WHAT IS A COSMIC FUNCTION POINT?

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The COSMIC method is an international standard (ISO 19761]) for sizing the functional requirements of any software.

'COSMIC' stands for the 'Common Software Measurement International Consortium', a non-for-profit organization. Its publications are completely open and available for free download.

COSMIC Function Points are now widely used around the world in software contracts, project management, benchmarking and estimating. The detailed COSMIC Measurement Manual as well as all COSMIC documentation can be downloaded from www.cosmic-sizing.org.

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COSMIC OVERVIEW

1.1 A Generic Model of Any Software

Figure 1 presents a generic model of all software of any size: this is a simplified representation of any software and of its interactions with the functional users and some persistent storage to which it has access to.

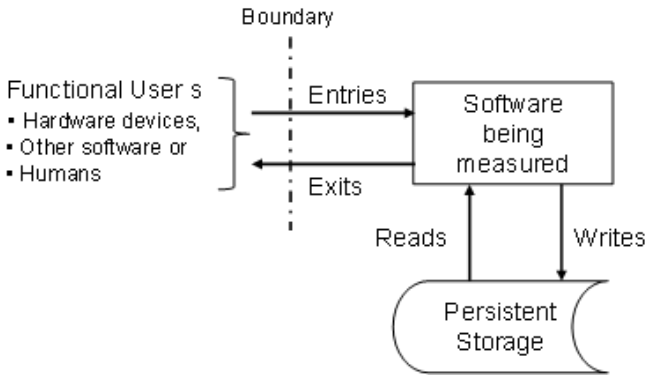

Figure 1 – A generic model of a software and of its four types of data movements

Any software may have:

A) Three types of **functional users** of a software:
1. Hardware devices
2. Other software
3. Humans

B) Four types of **data movements**:

- An Entry moves a data group into a functional process from a functional user.
- An Exit moves a data group out of a functional process to a functional user.
- A Write moves a data group from a functional process to persistent storage.
- A Read moves a data group from persistent storage to a functional process

C) **Persistent storage:**
- Any storage accessible by a software if it needs to store data or to retrieve stored data.

1.2 COSMIC Function Point

A COSMIC Function Point (CFP):

- is a measure of the functional size of any type of software;
- represents a movement of data and any software;
- is one of the 4 types of data movements (Entry, Exit, Read, Write);
- can measure the smallest software function that exists and the largest software function that can be built;
- can be used to compare the size of software pieces made in the past with those of the present and those of the future;
- can compare the size of software functions independently of the methodology used to build them.

The COSMIC measurement principle is:

> ***The functional size of a piece of software is equal to the number of its data movements***

A functional size is measured in units of 'COSMIC Function Points', abbreviated as 'CFP' where:

> ***1 CFP is defined, by convention, as the size of a single data movement of a single data group***

Then:

- The size of a functional process is equal to the number of its data movements types in CFP.
- The size of a piece of software is equal to the sum of the CFP sizes of its functional processes.

Example 1: When there is a single data movement of the 4 types in Fig. 1, the functional size is:

1 Entry + 1 Exit + 1 Read + 1 Write = 1 CFP + 1 CFP + 1 CFP + 1 CFP= ***4 CFP****.*

Example 2: When there are two data movements of the 4 types in Fig. 1, the functional size is:

2 Entries + 2 Exits + 2 Reads + 2 Writes = 2 CFP + 2 CFP + 2 CFP + 2 CFP = 8 CFP

1.3 How do you find all of the data movements of a piece of software?

The functional requirements describe the functional processes to be executed by a software. Figure 2 presents a generic representation of functional processes in a software.

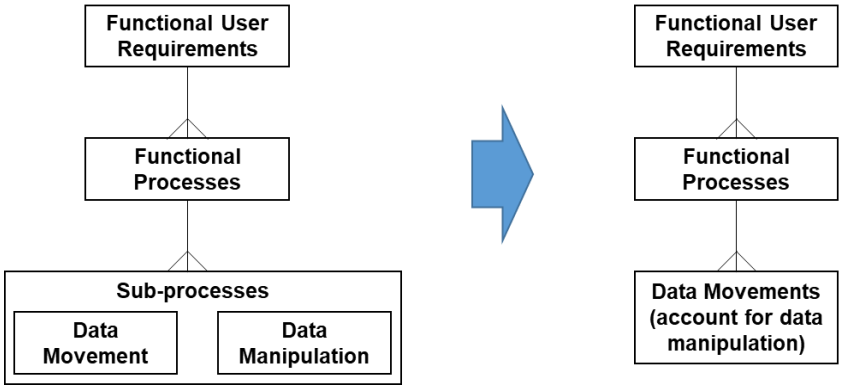

Figure 2 - Functional requirements, Functional Processes and Data Movement

The following elements are useful to ensure that a measurer can identify all functional processes and all data movements in a consistent manner – see Figure 3.

- A **functional user** informs software that an event has occurred by sending data about the event. The software must do something useful (e.g., a functional process) for the functional user(s) that have an interest in the response to that event.
- A **triggering event** causes a functional user to generate a data group (possibly in the form of a message) that is moved by a 'triggering Entry' into its functional process, thus starting the functional process.
- A **functional process** may include both data movements and data manipulation:

a) As an approximation for measurement purposes, data manipulation sub-processes are not separately measured; the functionality of any data manipulation is assumed to be accounted for by the data movement with which it is associated.
b) As another such approximation, all data describing any one data group that is entered into one functional process is considered as one data group moved by one Entry. Idem for Exit, Read and Write.
c) A functional process may have multiple Entries, each moving data describing a different object, count as many data movements. For all data entered, describing the same object, identify one Entry. Idem for Exit, Read and Write.
d) There is no upper limit to the number of data movements in a functional process.

Note 1: A functional process shall include at least one Entry data movement and either a Write or an Exit data movement, i.e. it shall include a minimum of two data movements.

Note 2: After a functional process has written some data on persistent storage, that 'persistent data' is available to other functional processes that need it or to another occurrence of the functional process that wrote it.

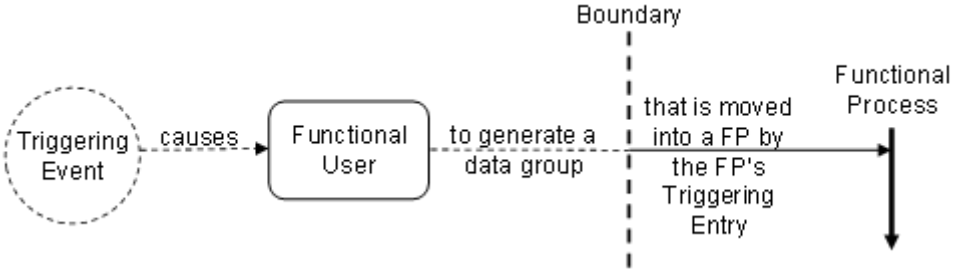

Figure 3 - The relationship between triggering events, functional users and functional processes

1.4 Size of functional changes to a software

The size of some required change(s) to an existing piece of software is measured as follows:

- The size of a required change to a single data movement (i.e. that must be added, modified or deleted) is measured by convention as 1 CFP.
  - 'Modified' could mean any change(s) to the data manipulation associated with the data movement and/or to any of the attributes of the data group moved.
  - The minimum size of a change to a functional process is therefore 1 CFP.
- The size of all the changes to a piece of software is equal to the number of data movements that are added, modified or deleted, summed over all functional processes.

1.5 COSMIC can size software in any layer of any software architecture

COSMIC Function Points can be used to measure the size of a piece of software at any level in any layer of a software architecture, as in Fig. 4. The rules that helps ensure consistency of measurement with COSMIC in this context are described in more details in the COSMIC Measurement Manual.

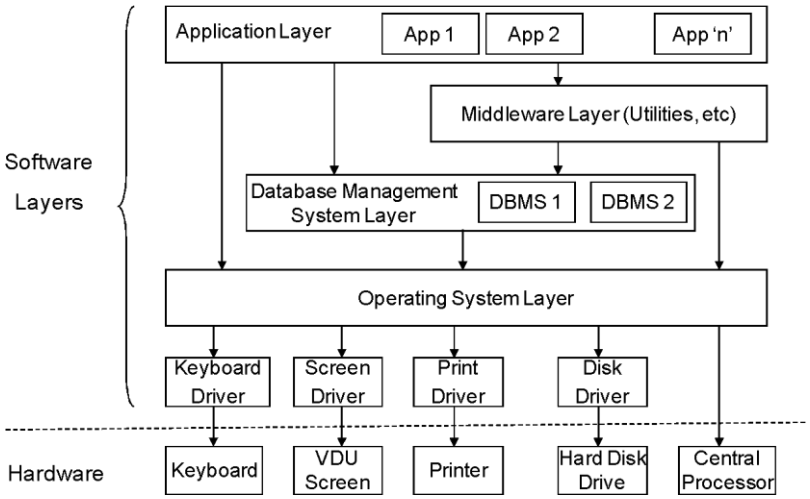

Figure 4 – COSMIC is applicable to any layer of software

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COSMIC MEASUREMENT EXAMPLES

2.1 Example from the Rice Cooker case study

Functional Requirement 1 – On receipt of the Start signal:

The software:

a) sends a 'Turn ON' signal to the Cooking Lamp
b) sends a 'Turn ON' signal to the heater.

This functional requirements is measured as follows with COSMIC:

Functional user	Data Movement	Data Group moved	Data Movement Type	CFP
Start button	Receive Start signal	Start signal	E (Entry)	1
Heater	Send a Turn ON command to the Heater	Heater command	X (eXit)	1
Cooking Lamp	Send a Turn ON command to the Cooking lamp	Cooking lamp command	X (eXit)	1
			Size of Functional Requirement 1 = 3 CFP	

Functional Requirement 2 - On receipt of a 30-second signal:

Starting at t = 0, and at each following 30-second interval, the software:

a) receives the 30-second signal;
b) receives the elapsed time signal;
c) gets the cooking mode from persistent storage;
d) selects a new target temperature, for the cooking mode by reading it from the relationship in persistent storage at time = [current elapsed time + 30 seconds]. See Figure 1;
e) puts this new target temperature into persistent storage, which becomes the current target temperature until the next 30 sec. signal.

This functional requirement is measured as follows with COSMIC:

Functional user	Data Movement	Data Group moved	Data Movement Type	CFP
Timer	Receive 30-second signal	30-second signal	E (Entry)	1
Timer	Receive Current elapsed time signal	Current elapsed time signal	E (Entry)	1
	Get cooking mode	Cooking mode	R (Read)	1
	Get New target temperature for [Current elapsed time + 30 secs.] and Cooking	New target temperature	R (Read)	1

	mode. (This will replace the Current target temperature)			
	Store the (new) Current target temperature	Current target temperature	W (Write)	1
Size of Functional Requirement 2 =				**5 CFP**

2.2. Example from the Course Registration case study

Functional Requirement 2.1.1.3 - Enquire on a Professor's details

a) When a Registrar wishes to enquire on the details of a Professor, he must first select the sub-option 'Enquire on a Professor' as in 2.1.1.2 and he must enter a Professor ID.

b) The software searches for a Professor with the specified ID and displays the Professor's name and address and other details.

c) Alternatively, if a Professor with the specified ID is not found, the software displays an error message, "Professor Not Found". The Registrar can then type in a different ID or cancel the operation.

This set of functional requirements is measured with COSMIC as follows:

Functional Requirement	Functional user	Data Movement	Data Group moved	Data Movement Type	CFP
2.1.1.3 Enquire on a Professor's details	Registrar	The Registrar enters Professor ID	Professor ID	E (Entry)	1
		The software retrieves the Professor details	Professor details	R (Read)	1
	Registrar	The software displays the Professor details	Professor details	X (eXit)	1
	Registrar	Display error message	Error Messages	X (eXit)	1
Size of Functional Requirement 2.1.1.3 = 4 CFP					

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COSMIC DOCUMENTATION

The COSMIC Group has published a number of Guidelines and Case studies for various software domains and related topics – see Figure 5:

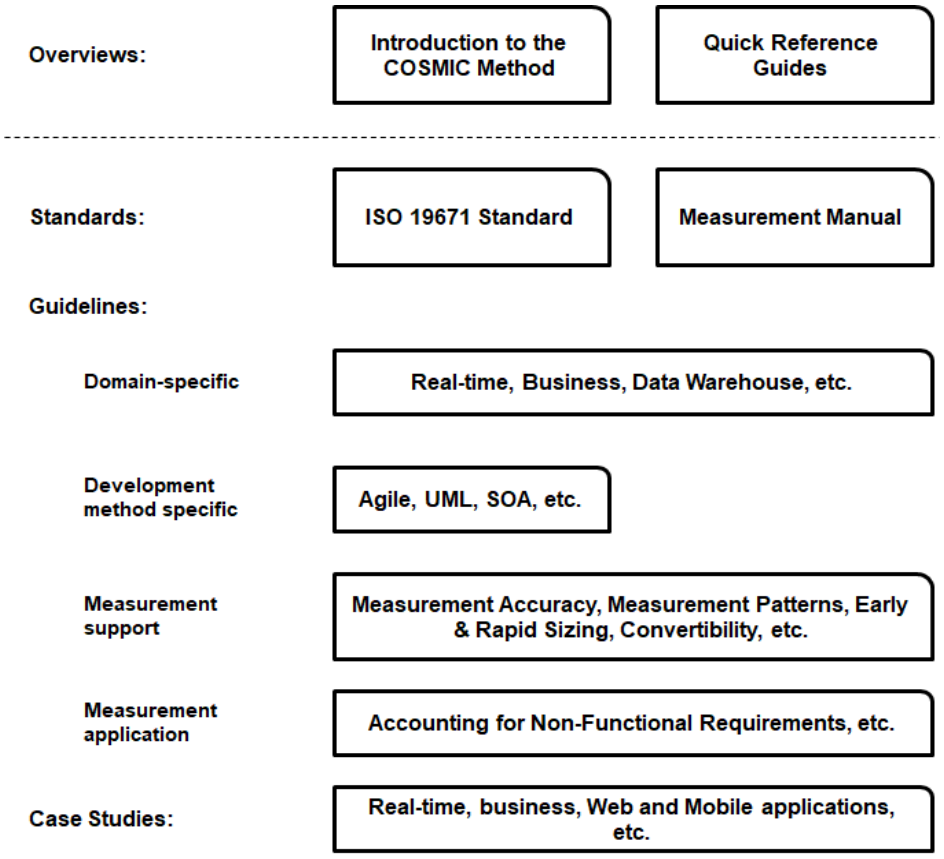

Figure 5 – COSMIC Documentation structure

Translations of the 'Measurement Manual' are also available in 11 languages in addition to English. All these can be found on the COSMIC web-site www.cosmic-sizing.org.

This same web-site has more general background information on functional size measurement and its uses, on the COSMIC organization and its activities, on suppliers of COSMIC-related services, COSMIC certification examinations, COSMIC Newsletters, how to contribute to and get COSMIC benchmark data, etc., as well as measurement support tools and many COSMIC-related research papers, all for free download.

Change Requests

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