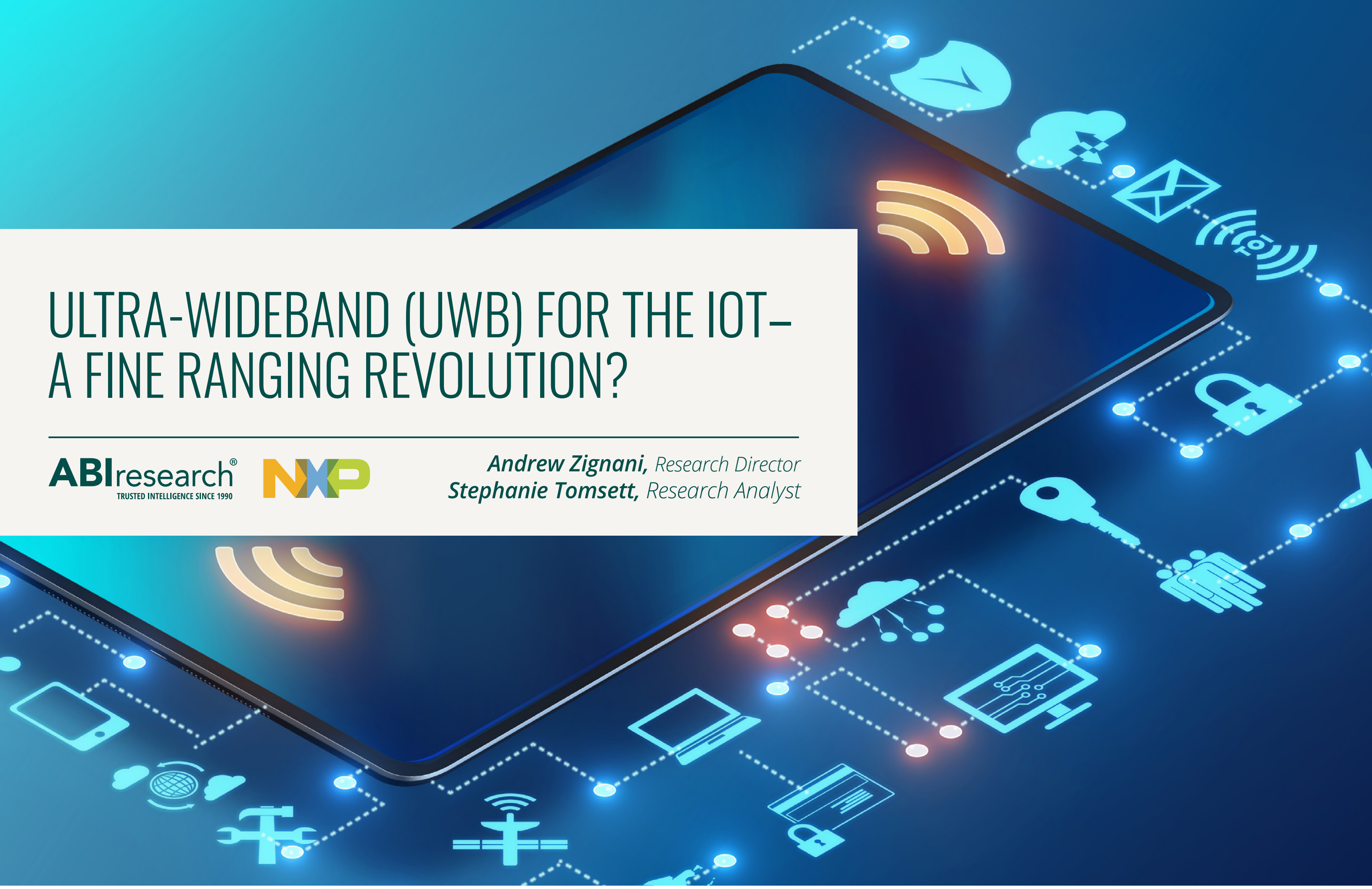


ULTRA-WIDEBAND (UWB) FOR THE IOT– A FINE RANGING REVOLUTION?

Andrew Zignani, *Research Director*
Stephanie Tomsett, *Research Analyst*

TABLE OF CONTENTS

Executive Summary 1
Introduction 2
Enter Ultra-Wideband (UWB) 2
How Does UWB work? 3
What Makes UWB Unique? 3
UWB Supported by a Growing Ecosystem 5
Current State of Adoption 6
IoT Use Cases for UWB 7
Access Control 8
RTLS, Item Tracking and Indoor Navigation 10
UWB in the Smart Home 13
Long-Term Use Case Roadmap 16
Challenges and Growth Drivers for UWB Adoption in the IoT 17
Key Challenges and Strategic Recommendations for the UWB Ecosystem 19
Conclusion and Strategic Recommendations 21

EXECUTIVE SUMMARY

Thanks to its unique precision, robustness, and reliability, Ultra-Wideband (UWB) has re-emerged as a secure, fine ranging technology capable of enabling a wide range of innovative location-based user experiences and services that previous wireless technologies have been unable to effectively support. This includes a combination of device-to-device and device-to-infrastructure applications, including hands-free secure vehicle and building access, indoor localization, asset tracking, hands-free payments, seamless smart home interaction and automation, augmented reality, gaming, and a whole range of emerging smart building, smart city, industrial, and other IoT applications. While there are numerous hurdles for the technology to overcome—including standardization and interoperability, widespread chipset and device availability, greater education, and awareness, among others—ABI Research believes that UWB technology has the potential to become a ubiquitous technology embedded within smartphones and vehicles, which will act as a catalyst for large scale UWB adoption across a whole range of new IoT applications. **By 2025, ABI Research anticipates there will be over 1 billion annual device shipments of UWB technology.** However, the real potential of UWB technology will come as the ecosystem develops, the installed base of devices increases, and truly innovative and compelling secure-ranging use cases across various IoT end markets are envisioned and realized.

INTRODUCTION

The installed base of connected devices is expected to reach over 66 billion by 2025, spanning across a number of verticals, including mobile devices, PCs, wearables, home entertainment, smart home, consumer electronics, automotive, smart building, smart city, industrial, and other IoT applications, according to ABI Research. Enabling this tremendous growth are a range of different wireless connectivity technologies, each with their own specific strengths and weaknesses, which continue to evolve in better service new use cases, enhance performance within existing domains, or to help create unique end user experiences and services that will drive the market forward.

Wi-Fi, for example, continues to evolve via Wi-Fi 6 and 6E to enable faster, more efficient, more reliable, and lower latency connectivity, addressing growing performance and traffic demands. Bluetooth has introduced support for mesh networking to better address more scalable commercial lighting and sensor networks, as well as added Direction Finding capabilities for enhanced positioning performance and enabling enhanced personal and public audio experiences thanks to the arrival of LE Audio. Near-field communication (NFC) has recently introduced wireless charging capabilities that allow NFC devices such as smartphones to charge small battery constrained devices such as wearables, earbuds, and accessories. NFC tags are also evolving to support anti-tamper and additional security capabilities to enable a range of anti-counterfeiting, brand protection, and supply chain tracking use cases. In short, the wireless connectivity landscape as a whole is continuing to evolve to better service the vast array of applications and market opportunities that the IoT promises.

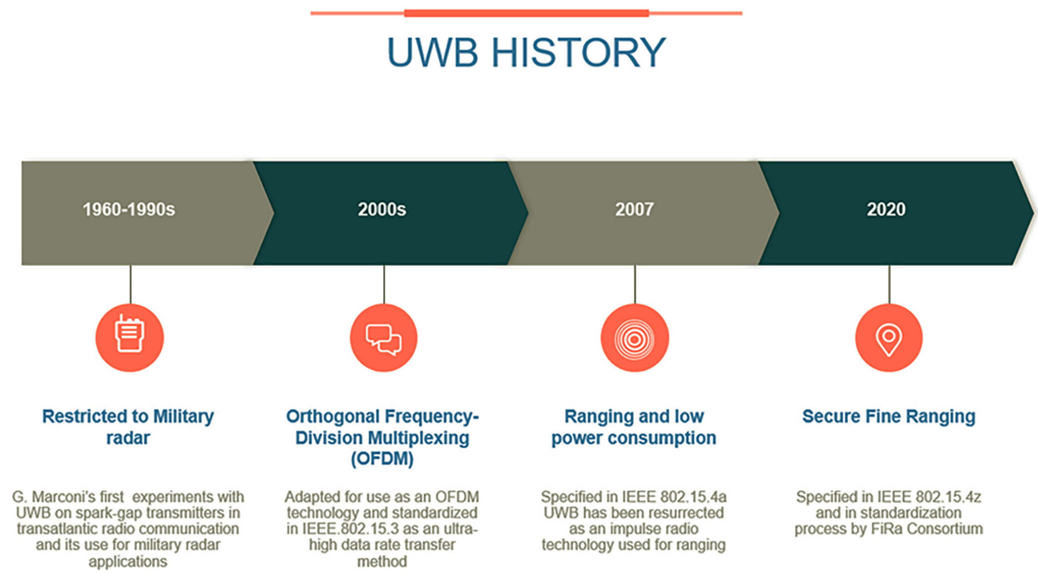
However, there is no one-size fits all technology, and each one has unique characteristics making them better suited to certain use cases, whether that be range, power consumption, throughput, security, or other metrics. Ultra-Wideband (UWB) has recently re-emerged and evolved, thanks to its unique technical features and characteristics that set it apart from what is on the market today. These unique features allow it to take advantage of growing demands for secure ranging and localization within a variety of automotive, industrial, and IoT applications, enabling new user experiences that existing technologies have not been able to address effectively to date.

ENTER ULTRA-WIDEBAND (UWB)

Ultra-Wideband is not a new technology. Originally used for military communications, UWB was authorized for commercial use by the Federal Communications Commission of the United States in 2002, allowing operation on the unlicensed 3.1 GHz to 10.6 GHz spectrum. Initially positioned as a data transfer technology in a similar vein to Wi-Fi, for various reasons including power restrictions, UWB was unable to succeed. Since then, the technology has repositioned itself, shifting away from data transfer applications and moving towards an impulse radio based secure ranging and localization technology, built upon the IEEE 802.15.4a and IEEE 802.15.4z standards. Over the last decade, 802.15.4a based solutions have started to see increased adoption within high accuracy indoor real-time locating system (RTLS) applications, while in the last few years, development of the 802.15.4z standard has led to additional security extensions being added to the technology. These will provide UWB with the ability to provide secure, authentic, centimeter-level accurate distance and location measurement, enabling a number of secure fine ranging and positioning applications demanded by automotive, mobile, smart home, smart building, and other IoT solution providers. Figure 1 highlights the history of UWB technology.

Figure 1: The History of UWB

Source: FiRa Consortium



HOW DOES UWB WORK?

Ultra-Wideband is a short-range impulse radio technology that can securely and accurately calculate the relative position of other UWB-enabled devices at a distance of up to 100 meters with up to 10 cm of accuracy. As the name suggests, UWB uses a wide channel bandwidth (500 MHz) between 3.1 GHz and 10.6 GHz and short two nanosecond (2 ns) pulses to accurately measure the Time-of-Flight (ToF) between two devices, such as smartphones, wearables, keys, tags, door locks, and anchor points. When in proximity, these devices begin ranging using ToF measurements that calculate the roundtrip time of the communication. One device can therefore calculate the relative location of the other instantly (with refresh rates at 100 times per second) and continuously, with movements being monitored in real-time. Meanwhile, angle of arrival techniques ensure that the system knows the precise location and direction of a device, ensuring that devices such as door locks can determine what side of the door a user is standing, and fully understand user intent.

WHAT MAKES UWB UNIQUE?

UWB has a number of benefits over other technologies, particularly related to positioning accuracy, latency, robustness, and security. While other technologies often calculate distance and location information from signal strength via RSSI (received signal strength indication) techniques, these systems can be subjected to relay station attacks from unauthorized remote users, which involves the interception and spoofing of the wireless signals, causing false readings. UWB provides much greater resistance to these attacks as it is able to determine the ToF more accurately between two devices. This means it can detect when the ToF is too long for the device to truly be in close proximity, prohibiting relay attacks and determining the exact distance between devices at all times.

ULTRA-WIDEBAND (UWB) FOR THE IOT–
A FINE RANGING REVOLUTION?

Andrew Zignani, *Research Director*
Stephanie Tomsett, *Research Analyst*

TABLE OF CONTENTS

Executive Summary 1
Introduction 2
Enter Ultra-Wideband (UWB) 2
How Does UWB work? 3
What Makes UWB Unique? 3
UWB Supported by a Growing Ecosystem 5
Current State of Adoption 6
IoT Use Cases for UWB 7
Access Control 8
RTLS, Item Tracking and Indoor Navigation 10
UWB in the Smart Home 13
Long-Term Use Case Roadmap 16
Challenges and Growth Drivers for UWB Adoption in the IoT 17
Key Challenges and Strategic Recommendations for the UWB Ecosystem 19
Conclusion and Strategic Recommendations 21

EXECUTIVE SUMMARY

Thanks to its unique precision, robustness, and reliability, Ultra-Wideband (UWB) has re-emerged as a secure, fine ranging technology capable of enabling a wide range of innovative location-based user experiences and services that previous wireless technologies have been unable to effectively support. This includes a combination of device-to-device and device-to-infrastructure applications, including hands-free secure vehicle and building access, indoor localization, asset tracking, hands-free payments, seamless smart home interaction and automation, augmented reality, gaming, and a whole range of emerging smart building, smart city, industrial, and other IoT applications. While there are numerous hurdles for the technology to overcome—including standardization and interoperability, widespread chipset and device availability, greater education, and awareness, among others—ABI Research believes that UWB technology has the potential to become a ubiquitous technology embedded within smartphones and vehicles, which will act as a catalyst for large scale UWB adoption across a whole range of new IoT applications. **By 2025, ABI Research anticipates there will be over 1 billion annual device shipments of UWB technology.** However, the real potential of UWB technology will come as the ecosystem develops, the installed base of devices increases, and truly innovative and compelling secure-ranging use cases across various IoT end markets are envisioned and realized.

ABIresearch | www.abiresearch.com

CONTINUE READING THIS FREE WHITEPAPER (23 PAGES)

Executive Summary	1
Introduction	2
Enther Ultra-Wideband (UWB)	2
How Does UWB Work?	3
What Makes UWB Unique?	3
UWB Supported by a Growing Ecosystem	5
Current State of Adoption	6
IoT Use Cases for UWB	7
Access Control	8
RTLS, Item Tracking and Indoor Navigation	10
UWB in the Smart Home	13
Long-Term Use Case Roadmap	16
Challenges and Growth Drivers for UWB Adoption in the IoT	17
Key Challenges and Strategic Recommendations for the UWB Ecosystem	19
Conclusion and Strategic Recommendations	21