8° Automotive SPIN Italy Workshop

Milano, February 17 2011

The Metric Cards

A Balanced Set of Measures ISO/IEC 15504 compliant

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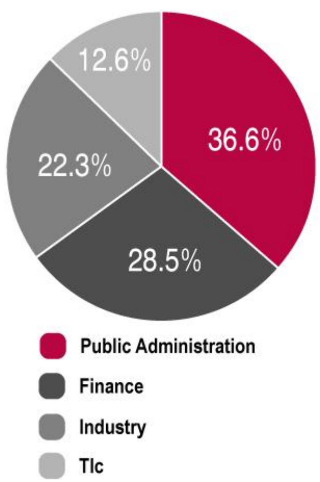
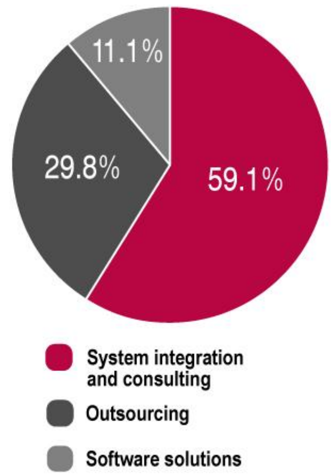
The **first Italian ICT player**

- more than 730 M/€ revenues
- 1000 clients
- 6,300 IT specialists





Research and Development		PA & HC	Finance	Industry	TELCO	Utilities
System Int. & Consultancy	%	46	70	54	80	80
Outsourcing	%	35	10	27	10	
Software	%	19	20	19	10	20

ERP	IT Security	ECM
Managed Operations	Plant Management System	Broadband & Media

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Misurare per Migliorarsi

- ✓ **G1.** Recap the balancing principles for quantitatively managing a project
- ✓ **G2.** Show a Top10 metrics for Automotive SPICE (ASAI-WG)
- ✓ **G3.** Discuss the attention points for applying such metrics

- **Introduction**
  - Two years ago…
    - Top Metrics for SPICE-compliant projects
    - Balancing measures by viewpoints and measurable entities
  - One year ago…
    - Measuring product FURs: Functional Size Measurement (FSM) methods
    - The COSMIC method
- **The Metric Cards**
  - GQM and MIM
  - The ASAI document (WD3)
  - Some examples
- **Conclusions & Prospects**
- **Q&A**

You cannot control what you cannot measure but…

You cannot measure what you cannot define but…

You cannot define what you don't know…

Two years ago...

http://www.automotive-spin.it/uploads/5/Buglione_5W.pdf

A-SPICE: possible appraisal profiles

Management Process Group (MAN)
- MAN.1 Organizational alignment
- MAN.2 Organization management
- A MAN.3 Project management
- MAN.4 Quality management
- A MAN.5 Risk management
- A MAN.6 Measurement

Engineering Process Group (ENG)
- A ENG.1 Requirements elicitation
- A ENG.2 System requirements analysis
- A ENG.3 System architectural design
- A ENG.4 Software requirements analysis
- A ENG.5 Software design
- A ENG.6 Software construction
- A ENG.7 Software integration
- A ENG.8 Software testing
- A ENG.9 System integration
- A ENG.10 System testing
- ENG.11 Software installation
- ENG.12 Software and system maintenance

Supporting Process Group (SUP)
- A SUP.1 Quality assurance
- A SUP.2 Verification
- SUP.3 Validation
- A SUP.4 Joint review
- SUP.5 Audit
- SUP.6 Product evaluation
- A SUP.7 Documentation
- A SUP.8 Configuration management
- A SUP.9 Problem resolution management
- A SUP.10 Change request management

The Acquisition Process Group (ACQ)
- ACQ.1 Acquisition preparation
- ACQ.2 Supplier selection
- A ACQ.3 Contract agreement
- A ACQ.4 Supplier monitoring
- ACQ.5 Customer acceptance
- A ACQ.11 Technical requirements
- A ACQ.12 Legal and administrative requirements
- A ACQ.13 Project requirements
- A ACQ.14 Request for proposals
- A ACQ.15 Supplier qualification

Resource & Infrastructure Process Group (RIN)
- RIN.1 Human resource management
- RIN.2 Training
- RIN.3 Knowledge management
- RIN.4 Infrastructure

Operation Process Group (OPE)
- OPE.1 Operational use
- OPE.2 Customer support

Supply Process Group (SPL)
- A SPL.1 Supplier tendering
- A SPL.2 Product release
- SPL.3 Product acceptance support

Process Improvement Process Group
- PIM.1 Process establishment
- PIM.2 Process assessment
- A PIM.3 Process improvement

Reuse Process Group (REU)
- REU.1 Asset management
- A REU.2 Reuse program management
- REU.3 Domain engineering

A Automotive-SPICE

not included in ISO/EC 15504

HIS (VW, Audi, BMW, Porsche, D&C)

FIAT

FORD

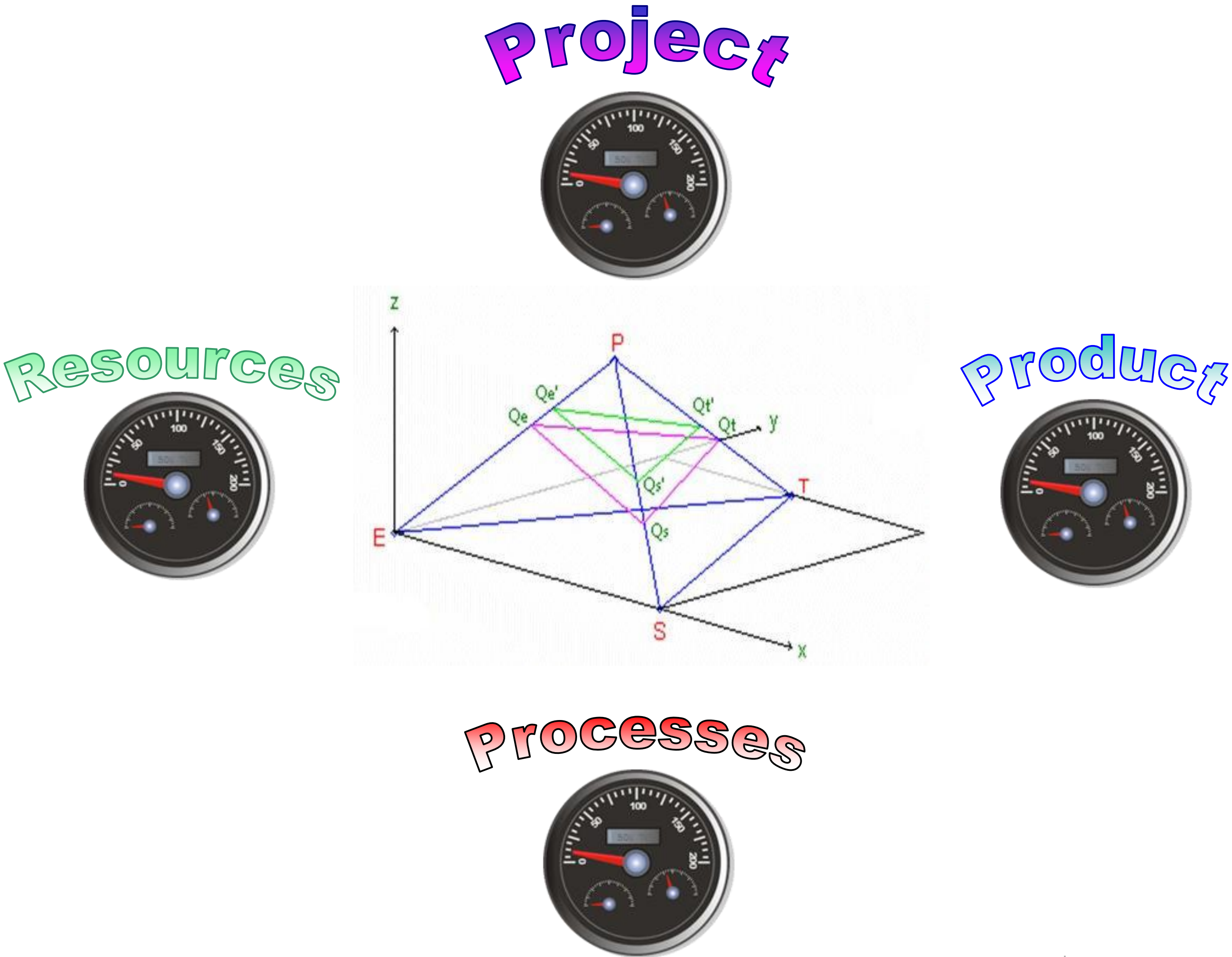
(A)SPICE: list of representative measures (1)

Entity	Attribute	Measure	Threshold	A-SPICE
Project	Planning compliance	Effort (man/hrs) per SLC phase, per iteration (abs, %)	(profiles on hist.data)	MAN.3
Resource	Time	% of open complaints / notes for delaying in providing the agreed furnitures (tracked) per contract	≤10%	ACQ.4
Process*	Time performance	SPI (Schedule Performance Index)	ongoing	MAN.3
Process*	Cost performance	CPI (Cost Performance Index)	ongoing	MAN.3
Process	QA performance	% of non-conformances still open	≤15%	SUP.1
Process*	Maturity	Problem Reports (PR) by status (open, closed)	(profiles on hist.data)	SUP.9
Process	Changeability	Avg Change Requests (CR) working time by status	(profiles on hist.data)	SUP.8 - SUP.10
Process*	Planning reliability	Requirements Volatility of 'Scope Creep' Index (# of modified/new UR not formally traced / tot. # UR) by iteration	≤10%	ENG.4
Product*	Code Length	Kilo Lines of Code (KLOC) [system, function, module] *c.a 5 functions per module*	(abs, 100-150, 700-1000)	ENG.4
Product*	Functional Size	Functional Size (fsu) [system]	(abs)	ENG.4

(A)SPICE: list of representative measures (1)

Entity	Attribute	Measure	Threshold	A-SPICE
Product*	Maintainability	Cyclomatic Complexity (of a function)	≤20	ENG.5, ENG.6
Product*	Maintainability	# of transfer parameters in a function	≤5	ENG.6
Product*	Maintainability	Avg size of a function statement (operands+operators / # of executable statements)	≤10	ENG.6
Product*	Code Stability	# of exit points from a function	1	ENG.5, ENG.6
Product*	Code Stability	# of calling functions of a function (fan-out)	≤10	ENG.5, ENG.6
Product	Code Stability	# of execution paths in a function	≤1000	ENG.5, ENG.6
Product	Testability	Branch Coverage	100%	ENG.8
Product*	Testability	Max # nesting depth of the function control structure	≤4	ENG.8

Balancing perspectives & measurable entities



Introduction

One year ago...

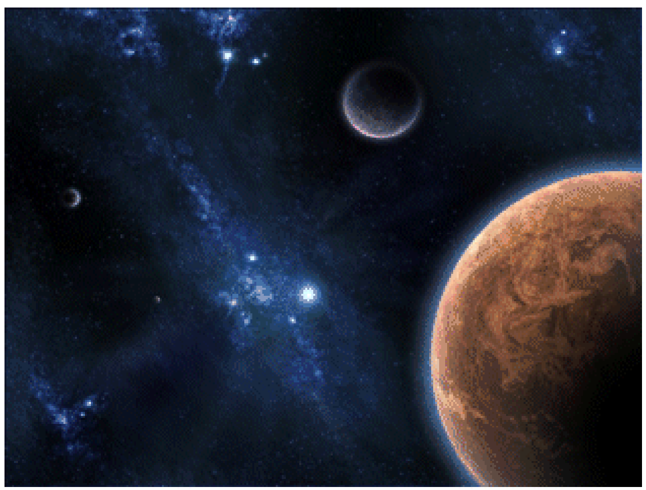
ENGINEERING

AUTOMOTIVE SPIN ITALIA

7° Automotive SPIN Italy Workshop

Pisa, May 21st 2010

COSMIC



A new method for measuring software functional size

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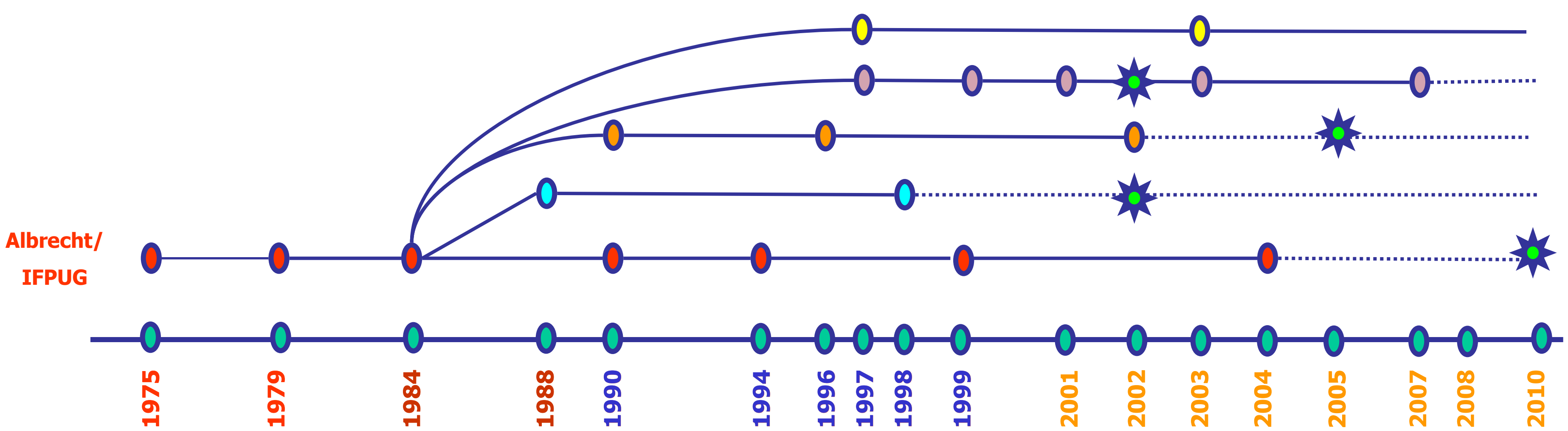
ENGINEERING 30°

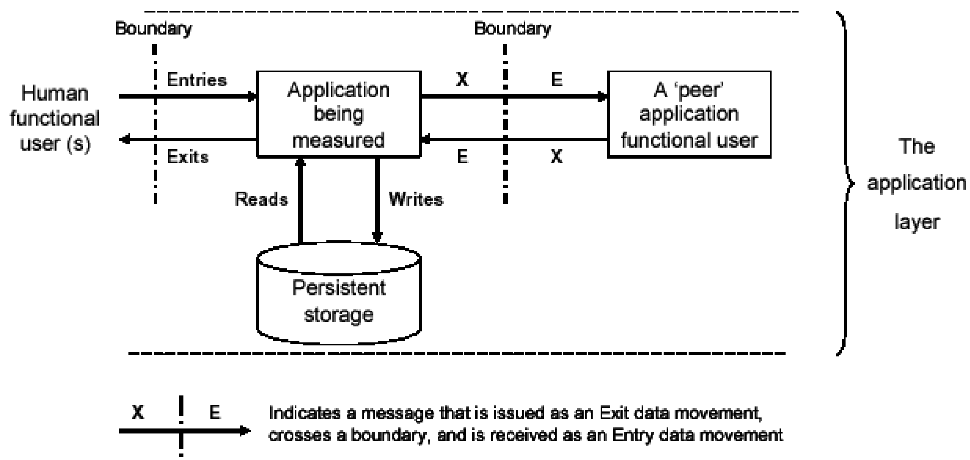
http://www.automotive-spin.it/uploads/7/7W_buglione.pdf



- **COSMIC-FFP** (ISO/IEC **19761:2003**): v2.1 (2002), first FSM method (2°generation) standardized by ISO
- **IFPUG FPA** (ISO/IEC **20926:2009**): v4.3 (2009), it explicitly excludes VAF
- **UKSMA MarkII FP** (ISO/IEC **20968:2002**): v1.3.1 (1998), it explicitly excludes corrective factors
- **NESMA FPA** (ISO/IEC **24570:2005**): update of the Dutch v2.0 (1998) up to v2.1, mostly devoted to enhancement projects
- **FISMA FPA** (ISO/IEC **29881:2008**): the v1.1 Finnish method, including some BFC (Base Functional Components) different than other FSM methods

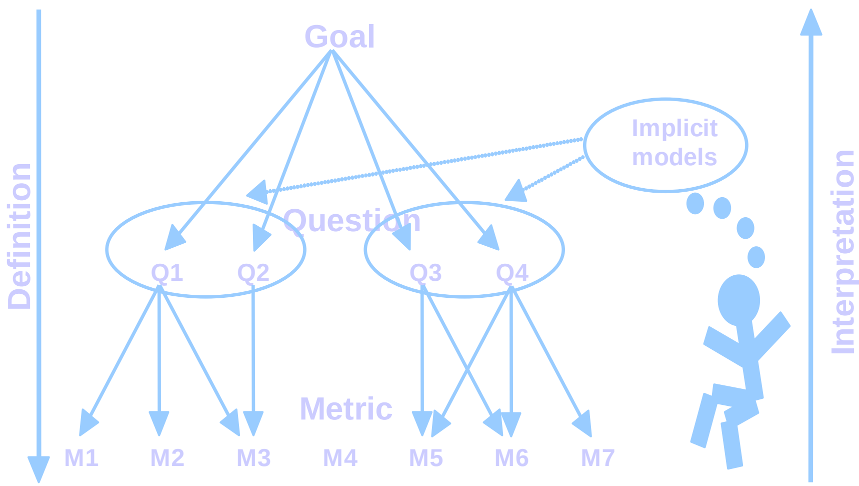
Each method has its own CPM (*Counting Practice Manual*) or MM (*Measurement Manual*) with details about "how" counting the *points.*

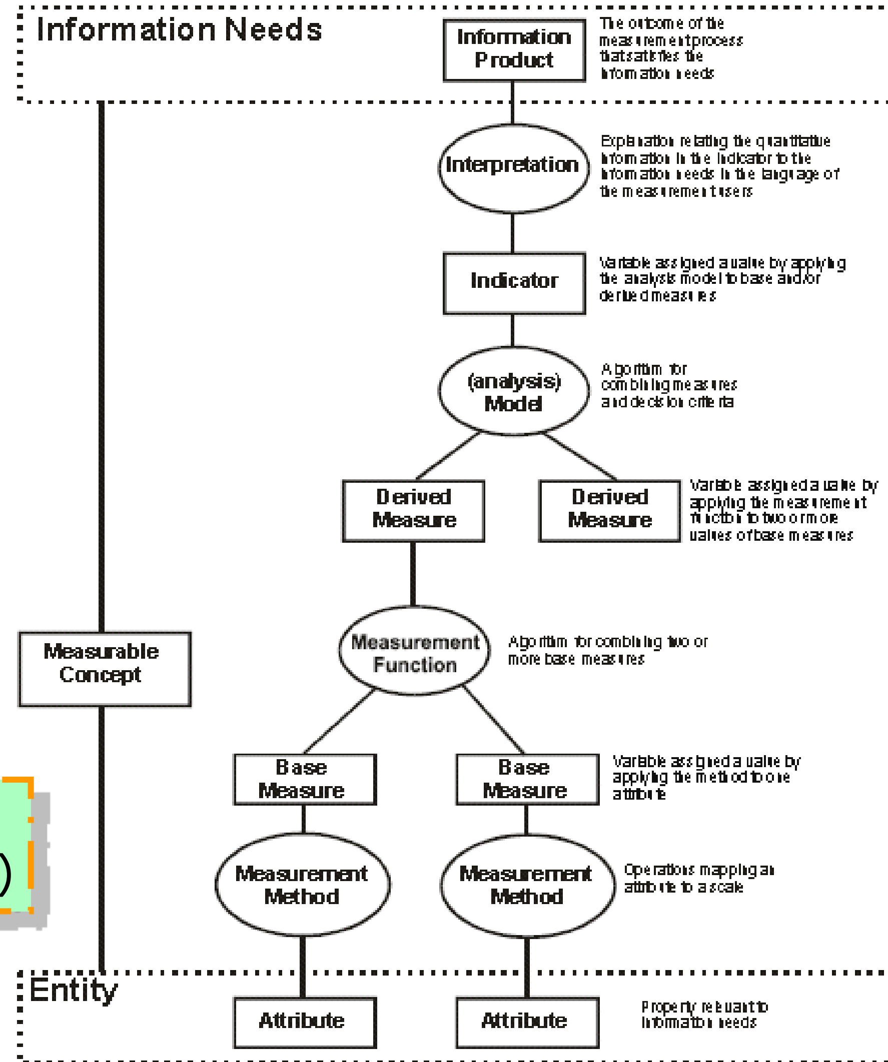
- **v3.0 – Refining the method**
  - ✓ Main changes from COSMIC-FFP:
    - Three macro-phases: Measurement Strategy, Mapping and Measurement
    - Granularity level in the counting
    - Clear distinction between 'principles' and 'rules'
    - Maggiore e migliore strutturazione del dataset di documenti e guide
    - Series of Guidelines (GL) per application domain
    - Possibility of Local extensions
  - ✓ BFC:
    - **E** – Entry, **X** - eXit, **R** – Read, **W** –Write
  - ✓ Size Unit:
    - Change of name from *cfsu* to **CFP** (COSMIC Function Point)



Source: Abran A., Desharnais J.M., Oligny S., St-Pierre D., Symons C., *COSMIC-Measurement Manual*, v3.0, September 2007, COSMICON

No.	Funct. Process	Triggering Event	Data Movement Description	Data Group	DM Type	CFP	CFP
1	Select target temperature	30sec. Timer Signal	Receive Triggering event Read Cooking mode RAM Receive Elapsed Time Read Temperature relationship from ROM Write target temperature	30sec. Timer Signal Cooking mode Elapsed time Signal Temperature relationships Target temperature	E R E R W	1 1 1 1 1	5
2	Control Heater	5sec. Timer Signal	Receive Triggering event Receive Actual Temp. from Sensor Read Target temperature Fissa il comando Calore (On/Off)	5sec. Timer Signal Actual Temperature Target Temperature HeaterTurn On/off command	E E R X	1 1 1 1	4
3	Control Cooking Lamp	Elapsed Time Signal	Receive Triggering event Send Cooking Lamp Command	Elapsed time Signal Cooking lamp turn on/off command	E X	1 1	2
						Tot	**11**

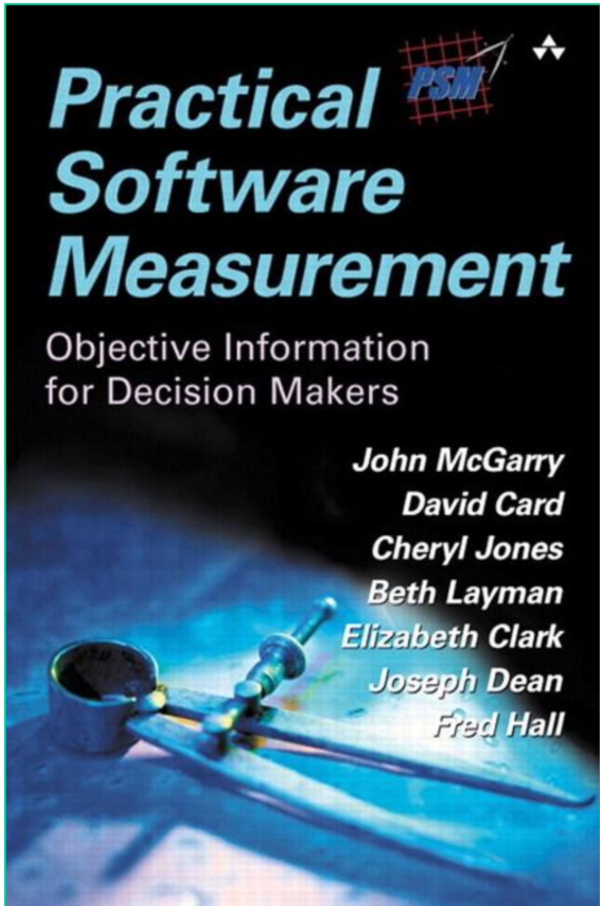




- **GQM** (Goal-Question-Metric)
  - **MIM** (Measurement Information Model)

MIM card (ISO/IEC 15939:2007, App.A)

Information Need	Estimate productivity of future project
Measurable Concept	Project productivity
Relevant Entities	1. Code produced by past projects 2. Effort expended by past projects
Attributes	1. C++ language statements (in code) 2. Timecard entries (recording effort)
Base Measures	1. Project X Lines of code 2. Project X Hours of effort
Measurement Method	1. Count semicolons in Project X code 2. Add timecard entries together for Project X
Type of Measurement Method	1. Objective 2. Objective
Scale	1. Integers from zero to infinity 2. Real numbers from zero to infinity
Type of Scale	1. Ratio 2. Ratio
Unit of Measurement	1. Line 2. Hour
Derived Measure	Project X Productivity
Measurement Function	Divide Project X Lines of Code by Project X Hours of Effort
Indicator	Average productivity
Model	Compute mean and standard deviation of all project productivity values
Decision Criteria	Computed confidence limits based on the standard deviation indicate the likelihood that an actual result close to the average productivity will be achieved. Very wide confidence limits suggest a potentially large departure and the need for contingency planning to deal with this outcome.



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2.3 Component Status

Category: Work Unit Progress

Common Issue Area: Schedule and Progress

Applicability: Applies to most types of projects

Analysis Guidance and Examples

Analyzing component status helps identify or predict schedule slips by comparing the number of work units or components completing a project phase to the number planned for completion to date. In the example in Figure 5-14, design progress is graphed with a line chart depicting cumulative measures for the original plan (Plan 1), the current plan (Plan 2), and the actual components designed to date. Each point is calculated by adding the number of components allocated for the reporting period to the corresponding cumulative total from the last reporting period. The figure shows that design progress was behind the original plan at the end of August 1999, resulting in a replan of the overall activity. Actual design progress has remained fairly close to the new plan (Plan 2). The plan line, however, requires a significant increase in the completion rate over the next few months, raising concern about the feasibility of the plan.

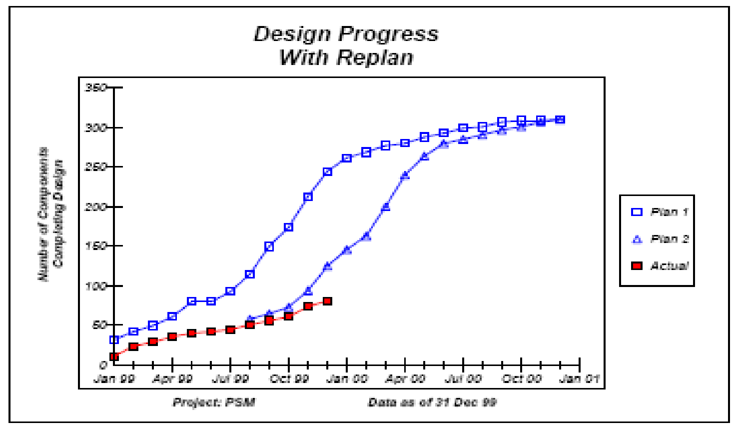


Figure 5-14.

Major changes in the rate of progress should be investigated. Once an actual trend line is established, it difficult to modify the rate of completion. A 10-percent cumulative deviation, or 20-percent-per-p deviation from the plan usually is viewed as significant.

Table 8.4.1 Time behaviour metrics c) Turnaround time

External time behaviour metrics c) Turnaround time

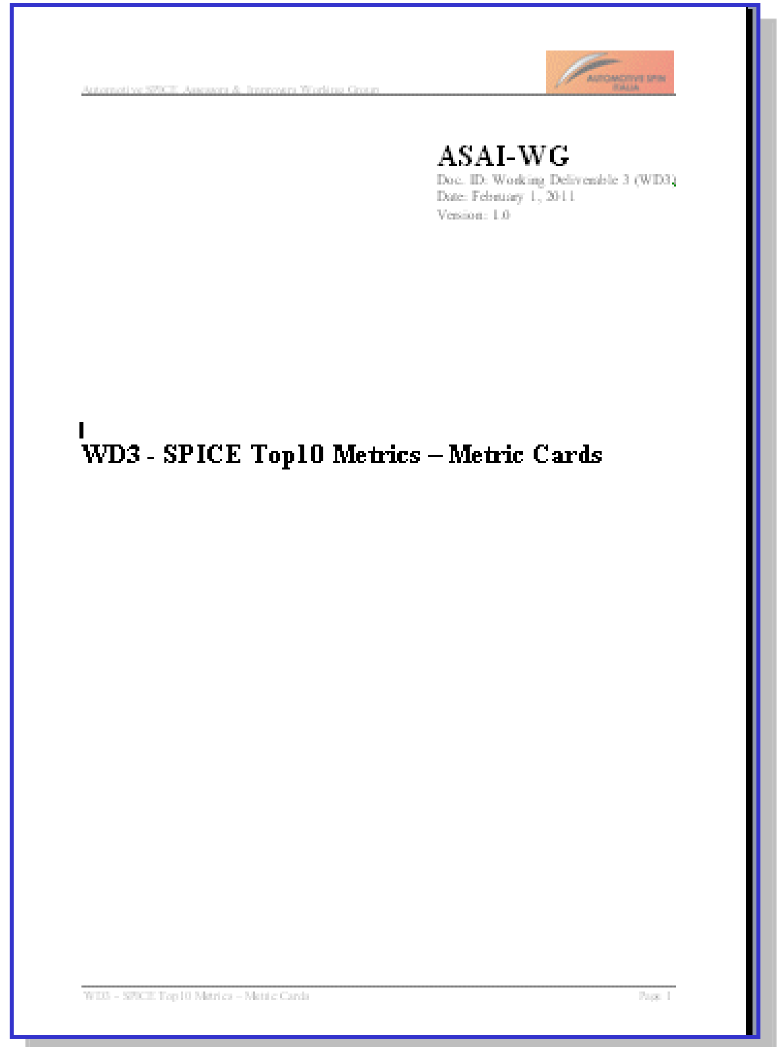
Metric name	Purpose of the metrics	Method of application	Measurement, formula and data element computations	Interpretation of measured value	Metric scale type	Measure type	Input to measurement	ISO/IEC 12207 SLCP Reference	Target audience
Turnaround time	What is the wait time the user experiences after issuing an instruction to start a group of related tasks and their completion?	Calibrate the test accordingly. Start the job task. Measure the time it takes for the job task to complete its operation. Keep a record of each attempt.	T = Time between user's finishing getting output results and user's finishing request *NOTE: It is recommended to take account of time bandwidth and to use statistical analysis with measures for many tasks (sample shots), not only one task (shot).*	0 < T The shorter the better.	Ratio	T= Time	Testing report Operation report showing elapse time	5.3 Sys./Sw. Integration 5.3 Qualifica-tion testing 5.4 Operation 5.5 Mainte-nance	User Developer Maintainer SQA
Mean time for turnaround	What is the average wait time the user experiences after issuing an instruction to start a group of related tasks and their completion within a specified system load in terms of concurrent tasks and system utilisation?	Calibrate the test. Emulate a condition where a load is placed on the system by executing a number of concurrent tasks (sampled shots). Measure the time it takes to complete the selected job task in the given traffic. Keep a record of each attempt.	X = Tmean/TXmean Tmean = Σ(Ti)/N, (for i=1 to N) TXmean = required mean turnaround time Ti = turnaround time for i-th evaluation (shot) N = number of evaluations (sampled shots)	0 < X The shorter is the better.	Absolute	Tmean= Time TXmean= Time Ti= Time N= Count X= Time/ Time	Testing report Operation report showing elapse time	5.3 Sys./Sw. Integration 5.3 Qualifica-tion testing 5.4 Operation	User Developer Maintainer SQA

www.iso.org

- ## ASAI-WG
  - ✓ Automotive SPICE Assessors & Improvers Working Group
  - ✓ Born in Jan 2009, it's a WG whose main goal is to identify recurring issues and problems as well as achieve an agreed policy to address them in practice

- ## The Metric Cards document
  - ✓ For making more concrete the discussions held in previous A-SPIN meetings about measurement, this is a practical document for proposing definitions for a core set of measures, balanced among viewpoints and measurable entities
  - ✓ http://www.automotive-spin.it/download.php

- ## Contents & Updates
  - ✓ This is a living document, that can be continuously updated
  - ✓ The initial set of measures would like to be a first attempt for those needing to establish a measurement plan from scratch
  - ✓ Of course, a goal-driven analysis must be done for your own project, trying to look at the viewpoints, issues and core aspects you need to control and measure
  - ✓ For any update, comment, feedback, please send an email to **luigi.buglione@eng.it**


Automotive SPICE Assessors & Improvers Working Group

ASAI-WG

Doc. ID: Working Deliverable 3 (WD3)

Date: February 1, 2011

Version: 1.0

WD3 - SPICE Top10 Metrics – Metric Cards

WD3 – SPICE Top10 Metrics – Metric Cards — Page 1

Automotive SPICE Assessors & Improvers Working Group

AUTOMOTIVE SPIN ITALIA

2.2 SFS – Software Functional Size

Measure Name	**SFS** – Software Functional Size	**Id.**	ENG.4
Purpose	To calculate the size of the functionalities to be added, changed, inserted in a software solution.		
Entity	Product	**Attribute**	Functional Size
SLC phase where applied	Bid (early-Stage) phase, Design phase, Project Closure.		
Unit of Measure(s)	*Fsu (Functional Size Unit)* Note: each fsu is composed by its own BFCs.		
Measurement Scale	Ratio		
Counting rule	To calculate the weighted sum by BFCs (Base Functional Components) considered in the chosen Functional Size Measurement (FSM) method.		
Formula	$fsu = \sum_{i=1}^{n} \sum_{j=1}^{m} BFC_i * w_j$	Legend: fsu = functional size unit BFC ...	

Responsible for Gathering Data	Functional Analyst
Gathering frequency	Typically to be counted in three moments in time in the project lifetime: ▪ After the elicitation of high-level requirements (HLR) ▪ At the end of the Design phase ▪ At the Project closure
Gathering methodology	Manual
Examples	• URL: http://www.softwaremetrics.com/freemanual.htm • URL: http://www.semq.eu/leng/sizestfsm.htm
Comments/Notes	• Fsu is the generic term for including all the possible units of measure related to the several FSM methods • BFC depends on the FSM method (e.g. for the IFPUG FPA, BFC are 5: ILF, EIF, EI, EO, EQ; for COSMIC are 4: Entry, Exit, Read, Write; etc.) • COSMIC is the solely FSM method without a weighting system: in such case, please consider the 'w' variable always equal to 1. • Any FSM method sizes only the FUR (Functional User Requirements) for a software product. Therefore NFR (Non-Functional Requirements) are out of scope from this measure. For instance, IFPUG is working on a new method called SNAP (Software Non-functional Assessment Process), to be released by 2011. Or the ISO/IEC 9126-1 Quality Model attributes can be considered, looking at their related metrics in parts 2-3-4. • For estimation purposes, it is very useful to maintain the data gathering in the project historical database (PHD) at the BFC level: a prediction mod a multiple regression model is more efficient th
Possible associated answers:	• How many functionalities ar • Which is the val •

- **The Value of Measurement**
  - ✓ Measurement is not a primary, but a support process in most known SPI models (e.g. CMMI, ISO/IEC 15504, etc.)
  - ✓ It's not part of Project Management process but a process aside (e.g. MA in CMMI; MAN.6 in ISO/IEC 15504-2, etc.)
  - ✓ Fundamental to elicit measures from the informative needs, avoiding to adopt 'standards' measures simply because mostly used in the ICT world if not really needed in our own organization
  - ✓ Measurement must be not a cost, but an investment; measure its ROI in projects, moving from the savings from better estimates during the short-mid term
- **Some basic criteria...**
  - ✓ GQM (Goal-Question-Metric) represents a starting point for determining measures
  - ✓ A series of variants as GQ(I)M, V-GQM and GQM+Strategies can be adopted
  - ✓ The '5Ws+H' rule from journalism is a common-sense series of criteria for setting up a measurement program
  - ✓ Part of such information (what, why, who, when, where, how) should be part of the 'metric cards' in order to consistently adopt measures across different teams and organization(s)
- **The Metrics Cards**
  - ✓ Each 'metric card' should contain a series of not ambiguous information about the '5Ws+H'
  - ✓ Link each measure to 1+ processes, trying to prioritize those ones than can be used jointly in a supply chain logic (more informative value at the same operative cost)
  - ✓ The selection of a balanced set of measures across multiple viewpoints and measurable entities can help in having a more affordable and real picture of the organization
  - ✓ Measure few, measure well: the BMP technique can help in this!

Misurare il software

Quantità, qualità, standard e miglioramento di processo nell'Information & CommunicationTechnology

Franco Angeli, 2008 – 3ª edizione
Collana: *Informatica ed Organizzazioni*
pp. 380 -Volume 724.20
ISBN 978-88-464-9271-5

Luigi Buglione

www.semq.eu/leng/booksms.htm

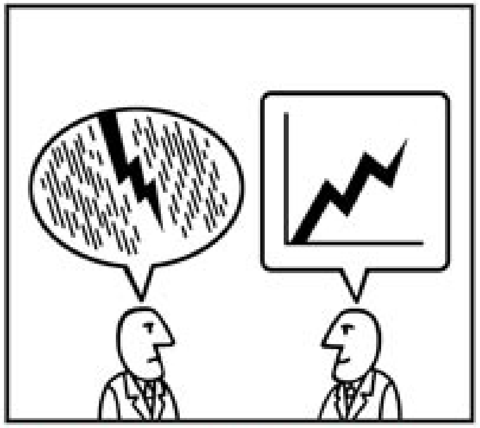
Parte dei proventi sono devoluti alla

FISM (**F**ondazione **I**taliana **S**clerosi **M**ultipla)

Thanks for your attention!

Grazie per la vostra attenzione!

Thanks for your Attention !



We care of your problems and we have in mind a solution

SPIMQ

Misurare per Migliorarsi

ENGINEERING

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