Entity Relationship Model

Consensus

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Fundamentals

Entity Relationship Model

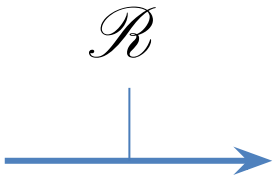
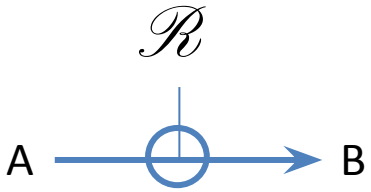
- An *entity relationship model*, also called an entity-relationship (ER) *diagram*, is a graphical representation of entities and their relationships to each other, typically used in computing in regard to the organization of data within databases or information systems.[1]
- To bridge the gap between users and systems, we need a representation of entities and their relationships *as they are* in regards to the organization of information *in the human mind*, and which can be applied to the organization of data (= digital information) within databases or information systems.
- To allow communication between *existing* users and systems, the model must be both the smallest common multiple and the greatest common denominator of such models among all *existing* information and thought systems.
- Finally it must allow to represent not only entities and their relationships but also the changes affecting them, and how change propagates within and between users and systems, that is: how their changes relate to each other.

1. from Wikipedia: entity relationship model

Nodes, Links and Relationship Instances

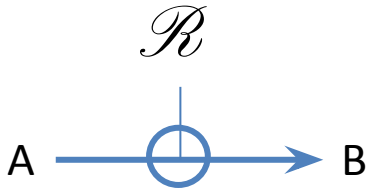
- Most representations consider entities as *nodes* and relationships as *links* within a network or graph of such inter-related... "*things*"
- Obviously this falls short of considering the links themselves as connectable entities. This shortcoming typically leads to the later introduction of e.g. *types*, *attributes*, *primary keys*, etc. which defeats the model
- In Consensus we consider both *nodes* and *links* as entities which can be associated *to*, *from* and *via* each other as per the following representation (see next slide)
- Finally, to complete the model, we need also to consider the *association* of such entities as an entity in its own rights, which in Consensus we call a *Relationship Instance*

Consensus Entities

Representation	Description
A B	A and B are Nodes
	$\mathscr{R}$ is a Relationship
	Relationship Instance
Example	
	A $\mathscr{R}$ B in *this* = Relationship Instance[1]

1. Higher-order associations can be easily created from such ones, as will be made clear later in this presentation

Consensus Data Model

Representation	Description
	A $\mathscr{R}$ B in *this* = ◯ Relationship Instance

Data Model[1]

INSTANCE	SOURCE	MEDIUM	TARGET
A		(A)	
$\mathscr{R}$		($\mathscr{R}$)	
B		(B)	
◯	A	$\mathscr{R}$	B

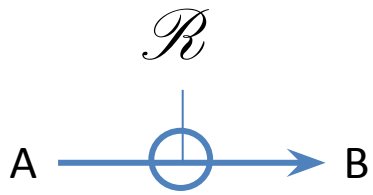
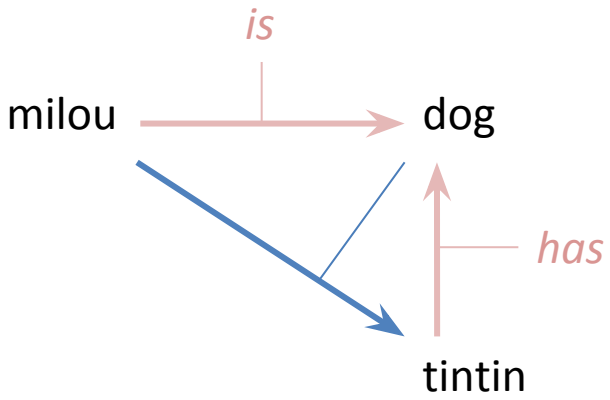
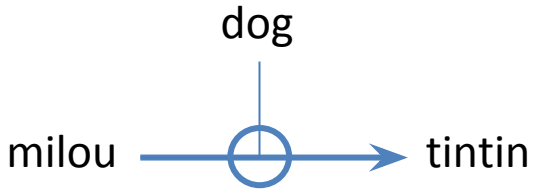
Note: A , $\mathscr{R}$, B and *this* are the unique row entry identifiers in this table, whereas (A), ($\mathscr{R}$) and (B) may refer to a separate symbol table. The distinction is made depending on whether the SOURCE and TARGET coordinates are empty or not.

Consensus Key Associations

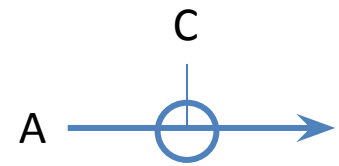
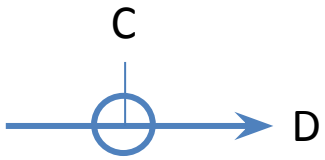
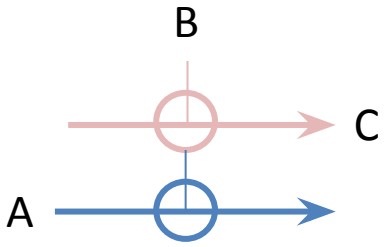
About this section: Update 2017-01-27

- The purpose of this section was to show that the proposed Entity Relationship Model answered indeed all the requirements stated in the previous section.
- Having played with the model for some time, I realized that the “is” and “has” associations were fundamental building blocks, and that a pattern emerged (as shown on the next slide) which allowed to get rid of these *words* altogether.
- This relied on a convention whereby a relationship instance may represent different types of relationship depending on whether the SOURCE, MEDIUM and TARGET coordinates of a relationship instance are informed or not.
- Although this research has value in showing the completeness of the model, the fact is that I was still looking for an *intrinsic* value to be associated with an entity, as opposed to my later realization that any such value or function is given *contextually* by the position of the entity within the overall network, according to genetic evolution.
- Bottom line is: we keep the “is” and “has” and other keywords, which makes the model much more readable :)

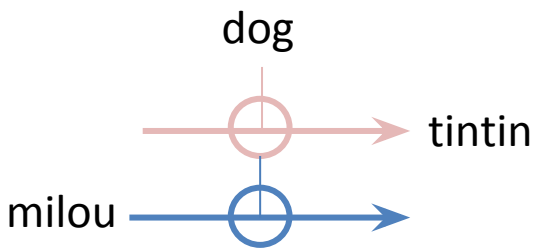
is of Relationship Instance

Representation	Description
	A ℛ B = A relates to B via ℛ ○ = the relationship instance of A to B via ℛ
	milou *is* dog tintin *has* dog milou *is* dog *of* tintin
	○ = milou *is* dog *of* tintin Relationship Instance

has and *is* Relationships

Representation	Description
	A *is* C ◯ = A *as* C
	D *has* C ◯ = D *'s* C
	C *has* B ◯ = C *'s* B A *is* C *'s* B ◯ = A *as* C *'s* B

Example Database Representation

Representation	Description
	tintin *has* dog ○ = tintin *'s* dog milou *is* tintin *'s* dog ◯ = milou *as* tintin *'s* dog

Database Representation

INSTANCE	SOURCE	MEDIUM	TARGET
milou as dog	milou	dog	
tintin's dog		dog	tintin
milou as tintin's dog	milou	tintin's dog	

Consensus Key Associations

- Consensus *interpretes* the specific following associations in the Data Model as

INSTANCE	SOURCE	MEDIUM	TARGET	interpretation
E		(E)		E = *declaration*
id	A	B		A *is* B *id* = A *as* B
id		B	C	C *has* B *id* = C*'s* B
id	E			E is *deactivated* *id* = E's *deactivation*
id			E	E is *activated* *id* = E's *activation*

- This, coupled with appropriate *expressions*[1], allows Consensus to translate user *descriptions* into their related Database Representations, and vice-versa

1. see next slide. See Also Consensus Queries

Update 2017-01-27

- The following table aimed to show each association translates into natural language, using an SQL-type representation where

  In *red* we have the SQL statement

  select SOURCE / MEDIUM / TARGET / INSTANCE where { SOURCE / MEDIUM / TARGET / INSTANCE is informed or not }

  In *black* we have the corresponding statement in natural language

- For instance[1]

  select INSTANCE where SOURCE in A and MEDIUM in B

  translates as « A as B » (e.g. Dog as Animal)

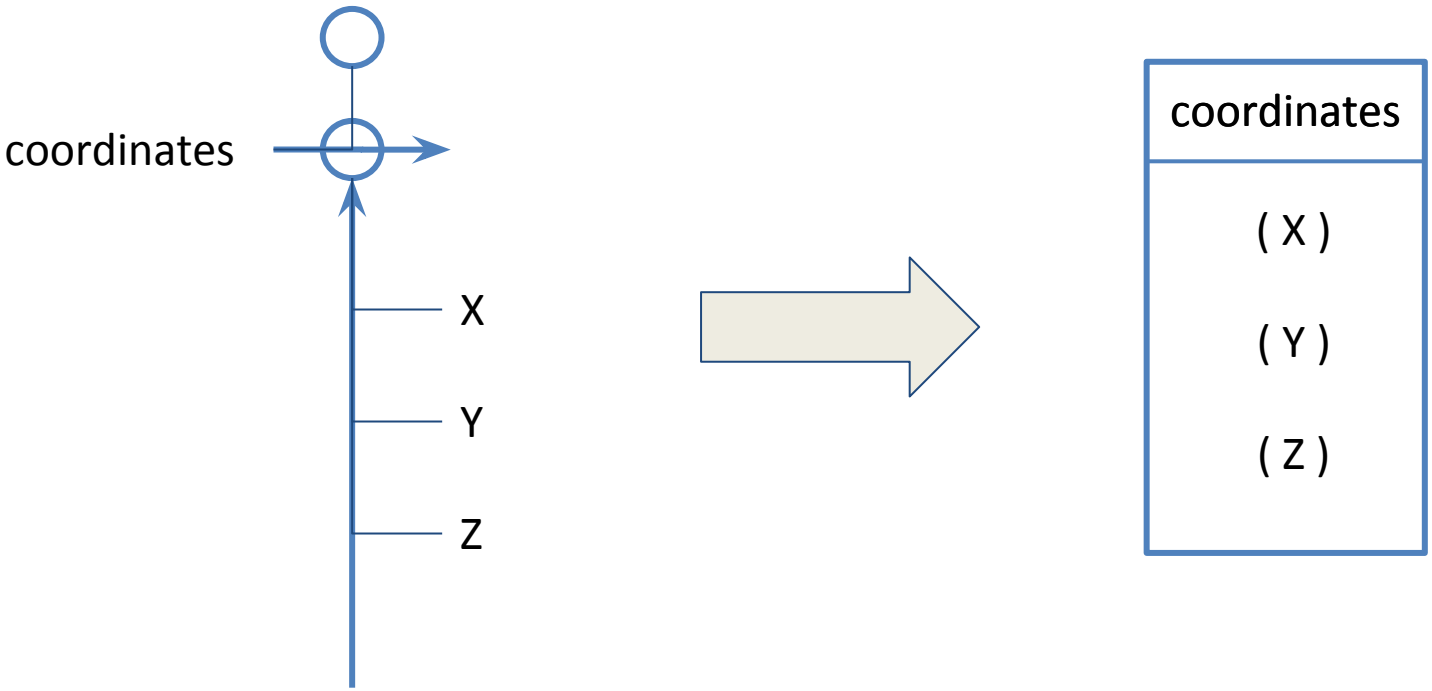
- In today's representation (which uses "is" and "has") we simply say that the relationship instance [A-is->B] represents "A as B" or more litterally "that per which A is B".

1. see highlight in next slide

select				where			
SOURCE	MEDIUM	TARGET	INSTANCE	S	M	T	I
select source where source in X X which = source	select medium where source in X That which identifies X		select instance where source in X X as something	{ X }			
select source where medium in X That which is X	select medium where medium in X X which = medium	select target where medium in X That which has X	select instance where medium in X something's X or something as X		{ X }		
	select medium where target in X That which composes X	select target where target in X X which = target	select instance where target in X X's something			{ X }	
select source where instance in X That which, as something, = X	select medium where instance in X That which either identifies something which, as something, = X or composes something whose something = X	select target where instance in X That whose something = X	select instance where instance in X X which = instance				{ X }
select source where source in A and medium in B A which is B	select medium where source in A and medium in B B which identifies A		select instance where source in A and medium in B A as B	{ A }	{ B }		
				{ A }		{ B }	
select source where source in A and instance in B A which, as something, = B	select medium where source in A and instance in B That which identifies (A which, as something, = B)		select instance where source in A and instance in B B which = A as something	{ A }			{ B }
	select medium where medium in A and target in B A which composes B	select target where medium in A and target in B B which has A	select instance where medium in A and target in B B's A		{ A }	{ B }	
select source where medium in A and instance in B That which, as A, = B	select medium where medium in A and instance in B A which either identifies something which, as A, = B or composes something whose A = B	select target where medium in A and instance in B That whose A = B	select target where medium in A and instance in B B which = either something as A or something's A		{ A }		{ B }
	select medium where target in A and instance in B That which composes (A whose something = B)	select target where target in A and instance in B A whose something = B	select instance where target in A and instance in B B which = A's something			{ A }	{ B }
				{ A }	{ B }	{ C }	
select source where source in A and medium in B and instance in C A which, as B, = C	select medium where source in A and medium in B and instance in C B which identifies (A which, as B, = C)		select instance where source in A and medium in B and instance in C C which = A as B	{ A }	{ B }		{ C }
				{ A }		{ B }	{ C }
	select medium where medium in A and target in B and instance in C A which composes (B whose A = C)	select target where medium in A and target in B and instance in C B whose A = C	select instance where medium in A and target in B and instance in C C which = B's A		{ A }	{ B }	{ C }
				{ A }	{ B }	{ C }	{ D }

Higher Order Associations

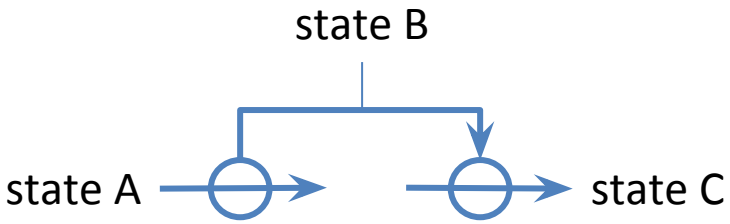
- Higher level interpretations can be built upon Consensus key associations and upon each other, such as



Change Propagation

- Consensus Change Propagation Model builds upon the following associations

Database Representation			
INSTANCE	**SOURCE**	**MEDIUM**	**TARGET**
deactivation	state A		
activation			state C
change	Either - activation - deactivation - change	state B	Either - activation - deactivation - change

Representation	Description
	**on** State A is deactivated **in** state B **do** state C is activated

Thank You!