SIMF Meta Concept List Terms and Definitions

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1 Terms and Definitions

For the purposes of this document, the following concept definitions apply.

Term	***Definition***
100% principle	All relevant general static and dynamic aspects, i.e. all rules, laws, etc., of the universe of discourse should be described in the conceptual schema. The information system cannot be held responsible for not meeting those described elsewhere, including in particular those in application programs. (ISO TR9007, page I-8)
action	One or more elementary actions that, as a unit, change a collection of facts into another collection of facts (Adapted from ISO TR9007).
actor	A person executing a process.
arity-role based	Number of roles in a fact type. *Note*: A fact type with exactly one role is called a *unary* role-based fact type. A fact type with exactly two roles is called a *binary* role-based fact type. A fact type with more than two roles is called an *n-ary* role-based fact type.
arity-variable based	Number of variables in a fact type. *Note*: A fact type with exactly one variable is called a *unary* variable-based fact type. A fact type with exactly two variables is called a *binary* variable-based fact type. A fact type with more than two variables is called an *n-ary* variable-based fact type.
asserted fact	Fact instance that is simply asserted (declared to be the case) rather than being derived from other facts. *Synonyms*: primitive fact; base fact.
asserted fact type	Fact type, each of whose population instances is an asserted fact. *Synonyms*: primitive fact type; base fact type.
atomic fact	Fact that cannot be decomposed, without loss of information, into multiple facts involving exactly the same instances of the same value types. *Note*: An atomic fact is either an elementary fact or an existential fact. *Synonym*: irreducible fact.

atomic fact type	Fact type, each of whose population instances is an atomic fact.
behavioural rule	A guideline that an actor is supposed to follow; if not and the facts are observed, a derivation rule is used to derive the penalty.
cardinality integrity rule	Constraint on a variable or role, or sequence of variables or roles that determines the minimum and/or the maximum number of population instances that the variable resp. role or sequence of variables resp. roles may contain for each state of the fact base.
compound fact	Fact that can be decomposed, without loss of information, into a conjunction of multiple facts involving exactly the same instances of the same value types. *Note*: A compound fact is *not* an atomic fact.
compound fact type	Fact type whose population instances are compound facts.
conceptual schema	Structure that determines the permitted states and transitions between these states of the fact base, as well as the meaning of every included term that could be misunderstood by the intended audience or business community as in ISO TR9007. *Note*: A conceptual schema declares the fact types, integrity rules, derivation rules, and concept definitions relevant to the selected universe of discourse.
conceptualization principle	A conceptual schema should only include conceptually relevant aspects, both static and dynamic, of the universe of discourse, thus excluding all aspects of (external and internal) data representation, physical data representation and access as well as all aspects of a particular external user representation such as message format, data structures, etc. (ISO TR9007, 1987, page I-9).
data	The representation forms of information dealt with by information systems and users thereof (Source: ISO TR9007).
deep structure fact	The meaning of a surface structure fact. In linguistics, … the *deep structure* of a linguistic expression is a theoretical construct that seeks to unify several related structures. For example, the sentences "Pat loves Chris" and "Chris is loved by Pat" mean roughly the same thing and use similar words. Some linguists, in particular Noam Chomsky, have tried to account for this similarity by positing that these two sentences are distinct *surface forms* that derive

from a common *deep structure* (Source: Wikipedia).

The following 4 surface structure facts mean exactly the same.
Serge visited Germany 7 times in 2011.
Serge visited in 2011 7 times Germany.
Serge visited in 2011 Germany 7 times.
Germany was 7 times visited by Serge in 2011.

The above four surface structure facts all represent the same deep structure fact. Said otherwise the four surface structure facts represent the same meaning.

As this distinction between deep and surface structure is essential in semantic conceptual domain modelling, we phrase it also in another way. Below are 4 surface structure facts.

A1: Serge visited Germany 7 times in 2011.
A2: Serge visited in 2011 7 times Germany.
A3: Serge visited in 2011 Germany 7 times.
A4: Germany was 7 times visited by Serge in 2011

Each of these 4 examples is associated with a *different* Fact Communication Pattern (FCP); each of these 4 Fact Communication Patterns is associated with one and the same Fact Type.

The 4 Fact Communication Patterns are:

FCP1: <Person> visited <Country> <Number> times in <Year>
FCP2: <Person> visited in <Year> <Number> times <Country>
FCP3: <Person> visited in <Year> <Country> <Number> times
FCP4: <Country> was <Number> times visited by <Person> in <Year>

These 4 FCP's belong to the Fact Type, consisting of the 4 variables <Person>, <Country>, <Number> and <Year> and the predicate V.

Hence there is one Fact Type:

FT1: V <Person>, <Country>, <Number>, <Year>

with 4 associated Fact Communication Patterns

FCP1: <Person> visited <Country> <Number> times in <Year>
FCP2: <Person> visited in <Year> <Number> times <Country>
FCP3: <Person> visited in <Year> <Country> <Number> times
FCP4: <Country> was <Number> times visited by <Person> in <Year>

definite description Identification of an individual by means of a unique description. Adapted from: For all x. (Source to be completed).

derivation rule Rule that specifies how to derive instances of a derived or semi derived

	fact type from other facts, or how to derive membership of instances in a derived or semi derived subtype from properties of its super type(s).
derivation status	Indication that the instances of a fact type or subtype (a) are all asserted, or (b) are all derived, or (c) may include some asserted instances and some derived instances.
derived fact	Fact that is deduced from other facts by means of a derivation rule. *Note*: A fact that is *not* derived is an asserted fact.
derived fact type	Fact type, each of whose instances is a derived fact.
derived subtype	Subtype, each of whose instances is derived from facts of its super type(s) by means of a derivation rule.
domain object	Individual thing of interest that is either an entity or a value.
domain object type	Type, each of whose instances is a domain object. Note: The population of a domain object type is always finite.
elementary action	The insertion, deletion, or retrieval of a fact (Adapted from ISO TR9007).
elementary fact	Fact that declares that an object has a property, or that one or more objects participate in a relationship, where the fact cannot be split into (rendered as a conjunction of) simpler facts with the same lexical objects without information loss. *Example*: Each of the following two fact readings expresses the same fact: Example to be completed.
elementary fact type	Fact type, each of whose instances is an elementary fact.
entity	Any concrete or abstract thing of interest (Adapted from ISO TR9007). *Note*: An entity can typically change its state over time (e.g. by participating in new facts). An entity is not a value, such as a name or numeral. *Synonym*: Non-lexical object.
entity type	Object type, each of whose instances is an entity.
equality integrity rule	Set-comparison constraint that specifies that, for each state of the fact base, the populations of the constrained variable or role sequences must

be equal.

exclusion integrity rule Set-comparison constraint that specifies that, for each state of the fact base, the populations of the constrained variable or role sequences must be mutually exclusive (i.e. do not overlap).

existential fact Atomic fact that imply asserts the existence of an object.

Examples:

There exists a Country named 'The Netherlands'.
Within the collection of all countries the name 'Belgium' identifies a specific country.
There exists a CountryCode 'DE'.
Within the collection of all Country Codes the code 'FR' identifies a specific country code.

existential fact type Atomic fact type, each of whose population instances is an existential fact.

fact A verb with an ordered set of lexical object instances.

Proposition that is taken to be true by the relevant community, and is expressed by a sentence that either simply applies a predicate to one or more individuals or simply asserts the existence of an individual. (to be reviewed)

Note:

1. A fact consists of a predicate and an ordered set of individuals where an individual is designated by an ordered set of lexical objects.
2. A fact is neither a concept definition, nor a fact type, nor an integrity rule, nor a derivation rule, nor a behavioural rule, nor a process, nor an actor nor an event.

Examples: (TODO: extension with objects designated by more than one lexical object)

1. Mozart was born in Austria. {binary fact}
2. Mozart died at the age of 35. {binary fact}
3. Verdi was born in Italy.
4. Verdi died at the age of 87.
5. The capital of Austria is Vienna.
6. The capital of Italy is Rome.
7. Bach was born in Germany.
8. Mozart visited Italy in 1769. {ternary fact}

9. Mozart visited France in 1763.

10. Verdi visited France in 1853.

11. Serge was born in Algeria.

12. Harald was born in Germany.

13. Serge visited Greece in 2005.

14. Harald visited The Netherlands in 2010.

15. The Nobel Peace Prize is awarded in Oslo.
    (Binary fact) [Elementary and asserted]

16. The Nobel Prize in Physics is awarded in Stockholm.
    [Elementary and asserted]

17. The Nobel Prize in Physics is 28 times shared by three Laureates.
    (Ternary fact) [Elementary and derived]

18. The Nobel Prize in Chemistry is 22 times shared by two Laureates.
    [Elementary and derived]

19. The Nobel prize in Chemistry of 1954 was awarded to Linus Pauling.
    (Ternary fact) [Elementary and derived]

20. The Nobel Peace Prize of 1962 was awarded to Linus Pauling.
    [Elementary and derived]

21. The Nobel Laureate Elizabeth H. Blackburn of the Nobel Prize in Physiology or Medicine in 2009 was awarded for the work "of how chromosomes are protected by telomeres and the enzyme telomerase".
    (Quaternary fact) [Compound and derived]

22. The Nobel Laureate Willard S. Boyle of the Nobel Prize in Physics in 2009 was awarded for the work "for the invention of an imaging semiconductor circuit - the CCD sensor".
    [Compound and derived]

23. George E. Smith was awarded for his work “for the invention of an imaging circuit – the CCD sensor”.
    (Binary fact) [Elementary and asserted]

24. The award received by George E. Smith for his work “for the invention of an imaging circuit – the CCD sensor” resulted in ¼ of the prize.

(Ternary fact) [Elementary and derived]

25. The work "for the invention of an imaging circuit – the CCD sensor" was awarded the Nobel Prize in Physics 2009. (Ternary fact) [Compound and asserted]

26. Compound, because there are 2 elementary facts:

27. 1. The work "for the invention of an imaging circuit – the CCD sensor" was awarded the Nobel Prize in Physics

28. 2. The work "for the invention of an imaging circuit – the CCD sensor" was awarded in 2009

29. There exists a Nobel Prize named Nobel Peace Prize. (Unary fact). [Existential and asserted fact]

30. There exists a Nobel Prize called Nobel Peace Prize. (Unary fact). [Existential and asserted fact]

31. There exists a Nobel Prize identified by the name Nobel Peace Prize. (Unary fact). [Existential and asserted fact]

32. Within the collection of all Nobel Prizes the Nobel Peace Prize identifies a specific Nobel Prize. (Unary fact). [Existential and asserted fact]

33. Within the collection of all Nobel Prizes the Nobel Prize for Physics identifies a specific Nobel Prize. (Unary fact). [Existential and asserted]

fact base Set of facts that are of interest to the relevant community and conform to the conceptual schema.

fact communication pattern A pattern to be used to generate facts.

fact type Type, each of whose instances are facts that express the same kind of information.

Note: An elementary fact type is a non-empty set of typed predicates (i.e. predicates with specific value types assigned for its placeholders).

frequency constraint Constraint that restricts, for each state of the fact base, the number of times any given sequence of values that instantiate the constrained variable sequence in the relevant context may appear in the population of that variable sequence in that context.

	Note: The frequency can be expressed by a list of one or more discrete numbers or numeric ranges having minimum and/or maximum values. A frequency constraint with a maximum frequency of 1 is not allowed (instead, a uniqueness constraint should be used for this case). *Synonym*: occurrence frequency constraint
ground fact	A fact in which lexical objects refer to ground objects.
ground object	An object that has no grammar function with respect to other objects.
Helsinki principle	any meaningful exchange of utterances depends upon the prior existence of an agreed set of semantic and syntactic rules. The recipients of the utterances must only use these rules to interpret the received utterances, if it is to mean the same as that which was meant by the utterer. ISO TR9007, principle accepted at the TC97/SC5/WG3 meeting in Helsinki 1978 (Page 0-2 in ISO TR9007).
integrity rule	Restriction on what states or transitions of the fact base are permitted.
object	An individual thing of interest, about which the community wishes to communicate. *Examples*: The Country named 'The Netherlands'. The country name 'Belgium' The character string 'France' *Note*: An object is either an entity, a domain value ?, or a data value. *Synonym*: Individual
object type	Concept used to classify individual things into different kinds. *Examples*: Country; CountryName; String *Note*: An object type is an entity type or a value type.
population	The current state of the fact base associated with the conceptual schema under discussion. *Note*: A fact base associated with the conceptual schema may change over time.
predicate	A linguistic object, analogous to a verb, which says something about an entity or entities to which terms in the fact refer.
proper name	A singular term that identifies an individual without describing it. Adapted from: For all x. (Source to be completed).

process	A description when executed by a human or computer, consults or produces facts (Source: ECSS-E-TM-10-23A).
property	Unary variable-based fact type in which a lexical object participates. *Example*: In the unary (variable based) fact "Fred smokes", the property of smoking is assigned to Fred.
proposition	That which is asserted by a declarative sentence. *Example*: *Note*: Each proposition is either true or false, but not both.
role	Part played by an object in a fact. Role consists of a single or combination of variable.
rule	An integrity rule, a derivation rule or a behavioural rule.
rule communication pattern	A pattern to be used to generate rules.
set-comparison constraint	Constraint that specifies a subset, equality or exclusion condition to be satisfied when comparing the populations of compatible variable or role sequences. *Note*: Each set-comparison constraint is either a subset constraint, an equality constraint, or an exclusion constraint. Compatible variable or role sequences require the variable resp. role occurrences across matching positions in the sequences to be compatible.
singular term	In (the English) natural language, a word or phrase that refers to a specific person, place or thing. Adapted from Source: For all x. (Source to be completed)
structure of a fact	A set of ordered positions where each position is either the constant part in the surface structure fact before the first instantiated variable or filled-place, or a place with the instantiated variable, or the constant part between two instantiated places or the constant in the surface structure fact after the last instantiated place.
subset constraint	Set-comparison constraint that specifies that, for each state of the fact base, the population instances of a sequence of one or more variable resp. role occurrences must be a subset of the population instances of another compatible sequence of variable resp. role occurrences.
subtype	Object type, each of whose instances belong to an encompassing type. *Example*:

Woman is a (proper) subtype of Person.

super type Object type that has at least one subtype, and may have some instances not in any of its subtypes.

surface structure fact The observable appearance of a deep structure fact. Every deep structure fact needs to have at least one surface structure fact associated with it and possibly more.

synonym Different terms that refer to the same entity (Source: ISO TR9007).

term A linguistic object that refers to an entity (Source: ISO TR9007).

type The proposition that the associated population can have members a part of which is shared with the type (Source: Adapted from ISO TR9007).

uniqueness constraint Constraint over a sequence of one or more variable or roles that ensures that in each state of the fact base, each instantiation of that variable or role sequence occurs at most once.

universe of discourse The aspects of the world that the relevant community wishes to talk about in the conceptual model. The set of things we are communicating about. Adapted from: For all x. (Source to be completed)

All those entities of interest that have been, are or ever might be (Source: ISO TR9007).

Synonym: Business domain

Acronym: UoD

value Unchangeable object that can be assigned to a variable.

Examples:
The country code 'NL'; the number 7.

Synonyms: domain value; lexical object; label

value constraint Constraint that specifies the permitted values for a variable.

value type Object type, each of whose instances is a (domain) value.

Synonym: Lexical object type

variable A term which refers to unspecified, indeterminate entities in the Universe of Discourse (Source: ISO TR9007).