Webinar - Time and Duration Analysis

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November 22, 2016

Speaker

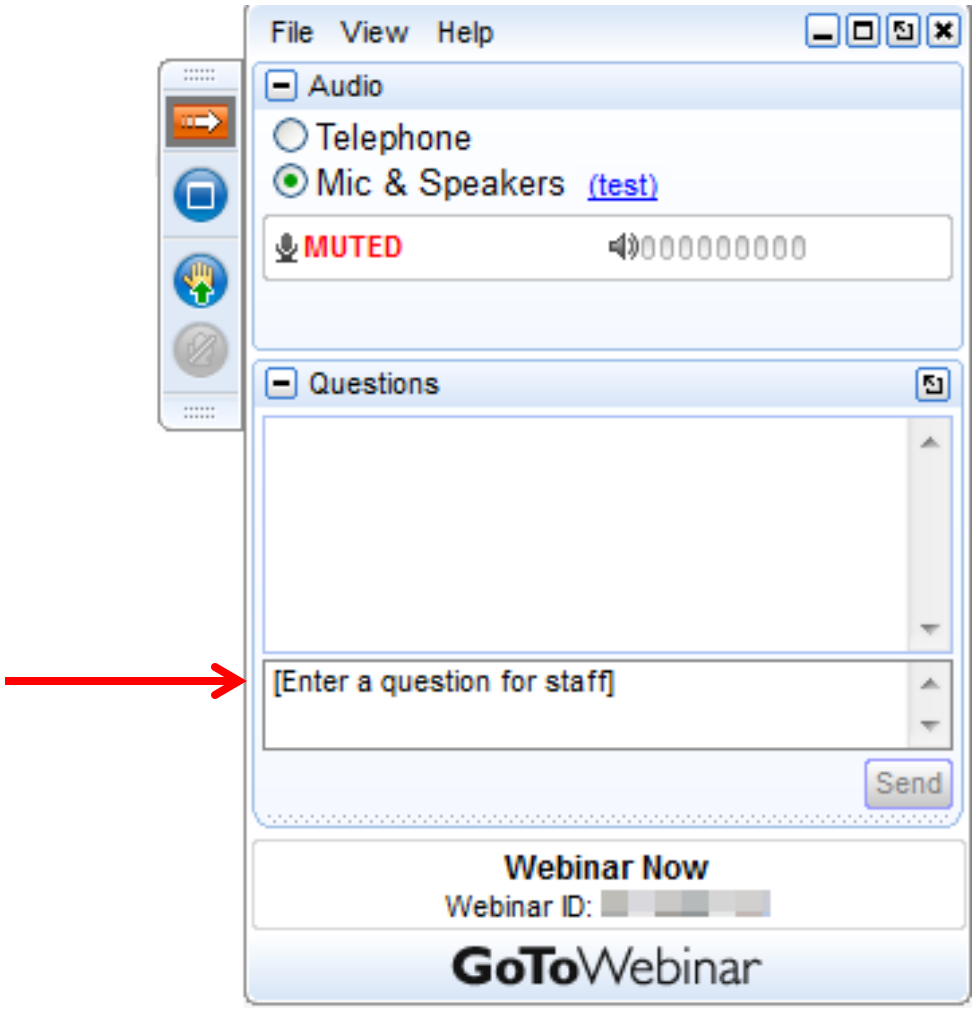
- **Nerijus Jankevičius**, nerijus@nomagic.com
- *Product Manager @ No Magic Europe*
- *Since 1997*

- Leads the development of MBSE tools and solutions

- Consulting companies such as NASA/JPL, ESO, BAE Systems, Kongsberg Defense and Aerospace, Nokia, Bernafon, GE Transportation, Bombardier Transportation, Pratt & Whitney, MITRE and others.

- OMG member since 2004
- INCOSE member since 2007
- Co-author of UML and SysML languages

Q&A: Type your questions here



Outline

- Introduction
- Timing concepts
  - Clocks, time steps
  - Time units
  - Time and duration constraints
  - Concurrency
- Timelines
- Duration simulation and analysis
- Constraints and requirements verification

EXECUTABLE UML/SYSML SEMANTICS PROJECT REPORT

"Many UML based tools do have execution capability with sequence diagrams and state machines.

However, the current SysML tools still are inadequate in their ability to provide executable activity diagrams and associated timelines, even though this was considered an important requirement in the behavior requirements in the UML for Systems Engineering RFP3."

EXECUTABLE UML/SYSML SEMANTICS PROJECT REPORT

(2008)


magicdraw
magicdraw
Architecture Made Simple

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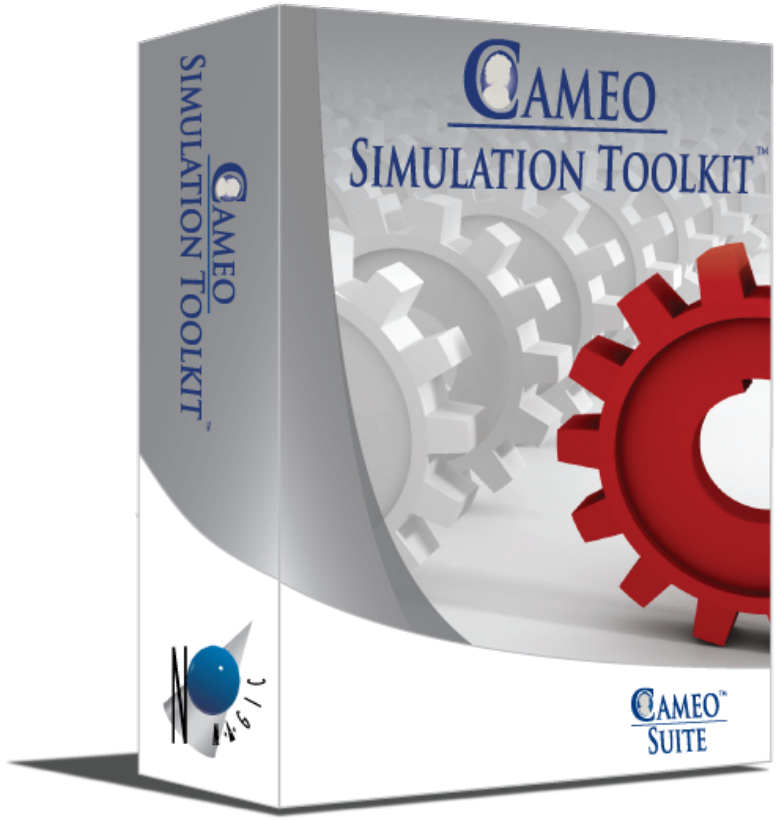

CAMEO
SIMULATION TOOLKIT
CAMEO
SIMULATION TOOLKIT
CAMEO
SUITE

Cameo Simulation Toolkit

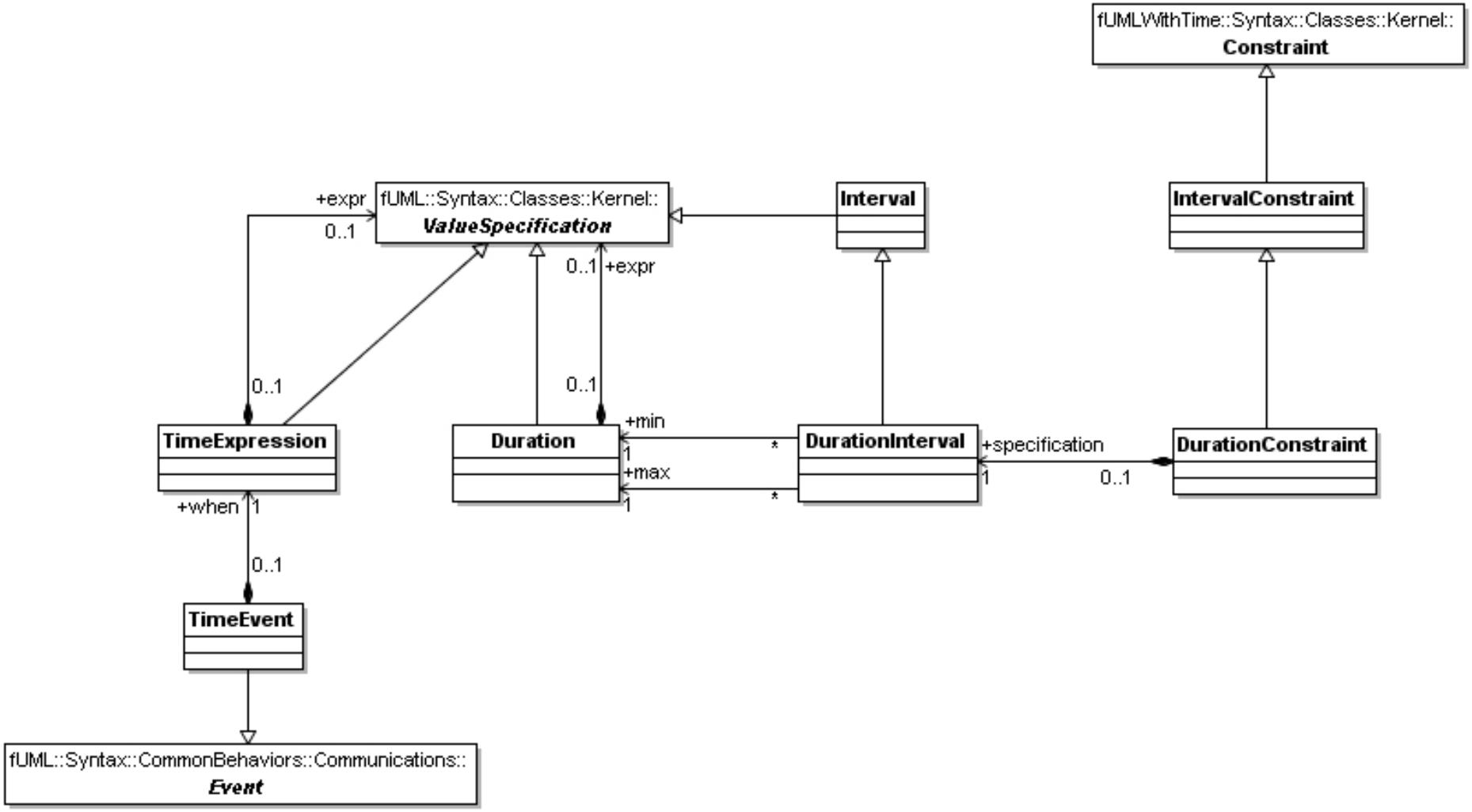
- Model execution framework and infrastructure:
  - Model debugging and animation environment
  - Pluggable engines, languages and evaluators
  - User Interface prototyping support
  - Model driven configs and test cases

- The standard based model execution of:
  - **Activities (OMG fUML standard)**
  - Composite structures (OMG PSCS)
  - Statemachines (W3C SCXML standard)
  - Actions/scripts (JSR223 standard)
  - Parametrics (OMG SysML standard)
  - Sequence diagrams (OMG UML Testing Profile)

The execution semantics for timing

- Concept of the flow of time (semantics of clocks, ticks and time values).
- Time events
- Time and duration constraints
- Time units

UML SimpleTime package

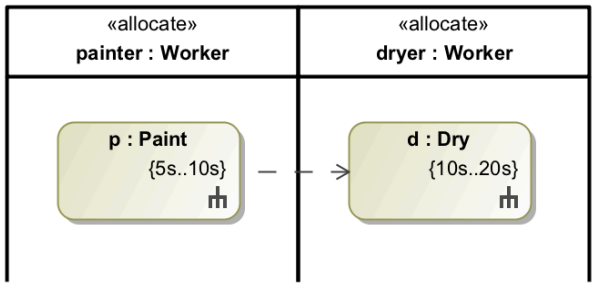


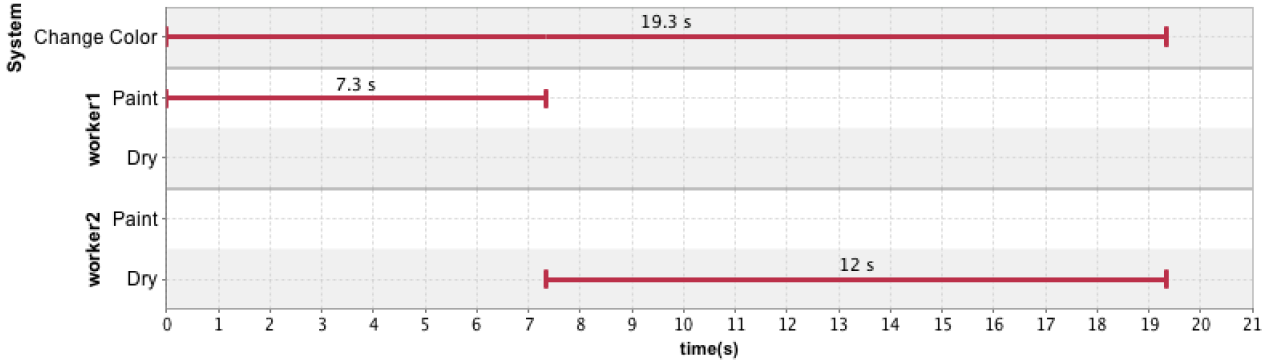
Clocks in Cameo Simulation Toolkit

- PC clock
  - Independent, out of control
  - Convenient but imprecise
  - Different results on every run or machine
- Simulation clock
  - Our own clock semantics, full control
  - Start time, end time, time step
  - Precise results
- Model-based clock
  - Custom clock implementation

Duration simulation and analysis

- To produce a timeline for the execution of an activity, it is necessary to know how long nodes in the activity take to execute.
- The way to do this is to attach a duration constraint to an action within an activity in order to specify a non-zero execution duration for it.





Time Units

- ms – milliseconds (default)
- s - second
- m – minutes (also “min” in 18.5)
- h - hours
- d - days
- week, month, year – coming soon

Time Events

Used as Trigger events

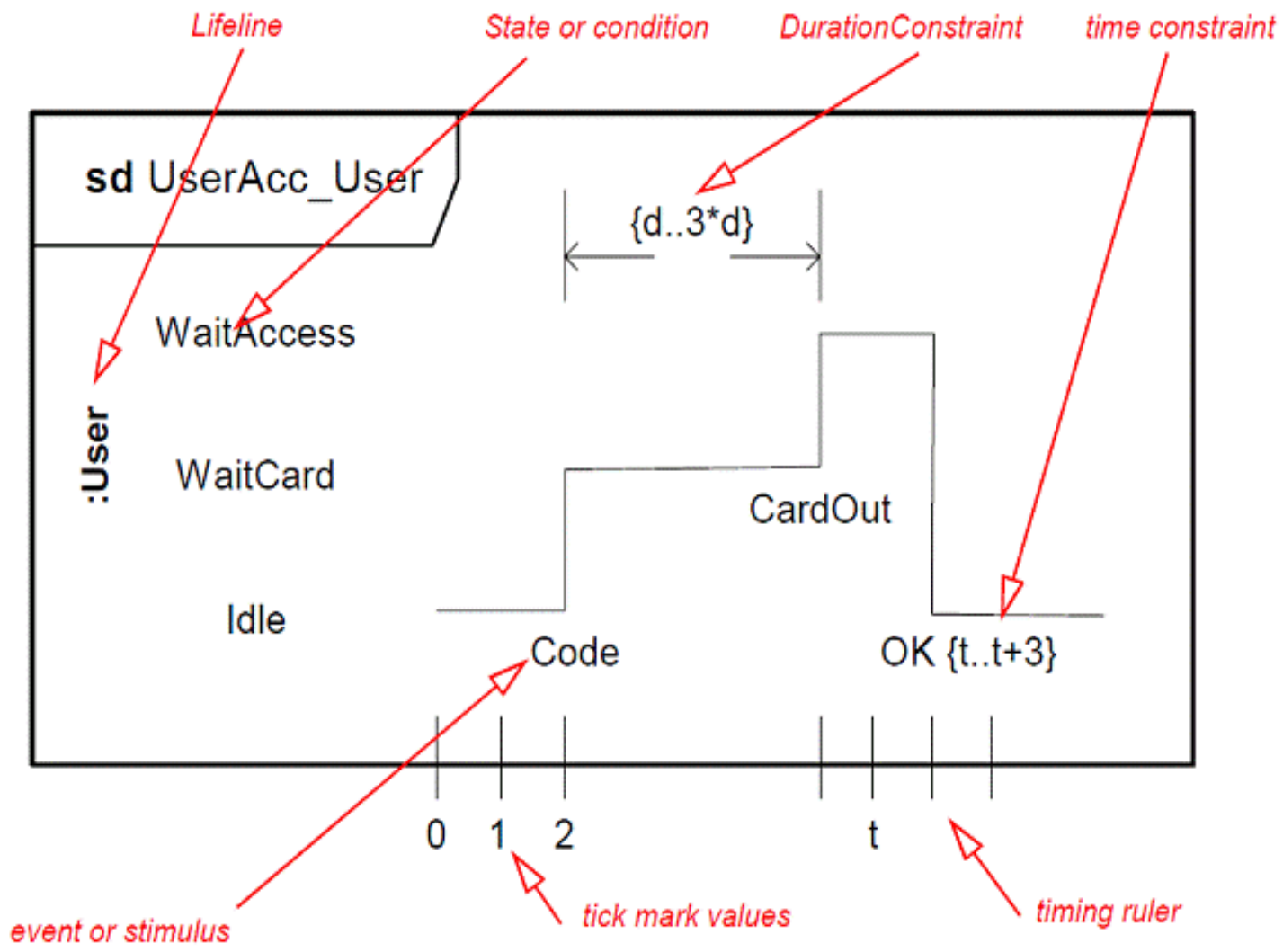
- AcceptEventAction -> Trigger -> Event
- Transition -> Trigger -> Event

- Absolute or relative
- Time units supported
- Variable names supported (e.g. “x s” where x is a value property of the context block)

UML Timing Diagram

- Timing diagrams show change in state or other condition of a structural element over time.
- The primary purpose of the timing diagram is to show the change in state or condition of a lifeline (representing a Classifier Instance or Classifier Role) over linear time.
- The most common usage is to show the change in state of an object over time in response to accepted events or stimuli.

UML Timing Diagram

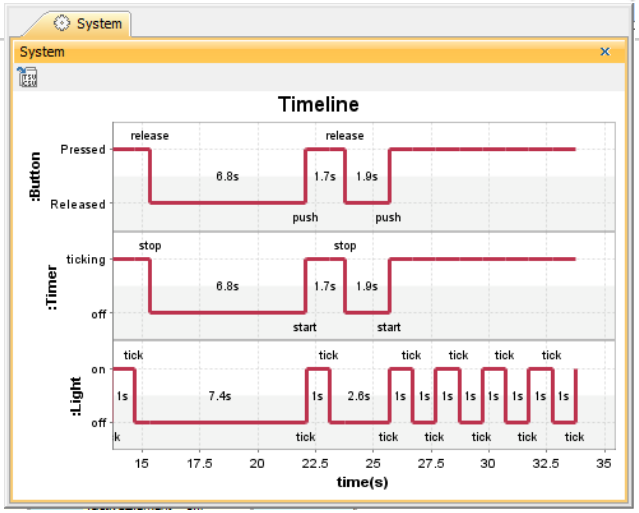


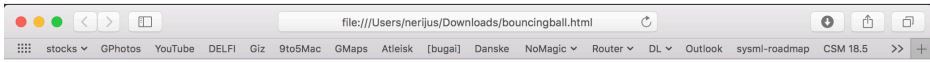
Timing diagrams in SysML

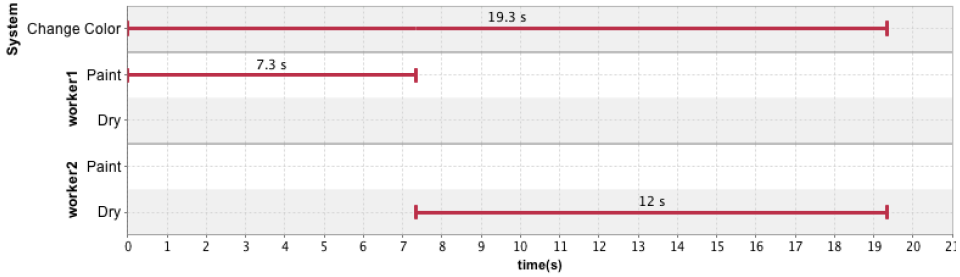
- The Timing diagram is excluded due to concerns about its maturity and suitability for systems engineering needs.

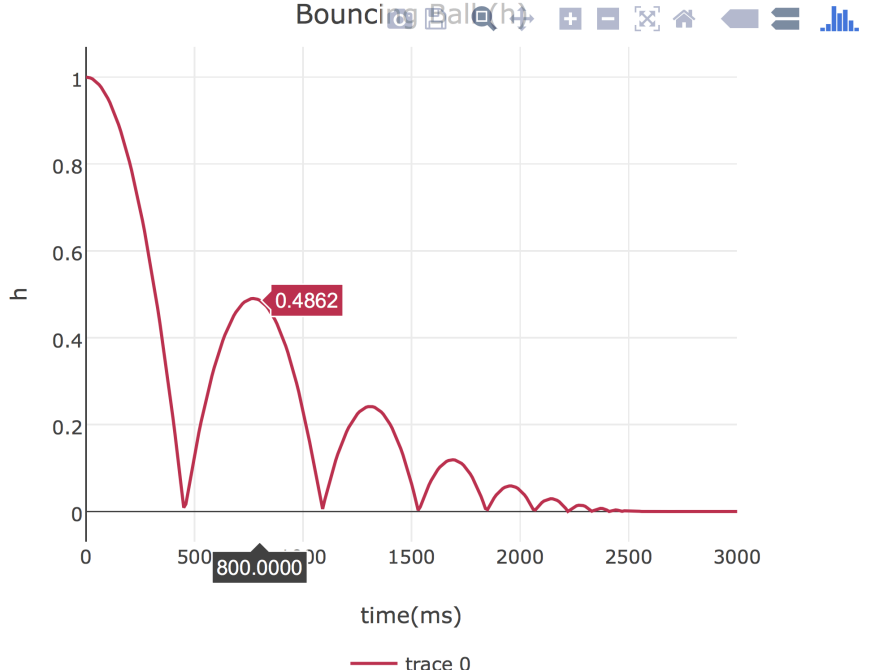
Timelines as execution result

- Timelines
  - Time series chart
  - States and events (Timing Diagram)
  - Activities and actions
- CSV, TSV import/export
- Save as image
- Include into diagrams



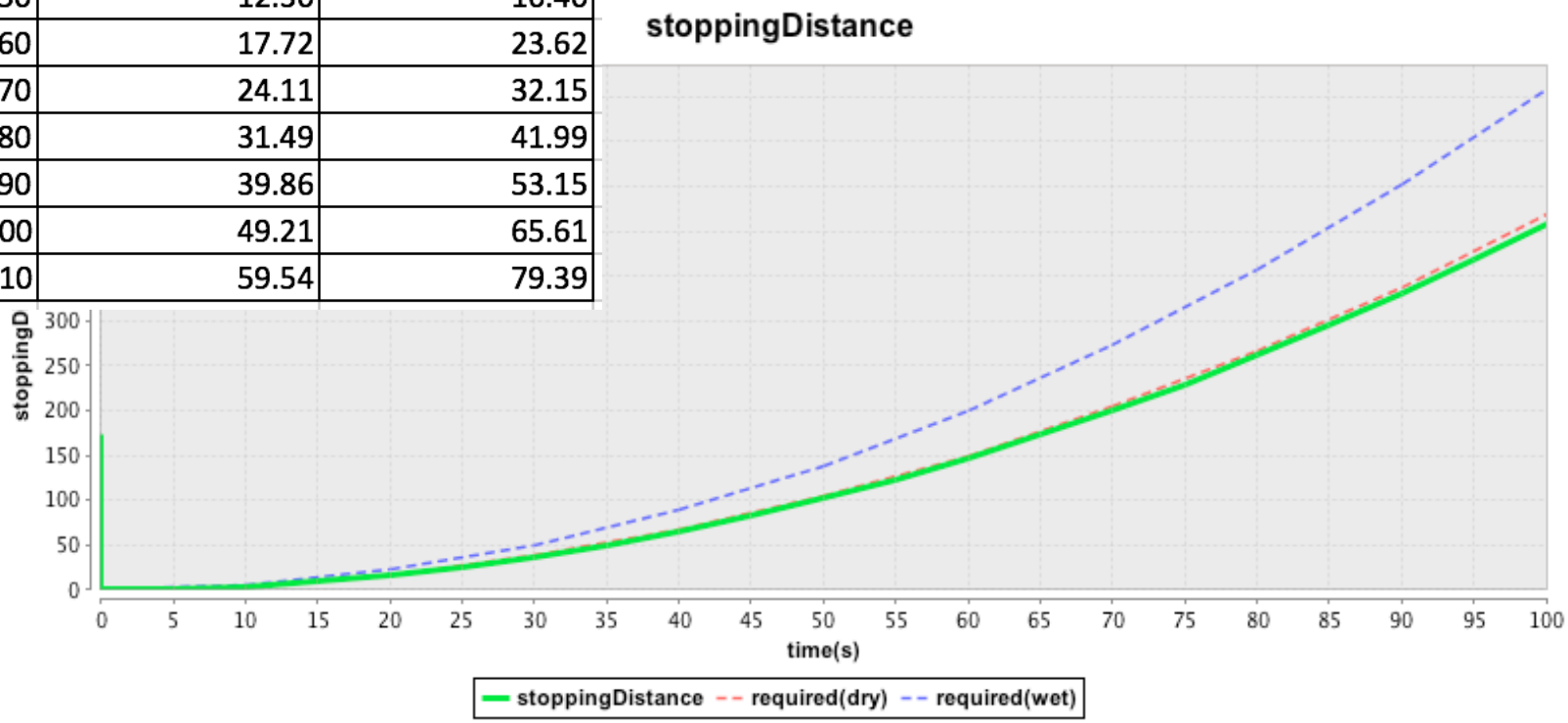






Performance requirements verification

Initial Speed (km/h)	Required Stopping distance (m)(dry)	Required Stopping distance (m)(wet)
0	0.00	0
10	0.49	0.66
20	1.97	2.62
30	4.43	5.91
40	7.87	10.50
50	12.30	16.40
60	17.72	23.62
70	24.11	32.15
80	31.49	41.99
90	39.86	53.15
100	49.21	65.61
110	59.54	79.39



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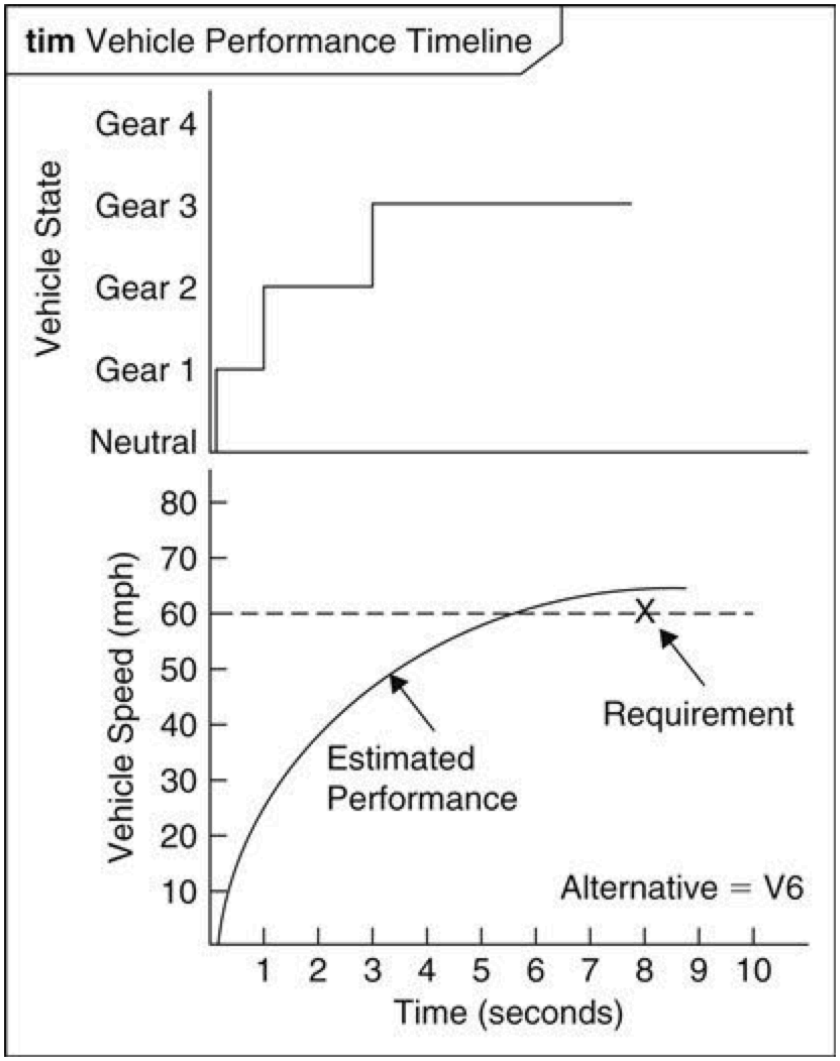

Friedenthal, Sanford; Moore, Alan; Steiner, Rick (2011-11-22).
A Practical Guide to SysML: The Systems Modeling Language (The MK/OMG Press)

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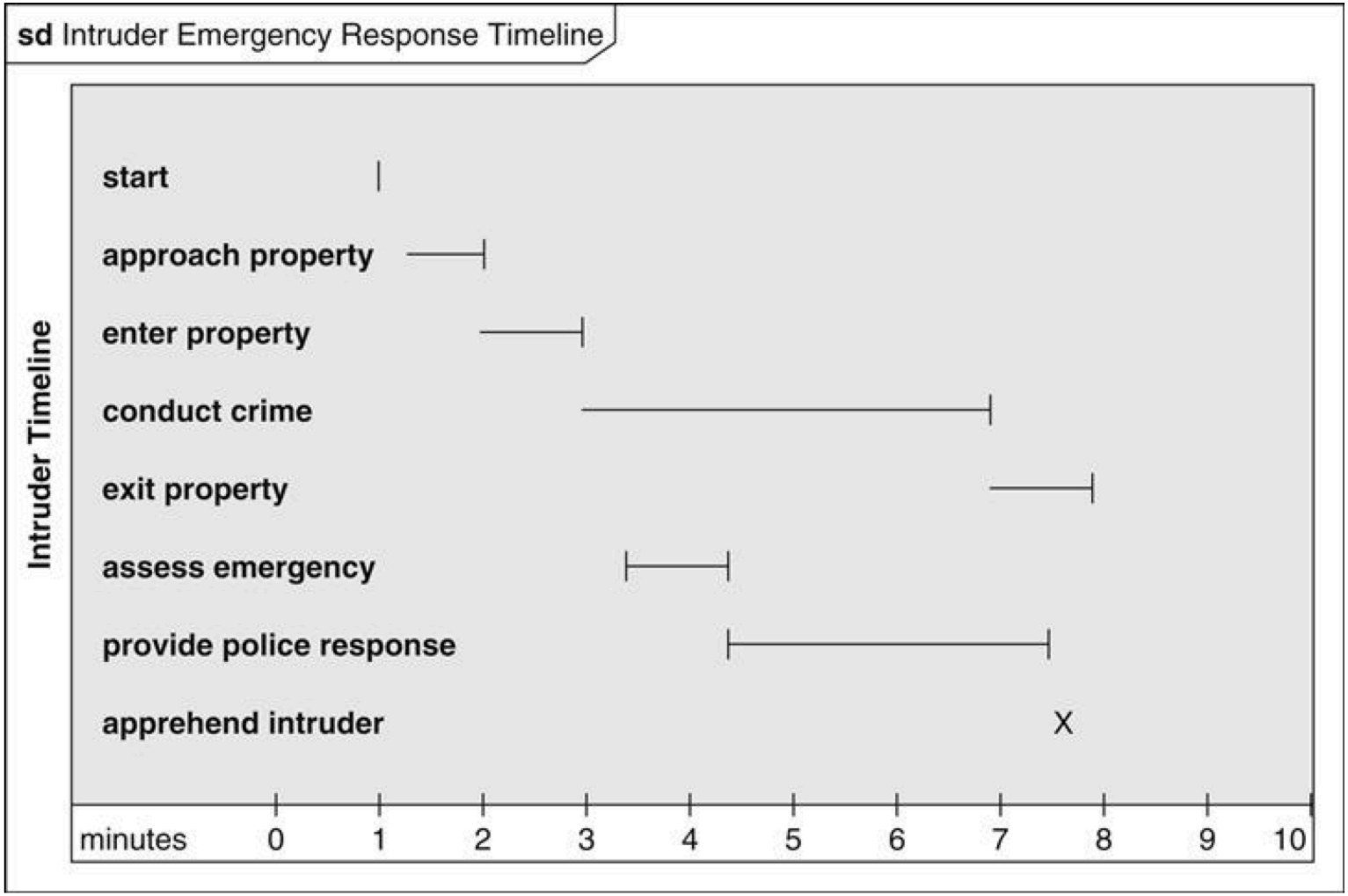

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Demo

Thank You!

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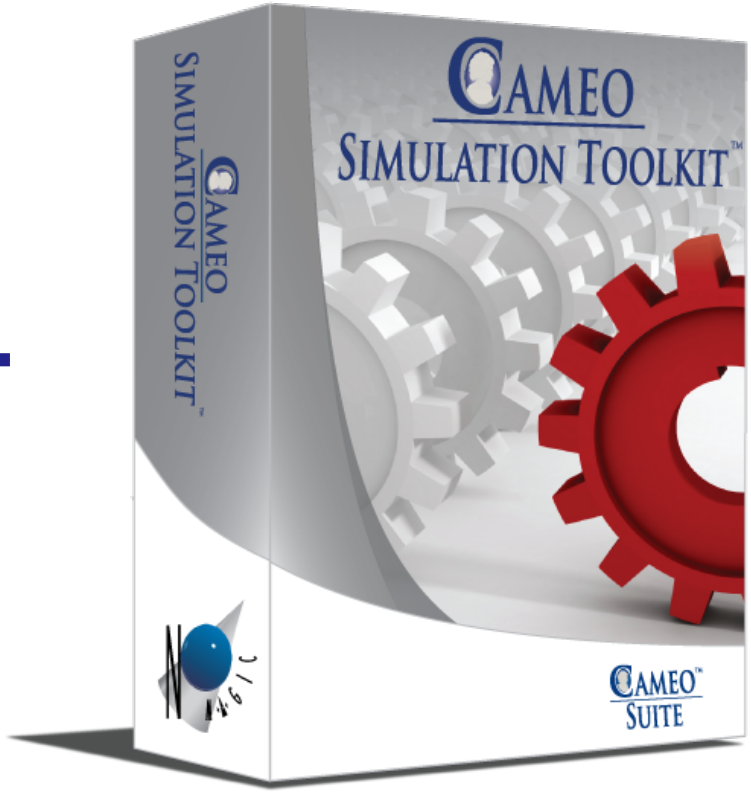

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