‘Manda, Panda, and the CMMI®

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‘Manda, Panda, and the CMMI®

Joe Schofield, yhs

“*Daddy, we’re going to have a new member in our family*.” ‘Manda

The opinions expressed in this presentation are solely / sorely, the presenter's.

A Quick Look Back & Update on Recent IFPUG / ISMA Presentations

2006	**Defect Collection & Analysis – The Basis of Software Quality Improvement** ***Defect Management through the Personal Software Process(SM); CrossTalk, September 2003*** ***The Team Software ProcessSM - Experiences from the Front Line*; Software Quality Forum; Arlington, Virginia, March; 2003** ***Measuring Software Process Improvement - How to Avoid the Orange Barrels*; System Development, December 2001** ***Usable Metrics for Software Improvement within the CMM*; Software Quality Forum 2000; Santa Fe, N.M.; April, 2000**
2004	**Applying Lean Six Sigma to Software Engineering** ***When Did Six Sigma Stop Being a Statistical Measure?; CrossTalk, April 2006*** ***Lean Six Sigma - Real Stories from Real Practitioners*; Albuquerque, N.M.; N.M. SPIN; August 2005** ***Six Sigma & Software Engineering: Complement or Collision*; Albuquerque, N.M.; N.M. SPIN; August, 2004**
2003	**Amplified Lessons from the Ant Hill – What Ants and Software Engineers Have in Common** ***Lessons from the Ant Hill - What Ants and Software Engineers Have in Common*; Information Systems Management, Winter 2003**
2002	**Counting KLOCs – Software Measurement's Ultimate Futility (I can't do this anymore, or who am I fooling?, or why not count ants?)** ***The Statistically Unreliable Nature of Lines of Code;* CrossTalk, April 2005** ***A Practical, Statistical, and Criminal Look at the Use of Lines of Code as a Software Sizing Measure* ; N.M. SPIN; March, 2004**

Taking a step back (or forward?)

C – the quality or state of having the attributes required for performance or accomplishment

M – to become fully developed or ripe

M – an example for imitation or emulation

I – the act or process of integrating

CMMI's roots are found in other quality improvement efforts defined by Deming, Crosby, and Juran.

Origins and History of the CMMI

1987 – 1997 CMM developed

2002 version 1.1 of the CMMI was released subsuming SW-CMM

2005 (December) SW-CMM sunset

2006 (August) version 1.2 was released

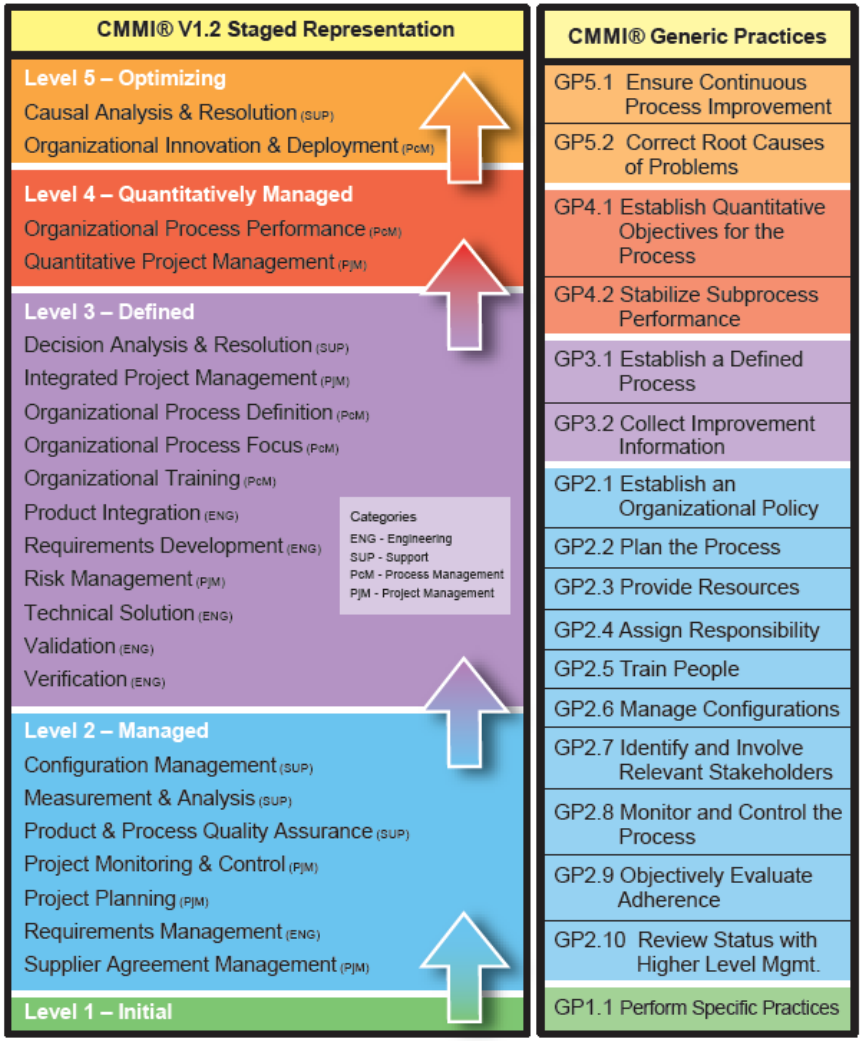
Goal is to improve usability of maturity models

Developed with government, industry, and SEI contributors.

Origins in a number of Capability Models and standards:

- EIA 731
- SW-CMM
- IPD CMM
- FAA iCMM
- Systems Security Engineering CMM
- Software Acquisition CMM
- People CMM

Process Areas by Maturity Levels, Related Generic Practices, & Categories



Process Areas and Purpose Statements

Level 5 Process Areas

Organizational Innovation and Deployment - The purpose of Organizational Innovation and Deployment is to select and deploy incremental and innovative improvements that measurably improve the organization's processes and technologies. The improvements support the organization's quality and process-performance objectives as derived from the organization's business objectives.

Causal Analysis and Resolution - The purpose of Causal Analysis and Resolution is to identify causes of defects and other problems and take action to prevent them from occurring in the future.

Level 4 Process Areas

Organizational Process Performance - The purpose of Organizational Process Performance is to establish and maintain a quantitative understanding of the performance of the organization's set of standard processes in support of quality and process-performance objectives, and to provide the process performance data, baselines, and models to quantitatively manage the organization's projects.

Quantitative Project Management - The purpose of the Quantitative Project Management process area is to quantitatively manage the project's defined process to achieve the project's established quality and process-performance objectives.

Level 3 Process Areas

Decision Analysis and Resolution - The purpose of Decision Analysis and Resolution is to analyze possible decisions using a formal evaluation process that evaluates identified alternatives against established criteria.

Integrated Project Management - The purpose of Integrated Project Management is to establish and manage the project and the involvement of the relevant stakeholders according to an integrated and defined process that is tailored from the organization's set of standard processes.

Organizational Process Definition - The purpose of Organizational Process Definition is to establish and maintain a usable set of organizational process assets.

Organizational Process Focus - The purpose of Organizational Process Focus is to plan and implement organizational process improvement based on a thorough understanding of the current strengths and weaknesses of the organization's processes and process assets.

Organizational Training - The purpose of Organizational Training is to develop the skills and knowledge of people so they can perform their roles effectively and efficiently.

Product Integration - The purpose of Product Integration is to assemble the product from the product components, ensure that the product, as integrated, functions properly, and deliver the product.

Requirements Development - The purpose of Requirements Development is to produce and analyze customer, product, and product-component requirements.

Risk Management - The purpose of Risk Management is to identify potential problems before they occur, so that risk-handling activities may be planned and invoked as needed across the life of the product or project to mitigate adverse impacts on achieving objectives.

Technical Solution - The purpose of Technical Solution is to design, develop, and implement solutions to requirements. Solutions, designs, and implementations encompass products, product components, and product-related life-cycle processes either singly or in combinations as appropriate.

Validation - The purpose of Validation is to demonstrate that a product or product component fulfills its intended use when placed in its intended environment.

Verification - The purpose of Verification is to ensure that selected work products meet their specified requirements.

Level 2 Process Areas

Requirements Management - The purpose of Requirements Management is to manage the requirements of the project's products and product components and to identify inconsistencies between those requirements and the project's plans and work products.

Project Planning - The purpose of Project Planning is to establish and maintain plans that define project activities.

Project Monitoring and Control - The purpose of Project Monitoring and Control is to provide an understanding of the project's progress so that appropriate corrective actions can be taken when the project's performance deviates significantly from the plan.

Supplier Agreement Management - The purpose of Supplier Agreement Management is to manage the acquisition of products from suppliers for which there exists a formal agreement.

Measurement and Analysis - The purpose of Measurement and Analysis is to develop and sustain a measurement capability that is used to support management information needs.

Process and Product Quality Assurance - The purpose of Process and Product Quality Assurance is to provide staff and management with objective insight into processes and associated work products.

Configuration Management - The purpose of Configuration Management is to establish and maintain the integrity of work products using configuration identification, configuration control, configuration status accounting, and configuration audits.

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Capability Maturity Model Integration Structure

**The CMMI is comprised of *constellations*:
Development, Acquisition, and Services.**

**The CMMI for Development is comprised of two
representations: Continuous and Staged.**

Both representations are comprised of *Process Areas* (22).

A Process Area is *satisfied* using a formal appraisal approach by satisfying *Specific Goals* (SGs) and *Generic Goals* (GGs).

Specific Goals are satisfied with the *evidence* of performing *Specific Practices* (SPs).

Generic Goals are satisfied with the evidence of performing *Generic Practices* (GPs).

Each Process Area has its own unique Specific Practices (thus the name!).

All Process Areas share the same Generic Practices dependent on the targeted capability or maturity level.

Buying a dog – selecting a supplier

Supplier Agreement Management — *a maturity level 2 Process Area*

Purpose is to manage the acquisition of products from suppliers for which there exists a formal agreement

Specific Practices include:
SP 1.1 Determine Acquisition Type ☑
SP 1.2 Select Suppliers ☑
SP 1.3 Establish Supplier Agreements ☑
SP 2.1 Execute the Supplier Agreement
SP 2.2 Monitor Selected Supplier Processes
SP 2.3 Evaluate Selected Supplier Work Products ☑
SP 2.4 Accept the Acquired Product ☑
SP 2.5 Transition Products ☑

And in real life . . .

Measurement Criteria that Supports Decision–Making

Measurement & Analysis — *a maturity level 2 Process Area*

Purpose is to develop and sustain a measurement capability that is used to support management information needs.

Specific Practices include:
SP 1.1 Establish Measurement Objectives ☑
SP 1.2 Specify Measures ☑
SP 1.3 Specify Data Collection and Storage Procedures ☒
SP 1.4 Specify Analysis Procedures ☑
SP 2.1 Collect Measurement Data
SP 2.2 Analyze Measurement Data
SP 2.3 Store Data and Results
SP 2.4 Communicate Results

And in real life . . .

Measurement Objective – to objectively determine the cost and benefit of pet ownership

accident - the emission of liquid or solid material in other than its intended place.

cost (total expected cost of ownership) – procurement, support (grooming, shots, vet, hair removal, vacation boarding), disposition

nice to me – comes / goes when called, does not consume my personal possessions, does not bark once I retire

Deciding about getting a dog

Decision Analysis and Resolution (DAR) – *a maturity level 3 Process Area*

Purpose is to analyze possible decisions using a formal evaluation process that evaluates identified alternative against established criteria

Specific Practices include:
SP 1.1 Establish Guidelines for Decision Analysis
SP 1.2 Establish Evaluation Criteria ☑
SP 1.3 Identify Alternative Solutions ☒
SP 1.4 Select Evaluation Methods ☒
SP 1.5 Evaluate Alternatives ☒
SP 1.6 Select Solutions

And in real life . . .

	Nice to me? (.9)	$ (.05)	Size (.05)
Dog 1			
Dog 2			
Dog 3			

Piloting dog assimilation

Organizational Innovation & Deployment — *a maturity level 5 Process Area*

Purpose is to select and deploy incremental and innovative improvements that measurably improve the organization's processes and technologies. The improvements support the organization's quality and process-performance objectives as derived from the organization's business objectives

Specific Practices include:
SP 1.1 Collect and Analyze Improvement Proposals
SP 1.2 Identify and Analyze Innovations ☒
SP 1.3 Pilot Improvements ☑
SP 1.4 Select Improvements for Deployment
SP 2.1 Plan the Deployment
SP 2.2 Manage the Deployment
SP 2.3 Measure Improvement Effects ☑

And in real life . . .

	Day 1	Day 2	Day 3
Time with dog	120 min	45 min	60 min
Accidents	6	4	3
Feedings	3	3	4
Number of fights	4	4	2

Policy regarding getting a dog (or pet)

GP 2.1 – Establish an Organizational Policy

The purpose of this generic practice is to define the organizational expectations for the process and make these expectations visible to those in the organization who are affected. In general, senior management is responsible for establishing and communicating guiding principles, direction, and expectations for the organization.

Specific Practices: None

And in real life . . .

Parents in role of Senior Management

Does a posting on the refrigerator constitute "communicating"?

Can it be flushed once it expires?

And your plan is . . .

GP 2.2 – Plan the Process

The purpose of this generic practice is to determine what is needed to perform the process and to achieve the established objectives, to prepare a plan for performing the process, to prepare a process description, and to get agreement on the plan from relevant stakeholders.

Subpractices:

1. *Define and document the plan for performing the process.* [X]
2. *Define and document the process description.* [X]
3. *Review the plan with relevant stakeholders and get their agreement.* [X]
4. *Revise the plan as necessary.* [X]

And in real life . . .

"Your happiness" does not constitute an established objective.

"I'm going to the airport Saturday to pick up my dog" does not constitute a plan.

Parents are relevant stakeholders!

Training before and while owning a dog (or pet)

GP 2.5 – Train People

The purpose of this generic practice is to ensure that the people have the necessary skills and expertise to perform or support the process.
Appropriate training is provided to the people who will be performing the work. . . .
Examples of methods for providing training include self-study; self-directed training; self-paced, programmed instruction; formalized on-the-job training; mentoring; and formal and classroom training.
Training supports the successful performance of the process by establishing a common understanding of the process and by imparting the skills and knowledge needed to perform the process.

And in real life . . .

Training precedes product acceptance.

"Dog Training for Idiots?"

"Owner Training for Idiots?"

Selected resources from Amazon:

Talk to me . . .

GP 2.7 – Identify and Involve Relevant Stakeholders

The purpose of this generic practice is to establish and maintain the expected involvement of stakeholders during the execution of the process.

1. Identify stakeholders relevant to this process and their appropriate involvement.
2. Share these identifications with project planners or other planners as appropriate.
3. Involve relevant stakeholders as planned.

And in real life . . .

"Daddy, we're going to have a new member in our family."

"I'm going to the airport to pick-up a dog on Saturday."

"Can you watch my dog grandpop?"

Objective evidence of progress, please

GP 2.9 – Objectively Evaluate Adherence

The purpose of this generic practice is to provide credible assurance that the process is implemented as planned and adheres to its process description, standards, and procedures. This generic practice is implemented, in part, by evaluating selected work products of the process.

And in real life . . .

How did it go today? (wife)

Are shots current?

What's the vet groomer say?

Check-in, hey, once in a while!

GP 2.10 – Review Status with Higher Level Management

The purpose of this generic practice is to provide higher level management with the appropriate visibility into the process.

And in real life . . .

Puppies don't "grow" out of immature practices; they are trained into performing better practices. Puppies are like people!

The best training includes observation of the desired practice—doggie see, doggie do.

More here . . .

Measurement data while owning a dog

GP 3.2 – Collect Improvement Information

The purpose of this generic practice is to collect information and artifacts derived from planning and performing the process.

Subpractices:

1. *Store process and product measures in the organization's measurement repository.*
2. *Submit documentation for inclusion in the organization's process asset library.*
3. *Document lessons learned from the process for inclusion in the organization's process asset library.*
4. *Propose improvements to the organizational process assets.*

And in real life . . .

"Go outside" means "go outside" and "don't go inside"!

Relies on defined measurement data.

Make draw from DAR process for determining key measures.

Introducing the suspects – Scene 2 – Christina & Elektra

(and what we Didn't Learn the First Time!)

A quick summary:

No Policy (GP 2.1)

Not much of a plan (PP, GP 2.2)

No training, human or otherwise (caninus) (OT, GP 2.5)

No Stakeholder involvement (IPM, GP 2.7)

No prior Review Status with Senior Management (GP 2.10)

No objective evidence (GP 2.9)

No improvement information (GP 3.2)

No pilot (OID, GP 5.1)

Lessons Learned and Take Aways – So What?

Avoid having children

Avoid having pets; instead consider plants that are silk or plastic

Ignoring the items above, consider a framework for training, implementation, and appraisal (constitutes a constellation with the SEI)

Find new ways to apply and understand models (what others have learned)

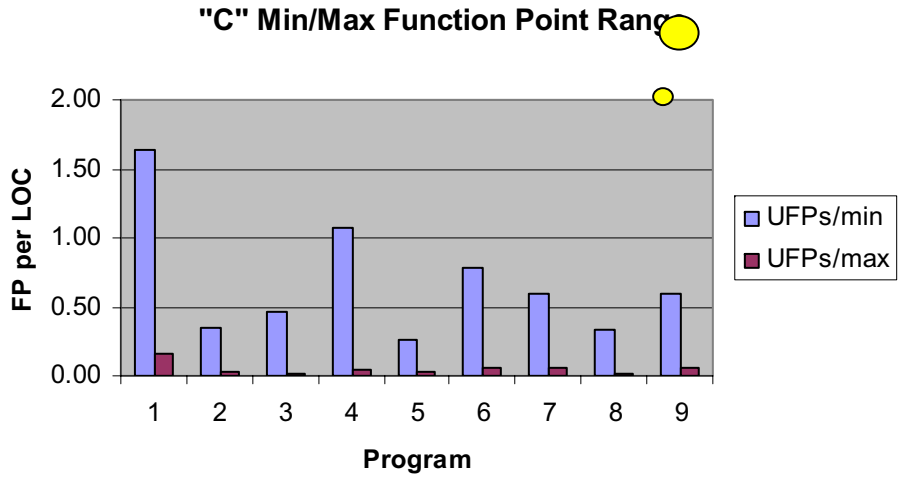
Preach what you practice

Min and max values for “C” code compared to Function Point size over 9 programs (n = 49)

	*P1	P2	P3	P4	P5	P6	P7	P8	P9	
Min	22	20	15	13	27	23	25	21	25	
Max	221	311	336	289	270	306	242	383	284	
UFPs	36	7	7	14	7	18	15	7	15	
UFPs/min	1.64	0.35	0.47	1.08	0.26	0.78	0.60	0.33	0.60	
UFPs/max	0.16	0.02	0.02	0.05	0.03	0.06	0.06	0.02	0.05	
Variance Range	10.05	15.55	22.40	22.23	10.00	13.30	9.68	18.24	11.36	14.76

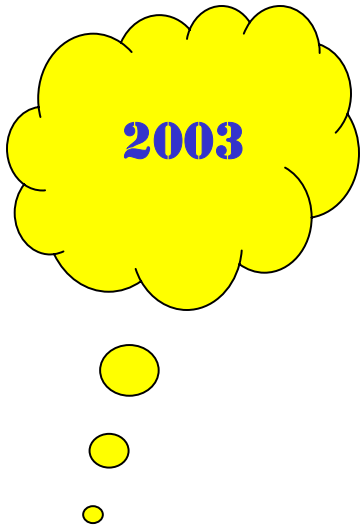
2002

Largest min to max variance is > 22, smallest is almost 10, average is almost 15.



Note that in these three examples, variance and averages increased as the population increased.

Software engineers are smarter than ants, right?



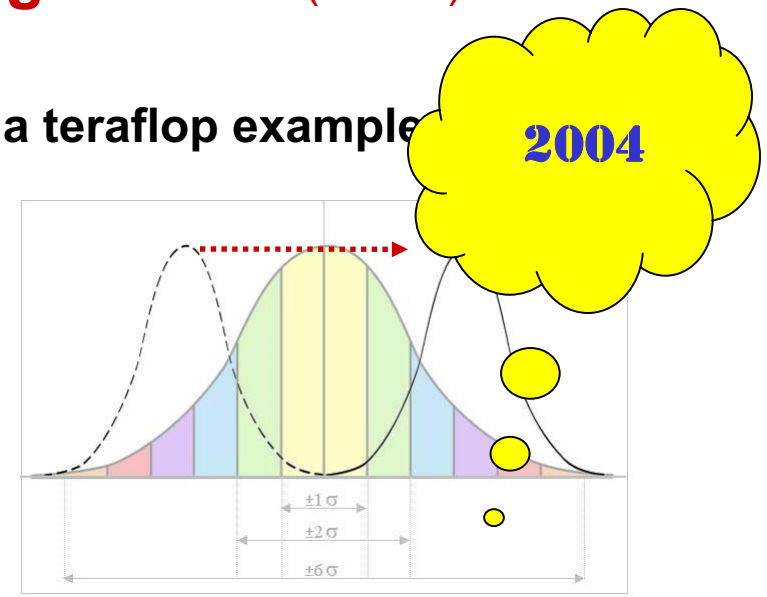
Observation: When ants underestimate the size of a job, they compensate with waves of more ants. Most software projects cannot afford this tactic.

Lesson: Use reliable sizing measures like Function Points to assess progress. Avoid the practice of counting lines of code as a measure of size or progress.

Reference: *A Practical, Statistical, and Criminal Look at the Use of Lines of Code as a Software Sizing Measure*, Schofield, Structured Development Forum, March, 2003

When Lean Six Sigma Isn't (cont'd)

"What if" the *sigma shift* went to the right – a teraflop example



TeraFlops machine
1T floating point operations instructions per second =
3 defects per 100 seconds =
108 defects per hour =
18,144 per week =
943,488 DEFECTS per year =
50M+ a year at "shifted 6 sigma" (4.5 sigma)
(these numbers are rounded down)

[1] **PetaFlops machine**
predicted to be ready by 2005 or 2006
1,000 times faster than a 1TFlop machine =
943,488,000 defects per year @ 7.5 sigma =
50B (that's BILLION) at "shifted 6 sigma"
PETAFLOP Imperative; Informationweek; June 21, 2004; pgs. 55 – 62

Who can repair / afford / manage that many defects?

[2] **IBM's Gene/L at Lawrence Livermore National Lab operates @ 70.72TF**
IBM will increase the speed to 360 TF in 2005
U.S. Regains Top Supercomputer Spots; Informationweek; November 15, 2004; pg. 28

When Lean Six Sigma Isn't (cont'd)

2006

A Way to Look at Defects

Phase Injected

Phase Detected	Planning	Analysis	Design	Impl.	Deploy.	Ops.
Planning	109	4	8	8		
Analysis	1	290	2			
Design	3	9	476	2		
Imple.	1	1	13	296		
Deploy.				1	20	
Ops.			3	24	2	30
Total Injected	114	304	502	331	22	30
% leakage	4	3	3	7	9	

Find

Remove

Prevent

What does this association matrix REVEAL?