WORKFORCE MANAGEMENT IN CABLE TV
TYING IT ALL TOGETHER

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INTRODUCTION

Cable Operators are always seeking ways to boost profits and free cash flow by increasing revenues and by lowering costs. Revenues are increased by expanding product offerings, adding new residential and commercial subscribers and by improving the overall customer experience to out-distance the competition. Costs are reduced by reducing customer churn by narrowing the frustrating “service window”; proactively responding to network problems using predictive solutions like monitoring to correct a problem before an outage occurs and exceeding all requirements of Service Level Agreement covenants with the customer. In addition costs are lowered by improving efficiencies like accurately applying the right resources at the right time in the right place and getting control of the supply chain are also important areas.

There exists a variety of software programs and technologies that can help Operators meet these business objectives across all departments within an enterprise.

This paper will provide the reader an overview of available Workforce Management programs, technologies and tools available to Cable TV Operators and how Workforce Management fits into an Enterprise with the various components.

Specific focus will be on Field Service Management, an element of Workforce Management and the primary function of Technical Operations, as it is one of the primary areas where Cable TV Operators can significantly improve their customers experience and lower overall operation costs.
WHAT IS WORKFORCE MANAGEMENT?

Workforce Management (WFM) is a program that encompasses all the activities needed to maintain a productive workforce. WFM consists of Human Resource Management and in the case of Cable Operators with field personnel, Field Service Management is included. WFM effectively manages productive “customer-facing” time and non-productive time such as training, maintenance, drive times, etc. (Snow, 2011) Typically WFM is part of the overall Enterprise Resource Planning (ERP) system an enterprise integrates in order to manage and encompass all the activities across multiple departments needed to maintain a productive workforce that best serves its customers and manages its supplier base. The purpose of ERP is to facilitate the flow of information between all business functions inside the organization and to manage the connections to customers and other stakeholders outside the organization. (Dictionary.com, 2011)

Traditionally managing the workforce has been achieved through various manual processes involving lots of paperwork, multiple management signatures, facsimiles, phone calls, mail and e-mail, punch cards, time clocks, paper calendars, white boards, Excel Spreadsheets, and lots of redundancy and inefficiencies related to troubleshooting and dispatching to customers. WFM is an evolving methodology that is taking advantage of new technologies such as automated software programs, wireless and cellular technologies, Smart Phones, Global Positioning, and many other tools to orchestrate these processes in real time using mobility.

Figure 2: Categories of ERP (Enterprise Resource Planning)
Under an ERP system, there are three general categories that cover all the departments within the enterprise. These are CRM (Customer Relationship Management) that applies to working with customers; WFM (Workforce Management) that applies to employees and SCM (Supply Chain Management) that applies to vendors and suppliers. Note how the umbrella ERP covers the three main areas shown Figure 2.

**CUSTOMER RELATIONSHIP MANAGEMENT (CRM)**

Customers are engaged and serviced via components of Customer Relationship Management (CRM) software programs. CRM systems are ways for operators to streamline customer-related processes across the various functions in the organization. These areas include Billing (Receivables), Sales with Sales Force Automation (SFA) programs, Customer Service and E-commerce solutions that provide customer live interaction via the Internet.

There are on-premise CRM solutions that an operator owns in-house or they could use hosted CRM solutions from a third party. CRM solutions providers continue to implement ongoing advancements in mobile CRM applications to allow field service staff such as sales and technicians to access customer data on the road. (Business-Software.com, 2011)

**SUPPLY CHAIN MANAGEMENT (SCM)**

Internal inventory purchasing, vendors, contractors and other suppliers are managed by Supply Chain Management (SCM) tools and programs. These programs manage inventory and the internal parts acquisition by employees, issue purchase orders, pay invoices (Payables), and process bids and online Auctions. Automatic processes such as EDI Electronic Data Interchange establish automatic payment exchanges from the Operator’s bank to the supplier’s bank eliminating manual processing and paperwork.

Procurement programs can streamline employee ordering, enforce spending policies, and dramatically reduce procurement costs by reducing time and
eliminating paperwork. Contracts pricing and ordering with vendors is simplified and automated. (Oracle Corporation, 2009)

Barcoding technologies enable accurate inventory count, min-max order planning and tagging of asset to disbursed location.

**WORKFORCE MANAGEMENT (WFM)**

For Cable TV Operators WFM programs focus on Human Resources and Field Service. Both elements are vital to ensuring that the enterprise can fulfill the needs of the customer.

Human Resource Management Systems (HRMS) focuses on areas such as payroll & benefits, time & attendance, career planning, talent management, learning and training management, performance management, scheduling, tracking and emergency assist management. Finance and Accounting programs connect with Billing and Payables programs.

Businesses such as Cable Operators who employ workers in the field such as sales and service technicians require Sales Force and Field Service Management. This paper will dig into Field Service Management processes, functions, equipment and software programs that the Cable Operator manages and that has available today and in the future. Cable TV must manage the construction and operation of the physical Outside Plant delineated by Network Operations and Technical Operations. Network Operations deploys field personnel to install, inspect, modify, upgrade and repair network elements such as fiber cable, hardline cable, power supplies, nodes, amplifiers, etc. Technical Operations deploys field personnel to manage the “last mile” of from the Tap to the subscriber where they meet and install service to the customer. Both Operations departments gather and compile operating data and levels that are compiled and used to plan maintenance and to dispatch field personnel to address problems.

As we get into details about Workforce Management Programs for Field Service, it is important to point out the key elements of Cable TV Plant that are necessary to fully manage all the variables of Field Service.
Field Service Management processes are designed to make sure that the companies who have employees sent out to the field can assign the right employee with the right skill set with the right tools and parts with the right equipment to the right job at the right time to satisfy the requirements of the customer. This includes elements such as scheduling, routing, dispatching, parts management, vehicle tracking and uses mobile technologies to enable communications in real time. (Ronz, 2011)

Cable Operators integrate the data inflow from customer service and from Outside Plant sources such as monitoring, maintenance and demand data from Network Operations and Technical Operations. For the Cable Operator tying all of these elements together is necessary to successfully manage the Field Service Functions. These elements are managed by a variety of software programs both from a third party source for CRM and monitoring to home-grown solutions to capture and process signal levels from CPE.

Mobile Workforce Management (MWFWM) is the program that ties together the “off-the-shelf” mobility workforce management software programs, GPS tracking and navigation programs, fleet management and telematics programs, mobile handheld devices and the coordination of all wireless carrier services and related components involved.
Cable Operators must constantly monitor and ensure that the physical Outside Plant is operating smoothly and efficiently. This ensures the delivery of high quality signal as guaranteed in service level agreements. Capturing, processing, integrating, managing and dispersing all of the Plant data information is imperative and part of the Field Management Program. Operators have incorporated a wide-variety of software solutions and programs over the years to manage this part of the operation. As a result a hodge-podge of third party and home-grown solutions have been developed and implemented. In each case however, the information that is collected is integrated into their Geographic Information (GIS) system which then in turn offers Technical Operations and Network Operations work orders that get turned into Tickets and entered into the work order scheduling.

**GEOGRAPHIC INFORMATION SYSTEM (GIS)**

Applying geospatial data to Geographic Information Systems (GIS) makes it easier to correlate and integrate different data sets to provide new and useful insights into the interaction of many geographic phenomena. (Groot & McLaughlin, 2000). Geospatial data is data defined spatially (in location) by four dimensions (geometry and time) related to the Earth. Geospatial data is spatially referenced in Cable TV by latitude and longitude with temporal changes for over time.

In Cable TV, the Geospatial Data, Plant and Strand CAD maps, monitoring information, signal leakage information is collected and linked in the GIS system and overlapped with GPS maps to tie together all Plant information, trouble, leakage, weather events, traffic congestion, etc. This then provides Technical Operations accurate information for planning maintenance, responding to demand events and for linking customer work orders for efficient scheduling of daily quotas.
MONITORING

END-OF-LINE MONITORING FROM THE CUSTOMER PREMISE EQUIPMENT (CPE).

For operators deploying DOCSIS 3.0 monitoring systems are available the continuously analyze RF performance in the upstream from the premise all the way back to the Headend. Alarms, current status, trends and ongoing history of device performance is tracked and managed. Compiled data is sent to the Operations to plan maintenance and repairs before outages occur. (JDSU, 2009)

Mandatory FCC proof of performance must be submitted twice yearly to the FCC. Using an End-of-Line monitoring program lets the operator capture this data with a bare minimum of truck rolls. Observed on a monthly basis, any defects discovered can be remedied as part of a planned maintenance cycle in the Workforce Management System. (Day, 2011)

NETWORK MONITORING.

Power Supplies, Optical Nodes and other actives with a DOCSIS-based transponder provide performance data back to Headend. The transponder uses standards adopted by the SCTE-HMS subcommittee for both fiber node and power supply monitoring. Alarm criteria and thresholds are established to alert Operations when an outage or potential degradation in service has occurred. These alarms are then incorporated into the Operations Workforce Management System to schedule resolution. (Cheetah Technologies, LP, 2010)
**LEAKAGE DETECTION**

Automatic signal leakage detection captures RF leakage outbreaks and records with a time/date stamp and GPS location and sends data back to central database server where it can be compiled, prioritized and assigned to technicians. (Trilithic, Inc., 2010). Using either a handheld or vehicle mounted detector, the data is captured and uploaded via Wi-Fi, cellular or cached for later Ethernet connection.

Any vehicle belonging to the operator can be equipped with the leakage detector. The more capture of leakage data, the more accurate the isolation of the spot becomes. This also assists in complying with the FCC CLI requirements of riding out 75% of the system and capturing data for the annual Form 320 submission.

**TEST EQUIPMENT**

Test equipment on-site linked with software at the Headend enables comprehensive verification testing of all services per the Operators Standard Operating Procedures.

- Full DOCSIS testing
- VoIP Testing
- Advanced RF Testing
- Advanced IP Testing
- Forward and Reverse Sweep
- Home Certification
- Monitoring

Once the customer is assigned a birth certificate of a certified installation, the baselines are established for ongoing monitoring and trending of the signal quality. Many test equipment manufacturers have complemented their hardware and software products with workforce management components that run on their servers and link to the Operators servers.
Mobile Workforce Management (MWFM)

Mobile Workforce Management (MWFM) encompasses all the tools, software programs, vehicles, field personnel, inventory and parts, tools, GPS, cellular and wireless communications and technologies required to deploy a successful mobile field workforce.

Software and wireless automation are key in constructing an efficiently run mobile field management program. Machine to Machine (M2M) communications technology, where machines “talk” to each other, incorporates the field-deployed wireless devices, the wireless carrier networks and the back-end server networks. This technology, having emerged from telemetry, uses Bluetooth, instant messaging, Internet, to link the devices wireless sensors to share real-time two-way data. (Crosby, 2008)

In this section we will review the MWFM options available in Workforce management software programs, GPS and Telematics, and wireless technologies and tools used.

WORKFORCE MANAGEMENT SOFTWARE PROGRAMS

FSM software programs are commonly referred to as Workforce Management (WFM) and/or Mobile Workforce Management solutions (MWFM) and are designed to help managers efficiently coordinate all the functions detailed above. These programs typically connect directly to the Operators core customer-care and billing applications (CRM) so that all interactions and information captured in the field is made available to the other users in the call center and even to customers via the Internet. They will automatically notify customers of appointment status and help narrow the service window.

Useful features common to mobile workforce management solutions include managing routes, forecasting, predictive planning creating workload quotas and scheduling, dispatch, communicating status in real time, managing on-board truck inventory and suspending appointments. Access to Google maps auto routes technicians to the right location base on appropriate skills. (TOA Technologies, 2011)
Displacing the traditional “Whiteboard” for tracking and dispatching technicians a Virtual Whiteboard is available that provides real-time information. Managers can manage capacity by viewing all resources and can distribute work orders automatically.

Capacity Management or Capacity Planning components of WFM software provide the operator advanced optimization of resources. Using algorithms designed to capture and use field data to determine, track, trend accordingly the software “learns” the patterns and capabilities and apply resources accordingly. It will learn the pace of work by all technicians for each type of job assigned the operating performance of the CPE, the capabilities of the test equipment, the history of the customer, and many other variables that are common decision criteria used by dispatch managers before assigning work orders. (TOA Technologies, 2011)

Other capabilities include tracking escalation and damages by uploading pictures and data tagged to an assigned tracking number and urgency level with appropriate supervisor notification. Equipment and vehicles are matched and tracked to a specific technician to help manage assets and fleet. (PenguinData Workforce Management, Inc., 2011)

Performance of technicians, validation of time and motion and work orders can be managed automatically by comparing work order completions against projections and pre-set expectations. (Snow, 2011) The quality of installation and customer satisfaction are managed through home certification practices and on-site and automated customer service follow up and surveys. Long term trending of all of this data provides productivity data for customer satisfaction monitoring, management reporting and ROI calculations. (Leuenberger, 2011)

Technicians can track their parts inventory and issue re-orders based on preset quantity thresholds that get triggered when individual part counts fall below threshold. At the completion of each job, the technician enters the parts used including lengths of cable, number of connectors, ground blocks, etc. The Set Top Box information and eMTA and all CPE details are logged into the system as well.
Real-time vehicle tracking views and analyzes technician activities including location, stops/stops, and work order information for workforce. It verifies and analyzes routes to improve driver efficiency. Managers can assess location and make dispatch decisions accordingly. (CSG Systems, 2009)

GLOBAL POSITIONING SYSTEM (GPS)
GPS is a satellite-based navigation system comprised of a network of 24 satellites put into orbit by the United States Department of Defense. The satellites orbit the earth twice daily and a precise orbit and transmit signal information to receivers on earth. The receivers process the information using triangulation to calculate the user’s exact location. (Garmin Ltd., 1996-2011)

Manufacturers of GPS receivers provide solutions for tracking vehicles and for issuing turn-by-turn navigational instructions. More and more devices are incorporating GPS receivers including cell phones, computers, iPads, vehicles and personal safety devices. Providers would like the truck to have on Dash Display for turn by-turn and audible navigation to eliminate the usage of cell phones while driving. (Gorman, Charter GPS Requirements, 2009)

Equipment providers incorporate GPS information to offer geospatial information to the Operator for asset tracking, customer assignment, trouble events, and this information is compiled into the operators GIS program.

Equipped with GPS transponders vehicles can be tracked to identify location real-time as part of an AVL (Automatic Vehicle Location) program. This is useful for helping dispatchers identify where any particular technician is located who can respond to a customer requirement.

VEHICLE TELEMATICS
Telematics integrates telecommunications and informatics and sends, receives and stores information in conjunction with controlling remote objects. Sensors can be installed in vehicles to track and monitor vehicle speed, RPMs, oil pressure, seat belt use, idle time, CO₂ emission, Fuel consumption, times vehicle was in reverse and any number of parameters important to managers. Data collected provides tools for effective vehicle maintenance planning and for connecting with the Workforce Management Program.
Operators can save significantly in gas consumption alone by using telematics. UPS, by the end of 2010 equipped 24,984 trucks in North America with telematics sensors which resulted saving the company 1.8 million miles of driving that equated to saving 186,000 gallons of fuel and 1,893 metric tons of CO₂ emissions. (UPS, 2010)

**WEB BASED TECHNOLOGIES**

**CLOUD COMPUTING**

The National Institute of Standards defines Cloud computing as a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model promotes availability and is composed of five essential characteristics, three service models, and four deployment models. (Mell & Grance, 2011)

Cloud computing is a fast growing trend with Google Cloud computing being one of the bigger names having success managing small to mid-sized enterprise computing. Now, with the acquisition of Motorola, Google will have more leverage and capabilities to expand their programs.

The advantages of Cloud computing are abundant and include not having any hardware to upgrade or replace, getting real-time upgrades, having the fastest available speeds, and providing users access to data from anywhere at any time using any web-enabled portal. Operators are currently paying license fees with software providers so having that provider manage it all in a cloud provides more value for that same fee. (Snow, 2011) The only equipment required of the Operator includes a web-enabled devices to access the cloud. “The goal is to become device agnostic, so you don’t have to take an engineer to the device. The more that is built in the Cloud the less concern and cost there is associated with the devices.” (Stainbrook, 2011)

Of the three service models in Cloud Computing, Software as a Service (SaaS) is perhaps the most widely recognized. There are hundreds of SaaS offerings available today in a wide variety of applications. The CRM solutions used today by Operators are an example of SaaS.
As Operators look to integrate all facets of ERP, discussed later, it is likely that they will require a hybrid platform solutions such as Platform as a Service (PaaS) or Infrastructure as a Service (IaaS) service model and a Mobile Enterprise Application Platform (MEAP). Because of the unique and expansive number of programs used across the multiple functions and departments in the Operator, PaaS is a platform to build, deploy and manage applications that are often specific to programming languages. (Wang, 2011). Due to security concerns Operators may end up developing their own private enterprise Cloud where they control 100% of the system onsite.

**JAVA**

Java is a programming language for writing software to leave on Internet Web sites and downloadable over the Internet to a PC. Java enables motion of inanimate objects on Web pages. It allows programs to run on any machine anywhere and contributes to cloud-based computing. JavaScripts can be embedded into HTML documents to enhance Web pages. (Newton, 2006)

It is specifically designed to have as few implementation dependencies as possible and is the most popular programming language particularly for server-client web applications. With the advent of cloud computing, the Java platform outweighs the traditional language of C and C++. (Wikipedia, 2011)

**HTML5**

As Operators continue to implement more mobility into the workforce, the development of HTML5 will offer users access to any application on the Web regardless of original platform design. It will permit mobile devices to experience rich multimedia content and provide for “desktop”-like experience on any device. This will enable Operators to expand in-house content to the field as it is seen at a PC. (Campbell, 2011)

**DATA FEEDS**

Each unique program running internal or external to the enterprise must have a method for connecting and exchanging information among them if automation is desired. To enable this programs contain APIs (Application Programming Interface) that enable hooking into a program to gather data from it and share it with another. SOAP (Simple Object Access Protocol) Calls are made to make connections between web servers and clients and are XML (eXtensible Markup Language) based. XML language is a way of tagging data so it can be read on browsers, servers, software and clients. XHTML blends the functionality of XML and HTML to mix complex documents with formulas or media. SaaS providers implement all forms of pushing and pulling data to connect and enable automation. (Newton, 2006)
MOBILE WIRELESS TECHNOLOGIES AND HANDHELD DEVICES

Mobile wireless technologies provide field services data collection systems and processed, real-time knowledge of the location of mobile workforce, assets and inventories, real-time knowledge of the capabilities and expertise of mobile workforce, and real time status and progress updates of the tasks, work assignments and schedules of the mobile workforce. Handheld devices enable the capture of up-to-date customer and work order information and allow field workers to report remotely on and close service orders that dramatically reduce the need for costly and time-consuming phone interactions among technicians and dispatchers. Companies participating in recent Aberdeen study reported that mobile workforce automation has enabled them to realize a 50% increase in work orders completed per day. (Vigoroso, 2005)

Packaged in ruggedized cases, tablets are fast becoming widely accepted as the best tool to enhance customer service by the technician. While with the customer, the technician can upsell advanced services by displaying animated features via web or loaded presentations. They can help train the customer on the new services by showing videos or documents as needed. They can view their next appointments and pull up technical documents while performing a repair. They can complete work order tickets, capture and upload pictures and videos, submit vacation requests and complete expense reports all from the tablet. (Sybase, Inc., 2011)

Despite the recognizable cost savings of mobilizing the workforce, Operators cringe at the thought of having to manage all of the mobility solutions, devices and applications in conjunction with the operating systems and back-end data sources. Managing the IT within the walls of the enterprise is challenging enough, but managing the security access and control of thousands of remote units accessing the enterprise server is daunting and a high risk. (Leuenberger, 2011)

The biggest challenges for enterprises managing mobility include:

- Securing Data. This includes the interception of data in transit and the retrieval of and wiping of data from a lost or stolen device.
- Supporting Multiple Devices.
- Simplifying Deployments, managing Applications and upgrades.
- Keeping Maintenance Costs Low.
- Integrating from the back-end.
Telecom Expense Management.
Connectivity and Data Speed Capabilities.
Blending Enterprise versus Personal usage in a single device.

Viable and fast growing solutions to such concerns are available in the form of Cloud-based Managed Mobility as a Service (MaaS). As Operators are doing with Workforce Management Software, contracting with SaaS providers, they can do the same to manage the mobility components. However, many enterprises still consider the security risk to averse and thus they are developing their own Mobile Enterprise Applications Platform (MEAP). Doing this allows and enterprise to embrace new mobile trends without compromising security. With a single, integrated interface the mobile device management solution can perform many vital tasks remotely:

Mobile Enterprise Applications Platform (MEAP)

- Distribution of software and updates
- Distribution of information and content
- Tracking of assets, hardware and software inventory
- Management of operating system and software patches
- Tracking of software license compliance
- Configuration updates
- Remote backup and restoration of data
- Over-the-air data encryption
- Antivirus and firewall protection
- Remote device kill and data deletion for lost or stolen devices.

Companies are also beginning to realize that being device agnostic offers many advantages. It significantly lowers the cost of equipment as employees select and buy their own preferred devices to use for both business and personal applications. They don’t have to manage the devices, just load apps and provide remote updates. The employees like using their own devices and become more productive in having the freedom to customize accordingly. Using a sandbox enables the segregation of enterprise and personal Data where employees have to login to get access. (Sybase, Inc., 2011)

CONNECTIVITY OPTIONS

Having tools and programs in place to manage the field workforce is a moot point if there isn’t constant availability of reliable and robust wireless connections available. Wireless usage is growing at an exponential rate which means the bandwidth availability is going to continue to get strained and slowed in the Radio Area Network (RAN). Wireless Wide Area Networks WiMAX and WLAN, Wireless Local area networks offer greater speed than cellular connections.
The potential of falling out of available cellular networks and the slower data rates makes moving to a WLAN preferable whenever possible. (Smith & Meyer, 2005)

**WI-FI**

Much of the equipment used today offers Wi-Fi to enable uploading of information either real-time or from cached storage. When the device falls in range of a hot-spot it uploads the data. Laptops without a cellular card require a Wi-Fi hot-spot to access the Internet while in the field. Operators are building their own Wi-Fi networks to further expand accessibility to subscribers and for use by their own workforce. Security is managed using Wireless Equivalent Privacy (WEP) with a shared key authentication requiring users to enter a WEP key for access. (Smith & Meyer, 2005).

Any device that is “Wi-Fi Certified” is interoperable with any other certified device. The certification indicates that the device operates in either RF band 2.5GHz for 802.11b, 80211g, or 802.11 and 5GHz for 802.11a. (Internet.com, 2011)

**BLUETOOTH AND RFID**

Bluetooth is a wireless protocol that allows connectivity between communication devices for the purposes of exchanging information between them. It operates in the 2.4 GHz ISM band and replaces the former infrared telemetry protocol which extends range up to 100 meters and flexibility as direct line of site is no longer required. It is meant to be a LAN extension for ease of communication connection. (Smith & Meyer, 2005)

RFID (Radio Frequency Identification) is a technology using RF to transfer data from an electronic tag or label through a reader for the purpose of identifying and tracking parts and objects. It falls under a broader category known as automatic identification technologies (Auto-ID) that includes bar codes, optical character readers and other applications. (RFID Journal, Inc., 2005)

Technicians scan the customer premise equipment at installation to tag subscriber with asset for ongoing tracking and billing. All on-vehicle parts, tools and inventory can be tagged with bar codes or RFID labels and managed automatically. Operators can reduce inventory costs significantly by knowing exactly what has been installed and what is currently on-board a particular vehicle.

Portable printers that are Bluetooth capable can be used for printing receipts and legal verbiage to give to subscriber. (Gorman, Tech Portal White Paper, 2009)
The primary carriers, AT&T, Verizon Wireless and Sprint use one of four different technologies to transmit calls to a cellphone. These are GSM, CDMA, TDMA and I-DEN. I-DEN and TDMA are being phased out. AT&T uses GSM at Bands 850 and 1900, Verizon uses CDMA at 800, 1900 and 2100 and Sprint uses CDMA/PCS at 1900 and 2100. (phonedog, 2007)

To the Operator, having the most expansive and robust cellular coverage is important. The technologies used aren’t what provide coverage but rather the number of cellular towers the carrier possesses in a particular area.

Operators will also want their providers to offer 4G service to capture advanced data rates for phone and Internet service on Smart Phones and Tablets. 4G is the fourth generation of cellular wireless standards succeeding 3G and 2G. It is expected to provide comprehensive and secure all-IP based mobile broadband to users offering 1 Gbps for low mobility deployments and up to 100 Mbps for high mobility deployments. (Grayson, Shatzkamer, & Wainer, 2009). In addition with the explosive growth of IP devices, the cellular carriers must provide IPv4 and IPv6 protocol capability as IP addresses get exhausted. (Verizon Wireless, 2011)

Ruggedized Cellular / Wireless Routers and Modems are available that are installed in vehicles and serve as a collection hub of all data gathered from the multiple instruments and devices carried by the technician and mounted on-board. These units provide secure and reliable high speed data transmissions with easy GPS and wireless integration and can support the latest 3G/4G interface support. (Sierra Wireless, 2011)

Any Business like Cable Operators who send technicians or staff “into the field” always have challenges managing the multiple variables involved. In a swivel chair fashion gathering information relative to the customer interaction to assessing technician, parts, equipment and vehicle status to dispatching and optimizing the workforce and to integrating the latest mobile applications. Since this part of the operators business is critical to meeting the goals of customer satisfaction and cost reductions finding the optimal solution that could completely automate the process is ideal. This involves capturing and managing real time knowledge and data of the mobile workforce assets and inventories. (Click Software, 2010).
Ideally, with the advent of so many technologies and mobility tools, it is theoretically possible to completely automate the Field Service Management process. Instead of a manager looking into the computer whiteboard to assign tickets, the computer automatically does this based on all the criteria, thresholds and resources established up front and captured over time. This process is triggered from the moment a customer “need” is entered into the system. The system then auto-assesses all elements internally and then automatically applies the resources by auto-dispatching commands to technicians whom have identified via login that they are available. Once a work order is complete parts and equipment replenishment orders are automatically transmitted to procurement where purchase orders are then administered electronically to suppliers, commands are issued to commence billing to the subscriber. The system would offer a full customer entry portal to allow self-scheduling, it would balance and build quota based on skill set and work schedules, it would auto routes and provisions all CPE; provide tech tracking, and a full QA program for CPE and customer service.  

(Parrott, 2011)

The problem is that with all the available Workforce Management SaaS providers available today, none evolved from the Cable TV industry and therefore haven’t developed all the functions that would be required to fully automate the Field Service piece for the cable industry. For them they generally may not need the ability to auto-assess variable “assets” that are standard or reoccurring practices with narrow focused skill sets such as ambulances, police cars, UPS trucks, etc. In Cable TV, Capacity Management is needed that looks at a variety of data sets. “What resources are available” to fill the specific job, at a specific time with a
specific skill set are a few before the right technician can be assigned is required. Capacity management, while existent in various modules may not meet the needs of many systems or have been cost prohibitive causing them to use “one-off” tools to track resource availability and although they have modules where all the information is kept and up to date, managers must manually review and then schedule routing and dispatch. This is the swivel chair effect that can open opportunities for errors that impact the customer experience. (Stainbrook, 2011)

As a result there are “gaps” in the range of available solutions and some of the MSOs have developed home-grown programs to fill these gaps. See Figure 3 Workforce Management Software "Gaps".
One concept is to turn the vehicle into an independent mobile Van Area Network (V.A.N.). When a technician starts his/her shift, and logs-in and turns on the van, all the equipment automatically signals Field Operations that they are working and available. This data is captured and applied to Customer Service portal so they can see availability. The automatic system would then assess all the necessary components on-board, the technician availability and skill level, location and then apply work order tickets appropriately.

**Figure 4 V.A.N. Van Area Network**

The equipment on board communicates to a central device Wi-Fi or Cellular router that aggregates all devices and transmits back to Technical Operations Hub via one of the Cellular Carriers. Technicians are coded by their VPN access code, WEP codes and their vans are
tracked via a telematics device showing vehicle metrics. The GPS unit tells where the technician and van are located and the navigational features directs technician to customer in fastest route. All equipment is standardized with common connectivity, and open architected.

The objective would be to eliminate all separate monthly service payments and integrate all connectivity into one communications hub for one monthly fee. Structuring a deal with the wireless carrier to provide a monthly data usage rate based on total fleet usage would be one scenario.

All of the equipment on the van can be reduced in feature-sets to eliminate redundancies between each of them. For example, having the equipment vendors remove the GPS functions, the displays, and other additional options can help reduce the cost of assets.

There are potential hurdles with putting together a V.A.N. network as shown. Wireless bandwidth constraints, connectivity limitations, security and cost of ownership are few issues to overcome. The Hub device would need to have storage capability for those times when they drop connectivity and sustain security access for immediate offloading when re-connected. The inability to run some applications is a problem but may be addressed by HTML5. Getting the manufacturers of the individual components and test equipment reduced in features and at a lower cost might be difficult. Finding the most cost effective way to integrate the entire fleet and keep it maintained and updated presents logistics challenges. Additionally, Operators would need the Wireless Carrier partner to provide a set monthly data allocation and low rate.
Imagine a scenario where sales forecasts based on real-time data from marketing and historical trend data automatically trigger construction design and build activities, that send bill-of-materials directly to procurement that are then ordered automatically on a receiving schedule to suppliers. Customer orders, trouble calls and Plant preventive and demand maintenance are automatically routed and dispatched to technicians driving Smart Vans with automatic customer notifications of status complete with on-site upselling and follow up surveys. Periodic real-time sales data is automatically compared against forecast and inventory levels making adjustments as necessary. Employee performance is captured via real-time performance and automatically accrued in Human Resources, which then triggers employee evaluations, performance reviews, training, and pay modifications. Vacation assortment, pensions, 401K and benefits management are easy to access and understand. Finance can auto-query all internal transactions to get immediate up-to-date data on inventory, payables, receivables, warranty-claims, and all the financial data within the enterprise.

Enterprise Resource Planning Programs offer such scenarios. For the Operator, a platform resembling the components shown in Figure 5: ERP for Operators would all fall one computer system. ERP Data becomes visible across the entire organization. It eliminates the need to synchronize changes between multiple systems as finance, marketing, sales, human resources, service and operations are all consolidated onto one server system. Decisions can be made more quickly and with fewer errors. Sales forecasting allows inventory optimization, order
tracking from acceptance through fulfillment, revenue tracking from invoice through cash receipt. Sensitive data is protected as prior multiple system security systems are now consolidated into one. The platform could be a cloud designed and controlled by the enterprise or managed by a third party in a SaaS or PaaS cloud solution.

**Figure 5: ERP for Operators – Single Platform**
Although in theory integrating ERP sounds optimal, in practice there are significant challenges and perhaps too much investment required to provide a justifiable ROI for Cable TV Operators. Open cooperation, coordination and overcoming resistance to sharing sensitive information between departments would present obstacles. Re-engineering business processes to fit into the new ERP system may overwhelm the Operator internally causing a shift inwardly and detracting from serving the customers. Getting locked in with an ERP partner is risky as it would provide the vendor with negotiating power related to down the road upgrade, maintenance and service expenses. There could be long-term legacy contracts from other third party providers that could complicate working with a new ERP provider.

**DISASTER RECOVERY**

Having complete automation promises significant cost savings from its inherent efficiencies. However, when a disaster strikes and all power and communications are cut, the Operator must still have the ability to respond. Thus, a program must be in place that has manpower trained and prepared to take-on all the functions that may be automated. This element must be incorporated into any Operators business plan when considering any form of Software-as-a-Service.

**SUMMARY**

Operators have many Workforce Management technologies and software solutions available today to greatly improve their productivity resulting in lower costs and higher customer satisfaction. Most Operators already have CRM and SCM solutions installed to handle Sales, Customer Service and Procurement. Some have added WFM solutions and technologies to manage key elements of Field Service.

Workforce Management program suppliers currently do not integrate automatically with the internal Network Operations Data tools and home-grown software programs. This can be an area of high cost to develop and prevent a justifiable ROI. Yet, subsets of the technologies and programs can be evaluated and integrated to provide savings such as reducing fuel costs through vehicle telematics and real-time navigational routing.

As advancements in technology develop and SaaS providers expand and become more competitive barriers to a comprehensive automatic ERP will likely erode. While analyzing which options best optimizes the Operators situation, a balance is required to analyze how to keep up with new technology benefits while sustaining stable operations and superior customer satisfaction.
KEY TERMS:

• 3G / 4G
• API – Application Programming Interface
• Bluetooth
• CDMA – Code Division Multiple Access
• CLI – Cumulative Leakage Index
• Cloud Computing
• CPE - Customer Premise Equipment
• CRM – Customer Relationship Management
• EDI – Electronic Data Interchange
• eMTA – Embedded Multimedia Terminal Adapter
• ERP – Enterprise Resource Planning
• FCC – Federal Communications Commission
• GIS – Geographic Information System
• GPS – Global Positioning System
• GSM - Global System for Mobile Communications
• HRMS – Human Resource Management System
• HTML5 – Fifth generation of HyperText Markup Language
• I-DEN – Integrated Digital Enhanced Network
• IaaS – Infrastructure as a Service
• JAVA – Programming language
• KPI – Key Performance Indicators
• M2M – Machine to Machine
• MaaS – Mobility as a Service
• MEAP – Mobile Enterprise Application Platform
• MFM – Mobile Field Management
• MWFM – Mobile Workforce Management
• NOC – Network Operations Center
• PaaS – Platform as a Service
• RAN – Radio Area Network
• RF- Radio Frequency
• RFID – Radio Frequency Identification
• ROI – Return on Investment
• SaaS – Software as a Service
• SCM – Supply Chain Management
• SFA – Sales Force Automation
• SLA – Service Level Agreements
• SOAP – Simple Object Access Protocol
• TDMA – Time Division Multiple Access
• Telematics – Communicate between remote objects
• V.A.N. – Van Area Network
• VPN – Virtual Private Network
• WEP – Wireless Equivalent Privacy
• WFM – Workforce Management
• Whiteboard – Marker board, dry-erase and analogous to Virtual, computer Whiteboard.
• Wi-Fi – Wireless standard for connecting electronic devices.
• WiMAX – Worldwide Interoperability for Microwave Access
• WLAN – Wireless Local Area Network
• XHTML – eXtensible HyperText Markup Language
• XML – eXtensible Markup Language
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