

It's So Meta!

Modeling Models in a Model Based Style
Guide Development

Heidi Jugovic
Mark Payton

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Agenda

- ▶ What is a Metamodel?
- ▶ Stakeholders and Use Cases of Style Guides
- ▶ Using Metamodels to Define Model Style
- ▶ Example of a Model-Based Style Guide
 - Style
 - Content Plan



Introduction to Metamodeling

What is a Metamodel?

- ▶ Meta- (Prefix)
 - “More comprehensive; transcending; usually used with the name of a discipline to designate a new but related discipline **designed to deal critically with the original one**” (i.e. *metadata*)
[— Merriam-Webster.com](https://www.merriam-webster.com/dictionary/metadata)
- ▶ Metamodel
 - “If models are abstractions of some reality, then metamodels are abstractions of models.”
[—Encyclopedia of Database Systems](https://www.encyclopedia.com/technology/computer-science/encyclopedia-of-database-systems)

Metamodels...what's the benefit?

- ▶ Understanding software and modeling languages
- ▶ Laying out Terms of Reference
- ▶ Defining Layers of Abstraction



Understanding Style Guides

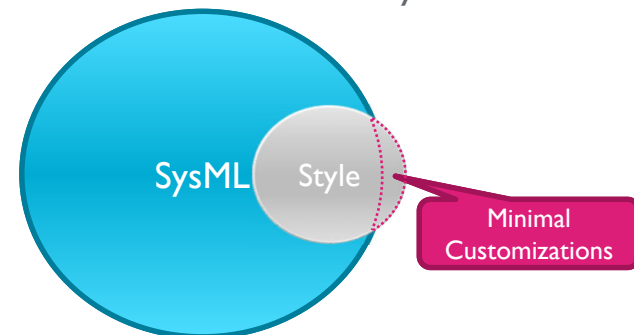
► Stakeholders

- Modeling Practitioners
- Engineering Disciplines & Specialty Engineers
- Managers
- Sponsors
- End Users



► Use Cases

- Restrict use of the modeling language
- Establish organizational policy & guidance
- Identify artifacts needed to support program objectives
- Articulate modeling objectives
- Determine modeling approach
- Federate models
- Model architectures consistently



Why Metamodels for Style Guides?

- ▶ Show unambiguously how to use the modeling elements to conform with the prescribed style
- ▶ Provide concrete modeling examples that can be implemented in a variety of situations
- ▶ Serve as “digital mentor” to exhibit the preferred approach to modeling
 - Aids modelers new to modeling or new to the style
- ▶ Illustrate how to integrate model elements and diagrams to form needed artifacts
- ▶ Capture an organization’s modeling best practices



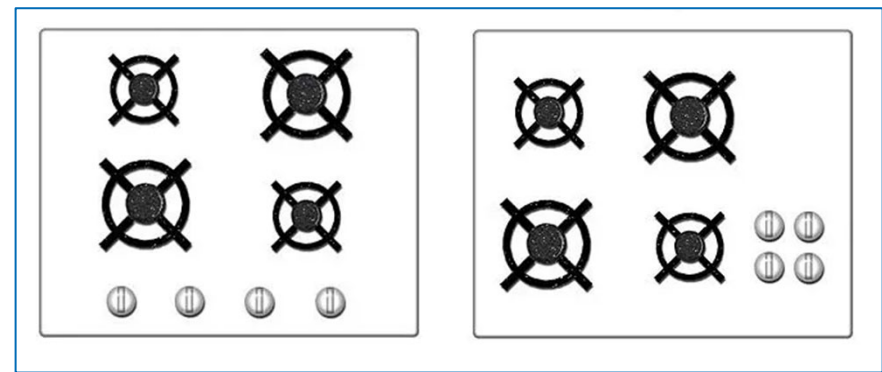
Metamodels help satisfy the style guide’s use cases and stakeholders’ needs



Benefits of Having a Model-Based Style Guide

- ▶ Provides **natural mapping** between style guide and model
 - No need to mentally toggle between multi-dimensional nature of model and linear nature of documents
- ▶ Embraces **digital transformation**
 - Transition from document-based engineering to model-based engineering
- ▶ Enables **model-based planning** tailored to your project/program
 - Surgically identify modeling elements needed to meet program objectives

Natural Mapping Example



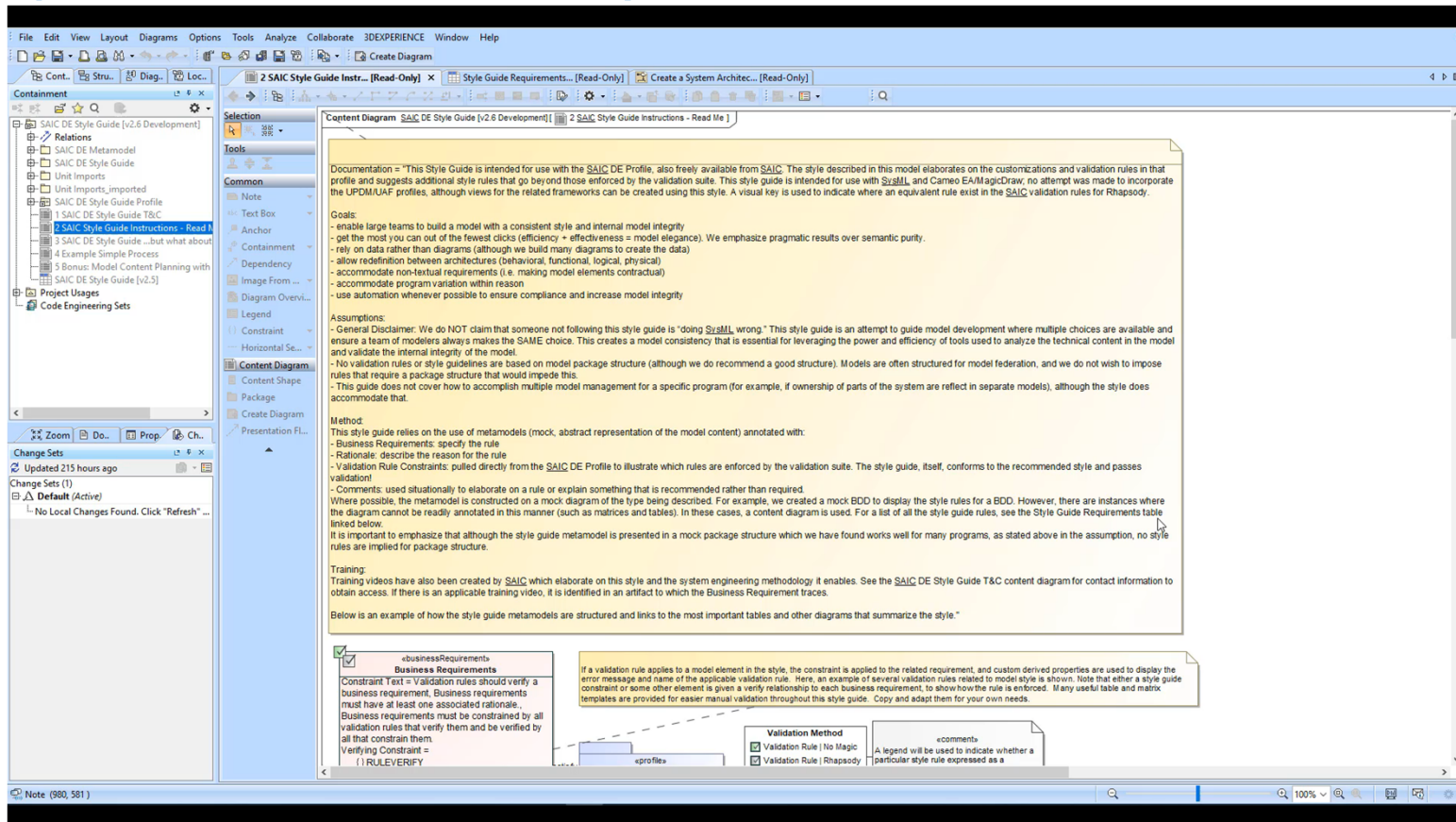
Source: Norman, 2013, p. 114

Pop Quiz!

For each example stovetop above, which knob do you expect to operate the Rear Right burner?



Example Metamodel-Based Style Guide



Questions

- ▶ Heidi Jugovic
 - Heidi.J.Jugovic@saic.com
- ▶ Mark Payton
 - Abraham.M.Payton@saic.com
- ▶ SAIC Validation Suite
 - <https://www.saic.com/digital-engineering-validation-tool>





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DigitalEngineering@saic.com

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Abstract

As DoD leans further into adoption Model Based Systems Engineering (MBSE) as a core piece of the digital transformation, many of the benefits are being realized by connecting models together in a digital thread or conducting analysis across models. Both methods benefit by having models that are similarly structured to enable the necessary connections. As a result, model style guides have become a hot topic of the day. However, ironically, most style guides are expressed in documents. This presentation will present a rationale for describing model styles in a model using an annotated metamodel, explain the benefits of doing so (and the pitfalls of doing otherwise), and present a detailed example of a rigorous, freely available, model-based style guide.



Presenters

- ▶ **Heidi Jugovic** has 15 years of defense engineering expertise with an emphasis on results-driven Model Based Systems Engineering and enabling the digital transformation. She is an INCOSE Certified Systems Engineering Professional (CSEP). She was Chair of the MBE Community of Practice for Northrop Grumman 2016-2018 and is currently co-chair of the Digital Engineering Community of Practice for SAIC. Heidi is an Army Veteran who served as a Missile Defense Early Warning Engineer/Operator/Technician (JTAGS) for two years and finds motivation as an engineer by making a difference in the mission and day-to-day effectiveness and safety of the Warfighter.
- ▶ **Mark Payton** is a Principal Digital Engineer in SAIC's Engineering Innovation Factory. He develops digital thread capabilities to break down stove-pipes between digital models. He integrates requirements engineering, system architecture models, and computational models. Mark also teaches a Hands-on Laboratory (HoL) class that covers Systems Engineering, MBSE, SysML, and SAIC's Digital Engineering Validation Tool. Prior to joining SAIC, he served 20 years as an officer in the United States Air Force in space operations.

