Conceptual modeling in agile information systems development

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Questions without definitive answers

What is it?

Is conceptual modeling a necessary or an optional activity in information systems development?

agile

Motivation

"The main purpose of conceptual modeling is to *improve communication* between the parties involved in the development process"

"Conceptual data modeling is an *indispensable part* of information system design and development"

Motivation

"…*might be* used to facilitate the design and implementation of an information system"

"Once you have the conceptual design, all the other design and implementation activities can and *should* be grounded in it…"

Manifesto for agile software development

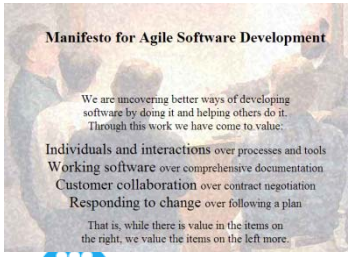
We are uncovering better ways of developing software by doing it and helping others do it. Through this work we have come to value:

…

Working software over comprehensive documentation

…

That is, while there is value in the items on the right, we value the items on the left more.



Motivation

To: antoni.olive
From: a student
Body:

Dear professor,

I've started to develop my final career project in the company.

Here they use agile development, and they do not generate any kind of documentation, and the requirements engineering and overall design are not very deep (I understand that this is their development method).

My idea of the project is to approach it in this way...

Objective of the talk

Is conceptual modeling
a necessary or an optional
activity in information systems
development?
agile

Implications

In (agile) information systems development

Practice

Do we need to perform conceptual modeling?

Teaching

Do we have to teach conceptual modeling?

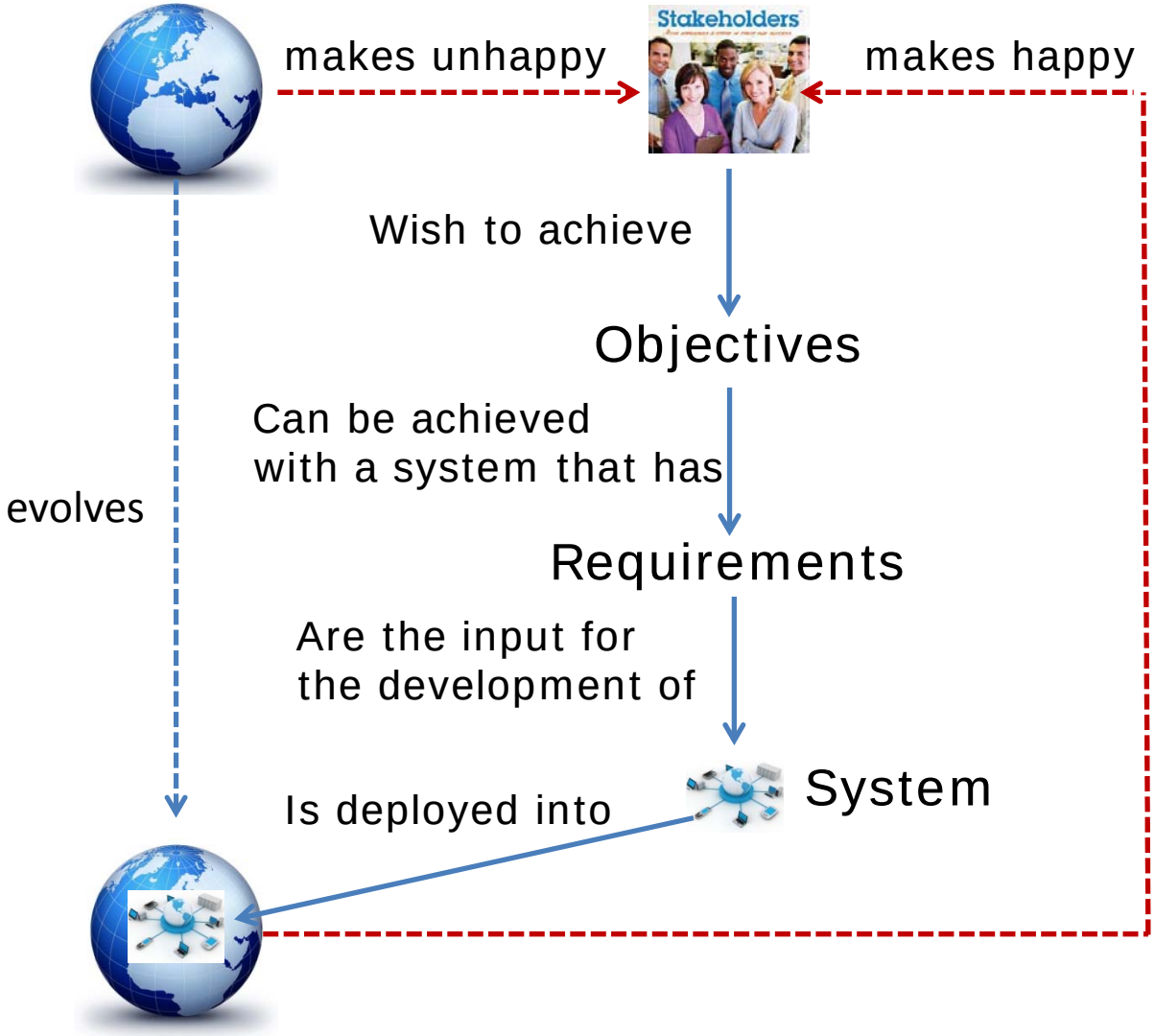
Research

Which is the nature and role of conceptual modeling?

Outline

- Back to basics: the need of requirements
- What are the conceptual schemas? Do we really need them?
- The main driving force of formal conceptual schemas
- Conceptual modeling in agile development. Is it needed?
- Conclusions

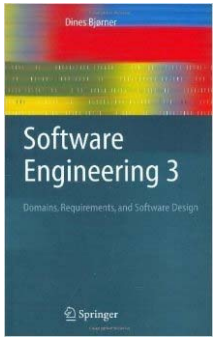
The system's lifecycle



You cannot develop a system unless you know its requirements

The principle of necessity of requirements

To develop an information system
it is necessary
to define its requirements



Before software can be designed, programmed, coded,
its requirements must first be reasonably well understood.

Are there exceptions?

Infinite monkey theorem

A monkey

- hitting keys at random on a typewriter keyboard
- for an infinite amount of time
- will almost surely type a given text,
- such as the complete works of William Shakespeare.

Infinite programmer theorem

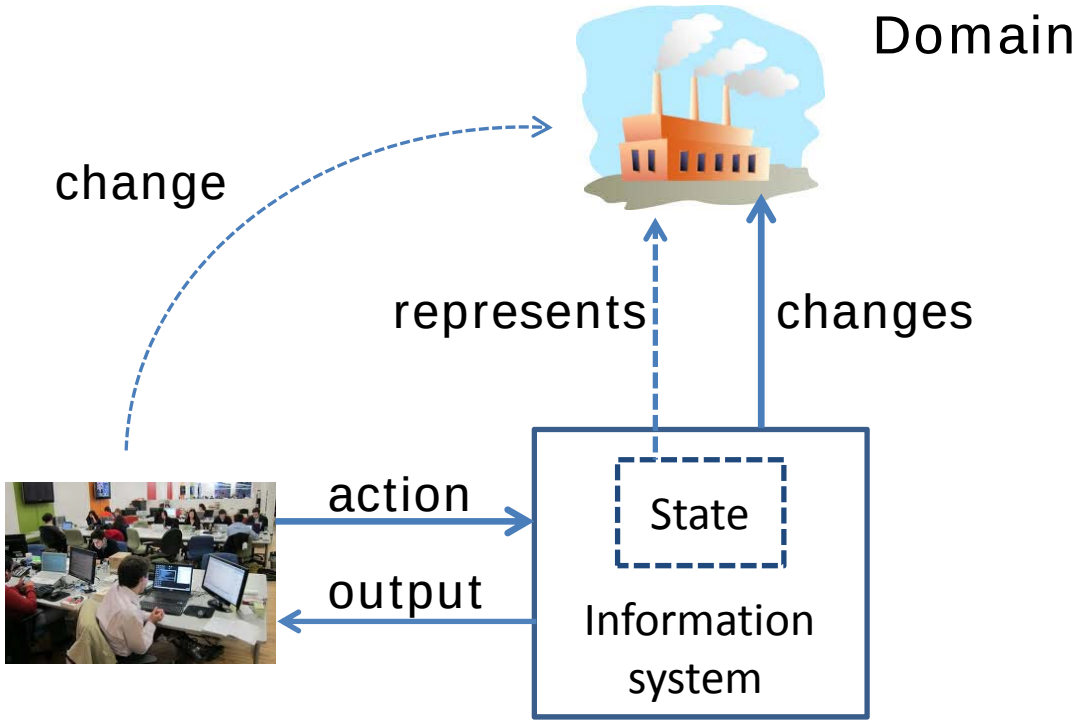
A programmer

- hitting keys at random on a typewriter keyboard
- for an infinite amount of time
- will almost surely type a a program,
- that satisfies the stakeholders' needs

Two types of requirements

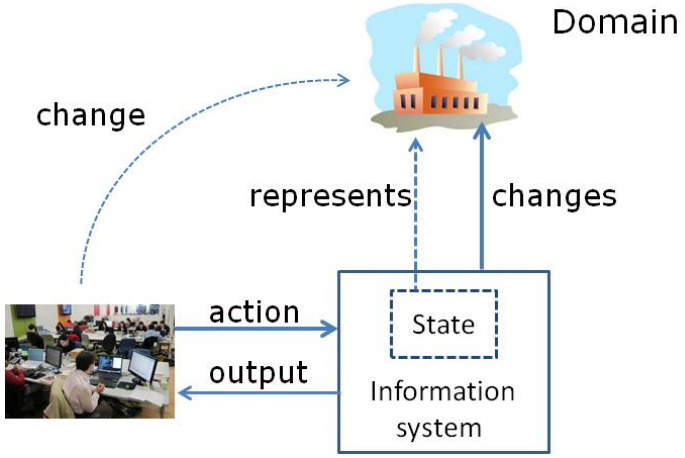
- Functional  The focus of this talk
- Quality

The functions of an information system



Functional requirements

- Domain concepts represented in the IS
- Definitions
- Integrity Constraints
- Events/Actions:
  - Triggering conditions
  - Constraints
  - Effect on the state
  - Output



The principle of necessity of functional requirements

To develop an information system
it is necessary
to define its functional requirements

Outline

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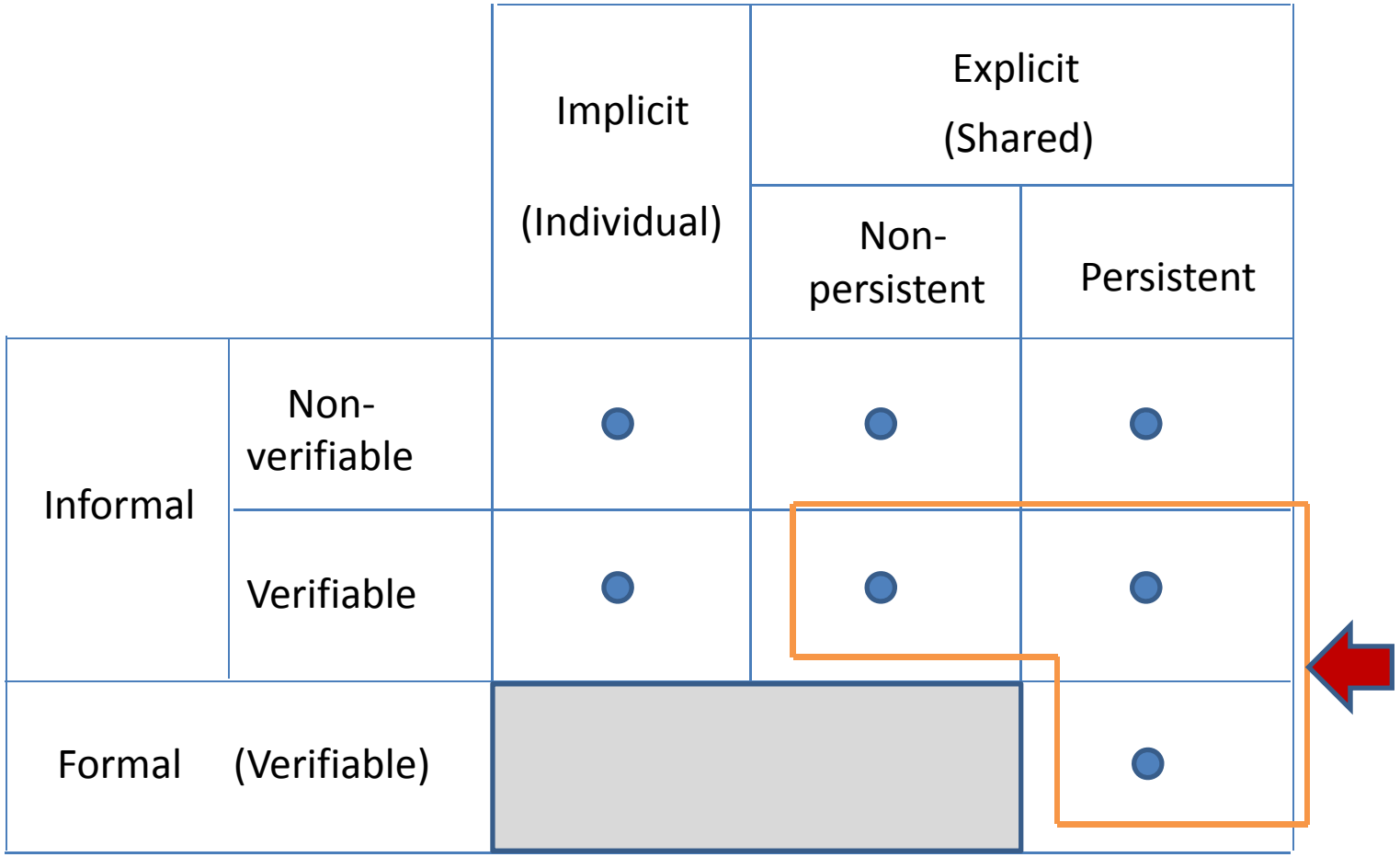
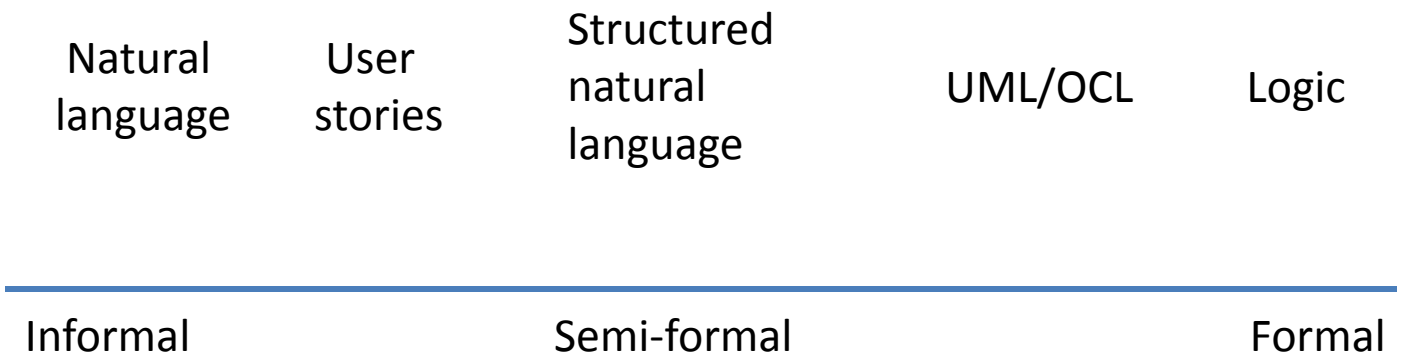
Classification of functional requirements



Four key classifications of functional requirements

- Formality
- Verifiability
- Explicitness
- Persistency

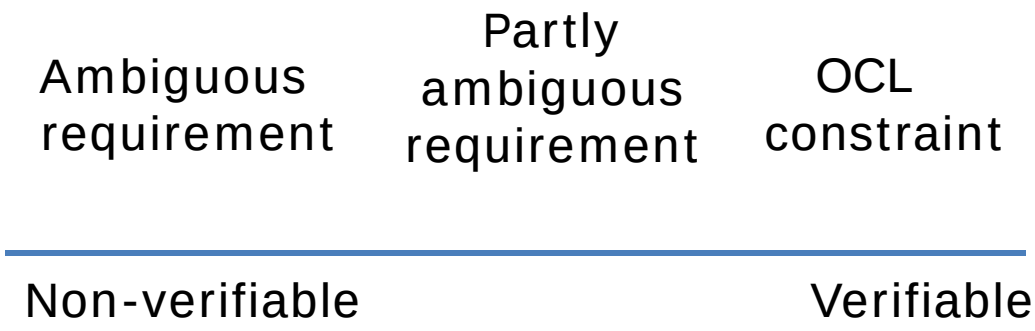
Formality



Degree of formality of the language

Verifiability

Verifiable:
A person or a machine can check that the software meets the requirement



Explicitness

Explicit: Made public in some form

Assumed requirements	SRS document
Implicit	Explicit

Persistency

Verbal

Paper document

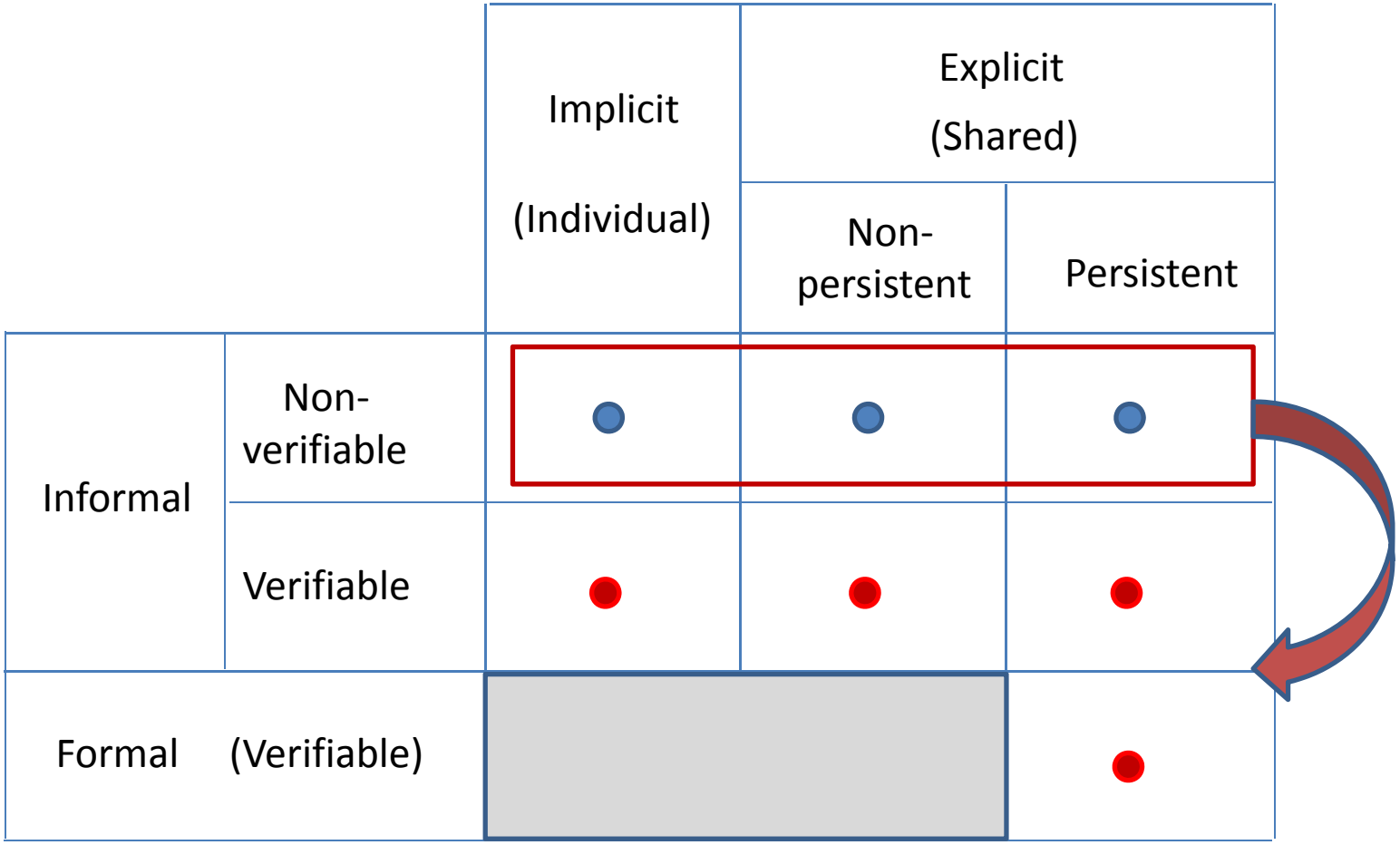
Computer file

Non-persistent | Persistent

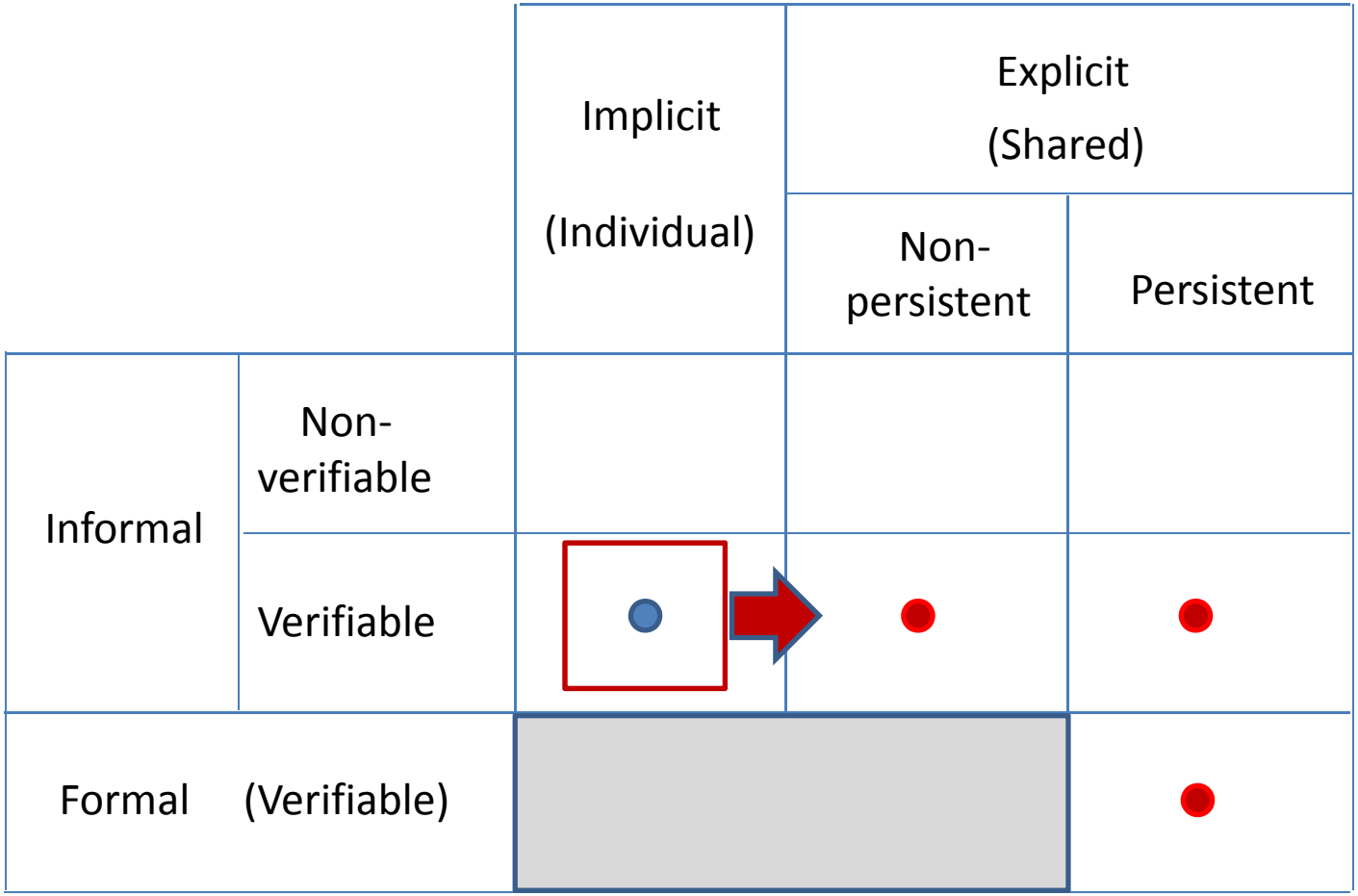
Classification of functional requirements

		Implicit (Individual)	Explicit (Shared)	
			Non-persistent	Persistent
Informal	Non-verifiable	●	●	●
	Verifiable	●	●	●
Formal	(Verifiable)			●

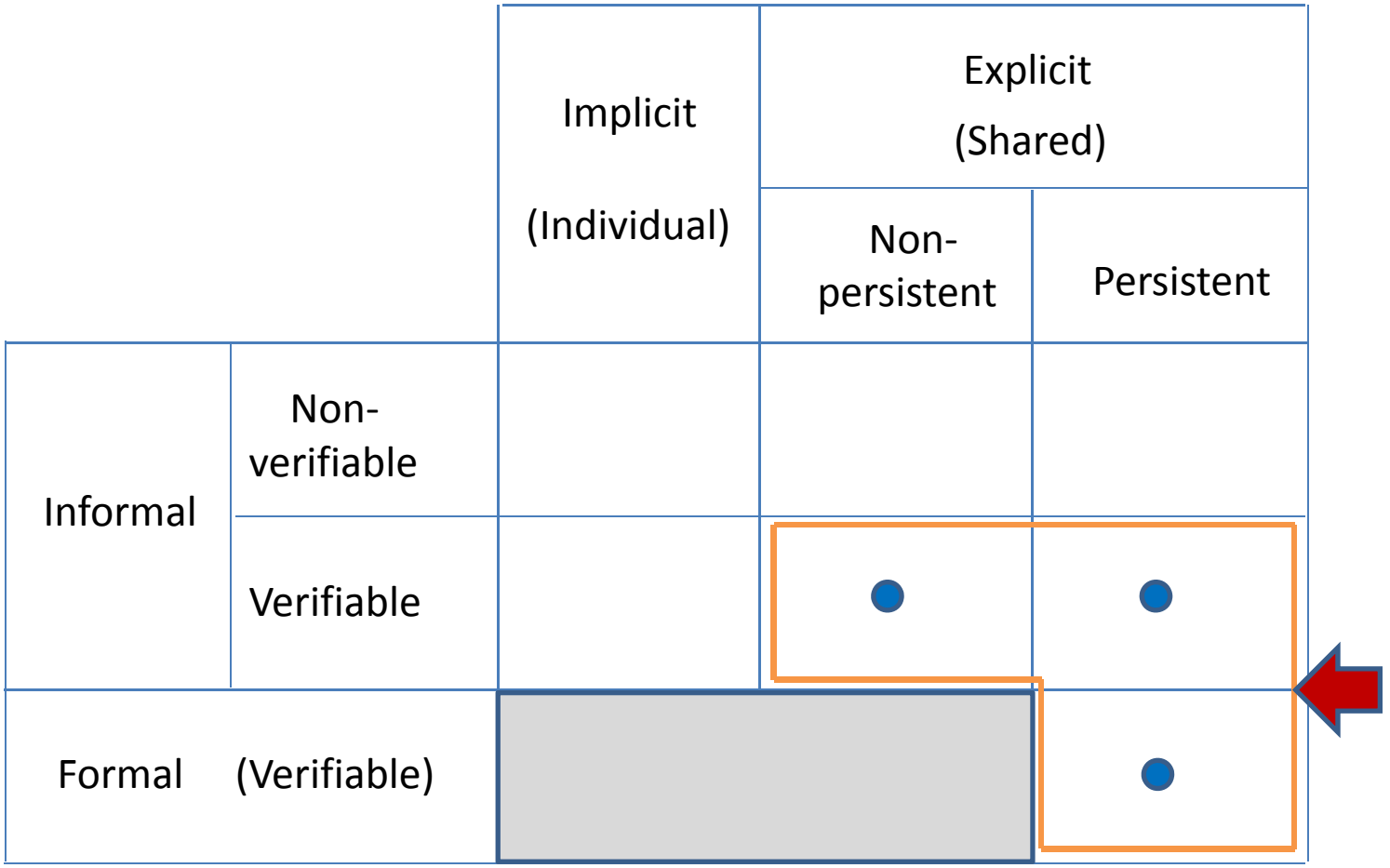
Functional requirements to be implemented must be made verifiable



Functional requirements to be implemented must be made explicit



Conceptual schema = Explicit, verifiable functional reqs.



The principle of necessity of conceptual schemas

To develop an information system
it is necessary
to define its **functional requirements**

To develop an information system
it is necessary
to define its **conceptual schema**

“Official” definitions

…conceptual modelers:

(1) describe structure models in terms of entities, relationships, and constraints;

(2) describe behavior or functional models in terms of states, transitions among states, and actions performed in states and transitions; and

(3) describe interactions and user interfaces in terms of messages sent and received and information exchanged.

http://www.conceptualmodeling.org/ConceptualModeling.html

“Official” definitions

… conceptual-model diagrams:

- …
- in some cases automatically generate (parts of) the software application.

http://www.conceptualmodeling.org/ConceptualModeling.html

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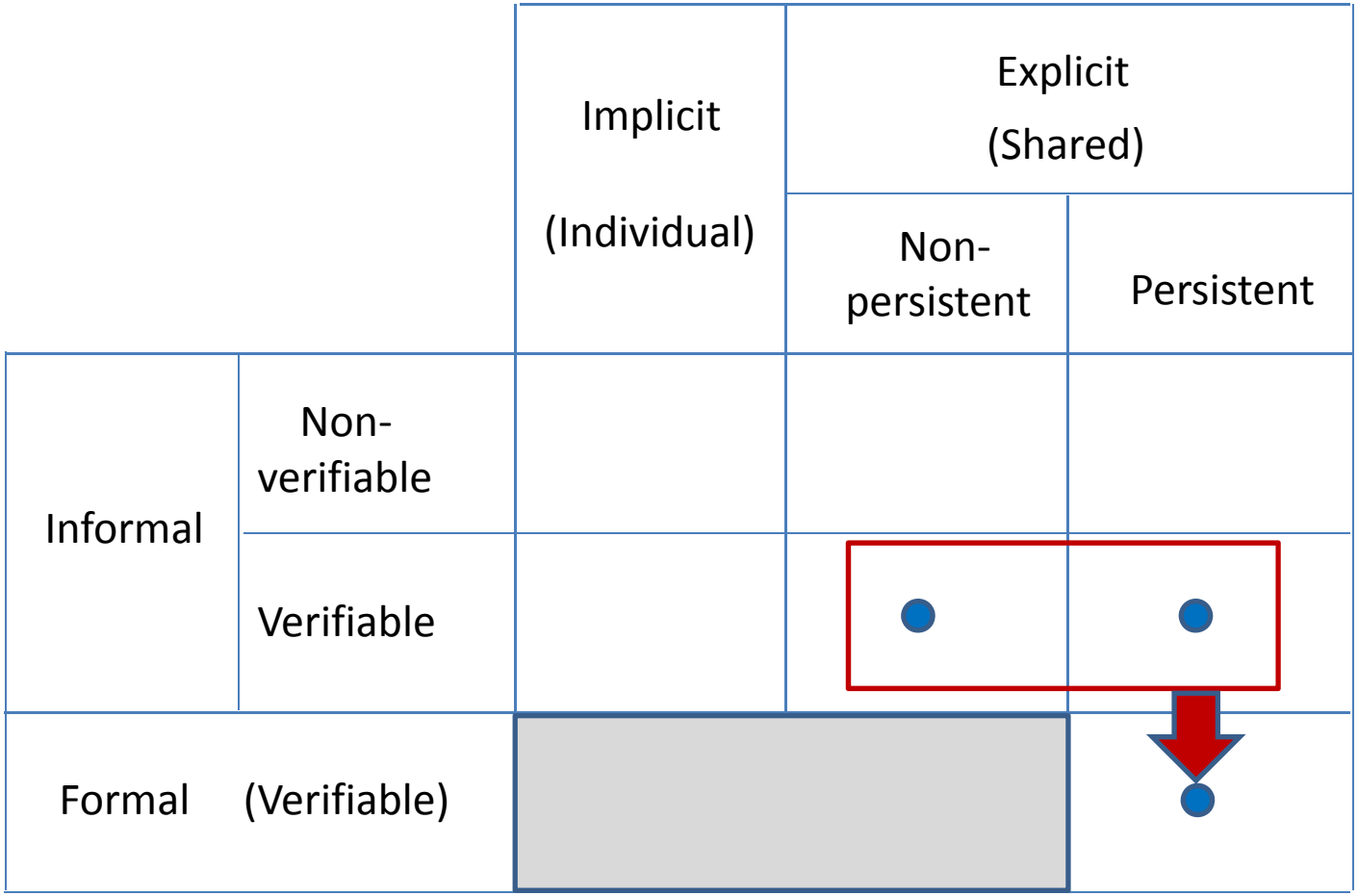
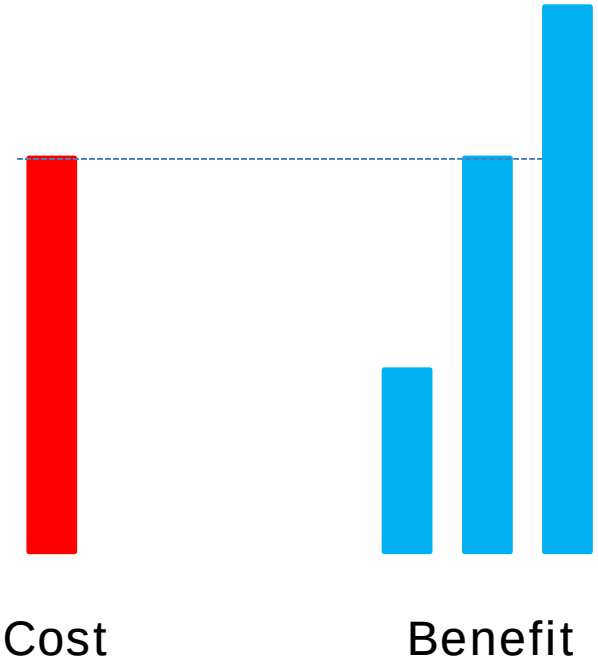
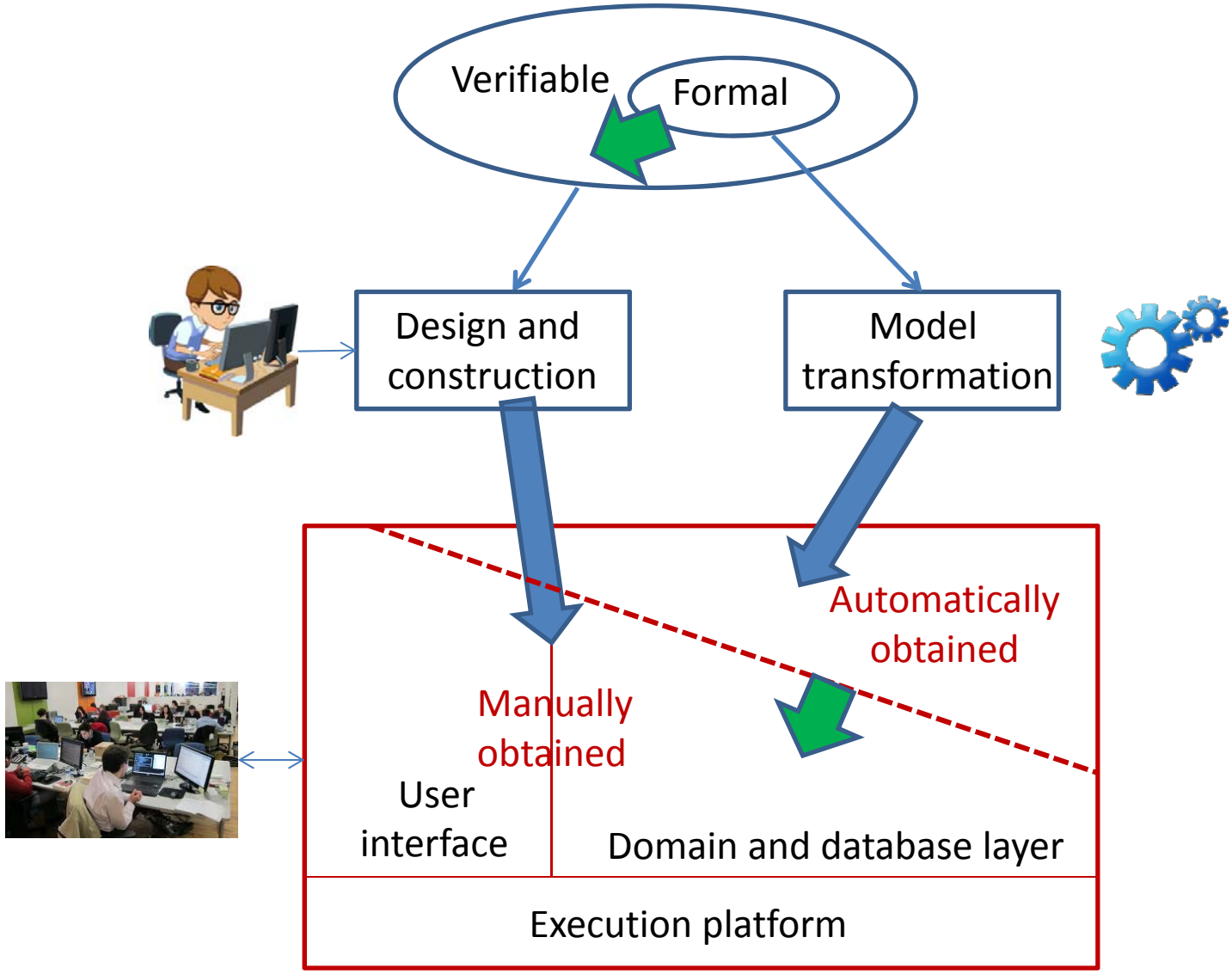
Conceptual schemas: Formal or informal?



Formalization?
A cost/benefit analysis



From requirements to implementation



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Manifesto for agile software development

We are uncovering better ways of developing software by doing it and helping others do it. Through this work we have come to value:

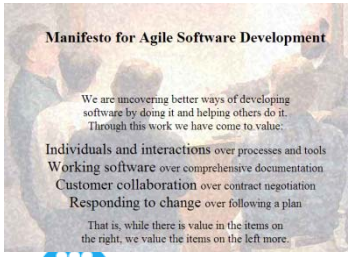
Individuals and interactions over processes and tools

Working software over comprehensive documentation

Customer collaboration over contract negotiation

Responding to change over following a plan

That is, while there is value in the items on the right, we value the items on the left more.

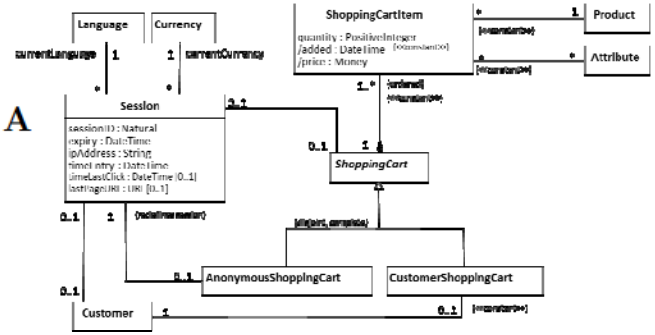


Conceptual modeling in agile software development
Two views

Working software over comprehensive documentation

Conceptual-Model Programming: A Manifesto

David W. Embley, Stephen W. Liddle, and Oscar Pastor



The focus of this talk

Functional requirements in agile development: User stories

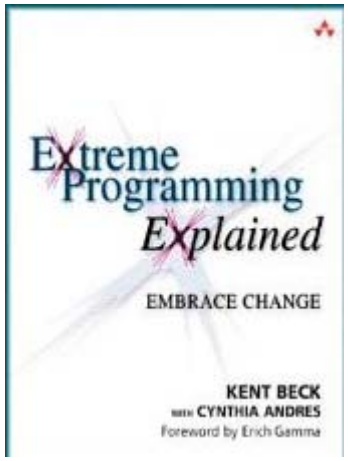
In consultation with the customer or product owner, the team divides up the work to be done into functional increments called “user stories”.

User stories

As a role I want feature so that reason

As a bank account holder
I want to be informed if my monthly balance
is projected to go to zero or below
so that I can arrange for an overdraft

User stories

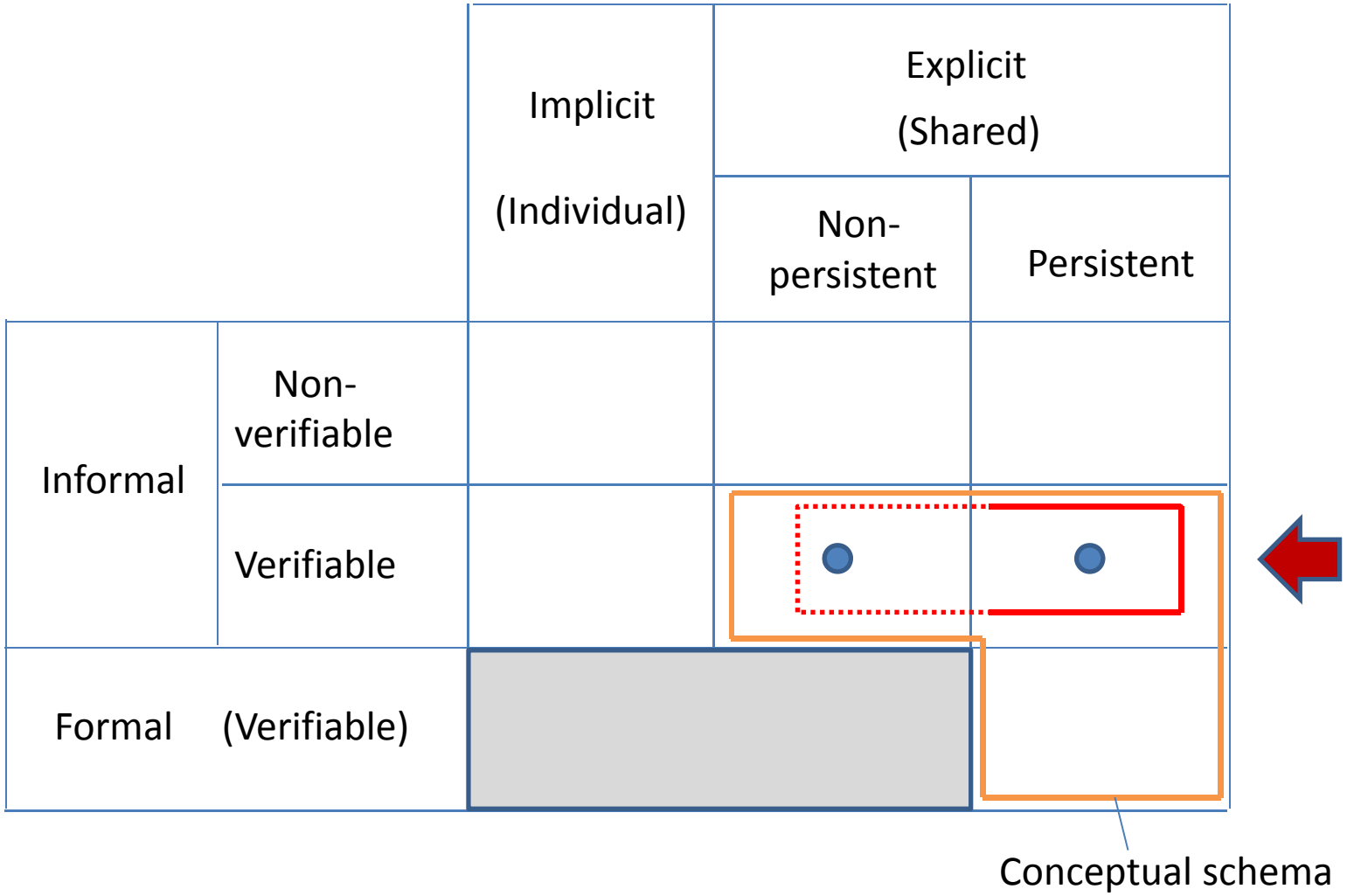


One thing the customer wants the system to do.

…

Should be verifiable.

User stories



The principle of necessity of conceptual schemas

in an agile way

To develop an information system
it is necessary
to define its conceptual schema

Alistair Cockburn's Cooperative game principle

Software development is a cooperative game…

The primary goal of the game is to deliver useful, working software.

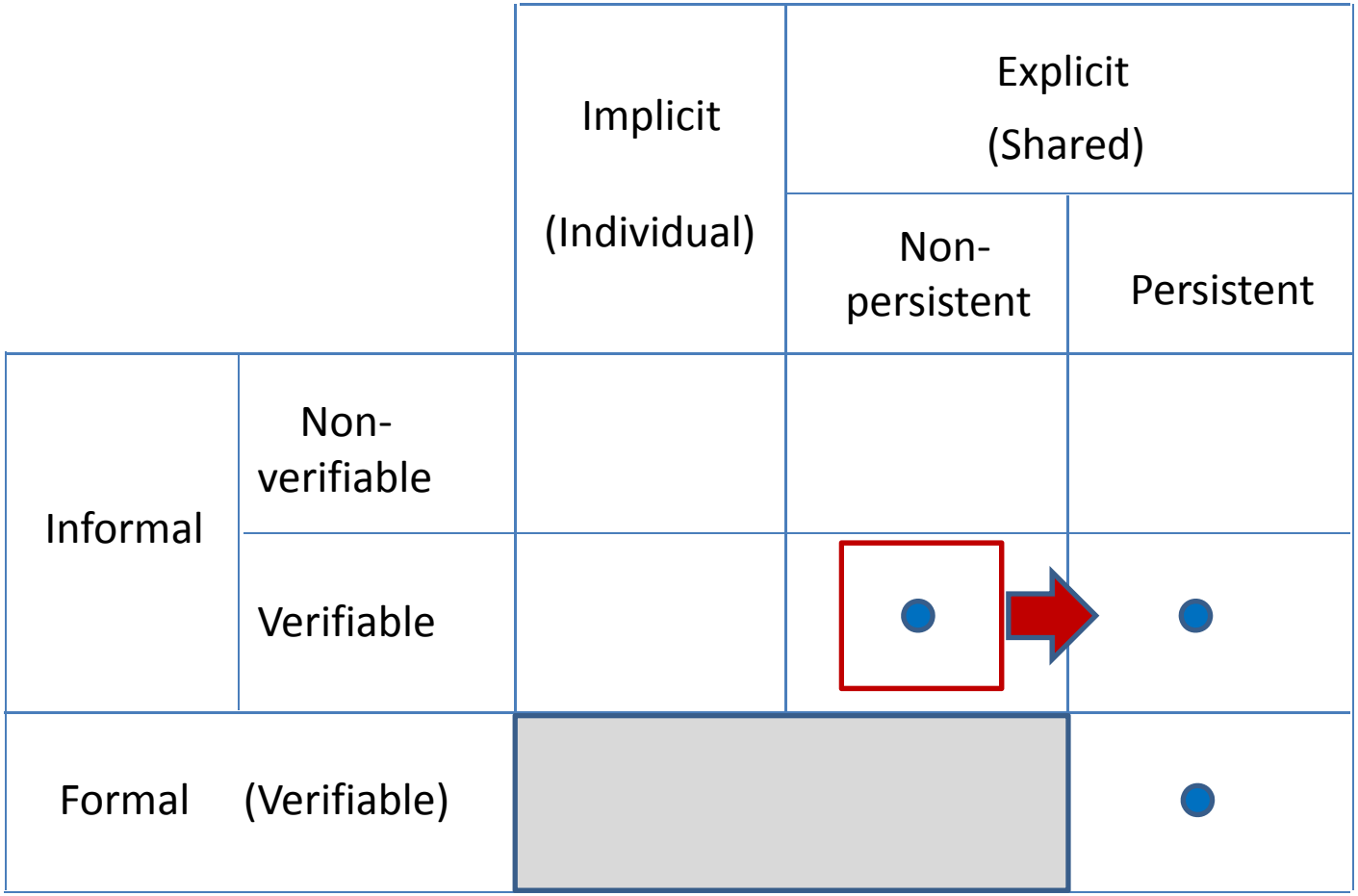
The secondary goal is to set up for the next game.

The next game may be:

- to alter or replace the system or
- to create a neighboring system.

Documentation

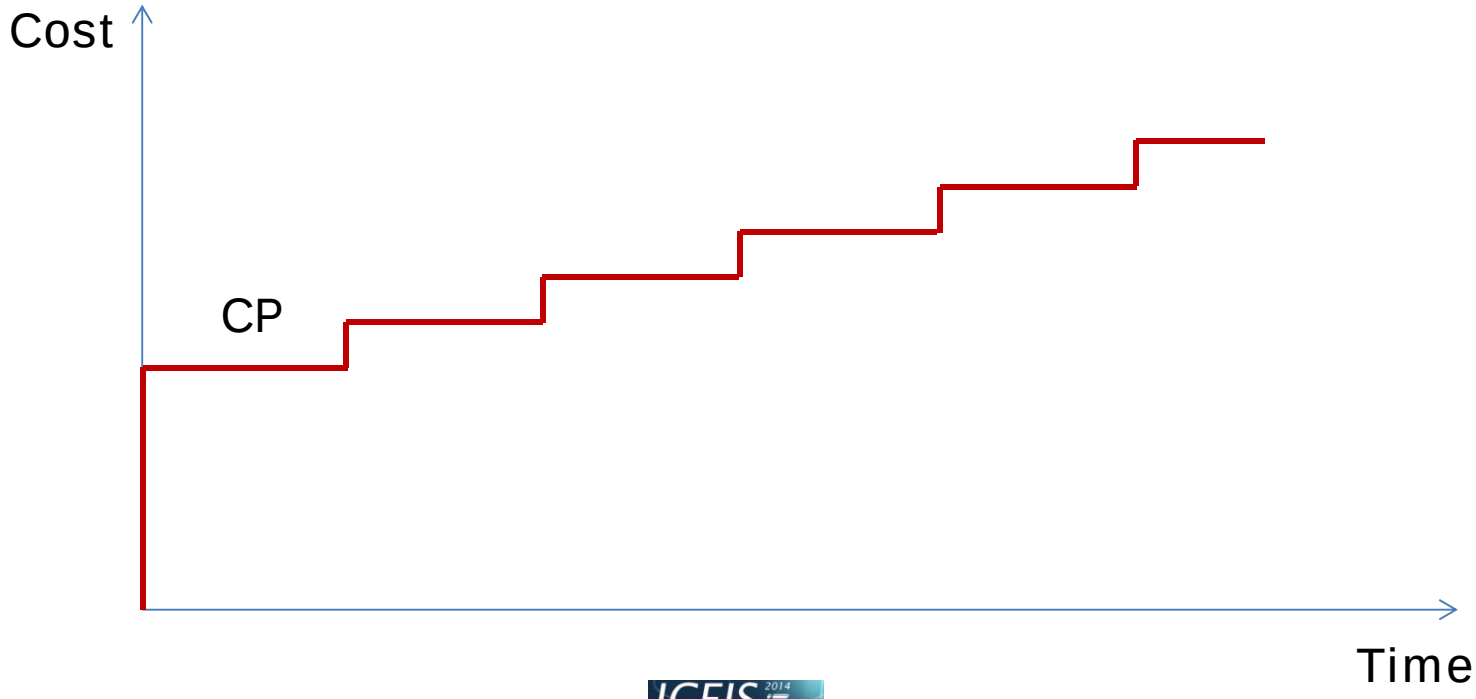
Conceptual schemas: Persistent or non-persistent?



Persistent or non-persistent? A life-cycle cost analysis

CP = Cost of initial documentation +
N * Average cost of updating documentation

N : Number of system's functional updates



Persistent or non-persistent? A life-cycle cost analysis

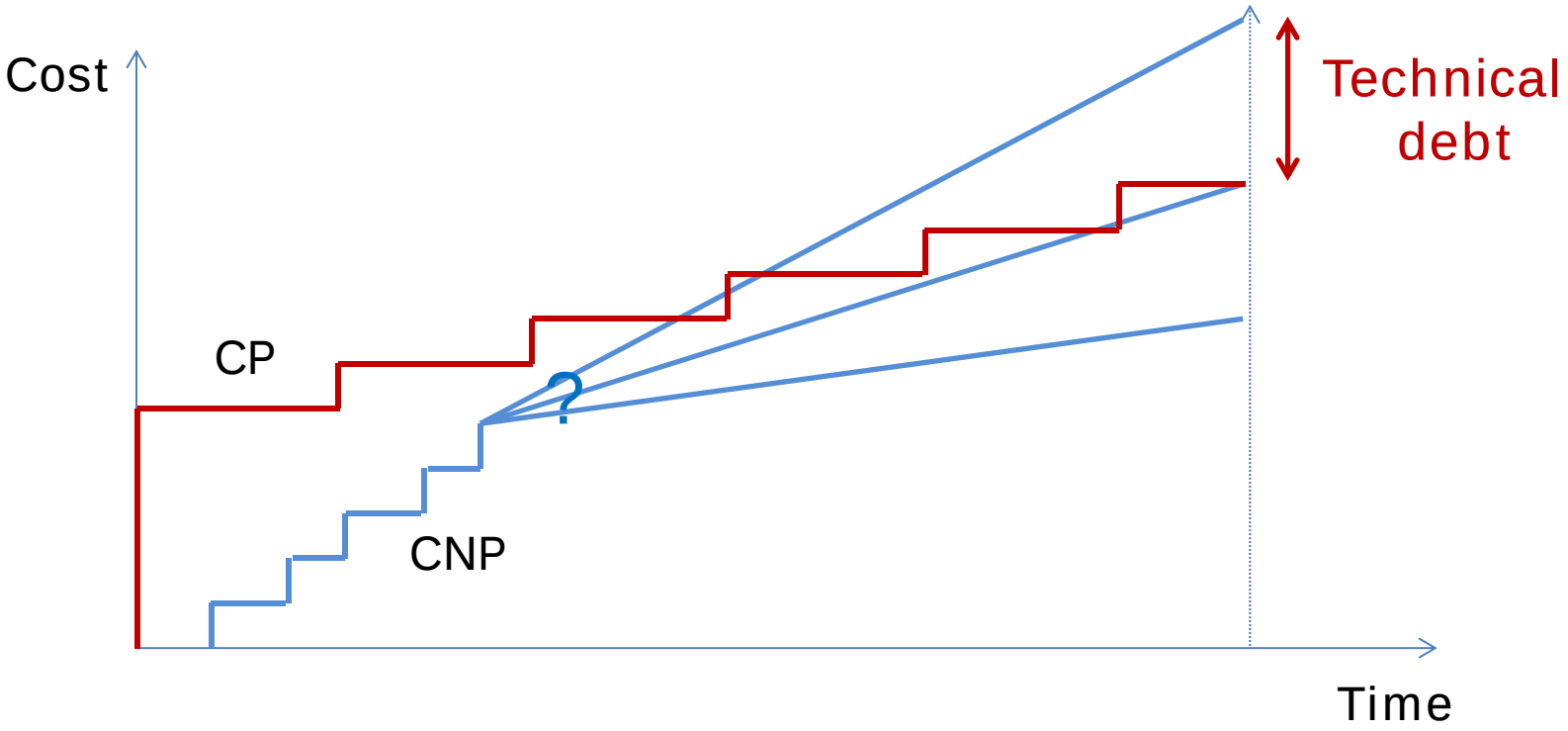
CP = Cost of initial documentation +
N * Average cost of updating documentation

CNP = M * Average cost of recovering requirements

N : Number of system's functional updates

M : Number of times functional requirements are needed and not available

Persistent or non-persistent? A life-cycle cost analysis



Technical debt

… A metaphor referring to the eventual consequences of poor … software development. The debt can be thought of as work that needs to be done before a particular job can be considered complete. If the debt is not repaid, then it will keep on accumulating interest, making it hard to implement changes later on.

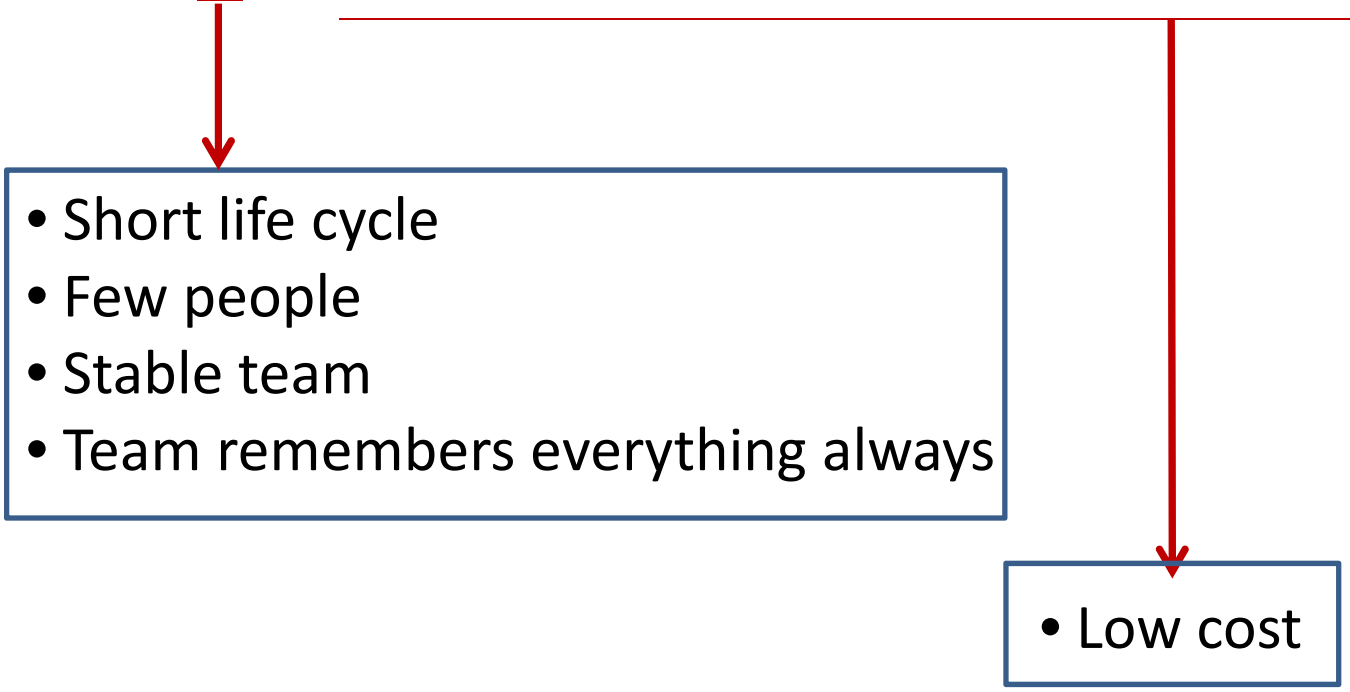
WIKIPEDIA
The Free Encyclopedia

Common causes of technical debt :

Lack of documentation, where code is created without necessary supporting documentation. That work to create the supporting documentation represents a debt that must be paid.

Non-persistent may be better when…

CNP = M * Average cost of recovering requirements



M : Number of times functional requirements are needed and not available

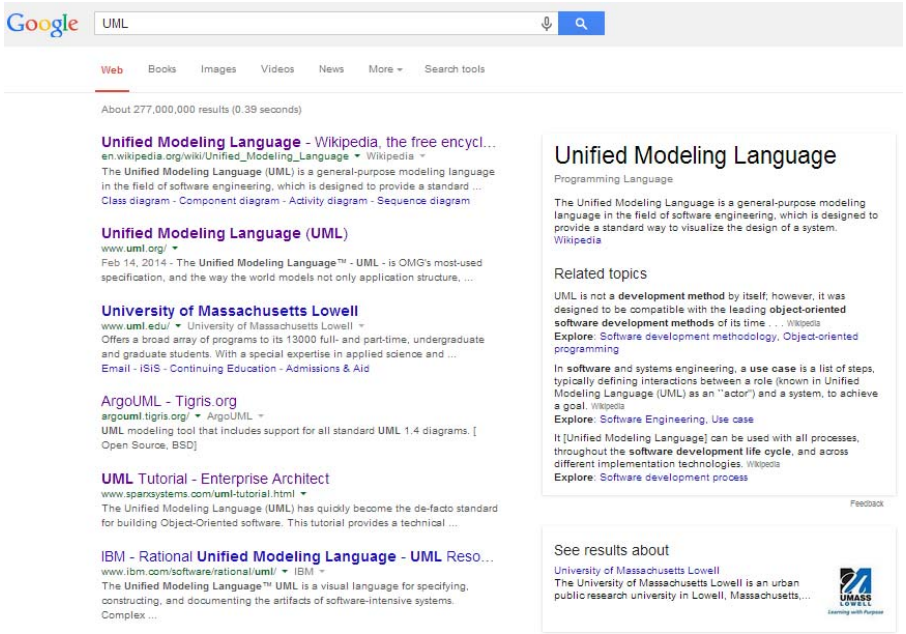
How to decrease the initial cost

May remain non-persistent requirements that:

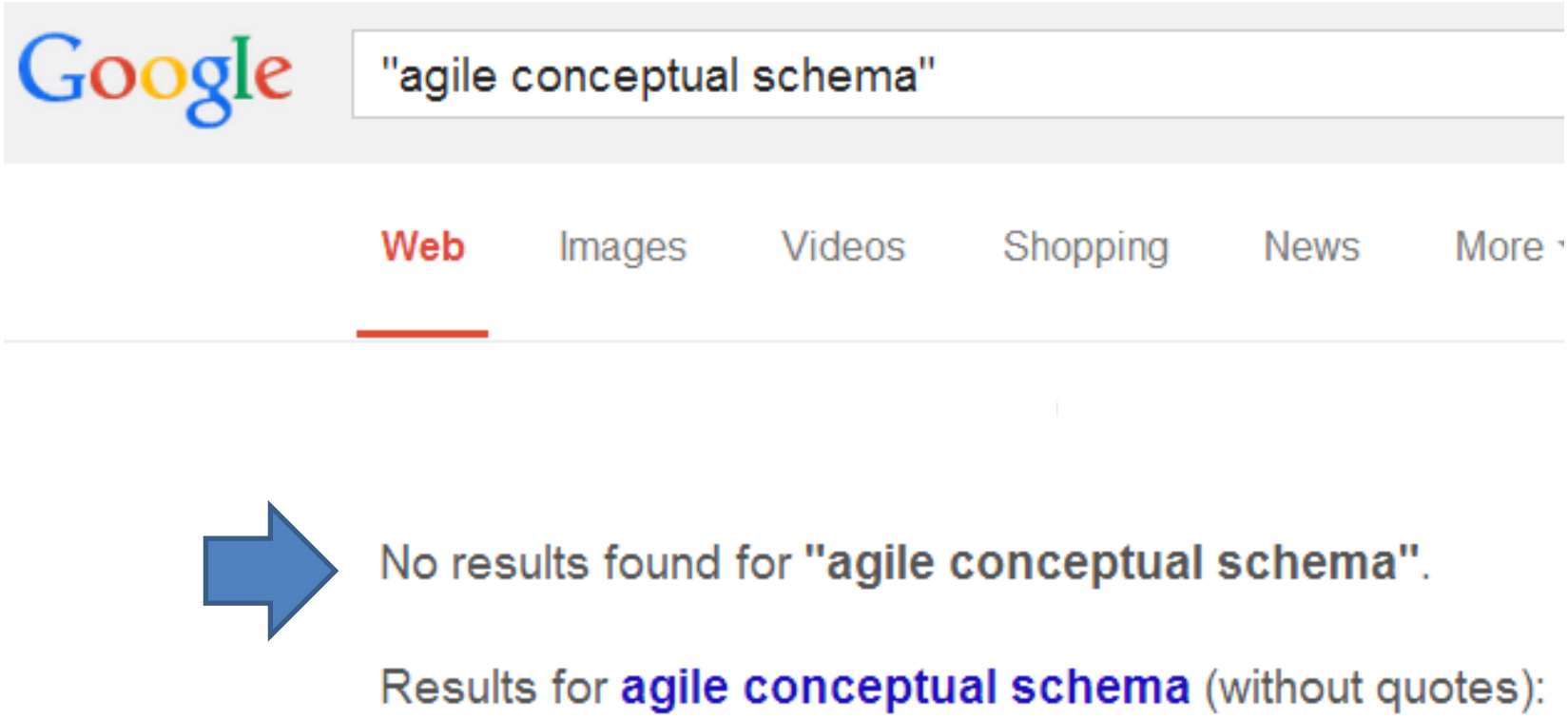
- Can be easily observed in the system
- Can be easily recovered
- Are common-sense
- Are obvious (dependent)

Sometimes requirements are easily observed in the system

But not always

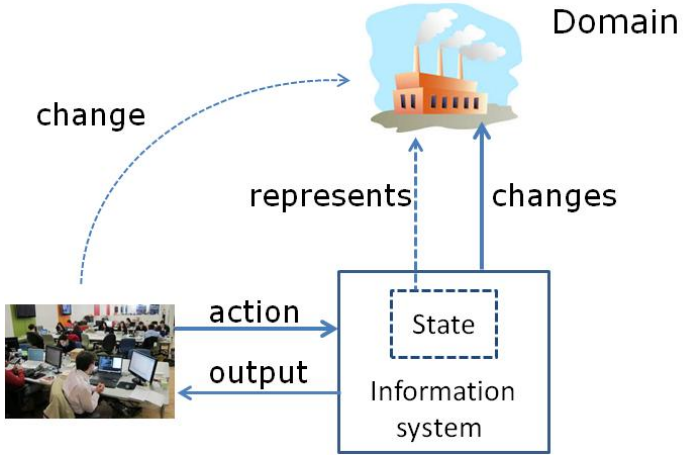


Agile conceptual schemas?



Agile persistent conceptual schemas?

- ✓ Domain concepts represented in the IS
- (*) ✓ Definitions
- (**) ✓ Integrity Constraints
- (***) ✓ Events/Actions:
  - Triggering conditions
  - Constraints
  - Effect on the state
  - Output



(*): When may not be known/accessible
(**): When not externally visible
(***): When not externally visible and independent

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Conclusions (I)

The principle of necessity applies also to agile methods:

To develop an information system
it is necessary
to define its conceptual schema

Conceptual modeling
is a necessary activity
in information systems development

Conclusions (II)

Key distinctions in conceptual schemas:

- Informal/formal
  - Formalization enables automatic processing
- Non-persistent/persistent
  - Has non-obvious cost implications
  - Agile conceptual schemas may be an appropriate persistence degree.

Thanks for your attention