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

USC Viterbi
School of Engineering
Systems Architecting and Engineering

- 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
  - AIAA Space Settlement Technical Committee Member
  - 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 minutes
- 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: Systems Architecting of Complex Systems**
  - **Dealing with Complexity in Systems and System-of-Systems**
- **Lecture 10: Systems Architecting of Fault-Tolerant and Trusted Systems**
  - **Fault Tolerance and Trust in today's safety-critical applications**
- **Lecture 11: Course Review**