Information Architecture for Complex Systems Design and Management

Wael Hafez

Abstract Complex systems are made up of many elements or agents. The behavior and functionalities of complex systems are the result of the interactions amongst the agents making up the system. For man-made systems, the system design is about realizing certain interaction patterns among the system agents that should result in a specific desired behavior or functionality. The system management on the other hand is about ensuring the resilience of such behavior and functionality against erosion and changes affecting the agents and their interaction patterns. That is, system management is achieved by ensuring the consistency and integrity of the designed structural patterns underlying a specific behavior. Systems become complex as the number of agents in the system grows, their variety increases and their interaction patterns overlap. The challenge of complex systems design and management can then be seen to originate mainly from the increasing uncertainties of how changes—either by design or by erosion—propagates across the different structural patterns and ultimately change the system behavior in an unpredictable way. As systems grow more complex, so also the changes they involve, and the unpredictability associated with the overall system behavior. The system management effort and cost thus become extensive and drain the system overall performance and efficiency. The paper argues that managing the communication across the system structural elements (agents) can enable a better management of complex systems uncertainties, and ultimately improve the efficiency of system design and management. The communication management approach is based on using information architecture for capturing the communication (interactions) among the system agents. Integrating system information architecture in the system design and management activities is argued to reduce the uncertainties associated with system operations, increase the resilience of the structural patterns and thus improve the overall system performance and manageability.

W. Hafez (✉)
Independent Researcher, Alexandria, VA, USA
e-mail: w.hafez@semarx.com