SEI Workshop on Software Systems at the Edge

Software Engineering Institute
Carnegie Mellon University
Pittsburgh, PA 15213

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2

Edge Software Systems

Edge software systems operate at the end of the connected network, close to where real-time decision makers act

Edge software systems typically include capabilities to access enterprise systems, obtain wide-scale situational awareness, and process locally collected data

However
- Networks may not guarantee reliable access to cloud resources, where this computation and data are typically available
- While some of the required cloud capabilities could be deployed locally to edge devices, these devices likely have limited resources that cannot properly execute these capabilities, especially for execution of AI and ML capabilities

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3

Call to Action and Theme of the Workshop

While much of industry is focused on the hardware and networking aspects of edge computing, much less attention is being given to the **software stack that enables mission capabilities, despite the operational uncertainty that is typical of tactical environments**

We need more adaptive architecting, development, and deployment approaches to improve upon often incorrect communications and resource assumptions at the edge

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4

Workshop Goals

Share current and future operational scenarios, trends, opportunities, and challenges

Share solutions and lessons learned related to the identified challenges

Identify priority areas in which greater research and development are necessary to address challenges

Contribute to defining the future of software systems at the edge, including next steps and necessary actions

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5

Agenda

09:00	Welcome
09:15	Edge Computing Challenges in DoD (Dr. Tom Longstaff — SEI)
09:45	DARPA's 5G Portfolio (Tejas Patel — DARPA)
10:15	Morning Break
10:45	Software Systems at the Edge: The SEI Portfolio (Kevin Pitstick — SEI)
11:15	Discussion: Challenges in Developing, Deploying, Operating and Evolving Software Systems at the Edge
12:15	Lunch
13:00	Panel: Critical Edge System Use Cases: Today and Tomorrow
14:30	Afternoon Break
14:45	Discussion: Lesson Learned and Gaps in Developing, Deploying, Operating & Evolving Edge Systems
16:45	Wrap-Up and Next Steps

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6

Edge Computing Challenges in the DoD — Dr. Tom Longstaff

Dr. Tom Longstaff is Chief Technology Officer of the Carnegie Mellon University Software Engineering Institute (SEI). As CTO, Longstaff is responsible for formulating a technical strategy and leading the research portfolio based on trends in technology, government, and industry across software engineering, cybersecurity, and artificial intelligence. Longstaff maintains an active role in the cybersecurity community and regularly advises organizations on the future of network threat and information assurance. He is an editor for multiple journals and has chaired many committees and conferences including a current National Academies study on AI test and evaluation.

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DARPA's 5G Portfolio — Tejas Patel

Mr. Tejas Patel joined DARPA as a program manager in August 2019 to develop, execute, and transition programs in cyberspace operations and other defense mission areas. Prior to his position at DARPA, Patel served as a principal investigator for a DARPA I2O program. He also has served as a contractor supporting I2O's portfolio of cyber research and development (R&D) programs, as well as a software engineer in private industry focused on the automation of computer network operations. Patel's prior civil service includes over half a decade of experience in cyber operations, development, and planning within the Department of Defense.

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Software Systems at the Edge: The SEI Portfolio — Kevin Pitstick

Kevin Pitstick is a senior software engineer at the Carnegie Mellon University Software Engineering Institute (SEI). He is a member of the Tactical and AI-Enabled Systems (TAS) initiative, where he is the principal investigator for the Automating Container Minimization for the Edge research project. He has over 10 years of software research and development experience in the defense, government, and academic domains. His primary areas of expertise and interest are edge computing, microservices, communication protocols, containerization, and AI and ML at the edge.

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9

Challenges

What challenges do you face in in developing, deploying, operating and evolving software systems at the edge?

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10

Lessons Learned

How have you solved these challenges?

What have you learned from solving these challenges?

What ideas do you have to solve these challenges?

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11

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Next Steps

We will produce a summary report with everything we learned today

- We will not include names of attendees, systems, programs, or organizations in the report without explicit permission
- We will share a draft of the outcomes with all attendees for review before potential open publication

After approval, we will engage with organizations such as OUSD(R&E), DOT&E, and DoD CIO to enable successful development, deployment, operation, and evolution of these systems with appropriate strategic and tactical support and to inform where to focus more research and development efforts

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12