Language Fragments' Language for Meta-Modeling Frameworks

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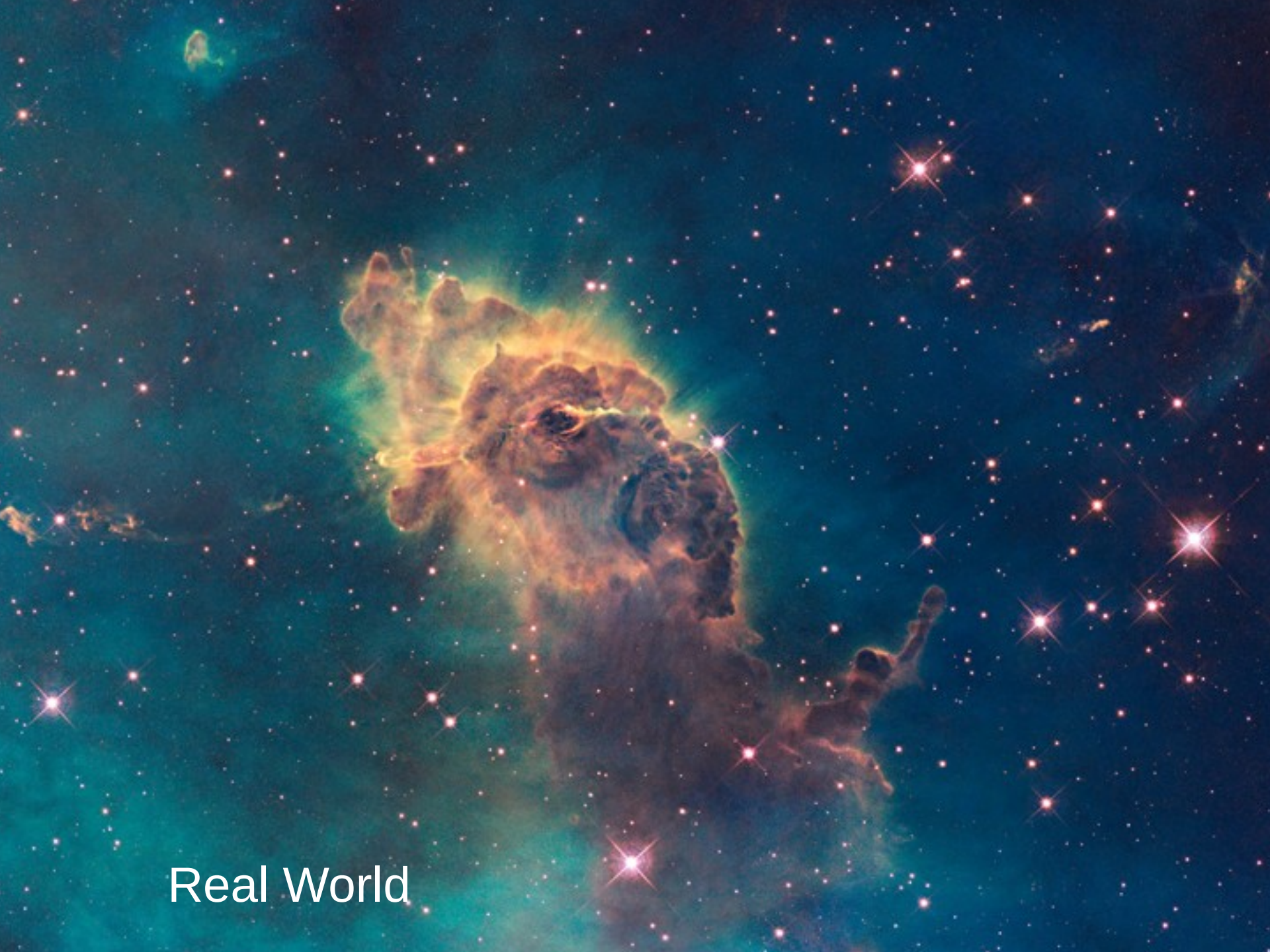
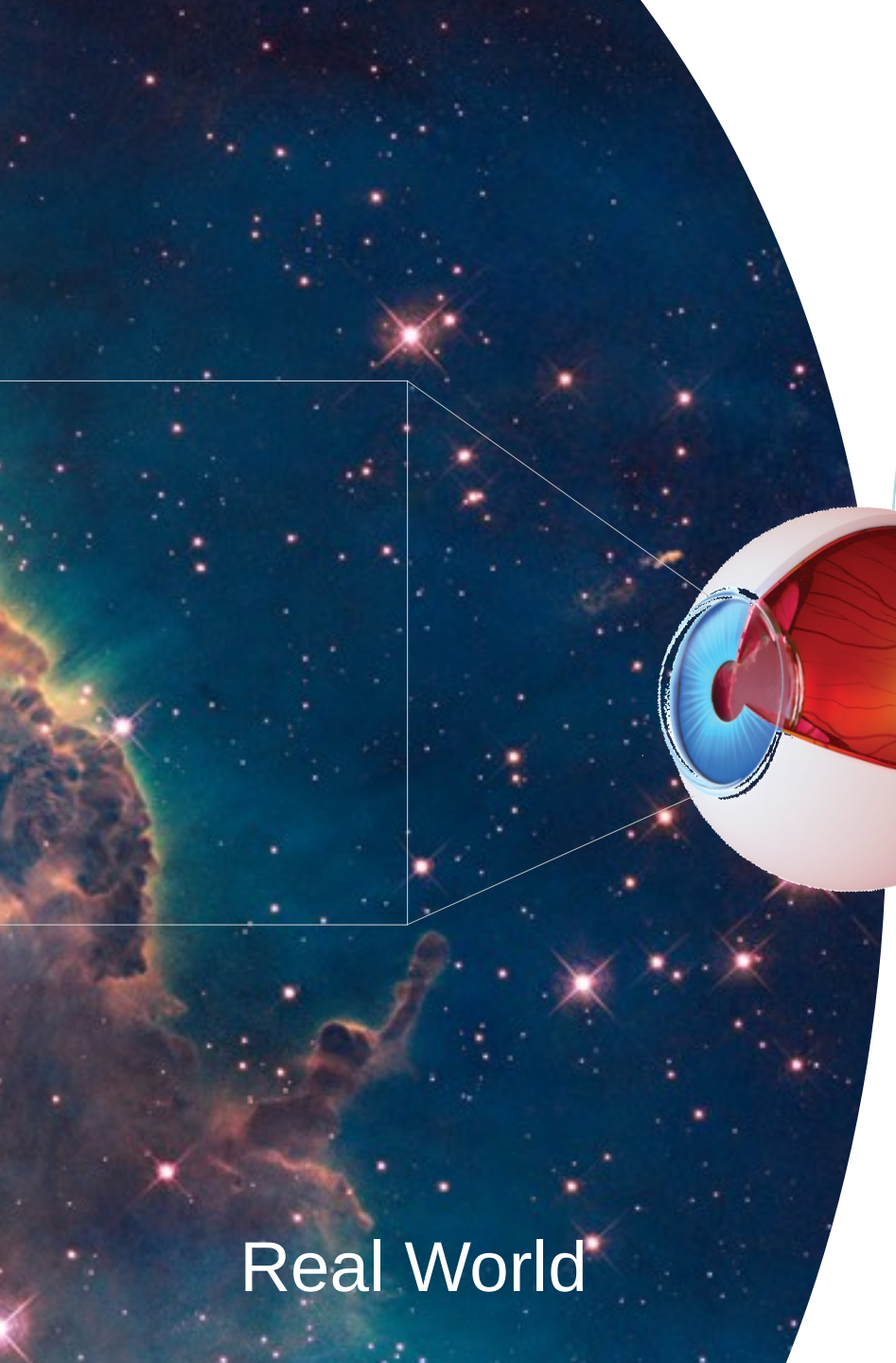
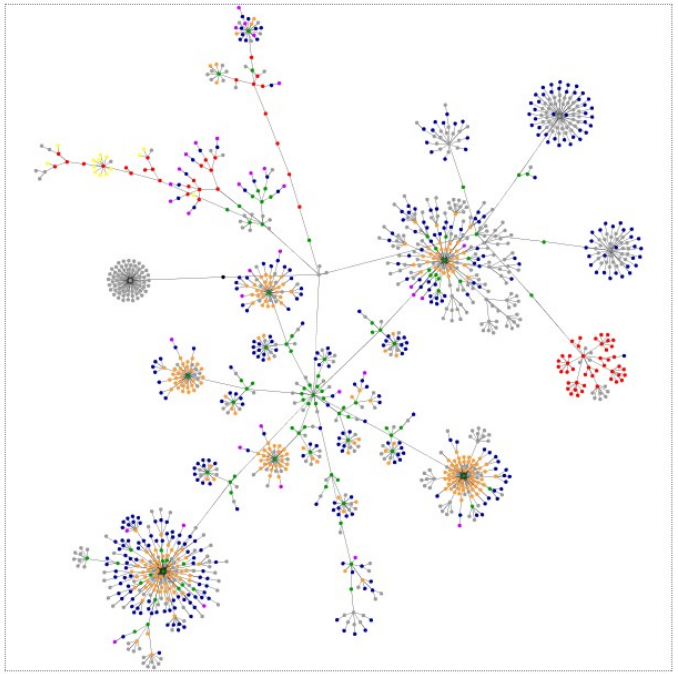

Real World

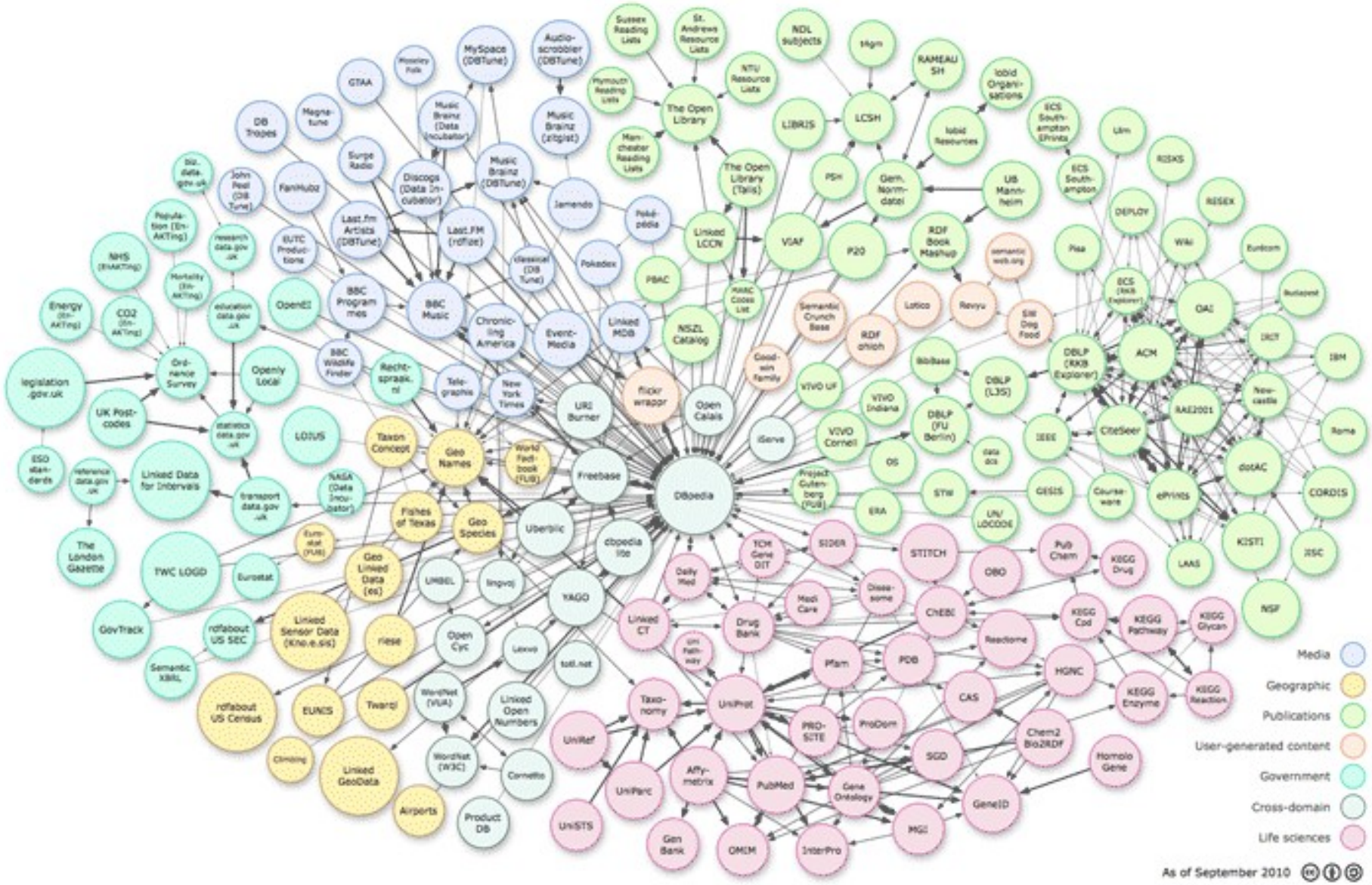




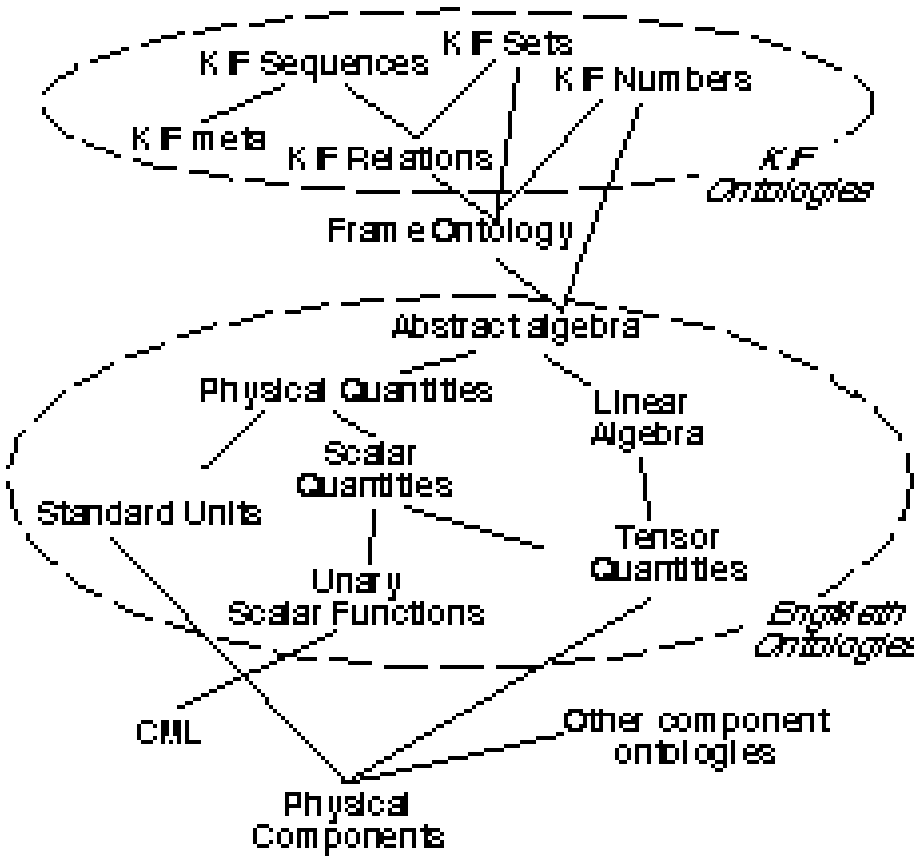
- Logical reasoning
- Properties of the world

Real World

Model World



Ontologies and Knowledge representation



Kif-Sets
- Kif-Extensions
  - Frame-Ontology
    - Abstract-Algebra
      - PHYSICAL-QUANTITIES
        - UNARY-SCALAR-FUNCTIONS
          - TIME-DEPENDENT-QUANTITIES
          - Cml
        - STANDARD-UNITS
          - UNARY-SCALAR-FUNCTIONS ...
          - TIME-DEPENDENT-QUANTITIES
          - Vt-Design
            - Vt-Domain
              - Vt-Example
          - Cml
        - SCALAR-QUANTITIES
          - TENSOR-QUANTITIES
          - Vt-Design ...
      - Vt-Domain ...
      - Configuration-Design
        - Vt-Design ...
  - Kif-Meta
    - Configuration-Design ...
    - Kif-Ontology
  - Kif-Relations
    - Frame-Ontology ...
    - Kif-Extensions ...

Kif-Numbers
- Kif-Lists
  - Kif-Extensions ...
  - Kif-Meta
    - Configuration-Design ...
  - Kif-Relations
    - Frame-Ontology ...
    - Kif-Extensions ...

Ontologies: Knowledge representation

Sentence ↔ Automotive Domain Metamodel

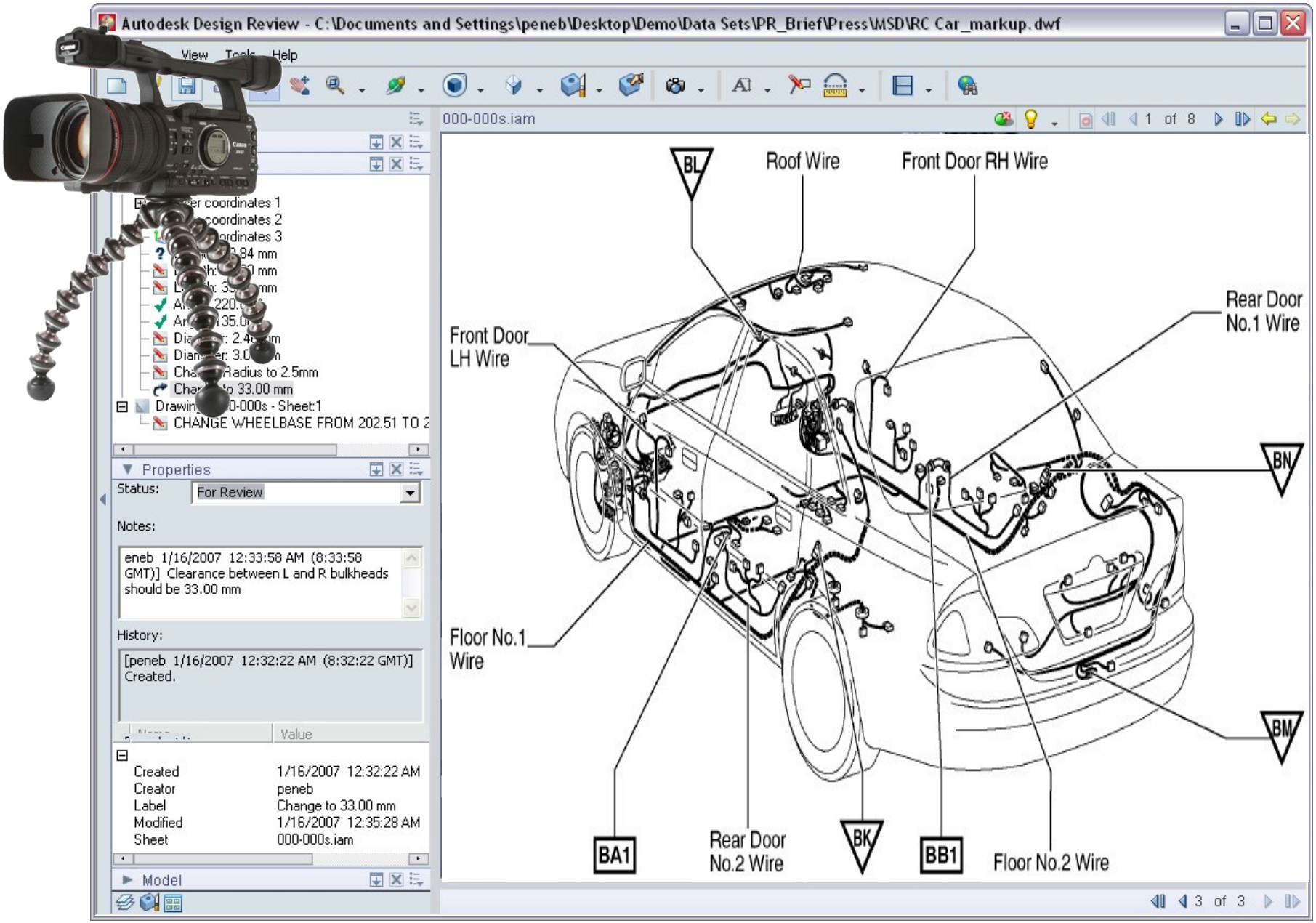
[[ ]]: Semantic mapping

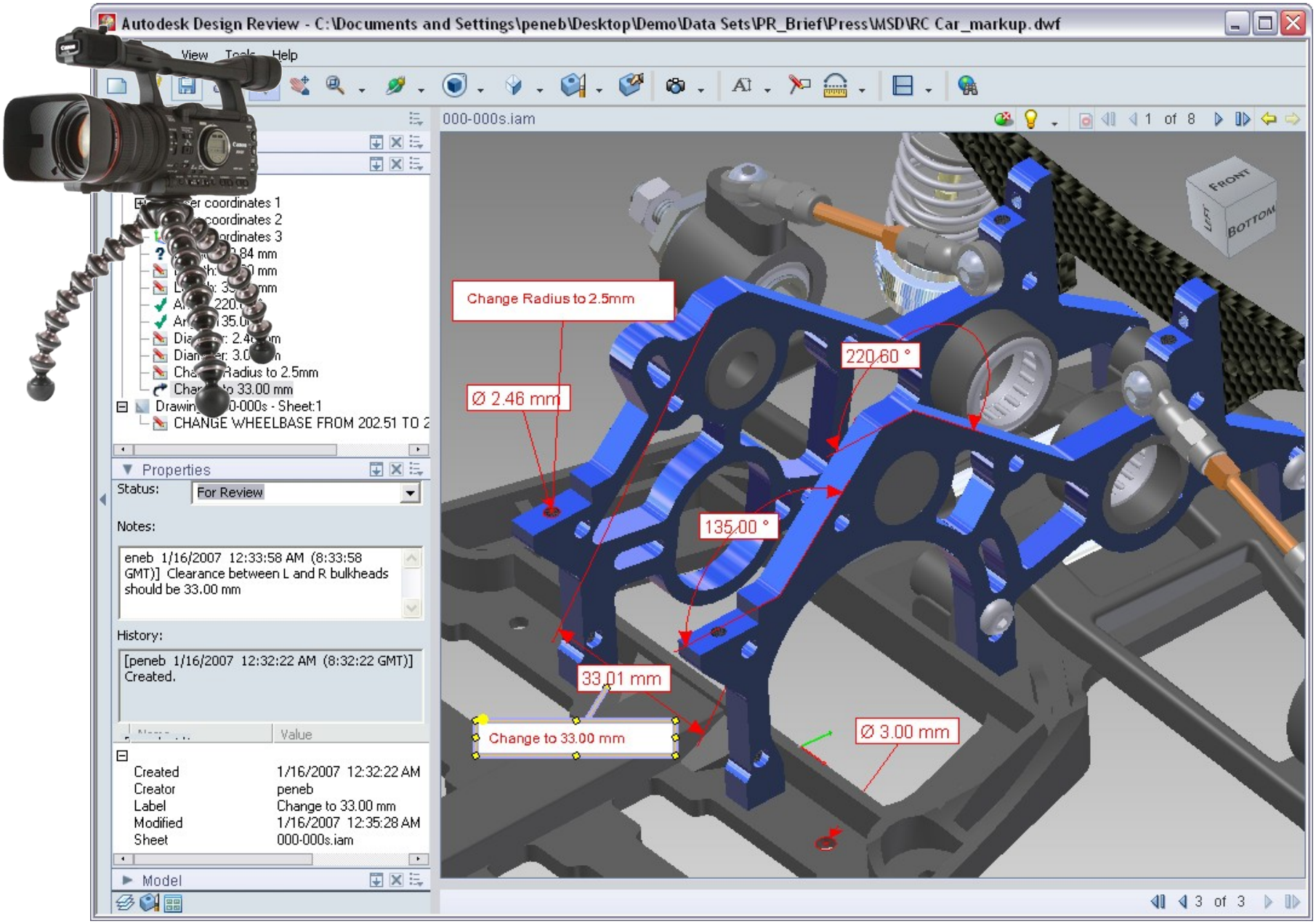
[[Sentence]] ↔ Semantic Domain Metamodel

Model Analysis
(Checking and Simulation)

Property p?

Automated Linguistic features


Autodesk Design Review - C:\Documents and Settings\peneb\Desktop\Demo\Data Sets\PR_Brief\Press\MSD\RC Car_markup.dwf
View
Tools
Help
000-000s.iam
1 of 8
Properties
Status:
For Review
Notes:
eneb 1/16/2007 12:33:58 AM (8:33:58 GMT)] Clearance between L and R bulkheads should be 33.00 mm
History:
[peneb 1/16/2007 12:32:22 AM (8:32:22 GMT)] Created.
Value
Created 1/16/2007 12:32:22 AM
Creator peneb
Label Change to 33.00 mm
Modified 1/16/2007 12:35:28 AM
Sheet 000-000s.iam
Model
CHANGE WHEELBASE FROM 202.51 TO 2
BL
Roof Wire
Front Door RH Wire
Front Door LH Wire
Rear Door No.1 Wire
BN
Floor No.1 Wire
BM
BA1
Rear Door No.2 Wire
BK
BB1
Floor No.2 Wire
3 of 3


Autodesk Design Review - C:\Documents and Settings\peneb\Desktop\Demo\Data Sets\PR_Brief\Press\MSD\RC Car_markup.dwf
View
Tools
Help
000-000s.iam
1 of 8
Change Radius to 2.5mm
220.60 °
Ø 2.46 mm
135.00 °
33.01 mm
Change to 33.00 mm
Ø 3.00 mm
FRONT
BOTTOM
LEFT
Properties
Status:
For Review
Notes:
eneb 1/16/2007 12:33:58 AM (8:33:58 GMT)] Clearance between L and R bulkheads should be 33.00 mm
History:
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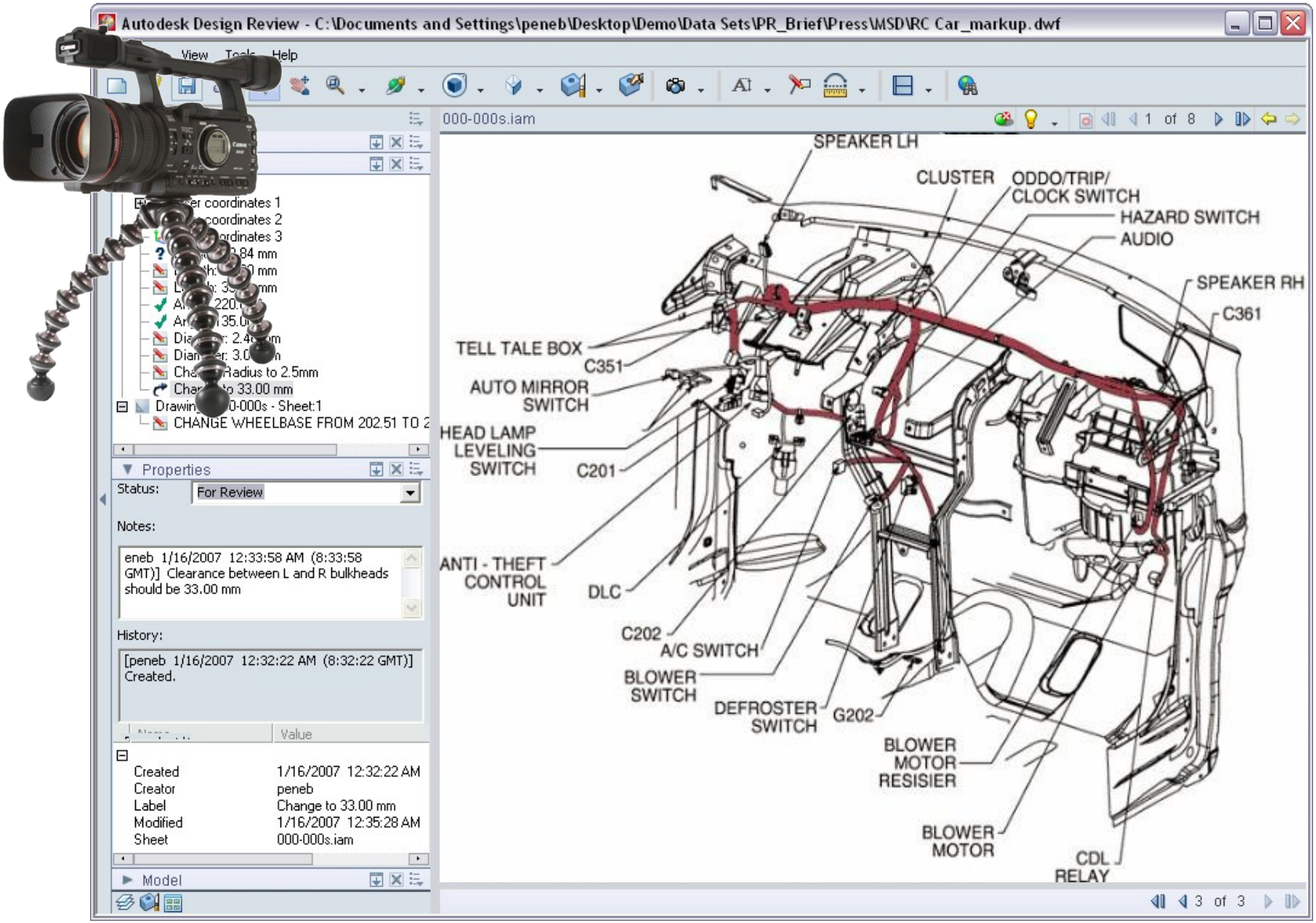
Sheet 000-000s.iam
Model
3 of 3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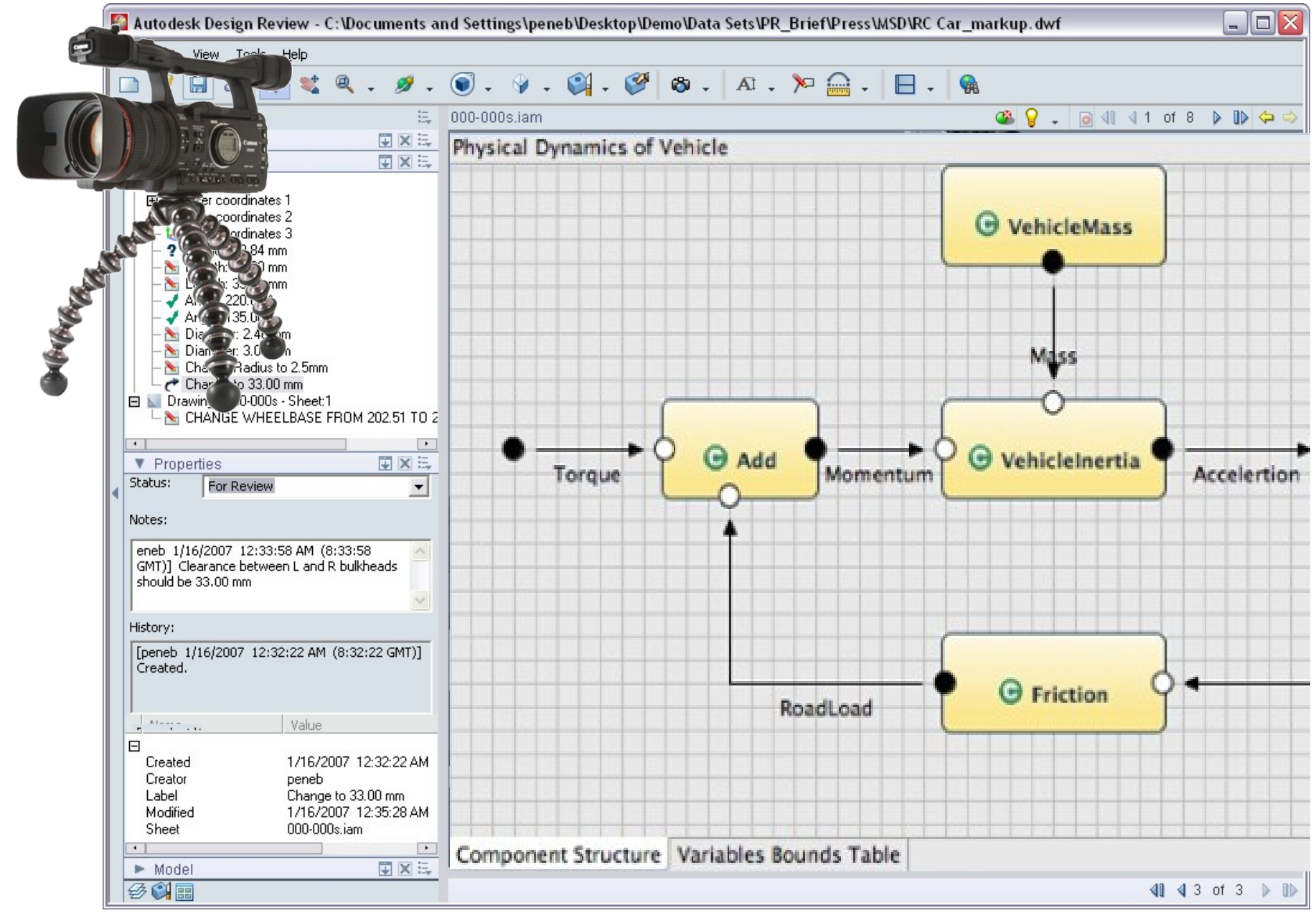
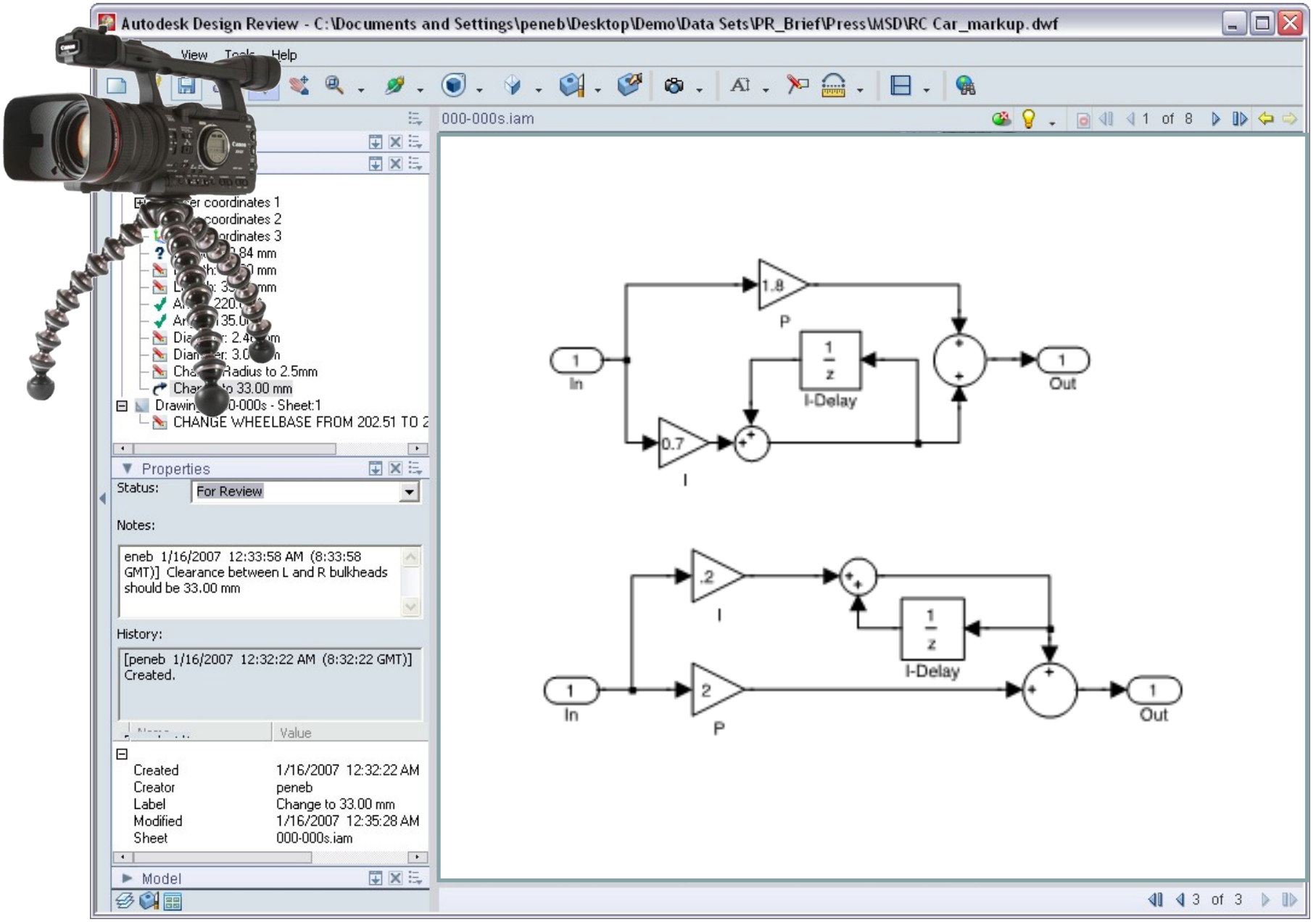
Value
Created 1/16/2007 12:32:22 AM
Creator peneb
Label Change to 33.00 mm
Modified 1/16/2007 12:35:28 AM
Sheet 000-000s.iam
Model
SPEAKER LH
CLUSTER
ODDO/TRIP/ CLOCK SWITCH
HAZARD SWITCH
AUDIO
SPEAKER RH
C361
TELL TALE BOX
C351
AUTO MIRROR SWITCH
HEAD LAMP LEVELING SWITCH
C201
ANTI - THEFT CONTROL UNIT
DLC
C202
A/C SWITCH
BLOWER SWITCH
DEFROSTER SWITCH
G202
BLOWER MOTOR RESISIER
BLOWER MOTOR
CDL RELAY
3 of 3


Autodesk Design Review - C:\Documents and Settings\peneb\Desktop\Demo\Data Sets\PR_Brief\Press\MSD\RC Car_markup.dwf
View
Tools
Help
000-000s.iam
1 of 8
Physical Dynamics of Vehicle
VehicleMass
Mass
Torque
Add
Momentum
VehicleInertia
Accelertion
RoadLoad
Friction
Component Structure
Variables Bounds Table
3 of 3
Change to 33.00 mm
Drawing 0-000s - Sheet:1
CHANGE WHEELBASE FROM 202.51 TO 2
Properties
Status:
For Review
Notes:
eneb 1/16/2007 12:33:58 AM (8:33:58 GMT)] Clearance between L and R bulkheads should be 33.00 mm
History:
[peneb 1/16/2007 12:32:22 AM (8:32:22 GMT)] Created.
Value
Created 1/16/2007 12:32:22 AM
Creator peneb
Label Change to 33.00 mm
Modified 1/16/2007 12:35:28 AM
Sheet 000-000s.iam
Model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View
Tools
Help
000-000s.iam
1 of 8
Properties
Status:
For Review
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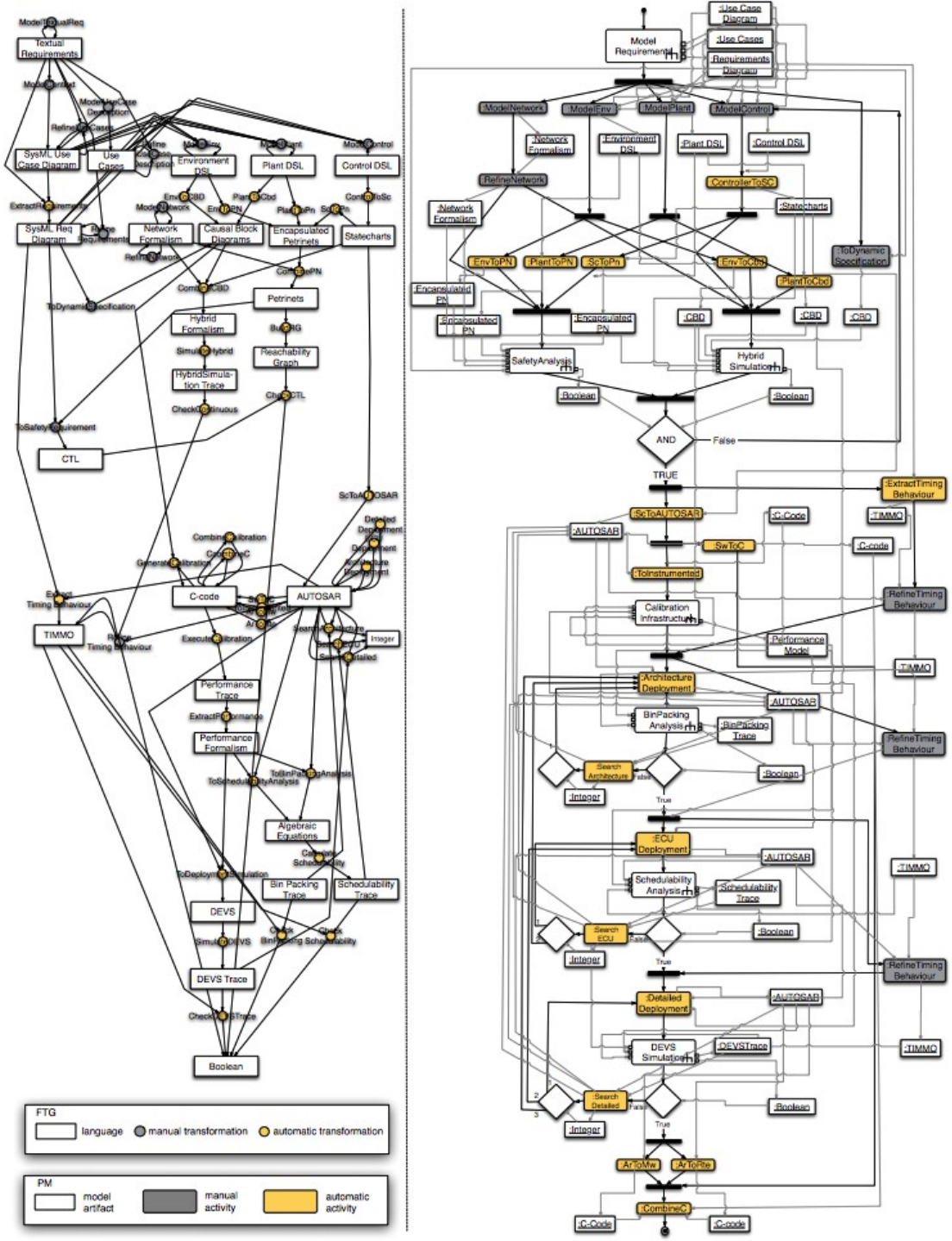
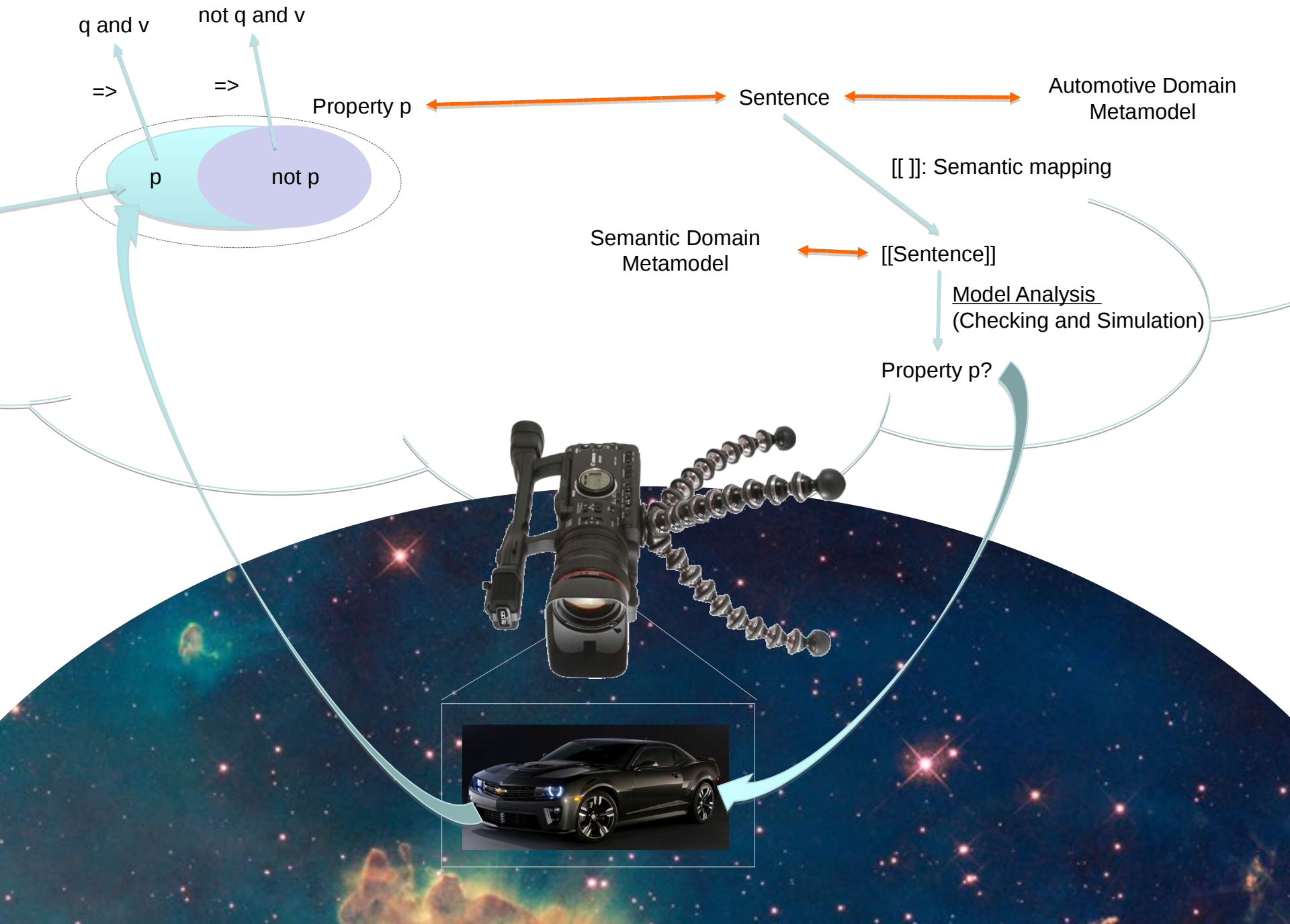
Value
Created 1/16/2007 12:32:22 AM
Creator peneb
Label Change to 33.00 mm
Modified 1/16/2007 12:35:28 AM
Sheet 000-000s.iam
Model
CHANGE WHEELBASE FROM 202.51 TO 2
1.8
P
1
In
1
z
I-Delay
1
Out
0.7
I
.2
I
1
z
I-Delay
1
In
2
P
1
Out
3 of 3

FTG+PM


Textual Requirements
SysML Use Case Diagram
Use Cases
Environment DSL
Plant DSL
Control DSL
SysML Req Diagram
Network Formalism
Causal Block Diagrams
Encapsulated Petrinets
Statecharts
Petrinets
Hybrid Formalism
Reachability Graph
HybridSimulation Trace
CTL
C-code
AUTOSAR
TIMMO
Performance Trace
Performance Formalism
Algebraic Equations
Bin Packing Trace
Schedulability Trace
DEVS
DEVS Trace
Boolean
FTG
language
manual transformation
automatic transformation
PM
model artifact
manual activity
automatic activity
Model Requirements
Use Case Diagram
Use Cases
Requirements Diagram
Model Network
Model Env
Model Plant
Model Control
Network Formalism
Environment DSL
Plant DSL
Control DSL
RefineNetwork
ControllerToSC
Statecharts
EnvToPN
PlantToPN
ScToPn
EnvToCbd
PlantToCbd
ToDynamicSpecification
Encapsulated PN
CBD
SafetyAnalysis
Hybrid Simulation
Boolean
AND
False
TRUE
ExtractTiming Behaviour
ScToAUTOSAR
C-Code
TIMMO
AUTOSAR
SwToC
C-code
ToInstrumented
Calibration infrastructure
RefineTiming Behaviour
Performance Model
Architecture Deployment
BinPacking Analysis
BinPacking Trace
Search Architecture
Integer
ECU Deployment
Schedulability Analysis
Schedulability Trace
Search ECU
Detailed Deployment
DEVS Simulation
DEVSTrace
Search Detailed
ArToMw
ArToPlte
CombineC


q and v
not q and v
=>
=>
p
not p
Property p
Sentence
Automotive Domain Metamodel
[[ ]]: Semantic mapping
Semantic Domain Metamodel
[[Sentence]]
Model Analysis
(Checking and Simulation)
Property p?

Objectives

- A model of a Meta-Modeling Framework

Field report

- MMCL viewed as syntax only
  - assumption: it is defined as being self-describable
  - question: the semantics has also to be self-describable?
  - answer: maybe. Semantics starts as being grafted at the **physical level**
    - **Meaning: code/implementation!**
- Needs we identified:
  - Relations between models
  - Relations between model elements, models and properties?

- Conformance semantics vs Instantiation semantics?
  - Is it models vs model elements?
    - no, because we can for instance instantiate a complete model (e.g., design-space exploration)
  - Verification Semantics vs Execution Semantics?
    - Instantiation (at both linguistic and ontological)

- Megamodeling for multi-level?
  - explicit type relationship
  - explicit conformance relationship

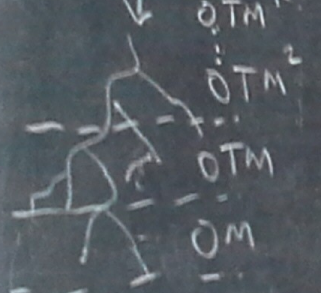
  But!
  - abuse of the notion of megamodeling
  - We need:
    - notion of sets (typed)
    - Hierarchical meta-modeling language

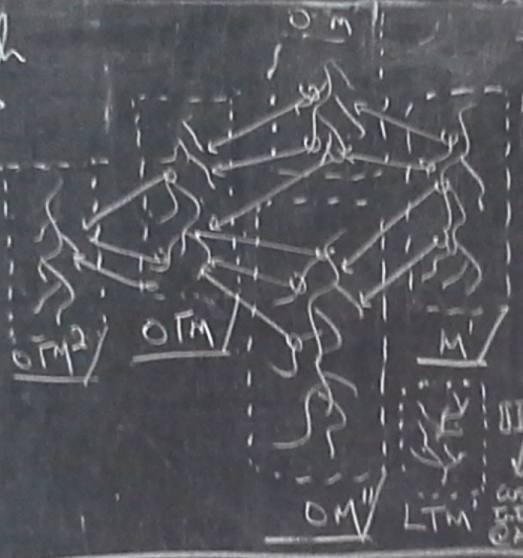
- Language Fragments for reuse?
  - language to describe placeholders and use them
  - Types and type implications that reach multiple levels through the ontological hierarchies
    - but actually we want to implicitly be able to compose multiple languages
  - How to define a fragment?
  - Maybe it is a kind of megamodeling language
    - Abstract Syntax of the Language
    - Semantics? Maybe via mapping using Relax-Augment-Modify Strategy
      - Why? Because we want to type the connections between models

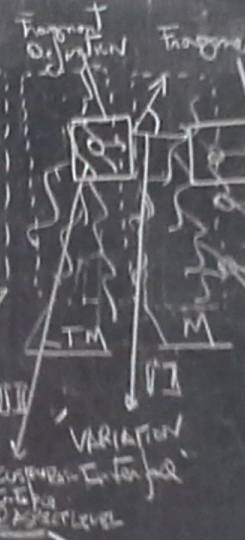
MONDAY | TUESDAY | WEDNESDAY | THURSDAY | [illegible]DAY | SATURDAY | SUNDAY

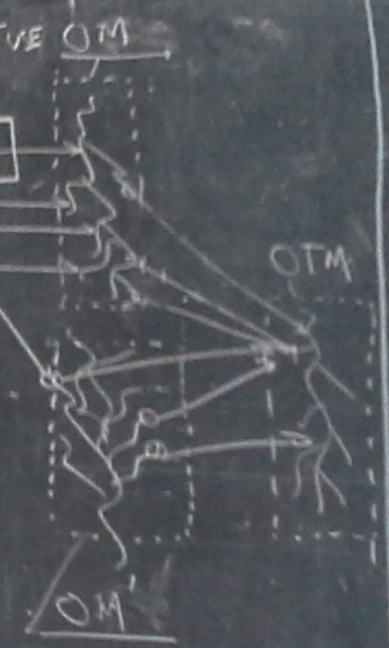
Relations between Ts at each Ontological Level? →

Ontological Classification? ↓









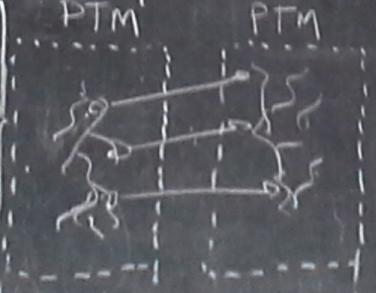
LTM ⊨ LTM²
M ⊨ LTM
M ⊢ OM (3)
M ⊢ OM' (4)
OM ⊨ LTM²
OM' ⊨ LTM²
OM ⊢ OTM
OTM' ⊢ OTM
OTM ⊨ LTM²
OTM ⊢ OTM
OTM' ⊢ OTM²
M' ⊨ LTM
M' ⊢ OM (1)
M ⊢ OM'' (2)
OM'' ⊢ OTM
OTM ⊢ OTM²

MAPPINGS?

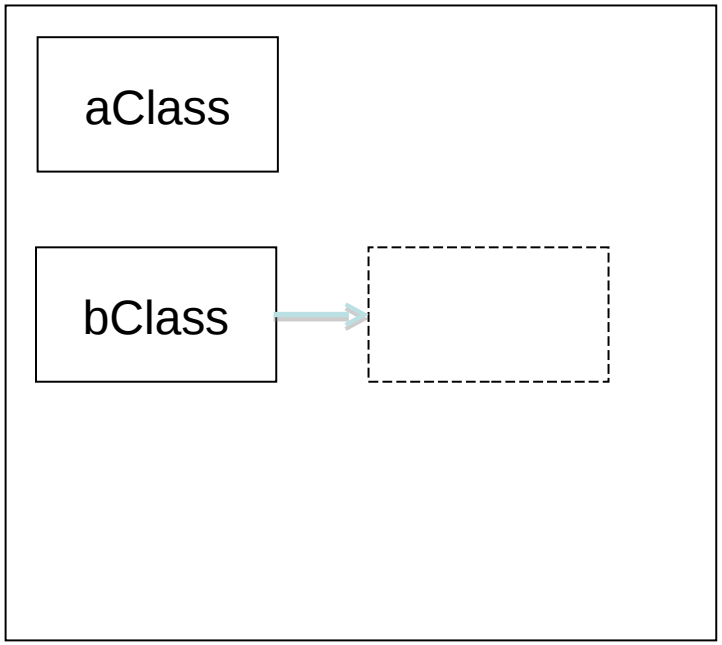
PTM ⊨ P(LTM)
PTM' ⊨ P(LTM')

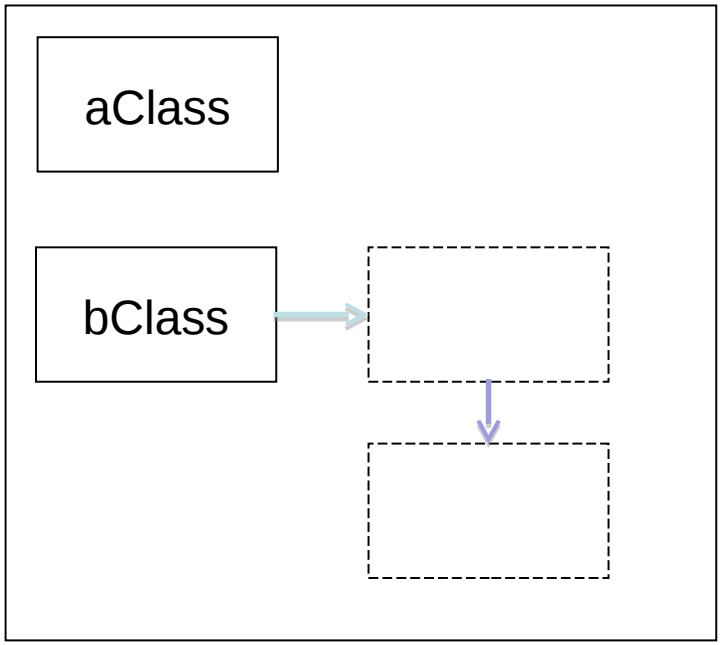
LTM^m ⊢ OTM^m
????

∀ M' ⊨ PTM':
(1) ∧ (2)
∃ M ⊨ PTM:
(3) ∧ (4)
LTM, LTM ⊢ OTM



Why?
- Provide ontological relations on models
- Define fragments semantics
  ↳ Fragment language


aClass
bClass


aClass
bClass