# Remote Monitoring & Control Service Bureau: An End-to-End Solution

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ABSTRACT

Utilities as well as commercial and industrial (C&I) customers today have an enormous challenge to remain aware of various energy, natural gas, water, wastewater, or environmental details for their many geographically dispersed locations. With large numbers of locations under the supervision of one organization, the costs to obtain readings at each location can be quite high. In addition, benefit is gained by reducing the time required to gather data readings from all locations and assemble them into information that can be used by utilities and C&I customers to make decisions that improve operational efficiency and business results. One solution to this challenge is through the use of a service bureau that provides an end-to-end solution for monitoring and control.

## INTRODUCTION

In today's environment, many utilities and their customers are faced with hundreds (sometimes thousands) of locations that require some level of monitoring. This information, once collected, is used for generating reports to help reduce operating costs. Examples of how these data are used include logging and reporting environmental data from remote water reservoirs and dams, graphing the profile of energy consumption over time, developing energy load curtailment/demand response programs, or monitoring the performance of remote energy distribution system hardware/circuitry. Any anomalies that may develop in these widely dispersed and/or distant regions could impact the efficiency and reliability of a corporate-wide monitoring and oversight program.

## WHAT IS A SERVICE BUREAU MONITORING & CONTROL SOLUTION?

A service bureau monitoring & control solution (M&CS) is an end-to-end management system that collects, transmits, and processes data, as well as controls equipment at multiple locations in near-real time. For utilities and commercial/industrial customers requiring insight about their energy, gas, water, or wastewater operations, and critical equipment status, the M&CS provides near real-time access to information via the internet. An effective M&CS service bureau solution will include a variety of hardware and communications options to meet dynamic and unique operational business requirements, some of which are listed in Table 1.

**Table 1: Monitoring & Control Applications**

| *Applications* | *Electricity* | *Gas* | *Water* | *Wastewater* |
|---|---|---|---|---|
| Interval data profiling (HHF/MDEF & MV90) | X | X | X | X |
| Automatic meter reading (compatible with MV90) | X | X | X | |
| Distribution system monitoring & control | X | X | X | X |
| • Capacitor bank | X | | | |
| • Cathodic protection | | X | X | |
| • Irrigation | | | X | |
| Environmental data monitoring (temperature, pressure, flow rates, wind, rain, snow, etc.) | X | X | X | X |
| Storage tank/reservoir/well monitoring & control | | X | X | |

## HOW ARE DATA COLLECTED AND FORWARDED TO THE DATA CENTER?

Data collection is provided through three forms of public communications providers (paging, satellite, or dial-up telephone), each with an appropriate communications fee for gathering the information over these public carriers. The same procedures can be followed using private radio platforms, allowing customers to instrument points and gather data over their existing private radio networks. Please see Figure 1 for a graphical representation of the communications architecture.

Wireless communication technology has expanded the reach of the M&CS service bureau approach. Data collection and remote monitoring of customer meters is possible through use of a family of remote terminal units (RTUs) that interface with low earth orbit satellites, terrestrial 2-way paging systems, or private RF networks. Please see Figure 2, which illustrates a 2-way paging RTU. Once collected, information from an RTU is sent over one of several data communications networks as an

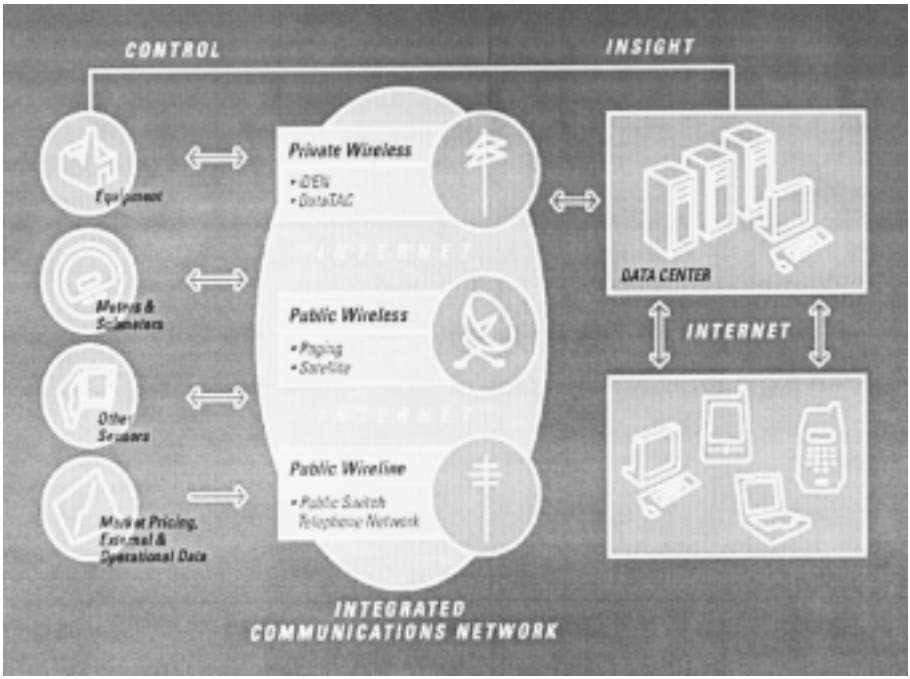


**Figure 1: Monitoring & Control System Architecture**

e-mail via the internet to the service bureau data center, where it is unbundled and formatted for compliance with a customer's database. The information can be displayed in a variety of client-defined formats that include graphs, tables, raw data, FTP, e-mail, or text pager services. If applicable, the information from the database can also be formatted for input into a utility's existing MV-90 system through FTP transfers in the appropriate file format. If customers own their data collection hardware or MV-90 systems, they can FTP data to the service bureau and have information immediately accessed and replayed to their customers anywhere in the world. The internet has no geographic boundaries. Essentially, customer flexibility in communications options (wireless or wireline) when combined with the internet have changed the rules for accessing and distributing data, and the service bureau M&CS serves as the vehicle to facilitate that process.

For control applications, the information flow begins with the customer via the internet and continues to the data center, then via the communication network, to the RTU, which sends a control message to the site.

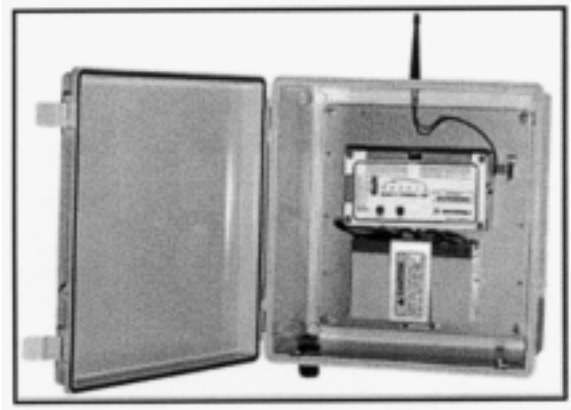

**Figure 2: Remote Terminal Unit (2-Way Pager Device)** This M&CS pager RTU has the storage capability of 15-minute interval data for 6-months if one-channel is used. For multiple channel use, the norm is 35 days of 15-minute interval data.

The units are enclosed within a NEMA 4X (IP 65) fiberglass weather resistant enclosure, as shown in Figure 2. The enclosure includes corrosion-resistant double-quick release latches with locking tabs. Outside dimensions of the enclosure are 12" (304.8mm) high, 10" (254mm) wide, by 7" (177.8mm) deep. The enclosure includes a battery backup.

## WHAT IS THE VALUE OF A SERVICE BUREAU APPROACH?

By allowing both utilities and their customers to access and use the M&CS in near real-time, the M&CS provides specific value to both parties. For utilities and their customers, the M&CS is a remote monitoring and load-profiling solution that can help reduce electricity demand, and enables customers to effectively take control of their operational costs. As such, many commercial customers are reviewing their usage information to determine where they can take steps to improve facility energy efficiency or increase the energy conservation awareness of their workforce. Some of the areas where commercial account energy managers can use a service bureau M&CS to focus attention include:

- Energy benchmarking determination
- Billing verification
- Energy profile monitoring and control with alarms and exception reporting
- Reduction of demand charges
- Near real-time aggregation of load data in support of utility demand response programs
- Measurement and verification (M&V) procedures in support of demand side management (DSM) projects
- Regional aggregation of facility data and comparison of energy use or demand parameters

Table 2 below helps illustrate various other value propositions as related to energy use. These same value statements can apply to any utility or environmental application particularly those covering a wide geographic region.

A service bureau M&CS can be implemented and brought on line quickly primarily because it is a hosted system maintained and upgraded by the vendor, with no special customer software required. Information can be accessible quickly wherever internet access is available, across county, state or national boundaries. The service bureau M&CS offers many significant advantages particularly in a global economy,

where customers are constantly seeking a competitive advantage. Table 3 provides an overview of some of the key attributes of a well-designed and fully functional service bureau M&CS.

## WHAT VISUAL TOOLS WILL THE SERVICE BUREAU M&CS PROVIDE TO THE CUSTOMER?

The data collected by the data center can be formatted for output to support various customer systems. Customer data outputs include real-time alarm messages and periodic data reports with all data archived for a designated period (usually 13 months). As stated earlier, the typical customer gets alarm messages through e-mail-enabled pagers, although these messages could be sent to any device that accepts incoming e-mail messages. Typical chart and graphical outputs, accessible through the internet, are displayed in Figure 3 and 4. A typical alarm historical display is portrayed in Figure 5.

In addition to the graphical, tabular, and alarm reports noted above, the service bureau's data center offers a powerful data analysis system that is flexible and can produce reports and information tailored to a specific customer's operational needs. Table 4 offers a snapshot of the units of measure available through the processing power of a service bureau, which collects energy, gas, water, wastewater, or environmental data and presents that information to customers in formats that meet their operational and administrative requirements. Couple the near M&CS real-time information delivery system with threshold alarming and equipment control functionality, and a customer now has the means to oversee and manage a corporate-wide monitoring and control system that affords a competitive advantage in a global economy.

## CONCLUSION

Information is critical to sound decision making and long-range forecasting of system demand and production requirements. The service bureau M&CS solution has significant value particularly in support of large commercial, industrial, or retail account operations where users must monitor hundreds and/or thousands of sites spread across regional, state, national, or even international boundaries.

**Table 2: Challenges, Solutions, and Value**

| *Challenge* | *Solution Need* | *Service Bureau M&CS Features/Functionality and Value* |
|---|---|---|
| Need to field a solution quickly | Rapid deployment | • Hosted solution is operational immediately after installation of RTU. |
| Hard to read meters | Automatic meter reading for specific areas of service territories. | • Capability to use M&CS for one to many customers, with RTUs that are easy to rapidly deploy and install. |
| Risking substantial expenditures on unproven system | Phased program with smaller initial deployment. | • Ability to deploy 50 to 100 units quickly, then expand to full operation. |
| Unable to establish accurate baseline usage for all customers | Interval data for all customers or utility distribution infra-structure. | • Load profiling available in near realtime over M&CS website showing interval data readings. |

| | | |
|---|---|---|
| Utilities and customers lack information and insight regarding electricity usage (e.g., interval data) | Load profiling features including benchmarking, exception reporting, threshold alarming, aggregation. | • M&CS load profiling, benchmarking, threshold alarms.<br>• Exception reporting, aggregation.<br>• Partner application interfaces where necessary. |
| Incompatible legacy systems create unwanted complexity for utilities | Interface with existing systems and applications (e.g., MV90, private RF networks). | • Able to interface with MV90 or other legacy systems if required.<br>• Ability to add private communications option.<br>• Flexible interfaces to legacy systems. |
| Utility and customers unable to control distribution equipment or privately owned energy hardware in hard-to-reach locations | Monitoring and/or controlling, in near- real time, with reporting capabilities. Notification when equipment thresholds are crossed, verification of on/off status in remote areas. | • Load profiling with benchmark levels indicated.<br>• Alarms when thresholds are crossed.<br>• Feedback when equipment is turned on or off. |

**Table 3: Service Bureau and Remote Terminal Unit Features, Functions & Benefits**

| | |
|---|---|
| **Data Communication Options** | Multiple communication options available via private networks, public switched telephone lines, 2-way paging, or orbital satellites. No FCC licensing required. |
| **Centralized Data Collection** | Data collection, storage, analysis, and network management using a single data center. |
| **Hosted Data Base** | No software to purchase. No licensing fees. Vendor hosts and updates the database and web presentation formats. |
| **Data Logging & Reporting Flexibility** | Logging intervals as frequent as once per minute. Reporting intervals as frequent as every five minutes. |
| **Critical Function Monitoring** | Monitoring of customer-defined thresholds. When thresholds are crossed, alarm messages are sent to e-mail addresses, including e-mail-enabled devices (pagers, PDAs, cell phones). |
| **Remote & Local Configuration** | Configure event counters and timers, alarm set points, and logging/reporting intervals either in the field or through the web interface. |
| **Multi-channel Data Gathering & Reporting** | Monitor an entire site and/or end-use loads through a single device. |
| **Near Real-Time** | Delivers messages as fast as within 30 seconds. |
| **Customer-defined Reporting Intervals** | Reporting frequency is scheduled or "on request." |
| **Customer Reporting Formats** | Customer-defined content for tables or graphs. Unique customer reporting formats can be accommodated. |

| | |
|---|---|
| **Data Transfer Diversity** | Transmits user data to customers via e-mail, file transfer protocol (FTP), or secure internet access. |
| **User Definable Security** | Password protected for system and data security. Multiple levels of security authorization for customer host and designated sub-account users. |
| **Field Capability** | Compact, weatherproof, and secure enclosure (NEMA 4X). |
| **Reliability** | Uses proven data communications services for 2-way message transfer between the remote location and data center. |
| **Satellite RTU** | Eleven input terminals (5 analog and 6 digital). |
| **2-Way Pager RTU** | Six (6) digital output terminals.<br>Six input terminals (2 analog [10-bit A/D] and 4 digital).<br>Two (2) switched relay outputs. Digital input event counters & timers. |
| **Power Source Flexibility** | Either solar or AC power options with battery backup. |
| **Alarm & Exception Reporting** | Alarms and exception reporting based upon customer-designated threshold monitoring set points. |
| **Scalability** | Expandable solution can be used for larger numbers of monitoring sites or to solve other monitoring & control challenges. |
| **Simple Turnkey System Design** | Initial planning, program management and operational services provided by vendor. |
| **Customer Service** | Service representatives and technical support available 24 hour per day, 7 days per week. |
| **Available Support Services** | Resources available to assist with program planning, implementation and management. |

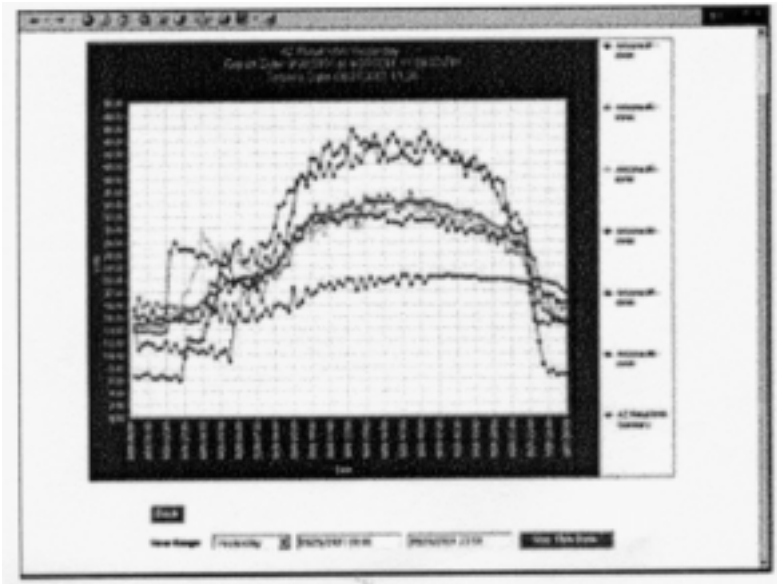

**Figure 3: M&CS Graphical Display**

**Figure 4: M&CS Tabular Display**

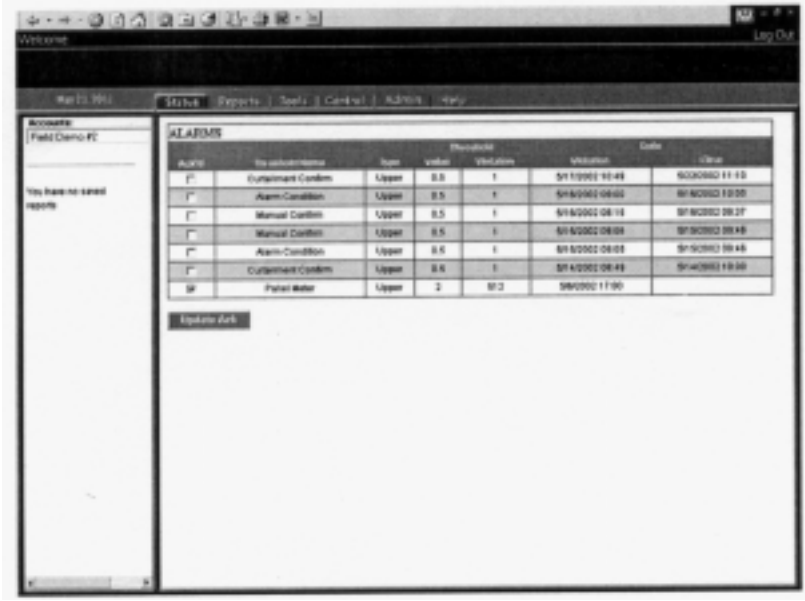


**Figure 5: M&CS Alarm Summary**

**Table 4: Service Bureau Presentation Units of Measurement**

| *Available Units of Measure* | |
|---|---|
| Pulse Count | Megawatt |
| Ampere | Watt |
| British Thermal Unit | Power Factor |
| British Thermal Units per Square Foot | Kilowatts per Square Foot |
| Kilowatt-Hour | Megawatts per Square Foot |
| Megawatt-Hour | Watts per Square Foot |
| Watt Hour | Pounds per Square Foot |
| kWh per Square Foot | Thousand Volt-Ampere Reactive Hour |
| MWh per Square Foot | 0/1 Equipment State |
| Watt-Hour per Square Foot | Degrees Centigrade |
| Cubic Feet Per Second | Degrees Fahrenheit |
| Gallons Per Minute | Day |
| Thousands of gallons per hour | Hour |
| Miner's Inch—BC | Minute |
| Miner's Inch—Co | Millisecond |
| Miner's Inch—MW | Second |
| Miner's Inch—W | Acre Feet |
| Voltage | Hundreds of Cubic Feet |
| Foot | Cubic Feet |
| Inch | Gallon |
| Percent | Thousands of Cubic Feet |
| kilowatt | Thousands of Gallons |

The service bureau M&CS approach provides the technology that can collect, aggregate, and report utility performance data on any number of locations and allow utility specialists or corporate operations managers to make business decisions in near real-time when considerable cost savings or operational improvements are feasible. This approach to operational oversight and management enables corporations to function more efficiently and enhances their bottom line. The service bureau monitoring and control solution provides a cost-effective and rapidly deployable option to establish a corporate-wide operational oversight program.

**Reference**

Motorola, Energy Monitoring & Control Solution for Utilities and Business, RC-30-2004

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ABOUT THE AUTHOR

**Marv Serhan** is an area marketing and business development manager for Motorola Utility Solutions. He is a former naval aviator and retired Navy captain who holds three graduate degrees in disciplines associated with national security & strategic studies, general management, and executive leadership. He has worked in the utility industry for five years and is a Certified Energy Manager with expertise in the design, implementation, and management of the service bureau concept to support utility or corporate-wide energy monitoring programs.

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