



ERICSSON

VIRTUAL CPE
AND SOFTWARE
DEFINED
NETWORKING

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Residential broadband service providers are looking for solutions that allow them to rapidly introduce innovative new services to keep up with fast changing consumer demands – thanks to massive adoption of smart devices, internet of things and cloud based services. Managing these services in an operator’s network is already a fairly complicated undertaking – the operation is made much more complicated when we factor the complexities introduced by managing and modifying millions of customer premises equipment (CPE) to enable these innovative new services.

The Virtual CPE solution from Ericsson is developed to address the above described problem. The virtual CPE will:

- Help service providers save expenses on operating and managing the residential CPEs
- Enable service providers to differentiate their service offering thru fast introduction of innovative and personalized services.

The home gateway is in transition

The customer premises equipment (CPE)/Home Gateway (HGW) in a residence is the device that connects the home LAN to the broadband operator’s WAN for Internet and media connectivity. The CPE began as a simple device, and the average subscriber connected few devices to it. That once simple device, however, quickly evolved to become complex and feature-rich—the connection point for many devices using many different interfaces and protocols. Increasing complexity in the CPEs led to increasing operational costs for the broadband operator in the form of costs associated with device upgrade or replacement, network upgrades, and support for new features.

Complexity impacts user experience and satisfaction

As CPEs become increasingly complex, it becomes hard for home users to troubleshoot problems. An operator’s call centre service technicians routinely try to troubleshoot CPE issues remotely. However, our experience with many of the largest broadband operators around the world has revealed to us that a substantial number of such service requests result in truck rolls to the customer premises for problem resolution. While relying on truck rolls to resolve problems

is an expensive proposition to an operator, the degraded customer experience in the process of resolving the problem is potentially an even bigger issue that an operator needs to contend with.

CPE services and lifecycle

In the interest of financial efficiency, operators typically let a CPE run thru its lifecycle of several years before replacing them. At the same time, the rapid pace of innovation in end user services requires powerful new CPEs to support such services. An operator is thus faced with the challenge of constantly upgrading the CPEs to meet customer expectations while simultaneously trying to efficiently manage the lifecycle of existing deployments. Supporting a network with such disparate types of hardware makes managing the network complex and expensive to maintain and upgrade.

People want more from the Internet

The way people use the Internet

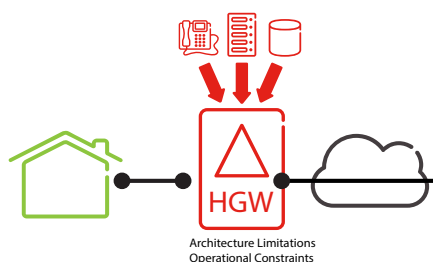


Figure 1 Traditional HGW location in relation to the broadband operator

is changing, too; and the need for web-based media and applications is only increasing. With the advent of smart appliances, smart thermostats, and home security and safety systems people are using web-based services to a much greater degree than before.

The HGW is relied on for much more than entertainment and news. It is used to:

- Monitor and manage the home environment including utilities
- Ensure residential/business perimeter and fire/gas safety
- Monitor and manage personal health and fitness
- Connect with others with voice and video over IP
- Interact with professionals and healthcare providers over secure video
- Play interactive HD games
- Enforce policy rules and parental controls for a household by user
- Access work resources

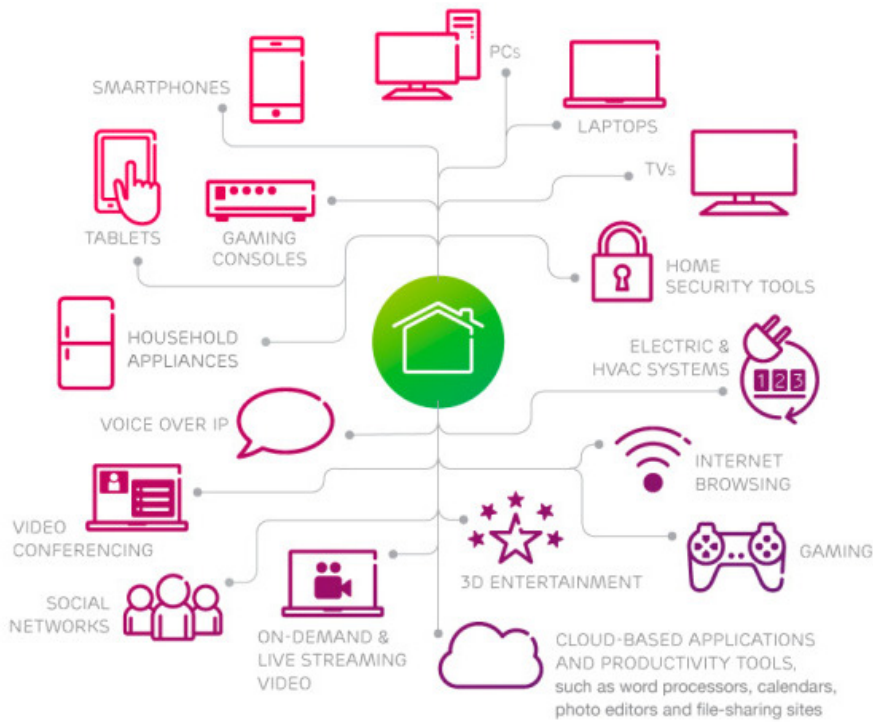


Figure 2 shows what users want from a broadband operator.

CPE complexity is not the answer

The variety of Internet-driven devices connected to the home gateway has also increased, but broadband operators are often unable to view or interact with the devices that are behind the CPE hardware in the home due to routing constraints introduced by Network Address Translation (NAT).

The traditional CPE model cannot gracefully or cost-effectively cope with the increase in feature and bandwidth needs, nor does it allow the broadband operator to:

- Granularly track service type and usage patterns
- Customize service offerings
- Monetize most user services

Traditional CPE can become a bottleneck and prevent a broadband operator from being able to give a subscriber better service. If granular control of particular data types were possible, the operator could offer better service.

When a broadband operator is limited to generic package subscription, it is even difficult to differentiate one service provider offering from that of another.

Efficient Virtual Customer Premises Equipment addresses real need

Virtual Customer Premises Equipment (Virtual CPE) addresses the heart of the broadband operator's concerns:

- Granular control of services to specific types of smart devices
- Ability to design and monetize personalized and custom services
- Control the increasing cost of maintaining a large WAN
- Reduce yearly operational costs and new subscriber start-up costs
- Use economical devices that have a lower risk of failure, such as a bridge

A Virtual CPE is the combination of a bridge installed in the residence and a remotely-hosted Virtual CPE for that residence that connects to machines in the Cloud.

The Virtual CPE contains the subscribers' profiles and account information. When a device at a subscriber's home connects to the Internet, the Virtual CPE allows or rejects the connection

request based on device type or other parameters, such as an individual user. With this model many residences can be hosted on a single machine, and the operator can:

- Aggregate and load balance subscriber traffic
- Use a Flow Control device for SDN
- Upgrade the software or hardware independent of the subscriber
- Granularly monitor service usage to generate service-specific revenue

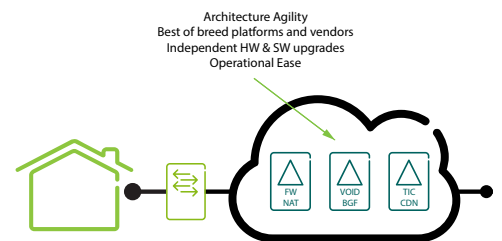


Figure 3 Location of Virtual CPE in a residential scenario

The virtual CPE provides a path for extending cloud-based services to a subscriber base.

The bridge sends all traffic to the broadband operator's WAN for processing. Depending on where the Virtual CPE is placed within the WAN (access node, Broadband Network Gateway, or Cloud with Service Chaining), processing occurs, and the correct services can be accessed.

The benefits of Virtual Customer Premises Equipment are significant

The immediate benefits of moving to a Virtual CPE are:

- Reduced capital expenditure
- Significant (up to 50%) reduction in calls to customer support
- Existing routed CPE can be reconfigured to operate in bridge mode to avoid field replacement for current subscribers, which results in less capital expenditure

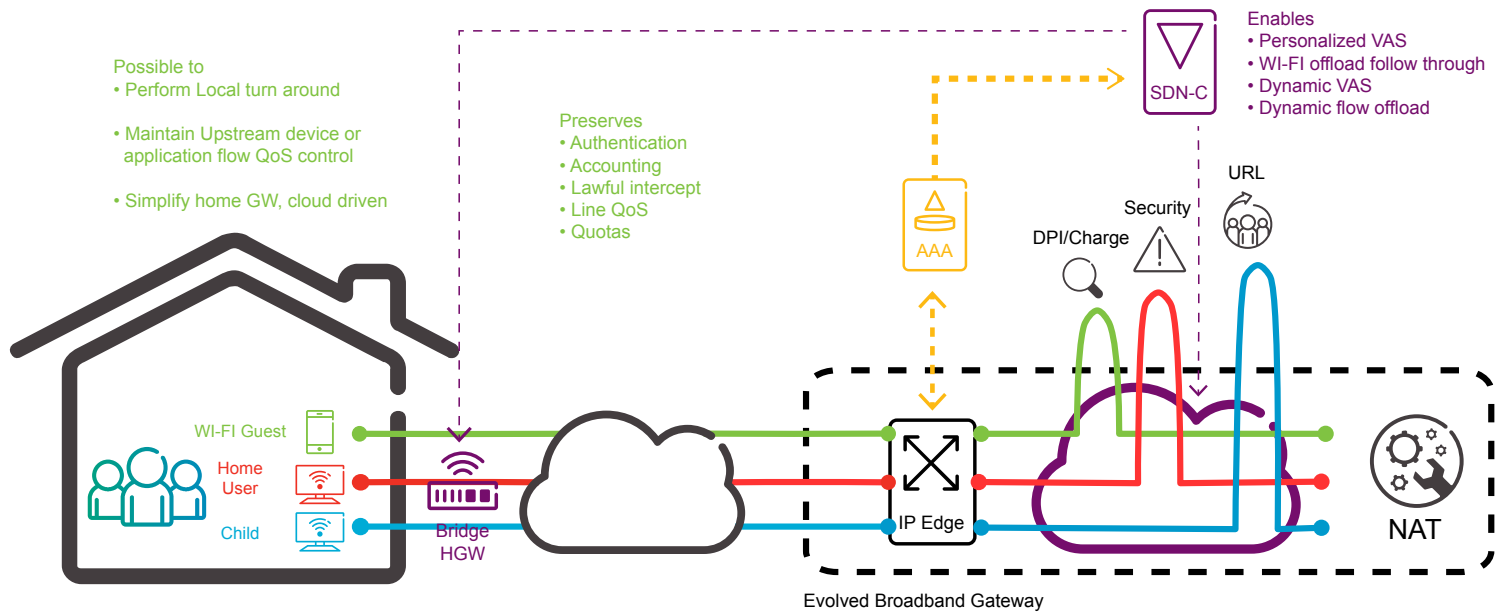


Figure 4 Virtual CPE with dynamic service chaining

- For operators who are looking to upgrade networks to IPv6, bridges are IPv4/IPv6 agnostic, which makes Virtual CPE solutions for the now and in the future
- Ability to change broadband vendor and not have to swap out the CPE
- Network flexibility from strategic placement of the Virtual CPE
 - o Access node
 - o BNG
 - o Cloud-based placement with dynamic service chaining

Software Defined Networking and the Virtual Home Gateway give flexibility

The Ericsson Dynamic Service Chaining solution uses Software Defined Networking (SDN) technology to intelligently chain service functions so that traffic from each subscriber only traverses a particular set of service functions as defined by the policy for a particular subscriber. This solution can also be used to apply service chaining policies to operator/user-defined services. For example, an operator can configure a service chaining policy such that only web traffic is sent to a content optimization service.

Figure 4 shows a residence with a bridge device and a Virtual CPE in the Cloud. The Virtual CPE sends requests to the SDN Controller and the SDN Controller sends the traffic to the appropriate services. This network service intelligence that allows the operator granular forwarding capabilities and enforcement of QoS policies is known as dynamic service chaining (or dynamic flow offload).

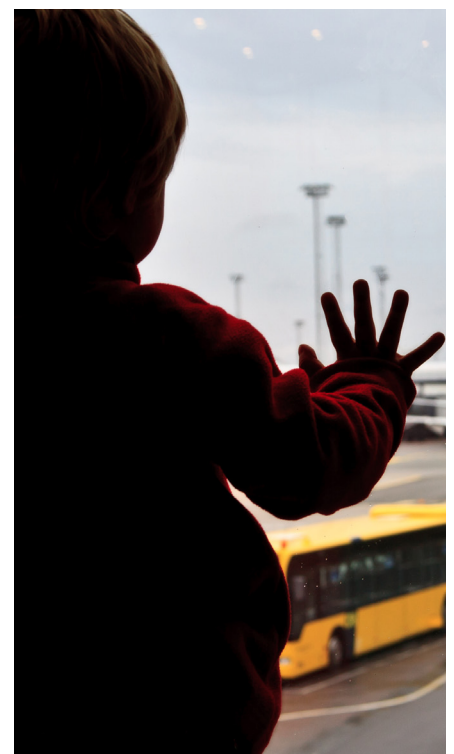
Dynamic service chaining promotes better resource usage on shared commodity hardware, and it allows the broadband operator to mix and match vendors for various applications.

The benefits of dynamic service chaining have to be balanced and scaled with the performance and reliability gains from running these apps on dedicated, optimized hardware.

Virtual CPE Solutions will evolve

The further evolution of virtualization and cloud services influence how we approach the development of Virtual CPE solutions. We are building feature-rich, robust SDN and Cloud-based Virtual CPE solutions that will give our customers more flexibility in the network than

before. These solutions will give broadband operators many different implementation options and offer increasing levels of deployment customizability. We are actively working at standards development organizations to standardize Virtual CPE solutions and are engaged with broadband operators around the world in Virtual CPE implementation planning, solution design, and trial activities, progressing rapidly towards deployments in scale.



About Ericsson

Ericsson is the world's leading provider of communications technology and services. We are enabling the Networked Society with efficient real-time solutions that allow us all to study, work and live our lives more freely, in sustainable societies around the world.

Our offering comprises services, software and infrastructure within Information and Communications Technology for telecom operators and other industries. Today more than 40 percent of the world's mobile traffic goes through Ericsson networks and we support customers' networks servicing more than 2 billion subscribers.