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MASTER THESIS

Broadband Services Virtual Operator for Bitstream Access Networks *Business Case and Infrastructure*

TITLE: Broadband Services Virtual Operator for Bitstream Access Networks: Business Case and Infrastructure

MASTER DEGREE: Master of Science in Telecommunication Engineering & Management

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Overview

The aim of this thesis is to study the technical and business model for the creation of a virtual operator for bitstream access networks in Catalonia, in the modality of carrier's carrier.

The substrate for this project is Xarxa Oberta network. Xarxa Oberta is a project which is under way at present and that will ultimately provide a backbone network connecting all municipalities in Catalonia. Open access networks are being deployed across Spain to provide access to broadband services where this was previously either not possible or not competitive. Additionally, multiple access networks are already deployed which currently subcontract interconnection and advanced services from third parties.

Xarxa Oberta offers the opportunity to create a bitstream virtual operator that offers its services to local service providers in several access networks across Catalonia.

The technical model uses both Fiber to the Home (FTTH) and Hybrid Fibre-Coax (HFC) technologies to develop a reference model for access network deployments, including both existing and open access network operators as potential customers. A complete open source stack is proposed to deploy Network Management System (NMS) and Operation and Business Support Systems (OSS/BSS). The infrastructure is defined, including equipment selection and deployment.

A business plan is detailed to analyse the viability of the project. The key activities, resources, channels, costs, revenues, etc are presented in detail. This business plan serves as a basis for the business model, which studies the economic viability of the operator.

Various scenarios are studied, each with different values for the main parameters (such as network size, number of networks, etc.). The results of these models give a structured view of the viability of the business for this virtual operator.

PREFACE

This thesis presents the result of nearly six months of study and could not have been conducted without the help of others. In this preface I would like to take the opportunity to thank these people.

First of all, I would like to thank my supervisor Carlos Bock for offering me the opportunity of collaborating with him on this subject. His knowledge and supervision has led me through the process of structuring and developing this thesis. Hopefully we will be able to collaborate more in the future.

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I would like to thank my parents for their everlasting patience with me and my endeavours. I would not have been where I am now if it hadn't been for their support.

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LIST OF ABBREVIATIONS

ADSL	Asymmetrical Digital Subscriber Line
AS	Autonomous System
BSS	Business Support System
CATNIX	Catalonia Neutral Internet Exchange
CATV	Cable Television
CMT	Comisión del Mercado de las Telecomunicaciones
CMTS	Cable Modem Termination System
CPE	Customer Premises Equipment
CRM	Customer Relationship Management
DHCP	Dynamic Host Configuration Protocol
DOCSIS	Data over Cable Service Internet Specification
DSL	Digital Subscriber Line
DSLAM	Digital Subscriber Line Access Multiplexer
DVB	Digital Video Broadcast
EMS	Element Management System
EPON	Ethernet Passive Optical Network
ERP	Enterprise Resource Planning
eTOM	Extended Telecommunications Operations Map
EU	European Union
FCAPS	Fault, configuration, accounting, performance, security
FTTB	Fiber to the Building
FTTC	Fiber to the Curb / Cabinet
FTTH	Fiber To The Home
GPL	General Public License
GPON	Gigabit-capable Passive Optical Network
GUI	Graphical User Interface
HFC	Hybrid Fiber Coaxial
IMGP	Internet Group Management Protocol
IPTV	Internet Protocol Television
IRR	Internal Rate of Return
ISP	Internet Service Provider
ITU	International Telecommunication Union
IX	Internet exchange
MGCP	Media Gateway Control Protocol
NMS	Network Management System
NPV	Net Present Value
ODN	Optical Distribution Network
OLT	Optical Line Terminal
ONU	Optical Network Unit
OSS	Operational Support System
PBX	Private Branch Exchange
PON	Passive Optical Network
PoP	Point of Presence
PSTN	Public Switched Telephone Network
RF	Radio Frequency
RIR	Regional Internet Registry
SIP	Session Initiation Protocol

SNMP	Simple Network Management Protocol
SRM	Supplier Relationship Management
TMN	Telecommunications Management Network
VLAN	Virtual Local Area Network
VoD	Video on Demand
VoIP	Voice over Internet Protocol
VPN	Virtual Private Network
XO	Xarxa Oberta

CHAPTER 1. INTRODUCTION

This thesis presents the results of the study of a technical and business model for a virtual operator on bitstream access networks. The aim of the operator's business would be to offer advanced connectivity services to network operators, carrying out all network related issues and leaving to the local operator sales and customer relationship processes.

The objective is to archive a critical mass that can access to good prices on bandwidth and equipment and share a network operation centre with the associated support team.

The concept of the virtual operator is based on a **carrier's carrier** approach. In this model a network operator owns an access network and offers services to end-users and the carrier's carrier offers advanced connectivity services to this network operator. This has many advantages for the network operator as it will require less or no technical staff at all and the network operator can focus on sales and customer consolidation.

Several access networks based on Hybrid Fiber-Coaxial (HFC) technology are deployed throughout Catalonia. As next generation networks such as Fiber to the Home (FTTH) result in very high deployment costs for operators, a migration plan is required to upgrade them gradually.

Five different access networks have been identified and studied in this project; all located in Catalonia are operated by small network operators without good interconnection to a backbone or Internet Exchange. Services are received through multiple service providers and a separate infrastructure provider that provides the trunk infrastructure to the municipality.

The access networks identified for this thesis are located in La Senia, Solsona, Capellades, La Pobla de Claramunt and Riba Roja d'Ebre. Their locations are spread throughout Catalonia, as can be seen in the following figure.



Fig.1-1 Isolated Access Networks in Catalonia

The virtual operator requires an infrastructure and various solutions to offer advanced services to these network operators. Specifically in Catalonia an interesting opportunity is arising, by using Xarxa Oberta as the interconnecting network.

1.1 Xarxa Oberta

In February of 2010 the Catalan government presented the “Xarxa Oberta” (**XO**, *English: Open Network*) project. This project aims to build and operate a fibre optic broadband communications network within Catalonia [1].

The main goal of the project is to interconnect all the public administrations distributed throughout all 947 municipalities in Catalonia. The project has been split into two separate phases.

The first phase will connect 52 municipalities in Terres de l'Ebre region, thereby interconnecting 349 public administration sites [2]. The existing infrastructure

that will connect to the XO already covers 44 municipalities, with 443 public administration offices.

The second phase, which can be split further, would consist of interconnecting the rest of Catalonia, but has temporarily been put on hold due to financial reasons.

The next figure, Fig. 1-1, presents the forecast of the XO after finalization of Phase I. Another objective of the XO is to take advantage of the anticipated infrastructure and offer XO exceeding capacity to the operator's market in the form of an open, independent, and neutral network.

The European Commission has approved the rollout of XO under EU state aid rules, allowing it to be open at wholesale level to communications operators [3]. The European Commission stated that private operators would be able to obtain fair and non-discriminatory access to the spare capacity of the XO wholesale infrastructure, excluding the four provincial capitals of Barcelona, Girona, Lleida and Tarragona.

The XO project has been awarded to Imagina-Axia consortium, which will be in charge of operating the network during twenty years (extendable to thirty). Once the concession is overall the assets will be transferred to the Catalan Government.

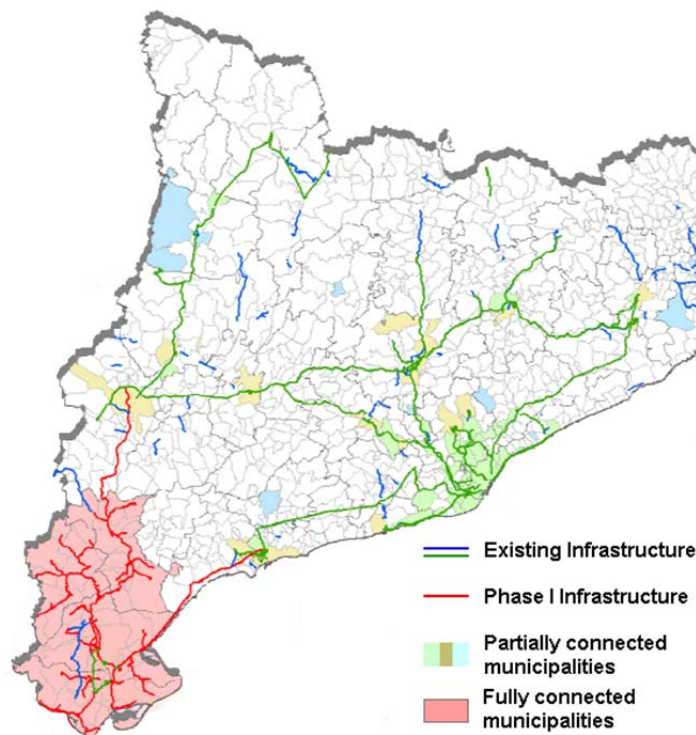


Fig. 2-2 Xarxa Oberta after Phase I

The XO project is a perfect opportunity to serve as a backbone network for the virtual operator to offer advanced connectivity services to various access network operators. The infrastructure can be leased from the neutral operator and the virtual operator will not need to roll-out its own infrastructure, dramatically reducing capital expenses.

1.2 Open Access Networks

To be able to fulfil with the European Digital Agenda goals, several public incentives have taken place to deploy these infrastructures with public funding, through open access networks. The Spanish regulator, Comisión del Mercado de las Telecomunicaciones (CMT), defined the conditions for operation of networks and provisioning of electronic communications services by public administrations. This Circular (1/2010) was accepted on June 15th, 2010 and defines that public administrations may operate public networks if it complies with the principle of the market economy [5].

Open access networks can therefore be deployed if they do not interfere with market competition. These public-owned infrastructures are operated by a neutral operator that grants access to multiple service providers on wholesale-only basis. These service providers pay this neutral operator fees to offer their services to end-users over this open access network.

The deployment of open access networks is an opportunity for small operators to offer services to end-users without having to deploy the infrastructure, saving very high capital expenses. However, there is assumed that operators that operate on open access networks will provide their own interconnectivity to the Internet and have their own technical deployment to offer advanced services such as VoIP or IPTV.

For small operators the capital expenses of this requirement may be excessive, meaning they will need to outsource this to a carrier's carrier. The virtual operator can therefore not only offer its advanced services to operators on existing access networks, but also to small operators on open access networks.

In the last years in Spain several open access networks have been deployed, funded by local or regional government. Some examples of municipalities with open access network deployments in Spain are Asturias (Asturcón) and Viladecans, while other initiatives are underway in Igualada and in the province of Navarra (Opnatel).

1.3 Document Overview

The objective of this thesis is to develop the technical model as well as the business model for a virtual operator offering bitstream access services within Catalonia, Spain.

Chapter 2 presents the different access network architectures the virtual operator will offer its services on, listing the main technical requirements.

Chapter 3 will present the technical deployment and operation in further detail. Subjects treated within this chapter are Point of Presence requirements, Internet exchange, housing and support systems (OSS/BSS).

Chapter 4 presents the definition of the virtual operator, based on the previous chapters. This chapter presents the defined infrastructure and the services that the virtual operator will offer

A business model is developed, which is presented in Chapter 5. This chapter will include all the necessary aspects of the business model, based on Alexander Osterwalder's Business Model Canvas.

The economic impact of the business is presented in Chapter 6. The goal of this chapter is to study whether the business model is financially viable.

Conclusions and additional recommendations outside the scope of this thesis are presented in Chapter 7.

CHAPTER 2. TRANSMISSION MODEL

This chapter will present the technical model for our Catalan-based virtual operator. It describes the technical aspects of the different types of technologies that are deployed in access networks and for which the virtual operator will offer advanced services. Section 2.1 presents the FTTx architecture and section 2.2 the HFC architecture. Section 2.3 details the broadband services and their requirements.

2.1. FTTx

The acronym FTTx stands for the various solutions available for optical fiber networks: “Fiber to the X”, where the X can be Home (H), Building (B) or Curb (C). The figure below, Fig. 2-1 presents the various FTTx access network architectures.

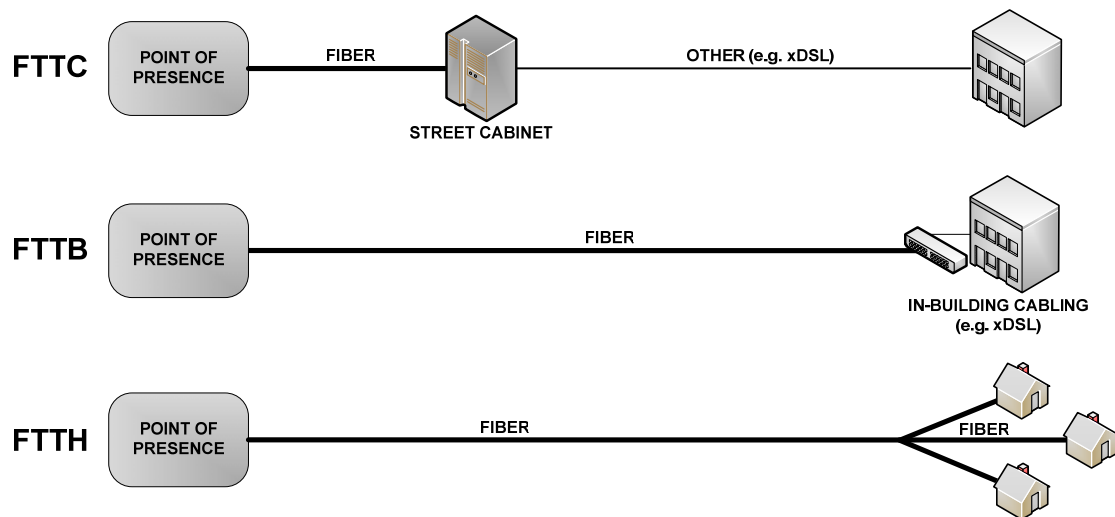


Fig.2-1 FTTx Access Network Architectures

The main difference between these architectures is the fiber termination point. With FTTC each DSLAM (in case of xDSL) or street cabinet is connected to the point of presence (PoP) with a fiber connection. The last mile connection to the subscriber can be copper or fiber based.

With FTTB the optical termination point is in the building where the subscribers are present. From this termination point the final connection to the subscriber can be either copper or fiber based. The fiber from the PoP to the building can be either dedicated or shared. In the last scenario, FTTH, each subscriber is connected to the PoP with fiber through a point to point or point to multipoint connection.

The European FTTH Council has discarded future FTTC deployments as they consider FTTH/B deployments the target architecture for the long-term future because of their almost unlimited scalability [6]. For FTTH/B several optical technologies are available for implementation in the network: Passive Optical

Networks (PON) and Point-to-Point Ethernet. The main disadvantage of Point-to-Point connections is the high number of connections in the network, therefore requiring more active components and more cabling. The following section will present the PON architecture in further detail.

2.1.1. PON Architecture

The main characteristic of PONs is the lack of active equipment in the network. This means that the network equipment do not require powering, network management is low and offers high network scalability.

Several PON standards exist, of which EPON (IEEE 802.3ah) and GPON (ITU-T G.984) are the most common. EPON is mostly deployed in Asia, while GPON is more present in Europe. Both standards are similar in their physical layer as they both transmit downstream data traffic at the 1490nm wavelength, upstream traffic at the 1310nm wavelength and the RF video signal at the 1550nm wavelength. However there are some differences that can be seen in the table below, Table 2-1, which presents the main characteristics for both EPON and GPON [7].

	EPON	GPON
Bandwidth (Downstream)	1 Gbps	2.4 Gbps / 1.2 Gbps
Bandwidth (Upstream)	1 Gbps	2.4 Gbps / 1.2 Gbps
Max. Split Ratio	32	64
Reach	10-20 km	10-20 km

Table 2-1 Comparison between EPON and GPON

Both the ITU and the IEEE have developed 10 Gigabit standards as successors to GPON and EPON, called XG-PON and 10G-EPON respectively. However, these are very recent and are still in test deployments and will therefore not be discussed further in this thesis.

The equipment used in PONs consists of:

- An optical line terminal (OLT) at the access network central office (CO)
- The optical distribution network (ODN), where the fibres can be spliced with optical splitters (splicing up to 1:64). This can be done in one or several splitting stages.
- The optical network unit (ONU) at the end user premises.

The following figure, Fig. 2-2, presents the general structure of a PON.

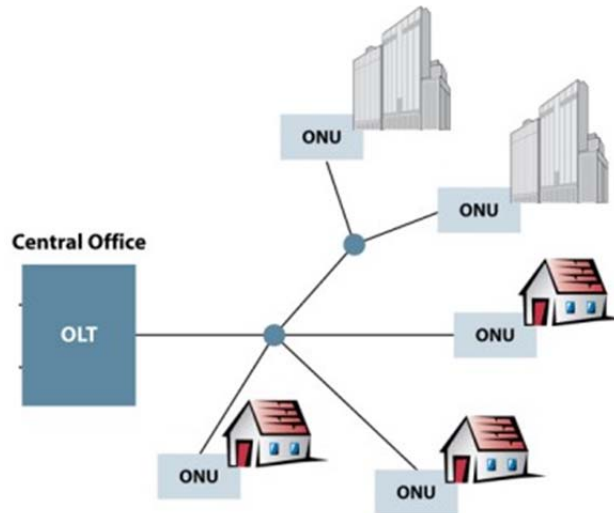


Fig.2-2 General PON Overview

For this thesis there is assumed that this access network will be provided by the local operator, which will be the customer of the operator that we present in this project.

Our virtual operator will connect its equipment to the OLT, located at the Point of Presence (PoP). The Point of Presence is a location where different service providers can connect to another network. In our case, the PoP will be in the same place as the CO and will become the interconnection point between the backbone network and the access network.

The figure below, Fig. 2-3, gives an overview of the general architecture for our PoP/CO.

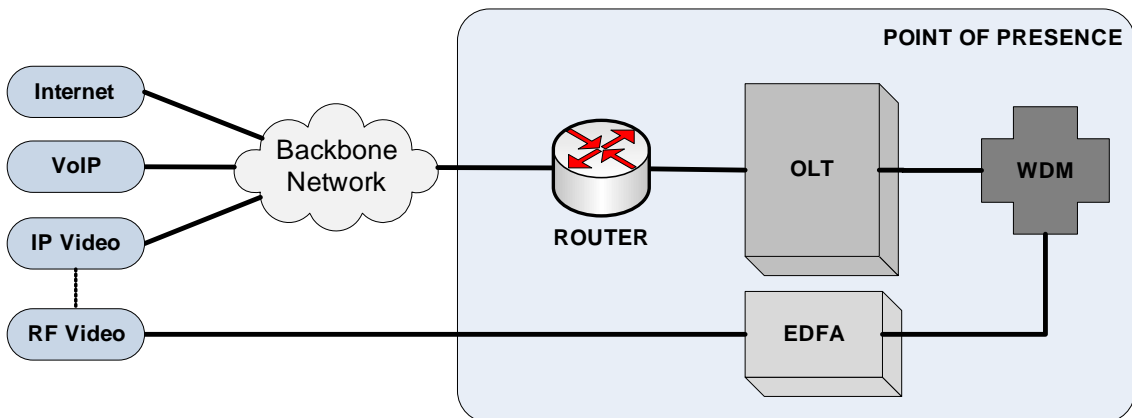


Fig. 2-3 Carrier's carrier interconnection model

The CO of a PON network consists mainly of an OLT where the virtual operator connects the equipment to offer advanced services and Internet transit. For Internet, VoIP or IP Video services the data traffic originates from the backbone network.

As far as video is concerned, just IP Video will be supported as a service offered by the virtual operator. RF video will not be transported due to technical and service limitations of XO. In some existing access networks (e.g. Riba Roja d'Ebre) RF video is already provided to support existing TV sets without a set-top box. For PON networks an RF video signal can be integrated in the access network through an amplifier and a wave division multiplexer.

There is assumed that the XO backbone infrastructure reaches the access network's point of presence. To interconnect the backbone and the access network a Layer 2 switch is required. This equipment should be provided by the virtual operator. Any additional devices required for the provisioning of value-added services on the access network are detailed in Section 4.1.

2.2. Hybrid Fiber-Coaxial (HFC)

Hybrid Fiber-Coaxial access networks, as the name states, consist of a combination of fiber optic cables and coaxial cables, as used for CATV systems. This network architecture has evolved from the CATV networks that were used to unidirectionally broadcast radio frequency (RF) video. At present, HFC networks are able to offer both analogue and digital television and IP services such as Internet and VoIP. The general HFC access network architecture is presented in Fig. 2-4 below [8].

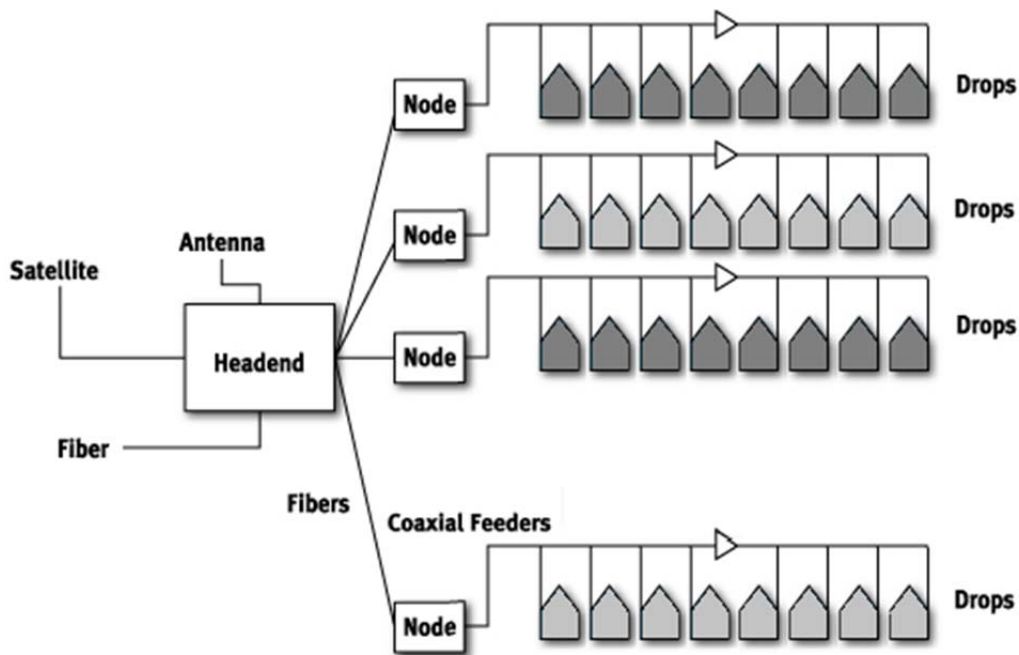


Fig. 2-4 HFC Access Network Architecture

The HFC access network consists of the following elements:

- Headend,
- Optical nodes
- Cabling (feeder and drop cables)
- Customer premises equipment (CPE or Terminal Equipment)

The headend serves as a CO and is connected to the optical nodes with fiber optic cables (feeder). These optical nodes convert the optical signal to a RF signal and feed these signals to the end users through coaxial cables (drop). If necessary, RF amplifiers are implemented in the coaxial segment to guarantee the quality of the signals being transmitted. The drop cable is connected to the CPE, which can be a television set, set-top boxes or a cable modem.

The coaxial network allows for bi-directional transmission by deploying DOCSIS equipment: Data over Cable Service Interface Specification.

This standard was first issued in 1997 and has been developed further through the years, being the latest version, DOCSIS 3.0, issued in 2006. Different DOCSIS standards exist for Europe and the United States of America, because of the different frequency allocation and bandwidth per channel. In Europe PAL standards use 8 MHz channels, allowing for higher throughput per channel than with 6-MHz NTSC systems that are used in the United States. The table below, Table 2-2, presents the main characteristics of the different DOCSIS versions for Europe.

DOCSIS	Version 1.0 / 1.1	Version 2.0	Version 3.0
Max. number of channels	1	1	No maximum
Bandwidth (Downstream)	50 Mbps	50 Mbps	# channels x 50 Mbps
Bandwidth (Upstream)	9 Mbps	27 Mbps	# channels x 27 Mbps

Table 2-2 Comparison between DOCSIS Versions

For our backbone operator, the only important element in the HFC access network is the headend, where the connection will have to be made with the XO backbone. The following section describes the HFC headend in further detail.

2.2.1. HFC Headend Architecture

The main element of the HFC headend is the Cable Modem Termination System (CMTS). Two different system architectures are available for CMTS, Integrated (I-CMTS) or Modulated (M-CMTS) [9]. The main difference between these two architectures is that I-CMTS offers all CMTS features in a single device, while the M-CMTS architecture is divided into several elements. A basic M-CMTS overview is presented in the figure below, Fig. 2-5.

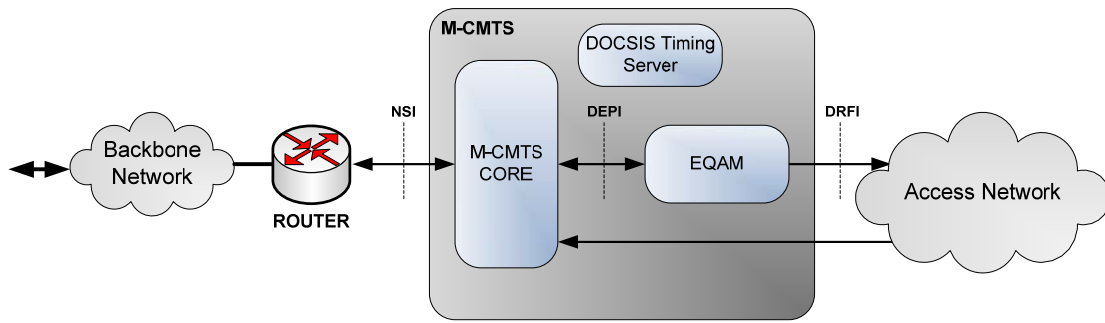


Fig. 2-5 M-CMTS Overview

The Modular (M-) CMTS architecture is divided into the M-CMTS Core and the Edge QAM Modulator (EQAM). The M-CMTS Core contains all the traditional DOCSIS CMTS functions, while the EQAM device functions required for the conversion to data packets over the HFC network. An additional module is the DOCSIS Timing server that ensures timing accuracy between the CMTS and the EQAM, by means of the DOCSIS Timing Interface.

The Downstream External PHY Interface (DEPI) between the Core and the EQAM is responsible for allocating resources to the connected devices. In I-CMTS systems there is no DEPI as the Core and EQAM are in the same module. Regardless of the system architecture, the CMTS is connected to the backbone network through a router that is connected to the Network Side Interface (NSI).

This NSI consists of various optical or Ethernet interfaces, depending on the manufacturer and model. The CMTS is connected to the access network through a Downstream RF Interface (DRFI), consisting of multiple optical interfaces. Multiple channels can be transmitted over each physical interface.

Similar to PON access networks, there is assumed that the XO backbone infrastructure is connected to the HFC Central Office. The virtual operator should deploy at least a Layer 2 switch at the HFC central office. Any additional devices required are detailed in Chapter 4.

CHAPTER 3.SUPPORT SYSTEMS

This chapter describes the operation of the virtual operator, focused on the network operations and management. Section 3.1 presents the support systems needed to guarantee the operation and management of the network. The systems that are suggested for the virtual operator are all open source systems.

The key factors to choose open source software over vendor-specific software are the lower costs of investment and ownership, no vendor dependency and the ability to customize the software to specific needs.

Popular open source systems consist of big communities that continuously adjust the systems to the latest community needs, contributing to qualitative systems that are able to compete with vendor-specific systems. The main criteria upon selecting the open source solution to be applied for the virtual operator are the size of the community, the maturity and robustness of the product, and the amount of available documentation.

3.1. Management

For this project the Telecommunications Management Network (TMN) is used as a reference for the network management requirements. The TMN forms the management system for the network to be managed, and is defined by ITU-T in recommendation M.3010 [10]. It offers standard interfaces that allow a network to be managed across different network elements.

The logical architecture of the TMN splits the management functionality in hierarchical layers, as presented in Fig. 3-1. The logical architecture consists of five layers, from bottom to top these are:

1. Network Element Layer (NEL)
2. Element Management Layer (EML)
3. Network Management Layer (NML)
4. Service Management Layer (SML)
5. Business Management Layer (BML)

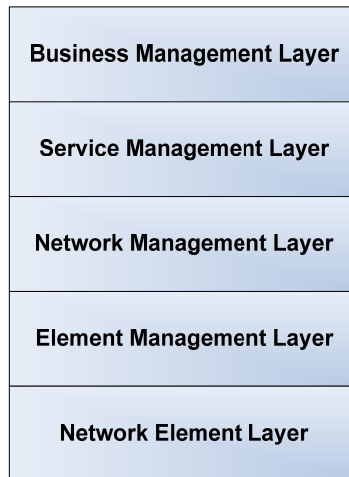


Fig. 3-1 TMN Logical Architecture

The NEL basically consists of the physical network elements and the functions they perform. An example of these functions is transmission of management data to higher layers, of both TMN and non-TMN interface network elements. The EML, with the information provided by the NEL, is responsible for the management of all the different elements in the NEL. An example of a system that performs these functions is an Element Management System (EMS). The NML manages the functions not for just the elements in the EML, but manages the functions between the elements as well. The Network Management System (NMS) performs these functions. The SML is used for functions such as service provisioning, user account management, QoS and monitoring. Its main objective is to manage the services, which is realized through the implementation of an Operational Support System (OSS). Finally, the BML is required for the business operations of the network, such as accounting, ticketing and Customer Relationship Management (CRM). These functions can be realized by implementing a Business Support System (BSS).

Summarizing, based on the TMN logical architecture four different systems can be defined to realize the network management in all layers:

- EMS
- NMS
- OSS
- BSS [11]

The remainder of this section will present these systems in further detail. In section 3.2 the open-source stack is suggested that will provide the new operator with a solid management platform.

3.1.1. Element Management System (EMS)

The Element Management System (EMS) is an application that manages a single network element. All EMS solutions are expected to provide FCAPS functionalities:

- Fault: detection, isolation and correction of errors
- Configuration: configuration of the network element
- Accounting: identification of costs and payments
- Performance: data analysis on network element behaviour
- Security: protected environment

EMS functionalities are similar to those of NMS applications, with the difference that processing is handled per Network Element and the information collected from multiple elements does not provide network information.

The EMS architecture is represented in the following figure, Fig.3-2:

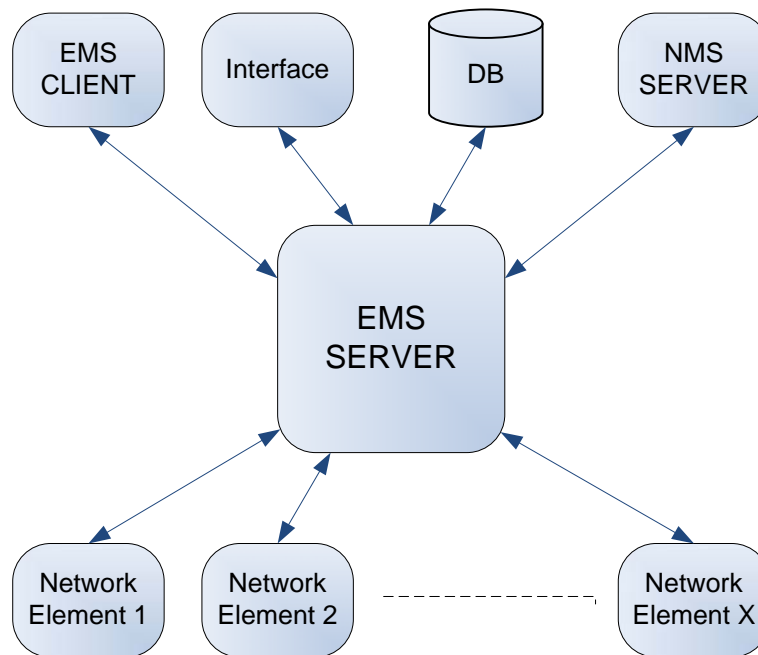


Fig. 3-2 EMS Architecture

The basic architecture consists of several network elements connecting to an EMS server. The information received from the network elements is stored in an EMS database and also transmitted to the NMS server. To ensure the proper integration of EMS data in NMS solutions, it is preferred that the information is standard-based (SNMP, SOAP, NETCONF, etc.). An adaptation layer should perform the conversion to a common format that is supported by the NMS. Each vendor that provides an EMS also should provide the adaptation application or a probe for the NMS to collect data from the EMS. Administrators can connect to the EMS Server through an EMS client or a separate interface. Some EMS solutions offer web-based GUIs while others provide a client application that communicates with the server.

EMS solutions are proprietary solutions, each vendor offering different EMS solutions for its products. Because of this characteristic, no open source EMS solutions exist, as this is a feature already offered by the vendor. The EMS is connected to the OLT or CMTS, and it is assumed that this is operated by the

neutral operator. Therefore, the new operator will not have to deploy an EMS solution.

3.1.2. Network Management System (NMS)

NMS is defined as any management solution that can collect data from network elements and performs one or more management functionality. It uses the FCAPS data obtained from the EMS to provide an overview of the entire network. The main components of an NMS are:

- Data collection
- Management
- Graphical User Interface
- North Bound Interfaces

The NMS consists of data collection components that collect the data from network elements using either a proprietary or standardized protocol. Standard protocols are recommended, as agents would be able to collect data from multiple different network elements.

Based on the collected data the NMS performs several key management functions. Examples of these functions are: event creation based on faults, modify running configurations, dynamic network discovery, and performance reports.

Most NMS solutions offer a user-friendly graphical representation in the form of a GUI. This allows the administrator to graphically view the infrastructure, performance parameters and fault reports, among others.

The northbound interface components provide the interfaces to higher layer support systems, such as OSS or BSS. This component generally consists of two elements: a framework and a server. Frameworks and servers often used in NMS solutions are J2EE interface in combination with Java application server, CORBA interface in combination with an Objects Request Broker (ORB), or the .NET interface and server.

NMS solutions exist according to five main classifications:

1. Customizable framework: provides a framework with general functionalities and allows for customization.
2. NMS Suite: complete framework including add-ons.
3. Function specialized NMS: only performs specific NMS functionalities (e.g. fault management NMS)
4. Domain specialized NMS: only manages network in a specific domain
5. Hybrid: any combination of the previous

Both proprietary and open-source NMS solutions are available. Examples of proprietary solutions are IBM NetCool (complete NMS suite), IBM Tivoli (hybrid NMS), AdventNetWebNMS (customizable framework) and HP OpenView (complete NMS suite). Examples of open source NMS solutions on the market

are OpenNMS (customizable framework), Hyperic HQ (customizable framework), Zabbix (function specialized: monitoring), and Zenoss Core (NMS suite).

3.1.3. Operational and Business Support Systems (OSS/BSS)

Operational Support Systems (OSS) and Business Support Systems (BSS) include the systems used to support the daily operations of the bitstream operator. OSS systems provide the service management of the network, while BSS solutions are more customer-centric and include functionalities such as billing, CRM, sales, etc.

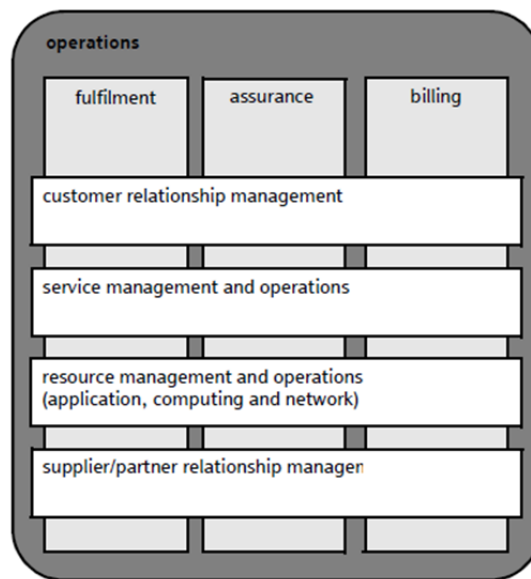


Fig. 3-3 eTOM Model

For OSS/BSS another model is used to represent operational and business requirements, which is the extended Telecommunications Operations Map (eTOM), of which the operations module is shown in the figure above, Fig.3-3. It is a very extensive model, which defines three main functionalities for network operations: fulfilment, assurance and billing [11]. Fulfilment is defined as the set of operations used to fulfil the customer’s order or needs. Within OSS this includes service provisioning and inventory management, while within BSS this includes order management and sales. Assurance is the set of operations required to assure that the services are offered according to expected performance. The last main functionality is billing, which involves ensuring the reception of payment for the services offered.

In the eTOM model these three functionalities must be applied to four main processes: Customer Relationship Management (CRM), service management and operations, resource management and operations, and partner/supplier relationship management (SRM).

For the four eTOM processes, four separate systems could be deployed. In most systems however, these processes are all integrated in Enterprise Resource Planning (ERP) systems. Both proprietary and open source solutions

exist for ERP systems. The two biggest open source projects in ERP are Compiere and Openbravo.

3.2. Open Source Stacks

After analyzing the functionalities and systems required for network management in the previous sections, this section will present the open source solutions recommended for the virtual operator. This section only presents the final recommendations. As an NMS solution OpenNMS is recommended, including integration with a security and a ticketing system. As an ERP solution Openbravo is recommended. The open source software solution for the virtual operator is shown in the following figure, Fig 3-4:

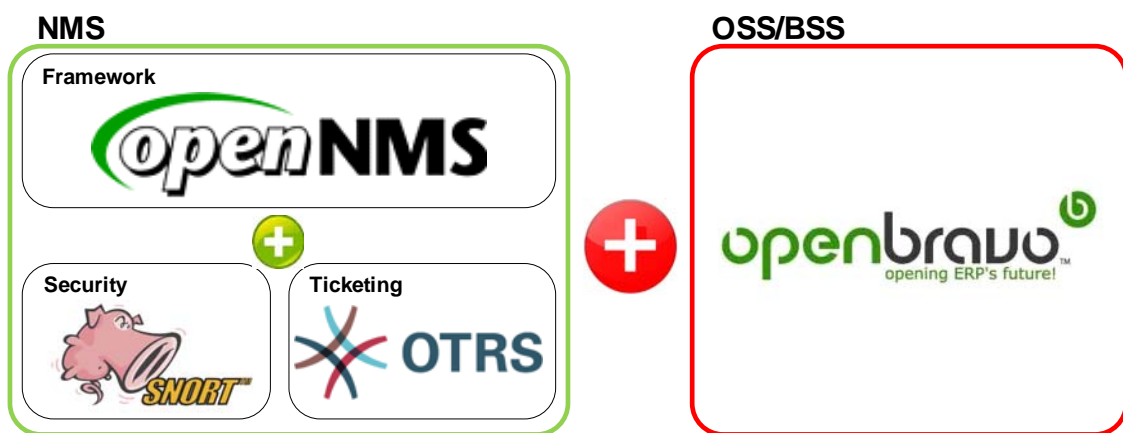


Fig. 3-4 Proposed NMS and OSS/BSS Solution

The implementation of this system will be centralized, requiring one server running at least two virtual machines with these systems at the Telvent Housing facilities.

3.2.1. OpenNMS + Add-ons



The OpenNMS framework is a customizable framework and is currently one of the most popular NMS products. It was the first open source enterprise-grade NMS, and to date it has developed a stable, mature platform that has won several awards and consists of a large supporting community. Commercial support and training is provided by the OpenNMS group, which offers support to large businesses at a fee. All source code is available under the General Public License v2 [12]. The main features of OpenNMS can be divided in four different segments: discovery, event management, service assurance, and performance measurement [13]. OpenNMS provides automatic discovery on many different levels; it supports L2-L3 discovery, network/node discovery as well as service discovery. The system is also capable of manually discovering devices, if this is

preferred. Events in OpenNMS can be both exterior events (such as SNMP traps from devices) and self-generated OpenNMS events (XML formats). Events can be filtered and sorted by severity, device, etc. to customize the notifications the network manager will receive by e-mail/SMS.

Regarding service assurance, OpenNMS is able to generate detailed reports on availability of services or devices. A large number of service monitors is available in the tool, from basic ICMP pings to round trip e-mail testing.

Performance measurements can be based on various types of data that the tool can collect. OpenNMS supports data collection for SNMP, JMX, HTTP, FTP and several other protocols. The data collected can be filtered against several thresholds, creating customized notices for the network manager if a part of the network is underperforming.

As OpenNMS does not provide full FCAPS functionality, it is recommended to integrate the framework with several add-ons. Of the possible solutions that can be integrated with OpenNMS, the most useful are Snort (security) and OTRS (ticketing) [14, 15]. These solutions will be described briefly in this section.



Snort is an open source intrusion detection system, used by many service providers to scan network activity and detecting dangerous activity. It performs real-time traffic analysis and packet logging to detect network attacks and probes.



OTRS is an open source ticketing system that can serve as a help desk or service management system, and was first released in 2002. It offers the operator both a Web-based and mail-based interface to offer support to end users who report trouble tickets. It is a stable and mature system that aids the operator in its end-user support.

3.2.2. OSS/BSS: Openbravo



As explained in section 3.1.3 the main OSS/BSS functionalities can all be performed by a single ERP system. For the new operator Openbravo ERP is recommended as its ERP solution. Openbravo ERP is the biggest open source

ERP solution, with over 2 million downloads since its foundation in 2001. Openbravo ERP has three times been awarded the InfoWorld Bossie Award for best open source software application [16]. Openbravo ERP is a web-based ERP solution aimed at small and medium enterprises. The source code is released under the Openbravo Public License, based on Mozilla Public License. The program is based on the Compiere ERP, the second biggest open source ERP solution. The main difference between the two solutions is the database usage. Compiere only supports Oracle databases, which require both license and maintenance fees, while Openbravo also supports PostgreSQL databases, which are open source.

Openbravo ERP offers all four key functionalities of a complete ERP system and divides these functionalities into eight different key features:

- Master Data Management: products, components, customers, vendors
- Procurement Management: rates, orders, invoice, receipts, accounting
- Warehouse Management: serial numbers, labels, etc.
- Project and Service Management: projects, tasks, resources, etc.
- Production Management: plans, orders, reports, etc.
- Sales and CRM: prices, shipments, invoicing, CRM, etc.
- Financials and Accounting: accounts, taxes, balance, banking
- Business Intelligence: reporting and analysis.

CHAPTER 4. OPERATOR DEFINITION

This chapter presents the definition of the virtual operator based on the findings of the previous chapters.

4.1. Infrastructure and Services

This section presents a more detailed overview of the technical deployment and connectivity services that will be offered by the virtual operator, to identify any additional requirements these additional services might introduce.

For the deployment of the equipment either a centralized or distributed model can be selected. In a centralized model, the equipment required needs to fulfil higher bandwidth and processing requirements as this will process the traffic for multiple access networks. In a distributed model the requirements are less strenuous, but the equipment is required at each access network's point of presence. For this reason a centralized architecture is selected for the deployment of the virtual operator's equipment.

This requires centralized housing facilities, which are detailed in section 4.1.1. To offer data services the virtual operator should have interconnectivity with other Internet service providers. This is detailed in section 4.1.2.

4.1.1. Housing

Besides a Point of Presence at each of the access networks, additional housing is needed to install the equipment the operator requires between the backbone network and the IX. The central housing facilities for the bitstream operator can be allocated at various data centres throughout Catalonia. It is recommended to implement this at (or near) Telvent Housing (previously CarrierHouse Barcelona), as these facilities offer direct connections to the Internet exchange. Telvent Housing provides telecommunications and IT facilities and interconnection with Tier 1 network providers [17]. It offers security, availability and reliability as services to operators. The service at Telvent includes 2 public IP addresses, 24x7 support and power supply. The costs of central housing are presented in Chapter 5.

4.1.2. Internet Exchange

The XO backbone network will only provide interconnectivity between the access networks and the local Internet Exchange, while not providing Internet connectivity. To be able to connect to the Internet the operator must connect to an Internet eXchange (IX), and maintain a connection with an upstream Internet service provider.

The IX is an infrastructure that allows Internet Service Providers (ISPs) to exchange Internet traffic directly between their networks.

The Catalan IX is based in Barcelona and known as Catalonia Neutral Internet Exchange Point (CATNIX), founded in 1999 [18]. The CATNIX facility is located at the Nexus building, at UPC Campus Nord, Barcelona. In 2005 the CATNIX facilities were extended to the Telvent Housing facilities, located in the Barcelona Zona Franca district. The main facilities do not offer housing, while the Telvent Housing facilities do, making these facilities the ideal location for the new operator.

The CATNIX infrastructure at Telvent Housing consists of one Cisco Catalyst 4507R-E switch to which operators connect their equipment. Currently twenty-three different operators are connected to this equipment with one or multiple ports. An operator can either connect to 100Mbps or 1Gbps ports on the CATNIX equipment, depending on the network requirements. This port is directly connected to the virtual operator's router. To get a connection to CATNIX a set of requirements would have to be fulfilled. An important requirement within the scope of this project is the requirement that the provider must have an Autonomous System (AS) registered at a Regional Internet Registry (RIR). There are five RIRs worldwide, the European RIR being RIPE NCC. Other requirements are routing related, such as which routing protocol to use (BGP-4) and the mandatory application of routing filters.

The CATNIX connection offers the possibility to exchange traffic with other Catalan service providers through peering. CATNIX participants must carry each other's traffic on their networks to improve the access to local information. This concept is called peering and is realized through a bilateral agreement between two operators. These peering agreements do not include Internet connectivity, for which the virtual operator has to realize a transit agreement with an upstream ISP.

Transit is an agreement between an operator and a transit provider that carries the traffic on behalf of the operator to and from every destination on the Internet. Transit prices are flat rate, depending on the capacity of the transit. Examples of transit providers are XO Communications, Cogent Communications and TeliaSonera.

4.2. Advanced Services

Broadband network technologies such as FTTH or HFC enable the support of high bandwidth consuming services such as triple play, video on demand, videoconferencing, etc.

The European FTTH Council finds that the choice of service package and the ability to provide these services has been one of the main criteria for success or failure of many of the independent FTTH networks [19]. According to a study realized by Point Topic, the leading broadband value-added services in terms of value were IP telephony, security, online gaming, IPTV and online music [20].

These services can basically be characterized in three types of broadband services:

- Data
- IP Telephony
- IP Television

4.2.1. Data

To offer data services the virtual operator should ensure interconnectivity between the access network and the Internet and ensure that the routing of is correct. This is already defined in section 4.1.2.

The router at the Internet Exchange should be able to route all incoming and outgoing traffic and should therefore consist of a powerful backplane and have a high packet processing rate. The majority of operators located at CANIX have deployed Cisco 7200 Series routers as they fulfil these requirements.

4.2.2. IP Telephony

For the virtual operator to offer IP telephony additional requirements must be fulfilled. First of all, all network elements should be available to support VoIP signalling over the network. The signalling protocol used for VoIP is the Session Initiation Protocol (SIP), an application layer protocol that can be used to manage any type of communication sessions. Within the SIP architecture the main elements are user agents, proxies, registrars and redirect servers. The figure below, Fig. 4-1, shows the interaction between these elements.

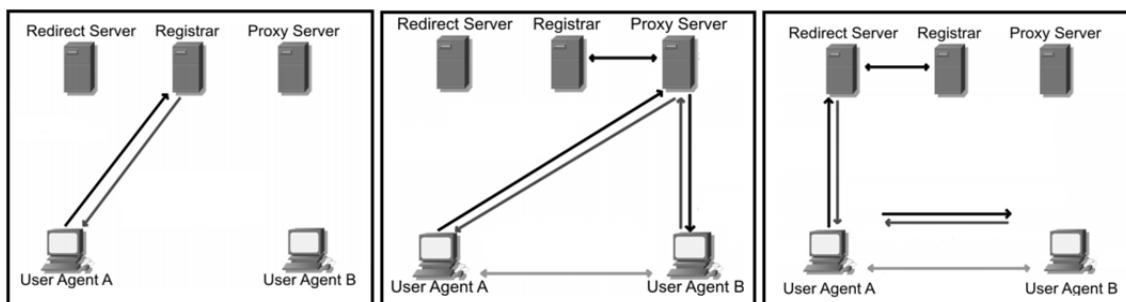


Fig. 4-1 SIP Network Elements

User agents are the devices that initiate and terminate the requests, like a soft phone or an Internet telephone. User agents obtain a SIP number from a registrar to register on this server. To be able to initiate call requests the user agent sends an INVITE request to the proxy server, which redirects the request to the extension being called. If accepted, the call is initiated between two user agents. The third option is through the redirect server, where the user agent sends an INVITE request to the redirect server, this looks up the IP address registered for that extension and sends it back to the requesting user agent. From there, the user agents mediate between each other. The functions of the redirect server, registrar and proxy can be performed on the same physical

device or even with the same software. This software is defined as an IP Private Branch exchange (PBX), which can serve as a SIP proxy, registrar and SIP redirect server.

The second requirement refers to the interconnection of the access network user agents with other VoIP users and traditional telephone numbers. Interconnection with other VoIP networks requires session border controllers, management servers (billing, services, etc) and call agents, while interworking between VoIP signalling and Public Switched Telephone Network (PSTN) signalling requires a media gateway. The general infrastructure is depicted in the following figure, Figure 4-2:

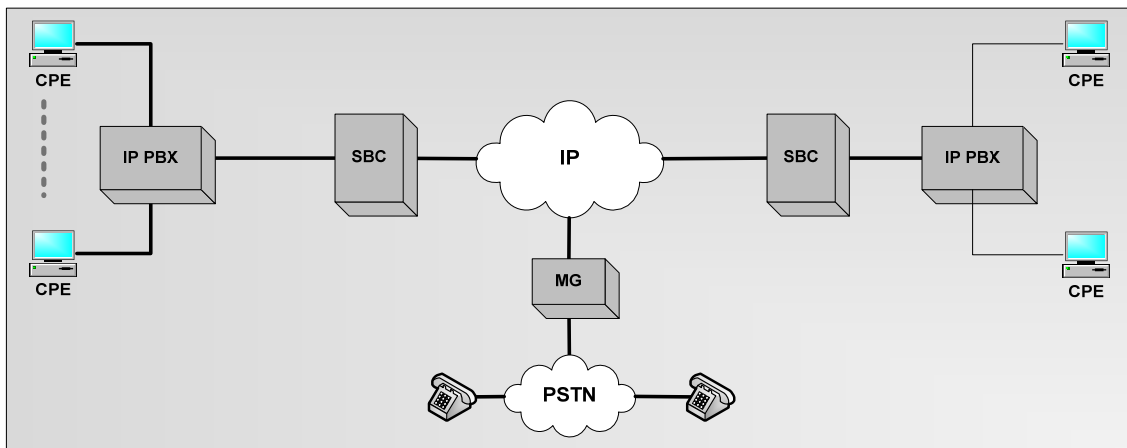


Fig. 4-2 VoIP Network Elements

Summarizing, the main network elements and their functionalities for VoIP service and PSTN access are the following:

- **Media Gateway Controller (MGC):** provides call control, call setup and termination.
- **Signalling Gateway (SG):** provides protocol conversion between the MGC and the PSTN. The SG and MGC are often referred to as a soft switch or a **Session Border Controller (SBC)**.
- **Media Gateway (MG):** performs voice processing between PSTN and IP networks.
- **Call Agents:** determines routes, initiates and terminates INVITE requests and other SIP messaging (not depicted in figure), communicating with both SBCs as MGs.
- **Servers:** A billing server is required that communicates with call agents to receive call details. Another server should maintain the customer database (not depicted in figure).

As the initial costs of purchasing these network elements can be excessive, the IP telephony services are partially outsourced [21]. The virtual operator will setup an IP PBX that can be used for calls between the users of the access network, and will require leasing of interworking services from a VoIP service provider. Lines need to be purchased from a VoIP trunk provider that realizes peering with other VoIP service providers and PSTN providers.



Of the various open source solutions available for IP PBX, Elastix is the most complete and most widely used, integrating many VoIP functionalities into a single software solution. Elastix is defined as “unified communications” integration software that supports voice, video, e-mail, fax, and instant messaging, based on Asterisk PBX [22]. As it is published under the General Public License (GPL) it can be used for free. It is a very robust and mature IP PBX, first developed in 2006 and continuously being improved with new and improved functionalities.

4.2.3. IP Television

IP Television (IPTV) is a way to deliver traditional television broadcast channels to the end users over an IP network. The method of transmission is different from traditional schemes such as terrestrial broadcast, CATV or satellite. For the new operator to offer IPTV several requirements must be fulfilled.

The first requirement is the implementation of an IPTV headend, where the video is captured, processed (encoded) and sent over the IP network. This headend is the location where the content or television channels are provisioned by the content provider(s). The main building blocks of a typical IPTV headend are presented in Fig. 4-3 below.

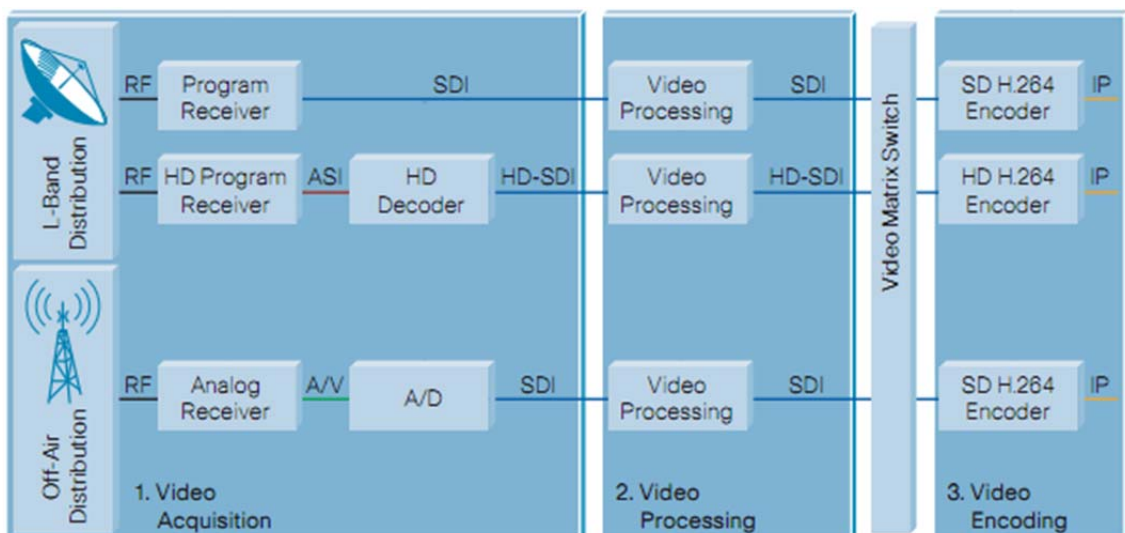


Fig. 4-3 IPTV Headend

The first process at the IPTV headend is the acquisition of video content [23]. The most common form of receiving these channels are through satellite receivers or off-air distribution. Depending on the reception type either analogue

or digital program receivers are required. The second process at the IPTV headend is the video processing, such as adjusting the signal to multiple different resolutions. The last processing step required before transmission of video over the IP network is the video encoding. This is the main factor that sets the quality of the video signal received at the end user. Currently, the most used encoding is H.264, also known as MPEG-4 or AVC. Most IPTV equipment providers offer these functionalities in a single device. Examples of IPTV equipment providers are WISI and FTE Maximal. The IPTV headend will be located at the Telvent Housing to avoid the need for multiple IPTV headends when operating on multiple access networks.

For IPTV two different services are defined [24]. The first service is linear IPTV, which is the equivalent to the offering of traditional television channels. An additional service offering is Video on Demand, giving end users additional features such as viewing content that has been previously broadcasted. Linear television and VoD services are defined in the following sections.

4.2.3.1. Linear Television

The equivalence of traditional television is a set of linear IPTV channels. All traditionally broadcasted television channels should be offered linearly on IPTV. These channels are transmitted as a multicast stream to the end users. Each television channel corresponds to a single multicast stream. Multicast is used through the backbone and access network. To guarantee the correct provisioning of IPTV a multicast router must be added to each access network's Central Office. This router will handle IMGP packets and manage the multicast group memberships of the users. Either a physical multicast router can be used or a logical multicast router through software suites that can be implemented for any computer to act as a multicast router. This multicast router must be added to the point of presence of each access network. For the end user to be able to receive multicast IPTV a set-top box will be needed. The function of this set-top box is to convert the IPTV packets into video signals for the television set. This device is provided by the network operator.

In Spain the main channels are distributed at no cost through terrestrial digital video broadcasting (DVB-T) channels. To receive these channels a DVB-T receiver is required that can capture these channels. Additional channels are distributed through satellite digital video broadcasting (DVB-S) channels and are not provided free of charge. These additional channels should be purchased from a content provider and require an additional DVB-S receiver. Chapter 4 presents these costs in further detail.

4.2.3.2. Video on Demand

Video on Demand (VoD) is defined as an additional service that can be offered alongside linear IPTV channels. Video on Demand is transmitted as unicast over the network, with a unique unicast stream from the storage server to the end user. For the virtual operator to offer VoD services an additional storage server would be needed that stores the content to be offered to the end user.

This storage server can be placed at different locations in the network, depending on server and bandwidth requirements. In practice, most VoD deployments use a VoD storage server at each Point of Presence as this solution requires less bandwidth. In the case of a single storage server at the central housing, unicast bandwidth is high, but only one storage server would be needed. If a storage server is located at the Point of Presence of the access network, the unicast stream will only be sent from the PoP to the end-user therefore only using additional bandwidth on this segment. This setup would require a VoD storage server at each Point of Presence.

4.3. Operator Network Infrastructure

This section will summarize the infrastructure, equipment and software solutions required for the virtual operator. The following figure presents the connectivity of the virtual operator’s equipment with third party equipment:

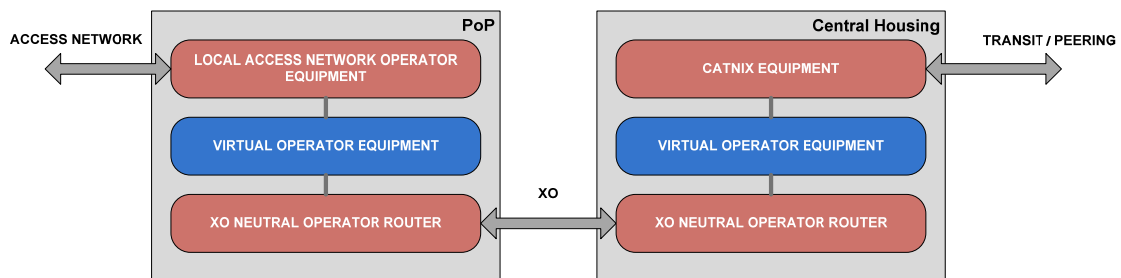


Fig. 4-4 Virtual Operator Connectivity

The following picture, Fig. 4-5 illustrates the infrastructure. It represents the situation where the virtual operator offers advanced connectivity services to one or more access networks. In the case it operates on multiple access networks, the equipment at Telvent Housing remains the same, and an additional Point of Presence is interconnected with the Xarxa Oberta backbone.

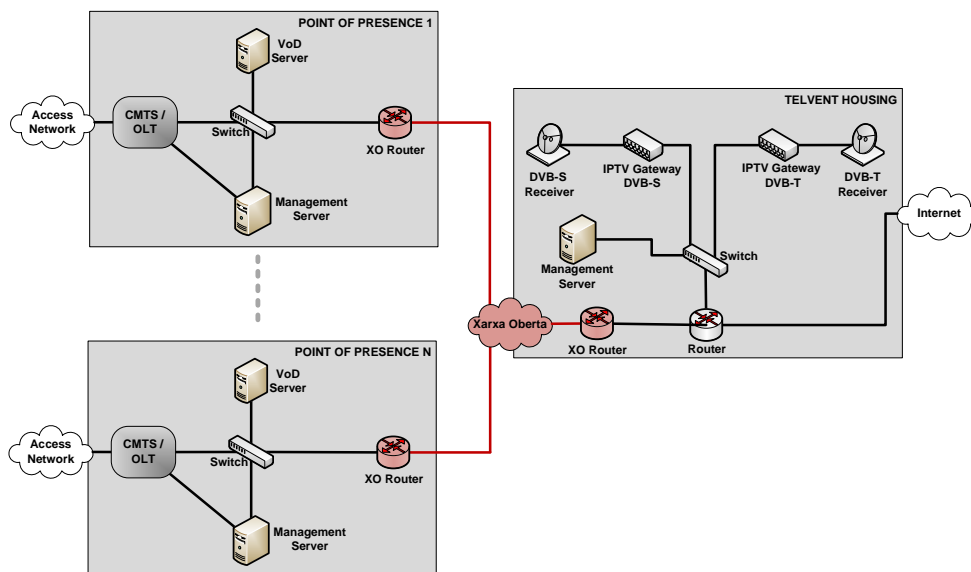


Fig. 4-5 Virtual Operator Infrastructure

This section will present the selected equipment for both locations in further detail.

4.3.1. Point of Presence

For the access network Point of Presence, the virtual operator will connect a switch directly to the Optical Line Terminal (for FTTH networks) or to the Cable Modem Termination System (for HFC networks). This switch should be configured with VLANs and be connected to a management server, the VoD server and the XO Layer 3 router that connects to the backbone. The switch requirements are low regarding bandwidth, manageability, etc, for which reason a relatively simple switch can be deployed, such as a Cisco 1900 Series Switch.

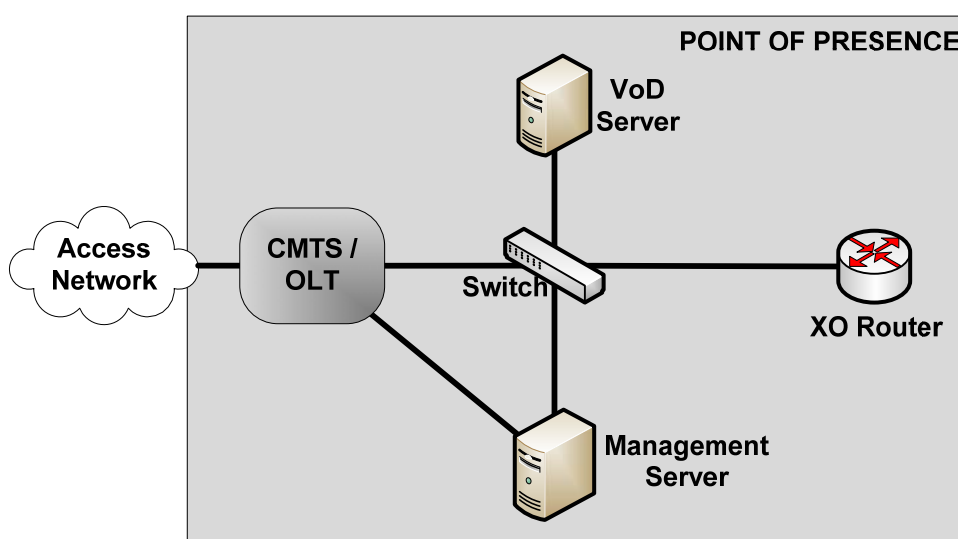


Fig. 4-6 PoP Equipment

The management server that is required at the Point of Presence should house the EMS platform and a DHCP server. For security reasons it is recommended to install a VPN server on this machine, to secure important management traffic that crosses the Xarxa Oberta or the public Internet. The largest open source VPN solution is OpenVPN, which supports Windows, Mac, and Linux systems and offers secure remote access to network resources. For the server to be able to house multiple operating systems on a single server several virtual machines are required. As the number of virtual machines required is small, the VMWare ESXi platform is a good option as a virtual machine platform. This platform supports up to four simultaneous virtual machines. The recommended virtual machine setup for the management server is the following:

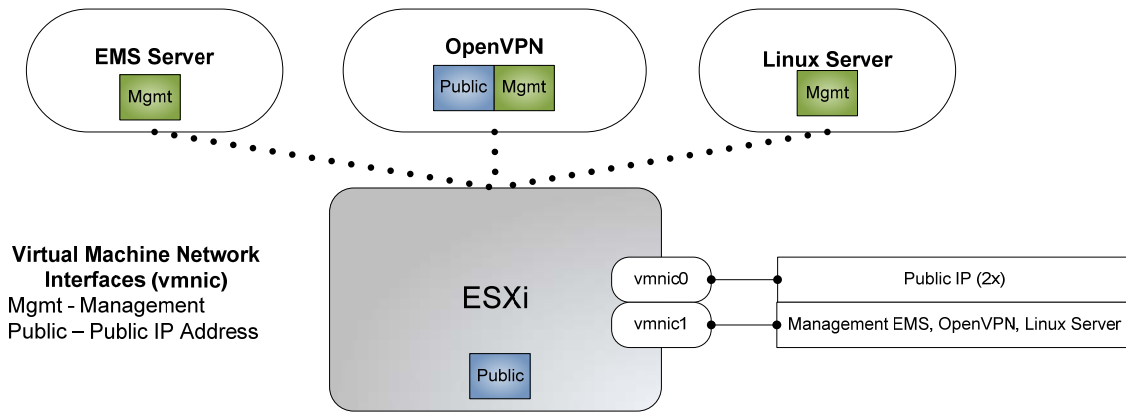


Fig. 4-7 Management Server Configuration (PoP)

The management server does not need excessive computing power, but should be able to support all operating systems. Additionally, a Video on Demand server is required at each Point of Presence, but only if the network operator contracts this service. This VoD server is purchased by the virtual operator from the IPTV equipment providers and will need to fulfil both the bandwidth and storage requirements accordingly.

4.3.2. Telvent Housing

At Telvent Housing the following equipment is required:

- Layer 3 Router
- Layer 2 Switch
- High performance management server
- IPTV Headend

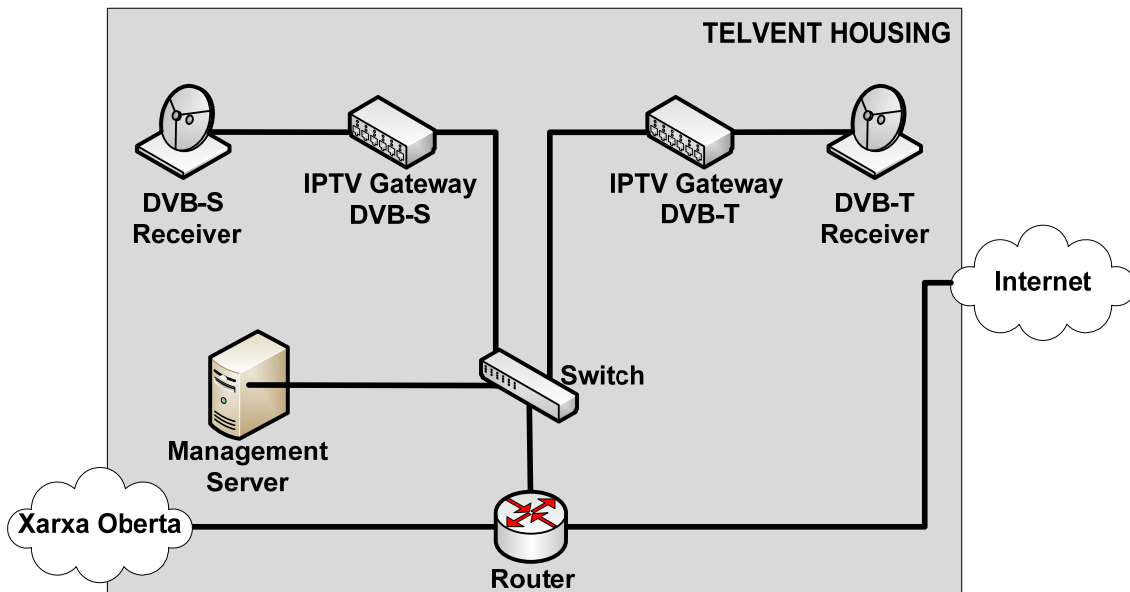


Fig. 4-8 Central Housing Equipment

Equipment

The router at the Internet Exchange should be able to route all incoming and outgoing traffic and should therefore implement a powerful backplane and offer

high packet processing rate. Many operators with CATNIX connectivity have deployed Cisco 7200 Series routers as they fulfil these requirements. Upon selecting an adequate switch for the central housing the main requirements that should be fulfilled are bandwidth, IEEE 802.1q VLAN support, QoS and network security. The Cisco 3400 ME Series has been selected for the virtual operator as it fulfils these requirements.

Systems

Additionally, a high-performance server is required that houses the IPTV software platform, the OpenNMS platform, Openbravo platform and the IP PBX. This requires high processing power, high capacity networking capabilities and storage.

The server located at the Telvent Housing should be more powerful than the one located at the point(s) of presence. Virtualization of the server is required to support multiple operating systems. Additionally, an OpenVPN server is installed for the virtual operator to securely connect to the server from a remote location. The VMware ESXi setup for this server is the following:

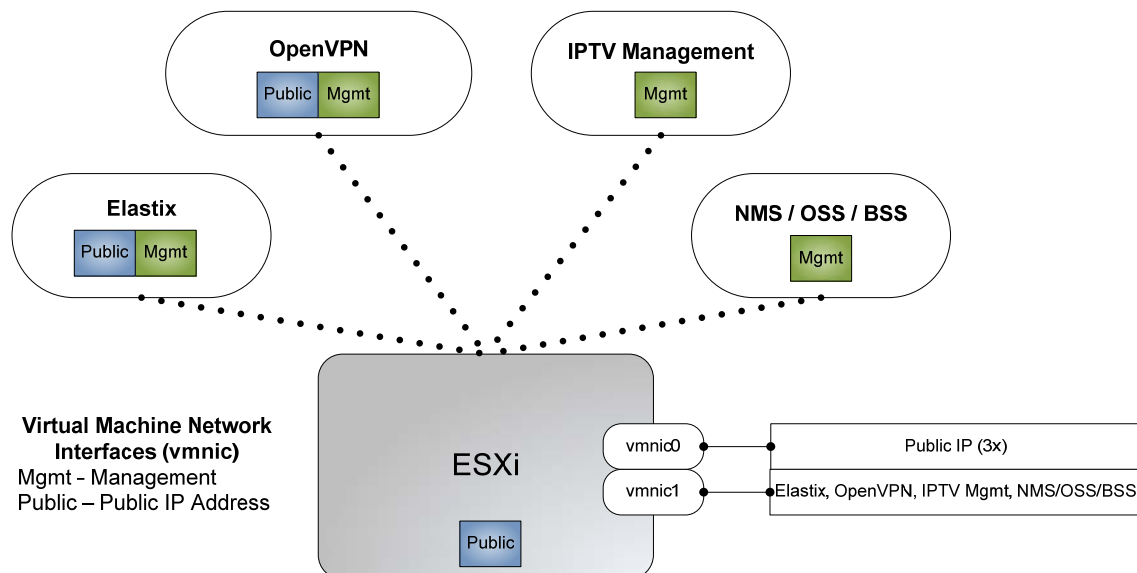


Fig. 4-9 Management Server Configuration (Telvent Housing)

The IPTV headend located at Telvent housing requires DVB-S and DVB-T receivers and an IPTV gateway for both types of signals. Switching and management can be realized at the same Cisco switch and Dell server defined previously.

CHAPTER 5. BUSINESS MODEL

This chapter presents the main results of the business model developed for the virtual operator to validate its viability

The areas that have been covered are [25]:

- Offer
- Customers
- Infrastructure
- Financial viability

The infrastructure has already been defined in the previous chapter. Thus, this chapter will present the customers and the offer, while chapter 6 focuses on the viability study.

5.1. Service Integration

Different models can be implemented to operate a telecom network. The service levels that telecom operators can offer consist of three layers: service layer, active layer and passive layer.

- Passive Layer: The passive infrastructure such as fiber, ducts, poles
- Active Layer: Active equipment, switching, network management
- Service Layer: Applications and configuration that ensure services on the infrastructure

A vertically integrated operator will offer all services, but an operator can also apply vertical differentiation. The different service integration levels that can be offered are shown in the following figure, Fig. 5-1:

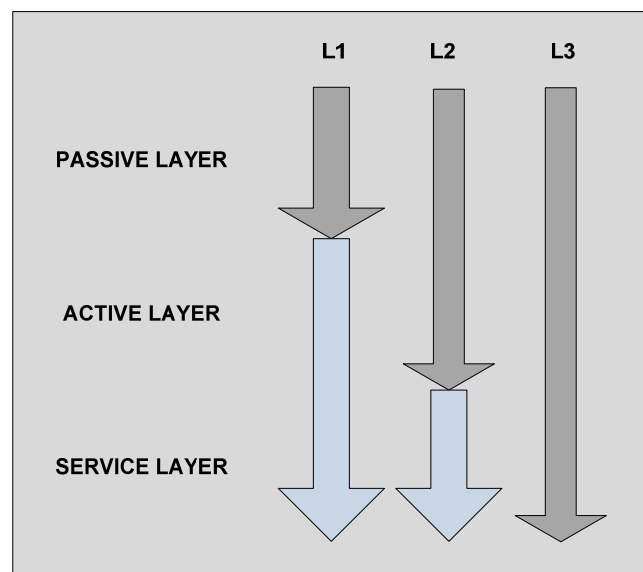


Fig. 5-1 Service Integration Levels

The positioning of our virtual operator is cover the service layer and rely on Xarxa Oberta to rent bitstream services that transport traffic to the operator IX in Barcelona.

Additionally, our virtual operator will support the equipment of our customers so they can concentrate on sales and customer assurance.

In conclusion, the proposed virtual operator will be totally service focused and will cover the service layer. The relationships of the virtual operator are defined in the following figure:

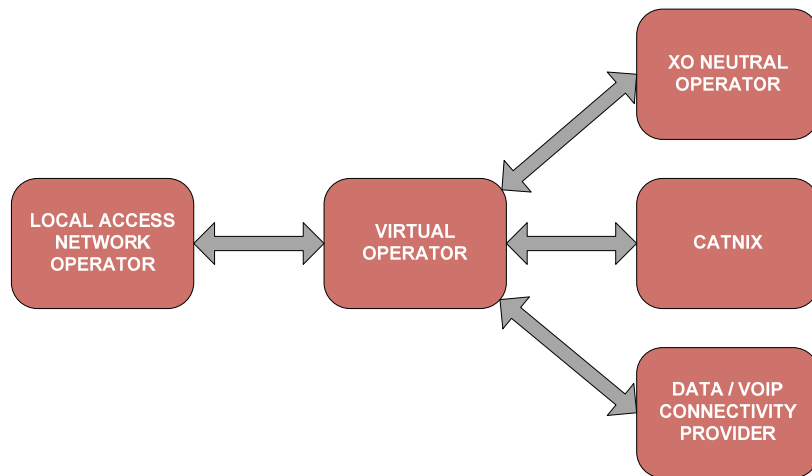


Fig. 5-2 Virtual Operator Relationships

5.2. Strengths, Weaknesses, Opportunities and Threats (SWOT)

A SWOT analysis of the business can identify the strengths, weaknesses, opportunities and threats. It provides more insight into the key factors that should be exploited and any weaknesses or threats that should be avoided.

The following figure presents the SWOT analysis for the virtual operator:



Fig. 5-3 SWOT Analysis

The strengths of the virtual operator are the price and quality advantage over the competitors, the fact that the customer can focus on its customer related activities and that it is a small and flexible organization.

The main weaknesses are the dependency of the third party providers (VoIP, XO, ISP) that the virtual operator relies on for its operation. Additionally, strong competition exists in a relatively small potential market.

Many opportunities are identified for the virtual operator, as the open source stack is re-usable a future expansion of number of customers is possible. Other potential opportunities are the increase of the number of migrations to or deployments of FTTH access networks. A strategic alliance with providers could be initiated, to improve the relationship and the price/quality of the service.

The biggest opportunity is also the biggest threat for the virtual operator: XO. The XO project has already been downgraded into different phases, and a change in a political climate could affect the continuity of the project. Another threat is that competitors could offer their bitstream connectivity services over the XO, as exclusivity is not a possibility.

5.3. Potential customers

The connectivity services that the virtual operator offers are aimed at service providers that do not have interconnectivity outside their access network or have this subcontracted to other providers.

We have performed a market study and found that currently in Catalonia there are around 30 CATV networks that may require these services in the short term. Additionally, we have found five of these network operators that have shown their interest in evaluating the contracting the services of our virtual operator.

The total number of inhabitants and users connected in the five identified initial potential customers is shown in the following table:

Municipality	Operator	Connected Clients
Capellades	Tecnocolor	500
La Pobla de Claramunt	Tecnocolor	200
La Senia	Senia Cable	300
RibaRojad'Ebre	Servitet	400
Solsona	Solsones	300

Table 5-1 Potential customers

These five networks are run by four different operators, which are the potential customers for the virtual operator. On the long term, the number of potential customers might increase due to the roll-out of open access networks and the resulting increase of small network operators, together with other CATV cables migrating to FTTH.

Another opportunity on the long term would for the virtual operator to extend its business and become a final service operator on open access networks, as the active and service layer are covered.

The value propositions offered by the virtual operator can be both quantitative and qualitative. For the access network providers the added values are the following:

- Price: No need to deploy any active equipment (except OLT/ONT), and less (or no) need for technical staff. Integrated services at a lower price.
- Convenience: Just one connectivity service provider for all services, support, no technical staff
- Service level: Advanced integrated services, such as IPTV, Video on Demand

5.3.1. Service Demand

Currently, different providers are offering their interconnectivity services, as shown in Table 5-2:

Operator	Internet Connectivity	Telephony
Capellades	Aire Networks	Xtra Telecom
La Pobla de Claramunt	Aire Networks	Xtra Telecom
La Senia	Aire Networks	Xtra Telecom
Riba Roja d'Ebre	Aire Networks	Aire Networks
Solsona	Aire Networks / ONO	Xtra Telecom

Table 5-2 Current Service Providers

These providers form the competition of the virtual operator, as these can provide service providers with telephony services (Xtra Telecom), data services

or both (Aire Networks). The current traffic and service demand from these service providers is the following:

Municipality	Traffic (Mbps)	Telephone Lines
Capellades	100 Mbps	500
La Pobla de Claramunt	25 Mbps	200
La Senia	150 Mbps	300
Riba Roja d'Ebre	20 Mbps	250
Solsona	25 Mbps	300

Table 5-3 Current Traffic Demand

In the current market situation, connectivity service providers offer an annual increase of 100% of the capacity for the same price. This results in an identical income from data connectivity but an annual traffic capacity increase of 100%.

For television there is no data available. As the majority of these access networks are CATV / HFC access networks there is assumed that RF Video is available. Due to the added values of IPTV, such as Video on Demand and the additional channels that can be offered through DVB-S, there is expected that clients will contract these services. The expected demand for IPTV is based on the actual uptake of triple play in the residential Internet market in Spain, shown in the figure below, Fig. 5-4:

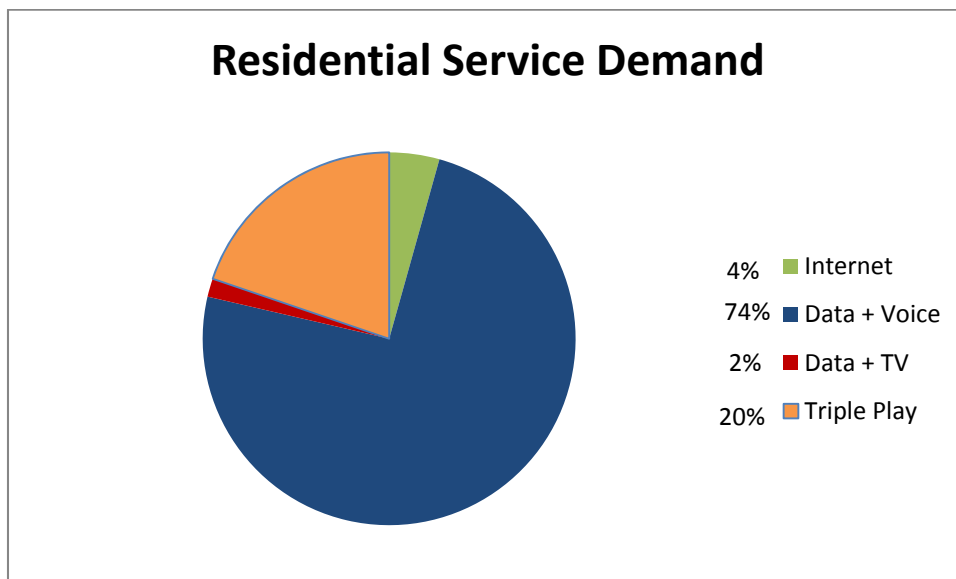


Fig. 5-4 Residential Service Demand

There is assumed that the same percentage of all clients will contract IPTV services, 20% of all connected clients. The resulting expected service demand for the various access networks is as follows:

Municipality	Telephone Lines	IPTV
Capellades	500	100
La Pobla	200	40
La Senia	300	60
Riba Roja d'Ebre	250	50
Solsona	300	60

Table 5-4. Expected Service Demand VoIP + IPTV

5.4. Offered Services

The services to be offered by the virtual operator can be divided into two segments: Connectivity services and Support.

5.4.1. Connectivity Services

As presented in Section 4.2 the virtual operator offers three types of advanced broadband services to the access network operators: Data, VoIP and IPTV. For all services IP connectivity should be provided to the access network operator.

5.4.1.1. Data

For data services the IP connectivity should also include connectivity to Internet. To increase the added value of the virtual operator the prices offered for data connectivity should be lower than the current services offered by the competition. The services offered by the competition are priced between € 50 and € 115 per Mbps capacity, depending on the total capacity contracted. These prices are all flat-rate, meaning that the bandwidth usage is unlimited and include Internet transit, IP addressing and routing.

The pricing for the data connectivity of the virtual operator is presented in the following table, Table 5-5:

Capacity (Mbps)	Monthly Service Fee	Additional Mbps
10	€ 1000	€ 80
25	€ 2000	€ 50
50	€ 3000	€ 40
100	€ 4500	€ 30

Table 5-5. Data Connectivity Service Pricing

With the above prices, the virtual operator is between 10% and 30% cheaper than the competition on the monthly service fees and between 6% and 22% on additional Mbps.

5.4.1.2. Voice over IP

The VoIP service offered should be the equivalent of the existing PSTN solution, both functionally as qualitative. The VoIP service consists of providing the access network operator with a range of telephone numbers and enable calls between both VoIP and traditional PSTN equipment.

Currently, the price model offered by VoIP providers is flat-rate, offering a telephone number with a limited call capacity for the user at a fixed monthly fee. This is available for service providers from € 3.50 per line per month, with no additional fees except the call costs. The virtual operator will need to partner with a different VoIP service provider (e.g. Azulcom) to offer its trunking and its direct dial-in (DDI) services. Therefore, the price of the voice service will be identical to the competition, as shown in the following table, Table 5-6:

Service	Monthly Service Fee	Additional fees
Telephony service	€ 3.50	Call costs

Table 5-6. Voice Service Pricing

By partnering with a VoIP service provider the virtual operator can obtain improved value on its service, making room for a larger margin for the virtual operator. The call costs will be billed by the VoIP service provider to the virtual operator, which bills these to the access network operator. For the virtual operator no margin is gained on the call costs.

5.4.1.3. IP Television

The IP Television service is an advanced service, offering linear television, additional channels and Video on Demand. There is no data on television services offered by the competition, the data used are reference prices from IPTV content providers. The table below, Table 5-7, shows the pricing scheme for IP television services:

Service	Monthly Fee
Linear television	€ -
Channel Package	€ 2.50 per user
Video on Demand	€ 3.50 per user

Table 5-7. IPTV Service Pricing

Applying these prices the access network operator can obtain a 40% margin on its TV services (assuming a monthly subscriber fee of €10), while the virtual operator obtains a 50% margin.

5.4.2. Support

The other core functionality of the virtual operator is to maintain the network and offer support to the network operator. Support for the services presented in the previous section is included. Support can be extended to access network maintenance and support, including CMTS or OLT installation, configuration and maintenance. Additionally, the service provisioning of services to clients on their terminal equipment is offered to the network operators. This service has a very high added value to the network operator as the need for technical staff is reduced to an absolute minimum. This service will be offered at the following prices:

Service	Monthly Fee
CMTS Support	€ 250
OLT Support (512-user block)	€ 250
Service Provisioning	€ 1 per user

Table 5-8. IPTV Service Pricing

For the virtual operator it is profitable to offer these support services as it offers a steady income over a long period, requiring staff that is already available to operate and maintain the management systems.

5.4.3. Service Level Agreement

A service level agreement (SLA) should be arranged between the access network operator and the virtual operator, which defines the availability of service. For the SLA the virtual operator is highly dependant of the Xarxa Oberta, which provides the backbone infrastructure. The SLA between the access network operator and the virtual operator may not exceed the SLA between the XO and the virtual operator, as this will lead to a drop in reliability and in incomes, as SLA exceeding must be compensated. The compensation levels will also need to be in line with the XO SLA. It is unknown what the SLA offered by the XO will be, so this needs to be estimated. The following table, Table 5-9, gives an indication of different possible SLAs and the corresponding maximum yearly outage:

SLA	Maximum yearly outage
99,99%	1 hour
99,95%	4 hours
99,86%	12 hours
99,73%	24 hours
99,45%	48 hours

Table 5-9. SLA Levels

Additionally to the maximum outage the maximum time to response must be defined. To achieve an optimal time to response either a 24x7 support or an emergency support is required. In both cases the maximum time to response

will be less than fifteen minutes, as support will always be readily available, except in the case of a busy line.

5.5. Cost Structure

This section presents the cost structure of the virtual operator's business. The costs can be divided in fixed costs and variable costs.

5.5.1. Fixed Costs

The fixed costs for the virtual operator consist of all equipment required for operation, located at Telvent Housing. Additionally, the initial registration fees are considered fixed costs. The table below, Table 5-10, presents the equipment costs at Telvent Housing.

Device	Cost
Cisco 7204 VXR	€ 14.000
Cisco ME 3400 Series	€ 6.000
Dell PowerEdge Server	€ 2.000
DVB-S Receiver	€ 500
DVB-S IPTV Gateway	€ 8.000
DVB-T Receiver	€ 500
DVB-T IPTV Gateway	€ 8.000

Table 5-10. Housing Equipment Costs

The registration fees required for the various connections and associations are presented in the following table, Table 5-11. The registration fee for the XO is unknown, and is estimated at € 1.000.

Entity	Registration Fee
CATNIX	€ 1.800
RIPE NCC	€ 1.800 + € 50 per IP address
Xarxa Oberta	Unknown

Table 5-11. Registration Fees

Additionally, as for the IPTV platform there is no open source solution available, a Software Suite must be purchased. The following table, Table 5-12, presents the license fee for various users.

IPTV License	Fee
100 Users	€ 12.000
200 Users	€ 20.000
300 Users	€ 25.000

Table 5-12. IPTV Software License Fees

5.5.2. Variable Costs

The variable costs consist of the PoP equipment, interconnection fees, service fees and staff.

5.5.2.1. PoP Equipment

For each Point of Presence the equipment costs are the following:

Device	Cost
Cisco Catalyst 1900 Series	€ 100
Dell PowerEdge Server	€ 1.000
VoD Server	€ 4.000

Table 5-13. Point of Presence Equipment Costs

5.5.2.2. Interconnection Fees

The interconnection fees consist of the fees for the Xarxa Oberta, CATNIX and transit fees from an upstream provider.

Transit prices have dropped at a high rate over the last years, with an average annual decrease of 61%. The following graph shows the evolution of transit prices between 2000 and 2010 per Mbps, with an uptake of 1 Gbps.

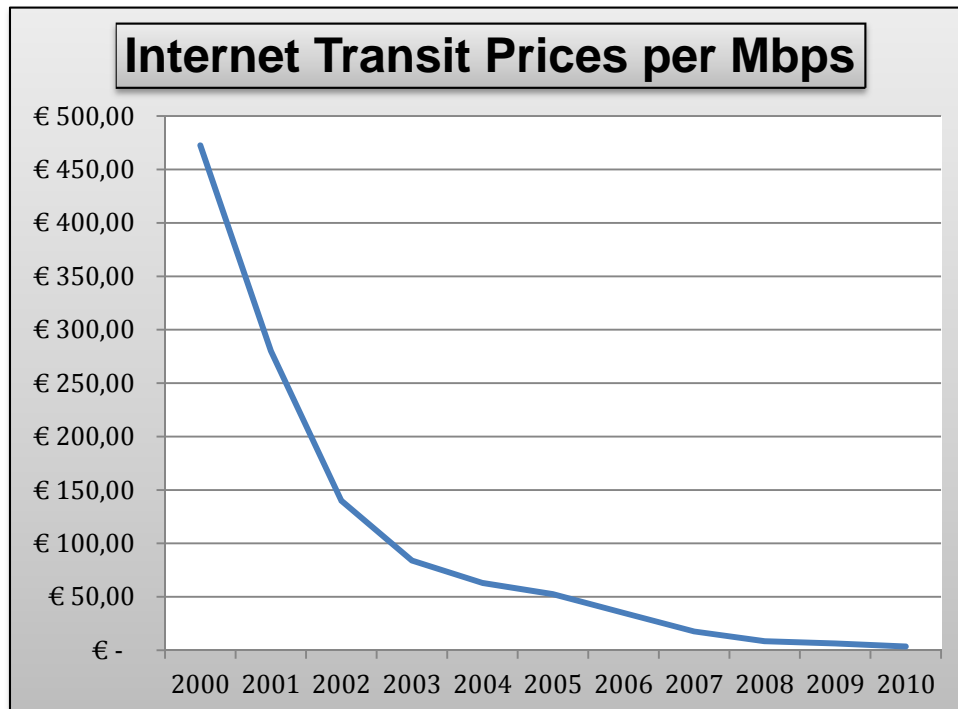


Fig. 5-5 Transit Price Evolution

The table below lists the assumptions for transit pricing for the virtual operator as monthly transit prices are expected to decline even further.

Transit Prices	2011	2012	2013	2014	2015
Gbps	€ 3500	€ 2450	€ 1720	€ 1200	€ 840

Table 5-14. Expected Transit Price Evolution

These prices will be implemented in the economic model, assuming a minimum purchase of 100 Mbps, with purchase increments of 100 Mbps, as is common with transit providers such as Cogent. For Xarxa Oberta, the interconnection fees are unknown, and are therefore estimated. The table below, Table 5-15, gives an overview of all the interconnection fees.

Provider	Monthly Fee
CATNIX – 100 Mbps	€ 266
CATNIX – 1 Gbps	€ 399
Xarxa Oberta – 100 Mbps	€ 600
Xarxa Oberta – 1 Gbps	€ 1.000
Upstream Provider – 100 Mbps	€ 350
Upstream Provider – 1 Gbps	€ 3.500

Table 5-15. Interconnection Fees

5.5.2.3. Service Fees

The service fees for the operator consist of VoIP services, IPTV services, and the IPTV support and content licenses. These prices are shown in the following table, Table 5-16:

Service	Monthly Fee
VoIP – DDI & Trunking	€ 2.50 per user
IPTV - Additional channel package	€ 1.00 per user
IPTV – VoD Content	€ 2.00 per user
IPTV – Support & Content Licenses	€ 285

Table 5-16. Service Fees

5.5.2.4. Staff

The virtual operator will only require technical staff for its operation. In the initial company phase the tasks of this staff are installing and configuring the network equipment and support solutions. Once the systems and equipment are deployed the technical staff will only need to configure and install the equipment required at the point of presence and offer support to the network operators. As the management systems are automated a single technician could monitor and maintain the infrastructure. Assuming support is available from 09:00 to 17:00 with emergency availability from technical support in case of emergencies and the fact that a single employee works 1760 hours per year, two engineers are sufficient. The associated staff costs are shown in the following table:

Staff	Gross Salary	Salary + Expenses	Annual Increase
Engineer	€ 25.000	€ 32.500	5%

Table 5-17. Salary Costs

CHAPTER 6. FINANCIAL VIABILITY

This chapter presents the financial viability of the virtual operator. For the viability study a scope of five years is applied, as this scope should be sufficient for the business to be profitable. To calculate the financial viability a cost model is applied, for all separate networks and for any possible combination of networks where the virtual operator may provide its services. Detailed models are presented in Appendix 5, and this chapter only presents the main results.

The most important decision factor to measure the viability of a project is the Net Present Value (NPV). This is the value after compensating costs and revenues. A project is viable when the NPV is positive. To calculate the NPV a discount rate should be applied, whose goal is to express the difference in value between money now and at a later moment in time. The discount rate is based on the average interest for risk free long term loans on the international market, excluding inflation. Due to the current economic crisis, in Spain the discount rate has been lowered to 1.25%. As of April 13th 2011 the discount rate has been increased to 2%. Taking into account possible future increases of the discount rate due to an improving economic situation in Spain, the applied discount rate for this project is 4%.

Another factor to measure the viability is the Internal Rate of Return (IRR). This parameter expresses the interest rate of the project, based on all the cash flows. The IRR is only valid for a positive NPV.

6.1. Investment

Initially, the required investment consists of all the fixed costs required for operation, which are equipment and software licenses, and registration fees. These are the same for the virtual operator, regardless of the number of networks for which it provides its services.

	Cost
Central Housing Equipment	€ 39,000
IPTV Licenses	€ 15,420
Registration Fees	€ 4,600
Total Investment	€ 58,020

Table 6-1. Required Investment for all operations

Depending on the number of access networks provisioned the required investment increases, as PoP equipment, an increased software license, staff and Internet resources should be purchased.

6.2. Single Network Operation

The results of operating on a single access network are shown in the table below, Table 6-2. As for Viladecans no data is available, for this network a small network operator with a 10% market share is assumed.

Network	Result	NPV
Capellades	- €259.910	- €245.828
La Pobla de Claramunt	- €388.358	- €363.913
La Senia	- €220.426	- €210.341
Riba Roja d'Ebre	- €395.058	- €370.302
Solsona	- €401.098	- €375.669
Viladecans*	- €311.288	- €293.474

Table 6-2. Single Network Operation Results

As expected, offering connectivity services to a single network operator is not profitable, and leads to average annual losses varying from € 44.000 to € 80.000. The Net Present Value and Internal Rate of Return have no added value in these calculations as the results are negative. If the virtual operator can only obtain one customer, it is not recommended to enter the business as this is not profitable and therefore the business is not viable.

6.3. Multiple Network Operation

In case the virtual operator offers its services to multiple access network operators, the business becomes viable. To determine the viability various scenarios are created, each representing a different combination of access networks as customers. Although multiple networks are serviced, the business is still not viable in all cases, as this depends highly on the traffic capacity contracted and the users on the access network. The access network combinations that present positive results after five years are shown in the following table, Table 6-3:

Networks					Result	NPV	IRR
Cap	Pob	Sen	Rib	Sol			
X		X			€73.934	€63.520	13%
X	X	X			€177.454	€160.252	27%
X		X	X		€170.754	€153.863	26%
X		X		X	€188.054	€169.697	27%
	X	X	X		€41.934	€34.276	8%
	X	X		X	€59.234	€50.110	11%
	X	X	X	X	€52.534	€43.721	10%
	X	X	X	X	€157.998	€140.640	22%
X		X	X	X	€295.834	€268.654	38%
X	X		X	X	€111.954	€96.835	16%
X	X	X		X	€302.534	€275.043	40%
X	X	X	X		€285.234	€259.209	38%
X	X	X	X	X	€745.746	€680.495	119%

Table 6-3. Multiple Network Operation Results

For any of the above combinations the virtual operator's business is considered viable, while combinations that are excluded from this table result in negative results and NPV. Providing services for just two networks, the business is only viable when both Capellades and La Senia are provisioned, resulting in an IRR of 13% and an NPV of €63.520. The reason operating on these two networks is profitable is due to the high traffic capacity contracted and the number of users

on these networks, resulting in a higher profit margin for the operator. Operating on three networks is viable in several cases, but not in all. Where the networks are small and have a small traffic capacity, the operation results in low profit margins, considering the relatively high investment costs. Optimal results are obtained when the virtual operator offers its services to four or more networks, with the maximum result obtained when operating all five networks resulting in an NPV of almost € 680.495 and an IRR of 119%.

The most important factor in the decision whether or not to start operation is the number of networks that will become clients. This will need to be evaluated before starting the operation.

6.4. Scenarios

This section will present in detail three possible scenarios to study the viability of the virtual operator. The three scenarios are the following:

- Pessimistic: Only two connected access networks
- Neutral: Three connected access networks
- Optimistic: All access networks connected

For these scenarios a more detailed overview is presented, including annual results, treasury overview, and balance sheets.

6.4.1. Pessimistic Scenario

The first scenario represents the virtual operator offering its services to two access networks: Capellades and La Senia.

A detailed overview of all models is presented in Appendix V. The table below presents the annual results for this scenario:

	Year 1	Year 2	Year 3	Year 4	Year 5
Result	-€ 38.868	€ 25.242	€ 30.590	€ 33.246	€ 23.724
Accumulative	-€ 38.868	-€ 13.626	€ 16.964	€ 50.210	€ 73.934

Table 6-4. Annual Results – Pessimistic Scenario

The accumulative result after five years is approximately € 74.000, resulting in an Internal Rate of Return of 13%, and therefore a viable business operation. It is the only combination of two networks for which this is the case, and all other scenarios with two networks are not viable. These calculations are realized applying a depreciation of five years for the equipment at Telvent Housing and the Point of Presence.

The table below presents the treasury sheet for the pessimistic scenario:

PESSIMISTIC SCENARIO					
Treasury	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
ENTRY					
Capital	€ 90.000	€ -	€ -	€ -	€ -
Credit	€ -	€ -	€ -	€ -	€ -
Service Offering	€ 186.720	€ 186.720	€ 186.720	€ 186.720	€ 186.720
EXIT					
Equipment	€ 69.200	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Registration	€ 44.600	€ -	€ -	€ -	€ -
Interconnectivity	€ 59.388	€ 46.788	€ 38.028	€ 31.788	€ 37.548
Service Fees	€ 36.600	€ 36.600	€ 36.600	€ 36.600	€ 36.600
ANNUAL	€ 1.932	€ 35.082	€ 40.430	€ 43.086	€ 33.564
ACCUMULATIVE	€ 1.932	€ 37.014	€ 77.444	€ 120.530	€ 154.094

Table 6-5. Treasury – Pessimistic Scenario

The treasury indicates that the total capital required for operation is €90.000. If this cannot be achieved, credit should be obtained at specific interest rates to cover a potential negative treasury.

An overview of the total costs of operation during these five years is presented in the following graph. This graph could be used to optimize operation and to identify potential cost reductions:

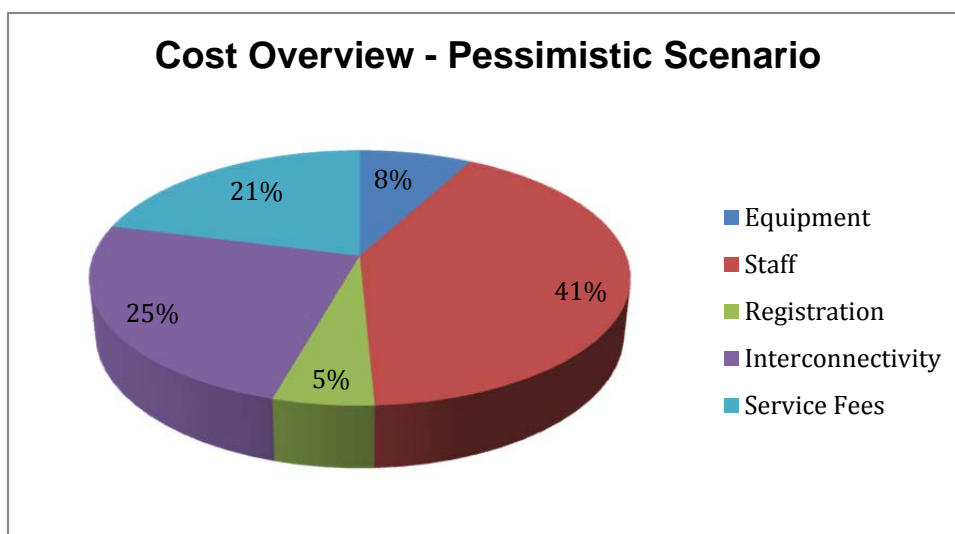


Fig. 6-1 Cost Overview – Pessimistic Scenario

Finally, the balance sheet for the pessimistic scenario is presented in the following table:

PESSIMISTIC SCENARIO					
Balance	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
ASSETS					
Fixed					
Equipment	€ 49.200	€ 39.360	€ 29.520	€ 19.680	€ 9.840
Current					
Cash	€ 1.932	€ 37.014	€ 77.444	€ 120.530	€ 154.094
Accounts receivable	€ 38.868	€ 13.626	€ -	€ -	€ -
TOTAL ASSETS	€ 90.000	€ 90.000	€ 106.964	€ 140.210	€ 163.934
LIABILITIES					
Capital Stock	€ 90.000	€ 90.000	€ 90.000	€ 90.000	€ 90.000
Credit	€ -	€ -	€ -	€ -	€ -
Accounts payable	€ -	€ -	€ 16.964	€ 50.210	€ 73.934
TOTAL LIABILITIES	€ 90.000	€ 90.000	€ 106.964	€ 140.210	€ 163.934

Table 6-6. Balance Sheet – Pessimistic Scenario

6.4.2. Neutral Scenario

The second scenario represents the virtual operator offering its service to three access networks, as a reference for this scenario Capellades, La Senia and Riba Roja d'Ebre are selected. The table below presents the annual results for this scenario:

	Year 1	Year 2	Year 3	Year 4	Year 5
Result	-€ 24.188	€ 53.202	€ 58.550	€ 48.294	€ 34.896
Accumulative	-€ 24.188	€ 29.014	€ 87.564	€ 135.858	€ 170.754

Table 6-7. Annual Results – Neutral Scenario

The accumulative result after 5 years is approximately €170.000, resulting in an Internal Rate of Return of 26%. From this table there can be concluded that the virtual operator's business is viable taking into account the neutral scenario.

The following table presents the treasury, which is useful for calculating the required capital.

NEUTRAL SCENARIO					
Treasury	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
ENTRY					
Capital	€ 80.000	€ -	€ -	€ -	€ -
Credit	€ -	€ -	€ -	€ -	€ -
Service Offering	€ 228.420	€ 228.420	€ 228.420	€ 228.420	€ 228.420
EXIT					
Equipment	€ 74.300	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Registration	€ 58.900	€ -	€ -	€ -	€ -
Interconnectivity	€ 59.388	€ 46.788	€ 38.028	€ 44.700	€ 54.336
Service Fees	€ 49.320	€ 49.320	€ 49.320	€ 49.320	€ 49.320
ANNUAL	€ 1.512	€ 64.062	€ 69.410	€ 59.154	€ 45.756
ACCUMULATIVE	€ 1.512	€ 65.574	€ 134.984	€ 194.138	€ 239.894

Table 6-8. Treasury – Neutral Scenario

To maintain the treasury positive at all times, a capital stock of € 80.000 is required. If this cannot be realized, credit should be obtained for this amount of money.

An overview of the total costs of operation during these five years is presented in the following graph. This graph could be used to optimize operation and to identify potential cost reductions:

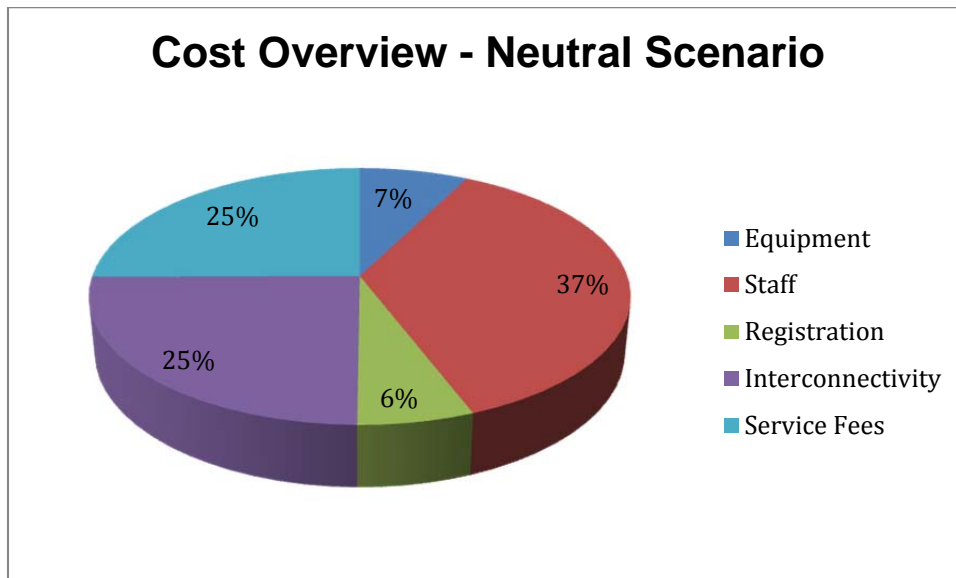


Fig. 6-2 Cost Overview – Neutral Scenario

Finally, the balance sheet is presented for the pessimistic scenario:

NEUTRAL SCENARIO					
Balance	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
ASSETS					
Fixed					
Equipment	€ 54.300	€ 43.440	€ 32.580	€ 21.720	€ 10.860
Current					
Cash	€ 1.512	€ 65.574	€ 134.984	€ 194.138	€ 239.894
Accounts receivable	€ 24.188	€ -	€ -	€ -	€ -
TOTAL ASSETS	€ 80.000	€ 109.014	€ 167.564	€ 215.858	€ 250.754
LIABILITIES					
Capital Stock	€ 80.000	€ 80.000	€ 80.000	€ 80.000	€ 80.000
Credit	€ -	€ -	€ -	€ -	€ -
Accounts payable	€ -	€ 29.014	€ 87.564	€ 135.858	€ 170.754
TOTAL LIABILITIES	€ 80.000	€ 109.014	€ 167.564	€ 215.858	€ 250.754

Table 6-9. Balance Sheet – Neutral Scenario

6.4.3. Optimistic Scenario

The third scenario represents the virtual operator offering its service to all access networks: Capellades, La Senia, Solsona, La Pobla and Riba Roja d'Ebre. The table below presents the annual results for this scenario:

	Year 1	Year 2	Year 3	Year 4	Year 5
Result	€ 50.632	€ 163.242	€ 171.926	€ 176.838	€ 179.028
Accumulative	€ 50.632	€ 213.874	€ 385.800	€ 562.638	€ 741.666

Table 6-10. Annual Results – Optimistic Scenario

The accumulative result after 5 years is approximately €740.000, resulting in an Internal Rate of Return of 119%. From this table there can be concluded that the virtual operator's business is viable taking into account the optimistic scenario.

The following table presents the treasury, which is useful for calculating the required capital.

OPTIMISTIC SCENARIO						
Treasury	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	
ENTRY						
Capital	€ 15.000	€ -	€ -	€ -	€ -	€ -
Credit	€ -	€ -	€ -	€ -	€ -	€ -
Service Offering	€ 374.430	€ 374.430	€ 374.430	€ 374.430	€ 374.430	€ 374.430
EXIT						
Equipment	€ 89.500	€ -	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008	€ 79.008
Registration	€ 87.500	€ -	€ -	€ -	€ -	€ -
Interconnectivity	€ 74.988	€ 57.708	€ 45.612	€ 37.116	€ 31.164	€ 31.164
Service Fees	€ 71.310	€ 71.310	€ 71.310	€ 71.310	€ 71.310	€ 71.310
ANNUAL	€ 1.132	€ 177.162	€ 185.846	€ 190.758	€ 192.948	€ 192.948
ACCUMULATIVE	€ 1.132	€ 178.294	€ 364.140	€ 554.898	€ 747.846	€ 747.846

Table 6-11. Treasury – Optimistic Scenario

To maintain the treasury positive at all times, a capital stock of € 15.000 is required. If this cannot be realized, credit should be obtained for this amount of money.

An overview of the total costs of operation during these five years is presented in the following graph. This graph could be used to optimize operation and to identify potential cost reductions:

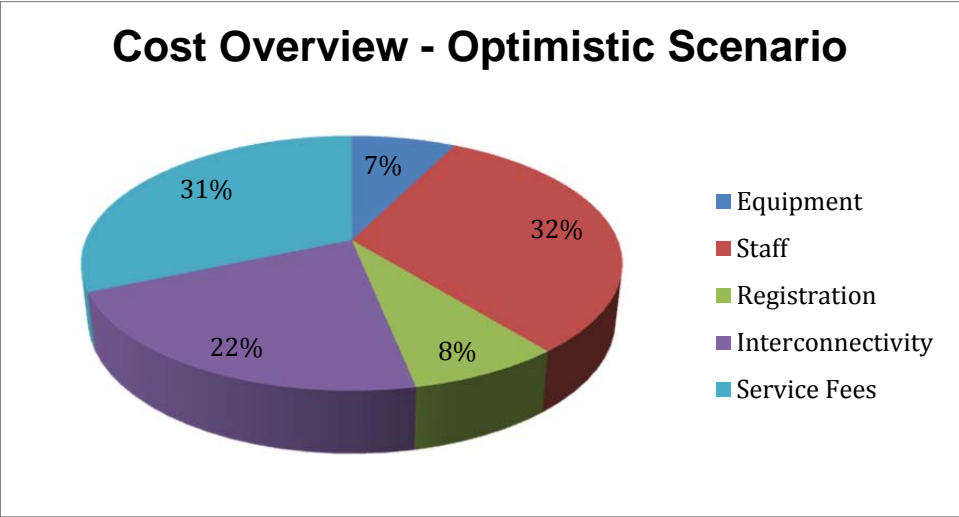


Fig. 6-3 Cost Overview – Optimistic Scenario

Finally, the balance sheet is presented for the optimistic scenario:

OPTIMISTIC SCENARIO						
Balance	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	
ASSETS						
Fixed						
Equipment	€ 64.500	€ 51.600	€ 38.700	€ 25.800	€ 12.900	
Current						
Cash	€ 1.132	€ 178.294	€ 364.140	€ 554.898	€ 747.846	
Accounts receivable	€ -	€ -	€ -	€ -	€ -	
TOTAL ASSETS	€ 65.632	€ 229.894	€ 402.840	€ 580.698	€ 760.746	
LIABILITIES						
Capital Stock	€ 15.000	€ 15.000	€ 15.000	€ 15.000	€ 15.000	
Credit	€ -	€ -	€ -	€ -	€ -	
Accounts payable	€ 50.632	€ 214.894	€ 387.840	€ 565.698	€ 745.746	
TOTAL LIABILITIES	€ 65.632	€ 229.894	€ 402.840	€ 580.698	€ 760.746	

Table 6-12. Balance Sheet – Optimistic Scenario

6.4.4. Conclusions

Based on the previous sections there can be concluded that for all scenarios the virtual operator's business is economically viable. The graphic below presents the results for the three scenarios:

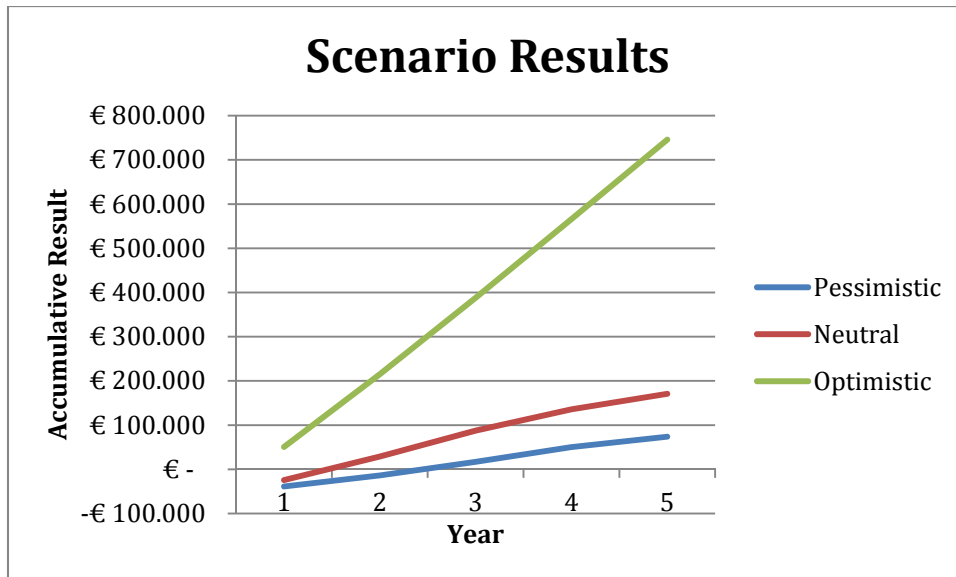


Fig. 6-1 Accumulative Results for different scenarios

As stated before, all scenarios end with a positive accumulated result after five years.

The following table presents the NPV and IRR for the three scenarios:

	Pessimistic	Neutral	Optimistic
NPV	€ 63.520	€ 153.863	€ 680.495
IRR	13%	26%	119%

There should be noted that with a different combination of networks in the pessimistic and neutral scenario, the results may differ. To ensure the financial viability of the operation it is recommended that at least three networks should be operated.

CHAPTER 7. CONCLUSIONS AND RECOMMENDATIONS

7.1. Conclusions

This chapter presents the main conclusions of the study into the technical and business model for the Catalan based virtual operator. The aim of the operator's business would be to offer advanced connectivity services to network operators, carrying out all network related issues and leaving to the local operator sales and customer relationship processes. The concept of the virtual operator is based on a **carrier's carrier** approach.

Five different access networks have been identified and studied in this project, all located in Catalonia are operated by small network operators without good interconnection to a backbone or Internet Exchange. The access networks identified are located in La Senia, Solsona, Capellades, La Pobla de Claramunt and Riba Roja d'Ebre. For the bitstream services on the backbone our virtual operator will rely on the XO backbone which will be deployed in Catalonia.

The technical management model is based on the TMN and eTOM models. After analysing these models an open source stack of an NMS and an OSS/BSS solution is proposed, consisting of OpenNMS and Openbravo ERP. This offers a robust and stable stack that can carry out all required management functionalities.

The services the virtual operator will offer are data, VoIP and IPTV. Various network devices are required to offer these. These devices are distributed between a centralized housing (Telvent Housing) and the access network point of presence. The open source stack and service management systems are located centrally at Telvent Housing.

The positioning of our virtual operator is cover the service layer and rely on Xarxa Oberta to rent bitstream services that transport traffic to the operator IX in Barcelona. Additionally, our virtual operator will support the equipment of our customers so they can concentrate on sales and customer assurance.

Three scenarios were created to study the financial viability of the virtual operator. For all scenarios the business is viable, although there should be noted that with different combinations of access networks as customers this may vary. For single network operation or operation on two networks the business is not viable, except in one case. To ensure viable operation at least three networks should be operated.

7.2. Recommendations

This section presents the recommendations for the virtual operator's business.

For the calculations of the financial viability two staff members are taken into account. Depending on the number of networks operated more might actually be required. The addition of a staff member would be viable if the results cover the additional costs.

Open access networks have not been studied further as currently there is no data available about these networks. In the future, these might also be considered potential customers for the virtual operator. Small operators that require a backbone connection and that want to focus on customer relationships can be considered potential customers. Future expansion of the virtual operator could be focused on these customers.

Additionally, the business model might be expanded regarding open access networks. The virtual operator's infrastructure supports end services and with the open access model this opens the opportunity for the virtual operator to offer services to end users. An initial study has been realized in the changes required in the business model, which is presented in Appendix IV.

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APPENDIX I.

Comparison Open Source NMS Solutions

A1.1. Introduction

This appendix presents an overview of the various NMS tools considered for the virtual operator. The tools taken in consideration are Hyperic, OpenNMS, Pandora FMS, Zabbix and Zenoss. For the virtual operator OpenNMS is selected as the NMS solution.

A1.2. OpenNMS



A1.2.1. Overview

OpenNMS is a Java-based network management system, whose work started in the late 1990s. It was the first open source enterprise grade NMS, and to date it has developed a stable, mature platform that has won several awards and consists of a large supporting community. Commercial support and training is provided by the OpenNMS group, which offers support to large businesses at a fee. No Enterprise Edition exists and all source code is available under the General Public License v2.

A1.2.2. Features

The main features of OpenNMS can be divided in four different segments: discovery, event management, service assurance, and performance measurement. OpenNMS provides automatic discovery on many different levels; it supports L2-L3 discovery, network/node discovery as well as service discovery. The system is also capable of manually discovering devices, if this is preferred.

Events in OpenNMS can be both exterior events (such as SNMP traps from devices) and self-generated OpenNMS events (XML formats). Events can be filtered and sorted by severity, device, etc. to customize the notices the network manager will receive by e-mail/SMS. Regarding service assurance, OpenNMS is able to generate detailed reports on availability of services or devices. A large number of service monitors is available in the tool, from basic ICMP pings to round trip e-mail testing. Performance measurements can be based on various types of data that the tool can collect. OpenNMS supports data collection for SNMP, JMX, HTTP, FTP and several other protocols. The data collected can be filtered against several thresholds, creating customized notices for the network manager if a part of the network is underperforming. The OpenNMS community has developed an integration module for Hyperic HQ, to benefit the complementary functionalities of the systems. This would add more software monitoring capabilities to OpenNMS.

A1.3. Pandora FMS



A1.3.1. Overview

Pandora FMS (Free Monitoring System) is an open source monitoring solution available under the GNU Public License version 2 (GPLv2). A commercial solution with extended functionalities is available as Pandora FMS Enterprise Edition. The project started in 2002 within an international company, after which the founders of Pandora FMS started the Spanish based IT company Artica. Pandora FMS can be used to manage infrastructures, events, availability, capacity or levels of service.

A1.3.2. Features

The Pandora FMS Open Source edition offers fewer features than the Enterprise edition, but even though contains many features for an NMS.

Pandora FMS includes automatic node discovery and a network topology detector. Another main feature of Pandora FMS is the performance and availability monitoring capability. The NMS runs periodic tests on availability (ICMP, SNMP, HTTP, SMTP, etc.) and performance (CPU, Disk, Overload, Connections, Latency, etc.) directly from the FMS server. Software agents are implemented that provide all the information on the system on which they are installed. Pandora FMS includes Fault & Event management, saving every event inside a log that can be accessed from the web console. This web console offers many more options, all customizable by the network manager.

A1.4. Hyperic HQ



A1.4.1. Overview

Hyperic HQ is the open source network management solution of Hyperic. Hyperic was acquired by Spring Source in May 2009, and also offers an enterprise edition with extended features. It offers a Java-based application that can be used for monitoring applications and platforms and to test network infrastructures.

A1.4.2. Features

Hyperic HQ provides six sets of features: discovery, organization, monitoring, control, alerts and presentation. It is important to note that Hyperic HQ cannot be used for automatic node or network discovery, as all features are focused on software and hardware within the nodes.

Node discovery for Hyperic HQ is not automatic, as it requires the deployment of an HQ Agent on each node to be monitored. Once this agent is deployed, it automatically discovers the software and hardware resources on the machine: OS, RAM, CPU, etc. Resources discovered by HQ Agents are stored in the HQ database. The deployed HQ Agents collect metrics on availability, performance, utilization and throughput. This monitoring configuration is fully customizable. HQ can be used for remote control of the software resources, with varying control options depending on the type of resource. Alerts are created once a metric passes a certain, customizable threshold. The response to these alerts can be configured in various ways: E-mail, SNMP traps, control, or communication to other NMS. The HQ Web Portal is a customizable graphical user interface. It consists of portlets, which can be customized to the needs of the network manager.

A1.5. Zabbix



A1.5.1. Overview

Zabbix is an open source enterprise class monitoring system which was developed in 2001. It monitors several important network and server parameters and stores these at the central Zabbix server. The Zabbix system is distributed under the GPLv2 and is therefore free of cost. However, similar to OpenNMS, the Zabbix Group was created which offers commercial support and training to large businesses

A1.5.2. Features

Zabbix offers many features, which can be divided into the main features monitoring, alerting and visualization. Zabbix is based on a centralized configuration, using distributed monitoring deploying Zabbix nodes throughout the network. This leads to a high scalability, as Zabbix can support up to 100.000 devices and/or servers. It offers automatic discovery of nodes by IP range, services and SNMP, as well as automatic monitoring of the discovered devices. Monitoring is done in real-time, and includes performance, availability and integrity monitoring. Zabbix can alert the network manager on customizable events via e-mail, SMS, through the IM service Jabber or other audio alerts in the system. The network manager is able to execute remote commands to solve the occurred problem as fast as possible.

The portal contains a personalized dashboard, which can be customized by the user. It includes the possibilities of mapping the network, graphing monitored statistics and creates reports on these statistics.

A1.6. Zenoss Core



A1.6.1. Overview

Zenoss Core is the open source solution within the Zenoss product family. An Enterprise edition is also available, but this implies both purchase and support costs. Zenoss was developed in 2006 and in the short period has already won several awards. Zenoss Core is capable of monitoring and managing applications, networks and servers.

A1.6.2. Features

The Zenoss Core features can be divided in several different segments: CMDB, Inventory, Availability, Performance, Event Management, Web Portal and Reporting

The Configuration Management Database (CMDB) is populated through automatic discovery and includes networks, servers, software and applications. Entities in this database can be grouped physically or logically to separate business systems, locations and/or responsibilities. The inventory of discovered devices and servers includes a detailed configuration of interfaces, memory, disk, OS and services. Events can be generated if changes take place in the device configuration. Monitoring the availability of the entities in the CMDB is possible in several different ways: ICMP pings, SNMP, SMTP and HTTP. Additionally, the availability of services and processes running on the host OSs can be monitored. Performance monitoring is supported for SNMP, J2EE, and other MIBs. Additional plug-ins are supported from Nagios, Cacti, or customized collections. Zenoss provides graphical overview of the performance over time, ranging from hourly to yearly. Critical thresholds can be adapted for customized event/alert creation. Events can be created based on results in the monitoring features, but also based on other logs or SNMP trap sources. Events can automatically be classified and prioritized. The secure web-portal contains an AJAX-enabled customized user interface that supports several roles with different permissions. Many features of the portal are customizable. It offers the capability of integrating Google Maps within the portal, offering intuitive geographic information. Zenoss supports reporting through e-mail, including both embedded graphics and other images. The graph selection is customizable.

A1.7. Comparison

The following table offers a complete overview of the features for the different NMS solutions.

	Hyperic HQ	OpenNMS	Pandora	Zabbix	Zenoss Core
General					
License	GPL	GPLv2	GPLv2	GPLv2	GPLv2
GUI	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Web Portal	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Features					
Resource Discovery	Manual	Auto or Manual	Auto	Auto	Auto
Topology Discovery		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
SNMP Polling	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Performance Monitoring	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Remote monitoring		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Event Handling	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Event sources	SNMP JMX	SNMP Syslog JMX SNORT		SNMP	SNMP Syslog
Alarms Notifications	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Dashboard	Dashboard E-Mail SMS	Dashboard E-Mail SMS Jabber IM	Dashboard SMS Jabber IM	Dashboard E-Mail SMS
Data Collection	SNMP Nagios	SNMP HTTP JMX JDBC Nagios			SNMP SSH JMX Nagios
Reports	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Statistics		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	
Maps		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Most solutions offer the same functionalities. The differences lie in detailed information such as which types of messages can be used as event sources, discovery methods, etc. All solutions are stable and robust solutions, and have a relatively large developing and support community. However, OpenNMS is the only solution that is considered enterprise grade NMS. Because of this, and the fact that the number of downloads (and therefore the community) of OpenNMS is by far the largest, OpenNMS is recommended for the virtual operator.



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APPENDIX II.

Comparison Open Source OSS/BSS Solutions

A2.1. Introduction

This appendix presents an overview of the various OSS/BSS tools considered for the virtual operator. The tools taken in consideration are Openbravo and Compiere. For the virtual operator Openbravo is selected as the OSS/BSS solution.

A2.2. Openbravo



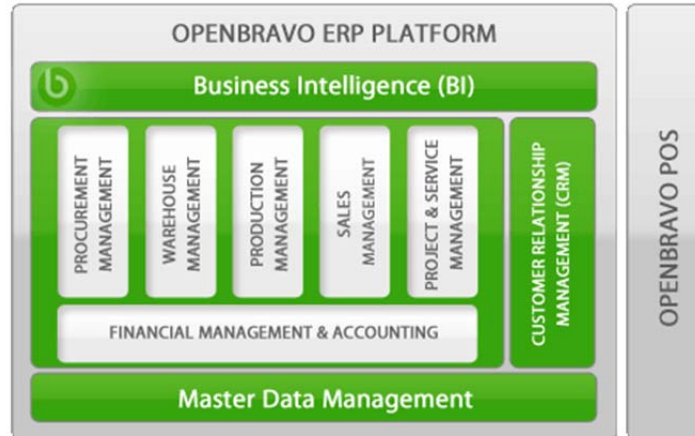
A2.2.1. Overview

Openbravo ERP is the biggest open source ERP solution, with over 2 million downloads since its foundation in 2006. Openbravo ERP has three times been awarded the InfoWorld Bossie Award for best open source software application. Openbravo ERP is a web-based ERP solution aimed at small and medium enterprises. The source code is released under the Openbravo Public License, based on Mozilla Public License. The program is based on the Compiere ERP, the second biggest open source ERP solution.

A2.2.2. Features

Openbravo ERP offers all four key functionalities of a complete ERP system and divides these functionalities into eight different key features:

- Master Data Management: products, components, customers, vendors
- Procurement Management: rates, orders, invoice, receipts, accounting
- Warehouse Management: serial numbers, labels, etc.
- Project and Service Management: projects, tasks, resources, etc.
- Production Management: plans, orders, reports, etc.
- Sales and CRM: prices, shipments, invoicing, CRM, etc.
- Financials and Accounting: accounts, taxes, balance, banking
- Business Intelligence: reporting and analysis.



Openbravo ERP is built with open standards, combining the MVC web applications development framework (Model, View, Control) and a model driven development (MDD). MVC is a web applications development framework that processes separately the database, user interface elements, and business logic. MDD is a software design approach that relies on metadata stored in a dictionary to model the behaviour of the application. This allows personnel with little coding experience to configure the application to suit the needs of each enterprise.

The technologies used in Openbravo ERP are the following:

- Java and JavaScript
- SQL and PL/SQL
- XML
- XHTML

A2.3. Compiere ERP



A2.3.1. Overview

Compiere ERP was the first open source ERP solution available, first developed in 1999. Since its first development it has undergone many changes and won several InfoWorld Bossie Award for best open source software applications. Currently it has been downloaded over 1.8 million times, although the number of weekly downloads is declining. The Compiere ERP was initially developed by ComPiere, Inc., that currently not only develops but offers support and training against fees. The Compiere ERP is available in three different versions: Open Source, Professional, and Enterprise. The first is published under the GNU public license, while the other versions require a subscription fee.

A2.3.2. Features

The Compiere ERP offers features that cover Performance Management, CRM and ERP. For performance management the following features are offered:

- Reporting
- Management Dashboard
- Business View Layer

These management features enable reporting, monitoring and access to management data regarding the ERP and CRM.

The ERP features are divided into six segments:

- Manufacturing: material planning, production scheduling, etc
- Warehouse Management: inbound and outbound logistics
- Purchasing: automating of purchasing process
- Materials Management: inventory receipts, shipment, etc
- Order Management: manage orders, inventory, invoices
- Financial Management: automated system for financial records

The CRM features are:

- Sales: all customer and product related activities
- E-Commerce: web store
- Service: automated tracking system
- Customer History: log of customer interactions

Compiere ERP integrates these functionalities into a single platform. It offers an interactive web-based user interface with secure access. It offers a stable, robust enterprise grade ERP based on an object oriented framework.

A2.4. Comparison

As Openbravo is based on Compiere ERP there are not many differences between the two solutions. However, Openbravo has adapted some key features to improve the solution. The main difference between the two solutions is the database usage. Compiere only supports Oracle databases, which require both license and maintenance fees, while Openbravo also supports PostgreSQL databases, which are open source. Another difference is the license used is different: where Compiere is based on the GNU license, Openbravo has implemented the Mozilla Public License 1.1. However, this does not affect the selection.

The table on the following page gives an overview of the differences between Compiere and Openbravo ERP.

	Compiere ERP	Openbravo ERP
General		
Code Origin	ComPiere Inc	ComPiere Inc
Desktop	Java Swing	Web based
License	GPL	MPL 1.1
Database	Oracle	Postgres
Business Size	Small-Mid	Small-Mid
Features		
Supported Platforms	All but UNIX/LINUX	All
CRM	Sales and Marketing Service	Commissions Customer Contact Sales Management
Financial	Accounts payable Accounts receivable	Accounts payable Accounts receivable Fixed Assets General Ledger
Human Resources	Scheduling Time and Attendance	Time and Attendance
Manufacturing	Material Capacity Inventory Scheduling	Inventory Warehouse Mgmt
Project Management	Billing Data Collection Expenses and Time	Billing Data Collection
Supply Chain	All	Only purchasing

ERP features offered are similar, although Compiere ERP offers more specific features for manufacturing. For the virtual operator these features are not relevant. Openbravo offers more CRM and financial features, which are important features for an ERP.

According to sourceforge.net, the main resource for open source software, Openbravo is the most downloaded ERP solution with almost 5.000 weekly downloads, against approximately 800 weekly downloads of Compiere ERP. Since Openbravo's development in 2006 this has been downloaded almost 2 million times from sourceforge.net while Compiere only reaches 560.000 downloads. This is an important factor in the ERP selection, as the number of downloads gives an indication on the community size.

Concluding, based on more enhanced features, the possibility of using open source databases and the community size, **Openbravo ERP** is selected as the virtual operator's OSS/BSS solution.



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APPENDIX III.

Comparison Open Source IP PBX Solutions

A3.1. Introduction

This appendix presents an overview of the various IP PBX solutions considered for the virtual operator. The solutions taken in consideration are Elastix, PBX in a Flash, and Trixbox. These are all Asterisk based IP PBX solutions. Additional modules that all solutions are based on are Hylafax (for fax features), FreePBX and SugarCRM.

For the virtual operator Elastix is selected as the IP PBX solution because of the robustness, additional features and because the community is most active and quickest growing community of all IP PBX solutions.

A3.2. Elastix



A3.2.1. Overview

Elastix is an open source communications software, that incorporates various communication alternatives at enterprise level. The IP PBX is based on Asterisk and was first released in 2006. It is created and constantly being developed by Palo Santo Solutions.

Elastix not only provides telephony but also integrates e-mail, fax, video conferencing and instant messaging. Elastix is published under the GPLv2 License and all available versions are available for free. Specific modules have been developed for added features and these are also freely distributed. The Elastix community is the largest community regarding IP PBX and support is offered through manuals, documentation and various forums. In February of 2011 Elastix was awarded the 2010 Internet Telephony product of the year Award.

A3.2.2. Features

As mentioned, Elastix does not only function as an IP PBX for telephony, but also supports other communication alternatives. These alternatives are:

- E-mail
- Fax and fax-to-email support
- Video Conferencing
- Instant Messaging

Regarding VoIP telephony, the basic features of Elastix are the following:

- Voicemail and voicemail-to-email support
- Softphone support
- Virtual conference rooms
- Extension roaming

- Caller ID
- Call recording
- IVR
- Echo cancelling
- DHCP Server
- Detailed reporting

The other features are presented in more detail in the comparative table of all IP PBX solutions.

A3.3. PBX in a Flash



A3.3.1. Overview

PBX in a Flash (PiaF) is, similar to Elastix and trixbox, an integration of Asterisk, freePBX and various other tools that combined forms a complete IP PBX solution. The solution is designed for both hobbyists and businesses to deploy VoIP solutions. PBX in a Flash markets itself as a lean, fast IP PBX solution, ready to use after quick install and configuration, hence the name “in a flash”. It is constantly being developed by its community, which offers on-line support to its users and various documentation is also available.

A3.3.2. Features

PBX in a Flash is a lightweight PBX based on Asterisk, freePBX and Webmin. Additional modules are not pre-configured and should be implemented separately. It shares the same basic features as Elastix and trixbox, without any additional supported features. Therefore, the PiaF features are not presented further in this section and the full features overview is presented in the comparative table in section A3.5.

A3.4. Trixbox CE



A3.4.1. Overview

Trixbox is an IP PBX that has developed from a project called Asterisk@Home. It was first released in 2004 and has grown into one of the largest Asterisk IP PBX distributions. Two versions of trixbox are available: Trixbox CE is developed under the GPL license and is therefore freely distributed, while Trixbox Pro is a commercial IP PBX solution. Many modules are available for

Trixbox CE, most available at no cost at all, according to the GPL. The Trixbox community is one of the largest communities, with the largest number of registered users of all IP PBXs. Trixbox is being developed by Fonality, which offers support and training for a fee.

A3.4.2. Features

As Trixbox is Asterisk based, it supports almost all features the same as Elastix and PBX in a Flash. However, an important drawback of trixbox is that it is specialized on audio telephony and does not support instant messaging, video calls, etc. The full set of features is presented in the comparative table in the following section.

A3.5. Comparison

	Elastix	PBX in a Flash	Trixbox
IP PBX			
Call recording	✓	✓	✓
Voicemail	✓	✓	✓
Voicemail-to-email	✓	✓	✓
IVR	✓	✓	✓
Echo cancelling	✓	✓	✓
Video phone	✓	Not included	Not included
DHCP Server	✓	✓	✓
Operator Panel	✓	✓	✓
Call detail records	✓	✓	✓
Billing reports	✓	Module required	Module required
Call queues	✓	✓	✓
Conferencing	✓	✓	✓
Caller ID	✓	✓	✓
Multiple Trunks	✓	✓	✓
Dial pattern match	✓	✓	✓
Callback support	✓	✓	✓
Follow-me	✓	✓	✓
FAX			
Fax to email	✓	Module required	✓
Fax to PDF	✓	Module required	✓
Web fax	✓	Module required	✓
E-MAIL			
Mail server	✓	Module required	Module required
List Management	✓	Module required	Module required
Web based client	✓	Module required	Module required
INSTANT MESSAGING			
Supported IM	GTalk, ICQ, Jabber, MSN, Yahoo	- Openfire,	-

Regarding the features, Elastix is the most complete IP PBX currently available. Furthermore, it has the advantage of a large active community and is being upgraded regularly. As trixbox also offers a commercial service, the size of the open source community has been on the decline. PBX in a Flash is mainly dedicated for home VoIP systems and does not offer features expected in a business system. All systems are equally robust and stable, as all are based on Asterisk and freePBX distributions, so this is not a differentiating factor.

For the virtual operator the Elastix IP PBX is recommended as this offers the most features, has a large and active community.



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APPENDIX IV.

Recommendation for virtual operator's business extension

A4.1. Introduction

This appendix presents in further detail the recommendation for the virtual operator to extend its business to serve end-users on open access networks. The technical model remains the same, while major changes are made in the business plan and business model. This appendix gives an overview of the changes in the business model required for the business extension.

A4.2. Market Study

The main opportunity for the virtual operator is the use of Open Access for its access networks and the XO for its backbone network. As explained in section 1.4 several open access networks exist in Spain, such as Asturias and Viladecans (Barcelona). Potentially, open access networks allow any operator to provide its services over the network. Regardless of open access, the market in which the virtual operator operates is the provision of retail telecommunication services: Internet, voice and television. In Spain this is a very big market with the yearly revenues for each service displayed in the table below, Table A4.1.

Service	Revenues in 2009
Internet	€ 3.8 billion
Fixed Telephony	€ 5.7 billion
Television	€ 3.5 billion

Table A4.1 Telecommunications Market Revenues in 2009

Especially of interest for the virtual operator is the Internet market, as this market is the core business, and it reflects the main competitors. The Internet retail market in Spain is dominated by ADSL technology, with a very strong role for the incumbent. The graph below, Fig A4-1, presents the market shares for the five main operators in the retail Internet market, technology independent.

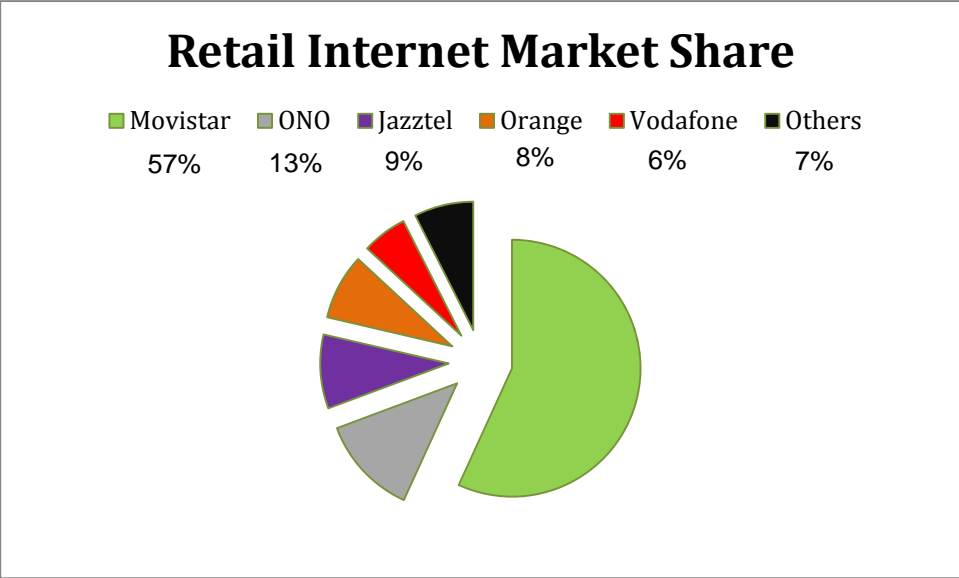


Fig.A4-1 Retail Internet Market Overview

Focusing on FTTH access, in 2009 around 19.000 lines had Internet access through this technology. The majority of FTTH lines were operated by Telefónica, now Movistar, using their own infrastructure. Other lines are either cable operators that have updated their HFC networks to FTTH (Telecable) or operators that use one of the Open Access Networks deployed in Spain (e.g. Adamo). The following graph, Fig. A4-2, shows the market share for each operator for FTTH access lines.

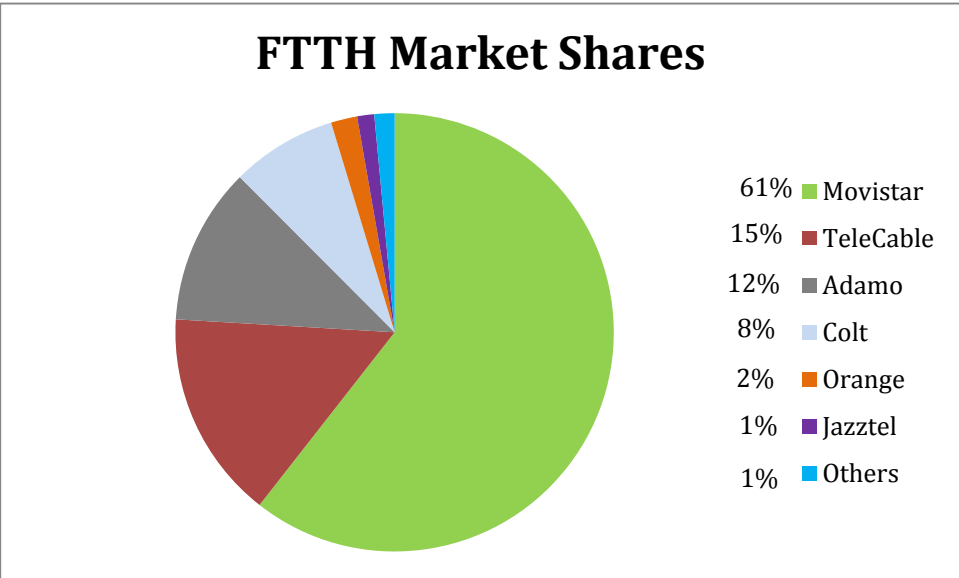


Fig.A4-2 FTTH Market Overview

Regarding Open Access Networks, there is no data on the market shares. Once finished, the Asturcón Open Access network will offer FTTH services to over 51.200 households, while the Viladecans Open Access network will offer FTTH to over 2.760 households.

A4.3. Customer Segments

Businesses may divide their potential customers into different segments, as is the case for the operator. As Internet has become almost a necessity for any household, all households are potential customers for the operator. Additionally, almost all businesses require Internet for their business processes. Therefore, the operator could reach two different segments: residential and business customers.

A4.3.1. Residential Customers

Potential residential customers of the operator in the retail market are all households in Spain. However, not all households currently have Internet connectivity, as the broadband penetration in Spain is still not 100%. In 2009 there were almost 9.8 million Internet connections. This corresponds to 21.0 lines per 100 inhabitants, or 51% of all Spanish households with broadband Internet access. In Catalonia the average is higher, with a penetration of up to 25.2 lines per 100 inhabitants in the province of Barcelona.

The requirements for residential customers can vary, hence the current existence of different service offerings among the different operators. Currently, the telecommunications services offered in Catalonia are mainly based on xDSL technology, with some operators offering CATV/HFC or FTTH. Downstream data rates of the services offered currently vary from 3 Mbps to 20 Mbps for xDSL, up to 50 Mbps for cable and even up to 100 Mbps on FTTH networks. Additionally, customers are often offered the option of maintaining their telephony and television services with the same operator. The following chart, Fig. A4-3, presents the different existing services and the percentage of users that have these services in Spain.

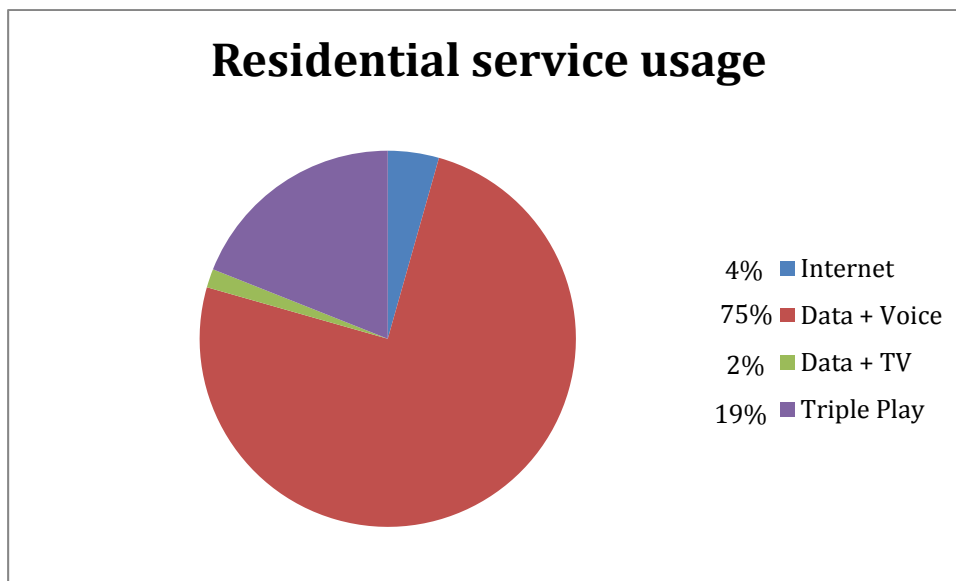


Fig.A4-3 Residential Service Usage in Spain

From the graph it becomes clear that the vast majority of residential customers have both data and voice services through their Internet operator, while another 19% also has television services. Just 4% of the residential customers have only Internet access, while 2% has both Internet and television services.

A4.3.2. Business Customers

Business customers may have different needs than residential customers, although the differences are decreasing. Many businesses rely completely on Internet access for their business processes, such as billing, support or e-mail, and therefore require a higher availability and reliability from the operator.

Business services should therefore be more advanced than residential services. Three main differences can be identified: the need for a service level agreement, static IP assignments and additional telephone lines. A Service Level Agreement (SLA) must be set up between the operator and the business customer that ensures the availability of the service offered. This SLA includes guarantees on availability and recovery time, among others. Another difference is the possibility of assigning a static IP address to a customer. If a business would like to run its own web-server or mail-server it would require a static IP address, while for residential services often dynamic IP addresses are used.

In general, the services required by businesses are generally the same, but the distribution of the service usage is different, as shown in Fig. A4-4.

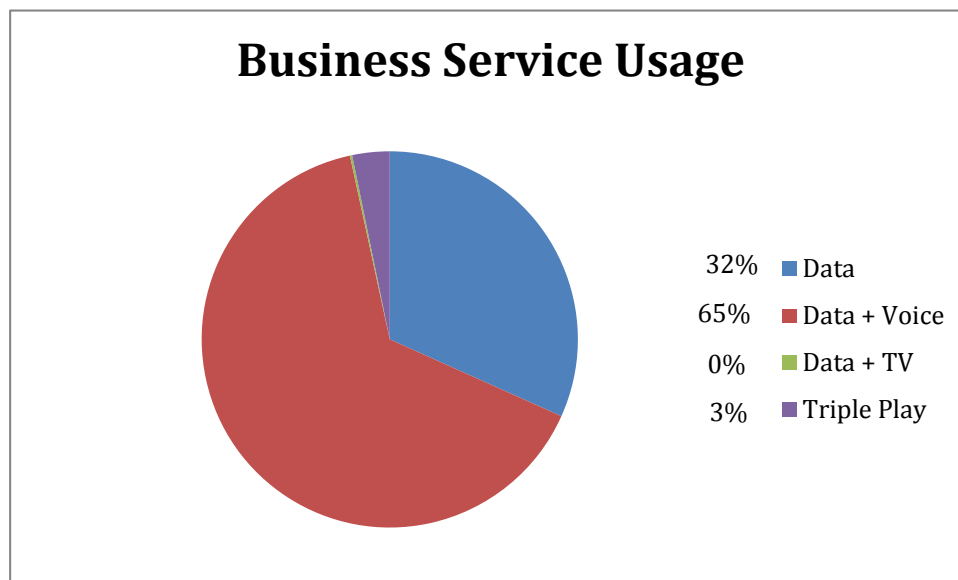


Fig. A4-4 Business Service Usage in Spain

Similar to residential demand, the majority of business (65%) demands both data and telephony. However, with business customers there is a much higher demand to just offer Internet access (32%), and the demand for television is very low (3%). With this graph it becomes clear that the demand from residential and business customers is quite different.

A4.4 Value Propositions

The value creating products and services for both residential and business customers are presented in this section. These values can either be qualitative (support, convenience) or quantitative (speed, price). These value propositions are divided between customer segments.

A4.4.1. Residential Value Propositions

For residential customers two main added value propositions can be defined: price and performance. Residential customers will require a certain minimum data rate to fulfil their needs at the lowest price possible.

The different services currently being offered in Spain are shown in the following table, TableA4-2. The table shows the various services offered and all prices for each service, for the five biggest operators in Spain. All prices exclude Value Added Tax (VAT). Additionally, any temporary promotions are not taken into account.






	Datarate (Mbps)		Service			Other	Equipment	
	Downlink	Uplink	Internet	Telephony	Television		Installation	WiFi Router
	20	1	€ 20,95	€ 14,00	€ 15,00	€ -	€ -	€ -
	6	0,5	€ 24,95	€ 13,97	n/a	€ -	€ -	n/a
	30	3,5	€ 31,95	€ 13,95	n/a	€ 61,80	€ -	n/a
	20	1	€ 29,95	€ 13,95	n/a	€ 61,80	€ -	n/a
	6	1	€ 25,95	€ 13,95	n/a	€ 61,80	€ -	n/a
	3	0,5	€ 21,95	€ 13,95	n/a	€ 61,80	€ -	n/a
	20	1	€ 24,90	€ 15,00	€ 5,00	€ -	€ -	€ 39,00
	6	1	€ 19,90	€ 15,00	€ 5,00	€ -	€ -	€ 39,00
	10	0,8	€ 40,90	€ 13,97	€ 10,00	€ 39,95	€ -	€ -
	3	0,32	€ 32,90	n/a	n/a	€ 66,00	€ -	n/a
	50	5	€ 45,90	€ 14,00	€ 5,00	€ 39,50	€ -	€ -
	30	1	€ 37,90	€ 14,00	€ 8,00	€ 39,50	€ -	€ -
	12	0,5	€ 35,90	€ 14,00	€ 10,00	€ 39,50	€ -	€ -
	6	0,3	€ 25,90	€ 14,00	€ 10,00	€ 39,50	€ -	€ -

Table A4-2 Services Offered By Five Biggest Operators

This table gives an overview of the services offered by the five main operators and the pricing of these services. These services are mainly offered over xDSL technology with the exception of ONO that operates on its own cable infrastructure. The average price for telephony is € 14.13, with prices between €13.95 and € 15.00 per month. For television services the prices range between € 5.00 and € 15.00 per month, with an average of € 8.50 per month. Internet service pricing differs highly between operator and data rate offered, with prices varying from € 19.90 per month for 6 Mbps up to € 45.90 per month for 50 Mbps.

The figure presented give a decent overview of the services and pricing, however it does not includes FTTH services, for which the services offered on

open access networks should be analysed. In the Open Access networks of Asturcón and Viladecans a total of four operators provide services based on FTTH: Orange, Adamo, Nostracom and Telecable. The services and pricing in the Open Access networks are presented in the following table:





	Datarate (Mbps)			Service		Other	Equipment		Open Access Network
	Downlink	Uplink		Data+Telephony	Triple Play		WiFi Router	Set-Top Box	
	50	50		n/a	€ 44,95	€ -	€ -	€ -	Viladecans
	100	20		€ 35,00	n/a	€ -	€ -	n/a	Viladecans / Asturcón
	100	100		€ 55,00	n/a	€ -	€ -	n/a	Viladecans / Asturcón
	20	2		€ 29,00	n/a	€ -	€ -	n/a	Asturcón
	100	20		€ 34,00	n/a	€ -	€ -	n/a	Asturcón
	10	0,8		n/a	€ 50,50	€ -	€ -	€ -	Asturcón
	20	1		n/a	€ 61,75	€ -	€ -	€ -	Asturcón
	30	1,5		n/a	€ 71,75	€ -	€ -	€ -	Asturcón

Table A4-3 Services Offered on Open Access Networks

Within the open access networks prices are relatively lower than normally, regarding the much higher data rate being offered. Triple play services are only offered by two operators, at relatively high prices, from €44.95 per month to € 71.75 per month. For the virtual operator this could be an opportunity to offer triple play at a lower price. Both Adamo and Nostracom offer 100 Mbps / 20 Mbps with telephony for approximately € 35.00, meaning that for the virtual operator to offer added value the price may not be higher than this.

A4.4.2. Business Value Propositions

For businesses other qualitative values are more important, besides the price and performance of the service. As mentioned in section 4.1 businesses require a higher availability, reliability and a higher level of support than residential users.

First of all, the SLA arranged between the business customer and the operator must guarantee the quality of the service. Common specifications in SLAs are Mean Time to Recovery (MTTR), availability and the response time in case of failure. An example of a competitor's SLA can be found in the case of Adamo's Business FTTH service, offering 100Mbps with 24/7 support in case of failure and an availability of 99.998%. This corresponds to a maximum annual downtime of just 10 minutes. This service is offered to businesses at €995.00 per month. Other business services offered by competitors can be found at a lower price, as ONO for example offers a simple business service with a 12 Mbps data rate and an inferior SLA for € 67.50 per month. The main difference between ONO's business and residential services are the number of telephone lines/numbers included in the service.

The new operator's SLA depends on the SLA offered by the Open Access Network and the XarxaOberta, as the SLA theoretically cannot exceed any of these SLAs. The advanced business services that the virtual operator could offer can therefore not have added value in terms of SLA improvement. The

added value could come from a higher bandwidth or a higher number of telephone lines available.

A4.5. Costs and Revenues

A4.5.1. Revenue Streams

For Internet service providers and operators in Spain, a flat-rate fee is applied. Customers will pay a monthly subscription fee for the services, and might be charged installation costs and equipment costs.

For residential services the service and pricing are defined as follows:

- Internet 100/20 + Telephony: € 35.00 p/m
- Internet 100/20 + Telephony + Television: € 50.00 p/m

With this service bundling and pricing scheme, the operator will offer the same or higher valued services than the competitors, regarding both price and performance. As none of the competitors are charging installation costs or equipment costs, the virtual operator is not in a position to charge these costs and must offer the same promotions.

For business services the services and pricing are defined as follows:

- Internet 100/20 + 2 Telephone Lines: € 50.00 p/m
- Internet 100/20 + 4 Telephone Lines: € 70.00 p/m

A static IP can be acquired by any customer for € 10.00 p/m. This is the price also applied by other competitors, such as Adamo.

A4.5.2. Cost Streams

The technical model is exactly the same, so costs presented for the virtual operator will be similar. Additional costs can be identified in staff, open access network leasing and acquisition of customer equipment.

A4.5.2.1. Staff

As the virtual operator will have to be involved in sales directly with the end user more staff is required. For interaction with customers sales personnel, sales support staff and technical support staff is required. Furthermore, technical experts are required for the installation, configuration and maintenance of the network equipment and systems. For the correct functioning of the business, it is recommended to have one manager to coordinate both sales and technical staff. The organizational chart is the following:

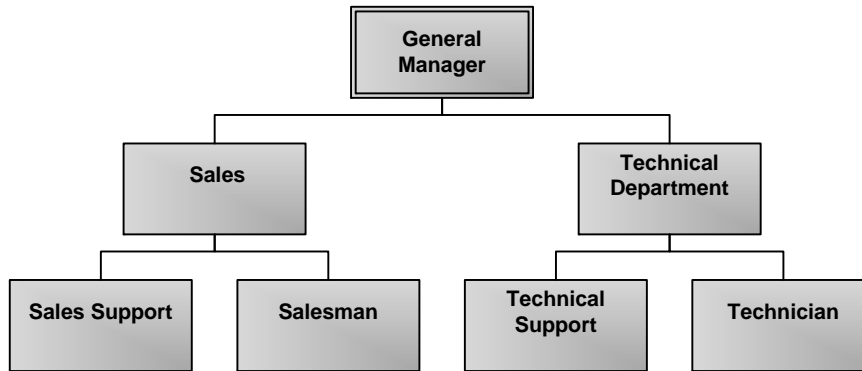


Fig.A4-5 Organizational Chart

The number of staff required for each position depends on the company phase and scale. Initially, more salesmen will be required to acquire customers. The sales support functionality could be fulfilled by salesmen, which combine these functionalities. Once customer acquisition is no longer the priority, the focus should be on customer retention, which is obtained through maintaining the infrastructure and through support. During customer acquisition there is not much need for technical support, so only technicians will be required. In case technical support is required during this phase this can be realized by the technicians. Once installation and configuration is done, technical support will have priority and a single technician could maintain the infrastructure. As 24/7 support is required, at least five technicians are required at all times.

A4.5.2.2. Customer Equipment

The customer equipment required depends on the services offered to the client. If data is contracted a wireless router should be provided by the operator for free. Additionally, a set top box is required if IPTV services are contracted.

A4.5.2.3. Open Access Network Leasing

The virtual operator leases the network infrastructure from the neutral operator. There are two types of fees associated with this leasing: a one-time subscription fee per client, and a monthly lease fee per customer.

These prices vary per Open Access Network, as shown in the following table:

	Registration Fee	Data 20 Mbps	Data 100 Mbps
Asturcón	€ 35	€ 15.95	€ 20.95
Viladecans	Unknown	Unknown	Unknown
Navarra	Unknown	Unknown	€ 19.00

Table A4-4 Open Access Network Prices



eetac

Escola d'Enginyeria de Telecomunicació i
Aeroespacial de Castelldefels

UNIVERSITAT POLITÈCNICA DE CATALUNYA

APPENDIX V.

Detailed Economic Models

COSTS AND REVENUES

REVENUES

REVENUES (PER MONTH)	
VoIP Telephony	€ 3,50
IPTV - Additional Channels Package	€ 2,50
IPTV - Video on Demand	€ 3,50
Support	€ 250,00
Service Provisioning	€ 1,00
DATA CONNECTIVITY REVENUES (PER MONTH)	
10 Mbps	€ 1.000,00
20 Mbps	€ 1.800,00
25 Mbps	€ 2.000,00
50 Mbps	€ 3.000,00
100 Mbps	€ 4.500,00
150 Mbps	€ 6.000,00

COSTS

EQUIPMENT COSTS	
CENTRAL HOUSING	
Cisco 7204 VXR	€ 14.000,00
Cisco ME 3400 Series	€ 6.000,00
Dell Server	€ 2.000,00
DVB-S Receiver	€ 500,00
DVB-T Receiver	€ 500,00
DVB-S IPTV Gateway	€ 8.000,00
DVB-T IPTV Gateway	€ 8.000,00
POINT OF PRESENCE	
Cisco Catalyst 1900	€ 100,00
Dell Server	€ 1.000,00
VoD Server	€ 4.000,00

SERVICE FEES	
VoIP Trunking & DDI	€ 2,50
IPTV - Additional Channels	€ 1,00
IPTV - VoD Content	€ 2,00
IPTV - Support & Content Licenses	€ 285,00

STAFF	
ENGINEERING	€ 32.500,00

REGISTRATION COSTS	
CATNIX	€ 1.800,00
RIPE NCC	€ 1.800,00
XARXA OBERTA	€ 1.000,00

IPTV SOFTWARE LICENSE	
100 USERS	€ 12.000,00
200 USERS	€ 20.000,00

INTERCONNECTIVITY	
CATNIX - 100 Mbps	€ 266,00
CATNIX - 1 Gbps	€ 399,00
XO - 100 Mbps	€ 660,00
XO - 1 Gbps	€ 1.000,00
CATNIX - Telvent Extension	€ 50,00

TRANSIT (100 Mbps)	
2011	€ 1.200,00
2012	€ 840,00
2013	€ 588,00
2014	€ 411,00
2015	€ 287,00

TRANSIT (1 Gbps)	
2011	€ 3.500,00
2012	€ 2.450,00
2013	€ 1.720,00
2014	€ 1.200,00
2015	€ 840,00

TRAFFIC AND USERS

Municipality	Data Traffic (Mbps)					Telephony Users	IPTV Users
	Year 1	Year 2	Year 3	Year 4	Year 5		
Capellades	100	200	300	400	500	500	100
La Pobla de Claramunt	25	50	75	100	125	200	40
La Senia	150	300	450	600	750	300	60
Riba Roja d'Ebre	20	40	60	80	100	250	50
Solsona	25	50	75	100	125	300	60
Viladecans (Hypothetic)	50	100	150	200	250	275	55

1: Capellades	100	200	300	400	500
1: La Pobla	25	50	75	100	125
1: La Senia	150	300	450	600	750
1: Riba Roja	20	40	60	80	100
1: Solsona	25	50	75	100	125
2: Capellades + La Pobla	125	250	375	500	625
2: Capellades + La Senia	250	500	750	1000	1250
2: Capellades + Riba Roja	120	240	360	480	600
2: Capellades + Solsona	125	250	375	500	625
2: La Pobla + La Senia	175	350	525	700	875
2: La Pobla + Riba Roja	45	90	135	180	225
2: La Pobla + Solsona	50	100	150	200	250
2: La Senia + Riba Roja	170	340	510	680	850
2: La Senia + Solsona	175	350	525	700	875
2: Riba Roja + Solsona	45	90	135	180	225
3: Capellades + La Pobla + La Senia	275	550	825	1100	1375
3: Capellades + La Pobla + Riba Roja	145	290	435	580	725
3: Capellades + La Pobla + Solsona	150	300	450	600	750
3: Capellades + La Senia + Riba Roja	270	540	810	1080	1350
3: Capellades + La Senia + Solsona	275	550	825	1100	1375
3: Capellades + Riba Roja + Solsona	145	290	435	580	725
3: La Pobla + La Senia + Riba Roja	195	390	585	780	975
3: La Pobla + La Senia + Solsona	200	400	600	800	1000
3: La Pobla + Riba Roja + Solsona	65	130	195	260	325
3: La Senia + Riba Roja + Solsona	195	390	585	780	975
4: La Pobla + La Senia + Riba Roja + Solsona	220	440	660	880	1100
4: Capellades + La Senia + Riba Roja + Solsona	295	580	875	1170	1465
4: Capellades + La Pobla + Riba Roja + Solsona	170	340	510	680	850
4: Capellades+ La Pobla + La Senia + Solsona	300	600	900	1200	1500
4: Capellades + La Pobla + La Senia + Riba Roja	295	580	875	1170	1465
5: All Networks	320	640	960	1280	1600

RESULTS OF ANNUAL GAINS AND LOSSES

Network	Year 1	Year 2	Year 3	Year 4	Year 5	Total	NPV
Capellades	-€ 63.532	-€ 45.438	-€ 49.331	-€ 46.674	-€ 46.116	-€ 251.090	-€ 233.744
La Pobla de Claramunt	-€ 87.892	-€ 69.042	-€ 69.431	-€ 70.890	-€ 82.284	-€ 379.538	-€ 351.828
La Senia	-€ 61.848	-€ 42.918	-€ 37.571	-€ 34.914	-€ 34.356	-€ 211.606	-€ 198.257
Riba Roja	-€ 91.232	-€ 69.882	-€ 70.271	-€ 71.730	-€ 83.124	-€ 386.238	-€ 358.217
Solsona	-€ 89.772	-€ 65.922	-€ 79.043	-€ 78.378	-€ 79.164	-€ 392.278	-€ 363.585
Viladecans	-€ 77.302	-€ 54.702	-€ 55.091	-€ 56.550	-€ 58.824	-€ 302.468	-€ 281.390
2: Capellades + La Pobla	-€ 71.788	-€ 25.878	-€ 20.531	-€ 17.874	-€ 17.316	-€ 153.386	-€ 146.344
2: Capellades + La Senia	-€ 38.868	€ 25.242	€ 30.590	€ 33.246	€ 23.724	€ 73.934	€ 63.520
2: Capellades + Riba Roja	-€ 75.128	-€ 26.718	-€ 21.371	-€ 18.714	-€ 18.156	-€ 160.086	-€ 152.733
2: Capellades + Solsona	-€ 73.668	-€ 22.758	-€ 17.411	-€ 14.754	-€ 14.196	-€ 142.786	-€ 136.898
2: La Pobla + La Senia	-€ 42.028	-€ 14.118	-€ 8.771	-€ 6.114	-€ 5.556	-€ 76.586	-€ 73.896
2: La Pobla + Riba Roja	-€ 71.412	-€ 41.082	-€ 54.203	-€ 53.538	-€ 57.516	-€ 277.750	-€ 257.787
2: La Pobla + Solsona	-€ 69.952	-€ 37.122	-€ 50.243	-€ 49.578	-€ 53.556	-€ 260.450	-€ 241.952
2: La Senia + Riba Roja	-€ 45.368	-€ 14.958	-€ 9.611	-€ 6.954	-€ 6.396	-€ 83.286	-€ 80.285
2: La Senia + Solsona	-€ 43.908	-€ 10.998	-€ 5.651	-€ 2.994	-€ 2.436	-€ 65.986	-€ 64.451
2: Riba Roja + Solsona	-€ 73.292	-€ 37.962	-€ 38.351	-€ 39.810	-€ 42.084	-€ 231.498	-€ 216.615
3: Capellades + La Pobla + La Senia	-€ 20.848	€ 54.042	€ 59.390	€ 49.134	€ 35.736	€ 177.454	€ 160.252
3: Capellades + La Pobla + Riba Roja	-€ 57.108	€ 2.082	€ 7.430	€ 10.086	€ 10.644	-€ 26.866	-€ 30.172
3: Capellades + La Pobla + Solsona	-€ 55.648	€ 6.042	€ 11.390	€ 14.046	€ 14.604	-€ 9.566	-€ 14.337
3: Capellades + La Senia + Riba Roja	-€ 24.188	€ 53.202	€ 58.550	€ 48.294	€ 34.896	€ 170.754	€ 153.863
3: Capellades + La Senia + Solsona	-€ 22.728	€ 57.162	€ 62.510	€ 52.254	€ 38.856	€ 188.054	€ 169.697
3: Capellades + Riba Roja + Solsona	-€ 58.988	€ 5.202	€ 10.550	€ 13.206	€ 13.764	-€ 16.266	-€ 20.726
3: La Pobla + La Senia + Riba Roja	-€ 35.348	€ 13.842	€ 19.190	€ 21.846	€ 22.404	€ 41.934	€ 34.276
3: La Pobla + La Senia + Solsona	-€ 33.888	€ 17.802	€ 23.150	€ 25.806	€ 26.364	€ 59.234	€ 50.110
3: La Pobla + Riba Roja + Solsona	-€ 63.272	-€ 24.918	-€ 22.283	-€ 26.154	-€ 25.596	-€ 162.222	-€ 152.963
3: La Senia + Riba Roja + Solsona	-€ 37.228	€ 16.962	€ 22.310	€ 24.966	€ 25.524	€ 52.534	€ 43.721
4: La Pobla + La Senia + Riba Roja + Solsona	-€ 32.408	€ 45.762	€ 51.110	€ 53.766	€ 39.768	€ 157.998	€ 140.640
4: Capellades + La Senia + Riba Roja + Solsona	-€ 13.048	€ 85.122	€ 90.470	€ 66.474	€ 66.816	€ 295.834	€ 268.654
4: Capellades + La Pobla + Riba Roja + Solsona	-€ 45.968	€ 34.002	€ 39.350	€ 42.006	€ 42.564	€ 111.954	€ 96.835
4: Capellades + La Pobla + La Senia + Solsona	-€ 9.708	€ 85.962	€ 91.310	€ 67.314	€ 67.656	€ 302.534	€ 275.043
4: Capellades + La Pobla + La Senia + Riba Roja	-€ 11.168	€ 82.002	€ 87.350	€ 63.354	€ 63.696	€ 285.234	€ 259.209
5: All Networks	€ 50.632	€ 164.262	€ 172.946	€ 177.858	€ 180.048	€ 745.746	€ 680.495

NPV DISCOUNT RATE 4,0%

INTERNAL RATE OF RETURN							
Network	Capital	Year 1	Year 2	Year 3	Year 4	Year 5	IRR
2: Capellades + La Senia	€ 90.000,00	-€ 38.868	€ 25.242	€ 30.590	€ 33.246	€ 23.724	13%
3: Capellades + La Pobla + La Senia	€ 75.000,00	-€ 20.848	€ 54.042	€ 59.390	€ 49.134	€ 35.736	27%
3: Capellades + La Senia + Riba Roja	€ 80.000,00	-€ 24.188	€ 53.202	€ 58.550	€ 48.294	€ 34.896	26%
3: Capellades + La Senia + Solsona	€ 80.000,00	-€ 22.728	€ 57.162	€ 62.510	€ 52.254	€ 38.856	27%
3: La Pobla + La Senia + Riba Roja	€ 90.000,00	-€ 35.348	€ 13.842	€ 19.190	€ 21.846	€ 22.404	8%
3: La Pobla + La Senia + Solsona	€ 90.000,00	-€ 33.888	€ 17.802	€ 23.150	€ 25.806	€ 26.364	11%
3: La Senia + Riba Roja + Solsona	€ 90.000,00	-€ 37.228	€ 16.962	€ 22.310	€ 24.966	€ 25.524	10%
4: La Pobla + La Senia + Riba Roja + Solsona	€ 90.000,00	-€ 32.408	€ 45.762	€ 51.110	€ 53.766	€ 39.768	22%
4: Capellades + La Senia + Riba Roja + Solsona	€ 75.000,00	-€ 13.048	€ 85.122	€ 90.470	€ 66.474	€ 66.816	38%
4: Capellades + La Pobla + Riba Roja + Solsona	€ 105.000,00	-€ 45.968	€ 34.002	€ 39.350	€ 42.006	€ 42.564	16%
4: Capellades + La Pobla + La Senia + Solsona	€ 70.000,00	-€ 9.708	€ 85.962	€ 91.310	€ 67.314	€ 67.656	40%
4: Capellades + La Pobla + La Senia + Riba Roja	€ 70.000,00	-€ 11.168	€ 82.002	€ 87.350	€ 63.354	€ 63.696	38%
5: All Networks	€ 15.000,00	€ 50.632	€ 164.262	€ 172.946	€ 177.858	€ 180.048	119%

CAPELLADES					
Revenues	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Data Connectivity	€ 54.000	€ 54.000	€ 54.000	€ 54.000	€ 54.000
VoIP Telephony	€ 21.000	€ 21.000	€ 21.000	€ 21.000	€ 21.000
IPTV - Additional Channels	€ 3.000	€ 3.000	€ 3.000	€ 3.000	€ 3.000
IPTV - Video on Demand	€ 4.200	€ 4.200	€ 4.200	€ 4.200	€ 4.200
Support	€ 3.000	€ 3.000	€ 3.000	€ 3.000	€ 3.000
Service Provisioning	€ 6.000	€ 6.000	€ 6.000	€ 6.000	€ 6.000
Total Revenues	€ 91.200	€ 91.200	€ 91.200	€ 91.200	€ 91.200

Costs	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ 12.000	€ -	€ -	€ -	€ -
Central Housing	€ -	€ -	€ -	€ -	€ -
PoP	€ -	€ -	€ -	€ -	€ -
IPTV Software License	€ 12.000	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Engineering	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Registration	€ 29.600	€ -	€ -	€ -	€ -
CATNIX	€ 1.800	€ -	€ -	€ -	€ -
RIPE NCC	€ 26.800	€ -	€ -	€ -	€ -
Xarxa Oberta	€ 1.000	€ -	€ -	€ -	€ -
Interconnectivity	€ 26.112	€ 37.548	€ 38.028	€ 31.788	€ 27.468
CATNIX	€ 3.792	€ 5.388	€ 5.388	€ 5.388	€ 5.388
X.O.	€ 7.920	€ 12.000	€ 12.000	€ 12.000	€ 12.000
Upstream Service Provider	€ 14.400	€ 20.160	€ 20.640	€ 14.400	€ 10.080
Service Fees	€ 22.020	€ 22.020	€ 22.020	€ 22.020	€ 22.020
VoIP Trunking	€ 15.000	€ 15.000	€ 15.000	€ 15.000	€ 15.000
IPTV - Additional Channels	€ 1.200	€ 1.200	€ 1.200	€ 1.200	€ 1.200
IPTV - Video on Demand	€ 2.400	€ 2.400	€ 2.400	€ 2.400	€ 2.400
IPTV - Support & Content License	€ 3.420	€ 3.420	€ 3.420	€ 3.420	€ 3.420
Total Costs	€ 154.732	€ 127.818	€ 131.711	€ 129.054	€ 128.496

Depreciations	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ -	€ 8.820	€ 8.820	€ 8.820	€ 8.820
All Equipment	€ -	€ 8.820	€ 8.820	€ 8.820	€ 8.820

Result	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
Total Result	-€ 63.532	-€ 45.438	-€ 49.331	-€ 46.674	-€ 46.116	-€ 251.090
NPV	€ (63.532)	€ (43.690)	€ (45.609)	€ (41.493)	€ (39.420)	€ (233.744)

LA POBLA DE CLARAMUNT					
Revenues	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Data Connectivity	€ 24.000	€ 24.000	€ 24.000	€ 24.000	€ 24.000
VoIP Telephony	€ 8.400	€ 8.400	€ 8.400	€ 8.400	€ 8.400
IPTV - Additional Channels	€ 1.200	€ 1.200	€ 1.200	€ 1.200	€ 1.200
IPTV - Video on Demand	€ 1.680	€ 1.680	€ 1.680	€ 1.680	€ 1.680
Support	€ 3.000	€ 3.000	€ 3.000	€ 3.000	€ 3.000
Service Provisioning	€ 2.400	€ 2.400	€ 2.400	€ 2.400	€ 2.400
Total Revenues	€ 40.680	€ 40.680	€ 40.680	€ 40.680	€ 40.680

Costs	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ 12.000	€ -	€ -	€ -	€ -
Central Housing	€ -	€ -	€ -	€ -	€ -
PoP	€ -	€ -	€ -	€ -	€ -
IPTV Software License	€ 12.000	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Engineering	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Registration	€ 14.600	€ -	€ -	€ -	€ -
CATNIX	€ 1.800	€ -	€ -	€ -	€ -
RIPE NCC	€ 11.800	€ -	€ -	€ -	€ -
Xarxa Oberta	€ 1.000	€ -	€ -	€ -	€ -
Interconnectivity	€ 26.112	€ 21.792	€ 18.768	€ 16.644	€ 24.276
CATNIX	€ 3.792	€ 3.792	€ 3.792	€ 3.792	€ 5.388
X.O.	€ 7.920	€ 7.920	€ 7.920	€ 7.920	€ 12.000
Upstream Service Provider	€ 14.400	€ 10.080	€ 7.056	€ 4.932	€ 6.888
Service Fees	€ 10.860	€ 10.860	€ 10.860	€ 10.860	€ 10.860
VoIP Trunking	€ 6.000	€ 6.000	€ 6.000	€ 6.000	€ 6.000
IPTV - Additional Channels	€ 480	€ 480	€ 480	€ 480	€ 480
IPTV - Video on Demand	€ 960	€ 960	€ 960	€ 960	€ 960
IPTV - Support & Content License	€ 3.420	€ 3.420	€ 3.420	€ 3.420	€ 3.420
Total Costs	€ 128.572	€ 100.902	€ 101.291	€ 102.750	€ 114.144

Depreciations	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ -	€ 8.820	€ 8.820	€ 8.820	€ 8.820
All Equipment	€ -	€ 8.820	€ 8.820	€ 8.820	€ 8.820

Result	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
Total Result	-€ 87.892	-€ 69.042	-€ 69.431	-€ 70.890	-€ 82.284	-€ 379.538
NPV	€ (87.892)	€ (66.387)	€ (64.192)	€ (63.021)	€ (70.337)	€ (351.828)

LA SENIA					
Revenues	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Data Connectivity	€ 72.000	€ 72.000	€ 72.000	€ 72.000	€ 72.000
VoIP Telephony	€ 12.600	€ 12.600	€ 12.600	€ 12.600	€ 12.600
IPTV - Additional Channels	€ 1.800	€ 1.800	€ 1.800	€ 1.800	€ 1.800
IPTV - Video on Demand	€ 2.520	€ 2.520	€ 2.520	€ 2.520	€ 2.520
Support	€ 3.000	€ 3.000	€ 3.000	€ 3.000	€ 3.000
Service Provisioning	€ 3.600	€ 3.600	€ 3.600	€ 3.600	€ 3.600
Total Revenues	€ 95.520	€ 95.520	€ 95.520	€ 95.520	€ 95.520

Costs	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ 12.000	€ -	€ -	€ -	€ -
Central Housing	€ -	€ -	€ -	€ -	€ -
PoP	€ -	€ -	€ -	€ -	€ -
IPTV Software License	€ 12.000	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Engineering	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Registration	€ 19.600	€ -	€ -	€ -	€ -
CATNIX	€ 1.800	€ -	€ -	€ -	€ -
RIPE NCC	€ 16.800	€ -	€ -	€ -	€ -
Xarxa Oberta	€ 1.000	€ -	€ -	€ -	€ -
Interconnectivity	€ 46.188	€ 46.788	€ 38.028	€ 31.788	€ 27.468
CATNIX	€ 5.388	€ 5.388	€ 5.388	€ 5.388	€ 5.388
X.O.	€ 12.000	€ 12.000	€ 12.000	€ 12.000	€ 12.000
Upstream Service Provider	€ 28.800	€ 29.400	€ 20.640	€ 14.400	€ 10.080
Service Fees	€ 14.580	€ 14.580	€ 14.580	€ 14.580	€ 14.580
VoIP Trunking	€ 9.000	€ 9.000	€ 9.000	€ 9.000	€ 9.000
IPTV - Additional Channels	€ 720	€ 720	€ 720	€ 720	€ 720
IPTV - Video on Demand	€ 1.440	€ 1.440	€ 1.440	€ 1.440	€ 1.440
IPTV - Support & Content License	€ 3.420	€ 3.420	€ 3.420	€ 3.420	€ 3.420
Total Costs	€ 157.368	€ 129.618	€ 124.271	€ 121.614	€ 121.056

Depreciations	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ -	€ 8.820	€ 8.820	€ 8.820	€ 8.820
All Equipment	€ -	€ 8.820	€ 8.820	€ 8.820	€ 8.820

Result	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
Total Result	-€ 61.848	-€ 42.918	-€ 37.571	-€ 34.914	-€ 34.356	-€ 211.606
NPV	€ (61.848)	€ (41.267)	€ (34.736)	€ (31.038)	€ (29.368)	€ (198.257)

RIBA ROJA D'EBRE					
Revenues	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Data Connectivity	€ 21.600	€ 21.600	€ 21.600	€ 21.600	€ 21.600
VoIP Telephony	€ 10.500	€ 10.500	€ 10.500	€ 10.500	€ 10.500
IPTV - Additional Channels	€ 1.500	€ 1.500	€ 1.500	€ 1.500	€ 1.500
IPTV - Video on Demand	€ 2.100	€ 2.100	€ 2.100	€ 2.100	€ 2.100
Support	€ 3.000	€ 3.000	€ 3.000	€ 3.000	€ 3.000
Service Provisioning	€ 3.000	€ 3.000	€ 3.000	€ 3.000	€ 3.000
Total Revenues	€ 41.700	€ 41.700	€ 41.700	€ 41.700	€ 41.700

Costs	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ 12.000	€ -	€ -	€ -	€ -
Central Housing	€ -	€ -	€ -	€ -	€ -
PoP	€ -	€ -	€ -	€ -	€ -
IPTV Software License	€ 12.000	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Engineering	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Registration	€ 17.100	€ -	€ -	€ -	€ -
CATNIX	€ 1.800	€ -	€ -	€ -	€ -
RIPE NCC	€ 14.300	€ -	€ -	€ -	€ -
Xarxa Oberta	€ 1.000	€ -	€ -	€ -	€ -
Interconnectivity	€ 26.112	€ 21.792	€ 18.768	€ 16.644	€ 24.276
CATNIX	€ 3.792	€ 3.792	€ 3.792	€ 3.792	€ 5.388
X.O.	€ 7.920	€ 7.920	€ 7.920	€ 7.920	€ 12.000
Upstream Service Provider	€ 14.400	€ 10.080	€ 7.056	€ 4.932	€ 6.888
Service Fees	€ 12.720	€ 12.720	€ 12.720	€ 12.720	€ 12.720
VoIP Trunking	€ 7.500	€ 7.500	€ 7.500	€ 7.500	€ 7.500
IPTV - Additional Channels	€ 600	€ 600	€ 600	€ 600	€ 600
IPTV - Video on Demand	€ 1.200	€ 1.200	€ 1.200	€ 1.200	€ 1.200
IPTV - Support & Content License	€ 3.420	€ 3.420	€ 3.420	€ 3.420	€ 3.420
Total Costs	€ 132.932	€ 102.762	€ 103.151	€ 104.610	€ 116.004

Depreciations	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ -	€ 8.820	€ 8.820	€ 8.820	€ 8.820
All Equipment	€ -	€ 8.820	€ 8.820	€ 8.820	€ 8.820

Result	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
Total Result	-€ 91.232	-€ 69.882	-€ 70.271	-€ 71.730	-€ 83.124	-€ 386.238
NPV	€ (91.232)	€ (67.194)	€ (64.969)	€ (63.767)	€ (71.055)	€ (358.217)

SOLSONA					
Revenues	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Data Connectivity	€ 24.000	€ 24.000	€ 24.000	€ 24.000	€ 24.000
VoIP Telephony	€ 12.600	€ 12.600	€ 12.600	€ 12.600	€ 12.600
IPTV - Additional Channels	€ 1.800	€ 1.800	€ 1.800	€ 1.800	€ 1.800
IPTV - Video on Demand	€ 2.520	€ 2.520	€ 2.520	€ 2.520	€ 2.520
Support	€ 3.000	€ 3.000	€ 3.000	€ 3.000	€ 3.000
Service Provisioning	€ 3.600	€ 3.600	€ 3.600	€ 3.600	€ 3.600
Total Revenues	€ 47.520	€ 47.520	€ 47.520	€ 47.520	€ 47.520

Costs	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ 12.000	€ -	€ -	€ -	€ -
Central Housing	€ -	€ -	€ -	€ -	€ -
PoP	€ -	€ -	€ -	€ -	€ -
IPTV Software License	€ 12.000	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Engineering	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Registration	€ 19.600	€ -	€ -	€ -	€ -
CATNIX	€ 1.800	€ -	€ -	€ -	€ -
RIPE NCC	€ 16.800	€ -	€ -	€ -	€ -
Xarxa Oberta	€ 1.000	€ -	€ -	€ -	€ -
Interconnectivity	€ 26.112	€ 21.792	€ 31.500	€ 27.252	€ 24.276
CATNIX	€ 3.792	€ 3.792	€ 5.388	€ 5.388	€ 5.388
X.O.	€ 7.920	€ 7.920	€ 12.000	€ 12.000	€ 12.000
Upstream Service Provider	€ 14.400	€ 10.080	€ 14.112	€ 9.864	€ 6.888
Service Fees	€ 14.580	€ 14.580	€ 14.580	€ 14.580	€ 14.580
VoIP Trunking	€ 9.000	€ 9.000	€ 9.000	€ 9.000	€ 9.000
IPTV - Additional Channels	€ 720	€ 720	€ 720	€ 720	€ 720
IPTV - Video on Demand	€ 1.440	€ 1.440	€ 1.440	€ 1.440	€ 1.440
IPTV - Support & Content License	€ 3.420	€ 3.420	€ 3.420	€ 3.420	€ 3.420
Total Costs	€ 137.292	€ 104.622	€ 117.743	€ 117.078	€ 117.864

Depreciations	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ -	€ 8.820	€ 8.820	€ 8.820	€ 8.820
All Equipment	€ -	€ 8.820	€ 8.820	€ 8.820	€ 8.820

Result	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
Total Result	-€ 89.772	-€ 65.922	-€ 79.043	-€ 78.378	-€ 79.164	-€ 392.278
NPV	€ (89.772)	€ (63.387)	€ (73.079)	€ (69.677)	€ (67.670)	€ (363.585)

VILADECANS (HYPOTHETIC SMALL OPERATOR WITH 10% MARKET SHARE)					
Revenues	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Data Connectivity	€ 36.000	€ 36.000	€ 36.000	€ 36.000	€ 36.000
VoIP Telephony	€ 11.550	€ 11.550	€ 11.550	€ 11.550	€ 11.550
IPTV - Additional Channels	€ 1.650	€ 1.650	€ 1.650	€ 1.650	€ 1.650
IPTV - Video on Demand	€ 2.310	€ 2.310	€ 2.310	€ 2.310	€ 2.310
Support	€ 3.000	€ 3.000	€ 3.000	€ 3.000	€ 3.000
Service Provisioning	€ 3.300	€ 3.300	€ 3.300	€ 3.300	€ 3.300
Total Revenues	€ 57.810	€ 57.810	€ 57.810	€ 57.810	€ 57.810

Costs	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ 12.000	€ -	€ -	€ -	€ -
Central Housing	€ -	€ -	€ -	€ -	€ -
PoP	€ -	€ -	€ -	€ -	€ -
IPTV Software License	€ 12.000	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Engineering	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Registration	€ 18.350	€ -	€ -	€ -	€ -
CATNIX	€ 1.800	€ -	€ -	€ -	€ -
RIPE NCC	€ 15.550	€ -	€ -	€ -	€ -
Xarxa Oberta	€ 1.000	€ -	€ -	€ -	€ -
Interconnectivity	€ 26.112	€ 21.792	€ 18.768	€ 16.644	€ 15.156
CATNIX	€ 3.792	€ 3.792	€ 3.792	€ 3.792	€ 3.792
X.O.	€ 7.920	€ 7.920	€ 7.920	€ 7.920	€ 7.920
Upstream Service Provider	€ 14.400	€ 10.080	€ 7.056	€ 4.932	€ 3.444
Service Fees	€ 13.650	€ 13.650	€ 13.650	€ 13.650	€ 13.650
VoIP Trunking	€ 8.250	€ 8.250	€ 8.250	€ 8.250	€ 8.250
IPTV - Additional Channels	€ 660	€ 660	€ 660	€ 660	€ 660
IPTV - Video on Demand	€ 1.320	€ 1.320	€ 1.320	€ 1.320	€ 1.320
IPTV - Support & Content License	€ 3.420	€ 3.420	€ 3.420	€ 3.420	€ 3.420
Total Costs	€ 135.112	€ 103.692	€ 104.081	€ 105.540	€ 107.814

Depreciations	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ -	€ 8.820	€ 8.820	€ 8.820	€ 8.820
All Equipment	€ -	€ 8.820	€ 8.820	€ 8.820	€ 8.820

Result	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
Total Result	-€ 77.302	-€ 54.702	-€ 55.091	-€ 56.550	-€ 58.824	-€ 302.468
NPV	€ (77.302)	€ (52.598)	€ (50.934)	€ (50.272)	€ (50.283)	€ (281.390)

CAPELLADES + LA POBLA DE CLARAMUNT					
Revenues	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Data Connectivity	€ 78.000	€ 78.000	€ 78.000	€ 78.000	€ 78.000
VoIP Telephony	€ 29.400	€ 29.400	€ 29.400	€ 29.400	€ 29.400
IPTV - Additional Channels	€ 4.200	€ 4.200	€ 4.200	€ 4.200	€ 4.200
IPTV - Video on Demand	€ 5.880	€ 5.880	€ 5.880	€ 5.880	€ 5.880
Support	€ 6.000	€ 6.000	€ 6.000	€ 6.000	€ 6.000
Service Provisioning	€ 8.400	€ 8.400	€ 8.400	€ 8.400	€ 8.400
Total Revenues	€ 131.880	€ 131.880	€ 131.880	€ 131.880	€ 131.880

Costs	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ 20.000	€ -	€ -	€ -	€ -
Central Housing	€ -	€ -	€ -	€ -	€ -
PoP	€ -	€ -	€ -	€ -	€ -
IPTV Software License	€ 20.000	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Engineering	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Registration	€ 39.600	€ -	€ -	€ -	€ -
CATNIX	€ 1.800	€ -	€ -	€ -	€ -
RIPE NCC	€ 36.800	€ -	€ -	€ -	€ -
Xarxa Oberta	€ 1.000	€ -	€ -	€ -	€ -
Interconnectivity	€ 46.188	€ 46.788	€ 38.028	€ 31.788	€ 27.468
CATNIX	€ 5.388	€ 5.388	€ 5.388	€ 5.388	€ 5.388
X.O.	€ 12.000	€ 12.000	€ 12.000	€ 12.000	€ 12.000
Upstream Service Provider	€ 28.800	€ 29.400	€ 20.640	€ 14.400	€ 10.080
Service Fees	€ 32.880	€ 32.880	€ 32.880	€ 32.880	€ 32.880
VoIP Trunking	€ 21.000	€ 21.000	€ 21.000	€ 21.000	€ 21.000
IPTV - Additional Channels	€ 1.680	€ 1.680	€ 1.680	€ 1.680	€ 1.680
IPTV - Video on Demand	€ 3.360	€ 3.360	€ 3.360	€ 3.360	€ 3.360
IPTV - Support & Content License	€ 6.840	€ 6.840	€ 6.840	€ 6.840	€ 6.840
Total Costs	€ 203.668	€ 147.918	€ 142.571	€ 139.914	€ 139.356

Depreciations	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ -	€ 9.840	€ 9.840	€ 9.840	€ 9.840
All Equipment	€ -	€ 9.840	€ 9.840	€ 9.840	€ 9.840

Result	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
Total Result	-€ 71.788	-€ 25.878	-€ 20.531	-€ 17.874	-€ 17.316	-€ 153.386
NPV	€ (71.788)	€ (24.883)	€ (18.982)	€ (15.890)	€ (14.802)	€ (146.344)

CAPELLADES + LA SENIA					
Revenues	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Data Connectivity	€ 126.000	€ 126.000	€ 126.000	€ 126.000	€ 126.000
VoIP Telephony	€ 33.600	€ 33.600	€ 33.600	€ 33.600	€ 33.600
IPTV - Additional Channels	€ 4.800	€ 4.800	€ 4.800	€ 4.800	€ 4.800
IPTV - Video on Demand	€ 6.720	€ 6.720	€ 6.720	€ 6.720	€ 6.720
Support	€ 6.000	€ 6.000	€ 6.000	€ 6.000	€ 6.000
Service Provisioning	€ 9.600	€ 9.600	€ 9.600	€ 9.600	€ 9.600
Total Revenues	€ 186.720	€ 186.720	€ 186.720	€ 186.720	€ 186.720

Costs	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ 20.000	€ -	€ -	€ -	€ -
Central Housing	€ -	€ -	€ -	€ -	€ -
PoP	€ -	€ -	€ -	€ -	€ -
IPTV Software License	€ 20.000	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Engineering	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Registration	€ 44.600	€ -	€ -	€ -	€ -
CATNIX	€ 1.800	€ -	€ -	€ -	€ -
RIPE NCC	€ 41.800	€ -	€ -	€ -	€ -
Xarxa Oberta	€ 1.000	€ -	€ -	€ -	€ -
Interconnectivity	€ 59.388	€ 46.788	€ 38.028	€ 31.788	€ 37.548
CATNIX	€ 5.388	€ 5.388	€ 5.388	€ 5.388	€ 5.388
X.O.	€ 12.000	€ 12.000	€ 12.000	€ 12.000	€ 12.000
Upstream Service Provider	€ 42.000	€ 29.400	€ 20.640	€ 14.400	€ 20.160
Service Fees	€ 36.600	€ 36.600	€ 36.600	€ 36.600	€ 36.600
VoIP Trunking	€ 24.000	€ 24.000	€ 24.000	€ 24.000	€ 24.000
IPTV - Additional Channels	€ 1.920	€ 1.920	€ 1.920	€ 1.920	€ 1.920
IPTV - Video on Demand	€ 3.840	€ 3.840	€ 3.840	€ 3.840	€ 3.840
IPTV - Support & Content License	€ 6.840	€ 6.840	€ 6.840	€ 6.840	€ 6.840
Total Costs	€ 225.588	€ 151.638	€ 146.291	€ 143.634	€ 153.156

Depreciations	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ -	€ 9.840	€ 9.840	€ 9.840	€ 9.840
All Equipment	€ -	€ 9.840	€ 9.840	€ 9.840	€ 9.840

Result	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
Total Result	-€ 38.868	€ 25.242	€ 30.590	€ 33.246	€ 23.724	€ 73.934
NPV	€ (38.868)	€ 24.271	€ 28.282	€ 29.556	€ 20.279	€ 63.520

CAPELLADES + RIBA ROJA D'EBRE					
Revenues	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Data Connectivity	€ 75.600	€ 75.600	€ 75.600	€ 75.600	€ 75.600
VoIP Telephony	€ 31.500	€ 31.500	€ 31.500	€ 31.500	€ 31.500
IPTV - Additional Channels	€ 4.500	€ 4.500	€ 4.500	€ 4.500	€ 4.500
IPTV - Video on Demand	€ 6.300	€ 6.300	€ 6.300	€ 6.300	€ 6.300
Support	€ 6.000	€ 6.000	€ 6.000	€ 6.000	€ 6.000
Service Provisioning	€ 9.000	€ 9.000	€ 9.000	€ 9.000	€ 9.000
Total Revenues	€ 132.900	€ 132.900	€ 132.900	€ 132.900	€ 132.900

Costs	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ 20.000	€ -	€ -	€ -	€ -
Central Housing	€ -	€ -	€ -	€ -	€ -
PoP	€ -	€ -	€ -	€ -	€ -
IPTV Software License	€ 20.000	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Engineering	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Registration	€ 42.100	€ -	€ -	€ -	€ -
CATNIX	€ 1.800	€ -	€ -	€ -	€ -
RIPE NCC	€ 39.300	€ -	€ -	€ -	€ -
Xarxa Oberta	€ 1.000	€ -	€ -	€ -	€ -
Interconnectivity	€ 46.188	€ 46.788	€ 38.028	€ 31.788	€ 27.468
CATNIX	€ 5.388	€ 5.388	€ 5.388	€ 5.388	€ 5.388
X.O.	€ 12.000	€ 12.000	€ 12.000	€ 12.000	€ 12.000
Upstream Service Provider	€ 28.800	€ 29.400	€ 20.640	€ 14.400	€ 10.080
Service Fees	€ 34.740	€ 34.740	€ 34.740	€ 34.740	€ 34.740
VoIP Trunking	€ 22.500	€ 22.500	€ 22.500	€ 22.500	€ 22.500
IPTV - Additional Channels	€ 1.800	€ 1.800	€ 1.800	€ 1.800	€ 1.800
IPTV - Video on Demand	€ 3.600	€ 3.600	€ 3.600	€ 3.600	€ 3.600
IPTV - Support & Content License	€ 6.840	€ 6.840	€ 6.840	€ 6.840	€ 6.840
Total Costs	€ 208.028	€ 149.778	€ 144.431	€ 141.774	€ 141.216

Depreciations	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ -	€ 9.840	€ 9.840	€ 9.840	€ 9.840
All Equipment	€ -	€ 9.840	€ 9.840	€ 9.840	€ 9.840

Result	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
Total Result	-€ 75.128	-€ 26.718	-€ 21.371	-€ 18.714	-€ 18.156	-€ 160.086
NPV	€ (75.128)	€ (26.690)	€ (19.758)	€ (16.636)	€ (15.520)	€ (152.733)

CAPELLADES + SOLSONA					
Revenues	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Data Connectivity	€ 78.000	€ 78.000	€ 78.000	€ 78.000	€ 78.000
VoIP Telephony	€ 33.600	€ 33.600	€ 33.600	€ 33.600	€ 33.600
IPTV - Additional Channels	€ 4.800	€ 4.800	€ 4.800	€ 4.800	€ 4.800
IPTV - Video on Demand	€ 6.720	€ 6.720	€ 6.720	€ 6.720	€ 6.720
Support	€ 6.000	€ 6.000	€ 6.000	€ 6.000	€ 6.000
Service Provisioning	€ 9.600	€ 9.600	€ 9.600	€ 9.600	€ 9.600
Total Revenues	€ 138.720	€ 138.720	€ 138.720	€ 138.720	€ 138.720

Costs	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ 20.000	€ -	€ -	€ -	€ -
Central Housing	€ -	€ -	€ -	€ -	€ -
PoP	€ -	€ -	€ -	€ -	€ -
IPTV Software License	€ 20.000	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Engineering	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Registration	€ 44.600	€ -	€ -	€ -	€ -
CATNIX	€ 1.800	€ -	€ -	€ -	€ -
RIPE NCC	€ 41.800	€ -	€ -	€ -	€ -
Xarxa Oberta	€ 1.000	€ -	€ -	€ -	€ -
Interconnectivity	€ 46.188	€ 46.788	€ 38.028	€ 31.788	€ 27.468
CATNIX	€ 5.388	€ 5.388	€ 5.388	€ 5.388	€ 5.388
X.O.	€ 12.000	€ 12.000	€ 12.000	€ 12.000	€ 12.000
Upstream Service Provider	€ 28.800	€ 29.400	€ 20.640	€ 14.400	€ 10.080
Service Fees	€ 36.600	€ 36.600	€ 36.600	€ 36.600	€ 36.600
VoIP Trunking	€ 24.000	€ 24.000	€ 24.000	€ 24.000	€ 24.000
IPTV - Additional Channels	€ 1.920	€ 1.920	€ 1.920	€ 1.920	€ 1.920
IPTV - Video on Demand	€ 3.840	€ 3.840	€ 3.840	€ 3.840	€ 3.840
IPTV - Support & Content License	€ 6.840	€ 6.840	€ 6.840	€ 6.840	€ 6.840
Total Costs	€ 212.388	€ 151.638	€ 146.291	€ 143.634	€ 143.076

Depreciations	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ -	€ 9.840	€ 9.840	€ 9.840	€ 9.840
All Equipment	€ -	€ 9.840	€ 9.840	€ 9.840	€ 9.840

Result	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
Total Result	-€ 73.668	-€ 22.758	-€ 17.411	-€ 14.754	-€ 14.196	-€ 142.786
NPV	€ (73.668)	€ (21.883)	€ (16.097)	€ (13.116)	€ (12.135)	€ (136.898)

LA POBLA DE CLARAMUNT + LA SENIA					
Revenues	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Data Connectivity	€ 96.000	€ 96.000	€ 96.000	€ 96.000	€ 96.000
VoIP Telephony	€ 21.000	€ 21.000	€ 21.000	€ 21.000	€ 21.000
IPTV - Additional Channels	€ 3.000	€ 3.000	€ 3.000	€ 3.000	€ 3.000
IPTV - Video on Demand	€ 4.200	€ 4.200	€ 4.200	€ 4.200	€ 4.200
Support	€ 6.000	€ 6.000	€ 6.000	€ 6.000	€ 6.000
Service Provisioning	€ 6.000	€ 6.000	€ 6.000	€ 6.000	€ 6.000
Total Revenues	€ 136.200	€ 136.200	€ 136.200	€ 136.200	€ 136.200

Costs	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ 12.000	€ -	€ -	€ -	€ -
Central Housing	€ -	€ -	€ -	€ -	€ -
PoP	€ -	€ -	€ -	€ -	€ -
IPTV Software License	€ 12.000	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Engineering	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Registration	€ 29.600	€ -	€ -	€ -	€ -
CATNIX	€ 1.800	€ -	€ -	€ -	€ -
RIPE NCC	€ 26.800	€ -	€ -	€ -	€ -
Xarxa Oberta	€ 1.000	€ -	€ -	€ -	€ -
Interconnectivity	€ 46.188	€ 46.788	€ 38.028	€ 31.788	€ 27.468
CATNIX	€ 5.388	€ 5.388	€ 5.388	€ 5.388	€ 5.388
X.O.	€ 12.000	€ 12.000	€ 12.000	€ 12.000	€ 12.000
Upstream Service Provider	€ 28.800	€ 29.400	€ 20.640	€ 14.400	€ 10.080
Service Fees	€ 25.440	€ 25.440	€ 25.440	€ 25.440	€ 25.440
VoIP Trunking	€ 15.000	€ 15.000	€ 15.000	€ 15.000	€ 15.000
IPTV - Additional Channels	€ 1.200	€ 1.200	€ 1.200	€ 1.200	€ 1.200
IPTV - Video on Demand	€ 2.400	€ 2.400	€ 2.400	€ 2.400	€ 2.400
IPTV - Support & Content License	€ 6.840	€ 6.840	€ 6.840	€ 6.840	€ 6.840
Total Costs	€ 178.228	€ 140.478	€ 135.131	€ 132.474	€ 131.916

Depreciations	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ -	€ 9.840	€ 9.840	€ 9.840	€ 9.840
All Equipment	€ -	€ 9.840	€ 9.840	€ 9.840	€ 9.840

Result	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
Total Result	-€ 42.028	-€ 14.118	-€ 8.771	-€ 6.114	-€ 5.556	-€ 76.586
NPV	€ (42.028)	€ (13.575)	€ (8.109)	€ (5.435)	€ (4.749)	€ (73.896)

LA POBLA DE CLARAMUNT + RIBA ROJA D'EBRE					
Revenues	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Data Connectivity	€ 45.600	€ 45.600	€ 45.600	€ 45.600	€ 45.600
VoIP Telephony	€ 18.900	€ 18.900	€ 18.900	€ 18.900	€ 18.900
IPTV - Additional Channels	€ 2.700	€ 2.700	€ 2.700	€ 2.700	€ 2.700
IPTV - Video on Demand	€ 3.780	€ 3.780	€ 3.780	€ 3.780	€ 3.780
Support	€ 6.000	€ 6.000	€ 6.000	€ 6.000	€ 6.000
Service Provisioning	€ 5.400	€ 5.400	€ 5.400	€ 5.400	€ 5.400
Total Revenues	€ 82.380	€ 82.380	€ 82.380	€ 82.380	€ 82.380

Costs	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ 12.000	€ -	€ -	€ -	€ -
Central Housing	€ -	€ -	€ -	€ -	€ -
PoP	€ -	€ -	€ -	€ -	€ -
IPTV Software License	€ 12.000	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Engineering	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Registration	€ 27.100	€ -	€ -	€ -	€ -
CATNIX	€ 1.800	€ -	€ -	€ -	€ -
RIPE NCC	€ 24.300	€ -	€ -	€ -	€ -
Xarxa Oberta	€ 1.000	€ -	€ -	€ -	€ -
Interconnectivity	€ 26.112	€ 21.792	€ 31.500	€ 27.252	€ 27.468
CATNIX	€ 3.792	€ 3.792	€ 5.388	€ 5.388	€ 5.388
X.O.	€ 7.920	€ 7.920	€ 12.000	€ 12.000	€ 12.000
Upstream Service Provider	€ 14.400	€ 10.080	€ 14.112	€ 9.864	€ 10.080
Service Fees	€ 23.580	€ 23.580	€ 23.580	€ 23.580	€ 23.580
VoIP Trunking	€ 13.500	€ 13.500	€ 13.500	€ 13.500	€ 13.500
IPTV - Additional Channels	€ 1.080	€ 1.080	€ 1.080	€ 1.080	€ 1.080
IPTV - Video on Demand	€ 2.160	€ 2.160	€ 2.160	€ 2.160	€ 2.160
IPTV - Support & Content License	€ 6.840	€ 6.840	€ 6.840	€ 6.840	€ 6.840
Total Costs	€ 153.792	€ 113.622	€ 126.743	€ 126.078	€ 130.056

Depreciations	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ -	€ 9.840	€ 9.840	€ 9.840	€ 9.840
All Equipment	€ -	€ 9.840	€ 9.840	€ 9.840	€ 9.840

Result	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
Total Result	-€ 71.412	-€ 41.082	-€ 54.203	-€ 53.538	-€ 57.516	-€ 277.750
NPV	€ (71.412)	€ (39.502)	€ (50.113)	€ (47.595)	€ (49.165)	€ (257.787)

LA POBLA DE CLARAMUNT + SOLSONA					
Revenues	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Data Connectivity	€ 48.000	€ 48.000	€ 48.000	€ 48.000	€ 48.000
VoIP Telephony	€ 21.000	€ 21.000	€ 21.000	€ 21.000	€ 21.000
IPTV - Additional Channels	€ 3.000	€ 3.000	€ 3.000	€ 3.000	€ 3.000
IPTV - Video on Demand	€ 4.200	€ 4.200	€ 4.200	€ 4.200	€ 4.200
Support	€ 6.000	€ 6.000	€ 6.000	€ 6.000	€ 6.000
Service Provisioning	€ 6.000	€ 6.000	€ 6.000	€ 6.000	€ 6.000
Total Revenues	€ 88.200	€ 88.200	€ 88.200	€ 88.200	€ 88.200

Costs	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ 12.000	€ -	€ -	€ -	€ -
Central Housing	€ -	€ -	€ -	€ -	€ -
PoP	€ -	€ -	€ -	€ -	€ -
IPTV Software License	€ 12.000	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Engineering	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Registration	€ 29.600	€ -	€ -	€ -	€ -
CATNIX	€ 1.800	€ -	€ -	€ -	€ -
RIPE NCC	€ 26.800	€ -	€ -	€ -	€ -
Xarxa Oberta	€ 1.000	€ -	€ -	€ -	€ -
Interconnectivity	€ 26.112	€ 21.792	€ 31.500	€ 27.252	€ 27.468
CATNIX	€ 3.792	€ 3.792	€ 5.388	€ 5.388	€ 5.388
X.O.	€ 7.920	€ 7.920	€ 12.000	€ 12.000	€ 12.000
Upstream Service Provider	€ 14.400	€ 10.080	€ 14.112	€ 9.864	€ 10.080
Service Fees	€ 25.440	€ 25.440	€ 25.440	€ 25.440	€ 25.440
VoIP Trunking	€ 15.000	€ 15.000	€ 15.000	€ 15.000	€ 15.000
IPTV - Additional Channels	€ 1.200	€ 1.200	€ 1.200	€ 1.200	€ 1.200
IPTV - Video on Demand	€ 2.400	€ 2.400	€ 2.400	€ 2.400	€ 2.400
IPTV - Support & Content License	€ 6.840	€ 6.840	€ 6.840	€ 6.840	€ 6.840
Total Costs	€ 158.152	€ 115.482	€ 128.603	€ 127.938	€ 131.916

Depreciations	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ -	€ 9.840	€ 9.840	€ 9.840	€ 9.840
All Equipment	€ -	€ 9.840	€ 9.840	€ 9.840	€ 9.840

Result	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
Total Result	-€ 69.952	-€ 37.122	-€ 50.243	-€ 49.578	-€ 53.556	-€ 260.450
NPV	€ (69.952)	€ (35.694)	€ (46.452)	€ (44.074)	€ (45.780)	€ (241.952)

LA SENIA + RIBA ROJA D'EBRE					
Revenues	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Data Connectivity	€ 93.600	€ 93.600	€ 93.600	€ 93.600	€ 93.600
VoIP Telephony	€ 23.100	€ 23.100	€ 23.100	€ 23.100	€ 23.100
IPTV - Additional Channels	€ 3.300	€ 3.300	€ 3.300	€ 3.300	€ 3.300
IPTV - Video on Demand	€ 4.620	€ 4.620	€ 4.620	€ 4.620	€ 4.620
Support	€ 6.000	€ 6.000	€ 6.000	€ 6.000	€ 6.000
Service Provisioning	€ 6.600	€ 6.600	€ 6.600	€ 6.600	€ 6.600
Total Revenues	€ 137.220	€ 137.220	€ 137.220	€ 137.220	€ 137.220

Costs	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ 12.000	€ -	€ -	€ -	€ -
Central Housing	€ -	€ -	€ -	€ -	€ -
PoP	€ -	€ -	€ -	€ -	€ -
IPTV Software License	€ 12.000	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Engineering	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Registration	€ 32.100	€ -	€ -	€ -	€ -
CATNIX	€ 1.800	€ -	€ -	€ -	€ -
RIPE NCC	€ 29.300	€ -	€ -	€ -	€ -
Xarxa Oberta	€ 1.000	€ -	€ -	€ -	€ -
Interconnectivity	€ 46.188	€ 46.788	€ 38.028	€ 31.788	€ 27.468
CATNIX	€ 5.388	€ 5.388	€ 5.388	€ 5.388	€ 5.388
X.O.	€ 12.000	€ 12.000	€ 12.000	€ 12.000	€ 12.000
Upstream Service Provider	€ 28.800	€ 29.400	€ 20.640	€ 14.400	€ 10.080
Service Fees	€ 27.300	€ 27.300	€ 27.300	€ 27.300	€ 27.300
VoIP Trunking	€ 16.500	€ 16.500	€ 16.500	€ 16.500	€ 16.500
IPTV - Additional Channels	€ 1.320	€ 1.320	€ 1.320	€ 1.320	€ 1.320
IPTV - Video on Demand	€ 2.640	€ 2.640	€ 2.640	€ 2.640	€ 2.640
IPTV - Support & Content License	€ 6.840	€ 6.840	€ 6.840	€ 6.840	€ 6.840
Total Costs	€ 182.588	€ 142.338	€ 136.991	€ 134.334	€ 133.776

Depreciations	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ -	€ 9.840	€ 9.840	€ 9.840	€ 9.840
All Equipment	€ -	€ 9.840	€ 9.840	€ 9.840	€ 9.840

Result	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
Total Result	-€ 45.368	-€ 14.958	-€ 9.611	-€ 6.954	-€ 6.396	-€ 83.286
NPV	€ (45.368)	€ (14.383)	€ (8.885)	€ (6.182)	€ (5.467)	€ (80.285)

LA SENIA + SOLSONA					
Revenues	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Data Connectivity	€ 96.000	€ 96.000	€ 96.000	€ 96.000	€ 96.000
VoIP Telephony	€ 25.200	€ 25.200	€ 25.200	€ 25.200	€ 25.200
IPTV - Additional Channels	€ 3.600	€ 3.600	€ 3.600	€ 3.600	€ 3.600
IPTV - Video on Demand	€ 5.040	€ 5.040	€ 5.040	€ 5.040	€ 5.040
Support	€ 6.000	€ 6.000	€ 6.000	€ 6.000	€ 6.000
Service Provisioning	€ 7.200	€ 7.200	€ 7.200	€ 7.200	€ 7.200
Total Revenues	€ 143.040	€ 143.040	€ 143.040	€ 143.040	€ 143.040

Costs	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ 12.000	€ -	€ -	€ -	€ -
Central Housing	€ -	€ -	€ -	€ -	€ -
PoP	€ -	€ -	€ -	€ -	€ -
IPTV Software License	€ 12.000	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Engineering	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Registration	€ 34.600	€ -	€ -	€ -	€ -
CATNIX	€ 1.800	€ -	€ -	€ -	€ -
RIPE NCC	€ 31.800	€ -	€ -	€ -	€ -
Xarxa Oberta	€ 1.000	€ -	€ -	€ -	€ -
Interconnectivity	€ 46.188	€ 46.788	€ 38.028	€ 31.788	€ 27.468
CATNIX	€ 5.388	€ 5.388	€ 5.388	€ 5.388	€ 5.388
X.O.	€ 12.000	€ 12.000	€ 12.000	€ 12.000	€ 12.000
Upstream Service Provider	€ 28.800	€ 29.400	€ 20.640	€ 14.400	€ 10.080
Service Fees	€ 29.160	€ 29.160	€ 29.160	€ 29.160	€ 29.160
VoIP Trunking	€ 18.000	€ 18.000	€ 18.000	€ 18.000	€ 18.000
IPTV - Additional Channels	€ 1.440	€ 1.440	€ 1.440	€ 1.440	€ 1.440
IPTV - Video on Demand	€ 2.880	€ 2.880	€ 2.880	€ 2.880	€ 2.880
IPTV - Support & Content License	€ 6.840	€ 6.840	€ 6.840	€ 6.840	€ 6.840
Total Costs	€ 186.948	€ 144.198	€ 138.851	€ 136.194	€ 135.636

Depreciations	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ -	€ 9.840	€ 9.840	€ 9.840	€ 9.840
All Equipment	€ -	€ 9.840	€ 9.840	€ 9.840	€ 9.840

Result	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
Total Result	-€ 43.908	-€ 10.998	-€ 5.651	-€ 2.994	-€ 2.436	-€ 65.986
NPV	€ (43.908)	€ (10.575)	€ (5.224)	€ (2.661)	€ (2.082)	€ (64.451)

RIBA ROJA D'EBRE + SOLSONA					
Revenues	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Data Connectivity	€ 45.600	€ 45.600	€ 45.600	€ 45.600	€ 45.600
VoIP Telephony	€ 23.100	€ 23.100	€ 23.100	€ 23.100	€ 23.100
IPTV - Additional Channels	€ 3.300	€ 3.300	€ 3.300	€ 3.300	€ 3.300
IPTV - Video on Demand	€ 4.620	€ 4.620	€ 4.620	€ 4.620	€ 4.620
Support	€ 6.000	€ 6.000	€ 6.000	€ 6.000	€ 6.000
Service Provisioning	€ 6.600	€ 6.600	€ 6.600	€ 6.600	€ 6.600
Total Revenues	€ 89.220	€ 89.220	€ 89.220	€ 89.220	€ 89.220

Costs	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ 12.000	€ -	€ -	€ -	€ -
Central Housing	€ -	€ -	€ -	€ -	€ -
PoP	€ -	€ -	€ -	€ -	€ -
IPTV Software License	€ 12.000	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Engineering	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Registration	€ 32.100	€ -	€ -	€ -	€ -
CATNIX	€ 1.800	€ -	€ -	€ -	€ -
RIPE NCC	€ 29.300	€ -	€ -	€ -	€ -
Xarxa Oberta	€ 1.000	€ -	€ -	€ -	€ -
Interconnectivity	€ 26.112	€ 21.792	€ 18.768	€ 16.644	€ 15.156
CATNIX	€ 3.792	€ 3.792	€ 3.792	€ 3.792	€ 3.792
X.O.	€ 7.920	€ 7.920	€ 7.920	€ 7.920	€ 7.920
Upstream Service Provider	€ 14.400	€ 10.080	€ 7.056	€ 4.932	€ 3.444
Service Fees	€ 27.300	€ 27.300	€ 27.300	€ 27.300	€ 27.300
VoIP Trunking	€ 16.500	€ 16.500	€ 16.500	€ 16.500	€ 16.500
IPTV - Additional Channels	€ 1.320	€ 1.320	€ 1.320	€ 1.320	€ 1.320
IPTV - Video on Demand	€ 2.640	€ 2.640	€ 2.640	€ 2.640	€ 2.640
IPTV - Support & Content License	€ 6.840	€ 6.840	€ 6.840	€ 6.840	€ 6.840
Total Costs	€ 162.512	€ 117.342	€ 117.731	€ 119.190	€ 121.464

Depreciations	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ -	€ 9.840	€ 9.840	€ 9.840	€ 9.840
All Equipment	€ -	€ 9.840	€ 9.840	€ 9.840	€ 9.840

Result	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
Total Result	-€ 73.292	-€ 37.962	-€ 38.351	-€ 39.810	-€ 42.084	-€ 231.498
NPV	€ (73.292)	€ (36.502)	€ (35.457)	€ (35.391)	€ (35.973)	€ (216.615)

CAPELLADES + LA POBLA DE CLARAMUNT + LA SENIA					
Revenues	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Data Connectivity	€ 150.000	€ 150.000	€ 150.000	€ 150.000	€ 150.000
VoIP Telephony	€ 42.000	€ 42.000	€ 42.000	€ 42.000	€ 42.000
IPTV - Additional Channels	€ 6.000	€ 6.000	€ 6.000	€ 6.000	€ 6.000
IPTV - Video on Demand	€ 8.400	€ 8.400	€ 8.400	€ 8.400	€ 8.400
Support	€ 9.000	€ 9.000	€ 9.000	€ 9.000	€ 9.000
Service Provisioning	€ 12.000	€ 12.000	€ 12.000	€ 12.000	€ 12.000
Total Revenues	€ 227.400	€ 227.400	€ 227.400	€ 227.400	€ 227.400

Costs	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ 20.000	€ -	€ -	€ -	€ -
Central Housing	€ -	€ -	€ -	€ -	€ -
PoP	€ -	€ -	€ -	€ -	€ -
IPTV Software License	€ 20.000	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Engineering	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Registration	€ 56.400	€ -	€ -	€ -	€ -
CATNIX	€ 1.800	€ -	€ -	€ -	€ -
RIPE NCC	€ 53.600	€ -	€ -	€ -	€ -
Xarxa Oberta	€ 1.000	€ -	€ -	€ -	€ -
Interconnectivity	€ 59.388	€ 46.788	€ 38.028	€ 44.700	€ 54.336
CATNIX	€ 5.388	€ 5.388	€ 5.388	€ 8.580	€ 10.176
X.O.	€ 12.000	€ 12.000	€ 12.000	€ 16.788	€ 24.000
Upstream Service Provider	€ 42.000	€ 29.400	€ 20.640	€ 19.332	€ 20.160
Service Fees	€ 47.460	€ 47.460	€ 47.460	€ 47.460	€ 47.460
VoIP Trunking	€ 30.000	€ 30.000	€ 30.000	€ 30.000	€ 30.000
IPTV - Additional Channels	€ 2.400	€ 2.400	€ 2.400	€ 2.400	€ 2.400
IPTV - Video on Demand	€ 4.800	€ 4.800	€ 4.800	€ 4.800	€ 4.800
IPTV - Support & Content License	€ 10.260	€ 10.260	€ 10.260	€ 10.260	€ 10.260
Total Costs	€ 248.248	€ 162.498	€ 157.151	€ 167.406	€ 180.804

Depreciations	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ -	€ 10.860	€ 10.860	€ 10.860	€ 10.860
All Equipment	€ -	€ 10.860	€ 10.860	€ 10.860	€ 10.860

Result	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
Total Result	-€ 20.848	€ 54.042	€ 59.390	€ 49.134	€ 35.736	€ 177.454
NPV	€ (20.848)	€ 51.963	€ 54.909	€ 43.680	€ 30.547	€ 160.252

CAPELLADES + LA POBLA DE CLARAMUNT + RIBA ROJA D'EBRE					
Revenues	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Data Connectivity	€ 99.600	€ 99.600	€ 99.600	€ 99.600	€ 99.600
VoIP Telephony	€ 39.900	€ 39.900	€ 39.900	€ 39.900	€ 39.900
IPTV - Additional Channels	€ 5.700	€ 5.700	€ 5.700	€ 5.700	€ 5.700
IPTV - Video on Demand	€ 7.980	€ 7.980	€ 7.980	€ 7.980	€ 7.980
Support	€ 9.000	€ 9.000	€ 9.000	€ 9.000	€ 9.000
Service Provisioning	€ 11.400	€ 11.400	€ 11.400	€ 11.400	€ 11.400
Total Revenues	€ 173.580	€ 173.580	€ 173.580	€ 173.580	€ 173.580

Costs	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ 20.000	€ -	€ -	€ -	€ -
Central Housing	€ -	€ -	€ -	€ -	€ -
PoP	€ -	€ -	€ -	€ -	€ -
IPTV Software License	€ 20.000	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Engineering	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Registration	€ 53.900	€ -	€ -	€ -	€ -
CATNIX	€ 1.800	€ -	€ -	€ -	€ -
RIPE NCC	€ 51.100	€ -	€ -	€ -	€ -
Xarxa Oberta	€ 1.000	€ -	€ -	€ -	€ -
Interconnectivity	€ 46.188	€ 46.788	€ 38.028	€ 31.788	€ 27.468
CATNIX	€ 5.388	€ 5.388	€ 5.388	€ 5.388	€ 5.388
X.O.	€ 12.000	€ 12.000	€ 12.000	€ 12.000	€ 12.000
Upstream Service Provider	€ 28.800	€ 29.400	€ 20.640	€ 14.400	€ 10.080
Service Fees	€ 45.600	€ 45.600	€ 45.600	€ 45.600	€ 45.600
VoIP Trunking	€ 28.500	€ 28.500	€ 28.500	€ 28.500	€ 28.500
IPTV - Additional Channels	€ 2.280	€ 2.280	€ 2.280	€ 2.280	€ 2.280
IPTV - Video on Demand	€ 4.560	€ 4.560	€ 4.560	€ 4.560	€ 4.560
IPTV - Support & Content License	€ 10.260	€ 10.260	€ 10.260	€ 10.260	€ 10.260
Total Costs	€ 230.688	€ 160.638	€ 155.291	€ 152.634	€ 152.076

Depreciations	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ -	€ 10.860	€ 10.860	€ 10.860	€ 10.860
All Equipment	€ -	€ 10.860	€ 10.860	€ 10.860	€ 10.860

Result	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
Total Result	-€ 57.108	€ 2.082	€ 7.430	€ 10.086	€ 10.644	-€ 26.866
NPV	€ (57.108)	€ 2.002	€ 6.869	€ 8.967	€ 9.099	€ (30.172)

CAPELLADES + LA POBLA DE CLARAMUNT + SOLSONA					
Revenues	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Data Connectivity	€ 102.000	€ 102.000	€ 102.000	€ 102.000	€ 102.000
VoIP Telephony	€ 42.000	€ 42.000	€ 42.000	€ 42.000	€ 42.000
IPTV - Additional Channels	€ 6.000	€ 6.000	€ 6.000	€ 6.000	€ 6.000
IPTV - Video on Demand	€ 8.400	€ 8.400	€ 8.400	€ 8.400	€ 8.400
Support	€ 9.000	€ 9.000	€ 9.000	€ 9.000	€ 9.000
Service Provisioning	€ 12.000	€ 12.000	€ 12.000	€ 12.000	€ 12.000
Total Revenues	€ 179.400	€ 179.400	€ 179.400	€ 179.400	€ 179.400

Costs	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ 20.000	€ -	€ -	€ -	€ -
Central Housing	€ -	€ -	€ -	€ -	€ -
PoP	€ -	€ -	€ -	€ -	€ -
IPTV Software License	€ 20.000	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Engineering	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Registration	€ 56.400	€ -	€ -	€ -	€ -
CATNIX	€ 1.800	€ -	€ -	€ -	€ -
RIPE NCC	€ 53.600	€ -	€ -	€ -	€ -
Xarxa Oberta	€ 1.000	€ -	€ -	€ -	€ -
Interconnectivity	€ 46.188	€ 46.788	€ 38.028	€ 31.788	€ 27.468
CATNIX	€ 5.388	€ 5.388	€ 5.388	€ 5.388	€ 5.388
X.O.	€ 12.000	€ 12.000	€ 12.000	€ 12.000	€ 12.000
Upstream Service Provider	€ 28.800	€ 29.400	€ 20.640	€ 14.400	€ 10.080
Service Fees	€ 47.460	€ 47.460	€ 47.460	€ 47.460	€ 47.460
VoIP Trunking	€ 30.000	€ 30.000	€ 30.000	€ 30.000	€ 30.000
IPTV - Additional Channels	€ 2.400	€ 2.400	€ 2.400	€ 2.400	€ 2.400
IPTV - Video on Demand	€ 4.800	€ 4.800	€ 4.800	€ 4.800	€ 4.800
IPTV - Support & Content License	€ 10.260	€ 10.260	€ 10.260	€ 10.260	€ 10.260
Total Costs	€ 235.048	€ 162.498	€ 157.151	€ 154.494	€ 153.936

Depreciations	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ -	€ 10.860	€ 10.860	€ 10.860	€ 10.860
All Equipment	€ -	€ 10.860	€ 10.860	€ 10.860	€ 10.860

Result	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
Total Result	-€ 55.648	€ 6.042	€ 11.390	€ 14.046	€ 14.604	-€ 9.566
NPV	€ (55.648)	€ 5.810	€ 10.530	€ 12.487	€ 12.484	€ (14.337)

CAPELLADES + LA SENIA + RIBA ROJA D'EBRE					
Revenues	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Data Connectivity	€ 147.600	€ 147.600	€ 147.600	€ 147.600	€ 147.600
VoIP Telephony	€ 44.100	€ 44.100	€ 44.100	€ 44.100	€ 44.100
IPTV - Additional Channels	€ 6.300	€ 6.300	€ 6.300	€ 6.300	€ 6.300
IPTV - Video on Demand	€ 8.820	€ 8.820	€ 8.820	€ 8.820	€ 8.820
Support	€ 9.000	€ 9.000	€ 9.000	€ 9.000	€ 9.000
Service Provisioning	€ 12.600	€ 12.600	€ 12.600	€ 12.600	€ 12.600
Total Revenues	€ 228.420	€ 228.420	€ 228.420	€ 228.420	€ 228.420

Costs	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ 20.000	€ -	€ -	€ -	€ -
Central Housing	€ -	€ -	€ -	€ -	€ -
PoP	€ -	€ -	€ -	€ -	€ -
IPTV Software License	€ 20.000	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Engineering	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Registration	€ 58.900	€ -	€ -	€ -	€ -
CATNIX	€ 1.800	€ -	€ -	€ -	€ -
RIPE NCC	€ 56.100	€ -	€ -	€ -	€ -
Xarxa Oberta	€ 1.000	€ -	€ -	€ -	€ -
Interconnectivity	€ 59.388	€ 46.788	€ 38.028	€ 44.700	€ 54.336
CATNIX	€ 5.388	€ 5.388	€ 5.388	€ 8.580	€ 10.176
X.O.	€ 12.000	€ 12.000	€ 12.000	€ 16.788	€ 24.000
Upstream Service Provider	€ 42.000	€ 29.400	€ 20.640	€ 19.332	€ 20.160
Service Fees	€ 49.320	€ 49.320	€ 49.320	€ 49.320	€ 49.320
VoIP Trunking	€ 31.500	€ 31.500	€ 31.500	€ 31.500	€ 31.500
IPTV - Additional Channels	€ 2.520	€ 2.520	€ 2.520	€ 2.520	€ 2.520
IPTV - Video on Demand	€ 5.040	€ 5.040	€ 5.040	€ 5.040	€ 5.040
IPTV - Support & Content License	€ 10.260	€ 10.260	€ 10.260	€ 10.260	€ 10.260
Total Costs	€ 252.608	€ 164.358	€ 159.011	€ 169.266	€ 182.664

Depreciations	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ -	€ 10.860	€ 10.860	€ 10.860	€ 10.860
All Equipment	€ -	€ 10.860	€ 10.860	€ 10.860	€ 10.860

Result	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
Total Result	-€ 24.188	€ 53.202	€ 58.550	€ 48.294	€ 34.896	€ 170.754
NPV	€ (24.188)	€ 51.156	€ 54.132	€ 42.934	€ 29.829	€ 153.863

CAPELLADES + LA SENIA + SOLSONA					
Revenues	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Data Connectivity	€ 150.000	€ 150.000	€ 150.000	€ 150.000	€ 150.000
VoIP Telephony	€ 46.200	€ 46.200	€ 46.200	€ 46.200	€ 46.200
IPTV - Additional Channels	€ 6.600	€ 6.600	€ 6.600	€ 6.600	€ 6.600
IPTV - Video on Demand	€ 9.240	€ 9.240	€ 9.240	€ 9.240	€ 9.240
Support	€ 9.000	€ 9.000	€ 9.000	€ 9.000	€ 9.000
Service Provisioning	€ 13.200	€ 13.200	€ 13.200	€ 13.200	€ 13.200
Total Revenues	€ 234.240	€ 234.240	€ 234.240	€ 234.240	€ 234.240

Costs	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ 20.000	€ -	€ -	€ -	€ -
Central Housing	€ -	€ -	€ -	€ -	€ -
PoP	€ -	€ -	€ -	€ -	€ -
IPTV Software License	€ 20.000	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Engineering	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Registration	€ 61.400	€ -	€ -	€ -	€ -
CATNIX	€ 1.800	€ -	€ -	€ -	€ -
RIPE NCC	€ 58.600	€ -	€ -	€ -	€ -
Xarxa Oberta	€ 1.000	€ -	€ -	€ -	€ -
Interconnectivity	€ 59.388	€ 46.788	€ 38.028	€ 44.700	€ 54.336
CATNIX	€ 5.388	€ 5.388	€ 5.388	€ 8.580	€ 10.176
X.O.	€ 12.000	€ 12.000	€ 12.000	€ 16.788	€ 24.000
Upstream Service Provider	€ 42.000	€ 29.400	€ 20.640	€ 19.332	€ 20.160
Service Fees	€ 51.180	€ 51.180	€ 51.180	€ 51.180	€ 51.180
VoIP Trunking	€ 33.000	€ 33.000	€ 33.000	€ 33.000	€ 33.000
IPTV - Additional Channels	€ 2.640	€ 2.640	€ 2.640	€ 2.640	€ 2.640
IPTV - Video on Demand	€ 5.280	€ 5.280	€ 5.280	€ 5.280	€ 5.280
IPTV - Support & Content License	€ 10.260	€ 10.260	€ 10.260	€ 10.260	€ 10.260
Total Costs	€ 256.968	€ 166.218	€ 160.871	€ 171.126	€ 184.524

Depreciations	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ -	€ 10.860	€ 10.860	€ 10.860	€ 10.860
All Equipment	€ -	€ 10.860	€ 10.860	€ 10.860	€ 10.860

Result	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
Total Result	-€ 22.728	€ 57.162	€ 62.510	€ 52.254	€ 38.856	€ 188.054
NPV	€ (22.728)	€ 54.963	€ 57.794	€ 46.454	€ 33.214	€ 169.697

CAPELLADES + RIBA ROJA D'EBRE + SOLSONA					
Revenues	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Data Connectivity	€ 99.600	€ 99.600	€ 99.600	€ 99.600	€ 99.600
VoIP Telephony	€ 44.100	€ 44.100	€ 44.100	€ 44.100	€ 44.100
IPTV - Additional Channels	€ 6.300	€ 6.300	€ 6.300	€ 6.300	€ 6.300
IPTV - Video on Demand	€ 8.820	€ 8.820	€ 8.820	€ 8.820	€ 8.820
Support	€ 9.000	€ 9.000	€ 9.000	€ 9.000	€ 9.000
Service Provisioning	€ 12.600	€ 12.600	€ 12.600	€ 12.600	€ 12.600
Total Revenues	€ 180.420	€ 180.420	€ 180.420	€ 180.420	€ 180.420

Costs	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ 20.000	€ -	€ -	€ -	€ -
Central Housing	€ -	€ -	€ -	€ -	€ -
PoP	€ -	€ -	€ -	€ -	€ -
IPTV Software License	€ 20.000	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Engineering	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Registration	€ 58.900	€ -	€ -	€ -	€ -
CATNIX	€ 1.800	€ -	€ -	€ -	€ -
RIPE NCC	€ 56.100	€ -	€ -	€ -	€ -
Xarxa Oberta	€ 1.000	€ -	€ -	€ -	€ -
Interconnectivity	€ 46.188	€ 46.788	€ 38.028	€ 31.788	€ 27.468
CATNIX	€ 5.388	€ 5.388	€ 5.388	€ 5.388	€ 5.388
X.O.	€ 12.000	€ 12.000	€ 12.000	€ 12.000	€ 12.000
Upstream Service Provider	€ 28.800	€ 29.400	€ 20.640	€ 14.400	€ 10.080
Service Fees	€ 49.320	€ 49.320	€ 49.320	€ 49.320	€ 49.320
VoIP Trunking	€ 31.500	€ 31.500	€ 31.500	€ 31.500	€ 31.500
IPTV - Additional Channels	€ 2.520	€ 2.520	€ 2.520	€ 2.520	€ 2.520
IPTV - Video on Demand	€ 5.040	€ 5.040	€ 5.040	€ 5.040	€ 5.040
IPTV - Support & Content License	€ 10.260	€ 10.260	€ 10.260	€ 10.260	€ 10.260
Total Costs	€ 239.408	€ 164.358	€ 159.011	€ 156.354	€ 155.796

Depreciations	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ -	€ 10.860	€ 10.860	€ 10.860	€ 10.860
All Equipment	€ -	€ 10.860	€ 10.860	€ 10.860	€ 10.860

Result	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
Total Result	-€ 58.988	€ 5.202	€ 10.550	€ 13.206	€ 13.764	-€ 16.266
NPV	€ (58.988)	€ 5.002	€ 9.754	€ 11.740	€ 11.766	€ (20.726)

LA POBLA + LA SENIA + RIBA ROJA D'EBRE					
Revenues	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Data Connectivity	€ 117.600	€ 117.600	€ 117.600	€ 117.600	€ 117.600
VoIP Telephony	€ 31.500	€ 31.500	€ 31.500	€ 31.500	€ 31.500
IPTV - Additional Channels	€ 4.500	€ 4.500	€ 4.500	€ 4.500	€ 4.500
IPTV - Video on Demand	€ 6.300	€ 6.300	€ 6.300	€ 6.300	€ 6.300
Support	€ 9.000	€ 9.000	€ 9.000	€ 9.000	€ 9.000
Service Provisioning	€ 9.000	€ 9.000	€ 9.000	€ 9.000	€ 9.000
Total Revenues	€ 177.900	€ 177.900	€ 177.900	€ 177.900	€ 177.900

Costs	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ 20.000	€ -	€ -	€ -	€ -
Central Housing	€ -	€ -	€ -	€ -	€ -
PoP	€ -	€ -	€ -	€ -	€ -
IPTV Software License	€ 20.000	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Engineering	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Registration	€ 43.900	€ -	€ -	€ -	€ -
CATNIX	€ 1.800	€ -	€ -	€ -	€ -
RIPE NCC	€ 41.100	€ -	€ -	€ -	€ -
Xarxa Oberta	€ 1.000	€ -	€ -	€ -	€ -
Interconnectivity	€ 46.188	€ 46.788	€ 38.028	€ 31.788	€ 27.468
CATNIX	€ 5.388	€ 5.388	€ 5.388	€ 5.388	€ 5.388
X.O.	€ 12.000	€ 12.000	€ 12.000	€ 12.000	€ 12.000
Upstream Service Provider	€ 28.800	€ 29.400	€ 20.640	€ 14.400	€ 10.080
Service Fees	€ 38.160	€ 38.160	€ 38.160	€ 38.160	€ 38.160
VoIP Trunking	€ 22.500	€ 22.500	€ 22.500	€ 22.500	€ 22.500
IPTV - Additional Channels	€ 1.800	€ 1.800	€ 1.800	€ 1.800	€ 1.800
IPTV - Video on Demand	€ 3.600	€ 3.600	€ 3.600	€ 3.600	€ 3.600
IPTV - Support & Content License	€ 10.260	€ 10.260	€ 10.260	€ 10.260	€ 10.260
Total Costs	€ 213.248	€ 153.198	€ 147.851	€ 145.194	€ 144.636

Depreciations	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ -	€ 10.860	€ 10.860	€ 10.860	€ 10.860
All Equipment	€ -	€ 10.860	€ 10.860	€ 10.860	€ 10.860

Result	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
Total Result	-€ 35.348	€ 13.842	€ 19.190	€ 21.846	€ 22.404	€ 41.934
NPV	€ (35.348)	€ 13.310	€ 17.742	€ 19.421	€ 19.151	€ 34.276

LA POBLA + LA SENIA + SOLSONA					
Revenues	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Data Connectivity	€ 120.000	€ 120.000	€ 120.000	€ 120.000	€ 120.000
VoIP Telephony	€ 33.600	€ 33.600	€ 33.600	€ 33.600	€ 33.600
IPTV - Additional Channels	€ 4.800	€ 4.800	€ 4.800	€ 4.800	€ 4.800
IPTV - Video on Demand	€ 6.720	€ 6.720	€ 6.720	€ 6.720	€ 6.720
Support	€ 9.000	€ 9.000	€ 9.000	€ 9.000	€ 9.000
Service Provisioning	€ 9.600	€ 9.600	€ 9.600	€ 9.600	€ 9.600
Total Revenues	€ 183.720	€ 183.720	€ 183.720	€ 183.720	€ 183.720

Costs	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ 20.000	€ -	€ -	€ -	€ -
Central Housing	€ -	€ -	€ -	€ -	€ -
PoP	€ -	€ -	€ -	€ -	€ -
IPTV Software License	€ 20.000	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Engineering	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Registration	€ 46.400	€ -	€ -	€ -	€ -
CATNIX	€ 1.800	€ -	€ -	€ -	€ -
RIPE NCC	€ 43.600	€ -	€ -	€ -	€ -
Xarxa Oberta	€ 1.000	€ -	€ -	€ -	€ -
Interconnectivity	€ 46.188	€ 46.788	€ 38.028	€ 31.788	€ 27.468
CATNIX	€ 5.388	€ 5.388	€ 5.388	€ 5.388	€ 5.388
X.O.	€ 12.000	€ 12.000	€ 12.000	€ 12.000	€ 12.000
Upstream Service Provider	€ 28.800	€ 29.400	€ 20.640	€ 14.400	€ 10.080
Service Fees	€ 40.020	€ 40.020	€ 40.020	€ 40.020	€ 40.020
VoIP Trunking	€ 24.000	€ 24.000	€ 24.000	€ 24.000	€ 24.000
IPTV - Additional Channels	€ 1.920	€ 1.920	€ 1.920	€ 1.920	€ 1.920
IPTV - Video on Demand	€ 3.840	€ 3.840	€ 3.840	€ 3.840	€ 3.840
IPTV - Support & Content License	€ 10.260	€ 10.260	€ 10.260	€ 10.260	€ 10.260
Total Costs	€ 217.608	€ 155.058	€ 149.711	€ 147.054	€ 146.496

Depreciations	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ -	€ 10.860	€ 10.860	€ 10.860	€ 10.860
All Equipment	€ -	€ 10.860	€ 10.860	€ 10.860	€ 10.860

Result	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
Total Result	-€ 33.888	€ 17.802	€ 23.150	€ 25.806	€ 26.364	€ 59.234
NPV	€ (33.888)	€ 17.117	€ 21.403	€ 22.942	€ 22.536	€ 50.110

LA POBLA + RIBA ROJA D'EBRE + SOLSONA					
Revenues	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Data Connectivity	€ 69.600	€ 69.600	€ 69.600	€ 69.600	€ 69.600
VoIP Telephony	€ 31.500	€ 31.500	€ 31.500	€ 31.500	€ 31.500
IPTV - Additional Channels	€ 4.500	€ 4.500	€ 4.500	€ 4.500	€ 4.500
IPTV - Video on Demand	€ 6.300	€ 6.300	€ 6.300	€ 6.300	€ 6.300
Support	€ 9.000	€ 9.000	€ 9.000	€ 9.000	€ 9.000
Service Provisioning	€ 9.000	€ 9.000	€ 9.000	€ 9.000	€ 9.000
Total Revenues	€ 129.900	€ 129.900	€ 129.900	€ 129.900	€ 129.900

Costs	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ 20.000	€ -	€ -	€ -	€ -
Central Housing	€ -	€ -	€ -	€ -	€ -
PoP	€ -	€ -	€ -	€ -	€ -
IPTV Software License	€ 20.000	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Engineering	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Registration	€ 43.900	€ -	€ -	€ -	€ -
CATNIX	€ 1.800	€ -	€ -	€ -	€ -
RIPE NCC	€ 41.100	€ -	€ -	€ -	€ -
Xarxa Oberta	€ 1.000	€ -	€ -	€ -	€ -
Interconnectivity	€ 26.112	€ 37.548	€ 31.500	€ 31.788	€ 27.468
CATNIX	€ 3.792	€ 5.388	€ 5.388	€ 5.388	€ 5.388
X.O.	€ 7.920	€ 12.000	€ 12.000	€ 12.000	€ 12.000
Upstream Service Provider	€ 14.400	€ 20.160	€ 14.112	€ 14.400	€ 10.080
Service Fees	€ 38.160	€ 38.160	€ 38.160	€ 38.160	€ 38.160
VoIP Trunking	€ 22.500	€ 22.500	€ 22.500	€ 22.500	€ 22.500
IPTV - Additional Channels	€ 1.800	€ 1.800	€ 1.800	€ 1.800	€ 1.800
IPTV - Video on Demand	€ 3.600	€ 3.600	€ 3.600	€ 3.600	€ 3.600
IPTV - Support & Content License	€ 10.260	€ 10.260	€ 10.260	€ 10.260	€ 10.260
Total Costs	€ 193.172	€ 143.958	€ 141.323	€ 145.194	€ 144.636

Depreciations	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ -	€ 10.860	€ 10.860	€ 10.860	€ 10.860
All Equipment	€ -	€ 10.860	€ 10.860	€ 10.860	€ 10.860

Result	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
Total Result	-€ 63.272	-€ 24.918	-€ 22.283	-€ 26.154	-€ 25.596	-€ 162.222
NPV	€ (63.272)	€ (23.960)	€ (20.601)	€ (23.250)	€ (21.879)	€ (152.963)

LA SENIA + RIBA ROJA D'EBRE + SOLSONA					
Revenues	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Data Connectivity	€ 117.600	€ 117.600	€ 117.600	€ 117.600	€ 117.600
VoIP Telephony	€ 35.700	€ 35.700	€ 35.700	€ 35.700	€ 35.700
IPTV - Additional Channels	€ 5.100	€ 5.100	€ 5.100	€ 5.100	€ 5.100
IPTV - Video on Demand	€ 7.140	€ 7.140	€ 7.140	€ 7.140	€ 7.140
Support	€ 9.000	€ 9.000	€ 9.000	€ 9.000	€ 9.000
Service Provisioning	€ 10.200	€ 10.200	€ 10.200	€ 10.200	€ 10.200
Total Revenues	€ 184.740	€ 184.740	€ 184.740	€ 184.740	€ 184.740

Costs	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ 20.000	€ -	€ -	€ -	€ -
Central Housing	€ -	€ -	€ -	€ -	€ -
PoP	€ -	€ -	€ -	€ -	€ -
IPTV Software License	€ 20.000	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Engineering	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Registration	€ 48.900	€ -	€ -	€ -	€ -
CATNIX	€ 1.800	€ -	€ -	€ -	€ -
RIPE NCC	€ 46.100	€ -	€ -	€ -	€ -
Xarxa Oberta	€ 1.000	€ -	€ -	€ -	€ -
Interconnectivity	€ 46.188	€ 46.788	€ 38.028	€ 31.788	€ 27.468
CATNIX	€ 5.388	€ 5.388	€ 5.388	€ 5.388	€ 5.388
X.O.	€ 12.000	€ 12.000	€ 12.000	€ 12.000	€ 12.000
Upstream Service Provider	€ 28.800	€ 29.400	€ 20.640	€ 14.400	€ 10.080
Service Fees	€ 41.880	€ 41.880	€ 41.880	€ 41.880	€ 41.880
VoIP Trunking	€ 25.500	€ 25.500	€ 25.500	€ 25.500	€ 25.500
IPTV - Additional Channels	€ 2.040	€ 2.040	€ 2.040	€ 2.040	€ 2.040
IPTV - Video on Demand	€ 4.080	€ 4.080	€ 4.080	€ 4.080	€ 4.080
IPTV - Support & Content License	€ 10.260	€ 10.260	€ 10.260	€ 10.260	€ 10.260
Total Costs	€ 221.968	€ 156.918	€ 151.571	€ 148.914	€ 148.356

Depreciations	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ -	€ 10.860	€ 10.860	€ 10.860	€ 10.860
All Equipment	€ -	€ 10.860	€ 10.860	€ 10.860	€ 10.860

Result	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
Total Result	-€ 37.228	€ 16.962	€ 22.310	€ 24.966	€ 25.524	€ 52.534
NPV	€ (37.228)	€ 16.310	€ 20.626	€ 22.195	€ 21.818	€ 43.721

LA POBLA DE CLARAMUNT + LA SENIA + RIBA ROJA D'EBRE + SOLSONA					
Revenues	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Data Connectivity	€ 141.600	€ 141.600	€ 141.600	€ 141.600	€ 141.600
VoIP Telephony	€ 44.100	€ 44.100	€ 44.100	€ 44.100	€ 44.100
IPTV - Additional Channels	€ 6.300	€ 6.300	€ 6.300	€ 6.300	€ 6.300
IPTV - Video on Demand	€ 8.820	€ 8.820	€ 8.820	€ 8.820	€ 8.820
Support	€ 12.000	€ 12.000	€ 12.000	€ 12.000	€ 12.000
Service Provisioning	€ 12.600	€ 12.600	€ 12.600	€ 12.600	€ 12.600
Total Revenues	€ 225.420	€ 225.420	€ 225.420	€ 225.420	€ 225.420

Costs	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ 20.000	€ -	€ -	€ -	€ -
Central Housing	€ -	€ -	€ -	€ -	€ -
PoP	€ -	€ -	€ -	€ -	€ -
IPTV Software License	€ 20.000	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Engineering	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Registration	€ 60.700	€ -	€ -	€ -	€ -
CATNIX	€ 1.800	€ -	€ -	€ -	€ -
RIPE NCC	€ 57.900	€ -	€ -	€ -	€ -
Xarxa Oberta	€ 1.000	€ -	€ -	€ -	€ -
Interconnectivity	€ 59.388	€ 46.788	€ 38.028	€ 31.788	€ 42.024
CATNIX	€ 5.388	€ 5.388	€ 5.388	€ 5.388	€ 8.580
X.O.	€ 12.000	€ 12.000	€ 12.000	€ 12.000	€ 19.920
Upstream Service Provider	€ 42.000	€ 29.400	€ 20.640	€ 14.400	€ 13.524
Service Fees	€ 52.740	€ 52.740	€ 52.740	€ 52.740	€ 52.740
VoIP Trunking	€ 31.500	€ 31.500	€ 31.500	€ 31.500	€ 31.500
IPTV - Additional Channels	€ 2.520	€ 2.520	€ 2.520	€ 2.520	€ 2.520
IPTV - Video on Demand	€ 5.040	€ 5.040	€ 5.040	€ 5.040	€ 5.040
IPTV - Support & Content License	€ 13.680	€ 13.680	€ 13.680	€ 13.680	€ 13.680
Total Costs	€ 257.828	€ 167.778	€ 162.431	€ 159.774	€ 173.772

Depreciations	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ -	€ 11.880	€ 11.880	€ 11.880	€ 11.880
All Equipment	€ -	€ 11.880	€ 11.880	€ 11.880	€ 11.880

Result	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
Total Result	-€ 32.408	€ 45.762	€ 51.110	€ 53.766	€ 39.768	€ 157.998
NPV	€ (32.408)	€ 44.002	€ 47.254	€ 47.798	€ 33.994	€ 140.640

CAPELLADES + LA SENIA + RIBA ROJA D'EBRE + SOLSONA					
Revenues	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Data Connectivity	€ 171.600	€ 171.600	€ 171.600	€ 171.600	€ 171.600
VoIP Telephony	€ 56.700	€ 56.700	€ 56.700	€ 56.700	€ 56.700
IPTV - Additional Channels	€ 8.100	€ 8.100	€ 8.100	€ 8.100	€ 8.100
IPTV - Video on Demand	€ 11.340	€ 11.340	€ 11.340	€ 11.340	€ 11.340
Support	€ 12.000	€ 12.000	€ 12.000	€ 12.000	€ 12.000
Service Provisioning	€ 16.200	€ 16.200	€ 16.200	€ 16.200	€ 16.200
Total Revenues	€ 275.940	€ 275.940	€ 275.940	€ 275.940	€ 275.940

Costs	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ 25.000	€ -	€ -	€ -	€ -
Central Housing	€ -	€ -	€ -	€ -	€ -
PoP	€ -	€ -	€ -	€ -	€ -
IPTV Software License	€ 25.000	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Engineering	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Registration	€ 75.700	€ -	€ -	€ -	€ -
CATNIX	€ 1.800	€ -	€ -	€ -	€ -
RIPE NCC	€ 72.900	€ -	€ -	€ -	€ -
Xarxa Oberta	€ 1.000	€ -	€ -	€ -	€ -
Interconnectivity	€ 59.388	€ 46.788	€ 38.028	€ 58.440	€ 54.336
CATNIX	€ 5.388	€ 5.388	€ 5.388	€ 10.176	€ 10.176
X.O.	€ 12.000	€ 12.000	€ 12.000	€ 24.000	€ 24.000
Upstream Service Provider	€ 42.000	€ 29.400	€ 20.640	€ 24.264	€ 20.160
Service Fees	€ 63.900	€ 63.900	€ 63.900	€ 63.900	€ 63.900
VoIP Trunking	€ 40.500	€ 40.500	€ 40.500	€ 40.500	€ 40.500
IPTV - Additional Channels	€ 3.240	€ 3.240	€ 3.240	€ 3.240	€ 3.240
IPTV - Video on Demand	€ 6.480	€ 6.480	€ 6.480	€ 6.480	€ 6.480
IPTV - Support & Content License	€ 13.680	€ 13.680	€ 13.680	€ 13.680	€ 13.680
Total Costs	€ 288.988	€ 178.938	€ 173.591	€ 197.586	€ 197.244

Depreciations	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ -	€ 11.880	€ 11.880	€ 11.880	€ 11.880
All Equipment	€ -	€ 11.880	€ 11.880	€ 11.880	€ 11.880

Result	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
Total Result	-€ 13.048	€ 85.122	€ 90.470	€ 66.474	€ 66.816	€ 295.834
NPV	€ (13.048)	€ 81.848	€ 83.644	€ 59.095	€ 57.115	€ 268.654

CAPELLADES + LA POBLA DE CLARAMUNT + RIBA ROJA D'EBRE + SOLSONA					
Revenues	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Data Connectivity	€ 123.600	€ 123.600	€ 123.600	€ 123.600	€ 123.600
VoIP Telephony	€ 52.500	€ 52.500	€ 52.500	€ 52.500	€ 52.500
IPTV - Additional Channels	€ 7.500	€ 7.500	€ 7.500	€ 7.500	€ 7.500
IPTV - Video on Demand	€ 10.500	€ 10.500	€ 10.500	€ 10.500	€ 10.500
Support	€ 12.000	€ 12.000	€ 12.000	€ 12.000	€ 12.000
Service Provisioning	€ 15.000	€ 15.000	€ 15.000	€ 15.000	€ 15.000
Total Revenues	€ 221.100	€ 221.100	€ 221.100	€ 221.100	€ 221.100

Costs	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ 25.000	€ -	€ -	€ -	€ -
Central Housing	€ -	€ -	€ -	€ -	€ -
PoP	€ -	€ -	€ -	€ -	€ -
IPTV Software License	€ 25.000	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Engineering	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Registration	€ 70.700	€ -	€ -	€ -	€ -
CATNIX	€ 1.800	€ -	€ -	€ -	€ -
RIPE NCC	€ 67.900	€ -	€ -	€ -	€ -
Xarxa Oberta	€ 1.000	€ -	€ -	€ -	€ -
Interconnectivity	€ 46.188	€ 46.788	€ 38.028	€ 31.788	€ 27.468
CATNIX	€ 5.388	€ 5.388	€ 5.388	€ 5.388	€ 5.388
X.O.	€ 12.000	€ 12.000	€ 12.000	€ 12.000	€ 12.000
Upstream Service Provider	€ 28.800	€ 29.400	€ 20.640	€ 14.400	€ 10.080
Service Fees	€ 60.180	€ 60.180	€ 60.180	€ 60.180	€ 60.180
VoIP Trunking	€ 37.500	€ 37.500	€ 37.500	€ 37.500	€ 37.500
IPTV - Additional Channels	€ 3.000	€ 3.000	€ 3.000	€ 3.000	€ 3.000
IPTV - Video on Demand	€ 6.000	€ 6.000	€ 6.000	€ 6.000	€ 6.000
IPTV - Support & Content License	€ 13.680	€ 13.680	€ 13.680	€ 13.680	€ 13.680
Total Costs	€ 267.068	€ 175.218	€ 169.871	€ 167.214	€ 166.656

Depreciations	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ -	€ 11.880	€ 11.880	€ 11.880	€ 11.880
All Equipment	€ -	€ 11.880	€ 11.880	€ 11.880	€ 11.880

Result	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
Total Result	-€ 45.968	€ 34.002	€ 39.350	€ 42.006	€ 42.564	€ 111.954
NPV	€ (45.968)	€ 32.694	€ 36.381	€ 37.344	€ 36.384	€ 96.835

CAPELLADES + LA POBLA DE CLARAMUNT + LA SENIA + SOLSONA					
Revenues	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Data Connectivity	€ 174.000	€ 174.000	€ 174.000	€ 174.000	€ 174.000
VoIP Telephony	€ 54.600	€ 54.600	€ 54.600	€ 54.600	€ 54.600
IPTV - Additional Channels	€ 7.800	€ 7.800	€ 7.800	€ 7.800	€ 7.800
IPTV - Video on Demand	€ 10.920	€ 10.920	€ 10.920	€ 10.920	€ 10.920
Support	€ 12.000	€ 12.000	€ 12.000	€ 12.000	€ 12.000
Service Provisioning	€ 15.600	€ 15.600	€ 15.600	€ 15.600	€ 15.600
Total Revenues	€ 274.920	€ 274.920	€ 274.920	€ 274.920	€ 274.920

Costs	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ 25.000	€ -	€ -	€ -	€ -
Central Housing	€ -	€ -	€ -	€ -	€ -
PoP	€ -	€ -	€ -	€ -	€ -
IPTV Software License	€ 25.000	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Engineering	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Registration	€ 73.200	€ -	€ -	€ -	€ -
CATNIX	€ 1.800	€ -	€ -	€ -	€ -
RIPE NCC	€ 70.400	€ -	€ -	€ -	€ -
Xarxa Oberta	€ 1.000	€ -	€ -	€ -	€ -
Interconnectivity	€ 59.388	€ 46.788	€ 38.028	€ 58.440	€ 54.336
CATNIX	€ 5.388	€ 5.388	€ 5.388	€ 10.176	€ 10.176
X.O.	€ 12.000	€ 12.000	€ 12.000	€ 24.000	€ 24.000
Upstream Service Provider	€ 42.000	€ 29.400	€ 20.640	€ 24.264	€ 20.160
Service Fees	€ 62.040	€ 62.040	€ 62.040	€ 62.040	€ 62.040
VoIP Trunking	€ 39.000	€ 39.000	€ 39.000	€ 39.000	€ 39.000
IPTV - Additional Channels	€ 3.120	€ 3.120	€ 3.120	€ 3.120	€ 3.120
IPTV - Video on Demand	€ 6.240	€ 6.240	€ 6.240	€ 6.240	€ 6.240
IPTV - Support & Content License	€ 13.680	€ 13.680	€ 13.680	€ 13.680	€ 13.680
Total Costs	€ 284.628	€ 177.078	€ 171.731	€ 195.726	€ 195.384

Depreciations	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ -	€ 11.880	€ 11.880	€ 11.880	€ 11.880
All Equipment	€ -	€ 11.880	€ 11.880	€ 11.880	€ 11.880

Result	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
Total Result	-€ 9.708	€ 85.962	€ 91.310	€ 67.314	€ 67.656	€ 302.534
NPV	€ (9.708)	€ 82.656	€ 84.421	€ 59.842	€ 57.833	€ 275.043

CAPELLADES + LA POBLA DE CLARAMUNT + LA SENIA + RIBA ROJA D'EBRE					
Revenues	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Data Connectivity	€ 171.600	€ 171.600	€ 171.600	€ 171.600	€ 171.600
VoIP Telephony	€ 52.500	€ 52.500	€ 52.500	€ 52.500	€ 52.500
IPTV - Additional Channels	€ 7.500	€ 7.500	€ 7.500	€ 7.500	€ 7.500
IPTV - Video on Demand	€ 10.500	€ 10.500	€ 10.500	€ 10.500	€ 10.500
Support	€ 12.000	€ 12.000	€ 12.000	€ 12.000	€ 12.000
Service Provisioning	€ 15.000	€ 15.000	€ 15.000	€ 15.000	€ 15.000
Total Revenues	€ 269.100	€ 269.100	€ 269.100	€ 269.100	€ 269.100

Costs	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ 25.000	€ -	€ -	€ -	€ -
Central Housing	€ -	€ -	€ -	€ -	€ -
PoP	€ -	€ -	€ -	€ -	€ -
IPTV Software License	€ 25.000	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Engineering	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Registration	€ 70.700	€ -	€ -	€ -	€ -
CATNIX	€ 1.800	€ -	€ -	€ -	€ -
RIPE NCC	€ 67.900	€ -	€ -	€ -	€ -
Xarxa Oberta	€ 1.000	€ -	€ -	€ -	€ -
Interconnectivity	€ 59.388	€ 46.788	€ 38.028	€ 58.440	€ 54.336
CATNIX	€ 5.388	€ 5.388	€ 5.388	€ 10.176	€ 10.176
X.O.	€ 12.000	€ 12.000	€ 12.000	€ 24.000	€ 24.000
Upstream Service Provider	€ 42.000	€ 29.400	€ 20.640	€ 24.264	€ 20.160
Service Fees	€ 60.180	€ 60.180	€ 60.180	€ 60.180	€ 60.180
VoIP Trunking	€ 37.500	€ 37.500	€ 37.500	€ 37.500	€ 37.500
IPTV - Additional Channels	€ 3.000	€ 3.000	€ 3.000	€ 3.000	€ 3.000
IPTV - Video on Demand	€ 6.000	€ 6.000	€ 6.000	€ 6.000	€ 6.000
IPTV - Support & Content License	€ 13.680	€ 13.680	€ 13.680	€ 13.680	€ 13.680
Total Costs	€ 280.268	€ 175.218	€ 169.871	€ 193.866	€ 193.524

Depreciations	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ -	€ 11.880	€ 11.880	€ 11.880	€ 11.880
All Equipment	€ -	€ 11.880	€ 11.880	€ 11.880	€ 11.880

Result	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
Total Result	-€ 11.168	€ 82.002	€ 87.350	€ 63.354	€ 63.696	€ 285.234
NPV	€ (11.168)	€ 78.848	€ 80.760	€ 56.322	€ 54.448	€ 259.209

ALL NETWORKS					
Revenues	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Data Connectivity	€ 231.600	€ 231.600	€ 231.600	€ 231.600	€ 231.600
VoIP Telephony	€ 76.650	€ 76.650	€ 76.650	€ 76.650	€ 76.650
IPTV - Additional Channels	€ 10.950	€ 10.950	€ 10.950	€ 10.950	€ 10.950
IPTV - Video on Demand	€ 15.330	€ 15.330	€ 15.330	€ 15.330	€ 15.330
Support	€ 18.000	€ 18.000	€ 18.000	€ 18.000	€ 18.000
Service Provisioning	€ 21.900	€ 21.900	€ 21.900	€ 21.900	€ 21.900
Total Revenues	€ 374.430	€ 374.430	€ 374.430	€ 374.430	€ 374.430

Costs	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ 25.000	€ -	€ -	€ -	€ -
Central Housing	€ -	€ -	€ -	€ -	€ -
PoP	€ -	€ -	€ -	€ -	€ -
IPTV Software License	€ 25.000	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Engineering	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Registration	€ 87.500	€ -	€ -	€ -	€ -
CATNIX	€ 1.800	€ -	€ -	€ -	€ -
RIPE NCC	€ 84.700	€ -	€ -	€ -	€ -
Xarxa Oberta	€ 1.000	€ -	€ -	€ -	€ -
Interconnectivity	€ 74.988	€ 57.708	€ 45.612	€ 37.116	€ 31.164
CATNIX	€ 5.388	€ 5.388	€ 5.388	€ 5.388	€ 5.388
X.O.	€ 12.000	€ 12.000	€ 12.000	€ 12.000	€ 12.000
Upstream Service Provider	€ 57.600	€ 40.320	€ 28.224	€ 19.728	€ 13.776
Service Fees	€ 71.310	€ 71.310	€ 71.310	€ 71.310	€ 71.310
VoIP Trunking	€ 54.750	€ 54.750	€ 54.750	€ 54.750	€ 54.750
IPTV - Additional Channels	€ 4.380	€ 4.380	€ 4.380	€ 4.380	€ 4.380
IPTV - Video on Demand	€ 8.760	€ 8.760	€ 8.760	€ 8.760	€ 8.760
IPTV - Support & Content License	€ 3.420	€ 3.420	€ 3.420	€ 3.420	€ 3.420
Total Costs	€ 323.798	€ 197.268	€ 188.585	€ 183.672	€ 181.482

Depreciations	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ -	€ 12.900	€ 12.900	€ 12.900	€ 12.900
All Equipment	€ -	€ 12.900	€ 12.900	€ 12.900	€ 12.900

Result	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
Total Result	€ 50.632	€ 164.262	€ 172.946	€ 177.858	€ 180.048	€ 745.746
NPV	€ 50.632	€ 157.944	€ 159.898	€ 158.115	€ 153.906	€ 680.495

PESSIMISTIC SCENARIO					
Revenues	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Data Connectivity	€ 126.000	€ 126.000	€ 126.000	€ 126.000	€ 126.000
VoIP Telephony	€ 33.600	€ 33.600	€ 33.600	€ 33.600	€ 33.600
IPTV - Additional Channels	€ 4.800	€ 4.800	€ 4.800	€ 4.800	€ 4.800
IPTV - Video on Demand	€ 6.720	€ 6.720	€ 6.720	€ 6.720	€ 6.720
Support	€ 6.000	€ 6.000	€ 6.000	€ 6.000	€ 6.000
Service Provisioning	€ 9.600	€ 9.600	€ 9.600	€ 9.600	€ 9.600
Total Revenues	€ 186.720	€ 186.720	€ 186.720	€ 186.720	€ 186.720

Costs	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ 20.000	€ -	€ -	€ -	€ -
Central Housing	-	€ -	€ -	€ -	€ -
PoP	-	€ -	€ -	€ -	€ -
IPTV Software License	€ 20.000	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Engineering	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Registration	€ 44.600	€ -	€ -	€ -	€ -
CATNIX	€ 1.800	€ -	€ -	€ -	€ -
RIPE NCC	€ 41.800	€ -	€ -	€ -	€ -
Xarxa Oberta	€ 1.000	€ -	€ -	€ -	€ -
Interconnectivity	€ 59.388	€ 46.788	€ 38.028	€ 31.788	€ 37.548
CATNIX	€ 5.388	€ 5.388	€ 5.388	€ 5.388	€ 5.388
X.O.	€ 12.000	€ 12.000	€ 12.000	€ 12.000	€ 12.000
Upstream Service Provider	€ 42.000	€ 29.400	€ 20.640	€ 14.400	€ 20.160
Service Fees	€ 36.600	€ 36.600	€ 36.600	€ 36.600	€ 36.600
VoIP Trunking	€ 24.000	€ 24.000	€ 24.000	€ 24.000	€ 24.000
IPTV - Additional Channels	€ 1.920	€ 1.920	€ 1.920	€ 1.920	€ 1.920
IPTV - Video on Demand	€ 3.840	€ 3.840	€ 3.840	€ 3.840	€ 3.840
IPTV - Support & Content License	€ 6.840	€ 6.840	€ 6.840	€ 6.840	€ 6.840
Total Costs	€ 225.588	€ 151.638	€ 146.291	€ 143.634	€ 153.156

Depreciations	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ -	€ 9.840	€ 9.840	€ 9.840	€ 9.840
All Equipment	€ -	€ 9.840	€ 9.840	€ 9.840	€ 9.840

Result	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
Total Result	-€ 38.868	€ 25.242	€ 30.590	€ 33.246	€ 23.724	€ 73.934
Accumulative	-€ 38.868	-€ 13.626	€ 16.964	€ 50.210	€ 73.934	

NPV	€ (38.868)	€ 24.271	€ 28.282	€ 29.556	€ 20.279	€ 63.520
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PESSIMISTIC SCENARIO						
Treasury	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	
ENTRY						
Capital	€ 90.000	€ -	€ -	€ -	€ -	€ -
Credit	€ -	€ -	€ -	€ -	€ -	€ -
Service Offering	€ 186.720	€ 186.720	€ 186.720	€ 186.720	€ 186.720	€ 186.720
EXIT						
Equipment	€ 69.200	€ -	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008	€ 79.008
Registration	€ 44.600	€ -	€ -	€ -	€ -	€ -
Interconnectivity	€ 59.388	€ 46.788	€ 38.028	€ 31.788	€ 37.548	€ 37.548
Service Fees	€ 36.600	€ 36.600	€ 36.600	€ 36.600	€ 36.600	€ 36.600
ANNUAL	€ 1.932	€ 35.082	€ 40.430	€ 43.086	€ 33.564	€ 33.564
ACCUMULATIVE	€ 1.932	€ 37.014	€ 77.444	€ 120.530	€ 154.094	€ 154.094

PESSIMISTIC SCENARIO						
Balance	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	
ASSETS						
Fixed						
Equipment	€ 49.200	€ 39.360	€ 29.520	€ 19.680	€ 9.840	€ 9.840
Current						
Cash	€ 1.932	€ 37.014	€ 77.444	€ 120.530	€ 154.094	€ 154.094
Accounts receivable	€ 38.868	€ 13.626	€ -	€ -	€ -	€ -
TOTAL ASSETS	€ 90.000	€ 90.000	€ 106.964	€ 140.210	€ 163.934	€ 163.934
LIABILITIES						
Capital Stock	€ 90.000	€ 90.000	€ 90.000	€ 90.000	€ 90.000	€ 90.000
Credit	€ -	€ -	€ -	€ -	€ -	€ -
Accounts payable	€ -	€ -	€ 16.964	€ 50.210	€ 73.934	€ 73.934
TOTAL LIABILITIES	€ 90.000	€ 90.000	€ 106.964	€ 140.210	€ 163.934	€ 163.934

CASHFLOWS						
0	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	
€ (90.000,00)	€ (38.868)	€ 35.082	€ 40.430	€ 43.086	€ 33.564	€ 33.564

NPV	€ 63.520
IRR	13%

NEUTRAL SCENARIO					
Revenues	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Data Connectivity	€ 147.600	€ 147.600	€ 147.600	€ 147.600	€ 147.600
VoIP Telephony	€ 44.100	€ 44.100	€ 44.100	€ 44.100	€ 44.100
IPTV - Additional Channels	€ 6.300	€ 6.300	€ 6.300	€ 6.300	€ 6.300
IPTV - Video on Demand	€ 8.820	€ 8.820	€ 8.820	€ 8.820	€ 8.820
Support	€ 9.000	€ 9.000	€ 9.000	€ 9.000	€ 9.000
Service Provisioning	€ 12.600	€ 12.600	€ 12.600	€ 12.600	€ 12.600
Total Revenues	€ 228.420	€ 228.420	€ 228.420	€ 228.420	€ 228.420

Costs	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ 20.000	€ -	€ -	€ -	€ -
Central Housing	€ -	€ -	€ -	€ -	€ -
PoP	€ -	€ -	€ -	€ -	€ -
IPTV Software License	€ 20.000	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Engineering	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Registration	€ 58.900	€ -	€ -	€ -	€ -
CATNIX	€ 1.800	€ -	€ -	€ -	€ -
RIPE NCC	€ 56.100	€ -	€ -	€ -	€ -
Xarxa Oberta	€ 1.000	€ -	€ -	€ -	€ -
Interconnectivity	€ 59.388	€ 46.788	€ 38.028	€ 44.700	€ 54.336
CATNIX	€ 5.388	€ 5.388	€ 5.388	€ 8.580	€ 10.176
X.O.	€ 12.000	€ 12.000	€ 12.000	€ 16.788	€ 24.000
Upstream Service Provider	€ 42.000	€ 29.400	€ 20.640	€ 19.332	€ 20.160
Service Fees	€ 49.320	€ 49.320	€ 49.320	€ 49.320	€ 49.320
VoIP Trunking	€ 31.500	€ 31.500	€ 31.500	€ 31.500	€ 31.500
IPTV - Additional Channels	€ 2.520	€ 2.520	€ 2.520	€ 2.520	€ 2.520
IPTV - Video on Demand	€ 5.040	€ 5.040	€ 5.040	€ 5.040	€ 5.040
IPTV - Support & Content License	€ 10.260	€ 10.260	€ 10.260	€ 10.260	€ 10.260
Total Costs	€ 252.608	€ 164.358	€ 159.011	€ 169.266	€ 182.664

Depreciations	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ -	€ 10.860	€ 10.860	€ 10.860	€ 10.860
All Equipment	€ -	€ 10.860	€ 10.860	€ 10.860	€ 10.860

Result	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
Total Result	-€ 24.188	€ 53.202	€ 58.550	€ 48.294	€ 34.896	€ 170.754
Accumulative Result	-€ 24.188	€ 29.014	€ 87.564	€ 135.858	€ 170.754	

NPV	€ (24.188)	€ 51.156	€ 54.132	€ 42.934	€ 29.829	€ 153.863
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NEUTRAL SCENARIO						
Treasury	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	
ENTRY						
Capital	€ 80.000	€ -	€ -	€ -	€ -	€ -
Credit	€ -	€ -	€ -	€ -	€ -	€ -
Service Offering	€ 228.420	€ 228.420	€ 228.420	€ 228.420	€ 228.420	€ 228.420
EXIT						
Equipment	€ 74.300	€ -	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008	€ 79.008
Registration	€ 58.900	€ -	€ -	€ -	€ -	€ -
Interconnectivity	€ 59.388	€ 46.788	€ 38.028	€ 44.700	€ 54.336	€ 54.336
Service Fees	€ 49.320	€ 49.320	€ 49.320	€ 49.320	€ 49.320	€ 49.320
ANNUAL	€ 1.512	€ 64.062	€ 69.410	€ 59.154	€ 45.756	€ 45.756
ACCUMULATIVE	€ 1.512	€ 65.574	€ 134.984	€ 194.138	€ 239.894	€ 239.894

NEUTRAL SCENARIO						
Balance	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	
ASSETS						
Fixed						
Equipment	€ 54.300	€ 43.440	€ 32.580	€ 21.720	€ 10.860	€ 10.860
Current						
Cash	€ 1.512	€ 65.574	€ 134.984	€ 194.138	€ 239.894	€ 239.894
Accounts receivable	€ 24.188	€ -	€ -	€ -	€ -	€ -
TOTAL ASSETS	€ 80.000	€ 109.014	€ 167.564	€ 215.858	€ 250.754	€ 250.754
LIABILITIES						
Capital Stock	€ 80.000	€ 80.000	€ 80.000	€ 80.000	€ 80.000	€ 80.000
Credit	€ -	€ -	€ -	€ -	€ -	€ -
Accounts payable	€ -	€ 29.014	€ 87.564	€ 135.858	€ 170.754	€ 170.754
TOTAL LIABILITIES	€ 80.000	€ 109.014	€ 167.564	€ 215.858	€ 250.754	€ 250.754

CASHFLOWS						
0	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	
€ (80.000,00)	€ 1.512	€ 64.062	€ 69.410	€ 59.154	€ 45.756	€ 45.756

NPV	€ 153.863
IRR	27%

OPTIMISTIC SCENARIO					
Revenues	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Data Connectivity	€ 231.600	€ 231.600	€ 231.600	€ 231.600	€ 231.600
VoIP Telephony	€ 76.650	€ 76.650	€ 76.650	€ 76.650	€ 76.650
IPTV - Additional Channels	€ 10.950	€ 10.950	€ 10.950	€ 10.950	€ 10.950
IPTV - Video on Demand	€ 15.330	€ 15.330	€ 15.330	€ 15.330	€ 15.330
Support	€ 18.000	€ 18.000	€ 18.000	€ 18.000	€ 18.000
Service Provisioning	€ 21.900	€ 21.900	€ 21.900	€ 21.900	€ 21.900
Total Revenues	€ 374.430	€ 374.430	€ 374.430	€ 374.430	€ 374.430

Costs	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ 25.000	€ -	€ -	€ -	€ -
Central Housing	€ -	€ -	€ -	€ -	€ -
PoP	€ -	€ -	€ -	€ -	€ -
IPTV Software License	€ 25.000	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Engineering	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008
Registration	€ 87.500	€ -	€ -	€ -	€ -
CATNIX	€ 1.800	€ -	€ -	€ -	€ -
RIPE NCC	€ 84.700	€ -	€ -	€ -	€ -
Xarxa Oberta	€ 1.000	€ -	€ -	€ -	€ -
Interconnectivity	€ 74.988	€ 57.708	€ 45.612	€ 37.116	€ 31.164
CATNIX	€ 5.388	€ 5.388	€ 5.388	€ 5.388	€ 5.388
X.O.	€ 12.000	€ 12.000	€ 12.000	€ 12.000	€ 12.000
Upstream Service Provider	€ 57.600	€ 40.320	€ 28.224	€ 19.728	€ 13.776
Service Fees	€ 71.310	€ 71.310	€ 71.310	€ 71.310	€ 71.310
VoIP Trunking	€ 54.750	€ 54.750	€ 54.750	€ 54.750	€ 54.750
IPTV - Additional Channels	€ 4.380	€ 4.380	€ 4.380	€ 4.380	€ 4.380
IPTV - Video on Demand	€ 8.760	€ 8.760	€ 8.760	€ 8.760	€ 8.760
IPTV - Support & Content License	€ 3.420	€ 3.420	€ 3.420	€ 3.420	€ 3.420
Total Costs	€ 323.798	€ 197.268	€ 188.585	€ 183.672	€ 181.482

Depreciations	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Equipment	€ -	€ 12.900	€ 12.900	€ 12.900	€ 12.900
All Equipment	€ -	€ 12.900	€ 12.900	€ 12.900	€ 12.900

Result	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Total Result	€ 50.632	€ 164.262	€ 172.946	€ 177.858	€ 180.048
Accumulative Result	€ 50.632	€ 214.894	€ 387.840	€ 565.698	€ 745.746

NPV	€ 50.632	€ 157.944	€ 159.898	€ 158.115	€ 153.906
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TOTAL	
Result	€ 745.746
NPV	€ 680.495

OPTIMISTIC SCENARIO						
Treasury	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	
ENTRY						
Capital	€ 15.000	€ -	€ -	€ -	€ -	€ -
Credit	€ -	€ -	€ -	€ -	€ -	€ -
Service Offering	€ 374.430	€ 374.430	€ 374.430	€ 374.430	€ 374.430	€ 374.430
EXIT						
Equipment	€ 89.500	€ -	€ -	€ -	€ -	€ -
Staff	€ 65.000	€ 68.250	€ 71.663	€ 75.246	€ 79.008	€ 79.008
Registration	€ 87.500	€ -	€ -	€ -	€ -	€ -
Interconnectivity	€ 74.988	€ 57.708	€ 45.612	€ 37.116	€ 31.164	€ 31.164
Service Fees	€ 71.310	€ 71.310	€ 71.310	€ 71.310	€ 71.310	€ 71.310
ANNUAL	€ 1.132	€ 177.162	€ 185.846	€ 190.758	€ 192.948	€ 192.948
ACCUMULATIVE	€ 1.132	€ 178.294	€ 364.140	€ 554.898	€ 747.846	€ 747.846

OPTIMISTIC SCENARIO						
Balance	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	
ASSETS						
Fixed						
Equipment	€ 64.500	€ 51.600	€ 38.700	€ 25.800	€ 12.900	€ 12.900
Current						
Cash	€ 1.132	€ 178.294	€ 364.140	€ 554.898	€ 747.846	€ 747.846
Accounts receivable	€ -	€ -	€ -	€ -	€ -	€ -
TOTAL ASSETS	€ 65.632	€ 229.894	€ 402.840	€ 580.698	€ 760.746	€ 760.746
LIABILITIES						
Capital Stock	€ 15.000	€ 15.000	€ 15.000	€ 15.000	€ 15.000	€ 15.000
Credit	€ -	€ -	€ -	€ -	€ -	€ -
Accounts payable	€ 50.632	€ 214.894	€ 387.840	€ 565.698	€ 745.746	€ 745.746
TOTAL LIABILITIES	€ 65.632	€ 229.894	€ 402.840	€ 580.698	€ 760.746	€ 760.746

CASHFLOWS						
0	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	
€ (20.000,00)	€ 1.132	€ 177.162	€ 185.846	€ 190.758	€ 192.948	€ 192.948

NPV	€ 680.495
IRR	119%