ABSTRACT

The design structure matrix (DSM) is a powerful tool for visualizing, analyzing, innovating, and improving systems, including product architectures, organizational structures, and process flows.

Akin to a traditional N² chart and the System-System matrix (SV-3) in the DoD Architecture Framework (DoDAF), the DSM is a square matrix showing relationships between system elements. These elements can be components, teams, activities, or others. By analyzing the DSM, one can prescribe a better (e.g., more modular) system architecture. Adding a time-basis enables one to prescribe a faster, lower-risk process. Because the DSM highlights process feedbacks, it helps identify iterations and rework loops—key drivers of cost and schedule risk.

The DSM is concise and visually appealing and is used in many organizations across diverse industries. Over the past decade the DSM has gained popularity. Users have found the tool extremely useful for fostering architectural innovation and enabling the situation awareness and empowerment that motivates the people executing complex processes.

This tutorial introduces the DSM and three distinctive applications useful to product developers, systems engineers, and project and program managers. Real-life examples are presented from the aerospace, automotive, semiconductor, and other industries. Participants will engage in hands-on exercises and come away with a clearer understanding of the drivers of some critical, emergent behaviors in systems.

Topics include:

1. General Introduction
   - Why are interfaces and dependencies important?
   - Why are they often mismanaged?
2. Introduction to the DSM
   - How does it work?
   - History
   - Types of applications
3. Application one: Product Architecture DSM for systems architecting
   - Motivation
   - Using the DSM
   - A detailed example—engine architecture
   - Exercise
   - Analysis opportunities and challenges
   - Tools
   - Discussion—strengths and weaknesses of the approach; when, where, and why to use it
4. Application two: Organization Architecture DSM for organization design
   - Motivation—well-integrated organizations, multi-team coordination
   - Capturing organizational interactions
   - Using the DSM
   - A detailed example (General Motors)
   - Tools
   - Discussion—strengths and weaknesses of the approach; when, where, and why to use it
5. Application three: Process Architecture DSM for program management
   - Problems with common process modeling methods
   - Activity coupling, interdependency, feedback, and iteration
   - Using the DSM
   - A detailed example
   - Exercise
   - Additional examples (Boeing, Intel, Lockheed Martin, etc.)
   - Analysis opportunities and challenges
   - Tools
   - Discussion—strengths and weaknesses of the approach; when, where, and why to use it
6. Integrative topics
   - Relationships between the applications
   - Beyond DSM: Domain Mapping Matrices (DMMs) and Multidomain Matrices (MDMs)
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Prior to joining TCU in 2003, he worked for Lockheed Martin Aeronautics Company as the technical lead and chief integrator for enterprise processes, and for the Lean Aerospace Initiative at the Massachusetts Institute of Technology (MIT), conducting on-site research at Boeing, Chrysler, General Electric, Lockheed Martin, McDonnell Douglas, Sundstrand, and Texas Instruments. He has also worked for Honeywell Space Systems and Los Alamos National Laboratory and served as a consultant for several organizations, including BNSF Railway, General Motors, Lockheed Martin, Northrop Grumman, Seagate, Southern California Edison, and the U.S. Navy.


He is a member of the Institute for Operations Research and the Management Sciences (INFORMS), the International Council on Systems Engineering (INCOSE), and the Production and Operations Management Society (POMS), and he serves on the Editorial Boards of IEEE Transactions on Engineering Management and Systems Engineering.

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