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Broadband Forum Liaison To:
IETF Liaison Statements (statements@ietf.org)
Ted Lemon, Internet AD (Ted.Lemon@nominum.com)
Brian Haberman, Internet AD (brian@innovationslab.net)
Jari Arkko, IETF chair (jari.arkko@piuha.net)

From:
Christophe Alter, Broadband Forum Technical Committee Chair (christophe.alter@orange.com)

Communicated by:
David Sinicrope, Broadband Forum Liaison Officer to IETF (david.sinicrope@ericsson.com)

Date: March 14th, 2014

Subject: Broadband Forum Work on "Network Enhanced Residential Gateway" (WT-317) and "Virtual Business Gateway" (WT-328)

Dear IETF colleagues,

The Broadband Forum has been working since 2012 on a couple of studies and projects addressing virtualization opportunities in home and business gateway architectures. This work is progressing well and getting increasing momentum in the industry.

We became aware that there is some IETF interest in home and business gateway virtualization – as illustrated in recent I-Ds draft-lee-vhs-ps-00 and draft-lee-vhs-usecases-00. In light of this, we thought that the following BBF work items may be of interest to the IETF community:

- WT-317 – Network Enhanced Residential Gateway
- WT-328 – Virtual Business Gateway

These documents are work in progress in the End to End Architecture Working Group of the Broadband Forum. We currently estimate that these work items will complete next year.

At the end of this letter we have included excerpts from WT-317 for your information. Please note the scope encompasses: selecting use cases, defining a set of network architectures and specifying nodal requirements to support them.

The BBF continues to value the collaborative working relationship between with the IETF and we welcome IETF input and coordination on this work. We also would like to ensure that the work we do is aligned with that in the IETF without overlap or duplication.

The BBF WG Chairs and Editor contact information is provided at the end of this liaison. They can be contacted directly for any further information. BBF would also be happy to setup a conference call for presenting and discussing this work with more details, if that would be valuable to interested IETF parties.

Sincerely,

Christophe Alter,
Broadband Forum Technical Committee Chair

CC:
Christophe Alter, BBF Technical Committee Chair (christophe.alter@orange.com)
Dave Allan, BBF E2E WG Co-Chair (david.i.allan@ericsson.com)
Dave Thorne, BBF E2E WG Co-Chair (david.j.thorne@bt.com)
Sven Ooghe, BBF E2E WG Vice-Chair (Sven.Ooghe@alcatel-lucent.com)
David Minodier, WT-317 Editor (david.minodier@orange.com)
Wassim Haddad, WT-321 Co-Editor (wassim.haddad@ericsson.com)
Naseem Khan, WT-321 Co-Editor (naseem.a.khan@verizon.com)
Robin Mersh, BBF CEO (rmersh@broadband-forum.org)
Gabrielle Bingham, BBF Secretariat (gbingham@broadband-forum.org)

Date of Upcoming Broadband Forum Meetings

A detailed list of upcoming meetings can be found at http://www.broadband-forum.org/meetings/upcomingmeetingsataglance.php

1. Purpose and Scope

a. Purpose

This Working Text specifies the Network Enhanced Residential Gateway (NERG) architecture. This architecture consists in shifting some of the functionalities of a residential gateway to the operator's network, for enabling network based features. The aim is to facilitate the deployment, maintenance and evolution of both existing and new capabilities without adding complexity to the RG and/or the home network.

b. Scope

The scope of this Working Text includes:
- The use cases and business drivers for locating various capabilities in the network
- Define the appropriate set of network architectures
- The nodal requirements to support the above architectures
- The role of the NERG in IPv4 address management and migration to IPv6
- The requirements for supporting both new and current residential services (Internet access, IPTV, VoIP, VoD, WiFi) over these architectures.
- The management and orchestration within the architectures
- QoS
- Security
- Privacy

2. Introduction

In order to support business and residential, fixed and mobile, wholesale and retail markets, TR-144 described various requirements including the need for network interconnection standards for broadband access, QoS support, Bandwidth on demand, increased overall bandwidth, higher network reliability and availability.

Architectures based on TR-101 related documents have been deployed for about 10 years, allowing the operators to promote value-added voice and video services while enabling them to differentiate from Broadcast or Cable TV operators.

During this period of time, despite quite a number of significant achievements (FTTH, IPv6, advanced video services, cloud storage, etc), the legacy end to end architecture hasn't fundamentally changed. A Residential Gateway (RG) located at the customer premises terminates the home network and connect the LAN devices to the Internet or to some service platforms

through the broadband access network. Over the years the Residential Gateway has evolved from a simple modem to a smart and complex RG. The RG population itself has become very heterogeneous as it is often quite difficult for a Telco to prune or stop maintaining a specific gateway model. Consequently the deployment of new features or services is often slow and not always possible as some old CPE may not have sufficient resources to support a given set of features.

Meanwhile, the business ecosystem has changed, these flagship value-added Telco services become commoditized while Over The Top (OTT) companies have gone from small startups to financial giants. Likewise the consumer electronics industry floods residential home networks with new devices. These changes have affected and are still affecting the Telco's business models with the current orientation mainly focused on commoditized data carrier, communication and basic triple play services.

Likewise, the IT ecosystem has also changed. Cloud services for residential customers have become commoditized, thanks to the generalization of a number of technologies and techniques used in datacenters (virtualization, storage) and the emergence of a new generation of technologies or network concepts such as NFV and SDN.

Minimizing or solving some of the intrinsic problems foreseen by the operators with a ten year experience of this current architecture and supporting some new use cases is the purpose of the Network Enhanced Residential Gateway architecture.

Issues of the current architecture to minimize or solve:
- Reduce the complexity of the software management of the RG
- Improve the TTM for deploying a new feature or service that would impact the RG in the current architecture
- Ease the introduction of a CGN NAT in the public IPv4 address exhaustion context
- Ease the home network troubleshooting

New use cases or services envisioned with NERG architecture:
- Providing the NSP the visibility on the devices at the subscriber home allows the following service enhancements:
- Downstream QoS on a per device and/or per user basis
- Forward the subscriber traffic to a centralized parental control platform on a per device and/or per user basis
- Benefit from a flexible and agile environment to possibly support a wide set of applications and services: IT technologies (standard x86); virtualization techniques (pay as you grow); in datacenter environment (redundancy, high availability)
- These applications may be provided by the NSP of third party players, promoting the concept of an application store for vRGs, hence opening the door to new business models.

- Enhance M2M services by shifting the M2M Home Automation Box to the network. This approach is mean for the operators to differentiate from the M2M consumer electronics players who have to sell a box to their customers.
- Offer a new user experience in browsing private or public media content by making an extensive use of DLNA-like protocols and by also shifting some of the functionalities of the SetTopBox to the network.

a. NERG Overview

NERG architecture consists in shifting most of the networking and service functions of the residential gateway to the network so as to extend the domestic LAN outside the customer home. It therefore mainly is a new functional distribution model.

Functions such as IP forwarding, routing, NAT and IP addressing related functions are located on the vG. The forwarding plane of the gateway that remains located on the customer' side is configured in bridge mode. Figure 1 depicts the NERG architecture.
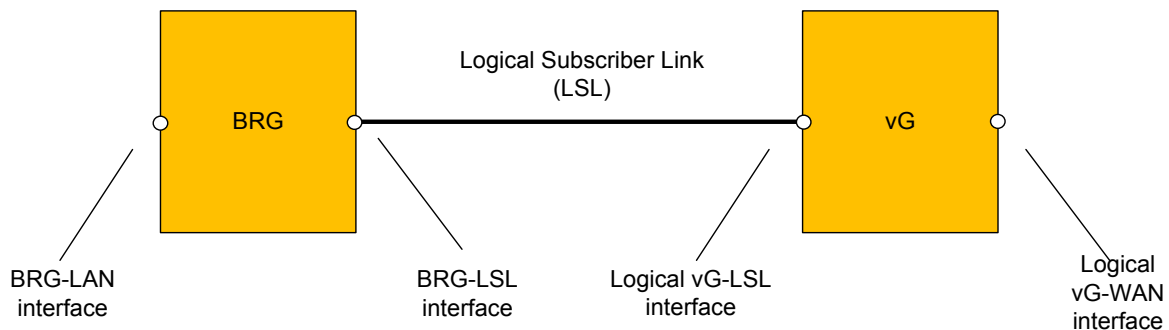

Figure 1 – NERG architecture overview

In this architecture it is commonplace to control the forwarding of the BRG from the vG or some other network controller. In those cases, the BRG supports an OpenFlow agent that communicates with a controller. Because the OpenFlow protocol is carried in-band, the architecture typically includes a protection scheme and optionally a fail-over scheme to secure the control protocol and to ensure its availability.

b. Definitions:

- **BRG**: Bridged Residential Gateway – Gateway located at the residential customer premises, configured in bridged mode between its LAN interfaces and the LSL interface.

- **vG:** virtual Gateway – Per BRG logical entity located in the network, supporting some network and service functions, including IP forwarding and IPv4 NAT. The vG is the default IP gateway for the LAN devices.

- **BRG-LAN interface**: Interface(s) on the Bridge Residential Gateway for connecting LAN devices (i.e.: in the home).

- **Logical Subscriber Link (LSL):** logical Point to Point L2 connection between the BRG and the vG.

- **BRG-LSL interface**: logical L2 interface on the BRG facing the vG.

- **vG-LSL interface**: Logical Interface on the vG facing the BRG.

- **vG-WAN interface**: Logical interface(s) on the vG to one or more IP networks.

- **vG host:** Node or set of nodes supporting a number of vG instances (i.e.: IT Blades, Edge Routers, OLT, DSLAM, etc., and/or combinations of these).

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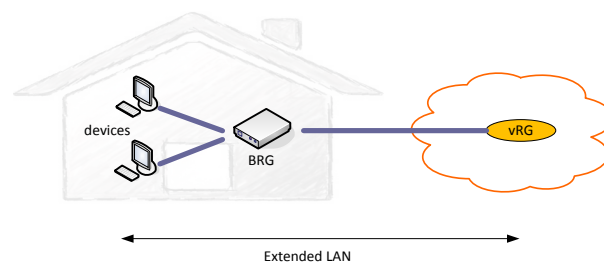

Figure 2 – Basic NERG Functional Architecture

3. vG Applications

a. M2M

b. Enhanced Service Troubleshooting

c. Downstream QoS and Parental Control on a per device basis

d. Per device parental control

e. Enabling access to media content in the network/cloud with a DLNA-like user experience

4. Nodal distribution scenarios
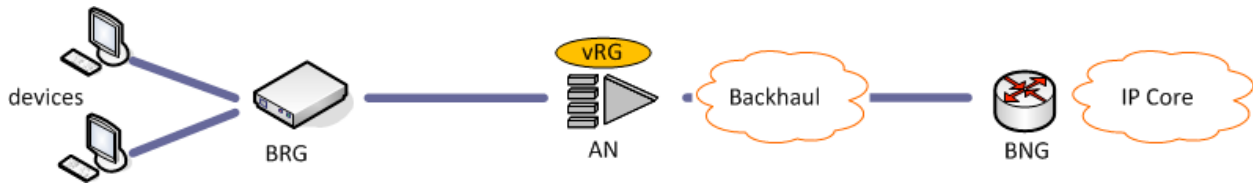
a. vG located on the AN

Figure 3 – vG hosted in Access Node

b. vG located on the BNG

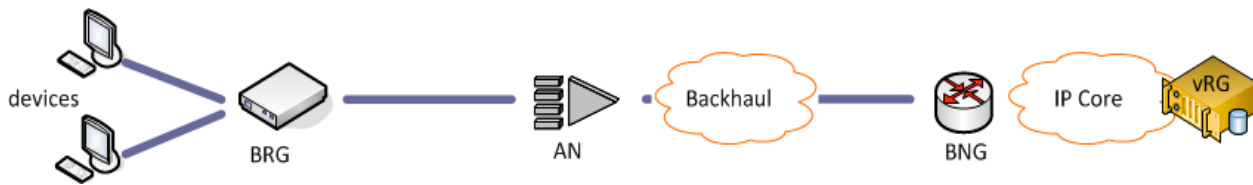**Figure 4 – vG Hosted in BNG**

c. vG located in the Cloud/DC

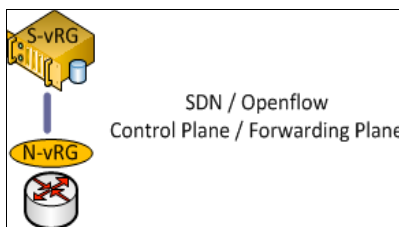**Figure 5 – vG Hosted in IT System**

d. Hybrid boxing – vG split

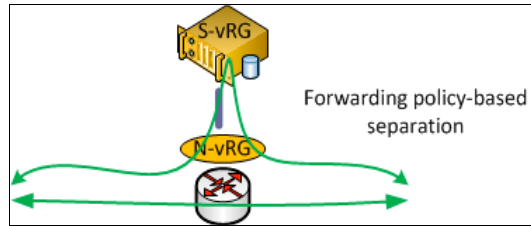**Figure 6 – Split vG Using OpenFlow to direct Network Element**

Figure 7 – Split vG Using Traffic Forwarding Rules