

Software Estimation challenge

— Stimulating good estimation practices
and a look at Metri's results

Nesma Conference 2020

**IT STARTS
WITH THE
FACTS.**

6/12/20

metri
IT STARTS WITH THE FACTS



About the IWSM Software Estimation challenge



2 Hosted at the 30th International Workshop on Software Measurement (IWSM) and the 15th International Conference on Software Process and Product Measurement (MENSURA) – Oct. 29, 2020 – Mexico City

- Attended by researchers and practitioners in all fields of software measurement.
- The workshop deals with many software measurement topics, while focusing this year on *'cost estimation and control'*.

Challenge aims: stimulating good estimating practices and providing an interactive discussion during the workshop.

This presentation will discuss the estimation solution developed by the Metri team.

OCTOBER 2020

MOVIE MANAGER

ESTIMATION CHALLENGE

30th Intergalactic Workshop on Software Measurement and the 15th Interstellar Conference on Software Process and Product Measurement in conjunction with the 5^o Congreso Nacional de Medición y Estimación de Software

FEATURING

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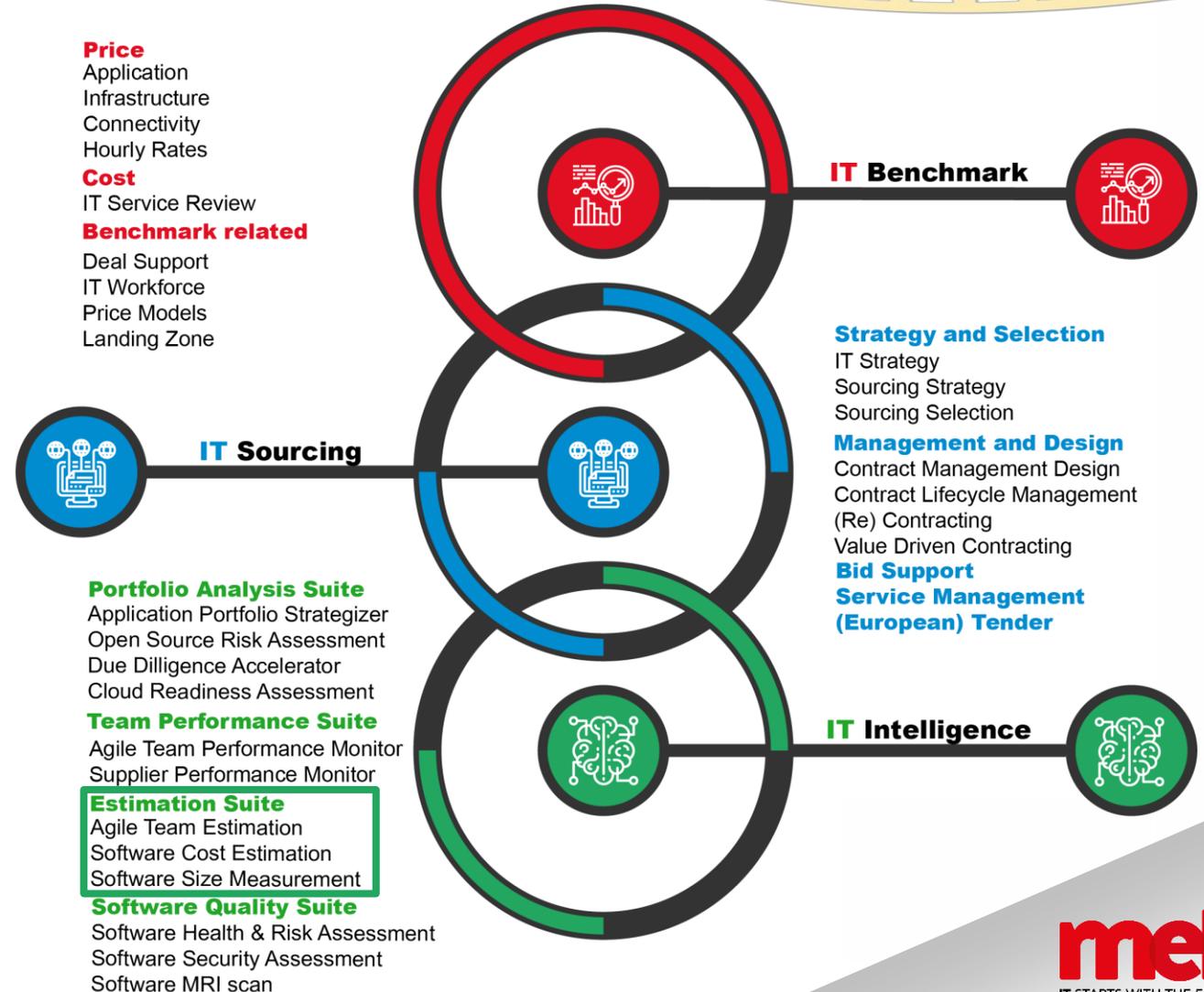
About Metri

4 Metri, founded in 2003, is an independent IT benchmarking, sourcing & performance measurement consulting firm, creating fact based and solid advice supporting innovation and drive business value creation.

Benchmarking & facts are our DNA. Clients appreciate us for our expertise and support in sourcing, governance and innovation decisions through scenario planning and business case analysis.

Our fact-based, bottom-up approach enables our clients to realize their IT objectives.

Metri. An effective combination of facts & people.



Challenge input, tasks and deliverables

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Input

- High level software requirements
- Description of a development and deployment environment

Tasks

1. Estimate the size of the functional requirements
2. Estimate the size of the nonfunctional requirements
3. Estimate the effort to develop the software, meeting the given requirements.

Deliverables

- A presentation of the elaboration of the tasks and their results.

Challenge input, tasks and deliverables

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Functional size estimates

Approaches and results

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Measurement strategy:

Purpose is to derive a size to base an estimate of the effort to develop and implement the software

Scope is the received set of functional requirements for a Movie Manager software application

FUR are defined by the received requirements and the assumptions about incomplete requirements

There is only one application **layer** involved in this estimate

The only **functional user** is an end-user of the web-based application

Since the Movie Manager must be developed and implemented we preferably need at least a class 2 estimate (AACE standard).

Since the requirements are incomplete, we used several approaches to estimate the functional size of the application:

- Determine the **Conceptual Data Model**, perform an indicative analysis (Nesma, ISO/IEC 24570:2018), and transform to CFP (Guideline on how to convert 'first generation' FP sizes to COSMIC)
- Perform an **EASY** estimate on the known requirements
- Work out all the User Stories (defined and *undefined*) and perform:
 - Size estimate based on the **Equal Size Band** approach
 - Detailed size measurement based on the **COSMIC standard** (ISO/IEC 19671:2011)

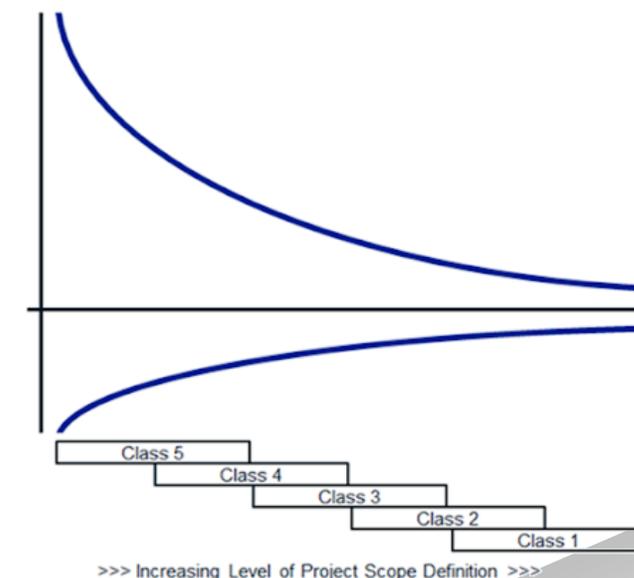
140 FP (Nesma)

107 CFP

115 CFP

115 CFP

75 CFP



>>> Increasing Level of Project Scope Definition >>>

Task 1

Estimation of the size

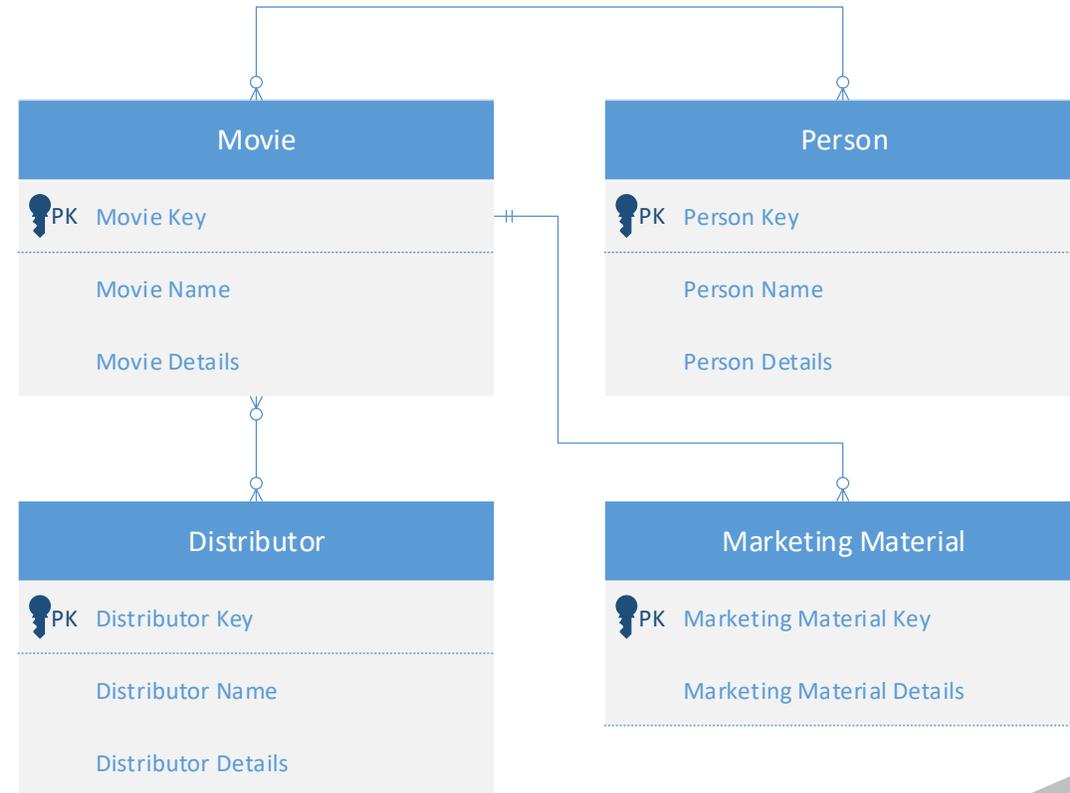
A look at some assumptions

Data model

- Marketing Material is always assigned to exactly one movie
- One Movie can be connected to multiple Marketing Materials
- If a Movie is deleted, all Marketing Material linked to this Movie is also deleted
- The relationship between Movie and Distributor is stored in the Movie-OOI. This means that Movie-OOI must be Read before being able to delete a Distributor
- ...
- ...

Functionality

- It is permitted to add a Person without assigning them a Role type
- It is not permitted to delete a Person or Distributor that is still linked to a Movie
- Because all Role types are set, there exists no functionality to manage Role types
- When viewing Movie details, a list of connected Persons and Distributors is also presented, along with buttons to delete the relationships
- When adding Marketing Material, it must be linked to a Movie. A Movie must exist before adding Marketing Material
- ...
- ...

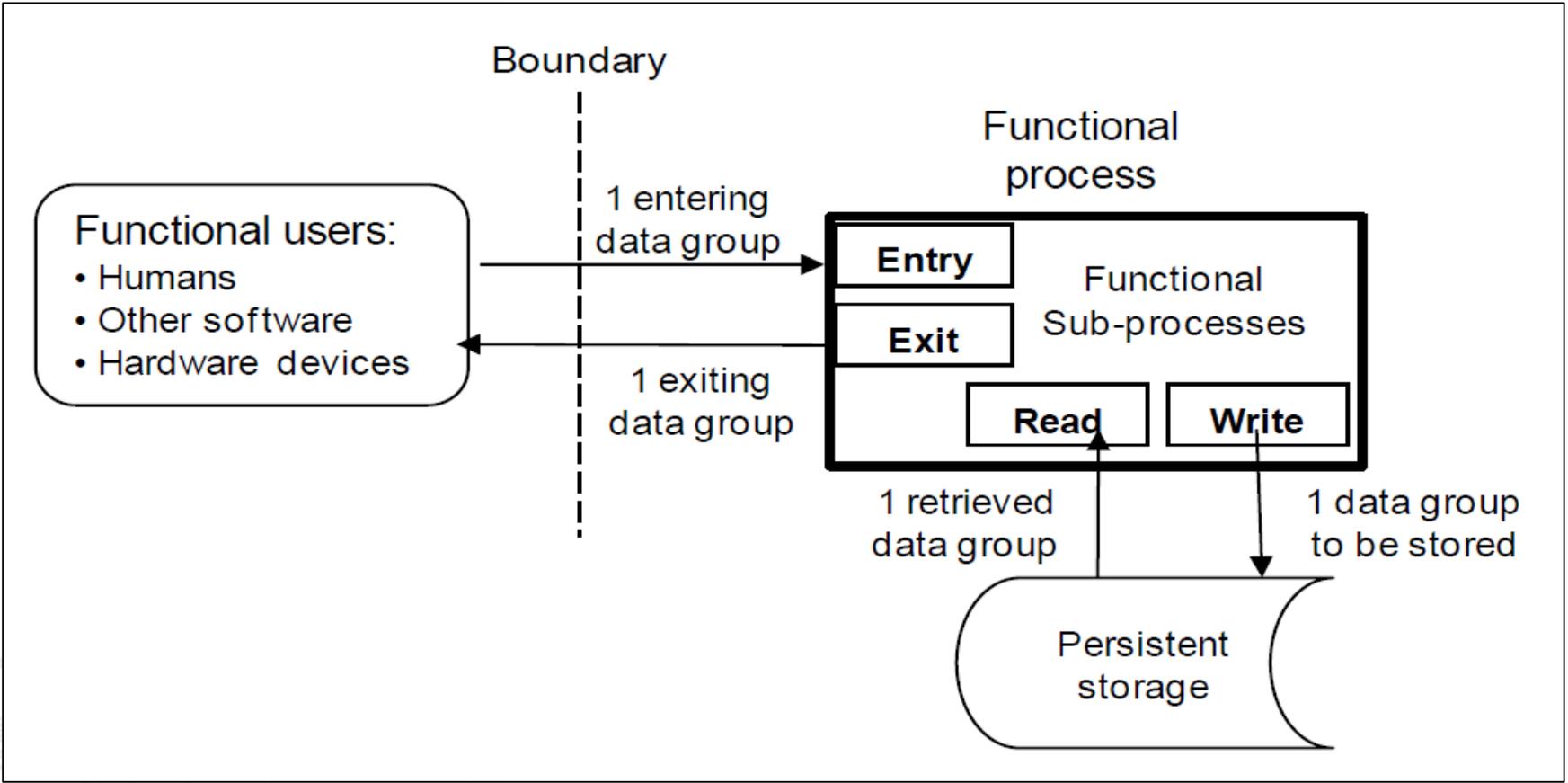




COSMIC functional size measurement

A crash course

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COSMIC measures data movements:

- Entry
- eXit
- Read
- Write



Cosmic applied to a functional requirement

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Requirements	User Stories	Functional Processes	Functional size				
			E	X	R	W	CFP
Maintain person	As a user I want to add a person	Insert person info	1			1	2
	As a user I want to update a person	Retrieve person list	1	1	1		3
		Retrieve person details	1	1	1		3
		Update person info	1			1	2
	As a user I want to make an inquiry about a person	Retrieve person list					--
		Retrieve person details					--
	As a user I want to delete a person	Retrieve person list					--
		Delete person info	1		1	1	3

Challenge input, tasks and deliverables

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The size of non-functional requirements

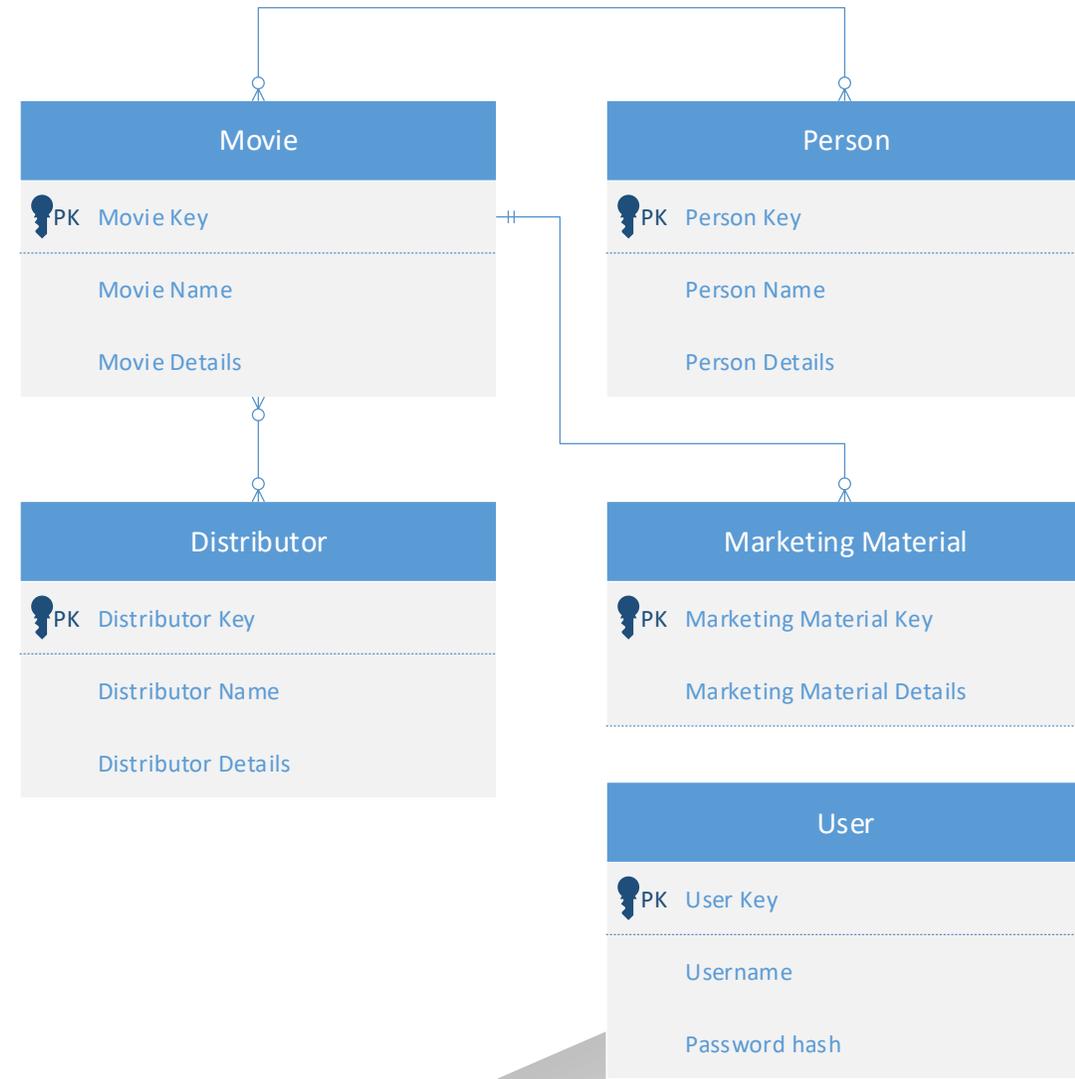
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The introduction of the two non-functional requirements leads to new and changed functional processes.

NFR 1: "All the inputs related to adding a person has to be validated"

NFR 2: "Only authorized users can add a person or a movie"

Non-functional requirements can lead to actual functionality and functional sizing.





The size of non-functional requirements

Detailed CFP count

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Requirements	User Stories	Functional Processes	Functional size				
			E	X	R	W	CFP
Maintain person	As a user I want to add a person	Insert person info	1			1	2
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	As a user I want to make an inquiry about a person	Retrieve person list					--
		Retrieve person details					--
	As a user I want to delete a person	Retrieve person list					--
		Delete person info	1		1	1	3

Additional size from NFR				
E	X	R	W	CFP
	1	2		3
				--
				--
	1	2		3
				--
				--
				--
	1	1		2



The size of non-functional requirements

Approaches and results

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Due to the inclusion of the non-functional requirements the measurement strategy had to be updated because a second **functional user** was identified: a person that **maintains the users** who are authorized to use the software application.

We used the following approaches to estimate the impact of the non-functional requirements:

- Determine the **Conceptual Data Model**, perform an indicative analysis (Nesma, ISO/IEC 24570:2018), and transform to CFP (Guideline on how to convert 'first generation' FP sizes to COSMIC) 175 FP (Nesma)
150 CFP
- Use an **Iceberg** transformation on the functional size of the operational functions (75 CFP) of the previous step 105 CFP
- Define the impact on *new and changed* Functional Processes and perform:
139 CFP
 - Size estimate based on the **Equal Size Band** approach 127 CFP
 - Detailed size measurement based on the **COSMIC standard** (ISO/IEC 19671:2011)

The final **size range** we have used as input for the effort estimation was 105 to 150 CFP with 127 CFP as most likely functional size.

Challenge input, tasks and deliverables

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Input

- High level software requirements
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Tasks

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- ➔ 3. Estimate the effort to develop the software, meeting the given requirements.

Deliverables

- A presentation of the elaboration of the tasks and their results.



Software development effort

Approaches

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To determine the effort needed to develop the Movie Manager software from scratch in Java and implement it as a web application, using a DBMS to store the collection data we first created a Basis of Estimate to document our baseline estimate.

From this Basis of Estimate we created a probability curve for both the effort and duration using the data in the Metri Database (>12,000 projects). As a sanity check we compared the results with the ISBSG database (>9,000 projects).

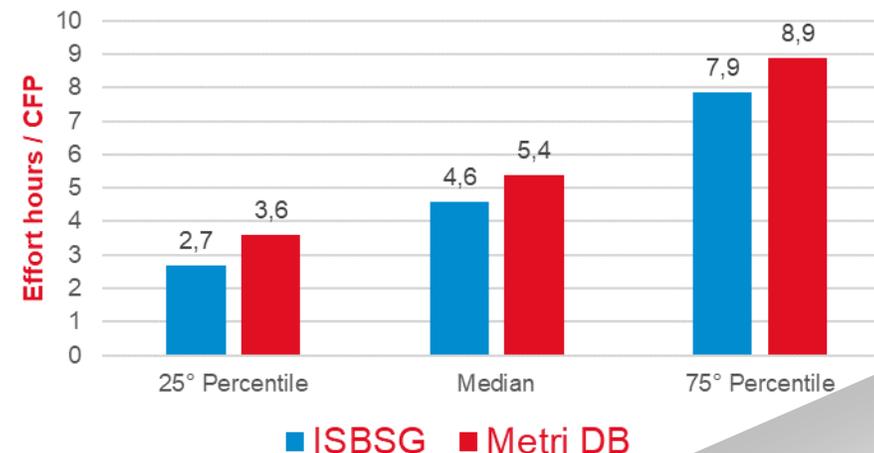
Selection Criteria ISBSG

- Data Quality Rating: A or B
- Development Type: New Development
- Primary Programming Language: Java
- Count Approach: COSMIC
- Size: S or M1 (30 - 300 CFP)
- Year of Project: >2014
- Result: 19 data points

Selection Criteria Metri Database

- Data Quality Rating: A or B
- Development Type: New Development
- Primary Programming Language: Java
- Count Approach: COSMIC
- Size: S or M1 (30 - 300 CFP)
- Year of Project: >2014
- **Country = the Netherlands**
- Result: 59 data points

Productivity



Software development effort

Basis of Estimate

BASIS OF ESTIMATE

Estimation purpose Build and implement	Engagement Application built as an internal product	Estimating methodology Functional Size	Estimate Classification AACEi class 2	Level of detail Fixed scope internal product
Design Basis Specs stable UI/UX to be def.	Sizing Basis Functional and NFR complete	Effort Basis Java + DBMS Internal agile proj. No constraints	Planning Basis Within regular office hours No overtime	Cost Basis Cost is not part of this estimate
Allowances Stable scope for the MVP	Assumptions Accepted by management Standard UI/UX	Exclusions No costs included for hardware and license fees	Exceptions Standard project- and estimation process	Risks and Opportunities Only standard contingencies
Containments Cost for mitigation not part of estimate	Contingencies Standard for time and effort	Management Reserve Out of scope for this estimate	Procedure Standard	Attachment Initial specs
Estimate QA Internal reviews performed on specs / estimate	Benchmarking Metri DB and ISBSG verification	Reconciliation No changes Initial version	Attachment Data Model	Attachment Assumptions

Basis of Estimate
as applied for the software services industry

AACE International
Recommended Practice
74R-13

Developed together with





Software development effort

Results

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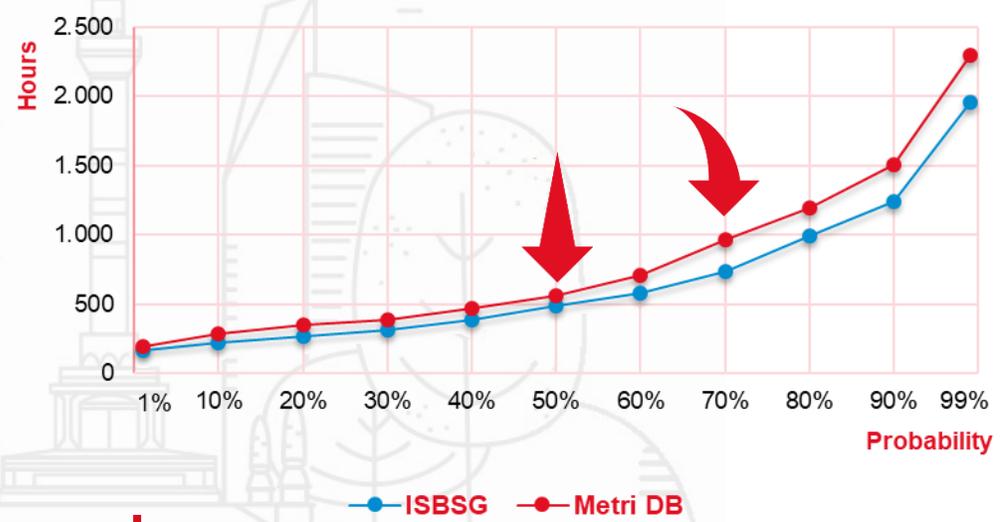
Estimated effort

Planning effort (median)	564 hours
Expected maximum risk (P70)	960 hours
Contingency (P70 – median)	396 hours

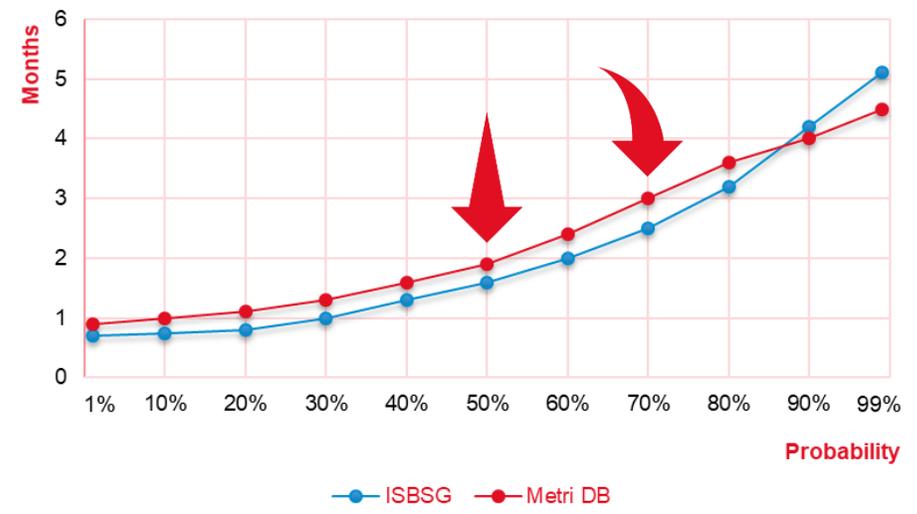
Estimated schedule

Planning schedule (median)	1.9 months
Expected maximum risk (P70)	3.0 months
Contingency (P70 – median)	1.1 months

Movie Manager
Monte Carlo development effort risk



Movie Manager
Monte Carlo schedule risk





Software development effort

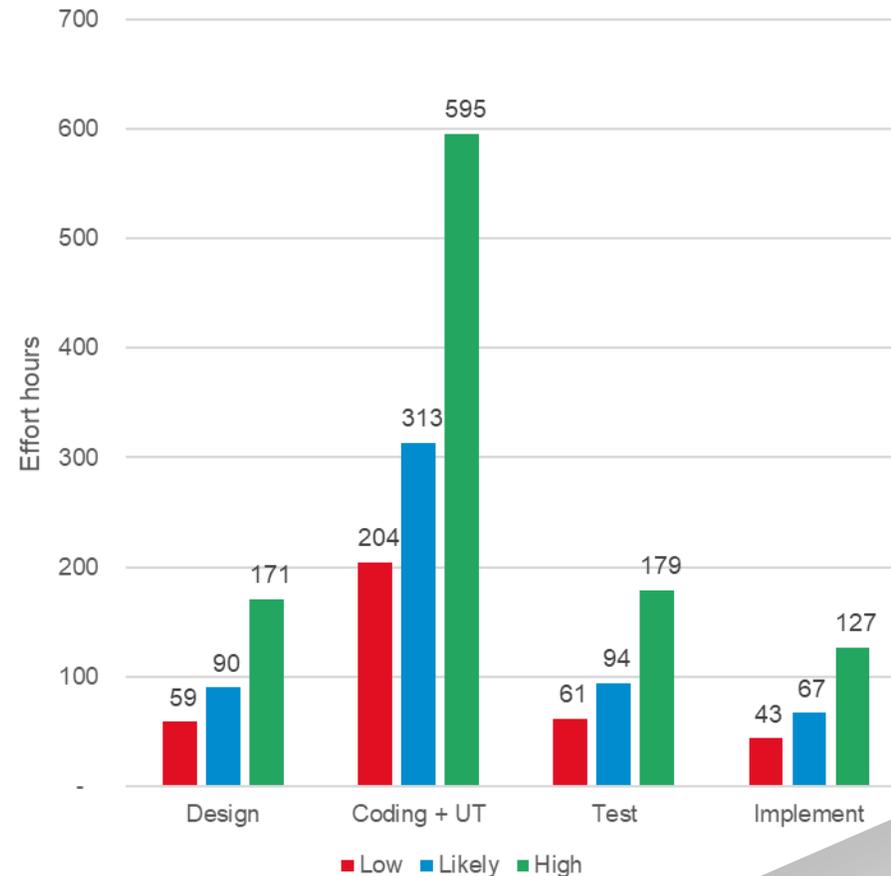
Activities in scope

Estimation details

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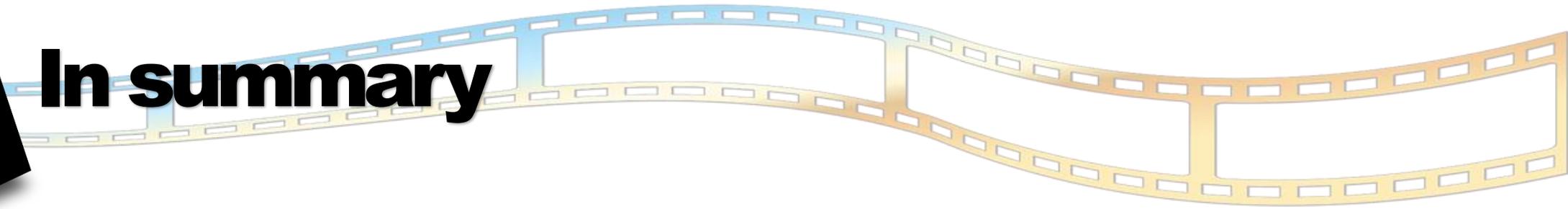
- Activities in scope:
UX/UI Design, Coding, Test and Implementation
- Constraints:
No constraints regarding duration and effort
- Requirements volatility:
Stable
- Development method:
Agile
- Application type:
web-based application
- Database type:
Exact DBMS to be decided
- Quality Standard:
Commercial High

Metri NL Dataset





In summary



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Challenge

- Hosted at the 30th International Workshop on Software Measurement (IWSM) and the 15th International Conference on Software Process and Product Measurement (MENSURA) – Oct. 29, 2020 – Mexico City
- Challenge aims: stimulating good estimating practices and providing an interactive discussion during the workshop.
- Challenge tasks: Estimate the size of the high-level requirements provided and estimate the effort required to develop the software.

Metri's approach

- Metri used multiple methods of measurement to determine the most likely functional size, from global estimates to detailed CFP analysis.
- To determine the effort required to develop the software, two datasets were used (ISBSG and Metri) to select similar projects.
- A *basis of estimate* was used to assure reproducibility, verifiability and defensibility of the estimation.

Jury feedback: enthusiasm about multiple measurement methods, probability and uncertainty and the analysis of a basis of estimate.

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