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**Technology Implementation Review**

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**Grande Yellowhead Regional Division #35  
Wolf Creek Regional Division #32**

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Best Practices and Key Learnings  
with Respect to Technology, its Implementation  
and Management in Education

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The purpose of this document is to share with Alberta educators, the best practices and key learnings resulting from the pioneering efforts of Grande Yellowhead Regional Division No. 35 and Wolf Creek Regional Division No. 32 in the implementation of technology in education. The views expressed in this document are the authors perspectives as a result of a review of these district initiatives.

## **TABLE OF CONTENTS**

<b>EXECUTIVE SUMMARY .....</b>	<b>1</b>
<b>INTRODUCTION .....</b>	<b>5</b>
PURPOSE AND OBJECTIVES .....	5
SCOPE.....	6
APPROACH.....	6
<b>CASE STUDY PARTICIPANTS.....</b>	<b>7</b>
WOLF CREEK REGIONAL DIVISION NO. 32 .....	7
GRANDE YELLOWHEAD REGIONAL DIVISION NO. 35.....	9
<b>FINDINGS: BEST PRACTICES AND KEY-LEARNINGS.....</b>	<b>10</b>
TECHNOLOGY SUPPORTED SERVICES .....	10
<i>Service Delivery - Administration</i> .....	10
<i>Service Delivery – Instructional</i> .....	10
TECHNOLOGY BUILDING BLOCKS .....	12
<i>School Computers</i> .....	12
<i>Software</i> .....	12
<i>School Wiring</i> .....	13
<i>Local Area Networks</i> .....	13
<i>Wide Area Network Facilities</i> .....	14
<i>Internet Feed</i> .....	15
TECHNOLOGY MANAGEMENT.....	16
<i>Technology Planning</i> .....	16
<i>Funding</i> .....	17
<i>Procurement and Acquisition</i> .....	17
<i>Suppliers</i> .....	18
<i>Obsolescence</i> .....	19
<i>Technology Management and Support</i> .....	19
<b>TECHNOLOGY SUMMARY .....</b>	<b>21</b>
SERVICE DELIVERY .....	21
<i>Administration</i> .....	21
<i>Teaching/Instruction</i> .....	22
TECHNOLOGY BUILDING BLOCKS .....	23
<i>School Computers</i> .....	23
<i>Software</i> .....	24
<i>School Wiring</i> .....	25
<i>Local Area Networks</i> .....	25
<i>Wide Area Networks</i> .....	26
<i>Internet Feed</i> .....	27
TECHNOLOGY MANAGEMENT.....	29
<i>Technology Planning</i> .....	29
<i>Funding</i> .....	29
<i>Procurement &amp; Acquisition</i> .....	30
<i>Suppliers</i> .....	31
<i>Obsolescence</i> .....	31
<i>Technology Management and Support</i> .....	31
<i>Technology Components and Standards - GYRD</i> .....	34
<i>Technology Components and Standards- WCRD</i> .....	35

**RESOURCES .....36**

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REFERENCE MATERIAL:	36
ACKNOWLEDGMENT	36

## Executive Summary

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Many school jurisdictions in the Province of Alberta are pursuing major technology initiatives aimed at equipping their schools with modern technology infrastructures. These initiatives will lead to modern computers in the schools, the establishment of local area networks (LANs) within schools, and the interconnection of schools throughout jurisdictions via wide area networks (WANs). Technology has the potential to redefine education. The jurisdictions are being pressed to integrate technology into the learning process and to make significant improvements in the administrative processes.

Two school jurisdictions, the Grande Yellowhead Regional Division No. 35 (GYRD) with its main office in Edson, Alberta, and the Wolf Creek Regional Division No. 32 (WCRD), with its main office in Ponoka, Alberta, have been actively implementing regional network technology in their schools. They have succeeded in making a major improvement in teaching while reducing the cost of administration. Each is a leader in this effort employing distinctive philosophies, and implementation strategies; using internal resources that have evolved over many years. These jurisdictions have invested heavily in technology and have an enthusiastic teacher community that is making excellent use of the investment.

The purpose of this study is to conduct a review of the technology in both jurisdictions, with the objective of:

1. investigating the technology planning, installation and management processes in GYRD and WCRD;
2. investigating the technology components present in GYRD and WCRD; and
3. identifying best practices, and identifying pitfalls, issues, and key-learnings, using GYRD and WCRD as case studies.

Although both jurisdictions have made excellent progress in applying the technology in their curriculum, the study did not examine the impact of technology on education. Curriculum impact is beyond the scope of the study.

Information was gathered for this study by:

- reviewing planning and technology documentation from each jurisdiction;
- interviewing the managers responsible for technology in each jurisdiction;
- touring technical sites and selected schools in each jurisdiction; and
- holding discussions with school staff and administrators.

The study findings are summarized in the following five themes:

**Theme One: Technology Integration in Education ... the ultimate goal is to integrate technology into a student's educational experience making it as familiar to them as other traditional skills such as handwriting .....**

- ⇒ Technology has had a dramatic impact on the education process at all grade levels. Although it is a difficult and time-consuming transition for some teachers to develop the necessary skills to allow them to integrate technology into the curriculum, the potential is high.
- ⇒ Effective technology integration is dependent on reliable, well maintained and supported equipment and software.
- ⇒ Networking and wide-area communications are key components of exploiting computer technology in school jurisdictions. Deployment must focus on making networked computers widely available to all students and staff.
- ⇒ Applications, made available to staff and students, must reflect an array of software and digital reference resources including access to the Internet.

- ⇒ Technology integration in instruction should be a primary strategy and stated goal of every jurisdiction. Teacher use of technology should be a key aspect of a jurisdiction's technology integration strategy.

**Theme Two: Technology and Administration...** *by streamlining administrative processes with technology, the amount of time spent doing administrative tasks is reduced in favor of more time with students ...*

- ⇒ A network can streamline administration processes through the deployment of centralized, automated administrative services and applications (e.g. student records and financial systems), electronic-mail, document management services, and centralized access to public documents.

**Theme Three: Technology Planning and Management ...** *network technology is complex ... management of the resource is critical and should not be underestimated....*

- ⇒ Technology planning and coordination should be done centrally and take a district wide perspective to be effective. Technology in the jurisdiction should be implemented in a planned and coordinated manner according to a central release strategy.
- ⇒ There should be clearly defined roles for principals, teachers, administrators, and technology personnel in planning, coordination, management, and implementation of a jurisdiction's technology.
- ⇒ Standardization is critical to cost-effective, efficient technology and network management. Jurisdictions should adhere to stringent standards with respect to network technologies, core administrative and instructional software packages, and workstation technologies.
- ⇒ Jurisdictions should adopt an enterprise-wide, network management approach to their wide and local area networks.

**Theme Three: Funding and Fiscal Management of Technology...** *there is a cost of ownership associated with technology, this needs to be recognized and managed accordingly....*

- ⇒ Some estimates place the cost of the original computer at only 40% of the actual cost of implementation. The rest can be attributed to networking, software, in-service training and building modifications. This concept needs to be recognized and appreciated by school jurisdictions.
- ⇒ The cost of technology is not a one-time expense. There are down-stream costs that must be considered, planned for and funded. These costs include the support and maintenance of networks, hardware, software and users.
- ⇒ Jurisdictions should recognize the long term nature of technology investment and make provision for the continual support and modernization.
- ⇒ To effectively maximize a jurisdiction's investment in technology, there should be a central technology group with the authority to allocate fiscal and other resources for developing, maintaining and evolving the technology of a jurisdiction.
- ⇒ The number of variables in the technology should be limited so that a jurisdiction can reduce the technical management of the technology. This is again an issue of minimizing the cost of ownership by minimizing required technical support.

**Theme Five: Telecommunications Infrastructure ...** *efforts to bring global information resources to Alberta students, requires access to telecommunications solutions for both urban and rural schools...*

- ⇒ Jurisdictions should investigate available telecommunications solutions to connect rural schools onto central backbone networks. These include:
- un-serviced copper pair technology, which has proven to be a stable and cost effective solution;

- deployment of synchronous data compression modems with analog lines, for remote schools, where Switch 56 technology is not available;
  - fibre optics, when buildings and schools are in close proximity and there are no physical right of way issues;
  - the Alberta Government telecommunications network, for the wide area component of the network; and
  - existing CATV corridors and wireless media, for interconnecting communities.
- ⇒ Both jurisdictions felt that over the long term, the province should examine the deployment of a scaleable province wide learning network, as recommended in Alberta Education's "Framework for Technology Integration in Education." They felt it should be an integrated network with an architecture that will allow jurisdictions to build WANs and also provide province wide connectivity. The success that Grande Yellowhead has had in utilization of the Government AGNpac, supports this observation.



## Introduction

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Many school jurisdictions in the Province of Alberta are pursuing major technology initiatives aimed at equipping their schools with modern technology infrastructures. These initiatives will lead to modern computers in the schools, the establishment of local area networks (LANs) within schools, and the interconnection of schools throughout jurisdictions via wide area networks (WANs). Technology has the potential to redefine education. The jurisdictions are being pressed to integrate technology into the learning process and to make significant improvements in the administrative processes.

Two school jurisdictions, the Grande Yellowhead Regional Division No. 35 (GYRD) with its main office in Edson, Alberta, and the Wolf Creek Regional Division No. 32 (WCRD), with its main office in Ponoka, Alberta, have been actively implementing regional network technology in their schools. They have succeeded in making a major improvement in teaching while reducing the cost of administration. Each is a leader in this effort employing distinctive philosophies, and implementation strategies; using internal resources that have evolved over many years. These jurisdictions have invested heavily in technology and have an enthusiastic teacher community that is making excellent use of the investment.

The experience gained in GYRD and WCRD is of value to other jurisdictions in the Province, that are undergoing similar technology initiatives.

### ***Purpose and Objectives***

The purpose of this study is to conduct a review of the technology in both jurisdictions, with the objective of:

1. investigating the technology planning, installation and management processes in GYRD and WCRD;
2. investigating the technology components present in GYRD and WCRD; and
3. identifying best practices, and identifying pitfalls, issues, and key-learnings, using GYRD and WCRD as case studies.

Although the study did not examine the use of technology in detail, both jurisdictions have a detailed three year plan that ties the expansion and upgrade of technology to the curriculum objectives issued by Alberta Education. Furthermore, the technology infrastructure that has been implemented is viewed in both jurisdictions as pivotal to planned improvements in education and are fundamental to equipping students to meet the challenges of the modern world.

Other Alberta Education documents that address the use and management of information technology in an educational setting include Alberta Education's:

- ⇒ "Framework for Technology Integration in Education;"
- ⇒ "Information Technology Guiding Principles;"
- ⇒ "Handbook for School Board Technology Planning;"
- ⇒ "Implementation Plan for Technology in Education;" and
- ⇒ "Meeting the Challenge IV: Alberta Education Business Plan (1997/1998 - 2000)."

These are required readings for technology managers and committees in provincial jurisdictions.

This study is not a substitute for these documents. Rather it is intended to augment the information provided in these documents with an account of how technology is being successfully implemented, managed and integrated in two Alberta school jurisdictions.

## **Scope**

For the purposes of this study, technology refers to using computing technology and telecommunications in the support of administrative and instructional goals.

The study examined the following aspects of each jurisdiction's technology infrastructure:

- ⇒ each jurisdiction's wide and local area network design;
- ⇒ a review of the major technology building blocks;
- ⇒ the procurement procedures within each jurisdiction, with respect to technology;
- ⇒ the ongoing service and support infrastructures of each jurisdiction;
- ⇒ the funding mechanisms employed by the jurisdictions;
- ⇒ the options explored with respect to distance sensitivity;
- ⇒ the information technology planning process in each jurisdiction; and
- ⇒ the nature of any technology partnerships, and alliances.

The study did not include a review of how the jurisdictions are managing voice communications. The study also did not consider how business and/or educational applications are being utilized in the jurisdictions to support educational and administrative functions.

## **Approach**

The focus of this study was on documenting best practices and key-learnings with respect to technology, its implementation, and management in education. These findings are presented in the main body of this report.

The last section of the document includes a descriptive summary of each jurisdiction's technical infrastructure. The summary was compiled as a means to extract best practices and key-learnings. It is not exhaustive nor should it be considered all-inclusive. It does not represent an audit of the technology in place in the jurisdictions. The summary is provided as a supplement and is included in the document as an additional technical reference for the reader.

Information was gathered for this study by:

- ⇒ reviewing planning and technology documentation from each jurisdiction;
- ⇒ interviewing the managers responsible for technology in each jurisdiction;
- ⇒ touring technical sites and selected schools in each jurisdiction; and
- ⇒ holding discussions with school staff and administrators.

## Case Study Participants

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GYRD and WCRD were selected for this review because of their work in the area of technology implementation and integration. Their technology is stable, and has been successfully integrated into both instructional and administrative processes.

### ***Wolf Creek Regional Division No. 32***



Wolf Creek Regional Division (WCRD) is a rural division centered on the Highway 2 corridor just north of Red Deer. WCRD was formed in 1995 when the operations of the County of Ponoka No. 3 Board of Education and the County of Lacombe No. 14 Board of Education were merged under Alberta Education's regionalization program. The division is roughly rectangular in shape and extends approximately 65 kilometers north to south and 120 kilometers east to west. The jurisdiction has 29 school sites, a regional administrative site located in Ponoka, and a secondary administration office located in Lacombe. The following communities are served by the division: Ponoka, Lacombe, Rimbey, Bentley, Eckville, Blackfalds, Clive, Mirror, and Alex.

The two boards, prior to amalgamation, had significantly different approaches to technology deployment and integration.

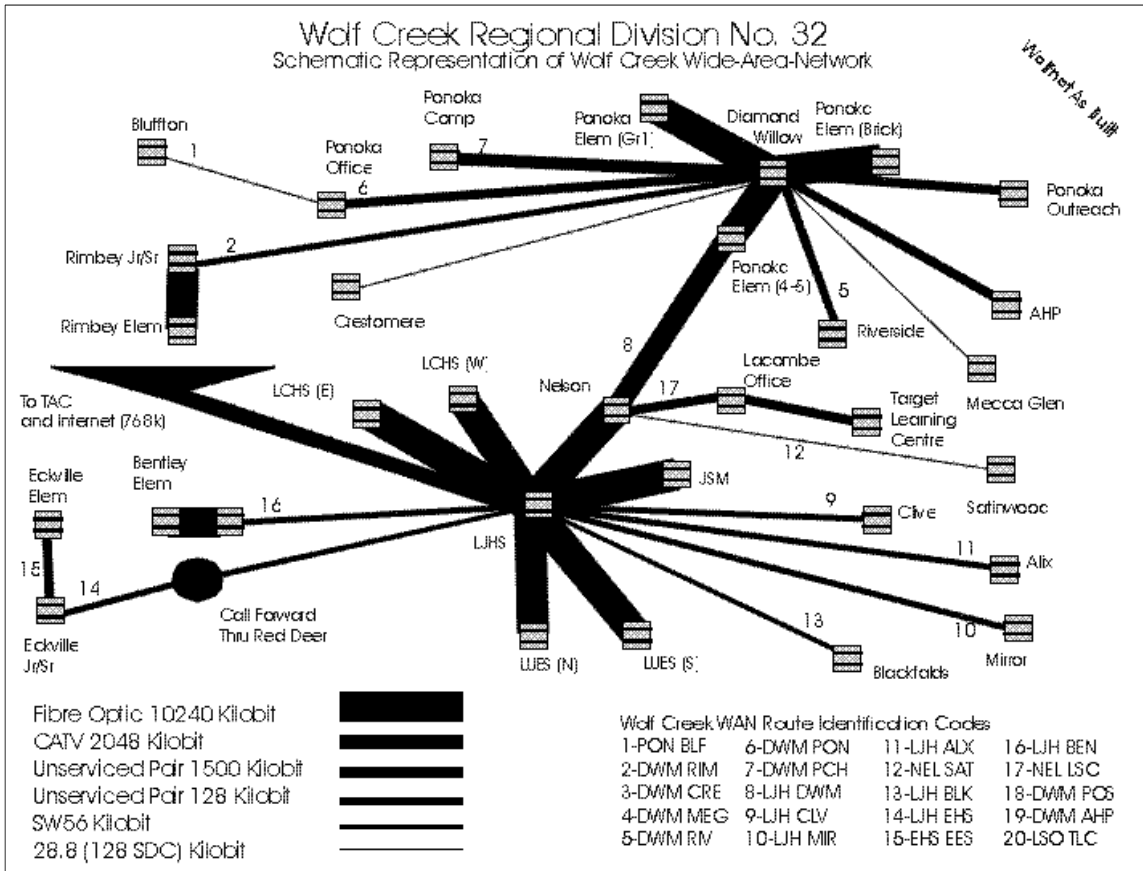
In the former Lacombe school district, networking and wide-area communications were recognized early as the key components of exploiting computer technology for both instruction and administration. Most teachers were introduced to technology through the use of electronic mail. Use of E-mail in the district dates back to 1988 when schools throughout the district were linked with a dial-in electronic mail system. This early experience with highly useful, and simple to use, technology has increased teacher awareness of opportunities to use the technology in teaching. Use in the classroom now includes research via the Internet and productivity software integration in many curricular areas. Students also use technology in concentrated, extended periods for project work.

Initial planning for a wide area network (WAN) for the district began in 1991 when the district set a goal of linking all computers in the district on one network. Intensive research for the network began in 1993. Actual work on the WAN began in 1994. The first wide area link became operational that year. Prior to regionalization, virtually every classroom in the Lacombe district had network access.

The former Ponoka district did not have a similar networking infrastructure. However, within six months after merging operations, the network and electronic communications system had been extended into all school offices throughout WCRD. Work continues on extending networked computers into every classroom and upgrading older technology. There is also a concerted effort to ensure teachers are familiar with technology and are equipped to use it in the classroom.

Technology integration has been a primary objective of the jurisdiction since regionalization. WCRD is in the process of reestablishing technology standards and practices to effectively manage its multi-million dollar technology investment.

WCRD operates an Intranet, named Wolfnet, which interconnects all division facilities with the exception of four Hutterite Colony schools. Hutterite colony teachers, however, have been provided remote Wolfnet access. The following schematic illustrates Wolfnet's current telecommunications infrastructure.



Schematic 1: Wolfnet

## **Grande Yellowhead Regional Division No. 35**



Grande Yellowhead Regional Division (GYRD) No. 35 is a rural division covering a geographical strip from Jasper to Grande Cache to Evansburg. It represents the amalgamation of three school jurisdictions: the former Yellowhead School Division, and the smaller Jasper and Grande Cache School Divisions.

In May, 1995, the GYRD School Board approved the GYRD Technology Concept Plan. This plan laid the foundation for the development of a communications network to service curricular and administrative applications. Concept planning, including community presentations occurred over a two-year period prior to the May, 1995 approval. Phase I of GYRD's technology rollout started in June 1995 with an additional capital investment of approximately \$2.5 million.

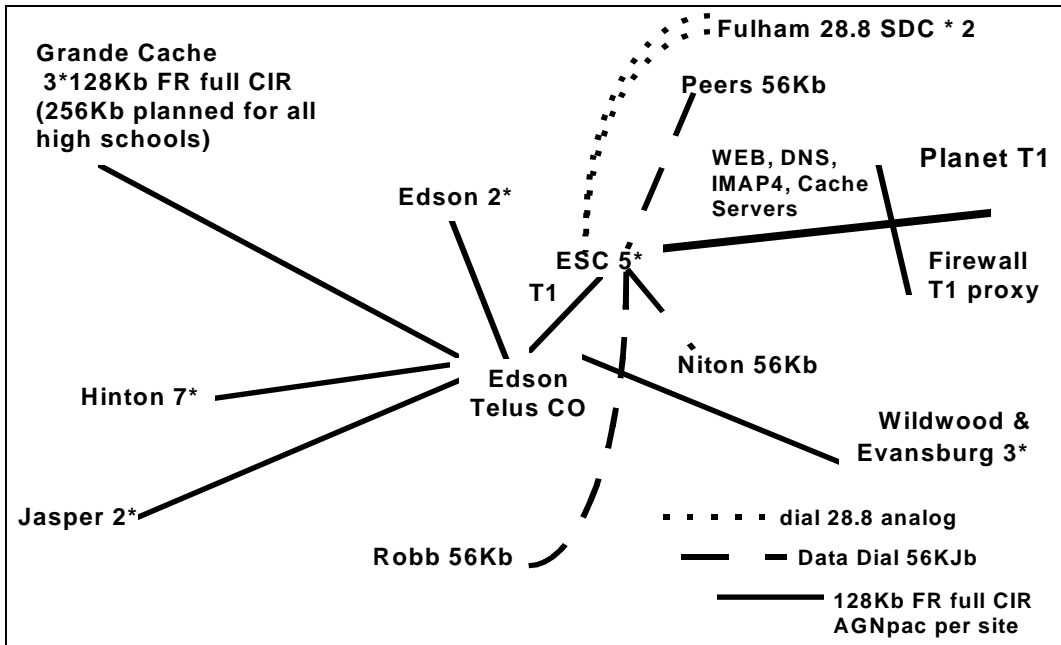
The Grande Yellowhead teaching staff are rapidly expanding their use of technology in the classroom. They have made digital resources available throughout the jurisdiction on demand to make information on CDs more available, are teaching basic computer skills, making library lookup possible in the classroom.

GYRDnet currently connects 30 buildings and incorporates 1,100 Windows-based personal computers, 40 file and/or application servers, and 7,500 partnered students (including both the Sundance Regional Separate Division No. 10 and GrandeYellowhead Regional Division). The network extends 340 kilometers from end-to-end and includes the communities of Grande Cache, Jasper, Hinton, Edson, Robb, Niton, Peers, Fulham, Wildwood, and Evansburg; and also services community libraries and community learning societies in the west Yellowhead corridor.

Phase II, of GYRD's technology rollout, will be completed in mid 1997. It will involve replacing 600 stand-alone Macintosh computers, in GYRD elementary schools, with 600 networked Windows-based personal computers. When phase II is completed, the number of networked Windows-based computers in the jurisdiction will be approximately 1,700 connecting to 50 file and/or application servers. At that point GYRDnet will reflect a projected capital investment of \$8 million, and will better ensure equity of access to all students regardless of school size or community.

GYRD's Intranet, GYRDnet, interconnects all division facilities and schools in the jurisdiction. The following schematic illustrates GYRDnet's current telecommunications infrastructure.

GYRD was chosen as a "pilot" jurisdiction to examine the advantage of using AGNpac, the Government of Alberta communication network as the carrier for a large part of their WAN (see diagram below). This arrangement has proven to be extremely effective, stable and scaleable. Although formal rate structures have not been established for these facilities, it is expected that rates will be ten to fifty percent of standard commercial rates for the equivalent facilities. These dramatic improvements are possible because it affords the ability to share facilities between departments. PWSS is currently examining further expansion of the network to other education stakeholders.



Schematic 2: GYRDnet

## Findings: Best Practices and Key-Learnings

The objective of this study was to identify best practices and key-learnings with respect to technology, its implementation and management in an education using GYRD and WCRD as case study models.

In this section best practices, and key-learnings are presented. Where appropriate, a cross-reference to the appropriate section of the Technology Summary has been provided for readers wanting to understand more fully the details of the technology.

### Technology Supported Services

#### Service Delivery – Administration

*Networking and wide-area communications are key enablers which dramatically extend the usefulness of computer technology in schools.*

The following observations, with respect to integrating technology into administration processes, were made.

⇒ Both school jurisdictions have taken advantage of their wide area network infrastructures to interconnect administration offices throughout their jurisdictions. As a result of this strategy, each jurisdiction has introduced district wide electronic mail and administration systems (e.g. student record systems, financial systems, etc.).

The following best practices, with respect to integrating technology into administrative processes, are detailed.

1. Electronic mail should be rolled-out to every employee of a jurisdiction and correspondence via electronic mail should be established as the primary communications vehicle within the jurisdiction;

2. Jurisdictions should take advantage of networking to integrate standardized student records and financial systems across the jurisdictions;
3. Jurisdictions should take advantage of networking to automate central services like:
  - ⇒ remote generation of technology work orders and maintenance orders;
  - ⇒ Education Information Exchange (EIE) add/change requests;
  - ⇒ transportation requests;
  - ⇒ month end reports from schools; and
  - ⇒ purchase orders.
4. Jurisdictions should utilize a web server, as an electronic document repository, to distribute internal and external corporate documents.

(Technology Summary - Page 21)

### **Service Delivery – Instructional**

*Technology integration in instruction should be a primary strategy and stated goal of every jurisdiction.*

*Teacher use of technology is a key strategy for successfully integrating technology into instruction.*

The following observations, with respect to integrating technology into instructional situations, were made.

- ⇒ Both jurisdictions acknowledge technology integration as primary strategies in their districts.
- ⇒ The study found that each jurisdiction has approached the issue of technology integration differently, particularly as it relates to the placement of computers. Wolf Creek has put more front end emphasis on computers in classrooms rather than in labs.
- ⇒ Teachers become more proficient with technology when they are afforded access to and gain utility from applications like electronic mail, administrative applications, and Internet resources.

The following best practices, with respect to integrating technology into instruction, are .

1. Jurisdictions should deploy technology as close to teachers as possible (see best practices - Computers in Schools).
2. Electronic mail, Internet access and key administrative applications should be made available to teachers throughout the jurisdiction.

(Technology Summary - Page 22)

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## Technology Building Blocks

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### School Computers

*The ultimate goal is to integrate technology into a student's educational experience making it as familiar to them as other traditional skills such as handwriting.....*

The following observations, with respect to deploying computers in schools, were made.

- ⇒ It is appropriate to deploy computers in laboratory settings if a jurisdiction's goals are to develop basic computer operating skills, to provide access for computer based project work, and to enable whole group learning activities.
- ⇒ A distributed model (i.e. computers in each classroom) works best when basic computer skills are already developed and the goal is to integrate computers into instruction and to develop technology application skills.
- ⇒ A jurisdiction, deploying a limited number of computers in schools, should first consider the deployment of computers in centrally located laboratories and meeting places. After the initial deployment, jurisdictions should deploy additional computer technology into the classrooms.

The following best practices, with respect to deploying computers in schools, are:

1. Computers should be readily available to students and teachers. Computer facilities in schools should be designed to be multi-use and freely available. Key strategies for deploying computers should include the eventual deployment of computers on to teachers' desktops.

(Technology Summary - Page 23 )

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### Software

*Standardize the core administrative and instructional software packages and implement software technology in a controlled manner according to a release strategy.*

The following observations, with respect to software, were made.

- ⇒ Software represents the most variable aspect of a jurisdiction's technology. It has the potential for unnecessarily increasing hardware, network and technology management costs.
- ⇒ Cost advantages are realized by choosing one standard for a particular type of software.

The following best practices with respect to software management are:

1. Jurisdictions should standardize the core administrative and instructional software packages.
2. Jurisdictions should implement new software technology in a controlled manner according to a release strategy that takes into account the hardware capabilities in the jurisdiction and the jurisdiction's instructional and administrative needs.

(Technology Summary - Page 24)

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## School Wiring

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*Wiring in schools should adhere to EIA/TIA standards.*

The following observations, with respect to school wiring, were made.

- ⇒ Both jurisdictions used internal technical resources to complete school wiring as opposed third party contracted resources. Using in-house resources was determined to be a cheaper alternative to outsourcing the wiring to a third party. The jurisdictions had better quality control over the final product.
- ⇒ A significant issue for the jurisdictions, with respect to school wiring, relates to the age of school buildings, that have undergone several renovations over the years. There have been problems in finding continuous conduit paths, lengths of cable runs, and finding appropriate secure space for network closets.

The following best practices, with respect to school wiring, are:

1. Schools should deploy category 5 wiring. Category 5 wiring will support a variety of speeds including 10 MB Ethernet, 100 MB Ethernet, and ATM.

(Technology Summary - Page 25)

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## Local Area Networks

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*Jurisdictions should adopt an enterprise-wide network management approach, from a central location, for local area network management.*

Jurisdictions, particularly those choosing to manage local area networks in remote locations, should adopt an enterprise-wide network management approach to local area network management. This allows the central technical group to take advantage of technologies that enable:

- ⇒ central management of user and server access; and
- ⇒ central management and diagnosis of network hardware.

The enterprise wide management approach, should include the following best practices:

1. adopting a static IP addressing scheme, that enables technology support staff to trace transmissions back to specific workstations;
2. adopting Internet protocol (IP) throughout the network;
3. adopting a standard local area network server configuration in each school;
4. establishing a series of global directories that are centrally managed;
5. standardizing to a minimum number of manufacturers for all network components from the network interface cards to the routers; and
6. minimizing the types and versions of network operating systems.

(Technology Summary - Page 25)

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## Wide Area Network Facilities

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*Un-serviced copper pair technology has proven to be a stable and cost effective alternative.*

*For remote schools, where Switch56 technology is not available, consider deploying synchronous data compression modems with analog lines.*

*Fibre optics is the best alternative when buildings and schools are in close proximity and there are no physical right of way issues.*

*Investigate the potential of interconnecting communities via CATV.*

*Investigate the potential of connecting onto the AGNpac. The network has proven to be very stable and scaleable.*

The following observations, with respect to access facilities, were made.

⇒ With respect to the first switching point from the schools to the wide area network, both jurisdictions have found un-serviced copper pair technology to be cost effective and stable. This technology has distance sensitivity limitations however, that only make it a suitable alternative for transmission distances of less than 5.5 kilometers.

⇒ Where better bandwidth technologies are not available, analog and Switch56 technology is being used to provide service to remote rural sites in both jurisdictions. Router compression has proven to be an effective strategy to increase service bandwidth.

⇒ Both jurisdictions deploy synchronous data compression modems with analog lines in remote schools. In addition, a dual facility with router load balancing allows a greater number of users. This has proven to be a workable alternative for linking remote schools on to the wide area network.

⇒ With respect to a backbone network, WCRD has laid its own fibre optic cable in Lacombe, Ponoka, Bentley and Rimbey. Fibre optics is used to connect schools in close proximity in a school campus model. It is also being used to connect network closets inside buildings. It has proven to be a cost-effective alternative that provides significant bandwidth growth potential for the jurisdiction.

⇒ WCRD has implementing a CATV connection between its Lacombe and Ponoka hubs. This alternative is relatively inexpensive and provides more bandwidth than the traditional T1 solution. The use of CATV cable is possible because Lacombe and Ponoka are situated on a major cabling corridor for Videotron.

⇒ GYRD's current WAN technology is connected via the provincial telecommunications network (AGNpac). The network has proven to be very stable and scaleable. The jurisdiction has requested scaleable bandwidth to AGNpac based on current traffic. This AGNpac subnet has the potential of scaling to full T1 with switches in each school. Pricing of AGNpac facilities has not been established but it is expected that they will be ten to fifty percent of those of comparable commercially available facilities. Dramatic cost improvement is possible through sharing facility usage with other public sector organizations.

With respect to wide area networks, the following are best practices where appropriate.

1. Jurisdictions should investigate available telecommunications solutions to connect rural schools onto central backbone networks. These include:
  - un-serviced copper pair technology, which has proven to be a stable and cost effective solution;
  - deployment of synchronous data compression modems with analog lines, for remote schools, where Switch56 technology is not available;

- fibre optics, when buildings and schools are in close proximity and there are no physical right of way issues;
  - the Alberta Government telecommunications network, for the wide area component of the network; and
  - existing CATV corridors and wireless media, for interconnecting communities.
2. Where possible, jurisdictions should switch, not route, network traffic.

(Technology Summary - Page 26)

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### Internet Feed

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*Internet access on the network has to be effectively planned and managed to ensure that it is available as required for instructional and administrative purposes.*

*Jurisdictions should consider deploying proxy cache servers to reduce unnecessary Internet traffic on the wide area network.*

*Headend Internet filtering is preferable.*

*Jurisdictions should implement headend Internet viruses protection.*

*Jurisdictions should adopt a private addressing scheme with an IP proxy via a firewall.*

The following observations, with respect to the Internet facilities, were made.

- ⇒ In both jurisdictions Internet usage continues to grow across the jurisdiction.
- ⇒ Internet access is having an impact on the bandwidth requirements of the current wide area networks.
- ⇒ The following issues with respect to managing the Internet in jurisdictions were observed:
  - Internet Service Providers can be reactive;
  - there is an increasing dependence in schools on the Internet leading to a greater demand being placed on the reliability of the Internet feed; and
  - there is a need for Internet Service Providers to be able to provide reports on the changing nature of Internet usage.

The following best practices, with respect to managing the Internet, are:

1. In order to reduce unnecessary traffic between the Internet service provider and the Internet head-end site, jurisdictions should implement browser cache servers (e.g. HTTP proxy cache server, and other function cache servers like PointCast). This strategy should consider installing a head-end cache server first with a potential of cascading cache servers to the schools.
2. Head-end Internet filtering is preferable. This reduces issues with multiple client operating systems. This also provides the jurisdictions with the ability to filter school based computers based on Internet addressing.
3. Jurisdictions should implement head-end Internet virus protection.
4. Jurisdictions should adopt a private Internet addressing scheme with an IP proxy via a firewall.

(Technology Summary - Page 27)

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## Technology Management

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### Technology Planning

*Technology planning and coordination should be done centrally and take a district wide perspective to be effective.*

*There should be clearly defined roles for principals, teachers, administrators, and central technology support personnel in technology planning and management processes.*

*The technology plan should identify an implementation strategy that reflects a systematic approach to technology deployment.*

The following observations, with respect to technology planning, were made.

- ⇒ A formal technology planning process, with user involvement, formalizes the commitment to integrate technology throughout the jurisdiction. It also increases awareness.
- ⇒ A key to successful technology planning is to understand the jurisdiction's instructional and administrative requirements. Both jurisdictions judge the effectiveness of their technology on the ability of users to work with and benefit from the technology and less on the technical capability of the equipment.
- ⇒ Advancing technology in a jurisdiction requires an identified technology champion who has the understanding, vision, drive, and the mandate to push a jurisdiction's technology forward. Successful technology deployment and integration is dependent on strong leadership and board support.
- ⇒ A jurisdiction, just starting a technology strategy and roll-out, without a resident technology expert or champion, would likely have to rely on outside help to create a technology vision, strategy, management framework and implementation plan for the jurisdiction.
- ⇒ A highly integrated and stable technology infrastructure is not typically successful if deployed as a "one-shot" investment strategy. Stability and integration occur through continuous improvements and deployments.
- ⇒ As technology integration progresses in a jurisdiction, user awareness and teacher activism increases. In the past, the central technology groups in each jurisdiction promoted technology innovation into the jurisdiction's schools; now teachers and administrators are requesting further technology deployments from the central technology group often at a level that out strips the central site's ability to provide it.

Based on these observations, the following best practices with respect to technology planning are:

1. A jurisdiction's technology planning and coordination should be done centrally and take a district wide perspective to be effective, equitable and manageable.
2. A jurisdiction should clearly define roles for principals, teachers, administrators, and the central technology support personnel in the technology planning and management processes.

3. A jurisdiction should assign a technology leader who is responsible and accountable for technology planning and deployment in the jurisdiction.
4. Maintenance and long-term support of the technology infrastructure should be considered in any technology deployment strategy.
5. A technology plan should identify an implementation strategy that reflects a systematic approach to technology deployment and reflects at least a three-year time horizon.

(see the Technology Summary page 29)

### Funding

*Some estimates place the cost of the original computer at only 40% of the actual cost of implementation. The rest can be attributed to networking, software, in-service training and building modifications.*

*The cost of technology is not a one-time acquisition expense. There are down-stream costs that should be considered, planned for and funded. These include: support and maintenance of network, hardware, software and users.*

The maintenance and on-going support of a complex technology network requires adequate funding and an effective decision making process. Each jurisdiction, however, has different technology funding mechanisms.

⇒ In GYRD there is a formal allocation of funding for technology integration. This appears to work well and supports effective decision-making.

⇒ Within WCRD this has not been the case and it has constrained progress. This has been recognized by the jurisdiction and is currently being addressed as part of the three-year technology planning process.

Based on these observations, the following best practices, with respect to technology funding, are:

1. To effectively maximize a jurisdiction's investment in technology, there should be a central technology group with the authority to allocate fiscal and other resources for developing, maintaining and evolving the technology of a jurisdiction.
2. Long range fiscal planning should ensure that jurisdictions maximize external grants.

(see the Technology Summary page 29)

### Procurement and Acquisition

*The trend is towards a wholesale replacement of workstations on a scheduled basis from a single vendor with very few workstations being purchased between major purchases.*

The following observations, with respect to technology procurement and acquisition, were made.

⇒ The more fragmented a jurisdiction's technology purchasing pattern, the wider the variety of equipment in use. The wider the variety of equipment in use, the higher the service and support costs become.

- ⇒ When purchasing is done at a school-based level, the central technology group is often left to respond to individual school-based technology purchasing requests. Consequently, the purchasing process is repeated. This results in an inefficient use of managerial time and fails to take advantage of economies of scale.
- ⇒ When technology purchases are funded from multiple budgets, the internal accounting functions required to track and reconcile technology expenditures and budgets can be time consuming and cumbersome.

Based on these observations, the following best practices, with respect to technology procurement and acquisition, are:

1. Hardware and software acquisition should be planned and managed on a jurisdiction wide basis, and within the context of the provincial technology directions, standards and guidelines. The acquisition process should be sufficiently responsive to meet school needs.
2. The central technology group should be involved in the acquisition process in order to ensure that effective standards are set, and kept up to date.
3. Technology purchases should occur on a scheduled basis, from a minimum number of vendors.

(see the Technology Summary page 29)

### Suppliers

*There are different skill sets required to support different technology products, therefore mixing products increases the risk of higher support costs.*

The following observation, with respect to technology suppliers, was made.

- ⇒ It is difficult to sustain a highly variable technical environment. There are specific skill sets required for different technologies, therefore mixing products has the risk of increasing support costs.

Based on these observations, the following best practices, with respect to technology suppliers, are:

1. Jurisdictions should actively limit the variations in technology products as much as possible.
2. Jurisdictions should form vendor alliances for their hardware, software and network components, including identifying a minimum number of vendors and sources for network components.

(Technology Summary - Page 31)

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## Obsolescence

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*To maximize their technology investment, jurisdictions should introduce “ever-greening” policies, and other management initiatives to manage the investment over the long-term.*

The following observation, with respect to managing technology obsolescence, was made.

⇒ Both jurisdictions recognize the need for “ever-greening” technology on a planned, coordinated basis. This is extremely difficult to achieve with current technology funding levels. There is a risk that if the current technology is not maintained the infrastructure overall will deteriorate.

The following strategies, with respect to managing technology obsolescence, are:

1. Jurisdictions should implement a planned replacement policy for technology within their jurisdictions.
2. Jurisdictions should establish a technology replacement and upgrading reserve funded through annual contributions.
3. There should be a district wide perspective taken when implementing technology upgrades and projects (e.g. a jurisdiction wide electronic-mail system, standardize student records migration, access to a central finance system).

(Technology Summary - Page 31)

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## Technology Management and Support

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*There needs to be recognition that wide and local area network technology is complex and therefore management of the resource is critical and should not be underestimated.*

*By limiting the number of variables in the network a jurisdiction can reduce the technical management of the network. This is again an issue of minimizing the cost of ownership - by minimizing the technical support required.*

*Standardization is critical to cost-effective, efficient network management.*

The following observations, with respect to technology management and support, were made.

- ⇒ Limiting technology variables simplifies technology management. This can be difficult since technology is always in transition.
- ⇒ When technology standards are applied, the depth of user and technical support personnel understanding is maximized. In highly standardized environments, peer support becomes the norm, and there is a heightened synergy of individuals’ computer skills.
- ⇒ Both jurisdictions benefit from in-school personnel to assist with local trouble-shooting and technology support. This has proven to be an effective and responsive strategy for the jurisdictions.
- ⇒ It is difficult to sustain a technical growth curve without sufficient technical resources. A commonly accepted industrial range for technology support resourcing reflects a ratio of 75 networked - workstations for a single technical resource staff. In a highly standardized environment this ratio can be extended significantly. Conversely, highly geographically dispersed environments can significantly decrease this support average.

The following best practices, with respect to technology management, are:

1. A primary strategy, for jurisdictions wanting to more effectively, and efficiently, manage their technology investment, should be to limit the variables in their technology.
2. Technology standards and processes should be established and followed.
3. Personnel should recognize that there is a balance between innovation and ease of management and support. Variations in standards come at a cost to the jurisdiction. The costs, risks and benefits associated with increased variations in established standards should be factored into technology purchasing decisions. Jurisdictions should ensure a full understanding of this concept.
4. An adequate number of technology resources should be available to support jurisdiction technology. Technical staff resources should be matched to the expansion of the technology or service or jurisdictions' will risk degradation of the service.
5. Technical staff should receive on-going technical training. Technology knowledge acquired through trial and error can be unnecessarily risky.
6. Jurisdictions should implement in-house help desk support to reduce support maintenance contract costs and to facilitate consistent methods and procedures.

(Technology Summary – Page 21)

## Technology Summary

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### *Interpreting this Section:*

The following summary represents a sample of each jurisdiction's technology. It was compiled as a means to extract best practices and key learnings. It is not exhaustive nor should it be considered all-inclusive. It does not represent an audit of the technology in place in the jurisdictions. Although not readily apparent in parts of the summary, the jurisdictions' technology infrastructures are similar in many respects. Differences may reflect the emphasis of the data gathering done in each jurisdiction.

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### **Service Delivery**

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#### **Administration**

##### **Wolf Creek Regional Division**

Basic components of Wolfnet includes:

- ⇒ a distributed, directory synchronized, feature-rich internal electronic mail system including internal news-groups like conferences (FirstClass)
- ⇒ a centralized Internet mail (POP3 - Netscape);
- ⇒ a centralized purchase order, maintenance work order, technology work order, transportation request, EIE change request, and month end report data base server with remote client access (FileMaker Pro);
- ⇒ a centralized collection of student records data for uploading to Alberta Education (MIG SIRS);
- ⇒ centralized network diagnostics and management system (Transend);
- ⇒ a centralized, secure, Internet firewall (with an IP proxy server) that provides services to all personal computers;
- ⇒ a centralized virus protection server at the Internet gateway (McAfee); and
- ⇒ trustee and limited employee dial-in access to the core network.

WCRD is in the process of transitioning all of its administrative functions in the division to 32 bit operating systems connected to the division's network. Administrative correspondence is virtually all via the network using the jurisdiction's electronic mail system (FirstClass).

##### **Grande Yellowhead Regional Division**

Basic components of GYRDnet includes:

- ⇒ a centralized client server Internet mail system (IMAP 4 - Simeon);
- ⇒ a centralized financial system (Bellamy);
- ⇒ a centralized collection of student records data for uploading to Alberta Education (McGraw-Hill);
- ⇒ centralized network diagnostics and management (Netware Directory Services and Transend Enterprise Management);
- ⇒ a centralized, secure, Internet firewall (with an IP proxy server) that provides services to all personal computers; and
- ⇒ trustee and full employee dial-in access by work site.
- ⇒ a centralized Internet filtering system.

A new central financial system (Bellamy) will be implemented in April 1997.

The jurisdiction has a centralized webserver that is utilized as a communications vehicle for all public documents. In addition, the jurisdiction is utilizing the network to do Internet research particularly in the policy development area.

The jurisdiction has defined a web page template for schools to follow when they want to publish material on the world wide web. Core jurisdiction material has a common "look and feel." Schools are also provided with a "free form" area for more creative school-based sites.

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## Teaching/Instruction

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### Wolf Creek Regional Division

WCRD has deployed computers to teachers' desks in the classrooms. By the end of August 1997, with minor exceptions, every teacher in the jurisdiction will have a computer on their desk with electronic mail and Internet access. WCRD believes that its early provision of electronic mail to teachers in the classroom was the key to successfully integrating technology into the WCRD classrooms.

The current electronic mail system (FirstClass) provides newsgroups, conferencing and "real-time" chat sessions. The newsgroup functionality is being used by teachers within and between schools and by special interest groups.

The jurisdiction has approximately 20 students participating in its Cyber Academy initiative. A separate mail server (one in Lacombe and one in Ponoka) has been set-up for the Cyber Academy mail users.

Wolfnet services have not been extended into the schools in the Hutterite Colonies. However, instructors in the colonies do have dial-in access to Wolfnet services.

The emphasis for the jurisdiction has been on core productivity tools including software such as word processing, spreadsheets, databases, telecommunications, and graphics. The jurisdiction's strategy has been to deploy and integrate generic productivity software tools useful across the curriculum. Teachers are currently implementing Internet as an alternative resource across all grade levels.

### Grande Yellowhead Regional Division

GYRD considers the adoption of technology by its teachers to be a primary strategy for integrating technology into the classrooms. GRYD has not deployed computers to teachers' desktops. Most computers in GYRD's schools are deployed in laboratories and libraries. Computers are also available in all staff preparation rooms and school offices.

GYRD has defined procedures regarding staff development to enhance technical proficiency among its teachers, support staff and administrators. There are clear expectations defining technology skill sets for teachers. This responsibility extends to support staff, administrators, and trustees. The current technology plan is very specific regarding new hiring practices for all employee groups.

SuccessMaker an integrated learning system for remedial learning assistance is being used at one junior high school (30 licenses) and 3 out reach schools (3 licenses per site) in the jurisdiction.

GYRD is currently investigating the technology issues surrounding home schoolers and virtual school delivery with respective access to GYRDnet.

The emphasis for the jurisdiction has been on core productivity tools including software such as word processing, spreadsheets, databases, telecommunications, and graphics. The jurisdiction's strategy has been to deploy and integrate generic productivity software tools useful across the curriculum. Teachers are currently implementing Internet as an alternative resource across all grade levels.

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**School Computers**

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**Wolf Creek Regional Division**

Historically, the jurisdiction's strategy with respect to the deployment of technology in the schools, was to deploy technology into computer laboratories (focusing on the writing process). In an premeditated effort to upgrade the teachers' technology skills, computers were deployed into the classrooms on to the teachers' desks.

Computers, both Macintosh and Windows '95-based machines are available in virtually all schools via designated computer labs, classroom pods, on rolling tables (mobile stations), and on the teachers' desks.

As a result of the merger of the two districts, each with significantly different histories in technology integration, there is currently a wide disparity in school and grade level access to technology. The current Technology Integration Grant is being used to minimize that disparity. While a minimum level of equity will be maintained in every school, variations in the ratio of students to computers will continue to exist based on school site priorities.

As of January, 1997, the division's current computer and peripheral hardware standards are:

- ⇒ Intel-only, Microsoft Windows-based microcomputers (Minimum P133) with CSA, Win NT, Novell, and ISO certification.
- ⇒ Power PC based Macintosh microcomputers
- ⇒ Apple and Hewlett-Packard postscript and PCL printers
- ⇒ Apple and Hewlett-Packard color scanners and color inkjet printers
- ⇒ Soundblaster OEM sound cards
- ⇒ Seagate SCSI or EIDE 4Gb/8Gb Travan tape drives (Seagate/Conner)
- ⇒ Quantum or Western Digital Hard Drives (EIDE, SCSI-2)

**Grande Yellowhead Regional Division**

Windows 3.11 -based machines are available in all GYRD school offices, staff preparation rooms, libraries, laboratories, and some classrooms throughout the jurisdiction. The current ratio of computers to students in GYRD is approximately 5 to 1, but this figure includes approximately 600 legacy Macintosh computers in the Elementary schools.

At the current time there is more access to technology in the junior high and high schools versus the elementary schools - this is somewhat due to career and technology study programs at the Junior and Senior high level. Elementary access to technology is an acknowledged issue in the jurisdiction. This will be resolved by Phase II of the technology deployment.

The current inventory of personal computers in the jurisdiction, purchased in May, 1995 as part of the Phase I technology roll-out, are: Intel 486/DX 80 computers with 420 megabytes hard drives, 1 megabyte SVGA video cards and 12 megabytes of RAM. Each runs Windows 3.11 with a compliment of standardized software.

The Phase II computer inventory purchase will include: Cyrix 686 computers with 1.3 gigabyte hard drives, 1 megabyte SVGA video cards and 16 megabytes of RAM. Each will run Windows '95.

As of January, 1997, the division's current computer and peripheral hardware standards are:

- ⇒ Intel-compatible, Microsoft Windows-based microcomputers
- ⇒ Lexmark Optra R+ (postscript and HP) printers
- ⇒ Soundblaster OEM sound cards
- ⇒ HP and Epson color scanners and color inkjet printers
- ⇒ Scantron OMI scanners (series 2000), Seagate 4Gb DAT tape drives

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## Software

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### Wolf Creek Regional Division

WCRD has a three tier software policy for administration and instruction.

Tier One: core applications. These are the basic applications for instruction and administration in the jurisdiction. For example, every computer in the jurisdiction is equipped with core software that is fully supported by the technical support group. Example of core administrative applications include: MSOffice '95, FileMaker Pro, Adobe Acrobat Reader, First Class electronic mail, Netscape, McAfee VirusScan.

Tier Two: extended software set. These are applications that can be utilized by school personnel, at the discretion of the school. The central technical group also supports this software. Examples include: Claris Works, Adobe Illustrator, Adobe PageMaker, Acrobat Exchange, Mega Gallery.

Tier Three: local software. These are applications that can be utilized by school personnel, at the discretion of the school. The central technical support group does not support this software.

WCRD has implemented central help-desk support for core and extended software applications.

Instructional productivity software is standardized on MS Office for Windows and Claris Works for Macintosh. Site licenses are maintained for both, as is a site license for McAfee VirusScan for Macintosh and Windows.

WCRD has adopted the Alberta Education technology standards as defined and released to date. Examples include MIME for Internet mail document extensions, MS Word as the word processor document format, and EDULINK file format (RIPEM), transmission medium, security encryption, and desktop operating system.

### Grande Yellowhead Regional Division

GYRD's philosophy, with respect to software, is to standardize as much as possible and implement new software technology in a controlled manner.

The current desktop standard for the jurisdiction is Windows 3.11 with Microsoft Office 4.2. This will not be upgraded until the fall of 1997, when the elementary schools will be equipped with Windows'95 and Office'95.

The division's technology plan defines Phase II core applications as:

- ⇒ age-appropriate primary education integrated application (Kid Works)
- ⇒ integrated graphics, clip art software (Corel Print House)
- ⇒ integrated word search, crossword utility (Puzzle Works)
- ⇒ FRIM language-based integrated application software (word processing, spreadsheet, database, and charting), desktop operating system with respective keyboard
- ⇒ division-standard hyper-media (HyperStudio)
- ⇒ division-standard keyboarding tutorial and utility (All the Right Type, Trial Type)
- ⇒ division-standard integrated applications (Microsoft Office)
- ⇒ division-standard student student/staff desktop publishing (Microsoft Publisher)
- ⇒ division-standard database for teacher-developed report cards (FileMaker Pro)
- ⇒ division-standard electronic mail (Simeon), web browser (Netscape), web bookmark management (Overdrive), and web reader (Adobe Acrobat)
- ⇒ division standard Internet filter (Cybersitter) and virus software (Xtree)

Many of the above tools are currently used in Phase I deployment.

GYRD has adopted the Alberta Education technology standards as defined and released to date. Examples include MIME for Internet mail document extensions, MS Word as the word processor document format, and EDULINK file format (RIPEM), transmission medium, security encryption, and desktop operating system.

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## School Wiring

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### Wolf Creek Regional Division

School wiring in each WCRD school reflects category 5 wiring.

WCRD did not outsource the wiring of their schools to a private third party company. School wiring was done with internal technical resources.

Schools funded the material costs, the central technology support group provided the labor. This was a cheaper alternative to outsourcing the wiring to a third party. In addition, the jurisdiction had better quality control over the final product - including strict adherence to category 5 wiring standards and installation practices.

WCRD deploys wiring on a whole-school basis (i.e.) to all computer laboratories, libraries, staff preparation rooms, administrative offices and classrooms.

By the end of August, 1997, the entire jurisdiction will be wired.

### Grande Yellowhead Regional Division

School wiring in each GYRD school reflects category 5 wiring.

GYRD did not outsource the wiring of their schools to a private third party company. School wiring was done with internal technical resources and the support of a temporary contract employee who did the conduit wiring. This was a cheaper alternative to outsourcing the wiring to a third party. In addition, the jurisdiction had better quality control over the final product - including strict adherence to category 5 wiring standards and installation practices.

Initially, wiring in school buildings extended to computer laboratories, libraries, staff preparation rooms, and administrative offices. Wiring in the schools is now done when computers are deployed.

Each school has an equipment room, which is identical in appearance, equipment, and set-up from one school to another. Most rooms are secure and locked-up with separate electrical circuits.

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## Local Area Networks

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### Wolf Creek Regional Division

WCRD's local area networks reflect the following:

- ⇒ a static IP addressing scheme, that enables technology support staff to trace transmissions back to specific workstations, and allows authorized bypassing of web filtering software and facilitates router filtering;
- ⇒ Internet protocol (IP) throughout the network;
- ⇒ a standard network server configuration;
- ⇒ a single manufacturer for network components from the network interface cards to the routers; and
- ⇒ and Windows NT & MacJanet operating systems.

WCRD is transitioning all administration users to Windows 32 bit operating systems. This transition required a significant amount of research with respect to pre-solving a number of cross-platform issues. Some the solutions included:

### Grande Yellowhead Regional Division

GYRD's local area networks reflect the following:

- ⇒ a static IP addressing scheme, that enables technology support staff to trace transmissions back to specific workstations, allows authorized bypassing of web filtering software and facilitates router filtering and firewall protection to secure servers;
- ⇒ Internet protocol (IP) throughout the network;
- ⇒ a standard local area network server configuration in each school;
- ⇒ a series of global directories that are centrally managed through Netware Directory Services;
- ⇒ a single manufacturer for network components from the network interface cards to the routers; and
- ⇒ Novell 4.1.

1. deciding to migrate all administration users to a Windows'95 environment. The technical staff made the transition easier for administration staff by tailoring the "look and feel" of the Windows'95 desktop to look more like the former Macintosh desktop;
2. standardizing to the MSOffice software package; and
3. choosing a cross-platform electronic mail package (FirstClass).

The transition to date has been extremely successful and relatively insignificant from a user perspective.

There are three operating systems in place in WCRD. The jurisdiction is gradually migrating towards a Windows NT operating system standard. This was chosen over other alternatives, based on ease of front-line administration.

GYRD is implementing a formalized back-up strategy for servers in each school. In the current configuration there are two mirror drives such that there is a duplication file structures on each server. A tape archive is also maintained.

Planning is also in progress regarding root level password changes for all devices in the event of hostile or friendly employee severance.

Cache servers are currently being deployed in selected schools. There is neither a web server nor a mail server on the LANs in the schools.

The communications servers in each school support 8 ports for employee dial-in access. Each LAN is supported by Novell 4.1 and is totally compatible to the Internet. GYRD has plans to upgrade its network operating system from Novell 4.1 to Internetwork.

## Wide Area Networks

### Wolf Creek Regional Division

Wolfnet currently deploys an IP -based, wide-area network connecting all schools in the jurisdiction to one of two central core metropolitan-area-networks (MAN). In addition to TCP/IP, the AppleTalk protocol is supported on that portion of the network that is greater than 56 kbps. The two MANs are interconnected with an E1-speed (2.0 megabyte per second) backbone, providing high-speed access to the core network for approximately 50% of the jurisdiction's population. The remaining population is connected to the core network by 128kbps un-serviced pair technology (4%), switched56 service (35%), and analog synchronous data compression modems (8%). The remaining 3% are Hutterite Colony or Home Education students.

WCRD has laid its own fibre optic cable in Lacombe, Ponoka, Bentley and Rimbey. The fibre optics is used to connect schools in close proximity in a school campus model. Fiber has also been deployed in some of the larger schools in the jurisdiction between network closets.

WCRD has implemented a CATV connection between its Lacombe and Ponoka hubs. This alternative is less expensive and provides more bandwidth than the alternative TI solution.

### Grande Yellowhead Regional Division

GYRD currently deploys an IP-based, wide-area network connecting all schools in the jurisdiction to the Education Services Center (ESC) in Edson completely based on Internet standards. Since early 1996, GYRDnet has been interconnected to the Alberta Government Network (AGNpac), a provincial wide-area network, as a prototype rural education network. The seventeen sites serviced by AGNpac have individual 128K Frame Relay circuits (full CIR) and the division's central office is serviced by T1 to AGNpac.

GYRDnet employs a variety of transmission media to support its WAN. With respect to the first switching point from the schools, GYRD is supporting 22 un-serviced pair technology sites and one ADSL site. GYRD has found this technology to be cost effective and stable. The technology was installed and implemented in July, 1995 and to date no problems or unusual maintenance requirements have arisen. This technology does have distance sensitivity limitations that only make it a suitable alternative for transmission distances of less than 5.5 kilometers. Current transmission speeds being achieved with ADSL technology are 128 kilobits per second. There is a potential for up to 1.5 megabit transmission using this same technology in the near future.

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## Wide Area Networks

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### Wolf Creek Regional Division

TELUS analog and Switch 56 technology is being used to provide service to the remote rural sites in the jurisdiction.

WCRD has deployed synchronous data compression modems with analog lines in three remote schools. This has proven to be a workable alternative for patching these remote schools onto Wolfnet. Wolfnet has deployed additional ports and routers to enable it to do load balancing for additional lines if required in the future.

### Grande Yellowhead Regional Division

Switch 56 technology is also being employed in three schools in the jurisdiction.

In addition GYRD has deployed synchronous data compression modems with analog lines in one remote school. This technology, when combined with load balancing via a router on two analog phone lines, is providing near 56kbps performance and can sustain a greater number users. This has proven to be a workable alternative for linking this remote school onto GYRDnet.

GYRD considers their current WAN technology (via AGNpac, etc.) to be at an entry level. The network has proven to be very stable and scaleable. The jurisdiction has requested scaleable bandwidth to AGNpac based on current traffic. This AGNpac subnet has the potential of scaling to full T1 with switches in each school.

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## Internet Feed

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### Wolf Creek Regional Division

WCRD's Internet service provider is TELUS Advanced Communications.

A single fractional T1 point of access to the Internet is provided via a firewall with private addressing being used behind the firewall. World Wide Web services are accessed via a proxy web server and web cache server. The same server runs the Internal Web services, Internet mail, Domain Name Services, and other related services. In addition, plans are underway to install external Web and File Transfer Protocol servers for publishing division and school documents.

Every computer in the jurisdiction was Internet capable on demand effective January 30, 1997. Prior to this point in time, Internet access was provided to classrooms via dial-out access.

The jurisdiction has implemented a UNIX-based cache server to enhance speed of transfer to the local desktop.

### Grande Yellowhead Regional Division

GYRD's Internet service provider is TELUS Advanced Communications full T1.

The jurisdiction owns a centralized webserver that is utilized as a communications vehicle. Jurisdiction news and documents are put into the public domain via the webserver.

GYRD has decided to not provide access to newsgroups and access to chatlines, now available in jurisdiction schools, may be eliminated. This is a strategy to combat illicit content and to reduce unnecessary bandwidth usage.

The goal of the jurisdiction is to have every computer in the jurisdiction Internet capable on demand. This was a stated goal in the jurisdiction's technical plans.

The following projects are in progress to further improve Internet access in the schools.

⇒ The installation of a central Netscape cache server running on Windows NT at the ESC

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## Internet Feed

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### Wolf Creek Regional Division

WCRD is utilizing filtering software to limit inappropriate material accessible within the jurisdiction (from the Internet). A stakeholder committee will investigate this issue over the next year to establish a long-term strategy with respect to this issue.

Currently the internal electronic-mail system is a proprietary system with offers the benefits of a rich feature set (FirstClass). The original intent was to gateway the internal system to the Internet, but this strategy has been abandoned since the next version of FirstClass will adhere to Internet standards, thus negating the need for a gateway. As a temporary measure WCRD has implemented a POP3 mail server and Netscape client software for Internet mail. WCRD will move to IMAP for Internet mail when FirstClass version 4.0 is released and deployed.

WCRD uses an internal private addressing scheme with entire class (B&C) addresses assigned to each site with no subnetting required. This provides 65.534 addresses per school.

### Grande Yellowhead Regional Division

site and a cache server in each school (this cascading of cache servers will serve to reduce bandwidth demands on the network due to increasing Internet demand at primary education sites). School cache server will be at a minimum Pentium 166, 64 megabyte RAM, 2.5 gigabyte hard drive; and

⇒ The installation of a central server dedicated to the Point Cast website. This server will be located centrally at ESC. Again this strategy is intended to reduce the amount of WAN traffic beyond GYRDnet.

GYRD has a Class B proxy server with 64 subnets. Each subnet has 4 Class C subnets with 254 user addresses per class. This proxy server set-up permits GYRD to expand the IP address base to include more extended stakeholders and users without renumbering IP addresses and cascading servers are planned.

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## **Technology Management**

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### **Technology Planning**

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#### **Wolf Creek Regional Division**

WCRD's Three-Year technology plan follows the technology-planning handbook provided by Alberta Education.

The focus of the WCRD Three-Year Technology Plan is on the establishment and support of a technology system or infrastructure that will support the application of technology in schools and administration sites.

WCRD has established a Technology Equity Committee. The mandate of this committee is to develop a WCRD policy on equity of access to funding and programs.

At a minimum, the WCRD equity policy will ensure school technology programs match provincial technology outcomes as specified in Alberta Education's Technology Exit Outcomes Project. The current expectation however, is that WCRD's equity policy and implementation will go beyond the provincial outcome standards.

The method in which technology is applied to instruction is a professional decision made at the school level.

#### **Grande Yellowhead Regional Division**

The goal of GYRD's planning process is to meet the requirements of the curriculum and the learner.

ESC's role in technology planning is to define technology standards and guidelines (definition, purchasing, upgrading, deployment and installation).

The schools are responsible for creating individual school plans following the yearly cycle for school education plans and results reporting. At a minimum, these plans must focus on school goals and initiatives, instructional integration, assessment, teacher resource materials, staff development, licensed software, projected school-based purchasing (hardware and software), and the current status of technology including an updated inventory.

The Technical Planning Committee meets twice a year. It is comprised of 8 employees who have been on Novell technical training. This group makes suggestions regarding desktop applications, and the future technical direction.

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### **Funding**

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#### **Wolf Creek Regional Division**

In WCRD, site based management is driven by a belief that those closest to a specific function are in the best position to make effective resource allocations. The move to site-based decision making is a fundamental principle of how WCRD is managed with the maximum spending authority possible at the school level.

With the adoption of the Three-Year Technology Plan, the jurisdiction approved the creation of a central pool (\$75,000) for network maintenance. This pool will be managed by the central

#### **Grande Yellowhead Regional Division**

Centralized technology funding was adopted when the original Technology Concept Plan was approved in May 1995.

GYRD has a centrally managed technology department (ESC) which manages a central pool of funds for the jurisdiction. These funds are intended to cover "in-house" technical support services, hardware and software maintenance contracts, network tariffs, and the replenishment of the technology capital replacement reserve.

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## Funding

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### Wolf Creek Regional Division

technology group and is a contingency fund. Contracted services for Internet head-end software maintenance and support contracts will come from this fund. The fund will be topped up to the \$75,000 limit annually. The \$75,000 limit will be reviewed annually and reset if necessary.

The annual budget for technology management in WCRD is estimated as follows:

Staffing: \$300,000

Travel expenses, vehicle, supplies: \$30,000

Research, dept. equipment, software: \$30,000

School sites will reserve \$50 per student per year for technology workstation replacement.

### Grande Yellowhead Regional Division

The annual budget for technology in GYRD is estimated as follows:

Human Resources: \$338,000

Travel expenses, vehicle reserve: \$28,000

Research, dept. equipment, software: \$31,300

Yearly Contracts: \$60,100

Network Tariffs: \$91,483

Annual Capital Reserves: \$360,000

GYRD has entered into contractual agreements with extended education stakeholders as a means to reduce overall operating costs and extend community access to computer and telecommunications technologies. Current contractual partnerships include:

- ⇒ Community Learning Societies (Advanced Education)
- ⇒ community libraries (four libraries in the Yellowhead region)
- ⇒ Sundance Catholic Separate Regional Division

The contracts that are established with the stakeholders match the jurisdiction's own three-year technology cycle.

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## Procurement & Acquisition

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### Wolf Creek Regional Division

Over the next three years a common purchase date and machine specification policy will be put into place. WCRD will not purchase computers reaching the end of their product life cycle. This is a conscience strategy to try to reduce the overall obsolescence of WCRD's computer inventory and to try to implement more stability into the purchasing process. A significant side benefit of this practice will be the gradual transition to a more standardized workstation inventory.

Computers will be bulk purchased twice a year - to take advantage of discount purchasing, better coordination and standardization.

### Grande Yellowhead Regional Division

GYRD has adopted a system-wide purchasing philosophy for core hardware and software. Bulk computer purchases are done every 3 years.

Core application software is funded from the central technology pool that is administered through ESC. Schools are responsible to plan and fund complementary software purchases in consultation with ESC. This year there will be approximately \$250,000 worth of hardware and software purchases by schools (beyond the capital pool). All acquisition and purchasing of hardware, software, etc. is centrally managed. This has led to GYRD taking advantage of vendor discounts.

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## Suppliers

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### Wolf Creek Regional Division

Wolfnet is based on 3Com products. WCRD has established a strategic alliance with the supplier (3Com) and vendor (Harris Adacom). Consistent adherence to 3Com networking products has allowed WCRD technical staff to become extremely proficient with Wolfnet's complex networking equipment.

In order to reduce the variation between computers, WCRD has drafted very tight specifications for all workstation purchases. Alliances are established by way of a Request for Proposal and Quotation (RFPQ) process. Any standing offer must address pre-defined hardware and software factory installation and pre-configuration requirements, a negotiated percentage mark-up, self-servicing warranty status, express parts access, factory training, access to factory technicians, and the provision of service documentation.

### Grande Yellowhead Regional Division

GYRD has chosen not to go with an open bidding situation looking for the lowest bidder. They instead are committed to a product-line family .

GYRD has identified a single vendor/source for everything from the network interface cards to the routers and all components in between.

Instead of selecting one specific workstation brand, GYRD has chosen hardware suppliers with tier II open architecture systems.

At the start of the Phase I of its technology rollout, GYRD bulk purchased several hundred machines. The jurisdiction has one standard configuration for all of its workstation hardware and carries a spare parts inventory. This allows computers in the jurisdiction to be upgraded on a modular basis.

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## Obsolescence

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### Wolf Creek Regional Division

The jurisdiction's plans to upgrade administration personal computers every 3 years. WCRD will be implementing a specified date replacement policy with the goal of standardizing the desktop environment in the jurisdiction.

The end of the life cycle for instructional computers is decided at the school level. The jurisdiction has, in place, an every-greening plan..

### Grande Yellowhead Regional Division

There is a 6 year cycle to remove and replace desktop equipment in the jurisdiction. GYRD replaces computer systems, including file servers, approximately every six years.

Current funding does not adequately address ever-greening the current infrastructure.

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## Technology Management and Support

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### Wolf Creek Regional Division

WCRD currently has 3 technical support personnel and a Manager of Technology Services.

The division has outsourced management of the advanced Internet security and the server head-end systems.

The central technology group, supports approximately 1,200 computers.

At the workstation level, WCRD technical staff are responsible for:

- ⇒ support and management of the Macintosh platform and environment;
- ⇒ support and management of the Windows-based platform and environment; and
- ⇒ support and management required to ensure that cross platform issues are seamless from a user perspective.

Current WCRD technology management issues include:

- ⇒ the eroded state of standards in the jurisdiction (due to the differences in the technology histories of the founding boards),
- ⇒ the continuous demand for rapid network deployment, and
- ⇒ the impediments to efficient and effective management that the central technology group faces with respect to decision making and the allocation of resources.

This current scenario has resulted in future monitoring, research and planning having less of an emphasis.

Technology support staff receive training in the following key areas: 3Com network device configuration, and Windows NT Certified Systems Engineer. A major problem for WCRD is matching technical skills to the technology infrastructure. In-house technical skills are starting to mature and further staffing is planned to address the gaps.

Technology site coordinators in each school have been identified. WCRD plans to ensure site based technology coordinators have an entry level Administering Microsoft Windows NT training

### Grande Yellowhead Regional Division

GYRD has clearly differentiated between the duties of the teachers (to teach), administration (to administer), local network administrators (to deal with entry level system issues) and technology support and management personnel (to plan, install, maintain and manage the technology).

There are currently 4 technical support personnel. 30% of their time is spent doing maintenance work (e.g. answering trouble calls, doing preventative maintenance in the summer time), and 70% of their time is spent doing implementation work (e.g. expanding the network, upgrading software etc.). There is also a Director of Technology and Communications.

GYRD Technical staff is stationed in Hinton and Edson and service schools across the division. All staff are viewed as generalists. Each staff member is required to enroll, complete and pass certified training programs reflective of GYRD's current and planned technologies.

In order to attract and retain good quality technical resources, GYRD has designed a competitive compensation scheme that includes: a competitive base wage, provision for home computers and laptop computers, and a training provision of \$5,000 per year per employee. To date there has been no technical staff turnover.

In schools with larger networks, identified school-based staff is trained as Certified Network Administrators (CNAs). Individuals who are the front-line technical support in the schools must first pass an Introductory Novell Network Administrator course. These individuals also sit on the Technical Planning Committee.

The division has outsourced management of the advanced Internet security and the server headend systems. The division will continue to outsource specialized services or will enter into cooperative ventures with other divisions to share the costs of technical support.

GYRD has established formalized guidelines in Policy 311 which define staff and students use.

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## Technology Management and Support

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### Wolf Creek Regional Division

course.

WCRD has established formalized guidelines that staff and students must commit to, these include:

- ⇒ Regional Network and Internet Agreement for Independent School Use; and
- ⇒ Acceptable Use Policy - Draft.

Wolfnet is entirely Internet compliant. It was conceived as one solution to many problems. As long as a service is IP compliant and can be connected to ethernet, Wolfnet can support it. Decisions about what will be supported can therefore be made based on functionality and ability to support rather than technical limitations.

Enterprise Wide Management is supported in the following ways:

- ⇒ All electronic mail directories are synchronized automatically. To add a new user identification (ID), technical services log into the appropriate server remotely and create the ID. The ID is then propagated automatically to all other servers. The central technical group manages all electronic mail IDs.
- ⇒ MacJanet curricular IDs are created locally by local network administrators. Windows NT curricular IDs are created locally by local network administrators.
- ⇒ WCRD has an identified strategy to migrate all Intel-based file and print servers to Windows NT servers. Macintosh servers will either be Windows NT or MacJanet.
- ⇒ The central technical group creates administrative IDs and passwords.
- ⇒ The choice of 3Com for all network components from the network interface card to the routers has enabled the central technical support staff to do remote analysis of the network right down to the desktop network interface card. This has only been possible because of WCRD's strict networking standards and the use of 3Com's Transend Enterprise Management software.
- ⇒ All networking equipment is strictly password protected with only the central technology group having configuration access.

### Grande Yellowhead Regional Division

These include:

- ⇒ Guideline 5 - ethical use of computer equipment and GYRDnet and acceptance of GYRD security procedures;
- ⇒ Appendix 1 - network acceptable use agreement;
- ⇒ Procedure 3.4 - requirement that schools have local policies regarding the means by which students are allowed access to GYRDnet and connected services;
- ⇒ Procedures 5.6 and 5.8 - contractual agreement between students & parents and the school regarding acceptance of the division's guidelines and regulations; and
- ⇒ Procedure Section 5 - defines staff and student computer network use.

GYRDnet is based on an enterprise-wide networking strategy. It is a highly standardized environment. The standards set by the central technology group are strictly enforced, such that technology that is not in accordance with the established standards will not be installed and/or supported by the central technology support staff.

Enterprise Wide Management is supported in the following ways:

- ⇒ The establishment of a global directory which is centrally managed by Netware Directory Services (NDS). Using this functionality, the central technical support staff can manage all user rights, files and passwords remotely. This has proven extremely valuable in moving, adding and deleting users from GYRDnet. NDS will simplify school year ends, and provide remote advanced server administration at the technical level.

The choice of 3Com for all network components from the network interface card to the routers has enabled the central technical support staff to do remote analysis of the network right down to the desktop network interface card. This has only been possible because of GYRD's strict networking standards and the use of 3Com's Transend Enterprise Management software.

## Technology Components and Standards - GYRD

GYRD's network and telecommunications infrastructure reflects the following components and corresponding manufacturer and/or other standard:

Network Components	Manufacturer/Vendor
local- area and wide-area networking technologies: network interface cards, hubs, switches, communication servers, enterprise management software	3Com
local-area network operating system	Novel Netware 4.1/Internetwork
local-area network file servers	Intel CPU and 3Com PCI 10/100 Mbps Network Interface Cards
application specific servers and operating systems	Bellamy Financial System (IBM AS400 server with client access for Windows '95) Netscape cache and Pointcast DEC servers with Windows NT
local-area hardware, communication, and cabling standard	10 Mbps and 100Mbps Ethernet (switched)
desktop operating standard	Windows 3.11 and Win'95
UNIX mail and web servers	Digital Alpha 1000, Digital Alpha 400, NT servers
firewall proxy	private internal Class B, and external registered Class C
IMAP 4 client/server electronic mail	Simeon for Win 3.11 and Windows '95
APC UPS series 2000 with PowerChute	APC Powerchute to protect the DEC, Novell, and Windows NT servers)
Category 5 - EIA/TIA structured wiring	Ortronics
Internet headend service	Telus Advanced Communications
wide area network links	primarily AGNpac with TELUS for lower end facilities where AGNpac is not available
local access - un-serviced pairs	TELUS Communications
backbone network	Alberta Public Works Supply and Service - via AGNpac
dial-in access	TELUS Communications
digital signaling units	RAD and Pairgain
modems	GVC external, 3Com PCMCIA, and Motorola Synchronous Data Compression

## Technology Components and Standards- WCRD

WCRD's network and telecommunications infrastructure reflects the following components and corresponding manufacturer and/or other standard:

Network Components	Standards
local- area and wide-area networking technologies: network interface cards, hubs, switches, communication servers, enterprise management software	3Com 10/100 Mbps (Asanté for Macintosh OS network interface cards only)
local area cabling standard	Category 5 - EIA/TIA structured wiring - twisted pair (Ortronics, Hubble) and multi-mode fibre.
metropolitan area links	128K un-serviced copper, 1.5 Mb un-serviced copper, multi and single mode fibre optics.
wide area network links	Analog, SW56 TELUS 2Mb CATV - Videotron
dial-in access to 3Com communications servers	communication servers located on core network
Internet headend	Telus Advanced Communications
UNIX POP3 Internet mail, DNS, Web Cache, Web Filter, and Internal web server	Digital Alpha 400
External WEB and FTP server	Intel based Windows NT
firewall and address proxy	Multiple private internal class B and Class C. External registered Class C.
Internet headend virus scanning	McAfee WebShield
digital signaling units	RAD ASM-31 & ASM-450, Motorola DU-170, Nortel Datapath
modems	GVC external, 3Com PCMCIA, and Motorola 3266 Synchronous Data Compression
administrative file servers	Win 95, Windows NT
instructional file servers	MacJanet, Windows NT
desktop operating standard	Mac OS, Win'95, Win NT
internal e-mail	FirstClass
IMAP 4 client/server electronic mail	First Class 4.0 (pending release)
power fault protection	APC Uninterruptable Power Supply

## Resources

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### **Reference Material:**

1. Grande Yellowhead Regional Division: Interim Three-Year Technology Plan 1997/98 - 1999/2000
2. Grande Yellowhead Regional Division: Policy 3100 - Computer Technology
3. Wolf Creek Regional Division: Three-Year Technology Plan 1997/98 - 1999/2000
4. Historical Documentation from the County of Lacombe No. 14 Board of Education

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