
CERIF 1.3 Full Data Model (FDM)

Introduction and Specification

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Abstract:

CERIF (the Common European Research Information Format) is a formal conceptual model to support the management of Research Information, including the set up of and the interoperation between Research Information Systems. Research Information is information about research entities such as people, projects, organisations, publications, patents, products, funding, or equipment, etc. and the relationships between them. Information Systems allow to structure, store, maintain, exchange, access, disseminate or assess the information they contain. We consider CERIF; its entities, their rich and flexible relationship management, the xml interchange format, and the CERIF Semantics a very powerful instrument for setting up scalable and quality-oriented information systems. The CERIF 1.3 release upgrades the model towards measurement extensions, elaborated on infrastructure entities and semantics, and includes geographic bounding box. This document provides a detailed description of the range and structure of the entire CERIF model – version 1.3.

CERIF is considered a standard; recommended by the European Union to its Member States. It has been developed with support by the European Commission in two major phases: 1987-1990 and 1997-1999. In 2000 the European Commission handed over care and custody of CERIF to euroCRIS (www.eurocris.org) a not-for-profit organisation dedicated to the promotion of **C**urrent **R**esearch **I**nformation **S**ystems (CRISs).

Status:

CERIF model improvements result from discussions among euroCRIS CERIF task group members during regular physical task group meetings, from the mailing list and forum communication, mostly triggered through real-world requirements from the euroCRIS community.

Location:

http://www.eurocris.org/Uploads/Web%20pages/CERIF-1.3/Specifications/CERIF1.3_FDM.pdf

Table of Contents

| | |
|---|----|
| 1. Introduction and Concise History | 5 |
| 1.1 Purpose of this Document | 6 |
| 1.2 CERIF 1.3 Components | 7 |
| 1.3 CERIF Upgrade | 8 |
| 2. The CERIF 1.3 Model | 9 |
| 2.1 CERIF Conceptual Structure | 9 |
| 2.2 CERIF Base Entities | 10 |
| 2.2.1 CERIF Entity Project | 11 |
| 2.2.2 CERIF Entity Person | 14 |
| 2.2.3 CERIF Entity OrganisationUnit | 16 |
| 2.3 CERIF Result Entities | 18 |
| 2.3.1 CERIF Entity ResultPublication | 19 |
| 2.3.2 CERIF Entity ResultPatent | 25 |
| 2.3.3 CERIF Entity ResultProduct | 26 |
| 2.4 CERIF Infrastructure Entities | 27 |
| 2.5 CERIF Geographic Bounding Box | 29 |
| 2.6 CERIF Indicator and Measure Entities | 29 |
| 2.7 CERIF 2 nd Level Entities | 31 |
| 2.8 CERIF Link Entities | 32 |
| 2.9 CERIF Multiple Language Features | 34 |
| 2.10 CERIF Semantic Layer [Semantic Features] | 35 |
| 2.11 Additional Features | 38 |
| 3. CERIF-based SQL scripts | 38 |
| 4. CERIF XML | 39 |
| 5. CERIF Semantics | 40 |
| 6. Pending Items | 40 |
| 7. CERIF Extensions | 41 |
| 8. Note | 41 |
| 9. Acknowledgements | 41 |

| | |
|--|----|
| 10. Appendix | 42 |
| 10.1 List of CERIF Entities | 42 |
| 10.1.1 CERIF Base Entities (Logical (PhysicalName)) | 42 |
| 10.1.2 CERIF Result Entities (Logical (PhysicalName)) | 42 |
| 10.1.3 CERIF Infrastructure Entities (Logical (PhysicalName)) | 42 |
| 10.1.4 CERIF 2 nd Level Entities (Logical (PhysicalName)) | 42 |
| 10.1.5 CERIF Link Entities (Logical (PhysicalName)) | 42 |
| 10.1.6 CERIF Multiple Language Features (Logical (PhysicalName)) | 45 |
| 10.1.7 Additional Entities (Logical (PhysicalName)) | 46 |
| 10.1.8 CERIF Classification Entities (Logical (PhysicalName)) | 46 |
| 10.1.9 CERIF Attributes | 46 |
| 10.1.10 Attribute in all Link Tables | 46 |
| 10.2 Logical / Physical CERIF Entity Names | 47 |
| 11. References | 52 |

1. Introduction and Concise History

Most nation-states have publicly-supported research programmes. It is realised that public sponsorship of research and development leads to wealth creation and improvement in the quality of life. Because public funding is involved, it is necessary for there to be appropriate governance, and for the related information to be available to the public. Broadly, each nation state has a similar research process of: strategic planning; programme announcement; call for proposals; proposal evaluation and awarding; project result monitoring, project result exploitation. However, research is international. A research project in country A is likely to be based on previous research in several other countries. Many research projects are now transnational: well-known examples include the human genome and climate change, but there are many others, especially where expensive infrastructure is utilised such as particle physics or space science. Furthermore, knowledge of the research activity in country A may influence the strategy towards research – including priorities and resources provided – in country B. Thus, there is a need to share research information across countries, or even between different funding agencies in the same country. Research Information is used by researchers (to find partners, to track competitors, to form collaborations); research managers (to assess performance and research outputs and to find reviewers for research proposals); research strategists (to decide on priorities and resourcing compared with other countries); publication editors (to find reviewers and potential authors); intermediaries/brokers (to find research products and ideas that can be carried forward with knowledge/technology transfer to wealth creation); the media (to communicate the results of R&D in a socio-economic context) and the general public (for interest). Most European countries collect and store their research information in digital repositories; these may be national, regional, institutional, functional, or thematic in their range, where each system builds upon a particular format or structure to serve for special requests. Research Information is relevant for actors in scientific environments as well as for decision makers to support related organization, management and planning. We consider Research Information as the transmitter between Science and Society and as such as a powerful instrument for governance. Having such an impact, Research Information has to be collected carefully and preserved systematically, in order to most effectively support society and the individuals within [1, 2, 4, 5, 7].

CRIS and CERIF approaches to enable advances into this direction are not new. The first release of CERIF has been published in 1991 with the aim of facilitating data exchange of records on research projects between European Member States, and to serve as a format to allow for the networking of databases. The European Working Group on Research Databases has recommended the CERIF format as a result of a workshop held in 1987. The CERIF 1991 data model which described project records only has been applied in the ERGO project* and the needs for an extension were recognised. In 1997 revision work was entrusted to unit D2 DG XIII of the European Commission. The revisions in the model were based on reflections of user requirements and led to a recommendation for CERIF 2000† to Member States and a handover of CERIF to euroCRIS‡. The CERIF 2000 release has added person and organisation as entities and many other entities relevant in the research context, such as publication, service, equipment, patent, country, language, event, and classification. Additionally, these entities had types and the relationships assigned roles to capture their semantics. In the CERIF 2006 release these roles and types at entities have been re-organised within the so called Semantic Layer to supply the needed flexibility for capturing different application semantics and views; allowing the assignment of multiple classification systems.

* ERGO project: <http://cordis.europa.eu/ergo/>

† EC Recommendation: <http://cordis.europa.eu/cerif/>

‡ euroCRIS: <http://www.eurocris.org/>

Alongside the 2006 model, the *CERIF XML* interchange format has been introduced [9, 11]. The CERIF 2008 release extended its predecessors with substantial elaboration on the publication entity, and thus established the long requested connectivity to repositories for scholarly publications. CERIF 2008–1.0 introduced the *CERIF Semantics* [12] for publication related entities as a first step towards a formal vocabulary for publication types. CERIF 2008–1.1 further elaborated towards publication entity improvements by including a relationship semantics for all publication-related entities. The CERIF 2008–1.2 release touched funding-related requirements, and substantially extends the CERIF Semantics. The CERIF 1.3 release omits the year in its name. From now on CERIF releases will be numbered. With CERIF 1.3, incorporates a major upgrade towards quantitative measurement means, extends on infrastructure entities including geographic binding. Furthermore, each formally defined vocabulary term in the CERIF Semantics document has its own uuid identifier.

This document is a walk through the CERIF 1.3 model following the introduced conceptual structure. The physical representations of database levels through ERM extracts and real life examples will support the understanding of the model in a more applied context.

1.1 Purpose of this Document

This document provides a detailed description of the CERIF 1.3 ER-Model and demonstrates potential use cases and application scenarios.

1.2 CERIF 1.3 Components[§]

The current CERIF 1.3 release comprises the following components:

- CERIF – 1.3 FDM: Model Introduction and Specification
this document
- CERIF 1.3 FDM: SQL scripts for most common databases
available for members only
- CERIF – 1.3 XML: Data Exchange Format Specification
separate document available from the website [11]
Note: Towards the Next Release
- CERIF – 1.3 XML Examples
available for members only
- CERIF – 1.3 XML Schema Files
CERIF XML validation files available from the website
<http://www.eurocris.org/Uploads/Web%20pages/CERIF-1.3/XML-SCHEMAS/>
- CERIF – 1.3 Semantics: Research Vocabulary
separate document available from the website [12]
- CERIF 1.3 Vocabulary
available as Excel file from the website
http://www.eurocris.org/Uploads/Web%20pages/CERIF-1.3/Semantics/CERIF1.3_Vocabulary.xls
and (embedded) CERIF XML (currently for Members only upon request)

Additional CERIF–1.3 related files and more documents or background information about CERIF and CRISs are available for downloaded from the euroCRIS website: <http://www.eurocris.org/>.

[§] CERIF–1.3 was modeled with Toad Data Modeler by Quest Software[§], which allows to draw ERM diagrams, to generate SQL scripts for most common databases (Oracle, Microsoft, IBM, etc.), to reverse engineer from databases, to create screenshots of the model and model parts, and to model at physical and logical level. The resulting CERIF SQL scripts are generated automatically from the physical level.

1.3 CERIF Upgrade

Compared to its preceding version (CERIF 2008–1.2) this release CERIF 1.3 incorporates the following new features:

- **New Entities:** cfClassificationSchemeDescription; cfClassificationSchemeName; cfClassificationExample; cfClassificationDefinition cfMedium; cfMediumTitle; cfMediumDescription; cfMediumKeywords; cfMedium_Medium; cfMedium_Classification; cfResultPublication_Medium; cfResultProduct_Medium; cfFacility_Medium; cfService_Medium; cfProject_Medium; cfPerson_Medium; cfOrganisationUnit_Medium; cfEvent_Medium; cfFunding_Medium; cfCitation_Medium; cfEquipment_Equipment; cfService_Service; cfFacility_Facility; cfFacility_Equipment; cfFacility_Service; cfEquipment_Service; cfFacility_Event; cfEquipment_Event; cfResultPublication_Service; cfResultPatent_Facility; cfResultPatent_Service; cfResultPatent_Equipment; cfResultProduct_Facility; cfResultProduct_Service; cfResultProduct_Equipment; cfGeographicBoundingBox; cfGeographicBoundingBox_GeographicBoundingBox; cfGeographicBoundingBoxName; cfGeographicBoundingBoxDescription; cfGeographicBoundingBoxKeywords; cfGeographicBoundingBox_Classification; cfPostAddress_GeographicBoundingBox; cfEquipment_PostAddress; cfFacility_PostAddress; cfService_PostAddress; cfMeasurement; cfIndicator; cfIndicator_Measurement; cfMeasurement_Classification; cfIndicator_Classification; cfIndicatorName; cfIndicatorDescription; cfIndicatorKeywords; cfMeasurementName; cfMeasurementDescription; cfMeasurementKeywords; cfPerson_Measurement; cfOrganisationUnit_Measurement; cfProject_Measurement; cfResultPublication_Measurement; cfResultPatent_Measurement; cfResultProduct_Measurement; cfFacility_Measurement; cfService_Measurement; cfEquipment_Measurement; cfPerson_Indicator; cfOrganisationUnit_Indicator; cfProject_Indicator; cfResultPublication_Indicator; cfResultPatent_Indicator; cfResultProduct_Indicator; cfFacility_Indicator; cfService_Indicator; cfEquipment_Indicator; cfEvent_Measurement; cfEvent_Indicator; cfMedium_Indicator; cfMedium_Measurement; cfIndicator_Indicator; cfMeasurement_Measurement;
- **New Attributes:** cfRoleExpression; cfRoleExpressionOpposite with cfClassificationTerm entity cfMediumIdentifier; cfMediumCreationDate; cfSize; cfMimeType; cfUniformResourceIdentifier with cfMedium entity cfAcronym with cfEquipment; cfFacility; cfService; cfFunding entities cfDescriptionSource; cfTermSource; cfDefinitionSource; cfNameSource; cfExampleSource with Classification entities cfStartDate/cfEndDate with cfResultPublication_Metrics entity cfTranslation in cfLanguageName entity
- **Removed Attributes:** cfEquipmentOwnerIdentifier; cfOriginalEquipmentManufacturerIdentifier with cfEquipment entity cfResultProductInternalIdentifier with cfResultProduct entity;
- **Renamed Attributes:** cfName in entity cfCurrencyEntityName to cfEntityName
- **Pending Entities:** cfResPublVersInf; cfResPatVersInf; cfResProdVersInf cfMiddleNames with cfPersonName entity
- **CERIF Vocabulary:** (not physically part of the model – currently provided in an Excel Sheet)!

2. The CERIF 1.3 Model

To reduce the complexity of the model towards a better understanding, this introduction and specification document follows a conceptual structure to allow for different perspectives and views while talking about model parts; it thus enables emphasis to particular model features. With respect to Entity-Relationship-Modelling (ERM), this conceptual structure is only a virtual structure and as such not inherent in the physical data model, and therefore also not incorporated in physical SQL scripts. It is used for organizing this document and considered an instrument to support the comprehension of the entire CERIF model and its strength.

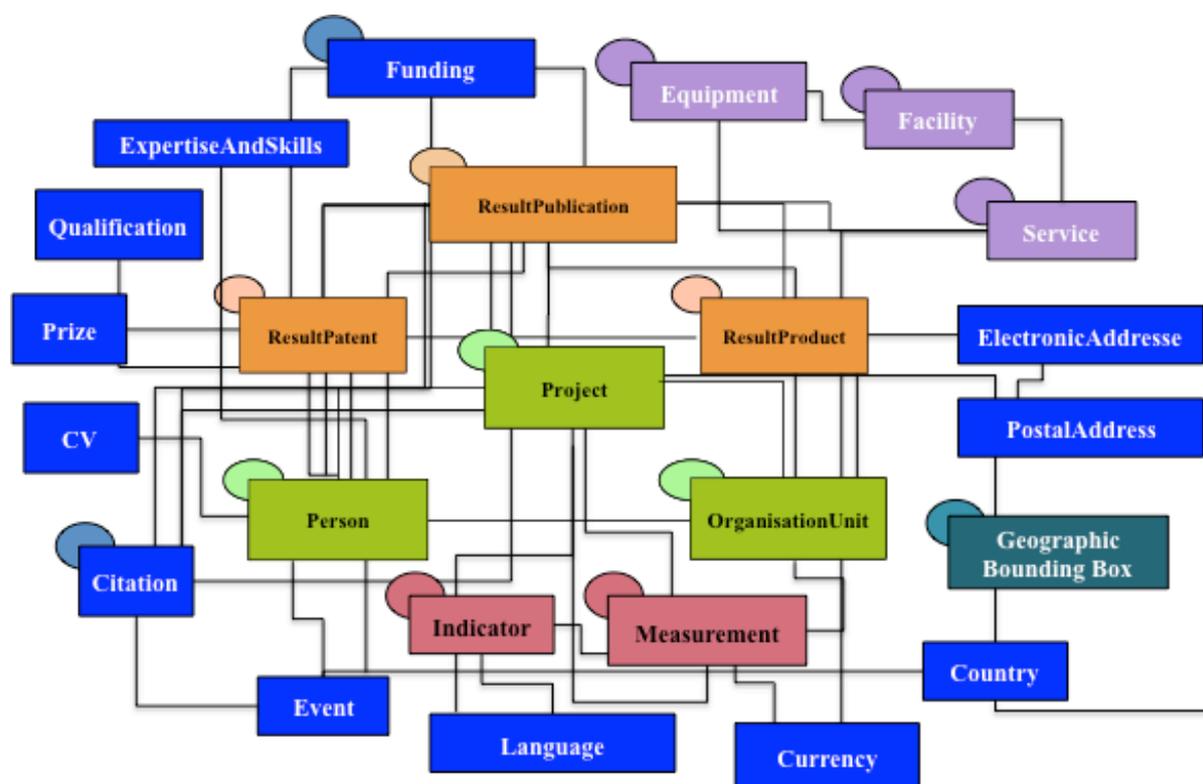


Figure 1: CERIF 1.3 Entities and their relationships (abstract view)

2.1 CERIF Conceptual Structure

We conceptually structure the CERIF model into entity types and features. In between the types we distinguish base, result, infrastructure, 2nd level entities, and link entities; as features we consider multilinguality and semantics, geographics and measurement. This conceptual structure is also supported by colors.

| CERIF Entity Types | | CERIF Features | |
|---|--------------------------------------|---|--------------------------|
|  | Base Entities [base] |  | Multiple Language [lang] |
|  | Result Entities [result] |  | Semantics [class]** |
|  | 2 nd Level Entities [2nd] |  | Geographics [geo] |
|  | Link Entities [link] |  | Additional [add] |
|  | Infrastructure Entities [infra] |  | Measurement [mm] |

** The CERIF Semantics additionally provides a vocabulary that is maintained outside of the CERIF data model and available from the public euroCRIS Website.

The conceptual model parts will subsequently be presented by abstract views. For the more technical details at logical or physical/database level (attributes, datatypes, keys) screenshots from Toad ERM submodels will be presented. Whereas the entity names in abstract views are presented in full length to describe the concept behind, the table names in the screenshots are abbreviated and include the ‘cf’ prefix for CERIF. Because in some databases the length of a table name is restricted to a particular number of characters, we have shortened the table names at physical level to ensure the consistency of SQL scripts across databases by avoiding uncontrolled truncations. The CERIF XML element names map to physical (short) names of the entities. The CERIF XML specification recommends the usage of the same conceptual structure for the ordering and grouping of xml files and in the XML file names [11].^{††}

A complete list of the CERIF entities is attached in the Appendix indicating their conceptual type or feature; a HTML presentation of the model, including the conceptual images, is referred to from the public euroCRIS website for online navigation: <http://www.eurocris.org/>.

2.2 CERIF Base Entities

The CERIF base entities are Person, OrganisationUnit and Project. *Figure 2* shows the base entities, as well as their recursive and linking relationships (in the little circles). Each base entity recursively links to itself and maintains relationships with the other base entities. The base entities allow for a representation of scientific actors and their different kinds of interactions.

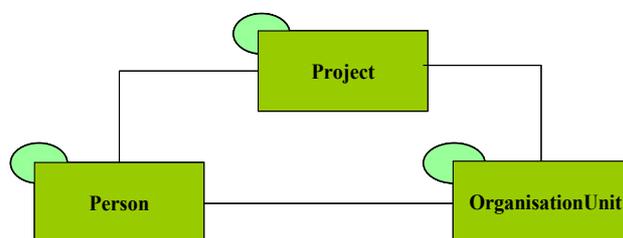


Figure 2: CERIF 1.3 Base Entities (abstract view)

Figure 3 below shows the base entities (cfProj, cfPers, cfOrgUnit) and some related entities from a ERM perspective. The little circles from *Figure 2* represent recursiveness; that is, the relationships within one entity; within project, within person, and within organisation. In *Figure 3*, these recursive entities are modeled as link entities (cfProj_Proj, cfPers_Pers, cfOrgUnit_OrgUnit). The recursive as well as all other interlinking relations are presented in *Figure 3*; cfPers_OrgUnit, cfProj_Pers, and cfProj_OrgUnit are so called CERIF link type entities and will be introduced in section 2.8. The yellow colored entities cfProjTitle, cfProjAbstr, cfOrgUnitName, etc., support the feature of multiple languages and will be explained in section 2.9.

^{††} A new CERIF XML specification is on the way, allowing for a highly flexible management and embedding of the single CERIF entities. It is currently tested within the CERIF taskgroup. Interested members should be in contact with the taskgroup leader.

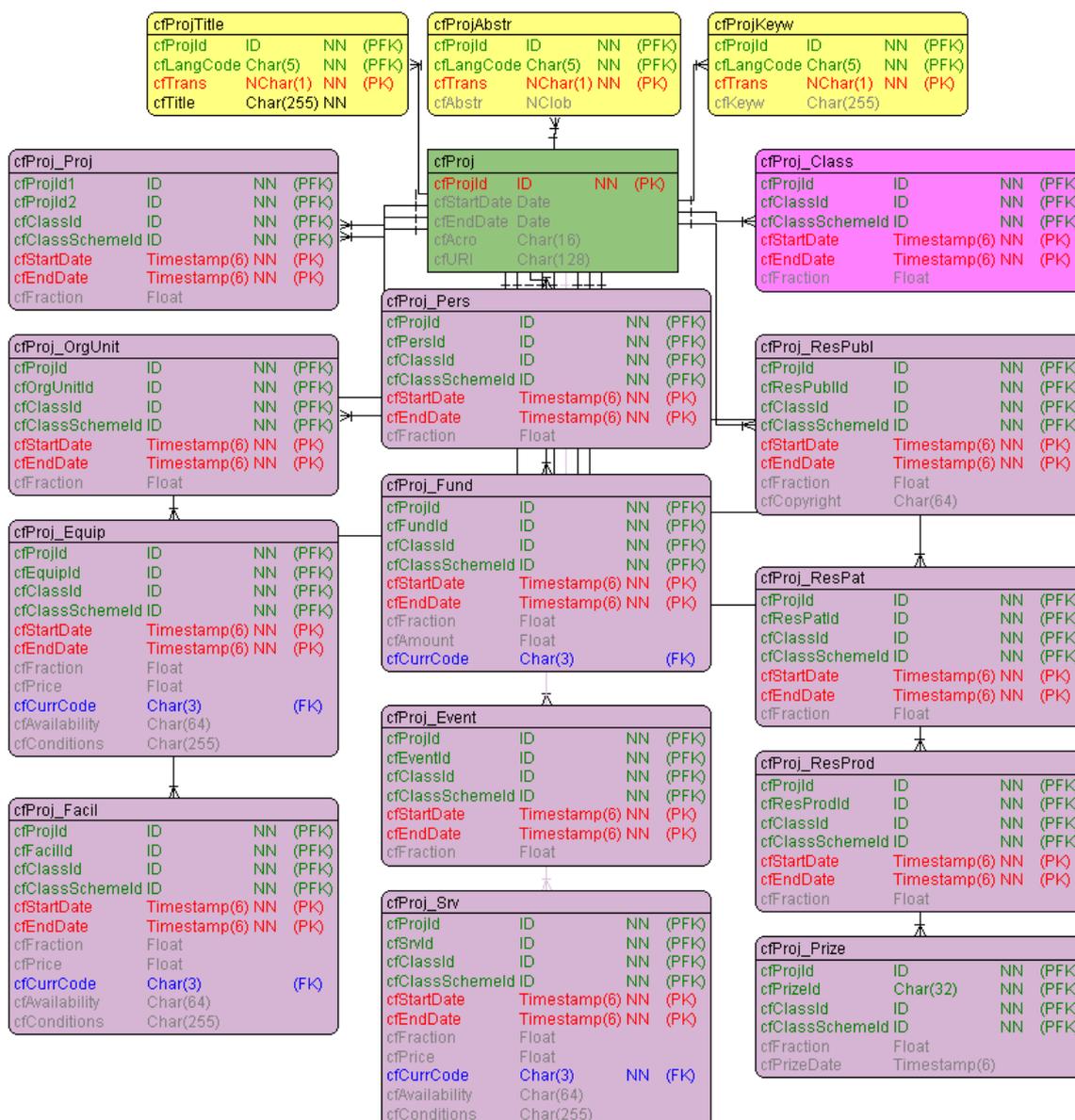


Figure 4: CERIF 1.3 Base Entity Project (physical view)

Table 1 shows an example project record from a database perspective where common [base] and multilingual [lang] attributes are stored in the upper rows, and the lower rows show example relationships [link] including their relationship semantics. Links are established by ids (i.e. cfClassId, cfResPublId, cfOrgUnitId, cfFundId) as indicated in the Attribute column, the carrying link entites are named in the Table column, the Type column indicates the conceptual type (base, link, lang), the semantic terms (i.e. Originator, Coordinator, Funder) are indicated in the Classification column, where each value belongs to a defined classification scheme (i.e. the FP6-IST scheme, the CERIF1.3-Project-Publication scheme [759af931-34ae-11e1-b86c-0800200c9a66], CERIF1.3-Project-Organisation scheme [6b2b7d25-3491-11e1-b86c-0800200c9a66] etc.).

The example record shows some common and multilingual project attributes: id, acronym, uri, start- and end date, title, abstract and keywords; the lower rows present some relationship examples. By cfClassId=2004-IST-3-uuid, the example record belongs to a FP6-IST scheme through the cfClassSchemeld=FP6-IST-uuid assignment. CERIF entities store their semantics by referencing ids with interlinking [link] entities.

Table 1: CERIF Project Example Record

| CERIF Project example database record | | | | Semantic Layer (CERIF Semantics) | |
|--|-------------|----------------|------------|---|--|
| Data | Attribute | Table | Type | Classifications (cfClassIds) | Classification Schemes (cfClassSchemeIds) |
| project-ist-world* | cfProjId | cfProj | base | | |
| IST World | cfAcro | cfProj | base | | |
| http://www.ist-world.org/ | cfURI | cfProj | base | | |
| 2005-04-01 | cfStartDate | cfProj | base | | |
| 2007-11-30 | cfEndDate | cfProj | base | | |
| Knowledge Base for RTD Competencies in IST | cfTitle | cfProjTitle | lang[en,o] | | |
| Wissensbasis für RTD Kompetenzen im Bereich IST | cfTitle | cfProjTitle | lang[de,h] | | |
| IST, Research Information, NMS, Portal, | cfKeyw | cfProjKeyw | lang | | |
| The objective of the project is to set up and populate an information portal with innovative functionalities ... | cfAbstr | cfProjAbstr | lang | | |
| classification-2004-ist-3* | cfClassId | cfProj_Class | link | 2004-IST-3-uuid* | FP6-IST-uuid* |
| publ-analyzing-eu-rtid* | cfResPubId | cfProj_ResPubl | link | eda2b2d9-34e5-11e1-b86c- 0800200c9a66 (Originator-uuid)* | 759af931-34ae-11e1-b86c- 0800200c9a66 (CERIF1.3-Project- Publication-uuid)* |
| publ-cris-research-activity* | cfResPubId | cfProj_ResPubl | link | eda2b2d9-34e5-11e1-b86c- 0800200c9a66 (Originator-uuid)* | 759af931-34ae-11e1-b86c- 0800200c9a66 (CERIF1.3-Project- Publication-uuid)* |
| publ-analytic-services-for-the- era* | cfResPubId | cfProj_ResPubl | link | eda2b2d9-34e5-11e1-b86c- 0800200c9a66 (Originator-uuid)* | 759af931-34ae-11e1-b86c- 0800200c9a66 (CERIF1.3-Project- Publication-uuid)* |
| fund-fp6* | cfFundId | cfProj_Fund | link | eda28bc1-34e5-11e1-b86c- 0800200c9a66 (Funder- uuid)* | 759af935-34ae-11e1-b86c- 0800200c9a66 (CERIF1.3- Project-Funding-uuid)* |
| orgunit-dfki* | cfOrgUnitId | cfProj_OrgUnit | link | c31d3380-1cfd-11e1-8bc2- 0800200c9a66 (Coordinator-uuid)* | 6b2b7d25-3491-11e1-b86c- 0800200c9a66 (CERIF1.3- Project-Organisation)* |
| orgunit-dfki* | cfOrgunitId | cfProj_OrgUnit | link | 2006- $\frac{1}{0.5}$ * | 06-Budget-Alloc* |
| orgunit-dfki* | cfOrgunitId | cfProj_OrgUnit | link | 2007- $\frac{1}{0.2}$ * | 07-Budget-Alloc* |

The given example project record is linked with some publications where the role of the project is indicated as an originator. In the same way, it is linked with an organisation in the role of a coordinator, and with the FP6 funding programme in the role of the funder. The example record only gives some relationships; the entire model allows for many more. The linkage mechanism by link entities is consistent across the model and will be explained in detail within section 2.8; for the semantic features we refer to section 2.9.

* For a better understanding, we labelled the classification and classification scheme IDs with natural language terms. In a real implementation, the formalized vocabulary term would be stored in the CERIF cfClassTerm entity to which the cfClassId propagates. We recommend UUIDs for CERIF classification (term) identifiers (http://en.wikipedia.org/wiki/Universally_unique_identifier) to ensure universal and unique record identification. The released formal terms have an assigned uuid with the CERIF 1.3 Vocabulary.

2.2.2 CERIF Entity Person

For identification of internal person records the base entity (cfPers) offers an id attribute (cfPersId). Besides, attributes birthdate, gender and uri (cfGender, cfURI) are considered common person attributes. CERIF allows for the maintenance of multiple person names or name variants with cfPersName and cfPersName_Pers.



Figure 5: CERIF 1.3 Base Entity Person (physical view)

The entity person maintains many relationships with other entities: person, project, organisation, publication, patent, product, funding programme, equipment, facility, service, event, prize, electronic address, physical address, expertise and skills, cv, language, country and classification (cfPers_Pers, cfPers_Proj, cfPers_OrgUnit, cfPers_ResPubl, cfPers_ResPat, cfPers_ResProd, cfPers_Fund, cfPers_Equip, cfPers_Facil, cfPers_Srv, cfPers_Event, cfPers_Prize, cfPers_EAddr, cfPers_PAddr, cfPers_ExpSkills, cfPers_CV, cfPers_Lang, cfPers_Country, cfPers_Class), as shown in *Figure 5* above. Each relationship or link entity carries semantics with a time-stamped reference to the CERIF Semantic Layer by cfClassId and cfClassSchemeId. Additionally, the person entity supports multilingual features for research interest descriptions and keywords (cfPersResInt, cfPersKeyw). Table 2 shows one example person record from a database perspective. The common and the multilingual attributes are stored in the upper rows; the lower rows show example relationships including their semantics. The relationships are established by ids (i.e. cfPersId2, cfResPublId, cfOrgUnitId, cfProjId) as indicated in the Attribute column, the carrying link entities are named in the Table column, the Type column indicates the conceptual entity type (base, link, lang), the semantic values (spelling Variant, M.A. Author, Affiliation, Board-Member, TG-Leader, Coordinator, Participant) and fractions are indicated in the Classification column, where each value belongs to a particular classification scheme (i.e. the CERIF1.3-PersonName-Person scheme [db2952c0-4d26-11e1-b86c-0800200c9a66], or the ACADEMIC-TITLES scheme, or the CERIF1.3-Person-Publication scheme [b7135ad0-1d00-11e1-8bc2-0800200c9a66], etc).

Table 2: CERIF Person Example Record

| CERIF Person example database entry | | | | | Semantic Layer (CERIF Semantics) | |
|---|---------------|-----------------|-------|--|---|--|
| | Data | Attribute | Table | Type | Classifications (cfClassIds) | Classification Schemes (cfClassSchemeIds) |
| person-brigitte-joerg* | cfPersId | cfPers | base | | | |
| f | cfGender | cfPers | base | | | |
| http://www.dfki.de/~brigitte/ | cfURI | cfPers | base | | | |
| Joerg | cfFamilyNames | cfPers | add | | | |
| Brigitte | cfFirstNames | cfPers | add | | | |
| Brigitte is interested in Research Information and Research Information Systems. | cfResInt | cfPersResInt | lang | | | |
| Information Systems, Research Information, Ontologies | cfKeyw | cfProjKeyw | lang | | | |
| person-brigitte-joerg* | cfPersId2 | cfPersName_Pers | link | af6468a0-3acf-11e1-b86c- 0800200c9a66 (SpellingVariant)* | db2952c0-4d26-11e1-b86c- 0800200c9a66 (CERIF1.3-PersonName-Person)* | |
| classification-MA* | cfClassId | cfPers_Class | link | M.A.-uuid* | ACADEMIC-TITLES* | |
| publ-analyzing-european-rtd* | cfResPublId | cfPers_ResPubl | link | 49815870-1cfe-11e1-8bc2- 0800200c9a66 (Author)* | b7135ad0-1d00-11e1-8bc2- 0800200c9a66 (CERIF1.3-Person-Publication)* | |
| publ-analytic-services-for- era* | cfResPublId | cfPers_ResPubl | link | 49815870-1cfe-11e1-8bc2- 0800200c9a66 (Author)* | b7135ad0-1d00-11e1-8bc2- 0800200c9a66 (CERIF1.3-Person-Publication)* | |
| orgunit-dfki* | cfOrgUnitId | cfPers_OrgUnit | link | 980965b0-1cd5-11e1-8bc2- 0800200c9a66 (Affiliation)* | 994069a0-1cd6-11e1-8bc2- 0800200c9a66 (CERIF1.3-Person- Organisation)* | |
| orgunit-It-lab* | cfOrgUnitId | cfPers_OrgUnit | link | 081e85f0-1cd7-11e1-8bc2- | 994069a0-1cd6-11e1-8bc2- | |

| | | | | | |
|--------------------|-------------|----------------|------|---|---|
| | | | | 0800200c9a66 (Subaffiliation)* | 0800200c9a66 (CERIF1.3-Person-Organisation)* |
| orgunit-euroCRIS* | cfOrgUnitId | cfPers_OrgUnit | link | Board-Member* | PERSON-ORGANISATION* |
| orgunit-CERIF-TG* | cfOrgUnitId | cfPers_OrgUnit | link | TG-Leader* | PERSON-ORGANISATION* |
| project-ist-world* | cfProjId | cfProj_Pers | link | c31d3380-1cfd-11e1-8bc2-0800200c9a66 (Coordinator[fract=0.7])* | 94fed50-1d00-11e1-8bc2-0800200c9a66 (CERIF1.3-Project-Person)* |
| project-It-world* | cfProjId | cfProj_Pers | link | ddc3dd10-1cfd-11e1-8bc2-0800200c9a66 (Participant[fract=0.3])* | 94fed50-1d00-11e1-8bc2-0800200c9a66 (CERIF1.3-Project-Person)* |

The example record shows some common and multilingual person attributes id, gender, family name, first name, research interest and keywords; the lower rows present some relationship examples. A reference cfPersId2='person-brigitte-joerg' in the cfPersName_Pers table allows for the storage of name spelling variants through the cfPersNameVar attribute in the link table (not indicated in table 2, but viewable in figure 5 within the corresponding entity). CERIF entities store their semantics by reference ids with interlinking (link) entities. The example record shows that the person is author of articles, has co-ordinated and participated in projects, and is active with different organisations. The example record only gives some relationships; the entire model allows for many more. The linking mechanism by link entities is consistent across the model and will be explained in detail within section 2.8; for the semantic features we refer to section 2.9.

2.2.3 CERIF Entity OrganisationUnit

For an identification of organisation records, the base entity (cfOrgUnit) offers an id attribute (cfOrgUnitId). Besides, the attributes acronym, currency, headcount, turnover and uri (cfCurrCode, cfAcro, cfHead, cfTurn, cfURI) are considered as common organisation attributes.

The organisation entity maintains many relationships with other entities: person, project, organisation, publication, medium patent, product, funding programme, equipment, facility, service, event, prize, electronic address, physical address, expertise and skills, cv, language, country and classification (cfPers_Pers, cfPers_Proj, cfPers_OrgUnit, cfPers_ResPubl, cfPers_Medium; cfPers_ResPat, cfPers_ResProd, cfPers_Fund, cfPers_Equip, cfPers_Facil, cfPers_Srv, cfPers_Event, cfPers_Prize, cfPers_EAddr, cfPers_PAddr, cfPers_ExpSkills, cfPers_CV, cfPers_Lang, cfPers_Country, cfPers_Class), as shown in **Figure 6**. Each relationship or link entity carries semantics with a time-stamped reference to the Semantic Layer by cfClassId and cfClassSchemeId. Additionally, the organisation entity supports multilingual features for name, research activity descriptions and keywords (cfPersResInt, cfPersKeyw). Table 3 shows one example organisation record from a database perspective. The common and multilingual organisation attributes are stored in the upper rows; the lower rows show some example relationships including their semantics. The relationships are established by ids (i.e. cfPersId, cfOrgUnitId, cfProjId) as indicated in the Attribute column, the carrying link entities are named in the Table column, the Type column indicates the conceptual entity type (base, link, lang), the semantic value terms (not-for-profit, President, Secretary, Treasurer, Strategy, etc.) are indicated in the Classification column, where each value belongs to a particular scheme (i.e. the scheme PERS_ORGUNIT, or the scheme CERIF1.3-Organisation-Classification [759af939-34ae-11e1-b86c-0800200c9a66]). The organisation example does not include any fraction values like the person or project examples in previous tables; the cfFraction attribute is not mandatory.

| | | | | (Private Non-Profit)* | (CERIF1.3-Organisation-Classification)* |
|--------------------------------|-----------|-----------------|------|---|---|
| person-keith-jeffery* | cfPersId | cfPers_OrgUnit | link | President* | PERS-ORGUNIT* |
| person-harrie-lalieu* | cfPersId | cfPers_OrgUnit | link | Secretary* | PERS-ORGUNIT* |
| person-geert-van-grootel* | cfPersId | cfPers_OrgUnit | link | Treasurer* | PERS-ORGUNIT* |
| person-anne-asserson* | cfPersId | cfPers_OrgUnit | link | Strategy* | PERS-ORGUNIT* |
| person-wolfgang-adamczak* | cfPersId | cfPers_OrgUnit | link | Conference* | PERS-ORGUNIT* |
| person-maximilian-stempfhuber* | cfPersId | cfPers_OrgUnit | link | CRIS-Architecture* | PERS-ORGUNIT* |
| person-nikos-houssos* | cfPersId | cfPers_OrgUnit | link | TG-Leader-Projects* | PERS-ORGUNIT* |
| person-brigitte-joerg* | cfPersId | cfPers_OrgUnit | link | TG-Leader-CERIF* | PERS-ORGUNIT* |
| person-sergey-parinov* | cfPersId | cfPers_OrgUnit | link | TG-Leader-Best-Practice* | PERS-ORGUNIT* |
| person-ed-simons* | cfPersId | cfPers_OrgUnit | link | TG-Leader-IR-CERIF* | PERS-ORGUNIT* |
| paddr-Voorschoten* | cfPAddrId | cfOrgUnit_PAddr | link | post-office-box-uuid* | ORGUNIT_PADDR* |
| eaddr-eurocris@eurocris.org* | cfEAddrId | cfOrgUnit_EAddr | link | 9931ac42-3864-11e1-b86c-0800200c9a66 (Email)* | 24ecf6a0-3864-11e1-b86c-0800200c9a66 (CERIF1.3-Organisation-ElectronicAddress)* |
| eaddr-eurocris* | cfEAddrId | cfOrgUnit_EAddr | link | Skype* | ORGUNIT_EADDR* |

The example record shows common and multilingual organisation attributes id, currency, uri, acronym, name, research activity; the lower rows present some relationship examples. With a reference cfClassId=Private Non-Profit’ the organisation record is classified as ‘not for profit’ type organisation. CERIF entities store their semantics by reference ids with interlinking [link] entities. The record maintains many person relationships with different roles: president, secretary, treasurer, etc. CERIF allows for the storage of address types: electronic addresses (email, skype) or postal addresses (post-office-box). The example record only gives some relationship examples; the entire model allows for many more. The roles that have been formalized in the CERIF Semantics as part of the CERIF Vocabulary are additionally identified through uuids (i.e. Email [9931ac42-3864-11e1-b86c-0800200c9a66], or Private Non-Profit [eda2b2f6-34c5-11e1-b86c-0800200c9a66]). The linkage mechanism by link entities is consistent across the model and will be explained in detail within section 2.8; for the semantic features we refer to section 2.9.

2.3 CERIF Result Entities

The CERIF result entities are ResultPublication, ResultPatent and ResultProduct. *Figure* shows the result entities and their linking relationships. The result entities like base entities recursively link to themselves. Result entities represent the research output.

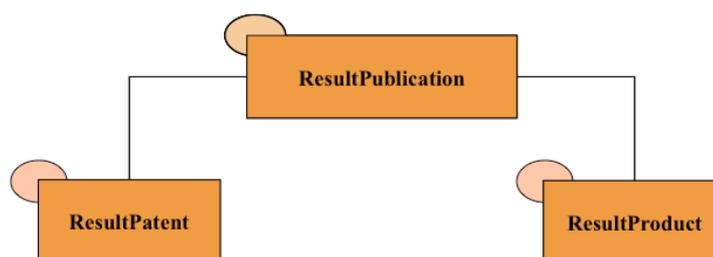


Figure 7: CERIF Result Entities

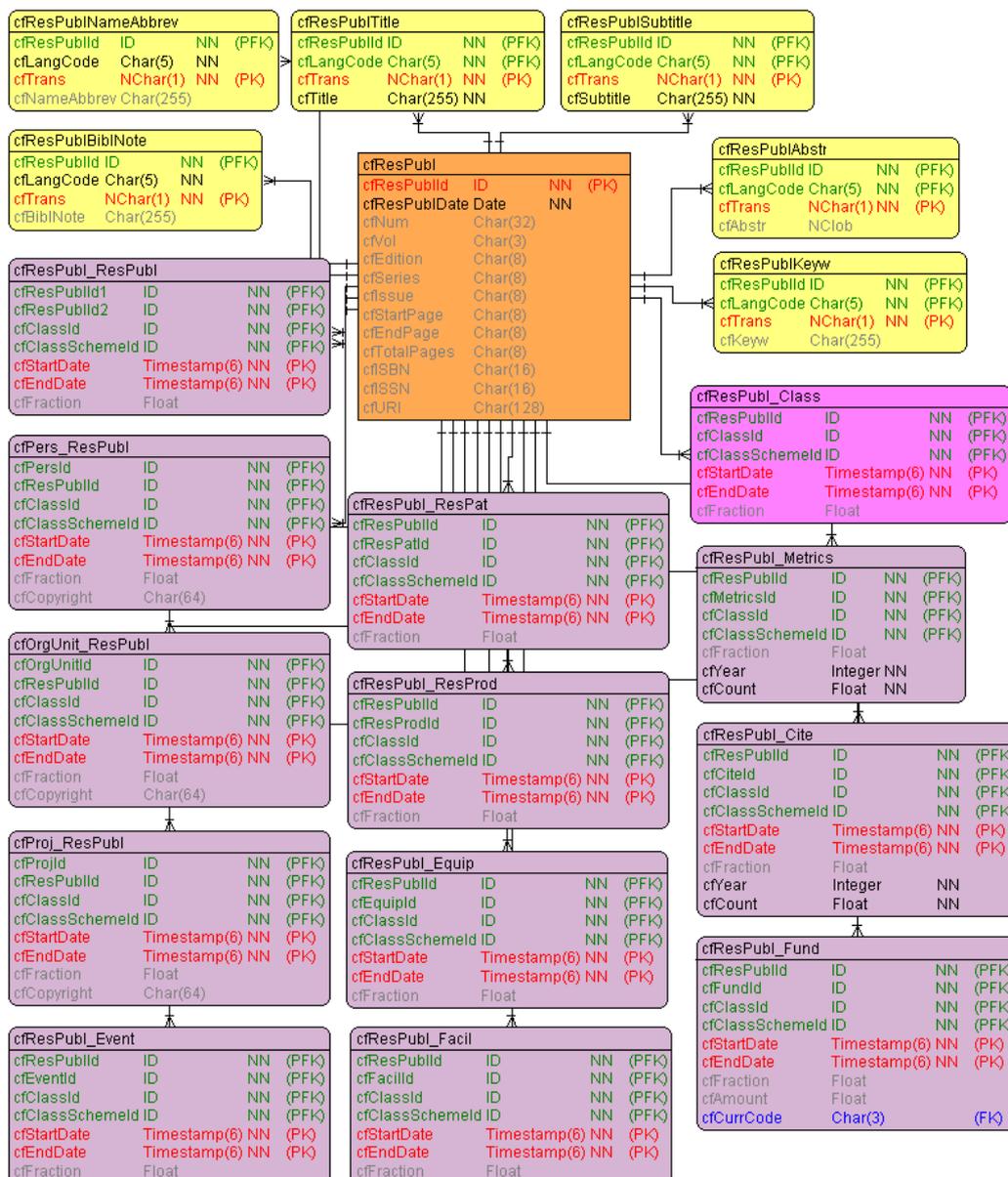


Figure 9: CERIF 1.3 Result Publication entity (physical view)

The result publication entity maintains many relationships with other entities: publication, patent, product, organisation, project, person, funding programme, equipment, facility, event, classification (cfResPubl_ResPubl, cfResPubl_ResPat, cfResPubl_ResProd, cfOrgUnit_ResPubl, cfProj_ResPubl, cfPers_ResPubl, cfResPubl_Equip, cfResPubl_Facil, cfResPubl_Fund, cfResPubl_Class) as shown in **Figure** . Each relationship or link entity carries semantics with a time-stamped reference to the CERIF Semantic Layer by cfClassId and cfClassSchemelId and a cfFraction attribute to assign value classified references. Additionally, the publication entity supports multilingual features with the title, subtitle, abstract, note, abbreviation and keywords (cfResPublTitle, cfResPublSubtitle, cfResPublAbstr, cfResPublKeyw, cfResPublNameAbbrev).

Table 4 shows one example publication record from a database perspective. The common and multilingual publication attributes are stored in the upper rows; the lower rows show some example relationships including their semantics. The relationships are established by ids (i.e.

cfPersId, cfOrgUnitId, cfProjId, cfEventId) as indicated in the Attribute column, the carrying link entities are named in the Table column, the Type column indicates the entity type (result, link, lang), the semantic values in terms of i.e. Conference Proceedings Article, Part, Author, Originator, Presentation, etc., and fractions are indicated in the Classification column where each value belongs to a scheme.

Table 4: CERIF ResultPublication Example Record

| CERIF ResultPublication example database entry | | | | Semantic Layer (CERIF Semantics) | |
|--|--------------|-------------------|--------|---|--|
| Data | Attribute | Table | Type | Classifications (cfClassIds) | Classification Schemes (cfClassSchemeIds) |
| publication-joerg-et-al* | cfResPubId | cfResPubl | result | | |
| 2008-01-01 | cfResPubDate | cfResPubl | result | | |
| 107 | cfStartPage | cfResPubl | result | | |
| 123 | cfEndPage | cfResPubl | result | | |
| 978-961-6133-38-8 | cfISBN | cfResPubl | result | | |
| http://www.eurocris.org/.../Papers/cris2008_Joerg.pdf | cfURI | cfResPubl | result | | |
| Analyzing European Research Competencies | cfTitle | cfResPublTitle | lang | | |
| Results from a European SSA Project | cfSubtitle | cfResPublSubtitle | lang | | |
| With this paper we present the approach of analyzing research competencies across EU countries | cfAbstr | cfResPublAbstr | lang | | |
| IST, ERA, CRIS, CERIF, Competencies, NMS, Analysis, | cfKeyw | cfResPublKeyw | lang | | |
| classification-conf-proc-article* | cfClassId | cfResPubl_Class | link | eda2d9ee-34c5-11e1-b86c-0800200c9a66 (Conference Proceedings Article)* | 759af938-34ae-11e1-b86c-0800200c9a66 (CERIF1.3-Publication-Classification)* |
| publ-get-the-good-cris* | cfResPublId2 | cfResPubl_ResPubl | link | eda28bc2-34c5-11e1-b86c-0800200c9a66 (Part)* | 759af938-34ae-11e1-b86c-0800200c9a66 (CERIF1.3-Publication-Publication)* |
| person-brigitte-joerg* | cfPersId | cfPers_ResPubl | link | 5a4c3440-1cfe-11e1-8bc2-0800200c9a66 (Author (percentage)) [frac=0.25]* | b7135ad0-1d00-11e1-8bc2-0800200c9a66 (CERIF1.3-Person-Publication)* |
| person-hans-uszkoreit* | cfPersId | cfPers_ResPubl | link | 49815870-1cfe-11e1-8bc2-0800200c9a66 (Author)* | b7135ad0-1d00-11e1-8bc2-0800200c9a66 (CERIF1.3-Person-Publication)* |
| person-jure-ferlez* | cfPersId | cfPers_ResPubl | link | 49815870-1cfe-11e1-8bc2-0800200c9a66 (Author)* | b7135ad0-1d00-11e1-8bc2-0800200c9a66 (CERIF1.3-Person-Publication)* |
| person-mitja-jermol* | cfPersId | cfPers_ResPubl | link | 49815870-1cfe-11e1-8bc2-0800200c9a66 (Author)* | c b7135ad0-1d00-11e1-8bc2-0800200c9a66 (CERIF1.3-Person-Publication)* |
| project-ist-world* | cfProjId | cfProj_ResPubl | link | eda2b2d9-34c5-11e1-b86c-0800200c9a66 (Originator)* | 759af938-34ae-11e1-b86c-0800200c9a66 (CERIF1.3-Project-Publication)* |
| event-cris-2008* | cfPersId | cfResPubl_Event | link | eda2d9f6-34c5-11e1-b86c-0800200c9a66 (Presentation)* | 759af938-34ae-11e1-b86c-0800200c9a66 (CERIF1.3-Publication-Classification)* |

The example record in table 4 shows the common and multilingual publication attributes id, date, startpage, endpage, isbn, number, title, abstract and keywords. The lower rows present some relationship examples. With a reference identifier in the format of a uuid, the cfClassId='eda2d9ee-34c5-11e1-b86c-0800200c9a66', the publication record is classified as a Conference Proceedings Article. A recursive relationship cfResPubl Id2='publication-get-the-good-cris' refers to the proceedings. The example shows some person relationships with different roles such as Author, Originator. The fraction example shows a %-allocation in the person-publication relationship link with the role of author (percentage), indicating a 25% value. A reference to project cfProj='project-ist-world' reveals the project as originator of the publication, an event link indicates that the paper was presented at the CRIS 2008 conference cfEventId=event-cris-2008. The record only gives some relationship examples; the entire model allows for many more. The linkage mechanism by link entities is consistent across the model and will be explained in detail within section 2.8; for the semantic features we refer to section 2.9.

Another example record in table 5 below again shows the common and multilingual result publication attributes id, date, no, volume, startpage, endpage, isbn and issn number, title, abstract and keywords; the lower rows present some relationship examples. The example publication record is classified as a 'Journal Article' and a recursive relationship via cfResPublId2='publication-vldb-journal' indicates the linkage to the journal of which the article is part. The example record is classified by the Springer Subjects scheme into 'Computer Science'. A person link carries the author role, and the link to the organisation record 'organisation-springer' indicates the publisher of the article. The following publication example records do not explicitly include any fraction values like the previous examples; the cfFraction attribute is not mandatory.

Table 5: CERIF ResultPublication Example Record of a Journal Article

| CERIF ResultPublication example database entry | | | | Semantic Layer (CERIF Semantics) | |
|---|---------------|-------------------|--------|--|--|
| Data | Attribute | Table | Type | Classification (ClassIds) | Classification Scheme |
| publication-veda-c-storey* | cfResPublId | cfResPubl | result | | |
| 1993-01-01 | cfResPublDate | cfResPubl | result | | |
| 4 | cfNum | cfResPubl | result | | |
| 2 | cfVol | cfResPubl | result | | |
| 455 | cfStartPage | cfResPubl | result | | |
| 488 | cfEndPage | cfResPubl | result | | |
| 1066-8888 | cfISSN | cfResPubl | result | | |
| http://www.springerlink.com/content/j23263j02m850617/ | cfURI | cfResPubl | result | | |
| Understanding Semantic Relationships | cfTitle | cfResPublTitle | lang | | |
| To develop sophisticated database management systems, ... | cfAbstr | cfResPublAbstr | lang | | |
| Database design, erm model, ... | cfKeyw | cfResPublKeyw | lang | | |
| classification-journal-article* | cfClassId | cfResPubl_Class | link | eda2d9ea-34c5-11e1-b86c-0800200c9a66 (Journal Article)* | 759af938-34ae-11e1-b86c-0800200c9a66 (CERIF1.3-Publication-Classification)* |
| classification-computer-science* | cfClassId | cfResPubl_Class | link | computer-science-uuid* | SPRINGER-SUBJECTS* |
| publ-vldb-journal* | cfResPublId2 | cfResPubl_ResPubl | link | eda28bc2-34c5-11e1-b86c-0800200c9a66 (Part)* | 759af932-34ae-11e1-b86c-0800200c9a66 (CERIF1.3-Publication- |

| | | | | | |
|------------------------|-------------|-------------------|------|--|--|
| | | | | | Publication)* |
| person-veda-c-storey* | cfPersId | cfPers_ResPubl | link | 49815870-1cfe-11e1-8bc2-0800200c9a66 (Author)* | b7135ad0-1d00-11e1-8bc2-0800200c9a66 (CERIF1.3-Person-Publication)* |
| organisation-springer* | cfOrgUnitId | cfOrgUnit_ResPubl | link | 7ef398b2-1cfe-11e1-8bc2-0800200c9a66 (Publisher)* | 6b2b7d26-3491-11e1-b86c-0800200c9a66 (CERIF1.3-Organisation-Publication)* |

Table 6: CERIF ResultPublication Example Record of a Journal

| CERIF ResultPublication example database entry | Semantic Layer (CERIF Semantics) | | | | |
|---|-------------------------------------|-------------------|--------|--|--|
| Data | Attribute | Table | Type | Classification (ClassIds) | Classification Scheme |
| publication-vldb-journal* | cfResPublId | cfResPubl | result | | |
| 1992-07-01 | cfResPublDate | cfResPubl | result | | |
| http://www.vldb.org/dblp/db/journals/vldb/ | cfURI | cfResPubl | result | | |
| The VLDB Journal | cfTitle | cfResPublTitle | lang | | |
| Published on behalf ... this journal | cfAbstr | cfResPublAbstr | lang | | |
| Persistent Object Systems, MM ... | cfKeyw | cfResPublKeyw | lang | | |
| classification-journal-article* | cfClassId | cfResPubl_Class | link | eda2d9e9-34c5-11e1-b86c-0800200c9a66 (Journal)* | 759af938-34ae-11e1-b86c-0800200c9a66 (CERIF1.3-Publication-Classification)* |
| publ-veda-c-storey* | cfResPublId2 | cfResPubl_ResPubl | link | eda28bc2-34c5-11e1-b86c-0800200c9a66 (Part)* | 759af932-34ae-11e1-b86c-0800200c9a66 (CERIF1.3-Publication-Publication)* |
| person-kyu-young-whang* | cfPersId | cfPers_ResPubl | link | 708b3df0-1cfe-11e1-8bc2-0800200c9a66 (Editor)* | b7135ad0-1d00-11e1-8bc2-0800200c9a66 (CERIF1.3-Person-Publication)* |
| person-philip-a-bernstein* | cfPersId | cfPers_ResPubl | link | 708b3df0-1cfe-11e1-8bc2-0800200c9a66 (Editor)* | b7135ad0-1d00-11e1-8bc2-0800200c9a66 (CERIF1.3-Person-Publication)* |
| person-christian-s-jensen* | cfPersId | cfPers_ResPubl | link | 708b3df0-1cfe-11e1-8bc2-0800200c9a66 (Editor)* | b7135ad0-1d00-11e1-8bc2-0800200c9a66 (CERIF1.3-Person-Publication)* |
| organisation-springer* | cfOrgUnitId | cfOrgUnit_ResPubl | link | 7ef398b2-1cfe-11e1-8bc2-0800200c9a66 (Publisher)* | 6b2b7d26-3491-11e1-b86c-0800200c9a66 (CERIF1.3-Organisation-Publication)* |

The link entities as semantic carriers are a major strength of the CERIF model. In the example record only some relationships have been presented where the entire model allows for many more, according to system context and needs. The linkage mechanism by link entities is consistent across the model and will be explained in detail within section 2.8; for the semantic features we refer to section 2.9. With the current release, the CERIF Semantics has been updated: CERIF 1.3 Semantics [12]. Furthermore, the result publication entity allows for the generation of complete reference records like BibTex, as shown in table 7.

Table 7: BibTeX example representation from underlying CERIF publication representations

| BibTeX example record (table 5) | BibTeX example record (table 6) |
|--|---|
| <pre> @article{ , author = {Joerg Brigitte, Uszkoreit Hans, Ferlez Jure, Jermol Mitja}, title = {Analyzing European Research Competencies in IST: Results from a European SSA Project}, year = {2008}, isbn = { 978-961-6133-38-8}, pages = {107--123}, publisher = {IZUM, Institut of Information Science}, address = {Maribor, Slovenia}, } </pre> | <pre> @article{ , author = {Veda C. Storey}, title = {Understanding semantic relationships}, journal = {The VLDB Journal}, volume = {2}, number = {4}, year = {1993}, issn = {1066-8888}, pages = {455--488}, publisher = {Springer-Verlag New York, Inc.}, address = {Secaucus, NJ, USA}, } </pre> |

2.3.2 CERIF Entity ResultPatent

For an identification of records the result patent entity (cfResPat) foresees an id attribute (cfResPatId). Besides, the attributes country code, registration date, approval date, patent number and uri (cfCountryCode, cfRegistrDate, cfApprovDate, cfPatentNum, cfURI) are considered common patent attributes. The result patent entity maintains many relationships with other entities: patent, publication, organisation, project, person, funding programme (cfResPat_ResPat, cfResPat_Class, cfResPubl_ResPat, cfOrgUnit_ResPat, cfProj_ResPat, cfResPat_Fund, cfPers_ResPat) as shown in **Figure 7**. Each relationship or link entity carries semantics with a time-stamped reference to the CERIF Semantic Layer by cfClassId and cfClassSchemId and a cfFraction attribute to assign fractional values to a classification reference. Additionally, the result patent entity supports multilingual features for title, abstract, and keywords (cfResPatTitle, cfResPatAbstr, cfResPatKeyw).

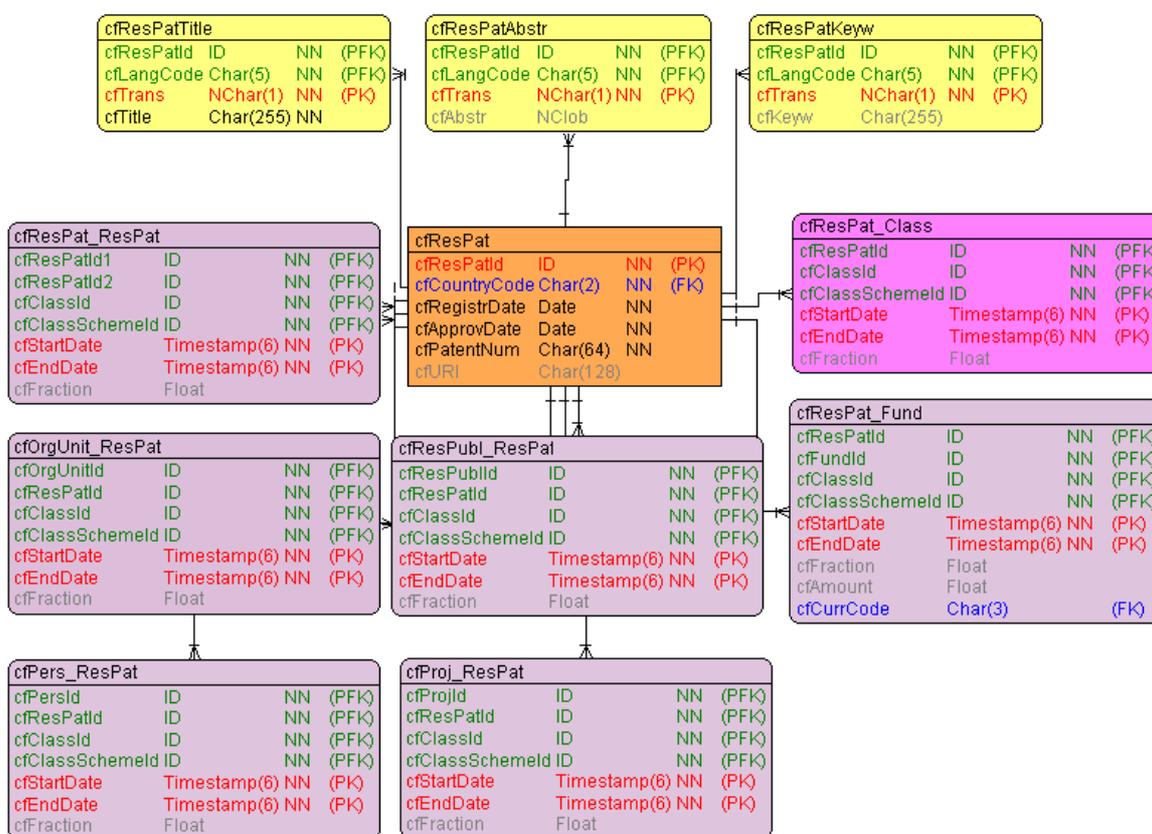


Figure 7: CERIF 1.3 Entity Result Patent (physical view)

2.3.3 CERIF Entity ResultProduct

For an identification of records the result product entity (cfResProd) foresees an id attribute (cfResProdId). Besides, the attributes internal identifier and uri (cfResProdInternId, cfURI) are considered as common product attributes. The result product entity maintains many relationships with entities: publication, organisation, project, person, funding programme (cfResProd_Class, cfResPubl_ResProd, cfProj_ResProd, cfPers_ResProd, cfOrgUnit_ResProd, cfResProd_Fund) as shown in **Figure 8**. Each relationship or link entity carries semantics with a time-stamped reference to the CERIF Semantic Layer by cfClassId and cfClassSchemId and a cfFraction attribute to assign fractional values to a classification reference. Additionally, the result product entity supports multilingual features for the name, for description, and keywords (cfResProdName, cfResProdDescr, cfResProdKeyw).

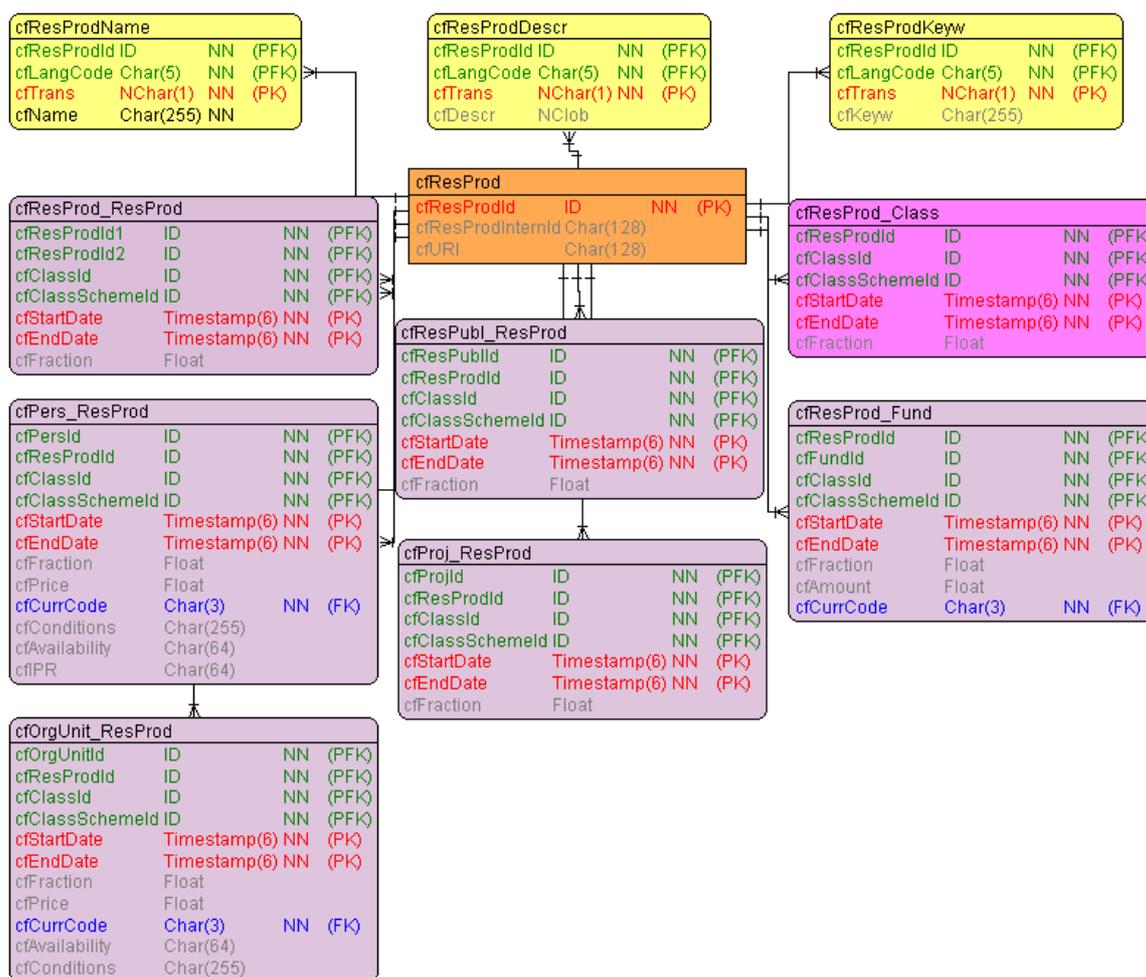


Figure 8: CERIF 1.3 Result Entity Product (physical view)

2.4 CERIF Infrastructure Entities

The CERIF infrastructure entities are Facility, Equipment and Service. *Figure 9* shows them with their recursive (the little circles) and linking relationships. Each Infrastructure entity links recursively to itself and is additionally linked to other infrastructure entities.

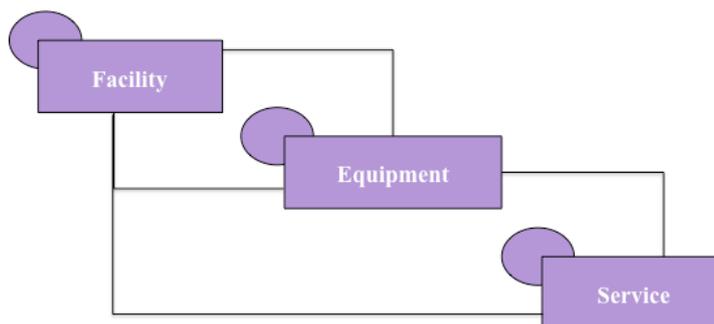


Figure 9: CERIF 1.3 Infrastructure Entities (abstract view)

Figure 10 shows the infrastructure entities (cfFacil, cfEquip, cfSrv) and their related entities from a physical view (ERM short names). The circles in figure 12 represents recursiveness; that is, the relationships in between each entity (cfFacil_Facil; cfEquip_Equip; cfSrv_Srv). The recursive and the interlinking relations (cfFacil_Equip, cfFacil_Srv; cfEquip_Srv) are so-called link type entities to be introduced in section 2.8. The yellow entities (cfFacilTitle, cfFacilDescr; cfFacilKeyw; cfEquipTitle; cfEquipDescr; cfEquipKeyw; cfSrvTitle; cfSrvDescr; cfSrvKeyw, etc.) support the feature of multiple languages and will be introduced in section 2.9. The infrastructure entities (cfFacil, cfEquip, cfSrv) are presented in their entity context, below (*Figure 10*). From the euroCris website, with the HTML Model navigation, a more granular view upon entities is available.⁷

⁷ CERIF 1.3 HTML Navigation (physical view):

<http://www.eurocris.org/Uploads/Web%20pages/CERIF-1.3/Physical/default.html>

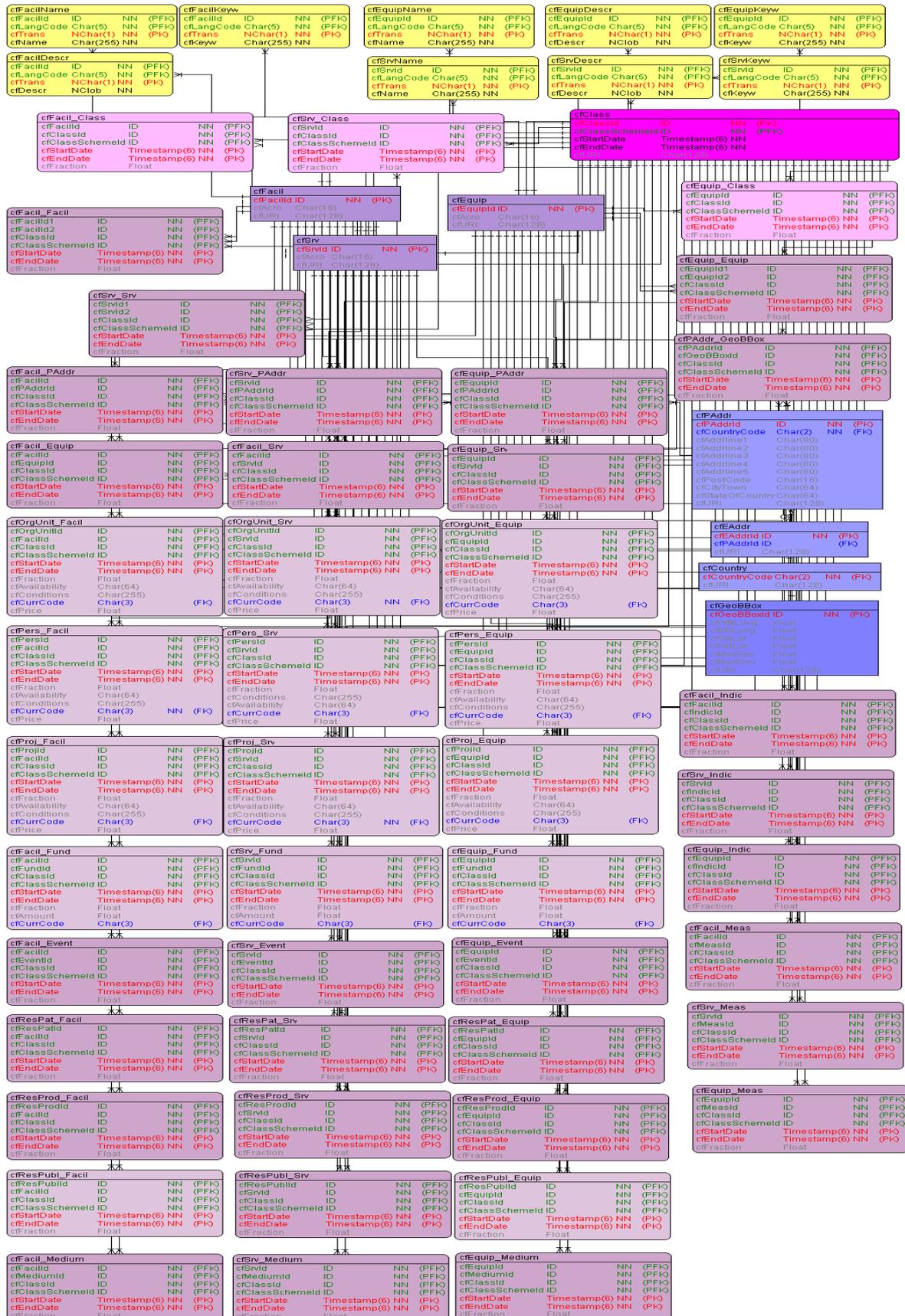


Figure 10: CERIF 1.3 Infrastructure Entities (physical view).

2.5 CERIF Geographic Bounding Box

With the latest release – in the context of research infrastructures, a geographic bounding box entity has been introduced for geographic binding *Figure 11*. It allows for relationships with infrastructure, and person and organization entities, cfPAddr_GeoBBox; cfFacil_PAddr; cfEquip_PAddr, cfSrv_PAddr, cfPers_PAddr, cfOrgUnit_PAddr through postal addresses.

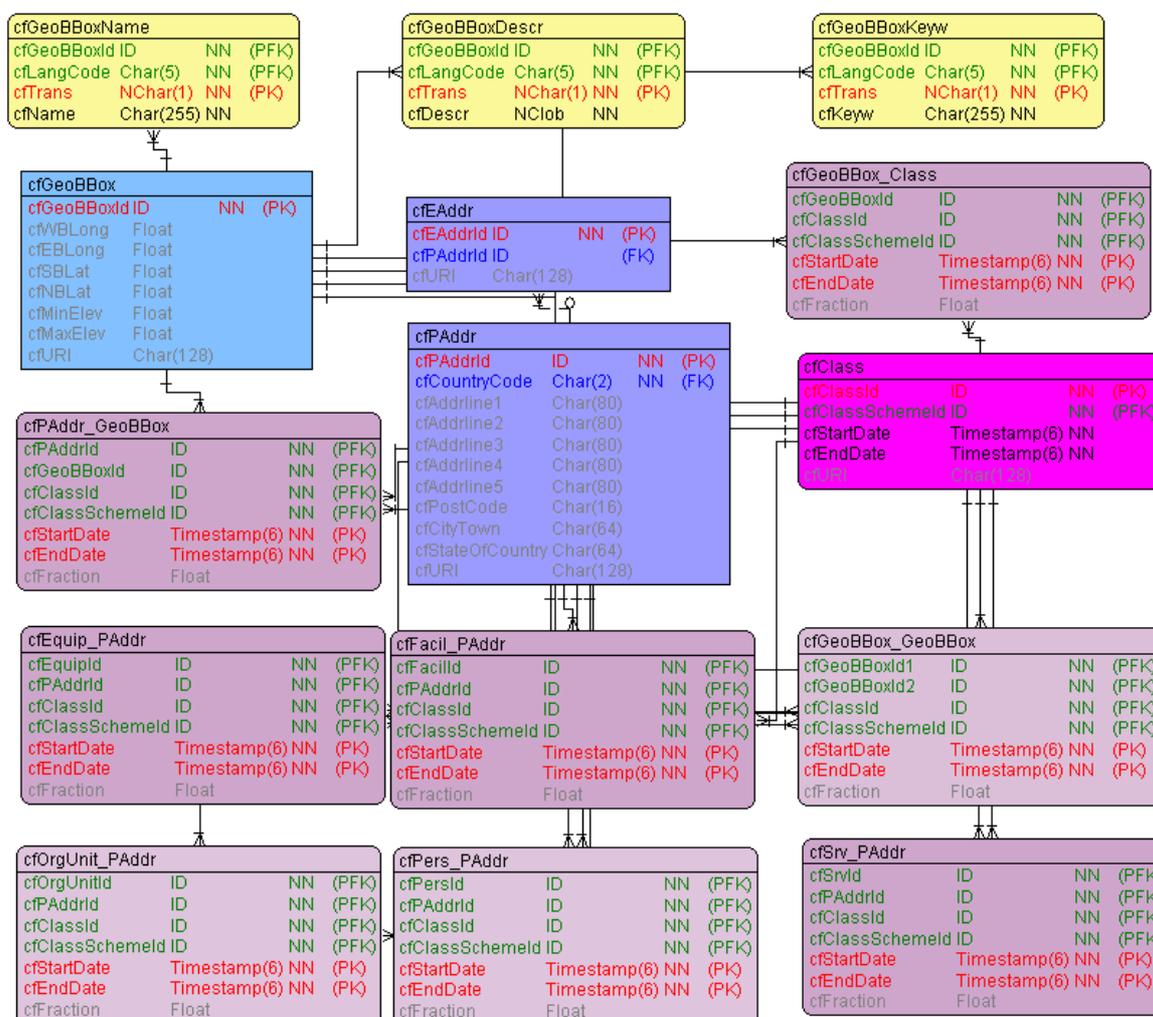


Figure 11: CERIF 1.3 Address and Geographic Bounding Box entities (physical view)

2.6 CERIF Indicator and Measure Entities

With the latest release, CERIF introduced Measurement and Indicator entities to enable quantitative measurements. The entities have been inspired by assessment activities, where impact was of interest beyond the count of citations, but rather with respect to societal or economic changes. The involved entities are repeated on the left-hand side and right-hand side, because measurements like impact may be considered inversely i.e. with esteem. *Figure 12*, intends to indicate that known CERIF entities are linked to a measure entity, where the linkage is realized with a typical CERIF link entity structure, employing references to the semantic layer. The mechanism becomes more clear from a more technical view indicated in *Figure 13* and *Figure 14* below.

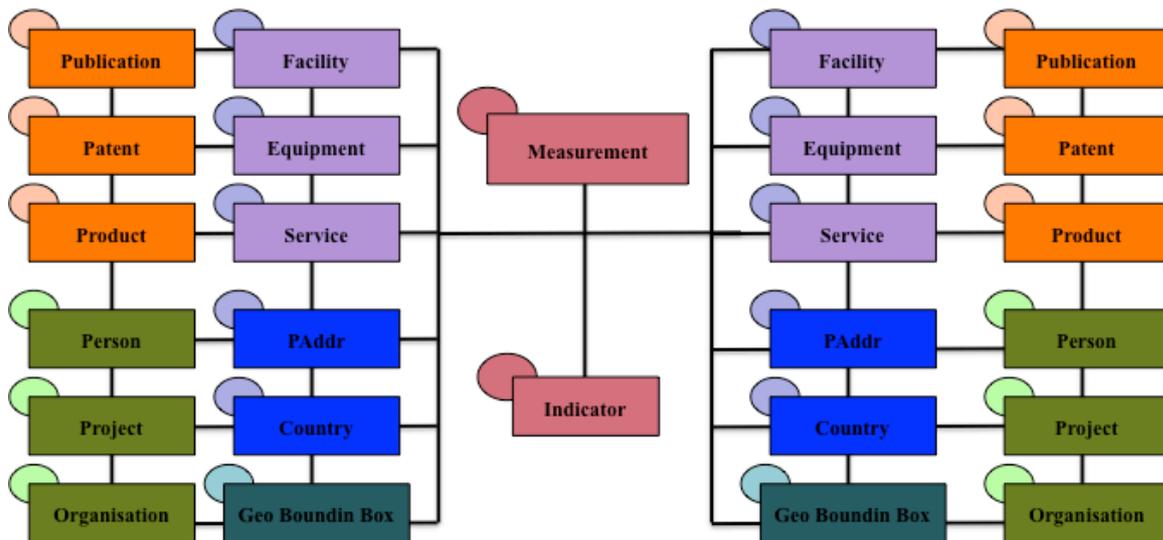


Figure 12: CERIF 1.3 Indicator and Measurement Entities in Context (abstract view)

Figure 13 shows the indicator and measurement entities (cfIndic, cfMeas) and their related entities from a physical view (ERM short names). The circles in abstract view of Figure 12 represent recursiveness; that is, the relationships in between each entity (i.e. cfIndic_Indic; cfMeas_Meas; cfFacil_Facil; cfEquip_Equip; cfSrv_Srv). The recursive and the interlinking relations are link type entities introduced in section 2.8. The yellow entities (cfIndicName; cfMeasName; cfIndicDescr; cfMeasDescr; cfIndicKeyw; cfMeasKeyw; etc.) support the feature of multiple languages and will be introduced in section 2.9. The indicator and measurement entities (cfIndic, cfMeas) are presented in their CERIF entity context, below (Figure 14). From the euroCRIS website, with the HTML Model navigation, a more granular view upon entities is available⁷.



Figure 13: CERIF 1.3 Indicator and Measurement Entities (physical view)

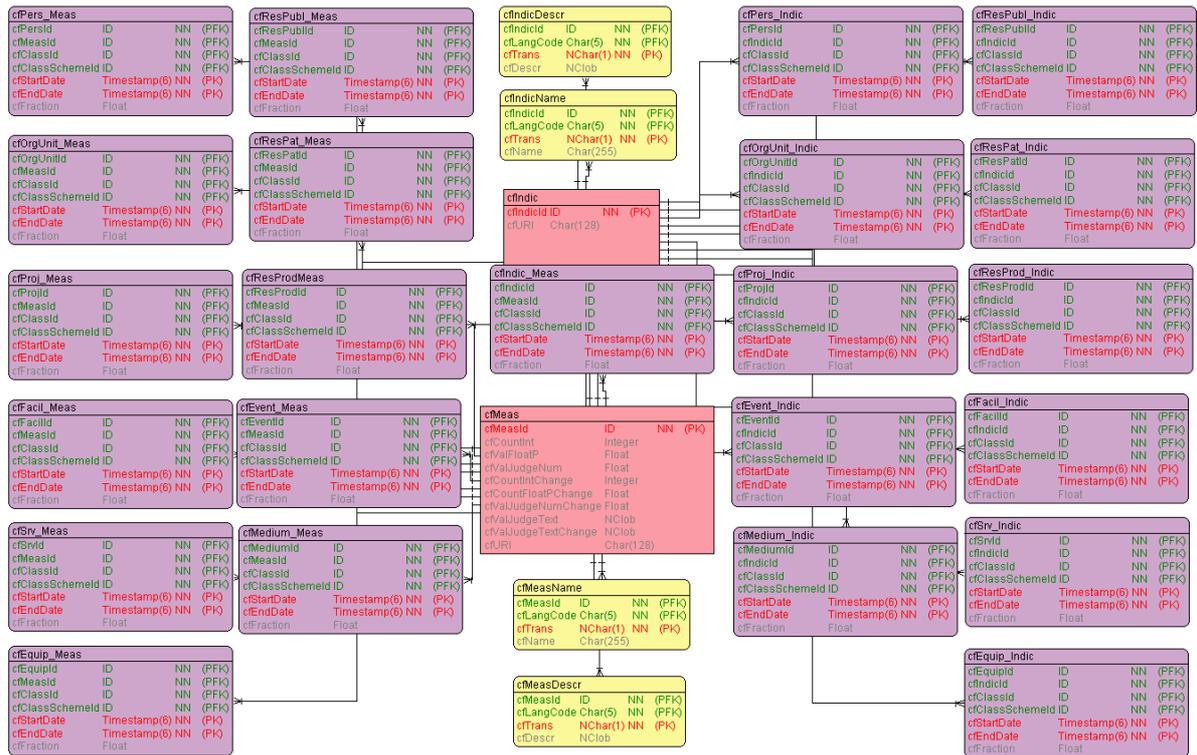


Figure 14: CERIF 1.3 Indicator and Measurement Entities in context (physical view)

2.7 CERIF 2nd Level Entities

Beyond the base and result entities, CERIF employs many so called 2nd level entities. In *Figure 15* the 2nd level entities are presented as a circle surrounding the base and result entities in blue color (including the infrastructure entities on top and measurement entities at the bottom).

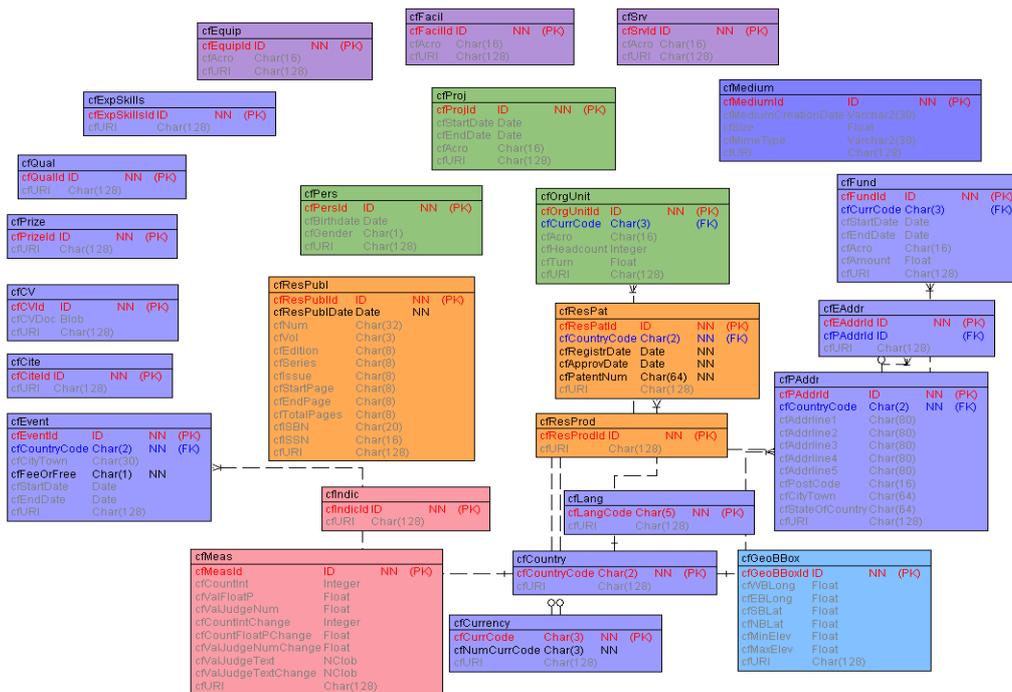


Figure 15: CERIF 1.3 Second Level Entities (physical view)

The 2nd level entities allow for the representation of the research context by linking to them from the base, result and infrastructure entities. Each 2nd level entity supplies some common attributes; at least an id and an uri attribute. The linkage mechanism and the multilingual features of 2nd level entities – not shown in *Figure 15* are equal to the mechanism and features presented with base and result entities. For more details about the link entities and their function as semantic carriers we refer to the subsequent sections.

2.8 CERIF Link Entities

The relationships or links between CERIF entities are called Link Entities. Link entities are considered a major strength of the CERIF model. A link entity always connects two entities, either base, or result, or infrastructure or measurement or second 2nd level entities. *Figure 16* shows an abstract view of some link entities (Person_ResultPublication, Person_Project, Person_OrganisationUnit, Project_Result Publication, OrganisationUnit_ResultPublication, Project_OrganisationUnit) connecting the base entities and the result publication entity.

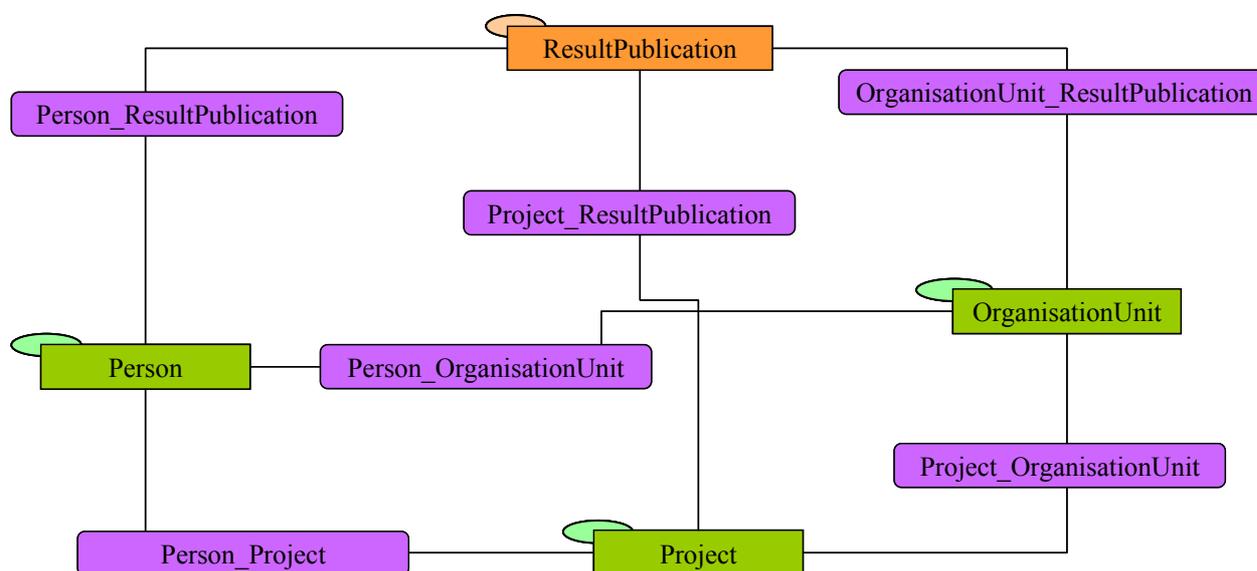


Figure 16: CERIF 1.3 Link Entities in the context of base and a result entity (abstract view)

The CERIF link entities have been mentioned in the context of the presented base, result and 2nd level entities; their structure and functionality at physical level is consistent all over the model as demonstrated with some example link entities in *Figure 18*, showing some CERIF link entities at physical level. *Figure 17* introduces their structure and functionality from a higher – meta perspective.

| cfEntity1Name Entity2Name | |
|--|-------|
| cfInheritedEntity1Identifier ID | (PFK) |
| cfInheritedEntity2Identifier ID | (PFK) |
| cfInheritedClassificationIdentifier ID | (PFK) |
| cfInheritedClassificationSchemeIdentifier ID | (PFK) |
| cfStartDate Timestamp | (PK) |
| cfEndDate Timestamp | (PK) |
| cfFraction Float | |

Figure 17: Meta perspective over CERIF 1.3 Link Entities

The physical name of link entities is composed of the names of the two linked entities, including the CERIF prefix as follows: cfEntity1Name_Entity2Name. The order of the linking entity names implies the order of the both identifier attributes, where the first (cfInheritedEntity1Identifier) is inherited from entity cfEntity1Name, and the second (cfInheritedEntity2Identifier) is inherited from the entity cfEntity2Name. All the identifiers at the meta perspective are labelled as inherited because they do not origin in the link entities themselves but rather are inherited from those entities (cfEntity1, cfEntity2, cfClassification, cfClassificationScheme) where they are maintained. All link entities establish linkage between two entities by id references cfInheritedEntity1Identifier and cfInheritedEntity2 Identifier. Additionally, each link entity carries semantics by reference to the so-called CERIF Semantic Layer via the cfInheritedClassificationIdentifier and cfInheritedClassi ficationSchemeIdentifier (see section 2.10) and a cfFraction attribute to assign fractional values to a classification (role or type) reference. Whereas the classification and classification scheme references are mandatory, the fraction attribute is not. Besides, each linking record requires a startdate and enddate^{**}. Some link entities allow for additional attributes like currency or copyright. **Alltogether, the inherited identifiers and the date attributes build the primary key of link entities.**⁸

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| cfClassId | ID | NN | (PFK) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| cfEndDate | Timestamp(6) | NN | (PK) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| cfFraction | Float | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| cfFraction | Float | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| cfFraction | Float | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| cfClass_Class | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| cfClassId2 | ID | NN | (PFK) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| cfClassSchemeId1 | ID | NN | (PFK) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| cfClassSchemeId2 | ID | NN | (PFK) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| cfClassId | ID | NN | (PFK) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| cfClassSchemeId | ID | NN | (PFK) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| cfStartDate | Timestamp(6) | NN | (PK) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| cfEndDate | Timestamp(6) | NN | (PK) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| cfFraction | Float | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| cfClassId | ID | NN | (PFK) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| cfStartDate | Timestamp(6) | NN | (PK) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| cfEndDate | Timestamp(6) | NN | (PK) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| cfFraction | Float | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| cfProjId | ID | NN | (PFK) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| cfStartDate | Timestamp(6) | NN | (PK) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| cfEndDate | Timestamp(6) | NN | (PK) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| cfFraction | Float | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Figure 18: Some CERIF 1.3 Link Entities (physical view)

Real data examples for link entities have been presented in the context of base and result entities with the tables 1-6. Some general linkage examples are provided in table 8. Because the cfFraction attribute is not mandatory it is not included in the examples of table 8, but has been introduced in previous example tables with base entities person, project and result entity publication.

^{**} We recommend to add 1901-01-01T00:0000-01:00 as a startdate, in case of unknown, and we recommend to add 2099-12-31T23:59:59-01:00 as an enddate, in case of unknown.

⁸ The linkage between cfClass and cfClassSchemeId may be dissolved with the next update of the CERIF model, in that the cfClassSchemeId will not continue to be part of the primary key in the SQL ERM.

Table 8: CERIF Link Entity Examples

| Link Table (Link Entity) | Inherited Entity1 Identifier* | Inherited Entity2 Identifier* | Inherited Classification Identifier* | Inherited Classification Scheme Identifier* | Start Date | End Date |
|-----------------------------|-------------------------------------|-------------------------------------|--|--|-------------------------------|-------------------------------|
| cfOrgUnit1_OrgUnit2 | orgunit-id1 | orgunit-id2 | hasPart-uuid | OrgUnitStructure-uuid | 2001-01-01 T12:00:00-05:00 | 2001-12-31 T12:00:00-05:00 |
| cfOrgUnit1_OrgUnit2 | orgunit-id2 | orgunit-id3 | isPartOf-uuid | OrgUnitStructure-uuid | 2009-01-13T 12:00:00-05:00 | 2009-01-13 T12:00:00-05:00 |
| cfPers_OrgUnit | person-id1 | orgunit-id1 | Head-uuid | OrgUnit-Person Roles- uuid | 2009-01-13 T12:00:00-05:00 | 2009-01-13 T12:00:00-05:00 |
| cfPers1_Pers2 | person-id1 | person-id2 | Supervisor-uuid | Academic Person Roles-uuid | 2009-01-13 T12:00:00-05:00 | 2009-01-13 T12:00:00-05:00 |
| cfPers_Proj | person-id2 | project-id1 | Participant-uuid | Project-Person Roles- uuid | 2009-01-13 T12:00:00-05:00 | 2009-01-13 T12:00:00-05:00 |
| cfPers_ResPubl | person-id1 | publ-id1 | Author-uuid | Publication-Person Roles-uuid | 2009-01-13 T12:00:00-05:00 | 2009-01-13 T12:00:00-05:00 |

Each record in a link table carries the semantics of the linkage by reference to the Semantic Layer. In table 8, the example records show that there may exist classification schemes for ‘Organisation Structure’, ‘Organisation-Person Roles’, ‘Academic Person Roles’, ‘Project-Person Roles’, ‘Publication-Person Roles’. Each semantic value (classification identifier in the format of a uuid) is assigned to a classification scheme. In table 8, the ‘hasPart’ and ‘isPartOf’ classifiers belong to a ‘Organisation Structure’ example scheme; the classifier ‘Supervisor’ belongs to the ‘Academic Person Roles’ scheme. Whereas the link entities only carry the semantics because they solely store ids, the real values and classifiers including their scheme assignments are maintained and stored within the CERIF Semantic Layer and will be explained in section 2.10.

2.9 CERIF Multiple Language Features

Much information in research environments needs representation in more than one language. The support of multilingual features is very important in countries where several official languages are spoken and maintained. As indicated in *Figure 19*, CERIF supports multiple language features for names, titles, descriptions, keywords, abstracts, and even for the semantics.

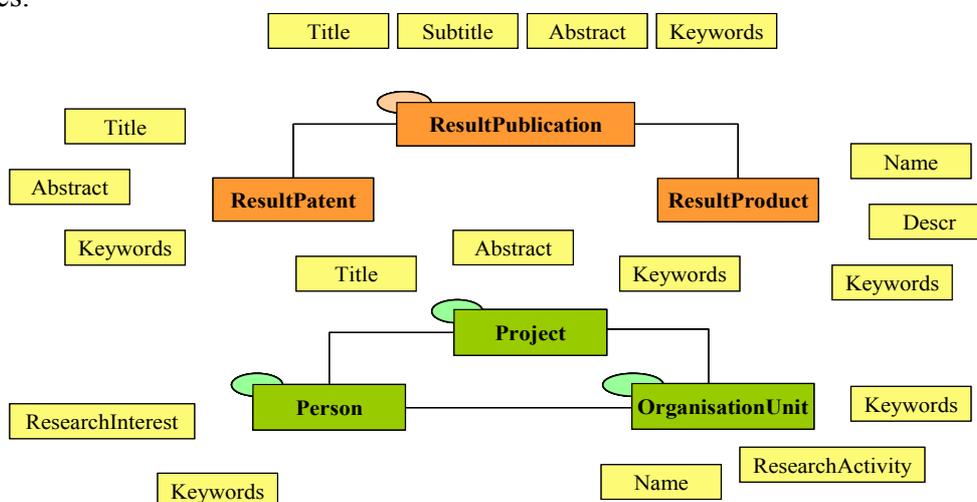


Figure 19: Some CERIF 1.3 Entities with Multilingual Features (abstract view)

Figure 20 below shows multilingual features for some selected entities. Their identifiers indicate the assignment towards their originating entities (cfProjId, cfOrgUnitId, cfResPubId). The encoded language is stored with the cfLangCode attribute that allows for five character values (i.e. en, de, fr, si, en-uk, en-us, fr-fr, fr-be, fr-nl). A translation attribute allows for information about the translation type: o=original, h=human, or m=machine. The title, abstract, keyword or research activity attributes (cfTitle, cfAbstract, cfKeyw, cfResAct) store the texts in a particular language.

| | | |
|---|---|---|
| cfOrgUnitName cfOrgUnitId ID NN (PFK) cfLangCode Char(5) NN (PFK) cfTrans NChar(1) NN (PK) cfName Char(255) NN | cfResPublTitle cfResPublId ID NN (PFK) cfLangCode Char(5) NN (PFK) cfTrans NChar(1) NN (PK) cfTitle Char(255) NN | cfProjTitle cfProjId ID NN (PFK) cfLangCode Char(5) NN (PFK) cfTrans NChar(1) NN (PK) cfTitle Char(255) NN |
| cfOrgUnitKeyw cfOrgUnitId ID NN (PFK) cfLangCode Char(5) NN (PFK) cfTrans NChar(1) NN (PK) cfKeyw Char(255) | cfResPublSubtitle cfResPublId ID NN (PFK) cfLangCode Char(5) NN (PFK) cfTrans NChar(1) NN (PK) cfSubtitle Char(255) NN | cfProjAbstr cfProjId ID NN (PFK) cfLangCode Char(5) NN (PFK) cfTrans NChar(1) NN (PK) cfAbstr NClob |
| cfOrgUnitResAct cfOrgUnitId ID NN (PFK) cfLangCode Char(5) NN (PFK) cfTrans NChar(1) NN (PK) cfResAct NClob | cfResPublKeyw cfResPublId ID NN (PFK) cfLangCode Char(5) NN (PFK) cfTrans NChar(1) NN (PK) cfKeyw Char(255) | cfProjKeyw cfProjId ID NN (PFK) cfLangCode Char(5) NN (PFK) cfTrans NChar(1) NN (PK) cfKeyw Char(255) |

Figure 20: Some CERIF 1.3 Entities with Multiple Language Features

Besides base, result and 2nd level, infrastructure, indicator and measurement entities, also the classification entities in the CERIF Semantic Layer allow for multiple language records. It is thus possible to maintain classification schemes in different languages. Even language names and country names can be maintained in several languages: België (cfLangCode=du), Belgien (cfLangCode=de), Belgique (cfLangCode=fr), Belgium (cfLangCode=en).

2.10 CERIF Semantic Layer [Semantic Features]

The so-called CERIF Semantic Layer is a simple but powerful instrument that allows for the representation of relationship kinds [6, 8], application views, subject classifications, any other classification schemes [13, 14, 15], or mappings between schemes. The CERIF Semantic Layer supplies the means for maintaining the CERIF Semantics: types, roles, terminology, subject classifiers, or mappings. It stores the semantic values that are carried by or referred to from the link entities via the cfClassSchemeId attribute references⁸, and it assigns each semantic value to a particular classification scheme. The CERIF Semantic Layer is constructed by the entities shown in *Figure 21*.

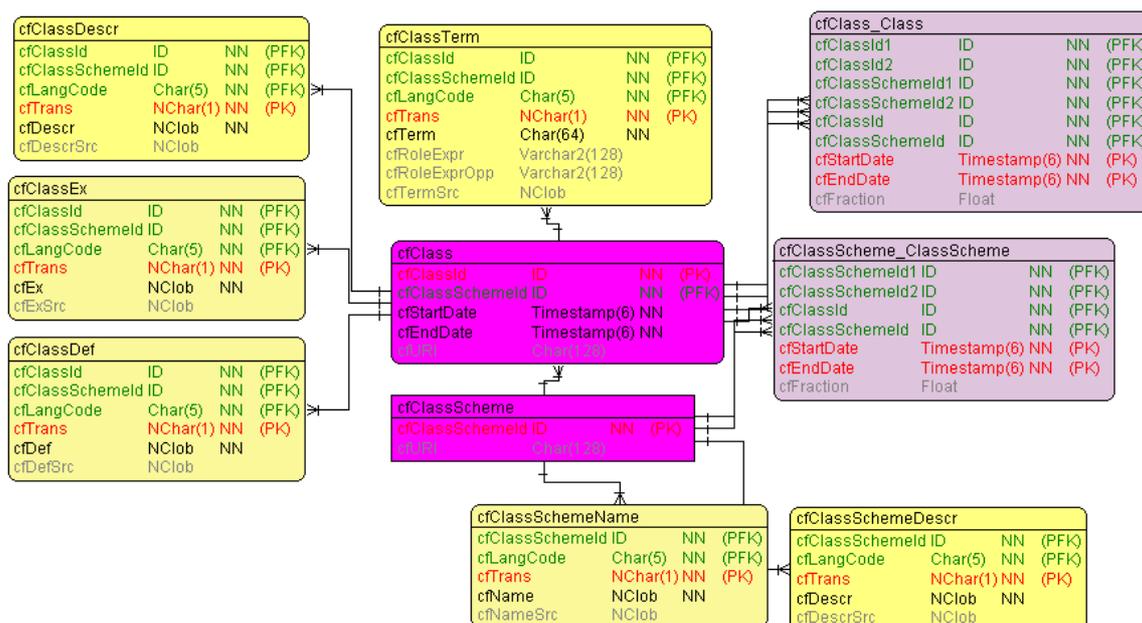


Figure 21: CERIF 1.3 Semantic Layer Entities (physical view)

The CERIF Semantic Layer consists of the two class-type entities classification (cfClass), and classification scheme (cfClassScheme). Additionally, it allows for a representation of multilingual terms (cfClassTerm) and term descriptions (cfClassDescr). The two class-type entities (cfClass, cfClassScheme) are interconnected with two recursive entities (cfClass_Class, cfClassScheme_ClassScheme) to allow for the representation of structures and for the mappings between classifications or classification schemes. The recursive entities of the CERIF Semantic Layer consistently support fractional values for classification references. The following records in table 9 show examples for a formal semantics, including CERIF 1.3 Semantics Vocabulary term references [12].

Table 9: CERIF Semantic Layer: Some formalized Semantics examples including some terms from the current CERIF - 1.3 Semantics

| CERIF Link Entity | cfTerm [cfLangCode=en] | cfClassDescr | Source of Description | cfClassScheme |
|-------------------|------------------------------|---|---|---------------------|
| cfResPubl_Class | Book | A collection of leaves of paper, parchment, vellum, cloth, or other material (written, printed, or blank) fastened together along one edge, with or without a protective case or cover. | http://lu.com/odlis/odlis_B.cfm #book | CERIF 1.3 Semantics |
| cfResPubl_Class | Book Review | An evaluative account of a recent book, usually written and signed by a qualified person, for publication in a current newspaper, magazine, or journal. | http://lu.com/odlis/odlis_R.cfm #review | CERIF 1.3 Semantics |
| cfResPubl_Class | Book Chapter Abstract | A brief, objective representation of the essential content of a book chapter, presenting the main points in the same order as the original but having no independent literary value. | http://lu.com/odlis/index.cfm#aabstract | CERIF 1.3 Semantics |
| cfResPubl_Class | Journal | A periodical devoted to disseminating | http://lu.com/odlis/odlis_J.cfm# | CERIF 1.3 |

| | | | | |
|-----------------|----------------------------|--|---|--|
| | | original research and commentary on current developments in a specific discipline, subdiscipline, or field of study (example: Journal of Clinical Epidemiology), usually published in quarterly, bimonthly, or monthly issues sold by subscription (click here to see an example). Journal articles are usually written by the person (or persons) who conducted the research. | journal | Semantics |
| cfResPubl_Class | Short Communication | A short communication is a concise, but independent report representing a significant contribution to a subject. | http://www.ejbiotechnology.info/iaformato/short_communications.html | CERIF 1.3 Semantics |
| cfResPubl_Class | Inbook | A part of a book, usually untitled. May be a chapter (or section or whatever) and/or a range of pages. | http://en.wikipedia.org/wiki/Bibtex#Entry_Types | CERIF 1.3 Semantics |
| | | | | |
| cfPers_ResPubl | Author | The person or corporate entity responsible for producing a written work (essay, monograph, novel, play, poem, screenplay, short story, etc.) whose name is printed on the title page of a book or given elsewhere in or on a manuscript or other item and in whose name the work is copyrighted. A work may have two or more joint authors. In library cataloging, the term is used in its broadest sense to include editor, compiler, composer, creator, etc. See also: attributed author, authorship, corporate author, personal author, and suppositious author. Under U.S. copyright law (Title 17 § 201), the original owner (or owners) of ... | http://lu.com/odlis/index.cfm#author | CERIF 1.3 Semantics |
| cfPers_ResPubl | Author (numbered) | | // requires a cfFraction value | CERIF 1.3 Semantics |
| cfPers_ResPubl | Author (percentage) | | // requires a cfFraction value | CERIF 1.3 Semantics |
| cfPers_Pers | Manager | In a person-person relationship responsibility to manage the human resources. | CERIF TG / euroCRIS | CERIF 1.3 Semantics |
| cfPers_Pers | Mentor | a wise and trusted guide and advisor | http://wordnetweb.princeton.edu/perl/webwn?s=mentor | CERIF 1.3 Semantics |
| cfPers_Pers | Supervisor | One who supervises or has charge and direction of. | http://wordnetweb.princeton.edu/perl/webwn?s=supervisor | CERIF 1.3 Semantics |
| cfClass_Class | Synonym | Equivalent word (two words that can be interchanged in a context are said to be synonymous relative to that context) | http://wordnetweb.princeton.edu/perl/webwn?s=synonym&sub=Search+WordNet&o2=&o0=1&o7=&o5=&o1=1&o6=&o4=&o3=&h=00 | A Thesaurus Relationship (Structural Element). |
| cfClass_Class | Broader Term | The Broader Term is the parent of the Preferred Term. | http://www.cmscalendar.com/cmsh-glossary.html?term=BroaderTerm | A Thesaurus Relationship (Structural Element). |

2.11 Additional Features

The current CERIF ERM model and SQL scripts contain Dublin Core and Formalised Dublin Core entities and attributes. With future releases we aim at providing a Dublin Core Element set mapping, rather than keeping its elements redundantly and inconsistently connected within the CERIF model. The PersonName entity is currently categorized as an additional feature, as it does not exactly fit into the conceptual structure otherwise.

3. CERIF-based SQL scripts

From the ERM model in Toad Data Modeler, SQL scripts are generated automatically for most common databases. Some examples extracts are shown in the extracts 19, 20, 21, 22.

```
Create table [cfPersName] (
    [cfPersId] Nchar(128) NOT NULL,
    [cfFamilyNames] Nchar(64) NULL,
    [cfFirstNames] Nchar(64) NULL,
    [cfOtherNames] Nchar(64) NULL,
    Primary Key ([cfPersId])
)
```

Extract 19: SQL Extract for MS SQL7 database

```
Create table "cfPersName" (
    "cfPersId" NChar(128) NOT NULL ,
    "cfFamilyNames" NChar(64),
    "cfFirstNames" NChar(64),
    "cfOtherNames" NChar(64),
    primary key ("cfPersId")
)
```

Extract 20: SQL Extract for Oracle9i database

```
Create table "cfPersName" (
    "cfPersId" Char(128) NOT NULL,
    "cfFamilyNames" Char(64),
    "cfFirstNames" Char(64),
    "cfOtherNames" Char(64),
)
```

Extract 21: SQL Extract for DB2 UDB v.8

```
Create table `cfPersName` (
    `cfPersId` Char(128) NOT NULL,
    `cfFamilyNames` Char(64),
    `cfFirstNames` Char(64),
    `cfOtherNames` Char(64),
    Primary Key (`cfPersId`) ENGINE = MyISAM/
```

Extract 22: SQL Extract for mySQL

4. CERIF XML

The CERIF 1.3 – XML: Specification document [11] specifies the interchange of CERIF data in CERIF XML format. The specification document as well as the XML schema [10] files for the validation of CERIF XML files are available for download from the public euroCRIS website: <http://www.euroCRIS.org/>. The XML specification maps to the physical level of the CERIF 1.3 FDM model and is being updated according to CERIF model updates.

The following examples show some CERIFXML representations of some link entity records including semantic references.

```
<cfPers_ResPub>
  <cfPersId>person-brigitte-joerg</cfPersId>
  <cfResPubId>publ-analytic-information-service-era</cfResPubId>
  <cfClassId>FirstAuthor</cfClassId>
  <cfClassSchemeld>cf2008-1.2_CERIF_Semantics</cfClassSchemeld>
  <cfStartDate>2008-01-01T00:00:00-00:00</cfStartDate>
  <cfEndDate>2008-12-31T00:00:00-00:00</cfEndDate>
  <cfFraction>0.25</cfFraction>
</cfPers_ResPub>
```

Example 1: CERIF XML Person - Publication Relationship

```
<cfPers_OrgUnit>
  <cfPersId>person-brigitte-joerg</cfPersId>
  <cfOrgUnitId>orgunit-dfki</cfOrgUnitId>
  <cfClassId>Affiliation</cfClassId>
  <cfClassSchemeld>cf2008-1.2_CERIF_Semantics</cfClassSchemeld>
  <cfStartDate>2001-01-13T00:00:00-00:00</cfStartDate>
  <cfEndDate>2009-01-13T00:00:00-00:00</cfEndDate>
  <cfFraction>1.0</cfFraction>
</cfPers_OrgUnit>
```

Example 2: CERIF XML Person -Organisation Relationship

```
<cfClass>
  <cfClassId>class-isA</cfClassId>
  <cfClassSchemeld>ATaxonomyRelationshipScheme</cfClassSchemeld>
  <cfStartDate>2007-01-01T00:00:00-00:00</cfStartDate>
  <cfEndDate>2009-12-31T00:00:00-00:00</cfEndDate>
  <cfFraction>1.0</cfFraction>
</cfClass>
<cfClass_Class>
  <cfClassId1>class-information-science</cfClassId1>
  <cfClassId2>class-science</cfClassId2>
  <cfClassSchemeld1>ATaxonomyRelationshipScheme </cfClassSchemeld1>
  <cfClassSchemeld2>ATaxonomyRelationshipScheme </cfClassSchemeld2>
  <cfClassId>class-isA</cfClassId>
  <cfClassSchemeld>ATaxonomyRelationshipScheme </cfClassSchemeld>
  <cfStartDate>2007-09-28T00:00:00-00:00</cfStartDate>
  <cfEndDate>2009-12-31T00:00:00-00:00</cfEndDate>
</cfClass_Class>
```

Example 3: CERIF XML Classification Relationship

With CERIF, multiple classification terms and structures can be maintained in parallel and easily identified as semantically different due to their classification scheme assignments. Furthermore, it is possible to map terms across classification schemes like in example 4.

```

<cfClass>
  <cfClassId>class-mappes-to</cfClassId>
  <cfClassSchemeld>class-scheme-CERIF-DC-mapping</cfClassSchemeld>
  <cfStartDate>2007-09-28T00:00:00-00:00</cfStartDate>
  <cfEndDate>2099-12-31T00:00:00-00:00</cfEndDate>
</cfClass>

<cfClass_Class>
  <cfClassId1>class-isAuthorOf</cfClassId1>
  <cfClassId2>class-Creator</cfClassId2>
  <cfClassSchemeld1>class-scheme-CERIF2008</cfClassSchemeld1>
  <cfClassSchemeld2>class-scheme-DC</cfClassSchemeld2>
  <cfClassId>class-mappes-to</cfClassId>
  <cfClassSchemeld>class-scheme-CERIF-DC-Mapping</cfClassSchemeld>
  <cfStartDate>2007-09-28T00:00:00-00:00</cfStartDate>
  <cfEndDate>2099-12-31T00:00:00-00:00</cfEndDate>
</cfClass_Class>

```

Example 4: CERIF XML Classification Mapping

CERIF XML is currently being substantially improved – a more flexible and embedded version of CERIF XML is on the way and being tested. Interested parties should be in contact with the CERIF taskgroup leader, for latest developments and testing. The new CERIF XML specification will be published with the next CERIF release.

5. CERIF Semantics

The structure and strength of the Semantic Layer as part of the CERIF model has been presented. A formal document representing the current CERIF 1.3 Semantics is available [12].

6. Pending Items

The pending items will be further considered and are on the way for discussion with the upcoming CERIF release.

Full Data Model:

Identifier Entity

Electronic Address vs Identifier Entity

Middle Name in cfPersonName entity?

cfVersionInfo entity with result entities

Removing of cfStartDate/cfEndDate (legacy) from Base Entities (only use link entities)

Take away cfClassScheme identifier from cfClass entity primary Key (in SQL?)

Geolocation as an additional entity to cfGeographicBoundingBox

Teaching/Courses an entity?

CERIF XML:

Release of embedded CERIF XML specification and Schema after testing.

New CERIF XML validating CERIF XML Scheme is available within euroCRIS.

CERIF Semantics:

Continued Integration with CASRAI⁹ / VIVO¹⁰ and extension of CERIF Semantics. Collaboration with the Linked Open Data, Best Practises, Architecture and CRIS IR Taskgroups.

CERIF License:

The CERIF TG agreed, the next CERIF release will be published under a Creative Commons No Derivs License 3.0.

CERIF Interoperation Compatibility Definition:

The CERIF Interoperation Compatibility Definition is being finalized and will be published with the upcoming CERIF release.

7. CERIF Extensions

Contributions, thoughts, error reports or bug reports are very welcome. Incoming feedback will first be discussed within the CERIF task group and subsequently presented to members. A decision towards extension will finally be taken and the CERIF model will be updated accordingly. Extension requests should be sent to the CERIF TG in a written document.

8. Note

For the next upcoming release, we will elaborate on the pending issues. All current technologies will be maintained in parallel. That is, a CERIF ontology will not replace the conceptual CERIF model and CERIF SQL scripts; also CERIF XML will be further maintained.

9. Acknowledgements

The CERIF taskgroup wishes to thank all actively involved contributors. Within the current update, we want to especially thank and refer to the JISC-funded MICE and CERIFy projects, and other UK JISC-funded projects, as well as the EU-funded MERIL project, for highly valuable discussions and input that materialized in the current CERIF 1.3 data model.

⁹ CASRAI and euroCRIS signed Memorandum of Understanding:

<http://www.eurocris.org/Uploads/Web%20pages/newsflash/Newsflash%2048.pdf>

¹⁰ VIVO project and euroCRIS joint statement: <http://vivoweb.org/blog/2011/11/joint-statement-eurocris-and-vivo-project>

10. Appendix

10.1 List of CERIF Entities

Following is a full list of the CERIF entities in alphabetic order, grouped by entity type, giving the Logical and Physical Name of entities in parentheses.

10.1.1 CERIF Base Entities (Logical (PhysicalName))

cfProject (cfProj)
cfPerson (cfPers)
cfOrgUnit (cfOrgUnit)

10.1.2 CERIF Result Entities (Logical (PhysicalName))

cfResultPublication (cfResPubl)
cfResultPatent (cfResPat)
cfResultProduct (cfResProd)

10.1.3 CERIF Infrastructure Entities (Logical (PhysicalName))

cfFacility (cfFacil)
cfEquipment (cfEquip)
cfService (cfSrv)

10.1.4 CERIF 2nd Level Entities (Logical (PhysicalName))

cfCitation (cfCite)
cfCountry (cfCountry)
cfCurrency (cfCurrency)
cfCurriculumVitae (cfCV)
cfElectronicAddress (cfEAddr)
cfEquipment (cfEquip)
cfEvent (cfEvent)
cfExpertiseAndSkills (cfExpSkills)
cfFacility (cfFacil)
cfFunding (cfFund)
cfLanguage (cfLanguage)
cfMetrics (cfMetrics)
cfPostalAddress (cfPAddr)
cfPrizeAward (cfPrize)
cfQualification (cfQual)
cfService (cfSrv)
cfMedium (cMedium)
cfMeasurement (cfMeas)
cfIndicator (cfIndic)

10.1.5 CERIF Link Entities (Logical (PhysicalName))

cfCitation_Classification (cfCite_Class)
cfClassification_Classification (cfClass_Class)
cfClassScheme_ClassScheme (cfClassScheme_ClassScheme)
cfCountry_Classification (cfCountry_Class)
cfCurrency_Classification (cfCurrency_Class)
cfCV_Classification (cfCV_Class)

cfElectronicAddress_Classification (cfEAddr_Class)
cfEquipment_Classification (cfEquip_Class)
cfEquipment_Funding (cfEquip_Fund)
cfEvent_Event (cfEvent_Event)
cfEvent_Classification (cfEvent_Class)
cfEvent_Funding (cfEvent_Fund)
cfEvent_ResultPublication (cfEvent_ResPubl)
cfExpertiseAndSkills_Classification (cfExpSkills_Class)
cfFacility_Classification (cfFacil_Class)
cfFacility_Funding (cfFacil_Fund)
cfFunding_Classification (cfFund_Class)
cfFunding_Funding (cfFund_Fund)
cfLanguage_Classification (cfLanguage_Class)
cfMetrics_Classification (cfMetrics_Class)
cfOrganisationUnit_Classification (cfOrgUnit_Class)
cfOrganisationUnit_DublinCore (cfOrgUnit_DC)
cfOrganisationUnit_ElectronicAddress (cfOrgUnit_EAddr)
cfOrganisationUnit_Equipment (cfOrgUnit_Equip)
cfOrganisationUnit_Event (cfOrgUnit_Event)
cfOrganisationUnit_ExpertiseAndSkills (cfOrgUnit_ExpSkills)
cfOrganisationUnit_Facility (cfOrgUnit_Facil)
cfOrganisationUnit_Funding (cfOrgUnit_Fund)
cfOrganisationUnit_OrgUnit (cfOrgUnit_OrgUnit)
cfOrganisationUnit_PostalAddress (cfOrgUnit_PAddr)
cfOrganisationUnit_PrizeAward (cfOrgUnit_Prize)
cfOrganisationUnit_ResultPatent (cfOrgUnit_ResPat)
cfOrganisationUnit_ResultProduct (cfOrgUnit_ResProd)
cfOrganisationUnit_ResultPublication (cfOrgUnit_ResPubl)
cfOrganisationUnit_Service (cfOrgUnit_Srv)
cfPerson_Classification (cfPers_Class)
cfPerson_CV (cfPers_CV)
cfPerson_DublinCore (cfPers_DC)
cfPerson_ElectronicAddress (cfPers_EAddr)
cfPerson_Equipment (cfPers_Equip)
cfPerson_Event (cfPers_Event)
cfPerson_ExpertiseAndSkills (cfPers_ExpSkills)
cfPerson_Facility (cfPers_Facil)
cfPerson_Funding (cfPers_Fund)
cfPerson_Language (cfPers_Language)
cfPerson_Country (cfPers_Country)
cfPerson_OrganisationUnit (cfPers_OrgUnit)
cfPerson_Person (cfPers_Pers)
cfPerson_PostAddress (cfPers_PAddr)
cfPerson_PrizeAward (cfPers_Prize)
cfPerson_Qualification (cfPers_Qual)
cfPerson_ResultPatent (cfPers_ResPat)
cfPerson_ResultProduct (cfPers_ResProd)
cfPerson_ResultPublication (cfPers_ResPubl)
cfPerson_Service (cfPers_Srv)
cfPersonName_Person (cfPersName_Pers)
cfPostAddress_Classification (cfPAddr_Class)
cfProject_Classification (cfProj_Class)
cfProject_DublinCore (cfProj_DC)
cfProject_Equipment (cfProj_Equip)
cfProject_Event (cfProj_Event)
cfProject_Facility (cfProj_Facil)
cfProject_Funding (cfProj_Fund)
cfProject_OrganisationUnit (cfProj_Orgunit)

cfProject_Person (cfProj_Pers)
cfProject_PrizeAward (cfProj_Prize)
cfProject_Project (cfProj_Proj)
cfProject_Service (cfProj_Srv)
cfProject_ResultPatent (cfProj_ResPat)
cfProject_ResultProduct (cfProj_ResProd)
cfProject_ResultPublication (cfProj_ResPubl)
cfResultPatent_Classification (cfResPat_Class)
cfResultPatent_Funding (cfResPat_Fund)
cfResultPatent_ResultPatent
cfResultProduct_Classification (cfResProd_Class)
cfResultProduct_Funding (cfResProd_Fund)
cfResultProduct_ResultProduct
cfResultPublication_Citation (cfResPubl_Cite)
cfResultPublication_Classification (cfResPubl_Class)
cfResultPublication_DublinCore (cfResPubl_DC)
cfResultPublication_Event (cfResPubl_Event)
cfResultPublication_Equipment (cfResPubl_Equip)
cfResultPublication_Facility (cfResPubl_Facil)
cfResultPublication_Funding (cfResPubl_Fund)
cfResultPublication_Metrics (cfResPubl_Metrics)
cfResultPublication_ResultPatent (cfResPubl_ResPat)
cfResultPublication_ResultProduct (cfResPubl_ResProd)
cfResultPublication_ResultPublication (cfResPubl_ResPubl)
cfService_Classification (cfSrv_Class)
cfService_Funding (cfSrv_Fund)
cfIndicator_Measurement; (cfIndic_Meas)
cfMeasurement_Classification (cfMeas_Class)
cfIndicator_Classification (cfIndic_Class)
cfPerson_Measurement (cfPers_Meas)
cfPerson_Indicator (cfPers_Indic)
cfProject_Measurement (cfProj_Meas)
cfProject_Indicator (cfProj_Indic)
cfResultPublication_Measurement (cfResPubl_Meas)
cfResultPublication_Indicator (cfResPubl_Indic)
cfResultPatent_Measurement (cfResPat_Meas)
cfResultPatent_Indicator (cfResPat_Indic)
cfResultProduct_Measurement (cfResProd_Meas)
cfResultProduct_Indicator (cfResProd_Indic)
cfFacility_Measurement (cfFacil_Meas)
cfEquipment_Measurement (cfEquip_Meas)
cfService_Measurement (cfSrv_Meas)
cfFacility_Indicator (cfFacil_Indic)
cfEquipment_Indicator (cfEquip_Indic)
cfService_Indicator (cfSrv_Indic)
cfMedium_Medium (cfMedium_Medium)
cfMedium_Classification (cfMedium_Class)
cfResultPublication_Medium (cfResPubl_Medium)
cfResultPatent_Medium (cfResPat_Medium)
cfResultProduct_Medium (cfResProd_Medium)
cfEvent_Medium (cfEvent_Medium)
cfOrganisationUnit_Medium (cfOrgUnit_Medium)
cfPerson_Medium (cfPers_Medium)
cfProject_Medium (cfProj_Medium)
cfFunding_Medium (cfFund_Medium)
cfCitation_Medium (cfCite_Medium)

10.1.6 CERIF Multiple Language Features (Logical (PhysicalName))

cfCitationDescription (cfCiteDescr)
cfCitationTitle (cfCiteTitle)
cfClassificationDescription (cfClassDescr)
cfClassificationTerm (cfClassTerm)
cfClassificationSchemeName (cfClassSchemeName)
cfClassificationSchemeDescription (cfClassSchemeDescr)
cfCountryName (cfCountryName)
cfCurrencyEntityName (cfCurrencyEntityName)
cfCurrencyName (cfCurrencyName)
cfEquipmentDescription (cfEquipPDescr)
cfEquipmentKeywords (cfEquipKeyw)
cfEquipmentName (cfEquipName)
cfEventDescription (cfEventDescr)
cfEventKeywords (cfEventKeyw)
cfEventName (cfEventName)
cfExpertiseAndSkillsDescription (cfExpSkillsDescr)
cfExpertiseAndSkillsKeywords (cfExpSillsKeyw)
cfExpertiseAndSkillsName (cfExpSkillsName)
cfFacilityDescription (cfFacilDescr)
cfFacilityKeywords (cfFacilKeyw)
cfFacilityName (cfFacilName)
cfFundingDescription (cfFundDescr)
cfFundingKeywords (cfFundKeyw)
cfFundingName (cfFundName)
cfLanguageName (cfLanguageName)
cfMetricsDescription (cfMetricsDescr)
cfMetricsName (cfMetricsName)
cfOrganisationUnitKeywords (cfOrgUnitKeyw)
cfOrganisationUnitName (cfOrgUnitName)
cfOrganisationUnitResearchActivity (cfOrgUnitResAct)
cfPersonResearchInterest (cfPersResInt)
cfPersonKeywords (cfPersKeyw)
cfProjectAbstract (cfProjAbstr)
cfProjectKeywords (cfProjKeyw)
cfProjectTitle (cfProjTitle)
cfResultPatentAbstract (cfResPatAbstr)
cfResultPatentKeywords (cfResPatKeyw)
cfResultPatentTitle (cfResPatTitle)
cfResultProductDescription (cfResProdDescr)
cfResultProductKeywords (cfResProdKeyw)
cfResultProductName (cfResProdName)
cfResultPublicationAbstract (cfResPublAbst)
cfResultPublicationBibliographicNote (cfResPublBiblNote)
cfResultPublicationKeywords (cfResPublKeyw)
cfResultPublicationNameAbbreviation (cfResPublNameAbbrev)
cfResultPublicationSubtitle (cfResPublSubtitle)
cfResultPublicationTitle (cfResPublTitle)
cfServiceDescription (cfSrvDescr)
cfServiceKeywords (cfSrvKeyw)
cfServiceName (cfSrvName)
cMediumTitle (cfMediumTitle)
cfMediumDescription (cfMediumDescr)
cfMediumKeywords (cfMediumKeyw)
cfIndicatorDescription (cfIndicDescr)
cfIndicatorKeywords (cfIndicKeyw)
cfMeasurementName (cfMeasName)

cfMeasurementDescription (cfMeasDescr)
cfMeasurementKeywords (cfMeasKeyw)
cfGeographicBoundingBoxName (cfGeoBBoxName)
cfGeographicBoundingBoxDescription (cfGeoBBoxDescr)
cfGeographicBoundingBoxKeywords (cfGeoBBoxKeyw)

10.1.7 Additional Entities (Logical (PhysicalName))

cfPersonName (cfPersName)
cfDublinCore (cfDC)
cfDCAudience (cfDCAudience)
cfDCContributor (cfDCContributor)
cfDCCoverage (cfDCCoverage)
cfDCCoverageSpatial (cfDCCoverageSpatial)
cfDCCoverateTemporal (cfDCCoverageTemporal)
cfDCCreator (cfDCCreator)
cfDCDate (cfDCDate)
cfDCDescription (cfDCDescription)
cfDCFormat (cfDCFormat)
cfDCLanguage (cfDCLanguage)
cfDCProvenance (cfDCProvenance)
cfDCPublisher (cfDCPublisher)
cfDCRelation (cfDCRelation)
cfDCResourceIdentifier (cfDCResourceIdentifier)
cfDCResourceType (cfDCResourceType)
cfDCRightsHolder (cfDCRighsHolder)
cfDCRightsManagement (cfDCRightsMM)
cfDCRightsManagementAccessRights (cfDCRightsMMAccessRight)
cfDCRightsManagementLicense (cfDCRightsMMLicence)
cfDCSource (cfDCSource)
cfDCSubject (cfDCSubject)
cfDCTitle (cfDCTitle)
cfFormalisedDublinCoreRightsManagementPricing (FDCRightsMMPricing)
cfFormalisedDublinCoreRightsManagementPrivacy (FDCRightsMMPrivacy)
cfFormalisedDublinCoreRightsManagementRights (FDCRightsMM)
cfFormalisedDublinCoreRightsManagementSecurity (FDCRightsMMSecurity)

10.1.8 CERIF Classification Entities (Logical (PhysicalName))

cfClassification (cfClass)
cfClassificationScheme (cfClassScheme)

10.1.9 CERIF Attributes

10.1.10 Attribute in all Link Tables

cfFraction (cfFraction)

10.1.10.1 Language-dependent attributes including cflangCode and cfTrans

cfAbstract (cfAbstr)
cfDescription (cfDescr)
cfKeywords (cfKeyw)
cfName (cfName)
cfResearchActivity (cfResAct)
cfResearchInterest (cfResInt)
cfTerm (cfTerm)

cfTitle (cfTitle)

10.1.10.2 Currency-dependent attributes

cfAmount (cfAmount)

cfPrice (cfPrice)

cfTurnover (cfTurn)

10.2 Logical / Physical CERIF Entity Names

The following table 1 gives an overview of all CERIF 2008 – 1.2 entities, their corresponding attributes with logical and physical names (including of prefixes).

Table 1: List of Entities with Logical (alphabetical order) and Physical Names

| Logical CERIF2008 - 1.2 Entities | Physical CERIF2008-1.2 Entities |
|---|--|
| cfCitation | cfCite |
| cfCitation_Classification | cfCite_Class |
| cfCitation_Medium | cfCite_Medium |
| cfCitationDescription | cfCiteDescr |
| cfCitationTitle | cfCiteTitle |
| cfClassification | cfClass |
| cfClassificationDefinition | cfClassDef |
| cfClassificationExample | cfClassEx |
| cfClassification_Classification | cfClass_Class |
| cfClassificationDescription | cfClassDescr |
| cfClassificationScheme | cfClassScheme |
| cfClassificationSchemeName | cfClassSchemeName |
| cfClassificationScheme_ClassificationScheme | cfClassScheme_ClassScheme |
| cfClassificationSchemeDescription | cfClassSchemeDescr |
| cfClassificationTerm | cfClassTerm |
| cfCountry | cfCountry |
| cfCountry_Classification | cfCountry_Class |
| cfCountryName | cfCountryName |
| cfCurrency | cfCurrency |
| cfCurrency_Classification | cfCurrency_Class |
| cfCurrencyEntityName | cfCurrencyEntName |
| cfCurrencyName | cfCurrencyName |
| cfCurriculumVitae | cfCV |
| cfCurriculumVitae_Classification | cfCV_Class |
| cfDublinCore | cfDC |
| cfDublinCoreAudience | cfDCAudience |
| cfDublinCoreContributor | cfDCContributor |
| cfDublinCoreCoverage | cfDCCoverage |
| cfDublinCoreCoverageSpatial | cfDCCoverageSpatial |
| cfDublinCoreCoverageTemporal | cfDCCoverageTemporal |
| cfDublinCoreCreator | cfDCCreator |
| cfDublinCoreDate | cfDCDate |
| cfDublinCoreDescription | cfDCDescription |
| cfDublinCoreFormat | cfDCFormat |
| cfDublinCoreLanguage | cfDCLanguage |
| cfDublinCoreProvenance | cfDCProvenance |
| cfDublinCorePublisher | cfDCPublisher |
| cfDublinCoreRelation | cfDCRelation |
| cfDublinCoreResourceIdentifier | cfDCResourceIdentifier |
| cfDublinCoreResourceType | cfDCResourceType |
| cfDublinCoreRightsHolder | cfDCRightsHolder |

| | |
|--|--------------------------|
| cfDublinCoreRightsManagement | cfDCRightsMM |
| cfDublinCoreRightsManagementAccessRights | cfDCRightsMMAccessRights |
| cfDublinCoreRightsManagementLicense | cfDCRightsMMLicense |
| cfDublinCoreSource | cfDCSource |
| cfDublinCoreSubject | cfDCSubject |
| cfDublinCoreTitle | cfDCTitle |
| cfElectronicAddress | cfEAddr |
| cfElectronicAddress_Classification | cfEAddr_Class |
| cfEquipment | cfEquip |
| cfEquipment_Classification | cfEquip_Class |
| cfEquipment_Funding | cfEquip_Fund |
| cfEquipment_Medium | cfEquip_Medium |
| cfEquipment_Equipment | cfEquip_Equip |
| cfEquipment_Service | cfEquip_Srv |
| cfEquipment_Event | cfEquip_Event |
| cfEquipment_PostAddress | cfEquip_PAddr |
| cfEquipmentDescription | cfEquipDescr |
| cfEquipmentKeywords | cfEquipKeyw |
| cfEquipmentName | cfEquipName |
| cfEvent | cfEvent |
| cfEvent_Classification | cfEvent_Class |
| cfEvent_Event | cfEvent_Event |
| cfEvent_Funding | cfEvent_Fund |
| cfEvent_Medium | cfEvent_Medium |
| cfEvent_ResultPublication | cfEvent_ResPubl |
| cfEventDescription | cfEventDescr |
| cfEventKeywords | cfEventKeyw |
| cfEventName | cfEventName |
| cfExpertiseAndSkills | cfExpSkills |
| cfExpertiseAndSkills_Classification | cfExpSkills_Class |
| cfExpertiseAndSkillsDescription | cfExpSkillsDescr |
| cfExpertiseAndSkillsKeywords | cfExpSkillsKeyw |
| cfExpertiseAndSkillsName | cfExpSkillsName |
| cfFacility | cfFacil |
| cfFacility_Classification | cfFacil_Class |
| cfFacility_Facility | cfFacil_Facil |
| cfFacility_Funding | cfFacil_Fund |
| cfFacility_Medium | cfFacil_Medium |
| cfFacility_Service | cfFacil_Srv |
| cfFacility_Event | cfFacil_Event |
| cfFacility_GeographicBoundingBox | cfFacil_GeoBBox |
| cfFacilityDescription | cfFacilDescr |
| cfFacilityKewords | cfFacilKeyw |
| cfFacilityName | cfFacilName |
| cfFormalisedDublinCoreRightsManagementPricing | cfFDCRightsMMPricing |
| cfFormalisedDublinCoreRightsManagementPrivacy | cfFDCRightsMMPrivacy |
| cfFormalisedDublinCoreRightsManagementRights | cfFDCRightsMMRights |
| cfFormalisedDublinCoreRightsManagementSecurity | cfFDCRightsMMSecurity |
| cfFunding | cfFund |
| cfFunding_Classification | cfFund_Class |
| cfFunding_Funding | cfFund_Fund |
| cfFunding_Medium | cfFund_Medium |
| cfFundingDescription | cfFundDescr |
| cfFundingKeywords | cfFundKeyw |
| cfFundingName | cfFundName |
| cfGeographicBoundingBox | cfGeoBBox |
| cfGeographicBoundingBoxName | cfGeoBBoxName |
| cfGeographicBoundingBoxDescription | cfGeoBBoxDescr |

| | |
|--|---------------------|
| cfGeographicBoundingBoxKeywords | cfGeoBBoxKeyw |
| cfGeographicBoundingBox_Classification | cfGeoBBox_Class |
| cfIndicator | cfIndic |
| cfIndicator_Classification | cfIndic_Class |
| cfIndicator_Indicator | cfIndic_Indic |
| cfIndicator_Measurement | cfIndic_Meas |
| cfIndicatorName | cfIndicName |
| cfIndicatorDescription | cfIndicDescr |
| cfIndicatorKeywords | cfIndicKeyw |
| cfLanguage | cfLang |
| cfLanguage_Classification | cfLang_Class |
| cfLanguageName | cfLangName |
| cfMedium | cfMedium |
| cfMediumDescription | cfMediumDescr |
| cfMediumKeywords | cfMediumKeyw |
| cfMediumTitle | cfMediumTitle |
| cfMedium_Medium | cfMedium_Medium |
| cfMedium_Classification | cfMedium_Class |
| cfMetrics | cfMetrics |
| cfMetrics_Classification | cfMetrics_Class |
| cfMetricsDescription | cfMetricsDescr |
| cfMetricsName | cfMetricsName |
| cfMeasurement | cfMeas |
| cfMeasurement_Classification | cfMeas_Class |
| cfMeasurement_Measurement | cfMeas_Meas |
| cfMeasurementName | cfMeasName |
| cfMeasurementDescription | cfMeasDescr |
| cfMeasurementKeywords | cfMeasKeyw |
| cfOrganisationUnit | cfOrgUnit |
| cfOrganisationUnit_Classification | cfOrgUnit_Class |
| cfOrganisationUnit_DublinCore | cfOrgUnit_DC |
| cfOrganisationUnit_ElectronicAddress | cfOrgUnit_EAddr |
| cfOrganisationUnit_Equipment | cfOrgUnit_Equip |
| cfOrganisationUnit_Event | cfOrgUnit_Event |
| cfOrganisationUnit_ExpertiseAndSkills | cfOrgUnit_ExpSkills |
| cfOrganisationUnit_Facility | cfOrgUnit_Facil |
| cfOrganisationUnit_Funding | cfOrgUnit_Fund |
| cfOrganisationUnit_OrganisationUnit | cfOrgUnit_OrgUnit |
| cfOrganisationUnit_PostAddress | cfOrgUnit_PAddr |
| cfOrganisationUnit_PrizeAward | cfOrgUnit_Prize |
| cfOrganisationUnit_ResultPatent | cfOrgUnit_ResPat |
| cfOrganisationUnit_ResultProduct | cfOrgUnit_ResProd |
| cfOrganisationUnit_ResultPublication | cfOrgUnit_ResPubl |
| cfOrganisationUnit_Service | cfOrgUnit_Srv |
| cfOrganisationUnit_Medium | cfOrgUnit_Medium |
| cfOrganisationUnit_Measurement | cfOrgUnit_Meas |
| cfOrganisationUnit_Indicator | cfOrgUnit_Indic |
| cfOrganisationUnitKeywords | cfOrgUnitKeyw |
| cfOrganisationUnitName | cfOrgUnitName |
| cfOrganisationUnitResearchActivity | cfOrgUnitResAct |
| cfPerson | cfPers |
| cfPerson_Classification | cfPers_Class |
| cfPerson_Country | cfPers_Country |
| cfPerson_CurriculumVitae | cfPers_CV |
| cfPerson_DublinCore | cfPers_DC |
| cfPerson_ElectronicAddress | cfPers_EAddr |
| cfPerson_Equipment | cfPers_Equip |
| cfPerson_Event | cfPers_Event |

| | |
|-------------------------------------|------------------|
| cfPerson_ExpertiseAndSkills | cfPers_ExpSkills |
| cfPerson_Facility | cfPers_Facil |
| cfPerson_Funding | cfPers_Fund |
| cfPerson_Language | cfPers_Language |
| cfPerson_OrganisationUnit | cfPers_OrgUnit |
| cfPerson_Person | cfPers_Pers |
| cfPerson_PostAddress | cfPers_PAddr |
| cfPerson_PrizeAward | cfPers_Prize |
| cfPerson_Qualification | cfPers_Qual |
| cfPerson_ResultPatent | cfPers_ResPat |
| cfPerson_ResultProduct | cfPers_ResProd |
| cfPerson_ResultPublication | cfPers_ResPubl |
| cfPerson_Service | cfPers_Serv |
| cfPerson_Medium | cfPers_Medium |
| cfPerson_Measurement | cfPers_Meas |
| cfPerson_Indicator | cfPers_Indic |
| cfPersonKeywords | cfPersKeyw |
| cfPersonName | cfPersName |
| cfPersonName_Person | cfPersName_Pers |
| cfPersonResearchInterest | cfPersResInt |
| cfPostAddress | cfPAddr |
| cfPostAddress_Classification | cfPAddr_Class |
| cfPostAddress_GeographicBoundingBox | cfPAddr_GeoBBox |
| cfPrizeAward | cfPrize |
| cfPrizeAward_Classification | cfPrize_Class |
| cfProject | cfProj |
| cfProject_Classification | cfProj_Class |
| cfProject_DublinCore | cfProj_DC |
| cfProject_Equipment | cfProj_Equip |
| cfProject_Event | cfProj_Event |
| cfProject_Facility | cfProj_Facil |
| cfProject_Funding | cfProj_Fund |
| cfProject_OrganisationUnit | cfProj_OrgUnit |
| cfProject_Person | cfProj_Pers |
| cfProject_PrizeAward | cfProj_Prize |
| cfProject_Project | cfProj_Proj |
| cfProject_ResultPatent | cfProj_ResPat |
| cfProject_ResultProduct | cfProj_ResProd |
| cfProject_ResultPublication | cfProj_ResPubl |
| cfProject_Medium | cfProj_Medium |
| cfProject_Service | cfProj_Srv |
| cfProject_Measurement | cfProj_Meas |
| cfProject_Indicator | cfProj_Indic |
| cfProjectAbstract | cfProjAbstr |
| cfProjectKeywords | cfProjKeyw |
| cfProjectTitle | cfProjTitle |
| cfQualification | cfQual |
| cfQualification_Classification | cfQual_Class |
| cfQualificationDescription | cfQualDescr |
| cfQualificationKeywords | cfQualKeyw |
| cfResultPatent | cfResPat |
| cfResultPatent_Classification | cfResPat_Class |
| cfResultPatent_Funding | cfResPat_Fund |
| cfResultPatent_ResultPatent | cfResPat_ResPat |
| cfResultPatent_Medium | cfResPat_Medium |
| cfResPatent_Service | cfResPubl_Srv |
| cfResPatent_Equipment | cfResPubl_Equip |
| cfResPatent_Facility | cfResPubl_Facil |

| | |
|---------------------------------------|---------------------|
| cfResultPateng_Measurement | cfResPat_Meas |
| cfResultPatent_Indicator | cfResPat_Indic |
| cfResultPatentAbstract | cfResPatAbstr |
| cfResultPatentKeywords | cfResPatKeyw |
| cfResultPatentTitle | cfResPatTitle |
| cfResultProduct | cfResProd |
| cfResultProduct_Classification | cfResProd_Class |
| cfResultProduct_Funding | cfResProd_Fund |
| cfResultProduct_ResultProduct | cfResProd_ResProd |
| cfResProduct_Service | cfResProd_Srv |
| cfResProduct_Equipment | cfResProd_Equip |
| cfResProduct_Facility | cfResProd_Facil |
| cfResultProduct_Medium | cfResProd_Medium |
| cfResultProduct_Measurement | cfResProd_Meas |
| cfResultProduct_Indicator | cfResProd_Indic |
| cfResultProductDescription | cfResProdDescr |
| cfResultProductKeywords | cfResProdKeyw |
| cfResultProductName | cfResProdName |
| cfResultPublication | cfResPubl |
| cfResultPublication_Citation | cfResPubl_Cite |
| cfResultPublication_Classification | cfResPubl_Class |
| cfResultPublication_DublinCore | cfResPubl_DC |
| cfResultPublication_Funding | cfResPubl_Fund |
| cfResultPublication_Equipment | cfResPubl_Equip |
| cfResultPublication_Event | cfResPubl_Event |
| cfResultPublication_Facility | cfResPubl_Facil |
| cfResultPublication_Funding | cfResPubl_Fund |
| cfResultPublication_Metrics | cfResPubl_Metrics |
| cfResultPublication_Medium | cfResPubl_Medium |
| cfResultPublication_ResultPatent | cfResPubl_ResPat |
| cfResultPublication_ResultProduct | cfResPubl_ResProd |
| cfResultPublication_ResultPublication | cfResPubl_ResPubl |
| cfResPublication_Service | cfResPubl_Srv |
| cfResPublication_Equipment | cfResPubl_Equip |
| cfResPublication_Facility | cfResPubl_Facil |
| cfResultPublication_Measurement | cfResPubl_Meas |
| cfResultPublication_Indicator | cfResPubl_Indic |
| cfResultPublicationAbstract | cfResPublAbstr |
| cfResultPublicationBibliographicNote | cfResPublBiblNote |
| cfResultPublicationKeywords | cfResPublKeyw |
| cfResultPublicationNameAbbreviation | cfResPublNameAbbrev |
| cfResultPublicationSubtitle | cfResPublSubtitle |
| cfResultPublicationTitle | cfResPublTitle |
| cfService | cfSrv |
| cfService_Classification | cfSrv_Class |
| cfService_Funding | cfSrv_Fund |
| cfService_Medium | cfSrv_Medium |
| cfService_Service | cfSrv_Srv |
| cfService_GeographicBoundingBox | cfSrv_GeoBBox |
| cfServiceDescription | cfSrvDescr |
| cfServiceKeywords | cfSrvKeyw |
| cfServiceName | cfSrvName |

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