Virtualizer

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Overview
Semiconductor and electronics companies developing the next generation of wireless, consumer and automotive devices are facing growing challenges. These challenges include verifying more complex multicore hardware, developing software in a timely and cost effective manner and communicating specification across their supply chain efficiently. Virtual Prototypes are fast, fully functional software model of systems under development executing unmodified production code and providing a higher debugging/analysis efficiency. They are used for software-driven verification, software development integration and test, and to communicate and enable the supply chain. Synopsys delivers the most complete virtual prototyping solution covering authoring tools, model libraries, end user debug and analysis tools, methodologies and services. Synopsys’ proven virtual prototyping experience and expertise has enabled leading semiconductor and electronics companies to deliver more competitive products up to 6 months faster.

The Impact of Software
Increased software content in electronic products is causing a paradigm shift. Software and hardware development has become so interdependent that maintaining separate development efforts can cost designs 8-20 months—and their market window. In addition, electronic product companies are constantly under pressure to deliver more competitive products faster. As a result, new development tools and approaches are required. These new development tools must address the challenges of concurrent hardware and software development, developer’s productivity and collaboration between teams and within the supply chain. Virtual prototyping provides a solution to these new development challenges and requirements.

What are Virtual Prototypes?
Virtual prototypes are fast, fully functional software models of systems that execute unmodified production code and provide higher debugging and analysis efficiency to users. Available pre-RTL, they enable concurrent hardware/software engineering and more productive software development, integration and test throughout the design flow from specification to deployment. Virtual prototypes can represent systems ranging from a processor core, system-on-chip or hardware board to electronic devices or a network of devices. These prototypes can be used throughout the specification, development and deployment of an electronic product.

Competitive Electronic Products Faster
Electronic product development is faster using virtual prototyping. This is achieved through:

- **Early availability:** Virtual prototypes can be available before the physical system (RTL, board, testbench, etc). They can represent the entire system, a subsystem or simply a set of relevant software development functionality (e.g., a core with the set of peripherals needed for OS porting). This scalability enables milestones to be optimized. Early availability enables concurrent hardware, software and system development.

- **Easier accessibility:** Virtual prototypes are software packages. As such, they can be duplicated and distributed worldwide to a large number of users in a matter of minutes rather than weeks. They provide a simplified development environment executable on every developer’s desktop.

- **Increased productivity:** Virtual prototypes, unlike physical hardware, provide visibility and controllability over the entire system. This includes cores, interconnects and peripherals. It results in faster edit-compile-debug cycle productivity. In addition, the system execution is deterministic and the debugging is non-intrusive.

Incorporating virtual prototyping in the electronic product development cycle also results in more competitive products through:

- Early validation of specification ensuring differentiated products meeting market requirements
- Higher quality with more extensive and corner case testing
- Reduced development costs through improved productivity

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Figure 1: From a physical to virtual development environment
**Quantitative results using Synopsys’ Virtual Prototyping Solution**
- Start software development 9 to 12 months prior to hardware availability
- Clarify and quickly correct hundreds of specification errors prior to implementation
- Identify and correct software bugs in hours rather than days
- Integrate new software on first silicon within a day
- Instantly enable development and collaboration at worldwide locations
- Remove physical hardware dependency from the supply chain
- Improve development cycles by 30% to 50%

**Use Virtual Prototyping from Specification to Deployment**
There are several virtual prototyping use cases and design tasks throughout the electronic product development cycle.

**Specification**
- Capture software functional requirements, definition phase prototyping

**Development: software-driven verification**
- Create system-level test incorporating software
- Validate RTL using system-level test

**Development: software development, system integration and test**
- System validation
- Self hosted test development environment
- Low-level software development
- Application, networked and distributed application software development
- QA testbench replacement
- Software centric power analysis
- Software performance optimization
- Fault injection testing

**Deployment**
- Go-to-market, technical support and customer enablement
Virtualizer

Virtualizer is comprised of a suite of modular tools and technologies which enable the development and deployment of virtual prototypes.

- For developers creating a virtual prototype, Virtualizer delivers faster time to virtual prototype availability through the broadest model portfolio, including support for the leading processor core IP and DesignWare® IP models, model reuse from architecture design flows, intuitive and SystemC/TLM aware authoring tools and automated packaging to facilitate the distribution of virtual prototypes across the supply chain.
- For developers targeting the use of virtual prototypes for software development, SoC HW/SW integration, verification or system validation, Virtualizer Development Kits (VDKs) provide fast and accurate virtual prototype simulation combined with advanced debug and analysis tools supporting system-level, multicore-aware software debug and analysis, concurrent hardware/software analysis, and synchronized debugging with third-party software debuggers and IDEs.

Virtualizer Creation: rapid and efficient development of virtual prototypes

Virtualizer enables the rapid and efficient creation of virtual prototypes design to meet the specific end-user needs. The focus of the Virtualizer creation tools are to accelerate the time to availability of the virtual prototype, while ensuring it meets the requirements of the end-user design task.

Virtualizer includes:

- The largest portfolio of processors, interconnects, peripherals and reference designs enabling designer to quickly start assembling virtual prototypes
- Peripheral modeling tool automatically generating template models, documentation and unit tests
- Integrated flows with component design tools such as high-level synthesis, processor design, algorithm design and model-based design tools
- Intuitive graphical and script based prototype assembly
- SystemC/TLM aware model debugging tools based on the eclipse framework
- Simulator delivering high-speed as well as timing accurate simulation performance
- Automated packaging of virtual prototypes for easy distribution of the virtual prototype and the associated debug and analysis tools to end-users

In order to ensure the right simulation support for the end user design task, Virtualizer supports multiple levels of abstraction and design methodologies. They include:

- The IEEE and Open SystemC Initiative (OSCI) loosely timed and approximately timed abstraction level defined by the Transaction Level Modeling (TLM) methodology
- SystemC-based untimed and cycle accurate abstraction level and modeling
- Virtual Processor Model (VPM) based modeling. VPMs provide simulation speed and accuracy specifically targeted at embedded control applications with hard real-time requirements

Figure 3: Virtual prototyping development flow

Virtualizer Graphical Assembly and SystemC/TLM-aware debugging accelerate virtual prototype development

Figure 4: Virtualizer Graphical Assembly and SystemC/TLM-aware debugging accelerate virtual prototype development
Hybrid modeling for HDL/virtual prototyping co-simulation or combined FPGA/virtual prototype execution targeted at verification and system integration

Virtualizer supports the broadest model library and reference design portfolio with more than 500 models available from Synopsys. These models include processor cores, interconnects, peripherals as well as complete reference designs running entire software stacks. Synopsys provides support for a wide range of popular processor architectures including ARM, MIPS, PowerPC, SH, V850, Tensilica, DSPs as well as peripheral IP models from DesignWare and ARM PrimeCell. In addition an extensive set of APIs enable developers to incorporate their own models for simulation, debugging and analysis in Virtualizer.

Virtualizer Development Kits (VDKs): Starting development earlier with higher productivity

Virtualizer Development Kits are targeted at developers interested in using a virtual prototype to achieve a specific design task. These design tasks include software development, integration and test, hardware verification, system validation, and more. VDKs enable developers to start development early (6 to 12 months prior to RTL). In addition the debug, analysis and interfacing capabilities delivered as part of the VDKs provide developers with a higher level of productivity. Two packages are available:

VDK is targeted at the software development, integration, test and verification regression users. It includes:

- Deterministic high-speed and accurate simulation performance on Linux and Windows hosts of multicore platforms executing unmodified production software
- Integration and debug synchronization with a broad range of embedded software debuggers and IDEs including ARM RVDS, Lauterbach Trace32, Eclipse based IDE, PLS, gdb/DDD, etc.
- Eclipse-based debug and analysis tools covering system-level multicore software debug, analysis and system-level hardware/software analysis
- Fully scriptable and customizable environment enabling scenario-based testing, record and replay, application-specific data capture, etc.
- Non-intrusive operating system awareness tool kits
- Virtual I/Os enabling connectivity to physical components such as USB or Ethernet
- Interfaces to other domain simulators including HDL simulators such as VCS®, physical system simulation, algorithm design simulators, etc.
- Integration with FPGA-based prototyping environments such as the HAPS® systems

VDK+ is targeted at the HW/SW system validation user. It includes all the VDK features above and then expands them with system-level hardware analysis and SystemC/TLM debugging. It provides developers with the aggregated view of the hardware and software behavior. As a result, concurrent engineering and communication between hardware and software teams can be improved resulting in fewer specification and implementation errors.

Supported platforms

Virtualizer and VDKs support both Linux and Windows. 32 bit and 64 bit host platform are supported (‘dependent on model availability)
Synopsys Services: ramp up faster, expand your capacity, leverage expertise

Synopsys has an extensive and successful track record of collaborating with customers to create and deploy virtual prototyping solutions. Synopsys services include:

- Tools and methodology training assist individual users to improve their use of the tools
- CoStart services enable faster project ramp up time by getting guidance from Synopsys tools, modeling and methodology experts
- Modeling services provide additional assistance to create component models or subsystems
- Virtual prototype creation services provide a complete platform delivery capability so that you can focus exclusively on using the virtual prototype

About Synopsys System-Level Solutions

Virtual Prototyping is part of a comprehensive system-level offering from Synopsys. Synopsys’ System-Level Solutions:

- Provide the broadest portfolio of system-level models from a single supplier
- Accelerate the creation and optimization of common SoC blocks
- Facilitate SoC architecture exploration and optimization
- Provide the most complete prototyping solutions to accelerate embedded software development and system validation
- And enable value throughout the semiconductor supply chain.

For more information on System-Level Solutions, visit: http://www.synopsys.com/systems.

Synopsys’ Virtual Prototyping solution is delivered through Virtualizer or CoMET/METeor.

For more information about the Synopsys Virtual Prototyping Solution visit us on the web at www.synopsys.com/virtualprototypes, contact your local sales representative or call 650.584.5000.