Generating a User-Friendly SimEvents Model from a Capella Physical Model

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(Short) Corporate Presentation
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DUAL MARKETS
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TRUSTED PARTNER FOR A SAFER WORLD
Zoom on Optronics for Airborne Applications

The European leader in airborne optronics

- Integrated optronic equipment onboard on more than **20 types of aircrafts, helicopters and unmanned airborne systems**
- **Reconnaissance and targeting pods** operating in 12 countries

Situational awareness and reconnaissance

Weapon engagement

Protection of platforms and pilot assistance
2 - Goals and Principles

« Estimate the Performance of Video Processing Chains in a Few Clicks »
Supporting the Architecture of Video Chains

Architecting optronics systems is a work of expertise
Supporting the Architecture of Video Chains

Architecting optronics systems is a work of expertise

Optronics systems are chains of image processing functions

- More and more complex
- To be optimized in many dimensions
Problem Statement: time performance prediction of these systems

- Predicting the time performance of these chains requires tools
  - Discrete-Event Simulation (DES) software is the state of the art technique
  - It simulates interactions and accounts the time spent

- D.E.S. is not used as of today
  - Delay and cost of developing a simulation
  - Architects just rely on standard office tools

- Challenge: how to enable the use of DES for Optronics Systems?
Engineering Process: Architecting Video Chains

The architecture is defined with Capella

The simulation runs on Matlab Simulink

It has to be easy to use
Our solution: automatic generation of the simulations

1. EXPORT
2. IMPORT
3. RUN SIMULATION
4. DISPLAY RESULTS

System architecture: nodes, functions, data Flow(s) and critical functional chain(s)

SimEvents
Scheduling and Synchronization Library

Authored within Thales with significant support from MathWorks France

Simulation chronogram
Demonstration

1. EXPORT
2. IMPORT

System architecture

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Simulation chronogram
3 - Simulation Principles

Mapping Capella → SimEvents
Scheduling

- Simulates a processing resource shared between several functions
  - Parameterized with policy, number of functions, etc.
- In Capella: functions are allocated on the physical resources
- In SimEvents:
  - The **Job** entity models one run through the chain
  - The **Step** block models the entry in the function
  - The **Scheduler** block models the resource sharing
Function Chaining

- Simulates the flow of data through the functions on the processors
- In Capella: functional chains order function involvements
- In SimEvents: the same order applies between Steps
  > Job entities flow from Schedulers to Steps in the order of the chain
  > Schedulers are laid out in this order
4 - Implementation

SimEvents & Matlab
Main Features

Some Numbers

- Approx. 6 eng.mths + MathWorks support
- Library of 12 SimEvents blocks
- 10 classes, 166 functions, 3000 lines of Matlab code

Main components

- Loader
  - XML parser
  - Model reduce
  - Model save & restore
- UI
  - AppDesigner-based menu
  - Mask-based block options, callbacks
- Generation
  - Chain-based Ordering
  - Block production
- Simulation
  - Block inner design
  - Event capture
- Chronogram display
  - external, JavaFX based
Example: Scheduler in SimEvents

- Internal view of the block (Unknown to the user)
- Automatically tailored based on block parameters
Conclusion

Initial objective
- Very early estimate of the processing chains performance

An appropriate tool for the targeted purpose
- Discrete-Event Simulation gives the expected estimates
- Generation approach gives good correctness guarantees
- Ease of use for video chain architects
- Added benefits: dynamic view of the system, architecture exploration

An appropriate platform
- Visual programming with SimEvents
- Efficient UI-building tools
- The Matlab API can edit and instrument all blocks