

Information Technology Performance Audit Executive Summary

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Submitted by



Center for Educational Leadership and Technology
199 Forest Street
Marlborough, MA 01752
Tel. (508) 624-4474
Fax (508) 624-6565
www.celtcorp.com



Executive Summary

In 2006, BVSD passed a multi-million dollar bond referendum to implement a number of technology initiatives, including a district-wide computer refresh, an upgrade to the wide area network, a new student information system, and other related projects. All of these technology projects are in various ages of completion. Understandably, school, administrative, and IT staff are all pressured by the challenges of change, resulting in internal conflicts, communication issues, and implementation priorities that will require on-going attention.

To review the status of these changes and determine the effectiveness of the implementation of the bond initiatives, Boulder Valley School District (BVSD) has contracted with the Center for Educational Leadership and Technology (CELТ) to conduct an enterprise-wide information technology performance audit, including an evaluation of the efficiency and effectiveness of the Information Technology Department and technology infrastructure, with a special emphasis on the delivery of technology services and recommendations for improvement.

CELТ has provided a capable team of experienced staff to address a wide range of pressing IT needs. CELТ staff has evaluated, developed, and implemented IT strategies and systems for hundreds of school districts, including some of the largest in the country. CELТ understands, recognizes, and appreciates the litany of unique infrastructure requirements exclusive to K-12 enterprises. Unlike other industries, K-12 enterprises do not benefit from the implementation of new technology alone; student learning can only be enhanced when the infrastructure is aligned and applied to support the core mission of education.

This IT audit is intended to assist district staff in identifying new ways to help schools provide every student and educator with the most appropriate learning technology resources and contemporary learning opportunities. It will also assist the school board and district leadership in making timely, informed, student-centered decisions. The outcomes of the project will underscore the major benefits of information technology for students, parents, and teachers as well as document the potential impact of 21st century technology skills on economic and workforce development.



1.0 Study Methodology

The overall objective for the study was to develop recommendations and strategies for using technology to improve student learning and staff productivity in a cost-effective manner. In order to achieve this objective, the study was divided into two stages. During the first stage, the CELT team performed comprehensive information gathering focused on the three major areas of inquiry that were outlined for this evaluation: support systems for technology, curriculum/classroom integration, and infrastructure. Using site visitations, focus groups, key stakeholder interviews, document reviews, surveys, and inventories, and other strategies, an accurate profile of the current status and impact of technology in schools was developed.

The second stage focused on the development of an evaluation report that outlined the key findings derived from the information gathered and offered research and experience-based recommendations to address the issues that were identified through this process. Figure 1 demonstrates the flow of this methodology from data collection through the development of findings and recommendations.

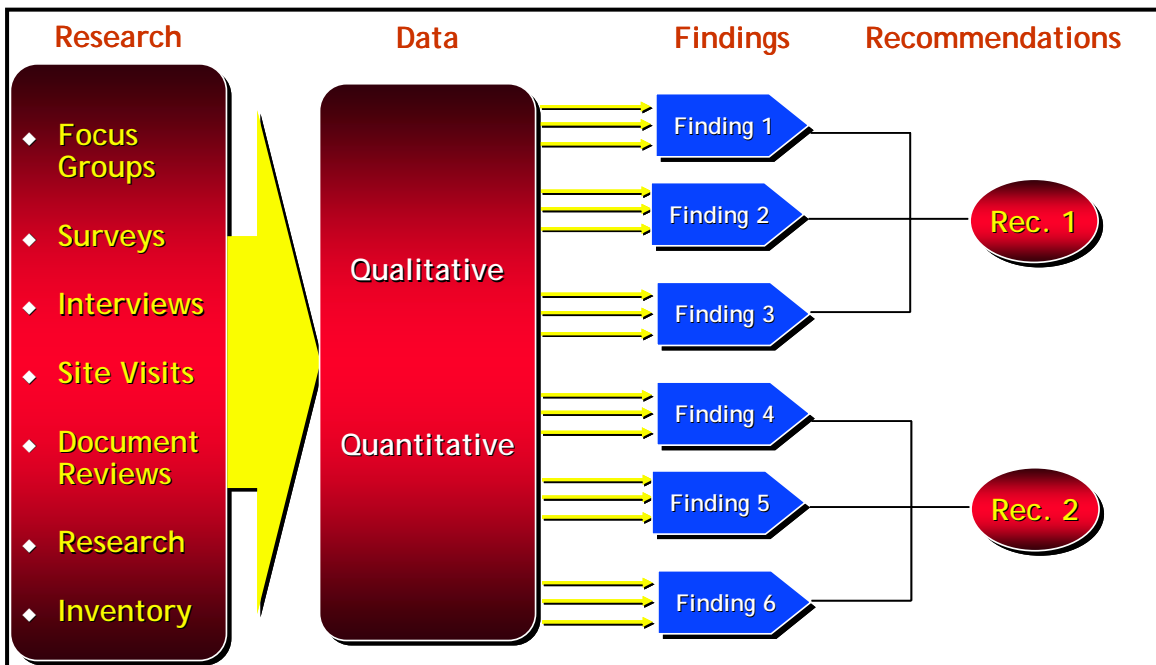


Figure 1. Methodology

The draft report was distributed to the three project teams to review for accuracy. Project team members received a password-protected PDF version of the document and were provided with an issues-resolution matrix (IRM) for submitting feedback. Reviewers use the IRM to comment on statements in the documents that they believe require change or clarification and recommend the revised wording. The CELT team reviews the IRM, often returning to the raw data to review the original notes, and makes the changes that are appropriate.



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The accompanying BVSD IT Performance Audit Report represents the culmination of this research and review process.



2.0 Major Findings and Recommendations

In an attempt to implement the initiatives funded by the 3A Bond and Referendum and demonstrate the impact, BVSD has undertaken several major projects simultaneously, including a district-wide implementation of Infinite Campus, a four-year refresh cycle of all equipment, the transition to a single PC platform for all computers, the replacement of wireless access points, and the migration of all school Websites to SharePoint.

The effects of one of these at a time would be felt across the district. While recognizing the interdependencies of several of these projects, the result of attempting so many at one time has resulted in a general distrust and lack of satisfaction with the IT department across the district. This section of the report is to identify the nature of this dissatisfaction and suggest the strategies that stakeholders believe would remedy the situation. The accompanying Executive Briefing summarizes the overarching findings and recommendations that are the result of this technology assessment. The major findings and recommendations are presented in the following sections:

- Support Structure for Technology Report
- Curriculum and Classroom Technology Integration and User Satisfaction Report
- Technology Infrastructure and Primary Technology Systems Report

Note that the complete technology assessment document, which presents a detailed analysis of the BVSD Information Technology performance audit in BVSD, is also available.

2.1 Support Structure for Technology

Adequate and district-wide technology support is an essential component of successful utilization and integration. In the Boulder Valley School District (BVSD), these services include professional development for all staff, technical support, a Help Desk, and help desk software for logging and tracking support calls. In defining this implementation, it is important to set district-wide guidelines and identify funding support services to maintain and repair technology resources, as well as to coordinate upgrades and procurement.

In evaluating BVSD's Current Support Structure for Technology, the following focus areas were explored. The findings and recommendations related to these topics are presented in detail in the BVSD IT Performance Audit Report and are summarized in Table 1.

- Benchmarks, industry standards, and performance measures for evaluating the Division's performance.
- Levels of computer use (hardware and software) by district administrative and instructional staff.
- Technology skills of district employees by category (using existing district rubrics)
- Effectiveness of the district's technology staff development program



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- User satisfaction with technology assets and technology department operations
- Adequacy of current resource level of technical support
- Efficiency of Help Desk function and the Trouble Ticketing System
- Determine the efficiency and effectiveness of staff/teacher/student technology support, including equipment allocations, deployment, maintenance and repair and response time.
- Determine if current methods of delivering service are efficient and effective and whether greater service could be achieved if all or part of the support function were outsourced. Could the support function be more efficient and effective if it relied more on automated tools rather than outside technicians?
- Determine what IT governance mechanisms or processes are in place to regulate and prioritize the work of the Division and how well these mechanisms work.
- Determine what mechanisms or input processes are in place to systemize the operations of the Division and how well they work.

Please note that the numbering scheme in Table 1 corresponds to the numbering scheme in the accompanying PowerPoint presentation, which contains a subset of these recommendations.

Table 1. Major Findings and Recommendations ~ Support Structure for Technology Report

Finding	Recommendation	Ranking																																								
User Satisfaction with Technology Assets and Technology Department Operations																																										
<p>⇒ In general, stakeholders feel that there is not a cohesive vision for how the technology should be used throughout the district. Usage varies depending on the school culture. Stakeholders are not convinced that the current strategy is aligned to educational goals. Users perceive that “IT is driving the curriculum, rather than the curriculum driving the technology.”</p>	<p>A1. All technology initiatives should be tied to district goals, assessment results, and student achievement. This must occur at the Cabinet level, so that IT can review the impact of new initiatives on all aspects of IT, including support, professional development, and hardware/software resources. No project should be undertaken unless it is certain that there are sufficient resources to execute.</p>	<table border="1"> <tr> <td>I</td> <td>H</td> <td></td> <td></td> <td></td> </tr> <tr> <td>M</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>P</td> <td>M</td> <td></td> <td></td> <td></td> </tr> <tr> <td>A</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>C</td> <td>L</td> <td></td> <td></td> <td></td> </tr> <tr> <td>T</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td>H</td> <td>M</td> <td>L</td> </tr> <tr> <td></td> <td></td> <td colspan="3">COST</td> </tr> </table>	I	H				M					P	M				A					C	L				T							H	M	L			COST		
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Level of Computer Use by District Administrative and Instructional Staff																									
<p>⇒ Instructional resources are not used to capacity because there is insufficient bandwidth, unreliable wireless, password issues, and disruptions due to frequent updates. These resources include video and streaming media tools, mobile labs, podcasting, and projection systems.</p> <p>⇒ In some cases, instructional staff report that they have stopped using the technology because of the issues that prevent them from doing so successfully. They feel that the reduction in use creates a false sense that everything is working fine.</p>	<p>A2. To address issues with frequent updates, consider using batch updates to limit the frequency with which LANDesk sends out updates. Make sure that a notice is sent to all users prior to updating so that they can plan accordingly.</p> <p>Technical issues addressed in the Technology Infrastructure report.</p>	<table border="1"> <tr> <td rowspan="3">I M P A C T</td> <td>H</td> <td></td> <td></td> <td style="background-color: cyan;"></td> </tr> <tr> <td>M</td> <td></td> <td></td> <td></td> </tr> <tr> <td>L</td> <td></td> <td></td> <td></td> </tr> <tr> <td colspan="2"></td> <td>H</td> <td>M</td> <td>L</td> </tr> <tr> <td colspan="2"></td> <td colspan="3">COST</td> </tr> </table>	I M P A C T	H				M				L						H	M	L			COST		
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Technology Skills of District Employees by Category																									
<p>⇒ Teacher technology competency ranges from low to advance. At some schools, teachers have difficulty with basics. While many users maintain teacher websites and integrate technology when able to do so, principals report that a significant proportion have low skill levels and do not use technology as a teaching tool.</p>	<p>A3. Develop an online self-assessment of the recently-developed teacher rubric to provide disaggregated results that can be used to identify priorities for professional development. Identify online or just-in-time strategies for training to address gaps.</p>	<table border="1"> <tr> <td rowspan="3">I M P A C T</td> <td>H</td> <td></td> <td style="background-color: cyan;"></td> <td></td> </tr> <tr> <td>M</td> <td></td> <td></td> <td></td> </tr> <tr> <td>L</td> <td></td> <td></td> <td></td> </tr> <tr> <td colspan="2"></td> <td>H</td> <td>M</td> <td>L</td> </tr> <tr> <td colspan="2"></td> <td colspan="3">COST</td> </tr> </table>	I M P A C T	H				M				L						H	M	L			COST		
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Effectiveness of the BVSD's Technology Staff Development Program																									
<p>⇒ Increased opportunities for technology-related staff development have been identified as a major need throughout the district.</p>	<p>A4. Diversify professional development offerings to include online, chat, computer-based training, demonstrations, and updates.</p>	<table border="1"> <tr> <td rowspan="3">I M P A C T</td> <td>H</td> <td></td> <td style="background-color: cyan;"></td> <td></td> </tr> <tr> <td>M</td> <td></td> <td></td> <td></td> </tr> <tr> <td>L</td> <td></td> <td></td> <td></td> </tr> <tr> <td colspan="2"></td> <td>H</td> <td>M</td> <td>L</td> </tr> <tr> <td colspan="2"></td> <td colspan="3">COST</td> </tr> </table>	I M P A C T	H				M				L						H	M	L			COST		
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Adequacy of Resource Level of Technical Support																																		
<p>⇒ The schools do not view technical support as a school level or school team issue but rather as the responsibility of IT.</p>	<p>A.5 Establish a more holistic and integrated “Information and Technology” support team at the school level consisting of the principal, library/media specialist, technology contact, Tier 1 Tech, and data entry clerk.</p>	<table border="1"> <tr><td>I</td><td>H</td><td></td><td></td></tr> <tr><td>M</td><td></td><td></td><td></td></tr> <tr><td>P</td><td>M</td><td></td><td></td></tr> <tr><td>A</td><td></td><td></td><td></td></tr> <tr><td>C</td><td></td><td></td><td></td></tr> <tr><td>T</td><td>L</td><td></td><td></td></tr> <tr><td></td><td>H</td><td>M</td><td>L</td></tr> <tr><td></td><td colspan="3">COST</td></tr> </table>	I	H			M				P	M			A				C				T	L				H	M	L		COST		
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<p>⇒ Trouble shooting guidelines are not available or provided to classroom teachers and/or school office staff.</p>	<p>A.6 A hierarchy of steps, processes, and guidelines need to be established for all BVSD staff groups outlining what steps should be taken before calling the help desk. A checklist for users would be helpful.</p>	<table border="1"> <tr><td>I</td><td>H</td><td></td><td></td></tr> <tr><td>M</td><td></td><td></td><td></td></tr> <tr><td>P</td><td></td><td></td><td></td></tr> <tr><td>A</td><td>M</td><td></td><td></td></tr> <tr><td>C</td><td></td><td></td><td></td></tr> <tr><td>T</td><td>L</td><td></td><td></td></tr> <tr><td></td><td>H</td><td>M</td><td>L</td></tr> <tr><td></td><td colspan="3">COST</td></tr> </table>	I	H			M				P				A	M			C				T	L				H	M	L		COST		
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Finding	Recommendation	Ranking																																
Efficiency of Current Methods of Delivering Service vs. Outsourcing																																		
<p>⇒ The BVSD uses FrontRange HEAT® Help Desk software to manage and track calls to the Help Desk and LANDesk to manage remote management of desktop computers.</p>	<p>A9. Explore the features of existing service management tools, such as FrontRange Heat™, and LANDesk to ensure full utilization and reduce the need to allocate onsite technical support staff. Find out why it is underutilized and systematically remove these barriers.</p>	<table border="1"> <tr><td>I</td><td>H</td><td></td><td></td></tr> <tr><td>M</td><td></td><td></td><td></td></tr> <tr><td>P</td><td></td><td></td><td></td></tr> <tr><td>A</td><td>M</td><td></td><td></td></tr> <tr><td>C</td><td></td><td></td><td></td></tr> <tr><td>T</td><td>L</td><td></td><td></td></tr> <tr><td></td><td>H</td><td>M</td><td>L</td></tr> <tr><td></td><td colspan="3">COST</td></tr> </table>	I	H			M				P				A	M			C				T	L				H	M	L		COST		
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<p>⇒ The IT department is staffed to provide support during the work day, but is not staffed to provide 24 x 7 support.</p>	<p>A7. Identify possible candidate context activities for outsourcing. Identify and quantify the risks of a service failure for these. Identify service providers and estimate costs, possibly through an RFP process. Compare outsourcing cost and risks with cost and risks of enhancing internal capabilities. Make outsourcing decisions based on cost and value.</p>	<table border="1"> <tr><td>I</td><td>H</td><td></td><td></td></tr> <tr><td>M</td><td></td><td></td><td></td></tr> <tr><td>P</td><td></td><td></td><td></td></tr> <tr><td>A</td><td>M</td><td></td><td></td></tr> <tr><td>C</td><td></td><td></td><td></td></tr> <tr><td>T</td><td>L</td><td></td><td></td></tr> <tr><td></td><td>H</td><td>M</td><td>L</td></tr> <tr><td></td><td colspan="3">COST</td></tr> </table>	I	H			M				P				A	M			C				T	L				H	M	L		COST		
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Finding	Recommendation	Ranking																							
Implementation of IT Governance Mechanisms																									
⇒ End-user and stakeholder participation/input is needed to improve the IT decision-making process. IT decisions are made in a vacuum without adequate participation from end-users or input from educators.	A8. Establish (or reactivate) the IT Steering Committee, Community Technology Advisory Committee, and/or Stakeholder Advisory Group to review various aspects of IT initiatives from the planning phase through implementation.	<table border="1"> <tr> <td rowspan="3">I M P A C T</td> <td>H</td> <td></td> <td></td> <td style="background-color: cyan;"></td> </tr> <tr> <td>M</td> <td></td> <td></td> <td></td> </tr> <tr> <td>L</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>H</td> <td>M</td> <td>L</td> <td></td> </tr> <tr> <td colspan="5" style="text-align: center;">COST</td> </tr> </table>	I M P A C T	H				M				L					H	M	L		COST				
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Mechanisms for Systemizing the Operations of the IT Department																									
⇒ Data on service metrics is not consistently collected or reported and is difficult to use for ongoing process improvement	A10. Implement the Balanced Scorecard process as a management and process improvement tool.	<table border="1"> <tr> <td rowspan="3">I M P A C T</td> <td>H</td> <td></td> <td style="background-color: cyan;"></td> <td></td> </tr> <tr> <td>M</td> <td></td> <td></td> <td></td> </tr> <tr> <td>L</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>H</td> <td>M</td> <td>L</td> <td></td> </tr> <tr> <td colspan="5" style="text-align: center;">COST</td> </tr> </table>	I M P A C T	H				M				L					H	M	L		COST				
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⇒ Communication issues are a concern of many users. In some cases, the expected information was provided but process issues prevented it from reaching all intended recipients. For example, students often identify problems, but no process exists for them to report those problems; also, no process exists to provide feedback concerning enhancement requests to the requestor. ⇒ Opportunities exist to improve project initiation, approval, management, and follow-up processes.	A11. Identify the most critical processes from the user viewpoint and review these for improvement or reengineering opportunities. Reengineer the processes that most directly impact stakeholder perceptions of IT service. Ensure that these are covered by Service Level Agreements.	<table border="1"> <tr> <td rowspan="3">I M P A C T</td> <td>H</td> <td></td> <td style="background-color: cyan;"></td> <td></td> </tr> <tr> <td>M</td> <td></td> <td></td> <td></td> </tr> <tr> <td>L</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>H</td> <td>M</td> <td>L</td> <td></td> </tr> <tr> <td colspan="5" style="text-align: center;">COST</td> </tr> </table>	I M P A C T	H				M				L					H	M	L		COST				
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2.2 Curriculum and Classroom Technology Integration and User Satisfaction

This section of the report addresses one of the key measurements of the success of any educational program or department - How well does it directly support classroom instruction and student learning? The research team explores this essential question through the four areas outlined below.

To evaluate curriculum and classroom technology integration and user satisfaction, the following focus areas were explored. The findings and



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recommendations related to these topics are presented in detail in the BVSD IT Performance Audit Report and are summarized in Table 2.

- Integration of technology to improve student learning, to promote the development of higher order thinking and information literacy skills, and to prepare students for a 21st century workforce
- Correlation of the district's "integrated" technology philosophy with the National Education Technology Standards (NETS•S)
- Technical support and management issues affecting classroom technology integration
- Leading edge, technology-based learning practices currently under way in the district

Please note that the numbering scheme in Table 2 corresponds to the numbering scheme in the accompanying PowerPoint presentation, which contains a subset of these recommendations.

Table 2. Major Findings and Recommendations ~ Curriculum and Classroom Technology Integration and User Satisfaction Report

Finding	Recommendation	Ranking																																								
<p>Use of Technology as a Tool to Improve Student Learning, Promote Information Literacy Skills, and Prepare for 21st Century Workforce</p>																																										
<p>⇒ The IT organization appears to be focused primarily on the technology infrastructure and resources rather than the "instructional and informational" technology needs of the district.</p>	<p>B1. Develop and embrace an enterprise-approach to information, communications, and technology services in support of learning for all students, staff, and community members. Prioritize professional development strategies to attain this vision systemically.</p>	<table border="1"> <tr> <td>I</td> <td>H</td> <td></td> <td></td> <td style="background-color: cyan;"></td> </tr> <tr> <td>M</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>P</td> <td>M</td> <td></td> <td></td> <td></td> </tr> <tr> <td>A</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>C</td> <td>L</td> <td></td> <td></td> <td></td> </tr> <tr> <td>T</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td colspan="2"></td> <td>H</td> <td>M</td> <td>L</td> </tr> <tr> <td colspan="2"></td> <td colspan="3">COST</td> </tr> </table>	I	H				M					P	M				A					C	L				T							H	M	L			COST		
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<p>⇒ The Instructional Technology Department offers a diverse "menu" of training possibilities and options that are well received by staff.</p> <p>⇒ The research team observed significant differences across the district regarding the use of technology as a tool to improve student learning and to prepare students for a 21st century workforce.</p>	<p>B7. Develop and implement curriculum and technology integration strategies for each instructional level (primary, elementary, intermediate, and high school) across all content areas. Identify technology competency benchmarks and reporting strategies for grades 3, 6, and 9.</p>	<table border="1"> <tr> <td>I</td> <td>H</td> <td></td> <td style="background-color: cyan;"></td> <td></td> </tr> <tr> <td>M</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>P</td> <td>M</td> <td></td> <td></td> <td></td> </tr> <tr> <td>A</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>C</td> <td>L</td> <td></td> <td></td> <td></td> </tr> <tr> <td>T</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td colspan="2"></td> <td>H</td> <td>M</td> <td>L</td> </tr> <tr> <td colspan="2"></td> <td colspan="3">COST</td> </tr> </table>	I	H				M					P	M				A					C	L				T							H	M	L			COST		
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<p>⇒ The research team observed significant differences across the district regarding the use of technology as a tool to improve student learning and to prepare students for a 21st century workforce.</p> <p>⇒ Access and use of BVSD's instructional resources is limited and fragmented.</p>	<p>B5. Identify and offer staff development strategies and resources to advance teacher skills with the integration of technology skills and the use of digital resources for teaching and learning on a daily basis across all disciplines.</p> <p>B6. Develop a Web-based clearinghouse that stores and archives the district's collection of instructional software, digital content, and internet resources and indexes them against the curriculum. (Technical barriers are addressed in the Technology Infrastructure report).</p>	<table border="1"> <tr><td>I</td><td>H</td><td></td><td></td></tr> <tr><td>M</td><td></td><td></td><td></td></tr> <tr><td>P</td><td>M</td><td></td><td></td></tr> <tr><td>A</td><td></td><td></td><td></td></tr> <tr><td>C</td><td></td><td></td><td></td></tr> <tr><td>T</td><td>L</td><td></td><td></td></tr> <tr><td colspan="2"></td><td>H</td><td>M</td><td>L</td></tr> <tr><td colspan="2"></td><td colspan="3">COST</td></tr> </table> <table border="1"> <tr><td>I</td><td>H</td><td></td><td></td></tr> <tr><td>M</td><td></td><td></td><td></td></tr> <tr><td>P</td><td></td><td></td><td></td></tr> <tr><td>A</td><td>M</td><td></td><td></td></tr> <tr><td>C</td><td></td><td></td><td></td></tr> <tr><td>T</td><td>L</td><td></td><td></td></tr> <tr><td colspan="2"></td><td>H</td><td>M</td><td>L</td></tr> <tr><td colspan="2"></td><td colspan="3">COST</td></tr> </table>	I	H			M				P	M			A				C				T	L					H	M	L			COST			I	H			M				P				A	M			C				T	L					H	M	L			COST		
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<p>Alignment of BVSD's "Integrated" Technology Philosophy with the National Educational Technology Standards (NETS)</p>																																																																						
<p>⇒ BVSD needs to adopt a well-defined set of student technology competencies for grades K-12 with IT benchmarks for grades 3, 6, and 9.</p> <p>⇒ BVSD must adapt/adopt a scope and sequence and lesson plan template for integrating technology competencies into the curriculum.</p>	<p>B2. Develop, adopt, endorse, and disseminate a formal set of student technology standards. Consider using the National Educational Technology Standards for Students (NETS•S) developed by ISTE (International Society for Technology in Education) as a starting point.</p> <p>B3. Implement a K-12 scope and sequence of technology skills so that all teachers can readily identify, understand, and assume responsibility for integrating appropriate technology skills into all content areas and/or process skills in a logical, progressive, and expected fashion.</p>	<table border="1"> <tr><td>I</td><td>H</td><td></td><td></td></tr> <tr><td>M</td><td></td><td></td><td></td></tr> <tr><td>P</td><td></td><td></td><td></td></tr> <tr><td>A</td><td>M</td><td></td><td></td></tr> <tr><td>C</td><td></td><td></td><td></td></tr> <tr><td>T</td><td>L</td><td></td><td></td></tr> <tr><td colspan="2"></td><td>H</td><td>M</td><td>L</td></tr> <tr><td colspan="2"></td><td colspan="3">COST</td></tr> </table> <table border="1"> <tr><td>I</td><td>H</td><td></td><td></td></tr> <tr><td>M</td><td></td><td></td><td></td></tr> <tr><td>P</td><td></td><td></td><td></td></tr> <tr><td>A</td><td>M</td><td></td><td></td></tr> <tr><td>C</td><td></td><td></td><td></td></tr> <tr><td>T</td><td>L</td><td></td><td></td></tr> <tr><td colspan="2"></td><td>H</td><td>M</td><td>L</td></tr> <tr><td colspan="2"></td><td colspan="3">COST</td></tr> </table>	I	H			M				P				A	M			C				T	L					H	M	L			COST			I	H			M				P				A	M			C				T	L					H	M	L			COST		
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<p>⇒ BVSD has no formally endorsed technology standards for teachers to meet when it comes to utilizing technology as a teaching tool. A draft teacher competency rubric; the 21st Century Technology Framework for BVSD Faculty, is available but has not been yet adopted by the teaching staff.</p> <p>⇒ Likewise, technology standards for administrators have not been embraced or endorsed. To be able to model, observe, and evaluate effective uses of instructional technology, administrators require strong technology foundation skills.</p>	<p>B4. Develop, adopt, endorse, and disseminate a formal set of teacher and administrator technology standards. District leadership is advised to compare the existing <i>21st Century Technology Framework for BVSD Faculty</i> to the draft NETS•T standards and consider using the revised National Educational Technology Standards for Administrators (NETS•A) when they become available.</p>	<table border="1"> <tr><td>I</td><td>H</td><td></td><td></td><td></td></tr> <tr><td>M</td><td></td><td></td><td></td><td></td></tr> <tr><td>P</td><td>M</td><td></td><td></td><td></td></tr> <tr><td>A</td><td></td><td></td><td></td><td></td></tr> <tr><td>C</td><td>L</td><td></td><td></td><td></td></tr> <tr><td>T</td><td></td><td></td><td></td><td></td></tr> <tr><td colspan="2"></td><td>H</td><td>M</td><td>L</td></tr> <tr><td colspan="2"></td><td colspan="3">COST</td></tr> </table>	I	H				M					P	M				A					C	L				T							H	M	L			COST		
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<p>Impact of Technical Support and Management Issues on Classroom Technology Integration</p>																																										
<p>⇒ No consistent, district-wide approach to providing technical or integration support to teachers was identified or observed.</p>	<p>B8. Revise job descriptions to reflect all job responsibilities, technical proficiencies, qualifications, certifications, and experience required for these positions. Define interdependencies and partnerships required between tech support and teaching staff.</p>	<table border="1"> <tr><td>I</td><td>H</td><td></td><td></td><td></td></tr> <tr><td>M</td><td></td><td></td><td></td><td></td></tr> <tr><td>P</td><td>M</td><td></td><td></td><td></td></tr> <tr><td>A</td><td></td><td></td><td></td><td></td></tr> <tr><td>C</td><td>L</td><td></td><td></td><td></td></tr> <tr><td>T</td><td></td><td></td><td></td><td></td></tr> <tr><td colspan="2"></td><td>H</td><td>M</td><td>L</td></tr> <tr><td colspan="2"></td><td colspan="3">COST</td></tr> </table>	I	H				M					P	M				A					C	L				T							H	M	L			COST		
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<p>⇒ No identified BVSD standard ratio for how many technology integration specialists are needed exists; district staff seeks guidance in this area.</p>	<p>B9. Develop a target-staffing ratio for instructional support for using technology effectively and integrating it into the curriculum based on the number of teachers and devise a strategy for achieving that goal.</p>	<table border="1"> <tr><td>I</td><td>H</td><td></td><td></td><td></td></tr> <tr><td>M</td><td></td><td></td><td></td><td></td></tr> <tr><td>P</td><td>M</td><td></td><td></td><td></td></tr> <tr><td>A</td><td></td><td></td><td></td><td></td></tr> <tr><td>C</td><td>L</td><td></td><td></td><td></td></tr> <tr><td>T</td><td></td><td></td><td></td><td></td></tr> <tr><td colspan="2"></td><td>H</td><td>M</td><td>L</td></tr> <tr><td colspan="2"></td><td colspan="3">COST</td></tr> </table>	I	H				M					P	M				A					C	L				T							H	M	L			COST		
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<p>Leading Edge, Technology-Based Learning Practices, and Critical Targets of Future Opportunity</p>																																										
<p>⇒ The Instructional Technology staff (director and two specialists) is highly regarded for their staff development efforts with current district initiatives.</p>	<p>B10. Establish guidelines and a differentiated process for implementing demonstration projects, pilot programs, and broad scale implementation.</p>	<table border="1"> <tr><td>I</td><td>H</td><td></td><td></td><td></td></tr> <tr><td>M</td><td></td><td></td><td></td><td></td></tr> <tr><td>P</td><td>M</td><td></td><td></td><td></td></tr> <tr><td>A</td><td></td><td></td><td></td><td></td></tr> <tr><td>C</td><td>L</td><td></td><td></td><td></td></tr> <tr><td>T</td><td></td><td></td><td></td><td></td></tr> <tr><td colspan="2"></td><td>H</td><td>M</td><td>L</td></tr> <tr><td colspan="2"></td><td colspan="3">COST</td></tr> </table>	I	H				M					P	M				A					C	L				T							H	M	L			COST		
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⇒ Initiatives like the use of classroom response systems (clickers) in many buildings are viewed as having a significant impact on classroom practice.	B11. Create a monitoring and evaluation rubric to assess the effectiveness, preparedness of the school/district, and feasibility of advancing each current district “pilot initiative” and/or “pockets of innovation” to determine an implementation prioritization list.	<table border="1"> <tr> <td>I</td> <td>H</td> <td></td> <td></td> </tr> <tr> <td>M</td> <td></td> <td></td> <td></td> </tr> <tr> <td>P</td> <td></td> <td></td> <td></td> </tr> <tr> <td>A</td> <td>M</td> <td style="background-color: cyan;"></td> <td></td> </tr> <tr> <td>C</td> <td></td> <td></td> <td></td> </tr> <tr> <td>T</td> <td>L</td> <td></td> <td></td> </tr> <tr> <td></td> <td>H</td> <td>M</td> <td>L</td> </tr> <tr> <td></td> <td colspan="3">COST</td> </tr> </table>	I	H			M				P				A	M			C				T	L				H	M	L		COST		
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2.3 Technology Infrastructure and Primary Technology Systems

The technology infrastructure of Boulder Valley School District (BVSD) is in the midst of significant change. This period of transformation is driven in large part by the passage of two key funding sources – the 3A Computer Replacement Referendum and the 3A Infrastructure Referendum. This investment will positively impact every school in the community. However, like any project of this magnitude, it has the potential to place tremendous additional burden on IT and the technology users district-wide. The new projects launched will be conducted by BVSD IT staff in tandem with their normal support and servicing roles. In addition, the careful navigation through the culture and the normal way of doing business will demand pin-point change management and superior customer relationship management.

Overall, it is clear that it will be tremendously valuable for everyone to brave the turmoil of change, as the rewards of a refreshed and modern technology infrastructure are becoming reality. However, the difficult balance of providing and managing the services and operational support while undertaking the sizable capital infrastructure improvement investments will be a significant challenge. The district and community has identified the need to invest in the foundation for the technology infrastructure and has provided the capital resources to address the network and end user computing devices. As the district forges on, the services and operational support needs will continue to be a challenge, as these day to day needs continue to grow and users are more dependent on the services provided by Information Technology.

In evaluating the curriculum, current state of the technology infrastructure, and primary technology systems throughout BVSD the following focus areas were explored. The findings and recommendations related to these topics are presented in detail in the BVSD IT Performance Audit Report and are summarized in Table 3.

Please note that the numbering scheme in Table 3 corresponds to the numbering scheme in the accompanying PowerPoint presentation, which contains a subset of these recommendations.



Table 3. Major Findings and Recommendations ~ Technology Infrastructure and Primary Technology Systems Report

Finding	Recommendation	Ranking																																								
<p>Network Infrastructure and Bandwidth, Adequacy of Network Design, and Adequacy of Network Capacity</p>																																										
<p>⇒ BVSD has obtained funding to support the construction of a state-of-the-art fiber-optic wide area network, which is slated to be online in 2009. The current WAN is inadequate and all users are negatively impacted. In addition, the evidence suggests that this has resulted in delaying the expansion of many network-supported instructional practices and ultimately users' avoidance leading to lack of widespread adoption of the vast number of technology initiatives that depend on the adequate communications bandwidth.</p>	<p>C1. Review immediately the capacity needs of the WAN. As a school comes online with the new Fiber WAN, utilize the network resources made available in another school to alleviate bandwidth problems. Seek refurbished equipment to reduce capital investment if additional equipment is necessary.</p>	<table border="1"> <tr><td>I</td><td>H</td><td></td><td></td><td></td></tr> <tr><td>M</td><td></td><td></td><td></td><td></td></tr> <tr><td>P</td><td>M</td><td></td><td></td><td></td></tr> <tr><td>A</td><td></td><td></td><td></td><td></td></tr> <tr><td>C</td><td>L</td><td></td><td></td><td></td></tr> <tr><td>T</td><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td>H</td><td>M</td><td>L</td></tr> <tr><td></td><td></td><td colspan="3">COST</td></tr> </table>	I	H				M					P	M				A					C	L				T							H	M	L			COST		
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<p>⇒ Standardizing the LAN infrastructure is a sound decision; however, seek E-rate internal connections funding/support for the 90% and 80% schools LAN and VoIP bond 2007 projects. E-rate will support all cabling and network switches, as well as servers used for network support and devices used to support the VoIP implementation. This could potentially save the district approximately \$1M.</p>	<p>C6. Assure BVSD is maximizing the potential of the federal E-rate program. Three schools (Sanchez, Columbine, and Halcyon) qualify for 90% discounts with E-rate. Six schools (University Hill, Emerald, Angevine, Arapahoe, Boulder Prep, and Casey Middle) qualify for 80% discounts with E-rate. For four (4) of the last nine (9) years, E-rate has funded internal connections for 80% and above schools.</p>	<table border="1"> <tr><td>I</td><td>H</td><td></td><td></td><td></td></tr> <tr><td>M</td><td></td><td></td><td></td><td></td></tr> <tr><td>P</td><td>M</td><td></td><td></td><td></td></tr> <tr><td>A</td><td></td><td></td><td></td><td></td></tr> <tr><td>C</td><td>L</td><td></td><td></td><td></td></tr> <tr><td>T</td><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td>H</td><td>M</td><td>L</td></tr> <tr><td></td><td></td><td colspan="3">COST</td></tr> </table>	I	H				M					P	M				A					C	L				T							H	M	L			COST		
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<p>⇒ Discrepancies were found between the description of the WAN and the diagram were found. Inefficiencies inherent in frame relay to ATM mappings may result in up to 20% or higher loss of data throughput (bandwidth) using this method. Also, the resulting contention on the ATM circuit well exceeds twice the capacity of the host circuit at peak load. These apparent design issues could be corrected and relieve some pressure on the WAN links for some campuses, however, the district has not taken steps to address the immediate needs and provide a short-term solution as they remain focused on the development of the new fiber WAN.</p>	<p>C7. Immediately review the Internet capacity needs with consideration of the increased short term WAN bandwidth being recommended; add additional capacity at the Internet access point.</p>	<table border="1"> <tr><td>I</td><td>H</td><td></td><td></td><td></td></tr> <tr><td>M</td><td></td><td></td><td></td><td></td></tr> <tr><td>P</td><td>M</td><td></td><td></td><td></td></tr> <tr><td>A</td><td></td><td></td><td></td><td></td></tr> <tr><td>C</td><td>L</td><td></td><td></td><td></td></tr> <tr><td>T</td><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td>H</td><td>M</td><td>L</td></tr> <tr><td></td><td></td><td colspan="3">COST</td></tr> </table>	I	H				M					P	M				A					C	L				T							H	M	L			COST		
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<p>⇒ The MGT report suggested that BVSD seek support for the WAN through E-rate by leasing the fiber deployment from an eligible telecommunications carrier. This was dismissed by identifying that the use of capital bond monies prohibits leasing and E-rate requirements are such that the school can never own the network.</p>	<p>C2. Consider leasing the school district's fiber network to an independent communications management firm for 24X7 support and potential E-Rate reimbursement, as well as time sharing the WAN with other community organization.</p>	<table border="1"> <tr><td>I</td><td>H</td><td></td><td></td></tr> <tr><td>M</td><td></td><td></td><td></td></tr> <tr><td>P</td><td>M</td><td></td><td></td></tr> <tr><td>A</td><td></td><td></td><td></td></tr> <tr><td>C</td><td></td><td></td><td></td></tr> <tr><td>T</td><td>L</td><td></td><td></td></tr> <tr><td></td><td>H</td><td>M</td><td>L</td></tr> <tr><td></td><td colspan="3">COST</td></tr> </table>	I	H			M				P	M			A				C				T	L				H	M	L		COST		
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<p>⇒ The district assumes a linear approach when implementing a myriad of technology initiatives; however, digital infrastructure requires parallel processing.</p>	<p>C3. While building out the fiber-based WAN, BVSD should also establish other working group, such as establish a portal strategy, develop active directory, develop a directory of virtual learning programs, and explore data governance/interoperability</p>	<table border="1"> <tr><td>I</td><td>H</td><td></td><td></td></tr> <tr><td>M</td><td></td><td></td><td></td></tr> <tr><td>P</td><td></td><td></td><td></td></tr> <tr><td>A</td><td>M</td><td></td><td></td></tr> <tr><td>C</td><td></td><td></td><td></td></tr> <tr><td>T</td><td>L</td><td></td><td></td></tr> <tr><td></td><td>H</td><td>M</td><td>L</td></tr> <tr><td></td><td colspan="3">COST</td></tr> </table>	I	H			M				P				A	M			C				T	L				H	M	L		COST		
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<p>Desktop HW and SW Standardization, Adequacy of Computers</p>																																		
<p>⇒ The district has adopted computer desktop standards necessary for the 3A Computer Replacement Referendum and based these standards on a single platform. The users' dissatisfaction over the adoption of the PC standard rings through loud and clear, and may be the lightning rod for many users' outward and negative expressions of IT beyond just the PC standardization decision. These negative expressions appear to be the reflection of stakeholder involvement, process, and communications failures with IT and not necessarily the end result. It is important to note that the standard-setting process has resulted in the reduction of several hundred models of desktop and laptop computers to about a dozen.</p>	<p>C8. Technology standards need to be debated, tested, agreed upon, accepted, used, and evaluated. To ensure this, a technology standards and review committee should be established that would oversee the entire process. This committee is designed to encourage participation from all district technology users groups and providers of technology.</p>	<table border="1"> <tr><td>I</td><td>H</td><td></td><td></td></tr> <tr><td>M</td><td></td><td></td><td></td></tr> <tr><td>P</td><td></td><td></td><td></td></tr> <tr><td>A</td><td>M</td><td></td><td></td></tr> <tr><td>C</td><td></td><td></td><td></td></tr> <tr><td>T</td><td>L</td><td></td><td></td></tr> <tr><td></td><td>H</td><td>M</td><td>L</td></tr> <tr><td></td><td colspan="3">COST</td></tr> </table>	I	H			M				P				A	M			C				T	L				H	M	L		COST		
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<p>⇒ While the design to relocate all servers to the data center is a sound and common practice, to be successful it requires a strong and robust connection via the network between the server location and intended users. Unfortunately, the inadequate state of the BVSD WAN connection should have overruled or delayed some of the plans for relocating application and file servers outside the individual campus.</p>	<p>C9. Temporarily refrain from adding or expanding to centralize applications, services, or servers until the severe congestion of bandwidth on the WAN has been solved.</p> <p>C10. In the long-term, develop a server and storage consolidation/virtualization strategy/plan. Include processor virtualization such as VMware or XenServer, Storage virtualization on the planned Storage Area Network (SAN) and blade servers.</p>	<table border="1"> <tr><td>I</td><td>H</td><td></td><td></td></tr> <tr><td>M</td><td></td><td></td><td></td></tr> <tr><td>P</td><td>M</td><td></td><td></td></tr> <tr><td>A</td><td></td><td></td><td></td></tr> <tr><td>C</td><td></td><td></td><td></td></tr> <tr><td>T</td><td>L</td><td></td><td></td></tr> <tr><td></td><td>H</td><td>M</td><td>L</td></tr> <tr><td></td><td colspan="3">COST</td></tr> </table> <table border="1"> <tr><td>I</td><td>H</td><td></td><td></td></tr> <tr><td>M</td><td></td><td></td><td></td></tr> <tr><td>P</td><td></td><td></td><td></td></tr> <tr><td>A</td><td>M</td><td></td><td></td></tr> <tr><td>C</td><td></td><td></td><td></td></tr> <tr><td>T</td><td>L</td><td></td><td></td></tr> <tr><td></td><td>H</td><td>M</td><td>L</td></tr> <tr><td></td><td colspan="3">COST</td></tr> </table>	I	H			M				P	M			A				C				T	L				H	M	L		COST			I	H			M				P				A	M			C				T	L				H	M	L		COST		
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<p>⇒ While most campuses understand the value Infinite Campus provides, they found the planning, implementation, and adoption experience to be the root cause of their dissatisfaction. Many point to the planning and rollout of Infinite Campus as being representative of the disconnect between IT and the campuses. Feeling that the product was purchased with the wrong justification and launched with little training and in the middle of a school year with too many bugs and defects, campuses largely feel burdened with this application.</p>	<p>C11. Investigate ways to redesign teacher interface and process in Infinite Campus to model and improve work flows resulting in increased efficiency. Begin with concrete feedback to determine priorities from teachers and administrators.</p>	<table border="1"> <tr><td>I</td><td>H</td><td></td><td></td></tr> <tr><td>M</td><td></td><td></td><td></td></tr> <tr><td>P</td><td>M</td><td></td><td></td></tr> <tr><td>A</td><td></td><td></td><td></td></tr> <tr><td>C</td><td></td><td></td><td></td></tr> <tr><td>T</td><td>L</td><td></td><td></td></tr> <tr><td></td><td>H</td><td>M</td><td>L</td></tr> <tr><td></td><td colspan="3">COST</td></tr> </table>	I	H			M				P	M			A				C				T	L				H	M	L		COST																																		
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<p>⇒ The district transitioned to a new Library Management System, thereby increasing its temporary network problem. As a result, some schools continue to use the old library system</p> <p>⇒ BVSD IT has responded quickly in investigating why the new LMS solution does not work as well as expected and has determined that an unusually large amount of data is being transferred across the network for even simple tasks, resulting in significant performance degradation. As this is a vendor provided software solution, it is not possible for BVSD to correct the situation and must rely upon the vendor to address this issue.</p>	<p>C5. Temporarily refrain from adding or expanding centralized applications and services until the bandwidth problem with the WAN has been solved.</p>	<table border="1"> <tr> <td rowspan="3">I M P A C T</td> <td>H</td> <td></td> <td></td> <td style="background-color: cyan;"></td> </tr> <tr> <td>M</td> <td></td> <td></td> <td></td> </tr> <tr> <td>L</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>H</td> <td>M</td> <td>L</td> <td></td> </tr> <tr> <td colspan="5" style="text-align: center;">COST</td> </tr> </table>	I M P A C T	H				M				L					H	M	L		COST				
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<p>⇒ It is critical for IT to become more customer-centric and service-oriented based upon a model of continuous improvement.</p>	<p>C4. Establish a Service Level Management strategy including adoption of Information Technology Infrastructure Library (ITIL) best practices throughout the BVSD IT Department including change and configuration management. In addition, include adoption of an IT scorecard.</p>	<table border="1"> <tr> <td rowspan="3">I M P A C T</td> <td>H</td> <td></td> <td></td> <td style="background-color: cyan;"></td> </tr> <tr> <td>M</td> <td></td> <td></td> <td></td> </tr> <tr> <td>L</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>H</td> <td>M</td> <td>L</td> <td></td> </tr> <tr> <td colspan="5" style="text-align: center;">COST</td> </tr> </table>	I M P A C T	H				M				L					H	M	L		COST				
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3.0 Conclusion

BVSD Information Technology Department has done a commendable job in defining and making available resources (applications) via the network to meet the district's mission. This availability stems from a clear desire by IT to service and support the schools as best as they can. Ultimately, these applications are what the users see and where their value is judged.

The BVSD IT Department finds itself in the same place as many other school districts' IT departments throughout the country, i.e., the demand for network bandwidth capacity is outpacing the ability to cost-effectively obtain it. The reasons for this conundrum are wrapped in a myriad of issues including money, centralized deployment of applications, and centralized infrastructure management. This new centralized approach has proven to be the most effective way to provide and manage the services and systems under IT's responsibility. This centralized approach of deploying applications, in addition to the continued demands of the Internet, will add more pressure on an already taxed network. This creates a difficult management decision for BVSD. Knowing there is light at the end of the network capacity tunnel through a state-of-the-art fiber-optic high-speed-network is a long term answer to the problem; however, how much will be lost as the districts users wait for this day? How much will users lose confidence in the applications they are using due to an inadequate infrastructure provided today? Is a delayed applications rollout better, or is it better to rollout the applications and not meet the users' quality of service expectations? In order to retain the users' confidence in IT's customer service, a short-term strategy must be established to balance application availability and quality of service expectations.

The current network provides access to core resources; however, the network is severely congested, causing significant delays and latency for the users. The network staff has done everything they can to maximize the utilization of the network; they have made difficult decisions on what traffic to allow or not allow. Ultimately, the inadequacy of the bandwidth in the WAN will, or has, created the appearance of inadequate applications on the network, even if these applications are the perfect solutions from a design and functionality perspective. In addition, BVSD IT needs to move into a service delivery model based on establishing service level agreements (SLAs) with the users it services. By establishing clear expectations with the stakeholders, it will provide the opportunity for IT and the stakeholder to manage the services and relationship based on measureable expectations and objectives.