As the Value of Enterprise Networks Escalates, So Does the Need for Configuration Management

Executive Summary

The enterprise network supports the most critical business applications and corporate communications. The impact of network outages has never been more acute. Yet, most enterprises diffidently accept network outages as a normal cost of doing business. What many managers do not realize is many outages are preventable with better configuration management.

As trends such as Web services, IP convergence and on-demand computing continue to develop, the reliability of the network will become even more important. The network will support even more critical business applications, increasing the cost of downtime (see Exhibit 1).
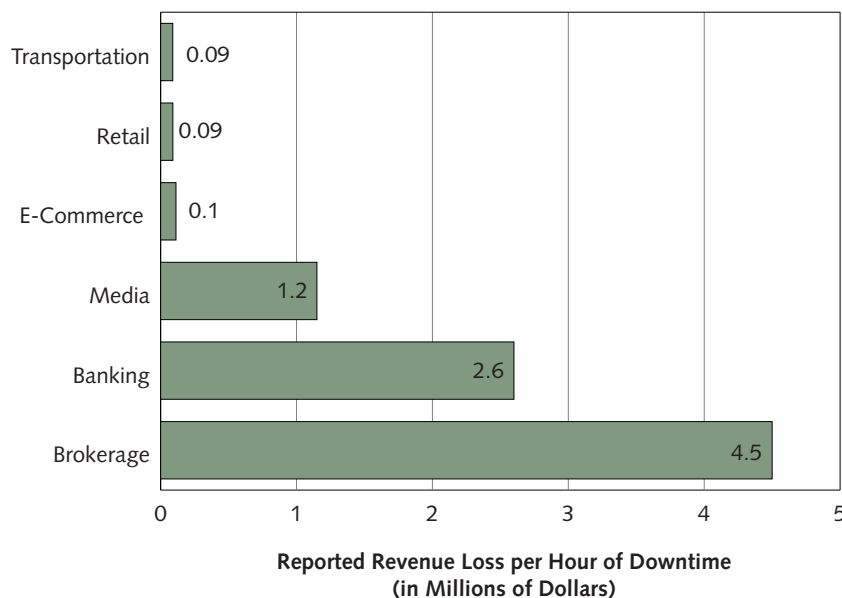
Even for more frequent and less publicly noticeable outages, the costs of downtime hurt the bottom line and offset the revenue and productivity benefits of new initiatives. In this report, the Yankee Group focuses on how network configuration management can give the enterprise the necessary discipline and workflow to maximize uptime. It maximizes uptime by increasing mean time between failures (MTBF) through effective change control, and reduces downtime and its associated cost of repair by minimizing mean time to repair (MTTR).

Configuration management can provide greater control of change, which leads to better network resiliency, security and scalability.

Exhibit 1
With More Critical Apps on the Network, the Cost of Downtime Escalates
Source: The Yankee Group, 2004

Reported Revenue Loss per Hour of Downtime
(in Millions of Dollars)

Industry	Value
Transportation	0.09
Retail	0.09
E-Commerce	0.1
Media	1.2
Banking	2.6
Brokerage	4.5

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I.   Introduction: The Role of the Enterprise Network

In only the past five years, the enterprise network has become the backbone of the business. Enterprises now rely on their networks to support mission-critical applications and service the needs of a business web of suppliers, vendors, partners, customers and employees.

The expanded role of the network and the following trends will continue to drive the need for maximum uptime:

- **Voice, video and data convergence:** IP convergence is more of a matter of when than if for most companies. Full convergence promises to create a competitive advantage for companies by bringing all of their collaborative applications together and delivering truly unified communications.

- **Web services:** Enterprise application integration (EAI) has been limited to only the largest of enterprises because of its complexity and because there was no standard to deliver this across organizations. Web services will simplify application integration and create a standardized way for companies to communicate with one another, bringing application integration to mid-size organizations. The Web services protocols ride on top of IP networks, making network uptime a critical component of Web services.

- **Migration to IP VPNs:** More companies are migrating to IP networks. IP has the necessary openness and flexibility to adapt to current company challenges and will be the delivery mechanism for many new technologies and applications.

- **On-demand computing:** Utility or on-demand computing will become a new computing model for companies where resources are pooled and allocated as needed by applications and resources. This will help deliver the true real-time enterprise where information is available to any user, over any device, at any time. Any on-demand computing environment will require an on-demand network.

These trends and new technologies have the potential to transform business and simultaneously reduce costs and increase revenue. However, the potential of these new technologies will never be realized if the security and reliability of the underlying network infrastructure cannot be guaranteed. Configuration management, as part of a thoughtful infrastructure management strategy, is a critical tool for managing the consistency, reliability and security of the enterprise network.

II.   The State of the Enterprise Network

The importance of the enterprise network has grown tremendously over the past five years but the way it is managed has not. Network changes are still largely managed ad hoc, node by node rather than holistically. This engineering-intensive, ad hoc approach to network management has created the following:

- **Eighty percent of IT budgets is used to maintain the status quo.** Because of increased complexity, lower budgets and continued business demand, the percentage of budget used for keeping the lights on will continue to increase. Without imposing a disciplined approach to managing the network, maintaining the current operating environment will continue to consume a larger percentage of the IT budget, leaving new, value-producing initiatives on the shelf.

- **A 2002 Yankee Group survey showed that, in multivendor networks (three vendors or more), 62 percent of network downtime is due to human error** (see Exhibit 2). Many outages are the result of manual processes and ad hoc changes by network cowboys who make changes to network devices outside of change control processes and during business hours. These errors are self-inflicted and quite often preventable.

Exhibit 2
Human Error Is the Leading Cause of Network Downtime
Source: The Yankee Group 2002 Network Downtime Survey
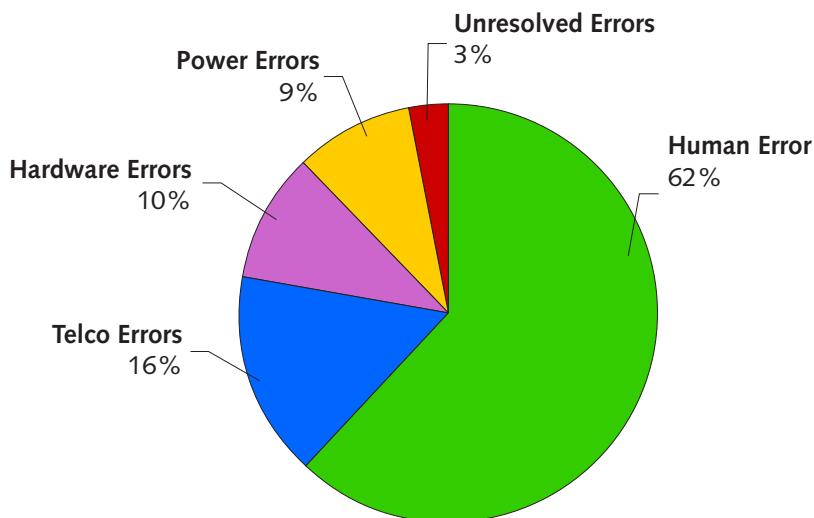
- **Accurate documentation is difficult to maintain.** Because networks are often managed ad hoc, changes are made on the fly and never recorded. Much of the what and why of network management lives inside the heads of these network cowboys, making the diagnosis and remediation process inefficient.

Despite the increased importance of the enterprise network, most organizations have not adopted any kind of configuration management strategy. By identifying methods of reducing or even eliminating self-inflicted errors, companies can save millions of dollars in lost productivity and availability.
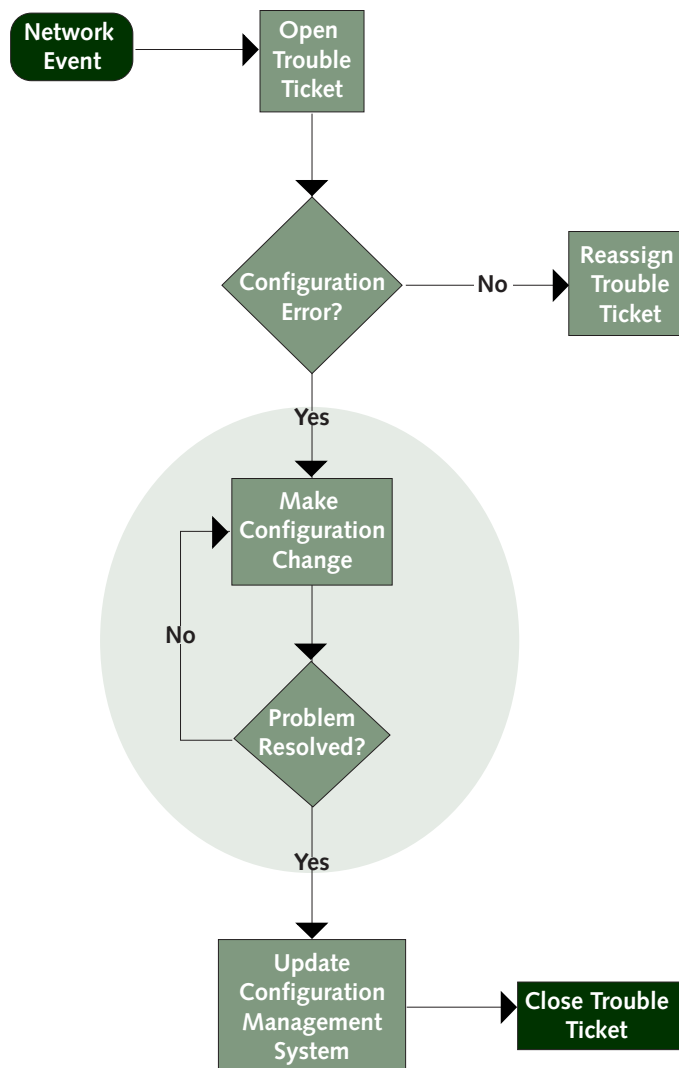
How Enterprises Deal with Downtime Today

Most network operations environments lack network-wide control of configuration baselines, which directly contributes to an unnecessarily high number of service outages and an impaired ability to quickly find and repair causal events.

Exhibit 3 shows a typical incident response workflow. The highlighted phase of the process shows where configuration management is ad hoc. The engineer may make multiple configuration changes and then manually document the changes later. With enterprise networks growing rapidly, there is a continual need to establish and maintain baseline configurations, and to have the ability to audit these configurations for every device in the network at all times. A collection of ad hoc tools cannot do this, leading to the following problems:

- **Configuration drift:** Different individuals within the network engineering staff make a variety of small changes to lots of network elements over time. Device configurations become inconsistent, resulting in elements that are similar but each having widely different settings. The baseline state for a given device is lost.

- **Loss of critical information:** When documenting change is done after the fact, information invariably gets lost. Either some change is not documented, an incident happens before the documentation is completed, or engineers never get around to documentation because of more firefighting.

- **Extended downtime:** When network engineers are troubleshooting, it is critical they can quickly restore the device to a stable state. This at least gets the device to a functional condition (referred to as a "safe harbor") while troubleshooting continues to identify the root cause. Without a means of automatically restoring to a baseline state, the device stays down longer, exacerbating the business impact.

- **Extended time to repair:** Troubleshooting time and incident resolution takes longer because an engineer needs to manually get the device back to a stable configuration through configuration archaeology as well as trial and error.

- **Lack of a verifiable baseline or enterprise gold standard:** Having an enterprise-wide gold standard for the configuration of each device is the goal; but it is a worthless exercise if there is no way to validate and audit configurations after they are deployed to the device and in production.

Exhibit 3
How Enterprises Handle Downtime Today
Source: The Yankee Group, 2004

```
Network          Open
Event    ──►    Trouble
                Ticket
                   │
                   ▼
            Configuration ──No──►  Reassign
               Error?              Trouble
                   │                Ticket
                  Yes
                   │
                   ▼
                 Make
            ┌─► Configuration
            │   Change
            │      │
           No      ▼
            │   Problem
            └── Resolved?
                   │
                  Yes
                   │
                   ▼
                Update
             Configuration ──►  Close Trouble
              Management         Ticket
                System
```

All of these problems lead to a higher cost of downtime, longer repair times and lower service reliability. The configuration of a device and the impact that configuration has on dependent devices is one of the first things a network manager will investigate during an outage. Without a consistent and controlled approach to device changes, it is nearly impossible to correlate those changes to network outages.

The Yankee Group Network Downtime Survey revealed 83 percent of companies have no ability to correlate outages with configuration changes. This leads to lengthy troubleshooting times that translate into increased mean time to repair. The network operations staff must scramble and guess what the problem is. In many cases, the proposed changes cause other problems that may not appear until later. Outages last longer and the costs to repair them increase because valuable and expensive engineering skills are dedicated to the effort.

Inaccurate documentation also leads to lengthy problem solving. Most engineers do not have a simple way to document device changes as they are made. It is common to see operations center staff track configuration changes in spreadsheets or in homegrown databases. This makes entering the information a manual and inconsistent process. Often a week or more elapses before an engineer can enter the details of a configuration change. The data is often not current or accurate and network operators lose valuable time looking for information or acting on the wrong information.

Trying to manage a network in this ad hoc fashion puts the network operations team on the defensive where they are constantly working from behind, fixing one problem after another. This continual firefighting takes away from other, more strategic, initiatives. The Yankee Group estimates approximately 90 percent of IT initiatives are delivered late, partially because of the lengthy troubleshooting that monopolizes IT staff time.

One of the keys to creating a successful network strategy will be to deploy configuration management software that can minimize the overall MTTR and help create a more consistent and manageable environment.

III. Configuration Management Overview

Configuration is the "C" in the FCAPS (Fault, Configuration, Accounting, Performance, Security) model, the standard model for components of network management. Leading network management tools such as those from HP OpenView, Computer Associates and IBM/Tivoli offer tools for virtually every requirement of the FCAPS model except configuration.

Configuration management has been the domain of the equipment manufacturers. In fact, until recently, the only configuration management platforms were those available directly from the hardware vendors. They provide basic abilities to make simple changes but have no advanced capabilities and lack the ability to manage multivendor networks. As a result, most network managers work with one network management system for alerts but require several configuration management tools for making changes to network elements.

As companies continue to build intelligence and automation into the network, manageability will be the key for any successful strategy. Configuration management, in particular, enables that manageability.

A strong configuration management strategy delivers these benefits:

- **A centralized view of all the network elements in a multivendor network:** Network engineers will have a common system to record and access configuration information for every network device, regardless of platform.

- **A uniform network element configuration:** Configuration management fosters a consistent environment. With more uniform configuration, MTTR is shorter. The network elements have a greater commonality that gives network engineers a better understanding of and more familiarity with the configuration of each device. It also enables operations staffs to institute a more structured, consistent troubleshooting process across the infrastructure.

- **Faster and more accurate device configurations, changes and deployments:** Standardizing on one configuration management tool enables automated configuration, faster changes and provisioning. Consistency means manageability.

- **Enforcement of compliance with standards and policies:** Many enterprises have standards and policies for equipment configuration but no means to track adherence to those standards. This can lead to security holes or misconfigurations, which lead to unplanned downtime, loss of proprietary data and audit findings.

- **Ability to track network changes and instill accountability:** Network managers can immediately detect when changes are made to the approved baseline state of a device, identify who made the change, then enforce configuration standards and change management processes.

- **Ability to quickly restore to a known and trusted state (safe harbor):** Rolling the device or a group of devices immediately back to a known functional condition reduces the impact of downtime. Without this capability, engineers would have to spend critical time searching for a stable configuration and manually reconfiguring devices.

As companies investigate configuration management platforms, the following features need to be incorporated into the solution:

- Multivendor capabilities

- Rollback and restoration capabilities

- Hierarchal user access and permissions

- Event-driven change detection

- Accounting and reporting

- Ease-of-use based on a strong GUI

- Detailed device information (current and historical)

- Centralized management

Implementing a configuration management tool that incorporates these capabilities delivers immediate benefits to the network manager and the enterprise. Business units will not have to cope with unplanned outages as often and the duration of downtime will be shorter. An additional benefit often overlooked is the positive impact on network security. Configuration management should always be part of the overall enterprise network security strategy.

Impact on Security

For years, network security has focused on the network perimeter. Organizations have spent money on firewalls, intrusion detection systems and VPN concentrators but have always treated security as more of an overlay to the network rather than an integral component. Configuration management is the core of any strong security strategy. It helps enforce policies, identify security holes and prevent unauthorized changes to network elements. The security concerns of companies identified by the Yankee Group Network Downtime Survey illustrate these risks:

- Fifty percent of respondents reported unauthorized changes were made in the past 12 months.

- Of the unauthorized changes reported, the network staff could not account for 47 percent of the changes.

- Seventy percent of companies used shared passwords to manage network devices where only 30 percent used centralized security servers such as TACACS+ or RADIUS.

- Sixty-eight percent of respondents had no method of tracking operator logins and configuration changes.

For companies that truly wish to make security part of the corporate DNA, configuration management is a must for delivering the necessary control mechanisms. These control mechanisms ensure only authorized personnel are making the necessary changes to the network within the defined best practices of the company or government organization.

Impact on the Business

Companies that fail to implement a robust configuration and control strategy for their networks will not have the required network flexibility or resiliency to take full advantage of productivity improving technology. Effective configuration management has critical business impact in four ways:

- **Increased efficiency:** Faster administration lowers MTTR; operations center staff are more efficient, and respond and resolve more problems faster.

- **Increased productivity:** As networks become more important, downtime negatively affects the productivity of end users. Ironically, today's networked organizations are like the mainframe environments of years past. If users do not have network access, they have very little information or functionality available to them. Configuration management prevents outages that idle employees.

- **Revenue protection and generation:** With more critical transactions relying on the network infrastructure, the costs of downtime have never been higher. Configuration management prevents many of the outages that affect revenue. When employees are more productive, they can focus on revenue-generating activities.

- **Reduced risk of regulatory non-compliance:** The ability to attest to internal change control processes meets specific requirements of emerging industry and government regulations, including the Sarbanes-Oxley Act, and is fundamental to avoiding audit findings.

The impact of configuration management should not be underestimated. It is realistic that operations centers could see a 20 percent increase in the efficiency of the network engineering and operations staff and a 20 percent reduction in MTTR. That would be analogous to adding one support person for every five people employed in network operations—at no cost. This alone can justify the investment in a multivendor configuration management tool. More important, the network operations center staff will never be able to manage the increasing network scale and complexity required for advanced business applications without a comprehensive configuration management strategy.

IV.   Conclusions and Recommendations

A comprehensive configuration management strategy is crucial for today's extended enterprise network. The scale and responsibility of the enterprise network is too great to be managed haphazardly. The costs of downtime are evident and in many cases preventable. To get started, the Yankee Group offers the following recommendations:

- **Calculate the cost of downtime.** Network managers need to work with business unit managers to identify and quantify the frequency of outages and the business impact. They should ask whether it is revenue or productivity that is adversely affected and if the lost revenue is recoverable.

- **Calculate support costs.** Network managers need to quantify MTBF, MTTR and the costs of repair. Identify how much time is spent troubleshooting, root cause analysis, and change management. How many man-hours can be recovered through effective configuration management?

- **Team up with the security organization.** In many organizations, network managers and security managers work in silos. By working together to establish configuration management policies and integrated change controls, each group's job gets easier. Each will have a consistent view of the entire network and an increased trust in the way device configurations are managed, making the network more efficient to secure and monitor.

Configuration management is often overlooked. Fault and performance management garners the most attention in the network operations center. What network engineers are beginning to realize is that a strong network configuration management strategy makes fault and performance management easier. New multivendor configuration management tools enable network managers to deploy consistent change management practices as well as discipline and workflow procedures across the entire network. The network is more reliable, is more secure, experiences fewer outages and minimizes the impact if unexpected changes do occur.

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