Network Survivability Analysis

by:
Richard R. Talbott
Johns Hopkins University Applied Physics Laboratory
240-228-6593
richard.talbott@jhuapl.edu

Advances in Local Area Network and computer technologies are providing system designers with many new options for interconnecting computer equipment. A recurring problem for military (and all critical business/medical/space) applications is to evaluate the redundancy of a system, or in another sense, to evaluate a system's sensitivity to equipment, network or component failures. Traditional approaches to quantifying the series/parallel nature of a system such as Reliability, Maintainability, Availability and Survivability, fail to provide guidance on desirable system topologies and a paradigm shift has been identified. Network Survivability Analysis (NSA) was originally published in 1987 and subsequently applied to the design of several surface Navy combat systems (AEGIS, Aircraft carriers and Amphibious landing ships); its lessons learned also altered the FDDI network design for NASA's Space Station and has been applied to the design of satellites under NASA's Advanced Technology Demonstration (ATD) program. NSA is based on the simple mathematics of truth tables and associated probability of outcomes similar to reliability analysis,

however the underlying assumptions have changed. Given the idea of progress, where one generation's black magic system design can become the next generation's cookbook method, NSA appears to reduce some confusion in system engineering.

Network Survivability Analysis

The following claims are made:

• This analysis provides a quantitative figure of merit for modeling network, equipment, and system architectures; it can be extended to include software and non-traditional areas such as logistic support, documentation and training.

• It tracks actual and proposed changes to an architecture, again providing a figure of merit supporting a cost/benefit style analysis.

• This analysis can be used to predict, in a general way, design decisions normally arrived at after extensive study, simulation, prototyping, experience and endless meetings.

• This analysis can be used at either coarse or fine resolutions allowing a simplification of complex information.

• This analysis has been particularly useful in teaching component developers how to think about big system redundancy, allowing them to include design features in their components at an early stage of development before system integration and testing.

- The models developed in this analysis can be used to provide real time status of a complex system showing progressive degradation as faults occur.