Alcatel Alenia Space - SpaceWire Overview

SpW Working Group meeting #6 – 18/05/2006

R&T - SpaceWire S/W Model

System view of SpW usage
traffic & margin (1/1)

- **Estimate of the traffic becomes very complex**
  - For interleaving of several sources and applications on the same link
  - With different cargo packet sizes and asynchronous effects
  - Which is the case of space application
    - Instrument data handling over one SpW link
      - ✓ Data distribution, command/control, time, synchro and interrupt
      - ✓ Autonomous application and user asynchronous events
    - Shared resources through a SpW network
      - ✓ as a Mass Memory with instruments, data processing and formatter
- **High interest of model simulation**
  - Validation by simulation from a preliminary network topology
  - Easy setting of data-rates, packet and buffer sizes, priority schemes
  - Statistical tests with record of maximum traffic and buffer loads
  - Allows to define a posteriori, buffer sizes and link data-rates
  - Runs with all typical anomalies allow to define realistic margin

R&T : MOST (1/6)

❑ R&T study to build models of Spacewire networks

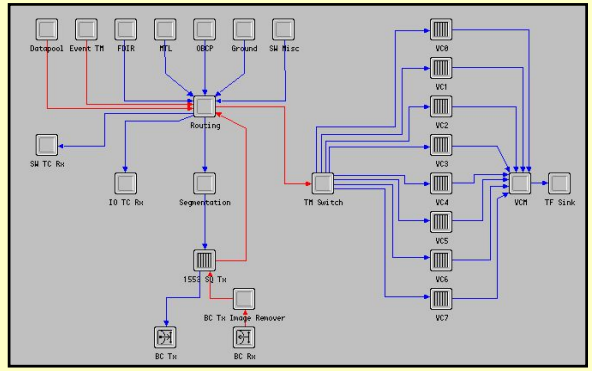
❑ Modeling Of Spacewire Traffic (MOST)

- Intended to simulate traffic
- Build any network topology involving routers and nodes
- Simulates node behavior in term of data generation and consumption
- Allows to parameterize data production
- Run scenarios including error cases
- Produces a report of traffic analysis (evaluates peaks and margins, shows long term evolutions of resources usage with graphics, identify saturations cases)

R&T : MOST (2/6)

MOST is based on

- network modeling already experienced in the frame of Hershel-Planck project to simulate 1553 and TM traffic



Example of in-house HP Model

- The R&T 2006 investments cover :
  - the creation of a SPACEWIRE library describing routers and nodes
  - the creation of networks models based on actual projects (proposals or phase A)
  - the stimulation of the network models with use-case scenarios
  - the elaboration of reports for traffic analysis
  - The correlation between simulation and actual network configurations on test bench (validation of the library)

Expected benefits of simulation

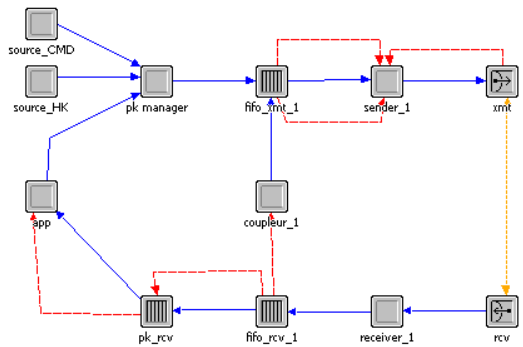
Simulation of networks

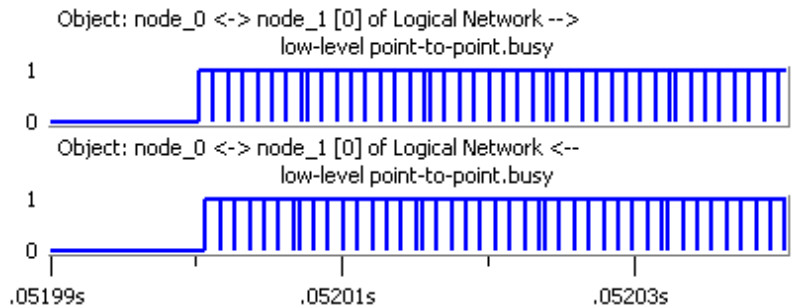
- **Can be used along all development phases**
  - To consolidate designs in phase A
  - To complete analysis in phase B and C
  - To complete validation coverage in phase D
  - To reproduce/investigate anomalies in phase D
- **In complement to functional/performance validation, correlated with local traffic analysis :**
  - Reconstitutes full traffic history for investigation with focus on traffic windows realized on avionics test bench during robustness tests
  - Adds easily other scenarios aimed at traffic verification
  - Covers cases which are unfeasible on avionics test bench (anomalies)

Accurate simulation

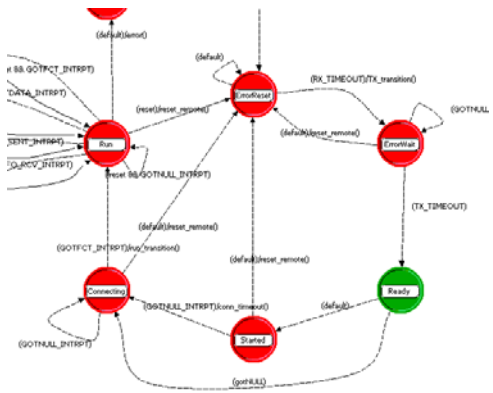
- **At character level due to traffic dependence on both directions**
  - **reliable because all features and mechanisms are simulated**

Node model





- **Realistic because based on**
  - **SpW standard**
  - **manufacturer data-sheets**

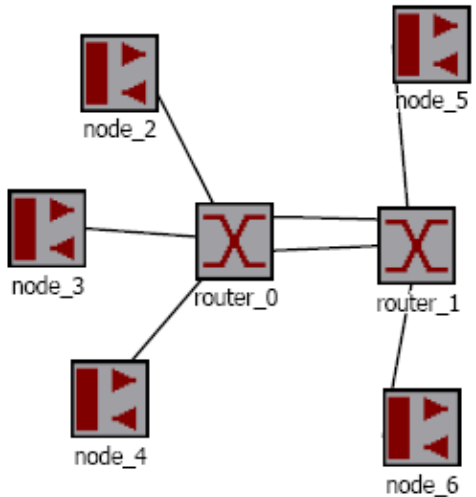


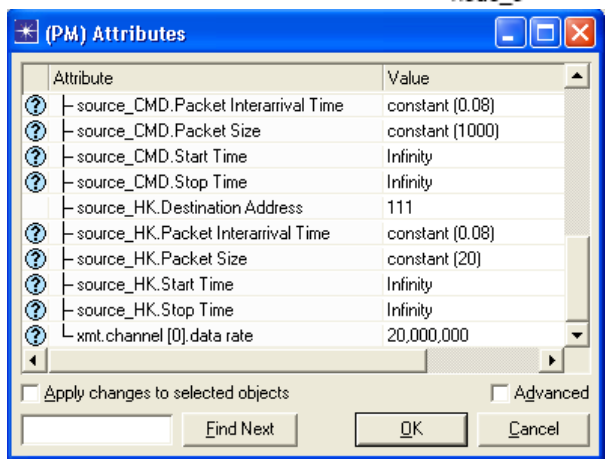
State diagram model

R&T : MOST (5/6)

Friendly tool for customizable network

- By picking objects from library
- By easy setting of key parameters
  - packet and buffer size, data-rate…
- Simulation up to application level
  - with external C functions
- Allowing incremental design

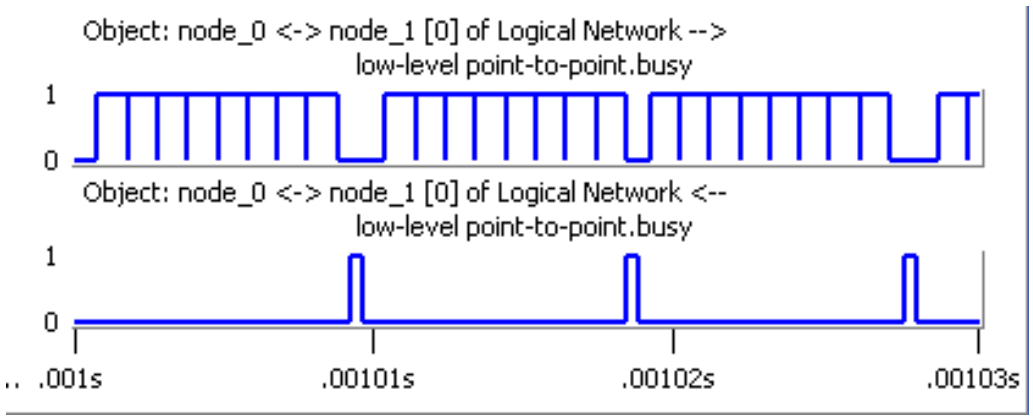




R&T : MOST (6/6)

Powerful tool for measurement and analysis

- **Wide set of measurement and statistics at each level**
  - **Delay, buffer use, traffic**
- **Powerful analysis tool from low to high level**
  - **with complete or statistical approachs**



Data and FCT transfert