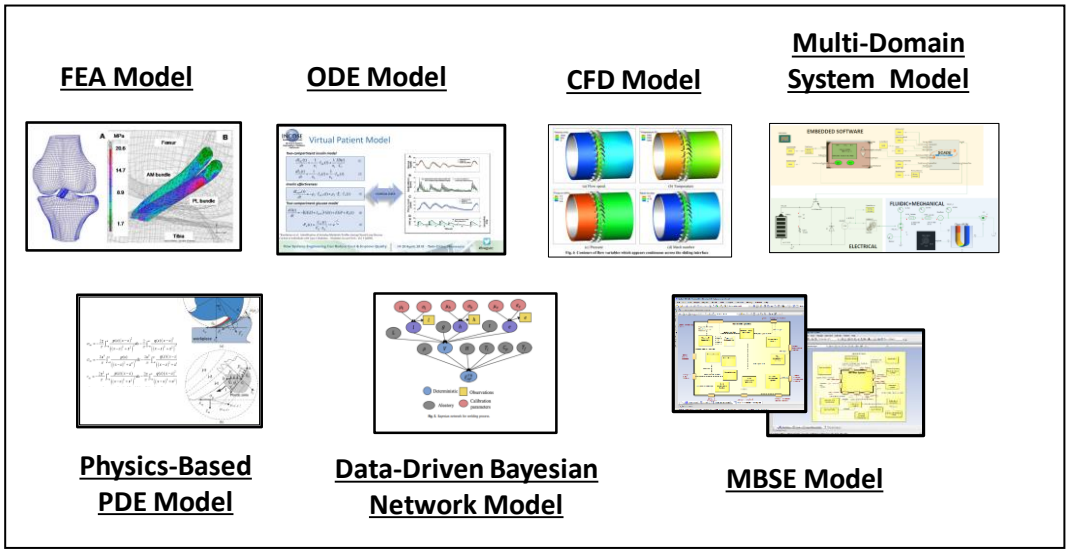
The Model Characterization Pattern (MCP): Summary

1 Purpose and Scope

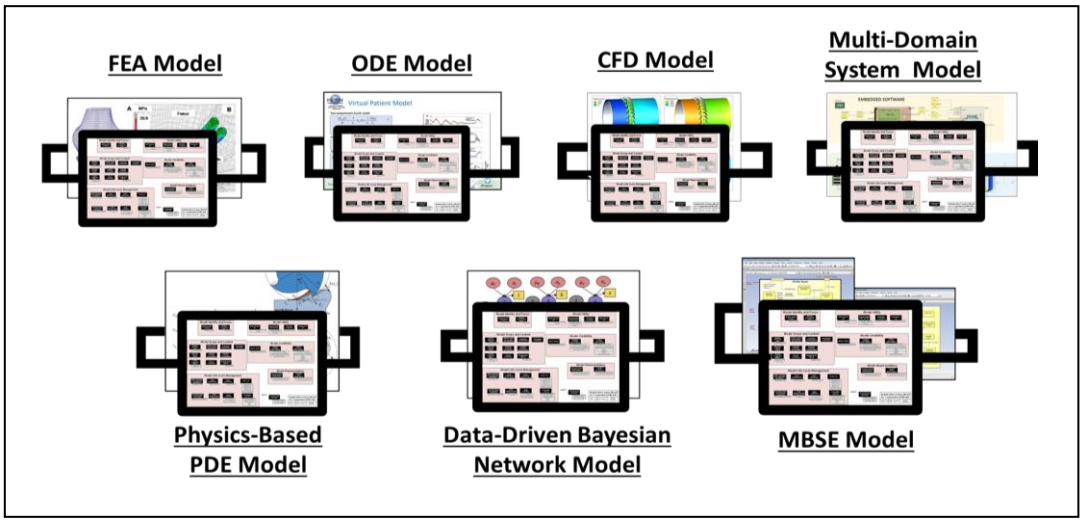
This document introduces and briefly summarizes the Model Characterization Pattern (MCP). Its scope is limited to describing the purpose and a high-level summary of the intended uses of the MCP. It includes a reference to the more detailed specification of the contents of the MCP and to S*Patterns in general.

2 Intended Uses and Origins of the Model Characterization Pattern

The purpose of the Model Characterization Pattern is to provide a common, shareable, configurable, universal framework of information to describe a virtual model of any type (e.g., numerical simulations, system models, artificial neural networks, architectural databases, empirical datasets, etc.):



The MCP effectively "characterizes" any model, and that is why it is called the "Model Characterization Pattern". The MCP is not the virtual model it describes, but is instead the description of that virtual model. Virtual models are very diverse, as to the technology of the model, the subject of the model, the purpose of the model, the modeling styles of the model author, the model credibility, and many other aspects. The single MCP data structure is able to describe all these different types and instances of virtual models because the MCP is a configurable S*Pattern data structure:



When the information characterizing a specific virtual model is inserted into the generic MCP's data structure, the result is referred to as a "configured MCP", because it now describes a specific virtual model. The configured MCP is sometimes also referred to as a "Model Wrapper", because it is in many ways analogous to the printed labels and bar codes that are found on packaged food products on a grocery shelf.

In the language of the systems community, the MCP is a "configurable system pattern" that is in fact a model of all virtual models, ready to be configured to describe specific model instances. In the language of the modeling community, the MCP is a "metadata pattern", which simply means that it is information that describes a virtual model and other related subjects about that virtual model.

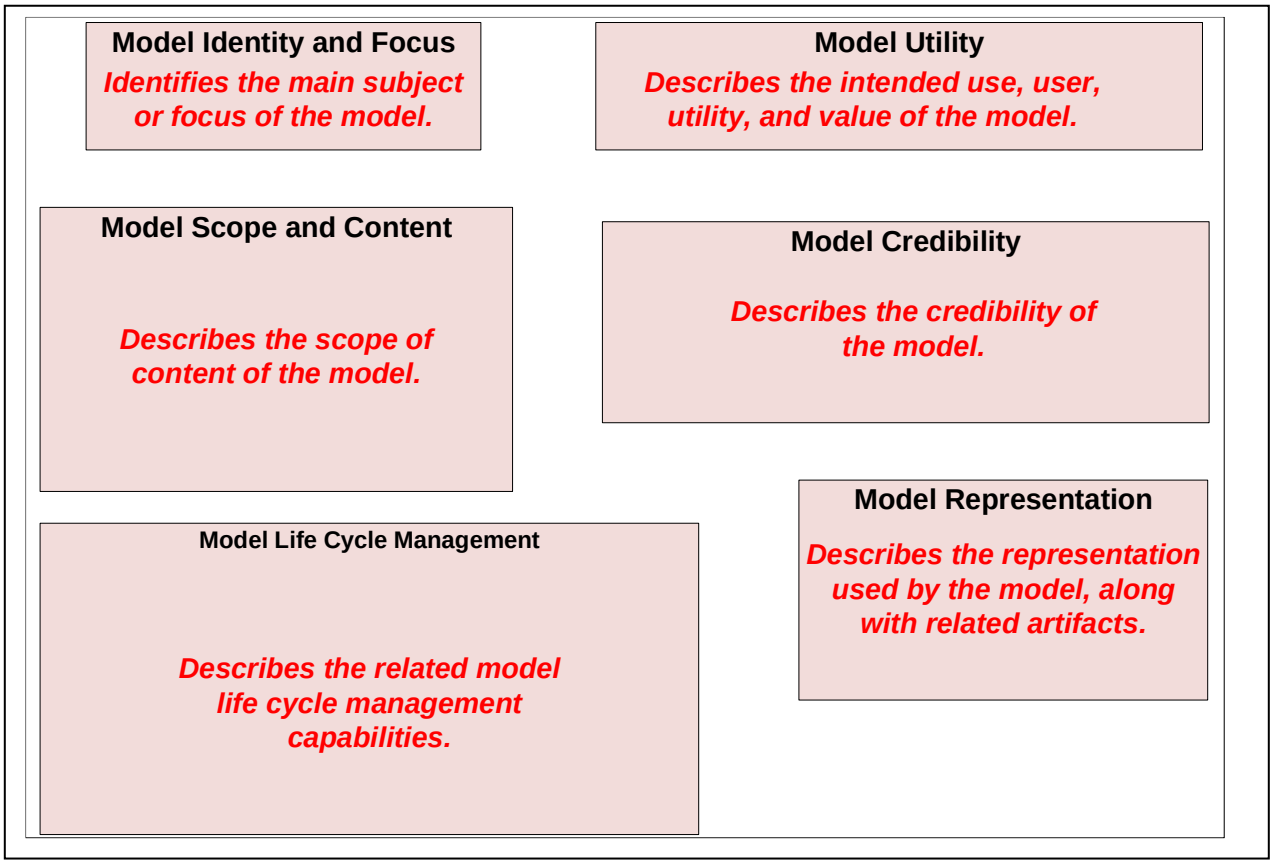
The MCP has arisen over several years of collaborative activities by the INCOSE MBSE Patterns Working Group, the ASME VV50 Model Life Cycle Working Group, and the V4 Institute. Configured MCPs (model wrappers) may be used for many different purposes, across the life cycle of the virtual models they describe. Among these MCP applications are the following:

1. More effectively plan new or improved virtual models, and to know whether you need them, versus making use of existing model assets you can more readily discover by their "wrappers".
2. Improve access to collections of models by exposing their characteristics to potential users more effectively, whether individually or through managed directories of characterization data.
3. Rapidly generate very systematic model requirements for new or existing models, for use in model development, verification, validation, and life cycle management
4. Lower the experience threshold needed to plan and manage virtual models, including model VVUQ as well as broader credibility assessment of models.
5. More effectively manage large collections of diverse virtual models and related information.
6. More effectively share models across supply chains and regulatory or industry domains.
7. Lower the cost and time necessary to obtain trusted/credible models in regulated or other domains.
8. Use or manage models that were generated by others; increase the range of others who can effectively use models that you generate; reduce the likelihood of model misuse.
9. Improve the accumulation and effective use of model-based enterprise knowledge.
10. Improve the integration of model-related work across specific engineering disciplines and overall systems engineering.
11. Increase ability to manage the integration of multiple computational models (e.g., using FMI), including their integrated VVUQ

Because of the wide range of possible MCP applications indicated above, it is not necessary, or even desirable, to try to accomplish all of these at one time—a single application from the above list could be so valuable to justify use of the MCP for only that purpose, saving the other applications for possible future consideration. Note that the individual stakeholders likely to find these applications of value will also vary from one application to another. Usually no single individual will be a "customer for" or an expert on all the different applications listed above.

3 Summary of the MCP Model Stakeholder Feature Groups

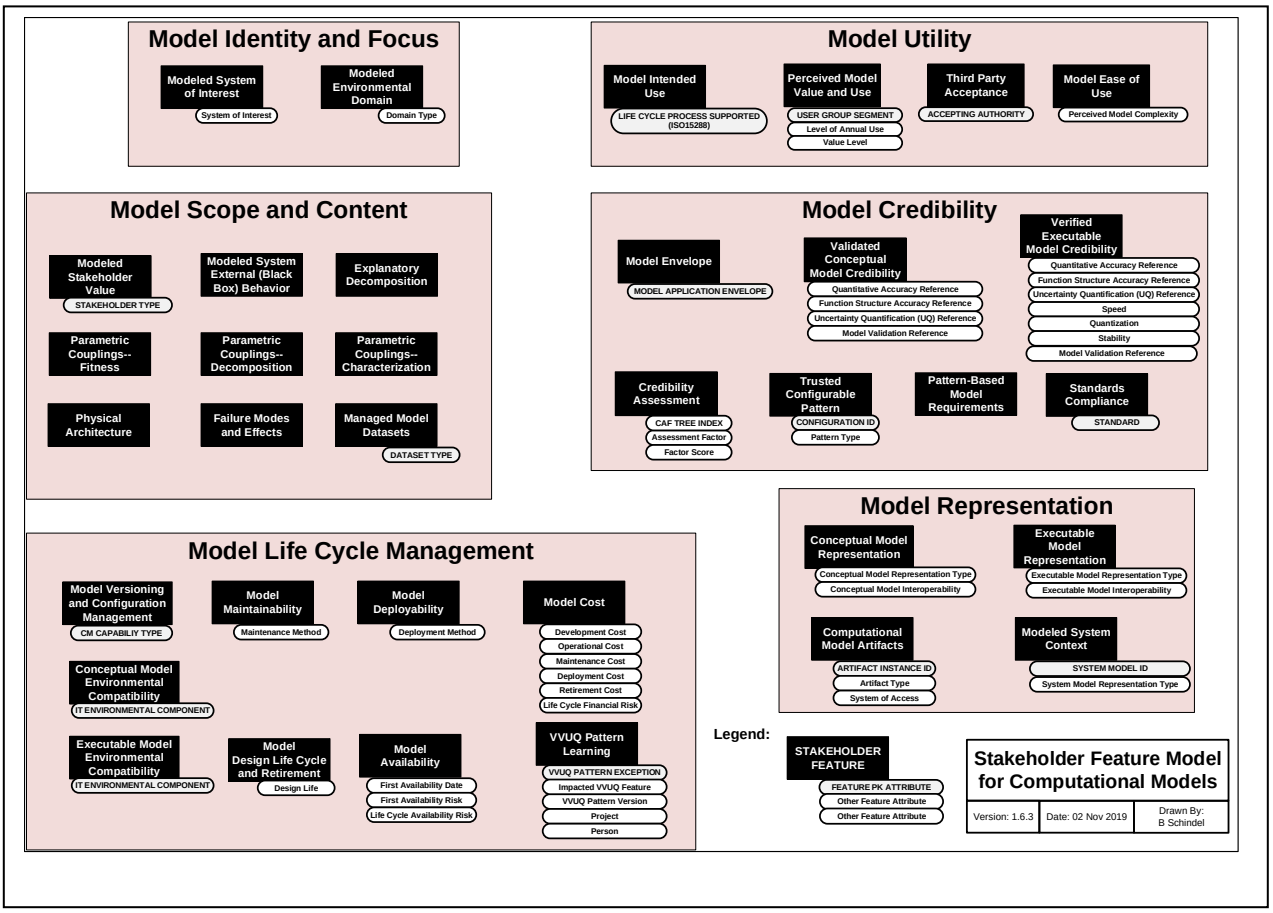
The top-level interface to the MCP is the Stakeholder Feature Pattern portion of the MCP. Its purpose is to describe, at a summary level associated with stakeholders of a virtual model of interest, the "degrees of freedom", "parameters", "characteristics", or "stakeholder requirements" for a given virtual model being characterized by the MCP. Six different Feature Groups organize a collection of different Stakeholder Features addressing a wide variety of model stakeholder issues:



The generic MCP is configured to describe a given virtual model, whether it is being planned or already exists, by filling in the "answers" to the questions implied by the various parameters of the Feature Groups. What is the scope and content of the model? What is the intended use of the model? How trusted is its credibility for that use? What is the technical scope of the model? How is it represented? Is the model a long-term enterprise asset or a one-time quick model unlikely to be used again?

4 Detailed Reference on the MCP Model Stakeholder Features

Individual Stakeholder Features are populated or de-populated based on their relevance for a given model of interest. The MCP collection of approximately 35 MCP Feature types is shown below. Some Features may be de-populated when they are not applicable for a given model of interest (e.g., the Failure Modes and Effects Feature). Some Features are nearly always of interest (e.g., the Modeled System of Interest Feature). Some Features may be populated multiple times (e.g., the Model Intended Use feature may be multiply populated to represent different uses.) Many Features also have Feature Attributes, which are additional parameters whose value may be set to represent different configurations.



A detailed description of each of the MCP Features and their Feature Attributes is beyond the scope of this introduction, but may be found at:

https://www.omgwiki.org/MBSE/lib/exe/fetch.php?media=mbse:patterns:model_characterization_pattern_mcp_v1.9.3.pdf

That reference also provides additional background on configurable patterns in general, as well as an example configuration of MCP.