هيئة الإتصالات وتقنية المعلومات
Communications and Information Technology Commission

Communications and Information Technology Commission

Consultation Paper

Assessment of the Establishment of International Internet Exchange Points (IIXPs) in the Kingdom of Saudi Arabia

23-10-1431 H

2-10-2010 G

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Annex A: Glossary of terms

1 Consultation Objectives and Procedure

The Communications and Information Technology Commission ("CITC") hereby issues this Public Consultation Document.

1.1 Objective and Aim of the Consultation

The objective of this consultation is to assist CITC to decide whether to establish one or more International Internet Exchange Points (IIXPs) within the Kingdom and, if so, the most appropriate means by which to do so.

1.2 Comments on Consultation Document

This Public Consultation Document is available on CITC's website at http://www.citc.gov.sa.

The CITC invites all interested parties to submit their written comments and responses to the numbered questions set out in section 5 of this Consultation Document (the "Consultation Questions"). All comments must be received by CITC no later than 3.00 p.m. on 5-1-1432 H, corresponding to 11-12-2010 G.

Comments filed in relation to this Public Consultation Document may be submitted to one or more of the following addresses:

a) E-mail to: ixp@citc.gov.sa;

b) Delivery (hard and soft copy) by hand or by courier to:

Office of the Deputy Governor for Regulatory Policies and Licensing Affairs
Communications and Information Technology Commission (CITC)
King Fahad Road, P.O. Box 75606
Riyadh 11588
Kingdom of Saudi Arabia

CITC may publish on its website copies of comments submitted by Respondents, other than information deemed confidential pursuant to the CITC Rules of Procedure. CITC encourages Respondents to support all comments with relevant data, analysis, benchmarking studies, and information based on the national situation or on the experience of other countries. In providing their comments, Respondents are requested to indicate the number of the Consultation Question(s) to which the comment relates. Respondents are not required to comment on all Consultation Questions. CITC will consider all comments received, but is under no obligation to adopt the comments of any Respondent.

The remainder of this Consultation Document is organized as follows:

- Section 2 presents relevant background information.
- Section 3 provides the market and regulatory situation, and describes relevant international best practices.
- Section 4 presents policy options on which CITC seeks comments.
- Section 5 presents a list of questions for Respondents.
- Section 6 describes the next steps following this consultation.

A glossary of relevant terms is included at the end of this Consultation Document.

2 Background

2.1 Introduction

This section describes the operation of the Internet, the role of an IIXP, and the means by which different operators that interconnect at an IIXP compensate one another for the carriage of Internet traffic. It then describes the multi-step IIXP review that CITC has undertaken.

2.2 The role of an IIXP

The Internet is an international ”network of networks”, operated by different organizations. These networks interconnect with one another to exchange Internet traffic, regardless of the geographic location at which the traffic originates or terminates. An IIXP contains a switch for Internet traffic. In many countries, global Internet backbone providers (“IBPs”), domestic facilities-based providers (“FBPs”) and Internet service providers (“ISPs”) can connect to an IIXP, using a leased line or their own fiber, in order to route Internet traffic among their networks. Many IIXPs are located in data centers, which contain computer servers used to ”host” Internet content. This provides an efficient way for content owners to acquire connectivity to the Internet from one of the IBPs or FBPs that connect to the IIXP’s traffic exchange infrastructure. In many cases, ISPs also collocate at a data center, where they may directly interconnect and exchange traffic.

Virtually every developed country, and many developing countries, has one or more IIXPs. Some countries have virtual IIXPs. A virtual IIXP is an IIXP that installs switching equipment in multiple third-party data centers, and leases fiber between or among them. This allows any operator present at any one of the data centers (and connected to the IIXP) to interconnect with any other operator connected to the IIXP in any of the other data centers. This can add redundancy, and can also increase the potential number of members of the IIXP. Every new data center in which the virtual IIXP co-locates brings a large number of potential new members that may connect to the IIXP at very low cost because they are already co-located at the data center.

There are two primary compensation arrangements used by service providers that interconnect at an IIXP. Service providers that carry large amounts of Internet traffic usually adopt a co-operative model of interconnection called *peering*, in which no payments are made between the ”peers” involved in the arrangement. This process is analogous to the ”bill and keep” arrangements often entered into by telecoms carriers that exchange roughly equal amounts of traffic without making payments to each other. Providers may peer by interconnecting directly with one another (private peering) or by connecting to a switch operated by the IIXP (public peering). By contrast, ISPs or smaller FBPs may not have the scale required to make a peering arrangement attractive to a larger player. In such a case, the ISP or smaller FBP may have to pay for *transit* on the larger provider’s network in order to deliver Internet traffic to its destination. A peering relationship only gives each peer access to the other peer’s customer base. By contrast, a transit relationship typically gives the buyer access to the entire Internet, including the seller’s peers as well as other customers.

2.3 The review process

CITC has initiated a review to assess whether to establish one or more International Internet Exchange Points (IIXPs) within the Kingdom and, if so, to develop an appropriate regulatory framework.[1] In conducting this assessment, CITC is considering a number of alternatives, including: having CITC establish an International IXP; having an FBP or commercial operator establish an International IXP; or adopting alternative approaches that do not involve the establishment of an International IXP.

CITC is conducting this review using a multi-phase approach.

During the **first phase**, CITC identified three relevant policy goals for the Kingdom:

- **Promotion of Internet usage**. The Kingdom should promote broadband take-up and general Internet usage. This can help to develop a vibrant knowledge-based economy and information society within the Kingdom, and to disseminate advanced technologies and services – such as e-government, telemedicine and distance learning – that will bring significant social and economic benefits.

- **Promotion of the Kingdom as an international hub**. The Kingdom should capitalize on its geographical location, access to significant international bandwidth, stable political situation and favorable business environment to become a hub for both international Internet traffic and on-line content.

- **Localization of Internet traffic**. Finally, the Kingdom should ensure , that all Internet traffic between domestic networks be "localized." That is, Internet traffic that originates and terminates on a network within the Kingdom must be routed within the Kingdom, rather than "tromboning" through another country. Localization of domestic traffic increases service quality, reduces cost, and enhances national security[2].

During the **second phase** of the project, CITC conducted an extensive study of Internet-related issues. This process included:

- An assessment of the current market and legal situation in the Kingdom;

- A benchmarking exercise that assessed fifteen separate countries around the world (including six countries in the Arab region), and ten IXPs located in various countries (including one in the Arab region), in order to identify international best practice regarding Internet regulation, and IXPs;

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1 An International IXP is a location at which all Internet traffic can be exchanged, regardless of the geographic location at which the traffic originates or terminates.

2 Interconnection Decree, Number 229, of 24 September 2004 (Decree 229), was issued by the Council of Ministers and requires all local Internet traffic to remain within the Kingdom.

- A gap analysis, which revealed a number of substantial differences between international best practices and the current situation in the Kingdom; and

- A policy assessment, which considered a range of policy options designed to achieve the three goals identified above.

As part of its assessment, CITC considered the impact of each proposal on the Government's ability to protect national security and to preserve the existing content filtering regime.

This public consultation on the policy proposal marks the **third phase** of the project. In this consultation, CITC is seeking comments regarding:

- the Internet market in the Kingdom;
- a number of different policy options; and
- regulatory issues relevant to implementation of each of the proposed options.

At the close of the comment period, CITC will carefully review all information collected.

Finally, as discussed further below, during the **fourth phase** of the process, CITC will issue a report that:

(1) assesses the comments received during this public consultation;

(2) sets forth the policy that CITC has adopted; and

(3) proposes regulatory instruments that are necessary to implement CITC's policy.

CITC will then conduct a second public consultation regarding the proposed regulatory instruments. Following a review of the comments received, CITC will make any necessary revisions, and will issue any appropriate regulatory instruments.

3 Market and regulatory situation in the Kingdom

As discussed above, CITC has undertaken a wide-ranging study of the situation in the Kingdom, and of international best practice regarding the regulation of the Internet and the operation of IIXPs. This study shows that the Kingdom has yet to achieve the three goals identified above, and has not yet implemented international best practices in a number of respects.

3.1 Existing situation in the Kingdom

CITC has considered a number of regulatory issues as part of its review. These include:

1) CITC's legal authority to own and operate (or contract out the operation of) an International IXP;

2) the license required if an entity, other than CITC, were to own and operate an International IXP;

3) the licensing regime applicable to data centers and ISPs; and

4) CITC's legal authority to require a dominant FBP to sell IP transit to other FBPs.

Conclusions from the review of each of these issues are provided in the following subsections.

CITC's authority to own and operate an International IXP

CITC's legal authority over the telecommunications sector is based primarily on three legal instruments – the Telecommunications Act, the Commission Ordinance, and the Telecommunications Bylaws ("Bylaws") – which constitute a key part of the Commission Statutes. In addition, Decree 133, adopted by the Council of Ministers, gives CITC authority over the information technology sector.

- *The Telecommunications Act*, provides the legislative foundation for the development and regulation of the telecommunications sector. Article Two of the Act provides that CITC is to "perform the functions and duties conferred upon it by this Act, the Bylaws, and the Ordinance."[3] This includes issuing licenses, adopting competition rules, and establishing the interconnection regime.[4]

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[3] Telecommunication Act . §2.

[4] *Id.* Ch. 5-7.

- *The Commission Ordinance*[5], defines CITC's functions, governance and financing. In particular, the Ordinance provides that CITC is to seek to achieve "the orderly expansion of the telecommunications infrastructure" and "[e]ncourage investment in telecommunication services and their infrastructure" in order to ensure that telecommunications services will be provided "at affordable prices and high quality in all the provinces of the Kingdom."[6]

- *The Bylaws*[7] provide CITC with broad and flexible regulatory authority over the telecommunications sector. In particular, in addition to the powers expressly granted in the Telecommunications Act and the Bylaws, CITC may "make such Bylaws or decisions as are consistent with a CITC statute and useful or necessary to fully implement and enforce CITC statutes."[8] CITC also has the power to "issue a decision to order any person, subject to any conditions that it determines, to do anything the person is required to do or to forbid the person from doing anything that the person is prohibited from doing under a CITC Statute."[9]

- *Decree 133*,[10] adopted by the Council of Ministers in 2003, expanded CITC's authority to include the information technology sector. In particular, Decree 133 authorizes CITC to implement "policies, plans, and programs" for the development of the IT sector, issue any "necessary license", "organize expansion of infrastructure of information technology in co-ordination with the concerned government and private organizations", and encourage investment in the sector.[11]

Thus, CITC's existing grant of authority – in particular, the authority under Decree 133 to "[o]rganize expansion of infrastructure of information technology" coupled with the authority under the Bylaws to "take such other actions ... as are consistent with a CITC statute and useful or necessary to fully implement and enforce CITC statutes" – provide sufficient authority for CITC to establish and operate an International IXP or to contract-out the day-to-day operation of the International IXP, subject to CITC's ultimate control.

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5 The Commission Ordinance (issued pursuant to the Council of Ministers resolution No. (74) dated 05/03/1422H (corresponding to 27/05/2001)); amended pursuant to the Council of Ministers Decree No. (133) dated 21/05/1424H (corresponding to 21/07/2003).

6 *Id.* Art. 3(d)-(g).

7 The Commission Bylaws (issued by the Minister of Post, Telegraph and Telephone, resolution No. (11) dated 17/05/1423H (corresponding to 27/07/2002)).

8 *Id.* Art. 3.1.

9 *Id.* Art. 3.3.

10 Council of Ministers Decree No. 133.

11 *Id.* ¶¶ 1, 4-7.

International IXP licensing issues

If CITC were to establish an International IXP, it would not be required to "license itself". However, if any other entity were to own and operate an International IXP, it would require a license.

The Telecommunications Act states that:

> *"Anyone who fulfills the conditions and has the interest to provide Telecommunications service should submit his application to the Commission in order to obtain the license."*[12]

Similarly, the Bylaws provide that

> "*No person shall ... provide a telecommunications service to the public, or ... operate a telecommunications network used to provide telecommunications services to the public ... except under and in accordance with a telecommunications license issued by the Commission*."[13]

A "public telecommunications service" is a service that provides for the conveying or routing of signals, in whole or in part, over a system that uses switches, cables and other means to provide services to the public.

The operation of an IIXP constitutes provision of a public telecommunications service. All IIXPs provide switching and routing of telecommunications traffic that originates or terminates on a public telecommunications network. In addition, a virtual IIXP transports such traffic among multiple data centers, typically over high-capacity fiber links. Finally, in some cases, an IIXP can provide service directly to members of the public, such as large corporations or educational institutions, which may route content through its switch. Thus, if an entity other than CITC were to operate an International IXP, the entity would require a license from CITC.

While the operators that currently hold FBP licenses could use those licenses to establish an International IXP, CITC would not have to issue a *facilities-based* license to other entities that seek to own and operate an International IXP. The operation of a switch or router, in itself, does not render an operator an FBP. For example, ISPs – which are licensed as services-based providers ("SBPs") – typically operate routers. In addition, even if the International IXP purchases transport among data centers from an FBP, rather than providing the service over its own facilities, it would not require an FBP license – just as an ISP, which purchases transmission from an FBP to access the Internet, does not require an FBP license. CITC, therefore, could issue a class license authorizing the establishment and operation of an International IXP. Alternatively, an International IXP could be established by Decree, in which case it would not be necessary for

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12 Telecommunications Act Art. 18.

13 Telecommunications Bylaws Article 10.1.

CITC to issue any sort of license. This is the procedure that the Government used to authorize the King Abdul Aziz City for Science and Technology ("KACST") to operate as the Kingdom's original ISP.

ISP and data center licensing

CITC has issued a class license for the provision of Internet access service by ISPs. This license has two significant special conditions. First, it limits the licensee to the following services: Internet access; email; IP address assignment; web design and website hosting; operation of data centers and equipment hosting; network monitoring; domain name registration; Internet content publishing; and Internet advertising.[14] Second, the license provides that an ISP must "[p]rovide its service or connect to the Internet only through methods determined by the Commission."[15] Because CITC licenses ISPs as SBPs, an ISP cannot deploy its own transmission facilities. As a result, the ISP's customers purchase connectivity – whether narrowband or broadband – from an FBP to connect to the ISP, while the ISP leases capacity from an FBP to connect to the Internet. ISPs may not interconnect directly in order to exchange traffic, a process known as "secondary peering." Instead, they must exchange traffic through an FBP.

CITC also has issued a class license for the operation of a data center, which in the Kingdom is referred to as a telecom hotel. The license defines the service as "a building equipped to host Information and Communications Technology (ICT) devices, equipment and provide interconnection services between these devices and the CITC-licensed facility-based ICT service providers only."[16] In particular, the license allows the holder to provide "hosting services for ICT devices" and "interconnection services for CITC-licensed facility-based ICT service providers." Any interconnect must be provided using "direct interconnection links." In other words, the licensee may offer cross connects – which are direct interconnection links – to allow private peering or transit, but may not operate a switch and, therefore, may not offer public peering. Indeed, the licensee is not allowed to "provide any additional service related to ICT" without the CITC's express approval.[17]

CITC has the authority to modify the ISP and telecom hotel licenses. Pursuant to the Telecom Bylaws, the CITC, after providing notice and an opportunity for comment, "may amend . . . a class license if . . . the amendment is necessary in order to carry out the objectives of Article Three of the [Telecommunications] Act."[18] Pursuant to this authority, the Commission may modify an FBP license if necessary to "ensure the provision of access to the public telecommunications

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14 The CITC ISP License, First Special Condition.

15 *Id.* Second Special Condition.

16 CITC Telecom Hotel License, Definition of Service.

17 *Id.* Service Provider Obligations.

18 Telecommunications Bylaws Art. 20.4 (c).

networks, equipment and services at affordable prices"; "promote and encourage fair competition"; to "safeguard the public interest and the end users interest"; and to promote deployment of new "telecommunications technology."[19]

CITC's authority to require a dominant FBP to sell IP transit to other FBPs

In the Kingdom, dominant service providers are subject to special interconnection-related obligations. In particular, a dominant service provider must prepare a Reference Interconnection Offer ("RIO") that complies with CITC's Interconnection Guidelines, and this must be submitted to and approved by CITC.[20] The RIO must include a service level agreement ("SLA") that describes the characteristics of the interconnection services, the service level obligations, and compensation details for failure to meet these obligations.[21] Thereafter, any interconnection arrangement that the dominant service provider offers must be consistent with the Interconnection Guidelines and its approved RIO, and must "meet all reasonable requests for access to its telecommunications network at any technically feasible point."[22] A dominant service provider that fails to comply with its interconnection obligations can be found to have abused its dominant position.[23]

CITC has applied the interconnection regime to IP-based services. For example, CITC's Interconnection Guidelines provide that a dominant service provider must include in its RIO "Data interconnection services", including services that use IP technology.[24] Similarly, the Regulatory Framework on Interconnection for IP Based Networks, International Cable Landing Points and Leasing of Dark Fiber makes clear that "[t]he Commission Statutes are applicable to interconnections for IP based networks . . ."[25] Although the Regulatory Framework states that "the Commission encourages FBPs to reach agreements on the interconnection of new IP-based services on a commercial basis",[26] nothing precludes CITC from applying regulatory requirements to these services, where necessary.

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19 Telecommunications Act Article 3, §§ 2, 3, 8, & 9.

20 Telecommunications Bylaws Art. 41.1 ("Every dominant service provider shall prepare a Reference Interconnection Offer for approval by the Commission . . ."); *id.* Art. 41.3 ("Every Reference Interconnection Offer shall … comply with the Interconnection Guidelines …").

21 Interconnection Guidelines § 4.3.

22 Telecommunications Bylaws Art. 39.2.d.

23 *Id.* Art. 36.g.

24 Interconnection Guidelines §§ 4.2 & 4.2.10.

25 Regulatory Framework on Interconnection for IP Based Networks, International Cable Landing Points and Leasing of Dark Fiber § 4.1 ("RF-IPN").

26 *Id.* § 4.3.

Consistent with this approach, the Incumbent, which is a dominant service provider, has already included an *international* Internet transit service (which the incumbent calls "Wholesale Internet Connectivity") in its RIO.[27] At least one FBP has entered into an agreement, pursuant to the RIO, to purchase international Internet transit from the incumbent. However, the incumbent's RIO does not contain a similar offering for *domestic* Internet transit, which is sold separately from international transit in the Kingdom. As a result, an FBP that seeks to obtain domestic IP transit cannot purchase this service on a wholesale basis directly from the incumbent. In order to do so, the FBPs have used affiliated ISPs to purchase connectivity from the incumbent on a retail basis. The incumbent is not required to, and does not, offer an SLA in conjunction with this service.

CITC has the authority to require the incumbent to offer domestic IP transit as a RIO service. If CITC were to do so, the incumbent would be required to provide other FBPs with access to these services at any technically feasible location.

3.2 Benchmarking of international best practices

As part of its review, CITC undertook a study of 15 "benchmark" countries and 10 IXPs. The purpose of this study was to determine relevant international "best practices". That is, to determine the practices followed in other countries that have successful Internet markets. CITC recognizes that it may not be appropriate for the Kingdom to adopt all of these practices at this time. However, the experience in other countries provides a "baseline" against which to assess the current policies in the Kingdom.

CITC selected the benchmarks countries and IXPs in order to provide the most balanced view possible.

CITC selected the benchmark countries from the following categories:

- countries with similar economic and demographic characteristics to the Kingdom
- countries that are comparable to the Kingdom in terms of ICT market development
- countries that are competing to be gateways to the Middle East region
- countries with advanced ICT and Internet markets that provide a sectoral development roadmap for the Kingdom
- countries with a benchmark IXP.

Applying the factors described above, CITC selected the following benchmark countries:

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[27] *See* the incumbent RIO Annex G, Sch. 10, § 3.1 (May 2008) ("STC shall provide Wholesale Internet Connectivity Service [i.e., international IP Transit] by providing the … transmission link from the site of the Other Licensed Operator in KSA to the distant country where the Internet Hub is located together with the necessary link to the remote Internet Hub."). Including Internet Transit in a RIO is not common practice in most countries. However, the incumbent's decision to do so may be helpful to the development of the market.

Europe	*Americas*	*Asia–Pacific*	*Middle East and North Africa*
United Kingdom	United States of America	Malaysia	United Arab Emirates
France	Canada	Singapore	Bahrain
Netherlands		Australia	Jordan
Germany			Morocco
			Egypt
			Lebanon

Figure 3.1: List of benchmark countries [Source: CITC]

CITC also selected a variety of successful and unsuccessful IXPs from the following categories, in order to assess what factors influence the success or failure of an IIXP:

- neutral, commercial IIXPs
- neutral, not-for-profit IIXPs
- IIXPs that are a hub for international traffic exchange
- virtual IIXPs
- operator-owned IIXPs
- IIXPs that have a multilateral peering agreement (MLPA)
- IIXPs that allow members to decide with which other members they will exchange traffic
- IIXPs that do not allow the sale of IP transit
- IIXPs that do allow the sale of IP transit.

Applying the factors described above, CITC selected the following benchmark IXPs:

IXP	*Location*
Amsterdam Internet Exchange	Netherlands
London Internet Exchange	UK
Deutscher Commercial Internet Exchange	Germany
Equinix	International
NetNod	Sweden
Hong Kong Internet Exchange	Hong Kong
SingTel Internet Exchange	Singapore
Emirates Internet Exchange	UAE
ParisNAP	France
Seattle Internet Exchange	USA

Figure 3.2: List of benchmark IXPs [Source: CITC]

3.2.1 Best practice in Internet regulation

The review of best practices in different countries regarding Internet regulation focused on the existance of peering requirements, the availability of international connectivity, and the licensing and regulatory requirements applicable to IXPs. International best practice in these areas is as follows:

Requirements applicable to peering

- No requirement for operators to peer with one another. Indeed, none of the benchmark countries has peering requirements in place. The one country that considered doing so – Australia – ultimately did not do so.

International connectivity

- A large amount of international connectivity, with multiple submarine cables landing in the country. This is a characteristic shared by all international hubs, such as the UK and the Netherlands.
- Either a high level of infrastructure-based competition in backhaul, or a regulatory environment that ensures cable landing stations, plus backhaul to cable landing stations, is open. This is the case in the international hubs of Europe and the USA.

IXPs licensing and regulation

- A light-touch IXP licensing regime – either a regime that does not require IXPs to be licensed, or a regime where an IXP may be set up with a license that is available quickly, with minimal requirements. All benchmark countries with a thriving IXP sector have a light touch (or no touch) IXP licensing regime.
- No regulation of IXPs beyond the normal, *ex post* competition laws that apply in all industries. Few, if any restrictions, on the activities of the IXP – other than compliance with lawful intercept procedures, which is required in all countries surveyed.

3.2.2 Best practice in the operation of IXPs

International best practice in the management of IXPs can be divided into four categories. The first is architecture, which covers the high-level layout and design of the IXP. The second is participation, which covers who is allowed to use the IXP. The third is activities, which covers what occurs at the IXP in terms of services and traffic exchange. The fourth is governance, which covers ownership of the IXP, and its decision making and governance structure. International best practice in these areas is as follows:

Architecture

- A multi-site virtual IXP, with data centers operated by competing third parties. This is the case, for example, at the largest European IXPs –

Amsterdam Internet Exchange (AMS-IX), London Internet Exchange (LINX) and Deutscher Commercial Internet Exchange (DE-CIX).

Participation

- Participation of a range of market players – including ISPs, international and regional IBPs, content providers and end users. Typically this is achieved by limiting restrictions on participation to purely technical issues, such as the requirement to have an Autonomous System (AS) number. This is the case at the majority of neutral IXPs, especially the most successful, such as LINX and AMS-IX.

- Participation of major international backbone providers, such as AT&T and TeliaSonera, as well as major content providers such as Google.

Activities

- A full suite of services, including public peering, private interconnections, and network statistics and maintenance. This is also the case, for example, at the largest European IXPs – AMS-IX, LINX and DE-CIX.

- Services that do not compete with users of the exchange. This means that the IXP does not offer connectivity beyond the IXP premises, with the exception of providing connectivity between IXP switches hosted at different locations. Such an IXP is said to be neutral. All of the largest benchmark IXPs are neutral.

- No restrictions on peering or transit, allowing participants to form these relationships as they see fit. This is the case at the major international hub IXPs of Europe, especially those that count the incumbent as a participant.

- No restriction on the exchange of international or domestic traffic. There is no benchmark IXP that restricts this as a matter of policy. In practice, however, some IXPs do exchange largely domestic traffic.

- A high level of security, including physical security at the data center level, and network security within the IXP. This is the case at all of the major hub IXPs in Europe.

- A high level of redundancy within the IXP switching network. This is the case at all of the major hub IXPs in Europe.

- Strict confidentiality, ensuring that participants' data and information is only made public if required by the authorities as part of a lawful intercept operation. This is the case in every benchmark IXP.

Governance

- Neutrality of ownership. The IIXP is not be controlled by an entity, such as an FBP, that competes with any of the IIXP's customers. Similarly, in the case of a multi-site virtual IIXP, the owner of one of the data centers in which the IIXP has a node does not control the IIXP, as this could create an incentive to discriminate against data centers owned by competing operators. Sfeguards are in place to ensure that neutrality of ownership is maintained. This may be achieved through a non-profit consortium of members. LINX, AMS-IX and DE-CIX are examples of this structure.

- Neutrality of operation**.** Decisions at the IIXP are be made in a neutral way, for the benefit of all members, rather than for a subset of members. Again, there are safeguards in place to ensure that this neutrality is maintained. LINX, AMS-IX, and DE-CIX are examples of this form of operation.

- Not for profit**.** The IIXP is run on a not-for-profit basis. Seven out of the ten benchmark IIXPs studied are operated on a not for profit basis.

3.3 Performance of the Kingdom against the three goals

As noted above, CITC has adopted three goals relevant to this proceeding — promotion of the Internet in the Kingdom, transformation of the Kingdom into an Internet content and transit hub, and localization of domestic Internet traffic. The Kingdom is not yet adequately meeting these goals. CITC believes that these goals are complementary – in particular, actions that promote the Kingdom as an Internet hub will help to also promote use of the Internet in the Kingdom.

Promotion of the Internet

The Kingdom is not yet successfully promoting Internet usage. Indeed, penetration of Internet access services is relatively low compared with the international benchmark countries. Broadband penetration in the Kingdom is well below that of more advanced benchmark countries. Indeed, broadband penetration is below that of Malaysia and Lebanon, countries that are significantly less prosperous than the Kingdom.

Figure 3.3, below, shows Saudi Arabia's fixed broadband penetration by percentage of households against that of the benchmark countries.

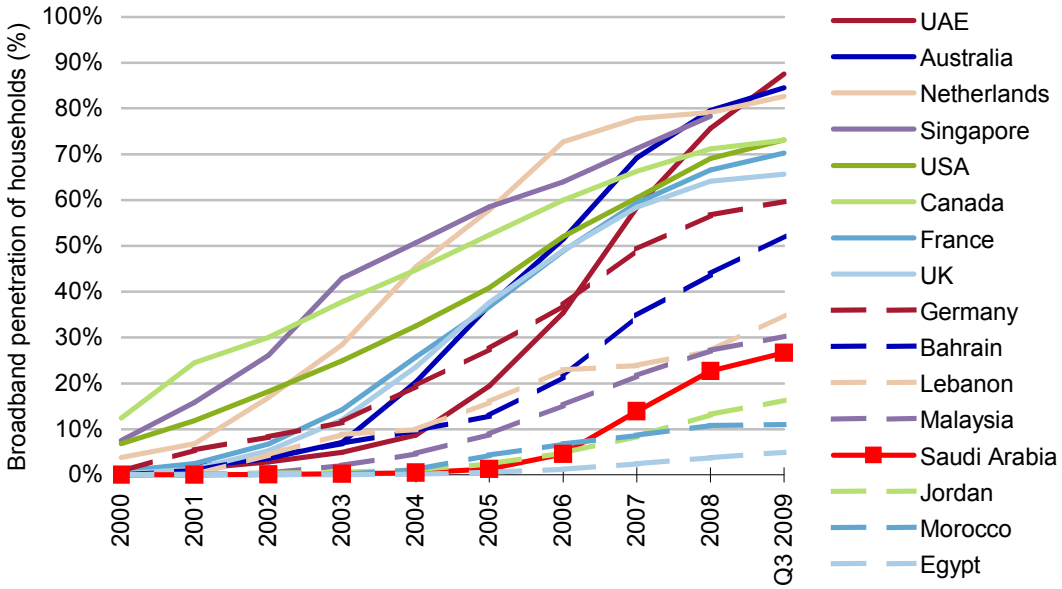

Figure 3.3: Saudi Arabia's fixed broadband penetration against that of benchmark countries [Source: TeleGeography, Euromonitor International, CITC, national regulatory authorities]

Promotion of the Kingdom as an international hub

Although the Kingdom is in a geographically advantageous location for the exchange of international Internet traffic, and a significant amount of submarine cable capacity lands in the Kingdom, the Kingdom has not yet been successful in becoming an international hub for the transport and hosting of Internet content.

Despite a high total bandwidth, Saudi Arabia has a relatively low bandwidth per capita, in particular compared to the United Arab Emirates (UAE). Qatar and Bahrain also have a higher bandwidth per capita. This, combined with the UAE's greater total capacity, suggests that the Kingdom has lost out to the UAE in the competition to be the most significant hub for international traffic exchange in the Middle East.

Figure 3.4 and Figure 3.5 show total and per-capita international Internet bandwidth for the Kingdom, and other Middle Eastern countries.

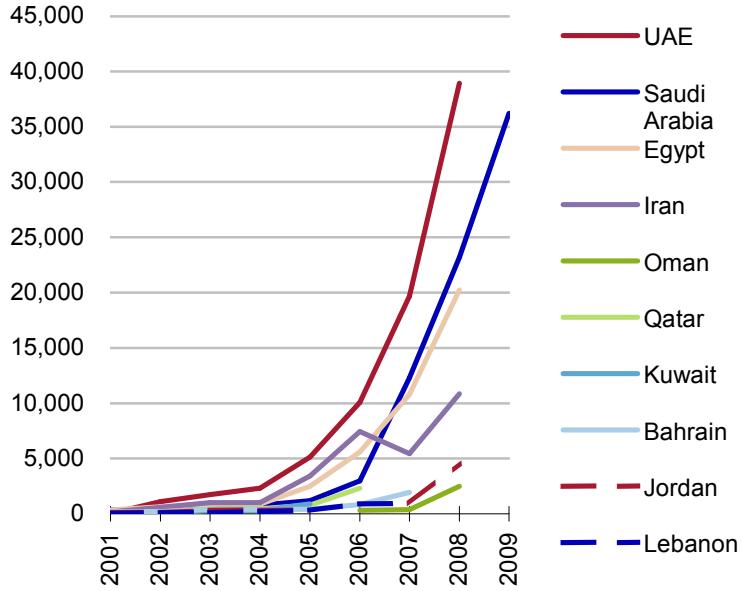

Figure 3.4: Total international Internet bandwidth – Middle Eastern countries (Mbit/s) [Source: ITU, TeleGeography]

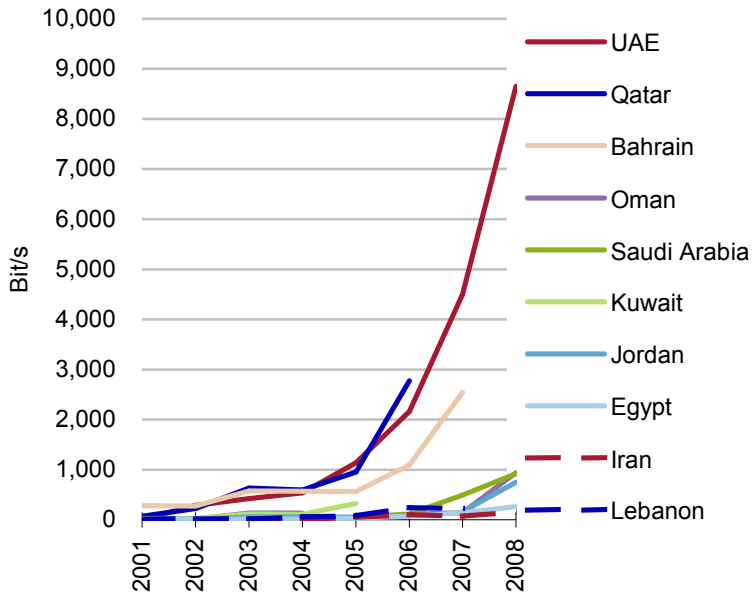

Figure 3.5: International Internet bandwidth per capita – Middle Eastern countries [Source: ITU, TeleGeography]

Furthermore, in comparison to the 15 benchmark countries (some of which are shown in the preceding figure), the Kingdom has one of the lowest levels of usage per capita. This is illustrated in Figure 3.6 below.

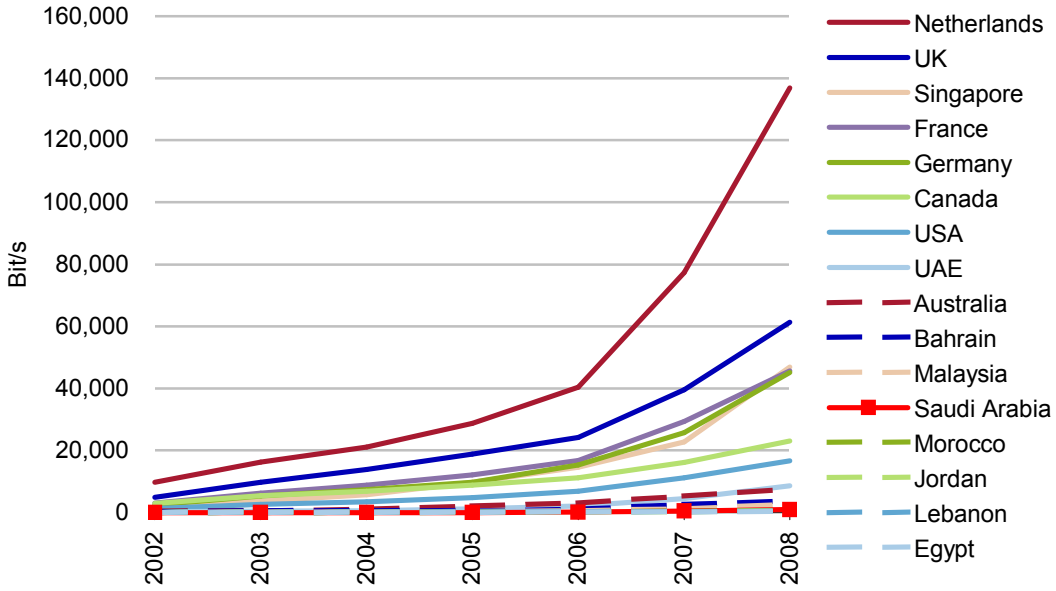

Figure 3.6: International Internet bandwidth per capita – benchmark countries [Source: ITU, TeleGeography, Euromonitor International]

Localization of traffic

As a result of various actions taken by the FBPs, only a small portion of domestic Internet traffic still trombones outside the Kingdom. However, in some cases, the method used by FBPs to prevent tromboning results in dropped packets, thereby degrading the quality of service. The current method used in the Kingdom for routing local traffic, where competitive FBPs route traffic to the incumbent via affiliated ISPs (described in Section **Error! Reference source not found.** above) further degrades network performance in two ways. First, it adds latency and degrades performance, as it adds unnecessary hops between networks. Second, the incumbent's retail IP transit offer, as sold to ISPs, does not come with a SLA.

4 Policy options

CITC has considered a number of policy options to ensure that the Kingdom achieves the goals of promotion of the Internet, transformation of the Kingdom into an international Internet content and transit hub, and localization. This consultation seeks public comment regarding several possible policies, specifically:

- establish an International IXP initially owned and operated by CITC;
- encourage the establishment of an International IXP owned either by an FBP (or group of FBPs) or by a commercial operator; or
- rather than establishing an International IXP, adopt regulatory requirements that require direct interconnection and the exchange of Internet traffic within the Kingdom.

This section describes all three options and, for each option, identifies the necessary legal instruments, and -- based on international best practices as well as current conditions in the Kingdom -- identifies a number of advantages and disadvantages.

4.1 Option 1: Establish an International IXP initially owned and operated by CITC

4.1.1 Description

The first option that CITC has identified would be to establish a government-owned, single-site International IXP, which eventually could be expanded to a multi-site virtual International IXP and then privatized. As described below, the option would be implemented in two distinct steps.

Step 1 – establishment of a neutral International IXP hosted in a neutral data center and require the incumbent to offer domestic IP transit pursuant to its RIO

If CITC were to adopt this option, it would take a number of actions in the near-term.

CITC would first establish a single-site International IXP, which would initially be owned and operated by the CITC. In order to do so, CITC would issue a request for proposal ("RFP") for the construction and operation of the International IXP in accordance with CITC's specifications. CITC would then conduct an objective evaluation, select the winning bidder, and enter into a binding contract. Because CITC would own and have ultimate control over the International IXP, it would not be necessary to issue a license. The International IXP would allow the exchange of both domestic and international traffic, and the sale of IP transit, as well as peering. CITC would create an Advisory Committee consisting of key stakeholders, which could include representatives of relevant government entities, FBPs, and other industry participants (such as ISPs and content providers). This advisory committee would assist CITC in developing guidelines and a governance structure for the International IXP.

At the same time, CITC would issue a second RFP soliciting proposals to host the International IXP within a privately funded, owned and operated Tier-4 data center. The RFP would include qualification requirements that would ensure that the selected vendor had substantial experience in other jurisdictions, and would be able to work closely with CITC. The RFP would contain stringent security requirements, including special provisions governing the hosting of government content. The RFP also would include provisions regarding the relationship between the International IXP and the data center, such as the amount of space to be provided to the International IXP, the means by which providers located in the data center could access the International IXP switch, how operational problems would be resolved, and the access of data center personnel to the International IXP's space.

CITC would consider proposals from current data centers within the Kingdom, as well as entities to host the International IXP within a data center. However, in order to ensure neutrality, entities that would use the International IXP/data center, such as FBPs or ISPs, would not be eligible to own and operate the data center that hosts the International IXP. In order to increase the commercial attractiveness of this option, CITC would work closely with government entities to facilitate hosting of public sector content at the data center. CITC would conduct an objective evaluation, and in consultation with other relevant government entities select the winning bidder, and enter into a binding contract that established the data centers security, neutrality, and other obligations. The party selected to construct own and operate the data center would receive a Class B Telecom Hotel license.

CITC would take a number of additional measures to enable FBPs, ISPs and content providers to interconnect directly with one another in the data center and to connect to the International IXP for peering or transit. Specifically, CITC would modify existing license conditions that limit the ability of ISPs, or others to collocate in the data center or to interconnect directly within the same building. CITC also would modify the telecom hotel license to allow data center operators to provide connection links within their premises.

During the period in which the International IXP and data center were being developed, CITC, would require dominant service providers to offer domestic IP transit as a cost-based wholesale interconnection service. Following a public consultation, the incumbent, which has been classified as dominant, would have three months to amend its RIO to include this service, along with international IP transit, which it currently offers in its RIO. Pursuant to the Bylaws and the Interconnection Guidelines, the incumbent would then be required to offer access to domestic or international IP transit at any technically feasible location requested by another FBP, which could include the International IXP.

Step 2 – extension of the International IXP to establish a virtual IIXP in multiple locations

At an appropriate time after the establishment of the initial International IXP and data center, CITC would conduct a consultation requesting feedback on the operation of the International IXP, and assess the demand for expanding the International IXP to additional locations. If CITC concluded that sufficient market demand had developed, it would transform the single-site,

government-owned International IXP into a virtual IIXP by selecting two additional privately owned, competing data centers, located in two additional parts of the Kingdom, to host IIXP nodes. The International IXP would obtain connectivity among the data centers, thereby enabling a provider that is physically located in one data center to be ”virtually” located in all of the data centers selected to host the International IXP. .

This is illustrated below in Figure 4.1.

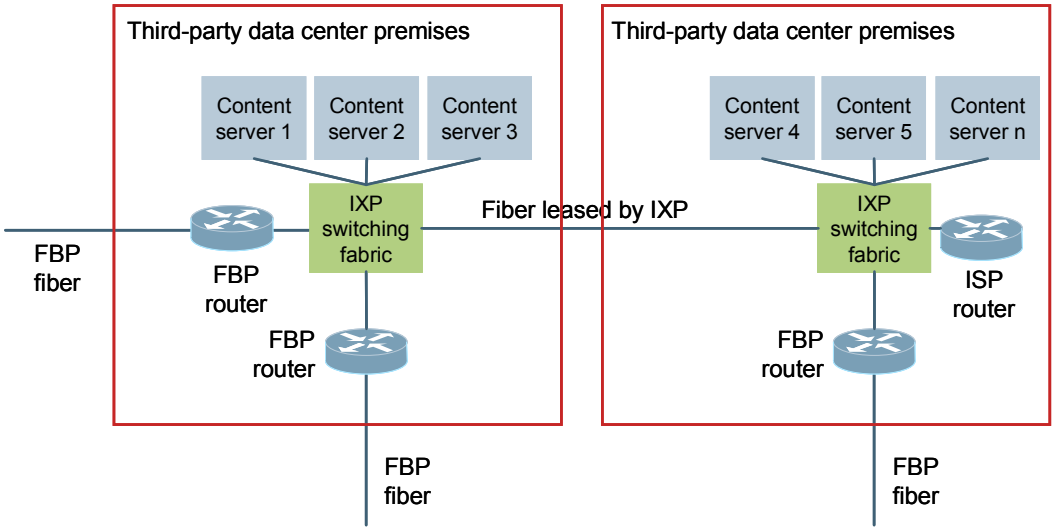

Figure 4.1: Illustration of a virtual IIXP [Source: CITC]

CITC would select the additional data centers using the same RFP procedure used to select the first data center. However, in order to ensure competition in the market for data hosting, the entity that hosts the initial International IXP node would not be allowed to operate the second or third data centers. In order to create a further incentive for investment in data centers that meet CITC’s specifications, CITC would commit that the International IXP would not locate nodes in any additional data centers for a specified period. In order to ensure that members do not use the International IXP to purchase low cost backhaul in competition with FBPs, the International IXP would implement policies that would ensure that the International IXP could not be used to send traffic between routers controlled by the same member. After selecting the additional data centers, CITC would enter into contracts with the selected operators, on similar terms and conditions to those for the original data centers. The operators would also register for Type B Telecom Hotel licenses. Eventually, additional data centers -- including data centers owned by the operators of the first three data centers -- could seek to host additional nodes of the International IXP.

At the same time as CITC conducts the selection process, it would initiate a process of “spinning off” the International IXP. In order to do this, CITC would create a not-for-profit entity. This entity could be established pursuant to a Decree, thereby obviating the need for CITC to issue a license. Once the entity was established, CITC would require it to develop operational guidelines and submit these to CITC for its review. CITC could approve, reject or require modifications to

the guidelines. Once approved guidelines were in place, CITC would transfer the ownership and operation of the International IXP to this entity.

The new entity would need to arrange for connectivity among the International IXP nodes. In order to do this, the new entity would issue an RFP, seeking bids from one or more FBPs. The new entity, pursuant to its approved operational guidelines, would pass the costs on to its members. Operators located at any of the data centers would also have the option to procure connectivity directly from an FBP.

The new entity would determine how the day-to-day operation of the exchange would be conducted. The new entity would have the option of: (1) retaining the operator selected by CITC (but subject to the direction of the new entity); (2) selecting a new operating company; or (3) taking direct responsibility for operations. CITC, in consultation with relevant Ministries, would retain the right to approve any operating company.

4.1.2 Regulatory Instruments

If CITC were to adopt this option, it would adopt the following regulatory instruments:

- **Regulatory framework for the Development of the Internet**. CITC would adopt a regulatory framework setting out its policy goals for the Internet sector and identifying the regulatory actions that CITC will take in order to achieve them. .

- **Decision**. The CITC Board would adopt a Decision authorizing CITC to own and operate (or contract for the operation of) an International IXP, create an advisory committee, and issue RFPs for the hosting of the International IXP in a data center that meets specified requirements.

- **International IXP guidelines**. On establishment of the International IXP, CITC would create operational guidelines that would allow for the exchange of both international and domestic Internet traffic exchange, allow both peering and the sale of IP transit, and permit FBPs, ISPs, content providers, and other businesses to connect to the International IXP. The guidelines also would address the composition, procedures, and responsibilities of the Advisory Committee.

- **Reference Interconnection Offer.** CITC would require the incumbent to offer both domestic and international IP transit services in its RIO at prices, terms and conditions acceptable to CITC.[28] As part of its offer, the incumbent would be required to include an SLA. Going forward, the incumbent would be required to offer both international and domestic IP transit at any technically feasible location, including the International IXP.

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[28] See The Commission Interconnection Guidelines. § 3.1. ("The Dominant Service Provider shall prepare the RIO within three months of being so directed by the Commission and [shall] submit it for Commission approval.").

- **Licensing modifications.** CITC would amend the current ISP license to allow ISPs to collocate, and engage in secondary peering, at a data center. CITC also would amend the data center license to allow the data center operator to provide in-building facilities to allow ISPs and other customers to connect directly to each other or to the International IXP switch.

- **Decree.** In order to privatize the International IXP, a Decree would be adopted creating the not-for-profit entity and authorizing CITC to transfer the assets of the International IXP to that entity.

4.1.3 Advantages and Disadvantages

This option has a number of advantages. As an initial matter, the establishment of an International IXP is consistent with international best practices. Indeed, almost all of the countries with successful Internet markets have at least one successful IIXP that acts as an international hub for traffic and content. Moreover, this option would help to achieve the three goals that CITC has identified. Specifically, this proposal would be the first step to turning the Kingdom into an international hub, by lowering the cost of accessing international Internet traffic. This option also would promote the growth of the Internet in the Kingdom while ensuring that all domestic Internet traffic is localized. FBPs would be able to select the arrangements for Internet interconnection that best meet their needs. If any FBPs chose to peer with one another, they could do so cost-effectively at the International IXP. In addition, while the incumbent would not be required to peer with another FBP, it would be required to offer international and domestic IP transit at any feasible location, which would include, but not be limited to, the International IXP. This would eliminate the need for FBPs to purchase domestic Internet connectivity, at retail, via an affiliated ISP -- thereby reducing cost and improving service quality. At the same time, this proposal would enable stakeholders other than FBPs -- such as ISPs and content providers -- to use the International IXP. This, in turn, would help achieve the critical mass necessary for a successful IIXP, which in time would attract additional participants.

This option would preserve and, indeed, could enhance network security. Compliance with tier-4 standards ensures that the data center would meet the highest standards of security, which are required by government and business users throughout the world. In addition, by providing alternate means to route traffic, this approach could provide greater resilience. For example, this option could eliminate the single point of failure resulting from an outage on an undersea cable or at a cable landing station by enabling operators to quickly and easily re-route traffic from one cable that connects to the International IXP to another cable connected to the International IXP.

Finally, the establishment of a multi-site virtual IIXP would offer additional redundancy. Members could choose to locate in more than one of the data centers, in order to distribute their traffic while also increasing resiliency in case of a fault at a data center or in its connectivity. At LINX, for instance, 91 out of 344 members are located in more than one of the data centers.

The option would have no impact on the operation of existing security and content laws.

At the same time, there are some potential disadvantages to this option. This option would require the expenditure of public funds to construct the International IXP. The option also would require CITC to serve as the owner and operator of the International IXP. This is an unusual function for a regulatory authority to perform -- either directly or through a contractor. Rather, the international best practice is for IIXPs to be developed by industry, typically through not-for-profit, member-driven associations. Requiring the incumbent to offer IP transit as a RIO service is also uncommon, even though international IP transit is already a RIO service. In addition, by creating more efficient interconnection agreements, this approach could reduce short-terms revenues of certain industry participants. There is, of course, a risk that no suitable entity will be found to construct a data center in which to host the International IXP. There is also a risk that key market participants might choose not to participate in the International IXP. Finally, the effectiveness of the IIXP at attracting international traffic may also be limited by the fact that the Kingdom has not fully liberalized the international market.

4.2 Option 2: encourage the establishment of an International IXP owned either by an FBP (or group of FBPs) or by a commercial operator

Instead of establishing an International IXP, CITC could encourage the development of an International IXP with a different ownership structure. CITC seeks comment on whether to encourage the establishment of an International IXP by:

- a neutral, commercial entity;
- a single FBP; or
- a consortium of FBPs.

4.2.1 International IXP owned by a neutral, commercial entity

Description

CITC would encourage an operator, such as Equinix, to open an International IXP that would be operated in a neutral fashion. In order to do so, CITC would develop an IIXP license, which would specify the rights and obligations of licensed IIXPs. Because an IIXP provides significant "network effects[29]," it might not be economically feasible to have multiple competing International IXPs in the Kingdom. Therefore, CITC would issue a Type A license, which would allow CITC to "limit the number of licensees authorized to provide the class of service" and to "establish competitive or other qualifications and licensing procedures."[30] (However, CITC would not

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29 Network effects are caused by the fact that the more connected parties a particular IXP has, the more attractive it is to potential new connected parties, due to the high number of potential partners for traffic exchange. This means that, in a market with several IXPs, one is likely to grow much larger than the others, due to network effects.

30 *Id.* Art. 11.4.d.

prevent FBPs, acting pursuant to their existing licenses, from constructing competing International IXPs.) The IIXP license would include a range of conditions, such as a requirement that the International IXP provide service on reasonable and non-discriminatory prices, terms and conditions.

The operator of the International IXP would likely seek to be part of a larger data center, in order to provide a suite of services to attract customers, and also to generate revenue. The operator could contract with one or more existing data centers. Alternatively, the operator could obtain a license to establish its own data center. CITC would either allow an IIXP licensee to operate an associated data center as part of its IIXP license or would issue a separate telecom hotel license to the operator.

As with option 1, CITC would take a number of additional measures to enable FBPs, ISPs and content providers to interconnect directly with one another in the data center and to connect to the International IXP for peering or transit. Specifically, CITC would modify existing license conditions that limit the ability of ISPs, or others to collocate in the data center or to interconnect directly. CITC also would modify the telecom hotel license to allow data center operators to provide connection links within their premises. Finally, CITC would require dominant service providers to offer both domestic and international IP transit as a cost-based wholesale interconnection service.

Regulatory Instruments

If CITC were to adopt this option, it would be required to adopt the following regulatory instruments:

- **Regulatory framework for the Development of the Internet**. CITC would adopt a regulatory framework setting out its policy goals for the Internet sector and identifying the regulatory actions that CITC will take in order to achieve them.

- **Reference Interconnection Offer.** CITC would require the incumbent to offer both domestic and international IP transit services in its RIO at prices, terms and conditions acceptable to CITC.[31] As part of its offer, the incumbent would be required to include an SLA. Going forward, the incumbent would be required to offer both international and domestic IP transit at any technically feasible location, including any IIXP that might be established.

- **IIXP License**. CITC would develop a new Type A class license that could be granted to entities that do not currently hold FBP licenses that seek to operate an International IXP in the Kingdom.

- **Licensing modifications.** CITC would amend the current ISP license to allow ISPs to collocate, and engage in secondary peering, at a data center. CITC also would amend the data

[31] See The Commission Interconnection Guidelines. § 3.1. ("The Dominant Service Provider shall prepare the RIO within three months of being so directed by the Commission and [shall] submit it for Commission approval.").

center license to allow the data center operator to provide in-building facilities to allow ISPs and other customers to connect directly to each other or to any IIXP switch.

Advantages and disadvantages

This option has several specific advantages, in addition to the advantages (described above) that result from establishing an International IXP. First, this option relies entirely on the private sector to develop and operate an International IXP, thereby reducing government expenditures and allowing CITC to devote its resources to performing the regulatory function. Second, because a commercial operator has a strong economic incentive to provide service to all customers in an efficient and non-discriminatory manner, this option is likely to result in a neutral IIXP, which is consistent with international best practices. Finally, this option would ensure adequate security. Indeed, private companies such as Equinix, Telehouse and Telecity have shown themselves capable of running secure data centers, while hosting their own or a third-party IIXP.

At the same time, this option has several disadvantages. It may not be feasible to operate the exchange on a profit-making basis, particularly in the early years when membership is relatively low. As a result, there is some risk that no company will seek to establish a commercial International IXP in the Kingdom. Even if a private operator chooses to establish an International IXP, the services sold in this IIXP would be sold on a commercial basis, with prices likely to be above what would be charged by an IIXP owned and operated by the government or by a non-profit entity. As a result, the higher prices would depress adoption and usage compared with a non-profit model. In addition, a third-party IIXP within a data center may focus more on selling higher value services in the data center, such as direct interconnections, at the expense of interconnection to the International IXP. For these reasons, while there is some precedent,[32] commercial operation of an IIXP is not consistent with international best practice, which is for an IIXP to be operated on a non-profit basis. In addition, allowing a new operator -- which may well be a foreign company -- to control such a key Internet asset, could raise security concerns. There also is no assurance that all significant industry participants would participate in the International IXP. As a result, there is some chance that none of the goals identified by CITC would be achieved.

4.2.2 International IXP owned by a single FBP

Description

Another alternative would be for CITC to encourage a single FBP to establish an International IXP. The operator would be free to select which services to offer, and whether to host it in its own data center, or to host it in one or more commercial data centers.

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[32] Commercially operated IXPs are often used in the United States, where Equinix data centers typically offer public peering over a switch owned by Equinix

Pursuant to their existing licenses, FBPs are free to construct and operate IIXPs in the Kingdom. However, if an FBP were to establish an International IXP, CITC would need to adopt regulations to ensure that the FBP provides service on reasonable and non-discriminatory terms. This would be especially important if a dominant service provider, which has the ability and incentive to discriminate against competing providers, were to operate the International IXP. For example, CITC might have to impose accounting separation rules, to ensure that the dominant service provider did not use its dominance in other markets to cross-subsidize the International IXP or otherwise distort the market.

Regulatory Instruments

- **Regulatory framework for the Development of the Internet**. CITC would adopt a regulatory framework setting out its policy goals for the Internet sector and identifying the regulatory actions that CITC will take in order to achieve them.

- **Reference Interconnection Offer.** CITC would require the incumbent to offer both domestic and international IP transit services in its RIO at prices, terms and conditions acceptable to CITC.[33] As part of its offer, the incumbent would be required to include an SLA. Going forward, the incumbent would be required to offer both international and domestic IP transit at any technically feasible location, including any IIXP that might be established.

- **IXP Regulations.** CITC would need to develop regulations to ensure that an FBP-operated IXP provided service in a reasonable and non-discriminatory manner to all potential customers.

- **Licensing modifications.** CITC would amend the current ISP license to allow ISPs to collocate, and engage in secondary peering, at a data center. CITC also would amend the data center license to allow the data center operator to provide in-building facilities to allow ISPs and other customers to connect directly to each other or to any IXP switch.

Advantages and disadvantages

The primary advantage of this approach is that one of the FBPs could immediately establish an International IXP pursuant to its existing license, quickly bringing the general benefits of an IXP discussed above. No government funds would need to be expended, and CITC would not have to perform any operational role. In addition, there are unlikely to be any security concerns resulting from such an IXP. The FBPs are established operators, which must comply with exiting security requirements.

The primary disadvantage of this proposal is that no FBP may choose to establish an International IXP. The FBPs have always had the legal authority to establish an International IXP. Yet, none of

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33 See The Commission Interconnection Guidelines. § 3.1. ("The Dominant Service Provider shall prepare the RIO within three months of being so directed by the Commission and [shall] submit it for Commission approval.").

them has chosen to do so. In addition, reliance on an operator-owned IXP is inconsistent with international best practices. Indeed, none of the best practice IXPs are owned by telecommunications operators. This is because customers may not perceive operator-owned exchanges as neutral. As a result, if one of the FBPs operated an International IXP, there is a good chance that other FBPs would decline to participate, significantly reducing its effectiveness. At the same time, the FBP might choose to limit the services it provided, based on its commercial interests. For example, an FBP might choose to allow only domestic traffic, or could decline to allow secondary peering by ISPs.

4.2.3 International IXP owned by a consortium of FBPs

Description

CITC could seek to foster the establishment of a consortium by the FBPs to own and operate an International IXP. This would require the FBPs to enter into a joint venture or similar cooperative arrangement. Such a consortium would not require any additional license from the CITC because each FBP is already licensed for the provision of the services required by the IIXP. However, CITC would need to adopt a regulatory regime to govern the operation of the International IXP.

Regulatory instruments required

- **Regulatory framework for the Development of the Internet**. CITC would adopt a regulatory document setting out its policy goals for the Internet sector and identifying the regulatory actions that CITC will take in order to achieve them.

- **Reference Interconnection Offer.** CITC would require the incumbent to offer both domestic and international IP transit services in its RIO at prices, terms and conditions acceptable to CITC.[34] As part of its offer, the incumbent would be required to include an SLA. Going forward, the incumbent would be required to offer both international and domestic IP transit at any technically feasible location, including any IIXP that might be established.

- **IIXP Regulations.** CITC would develop regulations to ensure that an IIXP operated by an FBP consortium provides service in a reasonable and non-discriminatory manner to all potential customers.

- **Licensing modifications.** CITC would amend the current ISP license to allow ISPs to collocate, and engage in secondary peering, at a data center. CITC also would amend the data center license to allow the data center operator to provide in-building facilities to allow ISPs and other customers to connect directly to each other or to the IIXP switch.

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[34] See The Commission Interconnection Guidelines. § 3.1. ("The Dominant Service Provider shall prepare the RIO within three months of being so directed by the Commission and [shall] submit it for Commission approval.").

Advantages and disadvantages

Here again, the primary advantage of this approach is that a group of some or all of the FBPs could establish an International IXP pursuant to their existing licenses. No government funds would need to be expended, and CITC would not have to perform any operational role. In addition, there are unlikely to be any security concerns resulting from such an International IXP, which would bring all of the general benefits of an International IXP discussed above.

There are, however, a number of disadvantages to this option. First, this option requires the FBPs to establish a cooperative arrangement for the establishment of an International IXP, including detailed arrangements regarding the allocation of costs. Fostering such an agreement among competitors may be difficult. As a result, there is a risk that this approach would require significant CITC involvement and, even with such involvement, might not result in the establishment of an International IXP. Even if an FBP consortium were established, there is no assurance that all of the FBPs would participate. Moreover, there is no assurance that an FBP consortium would provide service on a neutral basis to other entities. For instance, FBPs might be reluctant to allow independent ISPs – which currently purchase connectivity service from the FBPs - to participate in the International IXP.

4.3 Option 3: Do not establish an International IXP in the Kingdom, but require direct interconnection for the exchange of Internet traffic

CITC also seeks comment regarding two options that would improve the promotion of Internet usage but not involve the establishment of an International IXP in the Kingdom, specifically:

- requiring FBPs to engage in commercial negotiation leading to interconnection for the exchange of domestic Internet traffic.
- requiring FBPs to peer with each other on a settlement-free basis.

4.3.1 Direct interconnection

Description

Rather than establishing an International IXP, CITC would require the FBPs to enter into interconnection agreements for the exchange of Internet traffic. Under this approach, FBPs would exchange Internet traffic either by arranging for individual direct links between each of the FBPs or by agreeing to route all domestic Internet traffic by means of a national backbone network -- which could be operated either by a single FBP or a consortium of FBPs. In this scenario, all peering and transit arrangements, as well as the acquisition of direct links or links to the national backbone, would be conducted on an unregulated, commercial basis. This is illustrated below in Figure 4.2

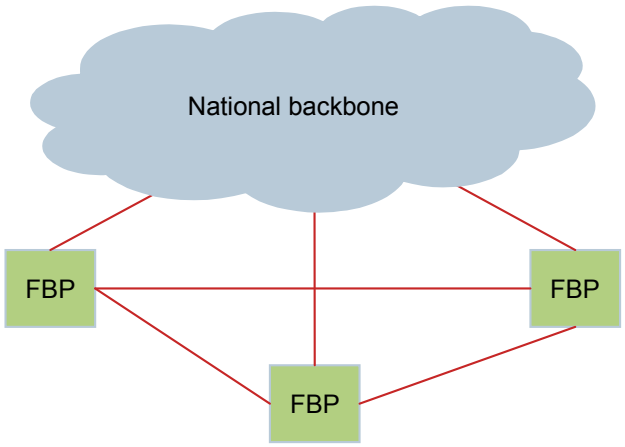

Figure 4.2: Illustration of direct interconnection via national backbone or direct links [Source: CITC]

In order to implement this option, CITC would issue an instruction requiring that, within a specified period of time, the FBPs negotiate commercial arrangement that would result in direct interconnection for the exchange of Internet traffic.

At the conclusion of the specified period, CITC would assess whether the operators were in compliance and, if not, take enforcement action. If necessary, CITC would intervene to facilitate agreements between FBPs.

Regulatory instrument

- **Direction**. CITC would direct the FBPs to enter into commercial agreements for the interconnection of their networks and the exchange of Internet traffic, either through direct interconnection or over a national backbone network.

Advantages and disadvantages

This option has several advantages. If executed fully, with all FBPs connecting either directly or via one of the national backbones, it would enable the local exchange of Internet traffic in a manner that is superior to the current arrangements, whereby a significant amount of traffic is exchanged via affiliated ISPs. In addition, it would preserve the existing security and content filtering arrangements in place in the Kingdom.

At the same time, this option has several disadvantages. This option would result in higher costs, and lower service quality, than would exist if an International IXP were established in the Kingdom. This is because FBPs must either buy multiple leased lines to each other, thus losing economies that arise from traffic aggregation, or must transit their traffic across one of the national backbones, which introduces latency. As a result, this option appears less likely to promote the growth of the Internet in the Kingdom. In addition, because this option would not result in the creation of a central point at which content and connectivity providers can come together to

interconnect their networks, this option is unlikely to foster the transformation of the Kingdom into an international Internet content and transit hub.

4.3.2 Mandatory peering

Description

Another alternative would be for CITC to require all FBPs to peer with each other on a settlement-free basis. The competitive FBPs would be likely to reach commercial peering agreements with one another. However, the incumbent -- which carries the vast majority of the Internet traffic in the Kingdom -- has no commercial incentive to peer with competitive FBPs, which carry relatively little Internet traffic. The incumbent, therefore, would be unlikely to agree to do so voluntarily. As a result, CITC would mandate that the incumbent peer with the other FBPs on terms specified by the regulator.

Regulatory instruments

- **Direction. CITC** would direct all FBPs to peer with each other, at any mutually agreeable location.

- **Reference Interconnection Offer.** CITC would require dominant service providers to peer with other FBPs. Following a consultation, the incumbent would have three months to submit a proposed RIO revision to implement this requirement. The RIO would need to include a detailed SLA. The peering arrangements would then be embodied in the interconnection agreements between the incumbent and the other FBPs, which are subject to CITC review. CITC would also need to resolve disputes between FBPs regarding any alleged failure by the incumbent to meet the applicable SLA.

Advantages and disadvantages

This approach would increase connectivity within the Kingdom, at a low cost to the competitive FBPs.

This approach also has a number of disadvantages.

First, it is plainly inconsistent with international best practices. No benchmark country has mandated and regulated peering. By requiring an operator to effectively give away network capacity to its competitors without *any* compensation, this approach could deter investment in the ICT sector. This, in turn, would impede CITC's ability to promote Internet usage in the Kingdom and transform the Kingdom into an international Internet hub.

Second, this approach would require significant, and ongoing, regulatory intervention. When two operators peer, they interconnect and exchange their customers' traffic with one another on a settlement free basis -- that is, neither operator compensates the other operator for carrying traffic that originated on the other operators network. In such arrangements, there is no service level

agreement. Rather, the operators agree to deliver traffic exchanged with each other on a "best efforts" basis. Because the operators only peer when it is mutually beneficial, they have every incentive to work together to ensure that they are devoting enough capacity to the peering connection to eliminate or minimize foreseeable congestion, and also to ensure a technically sound connection that delivers best efforts. In an arrangement under which one party does not have an economic incentive to peer with the other party, it would be necessary to adopt regulatory requirements that would ensure that the peering connections deliver a level of service equivalent to the level that exists pursuant to a "best efforts" agreement. Thus, if CITC were to adopt this option, it would need to establish mandatory quality of service standards governing the terms on which the incumbent peers with the other FBPs.

5 Questions for respondents

5.1 Introduction

As stated in the Notice, CITC invites comments on any or all of the questions set out below, covering: the situation in the Kingdom; the proposed policy; and legal issues.

5.2 The market situation

1. **CITC goals.** Are the goals that CITC has identified – promotion of the Internet, transformation of the Kingdom into an Internet hub, and localization – appropriate? Should CITC adopt any additional goals?

2. **Growth of the Internet.** Is the Kingdom adequately promoting the growth of the Internet? Why is the broadband penetration rate in the Kingdom lower than the broadband penetration rate in other, less developed countries?

3. **International Hub.** Is the Kingdom fulfilling its potential as a regional Internet content and traffic hub? To what extent is domestic content being hosted outside the Kingdom? Why? Why isn't more international content hosted in the Kingdom? Why doesn't more international Internet content transit through the Kingdom? What impact does the current situation have on consumers?

4. **Localization.** To what extent has domestic Internet traffic been localized? How has that been accomplished? Is localization being accomplished in the most efficient manner? Are there any adverse effects resulting from actions currently being taken to localize domestic Internet traffic?

5.3 Policy options

5. **Establishment of an International IXP.** Should CITC establish an International IXP? Would this be an effective means to achieve the three goals identified by CITC? Would the establishment of an International IXP raise any security concerns? How could these be addressed? What measures, if any, need to be taken to ensure that any International IXP does not undermine the existing filtering regime and the Government's ability to conduct lawful intercept of Internet traffic?

6. **Advisory Committee.** If CITC establishes an International IXP, should it establish an Advisory Committee? How would the Advisory Committee be constituted? What authority should the Advisory Committee have? What role should CITC play in the work of the Committee?

7. **Sale of IP transit at an International IXP.** If CITC establishes an International IXP, should FBPs be allowed to sell domestic and international IP transit there, or should all FBPs that participate in the International IXP be required to peer?

8. **International Internet traffic.** Are there any commercial or regulatory impediments to exchanging international Internet traffic at the IIXP? Would this have any impact on the existing filtering regime and the Government's ability to conduct lawful intercept of Internet traffic?

9. **Hosting the International IXP in a data center.** If CITC establishes an International IXP, should it seek to attract a privately owned and operated data center to host the IIXP? Should there be any restrictions on who should own or operate the data center? Is issuance of an RFP the most appropriate means to select a private operator? If not, what method should be used? What selection criteria should be used to select the data center operator? Are private investors likely to construct such a data center? What actions can CITC take to encourage private investment? If no qualified private investor is prepared to build the data center, should CITC do so itself?

10. **Obligations of a data center hosting the International IXP.** If CITC establishes an International IXP and hosts it in a data center, what requirements should CITC impose on the data center operator? Should the data center be required to be certified as a tier 4 data center? Should the data center be required to offer any specific services? Would any special requirements be needed to get government and private sector entities to host content in the data center?

11. **Establishment of a virtual IIXP.** If CITC establishes an International IXP, should it seek to foster the development of a multi-site virtual IIXP, with nodes in multiple locations? What factors should CITC consider before doing so? Should CITC own the International IXP indefinitely or should it transfer ownership to a non-profit consortium prior to expanding it to multiple sites? Should all users of the International IXP become members of the consortium? What membership requirements should be imposed? What type of governance structure should be adopted? Would such an entity be economically self-sufficient or would government subsidies be required? Should CITC have a permanent membership in any consortium?

12. **Operation of the virtual IIXP.** If a multi-site virtual IIXP is established, how should CITC select the data centers in which to locate additional nodes? Should CITC impose any geographic, ownership or other restrictions on the data centers in which the International IXP locates additional nodes? How should the International IXP obtain connectivity among multiple data centers? How should the International IXP recover the cost of this connectivity?

13. **Commercial IIXP.** Rather than establishing an International IXP, should CITC seek to attract a commercial entity to open an International IXP in the Kingdom? Would seeking to attract a commercial International IXP be an effective means to achieve the three goals identified by CITC? What actions should CITC take in order to attract a commercial IIXP to the

Kingdom? Should CITC allow a commercial IIXP operator to operate both the IIXP and the data center? Should CITC impose limits on the number of commercial International IXPs it will license? What conditions should CITC impose? What should CITC do if no commercial entity chooses to establish an International IXP in the Kingdom? Would the establishment of a commercial International IXP raise any security concerns? How could these be addressed?

14. **International IXP established by a single FBP.** Should CITC seek to encourage a single FBP to open an International IXP in the Kingdom? Would this be an effective means to achieve the three goals identified by CITC? Why haven't any FBPs sought to open an International IXP? What actions should CITC take in order to encourage an FBP to do so? What should CITC do if no FBP chooses to establish an International IXP in the Kingdom? Would an operator-owned International IXP be likely to act in a neutral manner? If not, what actions should CITC take? Would other FBPs, ISPs, and other market participants be likely to exchange traffic and host content at an International IXP/data center operated by an FBP?

15. **International IXP established by a FBP consortium.** Should CITC seek to encourage a consortium of FBPs to open an International IXP in the Kingdom? Would this be an effective means to achieve the three goals identified by CITC? What actions should CITC take in order to encourage the FBPs to do so? What should CITC do if the FBP chooses not to establish an International IXP in the Kingdom? What if some, but not all, FBPs are willing to form a consortium? Would an International IXP owned by an FBP consortium be likely to act in a neutral manner? If not, what actions should CITC take? Would other FBPs, ISPs, and other market participants be likely to exchange traffic and host content at an International IXP/data center operated by an FBP? Should CITC have a permanent membership in any consortium?

16. **Voluntary Interconnection**. Should CITC require FBPs to enter into commercial agreements to exchange Internet traffic either by arranging for individual direct links between each of the FBPs or by agreeing to route all Internet traffic by means of a national backbone network? Would this be an effective means to achieve the three goals identified by CITC? What should CITC do if the FBPs do not to enter into these agreements?

17. Mandatory Peering. Should CITC require FBPs to peer with each other for the exchange of Internet traffic? Would this be an effective means to achieve the three goals identified by CITC? Would this require CITC to establish quality of service standards? Would it be feasible to do so? What is the best manner to establish such standards?

18. **Other options.** Are there any other options, beyond those identified in this Consultation Paper, that CITC should consider? If so, please describe the option, including the actions that CITC would need to take in order to implement it. Would this option be consistent with international best practices? Would it achieve the three goals identified by CITC? What impact would it have on network security and CITC's ability to impose content requirements?

19. **Modification of Reference Interconnection Offer.** Should CITC require the incumbent to offer to other FBPs domestic IP transit pursuant to its RIO? Is there likely to be demand for

this service? What methodology should be used to establish the price of this offering? Are other FBPs likely to request access to this service at an International IXP? Would this be technically feasible? What service level requirements should be imposed? Are there other means to allow other FBPs to purchase domestic IP transit from the incumbent at an IIXP?

20. **ISP secondary peering.** Should ISPs be allowed to collocate at a data center and exchange traffic directly? Should ISPs be permitted to peer directly and/or through an IIXP switch? Who should provide the physical connectivity within the data center linking ISPs?

21. **Additional CITC actions.** What additional actions, if any, should CITC -- alone or in conjunction with other governmental entities -- take to foster the growth of the Internet in the Kingdom, help to transform the Kingdom into an international Internet content and transport hub, and promote localization? In particular, what policy or regulatory changes would be necessary to facilitate international Internet traffic exchange in the Kingdom and the transit of international Internet traffic through the Kingdom? How can CITC encourage content hosting in the Kingdom? What do content providers require in order to host content at a data center? What special measures would encourage international content hosting without impeding security and filtering requirements?

5.4 Legal issues

22. **CITC operation of an International IXP.** Are any legal or regulatory changes required to ensure that CITC has all necessary legal authority to own and operate (or contract for the operation of) an International IXP?

23. **IIXP licensing.** Would the establishment and operation of an International IXP by an entity other than CITC require a license? If so, could CITC issue a class license or would it be necessary to issue an individual facilities-based license? Should the IIXP license also permit the operation of a data center or should the IIXP service provider be required to apply for a separate telecom hotel license? As an alternative, would it be permissible to establish an International IXP pursuant to a Decree? Should CITC regulate the IIXP as a dominant operator in a specifically defined service market? What other means could CITC use to ensure that a non-governmental International IXP acts in a neutral manner?

24. **Data center selection.** Are any legal or regulatory changes required to ensure that CITC has all necessary legal authority to conduct a competitive tender to select a data center to host a Government-owned International IXP? Could CITC grant the data center operator a telecom hotel license, while imposing additional obligations – such as security requirements – pursuant to contract?

25. **Interconnection or peering agreements**. Are any legal or regulatory changes required to ensure that CITC has all necessary legal authority to require that FBPs enter into direct interconnection or peering agreements governing the exchange of domestic Internet traffic?

26. **Reference Interconnection Offer revision.** Are any legal or regulatory changes required to ensure that CITC has all necessary legal authority to require the incumbent to amend its RIO to include an offer of domestic IP transit? If the incumbent's RIO contained an offer to provide domestic IP transit, would the incumbent be required to allow other FBPs to access this service at an International IXP?

27. **Telecom hotel license.** Does the telecom hotel license need to be amended to allow a data center operator to provide the full range of interconnection services, including providing in-building connection to the International IXP switch and direct in-building connection between operators? Are any other amendments required?

28. **ISP license.** Does the ISP license need to be amended to allow collocation at the International IXP and direct interconnection at International IXP sites between ISPs? Are any other amendments required?

29. **Other approaches.** Are there any legal instruments, other than those identified by CITC, that would be necessary to implement the approach you propose in Question 18 above?

6 Next steps following consultation

Following the close of the consultation, CITC will conduct a careful review of all comments submitted. CITC will then prepare, and publish, a report that: (1) identifies and responds to the significant issues raised during the consultation process; (2) describes the policy decisions reached by CITC; and (3) contains proposed legal instruments to implement the policy.

CITC will then conduct a second consultation, which will seek comments regarding the legal instruments. CITC will review the comments, make any appropriate revisions, and then issue the legal instruments.

Annex A: Glossary of terms

Term	*Meaning*
Act	The Telecommunications Act
AMS-IX	Amsterdam Internet Exchange
AS	Autonomous system
Bylaw	Bylaw implementing the Telecommunications Act
CITC	The Communications and Information Technology Commission
DE-CIX	Deutscher Commercial Internet Exchange
FBP	Facilities-based provider
Hop	The number of times an IP packet is forwarded from one router to another on its way to its final destination
ICT	Information and communications technology
ISP	Internet service provider
IIXP	International Internet exchange point – that which enables the exchange of Internet traffic at a central point, either through direct connections or via a switching infrastructure
KACST	King Abdul-Aziz City for Science and Technology
Latency	The amount of time it takes for an IP packet to reach its destination
LINX	London Internet exchange
MLPA	Multilateral peering agreement
Ordinance	Ordinance of the CITC
RIO	Reference interconnect offer
SBP	Services-based provider – an operator that leases capacity on the network of other operators in order to provide services to end users
Secondary peering	Peering relationships between ISPs that do not go through FBPs
SLA	Service level agreement
Tier 4 Data Center	A data center that meets the most stringent requirements of the TIA-942 Data Center Standards
Tromboning	Routing traffic that both originates and terminates domestically via international links
Virtual IIXP	An Internet exchange with switching equipment co-located in multiple data centers, interconnected by fiber links between the data centers