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## Usage Record – Format Recommendation

### Status of This Document

Group Working Draft (GWD)

### Obsoletes

This document obsoletes GFD-R-P.098[? ].

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### Abstract

For resources to be shared, sites must be able to exchange basic accounting and usage data in a common format. This document describes a common format with which to exchange basic accounting and usage data on different resources. This record format is intended to facilitate the sharing of usage information, particularly in the area of ~~job accounting; storage accounting and cloud accounting~~ the accounting of jobs, computing, memory, storage and cloud usage but with a structure that allows an easy extension to other resources. This document describes the Usage Record components both in natural language form and annotated XML.

This document does not address how these records should be used, nor does it attempt to dictate the format in which the accounting records are stored at a local site; ~~instead~~ Instead, it defines a common exchange format. Furthermore, nothing is said regarding the ~~communications~~ communication mechanisms employed to exchange the records, i.e. transport layer, framing, authentication, integrity, etc.

## Contents

Abstract . . . . .	1
Contents . . . . .	2
1 Introduction . . . . .	5
1.1 Context . . . . .	5
1.1.1 History . . . . .	5
1.1.2 What This Document Is Not . . . . .	6
1.2 Format of the Record Specification . . . . .	6
1.2.1 . . . . .	6
2 Conventions Used in this Document . . . . .	6
2.1 Notational Conventions . . . . .	6
2.2 Meta Properties . . . . .	6
2.2.1 Description . . . . .	6
2.2.2 Metric . . . . .	7
2.2.3 Time Stamps . . . . .	7
2.3 Conventions . . . . .	7
2.4 Supported Data Types . . . . .	7
3 RecordIdentityBlock . . . . .	8
3.1 RecordId . . . . .	8
3.2 CreateTime . . . . .	8
3.3 Site . . . . .	8
3.4 Infrastructure . . . . .	9
4 SubjectIdentityBlock . . . . .	10
4.1 LocalUserId . . . . .	10
4.2 LocalGroupId . . . . .	10
4.3 GlobalUserId . . . . .	10
4.4 GlobalGroupId . . . . .	11
4.5 GlobalGroupAttribute . . . . .	11
5 ComputeUsageBlock . . . . .	12
5.1 CpuDuration . . . . .	12
5.2 WallDuration . . . . .	12
5.3 StartTime . . . . .	12
5.4 EndTime . . . . .	13
5.5 Host . . . . .	13
5.6 HostType . . . . .	14
5.7 Processors . . . . .	14
5.8 NodeCount . . . . .	14

5.9	Charge	15
5.10	Charge	15
6	JobUsageBlock	16
6.1	GlobalJobId	16
6.2	LocalJobId	16
6.3	JobName	16
6.4	MachineName	17
6.5	SubmitHost	17
6.6	Middleware	17
6.7	Queue	18
6.8	TimeInstant	18
6.9	ServiceLevel	19
6.10	Status	19
7	MemoryUsageBlock	21
7.1	MemoryClass	21
7.2	MemoryResourceCapacityUsed	21
7.3	MemoryLogicalCapacityUsed	21
7.4	MemoryResourceCapacityAllocated	22
7.5	StartTime	22
7.6	EndTime	22
7.7	Host	22
7.8	HostType	22
7.9	Charge	22
8	StorageUsageBlock	23
8.1	StorageShare	23
8.2	StorageMedia	23
8.3	StorageClass	23
8.4	DirectoryPath	24
8.5	FileCount	24
8.6	StorageResourceCapacityUsed	24
8.7	StorageLogicalCapacityUsed	25
8.8	StorageResourceCapacityAllocated	25
8.9	StartTime	26
8.10	EndTime	26
8.11	Host	26
8.12	HostType	26
8.13	Charge	26
9	CloudUsageBlock	27
9.1	LocalVirtualMachineId	27

9.2	GlobalVirtualMachineld	27
9.3	<a href="#">SuspendDurationStatus</a>	27
9.4	<a href="#">SuspendDuration</a>	28
9.5	Imageld	28
9.6	MachineName	28
9.7	SubmitHost	29
9.8	TimeInstant	29
9.9	ServiceLevel	29
9.10	<a href="#">Status</a>	29
10	Attributes Matrix	30
11	Field Summaries	34
11.1	RecordIdentityBlock	34
11.2	SubjectIdentityBlock	34
11.3	ComputeUsageBlock	34
11.4	JobUsageBlock	35
11.5	MemoryUsageBlock	35
11.6	StorageUsageBlock	36
11.7	CloudUsageBlock	37
12	Examples	38
12.1	Full example	38
12.2	Grid example	40
12.3	Cloud example	41
12.4	Local example	41
12.5	Minimal examples	41
12.5.1	Job record	41
12.5.2	Storage record	42
13	Security Considerations	44
14	Glossary	44
15	Contributors	45
16	Acknowledgments	47
17	Intellectual Property Statement	48
18	Disclaimer	48
19	Full Copyright Notice	48
20	References	50

# 1 Introduction

In order for resources to be shared, sites must be able to exchange basic accounting and usage data in a common format. This document focuses on the representation of resource consumption data. The document then goes on to describe an XML-based format for usage records. The record format is intended to be specific enough to facilitate information sharing among grid sites, yet general enough that the usage data can be used for a variety of purposes: traditional usage accounting, charging, service usage monitoring, performance tuning, etc. The purpose of this document is to outline the basic building blocks of the accounting record, and how to properly represent them. All other tangential concerns such as the use, transport mechanism, and security are out of scope for this representation layer.

## 1.1 Context

To comprehend the structure of the schema presented in this document, it is important to understand the context in which this specification has been developed. The accounting of different use-cases involves recording:

- General properties related to the record itself
- Properties related to the consumer of the resources
- Usage of one or more resources.

Hence, the usage record schema is made up of a set of blocks for general properties, consumer and distinct resources.

### 1.1.1 History

Before the definition of UR-2.0, different usage record definitions building on the job accounting definition of UR-1.0 [? ], started to surface to describe various resource usages, such as the EMI Compute Accounting Record (~~CAR~~)CAR [? ], the EMI Storage Accounting Record (~~StAR~~)StAR [? ], the EGI Cloud Usage Record (~~CUR~~)CUR<sup>1</sup> and the Storage Accounting Implementation (~~SAI~~)SAI [? ]. The definition of UR-2.0 came from the **experience experiences** of these record definitions and is built as an easily extensible superset of these new usage records.

---

<sup>1</sup><https://wiki.egi.eu/wiki/Fedcloud-tf:WorkGroups:Scenario4>

### 1.1.2 What This Document Is Not

This document and specification do not attempt to define a comprehensive “grid accounting” standard. As with all accounting implementations, there is no one-size-fits-all solution, that will meet the needs of all projects and resource providers. This document does not address summary records, “grid job” records, consolidated records, or anything other than an atomic resource consumption instantiation. Sufficient resource and user information is collected to allow for effective and appropriate levels of aggregation, consolidation, and summarization, but the details of how sites implement these features (e.g., what grids do with the atomic data) are beyond the scope of this document.

## 1.2 Format of the Record Specification

### 1.2.1

???????????

## 2 Conventions Used in this Document

### 2.1 Notational Conventions

The key words “MUST” “MUST NOT”, “REQUIRED”, “SHALL”, “SHALL NOT”, “SHOULD”, “SHOULD NOT”, “RECOMMENDED”, “MAY”, and “OPTIONAL” are to be interpreted as described in RFC 2119 [? ], except that the words do not appear in uppercase.

### 2.2 Meta Properties

Meta properties are associated with individual base properties to provide additional information and semantic meaning of the value for a base property. The meta properties outlined below are commonly encountered and should be supported for the indicated base properties.

#### 2.2.1 Description

The description provides a mechanism for additional, optional information to be attached to a Usage Record base property. The value of this meta-property MAY provide clues to the semantic context to use while interpreting or examining the value of the owning base property.

### 2.2.2 Metric

This meta-property identifies the type of measurement used for quantifying the associated resource consumption if there are multiple methods to measure resource usage. As an example, disk usage may be measured as total, average, minimum or maximum usage. However, even if pertinent to the assessed charge, this meta-property does not attempt to differentiate between requested and utilized quantities of resource usage.

### 2.2.3 Time Stamps

Time stamps should follow the ISO 8601[?] standard as well. This includes enumerating the time zone, as specified in the standard.

## 2.3 Conventions

Unless otherwise stated, all fields are optional. A required field is only required if the corresponding block is present.

## 2.4 Supported Data Types

1. String: Data of this type has no required restrictions on the length or available characters.
2. Integer
3. Positive Integer: Data of this type must have a value of zero or greater.
4. Non-zero Integer: Data of this type must have a value of one or greater.
5. Float
6. Timestamp: Data of this type must comply with the UTC time zone format specified in ISO 8601.
7. DomainName: Data of this type must comply with RFC 1034[?] format for fully qualified domain names. The constraints are a maximum 255 characters long, containing only alphabetic and numeric characters, the “-“, and the “.” characters.

### 3 RecordIdentityBlock

This block contains the properties related to the identity of the usage record itself.

#### Example

```
<ur:RecordIdentityBlock>
<!-- Identity properties go in here -->
</ur:RecordIdentityBlock>
```

#### 3.1 RecordId

A record identity uniquely defines a record in the set of all usage ~~record for the grid implementation~~records of the accounting context.

- ~~The *RecordId* attribute~~ *RecordId* MUST be present in the *RecordIdentityBlock*.
- ~~The *RecordId*~~ MUST have the type string.

#### Example

```
<ur:RecordId>"host.example.org/ur/87912469269276"</ur:RecordId>
```

#### 3.2 CreateTime

~~This attribute is used to specify the~~ The time when this particular Usage Record was created.

- ~~The *CreateTime* attribute~~ *CreateTime* MUST be present in the *RecordIdentityBlock*.
- ~~The *CreateTime* attribute~~ *CreateTime* MUST be an ISO 8601:2004 timestamp.

#### Example

```
<ur:CreateTime>2013-05-09T09:06:52Z</ur:CreateTime>
```

#### 3.3 Site

~~This property describes the~~ The site at which the resource is located. This property should contain a descriptive name of the group of resources which are accounted for in the record. The *Site* value should be constructed in such a way that it is unique within the context where it is used.

- ~~The *Site* field type~~ *Site* MUST be a string.

#### Example



```
<ur:Site>"ACME-University"</ur:Site>
```

### 3.4 Infrastructure

The infrastructure where the resource was used (e.g., EGI or OSG). The ‘description’ attribute SHOULD be used to give additional information on the used infrastructure.

- *Infrastructure* MUST be present [in the RecordIdentityBlock.](#)
- [Infrastructure](#) MUST be a string.

#### Example

```
<ur:Infrastructure>"OSG"</ur:Infrastructure>
```

## 4 SubjectIdentityBlock

This block contains the properties related to the identity of the subject accounted for. ~~Note that as~~ As all fields in this block are optional, this block SHOULD be associated with a profile that defines at least one field that must be present in the specific implementation.

### Example

```
<ur:SubjectIdentityBlock>
<!-- Identity properties go in here -->
</ur:SubjectIdentityBlock>
```

### 4.1 LocalUserId

~~This property describes the~~ The local identity of the user accountable for the resource consumption (e.g., the Unix user).

- ~~The LocalUserId field type~~ LocalUserId MUST be a string.

### Example

```
<ur:LocalUserId>"johndoe"</ur:LocalUserId>
```

### 4.2 LocalGroupId

~~This property describes the~~ The local group accountable for the resource consumption (e.g., Unix group).

- ~~The LocalGroupId field type~~ LocalGroupId MUST be a string.

### Example

```
<ur:LocalGroupId>"projectA"</ur:LocalGroupId>
```

### 4.3 GlobalUserId

~~This property describes the~~ The global identity of the user accountable for the resource consumption. The property should identify the user globally, such that clashes do not happen accidentally, e.g. it could be an X500 identity.

- ~~The GlobalUserId field type~~ GlobalUserId MUST be a string.

### Example

```
<ur:GlobalUserId>"/O=Grid/OU=example.org/CN=John Doe"</ur:GlobalUserId>
```

## 4.4 GlobalGroupId

~~This property describes the~~ The global group accountable for the resource consumption. The property should identify the group globally, such that clashes do not happen accidentally, e.g. using a FQDN-Fully Qualified Domain Name (FQDN) to construct it. In Grid terms a Grid context, this would typically be the ~~VO name~~ name of the Virtual Organization (VO).

- ~~The GlobalGroupId field type~~ GlobalGroupId MUST be a string.

### Example

```
<ur:GlobalGroupId>"binarydataproject.example.org"</ur:GlobalGroupId>
```

## 4.5 GlobalGroupAttribute

~~This property describes supplemental~~ Supplemental traits of the group property, e.g., ~~sub-groups a~~ sub-group, role or authority. This makes it possible to account for segments of a group, while still being able to account for the group as a whole. The ~~property consists of a type which~~ attribute type denotes the type of ~~attribute and an actual value for the attribute.~~ the group property.

- ~~The GlobalGroupAttribute property can be repeated~~ GlobalGroupAttribute MAY be present multiple times.
- ~~The GlobalGroupId property MUST exist in the record if~~ GlobalGroupAttribute MUST be a string.
- If GlobalGroupAttribute is specified, GlobalGroupId MUST be present.
- ~~The GlobalGroupAttribute type and field values~~ If GlobalGroupAttribute is specified, the attribute type MUST exist.
- ~~The attribute GlobalGroupAttributetype MUST have the type string. The GlobalGroupAttribute field type MUST type~~ MUST be a string.

### Example

```
<ur:GlobalGroupAttribute ur:type="subgroup">ukusers</ur:GlobalGroupAttribute>
```

## 5 ComputeUsageBlock

This block contains the properties related to compute usage.

### Example

```
<ur:ComputeUsageBlock>
<!--Compute Record properties go in here -->
</ur:ComputeUsageBlock>
```

### 5.1 CpuDuration

~~This element contains the~~ The CPU time consumed. If the task ran on many cores/processors/nodes, all separate consumptions shall be aggregated in this value. This has an impact for example on ~~on~~ MPI usage, where the consumption of all the “nodes” get aggregated into this CPU consumption.

- *CpuDuration* MUST be present ~~and~~ in the block.
- *CpuDuration* MUST contain a time duration as defined in ISO 8601:2004[? ].

### Example

```
<ur:CpuDuration>PT3600S</ur:CpuDuration>
```

### 5.2 WallDuration

WallClock time elapsed during the process execution. In the case of MPI parallel applications (like MPI) *WallDuration* might be lower than *CpuDuration*.

- *WallDuration* MUST be present ~~and~~ in the block.
- *WallDuration* MUST contain a time duration as defined in ISO 8601:2004[? ].

### Example

```
<ur:WallDuration>PT3600S</ur:WallDuration>
```

### 5.3 StartTime

~~This property describes a~~ A timestamp indicating the time at which the measured resource consumption started. Together with *EndTime* this defines a period over which the resource has been consumed.

- ~~The *StartTime* field~~ *StartTime* MUST be present in the block.

- ~~The *StartTime* field type~~ *StartTime* MUST be an ISO 8601:2004 timestamp.
- The time zone may be specified as Z (UTC) or (+—)hh:mm. Time zones that are not specified are considered undetermined.

### Example

```
<ur:StartTime>2013-05-31T11:00:00</ur:StartTime>
```

## 5.4 EndTime

~~This property describes a~~ *A* timestamp indicating the time at which the measured resource consumption ended. Together with *StartTime* this defines a period over which the resource has been consumed.

- ~~The *EndTime* field~~ *EndTime* MUST be present in the block.
- ~~The *EndTime* field type~~ *EndTime* MUST be an ISO 8601:2004 timestamp.
- The time zone may be specified as Z (UTC) or (+—)hh:mm. Time zones that are not specified are considered undetermined.

### Example

```
<ur:EndTime>2013-05-31T12:00:00</ur:EndTime>
```

## 5.5 Host

~~This is used to identify the~~ *The* host where the user consumed the resource. As an example, in case of MPI ~~process~~ *processes* more than one ~~Host~~ *Host* parameter can be specified. If a master node for the computation can be identified, it can be flagged as “primary” with a dedicated attribute. The ~~processId~~ *attribute* ~~attribute~~ *processId* SHOULD be used to identify the process ID of the process running at the host. For example this is required in case of MPI process that use multiple hosts.

- ~~The *Host* field type~~ *Host* MUST be a string.
- *Host* SHOULD be present.
- Multiple instances of ~~this element~~ *Host* MAY be present.
- The ~~processId~~ *attribute* ~~attribute~~ *processId* MAY be present multiple times in this element.
- The ~~processId~~ *attribute* ~~field type~~ *attribute* *processId* MUST be a ~~non-zero~~ *Non-zero* Integer.

**Example**

```
<ur:Host ur:processId=1042>"compute-0-1.abel.uio.no"</ur:Host>
```

**5.6 HostType**

The type of service according to a namespace-based classification. The namespace MAY be related to a middleware name, ~~and an~~ organization or other concepts; [org.ogf.glue.\\*](https://forge.ogf.org/sf/go/projects.glue-wg/wiki) is reserved for ~~Types types~~ defined by the OGF GLUE Working Group<sup>2</sup>.

- The *HostType* field type MUST be a string.

**Example**

```
<ur:HostType>"org.nordugrid.arex"</ur:HostType>
```

**5.7 Processors**

The number of processors used or requested. A processor definition may be dependent on the machine architecture. Typically ~~processor~~, [Processors](https://forge.ogf.org/sf/go/projects.glue-wg/wiki) is equivalent to the number of physical CPUs used. For example, if a process uses two cluster “nodes”, each node having 16 CPUs each, the total number of processors would be 32. [In addition, a processor can consist of several cores which may be used independently. In the example above the use of dual-core processors would thus increase the number to 64.](https://forge.ogf.org/sf/go/projects.glue-wg/wiki)

- ~~The Processors value~~ [Processors](https://forge.ogf.org/sf/go/projects.glue-wg/wiki) MUST be of type Non-zero Integer.

**Example**

```
<ur:Processors>1</ur:Processors>
```

**5.8 NodeCount**

Number of nodes used. A node definition may be dependent on the architecture, but typically a node is a physical machine. For example a cluster of 16 physical machines with each machine having one processor each is a 16 “node” machine, each with one “processor”. A 16 processor SMP machine however, is ~~1 one~~ physical node (machine) with 16 processors.

- ~~The NodeCount value~~ [NodeCount](https://forge.ogf.org/sf/go/projects.glue-wg/wiki) MUST be of type Non-zero Integer.

**Example**

```
<ur:NodeCount>1</ur:NodeCount>
```

---

<sup>2</sup><https://forge.ogf.org/sf/go/projects.glue-wg/wiki>

## 5.9 Charge

This ~~is~~ property may be used for economic accounting ~~purpose~~purposes. It is the charge applied to the user-users resource usage. ~~When specifying *Charge*, the following two attributes MUST be specified: *unit* —~~

~~The attribute *unit* defines the currency used to report the charge as defined in ISO 4217<sup>3</sup>. The *unit* attribute type MUST be an ISO 4217 alphabetic code. *formula* — The *unit*, while the attribute *formula* describes the~~ cost computation formula adopted to compute the applied charge.

- ~~The *formula* attribute type MUST be a string. The *Charge* field type *Charge* MUST be a float.~~

~~`ur:Charge ur:formula="42 units/CPU/day" ur:unit="USD">1.75</ur:Charge>`~~

## 5.10 Charge

~~This is property may be used for economic accounting purpose. It is the charge applied to the user resource usage.~~

- ~~When specifying *Charge*, the following two attributes MUST be specified: *unit* — defines the currency used to report the charge as defined in ISO 4217<sup>3</sup> *unit* MUST be present if *Charge* is specified.~~
- ~~The *unit* attribute type *unit* MUST be an ISO 4217<sup>3</sup> alphabetic code.~~
- ~~*formula* — The cost computation formula adopted to compute the applied charge. The *formula* attribute type MUST be a string. *formula* MUST be present if *Charge* is specified.~~
- ~~The *Charge* *formula* field type MUST be a ~~float~~string.~~

### Example

```
<ur:Charge ur:formula="42 units/CPU/day" ur:unit="USD">1.75</ur:Charge>
```

<sup>3</sup><http://www.iso.org/iso/currencySUBSCRIPTNBcodes>

<sup>3</sup><http://www.iso.org/iso/currencySUBSCRIPTNBcodes>

<sup>3</sup><http://www.iso.org/iso/currencySUBSCRIPTNBcodes>

## 6 JobUsageBlock

This block contains the properties related to job usage. The block is intended to be used for jobs submitted to a batch system, a Grid or something similar.

### Example

```
<ur:JobUsageBlock>
<!-- Job Record properties go in here -->
</ur:JobUsageBlock>
```

### 6.1 GlobalJobId

~~This property describes the~~ The global identity of the job. The property should identify the job globally, such that clashes do not happen accidentally. This could for example be a combination of a time stamp, a local job id and a host name.

- The *GlobalJobId* field type MUST be a string.

### Example

```
<ur:GlobalJobId>"host.example.org/ab1234/2013-05-09T09:06:52Z"</ur:GlobalJobId>
```

### 6.2 LocalJobId

~~This property describes the~~ The local identity of the job. ~~LocalJobId MUST contain the LRMS ID for the job as~~ For example, this may be the ID the job got assigned by the ~~batch system.~~ local resource management system (LRMS).

- ~~The LocalJobId field type~~ LocalJobId MUST be a string.

### Example

```
<ur:LocalJobId>"ab1234"</ur:LocalJobId>
```

### 6.3 JobName

~~This attribute may contain a descriptive~~ A descriptive name of the job. It has to be stressed that user defined job names are often difficult to retrieve from an accounting perspective and are not suitable for reliable accounting purposes.

- ~~The JobName field type~~ JobName MUST be a string.

### Example



```
<ur:JobName>"HiggsGammaGamma42"</ur:JobName>
```

## 6.4 MachineName

~~Identifier for the computing facility managing the job. *MachineName* SHOULD be a descriptive name of the machine on which the job ran. This may be a system hostname, the LRMS server *host name*. hostname or a sites name for a cluster of machines. The identification of the machine by name may assume the context of the site or Grid in which the machine participates, i.e. machine names may be unique within a specific site or Grid, but do not need to be unique globally.~~

- *MachineName* SHOULD be present in the record.
- ~~The *MachineName* field type~~ *MachineName* MUST be a string.

### Example

```
<ur:MachineName>"ce.example.org"</ur:MachineName>
```

## 6.5 SubmitHost

The host ~~submitting the job.~~ from which the jobs was submitted.

- In a ~~grid~~ Grid environment *SubmitHost* MUST be present.
- In a ~~grid~~ Grid environment *SubmitHost* MUST report the Computing Element Unique ID.
- The *SubmitHost* field type MUST be a string.

### Example

```
<ur:SubmitHost>
  "nordugrid-cluster-name=ce.example.org,Mds-Vo-name=local,o=grid"
</ur:SubmitHost>
```

## 6.6 Middleware

The purpose of this element is to mark whether the job was submitted locally or through a ~~grid~~ (Grid) middleware. At least the values “local” and “grid” MUST be supported. The ~~description attribute~~ attribute description SHOULD be used to give additional information on the used middleware.

- *Middleware* MUST be present.

- Middleware MUST be a string.
- The values “local” and “grid” MUST be supported.
- The ~~Middleware field type~~ MUST be a string. ~~The description attribute~~ attribute description SHOULD be used.
- The ~~description attribute type~~ attribute description MUST be a string.

### Example

```
<ur:Middleware ur:description="ARC CE">"grid"</ur:Middleware>
```

## 6.7 Queue

The name of the queue from which the job was executed or submitted.

- ~~Queue field type~~ MUST be a string.
- ~~A description attribute~~ The attribute description MAY be specified.
- The ~~description attribute type~~ attribute description MUST be a string.

### Example

```
<ur:Queue ur:description="execution">"Bigmem"</ur:Queue>
```

## 6.8 TimeInstant

~~This element may be used to insert in the records any time~~ Time instant related to the user payload. Three optional values for the ~~type attribute~~ attribute type are defined as they are of common usage by batch systems. The semantic is derived from Torque.

- *TimeInstant* SHOULD be present in the record.
- *TimeInstant* MAY be present multiple times.
- ~~The TimeInstant field type~~ TimeInstant MUST be an ISO 8601:2004 timestamp.
- The ~~following three types~~ attribute type MUST be a string.
- The following three values of the attribute type are defined and SHOULD be reported:
  - *Ctime* - Time job was created
  - *Qtime* - Time job was queued
  - *Etime* - Time job became eligible to run

~~The *type* attribute type MUST be a string.~~

### Example

```
<ur:TimeInstant ur:type="Etime">2013-05-31T10:59:42</ur:TimeInstant>
```

## 6.9 ServiceLevel

This element is used to insert computing benchmarks and normalization factors. At least one normalization factor MUST be present in the record.

- *ServiceLevel* MUST be present in the record.
- *ServiceLevel* MAY be present multiple times.
- The *ServiceLevel* field type MUST be of type float.
- At least the following types should be supported:
  - *Si2k* – SpecInt2000
  - *Sf2k* – SpecFloat2000
  - *HEPSPEC* – HEPSpec
- The *type* attribute MUST be present in the element.
- The *type* attribute type MUST be a string.

### Example

```
<ur:ServiceLevel type="Si2k">3.14</ur:ServiceLevel>
```

## 6.10 Status

~~This property will represent the completion~~ Completion status of the job. For example, this may represent the exit status of an interactive running process or the exit status from the batch queuing ~~system's~~ systems accounting record. The semantic meaning of status is site dependent.

- ~~The value of~~ *Status* MUST be of type String.
- ~~The *Status* property~~ *Status* MUST exist in the record.
- ~~The *Status* property~~ *Status* MUST support the following values:
  - *aborted* – A policy or human intervention caused the job to cease execution.
  - *completed* – The execution completed.

- *failed* – Execution halted without external intervention.
  - *held* – Execution is held at the time this usage record was generated.
  - *queued* – Execution was queued at the time this usage record was generated.
  - *started* – Execution started at the time this usage record was generated.
  - *suspended* – Execution was suspended at the time this usage record was generated.
- The *Status* property MAY support other values, as agreed upon within the implementation context.

### Example

```
<ur:Status>"aborted"</ur:Status>
```

## 7 MemoryUsageBlock

This block contains the properties related to memory usage. The block may be present several times to account for different types of memory (e.g., RAM and swap).

### Example

```
<ur:MemoryUsageBlock>
<!! Memory Usage properties go in here -->
</ur:MemoryUsageBlock>
```

### 7.1 MemoryClass

~~This property describes the~~ The class of memory used (~~virtual~~, Virtual and real memory must be supported but others might be specified). This is a descriptive value, which allows the memory system to provide details about the memory used.

- *MemoryClass* MUST be present in the record.
- The *MemoryClass* field type MUST be a string.
- The values “RAM” and “swap” MUST be supported.

### Example

```
<ur:MemoryClass>"RAM"</ur:MemoryClass>
```

### 7.2 MemoryResourceCapacityUsed

~~This property describes the~~ The number of physical bytes used on the memory system (e.g., the amount of memory resources used for this process). This is the main metric for measuring memory consumption.

- *MemoryResourceCapacityUsed* MUST be present in the record.
- The *MemoryResourceCapacityUsed* attribute field type MUST be ~~an~~ a positive Integer.

### Example

```
<ur:MemoryResourceCapacityUsed>14728</ur:MemoryResourceCapacityUsed>
```

### 7.3 MemoryLogicalCapacityUsed

~~This property describes the~~ The number of bytes allocated for this process on the memory system (e.g., the amount of memory resources made available for this process; ~~this~~). This

value may be higher than the *MemoryResourceCapacityUsed* because it may also include bytes that are not really used by the process).

- The *MemoryLogicalCapacityUsed* attribute field type MUST be ~~an~~ a positive Integer.

#### Example

```
<ur:MemoryLogicalCapacityUsed>56437</ur:MemoryLogicalCapacityUsed>
```

### 7.4 MemoryResourceCapacityAllocated

~~This property describes the~~ The number of bytes required by the process (e.g., the memory requested in a job description).

- The *MemoryResourceCapacityAllocated* attribute field type MUST be ~~an~~ a positive Integer.

#### Example

```
<ur:MemoryResourceCapacityAllocated>42000</ur:MemoryResourceCapacityUsed>
```

### 7.5 StartTime

Same as *StartTime* in *ComputeUsageBlock* ([see chapter 5.3](#)).

### 7.6 EndTime

Same as *EndTime* in *ComputeUsageBlock* ([see chapter 5.4](#)).

### 7.7 Host

Same as *Host* in *ComputeUsageBlock* ([see chapter 5.5](#)).

### 7.8 HostType

Same as *HostType* in *ComputeUsageBlock* ([see chapter 5.6](#)).

### 7.9 Charge

Same as *Charge* in *ComputeUsageBlock* ([see chapter 5.9](#)).

## 8 StorageUsageBlock

This block contains the properties related to storage usage.

### Example

```
<ur:StorageUsageBlock>
<!--Storage Record properties go in here -->
</ur:StorageUsageBlock>
```

### 8.1 StorageShare

~~This property describes the~~ The part of the storage system which is accounted for in the record. For a storage system, which is split into several logical parts, this can be used to account for consumption on each of these parts. The value should be able to identify the share of the storage system, given the storage system property.

- ~~The *StorageShare* field type~~ StorageShare MUST be a string.

### Example

```
<ur:StorageShare>pool-003</ur:StorageShare>
```

### 8.2 StorageMedia

~~This property describes the~~ The media type of storage that is accounted for in the record (e.g. e.g. “disk” or “tape”). This allows for accounting of different backend storage types).

- ~~The *StorageMedia* field type~~ StorageMedia MUST be a string.

### Example

```
<ur:StorageMedia>disk</ur:StorageMedia>
```

### 8.3 StorageClass

~~This property describes the~~ The class of the stored data, e.g. “pinned”, “replicated”, or “precious”. ~~This~~ It is a descriptive value, which allows ~~the storage system~~ to provide details about the stored data.

- ~~The *StorageClass* field type~~ StorageClass MUST be a string.

### Example

```
<ur:StorageClass>replicated</ur:StorageClass>
```

## 8.4 DirectoryPath

~~This property describes the~~ The directory path being accounted for. If the property is included in the record, the record should account for all usage in the directory and only that directory.

- ~~The *DirectoryPath* field type~~ *DirectoryPath* MUST be a string.

### Example

```
<ur:DirectoryPath>/projectA</ur:DirectoryPath>
```

## 8.5 FileCount

~~This property describes the~~ The number of files which are accounted for in the record.

- ~~The *FileCount* field type~~ *FileCount* MUST be a positive non-zero integer.

### Example

```
<ur:FileCount>42</ur:FileCount>
```

## 8.6 StorageResourceCapacityUsed

~~This property describes the~~ The number of bytes used on the storage system or storage share where appropriate. This is the main metric for measuring storage resource consumption. It should include all resources for which the identity of the record is accountable for.

*StorageResourceCapacityUsed* can include reserved space, file metadata, space used for redundancy in RAID setups, tape holes, or similar. The decision about including such “additional” space is left to the resource owner but should be made known to the user e.g. via the usage policy or a service level agreement. In contrary the *StorageLogicalCapacityUsed* denotes the pure file size (see chapter 8.7). If available, reserved space can be recorded explicitly with *StorageResourceCapacityAllocated* (see chapter 8.8).

- ~~The *StorageResourceCapacityUsed* property~~ *StorageResourceCapacityUsed* MUST be present in the ~~record~~ *StorageUsageBlock*.
- ~~The *StorageResourceCapacityUsed* field type~~ *StorageResourceCapacityUsed* MUST be a ~~nonnegative~~ non-negative integer.
- *StorageResourceCapacityUsed* SHOULD include all resources that are used to store the files. ~~The value~~



- [\*StorageResourceCapacityUsed\*](#) MAY also include resources that are no longer in use but are unavailable for reuse (e.g., if a file is removed from tape, the tape may not be immediately available for reuse), as documented in the appropriate [SLA-service level agreement](#) or usage policy documents.

### Example

```
<ur:StorageResourceCapacityUsed>14728</ur:StorageResourceCapacityUsed>
```

### Implementation Note:

Using bytes saves us from the argument of discussing if 1000 or 1024 should be used as a base. However, this also means that the number reported can be very large. Therefore any implementation should use at least a 64-bit integer to hold this variable (a signed 64-bit integer will overflow at 8 Exabytes).

## 8.7 StorageLogicalCapacityUsed

~~This property describes an integer denoting the~~ [The](#) number of “logical” bytes used on the storage system ~~by the identity of the record~~. By ”logical” is meant the sum of bytes of the files stored, i.e. excluding reservation~~and~~ any underlying replicas of files, [RAID overhead etc.](#)

- ~~The *StorageLogicalCapacityUsed* field type~~ [\*StorageLogicalCapacityUsed\*](#) MUST be a ~~nonnegative~~ [non-negative](#) integer.

### Example

```
<ur:StorageLogicalCapacityUsed>13617</ur:StorageLogicalCapacityUsed>
```

### Implementation Note:

Same as for *StorageResourceCapacityUsed* property ([see chapter 8.6](#)).

## 8.8 StorageResourceCapacityAllocated

~~This property describes the~~ [The](#) number of bytes allocated on the storage system or storage share ~~where appropriate~~. Depending on [the](#) implementation this property may be equal to *StorageResourceCapacityUsed*, ~~however this property~~. [However, it](#) should only take into account space allocated to the entity described in the record, not resources used for redundancy in RAID setups, tape holes, or similar.

- ~~The *StorageLogicalCapacityUsed* field type~~ *StorageLogicalCapacityUsed* MUST be a non-negative integer.

### Example

```
<ur:StorageResourceCapacityAllocated>14624</sr:StorageResourceCapacityAllocated>
```

Implementation Note:

Same as for *StorageResourceCapacityUsed* property ([see chapter 8.6](#)).

## 8.9 StartTime

Same as *StartTime* in *ComputeUsageBlock* ([see chapter 5.3](#)).

## 8.10 EndTime

Same as *EndTime* in *ComputeUsageBlock* ([see chapter 5.4](#)).

## 8.11 Host

~~This property describes the~~ The storage system on which the resources have been consumed. This value should be chosen in such a way that it globally identifies the storage system, on which resources are being consumed (~~eg., the FQDN~~ e.g. the Fully Qualified Domain Name of the storage system could be used).

- ~~The *Host* property~~ *Host* MUST be present in the ~~record~~ *StorageUsageBlock*.
- ~~The *Host* field MUST have the type string. The *Host* value SHOULD be constructed in such a way, that it globally identifies the storage system~~ MUST be a string.

### Example

```
<ur:Host>host.example.org</ur:Host>
```

## 8.12 HostType

Same as *HostType* in *ComputeUsageBlock* ([see chapter 5.6](#)).

## 8.13 Charge

Same as *Charge* in *ComputeUsageBlock* ([see chapter 5.9](#)).

## 9 CloudUsageBlock

This block contains the properties related to cloud usage.

Example

**Example**

```
<ur:CloudUsageBlock>
<!!|Cloud Record properties go in here -->
</ur:CloudUsageBlock>
```

### 9.1 LocalVirtualMachineId

~~This property describes the~~ The local identity of the Virtual Machine.

~~LocalVirtualMachineId MUST contain Virtual Machine ID as assigned~~ For example, this may be the ID assigned to by the Cloud ~~system.~~ management system.

- ~~The LocalVirtualMachineId field type~~ LocalVirtualMachineId MUST be a string.

**Example**

```
<ur:LocalVirtualMachineId>"ab1234"</ur:LocalVirtualMachineId>
```

### 9.2 GlobalVirtualMachineId

~~This property describes the~~ The global identity of the Virtual Machine. The property should identify the Virtual Machine globally, such that clashes do not happen accidentally. This could for example be a combination of time stamp, local Virtual Machine ~~id~~ ID and host name.

- ~~The GlobalVirtualMachineId field type~~ GlobalVirtualMachineId MUST be a string.

**Example**

```
<ur:GlobalVirtualMachineId>
  \DIFdelbegin \DIFdel{"}\DIFdelend host.example.org/ab1234/2013-05-09T09:06:52Z
\DIFdelbegin \DIFdel{"}\DIFdelend </ur:GlobalVirtualMachineId>
```

### 9.3 SuspendDurationStatus

~~SuspendDuration is a value that count for the~~ The status of the Virtual Machine.

- Status MUST be present in the CloudUsageBlock.

- Status MUST be string.
- Status MUST support the following values:
  - completed – The execution completed.
  - started – The execution started at the time this usage record was generated.
  - suspended – The execution was suspended at the time this usage record was generated.
- Status MAY support other values, as agreed upon within the implementation context.

### Example

```
\DIFadd{<ur:Status>"started"</ur:Status>
}
```

## 9.4 SuspendDuration

The amount of time in which the Virtual Machine ~~changed status to~~ status was “suspended”.

- *SuspendDuration* MUST be present ~~when Status if the Virtual Machine was suspended if the property Status (see chapter 9.3) of the Virtual Machine is~~ “suspended”.
- *SuspendDuration* MUST ~~contain~~ be a time duration as defined in ISO 8601:2004.

## 9.5 ImageId

~~ImageId identify provides the~~ The ID of the image used to instantiate the Virtual Machine ~~associated with the record.~~

- ImageId MUST be a string.

### Example

```
\DIFadd{<ur:ImageId>"UbuntuImage2013"</ur:ImageId>
}
```

## 9.6 MachineName

Same as *MachineName* in *JobUsageBlock* (see chapter 6.4).

## 9.7 SubmitHost

Same as *SubmitHost* in *JobUsageBlock* ([see chapter 6.5](#)).

## 9.8 TimeInstant

Same as *TimeInstant* in *JobUsageBlock* ([see chapter 6.8](#)).

## 9.9 ServiceLevel

Same as *ServiceLevel* in *JobUsageBlock* ([see chapter 6.9](#)).

## 9.10 **Status**

~~This property describes the status of the Virtual Machine.~~

~~This property MUST contain data of type string. This property MUST exist. This property MUST support the following values: completed — The execution completed. started — Execution started at the time this usage record was generated. suspended — Execution was suspended at the time this usage record was generated. This property MAY support other values, as agreed upon within the implementation context.~~

### **Example**

~~`ur:Status;"started";/ur:Status;`~~

## 10 Attributes Matrix

UR 2.0	UR 1.0	StAR 1.0	SAI 1.0	CAR 1.0	CIAUR 1.0	GLUE 2.0
<b>Record-Identity-Block</b>		<b>Record-Identity</b>		<b>Record-Identity</b>		
recordId	Record-Identity	recordId	Record-Identity	recordId	Record-Id/Storage-RecordId	
createTime		createTime	TimeInstant			
Site		Site		Site	Site	Admin-Domain.-Name
					ZoneName	
					TimeZone	
Infrastructure				Infrastructure		
<b>Subject-Identity-Block</b>		<b>Subject-Identity</b>		<b>User-Identity</b>		
LocalUserId	LocalUserId	LocalUser	LocalUserId	LocalUserId	LocalUserId	
LocalGroupId		LocalGroup		LocalGroup	LocalGroup-Id	
GlobalUserId		UserIdentity	GlobalUser-Name	GlobalUser-Name	GlobalUser-Name	
Global-GroupId	Global-Username	Group	Project-Name	Group	FQAN	
Global-Group-Attribute	Project-Name	Group-Attribute	Global-Group	Group-Attribute		
<b>Compute-Usage-Block</b>				<b>JobIdentity</b>		
CpuDuration	CpuDuration			CpuDuration	CpuDuration	
WallDuration	WallDuration			WallDuration	WallDuration	
StartTime	StartTime			StartTime	StartTime	
EndTime	EndTime			EndTime	EndTime	
Host		Host				
ProcessId	ProcessId			ProcessId		
HostType					CloudType	ServiceType.t
Processors	Processors			Processors	CpuCount	
ExitStatus				ExitStatus		
NodeCount	NodeCount			NodeCount		
Charge	Charge			Charge		
<b>JobUsage-Block</b>				<b>Job-Identity</b>		

GlobalJobId	GlobalJobId			GlobalJobId		
LocalJobId	LocalJobId			LocalJobId		
JobName	JobName			JobName		
Machine-Name	Machine-Name			Machine-Name		
SubmitHost	SubmitHost			SubmitHost		
Middleware						
Queue	Queue			Queue		
	Time-Duration			Time-Duration		
TimeInstant	TimeInstant			TimeInstant		
ServiceLevel	ServiceLevel			ServiceLevel		
	Extensions			Extensions		
Status	Status			Status		
<b>Memory-Usage-Block</b>						
Memory-Class	Memory/Swap			Memory/Swap	Memory	
Memory-Resource-Capacity-Used						
Memory-Logical-Capacity-Used	Memory/Swap			Memory/Swap	Memory	
Memory-Resource-Capacity-Allocated						
StartTime						
EndTime						
Host						
HostType						ServiceType.t
Charge						
<b>Storage-Usage-Block</b>						
StorageShare		StorageShare				
StorageMedia	(Disk)	StorageMedia				
StorageClass		StorageClass	ServiceLevel			
Directory-Path		Directory-Path	Project-Partition			
FileCount		FileCount				

Storage-Resource-Capacity-Used	Disk	Resource-Capacity-Used	Disk		Disk	
Storage-Logical-Capacity-Used	Disk	Logical-Capacity-Used				
Storage-Resource-Capacity-Allocated		Resource-Capacity-Allocated				
StartTime		StartTime	Time-Instant/ Time-Duration			
EndTime		EndTime	Time-Instant/ Time-Duration			
Host		Storage-System	Host			
HostType			StorageType			ServiceType.t
Charge			Charge			
			LocalFileId			
			GlobalFileId			
			Status			
			SubmitHost			
			Operation-Type			
<b>Cloud-Usage-Block</b>						
Local-Virtual-MachineId					Machine-Name	
Global-Virtual-MachineId					VMUUID	
Status					Status	
					SuspendTime	
Suspend-Duration						
ImageId					ImageId	
TimeInstant						



ServiceLevel						
SubmitHost						
Machine-Name						
<b>Network-Usage-Block</b>						
					NetworkType	
			Network	Network	Network-Inbound	
			Network	Network	Network-Outbound	
			Protocol-Type			

## 11 Field Summaries

### 11.1 RecordIdentityBlock

Element	Attribute	Short Description	Field Type	Requirement
<i>RecordId</i>		Identity of the record	String	REQUIRED
<i>CreateTime</i>		Time of creation of the record	ISO8601	REQUIRED
<i>Site</i>		The site where resource resides	String	OPTIONAL
<i>Infrastructure</i>		The infrastructure where the resource was used	String	REQUIRED
	description	Additional information on the used infrastructure	String	RECOMMENDED

### 11.2 SubjectIdentityBlock

Element	Attribute	Short Description	Field Type	Requirement
<i>LocalUserId</i>		Identity of the local user	String	OPTIONAL
<i>LocalGroupId</i>		Identity of the local group	String	OPTIONAL
<i>GlobalUserId</i>		Global identity of the user	String	OPTIONAL
<i>GlobalGroupId</i>		Global identity of the group	String	REQUIRED if <i>GlobalGroupAttribute</i> exists
<i>GlobalGroupAttribute</i>	type	Global group attribute Type of attribute	String String	OPTIONAL REQUIRED if <i>GlobalGroupAttribute</i> exists
	field	Description	String	REQUIRED if <i>GlobalGroupAttribute</i> exists

### 11.3 ComputeUsageBlock

Element	Attribute	Short Description	Field Type	Requirement
<i>CPUDuration</i>		CPU duration	ISO 8601:2004	REQUIRED
<i>WallDuration</i>		Wall duration	ISO 8601:2004	REQUIRED
<i>StartTime</i>		Start of consumption	ISO 8601:2004	REQUIRED
<i>EndTime</i>		End of consumption	ISO 8601:2004	REQUIRED

<i>Host</i>	processID	Host where resource is consumed UNIX pid of the process	String Non-zero Integer	RECOMMENDED OPTIONAL
<i>HostType</i>		Type of service	String	OPTIONAL
<i>Processors</i>		Number of processors requested/used	Non-zero Integer	OPTIONAL
<i>NodeCount</i>		Number of nodes requested/used	Non-zero Integer	OPTIONAL
<i>ExitStatus</i>		Exit status of the process	Integer	REQUIRED
<i>Charge</i>	unit	The charge to the user for the resource used Currency used	Float ISO 4217:2008 Currency	OPTIONAL REQUIRED if <i>Charge</i> is present
	formula	Cost consumption formula	String	REQUIRED if <i>Charge</i> is present

## 11.4 JobUsageBlock

Element	Attribute	Short Description	Field Type	Requirement
<i>GlobalJobId</i>		Global identity of the job	String	OPTIONAL
<i>LocalJobId</i>		Local identity of the job	String	OPTIONAL
<i>JobName</i>		Description of the job	String	OPTIONAL
<i>MachineName</i>		Computer facility	String	RECOMMENDED
<i>SubmitHost</i>		Host submitting the job	String	REQUIRED if in a grid environment
<i>Middleware</i>		Type of middleware	String	REQUIRED
	description	Description of the middleware used	String	REQUIRED
<i>Queue</i>		Queue name	String	OPTIONAL
	description	Description of the queue name	String	OPTIONAL
<i>TimeInstant</i>		Time instant related to the user payload	ISO 8601:2004	OPTIONAL
	type	Type of time instant	String	OPTIONAL
<i>ServiceLevel</i>		Normalization/benchmark	Float	REQUIRED
	type	Type of service level	String	REQUIRED
<i>Status</i>		Status of the job	String	REQUIRED

## 11.5 MemoryUsageBlock

Element	Attribute	Short Description	Field Type	Requirement
<i>MemoryClass</i>		Class of memory	String	REQUIRED
<i>MemoryResource-CapacityUsed</i>		Bytes used	Integer	REQUIRED

<i>MemoryLogical-CapacityUsed</i>		Logical bytes used	Integer	OPTIONAL
<i>MemoryResource-CapacityAllocated</i>		Bytes allocated	Integer	OPTIONAL
<i>StartTime</i>		Start of consumption	ISO 8601:2004	REQUIRED
<i>EndTime</i>		End of consumption	ISO 8601:2004	REQUIRED
<i>Host</i>		Host where resource is consumed	String	RECOMMENDED
<i>HostType</i>		Type of service	String	OPTIONAL
	processID	UNIX pid of the process	Non-zero Integer	OPTIONAL
<i>Charge</i>	unit	The charge to the user for the resource used Currency used	Float ISO 4217:2008 Currency	OPTIONAL REQUIRED if <i>Charge</i> is present
	formula	Cost consumption formula	String	REQUIRED if <i>Charge</i> is present

## 11.6 StorageUsageBlock

Element	Attribute	Short Description	Field Type	Requirement
<i>StorageShare</i>		Part of the storage used	String	OPTIONAL
<i>StorageMedia</i>		Details on the stored data	String	OPTIONAL
<i>StorageClass</i>		Class of the stored data	String	OPTIONAL
<i>DirectoryPath</i>		Directory path of the data accounted	String	OPTIONAL
<i>FileCount</i>		Number of files accounted	Non-zero Integer	OPTIONAL
<i>StorageResource-CapacityUsed</i>		Bytes used	Integer	REQUIRED
<i>StorageLogical-CapacityUsed</i>		Logical bytes used	Integer	OPTIONAL
<i>StorageResource-CapacityAllocated</i>		Bytes allocated	Integer	OPTIONAL
<i>StartTime</i>		Start of consumption	ISO 8601:2004	REQUIRED
<i>EndTime</i>		End of consumption	ISO 8601:2004	REQUIRED
<i>Host</i>		Host in which the storage is consumed	String	REQUIRED
<i>HostType</i>		Type of service	String	OPTIONAL
	processID	UNIX pid of the process	Non-zero Integer	OPTIONAL
<i>Charge</i>		The charge to the user for the resource used	Float	OPTIONAL

	unit	Currency used	ISO 4217:2008	REQUIRED if <i>Charge</i> is present
	formula	Cost consumption formula	Currency String	REQUIRED if <i>Charge</i> is present

## 11.7 CloudUsageBlock

Element	Attribute	Short Description	Field Type	Requirement
<i>LocalVirtualMachine-Id</i>		Local Id of the Virtual Machine	String	OPTIONAL
<i>GlobalVirtual-MachineId</i>		Global Id of the Virtual Machine	String	OPTIONAL
<i>Status</i>		Status of the Virtual Machine	String	REQUIRED
<i>SuspendDuration</i>		Amount of time in suspension	ISO 8601:2004	OPTIONAL
<i>ImageId</i>		Virtual Machine Image Id	String	OPTIONAL
<i>TimeInstant</i>		Time instant related to the user payload	ISO 8601:2004	OPTIONAL
	type	Type of time instant	String	OPTIONAL
<i>ServiceLevel</i>		Normalization/benchmark	Float	REQUIRED
<i>SubmitHost</i>		Host submitting the request for the Virtual Machine	String	OPTIONAL
<i>MachineName</i>		Computer facility	String	RECOMMENDED

## 12 Examples

### 12.1 Full example

Full example including all defined elements. Note that this does not necessarily make a useful working example as some resource blocks do not necessarily make sense when used together in a single record.

#### Example

```
<?xml version="1.0" encoding="UTF-8"?>
<UsageRecord xmlns="http://schema.ogf.org/urf/2013/04/urf"
xmlns:ur="http://schema.ogf.org/urf/2013/04/urf"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://schema.ogf.org/urf/2013/04/urf">
  <ur:RecordIdentityBlock>
    <ur:RecordId>"host.example.org/ur/87912469269276"</ur:RecordId>
    <ur:CreateTime>2013-05-09T09:06:52Z</ur:CreateTime>
    <ur:Site>"ACME-University"</ur:Site>
    <ur:Infrastructure>"OSG"</ur:Infrastructure>
  </ur:RecordIdentityBlock>
  <ur:SubjectIdentityBlock>
    <ur:LocalUserId>"johndoe"</ur:LocalUserId>
    <ur:LocalGroupId>"projectA"</ur:LocalGroupId>
    <ur:GlobalUserId>"/O=Grid/OU=example.org/CN=John Doe"</ur:GlobalUserId>
    <ur:GlobalGroupId>"binarydataproject.example.org"</ur:GlobalGroupId>
    <ur:GlobalGroupAttribute ur:type="subgroup">ukusers</ur:GlobalGroupAttribute>
  </ur:SubjectIdentity>
  <ur:ComputeUsageBlock>
    <ur:CpuDuration>PT3600S</ur:CpuDuration>
    <ur:WallDuration>PT3600S</ur:WallDuration>
    <ur:StartTime>2013-05-31T11:00:00</ur:StartTime>
    <ur:EndTime>2013-05-31T12:00:00</ur:EndTime>
    <ur:Host ur:processId=1042>"compute-0-1.abel.uio.no"</ur:Host>
    <ur:HostType>"org.nordugrid.ares"</ur:HostType>
    <ur:Processors>1</ur:Processors>
    <ur:NodeCount>1</ur:NodeCount>
    <ur:Charge ur:formula="42 units/CPU/day" ur:unit="USD">1.75</ur:Charge>
    <ur:ExitStatus>0</ur:ExitStatus>
  </ur:ComputeUsageBlock>
  <ur:JobUsageBlock>
    <ur:GlobalJobId>"host.example.org/ab1234/2013-05-09T09:06:52Z"</ur:GlobalJobId>
```

```

<ur:LocalJobId>"ab1234"</ur:LocalJobId>
<ur:JobName>"HiggsGammaGamma42"</ur:JobName>
<ur:MachineName>"ce.example.org"</ur:MachineName>
<ur:SubmitHost>
  "nordugrid-cluster-name=ce.example.org,Mds-Vo-name=local,o=grid"
</ur:SubmitHost>
<ur:Middleware ur:description="ARC CE">"grid"</ur:Middleware>
<ur:Queue ur:description="execution">"Bigmem"</ur:Queue>
<ur:TimeInstant ur:type="Ctime">2013-05-31T10:30:00</ur:TimeInstant>
<ur:TimeInstant ur:type="Qtime">2013-05-31T10:31:00</ur:TimeInstant>
<ur:TimeInstant ur:type="Etime">2013-05-31T10:59:42</ur:TimeInstant>
<ur:ServiceLevel ur:type="Si2k">3.14</ur:ServiceLevel>
<ur>Status>"aborted"</ur>Status>
</ur:JobUsageBlock>
<ur:MemoryUsageBlock>
  <ur:MemoryClass>"RAM"</ur:MemoryClass>
  <ur:MemoryResourceCapacityUsed>14728</ur:MemoryResourceCapacityUsed>
  <ur:MemoryLogicalCapacityUsed>56437</ur:MemoryLogicalCapacityUsed>
  <ur:MemoryResourceCapacityAllocated>42000</ur:MemoryResourceCapacityUsed>
  <ur:Charge ur:formula="42 units/MB/day" ur:unit="USD">0.0735</ur:Charge>
  <ur:Host ur:processId=1042>"compute-0-1.abel.uio.no"</ur:Host>
  <ur:StartTime>2013-05-31T11:00:00</ur:StartTime>
  <ur:EndTime>2013-05-31T12:00:00</ur:EndTime>
</ur:MemoryUsageBlock>
<ur:StorageUsageBlock>
  <ur:Host>host.example.org</ur:Host>
  <ur:StorageShare>pool-003</ur:StorageShare>
  <ur:StorageMedia>disk</ur:StorageMedia>
  <ur:StorageClass>replicated</ur:StorageClass>
  <ur:DirectoryPath>/projectA</ur:DirectoryPath>
  <ur:FileCount>42</ur:FileCount>
  <ur:StorageResourceCapacityUsed>14728</ur:StorageResourceCapacityUsed>
  <ur:StorageLogicalCapacityUsed>13617</ur:StorageLogicalCapacityUsed>
  <ur:StorageResourceCapacityAllocated>14624</sr:StorageResourceCapacityAllocated>
  <ur:Charge ur:formula="42 units/MB" ur:unit="USD">0.01473</ur:Charge>
  <ur:StartTime>2013-05-07T09:31:40Z</ur:StartTime>
  <ur:EndTime>2013-05-08T09:29:42Z</ur:EndTime>
  <ur:HostType>"org.dcache.storage"</ur:HostType>
</ur:StorageUsageBlock>
<ur:CloudUsageBlock>
<|Cloud Record properties go in here -->
</ur:CloudUsageBlock>

```

```
</ur:UsageRecord>
```

## 12.2 Grid example

Example of how a grid usage record may look like.

### Example

```
<?xml version="1.0" encoding="UTF-8"?>
<UsageRecord xmlns="http://schema.ogf.org/urf/2013/04/urf"
xmlns:ur="http://schema.ogf.org/urf/2013/04/urf"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://schema.ogf.org/urf/2013/04/urf">
  <ur:RecordIdentityBlock>
    <ur:RecordId>"host.example.org/ur/87912469269276"</ur:RecordId>
    <ur:CreateTime>2013-05-09T09:06:52Z</ur:CreateTime>
    <ur:Infrastructure>"EGI"</ur:Infrastructure>
  </ur:RecordIdentityBlock>
  <ur:SubjectIdentityBlock>
    <ur:GlobalGroupId>"binarydataproject.example.org"</ur:GlobalGroupId>
    <ur:GlobalGroupAttribute ur:type="subgroup">ukusers</ur:GlobalGroupAttribute>
  </ur:SubjectIdentity>
  <ur:ComputeUsageBlock>
    <ur:CpuDuration>PT3600S</ur:CpuDuration>
    <ur:WallDuration>PT3600S</ur:WallDuration>
    <ur:StartTime>2013-05-31T11:00:00</ur:StartTime>
    <ur:EndTime>2013-05-31T12:00:00</ur:EndTime>
    <ur:Host ur:processId=1042>"compute-0-1.abel.uio.no"</ur:Host>
    <ur:HostType>"org.nordugrid.arex"</ur:HostType>
    <ur:ExitStatus>0</ur:ExitStatus>
  </ur:ComputeUsageBlock>
  <ur:JobUsageBlock>
    <ur:GlobalJobId>"host.example.org/ab1234/2013-05-09T09:06:52Z"</ur:GlobalJobId>
    <ur:MachineName>"ce.example.org"</ur:MachineName>
    <ur:SubmitHost>
      "nordugrid-cluster-name=ce.example.org,Mds-Vo-name=local,o=grid"
    </ur:SubmitHost>
    <ur:Middleware ur:description="ARC CE">"grid"</ur:Middleware>
    <ur:ServiceLevel ur:type="Si2k">3.14</ur:ServiceLevel>
    <ur:Queue ur:description="execution">"Bigmem"</ur:Queue>
    <ur:TimeInstant ur:type="Ctime">2013-05-31T10:30:00</ur:TimeInstant>
    <ur:TimeInstant ur:type="Qtime">2013-05-31T10:31:00</ur:TimeInstant>
    <ur:TimeInstant ur:type="Etime">2013-05-31T10:59:42</ur:TimeInstant>
```



```

    <ur:Status>"aborted"</ur:Status>
  </ur:JobUsageBlock>
</ur:UsageRecord>

```

## 12.3 Cloud example

## 12.4 Local example

Example of how a storage record accounting for a local user could look like.

### Example

```

<?xml version="1.0" encoding="UTF-8"?>
<UsageRecord xmlns="http://schema.ogf.org/urf/2013/04/urf"
xmlns:ur="http://schema.ogf.org/urf/2013/04/urf"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://schema.ogf.org/urf/2013/04/urf">
  <ur:RecordIdentityBlock>
    <ur:RecordId>"host.example.org/ur/87912469269276"</ur:RecordId>
    <ur:CreateTime>2013-05-09T09:06:52Z</ur:CreateTime>
    <ur:Infrastructure>"OSG"</ur:Infrastructure>
  </ur:RecordIdentityBlock>
  <ur:SubjectIdentityBlock>
    <ur:LocalUserId>"johndoe"</ur:LocalUserId>
  </ur:SubjectIdentityBlock>
  <ur:StorageUsageBlock>
    <ur:Host>host.example.org</ur:Host>
    <ur:StorageResourceCapacityUsed>13617</ur:StorageResourceCapacityUsed>
    <ur:StartTime>2013-05-07T09:31:40Z</ur:StartTime>
    <ur:EndTime>2013-05-08T09:29:42Z</ur:EndTime>
  </ur:StorageUsageBlock>
</ur:UsageRecord>

```

## 12.5 Minimal examples

### 12.5.1 Job record

Minimal useful job record for a job run by the ukusers team of the binarydatapoint.example.org group.

### Example

```

<?xml version="1.0" encoding="UTF-8"?>

```

```

<UsageRecord xmlns="http://schema.ogf.org/urf/2013/04/urf"
xmlns:ur="http://schema.ogf.org/urf/2013/04/urf"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://schema.ogf.org/urf/2013/04/urf">
  <ur:RecordIdentityBlock>
    <ur:RecordId>"host.example.org/ur/87912469269276"</ur:RecordId>
    <ur:CreateTime>2013-05-09T09:06:52Z</ur:CreateTime>
    <ur:Infrastructure>"EGI"</ur:Infrastructure>
  </ur:RecordIdentityBlock>
  <ur:SubjectIdentityBlock>
    <ur:GlobalGroupId>"binarydataprotect.example.org"</ur:GlobalGroupId>
    <ur:GlobalGroupAttribute ur:type="subgroup">ukusers</ur:GlobalGroupAttribute>
  </ur:SubjectIdentityBlock>
  <ur:ComputeUsageBlock>
    <ur:CpuDuration>PT3600S</ur:CpuDuration>
    <ur:WallDuration>PT3600S</ur:WallDuration>
    <ur:StartTime>2013-05-31T11:00:00</ur:StartTime>
    <ur:EndTime>2013-05-31T12:00:00</ur:EndTime>
    <ur:Host ur:processId=1042>"compute-0-1.abel.uio.no"</ur:Host>
    <ur:ExitStatus>0</ur:ExitStatus>
  </ur:ComputeUsageBlock>
  <ur:JobUsageBlock>
    <ur:GlobalJobId>"host.example.org/ab1234/2013-05-09T09:06:52Z"</ur:GlobalJobId>
    <ur:MachineName>"ce.example.org"</ur:MachineName>
    <ur:Middleware ur:description="ARC CE">"grid"</ur:Middleware>
    <ur:ServiceLevel ur:type="Si2k">3.14</ur:ServiceLevel>
    <ur>Status>"aborted"</ur>Status>
  </ur:JobUsageBlock>
</ur:UsageRecord>

```

### 12.5.2 Storage record

Minimal storage record that is actually useful. There is no SubjectIdentity block, which should be interpreted as the record accounts for all usage on the storage system.

#### Example

```

<?xml version="1.0" encoding="UTF-8"?>
<UsageRecord xmlns="http://schema.ogf.org/urf/2013/04/urf"
xmlns:ur="http://schema.ogf.org/urf/2013/04/urf"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://schema.ogf.org/urf/2013/04/urf">
  <ur:RecordIdentityBlock>

```

```
<ur:RecordId>"host.example.org/ur/87912469269276"</ur:RecordId>
<ur:CreateTime>2013-05-09T09:06:52Z</ur:CreateTime>
<ur:Infrastructure>"OSG"</ur:Infrastructure>
</ur:RecordIdentityBlock>
<ur:StorageUsageBlock>
  <ur:Host>host.example.org</ur:Host>
  <ur:StorageResourceCapacityUsed>13617</ur:StorageResourceCapacityUsed>
  <ur:StartTime>2013-05-07T09:31:40Z</ur:StartTime>
  <ur:EndTime>2013-05-08T09:29:42Z</ur:EndTime>
</ur:StorageUsageBlock>
</ur:UsageRecord>
```

## 13 Security Considerations

There may be security concerns that should be addressed with respect to usage data. Possible security issues might include:

- Non-repudiation
- Confidentiality of certain elements
- Integrity
- Secure Transport

Recommendation of required solutions for these security concerns is out of scope for this layer. Another layer should address the necessary security requirements.

## 14 Glossary

Recommended but not required.

## 15 Contributors

~~Contact information for authors. You can also use this section to recognize contributions by other people who are not listed as authors, but made a useful contribution.~~

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## 16 Acknowledgments

~~Include if desired. Contributors to the document may also be listed in the previous section~~ This document is the work of the Usage Record Working Group of the OGF.

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## 20 References