Chapter 14

Modeling Complex Errors for Information Integrity Analysis

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ABSTRACT

This chapter is aimed at identification of a method for problem solving strategies to moderate the complex error resulting from change in environment by analysis, identification, and communication. The method is based on analysis through integrity of information. Integrity of Information (I*I) is defined as accuracy, consistency, and reliability of information at a given instance. The I*I value of any piece of information (in a work-related process) is subject to the 5 Cs in the environment, namely Complexity, Change, Communication, Conversion, and Corruption. The method provides an inventory about complex errors to modulate the complex error from the problem domain and share the right information at the right time with information integrity and also to project the need for an environmental view of information system design for large and complex enterprises.

1. SYSTEM ERRORS

System errors that may lead to system failures can be classified into three levels. At a primary level, they are due to service failures (e.g., consequences of thermal noise, random variations in electric supply, consequences of electromagnetic radiation, etc.), at secondary level, they are due to functional failures of equipments due to incorrect functioning of computer hardware and software, and at tertiary level, they are due to incorrect production (origination) of design information decision. In tradition of current engineering design approaches, which were developed for “standard” product in large volume business models, i.e., based on “fixed” design information decisions, for business competitive advantage most present technology markets aim at reduction of system errors and consequent failures at first two levels. However, research shows that only 40% of system errors are at first two levels, and 60% of system errors are at third level. Information production (origination) errors—these are complex errors and are present throughout the life cycle stages,

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2. TWO APPROACHES TO ERROR REDUCTION

2.1. Ad Hoc Approach

In any system—industry, organization, or setting—where error is common, there are many ways in which error reduction may be approached. One approach assumes that if people (engineers, doctors, specialists, technicians, operators, professionals, educationists, service providers, etc.) are more careful, pay more attention, and in general adopt more rigor in what they are doing then errors can be reduced and their effects mitigated. This approach particularly applicable at first two levels of system errors and failures there from tends to put great emphasis on the psychology of the individual who makes the error and on training, admonition, supervision, and ever-tighter and more detailed rules, with an implication of blame attached to those who make errors. That is to say, the error problem is seen as of that moment having no significance beyond itself. This approach, ad-hoc in nature, puts whole attention after a particular error. In real world, the error, however, does not occur again in the same form and in a same situation in a linearly predicted manner. Also, although people—engineers, doctors, specialists, technicians, etc.—are arguably among the most careful people in our society, they make mistakes. As a result, this approach, easier to pursue, gives a false sense of having taken steps for error removal. It never minimizes the error occurrence, though, and is invariably found less effective and more costly in the long run.

2.2. Integrity-Based Holistic, Systemic Approach

In contrast to the above there is a second approach—holistic and systemic—that sees the design of system elements, namely, objects (machines as well as concepts, e.g., design basis, budget), people, communication, software, norms (practices, standards, long-held beliefs), rules, procedures, behavior, policy, financial mechanism, etc. as being the source of errors. This approach emphasizes that people of good intention, skilled and experienced, may nonetheless be forced to commit errors by the way in which their behavior is impacted by interdependent, evolving, conflicting, and otherwise non-critical environmental factors. One need not deny that the most recognized system element, namely, people make errors because of fatigue, carelessness, or lack of training in order to espouse this approach to error. Similar observation is valid for errors in each of the other well-implemented system elements (objects, communication, software, norms, etc.) mentioned above. The fundamental hypothesis is that systems of which above elements are a part call forth errors from elements, not the other way around. Only as an attribution of last resort, or because of the tendency of a traditional, hierarchical management to be less concerned with integrity, i.e., correctness of design information decision than with economics, does one ascribe blame to an individual entity linked to an error.

3. FROM “TIGHTLY” COUPLED ENGINEERING SYSTEM TO A “LOOSELY” COUPLED INFORMATIONAL NETWORK

Traditional engineering design approach emphasizing “fixed” design information decision defines ‘system’ as a network of tightly coupled elements. Further, an element (e.g., machine) is also viewed as a system and it is defined as a set of tightly coupled components. (From this