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CROSSTALK

Jan/Feb 2016 **The Journal of Defense Software Engineering** Vol. 29 No. 1

SOFTWARE
A PEOPLE PRODUCT

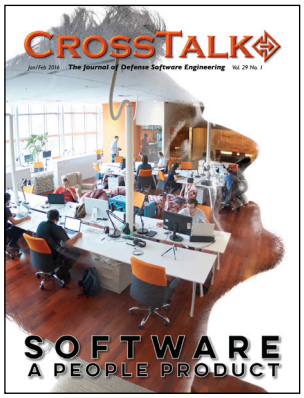
TABLE OF CONTENTS

Departments

3 From the Sponsor

42 Upcoming Events

43 BackTalk



Cover Design by Kent Bingham

Software - A People Product

4 **Increasing Collaboration By The Minute**
It is possible for individual people in a collaborative session to directly affect the mood for collaboration for better or for worse, minute by minute.
by Alistair Cockburn

8 **The Capability Conundrum: Creating Constructs for Unleashing the Power and Potential of Your Most Important Resource**
How can we improve innovation, training, and motivation when it comes to human capital?
by Jonathan Powell

12 **The Tragedy of the Commons: Establishing a Strategic Project Management Office (PMO)**
Establishing and maintaining a strategic project office will help facilitate and maintain the corporate transformation to a new level of efficiency, productivity, quality and commitment to excellence.
by Peter D. Morris

20 **Re-Using Open Source Software in Your Software Delivery**
Reuse of software presents both potential cost and schedule savings and corresponding risks to both cost and schedule.
by Karen McRitchie and Rick Spiewak

28 **Breakdown Model: A Disruptive Software Development Lifecycle for Fault Tolerant Software Systems**
Only when we understand all possible failure scenarios can we truly understand how to build software which is resistant to failure in each phase of the development lifecycle.
by Vaibhav Prakash and Danny Sunderesan

31 **Better Reliability Verification in Open-Source Software Using Efficient Test Cases**
The primary issues with integrating open-source software into a system is that more often than not the developmental methods cannot be verified and the software is already in a post-release version.
by Patrick Pape and Drew Hamilton

37 **Driving Secure Software Initiatives Using FISMA: Issues and Opportunities**
A method to classify security controls based on dimensions relevant to secure software.
by Robin Gandhi, Keesha Crosby, Harvey Siy, and Sayonnha Mandal

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We often focus on the tools required to develop software and it's true, there are many tools available that help develop requirements, design and test software. There are tools used to manage processes, configuration and even tools that help with software assurance and cyber security. But make no mistake, software is a product of people. In the end it's people that communicate their need, it's people that develop and refine the requirements, design the architecture, code the unit level programs, integrate the software modules, and test the software and processes for quality and functionality. There's no getting around it, it's a people product.

So, what are we doing to take care of the people? How do we prevent knowledge base from walking out the front door and signing on with the competition? How do we keep employees interested in our products, trained with the latest tools, languages, processes capabilities and management techniques to meet the challenges that allow for success? How do we continue to attract new talent to not only meet our existing demands, but keep up with our continued growth? One thing I have learned is if you are successfully developing software, then your business is growing and it's growing fast. Software is quickly taking over in terms of functionality. We rarely have to make hardware changes to add new capabilities; it's all done with software. Software is becoming more and more complex and the demand for MORE is the challenge facing all of us in the industry. These are the questions that keep me up at night while trying to successfully manage the Software Maintenance Group at Hill Air Force Base.

Not only do we have to figure out how to stay ahead of the game as we continue to move software from the art form, to an engineering discipline, we need to create a strategy for transferring the knowledge base from the grey beards to the young superstars and keep them interested enough to stay. Money is often considered the way to keep personnel from leaving, but more and more, our new rising superstars are more interested in the ability to work on products that interest them, work on technology that they find interesting, while working in an environment that's flexible enough to fit their lifestyle. The current market for software has created such a need that they can work almost anywhere they want. I recently saw a report indicating that there are four positions available for every software applicant we have. Those are TOUGH odds for the software industry.

The Software Maintenance Group at Hill Air Force Base is embroiled in a continual dilemma trying to overcome these obstacles. We constantly review policies to create an enticing environment for our employees. We recognize that getting "the right people on the bus" is crucial to our continued success. As a military organization, we certainly have our share of administrative constraints, just as all companies have their own challenges to overcome. We work hard to create the right mix of benefits, flexibility and positive environment for our people. Our goal is to create the "Best Place on the Planet to Work!"

The articles included in this edition of CrossTalk focus on Software – A People Product. I hope you enjoy them as you turn your organization's eye inward and focus on your people.

Richard L. Burnett
Deputy Director
309th Software Maintenance Group

The Capability Conundrum: Creating Constructs for Unleashing the Power and Potential of Your Most Important Resource

Jonathan Powell, UMBC and CACI

Abstract. In the foreseeable future, humans remain key to software systems development. Therefore, emphasis should be placed on how we maximize both the potential and productivity of what is in fact the most critical element of the Software Development Life Cycle (SDLC).

Introduction

Four years ago in this Journal I wrote:

"Today when the Navy needs next generation software for its submarine sonar systems, defense contractors are not deploying hordes of automatons to the Pentagon to gather requirements, design the software, build the prototype, make it ready for production, and then support it through operations and maintenance. It still comes down to people, and I submit it will come down to people for a long time to come. Even in the far out future, as parts of this chain are automated, people will be needed to intercede, because software is not perfect, and problems always arise. So if one's ability to overcome software challenges fundamen¬tally comes down to people, the question becomes, 'How do I get the most out of my people?' This will be the focus of this article."

Indeed, not much has changed on that front. There may indeed come a time when humans are removed from the Software Development Life Cycle (SDLC) in significant measure. But in the foreseeable future, humans remain key to software systems development. Therefore, emphasis should be placed on how we maximize both the potential and productivity of what is in fact the most critical element of the SDLC. With this in mind, this article will examine how do we enhance the quality of software talent. And how do we improve innovation, training, and motivation when it comes to human capital.

Attracting Talent

At a macro level, in the Aerospace and Defense Industry (A&D), we need to improve our ability to attract talented individuals who pursue careers in computer science, cybersecurity, and related fields. This is particularly challenging in an era where Google and Facebook are booming, and offer to college graduates the promise of riches and the opportunity to work on cutting edge technology and innovation. While the landscape is challenging, is doesn't have to be daunting. In certain sectors of A&D (parts of Defense, for example) there may be opportunities to expose prospective candidates to new technologies. However, what A&D really needs to do in order to make substantial gains in attracting and retaining top talent is "hook" them early. This is done by getting them involved doing mission work. For many people, the value of meaningful work outweighs money, new technologies, and other factors. And it is hard to get more meaningful than supporting our Nation's work catching bad guys and terrorists. There are a whole host of other meaningful areas in A&D as well, not just limited to National Security or Defense. Exposing our young talent to these areas and "setting the hook," imbuing them with the thrill of pursuing something higher than themselves, is what we're after. The characteristics of this work are where we have an advantage over many commercial players. The younger the age where the hook is set, the greater the chance of inspiring an enduring, even lifelong motivation to serve in mission oriented roles. This can be done through College Internships, CO-OPs, and the like. But younger is better, even offering internships at the high school level or education and exposure opportunities at ages younger than high school are important. This is especially true since the Facebooks of the world have an inherent advantage with their name brand and clout, and often the important and interesting mission work we perform is unknown to the general populace. Today, we in A&D have the opportunity to go for the "two-fer" – not only entice the younger generation with the attraction of "cool" mission-oriented work, but link this work to the "cool" technologies in the market or coming into the market, positively impacting the mission. A perfect example of this is 3-D Printing, and the revolution in design it is sparking. Take a kid who's good with computers, knows about 3-D Printing because 3-D Printing is used to build cool custom Lego parts, and introduce him or her to the cool applications that are being used in the Defense community, and bingo – game, set, match. And if that kid doesn't "bite," others will, and at a greater rate than through the traditional model of competing with Silicon Valley and others attempting to hire these students after they've graduated college. One other point for consideration here – the world has changed so now young talent can go work for a "cool" company and still have a mission focus (look at what Amazon is doing for the Intelligence Community). I would expect that the increase in commercial players in mission oriented work will continue – DoD has even made this a point of focus by standing up a Silicon Valley office. This is a positive development, and will only help get the word out on the important work and opportunities that exist in the A&D sector. This means traditional A&D players will need to work harder and come up with different innovations to continue to spark mission interest in youth in order to successfully compete for talent against non-traditional players in the space.

Innovation and Motivation

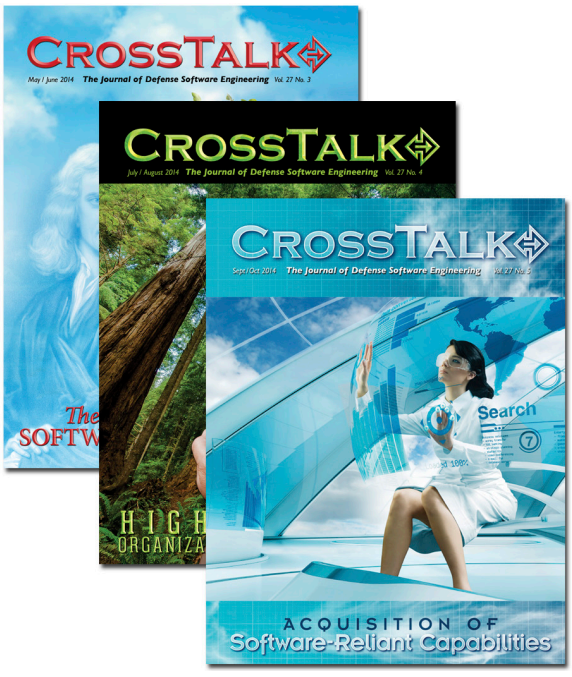
So the conversation still begins and ends with people. Not as pithy statements or some platitude, but a compass to follow. If the organization makes hiring and retaining the right talent its true guiding light, then innovation can surely follow. While having

knowledgeable and skilled resources in place is a foundation, by itself it is not enough. The organizational culture must encourage and enable innovation. Policies and procedures can support innovation – for example, giving people free time at work "off the clock" to innovate, experiment, and think. These policies and procedures are especially needed in professional services organizations where there's usually not a formal R&D organization, in which staff is formally allocated significant time to pursue special projects and experiments. Financial incentives can help entice employees to come up with new ideas and bonuses and the like for ideas that are reviewed and accepted could be codified in policy. However, perhaps the single most important determinant in promoting an organization where innovation thrives is through setting the conditions for open and honest communications. This has to start with the leader of the Organization – His/her behavior will permeate all aspects of how business is done, and either positively or negatively impact the "Corporate Culture," defined as "The way people behave from moment to moment without being told" [1]. An Open and Honest Culture, often referred to as "transparency," has a multiplier effect, positively impacting not just innovation, but also morale. Joyce Russell, Vice Dean at the R.H. Smith School of Business writes, "When a firm does not have trust or transparency, not only are there employee problems (low morale, productivity, commitment and loyalty), but also employees will undoubtedly pass that along to their clients or customers by treating them poorly. On the other hand, firms with a transparent culture are more successful since employees feel free to come up with more creative solutions, they share issues before they become major problems, and they are more engaged, motivated, and productive at work" [2].

Note earlier I wrote knowledgeable and skilled resources, not necessarily what's coined as "experience" (i.e. number of years of service). This is a bias, particularly in A&D, where experience can be viewed as a prerequisite or barrier to entry, instead of just one piece of the individual's mosaic. For certain functions, there may be a benefit in having "experience" act as a gate-keeper prior to contribution, but innovation is not one of them. Case in point – some senior engineers in our intelligence sector wrestled with a thorny issue for months, without finding a solution. Around that time, in came a couple of Virginia Tech Co-Ops and they literally had the problem solved in a couple of weeks. Why? Were they smarter? Better educated? No and No. The answer simply came down to the fact these two individuals had a completely different way of looking at things and brought that lens to the problem, yielding a rapid breakthrough. This is a single vignette, but its implications are telling. Silicon Valley recognizes this fact, and notoriously does not give the "gray hair" any more credence than the new kid on the block. It is the best idea that matters and the one Silicon Valley and the market rewards. More of this attitude needs to be injected into A&D. In fact, this sort of cross pollination of talented millennials and younger generations with the established "gray hairs" is needed if A&D is to stay viable.

Training

For Cyber Security training, there are two facets. First, recognition of the fact there are plenty of well-trained folks out there. But often times, these folks can't be hired in A&D because of barriers (for example, inability to get a security clearance because of some disqualifying item from the past) or they have no interest in working within the A&D arena – the white hat or ethical hacker may be a category of individual who's not necessary inclined to work in the A&D space because they may perceive entities in this space as being stuffy, bureaucratic, etc. Organizations like the FBI are making changes in their clearance processes, to widen the aperture of qualified candidates who can apply and be accepted. In addition to looking at policies and procedures like the FBI is doing, organizations can attempt to be innovative. For example, an A&D company may elect to form an independent Skunk Works



CALL FOR ARTICLES

If your experience or research has produced information that could be useful to others, CROSSTALK can get the word out. We are specifically looking for articles on software-related topics to supplement upcoming theme issues. Below is the submittal schedule for the areas of emphasis we are looking for:

CMMI - The Agile Way
Jul/Aug 2016 Issue
Submission Deadline: Feb 10, 2016

Supply Chain Risks in Critical Infrastructure
Sep/Oct 2016 Issue
Submission Deadline: Apr 10, 2016

Agile Methods
Nov/Dec 2016 Issue
Submission Deadline: Jun 10, 2016

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subsidiary, possessing a Google-like entrepreneurial bent and freedom, that talented individuals like the ethical hacker may be enticed to join. This can be challenging, because the organization has to derive a way to get the technical gems out of the skunk works and into the MILSPEC world of the end user. But where there are risks, there are rewards, and the potential rewards for successfully implementing such model could be huge for the A&D firm. Second is the case where training is in place and needs to be improved. Of course, many of today's experts in Cyber Security are self-taught or learn through non-traditional means. There ought to be a way to recognize the talents these people bring to the table. So today where a degree or certification is required, instead look at experiential or other substitutes. The Army is establishing a Cyber Branch (an entire field, akin to Infantry, Artillery, etc.). They should give serious consideration to non-traditional means to fill this branch, especially since they need to get going and reach critical mass of personnel immediately. So the tried and true ASVAB exam, and picking those who score highest for some form of follow-on training, won't get it done. However, what could work is offering bonuses to resources with a proven skillset (for example, network penetration resources, hackers, etc.) without barriers (i.e. not making a degree, certification, etc. a requirement), and have the entry procedure involve passing a one-on-one interview with a slate of known cyber experts to see if the resource really does have the skillset they portray. There's a lot of talent literally sitting in the basement of homes across America (ala the classic movie 'War Games') just waiting to be tapped, and the old pipeline approach simply won't get it done. In situations where training is needed and is provided, one enhancement has to be increasing the hands on, in-person elements. Cybersecurity is a space that requires on-the-job-training (OJT), where one can learn side-by-side with an experienced mentor or have the opportunity to experiment in a lab environment. I've heard numerous complaints about college or other offerings possessing high lecture content and low hands-on aspects, thus resulting in insufficient learning. Generally, anything that can be done to increase the hands-on aspects of training will improve the quality of the training and the curriculum. Note, here I am talking about the Doers – the Network defense, Pen Testers, Ethical Hackers, etc. Classroom and lecture are fine for policy makers, management, etc. But A&D is in dire need of Doers, and the way to increase the real pool of doers (different than the perceived pool of doers – those with certifications and degrees but aren't capable of performing hands on Cyber Security functions) is to ramp up the hands on aspects of training. There's not a need to be prescriptive in this regard. Just as long as the hands get on the keyboard in engaged and meaningful work, under the tutelage of someone who knows what they're doing, the learning will occur and most importantly, stick. And once this new pipeline of effectively trained folks is in place, one benefit is the assurance more of these folks will be effective in their roles sooner, versus the current scenario where people with degrees and certs are hired, but a significant portion are subsequently shown the door because they weren't the Doer they were perceived to be.

Conclusion

Software remains a product which is reliant upon human capital. Action needs to follow in order to nurture this critical resource, especially in sectors like A&D, if it is to remain viable in the future. While some companies and areas of government are making steps in adjusting the frameworks for attracting, retaining, training, and motivating software talent to meet current needs and those of the future, not enough is being done. As a first principle, let's take a look at our existing organizations, and ask ourselves how do we establish the conditions to harness and unleash the true array of human capital already available and bring these capabilities to bear. MIT Professor Alex Pentland sums this up nicely.

"It is not simply the brightest who have the best ideas; it is those who are best at harvesting them from others. It is not only the most determined who drive change; it is those who most fully engage with like-minded people. And it is not wealth or prestige that best motivates people; it is respect and help from peers" [3].

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3. See <http://fortune.com/2015/03/05/perfect-workplace/>

Upcoming Events

Visit <http://www.crosstalkonline.org/events> for an up-to-date list of events.

13th Annual IEEE Consumer Communications & Networking Conference
Las Vegas, NV
January 9-12, 2016
http://ccnc2016.ieee-ccnc.org/

12th Annual Open Forum for Large-Scale Network Defense Analytics
Daytona Beach, FL
January 11-14, 2016
http://www.cert.org/flocon/

International Conference on Verification, Model Checking, and Abstract Interpretation 2016
St. Petersburg, FL
January 17-19, 2016
http://conf.researchr.org/home/VMCAI-2016

ICCMS 2016: the 7th International conference on Computer Modeling and Simulation
Brisbane, Australia
Jan 18-19, 2016
http://www.iccms.org/

POPL 2016 Annual Symposium on Principles of Programming Languages
January 20-January 22, 2016
St. Petersburg, FL
https://regmaster4.com/2016conf/POPL16/register.php

D2D 2016: the First International Workshop on Data to Decision
February 3-5, 2016
Laguna Hills, CA
http://ssrg.nicta.com.au/Events/conferences/D2D2016/

Developer Week
February 12-18, 2016
San Francisco, CA
http://www.developerweek.com/

MODELSWARD 2016- The 4th International Conference on Model-Driven Engineering and Software
Rome, Italy
Feb 19-21, 2016
http://www.modelsward.org/

The Eleventh International Conference on Digital Telecommunications (ICDT 2016)
February 21-25, 2016
Lisbon, Portugal
http://www.iaria.org/conferences2016/ICDT16.html

14th USENIX Conference on File and Storage Technologies
February 22-February 25, 2016
Santa Clara, CA
https://www.usenix.org/conference/fast16

The 9th ACM International Conference on Web Search and Data Mining
February 22-February 25, 2016
San Francisco, CA
http://www.wsdm-conference.org/2016/

LEAN AND SIX SIGMA CONFERENCE
February 29- March 1, 2016
Phoenix, AZ
http://asq.org/conferences/six-sigma/

SIGCSE 2016
March 2-March 5, 2016
Memphis, Tennessee
http://sigcse2016.sigcse.org/

IoT Dev + Test Conference
April 17-22, 2016
San Diego, CA
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