CHAPTER 4 – ENTERPRISE INFRASTRUCTURE

"The State was like a holding company with 20 little companies. Agencies didn't share information, resources, or capabilities." CIO Magazine, September 1999 – Paul Quade, NCC Project Co-Director

Enterprise infrastructure represents the computing environment for the entire State of Colorado including desktops and networks. This infrastructure is the foundation of Colorado's transformation to e-government. Without an effectively managed, coordinated, and supported infrastructure, the State will be unable to achieve the goals established by Governor Owens.

Colorado must have a comprehensive statewide strategy for developing standards, leveraging technology procurements, and managing its technology infrastructure. This chapter includes immediate plans for managing desktop resources and wide area networks (WANs). In the long-term, to achieve an integrated approach, it will be necessary to have central guidance and leadership. An Enterprise Infrastructure Project Manager should be responsible for assembling a team to develop a comprehensive plan for desktop, network, and computing capacity management. In addition, the team should be responsible for implementing the Enterprise Infrastructure plan. Participation by the State Department's Chief Information Officers (CIOs) in the Enterprise Infrastructure team is essential to the project's success.

Figure 4-1: Enterprise Infrastructure Recommendations

Recommendation	Estimated Cost Savings / Cost Avoidance	Support for NCC Goals	Status
4.1. The State should establish a standard personal computer (PC) configuration and employ the Western States' Contracting Alliance (WSCA) PC awards as the basis for purchasing desktop computers.	$1.2 million annual cost savings	✔Efficiency and Effectiveness ✔Collaboration and Information Sharing	Ready to Implement
4.2. The State should mandate use of the statewide Multi-Use Network by all state agencies and should establish standard network protocols and monitoring tools.	$7.0 million cost avoidance	✔Efficiency and Effectiveness ✔Innovative Technology ✔Access to State Government ✔Collaboration and Information Sharing	Ready to Implement

DESKTOP COMPUTING

Desktop computers have become integral to the operations of state government. With the large number of desktops in the State's computing environment, it is critical to ensure this asset is properly managed.

Opportunity Statement

Colorado State Government, excluding Higher Education, purchases roughly 5,000 personal computers (PCs) each year. An estimated $8.0 million is spent annually on desktop hardware, and an additional $1.0 million is spent on desktop software. The current average purchase price for a PC in the State is approximately $1,600 per unit. This price is higher than necessary. The State could more effectively leverage its technology purchases and realize cost savings through adhering to improved desktop standards.

There are minimal statewide standards in place that affect Colorado's desktop environment. Agencies purchase hardware and software and maintain their desktop environment independently. As a result, the

State has a fragmented and inconsistent desktop infrastructure as described below.

- Lack of Standardization: Non-standard desktops inhibit effective communication and sharing of information as well as increasing support and maintenance efforts.
- Unsupported Applications: Unofficial / unsupported applications are being installed on state desktops by various end-users. These non-standard applications can corrupt existing configurations resulting in increased technical support issues and wasted network resources.
- Fragmented Configurations: Non-standard PC configurations increase the total cost of ownership due to costs related to supporting, maintaining, and monitoring multiple systems and environments.

Desktop standards and polices typically decrease the total cost of ownership of a PC. Decreases in the cost of ownership are a result of various efficiency and effectiveness improvements. These improvements include increasing buying power, redirecting technical support staff to more value-added activities, improving communications between departments, leveraging training resources, and increasing the level of staff productivity through more competent and capable utilization of desktop hardware and software.

Assessment

The NCC team reviewed desktop management practices in other states and identified Pennsylvania as utilizing a best practice. Pennsylvania has declared desktop computing technology to be critical to the effective and efficient operations of state government. As such, Pennsylvania established a statewide desktop infrastructure. The State of Pennsylvania coordinates the management of its desktops to ensure a flexible and responsive computing environment, to support interagency communications and exchange of information, and to be consistent with accepted industry standards. This approach is accomplished through a central agency working in partnership with work groups of stakeholders in state agencies to develop and implement the following practices statewide:

- Hardware and software standards and programs to minimize the cost of information technology (IT) ownership;
- An IT modernization plan for the State;
- An IT asset tracking program and statewide IT education programs;
- Technical assistance for agencies to expand Internet / intranet applications and enterprise client / server applications;
- Distributed management tools to facilitate hardware maintenance and software upgrades and metering; and
- Common workgroup and desktop-based applications that represent best practices in the use of desktop computing technology.

The State of Colorado can move in the direction of these best practices by implementing similar policies. Centralized leadership will be necessary to evaluate progress towards a statewide approach and should provide guidance and direction to ensure appropriate integration is achieved.

Recommended Solution

Recommendation 4.1: The State of Colorado should establish a standard PC configuration and employ the Western States' Contracting Alliance (WSCA) PC awards as the basis for purchasing desktop computers.

A desktop subcommittee of the CIO Forum, working in conjunction with the NCC initiative, was established to evaluate potential desktop standard issues. The group made several recommendations for standards, policies, and / or procedures for implementation statewide. They are:

- Define Minimum Desktop and Laptop PC Standard Configurations: The subcommittee defined three standard desktop and two standard laptop PC configurations. These standards also included allowable exceptions to the standard configurations under appropriate circumstances. The standards also indicate that departments should standardize on one PC vendor per platform, while the State should standardize on no more than four PC vendors. Finally, the subcommittee indicated that leasing of PCs is not recommended for the State.
- Establish Printer Standards: The subcommittee defined two standard network printer configurations based on volume of print and the number of users in an area. The standards

indicated that local desktop printers should not be utilized except in cases where increased security of printed documents is required, or for areas (such as reception areas) where desk coverage must be maintained.

- Create Desktop Operating System Software Standards: The subcommittee defined Microsoft Windows 98 and Windows NT as the current operating system standards for the State. Migration to newer versions of these products will only be recommended after the software has been on the market and is considered a stable release.
- Establish an Office Productivity Suite Standard: The subcommittee defined the State's office productivity software standard as Microsoft Office 97, with a migration plan to Office 2000 by June 2002. The subcommittee also recommended that departments include a training plan for support staff and end-users when migrating to a newer software suite.
- Develop Anti-Virus Software Standards: The subcommittee did not define a vendor-specific product due to the variety of hardware installations throughout the departments. However, the subcommittee outlined the following practices which must be followed:
  - ✓ Software must reside on individual desktops / laptops, and servers must be managed centrally within departments;
  - ✓ Departments should secure a department-wide license, including licenses for stand-alone desktops and telecommuters;
  - ✓ Software must be updated automatically and protect inbound and outbound traffic;
  - ✓ Procedures must be in place to automatically scan diskettes; and
  - ✓ Anti-virus Software is recommended for the home user.

Justification

This recommendation supports two of the Governor's goals.

Efficiency and Effectiveness

Through the definition of standard PC configurations and improved leveraging of the WSCA PC award and state awards, the State will be able to reduce the current average purchase price below $1,600 per unit. To complete the analysis, the CIO Subcommittee worked with the four PC vendors holding state awards. Using the standard configuration developed for the mid-range desktop PC, the average price between the four vendors was $1,350 per unit. This represents savings of $250 per PC, or annual cost savings of $1.3 million.

Furthermore, internal efficiencies can be achieved through improved standardization of the desktop environment. Technical support staff will be able to develop vendor specific knowledge, resulting in decreased troubleshooting and researching efforts. Less time will be required to support individual PCs when configurations are consistent from user to user.

Collaboration and Information Sharing

Standardized office productivity software will allow departments to share documents without having conversion issues between various software packages and versions. As a result, less time will be spent on converting, reformatting, and manipulating documents from one software package to another.

WIDE AREA NETWORKS

Most agency desktops are connected over networks to servers at Colorado Information Technology Services (CITS) which provide access to enterprise applications such as Colorado Financial Reporting System (COFRS) and the Colorado Personnel and Payroll System (CPPS) and also provide connections to the Internet and various e-mail systems. State, county, and local government agencies connect to state networks for business needs such as driver's license information, criminal background checks, benefit assistance, and worker's compensation records. These connections are made possible through the State's WANs. In general terms, these networks facilitate the transfer of data from one PC to another. Without the connectivity provided by the State's WANs, many state citizens, businesses, and employees could not access data that the State maintains.

Opportunity Statement

While many of these networks operate over the same backbone, there is limited integration and planning to maximize their capabilities. These network infrastructures are reflective of how state government is currently organized. These networks were designed to meet specific programmatic needs defined by individual agencies or consortia. Each network, although effective in solving the individual problems of an agency or

group, has not been designed with a planned statewide architecture in mind.

There are several WANs deployed in the State. CITS and / or departmental staff maintain the following networks:

- The Colorado Information Network (CIN) is the internal network for state agencies. The CIN, in conjunction with the Open Colorado Information Network (OCIN), is the State's network backbone.
- OCIN is the State's network for external stakeholders, including Internet access.
- The Asynchronous Transfer Mode (ATM) / Frame Relay network and the Digital Data Network are telecommunications networks that connect state offices to other networks.
- The Systems Network Architecture (SNA) network connects state agencies and transmits only text-based messages.
- The Cooperative Interactive Video In Colorado State government network facilitates video conferencing between various state agencies.

In addition, there are several WAN initiatives in development in Colorado:

- The Multi-Use Network (MNT) is a new public / private sector partnership that will aggregate telecommunication lines into a single ATM infrastructure.
- The Colorado Department of Transportation fiber project is another public / private initiative to lay strands of network fiber along the rights-of-way of Colorado highways.
- The Colorado Department of Public Safety - Colorado Bureau of Investigation is replacing the network for all law enforcement agencies in the State.

The lack of centralized planning, deployment, and management of the State's network infrastructure has resulted in several problems.

- Fragmented Infrastructure: The existing state network environment is currently under-developed and limited in functional capability.
- Duplicative Network Connections: There is a lack of consolidated network connections within each state-occupied building. If more than are agency shares a building, there are often multiple network connections.
- Multiple Network Management and Monitoring Tools: The State has various network management and monitoring tools for local area network (LAN) and WAN systems instead of one standard tool. The lack of standardization provides a challenge for monitoring the status and growth of the network infrastructure.
- Multiple Network Protocols: The State maintains multiple network protocols that are not always compatible. In some cases, these protocols are outmoded. This problem makes statewide information sharing difficult. Switching to one standard for a network protocol would position the State to provide a stable environment for data movement on its networks.
- Lack of Redundancy: The State's connection to its Internet Service Provider is not redundant, and is a single point of failure within Internet communications.
- Unnecessary Complexity: The SNA network connects the mainframe to over 9,000 terminals and printers. These devices are out-dated "dumb terminals" and do not have computing capacity or capability of running software. The large number of SNA devices increases network complexity and network maintenance costs.

Colorado will experience increasing problems if the lack of coordination continues.

Assessment

Telecommunications and networking have seen dramatic changes in technological capabilities. Colorado now has a requirement to invest in a unified network to effectively integrate these individual networks. Of all of the current network initiatives in the State, the MNT initiative truly integrates the State's telecommunication and networking capacity. Rather than individually upgrading a series of segregated, duplicative, and independent networks, MNT uses Colorado's combined buying power to encourage private sector investment in networking and telecommunications.

In addition to ensuring statewide use of the MNT, the State requires standard network protocols and monitoring tools. Transmission Control Protocol / Internet Protocol (TCP / IP) should be the exclusive network protocol. Other protocols in use should be eliminated. Network complexity and bandwidth is increased by each protocol, eliminating nonstandard

and non-routable protocols will reduce network bandwidth needs, connection problems, and troubleshooting time.

Adopting a single-vendor solution for network components including routers, switches, and hubs would provide cost efficiencies, easier upgrade / replacement paths, reduced training costs, and stable backup methods for the State's networks. By deploying a singe network management and monitoring tool to the LAN and WAN systems, the State can effectively monitor the status of its networks.

Finally, without a coordinated network infrastructure plan, state agencies, schools, libraries, and institutions of Higher Education will continue to purchase network services in a piecemeal fashion. This often duplicates service in a community, or even the same building. Acquiring services in this manner slows development efforts by not providing sufficient incentive for the private sector to fund and build-out the needed infrastructure. MNT is the appropriate initiative to achieve these goals.

Recommended Solution

Recommendation 4.2: The State of Colorado should mandate the use of the statewide MNT by all state agencies. The State should also establish standard network protocols and monitoring tools.

NCC recommends that the Governor issue an Executive Order to ensure consistent use of the MNT. This will ensure a scaleable and coordinated statewide telecommunications infrastructure that provides the citizens of Colorado integrated access to government services, educational opportunities, and information resources. The network platform subcommittee of the CIO Forum, working in conjunction with NCC, has established network standards for all major network components, including routers, hubs / switches, circuits, cable plants, network interface cards, and network protocols. In addition, the subcommittee has outlined the following criteria for network monitoring tools:

- Use open systems and open code software;
- Work across technical platforms, specifically the hardware listed in the Network Component Standard;
- Use the standard network management protocols; and
- Use web-based displays.

Justification

This recommendation supports all four of the Governor's goals.

Efficiency and Effectiveness

This initiative will ensure that Colorado does not spend more than is necessary to fulfill the stated demands for network technology.

Based on estimates from the Department of Personnel / General Support Services, the MNT initiative generates approximately $7.0 million in one time cost avoidance opportunities. This figure represents the difference between what Colorado would have paid for networking services in Fiscal Year (FY) 1999-00 (estimated $20.0 million) if MNT was not deployed versus the actual authorized operating expenditures allocated for MNT in FY 1999-00 ($13.0 million).

Another benefit of the MNT initiative is to avoid the continuing limitations of current networks that were implemented based on short-term demand over the years. As a result of unified network standards and comprehensive use of the MNT, the State will have a more effective network. In the long-term, this improved effectiveness should allow for consolidation of network support.

Innovative Technology

This project involves implementing the most current telecommunications technology, (ATM coupled with a fiber optic backbone), that will be managed and monitored 24 hours a day.

Access to State Government

This recommendation will result in significantly improved access to state government from most of rural Colorado. Citizens, businesses, and governmental entities will benefit from the upgraded facilities necessary to meet the objectives of this initiative. Rural areas of the State that are currently at or near capacity can benefit from additional bandwidth and the advanced services made available by the local telecommunications provider.

Collaboration and Information Sharing

Mandating the use of statewide MNT by all state agencies and developing standard network protocols and monitoring tools will help improve collaboration and information sharing between agencies.