A Few Words First

Audio Connection – Please mute phone (*6 toggle) – or your GM left-side name
Phone connections may be muted during presentation. Put questions in chat box.

Upcoming Meetings:
- May 8: Systems of Systems Managerial and Operational Affinity
  – Dr. Mike Yokel, Lockheed Martin
- June 12: Enterprise Data Management for Systems of Systems (SoS)
  – Barbara Mills, Sandia National Labs

CSEP Courses by *Certification Training International:*
   [Course details](#) (with more locations and dates)
   Upcoming Course Schedule (somewhat nearby):
   2019 Aug 12-16 | Austin, TX

Chapter SEP mentors: Ann Hodges alhodge@sandia.gov, Heidi Hahn hahn@lanl.gov

First slide, not retained in recording but retained in pdf presentation.

And Now - Introductions

Enchantment Chapter
Monthly Meeting

SE Fundamentals on Portfolio, Program, and Project Management (P3M)

Dr. Tina Srivastava, MIT Aeronautics and Astronautics Engineering, tinaps@alum.mit.edu

Abstract: The disciplines of Program Management and Systems Engineering are inherently intertwined. To develop and deliver complex systems, all three sides of the "iron triangle" (cost, schedule, and performance) must be known, traded, and evolved in consideration of the others. When there is tension and confusion over the roles of PMs vs. SEs, programs suffer from deadline overruns and failures. This presentation will introduce the fundamentals of system program management. The target audience includes professionals from both the systems engineering and project management spheres, including those seeking a deeper common understanding and those new to either discipline. Every systems engineer must understand key P3M fundamentals in order to critically evaluate and, when necessary, credibly challenge management on potentially unrealistic expectations related to project cost, schedule, scope, and risk. Advanced methods and tools of project management will be introduced in the context of managing complex projects. Finally, this presentation will discuss strategic issues and scenarios that cannot be fully predicted such as unplanned rework, perceived versus actual progress, and misalignments between work breakdown structures, organizations, and product architectures.

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anytime from the Library at www.incose.org/enchantment
NOTE: This meeting will be recorded

Today's Presentation

Things to Think About

- How can this be applied in your work environment?
- What did you hear that will influence your thinking?
- What is your take away from this presentation?

Speaker Bio

Dr. Tina P. Srivastava served on INCOSE's Board of Directors as Secretary from 2015 through 2018. Dr. Srivastava received the INCOSE Inaugural David Wright Leadership Award in 2014 for technical and interpersonal competencies in the practice of system engineering as a means for solving the great challenges of our planet. Dr. Srivastava is co-chair of the PM-SE Integration Working Group and is one of the authors and editors of the book *Integrating Program Management and Systems Engineering*. Dr. Srivastava is an entrepreneur and has held senior engineering leadership and technical management roles across the aerospace, cyber security, and commercial sectors. She was awarded the National Technical Innovation Award as Chief Engineer at Raytheon, leading a team of 30 in the development and deployment of an advanced radar system. Dr. Srivastava earned her S.B., S.M., and Ph.D. from MIT in Aeronautics and Astronautics Engineering, Strategy, and Innovation. She is a lecturer at MIT in the areas of aerodynamics, complex systems, technology road mapping and selection, and aviation. Dr. Srivastava is also an FAA certified pilot.

Dr. Tina P. Srivastava (tinaps@alum.mit.edu)

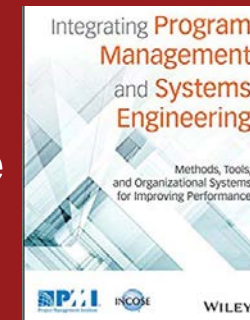# SE Fundamentals on Portfolio, Program, and Project Management (P3M)

Background: Dr. Tina P. Srivastava

- S.B. Aeronautics & Astronautics, MIT
- S.M. Engineering & Management, MIT
- Ph.D. Strategy, Innovation, & Engineering, MIT

- Founded security company with fellow MIT alums

- Board of Directors
- One of the Authors/ Editors of:

Integrating Program Management and Systems Engineering
Methods, Tools, and Organizational Systems for Improving Performance
WILEY

MIT **Zero-Gravity Flight Testing**

Raytheon

Pilot

INCOSE

- Chief Engineer, Raytheon
- $40M Radar Program
- Team of 30
- Successful transition
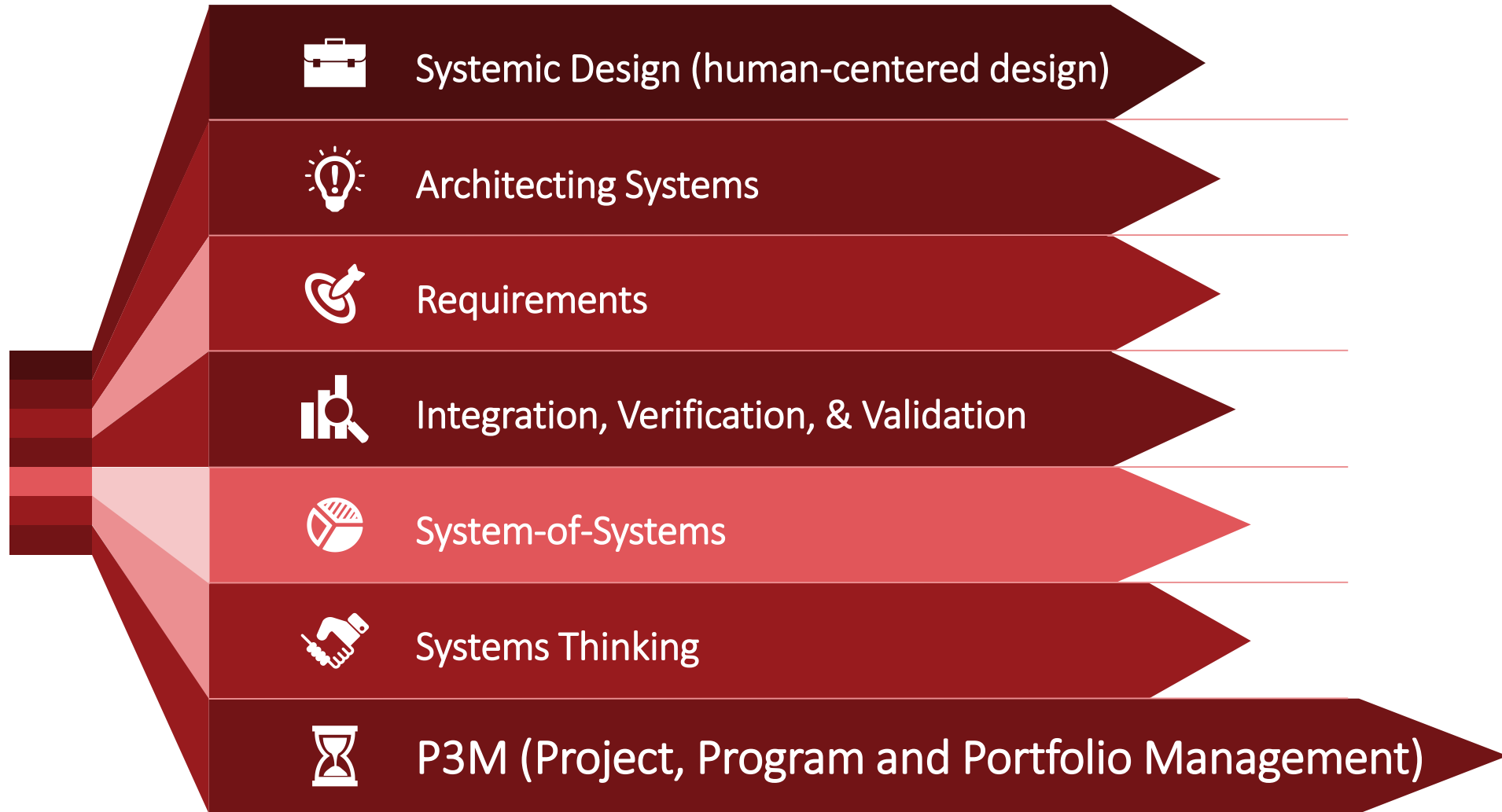- Received National Recognition for Technical Innovation

TINA P. SRIVASTAVA
INNOVATING IN A SECRET WORLD
The Future of National Security and Global Leadership

- Forthcoming book on innovation strategies for complex systems, security July 2019

Systems Engineering Fundamentals

SE Fundamentals

- Systemic Design (human-centered design)
- Architecting Systems
- Requirements
- Integration, Verification, & Validation
- System-of-Systems
- Systems Thinking
- P3M (Project, Program and Portfolio Management)

Exercise: Who has the responsibility?

Program Manager

Systems Engineer

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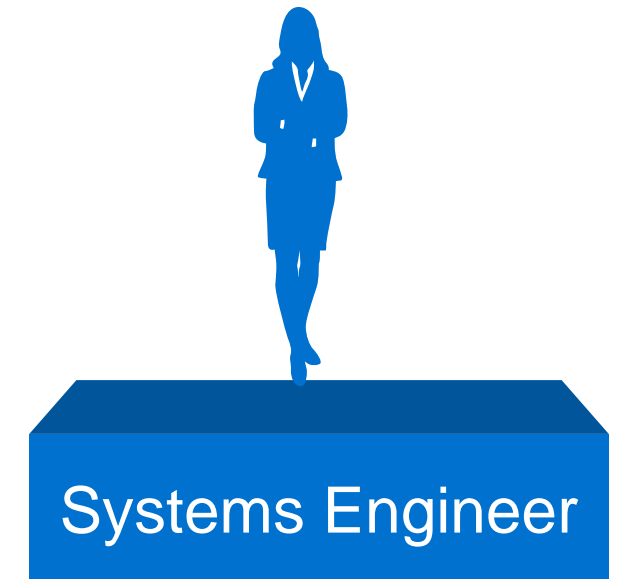# Exercise: Who has the responsibility?

Technical Requirements

?

Program Manager

Systems Engineer

Exercise: Who has the responsibility?

Technical Requirements

Program Manager

Systems Engineer

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Exercise: Who has the responsibility?

Managing the program's budget

?

Technical Requirements

Program Manager

Systems Engineer

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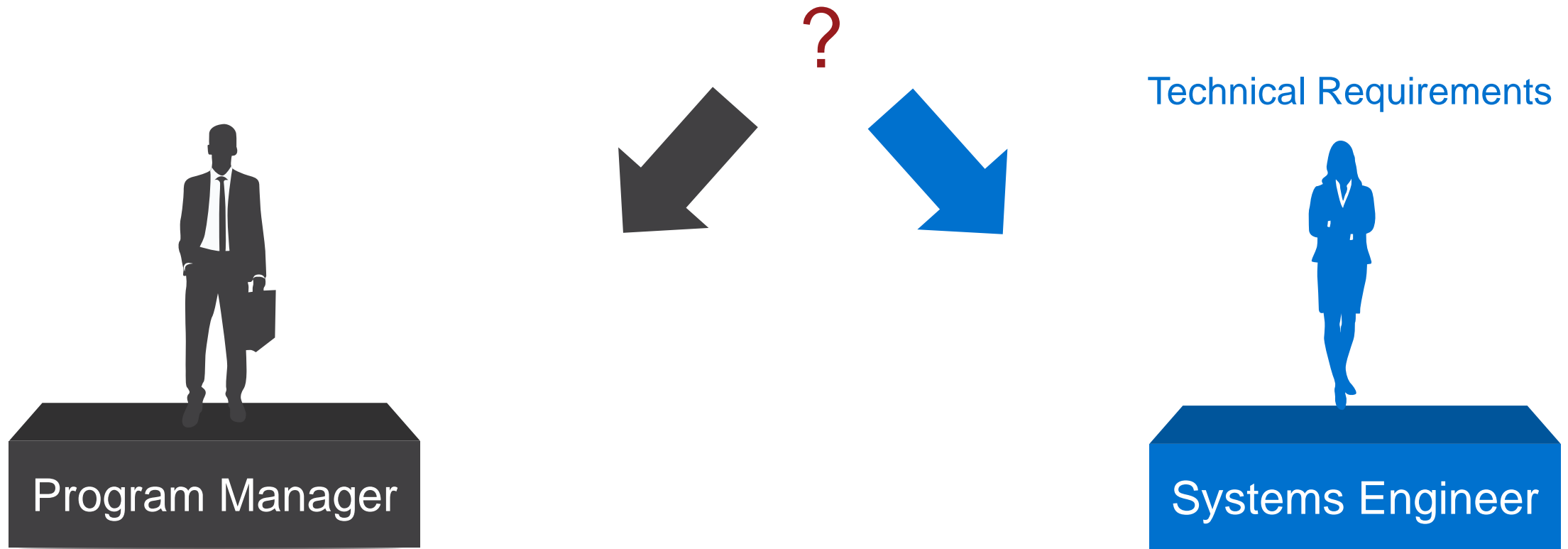
Exercise: Who has the responsibility?

Managing the program's budget
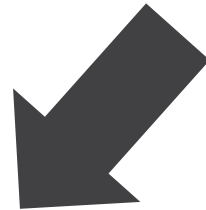
Technical Requirements

Program Manager

Systems Engineer

Exercise: Who has the responsibility?

External Supplier Relations

?

Managing the program's budget

Technical Requirements
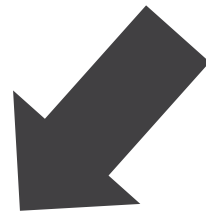
Program Manager

Systems Engineer

Exercise: Who has the responsibility?

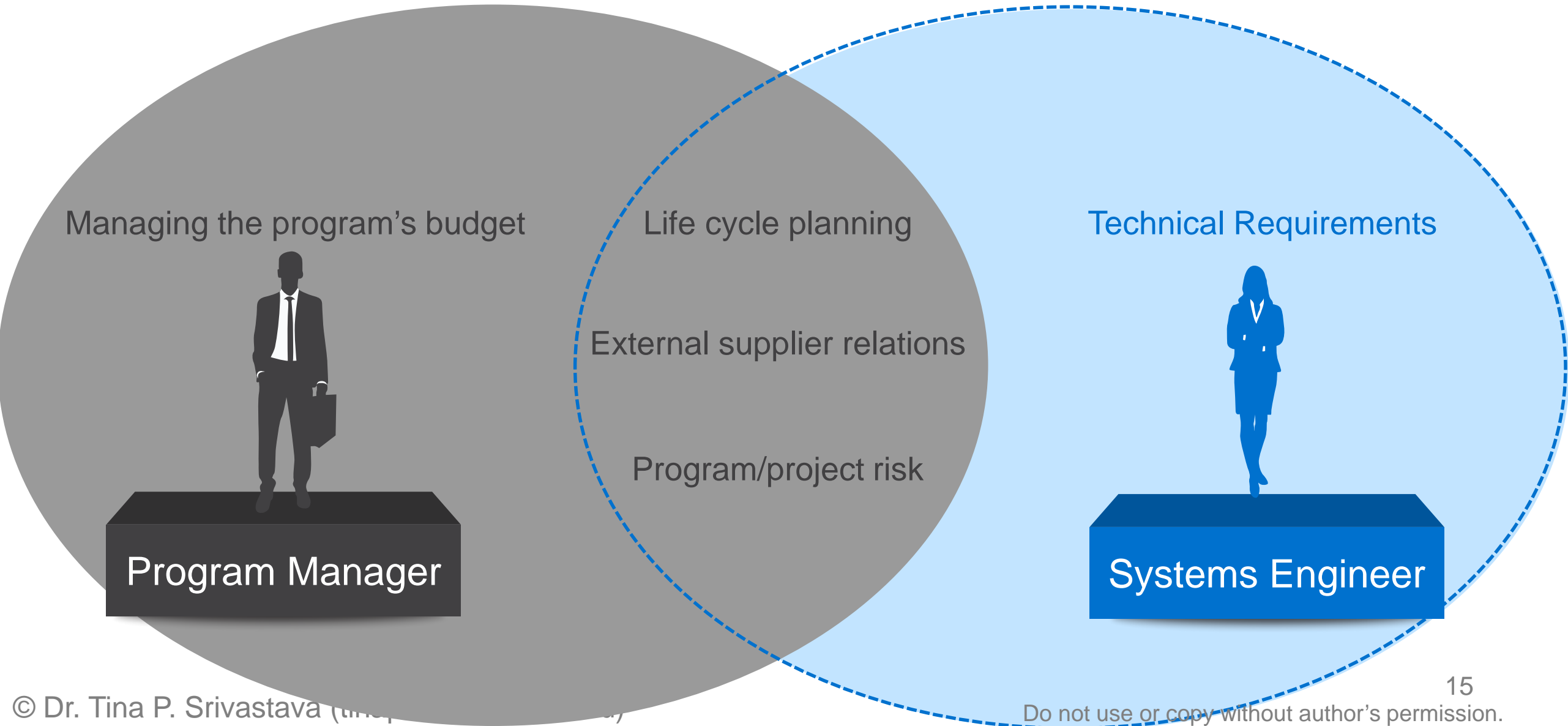## Life cycle planning

?

Managing the program's budget

Technical Requirements

Program Manager

Systems Engineer

Exercise: Who has the responsibility?

Managing the program's budget

Life cycle planning

External supplier relations

Program/project risk

Technical Requirements

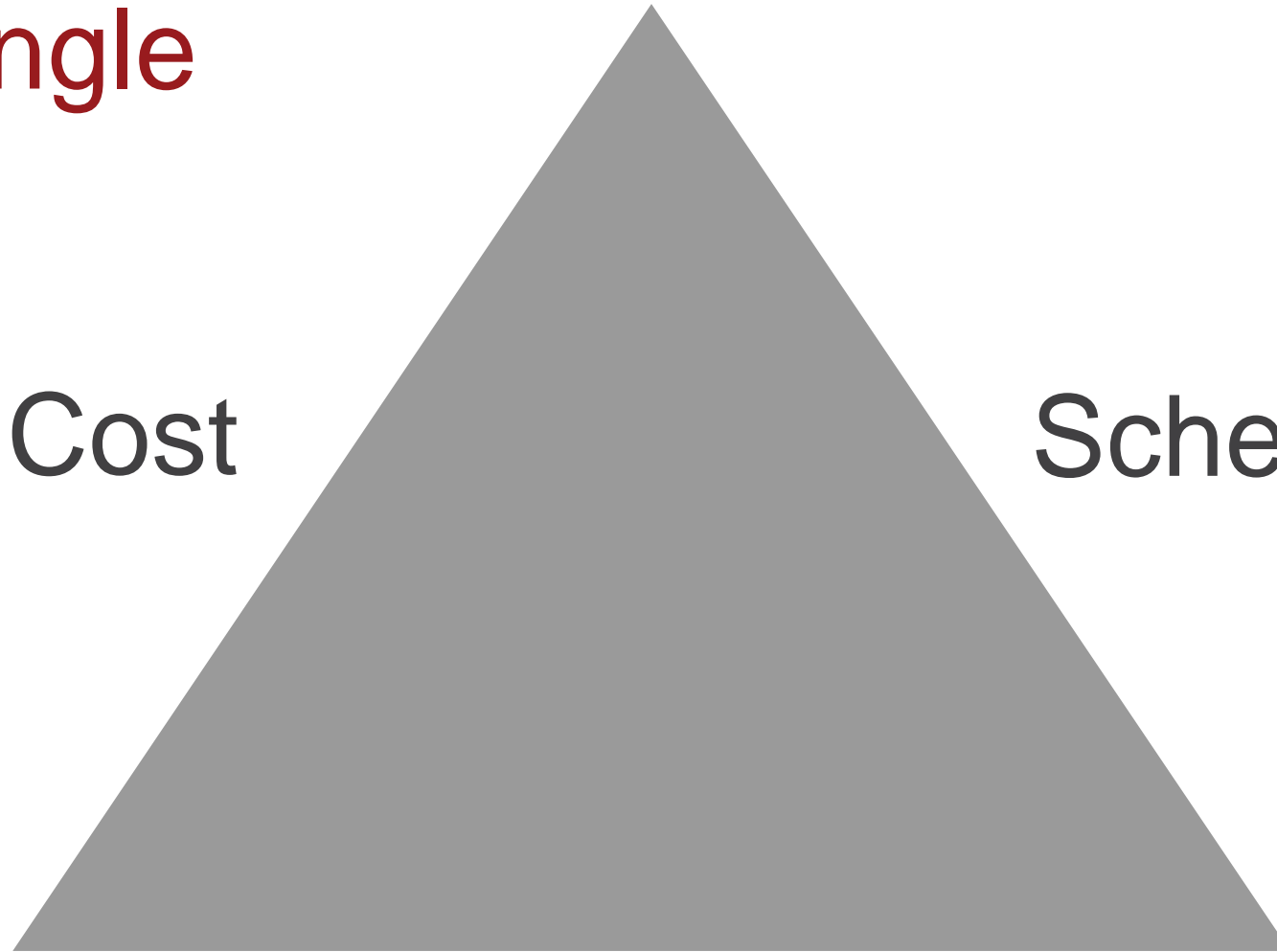**Program Manager**

Systems Engineer

Iron Triangle

Cost

Schedule

Performance

Fundamentals of P3M

What is a Project?

- "A project is a temporary endeavor undertaken to create a unique product, service, or result."

Definitions

Ref: (PMI, 2013)

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What is a Program?

- "A group of related projects, subprograms, and program activities that are managed in a coordinated way to obtain benefits not available from managing them individually."

 Definitions

Ref: *PMI Lexicon of Project Management Terms* (PMI, 2015)

Program vs. Project vs. Portfolio

- "Unlike a project where the focus is on producing a specific output based on a defined scope, a program begins with a desired benefit or set of benefits."

Definitions

Technology Roadmapping

Internalizing Portfolio vs. Program vs. Project

What is Technology Roadmapping?

- Tool that shows the relationship across technologies, capabilities, products/services, and needs

- Method to align investments in technology and the new development of capabilities to deliver on future market needs

Definitions

Types of Technology Roadmaps

- Product planning
- Capability development
- Strategic planning
- Long range planning
- Knowledge planning
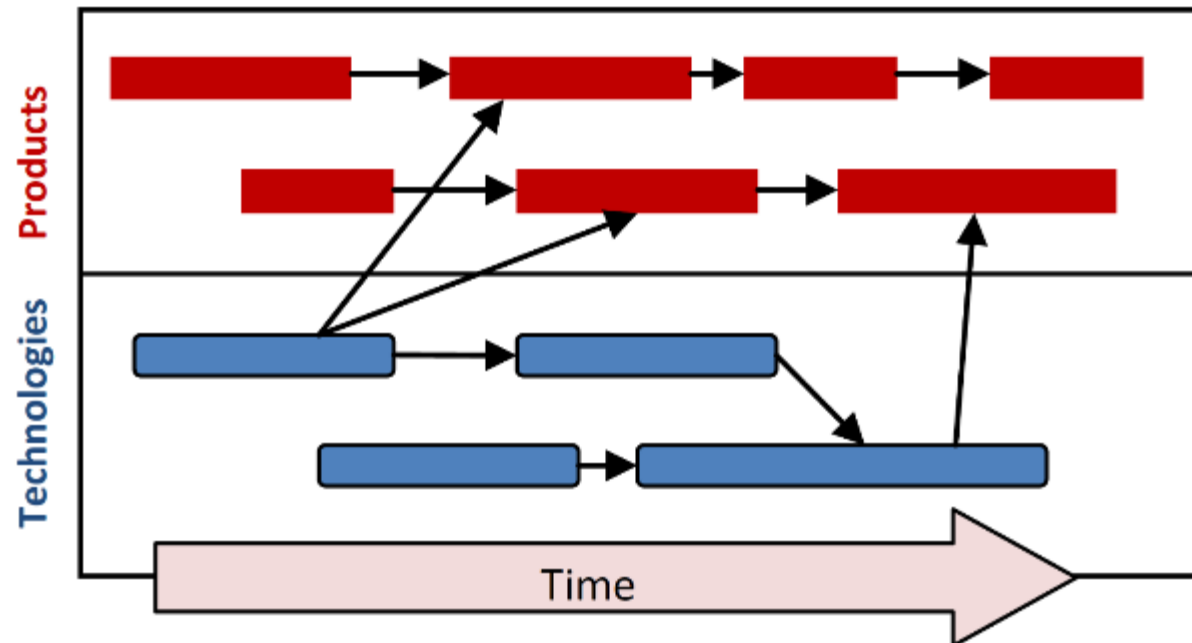- Project planning
- Integration planning

Definitions

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Types of Technology Roadmaps

- ## Product planning
  - – Different generations of products are tied to the necessary technologies for their development

Ref: Bernal, Luis, et al. "Technology roadmapping handbook." *International SEPT Program, University of Leipzig* (2009).
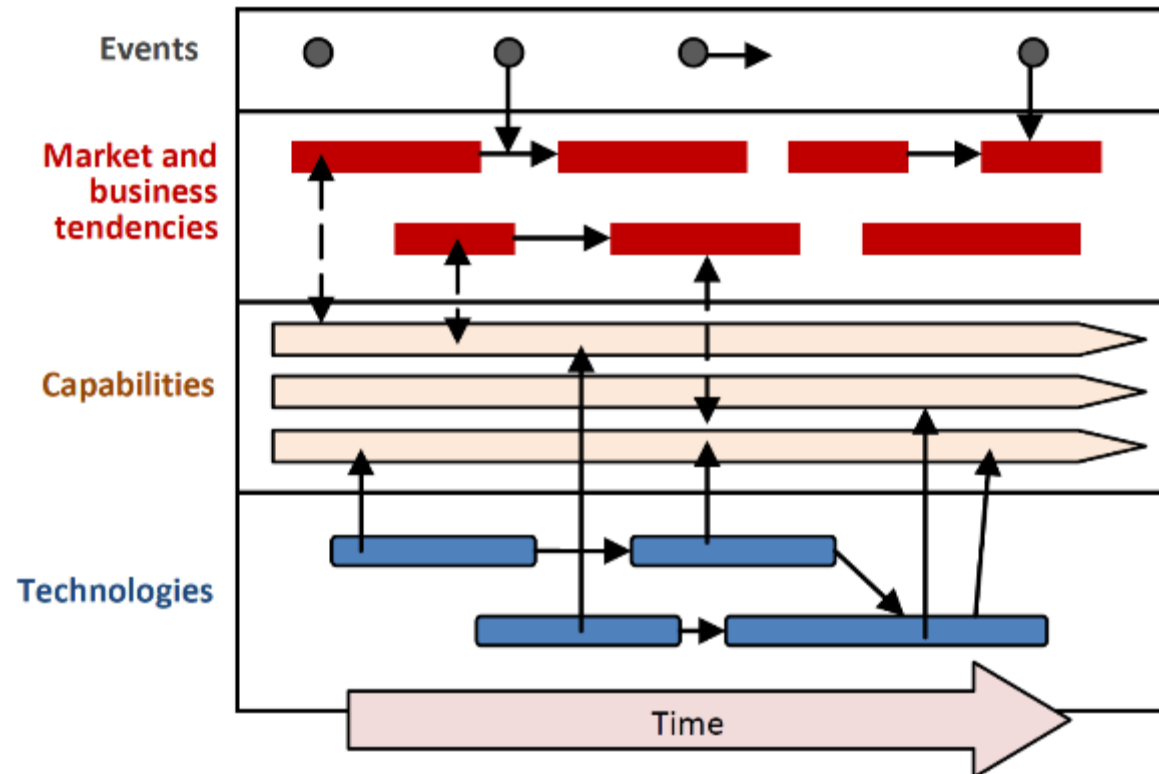
Types of Technology Roadmaps

- ## Capability Development
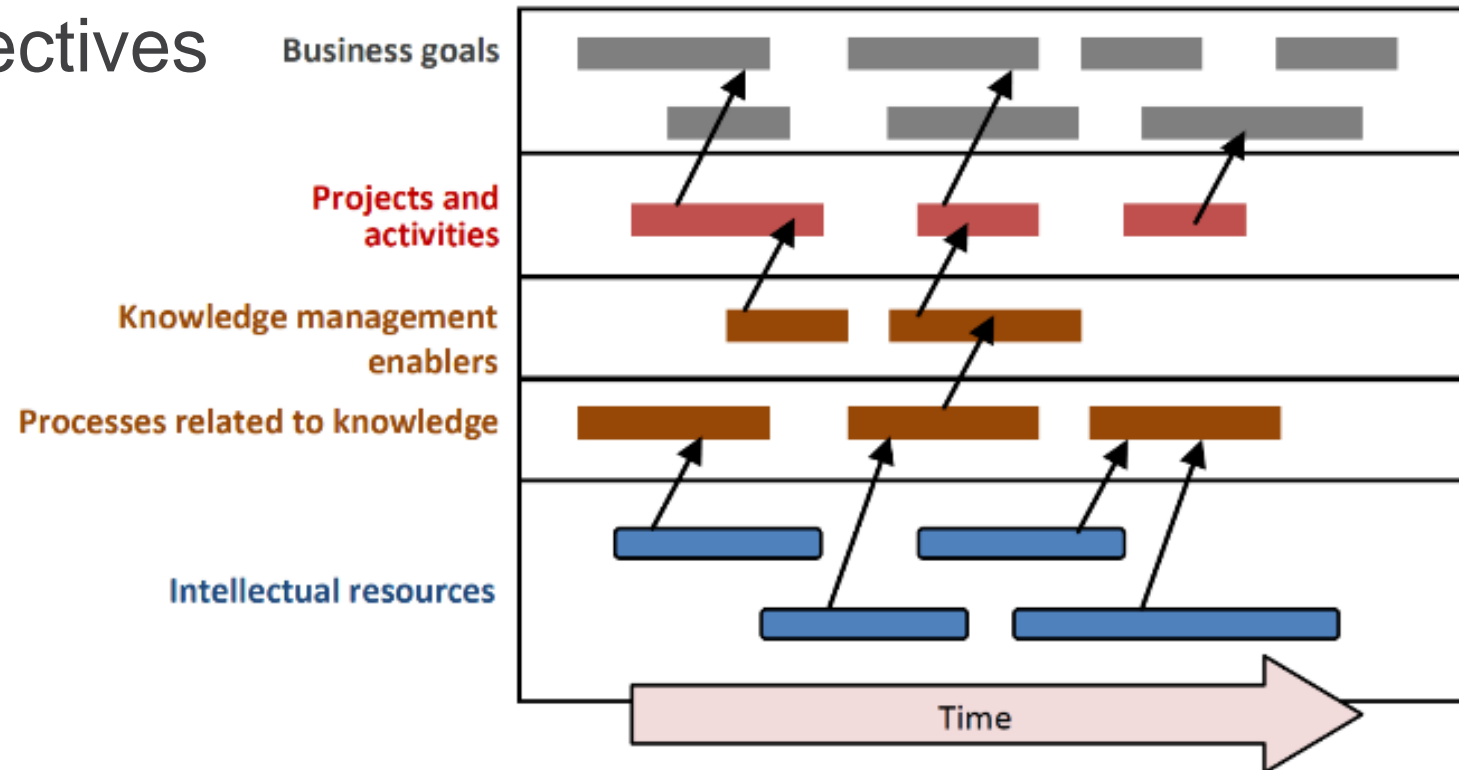 - – Technologies map to capabilities that map to market needs

Ref: Bernal, Luis, et al. "Technology roadmapping handbook." *International SEPT Program, University of Leipzig* (2009).

Types of Technology Roadmaps

- ## Knowledge Planning
  - – Align intellectual resources, capabilities, and business objectives
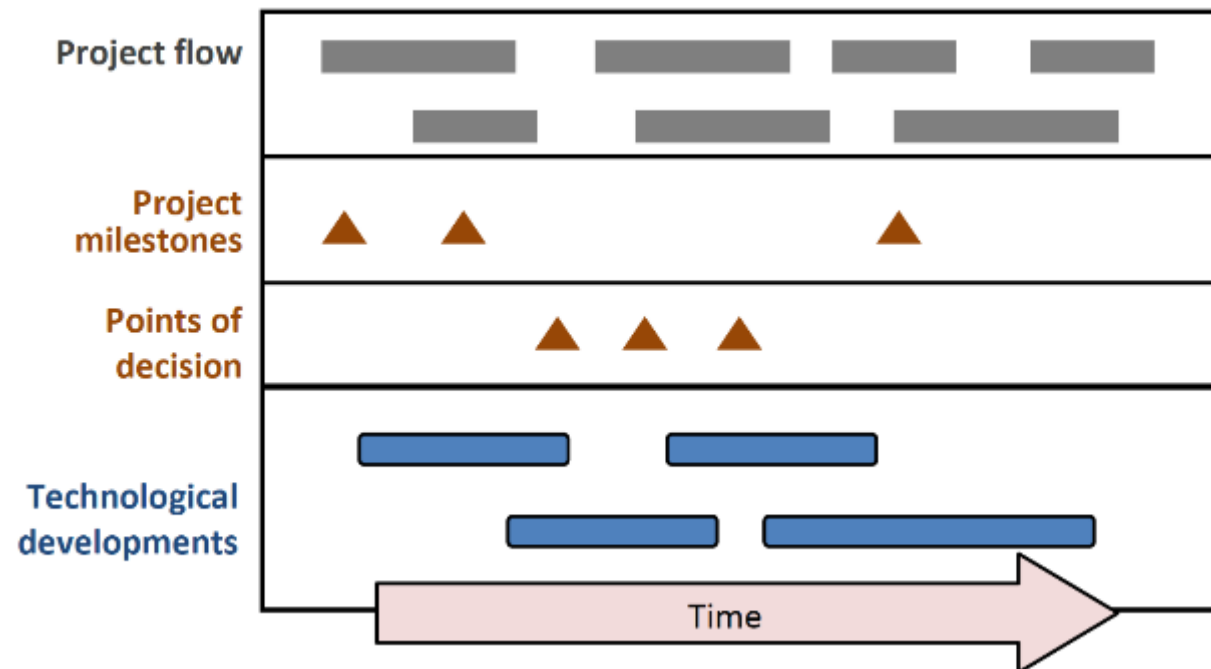

Ref: Bernal, Luis, et al. "Technology roadmapping handbook." *International SEPT Program, University of Leipzig* (2009).
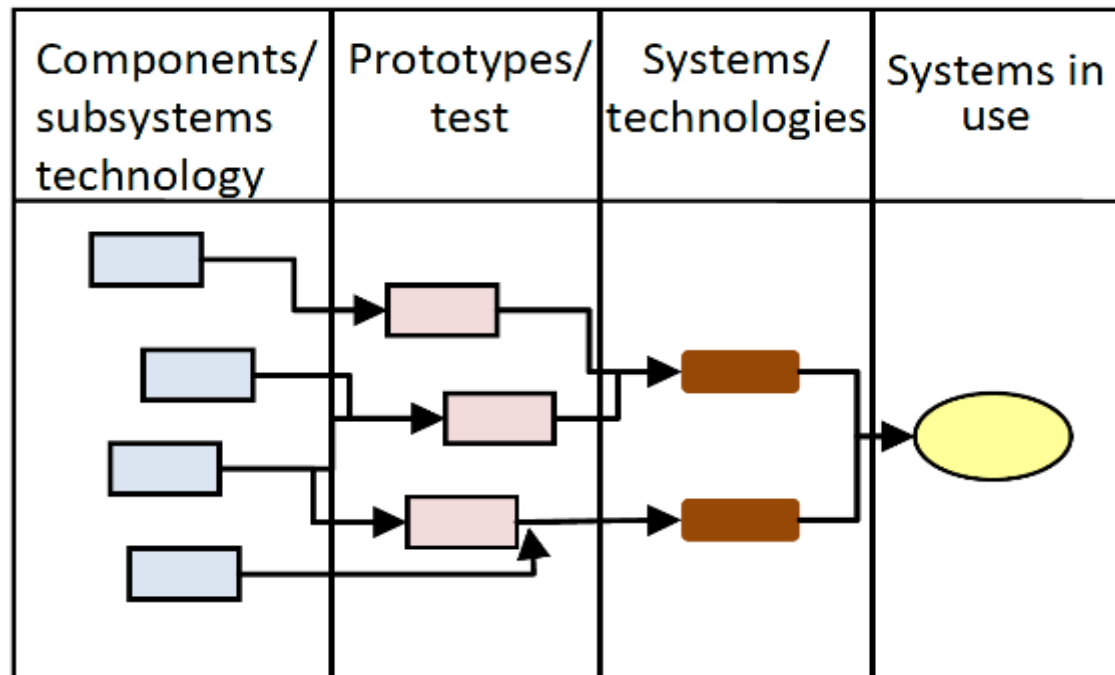
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Types of Technology Roadmaps

- Project Planning
  - Align project activities with technology development

Types of Technology Roadmaps

- Integration Planning
  - How technologies and products combine to create new systems and capabilities

Ref: Bernal, Luis, et al. "Technology roadmapping handbook." *International SEPT Program, University of Leipzig* (2009).

Portfolio vs. Program vs. Project

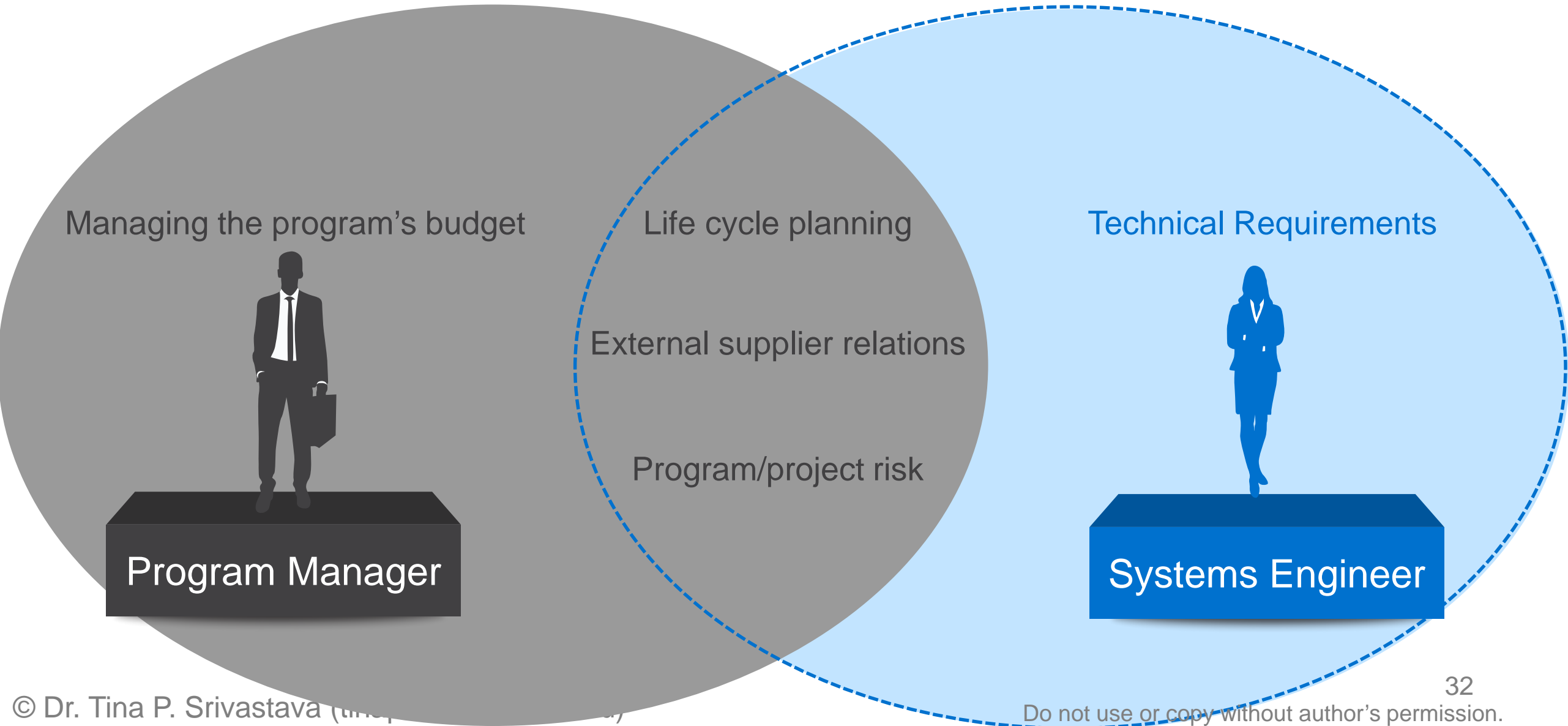- Discussion

SE, Project Management, Program Management

	Example: New Aircraft Development
Program Management	**Benefit:** Global market leadership in hub-to-hub connections
Project Management	**Deliverable:** Deliver engine for $16 million on 9 May 2020
Systems Engineering	**Functionalities including requirements:** Optimization of the entire system such that optimization of individual component does not lead to sub-optimization of the whole. The new engine must have over 300kN take-off thrust, weigh less than 6 tons, must be designed for manufacture on existing assembly lines, cost no more than $16 million to produce and be FAA certified by 9 May 2020

The Need for Integrating SE and PM

Exercise: Who has the responsibility?

Managing the program's budget

Life cycle planning

External supplier relations

Program/project risk

Technical Requirements

Program Manager

Systems Engineer

Tangible effects of unproductive tension

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Unproductive Tension

- Failing to communicate and establish a common set of objectives shared by all,

- Individuals/groups focusing on achieving objectives defined by their own discipline identity and/or processes,

- Being unable to work together to achieve the desired outcome, and

- Not valuing others' roles and contributions to achieving the desired outcome.

Unproductive Tension
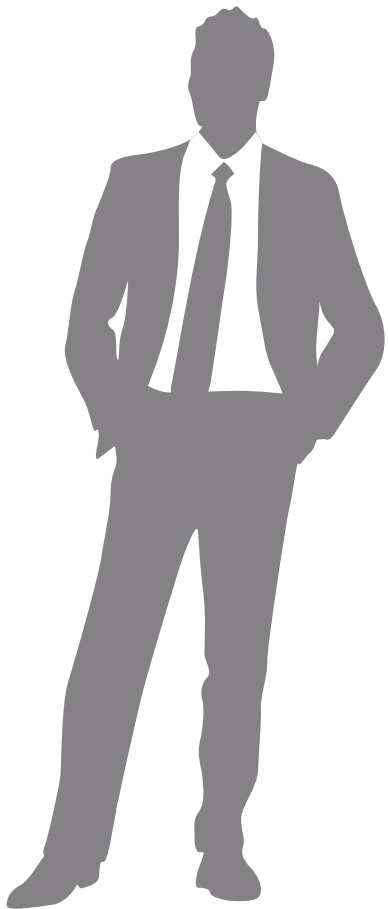
…when there's a conflict of interest between program manager and systems engineer. We had a project where it was not possible to meet the customer's budget for executing the project. We tried to cut cost. We reviewed the requirements, reduced or simplified some requirements in order to meet the customer's budget. Then, the program manager didn't accept any of the proposals; the design that was proposed was more important than meeting the requirements.

- Systems engineer, aerospace, Europe

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Value Proposition for Integration

- Cutting rework costs, cutting delay costs

- Increased performance from PM and SE resources

- Solution that meets stakeholder needs, delivered on time and within budget

Understanding SEs and PMs

- Backgrounds
- Understanding of the role by the customer
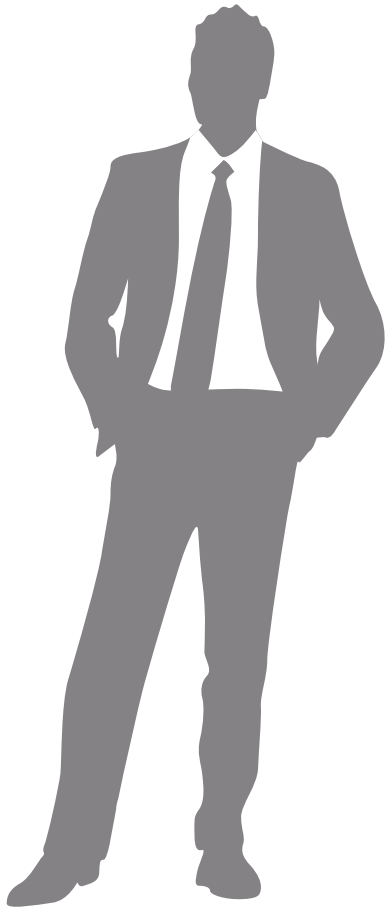- Understanding of the role by the organization

Program Manager

Systems Engineer

Example: PM view vs. SE view

Another service chief stated that requirement changes made during weapon system development are often viewed as sacrificing capability rather than reconciling requirements with operational conditions. The chief was concerned that program managers too often take the view that requirements cannot be changed and avoid elevating problems to leadership before they become critical, forgoing the opportunity to make needed trade-offs.
- U.S. Government Accountability Office 2015 report

Ref: *Integrating Program Management and Systems Engineering: Methods, Tools, and Organizational Systems for Improving Performance*

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Characteristics of Integrated Teams

- The program manager is involved in the technical aspects of the program

- Have the program manager and systems engineer working in the same location

- Collaborative decision making, team-based working environment

- Shared responsibility toward a common goal

- Understand the differences, culture, background, and behavior of the disciplines

Ref: *Integrating Program Management and Systems Engineering: Methods, Tools, and Organizational Systems for Improving Performance*

More Resources and Information

More Resources and Information

PM-SE Integration WG

INCOSE Connect Address
https://connect.incose.org/WorkingGroups/pm-se%20integration/SitePages/Home.aspx

INCOSE Web Page
http://www.incose.org/ChaptersGroups/WorkingGroups/process/pm-se-integration

Join the WG
Join by checking box next to WG on your INCOSE member profile

PM-SE Virtual Conference

PMI® Program Management & System Engineering Virtual Conference *in partnership with INCOSE and MIT*
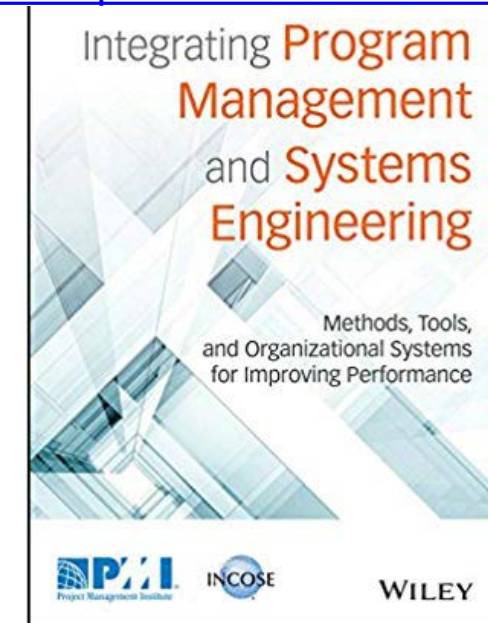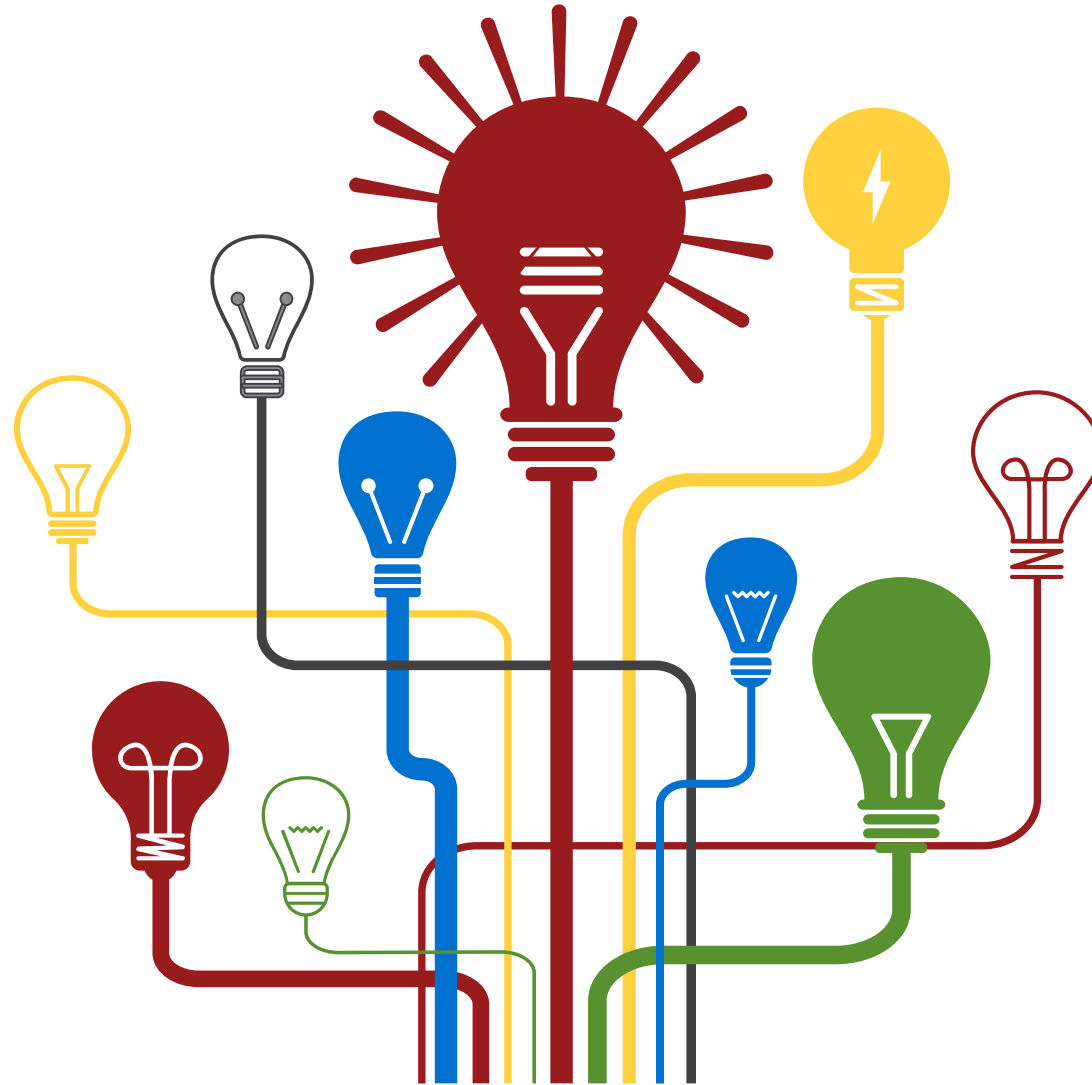27 September | 8:00 am – 4:30 pm ET | 6 PDUs

- Hosted by PMI
- INCOSE members receive free-admission
- Now available on archive

Book from INCOSE-PMI Alliance

Available for sale with an INCOSE membership discount on INCOSE Store:
https://connect.incose.org/Pages/Product-Details.aspx?ProductCode=PMandSEbook

Integrating Program Management and Systems Engineering
Methods, Tools, and Organizational Systems for Improving Performance

Q&A

Today's Presentation

Things to Think About

- How can this be applied in your work environment?
- What did you hear that will influence your thinking?
- What is your take away from this presentation?

Please

The link for the online survey for this meeting is

- www.surveymonkey.com/r/2019_04_MeetingEval

- www.surveymonkey.com/r/2019_04_MeetingEval

Look in GlobalMeet chat box for cut & paste link

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- The library page at: www.incose.org/enchantment

- Recording will be there in the library soon