GlideCAF – A Late Binding Approach to the Grid

S. Belforte, S. C. Hsu, E. Lipeles, D. Lucchesi,
M. Neubauer, S. Sarkar, I. Sfiligoi, F. Wuerthwein

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Talk Outline

- CDF Computing
  - Resources, requirement
- Moving towards the Grid Computing Paradigm
  - Supporting existing applications
  - Minimizing the impact on the end-users
- GlideCAF
  - Implementation, characteristics and status
- Summary

The CDF Analysis Farm (CAF)

1. Develop, debug and submit from personal PCs

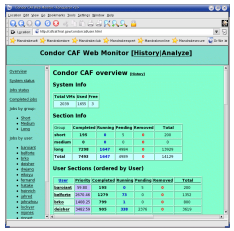
2 central farms in Fermilab
10 distributed farms worldwide

User selects the farm, usually
- Fermilab for data analysis
- Distributed farms for MC production

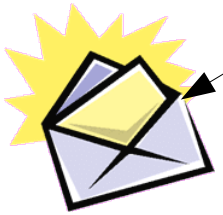
2. Track your running jobs interactively

3. Satisfied? No need to stay connected anymore

4. Follow your jobs on the web monitor



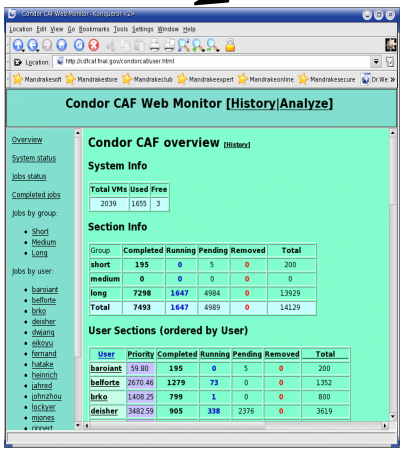
5. On job completion receive an email

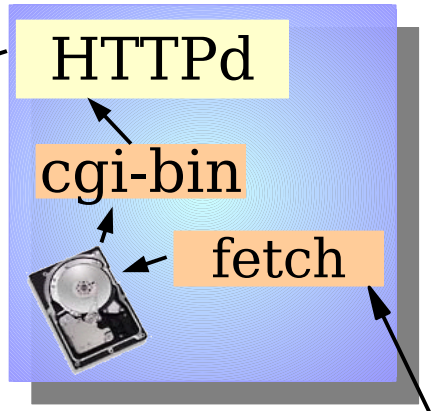


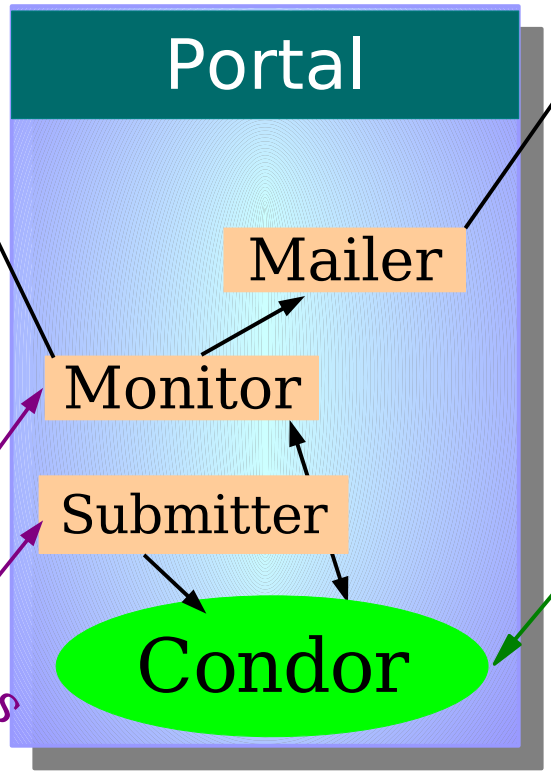
Output to any place

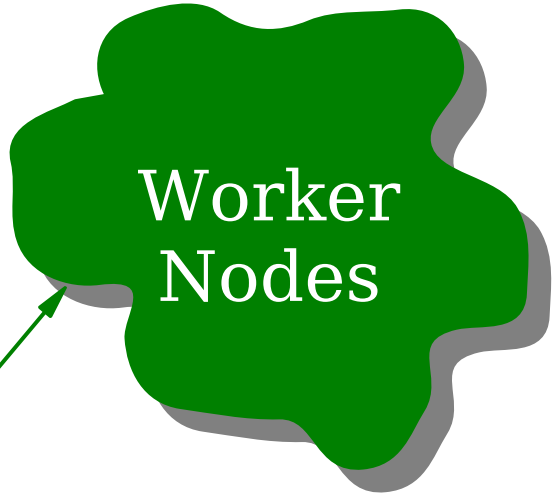
CAF Internals

CAF is just a Portal







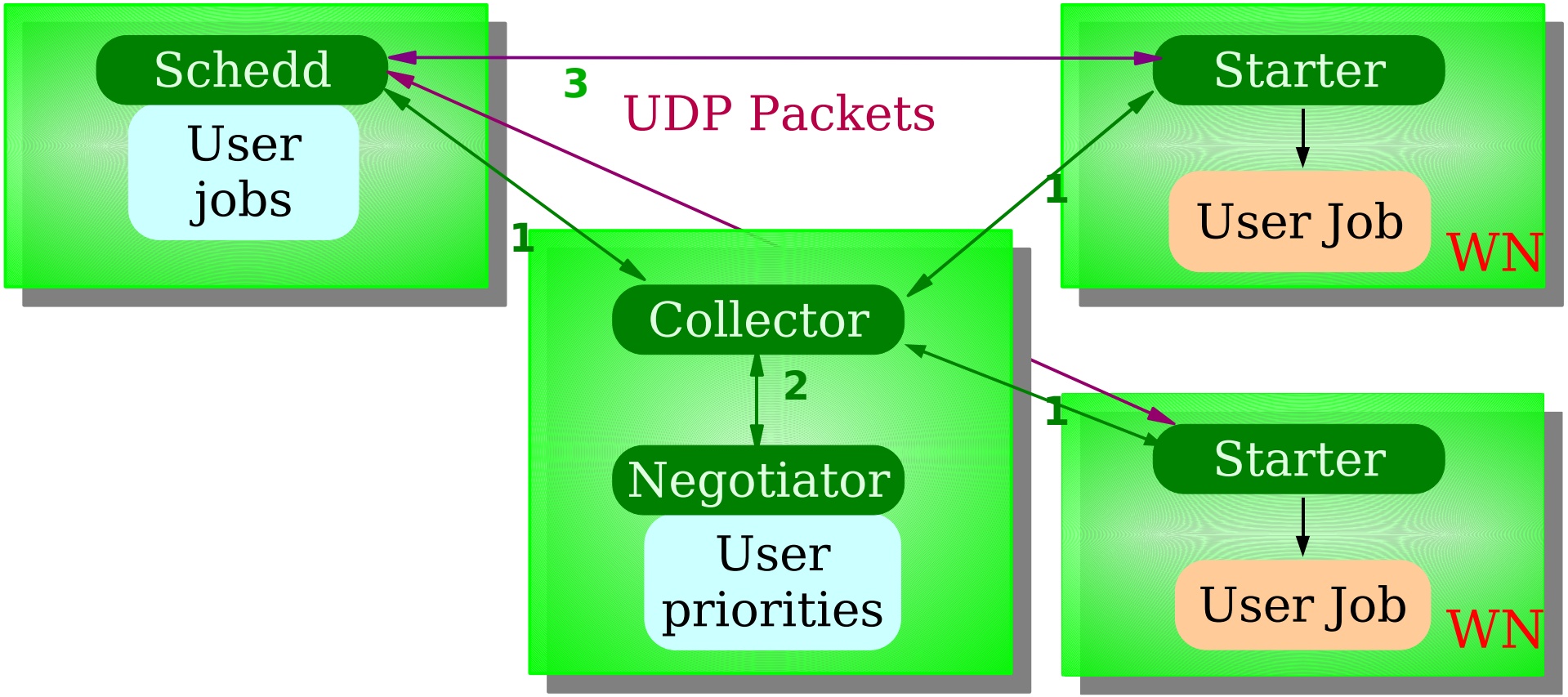


Kerberos

Most monitoring via regular web interface

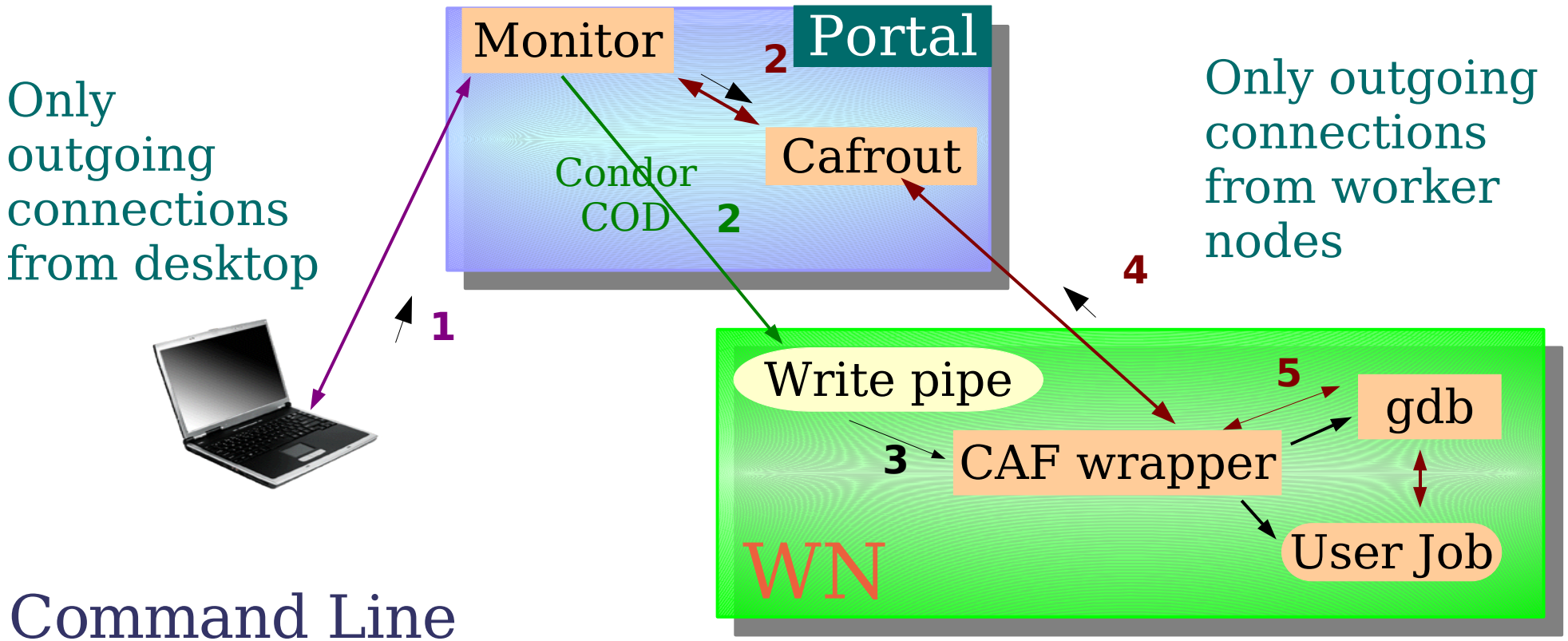
- Both running and completed jobs
- System monitoring, including memory usage and CPU load
- Usage history graph

Condor System Overview



- Schedd manages user jobs
- Negotiator assigns nodes to jobs
- Starter manages jobs on the WN
- Collector gathers information about other daemons

Interactive Monitoring



Command Line

- list of jobs
- process list of a section
- listing the working directory
- tail
- debugging a process

CDF Computing Resources

- 2 CAFs at Fermilab
  - 2.6 M SPECint2000
- 10 dCAFs worldwide with ~50% computing load
  - 2.5 M SPECint2000
- Dedicated MC production farms, e.g Karlsruhe

Computing Requirements:
Current: ~5 M SPECint2000
End of 2007: ~15 M SPECint2000

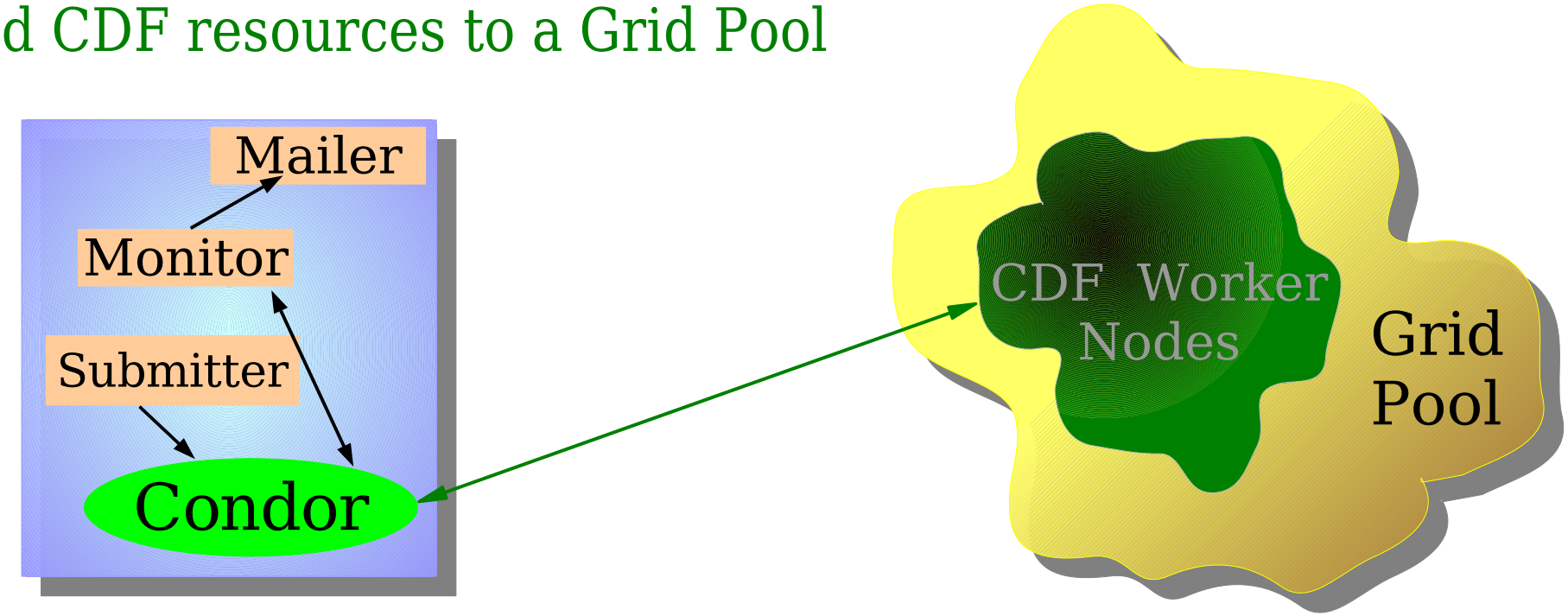
CDF priorities for computing outside Fermilab
- MC Production
- A few selected sites will become Physics Centres
  CNAF, the Italian Tier1 Centre chosen for B Physics

CAF Evolution needed

Expansion of dedicated pools no more an option

Turn attention to shared resources

Add CDF resources to a Grid Pool



- Harvest batch slots for CDF using Condor with GSI authentication
  - CDF user jobs pulled onto such slots
- Add a new component to the CAF framework for resource management

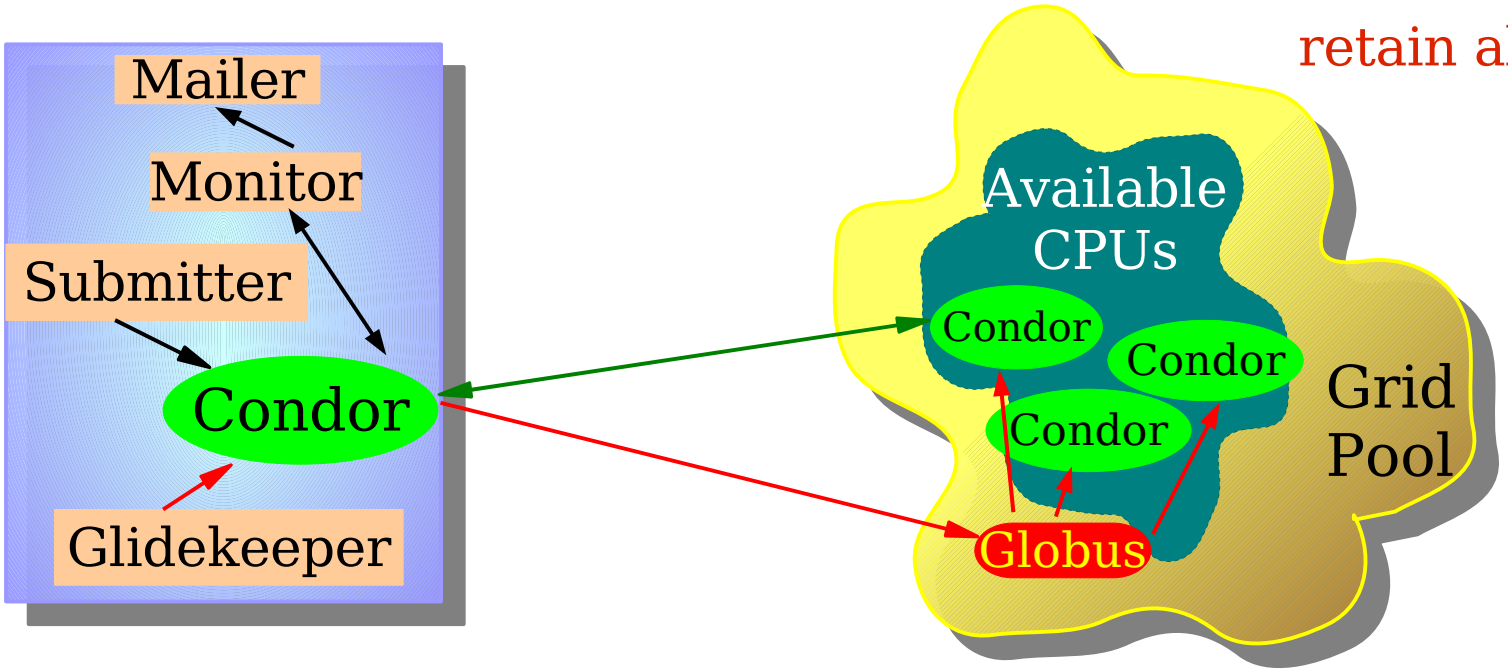
Additionally, utilize the idle CPU cycles at the Grid Site

GlideCAF Overview

Use Condor glide-ins

A simple extension of the CAF

retain all the virtues

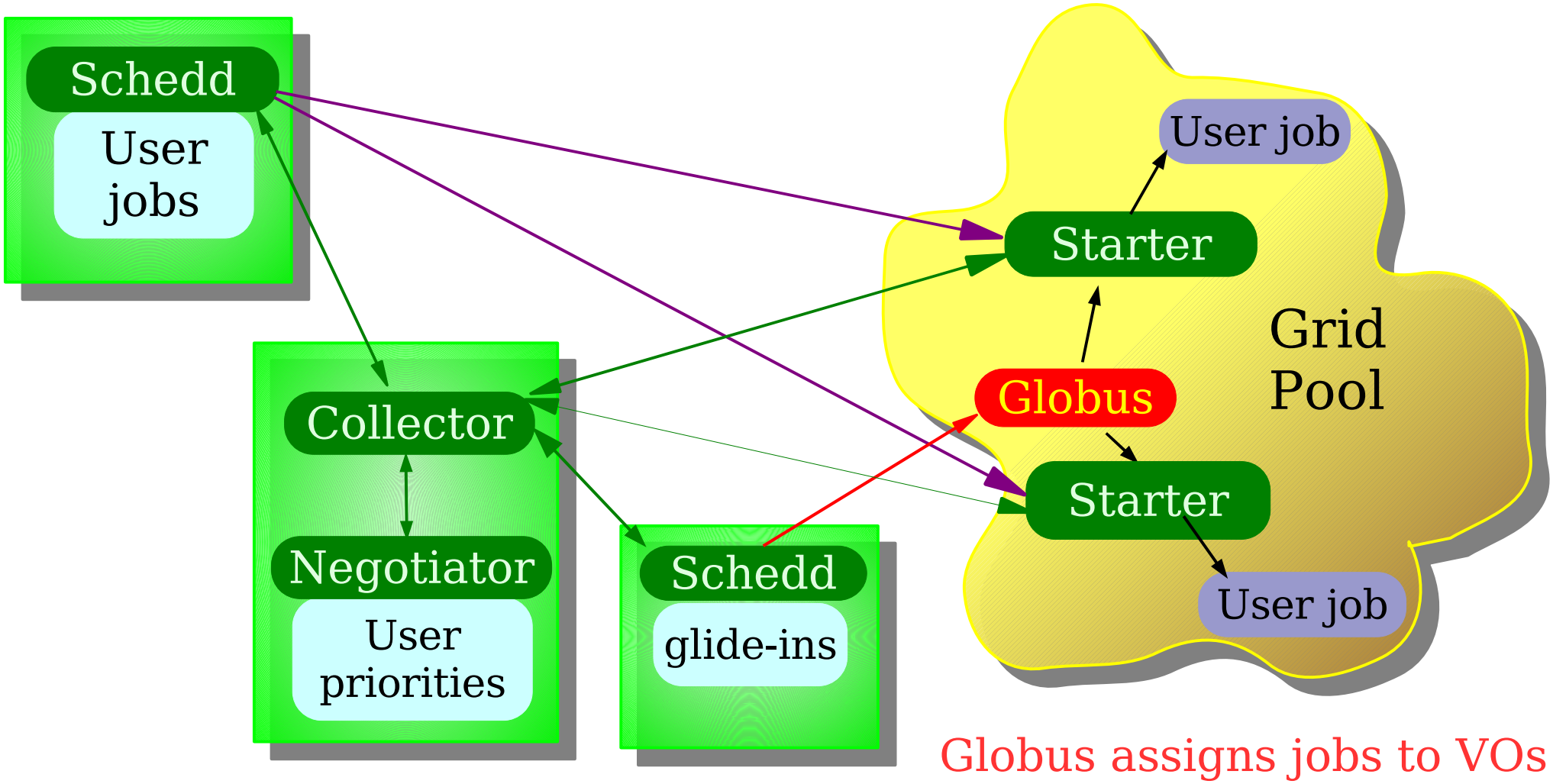


glide-ins are regular, properly configured Condor starter daemons submitted as jobs to the Grid CE

Once a job starts on a WN, it notifies the collector and joins the pool as a new VM

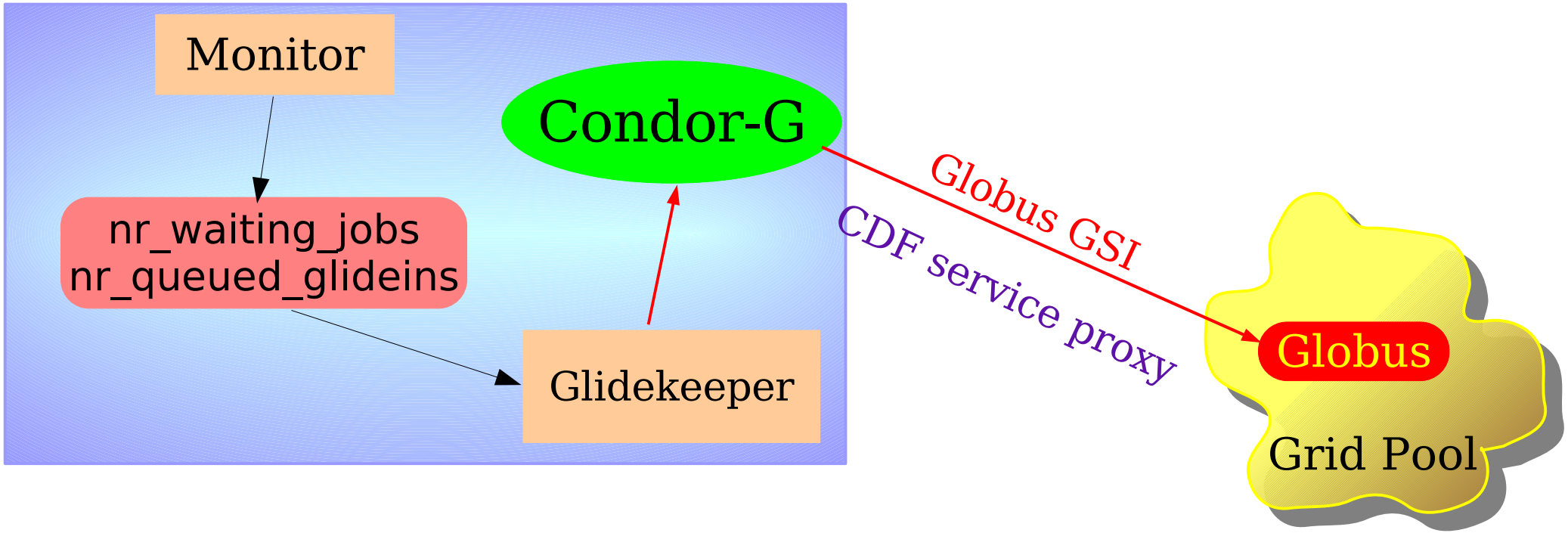
- indistinguishable from a dedicated one to Condor
- will be matched in the same way to a user job with the best priority

Condor System - glide-ins



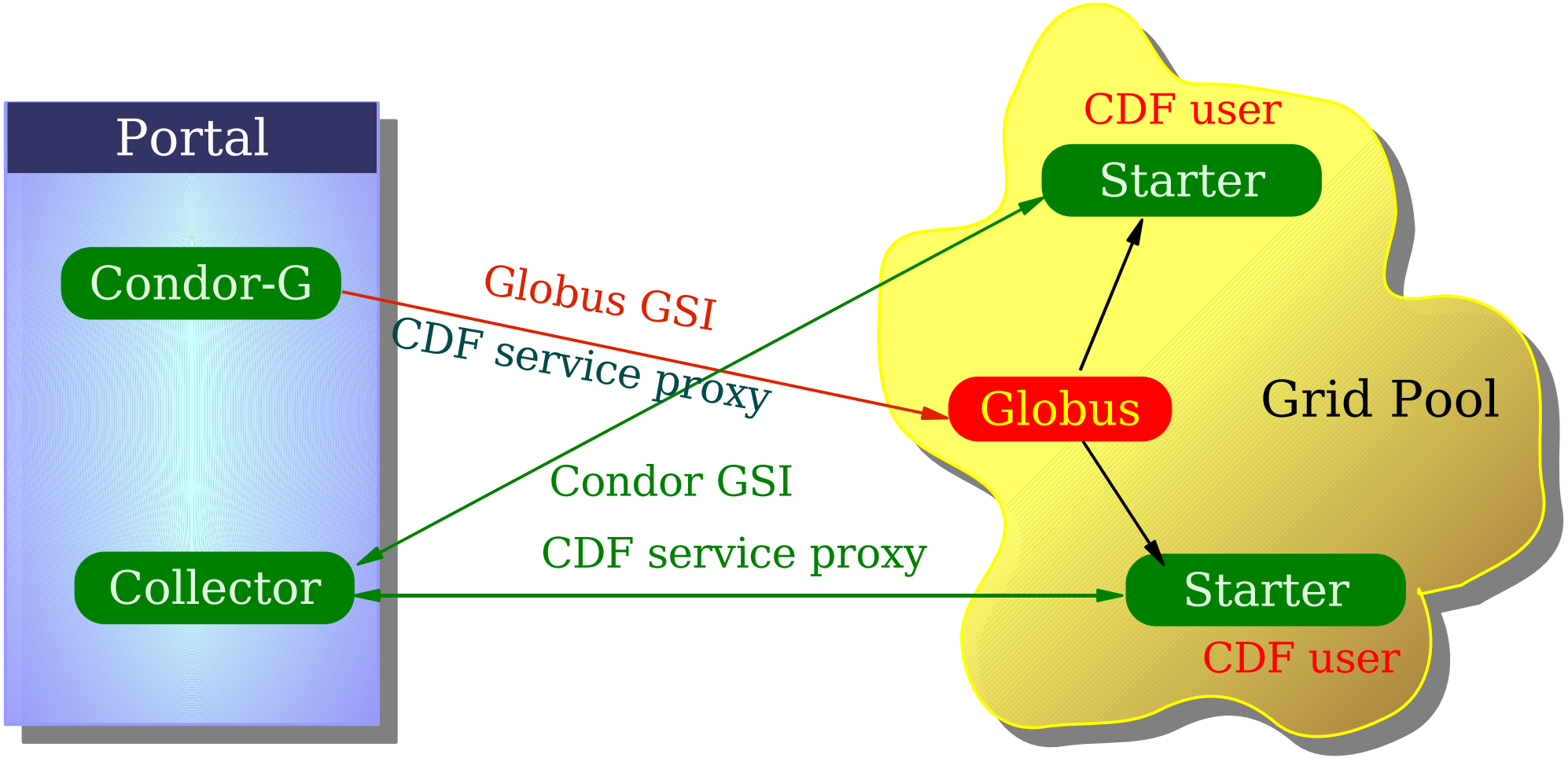
- Negotiator assigns nodes to jobs
- a secondary schedd manages the glide-ins

GlideCAF Details - glidekeeper



- The glidekeeper is the glide-in factory
  - fills the secondary schedd with glide-ins, as needed
    - nr_waiting_jobs > nr_queued_glideins
  - manages glide-ins, e.g removes held ones

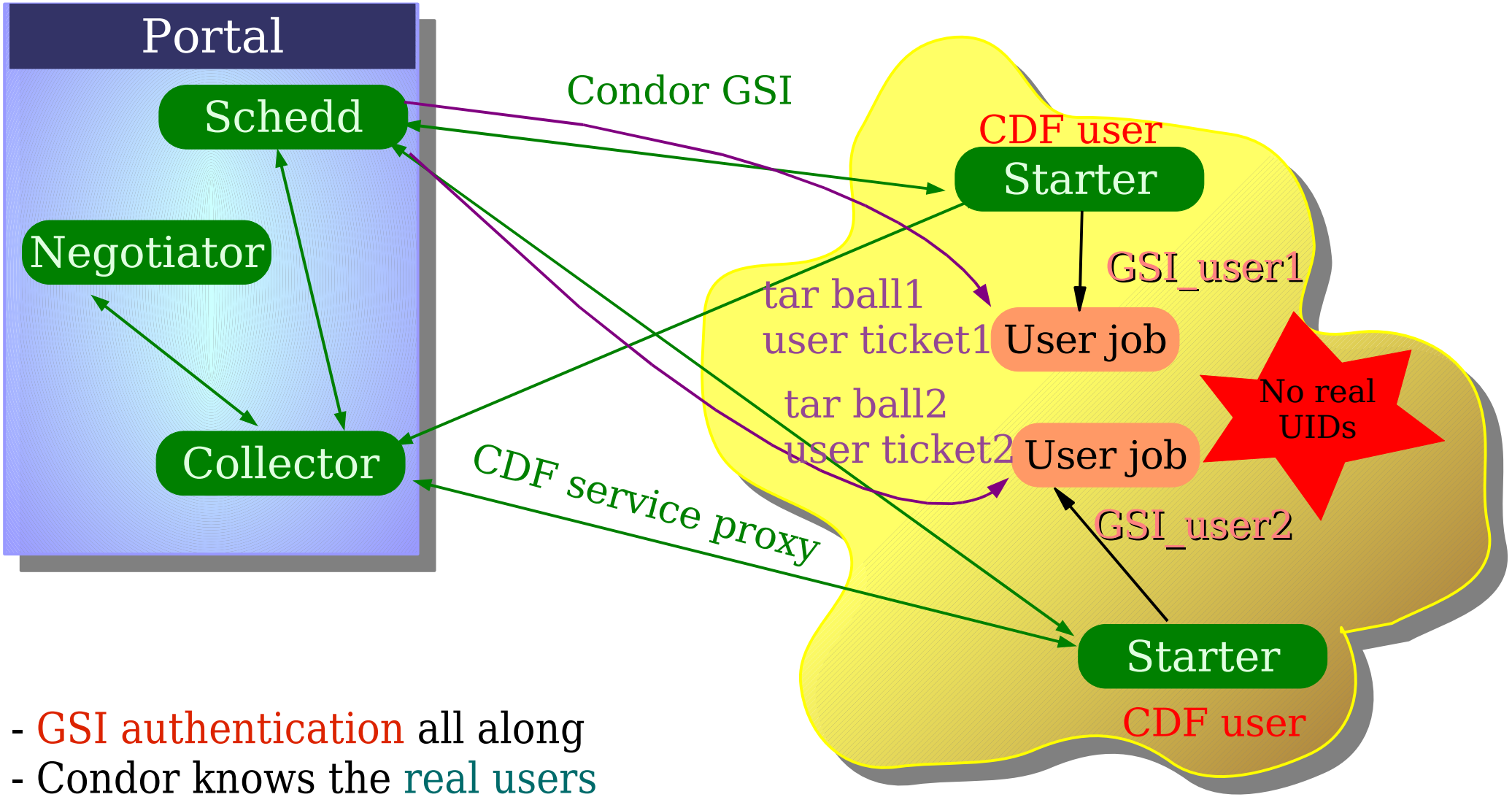
GlideCAF Details - glide-ins



GSI authentication all along

A single GSI CDF service proxy used for all the glide-ins

GlideCAF Details – CDF Jobs

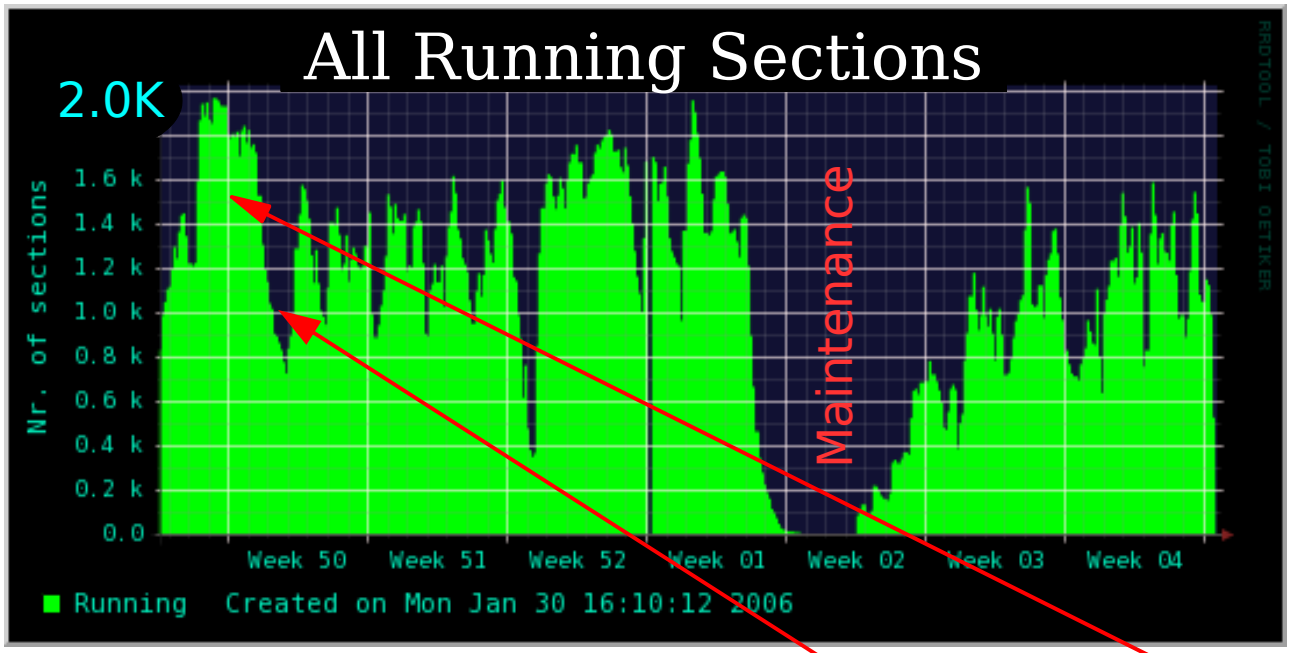


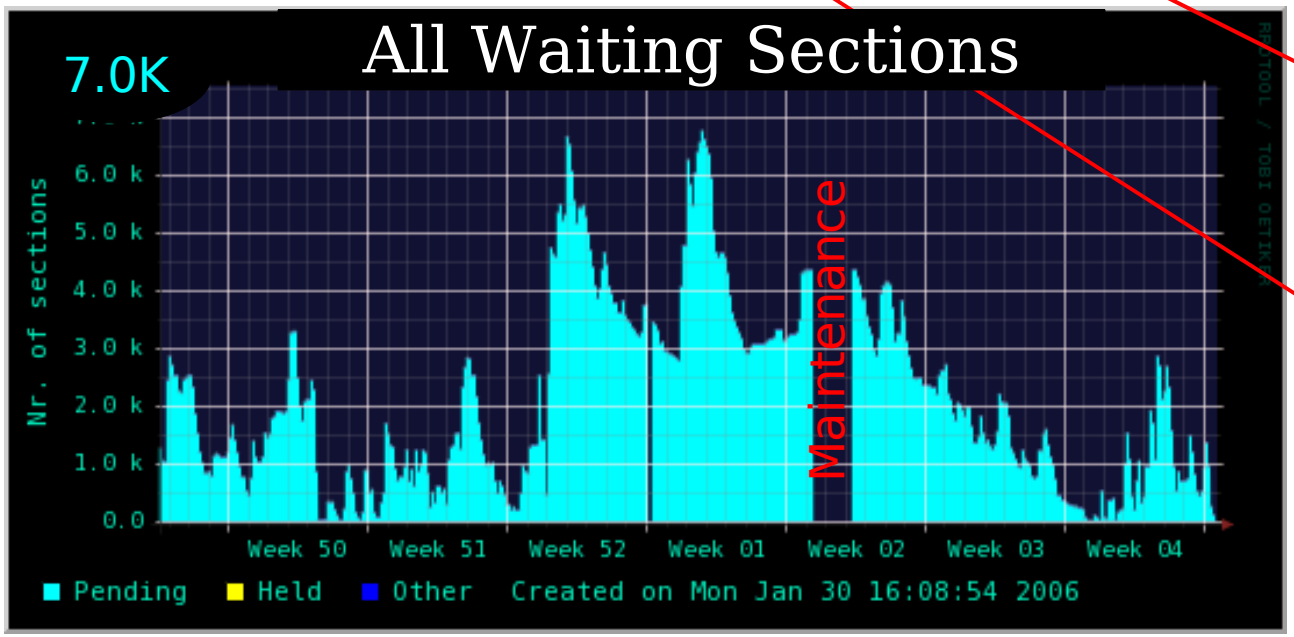
- GSI authentication all along
- Condor knows the real users
- The Grid site knows only about the CDF service certificate
- All jobs run under a single VO specific UID (e.g cdf001)

GlideCAF Deployment

- Production systems
  - CNAF Tier1 in Bologna, Italy
  - San Diego
  - Fermilab
  - Lyon Tier1 in France
- More GlideCAFs will appear soon
  - Karlsruhe, UCL

GlideCAF at CNAF





First prototype in April '05
In production since Sept '05
- CDF + glide-in resources
Pure GlideCAF since Dec '05

~ 670K jobs processed
~ 200 users
Negligible job loss

Use more than your share (~ 500)

Give back when others need it

GlideCAF Features(1)

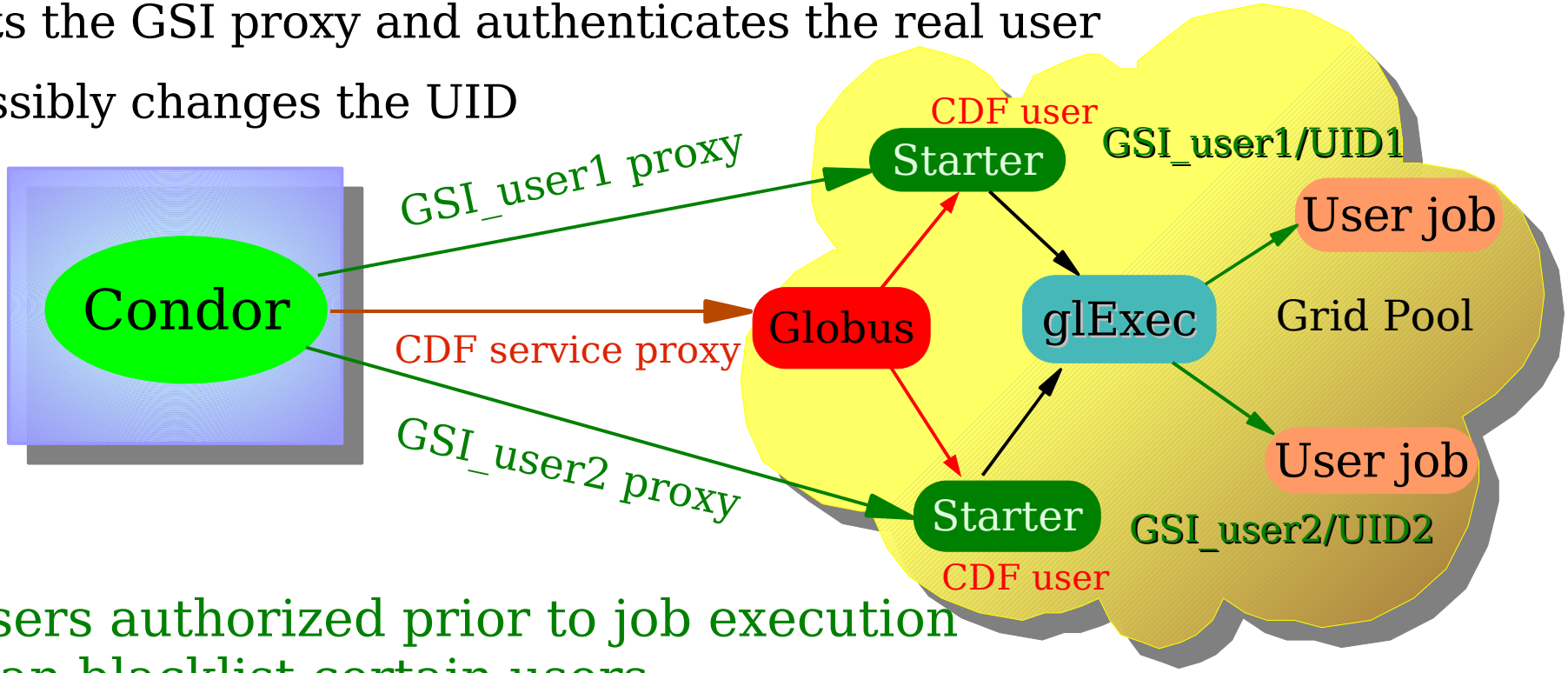
- Late binding of resources
  - User jobs sent only when resources are available, i.e glide-ins start and create VMs
  - eliminate risk of long, indefinite wait at the CE queues for a multi-site configuration
- Black hole removal
  - defective nodes kill only glide-ins but no user jobs
  - additional VO specific sanity checks can be performed
  - nodes failing recurrently can be blacklisted

GlideCAF Features(2)

- Fine grained policy management with two level negotiation
  - VO level at the Grid site
  - user level in Condor for each VO
- No Grid site specific installation required
  - Condor only environment
  - Only a small incremental change to the CAF infrastructure
- Monitoring continues to work natively
  - minor modification was needed

GlideCAF issues

- A single Grid certificate used for all the glide-ins
  - The site gatekeeper finds only one special user for that VO
    - no knowledge about the real users
- Looking at future evolutions of glExec for a solution
  - gets the GSI proxy and authenticates the real user
  - possibly changes the UID



- Real users authorized prior to job execution
- Sites can blacklist certain users

Plain GlideCAF Limitations

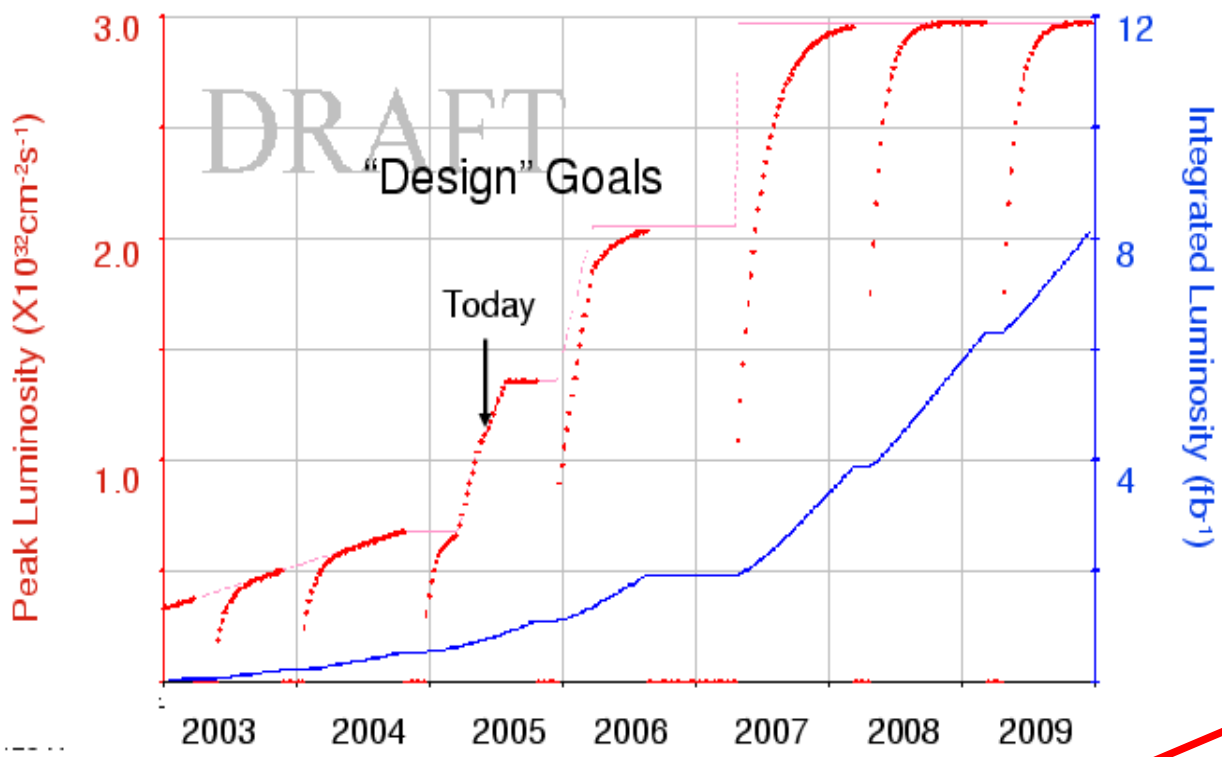
- CDF Software must be available on the WNs through a shared file-system (NFS, AFS)
- Collector and starters need good network
  - UDP based communication will not work over WAN
  - Require bi-directional traffic, will not work over firewalls
- A GlideCAF must be installed at each Grid site
  - reasonable for Large, CDF Friendly sites
    - CNAF, San Diego, Lyon
  - unmanageable if accessing scores of small sites
- See Matthew Norman's talk for GlideCAF extensions that lift the above restrictions

Summary

- CDF is able to use Grid resources
  - A number of GlideCAFs in production
- CAF infrastructure preserved
  - Transparent to end-users
  - Monitoring continues to work in a standard manner
- No new Middle-ware introduced
  - Just using Condor differently
  - Ensured a rapid turn-around
- GlideCAF extensions will take us further

Backup Slides

Computing Requirements



	FY	Int L. (fb^-1)	Evts (10^9)	Peak rate (MB/s)	Peak rate (Hz)
Actual	2003	0.3	0.6	20	80
Actual	2004	0.7	1.1	20	80
Estimated	2005	1.3	2.4	40	220
Estimated	2006	2.2	4.7	60	360
Estimated	2007	3.9	7.1	60	360
Estimated	2008	6.0	9.5	60	360
Estimated	2009	8.2	12	60	360

Data logging rate increases 3 times from 2004 to 2006

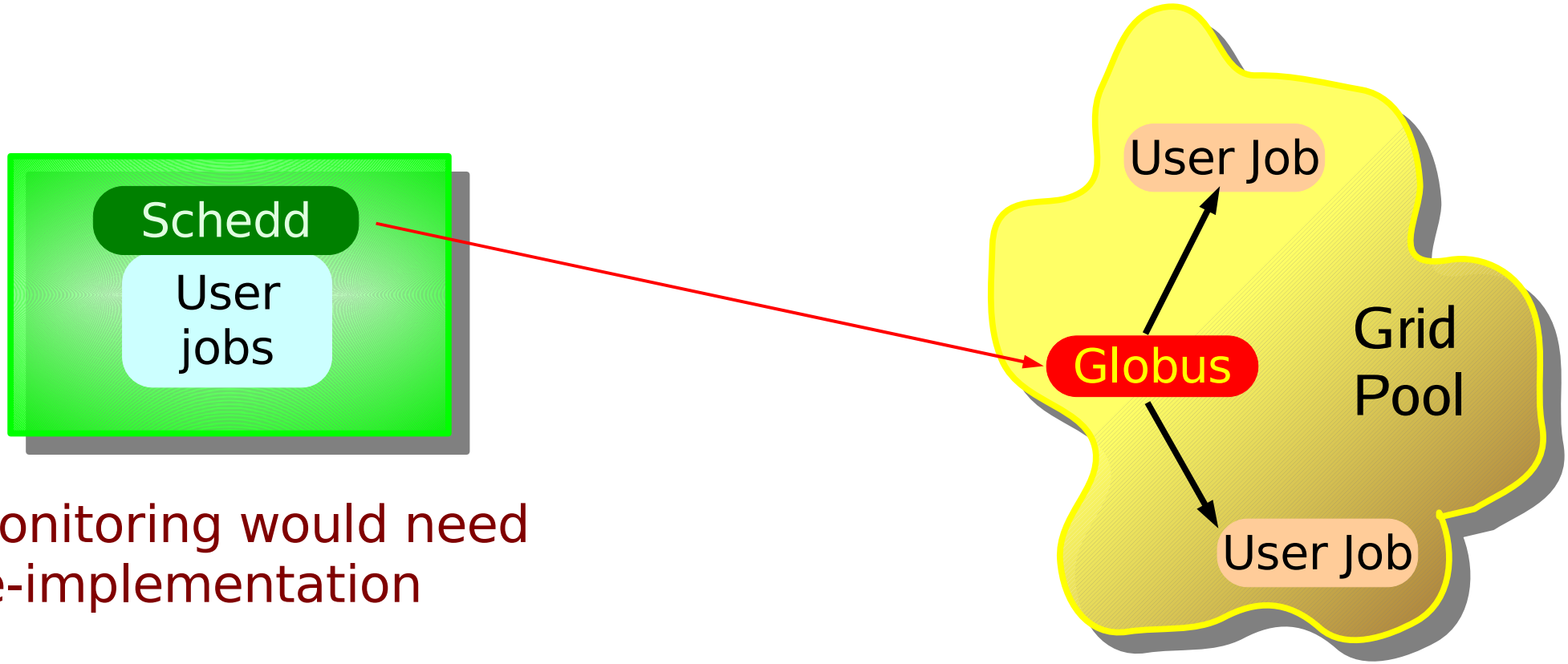
Event rate increases 4 times due to better compression

Requirements:

Current: 5 M SPECint2000

End of 2007: 15 M SPECint2000

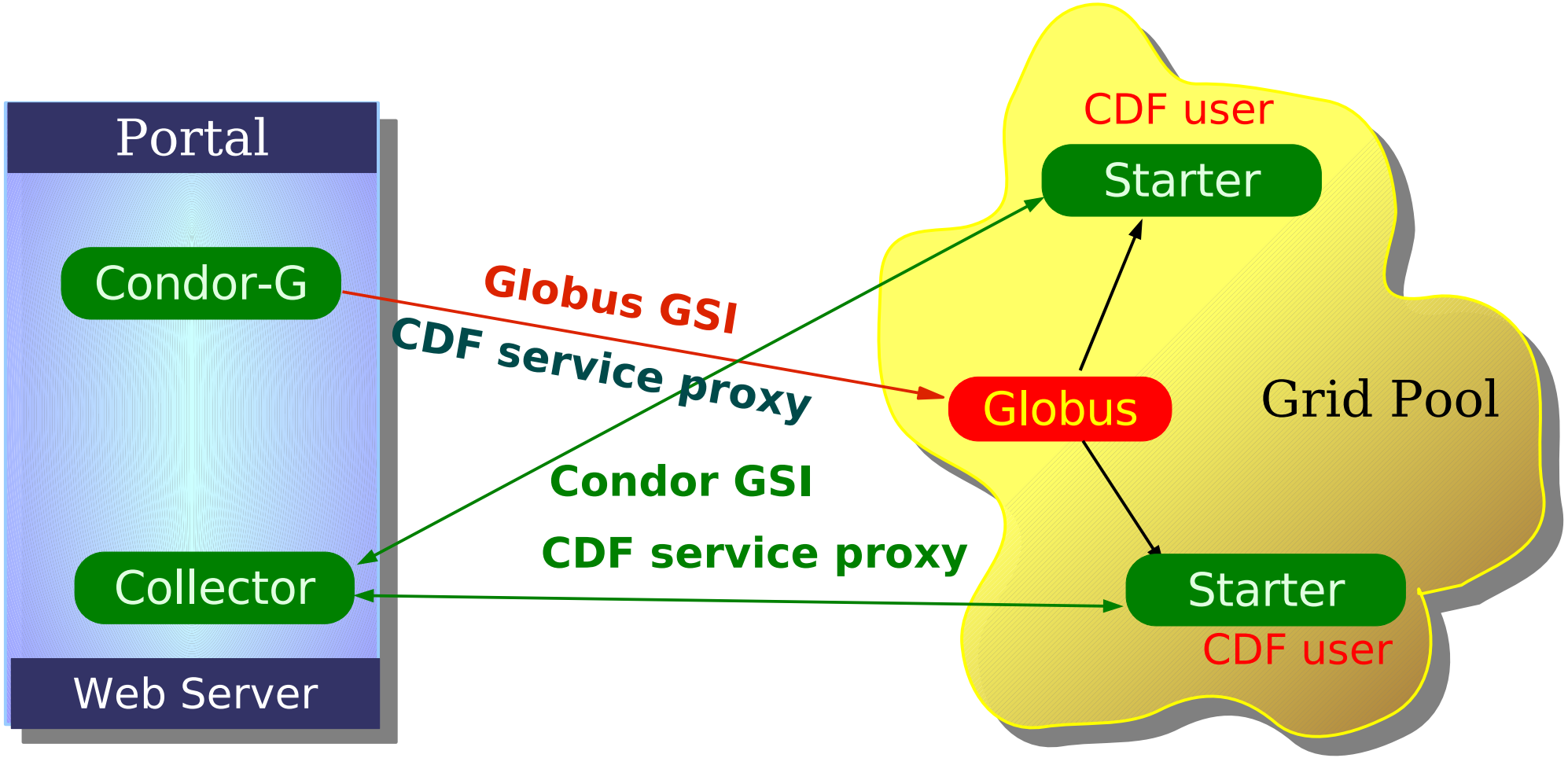
Condor System - Condor-G



Monitoring would need re-implementation

- Globus assigns nodes to jobs
- All control at the Grid site

GlideCAF Details - glide-ins



GSI authentication all along
The Web Server distributes glide-in binaries and site specific configuration to WNs

A single GSI CDF service proxy used for all the glide-ins