DRMAA
Distributed Resource Management
Application API — www.drmaa.org

DRMAA v2 - The Next Generation

Peter Tröger
Humboldt University of Berlin
peter@troeger.eu

DRMAA-WG Co-Chair

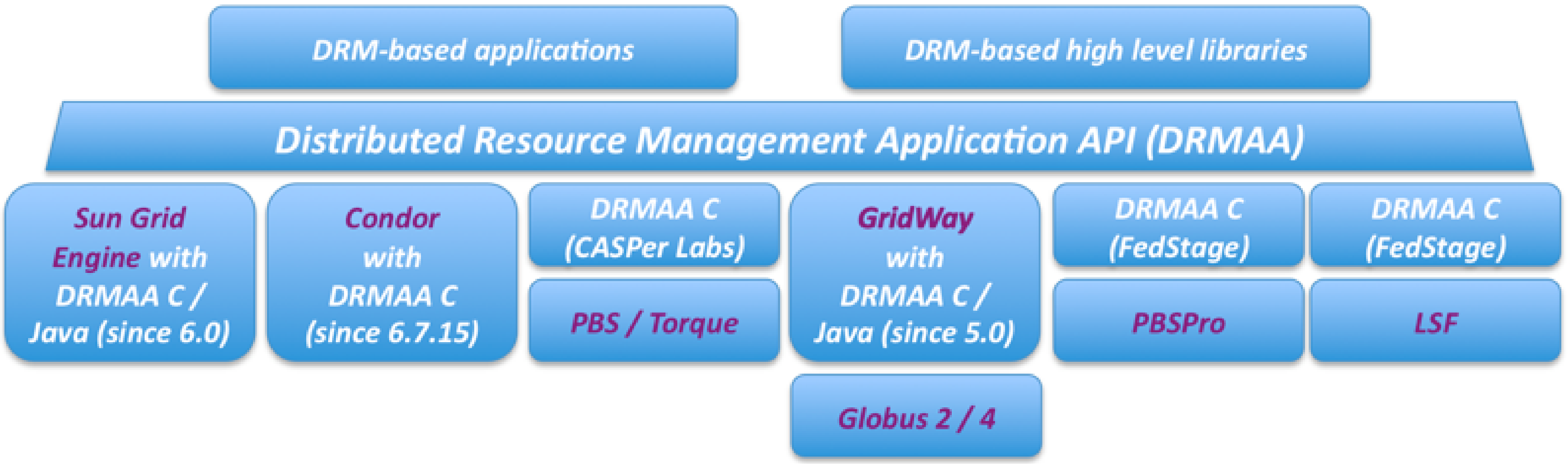
Past

DRMAA
Distributed Resource Management Application API — www.drmaa.org

- GGF / OGF specification since 2001
  - Job submission and control in a cluster / grid system
  - Application portability between different DRM systems
  - Simple API design, implementation as local library
  - Leave room for areas of disagreement
- Different DRMAA 1.0 standardization documents
  - June 2004 - DRMAA 1.0 proposed recommendation (GFD.22)
  - 2008 - Shift to IDL based root specification, some clarifications (GFD.130)
  - Official language binding documents for C, Java, Python
  - Experience reports, tutorials, unofficial language bindings for Perl, Ruby and C#

Today

DRMAA
Distributed Resource Management Application API — www.drmaa.org



DRM-based applications
DRM-based high level libraries
Distributed Resource Management Application API (DRMAA)
Sun Grid Engine with DRMAA C / Java (since 6.0)
Condor with DRMAA C (since 6.7.15)
DRMAA C (CASPer Labs)
PBS / Torque
GridWay with DRMAA C / Java (since 5.0)
Globus 2 / 4
DRMAA C (FedStage)
PBSPro
DRMAA C (FedStage)
LSF

- C-library implementations for all major DRM systems, some also with Java binding
  - Biggest user base with SGE implementation
  - Some famous applications: MOAB, Mathematica integration package, SAGA
- Recent collection of user demands and wishes
  - Public survey, SUN customer feedback, DRMAA implementation experiences
- Design of DRMAA v2 **happens now ! (Deadline: December 2009)**

DRMAA v1 Issues

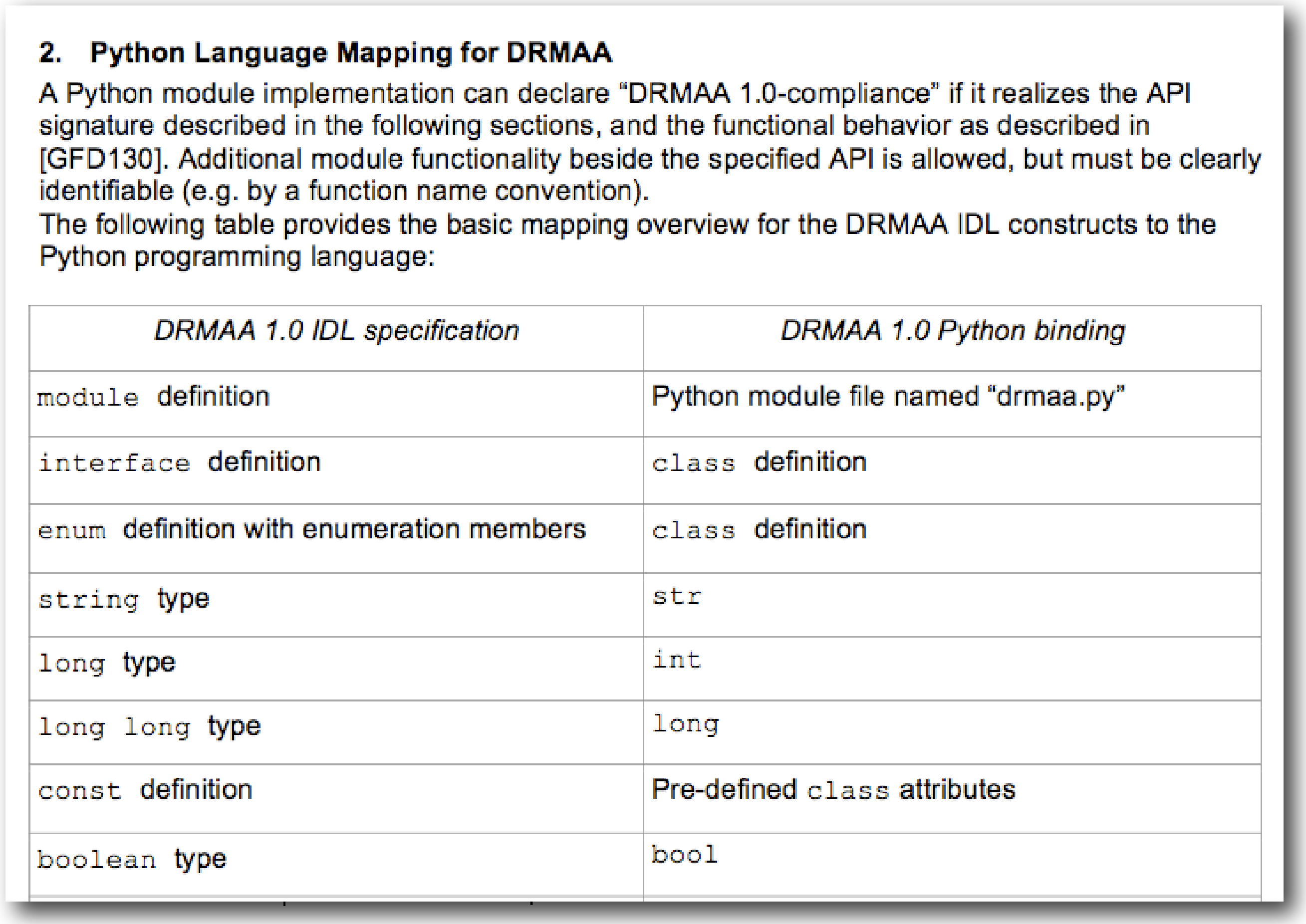
DRMAA
Distributed Resource Management Application API — www.drmaa.org

- Fix C-centric API design
  - Start from IDL version of DRMAA v1
  - Make the API really OO-friendly, but still language-independent
- Add new features
  - Resource monitoring, session handling, job objects, ...
- Remove obsolete / never implemented features
  - Date / time handling, ...
- Modify existing features for better usability / DRMS compatibility
  - Job synchronization, state model, job monitoring, ...

IDL-based Language Binding

DRMAA
Distributed Resource Management Application API — www.drmaa.org

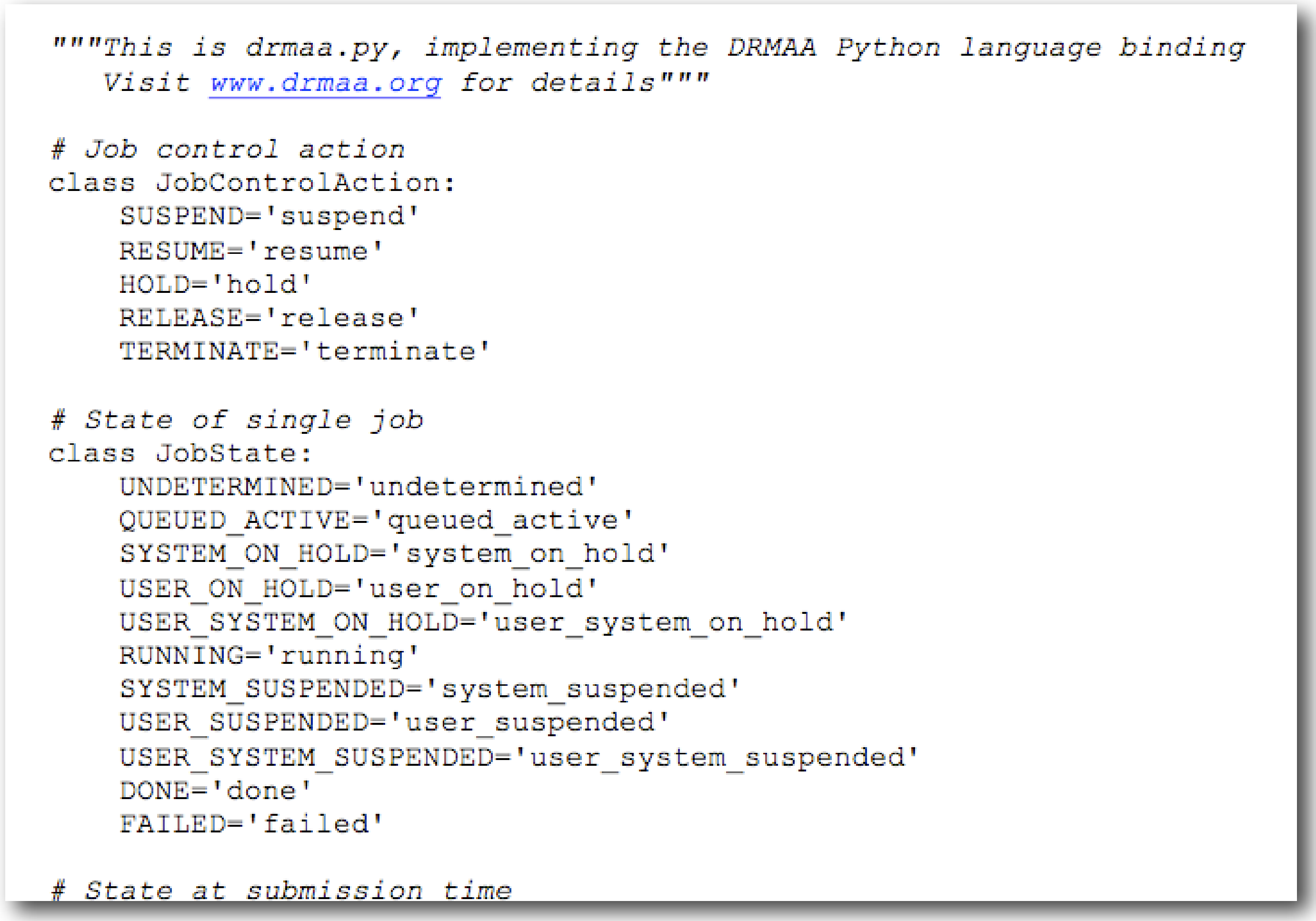
- All behavioral aspects in the root spec
  - API feature set, functional behavior, error conditions, multithreading issues
- Language binding provides syntactical mapping only (Example: GFD.143)
- Interfaces are mapped to classes (OO languages) or can be flattened (C language)



2. Python Language Mapping for DRMAA

A Python module implementation can declare "DRMAA 1.0-compliance" if it realizes the API signature described in the following sections, and the functional behavior as described in [GFD130]. Additional module functionality beside the specified API is allowed, but must be clearly identifiable (e.g. by a function name convention).
The following table provides the basic mapping overview for the DRMAA IDL constructs to the Python programming language:

DRMAA 1.0 IDL specification	*DRMAA 1.0 Python binding*
`module` definition	Python module file named "drmaa.py"
`interface` definition	`class` definition
`enum` definition with enumeration members	`class` definition
`string` type	`str`
`long` type	`int`
`long long` type	`long`
`const` definition	Pre-defined `class` attributes
`boolean` type	`bool`



```
"""This is drmaa.py, implementing the DRMAA Python language binding
   Visit www.drmaa.org for details"""

# Job control action
class JobControlAction:
    SUSPEND='suspend'
    RESUME='resume'
    HOLD='hold'
    RELEASE='release'
    TERMINATE='terminate'

# State of single job
class JobState:
    UNDETERMINED='undetermined'
    QUEUED_ACTIVE='queued_active'
    SYSTEM_ON_HOLD='system_on_hold'
    USER_ON_HOLD='user_on_hold'
    USER_SYSTEM_ON_HOLD='user_system_on_hold'
    RUNNING='running'
    SYSTEM_SUSPENDED='system_suspended'
    USER_SUSPENDED='user_suspended'
    USER_SYSTEM_SUSPENDED='user_system_suspended'
    DONE='done'
    FAILED='failed'

# State at submission time
```

DRMAA v2 Layout

DRMAA
Distributed Resource Management Application API — www.drmaa.org

```
module DRMAA{


interface Session


interface JobTemplate


interface JobInfo

...

}
```

```
module DRMAA2{

   interface SessionManager

   interface JobSession

   interface MonitoringSession

   interface JobTemplate

   interface Job

   interface JobInfo

   ...

   }
```

DRMAA v2 Session Management

DRMAA
Distributed Resource Management Application API — www.drmaa.org

```
interface SessionManager{
     readonly attribute string drmsInfo;
     readonly attribute Version version;
     JobSession createJobSession(in string sessionName, in string contactString)
     void closeJobSession(in JobSession s)
     void destroyJobSession(in string sessionName)
     string[] getJobSessions()
     MonitoringSession createMonitoringSession (in string contactString)
     void closeMonitoringSession(in MonitoringSession s)
};
```

- Create multiple sessions to one / more DRM systems at the same time
- Distinguishing between job management and machine monitoring
- *JobSession* instances are restartable by their *sessionName*
- Design of *MonitoringSession* interface is still unclear
    - Intended for ‚global view‘ of the DRM system, regardless of submission session

DRMAA v2 Job Session

```
interface DrmaaCallback {
   void notify(in DrmaaNotification event)

interface JobSession{
   readonly attribute string contact;
   void registerEventNotification(in DrmaaCallback callback)
      raises UnsupportedFeatureExeption, ....
   JobTemplate createJobTemplate()
   void deleteJobTemplate(in DRMAA::JobTemplate jobTemplate)
   Job runJob(in DRMAA::JobTemplate jobTemplate)
   sequence<Job> runBulkJobs(...)
   sequence<Job> waitAnyStarted(in sequence<Job> jobs, in long long timeout)
   sequence<Job> waitAnyTerminated(in sequence<Job> jobs, in long long timeout)
};
```

- Optional support for event push notification
- *waitAnyStarted():* Wait for one of the „start states“ to happen
  - *RUNNING, *_SUSPENDED*
- *waitAnyTerminated():* Wait for *FAILED* / *DONE* to happen

DRMAA v2 Job

```
interface Job {
      void suspend()
      void resume()
      void hold()
      void release()
      void terminate()
      JobState getState(out native subState)
      void waitStarted(in long long timeout)
      void waitTerminated(in long long timeout)
      JobInfo getInfo()
};
```

- New *Job* object as root concept (still represented by string in C-binding)
- *drmaa_control(string, JobControlAction)* replaced by dedicated methods
- *waitStarted()* and *waitTerminated()* as on *JobSession* level
- New *subState* concept for implementation-specific state information
- Explicit fetching of job information (instead of implicit *drmaa_wait()* result)

DRMAA v2 Job Info

DRMAA
Distributed Resource Management Application API — www.drmaa.org

```
interface JobInfo {
     readonly attribute Dictionary resourceUsage;
     readonly attribute boolean hasExited;
     readonly attribute long exitStatus;
     ... [old DRMAA1 job information] ...
     readonly attribute JobState jobState;
     readonly attribute string jobSubState;
     readonly attribute string masterMachine;
     readonly attribute string[] slaveMachines;
     readonly attribute string submissionMachine;
     readonly attribute string jobOwner;
     // amount of time since job was started
     readonly attribute long wallclockTime;
     // amount of time remaining until the job will be terminated
     readonly attribute long wallclockLimit;
     // amount of CPU seconds consumed
     readonly attribute long cpuTime;
     // and so on for submission time, dispatch time, start time, finish time,
     // memory usage and limits
     ...
};
```

Other Decisions

- Some removals (different hold states, partial time stamps) and renamings
- Some things are still rejected - security, job signalling, pending job changing
- Still huge list of open issues
  - Supported job and machine monitoring attributes
  - Maybe DRM monitoring (e.g. list of hosts, queues)
  - Possible new states (e.g. re-scheduled)
  - File transfer capabilities
  - Resource requirement specification in job template
  - More job template macros
  - Workflow support
  - DRMAA JSDL profile
  - ...

Participation

DRMAA
Distributed Resource Management Application API — www.drmaa.org

- Please talk with us
  - Subscribe to mailing list (check www.drmaa.org)
  - Bi-weekly phone conference (Tuesday, 19:00 UTC)
  - @Sun: Daniel Templeton, Daniel Gruber
- We need
  - Fresh ideas (still)
  - API design proposals for unsolved issues
  - Check for DRMS implementability (LSF, PBS, or EGEE, anybody ?)
  - Check for language binding issues
  - Your implementation story