



# Q-Rapids: Data-driven Engineering of Quality Requirements in Agile Projects

Dr. Jens Heidrich

Division Manager “Process Management”  
Fraunhofer IESE



Q-Rapids



Funded by the  
European Union



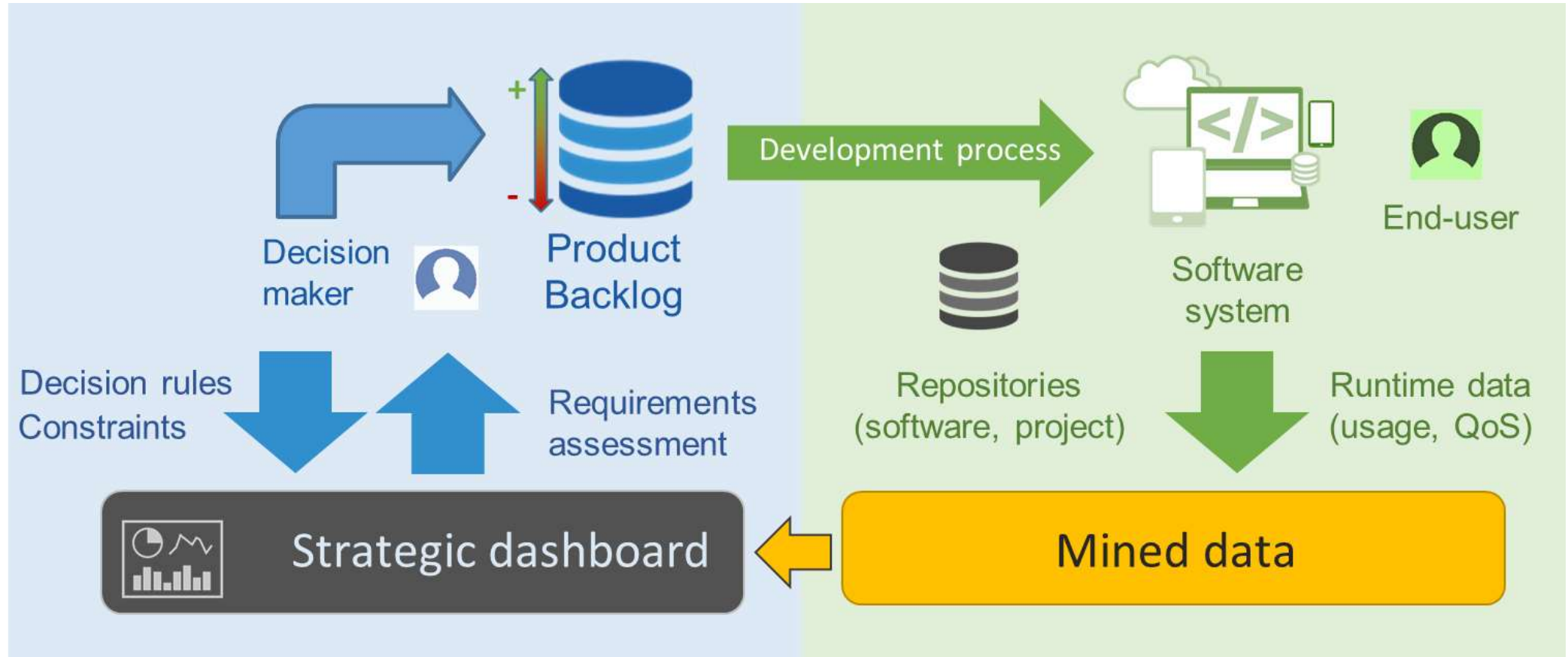
**Fraunhofer**  
IESE

# A Data-driven Project

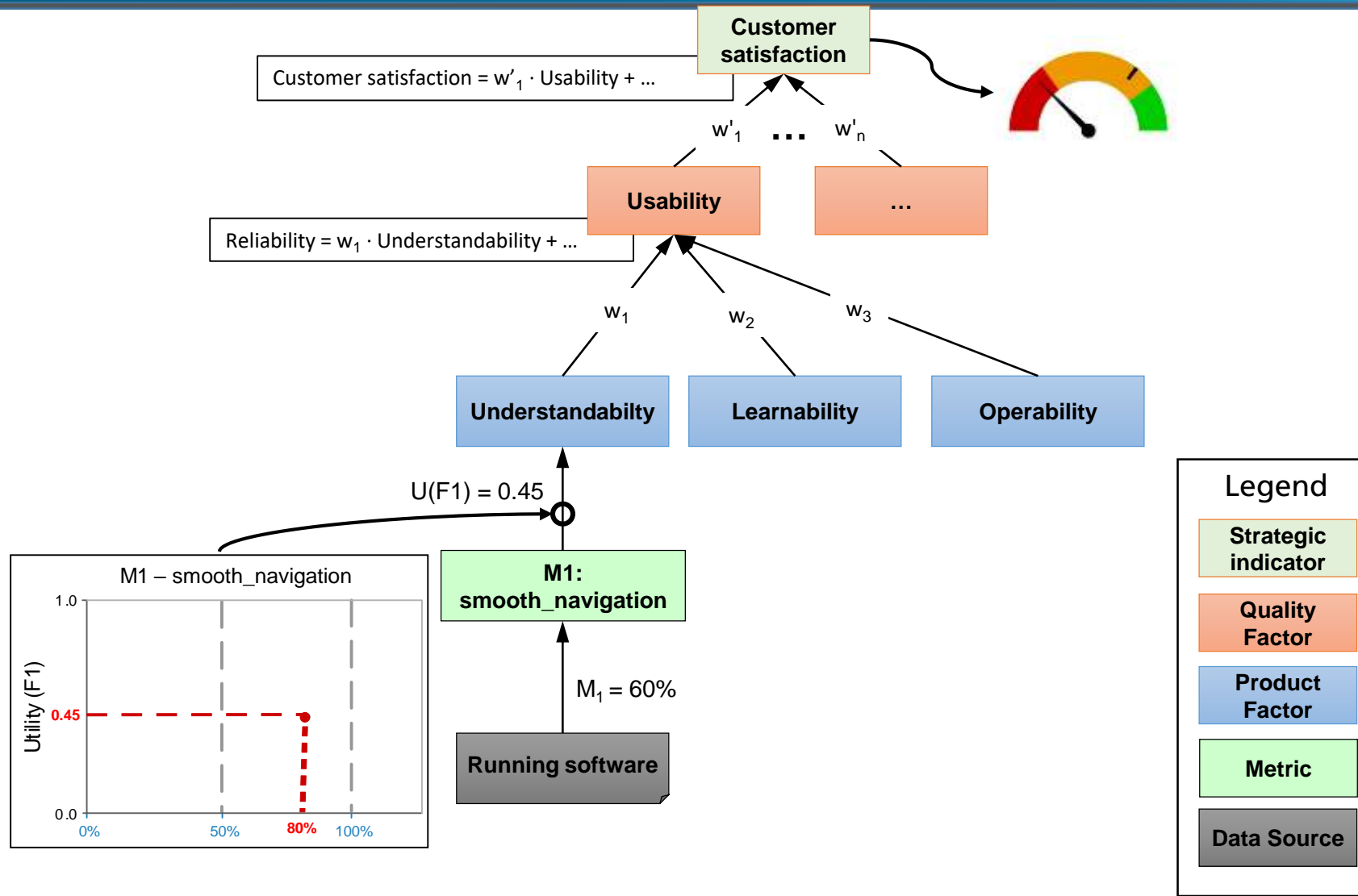
- ☞ Use of available data as a way to implement quality requirements analysis
- ☞ Q-Rapids project: an H2020 Research and Innovation Action aiming at supporting quality requirements management through data analysis

Project number: 732253		Project acronym: Q-Rapids	
General information			
Title	Quality-Aware Rapid Software Development		
Start date	1-Nov-2016		
Duration	36 months		
Call	H2020, Topic <i>Advanced Software Engineering</i>		
Keywords	Quality Requirements; Software Development		
Budget	approx. 5 Million Euros		
Partners	UPC, UOULU, FRAUNHOFER IESE, BITTIUM, SOFTEAM, ITTI, NOKIA		

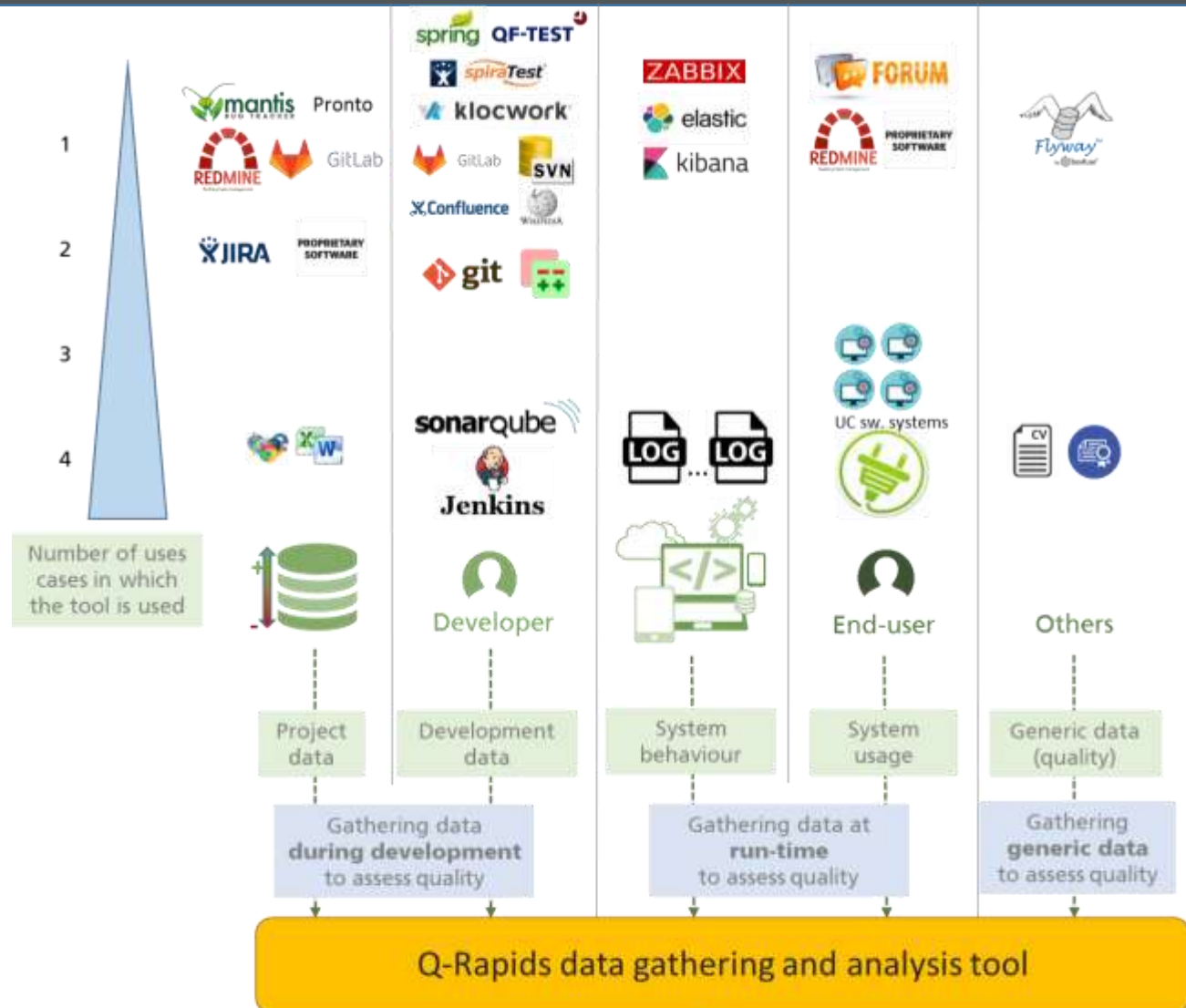
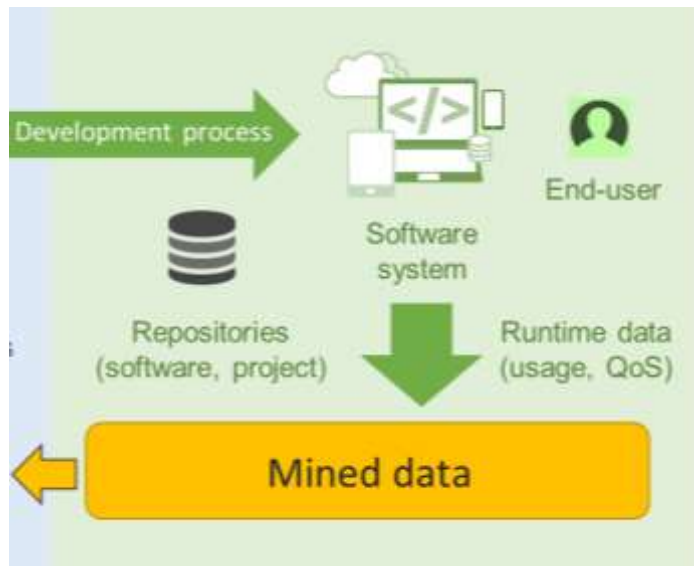
# The Q-Rapids approach (simplified)



# An Exemplar Scenario



# Combination of Different Real Data Sources



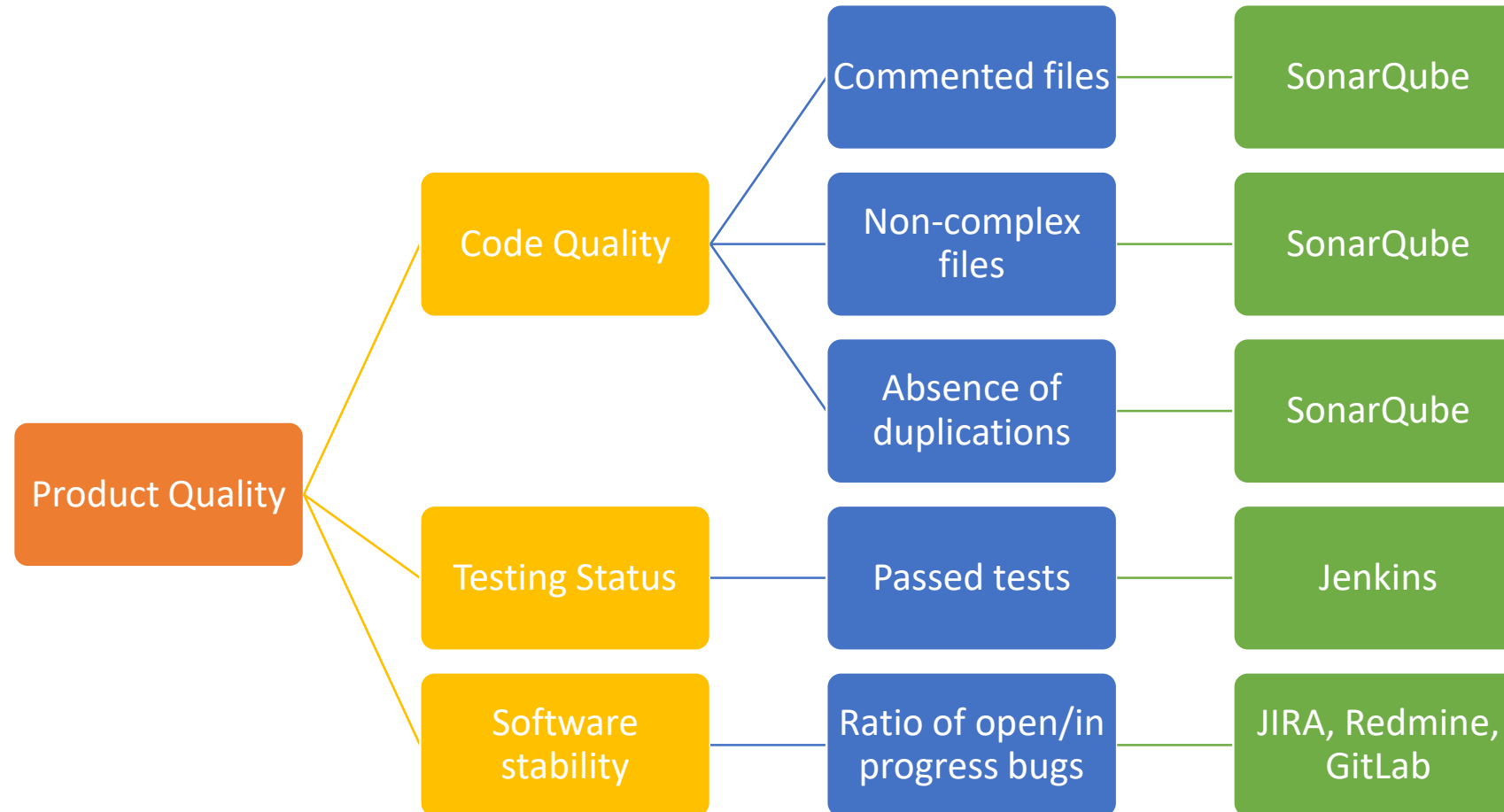
# Relevant Quality Factors at Industry

“ Which quality factors should be measured to support rapid software development? ”

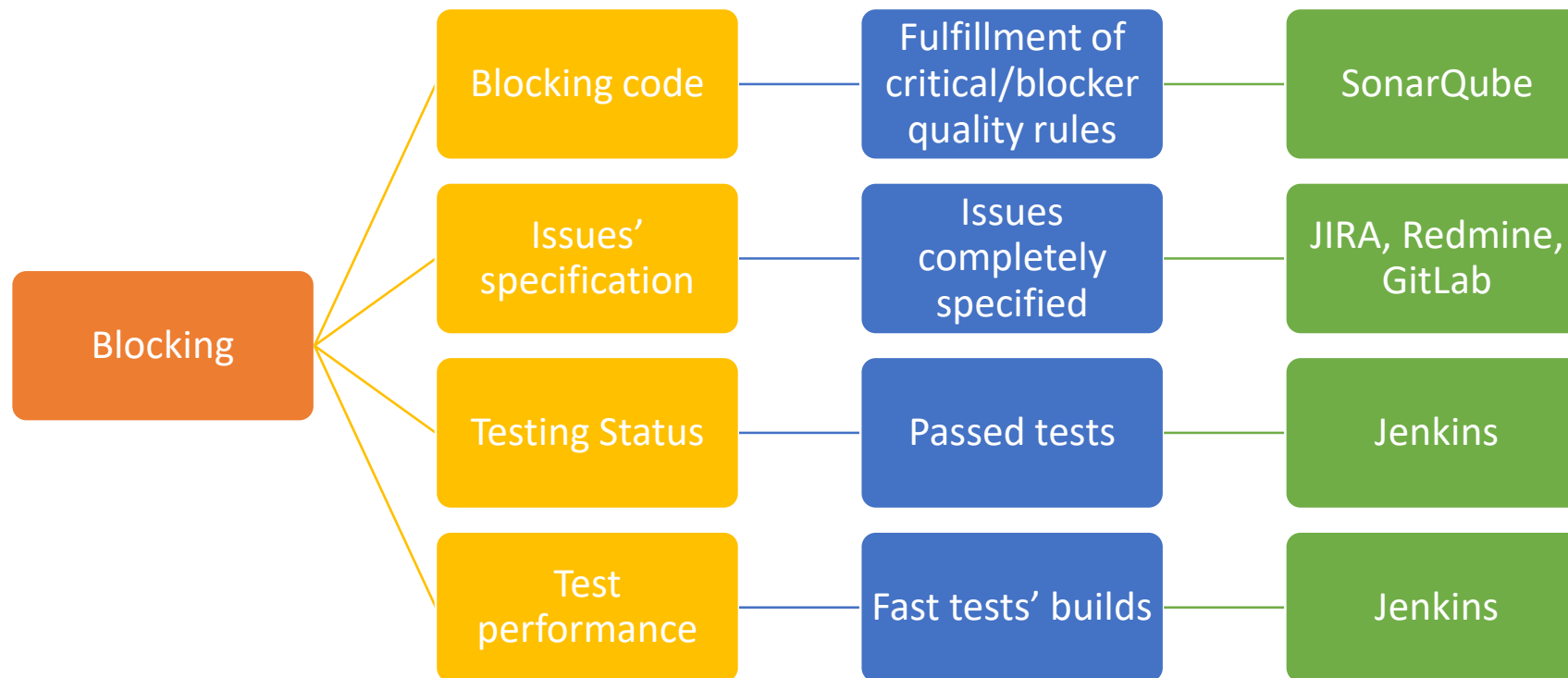
Q-Rapids Sw. Quality Workshops  
in the Industry Partners Premises



# Excerpt of the Quality Model (1/2)

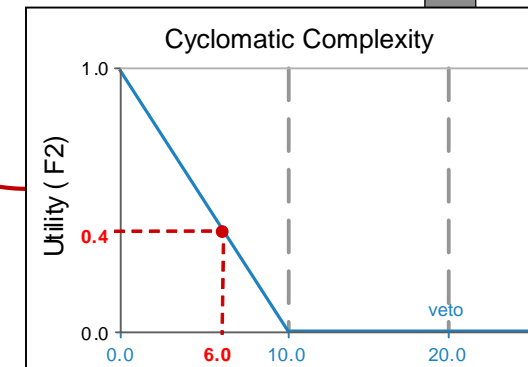
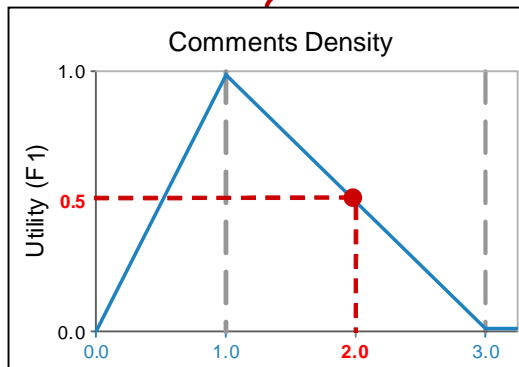
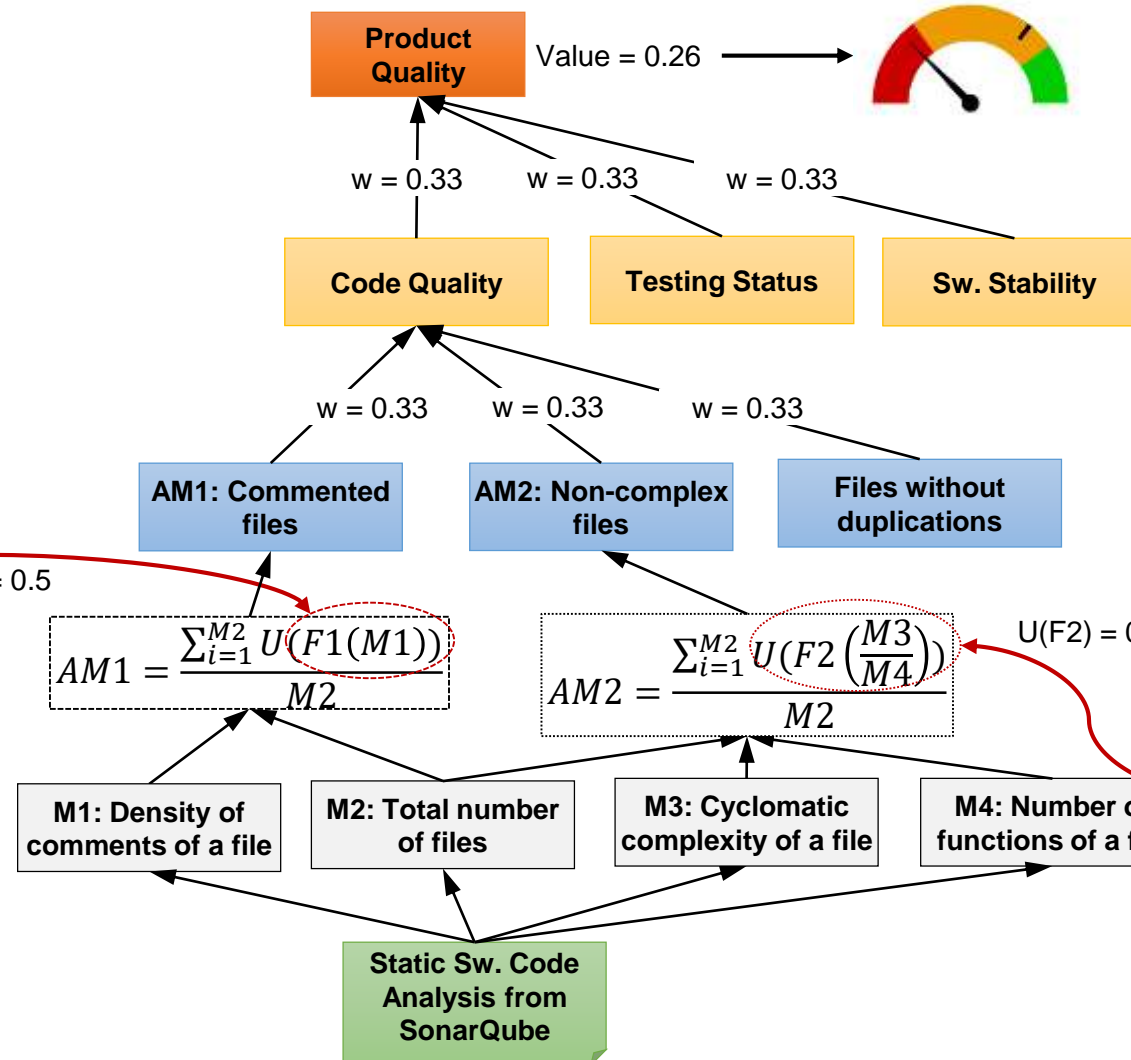
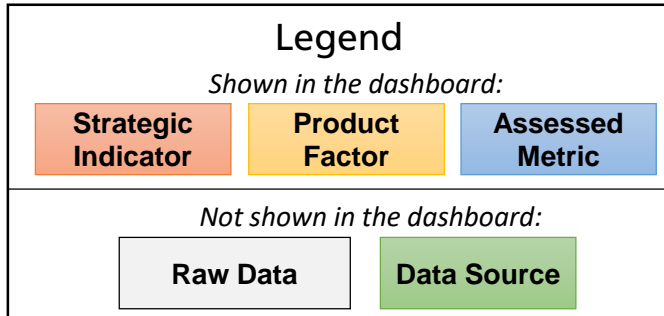


# Excerpt of the Quality Model (2/2)





# Quality Model Assessment: How does it Work?



A Bottom-Up Approach

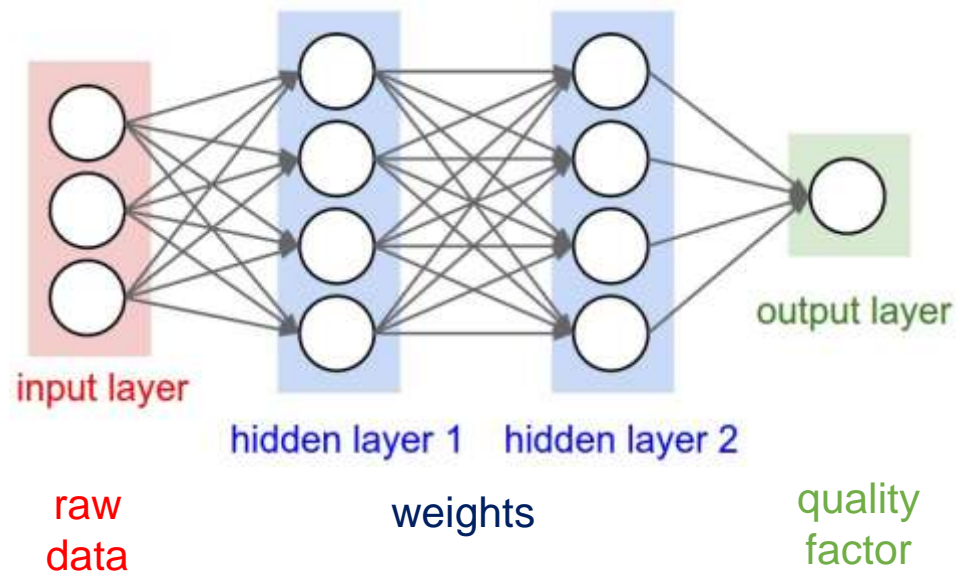
# A Data-driven Project

- ☞ During the sw. quality workshops in the companies, we identified:
  - ☞ Relevant strategic indicators and product factors
  - ☞ Availability of raw data from real data sources to compute assessed metrics
  - ☞ Metrics interpretation from experts to define utility functions in assessed metrics
  - ☞ Weights of the different elements for the aggregation
- ☞ But...
  - ☞ It is not always feasible to gather this knowledge from experts for each assessed metrics and aggregation
  - ☞ Use of artificial intelligence and data analysis to learn from the data gathered and initial quality models

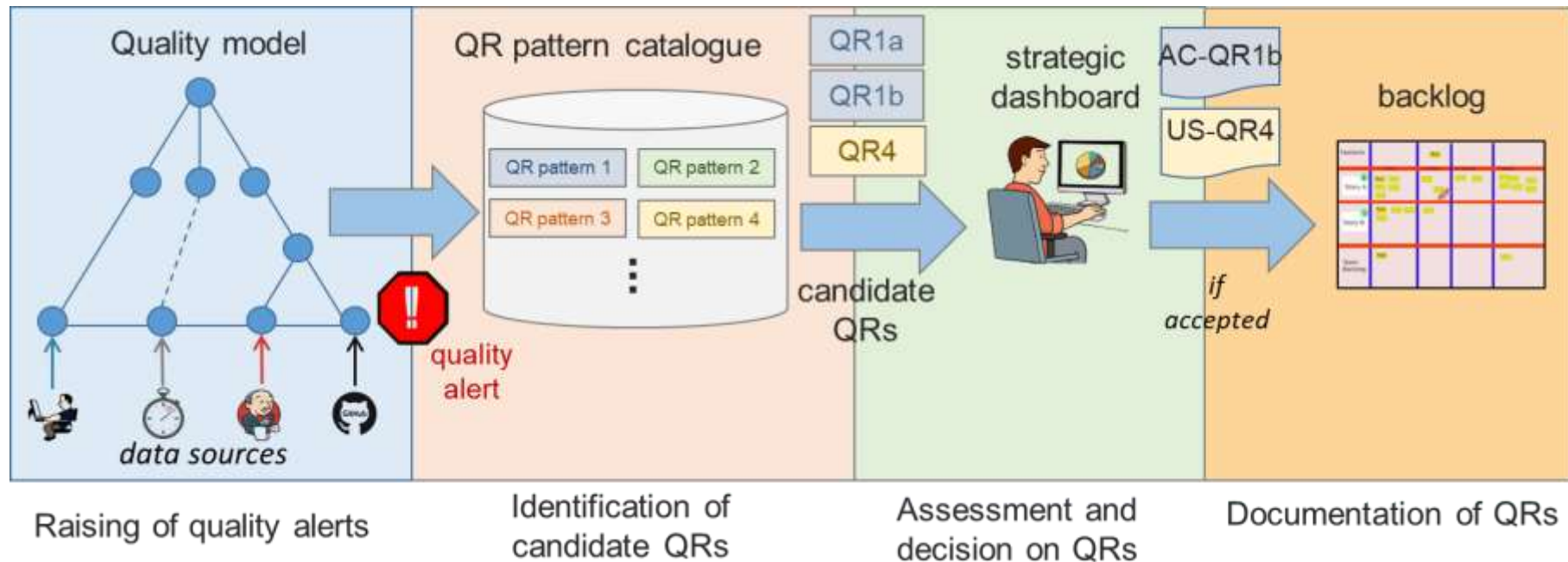


# Neural networks to assess quality factors

- Building neural networks for specific quality factors based on raw data (basic metrics, derived metrics,...). For each version during rapid development process, we have:
  - Quality Model Assessment
  - Raw Data and its Data Analysis
- Identifying new weights and relevant product factors and assessed metrics from the internal layers of the neural networks

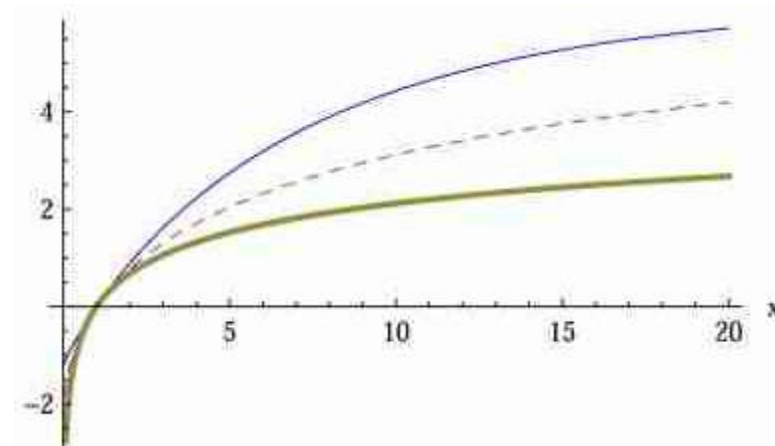


# Generation of Quality Requirements

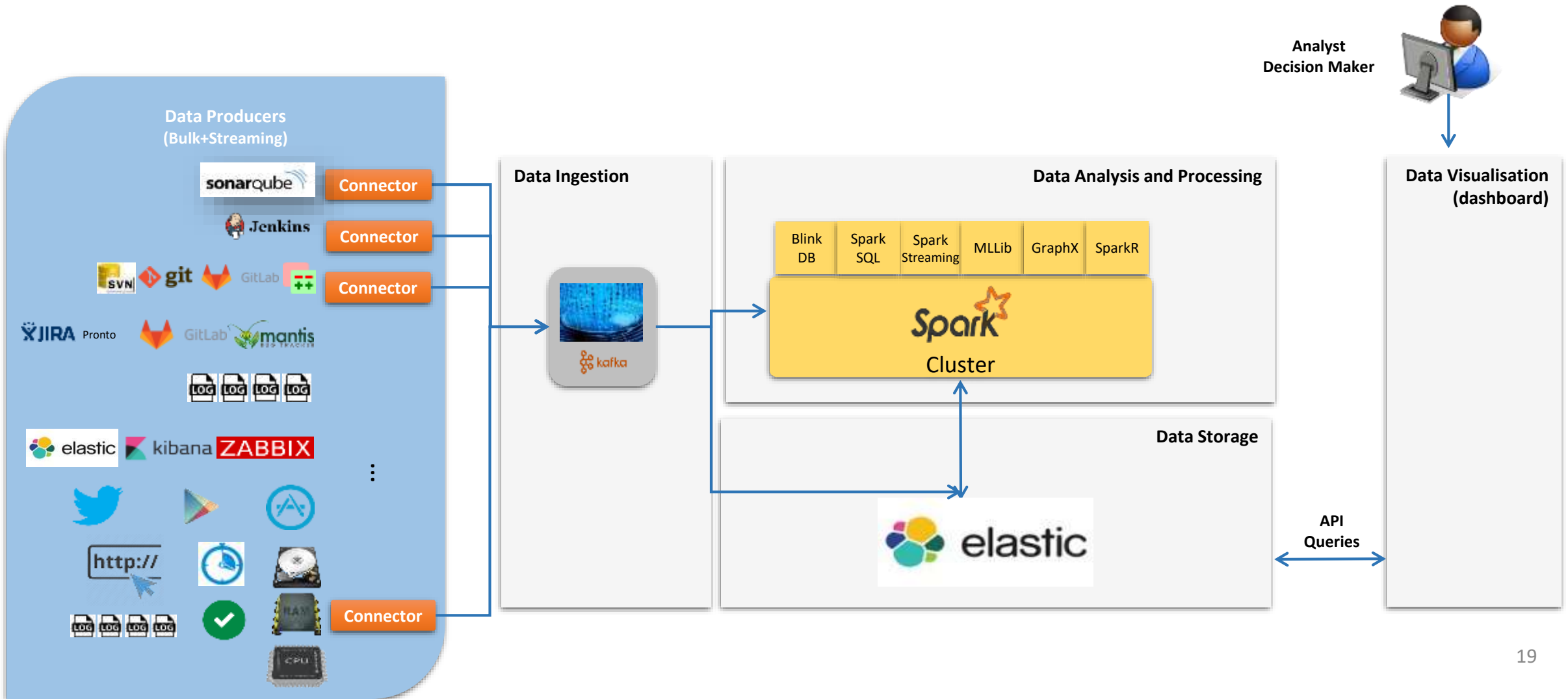


# Assessment of QRs Application: Prediction

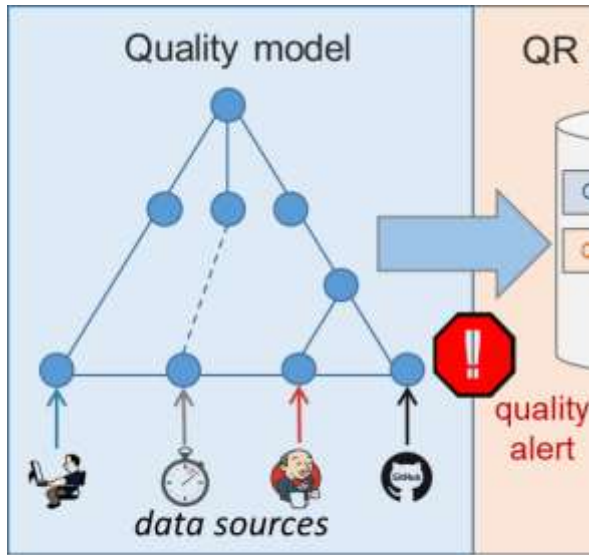
- qr Aggregation of factors into a single strategic indicator
- qr Drill-down capabilities
- qr Evaluation of decisions (impact, value, effort, risk, ...)
- qr Prediction rules to detect upcoming violations
- qr What-if analysis
- qr Mitigation strategies



# The Q-Rapids Architecture



# Quality Model Assessment Implementation



Raising of quality alerts

The screenshot shows the Kibana interface. The left sidebar contains navigation options: Discover, Visualize, Dashboard, Timeline, Dev Tools, and Management. A search dropdown menu is open, showing results for 'poc.metrics'. The main content area displays a search result for 'Complexity' with a score of 0.994. A bar chart above the search results shows the count of results over time, with a peak in late 2017. Below the search results, a table shows the details of the search results.

Time	_source
December 4th 2017, 01:00:00.000	<pre>{   "evaluationDate": "December 4th 2017, 01:00:00.000",   "metric": "complexity",   "datasource": "-",   "name": "Complexity",   "description": "Percentage of files that do not exceed a defined average complexity per function",   "value": 0.994,   "factors": "codequality",   "_id": "complexity-2017-12-04",   "_type": "metrics",   "_index": "poc.metrics",   "_score": - }</pre>

Field	Type
_id	complexity-2017-12-04
_index	poc.metrics
_score	-
_type	metrics
datasource	-
description	Percentage of files that do not exceed a defined average complexity per function
evaluationDate	December 4th 2017, 01:00:00.000
factors	codequality
metric	complexity
name	Complexity
value	0.994



# The Strategic Dashboard: current views



Q-Rapids: Quality-aware rapid software development

Strategic Indicators

Detailed Strategic Indicators

Quality Factors

Metrics

View mode:



Blocking



Customer Satisfaction



Product Quality



Time-to-Market

# The Strategic Dashboard: current views



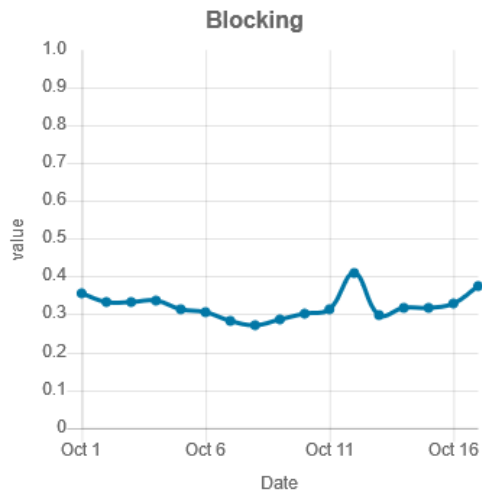
Strategic Indicators

Detailed Strategic Indicators

Quality Factors

Metrics

View mode:



# The Strategic Dashboard: current views



Q-Rapids: Quality-aware rapid software development

Strategic Indicators

Detailed Strategic Indicators

Quality Factors

Metrics

View mode:



Strategic Indicator: Product Quality

Product Quality



# The Strategic Dashboard: current views



Q-Rapids: Quality-aware rapid software development

Strategic Indicators

Detailed Strategic Indicators

Quality Factors

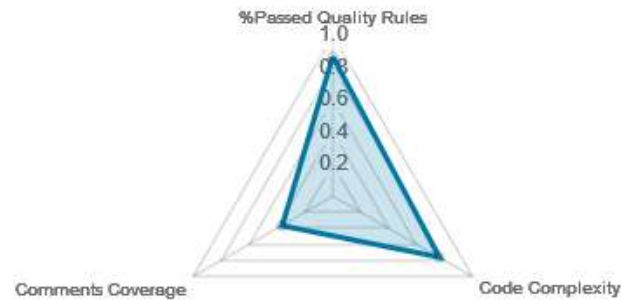
Metrics

View mode:

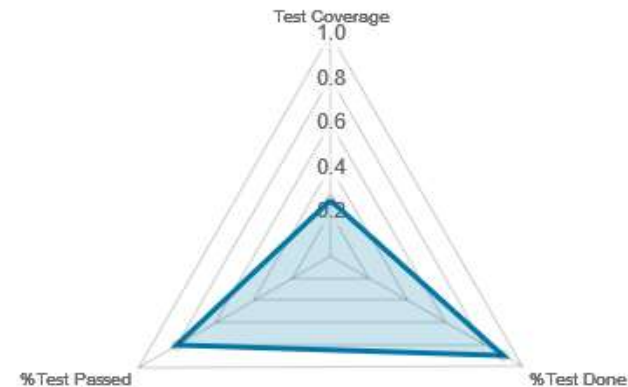


Strategic Indicator: Product Quality

Code Quality



Testing Status

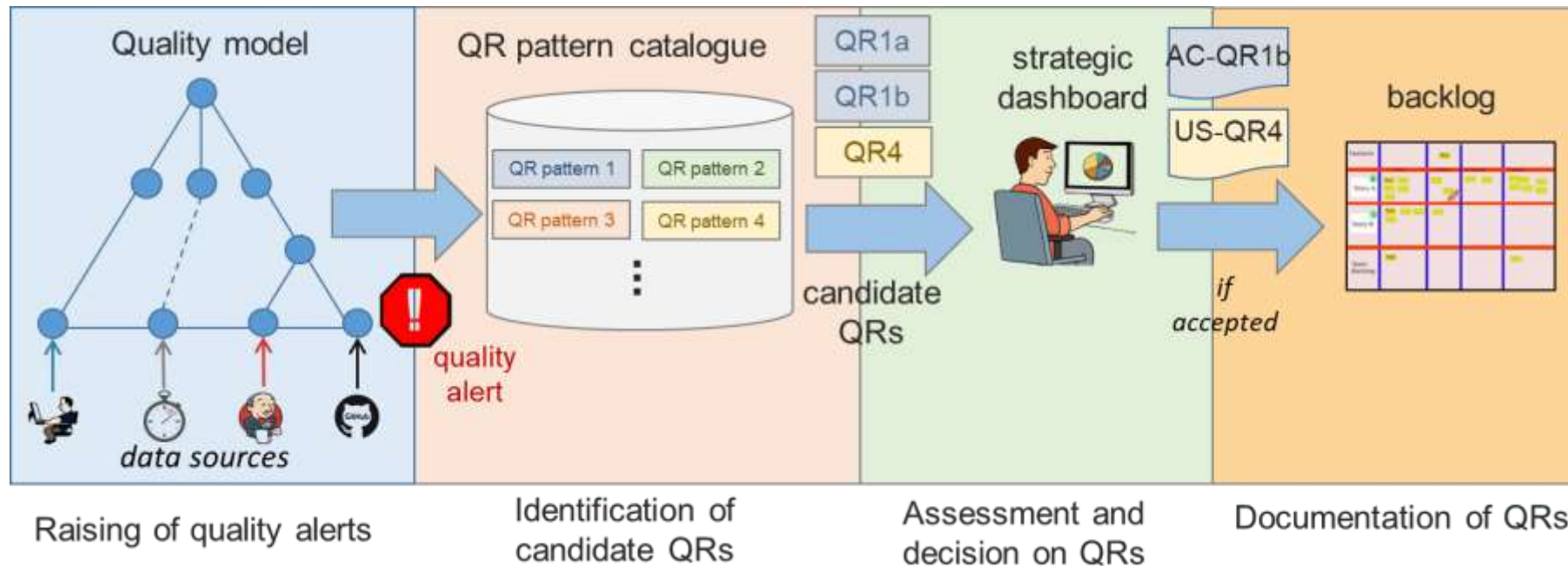


# The Rapid Software Development Process

- ☞ Implementing a continuous end-to-end flow of features in organizations
- ☞ Optimal management of features by real-time identification and understanding of quality requirements
  - ☞ Information provided by the dashboard at different organizational levels (business owners, product owners, developers, testers, ...)
  - ☞ Catalogue of possible actions: include/drop items in backlogs; re-prioritization; stop the line (until solving the blocking situation)
  - ☞ Fit to agile method of the organization, e.g.:
    - ☞ Kanban: input to Kanban board
    - ☞ Scrum: use of the dashboard in prioritization
  - ☞ In any case, gain of transparency

# Summary

- Generation of quality requirements and their integration in an agile development process based on learning algorithms and data analysis





# Thanks for your attention!

Dr. Jens Heidrich

Division Manager “Process Management”  
Fraunhofer IESE  
Fraunhofer-Platz 1  
67663 Kaiserslautern

Phone: +49 631 6800 2193

Email: [jens.heidrich@iese.fraunhofer.de](mailto:jens.heidrich@iese.fraunhofer.de)



Funded by the  
European Union

