A MATTER OF INTEROPERABILITY

THE NEW STANDARD THAT SIMPLY CONNECTS SMART HOME SYSTEMS

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INTRODUCTION

SMART HOME 2.0

The next 20 years will see homes changing more than over the hundred preceding them. Homes will expand in the activities they enable and support. Most crucially, with real time integration into the wider environment and economy, homes will increasingly respond to the needs of individuals, societies, economies, and the planet.

The evolution of the smart home market will be fundamental to that change. Having developed from a niche to a more mainstream market over the past few decades, smart home technology will become core residential infrastructure, just as plumbing and electricity are today, by updating and augmenting key resources.

Key to smart home transition into key home infrastructure is maximizing the potential from smart home market engagement and simplifying the installation and use of smart home devices. A key aspect that has so far limited smart home system adoption is one that has held back most new markets – it is a lack of interoperability. Without interoperability, end-users are faced with complexity and risk in selecting and installing new smart home devices The upcoming Matter specification represents a step change for the industry and one that will steer smart home players to reconsider and realign their strategies and the technologies and partnerships that will underpin their activities.

This paper examines the potential for the Matter specification to bring in-home interoperability to smart home systems and its ability to drive broadscale industry and consumer engagement. We also examine how leading wireless connectivity chipset vendors, such as NXP, will enable and support new smart home connectivity and OEM operational demands in the smart home.

SMART HOME GROWTH AND STANDARDIZATION

At the heart of smart home system limitations has been market fragmentation. As some smart home players have leveraged and driven fragmentation to secure and simplify control of their offerings and/or to retain control over their smart home development investments, it has split the market and limited its appeal to partners engaged and on the periphery of the market.

Chart 1
Smart Home Residential Penetration by Region
World Markets: 2021 to 2030
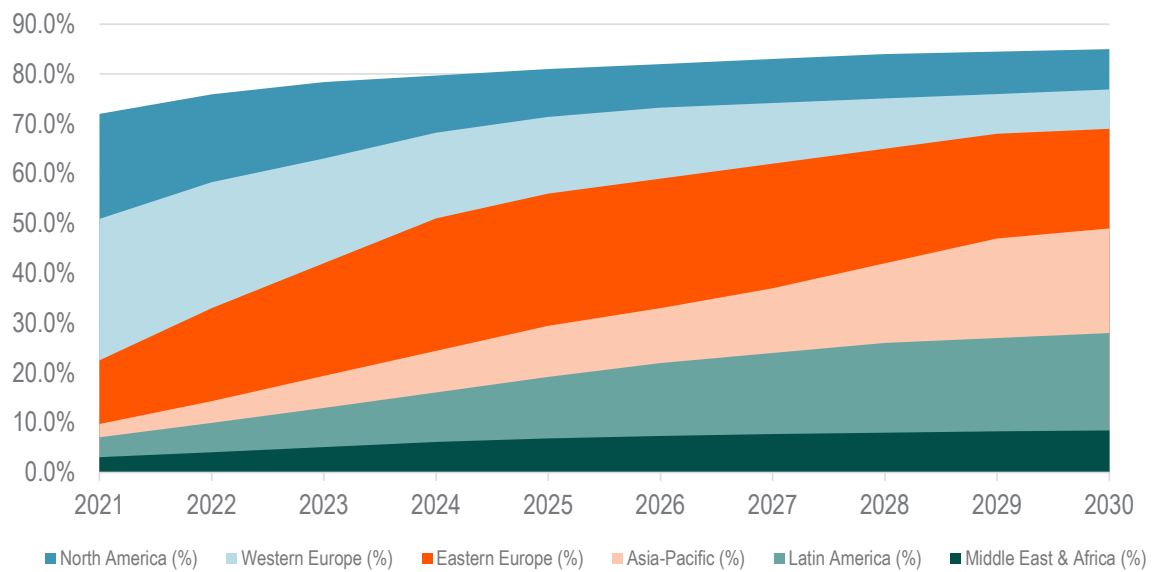
(Source: ABI Research)

Chart 1 shows the penetration of one or more smart home devices in homes around the world. However, multi-function, whole home smart home systems that can monitor and manage a range of devices and applications have a far lower penetration. Even where devices are operating together in a system, functionality remains limited. A key restraint on greater integration of smart-devices into systems has been:

- **Platform specific integrations:** OEMs have been required to commit resources to dedicated and separate efforts to integrate with each ecosystem smart home platform. So, a device developed to work with Amazon Alexa will require a separate, additional development and testing process to also integrate with Google Home and so on. This duplicates costs for the life of the product as systems are extended and maintained.

- **Connectivity complexity:** OEMs have to consider not just the wireless connectivity that suits the demands of product functionality, but also the target ecosystem. Smart home has been rife with competing short range wireless protocols ranging from proprietary, Z-Wave, Zigbee, and Bluetooth.

- **Security:** Smart home devices have been sold for their connectivity and functionality not for the security of their operation. There has been no standard for how devices are securely managed and how that security can be extended throughout a home system. Consumer concerns over device security vulnerabilities and system privacy have proven an additional brake on the market.

ENTER MATTER – FORMERLY PROJECT CHIP

Launched as Project CHIP in late 2019, the subsequently rebranded Matter specification is the most recent attempt to bring interoperability to the smart home market and, ABI Research believes, is the first that will gain significant traction.

With its focus on connectivity within the home, Matter offers the promise of more efficient smart home engagement for OEMs and consumers alike. However. the effort follows a number of earlier industry groups that have also formed alliances geared toward smart home standardization only to have them struggle for momentum while facing the staunchly unilateral approaches of the largest players in the market.

WHAT MAKES MATTER DIFFERENT?

Matter has the potential to succeed where other efforts have lagged for key reasons. These can be summarized as:

- Market support and momentum
- Technical approach
- Clear and limited initial scope
- Potential for future development and expansion

MARKET SUPPORT AND MOMENTUM

From its inception, Matter had the support of the three largest players in the smart home market and across consumer technology. Convinced of the long-term, multi-application value of the smart home market, Amazon, Apple, and Google all envisioned the project as a way to drive smart home growth and value faster than their individual, separate ecosystems could deliver on their own.

Alongside Amazon, Apple and Google at the launch of Project Chip were 10 other Zigbee Alliance board members: IKEA, Legrand, NXP Semiconductors, Resideo, Samsung SmartThings, Schneider Electric, Signify (formerly Philips Lighting), Silicon Labs, Somfy, and Wulian. A new working group was established within the Zigbee Alliance, to develop a new application layer smart home specification. The group represented players from throughout the smart home ecosystem.

Since the start of 2020, major players have dedicated staff and resources to the project in an effort to speed its delivery to the market and by October 2021, the scope of the specification had been defined and the number of companies engaged in its development had swelled to more than 210 players. During the course of the first half of 2022, the Matter specification will be ratified, published and the first compliant devices will be set for shipment.

1H 2021	2H 2022	1H 2022
Initial technical specifications available to members	Pre-balloting technical specifications available to members	SDK released 1st products certified Certification program released Members action GTM plans
Initial SDK and Test Even Efforts	Ongoing SDK & Cert Program Dev Test Events continue	

(Source CSA)

While market leaders and those most keenly invested in the development of the specification will offer compliant products and updated functionality meeting Matter certification by the second half of 2022, ABI Research expects the fourth quarter 2022 to be see the first large-scale ramp in the availability of Matter compliant smart home devices and appliances.

TECHNICAL APPROACH AND NETWORK ARCHITECTURE

The focus and scope of Matter also suggests further strength in its potential. Primarily:

- **Application Layer:** Matter is an application layer specification. The goal of the specification is to provide a uniform control layer to connect and manage devices within smart home environments. Key to the specification is that it is limited within the confines of the home. Wide area/cloud connectivity is not addressed. Driven by the major smart home voice-control players, the specification will provide a way for competing platforms to manage the same install base of devices, even sharing control between them via multi-admin support.

- **Transport:** Matter communications will operate only over IPv6 supporting transport – a handful of which are delineated and supported in the first specification.
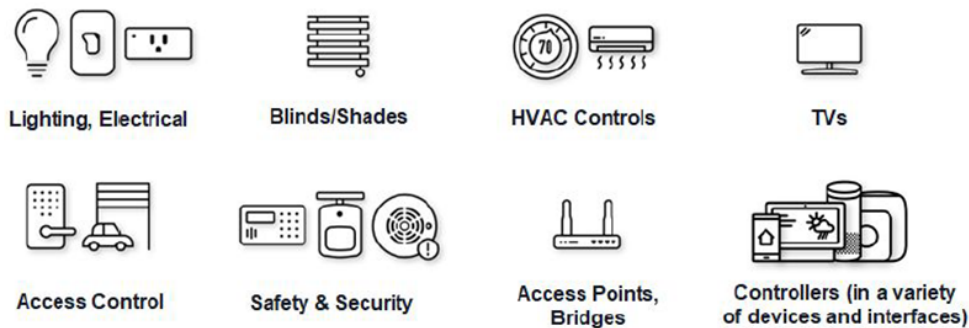

- **Communications:** In supporting Wi-Fi and Bluetooth - wireless protocols the project supports connectivity already well established in consumer and home connectivity. Similarly, with support for ethernet that connectivity is extended to support into the installer and new build market. It is in the selection of Thread that the specification takes the greatest step away from the smart home market as it stands. Though leveraging the same 802.15.4 silicon as the more established Zigbee protocol, Thread is relatively unused in smart home at present. Zigbee and Z-Wave have far larger support and install bases. Matter support for Thread will be a key step change for the smart home market but, ABI Research believes, the capabilities the technology brings combined with the appeal of Matter will bring vendors over to Thread adoption relatively rapidly.

- **Open-Source Software:** Specification development is an open-source program, managed by the CSA, with a publicly available repository covering software development and a second for Matter Working Group members only which is used to develop the Matter specification. Work contributed is licensed under the Apache 2.0 license. Only developers working for a company with CSA and Matter working group membership can participate in its development. Matter will maintain a library of standard implementations that members can leverage in developing support for their own Matter compliant products, significantly reducing the cost and time to market for product development, as well as ensuring uniformity across security and other implementations.

- **Topology:** Embracing the Border Router capabilities within Thread, Matter extends the concept so that a host of smart appliances throughout the home can integrate and expand the reach of Matter compliant smart home systems throughout a home. Smart TVs, voice control front-ends, and more will all support Wi-Fi, BT, and Thread capabilities to become 'good neighbor's' in a Matter-compliant home network. In addition, these become devices capable of being multi-function smart home controllers.

LIMITED INITIAL SCOPE

The Matter focus on the Application Layer, places standardization at the key point of system integration and control – the smart home management platform. Standardization at the platform integration will deliver greater access to devices deployed in the home to the voice control/management platforms in turn extending the scope of interactions and potential system functionality. In addition, standardized platform integration maximizes the ability to scale adoption by overlaying the application layer across existing products and already deployed devices.

In its initial specification Matter is limited to the following devices:

| Lighting, Electrical | Blinds/Shades | HVAC Controls | TVs |

| Access Control | Safety & Security | Access Points, Bridges | Controllers (in a variety of devices and interfaces) |

(Source CSA)

The initial device types set for support as part of the first specification are driven by existing market demand and popularity as well as the potential for devices that can be integrated into initial systems such as access control with smart lock and garage door control as well as security sensors, touchpads, and alarms.

The inclusion of Smart TVs in the first specification is key in several ways. These devices have typically been on the periphery of the smart home domain. While smart home capabilities have extended to TV screens it has typically been through add-on integration either through the service provider router or through OTA hardware such as Apple TV or Amazon Fire devices. Embedded Matter support further pushes entertainment control within the scope of simple, self-install consumer systems but also delivers the opportunity for Smart TVs to operate as border routers for Matter supporting Thread devices.

Access Points and Bridges are key to extending and bringing non-Matter devices into the Matter network. Access points will provide the capability for Thread and Wi-Fi devices to connect to the cloud while bridges bring a way to bring existing Zigbee nodes to integrate with Matter. Zigbee networks are the first goal for bridge support other protocols could follow but require more effort and engineering.

FUTURE DEVELOPMENT

There are some clear omissions from the first specification. Video support for cameras and smart doorbells is the most obvious. There are plans to add video in later versions or iterations of the Matter specification, alongside water leak detection and countertop appliances. Application management wise, energy management is a clear candidate for systems wide control but there is potential for health and wellness, climate measurements and more.

SMART HOME MARKET SCALE

Chart 2
Total Smart Home Hardware Shipments by Region
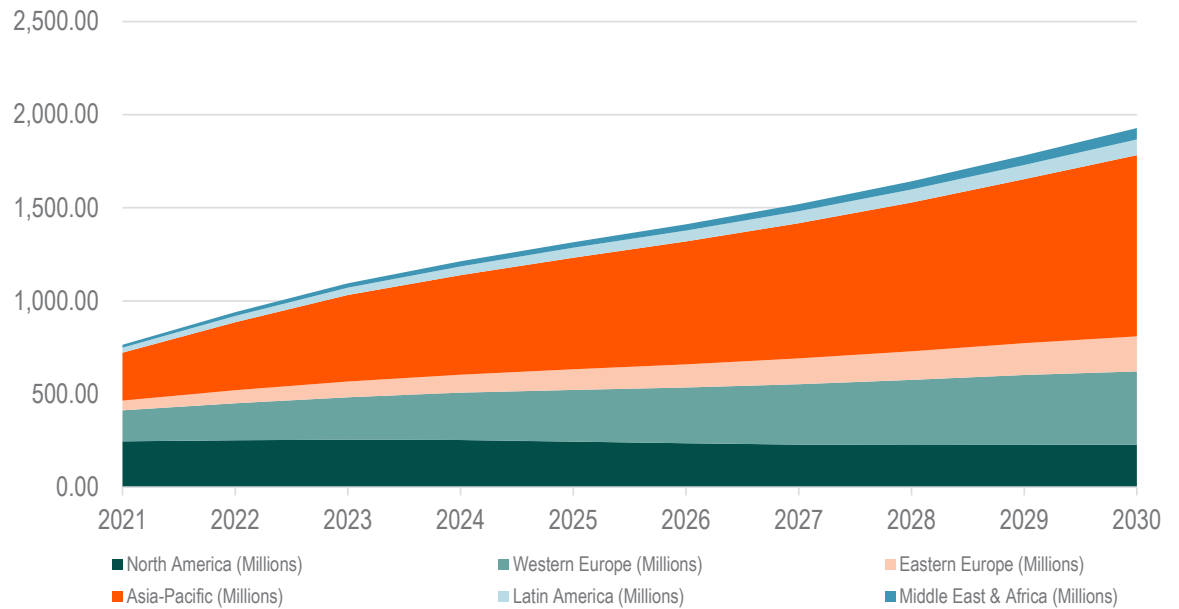*World Markets: 2021 to 2030*

(Source: ABI Research)

Chart 2 shows the significant scale that the smart home market supports with regard to the new connected equipment being installed and leveraged in homes around the world throughout the decade. Between 2022 and 2030, more than 20 billion wireless connected smart home devices will sold worldwide. A significant portion of these device types are immediately addressed by the Matter specification and over the next few years a majority share of these products, as well as others such as consumer robots and smart appliances, will support the Matter specification.

MATTER AND ENABLING TECHNOLOGIES

Smart home wireless connectivity is at the heart of smart home adoption and the Matter specification. Matter compliance will require OEM's to rethink product design, manufacturing, and lifecycle management. Leading wireless chipset vendors are preparing a variety of silicon and service offerings to support and drive the transition of Matter in the smart home market with NXP and others offering a diverse range of connectivity, security, and services offerings, alongside a range of innovative integrated circuits (ICs) that can help better address the varied demands across the smart home device market. Players including NXP, Silicon Labs, ST Microelectronics, Texas Instruments have all taken prominent roles in the CSA's Matter development process.

Silicon vendors, like NXP, have played a key role in the development of the Matter specification and the supporting protocols by engaging and contribute to open-source projects including Matter and Thread.

MATTER CONNECTIVITY

Matter will have a significant impact in supporting and driving demand for the connectivity options embedded into the initial specification.

Chart 3
Total Smart Home Shipments by Protocol
World Markets: 2021 to 2030
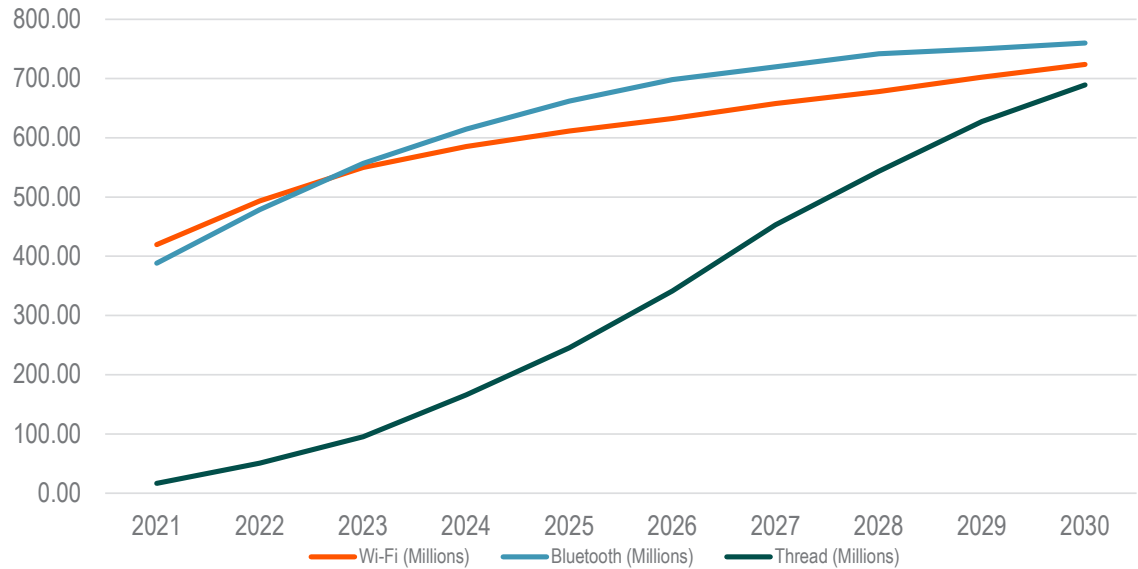
(Source: ABI Research)

Chart 3 shows the scale of demand for Matter supported protocols across smart home devices. While Matter leverages and extends the appeal of Wi-Fi and Bluetooth, it will drive the adoption and demand for Thread across a broad range of devices – from low-power low-cost sensors to voice control front-end devices taking on border router capabilities. Demand will grow at close to a 50% CAGR as shipments embedded with Thread rise to more than 674 million a year by 2030 from a handful of OEMs supporting the technology in 2021.

It is important to remember that a single device type will in many cases support Matter across a number of protocols, for example a voice control front-end with Matter supported across both Wi-Fi and Thread application communications.

WI-FI

With near ubiquitous availability in homes and support for high bandwidth communication including video and voice, the protocol already had a significant role in smart home devices and applications. Despite efforts to push Wi-Fi connectivity into battery powered end nodes – as a way to simplify installation bypassing the need for a dedicated bridge or gateway – the technology has proven popular only in devices with a permanent power supply. Wi-Fi will remain unchallenged in smart home devices where greater bandwidth is required and Wi-Fi's size, power and additional cost can be supported. Wi-Fi is further bolstered by its ubiquity in homes, its vendor and end-user familiarity, market pricing that leverages enormous scale of production and a functional ability to require no additional hardware (gateway) to access the cloud.

Wi-Fi 6 has started to push into the smart home devices and appliances and the capability of the specification to manage and prioritize traffic within the smart home network. For example, to turn on a light ahead of more general traffic on the network. However, Wi-Fi will remain a more complex and more expensive option. Embedded Wi-Fi requires more than 20 external components whereas Thread requires just five. Clearly, in devices that don't require the bandwidth or can't afford the cost and size Wi-Fi, Matter will drive support for Thread.

THREAD

The requirement of smart home systems to integrate small, low-cost, typically battery powered sensors and other node devices has long demanded the use of ultra- low power mesh networking protocols which can minimize power drain from communications while leveraging mesh to gain whole home coverage and greater reliability. Today, to reach the cloud these networks typically require a bridge or gateway to mediate between the ULP protocol and the cloud. However, Thread's support for Border Routers will be leveraged within Matter to populate homes with a number of border routers as the functionality is hosted by perma-nently powered Wi-Fi/Thread capable devices ranging from appliances to smart TVs to voice control front-ends. Thread was selected over more widely used ULP mesh offerings for its support of IPv6.

The key impact and change that Matter brings is in the choice of Thread. ABI Research believes that Matter's support alone will help make Thread the smart home ULP protocol of choice and the selection is already draw-ing significant new investment in the protocol. In the US, the greatest impact will be on Z-Wave, while the Mat-ter backing of Thread will not only drive 802.15.4 adoption but will steer that investment away from Zigbee.

Supporting the Matter driven market for Thread and BT, connectivity products are coming to market to support Thread with Bluetooth LE. Released at the end of 2021, NXP's wireless MCU K32W061/41 portfolio, target Matter implementations with dynamic multiprotocol support for Zigbee and Thread as well as Blue-tooth LE 5.0. Powered by an Arm Cortex-M4 MCU and with 640 KB on-board flash and 152 KB SRAM, the offerings support complex applications and over-the-air (OTA) upgrade capability without external memory.

BLUETOOTH

BT does not presently support the key IPv6 protocol that underpins Matter wireless communications. How-ever, the protocol is supported for its ability to ease device onboarding. BT ubiquity in smart devices makes it the protocol of choice for service initiation and onboarding enabling consumers and professionals alike to use smartphone cloud connectivity to become a gateway to set-up new devices and systems.

While not a transport network BT will have a valuable role within Matter devices and appliances as a way to not just onboard and integrate new devices into a smart home network but also, by leveraging smart devices as cloud gateways – a way to provision installations ahead of broadband connectivity, extending the provision of smart home set up to new homes and developments where broadband may not be present – most typically in new or temporarily vacant homes. The still emergent appeal of Bluetooth Mesh within the residential market will be affected and limited by the selection of Thread in Matter.

Matter leverages Bluetooth LE's existing appeal and support for onboarding smart home devices via a secure connection between the device and a smartphone. However, there are additional options within Matter for both QR codes and more disruptively NFC (integrated with Bluetooth LE) to be used in commissioning.

COMBINATION SOCS AND MULTI-PROTOCOL SUPPORT.

The smart home market has seen over the past few years a shift toward Wi-Fi/BT combo chips given the prevalence of Bluetooth in the kinds of devices that primarily use Wi-Fi such as voice control front-ends. That shift came as de-facto industry standard approaches emerged that deployed Bluetooth LE and Wi-Fi together - typically where Bluetooth LE is used or onboarding and Wi-Fi throughput from the device were required. The Matter specification brings additional appeal to add Thread into that single platform as de-vices leveraging both BT and Wi-Fi extend to support border router capabilities.

Further driving combination SoCs and multi-protocol support is the Thread/Matter capability for border routers. The growing smart appliance market is a key target for these devices as appliance vendors not only become more secure in the investment of adding connectivity into their products following the creation of

a single smart home addressable market but also for their smart devices to act as border routers in the home, becoming key nodes in the Matter complaint Smart home.

Fueled by Matter, silicon providers are delivering new multi-protocol support integrating 802.15.4 and in particular Thread capabilities alongside Wi-Fi and BT. OEMs should assess the potential for single tri-radio devices over existing dual-radio BT-Wi-Fi with an additional, separate device for 802.15.4 and primarily Thread.

Over the next 18 months, a new generation of tri-radio devices will come to market offering the potential to reduce complexity and cost in the product design, manufacture, and management of smart home devices by offering OEMs a single source supplier, smaller footprint, and fewer parts to procure and manage. First to market is set to be NXP's IW612 supporting Wi-Fi 6, Bluetooth 5.2 and 802.15.4 which has been developed to support and simplify Matter adoption among smart home OEMs. The offering is a single tri-protocol chip not just package of multiple chips. The availability of such devices offer smart home device developers greater control and simplicity in the development of their offerings.

Such a device targets the potential for adding Thread Border Router capabilities into everyday consumer products like voice control front-end smart displays and smart speakers, thermostats, and more to enable seamless communication between Matter with Wi-Fi and Matter with Thread devices. In addition, tri-radio offerings offer on-chip managed coexistence to deliver software managed priority services to reduce latency, maximize bandwidth and overall network efficiency while at the same time providing a connection to the cloud.

As connectivity pushes into more and more home devices, the ability for OEMs to adopt and manage that connectivity is increasingly vital. Tri-radio offerings should deliver much greater simplicity for those OEMs. A single chip with tri-radio capabilities means managed coexistence embedded in the design of the product. Additional features such as flexible antenna configuration, an embedded secure element and strong platform developer support or services should all become valuable product attributes.

MATTER PROCESSING

The range of devices across the smart home market from simple sensors to border routers and voice control front-end processors means a wide variety of processing platforms from microcontrollers to microprocessors.

Figure 1
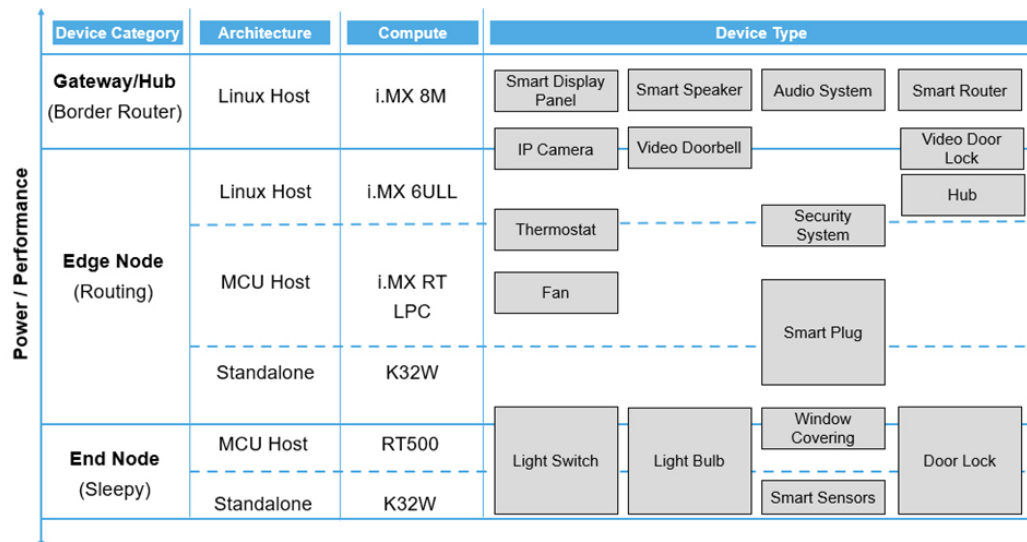*Matter Reference Platform: Typical Compute Use Cases*

(Source: NXP)

Figure 1 illustrates the differing processing requirements and related NXP products across smart home devices and controllers.

Support for IP to all smart home devices, as well as the security requirements (see below) within Matter, are key to raising the on-board processing requirements of many Matter compliant smart home devices.

As both Thread and Zigbee leverage 802.15.4 radios, there is potential for Zigbee-enabled devices to be 'up-graded' to support Thread. However, the greater payload required by the all-IP traffic at the heart of Thread requires greater than 128KB RAM, and greater than 1MB Flash to support the transition. This means that many installed Zigbee devices lack the processing resources to enable Thread enrollment via a firmware upgrade . While that means that low-compute resources on devices such as Zigbee contact or motion sensors will prevent a transition to support Thread, already deployed larger devices can be switched to support Thread and Matter. Amazon, Google and Apple, among others, have detailed that they will support Thread with Matter on already shipped voice control devices.

In a wider sense, device development will increasingly demand a re-examination of on-board processing requirements. Not just from the overhead from supporting Matter but from the increased competition that Matter will bring the smart home device market. With OEMs delivering standardized products to a single smart home ecosystem, the impetus will be to distinguish products by their functionality as well as performance and reliability. In addition, with greater control handed over to third-part management platforms, the ability to make smart home device more intelligent in their ability to deliver wider functionality than may be supported by the management platform will push OEMs to host more intelligence on devices. We have seen such intelligence and edge processing push into voice control front-end devices, Matter supplies the impetus for greater edge intelligence capabilities to also extend into gateways, border routers and additional device types.

We have already seen the potential for Matter to lead OEMs to develop and support new functionality within their offerings. Matter will also demand greater processing on devices both to support Matter but also extend greater intelligence pushed to smart home nodes.

MATTER SECURITY

A key shift Matter brings to the smart home market is a requirement for compliant devices to support levels of authentication and security that, while not new to smart home or the wider IoT market, has not been adopted uniformly across the market. Matter compliance will raise the demands placed on smart home devices and smart home device manufacturers' capabilities to integrate security and lifecycle management into their products. This step change will drive existing players to reassess their current security integrations and how those integrations are supported by component suppliers both during manufacture and onboarding but also through the life of the device.

Matter provides the framework, software libraries and supported mechanism to ensure compliant devices brought into a smart home environment are onboarded securely, and when a device has become insecure or infected, supply ways to limit and repair that breech. OEMs will have the option to use compliant Matter software libraries free of charge to support and to speed security implementations. While existing players may well prefer to continue to use their existing security capabilities and adjust them where needed to meet Matter requirements, the availability of Matter compliant software free of charge to Matter members significantly lowers the barrier of entry for players coming to smart home with their first products.

In turn, OEMs will look to silicon providers to deliver a range of Matter compliant security solutions that can help support and scale embedded security within devices and through their lifecycle.

Key to Matter security is the secure onboarding of devices into a Matter network. Much of the current focus is around leveraging Bluetooth LE or QR codes on compliant devices but the scope is also there for NFC as a commissioning and validating technology. Regardless of initiation tool, each device must have a vendor ID and a unique product ID contained within a device-unique certificate. This establishes the device provenance, compliancy to the CSA Matter specification, as well as the type of device and the permissions it will have within the smart home network. Also supported is the configuration for Wi-Fi and Thread network access (where applicable) and additional grouping within the network. The certification is mutually authenticated and encrypted.

OEMs are likely to leverage discrete secure element to onboard devices with a secure Matter ID . These secure elements, such as the EdgeLock SE051 from NXP, are typically agnostic to the on-board processing environment and offer the ability to upgrade security support via OTA updates as well as minimize the impact of the Matter security specification on the device processing and software requirements.

Handling and injecting of the cryptographic keys required for Matter device service authentication is not a trivial issue for OEMs. In addition, further complicating key management, given the lifespan of many smart home devices, OEMs will have to ensure that keys can be renewed several times throughout the life of a device.

Matter will use a distributed compliance ledger – managed using blockchain – to maintain and check compliance against the latest information such as which devices are certified or latest route attestation as devices communicating with the cloud and smart home management platforms. All communications are encrypted using AES-128-CCM encryption with 128-bit AES-CBC.

What is key to understand is that the Matter specification does not make manufacturers beholden to including Matter's security approach. Within the specification, there is an option to support proprietary as well as Matter-provided implementations to secure devices and their OTA firmware updates. Even so, Matter clearly represents a key development that will bring new and existing players into a new generation of on-board security management. The impact of greater security increases the appeal for the inclusion of separate secure element to the BOM of the device to offset the cost of in-house software only capabilities. Partnerships with silicon providers or trusted third-parties who are able to deliver lifecycle management of device credentials will become an increasingly valuable tool for many smart home OEMs.

The unique device ID requirement within Matter presents OEMs with the choice of a range of approaches. Management of the device secure certificates can be from an in-house platform to assign, register and manage device IDs throughout the product lifecycle, but this is a high skill and intensive route for the vast majority of players. A more likely possibility is to turn to a partner - most typically the silicon provider for the device or product range.

OEMs will have the potential to source pre-configured secure elements with device attestation certificates from their platform/secure element supplier. This effectively separates the security requirements from dedicated equipment or connectivity requirements during device manufacturing. Alternatively, OEMs may look to having device attestation certificates issued dynamically by a trusted partner to secure elements as they are embedded in devices. This approach supports greater flexibility in the assignment of secure elements to a range of devices in the manufacturing process as well as support new configurations and certificate installation throughout the life of a device.

Examples of both options can be found in NXP's EdgeLock 2GO Custom and EdgeLock 2GO Managed service with the former assigning certificates as the secure element is manufactured and the managed offer which can assign certificates as the secure element certificate is assigned as part of the device manufacturing process.

KEY OEM CONSIDERATIONS

For those OEMs that want to focus on the delivery of smart home products to the largest possible customer base, the Matter specification fundamentally changes how OEM vendors will approach, support, and enable smart home products. OEMs will be able to leverage existing, tested ways of bringing their devices into a smart home deployment and ensure the security of those devices.

The cost of developing and supporting key aspects such as onboarding and device security should be reduced significantly. This lowers the barrier to entry and the cost of operation for OEMs as they amass an install base.

Matter compliance will lift the burden of developing and certifying specific products for each major smart home platform/ecosystem. This immediately impacts the total addressable market for each product, changing the dynamics and the ROI on new product development. ABI Research believes the enablement of a 'single market' for smart home devices alone will draw new players into the smart home space, but there are additional changes that will drive and impact OEM smart home engagement.

The consumer experience: Interoperability across eco-systems and multi-user admin enabling a choice of voice interface within a smart home installation greatly simplifies and improves end-user engagement with smart home investments. Uniform, dependable on-boarding further simplifies adoption and extends that simplicity not just to end-users but wider implementations from property developers, building management companies, installers and more.

Matter will help solidify target ecosystem, connectivity selection, security provision and device management control for those vendors supporting the specification. However, it will also open new areas of focus and strategic planning.

APPLICATION SUPPORT

Some OEMs will look to Matter to free them from the demands of delivering their own smart home apps to onboard and maintain connectivity for their smart home offerings. Instead, with Matter controller capabilities in a host of devices and most importantly smartphones, these functions can be managed from directly within a third-party smart home platform.

However, many of the largest OEM players, especially with already established consumer brands, are likely to continue to offer their own apps for the following reasons:

- While Matter will enable uniform control, it is unlikely to extend to detailed or complicated control of a device. The ability to manage exact color shades from smart lighting, for example, will remain the persevere of OEMs and they will continue to see more detailed control as a key differentiator.

- Branded apps reinforce the OEMs connection with the customer and provide a valuable tool for up-selling and other valuable customer integration. This is increasingly valuable as additional services can be overlaid by OEMs across their install base.

- Matter delivers a high level of security for communications and devices within the home, however, as it does not address cloud connectivity, some OEMs will continue to look to their own cloud connectivity to ensure security between their devices and the cloud.

CONNECTIVITY

For many players in the smart home market Matter will require a strategic shift toward support for Thread. Given the importance of border routers within the Matter framework this will apply both across the traditional low power sensors and devices as well as the largest appliances. ABI Research has long tracked the growing popularity of Wi-Fi and Bluetooth, now with Matter's focus on and the following market support for Thread, the impetus is there for multi-protocol radio support within smart home devices. OEMs will look to their silicon partners to deliver platforms to suit a range of processing requirements including host-less and hosted (MCU or MPU).

Additional Features: With standardization and more uniform management of devices delivered by third-party platforms, OEMs will increasingly look to differentiate their products through increased functionality and improved consumer experience. This can drive greater engagement for adjacent technologies outside of Matter's initial focus including NFC for onboarding and UWB to deliver greater location awareness within the smart home environment.

SERVICES

With the security requirements within Matter demanding secure and unique device management throughout the lifecycle of a smart home product, many existing and new entrants in the smart home market will have to decide whether to manage these features in house or turn to a third-party to deliver them. ABI research believes this will put a greater value on ability for third-parties partnerships to deliver these capabilities and believe in many case it will be silicon providers that will offer these services alongside their connectivity, security, and computing offerings.

For OEMs themselves there will also be increased opportunity to layer additional services to end users by leveraging the intelligence drawn from their connected devices in the home. Strategically, OEMs will have to assess whether to offer these services directly or through partners. For example, an application such as energy management offers the ability to efficiently link energy usage with the demands of energy generation and distribution bring value to end-users and ecosystem partners.

Service capabilities can also extend into physical management of appliances within the home typing connectivity to the ongoing value of operations. For example, supported by standardized connectivity the opportunity for large appliances vendors to roll out offerings that tie installation and maintenance into their product offerings is significant.

ON-BOARD INTELLIGENCE

Matter is focused on securing and improving smart home operations within the home. Increased demand for product differentiation combined with the value of additional services made available to OEMs will also drive up the value of embedding greater intelligence within devices – over the more recent reliance on the cloud. Greater sensing capabilities and the ability to interpret and act on data on devices themselves will underpin OEM capabilities to both boost the appeal of their offerings as well as the user experience. Being able to identify individuals in the home and align presence to personalizing the environment or changing the home environment in relation to a range of external factors such as weather or wider demand smart city networks. We have seen edge AI already push into smart home voice control front-ends and expect this to push deeper in smart home devices, spurred on by the detailed opportunities that Matter offers the OEM market.

MATTER – A FOUNDATION FOR THE TRANSFORMATIONAL SMART HOME

DATA EXCHANGE

The emerging transformational smart home (as defined in ABI Research's Transformational Smart Home report (AN-5336) is dependent on widespread data sharing between a wide range of devices and applications within a home. Where data silos have typically resided either with OEMs or smart home platform/system providers limit the potential for intelligent multifunctional home automation, Matter ensures systemwide interoperability in the home and multi-admin platform support for those systems.

In turn, those platform providers, armed with a more complete understanding and control of that home environment, will be increasingly incentivized to boost their offerings and revenue generation through integration with third-party applications, industries, and partners. The key value of smart home data and bringing in new partners, is scale and Matter is a key building block in bringing that scale.

The secondary smart home data market will still face issues in integrating disparate platform partners, each of which has different data exchange interests, investments, and functional capabilities to leverage smart home data. Matter doesn't address data standardization across smart home platforms and it remains to be seen if standardization can be pushed further up the value chain to the platform level, but as Matter brings richer data into competing platforms, the impetus is there.

Smart home has barely begun to scratch the surface of what is truly attainable in a future data sharing environment. A smart home data exchange capability will not only provide a streamlined approach to tackling challenges around device management services and security analytics, but also provide a more stable foundation for legislative, regulatory, and standardization initiatives.

DATA EXCHANGE AND NEW INTEGRATED APPLICATIONS

Simplifying and driving smart home data exchange will enable the development of a wide range of interrelated services in the home. Some examples are provided below.

DIGITAL LIFESTYLE HOME

The smart home will increasingly be at the heart of a consumer digital lifestyle, and it will increasingly be aware of buying behavior and preferences, interests and activities, future plans and daily routines, product consumption, and intentions. All of these insights have value to a range of industries, both within each specific home and across millions of homes. The smart home can help influence and support the selection and delivery of insurance, healthcare, transportation, energy consumption and supply, retail selection, delivery, and receipt. Personal lifestyle (health, banking, shopping, etc.) advisors in the form of virtual avatars or embedded smart home interfaces could be capable of drawing information across a home and beyond to ingest and connect to third-party databases and social media APIs, cross-reference data with aggregate information from other users, and make recommendations based on user history and planned actions.

CONSUMER ROBOTICS

Collective smart home intelligence can fuel the integration of consumer robotics within the home as a physical extension of the smart home platform. Robotic services from vacuum cleaners to social engagement or household chores, such as loading and unloading smart appliances, could be integrated into the operation of the wider home. In addition, data collected by a robot system's ability to dynamically map a home and update smart home systems to maximize home performance.

SPEED NEW REVENUE STREAMS AND OPPORTUNITIES

The smart home is a perfect environment to bridge data between automotive, smartphones, wearables, and payments to create new revenue streams, and to allow steady data flows between multiple vendor databases (as

part of the existing focus on data-sharing initiatives). This will also foster collaboration between different players from previously unrelated market segments, ultimately creating new applications for their users.

IMPROVED ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

The significant volume of data that are capturable across the smart home user base, if shared, and structured in a standardized approach has the potential to deliver an Artificial Intelligence (AI) and Machine Learning (ML) dataset that can be leveraged to drive a wide range of consumer intelligence and actionable insights. Correlations exist between in-home activity and healthcare, occupancy and insurance claims, energy use and home safety, and many more.

SECONDARY SMART HOME DATA OPPORTUNITIES

Outside of immediate smart home data distribution to drive smart home industry functionality there are five key data sharing/exchanging/selling initiatives for smart home players: Governmental/Smart Cities, Insurance, Healthcare, Energy and Home Maintenance and Management. In addition, the volume and detail of smart home data can also support improved ML Repositories and the development of greater network resilience.

The smart home market has barely begun to scratch the surface of what is truly attainable in a future data sharing environment. A smart home data exchange capability will not only provide a streamlined approach to tackling challenges around device management services and security analytics, but also provide a more stable foundation for legislative, regulatory, and standardization initiatives.

OFFLINE & EDGE INTELLIGENCE

Over the past decade, cloud computing underpinned smart home devices and service adoption, challenging high-end in-home controllers in the home. Cloud computing brought cheaper and more simple devices to market, but as Matter brings uniform control to smart home devices, OEMs will be incentivized to deliver greater functionality to their offerings to better compete and building greater intelligence into smart home devices becomes an increasingly attractive proposition. As edge analytics gains momentum across a range of vertical markets, including smartphones, Industrial IoT (IIoT), and automotive, edge is increasingly viable for improving and extending smart home system capabilities. Edge capabilities offer greater system responsiveness and resilience - pushing smart home intelligence and control back into the home in end devices and/or in smart home gateways. Key drivers for edge include:

- **Faster, more detailed in-home sensing and system response.**

- **Greater device and system reliability** ensuring the increasingly valuable smart home system operates when cloud connectivity is lost.

- **Self-healing capabilities for nodes and networks** as two-way communications on end-nodes support device management and Over-the-Air (OTA) upgrades and fixes.

- **Improved Security/Privacy** by restricting data sharing outside the home

- **Operational Cost:** Where OEMs retain a role in the management of their installed devices, edge analytics pushes the cost aspects, such as power and cooling, from the provider that paid for cloud operations to the consumer. The amount is small enough not to trouble the end user, but at scale represents significant savings for the provider.

The edge analytics market does not free OEMs and service providers from the cloud completely. What is emerging is a hybrid smart home system that pushes intelligence and autonomy to nodes within the home, but still depends on cloud connectivity for aspects of maintenance and system management. The goal of embedded edge analytics in the smart home is to ensure that the cloud connection is needed as infrequently as possible.

CONCLUSION, NEXT STEPS FOR OEMS

Matter has the market impetus and support to drive a step change in the smart home market. It will re-structure the key technology requirements that add connectivity and bring devices and appliances into the smart home space.

Chart 4
Smart Home Matter Compliant Device Shipments by Type
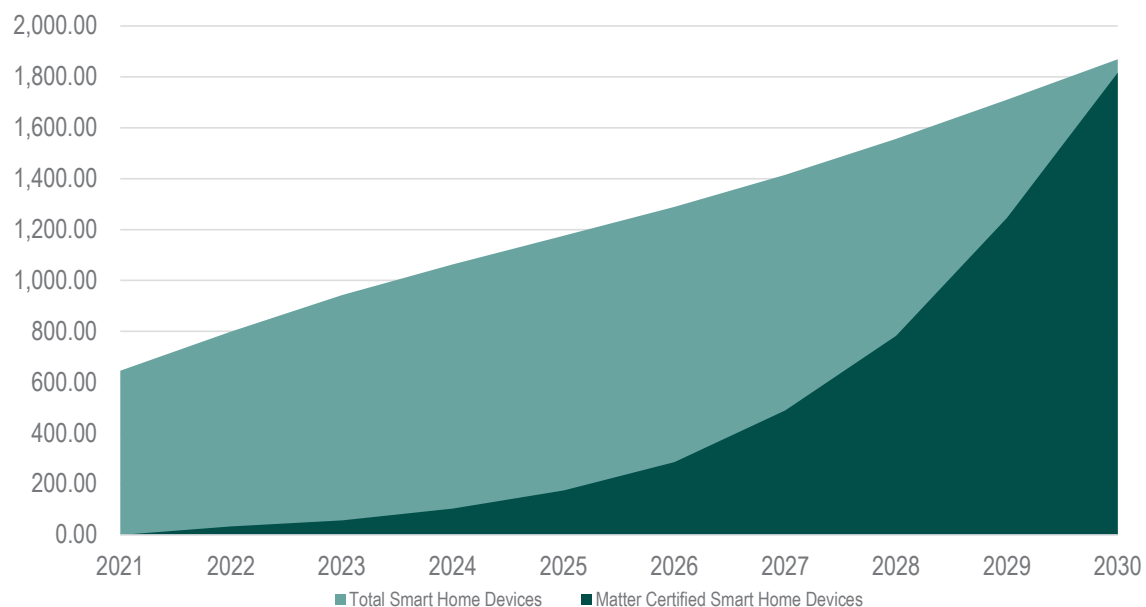*World Markets: 2021 to 2030*

(Source: ABI Research)

Legend: Total Smart Home Devices — Matter Certified Smart Home Devices

Chart 4 highlights how Matter compliance will penetrate the smart home device market. Initial shipments will begin in 2022 with some vendors committed to leading the charge with complaint devices expected to ship shortly after the specification is first published.

For those OEMs already engaged in the market, Matter reduces the technical constraints in targeting the entire smart home opportunity with single versions of a connected product. For existing players and new entrants alike, it brings greater simplicity in technology selection for each product and for the lifecycle management of those devices and appliances.

Built upon the market enabled by Matter, vendors in the smart home market will increasingly be drawn from outside of the technology market bringing specialist capabilities that do not feature embedded connectivity or supporting connected products. OEMs will increasingly look to their partners and suppliers to deliver not just integrated connectivity, processing and security hardware and software, but also – and Matter will help drive this – the services and infrastructure to simplify the creation and management of those devices. Service ranging from software development tools to long-term device management.

It is those silicon providers that can support the new Matter specification across their connectivity, processing and security services as well as provide the developer environment and ease of management across the array of smart home demands that will benefit the most from Matter adoption. For example, typically, MCU suppliers have custom tools and their own integrated development environment, but as additional features are added – say a secure element – the resources available to compile or debug are more limited. This plays to the strength those silicon players with the broadest portfolios and a consistent developer environment

across the mix of demands across client smart home designs. For example, NXPs MCUXpresso integrated developer environments for its family of Amr Cortex-M offerings also encompassing Matter driven demand for added secure elements and other extended capabilities such as NFC. These services have the potential to speed Matter compliant smart home products developed in-house by OEMs or as a service from the silicon provider.

However, by lowering such barriers to entry, Matter looks set to intensify competition in the smart home device market as new entrants engage with the market and OEMs will have to respond with new customer engagement, product capabilities, pricing, and revenue models to support their smart home plays. With these developments in mind, ABI Research recommends the following topics should be part of any OEMs ongoing smart home strategy:

- Determine the core value and attributes that any smart home device must deliver to be competitive and deliver end-user value.

- Engage in the Matter specification and assess how to best leverage the available standardized approaches across onboarding, communications, security and more. For any vendor targeting the broad market and even in most high-end and custom deployments, Matter certification should be strongly considered.

- Determine the key differentiators each OEM can bring to a product and what can be better managed by partners and third-parties. Where there is potential to leverage third-party suppliers across the value chain where expertise and scale can improve quality and lower cost in developing and supporting Matter compliant devices and services.

- Ensure that future functionality and value can be supported by products as new markets emerge for interconnection between deployed devices and new system functionality.

- Ensure than smart home investment is made with a clear understanding of how new services and revenue models can be supported on existing as well as new deployments.

- Matter sets a benchmark but not a ceiling: Investigate the potential for greater connectivity, functionality and value for end-users and smart home partners from adding features and functions beyond Matter's current specification. Support for NFC and UWB and their integration into product platforms should be assessed.

Matter will be at the heart of a re-examination of the smart home market and its potential to serve a range of markets beyond these immediately engaged in the delivery of connected devices and appliances in the home. This reassessment will take place both within and outside of the industry. It will drive engagement, innovation, adoption, and investment. It will also be a foundation for a fundamental shift in how homes will transform throughout the decade and beyond.

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