

Report on Performance Measures

Colorado Government Technology Services Computing Services

September 2001

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June 29, 2001

Members of the Legislative Audit Committee:

This report contains the results of our assessment of Computing Services' ability to measure and manage performance and provide adequate levels of service to user agencies. The report details the scope of this review, provides an overview of Computing Services' operations, and presents observations and recommendations that will enable Computing Services to enhance performance measurements.

We are very pleased by the opportunity to be of service to you and the Office of the State Auditor.

Sincerely,

ARTHUR ANDERSEN LLP

By: Randy R. Roehm

COLORADO GOVERNMENT TECHNOLOGY SERVICES
COMPUTING SERVICES

REPORT ON COMPUTING SERVICES' PERFORMANCE MEASURES

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Chapter I. Report Summary

Authority, Standards and Purpose/Scope of Assessment

The assessment of performance measures at the Colorado Government Technology Services (CGTS) Computing Services was conducted under the authority of Section 2-3-103, C.R.S., which authorizes the Office of the State Auditor to conduct audits of all departments, institutions, and agencies of state government. The assessment was conducted in accordance with generally accepted government auditing standards. Assessment work was performed during June 2001.

The purpose of this engagement was to review and assess Computing Services' ability to measure and manage performance and provide adequate levels of service to user agencies. This objective was accomplished through an identification of Computing Services' critical processes and functions and a review of related performance measures. The areas analyzed include:

- Service Level Management
- Customer Support Management
- Problem Management
- Technical Change Management
- Performance Management
- Capacity Management
- Contingency Management
- Structure of Organization
- Security Management
- Resource Charging/Cost Management
- Operations Management
- Technical Environment

Within these areas, we assessed the existence of performance measures. Performance measures are the "vital signs" of an organization. They quantify how well the activities within a process, or the outputs of a process, achieve specified goals. When performance measures are integrated into a comprehensive system of measures at all organizational levels, they can help optimize performance for an entire process and ultimately an entire organization.

We conducted interviews with key personnel and reviewed procedural and technical documentation to achieve the following objectives:

- Identify Computing Services' critical processes and functions.
- Identify the performance measures that are currently in place for each of the critical processes/functions and review existing measurements.
- Understand existing Service Level Agreements (SLAs) between CGTS and user agencies. To the extent SLAs do not exist, provide suggestions on what should be considered for inclusion in a SLA between CGTS and user agencies.
- Complete and submit an information technology poll to Andersen's Global Best Practices group and provide the results of this high level benchmarking of how Computing Services manages information technology.

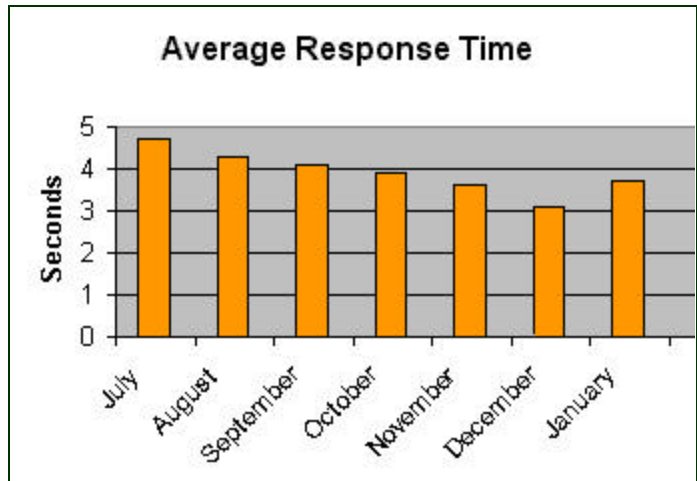
Summary of Observations

Computing Services provides data processing services to the executive, legislative, and judicial branches

of state government. Computing Services' mission is, "to efficiently, effectively, and economically provide quality information products and services to meet customer program objectives." **Historically, Computing Services has not utilized formal performance measures to meet these objectives and to manage the organization.** Without available metrics, we were unable to conclude on the adequacy of many performance areas. Throughout Computing Services, various levels of data and information are present. In a few instances this information is regularly reported and analyzed over time. **Overall, the status of management reporting on key performance indicators is immature or does not exist.** We recommend that certain strategic performance measures be recorded, accumulated, transitioned from data to meaningful measures, and reported monthly in a summary format that lends itself to trending. One of the main advantages of using performance measures is to enable Computing Services to express the results of a business process in quantitative terms. Instead of using subjective words such as good, fast, or low cost to report results, performance measures translate those subjective judgments into precise metrics that can be recorded and analyzed. In addition to being quantifiable and controllable, to be truly effective, Computing Services' performance measures must also be: aligned with state and department objectives, supportive of continuous improvement, and reported consistently and promptly.

When developing performance measures, Computing Services should not try to measure everything big and small, meaningful and mundane. Too many measures will compete for attention and decrease the aggregate power of the measures. Templates, outlines, and simple graphics should be used to organize and present performance measurement information. For example, the two reports below provide information related to the response time of mainframe transactions. The chart on the right is more appropriate for performance measure reporting.

USER SATISFACTION		Total System Avail		Degr W/O SVC		Degr W/O SVC Over		Degr all Prod Out		Overall User Satis (SJT) Total	
S: 10,RS: 5,P: 0		S: 10,RS: 5,P: 0		S: 10,RS: 5,P: 0		S: 10,RS: 5,P: 0		S: 10,RS: 5,P: 0		S: 10,RS: 5,P: 0	
STD. x ²	ACTUAL RATING	STD. x ²	ACTUAL RATING	STD. x ²	ACTUAL RATING	STD. x ²	ACTUAL RATING	STD. x ²	ACTUAL RATING	STD. x ²	ACTUAL RATING
95	EX	98.0	EX	91.70*	EX	97.90*	EX	99.90*	EX	95.70*	EX
99.3	VS	100	VS	100	VS	100	VS	95	VS	100	VS
95	EX	98.0	AG	91.70*	EX	97.90*	EX	99.90*	EX	95.70*	EX
99.2	VS	99	VS	92	VS	100	VS	96	VS	95	VS
95	EX	98.0	EX	91.70*	EX	97.90*	EX	99.90*	EX	95.70*	EX
99.3	VS	100	VS	100	VS	100	VS	95	VS	100	VS
95	EX	98.0	EX	91.70*	EX	97.90*	EX	99.90*	EX	95.70*	EX
99.2	VS	100	VS	95	VS	100	VS	95	VS	100	VS
95	EX	98.0	EX	91.70*	EX	97.90*	EX	99.90*	EX	95.70*	EX
99.4	VS	100	VS	100	VS	100	VS	95	VS	100	VS
95	EX	98.0	EX	91.70*	EX	97.90*	EX	99.90*	EX	95.70*	EX
99.3	VS	100	VS	100	VS	100	VS	100	VS	100	VS
95	EX	98.0	EX	91.70*	EX	97.90*	EX	99.90*	EX	95.70*	EX
99.5	VS	100	VS	100	VS	100	VS	99	VS	100	VS
95	EX	98.0	EX	91.70*	EX	97.90*	EX	99.90*	EX	95.70*	EX
99.3	VS	100	VS	100	VS	100	VS	99	VS	100	VS
95	EX	98.0	EX	91.70*	EX	97.90*	EX	99.90*	EX	95.70*	EX
99.5	VS	100	VS	100	VS	100	VS	99	VS	100	VS
95	EX	98.0	EX	91.70*	EX	97.90*	EX	99.90*	EX	95.70*	EX
99.8	VS	100	VS	100	VS	100	VS	99	VS	100	VS
95	EX	98.0	EX	91.70*	EX	97.90*	EX	99.90*	EX	95.70*	EX
99.5	VS	100	VS	100	VS	100	VS	100	VS	100	VS
95	EX	98.0	EX	91.70*	EX	97.90*	EX	99.90*	EX	95.70*	EX



See Appendix A for additional management reporting examples.

Industry standards have been included for certain metrics except where industry benchmarks were too general, simply not appropriate for Computing Services, or were not available. Where benchmarks were not available, Computing Services needs to measure their "starting point" - that is, their level of performance when they begin tracking performance measures. As performance continues to be measured

at regular intervals, the initial measurement provides a baseline for charting progress toward meeting targets and improving performance.

For each of the performance measures detailed in Chapter III, Computing Services must assign accountability for gathering, tallying, and disseminating results to ensure that tracking progress does not become buried paper on someone's desk.

We recommend a phased approach to implementing performance measures:

1. Start measuring the metrics recommended in Chapter III (e.g. number of calls to Help Desk, average customer time on hold, number of trouble tickets opened per month, staff to manager ratio, system availability percentage, etc.).
2. Assess actual performance for each measure.
3. Determine reasonable goals (these may be based on industry standard or tailored to Computing Services). For certain measures, we have recommended specific goals and included them in Chapter III. Other goals need to be developed using a combination of current performance, industry standards, and end user requirements.
4. Target the audience of a monthly performance measures reporting package. We recommend at a minimum, key middle and executive management personnel within Computing Services.
5. Fine tune the measures based on experience over a minimum three-month period of time.
6. Reassess which measures are appropriate for the different levels of management and those that should be published for Computing Services user agencies.
7. Publish selected performance measures.

Limitations on Disclosure of Information

We appreciate the assistance and cooperation provided to our representatives during the course of our work. This report is intended only for the use of the Colorado Office of the State Auditor, CGTS Computing Services personnel, and the Legislative Audit Committee and is not to be used for any other purposes. Upon release by the Legislative Audit Committee, however, this report is a matter of public record.

Recommendation Locator

Rec. No.	Page No.	Recommendation Summary	Agency Response	Implementation Date
1	14	Implement Service Level Agreements with customers.	Partially Agree	June 30, 2002
2	15	Implement customer service management metrics.	Agree	December 31, 2001
3	16	Define problem management tool requirements and evaluate existing tool.	Agree	June 30, 2002
4	16	Conduct annual customer survey.	Agree	May, 2002
5	19	Implement continuous feedback survey in the service center.	Agree	December 31, 2001
6	21	Generate monthly performance and capacity management metrics.	Agree	December 31, 2001
7	22	Create a quantitative grading scale for the disaster recovery test.	Agree	TBD: based on awarding of disaster recovery contract
8	23	Update the contingency plan.	Agree	Ongoing
9	24	Generate monthly organizational metrics.	Agree	January 1, 2002
10	24	Update job descriptions to reflect current job skill needs.	Agree	Ongoing
11	25	Create training/development plans.	Agree	April, 2002
12	26	Generate monthly security metrics.	Agree	April, 2002
13	28	Match resource charging to customers' utilization.	Disagree	
14	30	Trend tape and drive error reports daily.	Agree	December 31, 2001
15	31	Document processes and procedures for maintaining and assessing hardware and software inventory lists.	Agree	June 30, 2002

Chapter II. Overview of Colorado Government Technology Services Computing Services

The following outlines the mission, funding sources, organization and functions of Computing Services. Computing Services, commonly referred to as the Data Center, resides within the CGTS organization.

Mission

CGTS' mission is to provide information technology (IT) infrastructure and services to public sector customers as required by State statute and Executive Orders. These services include computing services, network services, archives and records management, data entry and imaging, and applications services. Computing Services, a branch of CGTS, provides data processing services to the executive, legislative, and judicial branches of state government. Computing Services' mission is, "to efficiently, effectively, and economically provide quality information products and services to meet customer program objectives." Computing Services performs various services for state agencies that include converting and processing data, maintaining and backing up data, preparing reports, and ensuring that its computer system is highly available, reliable and can be recovered in the event of a disaster.

Funding Sources

CGTS is a cash-funded agency with more than 90 billable customers in more than 30 state departments, institutions, and agencies. Billable items include computer processing time, computer storage space, printing charges, and database support. Funds for these items are appropriated to each department, with Computing Services receiving matching cash spending authority. The money in the cash fund is subject to annual appropriation. During Fiscal Year 2001 CGTS received an appropriated spending authority of about \$38.9 million, of which \$11.6 million is for providing computer services to state agencies.

The following chart shows the sources and amounts of funding appropriated in Fiscal Year 2001

Colorado Government Technology Services Appropriations For Fiscal Year 2001		
Funding Source	Computing Services	Division Total
General Funds		\$8,789,667
Cash Funds	\$11,582,391	\$30,016,956
Federal Funds		\$51,838
TOTALS	\$11,582,391	\$38,858,461
Source: Data provided by Colorado Government Technology Services, September 13, 2001.		

Chapter III. Observations and Recommendations

The following contains our findings and recommendations with regard to the performance measures of the CGTS' Computing Services. Each section is broken down into existing operations which includes current metrics (where applicable) and recommendations.

Benchmarking Analysis

During our review of Computing Services, we produced an information technology (IT) benchmarking report to compare CGTS' performance with that of other companies. Assessing CGTS performance relative to other companies' performance helps to identify strengths and opportunities for improvement. A summary of the benchmarking results is detailed below.

One hundred and forty companies from a broad range of industries, geographical locations and sizes participated in the benchmark process. Companies' employee headcount ranged from a minimum of 25 to a maximum of 90,000. Annual revenues ranged from \$5.7 million to a maximum of \$23.7 billion. Industries represented in the survey include:

Industry	No. of Companies
Manufacturing	41
Consumer Products	23
Commercial Services	25
Energy and Telecommunications	20
Financial Markets	7
Real Estate	8
Insurance	3
Healthcare	4
Nonprofit/Government	8
Unspecified	1

Note: Arthur Andersen has exercised professional diligence in collecting and reporting the benchmarking information. However, the data is provided from third party sources and has not been independently verified or audited. Any deductions drawn from this information should be considered preliminary until detailed analysis is performed to support a definitive conclusion.

Benchmark Area	CGTS Measure	Benchmark
<p>Staff to Management Ratio: This ratio gauges the number of staff personnel relative to the number of management personnel for the IT function. Leading companies prefer to maintain a relatively high staff to management ratio as it allows managers to hold a more traditional oversight role, and focus on strategic issues, while empowering staff to take more responsibility for the day-to-day activities.</p>	5.87	Median of 4.00
<p>Percent Change in IT Budget (two most recent fiscal years): Companies that apply best practices view their IT department as an essential element of their competitive strategy. These companies firmly believe that an investment in technology will pay off in increased productivity and enhanced efficiency. Over time, the IT budgets at high-performing companies grow in response to inflation and competitive pressures. Leading companies recognize the need for ongoing investment in information technology and adjust budgets accordingly.</p>	Increase of 0-5%	An increase of 6-15% was the most common response
<p>Anticipated Change in IT Budget (current and next fiscal year): Companies with higher percentages show that they have decided to implement a proactive stance with regard to expanding their computer systems and IT upgrades, or are currently in the midst of these initiatives. These companies view their IT department as an essential element of their competitive strategy.</p>	Increase of 6-15%	An increase of 6-15% was the most common response
<p>Average Annual Training Hours: Many companies have decided to train their employees, in order to keep up with the swift pace of technology, thereby making their company more competitive and productive. This indicates, in part, the level of commitment to employee development in the organization. Leading organizations believe that training employees improves the following: productivity; employee satisfaction; quality of products and services; and customer satisfaction. Although there is no predetermined amount of training that is optimal, leading organizations develop formal training programs customized to their organization's needs.</p>	CGTS training hours are not formally tracked	<p><u>% of companies...training hours</u></p> <p>2.....no training</p> <p>22.....1- 10 hours</p> <p>19.....11-20 hours</p> <p>14.....21-30 hours</p> <p>21.....31-40 hours</p> <p>22.....over 40 hours</p>

Benchmark Area	CGTS Measure	Benchmark
<p>Average Annual Salary for IT Staff: This graph measures the average annual salary per IT staff person. In interpreting this measure it is important to note that salary amongst types of IT staff may vary dramatically (programmers, developers, data entry technicians, network operators, etc. are averaged in this measure). Many leading companies tend to offer compensation plans that provide a stable base with variables linked to performance, rewarding individuals for outstanding achievements. In addition to strictly viewing compensation as an employment recruitment and retainment indicator, leading companies offer work/life programs and flexible work options to allow their staff to better balance their professional and personal lives.</p>	\$61,000 - \$70,000	A salary between \$51,000 - \$60,000 was the most common response
<p>Average Annual Salary for IT Management: Many leading companies tend to offer compensation plans that provide a stable base with variables linked to company performance. These organizations try to develop plans that support strategic goals of the IT department, while keeping their compensation plans internally equitable and externally competitive.</p>	\$91,000 - \$100,000	A salary between \$81,000 - \$90,000 was the most common response
<p>Location of IT Organizational Components: Organizational structure is more than the reporting relationships, spans of control, and hierarchical levels represented on an organizational chart. It is also the relationship between individuals and groups within the organization, and the systems they use to communicate, coordinate, and integrate their efforts. The benefit of a single location is the reduction of duplication of effort, while having multiple locations allows for closer interaction between parties.</p>		
Programming	2-3 Locations	Single Location
New System Design	2-3 Locations	Single Location
IT Customer Support	2-3 Locations	Single Location
System Maintenance and Upgrades	2-3 Locations	Single Location
Research and Development	2-3 Locations	Single Location
Hardware Acquisition	Single Location	Single Location
Software Acquisition	2-3 Locations	Single Location
Training	2-3 Locations	Single Location
Administration	Single Location	Single Location

Benchmark Area	CGTS Measure	Benchmark
Average Age of Computer Systems: The pace of information technology is so rapid that systems providing additional functionality--faster processing times, increased storage capacity, improved information-sharing capabilities, more secure networks--are produced daily. Leading companies review IT product offerings regularly to assess whether the additional functionality provided by upgraded systems would justify cost and implementation.	Software: less than 1 year Hardware: 1-3 years	Software: 1-3 years Hardware: 1-3 years
Workstation Connectivity (measured as a % of workstations): Workstation connectivity is an effective measure of the degree to which employees are able to access and utilize information, and communicate both internally and externally. An organization that is more widely linked through network, internet, intranet, groupware and remote access helps to enhance communication, minimize duplication of efforts, maximize knowledge sharing, and help to create a more efficient and effective organization.		
Network	76-100%	76-100%
Internet	76-100%	76-100%
Intranet	76-100%	76-100%
GroupWare	76-100%	76-100%
Remote Network Access	1-25%	1-25%
Existence of Policies and Procedures: Companies that apply best practices formalize their policies and procedures in a written document. The document provides objective instructions that make clear what is expected of all involved, thus eliminating the possibility of confusion and ensuring the integrity of the process.		
Network Admin	No	36% have policy/procedure
IT Security	Yes	52% have policy/procedure
Contingency Planning	Yes	45% have policy/procedure
System Operations/ Maintenance	Yes	60% have policy/procedure
Technical Support	Yes	43% have policy/procedure
File Backup/Archival	Yes	67% have policy/procedure
Hardware Selection/ Acquisition	Yes	35% have policy/procedure
Software Selection/Acquisition	Yes	34% have policy/procedure

Benchmark Area	CGTS Measure	Benchmark
<p>Percent of IT Personnel who are contractors: Contractors are those individuals working in the IT department but not actually employed by the company directly. Organizations often look to outside contractors for the following reasons: 1) to obtain a specific expertise that is not available internally; 2) for assistance with temporary projects; 4) to perform routine, less strategic tasks allowing employees and the IT organization to focus on more critical areas.</p>	0%	1-20%
<p>Percent of Network Downtime: End users benefit from a reliable IT department that ensures there is a minimal amount of network downtime. Companies that apply best practices typically incur less network downtime. This is achieved through the implementation of modern and reliable networking systems, having a sufficiently trained IT staff and solid management, and having a well-documented, effective recovery plan in place.</p>	1-5%	1-5%
<p>Percent of Organizations with IT Strategic Plan: IT organizations articulate their vision, mission, and goals through a formally documented IT strategic plan.</p>	CGTS has a plan covering strategy for fiscal year 2002	Strategic Plans exist in 49% of Organizations
<p>How IT Intangibles are Measured: Companies that apply best practices regularly solicit customer (IT users) feedback. The input of users can be utilized to understand their needs and wants and improve the systems and services.</p>	CGTS conducts surveys on a ad hoc basis	26% of companies conduct surveys and 56% rely on feedback from the field
<p>Joint Venture & Strategic Outsourcing Rules: Strategic relationships and joint ventures offer many benefits including: improving quality, cost control, service, innovation, and new product development initiatives; creating the ability to overcome limited resources such as financial, technological and physical; participating in reciprocal training and education programs; and assisting in opening the door to a new market or larger market share.</p>	CGTS does not have strategic outsourcing or joint ventures	64% of companies have strategic outsourcing or joint ventures
<p>Programs to Retrain and Retain Employees: Many leading organizations establish training protocols and offer incentive programs in order to retain and retrain employees. Such programs increase employee satisfaction by providing them with opportunities to increase their competency base and earn rewards for outstanding performance; both of which translate into key success factors in the organization's ability to recruit new hires and retain existing employees.</p>	CGTS has no special programs	36% of companies have special programs to retrain and retain employees

Benchmark Area	CGTS Measure	Benchmark
<p>Percent of Organizations Using an Enterprise Resource Planning System (ERP): Enterprise resource planning systems (ERP) are powerful, functional, client/server or web-based support software applications designed to assist and improve business planning and analysis throughout the organization. Challenges being faced in the New Economy, such as globalization, a new generation of people entering the workplace, and the increased importance on intangible assets such as knowledge, relationships, and intellectual property have caused the market for such systems to increase dramatically.</p>	<p>CGTS does not use an ERP</p>	<p>An ERP system is used in 50% of organizations. These organizations generally used ERP systems to manage the following business functions: finance/accounting, purchasing, billing/customer service, and operations/production.</p>

IT Department cost allocations

The following table allows companies to compare their cost allocations with those of the benchmark group. At a glance, they can view opportunities for improving effectiveness. For example, under-spending in direct labor may indicate an understaffed department or non-competitive wages. Under spending in hardware/software purchases may indicate a limited use of new, more efficient and effective technology.

Percent of IT Budget ("→" denotes CGTS measure)	Benchmark Group					
	1-10%	11-20%	21-30%	31-40%	41-50%	>50%
Direct Labor	8%	16%	22%	16%	→ 19%	20%
Contract/outsourced services	52%	19%	13%	8%	5%	3%
Hardware purchases/leases	→ 33%	38%	21%	5%	1%	2%
Software purchases/leases	→ 55%	36%	7%	2%	0%	0%
Maintenance and licenses	58%	32%	→ 7%	2%	0%	0%
Overhead and supplies	→ 80%	15%	4%	1%	0%	0%
Other	→ 83%	9%	55%	2%	0%	1%

Service Level Management

We reviewed Service Level Agreements (SLAs) between Computing Services and user agencies. We found that documented SLAs do not exist for Computing Services' mainframe services. Because limited service metrics are available, Computing Services is unable to quantitatively assess the effectiveness and efficiency of service management.

Background

An SLA defines the responsibilities of an IT service provider and the users of that service. It also identifies and defines the service offering as well as the supported products, performance levels, the measurement and reporting criteria and appropriate quality standards for the service. An SLA manages expectations of the service provider and service user. In most cases, SLAs are typically complimented with other contractual documents that together cover multiple items such as corrective actions, penalty and incentive clauses, acceptable amount of service deviation, change order procedures, reporting policies, termination criteria, and dispute resolution procedures. When taken in this broad sense, an SLA defines the complete set of responsibilities and obligations of a service provider and the users of that service.

SLAs are a valuable mechanism for IT service providers to manage customer satisfaction and promote cost reduction. An agreement that clearly outlines the rights and obligations of the parties significantly reduces the potential for disagreement to arise in the course of the parties' business relationship. Customer dissatisfaction generally results from a gap between actual performance by a service provider and the performance expected by the customers. By clearly defining minimum performance criteria and reporting against that criteria, gaps can be identified and managed. Additionally, by identifying and documenting key services and guaranteed service levels, the service provider prioritizes these services to employees and guides decisions about resource allocation. Overall, SLAs are an accepted method of ensuring that outsourcing arrangements work to the satisfaction of all parties.

Existing Operations

Documented agreements do not exist between Computing Services and user agencies for mainframe related services. Control Process Procedures (CPP) outline batch job requirements for the mainframe. CPPs define the start time, frequency, and output of the job; procedures for problems; and a contact list. Procedural agreements are in place between CGTS and state agencies that house servers in the operations area of 690 Kipling. These server agreements outline operational procedures, such as startup/shutdown procedures, to be conducted by CGTS resources. Agreements also record contact and access lists. The server agreements and CPPs act as instructions for Computing Services to follow. Server agreements and CPPs are not measured nor do they define minimum service requirements. They act as a guide to maintain computer operations.

At a minimum, Computing Services should produce SLAs with the three largest customers in the near term and complete the others before the end of FY 2003. SLAs should contain a variety of quantifiable measures, for example:

Measure:	Example:	Current Performance:
Response time	Three seconds or better 99.9% of the time	Five seconds or better 95% of the time
Percentage of the time services are available	Guarantee availability 99.9% 24 hours a day, seven days a week, 365 days per year	Hardware: 98% availability Software: not reported
Schedule for advance notification to customer of changes that may affect users	Changes categorized by affect on the customer: A – System Management Routine Task – one day B – CGTS Internal Routine Task – one day C – Single Agency Involvement – three days D – Multiple Agency Involvement – five days	Not reported
Usage statistics that will be provided monthly to the customer	Batch job time, number of erred jobs, service unit consumption, etc.	Service unit consumption provided in monthly bill
Escalation procedures	A – Critical – Senior management notified within 30 minutes B – High – Management notified within 1 hour C – Medium – Management notified within 8 hours D – Standard – Management notified on case by case basis	Not reported
The number of users that can be served simultaneously	600 simultaneous users may access the system during prime time	Not reported
Customer Service Measures	All calls answered by third ring, time on hold less than 60 seconds, etc.	Not reported

We recommend the SLA detail services provided by Computing Services and the responsibilities of both Computing Services and the user agency. Initial SLAs should include service guarantees for three to four of the above measures. We recommend that initial SLAs include agreed upon objectives related to response time, availability, and notification of changes. However, SLAs should be driven by customer priorities and feedback.

In private industry, if the minimum service levels are not met, the customer fee is generally reduced by a pre-determined dollar amount. Although this model does not appear feasible in the existing Colorado State budgeting and allocation process, it is critical to the success of SLAs that the service provider be held accountable for meeting SLAs. Accountability can take the form of an incentive if the service provider meets SLAs or a penalty when SLAs are not met. Alternative methods to provide SLA accountability include:

- SLAs are tied to individual compensation, personnel evaluation/job advancement or department and employee recognition programs;
- For any SLA that is not met, CGTS is required to develop a corrective action plan to meet customer needs in a timely fashion, or
- If SLAs are continuously not met, state agencies may be relieved of their obligation to use CGTS for IT services.

Recommendation No. 1

We recommend Computing Services implement Service Level Agreements (SLAs) with its customers. Creation of Service Contracts and SLAs will ensure services offered to customers are defined, measured, reported and managed. We recommend starting with a pilot based on three entities.

Computing Services' Response:

Partially Agree. An SLA implementation will be attempted with only one major customer due to staff resource constraints prior to June 30, 2002.

Problem, Change, Customer Service Management

We reviewed Computing Services' problem, change and customer service performance management processes. We found that performance metrics do not exist. Without metrics, Computing Services is unable to quantitatively assess the effectiveness and efficiency of these processes. Additionally, we found limited mechanisms for obtaining and assessing user agency feedback related to customer service resulting in an inability to objectively measure customer service. We also identified limited functionality within and inconsistent use of the Infosys helpdesk software.

Existing Operations

The Service Center performs three distinct functions: Customer Helpdesk, Scheduling, and Mainframe Monitoring.

The Customer Helpdesk fields an average of 1,563 calls per month pertaining to Mainframe System Software, Mainframe Operating System, the Mainframe's security program Top Secret, video conferencing, and telecommunications. Problem and change management monitoring and tracking is performed using Infosys. Infosys is a text-based program run on the mainframe whose capabilities include problem/change tracking and monitoring, problem/change assignment, change routing, and reporting.

Problems called in by customers may or may not be logged into Infosys. If the helpdesk operator can resolve the customer's needs or if a technician is available to assist the customer, the call may not be documented in Infosys. If the customer requests a Problem Management Report (PMA) or if the problem requires more research, a PMA is created in Infosys.

Changes, defined as upgrades, additions, or deletions, require approval from three levels of management before implementation. The Operations Manager, Technical Manager, and Change Manager review the change PMA noting the risk, implementation steps, and proposed implementation date. In order to implement a change, all three managers must approve the change. The change is considered closed when the Change Manager reviews the implemented change and updates the PMA as closed.

The Service Center notifies customers of PMAs by posting them to the CGTS intranet; conducting a

problem/change meeting weekly with internal and external customers, vendors, and technicians; and via broadcast messages sent weekly via email.

Scheduling is the second function of the Service Center. The scheduling software, CA-7, allows for the scheduling of jobs on the mainframe. In order for a customer to schedule a job, the customer must develop the code, deliver it to the Service Center, and complete a CPP. The Service Center then uses CA-7 to allocate the time needed on the mainframe. Each day, the Service Center uses CA-7 to produce a list of jobs to run. This report lists the jobs, start times, and any preparatory work to be accomplished.

The third function of the Service Center is Mainframe Monitoring. Mainframe monitoring is performed using the Master Console, which is physically located in the Service Center. Messages scroll across the screen notifying the Service Center of jobs started, running, and completed. Warning error messages display in yellow. Urgent error messages display in red, set off an audible alarm, and require immediate attention. Many of the errors can be corrected in the Service Center by referring to a manual that lists general errors and provides line by line resolution instructions. If the Service Center cannot correct the error, a technician within CGTS is contacted.

Recommendation No. 2

We recommend the following metrics be reported on a monthly basis. Monthly reporting should include metrics for the previous year and should be portrayed graphically for ease of analysis. (Metrics related to Computing Services' current performance are not available.)

- a. Number of PMAs (problems and changes individually) generated and closed per month.
- b. Aging of PMAs would compare the time to resolve problem or change compared to the estimated completion time.
- c. Number of calls resolved by the Service Center and number transferred for resolution by a technician. The industry standard to resolve customer calls at the Helpdesk averages 72%.
- d. Root cause tracking allows management to determine areas of concern and to forecast potential problem areas.
- e. Incoming call statistics, currently being tracked, can be compared to industry standards.
 - Average speed of answer less than 30 seconds for 80% of incoming calls
 - Average hold time less than 60 seconds
 - Abandonment rate less than 4%.

Computing Services' Response:

Agree. A monthly report will be initiated with a portion of the recommended metrics prior to December 31, 2001. Additional metrics will be added as procedures and process automation are developed.

Infosys

Infosys has been used at CGTS for approximately 20 years. It has the ability to capture recommended performance measures but reporting capabilities are limited resulting in an inability to generate reports detailing certain measures. To ensure critical performance measures are available, we recommend that

problem and change management tool requirements be defined. If Infosys doesn't meet the requirements, consider obtaining another tool. When defining requirements, consideration should be given not only to reporting requirements but to potential Help Desk efficiencies that can be achieved through the use of more sophisticated automated tools. To increase the efficiency of Help Desk functions, best in class organizations utilize sophisticated, windows based or "point-and-click" software that is integrated with other applications such as automated call distribution and email.

Regardless of the long-term technical solution, we recommend that all problems and changes are recorded in Infosys by the Service Center. In order to have meaningful metrics, all types of calls and levels of complexity must be recorded. Benefits of recording all calls include cradle to grave tracking, auditing, trending/historical tracking, problem resolution tracking (problems consistently solved the same way), and job performance.

Formalize/enforce process used by Service Center operators when transferring problems to technicians. Currently, the Service Center operators often call the technicians directly for assistance with a problem. To ensure technicians are effectively managed, problems addressed in priority order and assigned to the appropriate technician, the Technical Manager should assign problems to technicians.

Recommendation No. 3

We recommend enhancing Infosys or obtaining another problem management tool that meets Computing Services' business requirements.

Computing Services' Response:

Agree. This is pending the identification of sufficient funds and staff resources to implement. Additional funds were sought in the FY03 budget request process and at the time of this drafting, the funding has been denied. Process improvement with the existing Infosys will be undertaken regardless of funding by June 30, 2002.

Customer Feedback Survey

Although CGTS recently conducted a survey to obtain customer feedback, the customer survey is not conducted regularly. Customers should be surveyed annually and be asked to qualitatively grade various key processes and aspects of customer service. The grading areas should remain fairly consistent each year to allow for annual trending of results. If it's not feasible to obtain survey results from a high percentage of customers, design the survey distribution and collection process to obtain responses from a representative sample of customers. This will ensure a more accurate measurement and provide a consistent baseline for performance comparison each year.

Recommendation No. 4

We recommend that an annual customer survey continue to be conducted and used to measure customer service performance over time.

Computing Services' Response:

Agree. A survey will be undertaken no later than May, 2002.

In addition to an annual customer survey, best companies are obtaining customer feedback about specific PMAs on a continuous basis. Customer surveys with measurable responses will provide real-time feedback to the Service Center on customer satisfaction. Surveys can be used to identify areas needing improvement and can provide feedback on individuals' job performance. To maximize the number of completed surveys, the survey should be brief and easy to complete. Best companies automatically generate, email, accumulate and report survey results to reduce the amount of manual effort. The following is an example of a brief, quantifiable survey.

To what extent did Computing Services meet your expectations?

1. Was approachable and easy to contact for support:

5 = Exceeds 4 = Meets Most 3 = Meets Some 2 = Meets Few 1 = Does Not Meet
Comments:

2. Responded to my problem/request in a timely manner:

5 = Exceeds 4 = Meets Most 3 = Meets Some 2 = Meets Few 1 = Does Not Meet
Comments:

3. Resolved my problem in a timely manner:

5 = Exceeds 4 = Meets Most 3 = Meets Some 2 = Meets Few 1 = Does Not Meet
Comments:

4. Understood my problem/request:

5 = Exceeds 4 = Meets Most 3 = Meets Some 2 = Meets Few 1 = Does Not Meet
Comments:

5. Was professional, friendly and courteous:

5 = Exceeds 4 = Meets Most 3 = Meets Some 2 = Meets Few 1 = Does Not Meet
Comments:

6. Provided timely and clear communication:

5 = Exceeds 4 = Meets Most 3 = Meets Some 2 = Meets Few 1 = Does Not Meet
Comments:

Please assess the effectiveness of the resolution that was provided:

7. Was your problem/request resolved to your satisfaction?

5 = Exceeds 4 = Meets Most 3 = Meets Some 2 = Meets Few 1 = Does Not Meet
If No, please explain:

Please assess the overall quality of service (total experience) you received regarding this event:

8. Overall quality of service (total experience):

5 = Exceeds 4 = Meets Most 3 = Meets Some 2 = Meets Few 1 = Does Not Meet Comments:

Recommendation No. 5

We recommend sending customer surveys to obtain feedback on a sample of closed PMAs.

Computing Services' Response:

Agree. A sampling survey will be undertaken prior to December 31, 2001.

Performance/Capacity Management

We reviewed performance and capacity management performance measures. We found that although a Performance Workload Highlights report is generated monthly, the format is too detailed for management level reporting and trending. Additionally, opportunity exists to set higher performance goals than those that have been established by Computing Services. (Current goals are detailed below.)

Existing Operations

CGTS is mainframe centric therefore most of the responsibilities of the Technical Group and Database Group focus on the performance and capacity of the mainframe. CGTS also houses 74 servers that must be monitored on an individual basis. These servers are administered remotely by the customer from the customer site. Thus, Computing Services is not responsible for server performance and capacity.

The Technical Group has two areas of responsibility. On the mainframe, the Technical Group is responsible for the installation and support of mainframe Operating System software, utilities, and data collections. This area works closely with the Service Center to resolve customer issues. Their second area of responsibility involves desktop support and limited maintenance on servers housed at CGTS.

The Database Group has three areas of responsibility: database administration, Customer Information Control System (CICS), and storage management. The database administrators maintain the databases on the mainframe and install database software. CICS, the second area the Database Group is responsible for, allows remote sites to communicate with the mainframe. The third area involves storage management. Storage management on the mainframe entails the physical management of disks and tapes. A dedicated individual monitors the public storage (temporary storage), the storage volume (pool of storage where data sets are stored), and private storage (long term storage).

Mainframe performance reports are generated before and after the implementation of a major change (i.e. upgrade to the operating system) to monitor fluctuations. Once the change has been implemented, tested, installed, and stable, reports are no longer generated.

CICS response time and availability reports are available on a monthly basis. The data from these reports is then further broken down to agency response time.

A Performance Workload Highlights report is generated monthly which measures four areas, each with a rating scale to measure success. The four areas are:

1. On-line response time (the time to complete a terminal to CPU to terminal action)

2. System availability (hardware, related devices, O/S, and related software are available)
3. Service interruptions (interruptions caused by a software component that is disruptive to the customer community)
4. Overnight batch production (measure based on ability to have scheduled batch production jobs completed by 6:30 a.m.)

The following matrix details Computing Services current standard, actual performance and industry standard.

Area	Computing Services' Current Standard	Industry Standard
Response Time	<p>The goal for Computing Services' response time is 95% of all transactions completed in five seconds or less. Per performance reports, this goal is consistently achieved.</p> <p>Response time is also depicted in the CICS monthly metric. Modification of this graph to depict a more specific, actual response time (e.g. less than one second, one to three seconds, three to five seconds, and greater than five seconds) rather than simply "five seconds or less" will allow Computing Services to better understand and manage customers' actual response time and user experiences.</p>	<p>Based on our experience, a five-second response is not an aggressive goal. However, industry standards vary depending on customer requirements. Similar organizations provide response times ranging from sub-second to seven seconds. Appropriate response times need to be negotiated with the customer and included in the SLA.</p>
System Availability	<p>The current standard is that computer hardware is available 98% of the time 24 hours per day, seven days per week. Per performance reports, this goal is consistently achieved.</p>	<p>Industry standards vary depending on customer need, however 99.5% - 99.9% is common for mainframe availability.</p>
Service Interruptions	<p>A Service Interruption is considered any software interruption greater than 30 minutes between the time of 7:00 a.m. and 6:00 p.m. Current standard is to have 87 – 90% of days without interruptions. Per performance reports, this goal is consistently achieved.</p>	<p>Typically 99% is seen in private industry. However it is largely dependent on customer requirements and tolerance. Customers may opt for lower availability to avoid the increased cost associated with higher availability.</p>
Overnight Batch Production	<p>Overnight batch job output by 6:30 a.m. The current standard is to meet this goal 80 – 88% of workdays. Per performance reports, this goal is consistently achieved.</p>	<p>Non-mission critical jobs should complete on time 90 – 99% of the time. Mission critical jobs should complete on time 95 – 99% of the time.</p>

The matrix above relates to mainframe services. CGTS is in the beginning stages of expanding their role in server administration. They are defining processes to gather requirements from customers to purchase, secure, administer, and maintain customer servers. CGTS will be responsible for performance and capacity of these servers and will need to define measures specific to these new services.

Recommendation No. 6

We recommend that Computing Services generate management metrics monthly and report them using a graphical format. Currently, metrics are generated either on an ad hoc basis or displayed in a difficult to read format. Graphically depicting this information will allow management to review monthly performance at a glance and easily observe trends over time. For example, the Current Performance Workload Highlights (mentioned above) contains valuable information but it is difficult to read and understand. In addition, for the current Performance Workload Highlights to be beneficial, ratings outlined in the Standard Operating Procedure (SOP) should be updated to reflect industry standards and/or monthly goals.

Computing Services' Response:

Agree. Selected elements will be graphically presented by December 31, 2001. Increasing the number of elements and refining the goals will be ongoing into FY03.

Contingency Management

We reviewed contingency management performance measures. We found that metrics related to contingency management do not exist. Without metrics, Computing Services is unable quantitatively assess the effectiveness and efficiency of contingency management efforts. Although significant improvements have been made in the past several years, opportunity exists to enhance the evaluation and reporting of the annual disaster recovery test. Additionally, components of the contingency plan are outdated.

Existing Operations

The Disaster Recovery Coordinator is responsible for developing, documenting, testing and maintaining Computing Services' disaster recovery plan. A disaster is defined as an event that prevents customers from accessing the resources located at 690 Kipling for a period greater than 72 hours. The disaster recovery plan is restricted to the mainframe and does not include the servers located at Computing Services. Customers using the servers are responsible for recovering their operating system, data and applications in case of a disaster.

For recovery purposes, Computing Services maintains backup copies of the mainframe operating system, system products (tape management, compilers) and certain system libraries (JCLLIB, etc.). Although the backup of applications and data is the responsibility of the customer, Computing Services will provide some backup services if requested by the customer. Computing Services recommends customers utilize ARCUS, a third party offsite storage facility. ARCUS provides a secure location offering video surveillance, security gates and halon fire protection.

Computing Services has contracted with SunGard to provide a hot and cold disaster recovery site. Both sites are located in Philadelphia, Pennsylvania. In the case of a disaster, backups stored at ARCUS are flown via two separate carriers for fault tolerance purposes to the Hotsite. The Hotsite provides for thirty-two days of operation for customers to connect to mission critical applications. If a disaster extends beyond thirty-two days, the operations would move to the Coldsite. At the Coldsite, vendors would supply the appropriate hardware and backups of the O/S 390 operating system, the mainframe database, and backed up customer programs would be restored.

The contingency manual describes in detail whom to contact and outlines how to initiate the disaster recovery plan. The technical restoration manual describes a step-by-step process to startup the Hotsite. The Disaster Recovery Coordinator, Technology Services Manager, Computing Services Manager, three shift supervisors, and the ARCUS offsite storage facility store copies of the technical restoration manual.

A disaster recovery test is conducted each year. Time is allocated for Computing Services to get the Hotsite online and allow customers to connect to the Hotsite. The disaster recovery test is graded as pass or fail based on Computing Services' ability to restore the operating system, mainframe database, and provide customers the ability to connect to the Hotsite. Prior year tests have received a pass rating because these three measures were achieved, even though customers were unable to run their applications from the Hotsite. At the conclusion of the annual test, problems encountered during the exercise are documented. These problems are entered into the Infosys problem management tool for resolution. In addition, the Disaster Recovery Coordinator provides a debriefing of the disaster recovery plan's successes and failures to upper management.

Recommendation No. 7

We recommend the disaster recovery test be enhanced from the existing pass/fail grade to a more detailed, quantitative grading scale. This additional detail will allow Computing Services to better evaluate the disaster recovery test's success over time. Critical factors necessary for a successful disaster recovery need to be individually identified and evaluated. A successful disaster recovery test includes, but is not limited to the following critical factors:

- Are the necessary disaster recovery backup tapes flown to the Hotsite?
- Do the backup tapes arrive at the Hotsite when scheduled?
- Is Computing Services able to restore the operating system at the Hotsite?
- Is the operating system (O/S) restored within the expected time frame?

Critical factors should be given a rating scale. For example, the following rating scale could be employed.

Critical Factors	Evaluation Criteria				Score
	4	3	2	1	
Backup tapes arrived on schedule	Arrived Early <input type="checkbox"/>	Arrived on Time <input checked="" type="checkbox"/>	Arrived <2hrs late <input type="checkbox"/>	Arrived >2hrs late <input type="checkbox"/>	3
O/S restored within expected time frame	Restored >2hrs early <input type="checkbox"/>	Restored on Time <input type="checkbox"/>	Restored <2hrs late <input checked="" type="checkbox"/>	Restored > 2hrs late <input type="checkbox"/>	2
Total Score					5/8

Based on the above example, the identified disaster recovery test critical factors received a score of five out of a maximum score of eight. Each critical factor result should be compared to expected results to identify areas that are successful and areas that need improvement. Trending the annual disaster recovery results will identify if the disaster recovery plan is improving on a year to year basis.

Computing Services' Response:

Agree. This method will be utilized in the next Disaster Recovery test. A test date is not available as a new Disaster Recovery provider is being sought through a bid process.

Contingency Plan

The contingency plan does not accurately reflect individuals' disaster recovery responsibilities nor does it contain consistent, current employee contact information such as address and phone number. Outdated or inaccurate information could result in an inability to recover resources in the event of a disruption.

Recommendation No. 8

We recommend that certain components of the contingency plan be updated. Processes should be implemented to ensure the contingency plan is appropriately updated when changes occur.

Computing Services' Response:

Agree. This is an ongoing process in order to maintain employee information.

Structure of Organization

We reviewed security organizational structure performance measures. We found that metrics related to organization do not exist. Without metrics, Computing Services is unable quantitatively assess the effectiveness and efficiency of the organization. Additionally, we identified that:

- Job descriptions do not consistently include required skills;
- Employee training plans are not consistently maintained, and

- Actual training hours are not tracked and reported.

Existing Operations

The organizational structure of CGTS is designed to align services, eliminate redundancy of duties, enhance supervisor to staff ratio, and assist customers in identifying relevant contact points for problem resolution.

The CGTS director envisions managing CGTS through strategic initiatives. Strategic initiatives will link to functional area objectives and all objectives will link to specific job duties. Two areas of focus are required to fulfill this vision: update job descriptions and enhance employees' skill sets.

Recommendation No. 9

The following metrics should be reported monthly and trend analysis performed. Unusual or unexpected fluctuations should be identified and the root cause identified. The metrics will help manage costs associated with human resources.

- Employee turnover rate
- Staff to manager ratio
- Average salary by function and level

Computing Services' Response:

Agree. Core personnel trends, such as turnover rate will be initially recorded at the department level by the centralized department human resources staff. Initial recording and reporting will commence no later than January 1, 2002.

Job Descriptions

Existing job descriptions do not consistently include required skills. Definition and allocation of responsibilities enable related functional areas to work together effectively and ensure current skill levels are sufficient to maintain effective operations. With the state moving toward a performance pay system, up-to-date and accurate job descriptions will facilitate objective evaluation. Updating job descriptions should be implemented using a phased approach conducted over an adequate period of time to accurately complete this process.

Recommendation No. 10

We recommend job descriptions be updated to reflect current skill needs.

Computing Services' Response:

Agree. This action is already underway and it is an ongoing task with no end date possible.

Training/Development Plans

Currently, training hours are not consistently tracked nor are training plans in place for the majority of CGTS personnel. Training/development plans will help Computing Services address "performance gaps"

(training needed to meet performance standards for a current task or job), "growth gaps" (training needed to achieve career goals) and "opportunity gaps" (training needed to qualify for an identified new job or role).

Recommendation No. 11

We recommend creating training/development plans that align with the strategic initiatives of Computing Services. Additionally, CGTS should maintain a record of training hours incurred for each employee.

Computing Services' Response:

Agree. Supervisors are asked to maintain training history as part of performance tracking. Employee reports of training that has been requested as well as training that has been completed will be recorded as part of the Annual Performance Review starting in April, 2002.

Security Management

We reviewed security management performance measures. We found that metrics over the performance of security processes do not exist. Without metrics, Computing Services is unable quantitatively assess the effectiveness and efficiency of security efforts.

Existing Operations

Physical Security

Physical security at CGTS is strict because it is collocated with the Colorado Bureau of Investigation. Building access is monitored via cameras and individuals are required to enter and exit through a manned checkpoint. In addition, individuals must enter a security code to access the computer operations center. There have been no reported incidents of stolen state property within the last several years.

Server Security

Security administration for the servers is the customers' responsibility. Customers are responsible for establishing security policies, and administering user access and firewalls. However, customers experiencing security issues such as a denial of service attack, can consult Computing Services for assistance in resolving the problem. To receive CGTS assistance, a customer would complete a Network/Computer Security Intrusion Report documenting the issue. The Intrusion report details items such as the type of attack, the time of attack, type of network, etc. Currently, CGTS does not incorporate the Intrusion report into a performance metric nor report on or trend individual server attacks.

Mainframe Security

Computing Services' Systems Security Administrator is responsible for security administration of the Amdahl Millennium 785 mainframe. In addition, the service center operators have administrative rights to perform tasks such as resetting user passwords. Computing Services' larger customers (e.g., Colorado Department of Human Services, Department of Revenue) have security administration privileges only for their agency's specified area on the mainframe.

Computing Services' Systems Security Administrator manages mainframe security through a program called TopSecret. The mainframe is currently running TopSecret version 5.0. TopSecret allows the administrator to establish user accounts, passwords, password expiration requirements, permissions and rights. TopSecret also generates reports detailing violations and security changes. We reviewed the daily violations report that is produced and lists violations incurred at the main frame, for example, a user typing an invalid password. Security change reports list changes to a user file occurring over the past thirty days (e.g. changing a user's permissions). The Systems Security Administrator reviews these reports to identify and research potential security issues. Additionally, the Systems Security Administrator monitors logs produced by the mainframe identifying unsuccessful scans and logon attempts on a daily basis. Logs reviewed include information related to failed login attempts resulting from a user entering an invalid password to access the mainframe, unsuccessful attempts to access mainframe resources (i.e. the number of times a user attempts to access a file to which they have not been granted access rights), etc. Although the mainframe is subject to numerous Internet scans and attacks, a mainframe compromise has not been identified.

A formal SOP exists to guide mainframe security. It describes the roles, responsibilities and procedures for administering the mainframe's security. However, formal performance metrics measuring the performance of the Systems Security Administrator do not exist. The Systems Security Administrator relies on feedback from customers to determine the success of security administration. Per the Systems Security Administrator, half of his time is devoted to proactive security functions while the other half of his time is spent on reactive security measures.

Recommendation No. 12

We recommended the following security metrics be generated and reported:

- a. *The number of users with excessive access rights (i.e. users with rights to access data or perform functions nonessential to their job function) – the metric can be calculated during an annual review of user rights. The review should include systems for which Computing Services is responsible for security administration.*
- b. *An annual security audit to assess the adequacy of security policies, procedures and configuration - the security audit should ensure the technical environment is configured in accordance with security policies and procedures (e.g. minimum password length, password expiration interval, password complexity requirements, etc.). The audit should also assess that users are granted only rights necessary to achieve their assigned job functions (i.e. identify users that have been granted rights to access data or programs that are not essential to perform their job functions).*
- c. *The annual cost of information security - security costs include human resources, training, software, hardware, external services and physical security costs. Security costs vary significantly between organizations depending on security requirements. Generally, 6% to 8% of the IT budget is spent on security. In our experience, we've seen organizations spend as little as 3% and as high as 10%. To be meaningful to CGTS, the percentage would need to be calculated at the CGTS level rather than solely within Computing Services (i.e. the metric needs to be holistic, including network and application security in addition to mainframe). Trending security costs will help identify if an*

adequate or excessive amount is spent on security. Large fluctuations in security spending should result from appropriate business decisions, if not, fluctuations should be researched and resolved.

Computing Services' Response:

Agree. CGTS in conjunction with the OIT is currently coordinating a statewide systems/network Security Assessment. The MNT has already had an assessment completed by Cyber, Inc. in June 2001. The statewide assessment is being conducted by Sandia National Laboratories, Inc. and the outcome will be a comprehensive analysis to include a report of findings, identification of vulnerabilities/threats, policy direction, and recommendation of identified alternatives. This assessment is scheduled to be complete in November 2001 and one of the outcomes is to develop and track metrics to quantitatively assess the effectiveness and efficiency of CGTS and statewide security efforts. This includes security metrics, ongoing security audits, and security administration costs analysis. These metrics will be developed and placed into effect by April 2002 and enhanced as appropriate on an ongoing basis.

Resource Charging/Cost Management

We reviewed resource charging/cost management performance measures. A critical goal of these processes is to ensure that data center operating costs are fully recouped based on resources consumed. This goal is inherently met by the annual funding process. However, we found that current budget and funding processes are not designed to encourage user agencies to efficiently utilize data center resources in the short term because increases or decreases in utilization are not accounted for until the following fiscal year. Customers will be more motivated to be efficient if Computing Services charges customers for their current, actual usage. Charging customers for actual usage will help Computing Services to provide a higher quality of service at a lower cost because customers have a cost incentive to be efficient.

Existing Operations

CGTS is a cash funded agency operating on an annual budget of \$38.9 million for fiscal year end 2001. Computing Services is an organization in CGTS that provides data center services to state agencies for a fee. According to CGTS management, for fiscal year 2001, agencies' bills are calculated by multiplying their mainframe utilization by a predetermined rate. For fiscal year 2002, fees are based upon an average utilization of the three prior fiscal years' utilization. In fiscal year 2003, fees will be based upon an agency's utilization of Computing Services' resources from a single prior fiscal year.

On the fourth of each month, the Office Manager initiates the billing process. Invoices are generated and submitted to the customers and the Colorado Financial Resource System (COFRS). Invoices are submitted within five working days of the first of the month.

Although utilization will continue to be measured for each agency over the course of each month, for fiscal year 2002, monthly invoices will not correlate to an agency's monthly utilization. Instead, a flat fee will be charged to the agency each month. The monthly flat fee is calculated by taking an agency's average utilization percentage for the prior three fiscal years and multiplying the percentage by

Computing Services' budget for the year then dividing by twelve months. For example, assuming an agency has an average mainframe utilization of 20 percent and Computing Services' annual budget is \$12 million, the agency would be billed \$200,000 a month ($\$12,000,000 * 20\%$ divided by 12 months). Utilization of CGTS resources throughout fiscal year 2001 will determine rates and costs for fiscal year 2002.

Customers are charged based upon 11 billing categories that comprise an agency's annual utilization percentage. The billing categories are as follows: CPU Service Units (where a service unit is a measure of the amount of CPU resource required to complete a given unit of work), CICS Service Units, ADABAS Service Units, DASD Usage (disk storage), Data Entry, TCP/IP & Dial-up Access, Tape Usage, Type 1 Terminals (transaction oriented devices), Type 2 Terminals (remote job entry terminals), Printed Lines, and Printed Pages.

Recommendation No. 13

Charging customers for actual usage does not directly align with the State government's annual budget and appropriation process. To more closely align cost management objectives with the annual budget and appropriation process, we recommend each user agency's budgeted utilization be compared with their actual monthly utilization. Material variances from budget should be reported monthly. If a material variance exists, the user agency's bill should be adjusted to reflect actual utilization. The adjustment can occur on the current bill or a future bill. However, the more timely the adjustment is made, the more effective it will be in motivating customers to efficiently manage resource usage.

Computing Services' Response:

Disagree. The current proration billing is the result of agreement between GSS, OSPB and JBC. It is usage based, although the lag is notable. A six month adjustment to the billing to mitigate the lag is anticipated, but not yet designed and implemented. The previous, long-standing implementation of rate-based billing has deteriorated over the past five years as the dynamics and rate of utilization changes outstripped the accuracy of the utilization estimates done within a budget cycle. The constraints placed both upon the ability to change rates and the customer's ability to gain modified funding created continual adversity and hardship on both the data center and the customer community.

Auditor's Addendum

We emphasize the importance of providing user agencies with budget to actual utilization information and adjusting charges to reflect material utilization changes. These processes represent good business practices.

Operations Management

We reviewed operations management performance measures. We found that Computing Services' operations performance can be effectively measured using performance metrics and SLAs identified in other process areas (e.g. performance management, service level management, etc.).

Existing Operations

The Computing Services' operations group performs a broad range of services. The operations group is responsible for output handling, mainframe tape mounting and backups, and cursory server monitoring and maintenance. The Service Center has primary responsibility for job scheduling, backup/archive scheduling and mainframe monitoring. The operations group assists the Service Center in carrying out these responsibilities.

Mainframe

The operations group ensures the jobs scheduled by the Service Center are processed by the mainframe. The operations group monitors job processing activity via CA-7, a job scheduling program from Computer Associates. Scheduled jobs are assigned a priority number for job processing and the operations group has the ability to increase or decrease a job's priority number if critical jobs fall behind schedule. Problems encountered such as incomplete job runs are reported to the Service Center for resolution.

A Control Process Procedures (CPP) manual assists with output handling. Manuals are located at the Service Center and Operations Center. The CPP lists vital information on how each customer's job should be processed. Processing details include customer contact information in case of a job processing error, delivery instructions, and job processing schedule. Daily logs list when jobs complete and the when output is delivered to the customer.

The operations center is not responsible for scheduling backups/archives, only for conducting mainframe tape mounting. Operators monitor the mainframe's tape management program for instructions detailing the tapes required for a given backup procedure. Problems encountered during the backup procedure are directed to the Service Center.

The operations center produces a daily error report. The error report lists tapes and drives that had read/write errors and tapes that need cleaning. In the past, the daily reports were sent to BASF, a company that compiled the results for the year. The operations center used the BASF report to identify the drives and tapes that were consistently encountering problems, the average number of mounts per device, and the capacity of single volume tapes in the library.

The operations center maintains an inventory list for the tapes stored offsite. SOPs identify how often inventory reviews are required. Annual and semi-annual inventory reviews are conducted. The purpose of the reviews is to verify the presence and availability of purchased magnetic tape resources, identify and recover media that has been "lost" due to physical loss, improper coding, or other circumstances that prevent media from being available for Computing Services use.

SOPs address the conduct and training requirements for operators. The operations supervisor maintains a training log for each operator to monitor compliance.

Server

Customers that require a server to be located at Computing Services complete a Computer Room Space/Network Lease Request. The lease request contains details such as a customer contact person and telephone number, type of operating system, IP address, installation and removal date. The lease request and additional information such as a backup schedule, if required, are attached to each server. Operators perform scheduled backups and cursory reviews of the servers. If a server needs assistance, the operator contacts the customer for direction. In addition, the operations manager maintains a server hardware inventory list.

Recommendation No. 14

We recommend that Computing Services trend the daily error reports to identify tapes and drives that produce errors over time. Trending will help identify which tapes or drives need replacing, therefore reducing errors and costs associated with error resolution.

Computing Services' Response:

Agree. The existing reports used by engineers identify errors by device and cause repair action to be undertaken. This information will be used for trending. A history and trending of tapes removed from service will also be undertaken. This trending will be initiated by December 31, 2001. The referenced BASF reports were costly and no longer influence tape media and hardware management processes. These reports did have significant impact during a period of manufacturing defect some 10 years ago and again during a period of hardware performance problems some four years ago, but lost the significance once the damaged media was removed and the hardware problem mitigated.

Technical Environment Management

We reviewed Computing Services' management of their technical environment. We did not identify significant weaknesses, however, existing procedures related to managing hardware and software are not adequately documented.

Existing Operations

The technical environment at Computing Services encompasses two primary areas: the mainframe and server areas. The primary purpose of the mainframe is to provide computing capacity for enterprise level applications utilized by Computing Services' customers. The mainframe environment consists of an Amdahl Millennium 785 leased within the past three years running IBM's 390 version 2.9 operating system (O/S). The data center management has elected to remain six months behind the most current O/S to avoid problems traditionally associated with new software releases and to test software compatibility.

Computing Services' server environment provides housing for customer servers. Customers locate their servers with Computing Services because Computing Services offers twenty-four hours / seven days a week physical security, robust network connections, and staff availability to perform startup/shutdown procedures. Computing Services includes 74 servers each running various applications and operating

systems. A procedure manual is attached to each server describing the appropriate action to take concerning that particular server. For example, procedures may identify name and number of the customer contact in case of an emergency and the type of scripts to run, if any. The burden of maintaining the server's O/S, applications, performing installations and security access is the primary responsibility of the customer, not Computing Services.

Hardware inventory is maintained by the Computing Services Manager. Hardware upgrades are not performed on a regular, periodic basis, for example, replacing servers every two years. Computing Services replaces hardware when the capacity, performance and availability needs of their customers are not met due to insufficient hardware residing at Computing Services.

Software inventory is maintained by the Technical Group Manager. Microsoft Access is used by the Technical Group Manager to manage and generate a software inventory list tracking the individual responsible for the software, software vendor name, and the version number. The Technical Group Manager receives vendor notification and reviews technical journals to identify software upgrades. Upon receiving this information, the Technical Manager consults the software inventory list to determine if Computing Services' software version warrants an upgrade. The technical group manager takes into consideration such items as the additional benefits offered to Computing Services' customers by the upgrade, the ramifications of not upgrading, and potential loss of vendor technical support if Computing Services' does not upgrade. Although existing processes are adequate, procedures related to managing hardware and software are not adequately documented. Without sufficient documentation, employee turnover may jeopardize the consistency and continuity of job functions and related business objectives. Additionally, formal control processes and procedures will assist in ensuring the appropriate hardware and software versions are implemented.

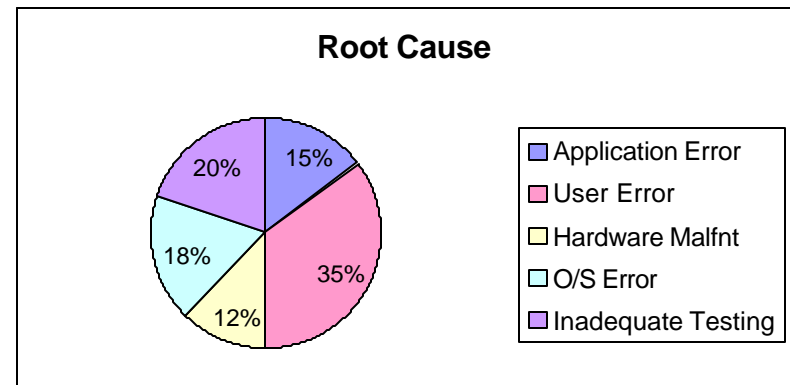
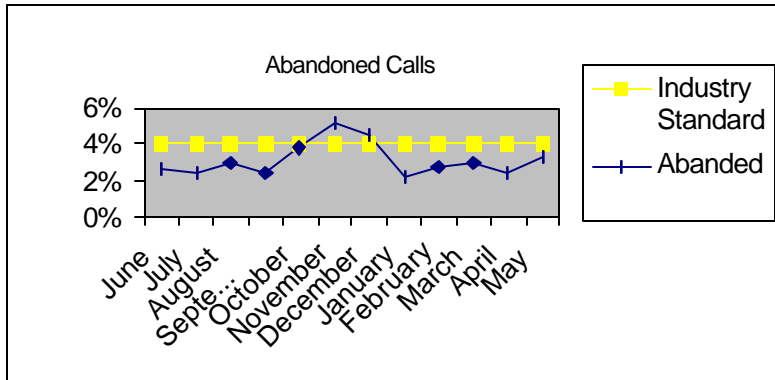
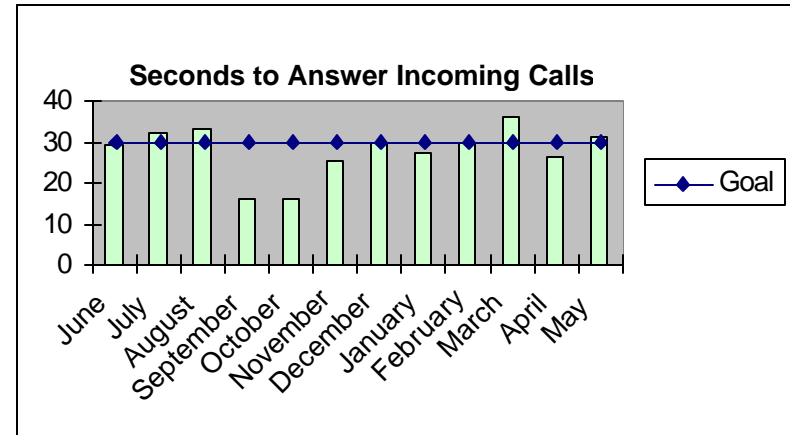
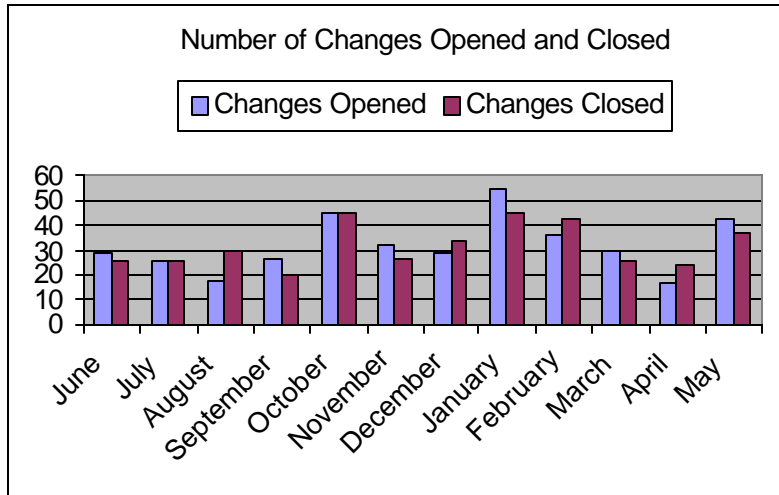
Recommendation No. 15

We recommend Computing Services document processes and procedures that describe how the hardware and software inventory lists are to be monitored and updated.

Computing Services' Response:

Agree. The established procedures will be documented by June 30, 2002.

Appendix A Example Management Reports



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