“Feature Interaction and Robust Command and Control Software: Opportunities for Technology Adoption and Research”

Charles C. Howell
The MITRE Corporation
7515 Colshire Drive, M/S H505,
McLean, VA 22102
Telephone: 703-883-7615/Fax: 703-883-1279
howell@mitre.org
Command and Control systems are increasingly software intensive and increasingly involve the composition and integration of complex systems of systems. Experience shows that such complex compositions often encounter unexpected and unwanted “feature interaction”. Feature interaction has been the focus of considerable technical research in the telecommunications industry. There is an active community of academic and industrial research addressing techniques, notations, and tools to help identify potential feature interaction problems. An example of the activity in this community can be found at http://www.site.uottawa.ca/fiw03/, the 7th International Feature Interaction Workshop. A good description of the feature interaction problem can be found at http://www.comms.eee.strath.ac.uk/~stsang/FI.html:

“The feature interaction problem can be simply defined as the unwanted interference between features running together in a software system. The feature interaction problem has already been a big issue in the Intelligent Network domain (public communication networks) and this situation is likely to continue as the "information society" becomes more dependent on communications and distributed systems. The effect of the problem is that features and services, which otherwise operate correctly, will not act predictably when placed together in a network.”

Feature interaction research (and practice) includes both avoidance and detection/resolution. Examples of the former include formal specification and analysis techniques. Examples of the latter include resolution protocols and "meta rules" for priority and precedence in service composition. Command and Control systems are exceptionally challenging in complexity, scale, and consequences of failure. It is clear that the development and deployment of these systems will continue to grapple with various aspects of the feature interaction problem. It is less clear that existing feature interaction research can scale to address these kinds of systems. If progress can be made in this area, it would address a significant challenge to the predictable and affordable deployment of robust command and control systems of systems.

There has been surprisingly little exploitation of the progress made on the feature interaction problem in the technical community outside of telecommunications. The focus of the proposed paper for the 2004 Command and Control Research and Technology Symposium is to

- review research and practice related to feature interaction,
- explore the mapping of these results to system of system integration and composition challenges for command and control systems, and
- suggest technology adoption opportunities and a research agenda for the feature interaction problems applied to complex command and control systems.