MFM Project

Analysis of Telephone PBX Requirements

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As part of the City of Ternopil/Research Triangle Institute Municipal Finance and Management Project, an analysis was undertaken of the requirements for a modern telephone PBX system for the City. A number of onsite interviews and inspections were undertaken in February 1995 as a basis for the this analysis.

A. Existing Telephone System

At the present time, the municipal government of Ternopil has three analog network telephone systems which interface with the City's analog telecommunication system that serves approximately 50,000 residential and institutional users. Currently there is a backlog of 12,000 requests for telephone service in the city

1. Primary Ternopil City Government Telephone System

There are some 65 individual telephone lines that connect the citizens of Ternopil with the various City departments and offices. These lines enter the Ternopil City government building through an underground conduit and then are distributed to each of the respective municipal offices on the different floors of the building. On each floor the lines are commonly attached to the wall surface along the hallways where the wire terminates in a small, often exposed, distribution panel which in turn connects circuits to the telephone sets in the various municipal offices. The telephone stations in the different offices are primarily pulse-only sets because the signals are analog coming directly from the Ternopil telephone system.

The availability of special telephone features is limited to a few City officials. Within one city office, there can be multiple telephone sets which share lines or permit transfer of calls within one department or City office. However, there is no internal telephone system: calling from one office to another requires dialing directly into the City of Ternopil telephone system and queuing along with calls from other citizens or institutions calling the municipal government office being dialed

.2. Central Dispatch System

There is a Central Dispatch System (CDS) for the City of Ternopil; it can be reached by a citizen dialing "080." The CDS can also be reached through two specific numbers that a citizen can dial directly to the central dispatcher.

The Ternopil CDS is for emergencies other than fire, police, ambulance and gas incidents, each of which have their own emergency telephone numbers (01, 02, 03, 04) and their own communications dispatch system. The Ternopil CDS interconnects a number of other emergency response crews, such as the elevator, water-canal and gas repair crews. It also interconnects with each public housing (zhek) office in Ternopil along with the Mayor, Deputy Mayors, Director of Communal Services and a number of other critical City Departments. There are a total of 32 lines connected to the Central Dispatch System. The central dispatcher can connect directly with each of the telephone sets connected to the CDS. The system permits conference calls when initiated by the central dispatcher.

The central dispatcher also has the capability of wireless radio communications with the water/canal

and elevator repair centers.

3. Special Telephone Service for the Mayor
There is a small, crisis-oriented telephone system that uniquely interconnects the Mayor with the Head of the Oblast, the Police Chief, the Director of the Ternopil Telephone Company. It is designed for use in times of civil disasters or other critical events.

B. Potential Telephone System for the City of Ternopil Municipal Organization
There are a number of reasons why city governments today decide to take advantage of modern electronic-oriented telephone systems. They can reduce costs. They improve the efficiency and effectiveness of city employees and their operations. They significantly improve the communications within and among the City departments and with other community institutions. They serve as the foundation for future integration of all forms of communications (voice, data, and multi-media) and as the foundation for mobile forms of constant communications for key City officials and professionals. Most of all, they provide the opportunity to improve communications with citizens as the foundation of improved municipal services.

With the present primary Ternopil City government telephone system, there is concern that it takes too long to reach key officials. It is often difficult to make good, quick connection with vital departments and offices either for crises or for day to day operations. Rapid intercommunications with critical services as the water-canal, transport, and energy are not as effective as they need to be. In general, there is recognition that improvement in telephone communications is a high priority to improve both internal communications among City offices and external communications with residents/institutions of Ternopil and with other cities.

PBX is an acronym for private branch exchange -- a telephone switch located on the premises of an organization. Because of the rapid advances in modern technologies, modern PBXs are electronic and automated. Much like a modern desktop computer, an electronic PBX can be programmed to:

(1) provide a range of features to improve telecommunications, both within the organization and between the organization and its consumers.
(2) serve as the basis for adding a number of new telecommunications services for citizens and for City employees, services not possible today.
(3) reduce the costs of telecommunications both through the reduction of the number of telephone lines currently required and through tools that monitor the means and costs of telecommunications. These tools can also be used to manage changes in the telephone system to adapt more quickly to changes as needs arise

A large number of additional features could be achieved with the installation of a modern electronic PBX and digital telephone system:

* Reduction in the number of telephone lines currently leased by the City
* Automatic distribution of calls from citizens and institutions.
* Direct inward dialing -- one City office can connect directly to another office within the City's PBX system.
* Multi-user and conference calls more easily obtained
* Call forwarding
* Memory for frequently called numbers
* Hearing aid compatibility
* Integrated speaker/microphone

* Speed dialing, one touch redialing, chain dialing capability
* One touch redialing
* Temporary tone (allowing pulse/rotary users to access tone services.
* Phone in use lights
* Automatic standby
* Direct Inward System Access (City officials and professionals can dial directly into the PBX from a remote site, without attendant intervention, gaining complete access to system facilities.)
* Improved support of modems and faxes
* Automatic maintenance routines
* Call detail recording
* Collection of operation data on telephone usage and issues for reports.

In addition, a modern electronic PBX and digital telephone system for the Ternopil municipal government to expand and integrate telecommunications capabilities to provide the opportunity for improved services for citizens, community institutions and for municipal officials and professionals. Such improvements could include:

* Voice messaging including voice mail
* Interactive voice responses.
* Dialed number and/or caller identification.
* Lost/abandoned call redialing
* Interface with one or more central dispatch services
* High speed transmission with remote sites
* Telemanagement to analyze and control telecommunications costs
  - alternate route selection for long distance calls
  - toll restrictions
* Improved telecommunications for citizens with disabilities
* Integration of data(computer) and telephone communications
* Pager and/or car telephones communications
* Improved intercity and international voice and data communications

C. Functional Requirements and Specifications for an Electronic PBX and Digital Telephone System for the Ternopil City Government

1. Overview

Initially, the municipal government of Ternopil will need an electronic-digital telephone system that will require 15 to 20 external telephone lines and can support 120 telephone sets within the main City Administrative building. For the budget allocated for this effort, a maximum number of modern electronic telephone system features should be sought along with opportunities for expansion both in units of telephone traffic load and in terms of advanced telecommunications features.

Two of these advanced features which should be anticipated in the near future is the inclusion of the current Central Dispatch Services and of a voice messaging system.

2. Minimum Specifications

(a) PBX

* a programmable electronic digital PBX

* traffic and management proprietary software licensed to the City for
    - automated maintenance routines
    - call detail recording
    - collection of operational data on telephone usage
* automatic call distribution for citizen and community institution callers
* direct inward dialing
* direct inward system access
* support for modems and faxes
* ability to accept 15 to 100 analog and/or digital trunk lines
* ability to handle 120 sets with an expansion capability up to 200 lines
* allow pulse/rotary users to access tone services
* multi-users and conference call capability
* ability to interface with up to 20 single department consoles
* interfaces and capabilities for future expansion:
    - centralized attendant services (central dispatch service)
    - T1 line high speed remote sites transmissions
    - voice messaging system
    - interactive voice response system
    - mobile telephone sets
    - lost/abandoned call redialing
    - dialed number and/or caller identification

(b) Telephone sets
* two types:
    - multi-featured, single line hand sets
    - multi-featured, multi-line secretarial/executive consoles
* features:
    - call forwarding
    - phone in use light
    - integrated speaker/microphone
    - speed dialing, one touch redialing, chain dialing
    - automatic standby
    - memory for frequently called numbers
    - hearing aid compatibility
    - non-magnetic telephone set instrument

(c) Wiring system
* twisted-pair lines
* to support a digital PBX and telephone set system
* to provide easily accessible secured wiring distribution

(d) Uninterruptable Power Service(UPS) for a reasonable time period.

D. Critical Issues With Implementation and Expansion of a Modern PBX Telephone System

The initial phase of implementation of a modern PBX telephone system for the municipal government of Ternopil should include all departments and offices currently housed in the municipal administrative building. In this initial phase, the most critical technical issue will be

interfacing the municipal digital telephone system with the City's analog telephone network. Over the next decade, as the Ternopil telephone system moves increasing toward digital telecommunications, more and more residents and institutions will have telephone sets that can take advantage of digital telephone network features. At that point the City government will be in a position to offer an increasing range of additional telephone communication features for its citizens.

Following the initial installation of a digital system for offices in the Ternopil municipal building, the subsequent phase of implementation will address two issues:

1. Interfacing with the current Central Dispatch System
2. Including municipal offices in remote locations in the city hall system.

The former should not be difficult; the latter could be difficult since it might require high speed digital transmission links from the remote sites to the PBX

Future expansion of the municipal PBX telephone system will focus on (a) adding features that expand services for the citizen and for the municipal professional (voice messaging/voice mail for example) and (b) integrating telephone with computer communications. Initially the latter will benefit the municipal officials-professionals primarily. Over the next two decades, such integration will provide residents and institutions of Ternopil opportunities for improved services from their city government.

An modern PBX digital telephone system has to be managed continuously. There are always organizational and procedural changes that require reconfiguration of the wiring distribution system. In addition, telecommunication usage data should be collected and analyzed to reduce costs and improve services. For that reason, it is important to designate someone early in the process who will eventually carry out the function of telephone system manager for the Ternopil City Administration.