Smart Home and Project Connected Home over IP

Final Version

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Smart Home Market: a huge opportunity

- Smart Home is the second largest market in the TMT Industry after wireless data
- Expected to reach $150B in 2023 from $100B in 2019 (11% CAGR)
- Geography split: North America (40%), APAC (30%) and EU (20%)
- Larger than other major consumer digital segments: OTT Video, Digital Music, Digital Games, Pay TV
- Revenue split: 70% from devices and 30% from services

Smart Home market segments 1/3

➢ Security and Safety:

- IP Cameras (indoor/outdoor/doorbell)
- Sensor (doors/windows)
- Smart locks

- Interest is high for such solution but does not translate today into significant sales
- Professional Home Security market is very robust and mature market with large incumbents like ADT, Honeywell, Bosch, Schneider Electric
- Incumbents have been able to protect their $45B/year business against upcoming smart home security providers.
- **Penetration of devices in the US: 7.1% (McKinsey Connected Home Study)**

Smart Home market segments 2/3

➢ Utilities Management

- Thermostat
- Lights (Switch and bulbs)
- Power outlets
- Various sensors for leak detections (water, gas)

- Consumers understand the benefits around managing energy consumption, but market demand remains low
- Consumer willingness to pay not as high as current market premiums of such solutions
- **Penetration of devices in the US: 5.3% (McKinsey Connected Home Study)**

Smart Home market segments 3/3

➢ Smart Appliances

- Kitchen: Cookware, Fridge, Dishwasher
- Laundry room: Washer/Dryer, vacuum cleaner
- Bathroom: smart scale, smart mirrors, connected toothbrush
- Various sensors for leak detection (water, gaz)

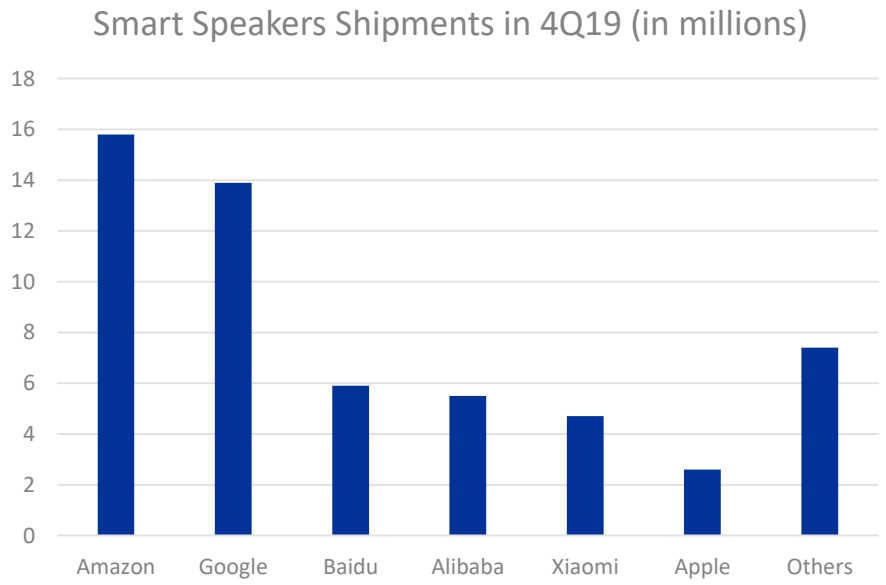
- Very early stage market.
- Examples: Thermostat that learn how warm you like the house when you wake up; Fridge let's you know when you are running out of milk; vacuums that do the floor cleaning for you.
- **Penetration of devices in the US: 1.8% (McKinsey Connected Home Study)**

Current smart home market key take aways

- The smart home market, except for smart speakers, remains stuck in the early adopter phase of the product life cycle.
- Market is very fragmented with inconsistent performance
- Many competing technologies which are mostly incompatible
- Customers struggle with what choice to make when choosing a product and it creates a lot of frustrations

Smart Speakers: becoming the Smart Home hub

- Only true smart home mass market device: 147 million units sold in 2019 (+70% vs, 2018)
- Smart Speakers coupled with AI-Assistants are rapidly becoming the smart home hub from where you can control all your connected devices with a simple voice command
- Amazon's Echo Dot is the leader with 25% market share in 2019. Google Nest speakers 20% and Apple's Homepod 4% market share.
- Chinese vendors remain dominant in China: Baidu, Alibaba and Xiaomi
- Other AI Assistants include: Samsung Bixby, Microsoft Cortana, Telefonica's Aura (leader in Spain).



Source: Strategy Analytics

➢ **Smart Speakers bring AI into the home positioning tech giants at the cornerstone of the future smart home market**

AI-assistants

- Application program that understand natural language voice commands and complete tasks for the user.
- Smart conversational AI is becoming the preferred UI for smart home
- Besides controlling the smart home devices through voice, AI-Assistants can provide a wide variety of services: provide weather, facts from the web, set an alarm or a time, make to-do lists or shopping lists, play music from streaming services (ex: Spotify/Pandora/apple/Amazon) or radio stations, read audio books, play video, TV shows, movies from streaming services (Ex: Netflix/Amazon Video).

AI-assistants	Apple Siri	Amazon Alexa	Google Assistant
Wake-up word	" Hey Siri"	"Alexa,..."	"OK Google, Hey Google,...)
Number of smart home devices supported	450	100,000	10,000
Number of unique brands	50-100	9,500	1,600
Number of Language supported	21	8	30
Number of devices deployed running the assistant	500 million	100 million	1 billion+
Monthly unique users	375 million	40 million	500 million
Presence on US Smart Speakers	6%	24%	70%
Presence on global Smart Speakers	4%	25%	20%

Recent market trends for smart speakers

- AI-assistants are being increasingly integrated into third party speaker devices. Category leaders for Bluetooth Speakers (Bose, Logitech, JBL,…) are now able to compete head-to-head with Amazon and Google devices.
- At the same time, Multiple AI-assistant are being integrated on the same speaker and used interchangeably (example: Sonos One speaker with Alexa and Google Assistant)

➢ Differentiation will be less through devices and more through AI-based services

➢ Large potential for future AI-based services based on personalization: face recognition, emotion/mood recognition, AI assistant acting as a friend, health monitoring, help to manage household bills,etc…

Summary smart home communication protocols

Smart Home Alliances					
	Zigbee	Z-Wave	Thread	802.11ah/ax	Bluetooth 5/Mesh
Year of creation	1998	1999	2016	2017	2017
Frequency Band	2.4GHz	908MHz	2.4GHz	900MHz/2.4GHz	2.4GHz
PHY/MAC Radio	IEEE 802.15.14	ITU-TG.9959	IEEE 802.15.4	802.11.ah	LE 1M/2M/Coded
Network/Transport Layer	Zigbee PRO	Proprietary	UDP/ IP - IPv6	IP Compatible	Proprietary
Application Layer	Proprietary (Dotdot)	Proprietary	Agnostic	Proprietary	Proprietary
Architecture	Mesh	Mesh	Mesh	Star/Mesh	Mesh
IP Based	no	no	yes	yes	no
Bandwidth	250Kbps	9.6/40Kbps	250Kbps	>100Mbps	1-5Mbps
Range	10m	30m	30m	30m (indoor)	10m
Target Markets	Smart home	Smart Home	Smart Home	Smart Home/ Factory	Smart Home/Factory
Radio Chipset vendors ecosystem	Silicon Labs, Qorvo, NXP, TI. Combo ZigBee/BLE: Qualcomm, Nordic, redpine	Single Source: Silicon Labs	Silicon Labs, Qorvo, NXP, TI, Qualcomm, Nordic, redpine	Lots of vendors offer a combo chip WiFi/BLE	Lots of vendors offer a combo chip WiFi/BLE

Existing Smart Home situation is a challenge !

- Numerous technologies for wireless connectivity at all levels of the network stack
- Each major platform provider (Amazon, Apple and Google) have implemented different approaches that are incompatible
- Device manufacturers and application developers incurs significant cost and overhead as they have to choose which platform to work with.
- Consumers struggle with what choice to make when purchasing a smart home product. Fragmentation, inconsistent performance and interoperability issues creates lots of frustration

➢ Does not benefit consumers and not conducive to optimal market growth

What is Project Connected Home over IP ?

- Project CHIP was announced in December 2019 in a joint release by Amazon, Apple, Google, and the Zigbee Alliance
- It is a new working group within the Zigbee Alliance that is committed to create a new universal application layer for the smart home ecosystem
- An open-source approach with a royalty free standard to increase compatibility among smart home products with security as a fundamental design tenet
- It is built on IP and designed to enable smart home devices, mobile apps and cloud services to communicate seamlessly
- The goal is to unify and possibly in time replace homegrown application layers like Amazon’s Alexa Home, Apple’s Homekit, Google’s Weave or Dotdot for the Zigbee Alliance.

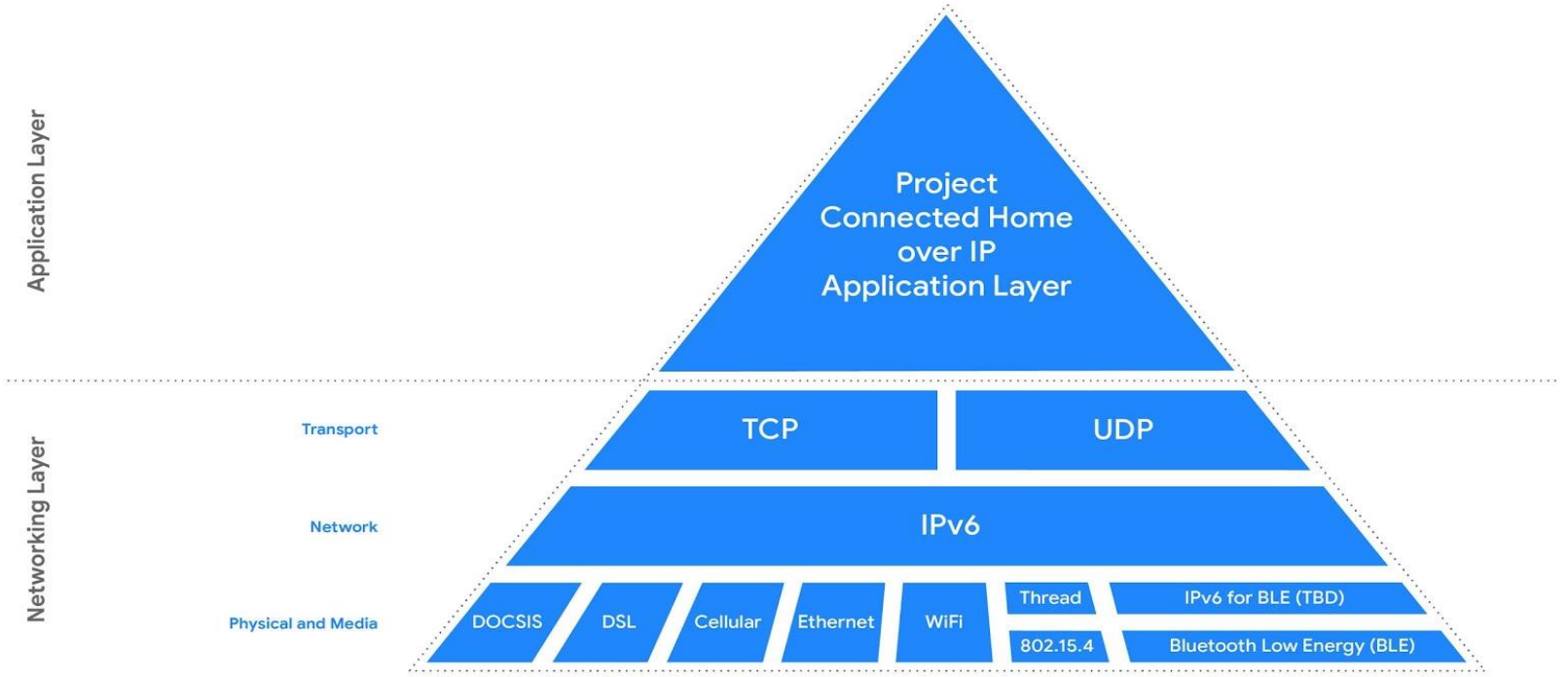
What are the benefits of CHIP ?

Project CHIP is expected to bring the following benefits to the Smart Home ecosystem (device manufacturers, application developers and consumers).

- Unified product out of the box experience
- The goal is to have a platform and ecosystem agnostic technology (any device, any ecosystem): the consumer device of choice will work in their home with the ability to do setup and control from their preferred system.
- Use of IPv6 for scalability. Each device will have its own IP address and able to connect directly with standardized networking equipment.
- CHIP will make it easier for developer to build a device that is compatible with most smart home services such as Amazon Alexa, Apple Siri and Google Assistant and others
- CHIP will create a unified data model for the rest of the industry to possibly adopt

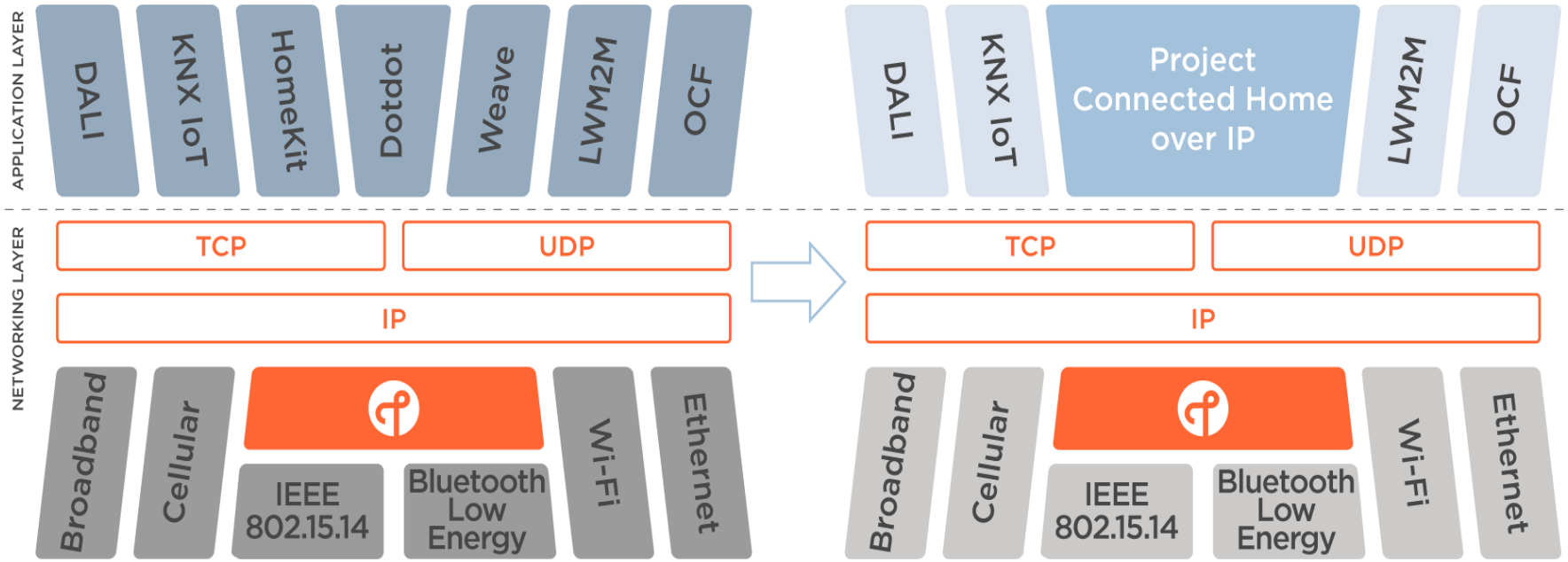
Companies participating in the Project Connected Home over IP (CHIP)

Where is CHIP in the OSI model ?



Source: Google Developers

Thread and Project CHIP



Source: The Thread Group

Smart Home in 2023 if CHIP succeeds

- Device manufacturers build single SKU devices that give a plug-and-play experience right out of the box independent from the network and applications used
- Consumers select devices based on features and quality without worrying about network and application compatibility
- Consumers have the choice at any time to use Alexa, Siri, Google Assistant or other compatible applications to control any of their devices. Full portability of AI-Assistants.
- Price of devices drops as manufacturers build fewer SKUs at higher volumes
- Special hubs and gateways are no longer needed since every device is addressable directly through IPv6

Can CHIP standardization efforts succeed ?

- Past standardization efforts to unify the application layer have had little success
- Why is CHIP different ?
  - Backed by a critical mass of very large companies: Amazon, Apple, Google
  - Build on market proven radio protocols (initially 802.15.4/WiFi/IP-based Bluetooth) with a very rich chipset manufacturer ecosystem
  - Based on market proven IPv6/TCP/UDP network and transport protocols
  - Amazon, Apple and Google are officializing a strategic transition to an open ecosystem (open source/royalty free). Putting in common their proprietary application layers (Homekit/Alexa Home/Weave) to build the new universal application layer (yet to be named)

Conclusion

- Smart Home is one of the largest opportunity in the digital consumer market but still in the early adoption stage.
- Smart speaker is the only is mass market device with 30+% penetration rates in the US/Western Europe and becoming the smart home hub quickening the transition to an AI-driven smart home and positioning tech giants like Amazon, Apple and Google at the cornerstone of the smart home market
- Facing increasing competition from multi AI-Assistant smart speakers eating into their device sale, Tech Giants will need to deepen differentiation through AI-services.
- In this context, Project Connected Home over IP aims at unifying the application layer while relying on existing radio technologies (starting with IEEE802.15.4/WiFi/ Bluetooth) and IP protocols at the network and transport layers (IPv6 and TCP/UDP).
- The application Layer is the last frontier that if properly unified through the right protocols & standardizations could remove the last friction for a true mass market adoption of smart home technologies.