Technical Specification Group, Radio Access Network ***TSGR#5(99)___583_____***
Meeting #5, Kyongju, 6-8 October 1999

Source:	Synopsys
Title:	A new C++ formal description technique possibly suitable for specification of the radio baseband processing for IMT2000.
Document for:	Information
Agenda Item:	
Related to:	TSGR#4(99)373 "Liaison from ITU-R TG 8/1 on formal description technique proposed for the specification of the radio baseband processing for IMT2000.

In TSGR#4(99)373, ITU-R TG8/1 asks 3GPP TSG RAN its opinion on using a formal description technique, namely SDL, for the radio baseband processing of IMT-2000 and expects RAN#5 to send its response to ITU-R TG8/1 for its Helsinki, October 25 - November 5, 1999 meeting.

The purpose of this contribution is to raise the awareness of another such formal description technique (FDT), based on the C++ programming language, and which has only recently been made public. This FDT may be even more applicable to radio baseband processing since it is based on the familiar C++ language, is fully executable, and applies directly to the areas of hardware/software co-design and opens the possibility of direct hardware compilation into silicon.

Backed by a community of well over 45 charter member companies, many of which are also active in 3GPP and ITU-R, the Open SystemC™ Initiative includes representation from the systems, semiconductor, IP, embedded software and electronic design automation (EDA) industries.

Attached for your information and consideration are:

Overview of the Open SystemC Initiative	Overview.pdf
News Release (September 27, 1999): "Major Industry Players Collaborate on Open C++ Modeling Platform to Solve Key System-on-a-Chip Problems"	Press9_27_99.doc
Supporting Orgainzations	Support_orgs.doc
Quotes from various organizations throughout the industry	Quotes.doc

Chris Cavigioli plans to attend 3GPP TSG SA #5.

More information, a draft specification and C++ source code can be obtained at http://www.systemc.org/

Chris Cavigioli
Synopsys, Inc.
700 East Middlefield Road
Mountain View, CA 94043-4033
USA

tel. +1 650 584 5591
jfax. +49 89 9218 5361
mobile +1 415 254 4545
GSM +49 172 705 2026
email: chriscav@synopsys.com

Editorial Contacts:

Catherine Glines-Dickson
Synopsys Inc.
650-584-4170
glines@synopsys.com

Ellie Katsoudas
The Hoffman Agency
408-975-3057
ekatsoudas@hoffman.com

Mindy Powers
CoWare, Inc.
408-845-7613
mindy@CoWare.com

Paula Jones
New Ideas in Communications
650-967-3711
paula@newiic.com

MAJOR INDUSTRY PLAYERS COLLABORATE ON OPEN C++ MODELING PLATFORM TO SOLVE KEY SYSTEM-ON-A-CHIP PROBLEMS

SystemC to Enable Fully Interoperable System-Level IP Exchange and Co-Design

SAN JOSE, CA, EMBEDDED SYSTEMS CONFERENCE, September 27, 1999 --Leading EDA, IP, semiconductor, systems and embedded software companies announced today the "Open SystemC(TM) Initiative" and immediate availability of a modeling platform for free Web download. Achieving a breakthrough in industry cooperation, SystemC is the first result of the initiative, which enables, promotes and accelerates system-level intellectual property (IP) model exchange and co-design using a common C++ modeling platform. Through an Open Community Licensing model, designers can create, validate and share models with other companies using SystemC and a standard ANSI C++ compiler. In addition, electronic design automation (EDA) vendors have complete access to the SystemC modeling platform required to build interoperable tools. There are no licensing fees associated with the use of SystemC, and any company is free to join and participate.

Backed by a growing community of well over 45 charter member companies, the Open SystemC Initiative includes representation from the systems, semiconductor, IP, embedded software and EDA industries. The steering group includes ARM, CoWare, Inc., Cygnus Solutions , Ericsson, Fujitsu, Infineon, Lucent Technologies, Sony Corporation STMicroelectronics, Synopsys, Inc. (NASDAQ:SNPS) and Texas Instruments. The goal of the Open Community Licensing model is to provide a foundation to build a market upon, and the role of the steering group is to provide an environment of structured innovation ensuring that interoperability is retained for the benefit of all.

Additional endorsements are available in the Open SystemC Initiative quote sheet and listed charter members include the following companies: Actel, Alcatel, Altera Corporation, American Applied Research, Aptix, Arcadia Design Systems, ARC Cores, Aristo Technology, ARM, Billions of Operations Per Second, CAE

Plus, Chameleon Systems, Inc., Co-Design Automation, Inc., CoWare, Inc., CSELT, Cygnus Solutions, Denali, Ericsson, Frequency Technology, Inc., Frontier Design, Fujitsu, Genedax, Inc., IKOS Systems, I-Logix, Inc., Infineon, Integrated Silicon Systems, Ltd., Intellectual Property, Inc., Internet CAD, LogicVision, Lucent Technologies, Magma Design Automation, MIPS Technologies, Inc., Monterey Design Systems, Motorola, Inc., Seva Technologies, Sican Microelectronics Corp., Simulation Magic, Snaketech, Sony Corporation, Stellar Semiconductor, STMicroelectronics, Summit Design, Sun Microsystems, SynapticCAD, Synchronicity, Synopsys, Inc., Tensilica, Inc., Texas Instruments, TransModeling, Inc., Ultima, Verplex Systems, Viewlogic Systems, Inc., Xilinx.

Huge new design challenges for system-on-a-chip (SoC) are the result of decreasing time-to-market coupled with rapidly increasing gate counts and embedded software representing 50-90 percent of the functionality. Because C and C++ are the dominant languages used by chip architects and software engineers today, initiative members believe that a C-based approach to hardware modeling is necessary. The preferred approach is to define a modeling platform using C++ class libraries and a simulation kernel, which provides greater interoperability, portability and readability. To date there has been no commonly accepted C++ style available in the industry, forcing companies to maintain multiple C++ models in order to exchange and reuse system-level models.

"Designing complex IP, such as ARM(R) processors, into today's leading-edge SoCs demands both fast and accurate models for application software development and hardware verification," said Tudor Brown, CTO at ARM. "Without a common dialect for these models, ARM must support multiple models for different C-based environments. SystemC is a significant initiative toward developing standards for system-level IP models."

"SoC demands complete validation of the system concept, and C++ offers the best simulation performance for system-level modeling of software and hardware at multiple abstraction levels," said Dr. Franz Neppl, senior vice president of corporate development at Infineon Technologies AGs. "The OpenSystemC Initiative is a breakthrough in cooperation for the EDA industry and delivers the interoperability we need."

Developed to address the hardware/software co-design reality of SoC, SystemC is the result of technical collaboration between Synopsys, CoWare and Frontier Design. Both Synopsys and CoWare had been developing similar C-based modeling solutions, adopted and used by industry leaders, over recent years. With the encouragement of those leaders, the similarity of these solutions was leveraged in an active collaborative effort that has now resulted in the Open SystemC Initiative. Frontier Design and Synopsys collaborated on the fixed-point data types necessary for applications in digital communications, digital audio and digital video. Additionally, the pioneering research in C-based design at IMEC, MIT, Stanford and UCIrvine is the foundation of SystemC.

"As a pioneer in co-design, CoWare is delighted to be a founding member of the Open SystemC Initiative in order to help secure the widespread adoption of C-based design," said Guido Arnout, president and CEO at CoWare. "Everyone knows a design paradigm shift is approaching but many semiconductor and IP companies are hanging back until a common approach emerges for exchanging models. Now, with the development of a common platform, there are no barriers."

"We are bringing clarity to the chaos that prevails in the system-level design

language world today and simultaneously opening up a whole new realm of opportunities," said Aart de Geus, chairman and CEO at Synopsys. "By championing interoperability at the beginning of this market, the Open SystemC initiative allows many companies to invest in an area that will be essential for future design. The fact that we have gathered together so many high-quality partners illustrates both the timeliness of meeting this need and the quality of SystemC as the right solution."

"We have been in the forefront of C-based hardware design for several years now," said Herman Beke, chairman and CEO at Frontier Design. "As a new EDA start-up and in the absence of interoperability between the many C-variants proposed by all EDA vendors, we consistently ran into customers' reluctance to fully exploit our advanced tools. We firmly believe that the Open SystemC initiative will create a low-risk environment for the design community, allowing everybody to expedite the move to a more productive next generation system level design methodology."

"Lucent has become the world's fastest-growing major semiconductor business by delivering system-on-a-chip solutions to the high-growth communications market," said Mark Pinto, chief technical officer and platform technology vice president at Lucent Technologies. "For growth of this segment to continue, we cannot allow design infrastructure issues to get in the way. We are happy to work with leaders in EDA, co-design, IP and semiconductors to drive the Open SystemC Initiative
throughout the industry for everyone's benefit."

"We are experiencing significant advantages of C-based design on top of Verilog–based flow," said Tadahiko Nakamura, general manager of the SOC Technology department, Sony Corporation. "We strongly support the Open SystemC Initiative's efforts to drive a fully interoperable standard for C-based design."

"As software content continues to grow in embedded systems, interoperability of software development tools with EDA solutions becomes increasingly significant," said Alex Daly, president and CEO of Cygnus Solutions. "At Cygnus we are committed to delivering leading-edge software development tools and technologies to address this content creation challenge. We welcome our role in the Open SystemC Initiative to ensure that the needs of the embedded software developer are addressed and met."

"Complexity of telecommunication systems is steadily increasing and new products are introduced in an ever increasing pace," said Jan-Olof Kismalm, director, Microelectronics, Corporate Function Technology, Telefonaktiebolaget LM Ericsson. "In the effort to keep product development times short in these complex systems we need to find new ways of describing complex functions and IP. We believe the Open SystemC Initiative is a good candidate to help us describe our systems in a more structured way allowing efficient co-design of hardware/software at an early stage in the design process which in return gives us shorter product development times."

"The lack of a widely adopted description language for system level IP and/or executable specifications is becoming a serious bottleneck in the system to silicon design flow for systems on a chip," said Mike Fazeli, World wide EDA manager, DSP Core Development/DSP/Wireless/BroadBand Access business units, Application Specific Products group, Texas Instruments. "The Open SystemC Initiative represents a giant step towards solving this bottleneck and

establishing a community sponsored System Level Description Standard that is consistent and complementary with SLDL requirements and Rosetta efforts."

"The lack of a widely adopted C or C++ design style has become a serious bottleneck for the exchange of intellectual property and executable specifications at system-level," said Philippe Magarshack, Design Automation & Libraries program director at STMicroelectronics' Central R&D. "It also prevents the establishment of a best-in-class, mixed-vendor, system-to-silicon design methodology. We welcome the Open SystemC Initiative, which represents a giant step towards solving these issues."

"We continue to drive and support industry collaborations that will develop the system-on-a-chip market and are enthusiastic about the community-driven Open SystemC Initiative," said Kiminori Fujisaku, general manger WWSLT, Fujitsu Microelectronics, Inc.

SystemC is freely available through an Open Community Licensing program, taking the best of open source licensing and Sun Microsystems' Jini Community Source Licensing (SCSL). The commercial license will be offered at no cost. The steering group, along with other community members, will be responsible for enhancements and upgrades to the source code in the modeling platform as it moves forward.

"By adopting a business model for Open SystemC that is similar to Sun's Community Source Licensing, the founding members of the Open SystemC community have reinforced their commitment to solving SOC design challenges and championing the interoperability cause" said Bill Joy, chief scientist for Sun Microsystems. "The business model has been proven to combine the advantages of open source and proprietary licensing approaches."

Geoffrey Moore, chairman of The Chasm Group and author of 'Crossing The Chasm' said, "The nascent system level design tools market is deep in the chasm. Today, since there is no common modeling platform, the opportunity costs of system designers adopting any single tool offering is much too high, and the market cannot develop. By providing a common modeling platform, the Open System C Initiative is filling the critical link in the value chain for system level design."

About SystemC
The Open SystemC Initiative establishes an interoperable, open modeling platform to promote the growth of C-based design and enable exchange of system-level C++ models and co-design. The collaboration is the first of its kind in the EDA industry and promises to establish a de-facto modeling standard for the benefit of the entire electronics industry. There is broad and growing support for SystemC from leading companies in the semiconductor, systems, IP, EDA and embedded software industries. The charter companies, with Synopsys as the administrating organization through the TAP-in(TM) program, have established a Web site at www.systemc.org where users can download the SystemC modeling platform which includes the SystemC specification, source code and reference manual. An initial draft release of the SystemC modeling platform is available now for community download.
# # #

Quotes from various organizations throughout the industry

Alcatel:
"Alcatel has been at the forefront of system-level design for system-on-a-chip, both individually and as part of industry initiatives such as the Virtual Socket Interface Alliance," said Johannes Schuck, director of the ASIC Design Labs at Alcatel. "However, to achieve a real breakthrough, the microelectronics system design industry is today definitely still lacking a common modeling platform. Therefore, we consider the Open SystemC Initiative as very positive for the industry."

Altera Corporation:
"The Open SystemC Initiative is a significant step toward merging system-level design specifications and the synthesis of physical design implementations. For SoC programmable logic, this will offer a path to further reduce design cycle time and faster time to market," said Robert Blake, Altera's senior director of product planning.

Aptix Corporation:
"It is critical for the development of system-on-a-chip technology that standards emerge for designing systems with C so that high level synthesis tools and verification tools have a common way of leveraging designs and models created by different companies at different points in time," according to Ralph Zak, vice president of marketing at Aptix. "Aptix is committed, as part of our block-based prototyping methodology, to support C as a design language and will build co-emulation capability supporting 'C' simulators and design environments. Consequently we are pleased to support and participate in developing a standard for C, C++ and hardware design extensions."

ARC Cores, Ltd.:
"The formation of the Open SystemC Initiative is a big step in exactly the right direction. ARC Cores was the first company to allow developers to create their own ideal microprocessor, so hardware/software codesign is obviously key to our technology. ARC's innovative hardware configuration tools, our recent acquisition of MetaWare's software expertise, and our enthusiastic support of Open SystemC will make it even easier for developers to create the perfect processor to fit their software, instead of writing software to fit their processor," said Jim Turley, vice president, Marketing, ARC Cores.

Arcadia Design Systems:
"We strongly endorse this initiative. As an SoC design services provider, we feel it will provide flexibility in making tradeoffs very early in the design process - a win for all IP providers and users of IP," said Wei-Kong Chia, Ph.D, president and CEO, Arcadia Design Systems.

ARM:
"Designing complex IP, such as ARM® processors, into today's leading-edge SoCs demands both fast and accurate models for application software development and hardware verification," said Tudor Brown, CTO at ARM. "Without a common dialect for these models, ARM must support multiple models for different C-based environments. SystemC is a significant initiative toward developing standards for system-level IP models."

The Ascent Group:
"The Open SystemC Initiative is a real tangible sign of Synopsys opening its doors and emerging as a leader in the industry. They clearly understand the

concept of ‘the more you share, the more you gain.’ With this move, Synopsys becomes the first major EDA vendor to truly adopt Internet thinking into its business model," said David Chen, president of The Ascent Group.

BOPS, Inc. (Billions of Operations Per Second):
"BOPS is very enthusiastic about the development of the Open SystemC Initiative and the benefits it will yield for our customers," said Mark Bowles, president, BOPS, Inc.

Chameleon Systems
"The Open SystemC Initiative solves a real problem for system level designers, by enabling companies like Chameleon Systems to offer true system level design flexibility in the emerging programmable system-on-a-chip platform space. We see a common HW/SW design C/C++ infrastructure that's linked to hardware implementation, as crucial to opening up system level exploration and implementation to the system architect," said Chris Phillips, CTO Chameleon Systems, Inc.

The Chasm Group, Geoffrey Moore:
Geoffrey Moore, author of Crossing The Chasm, said "the nascent System Level Design Tools market is deep in the chasm. To cross the chasm, the benefit of adopting commercial tools must be clearly greater than the pain in making the switch. There are two ways this could be achieved: Either one supplier becomes so dominant that they can alone set the standard, or the market participants together agree to support one standard, thus making a broad array of commercial tools available to those customers who support that standard. It is highly unlikely that a single company will dominate this market in the short to medium term, so establishing an open standard, as the Open System C Initiative is doing, is the only reasonable way to assure an environment which is mutually beneficial to both customers and suppliers. The members of this initiative are truly showing amazing foresight in choosing this route."

Co-Design Automation, Inc.:
"We are delighted to be working with Synopsys to advance the state of the art in systems design. The open nature of the Superlog simulation environment allows designers to specify and validate systems with a variety of modeling approaches. By combining the open source model with a structured refinement approach, Synopsys has enabled the first cohesive effort in this area, and we are pleased to participate in it," said Simon Davidmann, CEO, Co-Design Automation, Inc.

Cygnus Solutions:
"As software content continues to grow in embedded systems, interoperability of software development tools with EDA solutions becomes increasingly significant," said Alex Daly, president and CEO of Cygnus Solutions. "At Cygnus we are committed to delivering leading-edge software development tools and technologies to address this content creation challenge. We welcome our role in the Open SystemC Initiative to ensure that the needs of the embedded software developer are addressed and met."

Denali:
Since 1995, Denali has rapidly become the leading provider of software memory models and memory-centric simulation tools. We attribute much of this success to our attention focused on providing a consistent and robust solution across all leading design environments. We have spent a considerable amount of time integrating our technology to wildly different interfaces. A unified interface for system-level design tools would be a huge win for us and our customers. Such

an interface would enable us to focus even more on increasing the value of our tools rather than on integrating to different tools. We applaud the SystemC Initiative to develop such a standard," said Sanjay Srivastava, president, Denali.

Ericsson:
"Complexity of telecommunication systems is steadily increasing and new products are introduced in an ever increasing pace," said Jan-Olof Kismalm, director, Microelectronics, Corporate Function Technology, Telefonaktiebolaget LM Ericsson. "In the effort to keep product development times short in these complex systems, we need to find new ways of describing complex functions and IP. We believe the Open SystemC Initiative is a good candidate to help us describe our systems in a more structured way, allowing efficient co-design of hardware/software at an early stage in the design process, which in return gives us shorter product development times."

Frontier Design:
"We have been in the forefront of C-based hardware design for several years now", said Herman Beke, chairman and CEO at Frontier Design. "As a new EDA start-up and in the absence of interoperability between the many C-variants proposed by all EDA vendors, we consistently ran into customers' reluctance to fully exploit our advanced tools. We firmly believe that the Open SystemC Initiative will create a low-risk environment for the design community, allowing everybody to expedite the move to a more productive next generation system level design methodology."

Fujitsu Microelectronics, Inc.:
"The lack of a widely adopted C++ description style for system level IP and/or executable specifications is becoming a serious bottleneck in the system to silicon design flow for systems on a chip. The Open SystemC Initiative represents a giant step toward solving this problem," said Takashi Hasegawa, manager, System Level Design Methodologies WWSLT, Fujitsu Microelectronics, Inc. "The Open SystemC Initiative provides a defacto standard C++ based library infrastructure. This will facilitate the exchange of system level IP and or executable specifications which are essential for customer SOC solutions."

Genedax, Inc.:
"Open industry standards are essential if we are going to be able to efficiently address the designers problems. The SystemC Initiative is certainly an exciting step in the right direction toward an open environment that will benefit both users and EDA developers," said John Ott, vice president of Marketing and Sales Genedax, Inc.

IKOS Systems:
"IKOS' customers and partners are pushing for earlier system integration verification, and the Open SystemC Initiative is an important step toward this goal." said Larry Melling, vice president of Business Development and Strategic Marketing at IKOS Systems. "Standardization of system-level IP exchange will enable more rapid development of powerful system integration verification environments, and assist our efforts in developing high performance co-modeling environments that join these abstract system-level models with RT-level design implementation. We are enthusiastically supporting the Open SystemC Initiative."

I-Logix, Inc.:
"In today's environment of compressing time to market and rapidly increasing

software content, the need to integrate designs delivered by multiple development teams is critical. The Open SystemC Initiative is a major step forward that fits very naturally in the way designers are currently using I-Logix tools and their desire to integrate IP into their system level design," said Gene Robinson, CEO and president of I-Logix, Inc." We are therefore delighted to join the other founding partners in this promising initiative to accelerate the development of system-level design solutions while protecting IP."

Infineon Technologies AG:
"SoC demands complete validation of the system concept, and C++ offers the best simulation performance for system-level modeling of software and hardware at multiple abstraction levels," said Dr. Franz Neppl, senior vice president of Corporate Development of Infineon Technologies AG. "The Open SystemC Initiative is a breakthrough in cooperation for the EDA industry and delivers the interoperability we need."

Integrated Intellectual Property, Inc.:
"Such a platform will provide a backbone for productive and fast design cycles for SoCs," said Milan Gandhi, chief executive officer, Integrated Intellectual Property, Inc.

Integrated Silicon Systems, Ltd.
"C-level modeling has been an integral part of ISS's design methodology since our inception." said James G. Doherty, President and CEO of Integrated Silicon Systems, Ltd. "Logic simulation using existing industry-standard HDL-based solutions cannot address complete system simulation, yet no higher level industry standard currently exists. SystemC can fill that void, greatly easing the system design challenge and thus accelerating the industry transition to SoC design."

Lucent Technologies:
"Lucent has become the world’s fastest-growing major semiconductor business by delivering system-on-a-chip solutions to the high-growth communications market. For growth of this segment to continue, we cannot allow design infrastructure issues to get in the way," said Mark Pinto, chief technical officer and platform technology vice president at Lucent Technologies. "We are happy to work with leaders in EDA, co-design, IP and semiconductors to drive the Open SystemC Initiative throughout the industry for everyone’s benefit."

MIPS Technologies, Inc.:
"With the evolution of embedded systems development to highly integrated SoC solutions," notes Greg Stoner, manager of applications at MIPS Technologies, Inc. "the System-level market has developed a stronger need for standardization of modern Object Oriented systems design language. Combining these new tools with the MIPS-basedtm object oriented C++ core models will provide our customers with the ability to simplify design, modeling and integration of disparate IP systems. It is critical to have a common modeling foundation for our customers and SystemC, with their Open Community License, provides an excellent opportunity for accelerated industry adoption."

Massachusetts Institute of Technology (MIT):
Professor Srinivas Devadas from MIT mentioned that "we have been looking for a single language for system specification and implementation for our research activities at MIT. SystemC is not only powerful enough to represent hardware either at behavior or RTL, but it is also capable of representing real-time software tasks. It is truly suited for co-design and co-verification."

Monterey Design Systems, Inc.:
"Monterey Design System is committed to open standards and proud to be a member of the Open SystemC Initiative, an organization taking a unique approach to assuring open standards in our industry," said Jacques Benkoski, president and CEO of Monterey Design Systems. "As the bottleneck of designing complex system-on-a-chip shift to the physical design phase, standardization of IP descriptions will enable new generation of devices to incorporate more useful and diverse electronic functions."

Motorola, Inc.:
"At Motorola, we recognized the need to move to C-based system level modeling some time ago and we have been investigating various in-house and external solutions. Now that the leaders in synthesis and co-design have converged on an interoperable solution, we're pleased to join with them to back the Open SystemC Initiative," said Joe Pumo, director, System-on-a-Chip Design Technology Organization at Motorola.

RAPID (Reusable Application-Specific Intellectual Property Developers):
"The Open SystemC Initiative represents a forward-thinking approach to solving an important challenge facing the IP industry, because it focuses on both technical and business issues," said Jim White, RAPID board member and director of business development at Sierra Research and Technology.

Sican Microelectronics Corporation:
"Currently one of the major problems in SoC design is the system evaluation and simulation. A common industry-wide accepted open framework, which enables and simplifies interoperation of all players in this arena, IP providers as well as IP integrators and EDA companies, will definitely be a great benefit for the whole industry. Sican, acting as SoC Design House and major IP Provider, will carefully watch and support the "Open SystemC Initiative," said Thomas Oberthuer, product manager DesignObjectstm.

Simulation Magic, Inc.:
"SystemC will enable the system-design market in the same way that Microsoft's Windows enabled the PC market. Interoperability of models is a key factor for the success of companies like Simulation Magic, Inc. All of our customers want to develop one set of models and reuse them on multiple platforms," said Shay Ben-Chorin, president and CEO at Simulation Magic, Inc., a company which makes Virtual Silicontm, an integrated, graphical, rapid prototyping platform for multi-core systems-on-chip.

Sony Corporation:
"We are experiencing significant advantages of C-based design on top of Verilog–based flow," said Tadahiko Nakamura, general manager of the SoC Technology department, Sony Corporation. "We strongly support the Open SystemC Initiative's efforts to drive a fully interoperable standard for C-based design."

Stanford University:
Professor Giovanni De Micheli from Stanford University, a pioneer in the area of hardware-software co-design and hardware synthesis from the C language, said "I have worked in the area of system specification and co-design for several years and I can confidently say that SystemC is a powerful and efficient solution to the problems of system-level specification and synthesis."

STMicroelectronics:
"The lack of a widely adopted C++ design style has become a serious bottleneck for the exchange of intellectual property (IP) and executable specifications at system-level, as well as for the establishment of a system-to-silicon design methodology," said Philippe Magarshack, Design Automation and Libraries program director at STMicroelectronics' Central R&D.

"We welcome the Open SystemC Initiative, which represents a giant step toward solving this problem," added Mr. Magarshack. "The ability to readily acquire IP from different sources, as well as to exchange executable specifications with our customers and partners, will dramatically increase our efficiency and productivity in system-on-a-chip designs."

"In the RTL world we are still suffering from having to deal with a bilingual VHDL/Verilog world. Without the Open SystemC Initiative, we run the risk of having not two, but ten's of C or C++ dialects."

"This Initiative will allow not only System IP exchange, but also the seamless communication between the various System-level design tools that are necessary to address the spectrum ranging from specification, architecture and performance modeling to application-specific hardware synthesis."

Sun Microsystems, Inc.:
"By adopting a business model for Open SystemC that is similar to Sun's Community Source Licensing, the founding members of the Open SystemC community have reinforced their commitment to solving system-on-a-chip design challenges and championing the cause interoperability. The business model has been proven to combine the advantages of open source and proprietary licensing approaches," said Bill Joy, chief scientist for Sun Microsystems.

Summit Design:
"Summit endorses the SystemC Initiative which supports the needs of our customers and Summit's strategic direction of providing solutions for high level design creation and simulation of high level languages like C/C++ mixed with simulation of HDL," said Rich Davenport, president of Summit Design. "System designs which include application software, real-time operating systems and large gate counts need the option of simulating HDL for accuracy and C for speed."

SynaptiCAD, Inc.:
Dan Notestein, president of SynaptiCAD Inc., said "For C++ to achieve its full potential as a system modeling language, a critical mass of tools need to be available to designers. SystemC's open environment looks like a good way to kick-start this effort. SynaptiCAD plans to join the SystemC Initiative by enhancing our TestBencher Pro product to support generation of C++-based bus-functional models and test benches from language independent timing diagrams."

Tensilica, Inc.:
"Tensilica's automatic processor generator creates a new foundation for application driven system-on-a-chip design. The Open SystemC Inititiative carries software-centric system design to the next level," said Chris Rowen, president of Tensilica.

Texas Instruments, Inc.:
"TI has developed a platform for wireless telecommunications consisting of

several EDA tools and models," said Mike Fazili, EDA Manager at Texas Instruments. "Building on this platform requires interoperability at the system level. We cannot write tools for every configuration at this level. We have been working with Synopsys and CoWare to develop a language. They have clearly listened, and OSCI is delivering the mechanism. We are committed to providing models based on SystemC."

TransModeling:
"We strongly believe that C++ is the next step in performing system modeling. The SystemC Draft Specification is well thought out and should be an easy step into a higher level of abstraction for hardware designers without inventing yet another language," said Steve Westfall, president and CEO of TransModeling, Inc. "Our customers are demanding interoperable flows, and SystemC represents the best opportunity for industry alignment on a common C++ modeling style. We intend to enhance our SystemModeler product line to directly support SystemC."

University of California, Berkeley
EDA luminary and professor at the University of California at Berkeley, Dr. Kurt Keutzer said "System-on-Chip requires a solution to the hardware-software co-design problem. HDLs have run out of steam and are not suitable for the software world. It's absurd to think that the hardware world is going to dictate the language for system-level design. The tail doesn't wag the dog. SystemC makes the right pragmatic design choice for a design language in today's system design world."

University of California at Irvine:
Professor Rajesh Gupta from University of California at Irvine, a pioneer in hardware/software co-design and an early collaborator in the development of SystemC said "System on a chip demands complete, accurate, and rapid validation of both hardware and software. A single language specification for hardware and software is key to its success. SystemC is the best language-based approach to solving this problem. I am glad to have been a part of this pioneering development at Synopsys."

Viewlogic Systems, Inc.:
"Viewlogic, as a leading provider of eProduct design automation tools, wholeheartedly endorses the Open SystemC Initiative. It addresses our customers' need for a standards-based approach to C-language modeling at the system level. This open standard will help design automation and IP vendors alike to deliver plug-and-play components that address the system-level design automation puzzle," said Will Herman, president and CEO of Viewlogic Systems, Inc.

Verplex Systems, Inc.:
"We applaud the effort to bring the industry together with the Open SystemC Initiative," stated Michael Chang, president and CEO, Verplex Systems. "Cooperative efforts like this should help speed the adoption of a common C-based system-design methodology."

VHDL International and SLDL:
"Our industry recognizes the importance of bringing system-level design capabilities to the silicon level. The Open SystemC solution of a C-based modeling platform has the opportunity to leverage today's software development practices into significant portions of the new system-level design environment. OpenSystemC supports behavioral modeling within the complementary Rosetta

semantic framework of SLDL, and does not appear inconsistent with the overall SLDL requirements specification. Both SystemC and SLDL/Rosetta can carry us towards the future of system-level design," said Steven E. Schulz, senior member of technical staff, CAD Flow, Methodology, and Architecture, Texas Instruments.

Virtual Silicon Technologies:
Integration of complex IP cores from different sources has posed a great" said Mahesh Tirupattur Marketing Executive. Cross-industry collaborative efforts such as Open SystemC can help design system-on-chip by allowing mixing and matching IP cores from multiple vendors."

Virtual Socket Interface Alliance (VSIA):
"The Open SystemC Initiative's adoption of the yet-to-be released VSIA System Level Design (SLD) Data Types specification within SystemC is an endorsement of the importance and valuable technical content of this spec," said Larry Rosenberg, technical chair, VSIA. "Initiatives like Open SystemC should help spur greater use of tools and models leveraging VSIA's new SLD specifications."

Wind River Systems:
"We are pleased to support The Open SystemC initiative for promoting a common modelling platform, as it compliments our commitment to providing mbedded software developers with the necessary technology to create successful embedded applications," said Tom St. Dennis, CEO at Wind River Systems. "Interoperability and portability are important factors in EDA solutions and the success of this collaboration will be of great benefit to the electronics industry as a whole."

Xilinx, Inc.:
"As the programmable logic solutions leader, Xilinx recognizes that cores and IP are becoming more and more important," said Richard Sevcik, senior vice president, Software and COREs Group at Xilinx. "The Open SystemC Initiative directly addresses the industry needs for system-level IP modeling and we are pleased to support it."

Supporting Organizations

The Open SystemC Initiative (OSCI) is a collaborative effort among a broad range of companies to support and advance SystemC as a de facto standard for system-level design. OSCI is comprised of a community and a steering group.

The community consists of a large and growing number of system houses, semiconductor companies, IP providers, embedded software companies and EDA tool vendors. Initially, more than 50 companies endorsed OSCI – these charter members of the community are listed below. The community members use, modify and enhance the SystemC modeling platform. They return their enhancements and recommendations to the community.

The OSCI steering group is a team of companies, motivated and contributing resources, that ensure SystemC's success. The team is listed below. The steering group guarantees structured innovation of SystemC by reviewing both shared modifications and community requirements.

The steering group and community member contributors assure that each release of SystemC embodies the best of what the total SystemC community has to offer.

Community Charter Members

Actel
Alcatel
Altera Corporation
American Applied Research
Aptix
Arcadia Design Systems
ARC Cores
Aristo Technology
ARM
Billions of Operations Per Second
CAE Plus
Chameleon Systems
Co-Design Automation
CoWare
CSELT
Cygnus Solutions
Denali
Ericsson
Frequency Technology
Frontier Design
Fujitsu Microelectronics
Genedax
IKOS Systems
I-Logix
Infineon Technologies
Integrated Silicon Systems
Intellectual Property
Internet CAD
LogicVision
Lucent Technologies
Magma Design Automation
MIPS Technologies
Monterey Design Systems
Motorola
Seva Technologies, a Division of

Intrinsix
Sican Microelectronics
Simulation Magic
Snaketech
Sony Corporation
Stellar Semiconductor
STMicroelectronics
Summit Design
Sun Microsystems
SynaptiCAD
Synchronicity
Synopsys
Tensilica
Texas Instruments
TransModeling
Ultima
Verplex
Viewlogic
Virtual Silicon Technologies
Wind River Systems
Xilinx

Open SystemC Steering Group

ARM
CoWare
Cygnus Solutions
Ericsson
Fujitsu Microelectronics
Infineon Technologies
Lucent Technologies
Sony Corporation
STMicroelectronics
Synopsys
Texas Instruments

Open SystemC Initiative Endorsers

IMEC
MIT
RAPID
Stanford University
The Ascent Group
The Chasm Group
University of California, Irvine
VSIA