



SYMTA VISION

# SymTA/S Training

## OSEK Hands-On

### Tutorial 1

Solutions for Complex

Real-Time Systems



## Goals of this tutorial

- **Basic Setup and Analysis**
  - Configuration of basic **OSEK** and **Tasks**
  - Configuration of **Task Activation Offsets**
  - Modeling of **Interrupts, Activation Jitter, and Bursts**
  - Modeling **Runnables**
- You will answer some example “What-if” questions to investigate the design space



OSEK Hands-On Step 1:

# Basic OSEK Model



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OSEK Hands-On  
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## Outline Step 1: Basic Setup

- In the first step, we will set up the a typical ECU model with
  - one ECU with one CPU core
  - 5 tasks
  
- (the results can also be found in *OSEK-tutorial-1-step-1.xml*)

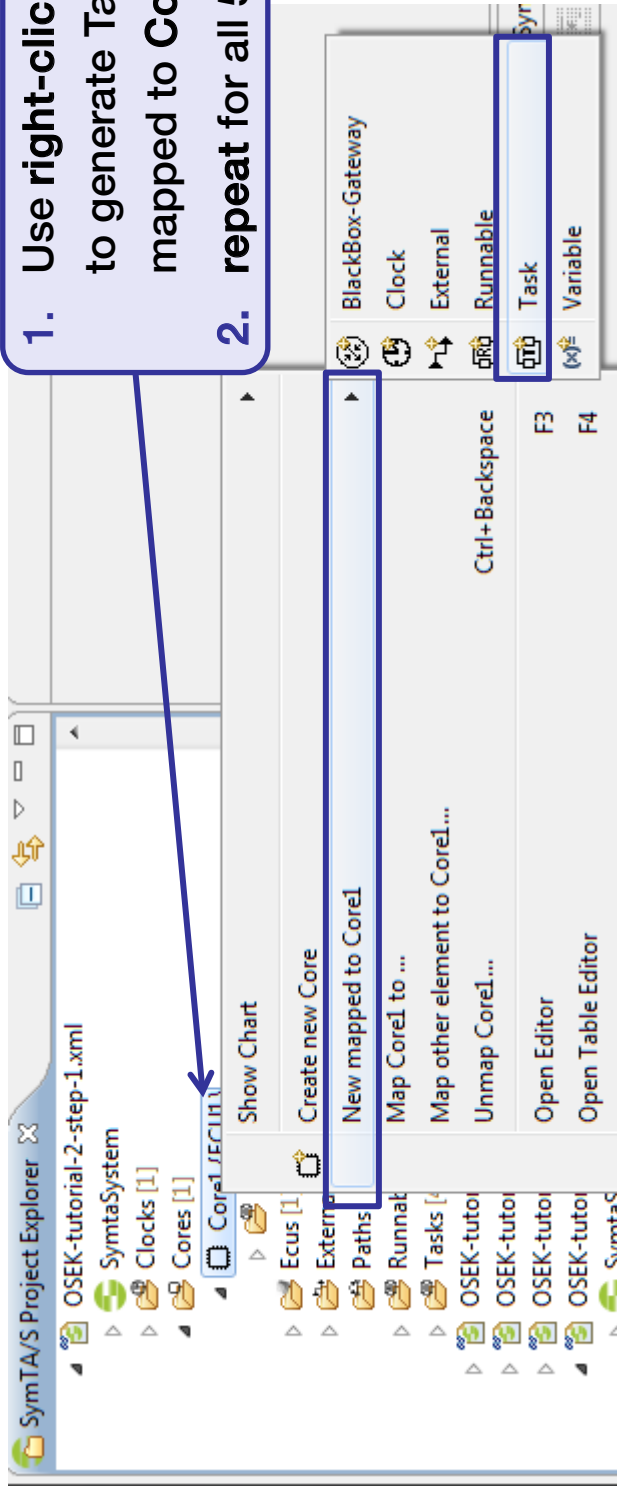


## Adding new model elements

- Use the project explorer to generate new model elements:
  - An ECU (“ECU”)
  - A processor mapped to that ECU (“Core”)

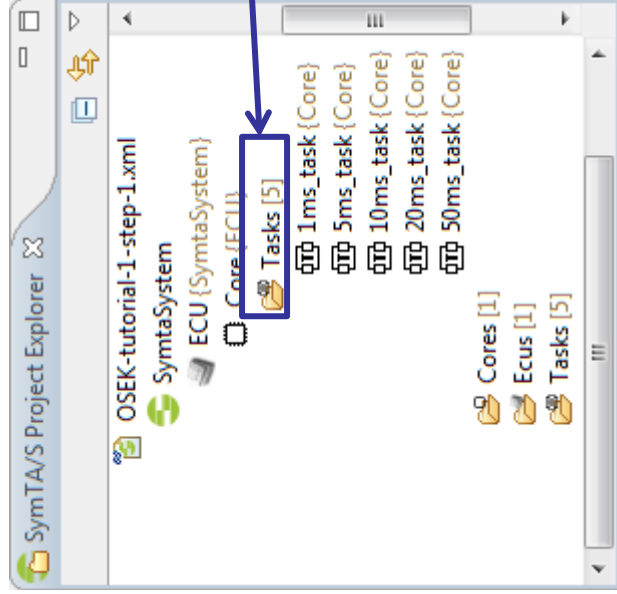


# Adding Tasks to the system



**1. Use right-click on Core to generate Tasks mapped to Core**

**2. repeat for all 5 Tasks**



**3. Double-click on the core's "Tasks" collection, to configure the task details**

# Setting the task parameters....

Worst-Case Task Execution Time (WCET)

Response time constraints?

Element	Task		Chaining			Question		Constraint				
	Parents	Read	W...e	Us...es	C...r	R...r	B...e	Order	Analyse	Ex...s	Min Response Time	Max Response Time
1 1ms_task	Core	<...>	<...>	IfExist	<...>	1	0	0	true	false	0 ms	<empty>
2 5ms_task	Core	<...>	<...>	IfExist	<...>	1	0	0	true	false	0 ms	<empty>
3 10ms_task	Core	<...>	<...>	IfExist	<...>	1	0	0	true	false	0 ms	8 ms
4 20ms_task	Core	<...>	<...>	IfExist	<...>	1	0	0	true	false	0 ms	<empty>
5 50ms_task	Core	<...>	<...>	IfExist	<...>	1	0	0	true	false	0 ms	<empty>
6	<...>	<...>	<...>	IfExist	<...>	1	0	0	true	false	<empty>	<empty>

Execution Time  
Core Execution Time  
[0.351 ms;0.432 ms]  
[0.171 ms;0.182 ms]  
[3.623 ms;4.298 ms]  
[0.107 ms;0.112 ms]  
[0.121 ms;0.121 ms]

Osek Task Parameter				Synchronization						
Task Type	A...d	T...d	Priority	N...p	B...e	Internal Activation	Synchronization	Offset	Relative Offset	Enabled
1 1ms_task	<...>	<...>	6	<...>	<...>	P (1 ms)	<empty>	<empty>	<empty>	true
2 5ms_task	<...>	<...>	5	<...>	<...>	P (5 ms)	<empty>	<empty>	<empty>	true
3 10ms_task	<...>	<...>	4	<...>	<...>	P (10 ms)	<empty>	<empty>	<empty>	true
4 20ms_task	<...>	<...>	3	<...>	<...>	P (20 ms)	<empty>	<empty>	<empty>	true
5 50ms_task	<...>	<...>	2	<...>	<...>	P (50 ms)	<empty>	<empty>	<empty>	true
6	<...>	<...>	<...>	<...>	<...>	No Event	<empty>	<empty>	<empty>	true

Is the task preemptive?

In OSEK, larger numbers are higher priority

All tasks are activated periodically



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# Configuration of Core

- ❑ Core shall run an OSEK scheduler
- ❑ Configure as follows:

The screenshot shows the configuration interface for a Core element. The main window displays the following configuration details:

- Element Name:** Core
- Core Scheduler:** GenericOSEK
- OSEK Analysis Settings:** Cooperative Tasks are fully pr (true)
- Note:** (empty)
- Comment:** (empty)
- Analysis Settings:** Worst Case Analysis (FullOffset), Analyze (All), Extended Analysis Result (All)

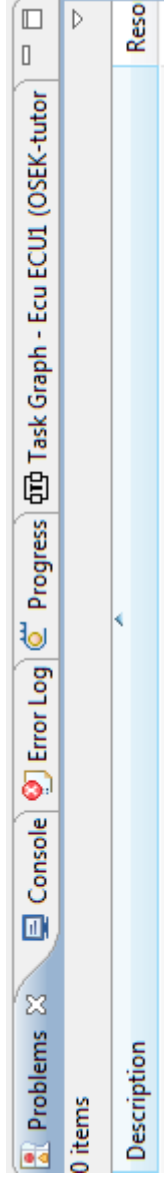
On the right side, there are three expandable sections:

- Osek Operating System Configuration:** Speed Factor (1), Execution Buffer (1), Kernel Priority (16)
- Parents:** The element has the following parents: ECU
- Possible Children Types:** The element has children of the following types: Clocks [0], External [0], Runnables [0], Tasks [5]



## Perform an Analysis

- Before the analysis, check the “Problems View” if there are modeling problems:

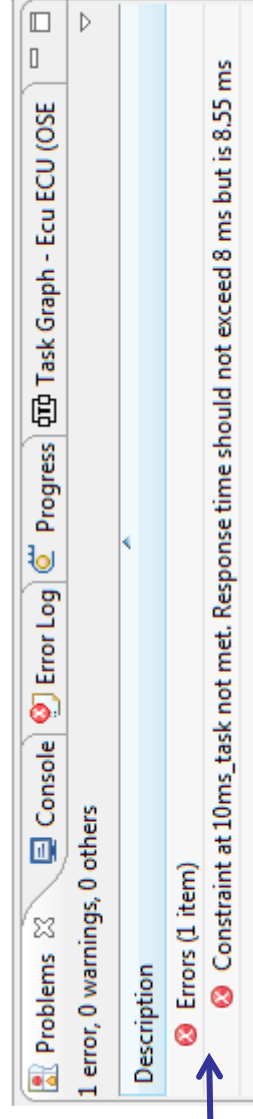


- Click on “Analyze System” to perform an analysis



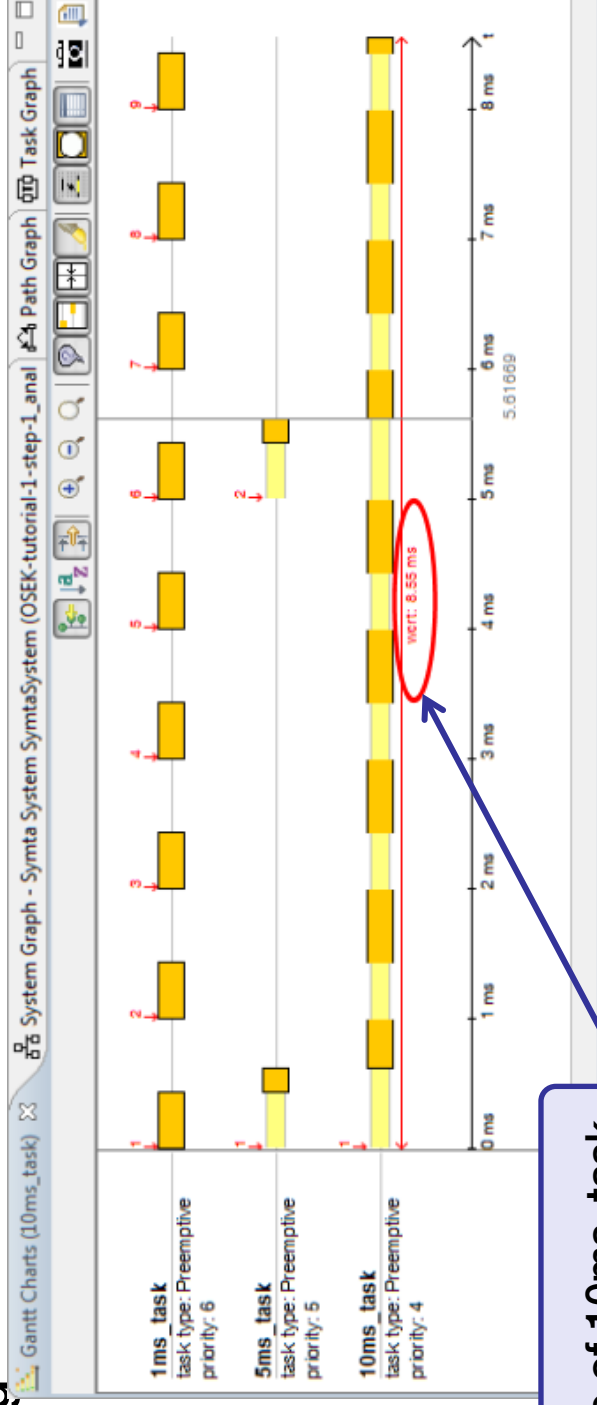
- SymTA/S now performs a timing analysis.
- After the analysis, check the “Problems View” again to see if there are potential timing problems!

Double-click on error to investigate error source!



## Track timing problems with Gantt Charts

- The Gantt Chart provides a quick and powerful overview on the resulting timing



Response time of 10ms\_task is too large due to coinciding high priority preemptions!

- The critical instant of this model relates to the possibility that all tasks can be executed at the same time. Using *offsets* will reduce this problem.

