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The case for a virtualized residential gateway

Operating cost savings and revenue benefits

Financial White Paper

Residential service delivery architectures are facing a number of transformative requirements due to the transition to IPv6 and the emergence of cloud-connected digital home networks with gigabit access speeds. Broadband service providers may incur massive costs to retrofit or replace legacy residential gateways (RGWs) and associated network infrastructure, while experiencing continued downward pressure on ARPU

The virtualized residential gateway (vRGW) architecture offers an elegant and evolutionary solution for reducing operational complexity and cost by moving a number of key functions of RGW equipment deployed at customer premises into the network cloud. The vRGW concept is being standardized by the Broadband Forum in WT-317 Network Enhanced Residential Gateway (NERG), and is applicable for traditional telecom as well as multisystem cable operators.

This financial paper discusses the findings of a Bell Labs study with respect to the operating cost savings and revenue benefits of deploying a vRGW architecture.

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Introduction

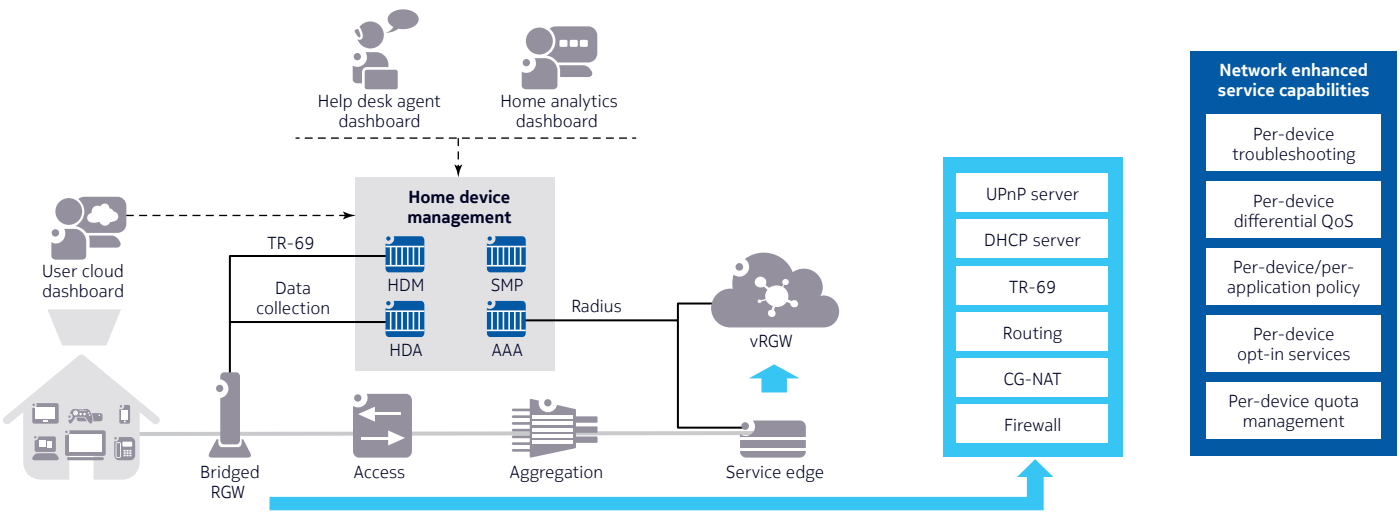
The residential services architecture has remained unchanged for some time, while service requirements have evolved. Cloud-based applications and rich media content have driven a steady increase in access speeds to 100 Mb/s and up; a plethora of user devices and gadgets are being connected in the digital home network, and the transition to IPv6 is well underway. As a result the complexity of in-home residential gateways has increased to the point of impeding service velocity and agility. Service providers must juggle an increasing number of hardware makes, models and versions and struggle to maintain a consistent and customer-friendly service experience. Costs and complexity are increasing while subscriber growth is stagnating, and ARPU is declining steadily.

A virtualized residential gateway (vRGW) allows service providers to address these issues with a cost-efficient and elegant solution that fully leverages existing network infrastructure. The vRGW takes some functions traditionally deployed in the home gateway and moves them into the network cloud along with centralized management and control (Figure 1). Doing so enables service providers to deploy a more simplified bridged residential gateway (BRG) with home device management functionality that supports more granular per-device service control capabilities. These dynamic control capabilities can be used by consumers to manage service usage, QoS and security policies for their individual home devices, and by the service provider to introduce new service assurance capabilities and value-added services.

This paper quantifies the impact of vRGW deployment on operating costs, profitability and revenues:

- Operating cost reduction between 20% and 40% from service fulfillment, assurance and life-cycle management that amount to improving gross profit by 5% to 13%
- Operational improvements in customer experience and service velocity drive additional cost and revenue benefits that improve EBITDA margins between 10% and 29%.

Figure 1. Virtualized residential gateway



HDA = Home Device Analytics
DMP = Data Management Platform
SMP = Service Management Platform

The results are validated for both low-cost and high-cost market environments and different subscriber growth rates. The highest savings are in developing markets, with higher churn and subscriber growth.

The results of this study are based on a reference network model. Actual savings will vary based on market conditions and local operating cost parameters. Bell Labs Consulting is available to assist network operators in evaluating vRGW deployment benefits for their specific deployment requirements.

The vRGW deployment model is based on the WT-317 Network Enhanced Residential Gateway (NERG) specification, which is being developed by the Broadband Forum, and can be applied to any access technology (DSL, PON, HFC) and both physical and virtualized service edges. Refer to [1] and [2] for more detail on the vRGW solution.

Study inputs and scope

The Bell Labs Consulting study evaluates a fixed access operator offering a range of dual and triple play services. Table 1 shows the basic assumptions made for subscriber count, growth, churn and service calls. A sensitivity analysis is applied on key parameters such as CPE (RGW) management,

subscriber growth rate, churn rate, support calls, truck roll costs and subscriber acquisition costs to reflect market conditions in low-cost (LC) and high-cost (HC) geographies. For each market scenario, Low, Medium and High subscriber growth rate scenarios are evaluated (Table 1).

Table 1. Service assumptions

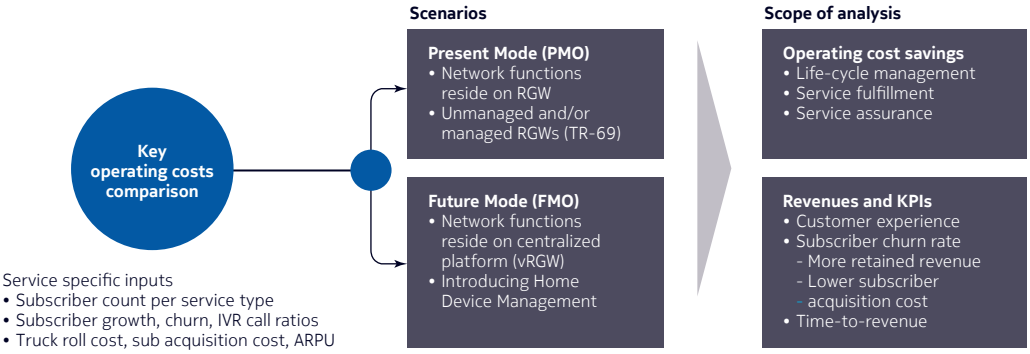
Services	Access types	RGW mgmt	Subs	% Sub growth per year	% Sub churn per month	% Sub calls per year	Sub acq cost (€)	Truck roll cost (€)	ARPU (€)
Double play (Internet, voice)	Bronze ADSL: ~10 Mb/s	LC: No HC: Yes	1M	L: 0 M: 5 H: 10	LC: 2 HC: 0.7	LC: 70 HC: 55	LC: 300 HC: 200	LC: 80 HC: 100	25
	Silver VDSL: ~30 Mb/s	LC: Yes HC: Yes	100K	L: 5 M: 10 H: 20	LC: 2 HC: 0.7	LC: 70 HC: 55	LC: 300 HC: 200	LC: 80 HC: 100	60
	Gold FTTH: 100 Mb/s	LC: Yes HC: Yes	25K	L: 25 M: 50 H: 75	LC: 2 HC: 0.7	LC: 70 HC: 55	LC: 300 HC: 200	LC: 80 HC: 100	95
Triple play (IPTV, Internet, voice)	Platinum FFTH: 100 Mb/s	LC: Yes HC: Yes	200K	L: 25 M: 50 H: 75	LC: 1 HC: 0.7	LC: 70 HC: 55	LC: 300 HC: 300	LC: 80 HC: 100	130

The operator offers a range of dual and triple play services with various properties:

- **Bronze** is the entry level dual play service plan, offering voice and Internet access based on ADSL with peak download speeds of up to 10 Mb/s. In the present mode of operation (PMO), this service is offered with an unmanaged RGW in LC markets. The PMO in HC markets already deploys a managed RGW.
- **Silver** is the mid tier dual play service, delivered over VDSL with up to 30 Mb/s download speeds. In the PMO, this service is offered with a managed RGW. For the FMO, the service provider wants to add Home Device Management to entice more Bronze users to upgrade.
- **Gold** is the premium dual play service, offering up to 100 Mb/s over FTTH and addressing the most demanding users. The service provider wants to offer a differentiated experience with Home Device Management and enable subscribers to set per-device QoS and security policies.
- **Platinum** extends the Gold service bundle with an IPTV package. It offers the highest ARPU and customer stickiness and together with the Gold Internet service represents the highest subscriber growth.

Figure 2 summarizes the PMO and FMO scenarios and the scope of analysis.

Figure 2. Study scope



Operating cost savings

The vRGW deployment model has a positive influence on a number of key performance indicators. The first part of the study translates these improvements into cumulative operating cost savings over 5 years for service Fulfillment, Assurance, and Life-cycle Management. The cost benefits will be evaluated for the LC and HC scenarios in Table 1.

Fulfillment

- Cost savings in order creation occur due to extended auto-installation capabilities, faster turn-up of endpoints and a reduction of truck rolls to address service activation issues with a vRGW.
- Cost savings in order modification result from a faster rollout of new service features and a faster turn-up of new service capabilities by leveraging network-enhanced service features in the vRGW.

The key assumptions for quantifying Fulfillment savings are listed in Table 2 and validated with service provider field data. Truck rolls represent over 80% of service fulfillment cost, so the opportunity to avoid truck rolls has a large cost impact. All Fulfillment sub-process areas are improved with vRGW adoption, with the exception of internal plant updates.

Table 2. Fulfillment improvements

Process	Improvement
RGW logistics	10% – 15% more RGWs shipped due to simpler RGWs and easier installation
Internal plant logistics	No change seen
RGW configuration	Up to 50% less time required to update/create RGW configurations
Service activation	Simpler RGW, centralized functionality result in shorter activation time
Truck rolls	15% – 25% more self-installations and fewer truck rolls due to simpler RGWs 30% – 40% more successful RGW activations and fewer follow-up truck rolls

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Assurance

- The vRGW model results in a simpler physical RGW at the customer premises, which results in fewer issues related to the RGW itself, an increased success rate of first support calls, and fewer truck rolls to resolve RGW issues.
- Superior analytics reduce the number of customer support calls as more issues can be resolved before a customer complains. There are fewer incidents requiring human intervention and a positive customer experience.

Table 3. Assurance improvements

Process	Improvement
Level 0 support	3% – 7% reduced customer help desk calls to due to proactive care 20% – 30% more calls handled successfully
Level 1 support	Up to 10% reduced handling time due to faster problem localization 10% – 15% higher first call resolution due to better failure diagnostics
Level 2 field support	20% – 30% reduced triage time due to faster localizing 30% – 40% fewer truck rolls required to service RGW
RGW logistics	30% – 40% fewer RGWs shipped as more problems are resolved without replacing equipment
Level 3 tech support	20% – 30% reduced problem handling time due to better diagnostics and analytics

Service provider data shows that 30% – 40% of trouble tickets are related to network Layer 3-7 issues and can be resolved better by leveraging a centralized vRGW platform in combination with Home Device Management capabilities.

Life-cycle Management

- Device management costs are lower because the vRGW model reduces the number of physical RGW variants that need to be maintained and stocked, since a subset of RGW functional requirements is moved into the network.
- New service features can now be introduced in a centralized manner through vRGW feature upgrades. This reduces pre-deployment test requirements and enables a fast and consistent introduction of new service features.

Table 4. Life-cycle management improvements

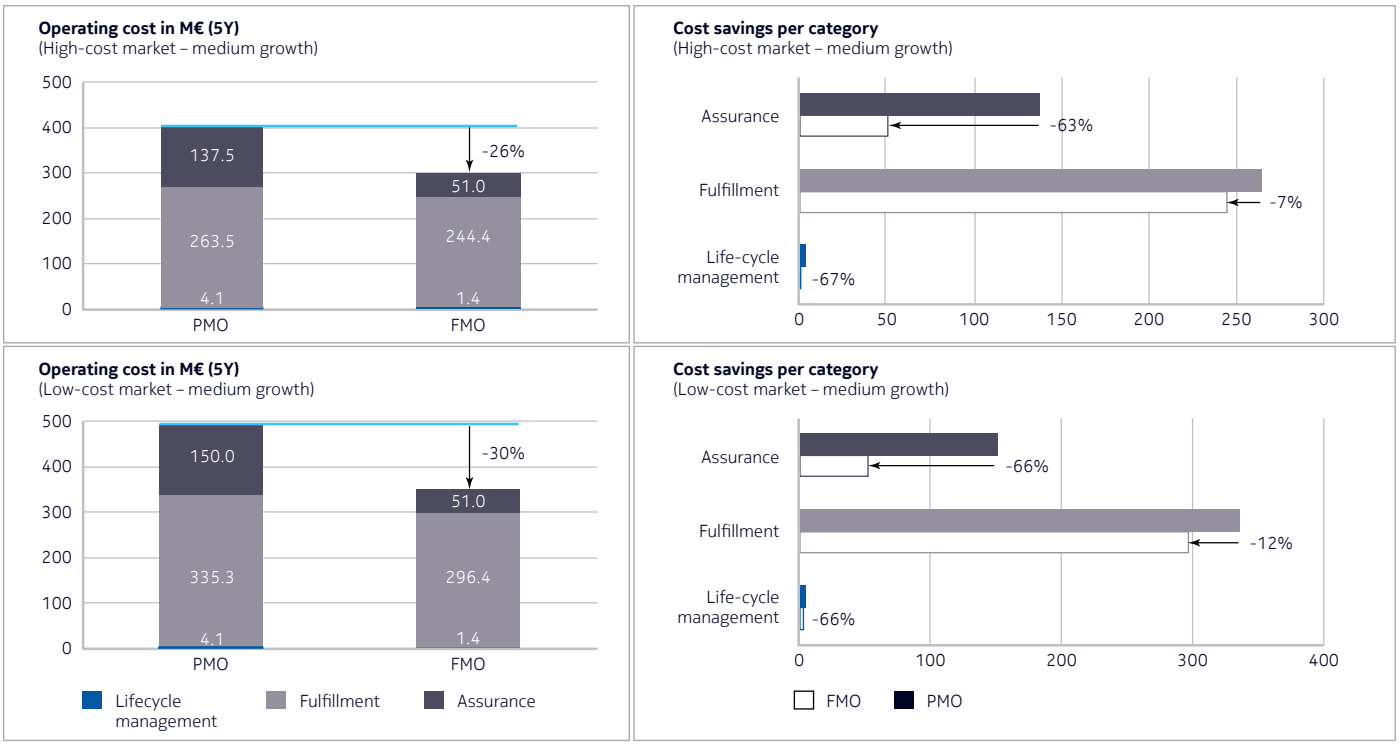
Process	Improvement
RGW acceptance	50% reduction in RGW types reduces validation and integration testing by 60%
Procurement/stock and failure rates	25% – 35% reduction in stock requirements due to reduced RGW complexity 25% – 35% lower failure rate due to simpler RGW device hardware
Service management	No changes envisioned under the project scope

Although Life-cycle Management costs are relatively small compared with Fulfillment and Assurance costs, the improvements in service velocity and agility are critical enablers to improve service innovation, time to market and revenue generation.

Quantitative analysis of operating cost savings

An overview of the operating cost comparison between the PMO and FMO are depicted in Figure 3. The top two charts show the results for the HC market; the bottom two charts depict the LC market.

Figure 3. Breakdown of operating cost savings

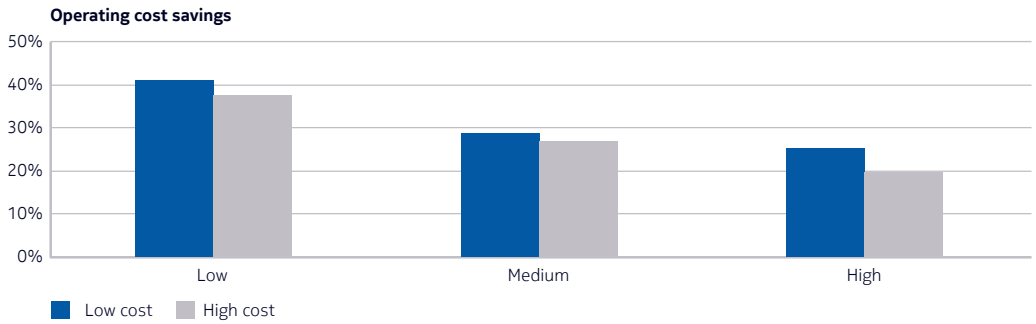


Key observations:

- 26% - 30% operating cost savings with Assurance representing over 80% of total cost savings.
- Truck rolls in the LC market are cheaper (€80 versus €100). But the PMO Fulfillment costs are higher due to increased service activation costs for basic dual play service as a result of using an unmanaged RGW.
- The PMO in HC markets shows lower initial costs due to managed RGWs, but still enjoys substantial savings from vRGW deployment (a drop of 26% in cumulative cost versus 30% in LC markets).

Figure 4 gives the operating cost savings in the FMO for all LC and HC market scenarios.

Figure 4. Cumulative operating cost savings in FMO



Cost savings for the LC market range from 40% in the low subscriber growth scenario, to 25% in the scenario with highest subscriber growth.

For the HC market, the cost savings range from 37% in the scenario with low subscriber growth to 20% in the scenario with highest subscriber growth.

The following paragraphs go into more detail on the origin of these cost savings.

Per-subscriber cost savings

The weighted ARPU follows from the calculations in Table 5. Dividing the aggregate ARPU for all services by the number of subscribers gives a weighted ARPU of €44.8 (M€59.37 over 1,325K subscribers). Assuming a gross margin of 45%, the average PMO COGS is €24.64 (55% of the weighted ARPU) per subscriber per month.

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Table 5. Weighted ARPU and COGS per subscriber in the PMO for the LC market scenario

Services	Access types	Subscribers	ARPU per subscriber (€)	Total ARPU (M€)	Gross margin	Total COGS (M€)
Double play	Bronze	1M	25	25	45%	13.75
	Silver	100K	60	6	45%	3.3
	Gold	25K	95	2.37	45%	1.3
Triple play	Platinum	200K	130	26	45%	14.3
Totals		**1,325K**	**44.8 (Weighted)**	**59.37**		**24.6 (Average)**

The FMO cost savings for the LC market with medium subscriber growth are shown in Table 6. Saving M€ 140.6 over 5 years over 1,325,000 subscribers amounts to saving €21.2 per year or €1.77 per month per subscriber.

Table 6. Cost savings over 5 years per subscriber in the FMO

LC market – medium growth	PMO cost (M€)	FMO cost (M€)	Cost savings (M€)	Annual savings per sub (€)
Life-cycle Management	4.1	1.4	2.7	0.4
Fulfillment	335.3	296.4	38.9	5.9
Assurance	150.0	51.0	99.0	14.9
Operational savings	489.4	348.8	140.6	21.2

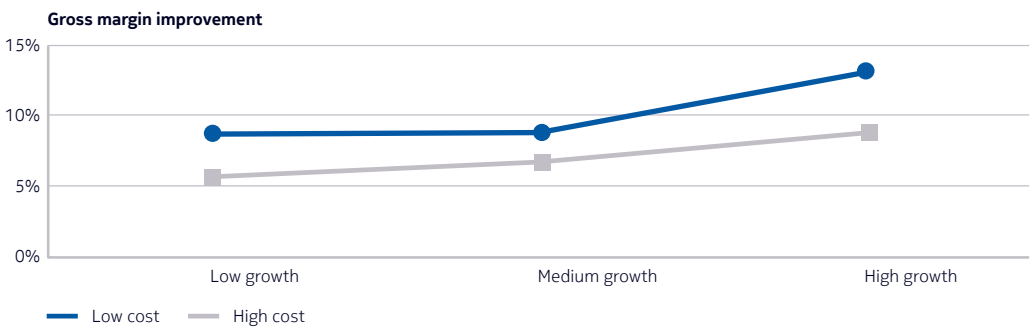
Subtracting the FMO cost savings per subscriber of €1.77 from the PMO COGS of €24.64 gives the FMO COGS of €22.87.

Upside on revenues and profitability

The second part of the study determines the impact of the operating cost savings on revenues and profitability.

Figure 5 gives gross margin improvements for all scenarios, based on the assumption of the PMO gross margin of 45%.

Figure 5. FMO gross margin improvements (all scenarios)



In the previous section we determined operating cost savings of €1.77 per subscriber per month for the LC scenario with medium subscriber growth rates. Subtracting these cost savings from the PMO COGS €24.64 produced an average FMO COGS of €22.87 per subscriber per month.

On a weighted ARPU of €44.8 this results in a gross margin of 48.9%, which is an improvement of 395 base points, an 8.8% improvement on a PMO gross margin of 45%.

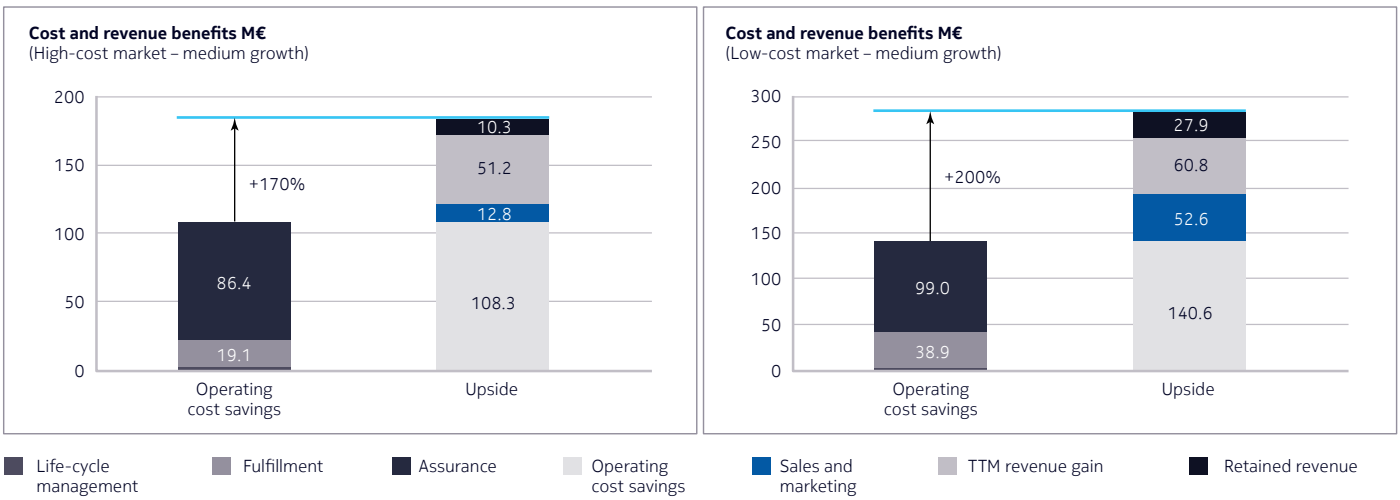
A combination of an improved customer experience and better life-cycle management offers measurable results in customer loyalty and time-to-revenue for service deployment. Customers stay longer with their current contract, they are less inclined to switch providers, and less effort is required to retain existing or acquire new customers (Table 7).

Table 7. Revenue pull-through of vRGW deployment

Process	Improvement
Customer loyalty	• Longer customer retention of service contracts • Up to 10% reduced customer churn rates • Lower customer retention/acquisition cost
Service velocity	• Faster service turn-up times • Up to 12 weeks faster time-to-revenue

This results in an upside in additional savings in sales and marketing cost due to the improved customer experience, revenue gains due to faster time-to-market, and increased revenue retention due to improved customer loyalty and reduced churn rates. Figure 6 quantifies the upside for medium subscriber growth in LC and HC markets.

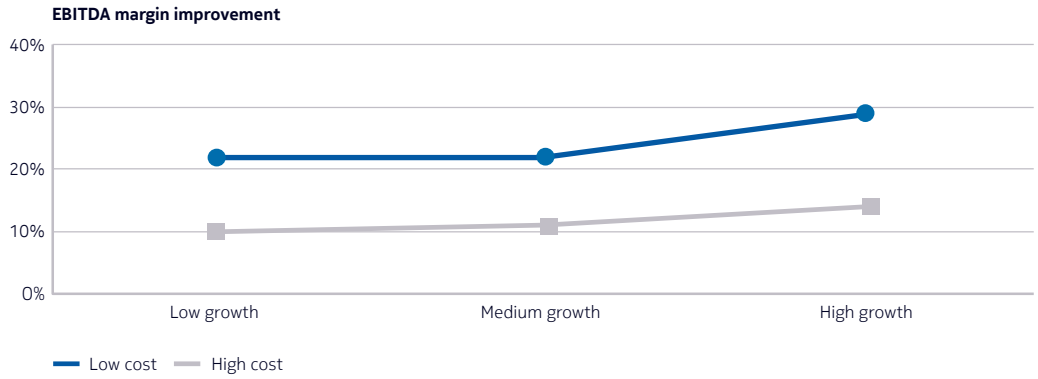
Figure 6. Revenue upside for medium subscriber growth scenarios



While the operating cost savings (Fulfillment, Assurance and Life-cycle Management) represent a large chunk of cost savings, the additional pull-through in savings on sales and marketing and revenues can double these cost savings: +170% in the HC market and +200% in the LC market with medium subscriber growth.

- Revenue pull through for low subscriber growth rates is 170% in the LC market and 150% in the HC market. The pull through for high subscriber growth is 200% in the LC market and 210% in the HC market.
- Cost savings of M€52.6 in sales and marketing in the LC market result in a 37% uplift on operating cost savings of M€141. Savings of M€12.8 in the HC market give a 12% uplift on operating cost savings of M€108.
- Comparing the LC and HC markets, the absolute benefits are higher in the LC market, as the customer experience is weaker and the market starts from higher churn rate, which leads to more absolute benefits.

Figure 7. EBITDA margin improvements



Adding the FMO savings on COGS from Fulfillment, Assurance, Life-cycle Management and the savings in sales and marketing cost allows calculating the impact of total cost savings on Earnings before interest, taxes, depreciation and amortization (EBITDA) margins.

For the calculations we assumed the PMO EBITDA profit margin is 25% for the LC market and 30% for the HC market scenarios. Figure 7 gives the EBITDA margin improvements for all scenarios.

The EBITDA margins for the LC market improved between 22% and 29% (545 and 729 base points), depending on subscriber growth.

The HC market scenarios show EBITDA margin improvement between 10% and 14% (290 and 427 base points).

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Annex: KPI improvements

The vRGW deployment model has a positive influence on a number of key performance indicators as listed in Table 8.

Table 8. vRGW influence on key performance indicators

Key performance indicator	Measurement
% Customer self-installations	Percentage of service orders completed through customer self-installation
% First time installed right	Percentage of service orders completed successfully without further support
% Truck rolls required	Percentage of service orders requiring a truck roll
% In-time order completion	Customer experience of effectiveness in fulfilling service commitments
Mean order completion time	Customer experience of promptness in fulfilling service commitments
% Problems resolved on first call	Customer experience of problem resolution effectiveness without escalation
% Support calls abandoned	Customer experience of effectiveness in receiving service
% Calls requiring truck rolls	Indication of reported problems requiring a truck roll
Mean customer call waiting time	Customer experience of promptness in receiving service
Mean field response time	Responsiveness of field personnel to request for a truck roll
Mean time to repair	Duration of service request from call acceptance to problem resolution

Besides operating cost savings that contribute to the bottom line, virtualizing the RGW delivers measurable, structural process improvements in customer experience, service delivery and assurance

to facilitate a more innovative, agile and responsive organization that is better equipped as market conditions evolve.

Acronyms

ADSL	asymmetric digital subscriber line
ARPU	average revenue per user
BRG	bridged residential gateway
CAPEX	capital expenditures
COGS	cost of goods and services

CPE	customer premises equipment
EBITDA	earnings before interest, taxes, depreciation and amortization
FMO	future mode of operation
FTTH	fiber to the home
HFC	hybrid fiber coax
HC	high cost
LC	low cost
NERG	Network Enhanced Residential Gateway
OPEX	operational expenditures
PMO	present mode of operation
PON	passive optical network
RGW	residential gateway
TCO	total cost of ownership
TTM	time to market
VDSL	very-high-speed DSL
vRGW	virtualized residential gateway

Resources

1. Benefit from a virtualized residential gateway. TechZine article
2. Virtualized residential gateway. Driving the delivery of enhanced residential services. White paper

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