

The Connected Learning Community Technology Roadmap

Introduction

Just as you can take multiple roads to reach a destination, there are multiple ways to implement technology. It all depends on how far you want to go, how much time and money you have, and where you're starting from.

Throughout this guide, you'll see how pioneering schools and school districts have successfully initiated the technology journey. This Technology Roadmap can be your guide to choosing the best route for your school or district's unique journey.

Who Can Use the Roadmap?

The Technology Roadmap is intended for the team of technology decision makers at your school or school district. This includes, but isn't limited to, the following:

- Curriculum directors
- Heads of schools
- Lead teachers
- Media specialists
- Parent-teacher associations/organizations
- Principals
- School board members
- Superintendents
- Technology committee members
- Technology coordinators
- Business and community partners

Although not all topics addressed in the Technology Roadmap will apply to every member of your technology team, reviewing the roadmap will give the team a better understanding of the components that must be considered when implementing technology in a school or district.

How To Use the Roadmap

Use the Technology Roadmap as a guide for your unique situation. If your school or district is just beginning its journey, this document will orient you to the key issues you'll face and help you hit the ground running.

If you are an experienced technology planner, you'll find helpful strategies for enhancing and expanding your current use of technology. We have included success stories from schools that have already traveled down the technology integration road, and references that will point you to resources beyond this guide.

From creating a vision and planning your network to securing funding and approval, the materials contained in the Technology Roadmap are intended to help you fulfill your school or district's particular education goals and vision.

We hope the roadmap helps you overcome the challenges of the road ahead. We encourage you to use this guide just as you would any map. Add your own notes in the margins. Mark your own route along the way.

Chapter 1

Making the Connection: Technology and Improved Education

OVERVIEW

This chapter examines technology's potential to improve learning; explores how the roles of administrators, technology coordinators, teachers, and students must change to support that potential; and provides strategies for facilitating the change process.

In a progressive society, change is constant.

Benjamin Disraeli, prime minister of Great Britain, 1874–1880

Computers and communications technology are changing the way knowledge is transmitted as dramatically as the Gutenberg printing press did in the fifteenth century. As computers revolutionize the way people process and disseminate information, they are bringing about a paradigm shift in the education process.

Destination: The Connected Learning Community

In the Connected Learning Community—Microsoft's vision for technology in education—students, teachers, parents, and communities are linked in a global environment that offers compelling new opportunities for learning.

Today, the education community has an unprecedented opportunity to move toward this vision because of two technology milestones:

- 1 The rapid and continuing evolution of the personal computer from a productivity tool into a full-fledged, accessible learning tool
- 2 The creation of the Internet, a worldwide network of learning resources easily accessible through personal computers at low cost

core elements of the Connected Learning Community

- All students and teachers have access to a computer, productivity software, and the Internet.
- Each student is empowered to pursue his or her own learning path.
- Students, parents, educators, and the extended community are all connected by technology.

Learn more about how schools are building Connected Learning Communities by visiting Microsoft's education Web site at <http://www.microsoft.com/vision/sch/default.asp>.

Those developments make it possible for students, teachers, parents, and communities to create a new learning environment of connected personal computers. In turn, that connectivity can serve as a powerful vehicle for enhancing education by providing students, teachers, parents, and the global community with unlimited information access. By using advanced networks, communications technology, and productivity tools, schools can improve administrative efficiency and transform the teaching and learning process into one characterized by interactive, collaborative, student-centered, global exploratory activities.

Validating the Impact of Technology on Education

Although an increasing body of research suggests the effective use of technology can be a catalyst for improving education, definitive results are not yet available.

Many researchers contend that effective technology use requires more sophisticated and complex instructional designs; but the more complex the design, the more difficult it is to evaluate. They believe new methods of evaluation must be developed to assess the various benefits of technology on teaching and learning. Additionally, they argue that the use of computers in the classroom requires a different style of teaching. While the focus of research has been on the effects of technology on students and the way they learn, researchers contend that more attention should be paid to the effects educational technology

has on the way teachers teach.

But educators, parents, and policymakers are not waiting around for research-based evidence: Districts and schools throughout the nation are making multimillion-dollar investments in technology. A U.S. Department of Education report notes that "[s]upport for the use of technology to promote fundamental school reform appears to be reaching a new high." Public schools have continued to make progress toward meeting the goal of connecting every school to the Internet. Indeed, schools have shown increases every year since 1994, when 35 percent of public schools were connected to the Internet. In the fall of 1998, 89 percent of public schools were connected to the Internet.¹

Technology spending for public schools was expected to reach \$5.2 billion in the 1997–98 school year, up from \$4.3 billion in the previous year. The federal government is boosting its spending for technology in public schools. In addition to the \$2.25 billion e-rate initiative, which allows enables the government to complete the hook-up of every school and library in the country to the Internet, a new \$450 million Technology Literacy Challenge helps to provide computers, software, teacher training and Internet access to poor areas.²

So, will educational technology lead to improved student achievement? Do computers have a positive impact on the way students learn and teachers teach? While these fundamental questions are yet to be definitively answered, there is mounting evidence that the answer is yes.

Research Findings

The RAND Corporation's report on the effectiveness of technology in education concludes that schools use computers in many different ways; consequently, it is difficult to draw broad conclusions concerning their effectiveness. The report suggests that researchers must examine the various ways technology is being used in education and evaluate its effectiveness on the basis of whether it helps students and teachers achieve educational goals, rather than on its impact on traditional measures of learning. The RAND report indicates that technology is being used in education for the following:

- To tutor students
- To support collaboration among students and teachers
- To facilitate acquiring educational resources from remote locations
- To aid teachers in assessment of student progress and the management of instruction
- To help students write and compute

The RAND report includes the research of James Kulik, who has spent over a decade analyzing more than 500 studies of the effectiveness of computers for instruction. These studies focused on different uses of the computer with different student populations. Kulik concluded the following:

- Students usually learn more in classes in which they receive computer-based instruction.
- Students learn their lessons in less time with computer-based instruction.
- Students like their classes more when they receive computer help in them.
- Students develop more positive attitudes toward computers when they receive help from them in school.
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Although Kulik's work provides preliminary support for the positive impact of technology on education, it is significant to note that the cases that served as the basis of his research involved instructional programs developed before 1990 that emphasized drill and practice. The use of technology in education is far more diversified today. From that perspective, Kulik's findings provide only a narrow view of technology's educational impact.

For more information on research that shows the positive impact of technology on student performance and motivation, see the article "Laptop Use and Impact in the Context of Changing Home and School Access" at <http://www.microsoft.com/education/aal/research3.asp>.

¹ <http://nces.ed.gov/pubs99/1999017.html>

² <http://www.ed.gov/PressReleases/04-2000/wh-000417d.html>

Another study, commissioned by the Software Publishers Association, summarizes the findings of research on educational technology conducted from 1990 through 1995 on a variety of instructional technology uses. It provides a picture that is more representative of current uses of technology in schools. The major findings are as follows:

- Educational technology has a significant positive effect on student achievement in all major subject areas, in preschool through higher education, and for both regular education and special needs students.
- Educational technology has positive effects on student attitudes toward learning, such as motivation and self-confidence.
- The impact of educational technology is dependent upon the following:
 - Specific student populations
 - Software design
 - Teacher's role
 - Student grouping
 - Degree of access to technology

Researchers question the usefulness of evaluating technology programs by measuring student outcomes on standardized tests. When the North Central Regional Education Laboratory (NCREL) surveyed experts about traditional models of technology effectiveness, respondents noted:

Effectiveness is not a function of the technology, but rather of the learning environment and the capacity to do things one could not do otherwise.

The reliance on standardized tests is ludicrous...Technology works in a school not because test scores increase, but because technology empowers new solutions.

By 1999, the impact of technology on education was so clear that a Department of Education conference on the subject took this impact as a given and focused on the follow-up issue of assessing the quality of education technology programs.³

Changing the Way We Teach and Learn

If research is beginning to reveal that technology, when used in innovative ways, supports the kinds of changes in curriculum, pedagogy, and organization that are critical to the improvement of schools, what does that mean for the educational community?

Technology-rich schools have shifted the educational process from teacher-centered instruction to student-centered learning, the advent of the Internet facilitating this shift to learning through exploration and investigation. In the student-centered model, teachers empower students to be responsible for their own learning and encourage them to use technology to follow individualized paths of learning. This process supports the development of lifelong learning skills that allow the students to adapt to change.

Changing Roles

To learn more about the evolution of "smart classrooms" at Blackstock Junior High School in Oxnard, California, see "Building a Connected Learning Community from the Ground Up" at <http://www.microsoft.com/education/instruction/articles/blackstockjhs2.asp>.

In a technologically advanced world, it's essential to have the skills to adapt easily to change. How can educators redefine their roles in ways that will transform schools to meet the needs of today's students—tomorrow's citizens, workers, and leaders? And how will the roles of administrators, teachers, and students need to change in order to use technology effectively?

Administrators are typically charged with implementing the change process in their domain. To support technology use, administrators will need to become facilitators, consultants, and mentors rather than top-down supervisors. As instructional leaders, they must promote new models of instruction that technology supports. And with the dramatic changes in the roles of administrators, teachers, and students that student-centered learning will require, administrators must be cognizant of the uncertainty that change

³ <http://www.ed.gov/Technology/TechConf/1999/confsum.html>

creates and facilitate the change process by providing leadership, direction, and support. Teachers who make use of cooperative learning and project-based activities will become learning coaches, no longer the "sages on the stage," the purveyors of information. Rather, they will assume the role of the "guide on the side," someone who helps students navigate through the information made available by information technology. Technology becomes the tool that assists the teacher in creating a learning environment that is interactive, collaborative, multidisciplinary, and exploratory. When students use technology as a productivity or communication tool, they will become active learners, engaging in a higher-order thinking process in order to make choices and decisions about how to gather, organize, analyze, and share information. When technology is used to engage students in performing authentic, challenging tasks, the students will cultivate initiative, design their own learning processes, and regulate their own learning pace.

Facilitating Change

Facilitating change can be a difficult task. However, the barriers to change can be overcome if a school leader is willing to create a climate that supports change. In general, a leader (whether an administrator or a teacher) should:

- Have a clear vision of technology in the educational environment.
- Provide a clear rationale for the implementation of technology.
- Communicate the school or district's vision for technology.
- Provide staff with the information they need to understand technology's merits.
- Provide numerous professional development opportunities to learn about technology.
- Explain the change process and the timelines.
- Recognize the human issues related to change.

Administrators can also promote change by creating and nurturing a small group of early technology adopters. These pioneers and their enthusiasm for new ideas are essential to build the critical mass of support necessary for technology adoption. The progress of any change effort is ultimately dependent on not only the eager and willing teachers and staff but also those who are not so eager. The two groups must work together to transform anxiety to proficiency and proficiency to mastery. Instead of thinking in the short term, both administrators and teachers must look at the bigger picture. Although this at first seems difficult, creating a clear vision for learning and setting measurable educational goals is one of the keys to success. Set your sights on what you would like to accomplish in seven years, five years, three years, and next year. Think big! Think about your learning objectives and outcomes, and find ways to use technology to assist you in achieving them. Time spent planning for long-range goals is time well spent. The rewards will be beyond what you thought possible.

To Change or Not to Change?

Computer networks and electronic mail connect teachers to one another, to students, and to homes in ways that were merely a dream five years ago. Once a level of familiarity with technology exists among faculties, shared experience and the potential of exploration may be the enticing bait that hooks everyone in the school or district. Technology is about breaking down barriers and moving beyond walls, and its use in schools will eventually bring together those who once thought isolation was the key to success.

Traveling the Integrated Technology Interstate to Improved Schools

If you recognize the powerful role that technology can play in helping schools reach their education goals, you are ready to journey on the Integrated Technology Interstate.

The Integrated Technology Interstate gives you a glimpse of how classroom teaching and learning can be transformed through technology. Traveling on Ideal Way requires that teachers and students take a more active part in the learning process: The "way" is characterized by independent learning activities, student to student interaction, cooperative learning experiences, and investigation and discovery. Beyond Ideal

Way lies the Discovery Zone, a place where children are motivated to learn through their natural inquisitiveness. There, students are active participants in the Connected Learning Community and critical thinkers who possess the skills for lifelong learning.

As you journey through *Technology Roadmap*, we offer directions, but ultimately you will choose your own path. It is our hope the roadmap provides the information necessary for your school or district to successfully reach Ideal Way.

Chapter 2

Getting Started

OVERVIEW

The first step in the technology planning journey is to identify and select a "driver." This chapter offers strategies for choosing an appropriate leader and provides road signs to mark the challenges that lie ahead. Included is practical advice for establishing a strong technology committee to serve as the driving force for the planning process.

*A leader is best
When people barely know that he exists,
Not so good when people obey and acclaim him,
Worst when they despise him,
"Fail to honor people,
They fail to honor you";
But of a good leader, who talks little,
When his work is done, his aim fulfilled,
They will all say, "We did this ourselves."
Chinese philosopher Lao-tzu, sixth century B.C.*

Selecting a Leader

If you are beginning your school or district's technology journey from "mile zero," the first step is to choose an individual to lead the planning process. Just as the success of a cross-country road trip depends in large part on who is behind the wheel, the success of your technology plan depends upon its "driver."

If you are in the process of updating an existing plan to incorporate newer technology, it is equally important to have a qualified individual lead the process. Ultimately, the success of any effort depends upon the talents, experience, personalities, vision, enthusiasm, and creativity of the people involved. Who should lead the planning process for the technology initiative depends on your school or district's unique situation and its available resources, but the following considerations are applicable for any school or district:

Tip

If you would like outside assistance in developing your technology plan, Microsoft Solution Providers (MSPs)—independent companies that work with Microsoft—offer education organizations information, technology, and support services for Microsoft products, platforms, and technologies.

Microsoft Solution Providers are well versed and up to date on the latest Microsoft strategies, development directions, and products and can round out the expertise of your technology leader by providing the following services:

- Application development
- Consulting
- Integration
- Software customization
- Technical training

To learn more about Microsoft Solution Providers, visit the Microsoft partner Web site at <http://www.microsoft.com/education/partner/resource/solprov.htm>.

Appoint from a high level. If a district-wide technology plan is being created, the district superintendent should choose the leader; if the technology plan is school-based, then the principal or his or her designee should assume the leadership role. This involvement of the highest administrators in the selection process elevates technology planning to a prominent level and ensures that a broad range of interests and needs is considered. Additionally, it gives the technology team the best chance to foster the support needed to secure funding for and implementation of a technology plan.

Decide what credentials and attributes your leader needs to have. If your priority is to motivate and mobilize an education community that may be resistant to change, choose a leader who has strong, charismatic leadership qualities and a high degree of credibility in the community. If your district places a priority on community involvement in planning efforts, consider choosing a leader from the business world. A leader from the private sector may also neutralize—or, at the least, not aggravate—internal school district politics.

Don't feel you need to choose an expert in computer and networking technologies. If your designated planning leader is an expert, that's great; consider yourself lucky. If your leader is not a technology expert, be prepared to support him or her with outside expertise. Either way, it is important that the technology leader have a clear vision of how technology can improve education.

Leadership Challenges and Strategies in the Technology Age

Once the leader is in place, the next step is to begin setting a course that takes your school or district to its intended destination with a minimum of detours. In introducing a technology plan, the leader is likely to face not only the familiar challenges related to any change process, but also significant cultural, procedural, and philosophical challenges. The following strategies are intended to assist the technology leader in overcoming those challenges:

Promote a climate that supports collaboration and innovation. An effective leader must—from the start—create an environment that supports collaboration, innovation, and experimentation by:

- *Encouraging collaboration at every step* in the technology planning and implementation process. Research shows that collaboration is one of the factors most commonly associated with improving schools, bringing about positive change, and winning approval from various constituencies.
- *Increasing opportunities for collaboration* by reorganizing staff, resources, time, and space. Teachers involved in the technology initiative should not have to "fit in" technology planning. The administrative budget should be reallocated to fund 1) joint planning periods and common planning time, 2) shared classrooms and resource rooms, and 3) support staff for classroom teachers as they take on additional planning responsibilities.
- *Creating a safety net for risk-takers*. Experimentation is unlikely to occur if risk-takers feel the leader will not support their efforts. A good leader acknowledges at the outset of a program that mistakes will be made and that valuable lessons can be learned from mistakes.

Galvanize the key stakeholders. Key stakeholders typically include parents, students, teachers, administrators, technology experts, district-level personnel, government officials, community and nonprofit organizations, the private sector, and the general public. Stakeholder groups can create innovative and strategic alliances that provide a valuable pool of diversified strengths, knowledge, expertise, and resources.

It is the technology leader's role to initiate cooperative efforts among stakeholders to leverage personal, technical, and financial resources for a project. To get stakeholders involved, the leader must:

- Develop the technology vision in collaboration with the stakeholders, not in isolation.
- Start small rather than wait until all the various stakeholders are on board to begin planning. A strong core group will bring others to the table.
- Embrace the notion of collaborative ventures to bring the technology vision to reality. Others will see the merit of the goals and work to help achieve them.

Develop a plan for sustaining leadership. The success of your school or district's technology program depends on sustained, consistent leadership that provides direction and maintains momentum throughout the planning and implementation process. Because it can take several years to bring together the funding, infrastructure, professional development, curriculum, and support elements of a successful technology program—and personnel turnover may likely occur during that time—it is critical to establish a succession of leadership plan that ensures continued support for the technology plan.

Involve a majority of teachers. How does a school get all or almost all its teachers involved in—not to mention, enthusiastic about—the technology initiative, particularly when many of those teachers have little or no experience with technology? The following are a few suggestions:

- *Create a core group of early adopters*. Take advantage of those teachers who are interested in technology and eager to learn about and use it with their students.
- *Strive to extend computer access to all teachers*. Place computers in areas where teachers have easy

access to them. If possible, implement a loan program in which teachers can check out a computer for home use on a limited-time basis. Using computers in a relaxed home setting may help teachers overcome any anxiety they feel about technology. Their increased comfort and proficiency level will, in turn, help them to see ways technology can support classroom projects.

- *Provide teachers with incentives and recognition for designing good instructional uses of technology.* Reward those teachers who are quick to undertake the challenge of using technology in innovative ways.
- *Look for candidates with successful experience in the integration of technology and curricula when hiring new teachers.*

Integrate existing technology plans. If you are developing a technology plan for your individual school site, it is important to consult first with your district. In most districts, a broader technology plan is already in place, and "piggy-backing" on that existing plan may save a lot of time, money, and other resources. There may even be district funds available to help implement your school's plan.

Knowing what the district's technology priorities are helps define the school's technology learning goals and leads to more cost-effective solutions for the entire district. With an integrated approach to systems development, each school in the district will be able to benefit from bulk purchasing agreements and an overall lower cost of implementation and ongoing support. Integrated systems based on common technologies also make future expansion and connectivity less expensive and easier to manage. State the guiding principles. The technology plan you create will be a statement of philosophy about what technologies and applications will work best in your school or district and why. Whether you are writing an initial technology plan or expanding a current one, the following are critical issues to consider:

- *Standardization.* Market-driven standards cover virtually every technical aspect of the computer industry: microchips, operating systems, computer architectures, networking protocols, and so on. Industry standards help ensure interoperability and compatibility, protect consumers against obsolescence, and reduce the costs of training and support. Similarly, using a standard computer and applications in a district or school cuts training and support costs significantly. If your school or district has no existing computer technology, there may be little or no objection to specifying standards in each appropriate category, but if some technology is in place, standards may cause short-term disruption, especially if existing equipment doesn't meet them.
- *Integrated system.* Networked computing technology can benefit all members of your teaching community, from teachers to administrative assistants. While the immediate emphasis of your technology plan may be to get computers into the classroom, a flexible, multipurpose system will better serve your district in the long run. However, a single, district-wide system may be a hard sell. Because of financial constraints, districts are often tempted to start with dedicated educational or administrative systems. Unfortunately, such cost-saving measures often cause more problems than they resolve. Who gets access to the system first? Which administrative and educational needs will be judged as critical and which will be postponed pending additional funding or time? Capabilities and access issues can easily stall your technology program in an endless series of political battles. And in the future, incompatibilities may arise between existing and new systems designed with different technologies and agendas.

How do you get around this problem? Plan on an infrastructure that can support a wide range of users across as many locations as possible given the initial funding. Integrated systems based on Internet/intranet technologies have become the leading form of information distribution in the corporate arena for two simple reasons: compatibility and scalability. Those two issues will challenge your school or district throughout its technology journey. The more you plan for flexibility at the beginning, the more benefits your school or district will realize as its system is expanded and maintained into the future.

- *Policies.* Who has the right to use the computer system? When? Under what conditions? How can you provide security against unauthorized use? You will need to establish such policies before the system is installed. The use of technology often raises difficult ethical questions. That's very much the case when it comes to personal computers and the information society. Consider your school or district's position on controversial topics such as access before they become a crisis. Your policy can then serve as a guideline—rather than a reaction—to difficult situations as they occur.
- *Safeguards on personal use.* The Internet provides—through news groups, Web sites, and other Internet locations—an exciting educational resource but one that must be handled with great care. Your students' parents will certainly want to see that your technology plan bars student access to inappropriate material. "Firewalls" or buffers that limit electronic access to your district and schools can

also limit access to objectionable materials outside them. And instead of providing "live" or direct Internet access, you can provide access only to a subset of Internet materials. Data screening services are now available, and new technologies allow you to "copy" a Web site for students to browse offline.

- *Confidentiality.* Certain information on your server, such as student health and academic records, should be private. A combination of technology and policy can prevent inappropriate access or exposure of confidential information. With advanced operating system software, such as Microsoft® Windows NT® Server, you can restrict access to authorized users and set several levels of security, allowing users to access only those parts of the system to which they have legitimate claims.
- *Intellectual property.* A school system has a special responsibility to teach young people to respect the law, including the laws of copyright and intellectual property: Copying software for home use and installing unlicensed software on school district machines are illegal.

Provide technology support for use and maintenance. A technology plan *must* include provisions for continuous on-site technical assistance and user support. Machines that do not print or computers that display a constant stream of error messages discourage technology users. Responsive assistance means not only correcting hardware or software problems in a timely fashion, but also providing "just-in-time" support to meet the skill development needs of technology users. On-site trained support staff can make the difference between a program that works and one that doesn't. Microsoft Solution Providers can help train your in-house technical support staff or provide technical support services for system maintenance and day-to-day troubleshooting.

Promote adequate and equal technology access. Technology can be the great equalizer, but only if all children have access to it; therefore your technology plan must address providing every student population in your school or district with equal access. For example, computers can help eliminate learning barriers for special needs students by providing a rich environment that is highly adaptable to their individual needs.

Seek consensus on the technology plan. Complete consensus is impossible, but the more support the plan has, the easier it will be to implement. It is important to gain as much internal and external support as possible. Communicating the technology plan early and often can boost its chances of success.

Establishing a Strong Technology Committee

The next phase of the journey involves assembling a strong technology team. Although the technology leader will drive the planning and implementation process, a hardworking and knowledgeable technology committee is essential. Committee members bring to the table a broad array of perspectives, insight, and resources and are more than just "backseat drivers"; their roles can include:

- Helping drive the planning process.
- Obtaining needs assessments in a timely way.
- Developing and reviewing the written plan, including ensuring that the plan addresses established goals and objectives and meets everyone's needs.
- Helping gain consensus for the plan from both internal and external constituencies.

Selecting the Committee Members

The technology committee should be composed of individuals from your school or district's stakeholder groups. A well-balanced technology committee would include members that represent:

- *All affected parts of the school or school district.* Include representatives from a variety of departments at both the school and district levels. Draw school-site representatives from curriculum development, administration, technology, academic and vocational education, and the media center, as well as teachers from various grade levels. If your school has computer-literate students, consider including one on the committee. Team members from the district level should include the superintendent, school board members, technology coordinators, and curriculum personnel.
- *Outside stakeholders,* especially those who can contribute resources or expertise, or whose support will be crucial to the plan's acceptance. These include parents, school board members, business leaders, college and university persons, and community representatives.

Establishing the Timeline

One of the first tasks of the technology committee is to set up milestones to mark its progress. As part of

the planning process, the committee proposes the timeline needed to implement the plan, establishing the time by which each step in the plan should be completed.

How long should the planning process take? If you were the only one you needed to satisfy, you might design your technology plan in a single afternoon. But you're not, and you won't. The hardest, most time-consuming part of planning is building consensus—or the closest thing to it—among all relevant groups. It's also the most important, because that general agreement is the foundation on which you gain approval and move ahead with implementation. So the larger and more diverse your constituencies, the longer your planning process will likely take. A single school or small district may conceivably develop a complete plan in a few weeks and implement it over the course of a few months. A medium- to large-sized district may require a year for the planning process, and several years to fully implement a technology solution that includes networked computers throughout the district.

Keep in mind that although you will need consensus from your constituents regarding your overall plan, you won't have time to reach agreement on every element of implementation. The technology leader may need to make tough decisions concerning the actual details of the plan.