salience consulting

Top 10 challenges with national broadband network projects

salience whitepaper

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Executive Summary

Many countries are currently either planning or implementing National Broadband Networks (NBN). The benefits from these developments are well articulated and governments often provide support for these projects through direct funding, subsidising the rollout and by making sure the right regulatory and legal framework is in place for successful deployment. We expect that the trend of deploying fixed-line NBNs based on fibre will continue for the next several years.

In our work we have often seen operators repeat the same mistakes as in previous deployments. This appears to be because NBN planners often do not devote enough time to learning the challenges faced by other NBN projects.

In this whitepaper we identify what we believe are the top 10 strategy, planning and implementation challenges related to new NBN projects. This is derived from our experience providing consulting to broadband operators.

Challenge 1: Unrealistic planning of deployment timeframes, budget and reliance on poor data: We have observed many examples of network deployment planning which has been based on little more than intuition. When good proactive planning has not been done, the rollout is jeopardised because decisions are made based upon poor data. The resulting plans do not properly consider the network architecture requirements or customer requirements, the serious challenge of land acquisition has been overlooked and skilled workers have not been available during the rollout.

Challenge 2: Deciding on a shared national passive or active fibre network: Too little consideration is given to the best physical network architecture. NBN operating companies can provide a passive access service, or an active bitstream service. This is an interesting challenge. Providing wholesale services using a shared active network has far lower upfront fixed costs and may therefore be a more attractive to service providers. However, in the face of uncertain demand for service, unless providers place high value on the strategic benefits of infrastructure ownership, any GPON architecture to support multiple operators means deploying overlay networks through same ducts.

Challenge 3: Defining and negotiating the role of the incumbent and its communication infrastructure: NBN deployments often do not manage the incumbent well. Unless an effective role is found for the incumbent, the NBN Company may find itself in conflict with the incumbent. The economics of FTTx network deployment is characterised by high fixed costs of which the dominant component is the civil works: digging the roads and laying duct. NBN deployment costs and timelines can be significantly reduced if an effective role is found for the incumbent and its existing duct network.

Challenge 4: Decision to reuse the last mile or replace all copper with fibre: This is a challenge because the decisions are often based upon an ideal of deploying fibre everywhere, rather than a plan for a realistic network evolution. For most Internet users, the services and speeds provided by a mixed-technology solution are generally acceptable. A properly structured business case will often favour minimising the overall investment by reusing the last mile copper with a VDSL based solution being sufficient to serve the demand needs of the immediate future.

Challenge 5: Deciding the technology choice between GPON and Active Ethernet: Our general view is that the cost effective deployment and relatively low operational costs of the GPON architecture makes it a favourite architecture for most of the NBN FTTH deployments. The case becomes even stronger where low household density is observed and longer reach is required. However, there are specific cases where an Active Ethernet solution might be better suited, typically in high-rise urban residential environments.

Challenge 6: Building an effective new NBN Company: Our view is that a NBN should be a process-driven organisation with clear authorities and accountabilities. A new NBN should be a young and dynamic technology start-up that captures the enthusiasm and dedication of its employees. However in too many cases a NBN is formed out of a government department and is heavily burdened with government processes and the checks-and-balances system that tend to disempower.

Challenge 7: Coping with a shortage of skilled workers during network roll-out: One of the most significant causes of delay in new NBNs is a shortage of skilled fibre technicians. This mistake is more often repeated than perhaps any other. Adequate advanced planning and timely contracting/recruitment of engineers is crucial. Fibre training and accreditation must be done in advance of the rollout as the prime contractor is often not able to import labour, due to immigration controls, and there is insufficient skilled resource in the country accessible to the contractor. These types of skills shortages have resulted in a number of national fibre programmes running behind their original schedules.

Challenge 8: Managing in-building cabling installations: Connecting fibre into every apartment in a high-density housing unit can be problematic and has introduced both delays and cost increases in NBN deployments. Planners often underestimate the difficulty of getting approval from owners, renters and stakeholders to access buildings. Furthermore, the issue of how to physically connect in a way that is cost effective and aesthetically acceptable has also introduced delays.

Challenge 9: Underestimating the task of land acquisition and rights of way: Land acquisition and gaining rights of way are typically the greatest disruptions to the deployment of telecommunications networks, and often the most overlooked. This is because the problem of land acquisition only fully emerges after deployment has started. Most government-sponsored NBN companies start with the assumption that the government will give them land. This almost always proves to be a false assumption.

Challenge 10: Miscalculating and overestimating the degree of existing infrastructure reuse: A common mistake made by NBN programmes is to underestimate the amount of effort required for the actual implementation of the national FTTH infrastructure, resulting in an implementation plan that is not realistic. The common implementation plan miscalculations are due to: a) underestimating the ramp-up stage of the rollout; b) ignoring the time needed to gain access to land and rights of way; c) overestimating the ability to reuse existing infrastructure; d) delayed regulatory frameworks and guidelines; e) vendors not having the resources to ramp-up to meet the implementations plan because they misunderstood local circumstances in their statement of work.

Introduction

Countries across the globe have defined long-term strategic plans that aim to increase the contribution of ICT to the overall GDP of the country. Examples of these plans are Singapore's Intelligent Nation 2015 (iN2015), Qatar's 2015 and Oman's 2020 strategic plans.

A National Broadband Network (NBN) is one key initiative that has the goal of providing accessible and affordable broadband connectivity to everyone. This supports increased use of ICT technologies and provides digital inclusion for non-connected communities. As a consequence, the vision for deployment (the "why") needs to be clear before any planning decision are made (the "how"). This strategy will also need to be adjusted if, for example, the environment changes in order to maintain alignment with on-going technology developments or there are changes within a national and metropolitan civil works plans.

In our work, we often see operators repeating the same mistakes as were made in previous deployments. This appears to be because NBN planners often do not devote enough time to learning the challenges faced by other similar NBN projects.

In this whitepaper we summarise what we believe to be the top 10 strategy, planning and implementation challenges related to new NBN projects. This is derived from our experience providing consulting to numerous broadband operators.

Each NBN project has its own unique challenges and operators may not always encounter all of these same challenges. However, the 10 challenges discussed here form important planning and operational considerations. We don't offer magic solutions, but by highlighting the Top-10 we hope to help others by making them aware of the challenges they will face, and perhaps avoid the negative cost and schedule impacts associated with avoidable rework.

Planning and strategy challenges

Challenge 1: Unrealistic planning of deployment timeframes, budget and reliance on poor data

Adequate planning is absolutely necessary to ensure a well-managed roll-out. Several studies have shown the disruptive impact of rework in complex projects. When something has to be done again, it often takes longer to do it the second time than it would have to get it right the first time.

The integrity of a rollout plan lies in the reliability of the data used to generate that plan. Obtaining accurate data is fundamental to planning. When planning a NBN, data on population and housing density can often be unreliable or out of date. Data that describes population, housing density and civil infrastructure forms the foundation of the NBN business plan and thereby determines the architecture of the network and the project budget for network build. The project budget is fundamental to all subsequent business planning, including the scale of the NBN rollout and the time required in building the network. Therefore, if the base data is unreliable the entire plan becomes unstable and costs will be overrun, milestones will be missed and schedules will not be kept.

The amount of effort to validate data sets is not great when compared to the effort of managing a network rollout based on bad data; yet our experience shows that the quality of base data is often not given enough serious consideration at the outset of NBN planning. Gathering, cross-checking and validating data should be one of the highest priorities before network planning begins.

Physical surveys are considered to be a costly exercise but experience shows that they are fundamental in gaining deployment efficiencies and speeding the pace of deployment. One example is BT Openreach, who reported a 40% unit cost reduction due to a far more accurate rollout gained by analysing the survey data and making informed planning adjustments[1].

In our work, we have observed examples of network deployment planning based on little more than intuition. Often the base data has been bad; the plans have not properly considered the architecture or the customer requirements; the serious challenge of land acquisition has been overlooked; skilled workers have not been available; or there have been avoidable problems dealing with the incumbent operator. The key to a successful NBN is neither glitzy technology nor the speed of deployment. The key to success lies in proper planning. Putting effort up-front might feel like a delay, especially when everyone is eager to get started and to show progress, but proper planning will produce better outcomes faster and cheaper than rushing to deploy. While this may sound like a motherhood statement, it bears highlighting due to the number of NBN deployments that have failed to properly address this challenge.

Once the data is validated, NBN planners should allow time to select the right strategy and the best commercial framework. This is something that is also often misunderstood. A good example is iDA Singapore which was initially hoping to run the procurement process for the new entities within 1.5 years – the actual time doubled and it took 3 years to award the licenses.

1 Interview with BT Openreach senior executive

Challenge 2: Deciding on a shared national passive or active fibre network

In many NBN deployments the national regulator has been asked to determine how the national infrastructure can maximise benefits for users but at the same time provide a fair and attractive platform that enables service providers to invest, innovate and compete. The choice is often between allowing service providers to independently compete in all service layers and create their own synergies, or to provide support for a national network infrastructure company. This prompts a fundamental decision about the NBN Company providing a passive or active wholesale service.

There is an ongoing debate about the best method for providing access network wholesale. However the key variables influencing the outcome are always the cost of deployment, and ability to mandate open access under regulated pricing.

A UK Ofcom study[2] shows that considerable cost can be avoided through passive duct access versus competitive new build network deployment. However, whilst competition under duct access avoids the cost of multiple duct networks, operators continue to duplicate investment in the fibre and active elements of their networks. This duplication of investment drives up the cost of competition.

Some NBN programmes, such as Qnbn Qatar, have decided to provide a passive wholesale service and have designed a network to allow multiple operators to share Qnbn's passive network infrastructure by using separate fibres. This design leads to increases in the overall infrastructure and operating cost, as separate GPON overlay networks are needed for each service provider and more fibre must be deployed requiring greater duct space and more joint boxes and splitters, with a set of splitters dedicated to each service provider. The complexity of implementing and operating a passive wholesale solution can outweigh the complexity of creating a wholesale model based on providing an active service.

The Ofcom study provides an analysis concluding that the cost of competition would actually exceed the cost of a greenfield connection in a market with a single infrastructure. That is, having four competing physical networks instead of one will result in the cost per end user more than doubling.

Wholesale access using a shared active network has added transmission costs but far lower upfront infrastructure costs. However, active wholesale could be more attractive to service providers in the face of uncertain demand. The Ofcom study analysed that BT's active product would be more expensive than a shared passive service when considered at large scale. The Ofcom analysis showed that the service provider, buying a passive wholesale service, would have to connect 24% of homes in an area to break even (which is high if facing competition). The conclusion of the Ofcom analysis was that unless service providers place a high value on the strategic benefits of infrastructure ownership then they are likely to find active wholesale access a more attractive and less risky option in the face of uncertain demand.

[2] Economics of Shared Infrastructure Access prepared by CSMG for Ofcom - 18 February 2010

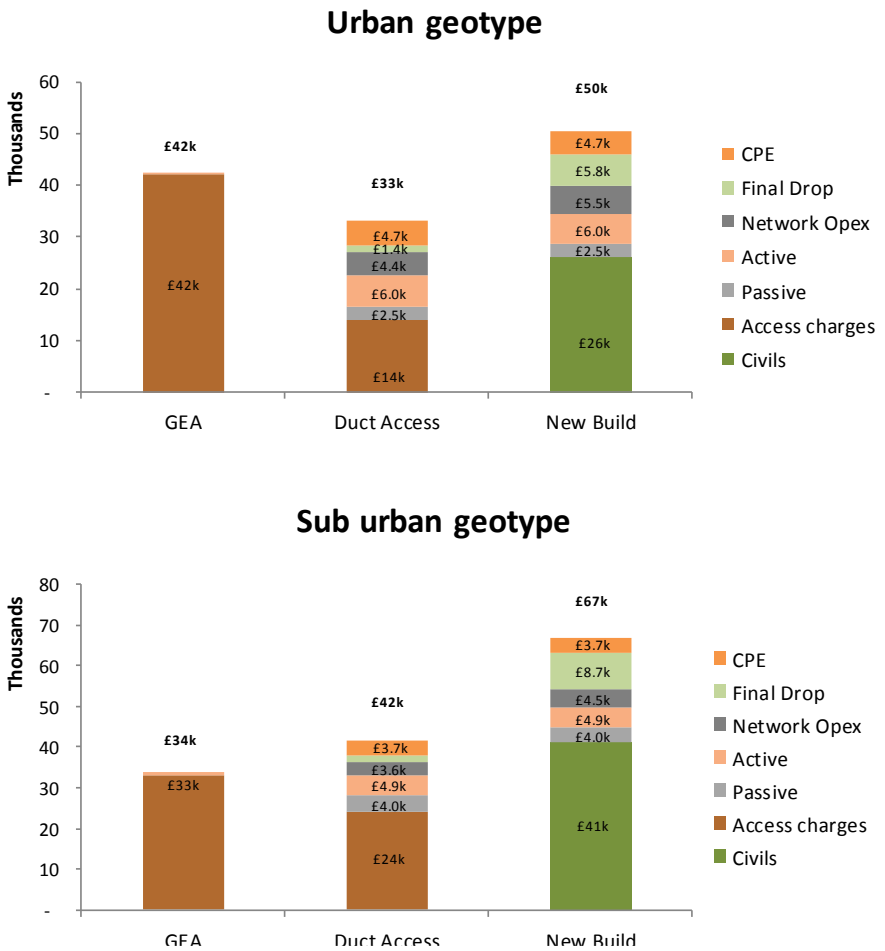

Figure 1: Annualised cost of FTTH deployment comparison for urban and sub-urban geo-type at 31% penetration (Source: UK Ofcom study 2010)

Challenge 3: Defining and negotiating the role of the incumbent and its communication infrastructure

The economics of FTTx network deployment is characterised by high fixed costs of which the dominant component is civil works, digging the roads and laying duct. Therefore the cost and deployment timeline could be significantly reduced if an effective role is found for the incumbent and its existing duct network. However, the challenge of reaching agreement with the incumbent is not trivial. The incumbent operator may decide to defend their dominant position and protect their fixed revenues and exhibit obstructive behaviour towards the NBN unless they see a clear and tangible business benefit, or a credible threat of a regulated network separation.

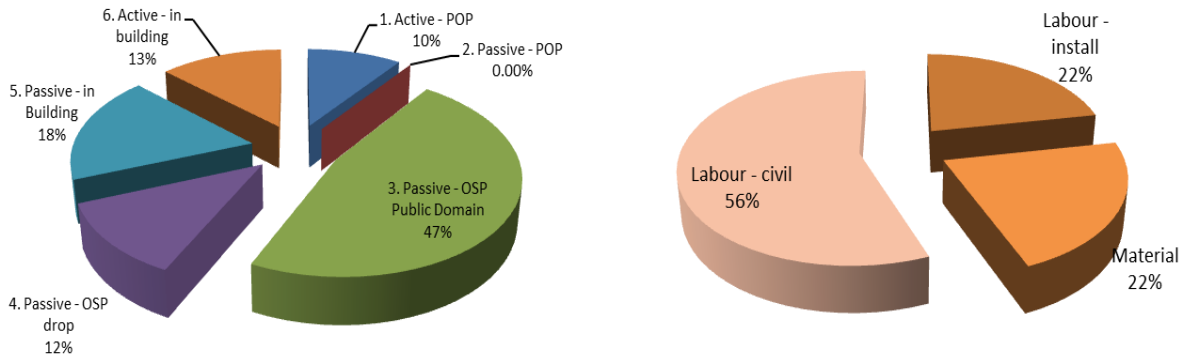

Figure 2: Basic cost distribution results in FTTH CAPEX model (Source: FTTH vendor)

There are a number of international cases related to this challenge. In Singapore the iDA initiated a competitive tender for national Netco and Opco licenses. After starting the tender process it became clear that the cost of the deployment without reusing SingTel ducts would be higher than planned and the bidding consortium that included the incumbent would therefore have an unfair advantage over other bidders. Following this, the iDA had negotiations with SingTel for acquiring the existing assets and adding them to the bid as part of the government subsidy: however this approach did not succeed. Finally the iDA awarded the Netco tender to the SingTel consortium while mandating structural separation between the newly formed company and the rest of the SingTel's operations. SingTel's share in the new venture was limited to 30%. This resulted in a balanced service model and is a good example of successfully incentivising the incumbent while implementing regulatory controls.

Some other countries have created regulated solutions for functional separation of the incumbent operator (e.g. Sweden and the United Kingdom). In these cases, the incumbent operator is fully subject to open access obligations such as wholesale price regulation. The aim of functional separation, a fairly intrusive remedy, is to achieve the principle of Equivalence of Input (EOI) and thereby overcome resistance from incumbents, and encourage them to accept ex-ante regulation. Under European Union law, it is a "last resort" remedy that is only applicable if other remedies have failed to achieve effective competition, and there is little or no prospect of infrastructure competition within a reasonable timeframe.

Challenge 4: Decision to reuse the last mile or replace all copper with fibre

The choice of rolling out a pure fibre or a mixed technology solution is a key challenge. Many new NBNs have decided to rollout a pure fibre solution, providing fibre-optic connections to every home and business.

However, for some NBN companies a combination of FTTH and upgrades to the copper network to VDSL can be a good alternative to full FTTH, especially where capital expenditure is constrained. The mixed technology solution combines Fibre to the Cabinet (FTTC) with FTTH and is based upon minimising the overall investment by reusing the existing last mile copper network to deliver high bandwidth services over VDSL.

Whether a mixed technology option is applicable or not depends on multiple factors such as the quality of the copper lines, the lengths of the last mile connections and the ability to use or install street cabinets where VDSL equipment can be deployed. Therefore, it is important to perform a careful audit of existing network assets when building a case for a mixed technology NBN.

Operators that self-fund network investment, such as BT in the UK, are in favour of this option. They consider FTTC to be a progressive upgrade of their network assets, which brings fibre closer to their customers. This approach often considers FTTC as an interim step in the evolution of their network, leaving only the last few km of copper to be replaced by fibre in the future.

Other self-funded operators such as Etisalat in the UAE have chosen not to use a mixed technology solution and to rollout a national FTTH network. However, the scale of deployment in the UAE is more manageable due to the highly urbanised population and the relatively small geographic size of their network compared to BT's in the UK.

From our experience, a mixed use solution is often the best option for an incumbent operator who is taking the lead on fibre deployment based upon a carefully developed business case comparing the cost vs benefit of a FTTC vs FTTH option.

It is important to note that if wholesale access is provided using a mixed technology approach, there is no option for a passive only product.

Case Study

BT abandons original rollout target for UK FTTH broadband and moves toward slower speed FTTC

BT is deploying high-speed broadband and is investing £2.5bn to reach two-thirds of the UK population by spring 2014. A further £830m will be provided by the UK government to address rural broadband deployments, for which BT and other operators will compete. This should extend national coverage to about 90% by 2017.

Originally BT committed to £1.5bn to make superfast broadband (FTTC & FTTH) services available to 40% of UK by 2012 (around 10 million premises). At the time, the operator promised that 1 million premises would be covered by their ultrafast (330Mbps) fibre optic based Fibre-to-the-Premises (FTTH) service. This target was subsequently revised upwards to 2.5 million premises in October 2009.

Since then the investment has increased to £2.5bn and the commercial target reset at coverage of 66% of the UK by spring 2014. However most of this increased coverage will be supplied by BT's 80Mbps FTTC service.

"We don't tend to talk about that particular target for FTTH any more as our fibre programme has evolved, so it is far less relevant today," said a BT spokesperson to *PC Pro*[3]. The spokesperson added that BT's FTTH-on-demand service, where businesses or consumers can request installation on an individual basis, could also improve the penetration rate.

According to Peter Cochrane, one of the UK's foremost telecommunications experts and a former chief technology officer of BT: "Fibre to the cabinet is one of the biggest mistakes humanity has made," he said. "It ties a knot in the cable in terms of bandwidth and imposes huge unreliability risks"[4].

Challenge 5: Deciding the technology choice between GPON and Active Ethernet

Selecting the best technology is the one of the first choices faced by CTOs of new national networks. The decision is not straightforward and depends on a number of factors such as the topography of the country, the split between high and low density housing and the availability of existing outdoor network elements. In this instance high-density housing refers to high-rise apartment buildings with dedicated space for telecommunications transmission equipment.

In most of the cases the technology options narrow to a choice between passive optical network deployment based on GPON, or an active metro Ethernet solution based on a typical extended LAN architecture.

[3] http://www.pcpro.co.uk/news/broadband/381433/bt-quietly-drops-25-fibre-to-the-premises-target

[4] http://delimiter.com.au/2012/04/30/fttn-a-huge-mistake-says-ex-bt-cto/

GPON (Gigabit Passive Optical Network) is a point-to-multipoint passive optical network bringing fibre to the home through optical splitters to enable a single optical fibre from the Central Office to serve multiple premises. The network consists of an Optical Line Termination (OLT) at the service provider's central office and a number of Optical Network Termination units (ONTs) near end users.

GPON identifies 7 transmission speed combinations, but the one that is currently implemented is the asymmetric 1.2 Gbit/s up, 2.4 Gbit/s down.

Active Ethernet is a dedicated medium in which each end user is allowed independent network access through a home gateway directly connected to the Ethernet router in the Central Office or street cabinet by a direct fibre.

Active Ethernet operates on a point-to-point optical circuit over dedicated fibres or over shared fibre with a wave-division multiplexed (WDM) overlay.

Pictorial comparison of the required elements to be deployed using each fibre solution is given in Figure 3.

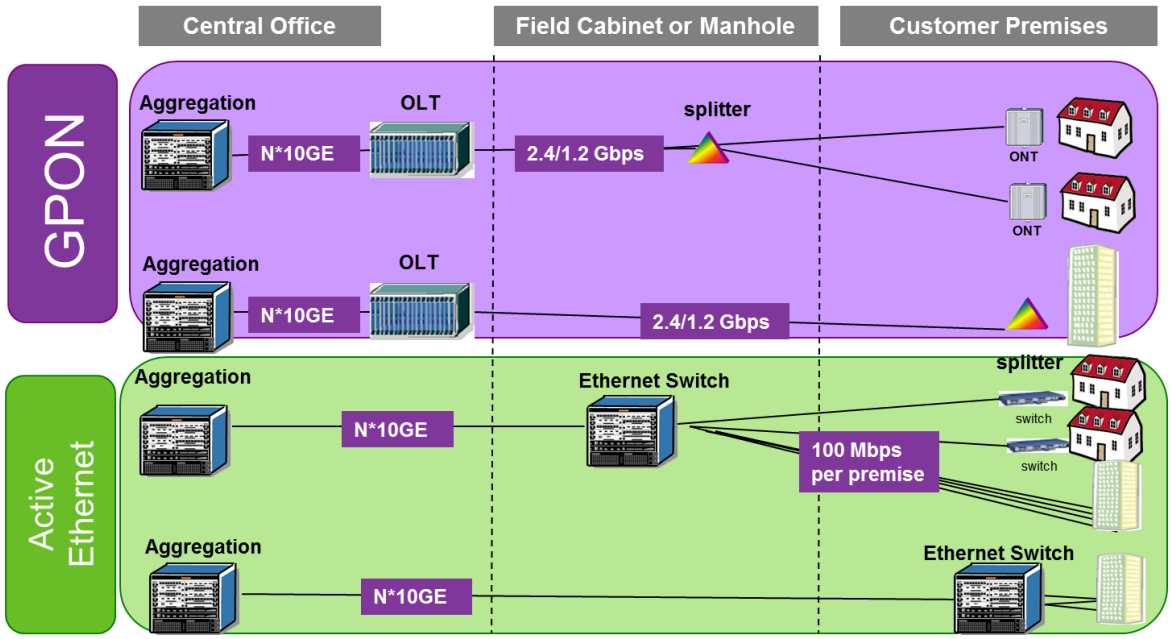

Figure 3: Network topology comparison - GPON versus Active Ethernet

Based on our experience and comparing the two technologies, these each have benefits and detractions that make them more or less suitable as a technology choice for new NBNs. We have summarised these in the table below:

FTTH technology	PROS	CONS
GPON	• Passive technology so no active equipment or power requirements • Lower cost of deployment • Low Operational costs • Good scalability and shared head end equipment	• Asymmetric bandwidth • Shared fibre medium with contention ratio at the splitter
Active Ethernet	• Symmetric bandwidth provision is more aligned with future user requirements • Familiar LAN based technology • Better support for open access network as separate fibre per user	• Higher cost of deployment • Active elements in street cabinets need power feed and air conditioning • Higher operational spend • Less scalable

Our general view is that the lower cost of installing and operating a GPON network makes it a favourite technology for most national FTTH deployments. The case for GPON becomes stronger in environments with low household density and where a longer reach is required.

However, there are specific cases where an Active Ethernet solution might be better suited and this is usually the case of high-rise urban environments. This is illustrated by the Hong Kong case study provided below. It is important to note that a mixed technology solution is also possible where Active Ethernet is used to cover dense parts of the country with a combination of commercial and high-rise urban residential units whereby other parts of the country may have more sparse housing coverage and therefore better served with GPON technology.

Case study

HKBN deployed cost effective FTTH Active Ethernet network leveraging on the high-density environment

Established in 1999, Hong Kong Broadband Network Limited ('HKBN') is a leading broadband service provider in Hong Kong with over 1.3 million subscribers.

In July 2012 the company announced total investment of over HK$4 billion (500 million USD) since year 2000, reaching a milestone of 2.0 million homes passed, out of 2.4 million total homes in Hong Kong.

Hong Kong's high residential density, which is based upon high-rise buildings, is 200 times denser than a typical US city. Hong Kong apartment buildings contain between 400 and 500 apartments each, and this provides the business justification for a Metro Ethernet Solution deployed in the telecom rooms within these high-rise buildings.

The company has reported one of the lowest costs for FTTH deployment at an average of 200 USD per customer passed. The company has adopted a long-term view on its investment, expecting to sustain losses for seven years before turning profitable in 2007.

In 2005, HKBN was the first Internet service provider in the world to offer 1Gbps residential FTTH service. The same service is today offered at HK$199/month (US$26/month) making this the lowest priced high-speed broadband service in the world.

Implementation challenges

Challenge 6: Building an effective new NBN Company

When rolling out a new NBN, planners often fail to properly consider the challenge of building a new organisation from scratch. One of the key mistakes is to focus on technology and engineering and to not give enough attention to the structure and processes of the new NBN Company.

Very rarely is enough thought given to the motivation of employees within new NBNs. Our observation is that without proper organisational planning certain things will happen. Among these is a nepotistic approach to recruitment resulting in a team being more "friends and family" than "best in class". Also, without well-defined roles and responsibilities, employees may waste a lot of time feeling confused about who is responsible for what. Without well-defined processes, teams will try to "reinvent the wheel" time and again.

A NBN Company should be a young and dynamic technology start-up and capture the enthusiasm and dedication of its employees. However, in many cases a NBN Company is formed out of a government department and is heavily burdened with government processes and the checks-and-balances system that tends to disempower. A good NBN Company will be run like a Silicon Valley start-up, with generous reward plans for success, led by dynamic and charismatic managers who immerse themselves in the day-to-day running of the company. We recommend giving thought to the structure and culture of the NBN Company to get the most out of employees.

Case study

Transitioning government employees of TECOM Holding into new telecom organisation

In 2006 the formation of the new UAE telecom company under the brand name "du" was initiated by transferring the employees from the telecom arm of the government entity TECOM into du.

According to Asma Bajawa, the former EVP HR in du "One of the hardest people related aspects we had to deal with when transitioning TECOM employees to du was the expectations of the TECOM workforce. The main issue was that existing TECOM employees did not understand why different skillsets were required for operating a tier one service provider, compared to their current skills".

Fairness and equity in pay and benefits was another challenge – TECOM employees were paid much lower salaries and benefits than the market rates for a tier one operator. In order to attract and recruit suitable skills for the new business, higher rates of pay and benefits had to be put in place in line with the market.

The HR team has to manage the balance between external versus internal recruitment for key positions ensuring that people from within are not overlooked and also that key positions are not compromised by people from within being placed without the necessary skills.

Also du is a process-driven organisation, and adjusting to this proved to be a serious challenge for some employees who were used to an ad-hoc style of management. Creating the right culture has helped du overcome these issues and create a successful and profitable tier one operator in the UAE.

The lack of clear processes and authorities is one of the most destructive conditions that we see in new NBN companies in the Middle East. Implementing a new organisation relies upon people knowing what they can and can't authorise, what they will held accountable for and what they need to do to succeed. There are many established systems for operating a telecommunications company such as ITIL or the TM Forum's Frameworx. Unfortunately these are rarely considered at the outset. Senior managers in new NBN's must establish the basis of operations as one of the highest priorities if the organisation is going to function as a team.

Challenge 7: Coping with a shortage of skilled workers during network roll-out

The traditional telecom engineer is trained on copper network installations and maintenance. The installation of the new fibre based network involves new skills and techniques such as fibre splicing, blowing fibre through tubes and optical fibre testing. These skills need to be gained and accredited in order for there to be enough skilled installers for the new network to be successfully deployed. The importance of the appropriate craftsmanship when deploying fibre is also emphasised due to the fragile and sensitive nature of the fibre cables i.e. glass core that is prone to breaking if bent or mishandled.

The other relevant factor is the need for enough fibre technicians to address the scale of the national fibre deployment, which is very different from the levels of field engineers that are retained by telecom operators for normal O&M purposes.

In order to overcome this problem telecom operators are up-skilling their resources and accrediting the contractors through opening specialised fibre installation training centres. A few examples of these initiatives are:

- UAE's Etisalat trained 2,000 technical staff to handle fibre and opened Etisalat Academy. Etisalat Academy is the largest development & training centre throughout the Middle East and North Africa. It is one of the largest business units/ subsidiaries with its main campus in Dubai and branches in Damascus, Khartoum and Amman.
- UK's BT had initially trained 4,000 engineers when it announced its super-fast broadband rollout in 2009. The training was delivered through combination of the newly established Network Health Academy, online training and assigning mentors to supervise installations for a post training period. Subsequently the telco recruits and trains additional engineers every year.
- Qatar's ooredoo had accredited a number of contractor engineers to be handling its network and fibre installations. However, with current parallel deployment between ooredoo and QNBN, the availability of skilled resources has become a programme bottleneck.

While the operators are scaling up their own fibre teams this does not mean that there are enough skills for a concerted NBN rollout. It is critical that planners begin to develop in-country skills through alliances with vendors and vocational training institutions in advance of deploying any network.

Therefore, adequate advanced planning and timely training of engineers is crucial. Fibre training and accreditation takes time and there are limitations of available training courses. In past deployments, skills shortage has resulted in number of national fibre programmes running behind their schedules. Our case study below describes the scale of the problem in Australia where only 50% of the roll-out targets were met due to the availability of skilled fibre technicians.

Case study

NBN Australia facing skills shortages leading to roll-out delays and high levels of rework in some areas

The government of Australia has set up NBN Co Limited (NBN Co) to design, build and operate a national broadband network connecting 13 million premises within 10 years.

NBN Co. is deploying a national wholesale only, open-access network which aims to deliver high-speed broadband to all Australian premises with a combination of fibre, fixed wireless and satellite technologies. NBN Co's target is to have 93% of premises connected to the NBN through FTTH capable of providing broadband speeds of up to one gigabit per second. The remaining 7% of premises will have access through fixed wireless and two Ka-band satellites covering remote areas with speeds of up to 25 megabits per second.

The roll-out of Australia's National Broadband Network (NBN) has seen a surge in the demand for workers with telecommunication skills resulting in a shortage of skilled workers. This skills shortage was highlighted in Innovation and Business Skills Australia's 2010 ICT Sector Environmental Scan, which reported that Australia needed 8,000 more skilled telecommunications workers to implement the NBN.

Recently the Australian Financial Review has published documents that exposed the increasingly bitter relationship between NBN Co and its contractors, amid rising concerns about labour and skills shortages. According to the documents, NBN Co highlighted issues with all of its construction partners, for providing the wrong rollout information and is struggling to both recruit and retain skilled resources.

However NBN Co claims that subcontractors were not hiring enough fibre technicians to roll out the network and were not meeting strict specifications for fibre installations. Whatever the reason, a shortage of skilled workers has caused major delays. One partner (Transfield) will meet 65% of the rollout target while another partner (Silcar) will only meet 45% of the target.

Challenge 8: Managing in-building cabling installations

Connecting fibre into every apartment in a high-density housing unit can be problematic and has introduced both delays and cost increases in NBN deployments. Planners often underestimate the difficulty of getting approval from owners, renters and stakeholders to access buildings. Furthermore, the issue of how to physically connect in a way that is cost effective and aesthetically acceptable has also introduced delays.

For example, Singapore, Hong Kong and Australia all had major issues with fibre to the apartments being installed.

In Singapore most of the building owners had rejected the offer of free cabling of their buildings due to unsightly installation methods that had surface mounted ducting on interior walls. The rate of acceptance by building owners has only increased after the official ICT authority began to fine building owners who reject NBN cabling.

Veteran FTTH network operators in Hong Kong have warned that gaining access to apartment buildings is by far the most difficult aspect of deploying a FTTH network. A senior executive from Hong Kong incumbent operator PCCW was quoted saying "Getting into the buildings from the street or up the side of buildings requires a number of factors, such as forming a working relationship with the building management or owners, and that's just to get permission to enter the building in the first place. From there, you then have to deal with a lot of different factors, such as the amount of in-building decoration that has to be disturbed in order to deploy the in-building wiring. This is actually a really serious but often overlooked factor in deploying network infrastructure." A senior executive from Hong Kong Broadband Network (HKBN) says it took the company "years to resolve this problem of getting in-building access," though he adds that HKBN has largely overcome the barriers it faced in the earlier years of deploying its near city-wide FTTH network.

Australia NBN Co. has also been running into problems gaining access to apartment buildings, most notably in the early-rollout within Melbourne, where only just over half of premises agreed to have the network connected. NBN Co. says it "typically makes several attempts to gain consent from stakeholder groups to install the network in a building." Owners of apartment buildings were warned that their Telstra network might get disconnected when the switch-over happens leaving those apartment building without a NBN connection unable to receive any telecom service.

Qatar's national FTTH provider was forced to adjust the roll-out programme to include fibre to high-density apartments as their initial scope covered only reaching the buildings' telecom rooms.

This challenge is very real and will introduce rework if proper planning is not done. A small dedicated team, working early on in the deployment, can have a very positive impact in managing this challenge.

Case study

Singapore's OpenNet had major issues and experienced delays from resistance of building owners to accept FTTH cabling.

OpenNet is the national passive fibre company in Singapore that is tasked to deploy and operate the national fibre broadband infrastructure.

According to data from the Infocomm Development Authority (iDA) of Singapore, as of November 2010 about 90% of private owners of high-density buildings contacted by OpenNet had rejected OpenNet's offer to install FTTH connections in their buildings. The reason for this was that the free offer by OpenNet didn't provide the aesthetic appearance required by the owners who wanted cables to be concealed within walls or false ceilings. However this work required breaking walls and neither party was keen to fund the increased cost.

Following the disagreement, iDA issued a statement that all buildings must facilitate the process of laying the fibre optics cable. Building owners who do not comply may be fined up to $10,000 or face imprisonment for a term not exceeding three years or both. Also, private apartments who want the fibre-optic cables should bear the cost for providing certain facilities such as cable distribution systems and lead-in pipes, if these are not already present.

A renewed effort by OpenNet has improved the acceptance rate: As of end-August the firm had contacted 47% of the owners of the country's high-density buildings, half of which have since completed NBN installations.

Challenge 9: Underestimating the task of land acquisition and right of way

Our experience shows that NBN deployments often start with a team that is too small for the task. This means that the focus tends to be on core deployment planning while some tasks are not given the attention that they deserve.

One task that often gets pushed aside is the planning for land acquisition and rights-of-way for new Central Office buildings. Land acquisition is one of the greatest disruptions to the deployment of telecommunications networks because if proactive planning has not been done, then the problem of land acquisition only fully emerges after deployment has started. Most NBN networks start with assumptions such as the government will gift or mandate the provision of land. This almost always proves to be a false assumption. In the Middle East most cities are growing rapidly, and every ministry is asking for land. It is absolutely essential that land acquisition is made a dedicated and separate function early in the planning phase and stakeholders are engaged in order to avoid major delays during the deployment. As Grant Donaldson stated in his paper on Australia's NBN deployment: "If NBN Co Limited was required to negotiate land… there would be no prospect of the National Broadband Network being delivered within any sensible period.

An OECD study entitled "Public Rights of Way for FTTH deployment"[5] examines barriers to rights of way which may slow the pace of fibre rollout in local access networks, and suggests the policy options available. The study suggests that improved access to rights of way and reduced access costs can be achieved in a number of ways, which include:

- Reducing barriers associated with obtaining authorisation for access to and use of rights of way
- Ensuring clarification of jurisdiction for both granting rights of way and settling disputes and coordination among the public authorities involved
- Harmonising administrative procedures for access to rights of way and ensuring consistency in the application of these procedures across a country
- Developing a reasonable system of compensation for access to and use of municipal public rights of way
- Ensuring that operators investing in ducts are subject to a minimum set of obligations for remediation and maintenance
- Encouraging and/or obliging sharing of ducts and other rights of way both by incumbent communication companies and by other utilities that have infrastructure
- Examining the role of public-private partnerships in the deployment of dark fibre and/or third party infrastructure providers for duct sharing
- Examining the possibility of regulatory measures to facilitate the sharing of inside wiring between operators in multi-dwelling units
- Developing policies to construct joint ducts by new entrants

Creating an early focus on requirements for land will help new NBNs avoid the rework and delay associated with trying to find land for central offices after network deployment has begun.

Challenge 10: Miscalculating and overestimating the degree of existing infrastructure reuse

Another common challenge faced by NBN programmes is accurately estimating the amount of effort required for the actual implementation of the national FTTH infrastructure. Common implementation plan miscalculations are due to:

- Underestimating the ramp-up stage of the rollout
- Underestimating the time needed to gain access to land and rights of way
- Overestimating the ability to reuse of the existing infrastructure
- Delays in obtaining regulatory frameworks and guidelines
- Vendors not having the resources to ramp-up the deployment
- Vendor implementation plans ignoring local circumstances and being based on assumptions derived from elsewhere

[5] Public Rights of Way for Fibre Deployment to the Home. Published by OECD 04 April 2008

If these factors are not fully considered then this can result in an implementation plan that is not realistic. In our experience we have not yet seen an implementation plan that hasn't been affected by most of these issues.

One of the most typical misjudgements is a high expectation for duct reuse. One of our Gulf clients found that the 80/20 brownfield/greenfield rule to be incorrect after initial surveys were done. This resulted in a much larger amount of work in greenfield areas: due to limited duct availability, many of the manholes requiring expansion. Needless to say this had a high impact on the calculations of capital expenditure needed for the rollout.

In its planning stages, BT performed surveys on the availability of duct space and found very little space to be available. This has resulted in a special programme for clearing and regenerating ducts to enable the rollout.

Alternative duct solutions are also being considered elsewhere. For example, in Paris, use of the sewer network has been encouraged by the difficulty in obtaining permission for street works. The success of infrastructure access in the sewer system is in part due to the excellent condition and easy of accessibility to the infrastructure, and the amount of capacity available.

The issue of duct space is addressable by performing field surveys. The effort to perform these surveys will always pay off in reduced rework and improved deployment times.

Authors

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Ivan has more than ten years of experience working in the telecoms sector across Europe, East Asia and the Middle East. Prior to Salience he was principal consultant with British Telecom in Dubai. Ivan has acted as a senior manager for operators in the Middle East region to deliver a national broadband strategy in Saudi Arabia and to lead on developing the business case, company start up and investment strategy for a Qatar based cable operator.

Prior to that Ivan held various roles in BT ranging from Specialist Consultant working on Global Next Generation Network (NGN), Fibre Access and Services transformation projects in the UK, Singapore and India, responsible for setting up and heading BT's Asian Innovation Team in Malaysia and leading on number of initiatives as part of R&D activities in mobility, NGN and smart cards.Ivan is regular speaker at telecom conferences on the subject of broadband strategies.

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Graeme's focus is on structuring and leading "strategy to implementation" consulting projects. Core consultancy skills include project leadership, procurement and negotiation and building and communicating the case for change, strategic investment advice and business performance improvement.

Graeme has worked in the Middle East since 1991, and some notable achievements include bringing the Internet to the UAE in (1993) as part of a UAE University program, starting-up AT&T Network Systems in Abu Dhabi (1995), helping PA Consulting Group establish their business in Dubai (2006) and building a regional telecom consulting business for BT (2008).

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Garineh's main strengths lie in her ability to process information and to create clear outputs from different sources of data. Garineh has a university degree in Computer Information System from the University of Jordan and has worked for operators such as British Telecom and Expresso Telecom

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