An Executive Brief

EMBEDDED SOFTWARE
2008 MARKET INTELLIGENCE SERVICE

Track 2: Software/System Modeling and Test Tools
Volume 2: Virtual System Prototyping/Simulation Tools for Software Development and Verification

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Last year, VDC conducted a preliminary study focused on the market for Electronic System Level (ESL) tools. Within the ESL market, VDC specifically defined a unique class of tools called virtual system prototyping/simulation tools for software development and verification. These tools provide development platforms for software engineering via high-level modeling and fast simulation of target hardware within a host development environment.


An extensive analysis of the world market for software and system modeling tools used in embedded applications leads us to the following conclusions:

**Market Overview**

Today’s commercially available virtual system prototyping/simulation solutions each have unique focuses and strengths, with most ultimately making some trade-offs between simulation performance, cycle accuracy, and system-level breadth. For this reason, it is challenging to define these tools based on a rigid set of characteristics. However, virtual system prototyping/simulation solutions are generally known for the following benefits they potentially deliver to users, including:

- Early access to hardware prototypes that are accurate enough to confidently proceed with software development and debug on virtual hardware prior to the availability of a physical prototype, reference design, or the final hardware device.
- Fast execution of software within a virtual environment that closely meets or exceeds the performance that the end device or system will provide, while at the same time providing a strong link to the behavior of the underlying hardware platform.
- Cost/time savings over building a physical prototype that may be technically complex to build and/or costly to produce, configure, monitor, and maintain.
- Portability/replicability of the virtual platform, enabling distributed teams to have access to identical versions of the virtual prototype.
- Greater visibility into complex systems (with multiple processing units networks of systems), allowing for advanced debugging.
- Early input into the hardware development process.

In 2007 VDC estimates that the emerging market for virtual system prototyping/simulation tools, though currently a relatively small industry, grew substantially from 2006, and anticipates a healthy rate of growth over the foreseeable future. VDC believes that the demand for these types of tools will continue to grow as hardware designs become more complex, software becomes a more important part of the engineering lifecycle, and the need to accelerate time to market continues to place pressure on product suppliers. VDC sees this demand originating both from semiconductor manufacturers interested in delivering better silicon designs and development kits to their customers and from systems manufacturers looking to benefit from the advantages the technology can potentially bring in terms of development efficiency.
Strategic Issues, Drivers, and Trends

Software continues to emerge as an increasingly important aspect of the hardware and system engineering process. The amount of software content within the typical embedded engineering project is growing quickly. In fact, VDC’s most recent survey of embedded system engineers (working on a variety of projects and tasks) indicated that the average engineer expects the number of lines of software code to increase by nearly 20% on their next project. Based on this and other metrics, VDC estimates that the total embedded software code base may be growing at a rate of approximately 9% per year.

VDC expects market participants to place increasing focus and effort on enabling the effective development of software throughout the system engineering process as a result of the expanding importance of software development/test across all types of embedded system engineering disciplines (See Exhibit 1).

<table>
<thead>
<tr>
<th>Exhibit 1</th>
<th>Percent of Time Spent on Various Design Tasks on Current Project by Primary Role within Company (Average of Respondents)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project management/planning</td>
<td>Software Engineer 7% Hardware Engineer 9% System Architect/Engineer 12%</td>
</tr>
<tr>
<td>System architecture design and specification</td>
<td>12% 19% 22%</td>
</tr>
<tr>
<td>Algorithm design</td>
<td>10% 7% 7%</td>
</tr>
<tr>
<td>IC/SoC design/verification</td>
<td>0% 6% 0%</td>
</tr>
<tr>
<td>Board level engineering/test</td>
<td>3% 22% 7%</td>
</tr>
<tr>
<td>Firmware development/test</td>
<td>29% 24% 26%</td>
</tr>
<tr>
<td>Operating system development/test</td>
<td>4% 1% 4%</td>
</tr>
<tr>
<td>Software application/middleware development/test</td>
<td>22% 3% 12%</td>
</tr>
<tr>
<td>System integration/test/verification</td>
<td>12% 9% 10%</td>
</tr>
</tbody>
</table>

Respondents to VDC’s survey of embedded engineers continue to indicate that physical prototyping methodologies are the most common prototyping approaches toward software engineering. However, VDC expects to see broader use of virtual prototyping techniques, including instruction set simulation, operating system emulation, and virtual system prototyping/simulation tools used in combination with more traditional physical prototyping methodologies over time. While evidence of a rapid migration to virtual prototyping methodologies from this year’s survey of embedded system engineers is somewhat less pronounced than data from last year’s ESL survey, VDC continues to expect greater use of virtual prototyping methods to manage increasing system complexity over time (See Exhibit 2).
VDC notes a number of key trends impacting the virtual system prototyping/simulation tools market, including:

- Increasing design complexity of hardware impacting software engineering
- Future opportunities for the advancement of hybrid prototyping methods
- General lack of model availability and interoperability
- Semiconductor suppliers’ investment in customer enablement through virtual platforms
- Emergence of market for open virtual platforms

**Market Drivers**

Based on the value propositions that virtual system prototyping/simulation tools can offer, VDC believes that there are a number of trends within the embedded software and systems development market that will increase the demand for solutions of this nature. Some of these include:

- Growing complexity and level of functionality per device/system, including the increasing amount of complex software code to be designed/tested and the increasing sophistication of embedded hardware platforms, including the migration toward networked multiprocessor systems and multi-core hardware environments.
- Growing importance of software design within the embedded system development market and the greater influence of software development on product development projects.
- Greater interoperability of hardware models from different sources and continued efforts to standardize approaches to enabling effective message passing and co-simulation among of discrete types of models.
- Increased adoption of the Eclipse framework by leading embedded software vendors, potentially easing integration of virtual prototyping/simulation and software debug environments.
• Intense time-to-market constraints and the inherent value of getting products to market more rapidly – especially in a highly competitive technology markets.

• Push from board and semiconductor companies to provide useful tools to support their customers and successfully support rapid product development.

• Increasing use of Electronic System Level (ESL) design methodologies and formal modeling and design techniques at the system level, especially within the semiconductor market.

**Market Inhibitors**

While current embedded development trends present reasons as to why virtual system prototyping/simulation tools should experience success going forward, there are a number of factors that may be impeding the extent of growth within this market, including:

• Lack of general model availability and the time and resources required to build and maintain usable virtual prototypes of hardware.

• Remaining questions about what engineering teams (either internally, within the supply chain, or a combination of both) should take ownership of designing and managing virtual hardware models.

• Availability of open source and semiconductor supplied alternatives to commercial offerings.

• The fact that commercial vendors must support the development of unique virtual hardware models, making these solutions highly service/support oriented, and difficult in some cases to leverage across dissimilar designs.

• The degree of user trust in and experience with traditional methods of debugging, instruction set simulation, physical prototypes and reference designs, and other proven development tools/processes.

• The need to tightly integrate these tools into the larger software development/debugging process currently in use within today’s OEMs.

• Difficulty in convincing software development teams to invest heavily in tools as a result of the pricing pressure on standard tools within the broader software engineering market.

**Market Estimates and Forecasts**

In 2007, VDC estimates that the market for virtual system prototyping/simulation tools for software development and verification grew substantially from 2006 to 2007 and expects this market to continue to grow through 2010.

Key findings of VDC’s market analysis include:

• Semiconductor suppliers and systems companies each represent significant revenue categories.

• Product licensing accounted for the majority of market revenue in 2007. Maintenance licensing revenue is expected to increase slightly through 2010 and professional services revenue is expected to continue to represent more than 35% of the total market.
The Asia-Pacific region (driven in large part by Japan) is expected to grow the fastest over the forecast period.

VDC believes that the mobile phone and consumer electronics industries represented the largest markets for VSS tools in 2007. Telecom/datacom, military/aerospace, and automotive were also major markets for VSS solutions.

Competitive Analysis

The top five leading vendors within the virtual system prototyping/simulation tools for software development and verification market included: ARM, CoWare, Synopsys, VaST, and Virtutech.

In addition to the above market leaders, there are a number of other important technologies within the ESL and embedded software markets that in many respects can be seen as both competitive and complementary to virtual system prototyping/simulation products, including offerings from:

- ESL and EDA tool vendors
- Instruction set simulator and operating system emulation solutions suppliers

Summaries and Observations

VDC notes the following observations regarding the market for virtual system prototyping/simulation tools for software development and verification:

- Importance of model availability and interoperability
- Importance of link to semiconductor implementation
- Emergence of hybrid methods to achieving fast hardware prototyping
- Strong value proposition needed to drive adoption by software engineering teams
ABOUT THE STUDY

As part of its *Embedded Software 2008 Market Intelligence Service*, VDC Research Group (VDC) is pleased to announce the release of a study covering the global market for virtual system prototyping/simulation tools for software development and verification.

VDC has defined this market to include tools that enable the creation, assembly, and simulation of hardware designs modeled at a high-level of abstraction (above RTL) that offer simulation speeds fast enough to support efficient software development and verification through system simulation, and that are primarily targeted to this function.

ABOUT VDC RESEARCH GROUP

VDC Research Group (VDC) is a technology market research and strategy consulting firm that advises clients in a number of technology markets including: Automatic Identification and Data Collection, Embedded Hardware and Systems, Embedded Software and Tools, Industrial Automation and Control, Mobile and Wireless, and Power Conversion and Control. Using rigorous primary research and analysis techniques, the firm helps its clients identify, plan for, and capitalize on current and emerging market opportunities. We strive to deliver exceptional value to our clients by leveraging the considerable technical, operational, educational and professional experience of our research and consulting staff. During our nearly four decades of ongoing operation, we have had the pleasure of serving most of the world’s leading technology companies, many high-profile start-ups, and numerous blue-chip early and later stage investors. Our products and services consist of research reports, annual research programs, and custom research and consulting services. Founded in 1971, the firm is located in the Boston area. Please visit our Web site at [www.vdcresearch.com](http://www.vdcresearch.com) to learn more.


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