



A short course on:

“A Platform driven approach to building Product Lines & using Systems Thinking to manage chaos and complexity”

Introduction

Enterprise Architecture today is a very complex craft requiring super specialties from many disciplines. Product Lines are a proven approach to building systems that dramatically improves the productivity, longevity and efficiency of the process of systems development.

While there is a lot of material about Product Lines that describes basically what product lines are; there is very little material available that describes how to build a complex product line practice - especially in the context of technology services companies. The reason for the absence of such material is because putting together a Product Line practice requires solving problems of a different order magnitude compared to designing standalone systems.

Product Line practices are strategic initiatives that requires the design of processes, systems and structures that are fundamentally different from those required for single system development. Product Lines are analogous to designing an automobile plant that can produce different models of automobiles as opposed to single system design which is analogous to designing a robust automobile. Product lines call for the identification and development of strategic assets, the decision features and configurations that make different products from these assets, the production techniques or means of development and clear statements of scope of outputs that can be produced.

In this course we introduce the concepts of Product Lines in detail and more uniquely introduce a platform driven design based approach to building product lines. We illustrate the dimensions of product lines within technology services organizations both in the context of product engineering customers and in the context of software development projects for enterprise customers. We illustrate the

concepts and complexities of product lines using a set of case studies.

The implementation of a product line while decidedly beneficial in the longer term adds several magnitudes of complexity to the development of enterprise architecture and systems. A systematic approach is required to reduce the complexity and chaos of developing product lines for large scale systems that can pin their design to a very few fundamental design properties. This approach forms the basis for many of the challenges such as making build v/s buy decisions, reducing the uncertainty of estimation and creating a consistent and verifiable mechanism of dealing with the large number of non functional requirements that characterize an enterprise system of today.

In this course, we introduce methodology based on Systems Thinking discipline for Product Lines and Platforms. We cover concepts, techniques, and principles of systems thinking and how to apply them in the context of putting together a 'design platform' that could be used as a vehicle for creating product line practices.

The course follows an iterative pattern of core concepts, their application, techniques and usage illustrated with case studies. The course brings the perspectives we have obtained from working with several product companies including building and running the product lines for 2 large scale product lines as well as our experience of working with large and small technology services companies.

Target audience and duration

The course is designed for your architects and senior developers and will consist of around 14-16 lectures of 2 hours each distributed over four days. The course can be done either across four continuous days (Wed,Thu,Fri,Sat) or in two sessions - (Fri-Sat, Fri-Sat).

Areas of coverage

The course covers four major areas of Systems Thinking and Product Lines as described below:

Systems Thinking Framework and Systems Models

This track lays down a complete framework of Systems Thinking, its basic concepts, techniques and laws. We cover the basic systems models, and describe a framework for modeling any enterprise system. We then illustrate how several facets of Enterprise Architecture such as dealing with non functional requirements such as scalability and performance can be mapped onto this framework.

Topics:

- The concepts and framework of Systems Thinking - general systems thinking, multi-function, multi-process, multi-structure organizations and systems.
- The four models of systems and four structures of information structures.
- The four dimensional model of an Enterprise - business system, IT-Systems, Software Systems and Infrastructure Systems - the properties of each dimension, architectural problems at each dimension, how to transform a solution at one dimension to another dimension.
- Reasoning about requirements, requirement completion and correctness.
- Case Studies.

Using Systems Thinking to Manage Chaos and Complexity

Enterprise Systems and Enterprise Architecture today consist of many different areas, specialties, methodologies, approaches - starting from requirements engineering to deployment management. In this track, we cover some systems approaches to systematically reduce the complexity. This track covers some techniques to reduce all the non-functional requirements to four basic engineering characteristics, how to transform the domain problems into structural, architectural problems using a series of iterative transformations.

Topics:

- Systems Thinking and Science of Reduction
- Systems Principles and techniques for Enterprise Architecture and Design
- Methods of establishing design quality and requirements quality
- Quality Software Management - first order measurements

Product Lines and their applicability to technology services organizations

This track introduces product line concepts, formal definitions and CMU models, the core concepts of product lines in terms of strategic assets, feature definitions, production processes and scope of product outputs. We cover the aspects of complexity in the design of product lines, different ways of identifying assets and various methods of production in use using a variety of examples and real life experiences derived from working with several product organizations. We finally present product line development in the context of technology services companies and lay the foundation for design platforms as the foundation of product line approaches.

Topics:

- Product lines, definitions and concepts
- The difference between product lines and reusability approaches
- Core concepts of product lines - assets and their configuration, product definitions, production means and product output
- Case studies of product lines and product line roadmap development

- Techniques to develop architecture and technology roadmaps and blueprints and deriving release schedules and project plans from these roadmaps
- Complexity of designing product lines and the need for a design platform

Design Platforms and process of problem solving

In this track, we cover how to go about creating a design platform - which consists of a body of knowledge of design and problem solving, some techniques for communicating the design process and making design alternatives, how to communicate designs to teams at various levels, and some techniques and processes of problem solving that can be applied irrespective of domain and the nature of the application.

Topics:

- From Product Lines to Platforms.
- What is a Design Platform
- What is required to create a design platform:
 - techniques for release engineering and requirements engineering
 - development process and process methodologies
 - Integrating agile development with standard waterfall methods
 - Methods of creating core assets and reusable architectures
 - Building a knowledge base of design, how to document design and problem solving process, capturing design essentials and maintaining conceptual integrity
 - Techniques of communicating architecture and design to programmers, testing teams and other stakeholders

Key Takeouts

- Perspectives on Product Lines, how to use and create Product Line practices in Technology Services Organizations
- The process of problem solving and iterative design techniques
- How to create long term architectural assets, blueprints and roadmaps
- A framework to capture the Non-Functional/Quality attributes of Enterprise Systems
- How to use Systems Thinking in Architecture and Design
- Techniques and Patterns of problem solving
- Real world case studies, examples of product lines and applications of Systems Models