Brief position paper for
the Third IEEE Information Survivability Workshop (ISW-2000)

"Feature Interaction and Survivable Networked Information Systems"

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"Software is the new physical infrastructure of the information age. It is fundamental to economic success, scientific and technical research, and national security. The Nation needs robust systems, but the software our systems depend on is fragile. Software fragility is its tendency not to work properly - or at all - for long enough periods of time or in the presence of uncontrollable environmental variation. Fragility is manifested as unreliability, lack of security, performance lapses, errors, and difficulty in upgrading."

(PITAC, February 24, 1999, Bill Joy and Ken Kennedy co-chairs, available at http://www.ccic.gov/ac/report/)

"Because a typical Networked Information System (NIS) is large and complex, few people are likely to have analyzed one, much less had an opportunity to study several. The result is a remarkably poor understanding today of design and engineering practices that foster NIS trustworthiness."

Schneider et al., National Research Council, "Trust in Cyberspace", 1998, http://www.nap.edu/readingroom/books/trust/

Feature interaction is the focus of considerable technical research in the telecommunications industry. What is it? From 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."

Consider a specific example of feature interaction. Alice has Call Waiting (CW) - rather than getting a busy signal when she is on the line, a second caller gets rings and the receiving caller gets a special tone indicating there is a second call waiting. Bob has Automatic Callback (AC) - if a called line is busy, the feature will automatically redial the line when it becomes idle. Alice is talking w/ Carol. Bob calls Alice. From "Bob's" perspective the line will appear to be idle (i.e., it will ring while Alice gets a special CW tone. From Bob's perspective, does thus defeat the use of AC? Clearly

this situation can be handled with additional signal information and precedence decisions. The illustration is not meant to show that simple feature interaction problems are unsolvable, merely that they are subtle and that they introduce a risk in the ongoing composition of services in NISs that we would like to be survivable.

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.tts.lth.se:80/FIW98/: "FIW'98 is the fifth in a series of workshops addressing the issue of feature interactions. The purpose of the workshop is to bring together representatives of the Telecom industry and the research community working on various aspects of feature interactions in order to discuss possible solutions and their practical applications, as well as to set directions for further research."

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.

Telecommunication plays a fundamental role in many critical infrastructure systems where survivability is a key concern, and the telecommunications system itself is a prototypical Networked Information System (NIS) with survivability concerns. Thus the work on feature interaction seems worth discussing at the workshop even if it were strictly a telecommunications problem. However, many weaknesses in critical NISs other than telecommunications can be viewed as at least partially resulting from feature interaction in the broad sense. There has been surprisingly little exploitation of the progress made on the feature interaction problem in the technical community outside of telecommunications, and the Workshop seems to be an excellent opportunity to investigate its wider use. Perhaps we can see farther by at least "stepping on the toes of giants" if not standing on their shoulders...

If there is interest, I would be happy to provide some brief background on the tools and techniques described in this position paper. I would be very interested in discussions of opportunities for adapting these techniques to use in assessing and increasing the survivability of critical networked information systems.