

INVITATION
and Call for Position Papers

CST-HCCPS
**National Workshop on Composable and Systems Technology
for High Confidence Cyber-Physical Systems**
Research Needs and Roadmap

July 9-10, 2007

**The Westin Arlington Gateway
Arlington, VA 22202**

The High Confidence Software and Systems (HCSS) Coordinating Group (CG) of the Federal Networking and Information Technology R&D (NITRD) Subcommittee, Committee on Technology of the National Science and Technology Council, invites you to attend and to consider submitting a position paper for the National Workshop on *Research Directions in Composition and Systems Technology for High Confidence Cyber-Physical Systems (CST-HCCPS)*. The CST-HCCPS Workshop is a follow-on to a series of vendor briefings held between the Fall of 2005 and early 2006, as well as two earlier workshops held in July 2006 and November 2006.¹ It will be held in The Westin Arlington Gateway Hotel in Arlington, Virginia on July 9th and 10th, 2007.

Submission of position papers is not a requirement for attending the Workshop. However, through this call for position papers, we solicit inputs that can be used by the HCSS CG to help identify the research needs, challenges, and roadmap for CST-HCCPS. The organizers will deliver a report to the Government that summarizes the workshop's findings. By submitting a position paper, you will have the opportunity to provide technical facts and information that potentially can help shape the future direction of HCSS. Due to the workshop's ambitious schedule, position papers are requested by Wednesday, June 20, 2007.

Background and Goals

The purpose of the CST-HCCPS Workshop is to assess research needs and promising technical approaches pertaining to restructuring current systems technology to derive the high confidence software platforms needed for cyber physical systems (CPS). The goal is to provide a sound, practical technological base for deeply integrating the cyber and physical

¹ These workshops are designed to support the High Confidence Software and Systems (HCSS) Coordinating Group of the Networking and Information Technology Research and Development (NITR&D) Sub-committee, National Science and Technology Council, Executive Office of the President.

aspects of future certifiably dependable engineered systems. The CST-HCCPS Workshop will produce documentation which will be delivered in the form of a final report to help shape national research investments in HCSS-related systems and assurance technologies.

Despite advances in standards-based commercial-off-the-shelf (COTS) technologies, key challenges—which are often multidisciplinary in nature—must be addressed before COTS hardware and software can be used effectively and productively to build mission-critical CPS. For example, developers of these systems continue to use *ad hoc* means to develop, configure, and deploy their applications due to the lack of formally analyzable and verifiable building block components at the operating system and middleware layers. Yet the physical and cyber complexities of new and planned systems will require guaranteed behaviors and prevention of unfavorable emergent behaviors.

The certification of CPS may entail the verification of invariants from a multitude of domains: a CPS may have to be certified with respect to its memory safety, type safety, real-time performance and QoS constraints, convergence properties and dynamics, among others. Many techniques from a variety of disciplines exist for analyzing properties along these dimensions; yet, the adoption of these techniques has been slow at best, partly because these techniques have been developed (traditionally by different communities) in relative isolation from one another, without consideration of whether or not they could be integrated into CPS development platforms, in a manner that makes them accessible to developers of CPS, and whether or not they would be amenable to compositional system design and verification.

Recognizing this tremendous challenge and responsibility, the HCSS Coordinating Group (CG) has decided to conduct an extensive community outreach for exploring new ideas and identifying emerging trends that could be used as input for a National research agenda on CST-HCCPS. In that context, this workshop will focus on multidisciplinary R&D strategies and tactics for restructuring the current real-time operating system (RTOS), virtual machine (VM), and distributed computing middleware (MW) platforms into a sound and assured real-time technology base, which integrates mature verification and certification techniques.

The CST-HCCPS Workshop is timely for the following reasons:

- In 2005 and 2006, the HCSS CG held a series of vendor non-disclosure briefings that led to the conclusion that significant R&D efforts targeting composable, verifiable system software technology is needed to leverage the development and adoption of next-generation of CPS.
- Until recently, constituencies in the RTOS, MW, and VM software communities on the one hand, and the verification and assurance communities on the other hand, have had limited opportunities to work together to define shared problems. This is particularly important in light of outcomes from the Verification Grand Challenge effort (<http://vstte.ethz.ch/>), which indicate that much of the groundwork necessary for the systematic specification and verification of HCSS has been done, and that the challenge is in integrating this existing body of work into emerging compositional system development platforms.

Participation

Workshop attendance is by invitation only. Anyone interested in participating is encouraged, but not required, to submit a position paper following the submission guidelines outlined below by Friday June 15, 2007. Notifications will be sent by Monday, June 25, 2006 to all

those who will be invited and will include information of the roles they will be asked to play. The workshop will be structured largely as a working meeting, with some participants invited to make presentations. Please indicate in your position paper if your participation at the workshop is conditional on making or on not making such a public presentation.

Government representatives interested in being invited to attend as observers are asked to submit a brief biography with a few sentences describing your past or current interests in cyber-physical systems.

Position Papers

The premise of the workshop is that composable CPS systems will benefit from the convergence of principles and technologies from both the software verification and assurance community and the systems community, with its RTOS, MW, and VM constituencies.

In light of the above, and in line with the goals of the workshop, position papers are solicited from the key RTOS, MW, and VM constituencies of the systems community to be discussed in a setting that is informed by key participants from the specification and verification community. The following are examples of appropriate foci or topics (not exclusive of others) for position papers:

1. Discuss possible ways for integrating specific mature verification and assurance technologies into high confidence software development platforms.
2. Propose frameworks that allow the stitching together of various verification or certification techniques that leverage diverse theories, formalisms, or approaches.
3. Identify well-defined technical challenges that must be addressed for specific verification technologies to be useful in the context of CPS applications.
4. Expose limitations of existing verification approaches as applied to CPS systems, given the uncertainty/non-determinism of the physical world with which CPS systems interact.
5. Discuss novel ways for supporting the programming life-cycle of CPS applications, including the integration of the verification/certification processes with compile-time and run-time support.
6. Discuss novel approaches to trading off the expressiveness of safety criteria and the scalability of the verification processes, on the one hand, and the practicality and ease of software development on the other hand.

The product of the workshop will be a detailed report documenting research needs and roadmapping promising technology directions.

Submission Guidelines

- Each position paper should include at most a half-page bio, organization/affiliation, e-mail address, and phone number for each author.
- Position papers should be at most three pages in length (including bio and contact info) and should be formatted in a 12-point font for printing on 8.5-by-11-inch paper.
- Position papers should be provided in PDF format and addressed to the attention of the CST-HCCPS Workshop Program Committee and submitted via the Workshop website.

Please note that submitted position papers will be available on-line and authors are advised *not* to include any proprietary information that they do not want disseminated to the public.

Important Dates

- June 20, 2007** Submission deadline for position papers
- June 25, 2007** Notification of acceptance/rejection
- July 9-10, 2007** CST-HCCPS Workshop

Venue

The workshop will be held at The Westin Arlington Gateway in Arlington, Virginia located at 801 North Glebe Road, Arlington, Virginia 22202. Additional hotel information can be found at the Workshop website at <http://www.isis.vanderbilt.edu/CTS-HCCPS>.

Additional Information

The Workshop website at <http://www.isis.vanderbilt.edu/CTS-HCCPS> provides up-to-date information. For more information on the CST-HCCPS Workshop, or if you wish to be put on the workshop mailing list, please contact both the workshop organizers at best@bu.edu, raj@ece.cmu.edu, or d.schmidt@vanderbilt.edu.

CST-HCCPS Workshop Organizers

- Azer Bestavros, Boston University (Co-Chair)
- Raj Rajkumar, Carnegie Mellon University (Co-Chair)
- Doug Schmidt, Vanderbilt University (Co-Chair)

CST-HCCPS Program Committee

- Steve Goddard (U Nebraska Lincoln)
- John Hatcliff (KSU)
- Bruce Krogh (Carnegie Mellon)
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- George Pappas (University of Pennsylvania)
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HCSS CG Sponsor Agencies

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