

A Summary of SAE 549:

Systems Architecting



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



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SAE-549-Summary.ppt

Mr. Kenneth Cureton



- Instructor of SAE 550 from 1996 to 2014 & 2017 onward, SAE 574 from 2003 to 2013, SAE 599 in 2014 then SAE 546 in 2018, SAE 549 in 2003 & 2017 onward
- Senior Systems Engineer (Retired) for The Boeing Company Huntington Beach CA-- Boeing Defense, Space, & Security: Phantom Works
 - Manned Space, Satellite Systems, Networked Systems, Defense Conversion
- Network-Centric Operations Industry Consortium (NCOIC) Technical Council Chair Emeritus
- 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
- 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

- ❑ **One Research Paper required of each student**
 - **In place of a Final Exam, 50% of class grade**
 - **Papers are typically 8 single-spaced pages, suitably formatted for publication in a technical journal or conference proceedings**
- ❑ **One Mid-Term Exam, covering class principles**
 - **30% of class grade**
- ❑ **One Case Study, four homework assignments applying class principles for various analyses of the Case Study**
 - **20% of class grade**

SAE 549 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 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: Systems Architecting and Political Process**
 - **Tools and Techniques for coping with the impacts of Politically-Driven Budgets & Policies on the Engineering Design Process**
- ❑ **Lecture 10: Systems Architecting, Complexity and Complex Systems**
 - **Dealing with Complexity in Systems and System-of-Systems**
- ❑ **Lecture 11+: Special Topics**
 - **e.g. System Affordability, Case Studies in Complex Systems, Model-Based Engineering for Complex System-of-Systems**