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Staking a Claim in the Connected Home: Service Provider Solutions

A Parks Associates Whitepaper Developed for Calix

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Staking a Claim in the Connected Home: Service Provider Solutions

The evolution of the connected home continues to create opportunities for communication service providers.

> **117 million** households in North America have broadband—**87%** market penetration. **76% of broadband households use Wi-Fi as their primary connection technology.**
>
> © Parks Associates

New operator-grade solutions for customer premise equipment (CPE) address critical frustration points for consumers while embedding technology to support new service revenue and differentiation from competitors. However, operators are competing with a growing array of products that are staking a claim in the home with offers of an improved Wi-Fi experience, smart home controls, voice interfaces, and enhanced data privacy and security features.

The winners in this land rush for a claim in the connected home will **control the data**, **capture share of mind**, and **provide a foundation** for long-term revenue growth and share of wallet for years to come.

## Crafting a new approach to operator-grade solutions

In the face of competing offers, consumers continue to rely on operators for the majority of home networking solutions.

As of Q3 2017, more than 61% of U.S. broadband households obtained a home network router through their broadband provider and a similar number obtained an Internet modem.

The hybrid residential gateway — with modem/router — continues to serve the majority of U.S. households, providing operators with the ability to give consumers the ultimate connected home experience. Consumer-class solutions available through retail channels challenge this position by offering features that operators have been slow to implement at scale, but a **comprehensive networking solution that addresses all the potential opportunities has not been introduced.**

Home Network Routers Obtained from Broadband Service Provider

Owners of Networking Routers in U.S. Broadband Households
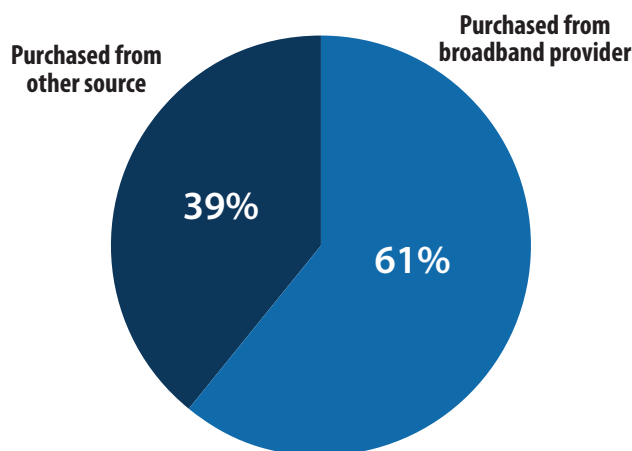
Purchased from other source: 39%

Purchased from broadband provider: 61%

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Operator-grade solutions have the opportunity to rebuff this competition where they can compete on a more comprehensive set of features and deliver the reliability and support that are the hallmark of their service relationship with their customers. **New feature-rich CPEs can differentiate operators by adding value that aids customer acquisition and retention.**

New opportunities exist for trading in a one-size-fits all approach to hardware in favor of introducing tiered gateway solutions designed for customer segments with different home networking requirements.

Raising the Bar for Home Networks

The proliferation of connected home devices has led to an average of 9.1 connected devices per U.S. broadband home.

While some connected entertainment devices, such as DVD/Blu-ray players, have been in decline, new streaming media devices, mobile devices used for streaming media in the home, smart speakers, and smart home products have placed increasing demands on the home network.

> **Currently 26% of U.S. broadband households own at least one smart home device, and annual sales of all connected home devices are projected to increase to 442 million units by 2020.**
>
> © Parks Associates

Overall Smart Home Device Ownership
#### U.S. Broadband Households
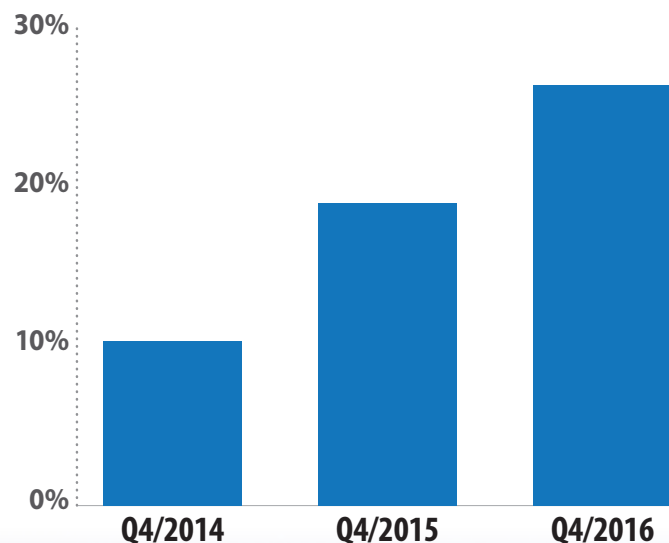
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Many communication providers have been waiting for connected device adoption to reach greater penetration before rolling out hardware optimized to support them, and that day has come.

> **Streaming media habits, in particular, put a strain on home networks—69% of U.S. households subscribe to at least one over-the-top (OTT) streaming media service and many OTT services offer multiple concurrently streaming accounts.**
>
> © Parks Associates
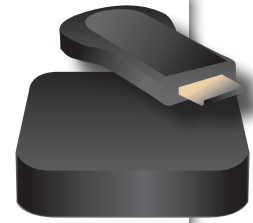
If, for example, a household with five accounts streamed HD video simultaneously, they would require a minimum of 30 Mbps on a sustained basis to provide the optimal viewing experience. According to Akamai, the average connection speed for U.S. homes stands at 18.7 Mbps. Only 48% of homes have speeds above 15 Mbps.[1] Cisco's Visual Networking Index forecasts consumer video-on-demand (VoD) traffic will nearly double by 2021.[2]

Factors Influencing the User Experience

- home architecture
- distance of devices from the router
- bandwidth competition from non-media devices
- fluctuations in the network
- data compression rates from the content source

This rapidly growing installed base of devices creates opportunities for gateway support in three primary areas:

- premium Wi-Fi performance
- universal support for Internet of Things (IoT) devices
- data security from edge to cloud

Premium Wi-Fi performance promises better coverage and less congestion

Parks Associates finds that in the past year, 37% of U.S. broadband households report their Wi-Fi network seems slow. This perception could arise from a number of factors, but perception is reality: **consumers have a need for speed.**
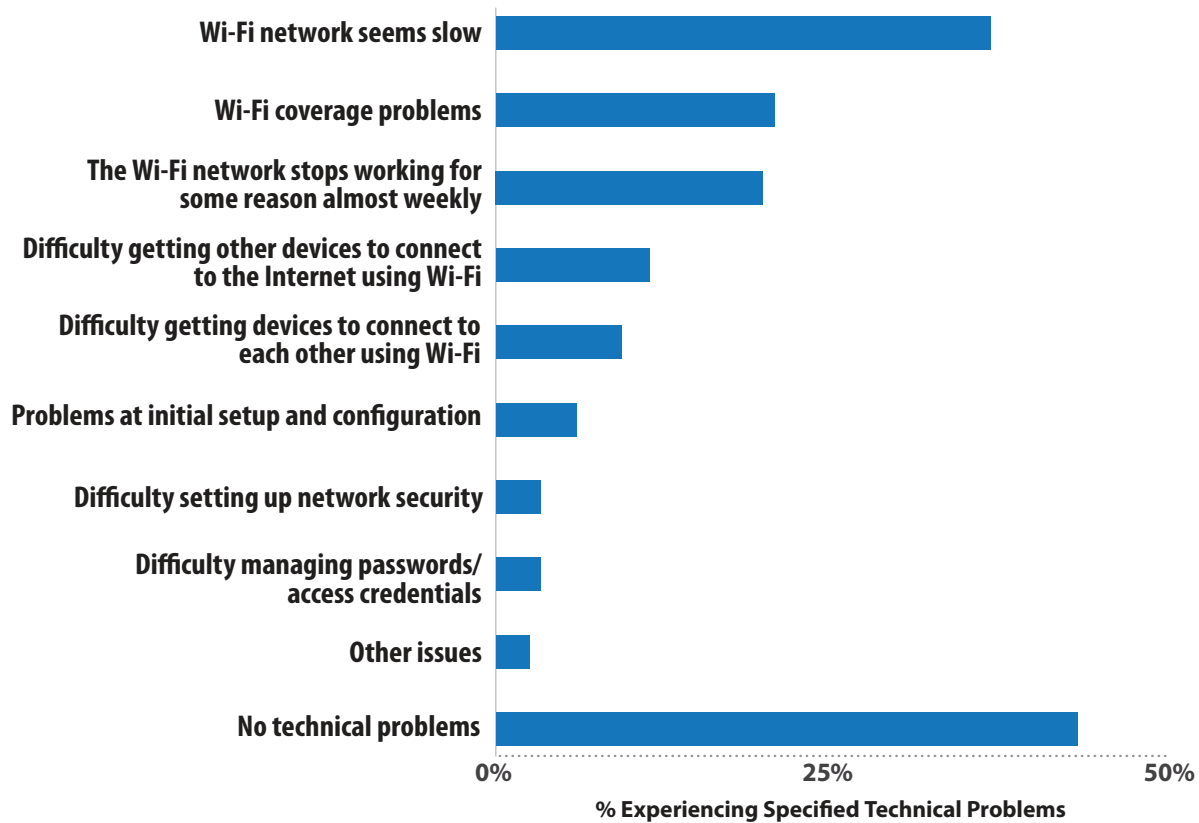
Twenty-percent of broadband households report Wi-Fi coverage problems in the past year and 19% report their Wi-Fi network stops working almost weekly. In the past, range extenders and multiple access points sought to address some of these issues, but each has their drawbacks.

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[1] Akamai, "State of the Internet: Q1 2017 report," https://www.akamai.com/fr/fr/multimedia/documents/state-of-the-internet/q1-2017-state-of-the-internet-connectivity-report.pdf

[2] Cisco Visual Networking Index: Forecast and Methodology, 2016–2021, Updated September 15, 2017, https://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/complete-white-paper-c11-481360.html

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Wi-Fi Network Technical Problems
Among 82% of U.S. Broadband Households Using Wi-Fi at Home

Wi-Fi network seems slow
Wi-Fi coverage problems
The Wi-Fi network stops working for some reason almost weekly
Difficulty getting other devices to connect to the Internet using Wi-Fi
Difficulty getting devices to connect to each other using Wi-Fi
Problems at initial setup and configuration
Difficulty setting up network security
Difficulty managing passwords/access credentials
Other issues
No technical problems

0%   25%   50%

% Experiencing Specified Technical Problems

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Mesh networking router solutions have emerged to address the pain points of coverage, congestion, resiliency, and product design. These devices typically relegate the gateway to pass-through mode. These systems may offer dual- and tri-band architecture to improve coverage and manage traffic congestion without diminishing throughput when connecting multiple nodes. They use a single SSID to provide a more seamless user experience. Improved product design makes the devices suitable for visibility anywhere in the home, rather than hidden under a desk.

While most models support 802.11ac, the latest reference designs coming from manufacturers are upgrading to 802.11ax, with the following benefits:

- Improves overall spectral efficiency that increases user throughput by four times that of 802.11ac

- Provides for longer-range coverage and improved interference reduction for both the 2.4 GHz and 5 GHz bands

- Designed from the ground up to support IoT transmission efficiency and greater power savings

- Built currently to deliver a full 6 Gbps wire rate bandwidth, which in the future may increase up to 10 Gbps.

Support problems in setting up smart home devices on home networks provide another opportunity where service providers can address consumer demands for ease of use.

Consumer Network Troubles

14% reported difficulty connecting smart devices to the router and an equal number reported difficulty configuring settings

32% experienced technical issues resulting in poor device performance

25% experienced trouble getting the wireless network to work for computing and entertainment devices

Among U.S. broadband households

© Parks Associates

Various factors influence user experience challenges, but networking hardware solutions can be enhanced to ease setup.

For example, **voice recognition** can be provided for setup of the SSID or to identify, name, and assign devices to locations in the home. This simple, more natural interface can reduce the friction in setting up IoT devices.

Regardless of where setup problems arise, **13% of households** that have experienced a tech problem contact the broadband, pay-TV, or mobile service provider for help resolving smart home device problems. Premium CPEs can reduce these support calls and increase customer confidence in their communications provider.

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## Universal smart home support positions operators at center of home control

The first generation of smart home control was provided by security and smart home control hubs. More recently, smart speakers with voice assistants offer user interfaces for cloud-based home automation with at least one model, the Amazon Echo Plus, which also includes an embedded Zigbee radio. Verizon's FIOS gateway includes a Zigbee radio, and Comcast's recently introduced XB6 gateway includes support for Zigbee and Bluetooth LE wireless networking protocols. Some reference designs for residential gateways are showing up with what could be termed **universal support for all of the major smart home standards, including Zigbee, Z-Wave, Bluetooth LE, Google Thread, and Apple HomeKit.**

These solutions seek to solve the problem of fragmented networking methods by supporting virtually any device a consumer may choose and removing the need for separate hubs and controllers, at least for basic functionality. **Operators will have to make choices about how tightly to curate, test, and certify compatible products.** Some hardware manufacturers are now pre-certifying interoperability for the most popular smart home products to make this process easier for service providers. Customizable white-labeled apps make it easier than ever for service providers to roll out device bundles around favorite use cases and generate recurring revenue.

> Consumers expect simplified user experiences across multiple interfaces from setup to daily operation, but approximately one-half of smart home device owners experience problems when setting up their devices.

Problems in Setting Up Smart Home Devices (2015-2017)
U.S. Smart Home Device Owners Who Self-Installed Their Devices
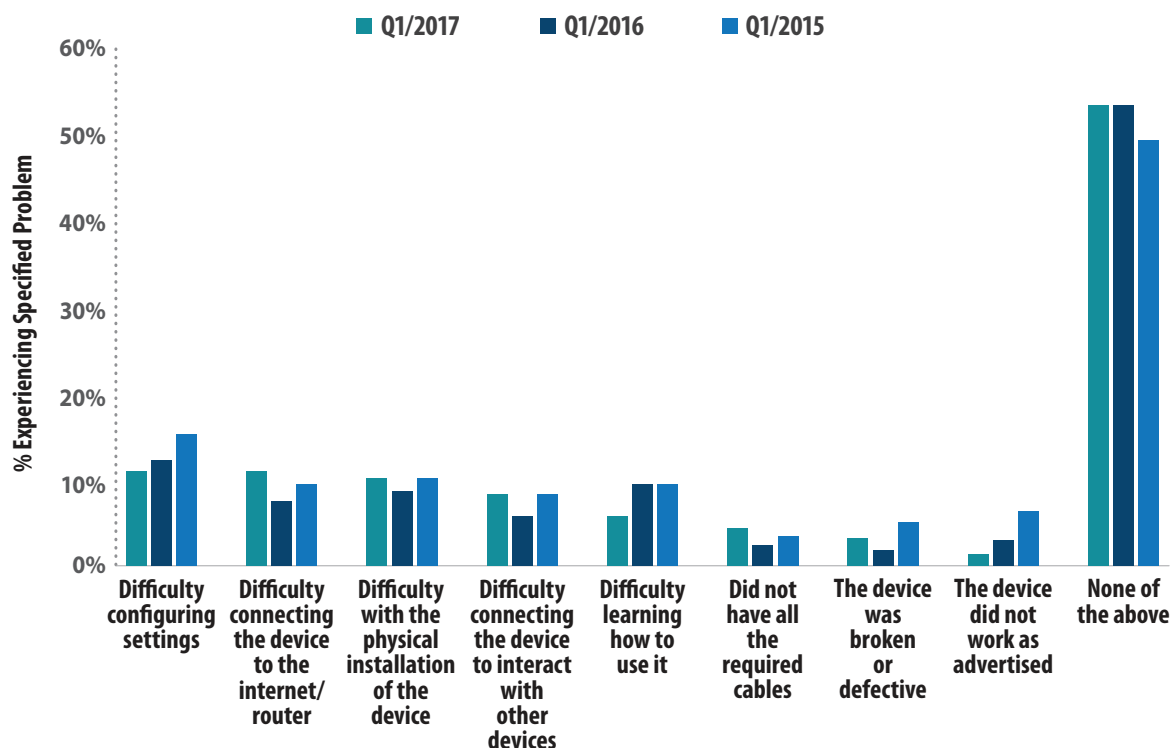
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By supporting interoperability at the gateway level, these new designs offer opportunities to simplify and improve on the user experience. Voice integration will further enable setup and configuration of automation settings.

> ## Operators can become a driver of the connected home market rather than passively providing home networking support for other companies.

CPEs with unified smart home support offer new revenue opportunities for operators for a variety of use cases:

- home security
- safety of loved ones and property
- connected health
- independent living

With IoT device support in the gateway, recurring revenue services can be targeted to carefully defined customer segments as initial beachhead offerings. More devices can be sold direct to consumers, layered on top of the home network, and integrated through a common application.

Data security to the edge can boost consumer confidence and adoption
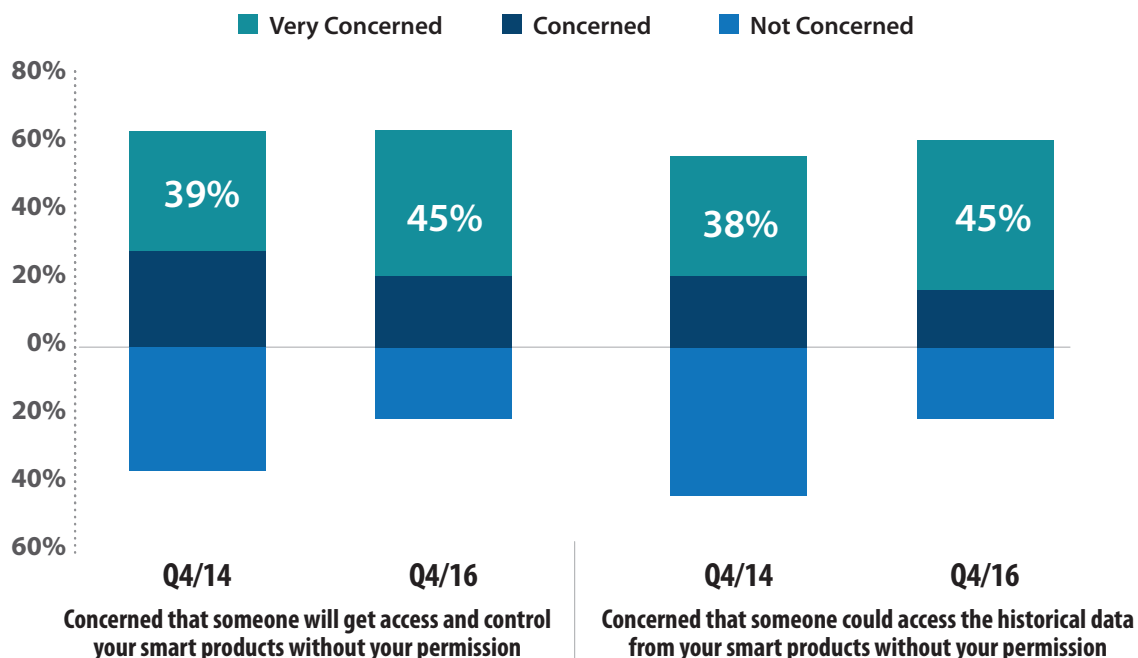
Consumer concerns about data security are rising, creating headwinds for smart home growth. Almost half of consumers are "very concerned" about hackers getting control of devices and accessing data. In the past two years, the share of "very concerned" has increased and the share of "not concerned" has decreased by about half.

> **76%** of broadband households express high levels of concern about security and privacy when using their connected devices.
>
> © Parks Associates

Concerns About Hacking of Smart Products Over Time
U.S. Broadband Households

Legend: ■ Very Concerned ■ Concerned ■ Not Concerned

	Q4/14	Q4/16		Q4/14	Q4/16
Very Concerned	39%	45%		38%	45%

Concerned that someone will get access and control your smart products without your permission

Concerned that someone could access the historical data from your smart products without your permission

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Challenges in securing the home network create opportunities for embedding more vigorous security support that monitors both incoming traffic and the behavior of edge devices that might be infected with malware or compromised in a botnet attack.
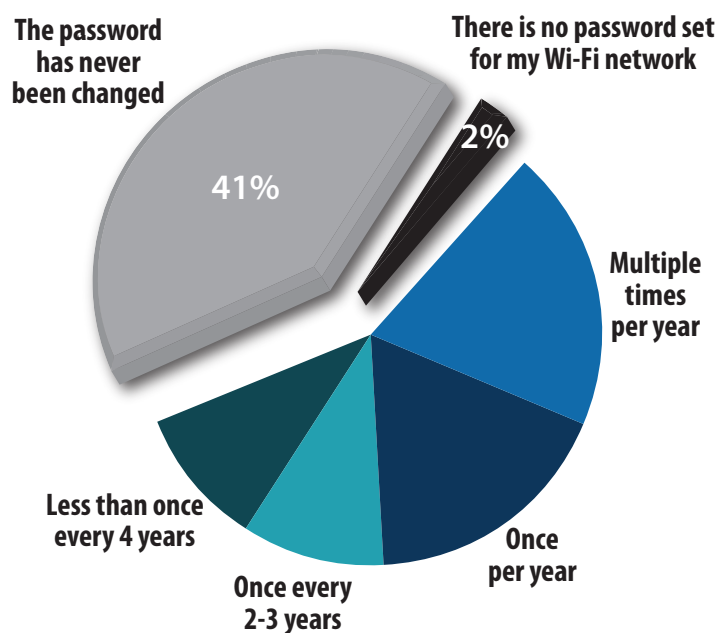
Advanced edge monitoring continually evaluates the security status of devices, quarantines at-risk devices to minimize damage, and notifies the consumer of actions to be taken, such as replacing default credentials with strong passwords.

Some of the latest security features for gateways:

- A challenge-response form of cryptography embedded into the hardware at manufacturing using a physical unclonable function (PUF) making it virtually impossible to duplicate
- Software-enabled Wi-Fi protected setup (WPS) that offers a simplified and secure way for connecting devices to the network
- Deep packet inspection (DPI) that filters incoming content for intrusion detection and prevention
- Vulnerability events detection that analyzes the network activity log to identify vulnerabilities and assesses their risk
- Secure boot that ensures only trusted software can open with the operating system
- Networking anomaly detection that compares edge device activity to known profiles for appropriate networking activity
- URL filtering assesses website trustworthiness by comparing all network traffic to a filtering database that assigns websites to predefined classes that can be handled different ways with granular controls
- Intrusion prevention system (IPS) with signatures of known threats that are updated by a subscription to a cloud database
- Parental controls that provides time, role, and device-based configuration with contextual and meta-data matching

Frequency of Changing a Wi-Fi Network Password

Among 82% of U.S. Broadband Households Using Wi-Fi at Home

The password has never been changed — 41%

There is no password set for my Wi-Fi network — 2%

Multiple times per year

Once per year

Once every 2-3 years

Less than once every 4 years

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41% of U.S. broadband households have never changed their Wi-Fi password. Less than **20%** change the password more than once a year.

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By introducing and emphasizing more rigorous data security features into the gateway, operators can position themselves as guardians of consumer privacy and providers of peace of mind through security updates that mitigate constantly shifting threats.

Hybrid local-cloud solutions can leverage enterprise-level security applications for the home network. This might involve a real-time signature matching service for authentication that can provide real-time virus protection and shield out the latest botnets without requiring any manual updates. Consumer-facing controls can also be introduced to provide visibility into the home network and more granular access controls for children and partitioned access for guests that does not give them access to all devices on the network.

Software defined networking (SDN) platforms enable operators to support, manage and monetize connected homes

Cloud-based SDN platforms provide remote management of home networks to reduce operational costs and increase revenue. They can provide analytics-based automation and optimization, proactive technical support, faster response times, and reduce truck rolls for service calls. With deep visibility into the subscriber's network, operators may be able to resolve issues before the subscriber is even aware of them. With voice integration, subscribers can initiate troubleshooting and reboot of the network without having to navigate with a remote control or contact support via phone or web.

On the revenue side, new orders for services such as increased bandwidth can be initiated by voice and automated in real-time to provide unprecedented speed and convenience for the subscriber. Operators can also proactively offer bandwidth upgrade for a better experience to subscribers that are consistently reaching their bandwidth limit. By applying analytics to big data gathered from the subscriber base, operators have substantial advantages for developing new services and features that are tailored to the subscriber's behavior.

Protecting and expanding the operator's claim

Communication service providers have an established claim in the connected home by virtue of their existing customer relationships, but that claim is by no means secure in today's competitive environment.

If operators want to compete effectively, increase revenue from broadband, and expand their footprint in the home, they will need to add value.

Premium CPE, as described in this whitepaper, offers value-added features that can set operators apart and buck the tide of commoditization.

These premium CPEs enable **operational efficiencies, new revenue opportunities, and the enhanced user experience** that will expedite smart home adoption and capture more value for operators.

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Turn smart home complexity into revenue

Operators must not be content with the role of connectivity supplier, while continuing to bear the burden of support calls for the consumer electronics industry. They must embrace the opportunities associated with the coming wave of IoT devices and, rather than surrendering the hard-won position in the home network, transform their business models.

The Calix Experience Operating System (EXOS) is a carrier-class OS that will empower service providers to go on the offensive and support residential customers now — and business and mobile subscribers in the future — across the full wireless and smart technology experience.

Managing this increasingly complex and chaotic environment is challenging, but EXOS presents operators with a clear opportunity to create significant new revenue sources. Ultimately, with EXOS, operators can evolve from being a connectivity provider to become an experience provider, owning the home and delivering on subscribers' demands for improved support, enhanced security, and a better overall experience.

Want to offer the world's most advanced premises systems?

Consumers have always looked to the consumer electronics industry — not to their service provider — for cutting-edge technology. Not anymore.

EXOS will be implemented in the newly designed Calix EXOS-powered GigaFamily premises systems, made specifically for service providers. The EXOS-powered GigaFamily allows service providers to control the connected experience, removing complexity for subscribers. With built-in support for Alexa (and other voice-activation systems), the EXOS-powered GigaFamily allows for the rapid introduction of new features that take advantage of vast ecosystems of partners.

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About Calix

Calix, Inc. (NYSE: CALX) pioneered Software Defined Access and cloud products focused on access networks and the subscriber. Its portfolio of Intelligent Access systems and software combines AXOS, the revolutionary platform for access, and EXOS, the experience OS, with Calix Cloud, innovative cloud products for network data analytics and subscriber experience assurance. Together, they enable communications service providers to transform their businesses and be the winning service providers of tomorrow. For more information, visit the Calix website at www.calix.com.

Parks Associates is an internationally recognized market research and consulting company specializing in emerging consumer technology products and services.

Founded in 1986, Parks Associates creates research capital for companies ranging from Fortune 500 to small start-ups through market reports, primary studies, consumer research, custom research, workshops, executive conferences, and annual service subscriptions.

The company's expertise includes the Internet of Things (IoT), digital media and platforms, entertainment and gaming, home networks, Internet and television services, digital health, mobile applications and services, support services, consumer apps, advanced advertising, consumer electronics, energy management, and home control systems and security.

For more information, visit **parksassociates.com** or contact us at **972.490.1113** / **info@parksassociates.com**

About The Author

Brad Russell, *Research Director, Connected Home,* **Parks Associates**

Brad Russell explores leading-edge issues in connected consumer electronics, smart home devices and platforms, IoT data privacy and security, and data-driven applications. He has a background in marketing communications, technology startups, and online media. Brad balances the art and science of market research to generate insights that lead to more astute business decision making and value-generating practices.

Brad received his BS degree in advertising and marketing from the University of Texas at Austin. He also earned MDiv and DMin degrees from two leading seminaries with concentrations in ethics and cross-cultural leadership.

INDUSTRY EXPERTISE: Connected Consumer Electronics, Smart Home Devices and Platforms, IoT Data Privacy and Security

Twitter ID: @bradrusselltech