THE CASE FOR SMART CITY COMMUNICATIONS OPERATORS

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This document provides an introduction to, and overview of, local real estate fibre optic broadband and TV communications operations. It provides real estate developers with a guide to the possible business models, technical options and general approach to making the best use of modern telecom technology to enhance the value and enduring attractiveness of your property.

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This white paper is an independent public report produced by Ventura Team LLP sponsored by MEFC (Middle East Fibre Cable Manufacturing Company).

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In consulting, we have planned and implemented millions of homes passed, worked on covering hundreds of millions of people with mobile, optimised investments of up to $3 billion and saved up to 25% of network deployment costs for our clients.

Our new venture, Ventura Next, designs, builds and manages incredibly efficient and profitable operations for network owners who lack the time, expertise or confidence to exploit their own passive network asset - helping them to increase take-up, generate higher revenues and deliver world-class services to users. Our team has the systems and skills to deliver state-of-the-art FTTH solutions building on our Swedish heritage in delivering FTTH networks since 1999.

Since its inception in 1995, Middle East Fiber Cable Manufacturing Co. (MEFC) has established itself as a leader in manufacturing optical fiber cables for telecommunications and industrial sectors.

Headquartered in Riyadh, Saudi Arabia, MEFC is a Saudi-Japanese Partnership it has established this partnership in 2007 with Fujikura a well-known and along established company in fibre and cable industry.

1 Introduction and Summary

The public's expectations of their living and working environments are constantly increasing - , particularly regarding the speed of the Internet and the control that they have over their immediate surroundings. Compared to the overall cost of real estate construction, telecoms, entertainment and smart city systems need relatively little investment. However, they add significant value and attractiveness to a development and can materially increase sale values, occupancy and / or yields. Several studies in different countries have found that there is a premium for a property with fibre connectivity ranging between 2% and 4% of the value of the property. In other words, the selling price of a development with fibre is higher than one without. This value uplift pays for the fibre many, many times over which is why it is now such a popular feature with real estate developers.

The real estate developer can provide at low cost what is otherwise one of the most costly elements of the international telecom network - the "last mile". Developers are increasingly interested in leveraging this 'game changing' investment instead of simply turning it over to the telecom operators. In some countries, notably Sweden, a new class of local Communications Operator has developed that helps the real estate owner ensure that their optical fibre is used to best effect and to provide tenants / purchasers with as wide a range of telecom and smart building services as possible.

This analysis shows that the saving in total network build cost made by developers that install networks in their developments (coloured green) is significant to the telecom industry.

In this white paper we describe the concept, costs, practical issues and potential benefits of establishing a fibre communications operator for major real estate developments (whether business, residential or mixed).

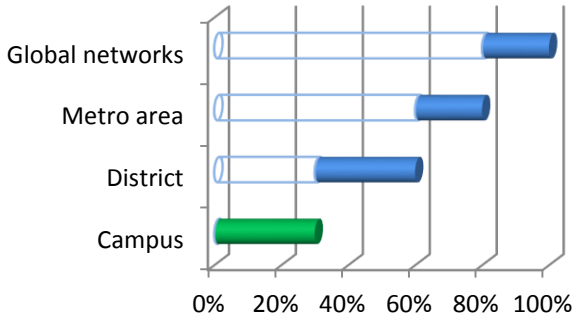


Figure 1 The Basic Total Capital Cost Structure of the Internet.

2 SMART Buildings / Cities Need Neutral Open Fibre

The real estate company or residents association generally wants to maximise the range of available services and service providers (like broadband companies) available in a location. This is very much consistent with the idea of open access, in which the fibre optic cables are available to all telecom service providers, enabling a choice of operator for the customer. The open access model is quite different to the traditional telecom operator model where an operator owns - or at least controls - the wire into the customer's premise in what is essentially a monopoly.

Such provision of services by a single company means the operator is responsible for all aspects of service delivery including installation and appropriate equipment for end-users. One benefit of this is that both residential and business subscribers know exactly who is responsible for identifying and resolving service issues. However, in cases where the operator is not responsive, the lack of any alternative can make the process of ordering, installing, providing and maintaining a service very

frustrating. Unfortunately, the result of a local monopoly has usually been poor customer service, high prices and performance / products that are well below world-class standards.

All too often, this traditional 'single operator' approach has disadvantaged real estate owners / managers:

- Weak negotiating position due to operator monopoly – real estate client is unable to take a revenue share or often even modest access fees;
- Limited or no motivation for the operator to 'do better' or even meet reasonable customer service standards as the market is essentially captive for them;
- Limited probability of meaningful service innovation due to lack of competition;
- Difficult for the property owner to 'add' in their own value-added services to the local network such as surveillance, access control etc.;
- Poor reputation for the development's communications – leading to potentially lower prices and take up for the development.

Our view is that these challenges mean that open networks are superior, with the inherent competition between operators driving improved services and pricing for customers. This approach also enables the addition of the Estate Management Services outlined in Figure 3 – a significant enabler in differentiating their development and creating a signature set of services.

Services for Residents	Estate Management Services
• Choice of fast broadband provider • Choice of over-the-air or Cable TV • Choice of Cable TV operator • Choice of telephone provider • Integrated HD quality video entry phone • Remote climate / lighting control • In-home secure video or motion sensors to keep tabs on the elderly for example	• Monitoring climate control, lighting • Building information gathered in real time • Surveillance, security and alarms • Recording of HD video of doors ad entry phone use • Remote meter reading • Occupants can check utilisation of common facilities like garages, tennis courts or laundry rooms using live local video

Figure 2 Typical Range of Services on an Open Local Network

Whether this approach is possible at a particular location will depend on the proximity to existing operator networks (or an open metro area network), local regulation and the maturity of the open access ecosystem in that city.

3 The Concept of Open Access Fibre

The real estate company or residents association generally wants to maximise the range of services and service providers (like broadband companies) available in a location. This lead to the idea of *open access,* in which the fibre optic cables are available on reasonable terms to any and all service providers – promoting competition and expansion of the services available.

The open access model is quite different to the traditional telecom operator model where an operator owns or at least controls the wire into the customer's premise in what is essentially a monopoly. The result of that monopoly is usually poor customer service, high prices and performance / products that are well below world-class standards. Critically, this means that the real estate owner rarely can monetise their own network but instead is beholden to the monopoly.

3.1 Characteristics of Open Access Networks

Open Access is an approach where the local network is owned and controlled independently from the telecom and TV operators. The organisation that runs the network for the owner is often refered to as a *Communications Operator*. The customer never deals directly with the Communications Operator (CO) but may see an online shop or "services supermarket" provided by the CO and where they (the customers) can select different services. The retail service providers compete to deliver telecoms services using the open network on an equal basis.

The open networks themselves are typically Fibre to the Home (FTTH) and so can deliver superfast broadband speeds to customers. This means download speeds of up to 1 Gigabit/s and the ability to provide symmetric services where the upload speed is the same as the download speed. This capability is unique to fibre and other fixed broadband technologies such as cable, ADSL and VDSL cannot provide this raw speed nor symmetry.

The diagram below shows a number of variations for the operation of a network. Vertically, it shows three different parts to help understand who does what in each variant:

- The Service Layer represents the delivery of content and services to end users by Retail Service Providers (RSPs);
- The Active Layer represents the active electronics run by the local Communications Operator;
- The Passive Layer represents the optical fibre cable and ducting built and owned by the real estate developer (or their successor asset management company).

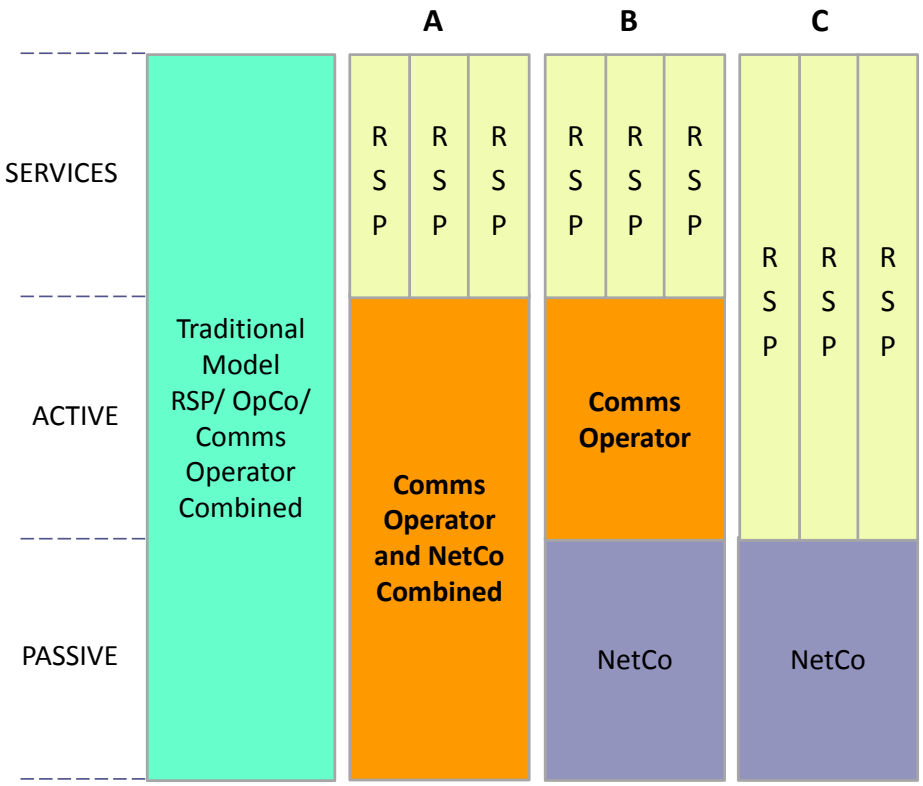


Figure 3 Comparison of Different Models (A, B, C) of Open Access and the Traditional Monopoly Model

Unlike the traditional network, which is shown by the green left-hand block in Figure 4, the Open Access network models (A, B and C) separate the management of the local campus network from the supply of services by Retail Service Providers. There are then a number of possible variants of the open access approach:

- In model A (in figure 4), known as Wholesale Open Access, one company runs and operates the network but other companies (referred to as Retail Service Providers – RSP's) deliver services and content directly to end users.
- In model B, the model is slightly more complex. The Communication Operator runs the network on behalf of the fibre owner (NetCo) but again, services and content are delivered by retail service providers. This is typical for municipality networks in countries like Sweden.
- Model C is referred to as 'Full Open Access'. Service providers directly rent fibre into each premise. This model is simple and can work well if the range of service providers is very limited or the real estate company does not to enable a wider range of smart home or smart city services.

For consumer and small business projects, model B is the most common. It is often costly and difficult for service providers to orchestrate pragmatically the rental of dark fibre directly to a home - although it is not unknown. The diagram below shows the value chain in Model B and shows the main functions of the Communications Operator (in green).

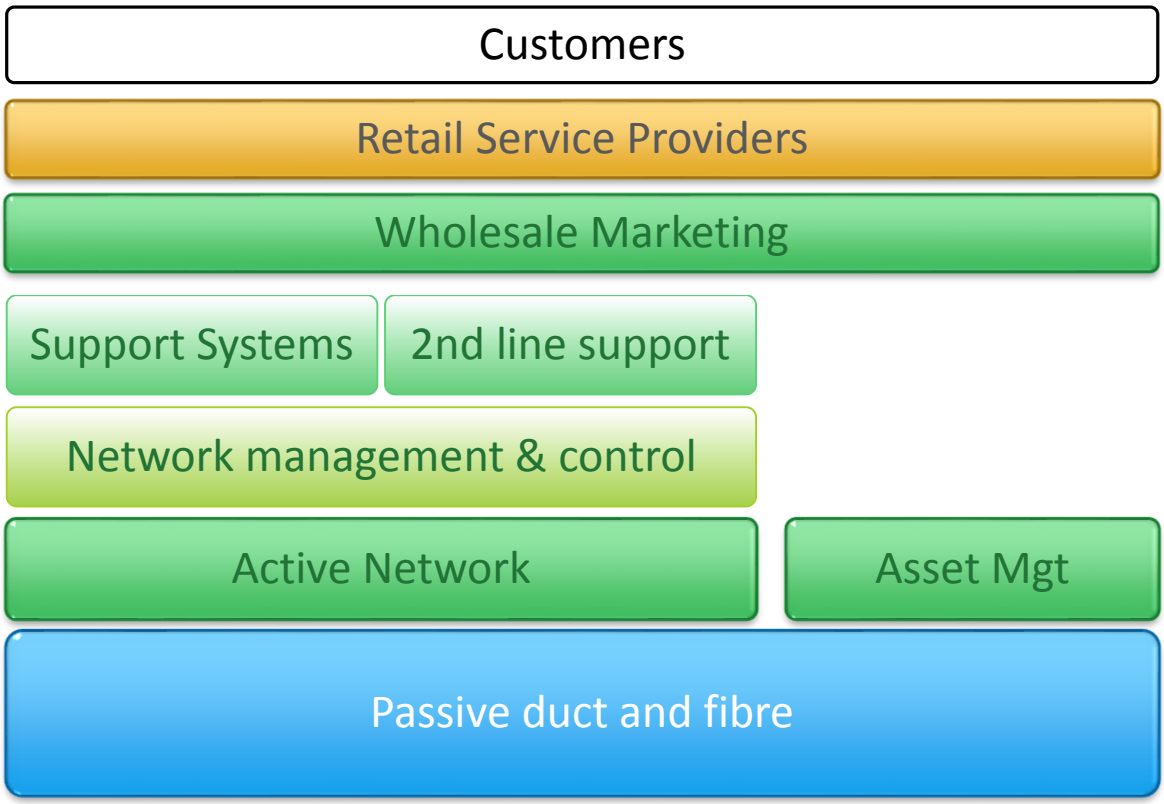


Figure 4 Value Chain of a Typical Local Fibre Project – the Communications Operator generally delivers the activities shown in green for the fibre owner (blue)

Example of City-wide Open Passive FTTH: Muscat, Oman

In Oman, the combined construction of a new sewage system and modernisation of existing sewers created the opportunity to include ducts for FTTH during the trenching process, almost for free. At this point, there was no competition for fixed services in the Sultanate. The open access approach was seen as helpful in attracting new operators to the Sultanate as the traditional barrier to entry of high capital expenditure is avoided. Having multiple service providers able to use the network should also ensure higher take up by users compared to a single operator approach.

The approach chosen was open access to fibres by creating a number of overlaying GPON networks – each to be used by a different service provider. The network operator provides the service providers with a point of connection and the service provider installs the necessary customer premise equipment (CPE) in homes or businesses.

4 Alternative Approaches to Local Network Design

There are numerous possible different designs for a local network but here we describe the three main types. Of these, the all fibre network is rapidly becoming most popular in the GCC region and is the most future-proof.

4.1 Cabling – the Passive Layer

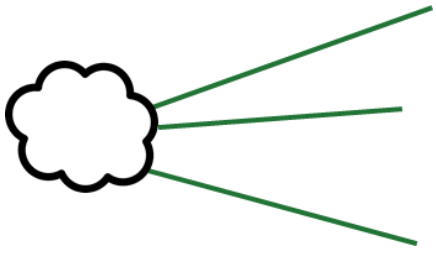
The terms *structured cabling* or *premise cabling* refer to the wires both inside buildings and between buildings in restricted geographic areas like residential developments, a campus, data centres or business parks. Cable designs follow industry standards (defined by TIA-568 or ISO/IEC 11801 and related standards) that are used for LANs, telephone systems and even other systems adapted to structured cabling like CCTV, security or building management.

There are four major types of communications cabling available for data networking today: unshielded twisted-pair (UTP), shielded or screened twisted-pair (STP or ScTP), coaxial, and Fibre-optic (FO). In thinking about cabling, it is important to distinguish between backbone cables and horizontal cables:

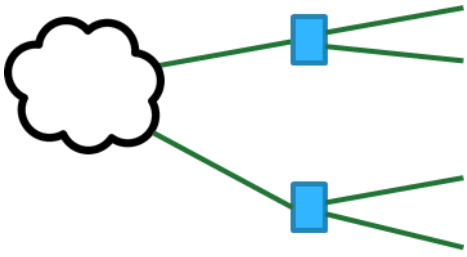
- backbone cables carry high traffic volumes and connect network equipment such as servers, switches, and routers and connect equipment rooms and telecommunications rooms;
- horizontal cables run from the nearest telecommunication rooms or switch in a riser (say) to the wall outlets in the home or office and generally serve a single customer or user.

For new installations, single mode fibre optic cable is essentially universal as a backbone cable[i]. Fibre is also increasingly popular for the 'horizontal' connection to the wall outlet as well but imposes a slightly higher initial equipment cost than using the more traditional Ethernet.

Using fibre all the way into the home requires some electronics in the apartment but saves money and space in installing numerous traditional parallel wiring systems. With fibre, the central equipment could be several kilometres away allowing a large number of customers to be served for a single place making repairs and operations much easier and cheaper. We recommend that; between this aggregation point and the home, a pair of fibres (or two pairs for ultimate future proofing) run all the way. The alternative is to use a tree and branch type arrangement called a Passive Optical Network (PON), which is usually a little lower cost but much less flexible in the long term. The balance of costs and benefits must be assessed for each specific development.



With point-to-point fibre pairs of fibre run all the way from a central point to each home so near the centre thousands of fibres are required



The PON approach is to share a fibre and split the signal down to each home (usually 32x or 64x) at a point in the basement (say)

Figure 5 Schematic of point-to-point fibre and a passive optical network using a tree and branch structure

However, unless the development is large, or on the scale of a small city, then it is probably still lower cost overall to use a combination of traditional coax TV cable and CAT5e or CAT6 from the apartment to the riser.

This arrangement can provide broadband up to Gigabit speeds as well as deliver any conceivable property owner or new specialised service simply by using well-understood, mass-market, Ethernet technology. Standard Cat5e copper cabling for broadband runs from the home to a powered device called an Ethernet switch in the riser or perhaps an equipment room nearby.

With Ethernet, equipment must be no more than 90 metres from the customer although this is only very rarely a practical limitation.

Figure 6 Ethernet Cat5 cable and switch

In the table below, we compare the merits of these three main alternatives for the passive layer (i.e. the cabling).

	Cables installed	Pros	Cons
Traditional	1) TV coax from roof 2) Copper telephone wire 3) Entry phone wires 4) Alarm wires 5) Cat5e or fibre 6) Cable TV coax	Well understood	Expensive Complex cabling is more costly to manage and repair
All fibre	1) One (or two) pair(s) of fibres to each apartment or typical small office	Simplest and cheapest cable installation Enables single area aggregation point serving thousands of customers	Not yet common so installation skills issues Optical interfaces still cost slightly more than analogue
Hybrid	1) TV coax from roof 2) Cat5e from riser to apartment 3) Fibre in riser 4) (Optional CATV coax)	Draws on conventional cabling installer skills Delivers full range of services inc. broadband up to Gigabit speeds	Requires active equipment and power around the property

Which approach is best in a specific development depends on local conditions, the availability of competing telecom operators and the approach to active services (which we discuss in the next section).

4.2 Active Layer: Enabling Service Provision

One of the more confusing aspects of real estate telecom is the question of what is the best technical architecture for providing services. It often seems that every equipment vendor has their own different approach and there is an almost ideological divide between proponents of GPON (a tree topology) and those of point-to-point fibre (a star topology).

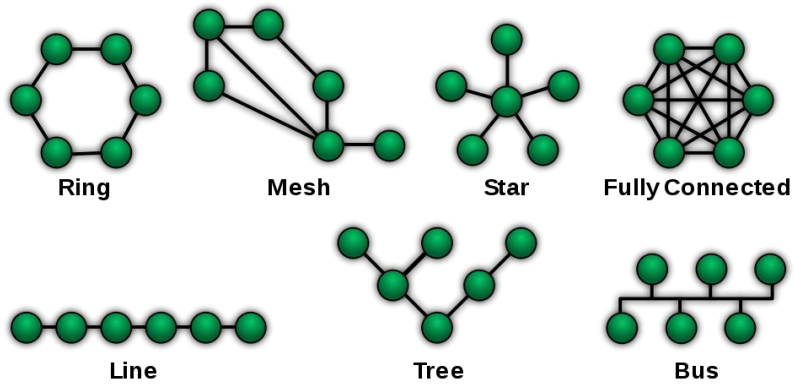


Figure 7 Alternative Telecom Active Network Topologies (Source: Wikipedia)

Based on long experience our clear recommendations are to:

- build an **active star** network;
- if there is existing Cat5e for the final connection its most practical and lowest cost to re-use it;
- for new-builds use **point-to-point fibre** with the hub of the star being in a large central facility to minimise operating costs and make operation easier.

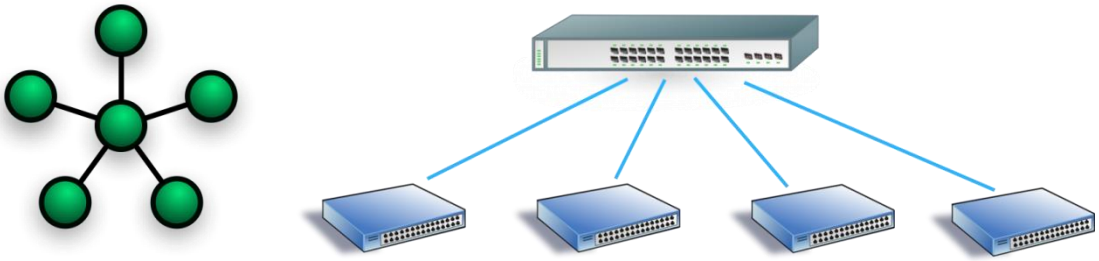


Figure 8 In an Active Star network the access nodes (blue) are each directly connected over fibre to an aggregation node (green). Traditional Cat5e connects the customer to the access node.

In established real estate developments where fibre is scarce, or perhaps ducts are full making it too costly to install more, then our recommended fall-back is a ring topology as shown below. However, a fibre access ring should not have more than seven switches in serial configuration – and preferably fewer.

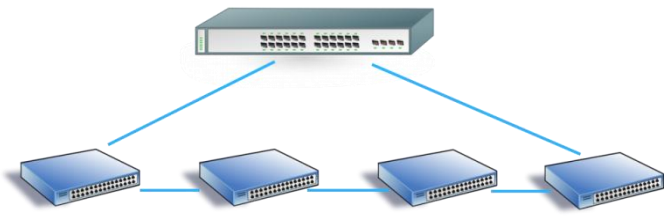


Figure 9 Where fibre is scarce the second – albeit inferior – choice is a ring

5 Commercial Business Models and Typical Financials

There is considerable innovation around the world in the commercial models for local fibre / real estate telecom networks. Underlying the different models are the tensions between the different economics of the layers of the value chain. These are set out below.

Layers	Characteristics	Asset Life (years)	EBITDA Margin
Telecom services, cable TV, Apps	These are services. Providers rely heavily on content, branding, customer service and pricing to differentiate one from another.	<5	15%-20%
Wholesale	One company provides and operates the active equipment so ensuring the lowest cost for all.	7	20%-25%
Optical fibre	The optical fibre and ducts are best built-in during the construction of a development. Usually they remain the property of the building owner, although the owner may use the wholesale operator as an asset manager.	Fibre 25	97%[R1]
Ducts & trenches		Ducts 40+	

Figure 10 Layers of the network value chain. Each layer may be provided by a different company although usually the two lower blue layers are built and owned by the real estate owner

Of these, clearly the lower two blue layers in figure 11 represent the most natural for a real estate developer to construct and own in the long term. They are real estate assets with long lives and low running costs. In contrast, the active layers comprise electronics and software undergoing constant technological change and imposing significant operating costs compared to revenues. Asset lives are at most seven years. There are two main alternative means of arranging the upper (green-shaded) service layers:

Parallel vertically integrated networks

One or more telecom operators and one or more cable TV operators use separate fibres from the developer to each provide rival networks. The co-existence of lots of networks is not economically viable in most cases so this approach tends to lead to a monopoly or duopoly in a development.

In such cases, a fixed term concession contract is used so that there is a chance to change away from an underperforming operator once every few years.

A single wholesale operator serves various retail brand operators

More effective in providing a range of choice is to use a wholesale communications operator such as VenturaNext which has developed a *services supermarket™* system for this purpose. In this arrangement, the local active equipment is both provided by, and operated by, the wholesale communications operator. This operator provides connections to the customer rented to each branded retail service provider as and when they attract a customer.

This model requires the wholesale operator to have attracted brands to its platform and in the early years in any country, the major operators will often decline to use such a system preferring instead to defend the traditional vertically integrated model. Local circumstances will therefore vary.

5.1 Closed verses Open Networks

After more than a decade of open access fibre, Sweden has a richer variety of experience than anywhere else in the world. What has emerged in Sweden is a clear local geographic split between the closed (vertically integrated) cable TV and telecom networks in some areas and the open fibre networks in others. The open networks were built by a municipal utility, housing corporation or major real estate developer following the model of the pioneering municipal fibre utility, Stokab, in Stockholm.

This pattern, of a geographically and politically driven mix of open and closed networks, is spreading to many other countries. The exceptions are those countries where there is large-scale Government intervention that imposes a single national model, as in Australia, Qatar and Singapore.

5.2 Typical Revenue Shares in a Swedish Open Access Network

For open access networks, the diagram below shows how revenues are typically shared out between the three layers (the service provider, the wholesale communications operator and the fibre).

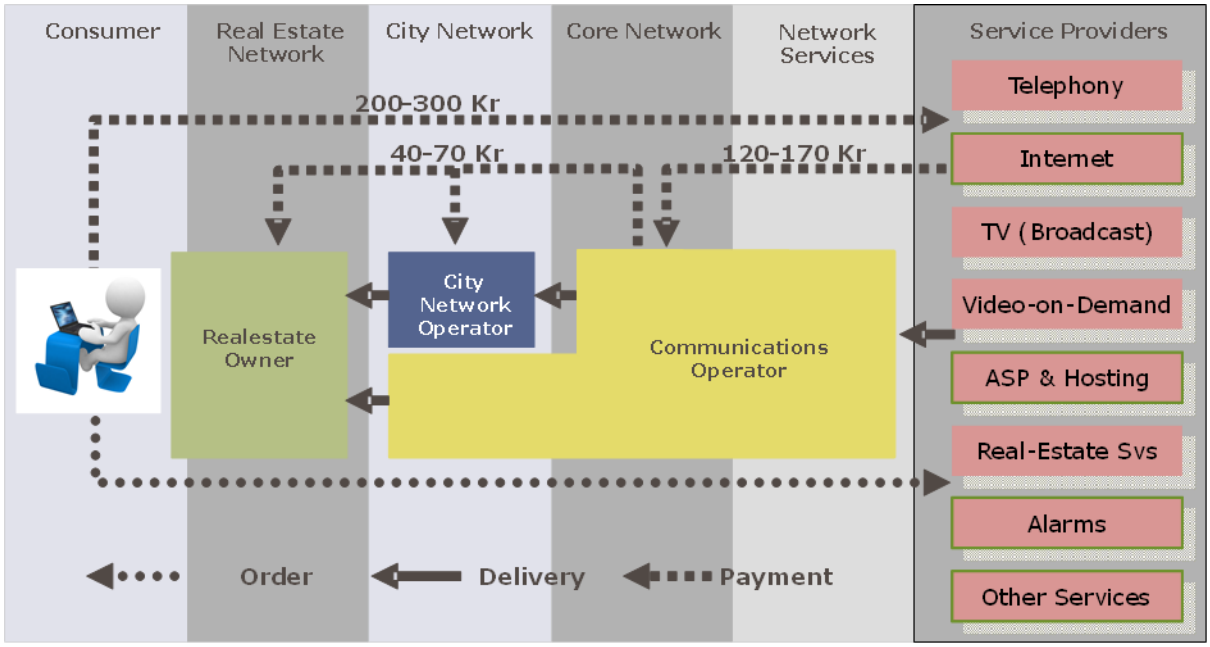


Figure 11 Example of Typical Payment and Service Flows in a Swedish Open Access Network

We derived this typical profile from our own operator's experience in Sweden. The consumer places an order for a service like TV, broadband, security alarm etc. through a Services Supermarket™ to the retail Service Providers. The service providers have connected at one central point to the wholesale platform, which then takes care of provisioning and operating their service down to the consumer at home.

When a new service has been provisioned, the consumer makes a payment each month to their service provider of 200 – 300 Swedish Kronor depending on the service and package chosen (this is about $32 to $48 per month).

The Service Provider pays the Communications Operator 120 – 170 Swedish Kronor depending on location ($19 to $29 per month) for delivery of the service and use of the network. In turn, the

Communications Operator passes on network access fees of typically between 40-70 Swedish Kronor per month in total ($6-$11) to both the citywide fibre owner and the local real estate fibre owner. The amounts paid vary between cities and often within a city area depending on who owns the specific fibre.

5.3 Example of Possible Revenue Share in a GCC Campus Fibre Network

If the developer achieves a 2%-4% uplift in initial sale value by enabling ultra-fast broadband at a development, then the profit from that is likely to be many times greater than the cost of establishing a local network operation with a suitable open access provider. Nonetheless, this section illustrates potential costs, and more importantly, the ADDITIONAL revenues over and above the uplift in real estate value.

Figure 13 illustrates possible revenue shares for a campus fibre network in the GCC region. In this example, we assume customers spend on average $80 a month on their broadband and other services. This figure is shown at the top of the waterfall.

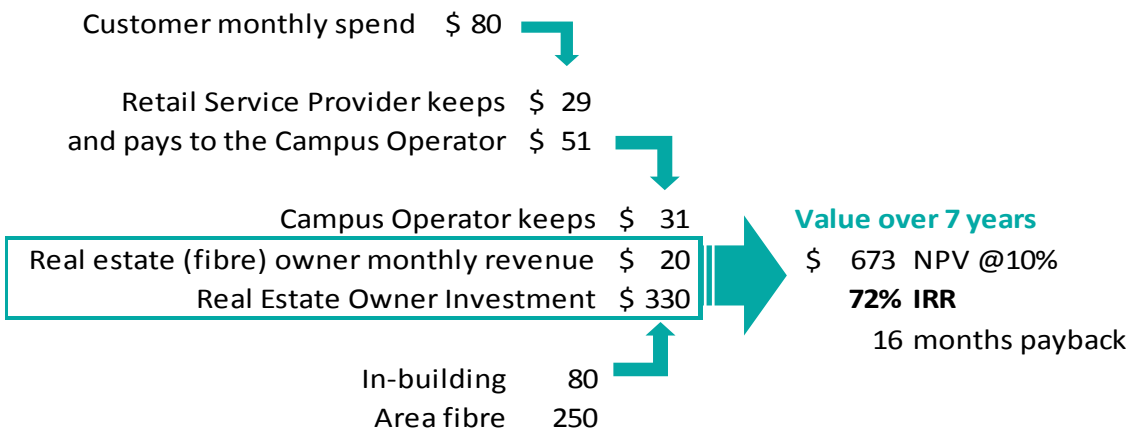


Figure 12 GCC Region Possible "Waterfall" of Revenue Shares

From the revenue collected by the retail service providers (like an ISP or a streamed television company), just over $50 will then be paid to the open access campus operator. This assumption reflects a mature environment in which such wholesale operators have a reasonably large customer base. In the early days of open access, retail service providers are likely to keep a much higher proportion of the revenue and indeed the campus operators may struggle to attract the big-name brands in a particular country.

The campus operator will keep around 60% of its revenue and passes the rest (being $20 per month in this example) on to the fibre owner. We have estimated in this example that the cost for the real estate developer of adding fibre to their development would be $330. This is quite a high figure because we have assumed wide area is fibres or that numerous developments are connected together across the city. Nonetheless, despite this relatively high cost in the example, the real estate developer enjoys the rate of return in excess of 70% per annum and a simple payback in less than two years. This return excludes the expected increase in sale values of the development.

6 Benefits to Stakeholders

Open access enables delivery of ultra-fast broadband alongside SMART building services from the first day of occupation of a new development – the most efficient and beneficial approach for all stakeholders. Each of the different parties involved sees their own set of benefits. We summarise these in the graphic below and describe them in detail in the sub-sections that follow.

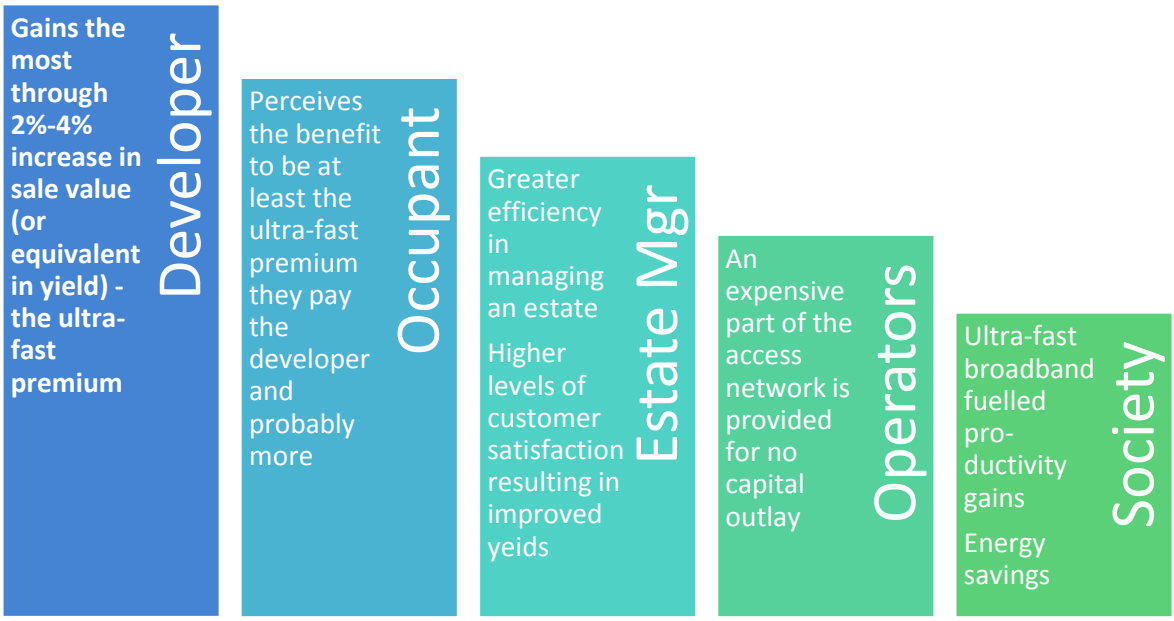


Figure 13 Society and Different Stakeholders Benefit from Local Telecom

6.1 Benefits to the Real Estate Owner/Developer

The major benefit for the Developer is the improved attractiveness of a development, which generates greater financial return. There are also other longer-term benefits as we set out below.

Attractiveness	Efficiency	Financial
•Ultra-fast broadband and communications "ready to go" are very popular and a great selling point •Has been shown to add 2%-4% to property value •Units rent faster leading to higher occupancy rates •State of the art security and building services provide a sense of safety and wellbeing	•Smart controls and monitoring can reduce energy use - for example by detecting problems such as doors left open that drive up aircon costs •Improved security reduces degradation •Early management interventions tend to cost less and prevent problems escalating	•Has been shown to add 2%-4% to property value •Monthly income (yield) on the fibre •Fewer separate cable types mean lower costs •Landlord portal reduces ongoing costs whilst also enabling a bettter relationship with occupants

Figure 14 Key benefits of open fibre for real estate owners and managers

Attractiveness improves because for an increasing number of businesses fibre, or rather the ultra-fast broadband that it enables, is a differentiator, if not already a necessity. For consumers fibre broadband is increasingly desirable for entertainment, lifestyle and work related activities.

As a result, it is increasingly the case around the world that the property already served by fibre is more attractive to buyers or to tenants. The general experience is that properties with fibre attract a price premium of between 2% and 4% on sale value. In the case of rented property, there is likely to be a price premium and an occupancy rate benefit for those with fibre.

In the longer term, the benefits of smart systems in providing a sense of safety and wellbeing as well as ease of management are also manifested in the increased attractiveness of the property, which leads to higher yields.

The fibre owner keeps long term control of their asset.

6.2 Benefits to the Occupant

For the initial sale of a new real estate unit, the "ready to go" availability of broadband is an important selling point. Provided prices are reasonable simple availability *with instant activation* far outweighs any other communications related benefit.

Over time of course, the occupant of a SMART development with open access will benefit from a choice of service providers so they can shop around and find the best deal. If one operator starts to provide poor service (whether in terms of technical performance or customer service) then they can move to another provider.

The end-customer can also use different services from different service providers, simultaneously. For example, cable TV from one company and broadband from another. This choice is popular and in the longer term, take-up and customer satisfaction are usually higher where multiple operators are present because of the wider variety of services. A study by Gonzalez et al for the Universidad Politécnica de Madrid, estimated that take-up for an Open Access Network will typically be as much as 15% higher than for a monopoly network.

6.3 Benefits to Estate Managers

For the real estate manager, efficiency benefits from telecom are also important and will last for many years. Intelligent building and control systems are constantly evolving and having the use of a future-proof fibre infrastructure means that whatever the latest systems or sensors are, there is the basic "nervous system" around the development to support them.

6.4 Benefits to Telecom Operators

Major telecom operators' first instinct will be to obstruct the development of real estate operators in order to defend their traditional business model. However, if such local infrastructures become widespread then we believe that overall there will be a benefit to telecom operators. This is because the access network is traditionally a highly capital intensive yet relatively low return part of the business. Therefore, if real estate developers provide that access infrastructure more efficiently, then the cost of access for the telecom operator will be lower. Operators will also avoid some heavy demands on financing access network construction.

As fibre networks have a lower operating cost than traditional networks (20% lower is a widely agreed figure) the more fibre there is, the more profitable the telecom operators can become.

6.5 Benefits to Overall Telecom Industry and to the Nation

In the European Union, the USA and many other parts of the world widespread use of faster broadband is believed to be a crucial factor in generating faster economic growth. Evidence shows that a 10% increase in the broadband penetration rate yields a GDP impact of around 1%.[ii] However, ultra-fast broadband is relatively new and its effects will be more difficult to measure than the introduction of basic broadband were. Because of these factors, there is a lack of empirical evidence and so the economic literature has not yet delivered firm conclusions regarding the impact of a migration to faster speeds.

However, most economists and policymakers accept that ultra-fast broadband will increase business & social productivity and also will stimulate the growth of new services and markets. Such innovation and evolution is the basis of economic progress.

A study by the University of Rome projected gains purely from the national deployment of ultra-fast broadband of 1.1% of GDP directly and a further 3.5% indirectly. They also estimated 1.1% more employment and a 14% improvement in welfare as measured by the United Nations Human Development Index.[iii]

There is also a view that by enabling the formation of new social relationships and communities of interest the general functioning of the economy – which relies on the free flow of price information, capital and on trust – will improve.

On a more mundane level, such networks could enable the better delivery of public services and experimentation in new areas like telecare. A range of new IP-based electronic public services such as e-government, e-learning, e-health, etc. could be prototyped and proved using these high-speed, responsive, networks as test-beds prior to wide deployment in later years.

End Notes:

[i] The relevant international standards are: G652 D , G657 A,B, C

[ii] Czernich, N., Falck, O., Kretschmer, T. and Woessmann, L. (2011), Broadband Infrastructure and Economic Growth. The Economic Journal, 121: 505–532. doi: 10.1111/j.1468-0297.2011.02420.x

[iii] http://www.cisco.com/web/about/ac79/docs/ps/UBB-in-Developed-Countries.pdf, : Cisco IBSG and University of Rome II Tor Vergata, 2011.

