EARLY SIZING OF REQUIREMENTS FOR ESTIMATION PURPOSES

MODULE 2: SELECTION OF TECHNIQUES

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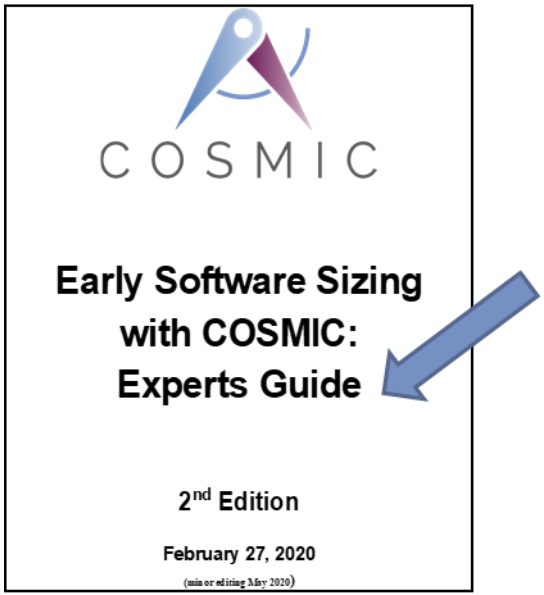
A Tutorial with COSMIC Sizing – ISO 19761

Introduction

Tutorial is based on:



- This tutorial presents strengths & weaknesses of Early Sizing technique
  - This tutorial **does not** include **effort estimation**.

Topics in this Module 2

Selection of a technique based on:

1. Strengths & Weaknesses
2. Quality of the Sources of Information
3. Which technique to select?
4. Recommendations (optional)

Average Functional Process technique

Strength:

- Easy to use.

Weaknesses:

- Domain dependent.
- Requires sampling of detailed measurements from the organization.
  - This data is often not (yet) available.

Average Use Case technique

Strengths:

- Easy to use if there is a local standard on what is a Use Case, more specifically describing the expected level of granularity of a Use Case.

Weaknesses:

- Concept of Use Case is interpreted in different ways by different organizations and people, so that the amount of functionality associated to a Use Case can vary widely [11]:
  - will not work unless the organization producing Use Cases adopts some sort of standard to ensure consistency in their size.
- The scaling factor is the product of 2 other scaling factors which are themselves estimated.
  - This increases the uncertainty of the approximation result.

Fixed Size Classification technique

Strengths:

- Easy to use.
- Can be implemented in a simple way.

Weaknesses:

- Domain dependent.
- Assigning functional processes to a size class is subjective.

Fixed Size Classification technique

1. Proved to be useful on software with small, relatively simple FPs of limited size range.
2. The approach can easily be extended to account for FPs with more data movements.
3. Adequate choice of size classes is crucial for achieving good estimates.
4. Valid as long as size classifications are representative for the measured software.
5. Objective local rules to assist Measurers in assigning the correct classification are suggested.

Equal Size Bands technique

Strengths:

- Easy to use.
- Applicable for both business application and real-time domains.

Weaknesses:

- Band sizes should be determined carefully. (Variance analysis can be used).
- Assigning FPs to a size class is a subjective process.
- When there are few number of FPs in the “Very Large” band, “average size” should be used carefully.

Equal Size Bands technique

Recommended Area of Application

1. Recommended for software that has a significantly skewed distribution of the size of its FPs.
2. Valid as long as size classification is considered to be representative for the software at hand.
3. Local rules should be determined to assist Measurers in assigning the correct classification.
4. The greater the skew, the accurate the method gets.

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Equal Size Bands technique

Applicability and Reported Use

- Software systems typically have many small FPS and larger FPs are fewer.

Software Iceberg Analogy

Scaling factors in the Course Registration Case Study

Strengths:

Very earliest stages with requirements known only in the broadest outline:

it is possible to determine sizing factors using the iceberg analogy with known sizes of other existing software already sized.

Weakness:

Can be used in most organizations provided that data can collected on past projects and identify classifications of functionalities and levels of documentation that are relevant to the context.

Functional Size Patterns

Strengths:

- Reduces measurement effort.
- Could be applied by relatively inexperienced users of the COSMIC method.
- Increases accuracy by helping to avoid common measurement mistakes.
- Enables improved repeatability of early size estimation.

Functional Size Patterns

Weaknesses:

- FSM patterns and their usage have not yet been quantitatively evaluated against the solution objectives for COSMIC FSM. More case studies and research is needed.
- A set of COSMIC FSM Patterns still needs to be developed and made available.
- COSMIC measurement support tools should implement the concept of FSM patterns.

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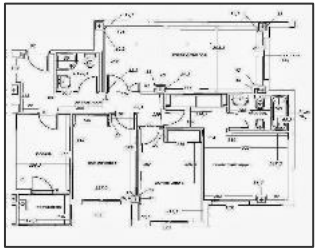
Analogy in Engineering: Quality of Information Sources at Measurement



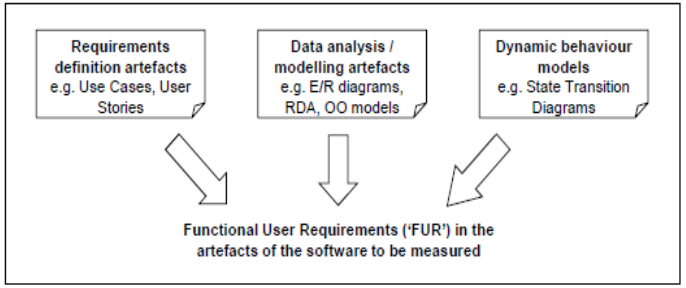


Figure 1.1 – Pre-implementation sources of Functional User Requirements

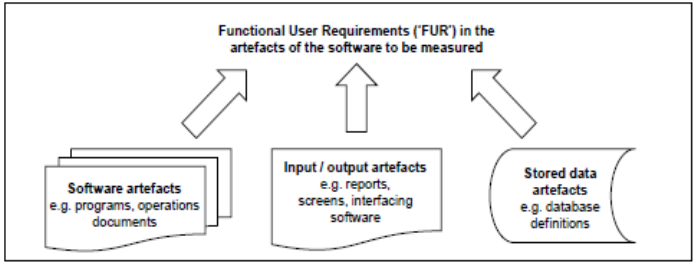
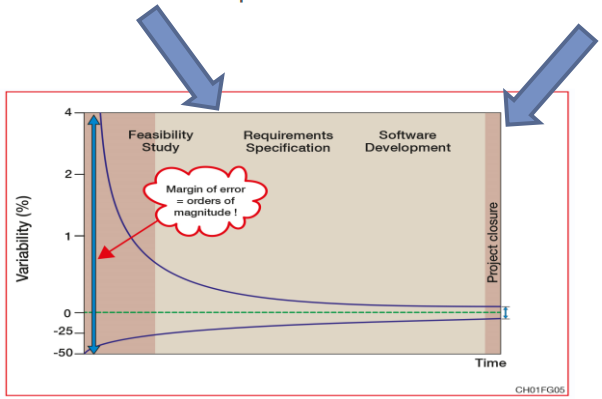


Figure 1.2 – Post-implementation sources of Functional User Requirements

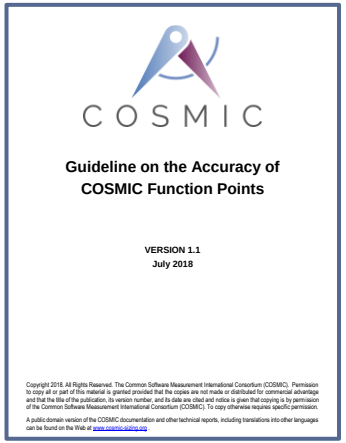
Availability of requirements for measurement purposes



Quality of Information Sources

Table 1: Quality rating of an individual functional process

Rating	Functional Process Quality Level	Quality of the functional process definition
(a)	Completely defined	The functional process and its data movements are completely defined
(b)	Partially Documented	The functional process is partially documented: not in sufficient detail to identify all the data movements
(c)	Identified	The functional process is listed but no details are given of its data movements
(d)	Counted	A count of the functional processes is given, but there are no more details
(e)	Implied (a 'known unknown'), not mentioned or missing (an 'unknown unknown')	The functional process is implied in the actual requirements but is not explicitly mentioned, or is missing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Guideline on the Accuracy of COSMIC Function Points

VERSION 1.1
July 2018

Context Approach

- Based on the characteristics they could choose to utilize different Early Sizing techniques for different categories:

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Rating	Sizing technique to be Used
A	Precise COSMIC Measurement
B	Precise COSMIC Measurement x 1.2
C	Average, Patterns
D	FSM Patterns
E	%12 of sum of other categories

Quality of Actual Requirements

b – Partially Documented

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- Functional processes are documented but not in sufficient detail to identify the data movements.

➢ May Use:

  - Average Functional Process Approximation
  - Average Use Case Approximation
  - Fixed Size Classification Approximation
  - Equal Size Bands Approximation
  - Functional Size Patterns

Quality of Actual Requirements

c - Identified

- Functional processes are listed but no details are given of its data movements

➢ May use:

  - Average Functional Process Approximation
  - Average Use Case Approximation
  - Functional Size Measurement Patterns

Quality of Actual Requirements

d - Counted

A count of the functional processes is given, but there are no more details

- May use:
  - Average Functional Process Approximation
  - Average Use Case Approximation
  - Functional Size Patterns

Quality of Actual Requirements

e - Implied (A 'known unknown')

- The functional process is implied in the actual requirements but is not explicitly mentioned

➢ May Use:

1. Average Functional Process Approximation
2. Average Use Case Approximation
3. Fixed Size Classification Approximation
4. Equal Size Bands Approximation
5. Functional Size Patterns

➢ May require Judgements.

Quality of Actual Requirements

Not mentioned requirements:

- **An 'unknown unknown'**

- Existence of the functional processes is completely unknown at present
- Expert judgment with a contingency for 'scope creep' on the basis of past experience.

Quality of Actual Requirements

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a - Completely Defined

- Functional process and its data movements are completely defined.
- ➢ Use standard COSMIC FSM method

Topics in this Module 2

Selection of a technique based on:

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3. **Which technique to select?**
4. Recommendations (Optional)

How to select which technique to use

- Is there a list of functional processes?
  - If **yes -** candidate techniques:
    - Average size of functional processes
    - Fixed size classification,
    - Equal size bands
  - Is there a meaningful sample of requirements?
    - Average Size of Functional Processes,
    - Equal size bands
    - Software Iceberg analogy

How to select which technique to use (2 of 2)

- Is there only a list of Use Cases?
  - If **yes**,
    - Average size of use cases, or
    - Early & rapid sizing (typical process)
    - Software Iceberg analogy
  - Can the number of functional processes be approximated by looking at Use Cases ?
    - If **yes**: Fixed size classification
    - If **not:**, approximate the size of the use cases (small, medium or large)?
      - If **yes**, Early & Rapid sizing
      - If **not**, estimate size by asking whether the overall process is small-medium- large.

Summary comparison of some techniques

Technique	Strength	Weakness	Area of application
Average Functional Process.	Easy to use.	Domain dependent.	
		Requires sampling.	Same as sample.
Fixed Size Classification.*	Easy to use.	Domain dependent.	
	Scaling factors are documented.	Assigning a class to an FP is subjective.	Size classification must fit the software.
Equal Size Bands.	Easy to use.	FPs need to be classified correctly.	Business and real-time embedded.
	More bands lead to a more accurate approximation.	Bands must be significantly far enough apart.	Skewed distribution of FPs.
		Requires sample dataset.	
Average size of Use Cases.*	Easy to use when Use Cases are standardized.	Functionality assigned to a Use Case can vary.	Standardized UCs.
		Scaling factor is a product of two factors that contain estimation.	
		Requires sample dataset.	Same as sample dataset.

Group Exercise

Table 1: Quality rating of an individual functional process

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Which technique to select in which context?

Info Sources Quality		Functional Process Average	Use Case Average	Fixed Size Bands	Equal Size Bands	Functional Patterns
A	Complete					
B	Partial					
C	Identified					
D	Counted					
E	Implied					

Topics in this Module 2

Selection of a technique based on:

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4. **Recommendations (Optional)**

Recommendations

Before selecting any early sizing technique:

1. Assess the quality of requirements at hand.
2. Examine historical data:
   - identify characteristics such as averages, deviation and distribution.
3. Determine management's need for accuracy of sizing.
4. Select early sizing technique that suits your conditions.

Recommendations

With a requirements document that you know, it is suggested that you use 2 techniques:

A) Average size of functional processes or

B) Early & Rapid COSMIC approximation

When you have the list of functional processes:

- Technique A will be more accurate.

When you only have the list of Use Cases:

- look at the values at the level of Typical Processes.

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Applicability of techniques

Some techniques may be more suitable for certain contexts, than the others.

Choice of the best technique will depend on:

- ✓ Software domain (e.g. business, real-time or infrastructure)
- ✓ Typical size,
- ✓ Adequacy of historical data.
- ✓ Measurer's level of experience level.

Emerging Early Sizing techniques

1. Informally written textual requirements.
2. Average number of data groups.
3. Use Case names.
4. Actions in UML Use Case diagrams.
5. Equal Number Bands.
6. Equal Range Bands..
7. ….

QUESTIONS?