

A Summary of SAE 549:

Systems Architecting



University of Southern California
Viterbi School of Engineering
Systems Architecture & Engineering (SAE)



Ken Cureton
cureton@usc.edu
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SAE-549-Summary.ppt

Mr. Kenneth Cureton



- Instructor of many Systems Architecting & Engineering (SAE) classes since Fall of 1996
- Senior Systems Engineer (Retired) for The Boeing Company Huntington Beach CA-- Boeing Defense, Space, & Security: Phantom Works
 - Manned Space, Launch Systems, Satellite Systems, Networked Systems, Cyber Security, and Defense Conversion
- Was employed as a Computer Hardware/Software and Systems Engineer for 46 years: Government, Small Business, & Aerospace Sectors
- Professional Societies (Senior Member): AIAA, INCOSE, IEEE
 - IEEE SMC former co-chair MBSE Working Group
 - INCOSE Resilient Systems Working Group (RSWG) chair
 - Network-Centric Operations Industry Consortium (NCOIC) Technical Council Chair Emeritus
- Formal Education:
 - BS in High-Energy & Nuclear Physics
 - MS in Systems Architecting & Engineering

SAE 549 Overview

❑ Part of Systems Architecting & Engineering (SAE) Series

● Summary:

“Introduction to systems architecture in aerospace, electrical, computer, and manufacturing systems emphasizing the conceptual and acceptance phases and using heuristics.”

● Objectives:

- To improve students’ ability to think critically, ask the right questions, and apply the right methods when architecting various types of systems
- To improve students’ understanding of the role of system architects and their relationship to systems engineers and transdisciplinary systems engineering
- To introduce the students to new, advanced multidisciplinary topics (e.g., systems thinking, systems modeling, psychological principles in systems architecting, biologically-inspired architectures, agent-based modeling, human capabilities and limitations) relevant to complex systems architecting
- To introduce the students to key concepts in performing trade-off analysis which is important to both systems architecting and engineering

● Required Course in University of Southern California’s Masters Program in Systems Architecting & Engineering

- Class originated by Dr. Eberhardt Rechtin in the late 1980’s

SAE 549 Class Format

- ❑ **Spring/Fall Semester Class, One night/week, Typically Two Holidays**
 - **14 Weekly Lectures, 2 hours 30 minutes each + 10 minute break**
- ❑ **Summer Semester Class, One night/week, Typically No Holidays**
 - **Same content, 12 Weekly Lectures, 3 hours + 10 minute break**
- ❑ **Distance Learning Format via Distance Education Network (DEN)**
 - **Available on-line at <http://courses.uscden.net>**
 - **Typically only a few students in the TV Studio, majority of students are scattered across the US**
 - **Class content webcasted for online/offline viewing**
 - **Class content in reading materials and presentation slides hosted on DEN Desire-2-Learn (D2L) Software for student access**
 - **Simultaneous Webex for real-time interaction: Voice and Chat**

SAE 549 Class Grading

- ❑ **Five homework assignments**
 - **Students analyze a hypothetical new System using the class concepts and analyses covered in the first five lectures**
 - **Ungraded but required**
- ❑ **One Midterm Paper, combining and integrating the homework assignments**
 - **In place of a Midterm Exam, 35% of class grade**
 - **Papers are typically about 6-to-8 single-spaced pages**
- ❑ **One Research Paper required of each student**
 - **In place of a Final Exam, 65% of class grade**
 - **Papers are typically about 10-to-15 single-spaced pages (with about 8 pages of technical analysis), suitably formatted for publication in a technical journal or conference proceedings**

SAE 549 Typical Class Content

- ❑ **Lecture 1: Intro to Systems Architecting**
 - **Coping with the Complexity, Scale, and Mission Requirements of Today's Systems**
- ❑ **Lecture 2: System Architecture and Architectural Frameworks**
 - **Key Perspectives and Concepts**
- ❑ **Lecture 3: Architecture Trade-off Analysis**
 - **Analyze System Architectures with respect to competing Quality Requirements and Perform Trade-offs among them in order to make Informed Architectural Decisions**
- ❑ **Lecture 4: Systems Thinking**
 - **Ensuring that Today's Decisions do not become Tomorrow's Problems**
- ❑ **Lecture 5: Heuristics**
 - **Cost-Effective Short-Cuts to Desired Ends**

SAE 549 Typical Class Content

- ❑ **Lecture 6: Human-System Integration: Implications for Systems Architecting**
 - **Role of the Human is Changing from System Operator to an Agent who is an Integral Part of the System**
- ❑ **Lecture 7: Modeling, Simulation, and Prototyping**
 - **Involving Stakeholders in Decision-Making**
- ❑ **Lecture 8: Cyber-Physical Systems**
 - **Safety-critical Applications with Interactions Between Physical System and Cyber Elements with Influence by Human Agent(s)**
- ❑ **Lecture 9: Cyber-Physical-Human Systems Architecting**
 - **Example of systems that can perform fully autonomously, fully manually, and in between as needed**
- ❑ **Lecture 10: Systems Architecting of Complex Systems**
 - **Dealing with Complexity in Systems and System-of-Systems**

SAE 549 Typical Class Content

- ❑ **Lecture 11: Systems Architecting of Fault-Tolerant and Trusted Systems**
 - **Fault Tolerance and Trust in today's safety-critical applications**
- ❑ **Lecture 12: Course Review**