Reconnaissance Satellite Sub-System

Introduction

Mirabilis Design Inc.'s customer is a manufacturer of avionics and airplane engines with a multibillion dollar turnover. It is also a leading producer of auxiliary power units (APUs) and other aeronautics products.

The customer needed a new design for a reconnaissance satellite that processed and routed the traffic to other satellites, aircraft, and ground stations. It was to function as a compute server and router in the sky.

The government had mandated that the prototype be simulated first and all use cases tested before beginning the actual physical development of the satellite. Consequently, the customer required a comprehensive simulation environment.

The customer faced the following challenges:

1. The existing simulator was inadequate; a more advanced and broader simulator was required, with better support.
2. Seamless integration of the simulator into their software environment was needed.

Mirabilis Design stepped in and with its extensive IP library, the actual simulation was created successfully and all use cases tested. It also helped that the customer was already familiar with Mirabilis Design and its flagship product VisualSim.

The Simulation Challenge the Customer Faced Before Mirabilis Design and VisualSim

Custom hardware designs were expensive and time consuming to develop.

The customer needed to establish a new standard that would help them to mitigate payloads design costs and reduced development time through common standards.

Their existing product did not have all the required features, and they also needed to build a much larger system than what was current.

The simulator that had been in use till then, was not being supported any more. Therefore a more sophisticated simulator was required.

Eventually their objectives were refined to:

- Develop a virtual system prototype
- Deliver test systems (test models)
- Evaluate selected system configurations

Why the Customer Chose Mirabilis Design and VisualSim

The customer was familiar with Mirabilis Design's methodology. Students recruited from the university were already familiar with VisualSim.

The customer saw that VisualSim was fully protected, it had all the libraries, and the simulation was faster. VisualSim successfully replaced a competitor product.

The technical support provided by Mirabilis Design was a major motivation.

The methodology deployed by Mirabilis Design was also very similar to the customer's previous generation product (the simulator in the bus) that was in use.

Working closely with our applications engineer ensured constant collaboration and customer support. Consequently the project was executed very fast.

How the customer used VisualSim

VisualSim was used for the following:

- Building Virtual Prototypes based on Fundamental Architect blocks
- Developing testing features within the models
- Measuring performance levels
- Appropriately use abstraction levels

The role of VisualSim:

- Estimating processing time, read data and write data size
- Scheduled tasks across different slots of the ARINC653 and ran simulations with dynamic variations of data
- Simulated 100 days of satellite behavior within two days of real-time
- Aided in measuring peak and cumulative power consumed by hardware devices
- Computed the heat generated and the cooling capacity
- VisualSim model diagnostic ensured the task complete within the specified deadline in case of failure.

The Results

VisualSim Architect was deployed and the project was successfully completed.

- Accurate virtual prototype of the required I2C bus was built
- Operation of the bus in various use cases were tested
- Protocols specifications were validated

The success ensured the planning of the future project with an expanded scope:

- Optimize 1553 interface model
- SpaceWire interface
- Model Serial RapidIO
- Model of scalable backplane
- VITA 65 (open VPX), VITA 46 (VPX) integrating data, control, management and power plane

The customer built a team around VisualSim and influenced universities to use VisualSim.

With Mirabilis Design's comprehensive IP library, the actual simulation and use cases were created and tested respectively, before the physical development of the prototype.

If you would like similar results, reach out to us!