Model Portfolio Management (MPM): A Guide for Best Practices

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Agenda
MPM Guide Presentation Topics

- **Background**
  - *Problem/Solution*
  - *Implementation*
  - *Definitions*
  - *Use Cases*
  - *Approach*
  - *Deliverables*
  - *Roles and Responsibilities*
- **Life Cycle** (Goals, Work Products, and Activities)
  - *Initiation*
  - *Planning*
  - *Execution*
  - *Monitoring and Control*

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Problem/Solution

Bottom Line Up Front (BLUF)

- **Problem**
  - *Acquirers routinely ask for "Model Management" work and get large variance of responses*
  - *"Model Management" scored low by organizations – International Council on Systems Engineering (INCOSE) Model-Based Capabilities Matrix*
  - *"Model Management" as a significant area of improvement – Systems Engineering Research Center (SERC) Systems Engineering (SE) Survey*
  - *No prior guide or standard that addresses managing a collection of models*

- **Solution**
  - *The Aerospace Corporation wrote the "Model Portfolio Management (MPM) Guide" technical operating report TOR-2020-01577, cleared for public release to serve organizations that would like to manage their collection of models and to serve as a solicitation reference document*
  - *The TOR is already being used as a reference for US government acquisitions*
  - *INCOSE is in the process of adopting the guide*

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Implementation

Where does the MPM Guide fit in

Acronyms
DE – Digital Engineering
MBSE – Model-based Systems Engineering

Define "what" needs to be done

Address the "how" and "how well"

DE Strategy

DE Implementation

MBSE Implementation

Model Portfolio Management Guide

Model Life Cycle Management Guide

Model Integration Guide

Model Style Guide

Model Requirement Guide

Model Metrics Guide

Model Verification & Validation Guide

Model Security Guide

Model Configuration Management Guide

Model Development Plan

Source: MPM Guide Figure 2. Model-Relevant Tree

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Definitions
Key Definitions in MPM Guide

Term	Definition
Portfolio	*A collection of **projects** grouped together to facilitate effective management of work to meet strategic business objectives. (Mathur, 2006)*
Model Portfolio	*A collection of **models** grouped together to…*
Model Portfolio Management	*The administration of a collection of models to achieve strategic objectives…*
Model Portfolio Management Life Cycle	*A continuous set of activities to be performed for the Model Portfolio Management process to be successful.*

Full definitions to these terms and many others can be found in the MPM Guide
Source: "The Standard for Portfolio Management," Project Management Institute (PMI).

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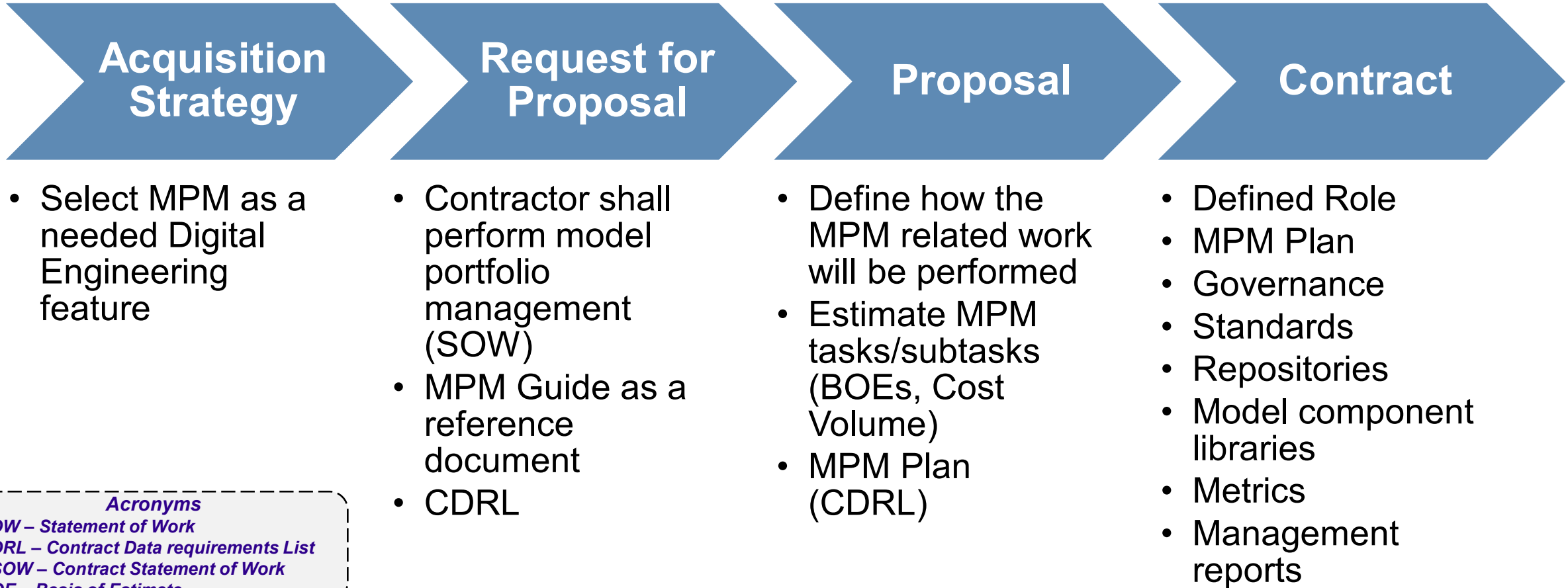
Use Cases
How to use the MPM Guide
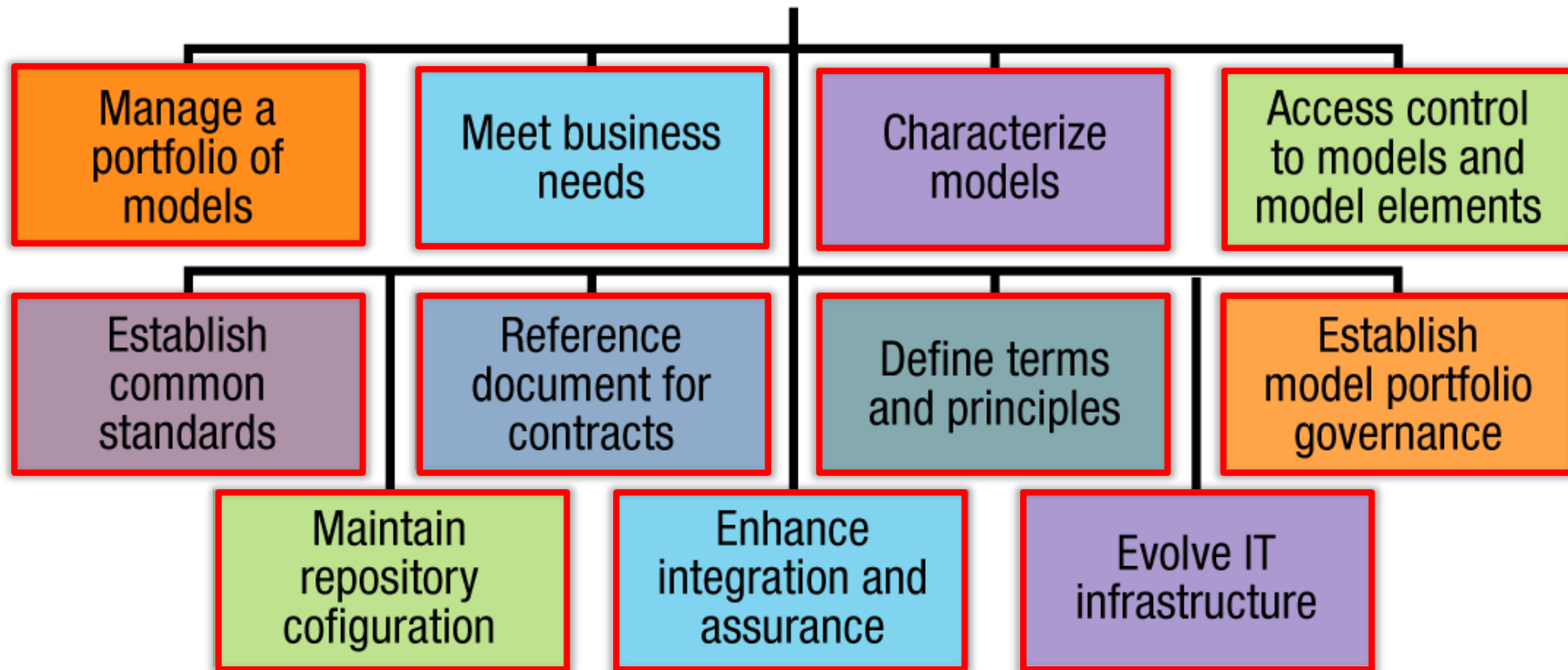
Full definitions to these Use Cases and many others can be found in the MPM Guide

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Approach
Approach for Contracting

Acquisition Strategy	Request for Proposal	Proposal	Contract
• Select MPM as a needed Digital Engineering feature	• Contractor shall perform model portfolio management (SOW) • MPM Guide as a reference document • CDRL	• Define how the MPM related work will be performed • Estimate MPM tasks/subtasks (BOEs, Cost Volume) • MPM Plan (CDRL)	• Defined Role • MPM Plan • Governance • Standards • Repositories • Model component libraries • Metrics • Management reports

Acronyms
SOW – Statement of Work
CDRL – Contract Data requirements List
CSOW – Contract Statement of Work
BOE – Basis of Estimate

MPM Guide as an RFP reference document to ensure government insight, access, and use.

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Deliverables
Recommended Deliverables from Contractors to Government

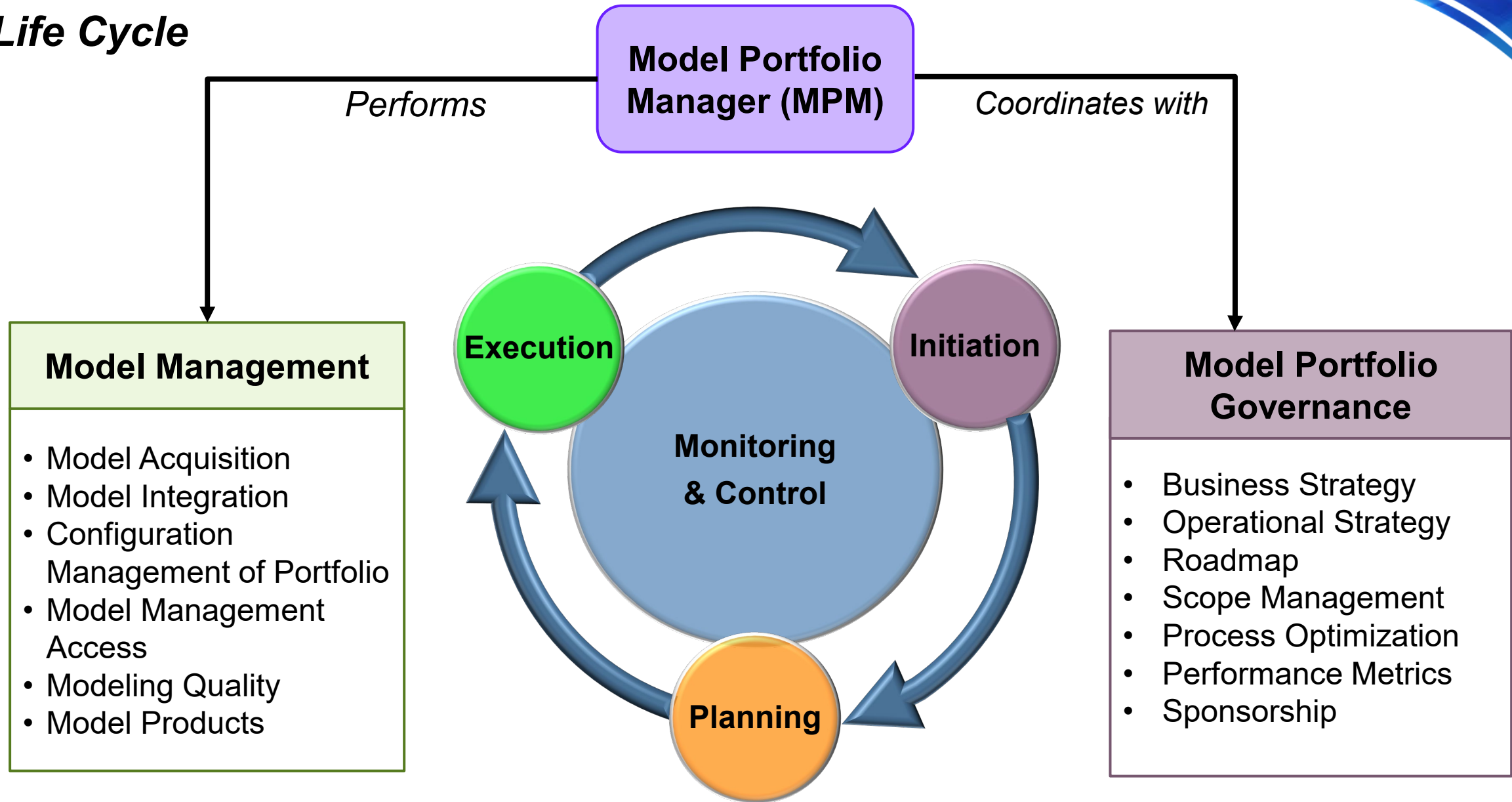| Name	Description
MPM Plan/Model	Defines the key components in the MPM Life Cycle (resources, structure, hierarchy, processes, users, scope, etc.
Governance Plan/Model	The governance plan may be a stand-alone view (documented or modeled) or may be a subsidiary to the MPM Plan.
Model Accession List	An index of working models made readily available for review by model integrators.
Model Data Accession List	An index of working data items accessible to relevant stakeholders to review model data.
Model View Accession List	An index of digital views accessible to relevant stakeholders to review model views.
MPM Risks Register	An index of risks and mitigation plans impacting the model portfolio.

Full Description to these deliverables and many others can be found in the MPM Guide

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Roles and Responsibilities

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Life Cycle

Model Portfolio Manager (MPM)

Performs → **Model Management**

Coordinates with → **Model Portfolio Governance**

Model Management

- Model Acquisition
- Model Integration
- Configuration Management of Portfolio
- Model Management Access
- Modeling Quality
- Model Products

Model Portfolio Governance

- Business Strategy
- Operational Strategy
- Roadmap
- Scope Management
- Process Optimization
- Performance Metrics
- Sponsorship

Cycle (center): Execution · Initiation · Monitoring & Control · Planning

MPM roles of Management and Governance across the MPM Life Cycle

Source: "The Standard for Portfolio Management," Project Management Institute (PMI)

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MPM Initiation

GOALS
- Business/Operational Strategy
- Portfolio Components
- Financial Goals
- Performance Metrics
- Communication
- Governance
- Stakeholders' Definition & Roles
- Ongoing Management Plans

Initiation

ACTIVITIES
- MPM Strategy
- Model Management CONOPS
- Prioritization Criteria
- Stakeholders' Definition & Roles
- Communications Planning
- Model Portfolio Manager
- MPM Roadmap
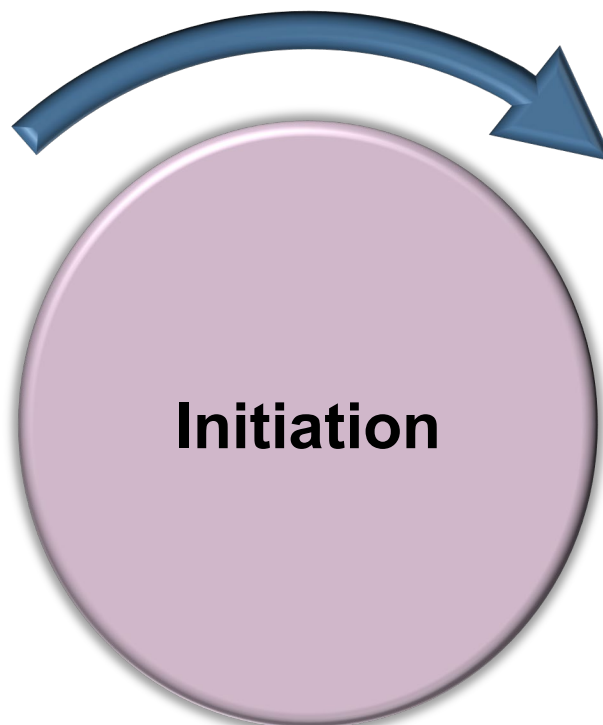
Examples
- *Stakeholders' Definition & Roles*
- *Strategy*
- *Modeling Guidelines*
- *Intellectual Property Rights*
- *IT Infrastructure*

Acronyms
CONOPS – Concept of Operations

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Table 1. Stakeholder Roles, Interest and Expectation

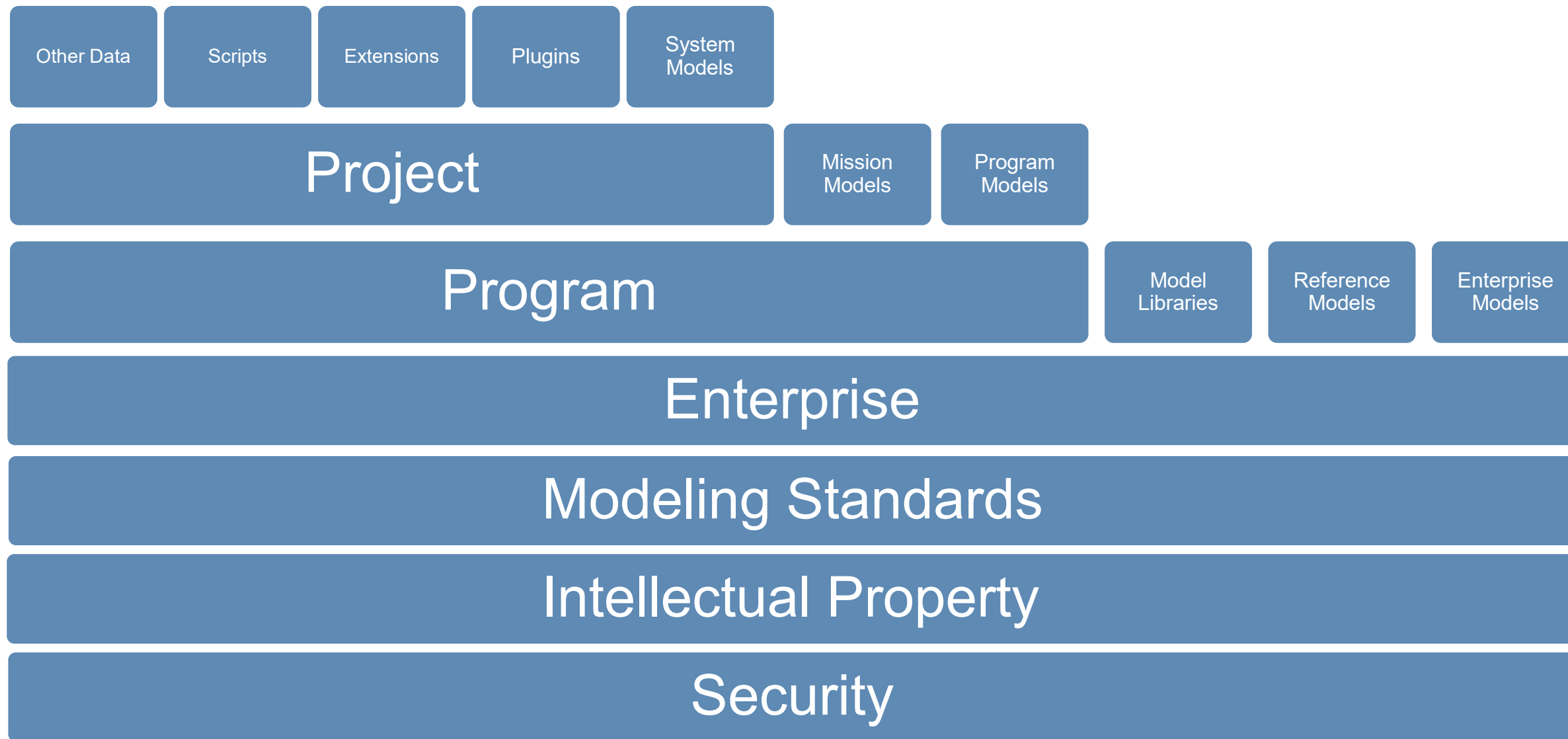| Stakeholder	Roles	Interests	Expectations
Sponsor or Organizational Executive	Provide funding and resources	Alignment with goals	Informed regularly of key portfolio decisions and milestones
Model Portfolio Manager	Provides the management of the portfolio of models needed by the organization	Portfolio of models meets the organizational goals and objectives	At the sponsor's request, performs portfolio model management with the Portfolio Governing Body and model managers
Portfolio Governing Body	Oversees the portfolio priorities, manages spending, and manages timely delivery of value	Portfolio level risks and issues that require key decision and change management	Informed regularly of developments, change needs, and progress
Model Managers	Ensures model life cycle management	Mitigates portfolio level risks and issues impacting their model	Adheres to MPM agreements and is informed of portfolio changes, risks and issues

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MPM Planning

GOALS

- MPM Plan
- MPM Scope
- Budgeting
- Model/Data Interdependencies
- Risks & Issues
- Resourcing
- Prioritization
- Sponsor/Stakeholder Accountability
- Portfolio Metrics
- Scope of Components
- Product/Service Requirements

Planning

ACTIVITIES

- MPM Scope Plan
- MPM Plan
- Modeling Resources
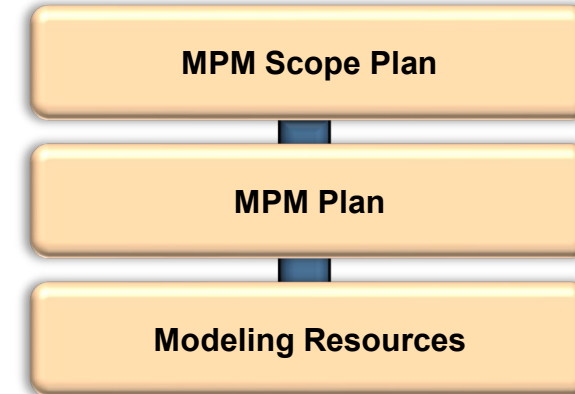
Examples

- **Portfolio Components**
- *Model & Data Registries*
- *Accession Lists*
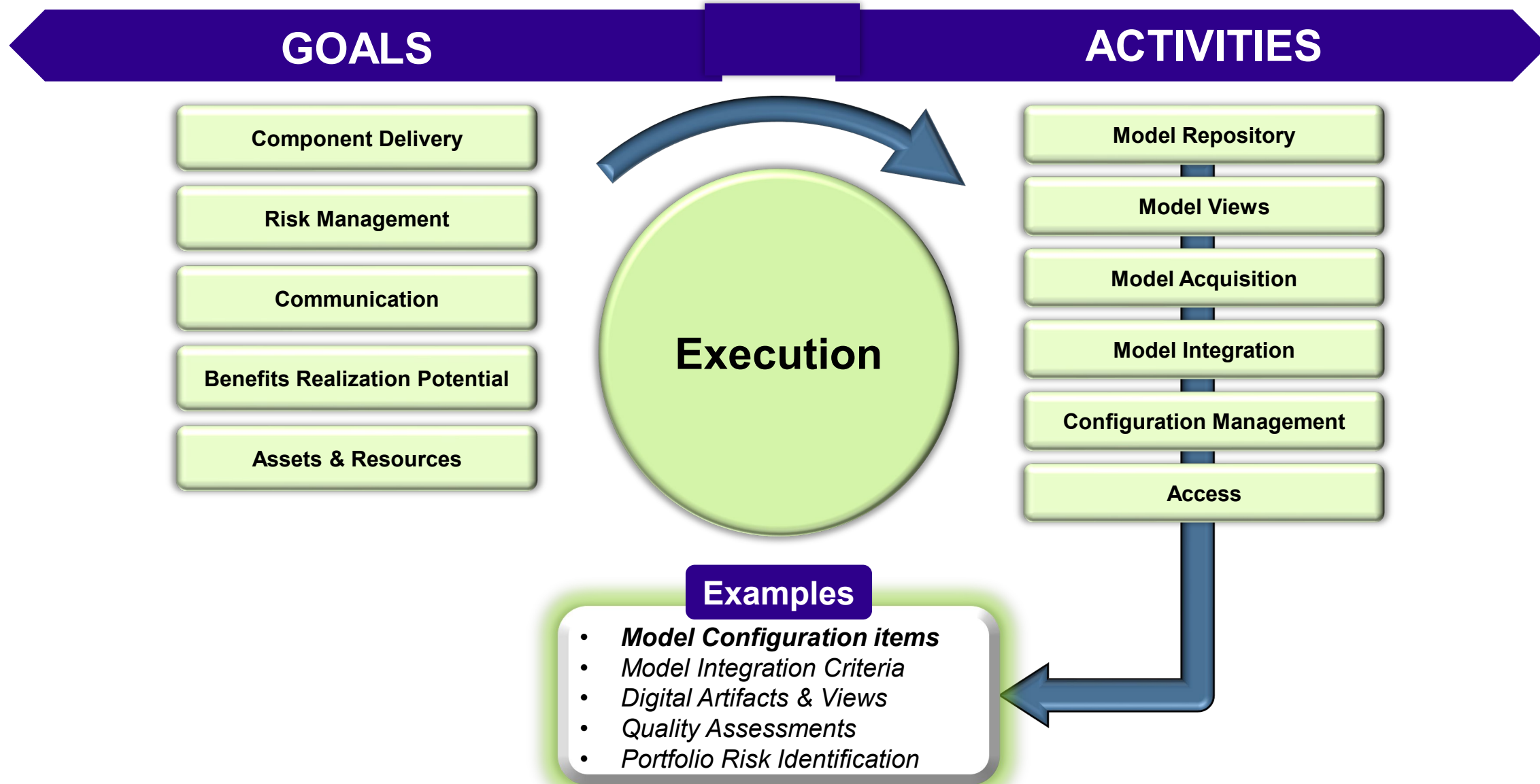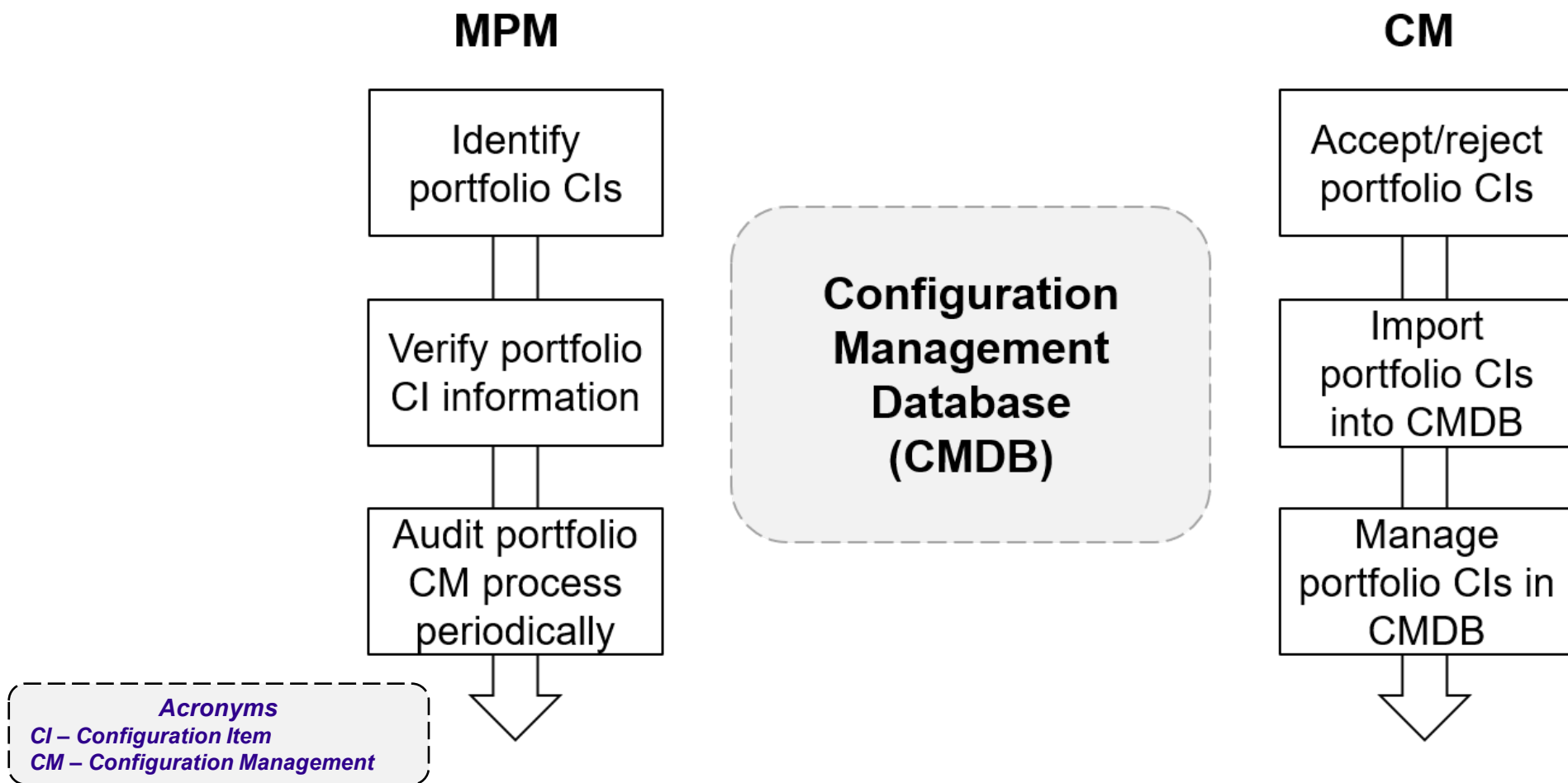- *Modeling Software*
- *Model Libraries*

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Figure 3. Portfolio Components

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Image Source: TOR-2020-01577 Model Portfolio Management Guide

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MPM Execution

GOALS

- Component Delivery
- Risk Management
- Communication
- Benefits Realization Potential
- Assets & Resources

Execution

ACTIVITIES

- Model Repository
- Model Views
- Model Acquisition
- Model Integration
- Configuration Management
- Access

Examples

- **Model Configuration items**
- Model Integration Criteria
- Digital Artifacts & Views
- Quality Assessments
- Portfolio Risk Identification

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Figure 5. Responsibilities of Portfolio CM

Image Source: TOR-2020-01577 Model Portfolio Management Guide

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MPM Monitoring & Control

GOALS | ACTIVITIES

Portfolio Performance

Organizational Needs & Changes

Standards Compliance

Monitoring & Control

MPM Metrics

Portfolio Risk Monitoring

Portfolio Optimization

Model Maintenance

Examples

- ***Model Reuse***
- *Model Views Update*
- *Model Data Consistency*
- *Model Library Adjustments*
- *Model Retirement & Archive*

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Figure 6. Model Portfolio Reuse

Image Source: TOR-2020-01577 Model Portfolio Management Guide

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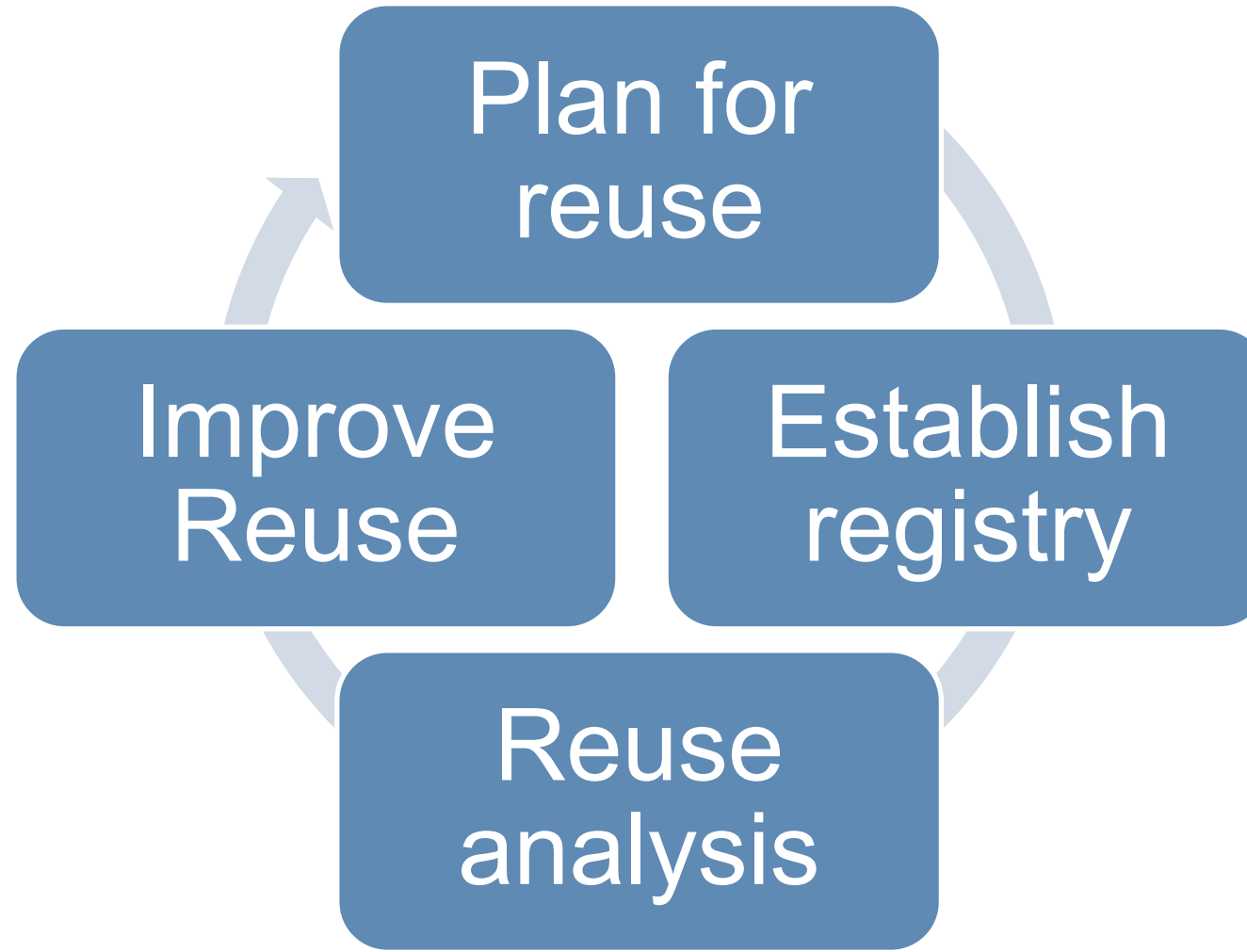
Summary

The Model Portfolio Management Guide:

- Solution to not having a common definition of what is "Model Management"
- Tailorable to choose what is most important to an organization
- Serves as a reference document for model-based acquisition to ensure government insight, access, and use
- Already being used by US government
- Cleared for public release
- Being adopted by INCOSE

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Thank You

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References

1. INCOSE, "Model-Based Capabilities Matrix and User's Guide," INCOSE, 2020.
2. D. o. Defense, "DoD Digital Engineering Strategy," DoD, 2018.
3. The Standard for Portfolio Management, Fourth Edition ed., Pennsylvania: Project Management Institute, Inc., 2017.
4. The Standard for Program Management, Fourth Edition ed., Pennsylvania: Project Management Institute, Inc., 2017.
5. "Systems and software engineering – Methods and tools for Model-based systems and software engineering (Draft)," International Organization for Standardization, Geneva, 2020.
6. "ISO/IEC 27000 Information technology — Security techniques — Information security management systems — Overview and vocabulary," Geneva, 2018.
7. A. M. a. R. S. Sanford Friedenthal, A Practical Guide to SysML: The Systems Modeling Language, Third Edition, San Francisco: Morgan Kaufmann Publishers, 2015.
8. "Systems and software engineering -- Architecture description ISO/IEC/IEEE 42010".
9. a. I. C. S. INCOSE Systems Engineering Research Center, "Guide to the Systems Engineering Body of Knowledge (SEBoK)," 31 October 2019. [Online]. Available: www.sebokwiki.org.
10. OMG, "Primary use cases of MBSE libraries," OMG, https://www.omgwiki.org/MBSE/lib/exe/fetch.php?media=mbse:incose_usability_libraries_2pg_v4.pdf.
11. A guide to the Project management Body of Knowledge, Pennsylvania: Project management Institute, Incorporated, 2017.
12. Julie S Fant, PhD, Myron Hecht, Robert Pettit, PhD, and Peggy Hwu,, "ATR-2020-00232 System Engineering Model Assurance Levels (MALs) Detailed Criteria," The Aerospace Corporation, distribution may be requested, El Segundo, 2020.
13. Julie S Fant, PhD., Karen E. McShane, Vineet Velmurugan, Ronald Nussbaum, PhD., Robert G. Pettit, PhD, "ATR-2020-00806 Overview of Model Assurance Levels (MALs) for Systems and Software Models," The Aerospace Corporation, distribution may be requested, El Segundo, 2020.

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References (Continued)

14. "Draft ISO/IEC CD 24641 Methods and Tools for Model-Based Systems and Software Engineering (MBSSE)," 29 April 2020.

15. "Criteria," [Online]. Available: https://www.lexico.com/en/definition/criterion.

16. J. Coleman, "DEIX Topical Encyclopedia Entries," Object Management Group (OMG), 28 December 2018. [Online]. Available: https://www.omgwiki.org/MBSE/doku.php?id=mbse:topical_encyclopedia_for_digital_engineering_information_exchange_deixpedia. [Accessed 28 August 2020].

17. R. E. Giachetti, Design of Enterprise Systems: Theory, Architecture, and Methods, Boca Raton, FL: USA: CRC Press, Tayloar and Francis Group, 2010.

18. "Governing Body," [Online]. Available: https://www.lexico.com/definition/governing_body.

19. "Manager," [Online]. Available: https://www.lexico.com/en/definition/manager.

20. "Metric," [Online]. Available: https://www.lexico.com/en/definition/metric.

21. J. P. Siegel, "Terms and Acronyms," 7 September 2005. [Online]. Available: https://www.omg.org/gettingstarted/terms_and_acronyms.htm#M.

22. S. Mathur, "Project portfolio management techniques," in PMI Global Congress 2006, Bangkok, Thailand. Newton Square, PA, USA, 2006.

23. "Practice," [Online]. Available: https://www.lexico.com/en/definition/practice.

24. "Principle," [Online]. Available: https://www.lexico.com/en/definition/principle.

25. "Process," [Online]. Available: https://www.lexico.com/en/definition/process.

26. "DOD Dictionary of Military and Associated Terms," January 2020. [Online]. Available: https://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/dictionary.pdf?ver=2020-01-24-100230-123.

27. P. Weaver, "Understanding programs and projects--oh, there's a difference!," in PMI Global Congress 2010, Melbourne, Victoria, Australia. Newtown Square, PA, USA, 2010.

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Related Publications

- Model Portfolio Management Guide
  - *A. Hoheb, A. Chang, M. Zetilyan, J. Howie – TOR-2020-01577*
- Model Portfolio Management Guide Overview
  - *A. Hoheb, M. Zetilyan – 2021 INCOSE International Workshop (OTR 2021-00292)*
- Model Portfolio Management (MPM) Guide: A Guide to Defining the Scope, Purpose, Tasks and Products of Model Portfolio Management
  - *A. Hoheb, M.Zetilyan, A. Chang, J. Howie (OTR 2021-00592)*
- Defeat Entropy: A Guide To Managing Your Model Portfolio
  - *June 2021 issue of Getting It Right*
  - *https://aerospace.org/story/defeat-entropy-guide-managing-your-model-portfolio*

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