Internet Bandwidth Management

in Trinidad and Tobago (2006 – 2008)

A Consultative document

Version 1.0

February 2006

fastforward

Trinidad and Tobago. Accelerating into the digital future.

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1. Name of Policy:

Strategy for Internet Bandwidth Management in Trinidad and Tobago.

2. Target Audience:

This document is targeted to the policy planners and strategists in the public and private sectors with particular interest in the provision of Internet services to the private and commercial populace of Trinidad and Tobago.

3. Scope of Application:

This policy will impact all agencies currently involved in the development of the information based/ knowledge economy. These include;

- Evolving Technologies and Enterprise Development Company (eTeck),
- Telecommunications Authority of Trinidad and Tobago,
- Ministry of Public Administration and Information
- Ministry of Trade and Industry,
- Ministry of Finance
- Internet Service Providers

4. Aim:

This paper seeks to gain feedback and proposals on a way forward to facilitate a more proactive relationship with the wider Internet, and thus encourage an environment conducive to indigenous content development and innovation in services. This strategy if assented and implemented will go a long way in assisting the wider goals of the National ICT Strategy, but will also facilitate Trinidad and Tobago meeting International Obligations identified in the Latin American and Caribbean Action Plan for the Information Society, eLAC 2007.

5. Objectives

To achieve this goal the paper intends to identify;

- The structure of the Internet and the associated implications for end user experience, economic sustainability and content development,

- A strategy for domestic Internet bandwidth management, providing a rationale to pursue such,

- Market based initiatives which can assist in facilitating Internet bandwidth Management, while re-engineering how Trinidad and Tobago interacts with the Internet,

In this regard the proposals herein are structured to minimize the direct intervention of Government in taking these proposals forward, this is to encourage increased competitiveness of the ICT sector in Trinidad and Tobago.

6. Context:

This policy will function in conjunction with associated policies developed by the Government of Trinidad and Tobago. These include;

- ***Fastforward***, Trinidad and Tobago's National ICT strategy 2003 – 2008,
- The Telecommunications Act (2001) as amended

7. Revision history:

Date	Change Details	Author	Version
3rd Feb 2006	**n/a**	**ICT Division**	**1.0**

Responding to this Consultation

Comments and suggestions on this consultative document should be done according to the following prescribed consultation response form, an example of which is included at Appendix A.

In responding please state in your cover letter whether you are commenting as a member of the general public, representing non-government organisations or writing on behalf of a business/organisation. If you are writing on behalf of an organisation you must indicate the process that was use used to solicit views from your organisation's membership. Supporting documents should be attached to the consultation response form.

Reference must be made to the paragraph number to which the comments/suggestions are associated.

Comments should be sent via email and post by the 25th June 2006 to the:

Executive Manager,
ICT Policy and Stakeholder Engagement
Ministry of Public Administration and Information
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8. Discussion

Background

The most prized asset in today's world is timely accurate information. Businesses in Trinidad and Tobago, the Caribbean and the world today depend on timely information. In many cases the Internet is used as a vehicle to disseminate and explicate this information in new forms of data in numerous varieties that help many forecasters, economist, entrepreneurs and governmental organizations make critical decisions. To be involved in this global movement of information is to become more involved in the developing Internet economy. Trinidad and Tobago has recognised this in a number of international treaties and action plans (most recently **eLAC 2007**, the WSIS Action Plan for Latin America and the Caribbean region) where there has been a commitment to engender local content in the medium term.

To do so involves developing a particular culture, an industry of content management service which interacts with the broader Internet. Otherwise, control of the burgeoning domestic (and international) service-based electronic economy will be ceded to the jurisdictions that do provide these services.

Traditionally, to operate in an efficiently and timely manner, most, if not all, information was transferred between Internet Backbone or Service Provider connections in the United States. This was due to the prevalence of hosted information managed on servers based on huge main frame computers mostly located in the United States (US) as well as a concentration of connection to other ISPs from around the world made the US a natural locus for interconnection. There is still a common perception that this is the best way to do this, citing the economies of scale and inherent redundancies available. To maintain this paradigm however traps the developing economy to a somewhat parasitic relationship with the Internet: the cost of operation in this model drives higher Internet costs, and drains the domestic economy by including an implicit tax (to the US) for every transaction in the I-economy. Thus, the more the domestic I-economy is encouraged, the greater the loss to the domestic revenue.

This is critical, for without understanding the associated implications of the traditional structure of the Internet, despite new infrastructure development, unless a concerted effort is undertaken to encourage a new model, the situation is likely to endure and eventually be exacerbated.

This backdrop has impacted on the Internet industry. While the Government works to enable e-transactions over the Internet, there must be an associated thrust to more effectively manage the domestic content on shore. However, there are two major limiting variables which directly affect the implementation of a hosting industry in Trinidad and Tobago. These variables are:

1. The business models of the local ISPs

2. The cost and quality of local and regional telecommunications infrastructure.

Policy makers in Trinidad and Tobago can pursue initiatives to reduce this problem by encouraging a more efficient regional Internet infrastructure, and implementing domestic bandwidth management.

This document addresses these concerns and seeks feedback on developing a way forward while engendering a culture of innovation and meaningful local interaction with the Internet via the development of content in Trinidad and Tobago.

8.1 The traditional model of Internet backhaul access

An observation that is increasingly gaining acceptance worldwide is that the use of the Internet, as currently done, poses some fundamental challenges for companies, governments and users outside the United States.

Despite these concerns, this practice is not unique. Many around the world understand that despite the Internet's inherently meshed architecture, the network has a nucleus in the United States. Accordingly, companies host their sites there. Moreover, Internet Service Providers (ISPs) who provide connectivity to hosting service providers, which operate outside the United States are in the uncomfortable position of leasing a disproportionately large amount of bandwidth from the United States to route regional traffic, aggregating its investment in international infrastructure and creating the situation where there is more capacity to the US than to its immediate (even domestic) neighbouring networks.

This situation, commercially sound though architecturally inefficient, is an important hurdle to domestic electronic commerce as well as content development worldwide and could be one of ***fastforward***'s biggest problems in achieving its long term goals and objectives. A robust Internet can develop only if there is satisfactory national and regional telecommunications infrastructure, competitive with those deployed elsewhere in terms of price and performance.

8.2 The economics of the Internet

8.2.1 International telecommunications links and costs of access

Today's physical international telecommunications network was built based on assumptions about international call traffic patterns. As such, the majority of routes (still) follow lines of colonial control (thus most Commonwealth nations have an inordinate amount of sunk investment in telecommunications capacity to the United Kingdom) and loci of international business; such as the Eastern seaboard of the United States of America. For this reason, the best prices, best-performing links as well as the best availability were on U.S. routes; the most popular incoming and outgoing calling destination, and thus the single destination to which the most infrastructure was built.

U.S. carriers own the vast majority of that capacity. When the Internet was first developed, and rose in popularity in the early 1990s, it rode atop of the existing telecom infrastructure that was constructed for the purpose of long-distance voice calls. Thus the prevalence in availability of inexpensive, high capacity links to the US (See Fig 1.).

To compound the issue, not regulated by traditional telecommunications frameworks which guided switched telephony, a finance settlement structure (for the termination or carriage of traffic) developed which was very different

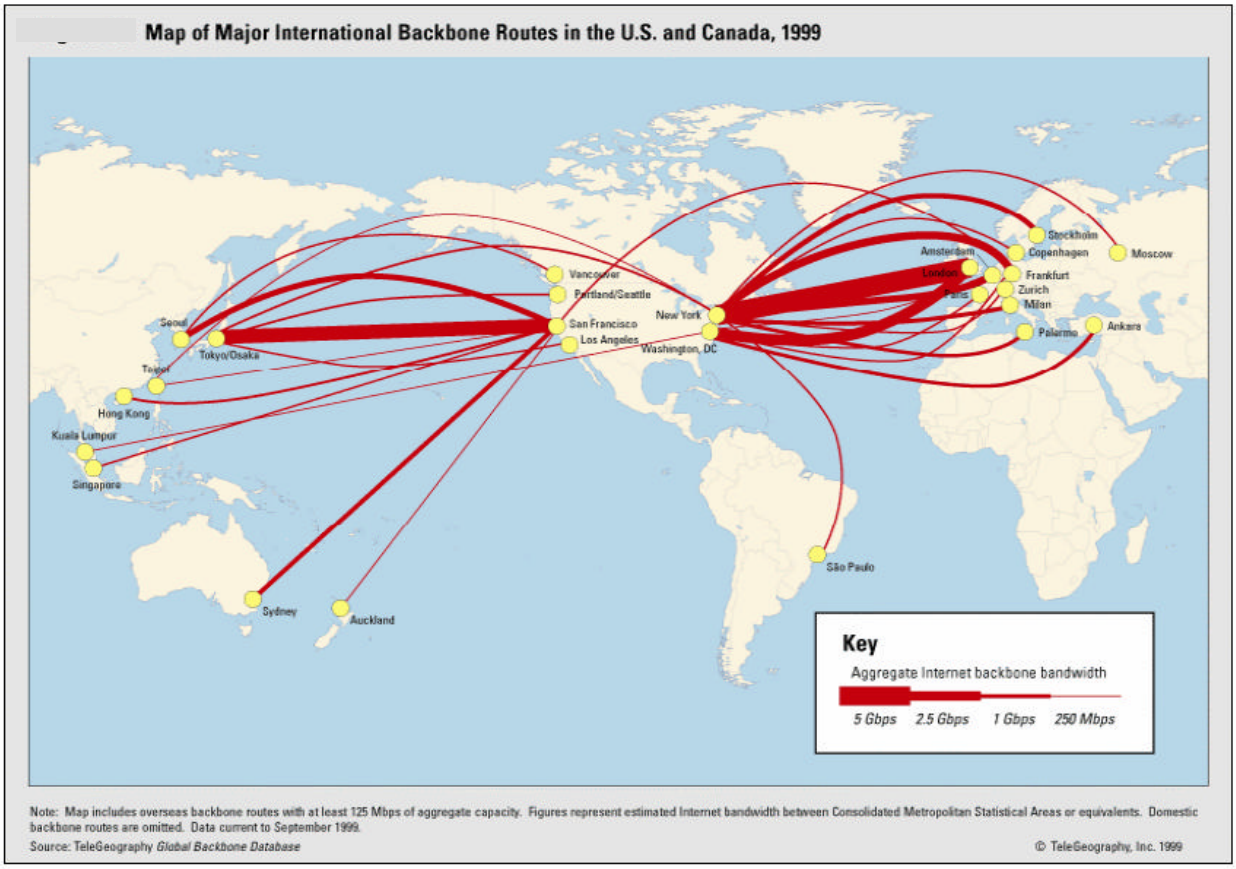


Fig 1.

to that experienced by the sister telecommunications networks: instead of a system where each carrier owns or is responsible for the cost of half of each link utilised, the Internet's settlement regime is structured such that similar sized (or tiered) carriers pay each other nothing in the exchange of traffic. This is known as "peering".

Smaller networks however, would have to pay to gain access to the backbones of the larger (higher tiered) Internet carriers (transit connection) and carry the burden of cost of all transmission costs to the points of interconnection (access) to higher tiered network (called NAPs).
Telstra, an early opponent to the economic structure of the Internet complained in 1997 that the FCC's settlement rate benchmark order was lopsided; encouraging external (to the US) telephony carriers to determine cost-based settlement rates but inadequately addressing the

> *"above cost fees that US carriers charge foreign carriers for international capacity needed to service the burgeoning growth in Internet traffic."*

The FCC's response to this has not attempted to address the issue of the international capacity charges.

This has remained unchanged despite further calls at ITU and WTO from member states, including Australia, China and Mexico, to revisit the peering/ Internet settlement regime into something which approximates to the outcome of the World Telecommunications Standardisation Assembly 2000 which recommends that;

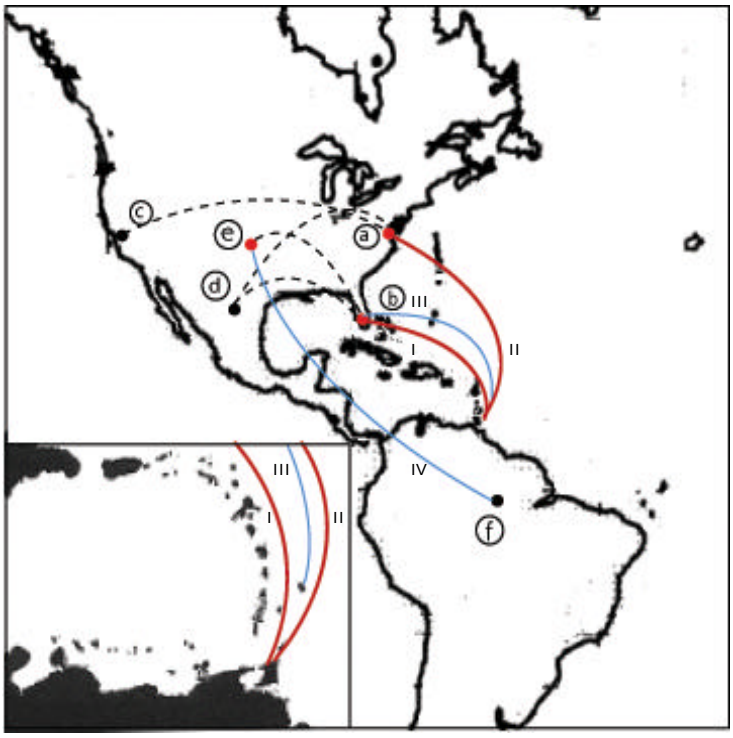
> *"[parties] involved in the provision of international Internet connections negotiate and agree to bilateral commercial arrangements enabling direct international Internet connections that take into account the possible need for compensation between then for the value of elements such as traffic flow, number of routes, geographical coverage and cost of international transmission amongst others"*[1]

This recommendation is not mandatory, and to which the US and Greece have not assented. Consequently, as it stands, in sending traffic to and receiving traffic from the US Internet backbone providers (IBPs), the smaller carrier has the burden of all the cost. China has argued that this arrangement amounts to "double interconnection" charges by the backbone providers, inherently inequitable and representative of abuse of market power.

In fact there are arguments that the nature of the operation encourages anti-competitive behaviour by the US based tier-one providers; as the consolidation of market power aggregates in fewer operators in a non-regulated environment there is no impetus or assurance of reasonable competitive pricing. In fact, the nature of the peering agreements is such that they are not transparent to the general public, and generally bind smaller ISPs to a monopolistic, exclusive relationship with a higher tiered ISP/ IBP. This oligopoly being created at the core of the Internet is not likely to become more transparent or customer friendly without appropriate regulatory oversight.

[1] See http://www.itu.int/newsarchive/press/documents/diii.htm

Also, the further the smaller ISP is from the American NAP, the more costly Internet access. The tier-one carriers, at the apex of this pecking order, are



1. Internet traffic leaves Trinidad and Tobago by two routes – fibre optic cable which lands in Miami or Puerto Rico (Route I to NAP (b)) and VSAT which can terminate in disparate loci such New York, California or Canada (Route 2 to NAP (a))

2. For information hosted in the US, the server may be located anywhere: e.g. in Texas (point d), California (point c).

3. A domestic user accessing local information hosted at points (c) or (d) must first traverse Route I or II and then be routed across the US Internet backbone. It is unclear how many routers/ nodes may be traversed.

4. The greater the number of routers/ nodes traversed, the greater the latency associated with data transmission.

5. A domestic user accessing information from
   (i) Barbados or
   (ii) Latin America
   is routed to the US via routes I or II, and then routed with the US backbone before being routed via
   (i) route III to Barbados or
   (ii) route IV to Latin America point (f) from NAP (e)

Fig 2: An illustration of current internet routing in Trinidad and Tobago.

thus always enjoying the net receipts of the operation of the Internet[2].

8.2.2 The information super-highway: the single Internet backbone

The Internet backbone, the heart of the "information super-highway", is owned by US firms, and is composed of the tier-one ISPs like MCI WorldCom's UUNet, Sprint, and GTE Internetworking. Not only do these firms cumulatively control the majority of telecommunications infrastructure in the US, but a subset of these firms, including the British Cable and Wireless PLC (C&W), also own the majority of international telecommunications links which, as discussed above, also aggregate to the US. Further, along with the US Department of Commerce's MOU with the

[2] As a point of note: it has since taken considerable legal, regulatory and political pressure to weaken the powers of this oligopoly: the tier-one carriers have been forced to publish and thus clearly define the requirements to gain peering, vs. transit connection. This thus facilitates the possibility of more networks joining this elite group of Internet Backbone suppliers.
See 2. McGarty, T.P. (2002)

Net's California based Administrator, ICANN, these US based tier-one carriers also control the vast majority of the Internet's routing table[2].

This aggregation of influence over every functional element of the Internet has not escaped the notice of some burgeoning powerhouses in the global ICT arena, such as Trinidad and Tobago's Latin American partner, Brazil.

Since the largest number of users, as well as the world's most popular Internet content is based in the United States and hosted by these ISPs directly or via down-stream ISPs, ISPs outside the United States must connect with the U.S. backbone else they are effectively not on the Net.

While this explains why a non-U.S.-based ISP needs to link to the United States, it also reveals the incentive to hub traffic in the United States to be re-routed elsewhere. All ISPs outside the United States share this market dynamic, and so nearly all have direct connections to the United States.

As one may expect, the U.S.'s low telecom costs for high-speed bandwidth acted as an incentive to encourage this strategy to hub traffic there even if the traffic returns to the same region. As a result, many find it more convenient and less expensive to exchange traffic in that one central hub, rather than dedicate infrastructure to every country where they need to reach other ISPs to swap traffic.

8.2.3 An unexpected threat to traditional international telecommunications

Further, as traditional telephony networks migrate to IP systems via next generation networks (NGNs) and integrated messaging systems (IMS) (as AT&T, BT et al. have begun to), if the Internet carrier settlement system remains, along with the international practice of limited regulation of Internet traffic, there is the possibility of an arbitrage[3] in landing rates which could be exploited by international carriers. If this becomes the norm, international telecommunications will effectively become a loss making, capital draining activity for developing economies, or those geographically removed from the US backbone NAPs.

Consider the following, where any international call may be routed through the Internet (or Internet-like) environment. If the settlement structure remains unchanged, the transmission cost is paid by the end user in the 'remote' state, and routed by that tier-one carrier to the point of termination.

[3] Evidence of this arbitrage driving Internet based bypass is already starting to appear in the region. In October 2005, at the Jamaican Tech Portal : TechJamaica.com, it is reported that since the Government instated inbound tax has been levied, it is estimated that "… anywhere from 20 to 50%…" of inbound telephony traffic bypasses the traditional telco gateways, entering the country instead through mechanisms such as Internet driven Voice over IP.
See http://www.techjamaica.com/content/view/1031/50/

Conversely, a call from the US will be routed to the carrier of the 'remote' state, at its cost of transmission, and little or no cost to the US based carrier.

This will effectively result in a unilateral revenue flow for international telecommunications: out of the developing or 'remote' economy, into that of the Northern states where the backhaul resides (and is incorporated). Merely liberalising the domestic telecommunications environment is not sufficient as a strategy in stemming, or reversing this tide.

Key point 1:

a) Do you think this description of the status quo accurate?

b) If not, where are amendments appropriate, and what should those amendments be?

8.2.4 Reviewing interaction with the Internet

Not withstanding the extremely complicated aspects stated above in terms of architecture, cost and efficiency when it comes to routing Internet traffic, the situation may not be that entirely bleak for CARICOM, regional Internet industry executives and government policy makers. The situation need not be permanent.

The way to remedy this sensitive situation is both to attack the core problem and to create the broader commercial landscape for the Internet industry to further develop. This would mean;

1 More regional bandwidth, lower prices,
2 Robust competition, and
3 Regional cooperation to create central regional hubs for routing internet traffic.

Going forward, to encourage a more meaningful participation in the Internet economy, governments of developing states should consider developing initiatives to re-engineer how they interact with the wider Internet.

In its review of the situation in Africa in 2000, the ITU noted that;

> *"…if [the remote region] had a greater ability to exchange traffic locally at a national level and regionally…it would not be paying for expensive international bandwidth… Likewise, if it had more outgoing traffic and some regional carriers, these would be able to peer with their international equivalents and lower the costs of international bandwidth."*[3]

The initiatives identified below are geared to, either individually or cumulatively, support increased utilisation, and decrease the overall cost of bandwidth for Internet access. These could include;

8.2.4.1 Increase Computer and Internet Penetration Rates

The current Internet penetration rate in Trinidad and Tobago is currently extremely low at 17%[4]. This low rate can be linked to lack of diffusion of computers in the wider populace. This must be addressed, for with the lack of computers driving low possibility for individuals on the Internet, why should any administration bother to even invest in such a bold approach as developing an indigenous hosting industry?

Fastforward recognises this and identifies a number of initiatives geared specifically to increasing access by the citizenry to computers and thereby the Internet. These strategies include:

- Community Connections programme: This includes a network of Community Access Centres (CACs) which are envisioned to:
  - facilitate access to the Internet and ICT applications
  - encourage training in the use of ICTs as tools
  - encourage the development of indigenous content, which could be incorporated into community portals accessible to the wider Internet.

- Computers for Communities programme: where the focus is on a programme dedicated to the developing entrepreneurs in the business of refurbishing and resale of used computers.

- LibraryNET: which envisages high speed connectivity to the Internet accessible at all public libraries,

- SchoolNET: which envisages the infusion of ICTs in the national education system through connectivity and application in curriculum presentation.

It should be noted that because of these initiatives, there may be an associated upsurge in the type, quality and amount of indigenous content online. If they are successful, it is these programmes which will most demand the development of a strategy which is geared to rationalising the approach to the hosting of content on the Web as well as the augmenting of international and domestic bandwidth and infrastructure.

8.2.4.2 Increase Local-Loop Internet Capacity

As more local content and applications become a greater part of citizens' Internet use regionally, Caribbean Governments and businesses should work

[4] MORI opinion Leaders Survey Wave V, April 2005

together to increase bandwidth on local access networks to jumpstart more sophisticated applications used over the Internet.

Some ideas espoused by thinkers in this field include;

1) Encouraging firms to deploy alternative high-speed local access technologies such as via power lines, cable plant, and wireless technology.

2) Governments can directly invest in backbone infrastructure deployment. Models worldwide include matching funds proffered by venture capitalists, as is done in Germany, where these investments are focussed in "strategic areas."

These ideas can find succour in the initiatives already underway domestically. The Government of Trinidad and Tobago has embarked on an exercise geared to the liberalisation of the domestic telecommunications sector. The process, currently underway, follows similar headway made throughout the Caribbean in Barbados, Jamaica, and the OECS etc. In conjunction with the liberalisation initiative, and in alignment to the principles set out in the ***fastforward*** agenda, a Universality programme is being developed.

This programme is geared to encouraging re-investment into the domestic infrastructure by the participants in the telecommunications sector. The infrastructure to be deployed in this programme is also to be data-centric, that is, equally geared to the provision of high speed data as well as voice and based on the recent advances in technology development in the sector.

8.2.4.3 Limiting dependence on the central US backbone through alternative routing strategies.

The traffic exchange among data networks is the most essential aspect of the U.S dominated monopoly backbone. National, and more importantly, international network interconnection points must be coordinated in the region. Currently, over 90% of ISPs and local businesses probably often go outside of Trinidad and Tobago for advanced Internet solutions[5]. As a result jobs and revenue go elsewhere instead of being re-invested in the local economy.

This certainly does not help the cause of the National ICT Strategy. To support the thrust of ***fastforward*** with its focus on increasing innovation, e-business and governance through Internet usage and content development, a strategy should be developed to, where appropriate, circumvent the central US backbone without compromising the homogenous Internet experience.

[5] In 2003, the National e-Commerce Secretariat completed a survey which intimated that 43% of firms had their own web site. Of these, 50% chose for international hosting services providers, while 45% claimed they used local hosting services providers. Interestingly enough, in 2005, on sampling the major domestic hosting service providers, the majority of respondents (with the exception of TSTT) were resellers of hosting services located in the US.

Key to this initiative recognises the inter-relationship between content-location and routing methodology.

As long as the Internet-based content of a region remains hosted in the US, the existing routing arrangement must remain paramount, and the burdensome costs associated must be maintained.

As such, there must be a concerted effort to reduce the dependence of the US as the preferred hub for the hosting of Internet-based content. Similarly, the model of central locus for information network interconnection must be revisited. Decentralised domestic and regional routing of Internet traffic is burgeoning. Worldwide there has been a shift in paradigm of Internet service provision and possibly the Caribbean should mirror such a shift to maximise the advantages of the I-economy in the CSME.

Savings with a systematic mechanism of decentralised routing this could be further extended to the operator's customers. Consequently downstream service-based segments of the industry, such as content-management and hosting, could become more strategic, efficient and cost effective.

Many international commentators suggest that the way forward includes strengthening the infrastructure links, especially through competitive entrants to assist in driving prices down due to market pressures. While this is a possible solution, it is mired in the stratus quo and may not realistically mirror the environment enjoyed in the US as discussed in section 9.4. If the aim is to better interact with the Internet, a truly revolutionary approach to accessing the Internet is needed, other approaches should be pursued simultaneously.

Recommendations on national and regional strategies to limit the dependence on the US backbone are discussed below.

8.2.4.4 Utilising the regulatory framework.

The telecommunications sector in Trinidad and Tobago is governed by the Telecommunications Act (2001) as amended ("The Act"). The Act envisages a technology agnostic model in its definition of the sector: identifying network providers distinctly from service providers.

Following hereunder, and in line with the ongoing developments in information and communication technology (ICT), the Authority has defined an authorisation framework which is service and technology neutral, which envisions equal regulatory oversight of participants in the same market, irrespective of platform.

The framework includes the Internet Service Provider as a public telecommunications service provider, with a need for authorisation and associated regulatory requirements and thus is subject to the same

regulations, for interconnection, international wholesale and retail rate oversight and access to facilities as traditional switched, fixed telephone companies.

Section 29 (3) of the Act in particular gives the Authority regulatory oversight to

> *"…regulate prices for public telecommunications services and international incoming and outgoing settlement tariffs by publishing pricing rules and principles".*

While generally considered in the realm of telephony, as ISPs are considered public telecommunications service providers and thus require a concession for operation, this language also gives the Authority oversight of such as the rates paid by ISPs for bandwidth to external parties.

In this regard, various mechanisms can be utilised so as to mitigate against cartelisation at the far end of the international telecommunications connection link the development of domestic telecommunications services.

Key point 2:

a) Do you agree with the analysis of the gap and the general nature of these key activities?

b) If not, where are amendments appropriate, and what should those amendments be?

8.3 Further review of the digital gap in ICT

It should be noted that while digital gaps between nations arise through:

- the number and architectural density of ISPs
- hosts connected to the Net
- proportion of individual users online
- Internet diffusion ratios
- number of organizations with leased-line connections

The imbalance also extends to content in terms of number of Web sites in developing countries, amount of local language content, and use of online content by key sectors. According to the International Telecommunications Union (ITU), there were more Internet hosts in Finland than in all of Latin America and the Caribbean in 1999, there were more hosts in New York than in all of Africa, and more than 80 percent of Web pages were in English[2].

There are at least seven (7) measures of market maturity for online content in a country:

1. Total number of Web sites about (and published in) the country

2. Local relevance and usefulness of this content
3. Local language standardization and usage on the Web
4. Amount of sub national content (about states, provinces, and cities)
5. Presence of meta content such as directories and search engines
6. Amount of ad revenues that target online audiences via these sites
7. Presence of third-party services from online traffic auditors, ad revenue auditors, and market research groups.

These measures point implicitly to an environment where information is generated and shared domestically. Emerging economies like Trinidad and Tobago must increase activity within each of these seven dimensions in order to help reduce the content gap. Accordingly, news media, public health services, government-citizen resources, NGOs, SMEs, and emergency relief organizations need to make more content and services available online.

A Domestic hosting industry can go a long way in achieving these milestones.

To facilitate this, world-class hosting infrastructure must be created in emerging economies so that locally generated content will be hosted predominantly in the region and not outside it, thereby saving lucrative foreign exchange revenues and safeguarding information sovereignty. Although great emphasis is being put on most of these areas via an aggressive National ICT agenda, more emphasis and work is still needed to accomplish specific targets that would enable fluent economic hosting of content and a vibrant lucrative eCommerce environment.

8.4 The effects of hosting content via the United States rather than hosting locally

According to the underlying concepts of the Internet's routing design, traffic should take the most direct path. Indeed, the architecture of transmission control protocol/Internet protocol (TCP/IP) allows for dynamic updating to find the most efficient path for the data flow. Yet the current topology is not truly distributed as there is a preponderance of bandwidth on certain routes (like those to the United States) based solely on historic and economic causes (the lower cost and higher available bandwidth) rather than engineering ones (the most direct route for traffic to travel)[3].

In Trinidad and Tobago, like most Caribbean territories, ISPs connect to the Internet via expensive international bandwidth solutions such as VSAT and fibre. Most of the data traffic flows out over these expensive connections even if it is intended to reach a local destination. This increases the cost burden on the various ISPs and Network Operators in terms of international bandwidth. It also causes the Internet to pose slow response to user's interaction.

The dependence of this model of operations is demonstrated by developments in hosting service providers' business strategy which plan to host websites for corporate, government or non-profit agencies. Most often the strategy is to lease server space from a U.S.-based company. This may seem normal and technologically reasonable because of the common belief that hosting sites from the United States would improve the performance not only for U.S. users, but for users in Trinidad & Tobago and the surrounding region as well. Although this might be a common strategy to those familiar with the Internet's current topography this has served as a potent symbol of defeat, raising simple questions:

> Why should a company in Trinidad and Tobago or CARICOM choose to reach Caribbean or regional users from the United States?
>
> More importantly from the macro-economic perspective: Why should it pay a U.S. company to do so?
>
> Further, why should it pay yet another US based company to rent server space to reach out to its regional partners?

Some industry executives and policy makers believe that bringing U.S.-based content closer to the source of the demand will ease the problem. While plausible from some contexts, hosting U.S.-based Web content regionally does not help address the issue of lack of indigenous content, and does not adequately address the issue of bandwidth aggregation in the US.

Could part of the solution include decentralising the US as a locus for content to be hosted? As the ***fastforward*** agenda encourages Internet driven e-commerce among local and regional partners, could there be an advantage to the engendering a domestic hosting industry? Could this be central to stemming the tide of revenue outflows and increasing the potential for inflows?

Another aspect of the external bandwidth challenge in facilitating a domestic hosting industry is the need for upgrade of external links if hosting is implemented in the traditional sense, that is, remote from the US backbone, in locations such as Trinidad and Tobago. To illustrate the concern, consider the following; if a company began the domestic hosting of local content which is however geared to the international market, the Trinidad & Tobago based hosting provider will find that while it saves foreign exchange in investing in a US based hosting agent, the cost of U.S. bandwidth, which will be reflected in subscription costs to its ISP, will increase as there will be a need to strengthen the inbound telecommunications facilities.

8.4.1 The effect on Internet download and response times

The first consideration of the impact on how the Internet works when information is hosted in United States rather than locally is simply that traffic

travels via a longer distance connection rather than a more direct route which is technically inefficient.

This topology increases the latency, or transmission delay, associated with page/ download requests. The impact of this is extremely far reaching: while the focus of many is in addressing the lack of availability of high-speed access telecommunications facilities (in the access loop) to the subscriber device or premises, because of the Internet topology in the background, the bottleneck limiting a higher speed Internet experience is migrated from the access loop to the international gateway.

Even if the International gateway is adequately provisioned, due to the inherent latency associated with trans-Atlantic and trans-Caribbean transit, even before negotiating routing to the actual locus of hosting (in Florida, New York, California or Texas for example), the response and download time for the subscriber's Internet experience is lengthened.

Accordingly, this has a knock on effect for hosting, and Internet based e-Commerce regionally as all Internet traffic travels between Trinidad and Tobago (T&T) and other CARICOM islands slower that it travels between T&T and North America. This due to the lower throughput of direct links between the islands, compounded by the traffic having to go to the US before being routed back to the destination Caribbean state, as most the regional ISP's probably interconnect only in the US.

8.4.2 The effect on the national macro economic position

Secondly, under these circumstances, the traffic travels on an international link, which means that a foreign carrier -- usually based in the United States -- receives income from the local ISP. In essence, the development of the Internet in a country outside the United States requires a payment to a U.S. carrier.

	TSTT	IISP**s	Total
Bandwidth (Mbps)	335.00	45.00	380.00
Avg. monthly rate per 1,544 Mbps (USD)*	12,000.00	12,000.00	n/a
Avg. monthly cost (USD)	2,603,626.94	349,740.93	2,953,367.88
Avg. annual cost (USD)	31,243,523.32	4,196,891.19	35,440,414.51
Avg. annual cost (TTD)	196,834,196.89	26,440,414.51	223,274,611.40

This represents an additional burden of cost which is carried by the Internet users in T&T compared to the US based equivalent provider.

NB: with the liberalisation of the international telecommunications market, the volume of capacity leaving the country is set to increase. Whether the cost of bandwidth will decrease sufficiently to offset the calculation projected remains to be seen.

* based on average rate for VSAT and wholesale rate via fibre offered by TSTT and IISPs
** IISP– Independent Internet Service Providers ; those ISPs who are not affiliated with the telecoms incumbent TSTT

Table 1; Estimate of Current International Internet bandwidth costs

As can be seen, this introduces, on average, an additional US$30 per month[6] to the cost of service provision that need not be incurred from the equivalent US based ISP. This underscores why the cost of Internet access in locations remote from the North American NAP is hard-pressed to be comparable to US counterparts; there is an additional hidden cost, that of more international carriage (vs. domestic for the comparable US based ISP) that must be recouped by the ISP, from the subscriber. The only way to limit this is to review the way how the Internet access is managed domestically.

However, since the North American-bound link is often seen as less expensive per unit throughput (see Table 1 above), and permits the ISP to access U.S.-based content as well as interconnect with other national ISPs, there is a commercial incentive to maintain this situation; a one stop point of interconnection, even though it is self-defeating in the long term for the domestic carrier.

Consider, if the National ICT agenda is a success, and the Trinidad and Tobago domestic economy is revitalised through Internet enabled e-Commerce, as long as the hosting paradigm continues, the more Internet usage generated in the domestic economy, the larger the requirement for international bandwidth for Internet access, and the larger the drain of foreign exchange to the economy[7].

[6] Assumes Internet penetration stands at 25% of the households in Trinidad and Tobago.

[7] According to the ITU (2003), Australia has already experienced the symptoms of this drainage syndrome. It is reported that in 2002 Australian providers began transferring this cost to end users by implementing download based quotas and premium rates. As Internet usage patterns indicated that over 70% of data downloaded originated overseas. This put pressure on providers as fixed package access rates were no longer able to cover the associated increased costs.

This philosophy entrenches the position of the United States and U.S. carriers for e-commerce traffic and is exacerbated by the nature of interconnecting Internet networks which has developed separately from the traditional framework for interconnecting international telecommunications networks. This is discussed further in (8.1) above.

It should be noted that the entrance of competitive international telecommunications facilities and service providers is creating downward pressure on the cost of international links, further reducing the per unit throughput cost. This however does not address the concern of maintaining a business model where there is unnecessary investment into international as opposed to domestic telecommunications infrastructure, which drains foreign exchange from the domestic economy.

8.4.2.1 The volume-based savings mis-conception.

In response to the conundrum that Internet access is prohibitively expensive, many often cite lack of usage as the major stumbling block for the relatively high prices for access. This creates a "chicken-or-egg" situation where penetration is low because of high prices, and prices are high because of low usage rates.

Is increasing volume (through subsidies etc.) really the answer?

On analysis, studies have shown that in remote locations (outside of the US) the backhaul connectivity to the US represents a lion's share of the cost of Internet service provision. According to table 2, the lion's share of the disproportionate cost of high speed access in Trinidad and Tobago can be attributed to the overhead to be recovered due to this back haul.

Some counter that the unit bandwidth prices for backhaul will decrease with increasing usage as is evidenced in the US. This is counter-intuitive and betrays a misunderstanding of the development of Internet services and the current state \of play in the industry.

As the Internet grew into prominence in the early 90's, many of the tier-one network providers discussed in 9.2 above invested large sums in laying fibre for high speed connectivity between the economic hubs of the North (particularly within the US, but including the routes between the US and Europe). This was done on the presumption that public access to data services would drive an explosion of usage, as seen in the Far East, and generate exorbitant returns.

The explosion of usage did not occur and the extra normal returns did not materialise. In fact, the compression of 2000/ 2001 created an environment where it was imperative that this sunk infrastructure begin providing returns. Supply of telecommunications bandwidth far outstretched demand, thus incredibly low bandwidth prices.

In the Caribbean, and other remote (from the US) locations, bandwidth is purchased on an as is needed basis. There is limited opportunity to develop such an environment to encourage extremely low bandwidth prices, particularly with bottleneck international facilities or cartelised far-end destinations.

Consider the standard demand-supply curves in Fig 3 below;

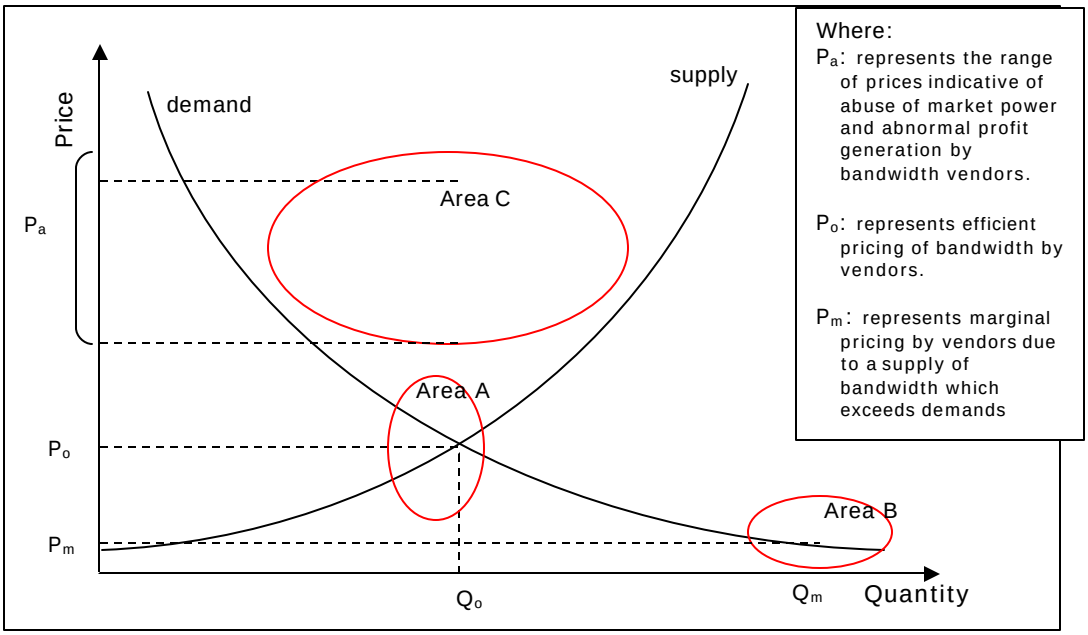


Fig 3. Supply - Demand curve for international bandwidth to the Caribbean region

Trinidad and Tobago (and the wider Caribbean) most probably currently exists at area A. The issue China has ventilated about abuse of monopoly power suggests that the rates may actually be inflated, suggesting that there may be a case for T&T's profile actually residing in area C. As usage increases any decreases in rate will most likely be attributed to bulk usage discounts. This will not materially move T&T's profile from A.

The North American/ trans-Atlantic bandwidth market may be characterised in area B. Here as supply vastly exceeds demand, downward pricing pressures command attractive rates. It will take substantially more than increasing the utilisation characteristic of the region to move the position on this demand-supply curve.

8.4.3 The security concern

Security of data is an ever more important aspect in the development and management of corporate and national information systems. As more and more personal, corporate, and commercially sensitive data is stored in

information systems, which are themselves increasingly interconnected, the security of these networks is paramount to the attractiveness of a region as a locus for hosting.

Network or Node security can be considered from a number of perspectives which will impact the risk profile of a location. These perspectives include,

i. Robustness of the telecommunications infrastructure to support redundancy and reliability,
ii. The stability of the economic and political environment,
iii. The risk of natural disasters, such as floods, hurricanes and earthquakes, which could compromise a locations' operability,
iv. The capacity of the human resources to support the required processes essential for reliability,
v. The legal and regulatory environment.

Traditionally, the United States is, and has been, extremely competitive as a location when considering the above. However, with the passage of recent anti-terrorism legislation, the Patriot Act, which contains provisions for the US Federal Authorities to 'snoop' or search information stored in databases within its jurisdiction, and the posture of the current Administration[8], the security of confidential data hosted in the US has become a concern.

Key point 3:

a) Do you think this description of the status quo accurate?

b) If not, where are amendments appropriate, and what should those amendments be?

8.5 Hosting content locally: essential for the Internet economy.

> *The capacity to acquire and generate knowledge in all its forms, including the recovery and upgrading of traditional knowledge, is perhaps the most important factor in the improvement of human condition (Human Development Report 1998/99, UNDP)*

Knowledge sharing is the interactive process of making the right information available to people at the right time in a comprehensible manner to enable them to act judiciously- enriching the knowledge base in the entire mechanism.

Hosting content locally can act as a catalyst to bring this fact to a reality thus transforming the way business, education and knowledge management is

[8] The recent impasse between the US Attorney General and Google, where the latter refused to facilitate surreptitious access to its subscriber databases is notable.

conducted. For example hosting content locally allows you the benefits of keeping extremely sensitive data that you want within your possession at all times.

Given Trinidad and Tobago's petro-carbon, manufacturing and tourism industries, there is vast potential for these activities to quickly become e-Commerce driven environments most utilized by interested stakeholders. These are tacit investments to be leveraged in the ICT agenda. Should these stakeholders continue to use the United States' backbone exclusively?

Hosting content can also stimulate the drive for involvement in entrepreneurship creating more niches ranging from local to international ventures. These ventures can range from technology parks to media centres, from sophisticated petrochemical inventory tracking systems to medical systems. Hosting content locally can transform the way of life, once done properly. Relevant and locally specific content constitutes the most critical element in growth of knowledge societies after connectivity. It would be futile, despite the ***fastforward*** programme's drive through a 'broadband strategy' for better, faster connectivity, to link communities onto the information superhighway at an exorbitant cost when little relevant content is available on it for communication.

The Trinidad and Tobago National ICT strategy dictates that we are to have a fast, reliable and consistent connectivity to the Internet. How is this faster

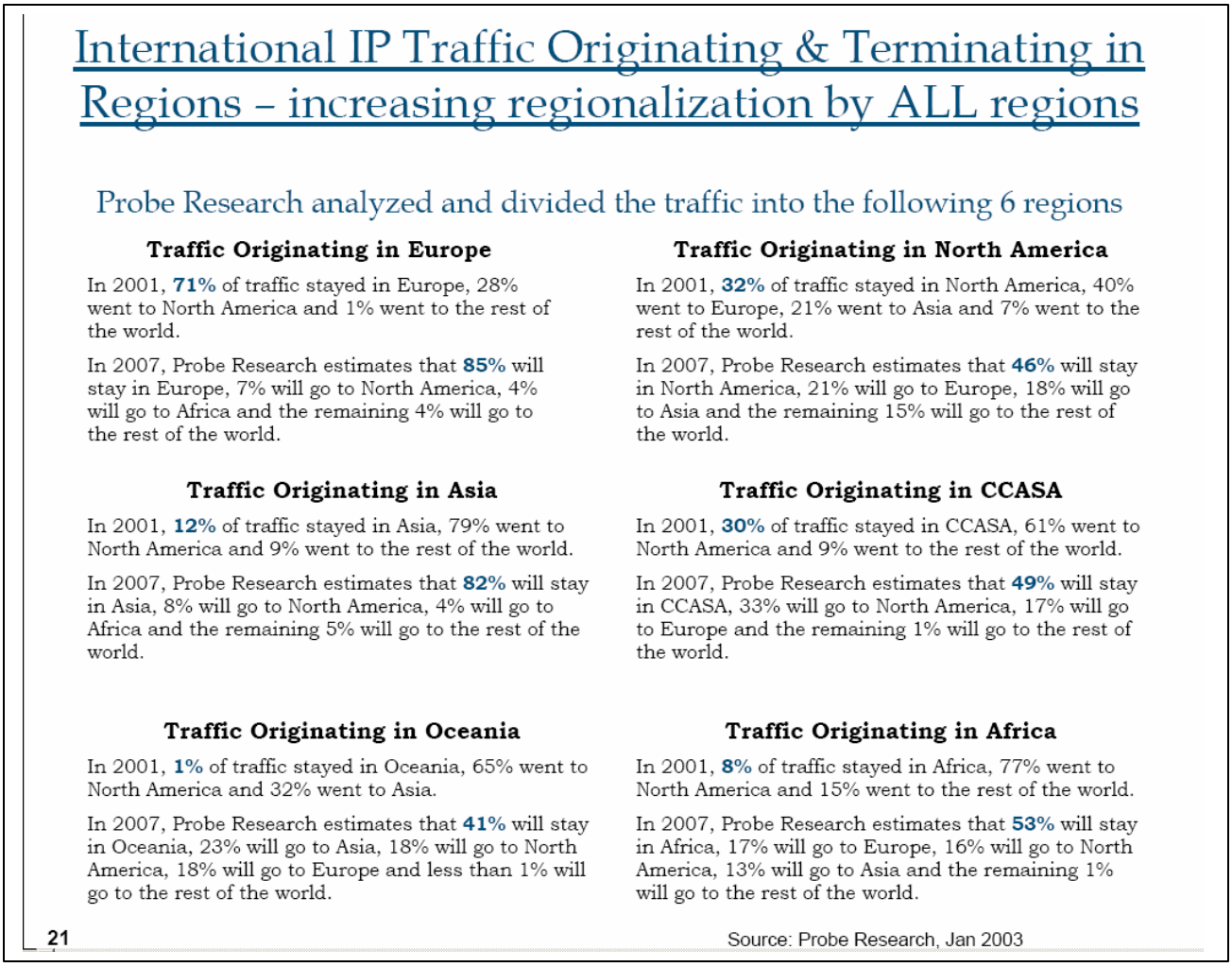


Fig 4

Internet to be materially maximised to the benefit of the wider economy? Only if the infrastructure thereby installed is leveraged to facilitate innovation in the ICT sector so that more advanced service based platforms can be launched.

In this regard there should be appropriate public policy to encourage the development of various nodes or hubs of high bandwidth, high capacity telecommunications infrastructure. These hubs must be made competitive to the hosting facilities available at international locations through the development of a total value proposition, including *inter alia* the cost, reliability and performance of the service. Once implemented, these hubs can be used to support the necessary environment to encourage the hosting of investment clusters in the content management industry within the domestic grid.

The number of regional NAPs or IXPs, and gaining wide acceptance across the five (5) major global telecom regions (See Fig 4)[9]. Associated with these deployments, it is not surprising that there has been a concomitant explosion in domestic hosting, identifiable by the growing projections of internal traffic patterns, leveraging the advantages of the domestic routing scene. The effect is exponential and self propelling: the presence of an IXP reduces cost and latency; increasing the value proposition for the end user and the potential developer of content. This in turn fuels innovation into more content, which in turn acts as a market driver to encourage end users online.

If we can emulate the same infrastructure locally, then regionally, it begs the question: With a relatively good back bone through out the nation could we actually be successful at hosting our own local content? What else is needed?

The concern about the associated need to strengthen links from the traditional backbone to the region to facilitate external access, and system redundancy, is not entirely addressed by the IXP model. The model does not and should not address the continued requests for content hosted extra-regionally as infrastructure will still need to be dedicated in this regard. However, there are alternatives which exist that can be targeted to the international oriented Web pages and requests.

8.5.1 Opportunities provided by Local Hosting of Content.

Hosting local content presents untold exponential opportunities. The Internet Revolution has created a totally new business environment and with the CSME in place and Trinidad and Tobago's secure financial position as the financial capital of the Caribbean, along with the manufacturing and the entrepreneur opportunities available, it's only time before a large portion of the private sector becomes a dotcom sector. Hosting local content could be helped by, and/ or aid, this situation and could lead to the development a robust foundation for e-Business.

Many companies are keen to embrace e-Commerce and compete in the new economy, but are faced with a fundamental challenge of how to identify e-Commerce opportunities which enhances competitiveness in the new economy. A proper hosting strategy, along with education changing the cultural business ethic, can assist this thrust and see a lucrative transformation for Trinidad and Tobago in this area. This in turn could result in catalyzing the digital transformation which would inevitably spur consumer demand.

All of this is however based on the theory that Trinidad and Tobago is the branded Trusted Global "Dot.Com" and an e-Business hub of the Caribbean and that an 'e-Lifestyle' that bridges the digital divides entrenched.

[9] That such research apparently omits the current state in the Caribbean underscores the need for the national regulatory agency, and then at the larger CARICOM regional level, to ascertain the international telecommunications and data traffic profile characteristics such as that demonstrated in Fig.2.

Although e-Commerce is done on a very small scale at present, hosting our own local content could revolutionize this medium and thus bring other innovative ideas and situations to be considered.

In the current regulatory framework, the Telecommunications Act (2001) defines a Value Added Service Provider (VASP) as one that collects, modifies and distributes information to a subscriber set. Under this broad definition, VASPs are effectively content aggregators and can range from mere mailbox providers (e.g. voice or data/ e-mail) to advanced operations such as Authentication/ Certification providers and Internet Web Hosting services. A few facets in which innovation can be encouraged are discussed below.

8.5.1.1 Open content

The idea of open content has its background in the open source software movement, and can be considered a new approach to treating with the development aspect of human and intellectual asset development. As a philosophy, open content refers to the principle that content should be freely reusable so as to make knowledge available as common knowledge for the common good of all. A fundamental principle of open content licensing is that any object is freely available for modification, use, and redistribution with certain restrictions. An effort like this could revolutionize local industries such as music, creative arts and the educational system. This could encourage greater creativity and efficiency within these domestic industries.

Hosting local content could drive an ingenious idea like this that could see Trinidad and Tobago arts and local entertainment industries leapfrog into the I-economy, becoming extremely relevant and competitive internationally.

The economic benefits of the collaborative model of open content development stem from two inter-related processes, collaboration and reuse. People with a common interest in different institutions collaborate in the creation of content. It stands to reason that as more people collaborate the costs per institution are reduced.

8.5.1.2 Proprietary Content, Intellectual property

In more traditional spheres, the proliferation of local content, particularly geared to the international market allows a new, direct channel to market what is arguably the region's most successful renewable resource: the vibrant diverse cultural mix inherent in our music, art and dance, and the intellectual property rights (IPR) associated with them.

Traditionally, for international distribution artists' work would have to be channelled through a limited number of channels, reducing control over the works, and the rights to any revenues thereby developed. Through domestic hosting such innovations can be better nurtured domestically. This facilitates the opening a new, high value adding component to the economy. Further, with a managed access to the Internet, these IPR firms are also afforded access to a great channel for dissemination of their virtual product.

Examples of such products include software applications, electronic/ interactive gaming, and multi-media opportunities in audio/ visual dissemination.

8.5.1.3 Data-warehousing and Tele-services

Finally, advances to other value added services could be a comprehensive network that could provide the necessary high transaction speeds to make such services effective. Further, domestic hosting, with a high speed access foundation, will reduce the cost associated with such initiatives reducing the risk of sustainability associated with the provision of such services in rural areas.

Hosting local content could be a catalyst for effective use of local content-based services via the domestic networks. Such services could include Tele-medicine. Tele-medicine could be based on a comprehensive information network that could provide instant medical advice to the public between facilities throughout Trinidad and Tobago. At advanced stages of development, Tele-monitoring of diseases at State level to achieve higher standards of public health could be undertaken.

A necessary pre-requisite of such a strategy is robust information system architecture, both domestically and internationally. Cumulatively an ability to host domestically, which is reliable and cost competitive will increase the attractiveness of Trinidad and Tobago as a location for ICT based anchor companies. Such ICT based infrastructure can be critical to reflect;

- a more mature operating environment (in terms of reduced costs) and
- an attractive investment environment (in terms of possibilities for locally based suppliers or downstream operations) for such firms.

Key point 4:

a) Do you agree with the analysis of the gap and the general nature of these key activities?

b) Is hosting a viable industry in Trinidad and Tobago?

c) If not, what antecedents limit the development of domestic hosting of content?

d) Do you think that Government can assist in reducing these limitations?

8.6 Techniques for improving Efficient Utilization of Bandwidth

Having identified the possible benefits which could be accrued through facilitation of Internet (Web) hosting, it is imperative that there is the necessary performance from the enabling telecommunications infrastructure.

Where investment in bandwidth is prohibited, there are a number of strategies firms have used to increase the performance of existing bandwidth. Below is a review of common strategies effected to facilitate efficient bandwidth utilisation; a precursor to any strategy on domestic hosting.

These techniques range from commercial initiatives which may be undertaken by a single Internet Service Provider, to broader initiatives which could impact the entire ISP segment of the telecommunications sector.

8.6.1 Compression of Content/Data

Enabling HTTP compression provides faster transmission time between compression-enabled browsers regardless of whether your content is served from local storage or otherwise. Enabling compression of static files/content results in more efficient utilization of bandwidth. By further enabling dynamic data compression, there is even more savings in bandwidth utilization.

This is a strategy to be undertaken by ISPs, and thus generally impacts throughput on the domestic legs of transport. Unless specific arrangements are made to introduce compression and the American NAP, the pursuit of this will not overcome the concern about the latency and flight of foreign exchange associated with the current topology of the Internet.

8.6.2 Dynamic Allocation of Bandwidth Source

Dynamic bandwidth allocation, or the maximization and utilization of bandwidth, combined with Quality of Service, enable voice and data to be transmitted simultaneously across a single access line, which can translate into significant cost savings for Service Providers. This maximization of bandwidth also allows one to deliver new revenue generating services, offers a lower Total Cost of Ownership (TCO) and is directly tied into protecting either your legacy or next generation investment.

8.6.3 Cache Engine/Cache Server

Cache engines enable ISPs and enterprises to accelerate content delivery, optimize the network, bandwidth usage, and control access to content.

A cache server is also a proxy server, which represents users by intercepting their Internet requests and managing them. It is in a position to cache the files that are received for later recall by any user. This enables faster access to popular URL requests of users without putting too much load on Internet bandwidths.

Similarly, at the user end caching technique in their PC/Laptops helps them optimize their bandwidth requirement.

8.6.4 Oversubscription of Bandwidth

Oversubscription approaches have been successfully implemented in networks for many years. Examples include in the provision of voice switches, ATM equipment, DSLAMs, Frame Relay, and VPNs to name a few.

In data networks, oversubscription has allowed carriers to provide many unique revenue-generating services such as guaranteed or committed bandwidth rate service, available bit rate services and private frame relay service. By implementing oversubscription with traffic prioritization, the carrier infrastructure can support many more users and is better utilized than if it were not oversubscribed, resulting in lower CAPEX and OPEX costs.

8.6.5 Mirroring of Data

In terms of topology, design and strategy, the physical location and connectivity of Internet content and resources is critical to the effective delivery of content based services. The positioning and hosting of content resources, where they physically sit on the network, must be considered carefully if requirements for end-to-end control and quality of service are to be achieved.

Also, the rapid increase in the number of Internet users also has a significant impact on the hosting infrastructure necessary to service requests. The infrastructure needed to deliver content requested simultaneously by hundreds or even thousands of users requires very significant levels of resilience and reliability. Such infrastructure may include content delivery technologies as well as web servers and connectivity.

A cost effective unconventional system can be implemented with remarkable results by replicating the content at the (main) Internet host server at a domestic agency/ location. Consequently, anyone hosting data in the traditional methodology can have a local mirror site, for either production or redundancy.

In this way one can maintain a mirror image of data hosted traditionally in the USA on a local server. That way multiple addresses can be assigned to each Domain Name, if one is not available, the next one will be used. Hence you will be accessible via your faster local mirror server. This concept is already being extensively utilized in India and other regions of the world.

In mirroring, the information stored in the original location is copied to a different location or locations. This assists in routing the Internet user to a server located close to them. Also, mirrored data in a different location helps manage a single web server query overload since it automatically routes all web queries beyond its peak load cut-off to a server with the same data in a different location.

Data mirroring reduces the queues and therefore could reduce unnecessary load on bandwidth and can also be a useful Disaster management tool.

8.6.6 Domestic ISP Peering through a national IXP

Hosting service providers connect to ISPs for access to the wider Internet. If hosting is implemented domestically, presuming a vibrant wholesale ISP – hosting service provider market, without rectifying the topology issues discussed in 7.1 above, the attractiveness of the domestic provider as an alternative will be limited. Consequently, resolving the topological weakness of how domestic ISPs interact in a critical antecedent to the implementation of a comprehensive thrust for domestic hosting.

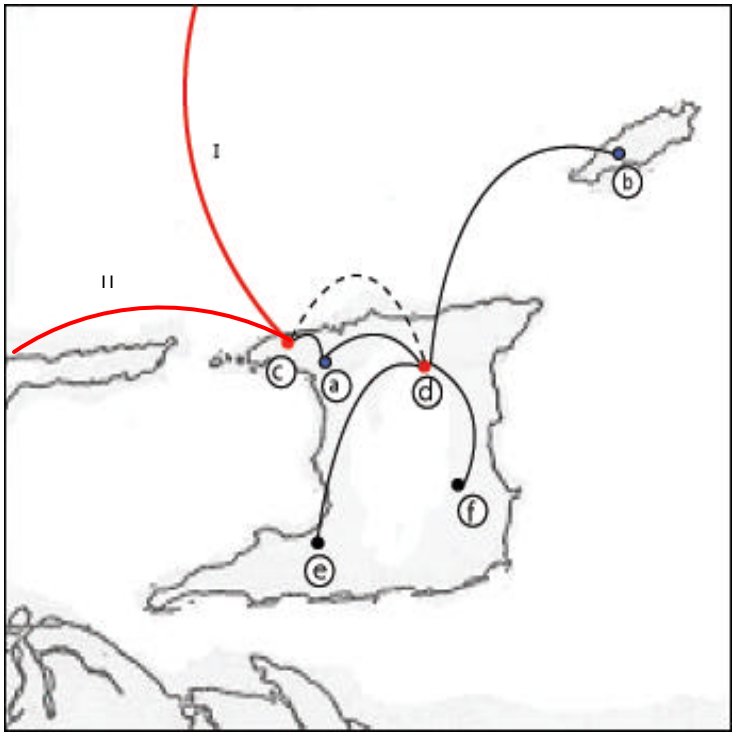
Direct peering of domestic ISPs for local routing of data traffic, mentioned above as a strategy to restructure the national interaction with the Internet, also results in efficient bandwidth utilisation.

A conventional method of managing Internet utilisation costs, the most important aspect about this strategy is that the cost of the IXP is minimal compared with the benefits. Due to the design topology of this architecture, the IXP has two benefits (short and long term) that directly address two obstacles to ICT growth.

1. The short-term benefit happens overnight. Once ISPs are connected to the IXP, the recurrent cost of international bandwidth will diminish, as this will be reserved for the proportionately smaller outbound traffic. This cost savings, however, is not the only value of an IXP.

2. More essential however is that the long-term benefits such that when the ISPs are connected to the IXP, latency or transit time of domestic traffic becomes a fraction of what it was since it stays within the same network. As a result of this increased speed and reliability, additional "value-added" services become possible on the national network.

Domestic exchange points reduces system latency, making web content hosting, audio and video streaming, e-Commerce, e-Governance, etc.



1. Domestic Users at points (a) and (b) can access content hosted at domestic locations at (e) and (f) irrespective of serving ISP.

   Examples of such local content include e-mail services, TTGOV web based services.

2. Traffic is routed through the domestic IXP at point (d). At this point all domestic ISPs networks interconnect, thus facilitating routing of domestic traffic on-shore.

3. Only where requests for content demands international connectivity, will the user be routed to external/ international gateway at (c). The user is unaware of the transition between domestic and international routing as this variation occurs transparently at the routing tables of the ISP.

4. At (c), traffic routed for Latin America may be routed via Route II if such is available.

Network Access Point: point of interconnection of data networks

Network Nodes: point of access to data networks, loci for hosting servers

Network Nodes: point of access to data networks, end-user premises

Defined extra T&T route

Defined intra T&T route

Undefined multi-hop route

possible. The increased applicability of these services will encourage local hosting in a very effective manner.

Examples where this strategy was pursued include, India, where the NiXi's routes domestic TCP/IP traffic meant for a location in India. This reduced the load of International bandwidth on ISPs in India as well as removing the erstwhile seeker/provider peering relationship with VSNL resulting in cost savings for ISPs. Similar benefits are being seen in the African Continent, where there has been a recent upsurge in the use of IXPs. Case studies speak to South Africa saving over US$150 Million annually in international bandwidth costs.

9.6.6.1 IXP: The Technical Concept and how it works.

The IXP concept stems from the concept that the Internet exchange point is built around interconnecting Internet Service Providers (ISPs and Network Operators) at one point and utilizes dynamic routing techniques, exchanging traffic destined for local services providers connected to the exchange point locally without utilizing the expensive international link capacity.

The Internet Exchange Point is a low-cost networking facility that will enable ISPs to interconnect and thereby pass packets locally. This will make data transmission more efficient and cheap. This simple device will also provide the infrastructure necessary for building a more robust local ICT industry, a strategy that fits right into ***fastforward*** vision and goals along with an innovative hosting strategy.

The IXP can be implemented through a number of models;

1. The single multi-lateral model: where within the industry there is a single locus where all ISPs interconnect. The interconnection arrangements are the same for all carriers as partners of a single multi-lateral agreement. An example of this is the Layer 3 router-reflector (L3RR) model of establishing the interconnect medium for the exchange of traffic. This provides an opportunity for operators to peer (exchange traffic) at a national level, in an efficient, relatively inexpensive, scalable fashion.

2. The multiple bi-lateral model: where each ISP negotiates direct bi-lateral interconnection agreements with others in the sector. In this model, a single ISP will have to manage multiple interconnection agreements, and this introduces an opportunity for collusion if not adequately regulated. This model also increases the net cost associated with the provision of domestic ISP interconnection.

The key to the success of an IXP model is based in its simplicity. The more complex the framework the less likely it will meet its primary objective; of providing a cheap, effective mechanism for ISPs to maximise their return on investment into bandwidth[3]. The IXP should be administered in a manner sufficiently neutral to assuage concerns of abuse by players. Also, to encourage involvement, the ISP's should have a significant stake in the management of the IXP.

The IXP is best implemented as a thrust from the ISP sector for the ISP sector. From review of international experiences, the major bulwarks to its implementation include regulatory barriers, lack of participation of incumbent bandwidth providers, lack of trust between participants.

Further Case Studies of IXPs:

Kenya:

In early 2000, the association of ISPs spearheaded an initiative which formed the non-profit IXP for Kenya. Due to lack of participation of incumbent, legal challenges delayed the launch of the Kenyan Internet Exchange Point (KIXP). Regulator eventually sided with the ISP backed KIXP, despite limited enthusiasm from incumbent.

Impact:
- Approximately 30% of international upstream traffic diverted through KIXP,

- Local latency has fallen from 1200 – 2000ms to 60-80ms.

- Monthly (64kbps) bandwidth costs dropped from US$3,315 to US$200

Mongolia:

The IXP, the Mongolian Internet Exchange (MIX), was established in 2001 as an initiative of the three leading ISPs. Within a year the number of members had doubled.

Impact:
- Local latency has fallen from 1300ms to less than 10ms.

- In 2003, an average 377 Gigabytes of data was transferred through the MIX daily.

- This equivalent international bandwidth has been freed, increasing performance of existing infrastructure

The equipment necessary to implement the L3RR IXP model is inexpensive given the associated cost savings. According to ITU estimates the costs are estimated to be in the range of US$7,000 to US$10,000. However, each ISP will have to acquire its own end equipment to interface as well as maintain a domestic link to the site of the IXP.

Key point 5:

a) Do you agree with the analysis above?

b) Are you aware if any of the bandwidth management strategies discussed deployed in Trinidad and Tobago?

c) If so, how successful have their implementation been in improving the consumer Internet experience in terms of
(i) reduced latency and
(ii) more attractive cost of service?

d) If not, are their any barriers; technical, regulatory of otherwise, which limit the attractiveness of deploying these methods?

e) In your opinion, can Government assist in the implementation of any of these methods? If so, which and how?

8.6.7 The Development of Regional Internet Carriers (RIC)

This initiative, not directly tied to a domestic hosting agenda, is the most ambitious of the approaches discussed but has the potential for the largest gains. With the development of RICs, particularly those which meet published peering requirements, many of the considerations associated with economic drain as discussed will be drastically reduced. In this strategy, the Regional Internet carrier aggregates regional capacity requirements, and peers into the US backbone. The potential for savings are multiplied as;

1) There are economies of scale which can be leveraged in the aggregation of regional traffic to the hub, and

2) The preferential peering rates can further reduce the cost of access to the hub, while reducing the associated transmission costs of the domestic ISPs.

The heart of this strategy is to embrace the peering interconnection model, but by utilising synergies emergent when collaborating as a region, gaining from reduced access rates to the Internet core.

These RICs may also function by providing link capacities between national/sub-regional IXPs, or alternatively through direct links from ISPs across the region in an interconnection arrangement either via a peering model. In this regard, CARICOM governments should consider following the lead provided by other mavericks in the international arena that have embarked on a number of multi-lateral connectivity projects. The critical point to note about these initiatives is the model of ownership adopted for access telecommunications networks: they mirror Montreal 2000 accord of shared-link cost between parties. States that have forged ahead in this path include India, Brazil and New Zealand.

The thrust to encourage the development of RICs will be strengthened through harmonised regional telecoms policies. Such policies could guide as to;

i. the *ex ante* or *ex post* requirements to be qualified as a Regional Internet Carrier,

ii. a framework where such a determination is recognised across the region.

iii. clarify whether the RIC can operate competitively within any of the domestic markets, and if so, how this will be managed to ensure that no anti-trust issues arise.

Further, if these are developed in a regional holistic competitive framework, further benefits can accrue as gains through innovation and efficiency are passed to the end user and commercial customers. With this in mind, the regional regulatory framework should be focussed on encouraging competition in this market, and should not over regulate in an attempt to artificially pressure wholesale rates lower. The risk associated with this in hampering innovation is an ongoing debate in the telecommunication regulatory circles.

Through incentives, Trinidad and Tobago can introduce the concept of encouraging new telecom infrastructure providers to increase the available direct inter island capacity for backbone networks in the region, strengthening these links so that prices can be competitive with those associated with U.S. based routes. It is imperative that Trinidad and Tobago lead the Caribbean in ceasing the common practice of investing public funds into initiatives to build more capacity that is not targeted for direct intra-regional communications.

China notes that once intra regional routing gains ground and there are savings which can be accrued, there is still the problem of growing payments out of the region. Consequently, in conjunction with this, there must be the focus on diversification of extra-regional links, encouraging investment to provide facilities from the CARICOM region to Latin America directly.

Annex A

Example of a Consultation Response Form

Name	
Organisation	
Postal Address	
Telephone/Fax	
Email Address	
Website (if applicable)	
Title of Consultative Document	
Response **Section No.**	**(maximum 500 words)**

Annex B
GORTT's Consultation Principles

Public Consultation involves the exchange of information between the Ministry and its stakeholders to facilitate a shared understanding of the issues under consideration. It is an open and accountable process whereby individuals and groups can contribute to decision-making processes and influence outcomes.

Consultation will be seen as an integral part of the policy formulation and implementation process which is the initiation or revision of policies, programmes and projects. It is also view as a mechanism to assess, monitor and evaluate the success of the delivery of government services.

Stakeholder analyses will be conducted to accurately identify those interest groups and associations that have significant and legitimate interests in a specific issue or policy area.

The consultation material will be concise, easily understandable and widely accessible. Each document must have an executive summary that covers the main points under review, this will ensure that the relevant stakeholders are in a position to read the appropriate documents related to his/her interest.

The relevant Government Ministry remains the key policy-adviser on matters within its portfolio and will be the final determinant as to the contents of any particular policy or strategy and will make the appropriate recommendations to Cabinet for consideration and approval.

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