PROJECT PERFORMANCE INTERNATIONAL

Architectural Design 5-Day Course

Principles and methods for effective technical system design

Why Architectural Design?

Many projects struggle not because of technology issues, but because design decisions are made without a coherent architectural foundation. When architecture is unclear, requirements are only partially satisfied, trade-offs are poorly understood, and risk increases as complexity grows.

This course addresses the principles and methods of designing, regardless of what is being designed. The course provides an integrated approach to technical design disciplines, combining structured methods with technology knowledge to maximize system effectiveness. The focus is on how physical, logical and trade off-oriented aspects of design interact, and how they should be applied across different development styles, including waterfall, incremental, evolutionary, agile, spiral, and influenced by concurrent engineering practice.

By exposing proven effective and efficient approaches to design, the course helps reduce enterprise risk and improves the likelihood of delivering successful systems and products.

Earn CE/CPD Credit

PMI Talent Triangle® Suggested PDUs

- Ways of Working - 30
- Power Skills - 8
- Business Acumen - 2

INCOSE Certified Systems Engineering Professional (CSEP)

- 40 Continuing Education PDUs

What You Will Learn

Participants learn a structured approach to architectural design grounded in a systems approach. You will practice developing physical and logical designs, evaluating alternatives through trade-off studies, and optimizing solutions in a disciplined way. **The course builds capability in model-based design, decision-making between feasible alternatives, and design optimization.** You will also gain an overview of reliability, safety, maintainability, and producibility engineering, and learn how to apply design principles and methods to different application scenarios.

Who Should Attend and Why

This course is designed for professionals who perform or manage the development of technology-based systems, products, or capabilities. **It is particularly valuable for architects, engineers, and managers who influence or approve design decisions.** Typical participants include people with job titles such as enterprise architect, system architect, systems engineer, design engineer, software engineer, hardware engineer, specialty engineer, project engineer, and engineering manager. The course is suitable for those working across small to large developments where design quality has a major impact on outcomes.

20,000 Professionals Trained Across 43 Countries

Training Methods & Materials

The course is delivered using a mixture of formal presentation, informal discussion, and extensive hands-on workshops. Workshops play a central role, applying a systems approach to design using a single workshop system throughout the course. **Techniques introduced in theory sessions are immediately exercised in practical workshops.**

Participants receive comprehensive course materials, including presentation content, supporting reading material, and numerous supplementary descriptions, checklists, forms, and charts for immediate workplace use. Complimentary access to PPI's Systems Engineering Goldmine is also provided to support ongoing learning beyond the course.

PPI Training Reviews

"The course was valuable for learning how to prioritise requirements that will drive the system architecture, and to generate a functional design that will set the basis for a good safety assurance program."

Course participant, Australia

"Thank you so much for a great week! I learnt a lot and have already begun making a list of improvements to implement at my company."

Course participant, the Netherlands

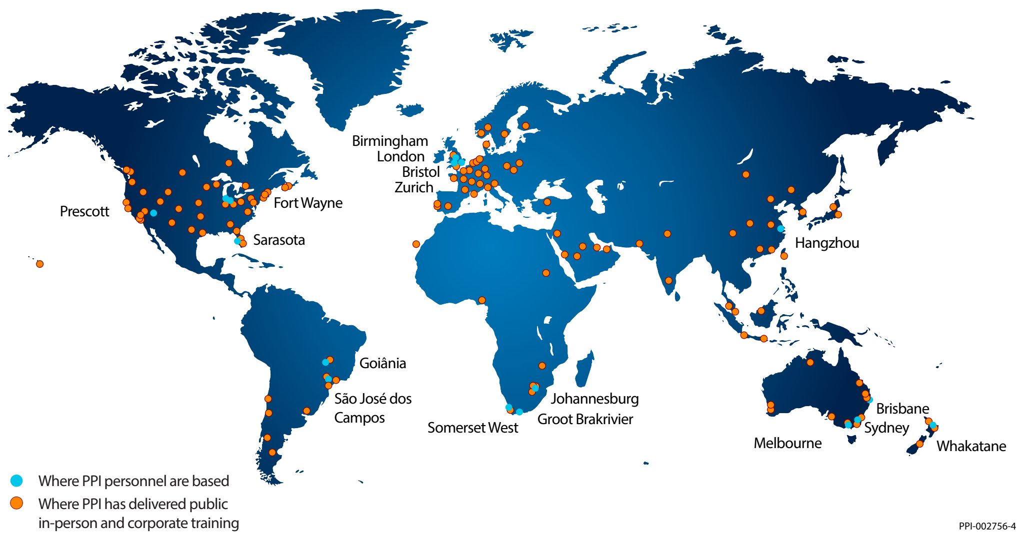
"I was impressed at the depth of the materials and the experience the presenter brought to the course. As a result, I feel more confident to go into the early phases of a project and develop an architecture that will set up the project for success throughout its lifecycle."

Course participant, Australia

Why PPI?

Trusted Worldwide
PPI delivers outstanding training and consulting to many hundreds of enterprises worldwide, from Fortune 100 companies (presently 19% of them) to small startups. PPI is a truly international company, with personnel based in eight countries, and clients across six continents benefiting from our work.

PPI Presenters
PPI's presenters are internationally recognized systems engineering practitioners and consultants who bring decades of real-world experience, ensuring every concept taught is value-adding, practical, relevant and immediately implementable.



Architectural Design 5-Day Course Outline

0. Introduction

- The business case for a systems approach to design

1. Design-Related Principles of Engineering

- Definition of terms
- ***Design interactive exercise – basic***
- ***Design interactive exercise – capability system***
- Systems engineering process overview – the football diagram
- Design within a systems engineering process model
- System views
- ***Workshop 1 – design-related principles***

2. System Development Strategies

- The solution domain: key concepts, relationships, and work products
- Waterfall, incremental, evolutionary and spiral development approaches
- ***Workshop 2 – solution development strategies for a product***

3. Concepts of Architecture and Detailed Design – Physical and Logical

- Physical architecture (structural view) – basic concepts
- Logical architecture – basic concepts
- Logical architecture related to physical architecture
- Reference architectures
- Architecture patterns
- Architecture models
- Architecture frameworks
- Useful forms of logical representation – functional, state-based, mathematical, hybrid, … with examples
- Model-based design in practice – Model-Based Systems Engineering (MBSE)/Model-Based Architecting (MBA)/Model-Based Design (MBD)/ Model-Driven Analysis (MDA)/Model-Driven Design (MDD)
- Knowledge, skills and attitudes for architecting

4. Initial Physical Conceptualization

- The role of technology and innovation
- Architectural design driver requirements
- ***Workshop 3 – identification of architectural design driver requirements***
- Techniques for stimulating innovation: brainstorming, Teoriya Resheniya Izobretatelskikh Zadatch (TRIZ)
- Perspiration engineering: configuration items
- Criteria for selecting configuration items
- Design complexity trade-off
- Relationship of Configuration Item (CI) definition to system integration
- ***Interactive exercise – a simple physical design***
- ***Workshop 4 – physical conceptualization of solution***
- ***Exercise – architectural design heuristics***

5. Functional Design

- Functional analysis in design – how to do it
  - Functional analysis/architecture process
  - Item flow and control flow
  - Un-allocatable and allocatable functions
  - Pitfalls in defining functions
  - Common pitfalls in functional design
  - ***Interactive exercise – a simple functional design***
  - ***Workshop 5 – physical and functional design, part A***
  - ***Workshop 5 – physical and functional design, part B (optional)***
  - Coupling, cohesion, connectivity
  - Failure Modes and Effects Analysis (FMEA)/Failure Modes, Effects and Criticality Analysis (FMECA) in design
  - Performance thread analysis
  - Allocation of functionality between hardware and software
- Fault Tree Analysis
- Event Tree Analysis
- Behavior modeling languages
- Other languages incorporating functional modeling: Systems Modeling Language (SysML 1.x), …
- MBSE language comparison
- SysML2
- Software tools supporting functional and physical design
- Pitfalls in functional design

6. State-Based Design

- State-based design – how to do it
  - ***Workshop 6 – a simple state-based design***
  - Relationship to object orientation
- SysML, and alternative languages incorporating state-based modeling
- Software tools supporting state-based design
- Pitfalls in state-based design

7. Object Process Methodology (OPM)

- Background to OPM
- OPM description
- Relationship to object orientation
- Software tools supporting OPM

Architectural Design 5-Day Course Outline (Continued)

8. Design Decision-Making and Optimization – Trade-Off Studies

- Designing for feasibility
- Designing for effectiveness: approach to design optimization
  - The role of Measure of Effectiveness (MOE) and goals
  - The origin of a system effectiveness model
  - Designing for the company versus designing for the customer – handling conflict of interest
- Using a system effectiveness model
  - Taking account of risk relating to goals
  - Taking account of risk relating to satisfaction of requirements
  - Event-based uncertainty
  - Risk aversion
  - ***Workshop 7 – using a system effectiveness model***
  - Cost/capability, return on investment and like concepts
  - Iterative optimization of design – an effective methodology
- Other techniques – Quality Function Deployment
- Software tools supporting design decision-making
- Some common pitfalls in design decision-making

9. Design For Six-Sigma (DFSS)

- What is Six-Sigma?
- Define, Measure, Analyze, Improve, Control (DMAIC)
- Define, Measure, Analyze, Design, Verify (DMADV)
- The DFSS toolset

10. Return to Physical Design

- Functional to physical allocation
- Facilities, procedures, people, and other types of system element
- Use of a specification tree
- System elements not designated as configuration items
- Some common pitfalls in developing system physical architecture
- Use of architectural design driver requirements
- Adding the detail to the design
- Design creates requirements – the duality of requirements and design
- Interface engineering
- Interface requirements specifications versus interface design descriptions/interface design drawings (ICDs)
- The Open Systems Interconnection (OSI) 7-Layer Model and similar in interface engineering
- Relationship to system integration
- Evolution of interfaces in systems having levels of structure
- Some common pitfalls in interface engineering
- Major artifacts created in design

11. Engineering Specialty Integration (ESI)

- What makes an engineering specialty special?
- Common engineering specialties
- A generic approach to ESI
- Organizational issues of ESI
- Pitfalls, and specialty engineering examples

12. Concurrent (Simultaneous) Engineering

- System of interest – enabling system relationships
- Why concurrent (simultaneous) engineering
- Organizational aspects of implementation
- Process aspects of implementation
- Pitfalls in implementation

13. Reliability and Safety Engineering

- Introduction to terminology
- Measures of reliability
- Probability theory related to reliability and safety
- Reliability Block Diagrams
- FMEA and FMECA
- ***Workshop 8 – performing a basic define failure modes and effects analysis (DFMEA)***
- Fault Tree and Event Tree Analysis
- Common cause/common mode failures
- Root cause analysis
- Markov analysis
- Component failure and repair distributions
- Monte Carlo simulation and Latin Hypercube sampling
- Reliability data and analysis
- Verification of reliability
- Measures of safety
- Hazard and Operability (HAZOP) studies
- Safety assurance
- ***Workshop 9 – performing a basic HAZOP Study***

14. Maintainability Engineering

- Measures of maintainability
- Principles of designing for maintainability
- General techniques of designing for maintainability
- Modules
- Access and handling
- Part selection
- Verification of maintainability

15. Producibility (Manufacturability) Engineering

- Measures of producibility
- Design for Manufacture (DFM) vs. Design for Assembly (DFA)
- Techniques of designing for manufacture
- Design for three-dimensional (3D) printing
- Techniques of designing for assembly
- Verification of producibility
- Producibility risk analysis

16. Summary and Key Points (0.5 hours)

- Action Plan

www.ppi-int.com

systems/product engineering training & consulting for project success ...