Systems Integration

from the perspective of:

- an organization that performs systems integration for other organizations
- integration of software systems
- strategic level (i.e., interpret overall performance needs and ensure system requirements met)

Defining Systems Integration

"melding existing systems and new technologies

to form more capable systems

that are intended to take on

additional tasks,

exhibit improved performance,

and/or enhance existing systems"

"a logical, objective procedure

for applying new and/or expanded performance requirements

in an efficient, timely manner

to the design, procurement, installation, and operational configuration

consisting of distinct modules (or subsystems),

each of which may embody inherent constraints or limitations"

Objectives of Proposed Methodology

"provide an

organized, sensible, accountable, and workable approach

to otherwise seemingly incomprehensible programs"

- encompass entire program
- facilitate understanding and communication
- enhance inclusion of all needs at earliest opportunity
- engage both top-down and bottom-up philosophy
- define and document entire program
- provide overall management framework

Systems Integration Life Cycle Phases and Activities
(One 7-Phase Approach)

① Requirements Definition and Specification
(definition of requirements by use; review of requirements for ambiguity, conflict, *et cetera*; development of systems specifications)

② Feasibility Analysis
(determine likelihood of successful development and deployment; examine new technologies; assess risk and develop risk strategies)

③ System Architecture Development
(describe functional system architecture; specify required technical capabilities)

④ Management Plan
(identify technical architecture alternatives; specify required configuration categories; prepare program and project plans (e.g., WBS); prepare subcontractor management plan; prepare risk management plan)

⑤ System Design
(logical and physical design; design approaches; use of automated aids)

⑥ Implementation
(identify technical configuration; specify required configuration component items; procurement from subcontractors; perform system tests; system deployment)

⑦ Evaluation
(review and evaluate system functioning; obtain, install, test, and accept modified components; maintain, modify, augment, and enhance systems; plan for system retirement/replacement)

System Integrator Activities and Knowledge

(see pages 491 and 492)

14.3.1 Activities

- Conduct general studies of needs to realize improved system performance.
- Develop detailed specifications and designs.
- Conduct risk studies and implement risk minimization strategies.
- Perform system analysis and design.
- Develop hardware and software design.
- Employ project planning and control.
- Perform business management and accounting.
- Develop and nurture relationships with customers and subcontractors.
- Develop hardware design and specification.
- Carry out configuration management.
- Accomplish testing.
- Implement technology based solutions to business needs.
- Train users of new systems.

Table 14.3 Knowledge Areas

Engineering Skills	Management Skills
Computers	Leadership
Networks	Conceptual design
Software	Information engineering
Industry and application familiarity	Staff supervision
Communications—in all forms	Planning and tracking
General business concepts	Technologies
Strong learning skills	Industry and applications
Risk analysis	Risk management plan
	Accounting and finance
	Contract administration

Systems Integration Strategy

Three generic concerns in *each* phase:

- Issue Identification
- Issue Formulation
- Issue Resolution

Strategy requires *both*:

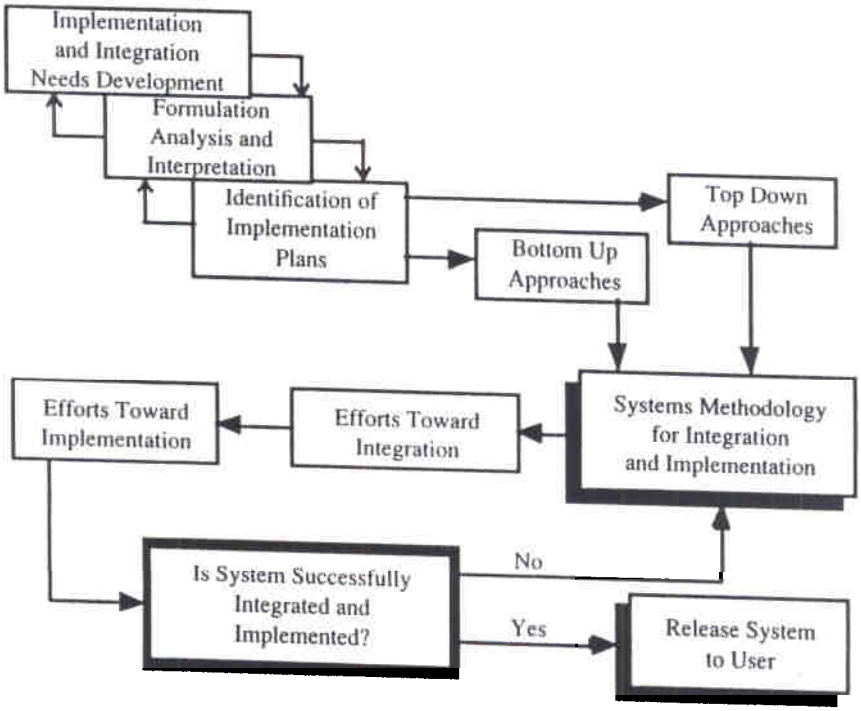
- Top-Down Approach

  long term issues related to overall system structure and architecture

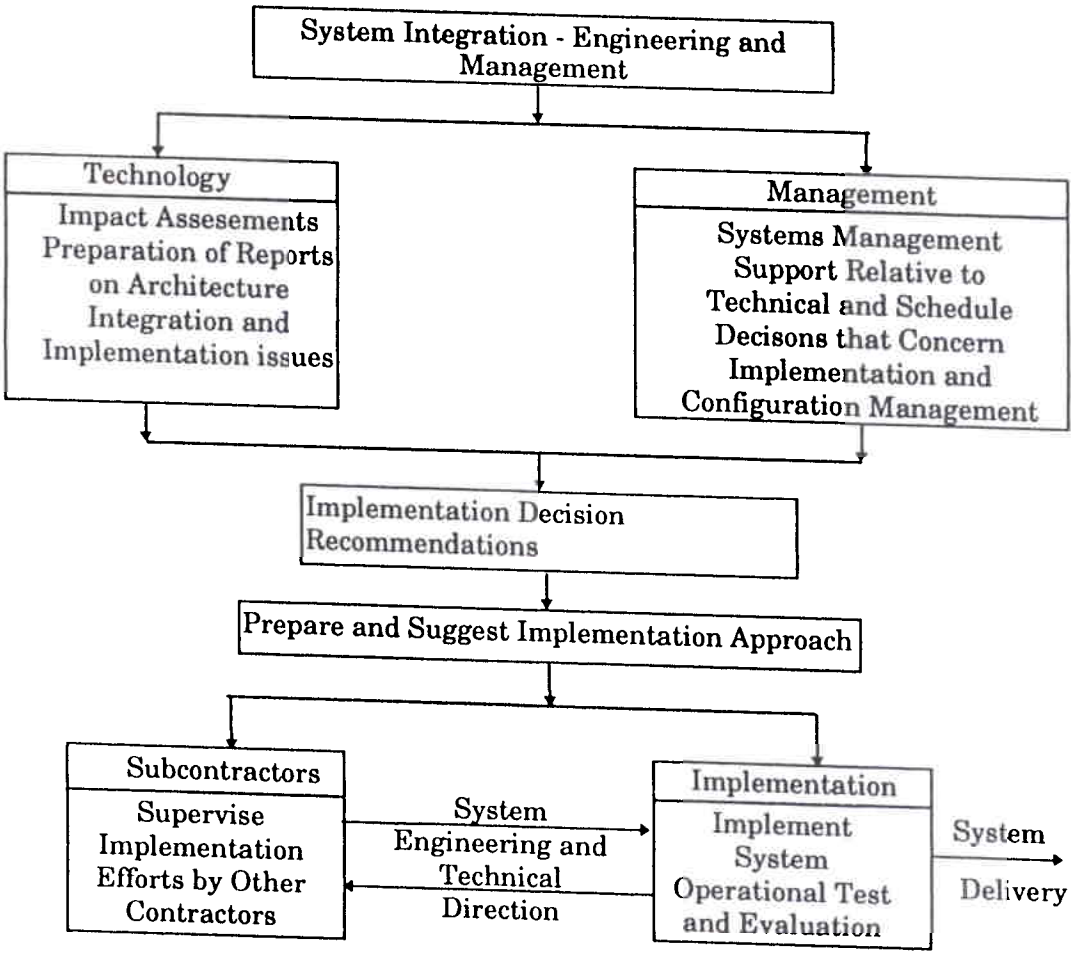
- Bottom-Up Approach

  detailed design and enhancement of extant systems for intended integration

System Integration Implementation Strategy
(Figure 14.3, Page 497)



System Integration Strategy
(Figure 14.5, Page 499)



Systems Integration Audit Trail

Audit trail yields documentation of ~

- ✓ design decisions,
- ✓ procurement actions,
- ✓ constraints definitions

Audit trail process tasks include ~

- ✓ Detailed review of customer requirements
- ✓ Track program progress
- ✓ Resolve problems
- ✓ Assign metrics for problem resolution
- ✓ Establish subcontractor requirements
- ✓ Documentation

Systems Integration Quality Assurance

- "Quality assurance involves

  those systems management processes, systems design methodologies, and development techniques and tools

  that act to ensure

  that the resulting product meets or exceeds

  a set of multiattributed standards of excellence"

- Quality is subjective and multiattributed

- Assuring quality requires that we

  define quality attributes

  assess effect of quality on performance

  determine metrics for quality evaluation

Systems Integration Quality Assurance

- Quality assurance entails
  - detection of faults
  - diagnosis of types and locations of faults
  - correction of faults

- Quality assurance perspectives
  - structural (verification)
  - functional
  - purposeful (validation)

Assuring Quality Assurance Integration

(see page 507)

- Organize quality assurance team as separate entity reporting to top management
- Establish quality assurance processes for all technical activities
- Validate requirements and specifications with customer
- Monitor progress of all aspects of program
- Conduct tests to ensure that quality assurance requirements are being met
- Provide test regimen for system performance evaluation and final delivery

Risk Management

Sources of Risk:

- **functional - usually technical aspects of project, such as performance**
- **nonfunctional - e.g., management, political climate, cost, *et cetera***

Assessment of Risk:

risk = (probability of occurrence) x (severity of impact)

- **probability and severity are typically subjective determinations**
- **high impact implies high risk, regardless of probability**

Major Components of Risk Management Plan

- **identification of "at risk" system components**
  (identification typically entails qualitative and subjective methods)
- **risk analysis**
- **risk avoidance measures**
- **risk management**
- **processes and procedures to handle risk**

"Systems Integration" - by J. D. Palmer - pages 483-518
in *Handbook of Systems Engineering and Management*, A. P. Sage and W. B. Rouse, eds.

What should be gained from reading and studying this chapter?

(1) You should be able to define systems integration and describe its purposes.

(2) You should be able to identify the seven-phase systems integration life cycle and describe the activities in each phase.

(3) You should be able to assess your strengths and weaknesses as an aspiring professional on a systems integration team.

(4) You should be able to convey an understanding, in the context of systems integration, of issue identification, issue formulation, and issue resolution.

(5) You should be able to describe the roles and purposes of strategic planning relative to systems integration.

(6) You should be able to describe the purposes of a systems integration audit trail.

(7) You should be able to describe at least three quality assurance concepts as they pertain to systems integration.

(8) You should be able to identify and describe at least two difficulties with systems integration risk management.