

WHITE
PAPER

Cloud-Based OTT Video Services: A Business Case Analysis



MANAGEMENT CONSULTANTS TO THE
NETWORKING INDUSTRY

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Network Strategy Partners, LLC (NSP)

As Management Consultants to the networking industry, NSP helps service providers, enterprises, and equipment vendors from around the globe make strategic decisions, mitigate risk, and effect change through custom consulting engagements. NSP's consultation services include business case and ROI analysis, go-to-market strategies, development of new service offers, pricing and bundling, as well as infra-structure consulting.

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Executive Summary

Internet video is a big success. The Nielsen Company reports that 70% of global Internet users watch Internet video. Internet video takes many forms. The simplest form is a low resolution small format image that is commonplace on almost all websites today. The next step up is video streaming or downloading sites offered by a wide range of media outlets with content ranging from user generated content at low resolution—YouTube—to TV and movie clips, previews and trailers at somewhat higher resolution. Cloud-based Over-the-Top video streaming has become a popular service for delivery of feature-length movies, e.g., Netflix. At the high-end consumer electronics companies offer a wide range of devices that permit viewing of feature length movies in HDTV on large screen TVs.

The success of Internet video, however, can be a mixed blessing for broadband service providers (BSP). Most use a flat rate pricing model with no cap on monthly usage. Increased use of Internet video threatens to drive up Internet traffic and operations cost but do nothing for revenue. New more sophisticated pricing and business models are needed for profitable delivery of web video services. One element of this is the “two-sided” telecoms business model that promotes the creation of open platforms that helps other service providers (enterprises, SMEs and government) interact with subscribers in more efficient ways than they can today. The business model is called two-sided because the BSP delivers value to and generates revenue from retail service providers as well as from subscribers.

Some of the ways service providers can increase revenues and improve ROI through use of the “two-sided” business model are:

1. Collaborate with WebTV services by offering superior video quality and content than that delivered by over the top video
2. Offer value-added network services such as bandwidth on-demand to enhance WebTV
3. Allow users to control their services using advanced policy management—this provides a new stream of revenue and helps reduce churn by more effectively addressing users’ needs

In order to implement more sophisticated pricing and business models service providers must ensure that their networks are intelligent and flexible. This is achieved through “Smart Networking”—broadband policy management, tools such as Deep Packet Inspection (DPI), and application and service layer traffic management.

This report analyzes five web video service scenarios using an Integrated SmartEdge solution from Ericsson. The ROI and cash flow benefits of the five scenarios are estimated. In addition a TCO analysis compares the Integrated SmartEdge solution to that of a solution using an edge router, BRAS and standalone DPI system.

Table 1 summarizes the five scenarios.

| Scenario | ROI | Payback (Years) |
|---|--------------|-----------------|
| 1 - No fees are charged to add enhanced QoS for video to the basic HSI service offering | 241% | <1 |
| 2 - Subscriber pays BSP on a per view basis to deliver Internet video with high QoS | 177% | <1 |
| 3 - Content provider pays BSP to deliver its content with high QoS | 326% | <1 |
| 4 - BSP offers a proprietary bundle of web video services through a portal | 1033% | <1 |
| 5 - BSP offers 3D TV to subscribers for a per view fee | 161% | 1 |

Table 1. ROI of Smart Networking for Web Video Service Scenarios

All five scenarios have high ROI and rapid payback. Scenarios 3 and 4 which employ the two-sided business model—payments are made to the BSP from subscribers and other service providers such as over the top video services—have the highest ROI. Scenarios 2 and 5 have the lowest ROI. These scenarios require a pay per-view fee from the subscriber. Market researchers have found that Internet users dislike these fees because the market has taught them that Internet services are free beyond the monthly access fee. Scenario 1 in which no additional charges are made to subscribers to improve the quality of video service delivery has higher ROI than Scenario 2 where the subscriber is assessed a fee for the delivery of each video with enhanced QoS. This shows that it pays to “give away quality”. Figure 1 depicts the “players” with revenue and service flows.

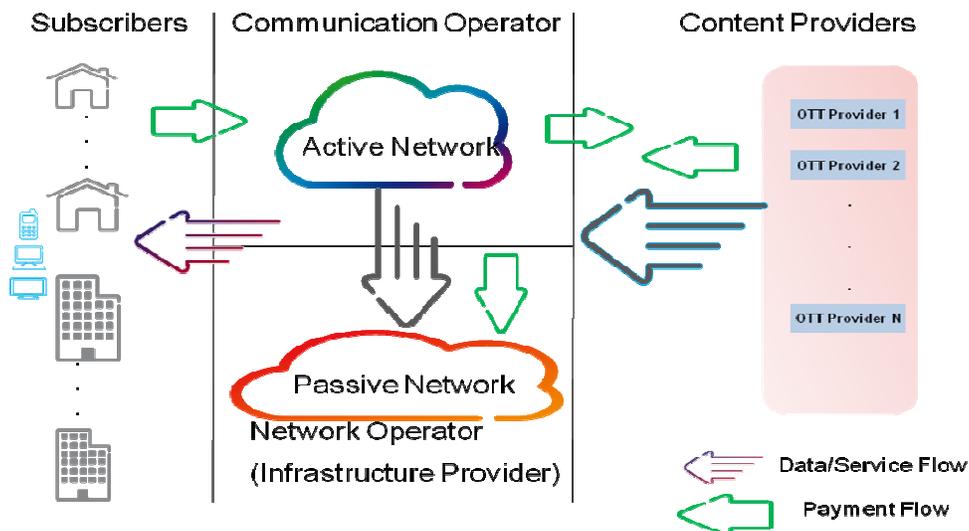


Figure 1. Revenue and Service Flows for Web Video Players

These high ROI results are produced by the smart networking capabilities of the Integrated SmartEdge solution. Key smart networking elements include the ASE—Advanced Services Engine—and the Ericsson Policy Manager.

A TCO comparison between the Integrated SmartEdge solution and an Edge Router with BRAS functionality and a standalone DPI system found a 12% TCO advantage for the Integrated SmartEdge solution. Most of this advantage comes from the functional integration of SmartEdge which eliminates the work of managing separate systems. Specifically testing and certification operations, training and network management equipment and software expenses are significantly lower for the Integrated SmartEdge solution.

Introduction

Smart networking is needed because Internet video's success puts a lot of stress on broadband service providers' (BSP) business models. Most Internet access services have a fixed monthly price tied to the maximum download and upload data rates. Average throughput is understood to be best effort and a maximum use limit is only enforced for a small number of abuse of service cases¹. The pricing model and terms of use are inconsistent with subscribers' Quality of Experience (QoE) expectations for video services and BSP profitability requirements.

Current broadband service pricing is linked to maximize quality of experience for web browsing. Traffic is characterized by short intermittent bursts. The maximum data rates can be sustained for short durations and if a packet is dropped it is unlikely that it will even be noticed by the user. The BSP exploits the traffic's compatibility with statistical multiplexing to minimize bandwidth cost through bandwidth over-subscription. In contrast, video streaming traffic is characterized by traffic flows requiring that data rates be sustained above minimum thresholds that can be as high as 5 – 10 Mbps. Dropped packets are observed as tiling defects or screen freezes. Furthermore, with session times reaching 90 minutes or more for feature length movies over subscription can cause catastrophic failure of traffic transmission as requests to restore service overload the IP network. This impairs customer satisfaction and places a substantial cost burden on the BSP to provide adequate network capacity.

There is also a mismatch between subscribers' willingness to pay for Internet video and the cost of providing it. For example, download data rate requirements for Email use and web browsing are 0.1 – 0.3 Mbps, while Standard Definition (SD) video requires 1 – 5 Mbps and High Definition (HD) video requires 5 – 10 Mbps². Thus, the bandwidth requirement for video is three to 100 times that required for web browsing. However, subscribers have little or no tolerance for paying for Internet video services. This is derived from subscribers' experience with the flat rate broadband services pricing model, broadcast TV where video transmission is free, and even cable TV tariffs where HDTV service delivery costs only a modest \$10 per month more than SDTV. This is confirmed by a Nielsen survey that found that 78% of survey participants believe that if they already subscribe to a newspaper, magazine, radio, or television service that they should be able to use online content for free³.

On the access side, Figure 2 shows the cost to connect per premise using FTTH with a GPON 64 split. It is very insightful to see that more than 70% of the cost is incurred to connect the premise to the central office. Relatively speaking the cost of [Metro+Edge+Core] is less than 5%. On a per box basis, the cost for combination of [Metro+Edge+Core] tends to be higher. The "per premise" cost is low because an operator can support hundreds of thousands of subscribers per box.

The "Edge" has the most intelligence of all the solutions and can add the most value in terms of user management, servicing and billing. So a marginal investment at the "Edge" to integrate

¹ Comcast has announced a 250 GB per month usage limit for its broadband service and the FCC estimates average monthly usage to be about 12 GB.

² Exhibit 9, "Broadband Performance", OBI Technical Paper No. 4, FCC, August 2010

³ "Changing Models: A Global Perspective on Paying for Content Online", Nielsen, February 2010

advanced features like Deep Packet Inspection, IPSec Security features, and Smart policy managers can pay big dividends in getting the most revenues out of the network.

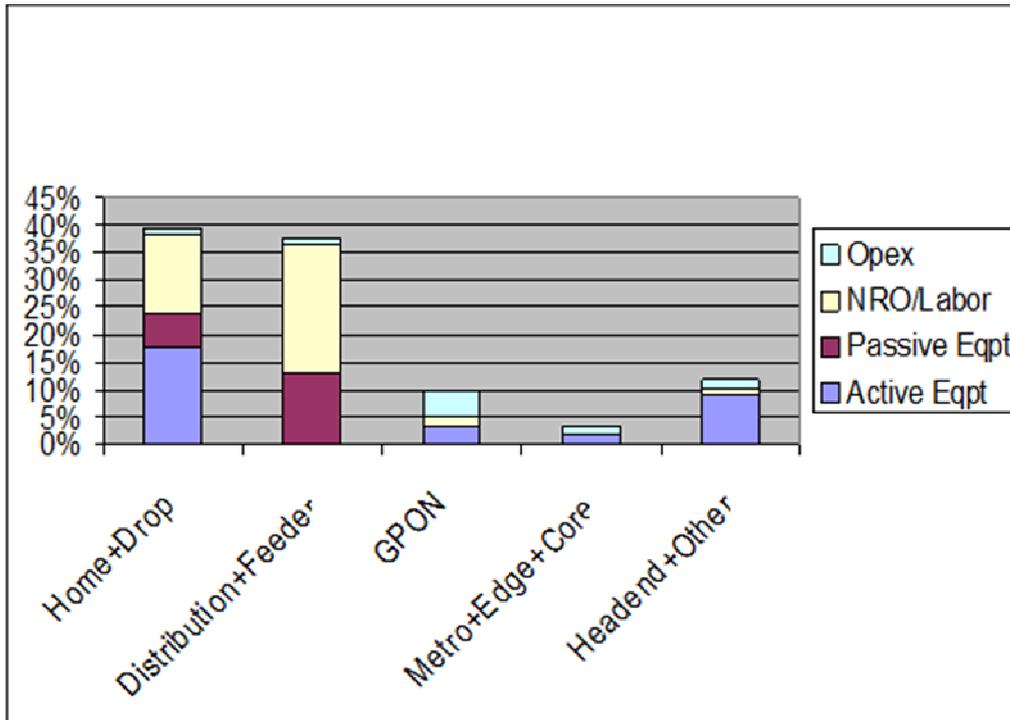


Figure 2. First year relative-cost to connect a premise with FTTH GPON (64 Split)

The following sections show how smart networking capabilities can be used to create new business models that meet subscribers’ expectations and payment preferences while simultaneously fulfilling BSPs’ financial requirements. Five web video service scenarios using an Integrated SmartEdge solution from Ericsson are developed. The ROI and cash flow benefits of the five scenarios are analyzed. In addition a TCO analysis compares the Integrated SmartEdge solution to that of a solution using an edge router and standalone DPI system.

ROI and Cash Flow Model for Web Video Smart Networking Scenarios

The ROI and cash flow benefits for each web video smart networking scenario are computed by performing an incremental analysis of an aggregation network. Figure 3 depicts the modeling process.

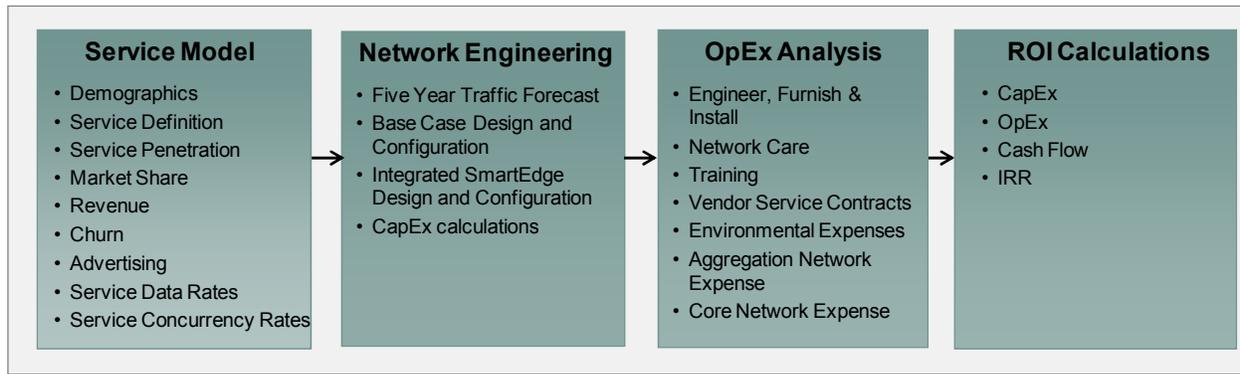


Figure 3. Modeling Process

The modeling process begins by characterizing the service area in terms of the number of households, services offered, service penetration and traffic characteristics. Revenue projections are made using the pricing plan for the two-sided business model—payments from video content providers and subscribers—as well as advertising revenue, if any. A churn model driven by customer satisfaction ratings is used to estimate revenue losses due to churn. Net revenue is then calculated as gross revenue less churn losses.

A traffic forecast is derived from the service traffic characterization. It is then used to configure the SmartEdge equipment. (See the Integrated SmartEdge Solution section (below) for an architectural overview.) Once configured the equipment is priced out to determine the capital expense (CapEx).

The operations expense for operating the SmartEdge equipment is calculated by using expense factors that are applied to the equipment configurations. The traffic forecast also is used to compute the annual cost of providing aggregation and core network bandwidth. Core network bandwidth has a unit cost of \$10,500/Gbps per month while aggregation network bandwidth has a unit cost of \$3,000/Gbps per month. Bandwidth unit cost is declining rapidly due to the strong scaling effects of next generation network equipment and fierce competition among network equipment vendors. This is modeled as a 20% annual decline in unit costs⁴

Incremental revenue, expense, CapEx, and cash flow then are calculated through two model passes. First estimates are made for the smart networking scenario. Then a second set of estimates are made for a Base Case without smart networking. The incremental revenue, expense, CapEx and cash flow are calculated by subtracting the Base Case values from each scenario's values.

⁴ The unit costs and their rate of decline are derived from Network Strategy Partners TCO models and by analyzing service providers' publicly available prices for bulk services.

Base Case Scenario

This scenario describes a typical service area served by one aggregation network. The serving area contains 50,000 households. Its edge router has no smart networking capabilities and a flat rate service pricing plan (\$40 per month) is employed. Traffic is projected as a function of the usage data shown in Table 2.

| Item | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
|---|--------|--------|--------|--------|--------|
| HSI Penetration | 40% | 42% | 44% | 46% | 49% |
| Monthly Hours Online per Household | 32.3 | 34.2 | 36.1 | 38.0 | 39.9 |
| Percent Time Downloading if Online | 40% | 50% | 60% | 65% | 70% |
| Actual Download Rate (Mbps) | 6.0 | 7.2 | 8.6 | 10.4 | 12.4 |

Table 2. Traffic demand drivers

The number of subscribers in the service area is found by multiplying the HSI penetration by the number of households. In the scenario the market is assumed to be mature with slow increases in HSI penetration. Hours of online use are steadily growing. This is driven in part by increased use of HSI for viewing videos⁵. Increased video usage also is driving increases in the percentage of time users who are online are actively downloading data. This can be seen by comparing web browsing with watching video. During web browsing the communications channel has substantial periods of inactivity while the user types in data for uploading and while the user is reading the web page. In contrast, a user watching a feature length movie will spend a minute or two requesting the movie followed by a continuous streaming video download of 90 minutes or more. The final traffic demand driver is the actual download data rate. The data rate used in this study is typical for a middle tier DSL or cable modem service. The projection is based upon FCC analysis that finds that actual download data rates are growing at 20% per year and that the typical actual throughput of a broadband connection is about 1/2 of the advertized maximum download data rate.

⁵ Projection is extrapolated from Exhibit 1, "Broadband Performance", OBI Technical Paper No. 4, FCC, August 2010

Figure 4 shows the resulting revenue and traffic forecasts derived from the demand driver projections.

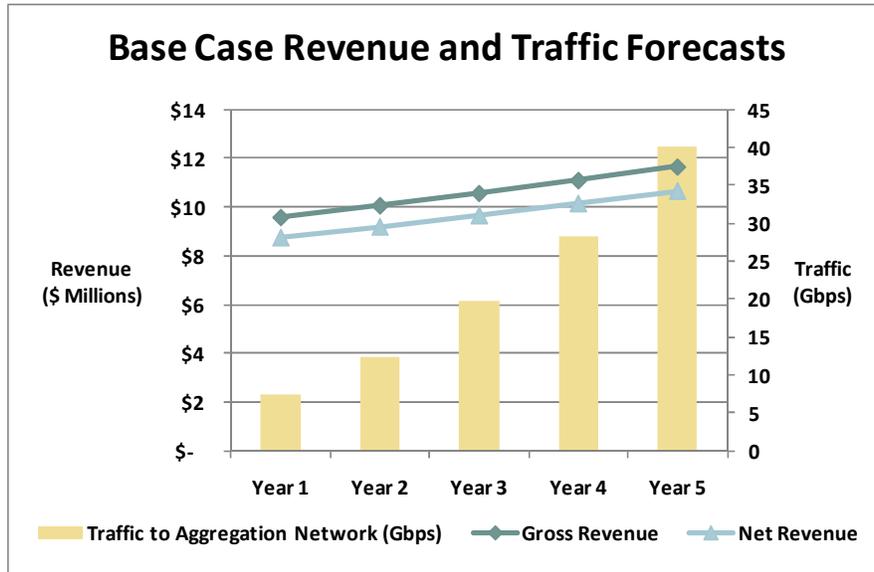


Figure 4. Base Case Revenue and Traffic Projections

Gross revenue is simply the number of subscribers multiplied by the price for HSI service. Net revenue is gross revenue less the cost of churn. The cost of churn is modeled as a function of customer satisfaction where satisfied customers have low churn and dissatisfied customers have high churn.

Figure 5 shows the relationship between churn and customer satisfaction rated on a scale of 1 – 5⁶.

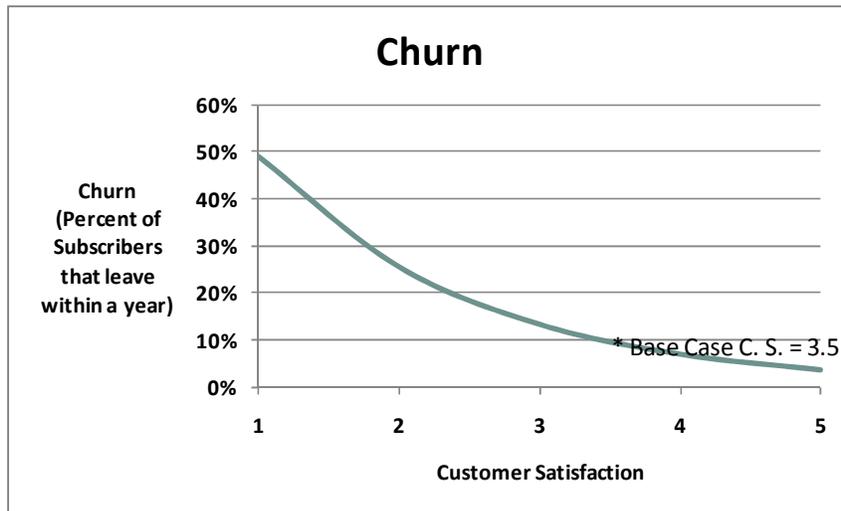


Figure 5. Churn as a Function of Customer Satisfaction

⁶ “Broadband Survey: Optimizing QoE and Minimizing Churn”, Analysys Mason Ltd., 2009

Customer satisfaction for the Base Case is assessed as 3.5 throughout the five-year study period. This implies that about 10% of the subscribers will be lost to churn each year. The opportunity cost of churn includes the cost of customer acquisition plus the loss of six months revenue for each subscriber account lost. Thus net revenue is consistently below gross revenue as shown in Figure 4.

The Figure 4 also shows that traffic grows much more rapidly (53% CAGR) than revenue (5% CAGR). Traffic grows due to the increased use of video while revenue does not increase for the reasons that were discussed in the introduction. Since total cost of ownership increases as traffic increases the BSP business model requires very strong scaling effects to control cost increases and new sources of revenue to sustain the business.

Integrated SmartEdge Solution

Figure 6 shows a network schematic of the Integrated SmartEdge solution as part of the Ericsson end-to-end architecture solution, in which subscribers can dynamically select their services and Content Providers. The solution includes pre and post sales services such as consulting, system integration, network roll-out, customer support and managed services.

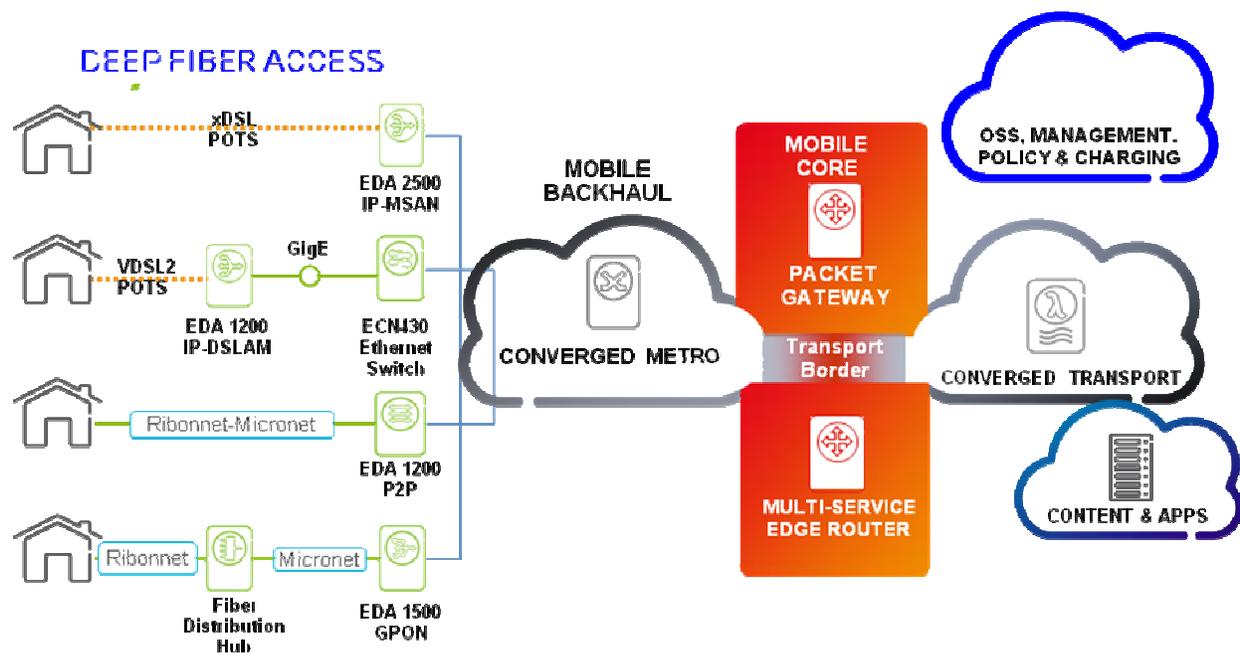


Figure 6. Integrated SmartEdge Solution

Ericsson Deep Fiber Access solutions enable new media experiences and consist of comprehensive e2e solutions that span from broadband access products, to passive fiber solutions, to the most comprehensive service offering.

(A) Broadband Access Portfolio:

The Ericsson Deep Access portfolio enables new media rich revenues, while lowering networks costs. It provides purpose-built solutions for any fiber and copper network scenario. Backed by Ericsson's extensive global services, the EDA Broadband Access portfolio includes -

- EDA 1500 Optical Line Terminal (OLT)
 - Highest-density, highest-capacity, service aware OLT
 - The **EDA 1500 GPON OLT** is a purpose build platform, designed to meet media rich demand and accelerate massive fiber deployments. It's the fastest OLT on the market with redundant 320 Gbps switch fabrics. The carrier grade design retains 100% of the capacity and suffers no traffic-loss with fail-over. The high density design with 8 PONs/board supports a total of 7,168 ONTs per single chassis. It uses scalable dedicated uplinks with 2x10GigE, 8xGigE per board. By using dedicated uplink boards, more uplinks can be added as traffic grows in the future. In addition no uplink loss will occur with a switch fail-over.
- EDA 1200 Point-to-Point (P2P)
 - The **EDA 1200 Point-to-Point** system offers Telco-grade, scalable P2P solutions with minimal up-front investment. It is based on a pizza box design for 24 to 32 with 100Mbps or 1 Gbps connections and 1 or 10Gbps uplinks. This makes it an ideal fit for lower density or distributed residential networks and business connections.
- EDA 1200 IP-DSLAM
 - The **EDA 1200 IP-DSLAM** enables existing copper lines to support media rich content with advanced VDSL2 technology. The EDA 1200 is a hardened IP-DSLAM specialized for cost-effective outdoor Fiber-to-the-Node deployments. The sustainable design requires no cooling with up to 30% lower power consumption resulting in lower OpEx. Placing the IP-DSLAM closer to the home combined with VDSL2 increases the bandwidth over copper significantly, allowing media rich services.
- EDA 2500 IP-MSAN
 - The **EDA 2500 IP-MSAN** drive the network modernization of existing copper networks by migrating the voice from legacy TDM voice switches and data traffic to a converged IP interface in the Central Office.
- T-series GPON ONTs and P2P CPEs
 - Ericsson provides a comprehensive portfolio for any FTTx application. Regardless if you are deploying a residential roll-out, mobile backhaul or business application we have the best ONT or CPE for you. Our solutions range from Fiber-to-the-Node, Basement, Floor, Home, Business and the Tower.

(B) Passive Fiber Solutions

Ericsson's passive fiber solution enables:

- Most efficient roll-out with Air Blown Fiber Micronet and Ribbonet® optimizing incremental fiber installations
- Minimal upfront investment for homes past and incremental/on demand network build out aligned with capacity and connections needed.
- Future expansions without civil works
- Prefabricated solutions that minimizes field work

(C) Global Services

Ericsson's Global Services offer the following:

- Telecom industry's most comprehensive professional services offering state-of-the-art expertise in consulting and system integration, network rollout, customer support, learning and managed services.
- Deep understanding of networks and service providers needs
- Largest service organization with local presence worldwide

(D) SmartEdge 1200

For the edge of the IP network, smart networking functions are hosted on the SmartEdge 1200, a multi-service edge router where the Ethernet aggregation, BRAS and L2/L3 PE routing functions are consolidated in a single platform. Smart networking capabilities are provided by:

- ASE – Advanced Service Engine, a card added to the SmartEdge 1200 that provides Deep Packet Inspection (DPI) and IPSec security features. It also implements management and reporting conducted by the Ericsson Policy Manager.
- Ericsson Policy Manager – A server that provides services such as Resource Admission Control, customer self-service through a web portal, single subscriber sign-on, flexible service provisioning, cooperative proxy support, and dynamic QoS for video streaming.

(E) Media Fabric

Delivery of Internet video also is supported by Ericsson Media Fabric, a service for delivering media content to home devices such as set-top boxes, gaming consoles, and DLNA-enabled⁷ TVs. Media Fabric provides the integration services necessary to implement the two-sided business model. It interfaces to media companies and BSPs that allow media companies expose their content. It enables BSPs to publish select content for users.

⁷ DLNA—Digital Living Network Alliance—is a standard used by manufacturers of consumer electronics to allow entertainment devices within the home to share their content with each other across a home network.

Web Video Smart Networking Scenarios

Five web video smart networking scenarios are presented and analyzed in this section. The analysis is an incremental analysis wherein the revenue, CapEx and OpEx for each scenario is calculated and then Base Case values are subtracted from each corresponding value. For example, if Scenario 1 has revenue of \$102 and the Base Case revenue is \$100 then the incremental revenue for Scenario 1 is \$2.

Scenario 1 – No additional fee is charged to enhance QoS of Internet video

In this scenario the BSP seeks to add subscribers and increase customer satisfaction by deploying smart networking to improve the quality of experience for Internet video. The DPI capability of the ASE card working with the Ericsson Policy Manager identifies each subscriber session of Internet video and adjusts QoS parameters to maximize the QoE for each session. This capability is added to the basic high speed Internet service offering—the base price is not increased and no extra charges are added for improving the QoE of Internet video.

Scenario 2 – Pay per-view for delivery of Internet video with high QoS

In this scenario the subscriber pays \$0.75 for each video session that he wishes to view with high QoS. The same smart networking systems are deployed as in Scenario 1. The Ericsson Policy Manager handles the subscriber initiated per-view ordering process. The per-view subscriber fees are the sole source of additional revenue in this scenario.

Scenario 3 – Content providers pays BSP to deliver their content with high QoS

In this scenario the content provider pays the BSP to deliver its content with high QoS. The same smart networking infrastructure described in the previous scenarios is used here. The Ericsson Media Fabric service can be an important enabler due to its ability to enable and meter the transactions between the BSP and each content provider. The per-view fee paid by the content providers is \$0.50. It is lower than the fee paid by the subscriber in Scenario 2 because content providers will require a volume discount. However, service take up rates will be higher because this cost is not seen by the subscriber. Consumers are conditioned to expect to pay for content but have an aversion to paying additional Internet service fees due to widely accepted flat rate pricing plans.

Scenario 4 – BSP offers a proprietary bundle of web video services through a portal

This service is similar to cable TV VoD offerings. It is branded by the BSP and is accessed through a portal that offers viewers a very broad range of video offerings—the long tail. QoE is managed by the smart networking infrastructure. Incremental revenue is created from many sources including better customer satisfaction, increased take up rates, and fees paid by either content providers or subscribers. The BSP assesses a per-view fee of \$1. This can be paid directly by the content provider or the subscriber. Current cable TV VoD services simply build this cost into the fee for each feature length movie. Another way to capture the fee would be to include this cost as part of the monthly subscription price. The proprietary branded bundle also creates the opportunity to sell advertising that is paid directly to the BSP. This is modeled as \$25 CPM (CPM = Cost per thousand

advertising impressions, where an advertising impression is counted for each time the ad is viewed by a subscriber.)

Scenario 5 – BSP offers 3D TV to subscribers for a per-view fee

In this scenario the BSP offers 3D TV to subscribers for a per-view fee. 3D TV is an emerging service with high 3D TV set prices—several thousand dollars—and it is bandwidth intensive. Recent special programming events have used a 6 MHz channel slot (38 Mbps)—enough bandwidth to handle several HDTV signals. Delivery of 3D TV over the Internet will require a very high speed access link, the QoS capabilities offered by smart networking, and a service like Ericsson Media Fabric to connect the Internet to a 3D TV. Rapid technological progress in the consumer electronics sector, however, can be expected to bring down the cost of the 3D TV and to lower the bandwidth requirement. This scenario assumes that subscribers with 3D TVs will pay \$1.50 for delivery of each 3D video.

Service Model Assumptions for the Five Scenarios

The incremental cash flow and ROI analyses are driven by the service model drivers discussed in the previous sections. This section presents the primary demand drivers for each scenario and compares and contrasts them so as to develop an understanding of the economics of Internet video service demand.

Four service model drivers are analyzed for all five scenarios:

1. Penetration of HSI service – The percentage of addressable households that subscribe to HSI service
2. Paid enhanced QoS per-view videos/month per subscriber – The number of paid enhanced QoS per-view videos a subscriber watches per month. Only enhanced QoS videos are counted. The payment could be made directly by the subscriber or the content provider or it could be bundled with other service fees such as the monthly subscription fee or the per-view fee for the content.
3. Customer satisfaction rating – A number between 1 and 5 where 1 is entirely dissatisfied and 5 is perfectly satisfied.
4. Traffic on the aggregation network – This is the total traffic between the aggregation network and the SmartEdge 1200

Figure 7 shows the increase in the subscriber penetration rate over that of the Base Case scenario for all five enhanced QoS scenarios.

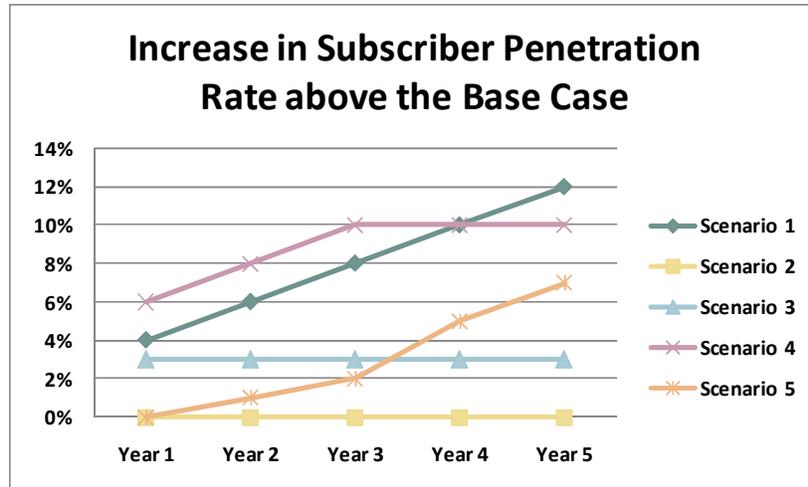


Figure 7. Increase in Subscriber Penetration Rate Above the Base Case Level

Scenarios can be grouped by those that enhance the basic HSI offering versus those that increase usage by existing subscribers but do not attract new subscribers. Scenario 1 where all subscribers received better quality videos for no extra fee and Scenario 4 where a proprietary bundle Internet video services are the most attractive to new subscribers. Scenario 1 is attractive because it provides higher quality service with no increase in the basic service fee. Scenario 4 is attractive because it offers a differentiate service bundle that competitors may not be able to match.

Scenarios 2 and 3 increase usage by existing subscribers but provide little or no attraction to new subscribers. Scenario 2 does not attract new subscribers because a per-view fee is charged to the subscriber to enhance the QoS of a video. Market research shows that users have a strong aversion to this type of pricing. However, once subscriptions are established users will make impulse purchases of pay-per-view services. In Scenario 3 content providers pay the BSP to deliver their programming with high QoS. Consequently, subscribers will not associate higher quality video with the BSP and this service will have a minimal effect on subscriber penetration.

Scenario 5—delivery of 3D TV—will have little effect on penetration for the next several years due to a lack of programming and the high cost of 3D TV sets. Once more 3D programming is offered and 3D TV set prices are reduced the offering will help attract new subscribers.

Figure 8 shows the number of paid enhanced QoS video/month per subscriber for all of the scenarios.

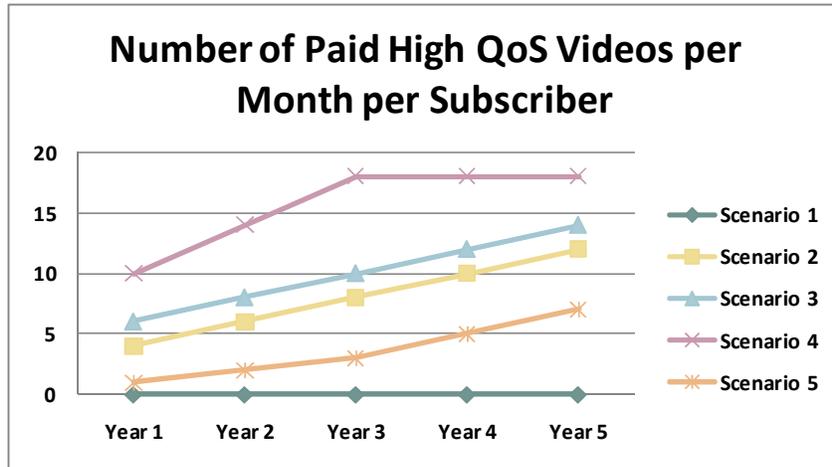


Figure 8. Number of Paid High QoS Videos/Month per Subscriber

Payments for delivery of high QoS videos may be made by subscribers or by content providers. Subscribers may not be aware of these transactions since the fees may be bundled with other BSP or content provider service charges. Scenario 1 has no videos of this type because improved video QoS is part of the basic service offering. The number of videos viewed per month increases with perceived value of the video versus its perceived cost. Therefore, Scenario 5 has the lowest number of videos per subscriber despite the high perceived value of a 3D video because the set and delivery costs are very high currently. As these costs drop more 3D videos will be purchased.

Somewhat more videos will be sold in Scenario 3 where the content provider pays for enhanced QoS than Scenario 2 where the subscriber pays for enhanced QoS because the subscriber is unlikely to perceive the cost of QoS when it is paid by the content provider rather than directly by himself.

Finally, the number of videos is highest for Scenario 4 because the proprietary bundle has the highest perceived service value while the cost of service is bundled with the cost of the overall service offering.

Figure 9 shows the increase in customer satisfaction rating of each scenario over that of the Base Case.

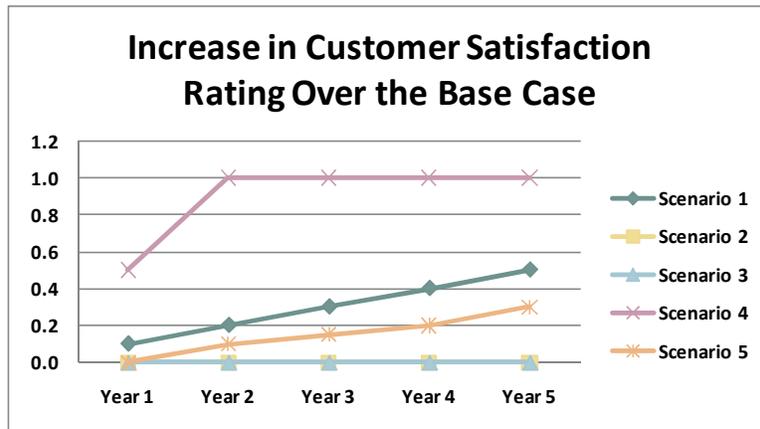


Figure 9. Increase in Customer Satisfaction Rating Over the Base Case

Changes in customer satisfaction ratings affect the incremental cash flow of each scenario because they are linked to the cost of churn. Increases in customer satisfaction decrease churn and its cost. Direct payments for improved QoS, as in Scenario 2, do not increase customer satisfaction because the subscriber’s perception is that he must pay extra to get the improved service quality—he expects it. Also Scenario 3 where selected content providers pay the BSP to improve the quality of their video offerings does not improve customer satisfaction because the better quality is associated with the content provider not the BSP. On the other hand Scenario 1 has a strong positive effect on customer satisfaction because the subscriber does not pay for the service improvements—the base service offer is simply better. Scenario 5 delivery of 3D TV is an exception to the rule that customer satisfaction is less if the subscriber directly pays for the service because 3D TV could not be offered over existing Internet infrastructure without smart networking capabilities. The absolute level of customer satisfaction is lower for Scenario 5 than Scenario 1 because few subscribers will use 3D TV over the next several years.

Figure 10 shows the increase in traffic in the aggregation network over that of the Base Case over five years for all scenarios.

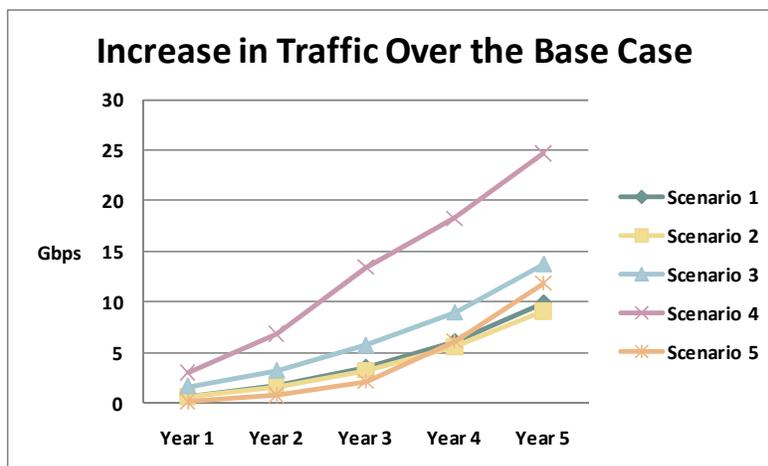


Figure 10. Increase in Aggregation Network Traffic Above the Base Case

Aggregation network traffic increases drive the TCO of the Integrated SmartEdge solution in two ways. Network traffic determines the number and type of ports of the SmartEdge 1200 system and in turn the number of required chassis. CapEx then is calculated by pricing out the system configuration. The system configuration also is used to estimate the OpEx to install, operate and maintain the SmartEdge 1200 system(s). Secondly, the bandwidth increases are used to determine the incremental annual cost of aggregation and core network transport services.

Over most of the five-year period Scenario 5 3D TV requires the least amount of bandwidth because its take-up rate is very low. Scenarios 2 and 3 have traffic increase slightly higher than Scenario 5 in the early years and lower in the latter years—they are more mature service offerings. Scenario 3 where content providers pay the BSP to deliver their videos with high QoS has consistently higher bandwidth requirements than Scenarios 1, 2 and 5. This is due to the content providers' more effective marketing of their paid content. Finally, Scenario 4 where the BSP offers a proprietary bundle of high QoS videos has much higher bandwidth requirements than the other scenarios. This is consistent with cable operators' results where premium video packages are top revenue producers—and bandwidth consumers.

Incremental Cash Flow and ROI Analysis of Enhanced QoS Video Scenarios

This section presents the cash flow analysis for each scenario. The analysis is presented graphically where:

$$\text{Incremental Cash Flow} = \text{Incremental Net Revenue} - \text{Incremental CapEx} - \text{Incremental OpEx}$$

CapEx expenditures are booked at the beginning of each year while Net Revenue and OpEx expenditures are booked at the end of each year. The cash flow chart shows Net Revenue as a positive value (Source of Cash) while CapEx and OpEx are shown as negative values (Use of Cash). Incremental cash flow can be either negative (loss) or positive (gain) as it is the difference between Net Revenue and the total of CapEx+OpEx.

ROI (Return on Investment) is the discount rate such that the investment in the initial period (Year = 0) equals the sum of the discounted cash flows for Years 1 through 5.

Figure 11 shows the cash flow graphic for Scenario 1 – No extra fee for enhanced QoS for all videos.

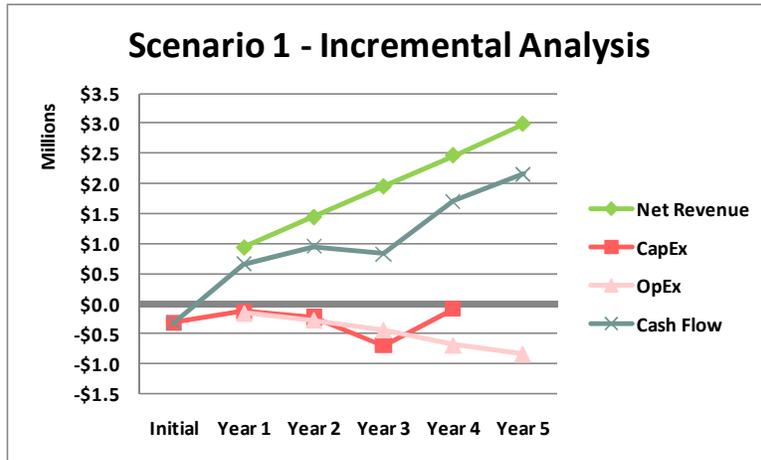


Figure 11. Incremental Cash Flow Analysis for Scenario 1

Cash flow is positive in every study year with payback in less than one year. The incremental **ROI is 241%**. Net revenue steadily increases as an increasing number of subscribers move to this high quality Internet video offering and as churn decreases. Incremental CapEx grows modestly despite the steady increase in traffic—this indicates good scaling of the incremental investment in smart networking. OpEx slowly increases. The cost of transport on the aggregation and core networks is the largest OpEx contributor.

Figure 12 shows the cash flow graphic for Scenario 2 – the subscriber is charged a per-view fee for every video he elects to watch with high QoS.

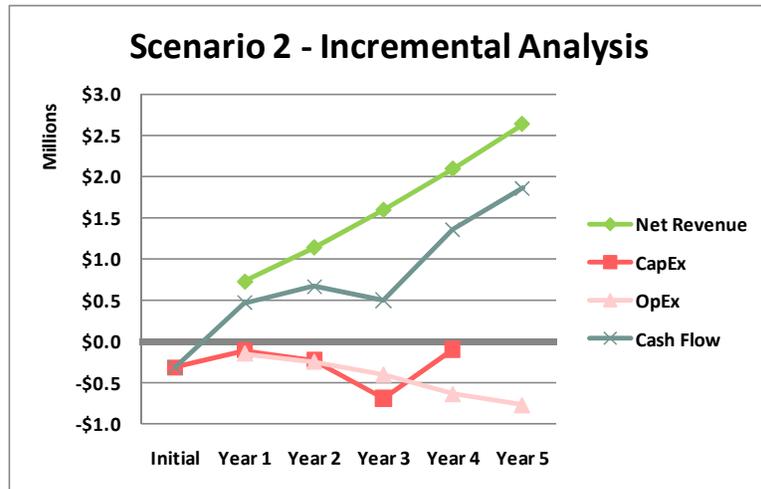


Figure 12. Incremental Cash Flow Analysis for Scenario 2

Cash flow is positive for each year of the study and **ROI is 177%**. The revenue growth trend differs from Scenario 1 in that revenue is realized for each video viewed with high QoS while in Scenario 1 incremental revenue is derived from increased service penetration and higher customer satisfaction. ROI and Net Revenue are lower for this scenario than for Scenario 1. Scenario 1’s strategy of

adding high QoS videos to the basic service offering without raising prices increases penetration and customer satisfaction while Scenario 2's pay-per-view approach does not. Consequently Scenario 1 has higher gross revenue and lower churn thus higher net revenue than Scenario 2. This yields higher ROI for Scenario 1. "Giving away quality" appears to be the more profitable strategy.

Figure 13 shows the incremental cash flow graphic for Scenario 3 – content providers pay for enhanced QoS delivery of their video content.

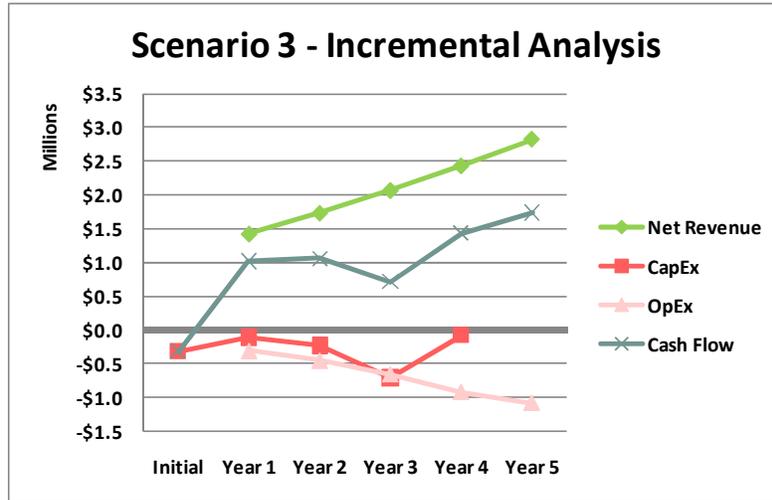


Figure 13. Incremental Cash Flow Analysis for Scenario 3

Cash flow is positive for each year of the study and **ROI is 326%**. The ROI is higher for this scenario than for Scenarios 1 and 2. Net revenue is higher in the early years of the study than it is for the first two scenarios. This accounts for Scenario 3's ROI advantage. Revenue grows rapidly in the early years because the per-view fees for enhanced QoS are paid by the content providers and thus hidden from subscribers. Incremental CapEx and OpEx are much the same as for the first two scenarios.

Figure 14 shows the incremental cash flow graphic for Scenario 4 – a proprietary bundle of video services with high QoS is offered to subscribers.

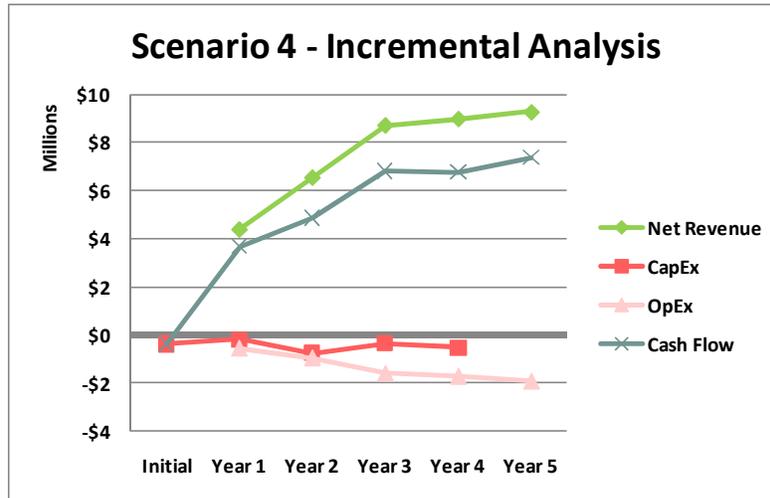


Figure 14. Incremental Cash Flow Analysis for Scenario 4

Cash flow is strongly positive in all study years and the incremental **ROI is 1033%**. Traffic is somewhat higher than in the previous scenarios as are CapEx and OpEx. However, the proprietary service bundle is a fully developed two-sided business model. This creates considerably more revenue from multiple sources including subscribers, content providers and advertisers. Revenue and the resulting cash flow are substantially greater than in the previous scenarios.

Figure 15 shows the incremental cash flow graphic for Scenario 5 – High QoS for 3D TV is offered on a pay-per-view basis.

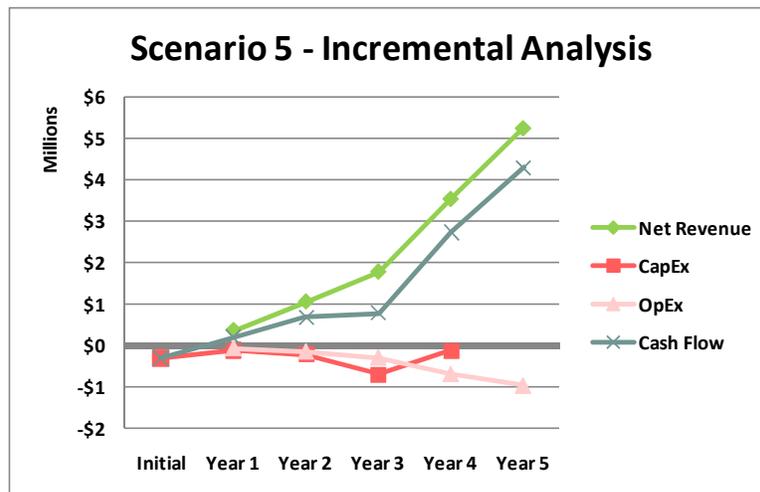


Figure 15. Incremental Cash Flow Analysis for Scenario 5

As would be expected for such an emerging service strong positive cash flow is not reached until the fourth year. **ROI none-the-less is 161%**. ROI is strong despite weak demand because there are few upfront costs for deploying smart networking. 3D TV currently uses a lot of bandwidth. However, this will remain a low penetration service for the next several years. Therefore, 3D TV's

share of total bandwidth on the aggregation network will remain small. Smart networking infrastructure also limits the bandwidth impact of 3D TV through policy management. In particular, most of the access bandwidth dedicated to a particular subscriber will be allocated to his 3D TV service. Other subscriber’s services will be unaffected by their neighbor’s use of 3D TV.

TCO Comparison of SmartEdge vs. a Multi-System Solution

This section provides a TCO comparison of the Integrated SmartEdge solution with a solution consisting of an Edge Router with BRAS functionality and a standalone DPI system. The Integrated Smart Edge solution is shown in Figure 6 while the Edge Router and standalone DPI solution is shown in Figure 16 below.

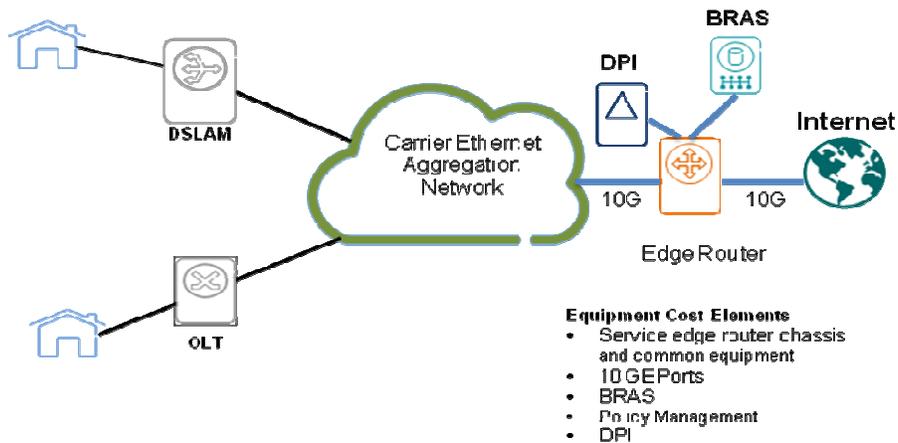


Figure 16. Edge Router, BRAS and Standalone DPI Solution

The traffic projection for Scenario 4—proprietary bundle of web video services—is used to model the TCO for both solutions.

The Integrated SmartEdge solution has 1% lower CapEx, 28% lower OpEx and 12% lower TCO than the Edge Router and Standalone DPI solution.

Figure 17 shows the differences in OpEx for each OpEx cost component.

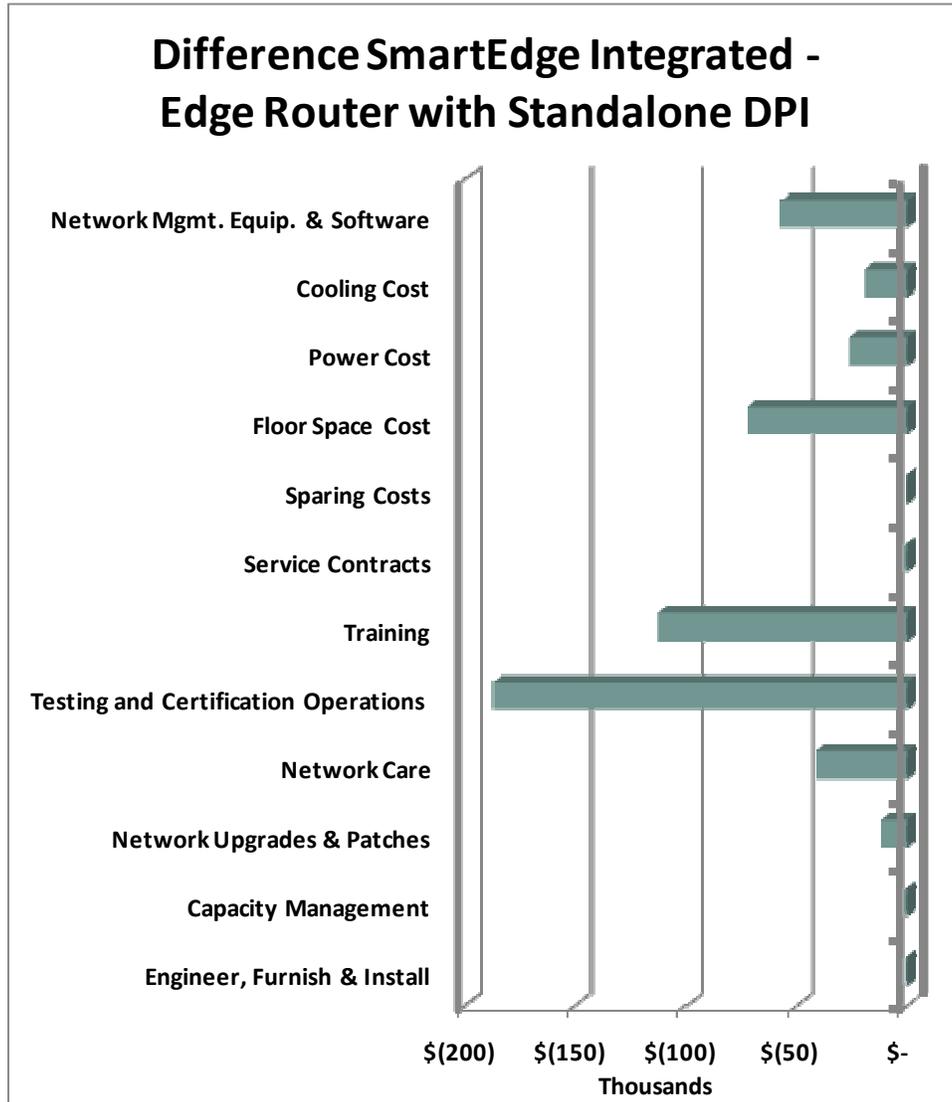


Figure 17. OpEx Differences – Integrated SmartEdge – Edge Router with Standalone DPI

The major expense savings for the Integrated SmartEdge solution compared to the Edge Router with BRAS and standalone DPI are related to the extra work involved in mating separate systems. Testing and certification operations, training and network management equipment and software expenses account for most of the cost advantage of the Integrated SmartEdge solution compared to the solution with separate Edge Router, BRAS and DPI systems.

Conclusion

Table 3 summarizes the cash flow and ROI results for the five web video services scenarios.

| Scenario | ROI | Payback (Years) |
|---|--------------|-----------------|
| 1 - No fees are charged to add enhanced QoS for video to the basic HSI service offering | 241% | <1 |
| 2 - Subscriber pays BSP on a per view basis to deliver Internet video with high QoS | 177% | <1 |
| 3 - Content provider pays BSP to deliver its content with high QoS | 326% | <1 |
| 4 - BSP offers a proprietary bundle of web video services through a portal | 1033% | <1 |
| 5 - BSP offers 3D TV to subscribers for a per view fee | 161% | 1 |

Table 3. Summary of Web Video Scenarios ROI Analysis

All five scenarios have high ROI and rapid payback. Scenarios 3 and 4 which employ the two-sided business model—payments are made to the BSP from subscribers and other service providers such as over the top video services—have the highest ROI. Scenarios 2 and 5 have the lowest ROI. These scenarios require a pay per-view fee from the subscriber. Market researchers such as the Nielson Company have found that Internet users dislike these fees because the market has taught them that Internet services are free beyond the monthly access fee.

Scenario 1 in which no additional charges are made to subscribers to improve the quality of video service delivery has higher ROI than Scenario 2 where the subscriber is assessed a fee for the delivery of each video with enhanced QoS. Scenario 1's comparably higher ROI is achieved through increased penetration of HSI service and the reduction of churn through improved customer satisfaction ratings. This shows that it pays to “give away quality”.

These high ROI results are produced by the smart networking capabilities of the Integrated SmartEdge solution. Key smart networking elements include the ASE—Advanced Services Engine—and the Ericsson Policy Manager. The web video services offerings especially the two-sided business model can be enabled by the Ericsson Media Fabric service that provides interfaces among the ecosystem participants as well as in home communications among consumer electronics devices like TVs, PCs, gaming systems and set top boxes.

A TCO comparison between the Integrated SmartEdge solution and an Edge Router with BRAS functionality and standalone DPI system found a 12% TCO advantage for the Integrated SmartEdge solution. Most of this advantage comes from the functional integration of SmartEdge which eliminates the work of managing two separate systems. Specifically testing and certification

operations, training and network management equipment and software expenses are significantly lower for the Integrated SmartEdge solution.

Network Strategy Partners, LLC

Tel: 978-287-5084

www.nspllc.com



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