Computer Network Management: Best Practices

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Abstract

Effective network management is essential in supporting business processes and operations; however, few studies provide empirical information on current network management practices to assist IT personnel to identify the weaknesses of their networks and to plan for improvement. Gartner Inc. has developed a five-phase Network Maturity Model to assist network teams to improve their networks; however, network teams need specific practices in each of the phases to guide their improvement processes. This study will use online questionnaire to gather data to be mapped into the maturity model to assist network teams to identify areas need improvements and to provide best practices in various industries and in organization of various sizes to guide the planning of network management improvement.

Computer networking was not a common business technology practice until the mid-1980s. Personal computers were invented in the late 70s, and by the mid-80s the technology was sufficiently mature to allow computers to communicate with each other to share resources. The computer networking industry had to solve two main problems when attempting to connect computers to form networks: hardware and software. Hardware pieces are required to make the physical connection and software is needed to instruct hardware to communicate with each other. For more than a decade, the research on computer networking had been on hardware and software. Electronic engineers worked to invent new connecting hardware and cables, to increase speed and capacity, to decrease the hardware size, and to increase the overall hardware performance. One the other hand, computer scientists directed their research to develop new programming languages, to search for better algorithm, and to develop new operation systems and application software to be used in a networking environment.

As computer networking became more common, there was increasing needs for network professionals to design, implement, and manage networks. Since the objectives of computer networking are to share resources and to support business processes, network professionals must have not only technical skills but also business concepts. Although the management of networks involves hardware, software, business process and users, research in network management continues to remain mainly in the technical areas, such as computer science and electronic engineering.

Review of Literature

The rapidly growing needs to share resources and information make network management increasingly important in today's computer world. However, the literature about network management research tends to focus on the technicality of network management. For

example, Chen and Ji (2005) researched a system to monitor and ensure signals sent to multiple computers reach all destinations. Some researchers have offered frameworks intended to encompass the evolution of networks to be able to change network behavior to meet user needs (Millor & Fernández 2005; Boutaba & Polyrakis, 2002). Other researchers have devoted their efforts to network protocols, which is defined as rules that all computers involved in an exchange of information have to follow (D'Arienzo, Prescapè, & Ventre, 2004; Verma, 2002; Wu, Hwang, & Liu, 2005). Another area that receives research attention is networking standards. Standards are necessary to ensure that hardware and software products from various vendors can work together and be compatible (Pilz & Swoboda, 2004; Chae-Sub & Knight, 2005; Zahariadis & Pramataris, 2002).

While academic research generally focuses on technicality of network management, articles published in trade magazines usually provide network management product information from the vendors' perspectives (Tynan, 2005; Carlson, 2005; Wirbel, 2005). This type of commercial-oriented information generally focuses on the functionality of the software but offers little assistance on 'how' other network professionals manage their networks. Case studies, on the other hand, report the implementation, challenges, or lessons learned from a single company (Carr, 2005). The limitation of this type of information is that it is applicable to businesses of the same industry and often times with the same networking characteristics, such as size or complexity.

Although research firms such as Gartner Inc. and Forrester Research may conduct research on network management, their reports are generally focused on large corporations. For example, Forrester Research Inc. reported a study conducted with 430 senior information technology (IT) executives from large companies in the US and Europe. The study found that IT

departments used management tools for specific areas (such as database management, network management, and server management), and the use of these tools created silos of information that made it difficult for the IT departments to cope with end-to-end monitoring. The study also found that 50 percent of IT problems related to application issues, such as poor performance, misconfiguration, and unpatched software (Saran, 2004). Although the findings of this study suggest common problem areas that network administrators should examine and analyze, the findings may not be applicable to medium to small businesses. In addition, the detail reports are usually beyond the reach of medium to small businesses due to their high costs.

Gartner's Network Management Model. Gartner, Inc. had developed a Gartner's Networking Maturity Model to enable network teams to identify shortcomings, to establish priorities, and to set goals for improvement (Pultz, 2005). This network maturity model describes network maturity in five phases: Chaotic, Reactive, Proactive, Managed, and Optimal as illustrated in Figure 1. In the initial, Chaotic phase, the network is undocumented. There is no procedure in place to guide employees' actions when problems arise; only ad hoc approaches that are applied on an individual or case-by-case basis. The overall approach to management is disorganized. In the Reactive phase, processes have been developed to the stage where similar procedures are followed by different people undertaking the same task. There is no formal training or communication of standard procedures, and responsibility is left to the individual. Network administrators deal with networking problems after they had occurred. In the Proactive phase, procedures have been standardized, documented, and communicated through training. Network personnel sets thresholds on various parameters for the network management tools to send warnings to alert the personnel before network problems arise. In addition, network administrators record trends of network usage and proactively management the utilization.

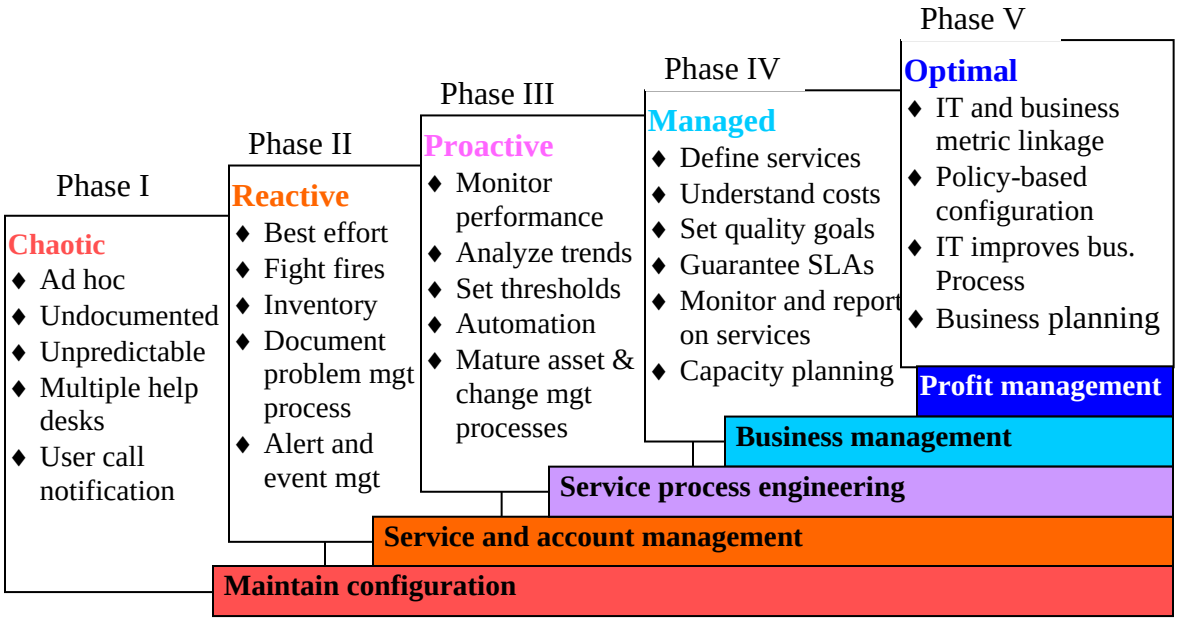

Figure 1. The Gartner Networking Maturity Model

In the Managed phase, it is possible to monitor and measure compliance with procedures and to take action where processes appear not to be working effectively. Network administrators are able to forecast and plan the network capacity needed in the future. In the Optimized phase, processes have been refined to a level of best practice, based on the results of continuous improvement and maturity modeling with other organizations. IT is used in an integrated way to automate the workflow, providing tools to improve quality and effectiveness, making the enterprise quick to adapt.

Due to the increasing security threats from the Internet and the rapid changes in IT technology, effective network management is essential in supporting business processes and operations. However, Forrest Research Inc. found that 67 percent of their respondents reported that they were unaware of problems until end-users called the helpdesk, and 41 percent categorized their approach to network management as reactive to problems (Saran, 2004).

The Gartner Networking Maturity Model provides a framework with general networking characteristics in various phases; however, network administrators lack the specific details to help them improve the management of their networks without attending a Gartner workshop.

Needs of the Research

Academic research generally focuses on technicality of network management, and articles published in trade magazines usually provide network management product information from the vendors' perspectives. Although the Gartner Networking Maturity Model provides general characteristics of networks in various phases, network administrator need more specific benchmarks against which to examine and analyze their own networks.

The main purpose of this study is to investigate hardware, software, and practices used in managing networks of various sizes in various industries. In addition, the study will gather information on network management issues and challenges. The gathered data will be used to establish best practices in each phase of the Gartner Networking Maturity Model. The study will collect data from network professionals in 10 different industries to establish industry-specific network management best practices and challenges. Data will be analyzed based on the size of the networks to identify management challenges, issues, and best practices that are specific to small, medium, and large corporate networks.

Significance of the Study

As previously mentioned, the literature is missing applied network management research. The findings of this research 1) will provide specific information to help organizations identify areas need improvements; 2) will provide best practices used in organizations of different sizes and different industries; and 3) will assist organizations prioritize their goals.

Networking management software industry continually seeks empirical information on current network management practices and desirable management software functionalities from network administrators to guide future product development. The challenges and issued identified in this study can provide needs analyses for network management tools development. The findings on both practices and networking issues will also enrich computer networking academic curricula development.

Research Methods

Survey instrument and validation. This project will use an online survey questionnaire to gather data. In the past year, the questionnaire was developed from many previous interviews with network administrators on network management hardware, software, and practices. The questionnaire has already undergone three iterations of validation. In each iteration, network administrators were asked to go through the questionnaire and provide feedback on the content, format, wording, and needs of clarifications. Then, modifications were made in the questionnaire. An online version of the questionnaire was then created using SurveyPro. The pilot test of the questionnaire involved two network administrators filling out the online survey and provided feedback for improvement. Modifications were made.

Research Subjects and Response Rate. This questionnaire will be sent to information technology personnel who are either in charge of or are knowledgeable about the organization networks, such as network administrators, technology director, system administrator, and security administrator. The questionnaire will be sent to these personnel in a wide range of industries via email.

Data Analysis Techniques. The questionnaire gathers descriptive data with multiple responses and rankings. The main data analysis techniques to be used are split-file frequencies and cross-tabulations for cross section analyses by industry and by organization size. These analyses will produce findings of the network management hardware/software/practices used in different industries

and in organization of various sizes. Cluster analyses will also be used to identify correlations between industry, organization size, and various network management challenges/issues. For example, certain industries might tend to have more security challenges or organizations with certain sizes might have certain management issues.

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