# Chapter 3.2
# Information Supply Chains:
## Restructuring Relationships, Chains, and Networks

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## ABSTRACT

Information supply chains (ISCs) take an information-centric view of supply chains, where information is not only used to support supply chain operations, but also to create value for customers and enable business partners to collectively sense and respond to opportunities in a networked ecosystem. Creating value in the ISC involves gathering, organizing, selecting, synthesizing, and distributing information. In so doing, ISCs should provide secure, confidential, reliable, and real time access to heterogeneous information, while ensuring that the right information is delivered to the intended recipients at the right time. In other words, security, information quality, and information lead-time delays are critical performance determinants in ISCs. Recent disaster events such as Hurricane Katrina have highlighted the need for and value of ISCs by exposing the vulnerability of supply chains to demand surges and supply disruptions. Mitigating supply chain vulnerabilities requires a mechanism that allows for continuously sensing the environment, detecting existing or anticipated vulnerabilities, and responding to these vulnerabilities in real time through information sharing and collaboration. This chapter describes how the autonomic computing paradigm can be used to build resilient information supply chains by restructuring the associated relationships, chains, and networks.

## INTRODUCTION

Supply chain vulnerability can be defined as (Rice and Caniato, 2003) *"an exposure to serious disturbance, arising from risks within the supply*

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*chain as well as risks external to the supply chain"*. Efficient supply chains should be responsive to demand surges and supply disruptions resulting from internal and external vulnerabilities. Demand surges and supply disruptions are characterized by the probability of their occurrence, the magnitude of the impact, and the ability to cope with them. Firms can respond to these vulnerabilities by either, reallocating and redirecting existing capacity (this involves prioritizing among customers), or, maintaining redundant capacity (this involves an inherent trade off between "just-in-time" lean supply chains and maintaining inventory and capacity slack "just-in-case" (Martha and Subbakrishna, 2002)).

Mitigating supply chain vulnerabilities requires complex coordination mechanisms among a network of entities, systems and organizations. Various points of contact and information handoffs leave open the possibility of errors. Effective supply chain managers react to such disruptive events by making decisions in real-time (Raghu and Vinze, 2004). This requires high levels of information sharing, real-time responsiveness, and collaboration.

Hurricane Katrina provided evidence of the importance of efficient decision-making, collaboration and information sharing in responding to demand surges and supply disruptions. Wal-Mart was able to move supplies to areas hit by hurricane Katrina because it had an emergency operations center that was staffed around the clock by decision-makers who had access to all of the company's systems (Worthen, 2005). District managers could call in to request supplies, and the decision makers, with the help of the logistics department would decide on how to relocate supplies to the affected area. They also relied on historical point-of-purchase-data from other hurricanes to forecast consumer demand before and after the hurricane, and used this data to stockpile emergency supplies in distribution centers around the affected areas. Wal-Mart therefore mostly relied on reallocating and redirecting existing capacity to meet the demand surge. In contrast, the Federal Government relied on redundant capacity maintained in the Strategic Petroleum Reserve to mitigate the supply disruptions caused by Hurricane Katrina in the Gulf of Mexico (Gross, 2005).

Responding to demand surges and supply disruptions therefore requires efficient redistribution and reallocation of resources based on real-time decision-making through information sharing and collaboration. In other words, there is a need for an information-centric view of supply chains that integrates information gathering, collaboration and decision making in order to support supply chain operations and create value for customers. This gives rise to the notion of Information Supply Chains (ISCs). There are three drivers for ISCs, each with unique perspectives to help with resiliency in the supply chain. The first is an organizational perspective that examines the differences and similarities between traditional supply chains and information supply chains in order to gain a better understanding of information supply chain requirements. The second is a process orientation that considers the unique informational challenges that arise in dynamic decision-making environments such as those caused by supply chain disruptions. The third is a technological perspective that investigates the use of autonomic computing principles in building a resilient information-based supply chain. The next three sections take a closer look at each of these orientations in turn. Section 5 presents an illustrative example of how autonomic computing principles can be used to build an ISC in the context of a healthcare supply chain that has been disrupted by an Influenza pandemic.

## INFORMATION SUPPLY CHAINS

A supply chain is a network of material, information and cash flows between suppliers (who provide raw material), manufacturers (who convert raw material to final products), distributors (who