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CMTrends
News and Perspectives for CM Professionals

in this issue

September 2013

ISSUE 14

Why is Software CM Different from Hardware CM?

by Joe Farah
Neuma Technology

Does your organization produce a lot of software? The answer is probably yes. If you include documentation as software, it's definitely yes.

From a CM perspective, a lot of shops will consider each software deliverable as a Configuration Item (CI) and hence will consider their shop to be performing CM on their software by simply assigning a part number to each deliverable CI and doing "sufficient" controlling and testing for status accounting, change control, and auditing.

On top of that, the shop will typically go to the software management and be assured that they are using GIT or Subversion tools* to track their software internally. So the checkmark goes against the "CM of Software" line item.

I hate to burst your bubble, but this is not Software CM.

In some ways, Software CM (SCM) is very similar to Hardware CM (HCM). You have customer requests and problem reports. These have to be rejected or accepted and passed on to the engineering team. Each request or problem has to go through a prioritization and/or planning stage, followed by an implementation stage and integration and verification stages. The finished changes have to be incorporated in a product release. The management is quite similar. But the CM tools need to be quite different.

Why do the tools have to be different? Why is SCM so different than HCM? There are many reasons.

First of all, software is designed to change, while hardware is designed to last. If you had to upgrade your smartphone hardware as often as its software, you'd almost never have possession of your phone.

Because software is designed to change there are way more software updates than hardware updates. You don't apply software updates in a serial fashion, as with hardware, when you have dozens to hundreds of updates a day pouring in from the development team. Instead, you design your software architecture so that it can accommodate dozens of developers working in parallel and dumping their changes into the product development stream. And you adjust your process so that the integrity of each of the updates can be relied upon.

This is why we have peer code reviews. This is why each developer has the equivalent of an entire test lab on his/her laptop, many times over. This is where the concept of continuous integration, along with automated sanity testing, becomes crucial. And the CM tools must support these processes, making peer reviews easy, even
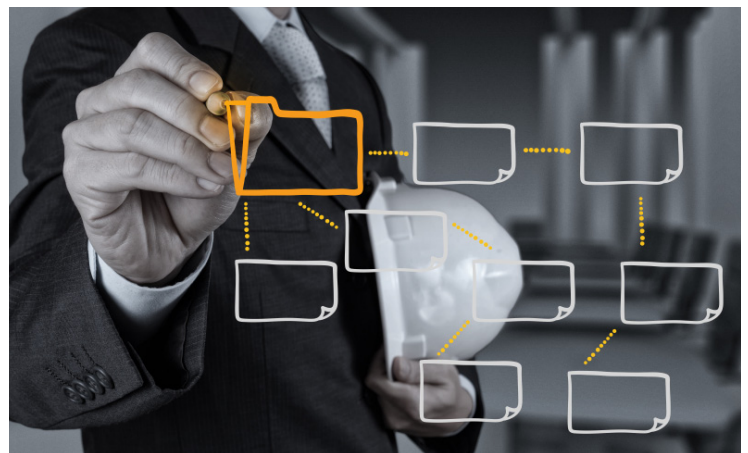
* For those unfamiliar with open source SCM solutions, Git (http://git-scm.com) is a free distributed version control system designed to handle everything from small to very large projects with speed and efficiency, while Subversion (http://subversion.apache.org) is a free version control system provided by Apache Software Foundation. They are by far the most popular open source SCM version control tools.

across distance and time zones, and allowing different levels of integration to occur amidst a torrent of updates.

Second of all, hardware changes are generally part centric. Software changes are function centric. You can isolate and change a hardware part, be it a screw, a chip, a board, a subsystem, whatever. This is not so easy to do with software. A problem fix often requires that changes be made to multiple files in different subsystems. A new feature will generally span several subsystems, such as the display software, the database, utilities, and feature code. And a simple change to one file can and often does bring up seemingly unrelated problems in another part of the product.

As a result, strong CM/ALM tools, such as Neuma's CM+ or IBM's RTC, are needed to provide extensive traceability capabilities. Whereas change information is primarily associated with a part number for hardware, this is not the case for software. The concept of software updates (a.k.a. change packages) as atomic units of change are used by tools such as CM+ to ensure that the logical change flows through the system as a single unit. It is not practical to track individual files and make sure that they flow through the system properly. This is all the more essential when a change has to be "pulled" because of its unexpected side effects found during integration.

Thirdly, software is a lot more complex than hardware. Hardware design, even at the IC level, is performed using well-defined components with strict interfaces and specifications. Software design, even in the best shops, is much more flexible and expressive. The closest you come to a truly formal design specification is an API (Application Programming Interface) and most of these bring with them a large number of questions,

ambiguities and semantic omissions. The fact that the average program relies on dozens, or even hundreds of APIs, means there is going to be buggy software.

But it's worse than that. Because of the interaction of software components, and the complexity in terms of function points, lines of code, coding styles, etc., there is no way to thoroughly exercise anything but a small fraction of the software's behavior prior to release and delivery. It's possible to do unit testing of an API based on an interpretation of its semantics. It's even possible to exercise every single line of code, though with difficulty. But a computer is a giant state machine, and it is impossible to exercise every line of code in every feasible state of the machine.
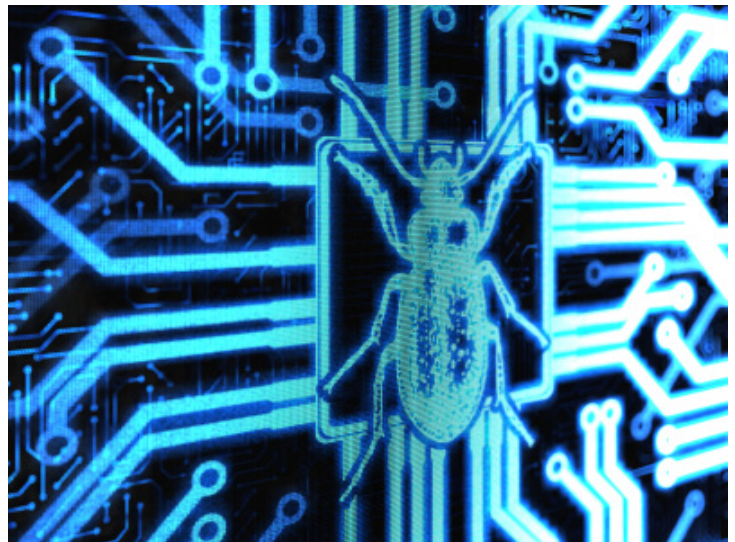
As a result, there will be many bug fixes. But there will also be many feature changes (because software is designed to change). So instead of a few versions of a part, as in hardware, it is typical to have dozens, if not hundreds of revisions of each file. And the tools must support these

revisions. They must support the ability to easily look through dozens of revisions for the cause of a problem. They must support the ability to easily compare, line-by-line, arbitrary revisions. They must support branching so that the support for files of one release doesn't interfere with development efforts for a subsequent release, and vice versa. The tools must provide a means to automatically merge a change performed for release 2 into release 3, so that the developer does not have to repeat the work.

There are millions of lines of code, each unique, and each with its surrounding context that is required to understand it. Each line is created spontaneously by a developer with very few guidelines, typically, on how to keep the entire product consistent.

Finally, once the software is put together, it is trivial to produce it. Add a change or ten and it's still easy to reproduce it – at virtually no cost. Verify one copy of the software and you're sure it works for all copies. You don't get faulty bits. So software production is not the costly, process-driving beast it is for hardware.

Tools like Subversion and GIT are effective version control tools. But they are little more than a small slice of Configuration Management. They don't provide real first order updates/change packages. They don't provide the necessary traceability or continuous integration capabilities. In fact, few software CM tools so. Fortunately Neuma's CM+ is one that does, and it is even more peculiar in that it can simultaneously support both SCM and HCM.

I would cringe at the effort required and quality lost with anything less than a full ALM-capable tool. Not a PLM tool that claims to do ALM. SCM and HCM, though similar in many management requirements, need to be handled through tools that are specific to software and hardware requirements. One cannot be shoehorned within the other. Yes a tool such as CM+ can specifically support software and specifically support hardware, but that is a rare tool. Software CM is different than Hardware CM, even though the CM principles are the same.

President and CEO of Neuma Technology, Joe Farah is a regular contributor to the CM Journal, the Techwell.com and more recently, Better Software magazine. Prior to cofounding Neuma Technology in 1990 and directing the development of CM+, Joe was director of software architecture and technology at Mitel, and in the 1970s a development manager at Nortel (Bell-Northern Research) where he developed the Program Library System (PLS), still heavily used by (former) Nortel's largest projects. A software developer since the late 1960s, Joe holds a B.A.Sc. degree in Engineering Science from the University of Toronto. You can contact Joe at farah@neuma.com.

JOE FARAH

NEUMA

The CM+ Company

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Schedule an On-Site Class with CMPIC!

All CMPIC training & certification courses are available to be taught at your facility for any number of students*, a meeting room, a projector, and a screen. That's it!

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To learn more, please contact the CMPIC office at (434) 525-8648, info@cmpic.com.

* Minimum 5 attendees for locations within North America; minimum 10 attendees for locations outside of North America - pricing shown online. Please request a quote for groups with less than five students per class - only available for locations within the continental United States.

Transportation rate based upon BTS's average 2012 US domestic itinerary air fare only - typical travel costs may be higher than shown above. Lodging & Meal rates based upon GSA's average 2012-2013 per diem rates for Orlando, FL; San Diego, CA; and Stafford, VA - CMPIC's most popular locations for public class training. Instructor travel based upon typical invoiced rate within the continental US - price may vary depending on location. Training costs based upon CMPIC's current fees with no discounts applied. All prices are in US Dollars.

CMTrends

2013 S.W.A.T.
Seminars, Workshops, And Training

Orlando, FL
5-7 August 2013

6 Exhibitors

5 Q&A Sessions

Securely Disposing of Software

Requirements Management

46 Companies

Building a CM Community

Tuesday Dinner

Thanks for Attending!

CMTrends

Orlando, FL
5-7 August 2013

2013 S.W.A.T.
Seminars, Workshops, And Training

CM with SOX & FISMA
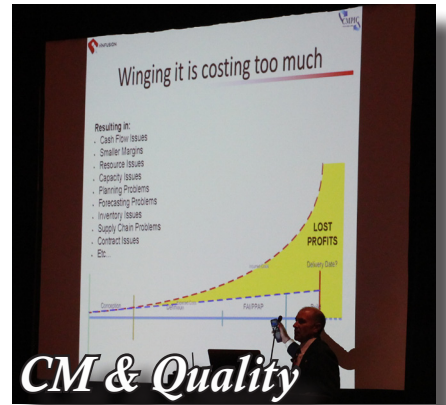
CM & Quality

17 Presentations

Mil-STD-3046

Social CM

CM & ROI

NATO CM Requirements

Workshops

CM Metrics of Value

9 Countries

ANNOUNCING

CMTrends

2014 S.W.A.T.

Seminars, Workshops, And Training

San Antonio, TX
18 - 20 August, 2014

CMPIC's annual CM Trends events have been a huge success! This interactive event invites you and other CM Professionals from around the world to discuss issues and solutions in configuration management. At CM Trends we do not restrict ourselves to lecturing about one methodology. Instead, we cover a wide variety of trends and topics that are relevant to you. You will be able to learn interactively through many informative presentations, workshops, group Q&A sessions, networking with some of the best in CM, and visiting with exhibiting PLM tool vendors.

Learn more at: CMPIC.com/configuration-management-seminar.htm

Experience the Full Spectrum of CM!

CMPIC

CMTrends

2014 S.W.A.T.

Seminars, Workshops, And Training

Tentative Agenda

Monday August 18th, 2014

7:00 - 8:00	Full Breakfast & Registration
8:00 - 9:30	Presentations & Workshops
9:30 - 10:00	Networking Break
10:00 - 11:00	Presentations & Workshops
11:00 - 11:30	Question & Answer Session with morning speakers
11:30 - 1:00	Lunch Break
1:00 - 2:00	Presentations & Workshops
2:00 - 2:30	Networking Break
2:30 - 3:30	Presentations & Workshops
3:30 - 4:00	Question & Answer Session with afternoon speakers
4:00 - 5:00	Exhibitor Showcase - PLM Tool Vendor demos

Tuesday August 19th, 2014

7:00 - 8:00	Full Breakfast
8:00 - 9:30	Presentations & Workshops
9:30 - 10:00	Networking Break
10:00 - 11:00	Presentations & Workshops
11:00 - 11:30	Question & Answer Session with morning speakers
11:30 - 1:00	Lunch Break
1:00 - 2:00	Presentations & Workshops
2:00 - 2:30	Networking Break
2:30 - 3:30	Presentations & Workshops
3:30 - 4:00	Question & Answer Session with afternoon speakers
4:00 - 5:00	Exhibitor Showcase - PLM Tool Vendor demos

Wednesday August 20th, 2014

7:00 - 8:00	Full Breakfast
8:00 - 9:30	Presentations & Workshops
9:30 - 10:00	Networking Break
10:00 - 11:00	Presentations & Workshops
11:00 - 11:30	Question & Answer Session with morning speakers
11:30 - 11:45	Event End

Post-Event Classes

This week's classes will be offered at a special discounted rate. Select *one* class to attend:

Course 6: "ANSI/EIA-649B Principles & Applications" certification course

Course 7: "CM Assessor" certification course

Course 9: "CM Standards & Practices Update" course

Wednesday, August 20th, 2014

1:00 - 5:00	Class in session

Thursday, August 21st, 2014

7:30 - 8:00	Full Breakfast
8:00 - 11:30	Class in session
11:30 - 1:00	Lunch Break
1:00 - 5:00	Class in session

Friday, August 22nd, 2014

|	
7:30 - 8:00	Full Breakfast
8:00 - 11:30	Class in session
11:30 - 1:00	Lunch Break
1:00 - 4:00	Class in session
4:00 - 5:00	Exam

MORE INFO

I-infusion Consulting

Since its inception in 1998 *i-Infusion/Imagine Technology, Inc*, has been helping clients achieve their operational and financial goals by helping them institutionalize Configuration Management best practices. *I-infusion's* award winning consulting resources can help your organization understand, prioritize, improve, orchestrate and implement with confidence to achieve your goals.

What is Configuration Management and how does it apply to my organization?

ANSI/EIA-STD-649B, The Configuration Management Standard, defines Configuration Management (CM) as "a technical and management process applying appropriate resources, processes, and tools to establish and maintain consistency between the product[1] requirements, the product, and associated product configuration information" and was designed to serve the public interest by eliminating misunderstandings between providers and purchasers, as well as helping to facilitate effective and efficient day-to-day operations.
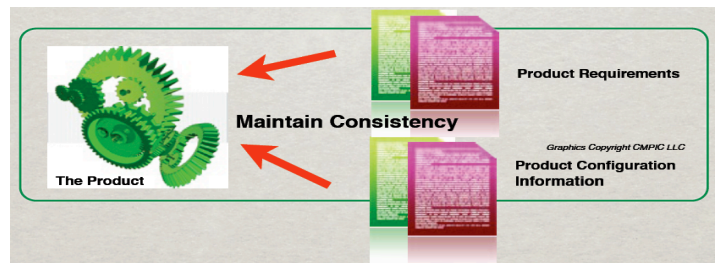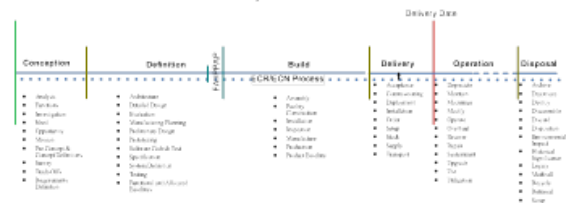
Configuration Management (CM) has applicability in all functional areas of an organization and across all phases of a products lifecycle.
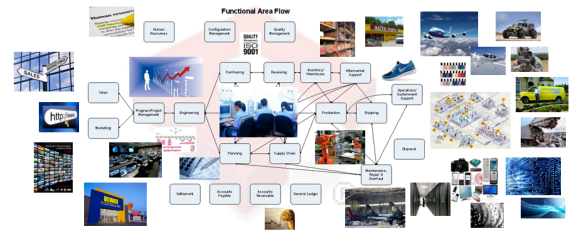
Effective and efficient CM execution requires a balanced and consistent implementation of CM functions guided by CM principles throughout the product's lifecycle.

When effectively applied, CM provides a positive impact on product life cycle costs.

End result, the investment in resources necessary to perform effective CM is returned in <u>long term cost avoidance</u>.

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[1] Product is defined as anything used in, or resulting from the execution of a process including the process itself.

i-infusion Consulting and ANSI/EIA 649

Whether your product is hardware, software, a service or a combination of any of these, it's a known fact that process standardization based on the principals of ANSI/EIA 649B reduce costs and improve operational effectiveness by providing the context for accurate configuration information to facilitate consistent creation/reproducibility and interchangeability throughout all phases of your products lifecycle across all functional areas of your enterprise.

All of *i-infusion's* consultants are certified CM Professionals/SME's with a firm understanding of 649B.

Enabled with this understanding and our powerful proprietary process definition tool, Orpheus_{TM} , *i-infusion* consultants can identify higher value projects in a shorter amount of time reducing your investment in consulting resources while improving your ROI.

If what you are wanting is improved cash flow and margins (faster/better/cheaper), better resource utilization resulting in increased capacity, and improved communication we can help.

Bottom Line

i-infusion's Consults have the experience and knowledge needed to quickly assess your organization key processes, give you realistic achievable recommendations for improvement, and provide you with the support to realize a significant Return On your Investment.

We are here to help your organization with Capturing, Organizing, Managing, and Communicating your product information for your Benefit!

For more information contact: *i-infusion/Imagine Technology, Inc*, at 800-311-8066, ask for A. Larry Gurule or if you prefer, email Larry at lgurule@i-infusion.com.

Not all Parts are Equal
Item Identification CM

by **Kim Robertson** & **Jon M. Quigley**

Ball Aerospace & Technologies   Value Transformation LLC

Film on the Lens

The director of configuration management for Genesis Test Equipment made his way thoughtfully to the thermal test chamber. He had a strong suspicion that he knew what had happened and had discussed these hunches with Mike, but he wanted to make sure. As he approached the vacuum bake chamber, a heated discussion was going on. Akio pursed his lips and said, "Ladies and gentlemen, this is not an occasion for placing blame but a chance for enlightenment. Please meet me in the corporate conference room at 11 for a working lunch and we will see if we can unravel the mystery."

The team members could not agree on a smoking gun. They eliminated 1) a contaminated thermal vacuum chamber prior to test start; 2) improper parts call outs; 3) poor process identification; 4) improper designated substitute parts; 5) contaminated test cables; and 6) contaminated feed through plates.

"Each of these six probable sources for contamination has been eliminated." Akio said, "I think our issue is a case of breaking the configuration. I have printed copies of the released fastener and staking material substitution list for everyone. Let's see what the build logs tell us."

Over the few next hours, 200 breaks in configuration were identified along with a large variance in staking. Akio stood up, took off his thick glasses, and looked slowly around the room pausing at each individual. His eyebrows stuck out like falcon wings over dark twinkling eyes. His phone rang so he paused to take the message. "This is very odd as I was told this thermal Vacuum test was of the first production unit from your team?"

Lynda said she could justify the configuration breaks, "During the build of this first production unit we as a team decided that we could get ahead of the build curve by using the extra fasteners we had on hand in the design development lab instead of waiting to source new fasteners. We also decided that using the higher grade of staking compound was overkill since the RTV material used on the prototype went through our vibration testing just fine. At the time we really didn't see anything fundamentally wrong with the approach."

"How do you feel about that now approach now?"

The team members talked among themselves for a few minutes. When they were done Lynda summarized, "We still don't feel we did anything wrong."

"Were there any dissenters among you?"

Akbar replied, "I do see something wrong. If we're knowingly going to change how we were going to proceed we should have documented it in changes to the engineering. We also should have made sure that any changes would result in a piece of test equipment that was sterile enough to be used in a medical laboratory which means much cleaner than in an operating room situation."

Akio nodded, "Precisely, this is a configuration management issue and a practical demonstration to all of us what happens when configuration management practices are not implemented. Your production units need to be ISO Class 2 compliant. What you were testing could possibly get there but it would cost many thousands of dollars in back out time to clean the chambers after each unit went into thermal vacuum to degas the components. That would erode any cost savings you may have gained tenfold over using the parts and processes specified on the engineering."

Interchangeability

"In a way you can look at fasteners in much the same way as blood. People with an O- blood are universal donors. People with AB+ are universal receivers. Parts cleaned to ISO class 1 are universal donors and those cleaned to ISO class 9 are universal receivers. This over simplifies it a bit so let's throw in something like a part Rh factor. Parts with a high level of quality assurance requirements are more valuable in medical and other applications such as aerospace than parts with no traceable quality assurance provenance. The parts, though seemingly equal from the form, fit, and function are in fact not equal in terms of quality characteristics. The additional investments in the quality assurance have implications on the level of risk associated with that product – thus concerns arise when we hear the words "drop-in replacement."

"Fasteners have over 14 criteria used for basic form, fit, and function characteristics and there are over 30 screw standards at present. Overlay the 9 ISO classes and you have the potential for a configuration management issue such as we face today. Even if the part has the same fit and function, simply cleaning the part to a higher standard changes its form. Parts with the same fit and function cleaned to the same ISO class are not equal. We differentiate the differences by

changing part identification - meaning configuration item identification and part number.

"Using parts not on the substitution list was a contributor to chamber contamination. Use of RTV S691 material for staking rather than following the engineering was another. Silicones are notorious for outgassing."

Jast looked up nervously from his phone, "We could have been responsible for a disaster in the medical research facility. It is worse than simply breaking configuration. Dr. Akiyama personally recommended the copper used in the assembly. I just received a text telling me that arsenic is in the copper on our device!"

There was a subtle roar of disbelief in the room.

Akio raised is voice above the din, "Folks, please take your seats and let's get back on subject." After the voices diminished he calmly said, "Antimicrobial Copper or arsenic copper is routinely used in hospital applications due to its ability to continuously kill greater than 99.9%

of bacteria that cause hospital acquired infections and degrade hygiene in hospitals. So you see this is not part of our problem.

"If you know the environment your end product must be designed to operate in and follow form, fit, function, and quality consideration as you move from proof of concept to production unit you will be properly managing the configuration of that unit. The only time you should break the documented configuration is in a test temporary situation and the departure must be documented before the test begins and a plan for returning to the original configuration needs to be part of the authorization."

Lynda asked, "Could you give us an example of a test temporary situation?"

"You could test with a version of the software that automates a check of all possible performance characteristics via a table load that differs from the Software you will deliver with the unit. Another

scenario would be to use cables with connectors that interfaced directly with the feed through plate rather than connectors that run to the equipment suite you will eventually be connected to."

As he finished there was a knock at the conference room door and Mike came in. His mug of cold coffee nestled in his hands. "I'm about to meet with the hospital research board. Do you have anything you can give me?"

Akio nodded, "Yes both our original assumptions proved out. It took a while to get there. Since Genesis viewed this as a learning tool for the team we used dual build and test teams. Right before we summed up our findings I was informed that production unit two has successfully completed all environmental and system test and we will deliver it tomorrow on schedule.

I haven't talked to this team but I am positive that if we give them the spare PWA rework can be completed in three weeks in plenty of time to meet our second delivery. We will have to clean the chamber again before running environmental testing on the reworked unit."

Mike sipped his coffee and smiled, "Great! No uproar about the choice of copper? Somehow I thought there would be."

Peals of laughter filled the room.

Kim Robertson is a CM practitioner, consultant and trainer with over 30 years' experience in contracts, subcontracts, finance, systems engineering and configuration management. He works at Ball Aerospace & Technologies Corp. He can be reached via LinkedIn.

KIM ROBERTSON

Jon M Quigley PMP is a product development expert with more than 20 years of experience and a founder of Value Transformation LLC. Value Transformation LLC provides training and consulting on a range of product development topics. Jon has multiple advanced degrees and certifications, as well as US patents secured. He can be reached at Jon.Quigley@ValueTransform.com.

JON M. QUIGLEY

CM for QA Professionals, Project Managers & Engineers

NEW CMPIC Courses 11 & 12

NEW

CMPIC

ANNOUNCING: Two new CMPIC Classes - CM for Quality Assurance Professionals and CM for Engineers & Project Managers. Each of these classes is only two days long and can be scheduled to be taught at your facility.

configuration management and the role of CM within their organization's quality management system.

CMPIC Course 11 - CM for Quality Assurance Professionals

This 2-day class will address the role of configuration management as it relates to industry QA standards and government requirements.

Configuration Management (CM) is an integral part of all Quality Assurance Standards. Quality System standards such as TL9000 (Telecommunications) and AS9100 (Aerospace) specifically require CM whereas other Quality System standards, such as ISO 9001 and TS 16949 (Automotive), reference CM as a means of assuring identification and traceability. Even without specifically using the term "configuration management", the US Code of Federal Regulations' quality sections, found in Title 10 Energy, Title 14 Aeronautics and Space, Title 19 Labor, Title 32 National Defense, and Title 21 Food and Drugs, require implementing all of the elements of CM.

This course will explain the various elements of CM such as planning, identification, change management, status accounting, verification, and audit. Students will walk away with a solid understanding of

CMPIC Course 12 - CM for Engineers & Project Managers

Configuration Management (CM) is an integral part of Engineering and Project Management. Many engineers and project managers know about the "CM department" but few know of the enormous benefits CM can bring when properly integrated with engineering / project management.

This 2-day course will provide a high level overview of the role of configuration management as it relates to overall efficiency and effectiveness. It will address the benefits of integrating CM with engineering / project management, responsibilities associated with CM, and the various elements of CM such as: planning, identification, change management, status accounting, verification, and audit. Attendees will be exposed to the complete landscape of CM activities and will learn how to make CM processes work for them.

These courses are only available to be taught on-site at your facility. At the end of class, students will be awarded a certificate of completion. **Learn more about these courses at www.cmpic.com.**

CMPIC's CM Training & Certification Courses

To register, please visit: www.cmpic.com/registration.htm
or contact the CMPIC office at: info@cmpic.com, (434) 525-8648

- **CM Principles & Implementation Certification Series, Courses 1 - 4**
  Upcoming Series:
  Orlando, FL Sept. 24 - Oct. 3, 2013   **2 Consecutive Weeks!**
  Hampton, VA Oct. 21 - 24 & Nov. 18 - 21, 2013
  San Diego, CA Dec. 9 - 12, 2013 & Jan. 13 - 16, 2014
  St. Augustine, FL Feb. 25 - Mar. 6, 2014   **2 Consecutive Weeks!**
  Houston, TX May 19 - 22 & June 23 - 26, 2014

- **CM for IT & Software Development Certification, Course 5**
  Orlando, FL Nov. 4 - 7, 2013

- **ANSI/EIA-649B Principles & Applications Certification, Course 6**
  Houston, TX Jan. 27 - 29, 2014
  Panama City Beach, FL June 9 - 11, 2014

- **CM Assessor Certification, Course 7**
  St. Augustine, FL Mar. 24 - 26, 2014

- **SCM: Strategies, Techniques and Tools Certification, Course 8**
  Stafford, VA Oct. 7 - 10, 2013
  Orlando, FL May 5 - 8, 2014

- **CM Standards & Practices Update, Course 9**
  San Diego, CA Nov. 18 - 20, 2013
  Orlando, FL April 7 - 9, 2014

View CMPIC's full public course schedule at: CMPIC.com/ configuration-management-training-schedule

On-Site Certification

Did you know that CMPIC offers onsite certification and training for as few as five attendees? This is a great way to train your staff and eliminate the need for a large travel expenditure. Call us to find out more, or visit www.cmpic.com.

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