Cisco Prime Home 5.X Overview and Use Cases

New Possibilities in Broadband Deployments

White Paper

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Cisco Prime Home Introduction

Service Provider Challenges

The increasing number of devices connected over the home network continues to compound the complexity associated with the delivery and management of broadband services. Today's subscribers are doing far more than simple browsing, with activities that include content streaming, file sharing, and network printing.

Factors such as the shift from analog video to IP-based set-top boxes, increased consumption of bandwidth, and the convergence of home automation and security over the home network (that is, quad-play services) further complicate this transition. Service providers must also overcome intense competition within the home network market such as increased consumer choice for broadband services (DSL, cable 3G/4G, satellite, fiber, and WiMAX) and the availability of over-the-top services offered from nontraditional providers.

Service providers need to be able to easily manage this diverse array of devices, rapidly troubleshoot and resolve problems, introduce premium services, and help ensure that subscribers actually receive the services and level of service they have paid for. In addition, they must be able to seamlessly deliver and manage services to these devices without increasing operating costs or compromising customer satisfaction.

Rising complexity of the home network presents an opportunity for service providers to offer remote network management capabilities. Subscribers need to be able to easily introduce devices to the network and utilize new service offerings without undue configuration and setup complexity, and they are turning to service providers to help them with this.

With remote network management capabilities, service providers gain visibility into the network beyond the gateway as well as the ability to configure gateway security and firewall capabilities, monitor and control bandwidth, and help ensure reliable and uninterrupted operation of service. Remote network management is implemented on the residential gateway and so is a natural extension of service for broadband providers.

Service providers are finding that to meet this demand, they need new and innovative ways to connect into their users' home networks.

They are looking for a solution that can:

- **Reduce and shorten service calls:** By remotely managing the home network and addressing issues prior to affecting customers, service providers will reduce the frequency and duration of service calls, which in turn will increase customer satisfaction.
- **Improve Internet Protocol Television (IPTV) and voice-over-IP (VoIP) deployments:** Service providers need to easily deploy new voice and video customers, as well as diagnose and troubleshoot common service quality problems.

- **Increase revenue:** Service providers need to roll out new high value data services for home network management.
- **Enhance multivendor device management:** Service providers need to offer their customers flexibility in broadband deployments - without requiring users to procure proprietary gateways or networking devices.

Meeting these challenges requires a technology partner who can provide new and innovative ways to meet these demands and create future opportunities for increased customer satisfaction as well.

Cisco Solution

The number of Internet-enabled devices in the home continues to grow, creating demand for better support and seamless interconnectivity for the consumer. Service providers are now realizing that to meet this demand they need better visibility into the connected home. The Cisco Prime™ Home solution answers this need with consumer applications and a support experience that easily integrates with existing Internet service provider (ISP) environments. The result is significantly lower support costs and higher recurring revenues in a cloud-based applications model.

Service Provider Benefits

Cisco Prime Home allows service providers to operate more efficiently and profitably while satisfying their customers' needs. The solution offers service providers the potential to significantly reduce support call volume and truck rolls, thus optimizing operational expenses (OpEx) and enhancing the subscriber experience. Cisco Prime Home provides the following benefits:

- **Improved customer satisfaction:** Cisco Prime Home helps service providers increase customer satisfaction and retention through:
  - Reduction in home network issues: Service providers will be able to proactively monitor and troubleshoot issues prior to affecting end users.
  - Decreased response times: Service providers will gain the ability to remotely control and respond to customers' customer premises equipment (CPE) issues more quickly.
  - Easy-to-use self-management tools for the consumer.
- **Lower operating expenses:** Cisco Prime Home helps reduce the number of truck rolls and support calls and shortens the average length of support calls.
- **Simplified management:** Cisco Prime Home helps automate home device mass management for reduced administrative overhead.
- **Increased revenue:** With access to the new solutions, service providers can realize new incremental service revenues.
- **Support for better business decisions:** Cisco Prime Home allows proactive analysis and addressing of support issues for new business model creation. Enhanced reporting and analytics capabilities provide the ability to generate customized reports to proactively troubleshoot problems or gain insight into network usage trends.
- **Flexibility to meet customer needs:** Cisco Prime Home provides the ability for service providers to offer multivendor device management.

Solution Overview

Based on the Broadband Forum's TR-069 protocol for provisioning and managing in-home devices, Cisco Prime Home provides a proven, standards-based approach to reducing churn and support costs through troubleshooting of common home networking problems such as Wi-Fi, firewall, and basic broadband connectivity of devices in the home.

The Cisco Prime Home platform provides these capabilities in a way that is easily integrated into service providers' existing systems using web-based application programming interfaces (APIs). Additionally, the Cisco Prime Home platform components have options that will enable a completely new set of revenue-generating advanced services, including:

- **High value subscriber services:** Cisco Prime Home helps enable the quick rollout of high-demand, easy-to-use services that drive customer satisfaction and service provider revenues.
- **Cisco Prime Home Plus:** This is a Cisco® partner program that helps enable third-party CPE partners to deploy enhanced manageability in their devices, creating an extensive choice of device solutions with industry-leading software capabilities.
- **Customer Service Representative (CSR) and consumer portals:** Service providers can proactively manage and maintain gateway and network health with an easy-to-use interface. All gateway software, including firmware, can be remotely upgraded by Cisco Prime Home, without user intervention. The Cisco Prime Home consumer portal offers consumer visibility into the home network and access to a variety of configuration tools and data services. By providing the subscriber with the ability to more easily troubleshoot problems, a majority of support calls are eliminated, helping to drive customer satisfaction and lower churn.

See Table 1. For more information, please see http://www.cisco.com/go/prime-home.

Table 1.   Benefits of Cisco Prime Home Plus Versus Standard TR-069 Access Control Server Capabilities

Functionality	Standard ACS	Cisco Prime Home Plus
TR-069-based device and service provisioning	Yes	Yes
Firmware upgrades	Yes	Yes
CPE data collection	Yes	Yes
Wi-Fi signal strength	No	Yes
Consumer services (for example, parental controls)	No	Yes
Consumer portal, remote access to the home	No	Yes
Bandwidth monitoring of WAN and LAN	No	Yes
Data analytics and bulk operations	No	Yes

In addition to the Cisco Prime Home solution, Cisco offers Cisco Prime Home Plus, a CPE-resident TR-069 client for the managed access market. It incorporates a TR-069 protocol stack, a fully developed TR-098 data model, and a growing list of gateway-resident applications. Cisco Prime Home Plus is now being licensed to other CPE vendors and is available on the Cisco Developer Network.

Cisco Prime Home Plus-enabled CPE helps ensure the highest level of TR-069 compliance providing comprehensive functionality and device manageability with extremely short integration times and low total integration costs.

Solution Components and Use Cases

With Cisco Prime Home, service providers can address the growing requirements of connected home users by offering additional management and expansion capabilities. The components of Cisco Prime Home are described here in detail with sample use cases to demonstrate context and component value.

Cisco Prime Home Analytics

Cisco Prime Home Analytics provides a flexible and reliable way for ISPs to collect, aggregate, view, and export data about their subscribers from any TR-069-enabled CPE. With Cisco Prime Home Analytics, service providers are no longer left guessing about subscriber trends and behavior. The intuitive user interface allows operators to better study the day-to-day changes in the network and in the home and make better business decisions. See the figure at right.

Cisco Prime Home Analytics Use Cases

Aggregated data can be used to study a wide variety of factors, including:

- Managed device trends, including shipment trends during promotions or information about which devices tend to churn more quickly than others. This data is useful when deciding on the value of higher- versus lower-end managed devices. It may also help indicate product longevity, based on an analysis of when gateways first came online in the system.
- Deployment and usage of managed devices by manufacturer, model, and firmware version.
- Uptake of Cisco Prime Home consumer services.
- Device trends in the home, which can be helpful for understanding up-sell potential and the results of targeted sales programs and can be used to design marketing programs. Examples of in-home managed device trends include:
  - Number of LAN devices per subscriber
  - Number of Wi-Fi versus Ethernet devices per subscriber
  - Percentage of subscribers using Wi-Fi security and levels of security
  - Wi-Fi channel use
  - Port forward use
  - Migrations and upgrades

Managed Wi-Fi

Configuring Wi-Fi has historically been challenging for end users. Terms such as Wired Equivalent Privacy (WEP), Service Set Identifier (SSID), hexadecimal, and many others often cause confusion and result in support calls. Many service providers encourage end users to make purchases at retail outlets to satisfy their wireless needs, which results in lost revenue opportunities and a multidevice solution that is less than optimal for both parties. Cisco Prime Home helps enable service providers to access the gateway's wireless configuration remotely using the CSR portal, which significantly reduces support calls and end-user dependencies.

Wi-Fi signal monitoring shows the signal strength for each Wi-Fi device in the home network, which is useful for diagnosing "slow connection" issues in the home. The indicator is based on data measured by an access point that is communicated to Cisco Prime Home, and the readings can be updated in real time to reflect changes in the Wi-Fi network.

Managed Wi-Fi Use Cases

- Immediately diagnose "slow connection" support calls with the Wi-Fi signal strength indicator
- Verify that the SSID and key settings match what the customer thinks they are
- Check encryption type
- Help change channel to improve performance
- Manage subscriber Wi-Fi configurations and offer subscribers in-call training, so that they can better self-manage going forward
- Manage multiple SSIDs from the CSR portal
- Help troubleshoot Wi-Fi-standard-related connection issues and per device throughput issues (which is facilitated through visibility into the wireless standard used per device)

Subscribers also are able to provision their own Wi-Fi connection and access the Wi-Fi SSID and key at any time through the subscriber portal.

Managed Firewall

Gone are the days of searching for port forwarding settings in obscure corners of the Internet. Cisco Prime Home helps enable the most popular multiplayer games, media devices, remote access, and messaging applications to work seamlessly through pull-down menus. Custom-defined port forwarding configurations for advanced users are also supported.

Managed Firewall Use Cases

- Unified Device Manager (UDM) is a feature that uses port forwarding to enable any device on the home or office LAN that has a web interface (such as printers, gaming consoles, surveillance cameras, as well as many others) to be remotely managed. UDM helps enable operators to offer a managed LAN service as part of their overall service offering.
- Enhanced UDM provides one-click setup and access to view local interfaces for LAN devices. Multiple LAN devices can have UDM access configured, and it is accessible from the CSR or consumer portal. Enhanced UDM does not interfere with LAN device login security (and the port and URL path are customizable), and it can be supported with any TR-069 CPE.
- Operators can explain conflicts and how to resolve them.
- Customer support can assist subscribers in managing a firewall through the CSR portal and teach them how to use the consumer portal to do the same.

Cisco Prime Home also allows subscribers to easily configure firewall ports for gaming and other applications without assistance from customer support.

Content Filtering

The content filtering feature is supported by a gateway-resident application included in both Cisco Prime Home Plus CPE and Cisco Prime Home. With content filtering, parents can specify which websites can or cannot be accessed by each device in the home. By simply adding to the list of "allowed" and "blocked" sites through the easy-to-use control panel, parents can help ensure a safer Internet experience for their family. Content filtering can

be enabled or disabled for each device, and default settings can be applied to new devices that appear in the home, creating an added layer of protection. Content filtering settings can be entered either by the CSR in the CSR portal or by the subscriber in the subscriber portal both from inside the home or remotely.

Content Filtering Use Cases
- Dynamic content filtering allows the creation of filter profiles that can be customized globally by the service provider, and users can specify a default profile (for example, kids, young teens, mature teens) for devices.
- Filters can be bypassed using the "Allow List" function, and ISPs can customize the "Blocked Website" page.

Time Blocking
- The time blocking feature is supported by a gateway-resident application included in both Cisco Prime Home Plus CPE and Cisco Prime Home. Time blocking allows subscribers to set Internet daily usage time limits and blackout periods for each LAN device. Settings can be entered either by the CSR in the CSR portal or by the subscriber in the subscriber panel from both inside the home and remotely.

Time Blocking Use Cases
- End users, computers, and gaming consoles can be granted Internet access according to a defined schedule (such as weekdays from 7-9 pm) or according to a specified number of hours on a daily or weekly basis (such as 2 hours per day not to exceed 14 hours per week).
- Time blocking may be configured per device and for the whole home.
- Bonus time may be added by the subscriber to any device or to the whole home.

Subscriber Records (Provisioning Cisco Prime Home)
Cisco Prime Home can be scaled to manage millions of TR-069-enabled devices regardless of WAN interface technology. Upon login the CSR is presented with a list of records (subscriber/device pairs) known to the system. Records can be searched based on complete or partial information, including subscriber name, subscriber code, serial number, IP address, or model number. Wildcards can be used in any of the fields.

Customer Support Portal
Today, when subscribers perceive they have a problem (for example, "My connection is too slow") it is often difficult to discern what is causing the problem. As a result, technical support calls often resemble a game of 20 questions. And, even after a long support call, technicians are often unable to solve problems and must escalate the call to an actual - and expensive - service visit.

Consider the following support scenario: a subscriber calls in with the complaint that video streaming from YouTube is choppy. Typically, this is an open-ended issue that could be caused for any number of reasons such as faulty/damaged wiring, a gateway provisioning error, a virus, contention with other users, or time-of-day network issues. The support team has to ask many questions to narrow down the possibilities and often is left guessing what the issue and its cause might be. This process is time-consuming, costly, and extremely frustrating for subscribers. In many cases, a truck roll is required, leading to equipment replacement and a high probability of no resolution or understanding of why the problem occurred in the first place.

With Cisco Prime Home, agents can quickly assess many characteristics about the home network to narrow down possible root causes. Agents are effectively able to remotely manage the network as if they were in the home. Instead of guessing at possible problem sources, technicians can review real-time and historical statistics to determine root causes and resolve them.

For example, if the problem occurs when Wi-Fi is in use, the agent can see the wireless signal strength for the gateway and endpoint devices such as a PC. This is information the average subscriber may not know or be able to easily access. If signal strength is an issue, the agent can recommend corrective actions such as moving the placement of the gateway or PC or both.

Agents can also determine whether an issue is something that affects the entire network or just a single device. This helps enable agents to eliminate possibilities immediately.

By accessing the CSR portal, advisors can quickly view, identify, and correct subscriber issues. The following figure shows the Customer Support page with summary subscriber, device, WAN/LAN network, and TR-069 status information along with a detailed view of the subscriber's network. The CSR portal maintains important subscriber and device information across the top of the GUI at all times. Operators can see device status and information about the last device check-in.

CSR Portal Use Cases

- The CSR portal provides a clear view of LAN device status, including name, IP address, MAC address, connection status/type, and applied services for each device on the subscriber's network.
- For LAN hosts that provide an HTTP UI, the "Local Interface" link can be enabled to provide a permanent, clickable link for immediate access to the LAN host's UI. This link will be available to CSRs through the CSR portal and to the subscriber through the subscriber portal.
- Wi-Fi signal monitoring shows signal strength for each Wi-Fi device in the home network, which is useful for diagnosing slow connection issues in the home.
- The wireless standards being used are displayed in the CSR portal, allowing operators to help troubleshoot Wi-Fi-standard-related connection issues and per device throughput issues on support calls.

Consumer Portal Features

One of the most effective ways to reduce support calls is to enable subscribers to troubleshoot issues on their own before they call for support. With Cisco Prime Home, the consumer portal offers subscribers the ability to manage their gateway using a web client located anywhere on the Internet. By accessing this portal, subscribers can quickly and easily view attached LAN devices, click into the UI of devices on their LAN, configure their Wi-Fi network, add port forwards, and manage their parental controls settings. See the following figure.

Note: The individual service pages available on the subscriber portal have an identical look and feel to the service pages available to the CSR in the CSR portal.

Consumer Portal Use Cases

- The consumer portal facilitates subscriber self-help access from anywhere, thereby reducing the volume of support calls.
- Subscribers can view attached LAN devices, determine whether they are connected, and view the Wi-Fi signal strength for each device.
- The consumer portal offers the ability to click into the UI of devices on the subscriber's LAN, for example, to view local web interface access of a camera or printer (consumer device click-through).
- The Wi-Fi network may be fully configured from the consumer portal, allowing the subscriber easy access to SSID and wireless key information and thereby reducing the volume of support calls.

- Subscribers can easily set up port forwards and static IP addresses needed for certain applications (for example, games and devices) to securely access the Internet.
- Subscribers can fully manage their parental controls settings from anywhere.
- CSRs can see the same information as the subscriber in the Control Panel - which allows the CSR to "teach" the subscriber to self-manage going forward.
- Service providers may include advertising on the consumer portal.
- It is possible to allow subscribers to enable new services through the consumer portal. For example, whole home parental controls may be made available to subscribers to enable.

Bandwidth Monitor

The bandwidth monitor feature is supported by a gateway-resident application included in Cisco Prime Home Plus CPE and in Cisco Prime Home. The bandwidth monitor (see the following figure) provides service providers and their subscribers with a visual accounting of upstream and downstream traffic for each LAN host and the gateway in aggregate. The CSR can view detailed usage data in the CSR portal and the subscriber can view summary information in the consumer portal.

Bandwidth Monitoring Use Cases

- Bandwidth monitoring allows service providers to immediately diagnose "slow connection" or "poor video streaming" by viewing the LAN-side traffic.
- Bandwidth monitoring provides an easy way to determine if one LAN device is responsible for most of the broadband traffic during different intervals of time.
- LAN devices may be deselected to allow further investigation of specific devices or groups of devices. Only the selected devices will appear, and the graph will automatically rescale.
- WAN-side aggregate information is available to determine if the subscriber is a high bandwidth user.
- Bandwidth monitoring can be used to help diagnose LAN device virus issues. If a virus is transferring continuous or large amounts of traffic, it will be clearly visible in the bandwidth monitor graphical analysis.

- On the LAN side it is possible to view upstream and downstream traffic over specific time intervals. A subscriber issue may be caused by too many devices sending upstream traffic (and therefore causing a poor customer experience).

Service: Captive Portal

The captive portal feature provides automatic browser redirection for LAN devices. When enabled, the subscriber's Internet session will be redirected to a service-provider-maintained web page (walled garden). Multiple captive portals can be structured to meet the service provider's needs. They can be enabled on a per subscriber basis or in a bulk fashion using the Bulk Operations feature.

Captive Portal Use Cases

- Facilitate provisioning processes (set Point-to-Point Protocol [PPP] credentials, establish email addresses, and more).
- Send service alerts and inform the customer his or her bill is past due and redirect the customer to a page to pay the bill with a credit card.
- Detect the devices in the home that have no Wi-Fi security and send the consumer a warning message.
- Detect the Wi-Fi devices that have poor signal strength, and redirect to a page with tips on improving Wi-Fi performance.
- Provide messaging on new marketing offers to specific subscribers.

Service: CPE Local GUI Click-Through

With the support of Cisco Prime Home, access to the gateway's local UI is rarely necessary but, should the need arise, the CPE local GUI click-through feature can be used to temporarily enable WAN HTTP support providing access to the gateway's embedded UI.

Service: LAN Device Click-Through

Cisco Prime Home offers an easy to manage interface for extending the administrative interfaces on unmanaged LAN devices in the home. The LAN device click-through feature provides the consumer with one-click setup and access to view local interfaces for LAN devices. This service is accessible from both the consumer and CSR portals.

LAN Device Click-Through Use Cases

- Extend one-click device management to consumers for web cameras, NAS servers, and other devices that have a local administrative UI.
- Make available a "White Glove" support offering that allows customers to purchase premium support for the service provider to manage home devices.

Replace Device (Automated RMA)

In the event of gateway failure the Replace Device feature can be used to rapidly transfer the failed device's configuration to the replacement device. Once connected, the subscriber's complete configuration will be copied to the new device by selecting it from the list of unassociated gateways (gateways not belonging to a subscriber) and then clicking the Copy Settings button.

Update Firmware

Cisco Prime Home makes updating a device's firmware a simple task. Select the desired firmware from a list of valid firmware images for the target device and queue the operation.

Update Firmware Use Case

- Firmware can be updated one device at a time, but typically firmware updates will be executed against an entire class of devices all at once using a bulk operation.

Bulk Operations

Cisco Prime Home provides the ability to execute bulk operations on a group of devices defined by a set of filter criteria. Cisco Prime Home Analytics can be used to filter the set of devices on which the bulk operation should execute.

Bulk Operations Use Cases

- Trigger firmware updates for all subscribers with device **x** and firmware version less than **y**.
- Globally update the gateways' TR-069 inform interval.
- Set the captive portal URLs to advertise enhanced service packages to high-bandwidth subscribers.
- Set the captive portal URLs to inform subscribers with unsecured Wi-Fi networks of the importance of Wi-Fi security and link them to the subscriber panel to set their own Wi-Fi settings.
- Modify the inform interval of a subset of devices; for example, for all CPE that has been online for 60 days, lower the inform interval to 72 hours to lessen network traffic.
- Modify device settings on the CPE; for example, change a wireless channel to "auto" for devices that are experiencing poor Wi-Fi performance or are stuck on a specific channel.
- Enable a new service to appear in the consumer portal for subscribers' trial use.
- Change TR-069 parameters such as the Access Control Server (ACS) URL and SSL on/off.

Bulk operations can be scheduled to execute during specified time windows and days of the week and can be triggered once or repeated weekly or monthly. Operations can actively solicit gateways or passively wait for a check-in before performing the action.

Summary

Cisco Prime Home helps enable remote management of every device on the home network from a single platform and provides in-depth and automated control of complex devices, allowing service providers to reliably offer innovative services that might be otherwise too difficult for users to configure.

Traditionally, visibility into the home network has stopped at the residential gateway. Small Network Management Protocol (SNMP) functionality might be available for upgrading, but otherwise, visibility beyond the gateway tends to be extremely limited. For example, when new CPE is connected to the network, its individual subscriber configuration can be retrieved quickly, helping to ensure that customers can begin to use equipment and services immediately. This eliminates the possibility of user error or confusion during configuration. The result is a positive user experience and reduction in support phone calls.

Cisco Prime Home collects detailed device information - including online status, wireless signal strength, and device manufacturer - and provides it to both service providers and subscribers through easy-to-use web portals. The ability to effectively configure, control, and troubleshoot equipment remotely lowers operating expenditures by reducing truck rolls and customer support calls, as well as accelerating the resolution of those support calls that are made, leading to higher customer satisfaction and lower churn.

The solution also facilitates real-time problem diagnosis and troubleshooting of common home networking problems such as Wi-Fi, firewall, and basic broadband connectivity of devices in the home.

Cisco Prime Home further simplifies management through bulk operations to automate the mass management of home devices and help enable service provides to lower the cost of deploying and maintaining large numbers of subscriber devices. Importantly, no software needs to be installed on subscriber devices to enable these services since remote home network management is handled by the residential gateway. In addition, control panels are accessible anywhere in the world through a browser or mobile application. Finally, in addition to mitigating the complexity of setting up and supporting devices in the home network, Cisco Prime Home also provides a platform for the rollout of new, high-value consumer services. Service providers may opt to charge for some of these subscriber services to increase revenues.

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