

ITEC - WP 9

D9.1 - ANALYSIS AND DESIGN DOCUMENTS FOR THE DIRECTORY

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ABSTRACT	This document reports on the analysis and design for the iTEC directory. It provides the information model that describes the relevant characteristics and their interrelationships as well as the relevant controlled vocabularies. The document defines the conceptual structure as well as the relevant binding(s).
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¹ PU = Public

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INN - Internal only, only the members of the consortium (excluding the EC services)

DOCUMENT HISTORY

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V0.2	30.03.2011	<ul style="list-style-type: none"> Restructuring. Adding data types, naming conventions, refining object type 'Person' spec, Inserting vocabularies for Application Functionality, Country, Communication Channel, Device, Organization Type 	Draft	Selected partners
V0.3	14.04.2011	Restructuring	Draft	Selected partners
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V0.7	04.05.2011	<p>First complete information model</p> <ul style="list-style-type: none"> Update of the Tool and Event information model Adding various vocabularies. Now 17 	Draft	All technical partners
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Executive summary

iTEC is a large-scale validation project about what (existing and new) ICT is useful or can be made to work in schools. In order to support this large scale investigation and validation exercise, iTEC identified a number of areas for which information should be gathered. These areas are: (a) learning activity with object types such as scenario's, learning stories, activities, (b) resources such as persons, organisations, and events, and (c) technology including applications, devices, and the technological capabilities of schools.

The information gathered about the object types in these areas is recorded in and can be retrieved from the iTEC directory. This document describes the information model for the iTEC directory as it will be implemented in a subsystem known as the iTEC directory back-end.

The iTEC directory back-end relates to different subsystems of the iTEC shell and the iTEC composer. More in particular, the iTEC shell may use the directory back-end in order to find resources such as people and events. It is also used by different components of the directory business layer of the composer comprising the SDE, the authorization module, and specific business logic modules of the composer itself.

This report discusses in more detail the functionality of the iTEC directory back-end but focuses on the information model itself including the vocabularies used and a binding that binds the information model to implementation technologies, in our case JSON.

In addition, this document also reports on the modelling process and how other work packages and stakeholders were involved.

Despite the fact that the scope of this deliverable has been broadened, the information model is now mature enough to go into implementation and subsequent validation by pre-pilots and pilots. Feedback from the (pre-)pilots will without doubt result in changes and further refinements of the information model and the binding.

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1 INTRODUCTION

iTEC is a large-scale validation project about what (existing and new) ICT is useful or can be made to work in schools. In this context, example key questions are:

- Are there good stories of - or good ideas for use of ICT in the classroom that are applicable to my own situation.
- Which technologies are (becoming) available?
- Which digital and other resources are available?
- How can I obtain them?
- How can I integrate them in my technical environment, my workflow, my class room activity?
- etc

An extensive set of question (see competency questions) are given in deliverable D10.1. In order to support this information need, iTEC developed a number of concepts including Scenario, Learning Story, Activity, Tool, People, Event, Technical Setting, etc that when properly described will help answering these questions. These descriptions can be stored in a directory. By sharing descriptions, the described artefacts can be shared and reused as well. However, existing solutions (e.g., LinkedIn, Facebook, events sites) do not allow an integrated approach as access through an API is limited. Therefore, a comprehensive directory is required that does not only relate the different object types but in addition allows for tailoring the available information to the iTEC needs.

PURPOSE AND SCOPE OF THE TASK LEADING TO D9.1

This task is concerned with modelling different object types related to the iTEC scenarios developed in WP2 and goes beyond what has been described in task 9.1 which is concerned with actors and events. Object of interest to iTEC must be properly described and this comprises the following subtasks:

- Review existing conceptual description frameworks (information models) and controlled vocabularies.
- Select and profile most appropriate description frameworks - to fit the project objectives
- Bind the selected profiles to relevant technologies

RELATIONSHIP WITH OTHER TASKS

WP9 has as main task to provide the iTEC directory back-end that holds most of the information shared by iTEC users. As such it is related to many WPs as stakeholders or users.

The following WPs provided input to the iTEC directory information model:

- WP2 provided the basis for the Scenario model
- WP3 and WP10 provided input around Scenarios, LearningStories, Activities
- WP4 provided input for the People and Organisation model
- WP3 provided input for the Events model
- WP8 provided input to the Tools model

Users of information modelled by this deliverable are:

- WP3 when they run the pre-pilots and elaborate the pre-pilots
- WP4 and WP6 when running the pilots
- WP5 will rely on the directory for getting usage data.
- WP7 is interfacing with the iTEC directory back-end for providing the Composer functionality.
- WP10 is taking the information stored in the iTEC directory back-end as a basis for the SDE RDF store. Data in the iTEC Back-end Directory will be periodically transferred to the SDE, to be transformed and enriched using a semantic representation. Therefore, a complete binding is needed between information models used in both systems.

STRUCTURE OF THE DOCUMENT

Section two gives an overview of the architecture that the information model will be supporting. Section 3 is provides the information model itself, section 4 provides the vocabularies of the information model section 5 provides the binding, and finally section 6 provides a conclusion and some interesting results.

IMPACTS OF THE DELIVERABLE

iTEC PROJECT

This deliverable relates to

- milestone MS28 (due month 9): iTEC actor information model released (Actor information model document exists) and
- milestone MS29 (due month 21): WP9 Directory released (A demo of the directory).

Despite the fact that the scope of this deliverable has been broadened very much, a first complete version (V0.7) of the information model – including the Actor information model was circulated for comments about one month in advance of the 9 month due date.

MS29 is due month 21 and D9.1 constitutes the basis for timely delivery.

There are no new risks detected during the period under report.

ETHICAL ISSUES

None

IPR ISSUES

None

2 THE ITEC DIRECTORY BACK-END

While the iTEC directory back-end is serving different systems, its main functionality is serving the composer which has a front-end, a business logic layer and a back-end (See figure 2.1). The business logic consists of the SDE, as developed by WP10, and specific composer business logic and authentication/authorization functionality developed by WP7.

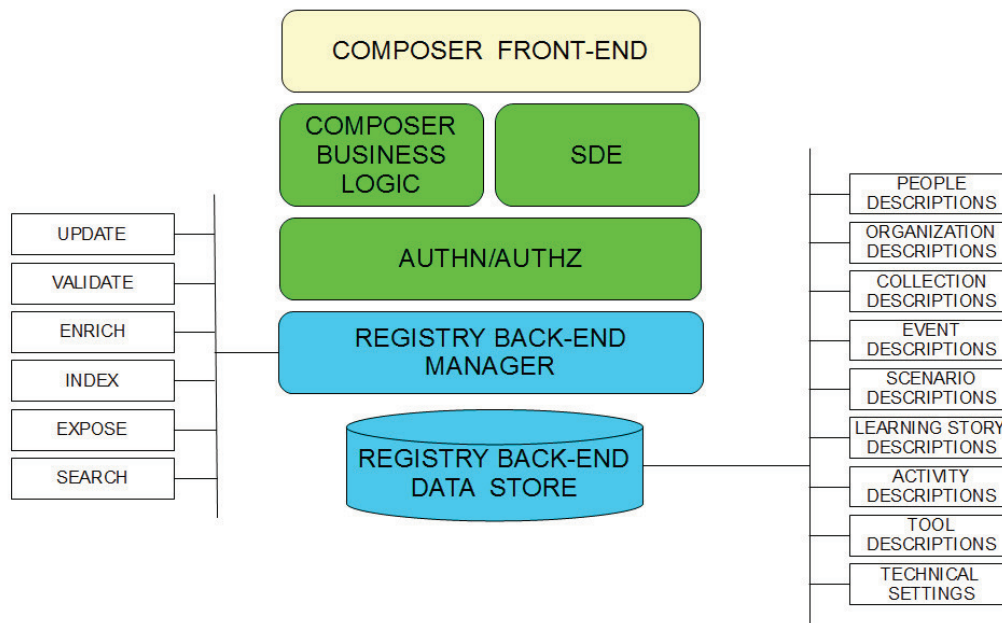


Figure 2.1 The directory back-end in the three-tier architecture of the iTEC composer

The directory back-end (in blue colour) consists of a Directory Back-end Manager and a Directory Back-end Data store. The latter holds data of the following object types

- **Activity:** An Activity identified in a Learning Story that must be carried out by one or more persons. A learning activity is larger than a task. A typical learning story will include 3-8 learning activities. A learning activity refers to the resources that are needed to successfully complete it. It also includes information such as motivation, preparation instructions, and guidelines.
- **Agent:** Something that can perform actions. In iTEC it is an abstract type with subtypes: Person, Organization
- **Collection:** A collection of other objects.
- **Event:** Something that happens or takes place at a determinable place and time
- **ITECObject:** This is an abstract type². Any of the other object types mentioned here are a subtype of ITECObject. An ITECObject has for example an id, a last modification date, and a creation date that each subtype will inherit.
- **LearningStory:** A narrative description of a learning context that is more concrete than an educational scenario and is more helpful to teachers when designing their lesson

² An abstract type can not be populated directly, but only when one of its subtypes is created.

plans. A learning story refers to several learning activities and is an exemplification of them working together.

- Organization: An organization such as an educational institution, governmental bodies, MoE
- Resource: This is an abstract class with subclasses: Person, Event, LearningObject, and Tool
- Person: A human being playing a role in the context of iTEC.
- Scenario: A narrative description of a preferable learning context that takes account of user stories, including the description of resources and the functionalities needed, the interactions they have, the tasks they perform and the aims of their activities, set within a description of the model learning environment
- TechnicalSetting: the set of tools that a school already has available (Local Technology) or that may be accessed through the iTEC Application Store (iTEC Technology). A teacher can have his own technical setting.
- Tool: information technology artefact used for educational purposes in the framework of the iTEC project

3 THE ITEC DIRECTORY INFORMATION MODEL

The iTEC directory information model describes all the information that can be recorded in and retrieved from the iTEC directory. This section discusses the information modelling process, the data types, and the information model itself.

3.1 THE INFORMATION MODELLING PROCESS

The development of the information model started with desk research and an initial model was presented and discussed in depth with all work packages³ which had the opportunity to give feedback. Further in depth discussions were organised with different stakeholders in the ensuing months. Technical work packages established a guiding principle (the Dublin guiding principle⁴) that iTEC would start with a minimal model and expand as requirements became clearer. This approach was followed in order to help the scoping of the information model taking into account that not all requirements are and could not be clear from the beginning of the project.

- The Scenario object type was modelled according to the example scenarios provided by WP2. The initial model was taken from the scenario descriptions as available in January 2011. This was updated in July 2011 with the format used at that time. Finally, the model was reduced after some further discussion following the Dublin guiding principle.
- WP3 and WP10 provided input around LearningStories and Activities. This went through several iterations with object types such as BundledScenarios and ScenarioInstantiations. Eventually⁵ it was decided by WP3 to use Activities and LearningStories, which gave a more stable model.
- KULeuven performed a comparative analysis of twelve existing directories of persons. The comparative analysis of Person directories led to the conclusion that for practical reasons the existing EUN schools database should be adopted. A number of meetings to refine and discuss this model were conducted.
- KULeuven also WP9 performed a comparative analysis of six existing directories for events. An initial model has been elaborated but more information from the Pilots will be required in order to decide which kind events are useful.
- The tools model was elaborated in collaboration with WP7 and WP8. The suggestion was to use the building blocks as developed in deliverable D2.3 of the iCamp project. After initial adoption the model was rejected as too complex for purposes of iTEC referring to the Dublin guiding principle. However, the approach to use affordances for describing Tool functionalities is retained for experimentation and validation.
- Other learning objects such as TechnicalSetting, Collection, ITECObject were developed based upon various requirements.
- Finally, 10 vocabularies were selected from the Vocabulary Bank for Education (VBE) and 8 vocabularies were developed in collaboration with various work packages.

³ Technical workshop in Brussels – January 2011

⁴ Technical Workshop in Dublin – June 2011

⁵ After the workshop in Arhus – March 2011

3.2 INFORMATION MODEL FORMAT

For each object type as well as compound data type a full specification is given. Such a specification consists of a structured set of data elements (see for example section 3.3.8 or the object types elaborated in section 1.1). Each data element has:

- A reference number. Reference numbers may be structured indicating that it is an element within a container element. For example: contact channel may consist of a tuple <name, connection>. Elements of the tuple would have a reference number 14.1 and 14.2, while the container element would have the reference number 14. Elements indicating a relationship to instances of another object type start from reference number 100.
- A name. A name which is unique within the object type or the container element.
- A description. A textual description of the data element.
- Multiplicity. Multiplicity indicates how many times a data element may occur. It can be a single integer n , which indicates that the data element should appear exactly n times. The most common use of n is 1, indicating that the data element should occur exactly once. Multiplicity may also be given as a range of two integers $n..m$, indicating that the data element should occur minimum n times and maximum m times. Finally, multiplicity can be given as $n..*$, indicating that the data element should appear minimum n times and that the maximum is undefined. In this case a number known as the *smallest permitted maximum* is given in parenthesis. This is the minimum number of items that the directory or another data handling tool is expected to be able to handle for a given data element. That is, implementers cannot set a maximum number of items that can be recorded for an element that is any smaller than the number specified by the smallest permitted maximum.
- Order. This attribute takes the value *unspecified* for multiplicity 1 or 0..1, and *ordered* or *unordered* otherwise. When the value *ordered* is given, then more explanation can be found in the Note column.
- Value Space. The space from which values can be drawn. For example it may be a set of vocabulary terms.
- Data type: See section 3.3
- Note. An additional note where appropriate. This may for example refer to Semantic Web equivalences (e.g., foaf⁶:givenName) for later use.

3.3 DATA TYPES

The *naming convention* for object types and their data elements is camel case. The object type names start with an uppercase character, the data elements start with a lowercase character. The iTEC information model supports the following data types:

3.3.1 CharacterString

A string of characters in Unicode.

3.3.2 Number

An integer or a real. See <http://www.w3.org/TR/xmlschema-2/#isoformats>

⁶ foaf stands for friend of a friend, one of the semantic web ontologies.

An integer has a lexical representation consisting of a finite-length sequence of decimal digits (#x30-#x39) with an optional leading sign. If the sign is omitted, "+" is assumed.

A real has a lexical representation consisting of a mantissa followed, optionally, by the character "E" or "e", followed by an exponent. The exponent *must* be an integer.

3.3.3 Boolean

Boolean takes the values 'true' or 'false'.

3.3.4 DateTime

This element is based on ISO 8601 and contains date and time information. The format follows Date and Time Formats as specified by the W3 consortium. See <http://www.w3.org/TR/NOTE-datetime> or <http://www.w3.org/TR/xmlschema-2/#isoformats>

YYYY[-MM[-DD[Thh[:mm[:ss[.s[TZD]]]]]]] where:

YYYY = four-digit year

MM = two-digit month

DD = two-digit day of month

hh = two digits of hour (00 through 23)

mm = two digits of minute (00 through 59)

ss = two digits of second (00 through 59)

s = one or more digits representing a decimal fraction of a second

TZD = time zone designator ("Z" for UTC or +hh:mm or -hh:mm)

At least the four digit year must be present. If additional parts of the DateTime are included, the character literals "-", "T", ":", and "." are part of the character lexical representation for the DateTime. If the time portion is present, but the time zone designator is not present, the time zone is interpreted as being UTC.

3.3.5 Duration

This element contains information about an interval in time.

P[yY][mM][dD][T[hH][mM][s1[.s2]S]] where:

y = number of years (integer, > 0)

m = number of months (integer, > 0)

d = number of days (integer, > 0)

h = number of hours (integer, > 0)

n = number of minutes (integer, > 0)

s1 = number of seconds (integer, > 0; or integer >= 0 if s2 > 0)

s2 = fraction of seconds(integer, > 0)

See <http://www.w3.org/TR/xmlschema-2/#isoformats>

The character literal designators "P", "Y", "M", "D", "T", "H", "M", "S" must appear if the corresponding nonzero value is present.

If the value of years, months, days, hours, minutes or seconds is zero, the value and corresponding designation (e.g., "M") may be omitted, but at least one designator and value must always be present. The designator "P" is always present. The designator "T" shall be omitted if all of the time (hours/minutes/seconds) are zero.

3.3.6 Language

In order to specify a language such as in a data element or in any language string, the following coding scheme is used. The first applicable format should be used.

1. use a 2 letter code from ISO 639-1
2. use a 3 letter code from ISO 639-2. See: <http://www.loc.gov/standards/iso639-2/normtext.html> (it does not matter between bibliographic & terminology since they only differ for languages that have 2-letter codes)
3. add the ISO Country code (ISO 3166) when necessary, separated by a dash.
4. use IANA registered language tags, prefixed with i-
5. use SIL Ethnologue 3-letter codes, prefixed with x-E-
6. make up a name for token languages prefixed with x-t-
7. make up a name, prefixed with 'x-' for user defined languages. A specific category of user defined languages are formal languages. They have a 'x-f-' prefix.

Examples are:

nl	Dutch
aus	Australian Languages
i-klíngon	IANA registered Klingon
x-E-pcd	Picard
x-none	Not possible to identify a language
x-f-ccRDF	Creative Commons expression in RDF format

3.3.7 ObjectID

ObjectID is an identifier pointing to an object in the iTEC back-end. It is constructed as `./<objecttypename>/<identifier>`. The `<objecttypename>` is the object type name as given in the next section, the `<identifier>` is a positive integer. Example `./Person/123`. At runtime the dot is resolved to the base URL where the back-end is running. In principle this will be 'itec.eun.org'.

3.3.8 LangString

LangString data elements contain Language and String parts, allowing the same information to be recorded in multiple languages.

Nr	Name	Description	Multi- plicity	Order	Value space	Data type	Note
1	langString	A datatype that represents one or more character strings. A LangString value may include multiple semantically equivalent character strings, such as translations or alternative descriptions.	1..* (100)	Unspecified	-	-	-
1.1	language	Human or formal language of the character string.	1	Unspecified	See section 3.3.6	CharacterString	-
1.2	string	Actual character string..	1	Unspecified	-	CharacterString	-

3.3.9 VocabularyTerm

VocabularyTerm data elements are constrained in such a way that their entries have to be chosen from a controlled list of terms - composed of source-value pairs - with the source containing the name of the list of terms being used and the value containing the chosen term. In general, the source element will be omitted in iTEC, given that all vocabularies come from the same source; viz. the iTEC vocabularies. However, external vocabularies could be used in the future.

Nr	Name	Description	Multi- plicity	Order	Value space	Data type	Note
1	source	An indication of the source of the value, for instance through a URI.	0..1	Unspecified	<URI to an external vocabulary>	CharacterString (smallest permitted maximum: 1000 char)	-
2	value	The actual value.	1	Unspecified	-	LangString (smallest permitted maximum: 1000 char)	If the vocabulary is used by machines then value would be typically a machine readable token; for example an identifier.

3.4.1 ITECObject

ITECObject							
Nr	Name	Description	Multiplicity	Order	Value space	Data type	Note
1	id	Unique ID for the Person record	1	Unspecified		Number, a positive integer	
2	lastModifDate	Date of last modification	1	Unspecified		DateTimeStamp	
3	creationDate	Date of creation	1	Unspecified		DateTimeStamp	
4	owner	The Person who has maximum rights to this Object	1	Unspecified		ObjectId	Usually the creator

3.4.2 Person

Person							
Nr	Name	Description	Multiplicity	Order	Value space	Data type	Note
1	login	Unique ID used in the authentication of the Person	1	Unspecified		CharacterString	
2	category	The category of a Person	1	Unspecified	See section 4.13	VocabularyTerm	
3	givenName	Given name or first name	1	Unspecified		CharacterString	foaf:givenName
4	familyName	Family name or last name / surname	1	Unspecified		CharacterString	foaf:familyName
5	birthDate	Date of birth	0..1	Unspecified		Date	bio:event -> bio:Birth -> and bio:date
6	gender	Gender of the Person	0..1	Unspecified		VocabularyTerm	foaf:gender
7	description	Description of the Person	0..1	Unspecified		LangString	dct:description
8	country	Country of residence	0..1	Unspecified	See section 4.4	VocabularyTerm	
9	registrationDate	Date of registration	1	Unspecified		DateTime	
10	mbox	Email address for the account	1	Unspecified		CharacterString, a valid email address	In LinkedData: foaf:mbox
11	website	Personal website	0..1	Unspecified	URL	CharacterString	foaf:homepage
12	languageMotherTongue	Mother tongue	0..1	Unspecified		Language	
13	languageOther	Other spoken languages	0..* (10)	Ordered		Language	
14	contactChannels	The channels through which a Person can be contacted	0..* (10)	Ordered			Some mappings to LinkedData: foaf:skypeID
14.1	name	The name of the channel	1	Unspecified		CharacterString	
14.2	connection	A String by which one could connect to this Person using this channel	1	Unspecified		CharacterString	This could be for example a skype name, a telephone number, etc
15	expertise	Tags indicating the expertise of this Person	0..* (10)	Unordered	See section 4.9	VocabularyTerm.	
16	img	A URL to the image of this Person	0..1	Unspecified	URL	CharacterString	In LinkedData: foaf:img. (But it might be resolved differently)
100	organization	A relation indicating the affiliation (object type Organization) of a Person	0..* (10)	Unordered		objectID	
101	learningStory	A relation indicating the LearningStory in which the Person is involved	0..* (1000)	Unordered		objectID	This relation has the relation attribute: role.

102	group	A relation indicating the Group (i.e., the collection of people) in which this Person is involved	0..* (1000)	Unordered	object of Collection	
103	knows	A relation indicating the Person known by this Person	0..* (1000)	Unordered	objectID	In LinkedData: foaf:knows. Perhaps also a relation attribute could be inserted.
104	technicalSetting	The tools used by this Person	0..* (100)	Unordered	objectID	

3.4.3 Organization

Organization							
Nr	Name	Description	Multiplicity	Order	Value space	Data type	Note
1	type	Organisation type (ex: School, Ministry, ...)	0..1	Unspecified	See section 4.12	VocabularyTerm	
2	sector	Private or public sector	0..1	Unspecified	See section 4.17	VocabularyTerm	
3	setting	Learner type related to gender	0..1	Unspecified	See section 4.15	VocabularyTerm	
4	address	Address organization	1	Unspecified		CharacterString	
4.1	officialName	Name of the organization	1	Unspecified		CharacterString	
4.2	street	Street of the organization	1	Unspecified		CharacterString	
4.3	town	Town of the organization	1	Unspecified		CharacterString	
4.4	postalCode	Postal code of the organization (not mandatory as some countries don't use Postal codes)	0..1	Unspecified		CharacterString	
4.5	region	Other Region format (for non-European countries or to map to EUN Vocabularies)	0..1	Unspecified	See section 4.1	VocabularyTerm	
4.6	country	Country of the organization (origin)	1	Unspecified	See section <input type="checkbox"/>	VocabularyTerm	
5	description	Description of the school	0..1	Unspecified		CharacterString	
6	telephone	Telephone number of the organization	0..1	Unspecified		CharacterString	
7	fax	Fax number of the organization	0..1	Unspecified		CharacterString	
8	mbox	Email address of the organization	0..1	Unspecified		CharacterString	
9	area	Area of the organization (Urban, Rural, ...)	0..1	Unspecified	See section 4.10	VocabularyTerm	
10	longitude	Longitude value (for Google Maps usage)	0..1	Unspecified	/	Numeric	The location of the main office
11	latitude	Latitude value (for Google Maps usage)	0..1	Unspecified		Numeric	
12	website	Website of the organization	0..1	Unspecified	URL	CharacterString	
13	ageRange	Supported pupil age	1	Unspecified	See section 4.11	VocabularyTerm	
14	numberOfComputers	Number of computers in the school	0..1	Unspecified		Numeric	
15	numberOfStudents	Number of students in the organization	0..1	Unspecified		Numeric	
100	technicalSetting	The tools used by this Organization	0..* (100)	Unordered		ObjectID	

⁷ Given in terms of latitude and longitude

3.4.4 Collection

Collection							
Nr	Name	Description	Multiplicity	Order	Value space	Data type	Note
1	name	The name of this Collection	1	Unspecified		LangString	
2	description	A description of this Collection	0..1	Unspecified		LangString	
100	member	A member of this Collection	0..* (1000)	Ordered		ObjectID	The order of entry is preserved. Members can be any object
101	collection	The parent Collection of this Collection	0..1	Unspecified		ObjectID	

3.4.5 Event

Event							
Nr	Name	Description	Multiplicity	Order	Value space	Data type	Note
1	name	The name of the Event	1	Unspecified		LangString	
2	eventDate	Starting data of the Event	0..1	Unspecified		Date	
3	eventDuration	Duration of the Event	0..1	Unspecified		Duration	
4	subject	Tags indicating the educational subject of this event	0..* (100)	Unordered	See section 4.9	VocabularyTerm.	
5	description	Event description	0..1	Unspecified		LangString	
6	intendedAudience	Description of the intended audience	0..1	Unspecified		LangString	
7	place	Place of the Event	0..1	Unspecified			
7.1	name	Name of the Place of the Event	0..1	Unspecified		CharacterString	
7.2	longitude	Longitude value (for Google Maps usage) of the Place of the Event	0..1	Unspecified		Numeric	
7.3	latitude	Latitude value (for Google Maps usage) of the Place of the Event	0..1	Unspecified		Numeric	
7.4	category	Category of the place	0..1	Unspecified	See section 4.6	VocabularyTerm	
8	eventType	Type of Event	0..1	Unspecified	See section 4.7	VocabularyTerm	
9	language	Language of the Event	0..* (100)	Ordered		Language	The order of entry is preserved
10	website	Website of the Event	0..1	Unspecified		URL	
11	minimumNumAttendees	Minimum number of expected attendees	0..1	Unspecified		Numeric	
12	maximumNumAttendees	Minimum number of expected attendees	0..1	Unspecified		Numeric	
13	organizer		0..* (100)	Ordered			The order of entry is preserved
13.1	role	Role of the organizing Agent	1	Unspecified		LangString	
13.2	agent	A relation indicating the agent playing a role in this Event	0..* (100)	Ordered		ObjectID	The order of entry is preserved
100	tools	Supporting tools.	0..* (100)	Unordered		ObjectID	For example FlashMeeting

3.4.6 Scenario

Scenario							
Nr	Name	Description	Multiplicity	Order	Value space	Data type	Note
1	title	The title of the Scenario	1	Unspecified		LangString	
2	aspirationStatement	A Statement detailing the educational aspirations of this Scenario	1	Unspecified		LangString	
3	narrativeStatement	A statement describing the Scenario	1	Unspecified		LangString	
4	webLink	A link for downloading the scenario	0..* (10)	Unordered		URI	
100	learningStory	A relation indicating the LearningStory derived from this Scenario	0..* (1000)	Unordered		ObjectID	

3.4.7 LearningStory

LearningStory							
Nr	Name	Description	Multiplicity	Order	Value space	Data type	Note
1	title	The title of the LearningStory	1	Unspecified		LangString	
2	description	A description of this LearningStory	1	Unspecified		LangString	
3	example	An example of this LearningStory	1	Unspecified		LangString	
4	tag	A descriptive phrase for this LearningStory	0..* (100)	Unordered		LangString	
100	scenario	A relation indicating the Scenario from which this LearningStory is derived	0..1	Unspecified		ObjectID	
101	activity	A relation indicating the different Activities that are part of this LearningStory	0..* (100)	Ordered		ObjectID	The order of input is preserved

3.4.8 Activity

Activity							
Nr	Name	Description	Multiplicity	Order	Value space	Data type	Note
1	title	The title of this Activity	1	Unspecified		LangString	
2	description	A description of this Activity	1	Unspecified		LangString	
3	learningOutcome	The expected learning outcome from this Activity	1	Unspecified		LangString	
4	tag	A descriptive phrase for this Activity	0..*(100)	Unordered		LangString	
5	motivation		1	Unspecified			
5.1	teacher	An explanation of why a teacher should consider this activity	0..1	Unspecified		LangString	
5.2	student	An explanation of why a student should consider this activity	0..1	Unspecified		LangString	
6	reasonForTechnology	An explanation of why using technology makes sense	1	Unspecified		LangString	
7	guidelines		1	Unspecified			
7.1	requiredTime	A description of the required time for this activity	1	Unspecified		Duration	
7.2	preparation	Suggested tasks for the preparation	1	Unspecified		LangString	
7.4	description	A guideline text	1	Unspecified		LangString	
7.3	assessment	A suggestion for the assessment	1	Unspecified		LangString	
8	resource	The resource to be used for this activity	0..*(100)	Ordered			Order is the order of input
8.1	type	The resource type	1..*	Unspecified	See section 4.8	VocabularyTerm	
8.2	optionality	A token indicating the optionality of this resource	1	Unspecified	See section 4.15	VocabularyTerm	
8.3	intensionSpec	Formal expression of a set of resources in an intentional way	0..*(100)	Unordered		characterString	For tools this would for example a set of triples <affordance, affordance/activity link, complianceRanking>. For learning content or persons it would for example be a query expression
8.4	exampleResourceLocation	A link to an existing resource(e.g., proven tools)	0..*(100)	Unordered		ObjectID	

100	location	A link to a selected resource. This is an extensional expression	0..*(100)	Unspecified	ObjectID	
101	learningStory	A relation indicating the LearningStory from which this Activity is linked.	1..*(100)	Unordered	ObjectID	

3.4.9 Tool

Tool							
Nr	Name	Description	Multiplicity	Order	Value space	Data type	Note
1	name	The name of this Tool	1	Unspecified		LangString	
2	version	The version number of this Tool	0..1	Unspecified		CharacterString	
3	description	A description of this Tool	0..1	Unspecified		LangString	
4	type	A term indicating the type of Tool	1	Unordered	See section 4.18	VocabularyTerm	
5	tag	A descriptive phrase for this Tool	0..* (100)	Unordered		LangString	
6	affordance	What one can do with this Tool	1..* (100)	Unordered			
6.1	name	The name of the affordance	1	Unspecified	See section 4.2	VocabularyTerm	
6.2	weight	A number indicating the level of support this tool is giving to this affordance	0..1	Unspecified		Number	
7	functionality	Utility/Function offered to a user	1..* (100)	Unordered	See section 4.3	VocabularyTerm	
8	image	A URI pointing to an image	0..1	Unspecified		CharacterString	
9	license	The license under which the tool is available	0..* (100)	Unordered		LangString	
10	worksWith	Other tools with which this tool works	0..* (1000)	Unordered			
10.1	tool	A relation indicating the Tool interoperating with this tool	with 1	Unspecified		ObjectID	This is also used to describe the shell technology under which it works
10.2	interoperability	Description of how to let it interoperate	0..1	Unspecified		LangString	
10.3	required	Indicates whether the Tool given in 10.1 is required to run this Tool	0..1	Unspecified		Boolean	

3.4.10 TechnicalSetting

TechnicalSetting							
Nr	Name	Description	Multiplicity	Order	Value space	Data type	Note
1	name	The name of this TechnicalSetting	1	Unspecified		CharacterString	
100	school	The School (Organization) that for which this technical setting holds	1	Unspecified		ObjectID	
101	tool	A relation indicating the Tool that is part of this TechnicalSetting	1..* (1000)	Unordered		ObjectID	

4 VOCABULARIES

iTEC vocabularies are stored and managed in the European Schoolnet's Vocabulary Bank for Education (VBE⁸). The VBE service makes it possible to manage a range of multilingual, controlled lists relevant to iTEC and learning in the European Union. It also stores a thesaurus used to describe educational topics. The VBE is provided as a web application enabling users to search or browse stored vocabularies in order to find out more about the terms used, their relationships, contexts and translations. The repository of published vocabularies is available for anyone to view via a web browser and the VBE can be searched and browsed to locate iTEC vocabularies or individual terms without registration or logging in. In order to be able to download vocabularies users must register. The VBE also offers a REST API allowing other iTEC tools and services to access the iTEC vocabularies and their translations in VDEX, Zthes⁹, and SKOS formats.

<http://europeanschoolnet-vbe.lexaurus.net/vbe/>

The iTEC directory information model references the following vocabularies:

4.1 ADDRESS REGION

iTEC adopts the USE level 3 NUTS – vocabulary. See

http://ec.europa.eu/eurostat/ramon/nomenclatures/index.cfm?TargetUrl=LST_CLS_DLD&StrNom=NUTS_33&StrLanguageCode=EN#

4.2 AFFORDANCES¹⁰

- online annotating
- asynchronous discussion
- asynchronous messaging
- audio capture
- audio conferencing
- audio sharing
- container
- data collection
- data projection
- data sharing
- drawing and painting
- expert searching
- file sharing
- geo messaging
- group individual contribution review
- ideas sharing
- mapping
- mark submission
- multimedia editing
- peer assessing
- photo capture
- photo sharing

⁸ The VBE was developed in the ASPECT project

⁹ See <http://zthes.z3950.org/>

¹⁰ This vocabulary is based on the iCamp project

- portfolio
- online presentation
- QR Code reading
- scanning
- shared editing
- task management
- teacher logging
- team sharing
- video capture
- video conferencing
- video editing
- video sharing
- voting

4.3 APPLICATION FUNCTIONALITY

- virtual learning environment (Use For personal learning environment)
 - student information system (Use For learning management system)
 - activity management tool
 - automated assessment tool
 - grading tool
 - competency management tool
 - online portfolio tool
 - student reporting tool
 - classroom management system
 - collaboration tool
 - calendar
 - location aware application
 - social networking tool
 - social bookmarking tool
 - annotation tool
 - tagging tool
 - rating tool
 - audio sharing tool
 - photo sharing tool
 - video sharing client
 - wiki
 - feedback tool
 - voting tool
 - survey tool
 - communication tool
 - synchronous communication tool
 - application sharing tool
 - audio conference tool
 - chat client
 - instant messaging client
 - phone
 - video conferencing client
 - asynchronous communication tool
 - blog
 - bulletin board system
 - forum

- messaging client
 - email
 - sms
 - mms
 - online journal
 - content management tool
 - file transfer client
 - online storage tool
- database
- data analysis tool
- reference tool
 - dictionary
 - encyclopedia
- game
 - online game
 - multi-player game
 - single-player game
 - offline game
 - multi-player game
 - single-player game
- geotagging tool
- instructional design tool
 - media authoring tool
 - concept-mapping tool
 - presentation graphics tool
 - audio editor
 - image editor
 - spreadsheet tool
 - video editor
 - web authoring tool
 - word processor
 - pdf editor
- multi-media repository client
- podcast client
- search engine
- simulation software
 - virtual world client
 - discrete event simulation
- syndication feed
- web browser
- OTHER (please specify)

4.4 COUNTRY

The vocabulary for Country is taken from ISO 3166.

4.5 DEVICE

- amplification system
 - internal speakers
 - external speakers

- computer
 - desktop computer
 - server
 - laptop computer
- data capture
 - audio input device
 - microphone
 - audio recorder
 - image input device
 - scanner
 - photo camera
 - video input device
 - video camera
 - motion detection device
 - datalogger
- display device
 - projector screen
 - projector
 - interactive projector
 - television screen
 - computer screen
- document reader
- games console
- interactive learning and teaching device
 - interactive multi-touch table
 - interactive overlay
 - interactive pen
 - interactive tablet
 - interactive whiteboard
 - learner response device
- manufacturing device
 - 2D printer
 - 3D printer
- mobile device
 - phone
 - mobile smartphone
 - mobile non smartphone
 - netbook
 - pda
 - tablet
- programmable robotic device
- video conferencing device
- wireless slate
- OTHER (specify)

4.6 EVENT PLACE

- aquarium
- art museum
- garden
- history museum
- movie theater
- park
- performing arts venue
- planetarium
- playground
- school campus
- science museum
- stadium
- street
- university campus
- virtual
- zoo
- OTHER

4.7 EVENT TYPE

- virtual meeting
- in service training
- school event
- community event
- hot seat
- workshop
- seminar
- conference

4.8 ITEC RESOURCE TYPE

- device
- event
- learning object
- person
- productivity tool
- shell

4.9 LEARNING SUBJECT

This vocabulary is taken from eTwinning¹¹.

- art
- astronomy
- biology
- chemistry
- citizenship
- classical languages
- cross curricular
- design and technology
- drama
- economics
- environmental education
- ethics
- european studies
- foreign languages
- geology
- health studies
- history
- history of culture
- home economics
- Informatics / ict
- language and literature
- mathematics / geometry
- media education
- music
- natural sciences
- philosophy / logic
- physical education
- physics
- politics
- pre-school subjects
- primary school subjects
- psychology
- religion
- social studies / sociology
- special needs education
- technology
- OTHER (specify)

4.10 LOCATION AREA

- agricultural
- industrial
- inner city

¹¹ eTwinning is part of Comenius, the EU programme for schools

- island
- mountains
- rural
- sea shore
- urban
- other

4.11 ORGANIZATION AGE RANGE

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12
- 13
- 14
- 15
- 16
- 17
- 18
- 19
- 20
- 21
- 22
- 23
- 24
- 25
- 26
- 27
- 28
- 29
- 30-35
- 36-39
- 40-49
- >50
- Not applicable

4.12 ORGANIZATION TYPE

- central government
- curriculum study centre
- industry
- international organisation

- learning resources centre
- library school
- local government
- lower secondary level 2 educational institution
- ministry of education
- post-secondary non-tertiary level 4 institution
- pre-primary level 0 educational institution
- primary level 1 educational institution
- professional association
- professional development school
- regional administration
- research centre
- school of education
- teacher centre
- post-secondary level 5 institution awarding 1st or 2nd tertiary degrees
- post-secondary level 6 institution awarding advanced research degrees
- upper secondary level 3 educational institution
- vendor
- youth organization
- OTHER (specify)

4.13 PERSON CATEGORY

- author
- counsellor
- expert
- learner
- manager
- parent
- teacher
- OTHER

4.14 PERSON GENDER

- male
- female

4.15 RESOURCE OPTIONALITY

- essential
- recommended
- niceToHave

4.16 SCHOOL GENDER SETTING

- boys only
- girls only
- mixed gender

4.17 SCHOOL SECTOR

- public
- private

4.18 TOOL TYPE

- productivity tool
- device
- shell

5 JSON BINDING

The iTEC API is an interface to a web service. When implementing web services the number of calls should be minimised and therefore more complex structures than relational tables in third normal form are used. A web service can handle in principle any valid Internet media type. However, this is often JSON, XML, or YAML. JSON¹² is promoted as a low-overhead alternative to XML as both of these formats have widespread support for creation, reading and decoding in the real-world situations where they are commonly used. JSON is gaining in popularity because a JSON string represents a data structure in JavaScript and other languages used to build web front-ends. This is an important aspect in the context of widgets being implemented in iTEC. In addition JSON strings are more readable. Therefore a JSON binding has been chosen. A second binding (i.e., RDF) will be elaborated in collaboration with WP10, as part of the implementation.

The API provides methods that take objects, as described in this information model, in the form of a JSON string as part of the parameters. The correspondence between the information model and JSON strings is as follows:

Data types

iTEC data type	JSON data type
CharacterString	String
Number	Number
Boolean: true	true
Boolean: false	false
DateTime	String
Duration	String
Language	String
ObjectID	String
LangString	{Language: String}
VocabularyTerm	String ¹³

The API works under the closed world assumption. This means that if a value for a field is missing, it is supposed not to exist in the world that the information model is describing. The value 'null' indicates a missing value. In some cases, values might not be known although one is sure that a corresponding situation does exist in the real world. For example, gender of a person, will always exist but might be unknown. If it is important for applications to make this distinction, such applications should provide a JSON string with appropriate values such as "unknown" or "undefined".

¹² See <http://www.json.org/>

¹³ The simplified form String can be used. If external vocabularies would be required then {source:String} would need to implemented.

Multiplicity

If the multiplicity in the information model specifies '0..*' or '1..*', then the values are given as a JSON array. For example:

```
"languageOther": [  
  "en",  
  "fr",  
  "de"  
],
```

Compound data elements

Compound data elements such as 'contactChannel' take JSON objects or a JSON array of JSON objects as values

```
"contactChannels": [  
  {  
    "channel": "mobile",  
    "connection": "+32473123456"  
  },  
  {  
    "channel": "telephone",  
    "connection": "+3259534567"  
  },  
  {  
    "channel": "linkedIn",  
    "connection": "blahblah"  
  },  
  {  
    "channel": "skype",  
    "connection": "ehcssanavf"  
  },  
],
```

Example JSON Binding

Table 5.1 gives an example person.

```
{
  "id": "1234",
  "openId": "jhlhds12345hjdssdhf",
  "givenName": "Frans",
  "familyName": "Van Assche",
  "birthDay": "1948-11-26",
  "description": {
    "lang": "en",
    "string": "Researcher at Katholieke Universiteit Leuven - Belgium"
  },
  "country": "BE",
  "registrationDate": "2011-01-27",
  "lastModifDate": "2011-01-27T11:04:25:547",
  "website": "http://azertyuiop.be",
  "mbox": "frans.van.assche@guess.be",
  "languageMothertongue": "nl",
  "languageOther": [
    "en",
    "fr",
    "de"
  ],
  "contactChannels": [
    {
      "channel": "mobile",
      "connection": "+32473123456"
    },
    {
      "channel": "telephone",
      "connection": "+3259534567"
    },
    {
      "channel": "linkedIn",
      "connection": "blahblah"
    },
    {
      "channel": "skype",
      "connection": "ehcssanavf"
    }
  ],
  "expertise": [
    "mathematics",
    "art"
  ]
}
```

Table 5.1 Example JSON binding for Person

6 CONCLUSION AND LESSONS LEARNED

This document provides the iTEC directory information model, including a description of its data types and vocabularies and its JSON binding.

The iTEC directory information model describes all data to be recorded in and retrieved from the iTEC directory. More in particular it is an information model for the iTEC directory back-end data store. Its main object types are Scenario, Learning Story, Activity, Person, Event, Organization, Collection, Tool, and Technical Setting. A number of relationships are identified.

The iTEC directory back-end relates to different subsystems of the iTEC shell and the iTEC composer. For example the iTEC shell may use the directory back-end in order to find resources such as people and events. It is also used by different components of the directory business layer of the composer comprising the SDE, the authorization module, and specific business logic modules of the composer itself.

The information modelling exercise also provided some interesting results. While addressing the same domain of IMS Learning Design, iTEC chose *not* to take it as a starting point but opted for refining the requirements as they emerge. It is interesting to see that after a year, the domain has been modelled with object types such as Activity, Learning outcomes, Persons & roles Resources – object types which are also at the heart of IMS LD. However there are also some differences: (a) an unordered set of activities seem to work better in a school context, and (b) there is growing support to one of the iTEC hypotheses that learning stories can more easily be shared and reused when resources are specified in an intentional way. Teachers are looking for interesting ideas more than engineered learning units; especially if tools are available for implementing these ideas more efficiently.

iTEC is also looking at resources beyond content. One less obvious type of resource is Event. A hypothesis to be tested in iTEC, is that sharing information about events is useful. iTEC had at the start of the project no preconception on the kind of events that are worthwhile sharing. Based on the comparative analysis and further discussion WP9 identified different types of event. At this stage iTEC will take two types - community events and events organised by schools/teachers - further into the pre-pilots.

As a matter of fact, all the models described in this report will be taken into the pre-pilots and into the pilots. It is expected that the information model will change because of that. Finally, taking this model into the implementation will require a second binding for the semantic web. It will be a mapping from the JSON binding presented in this document.

APPENDIX 1 : LIST OF ABBREVIATIONS

ACRONYM	MEANING
FOAF	Friend of a Friend
IANA	Internet Assigned Numbers Authority
ICT	Information and Communications Technologies
ISO	International Standards Organisation
JSON	JavaScript Object Notation
LARG	Learning Activity & Resource Guide
RDF	Resource Description Framework
REST	Representational state transfer
SDE	Scenario Development Environment
SIL	Summer Institute of Linguistics. The full name is not used anymore in Favour of SIL international.
SKOS	Simple Knowledge Organization System
UML	Unified Modelling Language
URI	Universal Resource Identifier
URL	Universal Resource Locator
VBE	Vocabulary Bank for Education
VDEX	IMS - Vocabulary Definition Exchange
W3C	World Wide Web Consortium
XML	eXtensible Markup Language
YAML	YAML Ain't Markup Language