Quark

A Method to assist Software Architects in Architectural Decision-Making

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Outline

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- The Quark method
- Arteon: R-module
- Example
- Implementation
- Conclusions

Motivation

Observations from literature:

- **Evolution** of software architecture (Kruchten+ 2006)
  - From **structural representation** to **decision-oriented**
  - Making **architectural decisions** based on **architectural knowledge**
- **Link** between QRs and software architectures
  - In general, **TwinPeaks** model (Nuseibeh 2001)
  - **QRs** play a critical role during system development, serving as **selection criteria** for choosing among myriads of alternative designs and ultimate implementations (Chung&Leite, 2009)

Motivation

Empirical observations: software architects…

- …are the **main source** of QRs.
- …may be receptive to new design methods as far as they still **keep the control**.
- …don't want to waste time into **too theoretical** methods and tools.
- …want to make **informed decisions**.

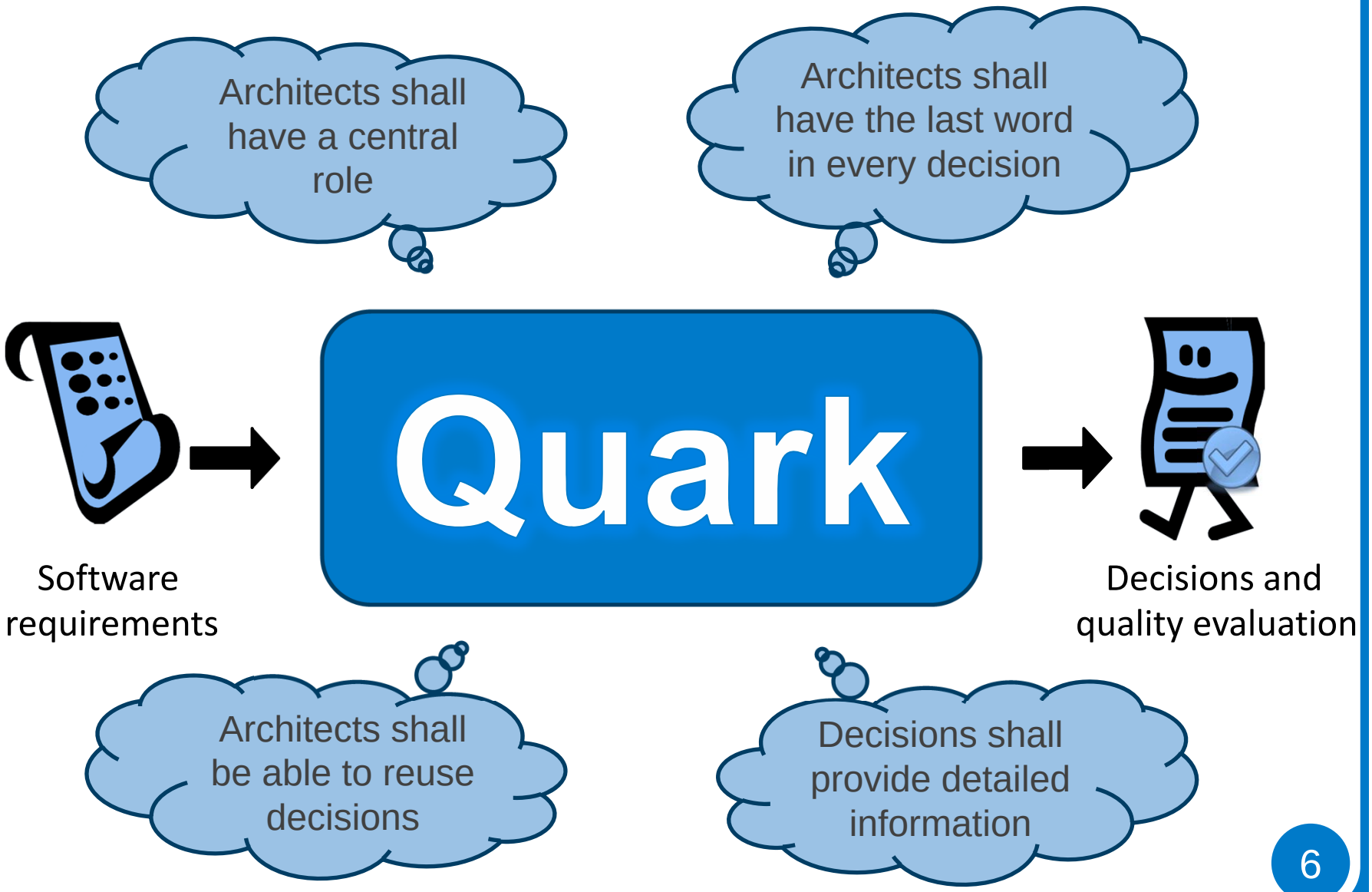
Ameller, D., Ayala, C., Cabot, J., Franch, X.: How do Software Architects Consider Non-functional Requirements: An Exploratory Study. In: 20th IEEE International Requirements Engineering Conference (RE), 2012.

Ameller, D., Ayala, C., Cabot, J., Franch, X.: Non-Functional Requirements in Architectural Decision-Making. IEEE Software, April 2013.

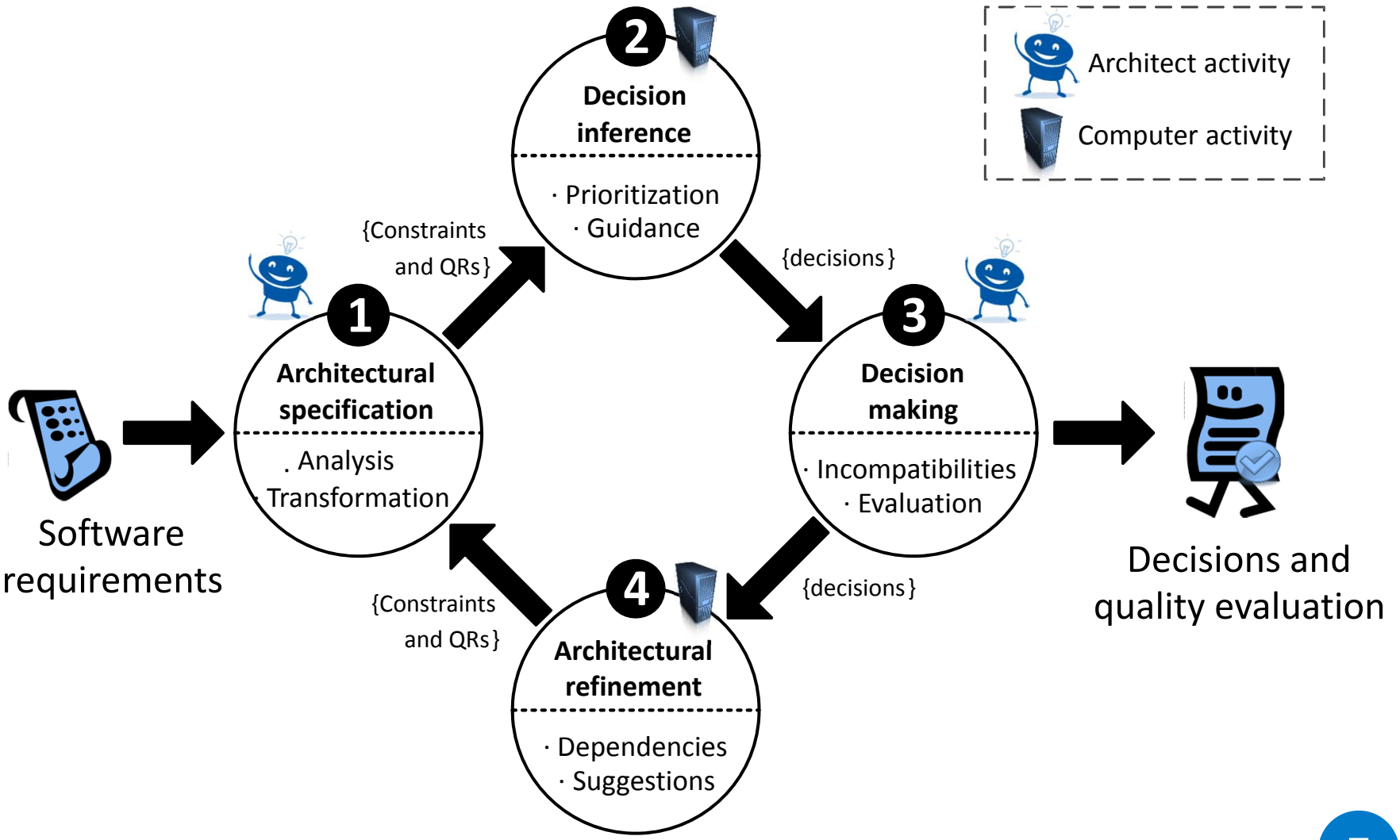
The Quark method

A ***method*** to assist ***software architects*** in architectural ***decision-making***

The Quark method



The Quark method



Arteon

Builds upon an ontology

- Ontologies applied for AK since 2006 (Akerman&Tyree)

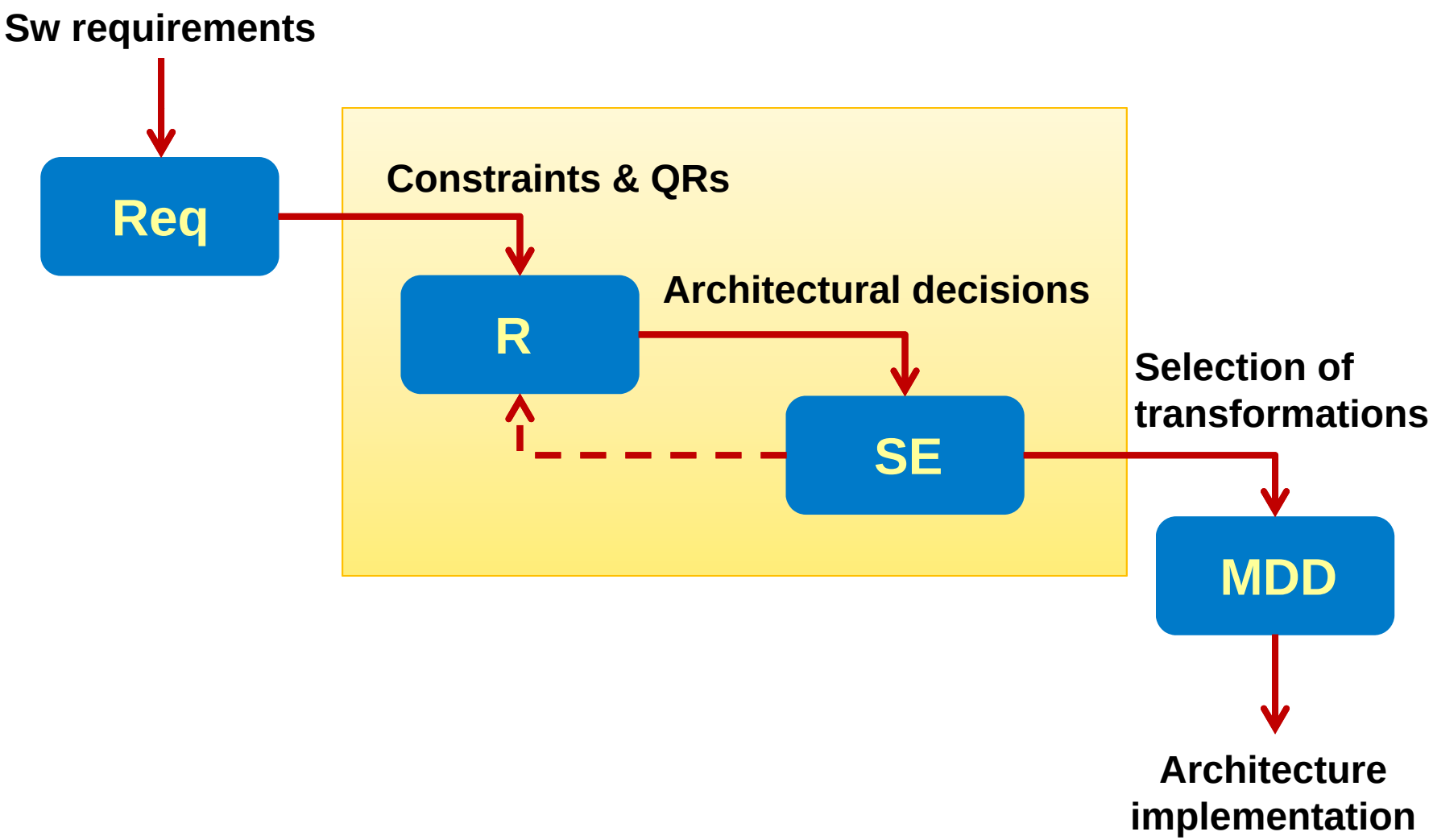
What is Arteon?

- Architectural and technological ontology
- Divided in 4 modules
- Follows the principles of ontology design (Gruber, …)

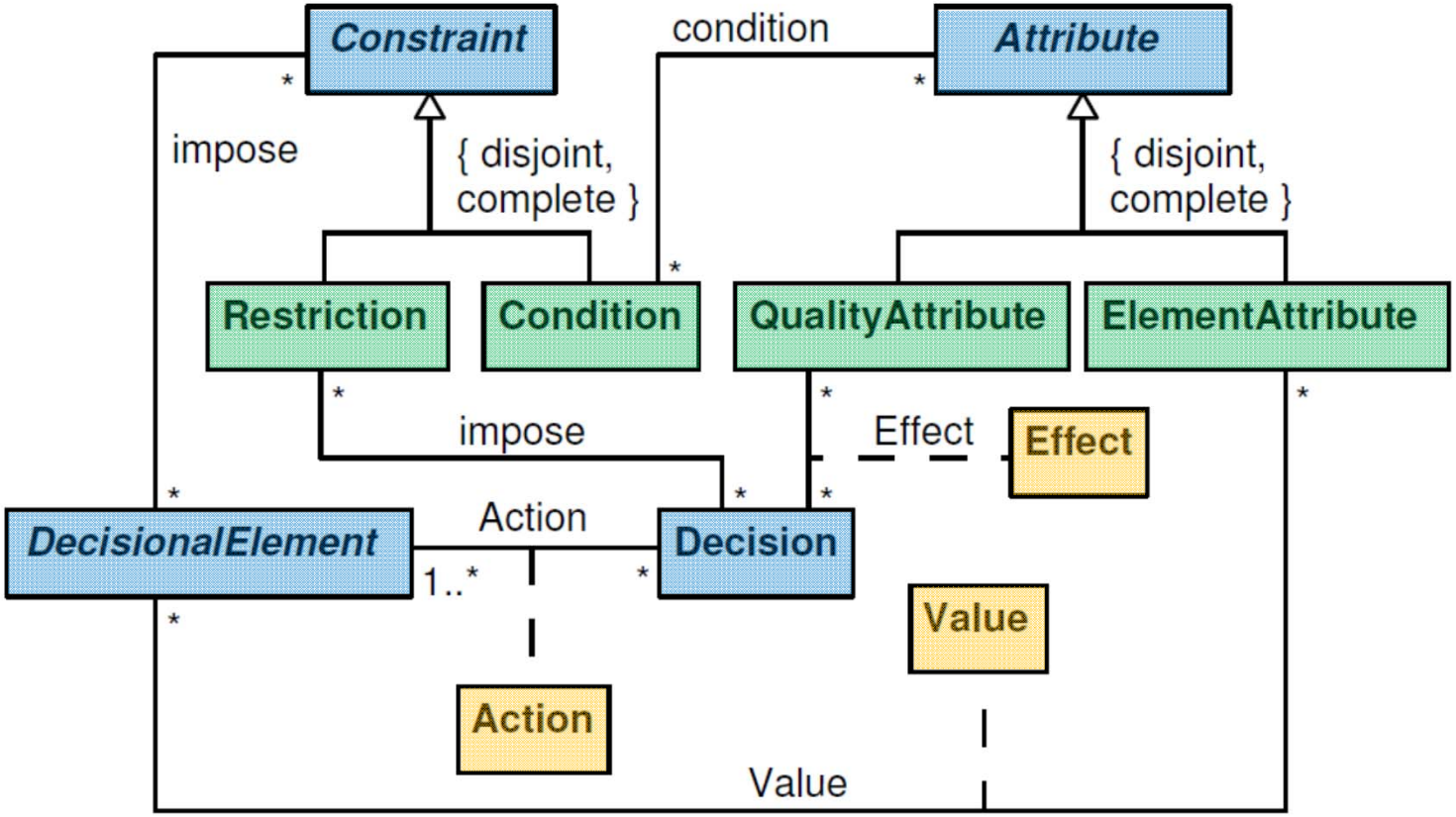
Why Arteon?

- To share and reuse AK, but more importantly, to guide and facilitate architects' decision-making.

Arteon: a modular ontology



Arteon: R-module (Reasoning)



Don’t worry; there is an example!

Example

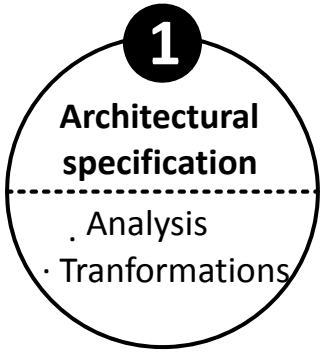
Software requirements

(R1) the software system shall keep the information about clients and providers

(R2) the software system shall be developed using OSS whenever possible

(R3) the software system shall ensure that the information about clients and providers is not lost

Example



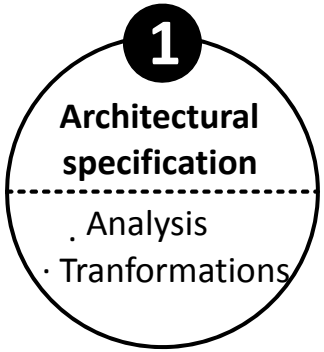
(R1) the software system shall keep the information about clients and providers

Architect: "It is an information system, so a DBMS will be required"

Quark: *use* DBMS

Arteon: Restriction that requires a decision that has the action *use* over the decisional element *DBMS*

Example



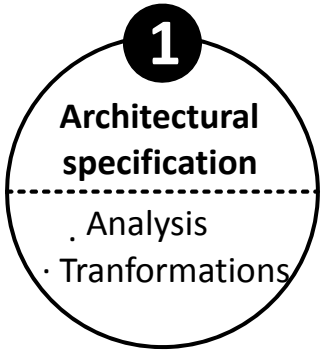
(R2) the software system shall be developed using OSS whenever possible

Architect: "I set a constraint on the technologies to limit them to the ones that are OSS"

Quark: "License" includes {"GPL", "LGPL", etc.}

Arteon: There is a condition over the element attribute "License" to include one of the previous values

Example



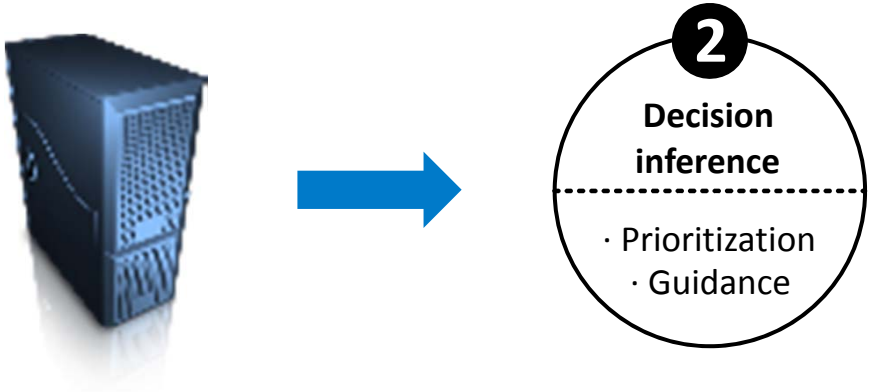
(R3) the software system shall ensure that the information about clients and providers is not lost

Architect: "The DBMS can be configure for backups, and the overall reliability is important"

Quark: "Backup facility" *equal* "yes"
"Reliability" *greater than* "average"

Arteon: There are two conditions: one over the element attribute "Backup facility" and the other over the quality attribute "Reliability"

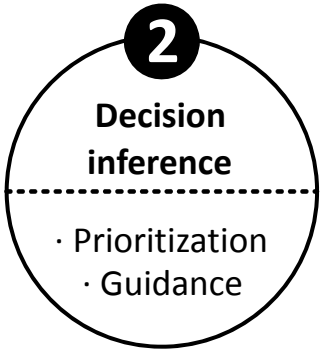
Example



- We need to uncover the relevant AK in order to make informed architectural decisions
  - E.g., find a comparative study[1] of MySQL 5, PostgreSQL 8.3, and SQL Server 2005
- This AK needs to be introduced in **Arteon**

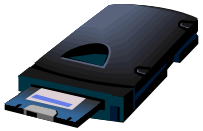
[1] *http://www.postgresonline.com/journal/archives/51-Cross-Compare-of-SQL-Server,-MySQL,-and-PostgreSQL.html (2008)*

Example

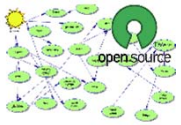


From the introduced AK we have information about:

OSS License



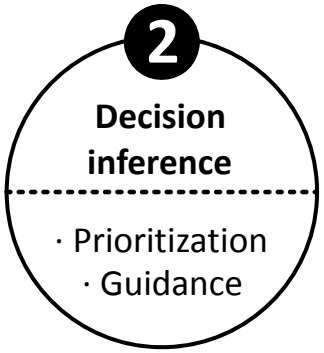
Backup facilities



OSS ecosystem
(OSS-related technologies that support this DBMS)

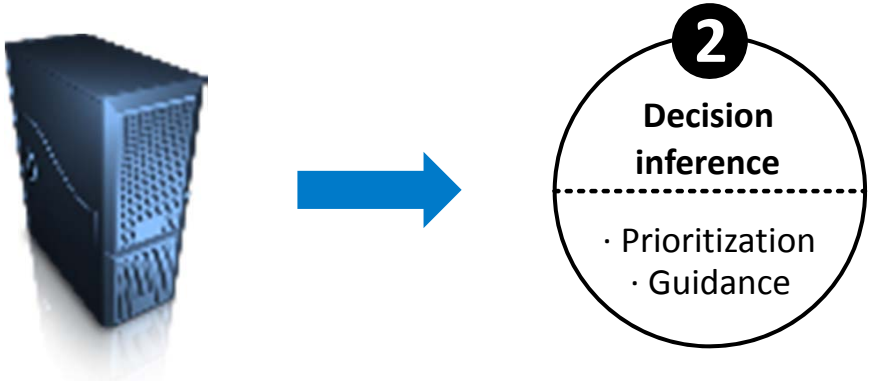
Reliability impact
(measured as ACID compliance)

Example



	open source	open source		ACID
1. *use* MySQL 5	✓	✓	?	?
2. *use* PostgreSQL 8.3	✓	?	?	✓
3. *use* SQL Server 2005	⊘	⊘	✓	✓

Example



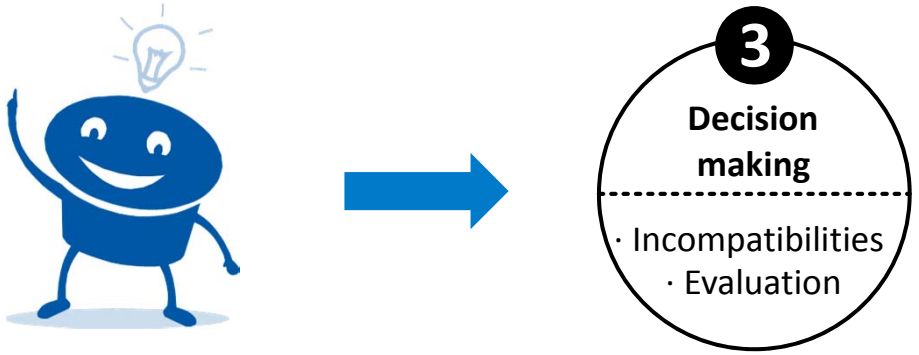
We provide informative decisions:

***use* MySQL 5** is selected because it is OSS, but there is no information available about backup facilities in MySQL. MySQL supports more OSS technologies than the other alternatives. Also, using MySQL has neutral impact in reliability because ACID compliance depends on the configuration.

How does this look in Arteon?

- **There is a decisional element called “MySQL 5”**
- **This decisional element has the “License” attribute with value “GPL”**
- **There is a decision to use the decisional element “MySQL 5”**
- **This decision has a “neutral” impact on “Reliability” quality attribute**

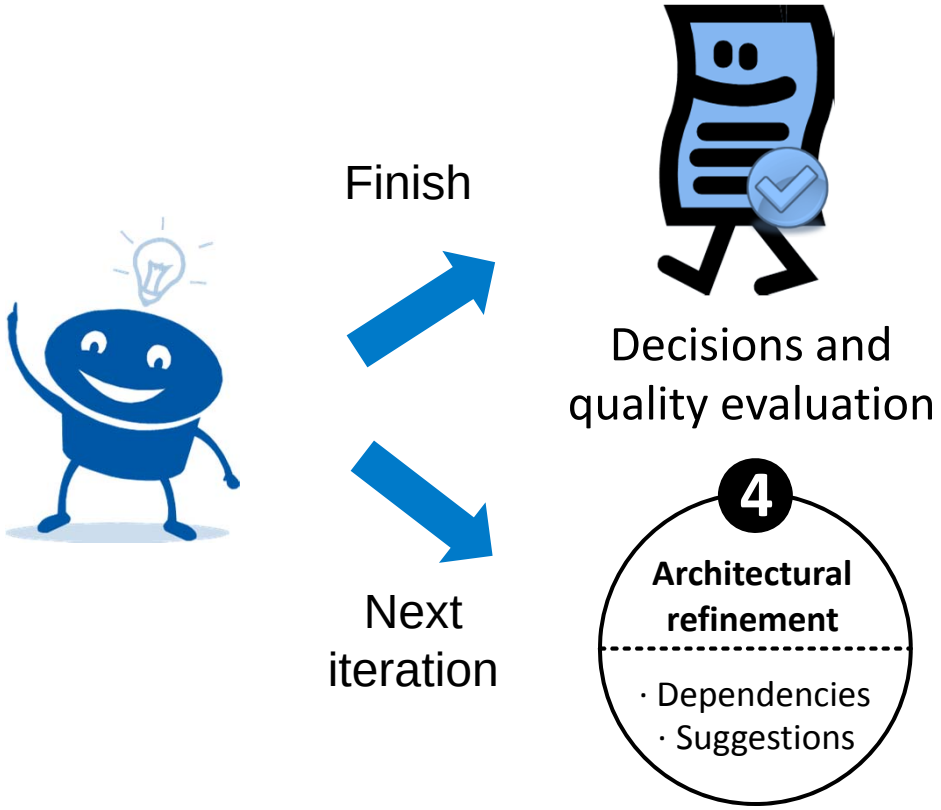
Example



The software architect has the last word

- The architect may prefer to use PostgreSQL, even it is not the highest-ranked decision
- **Important!**
  1. The architect is informed before decision-making
  2. Architecture decisions that were unknown to the architect have been put into consideration

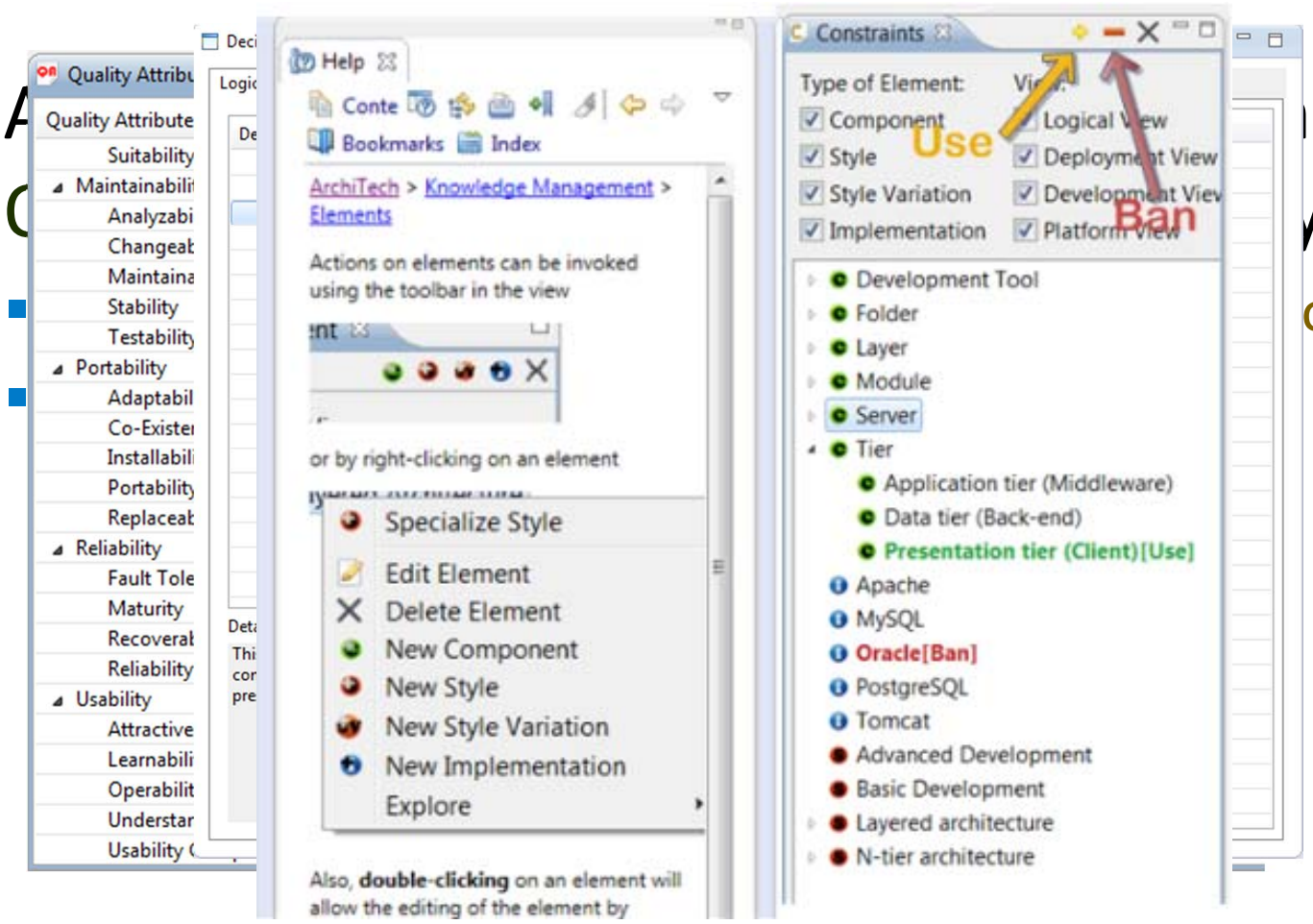
Example



Quark does not need to start from a full specification, it can start from a short list of requirements (like in this example), and then iteratively grow to a full list of ADs

Implementation

- A … e
  - C … y
    - … on



[1] www.upc.edu/gessi/architech

Conclusions

> "The life of a software architect is a long (and sometimes painful) succession of suboptimal decisions made partly in dark" (Kruchten, 1999)

One of the reasons to produce suboptimal decisions is lack of knowledge:

- The architect may not know all the effects of an AD
- Some AD is not considered because it is unknown

To improve this situation we have presented **Quark**, a method to assist software architects in architectural decision-making

Hope you liked it!

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