



Leading in the Age of Artificial Intelligence

featuring CTO Dr. Tom Longstaff as Interviewed by Eileen Wrubel

Welcome to the SEI Podcast Series, a production of the Carnegie Mellon University Software Engineering Institute. The SEI is a federally funded research and development center sponsored by the US Department of Defense. A transcript of today's podcast is posted on the SEI website at sei.cmu.edu/podcasts.

Eileen Wrubel: Hi, my name is [Eileen Wrubel](#), and I am the initiative lead for the Continuous Lifecycle Solutions Initiative here at the SEI.

Today, I am pleased to introduce to you [Dr. Tom Longstaff](#) who, in November, returned to the SEI as our chief technical [technology] officer. I say *returned* because Dr. Longstaff previously worked as the deputy director for technology in the [SEI CERT Division](#).

During his 15-year tenure in that role, Dr. Longstaff helped to create and shape many new areas of work for CERT researchers, including assisting the Department of Homeland Security and other agencies in the use of response and vulnerability data to define and direct a research and operations program in the analysis and prediction of network security and cyberterrorism events.

Welcome, Dr. Longstaff.

Tom Longstaff: Thanks.

Eileen: May I call you Tom?

Tom: Of course, please do.

Eileen: I would like to start by having you tell us a little bit about yourself and your background. Specifically, can you talk a little bit about your career before your first stint at CERT and then why you came back to us in this new role?

Tom: Sure. So, probably 100 years ago—it seems like 100 years ago—I was actually doing my undergraduate and my master's degree in physics and mathematics. I did my undergraduate at Boston University and then went to the University of California, Davis, where I didn't want to go to spend my graduate career, but went to Livermore Lab.



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At Livermore, I basically had been doing a whole bunch of physics-related things that a nuclear-weapons lab does and worked in that area, much of which was around computers and around various things I was doing in computers. One of the things I got to do a lot of was automated programming. So, I got to do a lot of conversion between the original programs that were written there and the things that had to be created for this brand new type of supercomputer called a [Cray](#). And we had sort of serial numbers one and two of these new Cray machines that we had to somehow get important code to. So, I spent an awful lot of time working that angle.

Somewhere in the middle of that, I decided this was actually a pretty good career move and shifted from physics to computer science. Went back, completely redid my undergraduate career in computer science. Managed to go all the way through until I was all but dissertation and then, like so many graduate students, I got stuck, right? I was there. I was being paid to be a graduate student. I was not making any progress.

In 1988, the Internet worm better known as the [Morris Worm](#) happened, and Livermore was one of the places on that original [ARPANET](#) that was attacked by the Morris Worm. My computer in my office was attacked by the Morris Worm as well as lots of other places. So, I joined the team that reverse engineered the worm, tried to understand exactly what was going on, and then put out various mitigations and repairs. And I got completely hooked on cybersecurity, completely hooked. After the Morris Worm, I went in and said, *I'm going to change my dissertation*. And my advisor says, *Oh, no, you are not. You are too far along to do that*.

So I rapidly, at that point, finished up my PhD. Got the PhD, and I joined what was called the CIAC team, the Computer Incident Advisory Capability, at Lawrence Livermore National Lab, where I became the technical director for things that were happening there. Had a wonderful mentor, [Gene Schultz](#), who taught me pretty much everything that I got to know about how to lead research and lead teams, until I caught the attention of [Rich Pethia](#) here at the SEI. Rich Pethia reached out and said, *We would like you to come and lead our new research team in CERT. So come to the SEI*.

So, I came in 1992 with a freshly minted PhD, a background in all kinds of weird, eclectic things around physics and mathematics and computer science and porting. A little bit of security and various things in here. And then just started working at CERT. Of course my CERT career here was a study in ADD jobs because I couldn't hold a job more than a couple years. So, every couple of years at CERT I changed to, and created, some new part of the organization and created some new element within CERT. Went all the way through there until I became the deputy director, as you had mentioned. And then I got into an area where I really wanted to do more, but the SEI wasn't growing very fast at that moment. CERT wasn't growing very fast at that moment. The Applied Physics Lab at Johns Hopkins University reached out to me and said, *How would you like to come manage a large branch?* And I said, *OK, I'll give that a try*. So, I



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went to Johns Hopkins University, and I went to the Applied Physics Lab, where I spent part of my career being a deputy branch manager, part of my career being a chief scientist, part of my career doing a variety of senior project-lead areas, being a cybersecurity advisor. Then I ended up doing an awful lot of work for the Department of Homeland Security, which meant a one-and-a-half to two-hour each-way commute from my home in Columbia [Md] to D.C.

I did that for about three years. Then one of my colleagues came along and said, *Hey, we are looking for somebody who might want to be an IPA or do an IPA at the National Security Agency*, which was right up the street from my house. And I was like, *No more commute, sign me up*. I went into the research directorate at NSA. I was in an open position so I could be out. I could have business cards. I could go to conferences and say that's where I was from. I got to help set a technical agenda that will sound very familiar to our current SEI in artificial intelligence and automation and automated response, doing a lot of work in those areas until after three years, I was serving as an SES [senior executive service] there.

Came back to APL. Completely changed roles again—you can see this is a standard in my career—completely changed roles again. Joined the program-management shop. I ran a group on the business side with contracts personnel, with a wide variety of financial managers and different people who made the business work. I learned everything about how to actually make the business work. Worked in those areas for a whole lot of different customers.

I was very comfortable. I was so happy about the jobs that I was doing there that I renovated my home, put in an entirely new kitchen, everything new in that area. I had an academic role at Johns Hopkins where I led four departments in the part-time master's program in the [Whiting School](#). About half of the students in the master's program were mine. So, I had this great academic role and I had this great job role.

And then the SEI reached back out to me and said, *We've been looking for a CTO, and we are really trying to find the right kind of fit. We wondered if you would come and talk to us*. And I said, *Well, I am pretty sure I am not who you want, but, yeah, I'm happy to come and talk*. The more I talked about the SEI, the more I got excited about what the possibilities were here, what we could achieve, what we could actually do and move forward in this new world where software is the ocean that everything swims in. There is nothing without software. I thought, *Okay, the SEI could really be a place to be for the next part of my career*. Had that very difficult conversation with my wife at home that, *Yes, we have just renovated our house. Yes, we are all set up, but I think we should move to Pittsburgh*.

That is what we are in the process of doing right now--is trying to get a house sold in Maryland and buy a house here in Pittsburgh and move here and get completely re-embedded in this new organization I am discovering called the Software Engineering Institute.



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Eileen: So let's talk about that world of possibilities that you see for the SEI.

Tom: The SEI has had several foundationally changing moments in its past. Right from the beginning, with the original process work that was based on measuring things that no one had ever measured before: Creating data to understand how we would create software. What is the process of creating software? How to begin to structure architectures? These are things that were game changing, both for the Department of Defense and for the world, in terms of where we were going to go. That was a whole era where the SEI made a name for itself in, *We use real data and real measurement, not opinion, to drive the advances that we are going to have moving forward.*

Then we came into the world of security and cyber and CERT. Again, this wasn't theoretical. It wasn't a mathematical foundation. It was, *We measure network activity. We create tools for understanding exactly what's going on. We capture the data at the time*—in what I called the data landfill. *But we capture data and we use that to drive all of our recommendations and everything that we wanted to do.* Those were the CERT years. At the same time, the architecture world and the idea of product lines, same thing. Completely based on real experiences in the commercial world and in the outside world and sort of coming into that space.

Now we are coming into a brand new era where the entire world is based on software and data with artificial intelligence, machine learning, and the kind of data-science-driven world of capabilities that we are creating. All of those capabilities, whether they are in the Department of Defense, in the private sector, no matter where they are, they are based on real measurements of data. In fact, even more than just measuring data: labeling it and understanding it so that we can use it to assist in decision making, to make predictions, categorizations, everything you might do.

It is a world in which, just as security was and is still important, the whole world of the use of data for what we are right now referring to as machine learning and AI, but the entire idea of data-driven processing and the data-driven world of software, is where we're going to go and what I'm excited about. One of the areas I'm excited about is how do we use all of these new technologies, not just to apply software to some other place, like our toasters knowing when the toast is done. But how do I apply it to AI that can actually compose software itself, that can begin to use these techniques to revolutionize the way that we assemble software in the future? Faster. Better. More efficient. Less vulnerabilities. Less problems. Less faults. I think the SEI is positioned to be the place where that world is going to be centered. It's going to be centered in the work that we do with the expertise that we have here at the SEI. That is what is really driving me and my vision here in terms of where we're going to go forward.

Eileen: That's an exciting picture.



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Tom: It's very exciting. And I do get sort of animated about it when I talk, because I'm very excited about where this is going.

Eileen: Why don't we talk a little bit about near-term challenges? What do you see as the most pressing challenges for DoD and federal agencies in, sort of, the intermediate term and how does your job reflect those priorities?

Tom: The DoD, like a lot of larger organizations, has to go through a transformation that's going to be very uncomfortable in the near term because, just as in the early days, they had to make a complete transition into how software was embedded into DoD systems. That was a really uncomfortable shift from building hardware and relying on hardware, everything fundamentally having to do with acquiring hardware, to now everything fundamentally having to do with that hardware-software partnership that goes into everything.

Now we have to make a whole other shift. Now it is going to be all about, *How do we take sensor data, how do we understand the use of sensor data in the development of new software, in the development of new capabilities?* And shift the idea of, *We start with requirements and build through to systems* to, *We start with the data we can collect to drive the things that we are going to create and move forward within the Department.* So, it is a near-term challenge for us to help our customers, our sponsors, the people that we work with really understand how to embrace this new world that we're going to start to approach. And how do we get into it?

All the way from *What are the acquisition regulations?* to *How do we guarantee costs, speed, capability?* to *How do you even have a language to talk about this?* Right now we don't have a good language to talk about this in the near term. So, we have to do that. We have to, in the short term, also help everybody that we have in the SEI align to this kind of future world. Everybody sort of has this vision. We all share a passion. The way it was put to me is that we all have this scattershot of projects and things that we do and we have to, in the short term, align it into a vector that we can really start to all grow into the same direction, so that we get there and really move ahead. And those are some of the short-term and medium-term challenges that I think we have.

Eileen: The SEI enjoys this unique position as being a unit of, and operated by, Carnegie Mellon. Can you talk a little bit about that relationship and how you see your role in terms of collaboration and facilitation between the SEI work and research and campus collaborators?

Tom: Well, it's still growing, of course. And we're still evolving that relationship, but the SEI is a linchpin. It is a fundamental connection point between the mission of what is happening within DoD and the academic research that's better at CMU than anywhere else in the world. Carnegie



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Mellon is, by anybody's estimate, the number one place in the world for doing AI and data-related research. Period, by a long shot.

The SEI has the ability to have people, staff, researchers, scientists that can talk to and work with those faculty members, those academic researchers, and the students within all of the departments--not just Computer Science, but throughout the entire set of departments and capabilities across Carnegie Mellon—and be able to translate and transfer all of that into capabilities that our own sponsors and customers and people that we work with need to have. So, we are that facilitation role in that particular area where we develop capability, we invent things ourselves, but we work with the university in those areas where they have unique academic expertise.

I will say that, in my experience, there are (I don't think) any other organizations like the SEI, no other FFRDC or any of those organizations, that is as close to their home university as we are. Both physically (having a building right on campus is a good thing) and also, kind of, emotionally and technically, to just be associated with the faculty that are there. It is very exciting. Of course it is a lot of fun, because you get to be around the students and around really creative people that have wild and crazy ideas about how the universe will be different and, sort of, things moving forward. We can look at that, and we can build upon that and develop that into the new world that we'll help create.

Eileen: It is a great story. It sounds so exciting. I am so glad to be a part of it. One thing, Tom, that our audience always likes to hear is how the people on our team stay current in the things that they care about in their profession. Can you tell me a little bit about your daily go-tos or the books that are on your bookshelf?

Tom: Sure. There are two halves of my brain when it comes to this, right? And I have really got it split right down the center. There is a half of my brain that loves the technology and the journals that are out there. I am an avid reader of many of the [IEEE journals](#). I am an editor in [Computers and Security](#), and, of course, I read not only the ones that are published there but the submissions with a great deal of interest in terms of the things that are happening in that area.

I am also a sucker for webpages and various kinds of places, like [Dark Reading](#). I must admit I go to security clickbait and software clickbait all the time in order to just go in there and understand where things are. I go to company websites and try really hard to read past the hype and understand what the white papers are behind the various companies that are there. I am finding that to be much more relevant to my technical side than a lot of the books and things that are out there, currently, for me. So, that is where I spend for that side of my brain, but I have also got another side that is really hung up on leadership books of various kinds. I have been spending quite a long time making sure I read the best that I can find in terms of some of these leadership



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books that are there, mostly because I really want to be able to effectively help to lead the SEI organization technically into the future that we want to create.

One of the books that truly did change my way of thinking in this way is [Start with Why](#) by Simon Sinek. That book in particular, with the SEI and with the things that we have to do, resonated so well in two ways. One, just for the technology and the change itself. *Why is this technology important? Not, What we are doing? Not, How we are doing it? Why is it so important in terms of going into that section?* But the other side of that is, *Why are we here at the SEI? Why are we, as staff members here at the SEI?* It has led me to believe that we really need to have a language of talking to each other within the SEI and with people on the outside about the exciting things that we are doing and why we are here, why we are really devoting our lives to this part of the world and moving it forward.

So, that's one of the books that I've really been looking at a lot. John Maxwell, I'm a big fan of [Leadership Gold](#), some of the other leadership books and things that he has that way. They are ones that I go back to. There is a book out there that I have read many times—and I do it whenever I need to collect some additional insight—it is a little strange. It is called [The Phoenix Project](#) by Gene Kim [and Kevin Behr and George Spafford].

Eileen: That is a great book.

Tom: It is a great book. I like it because, every time I read it, I bring out something a little bit different in that book as I, sort of, go through it that way. Of course, every time I change jobs or change positions, which I have done many times through my career, I always go back and read [Who Moved My Cheese?](#) Every time. Because it's just one of those things you have to read in transition. Those are the kinds of things that I go to back on that.

Eileen: Great. Thank you so much for sharing that with me.

Tom: You are welcome.

Eileen: I think that wraps us up for today. Thank you, everybody, for joining us. All of the books and journals that Tom has mentioned, we are going to make links to all of that available in the transcript of the podcast. So, thank you all very much.

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