European Middleware Initiative

Definition of the Compute Accounting Record

**EU Technical Note: Dxn.m**

|  |  |
| --- | --- |
| Document identifier: |  |
| Date: | **16/07/2012** |
| Activity: | **JRA1** |
| Lead Partner: |  |
| Document status: | **DRAFT** |
| Document link: |  |

**Abstract:**

In this document we define a Compute Accounting Usage Record on the basis of the already existing OGF UR V1.0 standard. The existing standard has been slightly modified both in syntactical and semantic aspects to allow for greater interoperability for the existing middleware layers and taking into consideration existing grid use cases.

**Copyright notice:**

Copyright (c) Members of the EMI Collaboration. 2010.

See http://www.eu-emi.eu/about/Partners/ for details on the copyright holders.

EMI (“European Middleware Initiative”) is a project partially funded by the European Commission. For more information on the project, its partners and contributors please see http://www.eu-emi.eu.

This document is released under the Open Access license. You are permitted to copy and distribute verbatim copies of this document containing this copyright notice, but modifying this document is not allowed. You are permitted to copy this document in whole or in part into other documents if you attach the following reference to the copied elements: "Copyright (C) 2010. Members of the EMI Collaboration. http://www.eu-emi.eu ".

The information contained in this document represents the views of EMI as of the date they are published. EMI does not guarantee that any information contained herein is error-free, or up to date.

EMI MAKES NO WARRANTIES, EXPRESS, IMPLIED, OR STATUTORY, BY PUBLISHING THIS DOCUMENT.

**Delivery Slip**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Name** | **Partner / Activity** | **Date** | **Signature** |
| **From** | Andrea Guarise | INFN/JRA1 |  |  |
| **Reviewed by** |  |  |  |  |
| **Approved by** |  |  |  |  |

**Document Log**

|  |  |  |  |
| --- | --- | --- | --- |
| **Issue** | **Date** | **Comment** | **Author / Partner** |
| 1 | 10/10/2011 | First complete DRAFT | Andrea Guarise/INFN |
| 2 | 3/11/2011 | V0.6 - Added clarifications on mandatories element in the record.  Changed SubmitHost syntax to use it for CEID | Andrea Guarise/INFN |
| 3 | 15/11/2011 | V0.7 – Added XSD schema and minimum and full examples. Changed JobUSageRecord root element to UsageRecord.  Added better clarification where to put VO membership groups and roles. | AndreaGuarise/INFN |
| 4 |  | V0.8 – Changed SiteName element to Site, Added format for record aggregation and its XSD schema.  Added Aggregated record example.  Detailed XSD change: inserted UserIdentityBaseType.  Fixed error in Datailed Record Summary. | AndreaGuarise/INFN |
| 5 | 01/12/2011 | V1.0 – Final Version with CAR and UAR V1.0  Changes since version 0.8 reflects minor tweaks in UAR record. | AndreaGuarise/INFN |

**Document Change Record**

| **Issue** | **Item** | **Reason for Change** |
| --- | --- | --- |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |

**Table of Contents**

1. Introduction 6

1.1. Purpose 6

1.2. About this Document 6

1.3. Document amendment procedure 6

1.4. Terminology 6

2. TeChnical description 8

2.1. Overview of the COMPUTE accounting record 8

2.1.1 Record Structure & Content 8

2.2. Conventions and terms 8

2.2.1 Conventions used in the specification 8

2.3. Related work 8

2.4. BASE Record properties 8

2.4.1 UsageRecord 9

2.4.2 UsageRecords 9

2.4.3 RecordIdentity 9

2.4.4 JobIdentity 9

2.4.5 UserIdentity 10

2.4.6 JobName 11

2.4.7 Charge 12

2.4.8 Status 12

2.4.9 ExitStatus 12

2.4.10 WallDuration 12

2.4.11 CpuDuration 12

2.4.12 EndTime 13

2.4.13 StartTime 13

2.4.14 MachineName 13

2.4.15 Host 13

2.4.16 SubmitHost 13

2.4.17 Queue 14

2.4.18 Site 14

2.4.19 Infrastructure 14

2.5. Differentiated Record Properties 14

2.5.1 Memory 14

2.5.2 Swap 16

2.5.3 NodeCount 16

2.5.4 Processors 16

2.5.5 TimeInstant 17

2.5.6 ServiceLevel 17

2.6. Aggregated USAGE RECORD 17

2.6.1 SummaryRecord 17

2.6.2 SummaryRecords 18

2.6.3 Site 18

2.6.4 Month 18

2.6.5 Year 18

2.6.6 UserIdentity 18

2.6.7 EarliestEndTime 19

2.6.8 LatestEndTime 19

2.6.9 WallDuration 19

2.6.10 CpuDuration 19

2.6.11 NormalisedWallDuration 19

2.6.12 NormalisedCpuDuration 19

2.6.13 NumberOfJobs 19

2.7. DETAILED RECORD SUMMARY 20

2.7.1 Field summary – BASE PROPERTIES 20

2.7.2 FIELD SUMMARY – DIFFERENTIATED PROPERTIES 21

2.8. AGGREGATED RECORD SUMMARY 21

2.9. Record Examples 22

2.9.1 Minimal Example 22

2.9.2 Full Example 22

2.9.3 Aggregated record Example 23

3. Detailed record - XSD Schema 24

4. Aggregated record – XSD schema 31

# Introduction

## Purpose

The purpose of this document is to describe the format specification of CAR, the Compute Accounting Record, which is planned to be implemented by the EMI accounting middleware sensors to enhance accounting tool interoperability. Although largely derived from the already existing OGF UR V1.0 standard, this document partially extends it and better defines its semantic aspect. This document may therefore pose the basis for an enhancement proposal toward new version of the OGF standard.

## About this Document

CAR defines the semantic and syntax of a message containing an Usage Record for compute-bound resources. It do not enters into detail of how the Usage Record should be used or the way such message is transported from the information producers to its consumers. It doesn’t enter either into implementation details of the compute accounting sensors.

The document is joint work of the component of the EMI compute accounting working group, Krzysztof Benedyczak, Cristina Del Cano Novales, Szigeti Gabor, Oxana Smirnova, John Gordon, Andrea Guarise, Will Rogers, Massimo Sgaravatto.

**References**:

|  |  |
| --- | --- |
| **R1** | ISO Technical Committee TC 154 – <http://www.iso.org/iso/catalogue_detail?csnumber=40874> |
| **R2** | Key words for use in RFCs to Indicate Requirement Levels, RFC 2119 – <http://tools.ietf.org/html/rfc2119> |
| **R3** | Usage record format recommendation – <http://ogf.org/documents/GFD.98.pdf> |

## Document amendment procedure

This document can be amended by the authors further to any feedback from other teams or people. Minor changes, such as spelling corrections, content formatting or minor text re-organisation not affecting the content and meaning of the document can be applied by the authors without peer review. Other changes must be submitted to peer review and to the EMI PEB for approval.

When the document is modified for any reason, its version number shall be incremented accordingly. The document version number shall follow the standard EMI conventions for document versioning. The document shall be maintained in the CERN CDS repository and be made accessible through the OpenAIRE portal.

## Terminology

|  |  |
| --- | --- |
| **CAR** | **Compute Accounting Record** |
| **StAR** | **St**orage **A**ccounting **R**ecord |
| FQDN | Fully Qualified Domain Name |
| ISO | International Organization for Standardization |
| **OGF** | Open Grid Forum |
| **EGI** | European Grid Infrastructure |
| **FQAN** | VOMS Fully Qualified Attribute Name |
| **GOC** | Grid Operation Center |

# TeChnical description

## Overview of the COMPUTE accounting record

### Record Structure & Content

The detailed usage record structure tightly follows the OGF UR record organization. That is the record is divided into three parts:

**Base Properties**

“Base properties are those items that all or most sites deem critical for accurately recording the usage of their resources. They include job and user identification, as well as most of the common types of resources that sites need to measure.”

We need to take into consideration that it is necessary to produce valid usage records for both grid-wide and local jobs.

**Differentiated Properties**

“These element definitions represent usage that may appear multiple times within a single Usage Record if usage is measured with several distinct metrics or several types of the usage are included.”

**Extension Framework**

These element definitions represent a mechanism for sites to exchange data that does not correspond to one of the common properties.

In CAR we let the Extension Framework for middleware specific extensions, relevant to specific use cases of the middleware itself, or of specific NGIs or projects Use Case.

Any time that we fond the original definition of the OGF UR needed an extension to cover for existing use cases or allow for interoperability, we decided to add new attributes or better define existing attribute’s semantic in the Base or Differentiated properties sections.

**Aggregate Usage Record**

The aggregate Usage Record follows the guidelines introduced by APEL SSM in case of aggregate record publication to the APEL central repository. The aggregated record tough has been revised to allow for more general use than the specific APEL Use Case and to not conflict with the Detailed Record Schema.

## Conventions and terms

This section defines various key-words, conventions and terms used in the specification.

### Conventions used in the specification

The key words ”MUST”, ”MUST NOT”, ”REQUIRED”, ”SHALL”, ”SHALL NOT”, ”SHOULD”, ”SHOULD NOT”, ”RECOMMENDED”, ”MAY”, and ”OPTIONAL” in this document are to be interpreted as described in RFC 2119 [R2].

## Related work

The record format described in this document is largely based on the usage record (OGF-UR) format recommendation of the OGF 98 standard [R3], as it tries to achieve a shared record format for accounting of consumed CPU-bound resources.

## BASE Record properties

This section describes the record properties and their fields and attributes. A summary of the fields is given in section 2.7.1, while examples of using the fields are given in section 2.9.

The format of the record is XML. The currently defined name space for the detailed record is <http://eu-emi.eu/namespaces/2011/10/computerecord>, denoted as “urf” in this document. The name space for the aggregated record is <http://eu-emi.eu/namespaces/2011/11/aggregatedcomputerecord>, denoted as “aur” in this docment. All time and duration formats are ISO types [R1]. These design choices are made in order to keep the format as close as possible to OGF usage record format.

Many of the properties presented in this section are optional, however a few are not. For the required properties, it is explicitly listed that they must be present in the record A record should only represent a single identity. This identity can either be a person or a group of users. If a record contains both user and group information, the implementation should assume that the resources have been consumed by the user in the context of the group information.

### UsageRecord

This is the top container property of the record format, as defined in OGF-UR §8.2

* JobUsageRecord MUST be present in the record.
* JobUsageRecord MUST be top container for the record.
* JobUsageRecord MUST NOT have a value.

This element is the root element in a document with a single usage record.

### UsageRecords

This property can hold a number of JobUsageRecord properties, i.e., act as a container for several job usage records.

* UsageRecords MUST only contain JobUsageRecord elements.
* UsageRecords MUST NOT have a value.

This element is the root element in a document with multiple usage records.

### RecordIdentity

Element.

This is the unique identifier for the usage record (not for the job). We leave the decision on the algorithm to the implementation phase. Record identities must be assured to be globally unique. Each JobUsageRecord element MUST contain a child RecordIdentity element.

* RecordIdentity MUST be present in the record.

#### recordId

Attribute.

This attribute contains the value used to uniquely identify the record.

* RecordId attribute MUST be present in the RecordIdentity Element.

#### createTime

Attribute.

This attribute is used to specify the time when this particular JobUsageRecord was created.

* createTime attribute MUST be present in the RecordIdentity Element.

### JobIdentity

Element.

This is the container for the information identifying the grid or local job metered by the usage record. The scope of the JobIdentity field can be either local or grid. An identifier of at least one scope MUST be present in the record. Identifiers of both scopes MAY appear in a single UsageRecord.

* JobIdentity MUST be present in the record.

#### GlobalJobId

Element.

This is an element child of JobIdentity. This can be the job unique identifier assigned by the grid meta-scheduler if we have one, or in general, by the grid middleware responsible for the job submission. In case of a local job this item MUST not be present.

* In case of ‘local’ job, GlobalJobId MUST NOT be present

#### LocalJobId

Element.

This is an element child of JobIdentity. This element MUST contain The LRMS ID for the job as assigned by the Batch system. It MUST be used both in case of grid or local jobs.

* LocalJobId MUST be present in the record.

#### ProcessId

Element.

This is an element child of JobIdentity. The UNIX pid of the job on the executing node. If all processes associated with a job are tracked as part of usage, each individual process identifier MAY be reported with this element.

* ProcessId MAY be present in the record.
* ProcessId MAY be present multiple time in the record.

### UserIdentity

Element.

This is the container for the information identifying the user associated with this usage. The scope representation of identity may be either local or global. Identifiers of both scopes MAY appear in a single UsageRecord. If both appear, there must be a semantic correlation between the presented local and global user identifiers.

* UserIdentity MUST be present in the record.

#### LocalUserId

Element.

This is an element child of UserIdentity. The unix username of the user running the job on the executing node.

* LocalUserIdentity MUST be present in the record.

#### GlobalUserName

Element.

This is an element child of UserIdentity. The user's certificate DN. In case of local jobs this field MUST be empty.

* GlobalUserName MAY be present in the record.
* In case of ‘local’ jobs GlobalUserName MUST NOT be present in the record.

#### LocalGroup

Element.

This is an element child of UserIdentity. The unix group of the user running the job on the executing node. In case multiple groups are available the effective one MUST be reported.

* LocalGroup SHOULD be present in the record.
* In case of multiple available Unix GID, the effective one MUST be reported.

#### Group

Element.

This is an element child of UserIdentity. The effective User VO of the user running the job on the executing node.

* Group SHOULD be present in the record.
* In case of multiple VirtualOrganization available, the effective one MUST be reported.

#### GroupAttribute

Element.

This is an element child of UserIdentity. It MAY be repeated any number of times in the Usage Records and it is used to specify any additional type of ‘group’ to which the user belongs to and is relevant to understand the accounting record.

**type**

attribute.

This is an attribute of the GroupAttribute Element. It is used to specify the meaning of a given instance of the GroupAttribute element.

The following GroupAttribute type MUST be treated by accounting servers if specified by the accounting sensors:

*type=”ProjectName”* – The name of the project, within an organization, to which the user belongs to.

The following GroupAttribute type MAY be treated by accounting servers if specified by the accounting sensors:

*type=”FQAN” –* VOMS FQAN assigned to the user. If multiple FQAN are available, the effective one MUST be reported.

type = “vo-group”- User’s VOMS FQAN group membership

*type = “vo-role” –User’s VOMS FQAN role capability.*

### JobName

Element.

This is an OPTIONAL record in the UR Document that may contain 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.

* JobName MAY be present in the record.

### Charge

Element.

This is an OPTIONAL record used for economic accounting purpose. It is the charge applied to the user for the job.

When specifying a charge, the following two attributes MUST be specified:

*unit* – defines the currency used to report the charge.

*formula* – The ost computation formula adopted to compute the applied charge.

* Charge MAY be present in the record.

### Status

This is the 'literal' value of the job status and not an exit status number. This parameter MUST be present.

The available status values are:

*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 generate

Not all the status available in the record definition is implemented (or implementable) by the accounting middleware sensors.

* Status MUST be present in the record.

### ExitStatus

Element.

This element allows to specify the numeric exit status value for the job.

* ExitStatus MAY be present in the record.

### WallDuration

Element.

WallClock time elapsed during the job execution. Basically it EndTime-StartTime no matter on how many cores, processors, nodes, sites the user job ran on.

* WallDuration MUST be present and MUST contain a time duration as defined in ISO 8601:2004 [R1]

### CpuDuration

Element.

This element contains the CPU time consumed. If the job ran on many cores/processors/nodes/sites, all separate consumptions shall be aggregated in this value. This as an impact on MPI jobs, where the consumption of all the 'nodes' of the MPI job get aggregated into this CPU consumption. This is the way LRMS accounting work on the batch systems underlying the avaialble CE implementations.

* CpuDuration MUST be present and MUST contain a time duration as defined in ISO 8601:2004 [R1]

#### usageType

Attribute.

This attribute specifies which type of CPU time measurement the CpuDuration Element refers to:

* user
* system
* all ( i.e. system+user)

The Element with usageType=”all” attribute MUST be present in the record.

### EndTime

Element.

The job end timestamp.

* EndTime MUST be present and MUST contain a time instant as defined in ISO 8601:2004 [R1]

### StartTime

Element.

The job start timestamp

* StartTime MUST be present and MUST contain a time instant as defined in ISO 8601:2004 [R1]

### MachineName

Element.

Identifier for the computing facility executing the job. This SHOULD be the LRMS server host name.

* MachineName SHOULD be present.

### Host

Element.

This is used to identify the host where the user payloads physically run. As an example, in case of MPI jobs more than one 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.

* Host SHOULD be present. Multiple instances of this element MAY be present.

### SubmitHost

Element.

In grid environment this refers to the CE Host. On a local batch system, this MUST be the LRMS server host name. On a GRID environment this MUST report the Computing Element Uniqe ID.

The ‘*type*’ argument MUST be present and MUST be used to report which type of facility the identifier refers to.

* SubmitHost MUST be present.
* type=”CE-ID” MUST be used in case of a grid facility.
* Type=”LRMS” MUST be used in case of a local facility.

### Queue

Element.

The LRMS queue. The queue information, per se, is useful just in a local context. In a grid environment it is meaningful just when parameters uniquely identifying the grid site are present.

Multiple Instances of this element MAY be present. In case multiple instances of this element are present, the *description* attribute MUST be used to describe which queue types are reported.

* Queue MUST be present.
* Multiple instances MAY be present. In this case
* The description=”execution” queue MUST be present.

### Site

Element.

This is the parameter used to identify the Site of the computing center where the job executed. The *type* attribute MUST be used to specify which definition of the site name is used.

To comply with EGI *GOCDB* requirements:

* Site MUST be specified with type="gocdb" and it MUST contain information on the site name as the GOC DB expects it.
* Multiple instances of Site MAY be present and SHOULD be used to insert other site identity types.

### Infrastructure

Element.

The purpose of this element is to mark whether the job was submitted locally or through a grid middleware. Values for the ‘type’ attribute MUST be ‘local’ or ‘grid’. The ‘description’ attribute SHOULD be used to give additional information on the used middleware.

* Infrastructure MUST be present.
* type attribute MUST be present.

## Differentiated Record Properties

### Memory

Element.

This element specifies the memory usage.

* Memory MAY be present in the record.

#### type

Attribute.

This attribute specifies the type of reported memory usage. Allowed values are:

*Shared* – The virtual memory used by the job.

*Physical* – The physical memory consumed by the job.

* ‘type’ attribute MUST be present in the element.

#### metric

Attribute.

This attribute specifies the metric for the reported memory usage. Allowed values are:

*average* – The measured memory refers to an average memory consumption.

*max* – The measured memory is the maximum value consumed by the job.

#### storageUnit

Attribute.

This attribute is used to specify the measurement unit for the memory consumption (i.e. Bytes KiloBytes etc..)

Allowed values are:

<xsd:attribute name=*"storageUnit"*>

<xsd:simpleType>

<xsd:restriction base=*"xsd:token"*>

<xsd:enumeration value=*"b"* />

<xsd:enumeration value=*"B"* />

<xsd:enumeration value=*"KB"* />

<xsd:enumeration value=*"MB"* />

<xsd:enumeration value=*"GB"* />

<xsd:enumeration value=*"PB"* />

<xsd:enumeration value=*"EB"* />

<xsd:enumeration value=*"Kb"* />

<xsd:enumeration value=*"Mb"* />

<xsd:enumeration value=*"Gb"* />

<xsd:enumeration value=*"Pb"* />

<xsd:enumeration value=*"Eb"* />

</xsd:restriction>

</xsd:simpleType>

</xsd:attribute>

* storageUnit attribute MUST be present in the element.

### Swap

Element.

The amount of swap space consumed by the user job.

* Swap MAY be present in the record.

#### type

Attribute.

This attribute specifies the type of reported memory usage. Allowed values are:

*Shared* – The virtual memory used by the job.

*Physical* – The physical memory consumed by the job.

#### metric

Attribute.

This attribute specifies the metric for the reported memory usage. Allowed values are:

*average* – The measured memory refers to an average memory consumption.

*max* – The measured memory is the maximum value consumed by the job.

### NodeCount

Element.

This element specifies the number of worker nodes (single boxes) used by the job.

* NodeCount SHOULD be present in the record.

### Processors

Element.

This element specifies the number of cores used by the job. Note that hereby we define core == processor.

* Processors SHOULD be present in the record.

#### description

Attribute.

This attribute MAY be used to better specify information on the reported metric.

#### metric

Attribute.

This attribute specifies the metric for the reported processor usage. Allowed values are:

*average* – Refers to an average number of processor used.

*max* – Refers to the maximum number of processors used by the job.

#### consumptionRate

Attribute.

This attribute specifies the consumption rate for the reported

processor usage. The consumption rate is a scaling factor that indicates the average percentage of utilization. It intends to facilitate the application of fair charging when accounting for multiplexed jobs.

### TimeInstant

Element.

This element MAY be used to insert in the records any time instant related to the user payload, we define three optional values for the type attribute which 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.

#### type

Attribute

This attribute specifies the type for the reported time instant. We define three types of time instants that SHOULD be reported:

Ctime - Time job was created

Qtime - Time job was queued

Etime - Time job became eligible to run

### ServiceLevel

Element.

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.

#### type

Attribute.

This attribute is used to specify which type of normalization factor/ benchmark metric is reported.

Values that SHOULD be treated are:

Si2k – SpecInt2000

Sf2k – SpecFloat2000

HEPSPEC06 – HEPSpec06

## Aggregated USAGE RECORD

This paragraph describes the Usage Record format that can be used to describe accounting information for the usage aggregation of multiple jobs.

### SummaryRecord

This is the element that can be used as root element for the description of a single aggregate usage record.

### SummaryRecords

This element can be used to include multiple aggregate records. It can contain multiple instances of the SummaryRecord Element

### Site

Element.

This Element specifies the Site to which the summary refers.

To comply with EGI *GOCDB* requirements:

* Site Element MUST be present in the record and MUST be specified with type="gocdb" and it MUST contain information on the site name as the GOC DB expects it.

### Month

Element.

This Element specifies the Month to which the summary refers to. Aggregation MUST be performed on the basis of the job EndTime.

The Month Element MUST be present in the record.

### Year

Element.

This Element specifies the Year to which the summary refers to. Aggregation MUST be performed on the basis of the job EndTime.

The Year Element MUST be present in the record.

### UserIdentity

This Element acts as container for User Identity information regarding the aggregated record.

#### GlobalUserName

Element.

This Element is used to specify the X509 Certificate DN of the user whose usage is reported in the record.

#### Group

Element.

This Element is used to specify the Virtual Organization of the user whose usage is reported in the record.

#### GroupAttribute

Element.

This Element is used to specify the additional attributes about of the user whose usage is reported in the record. It can be used for instance to specify the VOMS Group and Role of the user. The kind of GroupAttribute is specified using the ‘type’ Attribute of the element as defined in 2.4.5.5

### EarliestEndTime

Element.

Element containing the End time of the first job in the month.

### LatestEndTime

Element.

Element containing the End time of the last job in the month.

### WallDuration

Element.

Sum of wall clock times for all jobs in the month.

The WallDuration Element MUST be present in the record.

### CpuDuration

Element.

Sum of CPU clock times for all jobs in the month.

The CpuDuration Element MUST be present in the record.

### NormalisedWallDuration

Element.

Sum of normalized wall clock time for all jobs. Normalization unit MUST be specified using the ‘normalisationFactor’ attribute and the type of benchmark used for normalization using the attribute ’normalisationMetric’.

NormalisedWallDuration MUST be present in the record.

### NormalisedCpuDuration

Element.

Sum of normalized CPU time for all jobs. Normalization unit MUST be specified using the ‘normalisationFactor’ attribute and the type of benchmark used for normalization using the attribute ’normalisationMetric’.

NormalisedCpuDuration MUST be present in the record.

### NumberOfJobs

Element

Total number of jobs in the reporting period.

NumberOfJobs MUST be present in the record.

## DETAILED RECORD SUMMARY

### Field summary – BASE PROPERTIES

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Element** | **Attribute** | **Short Description** | **Field Type** | **Requirement** |
| JobUsageRecord |  | Top container |  | REQUIRED |
| UsageRecords |  | Container for grouping multiple records |  | OPTIONAL |
| RecordIdentity |  | Identity of the record |  | REQUIRED |
|  | recordId |  | String | REQUIRED |
|  | createTime |  | ISO8601 | REQUIRED |
| JobIdentity |  | Container for Job Identity information |  | REQUIRED |
| GlobalJobId |  |  | String | OPTIONAL |
| LocalJobID |  |  | String | REQUIRED |
| ProcecssId |  |  | String | OPTIONAL |
| UserIdentity |  | Container for User Identity Information |  | REQUIRED |
| *LocalUserID* |  | Unix username | String | OPTIONAL |
| *GlobalUserName* |  | User X509 DN | String | RECOMMENDED |
| *LocalGroup* |  | Effective UNIX group | String | OPTIONAL |
| *Group* |  | Effective User VO | String | RECOMMENDED |
| *GroupAttribute* |  |  |  | RECOMMENDED |
|  | Type=”ProjectName” | Name of Project to wich the user belongs. | String | RECOMMENDED |
|  | Type=”FQAN” | Effective User FQAN | String | OPTIONAL |
| JobName |  | Descriptive name of the job | String | OPTIONAL |
| Charge |  | Charge applied to the job |  | OPTIONAL |
|  | unit | currency |  |  |
|  | formula | Cost computation formula |  |  |
| Status |  | Literal exit status | String | REQUIRED |
| ExitStatus |  | Exit status | Integer | OPTIONAL |
| WallDuration |  | Job wallclock usage | ISO8601 | REQUIRED |
| CpuDuration |  | Job Cpu Time usage | ISO8601 | REQUIRED |
| EndTime |  | Job end timestamp | ISO8601 | REQUIRED |
| StartTime |  | Job start timestamp | ISO8601 | REQUIRED |
| MachineName |  | LRMS server hostname | String | OPTIONAL |
| Host |  | Worker Node(s) where the job run. | String | OPTIONAL |
| SubmitHost |  | Grid: CE, Local: LRMS head node. | String | REQUIRED |
| Queue |  | Executing queue | String | REQUIRED |
| SiteName |  | Information on the site where the job run. | String | REQUIRED |
| Infrastructure |  | To specify if the job whas submitted using ‘grid’ or ‘local’ infrastructure | String | REQUIRED |

Table : Summary of the base fields

### FIELD SUMMARY – DIFFERENTIATED PROPERTIES

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Element** | **Attribute** | **Short Description** | **Field Type** | **Requirement** |
| Memory |  | Element used to specify job memory consumption |  | OPTIONAL |
| Swap |  | Element used to specify job swap consumption |  | OPTIONAL |
| NodeCount |  | Number of Worker Nodes |  | REQUIRED |
| Processors |  | Number of Processors (Cores) | Integer | REQUIRED |
| metric |  | string |  |
| consumptionRate |  | float |  |
| TimeInstant |  | Time instants useful for accounting purpose | ISO 8601 - DateTime | RECOMMENDED |
| type | string |
| ServiceLevel |  | Normalisation metrics. | string | REQUIRED |
| type |  | string |  |

Table : Summary of the differentiated fields

## AGGREGATED RECORD SUMMARY

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Element** | **Attribute** | **Short Description** | **Field Type** | **Requirement** |
| Site |  | Site | String | REQUIRED |
| Month |  | Month of aggregation | String | REQUIRED |
| Year |  | Year of aggregation | String | REQUIRED |
| UserIdentity|GlobalUserName |  | User X509 DN | String | OPTIONAL |
| UserIdentity|Group |  | User Virtual Organisation | String | OPTIONAL |
| UserIdentity|GroupAttribute | type=”vo-group” | VOMS FQAN VO group | String | OPTIONAL |
| type=”vo-role” | VOMS FQAN VO role |
| EarliestEndTime |  | End time of the first job in the reporting month. | ISO8601-DateTime | OPTIONAL |
| LatestEndTime |  | End time of the last job in the reporting month. | ISO8601-DateTime | OPTIONAL |
| WallDuration |  | Sum of wall clock time for the jobs in the month. | ISO8601-Duration | REQUIRED |
| CpuDuration |  | Sum of cpu time for the jobs in the month. | ISO8601-Duration | REQUIRED |
| NormalisedWallDuration | normalisationMetric  normalisationFactor | Sum of normalized wall clock time for the jobs in the month. | ISO8601-Duration | REQUIRED |
| NormalisedCpuDuration | normalisationMetric  normalisationFactor ” | Sum of normalized CPU time for the jobs in the month. | ISO8601-Duration | REQUIRED |
| NumberOfJobs |  | Number of jobs in the reporting month | Integer | REQUIRED |

## Record Examples

### Minimal Example

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

<urf:UsageRecord xmlns:urf="http://eu-emi.eu/namespaces/2011/11/computerecord"

xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"

xsi:schemaLocation="http://eu-emi.eu/namespaces/2011/11/computerecord car\_v1.0.xsd ">

<urf:RecordIdentity urf:createTime="2001-12-31T12:00:00"

urf:recordId="token" />

<urf:JobIdentity>

<urf:LocalJobId>urf:LocalJobId</urf:LocalJobId>

</urf:JobIdentity>

<urf:UserIdentity>

<urf:LocalUserId>urf:LocalUserId</urf:LocalUserId>

</urf:UserIdentity>

<urf:Status urf:description="">token</urf:Status>

<urf:Infrastructure urf:description="" urf:type="local" />

<urf:WallDuration urf:description="">P1D</urf:WallDuration>

<urf:CpuDuration urf:description="" urf:usageType="all">P1D</urf:CpuDuration>

<urf:ServiceLevel urf:type="si2k">2150</urf:ServiceLevel>

<urf:EndTime urf:description="">2001-12-31T12:00:00</urf:EndTime>

<urf:StartTime urf:description="">2001-12-31T12:00:00</urf:StartTime>

<urf:SubmitHost urf:description="" urf:type="">http://tempuri.org</urf:SubmitHost>

<urf:Queue urf:description="">urf:Queue</urf:Queue>

<urf:Site urf:type="">urf:SiteName</urf:Site>

</urf:UsageRecord>

### Full Example

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

<urf:UsageRecord xmlns:urf="http://eu-emi.eu/namespaces/2011/11/computerecord"

xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"

xsi:schemaLocation="http://eu-emi.eu/namespaces/2011/11/computerecord car\_v1.0.xsd ">

<urf:RecordIdentity urf:createTime="2001-12-31T12:00:00"

urf:recordId="token" />

<urf:JobIdentity>

<urf:GlobalJobId>urf:GlobalJobId</urf:GlobalJobId>

<urf:LocalJobId>urf:LocalJobId</urf:LocalJobId>

<urf:ProcessId>urf:ProcessId</urf:ProcessId>

</urf:JobIdentity>

<urf:UserIdentity>

<urf:GlobalUserName>UserX509DN</urf:GlobalUserName>

<urf:Group>UserVO</urf:Group>

<urf:GroupAttribute urf:type="ProjectName">TheMagicalProject</urf:GroupAttribute>

<urf:GroupAttribute urf:type="FQAN">UserFQAN</urf:GroupAttribute>

<urf:GroupAttribute urf:type="group">UserFQAN-group</urf:GroupAttribute>

<urf:GroupAttribute urf:type="role">UserFQAN-role</urf:GroupAttribute>

<urf:LocalUserId>urf:LocalUserId</urf:LocalUserId>

<urf:LocalGroup>urf:LocalGroup</urf:LocalGroup>

</urf:UserIdentity>

<urf:JobName urf:description="">urf:JobName</urf:JobName>

<urf:Charge urf:description="" urf:formula="CpuDuration\*KSI2K/3600"

urf:unit="H\*KIS2K">0.0</urf:Charge>

<urf:Status urf:description="">completed</urf:Status>

<urf:ExitStatus>0</urf:ExitStatus>

<urf:Infrastructure urf:description="PBS" urf:type="grid" />

<urf:WallDuration urf:description="">P1D</urf:WallDuration>

<urf:CpuDuration urf:description="" urf:usageType="all">P1D</urf:CpuDuration>

<urf:ServiceLevel urf:type="si2k">2600</urf:ServiceLevel>

<urf:Memory urf:description="" urf:metric="total"

urf:phaseUnit="P1D" urf:storageUnit="B" urf:type="shared">12345</urf:Memory>

<urf:Swap urf:description="" urf:metric="total" urf:phaseUnit="P1D"

urf:storageUnit="B" urf:type="swap">123456</urf:Swap>

<urf:TimeInstant urf:type="Ctime">2001-12-31T12:00:00</urf:TimeInstant>

<urf:TimeInstant urf:type="Qtime">2001-12-31T12:00:00</urf:TimeInstant>

<urf:TimeInstant urf:type="Etime">2001-12-31T12:00:00</urf:TimeInstant>

<urf:NodeCount urf:description="" urf:metric="total">2</urf:NodeCount>

<urf:Processors urf:consumptionRate="1.0"

urf:description="" urf:metric="max">4</urf:Processors>

<urf:EndTime urf:description="">2001-12-31T12:00:00</urf:EndTime>

<urf:StartTime urf:description="">2001-12-31T12:00:00</urf:StartTime>

<urf:MachineName urf:description="">anHost.aDomain</urf:MachineName>

<urf:SubmitHost urf:description="" urf:type="">http://t2-ce-01.to.infn.it:8443/cream-pbs-short</urf:SubmitHost>

<urf:Queue urf:description="execution">Short</urf:Queue>

<urf:Site urf:type="gocdb">INFN-TORINO</urf:Site>

<urf:ProjectName urf:description="">urf:ProjectName</urf:ProjectName>

<urf:Host urf:description="" urf:primary="false">t2-wn-01.to.infn.it</urf:Host>

<urf:Host urf:description="" urf:primary="false">t2-wn-05.to.infn.it</urf:Host>

</urf:UsageRecord>

### Aggregated record Example

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

<aur:SummaryRecord xmlns:aur="http://eu-emi.eu/namespaces/2011/11/aggregatedcomputerecord" xmlns:urf="http://eu-emi.eu/namespaces/2011/11/computerecord" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://eu-emi.eu/namespaces/2011/11/aggregatedcomputerecord car\_aggregated\_v1.0.xsd ">

<aur:Site urf:type="gocdb">aur:Site</aur:Site>

<aur:Month>4</aur:Month>

<aur:Year>1975</aur:Year>

<aur:UserIdentity>

<urf:GlobalUserName>User X509 DN</urf:GlobalUserName>

<urf:Group>UserVO</urf:Group>

<urf:GroupAttribute urf:type="vo-group">vo-group</urf:GroupAttribute>

<urf:GroupAttribute urf:type="vo-role">vo-role</urf:GroupAttribute>

</aur:UserIdentity>

<aur:EarliestEndTime>2001-12-31T12:00:00</aur:EarliestEndTime>

<aur:LatestEndTime>2001-12-31T12:00:00</aur:LatestEndTime>

<aur:WallDuration>P1D</aur:WallDuration>

<aur:CpuDuration>P1D</aur:CpuDuration>

<aur:NormalisedWallDuration normalisationFactor="1" normalisationMetric="HEPSPEC06">P1D</aur:NormalisedWallDuration>

<aur:NormalisedCpuDuration normalisationFactor="1" normalisationMetric="HEPSPEC06">P1D</aur:NormalisedCpuDuration>

<aur:NumberOfJobs>0</aur:NumberOfJobs>

</aur:SummaryRecord>

# Detailed record - XSD Schema

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

<xsd:schema attributeFormDefault="qualified"

elementFormDefault="qualified" targetNamespace="http://eu-emi.eu/namespaces/2011/11/computerecord"

xmlns:urf="http://eu-emi.eu/namespaces/2011/11/computerecord"

xmlns:xsd="http://www.w3.org/2001/XMLSchema" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">

<xsd:annotation>

<xsd:documentation xml:lang="en">EMI Compute Accounting

Record Working Group XML Schema definition V1.0</xsd:documentation>

</xsd:annotation>

<xsd:complexType name="UsageRecordType">

<xsd:sequence maxOccurs="1" minOccurs="1">

<xsd:element maxOccurs="1" minOccurs="1" ref="urf:RecordIdentity" />

<xsd:element maxOccurs="1" minOccurs="1" ref="urf:JobIdentity" />

<xsd:element maxOccurs="1" minOccurs="1" ref="urf:UserIdentity" />

<xsd:element maxOccurs="1" minOccurs="0" ref="urf:JobName" />

<xsd:element maxOccurs="1" minOccurs="0" ref="urf:Charge" />

<xsd:element maxOccurs="1" minOccurs="1" ref="urf:Status" />

<xsd:element name="ExitStatus" type="xsd:int" maxOccurs="1"

minOccurs="0">

</xsd:element>

<xsd:element maxOccurs="1" minOccurs="1" ref="urf:Infrastructure">

</xsd:element>

<xsd:sequence maxOccurs="1" minOccurs="1">

<xsd:element maxOccurs="1" minOccurs="1" ref="urf:WallDuration" />

<xsd:sequence maxOccurs="unbounded" minOccurs="1">

<xsd:element maxOccurs="unbounded" minOccurs="1"

ref="urf:CpuDuration" />

</xsd:sequence>

<xsd:element ref="urf:ServiceLevel" maxOccurs="unbounded"

minOccurs="1" />

<xsd:element ref="urf:Memory" maxOccurs="unbounded"

minOccurs="0" />

<xsd:element ref="urf:Swap" maxOccurs="1" minOccurs="0" />

<xsd:element ref="urf:TimeInstant" maxOccurs="unbounded"

minOccurs="0">

<xsd:annotation>

<xsd:documentation>Type for time instant that SHOULD be present

and treated by accounting services: Ctime - Time job was created.

Qtime - Time job was queued. Etime - Time job became eligible to

run.</xsd:documentation>

</xsd:annotation>

</xsd:element>

<xsd:element maxOccurs="1" minOccurs="0" ref="urf:NodeCount" />

<xsd:element maxOccurs="1" minOccurs="0" ref="urf:Processors" />

<xsd:element maxOccurs="1" minOccurs="1" ref="urf:EndTime" />

<xsd:element maxOccurs="1" minOccurs="1" ref="urf:StartTime" />

<xsd:element maxOccurs="1" minOccurs="0" ref="urf:MachineName" />

<xsd:element maxOccurs="1" minOccurs="1" ref="urf:SubmitHost" />

<xsd:element maxOccurs="unbounded" minOccurs="1" ref="urf:Queue" />

<xsd:element name="Site" type="urf:SiteType" maxOccurs="unbounded"

minOccurs="1">

</xsd:element>

<xsd:sequence maxOccurs="1" minOccurs="0">

<xsd:element maxOccurs="unbounded" minOccurs="0"

ref="urf:ProjectName" />

</xsd:sequence>

<xsd:sequence maxOccurs="1" minOccurs="0">

<xsd:element maxOccurs="unbounded" minOccurs="0" ref="urf:Host" />

</xsd:sequence>

<xsd:sequence maxOccurs="1" minOccurs="0">

<xsd:choice maxOccurs="unbounded" minOccurs="0">

<xsd:element ref="urf:PhaseResource" />

<xsd:element ref="urf:VolumeResource" />

<xsd:element ref="urf:Resource" />

<xsd:element ref="urf:ConsumableResource" />

</xsd:choice>

</xsd:sequence>

</xsd:sequence>

</xsd:sequence>

</xsd:complexType>

<xsd:element abstract="true" name="Usage" type="urf:UsageRecordType" />

<xsd:element name="UsageRecord" substitutionGroup="urf:Usage"

type="urf:UsageRecordType" />

<xsd:element name="UsageRecords">

<xsd:complexType>

<xsd:sequence>

<xsd:element maxOccurs="unbounded" minOccurs="0" ref="urf:Usage" />

</xsd:sequence>

</xsd:complexType>

</xsd:element>

<!-- Common properties that may be measured with several different metrics

within the same usage record -->

<xsd:element name="Network">

<xsd:complexType>

<xsd:simpleContent>

<xsd:extension base="xsd:positiveInteger">

<xsd:attribute ref="urf:description" use="optional" />

<xsd:attributeGroup ref="urf:intervallicVolume" />

<xsd:attribute default="total" ref="urf:metric" use="optional" />

</xsd:extension>

</xsd:simpleContent>

</xsd:complexType>

</xsd:element>

<xsd:element name="Memory">

<xsd:complexType>

<xsd:simpleContent>

<xsd:extension base="xsd:positiveInteger">

<xsd:attribute ref="urf:description" use="optional" />

<xsd:attributeGroup ref="urf:intervallicVolume" />

<xsd:attribute default="total" ref="urf:metric" use="optional" />

<xsd:attribute ref="urf:type" use="required" />

</xsd:extension>

</xsd:simpleContent>

</xsd:complexType>

</xsd:element>

<xsd:element name="Swap">

<xsd:complexType>

<xsd:simpleContent>

<xsd:extension base="xsd:positiveInteger">

<xsd:attribute ref="urf:description" use="optional" />

<xsd:attributeGroup ref="urf:intervallicVolume" />

<xsd:attribute default="total" ref="urf:metric" use="optional" />

<xsd:attribute ref="urf:type" use="optional" />

</xsd:extension>

</xsd:simpleContent>

</xsd:complexType>

</xsd:element>

<xsd:element name="NodeCount">

<xsd:complexType>

<xsd:simpleContent>

<xsd:extension base="xsd:positiveInteger">

<xsd:attribute ref="urf:description" use="optional" />

<xsd:attribute default="total" ref="urf:metric" use="optional" />

</xsd:extension>

</xsd:simpleContent>

</xsd:complexType>

</xsd:element>

<xsd:element name="Processors">

<xsd:complexType>

<xsd:simpleContent>

<xsd:extension base="xsd:positiveInteger">

<xsd:attribute ref="urf:description" use="optional" />

<xsd:attribute ref="urf:metric" use="optional" />

<xsd:attribute name="consumptionRate" type="xsd:float"

use="optional" />

</xsd:extension>

</xsd:simpleContent>

</xsd:complexType>

</xsd:element>

<xsd:element name="TimeDuration">

<xsd:complexType>

<xsd:simpleContent>

<xsd:extension base="xsd:duration">

<xsd:attribute ref="urf:type" use="optional" />

</xsd:extension>

</xsd:simpleContent>

</xsd:complexType>

</xsd:element>

<xsd:element name="TimeInstant">

<xsd:complexType>

<xsd:simpleContent>

<xsd:extension base="xsd:dateTime">

<xsd:attribute ref="urf:type" use="optional" />

</xsd:extension>

</xsd:simpleContent>

</xsd:complexType>

</xsd:element>

<xsd:element name="ServiceLevel">

<xsd:complexType>

<xsd:simpleContent>

<xsd:extension base="xsd:token">

<xsd:attribute ref="urf:type" use="optional">

<xsd:annotation>

<xsd:documentation>Values that SHOULD be treated are: Si2k Sf2k

HEPSPEC</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

</xsd:extension>

</xsd:simpleContent>

</xsd:complexType>

</xsd:element>

<!-- This element should appear at most twice within a usage record, with

differing values for usageType for each appearance -->

<xsd:element name="CpuDuration">

<xsd:complexType>

<xsd:simpleContent>

<xsd:extension base="xsd:duration">

<xsd:attribute ref="urf:description" use="optional" />

<xsd:attribute name="usageType" default="all">

<xsd:annotation>

<xsd:documentation>usageType="all" (sum of system and user) MUST

be present in the record</xsd:documentation>

</xsd:annotation>

<xsd:simpleType>

<xsd:restriction base="xsd:token">

<xsd:enumeration value="user" />

<xsd:enumeration value="system" />

<xsd:enumeration value="all" />

</xsd:restriction>

</xsd:simpleType>

</xsd:attribute>

</xsd:extension>

</xsd:simpleContent>

</xsd:complexType>

</xsd:element>

<!-- These common properties should appear at most once within a usage record,

rather that at most once per metric per usage record -->

<xsd:element name="WallDuration">

<xsd:complexType>

<xsd:simpleContent>

<xsd:extension base="xsd:duration">

<xsd:attribute ref="urf:description" use="optional" />

</xsd:extension>

</xsd:simpleContent>

</xsd:complexType>

</xsd:element>

<xsd:element name="EndTime">

<xsd:complexType>

<xsd:simpleContent>

<xsd:extension base="xsd:dateTime">

<xsd:attribute ref="urf:description" use="optional" />

</xsd:extension>

</xsd:simpleContent>

</xsd:complexType>

</xsd:element>

<xsd:element name="StartTime">

<xsd:complexType>

<xsd:simpleContent>

<xsd:extension base="xsd:dateTime">

<xsd:attribute ref="urf:description" use="optional" />

</xsd:extension>

</xsd:simpleContent>

</xsd:complexType>

</xsd:element>

<xsd:element name="MachineName">

<xsd:complexType>

<xsd:simpleContent>

<xsd:extension base="urf:domainNameType">

<xsd:attribute ref="urf:description" use="optional" />

</xsd:extension>

</xsd:simpleContent>

</xsd:complexType>

</xsd:element>

<xsd:element name="SubmitHost">

<xsd:complexType>

<xsd:simpleContent>

<xsd:extension base="xsd:anyURI">

<xsd:attribute ref="urf:description" use="optional" />

<xsd:attribute name="type" type="xsd:string" use="required"></xsd:attribute>

</xsd:extension>

</xsd:simpleContent>

</xsd:complexType>

</xsd:element>

<xsd:element name="Host">

<xsd:complexType>

<xsd:simpleContent>

<xsd:extension base="urf:domainNameType">

<xsd:attribute ref="urf:description" use="optional" />

<xsd:attribute default="false" name="primary" type="xsd:boolean" />

</xsd:extension>

</xsd:simpleContent>

</xsd:complexType>

</xsd:element>

<xsd:element name="Queue">

<xsd:complexType>

<xsd:simpleContent>

<xsd:extension base="xsd:string">

<xsd:attribute ref="urf:description" use="optional"

default="execution" />

</xsd:extension>

</xsd:simpleContent>

</xsd:complexType>

</xsd:element>

<xsd:element name="JobName">

<xsd:complexType>

<xsd:simpleContent>

<xsd:extension base="xsd:string">

<xsd:attribute ref="urf:description" use="optional" />

</xsd:extension>

</xsd:simpleContent>

</xsd:complexType>

</xsd:element>

<xsd:element name="ProjectName">

<xsd:complexType>

<xsd:simpleContent>

<xsd:extension base="xsd:string">

<xsd:attribute ref="urf:description" use="optional" />

</xsd:extension>

</xsd:simpleContent>

</xsd:complexType>

</xsd:element>

<xsd:element name="Status">

<xsd:annotation>

<xsd:documentation>

Minimum required set =

{Aborted, Completed, Failed,

Held, Queued, Started, Suspended}

</xsd:documentation>

</xsd:annotation>

<xsd:complexType>

<xsd:simpleContent>

<xsd:extension base="xsd:token">

<xsd:attribute ref="urf:description" use="optional" />

</xsd:extension>

</xsd:simpleContent>

</xsd:complexType>

</xsd:element>

<xsd:element name="Charge">

<xsd:complexType>

<xsd:simpleContent>

<xsd:extension base="xsd:float">

<xsd:attribute ref="urf:description" use="optional" />

<xsd:attribute ref="urf:unit" use="optional" />

<xsd:attribute name="formula" type="xsd:string" use="optional" />

</xsd:extension>

</xsd:simpleContent>

</xsd:complexType>

</xsd:element>

<!-- identity elements -->

<xsd:element name="JobIdentity">

<xsd:complexType>

<xsd:sequence>

<xsd:element maxOccurs="1" minOccurs="0" name="GlobalJobId"

type="xsd:string" />

<xsd:element maxOccurs="1" minOccurs="1" name="LocalJobId"

type="xsd:string" />

<xsd:sequence>

<xsd:element maxOccurs="unbounded" minOccurs="0"

name="ProcessId" type="xsd:string" />

</xsd:sequence>

</xsd:sequence>

</xsd:complexType>

</xsd:element>

<xsd:element name="RecordIdentity">

<xsd:complexType>

<xsd:annotation>

<xsd:documentation>This is the place where to insert the effective

User VirtualOrganization </xsd:documentation>

</xsd:annotation>

<xsd:attribute name="recordId" type="xsd:token" use="required" />

<xsd:attribute name="createTime" type="xsd:dateTime"

use="required" />

</xsd:complexType>

</xsd:element>

<!-- Extensibility Framework -->

<xsd:element name="Resource" type="urf:ResourceType" />

<xsd:element name="ConsumableResource" type="urf:ConsumableResourceType" />

<xsd:element name="PhaseResource">

<xsd:complexType>

<xsd:complexContent>

<xsd:extension base="urf:ConsumableResourceType">

<xsd:attribute ref="urf:phaseUnit" use="optional" />

</xsd:extension>

</xsd:complexContent>

</xsd:complexType>

</xsd:element>

<xsd:element name="VolumeResource">

<xsd:complexType>

<xsd:complexContent>

<xsd:extension base="urf:ConsumableResourceType">

<xsd:attribute ref="urf:storageUnit" use="optional" />

</xsd:extension>

</xsd:complexContent>

</xsd:complexType>

</xsd:element>

<!-- Create a generic consumable resource. Carries the units attribute -->

<xsd:complexType name="ConsumableResourceType">

<xsd:simpleContent>

<xsd:extension base="xsd:float">

<xsd:attribute name="units" type="xsd:string" use="optional" />

<xsd:attribute ref="urf:description" use="optional" />

</xsd:extension>

</xsd:simpleContent>

</xsd:complexType>

<!-- Create a generic resource type -->

<xsd:complexType name="ResourceType">

<xsd:simpleContent>

<xsd:extension base="xsd:string">

<xsd:attribute ref="urf:description" use="optional" />

</xsd:extension>

</xsd:simpleContent>

</xsd:complexType>

<!-- Global Attribute Definitions -->

<xsd:attribute name="description" type="xsd:string" />

<!-- Units of measure attribute definitions -->

<xsd:attribute name="unit" type="xsd:token" />

<xsd:attribute name="storageUnit">

<xsd:simpleType>

<xsd:restriction base="xsd:token">

<xsd:enumeration value="b" />

<xsd:enumeration value="B" />

<xsd:enumeration value="KB" />

<xsd:enumeration value="MB" />

<xsd:enumeration value="GB" />

<xsd:enumeration value="PB" />

<xsd:enumeration value="EB" />

<xsd:enumeration value="Kb" />

<xsd:enumeration value="Mb" />

<xsd:enumeration value="Gb" />

<xsd:enumeration value="Pb" />

<xsd:enumeration value="Eb" />

</xsd:restriction>

</xsd:simpleType>

</xsd:attribute>

<xsd:attribute name="phaseUnit" type="xsd:duration" />

<xsd:attributeGroup name="intervallicVolume">

<xsd:attribute ref="urf:storageUnit" use="optional" />

<xsd:attribute ref="urf:phaseUnit" use="optional" />

</xsd:attributeGroup>

<!-- End units attributes -->

<xsd:attribute name="metric" type="xsd:token" />

<xsd:attribute name="type" type="xsd:token" />

<!-- Simple type definitions used to constrain values of attributes -->

<xsd:simpleType name="domainNameType">

<xsd:restriction base="xsd:string">

<xsd:pattern

value="([a-zA-Z0-9][a-zA-Z0-9'\-']\*[a-zA-Z0-9]\.)\*([a-zA-Z0-9][a-zA-Z0-9'\-']\*[a-zA-Z0-9])?" />

<xsd:maxLength value="255" />

</xsd:restriction>

</xsd:simpleType>

<xsd:complexType name="GroupAttributeType">

<xsd:simpleContent>

<xsd:extension base="xsd:string">

<xsd:attribute name="type" type="xsd:string"></xsd:attribute>

</xsd:extension>

</xsd:simpleContent>

</xsd:complexType>

<xsd:complexType name="SiteType">

<xsd:simpleContent>

<xsd:extension base="xsd:string">

<xsd:attribute name="type" type="xsd:string" default="gocdb"

use="optional"></xsd:attribute>

</xsd:extension>

</xsd:simpleContent>

</xsd:complexType>

<xsd:complexType name="InfrastructureType">

<xsd:attribute name="description" type="xsd:string"></xsd:attribute>

<xsd:attribute name="type">

<xsd:simpleType>

<xsd:restriction base="xsd:string">

<xsd:enumeration value="grid"></xsd:enumeration>

<xsd:enumeration value="local"></xsd:enumeration>

</xsd:restriction>

</xsd:simpleType>

</xsd:attribute>

</xsd:complexType>

<xsd:element name="Infrastructure" type="urf:InfrastructureType"></xsd:element>

<xsd:complexType name="UserIdentityBaseType">

<xsd:sequence>

<!-- <xsd:element minOccurs="1" maxOccurs="1" name="LocalUserId" type="xsd:string">

</xsd:element> -->

<xsd:element minOccurs="0" maxOccurs="1"

name="GlobalUserName" type="xsd:string">

</xsd:element>

<xsd:element minOccurs="0" maxOccurs="1" name="Group"

type="xsd:string">

</xsd:element>

<xsd:sequence maxOccurs="unbounded" minOccurs="0"><xsd:element minOccurs="0" maxOccurs="unbounded" name="GroupAttribute" type="urf:GroupAttributeType">

</xsd:element></xsd:sequence>

</xsd:sequence>

</xsd:complexType>

<xsd:complexType name="UserIdentityType">

<xsd:complexContent>

<xsd:extension base="urf:UserIdentityBaseType">

<xsd:sequence>

<xsd:element name="LocalUserId" type="xsd:string"

maxOccurs="1" minOccurs="1">

</xsd:element>

<xsd:element name="LocalGroup" type="xsd:string" maxOccurs="1" minOccurs="0"></xsd:element>

</xsd:sequence>

</xsd:extension>

</xsd:complexContent>

</xsd:complexType>

<xsd:element name="UserIdentity" type="urf:UserIdentityType">

</xsd:element>

</xsd:schema>

# Aggregated record – XSD schema

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

<schema targetNamespace="http://eu-emi.eu/namespaces/2011/11/aggregatedcomputerecord"

elementFormDefault="qualified" xmlns="http://www.w3.org/2001/XMLSchema"

xmlns:urf="http://eu-emi.eu/namespaces/2011/11/computerecord" xmlns:aur="http://eu-emi.eu/namespaces/2011/11/aggregatedcomputerecord">

<import schemaLocation="car\_v1.0.xsd"

namespace="http://eu-emi.eu/namespaces/2011/11/computerecord"></import>

<element name="SummaryRecord" type="aur:SummaryRecordType"></element>

<complexType name="SummaryRecordType">

<sequence>

<element name="Site" type="urf:SiteType" maxOccurs="1"

minOccurs="1">

</element>

<element name="Month" maxOccurs="1" minOccurs="1">

<simpleType>

<restriction base="int">

<minInclusive value="1"></minInclusive>

<maxInclusive value="12"></maxInclusive>

</restriction>

</simpleType>

</element>

<element name="Year" maxOccurs="1" minOccurs="1">

<simpleType>

<restriction base="int">

<pattern value="\d\d\d\d"></pattern>

</restriction>

</simpleType>

</element>

<element name="UserIdentity" type="aur:UserIdentityAggregateType"></element>

<element name="EarliestEndTime" type="dateTime"></element>

<element name="LatestEndTime" type="dateTime"></element>

<element name="WallDuration" type="duration" maxOccurs="1"

minOccurs="1">

</element>

<element name="CpuDuration" type="duration" maxOccurs="1"

minOccurs="1">

</element>

<element name="NormalisedWallDuration"

type="aur:NormalisedDurationType" maxOccurs="1" minOccurs="1">

</element>

<element name="NormalisedCpuDuration"

type="aur:NormalisedDurationType" maxOccurs="1" minOccurs="1">

</element>

<element name="NumberOfJobs" type="integer" maxOccurs="1" minOccurs="1"></element>

</sequence>

</complexType>

<element name="SummaryRecords" type="aur:SummaryRecordsType"></element>

<complexType name="SummaryRecordsType">

<sequence>

<element name="SummaryRecord" type="aur:SummaryRecordType"

maxOccurs="unbounded" minOccurs="0">

</element>

</sequence>

</complexType>

<complexType name="UserIdentityAggregateType">

<complexContent>

<extension base="urf:UserIdentityBaseType"></extension>

</complexContent>

</complexType>

<complexType name="NormalisedDurationType">

<simpleContent>

<extension base="duration">

<attribute name="normalisationFactor" type="int" default="1"></attribute>

<attribute name="normalisationMetric" type="string" default="HEPSPEC06"></attribute>

</extension>

</simpleContent>

</complexType>

</schema>