

# Surfing the Net for Software Engineering Notes

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It's quiet out there... yeah, TOO quiet. No feedback this time, so I'll stumble on with a mixture of newsgroup clippings and websites drawn together by no discernible pattern. The clippings and WWW sites (?cites?) are getting blurred - in particular, WWW pages have clippable nuggets of information (e.g., the IBM information on fun with Year 2000 issues) while newsgroup clippings increasingly rely on URLs for followup information (e.g., OO Testing techniques). I have not spent much time worrying about this - I think those who want to browse the Net will, those who just want to skim this section for overviews will, and those who will ignore this section already have!

This edition's collection of net flotsam and jetsam includes information on:

- software internationalization (I have grave doubts about that being a word, but I have even graver doubts about a synonym ;-)
- Suggestions for books, articles, URLs, and classes related to testing object oriented software
- One person's opinion on the use of the term "Six-Sigma" in the context of Software Engineering
- Information from IBM on the "Year 2000 Transition"
- Just for those who still like to get bits under their fingernails, a collection of "Programs for C Source Code Metrics"
- The Information Week home page, for a view of life from the MIS/IT perspective (not always the same as from the ACM/SIGSOFT view!)
- The World Wide Web Virtual Library: Safety-Critical Systems
- The home page for the DOD Data & Analysis Center for Software
- and finally, information on a shareware repository available from C-Net.

As always, suggestions appreciated.

Chuck

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**Subject: Re: Book wanted on SW Internationalization**

From: Nancy Hoft <nhoft@itech.mv.com>

Organization: MV Communications, Inc.

Date: Thu, 2 Nov 1995 22:06:19 GMT

If you are searching for information on internationalizing software for a particular computer platform, start by contacting the company that manufactures the computing platform for references. For example, if you program for UNIX, contact X/OPEN or Sun or whomever. If you program for Windows, contact Microsoft. If you program for Macintosh, contact Apple. And so on. Many companies currently offer information on internationalization and localization in a platform specific manner.

The O'Donnell book is quite good, I agree. I also have some recently published books that I'd recommend as well.

Tuoc V. Luong, James S.H. Lok, David J. Taylor, and Kevin Driscoll, *Internationalization: Developing Software for Global Markets*, John Wiley & Sons, 1995. ISBN: 0-471-07661-9. This is a great introduction to the whole project management cycle with descriptions of all the players and what they have to do. Includes lots of good advice on developing internationalized software.

Nadine Kano, *Developing International Software for Windows 95 and NT*, Microsoft Press, 1995. ISBN: 1-55615-840-8. A Microsoft-specific book. If that's the platform you code for, it's a must.

Tony Fernandes, *Global Interface Design: A Guide to Designing International User Interfaces*, Academic Press (with a CDROM), 1995. ISBN: 0-12-253790-4. This is a **GREAT** book! Tony Fernandes did an excellent job.

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**Subject: Re: O.O. Testing Techniques**

From: marick@cs.uiuc.edu (Brian Marick)

Date: 10 Nov 95 14:37:52 GMT

Organization: University of Illinois at Urbana

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Books that include some discussion of testing OO programs:

Jacobson et al, *Object-Oriented Software Engineering*, Addison-Wesley, 1992.

Marick, *The Craft of Software Testing*, Prentice Hall, 1995

McGregor & Sykes, *Object-Oriented Software Development*, Van Nostrand Reinhold, 1992.

Articles about testing OO programs:

There are a vast number. I suggest starting with the September 1994 Communications of the ACM, which is devoted to this topic. Chase references.

Web sites with discussion:

<http://www.clemson.edu/~johnmc/johnmc.html>

<http://www.cs.washington.edu/homes/gmurphy/testSTApp.html>

<http://www.stlabs.com/marick/root.htm>

<http://www.toa.com>

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Commercial courses

Three courses on testing object-oriented code (one by Robert

Binder, one by Ed Berard, and one by Reliable Software Technologies) are described in the Testing Courses FAQ. It can be found at <ftp://cs.uiuc.edu/pub/testing/faqs/courses>. A web version can be found through <http://www.stlabs.com/marick/root.htm>.

Brian Marick

Testing Foundations (a testing training and consulting company) [marick@testing.com](mailto:marick@testing.com) for business, [marick@cs.uiuc.edu](mailto:marick@cs.uiuc.edu) for recreation, <http://www.stlabs.com/marick/root.htm>

**Subject: Re: Six-Sigma and SW Eng.-Is it possible?**

From: [rbinder@mcs.net](mailto:rbinder@mcs.net)

Date: 13 Nov 1995 19:30:52 GMT

Organization: RBSC Corporation

Some recent posts about six sigma have been based on hazy definitions of this parameter. The following too-long post is offered to clarify this concept.

1. Six sigma means six standard deviations either above or below the mean of the normal distribution. If both end points are included, the total range is 12 sigma. In the context of statistical quality models, the  $2x$  span (i.e.  $\pm x$  sigma) is typically assumed. Thus  $x$  sigma implies a range spanning  $2x$  sigma. As the sigma value increases, a larger area under the "bell curve" is included: 50% at  $\pm 0.67$  sigma, 68.75% at  $\pm 1$  sigma, 99.73% at  $\pm 3$  sigma,  $> 99.999999\%$  at  $\pm 6$  sigma.
2. As a concept in statistical quality models of physical manufacturing process, 6 sigma has a very specific meaning.

Manufactured parts typically have a nominal design value for characteristics of merit. For example, the nominal design diameter of a shaft is 1.0 mm, weight 45mg, etc. Processes which produce parts are typically imperfect, so the actual value for characteristics of merit in any given part will vary from nominal. Assemblies which use these parts must be designed to tolerate parts with such variances. Determining these tolerances is a classical systems engineering problem. However, once set, any part that exceeds these limits is defective.

While it might seem that a 3 sigma tolerance is generous, it turns out to result in a (typically) unacceptable rate of defects. With 6 sigma tolerances, a single part, and stable production process, you'd expect to have only 2 defects per billion. However, manufacturing processes vary from batch to the next, so the batch average for a characteristic often drifts between  $\pm 1.5$  sigma. If the mean of a batch happens to be at either extreme, many of the parts will be defective (with a 3 sigma standard, 66810 in a million). Assuming a  $\pm 1.5$  sigma process drift, six sigma tolerances will result in 3.4 defects per million parts.

Multi-part products compounding the drift problem. The expected number of defectives for a one part product can be modeled by the distribution for that part. But as the number of parts in a product increases,

the chance of getting a product with no defective parts drops. If all parts are designed to 3 sigma, the chance of getting a defect free product with 100 parts is 0.0013. However, if all part design tolerances are extended to 6 sigma, the chance of a defective product with 10000 parts is less than 0.04 – or, putting a more cheery spin on this, you'd expect that at least 96% of the 100 part products would be defect free with 6 sigma design limits and no more than  $\pm 1.5$  sigma process drift (note this assumes no faulty interactions among "good" parts can occur.)

This is how Motorola has set their "Six Sigma" slogan/standard and why Lee Trevino (in a Motorola commercial) says he'd have to make over three million perfect golf shots to meet this goal. The related design strategy is straightforward: fewer parts, simplify the process, reduce the number of critical tolerances per part. (6 sigma processes are only part of the strategy for high quality manufacturing.)

3. What does the "six sigma" manufacturing model mean for software quality?

Not a  $\#\%\#\%$  thing, for three reasons.

- (a) Every software "part" is produced by a process which defies the kind of predictable mechanization assumed for physical parts. Even at SEI level 5, the simple variation in human cognitive processes is enough to obviate applicability. The behavior of a software "process" is an amorphous blob compared to the constrained, limited, and highly predictable behavior of a die, a stamp, or a numerically controlled milling machine.
- (b) The same kind of ordinal quantification of physical characteristics of merit cannot be applied to software without a wild stretch of imagination. A "software" either conforms or it doesn't. It is meaningless to attempt to define greater or lesser conformance: what would the units be? What would be the upper bound of conformance – would we reject too much conformance? What is the lower bound? The fact that people (and systems) will tolerate egregiously buggy software is not the same thing as establishing a quantitatively meaningful scale. Performance profiles (e.g. "fast busy no more than 1 minute in 10000.") are the only truly quantifiable design tolerance for software, but are never the whole requirement for any real system or single "part".
- (c) Even if software systems could be designed to such tolerances, they'd still be one-off artifacts. It is inconceivable that one would attempt to build thousands of identical systems with an identical development process, and then, post hoc, try to fix the process if it produces systems which don't meet the constraint(s) or just throw away the defective systems. (We can produce 1000s of copies by a mechanical process, but this is irrelevant with respect

to software defects.) Quantification of reliability (a la Musa) is whole different ballgame.

#### 4. "Six sigma" as a slogan, hype, goal, etc.

"Six sigma" implies a level of faults or failures which is subjectively deemed very low. It is this sense which is usually meant. There are many possible interpretations of "six sigma as slogan" for software: (a) "really cool" software, (b) software that works "most of the time", (c) a software system which has a fault density of X or less per [Instructions—NCSLOC—Function Points— ...], or (d) a software system which exhibits a failure rate of X or less per [CPU seconds—transactions—interrupts— ... ], where X is either  $3.4E10^{-6}$  (the "drift" number),  $2.0E10^{-9}$  (the absolute number). Other interpretations are certainly possible – this is exactly the problem. As a point of reference, fault density for the Space Shuttle avionics is reported to be on the order of  $3.0E10^{-6}$ ; typical data processing apps are reported to be  $4.0E10^{-2}$ . The problems with defining, recording, interpreting, and comparing fault/failure metrics offers yet another can of worms.

This is not to say there are no useful applications of statistical process control in software process management (my favorite is to use u-charts for inspection and test results.)

I say we leave 6 sigma to the hardware guys. Let's figure out what we need to do to routinely get very high field reliability in software intensive systems and agree on an operational definition for reliability measurement.

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### Year 2000 Efforts Under Way

#### IBM Readies Customers, Products and Services for Year 2000 Transition

Armonk, New York, October 30, 1995 ... Recognizing that the turn of the century poses a significant challenge for the Information Technology industry, IBM today announced it will provide customers with a comprehensive set of services, tools and support for their Year 2000 transitions.

For more than four decades, industry and businesses have written many of their computer programs and databases

with dates represented by only two digit years (e.g., 95 versus 1995). However popular this method was, and is, customers' system and application programs may yield incorrect results when the millennium advances, and the date approaches "2000."

This means that customers whose businesses typically rely on applications which make forecasts, projections, comparisons, or arithmetic operations are encouraged to complete their preparations for Year 2000 date changes now.

The difficulty for many businesses comes in assessing what applications have date-sensitive programs; how many need to be altered; what it takes to actually make the required changes to source code and data files; and finally, running tests to ensure that all is operating properly. IBM's Year 2000 services, tools, and support will assist customers with this process.

"If customers are to be successful in tackling the Year 2000 issue, they need to focus on specific date-change methodologies, processes – and overall project management," said John Phelps, Gartner Group. "Year 2000 projects need to be expedited by customers so that they can accurately determine their application programs' exposures and can begin corrective measures immediately."

"The problem is large; it's complex, and the IT industry has the skills and resources to take care of it – providing we give ourselves the time to solve it," said Peter de Jager, Year 2000 consultant and speaker. "IBM is right to encourage and advise businesses, and vendors who support that business, to address this issue today."

Because of IBM's commitment to protect its customers' investments – and its obvious interest in the long-term viability of the computer industry – the company has spent considerable time researching, testing and analyzing the Year 2000 issue and possible solutions.

"With today's announcement, IBM is sharing what we have learned about the Year 2000 with our customers, and all computer – more users, to help them make date transitions as smooth as possible," said Carla Gude, director of System Software Structure, IBM. "No matter how old or new their software is, customers and industry vendors will never know how much work is ahead of them – unless they focus now."

### Information, Services, Tools and Support

To assist customers in timely Year 2000 transitions, IBM has assembled a variety of information, services, tools and support. The following Year 2000 offerings are being announced by IBM today:

#### Year 2000 Customer Guidance Paper

IBM is making available to everyone a comprehensive Year 2000 resource guide, at no charge. The guide explains Year

2000 issues and helps users, vendors and customers successfully plan for – and implement Year 2000 transitions. The 180-page document, entitled “The Year 2000 and 2-Digit Dates: A Guide for Planning and Introduction,” is available on the World Wide Web through the IBM Software Home Page, at <http://www.software.ibm.com>. Customers can also obtain the guide from their IBM marketing representatives.

This no-charge resource is a compilation of IBM’s Year 2000 findings, recommended approaches and product listings. Also included in the guidance paper is a bibliography of other Year 2000 publications available throughout the industry. [...]

### Year 2000 Information at Your Fingertips

Information on IBM and ISSC’s Year 2000 services, tools and support can be obtained on the Internet via IBM’s Software Home Page on the Worldwide Web. The Software Home Page is located at <http://www.software.ibm.com>.

The Customer Guidance Paper and its “White Paper” summary are also available in several formats via the IBM Software Home Page.

The IBM FAX Information Service allows you to receive facsimiles of this, and other IBM product press releases. Dial 1 800 IBM-4FAX and enter “99” at the voice menu. From outside of North America, facsimiles may be obtained by calling 1-415-855-4444.

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#### Subject: Programs for C Source Code Metrics

<http://www.qucis.queensu.ca/Software-Engineering/Cmetrics.html>

Christopher Lott <[lott@informatik.uni-kl.de](mailto:lott@informatik.uni-kl.de)> has collected several tools that gather various static measures from C source code, primarily size and complexity of various types (McCabe, Halstead, etc.).

Click on the name of an individual package (below) to retrieve that package.

- **csize**: A tool to measure the size of C programs, written by Christopher Lott in 1994.
- **cyclo**: A tool to analyze cyclomatic complexity of a piece of ANSI C or C++ code, written by Roger Binns in 1993. Can generate a postscript flowgraph of the functions.
- **lc**: A tool to count lines of code in C files, written by Brian Marick in 1983 and updated 1992.
- **Mas**: Mas is a maintainability assessment tool for analyzing C programs that was developed under the sponsorship of Hewlett-Packard Corporate Engineering at the University of Idaho in 1992.
- **metre**: A software-metrics tool (McCabe, Halstead, backfired function points, and various statement and lines-of-code metrics) and a call-graph tool for ANSI/ISO Standard C, written by Paul Long in 1994 and updated in 1995.

- **metrics**: A collection of tools (control/halstead/kdsi/mccabe) which was put together by Brian Renaud around 1989.
- **spr**: A tool to measure NCSS for C source programs, written by Ted Shapin in 1989.

Chris’ comments about building and using the tools: *“I successfully built all of them using gcc on a sun using SunOS 4.1.3. For packages “csize” and “metre”, the authors went to considerable trouble to write portable code and flexible Makefiles. For cyclo and c-metr-pkg, no such effort was made, and consequently I had to monkey with some makefiles. Packages lc and spr are relatively simple and should not present any problems.*

*However, I have not used all of the tools extensively, so unfortunately I can’t make any helpful statements about reliability or ease of use.”*

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#### Subject: InformationWeek Home Page

<http://techweb.cmp.com/iwk/current/>

Latest Issue November 27, 1995

Welcome to InformationWeek’s home on the World Wide Web. IW is a weekly newsmagazine for business and technology managers with a print circulation of 325,000. This digital edition of IW is a multifaceted, open-ended information resource for managers using information technology (IT) to meet business goals. We welcome your feedback. Starting from the beginning of 1994, back issues of IW and all CMP publications can be accessed through the search button on the toolbar at bottom.

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#### Subject: The World Wide Web Virtual Library: Safety-Critical Systems

<http://gruffle.comlab.ox.ac.uk/archive/safety.html>

(Please mail [Jonathan.Bowen@comlab.ox.ac.uk](mailto:Jonathan.Bowen@comlab.ox.ac.uk) if you know of relevant on-line information not included here.)

This document contains some pointers to information on Safety-Critical Systems available around the world on the World Wide Web (WWW), a global hypermedia system providing worldwide information. Information on the following is available:

- [\*] Relevant newsgroups
- [\*] Repositories and mailing lists
- [\*] Clubs and organizations
- [\*] On-line publications
- [\*] Journals
- [\*] Books
- [\*] Meetings
- [\*] Searchable bibliography

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#### Subject: DACS Home Page

<http://www.utica.kaman.com/>

Welcome to the Data & Analysis Center for Software

The DACS is a Department of Defense (DoD) Information

Analysis Center (IAC), administratively managed by the Defense Technical Information Center (DTIC) under the DoD IAC Program. The DACS is technically managed by Rome Laboratory (RL). Kaman Sciences Corporation manages and operates the DACS, serving as a centralized source for current, readily available data and information concerning software engineering and software technology.

Interested in a specific topic? Try searching the DACS pages.

- About the DACS
  - DACS Information Overview
  - Spring 1995 Users Catalog
  - Initiating a DACS Special Study
- DACS Databases
- Current Awareness
  - What's New at the DACS
  - Newsletters
  - DACS Virtual Library
  - Calendar of Events
- Training and Education Programs
- Internet Services
- Software Tools Distributed by the DACS
- DACS Technical Reports On-Line

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From Digital Dispatch Volume 1, Issue 32, November 17, 1995

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