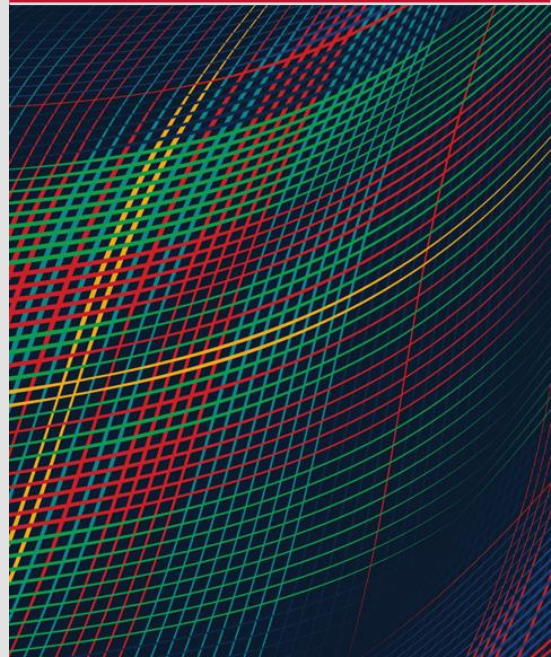
Carnegie Mellon University
Software Engineering Institute



Applying the three ways at the System Level

OCTOBER 12, 2023

Robin Yeman

© 2023 Carnegie Mellon University

[[DISTRIBUTION STATEMENT A] Approved for public release and unlimited distribution.]

Copyright 2023 Carnegie Mellon University.

The view, opinions, and/or findings contained in this material are those of the author(s) and should not be construed as an official Government position, policy, or decision, unless designated by other documentation.

NO WARRANTY. THIS CARNEGIE MELLON UNIVERSITY AND SOFTWARE ENGINEERING INSTITUTE MATERIAL IS FURNISHED ON AN "AS-IS" BASIS. CARNEGIE MELLON UNIVERSITY MAKES NO WARRANTIES OF ANY KIND, EITHER EXPRESSED OR IMPLIED, AS TO ANY MATTER INCLUDING, BUT NOT LIMITED TO, WARRANTY OF FITNESS FOR PURPOSE OR MERCHANTABILITY, EXCLUSIVITY, OR RESULTS OBTAINED FROM USE OF THE MATERIAL. CARNEGIE MELLON UNIVERSITY DOES NOT MAKE ANY WARRANTY OF ANY KIND WITH RESPECT TO FREEDOM FROM PATENT, TRADEMARK, OR COPYRIGHT INFRINGEMENT.

[DISTRIBUTION STATEMENT A] This material has been approved for public release and unlimited distribution. Please see Copyright notice for non-US Government use and distribution.

This material may be reproduced in its entirety, without modification, and freely distributed in written or electronic form without requesting formal permission. Permission is required for any other use. Requests for permission should be directed to the Software Engineering Institute at permission@sei.cmu.edu.

Carnegie Mellon® is registered in the U.S. Patent and Trademark Office by Carnegie Mellon University.

DM23-2038

[[DISTRIBUTION STATEMENT A] Approved for public release and unlimited distribution.]

Carnegie Mellon University
Software Engineering Institute

Introduction

Space Domain Lead

Carnegie Mellon University
Software Engineering Institute

Expertise spanning over twenty-eight years in software engineering with focus on Digital Engineering, DevSecOps, and Agile building large complex solutions across multiple domains from submarines to satellites. She advocates for continuous learning with multiple certifications including SAFe Fellow, SPCT, CEC, PMP, PMI-ACP, and CSEP. She is a Systems Engineering PhD candidate at Colorado State researching best practices to deliver complex safety critical solutions using Agile and DevSecOps.

© 2023 Carnegie Mellon University
[DISTRIBUTION STATEMENT A] Approved for public release and unlimited distribution.

Agenda

- Objectives
- Background
- The First Way
- The Second Way
- The Third Way
- Benefits / Challenges
- Conclusion

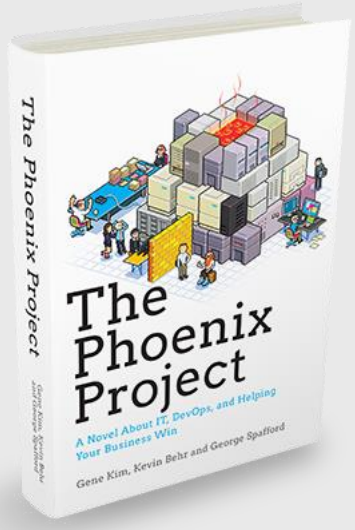
© 2023 Carnegie Mellon University
[DISTRIBUTION STATEMENT A] Approved for public release and unlimited distribution.

Objectives

- Situational Awareness of Phoenix Project and The Three ways
- Provide an understanding of why these concepts should be applied beyond software
- Demonstrate examples of how to apply three ways at system level

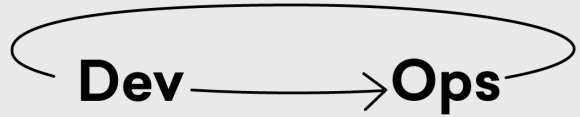
[DISTRIBUTION STATEMENT A] Approved for public release and unlimited distribution.

Background

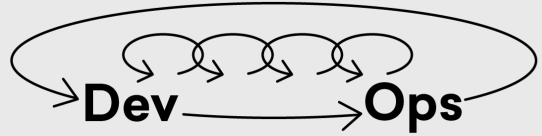


Gene Kim 2013

Systems Thinking / Flow



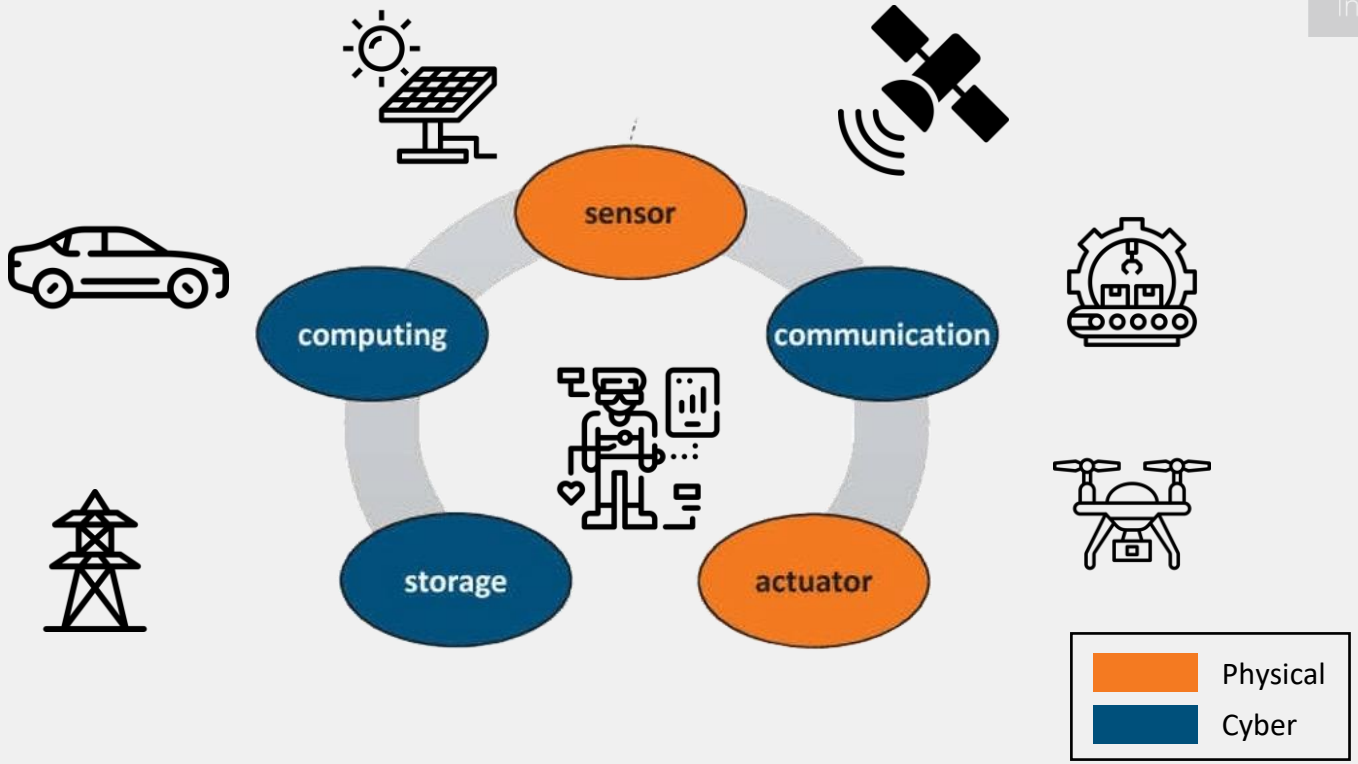
Amplify Feedback Loops



Culture of Continuous Learning

[DISTRIBUTION STATEMENT A] Approved for public release and unlimited distribution.

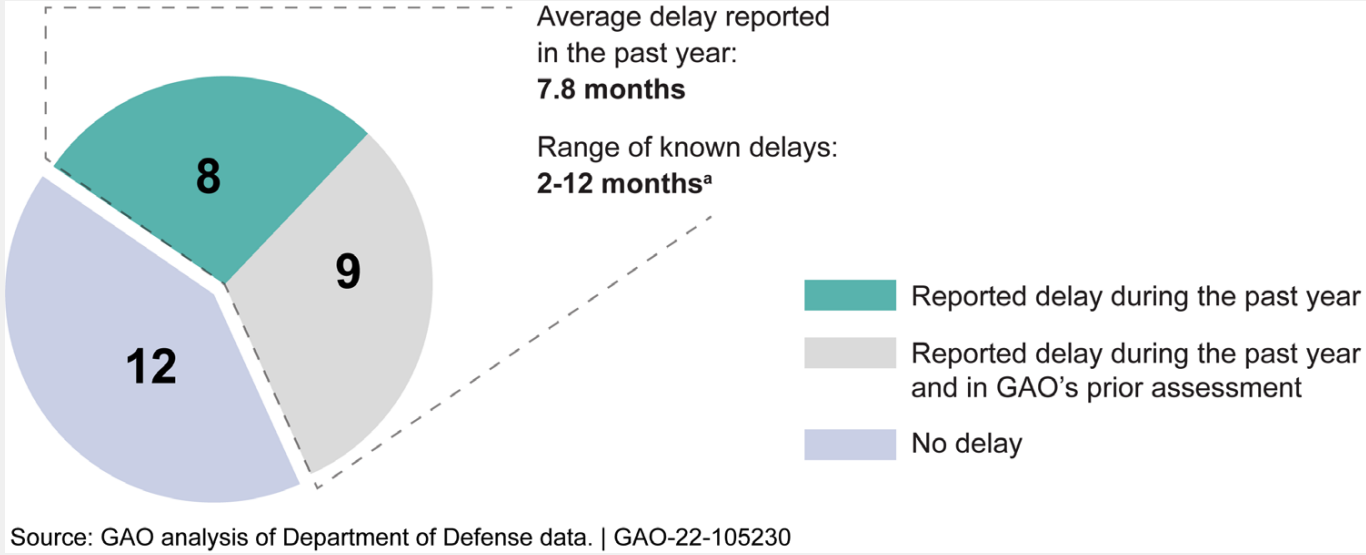
Cyber-Physical System (CPS)



Most of these systems are software defined and hardware enabled

[DISTRIBUTION STATEMENT A] Approved for public release and unlimited distribution.

What is the problem



Source: GAO analysis of Department of Defense data. | GAO-22-105230

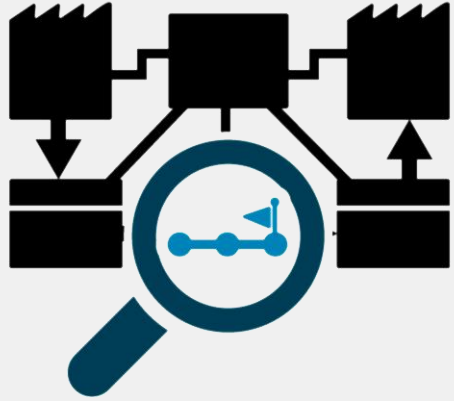
Can we apply the Three ways to major weapon systems and get similar benefits that we find in software?

[DISTRIBUTION STATEMENT A] Approved for public release and unlimited distribution.

The First Way

A holistic view that emphasizes the performance of the entire system as opposed to a specific silo or department while ensuring we do not pass defects downstream.

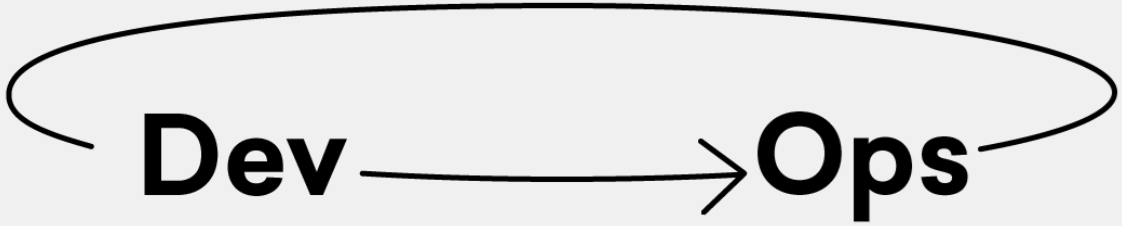
Look at the systems
As a whole



Visualize flow of value

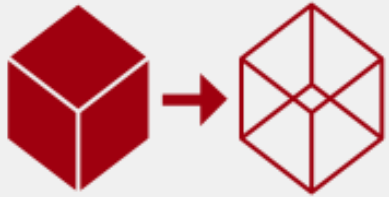
[DISTRIBUTION STATEMENT A] Approved for public release and unlimited distribution.

The Second Way



The second ways focus on getting feedback quickly, fail-fast / Learn-fast

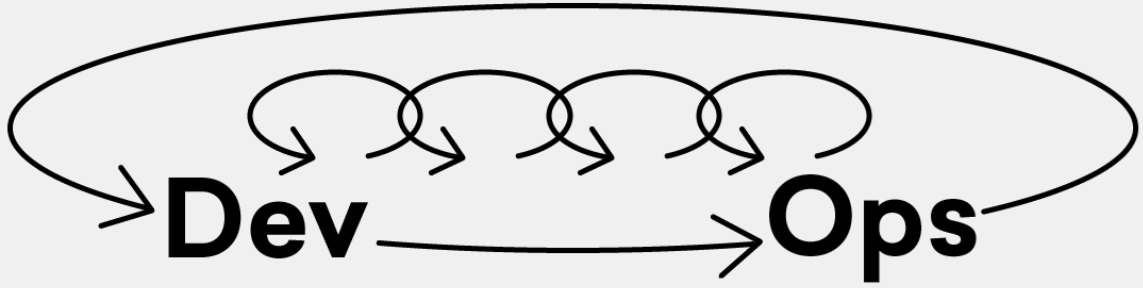
Test-Driven



Digital Twin

[DISTRIBUTION STATEMENT A] Approved for public release and unlimited distribution.

The Third Way



Creating an environment of innovation and continuous learning

Ensure the teams have clarity and competence

Phychological Safety

[DISTRIBUTION STATEMENT A] Approved for public release and unlimited distribution.

Benefits

- Increased Quality
- Enhanced resilience and security
- Shorter lead times
- Reduced cost
- Increased transparency
- Faster Innovation

[DISTRIBUTION STATEMENT A] Approved for public release and unlimited distribution.

Challenges / Considerations

- Awareness
- Organizational Structure
- Culture
- Regulatory Compliance

[DISTRIBUTION STATEMENT A] Approved for public release and unlimited distribution.

Revisit Objectives

- ☑ Situational Awareness of Phoenix Project and The Three ways
- ☑ Provide an understanding of why these concepts should be applied beyond software
- ☑ Demonstrate examples of how to apply

[DISTRIBUTION STATEMENT A] Approved for public release and unlimited distribution.

© 2023 Carnegie Mellon University
[DISTRIBUTION STATEMENT A] Approved for public release and unlimited distribution.