MINUTES OF THE FIRST MEETING

REGIONAL TELECOMMUNICATIONS PLANNING ADVISORY COMMITTEE (Reconstituted)

DATE: August 24, 2004

TIME: 2:00 P.M.

PLACE: Commissioners' Conference Room
Regional Planning Commission Offices
W239 N1812 Rockwood Drive
Waukesha, Wisconsin

Members Present

Kurt W. Bauer Chairman	Executive Director Emeritus, SEWRPC
William R. Drew Vice Chairman	Vice-Chairman, SEWRPC; Executive Director, Milwaukee County Research Park
Bob Chernow	Chairman, Regional Telecommunications Commission
David L. DeAngelis	Village Manager, Village of Elm Grove
Barry Gatz	Network Supervisor, CenturyTel
Michael E. Klasen	Director, Regulatory Affairs, SBC Wisconsin
J. Michael Long	Attorney-at-Law, Murn and Martin, SC
Jeff Mantes	Director of Public Works, City of Milwaukee
George E. Melcher	Director, Office of Planning and Development, Kenosha County
Paul E. Mueller	Administrator, Washington County Land Use and Park Department
Steven L. Ritt	Attorney at Law, Michael Best & Friedrich
Paul R. Schumacher	Program Manager, TriCounty Business Partnerships
Dale R. Shaver	Director, Waukesha County Department of Parks and Land Use
Gustav W. Wirth, Jr.	SEWRPC Commissioner

Members Absent

Kenneth Brown	District Manager, Nextel Communications, Inc.
Roger Caron	President, Racine Area Manufacturers and Commerce
Brahim Gaddour	Director of Network Operations, Time Warner Telecom of Wisconsin
Jody McCann	Director of Technology Research, Wisconsin Department of Administration, BadgerNet
James W. Romlein	Managing Director, MVLabs, LLC
Bennett Schliesman	Director, Kenosha County Emergency Management /Homeland Security
Mark Schoeppel	Vice President, Global IT Infrastructure, Johnson Controls, Inc.
Michael Ulicki	Vice President and Chief Technology Officer, Norlight Telecommunications
Darryl Winston	Director of Data Services, City of Milwaukee Police Department

Guest

Michael Falaschi	President, Wisconsin Internet

Staff

Philip C. Evenson	Executive Director, SEWRPC
Kenneth J. Schlager, PhD	Chief Telecommunications Engineer, SEWRPC
Lynn G. Heis	Staff Secretary, SEWRPC

CALL TO ORDER AND ROLL CALL

Chairman Bauer called the meeting to order at 2:15 P.M. Roll call was taken by circulating an attendance signature sheet, and a quorum was declared present.

Chairman Bauer welcomed the members of the Committee to the Commission offices. He thanked them on behalf of the Commission for their willingness to serve on the Committee and thereby assist the Commission in its work.

Chairman Bauer noted that the Committee was a reconstitution of the Commission Advisory Committee on Regional Telecommunications Planning originally created in 2003 to prepare a Prospectus for the conduct of a Regional Telecommunications Planning Program. He noted that of the 23 Committee members, 18 had served on the original Committee and had graciously indicated a willingness to continue to serve on the reconstituted Committee. He then asked each of the new members to introduce themselves; and for the benefit of the new members he then asked each of the Committee members to introduce themselves.

Chairman Bauer then introduced Mr. Philip C. Evenson, the Executive Director of the Commission, Mrs. Lynn G. Heis, Staff Secretary of the Committee, and Dr. Kenneth J. Schlager, who now serves as the Commission's Chief Telecommunications Engineer.

BACKGROUND AND CHARGE TO COMMITTEE

Chairman Bauer noted that the Committee was charged by the Commission with guiding the conduct of the telecommunications planning program outlined in the Prospectus prepared by the original Committee, and adopted by the Regional Planning Commission upon the recommendation of that Committee. It was envisioned, he said, that the Committee's work would be conducted through the review of preliminary drafts of Commission staff memoranda, and preliminary drafts of all technical and planning reports to be produced under the planning effort. Importantly, the Committee would be charged with submitting to the Commission a recommended wireless site and related infrastructure plan, a special public networks needs analysis and plan, and a recommended telecommunications network plan, all as outlined in the approved Prospectus.

Chairman Bauer indicated that the Committee would be asked to review all materials submitted to it on a page by page basis in a collegial manner. It was intended, he said, that Committee members, based upon their review of the draft materials, would in the Committee deliberations raise questions and offer recommended additions, deletions, or changes to the materials submitted for review and approval by Committee. He indicated that he hoped that any controversial issues raised could be resolved by consensus. If necessary, however, he would ask in accordance with Robert's Rules of Order, for a motion, second, and vote on noted resolution of the issues raised. Such formal action he said, would also be required with respect to Committee approval of all staff memoranda and all chapters of technical and planning reports submitted to the Committee.

Chairman Bauer indicated that following Committee action of each memorandum or report chapter, the material would be revised as necessary and the revised materials appended to the minutes of the

Committee meeting concerned with the Committee directed changes being noted in the revised material by the use of strikeouts for deletions, while additions are indicated in italics. In this way, he said, the Committee would always be provided with a second opportunity to address needed changes and the Committee would be assured that any changes reflect the intent of the Committee's action all as part of the formal approval of the minutes in accordance with Robert's Rules of Order.

Chairman Bauer then asked if there were any questions or comments on the proposed procedure. Hearing none, he then asked the Committee to consider Agenda Item No. 4.

Prefatory to that consideration, Chairman Bauer noted that the first page of each of the two staff memoranda to be considered at this meeting contained background information relating to the Regional Planning Commission; the statutory functions and duties of the Commission; the Commission role in telecommunications planning; and the creation of the Prospectus which is to generally guide the conduct of the Planning Program. He indicated that this information should be familiar to the "old" Committee members, but might be new and of interest to the "new" members. He asked, however, that comments or questions on this background information be postponed to consideration of the first staff memorandum.

REVIEW OF PRELIMINARY DRAFT OF TECHNICAL STUDY DESIGN MEMORANDUM NO. 1: TELECOMMUNICATION SERVICE MONITORING SYSTEM DESIGN

Chairman Bauer then asked the Committee to consider the preliminary draft of Technical Study Design Memorandum No. 1. He noted that all Committee members had received a copy of the draft memorandum dated March 12, 2004, for review prior to the meeting.

Chairman Bauer called attention to the first page of the memorandum, which as already noted earlier in the meeting, provided background information on the Regional Planning Commission; the statutory functions and duties of the Committee; the Commission role in telecommunications planning; and the creation of the Prospectus which is to generally guide the conduct of the Planning Program. He asked if there were any comments or questions concerning this background information. Hearing none, Chairman Bauer then asked Dr. Schlager to undertake a page by page review of the remainder of the memorandum. The following questions, comments, and proposals for change were raised during the Committee consideration of the chapter.

In answer to a question by Mr. Chernow, Chairman Bauer indicated that the memoranda to be reviewed at today's meeting represented new material which had not been previously presented to, or approved by, the "old" Advisory Committee. He noted that the preparation of six such staff memorandum was called for in the approved Prospectus, and stressed the importance of these memoranda since they set forth in some detail the work to be undertaken by the planning program staff.

In answer to a further question by Mr. Chernow, Mr. Schlager indicated that the service monitoring was to be conducted by the Commission staff utilizing a central computer server located in the Commission offices and remote agent stations located throughout the planning area as described in the memorandum. In answer to a further question by Mr. Klasen, Mr. Schlager indicated that there was no intent to place monitoring equipment within any service provider installation; and that the monitoring would involve only end point users.

In answer to a question by Mr. Chernow, Mr. Schlager indicated that the monitoring effort was intended to measure the performance of the existing system in terms of availability, response time, accuracy and throughput and that the performance of the system in terms of these characteristics should permit the adequacy of the system to serve certain specific users such as financial management firms, medical establishments, or police departments among others.

A brief discussion ensued concerning the availability parameters as listed on the top of page 5. In response to a suggestion by Mr. Klasen, it was agreed to change the first bulleted item under availability from "dial tone versus busy signal" to "dial tone versus network blockage".

Mr. Klasen noted that the proposed monitoring effort would be complex and asked that additional detail be provided on the parameters to be monitored. Mr. Schlager indicated that a list providing such detail was available. Chairman Bauer indicated that a copy of the list would be attached to the minutes of the meeting and would thereby be subject to review by and approval of the Committee as a part of the Committee's review and approval of the minutes. (A list of parameters proposed to be monitored is attached as Appendix 1).

Mr. Ritt noted that the proposed monitoring system was not proposed to be equipped to deal with the wireless network, or at least with the atmospheric transmission portion of that network. He therefore suggested, and the Committee agreed, that the second and third bulleted items under availability parameters as listed on page 5 be deleted.

In answer to a question by Mr. Chernow, Mr. Schlager indicated that performance analyses of the atmospheric transmission portion of the wireless network would be addressed in the third staff memorandum called for in the Prospectus, that dealing with the wireless antenna siting plan.

Mr. Chernow expressed a concern that the monitoring system proposed may be testing a simplistic system that is not in fact utilized in the "real world". Mr. Schlager indicated that the monitoring system and particularly parameters to be monitored represent standard measures widely used in the industry to test the performance of real world systems and were not invented by the Commission staff. He said that the procedures and methods have served the industry well including the operators of large private enterprise network developed for industrial management.

Mr. Long asked whether the Commission was concerned about any liability that might occur to the Commission if, for example, the monitoring procedure in some way served to interfere with the performance of an agent's system, or cause the system network to "crash". Mr. Wirth observed that in packet-switched networks, the network would never "crash". At worst, it would be subject to some delay. Mr. Evenson agreed and indicated that liability should not be an concern in that communication involved in the monitoring system between the central server and the agent computer is not in any way different than would be a communication between the Commission offices and the offices of the agent; for an example, the transmission of an e-mail message.

A lengthy discussion ensued concerning the use and applicability of the monitoring data, related industry standards and the potential problem that might be entailed in the identification monitoring effort of the performance of individual providers.

Mr. Wirth indicated that the Commission's basic reason for undertaking a telecommunication planning program was to help insure that the Southeastern Wisconsin Region was served by a telecommunications system of a quality that would adequately support the ability of the Region to compete with other regions of the world for economic development. The monitoring system, he said, would provide data not now available on the performance of the existing system.

Chairman Bauer observed that one of the tasks that would have to be addressed by the Committee later in the program was the formulation of a set of objectives and standards defining a desirable level of telecommunication services within the Region. The standards would have to provide quantitative measures of the ability of alternative plans to meet the agreed upon service objectives. The ability of the current system to meet those standards would be provided by the outputs of the monitoring system.

Messrs. Chernow and Klasen both observed that the three primary access network technologies to be monitored, as listed on page 6, were inadequate since they were apt to provide satisfactory service at relatively low speeds and that a need existed to monitor the performance of the network with respect to users that had a critical demand for high capacity broadband service. After some discussion, the Committee agreed that a 4th primary access network technology should be added to the line on page 6, namely "high capacity broadband". A discussion then ensued on the manner in which the agent locations might be selected for the high capacity broadband monitoring.

In the discussion it was noted that permission of users would be required to install the remote agent and this might present some difficulty with respect to provider businesses or industries that were high capacity broadband service users. In the discussion it was also noted that a geographic coverage would be an important factor to consider in selecting agent locations; and it was suggested that secondary and higher educational facilities might provide good potential agent locations.

Mr. Schlager noted that in the agent selection process not only geographic distribution would be important, but also distribution with respect to the level service used ranging from T-1 at the low end going up into OC service or whatever is found to be the faster service in use within the Region.

In answer to a question by Mr. Wirth, Mr. Schlager indicated that the staff had now solicited proposals for equipment and supporting software from various vendors in order to both assess the scope and quality of services provided and attendant costs. In answer to a further question by Mr. Schumacher, Mr. Schlager indicated that while the Commission would indeed use local expertise to the greatest extent possible, in some areas such as the provision of network monitoring system hardware and software, it would be necessary to use vendors active nationally.

Mr. Ritt noted concern over the proposed monitoring effort and particularly the manner in which the results might be reported. He indicated that it would be important not to identify specific service providers if controversial or adversarial situations are to be avoided. He also expressed concern that reported performance may not prove valid due to inadequacies of the monitoring procedure. Mr. Wirth observed that it was not the intent of the Commission to be vendor specific in any of its reporting, but it was the intent to be geographic specific.

Chairman Bauer noted that under long established Commission procedures, the Advisory Committee would be asked to review a preliminary draft of the proposed performance report and the Committee would be in a position to determine what performance data would or would not be published. He noted that in this respect, it may be necessary, in order to meet public record law requirements, to withhold certain specific data in the draft reports pending Committee consideration of the sensitivity of the data concerned.

There being no further questions or comments, on a motion by Mr. Drew, seconded by Mr. Chernow, and carried unanimously, Technical Study Design Memorandum No. 1: Telecommunication Service Monitoring System Design, dated March 12, 2004 was approved as amended. (Copy of revised memorandum attached as Appendix 2).

REVIEW DRAFT OF TECHNICAL STUDY DESIGN MEMORANDUM NO. 2

Chairman Bauer noted that all members of the Committee had received a copy of the preliminary draft of Technical Study Design Memorandum No. 2: Telecommunication Infrastructure Inventory, dated April 12, 2004, for review prior to the meeting. Chairman Bauer then asked Mr. Schlager to undertake a page

by page review of the memorandum. The following questions, comments, and proposals for change were raised during the Committee consideration of the memorandum.

A brief discussion ensued concerning the list of source based categories to be inventoried as set forth on the bottom of page 2 and at the top of page 3. After some discussion, it was agreed that power line based access communications should not be added to the list since it does not as yet represent an accepted technology. In answer to a question by Mr. Long concerning the wireless service provider inventory, Mr. Schlager indicated that it was not intended to inventory and map the location of all of the existing "hot spots" at which access to wireless Internet service may be provided.

A lengthy discussion then ensued concerning the potential availability of data, and particularly points of presence data, with respect to the SBC facility network. Significance of the SBC central office locations in this respect, together with the handling of packet-switched networks and the capacity of the network facilities was discussed. Chairman Bauer summarized this lengthy discussion by indicating that there was apparent agreement that the necessary network information would be requested from the various providers; if those providers are prohibited by their corporate policies from providing the needed information, either a fall back procedure for obtaining the infrastructure will be followed – which could involve use of TCP trace route software – or the facilities concerned would not be included in any Commission prepared network plan.

Mr. Klasen took exception to the text of the first full paragraph on page 10. He indicated because of the growing importance of security concerns with respect to both the provision and publication of facility route information, particularly at the specific level of detail as well as for other corporate reasons, SBC would not provide the data proposed to be requested. Mr. Schlager stressed the need for pertinent data about the core facility networks to the proposed network planning efforts and particularly the importance of data on points of presence – that points of connection to the core networks.

Chairman Bauer indicated that the difference in positions expressed would be difficult to reconcile. Accordingly, he suggested that Mr. Schlager, Mr. Klasen and the Chairman confer after the meeting to explore the possibility of achieving a revision of the first full paragraph on page 10 that would be acceptable to SBC and the Commission staff. Mr. Gatz asked to be included in the suggested conference.

[Secretary's Note: A revision of the first full paragraph on page 10 was agreed to between Messrs. Klasen, Gatz and Schlager. The revised paragraph is included in the attached revised copy of the Technical Study Design Memorandum No. 2.]

Another discussion then ensued concerning security in which Mr. Evenson noted that the Commission was not required under the State open records law to release any information contained in staff working documents; and that the Committee would be provided for review and approval preliminary drafts of all Commission technical and planning reports to be published under the planning effort, although it may be necessary to withhold certain specific data pending Committee review. It should, therefore, he said, be possible to address and accommodate security concerns and issues. Moreover, he reiterated there was no intent to disseminate data relating to individual organizations providing facility and service data within the planning area.

Mr. Schlager noted that the list of major Internet service providers set forth on page 11 was incomplete, the list being confined to the major providers. He noted that there were, to the best knowledge of the staff, actually 19 such providers operating within the planning area, and that a full list would be compiled as a part of the inventory process.

Mr. Ritt indicated that he had concerns about the text relating to the regional wireless communications infrastructure inventory as set forth on pages 13 and 14. In answer to a more specific question by Mr. Ritt, Mr. Schlager indicated that the intent was, as indicated in the text, to inventory the location of all FCC/FAA regional wireless antenna sites within the planning area; to inventory, all non-FCC/FAA antenna site users; and to map the coverage areas of each site at each radio frequency and antenna type involved. Mr. Ritt expressed concern that if the inventory information was in any way incorrect or imprecise, it could impede efforts of providers to expand service within the planning area in that county and municipal authorities may attempt to block additional antenna site locations based upon the inventory data.

In answer to a question by Mr. Long, Mr. Schlager indicated that it was definitely intended to conduct radio wave propagation modeling as part of the study, and to identify areas where the service coverage meets the service objectives and standards to be formulated under the planning effort. The radio wave propagation modeling would be supplemented, he said, with field measurements as may be found necessary.

Mr. DeAngelis indicated the value of the resulting data to the constituent counties and municipalities since there is presently no single data base that provides wireless service coverage within the planning area that could be viewed and used by interested governmental entities and concerned citizens.

Mr. Ritt observed that a far more useful mapping effort would entail delineating potential areas of urban development based upon published plans for water supply, sewerage and transportation facilities that could be used by the service providers to plan service extensions. He indicated he did not believe the Commission or its staff should be arbitrators of what is, and what is not, adequate coverage. In answer to a question by Mr. Wirth, Mr. Ritt indicated that the service providers knew where there were areas without coverage and did not need the Commission to identify those areas for the providers.

Mr. Shaver expressed exception to Mr. Ritt's comments, indicating that from a county and local governmental viewpoint, the public has an interest in definitive data concerning wireless service areas. Such data, he said, would be particularly useful when a provider requests an antenna location that might be served as well, or perhaps even better, by an existing or proposed antenna location elsewhere in the area concerned. He indicated that the counties and local communities would indeed appreciate information on the location of the existing wireless antennas, the types of service provided by those antennas, and the areas of their coverage.

Mr. Schlager indicated he believed that the necessary information could be available to the counties and local communities and to interested citizens on a non-company provider basis.

Chairman Bauer observed that the decisions and proposed actions of providers, while in the private interests concerned, may not always be in the public interest.

Mr. Ritt called attention to the last two cells in the extreme right-hand column of Table I noting that they should not contain actual or implied reference to recommended antenna site locations. The Committee concurred that any reference in Table 1 to recommended antenna site locations should be struck, and that the information referenced in the cells, should apply only to existing antenna sites.

There being no further questions or comments, on a motion by Mr. Chernow, seconded by Mr. Schumacher, and carried with Mr. Ritt voting no, Technical Study Design Memorandum No. 2: Telecommunication Infrastructure Inventory, dated April 12, 2004, was approved as amended.

DATE AND TIME OF NEXT MEETING

Chairman Bauer then asked the Committee to consider the date and time for the next Committee meeting. He distributed a copy of a table setting forth the results of a survey of meeting date availability undertaken by the staff as part of the appointment process. He noted that Tuesdays appear to be the day of the week identified as most convenient to most of the Committee members, with Wednesdays and Thursdays tied for second place.

After some brief discussion it was determined that the next meeting of the Committee should be scheduled to be held on Thursday, September 30, 2004, at 2:00P.M. in the Commission offices.

ADJOURNMENT

There being no further business to come before the Committee, on a motion by Mr. Chernow, seconded by Mr. Mantes, and carried unanimously, the meeting was adjourned at 4:50P.M.

Respectfully Submitted,

Lynn G. Heis
Staff Secretary

KWB/lgh
#98230 V1 - Telecommunications AC (Reconstituted) - Minutes First Mtg.

Appendix I

LIST AND DEFINITION OF NETWORK PERFORMANCE PARAMETERS PREPARED TO BE MONITORED

APPENDIX I : NETWORK MONITORING PARAMETERS

Synthetic Transactions: An automated web-based simulation that is run at regularly scheduled intervals to allow for unbiased performance measurement of an application over time.

Availability Monitoring: Any measure that is intended to judge the amount of time that a connection is available as well as anything that impacts that availability. Listed below are the key availability measures we will be assessing.

> Network Blockage: Applicable to dial-up connections only, this measures the number of times a blockage is encountered when a dial-up connection to the internet is attempted.
>
> Dropped Calls: Applicable to dial-up connections only, this measure indicates the number of times a dial-up connection is disconnected without the user's consent.
>
> Connection Speed: Applicable to dial-up connections only, this is the theoretical maximum speed that the dial up connection will be able to attain. This varies from connection to connection depending on the quality of the connection and the speed of the modems used.

Response Time: The time it takes for an application request to be completed. Listed below are the applications we are going to test using the network monitoring system.

> HTTP/HTTPS: Hyper Text Transfer Protocol or Secure Hyper Text Transfer Protocol is the method of communication used on the world wide web to display web pages.
>
> POP3/SMTP: Post Office Protocol and Simple Mail Transfer Protocol are the applications responsible for the transmission of e-mail messages across the internet.
>
> FTP: File Transfer Protocol is the application used to exchange files over the internet.
>
> VoIP: Voice over Internet Protocol is a combination of hardware and software that allows people to use the internet to place and receive phone calls.
>
> DNS: Domain Name Service provides the way that the internet ties web addresses with their appropriate Internet Protocol (IP) addresses.
>
> Traceroute: An application that allows you to track the specific path that your internet communication takes to go from your PC to your destination. Traceroute displays the IP address and name of the location as well as how long that location took to process your communication request.

Custom Scripts: Whether or not the Service Level Management (SLM) application supports the creation of customized testing scripts, this would allow us to develop any testing scripts that may not already come with the application.

Throughput: The amount of data that a connection can transmit from one location to another in a given amount of time. Listed below are the specific throughput measures we will be examining.

Transmission Rates: The rate that data is transferred, expressed in bits per second.

Download Time: The time taken to receive a given piece or pieces of data.

Upload Time: The time taken to transmit a give piece or pieces of data.

Accuracy: A method of measuring call (voice, data, or video) transmission accuracy. Listed below are the specific data accuracy measures we will be examining.

Voice Quality: The measure of the sound and conversation quality of a telephone call, in this case a VoIP telephone call.

Uncorrected Error Rate: The number of uncorrected errors that occur in a data transmission.

Appendix 2

REVISED TECHNICAL STUDY DESIGN MEMORANDUM NO. 1: TELECOMMUNICATION SERVICE MONITORING SYSTEM DESIGN

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

REGIONAL TELECOMMUNICATIONS PLANNING PROGRAM

TECHNICAL STUDY DESIGN MEMORANDUM NO. 1: TELECOMMUNICATION SERVICE MONITORING SYSTEM DESIGN

March 12, 2004

INTRODUCTION

The Southeastern Wisconsin Regional Planning Commission is the official areawide planning agency for the seven-county Southeastern Wisconsin region comprised of the Counties of Kenosha, Milwaukee, Ozaukee, Racine, Walworth, Washington, and Waukesha. The Commission is charged with the responsibility for the collection, analysis, and dissemination of basic planning and engineering data on a uniform, areawide basis, for the preparation of a framework of long range plans for the physical development of the Region; and for the promotion of intergovernmental cooperation and coordination in the adoption and implementation of such long range plans.

The Commission recognized that following the breakup of the Bell System and the American Telephone and Telegraph Company, and with the subsequent rapid advances in communications technology, telecommunications, while becoming increasingly important in the local, national, and global economy, also was becoming increasingly chaotic. The Federal Telecommunications Act of 1996, intended to further encourage local competition, has led to the development of a "network of networks" largely beyond the regulatory purview of any level of government.

Recognizing that telecommunications networks form a critical part of the regional infrastructure, the Commission, in December 2002, created an Advisory Committee to assist the Commission in addressing telecommunication issues within the Region. The Committee recommended that the Commission undertake a regional telecommunications planning program, and set forth the need for, and the scope and content of, such a planning program in a Prospectus published in December 2003.

The Prospectus recognized that the conduct of the recommended planning program must be preceded by the preparation of a study design. That study design was to include the preparation of a series of detailed staff memoranda setting forth the methods and procedures to be followed in accomplishing certain critical elements of the planning program. One of these technical study design memoranda was to address the design and deployment of a regional telecommunications network monitoring system.

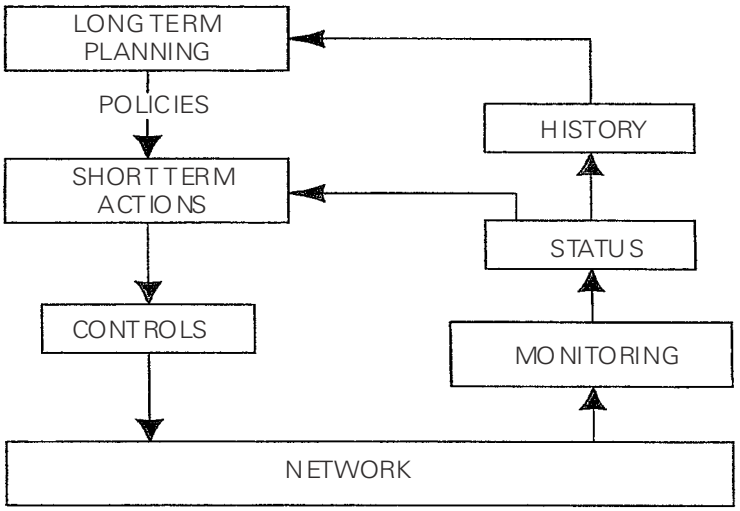
Need for a Network Monitoring System

Prior to the Bell System breakup, the Wisconsin Public Service Commission (PSC) was fully informed concerning both the infrastructure and the service quality of the regional telecommunications system. The PSC is no longer in possession of such information. Based on current statutes and regulations, the PSC information base is limited to data relating to the wireline incumbent local exchange carriers—the local telephone companies providing conventional wireline service using the legacy circuit-switched network. The PSC does not have any jurisdiction over packet-switched wireline networks which are becoming the dominant data and multimedia networks. It also has no jurisdiction over fixed or mobile wireless networks. The Prospectus further recognized that definitive knowledge of the current level of telecommunications services within the Region was essential to any public telecommunications planning effort. In conjunction with an infrastructure inventory, a regional network monitoring system will define the current state of the regional telecommunications network. Accordingly, this memorandum addresses the design and deployment of the needed monitoring system.

The role of monitoring in the regional telecommunications planning process can be further understood by reference to Figure 1. In the short term, monitoring provides information that allows for the correction of network faults and problems. In the long term, monitoring provides a continuing series of data that, when edited and organized, provide the basis for long term planning. Thus, the monitoring system provides a dynamic inventory of service patterns that help to identify future network requirements and needs.

Figure 1

TELECOMMUNICATIONS NETWORK PLANNING, DEVELOPMENT, AND MANAGEMENT



Source: SEWRPC.

Scope and Monitoring Effort

The current telecommunications network can be classified as follows:

1. Data and Multimedia Networks
    a. Internet
    b. Non-Internet
        1) ATM
        2) Frame Relay

2. Voice Networks
    a. Circuit-Switched
        1) Wireline
        2) Wireless
    b. Packet-Switched
        1) ATM, Frame Relay
        2) Internet (VoIP)

The proposed monitoring system should be focused on the probable future state of the regional telecommunications networks. With the current transition from circuit-switched to packet-switched networks, and the parallel transition to wireless from wireline voice networks, it would be imprudent to allocate significant resources to the monitoring of the circuit-switched wireline network. Service quality complaints related to circuit-switched based voice traffic are relatively few. Aside from installation and billing issues, the current circuit-switched wireline network provides generally high quality service for voice traffic.

Within the near future, however, the dominant networks within the Region may be expected to consist of:

1. Data and Multimedia Packet-Switched Networks
    -Wireline and wireless
    -Fixed locations

2. Wireless Voice Networks
    - Both circuit-switched and Voice over Internet Protocol (VoIP)
    - Primary mobile

A monitoring system for the first of the foregoing two classes of networks can be based upon a subset of the standardized Simple Network Monitoring Protocol (SNMP) currently used by most service providers and enterprise communications systems. Such monitoring could embrace both Internet and non-Internet services with a focus on end user levels of service. It is important to emphasize, however, that for dial-up Internet access users, the communication link to and from the Internet Service Provider (ISP) will transmit through the circuit-switched network at the physical layer level.

Use of the SNMP protocol to monitor the level of end user quality of service provided by wireless voice networks will not be feasible. Monitoring the quality of service provided to mobile users introduces problems not amenable to solution through currently available protocols, standards, monitoring equipment, or monitoring software alone.

Currently, quality of service evaluations of mobile wireless networks are based upon subscriber surveys, such as those conducted by the Consumers Union and presented in their publication "Consumer Reports," or from complaints submitted to the Federal Communications Commission. Such surveys and complaints lack the geographic and technical specificity required for planning purposes. Consequently, a special wireless network monitoring system would have to be developed for use in the planning program. Although network monitoring systems developed under the SNMP protocol have been deployed in enterprise and service provider wireline networks for at least the last decade, there are no known mobile terrestrial wireless monitoring systems in service at this time. Development of such a mobile wireless monitoring system would represent a significant research and development effort beyond the budgetary scope of the proposed planning program. Fixed wireless networks, as they develop in the Region, can be incorporated in the SNMP-based wireline monitoring system previously described. Also as mobile wireless communications networks become more dominant for voice communications in the coming years, such a mobile wireless network monitoring system could be developed and could find very useful application in Southeastern Wisconsin. Meanwhile, factors limiting quality of service for mobile subscribers such as dead zones will be identified in the antenna site and related infrastructure planning effort through radio propagation modeling and, as may be found necessary confirming field measurements.

The network service parameters that are to be monitored for planning purposes include:

1. Availability
   - dial tone ~~vs. busy signal~~ *versus network blockage*
   - ~~dropped calls on a wireless network~~
   - ~~dead zones on a wireless network~~

2. Response Time
   - turnaround time on a data message

3. Throughput
   - transmission rates on a data network
   - download/upload time for a standard file on a data or multimedia file on a data network

4. Accuracy
   - voice quality on a circuit-switched or packet-switched network
   - uncorrected error rate on a data/multimedia network

Recommended Monitoring System

The design of the proposed wireline network monitoring system will be based upon use of the Simple Network Management Protocol (SNMP). A more detailed description of SNMP is provided in Appendix I. Although this protocol was originally established for Internet users, it may also be used in Asynchronous Transfer Mode (ATM) networks. In an SNMP-based monitoring network, there are two kinds of entities: managers and agents. A manager is a computer located at a central location running some kind of software system that can handle the management tasks for a network. In many SNMP systems, this computer, often called a Network Management Station (NMS), is a particularly reliable industrial-grade computer called a server which has built-in redundant power supplies, processors and disk drives, so that it is capable of operating reliably 24 hours a day, 7 days a week. This need for reliability derives from the role of the NMS as a network monitor. With this responsibility, it is vital that the NMS be available to detect and help correct breakdowns in the network whenever they occur.

The second entity, the agent, is a piece of software that runs on the network device being monitored. In a typical enterprise or service provider network monitoring system, these devices can range from routers and switches to modem racks or even power supplies. In the proposed regional telecommunications

planning application, however, agent software will reside on an end-user computer or other subscriber devices. The task of the monitoring system will not be to manage and maintain the integrity of the network but to determine the level or quality of service available to regional subscribers.

In the proposed regional network monitoring, the NMS would be a server computer located at the SEWRPC offices in Pewaukee. The server would operate using special NMS software that would poll remote agents on a periodic basis, collecting performance data, storing this data and subsequently facilitate analysis of this data for the preparation of regional network performance reports.

The remote agents would consist of desktop or laptop computers located at geographically dispersed locations throughout the Region. Each of these agent computers would have installed special SNMP-compatible software that would record the results of network-related computer applications and provide data on network availability, response time throughout, and accuracy for later retrieval by the NMS.

To assure adequate geographic coverage and proactive cooperation, most, if not all, of the agents would be selected from the 147 local units of government in the Region. Adequate coverage for wireline communications monitoring can be achieved with approximately one agent for each of the original 74 U.S. Public Land Survey system townships in the Region. Supplementing these agents will be additional sites to achieve adequate representation of the three primary access network technologies:

1. Dial-up telephone sites
2. Digital Subscriber Line (DSL) sites
3. Cable modem sites
4. *High capacity broadband*

The other two access network technologies fixed terrestrial *and* wireless satellite wireless are not as well represented in the Region, so that the number of agents using these technologies will be necessarily limited to a small maximum number such as ten. Neither of these technologies, where they are in use, is believed to be geographically sensitive, so that geographic representation will not be necessary. Because cable modem sites tend to be concentrated in residential areas, it may be necessary to supplement local government sites with citizen subscribers. In any event, the total number of agents will be limited to 100 subscribers distributed relatively uniformly throughout the Region.

Serving as an agent in the regional network monitoring system will not inflict either cost nor work time burdens on the agent. The agent software will be installed by Commission staff personnel. Recording of performance data, whether from user or monitoring program applications, will be automated and transparent to the user. Agent software will always have a lower priority than user applications, so that user work priorities will not be compromised.

Installation and use of the network monitoring system will take place in two phases:

Phase I - Initial Inventory Data Collection

The initial phase of monitoring data collection will consist of an initial three month period of frequent and intense monitoring to establish network performance information for the telecommunications planning inventory, and to establish statistical variance parameters.

Phase II - Continuing Network Monitoring

The frequency and timing of the continuing phase of monitoring data collection will be based upon statistical variance analysis of the monitoring data collected in the initial inventory phase. The purpose of the second phase will be to determine trends in network performance; to identify substandard network performance and inform the service provider(s) involved; and to publish periodic reports on Regional network performance.

The vast majority of polling operations to be conducted under the network monitoring system to collect information from remote agents will be over the Internet. Since Internet costs typically involve a fixed monthly charge, a fixed budget allowance for network monitoring operation is sustainable. Exceptions to exclusive Internet-based operation could involve special scans of the Regional network required to investigate particular network performance values not available over the Internet. Such special network scans would be confined to the initial inventory or to authorized special network investigation projects during the post-inventory period.

Confining the network monitoring system polling to Internet transmissions does not necessarily restrict agent applications to the same network domain. Agent applications involving non-Internet usage can still be recorded and retrieved as part of the monitoring system. Although it is not possible to predict the volume of traffic involved in either the initial or on-going network monitoring, such traffic volumes are expected to be well within the capacity of the proposed monitoring system. Most network monitoring systems are required to manage a complex network of infrastructure of switches, routers and related

equipment in addition to overseeing the quality of service to end users. The regional network monitoring system by concentrating exclusively on end user service quality has a much greater capacity for growth and more extensive flexibility of operation.

Performance monitoring of each of the above network parameters will be carried out with the proposed network monitoring system:

1. Availability

   Availability will be measured by recording the number of blocked calls on an agent site. For dial-up sites, blocked calls are a major measure of service quality. The other sites, which have immediate access broadband capability, rarely encounter blocked access.

2. Response Time

   Response time is a key measure of network performance. From the viewpoint of a subscriber on a broadband circuit, it is often the only measure of performance. Response times will be recorded for the following network applications:

   a. Email
   b. File transfer
   c. Web transactions
   d. Voice over Internet Protocol

   Some of the applications recorded will be user applications normally carried out by the agent in normal operations. Others will be special synthetic applications of standard format and length stored and executed to provide standard measurements of network performance.

3. Throughput

   While response time measurements are application oriented, throughput measurements are network-link oriented. Throughput represents the effective data transfer rate on a network link expressed in frames per second. Throughput is a function of bandwidth, error performance, congestion and other factors including network protocol. Throughput on the same physical layer will differ between an ATM and an Ethernet protocol network. Throughput will be measured using special software programs on the network monitoring system server and agent computers.

4. Accuracy

   Network accuracy will be determined by comparing outgoing and returning data messages from the NMS server or agent computer with a standard known synthetic message stored in the NMS or agent. This comparison will measure the uncorrected error rate on a data/multimedia network.

   Accuracy—quality—for voice messages over ATM or VoIP networks will be determined through spectral comparisons of synthetic voice messages with stored voice template patterns.

Network Monitoring System Implementation

Implementation of the above network monitoring system may be accomplished in a number of ways:

1. Purchase of a complete network monitoring software from vendors such as:

   a. Net Scout
   b. Lucent
   c. Net IQ
   d. InfoVista

2. Develop a system based on a combination of:

   a. Purchased software elements
   b. Free software elements
   c. Custom programming as required

3. Program an SNMP-based software package with minimal use of existing software elements.

Since network monitoring systems have been operational for almost twenty years now (for enterprise and service provider networks but not government-sponsored regional networks), it would seem prudent to avoid the third of the above alternatives. The practical real choice is between the first two alternatives. The ready abundance of free software down-loadable from the Internet makes the second alternative quite attractive. The "downside" is the uncertainty of working with software packages of unknown quality

sometimes with little documentation. The approach used here is to determine the estimated costs of the first two alternatives allowing for the development uncertainties of the second alternative.

An example of the first alternative is a proposal from NetScout Systems, Inc., a leading provider of network monitoring system solutions. NetScout would provide a server computer with an associated fast Ethernet data collector (hardware) and their Performance Manager software for both the NMS and the remote active agents about $53,000. This cost reflects a 30 percent government discount and includes a one year warranty and product support for one year. This NetScout Performance Manager would allow SEWRPC to have the Server Computer (Dell) and the Data Collector to be installed at the NMS in Pewaukee with agent software that could be loaded at all of the remote agent desktop/laptop sites as required. This cost compares to a budgeted estimate of $41,000. While more costly, this alternative provides significant advantages:

1. Early Operation

   The system could be up and running at an early date providing important inventory data on service levels throughout the Region and demonstrating the value of the program to skeptics.

2. Staff Time Conservation

   A purchased turnkey hardware/software package would allow a small telecommunications systems planning staff to concentrate on other aspects of the telecom infrastructure inventory and the wireless network system design both of which will be labor-intensive and time-consuming.

3. Technology Risk Reduction

   Since versions of existing network monitoring systems can be modified to fit regional planning needs, it is unwise to risk a new development with its potential startup difficulties.

Competitive proposals will also be solicited from Lucent Technologies, NetIQ, Inc. and others offering hardware and software packages in network performance monitoring.

Performance Reporting

The end product of the proposed regional network monitoring system will be network performance reports on the state of the Regional networks. These reports will vary in scope and detail from reports on individual agent site locations to comprehensive area reports on performance classified by access method

and service provider. Response time reports will catalog turnaround times for each application by time of day with peak and average values for each agent location with summaries for geographic areas and for the Region as a whole sub-classified by access method. Similar report formats will be used for other performance parameters such as availability throughput and accuracy. Significant efforts will be made to communicate and coordinate with service providers prior to the public release of network performance reports in order to develop a cooperative and constructive approach to enhancing the development of high performance telecommunications networks in the Region.

Appendix I
Network Monitoring Technology

Background

Network monitoring systems were developed to assist network managers in the management of communication systems. Such systems have become increasingly complex with multiple terminals, computers, bridges, switches, routers and other devices transmitting and receiving data, voice and other media at high speeds over wide geographic areas. Such networks can vary in complexity from a small number of computers interconnected in one building as a local area network (LAN) to thousands of interconnected switches and routers in a wide area network (WAN) serving users throughout the world. Organizationally, these networks can be classified as either:

1. Enterprise networks
2. Public service provider networks

Enterprise networks typically serve a business organization, a government or other self-contained entity operating locally, nationally or world-wide. Service provider networks, as the name implies, serve multiple independent subscribers. Although distinct, these networks can often overlap. Examples include the leasing of service provider trunk lines and switch services by enterprise networks and the development of virtual enterprise networks using service provider infrastructure.

Originally, network monitoring systems were focused on the performance of servers, switches and routers since they were the vital elements in the network structure. The scope of network monitoring systems has now expanded to include all kinds of network devices from routers to end-user computers, printers, modem racks and even power supplies. The primary objective of a monitoring system is to assist the network manager in maintaining system operation by performing a wide variety of functions from troubleshooting faults in remote devices to usage accounting for client billing. In regional telecommunications planning, however, the emphasis will be on network performance monitoring, particularly in the quality of service provided to end users. Performance monitoring is one of the five network management functions defined by the International Standards Organization under ISO/FCAPS where FCAPS designates:

1. F-Fault
   -for fault detection and network troubleshooting
2. C-Configuration
   -for network topology and short term capacity planning
3. A-Accounting
   -for usage-based billing
4. P-Performance
   -for performance monitoring and service level management
5. S-Security
   -for intrusion detection/prevention and vulnerability assessment

Beyond performance monitoring, the other four functions are not of immediate interest to regional telecommunications planning as part of a regional network monitoring system. Fault management could be added later for designated public networks if these networks operate under the jurisdiction of SEWRPC. Configuration is also outside the scope of the proposed monitoring system, but it will be of interest later in the plan design work element and possibly for monitoring of future public networks. The accounting function will probably never be appropriate except again for designated public networks. The security function could be a logical part of a regional network monitoring system, but this function was specifically excluded by the regional telecommunications planning advisory committee. It is possible, however, that the security function would be added to the system at a later date.

Aside from the monitoring functions and categories of ISO/FCAPS and their selective implementation, it is important to understand the role of network monitoring as a continuing telecom inventory in the same way that travel time surveys and traffic flow monitors continually update the performance quality of transportation networks. In conjunction with the infrastructure inventory, the regional network monitoring system will define the state of the Regional Telecom Network.

Network Monitoring

Network monitoring, as a distinct telecommunications system activity, has emphasized data networks and particularly data networks using the Internet. The basic structure of network monitoring, as defined by the Simple Network Management Protocol (SNMP), is a product of the Internet Engineering Task Force (IEF) which is responsible for defining the standard protocols that govern Internet traffic including SNMP. Although the Internet each year accounts for an increasingly larger portion of telecommunications

traffic, it still does not encompass all traffic, not even all data traffic. Significant volumes of data are still transmitted over non-Internet networks such as service provider Frame Relay and ATM networks, particularly by business and institutional subscribers. Voice traffic, both wireline and wireless, still is largely carried over legacy circuit-switched networks. Such a dispersion of network traffic raises questions as to the scope of the proposed network monitoring system design.

In SNMP-based monitoring the NMS and the remote agents communicate in one of two ways:

1. Polling
2. Setting and Receiving Traps

A poll, in the context of SNMP, is the act of querying an agent for some piece of information. In the regional planning version of network monitoring, this information will involve level of service data collected by and stored at the remote computer or other device.

A trap is a way for the agent to tell the NMS that something has happened. This form of communication is central to network fault management and troubleshooting but not important to service level management. For this reason, polling initiated by the NMS will be the predominant mode of communication in the proposed network monitoring system.

The other major aspect of SNMP-based network relates to the kind of information monitored by the NMS and periodically updated and stored at the remote agent. An agent has in its possession a list of the objects (data) that it tracks. The format of this data is defined in the Structure of Management Information (SMI) by the SNMP. The data are stored in a Management Information Base (MIB) which can be thought of as a database of managed objects that the agent tracks. Any sort of status or statistical information that can be accessed by the NMS is defined in an MIB. Examples of such information are availability, response time, accuracy and throughput (transmission rate).

The operation of a network monitoring system functioning under SNMP then will involve a central Network Management Station (NMS) server computer periodically polling a series of remote device agents to collect the information stored on each agent's MIB. The remote agent will periodically update its MIB based on network access and transmission/reception performance. These updates will record both actual user network transactions and/or dummy network transactions initiated by the agent to determine network performance in the absence of sufficient network transactional activity.

SNMP-Compatible Hardware

Network monitoring systems are primarily implemented in software programs, but these programs must be executed on hardware devices - either special purpose devices for network monitoring or operating network elements such as switches, routers and end-user terminals, primarily desktop and laptop computers. One of the few special purpose hardware elements in the proposed regional network monitoring system will be the Network Management Station (NMS) server computer. As previously noted, this server computer is a highly reliable computer with built-in redundant components to guarantee operation 24 hours a day, 7 days a week.

The remote agent station hardware will be mostly general purpose desktop and laptop computers with built-in SNMP-compatibility. Many Windows-based personal computers have an integrated SNMP software module. If they do not, an SNMP software module can be easily added to the operating system.

Beyond NMS server computers, specialized SNMP-compatible network monitoring devices are available for network monitoring. For the most part, however, these devices are oriented to monitoring the internal operation of the network rather than the performance offered to end users. For this reason, these devices do not apply to the immediate proposed regional network monitoring system. They could well apply, however, to future special public networks in which SEWRPC could have an operational responsibility. An example would be an air or water quality environmental monitoring system in which SEWRPC could have network management responsibility. For this reason, a brief summary of special network monitoring hardware devices will be provided here.

Network probes are non-intrusive, high performance, real-time and historical monitoring devices. They collect key performance metrics such as traffic and application utilization, conversations, error conditions, resource utilization and response time. These probes are primarily monitoring network links in wide area (WAN), local area (LAN) and storage area networks. They are compatible with ATM and Frame Relay as well as Ethernet networks. They also operate at higher network layers such as the Internet (TCP/IP) all the way up to the applications layer. Some network probes not only collect data but also analyze this data and apply expert system techniques to diagnose problems and recommend corrective action.

SNMP-Compatible Software

Network monitoring software for the proposed regional network monitoring system falls into three categories:

1. SNMP agent software
2. NMS software
3. Trend-analysis and other supporting software

It is important to reemphasize that the proposed regional network monitoring system is unique in that it monitors only end-user devices such as desktop and laptop computers and not network infrastructure equipment. As previously mentioned, this limitation could change with future special public networks, but the current restriction to end-user terminal computers makes the proposed system considerably simpler that most enterprise network monitoring systems and certainly simpler than a service provider equivalent. The software needs of the regional system should be limited to:

1. Agent software that performs simulated applications and stores performance information on the agent MIB.

2. NMS software for the central server computer at SEWRPC that periodically polls remote agents and retrieves performance information for central storage and processing.

3. Special NMS software for trend analysis and report preparation including graphical presentations and other visual displays.

In operation, this software configuration would provide for the continuing collection, analysis and reporting of information on the performance of regional wireline networks.

Network information would be monitored at two different levels of the OSI reference model:

1. Physical/Data Link Layers
    a. Effective transmission rate (allowing for the detection, correction and retransmission of transmission errors)
    b. Accessibility (availability of service)

2. Application Layer with applications such as:
    a. Email
    b. File transfer
    c. Web transactions
    d. Voice over Internet Protocol (VoIP)

The first of the above categories relates to the basic physical capability of the network while the second concerns the practical uses for which subscribers employ the network.

Appendix 3

REVISED TECHNICAL STUDY DESIGN MEMORANDUM NO. 2: TELECOMMUNICATION INFRASTRUCTURE INVENTORY

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

REGIONAL TELECOMMUNICATIONS PLANNING PROGRAM

TECHNICAL STUDY DESIGN MEMORANDUM No. 2: TELECOMMUNICATION INFRASTRUCTURE INVENTORY

April 12, 2004

~~Section I –~~ INTRODUCTION

The Southeastern Wisconsin Regional Planning Commission is the official areawide planning agency for the seven-county Southeastern Wisconsin region comprised of the Counties of Kenosha, Milwaukee, Ozaukee, Racine, Walworth, Washington, and Waukesha. The Commission is charged with the responsibility for the collection, analysis, and dissemination of basic planning and engineering data on a uniform, areawide basis, for the preparation of a framework of long range plans for the physical development of the Region; and for the promotion of intergovernmental cooperation and coordination in the adoption and implementation of such long range plans.

The Commission recognized that following the breakup of the Bell System and the American Telephone and Telegraph Company, and with the subsequent rapid advances in communications technology, telecommunications, while becoming increasingly important in the local, national, and global economy, also was becoming increasingly chaotic. The Federal Telecommunications Act of 1996, intended to further encourage local competition, has led to the development of a "network of networks" largely beyond the regulatory purview of any level of government.

Recognizing that telecommunications networks form a critical part of the regional infrastructure, the Commission, in December 2002, created an Advisory Committee to assist the Commission in addressing telecommunication issues within the Region. The Committee recommended that the Commission undertake a regional telecommunications planning program, and set forth the need for, and the scope and content of, such a planning program in a Prospectus published in December 2003.

The Prospectus recognized that the conduct of the recommended planning program must be preceded by the preparation of a study design. That study design was to include the preparation of a series of detailed staff memoranda setting forth the methods and procedures to be followed in accomplishing certain critical elements of the planning program. One of these technical study design memoranda was to address the conduct of a regional telecommunication infrastructure inventory.

~~Section II~~ - CATEGORIES FOR A REGIONAL TELECOMMUNICATIONS INFRASTRUCTURE INVENTORY

An inventory of the existing telecommunication infrastructure within the seven county planning region will be required to provide a sound basis for a regional telecommunication planning effort. The required inventory will be conducted under each of the following four categories:

1. Facility Provider Inventory
2. Circuit Provider Inventory
3. Service Provider Inventory
4. Public Domain Data Collation

The facility provider inventory will focus on the fiber optic cable network; the circuit provider inventory will focus on the current access facilities and capabilities for Competitive Local Exchange Carriers (CLECs) at central offices; the service provider inventory will focus on the types of services provided by geographic subarea of the planning region. The fourth inventory category will collate pertinent network data currently available in the public domain.

This memorandum sets forth proposed procedures for data collection under each of the four inventory categories together with estimated time schedules and estimated costs.

Each of the above source-based categories may be further segmented based on network technology and function:

1. Facility Provider Inventory
    a. Operating fiber optic facility provider inventory
        (1) Private
        (2) Public
    b. Dark fiber optic facility provider inventory

2. Circuit Provider Inventory
    a. Circuit-switched central office (CO) inventory available for CLEC interconnection
    b. Packet-switched central office (CO) inventory available for CLEC interconnection

3. Service Provider Inventory
    a. Wireline Service Provider Inventory
        1) Circuit-Switched Network Service Provider Inventory
        2) Packet-Switched Network Service Provider Inventory
        3) Cable Network Service Provider Inventory
    b. Wireless Service Provider Inventory
        1) Mobile Cellular/Personal Communications System (PCS) Service Provider Inventory
        2) Fixed Wireless Service Provider Inventory
        3) Satellite Service Provider Inventory
        4) Public Wireless Networks

The facility provider network inventory contains two subcategories: dark fiber facility providers and operating network facility providers. The first offers only fiber cable in the ground which must be activated by interconnection to routing-switching center equipment to provide communications services. The second subcategory offers a fully operational access/core network ready for interconnection to enterprise or carrier networks at designated points of presence (POPs).

The two circuit provider inventory subcategories relate to the central offices for circuit-switched and packet-switched interconnections for regional CLECs. Currently, these interconnections are active only for circuit-switched central offices, but this emphasis could change based on State and Federal regulations.

Service provider inventory embraces a wide range of wireline and wireless subcategories from cable networks and traditional circuit-switched networks to mobile cellular/PCS and satellite networks. Plain old telephone service networks (POTS) are defined by their central office locations and characteristics. Other inventories are defined by serviced area maps or in the case of cable by municipal franchise agreements where true service area information is not provided. Wireless networks are completely defined by antenna base station locations and the attendant geographic coverage areas.

The fourth category, public domain data, covers a range of technologies, but is primarily available relative to traditional circuit-switched networks (Public Service Commission of Wisconsin) and wireless networks (Federal Communications Commission).

~~Section III~~ Inventory Sources, Procedures and Outcomes

Each of the inventory categories presented in Section II above are detailed in this section in terms of data structure, sources, processing procedures and inventory database outputs.

Facility Provider Inventory - Operating Networks

The Facility Service Provider Inventory is defined broadly here to include all private service provider core and/or distribution networks for which network structural information is made available. Such networks would embrace both facility service providers to businesses and other organizations such as Norlight Telecommunications and CLECs such as AT&T that supply both facility and residential services.

In accordance with the data structure outlined in the Prospectus, facility providers with operating networks in the Region are expected to provide the following information on their network infrastructures:

1. Points of presence; that is, access points for distribution or access networks, by street address;
2. Interface capabilities;
3. Approximate link routing; by street or other geographic alignment;
4. Capabilities; expressed by network protocol; and
5. Approximate capacity, expressed in band width (megabits per second)

Infrastructure data acquisition in this category will first require an enumeration of the facility providers in the Region. These existing regional facility service providers are envisioned as the primary sources of data in this category.

The current list of these providers includes:

1. AT&T;
2. Choice One;
3. Global Crossing;
4. Level 3;
5. MCI;
6. McLeod;
7. Norlight Telecommunications, Inc.; and
8. Sprint Corporation

In the preparation of this memorandum, Norlight was explored as an example of inventory information availability although the firm may not necessarily be typical of other providers in affording relatively open access to its network infrastructure data. All of the required data for facility providers were found to be available on the Norlight website; including:

1. A network map showing link routing;
2. Complete Points-of-Presence (POP) list for access to Norlight Network; and
3. Network Technology Description
    a. Optical Wave - Dense Wave Division Multiplexing
    b. Sonet

Network capabilities and capacity are implied by the two techniques specified. Interface capabilities of each point-of-presence are available upon request. The Norlight network, illustrates the Midwestern scope of the system with an infrastructure stretching over six states with expansion plans spanning three more. All of the information necessary to link new access/distribution networks in a future regional plan are either immediately available or readily obtainable.

Prospects of obtaining similar network infrastructure information from the other regional facility providers are uncertain, and will become known only as the actual inventory proceeds. A case can be made, however, that it is in the facility providers' best interest to provide such information in order that future regional network planning takes cognizance of each service provider's capabilities for inclusion in an emerging regional infrastructure.

The facility service provider infrastructure data, together with the wireless infrastructure data, represent the most important products of the Regional telecommunications inventory with respect to enhanced Regional network design. Detailed information on these two infrastructures is absolutely vital to any future telecommunication system initiatives. Industry representatives indicate that currently within the Region an excess of high speed packet-switched core network capacity exists with attendant potential growth capabilities for sometime into the future. The primary emphasis in near and middle term telecommunications network planning will be access networks bridging the last mile to potential end user subscribers. To utilize these core networks, however, the network structure capabilities and access points must be known. Facility service provider networks must be "open" networks universally available in the same way that there is an open architecture on the IBM-compatible personal computer. Such open networks are in contrast to cable networks and Incumbent Local Exchange Carrier (ILEC) packet-switched wireline networks that are not universally open networks and may be considered only in terms of the services they provide by geographic area.

The output of this category in terms of an inventory databank will be the data structure defined in the third paragraph of this section and as summarized in Table 1, for each of the cooperating facility service providers.

Facility Provider Inventory - Dark Fiber

A second class of facility provider inventory relates to fiber cable installed in the ground but not yet activated in terms of network infrastructure. Such currently idle fiber cable could be of significant importance in the implementation of a future regional telecommunications plan. For this reason, the property owners of such in-laid fiber links will be contacted and asked to provide the following information:

1. Type of fiber;
   -single mode or multi-mode
2. Capacity;
   -number of strands
3. Approximate link routing by street or other geographic alignment; and
4. Access points, if any

Circuit Provider Inventory - Circuit-Switched Network

Circuit provider facilities allow competitive local exchange carriers (CLECs) to access end-user subscribers as potential customers through tandem switches installed in the central offices of incumbent local exchange carriers (ILECs) such as SBC. CLECs provide their own switching equipment to interconnect for calls outside the coverage area of a particular central office. Although CLECs may lease other ILEC facilities such as trunk lines to other central offices or interchange carriers (IXCs), the primary advantage of circuit provider outlets is access to end-user subscribers.

The data structure of the inventory will be as defined in the prospectus, namely:

1. Building Locations - by street address; and

2. Capabilities
   - -access lines
   - -trunk lines
   - -xDSL availability
   - -tandem switch characteristics
   - -number of fiber strands
   - -interface specifications

The sources for circuit provider inventory data are the annual CLEC reports to the Public Service Commission of Wisconsin. This source is available only for circuit-switched networks and not for packet-switched networks which are not regulated by the PSC.

Processing procedures will take advantage of the availability of PSC reports in machine readable form. Selected data from ILECs may be tabulated into summary form with geographic coordinates -- expressed in State Plane Coordinates, 1927 North American Datum -- extracted for mapping purposes.

The outputs of the circuit provider inventory data compilation process will be:

1. A listing of circuit-switched central offices with their capabilities
2. A regional map of circuit-switched central offices

Circuit Provider Inventory - Packet-Switched Network

Data source availability for the packet-switched circuit provider is still uncertain and will become known only as the inventory proceeds. Since these networks do not report to the PSC on a regular basis, the only reliable sources are the ILECs themselves. Their willingness to share the information has not yet been established.

The data structure of the inventory resembles that of the circuit-switched network; more specifically:

1. Building Locations
   - -by street address
2. Capabilities
   - -access lines
   - -trunk lines
   - -SMDS availability
   - -Frame Relay availability
   - -ATM availability
   - -Interface specifications

Processing procedures for machine-readable data will resemble those of the circuit-switched network previously described. The output of this inventory will also be a listing and mapping of central offices with their individual capabilities.

Service Provider Inventories - Wireline

There are basically three classes of service provider wireline networks operating in the Region:

1. Circuit-switched service providers
2. Packet-switched service providers
3. Cable networks

Circuit-switched services are provided by ILECs such as SBC and CenturyTel and CLECs such as AT&T, MCI and TDS Metrocom. Packet-switched services are offered by ILECs, CLECs and Internet Service Providers. It is important to point out that not all packet-switched communication is over the

Internet. For most residential users, packet-switched communication is synonymous with the Internet, but many enterprise and carrier networks employ Frame Relay and ATM protocols which differ significantly from the TCP/IP protocol used on the Internet. Cable networks are converted broadcast networks that operate outside of the regulatory environment.

Circuit-Switched Network Service Provider

An inventory of the current circuit-switched service provider networks, both Incumbent Local Exchange Carrier (ILEC) and Competitive Local Exchange Carrier (CLEC) is required to define the existing telecommunications infrastructure of the Region. Particularly important are the data on the core networks that form the basis of this infrastructure. Detailed information on the circuit-switched networks, however, is not essential to the conduct of a ~~second~~ *sound* regional telecommunications planning process. The current excess capacity in the facility provider networks, both public and private, should provide more than adequate core capacity upon which to structure new broadband access and distribution networks over a range of future network designs. One of the primary objectives of the regional telecommunications planning process is provision of advanced broadband communications in all areas of the seven county Region. Given this objective, a mapping of current geographic service areas and central office access points (circuit provider inventory) will provide an adequate basis for future network plan designs.

This inventory will duplicate the sources, data structure, procedures and outputs of the circuit-switched circuit provider networks previously described with the addition of the Sonet/WDM core network that services the central offices in the Region. Recent discussions with SBC indicate that this major ILEC may not provide any information on their core network. This core network is the backbone of regional communications. Absent the availability of information on ILEC (and CLEC) core networks even in the traditional circuit-switched arena, a regional network infrastructure inventory would be incomplete. If SBC does not provide the requested information then the planning program can adopt one or more of the following courses of action:

1. Acceptance

   Limit wireline service provider inventory to a mapping of service areas in the Region.

~~2. Challenge~~

   ~~Pursue the need for such information through the FCC and the Department of Homeland Security based on public safety, emergency response and regional security.~~

2.~~3.~~ Public Bypass

Regard current ILEC/CLEC networks as closed commercial networks and plan for a future regional network based on facility network providers and public networks.

~~Since all regional wireline and wireless networks depend on the operation of regional core networks, it is difficult to justify the passive acceptance approach. To do so implies that government has no right to knowledge of a critical part of the Region's infrastructure. In normal times, such reliance on the marketplace is at least arguable. With the current state of heightened national security, such infrastructure knowledge may be critical in an emergency response. On September 11, 2001, the Verizon switching center located near the World Trade Center was destroyed. With no redundancy in the network, all wireline communications in lower Manhattan were cut off. In the year 2000, a break in an AT&T fiber optic cable in South Dakota caused inadvertently by a farmer plowing his field, plunged the State into a complete breakdown of wireline communications. Again, a lack of redundancy made the network vulnerable. In neither instance, were governmental authorities knowledgeable of the fragile state of the networks concerned.~~

3. Trace Routing

A third alternative is to collect network infrastructure information, namely trace routing programs such as TCP TraceRoute.

Available trace routing software allows capture of link-by-link, node by node, routing information on synthetic trace calls. Such information coupled with an IP address database could allow the delineation of the regional core networks based upon a number of trace calls that together would utilize all of the nodes and links of the regional core networks. It is estimated that perhaps two to three hundred calls would suffice. The calls can be automated, and arranged to provide full geographic coverage. In the use of this technique it may be necessary to verify the geographic coordinates of some nodes based on other information such as, for example, the known locations of the ILEC central offices. ILEC personnel have indicated that these original circuit switched central offices will likely continue to function as switching nodes for future packet-switched networks.

The final outputs of the circuit-switched service provider inventory will be identical to that of the circuit provider inventory: a listing and mapping of central offices with their characteristics, capabilities and

geographic service areas. No core network infrastructure data will be available unless the current ground rules are modified.

Packet-Switched Network Service Provider

Packet-switched networks may be expected to provide the primary infrastructure for future telecommunications, with circuit-switched networks relegated to a supporting or ancillary role. As with circuit-switched networks, however, detailed information on the current service provider networks is not essential to the conduct of a sound regional telecommunications planning process. For most residential and small enterprise subscribers, packet-switched access is synonymous with Internet access through an Internet Service Provider (ISP). Large enterprise users also employ asynchronous transfer mode (ATM) and frame relay connections as part of their private networks. Long term trends, however, indicate use of an Internet-like protocol for all packet-switching. Again, facility provider network capabilities and capacities appear to be adequate for future packet-switched networks. To the extent that existing ILEC and CLEC service providers wish to also be facility providers under network plan designs, they would be required to reveal their infrastructure characteristics. Otherwise, these service providers will be regarded as representing closed networks that will not necessarily be linked to alternative future regional network infrastructures.

The packet-switched network service provider inventory has an identical data structure and output format as the circuit-switched network. The difference relates to data sources. As previously stated, packet-switched networks are not regulated by the PSC, and no comprehensive annual reports are issued by ILECs or CLECs. Data availability depends on the wireline service providers. Currently, such availability is still uncertain and will become known only as the inventory proceeds.

A special class of packet-switched service providers are the Internet Service Providers (ISPs). Although generally not operating at the physical network level, ISPs provide packet-switched connection for the vast majority of packet-switched communications.

The ISP inventory output will map geographic coverage areas for each ISP with designations of access type - dial up or broadband. Most ISPs differentiate between residential users accessed through dial up or xDSL lines and enterprise users with leased lines of higher data rate capacities. The larger ISPs in the Region have multiple facility locations interconnected through leased lines forming individual ISP

networks. The willingness of individual ISPs to share this infrastructure information is still being determined.

The major ISPs in the Region are:

1. CoreComm, Inc.
2. Time Warner Cable
3. AOL/Time Warner
4. SBC/DSL

CoreComm, originally Execpc, is still the leader in dial up connections, but Time Warner Cable has achieved major market share in broadband Internet. The inventory, however, will define the service areas and network infrastructures of all Regional ISPs regardless of size or geographic distribution.

Cable Network Service Provider Inventory

Cable services for high speed data (broadband) communications are unregulated in the Region and throughout the U.S. The primary regional cable service provider, Time Warner Cable, will not furnish geographic service information for the regional infrastructure inventory. It will furnish a list of communities (127) with which it has franchise agreements. The Company, however, does not necessarily provide broadband services to all areas of each community. It has no obligation to provide universal service in these franchised communities. Rather, it offers services only when it is believed to be economically justified.

Since the cable industry is unregulated, it has no obligation to furnish network infrastructure information to any public agency. Even if such network infrastructure information were made available through the regional communities with cable franchise agreements, the cable providers have demonstrated no interest in providing network access to other technologies. For these reasons, the current cable high speed data network is best viewed as an existing broadband network with define capabilities, costs and service areas but with no relation to future regional network plans involving other telecommunications technologies.

Wireless Service Provider Inventory

The wireless service provider inventory represents one of the more direct and comprehensive of all of the regional telecommunications inventories. Purchase of a software/database package from Wireless Applications Corporation (WAC) of Bellevue, Washington, will provide a catalog of the existing antenna sites in Southeastern Wisconsin together with attendant pertinent technical data and site infrastructure characteristics such as frequencies and antenna configurations. The package also allows for limited propagation studies for frequencies up to 2.4 GHz at both existing and proposed sites. The only missing items in the package relate to secondary antenna site users, but these data are believed to be available from the local units of government. The WAC antenna site database contains site data from both the FCC and FAA databases. Antenna sites with smaller tower or building locations are sometimes omitted from both databases. For this reason, all antenna site data must be cross-checked with the appropriate local unit of government to assure a comprehensive antenna site inventory.

Using the Wireless Applications Corporation software and database supplemented by information from the local units of government, it should be possible to complete an inventory of the wireless telecommunications infrastructure in ninety days. The Wireless Applications software also permits preliminary mapping of the geographic coverage of each antenna site to provide a complete definition of wireless communications infrastructure within the Region. More detailed analysis of current antenna sites and future site candidates would be performed under the wireless antenna site and related infrastructure design work element.

The regional wireless communications infrastructure inventory will be conducted in a three stage sequence:

1. Inventory of the location of FCC/FAA regional wireless antenna sites. These data will be obtained from the Wireless Applications Corporation database, and be expressed in terms of both street address and geographic coordinates.
2. Inventory of all secondary and non FCC/FAA antenna site users. These data will be obtained from local units of government.
3. Delineation of the coverage areas of each antenna site for each radio frequency and antenna involved.

Locating and recording data on antenna site locations involves the use of the Power Search database of Wireless Applications Corporation. A special file provides additional technical information on antenna type and height and operating frequency of the communications system. Yet another file shows the coverage area of the antenna site for a designated antenna type and operating frequency. Radio propagation coverage is based on the Okumura radio propagation model and topographic -- not canopy -- data. More sophisticated modeling and canopy data will be needed for the antenna site and related infrastructure plan design.

It is important to reemphasize that antenna site data are often scattered through a number of databases. The Wireless Applications database includes the two major sources of antenna site registration - the Federal Commission (FCC) and the Federal Aviation Administration (FAA). A third source is the local units of government. Experience with both the Town of Delafield and the Village of Hartland indicates that these local governments not only have a complete inventory of all antenna sites within their boundaries, but they also have detailed technical data on antenna design, heights, and operating frequency not always available in the Wireless Applications database. While it will be more efficient to collect the great bulk of the required antenna site data through the Wireless Applications power search tool, the local communities can provide important supplementary information and also serve as a check on the comprehensive quality of the data by identifying and describing sites missing in other databases. The cooperation of the local governments contacted in an initial survey has been exemplary.

The Wireless Applications software package and database provides comprehensive information for the wireless communications infrastructure except for secondary -- that is, tenant -- site users. If these secondary users employ the same type of antenna and frequency, they will not affect the site coverage inventory. If they do operate with a different type of antenna or in a different frequency band, a secondary coverage area must be defined for each secondary operator.

Contact was made with the Town of Delafield to obtain information on secondary users of site number 1047997 on Winston Way. The original antenna site user is U.S. Cellular. One other wireless service provider, Nextel Communications, has been approved as a secondary antenna site user. The Village of Chenequa was also contacted to determine the presence of secondary antenna site user. On this site, too, U.S. Cellular was the original site owner and user. No secondary users were currently operating at this site.

Having located and specified the characteristics of an antenna site, use of the RF engineering option under Power Search allows for the delineation of the coverage area for a specified frequency. Power Search displays this coverage area as a map. The Regional coverage areas will also be coded by geographic areas, so that a tabulation by quarter section will be possible. This quarter section coding will allow for the preparation of special wireless coverage maps showing detailed area coverage throughout the planning area. It also should be possible to color code coverage areas for signal intensity to highlight areas of weak or no coverage within the Region. This quarter section coding will also serve as input to the integer programming model that will be used to select the minimal number of sites required to serve the current and future operating frequencies in the Region.

The end output of the wireless service providers inventory will be a tabulation of all current antenna sites in the Region and their coverage areas for both cartographic display and a development of a digital geographic information system database.

The detailed wireless service provider inventory will embrace three of the four wireless infrastructure categories originally listed - mobile cellular/PCS, fixed wireless and mobile public wireless networks. The fourth category, satellite wireless, will be defined only by geographic service areas and the nature of the communications services provided.

Public Networks

The most prominent public network in the area is the City of Milwaukee CSWAN (Community Safety Wide Area Network). As a DWDM/Sonet network, it has tremendous traffic-carrying far beyond the current needs of Milwaukee police, fire, public works and other municipal functions. For that reason, the CSWAN network has great growth potential as a core network for other future public network applications such as telemedicine, education and environmental monitoring. This network now extends to almost 100 municipal facility nodes which could serve as access points for future public network applications. The CSWAN network and Wisconsin DOT fiber network will be inventoried using the same data structure, processing procedures and output as the facility provider inventory previously described. Wireless public networks will be inventoried with other wireless infrastructure again as previously described.

Other public wireline networks will be inventoried as part of a survey of local units of government in the Region. Some medium-scale and small-scale public networks may well have been installed to

interconnect public safety, educational, telemedical or public works entities. These networks will be inventoried in terms of their network structure, capacities and capabilities.

Section IV - COSTS AND SCHEDULE

The budget for the infrastructure inventory work element is part of the Inventory and Network Monitoring System budget set forth in the prospectus for the planning program. The total regional telecommunications inventory includes both the infrastructure inventory herein described and the network performance (service quality) inventory provided by the network monitoring system, as described in Technical Study Design Memorandum No. 1. This budget of $143,000 is proposed to be allocated as follows:

Labor Cost - $42,000

-Resident Systems Engineer

-Staff Telecommunications Planner

Network Monitoring System - $43,000

-Server computer, central and remote active agent software

Regulatory Review - $48,000

Note: The original Imap budget of $10,000 has been deleted since a preliminary investigation showed no useful or unique data from this company.

The schedules for the infrastructure inventory and the network monitoring system activation are as follows:

<u>Infrastructure Inventory</u>

Start - Month 2, Year 1

Finish - Month 5, year 1

<u>Network Monitoring System - Inventory Phase</u>

Start - Month 1, Year 1

Finish - Month 5, Year 1

Network Monitoring System - Operational Phase

Start - Month 6, Year 1

Continuing

The above milestones are compatible with the project schedule shown on Figure 3 of the Prospectus.

DOCUMENTATION

The outputs of the telecommunications infrastructure and network performance inventories will be documented in a SEWRPC Technical Report to be published after the completion of these inventories in month 5, year 1 of the telecommunications planning program. This report will include data summaries of all the outputs listed in Table 1, together with descriptions of the data collection procedures employed for each infrastructure category. Network maps for the relevant categories will also be displayed in the report. The network performance inventory will also catalog summaries of the network performance parameters previously presented in Technical Study Design Memorandum No. 1 on the Network Monitoring System. A detailed description of the Regional Network Monitoring System will be included in the report.

Table 1

SUMMARY OF TELECOMMUNICATIONS INFRASTRUCTURE INVENTORY

Inventory	Sources	Procedures	Outputs
Facility Provider – Dark Fiber	Facility providers	Network map compilation, data compilation	Type of fiber – by link Number of strands – by link Network map Access points, by street address
Facility Provider – Operating Networks	Facility providers	Network map compilation, data compilation	Points of presence by street address Interface capabilities by equipment manufacturer Network map Network capabilities by band width in megabits per second
Circuit Provider – Circuit-Switched and Packet-Switched	Circuit providers	Data compilation	Building locations by street address Capabilities by band width in megabits per second Interface specifications by equipment manufacturer
Service Provider – Circuit-Switched	Service providers PSC of Wisconsin	Network map compilation, data compilation	Central office locations by street address Service area map Core network map
Service Provider – Packet-Switched	Service providers ISPs	Network map compilation, data compilation	Central office locations by street address Service area map Core network map
Cable Service Provider	Service providers	Data compilation Service area mapping	Franchise areas by service provider Service area map
Cellular/PCS Wireless Service Provider	Wireless Application Corp. FAA FCC Local governments	Radio propagation modeling Radio frequency field measurements	*Existing* ~~Recommended~~ antenna site locations by geographic coordinates Regional cellular/PCS coverage map
Fixed Wireless Service Provider	Wireless Application Corp. FAA FCC Local governments	Radio propagation modeling Radio frequency field measurements Coverage map preparation	*Existing* antenna site locations by geographic coordinates Coverage map preparation
Satellite Service Provider	Service providers	Data compilation	Service area coverage capacity

Source: SEWRPC.

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