



10° Automotive SPIN Italy Workshop
Milan (Italy), October 25 2012

MASP (Metrics in Automotive Software Projects)



Purpose, Scope & Results

Luigi Buglione, Ph.D.
Process Improvement & Measurement Specialist
Industry Business Unit
Engineering.IT
luigi.buglione@eng.it

www.eng.it





- ✓ **G1.** Introduce the 'metrication' issue in Automotive projects
- ✓ **G2.** Present the **MASP** project
- ✓ **G3.** Show the work products and next steps





- **Introduction**
 - A needed premise
 - What happened...
- **The MASP Project**
 - State-of-the-art: 5W's
 - Work product(s)
 - Metric Cards
 - BMP matrix
- **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**...

Introduction

What happened...



2009-06

ENGINEERING

AUTOMOTIVE SPIN ITALIA

5^o Workshop Automotive SPIN Italia Milano, 4 Giugno 2009

Top Metrics for SPICE-compliant projects

Luigi Buglione
Engineering.it
luigi.buglione@eng.it

www.eng.it

Automotive SPIN Italia (04/06/2009) - L. Buglione © 2009

2010-05

ENGINEERING

AUTOMOTIVE SPIN ITALIA

7^a Automotive SPIN Italy Workshop
Pisa, May 21st 2010

COSMIC

A new method for measuring software functional size

Luigi Buglione, Ph.D.
Process Improvement & Measurement Specialist
Industry Business Unit
Engineering.IT

www.eng.it

ENGINEERING

2011-02

ENGINEERING

AUTOMOTIVE SPIN ITALIA

8^a Automotive SPIN Italy Workshop
Milano, February 17 2011

The Metric Cards

A Balanced Set of Measures
ISO/IEC 15504 compliant

Luigi Buglione, Ph.D.
Process Improvement & Measurement Specialist
Industry Business Unit
Engineering.IT

www.eng.it

ENGINEERING

MASP

2011-04

<p>Management Process Group (MAN)</p> <ul style="list-style-type: none"> 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 	<p>Engineering Process Group (ENG)</p> <ul style="list-style-type: none"> 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 	<p>Supporting Process Group (SUP)</p> <ul style="list-style-type: none"> 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
<p>The Acquisition Process Group (ACQ)</p> <ul style="list-style-type: none"> 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 	<p>Resource & Infrastructure Process Group (RIN)</p> <ul style="list-style-type: none"> RIN.1 Human resource management RIN.2 Training RIN.3 Knowledge management RIN.4 Infrastructure 	<p>Operation Process Group (OPE)</p> <ul style="list-style-type: none"> OPE.1 Operational use OPE.2 Customer support
<p>Supply Process Group (SPL)</p> <ul style="list-style-type: none"> A SPL.1 Supplier tendering A SPL.2 Product release SPL.3 Product acceptance support 	<p>Process Improvement Process Group</p> <ul style="list-style-type: none"> PIM.1 Process establishment PIM.2 Process assessment A PIM.3 Process improvement 	<p>Reuse Process Group (REU)</p> <ul style="list-style-type: none"> 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

The MASP project

Purpose (Why)



- The 'Metrication' issue**

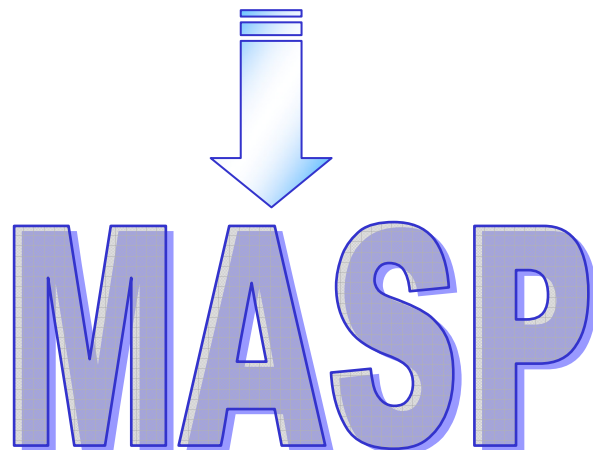
- ✓ Started a discussion within the Automotive SPICE Assessors & Improvers Working Group (ASAI) in mid-2009
- ✓ Nowadays MAN.6 process is not included in typical A-SPICE appraisals, losing a plenty of information about project monitoring that MAN.3 cannot assure and provide

- The 'Metric Cards' document**

- ✓ www.semq.eu/pdf/top10-metrics.pdf

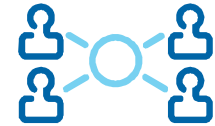
- What about Automotive?**

- ✓ Need to be more domain-focused
- ✓ Expression of interest for a new WG



3.6 SDR – Software Defect Rate

Measure Name	SDR – Software Defect Rate	ISO/IEC 15504	MAN.3 MAN.4
Purpose	To measure the quality of software product/item in terms of number of defects against its product size unit.		
Entity	Product	Attribute	Defectability
SLC phase where applied	Release phase		
Unit of Measure(s)	Defect <i>NOTE 1:</i> there are several ways and criteria for classifying defects. E.g. by severity/priority, or by typology, by origin, etc. <i>NOTE 2:</i> "a problem which, if not corrected, could cause an application to either fail or to produce incorrect results" (ISO/IEC 20926:2003 Software engineering -- IEPUG 4.1 Unadjusted functional size measurement method -- Counting practices manual)		
Measurement Scale	Ratio		
Counting rule	To calculate the ratio between the number of defects (delivered or discovered) and its product size (according to the product size unit used in the project monitoring). <i>NOTE:</i> for benchmarking purposes, it is suggested to split the values (both in the upper and low the formula) according to the nature of the requirements originating them (functional; non-functional); not done, the risk is to obtain higher values than expected.		



- **Expression of Interest**

- ✓ Kick-off meeting: April 2011
- ✓ 26 people expressed their interest in participating to MASP
- ✓ 11 people actively working on Metrics Cards

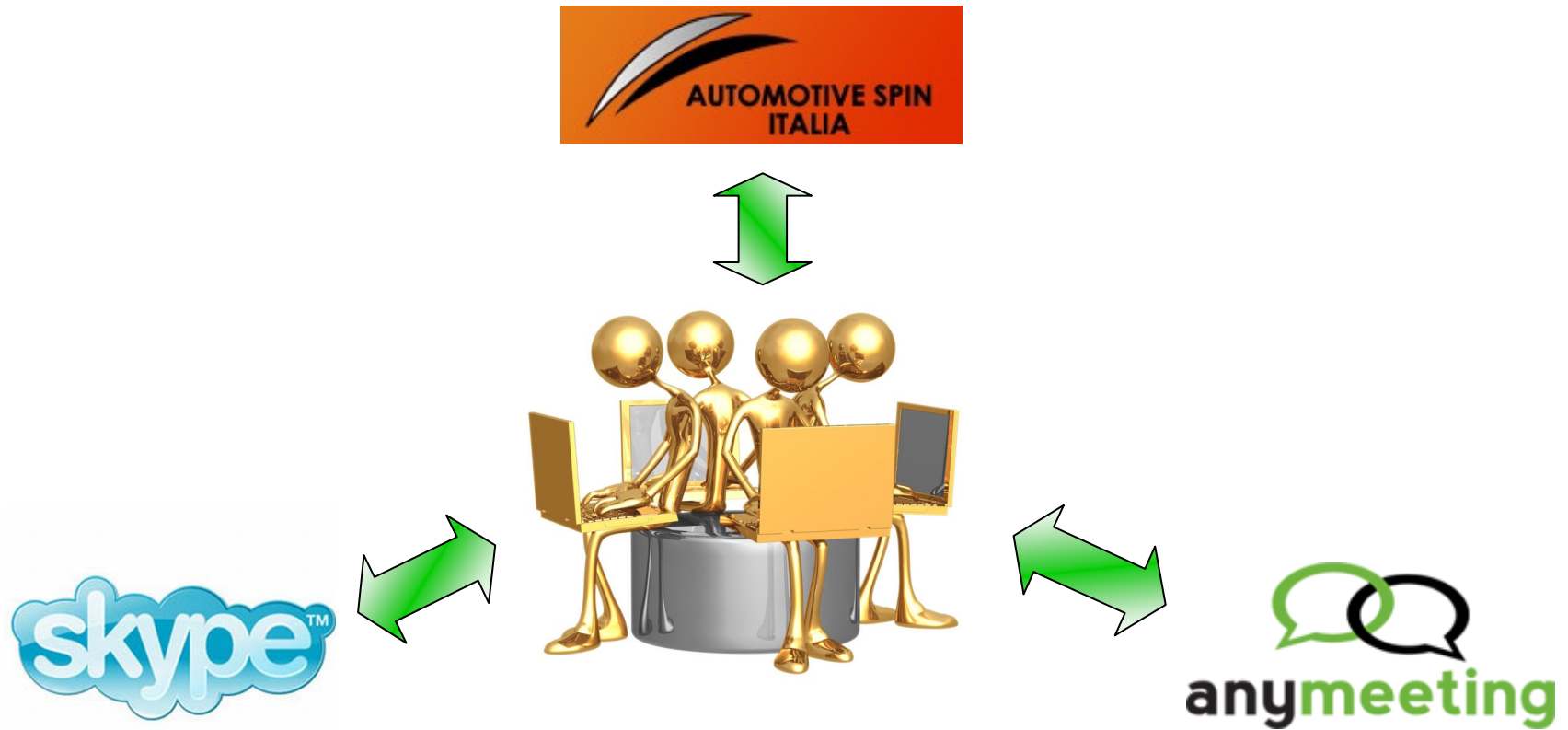
- **The (final) Working Group (WG) participants**

- ✓ Luigi **Buglione** (Engineering.IT – *coordinator*)
- ✓ Concetta **Argiri** (TXT Group)
- ✓ Roberto **Bagnara** (Univ. Parma/BUGSENG Srl)
- ✓ Marina **Borghi**
- ✓ Domenico **Di Leo** (Univ. Napoli – Federico II)
- ✓ Lorenzo **Falai** (Resiltech)
- ✓ Mario **Fusani** (CNR-ISTI)
- ✓ Giuseppe **Lami** (CNR-ISTI)
- ✓ Leonardo **Ricci** (Magnetis Marelli)
- ✓ Francesco **Rossi** (Resiltech)
- ✓ Isabella **Ruocco** (Magnetis Marelli)



The MASP project

The way we worked (When, Where & How)





Metric Cards for Automotive Software Projects



Technical Report

Version 1.0 – October 2012

MEC - Metric Cards			
#	Id	Title	ISO/IEC 15504
1	CBO	Avg of Coupling Between Objects	SUP.1
2	CC1	McCabe Cyclomatic Complexity	ENG.5, ENG.6
3	CDRE	Company Defect Removal Efficiency	ENG.8, ENG.10
4	CRE	Change Request Effort	MAN.3, SUP.10
5	CTA	Class Type Attributes	SUP.1
6	ENC	Engineering non Conformance	SUP.1
7	EXC	External Calls	SUP.1
8	IFC	Information Flow Complexity	ENG.6
9	OCC	Memory Occupation	ENG.6
10	PSM	Product Software Modification	ENG.6, MAN.3
11	RDR	Rule Deviation Rate	ENG.5, ENG.6
12	REI	Reliability Index	MAN.3, MAN.5
13	RES	Requirement Stability	ENG.1, ENG.4
14	SDR	Software Robustness Distribution	ENG.5, ENG.6
15	SFIN	Structural fan-in	ENG.5, ENG.6
16	SFOUT	Structural fan-out	ENG.5, ENG.6
17	WPU	Work Product Usage	PA2.2, PA3.2, PA3.3



Measure Name	OCC - Memory occupation	ISO/IEC 15504	ENG.6
Purpose	To track project progress by ROM and RAM occupation in order to document resources consumption and monitor consumption targets.		
Entity	Resource	Attribute	Maintainability
SLC phase where applied	Implementation		
Unit of Measure(s)	Kbyte		
Measurement Scale	Ratio		
Counting rule	To calculate the ratio between the memory occupied and the overall memory available (ROM, RAM)		
Formula	$\frac{\sum_{i=1}^n \text{ROM}_i + \sum_{i=1}^n \text{RAM}_i}{\text{Total Memory}}$		<u>Legend:</u>

Responsibility

Gather

3.2 CC1 – McCabe Cyclomatic Complexity

Measure Name	CC1 – McCabe Cyclomatic Complexity	ISO/IEC 15504	ENG.5, ENG.6
Purpose	To increase the maintainability of the source code		
Entity	Product	Attribute	Maintainability
SLC phase where applied	Coding		
Unit of Measure(s)	Edges; Nodes		
Measurement Scale	Interval		
Counting rule	Count of the number of linearly independent paths through the source code		
Formula	$CCI = E - N + 2P$		$E = \dots$
	Developer		



Entity\Attribute

Project	● M.05		
Resources			
Process		M.02 ●	● M.05
Product		● M.01	● M.06
	Attribute₁	Attribute₂	...



The real issue is **not to reduce** the cost of the measurement process, **but optimising** it against the informative value provided by the number of measures/indicators balancing them by each perspective of analysis.



- **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.)
- ✓ 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) or some of its variants (GQ(I)M, V-GQM...) represents a starting point for determining measures
- ✓ 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!

- **The MASP project → a new TR available**

- ✓ A new Automotive SPIN Italy working group [Apr-2011; Oct 2012]
- ✓ Technical Report (TR) ready – available for download from the AutomotiveSPIN Italy web
- ✓ On-going effort: **(1)** fix any possible error in current cards/document; **(2)** add few new cards; **(3)** evaluate any possible suggestion/comment received



Thanks for your attention!
Grazie per la vostra attenzione!