

Evaluation of Network Services

Division of Information Technologies,
Colorado Department of Personnel & Administration

Performed for:
Colorado Office of the State Auditor

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Transmittal Letter

September 20, 2002

Members of the Legislative Audit Committee:

This report contains the results of our evaluation of the Division of Information Technologies' Network Services section within the Department of Personnel & Administration. The evaluation was conducted in response to a request from the Department of Personnel & Administration for an assessment of network services operations. The work was performed pursuant to Section 2-3-103, C.R.S., which authorizes the State Auditor to conduct audits of all departments, institutions, and agencies of state government. The report presents our findings, conclusions, and recommendations, and the responses of the Division of Information Technologies.

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Report Summary

Evaluation Authority, Purpose & Scope

This evaluation was conducted pursuant to Section 2-3-103 C.R.S., which authorizes the Office of the State Auditor to conduct performance audits of all departments, institutions, and agencies of state government.

The evaluation, requested by the Department of Personnel & Administration, focused on the Network Services section and the MNT program within the Division of Information Technologies. Requirements of the evaluation were as follows:

- An examination of the current statewide service delivery structure and an assessment of the advantages and disadvantages of aggregating the networks into centralized networks.
- An assessment of the current status of and identification of needed improvements in the Network Services section's customer service efforts.
- An analysis of the Network Services section's costs and rate-setting methodologies.

This evaluation was performed from May to August, 2002. We acknowledge the assistance and cooperation that was provided by the Division of Information Technologies.

Background

Section 24-30-903, C.R.S., charges the Department of Personnel & Administration to work with local, state, and federal departments, institutions, and agencies to provide telecommunication services. The Network Services section within the Division of Information Technologies is responsible for the management of all state telephone and networking facilities and services, including all voice, video and data transmission networks. Network Services manages approximately 50% of the total State government network traffic within Colorado. Funding for the Network Services section for Fiscal Year 2002 was about \$18 million.

Report Summary

Section 24-30-908, C.R.S., requires users of the Department of Personnel & Administration's telephone and data communications services to be charged the full cost of the particular service, including material, labor, and overhead. At the same time, the statute states: "It is the responsibility of the Executive Director of the Department of Personnel and Administration to establish a policy of remaining competitive with private industry with regard to cost, timeliness, and quality of the telephone service or data communication functions provided by the Department"

In 2000, the Division was given the responsibility for implementing the Multi-use Network (MNT) across the State of Colorado. The MNT is a public/private partnership between the State and Qwest and its partners (Century/Tel, Phillips County Telephone Company, Eastern Slope Telephone Company, Citizens Communications, and Cisco Systems) to build a high-speed fiber-optic network for the State of Colorado. The intended benefits of the MNT include reduced administrative and maintenance costs to the State, the ability to deliver time sensitive services (e.g., video, data) to all counties of the State, increased economic development in rural areas, and the creation of a backbone for e-government with access to a statewide Intranet as well as the Internet.

The recommendations in this report emphasize the need to remedy management issues so the State of Colorado can achieve full cost recovery of Network Services operations, establish rates that are competitive with the private sector, and take full advantage of the MNT network. We identified the following concerns regarding the Division's telecommunications operations:

- The Division is not fully recovering its costs for telecommunications services and charges some rates that do not appear competitive with the private sector, as required by statute. These issues are due, in part, to a customer base that does not provide sufficient revenues to cover costs. In Fiscal Year 2002, the Network Services section experienced a revenue shortfall of almost \$5.4 million, with MNT expenditures exceeding revenues by about \$4 million. The MNT is not being fully utilized by all state agencies for all telecommunications services. However, the Division does not have sufficient information to facilitate the transition of state agencies onto the MNT while continuing to provide other network services. Information such as the types of telecommunications services that state agencies obtain outside of the Division, the reasons these agencies do not use Division services, and the barriers and costs associated with transitioning the agencies onto the MNT is needed to allow the Division to maintain current operations while implementing the MNT.

Report Summary

- The Division is paying approximately \$5 million per year to Qwest for MNT services, including the purchase of bandwidth that is about double the capacity being used by state agencies. At the same time, Qwest is providing circuits to state agencies independent of the MNT and is charging for those circuits. In addition, the Division does not have information regarding the usage of the MNT to allow negotiation of fees charged by Qwest. The Division should pursue moving these independent circuits onto the MNT as well as negotiating with Qwest for changes in fees and capacity to reflect usage.
- The Division currently operates both the MNT and Legacy networks (older data, voice, and video systems, most of which will eventually be replaced by the MNT). This results in duplicative service efforts and costs, and contributes to revenue shortfalls. There are various hardware and software issues associated with transitioning the remaining Legacy circuits onto the MNT. The Division does not currently have information on the costs of addressing these issues, and does not have plans or dates for completing the transition of all Legacy services onto the MNT. Such information and related planning is needed to enable the Division to continue implementation of the MNT.
- The Division does not have documented rate setting methodologies for its services. As a result, it is not possible to determine if rate setting strategies are appropriate to accomplish the purposes of the rates. In some cases, some relevant costs are not included in the rate setting process. For example, the Colorado Digital-Divide Elimination Fund (CDEF) surcharge, which is a 23% charge added to MNT rates to fund rural infrastructure development of the MNT, does not account for all investment depreciation costs and other operational costs. Furthermore, for some Legacy network services, the rate mechanism does not allow for rate changes as the number of users declines.
- The Division does not have service level agreements (SLAs) with all its vendors and customers. SLAs are valuable for managing services. They define minimum performance criteria and allow for measurement of service against those criteria.
- The Division could improve its contract administration function to ensure adequate oversight of contract performance.

Our recommendations and the responses of the Division of Information Technologies can be found in the Recommendation Locator.

Recommendation Locator

Rec. No.	Page No.	Rec. Summary	Division of Information Technologies Response	Implementation Date
1	19	Develop a viable business plan to address recurrent operating losses and expand the Network Services customer base.	Agree	Fiscal Year 2004
2	23	Reduce total operating costs and increase revenues by consolidating more state agency users onto the MNT where feasible.	Agree	June 30, 2003
3	26	Examine and report on the costs and benefits of transitioning the remaining Legacy circuits to the MNT.	Agree	December 31, 2002 & Ongoing
4	28	Develop and execute a business plan to increase video network utilization over the MNT.	Agree	June 30, 2003
5	32	Develop and document a rate setting methodology to better align MNT rates with actual costs.	Agree	Fiscal Year 2004
6	34	Create a variable rate structure that will increase the Legacy rate to meet cost recovery requirements as the subscriber base decreases.	Agree	July 2003
7	38	Develop Service Level Agreements for vendor contracts and customers.	Agree	June 30, 2003
8	41	Take steps to improve management of complaints by reevaluating current trouble system needs and pursuing improvements to the current system.	Agree	June 30, 2003
9	44	Establish an effective contracts administration function by identifying accountability for administering and monitoring all contracts.	Agree	Ongoing

Network Services Description

Background

Section 24-30-903, C.R.S., charges the Department of Personnel & Administration (Department) to work with local, state, and federal departments, institutions, and agencies to provide telecommunication services. The Network Services section within the Division of Information Technologies is responsible for the management of all state telephone and networking facilities and services, including all long distance, telecommunications, and networking services. This includes the management of voice, video and data transmission networks. Network Services manages approximately 50% of the total State government network traffic within Colorado. The Network Services section provides some telecommunications services to all state departments, with the primary users being the Departments of Natural Resources, Revenue, Personnel & Administration, Public Safety, Public Health and Environment, Labor and Employment, Corrections, Higher Education, and Human Services.

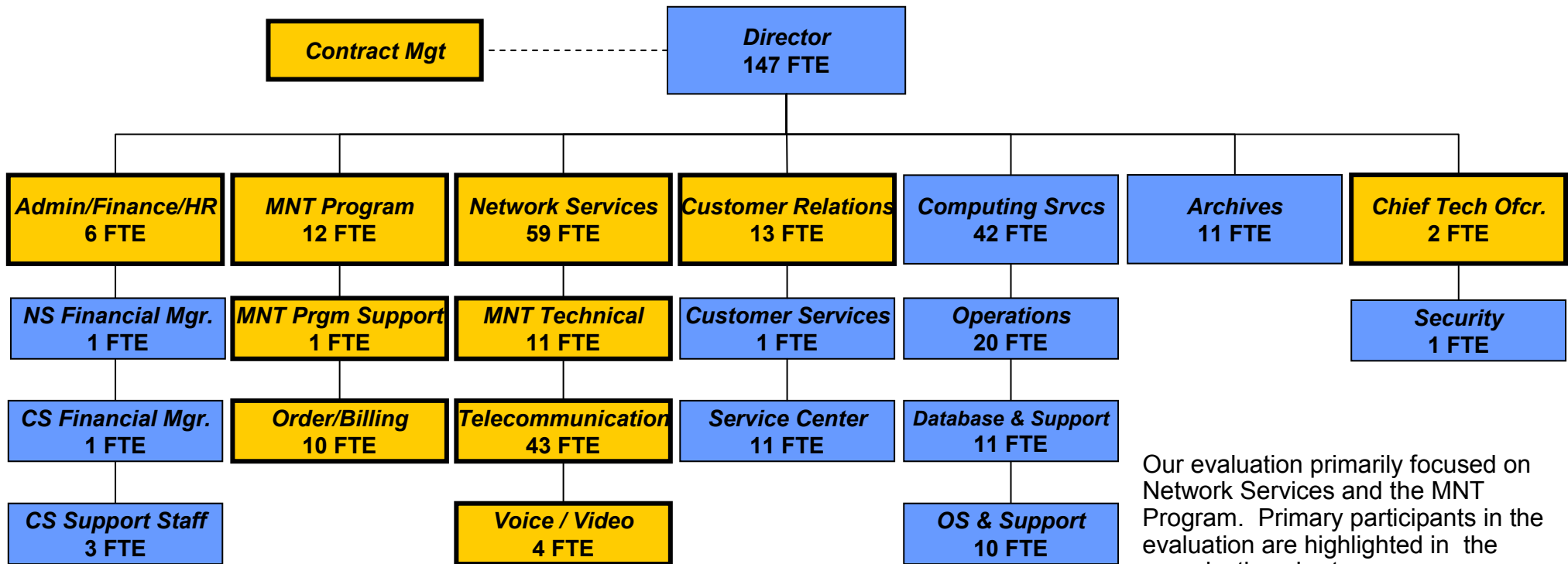
Section 24-30-908, C.R.S., requires users of the Department of Personnel & Administration's telephone and data communications services to be charged the full cost of the particular service, including material, labor, and overhead. At the same time, the statute states: "It is the responsibility of the Executive Director of the Department of Personnel and Administration to establish a policy of remaining competitive with private industry with regard to cost, timeliness, and quality of the telephone service or data communication functions provided by the Department"

User charges are credited to the Telecommunications Revolving Fund. By statute, the moneys in the fund "... are subject to annual appropriations by the General Assembly to the Department of Personnel and Administration for use in acquiring materials, supplies, labor, and overhead as required for telephone and data communication related services." Funding for Network Services for Fiscal Year 2002 was \$18,294,776.

The following figure shows the organization of the Division of Information Technologies.

Network Services Description

Organization and Functions of the Division of Information Technologies



Our evaluation primarily focused on Network Services and the MNT Program. Primary participants in the evaluation are highlighted in the organization chart.

Source: Division of Information Technologies April 2002

Network Services Description

The Multi-Use Network (MNT)

In 2000, the Division was given the responsibility for implementing the Multi-use Network (MNT) across the State of Colorado. The MNT is a public/private partnership between the State and Qwest and its partners (Century/Tel, Phillips County Telephone Company, Eastern Slope Telephone Company, Citizens Communications, and Cisco Systems) to build a high-speed fiber-optic network for the State of Colorado. The intended benefits of the MNT include reduced administrative and maintenance costs to State government, the ability to deliver time sensitive services (e.g., video, data) to all counties of the State, increased economic development in rural areas, and the creation of a backbone for e-government with access to a statewide Intranet as well as the Internet.

The MNT concept was developed to connect urban and rural communities across the State. The mandate for infrastructure development is aligned with local economic development based on the availability of advanced telecommunication services. Key rationale for development of the MNT is as follows:

- The State would serve as the “Anchor Tenant” in private/public partnerships. This arrangement would provide incentives for telecommunication providers to develop infrastructure and accelerate the introduction of new technologies throughout the State, bringing economic development opportunities to traditionally under-served areas.
- The State of Colorado was traditionally making isolated network investments without a fully scalable (enlarge or decrease in size) and coordinated network to meet the business needs of the State.
- New state information technology projects were being scheduled with the assumption that advanced networking and telecommunications services would be available. However, such advanced services were not available across the State, specifically in rural areas.
- Where advanced services could be obtained, they were often provided through the expense of “backhauling, “ which is the practice of bringing demand to a service location rather than bringing service to the location where it is required. Backhaul charges drive up circuit cost by a multiple of four or more times what it would cost if the service was available locally.
- Without a coordinated telecommunications plan, state agencies, schools, libraries, and institutions would continue to purchase telecommunication services in an isolated, piecemeal fashion. Such a practice often leads to duplication of services resulting in excessive costs that could be avoided with a shared network.

Network Services Description

- Additional impacts of a disjointed network include slowed infrastructure development, fragmentation of the State's ability to deliver services throughout Colorado, and an increased risk of failure for new information technology projects due to technical integration issues.
- Upgrading the State's telecommunication infrastructure will provide access to increased capacity, expanded local services, and reduced costs.

The MNT project is being implemented in 3 one-year phases, ending in 2003, in which 70 ANAPS (Aggregated Network Access Points - physical network points of presence on the MNT where public and private traffic demands are aggregated) will be implemented across the State. According to the currently available status report (dated August 2, 2002), 23 of the 39 planned Edge Sites were completed by July 2002. Edge Sites are those regional locations at which state and local government traffic is aggregated and sent through the ANAP. Network build-out is documented to be on track for May 2003 for the completion of the final 10 ANAPs. The 5 SuperANAPs are complete and operational. The MNT is to provide a high-speed fiber-optic network capable of transmitting multimedia services such as data, video and voice on a single network. It is the State of Colorado's intent to aggregate Colorado State Government agency telecommunication requirements from its current and diverse Legacy network to a single MNT platform.

We reviewed Network Services' management of voice, video and data networks to identify potential problems in areas of security, tracking, and implementation that would impede MNT growth and acceptance. We reviewed several sensitive security documents on-site at the Division office and verified that the existing security mechanisms will be migrating to a multi-layered schema by year end 2002. In addition, the network architecture, including data, voice, and video, was evaluated to determine its effectiveness and technical capabilities. Network information such as architecture diagrams, studies on how the network is being used, and Information Technology asset inventories were used to analyze the various networks currently operating under the management of Network Services. Central to the analysis was the development of the MNT and its ability to meet the objectives identified above. We found that the MNT network architecture is properly designed to support economic development objectives and additional customers. Several key factors support this conclusion:

Network Services Description

- Backhaul charge elimination within a 15 mile radius of the location where service is needed significantly reduces the cost to implement advanced network access to the Internet as well as multi-site interconnection. Backhaul charges are a type of mileage based communication traffic charge that involves the practice of bringing demand to a service rather than bringing service to the location where it is required.
- ATM PVCs (Asynchronous Transfer Mode Permanent Virtual Circuits) operate over a protected SONET facility (Synchronous Optical Network – which provides telecommunication transmission over fiber-optic cables) to most of the edge sites with extensions via high speed copper as required by the MNT architecture layout. Edge Sites are locations where there is a physical network point of presence on the MNT backbone.
- ANAPs (Aggregated Network Access Points) are architected to provide at least 45 Mb/s of bandwidth with the State purchasing a 20 Mb/s portion as the “anchor tenant.”
- ATM PVC architecture is stable and predictable.
- Existing frame relay circuits migrate easily into an ATM architecture.
- Capitol complex voice services have ATM trunks already in place.
- Additional bandwidth per site is readily available from Qwest based on current interfaces.

Detailed network architecture information can be found in Appendix B.

Although we conclude that the MNT architecture is structured to accomplish the goals of the MNT, we noted a number of areas of concern with respect to the Network Services section's ability to maintain its current operations while successfully transitioning all state agencies and services onto the MNT to realize the benefits of the network. The implementation of MNT, along with continued technical support for existing Legacy networks and telecommunication services, has required Network Services to evolve its management practices to comply with its statutory obligations to fully recover its costs and charge competitive rates while ensuring an adequate cash flow and pursuing the objectives of the MNT.

Findings, Recommendations, and Responses

Cost Recovery and Rate Setting

Background

The Network Services section is responsible for the management of all state telephone and networking facilities and services. One of the main initiatives in the area of telecommunications has been the development of the MNT. Executive Order B0201 dated January 12, 2001, mandates that “...all State departments, agencies and institutions, including higher education, shall migrate their telecommunication networks to the Multi-Use Network and cease operation and any new development of disparate telecommunication networks...” The MNT is intended to eventually handle all the State’s voice, video, and data communications. However, the Division is currently in the process of transitioning agencies and services onto the MNT and continues to operate Legacy networks, which are older data, voice, and video systems that will ultimately be replaced by the MNT.

Section 24-30-908, C.R.S., requires the Department of Personnel & Administration to recover the actual cost of providing services to State customers, including material, labor, and overhead. At the same time, the statute requires that the Department remain competitive with private industry in terms of cost, timeliness, and quality of services provided.

Service rates paid by state agencies and departments are the method by which the Network Services section recovers the costs of operations. Current rates for voice, video, and data were evaluated to determine the method used by Network Services to formulate its rate structure and to determine the sufficiency of the rates to cover costs.

Cost Recovery Efforts Should Be Improved

One element of our assessment of cost recovery and rate setting was to analyze the Division of Information Technologies’ operating and capital financial situation using data generated by the Colorado Financial Reporting System (COFRS) and additional sources provided by the Division. This analysis identified different lines of service within Network Services and categorized each in accordance with the COFRS accounting categories. The following table shows revenues and expenditures for Network Services for Fiscal Year 2002.

Cost Recovery and Rate Setting

Network Services Revenues and Expenditures (Excluding Depreciation) Fiscal Year 2002				
Service	Revenues	Expenditures (without depreciation)	Difference	Cost Recovery Percentage
Voice Services	\$ 2,413,181	\$ 1,839,474	\$ 573,707	131%
MNT	\$ 2,650,060	\$ 6,670,549	\$ -4,020,489	40%
Long Distance	\$ 5,342,596	\$ 3,616,373	\$ 1,726,223	148%
Legacy Networks	\$ 1,290,053	\$ 1,649,533	\$ -359,480	78%
Video Services	\$ 132,658	\$ 157,561	\$ -24,903	84%
Unallocated*	\$ 20,685	\$ 1,045,951	\$ -1,025,266	2%
Totals	\$ 11,849,233	\$ 14,979,441	\$ -3,130,208	79%

Source: Information provided by the Division of Information Technologies.
 * Unallocated expenditures include some Division salaries, office space lease, and network indirect costs.

As can be seen from the table above, overall revenues for services offered by the Network Services section fell short of expenditures, with the greatest shortage occurring in MNT. In addition to the cash losses depicted above, the following table shows that when depreciation is included, the loss rises to nearly \$5.4 million. These tables indicate that revenues and expenditures were not aligned for any of the services provided by the Network Services section in Fiscal Year 2002. In short, the Network Services section is not self-sustaining, as required by statute.

Cost Recovery and Rate Setting

Network Services Revenues and Expenditures (Including Depreciation) Fiscal Year 2002						
Service	Revenues	Costs			Difference (Revs - Costs)	Cost Recovery Percentage
		Expenditures	Depreciation	Total		
Voice Services	\$ 2,413,181	\$ 1,839,474	\$ 784,137	\$ 2,623,611	\$ -210,430	92%
MNT	\$ 2,650,060	\$ 6,670,549	\$ 166,438	\$ 6,836,987	\$ -4,186,927	39%
Long Distance	\$ 5,342,596	\$ 3,616,373	\$ 2,208	\$ 3,618,581	\$ 1,724,015	148%
Legacy Networks	\$ 1,290,053	\$ 1,649,533	\$ 204,319	\$ 1,853,852	\$ -563,799	70%
Video Services	\$ 132,658	\$ 157,561	\$ 54,504	\$ 212,065	\$ -79,407	63%
Unallocated*	\$ 20,685	\$ 1,045,951	\$ 1,031,320	\$ 2,077,271	\$ -2,056,586	1%
Totals	\$ 11,849,233	\$ 14,979,441	\$ 2,242,926	\$ 17,222,367	\$ -5,373,134	69%

Source: Information provided by the Division of Information Technologies.
 * Unallocated expenditures include some Division salaries, office space lease, and network indirect costs.

The largest shortfall of just over \$4 million, which occurred within MNT services, was partially offset by a significant surplus for long distance services of about \$1.7 million. According to the Division, excess fund balance from the Telecommunications Revolving Fund was used during the course of Fiscal Year 2002 to cover the majority of the revenue shortfall. It is important to note that Fiscal Year 2002 was the first year in which the MNT was operational and rates were charged. Furthermore, the Division reported that it was not appropriated any additional FTE to manage the MNT program.

However, the Division has experienced revenue shortfalls in the past, prior to the inception of the MNT program. In the 2000 audit report on 'Financial Management Of Network Services', the Office of the State Auditor reported that the Division had not been receiving sufficient revenues to pay expenses since 1997. The audit report cited concerns with the Division's rate-setting methodology and pointed out that user fees did not cover the full cost of network operations. We found that current pricing still does not reflect the actual costs of services and losses of this type will most likely continue until there is a change in the service rates and an increase in the customer base.

Cost Recovery and Rate Setting

However, the Division must balance the requirement to recover its costs with the statutory mandate to remain competitive with private industry with regard to cost, timeliness, and quality of services provided. We found the Division is not always complying with this requirement with respect to the costs of telecommunications services. We compared rates for selected services to industry benchmarks. Benchmarks were selected by surveying quoted rates for communication services offered by state governments considered to have best practices. These states were identified by the Progressive Policy Institute (in the 2002 New Economy State Index) and benchmarks include Washington, Arizona, Oregon, and Oklahoma. The benchmark database also includes rates available from federal agencies such as the Defense Information Service Agency and the General Services Administration Federal Technology Service.

The 'Comparison of Selected Rates' in the figure below provides a comparison of typical services provided by the Network Services section with a broad range of federal and state government rates available through web sites and publicly available information. We found the Division's rates for some services appear high relative to benchmarks. This explains, in part, why the Division is over-recovering costs for voice and long distance services. At the same time, Video Services offers a relatively low rate and experienced a \$79,000 shortfall (37%) in revenues in Fiscal Year 2002. Rate setting issues are discussed in greater detail later in the report.

The rates shown in the table were current as of Fiscal Year 2002. The range of rates is due, in part, to differences in service arrangements, such as leased versus owned services. For example, some elements of the Network Services voice network are managed and maintained by a Division employee, others are outsourced to Qwest and MicroTech Tel, Inc.

Comparison of Selected Rates				
	Network Services		Benchmark	
	High	Low	High	Low
Standard Phone Line	\$36.30	\$23.10	\$32.84	\$20.00
Voice Mail	\$14.03	\$3.30	\$10.03	\$5.11
Per Minute Long Distance				
Domestic		\$0.11	\$0.12	\$0.03
International		\$1.04	\$0.92	\$0.05
Video Conferencing				
Flat Rate		\$1,218.75	\$5,645.00	\$4,635.00
Per hour		\$62.50	\$205.23	\$54.00

1. Source: Federal and State Government Telecommunications Services

Cost Recovery and Rate Setting

Due to the statutory requirement to remain competitive, rather than simply increasing fees, the Division must consider alternatives for improving its cost recovery situation. In evaluating the Network Services section, we have identified a number of cost reduction concerns that must be addressed in addition to the need for increased revenues.

First, Network Services' customer base is not sufficient to support the cost of operations because some state agencies do not use the section for telecommunications services. A complete assessment of state agency usage of services provided by the Network Services section was not conducted in this evaluation nor has such a study been performed by the Division. However, one reason state agencies do not use the section's services may be the added charges, such as the Colorado Digital-Divide Elimination Fund (CDEF) surcharge, assessed by the Division which are not levied by external vendors. The CDEF charge is a 23% surcharge added to MNT rates to fund rural infrastructure development of the MNT. The CDEF charge is discussed in greater detail later in the report. By taking steps to increase the number of state agency customers using Network Services, the Division can more fully use current purchased capacity on the MNT, potentially reduce the CDEF charge on a per customer basis, and increase revenues to improve its cost recovery situation. However, the Division currently has no business plan to address the customer service needs of state agencies which would support improvements in services and expansion of the customer base. Such a plan should include methods to promote Division services such as billing, technical consulting, and help desk; demonstrate the Division's current success in delivering services; and constructively address any concerns raised by non-participating state agencies. In conjunction with evaluating the potential for increasing its customer base, the Division should develop a revenue forecasting model that calculates the impact of such increases on its operating budget and customer service levels. Finally, a defensible business plan could be used to negotiate better fees and rates with service providers such as Qwest.

Additional factors that impact the cost recovery situation include the following, which are discussed in greater detail later in the report:

- Since MNT became effective in 2002, the Division has not had network usage information. As this data is collected, the Division should re-evaluate fees paid to Qwest and its partners.
- The Division's rate setting methodologies for MNT and Legacy services are undocumented and do not appear to include all relevant costs.

In addition to the broad issues described above, we identified two administrative concerns that hinder the Division's efforts to accurately identify Network Services costs and incorporate them into their rates to ensure full cost recovery for all services.

Cost Recovery and Rate Setting

First, several accounts fail to consistently allocate costs and revenues between functions of the Network Services and Computing Services (also within the Division) sections. Although adjusting entries are made to correct these allocations at year end, accurate accounting of the costs on an ongoing basis would help the Division identify its true costs as well as preventing potentially misleading data and avoiding time spent making adjustments.

Second, the Division does not have a documented rate structure for its video services and does not charge for all agency requested video service. For example, some high usage customers may receive a break and get a '2-for-the-price-of-1' discount . Two agencies that receive such discounts are the Colorado Department of Transportation and the Colorado Department of Education. Other customers may not be charged due to high initial set-up fees. One example is the Office of Emergency Management, which spent approximately \$500,000 to get established on the video network via microwave. As a result of these price breaks, the Division is not recovering about \$79,000 annually, or about 37 percent of its total video services costs.

Recommendation No. 1:

The Division of Information Technologies should develop a viable business plan to address recurrent operating losses and expand its customer base by:

- a. Examining the customer service needs of state agencies to determine why all agencies do not use services provided by the Network Services section.
- b. Promoting customer services such as billing services, technical consulting, and help desk services; demonstrating current success in delivering services; and being prepared to constructively address any concerns raised by non-participating state agencies, to attract new state agency customers.
- c. Developing a revenue forecasting model that calculates the impact of changes in customer demand on operating budgets and customer service levels and incorporating this information into a business plan. The Division should then leverage the business plan to negotiate improvements to fee and rate agreements with service providers (e.g. Qwest).
- d. Improving accounting for both Network Services and Computing Services costs and revenues to ensure they are allocated to the correct organization on an ongoing basis.
- e. Documenting the rate structure for all services, including video, and implementing procedures to charge for all services provided.

Cost Recovery and Rate Setting

Division of Information Technologies Response:

Agree. The Division of Information Technologies (DoIT) currently is in the process of completing its five-year strategic plan. The plan includes customer service goals to more effectively map DoIT processes to customer business needs. In addition, DoIT recently developed a customer service group that actively promotes the items mentioned in the audit recommendation. The group has only been in existence in its current form for a few months and has already held its first quarterly customer meeting. A newsletter is planned and each manager also makes regular customer visits to promote services and answer customer service problems. The MNT program manager is actively promoting our services to non-MNT users.

DoIT is now underway with a complete overhaul of the revenue and expense model for Network Services which we expect to finalize later this year. The new model will include product and service definitions, unit identification and pricing, revenue and expense matches and expected usage by agency. The goal of the new approach, called "Truth in Rates," is to correctly match each identified service offering with its appropriate fully allocated costs. This will position our customers to know what the correct cost of each service is.

The customer service efforts of the Division are ongoing. The rate plan for Network Services is expected to be completed by December 31, 2002, and the new rates are expected to be in place for FY 2004, pending approval by the Office of State Planning and Budgeting and others as appropriate.

MNT Revenue Improvement

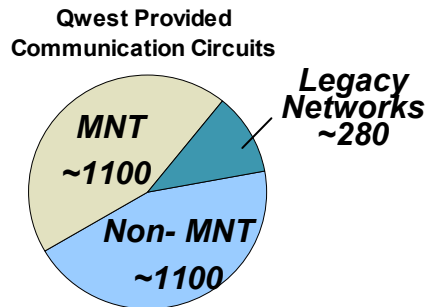
Background

In 2000, the Division was given the responsibility for implementing the Multi-use Network (MNT) across the State of Colorado. The MNT is a public/private partnership between the State and Qwest and its partners to build a high-speed fiber-optic network for the State of Colorado. The MNT was designed to carry integrated voice and video as well as text, graphics, and other electronic data between and among schools, public libraries, institutions of higher education, and state agencies.

The MNT Contract with Qwest Should Be Re-Evaluated

As noted earlier, the largest losses for Network Services in Fiscal Year 2002 are related to the MNT, which experienced an operating shortfall of about \$4 million. One factor contributing to this shortfall is that the Division is paying approximately \$5 million per year to Qwest for MNT services including the purchase of Edge Site bandwidth that is approximately double the capacity actually being utilized. The Edge Site equipment is owned by the State and the bandwidth capacities were established in the original agreement between the State and Qwest (then U.S. West) in June of 2000.

Presently, state agencies are paying for circuits provided by Qwest and other vendors outside of the MNT. In January of 2002, a report generated by Qwest identified approximately 1,100 communication circuits it has provided to the State of Colorado that are not part of the MNT, as shown below. The Division is working with Qwest to transition these individual leased circuits to the MNT.



Source Data: Division MNT Billing & Legacy Network

MNT Revenue Improvement

In addition, the Division estimates that there are fewer than 24 circuits that are provided by vendors other than Qwest. However, the Division has not done a complete statewide survey to determine the total number of circuits that are being provided outside the MNT by all vendors. The existence of a large number of State circuits leased from vendors outside of the MNT represent lost revenue for the MNT and additional cost to the State both in terms of paying for unused MNT capacity at a fixed rate and the expense of procuring duplicative circuits outside of the MNT. An accurate estimate of the potentially significant cost reduction through increased use of the MNT is not available without data from non-MNT customers.

Another area in which the Division lacks information that could help it identify duplicative and unnecessary costs relates to the current usage on each ANAP. Currently, the Division can only monitor and assess activity occurring in the 5 State-owned SuperANAP sites. Data on the State's traffic at Qwest-owned ANAP sites is not accessible by the Division. The State's contract with Qwest does not provide for adequate traffic reporting and Qwest has not provided such information to date. As a result, complete traffic studies of the MNT have not been conducted and complete network utilization is not known. This information is needed to allow the Division to negotiate with Qwest for reduced rates based on usage.

The State's contract with Qwest contains a "true-up" provision which outlines an opportunity for the Division to obtain reduced rates from Qwest in the fourth year of the contract (the fourth year begins in June 2003). The provision does not obligate Qwest to change its rates. The idea behind the "true-up" is to better align rates and fees charged by Qwest with the current usage of the State. However, the original agreement with Qwest was a one-year contract with automatic one-year renewals until either party terminates the agreement. Attachment 1 to the master contract is specific to the MNT and constitutes a five-year agreement expiring on June 23, 2005. The annual contract renewal may provide an opportunity for the Division to renegotiate with Qwest for reduced rates before the 2004 "true-up" provision becomes effective. The Division should determine the legality and feasibility of conducting renegotiations at the time of the annual contract renewals.

The June 2002 "Beanpole Telecommunication Project Performance Audit" conducted by the Office of the State Auditor, recommended that the Division begin immediately collecting information to use in negotiating lower rates, and not wait until the fourth year of the contract. The Division reports that it is in the process of identifying reporting procedures on ANAP usage.

MNT Revenue Improvement

The Division could reduce or eliminate duplicative and unnecessary costs by identifying the specific state circuits being provided by Qwest and other vendors, using the information as a source of potential new customers that should be converted to the MNT, and as a reason to reduce the rates being paid to Qwest. Encouraging more users onto the MNT also increases the Division's revenues for those circuits added to the MNT, more fully uses the fixed cost MNT bandwidth, and reduces both the revenue shortfall and the state funding for circuits outside of the MNT. If the number of circuits in use on the MNT doubled, we estimate cost recovery would potentially increase by approximately \$1.8 million to \$2.6 million per year in present value terms. Since the current MNT shortfall is about \$4 million, this approach alone will not solve the current financial situation. Furthermore, the MNT's costs must remain competitive with the private sector, in accordance with statute.

In addition, the Division should continue to work with Qwest to examine the traffic generated on each ANAP and existing demand from county users to gain a snapshot of utilization by county of each of the network edge systems. This traffic study will provide information to ensure that the ports the State purchases at each ANAP are appropriately sized. The size of the ports put into service dictates the cost of the network at that ANAP. This information is needed to determine the access capacities needed at each ANAP and to align State network usage with fees being paid to Qwest.

Recommendation No. 2:

The Division of Information Technologies should reduce total operating costs and increase revenues by consolidating more state agency users onto the MNT where feasible. This effort should include:

- a. Conducting a study to identify the specific state circuits being provided by all vendors and using the information as a basis for identifying potential new customers.
- b. Encouraging state agencies and departments to use the MNT in accordance with Executive Order B0201. The Division should require those agencies not using the MNT to provide clear and compelling reasons for not using the MNT to the Division as well as to the Governor's Offices of Innovation & Technology and State Planning and Budgeting. Cost effectiveness should be evaluated at the State government level as well as at the agency level.
- c. Continuing to work with Qwest to examine the traffic generated on each ANAP and existing demand from county users to gain a snapshot of utilization by county of each of the network edge systems. Requirements for network monitoring and reporting should be included in future contractual obligations with Qwest and other vendors as applicable.

MNT Revenue Improvement

- d. Using the traffic information collected to negotiate with Qwest to bring rates and fees in-line with actual usage of the MNT customers, to obtain a special tariff rate based on economies of scale to provide economic incentive for other State agencies to participate in the MNT as per unit costs decrease, and to adjust the amount of bandwidth being purchased to reflect agency needs.

Division of Information Technologies Response:

Agree. The Division of Information Technologies has already commenced a study to identify specific state circuits not administered by DoIT (and therefore not on MNT). The study begins with Qwest since the majority of circuits used by the State are Qwest circuits. At the conclusion of the Qwest study, circuits provided by vendors other than Qwest will be reviewed.

DoIT continues to encourage state agencies to use the MNT in accordance with Executive Order B0201. Conversion plans have been or are being developed on an agency-by-agency basis. Some agencies have almost completed their MNT conversion plan (e.g. Department of Corrections and Public Defender), some agencies are in the middle of their conversion plans (e.g. Public Safety, Revenue and Natural Resources), and some agencies are still developing their conversion plans (e.g. Human Services, Higher Education, and Labor and Employment). Only Judicial, which is not an Executive Branch agency, has no known plans to convert to MNT. DoIT will concentrate on encouraging those agencies still in the planning stages to convert to MNT as expeditiously as possible.

DoIT has commenced Bi-Lateral Change Order negotiations with Qwest to examine the traffic generated on an ANAP-by-ANAP basis. A process will be established for periodic reporting as Qwest is willing and able since the current contract provides for a June 30, 2004 timeframe to do this.

Relating rates, fees and actual usage by MNT customers is a constantly moving target since new circuit orders, moves, adds and changes (MACS) flow through the Order Entry and Billing system for MNT every day. Currently DoIT has 450 new orders or MACs as part of the dynamic process. As part of the Bi-Lateral Change Order process for the MNT contract, special tariff rates based on economies of scale will be discussed. If a contract change cannot be successfully implemented now, the concept can be reconsidered if the MNT contract is extended through the option to renew feature.

The expected implementation date for this recommendation is June 30, 2003.

Phase-Out of Legacy Network Systems

Background

The Legacy networks are the older data, voice and video systems used by the Division to support business operations. The equipment and technology is outdated and consists of Systems Network Architecture (SNA - an IBM network architecture design that was developed in the mid 1970s) and Digital Data Network (DDN - a network that uses both digital transmission and digital switching) technology. Though there are no usage studies for the Legacy networks to know the true utilization at present, current services supported by the network include data, voice, and video traffic. The largest Legacy networks customer is the Department of Human Services which utilizes approximately 75% of the SNA network.

Transitioning Legacy Network Customers to MNT Reduces Operational Costs

Since January 2000 approximately 200 Legacy network circuits have been migrated to the MNT. Currently, there are approximately 150 Systems Network Architecture (SNA) customer controllers and 130 Digital Data Network (DDN) customer circuits remaining on the Division's Legacy networks. These remaining circuits have a variety of hardware and software compatibility issues that can impede transition to a new architecture. An example of such an issue concerns an AS400 mini computer that runs Systems Network Architecture over the Digital Data Network. The mini computer version of SNA is different that the mainframe version of SNA. Before the mini computer can connect to MNT, the network application for the computer will need to be re-written so it can route through the mainframe to MNT.

The MNT is capable of providing all services previously offered by the Legacy networks. However, at this time, the Division is still operating the SNA and DDN Legacy networks. Major customers that now utilize both Legacy and MNT networks include the Department of Human Services and the Judicial Department. Although the Legacy networks may need to be retained to support certain agency Legacy systems, the transition or "sundown" of these networks to MNT needs to be completed. This will reduce the duplicative cost of administrative and maintenance services on dual networks. Based on annualized estimates of Legacy networks operating expenses and revenues, the Division could realize a cost savings by reducing and eventually eliminating the DDN and SNA networks. The final amount of cost savings would be the estimated annualized cost of operating the Legacy networks less the costs of conversion to the MNT. These costs are not currently known. Once the network upgrade is complete, the revenue currently being received for the Legacy networks would cease. The former Legacy users that have transitioned to the MNT would be charged the new MNT rate for their network services.

Phase-Out of Legacy Network Systems

However, the MNT conversion issues and their associated capital expenditures need to be examined to determine the potential cost and complexity of transition. In the architecture upgrade, individual State agencies may be required to incur additional set-up costs in equipment in order to transition from their existing Legacy networks to the MNT. These costs would be accrued on a case-by-case basis and therefore it is difficult to assess the total impact at present. To date, this type of cost information is not available.

Furthermore, the Division has not developed plans, studies, cost estimates, or completion dates regarding the transitioning of Legacy networks customers onto the MNT as well as the continued maintenance and usage of any retained Legacy networks customers. A statement of strategic direction for the transition is in process, but has not been finalized. Division staff stated that a complete study for the sundown of Legacy networks would be costly and would require additional budgetary support. We believe the Division should pursue efforts to examine and expedite the Legacy networks transition to reduce the duplicative costs of operations.

Recommendation No. 3:

The Division of Information Technologies should examine and report on the costs and benefits of transitioning the remaining Legacy circuits to the MNT. This effort should include:

- a. Identifying each individual Legacy network circuit that has not transitioned onto the MNT and the specific applications using the circuit; determining the potential obstacles to transition created by the application-dependent circuits; and estimating the costs of placing these applications and their associated circuits on the MNT.
- b. Using the information collected in part a, above, to conduct a cost/benefit assessment of transitioning the remaining circuits and agencies onto the MNT.
- c. Creating a comprehensive plan addressing the costs and benefits of completing the transition of all Legacy network customers onto the MNT and sundowning the existing Legacy network.
- d. Based on the results of the cost/benefit analysis, working with the remaining Legacy network customers to transition them to the MNT and sundown existing Legacy network equipment and connectivity as users come off the system.
- e. Repositioning and training Legacy network staff to work on MNT functions and operations.

Phase-Out of Legacy Network Systems

Division of Information Technologies Response:

Agree. The identification of the existing 150 System Network Architecture (SNA) and 130 Digital Data Network (DDN) Legacy network circuits and the specific use of those is within the direct control of DoIT. This evaluation will be completed concurrently with Recommendation No. 6, with results available by December 31, 2002.

Cost estimates associated with the replacement of customer owned hardware, software and the development of new applications currently incompatible with MNT will be more difficult to acquire. DoIT has no direct control of customer owned applications and equipment and must rely on the customer to provide these costs. An example is the SNA application owned and operated by Human Services. Some customers may be positioned to provide these costs while others will acquire cost estimates from vendors or through the state bids system. DoIT will work with customers on developing these cost estimates as appropriate. Thus, the completion of the cost/benefit analysis and MNT transition plan is dependent upon this interaction with our customers.

Full Utilization of the Video Network

One service that is currently provided entirely over the Legacy network is video transmission. The video network consists of 12 sites with 2 video bridges used for video conferencing on a multi-point basis. Network Services has indicated that the video network utilization is low, with modest rate increases in 2000 contributing to a video network utilization reduction by 10 institutions of higher education. Primary video customers include the Departments of Corrections, Education, Human Services, Public Health and Environment, and Transportation.

The current video locations are fixed sites. However, providing video services over the MNT will be a more optimal network solution since it will be more accessible to the end users. With the proper equipment, end users will be able to plug into the network from any location and utilize the video services. There are technical issues with transitioning the video network to the MNT due to the MNT's lack of circuit emulation capability at the Edge Sites. Although the Division is currently testing a potential solution to the circuit emulation issue, it has not conducted any studies to identify equipment needs, defined the requirements of customers needing video services, or estimated the rates that would be charged to new customers using video services over the MNT. These issues need to be examined and planned for to facilitate the transition of video services onto the MNT.

Recommendation No. 4:

The Division of Information Technologies should develop and execute a business plan to increase video network utilization over the MNT by:

- a. Developing a cost/benefit analysis to demonstrate the benefits of video via the MNT.
- b. Identifying and developing resources to provision the MNT with the additional equipment necessary to allow for circuit emulation for video.
- c. Developing a cost recovery rate model for the new video service over MNT.
- d. Examining the video application suite and defining requirements to service the primary customers that need video services. This includes, at a minimum, K-12 schools, colleges and universities, and specific state departments identified as high potential video consumers.
- e. Executing a strategic plan for implementing video services across the major user groups within the State.

Full Utilization of the Video Network

Division of Information Technologies Response:

Agree. Partial implementation of this recommendation has been completed with nine of the twelve sites operated by DoIT for video conferencing transitioned to MNT. The remaining three sites are outside of the area currently supported by MNT. This video network, commonly referred to as CIVICS, is a single video application that DoIT owns and operates. A decline of 50 percent in customer usage of this service has occurred in the last year. This is primarily as a result of increases to rates designed to achieve cost recovery. An evaluation will be conducted to determine if a business case supports continuation of this application within DoIT or if another service delivery mechanism could provide better services to our customers. This evaluation will be completed by June 30, 2003.

Circuit emulation for legacy video applications over MNT is currently operational and in BETA testing. If successful this will provide an interface compatible with MNT and legacy video applications allowing migration from legacy circuit transport networks to MNT. Completion is scheduled for June 30, 2003.

The completion date for the development and execution of a strategic plan to implement video services to all major user groups within the State can not be determined at this time. It is contingent upon the results of the DoIT video conferencing evaluation previously described and scheduled for completion in June 2003.

The MNT Colorado Digital-Divide Elimination Fund Surcharge

Background

Presently, the Division adds a 23% surcharge on to its monthly MNT rate to fund the Colorado Digital-Divide Elimination Fund (CDEF). The CDEF addresses the geographic disparity of service availability throughout the State of Colorado. The MNT is intended to bridge the “Digital-Divide” by enabling the same digital applications and services in the rural counties as in the metropolitan Front Range cities. The CDEF is intended to cover certain MNT contractual fees, including Qwest project management fees, Aggregated Network Access Point (ANAP) fees, State core switch (MGX) maintenance fees, Local Area Transport Access (LATA) crossing, Super ANAP circuits, and Internet Service Provider (ISP) Layer 3 development.

The CDEF Surcharge Should Be Re-Evaluated

There are several problems with the current rate methodology for setting the CDEF surcharge as described below:

- The original formulation of the 23% Colorado Digital-Divide Elimination Fund (CDEF) surcharge is undocumented. Therefore, the methodology for the calculation and ultimately the rate setting is unclear, making it impossible to determine if the surcharge covers the costs it is intended to cover and to what extent.
- The current MNT rate charged to customers does not account for all investment depreciation costs and other operational costs including leased services (e.g. equipment, service agreements) to meet cost recovery requirements.
- The current MNT rate structure was set to represent only a Layer 2 architecture, but Layer 3 traffic has been added to the network. A telecommunications network consists of a stack of various “layers” of service. The fiber optic cabling part of the infrastructure is known as the physical layer, or Layer 1. This cabling is made useful by switches that establish circuit connections from point to point, which is referred to as the transport layer, or Layer 2. The capability of the Internet to be able to route information from one network point to another is referred to as the network layer, or Layer 3. The Division is working towards implementing a Layer 3 architecture in 2002 and costs associated with this effort will need to be incorporated into the rate structure.

The MNT Colorado Digital-Divide Elimination Fund Surcharge

- The CDEF surcharge does not recover prior year losses. An example of how Network Services overhead and fees can be compared with other communication information service providers is illustrated in the following table. The Defense Information Systems Agency (DISA), the Department of Defense agency responsible for planning, developing, fielding, operating, and supporting communications networks and information systems, has experienced challenges similar to those of the Division in deploying new technology and providing communication services to government enterprises in a cost effective manner. The table below shows that the DISA established a rate of 15.8% for total overhead which includes a component to recover prior year losses. However, it should be noted that one of the main focuses of the MNT is to bring economic development opportunities to traditionally under-served areas of the State. Therefore, the costs of the program must be considered in light of this goal.

Network Services	
Federal Universal Service Fee	8.15%
Colorado Digital-divide Elimination Fund	23.00%
Total Overhead & Fee	31.15%

Defense Working Capital Fund	
Communication Information Services Activities	
Federal Universal Service Fee	6.95%
General & Administrative Overhead Rate	2.00%
Surcharge for Prior Years Losses	<u>13.80%</u>
Total Overhead	15.80%
Total Overhead & Fee	22.75%

Source: Defense Working Capital Fund FY02 Telecommunications Service Rates

Telecommunication companies are required to pay a percentage of their interstate end-user revenues to the Federal Universal Service Fund (FUSF). These funds are used to offset the cost of telecommunication services for low-income consumers and for service providers operating in areas of high cost; to allow for increased telecommunication access by schools and libraries; and to provide health care links for consumers in rural areas. This percentage paid by telecommunication companies is known as the Contribution Factor. It is set by the FCC and can be altered on a quarterly basis. The industry has the option of passing on the cost by charging all, a portion, or none of the Contribution Factor to the end user. As a result, FUSF end user charges can vary depending upon the telecommunication company providing the services.

The MNT Colorado Digital-Divide Elimination Fund Surcharge

Recommendation No. 5:

The Division of Information Technologies should develop and document a methodology for setting the CDEF surcharge to better align the rate with actual costs by:

- a. Collecting investment depreciation costs and variable costs for leased services and setting rates to include these costs.
- b. Determining fixed and variable costs for Network Services operations and applying business rules to simulate changes in cost due to changes in revenue. Specifically, these business rules would allocate fixed and variable costs on a per customer basis so that changes in demand would forecast changes in customer rates.
- c. Adjusting the rate to cover any remaining prior year losses.

The rate setting methodology should be dynamic and allow for continuous rate adjustments based on new users utilizing the MNT or other services and other changes affecting costs. Rate changes should be implemented to coincide with the annual budget submission process for state agencies.

Division of Information Technologies Response:

Agree. The Division of Information Technologies is in the process of implementing a fully allocated costing approach as part of the rate overhaul identified in Recommendation #1. This fully allocated costing approach involves identifying all costs as well as the needed revenue to cover those costs. Thus, the investment depreciation and variable costs for MNT services will be identified and accounted for in the fully allocated pricing model. Also, as part of our rate setting process, DoIT will identify customer demand for services and determine what changes in use will affect prices for other users.

As a cautionary note, the state budgeting process makes it difficult to make mid-year price corrections of any significance; normally price changes to customers are made at the beginning of each fiscal year. The data is also dependent upon the agency's ability to pay.

The Network Services rate plan is expected to be completed by December 31, 2002, and the new rates are expected to be in place for FY 2004, pending approval by the Office of State Planning and Budgeting and others as appropriate.

Legacy Network Rates

Background

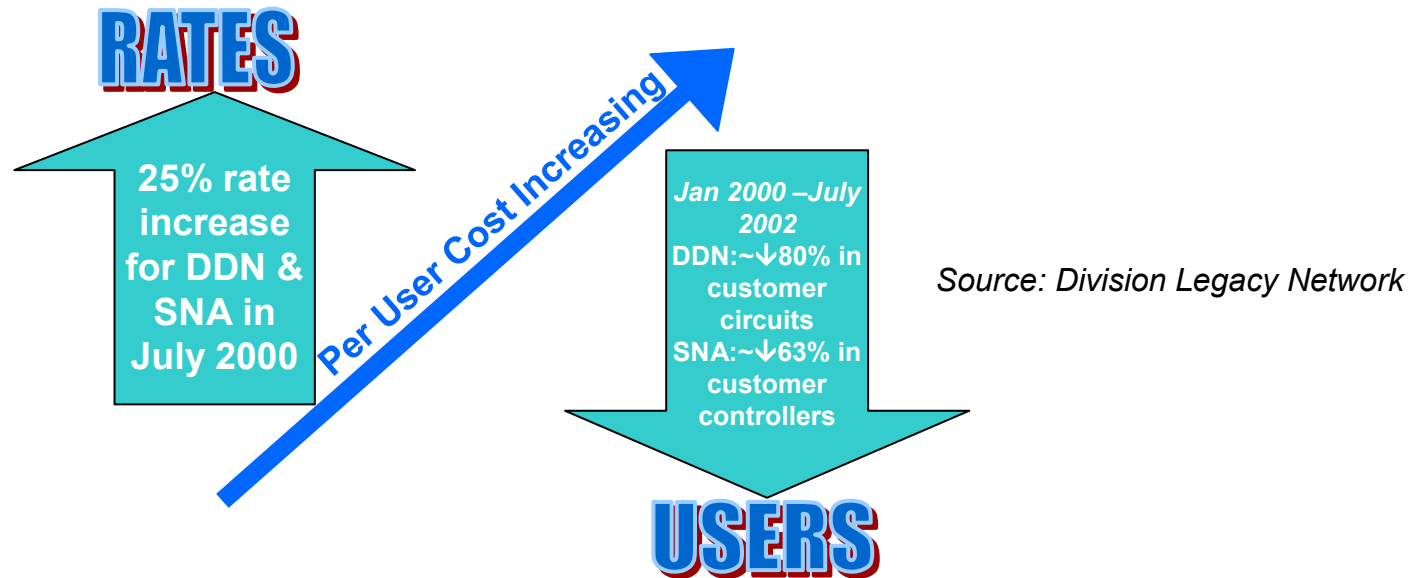
The Legacy Network consists of Systems Network Architecture (SNA - an IBM network architecture design that was developed in the mid 1970's) and Digital Data Network (DDN - a network that uses both digital transmission and digital switching) technology that is outdated and will soon be obsolete. Current services supported by the network include data, voice, and video traffic.

Legacy Network Rates Need to Be Re-Evaluated

Rates for DDN and SNA are not based on actual networks costs. They are based on an original rate that was set using mileage market pricing. Specifically, the original rate was based on the distance between the customer and the destination location. This rate setting practice was established prior to 1997. The Division does not have a variable rate structure to accurately reflect changes in operating costs based on increases or decreases in customer usage. A rate increase of 25% occurred on July 1, 2000 as the Division attempted to break even on its Digital Data Network (DDN) and Systems Network Architecture (SNA) services. The rates were raised in response to the volume loss that occurred as customers transitioned off the Legacy Networks. As the customer base shrinks, the remaining Legacy customers are burdened with the share of the cost to support the Legacy networks previously paid for by the customers who transitioned to the MNT. The increase in the per-user cost is an intended result to provide an economic incentive for customers to migrate to the MNT, where feasible, and to achieve network "sundown."

However, the increases have been inadequate and have resulted in an overall shortfall of approximately \$500,000. In fact, since January 2000 the Digital Data Network (DDN) has experienced an 80% decline in customer circuits while the Systems Network Architecture (SNA) has seen a 63% decline in customer controllers (end user devices), as shown in the figure on the following page. This decline in the customer base is a result of higher Legacy network rates and efforts of agencies to transition to the MNT.

Legacy Network Rates



A variable rate structure would allow for periodic adjustments in rates based on changes in customer demand and operating costs. The rates would then better reflect the actual cost of operating the Legacy Networks and would most likely increase as more customers transition onto the MNT, leaving fewer customers using the Legacy Networks. In other words, the rates should be set to fully cover actual costs and be high enough to provide a financial incentive for customers to move to the MNT as soon as possible.

Recommendation No. 6:

The Division of Information Technologies should assist the Legacy network “sundown” by creating a variable rate structure that will increase the Legacy rate to meet cost recovery requirements as the subscriber base decreases. The Division should communicate the rationale for this structure to Legacy customers so they understand why rates are increasing and how they can save money by migrating to the MNT.

Legacy Network Rates

Division of Information Technologies Response:

Agree. The customer base and associated circuits supporting System Network Architecture (SNA) and Digital Data Network (DDN) will be identified. A variable rate structure will be developed based upon an evaluation of all DoIT internal and external costs associated with providing these legacy network services. This process will be completed by December 31, 2002. The new rates may be implemented as soon as July 2003, pending approval by the Office of State Planning and Budgeting and others as appropriate.

Customer Service and Service Levels

Background

The customer service function for the Division is provided by a separate, centralized call center organization. In our assessment of the customer service organization, current documentation and procedures were obtained and evaluated. The Customer Service trouble reporting system was also examined to determine its usefulness.

When providing a service to an end user, often several systems and work groups may become involved. Providing quality service involves a system that ensures the customer does not have to be routed through various departments for the resolution of issues; one call takes care of the problem. Therefore, the goal of a customer service organization would be to create a method of operations that would appear to be seamless to the end user for the services being provided.

Responsibilities of the customer service center include communication of operational issues and outages, resolution of customer complaints and trouble tickets, and the implementation of documented methods and procedures to ensure services performed are consistent and are performed in a timely manner per industry standards. In addition, the customer service center is responsible for the development of Service Level Agreements (SLA) with both vendors and customers. Typically, SLAs are agreements between vendors and customers regarding the services to be performed, how they will be performed (procedures and performance levels), the products to be used, and the service measurements that will be used to determine quality of the service. Though some of the vendor contracts make reference to service agreements, service levels are not listed in detail in most of the Division's contracts.

Customer Service and Service Levels

Service Level Agreements (SLAs) With All Vendors and Customers Are Needed

Service Level Agreements (SLAs) are valuable tools for managing outsourcing arrangements to ensure customer satisfaction and promote cost effectiveness. However, there are currently only two formal SLAs in existence in the Network Services section that adequately address vendor performance. Of the major vendors that provide services to the Division (Qwest, Touch America, Front Range GigaPOP, MicroTech Tel, MCI, and Avaya), the only vendor SLAs that exist are with:

- U.S. WEST/Qwest for the ATM (Asynchronous Transfer Mode) Network for the MNT, and
- Front Range GigaPop for Commodity Internet Services.

There are 13 major 'lease of a service' contracts; there should be an SLA for each leased service.

In addition, we found there are no SLAs for the services offered by the Network Services section to its state agency customers. In a previous audit report released by the Office of the State Auditor, the need for SLAs within the Computing Services section of the Division of Information Technologies was identified. The same holds true for the Network Services section.

SLAs vary depending on the service offering but any SLA should clearly define minimum performance criteria for all services and measure against that criteria. Within the Network Services section, SLA requirements need to be determined and documented for each service type. Without documented service measurements and procedures, it is difficult to measure service quality and cost effectiveness. The only information on service performance is anecdotal, based on what employees remember. Examples of performance areas to be covered in an SLA include:

1. Mechanisms for conflict resolution and response times.
2. System monitoring requirements and timeframes. For example, the SLA should state what is to be monitored - usage, outages, etc. - and when the system is to be monitored - such as 24 hours a day, 7 days a week.
3. Escalation procedure trees and response times (e.g., the chain of command during an escalation and how long each level in the hierarchy is allowed to respond)
4. Outage and change management procedures, notification, and response times (e.g., schedules for notifying customers of changes that may affect them.)

Customer Service and Service Levels

5. Customer service measurements.
6. Service availability (e.g., the percentage of time services are available.)
7. Number of users that can be served.

At a minimum, the Division should begin preparing SLAs for its largest vendors (which includes MCI for long distance services and MicroTech Tel for site maintenance services) and complete SLAs for other vendors over the longer term.

SLAs also need to be tracked for validity to verify that service performance is meeting the SLA requirements.

Customer Service has contacted several states, such as Arizona, Kansas, Nebraska, Alaska, Kentucky, Oregon, South Dakota and Utah, for their SLA information and procedures to use as a benchmark by which to develop SLAs with the Division's customers. To date, only limited information has been received. Benchmarking against other states or other like organizations with proven SLA procedures is an appropriate approach for a governmental organization. The Division's current vendor SLAs may provide a general guideline as to SLA content for internal agreements, but they do not make an adequate template since they are based on specific service offerings that do not necessarily directly relate to the internal service environment.

Recommendation No. 7:

The Division of Information Technologies should develop SLAs for vendor contracts and customers. The Division should also continue with inquiries for SLA best practices to use as guidelines for SLAs with its customers and ensure that all SLAs include service requirements that are measurable over time, can be baselined, and can be tracked for performance. Once SLAs are developed, the Division should implement a means of managing and administering the SLAs to ensure the Division and its vendors are accountable if service levels are missed.

Customer Service and Service Levels

Division of Information Technologies Response:

Agree. DoIT has a project underway to establish service level agreements (SLAs) for suppliers and customers. The project will identify in broad categories so that suppliers will know what our expectations are and customers will know what they can expect. Currently, much of the information needed to track performance must be tracked manually. To move beyond a manual process and put into place the sophisticated automated tracking tools required in the current environment may require additional funding.

Manual tracking and SLAs are expected to be in place by June 30,2003 for all major service offerings in Computing Services and Telecommunications Services. SLAs are expected to be in place for all new vendor contracts by June 30,2003.

Customer Service and Service Levels

Enhance the Trouble Reporting Process

The Division's Customer Service center has a Trouble Reporting system called InfoSys that only meets minimal, immediate departmental TR tracking needs. A Trouble Reporting System is used to log and track problems identified with a system, process, or service. The current system, Infosys, is outdated and has been in use for over 20 years. It is mainframe based, not user friendly, does not create a knowledge base, and provides no trouble notification. The reporting capabilities are limited due to the fact that report queries must be programmed into the system. Therefore, it is difficult to obtain TR metric information such as typical TRs received and the departments most impacted.

In our review, we found that typical customer complaints regard outages and are generally phoned in to the Department. Issues are resolved through problem management meetings and use of Infosys. However, due to limitations in the system, we were not able to determine specific numbers of complaints or issues reported by type, or to determine trends in problems experienced by customers.

A comprehensive trouble reporting system would include:

1. The ability to track Service Level Agreements.
2. Computer and telephony integration (e.g. Caller ID, Caller History, Systems Used).
3. Creation/utilization of a knowledge base.
4. Reporting.
5. Tracking of performance metrics to measure actual levels of service against agreed levels of service.
6. Email notification to staff technicians of trouble tickets issued.
7. Automatic escalation of trouble tickets so that if there is lack of response at one level, the ticket is escalated up the chain of command for resolution.

Trouble reporting help desk software can vary in cost depending upon the size of the organization and information tracking needs. In addition, operating costs that would be incurred to implement a new system would include licensing fees for software, maintenance fees, and upgrade costs.

Customer Service and Service Levels

Recommendation No. 8:

The Division of Information Technologies should take steps to improve its management of complaints by:

- a. Re-evaluating current TR system needs and requirements.
- b. Assessing the potential to upgrade the current system to meet customer service needs.
- c. Evaluating more modern TR systems to identify systems that would meet Division requirements in terms of functionality and cost.
- d. Pursuing the implementation of improvements to or replacement of the current system.

Division of Information Technologies Response:

Agree. The Division of Information Technologies recognizes the need to improve processes pertaining to trouble reporting and management of customer complaints. We do recognize that the trouble-reporting tool does not sufficiently meet reporting, email notification, and escalation requirements. We believe that the current system must be enhanced or replaced in order to improve the Division's trouble-reporting process. We are currently evaluating alternatives to enable us to meet the aforementioned requirements. Replacement costs are estimated at \$150,000 plus approximately \$20,000 initial set up and approximately \$10,000 per year for on-going support of the system. Due to the current budgetary environment, the Department is unsure if it will be able to acquire a new tool. It is estimated that a complete evaluation of alternatives will be completed by June 30, 2003.

Network Services Contracts

Background

Contract administration should consist of active monitoring and evaluation of contracts to ensure that terms and conditions are being met. Contracts on file should be tracked as current versus 'out of force.' Associated contract costs should also be tracked to ensure expenditures do not exceed financial ceilings. In addition, contracts should be mapped to business services to ensure the agreements are consistent with Network Services operations.

The Division's contract management group is responsible for numerous contracts. For the purposes of this evaluation, a list of primary contracts for Network Services operations was obtained and evaluated in terms of contract type, scope, duration, terms, awards, termination clauses, and allocated cost. The 13 contracts shown in the following figure were evaluated.

Vendor	Service	Life of Contract* (Years)	Est. Total Contract Costs
Qwest	MNT	5	\$29,270,914
Touch America	MNT	5	\$420,000
MCI	Long Distance	6	\$21,000,000
Avaya	Site Equipment	1	\$1,750,263
MicroTech Tel	Site Maintenance	6	\$1,673,861
MicroTech Tel	Site Maintenance	1	\$1,070,646
MicroTech Tel	Site Maintenance	5	\$528,605
MicroTech Tel	Site Maintenance	3	\$119,025
Qwest	SNA	1	\$505,960
Qwest	SNA	2	\$252,980
Front Range GigaPOP	Internet Services	3	\$488,946
Qwest	ISDN	5	\$275,993
Qwest	Video Maintenance	5	\$165,086
Source: Review of contracts provided by the Division of Information Technologies. All contracts are typically one-year contracts with provisions for annual renewal for a period of years. The contract life shown here reflects the number of annual renewals provided for in the original agreement.			

Network Services Contracts

Contract Management Procedures Should Incorporate Best Practices

We found the Network Services section's contracts may not be adequately administered for cost and performance. Within the Division, the management of contracts is not controlled by a specific organization. Responsibilities are spread across several organizations including Project Management, Finance, and Contract Management. Project Management validates that the terms and conditions are being met. Finance determines which program/line of service the contract falls under and tracks associated costs. The Contract Manager tracks contract listings, monitors end dates, negotiates or re-negotiates contracts, and obtains contract performance information from Project Management and Finance. Though having several organizations involved in the contract validation process is typical, there is an inherent disadvantage in not having a single organization that tracks and evaluates the contracts overall. This structure for contract administration can lead to inconsistencies in how contracts are enforced for proper performance.

Over the past year, management of contract information has been in transition and the method for administering the contracts has not remained consistent. As a result, contracts have not been administered at the same level for cost and performance. For example, some contract administrators kept detailed costs for Network Services contracts, others did not. This becomes an issue because there has been inconsistent management of cost tracking. It is not possible to tie overall purchase order costs to a given contract without extensive manual effort.

One unit within the Division, such as Contract Management, should be authorized to function using current contract administration industry standards. Elements of contract administration should include the following best practices:

- Vendor work authorization and timing.
- Contract monitoring for cost, schedule, and technical performance.
- Quality control whereby the vendor's services are inspected to verify adequacy.
- Change control and approval procedures.
- Financial management.

Network Services Contracts

Recommendation No. 9:

The Division of Information Technologies should establish an effective contracts administration function by identifying accountability for administering and monitoring all contracts. This should include monitoring operational contract performance and tracking contract costs. In addition, systems and guidelines should be in place for adequate tracking of both current and “out of force” contracts.

Division of Information Technologies Response:

Agree. The Department of Personnel & Administration agrees that contract monitoring is critical and has taken several steps to improve contract administration department-wide. During the past year, the Department hired a Department Contracts and Procurement Manager to improve DPA’s contracting process. Through the leadership of the Contracts and Procurement Manager, DPA implemented a contracting and procurement policy on July 1, 2002. This policy integrates best practices as recommended in this audit. In addition, DPA is in the process of implementing a department-wide contracts tracking database designed to improve contract administration functions. Finally, the Department has also implemented a quarterly Contract User Group Training program.

Implementation of this recommendation is ongoing.

Appendices

- ▶ Appendix A - Report Glossary
- ▶ Appendix B - Network Diagrams

Appendix A - Report Glossary

- ▶ Aggregated Network Access Point (ANAP) – a physical network point of presence on the Multi-Use Network backbone. There are 70 ANAPs statewide, with at least one in each of Colorado’s counties. The ANAPs are owned, operated and managed by Qwest and are physically located in Qwest facilities. Network traffic in the form of frame relay or ATM circuits from State agencies, local government, schools, libraries and non-profit health providers are aggregated at the ANAP in each county and routed onto the Multi-Use Network. Private sector business traffic is also aggregated at the ANAP and routed onto the private sector side of the Multi-Use Network called the Colorado High Speed Digital Network. See also Aggregation Point.
- ▶ Asynchronous Transfer Mode (ATM) – a high speed cell switching technology capable of transmitting multimedia services such as data, video and voice on a single network. Because of this capability, ATM was selected as the desired technology for the high-speed Multi-Use Network. Use of ATM technology allows the State of Colorado to aggregate its communication usage from its current diverse and multiple networks onto a single, high-speed fiber optic network.
- ▶ Backbone – the high-speed lines and equipment that form the primary pathways within a network. Backbone networks provide interconnection between other networks. The backbone connects the ANAP locations.
- ▶ Backhaul – the practice of bringing demand to a service rather than bringing service to the location where it is required. A term used to describe the charges resulting from a circuit required to connect a location without requested service to a site where the service is offered. Backhauling adds considerable expense to network connections because it commonly uses circuits that are priced by distance.
- ▶ Bandwidth – a measure of capacity for a specific circuit, usually expressed as bits per second.
- ▶ Circuit - 1) A switched or dedicated communications path with a specified transmission speed (circuit speed) or bandwidth capacity. 2) A path for the transmission of electromagnetic signals to include all conditioning and signaling equipment.

Appendix A - Report Glossary

- ▶ Colorado Digital-Divide Elimination Fund (CDEF) - The Division charges a 23% surcharge that funds the Colorado Digital-Divide Elimination Fund (CDEF). The CDEF reflects the geographic disparity of service availability throughout the State of Colorado. The CDEF is intended to cover portions of the MNT contractual fees, including Qwest project management fees, Aggregated Network Access Point (ANAP) fees, State core switch (MGX) maintenance fees, Local Area Transport Access (LATA) crossing, Super ANAP circuits, and Internet Service Provider (ISP) Layer 3 development.
- ▶ Digital - A device or method that uses discrete variations in voltage, frequency, amplitude, and location to encode, process, or carry binary (zero or one) signals for sound, video, computer data or other information. For example, a digital clock displays the time as discrete numeric values, rather than angular displacement of analog hands. Digital communications technology generally permits higher speeds of transmission with a lower error rate than can be achieved with analog technology. When analog signals are received and amplified at each repeater station, any noise is also amplified. However, a digital signal is detected and regenerated, not amplified. Any noise less than a valid signal is eliminated by digital regeneration.
- ▶ Digital Data Network (DDN) - A network that uses both digital transmission and digital switching (switching in which digitized signals are switched without converting them to or from analog signals) of digital data (data represented by discrete values or conditions).
- ▶ The Defense Information Systems Agency (DISA) - is a Department of Defense combat support agency under the direction, authority and control of the Assistant Secretary of Defense for Command, Control, Communications and Intelligence. DISA provides reliable, flexible, and affordable communications networks and information systems support to warfighters regardless of location, mission, or military services or allied nations they belong.
- ▶ Edge Site - a physical network point of presence on the MNT backbone. There are 39 planned Edge Sites, each located in areas where State government agencies are highly concentrated and demand for integration of services exists. The Edge Site equipment is owned, operated, and managed by the State. Edge Sites are physically located in State owned facilities, primarily in Higher Education and the Department of Corrections. Network traffic in the form of frame relay or ATM circuits from State agencies, local government, schools, libraries and non-profit health providers may be aggregated at an Edge Site and routed onto the Multi-Use Network.

Appendix A - Report Glossary

- ▶ Layer 2 - The second layer of the open system interconnection (OSI) model, known as the data link layer. Layer 2 organizes data into frames and sequences for transfer across the physical layer. Layer 2 primarily detects and corrects message errors transmitted across any physical link, and allows the nodes on either end of a connection to signal one another when initiating a communications session. See media access control and logical link control.
- ▶ Layer 3 - The third layer of the open system interconnection (OSI) model, called the network layer. Layer 3 routes data from one element to another until it reaches its final destination.
- ▶ Legacy Network – Outdated technology that is or is soon to be obsolete and has not yet been replaced.
- ▶ Local Access and Transport Area (LATA) – a regulatory and geographical area that determines carriers that can provide service within the LATA area and the carriers who can cross the LATA boundary and provide service between LATA's.
- ▶ Permanent Virtual Circuit - 1) A virtual connection, permanently established, using scheduling techniques to generate, capture, and accommodate connection-provisioning requests. 2) In data networking services, a circuit that is defined in a static manner, with static parameters, but that is not tied to any physical path through the network. A virtual circuit is a communications link, either voice or data, that appears to the user to be a dedicated point-to-point circuit. A Permanent Virtual Circuit is a virtual circuit that provides the equivalent of a dedicated private line service over a switched network. Quality of Service (QoS) - A measurement of the telephone service provided to a subscriber; includes such factors as connection clarity or loudness.
- ▶ Sundown – The turn-down of a network element so that it can be removed from the network architecture.
- ▶ Super ANAP – Same as *Super Edge Site*.
- ▶ Super Edge Sites – a physical network point of presence on the MNT backbone. There are 5 Super ANAPs, each located in areas where there are extremely high concentrations of State government agencies. The Sedge Site equipment is owned by the State and operated and managed by Qwest. Sedge Sites are physically located in State owned facilities. Network traffic in the form of frame relay or ATM circuits from State agencies, local government, schools, libraries and non-profit health providers are may be aggregated at a Sedge Site and routed onto the Multi-Use Network. See also *Aggregated Network Access Point* and *Aggregation Point*.

Appendix A - Report Glossary

- ▶ Switch – a mechanical, electrical, or electronic device which opens or closes circuits, completes or breaks an electrical path, or selects paths or circuits.
- ▶ Systems Network Architecture (SNA) – An IBM network architecture design that was developed in the mid 1970's. The design provides for a tree-structured network layout using a mainframe as the network control center. The boundaries of the network include processors, controllers, and terminals. These network elements are referred to as the network's 'domain.'
- ▶ Systems Network Architecture Interconnection/Interworking (SNI) – A service that allows for the interconnection of separately defined and controlled SNA networks (e.g. different mainframe domains)
- ▶ Tariff Rate - Standards published by AT&T, other common carriers (OCCs), local exchange carriers(LECs), and interexchange carriers (IECs) that define service availability, cost and provisioning procedures.
- ▶ Wideband - A term applied to facilities or circuits where bandwidths are greater than that required for one voice channel and speeds from 64Kbps to 1.544Mbps.

Sources:

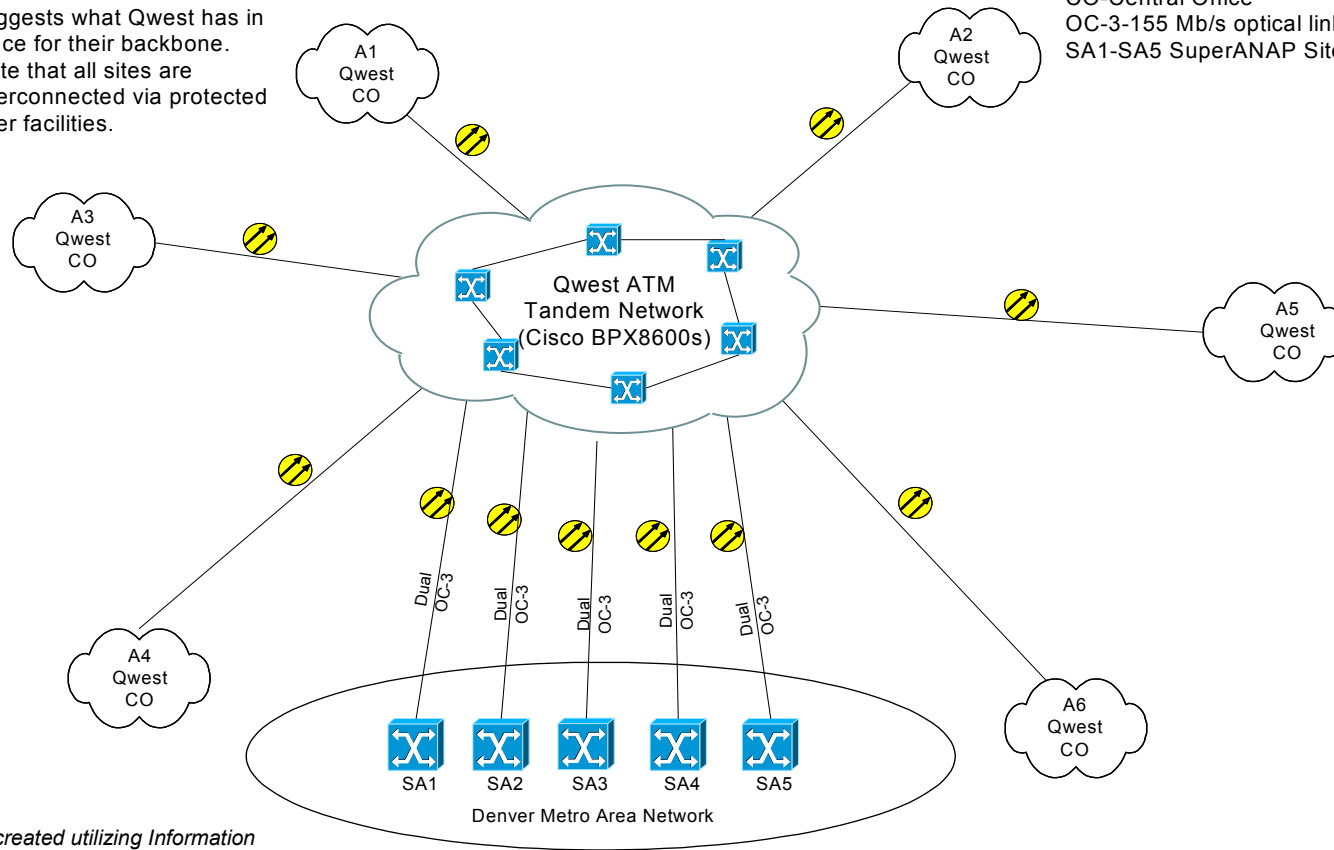
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Appendix B - Colorado State MNT Network Topology

This chart highlights the five SuperANAP sites and gives generic examples of county located ANAP sites. The ATM "cloud" in the center suggests what Qwest has in place for their backbone. Note that all sites are interconnected via protected fiber facilities.

Colorado State Multi-Use Network

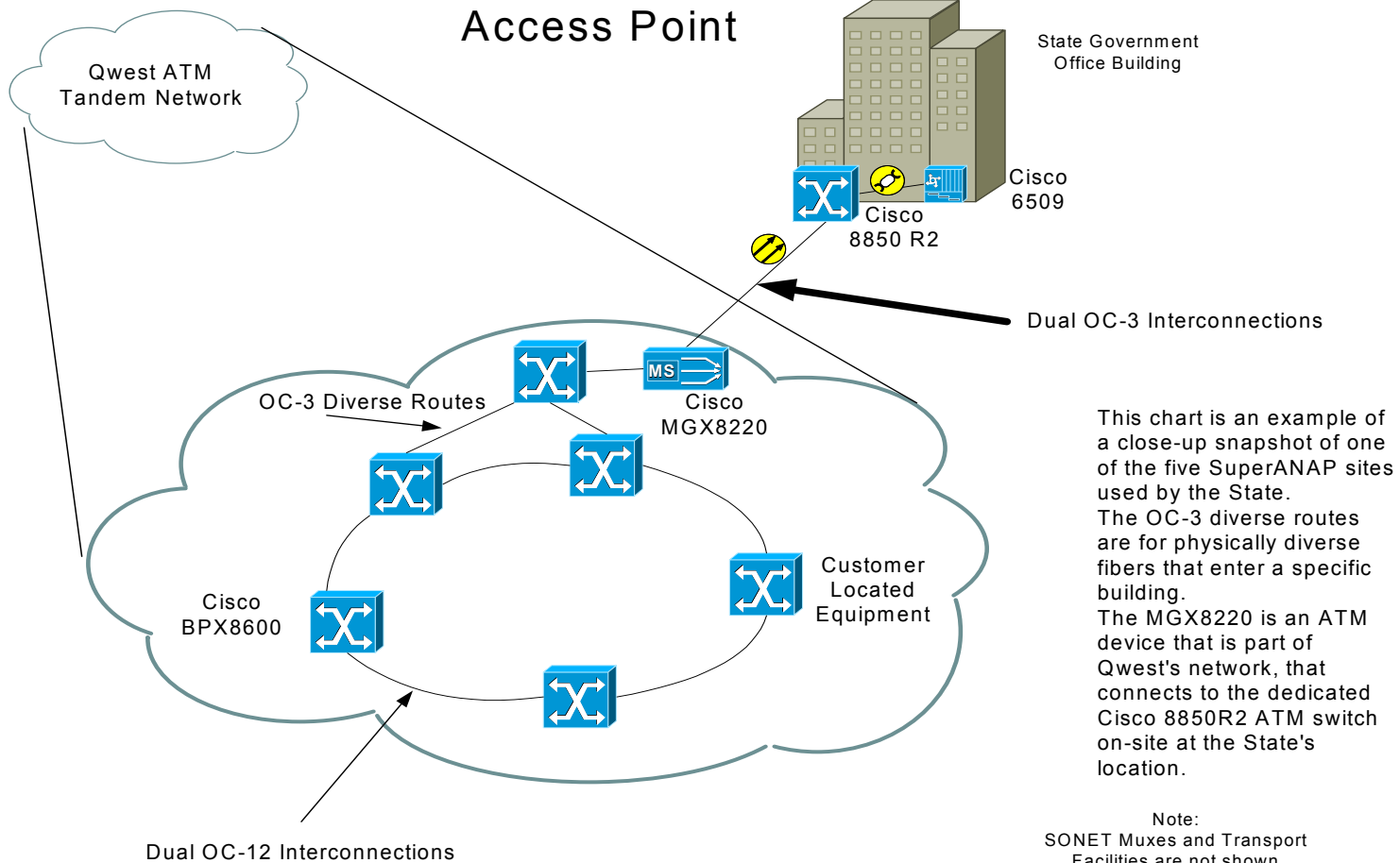
LEGEND
 A1-A5 ANAP Sites
 ATM-Asynchronous Transfer Mode
 CO-Central Office
 OC-3-155 Mb/s optical link
 SA1-SA5 SuperANAP Sites



Source: Charts were created utilizing Information received from The Division of Information Technology

Appendix B - Super ANAP Topology

Super Aggregated Network Access Point



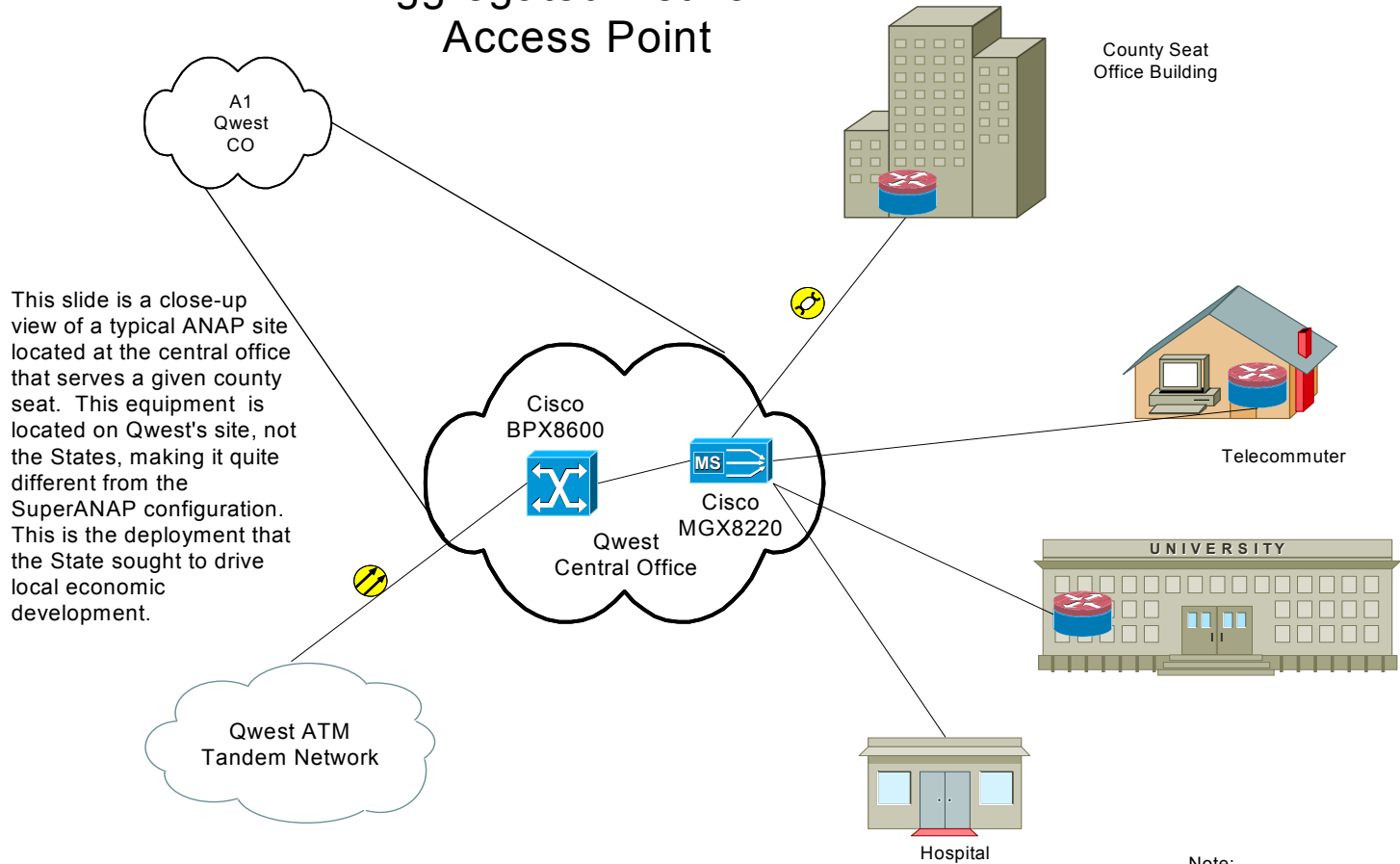
This chart is an example of a close-up snapshot of one of the five SuperANAP sites used by the State. The OC-3 diverse routes are for physically diverse fibers that enter a specific building. The MGX8220 is an ATM device that is part of Qwest's network, that connects to the dedicated Cisco 8850R2 ATM switch on-site at the State's location.

Note:
SONET Muxes and Transport Facilities are not shown

Source: Charts were created utilizing Information received from The Division of Information Technology

Appendix B - ANAP Topology

Aggregated Network Access Point



This slide is a close-up view of a typical ANAP site located at the central office that serves a given county seat. This equipment is located on Qwest's site, not the States, making it quite different from the SuperANAP configuration. This is the deployment that the State sought to drive local economic development.

Note:
SONET Muxes and Transport
Facilities are not shown

Source: Charts were created utilizing Information received from The Division of Information Technology

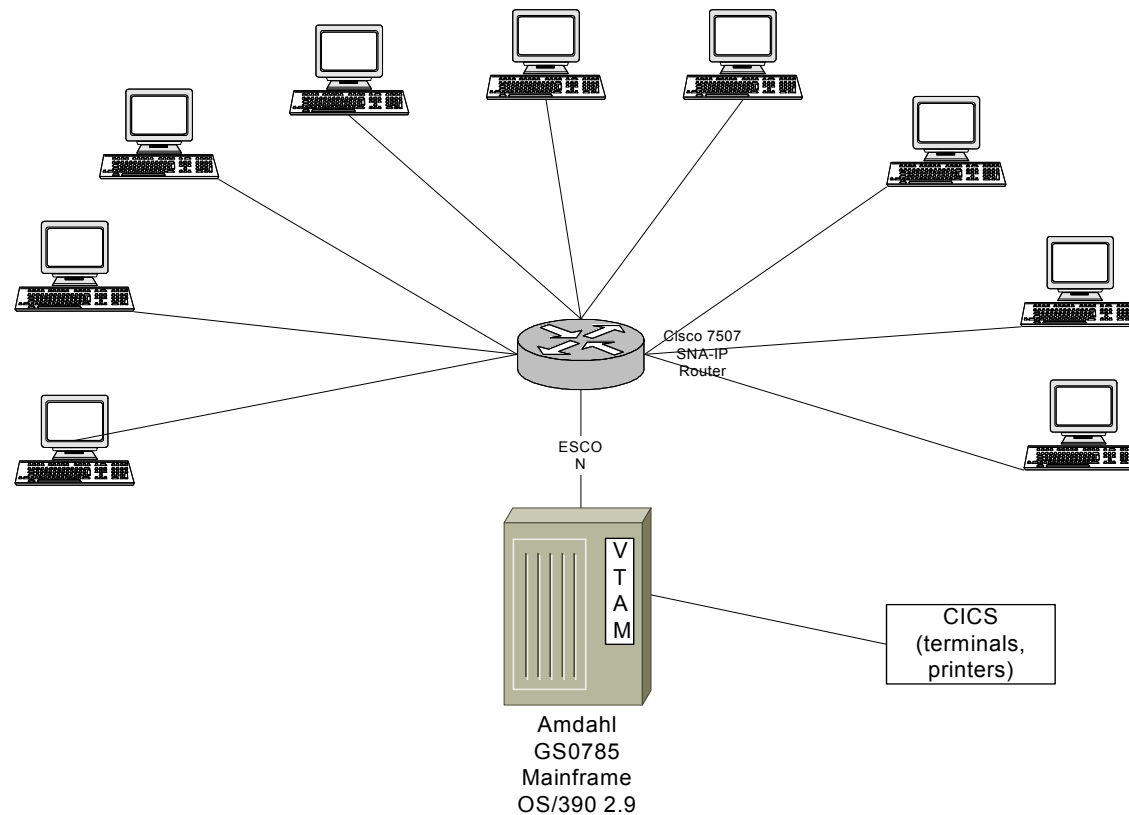
Appendix B - Network Architecture

Colorado State SNA Network

This slide outlines the generic architecture of the State's IP-based SNA network.

IP Encapsulated SNA
-130 Locations
-3200 SNA LUs

SNA and SNI via 3745
-20 Analog Lines to Controllers
-Small number of SNA LUs



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