

Innovation 2020 — The Connected Service Technician

Market testing the business value of field service automation

Application Note

Executive summary

Today's widespread use of field service technicians and vehicles — coupled with the speed of technological innovation — calls for a transformational technology solution that changes the face of field services and the supply chain. Many types of enterprises depend on a field service force to set up, install, enable and maintain their products, services and applications. Almost any type of product or service that requires a reasonably complex setup and installation process on the customer's premises will utilize a field service technician to perform the associated tasks. The most recent data (2014)* from the US Bureau of Labor Statistics show that in the United States alone, there are about 5.2 million individuals employed in the “installation, maintenance, repair” occupational code. In countries such as Australia and New Zealand where national broadband deployments are occurring, the need for field service support is critical to successfully rolling service out to end users.

To complete their work efficiently, technicians usually require a service vehicle, an inventory of parts, mechanical tools, measuring and testing devices, a laptop and a mobile device. However, such enablers do not necessarily result in an efficient workday. Work orders are generally provided in paper form, and ensuring that the right inventory and tools are in the vehicle is often a manual process involving a degree of guesswork. Further inefficiencies are likely because dispatchers are usually unaware of work order status, inventory usage, tool status, and so on until a technician returns to the depot with reports and paperwork for the day or week. Additionally, many equipment activation processes may require interaction with a central operations center and/or demand that a technician contact a call center and enter a queue to have someone activate a product or service to test it. The streamlined automation made possible by today's technology is clearly absent.

The end customer's experience is central to everything that is required to perform a successful setup and installation and then ensure that the product or service is functioning correctly. The more efficient the process and the more visibility to status and information provided to all players in the process flow, the better will be the customer experience. Beyond customer satisfaction, these efficiencies and visibility to real-time information can save time, reduce errors, and therefore lead to real, bottom-line cost savings.

To address problems such as work order inefficiencies, technician delays, error-prone manual processes and marginally satisfied customers, members of the ng Connect Program — led by Nokia and its Motive® and Velocix divisions along with Apptricity® Corporation and Trimble's ThingMagic® division — designed a solution concept in conjunction with VisionStream, Vidyo and Netcomm Wireless to support the Connected Service Technician (CST) vision conceived by [Chorus](#), a wholesale network provider in New Zealand. CST is enabled by these ng Connect member companies' technologies, which are integrated and provided via a connected service vehicle (CSV).

*United States Department of Labor, [Bureau of Labor Statistics](#), Occupational Employment Statistics: Occupational Employment and Wages, May 2014

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Introduction

Using five CSVs, Chorus leveraged the solution concept for a New Zealand market trial of an integrated platform intended to accelerate the installation of gigabit broadband nation-wide by increasing efficiencies and reducing costs. The CSVs minimized long trips to the warehouse, allowed for in-transit asset transfers and simplified work order processing. The two-month trial produced significant results, including time and cost savings in the areas of inventory management, installation, service provisioning, customer notification, tool and inventory tracking and electronically automated forms. These results can apply to any field service operation, not just that of a network provider. This solution concept is an excellent choice for organizations seeking dramatic improvements in their field service operations.

The challenge

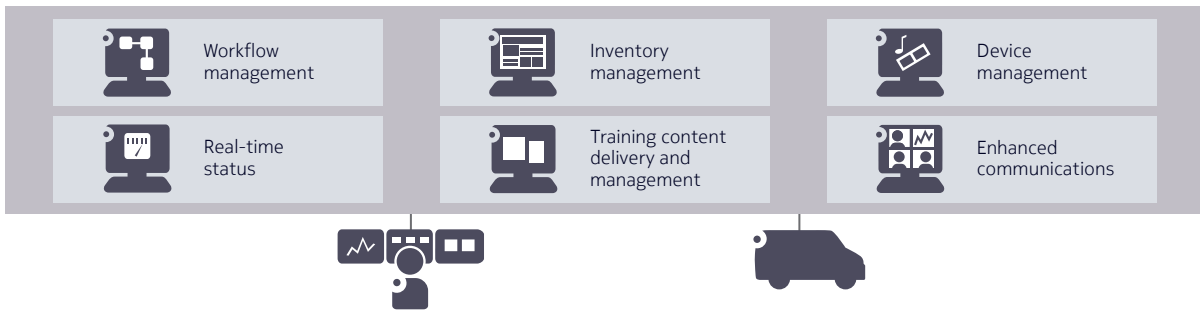
Both the supply chain and the value chain fall apart in the field. The value chains for field technical service support functions can often be complex and involve a number of enterprises all focused on optimizing their piece of the chain and delivering a positive experience to the end customer of the product or service. There may be multiple companies in a particular position in the value chain providing similar services based on such things as location, demand peaks, supply chain strategies, and so on. Lack of IT system integration, automation, and therefore visibility across the chain may drive systemic inefficiencies by forcing paper, spreadsheets, phone calls and various non-standard tools and applications to be used to manage the process. Inability to centrally track and manage equipment and hardware prevents process efficiencies from being realized.

Further complicating the complexities and inefficiencies, warehouse managers and installation technicians must find and utilize third-party tools to help them with their part of the overall process. Tools and hardware may not be “connected,” so processes develop in an undocumented and sometimes individual manner. This leads to information delays, errors, inability to track and manage inventory and devices, and an overall sub-optimal system.

High-level solution

The problem described above can be solved by developing an integrated platform (see Figure 1) that includes management of devices, workflow and inventory; enhanced communications; support for material delivery and management; and real-time visibility to system status by the key players within the value delivery chain. Such a solution could save time, reduce errors, minimize cost, increase collaboration, and provide better documentation while simultaneously improving the experience of the most important player in the chain — the end customer. Improving customer experiences along the entire value chain and providing a positive return on investment (ROI) in the process makes such a solution an obvious choice to create and implement.

Figure 1. Integrated technology platform



The photos at the bottom of Figure 2 show the physical implementation of the integrated platform as used during the trial.

The screenshots in Figure 2 on the top show the main screen on the technician’s tablet and the four applications that were part of the trial.

Figure 2. Technician’s tablet screen shots and the platform physical implementation

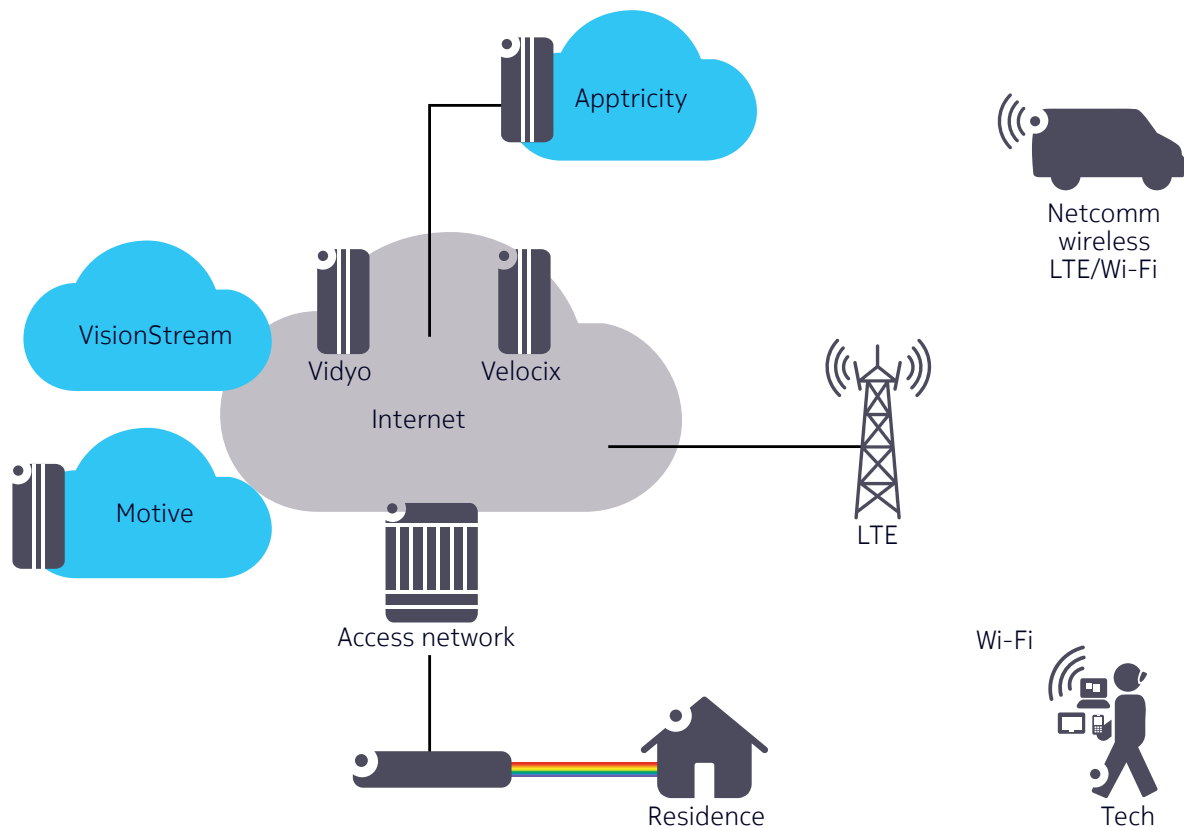


Solution details of CST-CSV

The Connected Service Technician (CST) solution is delivered through a combination of hardware and software solutions from multiple companies within the Nokia-founded ng Connect program. CST is enabled by the Connected Service Vehicle (CSV), which is an after-market LTE-connected commercial vehicle that leverages the cloud for service applications. Using the capabilities of the CSV, a service technician also becomes connected. With the right tools and applications interconnected through the CSV, the field tasks can be performed more efficiently. Visibility to data in real time makes the process of managing the field service jobs more effective. This concept is targeted at enterprises that operate a field service workforce that provides installation, maintenance and service to products, services and applications on the customer's premises. Parts of the overall platform could be used by other types of vehicle fleets, and therefore can capture a larger market opportunity.

Figure 3 shows the high level architecture used for the trial to enable the functionality that generates the platform's benefits.

Figure 3. Market trial architecture

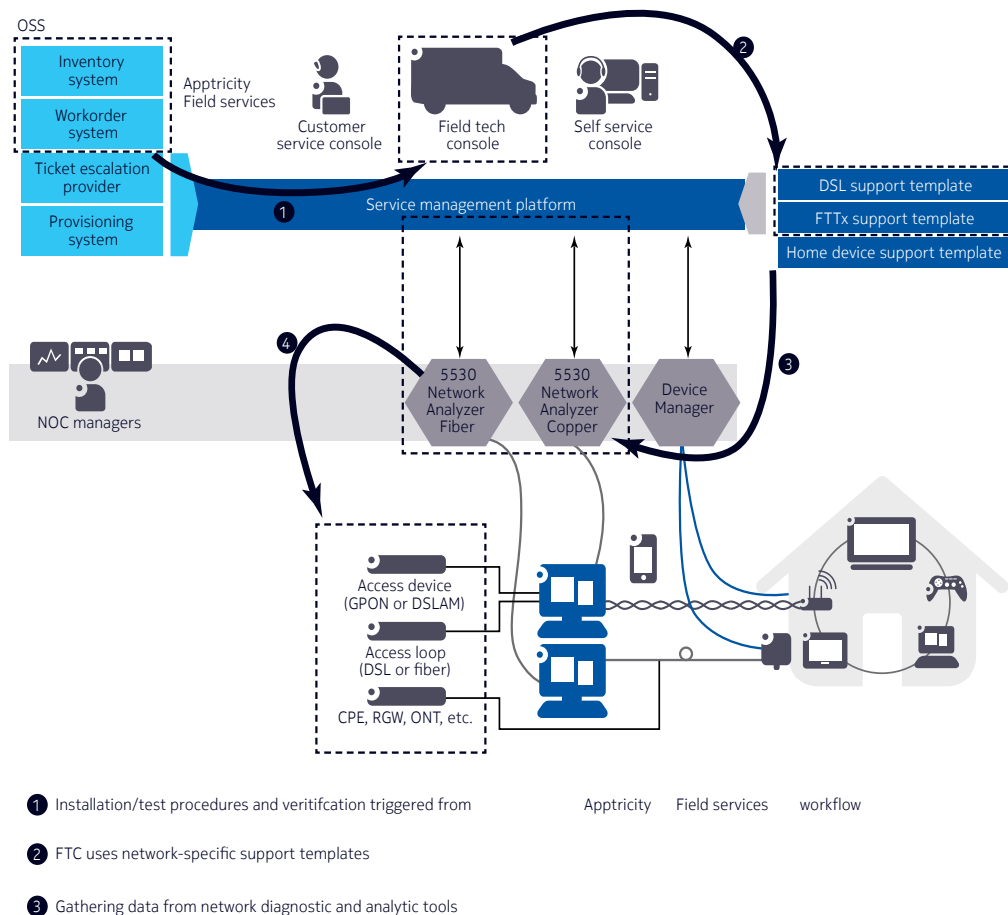


The benefits are enabled using the following ng Connect Member products, services, and applications:

Nokia Motive Field Tech Console (FTC)

During the process of installing a new broadband connection, a series of install-provision-test cycles are required as each element is deployed. Without the Motive FTC, these require discrete testing devices to be attached to each element as its deployed. This means power down, attach measuring device, then power up of network elements. In some cases the test requires the technician to call in to a central technical center to run performance tests or troubleshoot problems. The Motive FTC greatly reduces the time needed to perform these steps. Using the Nokia Motive Network Analyzer - Fiber within Motive FTC, the technician is able to provision, run tests and troubleshoot circuits with the tap of a button on the tablet. Within seconds, the test results are displayed. This avoids processes of physically connecting devices and performing tests, connecting laptops to load test programs onto the element, cycling equipment through start-up processes, and calling in to support centers. This capability enables major time savings during the installation process. The Motive FTC implementation detail is shown in Figure 4.

Figure 4. Motive Field Tech Console implementation

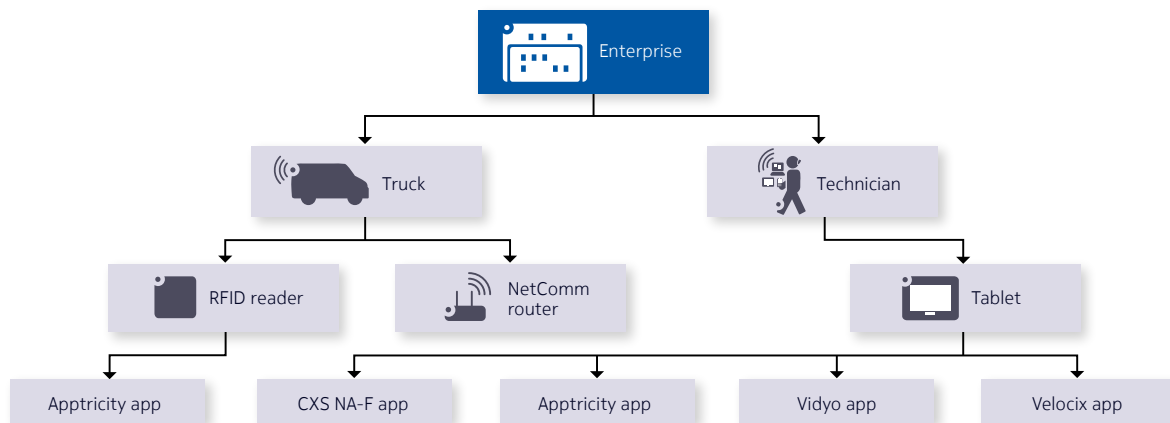


Nokia Motive Unified Device Manager (UDM)

The CSV is mobile and contains a number of devices that benefit from central control and interaction. First and foremost is the technician’s tablet device. This is the device that the technician uses to enter workflow information, display e-forms, run tests, provision, collaborate via video, and view training content. Utilizing Motive UDM, software application updates can easily be pushed to the device so all are running current software versions. Motive UDM also allows locking and/or wiping of the device in case it is lost or stolen. Monitoring and troubleshooting can be performed remotely. Other on-board devices such as the LTE/Wi-Fi® router and the RFID reader can also be controlled centrally via Motive UDM. This ability to remotely care for all of the connected onboard devices serves to avoid costly truck rolls and downtime for the technician.

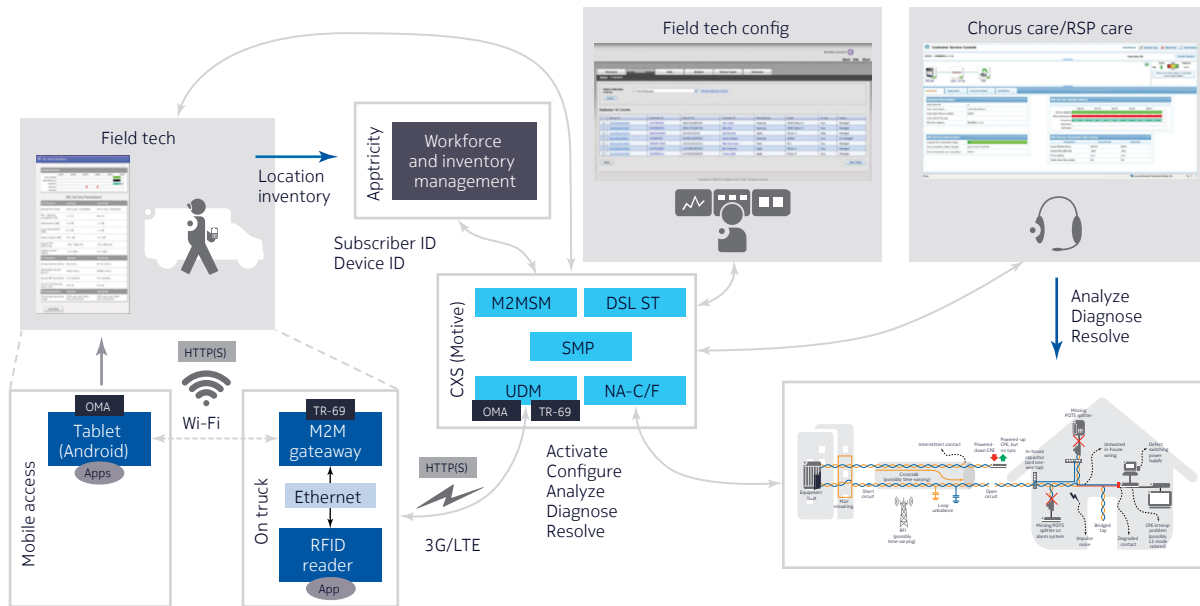
The hierarchy of Motive UDM for this trial is documented in Figure 5.

Figure 5. Motive Unified Device Manager hierarchy



The overall Motive market trial solution is shown in Figure 6.

Figure 6. Motive market trial solution



Apptricity Field Services

Well suited for route-based or mobile service businesses, Apptricity Field Services makes service vehicles intelligent by bringing enterprise solutions to the field. The system integrates and streamlines asset, inventory and work order management for start-to-finish tracking and control across the value chain. Apptricity Field Services significantly reduces excessive service calls, optimizes driving routes and ensures that “lost” tools and equipment are no longer an issue. Tools on a service vehicle become tagged inventory items, which makes it easy to quickly determine whether or not a specific tool is in the vehicle when leaving a site.

The tracking involved in moving inventory from the warehouse to a service vehicle and associating that inventory with a customer order occur automatically with real-time visibility. No paper trail is required. Inventory tracking via spreadsheets and manual data entry is totally eliminated. The system reduces errors, shrinkage and waste.

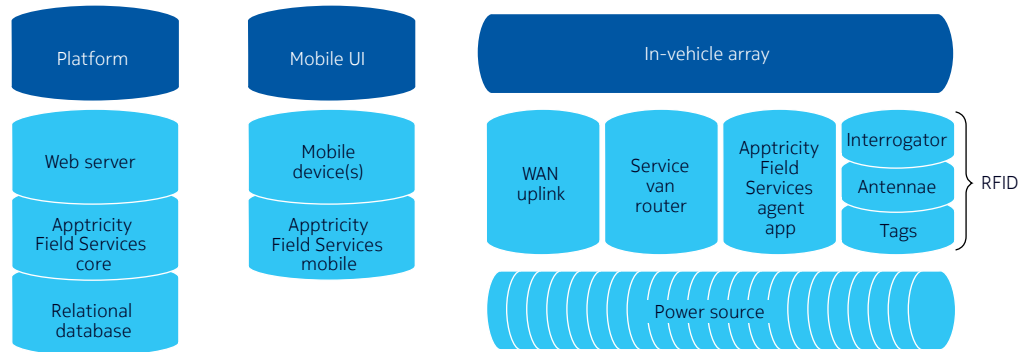
Apptricity Field Services includes ThingMagic RFID technology to interrogate RFID tags. Consisting of vehicle-mounted antennae and readers, the ThingMagic hardware picks up RFID signals from tagged tools and equipment. Records of these assets go directly to the server over the network and appear in real time on technicians’ tablets. If anything is removed from a CSV, it is instantaneously reflected on the technician’s tablet.

Due to tight integration with RFID technology, organizations never lose track of inventory as it is stored, loaded on vehicles, used or delivered. If needed, technicians can share expensive, infrequently used tools because they can readily view other vehicles’ tool inventory. Loss of tools, equipment, products and other assets on a vehicle is minimized or eliminated entirely. In addition, organizations can realize direct capital avoidance savings by purchasing fewer tools and preventing loss. Overall, the system’s advanced capabilities make field operations measurably more effective, efficient and profitable.

The Apptricity Field Services trial architecture is outlined in Figure 7.

Figure 7. Apptricity Field Services trial architecture

Apptricity Field Services architecture for the market trial



Vidyo video conferencing

Video conferencing enables collaboration from technician to technician, technician to supervisor, and any other type of instance where a face-to-face discussion simplifies, clarifies or eliminates a need for a truck roll. Many times technicians reach a point where they need to discuss how to proceed on a job with a more experienced technician or a supervisor. Sometimes site drawings may vary from the actual situation encountered by the technician. Without video conferencing, either a senior technician or supervisor would need to travel to a site or the technician would need to rely verbally on a sketched drawing to figure out how to proceed. Using the video application on the tablet, the technician can show the situation to another to make decisions. A picture (or even better, a video) is worth a thousand words, but also avoids truck rolls and mistakes that cost time.

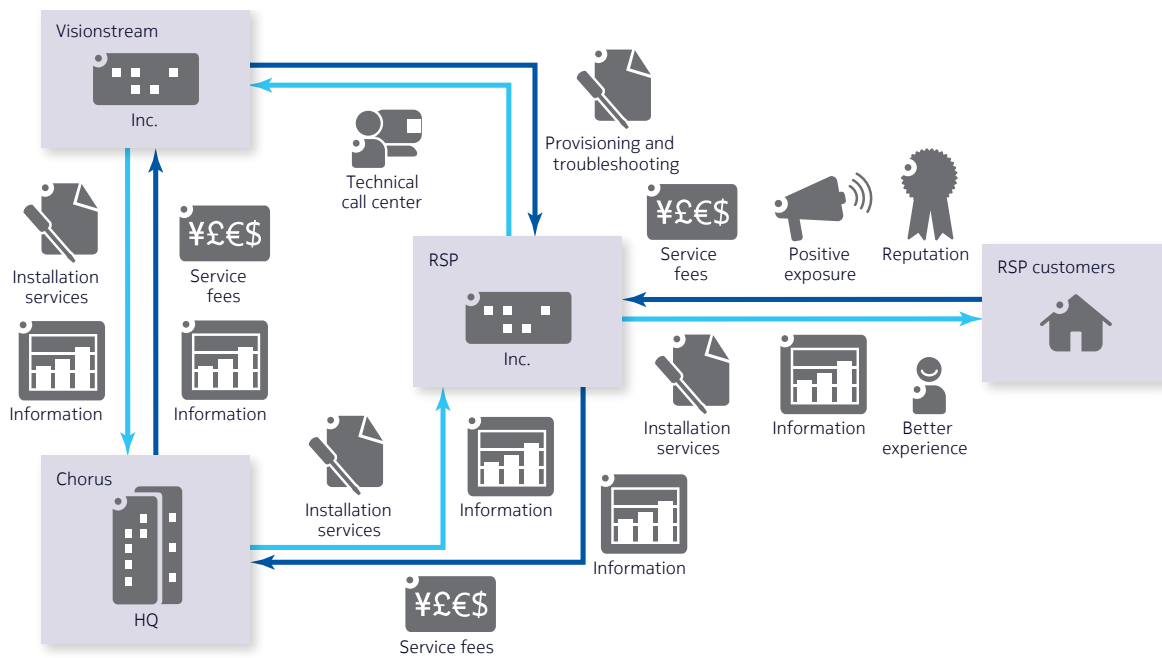
Velocix Content Delivery Network (CDN)

Installation processes can be complex, have variations, and require frequent updates. It is imperative that technicians always have the latest, most relevant information at their fingertips. This includes written materials and also videos. The case today is that they have much of the material in paper form. It is in the service vehicle but not indexed well and difficult to find quickly. No record exists tying specific training to a technician. Velocix CDN eliminates these problems by providing a centralized repository that is available via a button on their tablet. Information can be indexed and searchable, and the pain of finding documentation is eliminated, making the technician more apt to comply with documented processes, partake in training and keep skills current. Training certification can be linked with a technician so supervision knows who has taken specific training. The CDN enables a more efficient and effective overall installation process.

High-level business benefits

The value chain and players that perform the installation process may sometimes be complex. The more complex, the more important transparency and access to real-time status become. As an example, in the case of this market trial the network provider uses third-party installers. Figure 8 shows the relationships and complexity built into the value chain that performs broadband installations under the Chorus brand. This has clear advantages in efficiency and time-to-market, but requires all players to have a common ability to share data and have real-time visibility of installation status — which can be provided by a CST solution. In this case, the benefits flow to the entire chain, but even if the relationships were simpler, the concept still provides value because even within a single company these organizational boundaries and resulting challenges exist. Figure 8 shows the business relationship of the market trial players, and how values flow between them.

Figure 8. Installation value chain



Given the number of nodes and the complexity of this value chain, the business benefits of implementing this platform are many and fall into different categories, some more quantitative than others. Time savings can be measured and be readily transformed into bottom line cost savings. Other types of savings are cost avoidance and can be quantified, but do not directly impact bottom line results. Yet others fall into the category of efficiency or being able to manage operations in a more timely manner. Intuitively we understand the benefits of the softer areas but the results are difficult to measure. The benefits break down as follows.

- **Warehouse operations** - Consider the task of inventory management via written entries on paper and then transposing it into spreadsheets and then further into logistics systems becoming passively automated via barcode- and RFID-based tools. In this way the process can greatly improve real-time visibility and monitoring of such inventory. Errors are reduced and there is no delay in inventory levels being updated. As inventory to be used for installations is withdrawn from the shelves and placed on the trucks, the counts are automatically updated. No paper, no transcription, no errors. When inventory is removed from the truck it is tied to the customer location currently being processed. Visibility to equipment location is immediate. The ability to instantaneously view status enables better and more timely decisions to be made and opens the opportunity to optimize inventory levels and reduce assets tied up in excess inventory in the system.

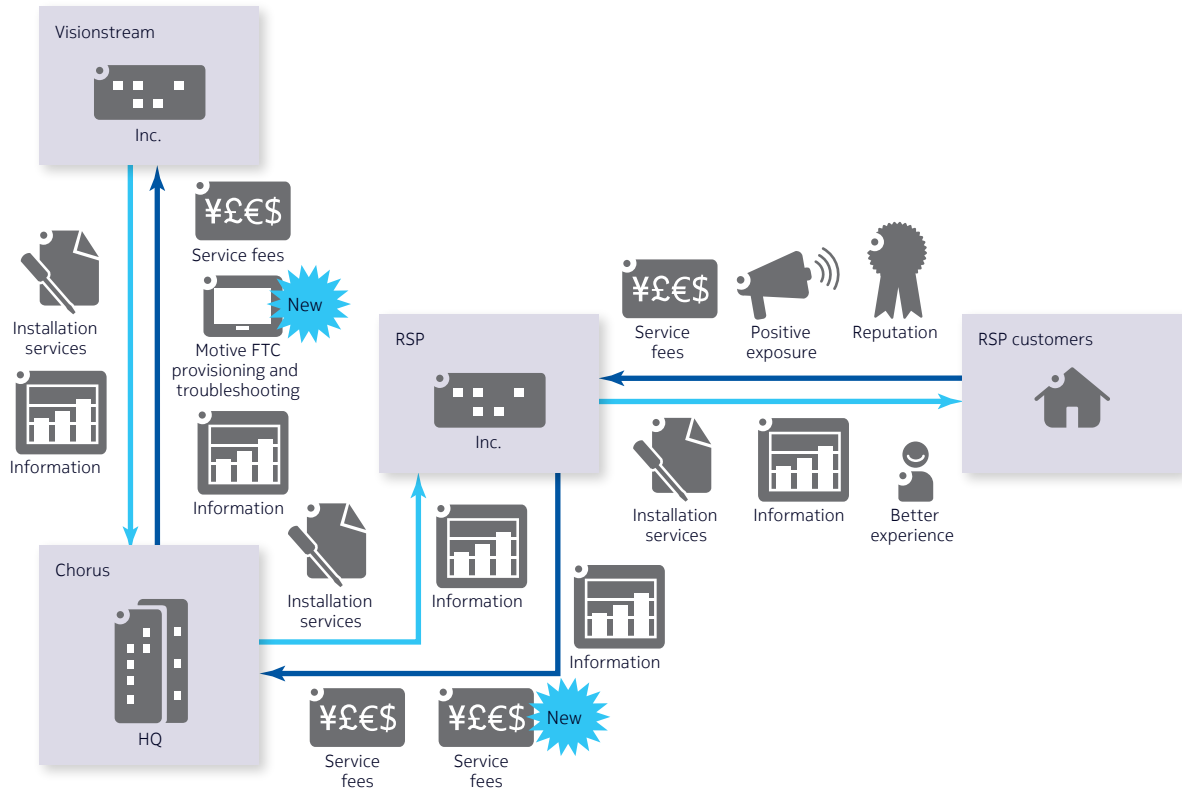
Visibility can also be placed in the end customer's hands. A simple application accessing status information coupled with a simple user interface can allow the end user to see their installation status as it progresses. This enhances the customer experience.

- **Installation processes** - By enabling e-forms and jettisoning the need for paper documents, clutter, information loss, and delays in visibility are eliminated. Customer documentation can be signed electronically and immediately uploaded to information systems for record keeping. Billing information can be processed immediately. Managing a business process can be done much more effectively if delays in information visibility and errors are eliminated.

A major reduction in installation time is attained by moving to processes that greatly simplify installation steps, such as pressing a test button on the tablet. Not only does this translate to direct savings and the ability to accomplish more installations with the same resources, it reduces time and therefore cost demands to other organizations involved in the process. Technician call centers can utilize their call center personnel in more valuable ways. Simplification of provisioning and testing reduces installation time, eliminates delays and makes the install process more predictable with less deviation. This allows tighter arrival time windows to be provided to end customers, which is less burdensome on them and leads to a better experience.

This capability even opens up new business models that we can describe as “Wholesale Activation Services.” In the case of a network wholesaler with many regional service provider (RSP) customers, the process for provisioning and testing can require the technician to interact with technical operations center personnel who are at times overloaded with calls. Technicians often wait on hold for extended periods to have RSP help center people set up circuits and test the installation. With Motive FTC streamlining the process, the need for the RSP to man support lines could be greatly reduced. The wholesaler could potentially charge a fee for the automated service using Motive FTC, which is a new revenue for them and a cost savings for the RSP (see Figure 9).

Figure 9. New business models enabled by the platform



- Device management processes** - In equipping the service vehicle and the technician to be both mobile and more connected, a number of devices and software applications are introduced into the system. These devices include the technician's tablet, the truck's LTE/Wi-Fi router, the RFID inventory hardware and potentially other devices. These devices may require firmware updates, patches, and in the case of the tablet, new applications and/or application versions. Some level of security is required too, in the event any of the devices were to be lost or stolen. Given this, it is essential to have a user-friendly platform to be able to push information to these devices and to lock or wipe them clean if necessary. Motive UDM allows remote management of devices without the need for truck rolls to accomplish updates and changes. Updates can be sent in bulk and IT can assure that all technicians are using the latest versions of applications.

Trial results

Summary results

- 30 percent to 40 percent of the warehouse manager's time saved via Apptricity Field Services to enable inventory automation and tracking
- Errors and mistakes due to use of paper and manual inventory tracking eliminated by using Apptricity Field Services to automate workflow
- Total installation time reduced by between one-third to one-half by using Motive Field Tech Console
- \$77 United States dollars (\$102 New Zealand dollars, 71 Euros) per update per vehicle can be avoided utilizing Motive Unified Device Manager
- Training documentation simpler to find and track using Velocix Content Management System
- Truck rolls avoided and time saved by using Apptricity Field Services to show field situations to remote supervisors, who can make real-time decisions and communicate them using Vidyo video communications

Trial results - further detail

The scope of the trial was new RSP fiber broadband installations. Five service vehicles and technicians were included. The results, which include qualitative, quantitative, and anecdotal information, are discussed in the following section.

Inventory management

Currently the management of inventory for the value chain delivering installations for RSP is done solely on spreadsheets. Inventory is received at the warehouse and added to the spreadsheet for that particular category (set-top boxes, gateways, optical terminations, etc.). Where applicable, serial numbers and MAC addresses are recorded for each unit. These units are then placed in the storage area. When an installation technician requires units to perform their scheduled jobs, they travel to the warehouse and fill out paper request forms. MAC addresses are entered on the form for the withdrawn material. These forms are copied and one remains with the warehouse manager; the other goes with the technician. Later, the technician will match units on the form to customer addresses where the units have been installed. At the same time as withdrawing new units, the technician turns in completed forms matching MACs, serial numbers, and customer addresses for jobs already done. The warehouse manager then enters the updates into the appropriate spreadsheets. The process is manual, updated views are delayed and outdated, and the potential for errors or lost paperwork exists.

Apptricity **Field Services** completely streamlines and automates the process described above, adding critical efficiencies. Inventory arrives at the warehouse and can simply be scanned to record inventory, serial numbers, and MAC addresses. The inventory becomes immediately visible in a central inventory

database via Apptricity Field Services. As inventory is moved from the warehouse to a technician's truck, warehouse inventory is decremented and truck inventory is incremented. If an item is moved from one vehicle to another, Apptricity Field Services accounts for its location. Finally, when an item is taken off of the truck to be installed at the current customer location, the unit is associated with the address automatically.

It's estimated that the normal non-trial process requires **30 percent to 40 percent** of the warehouse manager's time to manage spreadsheets. This time was eliminated during the trial due to the integration of Apptricity Field Services workflow with ThingMagic RFID. Not only is the warehouse manager freed to perform more important duties, but the chances of errors or lost information drop to near zero. The partners in the value chain can also see the real-time status of inventory in both the warehouse and on each vehicle. Without inventory visibility, there tends to be excess inventory in the system. By reducing the system inventory, cash flow is increased because fewer assets are resting on shelves and in vehicles.

Automated inventory tracking also opens up the possibility of developing an automated ordering process. When warehouse inventory reaches a certain threshold, new orders could be triggered, thus requiring even less effort by the warehouse manager.

Anecdotally, both the warehouse manager and the technicians liked using the automated system. Less paper was cited by all as a positive result. The technician's tools are tracked in the trial as well. One technician noted a recent time when he left something behind at a previous job. Time was lost back-tracking to the former job site to retrieve the tools. It took an hour of time that was unproductive. The trial inventory system would have warned the technician that the tool was not back in the vehicle before he departed.

Installation processes

The biggest result of the trial was the time that can be saved utilizing Motive's FTC. The allocated time for a new fiber broadband installation is 4 hours. Of that time, **35 percent to 58 percent** can be due to five required provisioning or test steps, two of which can require calls into a technical service center. The Motive FTC eliminates manual steps that require turning off a device, connecting a test device, maybe connecting a laptop to download test software, powering back on, and acquiring test results. The same steps performed using the Motive FTC require 5 minutes in total at the most. Thus, total installation time can be reduced somewhere between **one-third and one-half** the time of the non-trial process. This not only reduces time and cost, but enables installers to be able to do more per day. The time also becomes more consistent, which makes predicting when they'll arrive at the next job more accurate.

In 2014, Chorus handled nearly **42,000** of such installations. Applying the most conservative time-saving metric, about **58,000** hours could have been saved in 2014. This time could be used for additional new installations, repair operations, or a focus on utilizing only the top-performing installation technicians.

Apptricity Field Services also brings some value to the installation process by enabling automated text or email customer notification. Instead of requiring a phone call to the next customer to provide an estimate of when the installer will arrive, Apptricity Field Services can send it automatically. A web or mobile device-tracking application can also permit the customer to track progress on their own via Apptricity Field Services data access. This can save roughly 10 minutes for each installation and is likely to enhance the end user's experience also.

Device and firmware management processes

This results category is a bit different from others because there is no current process. Perhaps the key result of the trial is in demonstrating that new devices and applications can be introduced that open up new capabilities, but can be managed in a way so as not to create new workflows that are burdens in themselves.

Since the service vehicle is mobile, and the technician mobile from the vehicle, a platform is needed to be able to manage the devices from distant locations. If trucks roll into a depot or out to the field are required to install, troubleshoot and maintain devices, then the solution is creating new problems. With Motive UDM, this situation can be avoided because devices can be managed easily. Assuming an average truck roll for software updates to be 20 miles round trip, and the total time for travel and performing updates is 1.5 hours, the cost to perform an update is estimated to be about **77 United States dollars (102 New Zealand dollars, 71 Euros)¹** per truck per update².

In preparing for the trial, before Motive UDM was implemented, loading applications and managing the trial devices was a considerable task. Someone needed to drive to the location of the service vehicle to make changes and updates. With Motive UDM fully functional once the trial began, the problem was eliminated. Updates could be pushed out to all devices simultaneously. For the trial, only four applications were loaded, so in steady state only limited changes were required. However, if the platform were implemented across Chorus, there would be more applications and likely different technicians would need different applications and on different devices. This would be very difficult to manage for a large fleet. Motive UDM made the task simple. As a practical matter, Motive UDM is a critical enabler to achieve the cost savings of the CST/CSV. We estimate that for software updates alone, Motive UDM can enable over **919 United States dollars (1200 New Zealand dollars, 851 Euros)² per year per service vehicle¹** to be avoided because truck rolls are not required to perform the updates. Although no tablets were lost during the trial, the ability to lock or wipe them of their data if a loss did occur greatly reduces the risk of a device falling into the wrong hands and being misused.

Video capability

The technicians really liked having video capability. One comment received from a trial technician was about using video when there is an issue on a job site. When a problem is encountered, without video capability, they would verbally describe the problem to a supervisor, try to sketch it and send it via email, or maybe take a picture of it and send a picture message. Often the result was a need for a supervisor to travel to the site to view the issue firsthand. Video capability eliminates that need. As the technician stated: "A picture is worth a thousand words." It was suggested that a Skype-like service could offer the same result. However, the video application integrated into the platform is private and secure, and can be integrated to the work order process. Technicians like to be able to document what a work site looked like prior to them starting the installation. They can also document what the site looked like when they are finished their work.

1

Estimates are made using the following assumptions and information:

- Average cost per mile to operate a commercial vehicle in the United States: \$1.71 (2012, American Transportation Research Institute)
- Software application update frequency: Every 30 days (for the top 25 iOS apps, Sensor Tower blog, 4/15/2014)
- Average IT support salary, United States, annual: \$45,211 (Payscale.com)
- Assumptions: (average truck roll = 20 miles RT, travel and update time = 1.5 hours, IT benefits = 30% of salary)

2

Based upon 20 March 2015 conversion rates, 1 New Zealand dollar = 0.75 United States dollar, 1 Euro = 1.08 United States dollars

Training and support material content management

Anecdotes from the technicians indicate that they also like having a content management system behind their training and instructional materials. Instead of being handed paper copies of guidelines and engineering updates, these documents can be accessed via application loaded on the tablet. This eliminates storing paper in their vehicle, and more importantly, allows them a way to find exactly what they need by searching a database. Currently they can access copies on a shared drive, but they are flat, not categorized, and there are too many to look through. Besides the benefit to the technician in the field, the training process can be better managed and documented. Training can be pushed out to the field with no truck-roll needed, and credited to an installer as the training is completed. Currently, once a month, technicians travel to a depot for a meeting to hear about new processes. They are handed paper documents and management of the process ends at that point. By tracking and linking training to the technician, the opportunity to certify technicians for specific skills is opened.

Conclusion

In the two month market trial ending February 2015, Chorus, Nokia, Appticity, and VisionStream, along with Netcomm Wireless, ThingMagic and Vidy, made the installation of broadband to residences simpler, more efficient, and less costly via a Connected Service Vehicle (CSV). The positive results were both quantitative and qualitative. The enabling platforms could provide similar benefits to any enterprise that has a fleet of field service vehicles manned by technicians performing installation and service of complex products or systems, and may be extended even further.

As technology continues to evolve, and we look beyond 2015 toward the networks and business models of 2020, services will continue to get closer to customers and care and support will need to get closer, more personalized and [greener](#) as well. The role of the CSV and connected technicians will prove to be an even more important component as enterprises look to provide greater value to their customers and create their advantage in the marketplace.

Acronyms

CDN	Content Delivery Network
CST	Connected Service Technician
CSV	Connected Service Vehicle
FTC	Field Tech Console
LTE	Long Term Evolution
MAC	media access control
NA-C	Network Analyzer Copper
NA-F	Network Analyzer Fiber
RFID	radio frequency identification
ROI	return on investment
RSP	regional service provider
UDM	Unified Device Manager



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