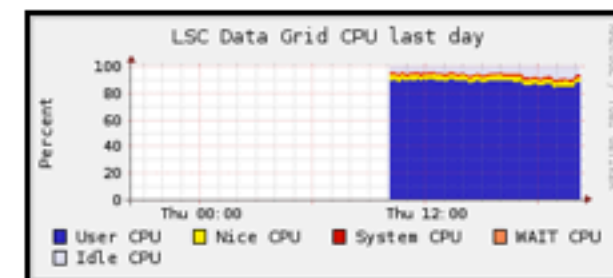
- Software tools needed to connect to LDG
- Supported on:
 - Mac OS X 10.5 and 10.6
 - Linux:
 - CentOS 5.3
 - Debian Lenny
 - Debian Squeeze
 - Ubuntu 10.04, 10.10, 11.04
 - Windows (sort of...via Java based tool)

LDG Client

- Installation is easy, using native packages
 - Disk image for Mac
 - Repositories for Linux

A screenshot of a terminal window with a light gray title bar. The title bar contains three window control buttons on the left and the text 'skoranda@garlic: ~' on the right. The terminal area has a black background with white text. The command 'skoranda@garlic:~\$ sudo aptitude install ldg-client' is entered, with a green cursor at the end of the line. The rest of the terminal area is empty.

```
skoranda@garlic:~$ sudo aptitude install ldg-client
```



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Grid Credential

- Two parts
 1. X.509 certificate
 2. Matching private key
- Simple text files you keep on your laptop

Private Key

- It's a secret!
- Must keep it secure
- UNIX file requirements
 - file permissions 0600
 - owned by user


```
skoranda@garlic: ~
skoranda@garlic:~$ cat .globus/userkey.pem
-----BEGIN RSA PRIVATE KEY-----
Proc-Type: 4,ENCRYPTED
DEK-Info: DES-EDE3-CBC,954CA7ACDD649457

KWvm95n5a9qpRb5Cw4jR1zHURfzNVPe3mcuYEtVE2Ec9QKcUFhD8z7eATc013aWg
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ln9JQXTIUscwSCajrWI/uhZ60jGBjvJIrM/7mAxknf2gY4KnoQr/9l0y5yPo9K4Z
UfAzLhYFErXMMU3NN+7g/pzjYuw2DBECb95r16jPYl4Q1Q7Uuc411l5dPrueffHI
Gsonh2PTl1pHoUzgWAoLnwojR65XFEGa+Dx/FIY/1eL4K+1kHoHwHkj/ZXQEPFmi
B2ywPrJQNJqeVcU8Yz5rrWhLQIFKuzkIKrfRarflNl3Knj9Pd4WmlrnF6RtTdYtk
+LaQPxAjXhaDYIimh57kDtapgj9+JrSoyW0EU36on4LT/p0h16F9WkpcxvoooA7E
8r1MKa0Plyr1v+fessrUvMkX4oH3a/UKFprAmhyXQgxJ5+Y0uA2Jojpuds/v0L7r
Uf4i382Q54zibMqsFAdJU/Gx0F8WxagPqoYW03MQttQk3YD1I8N3gA==
-----END RSA PRIVATE KEY-----
skoranda@garlic:~$
```

Private Key

- Kept secret by encrypting it on disk
- Need a passphrase to decrypt and use it
- Do NOT share your passphrase!
- More on passphrase later...

X.509 Certificate

- NOT a secret
- Public document
- 3 important parts
 1. Name
 2. Public key (matched to your private key)
 3. Signature of Certificate Authority (CA)

X.509 certificate

- UNIX file requirements
 - file permissions 0644
 - owned by user

X.509 Certificate

- 1st important part is Name
- “Distinguished Name” or DN
- Also called “Subject” of certificate
- Unique name for you across all grids!

`/C=KR/O=KISTI/O=GRID/O=Hanyang University/CN=73433894 Kyungmin Kim`

X.509 certificate

- 2nd important part is public key
- Used with matching private key
- Almost never need to know about this part

X.509 certificate

- 3rd important part is digital signature of certificate authority (CA)
- Binds together name/Subject/DN with the public key
- CA asserts that person with Subject is the holder of the public key

```
skoranda@garlic: ~
skoranda@garlic:~$ cat .globus/usercert.pem
-----BEGIN CERTIFICATE-----
MIIEELzCCAxegAwIBAgIDANLdMA0GCSqGSIb3DQEBAQUAMGkxEzARBgoJkiaJk/Is
ZAEZFgNvcmcxGDAWBgoJkiaJk/IsZAEZFghET0VHcm1kczEgMB4GA1UECjMXQ2Vy
dGlmaWNhdGUgQXV0aG9yaXRpZXMxFjAUBgNVBAMTDURPRUdyYWZlZmEwHhcN
MTEwMjIyMDQ0NzI3WhcNMTEwMjIyMDQ0NzI3WjBfMRMwEQYKCIImiZPyLGQBGRYD
b3JnMRgwFgYKCIImiZPyLGQBGRYIZG9lZ3JpZHMxDzANBgNVBASTB1B1b3BsZTEd
MBsGA1UEAxMUU2NvdH0gS29yYW5kYSAyMTI0DgwggEiMA0GCSqGSIb3DQEBAQUA
A4IBDwAwggEKAoIBAQDvQ1bdLcLgSmlwEMhDPPIqedpukxFAWIzCJmd/BTM5iayw
G6ZRDkSE0ag2sYA9gfw9oPUWXHx2eX0UKJuyt90kIagRU0KtnAIpcc09suHM0zoP
yXUhXuENDgIWvtpVjZxb0u7FVIFn+EQT4Fa0mNbdEN7bF/T414g5nDUJnV0c9G80
cPCn5MCFLwFrGP90FjWnG1FWWQwP9WwWm796sywPrC68S/Q1J8kbrnYpPC51rey
6BwryW646+/JdA3uDDf6kukeGMe9mQNRwv1tnPkwkIEb+78Wy90fcuci9sEIu2k
8USEozieJnZe5gScT3DfzK4AjRvWkurhfGWYV0p9AgMBAAGjgekweYwEQYJYIZI
AYb4QgEBBAQDAgXgMA4GA1UdDwEB/wQEAwIE8DA2BgNVHSAELzAtMA0GCyqGSIb3
TAMHAQMBMAwGCiqGSIb3TAUCAgEwDgYMKoZIhvdMBQIDAQEBMD4GA1UdHwQ3MDUw
M6AxC+GLWh0dHA6Ly9jcmwuZG9lZ3JpZHMub3JnLzFjM2YyY2E4LzFjM2YyY2E4
LmNybDAoBgNVHREEITAfgr1za29yYW5kYUBncmF2aXR5LnBoeXMudXdtLmVkdTAf
BgNVHSMEGDAWgBTKGR0Sjm6k0F1C1DE0CNvZjRcNXTANBgkqhkiG9w0BAQUFAAOC
AQEAGvPNTZSZNz0SIhPmL7rY2ENUw5MI+sKnBUZ0cL71kofwFm/T83ShXjb6fh1g
1NSKesQRkHFvYr+wIPHp8B38TFR0QYVeu+jdk1w0nX89kevwJavzNyEBkv45ZrDg
ihP5ADd1Hdg4YZEVZTXvVSAw+wnLGC4r9umTvPKrtC8KBKb3i8yPm9j19l+Jy0SU
yogUGWj+xAgbche6khLiyQ31V0wnpdnxX1umd0QJajuKuDHY+QvrEf5jvxJ1Gms0
8ozhVgzuPbU8LL5m3w+nk40lorPZGW8NuPKkHE0X+YkFd9I070Uu4lnCns0T8scu
Qlg4idhZCYX5bsjLzm0/IhbBrg==
-----END CERTIFICATE-----
skoranda@garlic:~$
```



```
skoranda@garlic:~$ openssl x509 -noout -text -in .globus/usercert.pem
```

Certificate:**Data:**

Version: 3 (0x2)

Serial Number: 53981 (0xd2dd)

Signature Algorithm: sha1WithRSAEncryption

Issuer: DC=org, DC=D0EGrids, OU=Certificate Authorities, CN=D0EGrids CA 1

Validity

Not Before: Feb 22 04:47:27 2011 GMT

Not After : Feb 22 04:47:27 2012 GMT

Subject: DC=org, DC=doegrids, OU=People, CN=Scott Koranda 212488

Subject Public Key Info:

Public Key Algorithm: rsaEncryption

RSA Public Key: (2048 bit)

Modulus (2048 bit):

00:ef:43:56:dd:2d:c2:e0:4a:69:70:10:c8:43:3c:
f2:2a:79:da:6e:93:11:40:58:8c:c2:26:67:7f:05:
33:39:89:ac:b0:1b:a6:51:0c:ab:04:39:a8:36:b1:
80:3d:81:fc:3d:a0:f5:16:5c:7c:76:79:7d:14:28:
9b:b2:b7:d3:a4:22:a8:11:50:e2:ad:9c:02:29:71:
c3:bd:b2:e1:cc:d3:3a:0f:c9:75:21:5e:e1:0d:0e:
02:16:be:da:55:8d:9c:5b:d2:ee:c5:54:81:67:f8:
44:13:e0:56:b4:98:d6:dd:10:de:db:17:f4:f8:d7:
88:39:9c:35:09:9d:5d:1c:f4:6f:0e:70:f0:a7:e4:
c0:85:2f:01:6b:18:f6:bd:d0:58:d6:9c:69:45:59:
64:30:3f:d5:b0:5a:6e:fd:ea:cc:b0:3e:b0:ba:f1:
2f:d0:d4:9f:24:6e:b9:d8:a4:f0:b9:d6:b7:b2:e8:
1c:2b:c9:6e:b8:eb:ef:c9:74:0d:ee:0c:37:fa:92:
e9:1e:18:c7:bd:99:03:51:c2:f9:6d:9c:f9:30:7a:
42:04:6f:ee:fc:5b:2f:4e:7d:cb:9c:8b:db:04:22:

```
skoranda@garlic:~$ openssl x509 -noout -text -in .globus/usercert.pem
```

Certificate:**Data:**

Version: 3 (0x2)

Serial Number: 53981 (0xd2dd)

Signature Algorithm: sha1WithRSAEncryption

Issuer: DC=org, DC=D0EGrids, OU=Certificate Authorities, CN=D0EGrids CA 1

Validity

Not Before: Feb 22 04:47:27 2011 GMT

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Subject: DC=org, DC=doegrids, OU=People, CN=Scott Koranda 212488

Subject Public Key Info:

Public Key Algorithm: rsaEncryption

RSA Public Key: (2048 bit)

Modulus (2048 bit):

00:ef:43:56:dd:2d:c2:e0:4a:69:70:10:c8:43:3c:
f2:2a:79:da:6e:93:11:40:58:8c:c2:26:67:7f:05:
33:39:89:ac:b0:1b:a6:51:0c:ab:04:39:a8:36:b1:
80:3d:81:fc:3d:a0:f5:16:5c:7c:76:79:7d:14:28:
9b:b2:b7:d3:a4:22:a8:11:50:e2:ad:9c:02:29:71:
c3:bd:b2:e1:cc:d3:3a:0f:c9:75:21:5e:e1:0d:0e:
02:16:be:da:55:8d:9c:5b:d2:ee:c5:54:81:67:f8:
44:13:e0:56:b4:98:d6:dd:10:de:db:17:f4:f8:d7:
88:39:9c:35:09:9d:5d:1c:f4:6f:0e:70:f0:a7:e4:
c0:85:2f:01:6b:18:f6:bd:d0:58:d6:9c:69:45:59:
64:30:3f:d5:b0:5a:6e:fd:ea:cc:b0:3e:b0:ba:f1:
2f:d0:d4:9f:24:6e:b9:d8:a4:f0:b9:d6:b7:b2:e8:
1c:2b:c9:6e:b8:eb:ef:c9:74:0d:ee:0c:37:fa:92:
e9:1e:18:c7:bd:99:03:51:c2:f9:6d:9c:f9:30:7a:
42:04:6f:ee:fc:5b:2f:4e:7d:cb:9c:8b:db:04:22:


```
skoranda@garlic:~$ openssl x509 -noout -text -in .globus/usercert.pem
```

Certificate:**Data:**

Version: 3 (0x2)

Serial Number: 53981 (0xd2dd)

Signature Algorithm: sha1WithRSAEncryption

Issuer: DC=org, DC=DOEGrids, OU=Certificate Authorities, CN=DOEGrids CA 1

Validity

Not Before: Feb 22 04:47:27 2011 GMT

Not After : Feb 22 04:47:27 2012 GMT

Subject: DC=org, DC=doegrids, OU=People, CN=Scott Koranda 212488

Subject Public Key Info:

Public Key Algorithm: rsaEncryption

RSA Public Key: (2048 bit)

Modulus (2048 bit):

00:ef:43:56:dd:2d:c2:e0:4a:69:70:10:c8:43:3c:
f2:2a:79:da:6e:93:11:40:58:8c:c2:26:67:7f:05:
33:39:89:ac:b0:1b:a6:51:0c:ab:04:39:a8:36:b1:
80:3d:81:fc:3d:a0:f5:16:5c:7c:76:79:7d:14:28:
9b:b2:b7:d3:a4:22:a8:11:50:e2:ad:9c:02:29:71:
c3:bd:b2:e1:cc:d3:3a:0f:c9:75:21:5e:e1:0d:0e:
02:16:be:da:55:8d:9c:5b:d2:ee:c5:54:81:67:f8:
44:13:e0:56:b4:98:d6:dd:10:de:db:17:f4:f8:d7:
88:39:9c:35:09:9d:5d:1c:f4:6f:0e:70:f0:a7:e4:
c0:85:2f:01:6b:18:f6:bd:d0:58:d6:9c:69:45:59:
64:30:3f:d5:b0:5a:6e:fd:ea:cc:b0:3e:b0:ba:f1:
2f:d0:d4:9f:24:6e:b9:d8:a4:f0:b9:d6:b7:b2:e8:
1c:2b:c9:6e:b8:eb:ef:c9:74:0d:ee:0c:37:fa:92:
e9:1e:18:c7:bd:99:03:51:c2:f9:6d:9c:f9:30:7a:
42:04:0f:cc:fc:5b:2f:4c:7d:eb:9c:0b:db:04:22:

X509v3 Certificate Policies:

Policy: 1.2.840.113612.3.7.1.3.1

Policy: 1.2.840.113612.5.2.2.1

Policy: 1.2.840.113612.5.2.3.2.1.1

X509v3 CRL Distribution Points:

URI:http://crl.doe grids.org/1c3f2ca8/1c3f2ca8.crl

X509v3 Subject Alternative Name:

email:skoranda@gravity.phys.uwm.edu

X509v3 Authority Key Identifier:

keyid:CA:19:1D:12:8E:6E:A4:38:5D:42:D4:31:0E:08:DB:D9:8D:17:0D:5D

Signature Algorithm: sha1WithRSAEncryption

1a:f3:cd:4d:94:99:37:3d:12:22:13:e6:2f:ba:d8:d8:43:54:
c3:93:08:fa:c2:a7:6d:46:4e:70:be:f5:92:87:f0:16:6f:d3:
f3:74:a1:5e:36:fa:7e:1d:60:94:d4:8a:7a:c4:11:90:71:6f:
62:bf:b0:20:f1:e9:f0:1d:fc:4c:54:74:41:85:5e:bb:e8:dd:
93:5c:34:9d:7f:3d:91:eb:f0:25:ab:f3:37:21:01:92:fe:39:
66:b0:e0:8a:13:f9:00:37:75:1d:d8:38:61:91:15:65:35:ef:
55:20:30:fb:09:cb:18:2e:2b:f6:e9:93:bc:f2:ab:b4:2f:0a:
04:a6:f7:8b:cc:8f:9b:d8:f5:f6:5f:89:c8:e4:94:ca:88:14:
19:68:fe:c4:08:1b:72:17:ba:92:12:e2:c9:0d:f5:54:ec:27:
a5:d9:f1:5f:5b:a6:77:44:09:6a:3b:8a:b8:31:d8:f9:0b:eb:
11:fe:63:bf:12:75:1a:6b:34:f2:8c:e1:56:0c:ee:3d:b5:3c:
2c:be:66:df:0f:a7:93:83:a5:a2:b3:d9:19:6f:0d:b8:f2:a4:
1c:4d:17:f9:89:05:77:d2:0e:ec:e5:2e:e2:59:c2:9e:cd:13:
f2:c7:2e:42:58:38:89:d8:59:09:85:f9:6e:c8:cb:ce:63:bf:
22:16:c1:ae

skoranda@garlic:~\$

X509v3 Certificate Policies:

Policy: 1.2.840.113612.3.7.1.3.1

Policy: 1.2.840.113612.5.2.2.1

Policy: 1.2.840.113612.5.2.3.2.1.1

X509v3 CRL Distribution Points:

URI:http://crl.doe grids.org/1c3f2ca8/1c3f2ca8.crl

X509v3 Subject Alternative Name:

email:skoranda@gravity.phys.uwm.edu

X509v3 Authority Key Identifier:

keyid:CA:19:1D:12:8E:6E:A4:38:5D:42:D4:31:0E:08:DB:D9:8D:17:0D:5D

Signature Algorithm: sha1WithRSAEncryption

1a:f3:cd:4d:94:99:37:3d:12:22:13:e6:2f:ba:d8:d8:43:54:
c3:93:08:fa:c2:a7:6d:46:4e:70:be:f5:92:87:f0:16:6f:d3:
f3:74:a1:5e:36:fa:7e:1d:60:94:d4:8a:7a:c4:11:90:71:6f:
62:bf:b0:20:f1:e9:f0:1d:fc:4c:54:74:41:85:5e:bb:e8:dd:
93:5c:34:9d:7f:3d:91:eb:f0:25:ab:f3:37:21:01:92:fe:39:
66:b0:e0:8a:13:f9:00:37:75:1d:d8:38:61:91:15:65:35:ef:
55:20:30:fb:09:cb:18:2e:2b:f6:e9:93:bc:f2:ab:b4:2f:0a:
04:a6:f7:8b:cc:8f:9b:d8:f5:f6:5f:89:c8:e4:94:ca:88:14:
19:68:fe:c4:08:1b:72:17:ba:92:12:e2:c9:0d:f5:54:ec:27:
a5:d9:f1:5f:5b:a6:77:44:09:6a:3b:8a:b8:31:d8:f9:0b:eb:
11:fe:63:bf:12:75:1a:6b:34:f2:8c:e1:56:0c:ee:3d:b5:3c:
2c:be:66:df:0f:a7:93:83:a5:a2:b3:d9:19:6f:0d:b8:f2:a4:
1c:4d:17:f9:89:05:77:d2:0e:ec:e5:2e:e2:59:c2:9e:cd:13:
f2:c7:2e:42:58:38:89:d8:59:09:85:f9:6e:c8:cb:ce:63:bf:
22:16:c1:ae

skoranda@garlic:~\$

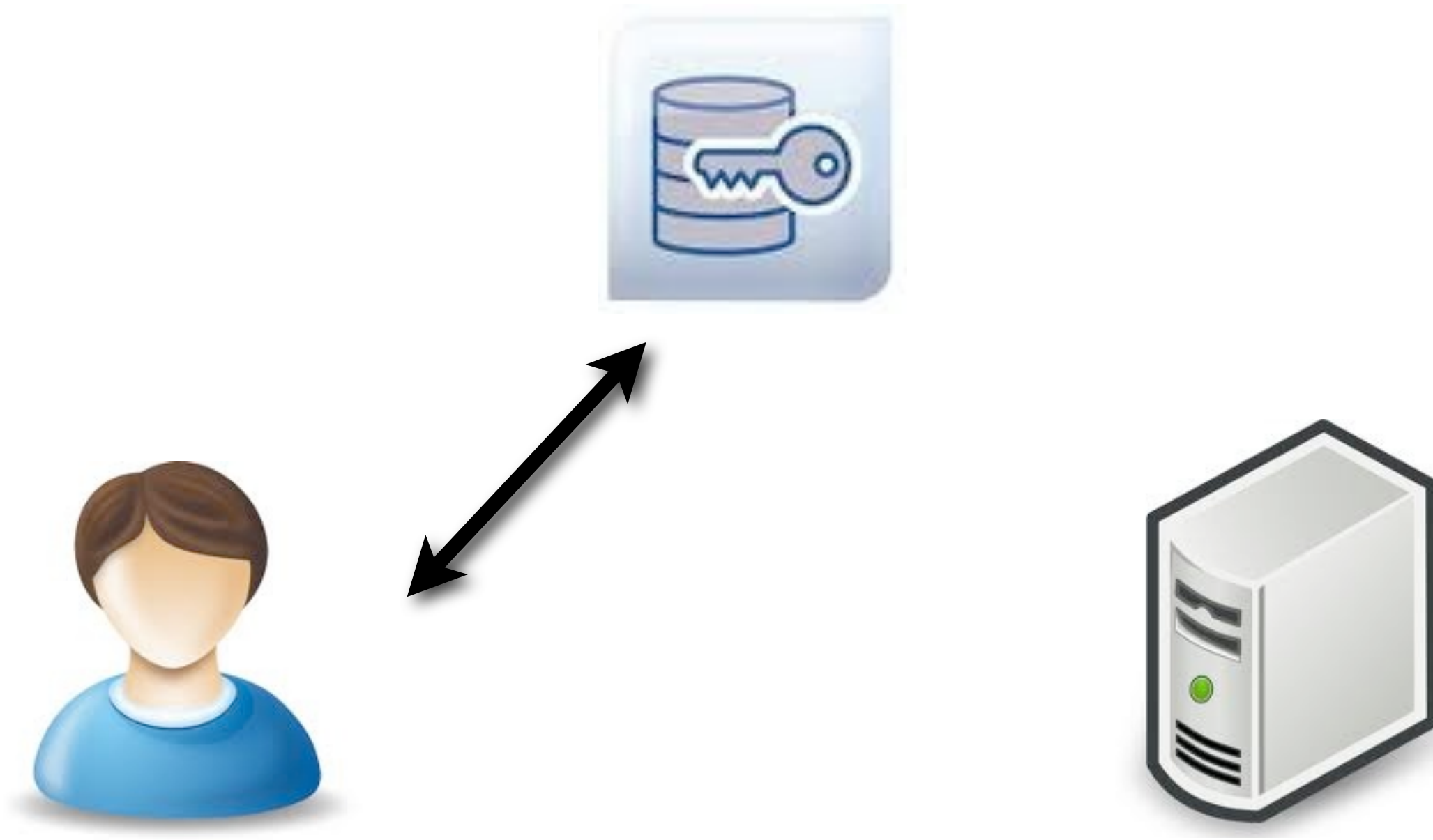
X.509 Certificate

- CA must verify your identity at time you request the certificate
- Without a strong verification process the CA cannot be trusted

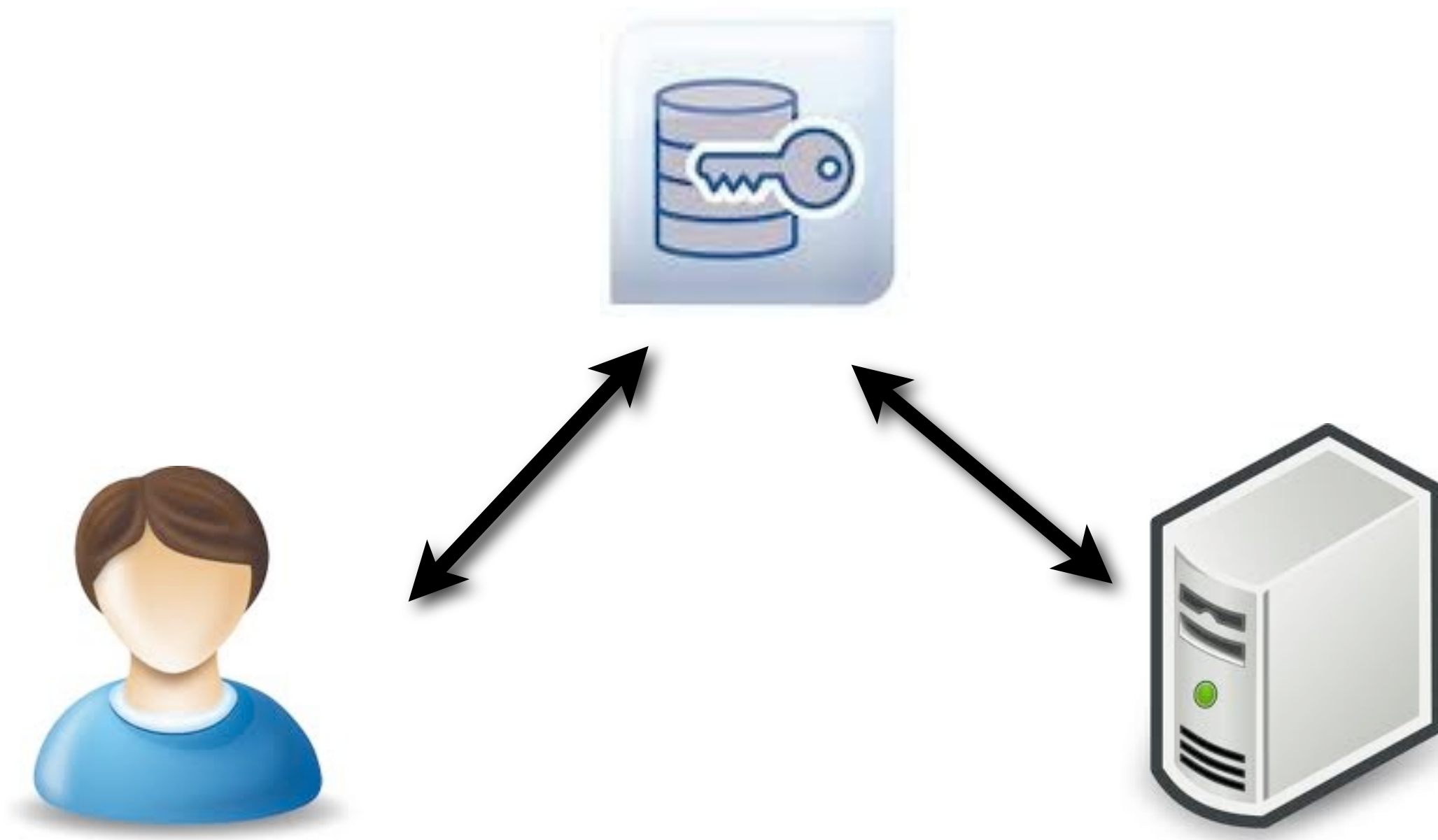
Third Party Trust Model



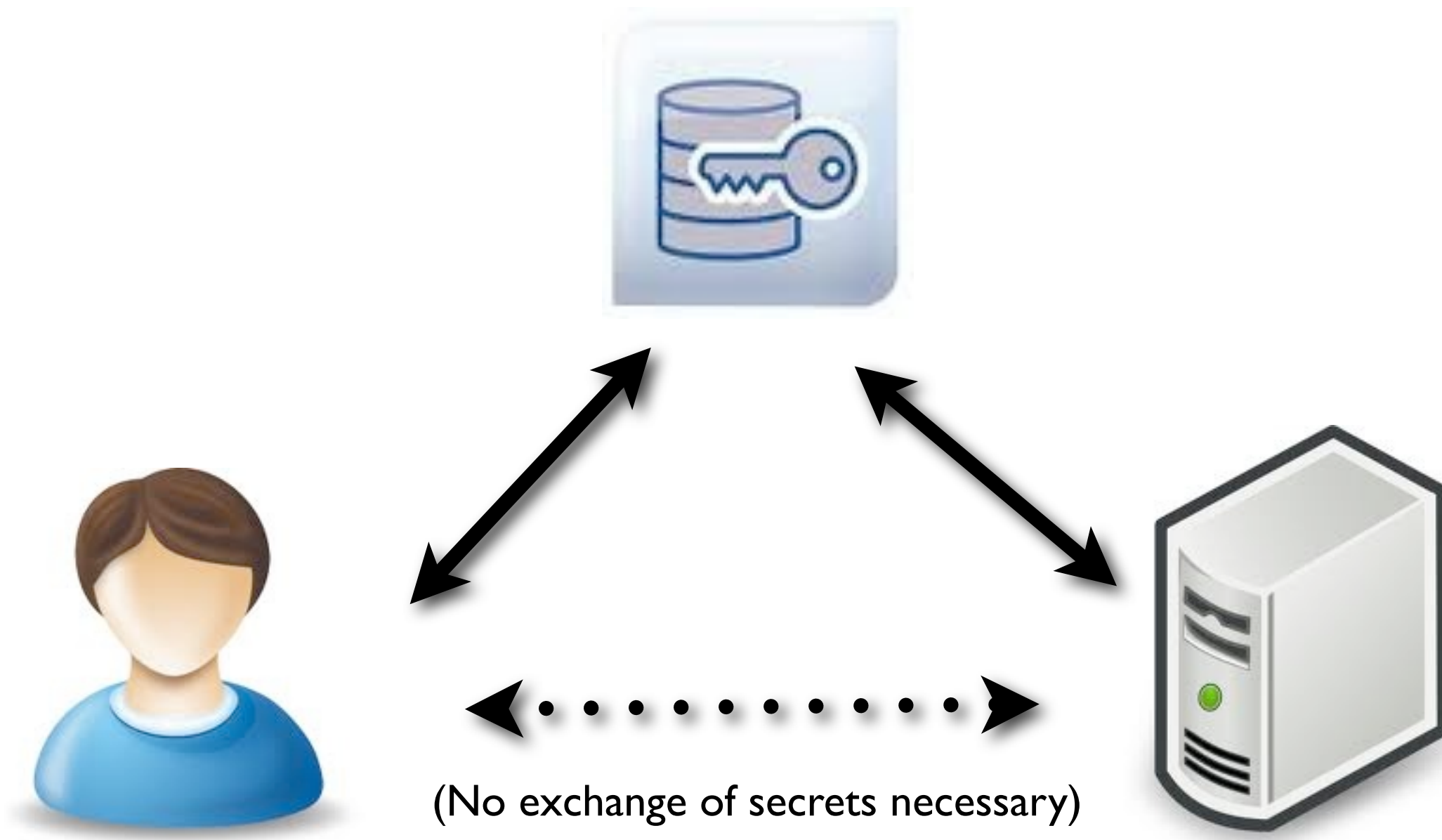
Third Party Trust Model



Third Party Trust Model



Third Party Trust Model







“a random string”



“XY^#78WGIWG”





“XY^#78WGIWG”





‘XY^#78WGIWG’





“a random string”





“a random string”





“a random string”

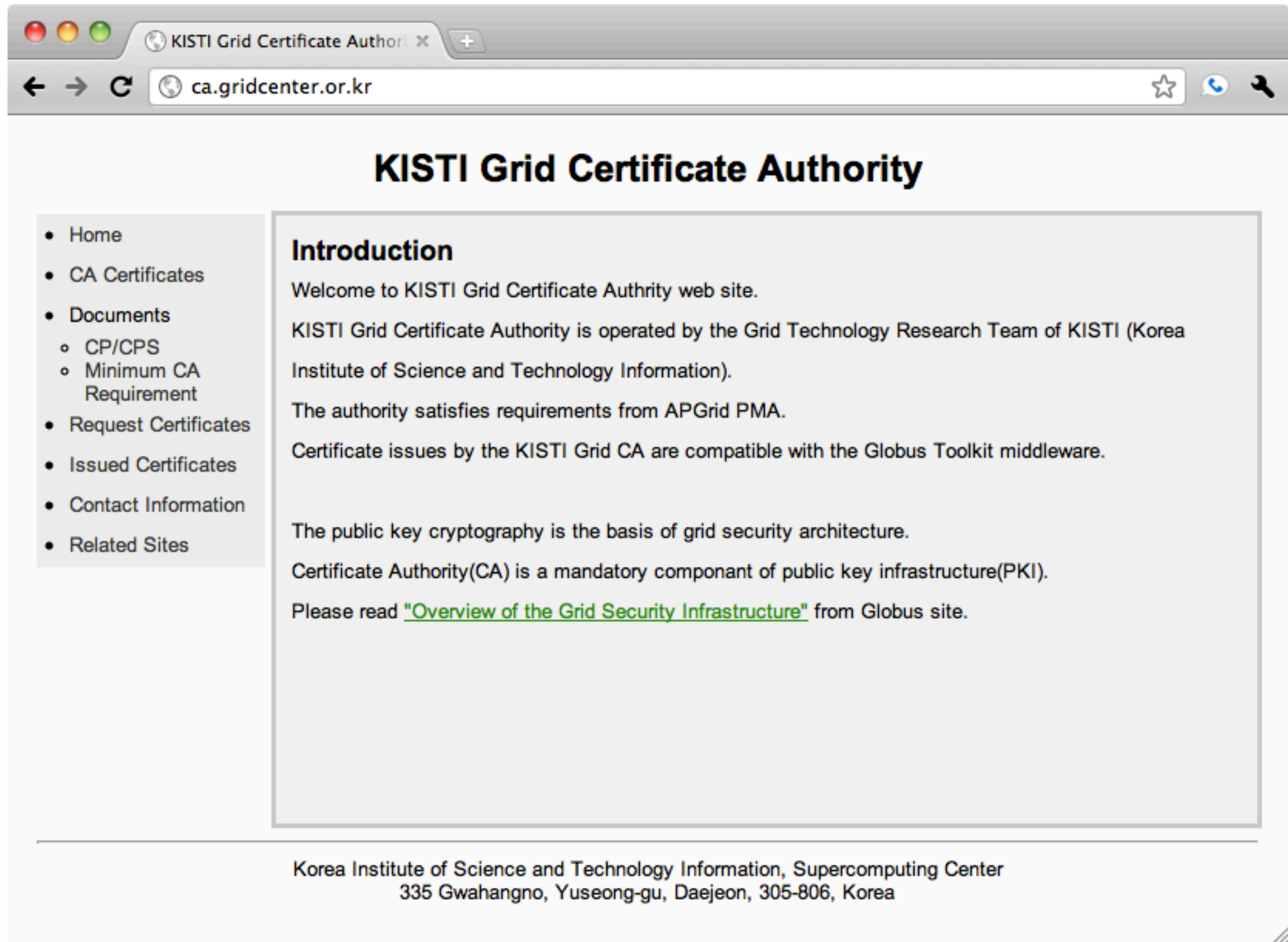
- Only the matching private key could have decrypted string
- Holder of private key assumed to be owner of public key
- Public key is on certificate
- Certificate has name on it
- Identity is established



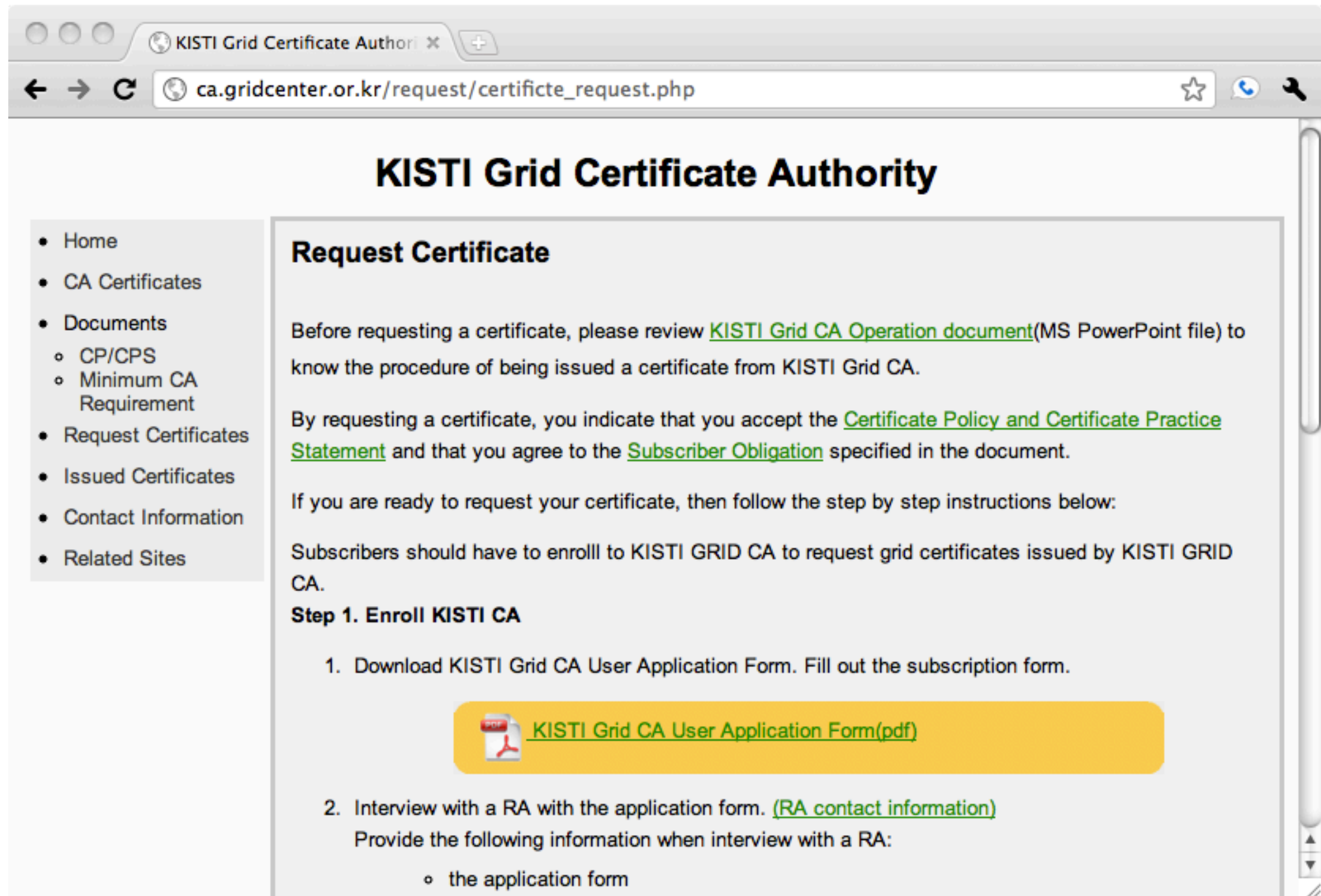
Obtaining X.509 cert

- Korean researchers
 - KISTI Grid Certificate Authority
 - <http://ca.gridcenter.or.kr/>
- Most countries have recognized CA
 - International Grid Trust Federation
 - www.igtf.net

Obtaining X.509 cert



Obtain X.509 cert



The screenshot shows a web browser window with the address bar displaying `ca.gridcenter.or.kr/request/certifcte_request.php`. The page title is "KISTI Grid Certificate Authority". On the left, there is a navigation menu with the following items: Home, CA Certificates, Documents (with sub-items CP/CPS and Minimum CA Requirement), Request Certificates, Issued Certificates, Contact Information, and Related Sites. The main content area is titled "Request Certificate" and contains the following text:

Before requesting a certificate, please review [KISTI Grid CA Operation document](#)(MS PowerPoint file) to know the procedure of being issued a certificate from KISTI Grid CA.


By requesting a certificate, you indicate that you accept the [Certificate Policy and Certificate Practice Statement](#) and that you agree to the [Subscriber Obligation](#) specified in the document.

If you are ready to request your certificate, then follow the step by step instructions below:

Subscribers should have to enroll to KISTI GRID CA to request grid certificates issued by KISTI GRID CA.

Step 1. Enroll KISTI CA

1. Download KISTI Grid CA User Application Form. Fill out the subscription form.

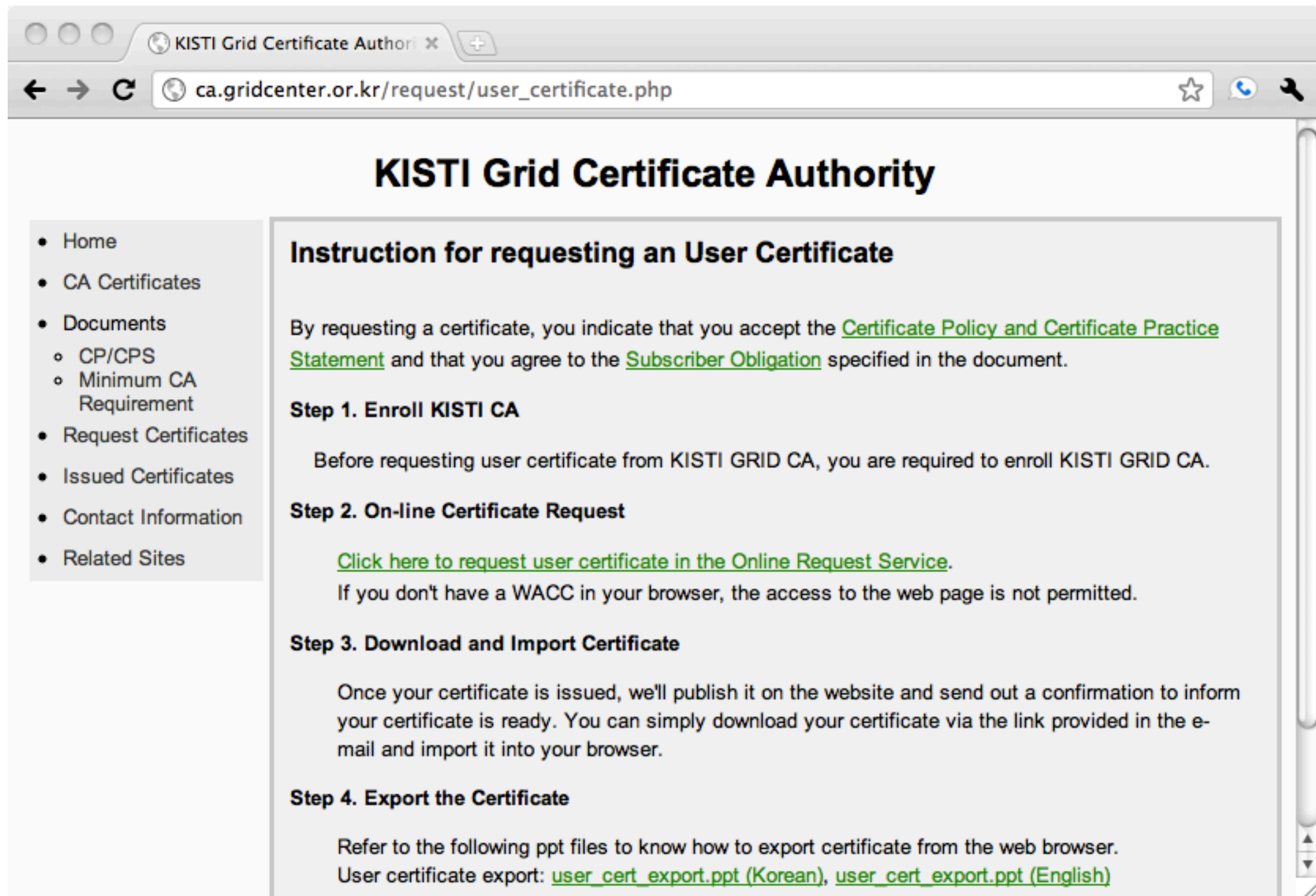
 [KISTI Grid CA User Application Form\(pdf\)](#)

2. Interview with a RA with the application form. [\(RA contact information\)](#)

Provide the following information when interview with a RA:

- the application form

Obtaining X.509 cert



The screenshot shows a web browser window with the address bar displaying `ca.gridcenter.or.kr/request/user_certificate.php`. The page title is "KISTI Grid Certificate Authority". On the left, there is a navigation menu with the following items: Home, CA Certificates, Documents (with sub-items CP/CPS and Minimum CA Requirement), Request Certificates, Issued Certificates, Contact Information, and Related Sites. The main content area is titled "Instruction for requesting an User Certificate". It contains the following text: "By requesting a certificate, you indicate that you accept the [Certificate Policy and Certificate Practice Statement](#) and that you agree to the [Subscriber Obligation](#) specified in the document." Below this, there are four steps: **Step 1. Enroll KISTI CA** with the instruction "Before requesting user certificate from KISTI GRID CA, you are required to enroll KISTI GRID CA."; **Step 2. On-line Certificate Request** with a link "[Click here to request user certificate in the Online Request Service.](#)" and a note "If you don't have a WACC in your browser, the access to the web page is not permitted."; **Step 3. Download and Import Certificate** with the instruction "Once your certificate is issued, we'll publish it on the website and send out a confirmation to inform your certificate is ready. You can simply download your certificate via the link provided in the e-mail and import it into your browser."; and **Step 4. Export the Certificate** with the instruction "Refer to the following ppt files to know how to export certificate from the web browser. User certificate export: [user_cert_export.ppt \(Korean\)](#), [user_cert_export.ppt \(English\)](#)".

KISTI Grid Certificate Authority

- Home
- CA Certificates
- Documents
 - CP/CPS
 - Minimum CA Requirement
- Request Certificates
- Issued Certificates
- Contact Information
- Related Sites

Instruction for requesting an User Certificate

By requesting a certificate, you indicate that you accept the [Certificate Policy and Certificate Practice Statement](#) and that you agree to the [Subscriber Obligation](#) specified in the document.

Step 1. Enroll KISTI CA

Before requesting user certificate from KISTI GRID CA, you are required to enroll KISTI GRID CA.

Step 2. On-line Certificate Request

[Click here to request user certificate in the Online Request Service.](#)

If you don't have a WACC in your browser, the access to the web page is not permitted.

Step 3. Download and Import Certificate

Once your certificate is issued, we'll publish it on the website and send out a confirmation to inform your certificate is ready. You can simply download your certificate via the link provided in the e-mail and import it into your browser.

Step 4. Export the Certificate

Refer to the following ppt files to know how to export certificate from the web browser.
User certificate export: [user_cert_export.ppt \(Korean\)](#), [user_cert_export.ppt \(English\)](#)

Obtaining X.509 cert

- First register with the CA and obtain PIN #
- Registration agent (RA) will verify your request
- May take a few days so start early!
- Will have certificate in your web browser

Tip



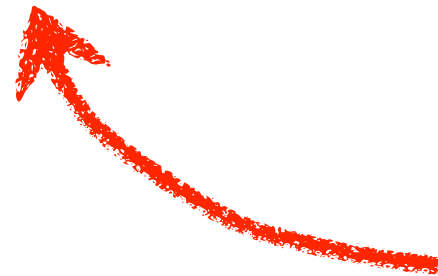
- KISTI CA users:
 - Use Microsoft Internet Explorer (IE) for this part
 - IE is required at this time

Obtaining X.509 cert

- Must export certificate from browser
- Follow instructions of CA
- Export to a single PKCS #12 file
- Not finished yet!

Obtaining X.509 cert

- Must export certificate from browser
- Follow instructions of CA
- Export to a single PKCS #12 file
- Not finished yet!



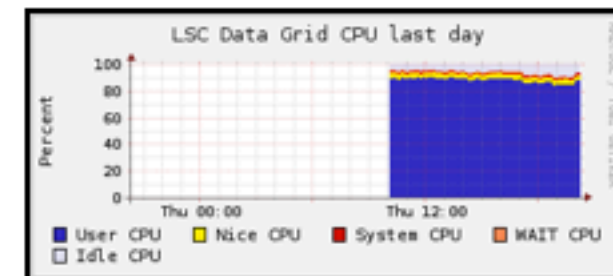
*Not a format
grid tools like!*

Obtaining X.509 cert

- Convert PKCS #12 file into two (2) files
- First move PKCS #12 file from Windows computer to Mac or Linux
- Use OpenSSL to do the conversion
- KISTI CA has nice instructions

Obtaining X.509 cert

- Two plain text files:
 1. `$HOME/.globus/usercert.pem`
 2. `$HOME/.globus/userkey.pem`
- Make sure file ownership and permissions correct



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User Manual

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Getting Started on the LSC DataGrid

The following five steps are the basic steps required in order to "get started", as a user, on the LSC DataGrid.

1. **Install the LSC DataGrid Client package:** In order to connect to the LSC DataGrid clusters the client tools need to be installed. Installation instructions, for various supported platforms, can be found [here](#).
2. **Get a certificate:** To use the tools in the LSC DataGrid Client package to connect to LSC resources you will need a Personal X.509 Grid Certificate, from DOEgrids or another appropriate certificate authority, for authentication. Instructions for obtaining such credentials can be found [here](#). It will take 24 to 48 hours to process your request.

3. **Request accounts:** Accounts on LSC systems can be requested at:

[LIGO Scientific Collaboration Virtual Organization Computer Resource Request Form](#)

LIGO VO Account Application

https://voms.phys.uwm.edu/lams/account_form.shtml

LIGO VO Computer Resource Request Form

(javascript should be enabled)

Personal Information

Full Name:

Institution:

Position:

Working Group:

Phone:

Fax: (optional)

E-mail:

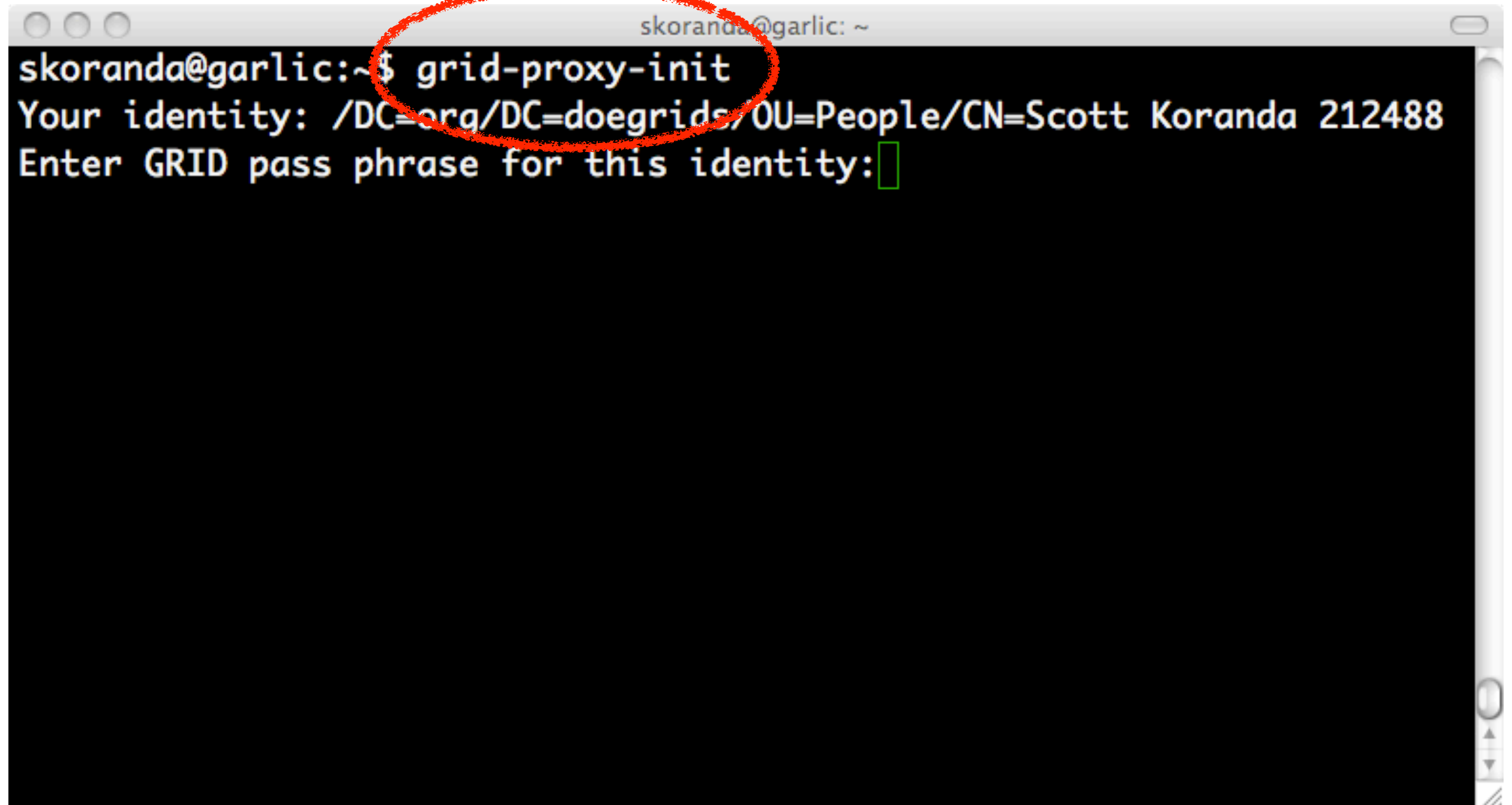
Site Access

Requesting Accounts

- Usually takes 2 to 3 days
- Admin from each site will notify by email
- Cannot apply until you have X.509/Grid certificate first!

Logging into LDG

1. Use grid cert to create “proxy certificate”
 - temporary, time limited certificate
2. Use Grid-enabled OpenSSH to login

A terminal window with a grey title bar containing three window control buttons on the left and the text 'skoranda@garlic: ~' on the right. The terminal has a black background with white text. The first line shows the command 'grid-proxy-init' being executed. The second line shows the output 'Your identity: /DC=org/DC=doegrids/OU=People/CN=Scott Koranda 212488'. The third line shows the prompt 'Enter GRID pass phrase for this identity:' followed by a green rectangular cursor. A red hand-drawn circle highlights the command and the identity string.

```
skoranda@garlic:~$ grid-proxy-init
Your identity: /DC=org/DC=doegrids/OU=People/CN=Scott Koranda 212488
Enter GRID pass phrase for this identity: 
```


skoranda@garlic: ~

```
skoranda@garlic:~$ grid-proxy-init
```

```
Your identity: /DC=org/DC=doegrids/OU=People/CN=Scott Koranda 212488
```

```
Enter GRID pass phrase for this identity: 
```

skoranda@garlic: ~

skoranda@garlic:~\$ arid-proxy-init

Your identity: /DC=org/DC=doegrids/OU=People/CN=Scott Koranda 212488

Enter GRID pass phrase for this identity:

```
skoranda@garlic: ~  
skoranda@garlic:~$ grid-proxy-init  
Your identity: /DC=org/DC=doegrids/OU=People/CN=Scott Koranda 212488  
Enter GRID pass phrase for this identity:  
Creating proxy ..... Done  
Your proxy is valid until: Fri Jul 29 09:23:42 2011  
skoranda@garlic:~$
```

```
skoranda@garlic: ~  
skoranda@garlic:~$ grid-proxy-init  
Your identity: /DC=org/DC=doegrids/OU=People/CN=Scott Koranda 212488  
Enter GRID pass phrase for this identity:  
Creating proxy ..... Done  
Your proxy is valid until: Fri Jul 29 09:23:42 2011  
skoranda@garlic:~$
```

```
skoranda@garlic: ~  
skoranda@garlic:~$ grid-proxy-init  
Your identity: /DC=org/DC=doegrids/OU=People/CN=Scott Koranda 212488  
Enter GRID pass phrase for this identity:  
Creating proxy ..... Done  
Your proxy is valid until: Fri Jul 29 09:23:42 2011  
skoranda@garlic:~$ grid-proxy-info -all  
subject   : /DC=org/DC=doegrids/OU=People/CN=Scott Koranda 212488/CN=9  
37755397  
issuer    : /DC=org/DC=doegrids/OU=People/CN=Scott Koranda 212488  
identity  : /DC=org/DC=doegrids/OU=People/CN=Scott Koranda 212488  
type      : RFC 3820 compliant impersonation proxy  
strength  : 512 bits  
path      : /tmp/x509up_u1000  
timeleft  : 11:58:12  
skoranda@garlic:~$
```



```
skoranda@garlic: ~
skoranda@garlic:~$ gsissh ldas-grid.ligo.caltech.edu
Last login: Wed Jul 27 19:11:00 2011 from 129.89.61.250
*****
Welcome to the LIGO-Caltech Computing Cluster
*****

ldas-grid.ligo.caltech.edu      Primary production submit machine
ldas-pcdev1.ligo.caltech.edu    Large memory development and post-processing
ldas-pcdev2.ligo.caltech.edu    Legacy 32-bit head node
ldas-pcdev3.ligo.caltech.edu    Local Caltech users and collaborators
ldas-pcdev4.ligo.caltech.edu    Development system with pre-release software

Note, all of these (except pcdev2) are configured to submit jobs to the same
pool of ~2500 Condor execute slots.

-----
```



```
skoranda@garlic:~$ gsissh hydra.phys.uwm.edu
Last login: Wed Jul 27 21:04:37 2011 from 129.89.61.250

*****

Welcome to the NEMO Cluster:

Please report any problems by sending an email to
uwm-help@gravity.phys.uwm.edu

Information about this resource can be found at this address
http://www.lsc-group.phys.uwm.edu/beowulf/nemo/

*****

We now have ldg 5.1 install on our headnodes, if you are experiencing any probl
```

Logging Into LDG

- Proxy + Grid-enabled OpenSSH = SSO
(single sign on)
- Only need to generate proxy once per day

Logging Into LDG

- Only need to type passphrase *once per day*
- So choose a long and strong passphrase!

Tip



Ideas for long & strong passphrase:

- First line from your favorite song or book
- List of your 5 favorite foods
- Full names of your 3 favorite physics heroes

Better to use lots of long words you will remember than short list of symbols and numbers

Logging into LDG

Where to login?

CIT, LHO, LLO

- Head nodes (machines you can log in to)
 - `ldas-grid.ligo.caltech.edu`
 - for Condor submission
 - `ldas-pcdev1.ligo.caltech.edu`
 - compile, local jobs CPU/memory intensive

To get LHO, replace `ligo` with `ligo-wa`. To get LLO, replace `ligo` with `ligo-la`.

CIT, LHO, LLO

- Home directory:
 - `/archive/home/$USER`
- Local scratch:
 - `/usr1/$USER`
 - (compile code and keep logs here)
- Secure web space:
 - `/archive/home/$USER/public_html`
 - `https://ldas-jobs.ligo.caltech.edu/~$USER/`

Syracuse (SUGAR)

- Head nodes:
 - `sugar.phy.syr.edu`
 - job submission
 - `sugar-dev1.phy.syr.edu`
 - compile, local jobs CPU/memory intensive
 - `spice-dev1.phy.syr.edu`
 - GPU development

Syracuse (SUGAR)

- Home directory:
 - `/home/$USER`
- Local scratch:
 - `/usr1/$USER`
- Secure web space:
 - `/home/$USER/public_html`
 - `https://sugar-jobs.phy.syr.edu/~$USER`

UWM (Nemo)

- Head nodes:
 - `marlin.phys.uwm.edu`
 - `hydra.phys.uwm.edu`
 - `trout.phys.uwm.edu`
 - `pcdev1.phys.uwm.edu`
 - compile, local jobs CPU/memory intensive

UWM (Nemo)

- Home directory:
 - `/home/$USER`
- Local scratch:
 - `/people/$USER`
- Secure web space:
 - `/home/$USER/public_html`
 - `https://ldas-jobs.phys.uwm.edu/~$USER`

AEI (ATLAS)

- Head nodes:
 - `atlas1.atlas.aei.uni-hannover.de`
 - `atlas2.atlas.aei.uni-hannover.de`
 - login and job submission
 - `titan1.atlas.aei.uni-hannover.de`
 - `titan2.atlas.aei.uni-hannover.de`
 - compile, local jobs CPU/memory intensive

AEI (ATLAS)

- Home directory:
 - `/home/$USER`
- Local scratch:
 - `/atlas/user/HOSTNAME/$USER`
 - for example, `/atlas/user/atlas1/skoranda`
- Secure web space:
 - `/home/$USER/WWW/LSC`
 - `https://atlas1.atlas.aei.uni-hannover.de/~$USER/LSC`

You can log in...now
what?

Accessing Data

- Before accessing data you need to determine which time segments to analyze
- Data quality (DQ) cuts or vetoes used to excise time segments with artifacts

DQ flags

- Detail quality of data as function of time
- Each flag is “on” or “off” at a point in time

“Segment” Database

- Catalog of DQ flags as function of time
- Used to determine segments of time with particular DQ flags set (or not)

Segment Database

- Accessed using command line tools
- Some web browser queries supported
- Runs at Caltech
- <https://segdb.ligo.caltech.edu>
- Access from outside Caltech cluster requires grid credential

time = 964483215

```
G1:GEO-CHI2_GT_10:1 964472580) 964483215 [964529580
G1:GEO-CHI2_GT_5:1 964473720) 964483215 [964486080
G1:GEO-CHI2_GT_6:1 964473720) 964483215 [964489020
G1:GEO-CHI2_GT_7:1 964472580) 964483215 [964500000
G1:GEO-CHI2_GT_8:1 964472580) 964483215 [964500000
G1:GEO-CHI2_GT_9:1 964472580) 964483215 [964529580
G1:GEO-SCIENCE:1 964472580) 964483215 [964486920
H1:APC-H0_PEM_BSC10_MIC:1 946849853) 964483215 [966349841
H1:APC-H0_PEM_BSC5_MIC:1 never) 964483215 [965952521
H1:APC-H0_PEM_BSC6_MIC:1 never) 964483215 [965952353
H1:APC-H0_PEM_BSC7_MIC:1 never) 964483215 [966047657
H1:APC-H0_PEM_BSC8_MIC:1 947022987) 964483215 [966366429
H1:APC-H0_PEM_BSC9_MIC:1 947026901) 964483215 [966305717
H1:APC-H0_PEM_IOT1_MIC:1 never) 964483215 [965952079
H1:APC-H0_PEM_IOT7_MIC:1 946999565) 964483215 [966366427
H1:APC-H0_PEM_ISCT1_MIC:1 947000695) 964483215 [966366429
H1:APC-H0_PEM_ISCT4_MIC:1 947000695) 964483215 [966438277
H1:APC-H0_PEM_ISCT7_MIC:1 never) 964483215 [965952069
H1:APC-H0_PEM_LVEA_MIC:1 947025539) 964483215 [966319365
H1:APC-H0_PEM_PSL1_MIC:1 never) 964483215 [965952085
H1:APC-H0_PEM_PSL2_MIC:1 never) 964483215 [965957387
H1:BCV-KW_H1_ASC_ETMX_P_H1_ASC_QPDX_P_1P66E_NEG06:1 963344873) 964483215 [965589407
H1:BCV-KW_H1_ASC_ETMX_P_H1_ASC_QPDX_P_1P66E_NEG06:10 945974723) 964483215 [now
H1:BCV-KW_H1_ASC_ETMX_P_H1_ASC_QPDX_P_1P66E_NEG06:11 947256712) 964483215 [now
H1:BCV-KW_H1_ASC_ETMX_P_H1_ASC_QPDX_P_1P66E_NEG06:12 960927008) 964483215 [now
H1:BCV-KW_H1_ASC_ETMX_P_H1_ASC_QPDX_P_1P66E_NEG06:13 962741910) 964483215 [now
H1:BCV-KW_H1_ASC_ETMX_P_H1_ASC_QPDX_P_1P66E_NEG06:14 964461793) 964483215 [964533177
H1:BCV-KW_H1_ASC_ETMX_P_H1_ASC_QPDX_P_1P66E_NEG06:15 never) 964483215 [964614335
H1:BCV-KW_H1_ASC_ETMX_P_H1_ASC_QPDX_P_1P66E_NEG06:16 931618175) 964483215 [now
H1:BCV-KW_H1_ASC_ETMX_P_H1_ASC_QPDX_P_1P66E_NEG06:17 never) 964483215 [966604695
H1:BCV-KW_H1_ASC_ETMX_P_H1_ASC_QPDX_P_1P66E_NEG06:18 931935123) 964483215 [now
H1:BCV-KW_H1_ASC_ETMX_P_H1_ASC_QPDX_P_1P66E_NEG06:19 932827993) 964483215 [now
H1:BCV-KW_H1_ASC_ETMX_P_H1_ASC_QPDX_P_1P66E_NEG06:20 never) 964483215 [966006688
H1:BCV-KW_H1_ASC_ETMX_P_H1_ASC_QPDX_P_1P66E_NEG06:21 933082117) 964483215 [now
```


DQ Report Page

caltech.edu https://segdb.ligo.caltech.edu/ Google

DQ Report Page

H1:DMT-PSL_POWER_LT_14W:1	964475139)	964483215	[964497938
H1:DMT-SCIENCE:1	[964476445	964483215	964488875)
H1:DMT-SCIENCE:2	[964476445	964483215	964488875)
H1:DMT-SCIENCE:3	[964476445	964483215	964488875)
H1:DMT-SCIENCE:4	[964476445	964483215	964488875)
H1:DMT-SEVERE_LSC_OVERFLOW:1	964474337)	964483215	[964497933
H1:DMT-SEVERE_LSC_OVERFLOW:2	941906072)	964483215	[now
H1:DMT-SEVERE_LSC_RF_OVERFLOW:1	964474337)	964483215	[964497933
H1:DMT-SEVERE_OM1_OVERFLOW:1	964474336)	964483215	[964497933
H1:DMT-TCS_ITMX_OUT_HIGH:1	961266945)	964483215	[now
H1:DMT-TCS_ITMX_OUT_HIGH:2	949412518)	964483215	[now
H1:DMT-TCS_ITMX_OUT_LOW:1	963684433)	964483215	[965286517
H1:DMT-TCS_ITMX_OUT_LOW:2	949412518)	964483215	[now
H1:DMT-TCS_ITMX_OUT_MED:1	961266945)	964483215	[965289633
H1:DMT-TCS_ITMX_OUT_MED:2	949412518)	964483215	[now
H1:DMT-TCS_ITMY_OUT_HIGH:1	963265814)	964483215	[964522067
H1:DMT-TCS_ITMY_OUT_HIGH:2	949214265)	964483215	[now
H1:DMT-TCS_ITMY_OUT_LOW:1	963265814)	964483215	[964522067
H1:DMT-TCS_ITMY_OUT_LOW:2	949424528)	964483215	[now
H1:DMT-TCS_ITMY_OUT_MED:1	963265814)	964483215	[964522067
H1:DMT-TCS_ITMY_OUT_MED:2	949250568)	964483215	[now
H1:DMT-UP:1	[964475394	964483215	964497935)
H1:DMT-UP:2	[964475394	964483215	964497935)
H1:DMT-UP:3	[964475394	964483215	964497935)
H1:DMT-UP:4	[964475394	964483215	964497935)
H1:DMT-WIND_OVER_30MPH:1	964390082)	964483215	[964600031
H1:SCI-AIRCRAFT_ELOG:1	950914215)	964483215	[966974415
H1:SCI-EARTHQUAKE_ELOG:1	963142875)	964483215	[964942215
H1:SCI-FLAG_ERROR:1	963142875)	964483215	[now
H1:SCI-FLAKY_DAQ_ELOG:1	956336415)	964483215	[965144325
H1:SCI-FLAKY_SERVO_ELOG:1	961214408)	964483215	[971049615
H1:SCI-GLITCY_DATA_ELOG:1	964452615)	964483215	[964522037
H1:SCI-HEAVY_MACHINERY_ELOG:1	961546485)	964483215	[now
H1:SCI-HIGH_MICROSEISMIC_ELOG:1	939714141)	964483215	[now
H1:SCI-HIGH_WIND_ELOG:1	956619615)	964483215	[969028215
H1:SCI-HUMAN_INTRUSION_ELOG:1	964470615)	964483215	[970930815
H1:SCI-LOW_POWER_ELOG:1	934173014)	964483215	[964488954
H1:SCI-NONSTAND_CONFIG_ELOG:1	963242219)	964483215	[964823415
H1:SCI-OTHER_ELOG:1	964118315)	964483215	[965011633

Find: SCIENCE Next Previous Highlight all Match case

Tip



- Use `tconvert` to convert from calendar to GPS

```
[screen 0: bash] skoranda@hydra:/people/skoranda
$ tconvert now
996201665
$ tconvert 01-feb-2010
949017616
$ tconvert "sep 22 2011"
1000684815
$ tconvert 999999999
Sep 14 2011 01:46:24 UTC
$ 
```

Segment Database

- Prepare veto definer files
 - XML documents
 - “ligolw” or “LIGO lightweight” is schema
 - detail which DQ flags to consider
 - different analysis groups use different vetoes
- Ask for details from current experts...

LIGO_LW File Format											
https://www.lsc-group.phys.uwm.edu/ligovirgo/cbc/public/segments/S6/H1L1V1-S6_CBC_LOWMASS_A_BEST_OFFLINE.xml											
process:table											
1: process_id	2: program	3: version	4: cvs_repository	5: cvs_entry_time	6: node	7: username	8: unix_procid	9: start_time	10: end_time	11: ifos	12: con
process:process_id:0	ligolw_veto_file	\$Revision: 1.1 \$	\$Source: /usr/local/cvs/ligovirgo/cbc/public/segments/S6/H1L1V1-S6_CBC_LOWMASS_A_BEST_OFFLINE.xml,v \$	928501213	ldas-grid.ligo.caltech.edu	\$Author: lundgren \$	16830	928271454	0	H1L1V1	Sld: H1L1V1 S6_CBC 1.1 201
veto_definer:table											
1: process_id	2: ifo	3: name	4: version	5: category	6: start_time	7: end_time	8: start_pad	9: end_pad	10: comment		
process:process_id:0	H1	DMT-OUT_OF_LOCK	1	1	928271454	0	0	0	Detector is out of lock		
process:process_id:0	H1	DCH-LDAS_C02_NOT_CALIBRATED	1	1	928271454	0	0	0	H1 LDAS C02 uncalibrated		
process:process_id:0	H1	DMT-BADGAMMA	4	1	928271454	0	0	0	H1 Bad gamma in h(t) DQ flags		
process:process_id:0	H1	DCH-TCS_SEVERE_GLITCHING	1	1	933822015	933828015	0	0	TCS problem due to uncontrolled LVEA temperature, producing severe DARM glitches		
process:process_id:0	H1	SCI-NONSTAND_CONFIG_ELOG	1	1	931212500	931215100	0	0	Injection of lines at 110 and 111 Hz and beats and harmonics visible in DARM_ERR		
process:process_id:0	H1	SCI-NONSTAND_CONFIG_ELOG	1	1	935250615	935355615	0	0	A Pcal injection causes a large number of bad triggers in the S6a search.		
process:process_id:0	H1	SCI-OTHER_ELOG	1	1	934977663	934977792	0	0	Bad glitches from out of lock times have corrupted a frame of hof		
process:process_id:0	L1	DMT-OUT_OF_LOCK	1	1	928271454	0	0	0			
process:process_id:0	L1	DCH-LDAS_C02_NOT_CALIBRATED	1	1	928271454	0	0	0	L1 LDAS C02 uncalibrated		
process:process_id:0	L1	DMT-BADGAMMA	4	1	928271454	0	0	0	L1 Bad gamma in h(t) DQ flags		
process:process_id:0	L1	SCI-HUMAN_INTRUSION_ELOG	1	1	933463250	933464444	0	0	PEM work in LVEA during science mode		
process:process_id:0	L1	SCI-HUMAN_INTRUSION_ELOG	1	1	933645436	933650570	0	0	PEM work in LVEA during science mode		
process:process_id:0	L1	SCI-OTHER_ELOG	1	1	931330815	931338015	0	0	Peak (possibly from recently switched off vacuum pumps) sweeps down in frequency through DARM ERR spectrum for 2 hours.		

LIGO Data Grid Wiki

welcome: [ScottKoranda](#) | [settings](#)
Refresh my LIGO group memberships

[LDGWiki](#) > [S6OnlineGroup](#) > [ligolw_segments_from_cats](#)

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ligolw_segments_from_cats

This documentation gives the basics introduction and examples to use `ligolw_segments_from_cats`. To see the complete syntax information, please type

```
ligolw_segments_from_cats --help
```

1. Step 1: specify the source you want to query against (choose one of the following 3 options):

- `-t segment_url, --segment=segment_url`

(1) A URL to a database, eg. [https://segdb.ligo.caltech.edu](#)

[https://segdb.ligo.caltech.edu](#)

(2) A URL to a DMT file would look like: [file:///archive/frames/online/DQ/H1/H-DQ_Segments-](#)

[file:///archive/frames/online/DQ/H1/H-DQ_Segments-](#)

3. Step 3: specify the gps-start-time and gps-end-time**4. Step 4: specify how you want your result files to be, choose one of the following:**

- (1). -c, --cumulative-categories: If set the category N files will contain all segments in categories $\leq N$
- (2). -p, --separate-categories: If set the category N files will contain only category N

Example

In this example, we show how to use a url as the veto file location to query against the segment database to get cumulative-category veto result within time range 930960015 and 931564887

```
ligolw_segments_from_cats --gps-start-time 930960015 --gps-end-time  
931564887 --segment-url https://segdb.ligo.caltech.edu --cumulative-  
categories --veto-file http://www.lsc-  
group.phys.uwm.edu/ligovirgo/cbc/public/segments/S6/H1L1V1-  
S6_CBC_LOWMASS_ONLINE-928271454-0.xml
```

This will create some xml files with the specified time range and veto categories.

LDGWiki: S6OnlineGroup/ligolw_segments_from_cats (last edited 2010-12-07 16:53:31 by [PeterCouvares](#))


```
-bash-3.2$ ligolw_segments_from_cats --gps-start-time 930960015 -  
-gps-end-time 930974415 --segment-url https://segdb.ligo.caltech.  
edu --cumulative-categories --veto-file http://www.lsc-group.phys  
.uwm.edu/ligovirgo/cbc/public/segments/S6/H1L1V1-S6_CBC_LOWMASS_0  
NLINE-928271454-0.xml  
-bash-3.2$
```

```
-bash-3.2$ ls
```

```
H1-VETOTIME_CAT1-930960015-14400.xml  
H1-VETOTIME_CAT2-930960015-14400.xml  
H1-VETOTIME_CAT3-930960015-14400.xml  
H1-VETOTIME_CAT4-930960015-14400.xml  
H1-VETOTIME_CAT5-930960015-14400.xml  
L1-VETOTIME_CAT1-930960015-14400.xml  
L1-VETOTIME_CAT2-930960015-14400.xml  
L1-VETOTIME_CAT3-930960015-14400.xml  
L1-VETOTIME_CAT4-930960015-14400.xml  
L1-VETOTIME_CAT5-930960015-14400.xml  
V1-VETOTIME_CAT1-930960015-14400.xml  
V1-VETOTIME_CAT2-930960015-14400.xml  
V1-VETOTIME_CAT3-930960015-14400.xml  
V1-VETOTIME_CAT4-930960015-14400.xml  
V1-VETOTIME_CAT5-930960015-14400.xml
```

```
skoranda@garlic: ~  
-bash-3.2$ head H1-VETOTIME_CAT1-930960015-14400.xml  
<?xml version='1.0' encoding='utf-8'?>  
<!DOCTYPE LIGO_LW SYSTEM "http://ldas-sw.ligo.caltech.edu/doc/lig  
olwAPI/html/ligolw_dtd.txt">  
<LIGO_LW>  
  <Table Name="process:table">  
    <Column Type="lstring" Name="process:comment"/>  
    <Column Type="lstring" Name="process:node"/>  
    <Column Type="int_4s" Name="process:unix_procid"/  
>  
    <Column Type="lstring" Name="process:version"/>  
    <Column Type="ilwd:char" Name="process:process_id  
"/>  
    <Column Type="int_4s" Name="process:start_time"/>  
-bash-3.2$
```

```
skoranda@garlic: ~  
-bash-3.2$ ligolw_print H1-VETOTIME_CAT1-930960015-14400.xml --table segment --column start_time --column end_time --delimiter " "  
930960015 930967923  
930969248 930970793  
930970940 930971369  
930971501 930972085  
930972517 930973854  
-bash-3.2$
```


Segment Algebra

- Often need to manipulate lists of segments
- Prone to errors
- Use existing libraries and tools
- Python segment module helpful

```
-bash-3.2$ python
Python 2.4.3 (#1, May  5 2011, 16:39:10)
[GCC 4.1.2 20080704 (Red Hat 4.1.2-50)] on linux2
Type "help", "copyright", "credits" or "license" for more information.
>>> from glue import segments
>>>
-bash-3.2$ python
Python 2.4.3 (#1, May  5 2011, 16:39:10)
[GCC 4.1.2 20080704 (Red Hat 4.1.2-50)] on linux2
Type "help", "copyright", "credits" or "license" for more information.
>>> from glue.segments import *
>>> s1 = segment(1,10)
>>> s2 = segment(20,30)
>>> s3 = segment(40,50)
>>> 
```



```
>>> s = segmentlist([s1, s2, s3])
>>> s
[segment(1, 10), segment(20, 30), segment(40, 50)]
>>> ~s
[segment(-infinity, 1), segment(10, 20), segment(30, 40), segment(50, infinity)]
>>> s.shift(100)
[segment(101, 110), segment(120, 130), segment(140, 150)]
>>> t = segmentlist([s1, s2, s3])
>>> s + t
[segment(1, 10), segment(20, 30), segment(40, 50), segment(101, 110), segment(120, 130), segment(140, 150)]
>>> s - t
[segment(101, 110), segment(120, 130), segment(140, 150)]
>>> 
```

Now you know
segments...how do you
find the data?

Finding GW data

- Data paths different across LDG
- Locations change as storage needs change
- Locations change for better performance
- Use tools for finding data and do not rely on on static lists of paths



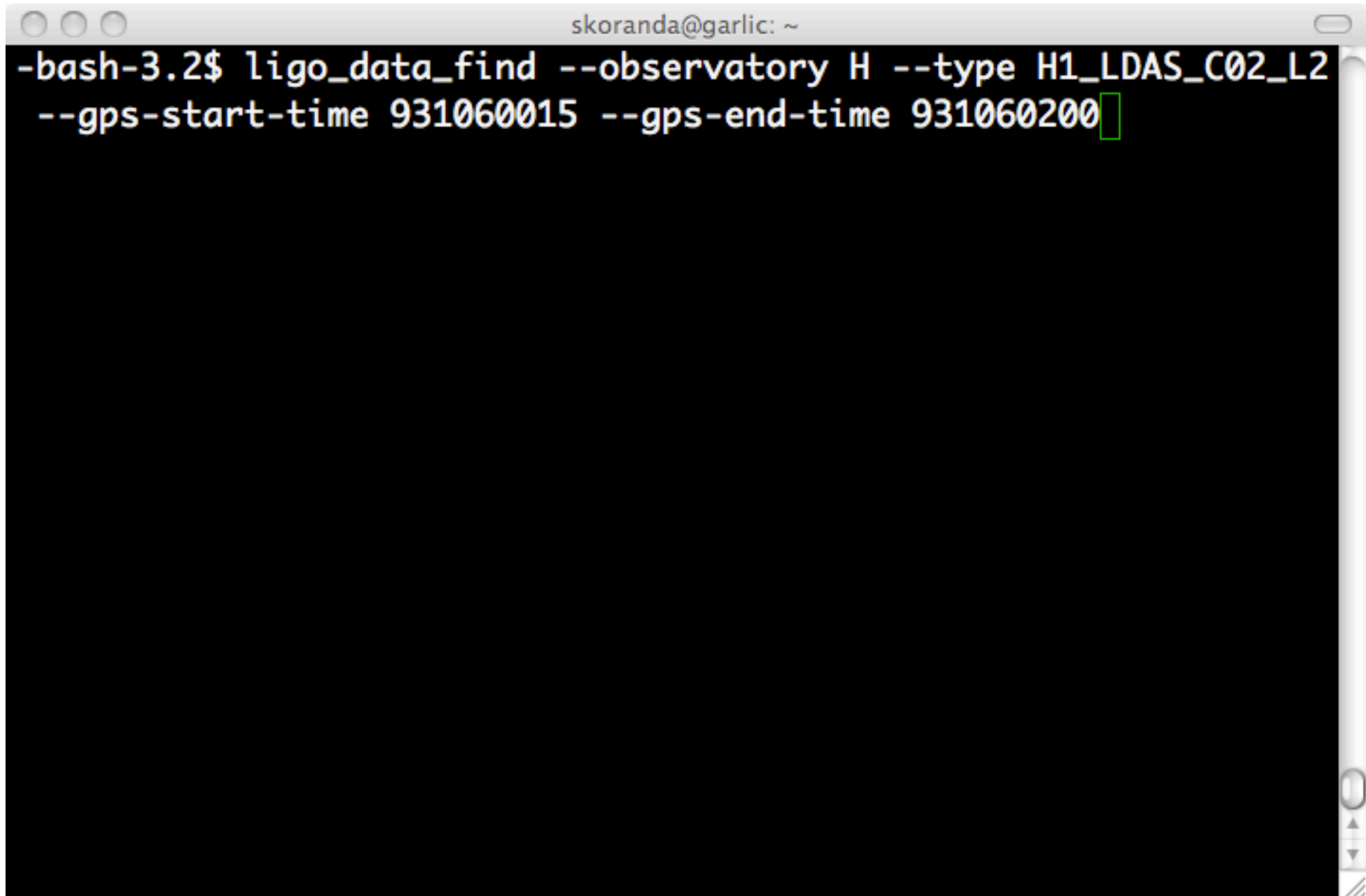
ligo_data_find

- Command line tool for finding data
- Each LDG site runs server to query
- Query to remote server needs grid cert
- No authentication to local server
- Finds data for any interferometer
 - will be renamed “gw_data_find”



ligo_data_find

- Inputs:
 - Observatory (instrument site)
 - Type of data file (raw, level 1, h(t), ...)
 - ask experts for frame type to use
 - GPS start and end times
- Output:
 - URL paths to data

A terminal window with a title bar that reads "skoranda@garlic: ~". The window contains a single line of text: "-bash-3.2\$ ligo_data_find --observatory H --type H1_LDAS_C02_L2 --gps-start-time 931060015 --gps-end-time 931060200". The text is in a monospaced font, with the command arguments in a light blue color. A green cursor is positioned at the end of the command line. The terminal background is black, and the window has standard macOS window controls (red, yellow, green buttons) in the top-left corner and a scroll bar on the right side.

```
skoranda@garlic: ~  
-bash-3.2$ ligo_data_find --observatory H --type H1_LDAS_C02_L2  
--gps-start-time 931060015 --gps-end-time 931060200
```



```
-bash-3.2$ ligo_data_find --observatory H --type H1_LDAS_C02_L2 --gps-start-time 931060015 --gps-end-time 931060200
gsiftp://ldas-cit.ligo.caltech.edu:15000/archive/frames/S6/LDAShof+C02/LH0/H-H1_LDAS_C02_L2-9310/H-H1_LDAS_C02_L2-931059968-128.gwf
file://localhost/archive/frames/S6/LDAShof+C02/LH0/H-H1_LDAS_C02_L2-9310/H-H1_LDAS_C02_L2-931059968-128.gwf
gsiftp://ldas-cit.ligo.caltech.edu:15000/data/node231/frames/S6/LDAShof+C02/LH0/H-H1_LDAS_C02_L2-9310/H-H1_LDAS_C02_L2-931059968-128.gwf
file://localhost/data/node231/frames/S6/LDAShof+C02/LH0/H-H1_LDAS_C02_L2-9310/H-H1_LDAS_C02_L2-931059968-128.gwf
gsiftp://ldas-cit.ligo.caltech.edu:15000/archive/frames/S6/LDAShof+C02/LH0/H-H1_LDAS_C02_L2-9310/H-H1_LDAS_C02_L2-931060096-128.gwf
file://localhost/archive/frames/S6/LDAShof+C02/LH0/H-H1_LDAS_C02_L2-9310/H-H1_LDAS_C02_L2-931060096-128.gwf
gsiftp://ldas-cit.ligo.caltech.edu:15000/data/node231/frames/S6/LDAShof
```

```
-bash-3.2$ ligo_data_find --observatory H --type H1_LDAS_C02_L2 --gps-s
tart-time 931060015 --gps-end-time 931060200
gsiftp://ldas-cit.ligo.caltech.edu:15000/archive/frames/S6/LDAShof
tC02/LH0/H-H1_LDAS_C02_L2-9310/H-H1_LDAS_C02_L2-931059968-128.gwf
file://localhost/archive/frames/S6/LDAShof
tC02/LH0/H-H1_LDAS_C02_L2-9310/H-H1_LDAS_C02_L2-931059968-128.gwf
gsiftp://ldas-cit.ligo.caltech.edu:15000/data/node231/frames/S6/LDAShof
tC02/LH0/H-H1_LDAS_C02_L2-9310/H-H1_LDAS_C02_L2-931059968-128.gwf
file://localhost/data/node231/frames/S6/LDAShof
tC02/LH0/H-H1_LDAS_C02_L2-9310/H-H1_LDAS_C02_L2-931059968-128.gwf
gsiftp://ldas-cit.ligo.caltech.edu:15000/archive/frames/S6/LDAShof
tC02/LH0/H-H1_LDAS_C02_L2-9310/H-H1_LDAS_C02_L2-931060096-128.gwf
file://localhost/archive/frames/S6/LDAShof
tC02/LH0/H-H1_LDAS_C02_L2-9310/H-H1_LDAS_C02_L2-931060096-128.gwf
gsiftp://ldas-cit.ligo.caltech.edu:15000/data/node231/frames/S6/LDAShof
```



```
-bash-3.2$ ligo_data_find --observatory H --type H1_LDAS_C02_L2 --gps-s
tart-time 931060015 --gps-end-time 931060200
gsiftp://ldas-cit.ligo.caltech.edu:15000/archive/frames/S6/LDAShof
tC02/LH0/H-H1_LDAS_C02_L2-9310/H-H1_LDAS_C02_L2-931059968-128.gwf
file://localhost/archive/frames/S6/LDAShof
tC02/LH0/H-H1_LDAS_C02_L2-9310/H-H1_LDAS_C02_L2-931059968-128.gwf
gsiftp://ldas-cit.ligo.caltech.edu:15000/data/node231/frames/S6/LDAShof
tC02/LH0/H-H1_LDAS_C02_L2-9310/H-H1_LDAS_C02_L2-931059968-128.gwf
file://localhost/data/node231/frames/S6/LDAShof
tC02/LH0/H-H1_LDAS_C02_L2-9310/H-H1_LDAS_C02_L2-931059968-128.gwf
gsiftp://ldas-cit.ligo.caltech.edu:15000/archive/frames/S6/LDAShof
tC02/LH0/H-H1_LDAS_C02_L2-9310/H-H1_LDAS_C02_L2-931060096-128.gwf
file://localhost/archive/frames/S6/LDAShof
tC02/LH0/H-H1_LDAS_C02_L2-9310/H-H1_LDAS_C02_L2-931060096-128.gwf
gsiftp://ldas-cit.ligo.caltech.edu:15000/data/node231/frames/S6/LDAShof
```

skoranda@garlic: ~

```
-bash-3.2$ ligo_data_find --observatory H --type H1_LDAS_C02_L2 --gps-start-time 931060015 --gps-end-time 931060200 --url-type file
file:///localhost/data/node231/frames/S6/LDAShoftC02/LH0/H-H1_LDAS_C02_L2-9310/H-H1_LDAS_C02_L2-931059968-128.gwf
file:///localhost/data/node231/frames/S6/LDAShoftC02/LH0/H-H1_LDAS_C02_L2-9310/H-H1_LDAS_C02_L2-931060096-128.gwf
-bash-3.2$
```

ligo_data_find

Other useful options:

- gaps: warn about missing data in segment
- match: match against regular expression
- names-only: just file names not paths
- show-types: show available frame types
- show-times: show segments in GPS range
- lal-cache: format output for use in LAL
- frame-cache: another output format

Frame File Naming Convention

H-H1_LDAS_C02_L2-931060096-128.gwf

L-L1_RDS_R_L1-957449792-64.gwf

GHLV-GALCALTERR_50MPC-940995415-1000.gwf

V-HrecOnline-994488000-4000.gwf

Frame File Naming Convention

Site(s)

H-H1_LDAS_C02_L2-931060096-128.gwf

L-L1_RDS_R_L1-957449792-64.gwf

GHLV-GALCALTERR_50MPC-940995415-1000.gwf

V-HrecOnline-994488000-4000.gwf

Frame File Naming Convention

Frame Type

H-H1_LDAS_C02_L2-931060096-128.gwf

L-L1_RDS_R_L1-957449792-64.gwf

GHLV-GALCALTERR_50MPC-940995415-1000.gwf

V-HrecOnline-994488000-4000.gwf

Frame File Naming Convention

GPS Start Time

H-H1_LDAS_C02_L2-931060096-128.gwf

L-L1_RDS_R_L1-957449792-64.gwf

GHLV-GALCALTERR_50MPC-940995415-1000.gwf

V-HrecOnline-994488000-4000.gwf

Frame File Naming Convention

Duration

H-H1_LDAS_C02_L2-931060096-128.gwf

L-L1_RDS_R_L1-957449792-64.gwf

GHLV-GALCALTERR_50MPC-940995415-1000.gwf

V-HrecOnline-994488000-4000.gwf

Frame File Naming Convention

Calibration version for LIGO $h(t)$

H-H1_LDAS_C02_L2-931060096-128.gwf

L-L1_RDS_R_L1-957449792-64.gwf

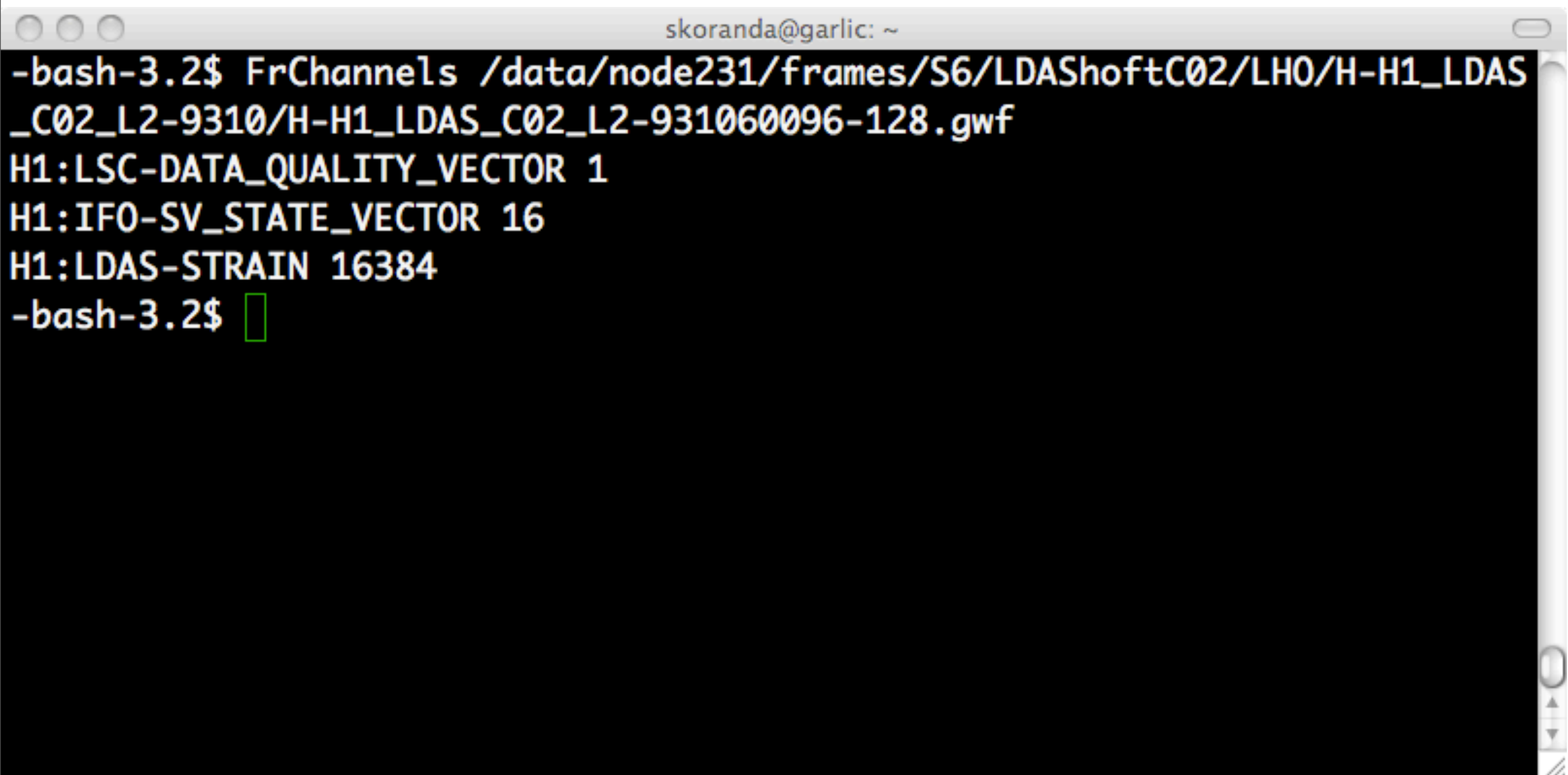
GHLV-GALCALTERR_50MPC-940995415-1000.gwf

V-HrecOnline-994488000-4000.gwf

Reading Frame Files

Libraries, modules, tools for:

- C code: LAL, FrameL
- Python: pyLAL
- Matlab: module “accessdatachannel”
- Command line: Fr* tools from ligotools

A terminal window with a title bar showing 'skoranda@garlic: ~'. The terminal has a black background with yellow text. The user has entered the command 'FrChannels /data/node231/frames/S6/LDAShof+C02/LH0/H-H1_LDAS_C02_L2-9310/H-H1_LDAS_C02_L2-931060096-128.gwf'. The output shows three lines of data: 'H1:LSC-DATA_QUALITY_VECTOR 1', 'H1:IFO-SV_STATE_VECTOR 16', and 'H1:LDAS-STRAIN 16384'. The prompt '-bash-3.2\$' is followed by a green cursor box.

```
skoranda@garlic: ~  
-bash-3.2$ FrChannels /data/node231/frames/S6/LDAShof+C02/LH0/H-H1_LDAS  
_C02_L2-9310/H-H1_LDAS_C02_L2-931060096-128.gwf  
H1:LSC-DATA_QUALITY_VECTOR 1  
H1:IFO-SV_STATE_VECTOR 16  
H1:LDAS-STRAIN 16384  
-bash-3.2$
```

skoranda@garlic: ~

```
-bash-3.2$ FrDump -i /data/node231/frames/S6/LDAShof+C02/LH0/H-H1_LDAS_  
C02_L2-9310/H-H1_LDAS_C02_L2-931060096-128.gwf | less
```

```

-----Parameters used-----
Input Files: /data/node231/frames/S6/LDAShof+C02/LH0/H-H1_LDAS_C02_L
2-9310/H-H1_LDAS_C02_L2-931060096-128.gwf
First frame   : 0 0 (GPS=0.0)
Last frame    : 2147483647 2147483647 (GPS=2147483647.0)
Debug level   : 1
Dump all Frame info
-----
/data/node231/frames/S6/LDAShof+C02/LH0/H-H1_LDAS_C02_L2-9310/H-H1_LDAS
_C02_L2-931060096-128.gwf          931060096 128  0 0
File(s) summary:
1 Frames in the requested time range (0 to 10000000000 (GPS))
First frame start at:931060096 (UTC:Wed Jul  8 03:48:01 2009) leng
th=128.00s.
:

```

```

First frame start at:931060096 (UTC:Wed Jul  8 03:48:01 2009) leng
th=128.00s.
Last frame end at:931060224 (UTC:Wed Jul  8 03:50:09 2009) leng
th=128.00s.
ADC :      0 type of AdcData :
Ser :      0 type of SerData :
Proc:      3 type of ProcData: H1:IF0-SV_STATE_VECTOR H1:LDAS-STRAIN H1
:LSC-DATA_QUALITY_VECTOR
Sim :      0 type of SimData :
Detector: 1 type of Detector: LH0_4k
StatData: 4 type of StatData: H1:CAL-CAV_FAC H1:CAL-CAV_FAC_Im H1:CAL-
OLOOP_FAC H1:CAL-OLOOP_FAC_Im
Event   : 0 Types of event in the file
Simulated Event   : 0 Types of event in the file
(END)

```

skoranda@garlic: ~

```
-bash-3.2$ FrDump -i /data/node231/frames/S6/LDAShofC02/LH0/H-H1_LDAS_  
C02_L2-9310/H-H1_LDAS_C02_L2-931060096-128.gwf -d 5 | less
```



```
Sat Jan 16 00:32:58 2010 Command line run: /archive/home/gmendell/createhoft/S6/bin/lalapps_ComputeStrainDriver -s 931060080 -e 931060240 --info H1 --filters-file /archive/home/gmendell/createhoft/S6aC02/H1/S6H1Filters_929904671.txt --gamma-fudge-factor 1.0 --wings 16 --frame-type H1_LDAS_C02 --factors-time 1.0 --strain-channel H1:LDAS-STRAIN --check-file-exists --data-dirL2 /archive/frames/S6/LDAShoftC02/LH0/H-H1_LDAS_C02_L2-9310 -C /ldas_outgoing/createrds/dsoron/contrib/createrds/S6aC02-H1_H0FT/cache/tmp_createhoft_H_job3_cache.txt
```

Sat Jan 16 00:32:58 2010 LAL Info:

LAL Version: 6.3.2

Git Tag: lal_lalapps_6_3_2_release

Git ID: 3317a1da88ee94427997fe54dd8ac59abd118

c29

Configure Date: 2009-11-20T15:01:44-0800

:☐


```

0: 1.539e+33 7.0858e+31 7.5969e+32 8.2079e+32 -3.6257e+32 -1.
1045e+32 -5.7672e+32 -6.1049e+32 1.7749e+33 1.0896e+33
10: 2.4018e+32 5.0231e+32 5.6824e+31 -5.5986e+32 1.7033e+32 9
.734e+32 -5.6175e+32 -1.2365e+32 -2.2433e+32 -8.4495e+32
20: -4.8838e+31 -8.7019e+32 6.0481e+32 1.6153e+32 3.2583e+32 9.
2887e+32 -1.4822e+32 -4.2818e+32 -5.6579e+32 -1.3072e+33
30: 7.1304e+32 7.2307e+31 -3.8825e+32 4.0953e+32 1.2575e+32 -6
.751e+32 8.9181e+32 -1.6446e+32 6.6538e+32 5.0792e+32
40: -1.2426e+33 1.8881e+32 3.8037e+32 -3.8209e+32 3.5156e-15 2.
2116e-15 -4.3633e-15 -2.719e-15 5.1023e-15 5.9118e-15
50: 1.3355e-15 1.0865e-15 8.5672e-15 -2.9601e-15 -1.9088e-15 -1.
9308e-15 -1.1565e-15 -1.3031e-15 -8.4167e-15 -0.010337
60: 1.1235e-15 0.0095051 5.848e-15 -1.099e-15 4.4328e-15 5.
1494e-15 -4.3844e-15 -6.5582e-15 6.4197e-15 5.1644e-16
:

```

```
-bash-3.2$ FrCheck -i /data/node231/frames/S6/LDAShoftC02/LH0/H-H1_LDAS_C02_L2-9310/H-H1_LDAS_C02_L2-931060096-128.gwf
```

```
Checking file /data/node231/frames/S6/LDAShoftC02/LH0/H-H1_LDAS_C02_L2-9310/H-H1_LDAS_C02_L2-931060096-128.gwf
```

```
Compression will NOT be checked
```

```
Sequential file reading. Please wait....
```

```
1 frames read
```

```
1 frame(s) in file. No read error. File Checksum OK (4e1e0788)
```

```
Reading using the TOC. Please wait....
```

```
Requested time range: 0 - 2147483647
```

```
File time range: 931060096 - 931060224
```

```
1 frames read
```

```
1 frame(s) in file. No read error. Structure Checksums OK
```

```
-bash-3.2$
```

Running Analysis Jobs

Condor on LDG

- Batch system for managing compute jobs
- Powerful “Class Ad” matchmaking
 - match requirements & resources
 - both jobs & resources have requirements
- “Fair share” instead of first-in-first-out
 - No notion of distinct queues
 - Jobs suspended or evicted as necessary
 - Support for checkpointing

Job Submit Description File

- Description of how to run job
- Commands or keywords and values
- Single submit file can queue one or many
- 300+ commands but just a few necessary
- Condor converts submit description to a “Class Ad” for job and advertises it, making it available to be matched to a resource

```
$ cat test01.sub  
universe = vanilla  
executable = /usr/bin/whoami  
log = test01.log
```

queue

```
$ █
```


skoranda@hydra:/people/skoranda

```
$ condor_submit test01.sub  
Submitting job(s).  
Logging submit event(s).  
1 job(s) submitted to cluster 31119805.  
$
```

\$ condor_q skoranda

-- Submitter: hydra.phys.uwm.edu : <192.168.0.13:33345> : hydra.phys.uwm.edu

ID	OWNER	SUBMITTED	RUN_TIME	ST	PRI	SIZE	CMD
31119805.0	skoranda	7/31 07:47	0+00:00:00	I	0	0.0	whoami

1 jobs; 1 idle, 0 running, 0 held

\$

\$ condor_q | head

-- Submitter: hydra.phys.uwm.edu : <192.168.0.13:33345> : hydra.phys.uwm.edu

ID	OWNER	SUBMITTED	RUN_TIME	ST	PRI	SIZE	CMD
28070399.0	tsidery	4/11 07:55	100+14:35:52	R	0	7.3	condor_dagman
28070550.0	tsidery	4/11 08:00	94+02:42:17	H	0	24.4	lalapps_inspnest
28070746.0	tsidery	4/11 08:07	103+00:04:18	R	0	24.4	lalapps_inspnest
30033263.0	atbraack	7/8 08:19	2+22:24:56	H	0	73.2	lalapps_inspnest
30033292.0	atbraack	7/8 08:19	2+22:58:57	H	0	73.2	lalapps_inspnest
30034067.0	atbraack	7/8 08:34	2+11:14:12	H	0	73.2	lalapps_inspnest

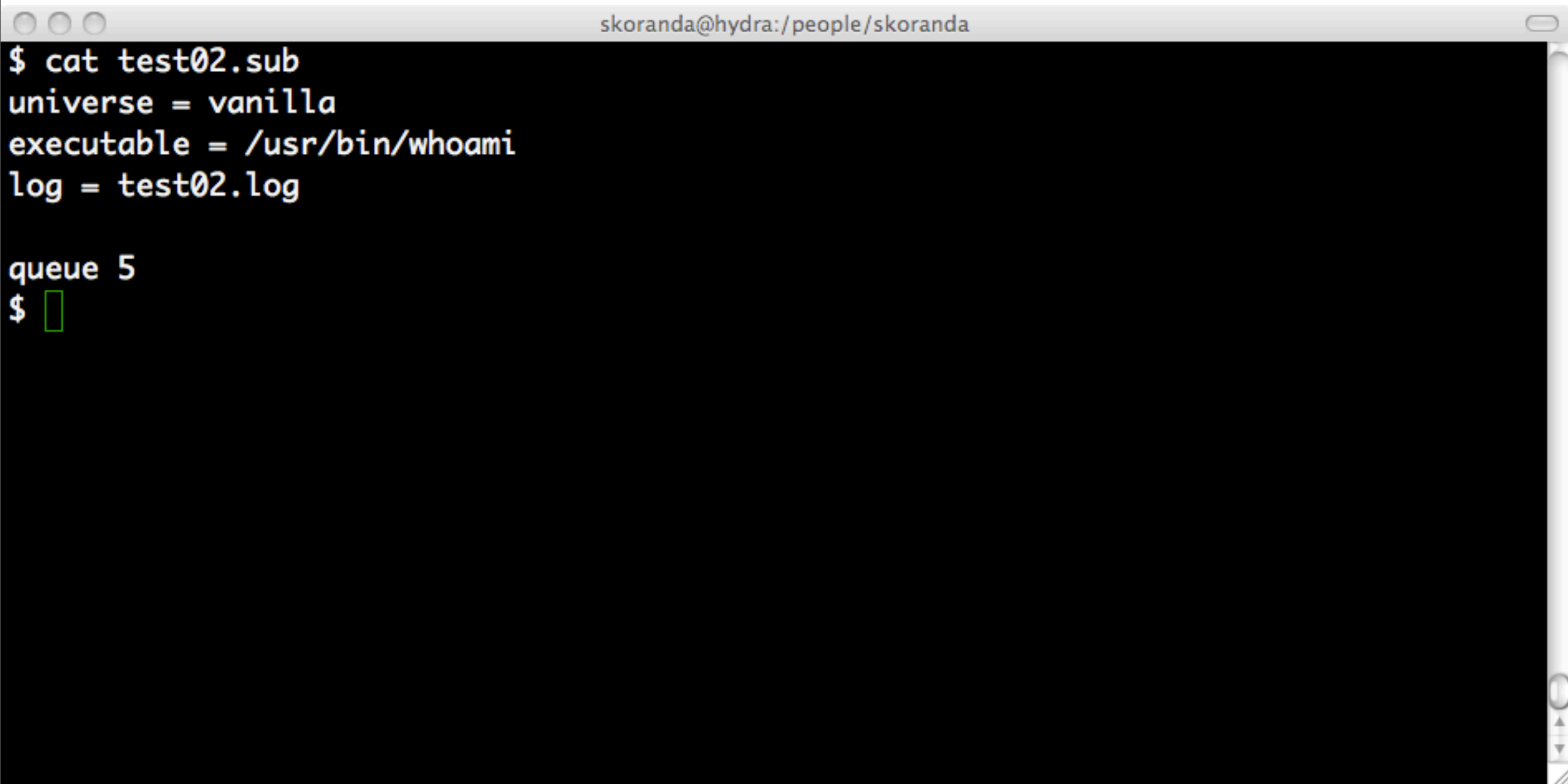
\$

```
$ condor_q | tail
31120724.0    magathos      7/31 19:33    0+00:00:00 I  0    19.5 lalapps_inspnest
31120725.0    magathos      7/31 19:33    0+00:00:00 I  0    19.5 lalapps_inspnest
31120726.0    magathos      7/31 19:33    0+00:00:00 I  0    19.5 lalapps_inspnest
31120727.0    magathos      7/31 19:35    0+00:00:00 I  0    19.5 lalapps_inspnest
31120728.0    magathos      7/31 19:35    0+00:00:00 I  0    19.5 lalapps_inspnest
31120729.0    magathos      7/31 19:35    0+00:00:00 I  0    19.5 lalapps_inspnest
31120730.0    magathos      7/31 19:35    0+00:00:00 I  0    19.5 lalapps_inspnest
31120731.0    magathos      7/31 19:35    0+00:00:00 I  0    19.5 lalapps_inspnest
```

```
5991 jobs; 1959 idle, 4000 running, 32 held
```

```
$
```

```
$ cat test01.log
000 (20740199.000.000) 08/01 08:19:16 Job submitted from host: <10.20.30.1:5733
4>
...
001 (20740199.000.000) 08/01 08:19:40 Job executing on host: <10.10.0.1:36200>
...
005 (20740199.000.000) 08/01 08:19:55 Job terminated.
    (1) Normal termination (return value 0)
        Usr 0 00:00:00, Sys 0 00:00:00 - Run Remote Usage
        Usr 0 00:00:00, Sys 0 00:00:00 - Run Local Usage
        Usr 0 00:00:00, Sys 0 00:00:00 - Total Remote Usage
        Usr 0 00:00:00, Sys 0 00:00:00 - Total Local Usage
0 - Run Bytes Sent By Job
0 - Run Bytes Received By Job
0 - Total Bytes Sent By Job
0 - Total Bytes Received By Job
...
$
```


A terminal window with a title bar showing 'skoranda@hydra:/people/skoranda'. The terminal has a black background with white text. The user has entered the command '\$ cat test02.sub', which has outputted three lines: 'universe = vanilla', 'executable = /usr/bin/whoami', and 'log = test02.log'. Below this, the user has entered 'queue 5', and the prompt '\$' is followed by a green cursor box.

```
skoranda@hydra:/people/skoranda
$ cat test02.sub
universe = vanilla
executable = /usr/bin/whoami
log = test02.log

queue 5
$ █
```



```
$ condor_submit test02.sub
Submitting job(s).....
Logging submit event(s).....
5 job(s) submitted to cluster 31120737.
$ condor_q skoranda
```

```
-- Submitter: hydra.phys.uwm.edu : <192.168.0.13:33345> : hydra.phys.uwm.edu
```

ID	OWNER	SUBMITTED	RUN_TIME	ST	PRI	SIZE	CMD
31120721.0	skoranda	7/31 19:32	0+00:00:00	I	0	0.0	whoami
31120737.0	skoranda	7/31 19:39	0+00:00:00	I	0	0.0	whoami
31120737.1	skoranda	7/31 19:39	0+00:00:00	I	0	0.0	whoami
31120737.2	skoranda	7/31 19:39	0+00:00:00	I	0	0.0	whoami
31120737.3	skoranda	7/31 19:39	0+00:00:00	I	0	0.0	whoami
31120737.4	skoranda	7/31 19:39	0+00:00:00	I	0	0.0	whoami

```
6 jobs; 6 idle, 0 running, 0 held
```

```
$
```

```
$ condor_rm 31120753.0
Job 31120753.0 marked for removal
$ condor_rm 31120753
Cluster 31120753 has been marked for removal.
$ █
```

[screen 0: bash] skoranda@hydra:/people/skoranda

```
$ cat test03.sub
universe = vanilla
executable = /bin/cat
arguments = /home/skoranda/mydata
output = test03.out
error = test03.err
log = test03.log
```

queue

```
$ █
```

Tip



- Always use output, error, log for every job
- Makes debugging much easier
- Admins will ask for those files if you ask for help or report a problem

```
$ cat test04.sub  
universe = vanilla  
executable = /bin/cat  
arguments = /home/skoranda/mydata  
output = test.$(cluster).$(process).out  
error = test.$(cluster).$(process).err  
log = test.$(cluster).$(process).log
```

```
queue 5
```

```
$ █
```

```
skoranda@hydra:/people/skoranda/foo
$ ls
test04.sub      test.31121158.1.out  test.31121158.3.out
test.31121158.0.err  test.31121158.2.err  test.31121158.4.err
test.31121158.0.log  test.31121158.2.log  test.31121158.4.log
test.31121158.0.out  test.31121158.2.out  test.31121158.4.out
test.31121158.1.err  test.31121158.3.err
test.31121158.1.log  test.31121158.3.log
$
```



```
$ cat inspiral_hipe_nsbhloginj.thinca_H1L1.NSBHLOGINJ.sub
universe = standard
executable = ../executables/lalapps_thinca
arguments = " --e-thinca-parameter 0.5 --l1-triggers $(macro11triggers) --multi-ifo-coin
c --user-tag NSBHLOGINJ --debug-level 33 --ifo-tag $(macroifotag) --gps-start-time $(mac
rogpsstarttime) --parameter-test ellipsoid --gps-end-time $(macrogpsendtime) --write-com
press --h1-triggers $(macroh1triggers) --data-type all_data $(macroarguments) "
copy_to_spool = False
log = /people/jclayton/logs/S6/test_new_cluster_nodes/run3/tmpRTLRon
error = logs/thinca-$(macrogpsstarttime)-$(macrogpsendtime)-$(cluster)-$(process).err
output = logs/thinca-$(macrogpsstarttime)-$(macrogpsendtime)-$(cluster)-$(process).out
notification = never
queue 1
$
```

When will my jobs run?

skoranda@garlic: ~

```
$ condor_status -total
```

	Total	Owner	Claimed	Unclaimed	Matched	Preempting	Backfill
--	-------	-------	---------	-----------	---------	------------	----------

X86_64/LINUX	2580	0	2556	24	0	0	0
--------------	------	---	------	----	---	---	---

Total	2580	0	2556	24	0	0	0
-------	------	---	------	----	---	---	---

```
$
```

```
$ condor_q -global | more
```

```
-- Schedd: ldas-pcdev1.ligo.caltech.edu : <10.14.0.18:33871>
```

ID	OWNER	SUBMITTED	RUN_TIME	ST	PRI	SIZE	CMD
38269744.0	rory.smith	3/25 05:15	5+18:01:16	H	0	19.5	lalapps_inspnest
38269745.0	rory.smith	3/25 05:15	5+14:40:39	H	0	19.5	lalapps_inspnest
38269746.0	rory.smith	3/25 05:15	5+21:26:04	H	0	19.5	lalapps_inspnest
38269747.0	rory.smith	3/25 05:15	5+19:15:27	H	0	19.5	lalapps_inspnest
38269748.0	rory.smith	3/25 05:15	5+21:45:08	H	0	19.5	lalapps_inspnest
38269754.0	rory.smith	3/25 05:15	5+16:50:04	H	0	19.5	lalapps_inspnest
38269755.0	rory.smith	3/25 05:15	5+18:06:06	H	0	19.5	lalapps_inspnest
38269756.0	rory.smith	3/25 05:15	5+21:43:13	H	0	19.5	lalapps_inspnest
38269757.0	rory.smith	3/25 05:15	5+23:58:36	H	0	19.5	lalapps_inspnest
38269758.0	rory.smith	3/25 05:15	5+18:09:08	H	0	19.5	lalapps_inspnest

```
skoranda@hydra:~  
$ condor_userprio  
Last Priority Update: 8/1 06:18  
  
User Name                                     Effective  
-----                                     -  
skoranda@nemo.phys.uwm.edu                   0.50  
tsidery@nemo.phys.uwm.edu                     1.00  
Rory.smith@nemo.phys.uwm.edu                  1.00  
nanohub@nemo.phys.uwm.edu                    5.00  
engage@nemo.phys.uwm.edu                     5.00  
geant4@nemo.phys.uwm.edu                     5.00  
channa@nemo.phys.uwm.edu                     12.00  
michal@nemo.phys.uwm.edu                     149.00  
vdbroeck@nemo.phys.uwm.edu                   1067.00  
magathos@nemo.phys.uwm.edu                   1340.00  
volodya@nemo.phys.uwm.edu                    1364.00  
ligo@nemo.phys.uwm.edu                       50000.00  
-----  
Number of users shown: 12  
$
```


Condor Scheduling

- “Fair share” and not first-in-first-out
- Condor will suspend then evict jobs to balance use
- LIGO configuration gives jobs at least 4 hours before eviction
- Jobs should checkpoint if possible
 - manage their own checkpoints or,
 - leverage Condor checkpointing for C or C++


```
$ cat hello.c
#include <stdio.h>
#include <stdlib.h>
#include <unistd.h>

int main(int argc, char ** argv){

    char myhostname[256];

    gethostname(myhostname, (size_t) 256);

    fprintf(stdout, "Hello world from node %s\n", myhostname);

    return 0;
}
$
```

skoranda@hydra:/people/skoranda

```
$ gcc -c hello.c
```

```
$ ls hello.o
```

```
hello.o
```

```
$
```

```
$ condor_compile gcc -o hello hello.o
LINKING FOR CONDOR : /usr/bin/ld -L/opt/condor/lib -Bstatic --eh-frame
-hdr -m elf_x86_64 --hash-style=gnu -dynamic-linker /lib64/ld-linux-x8
6-64.so.2 -o hello /opt/condor/lib/condor_rt0.o /usr/lib/gcc/x86_64-re
dhat-linux/4.1.2/../../../../lib64/crti.o /usr/lib/gcc/x86_64-redhat-l
inux/4.1.2/crtbeginT.o -L/opt/condor/lib -L/usr/lib/gcc/x86_64-redhat-
linux/4.1.2 -L/usr/lib/gcc/x86_64-redhat-linux/4.1.2 -L/usr/lib/gcc/x8
6_64-redhat-linux/4.1.2/../../../../lib64 -L/lib/../../lib64 -L/usr/lib/.
./lib64 hello.o /opt/condor/lib/libcondorsyscall.a /opt/condor/lib/lib
condor_z.a /opt/condor/lib/libcomp_libstdc++.a /opt/condor/lib/libcomp
_libgcc.a /opt/condor/lib/libcomp_libgcc_eh.a --as-needed --no-as-need
ed -lcondor_c -lcondor_nss_files -lcondor_nss_dns -lcondor_resolv -lco
ndor_c -lcondor_nss_files -lcondor_nss_dns -lcondor_resolv -lcondor_c
/opt/condor/lib/libcomp_libgcc.a /opt/condor/lib/libcomp_libgcc_eh.a -
-as-needed --no-as-needed /usr/lib/gcc/x86_64-redhat-linux/4.1.2/crten
d.o /usr/lib/gcc/x86_64-redhat-linux/4.1.2/../../../../lib64/crtn.o
```

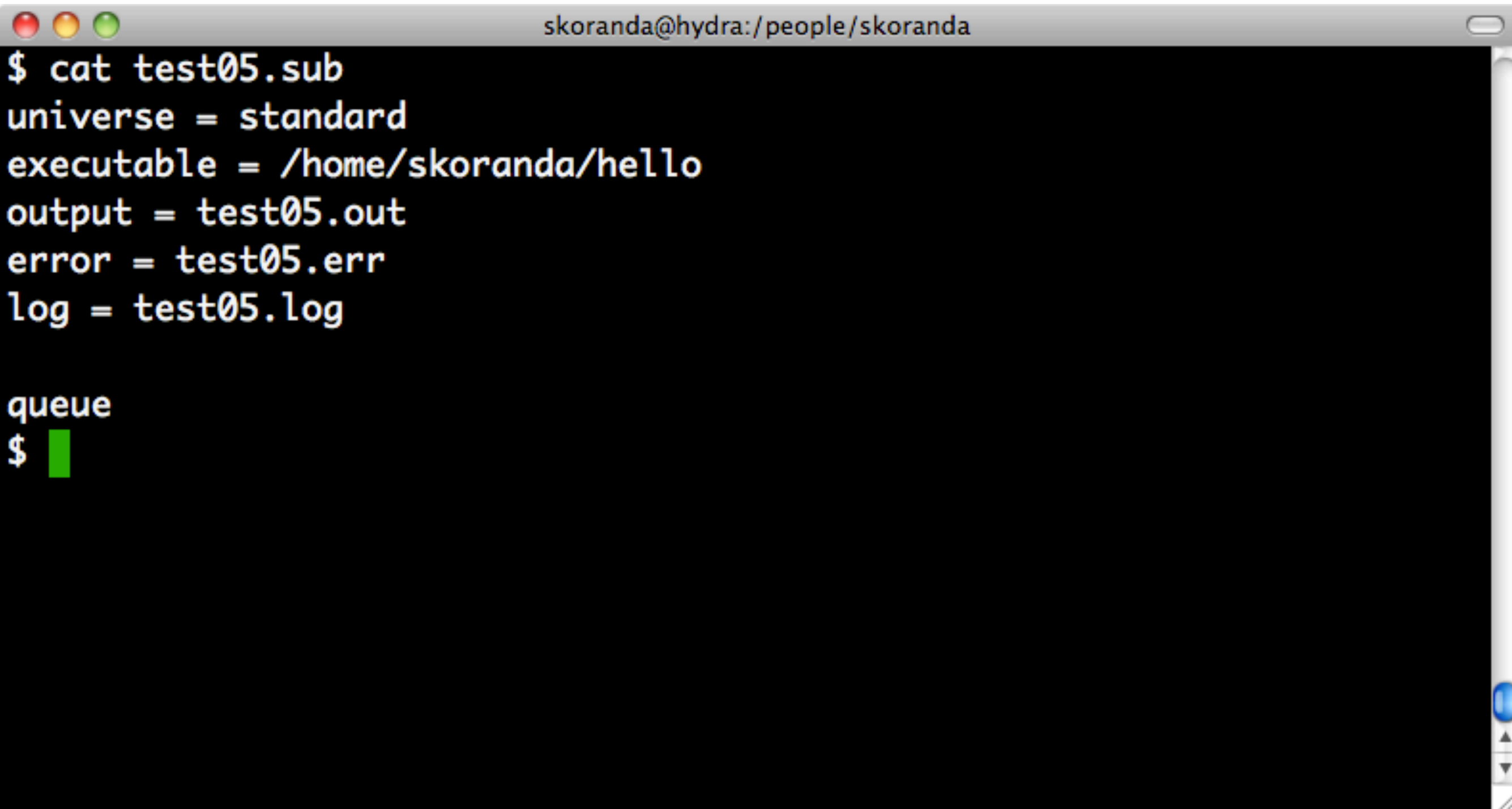
\$./hello

Condor: Notice: Will checkpoint to ./hello.ckpt

Condor: Notice: Remote system calls disabled.

Hello world from node hydra.phys.uwm.edu

\$

A screenshot of a macOS-style terminal window. The title bar at the top shows three colored window control buttons (red, yellow, green) on the left and a close button on the right. The title text reads "skoranda@hydra:/people/skoranda". The terminal content shows a shell prompt "\$" followed by the command "cat test05.sub". The output of the command is displayed in yellow text: "universe = standard", "executable = /home/skoranda/hello", "output = test05.out", "error = test05.err", and "log = test05.log". Below this, the word "queue" is printed in white. At the bottom, another shell prompt "\$" is shown with a green cursor block. On the right side of the terminal window, there is a vertical scrollbar and a blue circular button with a magnifying glass icon.

```
skoranda@hydra:/people/skoranda
$ cat test05.sub
universe = standard
executable = /home/skoranda/hello
output = test05.out
error = test05.err
log = test05.log

queue
$ █
```

Condor Checkpointing

- Checkpoint before eviction then restart from checkpoint
- Periodic checkpointing in case of node failure
- Can NOT checkpoint:
 - multi kernel-level threads
 - multi process jobs
 - dynamically linked programs
 - timers, alarms, sleep
 - Python, Mathematica, Matlab, ...

Condor Checkpointing: DMTCP

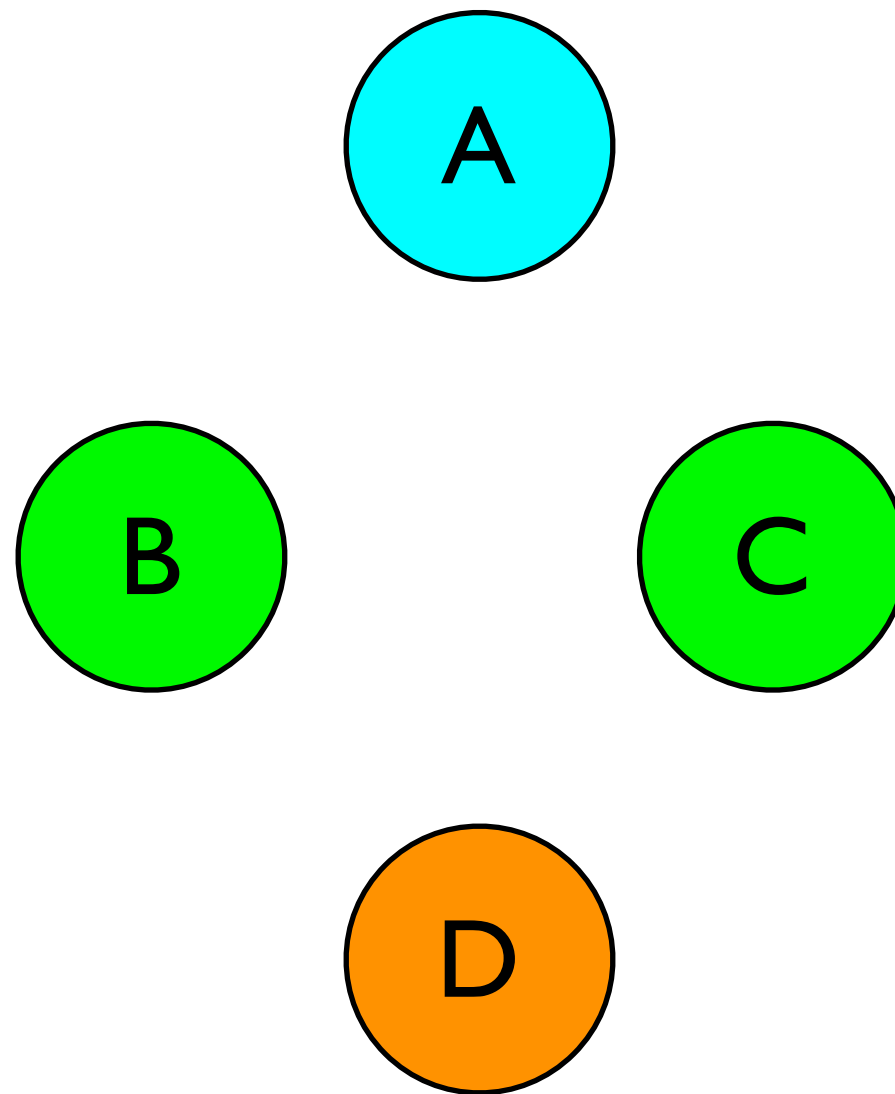
- Does NOT require relinking code
- Enables checkpointing for
 - Python
 - Matlab
 - Mathematica
- Still in testing phase



Condor DAGman

- Tool for managing workflows (pipelines)
- Output from one job input to another
- Jobs required to execute in particular order
- LIGO data analysis heavily uses DAGman

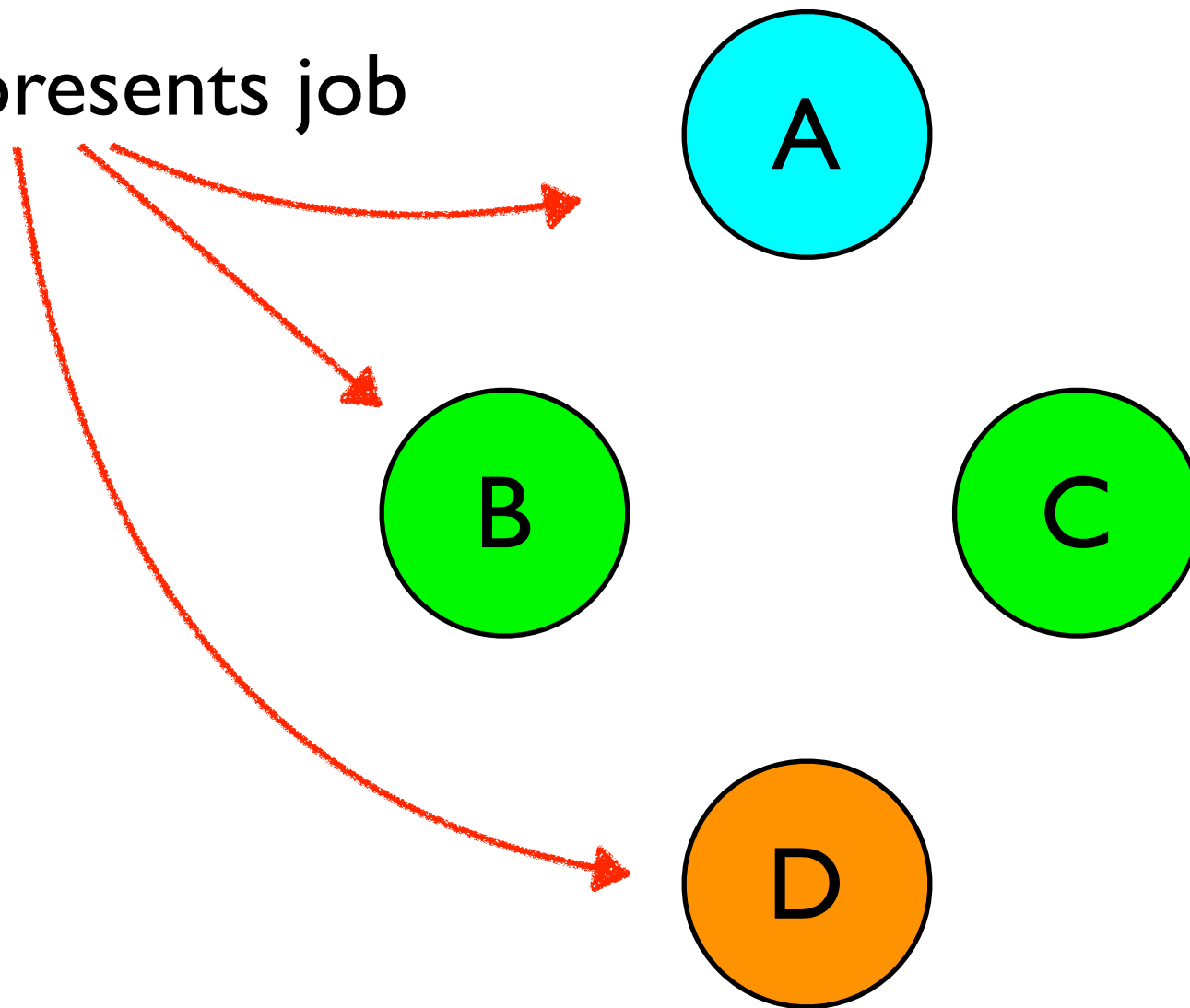
Directed Acyclic Graph



“Diamond DAG”

Directed Acyclic Graph

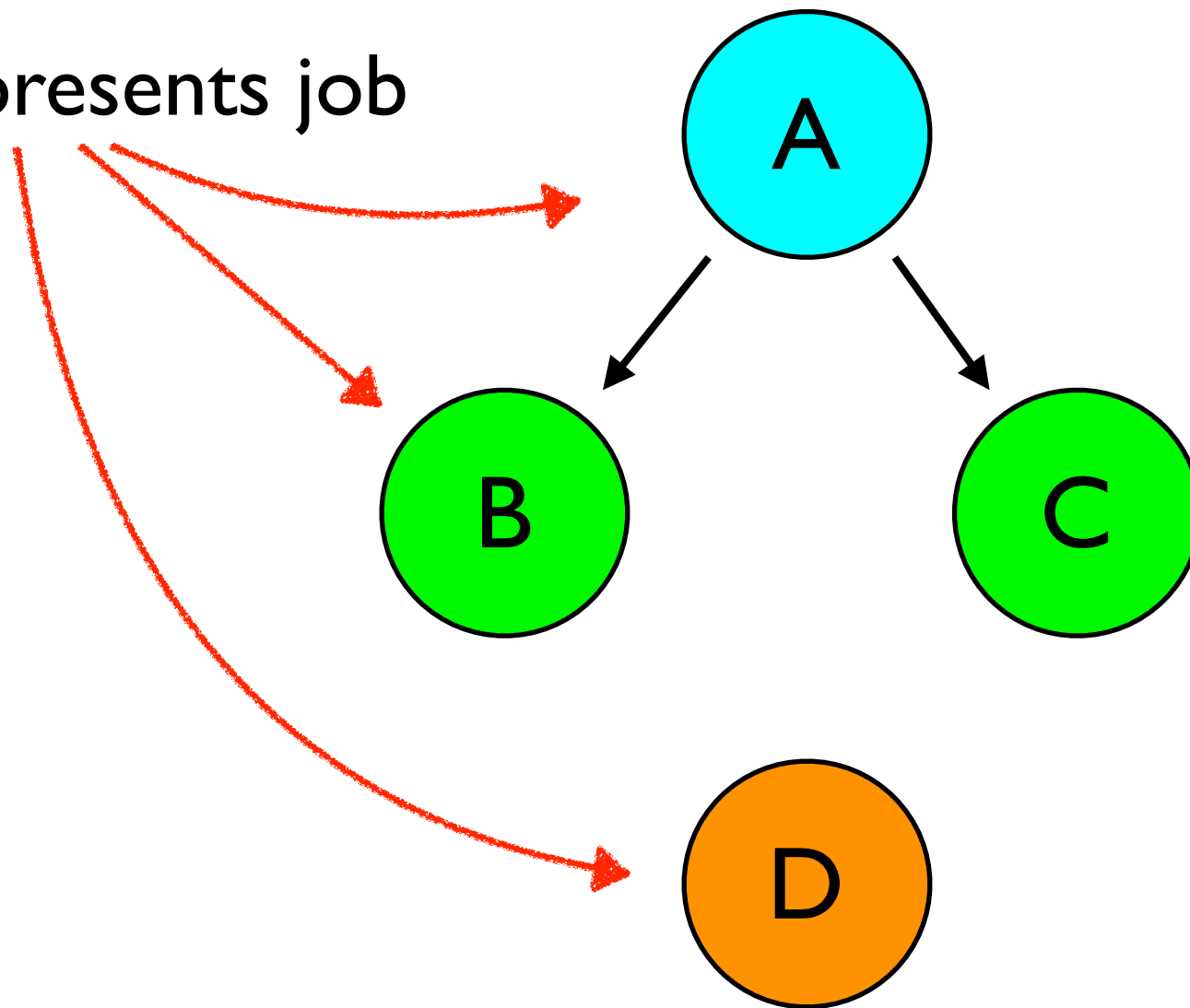
“node” represents job



“Diamond DAG”

Directed Acyclic Graph

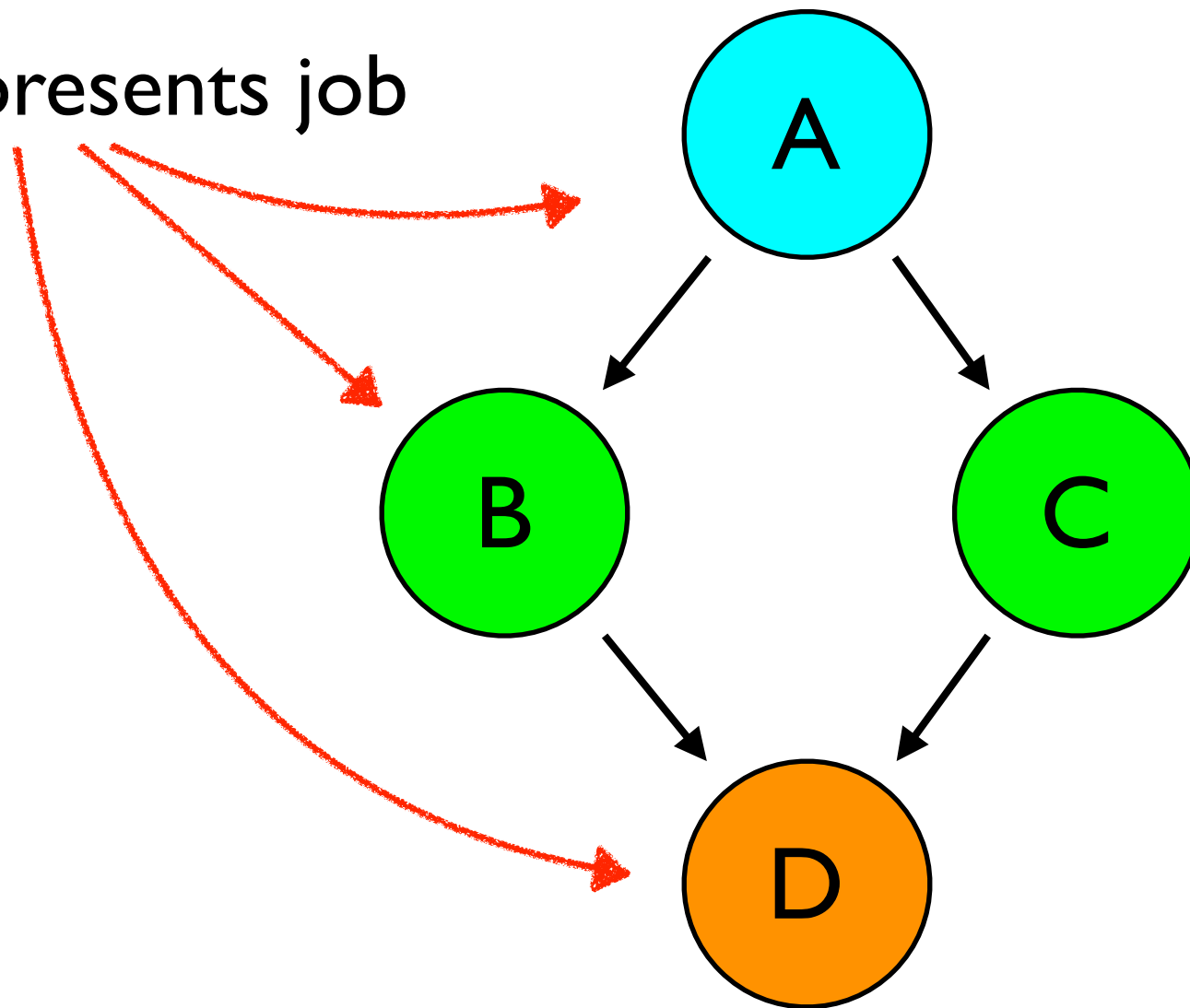
“node” represents job



“Diamond DAG”

Directed Acyclic Graph

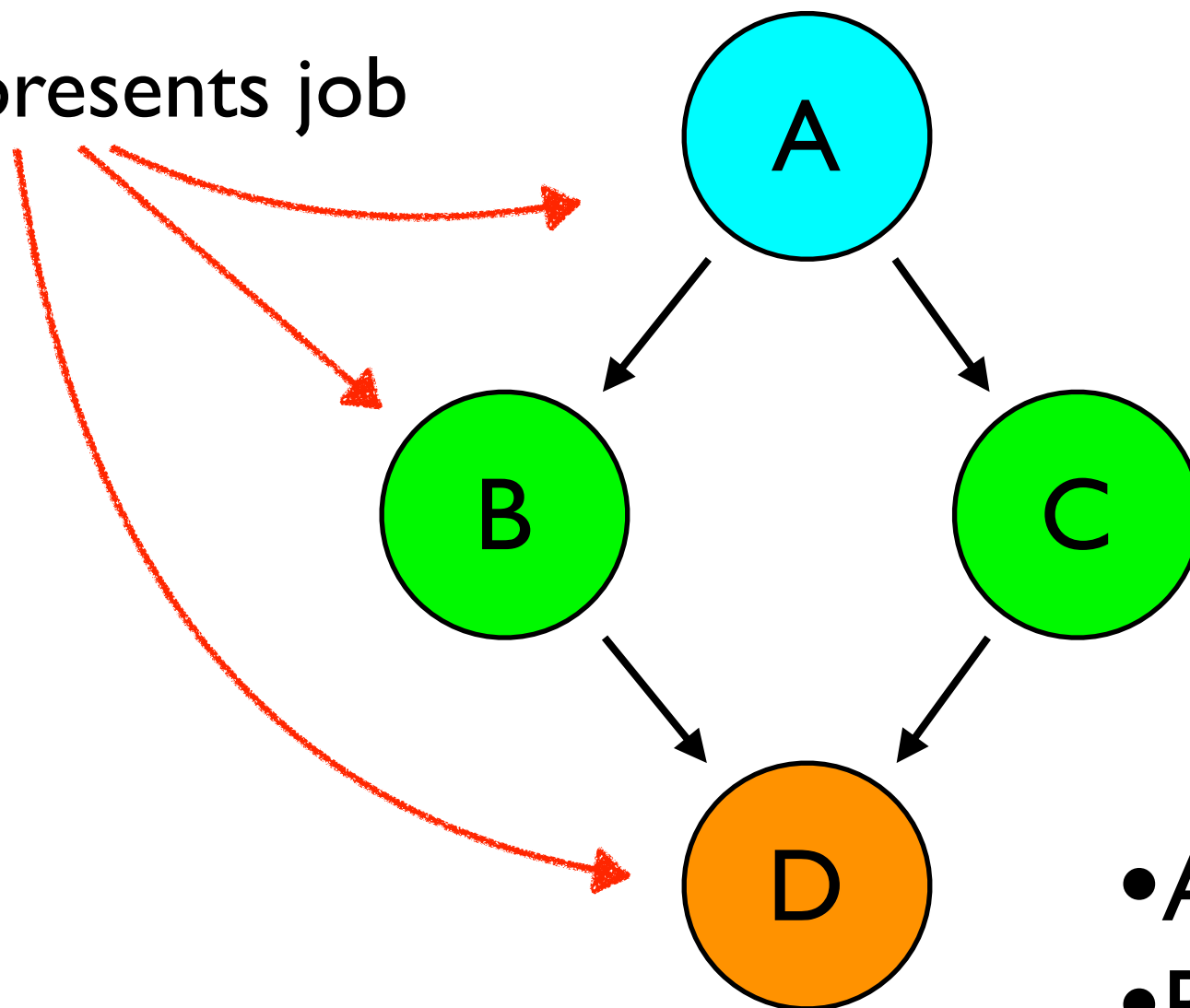
“node” represents job



“Diamond DAG”

Directed Acyclic Graph

“node” represents job

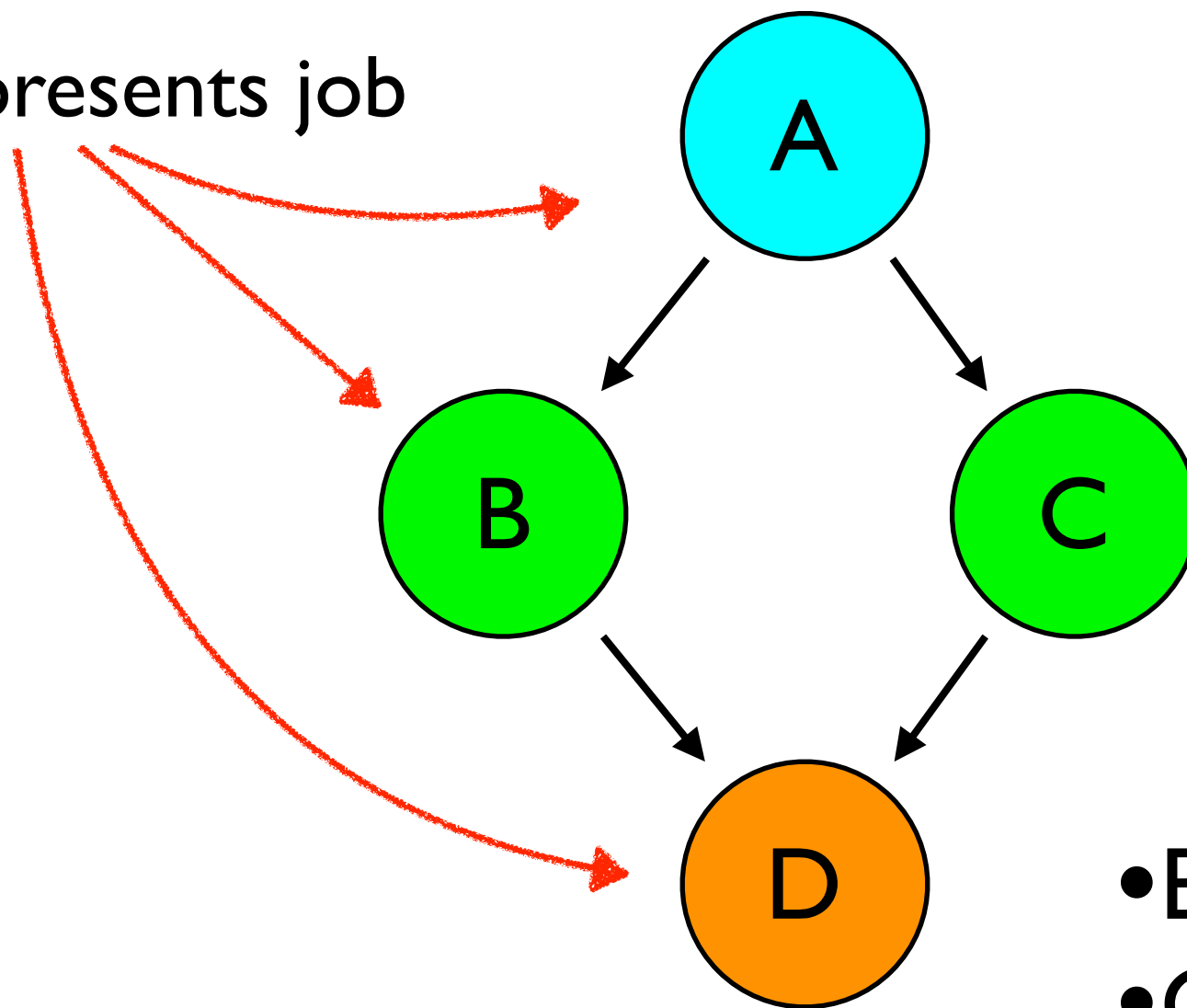


“Diamond DAG”

- A is parent of B & C
- B is parent of D
- C is parent of D

Directed Acyclic Graph

“node” represents job



“Diamond DAG”

- B is child of A
- C is child of A
- D is child of B & C

```
$ cat diamond.dag
# diamond.dag
#
#
JOB A A.sub
JOB B B.sub
JOB C C.sub
JOB D D.sub

PARENT A CHILD B C
PARENT B C CHILD D
$
```

DAGman

- `condor_dagman` manages submission of jobs
 - only submit children if parents succeed
 - if parent fails (non-zero return) stops
 - creates “rescue DAG”
 - saves state so you can fix and proceed
 - make as much process as it can

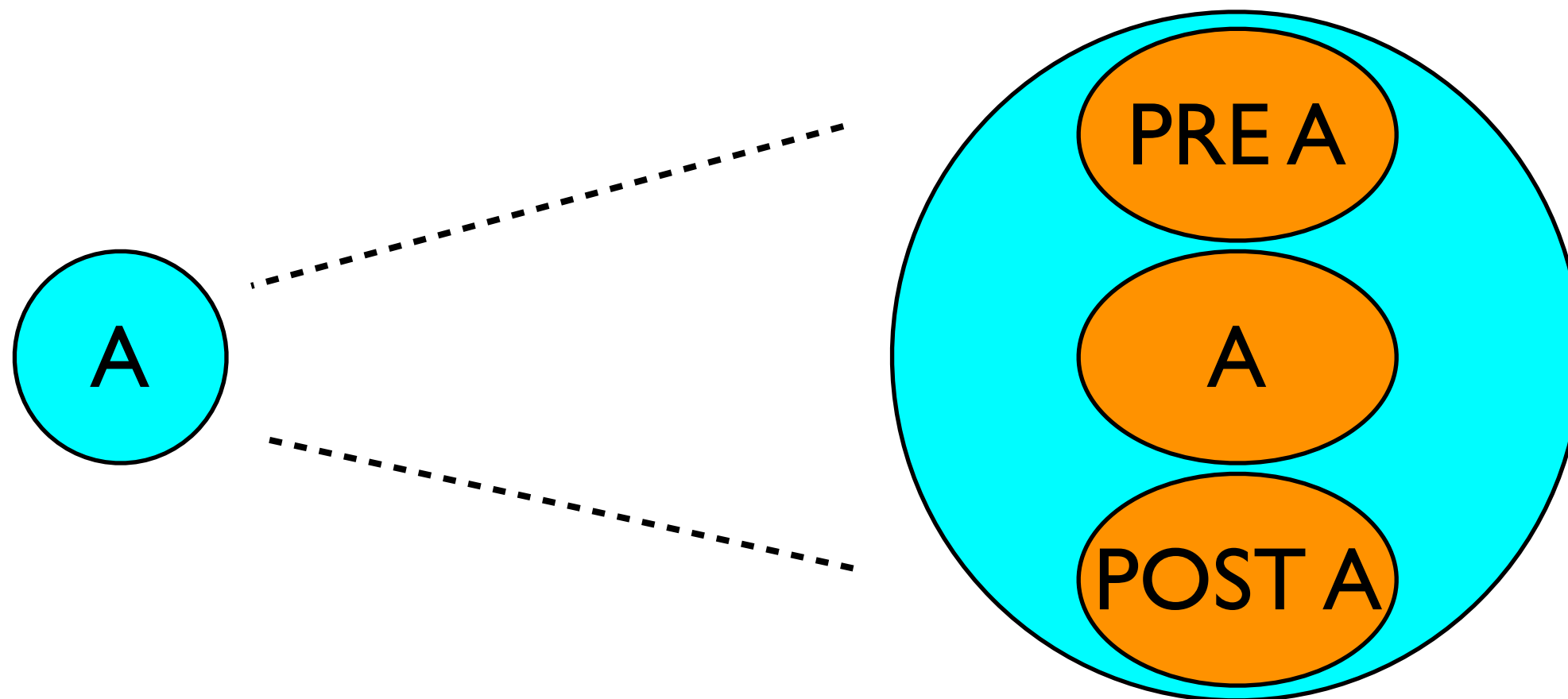
DAGman

- `condor_dagman` is itself a job managed by Condor
- you create a submit file for `condor_dagman`

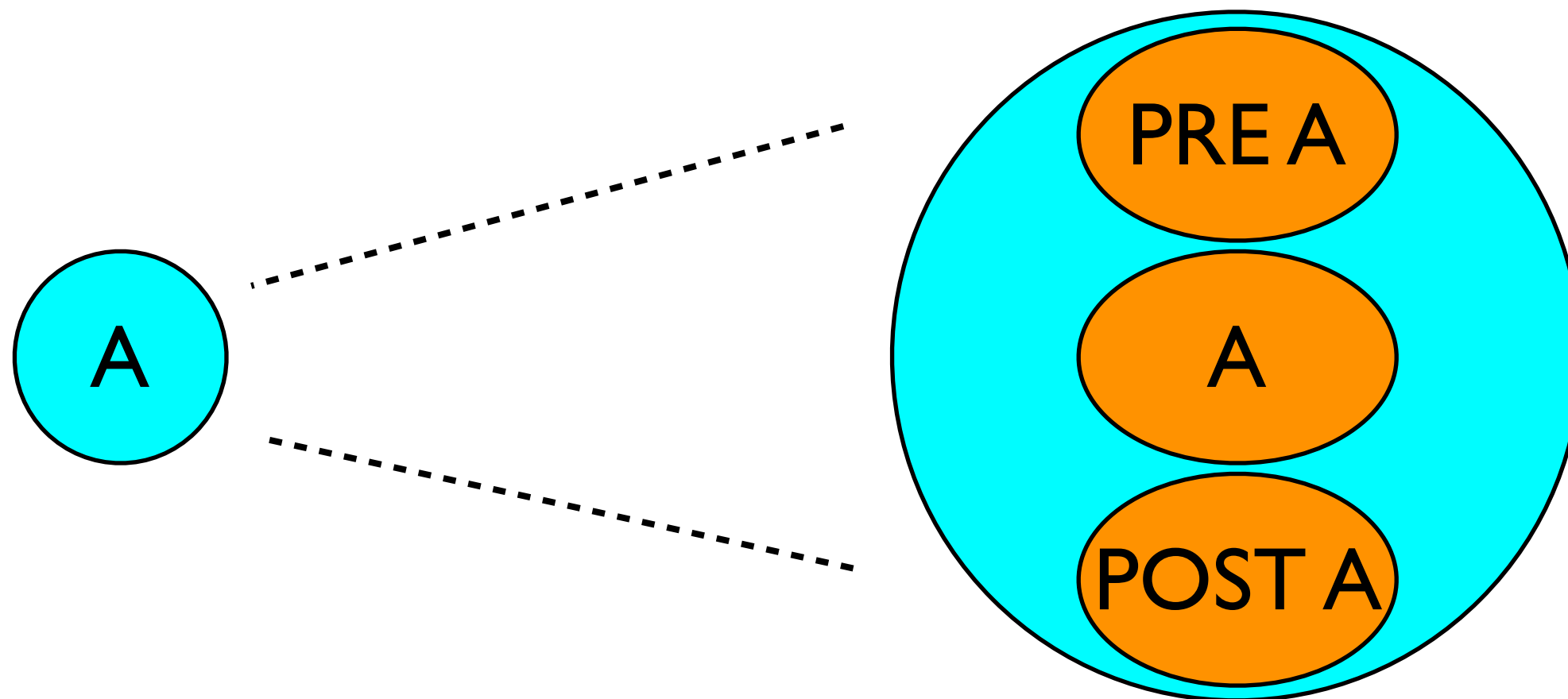
OR

- `condor_submit_dag my.dag`
 - automatically creates submit file for `condor_dagman`

DAGman



DAGman



- A only runs if PRE A succeeds
- POST A runs if A runs
- Success of node determined by POST A

```
$ cat diamond.dag
# diamond.dag
#
JOB A A.sub
SCRIPT PRE A A-pre.sh
SCRIPT POST A-post.sh

JOB B B.sub
JOB C C.sub

JOB D D.sub
SCRIPT POST D.sh

PARENT A CHILD B C
PARENT B C CHILD D
$
```

DAGman

- Things often go wrong...DAGman can help
- “RETRY” provides way to retry nodes

```
$ cat diamond.dag
# diamond.dag
#
JOB A A.sub
SCRIPT PRE A A-pre.sh
SCRIPT POST A-post.sh

JOB B B.sub
JOB C C.sub

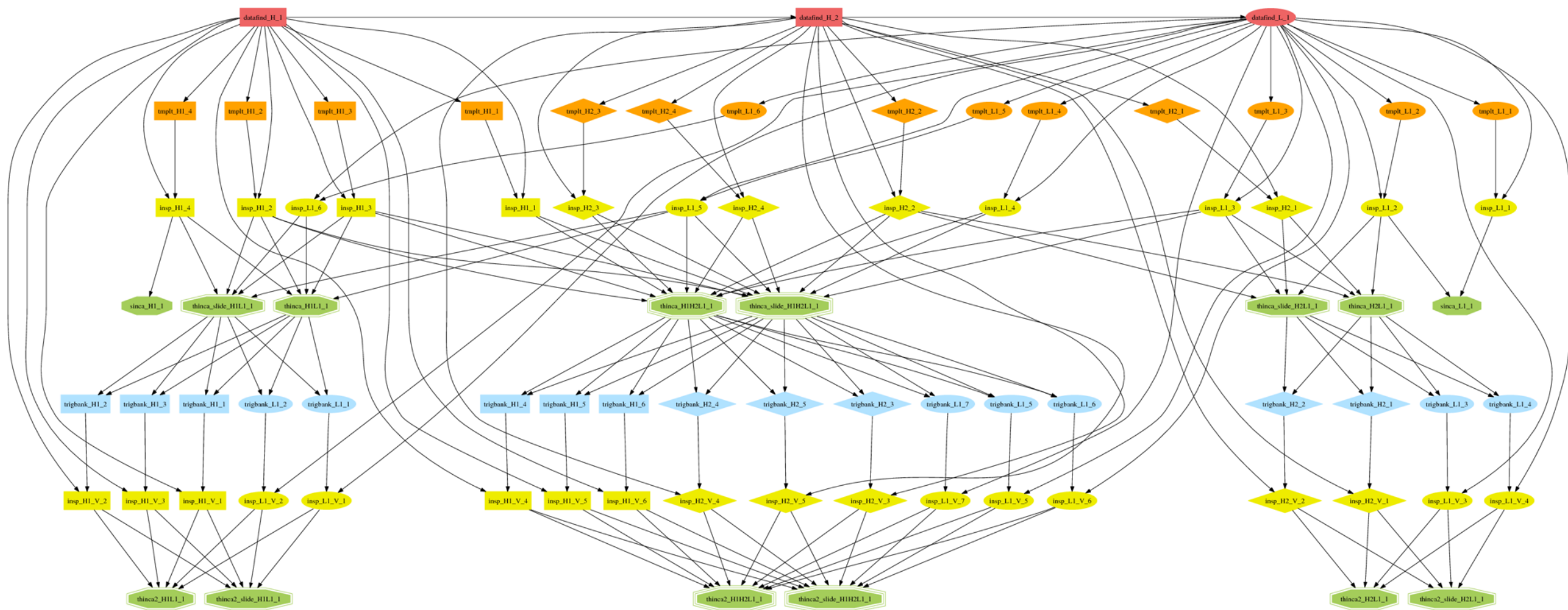
JOB D D.sub
SCRIPT POST D.sh

PARENT A CHILD B C
PARENT B C CHILD D
RETRY B 5
RETRY C 5 UNLESS-EXIT 117
$
```

DAGman

- DAGs with 10,000 nodes routine in LIGO
- DAGs with 100,000 nodes common
- Larger DAGs usually broken in sub-DAGs
 - node job can be a DAG itself
 - configurations to help manage complex DAGs

DATAFIND
↓
TMPLTBANK
↓
INSPIRAL
↓
A THINCA
↓
TRIGBANK
↓
INSPVETO
↓
THINCA2



pipeline.py

- Nobody composes DAGs by hand
- Various scripts used to compose DAGs
- CBC group uses Python module pipeline.py
 - Defines classes to represent nodes/jobs
 - ihope and HIPE build on pipeline.py

Pegasus



- Workflow management tool
- Works in cooperation with DAGman
- Uses DAX instead of DAG
 - XML description of workflow
 - includes details of input/output files and data flow

```
<job id="ID000001" namespace="ligo" name="lalapps_thinca" version="1.0" level="1"
" dv-name="11a6a45e94c03be111ce40735a0a341e">
  <argument>--e-thinca-parameter 1.0 --l1-triggers --multi-ifo-coinc --gps-
start-time 954311149 --l1-veto-file <filename file="L1-COMBINED_CAT_3_VETO_SEGS-
954287943-1209744.txt" /> --user-tag PHENOM_LOG_INJ_CAT_3_VETO --debug-level 33
--ifo-tag SECOND_H1L1 --h1-veto-file <filename file="H1-COMBINED_CAT_3_VETO_SEGS-
954287943-1209744.txt" /> --write-compress --gps-end-time 954313954 --do-veto
--parameter-test ellipsoid --h1-triggers --data-type all_data <filename file="
H1-INSPIRAL_SECOND_H1L1_PHENOM_LOG_INJ-954311085-2048.xml.gz" /> <filename file=
"H1-INSPIRAL_SECOND_H1L1_PHENOM_LOG_INJ-954311970-2048.xml.gz" /> <filename file
="L1-INSPIRAL_SECOND_H1L1_PHENOM_LOG_INJ-954310683-2048.xml.gz" /> <filename fil
e="L1-INSPIRAL_SECOND_H1L1_PHENOM_LOG_INJ-954312603-2048.xml.gz" />
  </argument>
  <execution key="site">local</execution>
  <execution key="executable">/home/ajw/S6/highmass_s6c_w910/954287943-955497
687/phenom_log_inj/./executables/lalapps_thinca</execution>
  <profile namespace="pegasus" key="collapse">20</profile>
  <profile namespace="dagman" key="retry">1</profile>
  <profile namespace="dagman" key="category">thinca</profile>
  <profile namespace="condor" key="priority">3</profile>
  <profile namespace="condor" key="universe">vanilla</profile>
  <uses file="H1-INSPIRAL_SECOND_H1L1_PHENOM_LOG_INJ-954311085-2048.xml.gz" l
ink="input" register="false" transfer="true"/>
:
```



```
<job id="ID000001" namespace="ligo" name="lalapps_thinca" version="1.0" level="1"
" dv-name="11a6a45e94c03be111ce40735a0a341e">
  <argument>--e-thinca-parameter 1.0 --l1-triggers --multi-ifo-coinc --gps-
start-time 954311149 --l1-veto-file <filename file="L1-COMBINED_CAT_3_VETO_SEGS-
954287943-1209744.txt" /> --user-tag PHENOM_LOG_INJ_CAT_3_VETO --debug-level 33
--ifo-tag SECOND_H1L1 --h1-veto-file <filename file="H1-COMBINED_CAT_3_VETO_SEGS
-954287943-1209744.txt" /> --write-compress --gps-end-time 954313954 --do-veto
--parameter-test ellipsoid --h1-triggers --data-type all_data <filename file="
H1-INSPIRAL_SECOND_H1L1_PHENOM_LOG_INJ-954311085-2048.xml.gz" /> <filename file=
"H1-INSPIRAL_SECOND_H1L1_PHENOM_LOG_INJ-954311970-2048.xml.gz" /> <filename file
="L1-INSPIRAL_SECOND_H1L1_PHENOM_LOG_INJ-954310683-2048.xml.gz" /> <filename fil
e="L1-INSPIRAL_SECOND_H1L1_PHENOM_LOG_INJ-954312603-2048.xml.gz" />
</argument>
<execution key="site">local</execution>
<execution key="executable">/home/ajw/S6/highmass_s6c_w910/954287943-955497
687/phenom_log_inj/./executables/lalapps_thinca</execution>
<profile namespace="pegasus" key="collapse">20</profile>
<profile namespace="dagman" key="retry">1</profile>
<profile namespace="dagman" key="category">thinca</profile>
<profile namespace="condor" key="priority">3</profile>
<profile namespace="condor" key="universe">vanilla</profile>
<uses file="H1-INSPIRAL_SECOND_H1L1_PHENOM_LOG_INJ-954311085-2048.xml.gz" l
ink="input" register="false" transfer="true"/>
:
```



```
<job id="ID000001" namespace="ligo" name="lalapps_thinca" version="1.0" level="1"
" dv-name="11a6a45e94c03be111ce40735a0a341e">
  <argument>--e-thinca-parameter 1.0 --l1-triggers --multi-ifo-coinc --gps-
start-time 954311149 --l1-veto-file <filename file="L1-COMBINED_CAT_3_VETO_SEGS-
954287943-1209744.txt" /> --user-tag PHENOM_LOG_INJ_CAT_3_VETO --debug-level 33
--ifo-tag SECOND_H1L1 --h1-veto-file <filename file="H1-COMBINED_CAT_3_VETO_SEGS-
954287943-1209744.txt" /> --write-compress --gps-end-time 954313954 --do-veto
--parameter-test ellipsoid --h1-triggers --data-type all_data <filename file="
H1-INSPIRAL_SECOND_H1L1_PHENOM_LOG_INJ-954311085-2048.xml.gz" /> <filename file=
"H1-INSPIRAL_SECOND_H1L1_PHENOM_LOG_INJ-954311970-2048.xml.gz" /> <filename file
="L1-INSPIRAL_SECOND_H1L1_PHENOM_LOG_INJ-954310683-2048.xml.gz" /> <filename fil
e="L1-INSPIRAL_SECOND_H1L1_PHENOM_LOG_INJ-954312603-2048.xml.gz" />
</argument>
<execution key="site">local</execution>
<execution key="executable">/home/ajw/S6/highmass_s6c_w910/954287943-955497
687/phenom_log_inj/./executables/lalapps_thinca</execution>
<profile namespace="pegasus" key="collapse">20</profile>
<profile namespace="dagman" key="retry">1</profile>
<profile namespace="dagman" key="category">thinca</profile>
<profile namespace="condor" key="priority">3</profile>
<profile namespace="condor" key="universe">vanilla</profile>
<uses file="H1-INSPIRAL_SECOND_H1L1_PHENOM_LOG_INJ-954311085-2048.xml.gz" l
ink="input" register="false" transfer="true"/>
:
```



```
<job id="ID000001" namespace="ligo" name="lalapps_thinca" version="1.0" level="1"
" dv-name="11a6a45e94c03be111ce40735a0a341e">
  <argument>--e-thinca-parameter 1.0 --l1-triggers --multi-ifo-coinc --gps-
start-time 954311149 --l1-veto-file <filename file="L1-COMBINED_CAT_3_VETO_SEGS-
954287943-1209744.txt" /> --user-tag PHENOM_LOG_INJ_CAT_3_VETO --debug-level 33
--ifo-tag SECOND_H1L1 --h1-veto-file <filename file="H1-COMBINED_CAT_3_VETO_SEGS
-954287943-1209744.txt" /> --write-compress --gps-end-time 954313954 --do-veto
--parameter-test ellipsoid --h1-triggers --data-type all_data <filename file="
H1-INSPIRAL_SECOND_H1L1_PHENOM_LOG_INJ-954311085-2048.xml.gz" /> <filename file=
"H1-INSPIRAL_SECOND_H1L1_PHENOM_LOG_INJ-954311970-2048.xml.gz" /> <filename file
="L1-INSPIRAL_SECOND_H1L1_PHENOM_LOG_INJ-954310683-2048.xml.gz" /> <filename fil
e="L1-INSPIRAL_SECOND_H1L1_PHENOM_LOG_INJ-954312603-2048.xml.gz" />
  </argument>
  <execution key="site">local</execution>
  <execution key="executable">/home/ajw/S6/highmass_s6c_w910/954287943-955497
687/phenom_log_inj/./executables/lalapps_thinca</execution>
  <profile namespace="pegasus" key="collapse">20</profile>
  <profile namespace="dagman" key="retry">1</profile>
  <profile namespace="dagman" key="category">thinca</profile>
  <profile namespace="condor" key="priority">3</profile>
  <profile namespace="condor" key="universe">vanilla</profile>
  <uses file="H1-INSPIRAL_SECOND_H1L1_PHENOM_LOG_INJ-954311085-2048.xml.gz" l
ink="input" register="false" transfer="true"/>
:
```



```
<job id="ID000001" namespace="ligo" name="lalapps_thinca" version="1.0" level="1"
" dv-name="11a6a45e94c03be111ce40735a0a341e">
  <argument>--e-thinca-parameter 1.0 --l1-triggers --multi-ifo-coinc --gps-
start-time 954311149 --l1-veto-file <filename file="L1-COMBINED_CAT_3_VETO_SEGS-
954287943-1209744.txt" /> --user-tag PHENOM_LOG_INJ_CAT_3_VETO --debug-level 33
--ifo-tag SECOND_H1L1 --h1-veto-file <filename file="H1-COMBINED_CAT_3_VETO_SEGS
-954287943-1209744.txt" /> --write-compress --gps-end-time 954313954 --do-veto
--parameter-test ellipsoid --h1-triggers --data-type all_data <filename file="
H1-INSPIRAL_SECOND_H1L1_PHENOM_LOG_INJ-954311085-2048.xml.gz" /> <filename file=
"H1-INSPIRAL_SECOND_H1L1_PHENOM_LOG_INJ-954311970-2048.xml.gz" /> <filename file
="L1-INSPIRAL_SECOND_H1L1_PHENOM_LOG_INJ-954310683-2048.xml.gz" /> <filename fil
e="L1-INSPIRAL_SECOND_H1L1_PHENOM_LOG_INJ-954312603-2048.xml.gz" />
</argument>
<execution key="site">local</execution>
<execution key="executable">/home/ajw/S6/highmass_s6c_w910/954287943-955497
687/phenom_log_inj/./executables/lalapps_thinca</execution>
<profile namespace="pegasus" key="collapse">20</profile>
<profile namespace="dagman" key="retry">1</profile>
<profile namespace="dagman" key="category">thinca</profile>
<profile namespace="condor" key="priority">3</profile>
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<uses file="H1-INSPIRAL_SECOND_H1L1_PHENOM_LOG_INJ-954311085-2048.xml.gz" l
ink="input" register="false" transfer="true"/>
```

Pegasus



- Pegasus converts DAX to DAG
 - Groups short running jobs together for efficiency
 - Better management of log, error, output files
- DAG is run using condor_dagman
- Pegasus offers higher level management tools
 - Do not have to examine each error and log file
 - Better handling of “rescue workflows” and re-use

For a failed workflow this will return

```
pegasus-analyzer: initializing...

*****Summary*****

Total jobs      :      83 (100.00%)
# jobs succeeded :      59 (71.08%)
# jobs failed   :      24 (28.92%)
# jobs unsubmitted :      0 (0.00%)

*****Failed jobs' details*****

-----dagman_ID000082-----

last state: JOB_FAILURE
This is a SUBDAG job:
For more information, please run the following command:
pegasus-analyzer -t -s -f /mnt/qfs4/khodge/s6_highmass/951868743-
953078487/allinj_summary_plots/plot_hipe_allinj_summary_plots_cat_5_veto.ALLINJ_SUMMARY_
PLOTS_CAT_5_VETO.dag

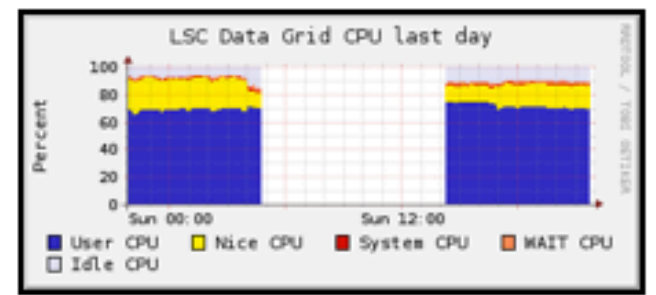
...etc...

*****Done*****

pegasus-analyzer: end of status report
```

Getting Help

Try a few web pages first...you might be able
to help yourself



Navigation

- [CompComm](#)
- [LSC](#)
- [LIGO](#)

DataGrid Details

- [What is LSC DataGrid?](#)
- [Cluster Usage](#)
- [Available Data](#)
- [Service Details](#)
- [OSG](#)

User Manual

- [How to get started](#)
- [Install Data Grid Client](#)
- [Getting Certificates](#)
- [Renewing Certificates](#)
- [Certificates in your Browser](#)
- [Certificates in Keychain](#)
- [Account Request](#)

General Information

Welcome to the LSC DataGrid

The LIGO Data Grid is the combination of LIGO Scientific Collaboration computational and data storage resources with grid computing middleware to create a coherent and uniform LIGO data analysis environment. The graph on the top right shows the current CPU usage across the six active centers across the world

Getting started?


If you are new to the LSC DataGrid and need instructions for installing grid tools, getting a certificate, and requesting access to LSC resources then please see [Getting Started on the LSC DataGrid](#) or click on "How to get started" on the navigation bar on the left.

Compute Center Status

Move to wiki.ligo.org/LDG soon...



DASWG



Data Analysis Software Working Group

[LIGO Data Grid](#) [Usage](#) [Available Data](#) [Services](#) [Wiki](#)

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[Mailing List](#)

General Information

The Data Analysis Software Working Group (DASWG) of the LIGO Scientific Collaboration are responsible for the development of data analysis software. The working group is open to all LSC members who are interested. DASWG holds regular and frequent membership meetings, both by telecon and at LSC meetings. It has a Chair, named by the LSC Spokesperson. One distinctive structural feature is the existence of a steering committee, the Data Analysis Software Committee, chaired by the working group Chair. The role of the Steering Committee is to broker consensus on issues where discussions of the general membership have been unable to find consensus.

Weekly telecon

The working group holds a weekly telecon at 09:00 Pacific time every Thursday. Dates and dial-in instructions are posted under [Participate > Telecon](#); the agenda and minutes of each meeting are posted at [Docs > Minutes](#)

Mailing list

Detailed information about the mailing list can be found at [Participate > Mailing List](#). The basics are:

DASWG

LIGO LSC Data Analysis Software V x

https://www.lsc-group.phys.uwm.edu/daswg/

LIGO Data Analysis Software Working Group

LIGO Data Grid Usage Available Data Services Wiki

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DASWG

- daswg@gravity.phys.uwm.edu
- daswg@ligo.org
- Admins monitor that email list
- Scientists jump in to also help



Site Support

- ldas_admin_cit@ligo.caltech.edu
- ldas_admin_lho@ligo.caltech.edu
- ldas_admin_llo@ligo.caltech.edu
- uwm-help@gravity.phys.uwm.edu
- <https://n0.aei.uni-hannover.de/tracking/projects/show/atlas>

Asking for help: bad example

To: daswg@gravity.phys.uwm.edu
From: some.user@ligo.org
Subject: help!

My job will not run! Help!!!!

Asking for help: good example

To: daswg@gravity.phys.uwm.edu
From: joe.user@ligo.org
Subject: job 3548760 on hold at LHO

Job 3548760 at LHO was put into the hold state. I examined the output of condor_q -long 3548760 but could not determine why the job is on hold.

The job submit file is
/home/joe/S6/job01.sub
The log file is
/home/joe/S6/job01.log

Please let me know how to further debug this problem.

Sincerely,

Joe

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Please Contribute!

The screenshot shows a web browser window with the address bar displaying <https://wiki.ligo.org/foswiki/bin/view/>. The page header features the LSC and VIRGO logos, a 'Jump' dropdown menu, and a 'Search' input field. The main content area is titled 'Welcome to the LSC/Virgo wiki' and includes a navigation bar on the left with links to 'Main', 'Main Web', 'Create New Topic', 'Index', 'Search', 'Changes', 'Notifications', and 'RSS Feed'. The page also displays a 'You are here' breadcrumb trail, a 'Hello Scott Koranda' message, and a list of 'My links' including 'Signing Shib metadata', 'MyLIGO development', 'Auth Project RT', and 'Formatting'. A blue box contains links for 'Edit', 'Attach', 'Print version', 'History', 'r49 < r48 < r47 < r46 < r45', 'Backlinks', 'Raw View', 'Raw edit', and 'More topic actions'. The footer shows the topic revision: 'Topic revision: r49 - 18 May 2011 - 18:05:17 - AdminGroup'.

FW WebHome < Main < Foswiki

<https://wiki.ligo.org/foswiki/bin/view/>

LSC **VIRGO**

Jump Search

Main

You are here: [Foswiki](#) > [Main Web](#) > [WebHome](#) (18 May 2011, [AdminGroup](#))

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Hello Scott Koranda

My links:

- Signing Shib metadata
- MyLIGO development
- Auth Project RT
- Formatting

[edit](#)

Main Web

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