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Webinar:
Defects: Pay Me Now and Pay Me Later

June 28, 2012
Time

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About Presenter's Firm

Joe Schofield is a SEI-certified instructor for the Introduction course as well as the Level 2 and Level 3 Practitioner courses. Joe taught these courses for many years before retiring from Sandia National Laboratories as a Distinguished Member of the Technical Staff. Spanning 31 years he led in the development of numerous IS/IT projects and the last thirteen of those years, he was directly responsible for the implementation of the CMMI® for an organization of 400 personnel. In addition he facilitated over 100 teams in the areas of software specification, team building and organizational planning by using lean six sigma and business process reengineering.

Joe serves as the President of the International Function Point Users Group, and is a CFPS, CSMS, CSQA, and a Lean Six Sigma black belt. He has over four dozen published papers, conference presentations and keynotes—including contributions to the books *IT Measurement, Certified Function Point Specialist Exam Guide, The Economics of Software Quality,* and just released, *The IFPUG Guide to IT and Software Measurement*. Joe is a frequent presenter in the Software Best Practices Webinar Series sponsored by Computer Aid, Inc. Joe has taught over 75 graduate courses since 1990.

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About Computer Aid, Inc. (CAI)

- **CAI** is a global IT outsourcing firm currently managing active engagements with over 100 Fortune 1,000 companies and government agencies around the world.
- **CAI** is a leader in IT Best Practices for legacy support and new development application management.
- **CAI's** focus is directed toward practical implementations that track and measure the right activities in software activity management
- **CAI** consistently promises and delivers double digit productivity in its outsourcing and consulting engagements.
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    - Standard processes
    - Management by metrics
    - SLA compliance management
    - Detailed cost, resource, and time tracking
    - Capacity management
    - Standard estimation
    - A unique, metrics based methodology along with a proprietary, real time data repository and management system **(TRACER®).**

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The Premise at Hand

First question: Shouldn't the title of the presentation be "Pay Me Now OR Pay me Later" – absolutely not! This discussion isn't about changing the oil in your car!

"Yes" this message could be restated more positively as "*save now and save forever*."

Defects increase the cost of development AND increase the cost of support.

Missing requirements ("we'll handle that in the next release") increase the likelihood of defect injection or the "we'll get it right the next time" syndrome.

In some cases, adding "re-work" is as simple as placing a product on a sprint backlog; however, by itself, doesn't trigger a defect detection.

The pervasiveness, sophistication, and architectural diversity of software further increases the cost of software defects. The title of this presentation might ought to be: "*Pay Me a Lot Now, and a Lot More Later*."

Rationale for the Premise

Pay Me Now (during development)	and . . . Pay Me Later (during support)
Defect and rework costs tend to be "hidden" during development as customer changes, scope creep, "testing", and more recently "refactoring."	These costs tend to be more visible but regarded as the cost of operations and maintenance.
These costs tend to be masked as schedule slippages and unexpected cost overruns. (no reason to consider these *unexpected* given history)	These costs will increase as defect removal occurrences become more frequent. (Watts' work on inserting more defects more likely during defect removal).
These costs are discoverable, treatable, and predictable. Measurements of past work, requirements volatility, test results (% in code vs. design and requirements), and latent defect prediction are leading indicators of the existence of these hidden costs.	Requirements elicitation, development, and management likely continue into operations and support and can be measured with volatility metrics.
These costs can be reduced with peer reviews & inspections, defined processes (as in CMMI-DEV ML3 and higher organizations).	These costs can be predicted from latent defect estimation techniques during development.

Sample Software Defects: Pervasive and Sophisticated

Who	What	Source
Home Depot	Malicious code	foxnews.com website; retrieved 1/11/2011
Toyota	Prius brake software	green.autoblog.com; February 9, 2010
BMW, DaimlerChrysler, Mitsubishi, and Volvo	Engine stalls, non-illuminating gauges, incorrect wiping intervals, and wrong transmission gears	Software Quality, informationweek, 3/15/2004
Medical staff	Prescription errors	Medication Systems; CIO; June, 2005: 28
Marriott, Ford, Justice Department, T J Maxx	Data breeches / loss	USA Today; October 25, 2007
MGM Hotels (5 of 7 on LV strip)	Registration software	Las Vegas Review-Journal; October 24, 2007
Cancer treatment center - Panama	21 deaths in 40 months from software-related overexposure to gamma rays	Baseline – The Project Management Center, We Did Nothing Wrong, March 4, 2004

Evidence of Paying Now and Paying Later (general)

Cost	Now	Later	Source
NIST reports that 80 percent of software development costs are traceable to *defect corrections.*	**X**		**The Economic Impacts of Inadequate Infrastructure for Software Testing; National Institute of Standards & Technology; US Dept of Commerce; May, 2002**
38 percent of polled organizations have no SQA program.	**X**	**X**	**CIO, By the Numbers, December 1, 2003, pg 28**
Software defects cost the U.S. $59.6B a year (almost a decade ago).		**X**	**Informationweek, Behind the Numbers, March 29, 2004; pg 94**
Thirty percent of project effort can be traced to rework.	**X**	**X**	**Dr. Dobb's Report; informationweek; July 12, 2010**

Evidence of Paying Now and Paying Later (requirements, design, review)

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Cost	Now	Later	Source
Requirements defects that are released can cost 50 – 200 times as much to correct as defects that were corrected close to the point of creation.		X	Boehm, Barry W. and Philip N. Papaccio. "Understanding and Controlling Software Costs," IEEE Transactions on Software Engineering, v. 14, no. 10, October 1988, pp. 1462-1477
Reworking defective requirements, design, and code typically consumes 40 to 50 percent or more of the total cost of most software projects and is the single largest cost driver.	X	X	Jones, Capers. Estimating Software Costs, New York: McGraw-Hill, 1998.
Delivered defects that originate in requirements and design far outnumber those from coding.	X		Capers Jones. 1997. Software Quality – Analysis and Guidelines for Success. International Thomson Computer Press
Half of all defects usually exist at design time. Consider also the loss of time by working on faulty requirements.	X		Gilb, Tom. Principles of Software Engineering Management. Wokingham, England: Addison-Wesley, 1988
As a rule of thumb, every hour you spend on technical reviews upstream will reduce your total defect repair time from three to ten hours.	X		Jones, Capers. Assessment and Control of Software Risks. Englewood Cliffs, N.J.: Yourdon Press, 1994
ROI for software inspections is between four and eight to one.	X		O'Neill, Don; National Software Quality Experiment: Results 1992 – 1999: Software Technology Conference, Salt Lake City, 1995, 1996, 2000

Evidence of Paying Now and Paying Later (testing through support)

Cost	Now	Later	Source
Testing composed 25 – 50 percent of the software life cycle, and it is perceived of adding no business value.	X	X	Two Reasons Why IT Projects Continue To Fail; Gartner; March 20, 2008
Only ½ of the defects in a product are removed by testing; this limitation is not a reflection on the testing process.	X	X	
47 percent of companies surveyed reported “higher than expected” maintenance costs associated with their software.		X	Dynamic Markets Limited; August 2007
Small code changes (often introduced during production “fixes”) are 40 times more likely to introduce new defects than original development work.		X	Watts Humphrey. 1995. A Discipline for Software Engineering. Addison-Wesley
Customer-reported defects cost an average of $4,200 to “deal with.”		X	The Requirements Payoff; Karl Wiegers; informationweek; July 12, 2010; pg 39 study by Dean Lefingwell, 1997

Causes of Paying Now and Paying Later

- lack of current familiarity by the developer (if being fixed by the same person)
- lack of familiarity by the developer (if being fixed by a different person)
- difficulty in finding all references to a changed variable
- difficulty in finding all variables in a calculation
- reliance on outdated comments in the code
- reliance on outdated documentation about the code
- failure to configuration manage all the products related to a defect repair
- failure to update test cases related to defect removals
- (let’s not forget) failure of management to foster a culture of quality
- failure to incent teams and individuals to perform
- the clustering tendency of defects
- lack of training in formal test techniques
- failure to test software against customer requirements (as opposed to the developer’s interpretation of requirements)
- inability to elicit testable requirements
- reliance on software development approaches not intended for software of high consequence
- a reliance primarily on testing to discover defects

Preventing Defect Escapes
(pay less now and later)
(Latent defect estimation)

Place a check mark in the intersecting cells for each defect found by each participant.
Count the defects that each engineer found (*Counts* for Engineer A, B, and C).
Column A: check and count all the defects found by the engineer who found the most unique defects. 5
Column B: check and count all of the defects found by all of the other engineers. 4
Column C: check and count the defects common to columns A and B. 2
The estimated number of defects in the product is AB/C. Round to the nearest integer. (5 * 4) / 2 = 10
The number of defects found in the inspection is A+B-C. 5 + 4 – 2 = 7
The estimated number of defects remaining is the estimated number of defects in the product minus the number found. (AB/C) – (A+B-C). 10 – 7 = 3

Use team “thresholds” to determine whether or not to repeat the Peer Review.

Defect No	Engineer Larry	Engineer Curly	Engineer Moe	“Column A”	“Column B”	“Column C”
1	√			√		
2	√			√		
3			√		√	
4	√	√		√	√	√
5	√			√		
6	√		√	√	√	√
7		√			√	
Counts	5	2	2	5	4	2

The capture-recapture method (CRM) has been used for decades by population biologists to accurately determine the number of organisms studied. LaPorte RE, McCarty DJ, Tull ES, Tajima N., Counting birds, bees, and NCDs. Lancet, 1992, 339, 494-5.
See also Introduction to the Team Software Process; Humphrey; 2000; pgs. 345 – 350

Quick Hits on Capture-Recapture Method

- **CRM can be used to predict the number of estimated defects remaining in a product. This estimate can then be used to make quantified, data-driven decision on how to proceed with a software product.** ***IFPUG MetricViews; Winter 2008***
- **Used by Jerry Weinberg to estimate remaining typos based on how many his reviewers found.** ***Beyond Defect Removal: Latent Defect Estimation with Capture Recapture Method; CrossTalk, August 2007***
- **Try this: Something Fishy (statistics) from PBS Mathline.** ***www.pbs.org/mathline***
- **A quickie primer –** ***Capture-recapture and Removal Methods*****.** ***www.ento.vt.edu~sharov/PopEcol/lec2/caprecap.html***
- **A more detailed look –** ***Life Cycle-Based Defect Removal with Capture Recapture Methods*****.** ***Computer Aid, Inc. webinar, April 22, 2008***
- **A quickie history – Capture-Recapture History.** ***www.pitt.edu/~yuc2/cr/history.htm***

Where do defects go after they die?

(it depends on if they've been saved or not!)

Defects get *defined* (organizational glossary)

Actual effort

The measure as expressed in FTEs, to complete a unit of work

Actual reliability

The measure of stability of a product by the customer; measur

Actual schedule

The timeline for completing a unit of work.

Actual size

The size of work product as expressed in Function Points.

discovered (PR, Testing, Customer)

Peer Review Script

Use this script to conduct a Peer Review on a completed SILC artifact.

Purpose:	To identify and remove defects early and efficiently from artifacts us cycle in order to improve the delivered product. **Note**: Design discu resolution during the inspection meeting is discouraged. Criticism o is prohibited.
Entry Criteria:	✓ Software work product to be reviewed is completed ✓ Supporting documentation is available as required ✓ Adequate review preparation by the Peer Review Team.
General Process:	1. Producer notifies Project Leader when artifact is ready for review.

**captured / saved* (recorded)

Metrics Database

ease Listing | Lessons Learned | Metrics | Defects | Custom Query | Help | Admin Functions | Leader Functions |

Product Releases | Estimate Metrics | Defects | Peer Reviews | Lessons Learned | Track Artifacts

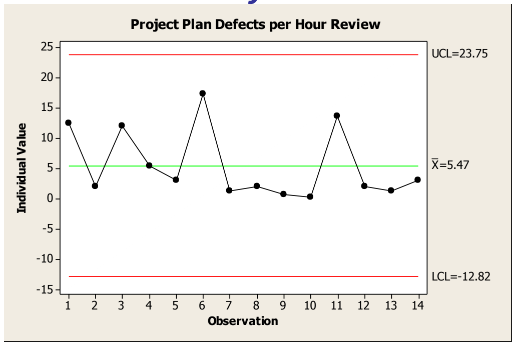
Product Name: Process Improvement
Release Version Name: F3

Required items are **bold.**

Attribute	Value
Discovered By	Change Request; Peer Review Item
Detection Phase	Planning
Injection Phase	Planning
Defect Type	Completeness
Defect Severity	Aesthetic
Cost to Repair	
Description/Class	
Disposition	

Submit | Submit & Add Additional Defects | Reset

analyzed



prevented (changes to SILC and project defined process)

⊟ **REQUEST INFORMATION**

SILCI PROJECT:

Issue Id: (Auto)

*** Title:**

*** Description:**

Severity: (None)

CONTACT INFORMATION:

*** Requested By - Name:**

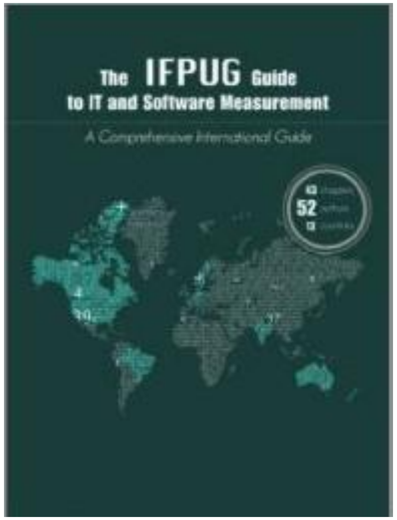
*** Requested By - User ID:**

Requested By - Phone:

*left unsaved (not recorded) these defects are of no value to the process, and, likely to be repeated

Tips for Avoiding Paying Now and Paying Later

- **Where requirements are understood, elicit them with JAD-like sessions, prototypes, user stories, and early validation. Track requirements volatility.**
- **Where requirements are less understood similar techniques can be used but validation will be less useful. Tracking requirements will only remind you of how "unstable" requirements are and volatile planning may be.**
- **Invest in inspections (more formal) and peer reviews (less formal) to reduce development time and cost, and to reduce defects.**
- **Use CRM as a way to determine the quality of inspections and peer reviews before moving a product "downstream."**
- **Develop a culture that values process improvement and product quality.**
- **Train software engineers in the *discipline* of software engineering and the *science* of computer science.**
- **Pilot "newest fads." Objectively and quantitatively evaluate prior to widespread adoption.**



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