smart systems design | Harbor Research

Attn: Greg Walker
Continental Automation Buildings Association (CABA)
1173 Cyrville Road, Suite 210
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Connected Home Artificial Intelligence
RFP – Final Proposal
30 August 2021

FROM: Harbor Research

Evidence of Knowledge and Experience (12.2, 13.2)

Harbor Research brings to this project substantial industry experience, and a team with relevant expertise in connected product solutions for the Internet of Things, intelligent buildings and artificial intelligence. Beyond Harbor Research's internal knowledge and expertise, we access thougth leaderhip from our wider community of industry experts in home automation, home security as well as advanced data-intensive, articifical intelligence applications. Senior staff will oversee and manage this research effort as well as participate in a focused and applied manner on the scope, design, and execution of this research program.

Glen Allmendinger - President and Founder

Glen is the founder and president of Harbor Research, a strategy consulting firm with offices in Boulder, Colorado and Berlin, Germany. Since the firm's inception in 1983, Allmendinger has worked closely with a broad spectrum of telecommunications, information systems, security, electronics, and automation and equipment manufacturing companies in North America, Europe, and the Far East. These companies range in scope from small, entrepreneurial start-ups to major multi-national corporations. His project direction and consulting has assisted these firms in the development of corporate and business unit strategies, new product, market and service opportunities, and new core capabilities.

Glen has consulted to the National Research Council on technology and competitiveness as well as emerging technologies for social wellbeing. He is a member of IEEE, ASME, and ACM and has worked closely with several industry trade associations including CABA. He has worked on DARPA-funded research focused on advanced analytics and sensing systems technology and was a key participant in the planning and development of the National Center for Manufacturing Sciences. Allmendinger received his BA from New York University, and completed graduate studies at MIT's Center for Advanced Media Studies.

Harry Pascarella – Vice President

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Harry specializes in Industrial IoT with a focus on manufacturing and natural resources markets. Harry works with clients across a variety of industries to validate and dimension their growth strategies and advise on industry segment and application target selections. Recently, Harry conducted several studies in smart buildings including a deep dive into energy management as well as a market study on the larger market that looked at usage behavior. Harry also worked with the largest LED lighting manufacturer in the United States to develop a business case for connected lighting platforms. Harry received his bachelor's degree in Economics from the University of Colorado – Boulder.

Daniel Intolubbe-Chmil – Consultant

As a Consultant, Daniel has led research initiatives shaping critical insight around the evolution of high-performance networks across industrial, commercial and enterprise verticals. Daniel also helps keep a pulse on the market, providing curated content and updates to Harbor's real-time market tracking across all sectors of the economy. Dan has helped lead two previous CABA Connected Home Council engagements, and has deep expertise across networking technologies within buildings and homes. Prior to Harbor, Daniel has conducted economic research to complete his Honors thesis regarding Education Policy, entailing policy/market research and econometric analysis. He graduated from CU Boulder with a degree in Economics and a minor in Humanities.

Michael Levy – Consultant

Michael is a Consultant at Harbor Research with experience leading research projects for a variety of projects across verticals. In particular, he has led research engagements that focused on real-time networking, data analytics and machine learning solutions, and sustainability. Michael participated heavily in the CABA Smart Home as a Service engagement, where he explored in-depth the evolution of connected home business models, applications, and services. Prior to Harbor, Michael worked for a mid-tier consultancy in Washington D.C. that specializes in privacy and cybersecurity, operating security operations centers (SOC) across the United States. He graduated from Northwestern University with a double-major degree in English Literature and German.

Luke Navilliat – Consultant

Luke is a Consultant at Harbor Research with experience leading research projects for a variety of projects across verticals. In particular, he has led research engagements that focused on control, networking and automation solutions for intelligent building environments. Luke has also written a whitepaper detailing the benefits and value propositions of end-to-end building management platforms for an innovative platform and software company. Prior to Harbor, Luke worked for the City of Boulder's Economics department where he determined incentives and fund allocations for businesses in Boulder. He graduated from CU Boulder with a degree in Quantitative Applied Economics.

Evidence of Previous Experience in the Smart Home & Artificial Intelligence (12.3, 13.2, 13.5)

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

Our firm has been involved in the development of the smart systems and machine-to-machine (M2M) 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. Our 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, services providers, and end-customers.

Highlights related to our experience include:

- The first comprehensive research study on the Intelligent device networking and M2M arena in 1999;
- Smart systems and IoT forecast modeling work since 2002;
- October 2005 Harvard Business Review article "Four Strategies For The Age of Smart Services" (we were the firm that "named" the concept of Smart Services);
- Over forty-five white papers to date on various opportunities related to smart devices and services;
- Launch of SmartSphere in 2016, first online platform to map relationships of top companies in the IoT space, analysis of 500 players including many in the smart buildings market and custom news tracking software against Harbor's taxonomies;
- Work with leading connected home and buildings constituents and market innovators (Cimetrics /Analytika, Skyfoundry, Eaton Residential Business, Tridium, Optimum Energy, Johnson Controls, Pacific Controls, Jones Lang LaSalle, Samsung, Schneider Electric, Honeywell);
- Work with a broad spectrum of connected home network equipment and silicon suppliers (Cisco, Dell, HP, IBM, Samsung, AT&T, Verizon, Intel, Qualcomm, Microsoft, etc.);
- Work with what we believe is the largest community of device manufacturers focused on developing Smart Device and Smart Services solutions;
- Collaborated with CABA in 2017 on identifying key demographics and behaviors of single and multi-tenant constituents.
- Collaboration with CABA in 2018 on identifying monetization strategies for intelligent buildings, and in 2019 on the evolution of Connected Home business models culminating in Smart Home as a Service (SHaaS).

Harbor Research's recent relevant experience in the connected homes arena and MDU market includes more than fifteen engagements over the last 4 years, including the following illustrative examples:

- **Connected Home Roadmap / Client: Continental Automation Buildings Association***

  Worked with CABA and steering committee members to develop a holistic view of the future of the connected home. This included a detailed forecast of future device shipments and software revenues, customer segmentation fed from large-scale surveys, and scenario analysis based on extensive primary research with industry thought leaders on the evolution of the smart home market.

- **Smart Home Hub Product Development and Customer Audience Definition / Client: Large Social Media Company – Consumer Products Division**

  Leveraged demographic and psychographic data on consumers to understand top features and functionality of new smart home hub products. This included audience segmentation and population

sizing as well as extensive secondary and primary research to validate customer segments and construct a product/solution roadmap.

- **Connected Multi-Dwelling Units and The Internet of Things / Client: Continental Automation Buildings Association***

  Worked with CABA and steering committee members to develop an opportunity assessment within Connected MDUs, conducting a survey with 1,500 MDU owners, technology suppliers and service providers in the space, including 60 in-depth interviews to validate research findings. The engagement summarized the top IoT application and use case opportunities among primary buyers of technologies in the space, supported by a 5-year smart systems forecast model.

- **Connected Home Developer Survey / Client: Tier-1 Semiconductor Supplier**

  Conducted primary research across 300 connected home developers to identify the required software and hardware features of a forthcoming connected home hardware development kit. Additionally, the survey identified key connected home developer buyer profiles to determine the size, use cases, and value proposition of the hardware development kit to the developer and the developer's organization.

- **Analysis of IoT Applications for Smart Buildings and The Connected Home / Client: Large Korean Technology Manufacturer***

  Analysis of IoT applications in the intelligent buildings market, including the Connected Home. We focused on developing a comprehensive forecast model to determine the number of connected devices and potential revenue streams; identifying and profiling key competitors in the marketplace; and developing use cases for attractive applications in the intelligent buildings space. Project findings helped client determine attractive applications to pursue as well as helped identify required capabilities for success.

*Contacts for project references available

Other example clients and engagements our team has worked on include:

- **ARM** – Future Mobile/Consumer Security Requirements Analysis
- **Revolv** – Review of Product Plans For Connected home Automation Offering
- **Tendril Networks** – Analysis of Energy and Related Services for Home and Consumer Markets
- **Honeywell** – Building and Residential Control Components – Security Systems Innovation
- **Intel** – Connected Home Developer Market Analysis – Analysis of Developer Requirements for Hardware Development Kits
- **Eaton Electrical and Residential** – Development of Home Automation System and Market Analysis for Residential and Light Commercial Opportunities for Network Services
- **Schneider Electric** – Building Management – Energy Management Opportunities
- **Cisco Systems** – Connected Consumer and Connected Real Estate Opportunity Analysis and Technology Roadmap for Security Services for Consumer and Commercial Applications
- **Bosch** – Corporate Planning – Residential and Commercial Security Systems Opportunity Analysis
- **Pacific Controls –** Connected Buildings, OEMs and Mobile Professional Opportunity Analysis
- **Lightsource Energy –** Residential And Commercial Rooftop Solar Energy And Monitoring Services Analysis
- **Ayla Networks –** Smart Home Whitepaper

For additional examples of previous experience related to connected homes, please see Appendix D of this document.

Summary of Harbor Research Project Approach (12.4, 12.5, 13.1, 13.5)

Proposed Project Methodology

Harbor Research is proposing a collaborative project methodology to conduct a market analysis, survey research and industry expert/thought leader interviews for CABA's Connected Home Council, including a methodology and supporting work scope to analyze the trends and forces, customer needs, use case opportunities, risks, and ecosystem formation around artificial intelligence technologies as it relates to the connected home industry.

Harbor would leverage heavy involvement from senior staff members including Glen Allmendinger and Harry Pascarella. Harry would assist with both the primary and secondary research efforts from which user behavior and interactions with smart speaker and hub technologies would be surfaced. Glen would oversee the entire project, and provide specific insights on players, business models and other market dynamics by tapping into his IoT and consumer market experience and contact base.

To define and develop business opportunities within artificial intelligence technologies as it relates to connected home, Harbor would undertake the following activities:

- Review and analyze existing applicable CABA and non-CABA industry research including past CABA research such as the Connected Home Roadmap, Monetization Study and other relevant industry research.
- Review previous Harbor Research analysis of Connected Home, Artificial Intelligence, IoT Platforms, and connected home devices, including existing 2017, 2018, and 2019 Connected home report research.
- Conduct interviews with CABA membership thought leaders as well as thought leaders in Harbor Research's community and network.
- Create a foundational framework for understanding the connected home's evolution of consumer needs, technology priorities, artificial intelligence technologies and applications, from which the Steering Committee and Harbor Research can collaborate, including:
    - Trends and forces shaping connected home adoption amid evolving connected home requirements; convergence and interoperability of disparate devices within the connected home, including the emerging relationships between connected home devices such as entertainment systems and control hubs, as well as impacts on and evolution of standards bodies as they relate to data ownership and privacy;
    - Market application map that addresses devices within the connected home market landscape; and relevant application requirements with regards to services, data analytics, systems, and processes for homeowners and technology suppliers;
    - Consumer preferences around artificial intelligence applications in the home, with a particular focus on data and ownership and user privacy as well as their appetite to install and use artificial intelligence applications in connected homes;
    - Ecosystems of existing players (artificial intelligence application developers, supporting technology developers, network providers, speaker manufacturers, home hubs, etc.) and emerging players in the industry to identify roles in the value chain;
    - Initial set of risks/vulnerabilities and customer pain points (e.g. functionality vs. security) and barriers to adoption to be validated or disproved by survey participants.

- Design a research process design to validate and analyze the proposed market concepts and hypotheses using surveys and in-depth interviews:

  Survey

  - Harbor will administer an online survey of market participants along with supplemental conversations, the survey will include **500-750** tenants (rent and own, single and multi-tenant living quarters), distributed across agreed upon segments and demographics in the United States and Canada (this will allow us to establish a detailed data set and to provide a statistical summary and analysis of research findings). The survey will be designed in conjunction and cooperation with the CABA Connected Home Council Steering Committee. Harbor will plan to explore the use of a preference-based survey approach to understand homeowners' behaviors and preferences in relation to artificial intelligence in the home, including:
    - Modes of interaction with artificial intelligence in connected homes
    - Identified homeowner/occupier needs/pain points, and use cases
    - Key value drivers and differentiators from the point of view of homeowner/occupiers
    - Consumer value and/or use cases not yet addressed by the industry
    - Consumer perception of value/adoption propensity in various AI applications in connected homes
    - Data privacy, data ownership and perceived risks of artificial intelligence in connected homes
    - Harbor will conduct this survey with the support of **a reputable panel or multiple panels** will allow us to quickly and effectively deploy this survey to the target audience.

  Interviews

  - Harbor will conduct parallel supplemental in-depth interviews (**approximately 7-10**) with marketplace stakeholders, including speaker manufacturers, service providers, software players, and home hubs (IoT platform providers), as well as related specialist artificial intelligence technology providers. Interviews will comprise of a mix of telephone and in-person interactions based on a discussion guide designed in cooperation with CABA. These interviews will work to understand how user needs and perceptions are shifting, along with how these marketplace stakeholders expect customers wish to interact with artificial intelligence applications in connected homes, including differences customer needs and technology and competitive movements.

Analysis

- Based on the above research and survey work, Harbor will create a series of strategic alternatives that align stakeholders with opportunities across payments and solution delivery opportunities for emerging and current applications and services. This analysis will include:
  - State and Evolution of the Market: Trends & Forces
    - See **Appendix D: Research Questions** for additional details
  - Customer Needs, Adoption, and Buying Behavior for Artificial Intelligence in Connected Homes
    - See **Appendix D: Research Questions** for additional details
  - Connected Home Artificial Intelligence Supplier Dynamics and Best Practices
    - See **Appendix D: Research Questions** for additional details
  - Evolution of the Opportunity: Future Considerations for Stakeholders
    - See **Appendix D: Research Questions** for additional details

- Harbor Research will utilize both industry expert interviews and consumer surveys to examine all major aspects of artificial intelligence in connected homes. The scope will also include recommendations for implementation and integration, specially covering the implications for real-time monitoring and data management applications, as well as strategic alternatives that align stakeholders with opportunities, challenges and key considerations arising from artificial intelligence in connected homes, including cybersecurity and privacy aspects.
- Harbor Research plans to develop a written report of 25-40 pages and a parallel summary and set of figures in PowerPoint. This represents a "scaled-down" version of typical landmark research reports in accordance with the level of funding available.
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Acceptance of Deliverables and Project Timeline (12.6, 13.6)

Harbor Research accepts the terms laid out in the RFP delineating the project deliverables as well as the total elapsed timeline for the study.

This proposal adheres to the following guidelines provided:

- We hereby offer to sell and/or supply to the Continental Automated Buildings Association (CABA), for terms and conditions set out herein, the supplies and/or services listed herein and/or any attached sheets at the price(s) set out therefore.
- We hereby certify that the price quoted is not in excess of the price charged anyone else, including our most favored customer, for like services.

CAVEAT: This study will contain all the elements of our previous Landmark Research studies including:

- State and Evolution of the Market: Trends & Forces
- Customer Needs, Adoption, and Buying Behavior for Artificial Intelligence in Connected Homes
- Connected Home Artificial Intelligence Supplier Dynamics and Best Practices
- Evolution of the Opportunity: Future Considerations for Stakeholders

The scope and scale of each section, however will likely be somewhat constrained as a reponse to the uncertain funding situation for this study on Connected Home AI and in accordance with the information contained in the Financial Proposal.

Activity	Anticipated Date
Research set-up and kick-off meeting	October 2021
Secondary research	Oct - Nov 2021
Primary research	Oct – Nov 2021
Analysis and reviews	Nov – Dec 2021
Draft report delivery	Dec 2021
Final report delivery	Jan 2022
Final Webinar (2 hours). A group webinar for all the funding organizations.	Jan 2022
Organizational Webinars (1 hour each). One webinar for each organization on the Steering Committee.	Jan - Feb 2022
Industry Webinar (1 hour). To all CABA contacts to present the high-level executive summary findings only. This occurs after the four (4) month embargo period.	2022

CABA Membership Status (12.7)

Harbor Research is a current and active member of CABA.

Harbor Research Profile (13.4)

An internationally recognized research, technology, and business development consulting firm, Harbor Research has predicted, tracked, and driven the development of the Internet of Things since our inception in 1984. While our history is long, our strategy is simple: capture and create value by combining accurate data discovery and analysis with creative systems-thinking. It is this mindset that has given us the privilege of working with some of the greatest companies in the world. Today, we continue to work with C-level executives and top management of some of the world's most consistently successful companies and innovative startups. In the same way that the market has flexed and grown over the years, our services and experience have grown to make us the premier service organization you see today. We work with clients in a variety of ways including consulting, advisory, research and content development, thought leadership and workshop facilitation.

Harbor Research has offices in both Denver, Colorado and Berlin, Germany with ample experienced personnel to complete the scope of this project on time and to the highest standards.

Appendix A: RFP Signature (12.8)

As this project is based on a competitive bidding process, only one (1) contract will be awarded, and it will be offered to the bidder whose proposal is deemed by the Steering Committee, Council Executive Committee and CABA to provide the best value. More than one (1) vendor can be selected if a joint proposal is submitted and selected.

Should the total cost of the selected vendor's proposal exceed the available total project budget, CABA and the Steering Committee may work with the vendor to achieve optimization of project scope, research objectives and methodology in accordance with the available project budget.

Once the project is awarded, the vendor and CABA will work together to create an official contract. This contract will be signed by both the vendor and CABA prior to the commencement of the research project.

Important Guide: Given the collaborative nature of the research, participation and funding levels of previous Landmark Research studies have allowed for a total budget of between $80,000 - $90,000 USD. This will be the estimated budget for this research project. We encourage prospective bidders to be creative in deriving their scope, objectives and cost of the research to provide maximum value.

Glen Allmendinger

President

Harbor Research, Inc.

Date: 30 August 2021

APPENDIX A: Mandatory Requirements and References

RFP Reference	Requirement (Bidder's proposal should repeat exactly as defined in the RFP)	Reference Page
12.2	Evidence of knowledge and experience of personnel of current theory and practice in the Connected Home discipline by providing short relevant biographies of all personnel who it is proposed will participate in the project. The vendor's project leader must have a minimum of 10 years relevant experience.	Pages 1-2
12.3	Evidence of previous experience in the Connected Home discipline by providing examples of relevant projects prepared for three (3) separate clients within the preceding 48 months. References may be required from these three (3) clients, only if requested by CABA. References are normally not required.	Pages 3-4
12.4	A summary of how the vendor proposes to perform the project and the relevant experience of the proposed staff.	Pages 5-7
12.5	**Identify the sample size of both the interviews and surveys.**	Pages 5-7
12.6	Acceptance of deliverables as identified in the Terms of Reference/Prospectus and proposed schedule.	Page 8
12.7	**The vendor must be a member of CABA or agree to become a member of CABA (US$850)** (before the RFP is reviewed).	Page 8
12.8	**RFP Signature** - Bidders must complete, sign (end of Section 17) and return this RFP form prior to the closing date.	Page 9
12.9	**Costs must be in $USD**. A fixed price including a full cost breakdown as per Section 16, "Financial Proposal" must be provided.	Financial Proposal
12.10	The Financial Proposal must be submitted as a separate package (PDF document) to the Technical Proposal **(NO FINANCIAL INFORMATION MAY APPEAR IN THE TECHNICAL PROPOSAL)**.	Financial Proposal

APPENDIX B: Rated Requirements and References

RFP Reference	Requirement (bidder's proposal should repeat exactly as defined in RFP) Technical Rating	Points		Referenced Section/ Page in Bidder's Proposal
		Max.	Min.	
13.1	The methodology section of the proposal will be an analysis of: • How the proposal will achieve the stated objectives • The breadth and depth of the proposed work • Effectiveness of the methodology • The innovativeness of the approach • Ability to reach non-traditional stakeholders • The understanding of the issues pertinent to the project • Include the sample size for both the surveys and in-depth interviews • Include the proposed segmentation of the sample groups (surveys and in-depth interviews) • The ideal project will have a North American focus (both Canada and the United States) • *Optional: Additional related research reports, research subscriptions or other material may be used to strengthen the proposal.*	40		Pages 5-7
13.2	The relevant knowledge and experience of the vendor's proposed staff in the Connected Home field and in performing studies of this nature. The vendor must indicate the proposed involvement of the senior staff assigned to the project.	20		Pages 1-2
13.3	The vendor's previous experience in the Connected Home sector and in conducting research projects requiring consultation with a broad cross-section of the industry. Previous research will be reviewed.	20		Pages 3-4
13.4	Corporate profile demonstrating a convincing record of fulfilling contracts on time and on budget, depth of personnel capability and other resources.	10		Page 8
13.5	The vendor's knowledge of the Connected Home industry both in North America and worldwide (if applicable).	5		Pages 3-4
13.6	Timetable, including interim and final stages.	5		Page 8
	TOTAL TECHNICAL POINTS:	**100**	**70**	
13.7	**Financial Rating**: Total price and detailed cost breakdown. **TOTAL FINANCIAL POINTS:**	**30**		

APPENDIX C: Additional Connected Home and Intelligent Buildings Experience

This above requested list of three projects is not a complete list of relevant Connected Home assessments the firm has completed. Other relevant work includes:

- For the largest social media and networking company in the US, we conducted a demographic research study on a consumer-device prototype to understand the use cases, applications and target constituents in support of a Market Requirements Document.
- For the largest manufacturer of electrical products in North America, we conducted user survey research as well as competitor, peer and alliance candidate direct interviews to uncover unmet customer and user needs for new and evolving "connected" energy management and services opportunities.
- For the global leader in network infrastructure equipment, Harbor conducted an analysis of managed services opportunities in connected residential multi-dwelling and commercial properties, including market sizing, competitor analysis, alliance development analysis and go-to-market design.
- For the world's largest semiconductor and processor manufacturer, Harbor conducted an analysis of IoT opportunities within the residential sector. Primary emphasis was placed on opportunities where media and content were dominant values to determine core computing and network bandwidth requirements.
- For a venture-backed startup, conducted an analysis of consumer energy services offerings to help target candidate developer alliances as well as partnership opportunities with utilities and related services providers.
- Worked with CABA to develop an opportunity assessment within Connected MDUs, conducting a survey of 1,500 MDU owners, technology suppliers and service providers in the space, including 60 in-depth interviews to validate research findings. The engagement summarized the top IoT application and use case opportunities among primary buyers of technologies in the space, supported by a 5-year smart systems forecast model.
- For a large silicon player, Harbor defined and developed a software architecture for competitive analysis of IoT platforms. This research examined twenty-five supplier and OEM platform providers in the IT, Telco and OEM markets to validate and segment monetization and pricing models.
- For a leading connected lighting solution provider, Harbor defined new and expanded smart services and IoT solutions as well as building the business case required to support this critical growth initiative. Harbor clearly articulated alternative strategies and solutions available to the company and defined clear steps and a program of actions to fully prosecute the market opportunity.
- For the software branch of a leading industrial and energy OEM, Harbor analyzed of the costs and economics of asset performance management in support of asset health, productivity, optimization, and compliance and integrity. Harbor developed a market model that broke down the costs of data management and analytics tools, and located gaps the company's software may not address currently and can be added to the product roadmap.
- For the largest manufacturer of electrical products in North America, we conducted user survey research as well as competitor, peer and alliance candidate direct interviews to uncover unmet customer and user needs for new and evolving "connected" energy management and services opportunities.

- For the global leader in network infrastructure equipment, Harbor conducted an analysis of managed services opportunities in connected residential multi-dwelling and commercial properties, including market sizing, competitor analysis, alliance development analysis and go-to-market design.
- For a venture-backed startup, conducted an analysis of consumer energy services offerings to help target candidate developer alliances as well as partnership opportunities with utilities and related services providers

APPENDIX D: Research Questions to Be Answered

State and Evolution of the Market: Trends & Forces

- What artificial intelligence applications are currently being introduced and adopted in connected homes and why? What are the major barriers to full scale adoption of new artificial intelligence ("AI") solutions in the home?
    - AI in **entertainment management** in connected homes (e.g. voice recognition technologies and virtual agents such as Alexa, and Siri, as well as hardware devices such as smart speakers and other smart home devices)
    - AI in **health & wellness management** in connected homes (e.g. aging-in-place programs, home fitness devices, remote guidance and care, technology-supported disease management, automated dispensers, remote patient monitoring & imaging, motion detection, caregiver and family support)
    - AI in **home education applications** in connected homes (e.g. virtual learning assistants)
    - AI in **home office applications** in connected homes (e.g. digital PA, smart desks and smart ergonomic furniture)
    - And others as relevant
- How will technologies such as **predictive analytics and maintenance** to reduce trips and human interaction impact the adoption of artificial intelligence in connected homes? And how are these same technologies **enabling new applications and business opportunities** in connected homes?
- What is the **role of utilities** in the evolving use of artificial intelligence in connected homes and how will this change with the **development of renewable energy and distributed generation**?
- How does the **connected home ecosystem** look as a whole from installation to operation to updates and ownership?
- How will the market evolve in the near-term and the long-term? What implications does this have for key stakeholders?
- What key regulatory and socioeconomic forces are driving or slowing the adoption of artificial intelligence in connected homes?
- What are the implications of wider adoption of artificial intelligence for **data ownership, cybersecurity, and use privacy**?

Customer Needs, Adoption, and Buying Behavior for Artificial Intelligence in Connected Homes

- What **artificial intelligence applications and use cases** are driving the largest business opportunities in which market sub-segments today (sub-segments include single unit, multi-unit and other types of connected homes)?
- What are the **top pain points** customers face when introducing new technology in connected homes? How do top applications and use cases address key customer needs and pain points? How do connected home constituents determine **cost-benefit metrics of artificial intelligence** technologies?

- What are the major pain points and disconnect between customers and suppliers when either integrating existing solutions or adopting new artificial intelligence solutions?
- What value propositions and KPIs do customers consider most when adopting artificial intelligence solutions in connected homes? Are these customers well informed of the value provided by artificial intelligence solutions in connected homes? How will this evolve in the future?
- How (pricing models) and what (willingness to pay) are customers willing to pay for artificial intelligence solutions in connected homes?
- What are the key differences in customer types? How should positioning, channel and sales tactics differ by customer personas?
- How do customers most often interact with suppliers? What customer budgeting, investment and solution packaging and delivery considerations do suppliers need to take into account when selling solutions?

Connected Home Artificial Intelligence Supplier Dynamics and Best Practices

- Who are the key established players across each of the following identified segments: hardware and software technology manufacturers and suppliers, OEMS, integrators and installers, service providers?
- Who are the key hardware and software innovators creating disruption with artificial intelligence in the connected homes market? How are they differentiating themselves?
- What new acquisitions, investments, partnerships and ecosystems are developing in the market for artificial intelligence in connected homes?
- What are the strengths and weaknesses of the identified players in the market today? Which business and solution delivery models are the most successful today, and how will this change in the future?
- How does channel to market and best practices differ across player type, solution, industry sub-segment, etc.?

Evolution of the Opportunity: Future Considerations for Stakeholders

- **What segments, technologies and software** are being adopted for artificial intelligence in connected homes both today and in the future?
- What are the **key socioeconomic and regulatory barriers and opportunities** in the market? How can stakeholders capitalize on these opportunities?
- What are the **best practices for mitigating customer concerns**, communicating value propositions and delivering or integrating artificial intelligence solutions?
- What major **barriers and difficulties** do suppliers have when delivering artificial intelligence solutions? How can stakeholders effectively **prepare to address** problems such as proprietary platform software solutions and differences in artificial intelligence hardware platforms?
- What are the **best practices for pricing and monetizing** artificial intelligence solutions in connected homes? What ecosystem participants will stakeholders need to engage to have an effective market channel? What customer behaviors and solution delivery considerations should they be taking into account when determining how best to structure their pricing and revenue models?

- What **Post-Covid opportunities** e.g. air filtration, UV lighting, sensors, etc.) are presenting themselves as viable business opportunities?

APPENDIX E: Current State of Connected Homes

Smart Systems in connected homes provide a distributed control and information system that enables the control and digital experience of a home environment. It is comprised of a network of intelligent devices placed throughout the home that control or augment various functions, all with the intention of making the occupants more comfortable, safe, and efficient while at home. Our use of the term "Smart Systems" is analogous to what is commonly referred to as the IoT, in the case of this work, 'home hubs' or 'connected home platforms'. The two terms are often used interchangeably, but within our research there is a distinction, and it is one that reflects the key changes affecting the market: our use of the term Smart Systems in a connected home context encompasses a broader set of control and information devices, enablers, tools and systems.

The market for connected home technology is fragmented and chaotic, with many technology suppliers bringing increasingly complicated portfolios of connected home products to market that have inundated consumers with countless choices. Additionally, the user experience of connected home products continues to become more natural and satisfying, with enabling technologies such as Voice Recognition and Artificial Intelligence underpinning the futuristic and value-rich connected home solutions that is driving demand for connected home solutions.

Amidst the market mayhem, homeowners and renters are seeking interoperable, easy to use and cost-effective means for better coordination of the systems in their home. They want their 'home hubs' to manage and process the data from the home's disparate devices while linking them all together through seamless voice recognition technology, system-wide decision-making aided by artificial intelligence, and deep data privacy and security considerations. While voice recognition, artificial intelligence, and cybersecurity solutions are varied in home occupants' use based on lifestyles and behaviors, these key enablers will continue to play a pivotal role in the future of the connected home.

While an increasing number of homeowners and renters are adopting smart home products throughout their homes, the sheer cost of these devices and services can make them prohibitively expensive for average consumers. As a result, device OEMs and service providers are beginning to look at providing smart home solutions and services through alternative payment plans and pricing schemes that lessen the initial burden of adoption while allowing for the suppliers to glean recurring revenue streams over the life of the products and services.

The implications on how consumers are adopting technologies in the home and how they prefer to pay for the services that they render in the future are vast and evolving. The opportunities for device OEMs and tech suppliers amidst this landscape depend on a number of factors, including target consumer demographics and psychographics, service and application partnerships, and solution delivery cooperation.

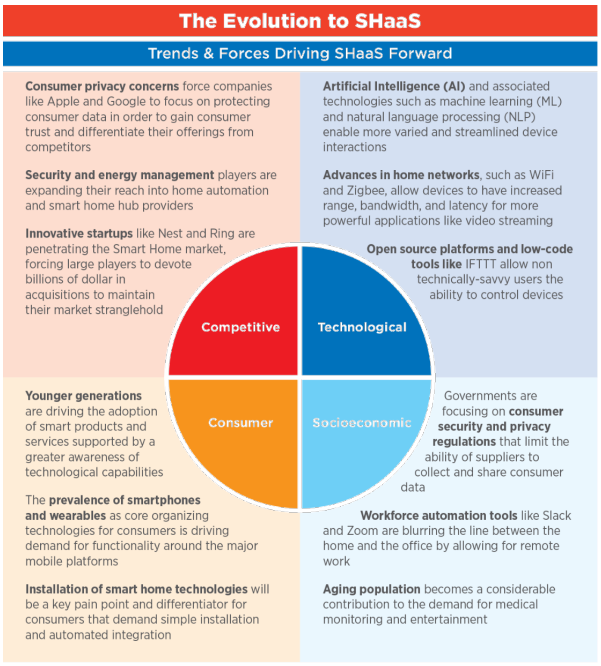
As connected home applications and use cases continue to evolve towards more complex routines and personalized services, so too will the models by which suppliers of those experiences and services transition their payment methods and delivery configurations in order to match the unique needs of the individual consumers.

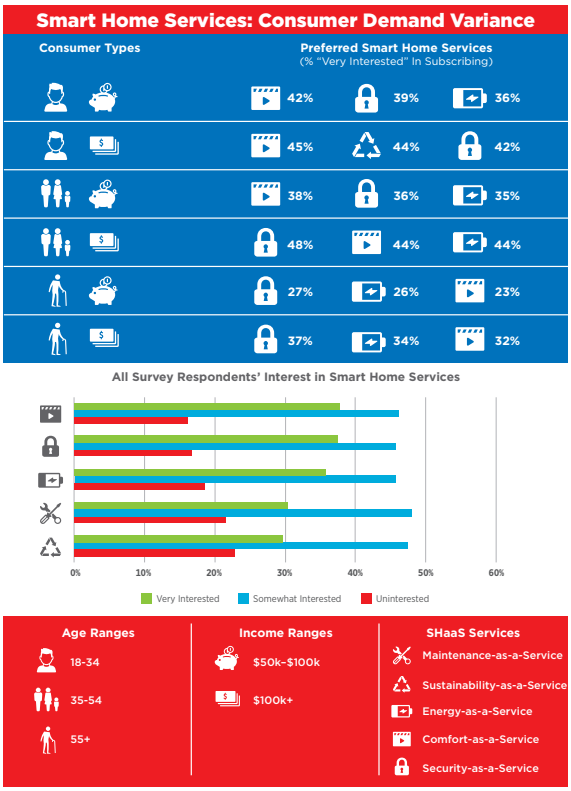
APPENDIX F: Sample Research

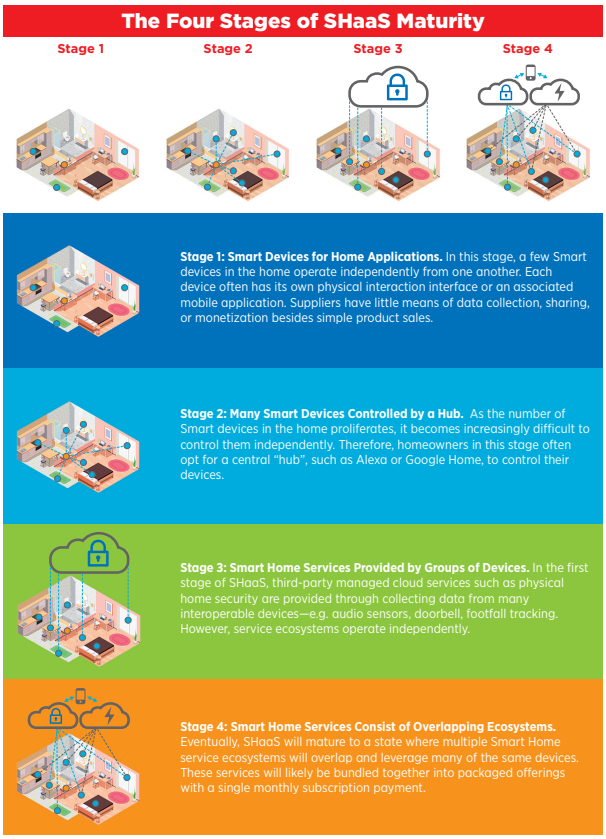
F1. CABA 2018 Landmark Research on Connected Home Roadmap (CABA members have access to report online)

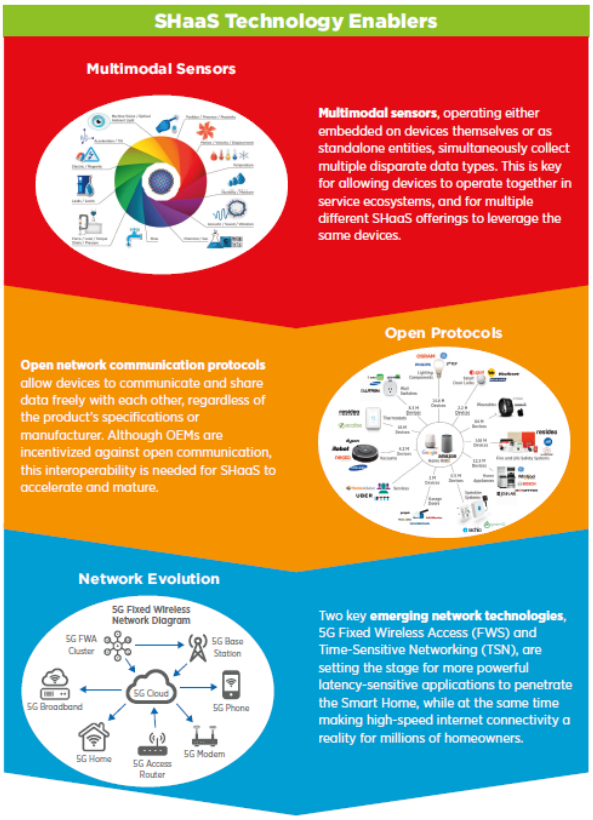
F2. CABA 2016 Landmark Research on MDUs (CABA members have access to report online)

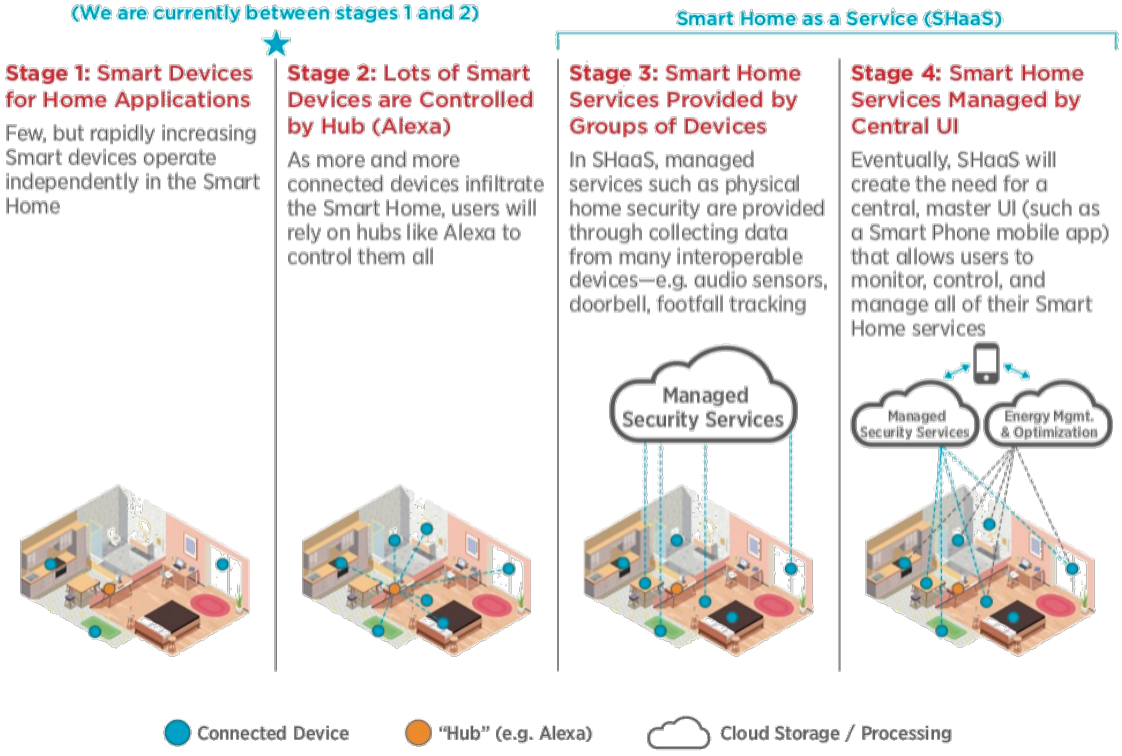
F3. CABA "Smart Home as a Service" Landmark Research 2020



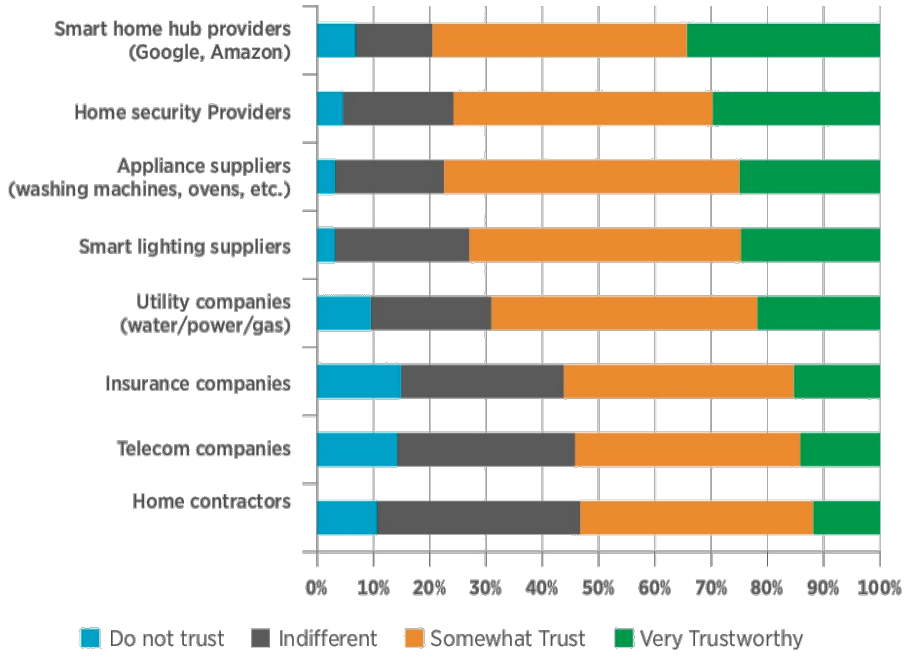



The Four Stages of SHaaS Maturity
Stage 1
Stage 2
Stage 3
Stage 4
Stage 1: Smart Devices for Home Applications. In this stage, a few Smart devices in the home operate independently from one another. Each device often has its own physical interaction interface or an associated mobile application. Suppliers have little means of data collection, sharing, or monetization besides simple product sales.
Stage 2: Many Smart Devices Controlled by a Hub. As the number of Smart devices in the home proliferates, it becomes increasingly difficult to control them independently. Therefore, homeowners in this stage often opt for a central "hub", such as Alexa or Google Home, to control their devices.
Stage 3: Smart Home Services Provided by Groups of Devices. In the first stage of SHaaS, third-party managed cloud services such as physical home security are provided through collecting data from many interoperable devices—e.g. audio sensors, doorbell, footfall tracking. However, service ecosystems operate independently.
Stage 4: Smart Home Services Consist of Overlapping Ecosystems. Eventually, SHaaS will mature to a state where multiple Smart Home service ecosystems will overlap and leverage many of the same devices. These services will likely be bundled together into packaged offerings with a single monthly subscription payment.

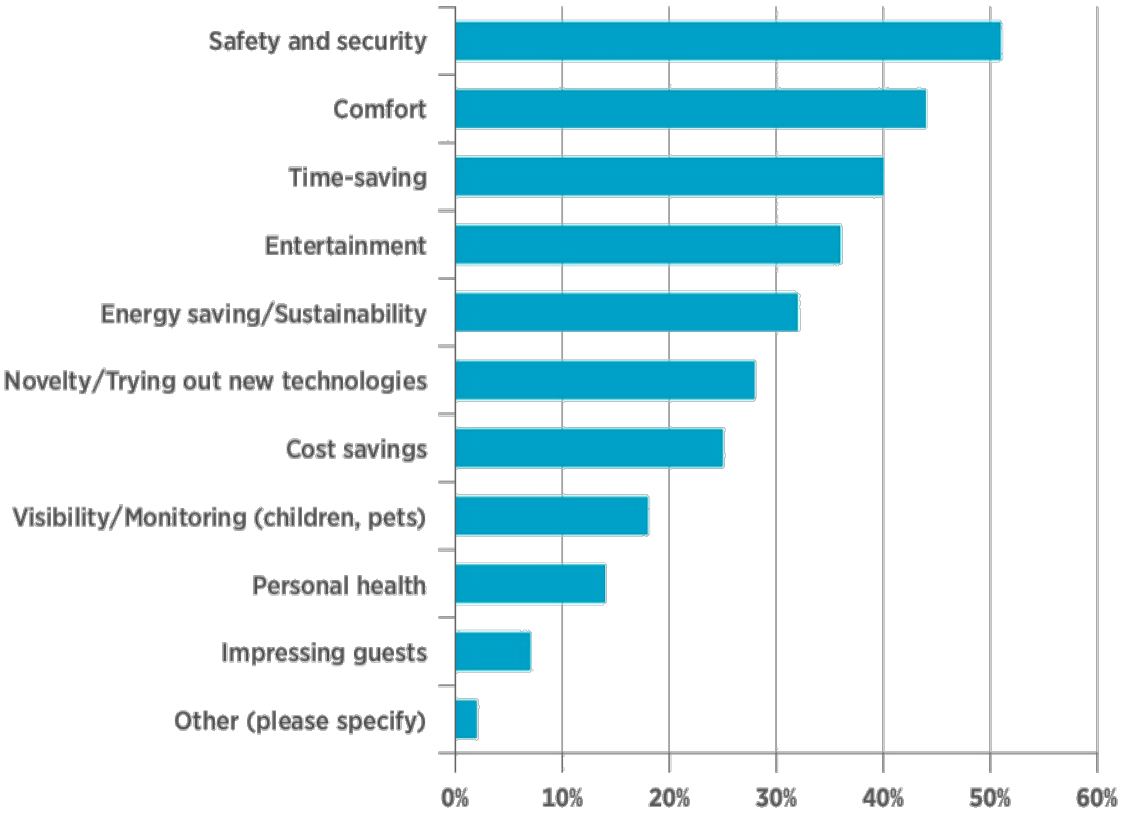

SHaaS Technology Enablers
Multimodal Sensors
Multimodal sensors, operating either embedded on devices themselves or as standalone entities, simultaneously collect multiple disparate data types. This is key for allowing devices to operate together in service ecosystems, and for multiple different SHaaS 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
5G Fixed Wireless Network Diagram
5G FWA Cluster
5G Base Station
5G Broadband
5G Cloud
5G Phone
5G Home
5G Access Router
5G Modem
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.


(We are currently between stages 1 and 2)
Smart Home as a Service (SHaaS)
Stage 1: Smart Devices for Home Applications
Few, but rapidly increasing Smart devices operate independently in the Smart Home
Stage 2: Lots of Smart Devices are Controlled by Hub (Alexa)
As more and more connected devices infiltrate the Smart Home, users will rely on hubs like Alexa to control them all
Stage 3: Smart Home Services Provided by Groups of Devices
In SHaaS, managed services such as physical home security are provided through collecting data from many interoperable devices—e.g. audio sensors, doorbell, footfall tracking
Stage 4: Smart Home Services Managed by Central UI
Eventually, SHaaS will create the need for a central, master UI (such as a Smart Phone mobile app) that allows users to monitor, control, and manage all of their Smart Home services
Managed Security Services
Managed Security Services
Energy Mgmt. & Optimization
Connected Device
"Hub" (e.g. Alexa)
Cloud Storage / Processing

Survey Question: Which of the following home suppliers do you trust most?



Survey Question: What were the primary motivations for adopting the Smart Home technology (security, comfort, etc.)?

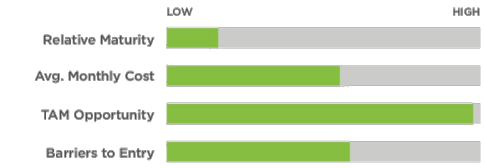


Health & Wellness-as-a-Service

Key Players

American Well, AWAIR, Lenovo

Key Attributes

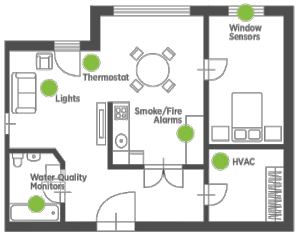


Background and Description

Current Outlook
Health and wellness applications in the Smart Home today are separate and disparate, relying on independent devices such as air quality monitors/sensors or telehealth and medicine wearables.

Future Outlook
Depending on each homeowner's unique health conditions (gleaned from EHRs), devices, sensors, and monitors will work in concert to monitor air, biophilia, and chemical quality to best serve each consumer.

Ecosystem and Device Overview

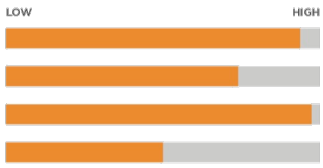


Security-as-a-Service

Key Players

ADT, ALARM.COM, resideo, SimpliSafe

Key Attributes

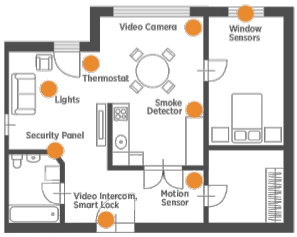


Background and Description

Current Outlook
Currently, home security is sold to consumers as either an independent DIY package of security devices like Smart Locks and cameras, which rely on the user for monitoring and threat detection.

Future Outlook
Innovators like SimpliSafe and Alarm.com are pioneering Home Security-as-a-Service, which over time will incorporate AI and scene intelligence for automated threat detection and deterrence.

Ecosystem and Device Overview

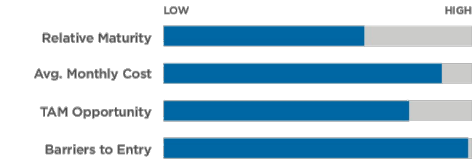


Energy Management-as-a-Service

Key Players

ENERGY STAR, BOSCH, Hydro Québec

Key Attributes

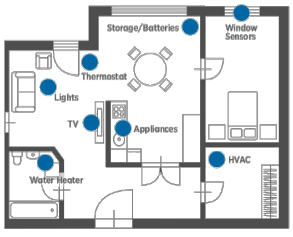


Background and Description

Current Outlook
Currently, state-owned utilities providers offer users little visibility or control into how their home consumes energy. The rise of Smart Meters is beginning to make consumption data widely available.

Future Outlook
In SHaaS, energy management and optimization will enable users to control and adjust energy consumption settings in accordance with their preferences.

Ecosystem and Device Overview

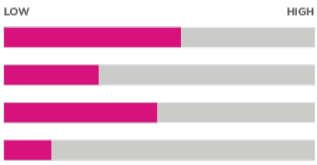


Comfort & Convenience-as-a-Service

Key Players

Control4, amazon alexa, PHILIPS hue personal wireless lighting

Key Attributes

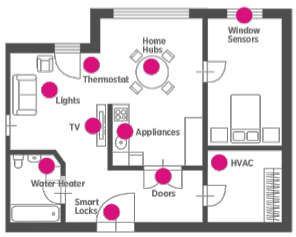


Background and Description

Current Outlook
Currently, some platforms and services exist to allow consumers to automate functions to add convenience to their lives with either voice-activated or fully-automated lights, televisions, and doors.

Future Outlook
In SHaaS, users will pay a monthly subscription for the ability to configure and control comfort "profiles", that control temperature and brightness settings in the home, automatically adjusting throughout the day.

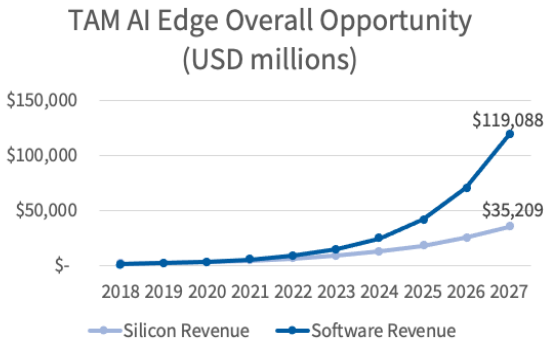
Ecosystem and Device Overview



F4. Recent Study "Artificial Intelligence at the Edge" in August 2018

The market for AI at the edge is large and growing

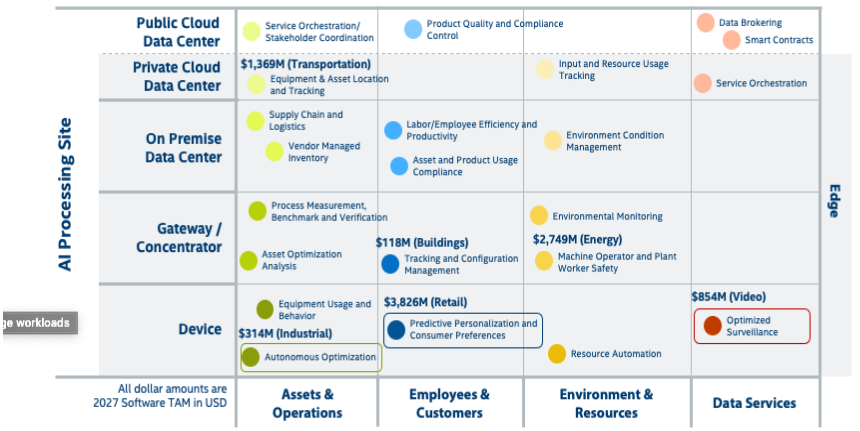
Silicon will grow at a CAGR of 50% while software will grow 64% over the time horizon, indicating that Intel should focus on its core silicon while looking to capture portions of the explosive software growth



TAM By Intel Segment (USD millions)	2018	2023	2027	Relative Mkt Share (Gain/Loss)	CAGR
Energy	$ 312	$ 2,698	$ 16,280	↓	49%
Industrial	$ 257	$ 2,621	$ 17,647	↑	53%
Smart Building	$ 295	$ 2,736	$ 16,184	↓	49%
Gaming & Entertainment	$ 3	$ 81	$ 851	↑	76%
Healthcare	$ 332	$ 2,886	$ 18,609	↓	50%
Office Automation	$ 52	$ 415	$ 2,959	↓	50%
Other	$ 7	$ 55	$ 340	↓	47%
Public Sector	$ 75	$ 841	$ 7,294	↑	58%
Smart Home	$ 387	$ 2,380	$ 11,120	↓	40%
*Video	$ 148	$ 1,203	$ 6,503	↓	46%
Retail Analytics	$ 145	$ 1,443	$ 8,702	↓	51%
Transactional Retail	$ 10	$ 114	$ 991	↑	58%
Visual Retail	$ 115	$ 922	$ 5,702	↓	48%
Transportation - CTL	$ 241	$ 2,232	$ 12,805	↓	49%
Transportation - SDC	$ 83	$ 678	$ 3,409	↓	45%
Transportation - ADAS	$ 90	$ 2,184	$ 24,901	↑	75%

Most valuable use cases are driving edge workloads

Across key verticals, strong areas of opportunity cluster around AI use cases that are best served through edge processing due to the mission- or time-critical nature of the applications



Illustrative Examples:

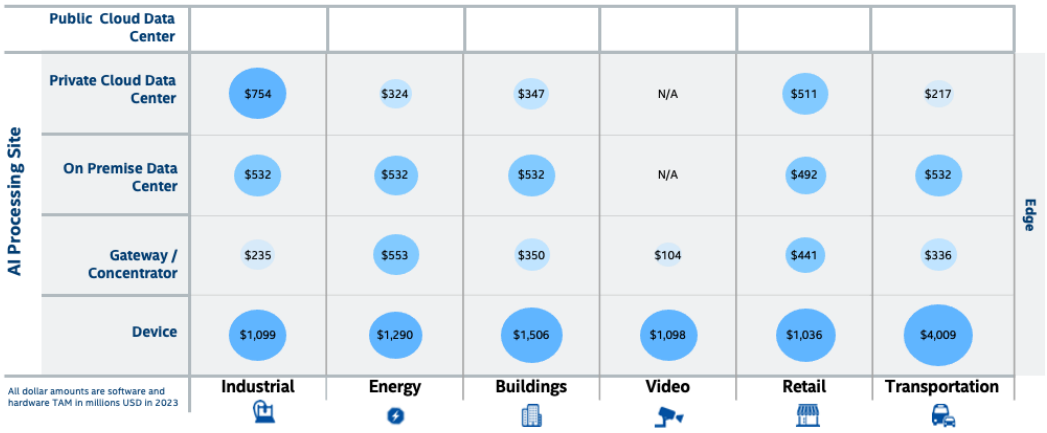
Autonomous optimization algorithms for industrial robots run constantly and require real-time sensory and environmental feedback which is best served through edge processing

In-store retail kiosks and digital signage must respond to customer behaviors in real-time, which is pushing workloads to the edge

Processing **high-fidelity video data across thousands of city security IP cameras** is pushing AI deployments to on the physical camera to avoid pressure on city IT infrastructure

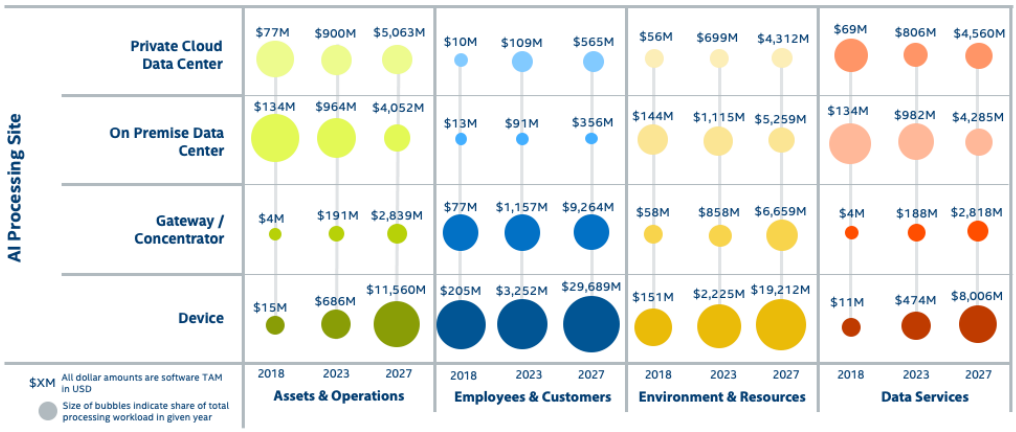
AI revenue opportunities are shifting to the edge

Across key verticals, the share of workload and associated 2023 revenue opportunity of both software and hardware is shifting broadly to edge devices



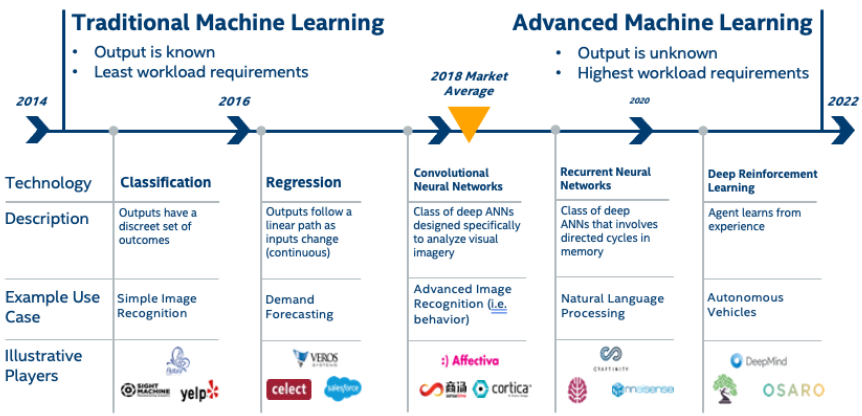
AI application opportunities are shifting to the edge

Across key verticals, the share of workload and associated revenue opportunity of software applications is shifting broadly to edge devices



AI progressing from supervised to unsupervised

Continued advancement in software technologies is pushing the market from where a bulk of players are developing today towards more complex unsupervised machine learning



"Deep learning is going to take over all machine learning algorithms. So, that's very obvious today from where we stand."
– CEO of Jungo Connectivity

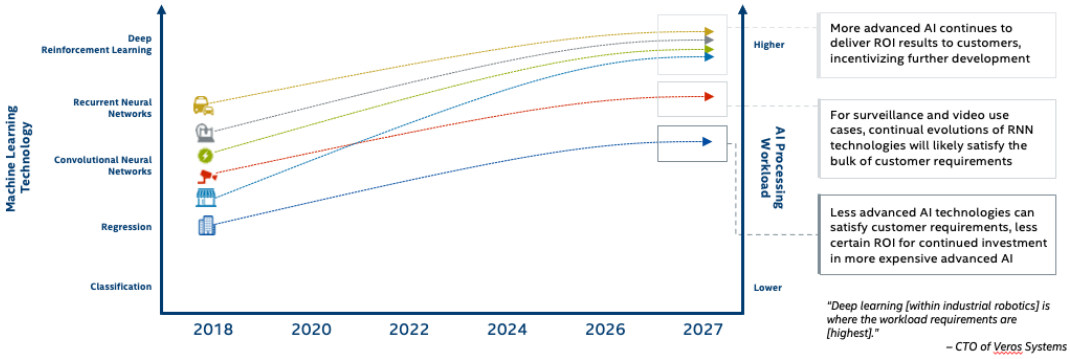
"DRL is at the forefront and one of the newest techniques in the world. I think that there is great potential with DRL when you are talking about real world systems"
– Director at Bonsai

"Sure, convolutional will always wins in imaging, but if you are doing anything outside of computer vision, DRL is an amazing workload and should be in everyone's toolbox."
- CEO at DeepVu

"The next big this is unsupervised learning... I think that the next wave will be this unsupervised learning where you essentially get the model started and it learns on its own as it progresses."
– Director at Neurala

More advanced AI will drive higher workloads

AI processing workloads will increase across all verticals, but will increase most significantly in verticals where more advanced AI technologies can continue to garner ROI for customers



"Deep learning [within industrial robotics] is where the workload requirements are [highest]."
– CTO of Veros Systems

"All of the workload processing that happens relative to automobile control systems happens at the edge, in the vehicle... And that's just going to increase and intensify"
– Head of Data Science at HERE Technologies

Buildings

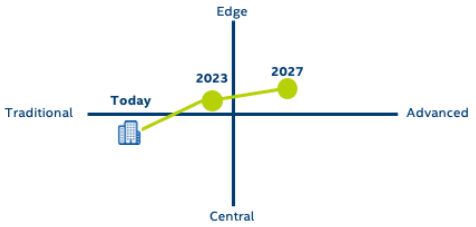
Summary

More conservative in AI adoption than other primary verticals, Buildings currently target AI technologies that optimize energy management

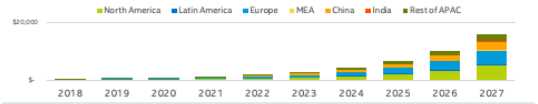
Key Customer Challenges

- AI adoption in Buildings is largely inhibited by a lack of understanding by decision makers of the beneficial impact that AI technologies have on optimizing their buildings' energy management
- Facility managers often lack the technical skill-set to understand how AI/ML technologies can integrate and enhance building equipment and systems.
- Many older buildings do not have the requisite infrastructure to be able to benefit from AI-based technologies

AI Tech Maturity & Processing Location



AI Edge Opportunity & Focus Areas



Top Use Cases

- Energy Management Optimization
- Consumer-Preferred Environments
- Predictive & Preventative Maintenance

Key Devices

- EMS
- BMS
- Lighting Control System
- HVAC
- Fire & Safety
- Security & Access

TAM Revenue Opportunity

	Silicon	Software
2018	$155 M	$140 M
2023	$1,280 M	$1,456 M
2027	$6,150 M	$10,033 M

Key Players

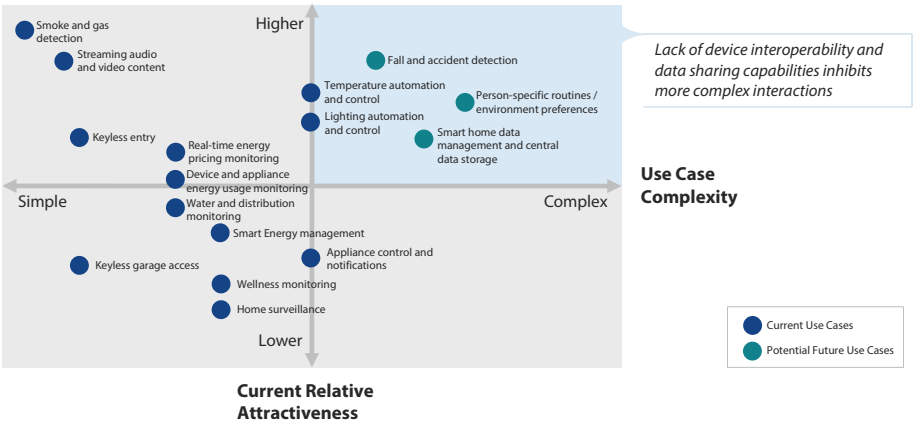
Hardware: Johnson Controls, Schneider Electric, Honeywell

Software: PointGrab, VERDIGRIS, enlighted, stem

F5. Smart Home Developer Kit Opportunity Assessment – Selected Slides Below

End Customer Smart Home Use Cases – Today's Map

Today's top use cases are fairly simplistic in terms of the complexity of the interactions between devices. In the future, as customers desire applications demanding more complex interactions between devices, interoperability will be paramount



Source: Harbor Research Smart Home and Buildings Occupant Data

6

Client April 2017 | Harbor Research

Key Findings – Smart Home HDK Market Opportunity

[Client] should tailor its HDKs to meet the feature requirements of the top smart home use cases, and position the HDKs towards large home product OEMs

Recommendation:

Competition

- **The most popular HDKs on the market aren't targeted towards any specific IoT application**, but the few that are targeted at smart home applications tend to target a variety of smart home use cases
- **Most HDKs are modular**, meaning that they either come with few or no embedded sensors and the ability to add additional sensors depending on the use case

Position the HDK as smart home specific, with a combination of embedded sensors and ability to add sensors as needed

Product Positioning

- The most enthusiastic developers for smart home HDKs are **developers at large home product OEMs** (i.e. Jenn Air, Maytag)
- **Developers generally use HDKs to stand up prototypes** to show to stakeholders, not to use in production
- **Prices of HDKs span from $10 to $300**, with an increase in complexity and application specificity directly correlating with an increase in price

- Position the product towards large-scale deployments of connected devices from home product OEMs, touting Intel's ability to scale custom, high performance chip sets
- Pricing should be around $250 for voice-only, and around $350 for voice and camera

Market Demographics

- The size of the addressable market of smart devices that could be developed with an HDK is large, with the device base of top use cases in smoke detection, lighting, and appliance control **expected to grow by 20-40% over the next 3 years**
- Developers see HDKs as cheap, flexible, and easy ways to stand up connected prototypes without having to acquire or develop the talent and skills necessary

Addressable Smart Home Devices Shipping in 2017: **336 M**

Target specific home product OEMs through identifying:

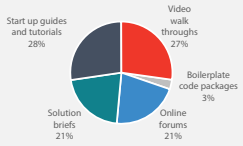
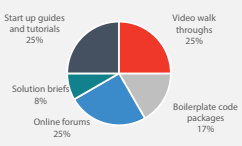
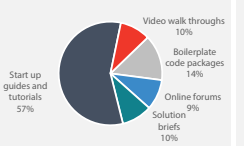
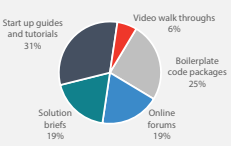
- Top device segment growth rates
- Maturity of company's connected device capabilities
- Potential device install base

5

Client April 2017 | Harbor Research

‘Best in Class’ Hardware Development Kits

Survey findings regarding the hardware, software, and support features that different developers are looking for highlight the most potent combination of functionality for [Client’s] development kits

	Developing a Smart Home Device – 89% of Responses		**Not Developing a Smart Home Device – 11% of Responses**	
	Used an HDK	Did not use an HDK	Would use an HDK	Would not use an HDK
Sensors				
Location	• GPS	• Motion Detector	• Motion Detector	• GPS
Visual	• LED as Light	• **Standard Camera**	• **Standard Camera**	• LED as Light
Audio	• **1 Microphone**	• **1 Microphone**	• **1 Microphone**	• **1 Microphone**
Tactile	• Temperature	• Temperature	• Temperature	• Temperature
Health	• Body Temperature	• Body Temperature	• Blood Pressure	• Blood Pressure
Connectivity	1. Wi-Fi 2. Cellular 4G/LTE	1. Wi-Fi 2. Bluetooth	1. Wi-Fi 2. Bluetooth	1. Wi-Fi 2. Bluetooth
Platforms	1. Google Home **2. Amazon Alexa**	1. Google Home **2. Amazon Alexa**	1. Google Home **2. Amazon Alexa**	1. Google Home **2. Amazon Alexa**
Voice Algorithms	**1. Amazon Alexa** 2. Apple HomeKit	**1. Amazon Alexa** 2. Microsoft Cortana	**1. Amazon Alexa** 2. Apple HomeKit	**1. Amazon Alexa** 2. Microsoft Cortana
Operating System	• Windows 10	• Windows 10	• Linux	• Windows 10 / Linux
Additional Library	• Sensor Aggregation	• Intercom / Monitoring	• Biometric	• Sensor Aggregation
Support				

Survey data based on responses from 310 hardware and software developers.

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End Customer Smart Home Use Cases – Addressable Device Market

Analyzing which smart home devices associated with top use cases are forecasted to grow fastest offers Intel a clear perspective into which features they should prioritize in their hardware development kits

	[1]Top Use Case Ranking:	Connected Device(s) Required:	[2]Connected Devices Shipped 2017:	[2]Connected Devices Shipped 2020:	[2]2017 – 2020 Shipped Device CAGR:
1	**Smoke and carbon monoxide detection**	• Smoke detector • Gas detector	• 90.64 million • 5.86 million	• 252.34 million • 16.32 million	41%
2	**Streaming audio and video content**	• Televisions & Sound Systems	• 279.43 million	• 450.70 million	17%
3	**Temperature automation and control**	• Thermostat	• 174.04 million	• 299.35 million	20%
4	**Lighting automation and control**	• Light bulb • Switches • Lamps	• 44.18 million	• 96.19 million	30%
5	**Keyless door entry**	• Door lock • Video intercom	• 1.37 million	• 2.99 million	30%
6	**Real-time energy pricing monitoring**	• Energy meter display	• 289.69 million	• 316.88 million	8%
7	**Device and appliance energy usage monitoring**	• Kitchen: oven, fridge, coffeemaker… • Bath: shower, pipes, water heater	• 5.54 million • 14.40 million	• 11.85 million • 31.36 million	29%
8	**Water and air distribution monitoring**	• (Gas and) Water meters • HVAC Units	• 289.69 million • 39.68 million	• 361.88 million • 86.39 million	11%
9	**Smart Energy management**	• Energy meter display	• 289.69 million	• 316.88 million	8%
10	**Appliances control and notifications**	• Kitchen: oven, fridge, coffeemaker… • Bath: shower, pipes, water heater	• 5.54 million • 14.40 million	• 11.85 million • 31.36 million	29%

[2]Overall Connected Device Growth from 2017 – 2020:

25%

[2]New Connected Device Types from 2016 – 2017:

35

Sources: [1]Harbor Research Smart Home and Buildings Occupant Data
[2]Harbor Research Smart Systems Forecast Model

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Future Roadmap and HDK Implications

Increasing device-level processing demands create a silicon opportunity in a wide array of connected home products. Prioritizing communications, data interoperability and flexibility will differentiate [Client's] HDKs

Smart Home Roadmap	Implications for [Client]
Hub-and-Spoke Ecosystems: Ecosystems are forming around popular home platforms with artificially intelligent "digital assistants", most notably Amazon's Alexa among others **A La Carte Platforms and Assistants:** Interestingly, developers are generally not motivated to use both the platform and voice assistant from the same brand	[Client] should develop HDKs capable of interacting with a broad suite of home hub platforms and position custom chips for commercial production of devices capable of integrating with any of the top platforms and assistants
No Interface is the Best Interface. Ultimately, home automation must focus on removing occupant interactions and moving device and system operational decisions to the background of users' lives to create maximal value with minimal user effort • In this vein, "intuitive interactions" are a stepping stone to "no interactions"	[Client] HDKs and custom chips should prioritize not only communications standards but data collection and formatting standards that focus on machine-readable data to facilitate collective awareness by local devices
True Interoperability. Device data will be shared among devices via peer-to-peer communications channels, enabling devices to locally coordinate actions to meet programmed or learned occupant preferences. Devices will filter and process relevant information internally, utilizing but not relying upon remote servers to reduce transmission costs and achieve a level of resiliency not feasible today	[Client] should leverage processing capabilities of chips as a market differentiator for product developers looking to position their devices as non-cloud dependent as growing awareness of the risks associated with reliance on remote servers becomes clearer

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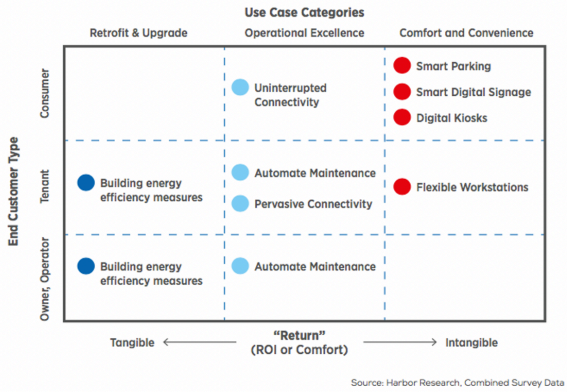
Client
April 2017 | Harbor Research

F6. CABA 2018 Landmark Research on Intelligent Building Monetization (select outputs below)

Use Case Categories Impact Owner / Operator Decision-Making

- **Retrofit & Upgrade:** Use cases included in this category include those that are predominately energy management related and that have very tangible metrics for measuring the expected return on investment
- **Operational Excellence:** Use cases that still have quantifiable returns but are less tangible than retrofit and upgrade use cases.
- **Comfort and Convenience:** Use cases that don't have objective or clear measures of return for the stakeholder



Source: Harbor Research, Combined Survey Data

Example: *Retail store customers desire interactive digital signage to enhance their user experience, pushing retail store owners/operators to choose less tangible ROI solutions in hopes that ROI is made up in customer loyalty or other qualitative metrics*

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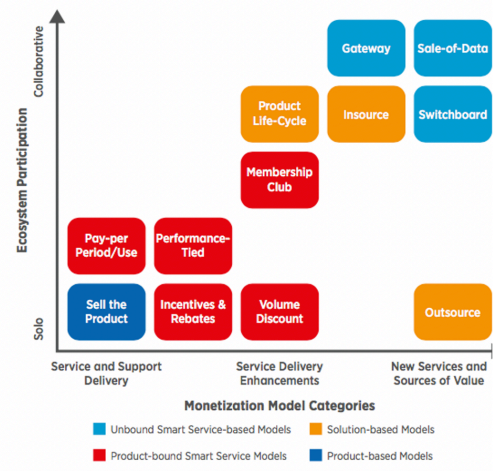
Top Use Cases Aligned with Player Types Result in Monetization Model Alignment



Unbound Smart Service:
Device serves as the point of access to other services which are less automated, or which are not sold directly to the device's end-user.

Solution-based Smart Service:
Made possible by customer activity chains that have a total value far in excess of the purchase price of the device.

Product-bound:
Revenue is collected not simply for the product, but, in some way, for the associated service.

Product-based:
The embedding of connectivity into the product does not open a great opportunity for selling value-adding services. For these companies, the only revenue model is the same old one, the "one-time transaction" model.

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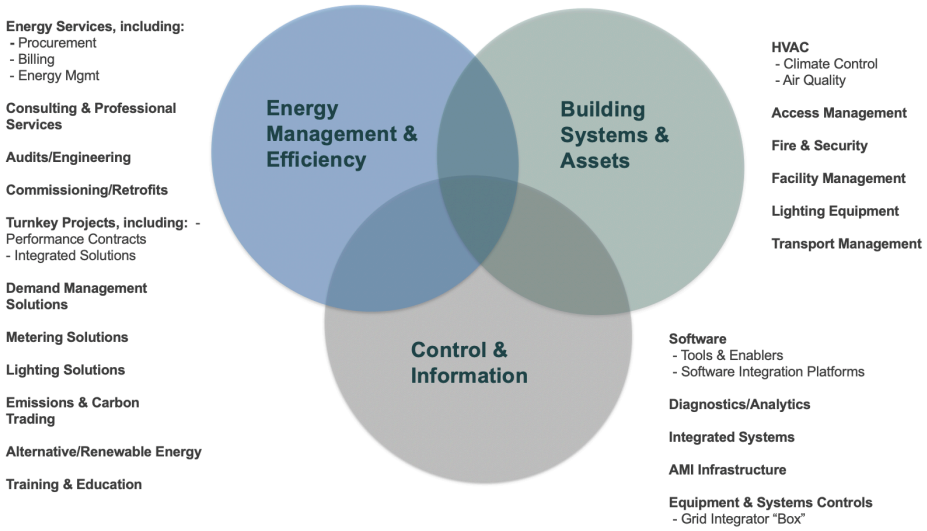
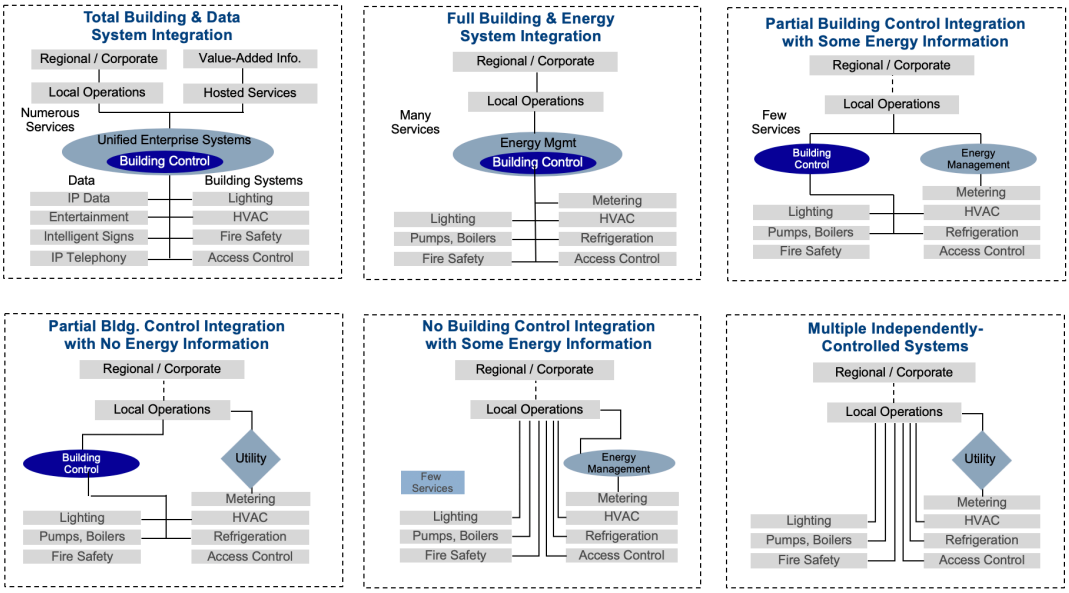
F7. Intelligent Buildings Opportunity Assessment (select outputs below)

Building, Energy Information & Control Convergence …Some Day



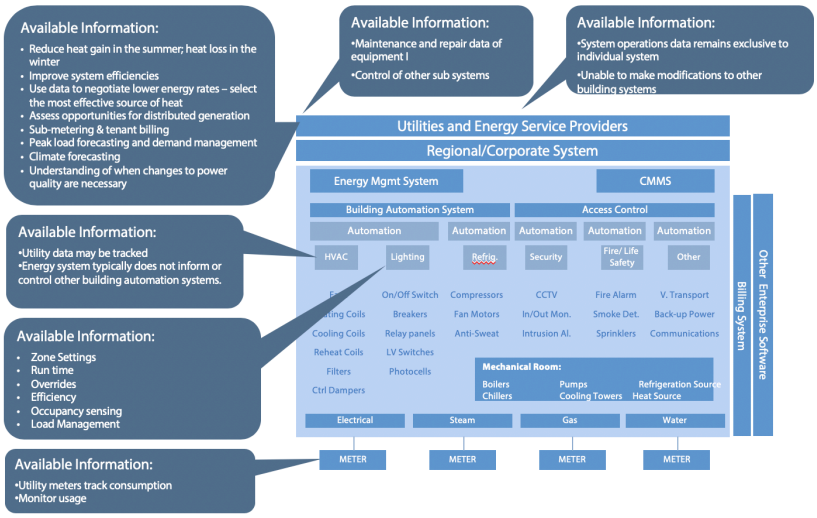
Customer Integration Demands Vary Widely



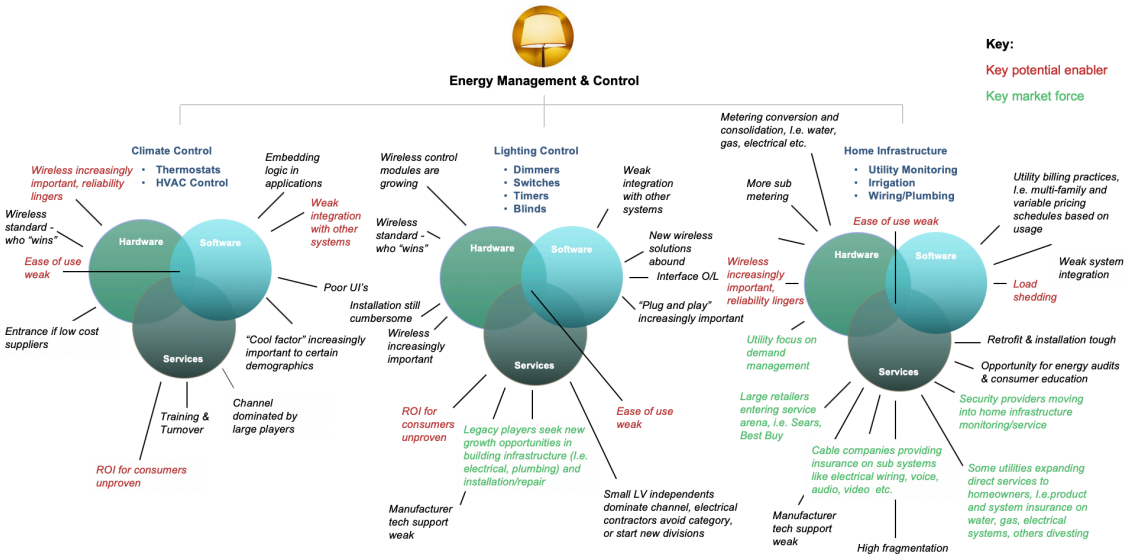
Evolution of Building Information Systems

While there are integrators and system suppliers that can integrate disparate facility & energy solutions …….. few understand how to optimize energy usage and costs…

Synthesizing **and** acting on the available information is key!



Illustrative Framing of Forces and Trends



Illustrative "Personas" and Behaviors Are Key To Needs & Usage

	Tech-Focused	**Security-Driven**	**Hassle-Free/ Service-Centric**	**Cost-Driven**
	Strongest needs are ensuring comfort and lifestyle through attractive appliances no matter the cost	Ensuring no service interruptions is a top concern along with cost concerns. Also care significantly about physical and cyber security	Want high degree of service and minimal hassle in choosing, operating and configuring systems	Highly motivated to reduce costs of bills and appliances –want high degree of control to ensure goals are met
Usage Goal	• **Comfort and Convenience**	• **Balance of comfort and cost**	• **Convenience and Cost**	• **Cost**
Device Profile	• **High tech home**	• **Time saving appliances**	• **Minimalist**	• **Time saving appliances**
Buying Behavior				
Price Sensitivity	• Low	• Medium	• Low	• Low
Interest in Technology	• High	• Medium	• Medium	• Low
Security Concerns	• Medium	• High	• Low	• Low
Care about Energy & Environmental Impacts	• Medium	• Low	• Low	• Medium

Ecosystem Opportunities and Challenges