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CERIF 2008 - 1.0 Full Data Model (FDM)
Introduction and Specification

Editors:

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Abstract:

CERIF (the **C**ommon **E**uropean **R**esearch **I**nformation **F**ormat) is a formal model to support the management of Research Information by enabling 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 and the relationships between them. Information Systems may be considered as tools to structure, store, maintain, exchange, access, disseminate or assess the information they contain. We consider CERIF, its entities, their rich relationships, and the management of their semantics a very powerful instrument for setting up scalable, interoperable and quality information systems. Compared to preceding versions, the current CERIF release includes a major upgrade in the coverage of the publication entity, the addition of the citation and metrics entities, and the introducion of the new CERIF Semantics with publication types and roles. This document offers a detailed description of the range and structure of the CERIF 2008–1.0 model and release.

The CERIF model 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 (http://www.eurocris.org) a not-for-profit organisation dedicated to the promotion of CRISs (**C**urrent **R**esearch **I**nformation **S**ystems).

Status:

CERIF model improvements are based on discussions among euroCRIS CERIF task group members. This document will be updated alongside major model updates.

Location:

http://www.eurocris.org/fileadmin/Upload/CERIF/CERIF2008_1.0_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, etc., and classification. Additionally, the 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. Alongside the 2006 model, the *CERIF XML* interchange format has been introduced [11] based on common XML recommendations [9]. The current CERIF 2008 release extends its predecessors with substantial elaboration on the publication entity, and thus establishes the long requested connectivity to repositories for scholarly publications. Additionally, CERIF 2008 – 1.0 introduces the *CERIF Semantics* [12] for publication entities as a first step towards a formal vocabulary to manage the semantics inherent in the relationships between research entities.

This document will walk 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] ERGO project: http://cordis.europa.eu/ergo/
[2] EC Recommendation: http://cordis.europa.eu/cerif/
[3] euroCRIS: http://www.eurocris.org/

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 – 1.0 release comprises the following components:

- CERIF 2008 – 1.0 FDM: Model Introduction and Specification
  this document

- CERIF 2008 – 1.0 XML: Data Exchange Format Specification
  separate document available from the euroCRIS website [11]

- CERIF 2008 – 1.0 Semantics
  separate document available from the euroCRIS website [12]

- CERIF 2008 – 1.0 FDM: SQL scripts for most common databases
  available from the euroCRIS website for members only

- CERIF 2008 – 1.0 XML Examples
  available from the euroCRIS website for members only

- CERIF 2008 – 1.0 XML Schema Files
  CERIF XML validation files available from the euroCRIS website

CERIF 2008 – 1.0 related files and more documents and background information about CERIF and CRISs are available for download from the public euroCRIS website: http://www.eurocris.org/cerif/cerif-releases/cerif-2008/. The physical SQL scripts and XML examples files are available for members only[4*].

[*] The CERIF 2008 – 1.0 release was modeled with Toad Data Modeler[4] 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 Upgrades

Compared to its preceding version (CERIF – 2006 1.1) the current release (CERIF 2008 – 1.0) incorporates some major upgrades: extensive coverage of the *ResultPublication* entity; addition of the *Citation* entity; addition of the *Metrics* entity, CERIF Semantics. The total list of changes (compared to CERIF 2006 – 1.1) shows the new entities, improved features and new documents:

- **Addition of new Entities in the Context of ResultPublication**
  cfResultPublicationNameAbbreviation
  cfResultPublicationSubtitle
  cfResultPublication_Metrics, cfMetrics_Classification
  cfResultPublication_Citation, cfCitation_Classification
  cfResultPublication_Event
  cfResultPublication_ResultProduct
  cfResultPublication_ResultPatent
  cfResultPublication_Equipment
  cfResultPublication_Facility
  cfMetrics, cfMetricsName, cfMetricsDescription
  cfCitation, cfCitationTitle, cfCitationDescription
  cfPersonName, cfPersonName_Person
  cfBibliographicNote
  cfEvent_Event

- **Addition of new Attributes to ResultPublication**
  cfNumber, cfVolume, cfEdition, cfSeries, cfIssue, cfISBN, cfISSN

- **Addition of the cfCurrencyCode attribute in cfOrganisationUnit_ResultProduct and cfPerson_ResultProduct Link Entities**

- **Addition of relationship names to all CERIF 2008 relationships**

- **Renaming of the cfBudget attribute to cfAmount**

- **Deletion of Entity ResultPublicationReference**
  (can now entirely be generated from CERIF 2008 attributes)

- **CERIF Semantics for Publication Types and Roles**

2. The CERIF 2008 – 1.0 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 CERIF model.

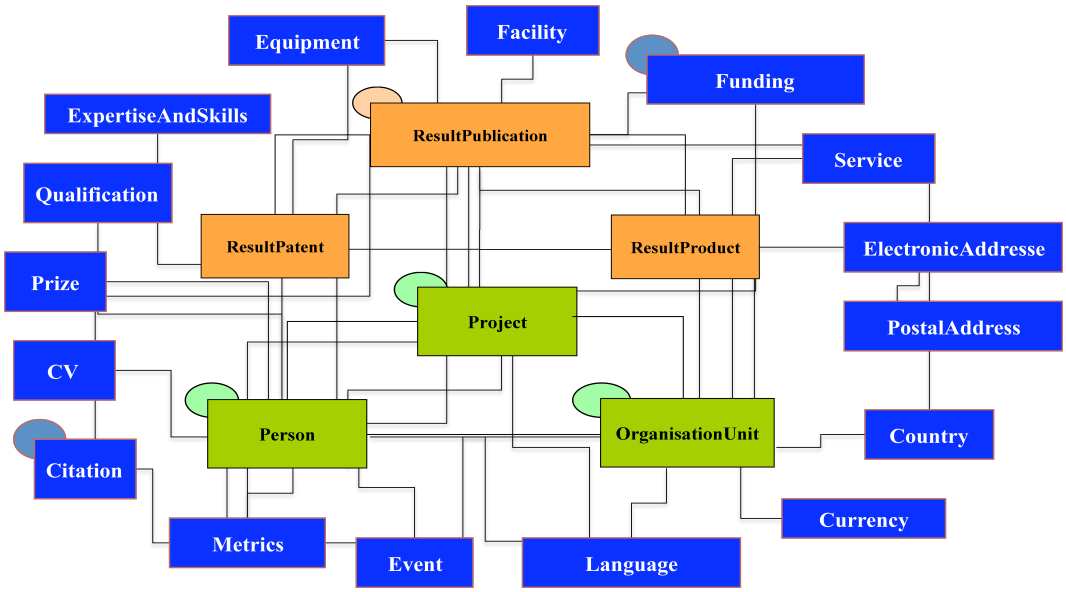

Figure 1: Some CERIF Entities and their Relationships

2.1 CERIF Conceptual Structure

We conceptually structure the CERIF model into entity types and features. In between the types we distinguish core, 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
Core Entities [core]	Multiple Language [lang]
Result Entities [result]	Semantics [class]
2nd Level Entities [2nd]	Additional [add]
Link Entities [link]	

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 a 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 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 including their conceptual type or feature; a HTML presentation of the model, including the conceptual images, is available from the public euroCRIS website for navigation: http://www.eurocris.org/.

2.2 CERIF Core Entities

The core CERIF entities are Person, OrganisationUnit and Project. Figure 2 shows the core entities and their recursive and linking relationhips. Each core entity recursively links to itself and maintains relationships with other core entities. The core entities allow for a representation of scientific actors and their different ways of interactions.

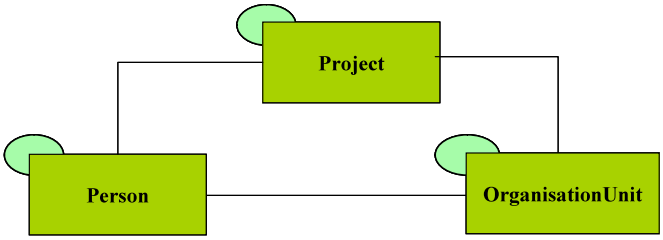

Figure 2: CERIF Core Entities

Figure 3 below shows the core entities (cfProj, cfPers, cfOrgUnit) and some related entities from a logical or physical perspective. The little circles in figure 2 represent recursiveness; that is, their relationships in between each other; within projects, within persons, and within organisations (cfProj_Proj, cfPers_Pers, cfOrgUnit_ OrgUnit). The recursive as well as the interlinking relations that are logically presented as cfPers_OrgUnit, cfProj_Pers and cfProj_OrgUnit in figure 3 are link type entities that 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.

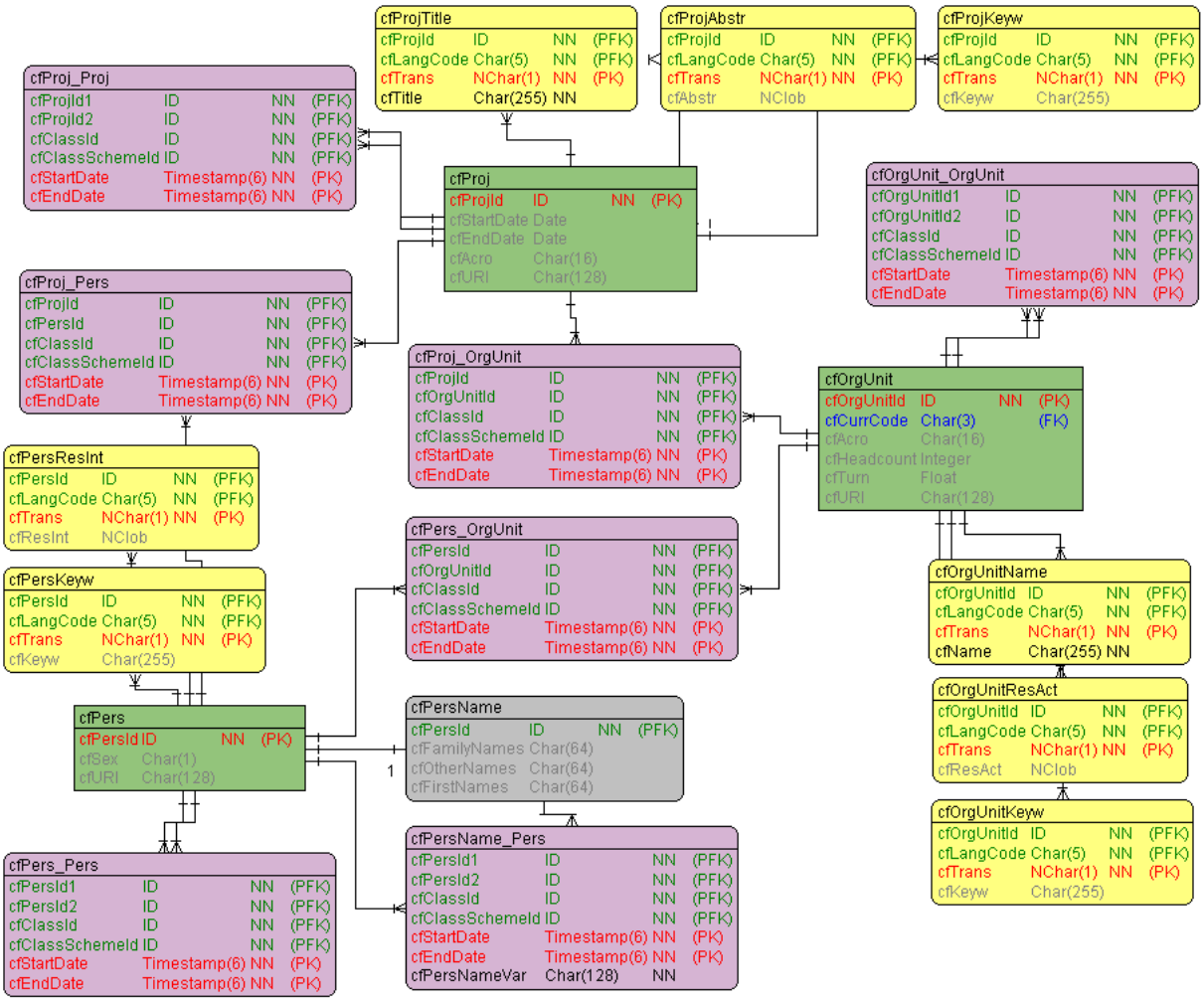

Figure 3: CERIF Core Entities, their Recursion and some Link Entities

Each core 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 core entity (cfProj) foresees an id attribute (cfProjId). Besides, the attributes acronym, uri, and start/end date (cfAcro, cfURI, cfStartDate, cfEndDate) are considered common attributes to represent project records. 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_FundProg, cfProj_Equip, cfProj_Facil, cfProj_Srv, cfProj_Prize, cfProj_Class) as shown in figure 4. Each such relationship or link entity carries semantics with a time-stamped reference to the CERIF Semantic Layer by cfClassId and cfClassSchemId. Additionally, the project entity supports multilingual features for title, abstract, and keywords (cfProjTitle, cfAbstr, cfProjKeyw).

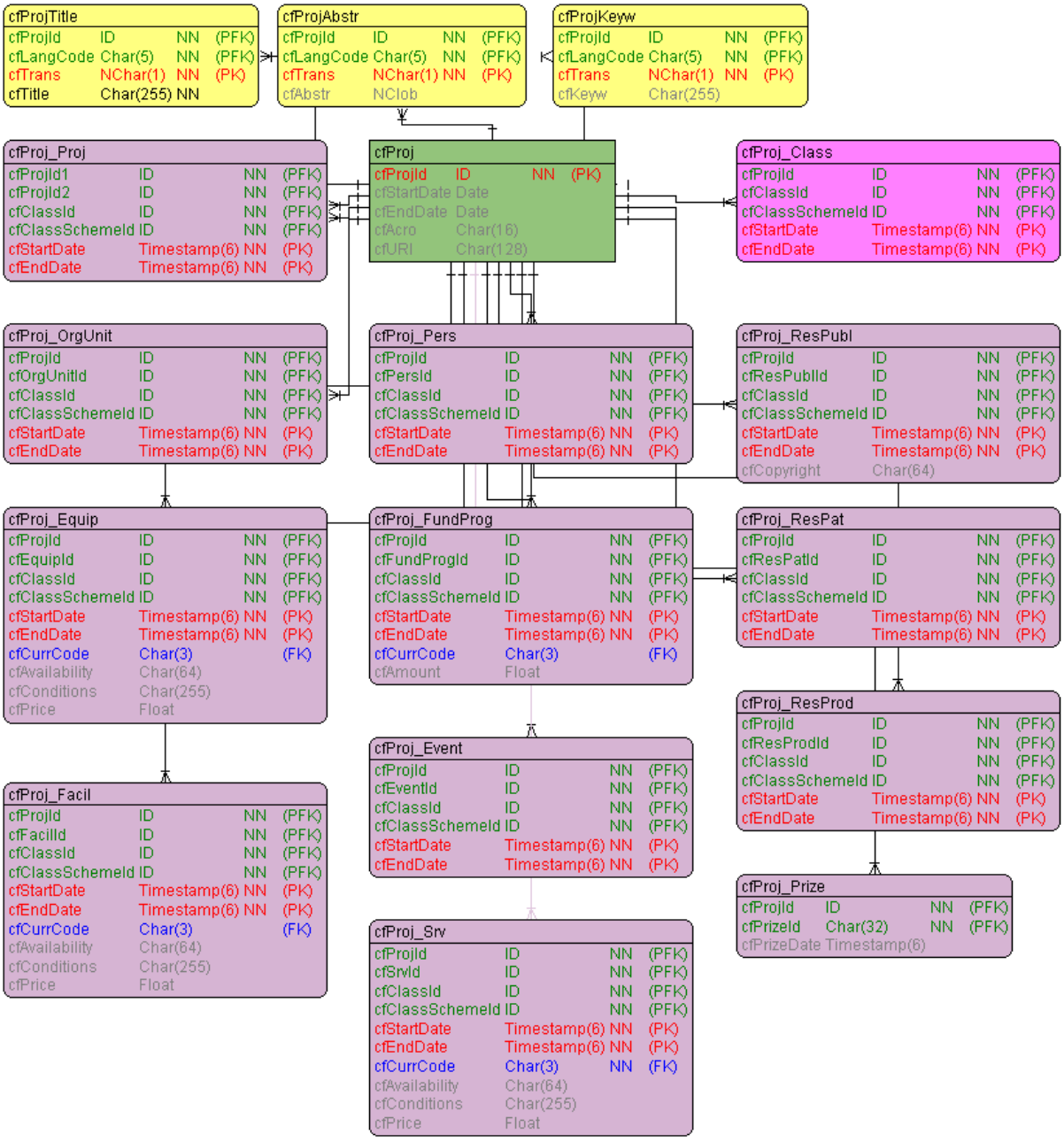

Figure 4: CERIF Core Entity Project

Table 1 shows an example project record from a database perspective where common (core) and multilingual [lang] attributes are stored in the upper rows, and the lower rows show example relationships (link) including their semantics. Linkage is established by ids (i.e. cfClassId, cfResPublId, cfOrgUnitId, cfFundProgId) indicated in the Attribute column, the carrying link entites are indicated in the Table column, the Type column indicates the conceptual types (core, lang, link), the semantic values (i.e. is originator of, is coordinated by, is funded by) are indicated in the Classification column where each value belongs to a defined scheme (i.e. FP6-IST, PROJ-PUBL, etc).

Table 1: CERIF Project Example Record

CERIF Project example database entry				**Semantic Layer (CERIF Semantics)**	
Data	**Attribute**	**Table**	**Type**	**Classification (ClassIds)**	**Classification Scheme**
project-ist-world	**cfProjId**	**cfProj**	**core**		
IST World	**cfAcro**	**cfProj**	**core**		
http://www.ist-world.org/	**cfURI**	**cfProj**	**core**		
2005-04-01	**cfStartDate**	**cfProj**	**core**		
2007-11-30	**cfEndDate**	**cfProj**	**core**		
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, Information System	**cfKeyw**	**cfProjKeyw**	**lang[en,o]**		
The objective of the project is to set up and populate an information portal with innovative functionalities that helps to promote RTD competencies in IST in the New Member States (NMS) and Associate Candidate Countries (ACC) in order to facilitate and foster the involvement of different research entities in joint RTD activities. The IST World portal is built on the CERIF standard and will contain information about RTD actors on the local, national and European level, such as persons, research groups, organisations and projects, and their experience and expertise. The portal will improve upon existing on-line services by offering innovative functionalities on top of the information repository.	**cfAbstr**	**cfProjAbstr**	**lang[en,o]**		
classification-2004-ist-3	**cfClassId**	**cfProj_Class**	**link**	**2004-IST-3**	**FP6-IST**
publication-analyzing-european-research-competencies-in-ist	**cfResPublId**	**cfProj_ResPubl**	**link**	**is originator of**	**PROJ-PUBL**
publication-cris-information-systems-for-research-activity	**cfResPublId**	**cfProj_ResPubl**	**link**	**is originator of**	**PROJ-PUBL**
publication-analytic-services-for-the-european-research-area-publication	**cfResPublId**	**cfProj_ResPubl**	**link**	**is originator of**	**PROJ-PUBL**
organisation-dfki	**cfOrgUnitId**	**cfProj_OrgUnit**	**link**	**is coordinated by**	**PROJ-ORG**
funding-programme-fp6	**cfFundProgId**	**cfProj_FundProg**	**link**	**is funded by**	**PROJ-FPROG**

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. With cfClassId=”2004-IST-3” the example record is classified according to the FP6-IST scheme. CERIF entities store their semantics by reference ids with interlinking (link) entities. The given example record is linked with some publications in the role of 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 CERIF 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.

2.2.2 CERIF Entity Person

For the identification of person records the core entity (cfPers) offers an id attribute (cfPersId). Besides, attributes sex and uri (cfSex, cfURI) are considered as common attributes to represent person records. The latest model release includes two new entities for the maintenance of person names (cfPersName, cfPersName_Pers). We recommend the storage of current names in the cfPersName table with proper attributes cfFamilyNames, cfOtherNames, cfFirstNames, and to use the cfPersName_Pers table for storage of name variants at a time with the cfPesNameVar attribute, as it allows for time-related variants (i.e. nick names, names before marriage) with the semantics assigned (see also example in table 4 below).

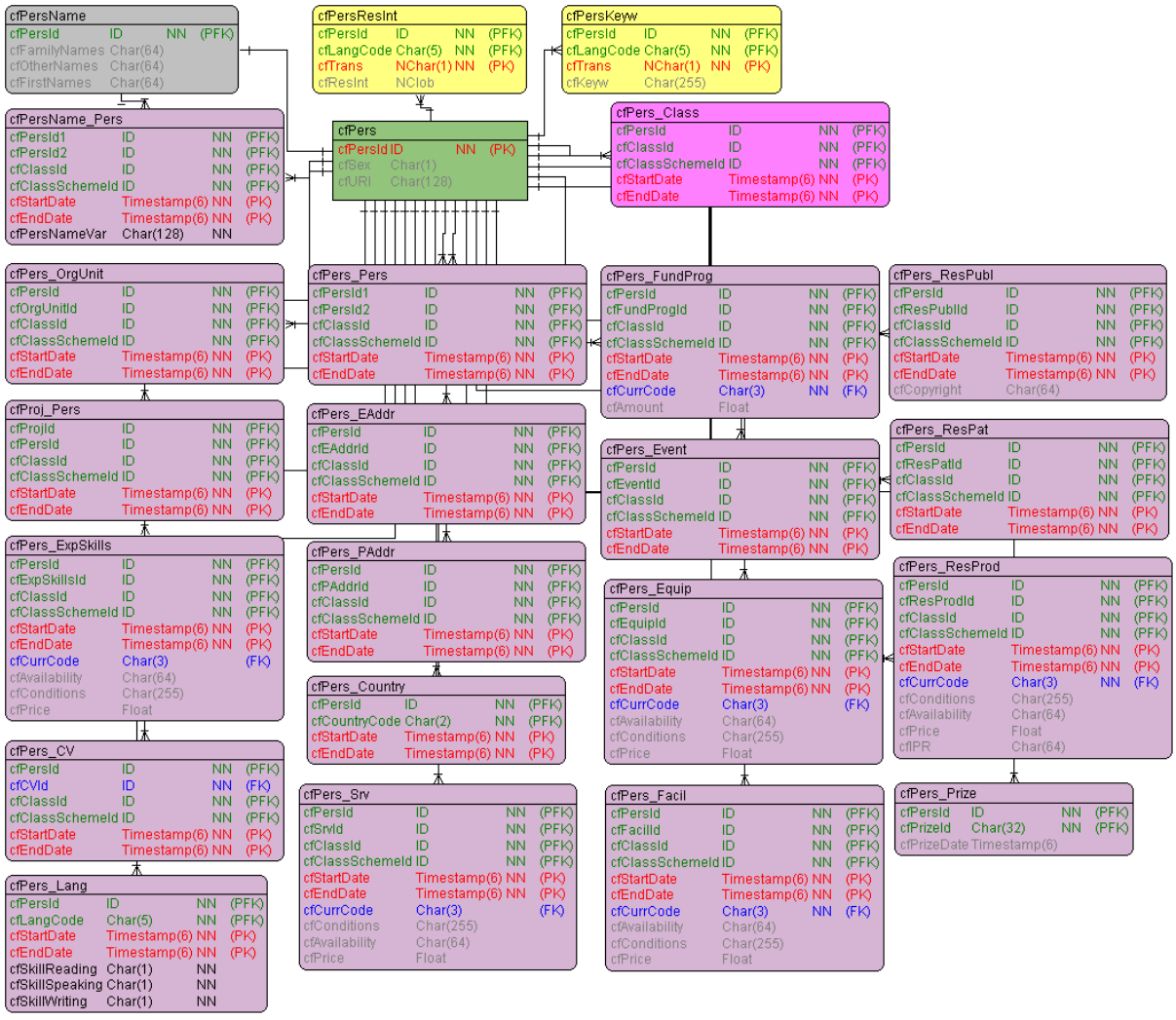

Figure 5: CERIF Core Entity Person

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_FundProg, 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 such relationship or link entity carries semantics with a time-stamped reference to the Semantic Layer by cfClassId and cfClassSchemId. 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) indicated in the Attribute column, the carrying link entites are indicated in the Table column, the Type column indicates the conceptual types (core, link, lang, add), the semantic values (spelling variant, M.A. is author of, is affiliated with, is member of board, is tg-leader of, is coordinated by, has participant) are indicated in the Classification column, where each value belongs to a particular scheme (PERS_PERSNAME, ACADEMIC-TITLES, PERS_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**	**core**		
f	**cfSex**	**cfPers**	**core**		
http://www.dfki.de/~brigitte/	**cfURI**	**cfPers**	**core**		
person-brigitte-joerg	**cfPersId**	**cfPersName**	**add**		
Joerg	**cfFamilyNames**	**cfPersName**	**add**		
Brigitte	**cfFirstNames**	**cfPersName**	**add**		
Brigitte is interested in Research Information and CRISs.	**cfResInt**	**cfPersResInt**	**lang**		
Information Systems, RI, …	**cfKeyw**	**cfProjKeyw**	**lang**		
Brigitte Jörg	**cfPersNameVar**	**cfPersName_Pers**	**link**		
person-brigitte-joerg	**cfPersId2***	**cfPersName_Pers**	**link**	**spelling variant**	**PERS_PERSNAME**
classification-MA	**cfClassId**	**cfPers_Class**	**link**	**M.A.**	**ACADEMIC-TITLES**
publication-analyzing-european-…	**cfResPublId**	**cfPers_ResPubl**	**link**	**is author of**	**PERS-PUBL**
publication-analytic-services-for-era	**cfResPublId**	**cfPers_ResPubl**	**link**	**is author of**	**PERS-PUBL**
organisation-dfki	**cfOrgUnitId**	**cfPers_OrgUnit**	**link**	**is affiliated with**	**PERS_ORGUNIT**
organisation-lt-lab	**cfOrgUnitId**	**cfPers_OrgUnit**	**link**	**is subaffiliated with**	**PERS_ORGUNIT**
organisation-euroCRIS	**cfOrgUnitId**	**cfPers_OrgUnit**	**link**	**is member of board**	**PERS_ORGUNIT**
organisation-CERIF-TG	**cfOrgUnitId**	**cfPers_OrgUnit**	**link**	**is tg-leader of**	**PERS_ORGUNIT**
project-ist-world	**cfProjId**	**cfProj_Pers**	**link**	**is coordinated by**	**PROJ_PERS**
project-lt-world	**cfProjId**	**cfProj_Pers**	**link**	**has participant**	**PROJ_PERS**

The example record shows some common and multilingual person attributes id, sex, family name, first name, research interest and keywords. Moreover, the recording of a name variant (Brigitte Jörg) in the link table cfPersName_Pers indicates its semantics as being a spelling variant. The lower rows present other relationship examples including their semantics. 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 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.

* The Attribute column in table 2 only shows the target identifiers in person-related link tables. In the link table cfPersName_Pers, the identifier cfPersId1 is inherited from the cfPersName table, which itself inherited the cfPersId from the cfPers table (see figure 5). As a consequence, the both identifiers in the cfPersName and cfPers tables are equal. When re-used at the link table cfPersName_Pers the identifiers are therefore numbered and technically treated like in recursive link entities.

2.2.3 CERIF Entity OrganisationUnit

For an identification of organisation records, the core 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 attributes to represent organization records.

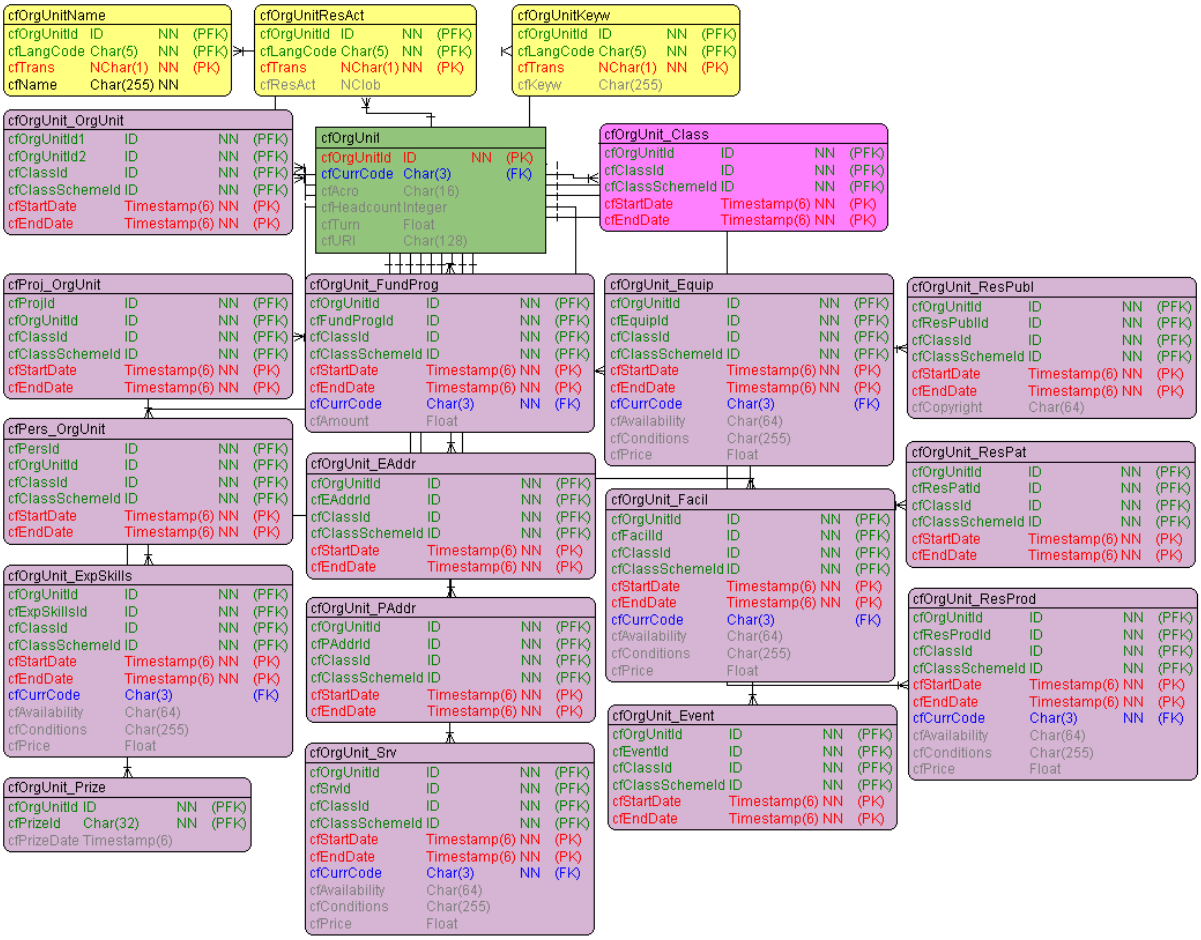

Figure 6: CERIF Core Entity OrganisationUnit

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_ResPat, cfPers_ResProd, cfPers_FundProg, 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 such relationship or link entity carries semantics with a time-stamped reference to the CERIF Semantic Layer by cfClassId and by cfClassSchemId. Additionally, the organisation entity supports multilingual features for name, research activity descriptions and keywords (cfPersResInt, cfPersKeyw). Table 3 shows an 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 indicated in the Table column, the Type column indicates the conceptual entity types (core, link, lang), the semantic values (not for profit, is president of, is secretary of, is treasurer of, is executive strategy, etc.) are indicated in the Classification column, where each value belongs to a particular classification scheme (PERS_ORGUNIT, ORGUNIT_ORGUNIT, etc).

Table 3: CERIF OrganisationUnit Example Record

CERIF OrganisationUnit example database entry				**Semantic Layer (CERIF Semantics)**	
Data	**Attribute**	**Table**	**Type**	**Classification (ClassIds)**	**Classification Scheme**
organisation-eurocris	**cfOrgUnitId**	**cfOrgUnit**	**core**		
EUR	**cfCurrCode**	**cfOrgUnit**	**core**		
http://www.eurocris.org/	**cfURI**	**cfOrgUnit**	**core**		
euroCRIS	**cfAcro**	**cfOrgUnit**	**core**		
European Current Research Information Systems	**cfName**	**cfOrgUnitName**	**lang**		
euroCRIS as the professional association of CRIS experts and custodian of CERIF is dedicated to improvement of ri availability.	**cfResAct**	**cfOrgUnitResAct**	**lang**		
classification-nfp	**cfClassId**	**cfOrgUnit_Class**	**link**	**not for profit**	**ORGUNIT_CLASS**
person-keith-jeffery	**cfPersId**	**cfPers_OrgUnit**	**link**	**is president of**	**PERS-ORGUNIT**
person-harrie-lalieu	**cfPersId**	**cfPers_OrgUnit**	**link**	**is secretary of**	**PERS-ORGUNIT**
person-geert-van-grootel	**cfPersId**	**cfPers_OrgUnit**	**link**	**is treasurer of**	**PERS-ORGUNIT**
person-anne-asserson	**cfPersId**	**cfPers_OrgUnit**	**link**	**is exec strategy**	**PERS-ORGUNIT**
person-wolfgang-adamczak	**cfPersId**	**cfPers_OrgUnit**	**link**	**is exec conference**	**PERS-ORGUNIT**
person-maximilian-stempfhuber	**cfPersId**	**cfPers_OrgUnit**	**link**	**is exec workshops**	**PERS-ORGUNIT**
person-mitja-jermol	**cfPersId**	**cfPers_OrgUnit**	**link**	**is tg-leader project**	**PERS-ORGUNIT**
person-brigitte-joerg	**cfPersId**	**cfPers_OrgUnit**	**link**	**is tg-leader cerif**	**PERS-ORGUNIT**
person-sergey-parinov	**cfPersId**	**cfPers_OrgUnit**	**link**	**is tg-leader bp**	**PERS-ORGUNIT**
person-ed-simons	**cfPersId**	**cfPers_OrgUnit**	**link**	**is tg-leader ir-cerif**	**PERS-ORGUNIT**
person-marika-meltsas	**cfPersId**	**cfPers_OrgUnit**	**link**	**is tg-leader dris**	**PERS-ORGUNIT**
paddr-Voorschoten	**cfPAddrId**	**cfOrgUnit_PAddr**	**link**	**post office box**	**ORGUNIT_PADDR**
eaddr-eurocris@eurocris.org	**cfEAddrId**	**cfOrgUnit_EAddr**	**link**	**email**	**ORGUNIT_EADDR**
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="classi fication-nfp" the example record is classified as "not for profit". CERIF entities store their semantics by reference ids with interlinking (link) entities. The example record maintains many person relationships with different roles: president, secretary, treasurer, etc. For organisation records, CERIF allows 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.

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 core 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 that will 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.

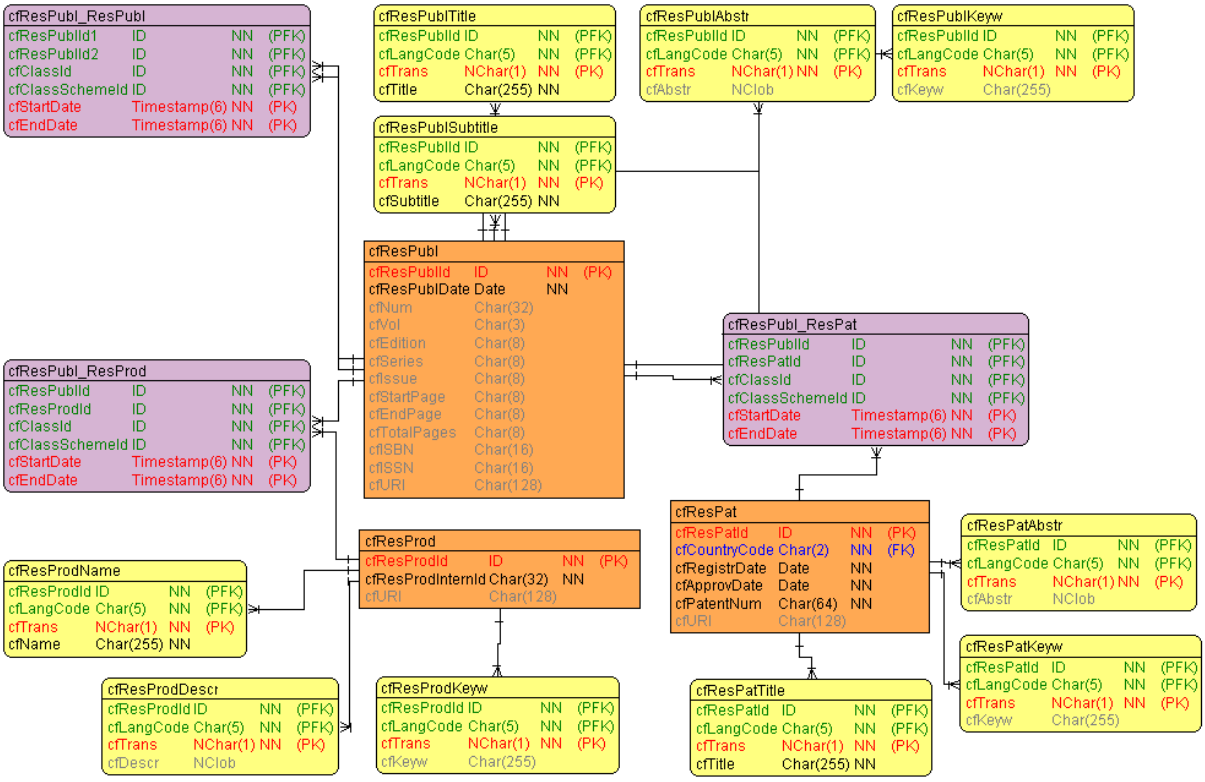

Figure 8: CERIF Result Entities, their Recursion and some Link Entities

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 attributes to represent publication records. 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_FundProg, cfResPubl_Class) as shown in figure 9. Each relationship or link entity carries semantics with a time-stamped reference to the Semantic Layer by cfClassId and cfClassSchemId. Additionally, the publication entity supports multilingual features for title, subtitle, abstract, note, abbreviation and keywords (cfResPublTitle, cfResPublSubtitle, cfResPublAbstr, cfResPublKeyw, cfResPublNameAbbrev).

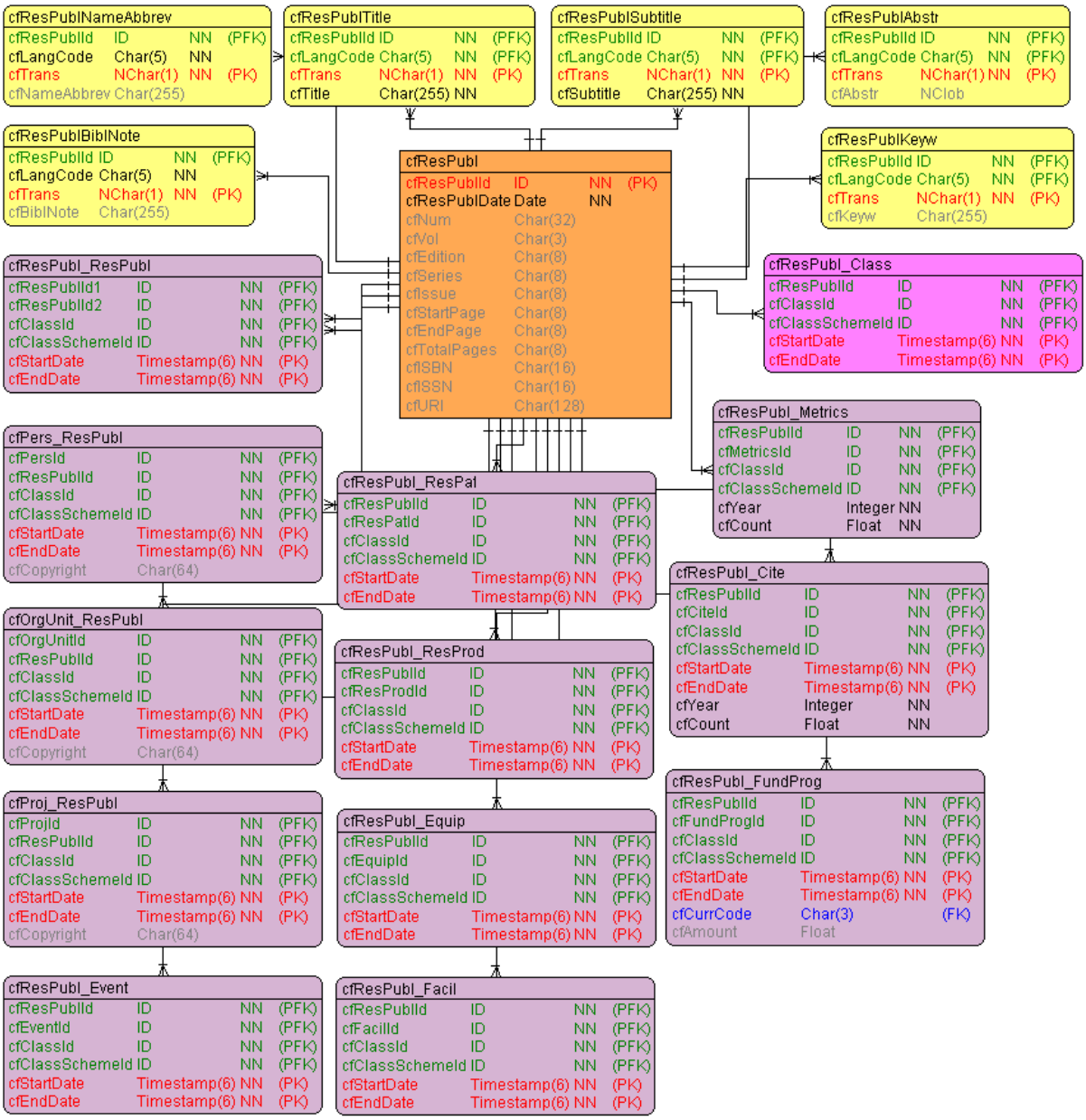

Figure 9: CERIF Result Entity ResultPublication

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 indicated in the Table column, the Type column indicates the entity type (result, lang, link), the semantic values (Conference Proceedings Article, is part of, is author 1 of, is originator of, presented at etc.) are indicated in the Classification column where each value belongs to a particular classification scheme (cfPublicationTypes-2008-1.0, 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 European countries ...	**cfAbstr**	**cfResPublAbstr**	**lang**		
IST, ERA, CRIS, CERIF, Research Competencies, NMS, Analysis, Visualisation, Data Collection,	**cfKeyw**	**cfResPublKeyw**	**lang**		
classification-conf-proc-article	**cfClassId**	**cfResPubl_Class**	**link**	**Conference Proceedings Article**	**cfPublicationTypes-2008-1.0**
publication-get-the-good-cris-going	**cfResPublId2**	**cfResPubl_ResPubl**	**link**	**is part of**	**RESPUBL-RESPUBL**
person-brigitte-joerg	**cfPersId**	**cfPers_ResPubl**	**link**	**is author 1 of**	**PERS-RESPUBL**
person-hans-uszkoreit	**cfPersId**	**cfPers_ResPubl**	**link**	**is author of**	**PERS-RESPUBL**
person-jure-ferlez	**cfPersId**	**cfPers_ResPubl**	**link**	**is author of**	**PERS-RESPUBL**
person-mitja-jermol	**cfPersId**	**cfPers_ResPubl**	**link**	**is author of**	**PERS-RESPUBL**
project-ist-world	**cfProjId**	**cfProj_ResPubl**	**link**	**is originator of**	**PERS-RESPUBL**
event-cris-2008	**cfPersId**	**cfResPubl_Event**	**link**	**presented at**	**RESPUBL-EVENT**

The example record 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 the reference cfClassId=”classification-conf-proc-article”, the publication record is classified as a Conference Proceedings Article according to the Cerif Semantics [12]. A recursive relationship cfResPublId2=”publication-get-the-good-cris-going” refers to the entire proceedings. The example shows some relationships with persons in different roles of authorship. 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 cfEventId=”event-cris-2008”. 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.

* The attribute cfResultPublicationDate requires the recording of at least the year. In cases where there is no month or days available, we recommend the recording convention: YYYY-01-01.

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 journal of which the article is part. The example record is classified by the Springer subject scheme into ”Computer Science”, the ISSN number is print, a person link carries the author role, and the link to the organisation record ”organisation-springer” indicates the publisher of the article.

Table 5: CERIF ResultPublication Example Record

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, there is a need to incorporate more understanding of the real world in the information that is stored in a database. Semantic data models have been developed to try to capture some of the meaning, as...	**cfAbstr**	**cfResPublAbstr**	**lang**		
Database design, entity relationship model, relational model, semantic relationships, …	**cfKeyw**	**cfResPublKeyw**	**lang**		
classification-journal-article	**cfClassId**	**cfResPubl_Class**	**link**	**Journal Article**	**cfPublicationTypes-2008-1.0**
classification-issn-print	**cfClassId**	**cfResPubl_Class**	**link**	**ISSN (print)**	**ISSN SCHEME**
classification-computer-science	**cfClassId**	**cfResPubl_Class**	**link**	**Computer Science**	**SPRINGER-SUBJECTS**
publication-vldb-journal	**cfResPublId2**	**cfResPubl_ResPubl**	**link**	**is part of**	**RESPUBL-RESPUBL**
person-veda-c-storey	**cfPersId**	**cfPers_ResPubl**	**link**	**is author of**	**PERS-RESPUBL**
organisation-springer	**cfOrgUnitId**	**cfOrgUnit_ResPubl**	**link**	**is publisher of**	**ORGUNIT-RESPUBL**

Table 6 shows another example record for the VLDB Journal. From table 5 with the cfResPublId2 there is a reference to the Journal record example in table 6, carrying the semantics (is part of). The record in table 6 establishes the same relationship in the opposite direction (has part) to its article cfResPublId2=”publication-veda-c-storey”. CERIF enables the storage of journal records as well as journal article records. The Journal as well as the Article is considered as a type of publication and each belongs to the CERIF Semantics [12].

* More and more, two different ISSN numbers are given for the print and online version of a publication. In cases where a publication has two different ISSN numbers (online and print) we recommend the storage of two separate publication records, classifying them into either category. It may additionally be assumed that the contents do not overlap 100%.

Table 6: CERIF ResultPublication Example Record

CERIF ResultPublication example database entry				**Semantic Layer (CERIF Semantics)**	
Data	**Attribute**	**Table**	**Type**	**Classification (ClassIds)**	**Classification Scheme**
publication-vldb-journal	**cfResPublId**	**cfResPubl**	**result**		
2002-04-05	**cfResPublDate**	**cfResPubl**	**result**		
0949-877X	**cfISSN**	**cfResPubl**	**result**		
http://www.springerlink.com/content/q3615k342775/?p=e7ae3af630154cc083ff2cc9ccb9fda0&pi=62	**cfURI**	**cfResPubl**	**result**		
The VLDB Journal	**cfTitle**	**cfResPublTitle**	**lang**		
classification-journal	**cfClassId**	**cfResPubl_Class**	**link**	**Journal**	**cfPublicationTypes-2008-1.0**
classification-issn-online	**cfClassId**	**cfResPubl_Class**	**link**	**ISSN (online)**	**ISSN SCHEME**
classification-computer-science	**cfClassId**	**cfResPubl_Class**	**link**	**Computer Science**	**SPRINGER-SUBJECTS**
classification-database-management	**cfClassId**	**cfResPubl_Class**	**link**	**Database Management**	**SPRINGER-SUBJECTS**
publication- veda-c-storey	**cfResPublId2**	**cfResPubl_ResPubl**	**link**	**has part**	**RESPUBL-RESPUBL**
organisation-springer	**cfOrgUnitId**	**cfOrgUnit_ResPubl**	**link**	**is publisher of**	**ORGUNIT-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. 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 semantic scheme for publication types and related roles has been introduced: CERIF Semantics [12].

The enhancements of the result publication entity with the current CERIF 2008 – 1.0 release allow 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 generated from table 4	**BibTeX example record generated from 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}, }

2.3.2 CERIF Entity ResultPatent

For an identification of records the result patent entity (cfResPat) foresees an id attribute (cfResPatIId). Besides, the attributes country code, registration date, approval date, patent number and uri (cfCountryCode, cfRegistrDate, cfApprovDate, cfPatentNum, cfURI) are considered common attributes to represent patent records. The result patent entity maintains many relationships with other entities: publication, organisation, project, person, funding programme (cfResPat_Class, cfResPubl_ResPat, cfOrgUnit_ResPat, cfProj_ResPat, cfResPat_FundProg, cfPers_ResPat) as shown in figure 10. Each relationship or link entity carries semantics with a time-stamped reference to the Semantic Layer by cfClassId and cfClassSchemId. Additionally, the result patent entity supports multilingual features for title, abstract, and keywords (cfResPatTitle, cfResPatAbstr, cfResPatKeyw).

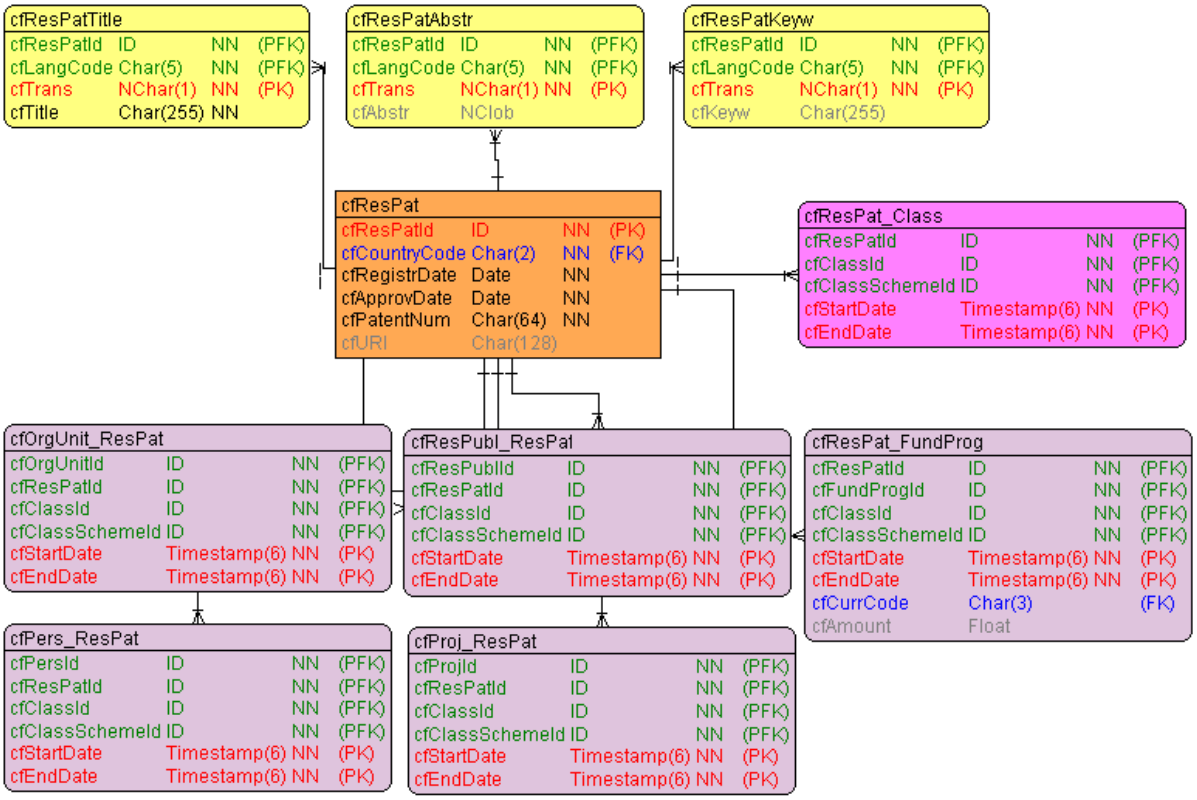

Figure 10: CERIF Result Entity ResultPatent

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 common attributes to represent product records. 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_FundProg) as shown in figure 11. Each relationship or link entity carries semantics with a time-stamped reference to the Semantic Layer by cfClassId and cfClassSchemId. Additionally, the result product entity supports multilingual features for the name, for description, and keywords (cfResProdName, cfResProdDescr, cfResProdKeyw).

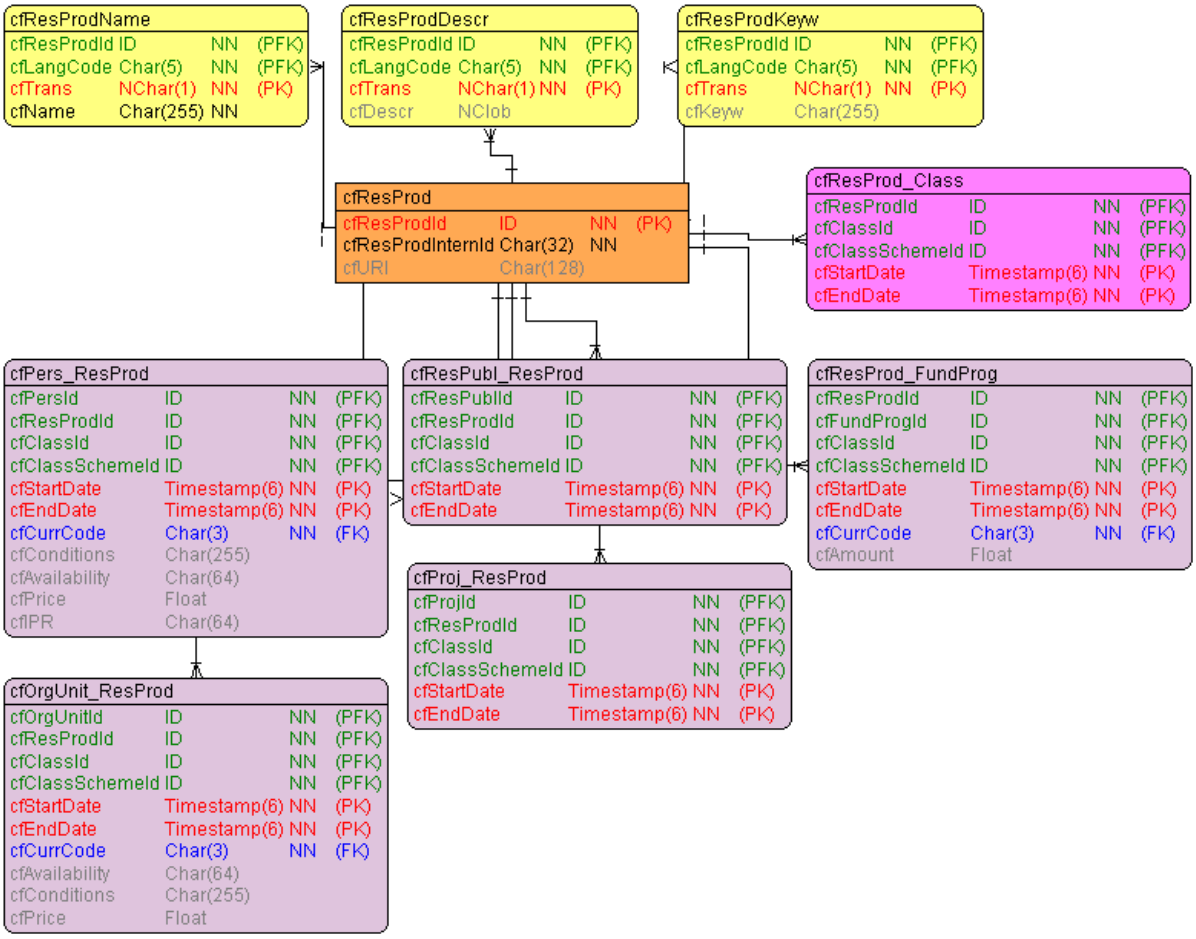

Figure 11: CERIF Result Entity ResultProduct

2.4 CERIF 2nd Level Entities

Beyond the core 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 core and result entities, in blue color.

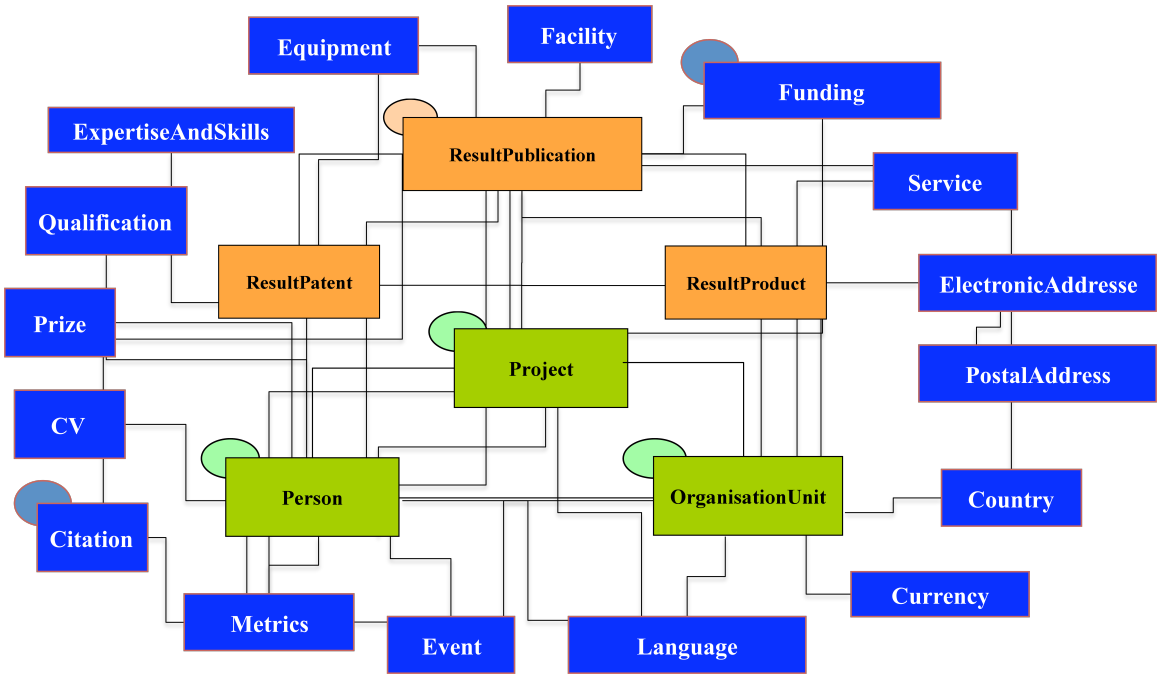

Figure 12: CERIF 2nd Level Entities in blue color organised as a circle around core and result entities

The 2nd level entities allow for the representation of additional research context by linking to them from core, result and 2nd level entities. Each 2nd level entity supplies some basic 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 core 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 core, 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_OrganisationUnit connecting the core entities and the result publication entity.

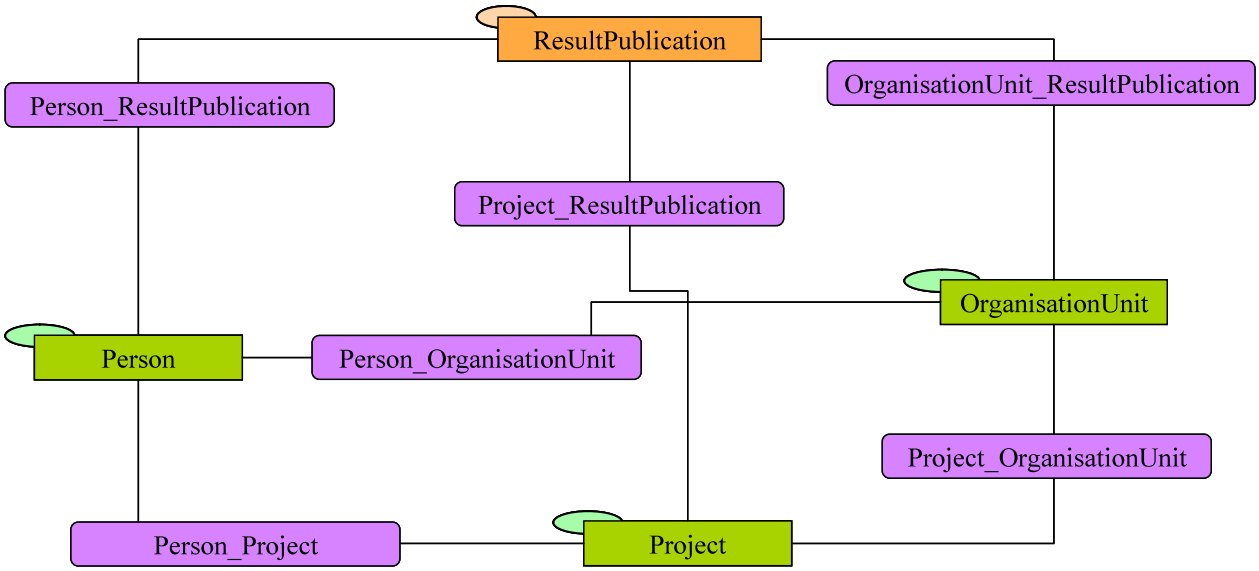

Figure 13: Some CERIF Link Entities in the context of the core entities and a result entity

The link entities have been mentioned in the context of the presented core, 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 14.

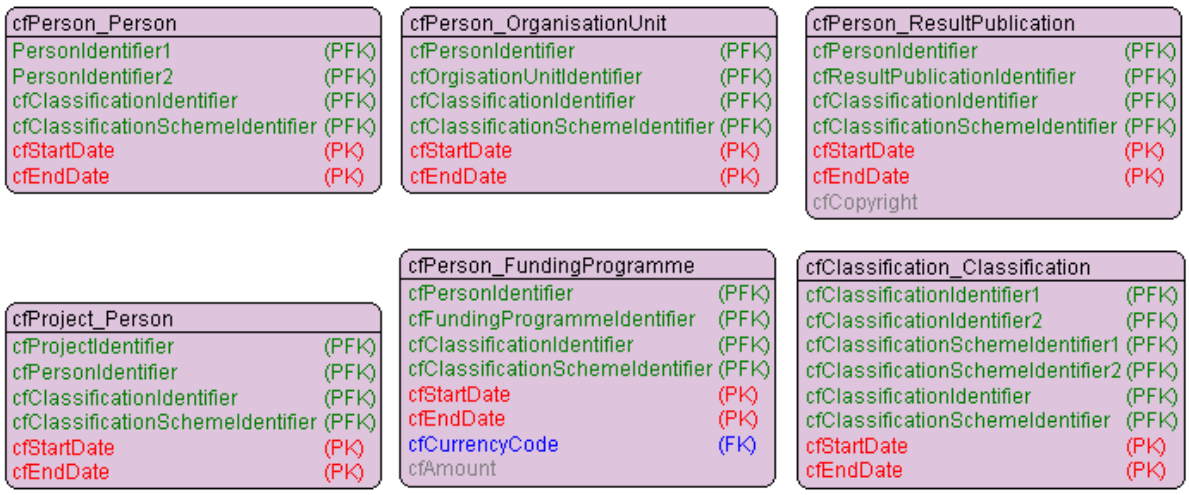

Figure 14: Some CERIF Link Entities to demonstrate the consistency in their structure

Where figure 14 shows examples of some link entities at physical level, figure 15 introduces their structure and functionality from a meta perspective.

cfEntity1Name_Entity2Name	
cfInheritedEntity1Identifier	**(PFK)**
cfInheritedEntity2Identifier	**(PFK)**
cfInheritedClassificationIdentifier	**(PFK)**
cfInheritedClassificationSchemeIdentifier	**(PFK)**
cfStartDate*	**(PK)**
cfEndDate*	**(PK)**

Figure 15: 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 two 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 at where they are maintained (cfEntity1, cfEntity2, cfClassification, cfClassificationScheme). All link entities establish linkage between two entities by id references (cfInheritedEntity1Identifier and cfInheritedEntity2Identifier). Additionally, each link entity carries semantics by reference to the so called CERIF Semantic Layer via the cfInheritedClassificationIdentifier and cfInheritedClassificationSchemeIdentifier (see section 2.7). Besides, each linking record requires a startdate and an enddate. Some link entities allow for attributes like amount or copyright as indicated in figure 14 above. Together, all inherited identifiers and the date attributes build the primary key of link entities.

Some examples for link entities have been presented in the context of core and result entities with the tables 1-6. Some further general linkage examples are now provided in table 8.

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
cfOrgUnit_OrgUnit	orga-id1	orga-id2	has part	OrgUnit-Structure	2009-01-13	2099-12-31
cfOrgUnit_OrgUnit	orga-id2	orga-id3	is part of	OrgUnit-Structure	2009-01-13	2099-12-31
cfPers_OrgUnit	person-id1	orga-id1	is head of	OrgUnit-Person-Roles	2009-01-13	2099-12-31
cfPers_Pers	person-id1	person-id2	is supervisor of	Acad-Person-Roles	2009-01-13	2099-12-31
cfPers_Proj	person-id2	project-id1	is participant of	Project-Person-Roles	2009-01-13	2099-12-31
cfPers_ResPubl	person-id1	publ-id1	is author of	cfPerson-ResultPublicationRoles-2008-1.0	2009-01-13	2099-12-31

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 ‘OrgUnit-Structure’, ‘OrgUnit-Person Roles’, ‘Acad-Person-Roles’, ‘Project-Person-Roles’, ‘Publ-Person-Roles’. Each semantic value (classification identifier) has to be assigned to one particular classification scheme. In table 8, the ”has part” and ”is part of” classifiers belong to the ”OrgUnit-Structure” scheme; the classifier ”is supervisor of” belongs to the ”Acad-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 that will be explained in section 2.7.

* The startdate attribute in link tables represent the date or time at which a record is true in the modeled world; also known as valid time. The cfEndDate attribute represents the date or time at which a record stops to be true in the modeled world, also known as the end of the valid time. In case of unknown startdate values, we recommend the value 1900-01-01. In case of open enddate records, we recommend the value 2099-12-31.

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.

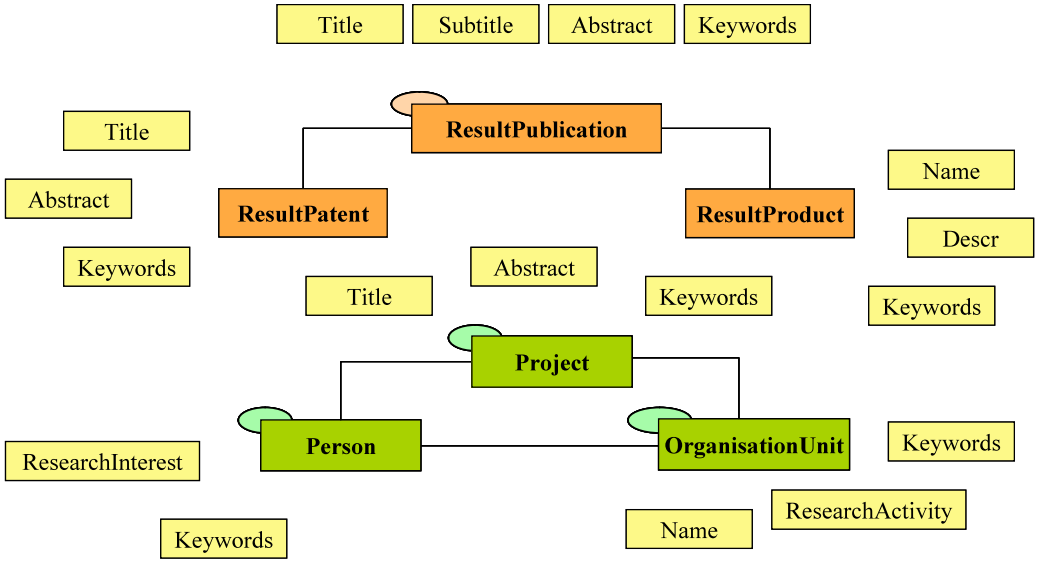

Figure 16: Some CERIF Entities with Multiple Language Features

Figure 17 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.

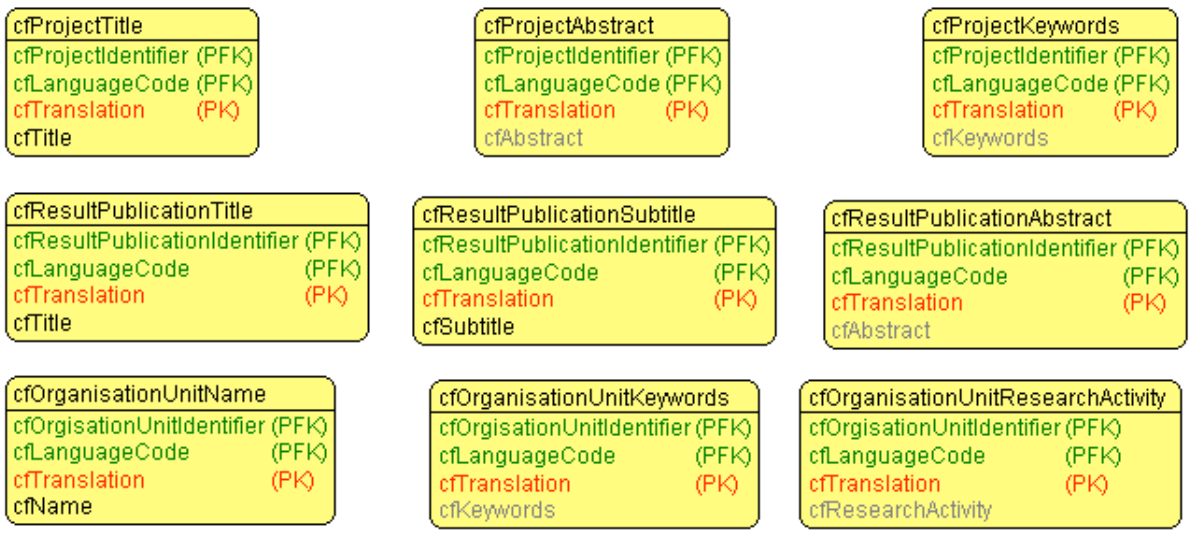

Figure 17: Come CERIF entities with Multiple Language Features

Besides the core, 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: any 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 18.

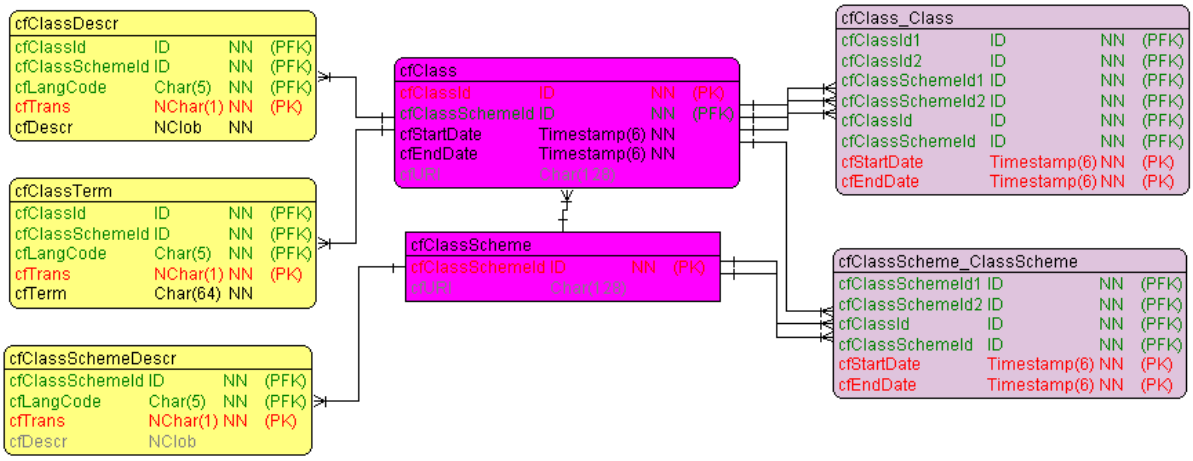

Figure 18: CERIF Semantic Layer

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 class descriptions (cfClassDescr). The both class type entities (cfClass, cfClassScheme) are inter-connected by two recursive link entities (cfClass_Class, cfClassScheme_ClassScheme) to allow for the representation of structures and for the mappings between classifications or classification schemes. The following records in table 9 show some semantic examples, including some of the new CERIF publication types and roles [12].

Table 9: CERIF Semantic Layer examples

cfClassId	cfTerm [cfLangCode=en]	cfClassDescr	Link Entity	cfClass SchemeId
class	lang	lang	link	class
class-1	Book	A book is a …	cfResPubl_Class	cfPublicationTypes-2008-1.0
class-2	Book Review	A book review is a ...	cfResPubl_Class	cfPublicationTypes-2008-1.0
class-3	Book Chapter Abstract	A book chapter is a …	cfResPubl_Class	cfPublicationTypes-2008-1.0
class-4	Book Chapter Review	A book chapter review …	cfResPubl_Class	cfPublicationTypes-2008-1.0
class-5	Inbook		cfResPubl_Class	cfPublicationTypes-2008-1.0
class-6	Anthology		cfResPubl_Class	cfPublicationTypes-2008-1.0
…				
class-10	is author of		cfPers_ResPubl	cfPerson-ResultPublicationRoles-2008-1.0
class-11	is author (numbered) of		cfPers_ResPubl	cfPerson-ResultPublicationRoles-2008-1.0
class-12	is author (percentage) of		cfPers_ResPubl	cfPerson-ResultPublicationRoles-2008-1.0
class-13	is editor (numbered) of		cfPers_ResPubl	cfPerson-ResultPublicationRoles-2008-1.0
class-14	is editor of		cfPers_ResPubl	cfPerson-ResultPublicationRoles-2008-1.0
class-15	is reviewer of		cfPers_ResPubl	cfPerson-ResultPublicationRoles-2008-1.0
…				
class-20	is synonym of	thesaurus synonym reference	cfClass_Class	thesaurus-structure
class-21	is broader term		cfClass_Class	thesaurus-structure
class-22	is narrower term		cfClass_Class	thesaurus-structure

2.8 Additional Features

The cfPersonName entity has been assigned to the (add) type of entity, because it is neither a core, a result, a 2nd level, or a link entity. The current CERIF release contains Dublin Core and Formalised Dublin Core entities and their attributes. With future releases we aim at generating Dublin Core from CERIF rather than keeping the elements within the physical model.

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 [cfPers] (
        [cfPersId] Nchar(32) NOT NULL,
        [cfFamilyNames] Nchar(64) NOT NULL,
        [cfFirstNames] Nchar(32) NULL,
        [cfOtherNames] Nchar(32) NULL,
        [cfSex] Nchar(1) Default u NOT NULL Check (f, m, u ),
        [cfURI] Nchar(128) NULL UNIQUE,
Primary Key  ([cfPersId])
)
```

Extract 19: SQL Extract for MS SQL7 database

```
Create table "cfPers" (
        "cfPersId" NChar(32) NOT NULL ,
        "cfFamilyNames" NChar(64) NOT NULL,
        "cfFirstNames" NChar(32),
        "cfOtherNames" NChar(32),
        "cfSex" NChar(1) Default u NOT NULL  Check (f, m, u ) ,
        "cfURI" NChar(128) NOT NULL  UNIQUE ,
primary key ("cfPersId")
)
```

Extract 20: SQL Extract for Oracle9i database

```
Create table "cfPers" (
        "cfPersId" Char(32) NOT NULL,
        "cfFamilyNames" Char(64) NOT NULL,
        "cfFirstNames" Char(32),
        "cfOtherNames" Char(32),
        "cfSex" Char(1) Default u NOT NULL Check (f, m, u ),
        "cfURI" Char(128) UNIQUE)
```

Extract 21: SQL Extract for DB2 UDB v.8

```
Create table `cfPers` (
        `cfPersId` Char(32) NOT NULL,
        `cfFamilyNames` Char(64) NOT NULL,
        `cfFirstNames` Char(32),
        `cfOtherNames` Char(32),
        `cfSex` Char(1) NOT NULL DEFAULT 'u'
        `cfURI` Char(128),
        UNIQUE (`cfURI`),
 Primary Key (`cfPersId`)) ENGINE = MyISAM;
```

Extract 22: SQL Extract for mySQL

4. CERIF XML

The CERIF 2008 1.0 – 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 – 1.0 FDM model and will be updated according to CERIF model updates.

The following examples show some CERIF XML representations of some link entity records including semantic references. For further examples we refer to [11].

```
<cfPers_ResPubl>
    <cfPersId>person-brigitte-joerg</cfPersId>
    <cfResPublId>publication-analytic-information-service-era</cfResPublId>
    <cfClassId>class-is-author-of</cfClassId>
    <cfClassSchemeId>class-scheme-cfPerson-ResultPublicationRoles-2008-1.0</cfClassSchemeId>
    <cfStartDate>2008-01-00T00:00:00-00:00</cfStartDate>
    <cfEndDate>2008-12-31T00:00:00-00:00</cfEndDate>
</cfPers_ResPubl>
```

Example 1: CERIF XML Person-Publication Relationship

```
<cfPers_OrgUnit>
    <cfPersId>person-brigitte-joerg</cfPersId>
    <cfOrgUnitId>organisation-dfki</cfOrgUnitId>
    <cfClassId>class-is-affiliated-with</cfClassId>
    <cfClassSchemeId>class-scheme-pers-orgunit-roles</cfClassSchemeId>
    <cfStartDate>2000-08-01T00:00:00-00:00</cfStartDate>
    <cfEndDate>2099-12-31T00:00:00-00:00</cfEndDate>
</cfPers_OrgUnit>
```

Example 3: CERIF XML Person-Organisation Relationship

```
<cfClass>
    <cfClassId>class-is-a</cfClassId>
    <cfClassSchemeId>class-scheme-tax-structure</cfClassSchemeId>
    <cfStartDate>2007-09-28T00:00:00-00:00</cfStartDate>
    <cfEndDate>2099-12-31T00:00:00-00:00</cfEndDate>
</cfClass>
<cfClass_Class>
    <cfClassId1>class-information-science</cfClassId1>
    <cfClassId2>class-science</cfClassId2>
    <cfClassSchemeId1>class-scheme-science-tax</cfClassSchemeId1>
    <cfClassSchemeId2>class-scheme-science-tax</cfClassSchemeId2>
    <cfClassId>class-is-a</cfClassId>
    <cfClassSchemeId>class-scheme-tax-structure</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 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 5.

```
<cfClass>
    <cfClassId>class-mappes-to</cfClassId>
    <cfClassSchemeId>class-scheme-CERIF2DC-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-is-author-of</cfClassId1>
    <cfClassId2>class-dc.Creator</cfClassId2>
    <cfClassSchemeId1>class-scheme-cfPublicationTypes-2008-1.0</cfClassSchemeId1>
    <cfClassSchemeId2>class-scheme-DC</cfClassSchemeId2>
    <cfClassId>class-mappes-to</cfClassId>
    <cfClassSchemeId>class-scheme-CERIF2DC-Mapping</cfClassSchemeId>
    <cfStartDate>2009-04-25T00:00:00-00:00</cfStartDate>
    <cfEndDate>2009-04-25T00:00:00-00:00</cfEndDate>
</cfClass_Class>
```

Example 5: CERIF XML Classification Mapping

5. CERIF Semantics

The CERIF Semantics is the 'filler' of the CERIF Semantic Layer. The structure and strength of the Semantic Layer as part of the CERIF model has been presented with this document. With the current CERIF 2008 – 1.0 release, the CERIF Semantics presenting publication types and roles has been introduced as a separate document [12]. In close cooperation with the CERIF Best Practice task group and from real life requirements, implementations and priorities, additional classification schemes will be developed and formalized as part of the CERIF Semantics in upcoming CERIF releases.

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 in one of the subsequent releases.

7. Next Steps

For upcoming realeases and upgrades the focus is on the syntax and semantics in the context of research funding. More work on proper namespaces may be considered for the CERIF XML specifications in the longer term. Additionally, the development of a CERIF ontology is on the agenda.

8. Acknowledgement

We want to thank Jan Dvorak, InfoScience Prague, for his feedback and error detection, and for thoroughly reading through the preview version of this document.

9. Appendix

9.1 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.

9.1.1 CERIF Core Entities (Logical (PhysicalName))

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

9.1.2 CERIF Result Entities (Logical (PhysicalName))

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

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

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

9.1.4 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_FundingProgramme (cfEquip_FundProg)
cfEvent_Event
cfEvent_Classification (cfEvent_Class)
cfEvent_FundingProgramme (cfEvent_FundProg)
cfEvent_ResultPublication (cfEvent_ResPubl)
cfExpertiseAndSkills_Classification (cfExpSkills_Class)
cfFacility_Classification (cfFacil_Class)
cfFacility_FundingProgramme (cfFacil_FundProg)

cfFundingProgramme_Classification (cfFundProg_Class)
cfFundingProgramme_FundingProgramme (cfFundProg_FundProg)
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_FundingProgramme (cfOrgUnit_FundProg)
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_FundingProgramme (cfPers_FundProg)
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_FundingProgramme (cfProj_FundProg)
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_FundingProgramme (cfResPat_FundProg)
cfResultProduct_Classification (cfResProd_Class)

cfResultProduct_FundingProgramme (cfResProd_FundProg)
cfResultCitation_Citation (cfResPubl_Cite)
cfResultPublication_Classification (cfResPubl_Class)
cfResultPublication_DublinCore (cfResPubl_DC)
cfResultPublication_Event (cfResPubl_Event)
cfResultPublication_Equipment (cfResPubl_Equip)
cfResultPublication_Facility (cfResPubl_Facil)
cfResultPublication_FundingProgramme (cfResPubl_FundProg)
cfResultPublication_Metrics (cfResPubl_Metrics)
cfResultPublication_ResultPatent (cfResPubl_ResPat)
cfResultPublication_ResultProduct (cfResPubl_ResProd)
cfResultPublication_ResultPublication (cfResPubl_ResPubl)
cfService_Classification (cfSrv_Class)

9.1.5 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)
cfFundingProgrammeDescription (cfFundProgDescr)
cfFundingProgrammeKeywords (cfFundProgKeyw)
cfFundingProgrammeName (cfFundProgName)
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)

9.1.6 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)

9.1.7 CERIF Classification Entities (Logical (PhysicalName))

cfClassification (cfClass)
cfClassificationScheme (cfClassScheme)

9.1.8 CERIF Attributes including language or currency

9.1.8.1 Language-dependent attributes including cflangCode and cfTrans

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

cfTitle (cfTitle)

9.1.8.2 Currency-dependent attributes

cfBudget (cfBudget)
cfAmoung (cfAmount)
cfPrice (cfPrice)
cfTurnover (cfTurn)

9.2 Logical / Physical CERIF Entity Names

The following table 1 gives an overview of all CERIF 2008 – 1.0 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 CERIF 2008 – 1.0 Entities	Physical CERIF 2008 – 1.0 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_FundingProgramme	cfEquip_FundProg
cfEquipmentDescription	cfEquipDescr

cfEquipmentKeywords	cfEquipKeyw
cfEquipmentName	cfEquipName
cfEvent	cfEvent
cfEvent_Classification	cfEvent_Class
cfEvent_Event	cfEvent_Event
cfEvent_FundingProgramme	cfEvent_FundProg
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_FundingProgramme	cfFacil_FundProg
cfFacilityDescription	cfFacilDescr
cfFacilityKewords	cfFacilKeyw
cfFacilityName	cfFacilName
cfFormalisedDublinCoreRightsManagementPricing	cfFDCRightsMMPricing
cfFormalisedDublinCoreRightsManagementPrivacy	cfFDCRightsMMPrivacy
cfFormalisedDublinCoreRightsManagementRights	cfFDCRightsMMRights
cfFormalisedDublinCoreRightsManagementSecurity	cfFDCRightsMMSecurity
cfFundingProgramme	cfFundProg
cfFundingProgramme_Classification	cfFundProg_Class
cfFundingProgramme_FundingProgramme	cfFundProg_FundProg
cfFundingProgrammeDescription	cfFundProgDescr
cfFundingProgrammeKeywords	cfFundProgKeyw
cfFundingProgrammeName	cfFundProgName
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_FundingProgramme	cfOrgUnit_FundProg
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_FundingProgramme	cfPers_FundProg
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_FundingProgramme	cfProj_FundProg
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
cfPublicationReference	cfPublRef
cfQualification	cfQual
cfQualification_Classification	cfQual_Class
cfQualificationDescription	cfQualDescr
cfQualificationKeywords	cfQualKeyw
cfResultPatent	cfResPat
cfResultPatent_Classification	cfResPat_Class
cfResultPatent_FundingProgramme	cfResPat_FundProg
cfResultPatentAbstract	cfResPatAbstr
cfResultPatentKeywords	cfResPatKeyw
cfResultPatentTitle	cfResPatTitle
cfResultProduct	cfResProd

cfResultProduct_Classification	**cfResProd_Class**
cfResultProduct_FundingProgramme	**cfResProd_FundProg**
cfResultProductDescription	**cfResProdDescr**
cfResultProductKeywords	**cfResProdKeyw**
cfResultProductName	**cfResProdName**
cfResultPublication	**cfResPubl**
cfResultPublication_Citation	**cfResPubl_Cite**
cfResultPublication_Classification	**cfResPubl_Class**
cfResultPublication_DublinCore	**cfResPubl_DC**
cfResultPublication_FundingProgramme	**cfResPubl_FundProg**
cfResultPublication_Equipment	**cfResPubl_Equip**
cfResultPublication_Event	**cfResPubl_Event**
cfResPubl_Facility	**cfResPubl_Facil**
cfResPubl_FundingProgramme	**cfResPubl_FundProg**
cfResPubl_Metrics	**cfResPubl_Metrics**
cfResPubl_ResultPatent	**cfResPubl_ResPat**
cfResPubl_ResultProduct	**cfResPubl_ResProd**
cfResultPublication_ResultPublication	**cfResPubl_ResPubl**
cfResultPublicationAbstract	**cfResPublAbstr**
cfResultPublicationBibliographicNote	**cfResPublBiblNote**
cfResultPublicationKeywords	**cfResPublKeyw**
cfResultPublicationNameAbbreviation	**cfResPublNameAbbrev**
cfResultPublicationSubtitle	**cfResPublSubtitle**
cfResultPublicationTitle	**cfResPublTitle**
cfService	**cfSrv**
cfService_Classification	**cfSrv_Class**
cfServiceDescription	**cfSrvDescr**
cfServiceKeywords	**cfSrvKeyw**
cfServiceName	**cfSrvName**

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