Fermilab

The Compact Muon Solenoid

OSG Users Meeting '08

GlideinWMS

Explained

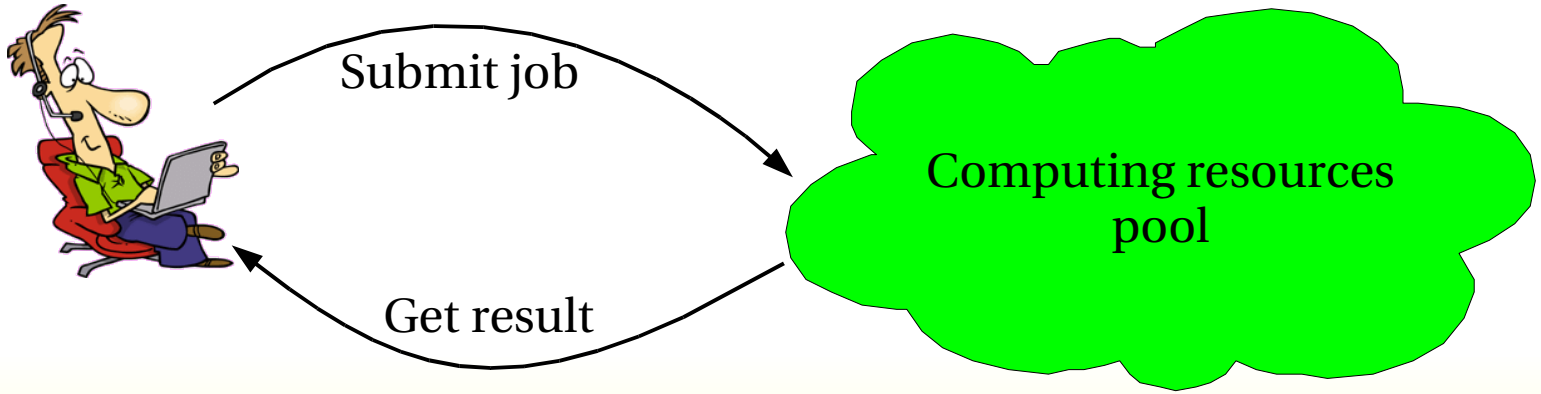
by Igor Sfiligoi (Fermilab)

Outlook

- Grid computing overview
- The pilot paradigm
- Introducing Condor glideins
- glideinWMS description
- glideinWMS in real life
- Conclusions

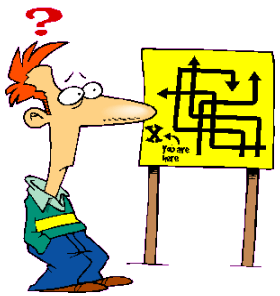
Portrait of a scientist

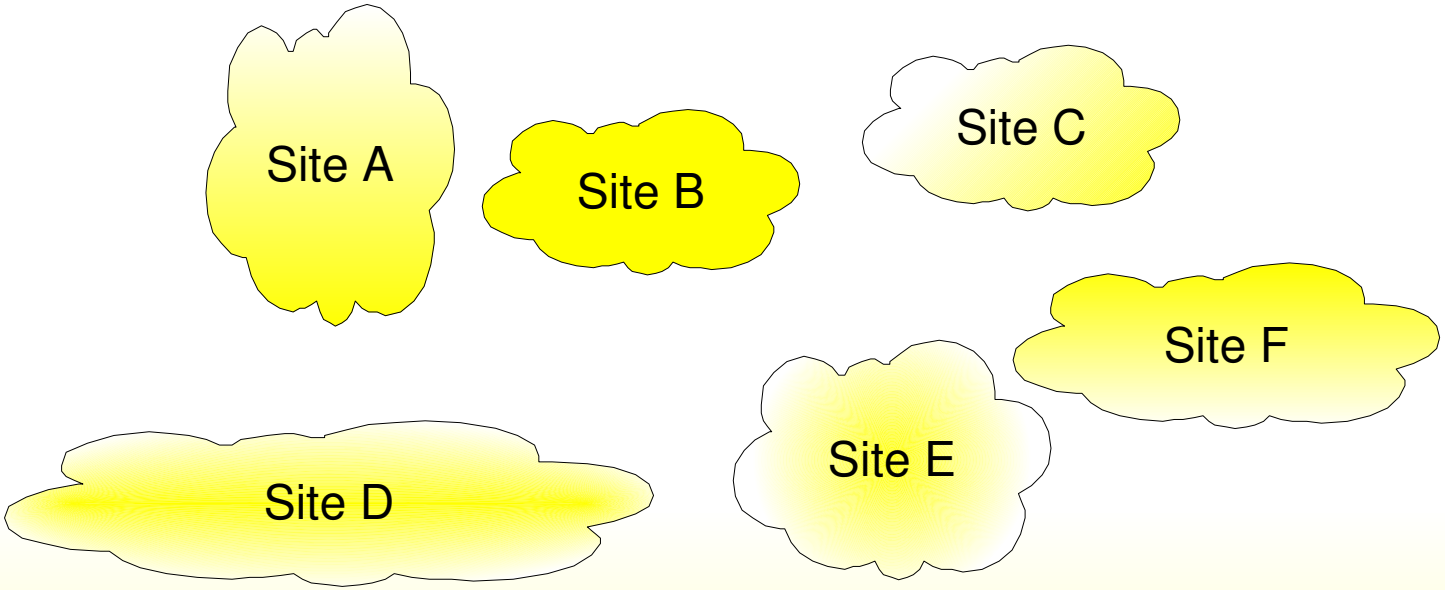
- Needs many computing cycles to analyze his data
  - More than can get from a personal desktop
- Wants to spend most of his time thinking about the scientific problems
  - Computing is just a tool



Portrait of the Grid

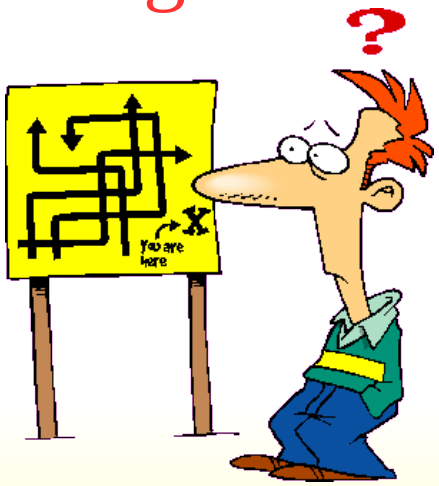
- Resources grouped in independent pools
  - Each with its own set of rules
- Resources in different pools configured differently
  - Users expected to adapt





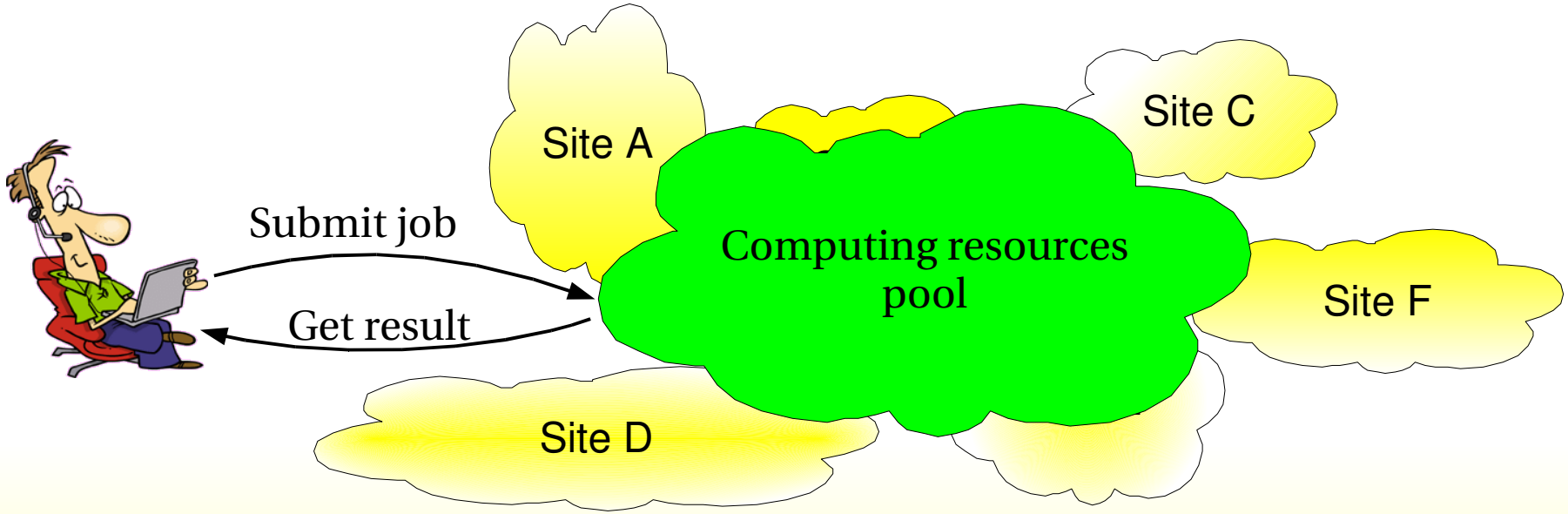
We have a problem!

- Scientists are forced to spend a significant amount of time thinking about computing
  - And every time a new site is added, the process starts again
- Time spent on computing problems is subtracting time available for scientific thinking!



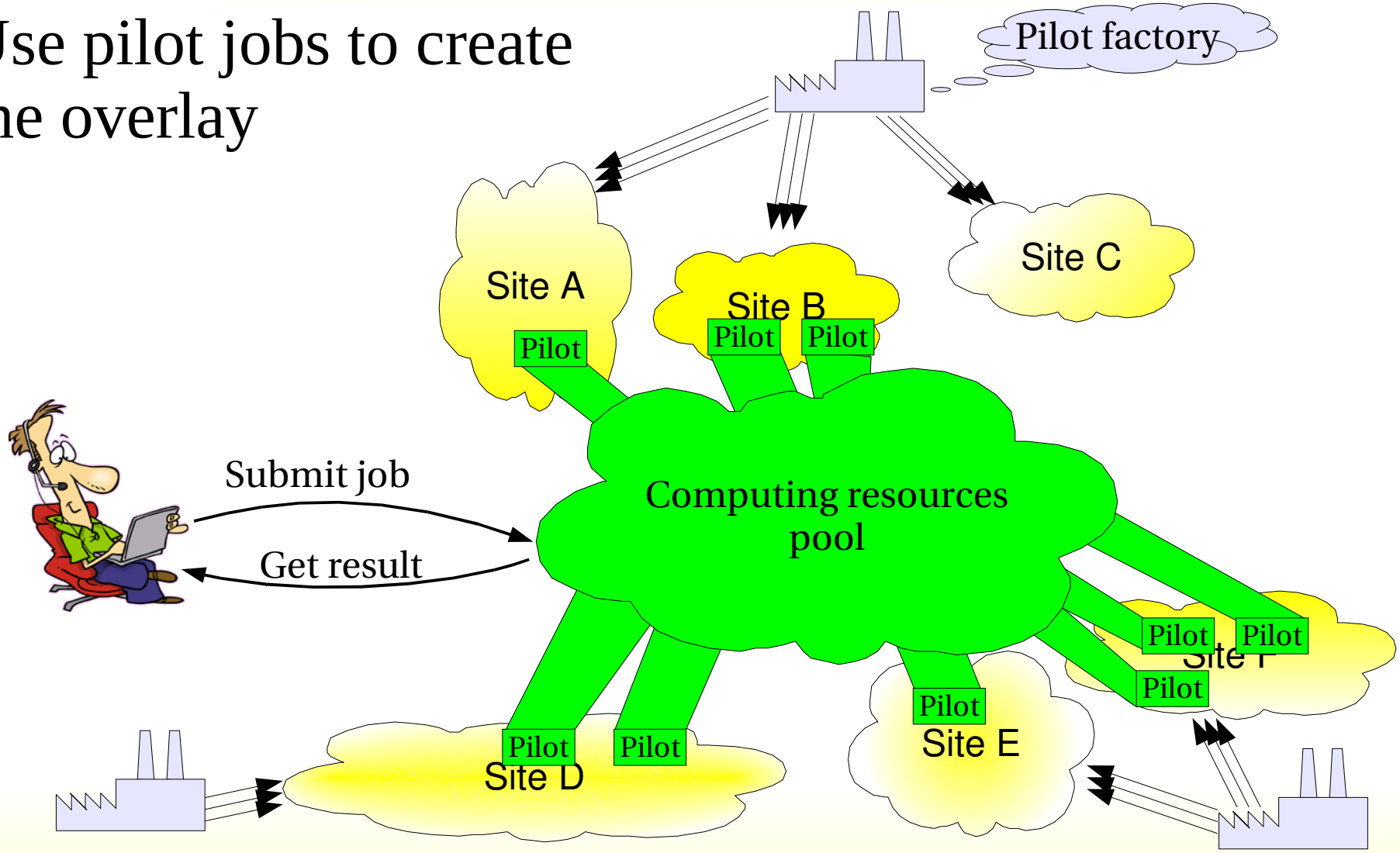
Let's make the Grid uniform

- ... by creating an overlay over the Grid sites
  - Hiding differences between sites
  - Making the Grid look as a single, uniform pool



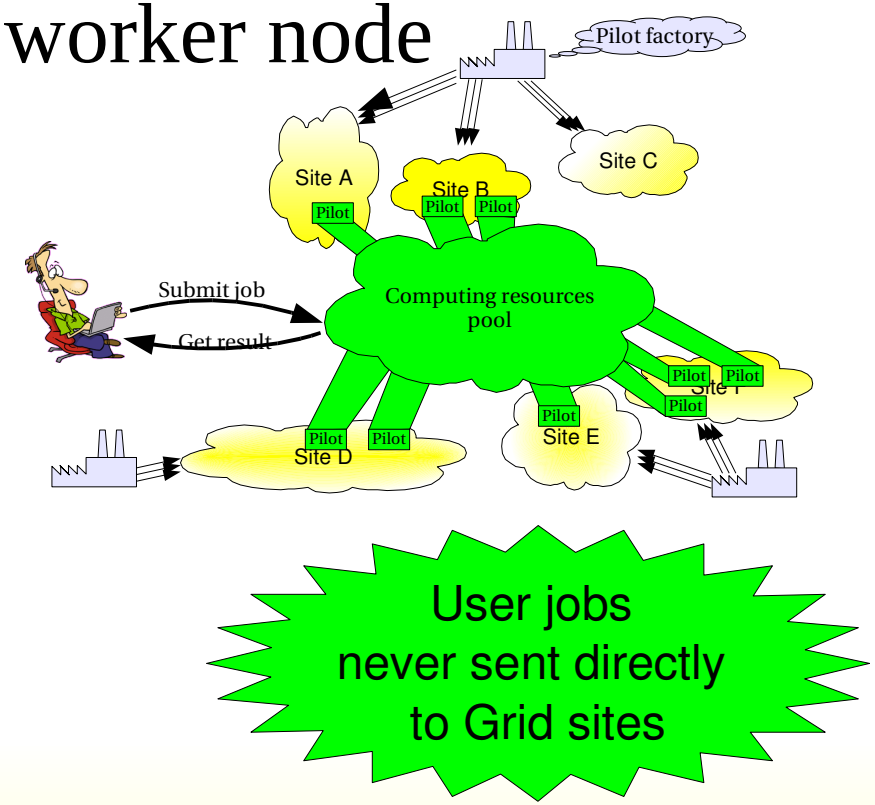
The pilot paradigm

- Use pilot jobs to create the overlay



The pilot paradigm (continued)

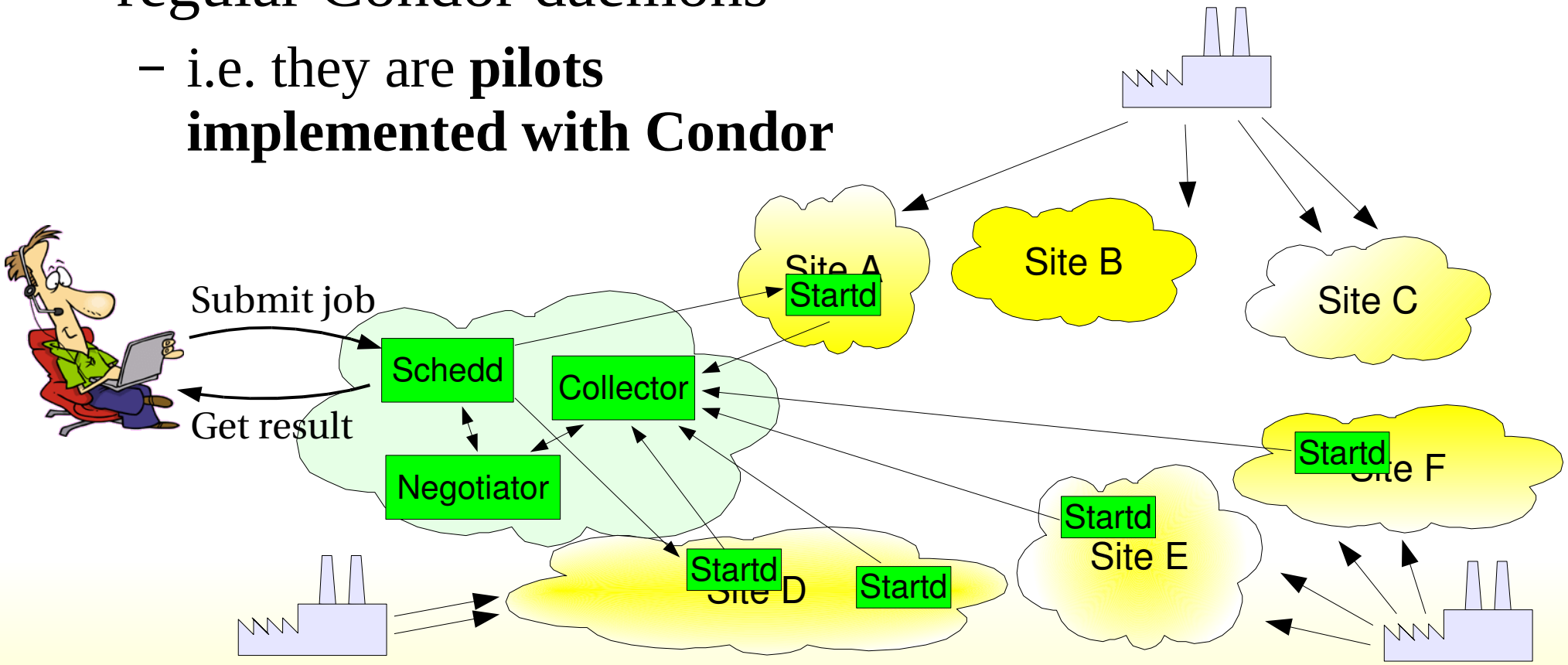
- Use pilot jobs to create the overlay
  - Users see only a uniform computing pool
- When a pilot lands on a Grid worker node
  - Validates Grid resource
  - Prepares the environment
  - Pulls a user job
- Grid heterogeneity exposed to pilot admins not users



Condor glideins

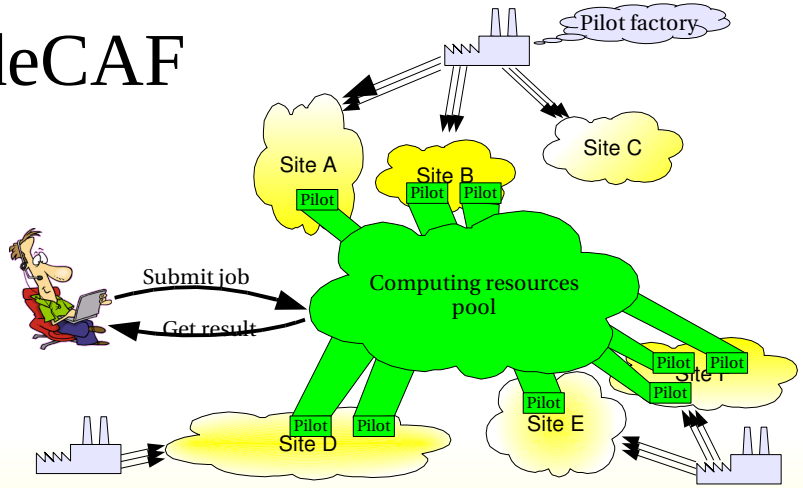
http://www.cs.wisc.edu/condor/

- Condor is based on a distributed architecture
- Condor glideins are Grid jobs that start regular Condor daemons
  - i.e. they are **pilots implemented with Condor**



Submitting glideins

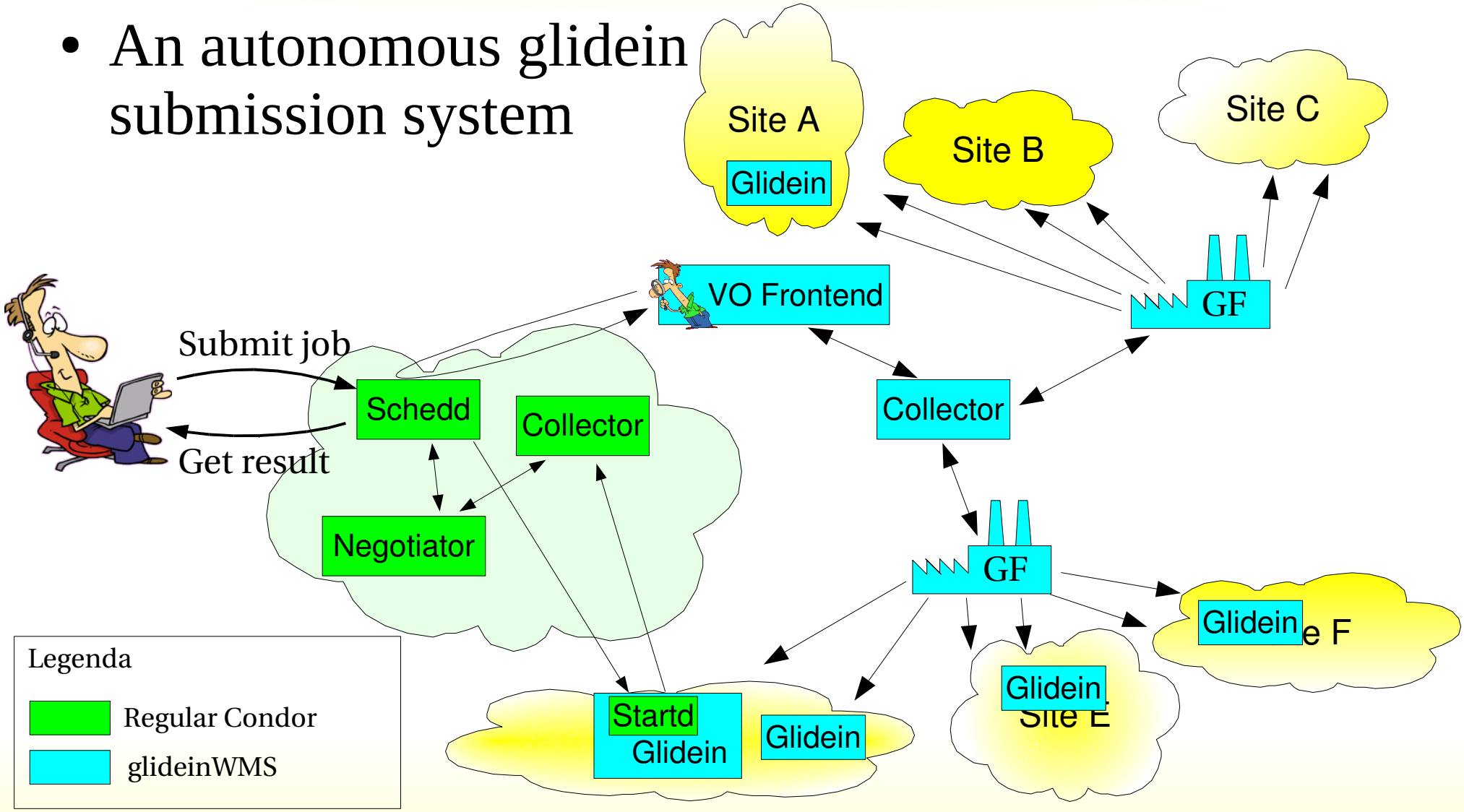
- Condor provides only a basic command line glidein submission tool
  - Good for trying out glideins
  - But not meant to be used as a glidein factory
- Several groups developed glidein factories
  - CDF has the CDF-specific GlideCAF
  - USCMS@FNAL is developing the **glideinWMS**



Introducing the glideinWMS

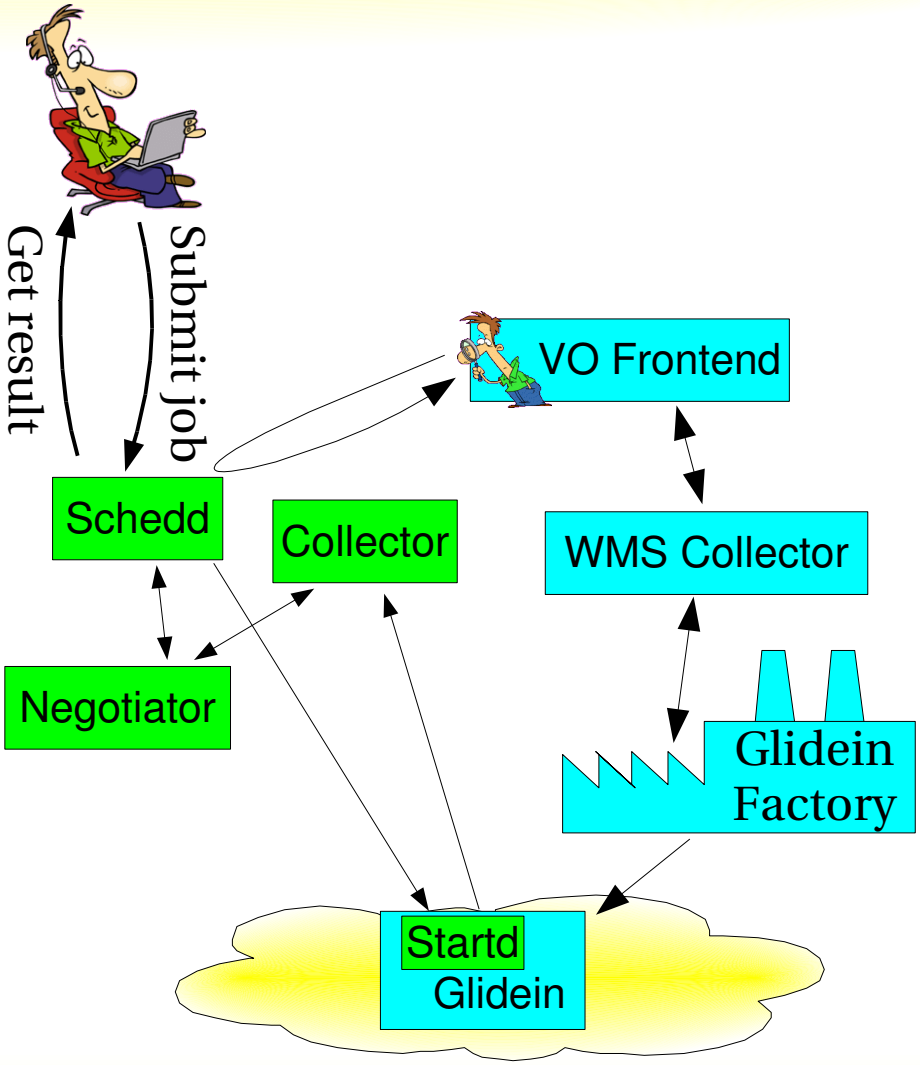
http://www.uscms.org/SoftwareComputing/Grid/WMS/glideinWMS/

- An autonomous glidein submission system



glideinWMS architecture

- glideinWMS composed of six logical pieces:
  - A Condor central manager (collector + negotiator)
  - One or more Condor submit machines
  - A glideinWMS collector
  - One or more VO frontends
  - One or more glidein factories
  - The glideins



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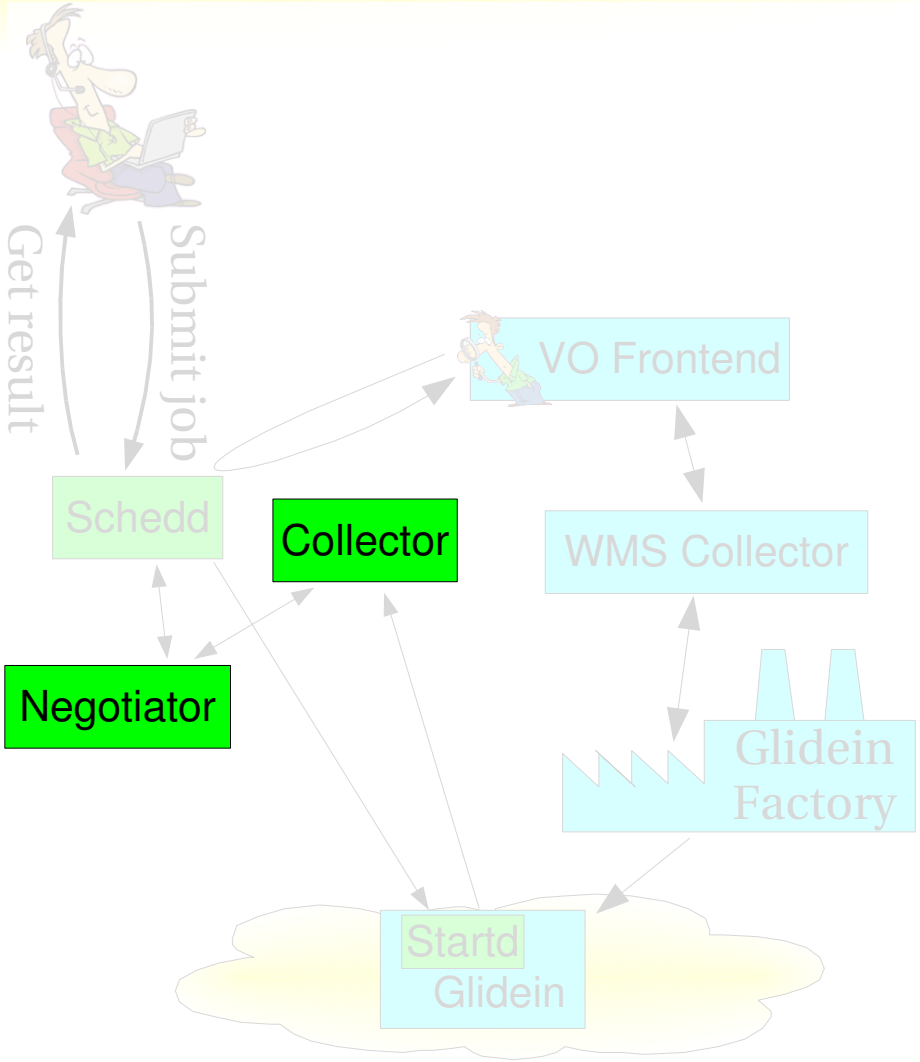

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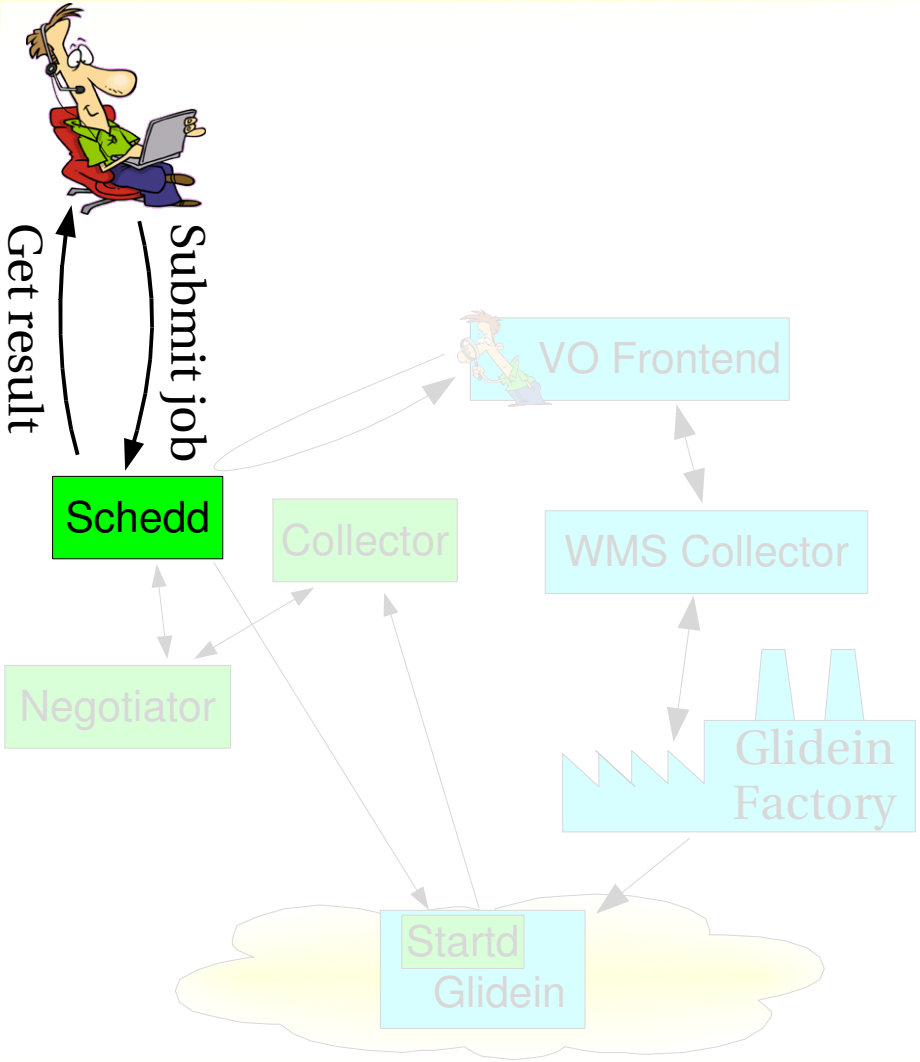

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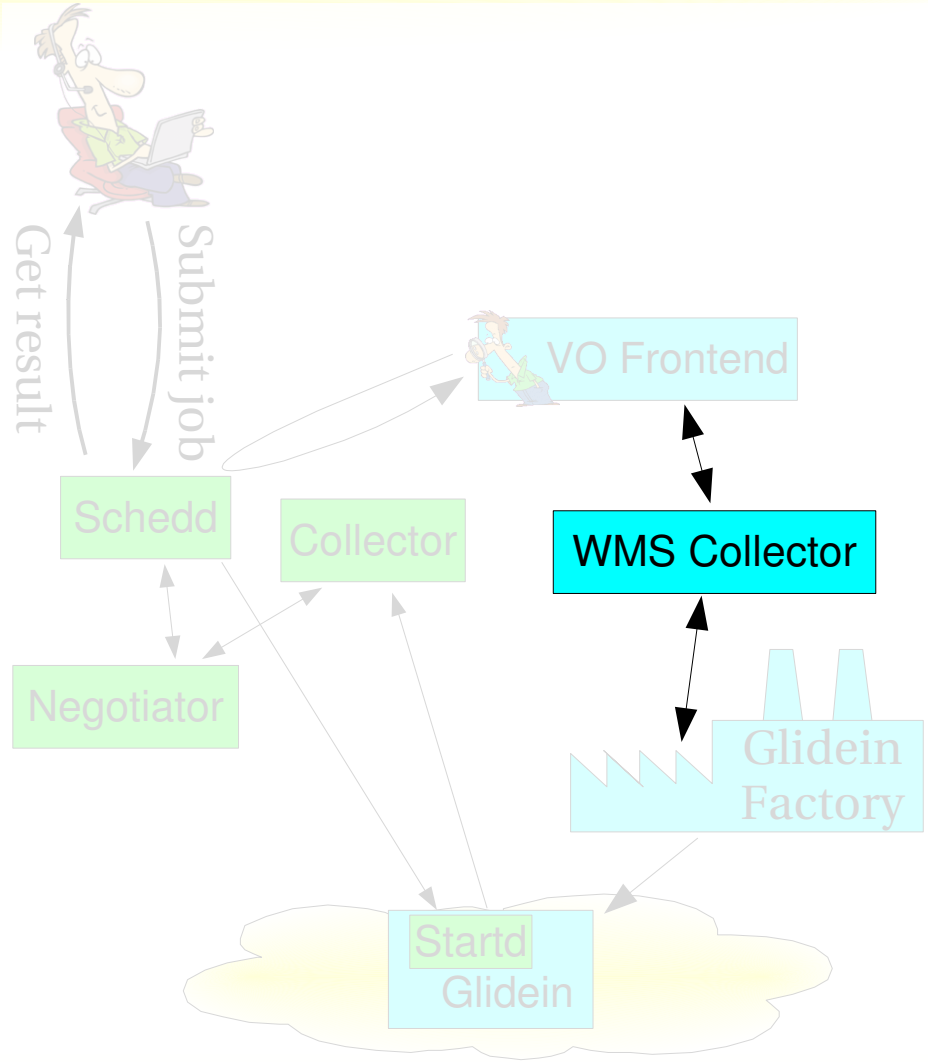

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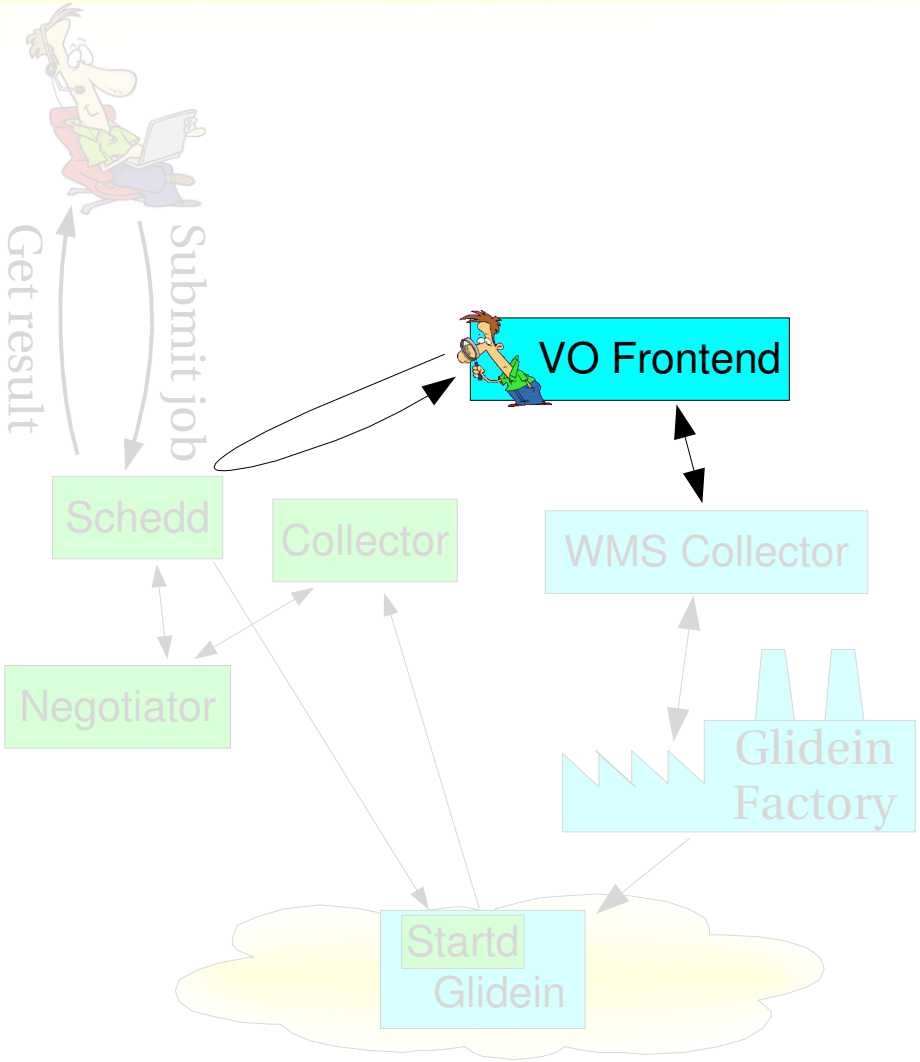

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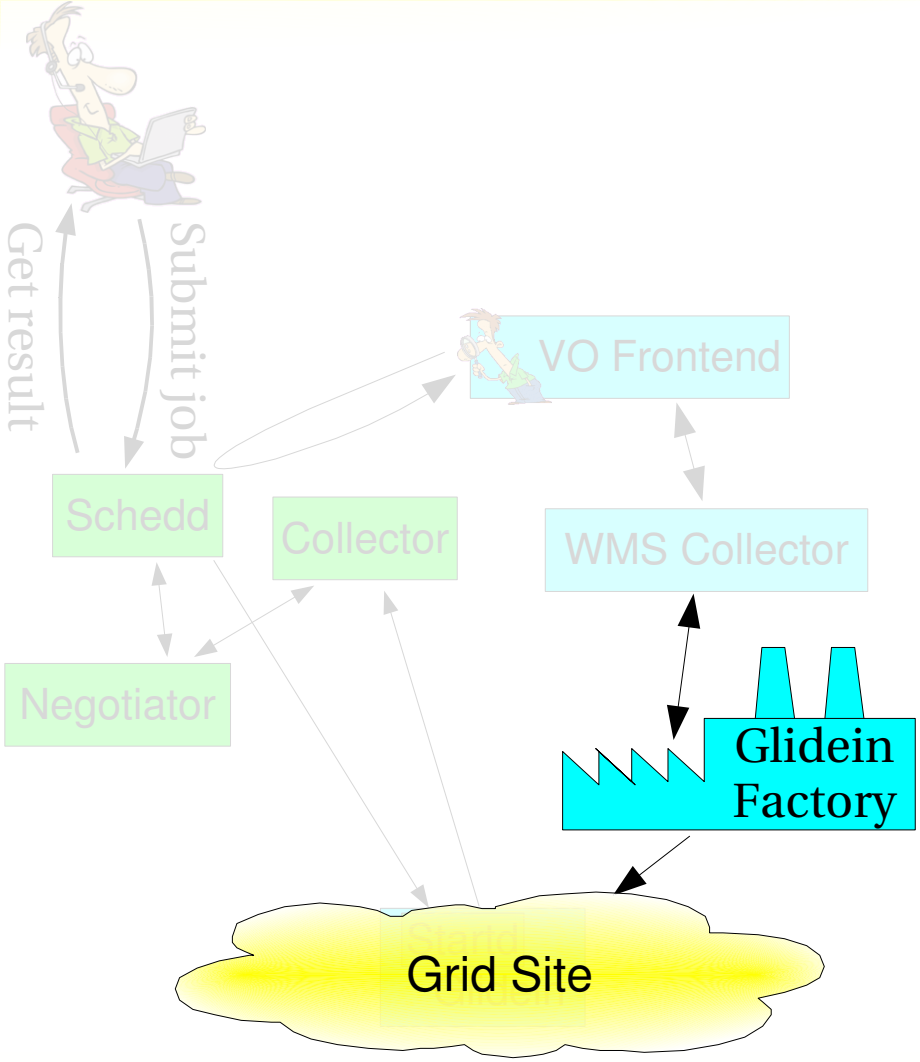

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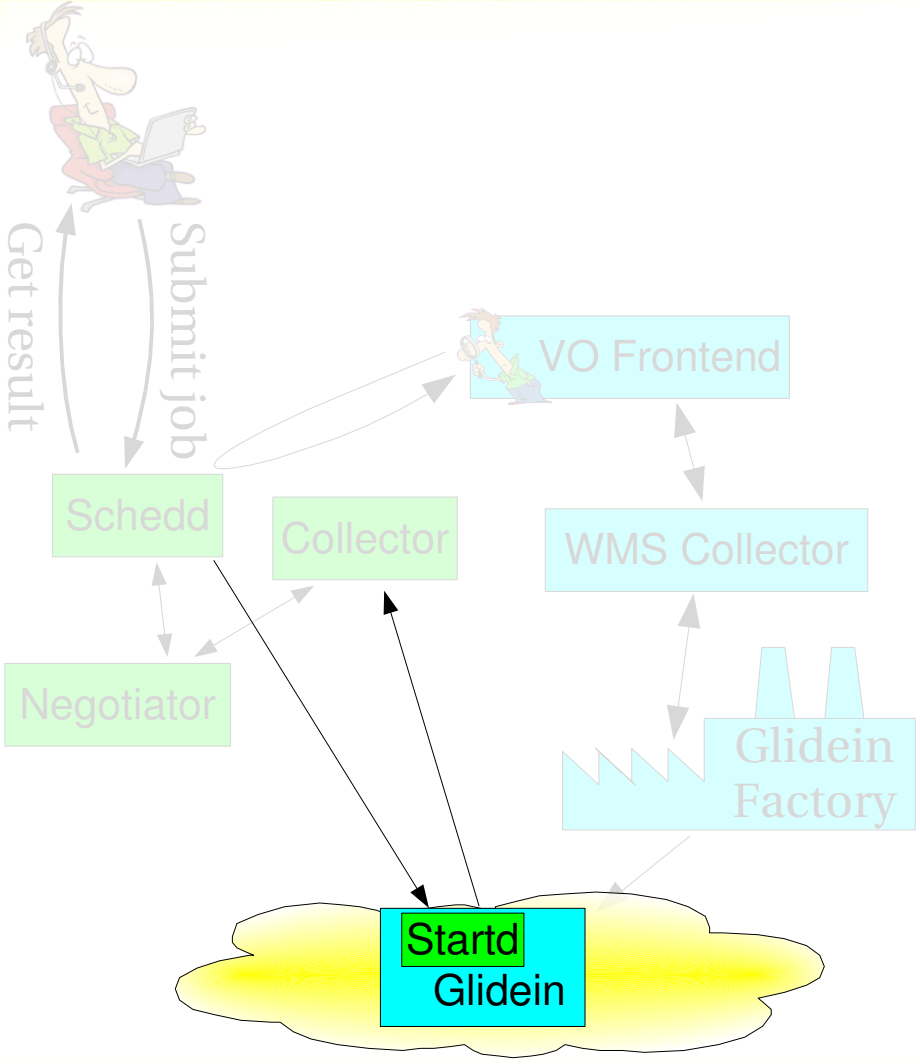

glideinWMS architecture (8)

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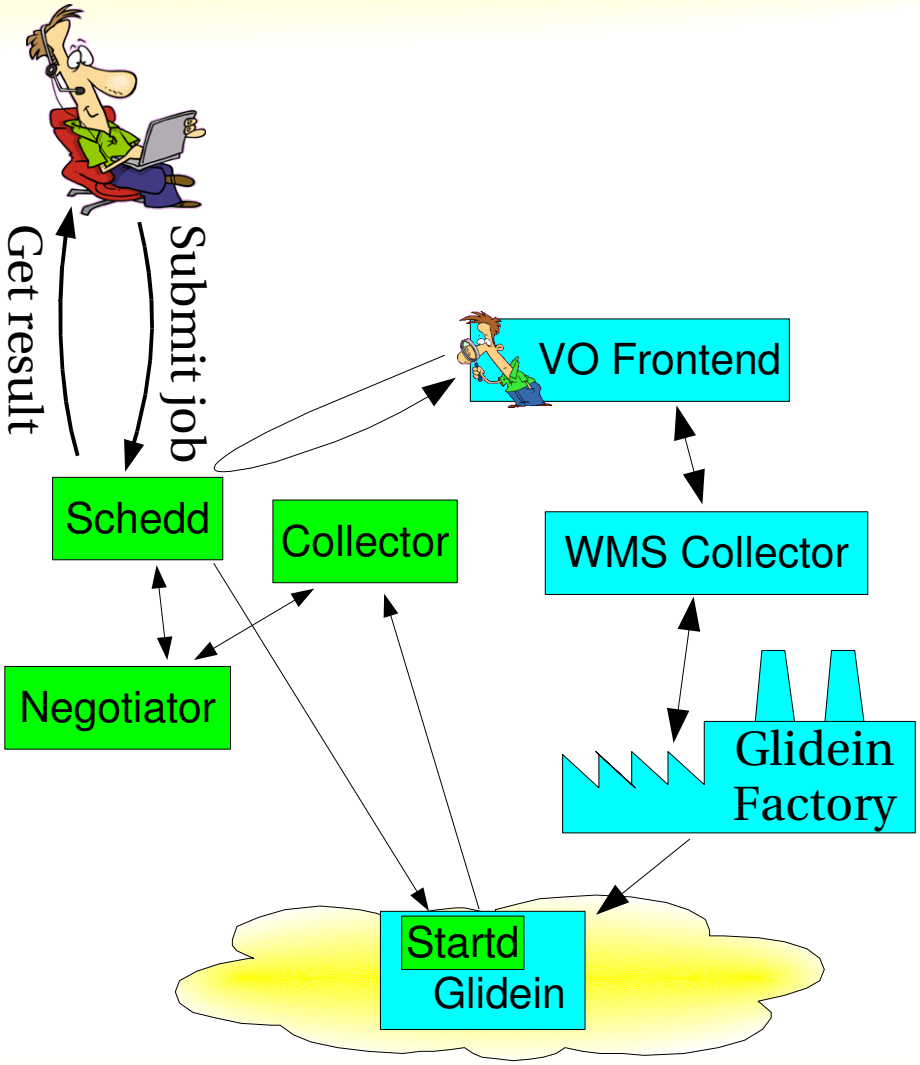
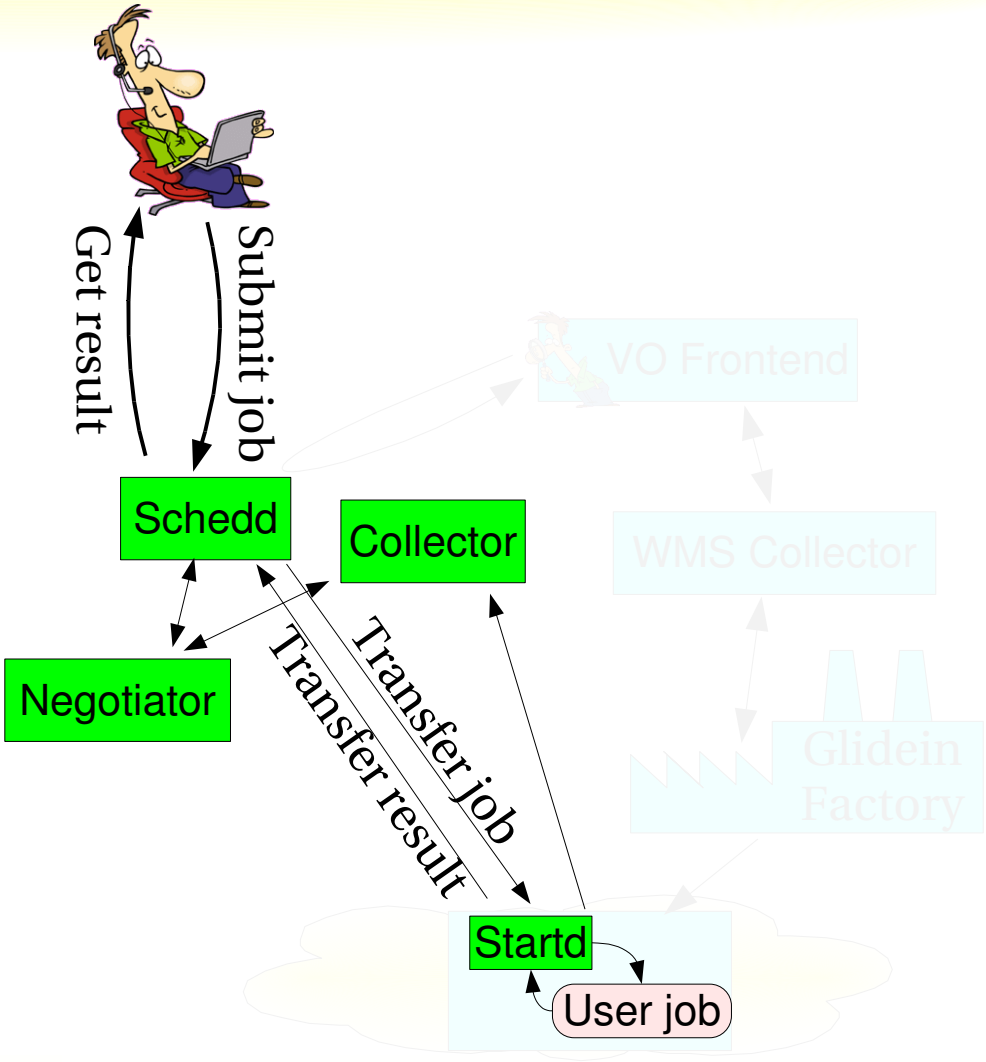


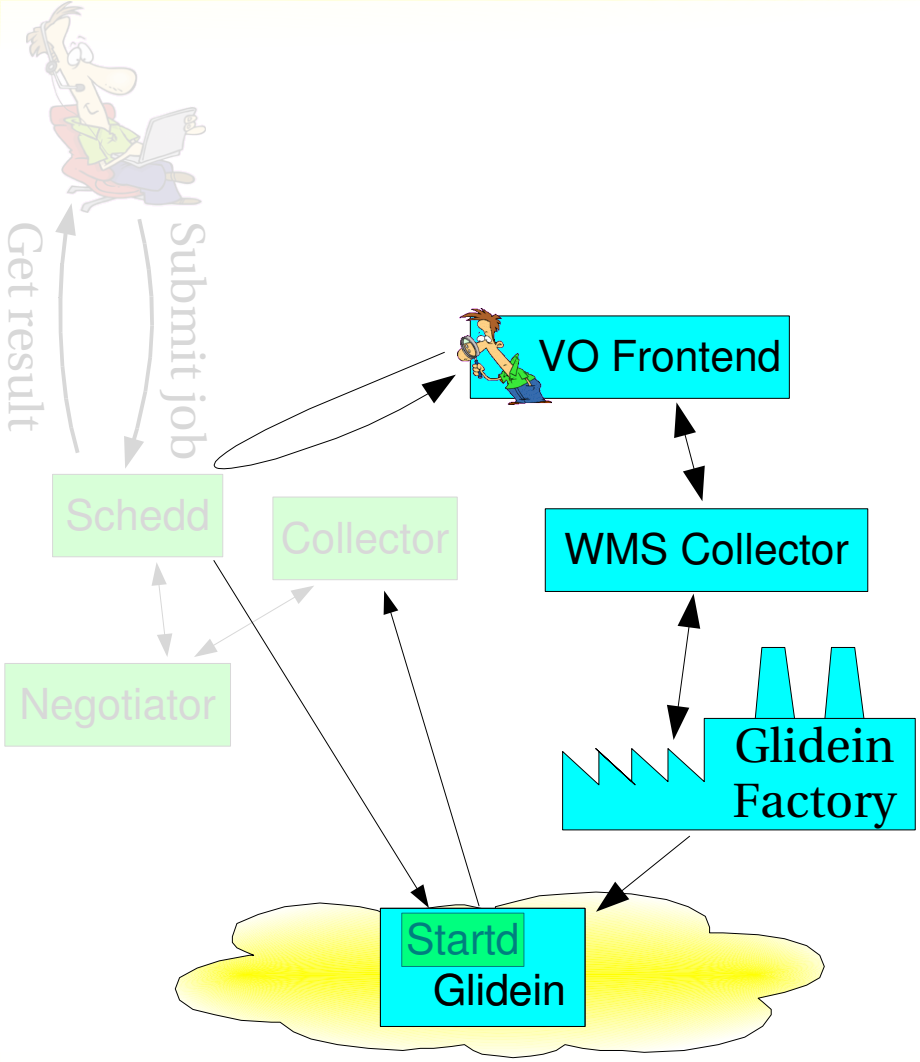
Condor handles user jobs

- A glidein Condor pool is still a Condor pool
  - Just a very dynamic one
- All Condor features available
  - ClassAds
  - Fair share
  - Group quotas
- Users really don't know about the glideinWMS



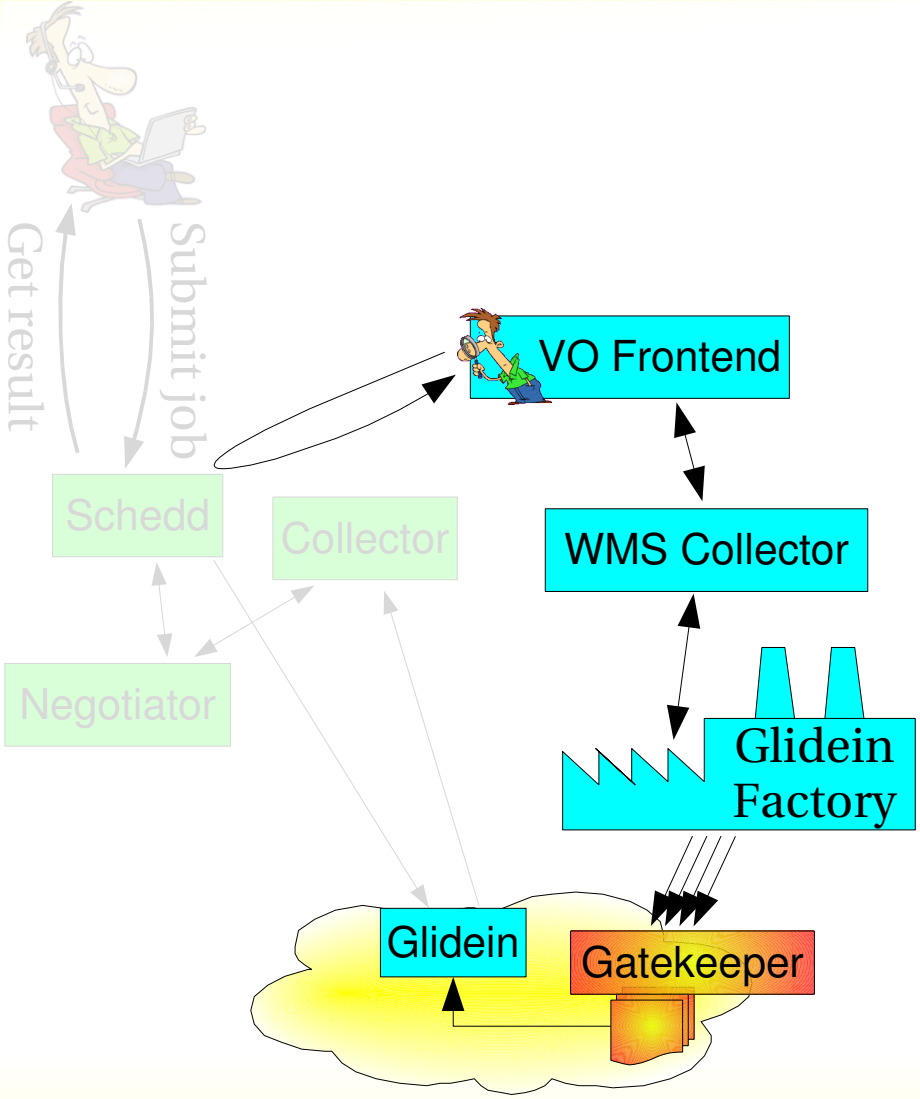
Glidein submission

- glideinWMS processes are responsible **only** for startd startup
  - A glidein just configures and starts it
  - Once started, startd has full control
- Startd configuration is often site specific
  - Glidein factory needs to know the site details



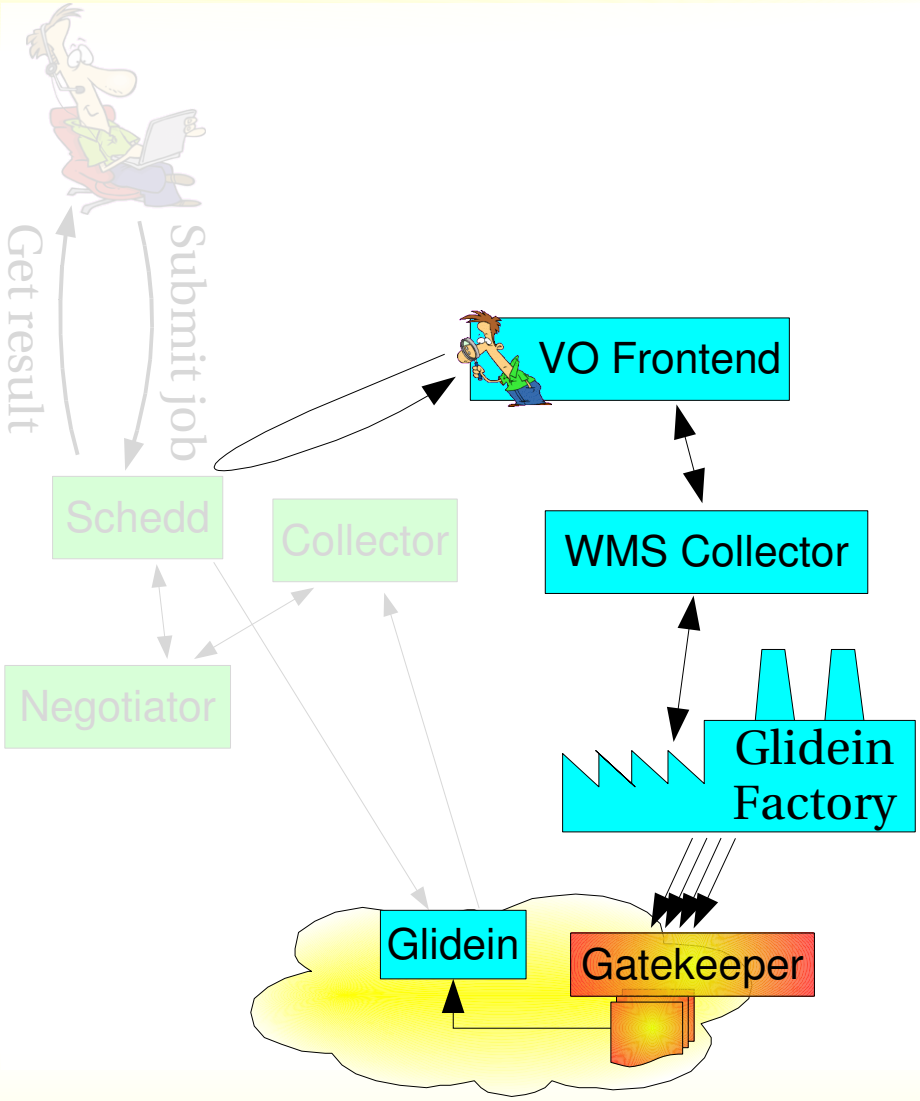
Glidein submission (2)

- Based on the principle of constant pressure
  - As long as there are enough waiting jobs in the queue, a fixed number of glideins are kept at each suitable Grid site
- Works nicely for systems with lots of waiting jobs
  - Will waste resources on seldom used systems



Glidein submission (3)

- Glidein submission is a collaborative work
  - VO frontend decides how many glideins to submit
  - Glidein factory actually does the submission
  - WMS collector is used for message passing
- Condor-G used for submission to Grid sites

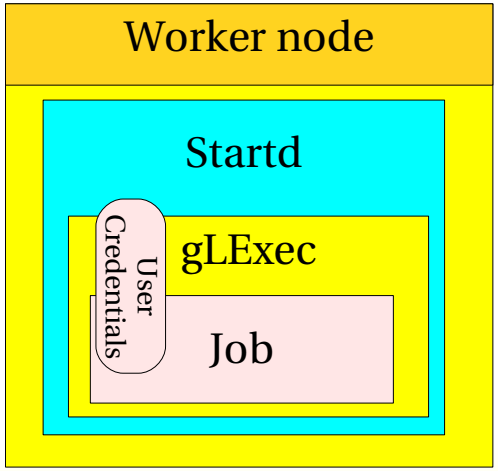


Security considerations

- GlideinWMS **requires** security over the wire
  - WAN network connections cannot be blindly trusted!
- All network traffic features integrity checks
  - Prevents man-in-the-middle attacks
- GSI authentication (X509 certificates/proxies) needed for all interactions with Condor daemons
  - Only trusted VO frontends can give orders to the glidein factories
  - Only trusted glideins can join the pool and fetch user jobs

Security considerations (2)

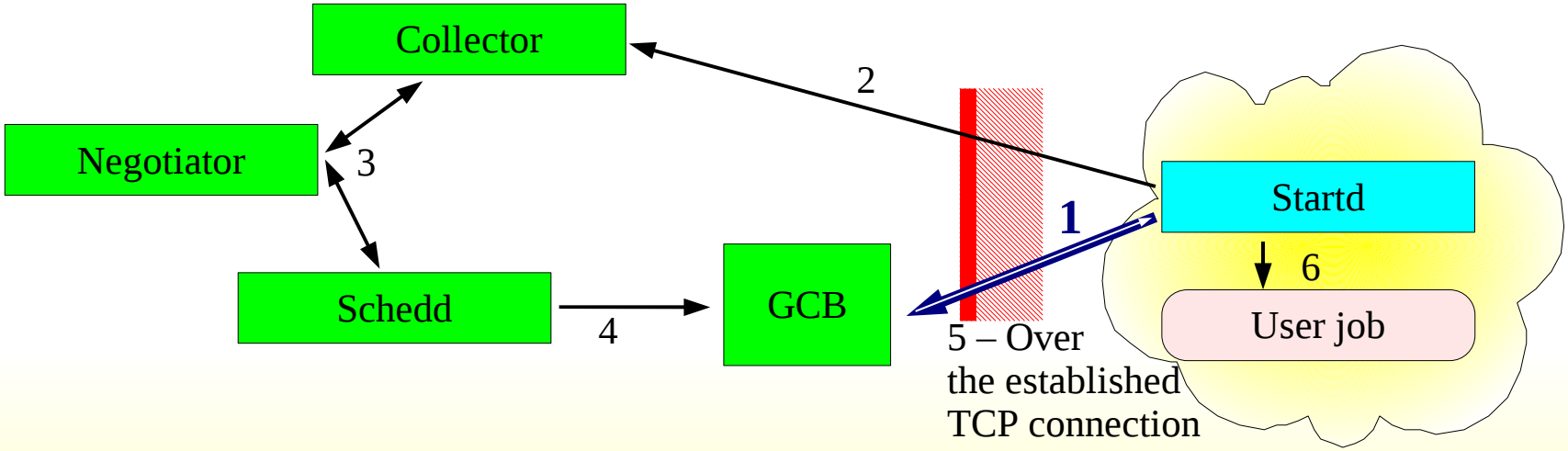
- Startd not running as a privileged user
  - Cannot change UID by itself when starting user job
- Interfaced to gLExec
  - condor_startd run as a non privileged user
    - Cannot change UID by itself when starting user job
  - gLExec allows to change UID given user proxy



Working over the firewalls

http://www.cs.wisc.edu/condor/gcb/

- Condor uses two-way communication
  - But incoming connection often blocked by Grid sites
- Can use Condor GCB (Generic Connection Broker) to make all communications one-way
  - By opening a long lived TCP connection
  - Outgoing connectivity always needed



User job monitoring

- Good monitoring a must for most users
- Condor provides a plethora of monitoring tools
  - Most useful are condor_q and condor_status
  - Third parties provide additional Condor monitoring tools
- glideinWMS provides tools for pseudo-interactive monitoring
  - ls, cat, top on the worker nodes
- The glidein factory also maintains a basic Web based graphical view
  - plus machine readable XML and rrd data

glideinWMS monitoring

- Good monitoring a must for most administrators, too
- Condor-G provides some tools
  - Mostly condor_q
- The glidein factory maintains a rich Web based graphical view
  - plus machine readable XML and rrd data
- Glideins return comprehensive logs
  - Useful for low level debugging
  - But require some expertise to browse though

Monitoring

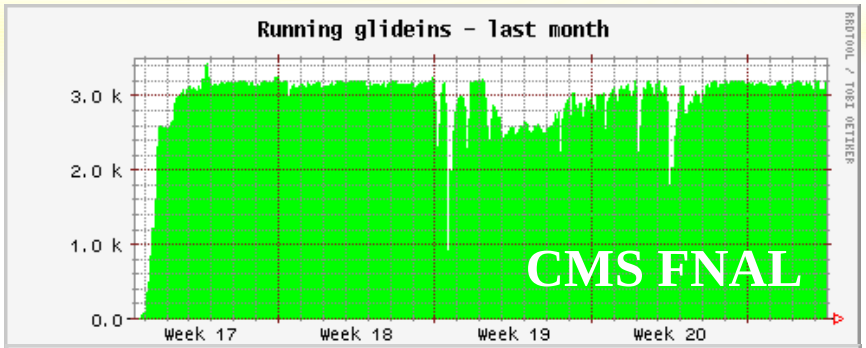
Demo

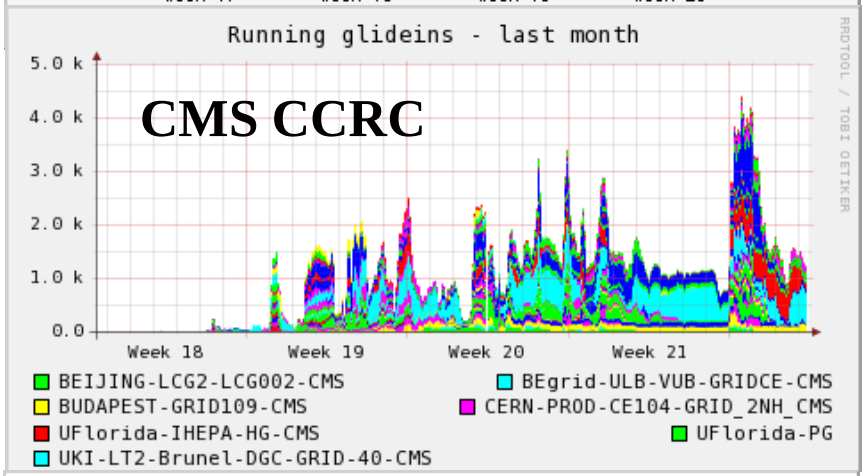
Status of glideinWMS

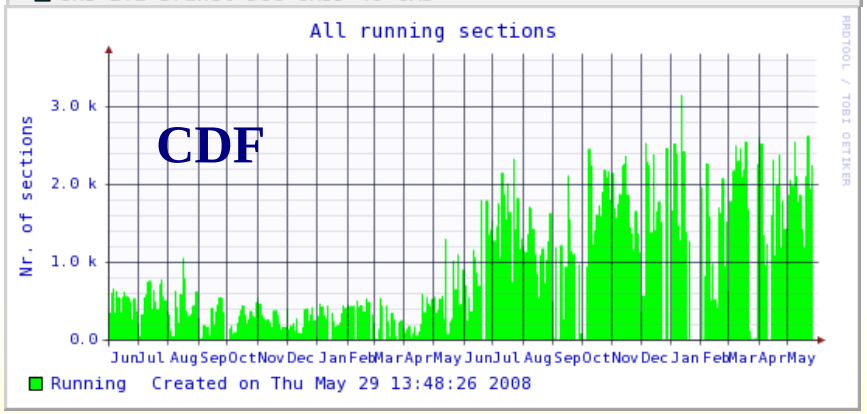
- Version 1.2.1 released May 30th
- Should be usable out of the box for most users
  - CMS is using it since v1.1
- Still in active development phase
  - More monitoring
  - More automated error checking
  - More automated error recovery
  - Better integration with other systems
- Condor also an evolving product

Glidein deployments in HEP

- CMS using glideins for production jobs at FNAL
  - And across all seven T1s
- CMS used them for analysis jobs in CCRC08
  - Across 40 T2s
- CDF and MINOS using them for user analysis







glideinWMS in numbers

- Deployed systems
  - CMS@FNAL stable 3k glideins for the past 6 months
  - CMS@CCRC up to 4k glideins over 40 sites globally
  - CDF average 2k glideins with 100s of users for past 2 years (by using the GlideCAF)
- glideinWMS Tested on a dedicated test pool, scaled without major problems to
  - 10k glideins at any time
  - 100k user jobs queued

Conclusions

- The average scientist should not be exposed directly to the Grid
  - Computing related overhead too high
- Glideins can hide the Grid complexity and make it look as a uniform computing pool
- Several HEP collaborations are happily using glideins in the real life
  - Other communities could benefit as well
  - glideinWMS is an easy path there

Backup Slides

glideinWMS contact info

GlideinWMS home page:

http://www.uscms.org/SoftwareComputing/Grid/WMS/glideinWMS/

Condor home page:

http://www.cs.wisc.edu/condor/

email: sfiligoi@fnal.gov

glideinWMS support

- Developed by USCMS team at Fermilab
- Released under the FermiTools license
  - A modified BSD license http://fermitools.fnal.gov/about/terms.html
- Support to non-CMS users available on best-effort bases
- We are interested in collaboration with other groups