Embedded Tech Trends

2013: Embedded Technologies in Action

"The Business and Technology Forum for Critical Embedded Systems"

Government Research Programs

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Microsystems Technology Office (MTO)

- Supports DARPA's mission of creating and preventing strategic surprise by investing in areas such as microelectromechanical systems (MEMS), electronics, computing, photonics and biotechnology.
  - www.darpa.mil/our_work/MTO/
- FOCUS AREAS
  - Biological Platforms
  - Computing
  - Electronic Warfare
  - Manufacturing
  - Novel Concepts
  - Photonics
  - Position, Navigation, and Timing
  - Thermal Management

- Microsystems Technology Office (MTO)
- Computing
  - This application area supports scientific study of, and experimentation with, new computational models and mechanisms for reasoning and communication in complex and interconnected systems in support of long-term national security requirements.
  - MTO is currently exploring methods for increasing the power efficiency of embedded computing systems; development of next-generation on-chip communication links; and novel approaches to "unconventional" computing models for minimizing power, processing time and instruction complexity.
- Photonics
  - Programs in this focus area exploit the high sensitivity and large bandwidth of photonic components, as well as the ease of transmission of optical signals, to enhance sensing and communications. Research in this area explores photonic integration to develop circuits of increasing complexity with a reduced footprint, and in the fundamental development of novel photonic devices to increase performance and expand capabilities.
  - The office's objectives in this focus area are to develop the framework and the devices necessary to produce easily designed, manufactured, and scalable photonic systems.
- Thermal Management
  - Significant enhancements in fundamental device materials, technologies and system integration have led to rapid increases in the total power consumption of DoD systems. In many cases, power consumption has increased while system size has decreased, leading to an even greater problem with heat density. Thermal management of DoD systems often imposes the main obstacle to further enhancements.
  - This focus area explores new materials and architectures for use in thermal management systems

Modular Open Systems Approach (MOSA)

- Both a business and technical strategy for developing a new system or modernizing an existing one.
- An integral part of the toolset that will help DoD to achieve its goal of providing the joint combat capabilities required for 21st century warfare, including supporting and evolving these capabilities over their total life-cycle.
- DoDD 5000.1 states that, "Acquisition programs shall be managed through the application of a systems engineering approach that optimizes total system performance and minimizes total ownership costs. A modular, open-systems approach shall be employed, where feasible."
- www.acq.osd.mil/osjtf/mosapart.html

MOSA Objectives

- *adapt to evolving requirements and threats*
- *promote transition from science and technology into acquisition*
- *and deployment*
- *facilitate systems integration*
- *leverage commercial investment*
- *reduce the development cycle time and total life-cycle cost*
- *ensure that the system will be fully interoperable with all the systems which it must interface, without major modification of existing components*
- *enhance commonality and reuse of components among systems*
- *enhance access to cutting edge technologies and products from*
- *multiple suppliers*
- *mitigate the risks associated with technology obsolescence*
- *mitigate the risk of a single source of supply over the life of a system*
- *enhance life-cycle supportability*
- *increase competition*

VICTORY Initiative

- Vehicle Integration for C4ISR/EW Interoperability (VICTORY) initiative
  - www.victory-standards.org
- Started as a way to correct the problems created by the "bolt on" approach to fielding equipment on US Army vehicles.
- Implementation of VICTORY allows tactical wheeled vehicles and ground combat systems to recover lost space while reducing weight and saving power.
- Additionally, implementation allows platform systems to share information and provide an integrated picture to the crews.
- Finally, implementation provides an open architecture that will allow platforms to accept future technologies without the need for significant re-design.
- Under the initiative, a framework for integration of C4ISR/EW and other electronic mission equipment on ground platforms continues to be developed. The framework includes:
  - an architecture, which defines common terminology, systems, components, and interfaces;
  - a set of standard specifications, that provide technical specifications for the items identified in the architecture;
  - a set of reference designs.

VICTORY Initiative

- VICTORY provides a phased set of standard specifications covering the capabilities needed to integrate C4ISR/EW mission equipment and platform applications. The overall VICTORY technical approach includes:
  - A "data bus-centric" design
  - Sharable hardware components - deploy software additions w/o adding hardware
  - Open standard physical and logical interfaces between system and C4ISR/EW components
  - A set of shared data bus services
  - Shared hardware and software IA components to enable systems integrators to build security designs that protect and control access to information
- The VICTORY standard specifications are developed by a Government-Industry standards body. This body follows an "adopt-adapt-author" methodology in the effort to move towards establishing a set of common open standards for use within the vehicle and mission system communities. These standards are independent of specific hardware or software solutions.

FACE Consortium

- Future Airborne Capability Environment (FACE™) Consortium
  - www.opengroup.org/getinvolved/consortia/face
- A managed consortium hosted by The Open Group
- FACE Consortium is an aviation-focused professional group made up of U.S. industry suppliers, customers and users.
- The Consortium is creating a technologically appropriate open FACE reference architecture, standards and business model that will result in:
  - Standardized approaches for using open standards within avionics systems
  - Lower implementation costs of FACE systems
  - Standards that support a robust architecture and enable quality software development
  - The use of standard interfaces that will lead to reuse of capabilities
  - Defined interoperability within FACE systems and components
  - Portability of applications across multiple FACE systems and vendors
  - Procurement of FACE conformant products
  - More capabilities reaching the Warfighter faster
  - Innovation and competition within the avionics industry

Future Airborne Capability Environment

- Formed by the merger of AeA (formerly the American Electronics Association), the Cyber Security Industry Alliance (CSIA), the Information Technology Association of America (ITAA) and the Government Electronics & Information Technology Association (GEIA), offers leading federal market research and standards development programs to the high-tech industry at large.
- Studies the market for IT, research & technology, and advanced electronics products and services for defense and civil government agencies, then uses the findings to produce an annual 10-year Defense Forecast, a 5-year Federal IT Forecast, and special studies on key markets such as Homeland Security, Services & Support, and Information Assurance, among others.
- Our unique market forecasting process enables us to connect industry with government, creating opportunities for members to conduct interviews with government customers. We also create best-practice industry standards as an ANSI-accredited national standards developer, and advocate on behalf of our industry on a host of issues to the legislative and executive branches of government.

TechAmerica
WHERE THE FUTURE BEGINS

www.geia.org

National Science Foundation

- Creating a Petascale Computing Environment for Science and Engineering
  - www.nsf.gov/funding/pgm_summ.jsp?pims_id=13649
- Goal for high performance computing (HPC): to enable petascale science and engineering through the deployment and support of a world-class HPC environment comprising the most capable combination of HPC assets available to the academic community.
- The petascale HPC environment will enable investigations of computationally challenging problems that require computing systems capable of delivering sustained performance approaching 10^{15} floating point operations per second (petaflops) on real applications, that consume large amounts of memory, and/or that work with very large data sets.
- Among other things, researchers will be able to perform simulations that are intrinsically multi-scale or that involve the simultaneous interaction of multiple processes.
- A competitive, petascale HPC system will:
  - Enable researchers to work on a range of computationally-challenging science and engineering applications at the frontiers of research;
  - Incorporate reliable, robust system software essential to optimal sustained performance;
  - Provide a high degree of stability and usability; and,
  - Function as a community-driven resource that actively engages the research and education communities in petascale science and engineering.

www.nsf.gov/funding/pgm_summ.jsp?pims_id=13379

National Science Foundation

- Building a More Inclusive Computing Environment for Science and Engineering
  - www.nsf.gov/funding/pgm_summ.jsp?pims_id=503148
- The NSF's vision for Advanced Computing Infrastructure (ACI), which is part of its Cyberinfrastructure for 21st Century Science and Engineering (CIF21), focuses specifically on ensuring that the science and engineering community has ready access to the advanced computational and data-driven capabilities required to tackle the most complex problems and issues facing today's scientific and educational communities.
- To accomplish these goals requires advanced computational capabilities within the context of a multilevel comprehensive and innovative infrastructure that benefits all fields of science and engineering.
- Tostore and process very large amounts of data coming from simulation and from experimental resources such as telescopes, genome data banks or sensors.
- Data come from many disparate sources, such as sensor networks; scientific instruments, such as medical equipment, telescopes, colliders, satellites, environmental networks, and scanners; video, audio, and click streams; financial transaction data; email, weblogs, twitter feeds, and picture archives; spatial graphs and maps; and scientific simulations and models.

www.nsf.gov/funding/pgm_summ.jsp?pims_id=13379