KIVA Systems®

The Right Move: Extricom WLAN and the Kiva Systems MFS

Speed and efficiency are critical business metrics in retail distribution centers. How fast and accurately an order is fulfilled after customers click the Send button on their browser often determines whether those customers come back for more. Ultimately that efficiency can mean the difference between success and failure for an online retailer.

Pushing these metrics to their limits is the driving force behind the Kiva Systems Mobile Fulfillment System, or MFS, a robotic automation system that can double worker productivity and streamline the fulfillment process dramatically. Wireless LAN infrastructure is an important part of this formula, as the system requires the careful orchestration of hundreds of continuously mobile robots by Kiva's centralized control software. To ensure that their infrastructure measured up, Kiva integrated Extricom wireless LAN, with its robust connectivity and unrivaled mobility, as a key solution component.

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Matt Verminski
VP of Hardware
Engineering
Kiva Systems

A Moving Picture

The traditional picture of an order fulfillment facility seems crowded and chaotic, with an army of order pickers trudging along aisle after aisle of fixed shelving searching for items, all to a deafening background clatter of conveyer belts and forklifts. It's an approach that is labor-intensive, difficult to scale, and inflexible in the face of changing demand.

But the picture has altered dramatically with the arrival of a revolutionary MFS solution from Kiva Systems. The MFS combines mobile robotic drive units and mobile inventory shelves, or "pods," to bring ordered items to work stations rather than making order pickers go find the inventory at fixed locations within a warehouse.

Gone are the myriad workers, the forklifts, and airport levels of noise. Instead, the warehouse quietly hums in a sort of mechanical ballet as squat orange robots whir across the floor non-stop, shuttling pods to workstations. There, order pickers directed by laser pointers take the items from the pod, pack the order, and it's on to a waiting truck for shipment.

The 15-Minute Order

Using the Kiva MFS to automate the most labor-intensive aspects of order fulfillment has allowed enterprises to achieve two to four times gains in worker productivity. Electrical costs can be substantially reduced as a Kiva enabled warehouse requires much less power than conventional systems. Worker job satisfaction and safety is improved, a by-product of lower noise levels and reduced chaos in the warehouse.

The most fundamental improvements, however, are speed and accuracy: in some companies, Kiva has reduced the elapsed time between order placement from the internet and fulfillment on the shipping dock to as little as 15 minutes, and pick accuracy approaches 100%. For enterprises shipping thousands of different SKUs this translates into customer satisfaction and bottom-line results.

The Wireless Backbone

Although the robots and inventory pods are the most visible part of Kiva's MFS, its most critical component operates behind the scenes. Every drive unit is intensively managed by the Kiva Control System (KCS), with constant wireless communication between the drive units and KCS to allow many fast-moving parts to work together. This overarching management through wireless is key to an enterprise's ability to dynamically adjust operations in real-time to meet fluctuating market demand.

Having a wireless infrastructure that supports uninterrupted mobility is therefore essential. "WLAN is the basic element of connectivity that spans all the elements of the Kiva system." states Matt Verminski, Kiva's VP of Hardware Engineering. "It's the backbone to making all of the robots do the work that they need to do. The wireless network controls hundreds of elements, and an interruption could stall a drive unit, or degrade system performance."

Project Scope

Provide seamless wireless connectivity for mobile drive units interfacing with control system of Mobile Fulfillment System deployed at major distribution centers ranging in size from 50,000 square feet to 1 million. Any issues with wireless connectivity could slow down system throughput.

Solution

Extricom EXSW-2400 Switches and EXRP-20E access points.

Completely redundant Extricom WLAN deployed in parallel for High Availability.

Results

Robust connectivity of Extricom WLAN ensures Kiva Robotic drive units can continually communicate with Control System, allowing system to be modified in real-time to meet changing demand.

Packet-by-packet processing provides uninterrupted mobility for robotic drive units.

Extricom's ease of deployment means Kiva MFS can be implemented without major pre-installation RF cell-planning.

Putting Wireless to the Test

Distribution centers are not ideal for Wi-Fi radio signals, however, so not just any solution could measure up to Kiva's standards. The WLAN has to support fast-moving robotic drive units in a highly dynamic environment, where changes in inventory and large amounts of metal shelving mean unpredictable RF signal propagation. The drive units communicate with the KCS to get new directions and update status, so RF issues or packet loss could keep the system from achieving peak performance.

With this in mind, Kiva carefully reviewed a number of wireless products for integration into the MFS solution. They set up a demo warehouse in their labs, complete with stock, pods, and mobile drive units, and put a select group of WLANs to the test. Although all of the systems could provide a base level of connectivity, only one, Extricom, was able to meet or exceed all of Kiva's stringent reliability and mobility requirements.

The Question of Mobility

For Kiva, their choice revolved around mobility: "Especially in the fault conditions we looked into, Extricom performed effortlessly compared to other technologies," recalled Verminski. "Seamless mobility is very important to us, and Extricom technology is what makes that possible."

Underlying Extricom's ability to easily support fast-moving wireless clients in a challenging environment is the Channel Blanket™ architecture, which aggregates the signal of multiple access points (APs), coordinated by a central switch, to create blankets of wireless coverage. As the Kiva drive units move, they benefit from constantly communicating with multiple APs operating on the same channel. This increases the basic reliability of the Extricom system compared to WLAN systems that have a single client-to-AP link.

While they are within the Channel Blanket, the Kiva robotic drive units are never subject to AP-to-AP handoff. In an Extricom system, drive units associate directly with the central Extricom WLAN switch, which determines which APs should be talking to which clients on a packet-by-packet basis. The drive units do not need to rate shift, scan for new APs and then re-associate with a new AP – the roaming process for typical WLAN systems.

This ensures the greatest system throughput and robust connectivity.

The Self-Adapting Network

The Extricom contribution to Kiva's MFS extends to operational and deployment considerations. As Verminski puts it, "The Extricom wireless network self-adapts to a constantly changing RF environment created by pods and drive units in continuous motion, so there's no need to tune APs and client transmission power levels. This also makes installation and support easier, since the channel cell planning and tuning step is eliminated."

Reliability is also a factor. Since all Kiva MFSs operate on a high availability basis with service level guarantees for their customers, completely redundant WLANs are deployed. Extricom's architecture allows independent Channel Blankets on each redundant system to be tuned to separate channels, so that the two WLANs are physically separate right down to the airwaves. There is no interference between Channel Blankets operating on different channels and the Extricom Switch eliminates co-channel interference within the blankets.

Uninterrupted Success

The Extricom WLAN has been recommended by Kiva for use with its MFS since 2008, and is at work at customers such as Diapers.com and Zappos.com. Kiva Systems is becoming known as a game-changing technology partner in the growing materials automation industry, and was recently recognized as the sixth fastest growing private company in America on the 2009 version of Inc. Magazine's annual Inc. 500 list.

For Verminski, Extricom's contribution to this success is basic but fundamental, "It comes down to uninterrupted mobility between APs. On traditional wireless systems prior to Extricom, we could make the switch from AP to AP a little smoother using advanced core drivers at the client end, but it was never going to be as good as with Extricom. Add to that the quicker, easier installs with high ongoing reliability and robustness, and the choice was obvious."

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