Improving quality of functional requirements by measuring their functional size

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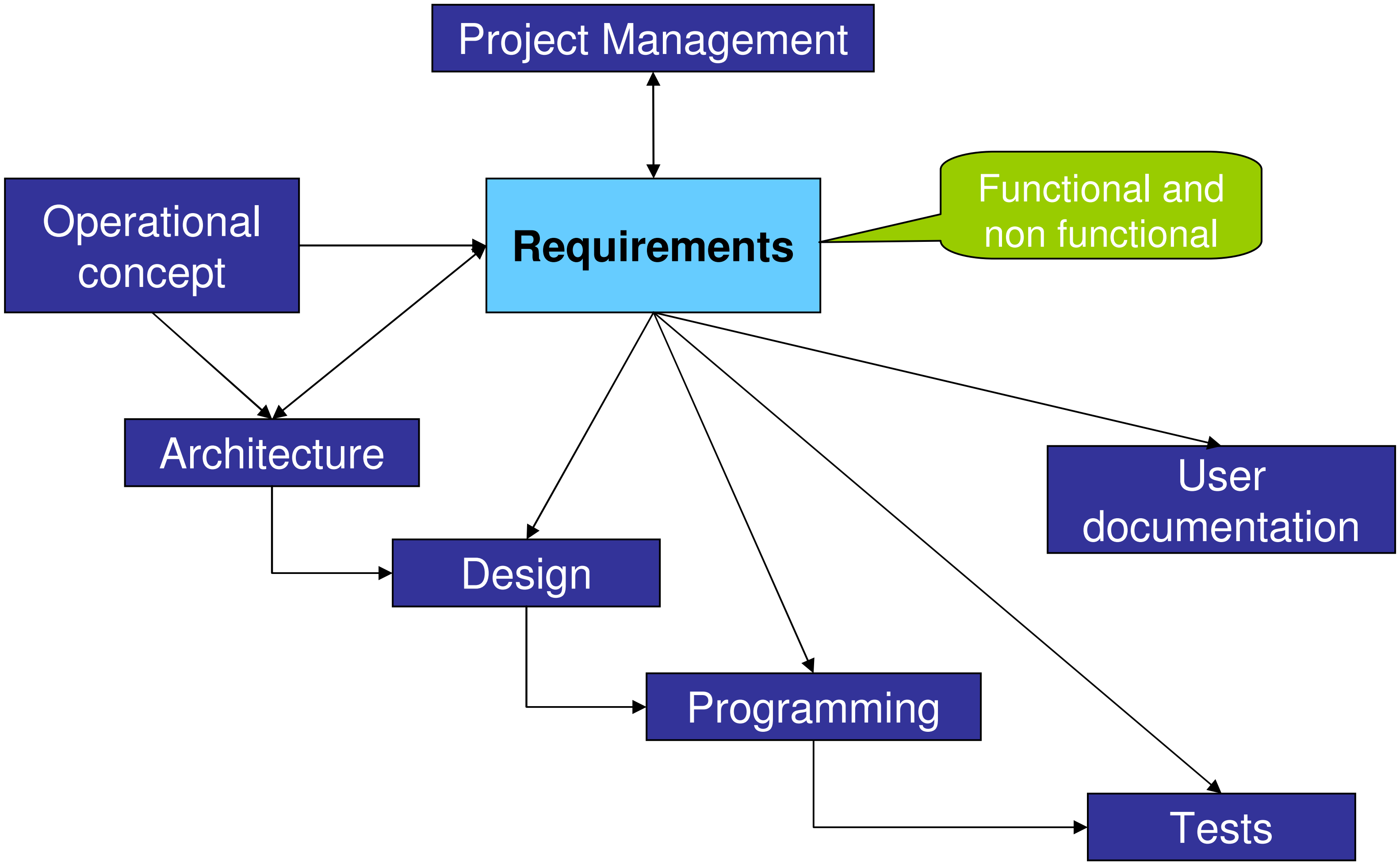
Content

Introduction

Inspection and FSM with COSMIC

Importance of software requirements



Requirements review mechanisms in industry

- Used to identify and fix defects in requirements
- Usually performed by individual or groups (MIL Std 2167A, ISO/IEC 12207)
- Peer reviews (inspections)
  - Introduced by Fagan in 1976
  - Several methods available
  - Some measures and indicators available
    - Effectiveness = effort / defect
    - Efficiency = # defects found and fixed in inspection / # total defects
    - Defect density = # defects / size
- Assumption:
  - Would it be of value-added to inspections, either for efficiency or effectiveness, if a measurer's role is included?

Inspection method used in experiment

1. Plan the inspection

[Document ready for inspection]

2. Hold a kick-off meeting

[Commitment obtained from participants]

3. Perform individual checking

[Defects found]

4. Conduct a logging meeting

[Defects understood by author]

5. Edit document

[Defects fixed]

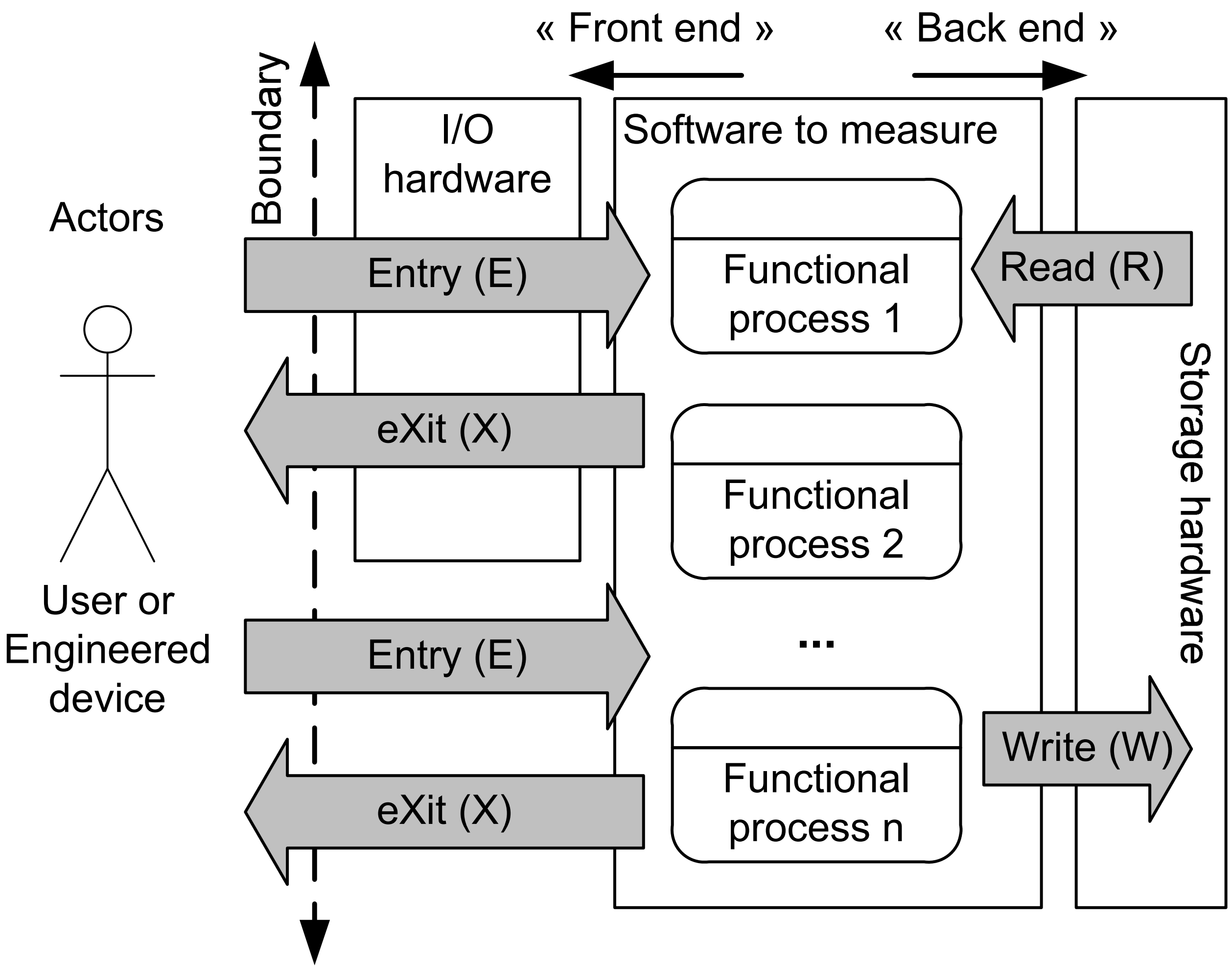
6. Verify corrections

[No new defects introduced]

7. Close inspection

[Defects fixed and inspection data collected]

The COSMIC method



Description of experiment

Step by step

Purpose and objective

- Objective:
  - Assess the efficiency and effectiveness of the COSMIC method as a method for finding defects in software functional requirements
- Purpose:
  - Perform an experiment involving industry experts
    - Some of whom would be skilled in measuring functional size with the COSMIC method
    - Others who would either be skilled in inspecting requirements or be knowledgeable on what is a well written software functional requirement
    - Special care was taken to get experienced practitioners in FSM and experienced inspectors and requirements writers in participating to this experiment

The requirements document

- SRS Document structure compliant to IEEE-830
- Requirements compliant to UML 2.0
- Usability testing application being described
  - Was actually implemented following the writing of the SRS in 2004
- SRS was 16 pages, 2900 words

The participants

- 4 FS expert measurers
  - All of them have participated on the COSMIC committee
- 3 inspectors with relevant industry practice in SW development and now teaching SW to undergraduate and graduate students
  - Respectively 8/15, 6/19, and 8/8 years of industry experience/total years of experience

The experiment steps

1. Prepare experiment
   a. Prepare material
   b. Call for participation
   c. Provide training on specific inspection method
2. Perform inspection
   a. Plan the inspection
   b. Hold a kick-off meeting
   c. Perform individual checking
   d. Perform functional size measurement
   e. Conduct a logging meeting
3. Compile experiment data
   a. Defects and issues log
   b. FSM detailed data
   c. Effort data
4. Review experiment data with participants
5. Analyze experiment data

Experiment results

From inspectors and measurers

Inspection results: total defects collected

Number of defects and issues by type per participant, including duplicates

		Defects			Issues		Total
Type		**C**	**M**	**S**	**Q**	**I**	
Inspectors	Insp #1	20	24	10	1	5	**60**
	Insp #2	10	28	2	0	6	**46**
	Insp #3	7	5	0	0	2	**14**
Measurers	Meas #1	5	1	8	2	1	**17**
	Meas #2	4	2	5	0	0	**11**
	Meas #3	8	14	6	1	0	**29**
	Meas #4	15	11	20	2	2	**50**
Total:		**69**	**85**	**51**	**6**	**16**	**227**

Inspection results: unique defects

Number of unique defects and issues by type, by category (inspectors and measurers)

		Defects			Issues		Total
Type		C	M	S	Q	I	
Category	F	37	55	17	5	4	**118**
	N	21	20	19	1	12	**73**
Total:		**58**	**75**	**36**	**6**	**16**	**191**

Number of unique defects and issues found by inspectors

		Defects			Issues		Total
Type		C	M	S	Q	I	
Category	F	19	39	6	1	3	**68**
	N	17	15	6	0	10	**48**
Total:		**36**	**54**	**12**	**1**	**13**	**116**

Inspection results: Effort spent and effectiveness

Inspection step	Duration	# Participants	Effort
Plan the inspection	15 min	1	15 min
Hold a kick-off meeting	10 min	5	50 min
Perform individual checking	--	3	170 min
Conduct a logging meeting	60 min	5	300 min
Total:			**535 min**

Effectiveness = 535 minutes / 36 unique critical defects
→ 14.9 minutes per critical defect

Measurement results: functional size in *cfp*

	Functional size	Average	Standard deviation
Meas #1	62	**59**	**3.3**
Meas #2	55		
Meas #3	61		
Meas #4	57		

Measurement results: defects found

Number of defects and issues found by measurers only

		Defects			Issues		Total
Type		C	M	S	Q	I	
Measurers	Meas #1	3	1	5	2	1	**12**
	Meas #2	3	2	4	0	0	**9**
	Meas #3	6	13	4	1	0	**24**
	Meas #4	10	8	17	2	2	**39**

Number of functional defects found by measurers only

		Defects			Issues		Total
Type		C	M	S	Q	I	
Measurers	Meas #1	3	1	4	1	1	10
	Meas #2	3	2	3	0	0	8
	Meas #3	6	13	3	1	0	23
	Meas #4	6	3	6	2	0	17

Measurement results: Value added of measurers over inspection team

	Critical & Minor	Value-added	Critical only	Value-added
Inspection team	58	--	19	--
Meas #1	4	7%	3	16%
Meas #2	5	9%	3	16%
Meas #3	19	33%	6	32%
Meas #4	9	16%	6	32%

Measurement results: Effort spent in minutes

	FSM effort	Average (min)	Standard deviation	Unique critical functional defects	Effectiveness (min/defect)
Meas #1	49	**57**	**13.4**	3	16.3
Meas #2	45			3	15
Meas #3	60			6	10
Meas #4	75			6	12.5

Effectiveness (on average) =
<u>13.5 minutes per critical functional defect</u>
(only found by measurers)

Discussion and future work

FSM: what it provided

- Functional size
  - For benchmarking and estimation
- Identification of defects not found by a team of inspectors
- A value-added on inspection efficiency & effectiveness
  - Between 16% to 32% of new critical functional defects
  - Effectiveness is 13.5 min/defect (on average) with measurement, compared to 14.9 min/defect in inspection
- But…
  - Measurers may have been over experienced
  - Other less experienced measurers may lead to different results
    - This will require further experimentation to verify

Further work...

- Other experiments with industry requirements documents
  - That may or may not be compliant with
    - IEEE-Std-830
    - UML 2.0
- Gain better understanding of specific defect types that may be found related to the measurement activity

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