Abstract: UMP System for Utilities and Resource Management.

This design concerns use of various communication technologies in an integrated, modular, Non- Hardware/Platform dependent system for use by utilities and other resource management organizations (henceforth referred to as "utility"or "utilities"). This system is available for use by the end-user of the utility/resource (henceforth referred to as "consumer") for utilization in dwelling, multi-dwelling and commercial energy/resource management systems. This design is a result of the need for a total Utility Management Processing (UMP) system . Unlike current Automatic Meter Reading (AMR) systems, it requires little more than the current billing system at the utility, coupled with the technologies presented in this paper and associated system implementations.

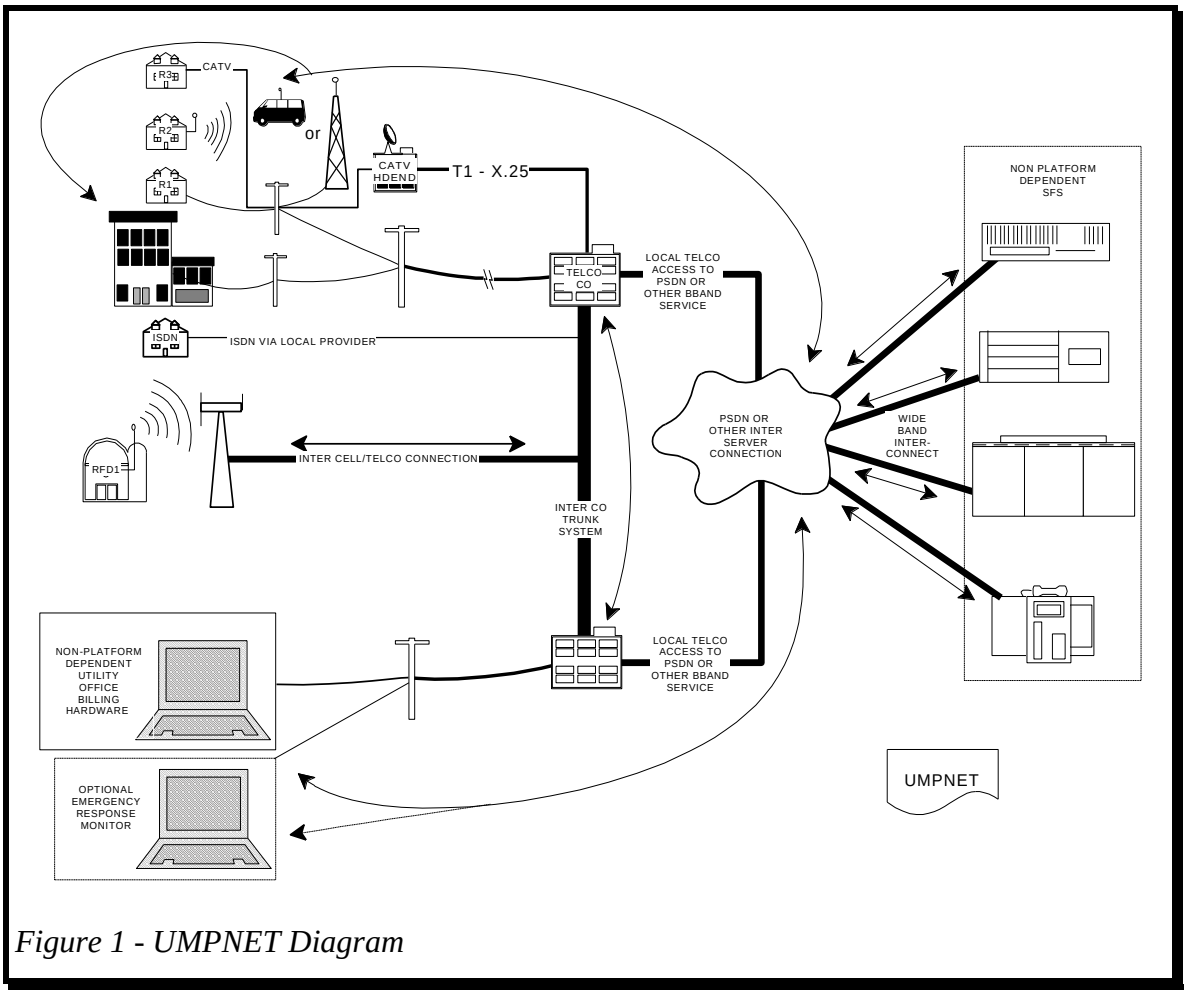

Figure 1 - UMPNET Diagram

Declaration

The system involves the use of many data communication and remote telemetry technologies in a holistic approach to management of the resources. The block illustrations show an increasing level of modularity and detail, starting with Figure 1. In Figure 1, the overall system's bi-directional capabilities are apparent. This system allows the entity that is supplying the resource total control over the distribution and complete monitoring of the resource usage, and allows Remote Real Time Consumption (RRTC) in many of the situations and implementations.

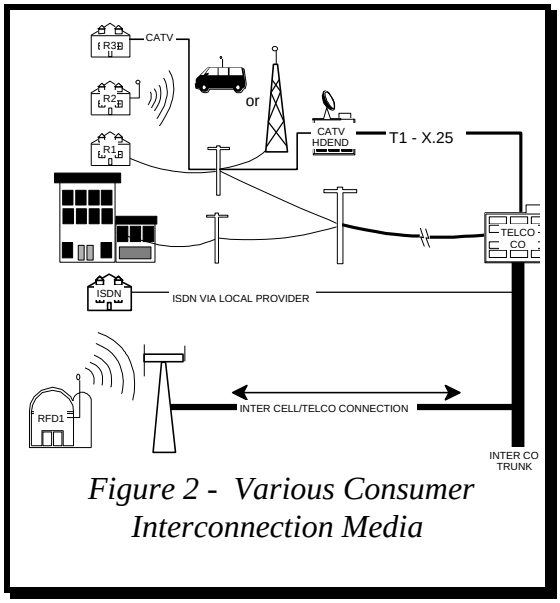

Figure 2 - Various Consumer Interconnection Media

With the UMP system, communication of consumer usage is not dependent on any one technology. It is possible for the utility to utilize any of the communication technologies (CIM or Consumer Interconnection Medium) declared within this document, and other technologies as they become available. This includes fixed and mobile RF (regardless of the actual modulation technique and spectral content), Cellular services, Plain-old telephone services (POTS), broadband land links (fiber, CATV, ISDN-1, ISDN-2, T1-3,), point-to-point wireless links (sub-microwave, microwave) and satellite up/down links. A sample of this technology is shown in Figure 2.

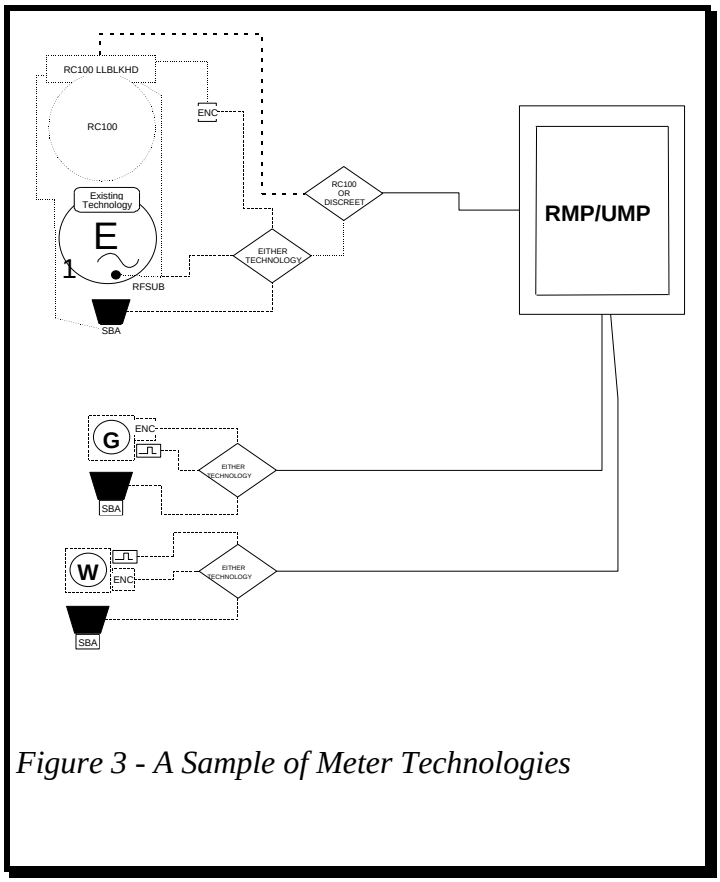

Figure 3 - A Sample of Meter Technologies

Communication of telemetry data to the consumer site from the utility is also non-dependent on the medium used. There is inherent limitations to control of the utility consumption as directed by the implementation of the system by the utility. In other words, if the utility does not

install solenoid shut-off valves or contactors, it cannot remotely terminate service. But this will not limit the data acquisition capabilities of the system.

In Figure 3, it is shown that the ability to acquire the consumer's usage information not dependent on the metering technology employed. All meters, whether machine readable (proprietary or public domain technologies) or older, non-machine readable metering are able to be utilized (by use of the SBA assembly). Machine readable technologies include:

Pulse-type (Hall effect) - existing meter technology in which pulses generated by a magnet coupled to the meter vane are used to increment a mechanical counter or other device located elsewhere on the consumer premises

Encoders - used by meters that are capable of being read by a gun that generates the proper clock/power signals and accessed from outside the premises (usually on an outside wall). There are various protocols and formats used today, with some being utilized in internal RF meterheads and other, previous AMR systems.

RF - RF meters are actually some sort of pulse, encoder or electronic buffer technology with a small transmitter built into the meterhead itself. The reason this type of technology should be addressed is that in order to be compliant with the existing installed base of meters (used primarily by electric companies), the UMP system must gather it's data from the RF signal due to the encoder/pulse/buffer being sealed in the existing meter.

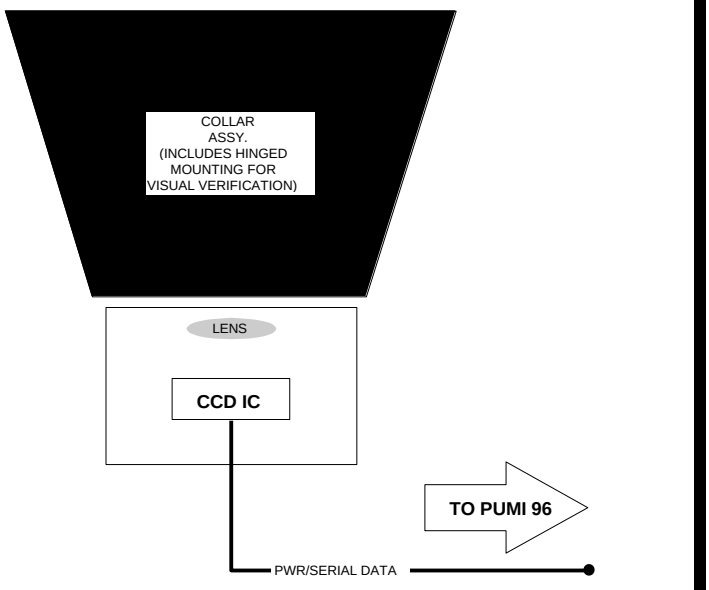

Figure 4 - Scan Boot Assembly (see SBA block description)

Visual-only (no obvious machine readable format available) meters are also able to be read by using a CCD imaging device (such as the Scan Boot Assembly or SBA, Figure 4) coupled to the consumer's utility management system. The scan file is converted to a machine readable format for use by the RMP.

As explained throughout this document, the concept of the UMP system is to autonomously store and manipulate data in a common format, with all data (regardless of source type or communication technology)

being channeled to a common site selected for use by the utility. Utilizing a PUMI (Programmable Universal Meter Interface, explained later) programmed for the correct meter acquisition/control functions, any protocol, SBA adapter, and ancillary devices (solenoid valves, contactors, leak detectors, etc...) can be accessed by the corresponding utility. Access to the respective utility functions is password-protected and secure from other utilities or outside parties. In POTS and Cellular CIM implementations, protection is inherent due to pre-programmed, valid CID (Caller ID) being the only way to connect to the RMP modem on a demand (also called Outbound) read originating at the utility billing office. Inbound (see next section) destinations (the SFS-see next section) are password/ID protected from unauthorized uploads and can only upload or download data to a valid Caller ID terminal (either billing office or system maintenance office origination).

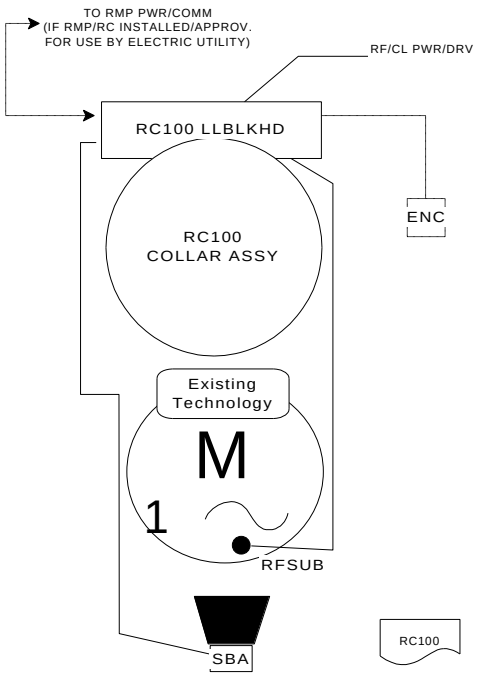

Figure 5 - RC100 collar w/options

In Figure 3, the addition of the RC100 Collar (explained later in this document and shown in Figure 5) allows the RMP to have unlimited access to power, even with the consumer's power disconnected. Coupled with the CLTX01 option (Cellular module, explained in the RFDEX1 block diagram description) uninterrupted access to a CIM technology occurs, regardless of the status of the consumers telecommunication state (disconnected or not available). With shared RMP and CIM, each utility would have undeniable access to their respective UMP hardware.

CIM Concept - MFUME

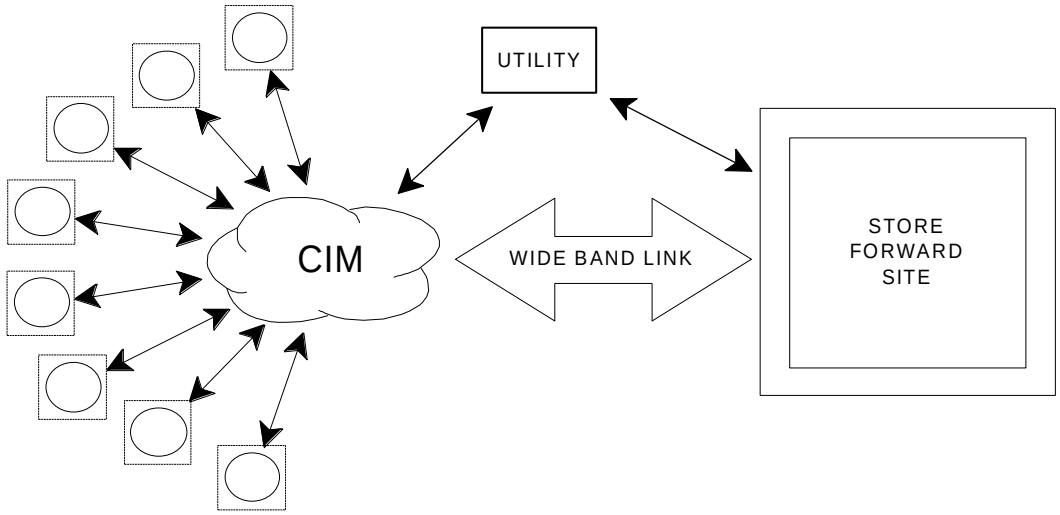

Figure 6 - MFUME Concept

The goal of the data acquisition and manipulation system is to allow utility billing software autonomous and automatic updates of consumer usage and control. This is accomplished by gathering of the consumer data (as stated, regardless of meter hardware, utility management system or consumer site communication technology) to one Store Forward Site (SFS). As shown in Figure 6, many consumer sites are tied to a wide-bandwidth data link via any available CIM. Since the SFS is the common point, access is available to the utility computer, in order to retrieve data sent autonomously by the RMP's at each site (in the AMR industry this is known as an Inbound function), and also can put data and programs in the SFS for download to the RMP sites during their next inbound call. The latter function is the basis for the Maintenance Free Utility Management Engineering (MFUME) concept.

Again, the SFS site hardware and software is non-dependent on any one technology, as long as the predetermined and future-required functions are satisfied. For example, the consumer sites could be a mix and match of dedicated and non-dedicated hardware such as dedicated Remote Meter Processors (RMP), existing consumer computers (non-platform dependent) acting as RMP units, RMP's installed by others (electric sell back to gas or water), any AMR device able to be connected to the SFS, etc... The SFS is also non-platform/software dependent, and can receive data over a myriad of communication mediums and under most Operating Systems (OS). All that is required is that these systems have the ability to freely exchange, store and manipulate data as set forth in this document. This will then create a system that can function in a self-supporting integration

of inquiry, logging, documentation, billing, termination of service, and other bidirectional functions. Limitations of current AMR technology are then eliminated.

Block diagram descriptions

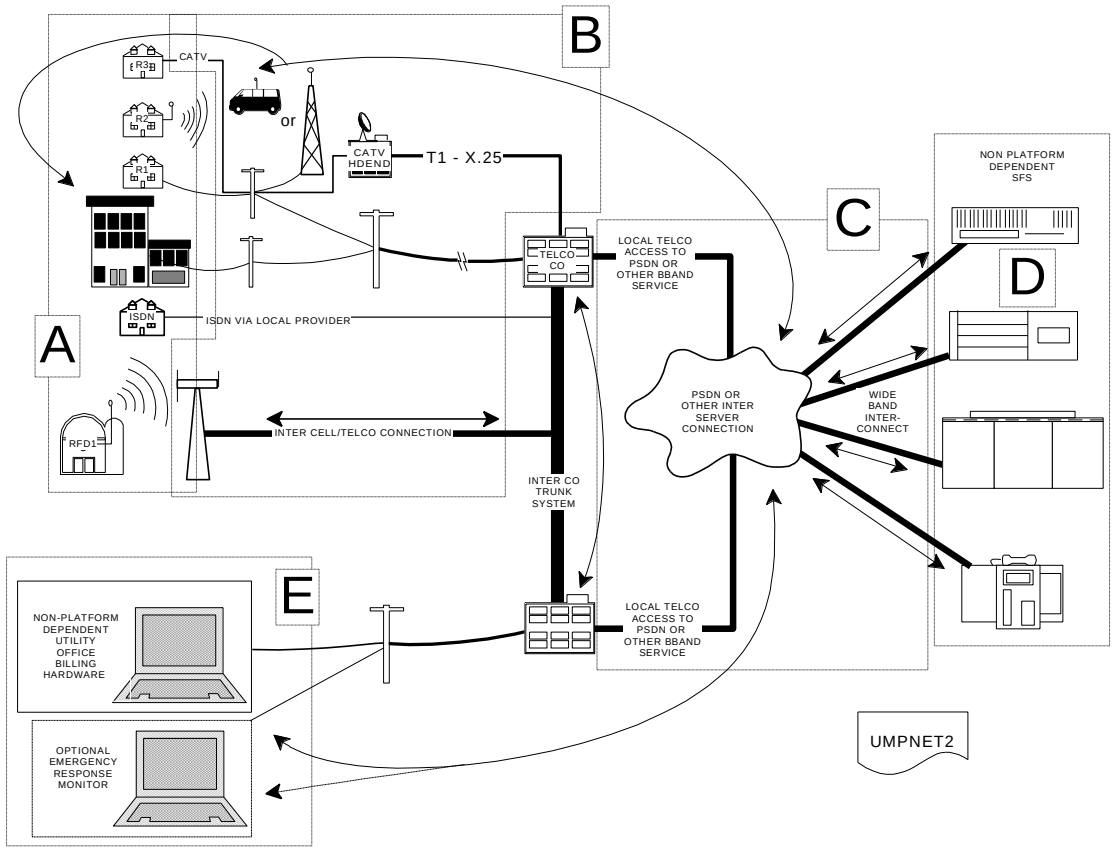

Figure 7 - UMPNET 2 Drawing

The first block diagram labeled UMPNET2 (Figure 7) , gives an overview of the system, in an effort to show the basic requirement for the system architecture. The five main areas are:

(A) the consumer site
(B) the communication networks between the SFS-Link and the consumer site(CIM) and the networks between the SFS and the utility billing office. It also is the communications network or system between the utility billing office and the consumer site
(C) PSDN or other wideband communication network
(D) the Store Forward Site (SFS)
(E) the utility billing office.

Since it is impossible to illustrate all possible configurations, this block shows only the major implementations currently available in a practical means. By nesting these blocks together, it is possible to show levels of increasing detail, down to the component level.

Communication mediums are shown as Landline, Fixed RF, Mobile RF, Cellular, CATV and ISDN. In addition to these technologies, other broad/wide-band systems could be used. The only requirement of the medium used at the consumer site is the ability to recover (either through demodulation or decoding) data originating at the RMP and the ability to forward this data the SFS. If the utility is not interested in demand reads (explained further in this document), or the ability to send data to the consumer site, then modulation or encoding at the utility is not a requirement of the medium. Unlike other systems until UMP, only a section of the service area might be unidirectional with no loss of data collection or autonomous capability. This uni/bi-directional connection to the consumer site known as the CIM (Consumer Interconnection Medium).

Shown on the UMPNET2 block are the various communication mediums (CIM)available. These mediums cover the entire gambit of current and planned telecommunication interconnections. As set forth by this specification, all mediums are eventually cross-coupled to a PSDN/WAN. The reader is cautioned to not limit this to what is widely known as the Internet/Information Superhighway. Unlike these primitive wide-band technologies, UMPNET is not dependent on conformance to TCP/IP or other protocols, FSK or other interconnect techniques. Although this network will definitely be utilized, any type of PSDN/SFS-to-CIM link can be used. But for sake of clarification, we will explain only those CIM technologies that have applicable hardware manufactured or to be manufactured.

In the UMPNET2 drawing, section A, blocks representative of a fraction of the consumer site configurations are presented. R1, R2, R3, RFD01, APT01, and ISDN (see Figure 8) represent detailed drawings that follow this discussion of the UMPNET2 drawing. In each, the three major utilities are represented, with the options and hardware/software available at each example.

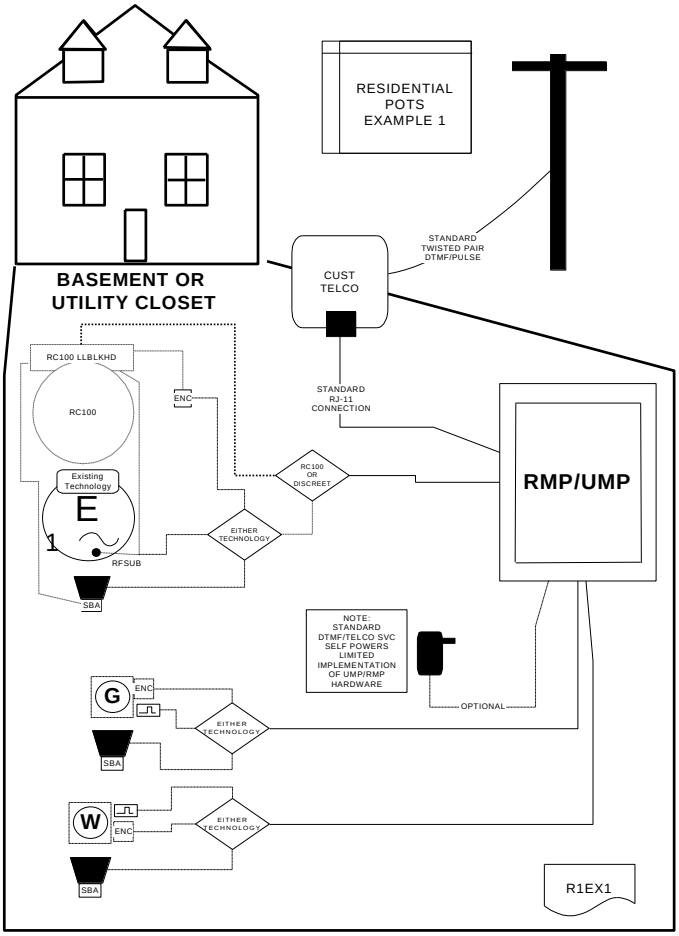

Figure 9 - R1 Example; typical POTS installation

Front End Examples

In this and other consumer site (known as the Front End) examples, the initial installation may have been by either of the three utilities. It is feasible (due to inter-utility conflicts; i.e. utilities that are unwilling to share RMP hardware) that each utility could have installed totally separate RMP/UMP systems (with the possibility of different CIM technology) but for the sake of simplicity, we will assume that the utilities at this consumer site are willing to share RMP units and utilize a common CIM. The three meters (labeled E, G and W) are shown with the interface possibilities. As indicated, either technology could be utilized in order to perform the actual data acquisition. In multi-utility installations like Figure 9, various technologies connected to the same RMP can co- exist. This is a function of the PUMI design, which can be programmed or re-programmed to see different types of data acquisition technology on its respective channels (see the PUMI description later in this document).

In Figure 9 (see previous illustration), the CIM shown is typical of the current two-wire switched network installed by the regional phone companies. This particular implementation of RMP hardware and other typical RMP consumer site installations will follow.