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# TOWARDS MODEL RE-USABILITY FOR THE DEVELOPMENT OF TELESCOPE CONTROL SYSTEMS

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# AGENDA

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- Document centric vs. Model centric approach
- Re-use of Requirements
  - Domain Specific Language
  - Instances of Boilerplates
  - Constrain the Design
- Re-use of Constraints for Interfaces
- Conclusion

# Document vs. Model centric (1/2)

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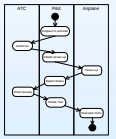
## Document centric

- Specify User Requirements as text
- Requirements analysis
- Write System requirements using text
- Describe level 1 design as text and model
- Write level 2 requirements as text
- Describe level 2 design as text and model

## Model centric



- Specify User Requirements as text
- Requirements analysis, capturing key properties with parameters and constraints in the model
- Generate System Requirements document
- Describe level 1 design, formally constrained by requirements parameters
- Generate level 2 requirements document

# Document vs. Model centric (2/2)

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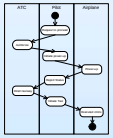
## Document centric

- Manual verification of Requirements and Design
- Manual creation of test cases
- Manual impact analysis using (inconsistent) requirements and design documentation

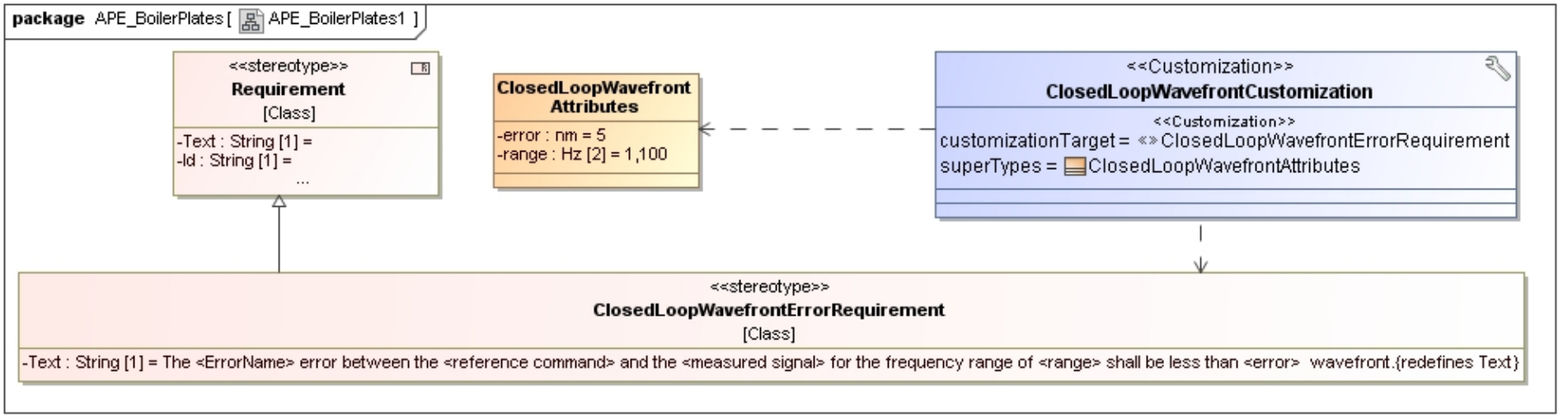
## Model centric



- Automatic validation of requirements and Design
- Automatic impact analysis – bottom up and top down

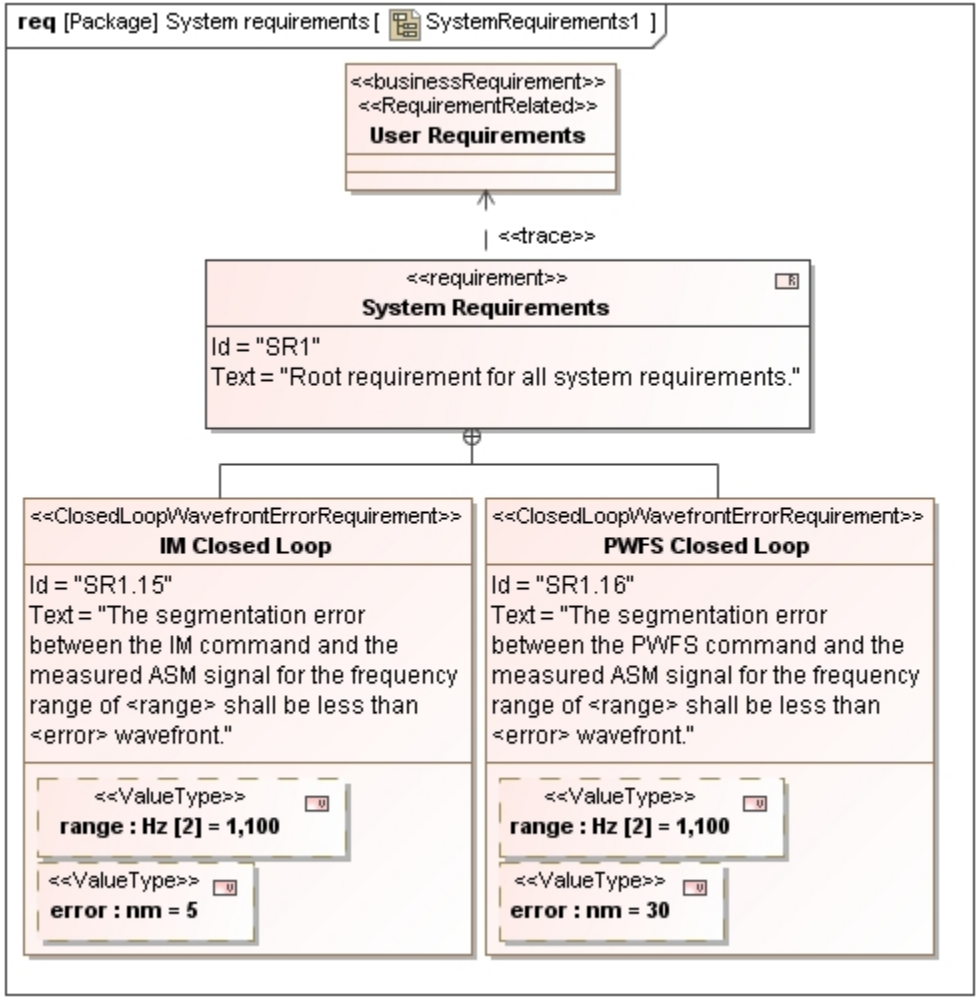
# REQUIREMENTS – Doman Specific Language

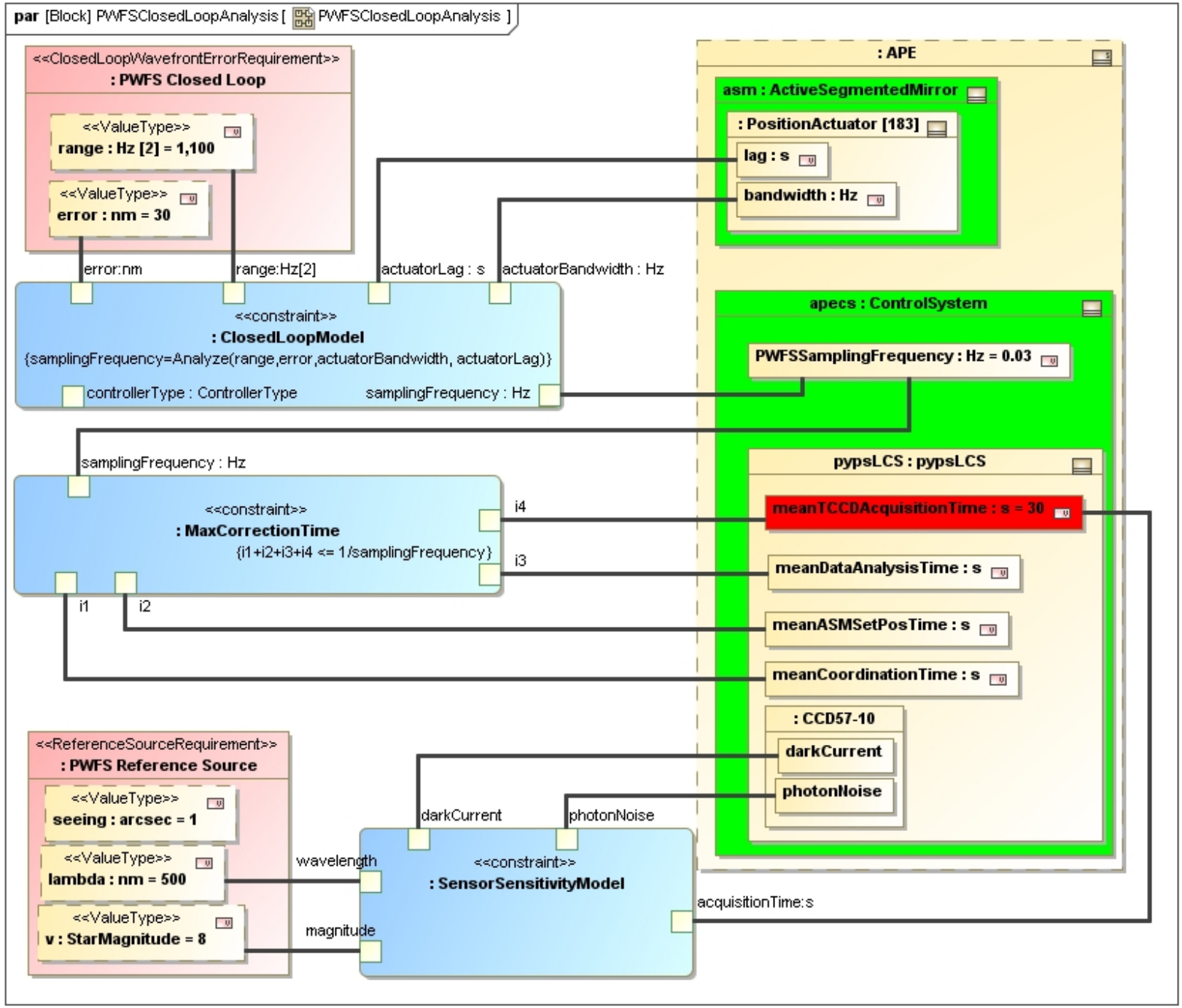
- Parameterize quantifiable parameters
- Standard text
- Reuse boilerplates for requirements



# REQUIREMENTS – Instantiation of Boilerplates

- Replace text parameters
- Redefine default values of quantifiable parameters




par [Block] PWFSClosedLoopAnalysis [ PWFSClosedLoopAnalysis ]
<<ClosedLoopWavefrontErrorRequirement>>
: PWFS Closed Loop
<<ValueType>>
range : Hz [2] = 1,100
<<ValueType>>
error : nm = 30
: APE
asm : ActiveSegmentedMirror
: PositionActuator [183]
lag : s
bandwidth : Hz
error:nm
range:Hz[2]
actuatorLag : s
actuatorBandwidth : Hz
<<constraint>>
: ClosedLoopModel
{samplingFrequency=Analyze(range,error,actuatorBandwidth, actuatorLag)}
controllerType : ControllerType
samplingFrequency : Hz
apecs : ControlSystem
PWFSSamplingFrequency : Hz = 0.03
samplingFrequency : Hz
pypsLCS : pypsLCS
<<constraint>>
: MaxCorrectionTime
{i1+i2+i3+i4 <= 1/samplingFrequency}
i4
i3
i1
i2
meanTCCDAcquisitionTime : s = 30
meanDataAnalysisTime : s
meanASMSetPosTime : s
meanCoordinationTime : s
: CCD57-10
darkCurrent
photonNoise
<<ReferenceSourceRequirement>>
: PWFS Reference Source
<<ValueType>>
seeing : arcsec = 1
<<ValueType>>
lambda : nm = 500
<<ValueType>>
v : StarMagnitude = 8
wavelength
magnitude
darkCurrent
photonNoise
<<constraint>>
: SensorSensitivityModel
acquisitionTime:s

# Re-use of Constraints for Interfaces (1/2)

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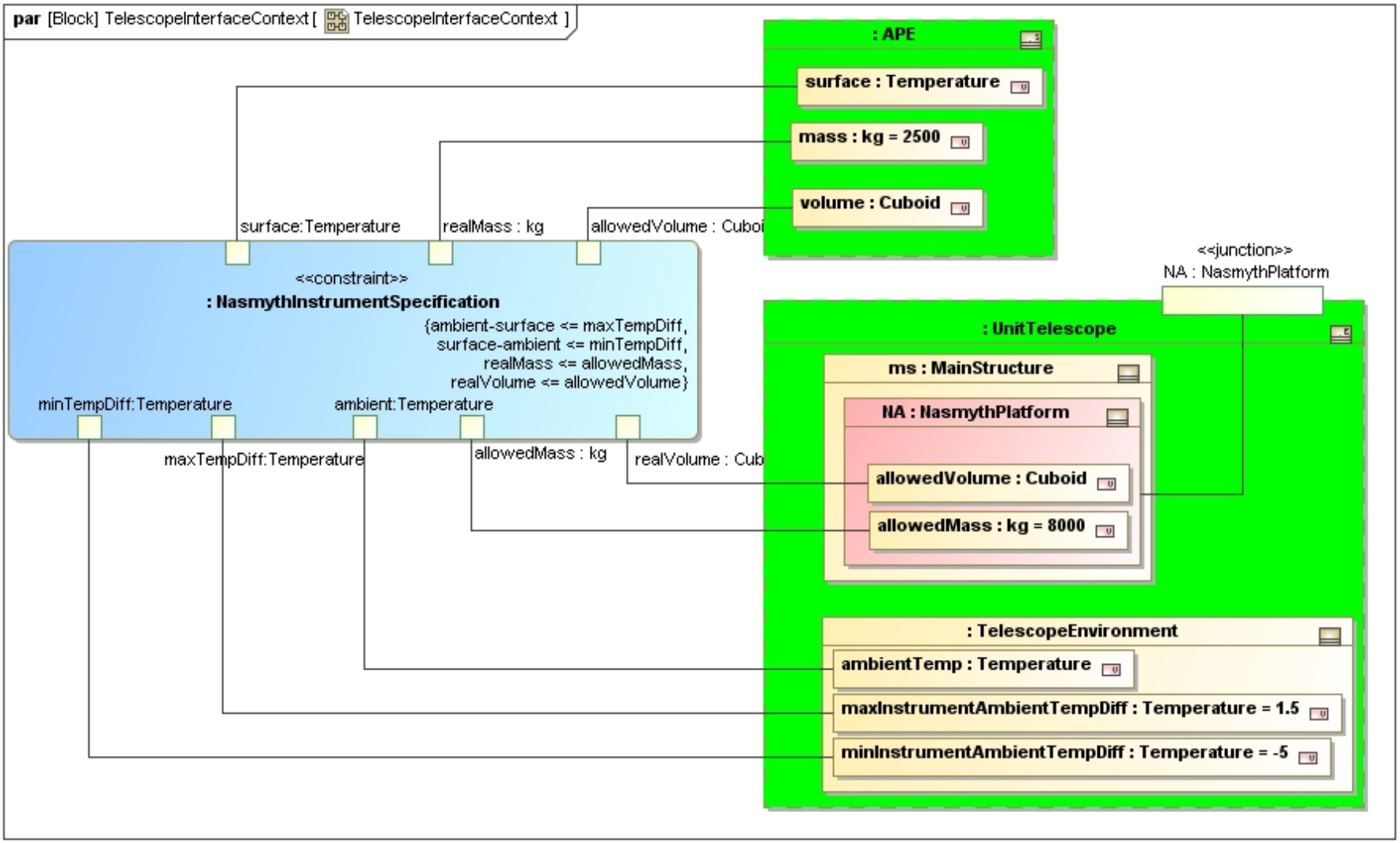
- Define quantifiable System Interfaces
- Constrain all participating components
- Propagate down the system hierarchy

# Re-use of Constraints for Interfaces (2/2)



# CONCLUSION

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- Requirements become more than text
- Bind requirements' parameters to system properties
- Specify system interfaces as executable constraints
- Reusability of model artifacts (requirements, constraints, etc.)

  -> easier due to higher abstraction level and less dependence on actual implementation
- Requirement validation during design phases
- Consistent and correct documentation via auto-generation
- Consistent impact and trade-off analysis