Smart Home as a Service

LANDMARK RESEARCH PROJECT

EXECUTIVE SUMMARY

CABA AND THE FOLLOWING CABA MEMBERS FUNDED THIS RESEARCH:

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SMART HOME AS A SERVICE

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 provide a comprehensive examination of all aspects of Smart Home as a Service (SHaaS). This report seeks to understand how use cases, customer environments, 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 autumn 2019 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 driving the business model evolution towards SHaaS, 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 organizations for funding this research:

Figure ES1 Landmark Study Funders

SILVER

AcuityBrands · ALARM.COM · american lighting association · CGI · CEDIA · Consumer Technology Association · Control4 · CSA GROUP · Hydro Québec · legrand · resideo · Rheem · Snap av · Southern California Edison · Southwire · TELUS

BRONZE AND TITANIUM

BIG ASS FANS · ComEd · DAIKIN · KNX · MOEN · netex managed services · NYSERDA · 3M · ILLINOIS McKechnie Family LIFE Home · WAC LIGHTING

Source: CABA Smart Home as a Service 2020 Report

Role of the Steering Committee

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

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.

Figure ES2 Smart Home as a Service Steering Committee Members

Source: CABA Smart Home as a Service 2020 Report

About CABA

The Continental Automated Buildings Association (CABA) is an international not-for-profit industry association, founded in 1988, composed of over 360+ 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 building 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.

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://www.harborresearch.com for more information.

Research Goals

The goal of this research is to examine in depth the current and future business model and go-to-market considerations that the "Internet of Things" (IoT) technologies and the services that these technologies enable will have in the connected home market. In particular, the main goal is to define "Smart Home as a Service (SHaaS)", understand the trends and forces that are enabling it, and detail how it will likely develop and impact the current Smart Home market.

The outcomes of this collaborative research project will provide a clearer understanding of the connected home landscape and the opportunities and solutions available to drive revenues. This study will assist organizations to make sound business decisions using reliable third party qualitative and quantitative data. Harbor Research has examined the opportunities provided by IoT for connected home stakeholders, including: consumers, integrators and installers, technology manufacturers, equipment manufacturers, and service providers—including insurance companies, network service providers, and utility companies.

To meet these goals, Harbor Research has conducted a detailed analysis about the current and future state of SHaaS, including key trends, buying behaviors, technology challenges and opportunities. From this analysis, we were able to gain perspective on how SHaaS will evolve, the key pain points and barriers to its evolution, and how its advent will impact business models and consumers.

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 Harbor Research reports on connected homes, consumer behavior, ecosystem development, IoT platforms, data management and analytics, network connectivity, 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.

- **Define and Analyze the Evolution of SHaaS Hypotheses:** From the above blend of primary and secondary research, Harbor Research will then create initial hypotheses about how SHaaS will evolve and what it will encompass.
- **Validate and Refine SHaaS Picture:** Once complete, Harbor will then conduct additional rounds of primary and secondary research focused on validating our hypotheses on how SHaaS will evolve and how it will affect each ecosystem participant.

Having identified and framed the opportunities via the process just described, Harbor Research performed this research by conducting primary research analysis along with supplementary market research and analysis. A consumer survey was developed and administered with more than 1,500 respondents, representing homeowners and renters from the United States and Canada.

The results of this survey were utilized to identify the current state of the SHaaS market from an adoption standpoint; uncover the most prevalent technical barriers, adoption challenges, and opportunities; reveal which SHaaS service offerings are driving the most adoption today and in the near-future, and learn about Smart Home consumer needs and pain points.

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

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 as SHaaS emerges. From this analysis, we developed a list of recommendations for each SHaaS ecosystem participant.

Report Structure

The report begins by providing a base understanding of the trends and forces driving the development of SHaaS, and the adoption of smart devices in general across the connected homes market. It also defines “as-a-service” business models and provides information that depicts the current state of the Smart Home and the frustrations that have arisen from a user perspective.

Monetization models in the Smart Home are the focus of the next section. After describing the various ways in which suppliers and service providers make money from the Smart Home market, we examine consumer frustrations with existing Smart Home business models. We will then explore how SHaaS will shift both monetization models and go-to-market strategies.

The report goes on to focus on the Smart Home consumer. Leveraging our survey, the report will address 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 analysis of the current ecosystem, networking capabilities, and other technical constraints and opportunities.

The report will define SHaaS and its evolution by identifying four stages of maturity. Through a careful examination of each stage, it will discuss SHaaS and its emergence from both a supplier and consumer perspective. It will also detail each of the SHaaS managed service offerings by highlighting their similarities and differences.

The fifth section of the report will focus on the technical capabilities of emerging technologies that are needed to ensure that SHaaS matures as expected. This section also describes the current Smart Home ecosystem, and how SHaaS will shift this ecosystem and the roles of each participant. In addition, this section paints a picture of the interface/interaction needs to manage SHaaS offerings.

Finally, having analyzed the current and future state of SHaaS, 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 how SHaaS is adopted.

SUMMARY OF FINDINGS

ES 1.1 Introduction & Summary

"Smart" devices are defined as devices with an ability to connect to an online network in order to execute functions. "Smart Systems" is what Harbor has defined as networks of Internet of Things (IoT) devices combined into applications. The future of the Smart Home is contingent on current standalone IoT devices networking together in order to enable more complex applications beyond a single device's off-the-shelf features.

Just as consumers have become aware of "smart" devices in the home, homeowners and tenants will begin to demand that their devices interact with other networked devices in order to create more complex functionality. One of the ways other industries have advanced complex and initially expensive value-added applications is offering these capabilities "as-a-service." We believe this trend will begin to take hold in the Smart Home.

Every day, more and more "smart" connected devices are penetrating the home. Only a few years ago, homes were deemed modern if they contained a single connected device—an Amazon Alexa Echo or a Google Home. Now however, even the homes of non tech-savvy individuals are replete with connected appliances, from thermostats to nanny cams, HVAC units, refrigerators, and doorbells.

This trend only seems to be accelerating. In the past year alone, seemingly every possible home appliance has spawned a "smart" counterpart, from connected water filters, to smart blenders, and even to connected litter boxes. And of course, this rapid explosion in the number of connected devices is also producing more and more consumer data for companies to leverage.

The difficulty of managing all these devices is leading to a paradigm shift in how technology providers are thinking about the smart home of the future. Instead of craving endless

smart devices, consumers are most interested in the services that devices provide—or so the thinking goes. In practice, while programs like Apple's HomeKit promise to serve as a centrally managed Smart Home platform, they still struggle to meet consumer demands for ease-of-use, interoperability, and data privacy.

Saturated with smart devices, consumers are frequently turning to experiences that leverage multiple devices and bundle them into distinct service-based ecosystems. These ecosystems are giving way to a new business model, "Smart Home as a Service," that represents a shift from device-based functions to managed services, which will usher in a new user experience more in-line with customer needs.

However, this shift requires the seemingly impossible—openness and collaboration among device manufacturers, insurance providers, utilities companies, network service providers, and a wide range of other ecosystem players. Ultimately, the speed at which SHaaS emerges, how pervasive the business model is, and who the main beneficiaries are all depend on the level of cooperation and collaboration between partners in the new Smart Home ecosystem.

Key Takeaways

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

Suppliers Need to Address Consumer Data Privacy and Security Concerns: Because SHaaS requires devices seamlessly sharing data in real-time between one another and with cloud infrastructure, consumers are naturally concerned about the privacy of their data and how it will be used. Suppliers and service providers need to build products and services with consumer privacy controls and protections to encourage end-users to take advantage of their offerings.

Technology Suppliers with Closed Ecosystems are Precluding SHaaS: Companies like Haier, Amazon, and Samsung seek to maintain their dominance over the Smart Home market by encouraging "closed" ecosystems where devices can only interact with one another and the hub if they are manufactured by the same supplier. This inhibits SHaaS because it discourages new entrants and multimodal devices that can support multiple Smart Home service ecosystems.

Shifting Business Models to SHaaS Unlocks New Revenue Streams for Smart Home Suppliers: Even when new technologies and services are delivered, the trend is to move towards a subscription model. When Uber changed the transportation service industry, it originally was on a per-trip cost basis only. Today, users can still employ this monetization model; however, for individuals that use Uber's services frequently, perhaps shedding the cost of car maintenance and insurance, there is a subscription service charge for unlimited usage per month.

The new SHaaS business model will disrupt traditional Smart Home business models in similar ways. Today, customers repeatedly pay charges for new devices, device updates,

on-device software applications, and mobile app interfaces for each device—all alongside a stack of monthly bills for cable, internet, water, energy, waste removal, and cellular service.

SHaaS Will Leverage Devices with Open Network Communication Protocols: The advent of hundreds of millions of connected Smart Home devices requires interoperability with a Smart Home hub. However, as SHaaS emerges and the hub's role as the chokehold of the Smart Home ecosystem diminishes, devices will need to interact and share data with other devices as well.

Traditionally, OEMs have built devices that interact only with other devices manufactured by the same OEM. This model coerces customers into only buying products manufactured by the same vendor, resulting in vendor lock-in. As SHaaS emerges, a similar trend must occur for users to be able to effectively plug-and-play devices that enable overlapping service ecosystems. To meet this challenge, a number of open network communication protocols have begun to emerge.

SHaaS Creates the Need for a Single, Open User Interface: As more and more smart devices invade the home, the demand for a single, centralized user interface increases exponentially. Ideally, this interface would be packaged as a mobile application, since more than 80 percent of Americans own such a device. However, product manufacturers are incentivized against conforming to a Smart Home mobile application. The more time a customer interacts with their screen, the greater ability for the OEM to influence behavior and market products and services. In addition, this interface needs to retain the flexibility to allow users to interact with their Smart Home services in accordance with their preference—whether voice, touch, or not at all.

OEMs Can Address the SHaaS Market Opportunity by Pivoting to Value-Added Services: Lastly, device manufacturers need to prepare for the future mature state of SHaaS where devices are de-emphasized and function as mere sensors and appliances. To prepare for this reality, OEMs should start augmenting their devices with value-added services, such as energy and asset management, that leverage the consumer data they collect. This data will unlock new revenue streams and improve the OEM's ability to offer more tailored products and services to consumers.

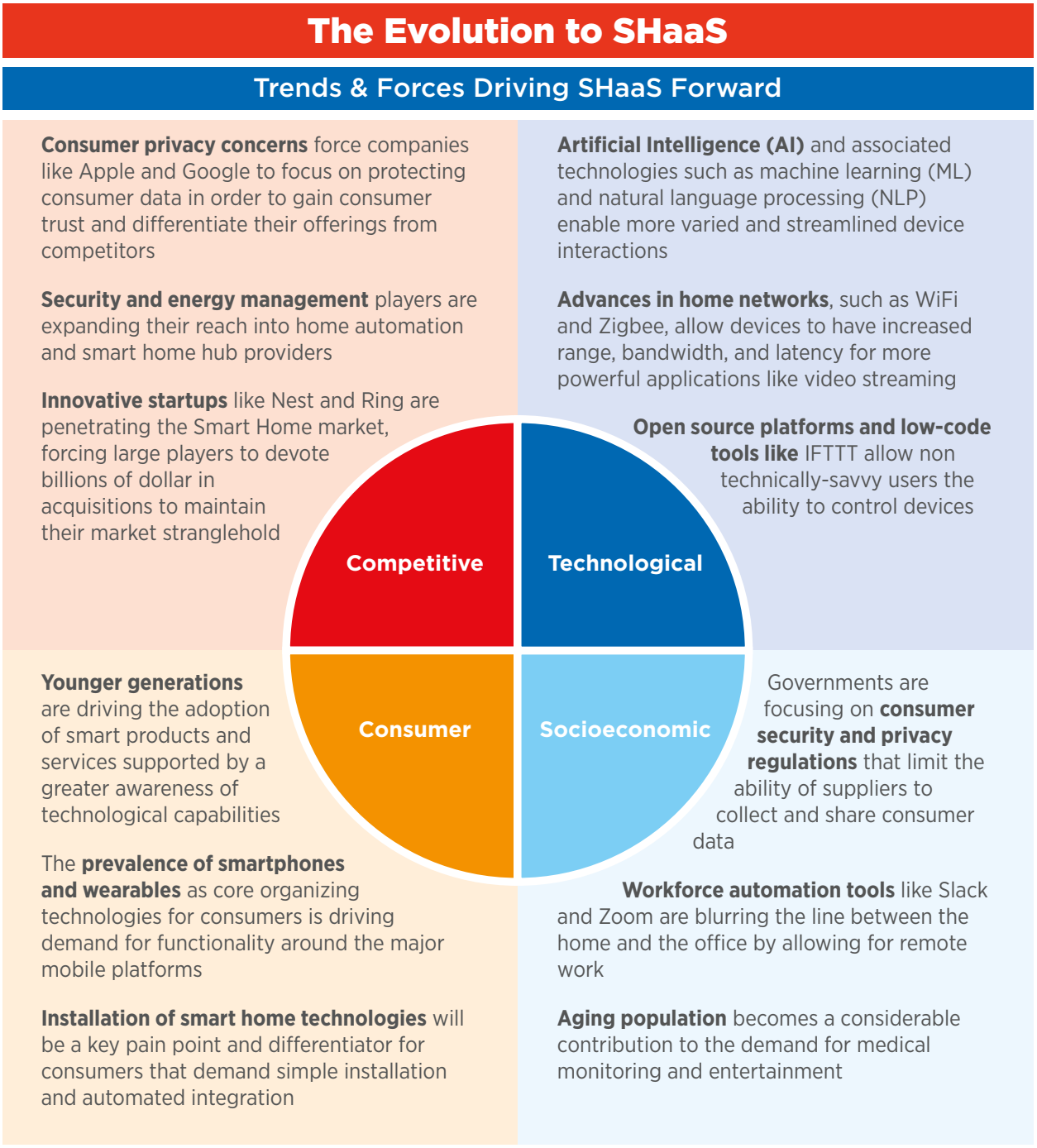
To survive in the SHaaS future, OEMs need to do a better job of collaborating with managed services providers to ensure that their devices can work as delivery mechanisms for these services, not just as single purpose-built devices. By doing so, OEMs can serve as the "middleman" between the service providers and the homeowner.

ES.1.2 Trends & Forces Driving the Evolution of the Smart Home to SHaaS

The development and evolution of smart home technology can be organized in the context of competitive, technological, consumer and socioeconomic trends. Each of these categories will support the key narrative around the cycle of use case and device innovation and the various technology and ecosystem requirements for the smart home landscape to reach the future state outlined in the introduction.

The portrayal below outlines the key trends and forces in each of the categories.

Figure ES3 Trends and Forces Driving SHaaS



Source: CABA Smart Home as a Service 2020 Report

A close examination of technology adoption in homes points to four key elements:

- **Competitive:** suppliers of devices, software and services developing advanced ecosystems or other tactics such as differentiated pricing to gain a competitive advantage
- **Technological:** advances that enable a wider range of devices, software and services to be adopted, such as the emergence of interoperability between smart speakers
- **Consumer:** trends and forces in what consumers are placing value on, such as use cases that are most desired
- **Socioeconomic:** trends in the economy as well as any regulations impacting the adoption of smart home technology, such as data and privacy laws

ES.1.3 Monetization in the Modern Smart Home

While each company's business model holds a degree of uniqueness—from its offerings, partner ecosystem, operating model, brand management and other value props—there are a finite amount of mechanisms to monetize. Monetization is a challenging topic for companies all across the value chain. As advancing technology churns out new devices to make our lives at home more comfortable, convenient, and secure, the manner in which Smart Home suppliers across the value chain will monetize the use of these devices will evolve as well.

The overarching business models that will inform new services in the Smart Home can be categorized into three broad categories: a "solo" opportunity that one company seizes alone; a partner-driven model, which includes opportunities that can be shared by one or more partners; and a collaboration driven model, which is dependent on interoperability across a large and complex ecosystem.

- **Solo:** Where most of the elements of the opportunity are attached directly to a product's life cycle such that they are designed to be deployed by the product player alone. For example, buying an appliance that is unconnected and serves a single purpose, such as a blender.
- **Partner-Driven:** Products that are designed to participate in a limited ecosystem, or what is sometimes called a "walled garden." These devices have additional value-added use cases through these limited partnerships, such as a Smart Home hub (Alexa) being able to stop and start your oven based on a timer set with a voice-command.
- **Collaboration-Driven:** Collaboration-driven opportunities take the previous models one step further to applications that drive diverse interactions between and among devices and people. Imagine devices being connected across the entire home. For example, if an occupant takes a timed shower to reduce water consumption, towards the end of the shower the coffee maker in the kitchen starts to brew a fresh batch. Once the home occupant has made it downstairs, her Smart Home hub starts rattling off the most compelling news headlines based on the individuals online article preferences.

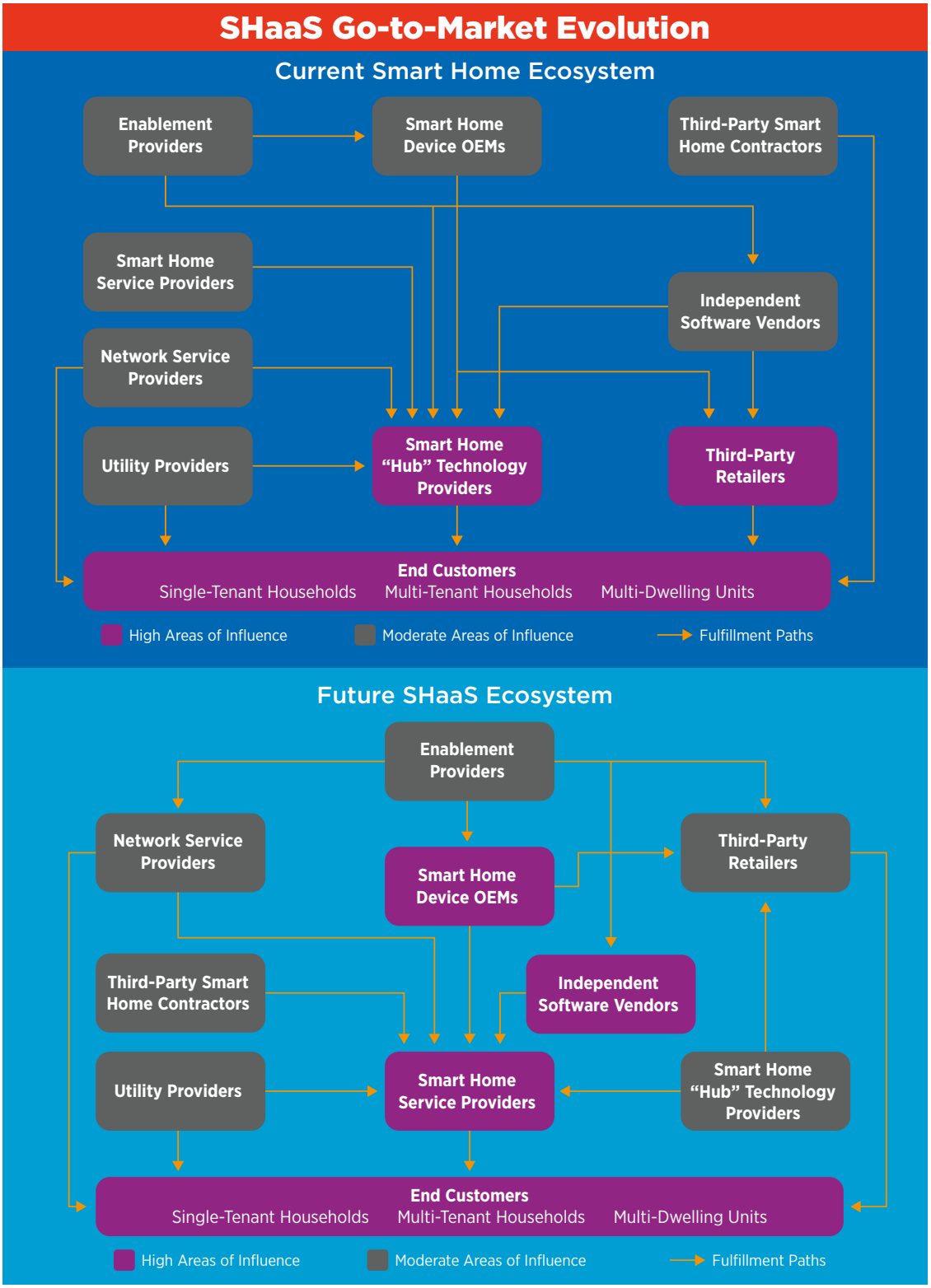
Today, the majority of Smart Home purchases are CapEx, or a one-time upfront charge. 66 percent of Harbor's Smart Home survey respondents noted that they purchased their Smart Home devices up-front and at full cost. This also may attribute to the top pain point consumers experience when purchasing Smart Home technologies: cost.

While devices will still be sold CapEx, the next logical step will be to add services on top of those devices. For example, the consumer can buy a fitness wearable for an upfront cost that has basic features and functions, but she can also subscribe to a virtual training tool for an additional service charge. The next step is to combine services among multiple devices. This would be similar to the walled garden ecosystem approach where more applications are available but only within a partner network.

For example, if a given consumer's Smart Home hub was a control point for their ecosystem of Smart devices, the consumer could ask it what her activity log has been this week, or ask when her schedule is open to fulfill her fitness goals. How will that scenario be monetized? Will there be a single supplier receiving value from that service, will it be a shared revenue, or will there be other adjacent means of achieving value such as sale of data? Eventually, we will see service providers using a subscription-based monetization model and leveraging devices in order to create a configured service, such as supplying cameras, motion sensors and smart doorbells, with little to no consumer CapEx purchases. The supplier would simply send a professional over to hook up the devices, configure the application, offer instruction on use, and charge a subscription fee until the service is complete.

As depicted below, SHaaS will shift Smart Home go-to-market strategies across the value chain.

Figure ES4 SHaaS Go-to-Market Evolution



Source: CABA Smart Home as a Service 2020 Report

The shift away from product-centric business and monetization models, traditional go-to-market strategies will be impacted. Building a new channel strategy can be cumbersome, and we will touch on it more in later sections. In order to capture additional value beyond device-based sales, go-to-market strategies will have a significant overhaul. In order to bring connected products to market, partnerships for connectivity enablement must be formed. To leverage data to improve usage and for potential sale-of-data revenue, means of data management must be integrated into a player's ecosystem.

As SHaaS becomes more common, this new go-to-market will continue to expand and recruit more service providers who use a central Smart Home interface to promote their products and services. These service providers will become the key focus of the ecosystem, as ISVs, OEMs, and Hub providers will have to work with them to integrate their offerings into packaged SHaaS offerings. Open data sharing in these service platforms allows OEMs and ISVs renewed market influence.

Often times, organizations understand that a trend is disrupting their industry, but they are hindered by a hesitation to change their go-to-market strategy and channel design. Particularly, this is a factor within organizations that have been incumbents in the home space for decades and have leadership that is reluctant to change with an "if it ain't broke, don't fix it" mentality. While there will be lead time and several organizations can still be product-based companies, this mentality will leave players behind competitors that do take the action to adjust their ecosystem and channel strategies.

ES.1.4 The Changing Smart Home Consumer

One of the key components to understanding the future SHaaS roadmap is the consumer themselves. This includes consumer demand for certain products, consumer demand for certain methods of payment, and consumer demand for certain player types to deliver their services. In fact, there are instances when consumers are unaware the existence of a service or product that they may demand.

For example, today about 40 percent of survey respondents said that they do not monitor their home security, and only 20 percent of survey respondents have cameras and watch footage. However, when the respondents were asked about "security-as-a service," which was described as a subscription service where a service provider installs cameras, smart door locks and motion detectors and wraps it up in one application, 83 percent of respondents noted they were interested. Here is a key example: consumers might be interested in something if it is packaged in a different delivery and payment method.

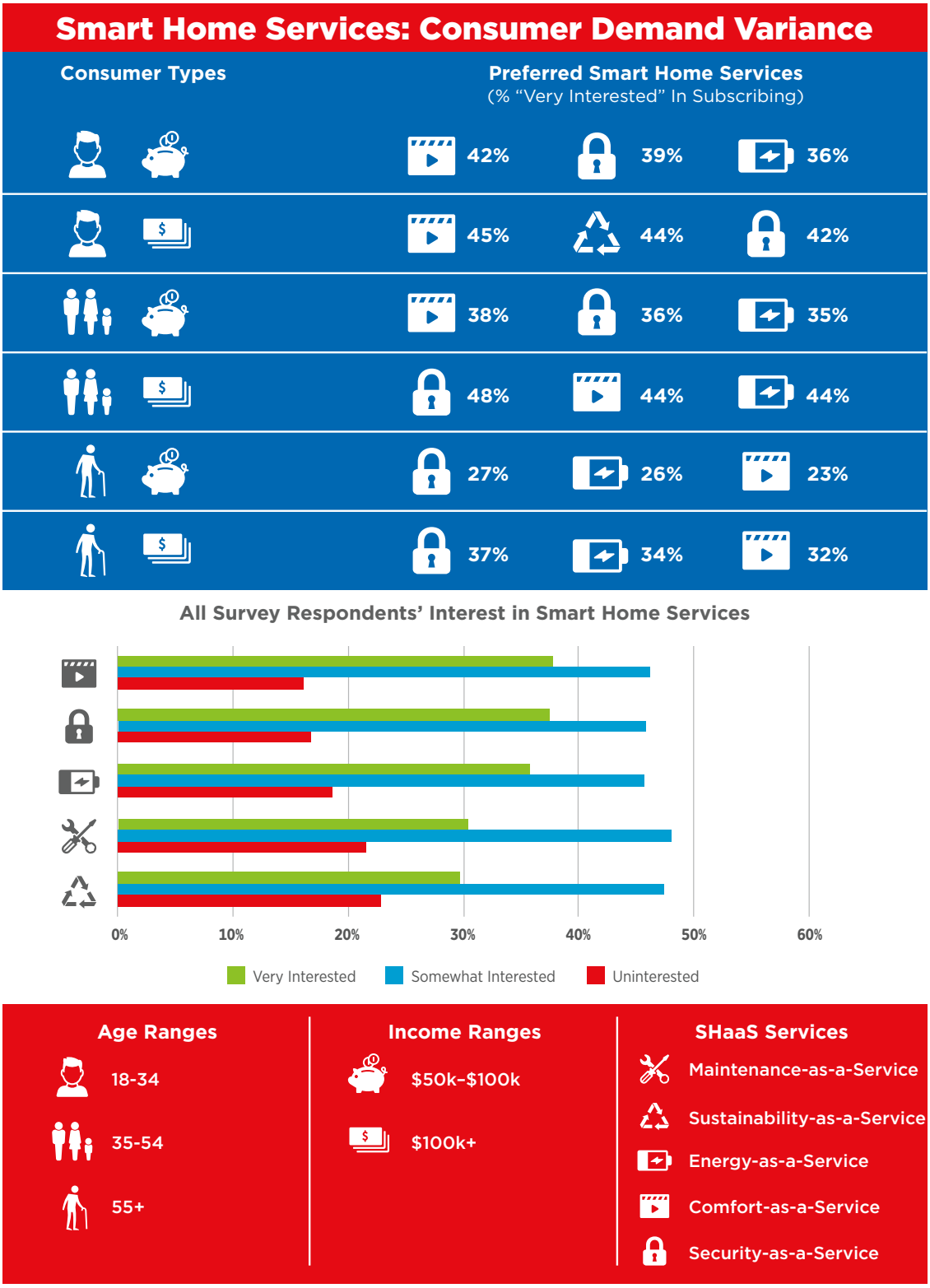
Given the massive variation in homeowner demographics, suppliers cannot rely on "one size fits all" Smart Home solutions. Instead, these companies need to carefully consider the target personas of their offerings, their specific needs, and how to best articulate their services' value propositions. Just as different movies are made with the intention of being consumed by different demographics and personas, Smart Home suppliers will need to intimately understand their target consumer or risk having their offerings flop. The companies who search for trends in consumer demand such as the one described above will be the players that succeed in the future Smart Home.

Today, cost is still the number one inhibitor of purchasing additional Smart Home

technologies among existing Smart Home tech users. However, 51 percent of survey respondents noted that data privacy concerns were a factor in preventing Smart Home purchases. When asked about problems or concerns with their Smart Home technologies, 19 percent of survey respondents noted security/privacy concerns, while only 6 percent noted difficulty using the device.

Figure ES5 Consumer Demand for SHaaS

Rank the following Smart Home services (not purchased upfront but a monthly subscription) that you would be most willing to pay for:



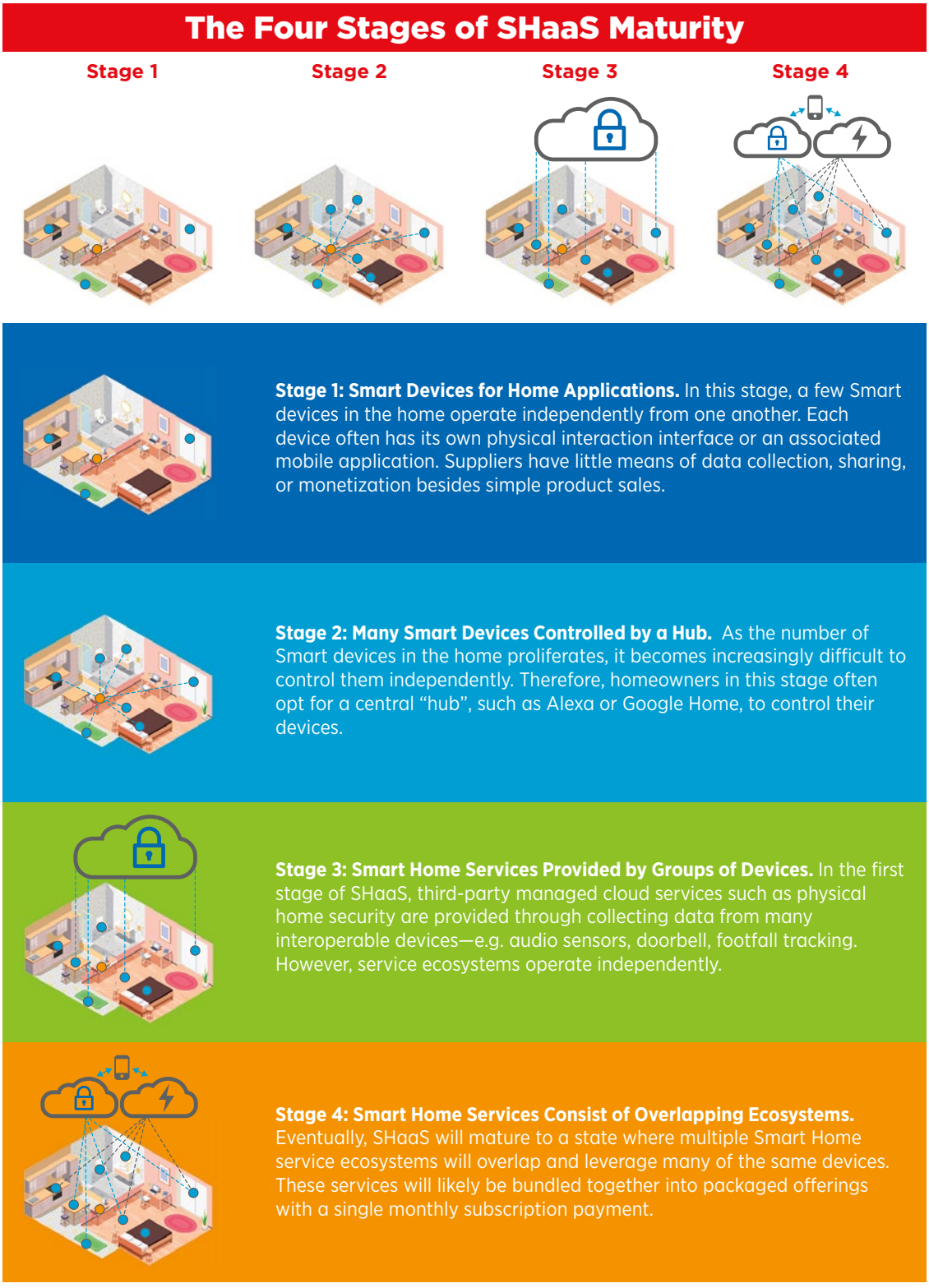
Source: CABA Smart Home as a Service 2020 Report

ES.1.4 The Evolution to SHaaS

It would be nice if the evolution of the Smart Home could be plotted as a simple line on a graph going from where we are today to where we will be in the future. Unfortunately, business-model evolution is rarely a clean process. Every household in North America is in a different stage of Smart Home adoption, and SHaaS will be a paradigm shift that matures over time.

To paint this picture of the SHaaS evolution, we broke the business-model shift into four distinct stages. By visualizing it this way, suppliers can position themselves for each stage of SHaaS as it matures while still retaining market share in the current Smart Home state.

Figure ES6 SHaaS Maturity Stages



Source: CABA Smart Home as a Service 2020 Report

Currently, there exists a fragmentation of opinions about what SHaaS means, how it will evolve, and what it will entail. Crucially, SHaaS is different than centrally-controlled Smart Home services. The latter refers to a collection of products and services in the home. SHaaS, by contrast, refers to a collection of Smart Home service ecosystems that involve a true business model evolution.

Key to the evolution of SHaaS is the shift from device-based functions to service-based functions. This evolution will consist of four stages. From the suppliers' perspective, each stage features key differences not only how devices are used in the home, but where the processing power and payments occur.

Each of these four stages will have distinct ecosystems and control points. While overcoming barriers is key to progressing in each stage of the Smart Home evolution, understanding and positioning for the current Smart Home market stage is important for gaining the consumer trust necessary to take a larger role in future stages.

ES.1.5 SHaaS Requires New Home Technology Capabilities

For SHaaS to emerge and become pervasive, it needs to leverage overlapping ecosystems of Smart Home services and devices that freely share data between one another for advanced predictive analytics. While in-home technology infrastructure is not quite to the point of enabling such a future vision, rapid advances in technology are exponentially expanding the potential for in-home applications.

Figure ES7 SHaaS Technology Enablers

SHaaS Technology Enablers

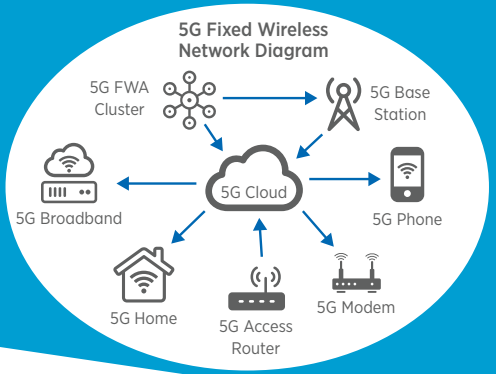
Multimodal Sensors

Multimodal sensors, operating either embedded on devices themselves or as standalone entities, simultaneously collect multiple disparate data types. This is key for allowing devices to operate together in service ecosystems, and for multiple different SHaaS offerings to leverage the same devices.

Open Protocols

Open network communication protocols allow devices to communicate and share data freely with each other, regardless of the product's specifications or manufacturer. Although OEMs are incentivized against open communication, this interoperability is needed for SHaaS to accelerate and mature.

Network Evolution



Two key **emerging network technologies**, 5G Fixed Wireless Access (FWS) and Time-Sensitive Networking (TSN), are setting the stage for more powerful latency-sensitive applications to penetrate the Smart Home, while at the same time making high-speed internet connectivity a reality for millions of homeowners.

Source: CABA Smart Home as a Service 2020 Report

In particular, three main technology innovations—multimodal sensors, open communication protocols, and next-generation home network infrastructure—are required to catalyze the growth of SHaaS.

Multimodal Sensors
For devices to support multiple Smart Home service ecosystems, they need to be able to collect different types of data simultaneously. For example, an in-home security camera needs to not only collect computer vision data, but also audio and speech data for deeper contextual analysis—while at the same time monitoring temperature and energy use for other Smart Home services.

Open Communication/Network Protocols
Smart Home services and business model evolution are wholly dependent on device interoperability and collaboration between members of the Smart Home ecosystem. While closed ecosystems benefit their masters in the short-term, they run up against issues of scalability. This is because of the limitations of a single company's ability to provide all of the Smart Home services that a consumer demands while providing the best value over competitors in each area.

Even technology mega-corporations like Amazon and Apple fail to maintain near-monopolies and market strangleholds as markets increase. For example, Amazon's e-commerce dominance has not translated well to competing with Spotify and Apple Music in the music streaming market, and Apple has not been able to position its Pages application over Microsoft Word.

Next Generation In-Home Network Infrastructure
5G-Enabled Fixed Wireless Access (FWA): FWA promises to completely replace legacy fixed-line broadband solutions, such as Fiber Optics, VDSL, and ADSL connections, with 5G cellular networking capabilities. FWA promises more than 100 more capacity than 4G networks while eliminating the need for wired broadband connections that typically require hardware procurement and installation.

Real-Time Networking at the Edge: In the automotive and industrial markets, the need for real-time networking capabilities for mission and safety-critical applications has led to innovations in wired Ethernet technology, known as Time Sensitive Networking (TSN). Over time, these techniques for real-time application communication may translate into the Smart Home, especially as demand for real-time applications grows.

ES.1.6 Critical Considerations for SHaaS

To succeed in the future of SHaaS, device manufacturers need to prioritize devices that are interoperable with not only Smart Home hubs but with other connected in-home devices as well. In addition, these OEMs need to collaborate closely with services providers to develop and promote packaged services to consumers. In particular, OEMs, service providers, and other players have the opportunity to take key steps to catalyzing and taking advantage of the SHaaS opportunity. These include:

Promoting Open Ecosystems and Collaboration: Currently, companies are incentivized to promote closed ecosystems that benefit themselves and don't share data or collaborate with other ecosystem partners that they view as competitive to their "winner-take-all" mentality. However, these companies need to understand that for SHaaS to be realized, there cannot be a single winner. Instead, companies across the value chain need to relinquish some control and share data freely between devices and third-party service providers.

Building Devices with Baked-In Transparency and Privacy: For Smart Home device manufacturers, they not only need to embed their devices with open protocols, but they also need to ensure that devices meet consumer concerns associated with transparency and data privacy. To accomplish this, these OEMs need to ensure that data privacy controls are included and tested in their devices before they market them to consumers. In addition, they need to include mechanisms that show consumers how exactly their data is being used and shared externally.

Augmenting Devices with Associated Value-Added Services: Lastly, device manufacturers need to prepare for the future mature state of SHaaS where devices are de-emphasized and function as mere sensors and appliances. To prepare for this reality, OEMs should start augmenting their devices with value-added services such as energy and asset management that leverage the consumer data they collect. This data will unlock new revenue streams and improve the OEM's ability to offer more tailored products and services to consumers.

To survive in the SHaaS future, OEMs need to do a better job of collaborating with managed services providers to ensure that their devices can work as delivery mechanisms for these services, not just as single purpose-built devices. By doing so, OEMs can serve as the "middleman" between the service providers and the homeowner.

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