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Connected Home Roadmap

LANDMARK RESEARCH PROJECT

EXECUTIVE SUMMARY

CABA AND THE FOLLOWING CABA MEMBERS FUNDED THIS RESEARCH:

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CONNECTED HOME ROADMAP

This report was prepared for CABA by Harbor Research.

Harbor Research

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RESEARCH BACKGROUND & INTRODUCTION

The Continental Automated Buildings Association (CABA) commissioned Harbor Research to study the current state and future roadmap for the smart home market. This report seeks to understand how use cases, customer environments and buying behaviors, and evolving ecosystem interactions all impact and influence the development of the connected home market.

Harbor Research and the Steering Committee first convened via a webinar in Spring 2018 and established a regular schedule of discussion and collaboration for the duration of the project. The findings presented in this report showcase the results of primary and secondary research, including in-depth executive interviews and a broad stakeholder online survey.

The outcomes of this collaborative research project will provide a clear understanding of the trends and forces influencing the direction of the connected home, as well as lay out potential paths and maneuvers for stakeholders looking to take advantage of the market opportunities that exist. Harbor Research and CABA would like to acknowledge and sincerely thank the following CABA members for funding, guiding and participating in this research:

Role of the Steering Committee

The Steering Committee represents a cross-section of solution providers in the connected home marketplace. Representatives from each company joined Harbor Research and CABA on regular collaboration calls to ensure the research scope met the project objectives. The Steering Committee plays a vital role in outlining the research product in terms of defining the required content as well in collaboration on the research approach including the development of the interview scripts and survey guides.

Each CABA Landmark Research project is directed by a Steering Committee made up of the Silver and Gold level project funders. The Steering Committee provides feedback and input throughout the course of the research to help define the scope, direction, and methodology. CABA and the project's Steering Committee commission a research firm to conduct the research while CABA provides project management and leadership.

About CABA

The Continental Automated Buildings Association (CABA) is an international not-for-profit industry association, founded in 1988, composed of over 390+ major private and public technology organizations dedicated to the advancement of connected home and building technologies. These organizations include private firms involved in the design, manufacture, installation and retailing of products, as well as public utilities and governments responsible for regulations and incentives that affect home and building automation. CABA is a leader in developing collaborative research across buildings stakeholder types and encourages the development of standards that accelerate market development.

Please visit http://www.caba.org for more information.

About Harbor Research

Founded in 1984, Harbor Research Inc. has more than 30 years of experience in providing strategic consulting, design, and research services that enable our clients to understand and capitalize on emergent and disruptive opportunities driven by information and communications technology (ICT).

Harbor Research has been involved in the development of the smart systems and Internet of Things (IoT) market opportunity since 1998. The firm has established a unique competence in developing business models and strategy for the convergence of pervasive computing, global networking and smart systems. Harbor Research's extensive involvement in developing this market opportunity, through research and consulting, has allowed the firm to engage with clients in the technology supplier community – both large and emergent players – as well as a diverse spectrum of device OEMs and services providers as well as broad end customer interactions.

Please visit http://harborresearch.com for more information.

Research Goals

The goal of this research is to examine in depth the current and future development

considerations that the "Internet of Things" (IoT) technologies and the services that these technologies enable will have in the connected home market. This report will provide actionable insights and data as it relates to the current and future market opportunities and development considerations that influence the trajectory of the connected home. Harbor Research has examined the opportunities provided by IoT for connected home stakeholders, including: consumers; builders and developers; integrators and installers; technology manufacturers; equipment manufacturers; and service providers, including insurance companies, net service providers and utility companies.

To meet these goals, Harbor Research has conducted a detailed analysis about the current and future state of the connected home marketplace, including key trends, buying behaviors, technology challenges and opportunities. Current and future applications for IoT technologies in homes have been examined in the context of plausible future outcomes for the connected home, including identifying the technical makeup of solutions and value propositions for various market participants. Within the various stages of the future connected home roadmap, actionable insights were developed to highlight the role of different stakeholders in these solutions and recommendations were made for how firms should structure their organization and offerings to capture new value from smart, connected offerings.

Research Methods

The methodology for defining, identifying, and analyzing IoT technical and business opportunities followed the procedures below:

- **Review Existing Connected Home and IoT Research:** Review and analyze existing CABA and industry research on the connected home market as it relates to design and implementation, cost structure and pricing models, impacts of Big Data, technology and market development roadmaps and North America connected home market sizing.
- **Review Previous Harbor Research Analyses:** Review and analyze previous HRI research on connected homes, consumer behavior, ecosystem development, IoT platforms, data management and analytics, and security.
- **Conduct Interviews with Thought Leaders:** Identify and organize a list of key stakeholders and conduct interviews with industry thought leaders and steering committee members.
- **Create A Foundational Roadmap for the Future Connected Home:** Develop an outcome-based connected home roadmap from which the CABA Steering Committee and Harbor Research can collaborate.

Having identified and framed the opportunities via the above detailed process, Harbor Research performed this research by conducting parallel quantitative and qualitative primary analysis along with supplementary market research and analysis. A consumer survey was developed and administered with over 2,000 respondents, representing all home owners and renters from the United States and Canada.

The results of this survey were utilized to identify the current state of the market from an adoption standpoint, uncover the most prevalent technical barriers, adoption challenges

and opportunities, reveal which IoT use cases are driving the most adoption today, and learn about consumers' view on needs and pain points.

Harbor Research meanwhile conducted in-depth expert interviews with marketplace stakeholders to understand how technical requirements and user needs are shifting, along with how these marketplace stakeholders see product and service monetization models evolving in connected homes.

Harbor Research forecasts the connected home opportunity by conducting a combination of primary and secondary research, as well as analyzing key players' financials and marketplace adoption. The 2018 addressable market of connected devices shipped and installed, and their relative annual service charge is sized based on a series of indices and metrics from market reports, industry data, company analysis and primary research. Companies' financial statements, earnings reports, subscription and licensing prices, and other metrics are used to determine revenues across revenue categories and device segments for system integrators, leading vendors and vertical specialist.

In addition, Harbor Research leveraged previous work the firm has conducted, as well as CABA research, to identify key trends, players, IoT application evolution and technical requirements for connected homes. Scenarios were developed to outline the plausible trajectories for the future connected home and the implications of each scenario on stakeholder maneuvers and product planning.

Report Structure

The report begins by providing a base understanding of the trends and forces driving the development of smart systems and the adoption of IoT technology across the connected homes market.

The report then addresses the current state of the connected home through an extensive user segmentation analysis through which a comprehensive view of the needs, challenges and pain points of current connected home consumers. The report also addresses the technical state of the connected home through analyzing the current ecosystem, networking, and other technical constraints and opportunities. Finally, this section breaks down the revenue opportunities in the current year for connected home devices and associated revenue types.

The third report section delves into the future state of the connected home, analyzing the future use cases, devices, and ecosystem maneuvers that will unlock additional value for both the consumers and suppliers. This includes the development of outcome-based scenarios that consider several levers that influence the future direction of the market, and therefore the future product planning considerations for market stakeholders.

Having analyzed the current and future state of the connected home, the report provides a set of actionable short-, medium-, and long-term recommendations based on stakeholder type that are influenced by the combination of findings from primary and secondary research. The report concludes by recommending maneuvers and considerations by stakeholder type based on the likely outcomes that may affect the trajectory of the connected home.

SUMMARY OF FINDINGS

ES 1.1 Introduction & Summary

The extent that the smart home has evolved in recent years has secured the connected home as a growing opportunity. For equipment manufacturers, technology suppliers, software providers and services organizations, determining how to build sustainable and defendable value in this evolving landscape can be daunting. Although smart home technologies will undoubtedly continue to grow, there are several trends and forces impacting the trajectory of the future smart home. Varying competitive, consumer, technological and socioeconomic elements result in differing scenarios that players in the smart home market can anticipate and develop distinct strategies in order to capture a slice of the market opportunity.

The smart home landscape from a user experience, technology, and competitive standpoint remains highly fragmented. The number of unique device protocols, software platforms, and ecosystems have continued to compound as the number of devices per home soar, leading to inflated device costs and frustrating consumer experiences. This reflects pervasive challenges of interoperability across the smart home landscape. Initial steps to address this have materialized in organizing ecosystems around prominent smart home hubs such as Amazon Alexa and Google Home; however, this will ultimately perpetuate isolated ecosystems and limit value potential in the long-run due to choke points in the channel, forcing suppliers to develop and partner with a limited number of home hub vendors. To unlock more of the smart home opportunity, players need to consider their role within future smart home ecosystems, the applications and services they provide in conjunction with other competing and complementary products, and the cooperation from a hardware and software perspective that will need to occur with other ecosystem participants to deliver a robust and satisfying user experience.

The development of the connected home is reliant on the evolution of ecosystem architectures that influence the partnerships, networking protocols, and software interoperability of future devices and services. Today, Amazon and Google act as more or less dictators of the smart home, cementing themselves as the main control point between every device interaction in the home. The likelihood that this architecture prevails or aids in the development of the future smart home is low. In the short-to-medium term, we'll likely see development towards "walled garden" architectures, where Amazon, Google, and other emerging hub-and-spoke "dictators" start to co-exist in the home, but do not cooperate outside of their own ecosystems. In the long-term, the future ecosystem architecture will likely become more localized in order to decrease costs and increase reliability and security while still allowing for full-home connectivity. For example, instead of smart bulbs in the bathroom requiring the connectivity bandwidth and software capabilities to connect directly to the smart oven in the kitchen, the light, as part of the bathroom ecosystem would be controlled by a local bathroom 'hub' or control point. The hub or control point would then relate to the kitchen ecosystem's hub to accomplish more complex use cases without additional complexity, cost, or setup requirements.

In parallel, smart home consumers are also rapidly evolving in terms of their technical aptitude and preferences. At a high level, the demographics of home owners and renters

are increasingly represented by the millennial generation and older generations are quickly becoming comfortable with smart home technologies. These users are adopting technologies for many of the same reasons homeowners have adopted previous generations of home equipment such as microwaves and security systems in the 20th century. Historically, adoption of home technology has centered around the tangibility of the ROI, where the entrance for many consumers into smart home starts with their motivation to decrease energy bills. This prominence of resource management is validated in the results of the Connected Home consumer survey reflecting the argument posited in this report of the progression of key use cases that parallels user adoption. While devices such as televisions and mechanisms such as door locks have reinforced certain behaviors, preferences and tendencies in the home historically, technology advancements have introduced new ways for consumers to improve upon these familiar experiences.

Today, prominent drivers of adoption from a use case perspective reflect consumers' progression from the bottom to the top of Maslow's hierarchy of needs—starting with savings around resource management and safety and security, then moving into improving entertainment and comfort experiences. These application areas reflect fundamental physiological and safety needs and traditional activities in the home; the latter of which is highlighted by the prevalence of television and music as key social mechanisms in the home. As technology evolves to create seamless experiences in these areas, consumers will begin branching out to address higher-order, less ROI-centric applications. This reflects the idea that consumers will initially want to improve upon experiences that are most familiar to them (i.e., making sure the home is secure and creating more engaging entertainment), with subsequent priorities focused on improving comfort and convenience in the home.

Key Takeaways

The top insights gleaned from this report that outline the key considerations for stakeholders in the future smart home landscape include:

Ecosystems Must Move Past the Walled-Garden, Dictatorship Mode. Smart hub players like Amazon and Google will be organizing points for the smart home ecosystem in the short to medium term. Ecosystem collaboration cannot stop here; players must continue to innovate beyond smart hub integration to support complex device, systems and application interactions in the home. While integration with popular hubs is important, as suppliers are forced to comply with the major hubs, the cost and complexity of integrating with multiple platforms will limit value potential for all smart home stakeholders

Emerging Applications and Services Requirements Demand Supplier Innovation Around User Experience. Traditional home manufacturers and suppliers face unprecedented demands to improve user experience in order to support a new generation of applications, services and device interactions for smart home consumers. This has implications for internal, organizational requirements to bring in a new developer talent and for expanding partnership opportunities between traditional suppliers and UX design firms.

Evolving Consumers Yield Evolving Supplier Data and Product Development Requirements. Consumer maturity will steadily take shape in the short to medium term (present to 5-year range) relative to knowledge of the benefits and risks of technology integration. As smart home users become more mature, suppliers will have to leverage user data and consumer insight tools to address changing consumer preferences and concerns—ultimately pointing to opportunities to refine cycles of consumer data insights and solution R&D to best respond and predict consumer behavior. This reflects a feedback loop between changing consumer usage and preferences and parallel supplier product development, where internal data analysis places suppliers in a more predictive than reactive role.

AI and Machine Learning Will Be Keystone Technologies for Smart Home User Experience Development. As smart home technology becomes more established as a key component of the home and consumers begin demanding more personalized, automated experiences, artificial intelligence and machine learning will be key tools to improve user experience. Beyond improving and optimizing consumer insight, artificial intelligence will impact many aspects of the smart home including improved home automation, efficient network management and automated service orchestration.

Cybersecurity Requires Careful Consideration for Every Stakeholder Seeking to Establish Greater Consumer Trust and Maintain Integrity of Highly Sensitive Data. Security will remain a key hurdle for all smart home stakeholders. In order for AI enabled applications to enhance user experience, these devices and applications require access to personalized and sensitive data. Smart home suppliers must generate user trust in order for the smart home to advance.

Future Proof Product and Ecosystem Strategies Ensure Competitive Advantage in the Long Run. In a market that rapidly evolves, suppliers will need to future proof products as much as possible by removing the close contingencies on hardware, where over-the-air updates to software can be the core foundation for maintaining the relevance of a product's capabilities. This rapid technology evolution also points to ways in which suppliers can optimize ecosystem strategy to ensure advantageous competitive positioning in the future. When considering the evolving smart hub and home platform environment, it's important for suppliers to not corner themselves into a single ecosystem, facilitating open interactions from a partner and technology perspective. This will ensure necessary progress towards a future collaborative environment that supports complex device and applications in the home, driving more value for consumers and suppliers alike.

From a technology standpoint, advances that will form the backbone of the future smart home include pervasive connectivity via home-tailored network technology for devices throughout the home, improvements to artificial intelligence for personalization and prediction, and voice recognition for frictionless user experiences. Advances in connectivity, intelligence and security related technologies will redefine user experience in the smart home by ensuring privacy while enabling seamless, highly personalized and automated applications.

Relative to connectivity, advances in Wi-Fi and multiprotocol solutions are the dominant forces to consider. With each iteration of Wi-Fi, improvements to coverage, capacity and security reinforce the protocol as the dominant solution for the future smart home. Other wireless protocols such as Bluetooth, Zigbee, Z-Wave and Thread will support the extension of connectivity throughout the home, supporting cordless, battery powered devices. However, with the numerous unique protocols represented under the same roof, suppliers will need to collaborate to avoid increasing costs of technology integration and exacerbated fragmentation of the connectivity landscape that will ultimately depress adoption.

Artificial intelligence is a key driver in enabling holistic intelligence throughout the home. Artificial intelligence tools are increasingly improving and gaining traction to better personalize, predict, and facilitate device and service interactions within the home; however, recent high-profile hacks and blunders by leading smart home companies have placed a heightened level of consumer and regulatory scrutiny on AI-enabled applications and devices that access to personal data. Therefore, successful devices in the future smart home must convince consumers that their data is safely secured.

Technology innovation, ecosystem collaboration and ongoing adaptation and testing of consumer behavior will drive new and higher-value generations of smart home applications. These applications will reach a level of predictive and automated capabilities that not only simplify interactions with devices, but almost remove human intervention from actions and operations of smart home devices and systems as a result of well-trained AI algorithms and feedback loops.

Given the volume and uncertainty underpinning the variables impacting the future smart home, it is impossible to create a singular vision for the future connected home roadmap. This report acknowledges several potential outcomes for the future smart home in the form of scenarios. In addition to maneuvers that stakeholders should consider regardless of the eventual future state and the implications stemming from each outcome. The report also outlines the ancillary actions each constituent can take to position themselves for success against the potential scenario outcomes.

ES.1.2 Trends & Forces Impacting the Current State of Connected Home

In order to understand what the future state of the connected home and the roadmap to get there will look like in the future, we must have an understanding of the current state of the market. The current state of the connected home market is best summed up as 'difficult.' An amalgamation of proprietary device platforms, network protocols, and inaccessible approaches to open ecosystem development is creating at best, a messy assortment of tangentially-related devices, or at worst, a heap of expensive hardware that actually creates an inferior home experience than the traditional, unconnected versions.

Segmentation of Connected Home Consumers

Smart home adopters typically share a few key traits: they are aware and interested in technology and have the means of affording it. User profiles are developed to better understand the key distinguishing and overlapping traits across smart home adopters. These user profiles encompass demographics, psychographics and motivations that when combined offer

clear insight into where consumer enthusiasm and sentiment is likely to be high or low. Combining a consumers' unique demographics, desired smart home technologies and motivations for consumption offers key insights for players looking to take advantage of future smart home growth.

Current State of Connected Home Ecosystem

Smart home players include incumbent OEMs, innovators of new devices, technology suppliers connecting devices, software players adding value to these technologies, and services and integration providers (e.g., utilities, maintenance and insurance providers). At the moment, technology suppliers, namely those who supply smart home hubs, own the most control over the smart home ecosystem. This is a result of today's "hub and spoke" ecosystem where devices and software applications are racing to partner with hubs in order to be leveraged in the home. This model will not enable holistic value creation where the future state of the smart home requires players to abandon restrictions on interoperable devices and systems currently bound by prominent smart home hub providers.

In the meantime, integration with other devices (surrounding smart hubs or otherwise) and the expansion of services will be critical stepping stones for ecosystem development. From voice-enabled climate and lighting control to automated utilities management, expanding digital capabilities in the home are opening up opportunities for new services and use cases across the smart home landscape.

Current State of the Smart Home

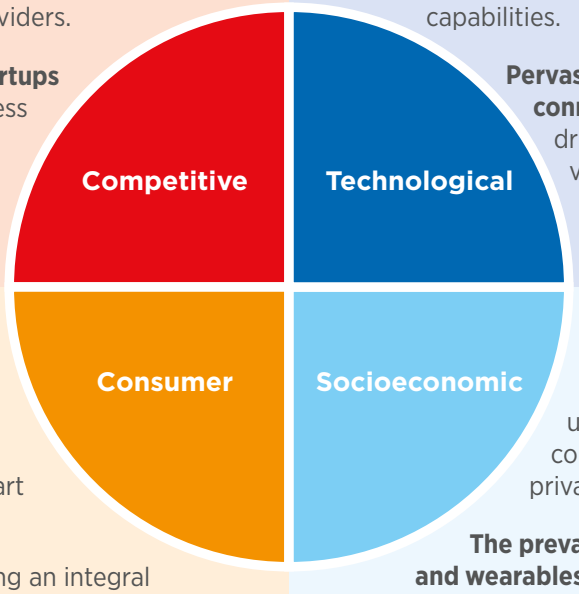
Trends & Forces Impacting Smart Home

"Strange bedfellows" partnerships are creating new device interactions, opening strategic channel opportunities and forming innovative monetization tactics.

Open source models aggregate value-added contributions and democratize access to technology development.

Security and energy management players are expanding their reach into home automation and smart home hub providers.

A **wave of innovative startups** is introducing new business and services models, driving capital investment movement.



Integration of emerging technologies such as AI and voice recognition are establishing a new generation of consumer use cases.

Home-tailored network technologies and topologies along with emerging data management platforms are creating more complex device and use case interactions.

Open source platforms and consortiums are establishing unified software and security capabilities.

Pervasive sensing and connectivity technologies driving unprecedented visibility to optimize smart home networks.

Younger generations and millennials are driving adoption of smart products and services supported by greater awareness of smart technologies.

Cybersecurity is becoming an integral element the **public and private regulatory** environment and will increasingly influence supplier strategy.

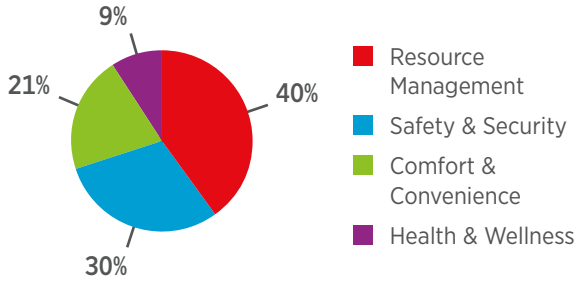
Aging population becomes a considerable contribution to the demand for medical monitoring and entertainment.

Connected products in the home are introducing unprecedented threat to consumer security and privacy.

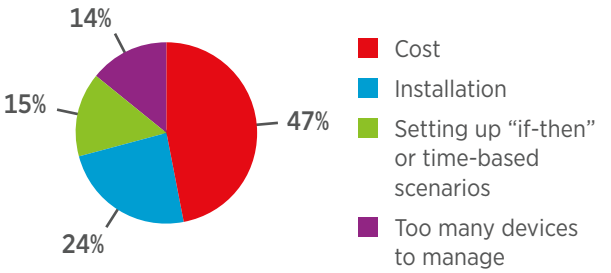
The prevalence of smartphones and wearables as core organizing technologies for consumers is driving demand for functionality around the major mobile platforms.

Aging Installation of smart home technologies will be a key pain point and differentiator for consumers that demand simple installation and automated integration.

Top Use Cases



Barriers to Adoption



Consumer Segmentation

				
Age	18-34	25-44	35-64	45-65+
Income	<$50-$100K	$50K-$150K	$50k-$200K+	$50k-$150K
Rent/Own	Rent	Own	Own	Own
Time spent at home	<9 hours	12-15 hours	12-15 hours	15+ hours
Pace of Household	Somewhat slow/relaxed	Neither Slow or Relaxed to Very Fast-Paced	Somewhat Slow and Relaxed	Very Slow
Tech adoption	First adopters	Early adopters / fast followers	Adopt with the masses	Slow to adopt / laggards
Top Uses of Technology	Entertainment	Entertainment, querying, daily activities	Entertainment, querying, daily activities	Entertainment, querying, daily activities
Top Challenges	Cost	Cost	Cost, Installation	Cost, Installation
Messaging	TV/Social Media	TV/Social Media	TV, Friends/Family	Friends/Family
Channel Device Purchased	Researched then purchased	Research, Spontaneous in Store	Word of mouth then research	Word of mouth then research

ES.1.3 Future State of Connected Home

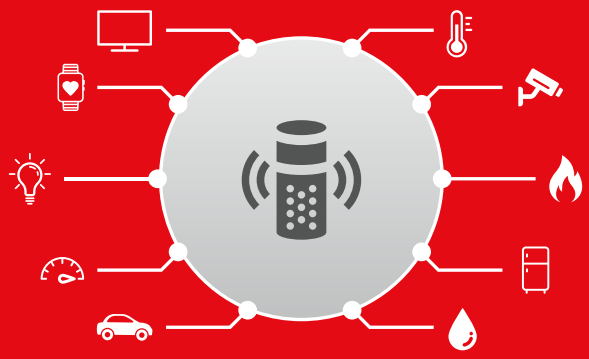
Although the smart home market is growing steadily today, there are a number of trends, forces, events and other elements that could result in varying levels of future growth. While it is impossible to predict the future perfectly and the roadmap of the connected home is still relatively blurry, considering potential scenarios and developing potential maneuvers for differing outcomes is a useful strategy to employ.

Evolution of Smart Home Landscape

Current State Requires Evolution of Smart Home Landscape

Hardware	Software	Ecosystem
Compliance with Numerous Network Protocols: Separate protocols for Z-wave, ZigBee, and Wi-Fi prevent devices from working together. **Multiple Connectivity Models Require Standard Topologies**: The dispersion of devices across Z-Wave, ZigBee, and Wi-Fi creates a mess of multiple control points for consumers where a multiprotocol strategy would rescue user experience. **Transition from Centralized, Cloud-based Models to Edge Computing**: Centralized computing slows functionality and makes devices captive to the dictator home hub and its server.	**Establish Open Approaches to Data Integration**: Devices must not only communicate with each other but must also have shared data and semantic interoperability to facilitate. This will allow for better analytics to improve user experience and provide data monetization opportunities. **Build User Friendly API Tools**: Suppliers must align on APIs to streamline user experience and reduce barriers to adopting new devices. **Reinforce Industry Security Standards and Best Practices**: As providers continue to leverage consumer data, privacy and security remain a massive barrier for consumer adoption.	**Partner and Developer Solutions to Improve Device Interoperability**: Ecosystem collaboration is necessary to allow devices to communicate, share data, and control disparate devices and systems to improve user experience. **Focus on Product Development and Partners to Improve User Experience**: Erratic smart home functionality results from a mess of siloed devices and outages due to over-reliance on centralized computer power. Third party "platform of platforms" and service providers step in as a temporary solution, pocketing smart home value and raising prices for consumers.

Dictator Model

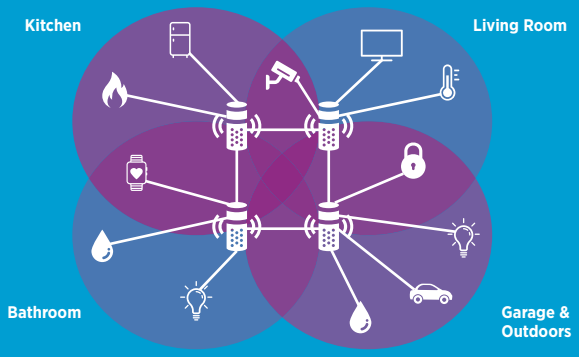


The Dictator Model involves a central control point, like a Smart Home hub, through which all devices are controlled. Devices cannot communicate with each other without the help of the dictator or hub, and hubs from different providers or in different systems (e.g., the kitchen vs. the bathroom) do not communicate with each other.

A Walled Garden Model

A Walled Garden Model involves isolated ecosystems of devices bound to a given smart home hub or platform (e.g., Alexa or Honeywell Home). Device interoperability is limited to that of a given platform product, forcing the consumer to settle for siloed operations or invest solely in devices compatible with a single home hub or platform vendor.

A Mesh Ecosystem



A Mesh Ecosystem involves hubs in different systems (e.g., the bathroom vs. the kitchen) and/or from different providers that are able to communicate with each other and with associated Smart Home devices.

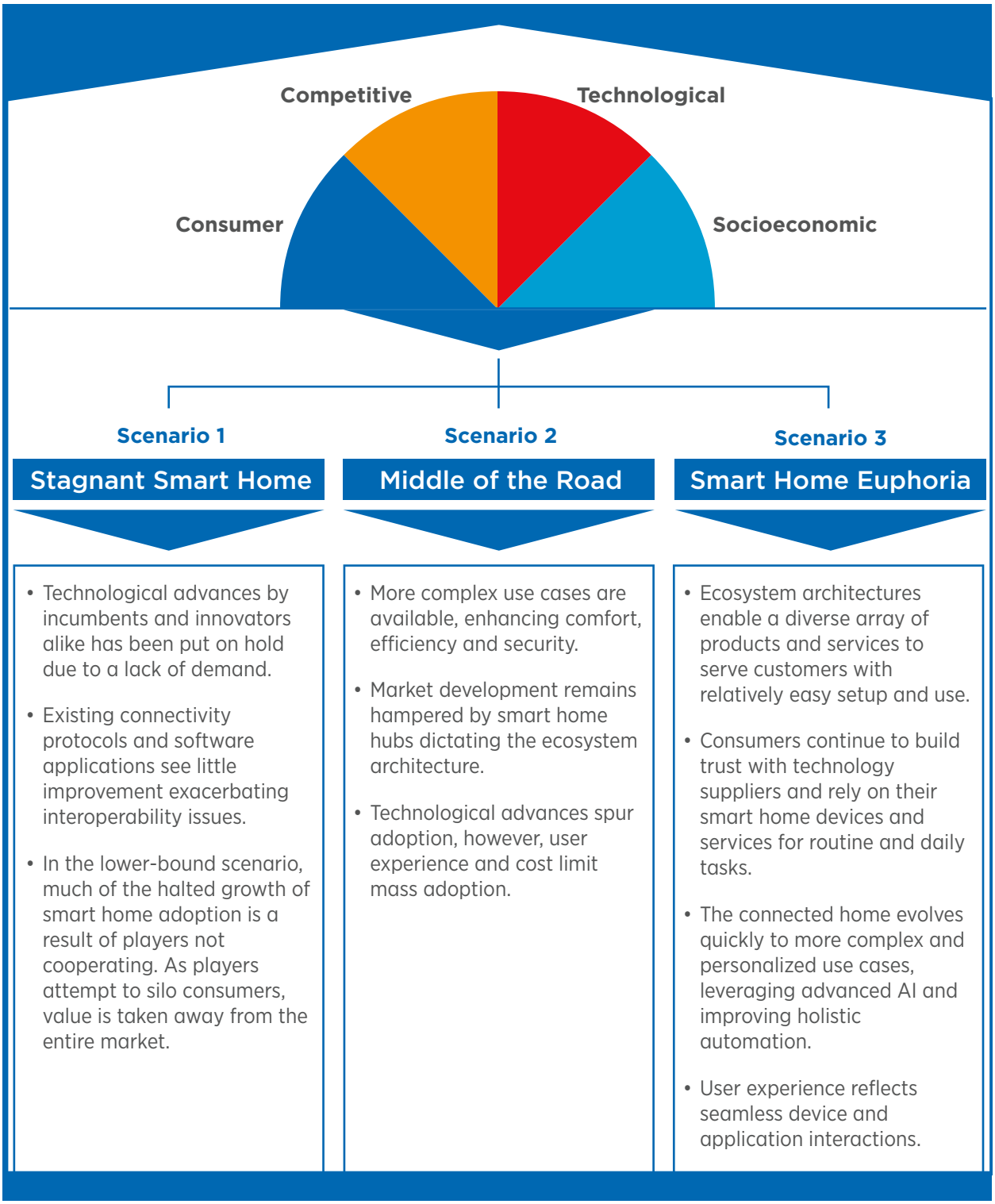
EXECUTIVE SUMMARY

Future Connected Home Roadmap Scenarios

Considering the levers driving the future roadmap, companies should consider the following scenarios when building their future product roadmaps for the connected home. Combined with general "table stakes" maneuvers and actions that companies should consider regardless of the scenario outcomes, scenarios help smooth the edges of a company's product roadmap strategy to most effectively capture value. The below portrayal displays how we view each element impacting the future of the smart home:

Smart Home Roadmap Scenarios

	Trend	Certainty Trend Will Occur	Impact on Future Smart Home
Competitive	Interoperability Between Players Increasing	Medium	High
	Partnerships Expanding Around Smart Home Hubs	High	Medium
Technology	Ubiquitous Connectivity Throughout The Home	Low	Medium
	Blockchain Enabling Secure Data Exchange	Medium	High
	Artificial Intelligence Advancing Complex Applications	High	High
Consumer	Users Limit Adoption Due To Privacy	Medium	High
	General Population Becoming More Familiar With Technology	Medium	Medium
Socioeconomic	Trade Embargos Prevent Ecosystem Development From Multinationals	High	Low
	Government Votes On Data Privacy Legislation	High	Medium



Scenario 1	Scenario 2	Scenario 3
Stagnant Smart Home	**Middle of the Road**	**Smart Home Euphoria**
• Technological advances by incumbents and innovators alike has been put on hold due to a lack of demand. • Existing connectivity protocols and software applications see little improvement exacerbating interoperability issues. • In the lower-bound scenario, much of the halted growth of smart home adoption is a result of players not cooperating. As players attempt to silo consumers, value is taken away from the entire market.	• More complex use cases are available, enhancing comfort, efficiency and security. • Market development remains hampered by smart home hubs dictating the ecosystem architecture. • Technological advances spur adoption, however, user experience and cost limit mass adoption.	• Ecosystem architectures enable a diverse array of products and services to serve customers with relatively easy setup and use. • Consumers continue to build trust with technology suppliers and rely on their smart home devices and services for routine and daily tasks. • The connected home evolves quickly to more complex and personalized use cases, leveraging advanced AI and improving holistic automation. • User experience reflects seamless device and application interactions.

ES.1.4 Critical Considerations for the Smart Home Roadmap

Based on the scenarios presented, as well as the likelihood and impact of the identified potential market trends and forces, there will be certain offensive and defensive maneuvers suppliers can engage in to best position themselves for the future. As the market evolves there are a set of maneuvers and recommendations that should be addressed across stakeholder types. In this section, we will lay out the key considerations and recommendations for all stakeholder types in the context of three phases of the smart home roadmap. Throughout each stage of development, smart home suppliers will need to contextualize their strategy to remain competitive, organizing priorities for use cases, addressable devices, ecosystem opportunities and key enabling technologies.

Critical Considerations to Unlock Value of the Smart Home

The smart home roadmap can broadly be organized in the context of hardware, software and ecosystem strategy. Each of these hold implications to critical considerations around technology innovation, product development, business, revenue and monetization models and ecosystem maneuvers that can best position smart home suppliers and downstream consumers.

From a hardware standpoint, the smart home market faces significant challenges around cost, edge intelligence, security and connectivity. Each of these challenges, if considered adequately, will translate into opportunities for value creation throughout the smart home value chain. This holds true for both software and ecosystem challenges as well. Relative to software, a major consideration for suppliers is improving user experience—from device and data integration to artificial intelligence and voice recognition capabilities. Much of the challenges faced by hardware will be supported by the open standardization of smart home software, from which developers can ensure functionality in multiprotocol environments, data privacy and security and intelligence at the edge that is supplemented by artificial intelligence and machine learning. Beyond innovating to overcome these technology hurdles, there is a significant need for smart home software development kits (SDKs) that simplify development and expedite deployment from OEMs to end-users. Lastly, the ecosystem considerations largely revolve pursuing strategic partnerships that enable value potential throughout the smart home roadmap, ultimately leading to highly integrated, collaborative ecosystems supported by an open hardware and software landscape.

Unlocking the Smart Home Opportunity

Hardware

Network providers (ZigBee, Z-Wave, Wi-Fi) should align on standardized protocols to ease challenges for tech suppliers and improve user experience.

Tech suppliers should strive for multiprotocol strategies to build devices compatible with several network types.

Suppliers must develop edge computing devices focused on improving security and latency of analytics.

Software

Suppliers must future proof products as much as possible by removing contingencies on hardware, where over-the-air updates to software can be the core foundation for maintaining relevance of a product's capabilities.

Given advancement of user maturity, suppliers must refine consumer data insights and solution R&D to best respond and predict behavior.

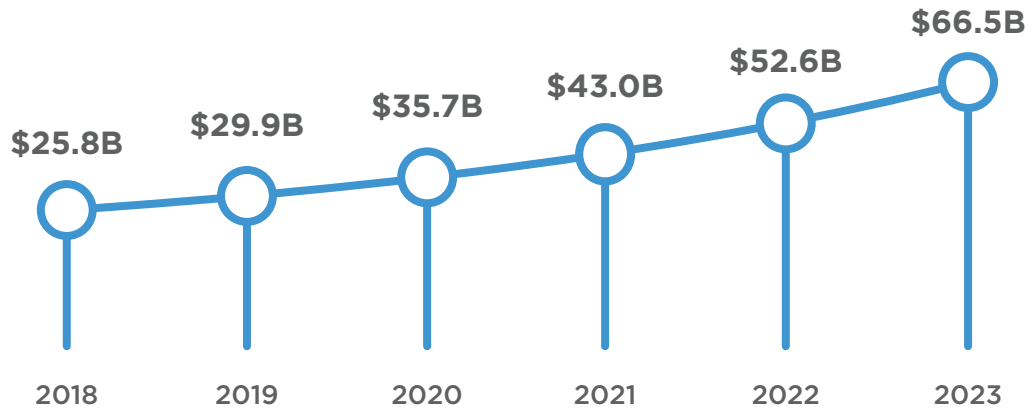
Players must invest in blockchain and security to instill confidence in consumers.

Ecosystem

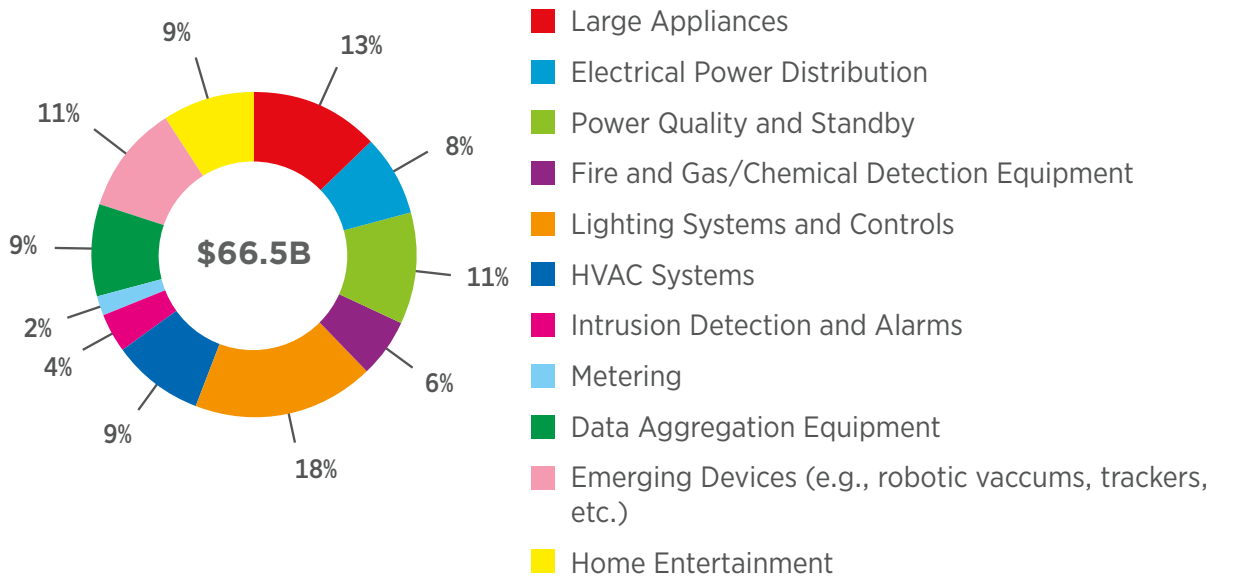
OEMs and tech suppliers should partner with software and service providers to drive indirect device sales and interoperability. This will allow suppliers to leverage devices as Smart Home control points.

1. Service providers should foster complex systems of local mesh networks.
2. Service providers should partner with real estate developers for long standing contracts and to install devices in new homes.
3. Software providers should build a platform of platforms to simplify user experience and improve security.
4. OEMs should strive to create localized ecosystems.

Total Smart Home Market Opportunity, North America



Smart Home Revenue by Device Segment, 2023 - North America



ES.1.5 Connected Home Roadmap Conclusion

The future of the connected home appears bright. Its realized success depends on how the various market trends and forces play out over the course of the next several years and will be defined and captured by the players who have best positioned their products and services to meet demand while accommodating for exogenous factors like socioeconomic trends and regulatory hurdles.

Smart Home Roadmap

Short Term (present-2 years)	
Ecosystem	• OEMs and technology suppliers organize around leading smart home hubs
Technology	• Applications emerge that provide orchestration across supplier networks
Customers	• Younger, wealthier demographics and early technology adopter reflect predominant
Top Devices	• Smart home hubs • Smart doorbells / locks • Intrusion detection & alarms
Top Use Cases	• Security and Energy Management

Medium Term (3-5 years)	
Ecosystem	• Ecosystems around smart home hubs drive OEM collaboration across diverse device types
Technology	• Advances in AI and voice recognition applications transform user experience in the home
Customers	• Customers become more educated around the benefits of smart home technology
Top Devices	• Integrated entertainment systems
Top Use Cases	• Entertainment & Music

Long Term (5+ years)	
Ecosystem	• Open ecosystems enable interoperability across devices and services, driving complex use case interactions within the home
Technology	• Platforms models create open data exchange across distributed, peer-to-peer, locally managed device network
Customers	• Consumer representation reaches represents expanding demographics
Top Devices	• AR/VR/Smart Projectors • Robotics • Smart kitchen appliances
Top Use Cases	• Comfort & Convenience • Health & Wellness

The prosperity of the connected home roadmap is likely to be contingent on the following themes that have been highlighted extensively throughout this report:

- Ecosystem architectures evolving to become more relational and open, while avoiding complexity and cost.
- Security standardization providing assurance to consumers that their data and privacy are well guarded.
- AI and natural language processing becoming more natively integrated into the smart home user experience to achieve a greater degree of personalization and automation, driving new value generation opportunities.

As connected device costs continue to decrease, devices proliferate throughout consumers' lives and consumers rely on them more heavily to perform critical functions of their routines, the connected home will begin to settle into a more mature, standard experience. Suppliers of technology in the home can best position themselves for success by addressing the customer needs and pain points that exist today while posturing themselves to address future, more complex needs and desires.

Consumers have already begun moving beyond safety and security use cases towards more convenience and routine-based applications, but as they progress further down the road towards more complex interactions with their devices, so too must the devices and services be more deeply and cleverly combined to create a truly seamless customer experience. This starts with a fundamental understanding of the current and future ecosystem architectures that are likely to enable the experiences that customers are looking for across their connected home, and likely will result in distributed, decentralized decision-making and control points that allow for a wider array of products and services to coexist.

The most robust and sustainable roadmap strategy for the future connected home involves three parts:

- Accommodate customer needs today against the current technology and ecosystem backdrop.
- Position and begin development of products and services that address the likely customer needs in the future against evolving technological and ecosystem dynamics.
- Consider the implications of macro-market factors on the proposed current and future strategy that could hinder or accelerate future goals.

Regardless of the connected home roadmap's actual trajectory, preparing a product portfolio and strategy that accommodates the needs of today while positioning for those of tomorrow and accounting for macro-market factors will be best positioned to win in the connected home of the future. The considerations laid out in this report around hardware, software and ecosystem strategy inform the most effective ways for suppliers to build trust in highly sensitive consumer environments, unlock holistic ecosystem value and continue to push technology innovation to new lengths.

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Connected Home Roadmap

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