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CERIF 2008 - 1.2 Full Data Model (FDM)
Introduction and Specification

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Abstract:
CERIF (the **C**ommon **E**uropean **R**esearch **I**nformation **F**ormat) 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; the CERIF entities, their rich and flexible relationship management, the CERIF XML interchange, and the CERIF Semantics a very powerful instrument for setting up scalable and quality-oriented information systems. This 2008 – 1.2 release includes a major upgrade by providing a formal CERIF Semantics for a defined, current core of entities. This document is considered a detailed description of the range and structure of the latest CERIF model and the final version of the 2008 series.

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

Status:
CERIF model improvements are based on discussions among euroCRIS CERIF task group members. This document is considered final in the CERIF 2008 series

Location:
http://www.eurocris.org/Uploads/Web%20pages/CERIF2008/Release_1.2/CERIF2008_1.2_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[1] 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[2] to Member States and a handover of CERIF to euroCRIS[3]. 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 classifcation systems.

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[1] ERGO project: http://cordis.europa.eu/ergo/
[2] EC Recommendation: http://cordis.europa.eu/cerif/
[3] 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 improvents by including a relationship semantics for all publication-related entities. This CERIF 2008–1.2 release touches funding-related requirements, and substantially extends the CERIF Semantics towards a defined, current core. The CERIF 2008–1.2 release is the last version in the 2008 series.

This document will walk you through the CERIF model by following a conceptual structure. The physical presentations of database levels and some 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 model and demonstrates potential use cases and application scenarios.

1.2 CERIF Components

The current CERIF 2008 – 1.2 release comprises the following components:

- CERIF 2008 – 1.2 FDM: Model Introduction and Specification
  this document
- CERIF 2008 – 1.2 FDM: SQL scripts for most common databases
  available for members only
- CERIF 2008 – 1.2 XML: Data Exchange Format Specification
  separate document available from the website [11]
- CERIF 2008 – 1.2 XML Examples
  available for members only
- CERIF 2008 – 1.2 XML Schema Files
  CERIF XML validation files available from the website
  http://www.eurocris.org/Uploads/Web%20pages/CERIF2008/Release_1.2/XML-SCHEMAS/
- CERIF 2008 – 1.2 Semantics
  separate document available from the website [12]

CERIF 2008–1.2 related files and more documents and background information about CERIF and CRISs can be downloaded from the euroCRIS website: http://www.eurocris.org/. The physical SQL scripts and XML examples files are available for members only[4].

[4] The CERIF 2008–1.2 release was modeled with Toad Data Modeler by Quest Software[4] 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 2008–1.1), the current release CERIF 2008–1.2 incorporates or leaves out the following features:

- **Pending Entities have been discussed with the following results:**
  No cfCall and no cfGrant entity and related entities will be added. Instead, the cfFunding entity will be renamed and via the cfClass and cfClassScheme entities, a typification for FundingProgramme, Call, Tender, etc. can be realized.
- **Deletion of Entities in the Context of Funding:**
  cfCall (so far pending, now removed)
  cfCall_FundingProgramme (so far pending, now removed)
  cfCallDescription (so far pending, now removed)
  cfCallKeywords (so far pending, now removed)
  cfCallName (so far pending, now removed)
  cfGrant (so far pending, now removed)
  cfGrant_FundingProgramme (so far pending, now removed)
  cfGrantDescription (so far pending, now removed)
  cfGrantKeywords (so far pending, now removed)
  cfGrantName (so far pending, now removed)
- **Renaming of Funding Programme entity and its related entities:**
  cfFundingProgramme -> cfFunding
  cfFundingProgramme_Classification -> cfFunding_Classification
  cfFundingProgramme_FundingProgramme -> cfFunding_Funding
  cfFundingProgrammeDescription -> cfFundingDescription
  cfFundingProgrammeKeywords -> cfFundingKeywords
  cfFundingProgrammeName -> cfFundingName
  cfFundingProgramme_Equipment -> cfFunding_Equipment
  cfEvent_FundingProgramme -> cfEvent_Funding
  cfFacility_FundingProgramme -> cfFacility_Funding
  cfService_FundingProgramme -> cfService_Funding
  cfOrganisationUnit_FundingProgramme -> cfOrganisationUnit_Funding
  cfPerson_FundingProgramme -> cfPerson_Funding
  cfProject_FundingProgramme -> cfProject_Funding
  cfResultPatent_FundingProgramme -> cfPatent_Funding
  cfResultProduct_FundingProgramme -> cfProduct_Funding
  cfResultPublication_FundingProgramme -> cfResultPublication_Funding
- **Renaming of Attributes:**
  cfSex -> cfGender
  cfFundProgId -> cfFundId
  cfFundProgId -> cfFundId
  cfFundProgId1 -> cfFundId1
  cfFundProgId2 -> cfFundId2
- **Renaming of Relationships:**
  "(...)FProg" -> "(...)Fund" // for all
- **CERIF Semantics (not physically a part of the model):**
  The terms for relationships between current, core CERIF entities have been collected and definitions provided for a better understanding

The CERIF 2008-1.2 release is the last version in the 2008 series.

2. The CERIF 2008–1.2 Model

To reduce the complexity of the model towards a better understanding, this introduction and specification document follows a conceptual structure. The conceptual structure allows for different perspectives and views when talking about parts of the model and enables the emphasis to particular model features. This conceptual structure is only a virtual structure and as such not inherent in the physical data model, and therefore, also not incorporated in the 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.

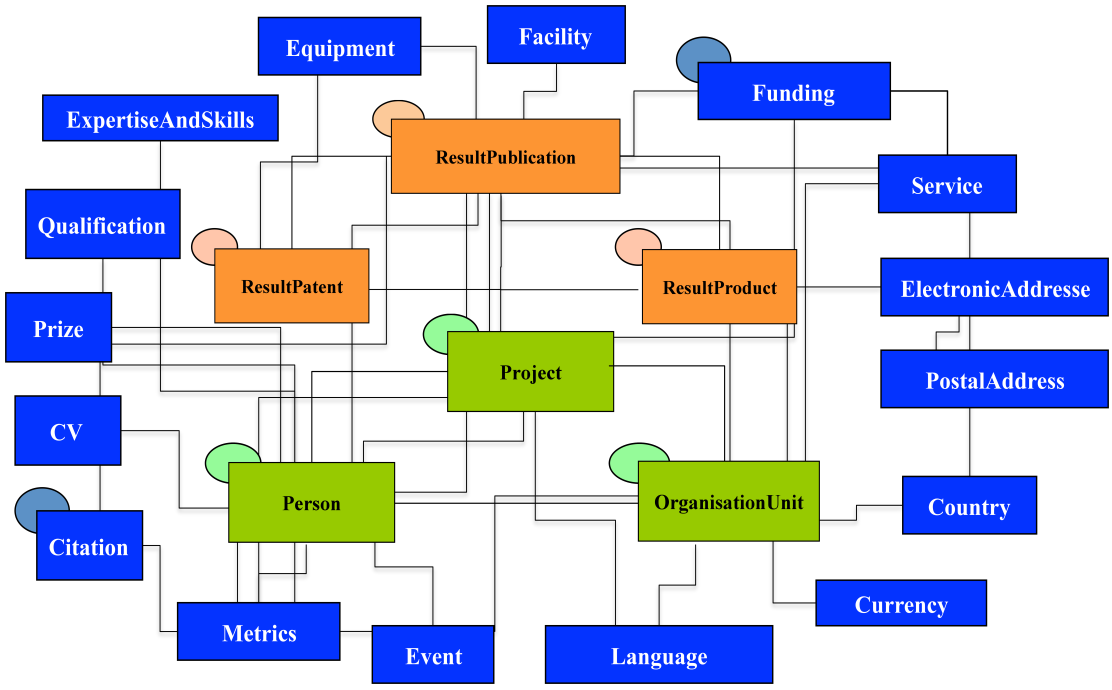

Figure 1: CERIF Entities and their Relationships

2.1 CERIF Conceptual Structure

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

CERIF Entity Types	CERIF Features
Base Entities [base]	Multiple Language [lang]
Result Entities [result]	Semantics [class]*
2nd Level Entities [2nd]	
Link Entities [link]	Additional [add]

* The currently defined CERIF core is not part of the conceptual CERIF Model, but considered a filler (content) of the conceptual CERIF Semantic Layer. The current core CERIF Semantics 2008-1.2 represents a common research context in a formal way [12].

The conceptual model parts will subsequently be presented in abstract views. For the rather technical details at logical or physical/database level (attributes, datatypes, keys) the corresponding screenshots from Toad Modeler will be incorporated. Whereas the entity names in abstract views are presented in full length, the table names in the screenshots are abbreviated and include the prefix 'cf' 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 with the physical (short) names of the model. The CERIF XML specification applies the same conceptual structure for a recommended ordering and clustering of the XML files in the XML file names [11].
A complete list of the CERIF entities is attached in the Appendix indicating their conceptual type or feature; a HTML presentation of the model, including the conceptual images, is referred to from the public euroCRIS website: 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 relationhips. 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.

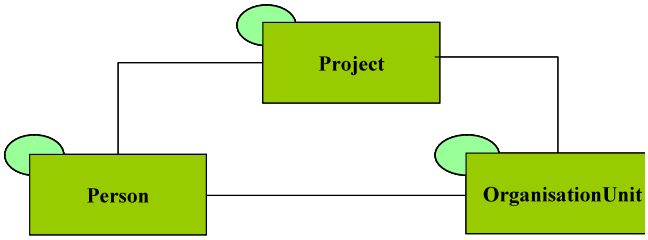

Figure 2: CERIF Base Entities

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 organization. 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 presented in figure 3; cfPers_OrgUnit, cfProj_Pers, and cfProj_OrgUnit are so called CERIF link type entities and will be introduced in section 2.5. The yellow colored entities cfProjTitle, cfProjAbstr, cfOrgUnitName, etc., support the feature of multiple languages and will be explained in section 2.6.

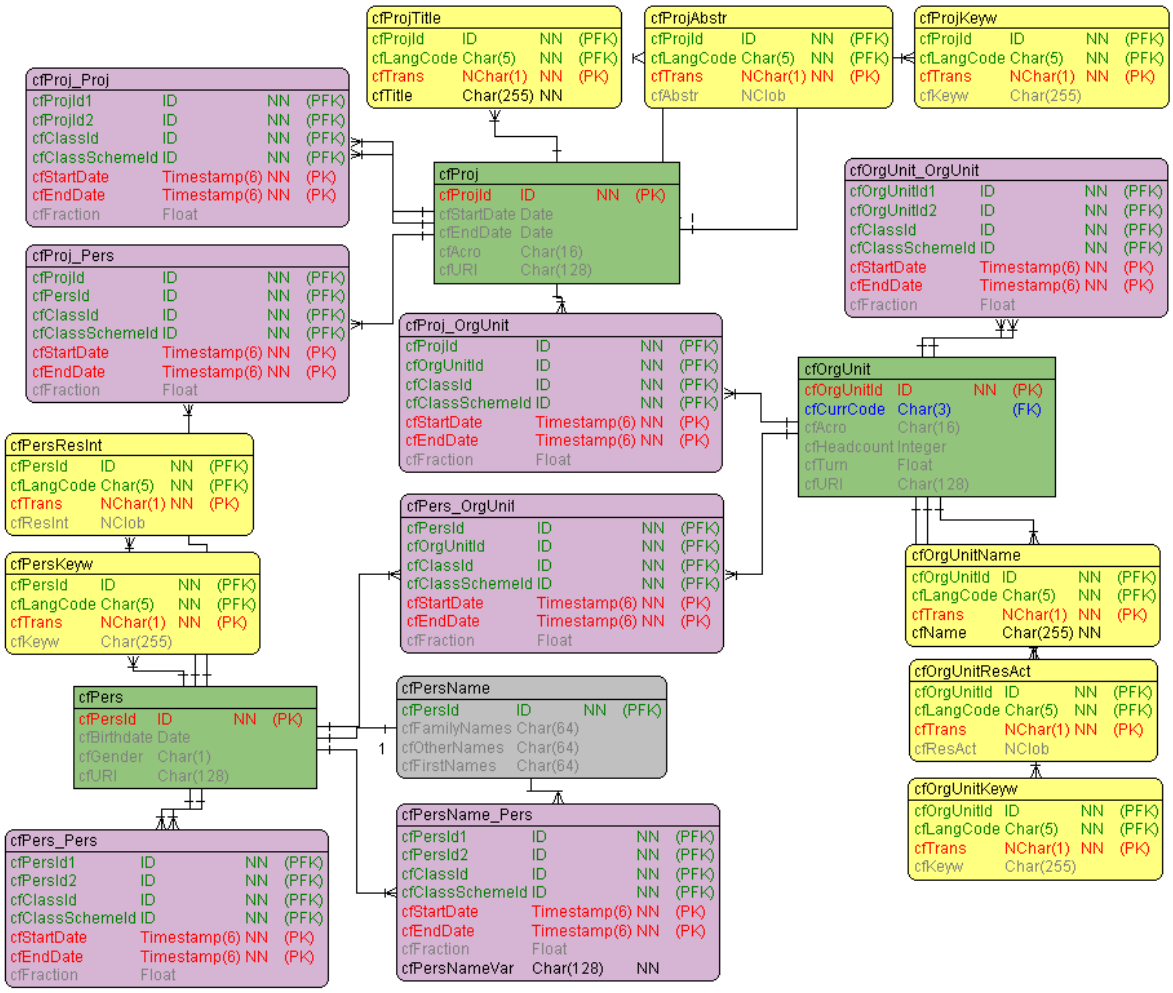

Figure 3: CERIF Base Entities, their Recursion and some Link Entities

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: project, person, organisation, publication, patent, product, funding programme, equipment, facility, service, event, prize and classification (cfProj_Proj, cfProj_Pers, cfProj_OrgUnit, cfProj_ResPubl, 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).

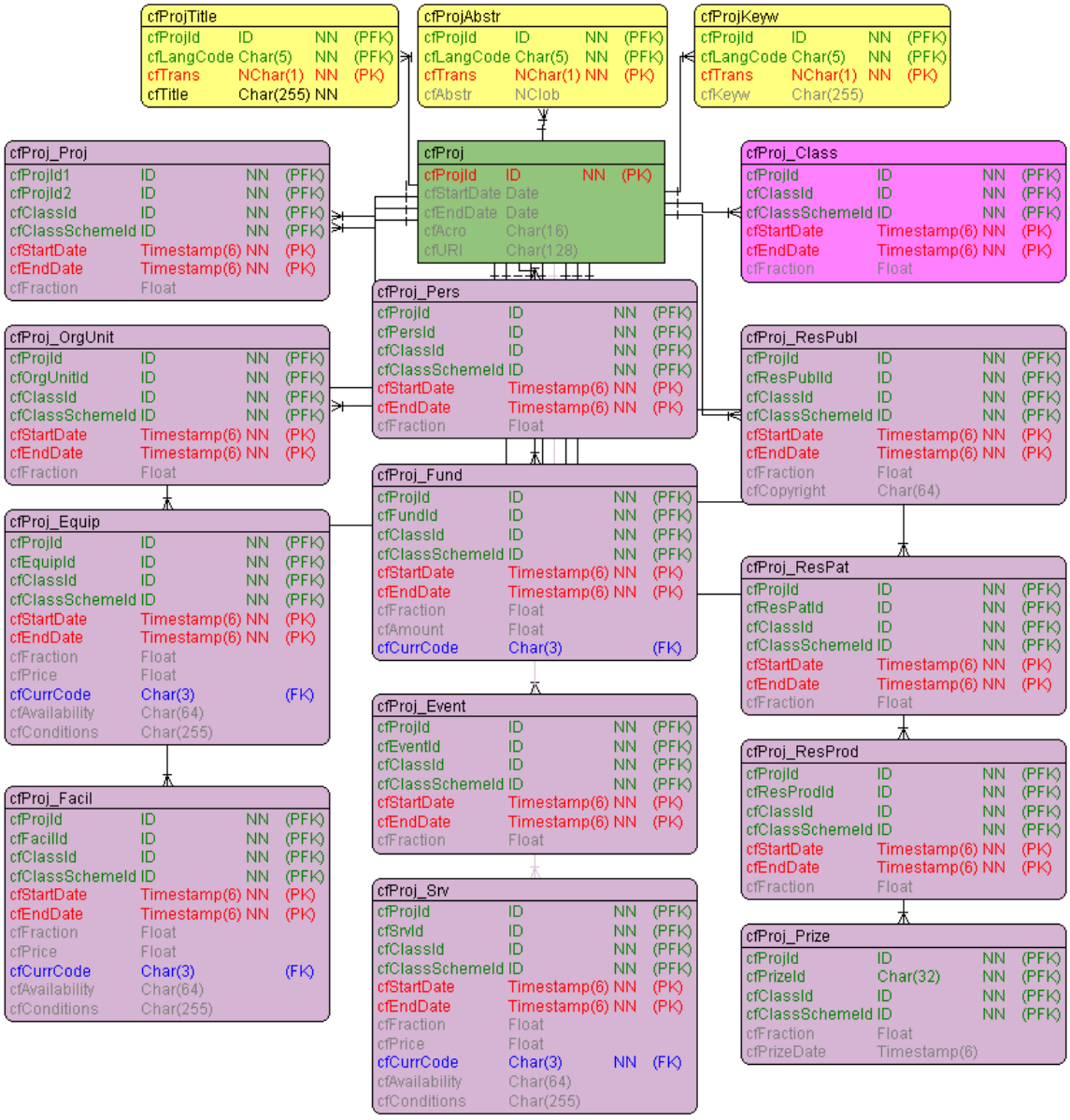

Figure 4: CERIF Base Entity Project

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 values (i.e. Originator, Coordinator, Funder) are indicated in the Classification column, where each value belongs to a defined scheme (i.e. FP6-IST, cfPROJ-PUBL, cfPROJ-ORG etc).

Table 1: CERIF Project Example Record

CERIF Project example database record				**Semantic Layer (CERIF Semantics)**	
Data	**Attribute**	**Table**	**Type**	**Classification (ClassIds)**	**Classification Scheme**
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***	**FP6-IST***
publ-analyzing-eu-rtd*	**cfResPublId**	**cfProj_ResPubl**	**link**	**Originator***	**cfPROJ-PUBL***
publ-cris-research-activity*	**cfResPublId**	**cfProj_ResPubl**	**link**	**Originator***	**cfPROJ-PUBL***
publ-analytic-services-for-the-era*	**cfResPublId**	**cfProj_ResPubl**	**link**	**Originator***	**cfPROJ-PUBL***
fund-fp6*	**cfFundId**	**cfProj_Fund**	**link**	**Funder***	**cfPROJ-FUND***
orgunit-dfki*	**cfOrgUnitId**	**cfProj_OrgUnit**	**link**	**Coordinator***	**cfPROJ-ORG***
orgunit-dfki*	**cfOrgunitId**	**cfProj_OrgUnit**	**link**	**2006-[fract=0.5]***	**06-Budget-Alloc***
orgunit-dfki*	**cfOrgunitId**	**cfProj_OrgUnit**	**link**	**2007-[fract=0.2]***	**07-Budget-Alloc***

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, the example record is classified according to a FP6-IST scheme by cfClassSchemeId. CERIF entities store their semantics by referencing ids with interlinking [link] entities. 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 co-ordinator, 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 2.5; for the semantic features we refer to section 2.7. With the current release, a formal semantic scheme for a CERIF core has been published: CERIF 2008 – 1.2 Semantics [12].

2.2.2 CERIF Entity Person

For the identification of 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.

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* For a better understanding, we labelled the IDs with natural language terms. In a real implementation, the formalized semantic term would be stored in the CERIF cfClassTerm entity because ID themselves do not necessarily incorporate any semantics. We recommend the use of UUIDs (http://en.wikipedia.org/wiki/Universally_unique_identifier) to universally and uniquely identify records.

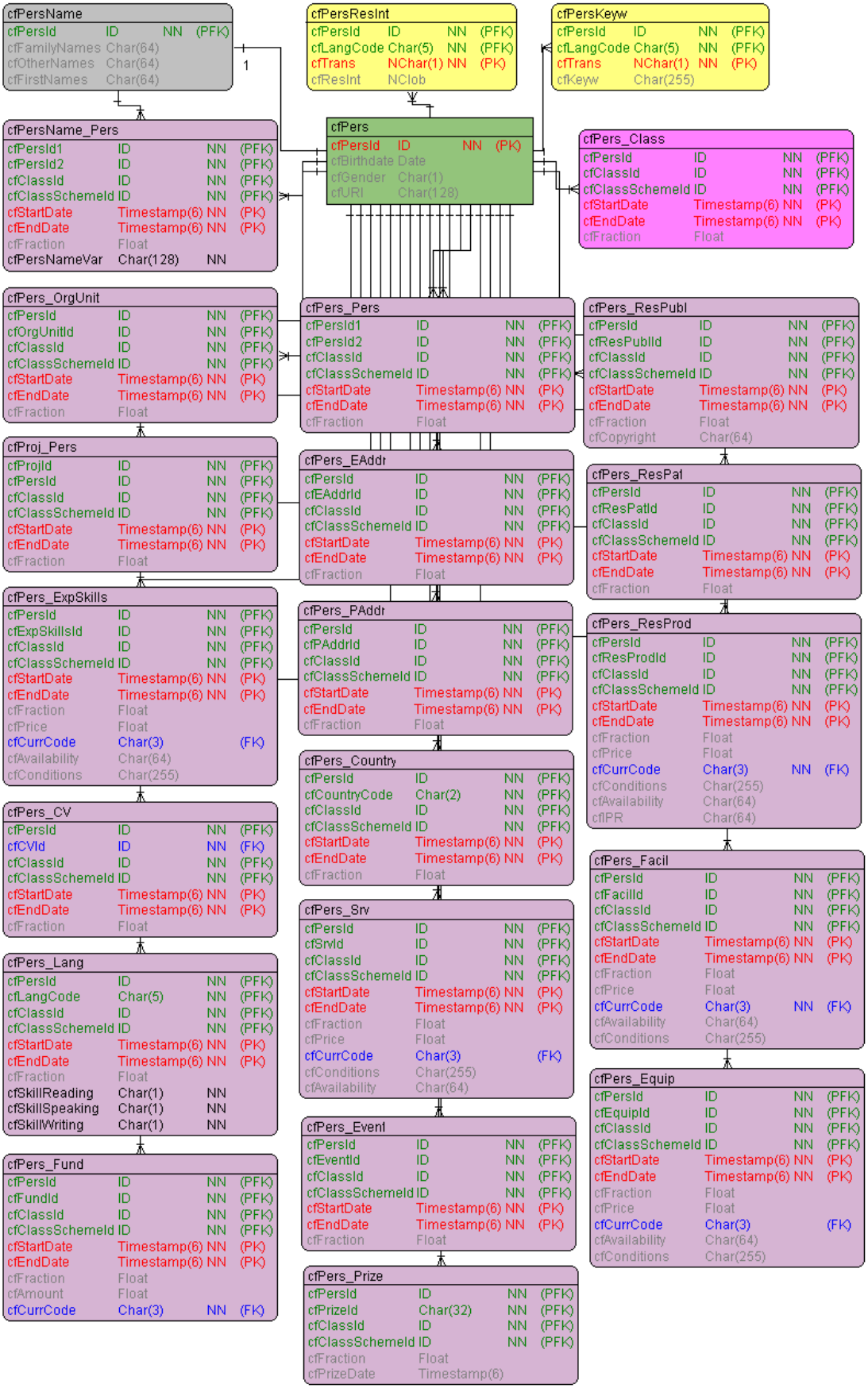

Figure 5: CERIF Base Entity Person

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 entites 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 (PERS_PERSNAME, ACADEMIC-TITLES, cfPERS_PUBL, etc).

Table 2: CERIF Person Example Record

CERIF Person example database entry				**Semantic Layer (CERIF Semantics)**	
Data	**Attribute**	**Table**	**Type**	**Classification (ClassIds)**	**Classification Scheme**
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**	**spellingVariant***	**PERS_PERS NAME***
classification-MA*	**cfClassId**	**cfPers_Class**	**link**	**M.A.***	**ACADEMIC-TITLES***
publ-analyzing-european-rtd*	**cfResPublId**	**cfPers_ResPubl**	**link**	**Author***	**cfPERS-PUBL***
publ-analytic-services-for-era*	**cfResPublId**	**cfPers_ResPubl**	**link**	**Author***	**cfPERS-PUBL***
orgunit-dfki*	**cfOrgUnitId**	**cfPers_OrgUnit**	**link**	**Affiliation***	**cfPERS_ORGUNIT***
orgunit-lt-lab*	**cfOrgUnitId**	**cfPers_OrgUnit**	**link**	**Subaffiliation***	**cfPERS_ORGUNIT***
orgunit-euroCRIS*	**cfOrgUnitId**	**cfPers_OrgUnit**	**link**	**Board-Member***	**cfPERS_ORGUNIT***
orgunit-CERIF-TG*	**cfOrgUnitId**	**cfPers_OrgUnit**	**link**	**TG-Leader***	**cfPERS_ORGUNIT***
project-ist-world*	**cfProjId**	**cfProj_Pers**	**link**	**Coordinator[fract=0.7]***	**cfPROJ_PERS***
project-lt-world*	**cfProjId**	**cfProj_Pers**	**link**	**Participant[fract=0.3]***	**cfPROJ_PERS***

* For a better understanding, we labelled the IDs with natural language terms. In a real implementation, the formalized semantic term would be stored in the CERIF cfClassTerm entity because ID themselves do not necessarily incorporate any semantics. We recommend the use of UUIDs (http://en.wikipedia.org/wiki/Universally_unique_identifier) to universally and uniquely identify records.

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 person name spelling variants. 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 2.5; for the semantic features we refer to section 2.7. With the current release, a formal semantic scheme for a CERIF core has been published: CERIF 2008–1.2 Semantics [12].

2.2.3 CERIF Entity OrganisationUnit

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

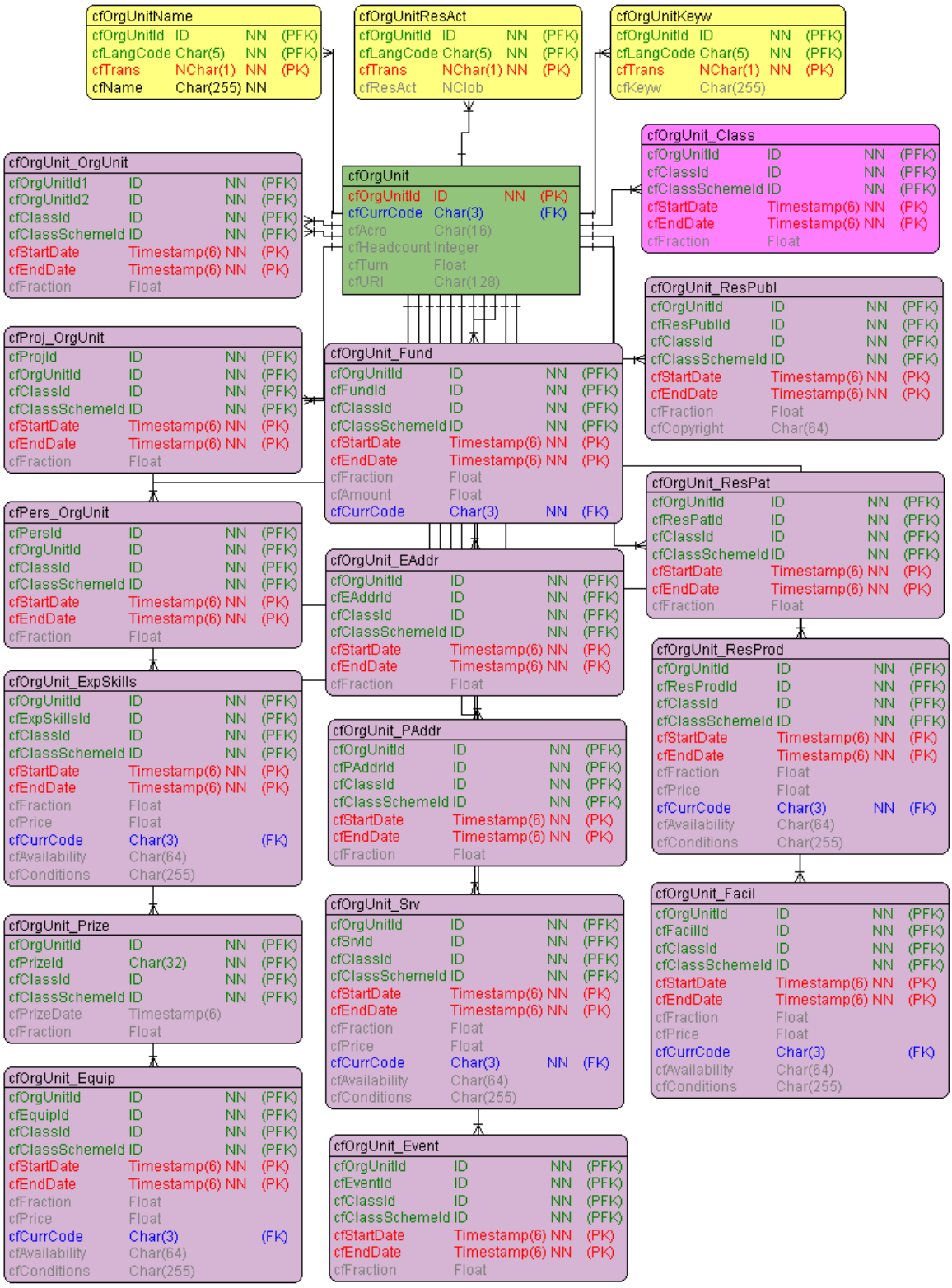

Figure 6: CERIF Base Entity OrganisationUnit

The organisation entity 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_Res Pat, 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 entites are named in the Table column, the Type column indicates the conceptual entity type (base, link, lang), the semantic values (not-for-profit, President, Secretary, Treasurer, Strategy, etc.) are indicated in the Classification column, where each value belongs to a particular scheme (cfPERS_ORGUNIT, cfORGUNIT_ORGUNIT, etc). The organisation example does not explicitly include any fraction values like the person or project examples; the cfFraction attribute is not mandatory.

Table 3: CERIF OrganisationUnit Example Record

CERIF OrganisationUnit example database entry				**Semantic Layer (CERIF Semantics)**	
Data	**Attribute**	**Table**	**Type**	**Classification (ClassIds)**	**Classification Scheme**
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**	**not-for-profit***	**ORGUNIT_CLASS***
person-keith-jeffery*	**cfPersId**	**cfPers_OrgUnit**	**link**	**President***	**cfPERS-ORGUNIT***
person-harrie-lalieu*	**cfPersId**	**cfPers_OrgUnit**	**link**	**Secretary***	**cfPERS-ORGUNIT***
person-geert-van-grootel*	**cfPersId**	**cfPers_OrgUnit**	**link**	**Treasurer***	**cfPERS-ORGUNIT***
person-anne-asserson*	**cfPersId**	**cfPers_OrgUnit**	**link**	**Strategy***	**cfPERS-ORGUNIT***
person-wolfgang-adamczak*	**cfPersId**	**cfPers_OrgUnit**	**link**	**Conference***	**cfPERS-ORGUNIT***
person-maximilian-stempfhuber*	**cfPersId**	**cfPers_OrgUnit**	**link**	**CRIS-Architecture***	**cfPERS-ORGUNIT***
person-nikos-houssos*	**cfPersId**	**cfPers_OrgUnit**	**link**	**TG-Leader-Projects***	**cfPERS-ORGUNIT***
person-brigitte-joerg*	**cfPersId**	**cfPers_OrgUnit**	**link**	**TG-Leader-CERIF***	**cfPERS-ORGUNIT***
person-sergey-parinov*	**cfPersId**	**cfPers_OrgUnit**	**link**	**TG-Leader-Best-Practice***	**cfPERS-ORGUNIT***
person-ed-simons*	**cfPersId**	**cfPers_OrgUnit**	**link**	**TG-Leader-IR-CERIF***	**cfPERS-ORGUNIT***
paddr-Voorschoten*	**cfPAddrId**	**cfOrgUnit_PAddr**	**link**	**PostOfficeBox***	**ORGUNIT_PADDR***
eaddr-eurocris@eurocris.org*	**cfEAddrId**	**cfOrgUnit_EAddr**	**link**	**Email***	**ORGUNIT_EADDR***
eaddr-eurocris*	**cfEAddrId**	**cfOrgUnit_EAddr**	**link**	**Skype***	**ORGUNIT_EADDR***

* For a better understanding, we labelled the IDs with natural language terms. In a real implementation, the formalized semantic term would be stored in the CERIF cfClassTerm entity because ID themselves do not necessarily incorporate any semantics. We recommend the use of UUIDs (http://en.wikipedia.org/wiki/Universally_unique_identifier) to universally and uniquely identify records.

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=’classi fication-nfp’ the organisation record is classified as ‘not for profit’. 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. For person records, 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 linkage mechanism by link entities is consistent across the model and will be explained in detail within section 2.5; for the semantic features we refer to section 2.7. With the current release, a formal semantic scheme for a CERIF core has been published: CERIF 2008 – 1.2 Semantics [12].

2.3 CERIF Result Entities

The CERIF result entities are ResultPublication, ResultPatent and ResultProduct. Figure 7 shows the result entities and their linking relationhips. The ResultPublication entity like a base entity recursively links to itself. The result entities represent research output.

Figure 7: CERIF Result Entities

Figure 8 shows the result entities (cfResPubl, cfResPat, cfResProd) and their related entities from a physical perspective. The circle in figure 7 represents recursiveness; that is, the relationships in between publications (cfResPubl_ResPubl). The recursive and the interlinking relations (cfResPubl_ResProd, cfResPubl_ResPat) in figure 8 are link type entities to be introduced in section 2.5. The yellow colored entities (cfResPublTitle, cfResPublSubtitle, cfResPublAbstr, cfResPatTitle, etc.) support the feature of multiple languages and will be introduced in section 2.6.

Figure 8: CERIF Result Entities, their Recursion and some Link Entities

Each result entity (cfResPubl, cfResPat, cfResProd) will subsequently be presented and some 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. 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 9. 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 clsssification reference. Additionally, the publication entity supports multilingual features for title, subtitle, abstract, note, abbreviation and keywords (cfResPublTitle, cfResPublSubtitle, cfResPublAbstr, cfResPublKeyw, cfResPublNameAbbrev).

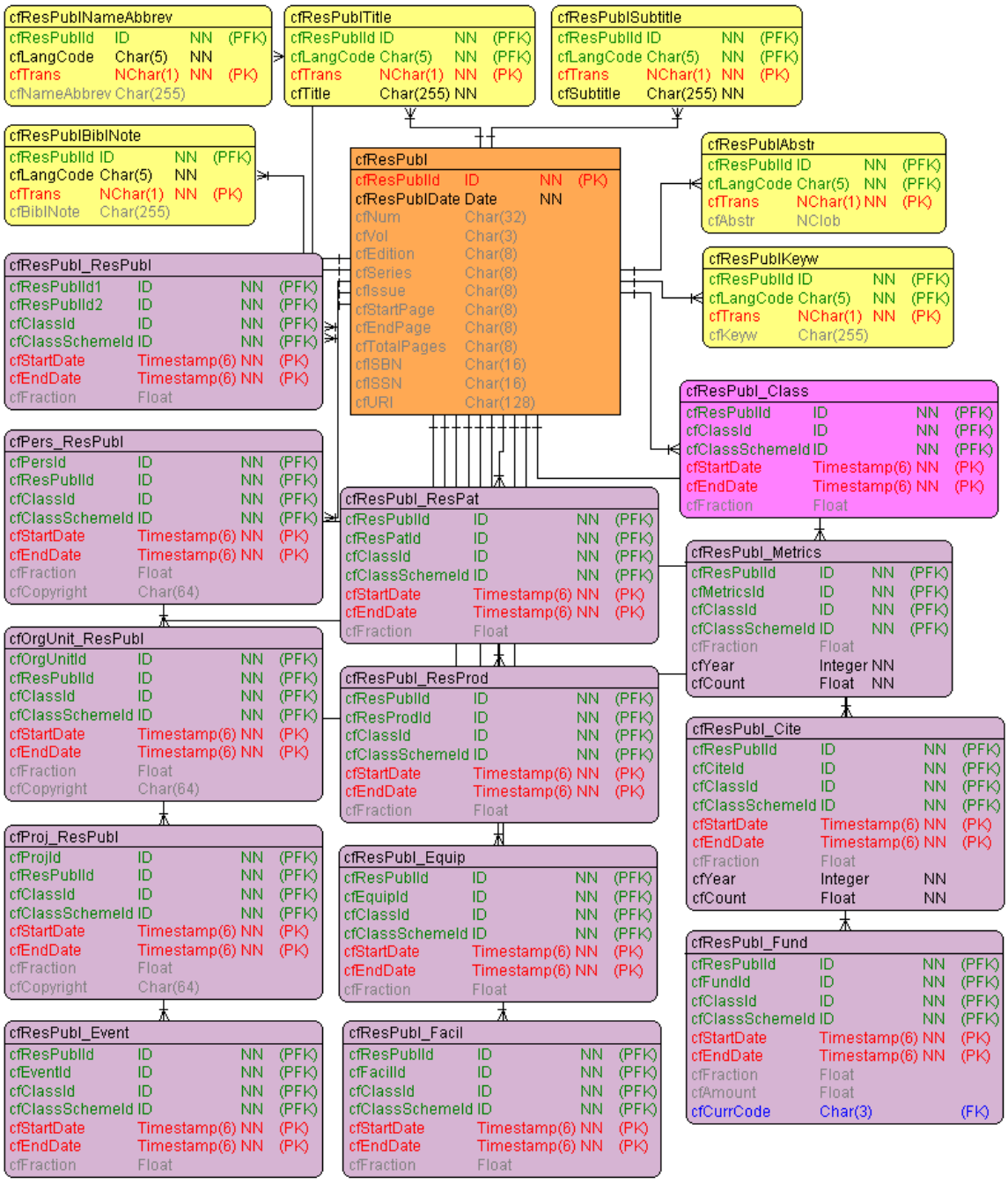

Figure 9: CERIF Result Entity ResultPublication

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 entites are named in the Table column, the Type column indicates the entity type (result, link, lang), the semantic values (Conference Proceedings Article, Part, Author, Originator, Presentation, etc.) and fractions are indicated in the Classification column where each value belongs to a scheme (cfRESPUBL-CLASS, RESPUBL-RESPUBL etc.).

Table 4: CERIF ResultPublication Example Record

CERIF ResultPublication example database entry				**Semantic Layer (CERIF Semantics)**	
Data	**Attribute**	**Table**	**Type**	**Classification (ClassIds)**	**Classification Scheme**
publication-joerg-et-al	**cfResPublId**	**cfResPubl**	**result**		
2008-01-01	**cfResPublDate**	**cfResPubl**	**result**		
107	**cfStartPage**	**cfResPubl**	**result**		
123	**cfEndPage**	**cfResPubl**	**result**		
978-961-6133-38-8	**cfISBN**	**cfResPubl**	**result**		
http://www.eurocris.org/fileadmin/Upload/Events/Conferences/CRIS2008/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 will present the approach of analyzing research competencies across EU countries	**cfAbstr**	**cfResPublAbstr**	**lang**		
IST, ERA, CRIS, CERIF, Research Competencies, NMS, Analysis,	**cfKeyw**	**cfResPublKeyw**	**lang**		
classification-conf-proc-article	**cfClassId**	**cfResPubl_Class**	**link**	**Conference Proceedings Article***	**cfRESPUBL-CLASS***
publ-get-the-good-cris	**cfResPublId2**	**cfResPubl_ResPubl**	**link**	**Part***	**cfRESPUBL-RESPUBL***
person-brigitte-joerg	**cfPersId**	**cfPers_ResPubl**	**link**	**FirstAuthor[fract=0.25]***	**cfPERS-RESPUBL***
person-hans-uszkoreit	**cfPersId**	**cfPers_ResPubl**	**link**	**Author***	**cfPERS-RESPUBL***
person-jure-ferlez	**cfPersId**	**cfPers_ResPubl**	**link**	**Author***	**cfPERS-RESPUBL***
person-mitja-jermol	**cfPersId**	**cfPers_ResPubl**	**link**	**Author***	**cfPERS-RESPUBL***
project-ist-world	**cfProjId**	**cfProj_ResPubl**	**link**	**Originator***	**cfPERS-RESPUBL***
event-cris-2008	**cfPersId**	**cfResPubl_Event**	**link**	**Presentation***	**RESPUBL-EVENT***

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 cfClassId=’classification-conf-proc-article’, the publication record is classified as a Conference Proceedings Article. A recursive relationship cfResPublId2=’publication-get-the-good-cris’ refers to the entire proceedings. The example shows some person relationships with different roles. The fraction example shows a %-allocation in the person-publication relationship link with the role of first author. 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 conferenc 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 2.5; for the semantic features we refer to section 2.7. With the current release, a formal semantic scheme for a CERIF core has been published: CERIF 2008 – 1.2 Semantics [12].

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 subject 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**	**Journal Article***	**cfRESPUBL-CLASS***
classification-computer-science*	**cfClassId**	**cfResPubl_Class**	**link**	**Computer Science***	**SPRINGER-SUBJECTS***
publ-vldb-journal*	**cfResPublId2**	**cfResPubl_ResPubl**	**link**	**Part***	**cfRESPUBL-RESPUBL***
person-veda-c-storey*	**cfPersId**	**cfPers_ResPubl**	**link**	**Author***	**cfPERS-RESPUBL***
organisation-springer*	**cfOrgUnitId**	**cfOrgUnit_ResPubl**	**link**	**Publisher***	**cfPERS-RESPUBL***

* For a better understanding, we labelled the IDs with natural language terms. In a real implementation, the formalized semantic term would be stored in the CERIF cfClassTerm entity because ID themselves do not necessarily incorporate any semantics. We recommend the use of UUIDs (http://en.wikipedia.org/wiki/Universally_unique_identifier) to universally and uniquely identify records.

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**	**Journal***	**cfRESPUBL-CLASS***
publ-veda-c-storey*	**cfResPublId2**	**cfResPubl_ResPubl**	**link**	**Part***	**cfRESPUBL-RESPUBL***
person-kyu-young-whang*	**cfPersId**	**cfPers_ResPubl**	**link**	**ChiefEditor***	**cfPERS-RESPUBL***
person-philip-a-bernstein*	**cfPersId**	**cfPers_ResPubl**	**link**	**ChiefEditor***	**cfPERS-RESPUBL***
person-christian-s-jensen*	**cfPersId**	**cfPers_ResPubl**	**link**	**ChiefEditor***	**cfPERS-RESPUBL***
organisation-springer*	**cfOrgUnitId**	**cfOrgUnit_ResPubl**	**link**	**Publisher***	**cfPERS-RESPUBL***

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 2.5; for the semantic features we refer to section 2.7. With the current release, a formal semantic scheme for a CERIF core has been published: CERIF 2008 – 1.2 Semantics [12]. The CERIF result publication entity allows for the generation of complete publication reference records like BibTex, as shown in table 7.

Table 7: BibTeX example records generated from CERIF publication examples

BibTeX example record (table 4)	**BibTeX example record (table 5)**
@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}, }	@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}, }

* For a better understanding, we labelled the IDs with natural language terms. In a real implementation, the formalized semantic term would be stored in the CERIF cfClassTerm entity because ID themselves do not necessarily incorporate any semantics. We recommend the use of UUIDs (http://en.wikipedia.org/wiki/Universally_unique_identifier) to universally and uniquely identify records.

2.3.2 CERIF Entity ResultPatent

For an identification of records the result patent entity (cfResPat) foresees an id attribute (cfResPatlId). 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 10. 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).

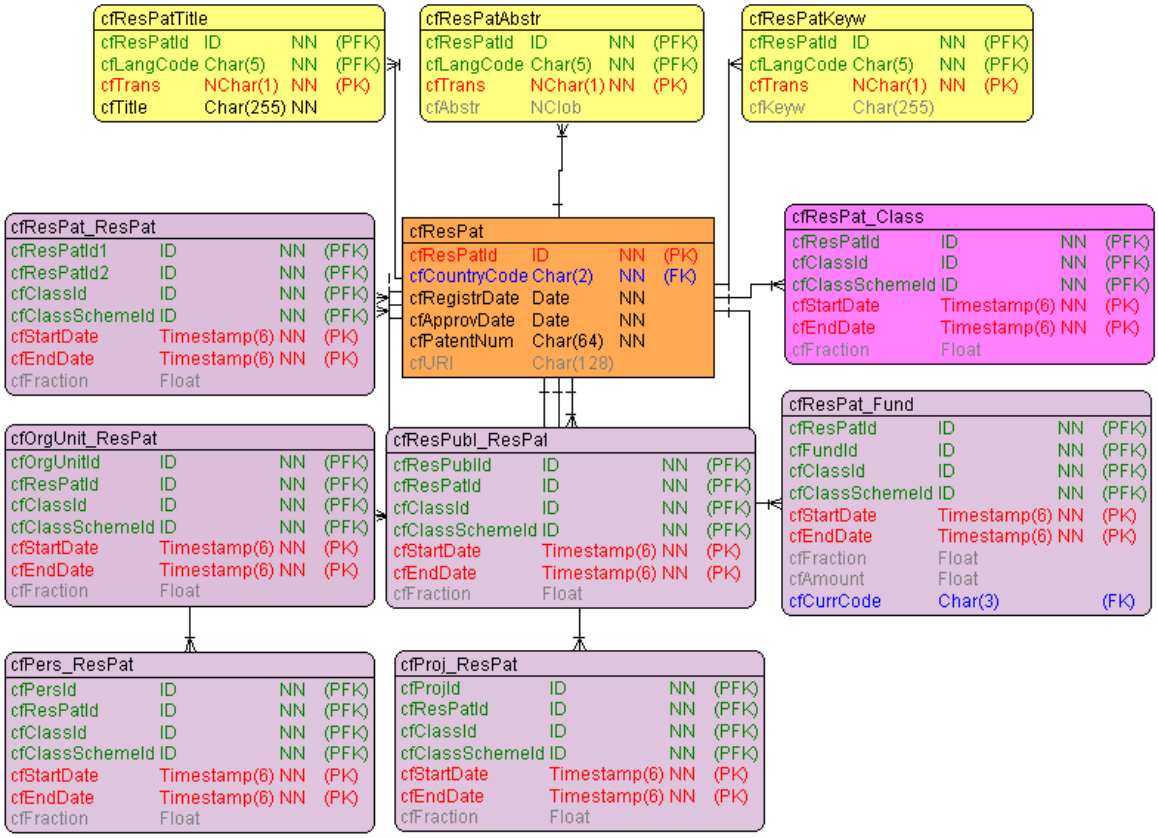

Figure 10: CERIF Result Entity ResultPatent

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_Res Prod, cfResProd_Fund) as shown in figure 11. 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).

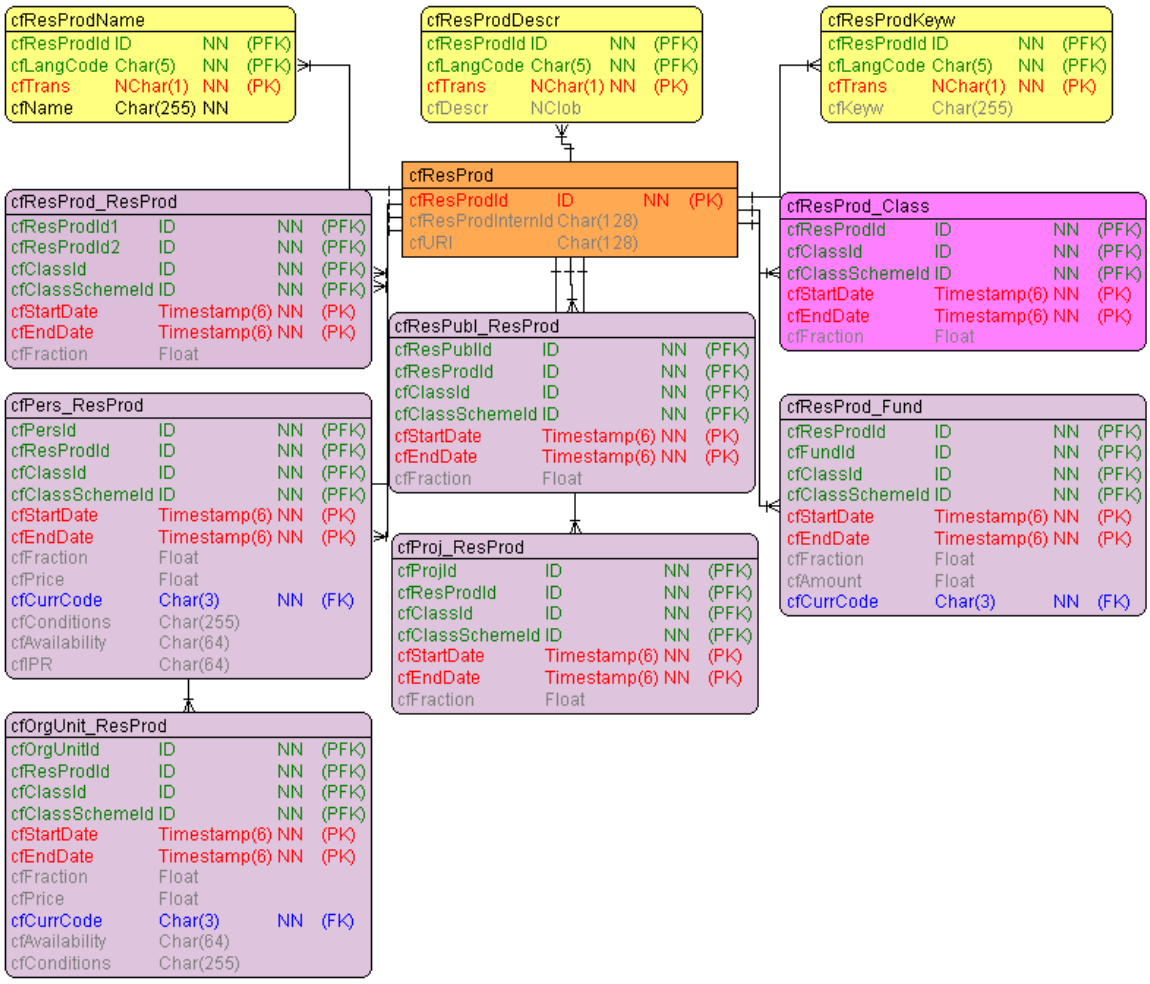

Figure 11: CERIF Result Entity ResultProduct

2.4 CERIF 2nd Level Entities

Beyond the base and result entities, CERIF employs many so called 2nd level entities. In figure 12 the 2nd level entities are presented as a circle surrounding the base and result entities in blue color.

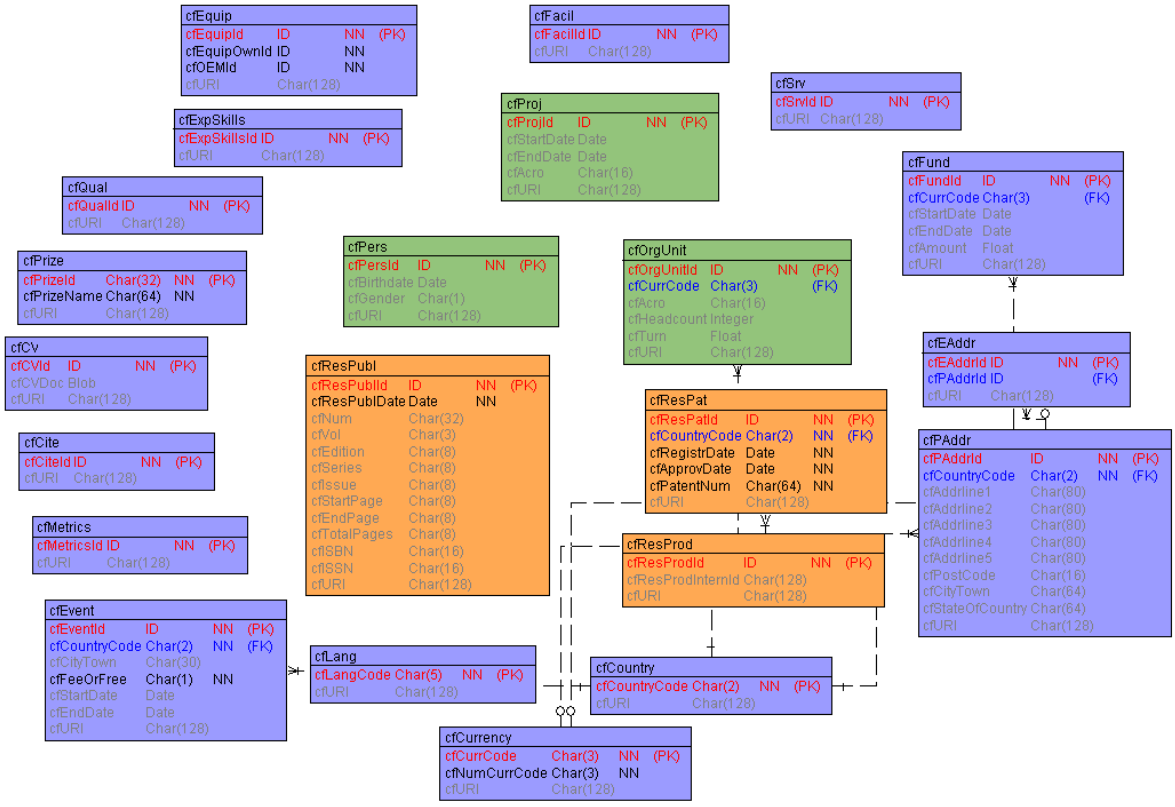

Figure 12: CERIF 2nd Level Entities organised as a circle around base and result entities

The 2nd level entities allow for the representation of the research context by linking to them from the base and result entities. Each 2nd level entity supplies some common attributes; at least an id and an uri attribute. The linkage mechanism and the multilingual features of 2nd level entities – not shown in figure 12 – 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 following sections.

2.5 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, result, or second 2nd level entities. Figure 13 shows an abstract view of some link entities (Person_ResultPublication, Person_Project, Person_OrganisationUnit, Project_ResultPublication, OrganisationUnit_ResultPublication, Project_Organisa tionUnit connecting the base entities and the result publication entity.

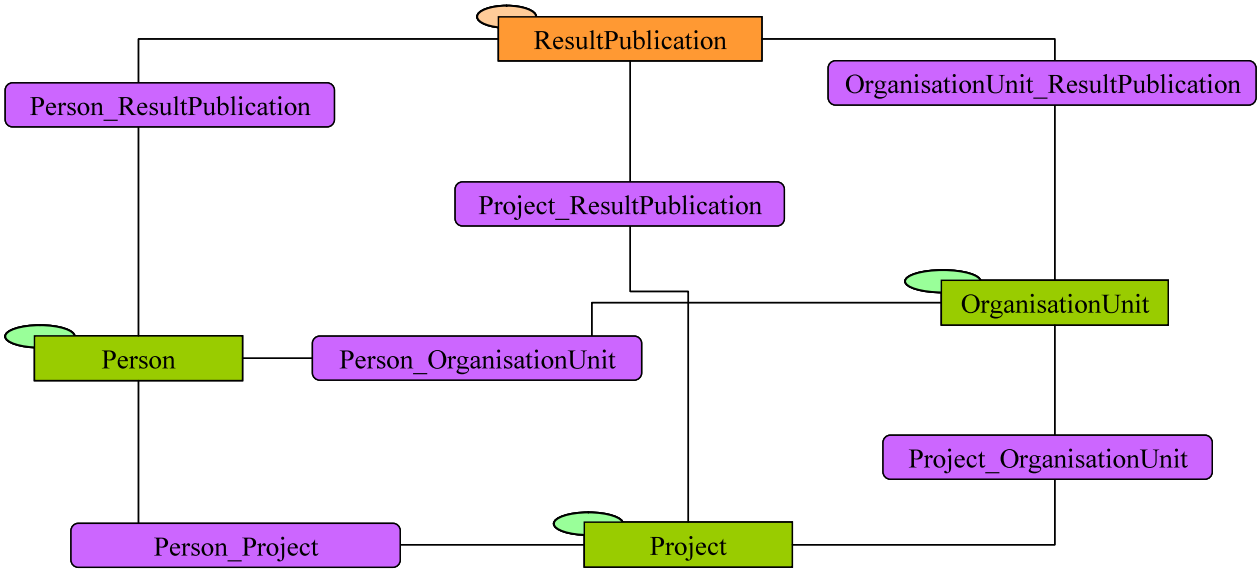

Figure 13: CERIF Link Entities in the context of the base entities and a result entity

The CERIF link entities have been mentioned in the context of the presented base, result and 2nd level entities; their structure and functionality at physical level is consistent all over the model as demonstrated with some example link entities in figure 15.

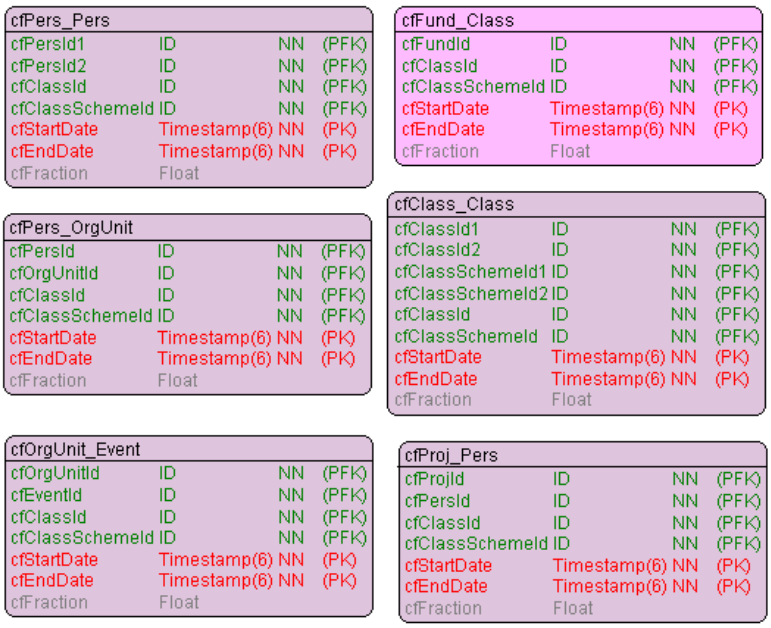

Figure 15: Some CERIF Link Entities to demonstrate the consistency in their structure

Where figure 15 shows examples of some link entities at physical level, figure 16 below introduces their structure and functionality from a meta perspective.

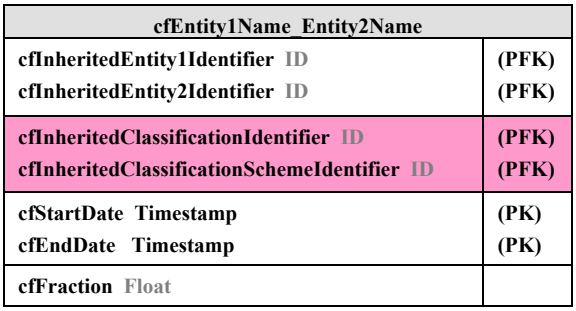

Figure 16: Meta perspective towards CERIF Link Entities

The physical name of link entities is composed of the names of the two involved entities, including the CERIF prefix as follows: cfEntity1Name_Entity2Name. The order of the linking entity names implies the order of the both identifier attributes, where the first (cfInheritedEntity1Identifier) is inherited from entity cfEntity1Name, and the second (cfInheritedEntity2Identifier) is inherited from the entity cfEntity2Name. All the identifiers at the meta perspective are labelled as inherited because they do not origin in the link entities themselves but rather are inherited from those entities (cfEntity1, cfEntity2, cfClassification, cfClassificationScheme) where they are maintained. All link entities establish linkage between two entities by id references cfInheritedEntity1Identifier and cfInheritedEntity2 Identifier. Additionally, each link entity carries semantics by reference to the so-called CERIF Semantic Layer via the cfInheritedClassificationIdentifier and cfInheritedClassi ficationSchemeIdentifier (see section 2.7) and a cfFraction attribute to assign fractional values to a classification reference. Whereas the classification and classification scheme references are mandatory, the fraction attribute is not. Besides, each linking record requires a startdate and enddate[**]. Some link entities allow for additional attributes like currency or copyright as indicated in figure 14 above. **Alltogether, the inherited identifiers and the date attributes build the primary key of link entities.**

Real data examples for link entities have been presented in the context of base and result entities with the tables 1-5. Some general linkage examples are provided in table 8. Because the cfFraction attribute is not mandatory it is not included in the examples of table 8, but has been introduced in previous example tables with base entities person, project and result entity publication.

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

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	OrgUnit-Structure	2001-01-01 T12:00:00-05:00	2001-12-31 T12:00:00-05:00
cfOrgUnit1_OrgUnit2	orgunit-id2	orgunit-id3	isPartOf	OrgUnitStructure	2009-01-13T 12:00:00-05:00	2099-01-13 T12:00:00-05:00
cfPers_OrgUnit	person-id1	orgunit-id1	Head	OrgUnit-Person Roles	2009-01-13 T12:00:00-05:00	2099-01-13 T12:00:00-05:00
cfPers1_Pers2	person-id1	person-id2	Supervisor	Academic Person Roles	2009-01-13 T12:00:00-05:00	2099-01-13 T12:00:00-05:00
cfPers_Proj	person-id2	project-id1	Participant	Project-Person Roles	2009-01-13 T12:00:00-05:00	2099-01-13 T12:00:00-05:00
cfPers_ResPubl	person-id1	publ-id1	Author	Publication-Person Roles	2009-01-13 T12:00:00-05:00	2099-01-13 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) has to be assigned to one particular 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 2.7. With the current release, a formal semantic scheme for a CERIF core has been published: CERIF 2008–1.2 Semantics [12].

* For a better understanding, we labelled the IDs with natural language terms. In a real implementation, the formalized semantic term would be stored in the CERIF cfClassTerm entity because ID themselves do not necessarily incorporate any semantics. We recommend the use of UUIDs (http://en.wikipedia.org/wiki/Universally_unique_identifier) to universally and uniquely identify records.

2.6 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 16, CERIF supports multiple language features for names, titles, descriptions, keywords, abstracts, and even for the semantics.

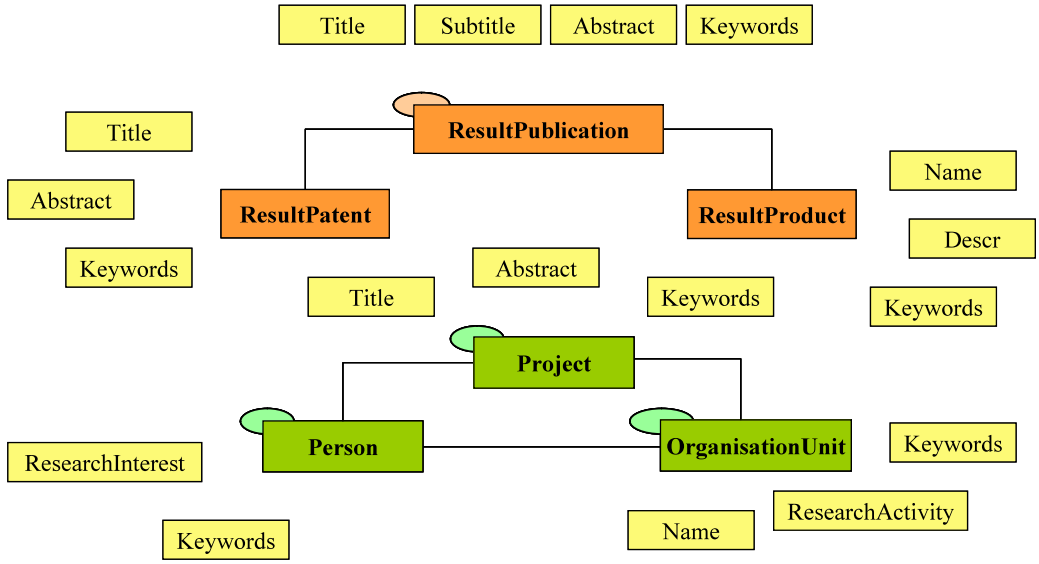

Figure 17: Some CERIF Entities with Multiple Language Features

Figure 18 below shows multilingual features for some selected entities. Their identifiers indicate the assignment towards their originating entities (cfProjId, cfOrgUnitId, cfResPublId). 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.

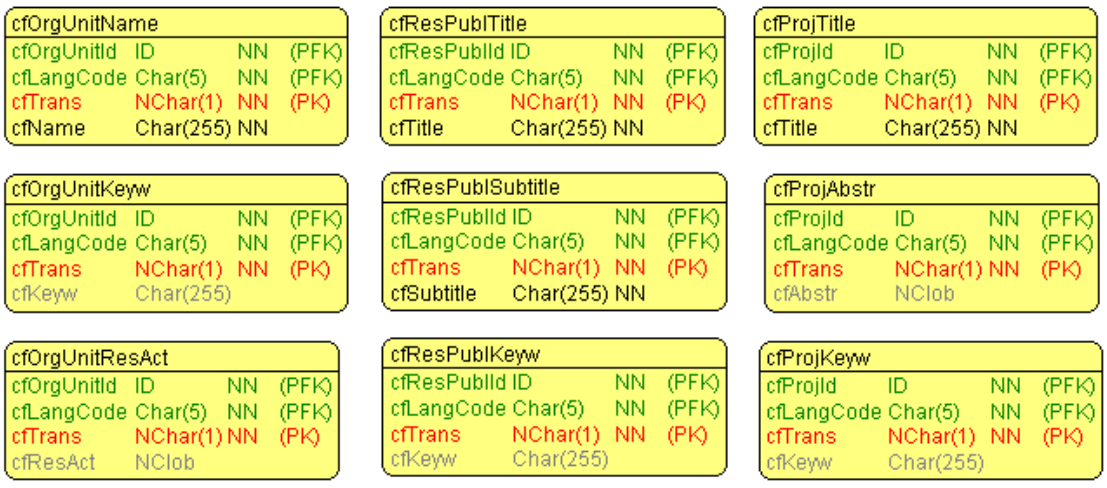

Figure 18: Some CERIF entities with Multiple Language Features

Besides the base, result and 2nd level 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).

2.7 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, and it assigns each semantic value to a particular classification scheme. The CERIF Semantic Layer is constructed by the entities shown in figure 19.

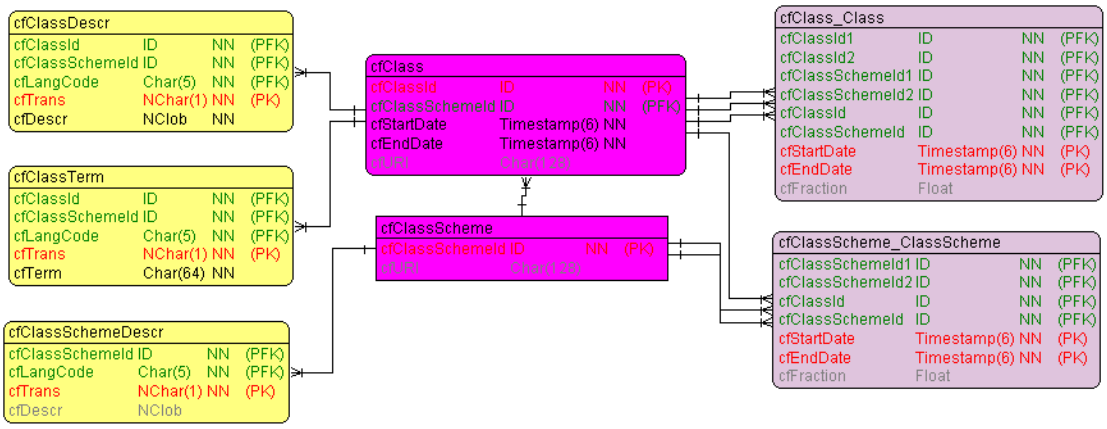

Figure 19: CERIF Semantic Layer

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 2008–1.2 Semantics term references [12].

Table 9: CERIF Semantic Layer: Some formalized Semantics examples including some terms from the current, formal core CERIF 2008-1.2 Semantics

CERIF Link Entity	cfTerm [cfLangCode=en]	cfClassDescr	Source of Description	cfClassScheme
cfResPubl_Class	**Book**	A collection of leaves of paper, parchment, vellum, cloth, or other material (written, printed, or blank) fastened together along one edge, with or without a protective case or cover.	http://lu.com/odlis/odlis_B.cfm#book	cf2008-1.2 CERIF Semantics
cfResPubl_Class	**Book Review**	An evaluative account of a recent book, usually written and signed by a qualified person, for publication in a current newspaper, magazine, or journal.	http://lu.com/odlis/odlis_R.cfm#review	cf2008-1.2 CERIF Semantics
cfResPubl_Class	**Book Chapter Abstract**	A brief, objective representation of the essential content of a book chapter, presenting the main points in the same order as the original but having no independent literary value.	http://lu.com/odlis/index.cfm#abstract	cf2008-1.2 CERIF Semantics
cfResPubl_Class	**Journal**	A periodical devoted to disseminating 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.	http://lu.com/odlis/odlis_J.cfm#journal	cf2008-1.2 CERIF Semantics
cfResPubl_Class	**Short Communication**	A short communication is a concise, but independent report representing a significant contribution to a subject.	http://www.ejbiotechnology.info/iaformato/short_communications.html	cf2008-1.2 CERIF Semantics
cfResPubl_Class	**Inbook**	A part of a book, usually untitled. May be a chapter (or section or whatever) and/or a range of pages.	http://en.wikipedia.org/wiki/BibTeX#Entry_Types	cf2008-1.2 CERIF Semantics
cfPers_ResPubl	**Author**	The person or corporate entity responsible for producing a written work (essay, monograph, novel, play, poem, screenplay, short story, etc.) whose name is printed on the title page of a book or given elsewhere in or on a manuscript or other item and in whose name the work is copyrighted. A work may have two or more joint authors. In library cataloging, the term is used in its broadest sense to include editor, compiler, composer, creator, etc. See also: attributed author, authorship, corporate author, personal author, and suppositious author. Under U.S. copyright law (Title 17 § 201), the original owner (or owners) of copyright in a work. In the case of works for hire, the employer or other person for whom the work was prepared is considered the author and	http://lu.com/odlis/index.cfm#author	cf2008-1.2 CERIF Semantics

		copyright owner, unless other arrangements are made by the parties in a signed written agreement.		
cfPers_ResPubl	**Author (numbered)**		// requires a cfFraction value	cf2008-1.2 CERIF Semantics
cfPers_ResPubl	**Author (percentage)**		// requires a cfFraction value	cf2008-1.2 CERIF Semantics
cfPers_Pers	**Manager**	In a person-person relationship responsibility to manage the human resources.	CERIF TG / euroCRIS	cf2008-1.2 CERIF Semantics
cfPers_Pers	**Mentor**	a wise and trusted guide and advisor	http://wordnetweb.princeton.edu/perl/webwn?s=mentor	cf2008-1.2 CERIF Semantics
cfPers_Pers	**Supervisor**	One who supervises or has charge and direction of.	http://wordnetweb.princeton.edu/perl/webwn?s=supervisor	cf2008-1.2 CERIF Semantics
cfClass_Class	**Synonym**	Equivalent word (two words that can be interchanged in a context are said to be synonymous relative to that context)	http://wordnetweb.princeton.edu/perl/webwn?s=synonym&sub=Search+WordNet&o2=&o0=1&o7=&o5=&o1=1&o6=&o4=&o3=&h=00	A Thesaurus Relationship (Structural Element).
cfClass_Class	**Broader Term**	The Broader Term is the parent of the Preferred Term.	http://www.cmscalendar.com/cmsh-glossary.html?term=BroaderTerm	A Thesaurus Relationship (Structural Element).

2.8 Additional Features

The current CERIF ERM model and SQL scripts contain Dublin Core and Formalised Dublin Core entities and attributes. With the 2011 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 2008 1.2 – 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 fils are available for download from the public euroCRIS website: http://www.euroCRIS.org/. The XML specification maps to the physical level of the CERIF 2008-1.2 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_ResPubl>
    <cfPersId>person-brigitte-joerg</cfPersId>
    <cfResPublId>publ-analytic-information-service-era</cfResPublId>
    <cfClassId>FirstAuthor</cfClassId>
    <cfClassSchemeId>cf2008-1.2_CERIF_Semantics</cfClassSchemeId>
    <cfStartDate>2008-01-01T00:00:00-00:00</cfStartDate>
    <cfEndDate>2008-12-31T00:00:00-00:00</cfEndDate>
    <cfFraction>0.25</cfFraction>
</cfPers_ResPubl>
```

Example 1: CERIF XML Person - Publication Relationship

```
<cfPers_OrgUnit>
    <cfPersId>person-brigitte-joerg</cfPersId>
    <cfOrgUnitId>orgunit-dfki</cfOrgUnitId>
    <cfClassId>Affiliation</cfClassId>
    <cfClassSchemeId>cf2008-1.2_CERIF_Semantics</cfClassSchemeId>
    <cfStartDate>2001-01-13T00:00:00-00:00</cfStartDate>
    <cfEndDate>2099-01-13T00:00:00-00:00</cfEndDate>
    <cfFraction>1.0</cfFraction>
</cfPers_OrgUnit>
```

Example 2: CERIF XML Person -Organisation Relationship

```
<cfClass>
    <cfClassId>class-isA</cfClassId>
    <cfClassSchemeId>ATaxonomyRelationshipScheme</cfClassSchemeId>
    <cfStartDate>2007-01-01T00:00:00-00:00</cfStartDate>
    <cfEndDate>2099-12-31T00:00:00-00:00</cfEndDate>
    <cfFraction>1.0</cfFraction>
</cfClass>
<cfClass_Class>
    <cfClassId1>class-information-science</cfClassId1>
    <cfClassId2>class-science</cfClassId2>
    <cfClassSchemeId1>ATaxonomyRelationshipScheme </cfClassSchemeId1>
    <cfClassSchemeId2>ATaxonomyRelationshipScheme </cfClassSchemeId2>
    <cfClassId>class-isA</cfClassId>
    <cfClassSchemeId>ATaxonomyRelationshipScheme </cfClassSchemeId>
    <cfStartDate>2007-09-28T00:00:00-00:00</cfStartDate>
    <cfEndDate>2099-12-31T00:00:00-00:00</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>
    <cfClassSchemeId>class-scheme-CERIF-DC-mapping</cfClassSchemeId>
    <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>
    <cfClassSchemeId1>class-scheme-CERIF2008</cfClassSchemeId1>
    <cfClassSchemeId2>class-scheme-DC</cfClassSchemeId2>
    <cfClassId>class-mappes-to</cfClassId>
    <cfClassSchemeId>class-scheme-CERIF-DC-Mapping</cfClassSchemeId>
    <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

5. CERIF Semantics

The structure and strength of the Semantic Layer as part of the CERIF model has been presented. A formal document representing a current core has been prepared with the current CERIF 2008–1.2 Semantics document [12].

6. 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.

7. Next Steps

For the next upcoming realease, we will elaborate the CERIF Semantics. Further upgrades will include the context of research funding. More work on proper namespaces may be considered for the CERIF XML specifications in the longer term. The development of a CERIF ontology is foreseen in order to support the collection and integration of CERIF XML entities. The CERIF ontology will not replace the conceptual CERIF model and the CERIF SQL scripts; they will be further maintained.

8. Appendix

8.1 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.

8.1.1 CERIF Base Entities (Logical (PhysicalName))

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

8.1.2 CERIF Result Entities (Logical (PhysicalName))

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

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

cfCitation (cfCite)
cfCountry (cfCountry)
cfCurrency (cfCurrency)
cfCurriculumVitae (cfCV)
cfElectronicAddress (cfEAddr)
cfEquipment (cfEquip)
cfEvent (cfEvent)
cfExpertiseAndSkills (cfExpSkills)
cfFacility (cfFacil)
cfFunding (cfFund)
cfLanguage (cfLanguage)
cfMetrics (cfMetrics)
cfPostalAddress (cfPAddr)
cfPrizeAward (cfPrize)
cfQualification (cfQqual)
cfService (cfSrv)

8.1.4 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_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)

8.1.5 CERIF Multiple Language Features (Logical (PhysicalName))

cfCitationDescription (cfCiteDescr)
cfCitationTitle (cfCiteTitle)
cfClassificationDescription (cfClassDescr)
cfClassificationTerm (cfClassTerm)
cfClassificationSchemeDescription (cfClassSchemeDescr)
cfCountryName (cfCountryName)
cfCurrencyEntityName (cfCurrencyEntityName)
cfCurrencyName (cfCurrencyName)
cfEquipmentDescription (cfEquipPDescr)
cfEquipmentKeywords (cfEquipKeyw)
cfEquipmentName (cfEquipName)
cfEventDescription (cfEventDescr)
cfEventKeywords (cfEventKeyw)
cfEventName (cfEventName)
cfExpertiseAndSkillsDescription (cfExpSkillsDescr)
cfExpertiseAndSkillsKeywords (cfExpSillsKeyw)
cfExpertiseAndSkillsName (cfExpSkillsName)
cfFacilityDescription (cfFacilDescr)
cfFacilityKeywords (cfFacilKeyw)
cfFacilityName (cfFacilName)
cfFundingDescription (cfFundDescr)
cfFundingKeywords (cfFundKeyw)
cfFundingName (cfFundName)
cfLanguageName (cfLanguageName)
cfMetricsDescription (cfMetricsDescr)
cfMetricsName (cfMetricsName)
cfOrganisationUnitKeywords (cfOrgUnitKeyw)
cfOrganisationUnitName (cfOrgUnitName)
cfOrganisationUnitResearchActivity (cfOrgUnitResAct)
cfPersonResearchInterest (cfPersResInt)
cfPersonKeywords (cfPersKeyw)
cfProjectAbstract (cfProjAbstr)
cfProjectKeywords (cfProjKeyw)
cfProjectTitle (cfProjTitle)
cfResultPatentAbstract (cfResPatAbstr)
cfResultPatentKeywords (cfResPatKeyw)
cfResultPatentTitle (cfResPatTitle)
cfResultProductDescription (cfResProdDescr)
cfResultProductKeywords (cfResProdKeyw)

cfResultProductName (cfResProdName)
cfResultPublicationAbstract (cfResPublAbst)
cfResultPublicationBibliographicNote (cfResPublBiblNote)
cfResultPublicationKeywords (cfResPublKeyw)
cfResultPublicationNameAbbreviation (cfResPublNameAbbrev)
cfResultPublicationSubtitle (cfResPublSubtitle)
cfResultPublicationTitle (cfResPublTitle)
cfServiceDescription (cfSrvDescr)
cfServiceKeywords (cfSrvKeyw)
cfServiceName (cfSrvName)

8.1.6 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)

8.1.7 CERIF Classification Entities (Logical (PhysicalName))

cfClassification (cfClass)
cfClassificationScheme (cfClassScheme)

8.1.8 CERIF Attributes

8.1.9 Attribute in all Link Tables

cfFraction (cfFraction)

8.1.9.1 Language-dependent attributes including cflangCode and cfTrans

cfAbstract (cfAbstr)
cfDescription (cfDescr)

cfKeywords (cfKeyw)
cfName (cfName)
cfResearchActivity (cfResAct)
cfResearchInterest (cfResInt)
cfTerm (cfTerm)
cfTitle (cfTitle)

8.1.9.2 Currency-dependent attributes

cfAmount (cfAmount)
cfPrice (cfPrice)
cfTurnover (cfTurn)

8.2 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 cf prefixes).

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

Logical CERIF2008 - 1.2 Entities	**Physical CERIF2008-1.2 Entities**
cfCitation	cfCite
cfCitation_Classification	cfCite_Class
cfCitationDescription	cfCiteDescr
cfCitationTitle	cfCiteTitle
cfClassification	cfClass
cfClassification_Classification	cfClass_Class
cfClassificationDescription	cfClassDescr
cfClassificationScheme	cfClassScheme
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
cfEquipmentDescription	cfEquipDescr
cfEquipmentKeywords	cfEquipKeyw
cfEquipmentName	cfEquipName
cfEvent	cfEvent
cfEvent_Classification	cfEvent_Class
cfEvent_Event	cfEvent_Event
cfEvent_Funding	cfEvent_Fund
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_Funding	cfFacil_Fund
cfFacilityDescription	cfFacilDescr
cfFacilityKewords	cfFacilKeyw
cfFacilityName	cfFacilName
cfFormalisedDublinCoreRightsManagementPricing	cfFDCRightsMMPricing
cfFormalisedDublinCoreRightsManagementPrivacy	cfFDCRightsMMPrivacy
cfFormalisedDublinCoreRightsManagementRights	cfFDCRightsMMRights
cfFormalisedDublinCoreRightsManagementSecurity	cfFDCRightsMMSecurity
cfFunding	cfFund
cfFunding_Classification	cfFund_Class
cfFunding_Funding	cfFund_Fund
cfFundingDescription	cfFundDescr
cfFundingKeywords	cfFundKeyw
cfFundingName	cfFundName
cfLanguage	cfLang
cfLanguage_Classification	cfLang_Class
cfLanguageName	cfLangName
cfMetrics	cfMetrics
cfMetrics_Classification	cfMetrics_Class
cfMetricsDescription	cfMetricsDescr
cfMetricsName	cfMetricsName
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
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
cfPersonKeywords	cfPersKeyw
cfPersonName	cfPersName
cfPersonName_Person	cfPersName_Pers
cfPersonResearchInterest	cfPersResInt
cfPostAddress	cfPAddr
cfPostAddress_Classification	cfPAddr_Class
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_Service	cfProj_Srv

cfProjectAbstract	cfProjAbstr
cfProjectKeywords	cfProjKeyw
cfProjectTitle	cfProjTitle
cfQualification	cfQual
cfQualification_Classification	cfQual_Class
cfQualificationDescription	cfQualDescr
cfQualificationKeywords	cfQualKeyw
cfResultPatent	cfResPat
cfResultPatent_Classification	cfResPat_Class
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cfResultPatent_ResultPatent	cfResPat_ResPat
cfResultPatentAbstract	cfResPatAbstr
cfResultPatentKeywords	cfResPatKeyw
cfResultPatentTitle	cfResPatTitle
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cfResultPublicationSubtitle	cfResPublSubtitle
cfResultPublicationTitle	cfResPublTitle
cfService	cfSrv
cfService_Classification	cfSrv_Class
cfService_Funding	cfSrv_Fund
cfServiceDescription	cfSrvDescr
cfServiceKeywords	cfSrvKeyw
cfServiceName	cfSrvName

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