Regulatory Framework

for

Open Access to Megaprojects

The Supreme Council of Information and Communication Technology

"ictQATAR"

Consultation Document

ICTRA 2013/04/28
28 April 2013

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1 INSTRUCTIONS FOR RESPONDING TO THIS CONSULTATION

1.1 Consultation procedures

All interested parties are invited to submit responses to the questions identified in this document and to provide their views on any other relevant aspects. Comments should reference the number of the question being addressed or the specific section of this document if not responding to a particular question.

The Supreme Council of Information and Communication Technology (**ictQATAR**) asks that, to the extent possible, submissions be supported by examples or relevant evidence. Any submissions received in response to this consultation will be carefully considered by ictQATAR when progressing to a revised Open Access Framework for Megaprojects. Nothing included in this consultation document is final or binding. However, ictQATAR is under no obligation to adopt or implement any comments or proposals submitted.

Comments concerning this consultation must be submitted by email to **raconsult@ict.gov.qa** or in writing by no later than May 30th, 2013. The subject reference in the email should be stated as "Consultation on Draft Framework for Megaprojects". It is not necessary to provide a hard copy in addition to a soft copy sent by email.

1.2 Publication of comments

In the interests of transparency and public accountability, ictQATAR intends to publish the submissions to this consultation on its website at **www.ictQATAR.qa**. All submissions will be processed and treated as non-confidential unless confidential treatment of all or parts of a response has been requested.

In order to claim confidentiality for information in submissions that stakeholders regard as business secrets or otherwise confidential, stakeholders must provide a non-confidential version of such documents in which the information considered confidential is blacked out. This “blackened out” should be contained in square brackets. From the non-confidential version it has to be clear where information has been deleted. To understand where redactions have been made, stakeholders must add indications such as “business secret”, “confidential” or “confidential information”.

A comprehensive justification must be provided for each and every part of the submission required to be treated as confidential. Furthermore, confidentiality cannot be claimed for the entire or whole sections of the document as it is normally possible to protect confidential information with limited redactions.

While ictQATAR will endeavor to respect the wishes of respondents, in all instances the decision to publish responses in full, in part or not at all remains at the sole discretion of ictQATAR. By making submissions to ictQATAR in this consultation, respondents will be deemed to have waived all copyright that may apply to intellectual property contained therein.

For more clarification concerning the consultation, please contact **Dr. Pascal Dutru (pdutru@ict.gov.qa)**.

2 Executive summary

With this proposed framework on wholesale access in Megaprojects, ictQATAR wants to ensure that the country will successfully master its major challenges which implicate substantial telecommunications and ICT requirements.

ictQATAR believes that a **state-of-the-art ICT infrastructure** is a prerequisite to meet the requirements. State-of-the art ICT infrastructure means:

- World class infrastructure in terms of capacity, efficiency and quality
- Product and service diversity
- Customer choice
- Affordable and competitive prices
- Innovation and ingenuity in the sector

Worldwide experience shows that this can **only be achieved** in a **pro-competitive environment**.

A monopolistic market structure over all layers of the telecommunications sector (the passive infrastructure, the active infrastructure and the services level) should be prevented. Such a market structure inevitably leads to a poor customer experience with low quality of service, low speed, limited choice and innovation with negative effects on market dynamics. This is true inside and outside of Megaprojects. **The objective of this consultation process is to define a concrete framework for open access in Megaprojects** to avoid these negative effects of a monopolistic market structure. The approach is primarily directed at new Megaprojects (**greenfield**). At existing Megaprojects (**brownfield**) those rules have to be taken into consideration to the widest extent possible. In addition, the approach deals with telecommunications services, only. **Smart City Services** like e-metering, e-traffic, security and surveillance, are **excluded** from this framework. Nonetheless, ictQATAR acknowledges that these services might be provided over a common fiber infrastructure and will require dedicated, evolutive and flexible network capacity.

Reaching the desired state of competition and choice for the end customers inside of a Megaproject may be reached by different means. Based on the **general principles** that all Megaprojects shall provide a wholesale open access solution and that all public telecommunications must be provided by Public Licensed Service Providers (**PLSPs**), ictQATAR seeks a **flexible solution**, which may be:

1) **Infrastructure based**
   Parallel passive fiber infrastructure is deployed by more than one PLSP/Q.NBN to the end customer. This has the advantage that each PLSP has full control over the fiber and all QoS parameters. The approach requires coordinated deployment and clear deployment rules to avert duplication of infrastructure investment.
2) **Service based**
   The first Public Licensed Service Provider **(PLSP)**, which deploys passive and active infrastructure inside a Megaproject, provides other PLSPs an active wholesale access product. The other PLSPs are completely dependent on the active wholesale product, which is fully controlled by the first PLSP (network operator). Such active wholesale products do not fully allow for QoS and service differentiation. Protracted implementation and high wholesale pricing issues must be carefully balanced with intended results.
3) **Combined approach**
   This would include a partial duplication of parts of the network (infrastructure based) by a second PLSP. The second PLSP offers products to end costumers on partly own infrastructure and partly on wholesale access bought from the first PLSP. This provides largely resilience and control, while avoiding expensive network duplication. The combined approach also provides for combination in view of different Megaprojects, i.e. Megaproject A is served on own infrastructure, Megaproject B is served on wholesale access product only.

The end costumer is only interested in provider choice and service quality and does not necessarily care about the underlying wholesale / retail relations between the different involved stakeholders. ictQATAR does **not want to prescribe a certain business model** or restrict the entrepreneurial freedom of doing business. Therefore, the recommended solutions take into account the current roles of stakeholders and business relations. The proposed framework is **viable and realistic**. Any solution that may be theoretically ideal but does not reflect the current structures and dynamics of the Qatari ICT market is therefore not intended by ictQATAR.
The **major principles** are:

1. Retail services to the end customer may only be rendered by a PLSP. The developer will not provide telecommunication services to the end-customer.
2. End customers have to be able to choose retail services from **all** PLSPs.
3. All PLSPs have to be able to offer retail services to end customer in a Megaproject. Open, transparent and non-discriminatory access must be ensured.

These major principles can be detailed as follows:

a. General

- ictQATAR is flexible regarding the open access solutions: It can be provided by different means of competition (service and infrastructure based)
- All rules regarding the open access framework apply equally to all service providers
- Fiber and other infrastructure have to be built according to latest industry standards.
- End customers (businesses and residents) can select the PLSP of their choice.

b. Passive Infrastructure – civil works (as ducts, manholes, cabinets, telecommunications rooms and other necessary collocation space, etc.) BETWEEN buildings

- Such infrastructure is owned by the Developer. This will prevent PLSPs/Q.NBN to monopolize this essential infrastructure.
- The Developer has to ensure that sufficient space is available for at least three service providers.

c. Passive Infrastructure – fiber BETWEEN buildings

- The installation can be done by a PLSP, Q.NBN or by the Developer itself.
- Open access has to be provided in any case.
- When passive access is not feasible for technical reasons, an active wholesale product (bitstream) has to be provided.

d. Passive Infrastructure – civil works (as ducts, risers, cable trays, telecommunications rooms and other necessary collocation space, etc.) INSIDE buildings

- Such infrastructure is owned by the building owners. This will prevent PLSPs/Q.NBN to monopolize this essential infrastructure.
- The building owner has to ensure that sufficient space is available for at least three service providers.

e. Passive Infrastructure – fiber INSIDE buildings (in-house fiber/cabling)

- Deployment of fiber inside the buildings is typically done by the building owner, but can also be done by a PLSP or Q.NBN.
- Open access has to be provided in any case. For cabling inside buildings, at least **4 optical fibers** should be designed per each household. Three fibers are used as active links, the last one as reserve or internal service. This should be ensured by deploying three active fibers and one backup fiber per dwelling.

f. Point to Point (P2P) topology

- ictQATAR prefers the P2P topology for network design to provide future proof broadband access solutions. Only P2P topology provides a dedicated fiber to the end customer and, thus, ensures long-term readiness for future service provision.

g. Non-discriminatory access at defined Open Access Points

Non-discriminatory access should be made available at least at the following Open Access Points

- Optical Distribution Frame (ODF)
- Central Telecom Room (-> Central Office with ODF) Distribution Point (manhole/ cabinet)
- Distribution Box (or Telecom Room)
- Floor Terminal Box
- Home Distribution Box

h. Wholesale access services

The proposed catalogue contains

- access to ducts,
- dark fiber,
- collocation (at concentration point) and
- Bitstream Access / VULA.

i. Active Infrastructure (routers, switches, repeater, etc.)

- PLSPs deploy, operate and maintain the Active Infrastructure.
- PLSPs have to provide open access solution to requesting PLSPs.

j. Closed User Groups (CUG)

- Public Infrastructure Megaprojects **(PI Megaproject)** such as airports, rail, metro and ports are different from “normal” Megaproject, as they are largely using telecommunications networks and services for their **own, internal purposes** (Closed User Group). This is defined and covered under the Closed User Group Class License.[1]
- For such PI Megaprojects it may be permissible to allow PLSPs to offer their services via the CUG’s network (“extension of services’).

Mobile solutions are treated as ancillary solutions within this Framework and are particularly related to backhauling and sites.

[1] Closed User Group Class License, September, 7th, 2011 - ICTRA 20110710b

3 Framework objectives and legal basis

This consultation document is issued by the Supreme Council of Information and Communication Technology (**ictQATAR**) in order to retrieve information and opinions of all relevant stakeholders regarding the statements and recommendations made in this document on the preparation of a Framework for Open Access to Megaprojects.

The objectives and legal basis for issuing these Instructions are outlined below.

3.1 Background and definition of Megaprojects

Qatar prepares itself to meet two decisive goals in the future. The first major milestone is to host the FIFA Football World Cup in 2022 in Qatar. The second milestone is the development objectives set out in the Qatar National Vision 2030. Reaching both goals and tackling the challenges that come with them is an extremely difficult task. Only if all necessary steps are identified well in advance and appropriate actions are taken this endeavor will succeed.

The **FIFA World Cup 2022** requires the planning and construction of the sport venues, accommodation and transportation for all participants and spectators. From a telecommunications perspective, ictQATAR needs to ensure that expectations in world-class information and communication technology are met and ultra-fast broadband and **outstanding customer experience** is available everywhere and all the time during the event. FIFA World Cup guests will expect unmatched performance and Qatar is dedicated to even excel these expectations. The London Olympic Games of 2012 may be a good example of how a good planning and infrastructure strategy create a very positive visitor experience concerning availability and quality of ICT services.

ictQATAR also puts the Megaproject Framework in perspective of broader development goals. The **Qatar National Vision 2030** is dedicated to reach considerable improvements in four major areas which are the human, the social, the economic and the environmental development. Information and communication technology (**ICT**) will play a pivotal role in almost all areas, as in the future it will not anymore only be an industry or a sector of its own, but pervade all areas of life and work as a common technological layer. ICT is based on a modern infrastructure in the first place and corresponding services built on this basis.
The most important benefits will materialize in the area of economic development where **Qatar strives to become a leading international ICT hub with a modern, diversified and sustainable economy**.

The following is expected from a **state-of-the-art ICT infrastructure**:

- World class infrastructure in terms of capacity, efficiency and quality
- Product and service diversity
- Customer choice
- Affordable and competitive prices
- Innovation and ingenuity in the sector

Worldwide experience shows that this can only be achieved in a pro-competitive environment.

A monopolistic market structure over all layers of the telecommunications sector (the passive infrastructure, the active infrastructure and the services level) should be prevented by all means. Such a market structure inevitably leads to a poor customer experience with low quality of service, low speed, limited choice and innovation with negative effects on market dynamics. This is true inside and outside of Megaprojects.

The objective of this consultation process is to define concrete rules for open access in Megaprojects. This is primarily directed at new Megaprojects (**greenfield**). At existing Megaprojects (**brownfield**) those rules have to be taken into consideration to the widest extent possible.

Megaprojects, consisting of residential, business and leisure facilities are somewhat unique in the Middle East. These Megaprojects can be compared to small independent cities within a large municipal area. Examples include The Pearl in Qatar, Lusail City in Qatar, the Palm Jumeirah in UAE and the proposed Water Garden City in the Kingdom of Bahrain.

Typically a **Megaproject** is a private undertaking, developed by a single company (Developer). Generally only one telecommunication service provider or the Developer itself deploys telecommunications infrastructure to reach the dwellings inside a Megaproject. Other service providers are excluded from a) deploying their own infrastructure, and b) rendering retail services on the basis of the first operator's infrastructure.[2]

However, Megaprojects equal a mid-size or even large city with multiple private residents, shops, offices, small and large business which are the end customers for telecommunication services. Being able to select only from one service provider is neither acceptable for residents and businesses inside Megaprojects nor for Qatar as a country striving for ICT excellence.

More Megaprojects are being constructed in Qatar and more are likely to be planned and built in future. A large number of customers will reside within the geographic boundaries of these Megaprojects, whose experience of telecom service provision in terms of quality, diversity and price will be impacted by the decisions of the Projects' Developers on how to satisfy these requirements. Due to the large scale of these Megaprojects, the impact is quite appreciable. Therefore a regulatory framework is required to address the regulatory aspects of how PLSPs gain access to telecommunications network infrastructure within Megaprojects and how telecommunications services are rendered within the geographic boundaries of these Megaprojects.

During the course of planning and construction, some Developers of such Megaprojects have been approaching ictQATAR to seek guidance on above mentioned telecommunications regulatory aspects. ictQATAR has been providing guidance and answers to their

[2] This might be acceptable if there is only one party demanding services for its own use, as this is not to the detriment of customer choice. This is e.g. the case in some high-rise buildings occupied by a single company or a hotel.

queries on case-by-case basis. A future framework aims to establish a standard and comprehensive telecommunications' regulatory framework for the Developers of Megaprojects in Qatar.

The present consultation document is designed to introduce ictQATAR's view on the matter and collect the opinions of all relevant stakeholders to the regulatory options and recommendations which are presented below.

A **Megaproject** is a large defined private and/or public-private **property development area**, authorized by the relevant competent authorities in Qatar in accordance with the applicable Qatari laws, which consists of different types of properties including residential buildings and/or villas, commercial establishments (such as shops, hotels etc.), businesses, banks, leisure facilities, etc.
For indicative purposes, The Pearl Qatar, Lusail, and Musheireb (formerly Dohaland) are examples of Megaprojects.

Additionally, a **Megaproject** can also be a Public Infrastructure Megaprojects (**PI Megaproject**), authorized by the relevant competent authorities in Qatar in accordance with the applicable Qatari laws, which is established by private and/or public-private property Developers and which is intended to be used by private service operators for their business purposes and by the general public.
For indicative purposes, Qatar Rail, Doha Metro, Hamad International Airport, Doha Ports or stadiums and arenas required for the 2022 FIFA World Cup are examples for PI Megaprojects.

The decision on whether or not a particular large property development project falls under the scope of this definition would remain at the sole discretion of ictQATAR.

3.2 Framework objectives

ictQATAR is pursuing the consultation on open access in Megaprojects because ictQATAR regards a competitive setup for provision of telecommunications services in Megaprojects as an important precondition for dynamic development in the ICT and telecommunications sector.
This applies not only to the specific requirements for the FIFA 2022 World Cup, where e.g. the London 2012 Olympics set a new benchmark for ICT customer experience inside stadiums, arenas and transport facilities. It also applies towards Qatar National Vision 2030 and ictQATAR's objective to make Qatar a world class ICT hub for the Gulf region and beyond. In the current market setup ICT dynamics have not developed at a pace, where future demand will be met. By starting the consultation process on open access in Megaprojects, ictQATAR intents allow for customer choice and set fair, transparent and non-discriminatory rules for a competitive market setup in Megaprojects.

The **key objectives** of a future Framework on the establishment of open access to Megaprojects are:

- To ensure availability of high quality telecom services to residents and businesses within the Megaprojects;
- To ensure customer choice in Megaprojects, i.e. to make sure that present and future residential and business customers in Megaproject can chose from two or more service providers;
- To encourage Developers to facilitate deployment of modern and future-proof telecom infrastructure (including the ancillary civil works) in their developments.
- To serve as framework for Megaprojects' Developers and licensed telecommunications operators regarding the deployment of telecommunications infrastructure and provision of telecommunications services within the geographic area of Megaprojects;

The **scope** of a future Framework on the establishment of open access to Megaprojects is related to:

- The geographic area of Megaprojects;
- The telecommunications aspects of the Megaprojects;
- Deployment of any types of telecommunications networks, infrastructure and facilities within the Megaprojects; and
- Provision of any telecommunications services to residents, businesses and visitors of the Megaprojects.

Smart City Services like e-metering, e-traffic, security & surveillance, etc. are **excluded** from this framework. ictQATAR is mindful, that these services might be provided over a common fiber infrastructure. Therefore the principles in the remainder of this document will influence the provision of Smart City Services. ictQATAR does not want to make any restrictions to these services. ictQATAR urges Developers to pursue a comprehensive roll-out design, which enables an open network for telecommunication services for end customers within their Megaprojects.

The framework ensures **end customer choice of service providers**.
The **framework is flexible** and does neither prescribe business models, nor implies inefficient network duplication. This means that a Public Licensed Service Provider (**PLSP**) has not necessarily to roll out its own fiber at a Megaproject but can use existing infrastructure. The deployment of infrastructure at a Megaproject is subject to commercial agreement between the Developer and the PLSP/Q.NBN.

A **Public Licensed Service Provider (PLSP)** is a "Service Provider" as defined under Article 1 of the Telecommunications Law (Decree Law No. (34) of 2006): "A person that is licensed to provide one or more telecommunications services to the public or licensed to own, establish or operate a telecommunications network to provide telecommunications services to the public. This includes providers of information or content provided using a telecommunications network."

3.3 Legal basis

The State of Qatar has empowered and authorized ictQATAR to liberalize and regulate the telecommunications sector under Decree Law 34 of 2006, the Telecommunications Law (**Telecommunications Law**), and Executive By-Law 1 of 2009 for the Telecommunications Law (**By-Law**). These laws establish the objectives and legal framework for ictQATAR to create the appropriate legal and regulatory conditions for the development of sustainable competition in the telecommunications sector so that, amongst other things, telecommunications may become a factor for promoting social and economic development in Qatar.

ictQATAR has mandated objectives and goals to achieve under the **Telecommunications Law. Article 2** outlines the main objectives that apply for the purposes of a Framework for Open Access to Megaprojects:

- Article 2 (1) promoting the telecommunications sector in order to consolidate national, social and economic development Article 2 (2) enhancing the telecommunications sector's performance in the State of Qatar through encouraging competition and fostering use of telecommunications;
- Article 2 (3) encouraging the introduction of advanced and innovative information and telecommunications technologies to meet the needs of customers and the public
- Article 2 (4) increasing customers' benefits and safeguarding their interests;
- Article 2 (5) encouraging sustainable investment in the telecommunications sector;
- Article 2 (6) relying, where possible, on market forces to safeguard the interests of customers and the public
- Article 2 (7) identifying and addressing anti-competitive practices in the telecommunications sector;
- Article 2 (9) establishing a fair regime that meets the requirements of the competitive market place through the implementation of interconnection between service providers and all procedures related thereto;
- Article 2 (12) ensuring that the regulation of the telecommunications sector remains in line with international rules; and
- Article 2 (13) ensuring the orderly development and regulation of the telecommunications sector.

Article 4 of the Telecommunications Law empowers ictQATAR to set and enforce remedies to: prevent anti-competitive practices (Article 4(4)), set the terms of interconnection and access between service providers (Article 4 (6)), safeguard the interests of customers (Article 4(8)), require the provision of information relating to network or service development plans, technical and statistical information (Article 4(10)).

Article 19 of the Telecommunications Law also requires ictQATAR to undertake functions and duties in respect of interconnection and access to: promote appropriate, effective and low cost interconnection between telecommunications networks and to promote access to facilities of other service providers to ensure interoperability of telecommunications services that originate or terminate in the State and promoting the growth of competitive telecommunications services markets (Article 19(1)), and to establish a public, transparent and commercially viable regulatory framework aimed at the facilitation of the regulatory procedures, and to remove or minimize the effects of other barriers to entry into telecommunications market (Article 19(2).

Article 40 of the Telecommunications Law requires ictQATAR to set and implement the competition policy and the related regulations in the telecommunications sector and to: review the state of competition in the telecommunications markets in the State and exercise its authorities, functions and powers to consolidate competition in the provision of telecommunications services (Article 40(1)), monitor and prohibit any abuse of market power or dominant position and anti-competitive practices in accordance with the Law (Article 40(2)), and determine and apply the appropriate procedures and arrangements to confront abuses of market power and anti-competitive practices in order to strengthen competition and safeguard the interests of customers and the public (Article 40(3)).

In order to achieve these objectives and goals, ictQATAR will make use of its legal powers and impose requirements on service providers in order to create a sufficient degree of competition inside Megaprojects.

Question 1	Do you agree that Megaprojects, due to their prominence and size, require a specific framework?
Question 2	Would you agree that end customers should benefit from a broad a diverse service offering, offered by various PLSPs?

4 Open Access Framework for Megaprojects

4.1 Market Players

Currently the following operators are active in the fixed line market and, thus, determine the market for Megaprojects:

- **Qatar Telecom (Qtel) Q.S.C**. (**QTel**) is Qatar's incumbent, state owned former monopolist and the dominant operator in the Qatari fixed line market. It is running the legacy copper network and is currently deploying a countrywide fiber infrastructure, including in Megaprojects. Currently re-branded as Ooredoo, QTel offers retail services on this basis. Currently QTel has a de facto monopoly without substantial competition.
  In addition, QTel has diversified into a multinational telco with subsidiaries across the Middle East and South East Asia.
  QTel's annual turnover in 2012 was around 34billion QAR for the group and 6.3 billion QAR in Qatar (each including fixed and mobile)[3]. In 2012 it had an overall subscriber base in Qatar of 2.529.000.
- **Vodafone Qatar Q.S.C.** (**Vodafone)** is Qatar's second fixed line PLSP. Vodafone's declared strategy is to rely on the passive fiber network infrastructure deployed by Q.NBN[4]. To the limited extent Q.NBN's network has been built, Vodafone offers a limited range of telecommunications services. Currently Vodafone cannot be seen as a serious competitor in the fixed line sector.
  Vodafone's annual turnover in Qatar in 2012 was around 938m QAR, to a very large extent stemming from its mobile business.
- **Qatar National Broadband Network Q.S.C. (Q.NBN)** is a government owned **Passive Infrastructure Provider**. Q.NBN is mandated to deploy a countrywide passive fiber network. Q.NBN is yet to become a passive network provider of substantial size.

4.2 Introduction of possible models

Reaching choice for the end customers inside of a Megaproject may be reached by different means. A fiber infrastructure classification can be made as follows:

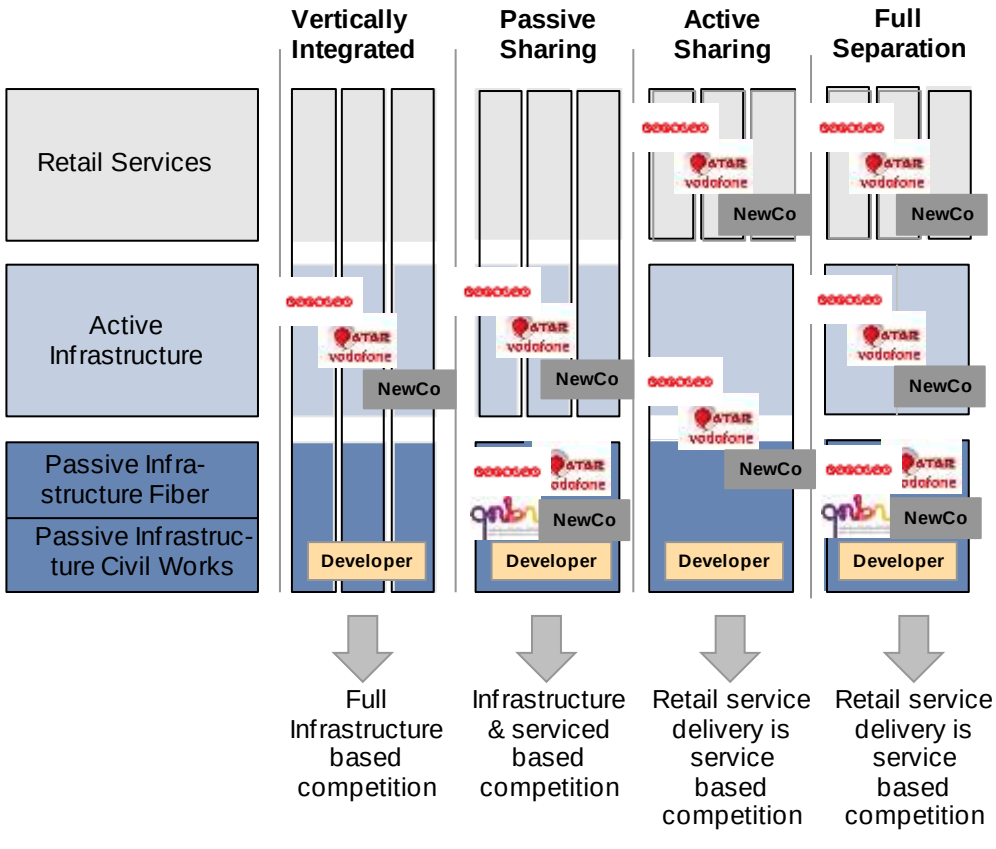

Figure 1: Models in Megaprojects
(adapted from FTTH Council 2012)

The figure shows the three different layers of a telecommunications market: the passive network (bottom), the active network and the retail services level (top of figure). The figure also shows different models which can ensure a competitive setup which ranges from vertically integrated (left side), passive sharing, active sharing full separation (right side of the figure). In each of the models the end costumer can choose from different service providers. The impact on the relations between different players (the wholesale level) can be substantial regarding costs, capacity, product diversity or quality.
Each of these levels can be obtained by different players in the market, following the overall market structure, which would in each case have different implications concerning the level of competition on the level. The overall market setting has implications for possible solutions towards a competitive environment in Megaprojects.

Vertically Integrated

Each PLSP is active on each level of the market (passive network, active network, retail). Each PLSP deploys its own network and offers its own retail services.
Put in Qatari context QTel, Vodafone and a possibly newly licensed service provider (NewCo) building their own infrastructure or have usage rights for one dedicated fiber to end customer. However, in the current setup, QTel is the only service provider which is active on all three levels of the telecommunications market.

How does the model ensure open access?

[3] ooredoo Annual Report 2012
[4] "Vodafone Qatar is building its own fixed line core network and will use Q.NBN's infrastructure for provision of the last-mile fiber", Vodafone Qatar Annual Report 2012, p. 48

- Every vertically integrated operator has direct access to the end customer. Therefore the end customer can directly select the service from the operators of choice.

Advantages

- This model gives direct and full end to end control of the PLSP on services and customer relations. PLSPs can differentiate e.g. in Quality of Service (QoS) levels, products, speed and price.
- Resilient solution

Disadvantages

- The model may lead to infrastructure duplication and additional CAPEX requirements. Fiber rollout standards (e.g. three or more fibers to each end customer within buildings to be shared by all PLSPs) will limit this downside.

Passive Sharing

All PSLPs rely on a single, shared passive network. The PLSPs deploy their own active equipment to offer their own retail services.
Put in Qatari context, one operator (QTel, Vodafone, Q.NBN or NewCo) provides – together with Owner – all passive infrastructures within a Megaproject. All PLSPs can buy wholesale access to this passive infrastructure and offer services to the end-customer. This model is to some extent being introduced to Qatar right now, as Vodafone does not have its own passive network but is reliant on the passive network deployed by Q.NBN, which might also applies to a possible future third operator. A model in which Q.NBN serves as the only passive infrastructure provider in Qatar is not foreseen.

How does the model ensure open access?

- Each PLSP can rely on a common passive infrastructure basis. It does not have to deploy its own passive infrastructure but only active equipment. This reduces considerably the necessary investment and deployment time and facilitates establishment of a competitive environment.

Advantages

- Efficient CAPEX spent (infrastructure) and quick time-to-market

Disadvantages

- If the passive infrastructure provider is also retail service provider, abusive usage of market power needs to be prevented (excessive pricing, slow service provisioning, etc.)

Active sharing

Active sharing refers to mainly service based competition only concept. One service provider operates the passive and the active infrastructure and provides wholesale access for a third service provider to provide alternative services to the end costumer. Usually the wholesale product is a bitstream access **(BSA**) or virtual unbundled local access **(VULA)** product.
Put in Qatari context, the active and passive network in a Megaproject is operated by QTel or Vodafone (or a NewCo). Q.NBN's license does not include operations of active components. QTel, Vodafone or the NewCo operating a passive and active network and offering wholesale access to alternative licensed providers. These can offer broadband services to the end costumer. This model is currently not applied in Qatar.

How does the model ensure open access?

- Each PLSP can rely on existing passive and active infrastructure, over which the PSLP is offering retail services. The PLSP does not have to deploy its own infrastructure. This reduces the necessary investment and deployment time considerably.

Advantages

- Efficient CAPEX spent
- Fast time-to-market.

Disadvantages

- Competing PLSPs which have to rely on the infrastructure of other PLSPs face limits in differentiating e.g. in QoS levels, products, speed and price.
- Usually this approach requires regulatory intervention (e.g. for bitstream offers)

Full separation

Different players operate on each level of the value chain. These players are separated from each other, but they may well be in competition to each other on the various levels. Sharing of a certain level by different operators may therefore not necessarily happen.
Put in Qatari context, Q.NBN, QTel, Vodafone or a NewCo providing the passive infrastructure, a different player than the passive service provider operates the active components and retail services are offered on top by any requesting licensed service provider. The retail service would always be based on a wholesale access product such as VULA or Bitstream Access. In the pure model approach passive network, active network and retail service provider have to be distinctive providers. This model is currently not applied in Qatar.

How does the model ensure open access?

- Each PLSP relies on the existing passive and active infrastructure. It does not have to deploy its own infrastructure but may only offer retail services. This reduces considerably the necessary investment and deployment time and facilitates establishment of a competitive environment.

Advantages

- In the pure model of full separation there are clearly defined roles for passive network and active network providers. There is no overlap of roles. All retail service providers buy wholesale access products on the transparent and non-discriminatory basis. A level playing field for retail service providers.

Disadvantages

- Only works if the layers are clearly separated, otherwise abuse of market power likely.
- Business and partnership models might be difficult to reach
- Usually requires full regulatory framework for assignment and definition of roles and responsibilities

An **international comparison** shows that there is no "one-fits-all" solution for the provision of open access to Megaprojects. Different models run around the globe successfully:

- A **vertically integrated approach** is currently rolled out in **Switzerland**, where the incumbent Swisscom in cooperation with municipalities deploys four fibers in each business or dwelling unit. By that rollout cooperation Swisscom obtains long-term usage right of two fibers. The other two are reserved for the municipality which might compete on services or lease the fiber to alternative service providers.
- The role model for **passive sharing** is **Australia**, where a state owned company called NBN was founded, which is the only one deploying a countrywide passive fiber optical network, replacing the incumbent's current copper network. NBN will then offer wholesale based open-access to all telco operators in the country.
- There are two prominent cases for **full separation**:
  One is to be found in **Singapore**, where a private consortium is deploying and running the passive fiber infrastructure level (NetCo) under the supervision of the regulator "IDA", and another private operator is deploying and running the active infrastructure level (OpCo). Both will then offer regulated wholesale based open-access to all retail service providers in the country. Competition will only take place on the services level.
  The second example is **Britain** where incumbent BT was forced by the regulator "Ofcom" to functionally and legally separate its network ownership and wholesale arm (NetCo) and its services and retail arm (ServCo).

ictQatar's solution would be flexible solution that might take different combinations of the four approaches in each Megaproject, depending on the respective conditions and requirements – though a full separation model is not foreseen. Instead ictQATAR proposes a set of basic principles, which apply in each Megaproject: 1) telecommunications service provision is done by licensed service providers only, 2) end customers have the opportunity to chose from different service providers, and 3) all PLSPs have to be able to offer retail services to end customer in a Megaproject, which means that open, transparent and non-discriminatory access must be ensured. In addition, the Developer must always provide access to passive infrastructure (telecom room, collocation, access to ducts, etc.) to requesting PLSPs.

Question 3	Which model do you see most appropriate for Megaprojects in Qatar? Please provide a reasoning.
Question 4	Do you see additional models or variations which may be introduced? Please provide a reasoning.

4.3 Setup of and roles in Megaprojects

4.3.1 Network layers and roles

There are different **layers** in a network inside a Megaproject:

- Passive Infrastructure – civil works (as ducts, manholes, cabinets, telecommunications rooms and other necessary collocation space etc.) BETWEEN buildings
- Passive Infrastructure – fiber BETWEEN buildings
- Passive Infrastructure – civil works (as ducts, risers, cable trays, telecommunications rooms and other necessary collocation space etc.) INSIDE buildings
- Passive Infrastructure – fiber INSIDE buildings (in-house fiber/cabling)
- Active Infrastructure (routers, switches, etc.)
- Non-discriminatory access at defined Open Access Points
- Wholesale access services

The layers can be attributed to distinctive roles

1. **Developer / Building Owner**
   The Developer / the Building Owner are responsible for passive infrastructure - civil works. This applies for all passive infrastructures between and inside buildings. In case developer and building owner are two different entities, the developer deploys and owns the civil works passive infrastructure between buildings, the building owner deploys and owns all passive network civil works within buildings. Typically the developer also provides the standards of e.g. fiber roll-out.

2. **Passive Infrastructure Provider (fiber)**
   The passive fiber network provider deploys the passive network infrastructure (fiber) inside a Megaproject, but does not offer retail services to the end-customer. A Passive Infrastructure Provider creates the necessary basis for PLSPs to deploy their active equipment and to render retail services.
   Currently Q.NBN is the only provider licensed to rollout a passive fiber infrastructure on an infrastructure only basis.
   Any PLSP – currently QTel and Vodafone – may deploy a passive fiber network.

3. **Active Infrastructure Provider**
   Active Infrastructure Providers will deploy the active equipment inside a Megaproject and offer retail services to the end customers. The active network operator also operates and maintains the network.

In the Qatari market active network deployment is performed by a PLSP.

4. **Retail Service Provider**
   The retail service provider delivers public telecommunications services to the end customer. It controls the full customer relationship. Usually the retail service provider has the end-to-end responsibility for service delivery. The retail service provider is in charge for service availability, fault clearance and customer care.
   Retail services to the end customer may only be provided by PLSPs.

5. **End Customers**
   The end customer is a resident or a business inside a Megaproject, which needs services offered by the retail service providers. The Developer itself might also be an end customer for all those ICT services needed to run its own business. The end customer will finally consume and pay for the services offered in the Megaproject.

4.3.2 Current approach on infrastructure deployment

The following will describe the current setup and responsibilities in Megaprojects[5].

1. Megaprojects are **connected to the outside** by one or more **PLSPs'** or **Q.NBN's** network.

2. **Inside** Megaprojects the deployment of **passive infrastructure - civil works** (e.g. ducts) between the buildings is done by the **Developer** which includes the installation of trenches, ducts and manholes etc. Developers own this infrastructure. The deployment of this infrastructure typically follows technical guidelines currently issued by QTel.

3. Regarding the deployment of the **fiber outside the buildings** (passive infrastructure – fiber between the buildings; active infrastructure) a **number of approaches** are being followed which are shown by the following examples:

- **Lusail**
  One PLSP (QTel) deploys its **fibers** into the ducts, reaching every building on the premises (typically up to the basement). QTel does not only deploy a passive network, but also the active components, and then offers its own retail services on this basis: it acts as a vertically integrated provider along the entire value chain.
- **Barwa City**
  Q.NBN deploys its passive network between and inside the buildings of the Megaproject. This is an open access network over which all PLSPs can provide their retail services to the end customers. The active network components are deployed by the PLSPs.
- **Hamad International Airport (HIA) – an example for a PI Megaproject**
  In this case the Developer itself deploys the passive and active network, which is owned, operated and maintained by the Developer. The reason for this specific approach is that HIA is largely a Closed User Group (**CUG**) with a bespoke network solution (as defined and covered under the CUG Class License). Retail services to end customers are only provided by PLSPs.
  ictQATAR regards this approach to be a special exception.

4. The deployment of **in-house passive Infrastructure** (ducts, risers, cable trays, telecommunications rooms and other necessary collocation space etc and in-house fiber/cabling), is done and the owned by the **Building Owner**, which may be the Developer. The in-house wiring currently typically follows technical guidelines by QTel.
   Joint infrastructure guidelines, such as the QTel, Vodafone, Q.NBN "In-house wiring guidelines"[6] might help all stakeholders to meet international standards in infrastructure rollout.

5. Typically, the **PLSP operates and maintains the active network**[7].

1. Typically no or little non-discriminatory access at defined Open Access Points is available. The exception being Barwa, where Q.NBN rolled out the fiber infrastructure and collocation space for QTel and Vodafone is available.

2. Wholesale access services (as e.g. Bitstream) are not available.

Question 5 Are you aware of other principle approaches on infrastructure deployment?

4.4 ictQATAR´s proposal for open access

4.4.1 Introduction

Establishing competition inside of Megaprojects may be reached by different means. Based on the **general principles** that all Megaprojects shall provide a wholesale open access solution and that all public telecommunications must be provided by PLSPs, ictQATAR seeks a **flexible solution**, which may be structured around the following generic models:

1) **Infrastructure based**
   Parallel passive fiber infrastructure is deployed by more than one PLSP/Q.NBN to the end customer. This has the advantage that each PLSP has full control over the fiber and all QoS parameters. The approach requires coordinated deployment and clear deployment rules to avert duplication of infrastructure investment.
2) **Service based**
   The first Public Licensed Service Provider **(PLSP)**, which deploys passive and active infrastructure inside a Megaproject,

[5] This is not a valuation of this approach or meant to be a description of a future approach.
[6] See e.g. http://qnbn.qa/wp-content/uploads/2012/11/Q-NBN-SOHO-and-Residential-Services-Internal-Cabling-Guideline.pdf accessed 8 Apr 2013
[7] Within PI Megaprojects the developer may operate and maintain the network.

provides other PLSPs an active wholesale access product. The other PLSPs are completely dependent on the active wholesale product, which is fully controlled by the first PLSP (network operator). Such active wholesale products do not fully allow for QoS and service differentiation. Protracted implementation and high wholesale pricing issues must be carefully balanced with intended results.

3) **Combined approach**
This would include a partial duplication of parts of the network (infrastructure based) by a second PLSP. The second PLSP offers products to end costumers on partly own infrastructure and partly on wholesale access bought from the first PLSP. This provides largely resilience and control, while avoiding expensive network duplication. The combined approach also provides for combination in view of different Megaprojects, i.e. Megaproject A is served on own infrastructure, Megaproject B is served on wholesale access product only.

The end costumer is only interested in provider choice and service quality. ictQATAR does **not want to prescribe a certain business model** or restrict the entrepreneurial freedom of doing business. Therefore, the recommended solutions take into account the current roles of the stakeholders and envisage certain business models which are likely to come true or are already implemented right now. However, they do not restrict stakeholders to these patterns as long as the goal of an open access regime to Megaproject is fulfilled.

For existing Megaprojects **(brownfield)** and new Megaprojects **(greenfield)** open-access solutions are proposed in more detail below. ictQATAR has a clear vision on open access solutions at both service and infrastructure levels for new greenfields. The proposed framework shall be **viable and realistic**. Any solution that may be theoretically ideal but does not reflect the current structures and dynamics of the Qatari ICT market is therefore not intended by ictQATAR. The proposed solution seeks a **compromise** between the interests and positions of stakeholders. Only a solution will succeed that on the one hand has a clear view on the mission of opening up Megaprojects to competition, but on the other hand also keeps in mind its need for acceptance with the stakeholders.

In the process of drafting the present consultation paper talks with all important stakeholders were held in order to identify their interest and positions. The collected input is reflected in this paper and will considerably increase the level of acceptance of the proposed solution. **The relevant outcome of the framework shall be a competitive environment from an end customer's perspective and includes the possibility for a customer to choose different services from different operators.**

The typical Megaproject setup (Target Scenario) is depicted in the following figure.

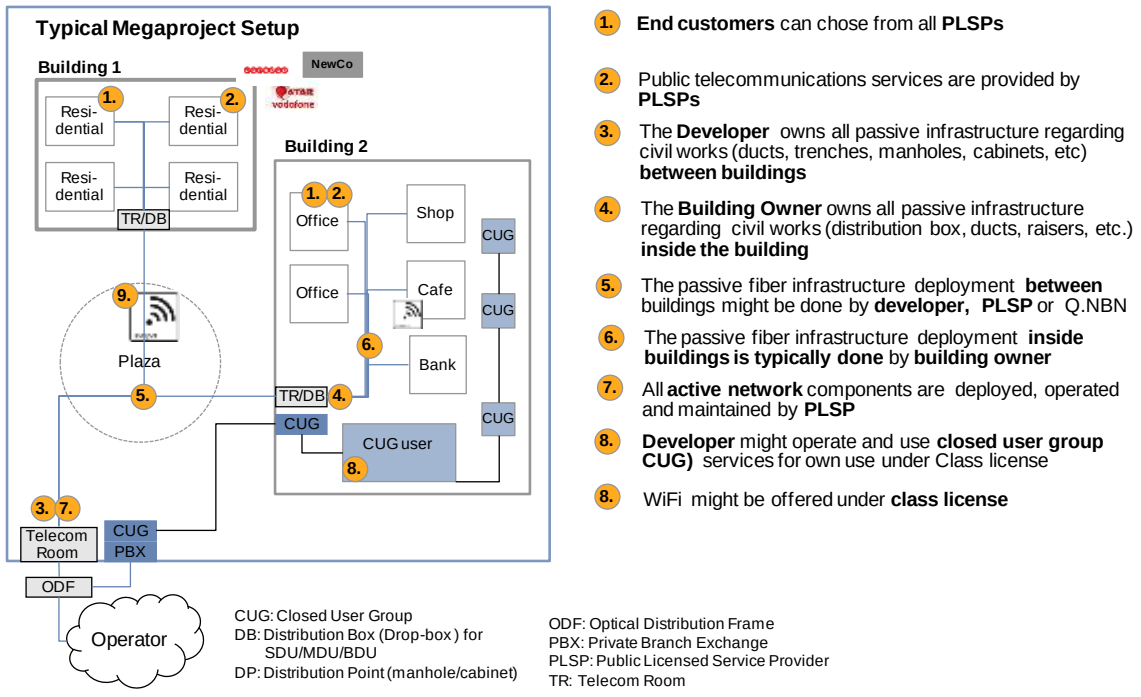

Figure 2: Typical Megaproject Setup

4.4.2 Principles for the Megaproject Framework

The **major principles** for the Megaproject Framework are:

1. Retail services to the end customer may only be rendered by a PLSP.
2. End customers have to be able to choose retail services from all PLSPs.
3. All PLSPs have to be able to offer retail services to end customer in a Megaproject. Open, transparent and non-discriminatory access must be ensured.

These major principles can be detailed as follows:

a. General

- ictQATAR is flexible regarding the open access solutions: It can be provided by different means of competition (service and infrastructure based)
- All rules regarding the open access framework apply equally to all service provider
- Fiber and other infrastructure have to be built according to latest industry standards.
- End customers (businesses and residents) can select the PLSP of their choice.

b. Passive Infrastructure – civil works (as ducts, manholes, cabinets, telecommunications rooms and other necessary collocation space etc) BETWEEN buildings

- Such infrastructure is owned by the Developer. This will prevent PLSPs/Q.NBN to monopolize this essential infrastructure.
- The Developer has to ensure that sufficient space is available for at least three service providers.

c. Passive Infrastructure – fiber BETWEEN buildings

- The installation can be done by a PLSP, Q.NBN or by the Developer itself.
- Open access has to be provided in any case.
- If passive access is not feasible, an active wholesale product (bitstream) has to be provided.

d. Passive Infrastructure – civil works (as ducts, risers, cable trays, telecommunications rooms and other necessary collocation space, etc.) INSIDE buildings

- Such infrastructure is owned by the building owners. This will prevent PLSPs/Q.NBN to monopolize this essential infrastructure.
- The building owner has to ensure that sufficient space is available for at least three service providers.

e. Passive Infrastructure – fiber INSIDE buildings (in-house fiber/cabling)

- Deployment of fiber inside the buildings is typically done by the building owner, but can also be done by a PLSP or Q.NBN.
- Open access has to be provided in any case. For cabling inside buildings, at least **4 optical fibers** should be designed per each household. Three fibers are used as active links, the last one as reserve or internal service. This should be ensured by deploying three active fibers and one backup fiber per dwelling.

f. Point to Point (P2P) topology

- ictQATAR prefers the P2P topology for network design to provide future proof broadband access solutions. Only P2P topology provides a dedicated fiber to the end customer and, thus, ensures long-term readiness for future service provision.

g. Non-discriminatory access at defined Open Access Points

Non-discriminatory access should be made available at least at the following Open Access Points

- Optical Distribution Frame (ODF)
- Central Telecom Room (-> Central Office with ODF) Distribution Point (manhole/ cabinet)
- Distribution Box (or Telecom Room)
- Floor Terminal Box
- Home Distribution Box

h. Wholesale access services

The proposed catalogue contains

- access to ducts,
- dark fiber,
- collocation (at concentration point) and
- Bitstream Access / VULA.

i. Active Infrastructure (routers, switches, repeater etc.)

- PLSPs deploy, operate and maintain the Active Infrastructure.
- PLSPs have to provide open access solution to requesting PLSPs.

j. Closed User Groups (CUG)

- Public Infrastructure Megaprojects **(PI Megaproject)** such as airports, rail, metro and ports are different from “normal” Megaproject, as they are largely using telecommunications networks and services for their **own, internal purposes** (Closed User Group). This is defined and covered under the Closed User Group Class License.[8]
- For such PI Megaprojects it may be permissible to allow PLSPs to offer their services via the CUG’s network (“extension of services’).

Question 6	Do you agree with the major principles? Should they be amended or enhanced?
Question 7	Do you have any comments on the Detailed Principles

4.4.3 Roles and Responsibilities in the various models

Since ictQATAR seeks flexible solutions that might take different combinations of typical approaches (see Figure 1: Models in Megaprojects), various models are possible.

Vertically integrated

[8] Closed User Group Class License, September, 7th, 2011 - ICTRA 20110710b

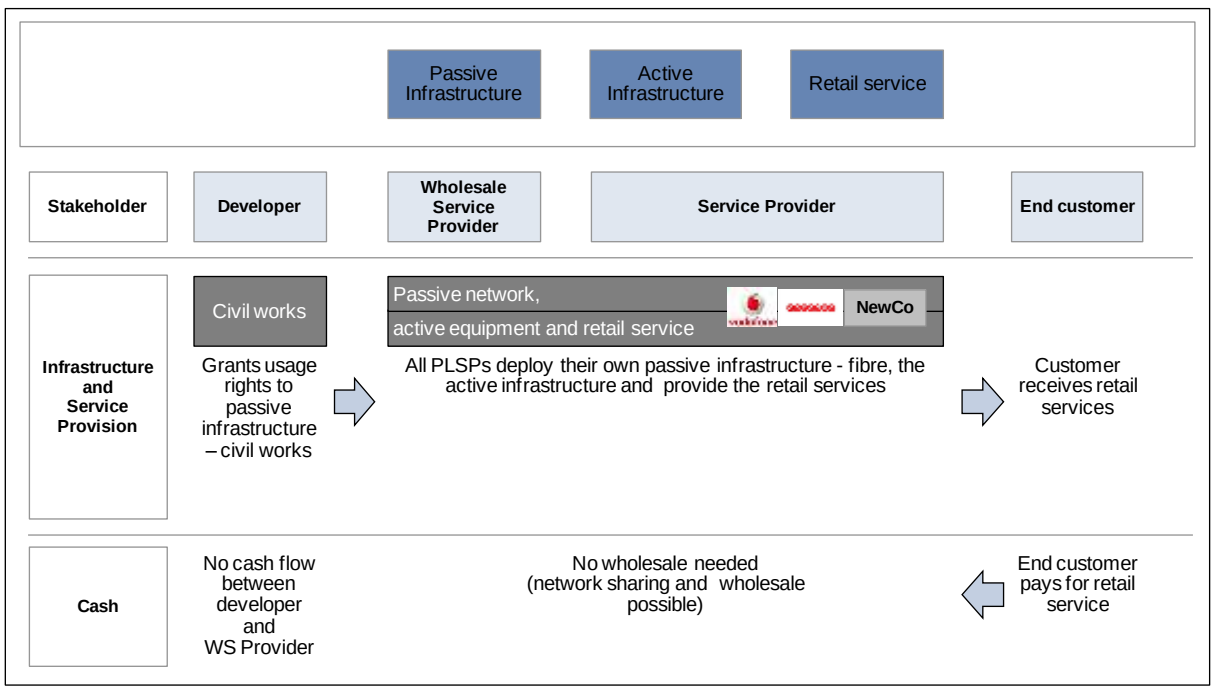

Figure 3: Business model for vertically integrated PLSPs

In the pure form of this model **each PLSPs sets up its own network infrastructure**. These providers offer their own retail services to the end customers.
In the pure form **no wholesale** will be necessary, as all PLSPs have the complete path to the end customer. Parallel infrastructure might consist of a dedicated fiber to the end consumer based on agreed rollout principle (e.g. four fibers per business/dwelling unit in a Megaproject).

Typically, it will not be a pure form of this model which is applied, but a PLSP or Q.NBN is rolling out fiber for multiple operators. Other PLSPs will get access to dark fiber on a wholesale basis.

Active Sharing

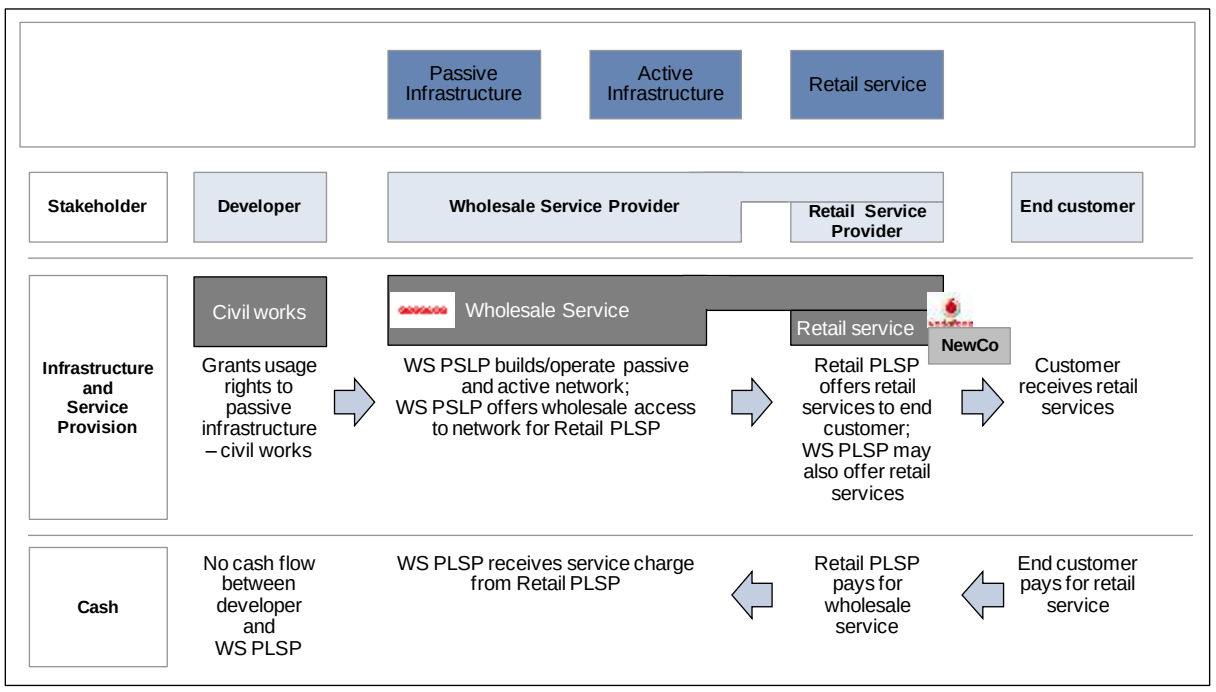

Figure 4: Business model for active sharing

A PLSP (first provider) sets up the entire network (active and passive) within a Megaproject. It does so in passive infrastructure – civil works deployed by the Developer. This first provider may as well offer its own retail services to the end customer on the basis of the deployed network.
The PLSP will act as a wholesale service provider and have to offer **wholesale access** to every other PLSPs which wants to offer services to the end customers inside the Megaproject. This wholesale access will rest upon the principles of transparency, fairness and non-discrimination. The wholesale service will be on the basis of **regulated and cost-oriented tariffs**.

Passive sharing

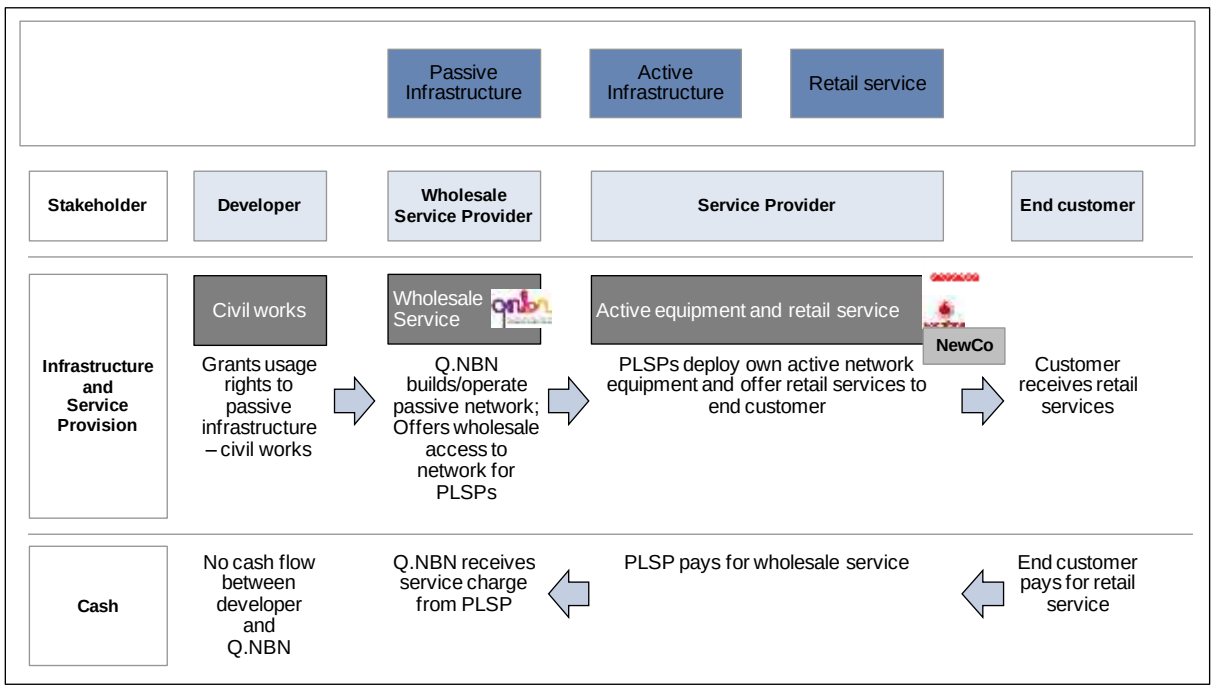

Figure 5: Business model for passive sharing

In this model Q.NBN sets up the passive network infrastructure within a Megaproject. It does so in passive infrastructure – civil works which was deployed by the Developer.
Q.NBN will act as a wholesale service provider and has to offer **wholesale access** to every PLSP which wants to offer its services to the end customers inside the Megaproject. These PLSPs have to deploy their own active equipment and offer their retail services on this basis.
The wholesale access will rest upon the principles of transparency, fairness and non-discrimination. Q.NBN will get reimbursed for the wholesale access to its passive infrastructure on the basis of **regulated and cost-oriented tariffs**.

In case Q.NBN will not meet the requirements of a nation-wide passive infrastructure provider, other PLSP have to take the Q.NBN role for fast and efficient passive network deployment.

Question 8	Are there any additional roles, responsibilities and relations to be added regarding a typical Megaproject setup?
Question 9	Would you see any difficulties in applying these principles to brownfield megaprojects?
Question 10	Would you see any difficulties in extending these principles outside Megaprojects? If yes, how could the principles be amended to apply them outside?

4.5 Technical principles

4.5.1 FTTH Reference Model

The implementation of wholesale access in Megaprojects must take into consideration all technical needs and requirements from all involved parties. To this end ictQATAR is proposing a FTTH reference model defining the main components of the technical infrastructure.
The necessary electronic active equipment to provide fiber services is located at the operator's Central Office **(CO)**. It is the central point connecting a large number of end customers. End customers are usually classified as Single Dwelling Unit **(SDU),** Multi-Dwelling Unit **(MDU)** and Business Dwelling Unit **(BDU).** The general joint nodes between CO and SDU/MDU/BDU are Telecom Rooms, Distribution Points (**DP**), and Distribution Boxes (**DB**). This applies for all fiber architecture regardless size or number of units.
Based on FTTH Council Standards and best practices, ictQATAR has developed a **generalized FTTH reference model** for Megaprojects depicting the passive infrastructure from the CO to SDU, MDU and BDU including the in-house cabling. The main components of this reference model are:

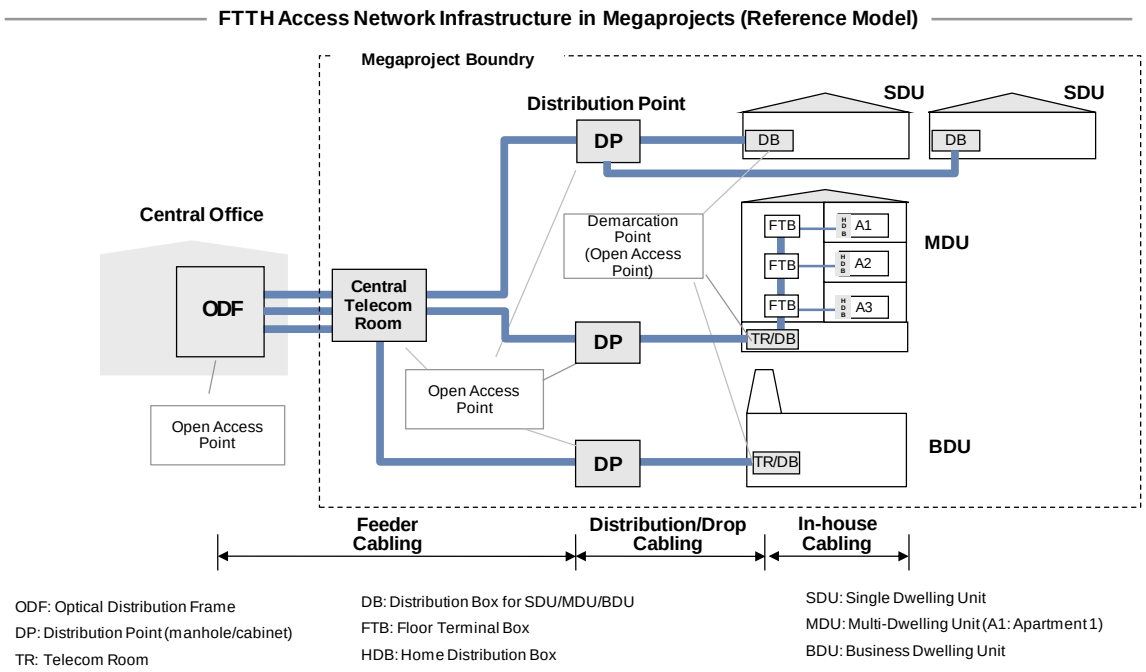

Figure 6: FTTH access network infrastructure reference model

- **Central Office**: big telecommunications room in one building or separate building to house active transmission equipment from the service providers, manage all fiber terminations and facilitate the interconnection between optical fibers and active equipment; Central Office is defined as Point of Presence (**POP**) in many cases. Only CO is used in this document.
- **Optical Distribution Frame**: connects outside optical cables/fibers to the active equipments in the Central Office
- **Central Telecom Room**: specified for Megaprojects as a centralized access point for network operators with or without ODF. For a large size project, a Central Office may be collocated at Central Telecom Room.
- **Feeder Cabling**: large size optical cables and supporting infrastructure (e.g. ducting or poles), connecting CO with DPs
- **DP**: manhole or cabinet as concentration point converting feeder cables to smaller distribution cables. In case of GPON P2MP, splitters may be installed here
- **Distribution/Drop Cabling**: medium or small size optical cables connecting DP and DB or Telecom Room of SDU/MDU/BDU
- **DB** or **Telecom Room**: transition node from outdoor to indoor cables.
    - DB for MDU and BDU is mostly defined as Building DB, i.e. Building Entry Point.
    - DB for SDU may be Home DB, i.e. Optical Telecommunication Outlet
    - Telecom Room is mostly deployed for MDU and BDU
- **In-house cabling**: in most cases for MDU, also for BDU (if required), connecting DB or Telecom Room to each unit e.g. apartment, excluding home-cabling within a unit
- **Floor Terminal Box**: floor distributor as an optical element allowing the transition from the vertical to the horizontal cables for MDU
- **Home DB**: optical telecommunications outlet provide an optical interface to the equipment cord of the Optical Network Termination (**ONT**) / Customer Premise Equipment (**CPE**)

Within this network architecture, **ictQATAR** has **defined** a number of points that are in principle **open access points**, i.e. at these points the network provider has to open its network to alternative second providers. In general, the **DB** is the **DP** for network operators to access and share the in-house infrastructure and cabling.

Regarding of the 3-layers business model (passive/active/retail) described before, **developers** or **building owners** or **PLSPs** may build up the passive infrastructure. On top of the passive infrastructure, PLSPs will deploy the active networks and make the network operational by installing active components both for the Central Office and end customers (SDU/MDU/BDU). **PLSPs** offer services directly to end customers.

4.5.2 Topology (P2P and P2MP)

FTTH provides a full fiber network from the CO directly to the end customers. There are two typical topologies of FTTH networks: Point-to-Point (**P2P**) or Point-to-Multipoint (**P2MP**). The P2P topology provides a dedicated fiber between CO and end customer. The P2MP topology provides a shared fiber between CO and DP (manhole/cabinet), then dedicated fiber between DP and end customers. P2P and P2MP are mostly applied to Ethernet and GPON, respectively.

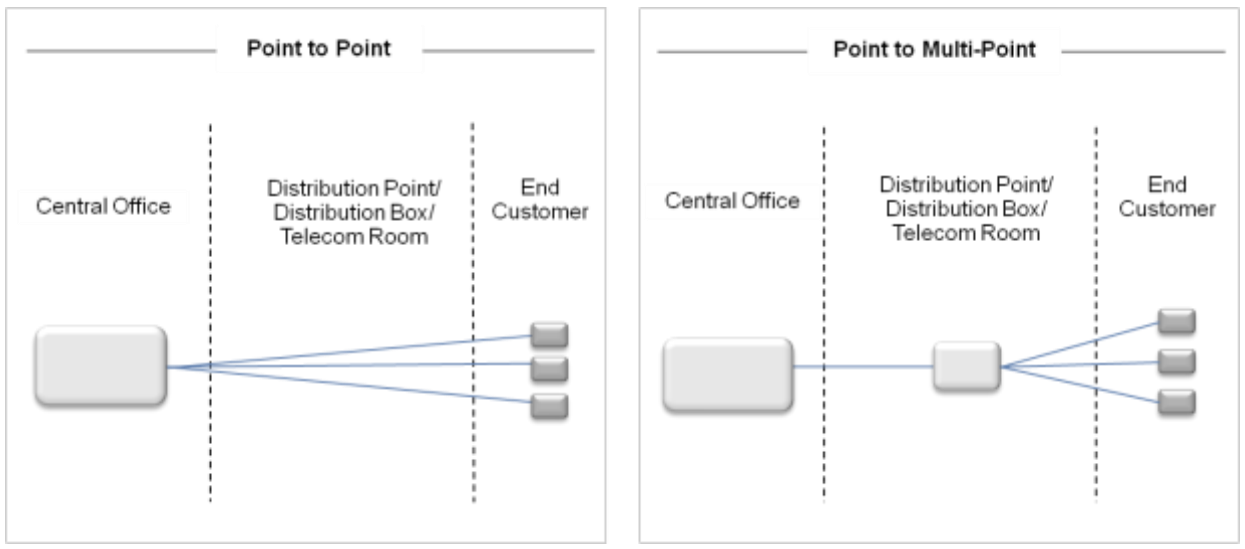

Figure 7: FTTH topology overview

Both topologies have distinctive advantages and disadvantages. Regarding investment, wholesale access provisions, and Operations & Maintenance, these are as follows:

P2P vs P2MP Costs (Investment)
Deployment (civil work and cabling) are the major costs for FTTH greenfield projects. Material is the optical cables, enclosure and other passive components. The **active equipments** in the central office are a **small part** of the overall CAPEX. **P2P topology** requires **more optical fibers** and **space** than P2MP topology. Deployment costs are similar to P2MP. The increasing **costs of CO active components** and material (cables, manhole, etc.) for **P2P** have only **limited impact** on the overall CAPEX of FTTH projects.

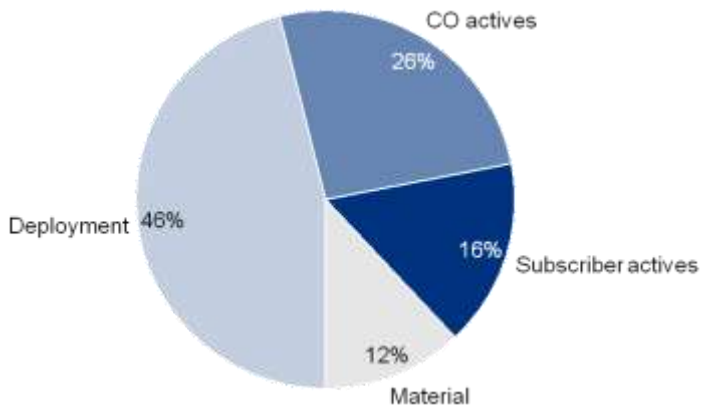

Figure 8: CAPEX Breakdown of an FTTH greenfield Project (*FTTH Council Europe, Business Guideline, 2013*)

P2P vs P2MP Open Access (Unbundling)
P2P provides a **fully physical unbundling** over fiber optical cables from CO to end customers. It is **more transparent** for open access, more efficient and generally more future proof.
P2MP has **limitation for physical fiber unbundling.** It may provide only open access based on active network infrastructure (Bitstream Access / VULA). Wavelength unbundling over P2MP is not yet standardized.

P2P vs P2MP Operations & Maintenance
The **power consumption** for PON P2MP is relatively lower than the Ethernet P2P. But P2P topology simplifies the **trouble shooting** directly from Central Office. Especially, **technology upgrades** for Ethernet P2P is easier than in a PON P2MPenvironemnt. Thus, P2P is better for the **long term planning** with future proof. In addition, Ethernet P2P with dedicated fiber connection is better to ensure the **data protection** for end customers.

4.5.3 Open Access - Overview

The term **open access** implies that network resources are made available to other service providers. Access has to be granted on fair and non-discriminatory terms; in other words, the **price for access** is the **same** for **all service providers** and shall be less than the cost of building a separate infrastructure. All PLSP requesting access shall be granted wholesale access to end customers in Megaprojects.

This enables any PLSP to reach end customers without the need to deploy their own entire fiber access network. The **access conditions** are the same for all access seeking parties. The wholesale **pricing structure** is **transparent**, **non-discriminatory** and **equal**.

Wholesale access products can be offered at different levels of the infrastructure. They depend on the type of open access model. In general, ictQATAR's approach to Megaprojects distinguishes between fiber infrastructure, which is directly related to telecommunications service delivery, and non-telco access infrastructure (labeled as civil works infrastructure). The latter includes especially trenches, ducts and manholes. The main differentiator, however, is between active and passive networks.

- **Passive open access infrastructure** (e.g. dark fiber,) includes all passive components, i.e. no power consumption included. It provides service providers the opportunity to share network components and deploy their own infrastructures on top for delivering services to the end customer
- **Active open access infrastructure** (e.g. Ethernet layer-2 and IP layer-3) includes all active equipment such as routers, switches, etc. It makes it possible for service providers offering residential, business and public services to share a common active infrastructure that is built by a passive infrastructure provider and operated by an active infrastructure provider[9]

Each **alternative PLSP** has complete control over the fiber cables from the CO to the end user. In this case, the alternative operator co-located its own equipment in the incumbent's central office (or Telecom Room) and provides broadband Internet and voice services.

4.5.4 Open Access Points

Depending on the actual implementation in the Megaproject, access to various points in the network is foreseen. The potential access points are depicted in Figure 6: FTTH access network infrastructure reference model.
ictQATAR has defined the following **Open Access Points** in Megaprojects. Access Points have to be made available on non-discriminatory basis to all requesting PLSPs. These open access points are:

- ODF
- Central Telecom Room (-> Central Office with ODF)
- DP (manhole/ cabinet)
- DB (or Telecom Room)
- Floor Terminal Box
- Home DB

Concentration point unbundling (Central Telecom Room, DP, DB)
Concentration point unbundling is relevant for specific network architectures within the FTTH scenario. A party requesting unbundling at the concentration point may have access to the unbundled fiber (sub) loop to set up a **Point to Point** as well as

[9] According to *FTTH Council Europe, Business Guide, 2013*

a **Point to Multipoint** technology in its own upstream network – independently of the network structure or technology chosen by the operator who gives access to its network.

ODF unbundling

To **unbundle P2P** fiber networks, the alternative operator will **terminate** its fiber in the **ODF location** (e.g. central office). For passive fiber connections from their collocation footprint the alternative **PLSP** connects directly to the local access fiber at the ODF.

Wavelength unbundling is a physical unbundling with separate wavelengths over a single fiber at the ODF, likely to be unbundled **on P2MP topology.** Wiring Data/Diagram (WDM) technology is currently used mainly in transport networks or large corporate networks, still **not for access networks**.

4.5.5 Passive and active wholesale products

ictQATAR is flexible regarding the open access solutions: Open access can be provided either infrastructure or service based. Also a combination of the two is possible.
A possible service catalogue for the different layers could include:

Wholesale Products	Passive Infrastructure – civil works (BETWEEN Buildings)[10]	Passive Infrastructure – civil works (INSIDE Buildings)[11]	Passive infrastructure – fiber BETWEEN Buildings	Passive infrastructure – fiber INSIDE Building	Active infrastructure (routers, switches, etc.)
Duct Access	X	X			
Collocation	X	X			
Dark Fiber			X	X	
Bitstream / VULA					X

Passive Infrastructure – civil works (as ducts, manholes, cabinets, telecommunications rooms and other necessary collocation space, etc.) BETWEEN buildings

A **duct access** product could be used by the operators to **reach any** of the **concentration points**, i.e. either to reach the cabinet, manhole or even the buildings. Duct access is a wholesale passive access product. The space and technical requirements have to be taken into account.

For **collocation** at the **concentration point** including ODF applies, it should be possible for a certain number of alternative operators to install (operate and repair) an ODF or a set of splitters and interconnect/access to the Megaproject network operator optic infrastructure within the concentration point.

Passive Infrastructure – civil works (as ducts, risers, cable trays, telecommunications rooms and other necessary collocation space, etc.) INSIDE buildings

A **duct access** product could be used by the operators to **reach** end customer. Duct access is a wholesale passive access product. The space and technical requirements have to be taken into account.

Collocation can be possible at the **building**, at the concentration point or at the cabinet. Building collocation depends on conditions to access the building, such as ducts, cabling, etc.

Passive Infrastructure – fiber BETWEEN buildings

A **dark fiber access** (feeder cabling / distribution drop cabling) product could be used by the operators to **reach any** of the **concentration points**, i.e., either to reach the cabinet, manhole or even the buildings. Dark fiber is a wholesale passive access product (**unlit optical fiber**) and can be used by the operators to connect its equipments in **access networks.**

Passive Infrastructure – fiber INSIDE buildings (in-house fiber/cabling)

Access to in-house wiring is related to **unbundling/sharing** of the **fiber loop** in a **FTTH scenario**.

Active Infrastructure (routers, switches, etc.)

Bitstream is access at layer 2 (ATM, Ethernet) and/or layer 3(IP). The wholesale products may be applicable for all roll-out scenarios and generally allow the maximum freedom for alternative operators to define the QoS and the configuration of their own retail services. The active infrastructure belongs to deploying party, which is usually the network operator.

Virtual Unbundled Local Access (VULA) is taken as a **special case** of **Bitstream Access**, allowing competitors to deliver services over the fiber infrastructure of Passive Network Providers, and with a degree of control. The Passive Network Providers still effectively retain control over the physical line but gives competitors much more control over the connection.

4.5.6 Right of Way

Right of way usually refers to an operator's right to deploy infrastructure on public or private grounds. Right of way is a term first used to describe the right to travel unhindered, to access a route regardless of land ownership or any other legality. The minimum necessary involvement of any developer is providing **appropriate rights of way for deployment of telecommunications infrastructure**. For Megaproject, Developers/Building Owners have an intrinsic interest to ensure high-quality telecommunications infrastructure inside their Megaprojects. Thus, they should be ready to grant right of way - the right to install fiber cables - for infrastructure deployment, if certain rules and procedures are recognized.

[10] Passive infrastructure services civil works BETWEEN and INSIDE buildings (ducts, collocation, etc.) have to be provided by Developer / Building Owner.
[11] See FN 10

Developers should ensure that any PLSP has **equal access to such allocated corridors** and other plots of land for the purpose of deploying infrastructure. Where necessary to connect specific buildings (or where dedicated corridors are not provided), access to land that has not been specifically allocated for telecommunications needs should also be provided.

Under the standard approach it is the developer's task to perform the basic civil works and deploy the underlying infrastructure of trenches, ducts and manholes. **Developers** have to provide **all infrastructure providers access** to these facilities.

4.5.7 Target technical solution

Topology

ictQATAR **prefers the P2P topology** for network design to provide future proof broadband access solutions. The fiber unbundling (not wavelength) is preferred for open access. Four optical fibers per unit or household are defined for Megaprojects[12], Three fibers are available for network operators; One fiber as reserve.

P2MP Topology

- If P2MP topology is deployed in some special cases of SDUs and MDUs, fiber unbundling is required to provide an open access solution.
- Three layers fiber infrastructure (passive/active/retail) should provide three independent End-to-End connections from CO to end customers. **The capacity planning** for ODF, optical cables, ducts, DPs, DB, Floor Terminal Box, splitters **should be designed at least 3 times** as the **single P2MP** infrastructure.

1. **SDU**: the splitting ratio for splitters is maximum 1:16, splitter in DP, maximum 14 ports of one splitter are connected
2. **MDU**: splitters (maximum 1:16) are deployed only in the DB or Telecom Room, not in the DP, i.e. P2MP only from DB to Home DB).

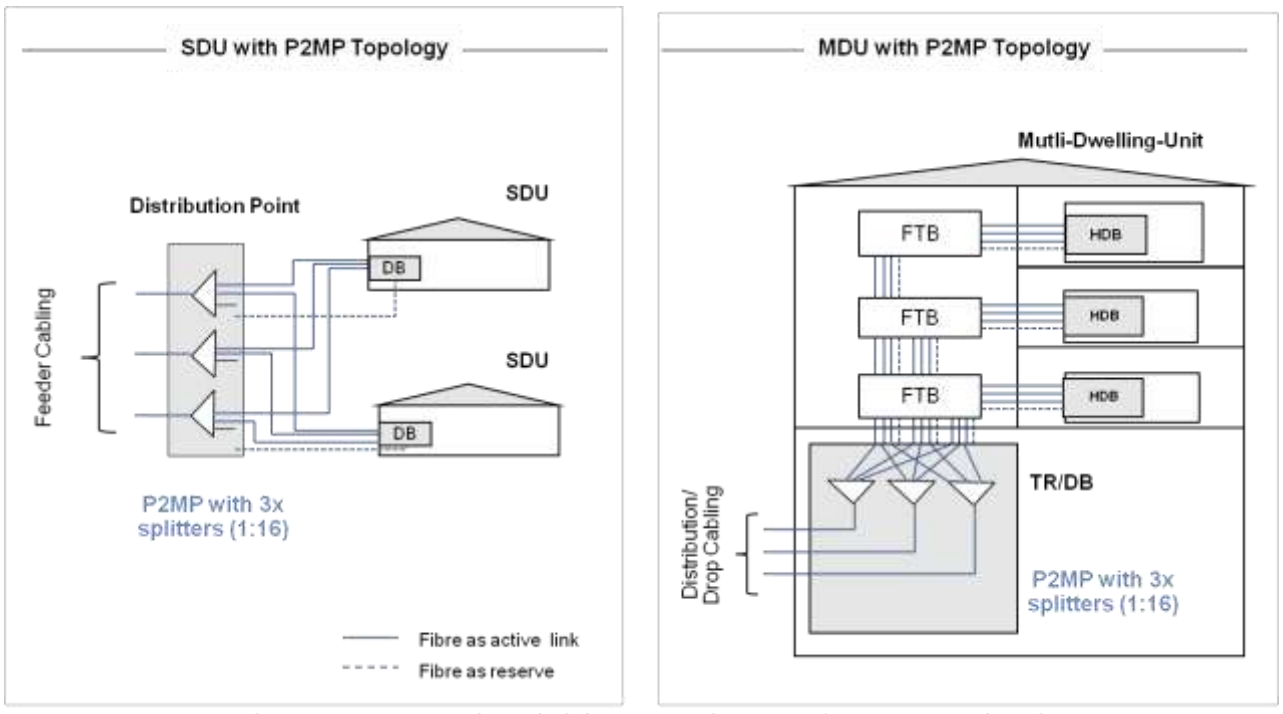

Figure 9: P2MP Toplogy (minimum requirements for MEGA-projects)

Cabling between the buildings

The **requirements of the guideline** are the following:

At least **4 optical fibers** should be designed per unit, i.e. per SDU, per apartment in MDU, or per BDU. Three fibers are used as active links, the last one as reserve or internal service. All passive infrastructures between CO and DB should have at least three-times capacity for ODF, ducts, cables, DP, DB by network dimensioning.

1. The network design for **BDU should be P2P** topology from CO to BDU. A fiber redundancy (redundancy protection cable) is preferable, but depends on services and alignment between PLSP and business customers.
   3. **Non-discriminatory access** to the concentration points and ducts for optical cabling sharing;
   4. **Connectors** are preferred for the optical cables in Central Office, DP, DB or Telecom Room

In-house cabling

At least **4 optical fibers** should be designed per each unit, i.e. per SDU, per apartment in MDU, or per BDU. Three fibers are used as active links, the last one as reserve or internal service. **Non-discriminatory access** to DB or Telecom Room and ducts for optical cabling has to be ensured. **Connectors** are preferred for the optical cables in DB or Telecom Room, Floor Terminal Box and Home DB.

In-house cabling (ducts) should be **deployed** by **building owners**, and follow up the **in-house cabling guideline** endorsed **by ictQATAR**. The optical cables can be built by developers or network operators. All ducts belong to the Building Owner. No transfer of

[12] This corresponds with the joint Qtel, Vodafone, Q.NBN Wiring Guidelines "The internal Wiring Guidelines for Small Office – Home Office (SoHo) and Residential Services"

passive infrastructure civil works inside building ownership shall be allowed. Optical cables belong to Developers or network providers within the Megaproject. Home cabling within an apartment or a single room should follow internationally accepted rules and standards. **Reference** could be made to e.g. FTTH Handbook (FTTH Council Europe) or similar standardization bodies. A reference model to show the in-house cabling structure looks as follows:

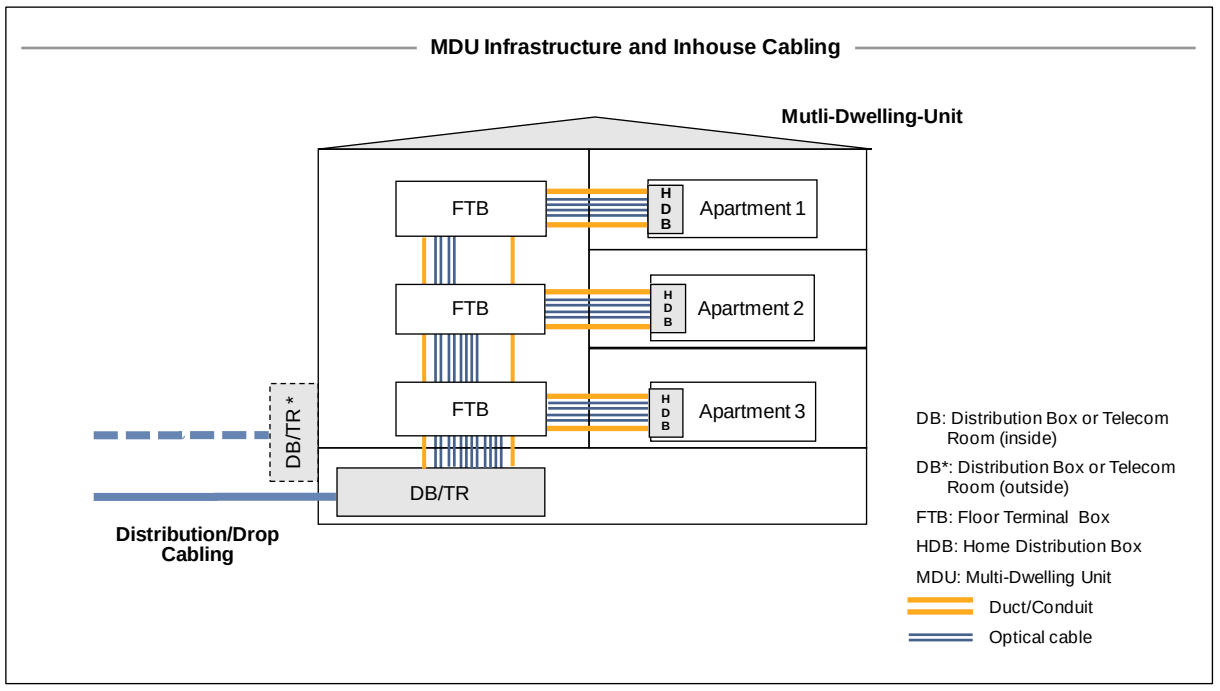

Figure 10: MDU infrastructure and in-house cabling

Access points (and collocation rooms)
Chapter 4.5.4 defines the open access points, e.g. Central Office, DP, DB or Telecom Room.

- **Central Telecom Room (or Central Office for large scale Megaprojects)**: developers may build Central Telecom Room or Central Office with all passive infrastructure
- **DB** or **Telecom Room** in the building and DPs: developers may build the Telecom Room or DB in the buildings, and DPs outside, as well **Floor Terminal Box** or **Home DB**.
- To provide an open access based on fiber unbundling for 3 active network operators, the space for open access points have to be designed at least **three-times capacity** of a single P2MP infrastructure.
- Providers of passive equipment grant **non-discriminatory access** to CO, DP, DB or Telecom Room, Floor Terminal Box and Home DB.
- Most of access points are **passive components**. Only Central Telecom Room or customers' premises may need **power supply**. The Megaproject owners have to provide and ensure power supply for Central Telecom Room (or CO in Megaprojects). Building owners **pay** for **power consumption** in CO and for other active network components. End customers have to pay the power consumption for CPE (Customer Premise Equipment) or ONT (Optical Network Termination).
- If CO or Central Telecom Room needs power, **one or more power supply backup systems** have to be deployed: 1) high performance/capacity backup batteries; 2) power generators to provide power for at least half a day.

Passive Infrastructure - Civil Works

Passive Infrastructure – civil works consists of ducts, trenches, manholes, telecommunication rooms, cabinets, etc. The civil work depends on the deployment techniques and difference rollout scenarios. A duct infrastructure allows for additional access network development and reconfiguration. The developers should follow up the international technical recommendations for civil work or deployment, e.g. FTTH Handbook (FTTH Council Europe). The quality of deployment has to be ensured not only to provide a high performance infrastructure, but also prevent the normal **damage,** like **water, dirtiness**, etc. The **technical specification** or **guideline of civil work** has to be provided by developers, which should be **submitted to ictQATAR for review**.

Question 11	Please provide your comments on the "infrastrutrure and technical principles".
Question 12	Do you need any other wholesale products besides the ones detailed above (ducts access, dark fiber, colocation (at concentration points), Bitstream / VULA)?
Question 13	Do you have any comments on ictQATAR's proposed Technical Target Solution?
Question 14	Please provide any other comments you might have.

4.5.8 Ancillary Solutions for Mobile Telephony

Mobile solutions are treated as ancillary solutions within this Megaproject approach. Optical cables are applied to mobile backhauls in the broadband mobile access networks (3G or 4G). Many rooftop solutions install the antenna (and active mobile equipments) on top of the buildings as mobile base station. The connection from base station (access network) through the building to aggregation networks may be optical cables. The optical riser cable in the building is a type of in-house cabling for FTTH deployment. The technical specification of FTTH in-house wiring could be taken as reference for mobile optical riser cabling in the building. In this case, the mobile base station (site) is collocated at the FTTH unit (e.g. MDU or BDU).
Developer / Building owner may ask network operators to install antennas on the top of buildings. Cables and mobile active equipment belong to mobile network operators.

Annex I Definitions and acronyms

BDU	Business Dwelling Units
BSA	Bitstream access
CAPEX	Capital Expenditure
CO	Central Office
CPE	Customer Premise Equipment
CUG	Closed User Group
DB	Distribution Box
DP	Distribution Point
FTTH	Fiber-to-the-home
GPON	Gigabit Passive Optical Network
HIA	Hamad International Airport
ICT	Information and communication technology
ictQATAR	Supreme Council of Information and Communication Technology
IPTV	Internet Protocol Television
MDU	Multi Dwelling Units
NG PON	Next Generation – PON
ODF	Optical Distribution Frame
ONT	Optical Network Termination
QTel	Qatar Telecom (Qtel) Q.S.C.
PI Megaproject	Public Infrastructure Megaproject
PLSP	Public Licensed Service Provider
PON	Passive Optical Network
POP	Point of Presence
P2MP	Point-to-MultiPoint
P2P	Point-to-Point
Q.NBN	Qatar National Broadband Network Q.S.C.
SDU	Single Dwelling Units
Vodafone	Vodafone Qatar Q.S.C.
VULA	Virtual Unbundled Local Access (“bitstream on fiber”)
WDM	Wiring Data/Diagrams

Annex II List of stakeholders where meetings were held

In the course of preparing the present consultation document ictQATAR held meetings with the following stakeholders:

- Qatar Satellite Company

- QTel

- Kahramaa

- Hamad International Airport

- Qatar Rail

- Vodafone

- UDC / The Pearl

- Q.NBN

- Barwa

- Ashgal

- Ministry of Municipality and Urban Planning

- Lusail

- General Directorate of Customs

- Qatar Ports

- Qatar Petroleum

Annex III Questions

Views and comments, on the fullest extent possible, on this Consultation Document are invited from industry participants, other stakeholders and interested parties. We would ask to provide views and comments on this Consultation Document generally and on a number of specific questions in particular. A complete list of the questions is contained in the following list of questions:

Annex IV Table of figures