Global Advances into the New World of Systems of Systems

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As we all know, the world continues to become more complex, more interdependent, more global and more reliant on technology. As important, the systems developed using technology are themselves more interdependent with innumerous implications to society. One newly emergent consequence that is both a problem and opportunity is the unintended consequences of digital, information and networking technologies in particular. These allow the capability to connect systems, data and the control of independent systems to a level not imagined even as recently as twenty years ago. Enter the new world of Systems-of-Systems (SoSs).

The idea of a SoS is to look at a much larger grouping of independent systems (e.g., airplanes, power grids, internet, road infrastructure) as a unified whole that performs a larger function with the intent that by doing so the total SoS can be better optimized for performance, human/world safety and economic efficiency. There are many levels and types of SoSs. Many are company or country specific such as the US Army's "Future Combat System (FCS) that is part of a much larger concept to use Network Centric (NCO) concepts and technologies to develop an "Information Battlefield" with increased situational awareness and responsiveness. Other SoSs are emergent in commercial, civil and defense circles, especially in the US and Western Europe. The level of emergence of each of these SoSs differs by domain and country.
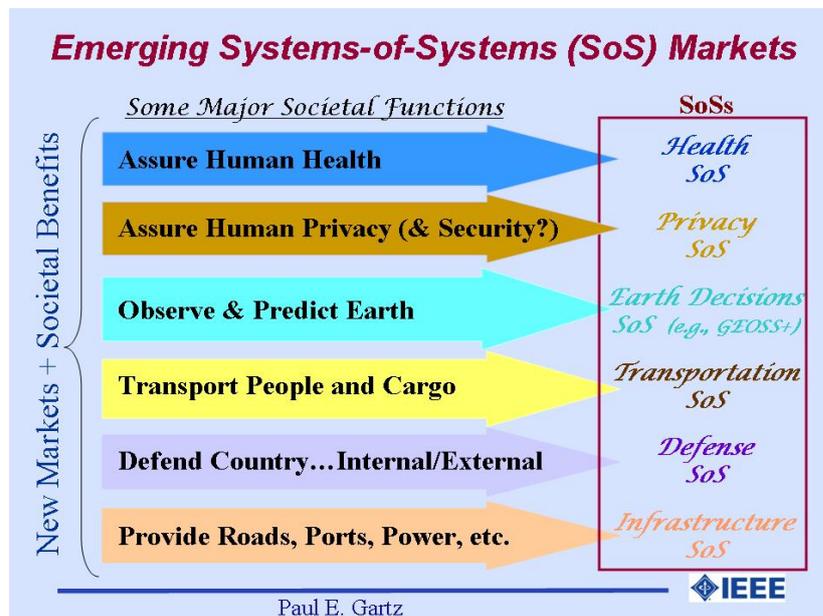

Figure 1 A special class of these SoSs occurs when they affect entire societal functions. The chart below shows a number of these societal-emergent SoSs.

Currently, in late 2008 we are seeing the unintended consequences of a key SoS, the financial sectors as the world, that were triggered by US and global banking issues with spillover into equity markets, jobs, personal, corporate and country-wide assets and damaged lives of millions of people. These were, of course, unintended consequences but illustrate the power of narrow considerations of local failures on a "total system"…in this case the "Infrastructure SoS".

The Institute of Electrical and Electronic Engineers (IEEE), the largest professional organization in the world, has begun actions to surface and address the issues and opportunities of these human-machine SoSs. It turns our that the key "glue" that transforms a series of large, complex systems, such as $200M airplanes, into a SoS are mainly IEEE-addressed technologies of electronics, digital, information, power, computing, software, networking and more.

The IEEE "Systems Council" was formed in 2005 as an integrating organization to address these. In 2008, "Society Presidents' Summits" were held to determine a direction and the presidents agreed on an unprecedented step of IEEE cooperation to a) address SoSs of global and nationals significance jointly (vs independently society-by-society), b) start with global healthcare SoS in a jointly run 2010 conference and c) expand into other SoSs if this proves successful. No such working together among IEEE societies has occurred before and no professional organization globally has attempted to bring together such a wide scope of professional engineers, scientists and others who deal with complexity to address the complex issues of SoS at a global level. For those specifically in the reliability/availability domain, SoSs in general and Healthcare SoS in particular offer major challenges to assure these systems don't "fail".

For more information or to volunteer to participate in this conference as an organizer or speaker please contact the conference co-chairs: Paul E. Gartz; paul.e.gartz@boeing.com or Elliot Sloane; ebsloane@villanova.edu. A website will be up and running starting in early 2009 and accessible through IEEE Systems Council; www.ieeesystemscouncil.org.