Security & Scalability:

NAVIGATING THE BLUETOOTH LE LANDSCAPE FOR RETAIL

IHL GROUP

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A Guide to Bluetooth LE & Unified IoT Management in Retail

Bluetooth Low Energy (Bluetooth LE) is not just a technology, but an enabler of retailer's digitalization of the store. While proprietary networks alone can provide a number of functions, their proprietary nature can also bring limitations when exploring new functionality. Bluetooth LE brings a breadth of new capabilities to complex retail environments that demand Electronic Shelf Labels (ESLs), Digital Shelf Systems (DSSs) and other IoT devices:

- **Faster image and data transmission:** update the ESLs, DSSs and other IoT devices with a data rate up to four times faster than existing solutions.
- **Channel hopping and proven communication protocol:** Bluetooth LE uses a sophisticated algorithm to avoid interference and ensure reliable data transmission with an established communication protocol, used in billions of devices worldwide.
- **Low battery usage:** By its definition, Bluetooth LE is significantly more energy efficient than other existing technologies.

But Bluetooth LE is not only about technical advantages. It also enables new use cases that can transform your customer experience and business operations, such as:

- **Locationing and geofencing-based use cases:** Track the location and movement of your staff, and devices within your store, and trigger on-location actions, and operational recommendations based on their proximity to specific products or zones, facilitating in-store fulfillment and in-aisles initiatives.
- **Proximity sensing with Bluetooth LE-enabled devices:** With IoTs relying on Bluetooth, you can detect proximity to a given product and send relevant information or cross-sell suggestions on the label or on their mobile device as well as personalized promotions.

Bluetooth LE opens the door to building a standard-based unified retail where IoT devices such as ESLs, Digital Shelf Systems or sensors from different vendors can communicate and consolidate into one management platform, leveraging a common approach to communication. This can help you streamline your operations, reduce costs, and enhance your security and scalability.

Base Bluetooth LE A Flexible Framework to Build Upon

The Bluetooth LE standard provides a framework that defines the base protocols and standards for data transmission and security. However, it does not specify how to implement the higher-level features and functionalities that are necessary for creating a unified, scalable, and secure retail ecosystem.

One of the main question when using Bluetooth LE for ESLs, DSSs and IoTs is how to manage the communication between thousands of devices and access points (APs) in a store. Bluetooth LE has a feature called Periodic Advertising with Responses (PAwR), which allows the labels to send and receive data at predefined intervals, minimizing power consumption and synchronizing IoT devices to limit interferences. However, PAwR only covers how a label communicates with one AP at a time. It does not define how the label establishes the connection with other APs in the store if it is moved or out of range. This requires pairing again, which is impractical for ESLs that can easily be relocated.

Another challenge is how to onboard and update the labels with the latest pricing and promotional information. While Bluetooth LE defines the base mechanism to connect IoTs one by one, it does not specify how to perform the initial configuration and automated onboarding of a large number of labels, which can be time-consuming. Moreover, it does not prescribe compression standards for image sending, which can influence the quality and speed of the updates.

But most important of all the Bluetooth LE framework alone does not address the security risks of transferring sensitive data beyond the APs or upstream, which makes this part vulnerable to hacking or interception via any number of endpoints. Bluetooth LE encrypts the communication on the radio level, but not the entire data flow from the cloud to the label.

To overcome these limitations, retailers need to consider an augmented implementation that leverages Bluetooth LE as a foundation and adds the necessary features and functionalities to serve the specific needs of the retail industry. Such a complementary layer should provide:

- **Full adherence, compliance, and compatibility** with the established Bluetooth LE standard for Electronic Shelf Labels
- **Seamless and secure communication** between the labels and multiple APs, without requiring new pairing or another onboarding.
- **A fast and simple onboarding process** that can register and configure the labels in bulk, without manual intervention.
- **A robust and efficient image compression algorithm** that can deliver high-quality and consistent updates to the labels, regardless of the content or size.
- **An efficient management of IoTs' battery life and power consumption.**
- **An end-to-end encryption that protects the entire data flow** from the cloud to the label, preventing any unauthorized access or tampering.
- **A scalable and flexible architecture** that can support different store layouts, sizes, and locations, and integrate with various IoT devices and platforms.

Introducing VusionOX Augmented Security With End-to-End Encryption Protecting The Entire Ecosystem

In a world where cyber-attacks happen every 39 seconds[1], leaving security to chance is not an option. That's why VusionGroup designed VusionOX – an augmented implementation of Bluetooth-LE that provides end-to-end security to Bluetooth LE devices, such as electronic shelf labels with encryption from the cloud to the edge.

Encryption is the process of transforming data into a format that can only be read by authorized parties who have the right key to decrypt it. This protects the data from being accessed or modified by anyone else, such as hackers, competitors, or malicious insiders.

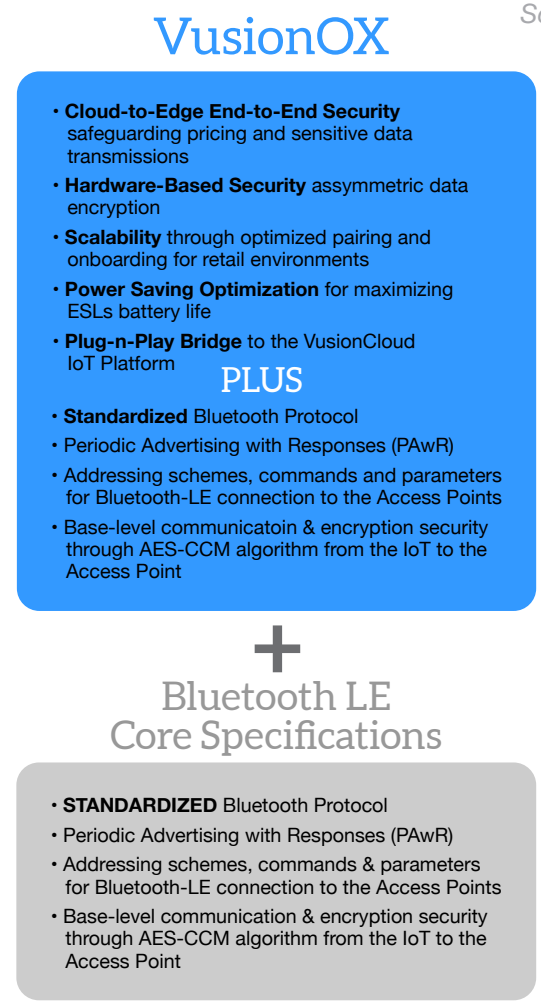
There are two main types of encryption: Symmetric encryption employs a single key for both encryption and decryption, prioritizing speed but necessitating secure key distribution. On the other hand, asymmetric encryption provides a higher level of security with distinct keys for encryption and decryption, making it more challenging for unauthorized parties to intercept or decipher the encrypted data.

HOW DOES IT WORK?

VusionOX uses cloud-to-edge end-to-end asymmetric encryption, backed by hardware-based security. This means that the data is encrypted at the source, in the cloud or in the edge device, and remains encrypted throughout the entire transmission, until it reaches the destination. No one can access or alter the data in transit, at the cloud, the AP or radio level.

BLUETOOTH STANDARD & THE VUSIONOX IMPLEMENTATION

Source: IHL Group



1. https://www.watchguard.com/wgrd-news/blog/there-was-cyberattack-every-39-seconds-2023

The hardware-based security is provided in the Qualcomm® Root of Trust which is a secure element embedded in the Qualcomm® chipsets powering our Electronic Shelf Labels, and Digital Shelf Systems. The secure element is a tamper-resistant component that stores and protects sensitive data, such as cryptographic keys, certificates, and credentials. It also performs cryptographic operations, such as encryption, decryption, signing, and verification.

Each IoT device, like ESLs or DSSs, is assigned a unique identifier during the manufacturing process. This unique identifier is derived from the secure element within the Qualcomm® chipsets and used to encrypt data packets, making them verifiable and resistant to replication.

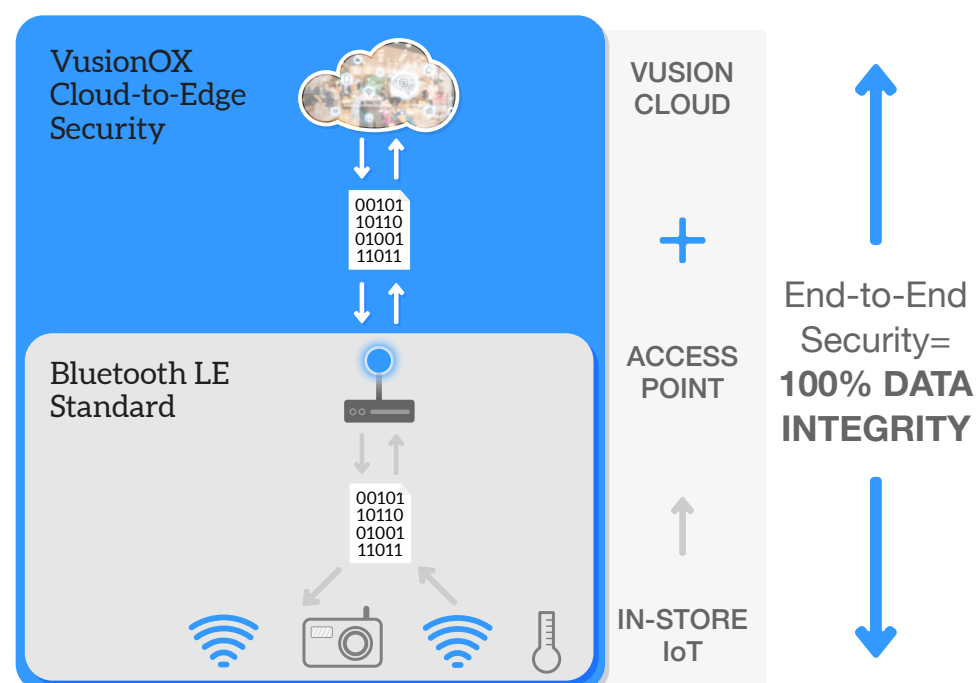
We have also added an extra software layer of security through VusionOX, which creates a secure pipe that wraps the information stream and adds additional headers and footers that contain information such as sequence numbers, checksums, and timestamps. This ensures that the data is not only encrypted, but also protected from replay attacks, packet loss, or corruption.

WHAT ARE THE BENEFITS?

Our system offers several benefits for retailers and consumers who use our Electronic Shelf Labels, Digital Shelf Systems and other IoT devices.

- It entirely complies with the established Bluetooth LE standard bringing full compatibility with the Bluetooth LE ecosystem, while adding a complementary layer of security and optimizing scalability for retail.
- It protects the confidentiality, integrity, and availability of the data, ensuring that it is not accessed, modified, or disrupted by unauthorized parties.
- It prevents data breaches, cyberattacks, or fraud, which could result in financial losses, reputational damage, or legal liabilities.

With our best in-class solution combining VusionGroup's IoT, VusionCloud and the Qualcomm® technologies, accessing contextual real-time data, analytics, and positioning capabilities can become a reality for your operation.

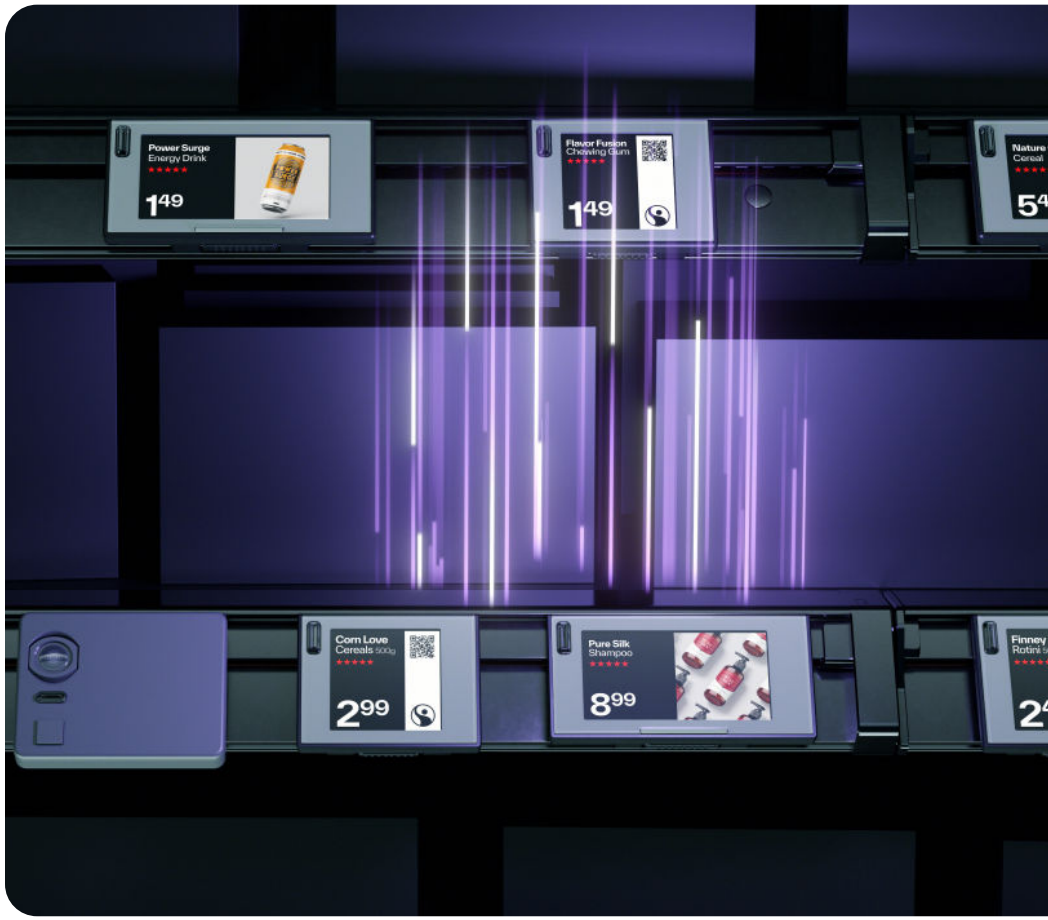


How VusionOX & Qualcomm® Bluetooth® SoC Enable Rapid Scalability For Retailers

One of the main challenges that retailers face when adopting electronic shelf labels (ESLs), Digital Shelf Systems (DSS) and other Internet of Things (IoT) devices is scalability. How can they install, manage, and update tens of thousands or even millions of IoT devices across multiple stores without compromising performance, security, or efficiency? How can they ensure a smooth and seamless transition from legacy systems to digital solutions?

With over 30 years of expertise in ESL technology, VusionGroup has unique know-how that enables retailers to go digital efficiently and effectively. By leveraging a strategic partnership with Qualcomm Technologies, Inc., VusionGroup offers retailers a comprehensive solution for contextual real-time data, analytics, and positioning capabilities, that can be scaled rapidly and reliably.

EdgeSense™, the latest innovation from VusionGroup, is powered by the Qualcomm® ultra-low power Bluetooth® Low Energy SoC. This Bluetooth solution enables EdgeSense™ to communicate with the VusionCloud Retail IoT Platform via the VusionOX Bluetooth LE implementation, which offers several advantages over other wireless protocols.



First, VusionOX allows for multipoint connectivity, meaning that each ESL or EdgeSense™ rail can be paired with multiple access points (APs) in the backend. This eliminates the need for manual pairing of each IoT with a single AP, which can be time-consuming and impractical. Instead, through the onboarding process, each in-store device is paired with one AP, and the VusionCloud IoT Platform manages the rest of the connection of the ESL or DSS through the entire store through backend management. This optimizes the AP to which the IoT connects for better performance and reliability.

Second, VusionOX enables dynamic grouping of IoT based on smart assignment algorithms. This means that the VusionCloud Platform can create and manage subgroups of IoT according to various criteria, such as location, product category, promotion status, or update frequency. This allows for faster and more efficient data transmission and updates, as well as targeted marketing and personalization. For example, the VusionCloud Platform can push price updates only to the IoT that are part of a promotion or send personalized offers to the IoT that are near a customer's smartphone.

Third, VusionOX ensures optimal battery usage and longevity for in-store devices. VusionGroup's ESLs and DSSs have a built-in system that enables power saving and optimizes battery usage before the onboarding phase, throughout the process and their entire lifecycle. Out of manufacturing, all IoTs are set to a dormant mode that saves battery life prior to onboarding. In this mode, IoTs listen in low power mode until receiving dedicated packets sent by the APs at a regular interval. Once activated, the IoTs enter the onboarding mode, where they communicate with the APs and the VusionCloud Platform to complete the installation process. After the onboarding is done, the IoTs enter their low power operational mode, where they receive and display data.

By using VusionOX, ESLs and DSSs, can be onboarded quickly and easily, without compromising performance or battery life. A store with 100,000 tags can be brought online in approximately 30 minutes, and the IoTs can last up to 15 years on battery depending on their usage.

With the VusionOX Bluetooth LE implementation, leveraging Qualcomm Technologies powered SoC , retailers can scale their digital transformation across multiple stores and locations, and benefit from real-time and dynamic pricing, location-based experiences, advanced analytics, and personalized promotions. The solution is not only scalable, but also secure, dependable, and compliant with the highest standards of data protection and privacy. By partnering with VusionGroup and Qualcomm Technologies, retailers can unlock the full potential of IoT and deliver superior value to their customers and stakeholders.

To Bluetooth & Beyond, Next Gen Retail is Here

Bluetooth LE is not just wireless technology. It is a game-changer for the retail industry, enabling new levels of connectivity, interactivity, and intelligence across the entire store ecosystem. With Bluetooth LE you can unify all your sensors, ESLs, DSSs, IoT devices, and mobile applications under one secure and scalable environment and create a seamless and engaging shopping experience for your customers.

But not all Bluetooth implementations are created equal. In a world where cyber-attacks happen every 39 seconds, leaving security to chance is not an option. You need a solution that protects your data, your devices, and your reputation, while allowing you to scale up to meet the growing demands of your business. You need a solution that is designed by experts in Bluetooth technology and retail innovation. You need the VusionGroup and Qualcomm Technologies' powered solution.

Security and scalability are the pillars of going digital in retail. Digitalizing stores is a huge undertaking and choosing partners with proven expertise to deliver such innovative technologies at scale is critical to smooth sailing. Higher sales, better labor utilization, targeted promotions, higher profits, and simplified security are just a few of the advantages you can expect with this new solution.

With the ability to leverage your existing architecture, unparalleled scalability, and management, the Qualcomm Technologies and VusionGroup solution stands far above the competition.

Take the first step towards transforming your business today. Scan the QR Code to learn more.

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