

**SYST 659 / SYST 750 Service Oriented Architectures. Spring 2013.** Notions of Service Oriented Architectures (SOA) have recently become popular and potentially very useful in the management, business and engineering worlds as the enterprise-focused Information Technology (IT) architecture of choice. SOA is an approach to defining integration-architectures based on the concept of services, where a service is defined as a mechanism that enables access to one or more capabilities using a prescribed interface. A Service Oriented Architecture (SOA) is a way of organizing services and associated hardware and software so that it is potentially possible to respond quickly to the changing requirements of the marketplace. This course attempts to answer that question by exploring the possibility and advantages of applying SOA to the systems engineering design process, specifically as a key enabler of the Model Based Systems Engineering (MBSE) paradigm. Corequisite: SYST 619, or permission of instructor.

The notion of Complex Engineered Systems (CES) has emerged from initial efforts in the area of Complex Adaptive Systems and such emerging technologies as the Internet, GPS, wireless networking, and many others. These complex engineered systems are comprised of many heterogeneous subsystems and are characterized by observable complex behaviors that emerge as a result of interactions among the subsystems at several levels of organization and abstraction. Understanding, designing, building and controlling such complex systems is a major challenge for systems engineers today. Service-oriented architecture (SOA) is one of the major resulting realities. A SOA generally provides a comprehensive plan to interrelate the enterprise with technology. SOA integrates talents and skills of an entire enterprise, with requisite and associated needs and computing know-how. In this course, we will present a service-oriented modeling framework that employs agile, universal, and integrated business and technology language to facilitate design, architecture and integration initiatives.

This course is part of the degree track, concentration, and certificate in architecture based systems integration. There is much interest today in the engineering of systems that are comprised of other component systems, and where each of the component systems serves organizational and human purposes. These systems families are often categorized as system families, systems-of-systems, or federations of systems. The design of architectures is a major ingredient in the design of systems families and provides the conceptual basis for achieving system integration. Towards this end, the Department of Defense has issued new regulations for acquisition of systems. These require an architecture-based approach and focus on how a proposed system will be integrated with other existing or planned systems. Studies in this area cover: formulation of the system integration problem, definition of architecture frameworks, use of structured analysis and object oriented methodologies for the design of architectures, modeling and simulation for evaluation of architectures and approaches to integration, and interoperability. Both defense and industrial applications are considered in this course.

#### References:

- Braha, D., Minai, A. A., and Bar-Yam, Y. (Eds.), **Complex Engineering Systems**, Springer, Cambridge MA, 2010.
- Bell, M., **Service-Oriented Modeling: Service Analysis, Design, and Architecture**, Wiley, Hoboken, 2008.
- Marks, E. A., and Bell, M., **Service Oriented Architecture: A Planning and Implementation Guide for Business and Technology**, Wiley, Hoboken, 2006.
- Sage, A. P. and Rouse, W. B. (Eds.), **Handbook of Systems Engineering and Management**, John Wiley and Sons, New York, 2<sup>nd</sup> Edition, 2009.

These references would be well worth purchasing for the course but are not at all required as texts. A plethora of contemporary literature available on the Internet concerning the subjects to be covered will be of much use, and experience will be gained in the Internet as a research tool during the course.

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**Course Call Numbers** SYST 659 001 (13156), SYST 750 002 (21024) Spring 2013 Wednesday from 4:30 PM to 7:10 PM in Room 211 of Innovation Hall.

**Grades:** 50% - examinations; 15% - term paper; 35% - home assignments. Two take home exams will be given. There will be a term paper assignment in the general area of the course, and homework assignments.

SYST 659 Service Oriented Architectures- Syllabus and Outline, Spring Semester 2013 (subject to change)

1. From Complex Adaptive Systems to Complex Engineered Systems (23 January, 30 January)
  2. Engineering Complex Systems: Agent and (especially) Service Orientation (6 February)
  3. Structure and Dynamics of Complex Product Design Issues (13 February)
  4. Structure and Dynamics of Complex Service Design Issues (20, 27 February)
  5. Understanding Complexity in Systems Engineering Design, Architecting, and Integration (6, 20 March)      No class on 13 March – Mid Term break
  6. Models for Services (27 March)
  7. SOA Business Modeling, Technology, and Identification, Analysis, and Design (3, 10 April)
  8. SOA Architecture Organization Model, Business Cases, and Return on Investment (17, 24 April, 1 May)
  9. Mid Term Exam due to Blackboard 20 March
  10. Term Paper due to Blackboard 1 May
  11. Final Exam due to Blackboard 8 May
- APS 4 October 2012