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

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## 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.

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\* 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<sup>§</sup>

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](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/>.

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<sup>§</sup> CERIF–1.3 was modeled with Toad Data Modeler by Quest Software<sup>§</sup>, 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.

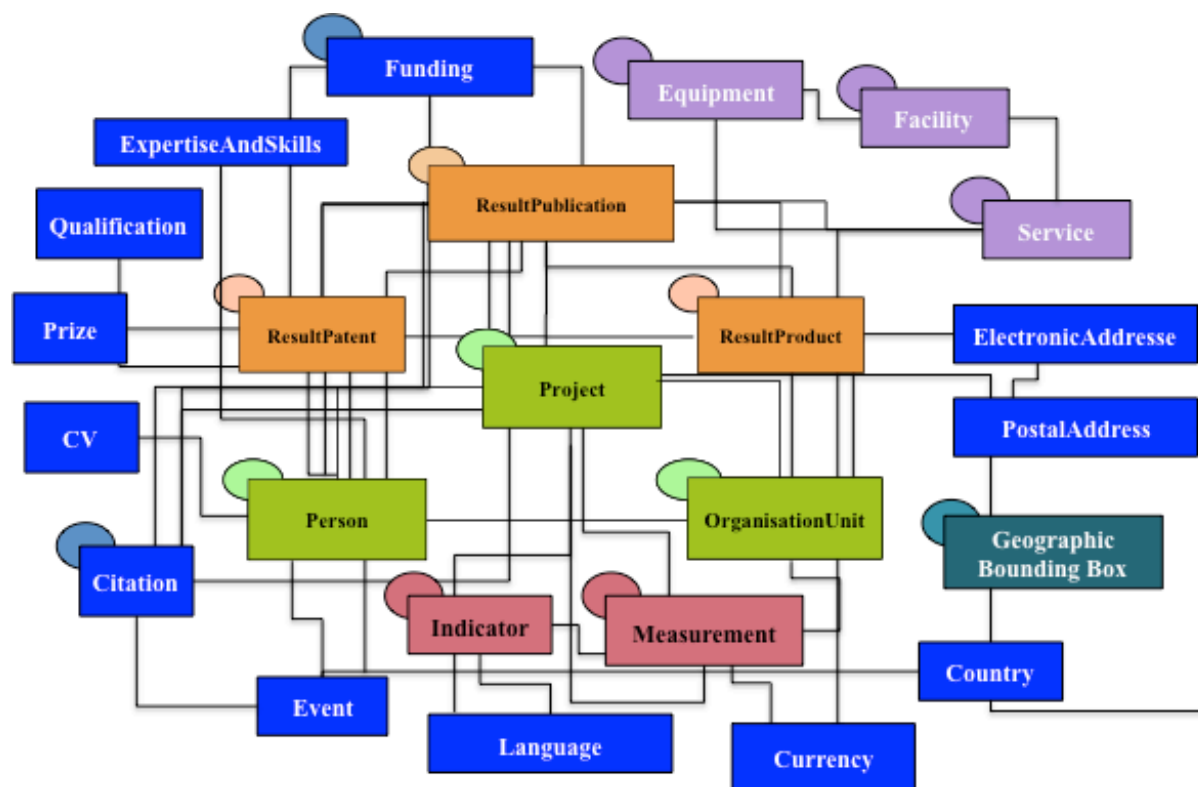












Figure 1: CERIF 1.3 Entities and their relationships (abstract view)

### 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, 2<sup>nd</sup> 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 <sup>nd</sup> 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].<sup>††</sup>

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.

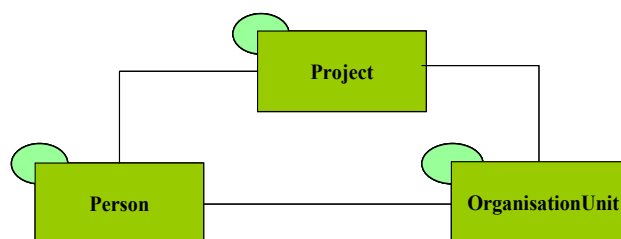


Figure 2: CERIF 1.3 Base Entities (abstract view)

**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.

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<sup>††</sup> 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.

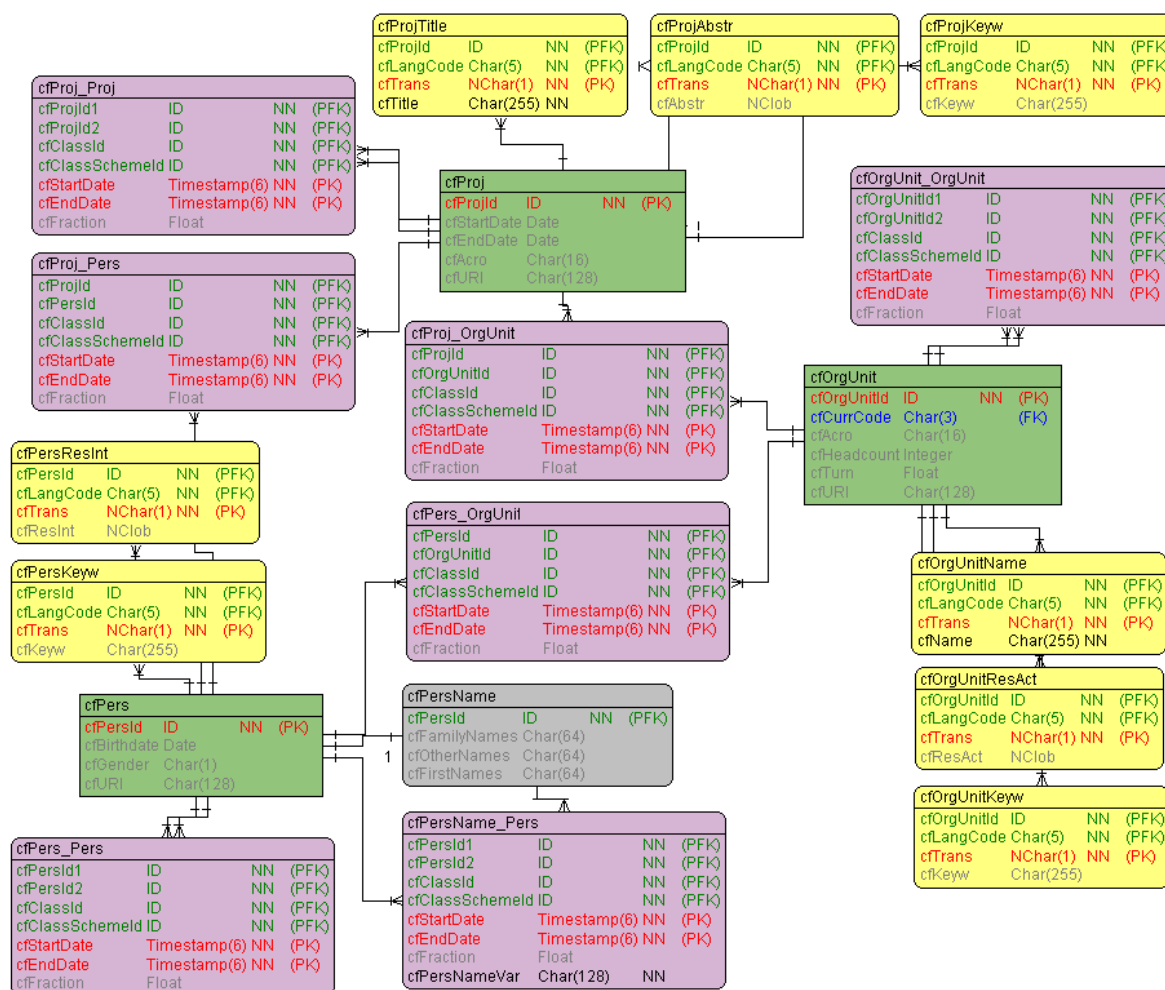


Figure 3: CERIF 1.3 Base Entities, their Recursion and some Link Entities (physical view)

Each base entity cfProj, cfPers, cfOrgUnit will subsequently be presented and some examples will be provided to support their understanding.

### 2.2.1 CERIF Entity Project

For an identification of project records, the base entity (cfProj) foresees an id attribute (cfProjId). Besides, the attributes acronym, uri, and start/end date (cfAcro, cfURI, cfStartDate, cfEndDate) are considered as common project attributes. The project entity maintains many relationships with other entities i.e. project, person, organisation, publication, patent, medium, product, funding programme, equipment, facility, service, event, prize and classification (cfProj\_Proj, cfProj\_Pers, cfProj\_OrgUnit, cfProj\_ResPubl, cfProj\_Medium, cfProj\_ResPat, cfProj\_ResProd, cfProj\_Fund, cfProj\_Equip, cfProj\_Facil, cfProj\_Srv, cfProj\_Prize, cfProj\_Class) as shown in **Figure 4**. Each relationship or link entity carries semantics with a time-stamped reference to the CERIF Semantic Layer by cfClassId and cfClassSchemeId and a cfFraction attribute to assign fractional values to a classification reference. Additionally, the project entity supports multilingual features for title, abstract, and keywords (cfProjTitle, cfAbstr, cfProjKeyw).

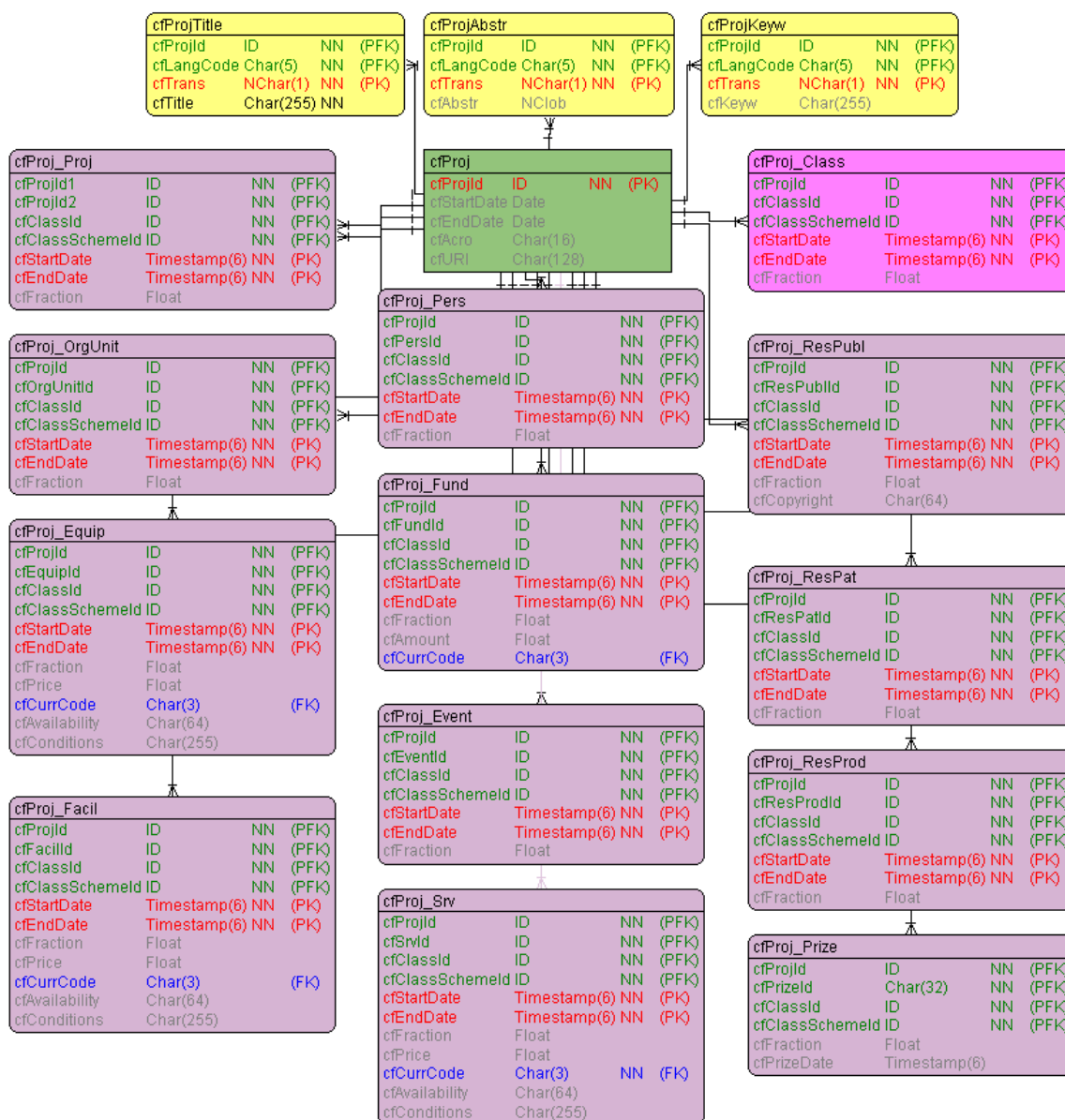


Figure 4: CERIF 1.3 Base Entity Project (physical view)

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](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.

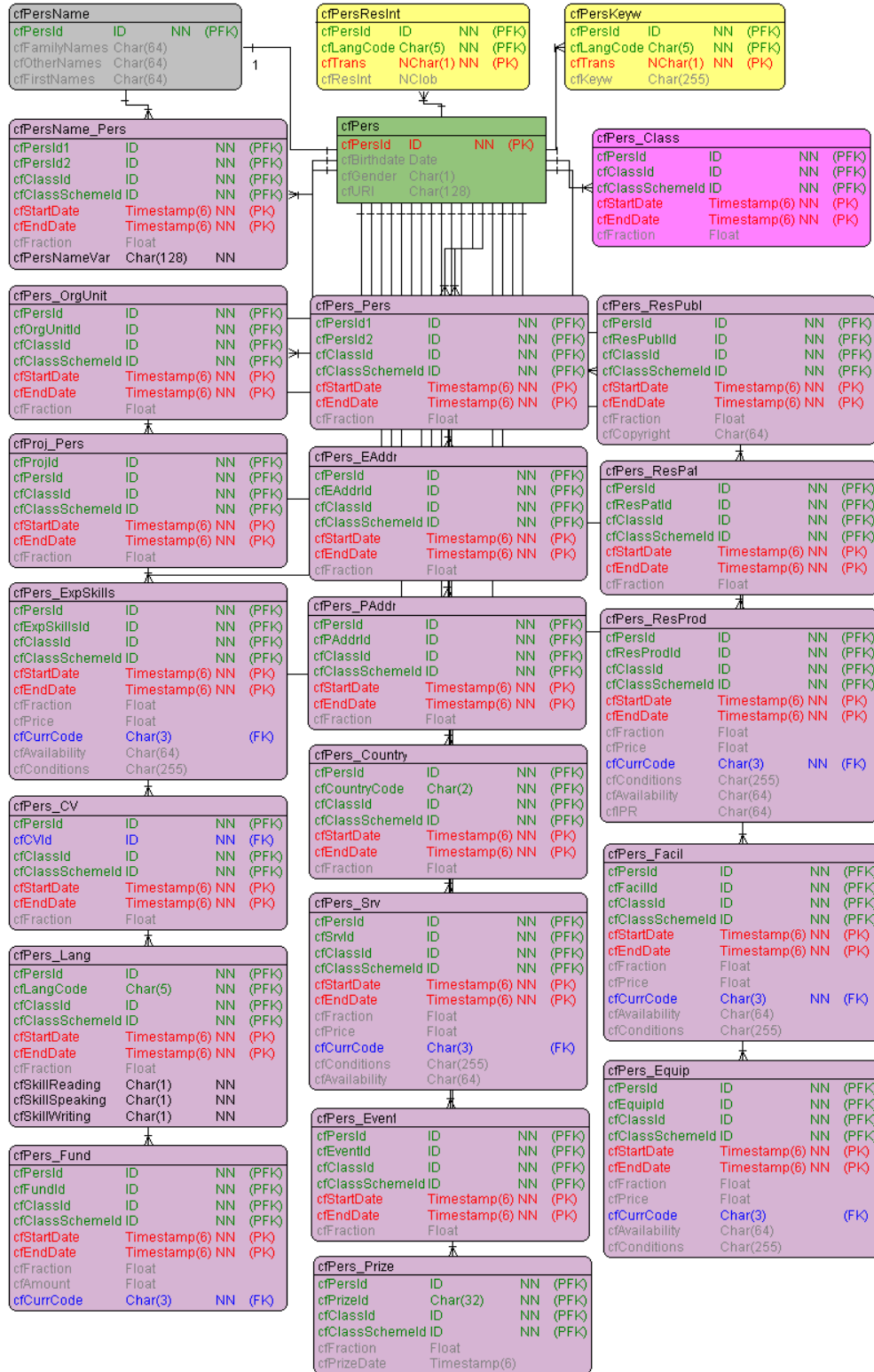


Figure 5: CERIF 1.3 Base Entity Person (physical view)

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.



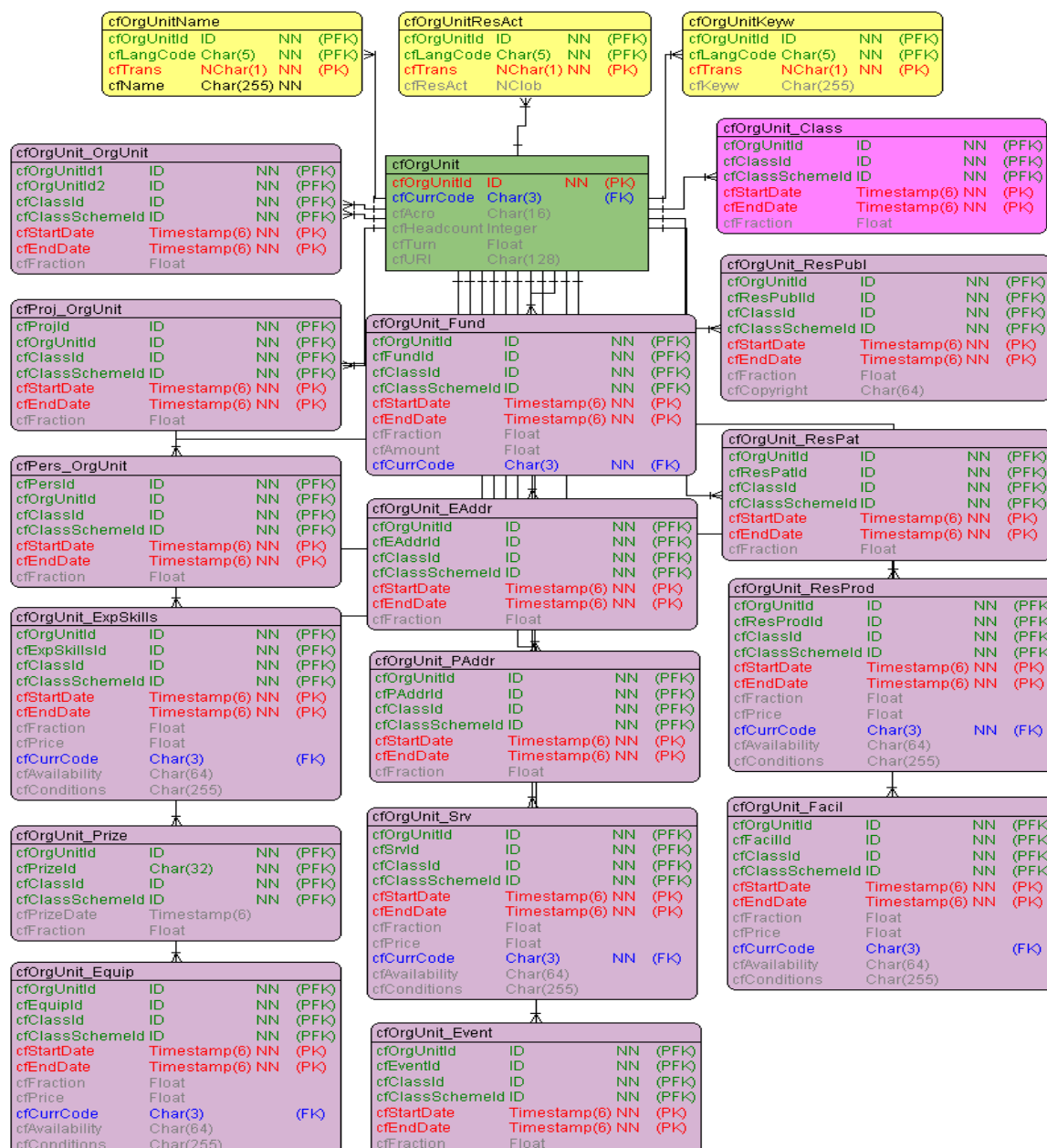


Figure 6: CERIF 1.3 Base Entity Organisation Unit (physical view)

Table 3: CERIF OrganisationUnit Example Record

CERIF OrganisationUnit example database entry					Semantic Layer (CERIF Semantics)	
	Attribute	Table	Type	Classifications (cfClassIds)	Classification Schemes (cfClassSchemeIds)	
orgunit-eurocris*	cfOrgUnitId	cfOrgUnit	base			
EUR	cfCurrCode	cfOrgUnit	base			
http://www.eurocris.org/	cfURI	cfOrgUnit	base			
euroCRIS	cfAcro	cfOrgUnit	base			
European Current Research Information Systems	cfName	cfOrgUnitName	lang			
euroCRIS is a professional ...	cfResAct	cfOrgUnitResAct	lang			
classification-nfp*	cfClassId	cfOrgUnit_Class	link	eda2b2f6-34c5-11e1-b86c-0800200c9a66	759af939-34ae-11e1-b86c-0800200c9a66	

				(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.

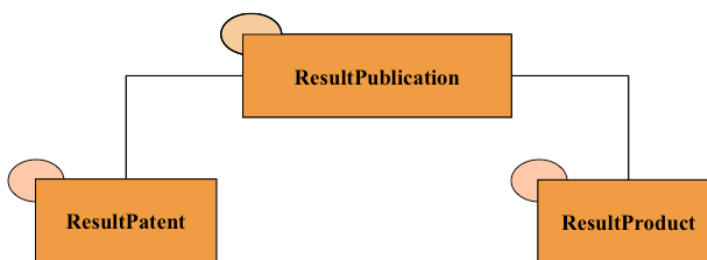


Figure 7: CERIF Result Entities

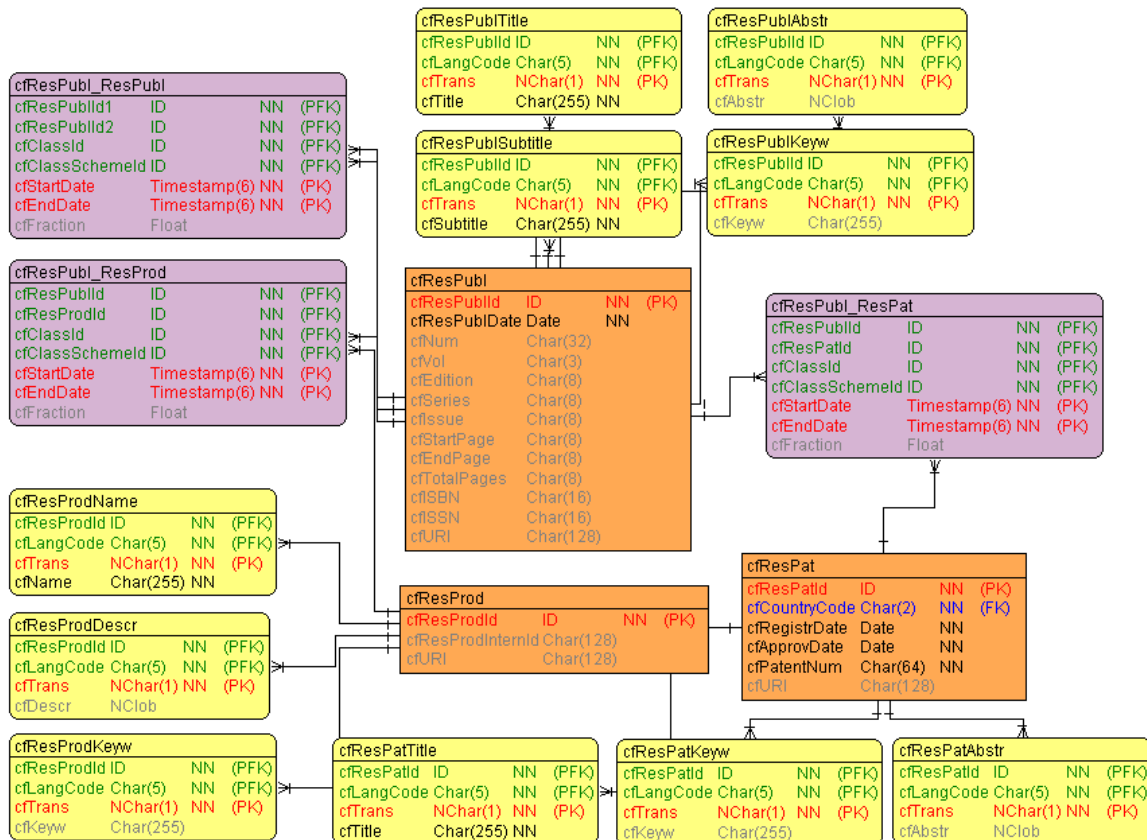


Figure 8: CERIF 1.3 Result Entities, their recursion and some link entities (physical view)

Figure shows the result entities (cfResPubl, cfResPat, cfResProd) and their related entities from a physical view (ERM short names). The circles in Figure represent recursiveness; that is, the relationships in between publications (cfResPubl\_ResPubl; cfResPat\_ResPat; and cfResProd\_ResProd). The recursive and the interlinking relations (cfResPubl\_ResProd, cfResPubl\_ResPat) are so-called link type entities that will be introduced in section 2.8. The yellow entities (cfResPublTitle, cfResPublSubtitle, cfResPublAbstr, cfResPatTitle, etc.) support the feature of multiple languages and will be introduced in section section 2.9. Each result entity (cfResPubl, cfResPat, cfResProd) will subsequently be presented and examples for the publication entity will be provided to support understanding.

### 2.3.1 CERIF Entity ResultPublication

For an identification of records the result publication entity (cfResPubl) foresees an id attribute (cfResPublId). Besides, the attributes publication date, number, volume, edition, series, issue, startpage, endpage, total pages, isbn, issn, and uri (cfResPublDate, cfNum, cfVolume, cfEdition, cfSeries, cfIssue, cfStartPage, cfEndpage, cfTotalPages, cfISBN, cfISSN, cfURI) are considered as common publication attributes in CERIF.

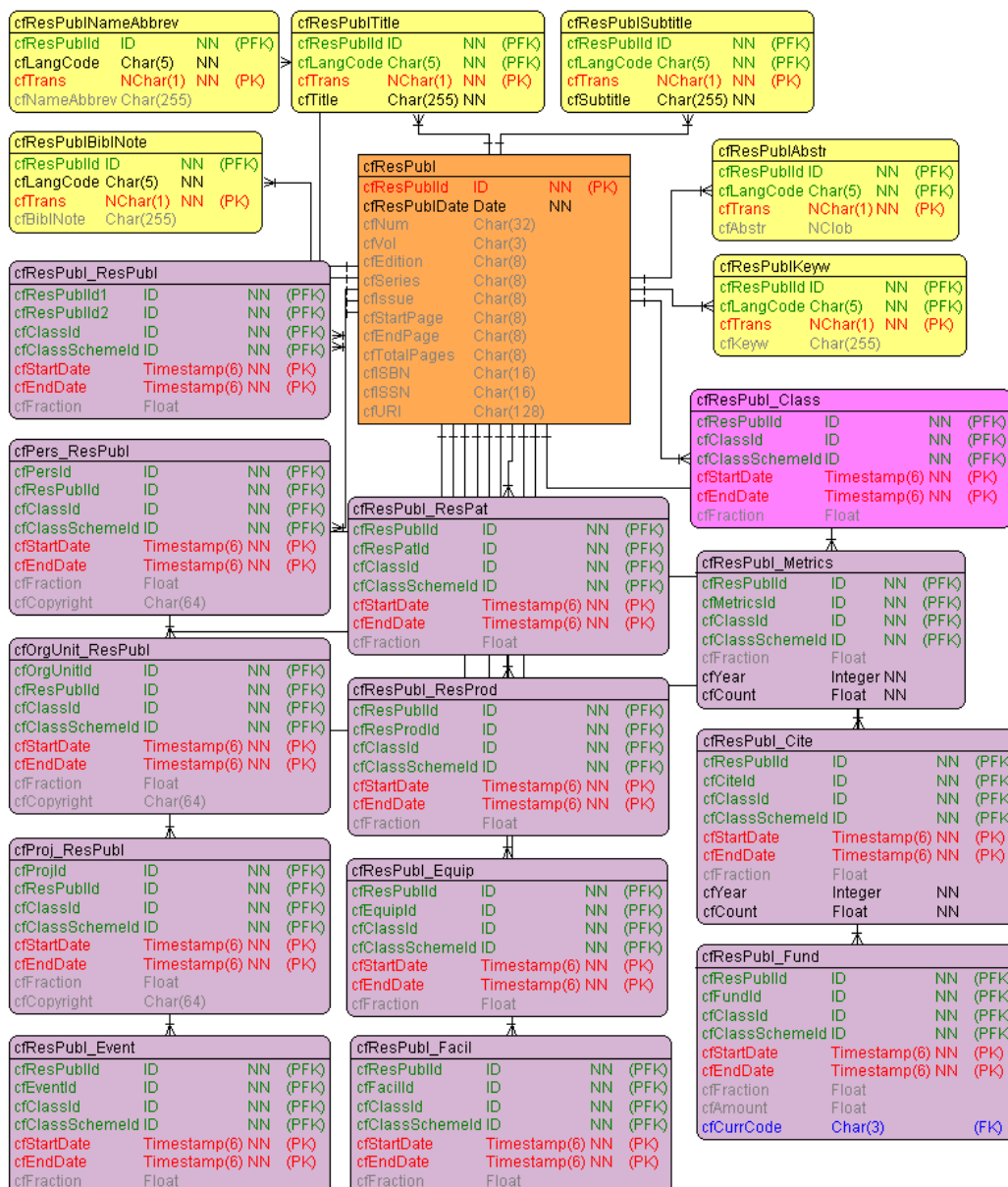


Figure 9: CERIF 1.3 Result Publication entity (physical view)

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 cfClassSchemelD 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).

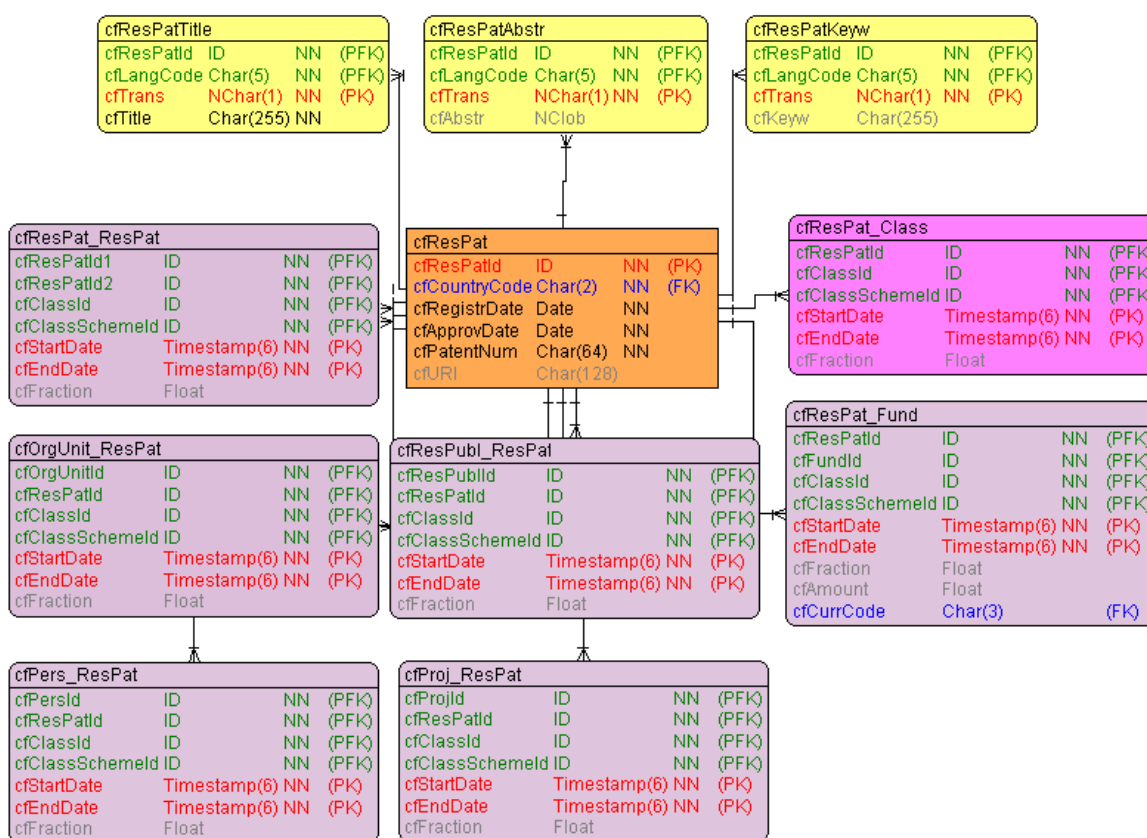


Figure 7: CERIF 1.3 Entity Result Patent (physical view)

### 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).

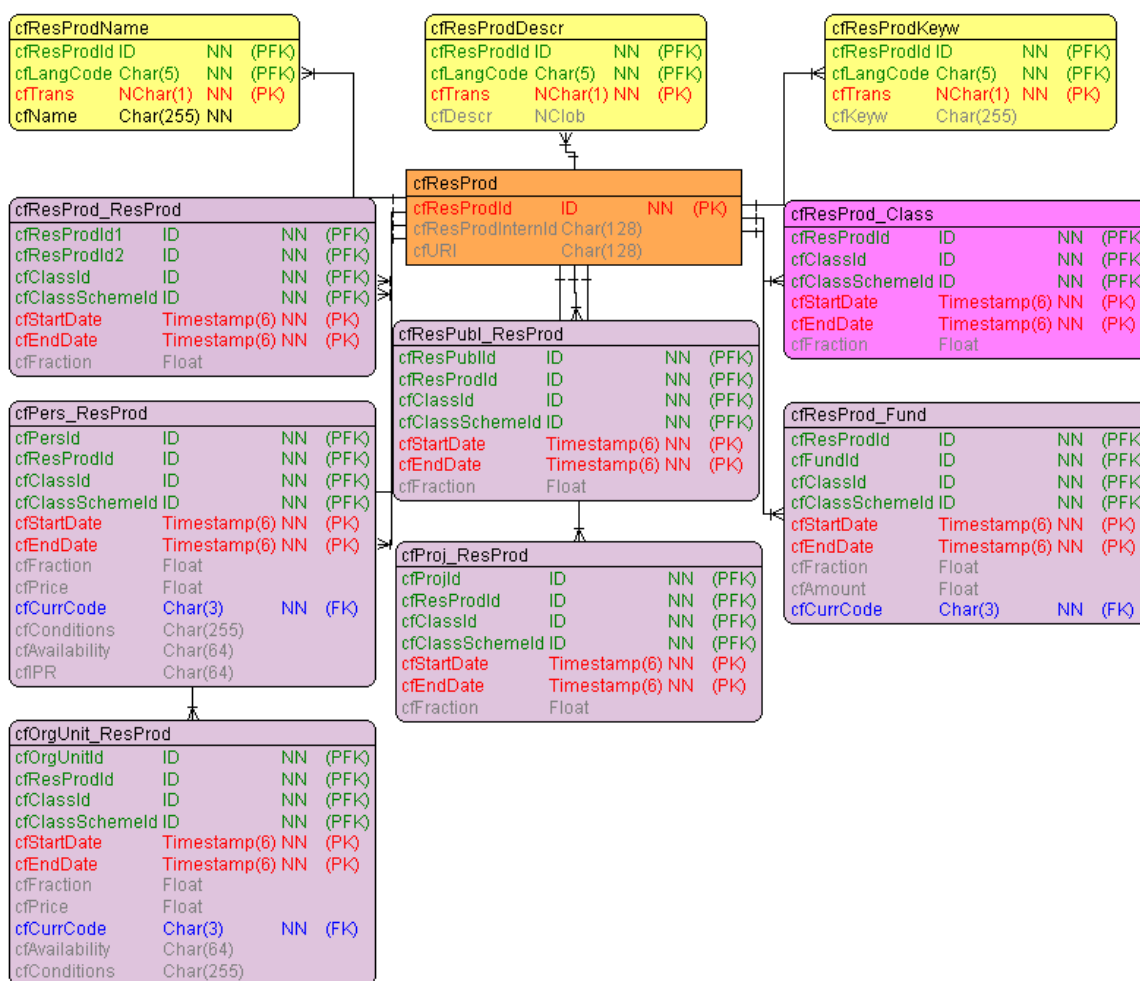
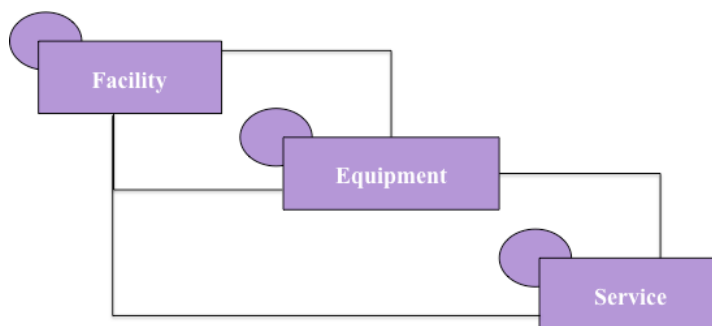


Figure 8: CERIF 1.3 Result Entity Product (physical view)

## 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.<sup>7</sup>

<sup>7</sup> CERIF 1.3 HTML Navigation (physical view):

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

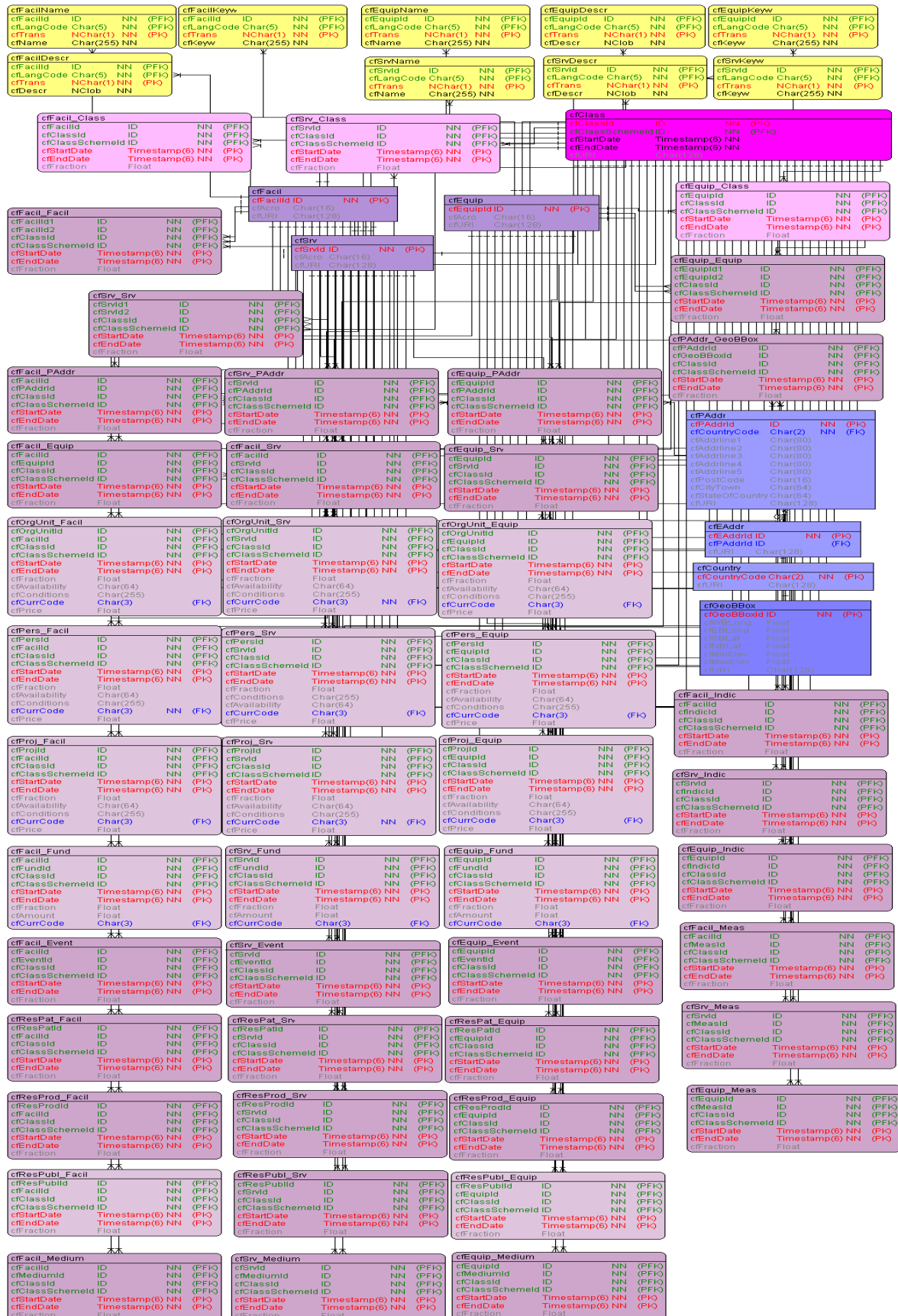


Figure 10: CERIF 1.3 Infrastructure Entities (physical view).

## 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.

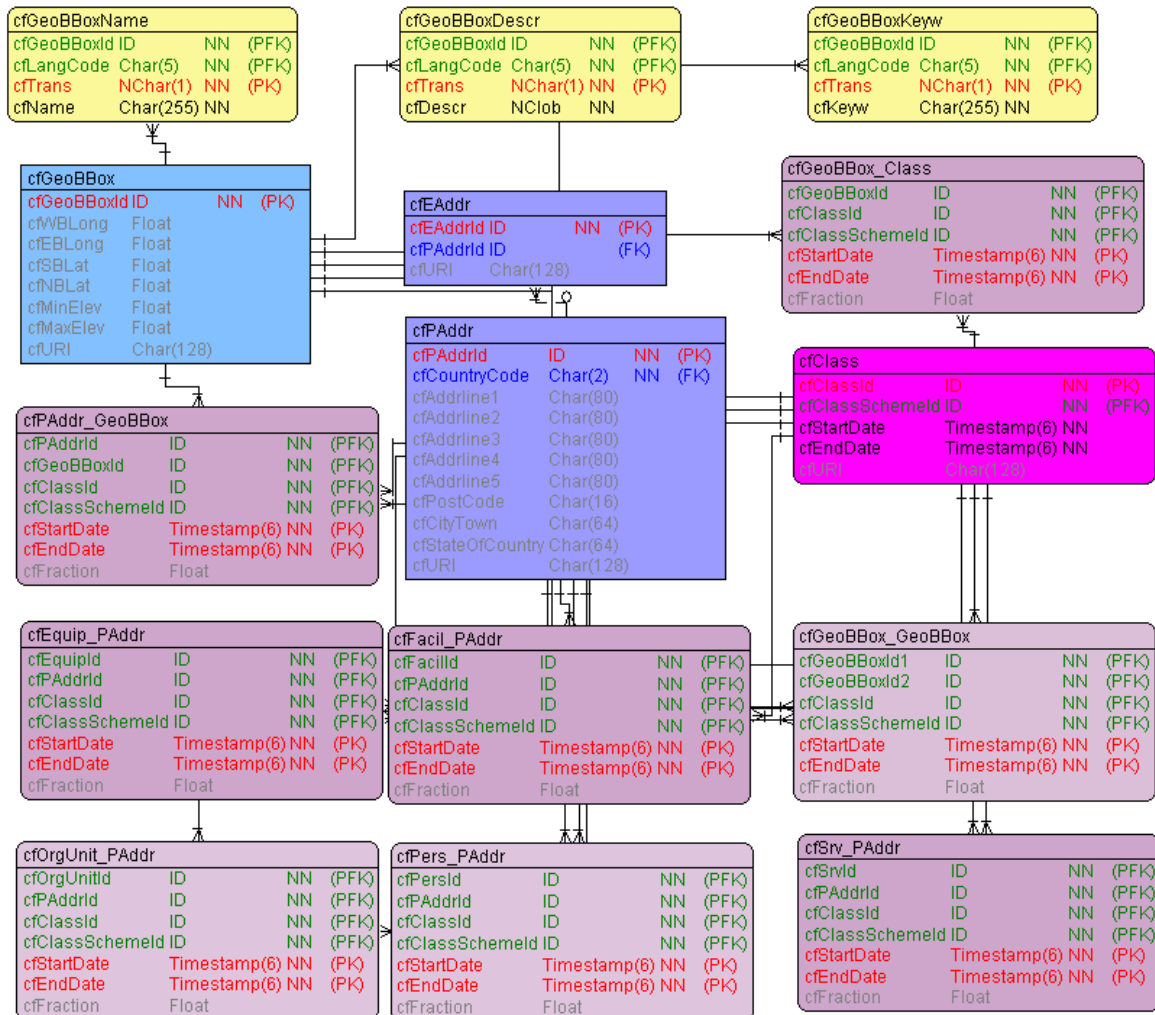


Figure 11: CERIF 1.3 Address and Geographic Bounding Box entities (physical view)

## 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.

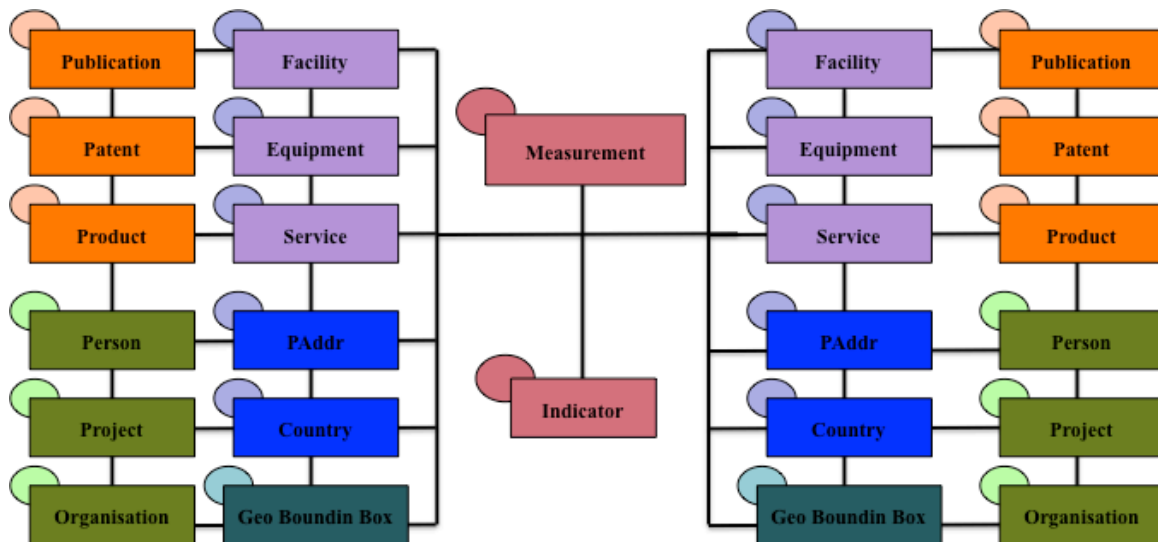


Figure 12: CERIF 1.3 Indicator and Measurement Entities in Context (abstract view)

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 available<sup>7</sup>.



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

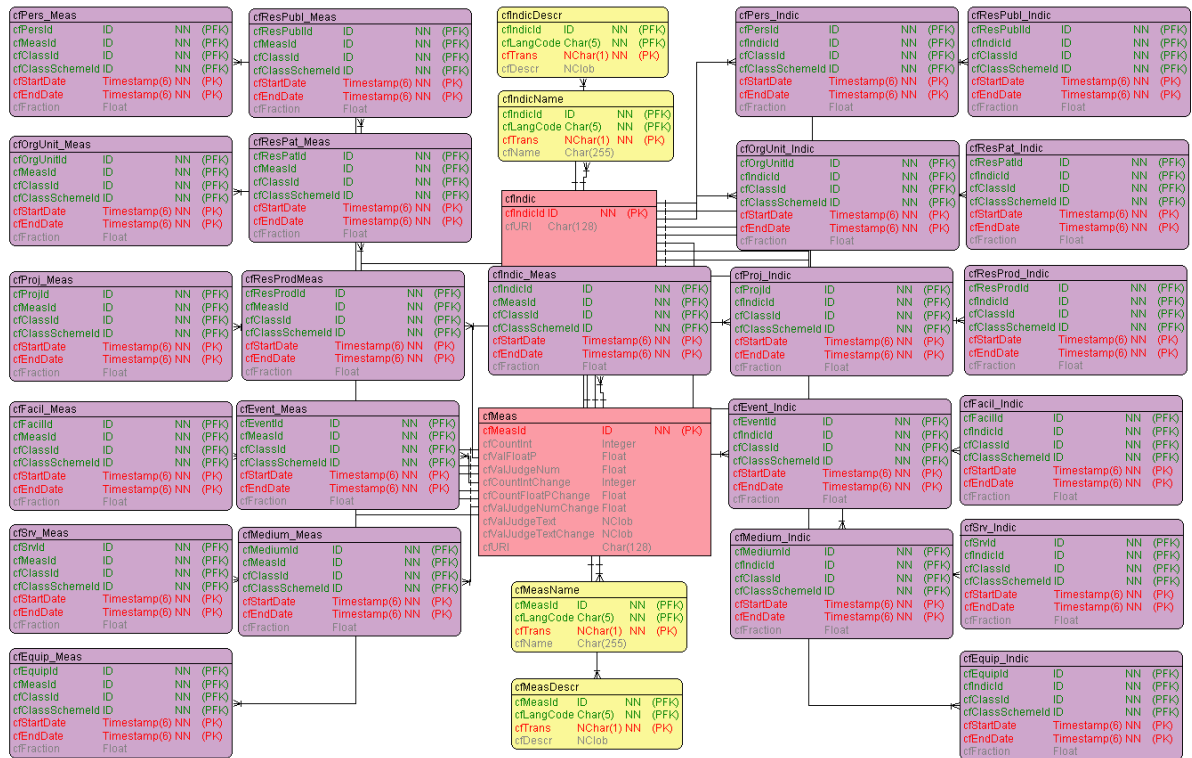


Figure 14: CERIF 1.3 Indicator and Measurement Entities in context (physical view)

## 2.7 CERIF 2<sup>nd</sup> Level Entities

Beyond the base and result entities, CERIF employs many so called 2<sup>nd</sup> level entities. In *Figure 15* the 2<sup>nd</sup> 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).

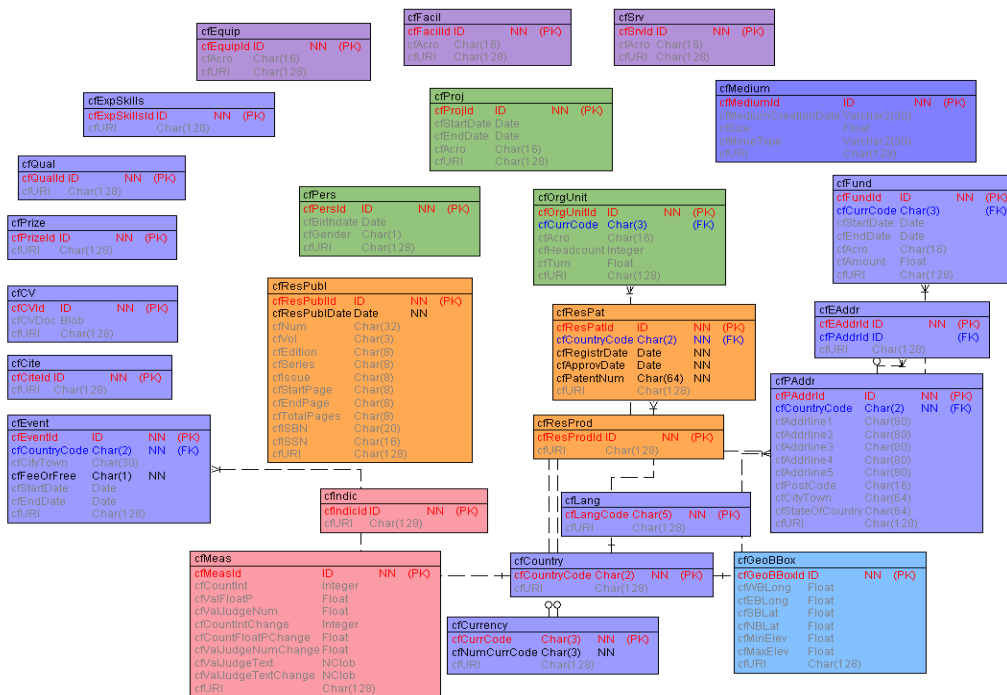


Figure 15: CERIF 1.3 Second Level Entities (physical view)

The 2<sup>nd</sup> level entities allow for the representation of the research context by linking to them from the base, result and infrastructure entities. Each 2<sup>nd</sup> level entity supplies some common attributes; at least an id and an uri attribute. The linkage mechanism and the multilingual features of 2<sup>nd</sup> 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 2<sup>nd</sup> 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.

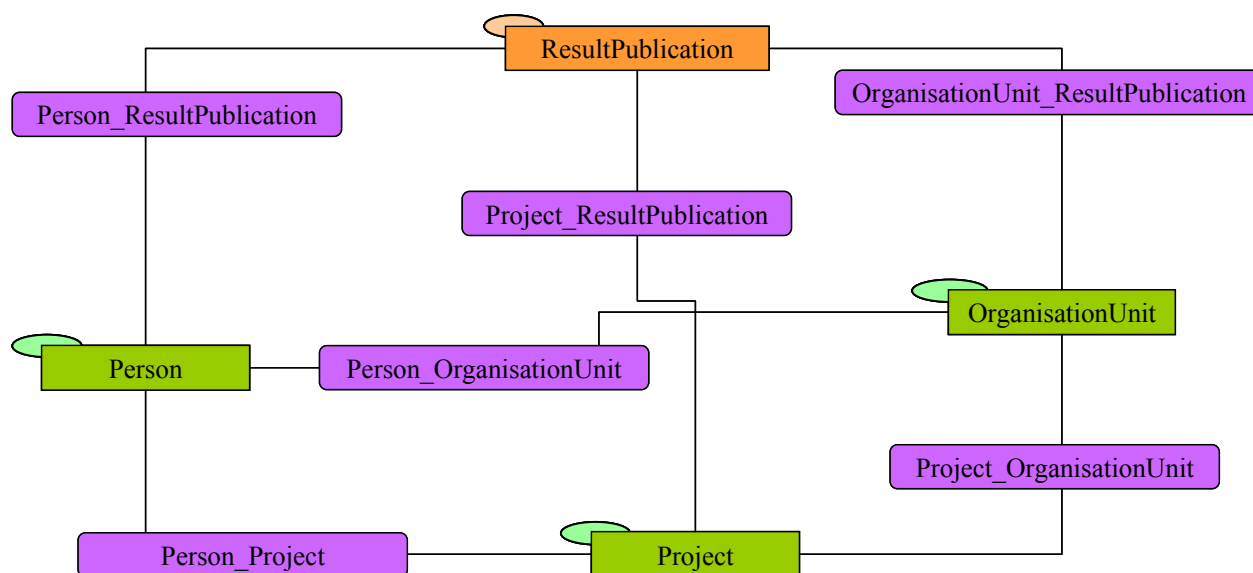


Figure 16: CERIF 1.3 Link Entities in the context of base and a result entity (abstract view)

The CERIF link entities have been mentioned in the context of the presented base, result and 2<sup>nd</sup> 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 cfInheritedClassificationSchemeIdentifier (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<sup>\*\*</sup>. 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.**<sup>8</sup>

cfPers_Pers			
cfPersId1	ID	NN	(PFK)
cfPersId2	ID	NN	(PFK)
cfClassId	ID	NN	(PFK)
cfClassSchemeId	ID	NN	(PFK)
cfStartDate	Timestamp(6)	NN	(PK)
cfEndDate	Timestamp(6)	NN	(PK)
cfFraction	Float		

cfFund_Class			
cfFundId	ID	NN	(PFK)
cfClassId	ID	NN	(PFK)
cfClassSchemeId	ID	NN	(PFK)
cfStartDate	Timestamp(6)	NN	(PK)
cfEndDate	Timestamp(6)	NN	(PK)
cfFraction	Float		

cfPers_OrgUnit			
cfPersId	ID	NN	(PFK)
cfOrgUnitId	ID	NN	(PFK)
cfClassId	ID	NN	(PFK)
cfClassSchemeId	ID	NN	(PFK)
cfStartDate	Timestamp(6)	NN	(PK)
cfEndDate	Timestamp(6)	NN	(PK)
cfFraction	Float		

cfClass_Class			
cfClassId1	ID	NN	(PFK)
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		

cfOrgUnit_Event			
cfOrgUnitId	ID	NN	(PFK)
cfEventId	ID	NN	(PFK)
cfClassId	ID	NN	(PFK)
cfClassSchemeId	ID	NN	(PFK)
cfStartDate	Timestamp(6)	NN	(PK)
cfEndDate	Timestamp(6)	NN	(PK)
cfFraction	Float		

cfProj_Pers			
cfProjId	ID	NN	(PFK)
cfPersId	ID	NN	(PFK)
cfClassId	ID	NN	(PFK)
cfClassSchemeId	ID	NN	(PFK)
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.

<sup>\*\*</sup> 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.

<sup>8</sup> 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.

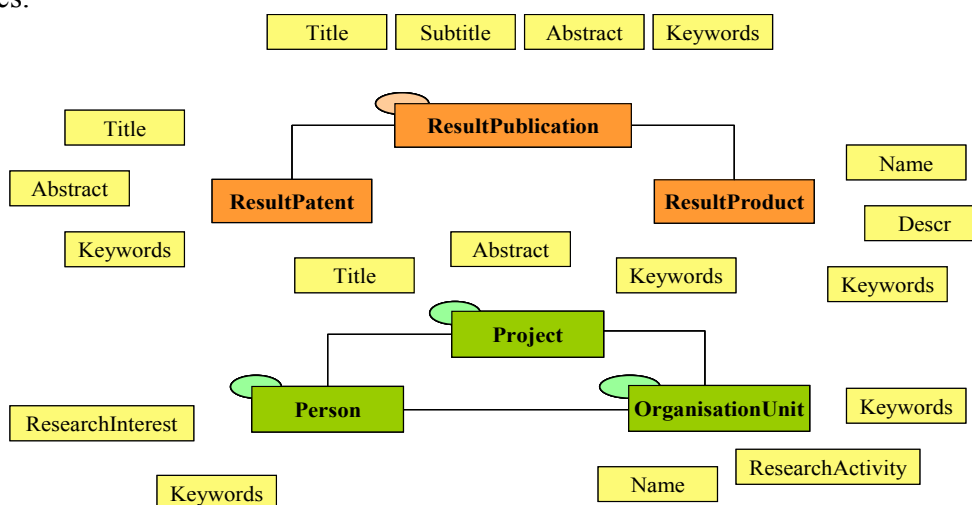


Figure 19: Some CERIF 1.3 Entities with Multilingual Features (abstract view)

*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.

<b>cfOrgUnitName</b> cfOrgUnitId ID NN (PFK) cfLangCode Char(5) NN (PFK) cfTrans NChar(1) NN (PK) cfName Char(255) NN	<b>cfResPublTitle</b> cfResPublId ID NN (PFK) cfLangCode Char(5) NN (PFK) cfTrans NChar(1) NN (PK) cfTitle Char(255) NN	<b>cfProjTitle</b> cfProjId ID NN (PFK) cfLangCode Char(5) NN (PFK) cfTrans NChar(1) NN (PK) cfTitle Char(255) NN
<b>cfOrgUnitKeyw</b> cfOrgUnitId ID NN (PFK) cfLangCode Char(5) NN (PFK) cfTrans NChar(1) NN (PK) cfKeyw Char(255)	<b>cfResPublSubtitle</b> cfResPublId ID NN (PFK) cfLangCode Char(5) NN (PFK) cfTrans NChar(1) NN (PK) cfSubtitle Char(255) NN	<b>cfProjAbstr</b> cfProjId ID NN (PFK) cfLangCode Char(5) NN (PFK) cfTrans NChar(1) NN (PK) cfAbstr NClob
<b>cfOrgUnitResAct</b> cfOrgUnitId ID NN (PFK) cfLangCode Char(5) NN (PFK) cfTrans NChar(1) NN (PK) cfResAct NClob	<b>cfResPublKeyw</b> cfResPublId ID NN (PFK) cfLangCode Char(5) NN (PFK) cfTrans NChar(1) NN (PK) cfKeyw Char(255)	<b>cfProjKeyw</b> 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 2<sup>nd</sup> 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 references<sup>8</sup>, and it assigns each semantic value to a particular classification scheme. The CERIF Semantic Layer is constructed by the entities shown in *Figure 21*.

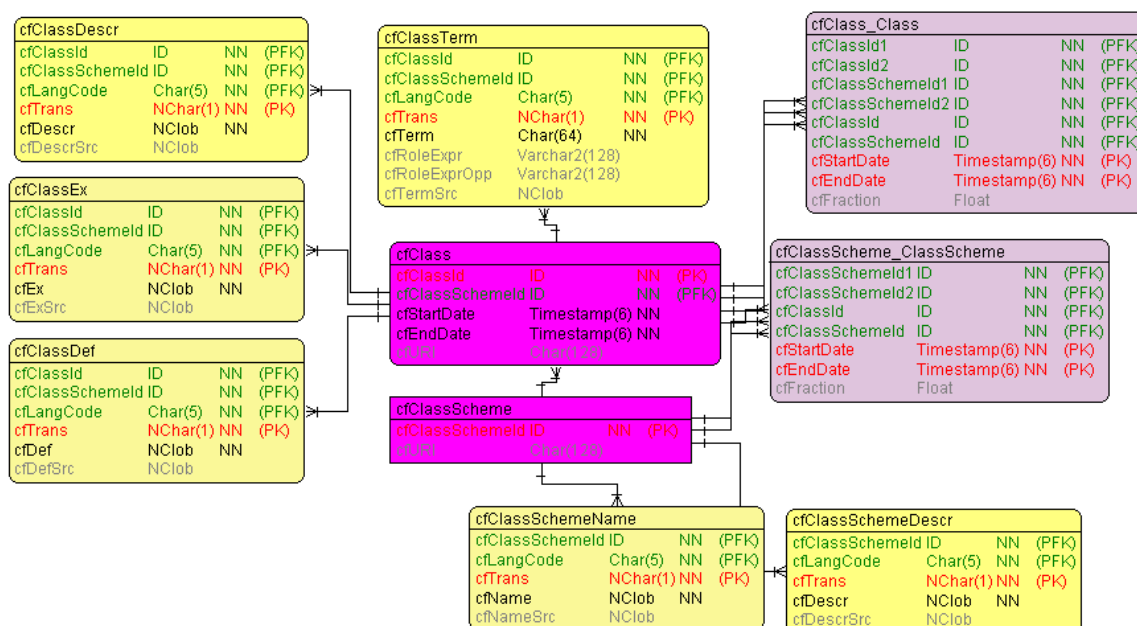


Figure 21: CERIF 1.3 Semantic Layer Entities (physical view)

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	<b>Book</b>	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.	<a href="http://lu.com/odlis/odlis_B.cfm">#book</a>	CERIF 1.3 Semantics
cfResPubl_Class	<b>Book Review</b>	An evaluative account of a recent book, usually written and signed by a qualified person, for publication in a current newspaper, magazine, or journal.	<a href="http://lu.com/odlis/odlis_R.cfm">#review</a>	CERIF 1.3 Semantics
cfResPubl_Class	<b>Book Chapter Abstract</b>	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.	<a href="http://lu.com/odlis/index.cfm#a">http://lu.com/odlis/index.cfm#a</a> bstract	CERIF 1.3 Semantics
cfResPubl_Class	<b>Journal</b>	A periodical devoted to disseminating	<a href="http://lu.com/odlis/odlis_J.cfm">#</a>	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	<b>Short Communication</b>	A short communication is a concise, but independent report representing a significant contribution to a subject.	<a href="http://www.ejbiotechnology.info/iaformato/short_communications.html">http://www.ejbiotechnology.info/iaformato/short_communications.html</a>	CERIF 1.3 Semantics
cfResPubl_Class	<b>Inbook</b>	A part of a book, usually untitled. May be a chapter (or section or whatever) and/or a range of pages.	<a href="http://en.wikipedia.org/wiki/BibTeX#Entry_Types">http://en.wikipedia.org/wiki/BibTeX#Entry_Types</a>	CERIF 1.3 Semantics
cfPers_ResPubl	<b>Author</b>	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 ...	<a href="http://lu.com/odlis/index.cfm#author">http://lu.com/odlis/index.cfm#author</a>	CERIF 1.3 Semantics
cfPers_ResPubl	<b>Author (numbered)</b>		// requires a cfFraction value	CERIF 1.3 Semantics
cfPers_ResPubl	<b>Author (percentage)</b>		// requires a cfFraction value	CERIF 1.3 Semantics
cfPers_Pers	<b>Manager</b>	In a person-person relationship responsibility to manage the human resources.	CERIF TG / euroCRIS	CERIF 1.3 Semantics
cfPers_Pers	<b>Mentor</b>	a wise and trusted guide and advisor	<a href="http://wordnetweb.princeton.edu/perl/webwn?s=mentor">http://wordnetweb.princeton.edu/perl/webwn?s=mentor</a>	CERIF 1.3 Semantics
cfPers_Pers	<b>Supervisor</b>	One who supervises or has charge and direction of.	<a href="http://wordnetweb.princeton.edu/perl/webwn?s=supervisor">http://wordnetweb.princeton.edu/perl/webwn?s=supervisor</a>	CERIF 1.3 Semantics
cfClass_Class	<b>Synonym</b>	Equivalent word (two words that can be interchanged in a context are said to be synonymous relative to that context)	<a href="http://wordnetweb.princeton.edu/perl/webwn?s=synonym&amp;sub=Search+WordNet&amp;o2=&amp;o0=1&amp;o7=&amp;o5=&amp;o1=1&amp;o6=&amp;o4=&amp;o3=&amp;h=00">http://wordnetweb.princeton.edu/perl/webwn?s=synonym&amp;sub=Search+WordNet&amp;o2=&amp;o0=1&amp;o7=&amp;o5=&amp;o1=1&amp;o6=&amp;o4=&amp;o3=&amp;h=00</a>	A Thesaurus Relationship (Structural Element).
cfClass_Class	<b>Broader Term</b>	The Broader Term is the parent of the Preferred Term.	<a href="http://www.cmscalendar.com/cmsh-glossary.html?term=BroaderTerm">http://www.cmscalendar.com/cmsh-glossary.html?term=BroaderTerm</a>	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 CASRAI<sup>9</sup> / VIVO<sup>10</sup> 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 realease, 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.

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<sup>9</sup> CASRAI and euroCRIS signed Memorandum of Understanding:

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

<sup>10</sup> 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 2<sup>nd</sup> 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)  
cfOrganisaitonUnit\_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 (cfResPublBiblINote)  
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*

<b>Logical CERIF2008 - 1.2 Entities</b>	<b>Physical CERIF2008-1.2 Entities</b>
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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