Modelling the Deployment of NGANs in a Competitive Market

Author: Albert Domingo Vilar
Director: Xavier Castillo Ferrer
INTRODUCTION
CURRENT SITUATION
NEXT GENERATION ACCESS
ASSUMPTIONS & BUILDING THE MODEL
ANALYSIS
CONCLUSIONS
WHAT IT IS OPTICAL FIBRE?

It is the medium and technology associated with the transmission of information as light pulses guided over a filament of transparent dielectric material, usually glass or plastic.

source: Bob Mellish
WHAT IT IS OPTICAL FIBRE?

- 1.56mm per fibre
- C band:
  \[ \lambda = 1530 – 1565 \]
  But also O, E, S bands used
- Typical attenuation: 0.25 db/km

source: Bob Mellish
WHAT IT IS GOING TO BE AN OPTICAL FIBRE?

- 96 fibres
- Diameter: 15mm
- Weight: 200 Kg/Km
- Deployment: manually or by winch

- 96 fibres
- Diameter: 8mm
- Weight: 50 Kg/Km
- Deployment: blowing

Source: Telecom Italia
Current Situation

TESAU PROPOSAL 2007

➢ LLU has been a success in bringing competition to access networks
➢ Alternative operators caution of the possible elimination of competition if TESAU is allowed to deploy its FTTH network

This leads to a CMT public consultation
PUBLIC CONSULTATION ABOUT NGAN, MAY 2007

- Main problem: ducts installation costs
- POSSIBLE SOLUTIONS:
  - Using ducts of the SMP operator, in this case TESAU’s ducts
  - The use of the electrical, gas and water ducts
  - Also metro tunnels and sewers are considered

CMT 2008 RESOLUTIONS
CMT 2008 RESOLUTIONS

MAIN DISCUSSIONS:

- Allow access to TESAU ducts for other operators that want to deploy fibre, so they can use them. (in this case includes posts)

- Give all the information about their fibre deployment plans to all the operators. In this way the places that are going to be connected with new fibre becomes public information.

- Virtual loop on the service offered by FTTH-GPON.
Current Situation

CMT 2008 RESOLUTIONS

> MAIN DISCUSSIONS:

> Allow access to TESAU ducts for other operators that want to deploy fibre

**June**

> TESAU must give all the information about their fibre deployment plans to all the operators. After giving this information, TESAU may start selling TRIO FUTURA under a pilot project scheme

> Virtual loop on the service offered by FTTH-GPON.
**PROPOSALS 2008**

- **MAIN DISCUSSIONS:**
  - TESAU can start to sell its FTTH service TRIO FUTURA

---

**November**

Trío Futura 30 Mb Familiar DVR

Telefónica le ofrece una nueva gama de servicios de última generación, disponibles gracias a la tecnología más innovadora, fibra óptica hasta su hogar.
PROPOSALS 2008

MAIN DISCUSSIONS:

- It has created Carpe, a tool that contains all TESAU’s ducts and is available to all operators that want to deploy a fibre network.
Nowadays Situation

PROPOSALS 2008

MAIN DISCUSSIONS:

Spain is classified with 2 zones:

Zone 1: where TESAU < 50% of market
(fewer constraints)

Zone 2: where TESAU has SMP
(all constraints applied)
CMT RESOLUTION OF 22\textsuperscript{ND} JANUARY ON 2009

- MAIN CONCLUSIONS:
  - All the Spanish country is ruled by the same constrains (no zones 1/2)
  - Services up to 30Mbps have to be offered by TESAU under wholesale agreement (market 5)
  - TESAU must provide access to its ducts with a cost oriented rental price to other operators (market 4)
The main objective of this thesis is to build a simple model that will explain how new operators will take investment decisions relating to a new Fibre To The Home Network roll out. The model is for a highly populated zone like Barcelona’s Metropolitan Area.

The thesis simulates the deployment costs for an operator following CMT’s recommendations. Issues like the duct’s rental prices, or the economic returns for a second operator that must replicate the telecommunications network deployed in parallel to the incumbent, are addressed.
Next Generation Access

FTTX FIBER TO THE “X”

- Active or Passive Fibre to the HOME

- Inside a dense area we have chosen passive solution
POINT TO POINT (P2P)

Estimated Power consume: 8KW
POINT TO MULTIPOINT (P2MP)

Optical Centre

4096 users
64 fibres

OMDF 64

Splitter 1:64

64 fibres

Backbone connection

Estimated Power consume: 1.4KW
Next Generation Access

FTTX FIBER TO THE HOME GPON

OLT

1550nm

1490nm

1310nm

TV

C

B

A

A

B

C

1550nm

1490nm

1310nm

TV

C

B

A

A

B

C

1550nm

1490nm

1310nm

TV

C

B

A

A

B

C

1550nm

1490nm

1310nm

TV

C

B

A

A

B

C

ONU

Passive splitter

A

B

C
The model

OPERATOR’S TYPES

Content /Service Provider

Communications Provider

Infrastructures Provider

Home consumer

The model separates the operator costs in:

- infrastructures
- communications
- services
The model is for an Integrated Vertical Operator like TESAU
The model

INFRASTRUCTURES

<table>
<thead>
<tr>
<th>Ducts installation case</th>
<th>Cost/metre</th>
</tr>
</thead>
<tbody>
<tr>
<td>normal ditch</td>
<td></td>
</tr>
<tr>
<td>Road</td>
<td>62,00 €</td>
</tr>
<tr>
<td>Footpath</td>
<td>80,00 €</td>
</tr>
<tr>
<td>Grass verge</td>
<td>42,00 €</td>
</tr>
</tbody>
</table>

Miniditch
Cost -> 50%
### RENTAL PRICE INSIDE THE MODEL

\[
\beta_i = \sigma \cdot \text{Nowadays Cost Oriented installation}
\]

<table>
<thead>
<tr>
<th>Ducts rental</th>
<th>( \beta_i ) [Cost €/metre year]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road</td>
<td>3,10 €</td>
</tr>
<tr>
<td>Footpath</td>
<td>4,00 €</td>
</tr>
<tr>
<td>Grass verge</td>
<td>2,10 €</td>
</tr>
</tbody>
</table>
INFRASTRUCTURES

- Extra fibre: 15%
- Assuming 21% ducts filling
- Rent from A to B
SYMMETRIC OBLIGATIONS APPLIED
The model

ASSUMPTIONS INSIDE BARCELONA’S BUILDINGS

<table>
<thead>
<tr>
<th>Deployment</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other operator</td>
<td>30%</td>
</tr>
<tr>
<td>Facade</td>
<td>40%</td>
</tr>
<tr>
<td>New deployment</td>
<td>30%</td>
</tr>
</tbody>
</table>
**COMMUNICATIONS**

<table>
<thead>
<tr>
<th>OLT</th>
<th>cost/number of homes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000 homes</td>
<td>60,000,00 €</td>
</tr>
<tr>
<td>2000 homes</td>
<td>100,000,00 €</td>
</tr>
</tbody>
</table>

**INFRASTRUCTURES & COMMUNICATIONS MODEL**

User Set top box | Cost
--- | ---
1 Set top box | 200,00 €

$$A_i = \frac{T_i}{2000} \cdot \text{OLT cost} + P_i \cdot \vartheta_i \cdot \text{ONU cost}$$

OLT cost/number of homes

- 1000 homes: 60,000,00 €
- 2000 homes: 100,000,00 €

**PF = 1500 m**, **HF = 345 m**
The model

SERVICES

➢ IP-TV
➢ Healthcare
➢ Home Security
➢ Homeworking//Teleworking
  ▪ SAAS
➢ Education
➢ Others:
  ▪ Gaming
  ▪ Videoconference
  ▪ 3D services
  ▪ Karaoke
SERVICES

<table>
<thead>
<tr>
<th>Service</th>
<th>Fibre Triple Play</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator</td>
<td>59,00 €</td>
</tr>
<tr>
<td>Access</td>
<td>10,00 €</td>
</tr>
<tr>
<td>Vat (16%)</td>
<td>11,04 €</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>80,04 €</strong></td>
</tr>
</tbody>
</table>

Services are incremented but price is maintained through 20 years

Services’ cost is assumed as 15€ per home and month

<table>
<thead>
<tr>
<th>Service</th>
<th>Fibre Triple Play</th>
</tr>
</thead>
<tbody>
<tr>
<td>TESAU</td>
<td>85,90 €</td>
</tr>
<tr>
<td>Access</td>
<td>13,97 €</td>
</tr>
<tr>
<td>Vat (16%)</td>
<td>15,98 €</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>115,85 €</strong></td>
</tr>
</tbody>
</table>

OTHER ASSUMPTIONS
- Discount rate 10%
- Inflation rate 4%
CASH OUTFLOW

- Fibre: 22%
- Renting Ducts
- Splitters: 8%
- Home deployment: 7%
- OLT/ONU: 9%

5 years investment: 54%
The model

CASH OUTFLOW

- Fibre: 2%
- Renting Ducts: 3%
- Splitters: 6%
- Home deployment: 6%
- OLT/ONU: 83%

20 years investment
**The model**

# ROLL OUT TYPES

<table>
<thead>
<tr>
<th>Deployment</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deploy 1</td>
<td>Start with a neighbourhood and then cover Barcelona in a slowly way.</td>
</tr>
<tr>
<td>Deploy 2</td>
<td>Low and slow penetration model. Reaching 39% of the coverage area in 20 years.</td>
</tr>
<tr>
<td>Deploy 3</td>
<td>Deployment step by step, it has been taken as the double of deployment 2.</td>
</tr>
<tr>
<td>Deploy 4</td>
<td>10% of area covered each year, up to 90% in 9 years, then slow growth to reach nearly all Barcelona homes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Barcelona’s % buildings connected</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Years</strong></td>
</tr>
<tr>
<td>Deploy 1</td>
</tr>
<tr>
<td>Deploy 2</td>
</tr>
<tr>
<td>Deploy 3</td>
</tr>
<tr>
<td>Deploy 4</td>
</tr>
</tbody>
</table>
## The model

### ROLL OUT TYPES

<table>
<thead>
<tr>
<th>Deployment</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deploy 5</td>
<td>5% of annual deployment step</td>
</tr>
<tr>
<td>Deploy 6</td>
<td>Aggressive deployment, 80% coverage reached in 3 years and 90% in 5, it is nearly growing 30% during the three first years</td>
</tr>
<tr>
<td>Deploy 7</td>
<td>Aggressive start-Moderate growth</td>
</tr>
<tr>
<td>Deploy 8</td>
<td>Standard model</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Barcelona’s % buildings connected</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Years 1</td>
</tr>
<tr>
<td>Deploy 5</td>
<td>5,0%</td>
</tr>
<tr>
<td>Deploy 6</td>
<td>30,0%</td>
</tr>
<tr>
<td>Deploy 7</td>
<td>15,0%</td>
</tr>
<tr>
<td>Deploy 8</td>
<td>20,0%</td>
</tr>
</tbody>
</table>
Duct’s rental price $\beta_i$

$\beta_i = 1.92 \, \text{€}$

Average of the 8 models

<table>
<thead>
<tr>
<th>Mean Case</th>
<th>Market Penetration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Years</strong></td>
<td>1</td>
</tr>
<tr>
<td><strong>Low</strong></td>
<td>2,0</td>
</tr>
<tr>
<td><strong>Medium</strong></td>
<td>3,0</td>
</tr>
<tr>
<td><strong>High</strong></td>
<td>5,0</td>
</tr>
</tbody>
</table>
Impact variables

Average cost per home 1800 €
Cost per home between 900 € and 5178 €
Impact variables

- Average cost per home 1500€
- Cost per home between 900€ and 4000€
Model 8 -> reaching 115,000 homes in 20 years

- Impact variables

- Total cost per home [€]

- Years

- Cost per home
- Ducts' rental
Impact variables

Model 8

Cost per home [€]

0  2  4  6  8  10  12  14  16  18  20

Years

0  500  1000  1500  2000  2500  3000
Model 8

Impact variables

Rental ducts cost (€)

Years
Impact variables

- Duct’s rental price $\beta_i$ around 1€
  - Paris sewers 0,65€

- Councils decisions
  - Allow aerial cable, facade installation...

- Resolution of 22\textsuperscript{nd} January is valid until when?
  - People wanting 100Mbps?
  - Competition with speeds higher than 30Mbps?
  - Only TESAU deploying fibre?
DIFFERENT MODELS BRING DIFFERENT INVESTORS

MODEL 2
- Step by step
- 10 m € peak funding
- Covering 39%

BCN in 20 years

RETURN:
- 3 – 4 years to positive NPV
DIFFERENT MODELS BRING DIFFERENT INVESTORS

MODEL 6
- Covering BCN
- +300 M € peak funding
- Covering 99% BCN in 10 years

RETURN:
- +20 years to Positive NPV
IDENTIFIED RISKS:

- HOMEOWNER’S ASSOCIATIONS
- PRICE ACCEPTANCE OF THE SERVICES
- TESAU OWNS & FILLS ALL THE INSTALLED DUCTS
- HUNDREDS OF MILLION EUROS NEEDED TO ATTAIN A SIGNIFICANT COVERAGE
- OTHER TECHNOLOGIES MAY APPEAR MAKING GPON OBSOLETE OR EXPENSIVE
WHO IS GOING TO INVEST?

-Costs of FTTH-GPON are not a few Million €

-Only cover Barcelona and Madrid, or we want an ENTIRE country connected?

-20 years to recover an inversion is not possible for an operator that spends hundreds of million Euros, or yes?

-Cost per home is not going to be the same for a new operator than for TESAU
WHAT IS THE REGULATION MODEL?

- If there is a high user demand the model is clear:
  - Integrated Vertical operator that offers the service that the final user is searching for. (IPTV; HD; VOD...)

- If the Network is first and we wait for new services to appear:
  - We are searching an open model that is implemented with separated layers to allow maximum flexibility and usually its funds come from public administration

- BOTH CASES ARE IN NEED OF A REGULATION MODEL THAT ENSURES THEIR POSSIBILITIES
El codificador inteligente

El codificador del futuro será un pequeño ordenador que incluirá al clásico ‘ratón’. A este codificador se le podrán conectar el teléfono, el ordenador, la cámara de vídeo y el televisor.

FIBRE IS NOT NEW

Las rutas: fibra óptica y cable coaxial
En España, la nueva tecnología de la CATV utilizará la fibra óptica o el cable coaxial, o combinará ambos. Algunas redes serán de fibra óptica, y las terminales en las hogares, de cabo coaxial.

La 'superanálisis'
La densa red viaria de la TV, formada por miles de televisores de cada hogar

Satélite
Los programas se transmiten a un satélite que remite la señal a una estación terrestre

Nodo
Barrio o municipio

Cada nodo sirve a un barrio o a un municipio, y de esta configuración se extraen imágenes, sonidos o datos

La fibra óptica
El cable de fibra óptica es un guaño de "medios" de vidrio que transportan pulsos de luz.
La TV por cable sufre interferencias

La ley que prepara el Gobierno para regular este importante sector audiovisual sigue congelada

Según un estudio, los municipios catalanes interesados en esta infraestructura de futuro

Un cable de fibra óptica telefónico puede transmitir 3.5 millones de conversaciones simultáneas

FIBRE IS NOT NEW:
Conclusions

WE WILL NOT SEE A HUGE NUMBER OF FTTH DEPLOYMENTS

WE WILL NOT SEE A FAST DEPLOYMENT

WE ARE EXPECTING THAT MUNICIPALITIES AND COUNCILS WILL START THEIR OWN NGAN PROJECTS WITHOUT ANY GUIDANCE?

WE NEED A NEW REGULATION
- Spanish regulation partially protects INTEGRATED VERTICAL MODEL

 sonday we have regulation, maybe tomorrow no ！！！！

- Today TESAU can bring it to the Audiencia Nacional!!
THANK YOU
albert.domingo.vilar@gmail.com