Caribbean Regional Communications Infrastructure Program ("CARCIP")

Feasibility Study for Broadband Connectivity in the Caribbean Region Focusing in particular on Grenada, St. Lucia and St. Vincent

Technical, Economic and Financial Feasibility Assessment

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1. Executive Summary

The objective of this feasibility study, carried out under the CARCIP Program (Caribbean Regional Communications Infrastructure Program), is ascertaining the conditions of existing networks, identifying infrastructure gaps, providing technical and financial network planning for identified gaps in the following Countries: Grenada, Saint Lucia, St. Vincent and the Grenadines.

The overall objective is providing ubiquitous broadband connectivity at affordable prices to promote economic development in the three Countries and advance the development of an ICT-enabled services industry in the Caribbean Region. This report provides a detailed analysis of the ICT sector and communications infrastructure available in each country and proposes network solutions to fill identified gaps at domestic, regional and international level. Findings from assessment of the enabling regulatory environment are also discussed.

The general state of Broadband Infrastructure within the Region is advanced. All Countries studied have multiple fiber-optic backbones, operated by multiple telecommunications providers serving every major population center.

The Team did not find significant near-term telecommunications infrastructure gaps that couldn't be supported with current Universal Service Programs. The Team extensively studied current Broadband adoption rates as well as forecasted penetration rates based upon generally accepted Industry practices and placed these forecasts against a variety of existing telecommunications infrastructure.

Through these analyses it was determined that the **primary infrastructure gaps** were:

- Government Networks that offer pricing sustainability with scalability and security to protect National Interests. It is recommended as part of this study that a robust, multi-provider Carrier Ethernet network be deployed to support the growing demands of E-Government, Education and public safety.
- To relieve the eventual capacity constraints on the microwave systems between Grenada and Carriacou and Petite Martinique, a new submarine fiber optic cable, connecting also Grenada and Saint Vincent is proposed. This proposed cable could land at existing cable points (specifically in Grenada) and travel north to Carriacou. From Carriacou the cable system would continue 2.6 miles to Petite Martinique. As a result of the microwave spectrum analysis and the traffic forecasts (2012 -2025) carried out as part of the assignment, it was determined that that the existing

microwave spectrum could support the traffic requirement between Grenada and Carriacou and Petite Martinique through the year of 2021.

- To relieve the eventual capacity constraints on the microwave systems between St. Vincent and the Grenadines Islands, a new submarine fiber optic cable is proposed. This proposed cable could land at existing cable points (specifically in St. Vincent) and travel south to Bequia. From Bequia, the cable system would route to Mustique, then on to Canouan, Mayreau and terminate in Union Island. As a result of traffic forecasts (2012-2025) carried out as part of the assignment, it was determined that the proposed submarine fiber optic cable capacity demands through the Grenadine Islands is adequate for a number of year as well is the proposed system from Grenada to Carriacou and Petite Martinique.

A capacity analysis was also performed against developed traffic forecasts to the International Submarine Infrastructure serving the area. Findings show that there seems to be adequate capacity through the study periods. However, the Eastern Caribbean Fiber Systems, one of the three International submarine systems in the Region, is expected to "End of Life" in 2020. This will not have an adverse effect on available capacity, though it may impact pricing in the Region as 1 of 2 competitors would be removed from the International transit market.

Broadband rates rather than broadband coverage and service availability have emerged during sector analysis as a major deterrent to service adoption. The main identified drivers for broadband prices are:

Traffic transit on expensive International routes due to the lack of an effective Internet Exchange (IXP) strategy that keeps traffic local.

The price of wholesale connectivity.

The price of electircity Power in Grenada is extremely costly and affects the operational costs of telecommunications networks. LIME is very sensitive to the costs of power when designing networks and services.

An **expanded Internet Exchange Point ("**IXP") including data centers or data banks that would store content and cloud-based services locally is recommended to reduce the traffic demands on inter-regional and International transit and improve the overall quality of broadband and cloud-based services. It is recommended as part of this study that each Country expand the IXP strategy to include a data center whereas each country specific IXP / data center is regionally interconnected to provide storage and access to content that is local to each country and the region such as E-Government, educational content as well as data and content storage for local businesses that would typically be accessed by local broadband users.

It was also identified that very little Internet content and applications are actually housed within the region as most users, both residential and business users, store and access data and applications through International destinations, primarily in the U.S. Though Grenada has deployed an IXP, the perceived level of success is in question. There are only two providers currently connected to the IXP with minimal traffic being exchanged (less than 1/10 of 1 percent of entire Country traffic). Some issues that might affect the success of a local and regional IXP are the fact that there's very little data and application being hosted in each country or the region as a whole. Most hosting is provided (economically) in the U.S. so therefore the majority of the traffic will have traversed the undersea networks to access content. This places undue costs and inferior quality in that the International Submarine Infrastructure would be required transports for most data requests. This will become more evident as more consumers and businesses begin to leverage the economies, quality and simplicity of "Cloud" based services. Much of the content to be hosted locally may be already available (government content, educational content for schools).

A strategy to expand to the Internet Exchange Point (IXP) concept to include a data center (data bank) where businesses can locally host web sites and further develop private, public and hybrid cloud based services for businesses and residents is provided in this Study in order offer a more successful IXP.

A comprehensive regulatory review was carried out to assess the enabling environment for the broadband networks and the development of a healthy broadband market.
Open Access, intended as the possibility for all licensed operators to access existing and planned infrastructure under transparent, equitable and non discriminatory conditions, was considered key to promote competition which in turn should drive broadband prices down and promote broadband service penetration. The review was carried out checking the existence of enabling measures for open access.
As pricing remains central to adoption and if the need for price regulation should arise, this should take place as far upstream as possible. The regulatory review had therefore a strong focus on wholesale.
With the final objective to promote the sector growth and competition, National Telecommunications Regulatory Commissions (NTRCs) have implemented modern practices including open licensing regimes, passive sharing, interconnection, right of ways, the possibility to share private networks owned by entities other than telecommunications operators; Universal Access programs targeting broadband expansion.
Weaknesses have been identified in the area of wholesale regulation.

Major steps have been taken in the wholesale regulatory regime towards the application of generic competition (ex ante regulatory measures only in case of dominance), weaknesses

areas.

Weaknesses, have been identified in the following areas:

- Lack of a regulatory framework to determine dominance
- No provision for joint dominance
- Definition of the process allowing NTRC to intervene if the two parties involved in wholesale negotiations do not find an agreement.
- The *retail minus* model as currently implemented for wholesale pricing may lead to a margin squeeze.

Identified weaknesses may impact regulatory efficiency in managing current market scenario, which is characterized by the presence of two broadband operators with similar networks and similar costs (oligopolies).

To complement the supply side strategies, numerous demand side policies have been implemented in the thee countries, mainly consisting in subsidization, connectivity programs addressing schools along with the introduction of ICT in education and digital literacy programs, the implementation of public access centers, plans for of e-government services in addition to e-health and e-learning programs, the promotion of broadband packages at discounted rates by private operators.

Expanded IXPs are the platforms to be leveraged to reduce prices of broadband connectivity, develop local content, deliver planned e-government services and achieve the ultimate goal of ubiquitous connectivity at affordable prices.

2. Introduction

The overall objective of this feasibility study, carried out under the CARCIP Program (Caribbean Regional Communications Infrastructure Program), is providing ubiquitous broadband connectivity at affordable prices to promote economic development in Grenada, saint Lucia and Saint Vincent and advance the development of an ICT-enabled services industry in the Caribbean Region.

For each Country this report contains detailed information about:

- The market status
- The status of the existing, in construction, or planned submarine cable networks in the region, national backbone networks and cross border connectivity
- Transmission infrastructure gaps
- Long term traffic forecasts
- Assessment of extension work/new infrastructure required at following levels:
  - Within countries
  - Linking countries
  - Regional
  - International
- Technical options and technical planning for identified network gaps
- Existing Government networks and recommended topologies
- Relevant regulatory frameworks and recommended policy measures

The detailed methodology followed in carrying out this feasibility study s described in Annex A.

The scope of the study and the adopted approach are summarized in Figure 1.

The core of the report is on broadband networks and the regulatory environment that is conducive to broadband deployments.

In an ideal seamless value chain of broadband, activities focused on the following segments:

(a) International connectivity

(b) Domestic and regional backbones

For them the Team identified:

- Connectivity gaps in order to feed the planning activities

- Possible bottlenecks in accessing facilities owned by incumbent/dominant operators that may contribute to high prices for broadband
- Regulatory constraints to broadband expansion
- Strategies to mitigate the causes behind the high cost of bandwidth, one of the factors inhibiting the growth of broadband Internet usage and the development of bandwidth intensive applications that would contribute to driving the economy in these countries.

For the access segment (i.e. local connectivity) the Team simply assessed the availability and quality of existing networks.

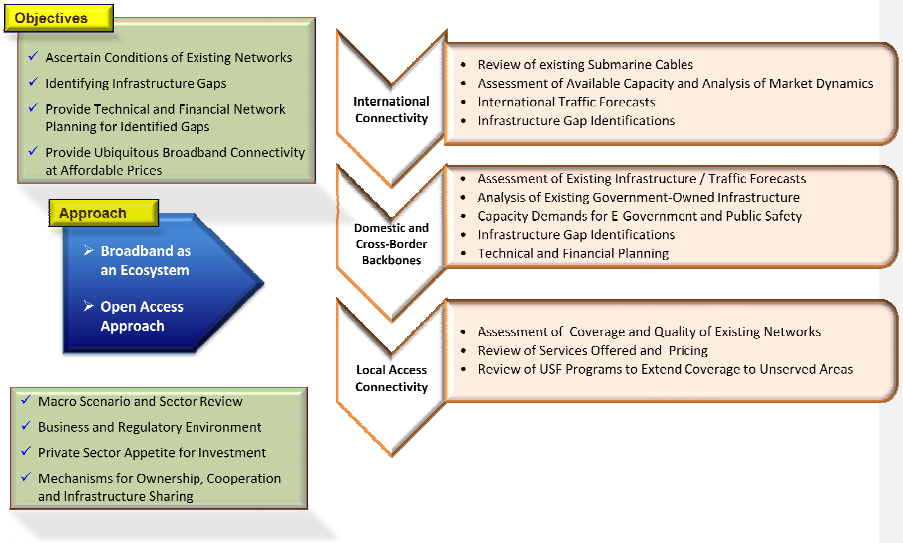

Figure 1 Scope of the study and approach

Two fundamental principles guided the approach through the different steps of the assignment:

1. **Open Access** intended the creation of competition in all layers of the network allowing a wide variety of physical networks and applications to interact in an open architecture.
   In all of the three Countries the ability of the backbone network to reduce costs through open access and proper pricing of wholesale connectivity was indeed considered as one of the key determinants of providing affordable broadband connectivity that boosts service adoption.

Under this approach, the networks proposed in the Study should be available to *wholesale customers* via open access rules so that network providers offer capacity or access to all market participants on equal and non-discriminatory terms and conditions.

2. **Broadband as an Ecosystem -** consisting of *supply* and *demand* components, both of which are equally important if the expansion of broadband networks and services is to be successful.

Under the ecosystem approach, the Team has considered the *supply* of broadband networks, e.g. the availability of broadband infrastructure as the first necessary condition and the demand for broadband just as important in order to make network investments worthwhile.

The following were considered building blocks of demand: affordability (pricing), awareness (benefits), attractiveness (perceived values). Details of reviewed demand side policies are provided in Section 5.3.

The main identified drivers for broadband prices are:

Traffic transit on expensive International routes due to the lack of an effective Internet Exchange (IXP) strategy that keeps traffic local.

The price of wholesale connectivity.

The price of electircity Power in Grenada is extremely costly and affects the operational costs of telecommunications networks. LIME is very sensitive to the costs of power when designing networks and services.

These factors along with strategies to mitigate their influence on broadband price are widely discussed throughout the report.

3. Regulatory Review

The regulatory review was carried out with two specific objectives:

- Understand the dynamics between the Regional Regulator (ECTEL) and national Regulators
- Assess in the regulatory framework the availability of measures enabling open access to existing and proposed networks.

3.1. Regional and National Regulation

The Treaty Establishing ECTEL (Eastern Caribbean Telecommunications Authority) has been established within the framework of the Organization of Eastern Caribbean States (OECS) and was signed in St. George's Grenada, on May 4, 2000, by the Prime Ministers of the Contracting States of the OECS Telecommunications Sector Reform Project. Five of the nine countries, which are members of the OECS, are parties to the ECTEL Treaty. The ECTEL participating states are Dominica, Grenada, St. Kitts and Nevis, St. Lucia and St. Vincent and the Grenadines.

Through the Treaty, the foundation for a harmonized and coordinated approach to telecommunications liberalization among the Contracting States was established.

National Telecommunucations Regulatory Commissions (NTRC) were established in ECTEL member Countries with the following objectives:

- Ensure fair competitive practices by Telecommunications providers, promote and maintain high quality Telecommunications services at fair and competitive prices for consumers.
- Regulate the newly liberalized Telecommunications markets in collaboration with ECTEL
- Oversee the development of the telecommunications sector.

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The NTRC in Grenada was established pursuant to the Eastern Caribbean Telecommunications Authority Treaty and the Telecommunications Act 31 of 2000.

The NTRC in Saint Lucia was established under the Telecommunications Act of 2000.

The NTRC in St. Vincent and the Grenadines came into effect by the passing of the Telecommunications Act 2001.

The regulatory review carried out to better understand the dynamics between ECTEL and NTRCs revealed that there are no inconsistencies in the roles of regional and national regulators. Specifically, main ECTEL functions consist in: promoting objective and harmonized

regulatory regime in telecommunications of the contracting States; providing guidelines and recommendations for a regional policy; sector monitoring; managing the spectrum on behalf of the contracting states; reviewing applications for licenses made in contracting states and providing recommendations in order to ensure compliance with ECTEL's technical and financial requirements; providing opinions and mediating in the event of a dispute between licensees in Contracting States, advising in the award of USF projects.

ECTEL Contracting States take appropriate measures to implement ECTEL policy, Universal Service Funds are under the jurisdiction of Contracting States and they manage the Universal Fund taking into account the recommendations of ECTEL. NTRCs are responsible for technical regulation, the setting of technical standards of telecommunications that ensure the compatibility with international standards; for planning, supervising, regulating and managing the use of the radio frequency spectrum in conjunction with ECTEL; regulate prices for telecommunications services; review applications for licenses.

Telecommunications Regulations Acts in the three Countries have been developed under the umbrella of ECTEL and are homogeneous with almost identical contents.

3.2. Market Entrance

There are no particular obstacles of regulatory nature to market entrance in the libelized telecommunications sector. . This appears to be confirmed by the high number of licensed operators in the three Countries (Please Refer to Tables with ECTEL registers).

3.3. License Types and Procedures

There's a simple and transparent licensing process with a clear articulatio of penalties and method of enforcement. With regard to international connectivity, there are no restrictions for the installation of new submarine cables. According to the Telecommunications Acts, any person (this includes any corporation, either aggregate or sole, any partnership or association, and any undertaking, club, society, or other body of one or more persons and any individual) who wishes to land or operate submarine cables within the countries territory for the purpose of connecting to a telecommunications network, shall first obtain a license, in addition to any other approvals or permits required under the national law. The only mandatory permission is an operator license, and since the market is open it is easy to enter.

3.4. Right-of-Ways

It seems that there are no obstacles to access to public land and works for layering cables. According to the National Telecommunications Acts, a person nominated by a public telecommunications provider and duly authorized in writing by the Minister or relevant authority may, at any reasonable time, enter upon and survey any land, other than land covered by buildings or used as a park, for the purpose of ascertaining whether the land would be suitable for use by the provider for, or in connection with, the establishment or running of the provider's system. For the purpose of providing a telecommunications service, telecommunications provider may lay or maintain or remove, any line or cable, in or over a street or a public ground.

Based on the discussions with Saint Lucia USF/NTRC officials, new entrants in Saint Lucia, once entered the market, have not started because the small market size and tough competition.

3.5. Interconnection

All Operators in Grenada, Saint Lucia and St. Vincent must offer Interconnection to their networks on a Transparent and non-discriminatory basis.

A telecommunication provider who operates a public telecommunications network cannot refuse, obstruct, or in any way impede another telecommunications provider from making an interconnection with his or her telecommunications network. A request may be refused on reasonable technical grounds only and in that case NTRC may intervene for dispute resolution.

There'a a clear articulation of NTRC's role and powers. The regulated Process for Interconnection is described and timeframes are provided in which negotiations must be completed and permits the Commission to intervene if the parties do not reach an agreement were not retrieved (Interconnection to be established as soon as reasonably possible in Interconnection Regulation).

The pricing of interconnection is cost oriented as recommended by international best practices.

The regulation provides the possibility to make the determination of a Dominant Interconnection Provider.

3.6. Shared Infrastructure

Regulation makes provisions for the sharing of infrastructure in all the three countries based on

identical regulations and consist in the sharing of passive infrastructure. The model that is most prevalent, among the different models of facilities ownership, in the ECTEL Member States is the one in which the facilities are owned by one operator and other operators may seek access to these facilities.

The Telecommunications Act in the ECTEL Member States defines infrastructure sharing as "the joint utilization of a particular physical structure, segment, element, or feature of the entire infrastructure" and defines infrastructure as "facilities, submarines cables and landing sites, towers, sites and underground facilities".

The Telecommunications Act in the ECTEL Member States requires that where it is technically feasible, a telecommunications provider provides access to its facilities, including towers and underground facilities, to another telecommunications provider for the sole purpose of enabling the second provider to install a facility for use in connection with the supply of a telecommunications service.

The Act further requires that access to such facilities be on such terms as are applicable to interconnection and on such terms and conditions as are agreed between providers or failing agreement, on terms as determined by the Commission:

- NTRC outlines the obligations and responsibilities of parties wishing to enter into an infrastructure sharing arrangement
- Pricing is cost based
- Commercial negotiations between interested parties are encouraged, with the possibility for the Commission to intervene if an agreement is not reached.

Dispute resolution mechanisms are in place

.Sharing with other infrastructure industries is allowed.

3.7. Wholesale

Wholesale regulation is available for Saint Lucia and Grenada. It's not available for St. Vincent and the Grenadines.

Regulation provides obligations for a public network operator to make available all of its retail services as wholesale services, non discriminatory conditions.

NTRCs, acting on the recommendation of ECTEL and after a consultation process, may with respect to a particular market or markets, designate a public network operator as a *dominant* wholesale service provider for the purposes of providing retail services at a discount and

providing special wholesale services, if the following conditions are met:

- The network operator enjoys a position of economic strength affording it the power to behave to an appreciable extent independently of competitors, customers, and ultimately, consumers in a market or markets for telecommunications services;
- It is in the best interest of consumers the network operator to be so designated.

The Commission may determine after a public consultation process, a standard wholesale discount from retail prices at which dominant wholesale service providers must offer wholesale services. The discount is calculated to reflect the costs associated with providing a retail service (or services) to end-user customers that the dominant wholesale service provider avoids when making such service(s) available as wholesale services offset by the costs that the dominant service provider may incur to make such service(s) available as wholesale services.

NTRCs, acting on the recommendation of ECTEL, can also require, after a public consultation, a dominant wholesale service provider to make available the so called "special wholesale services".

A special wholesale service consists of components or functions of a retail service that are essential in order to offer a retail service to end users that s competitive with the retail service offered by the dominant wholesale service provider and which the other providers of telecommunications services cannot economically offer themselves or obtain form a public network operator other than the dominant wholesale provider. This is the case for the access to backbone networks.

The regulation mandates that the dominant wholesale service provider publish tariffs for special wholesale service. The tariffs for special wholesale services must be non-discriminatory and compliant with the following competitive safeguards:

When a dominant wholesale service provider seeks to raise the price of a special wholesale service or reduce the price of the corresponding total retail service, the dominant wholesale service provider must demonstrate that the prices of its wholesale service satisfy the following condition:

a. The difference between the price of the retail service and the price of the corresponding wholesale service cannot be less than the difference between the long-run incremental cost of the retail service and the long run incremental cost of the corresponding special wholesale service.

b. Where a dominant wholesale service provider seeks to change the price of a retail service, the dominant wholesale service provider must make a corresponding adjustment to the wholesale price, which is applied to all agreements in force at the time of the change in the retail price.

3.8. Private Networks

Regulation for private networks is well developed. Private networks, (i.e. those systems that provide telecommunications service to a person or entity that is for the sole and exclusive use of that person or entity and is not interconnected with the public telecommunications network) cannot be used for resale, except that the owner of a private network may resell spare capacity on its facilities or cede or assign his or her rights to use such facilities or sublet or otherwise part with control thereof to a licensed telecommunications operator. It seems therefore possible to leverage, if available, the telecommunications infrastructure (i.e. fiber) owned by utility providers (e.g. electricity providers).

Sharing of passive infrastructure (e.g. poles, towers) provided by Electric utilities is allowed and is a common practice in the three Countries. In Saint Lucia Karib Cable primarily lease rights to utility poles owned by LUCELEC.

Electric utilities have some fiber throughout the Islands to support electric grid control, though none of this fiber optic infrastructure has been made available for general broadband services.

The following main reasons make unfeasible the use of fiber owned by Utilities:

- Transmission owned by electric utilities is very limited and often dated. In Saint Lucia, LUCELEC (publically owned), has a fiber network leveraging their transmission facilities (via OPGW or fiber placed imbedded within the transmission ground wire) from North to South. This fiber infrastructure is for the exclusive use of LUCELEC and no commercial or wholesale telecommunications services are offered. This network was installed in the 1980's and might be multimode fiber.

  Multimode fiber requires more expensive electronics (lasers) to operate.

  These early OPGW networks have exceeded their predicted 20-year life, so the future life of this network could be in jeopardy.

- NTRCs' officials believe that leveraging utilities infrastructure is not needed as there's not an issue with the availability of broadband infrastructure.

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Box 1 -- Access to Facilities of Existing operators in ECTEL Member Countries

In 2009, ECTEL, recognizing, the issue of access to telecommunications networks as a major barrier for new entrants, developed a document entitled 'Draft Guidelines for the Pricing of Access to Facilities in the Member States'. The traditional approach to the regulation of access was to include these rules in interconnection regulations. ECTEL's view was that this situation could potentially result in uncertainty in access disputes and cause delay in market entry.

In addition, The Telecommunications Acts 2000 in Contracting States defined 'facilities' quite broadly. In 2009 the Draft Telecommunications Access to Facilities Regulation was specifically drafted to specify some of the various elements which could constitute a telecommunications 'facility" or part of a 'network.' This approach has been taken deliberately to reduce the likelihood of having the Commission make a determination whether a particular type of element fell within the statutory definition.

We provide below a summary of the main points contained in the Draft Telecommunications Access to Facilities Regulation that are relevant for backbone networks and wholesale access pricing.

- The Regulation removed the ambiguity on which facilities had to be addressed by Regulation. Draft Regulations were intended to apply to all types of telecommunications networks and facilities and any physical component of a telecommunications network both for access and sharing, including towers, wires, lines, terrestrial and submarine cables, as well as any supporting infrastructure
- The need was recognized to develop special rules for dominant operators who may dominate one or several markets where access is concerned to *essential facilities*.
- Draft Regulations conferred the power to the Commission to regulate the rates, terms and conditions for access to any facility or telecommunications network.
- Similar to the obligations for interconnection, prices for access to and use of facilities should be as transparent as possible, and must be cost based.
- Every public network operator must provide access to facilities that it owns or controls, on a non-discriminatory and equitable basis,.
- Prices for access to and use of different facilities may vary according to the facilities involved, but must be based on the costs of the owner of such facilities. Every public network operator should make available, upon request, prices for access to and use of facilities that it owns.

Consultations were run in ECTE's member countries. ECTEL received comments from Cable & Wireless, Tele Saint Lucia, Digicel, Karib Cable, St. Vincent NTRC, 21st Century.
Numerous concerns were expressed by Operators about the Guidelines developed by ECTEL:

- Mandatory access was considered too aggressive.
- The draft were considered under developed
- The need was highlighted for dominance to be established in the wholesale market
- Need for consultants to develop costing models and high expenses for their remuneration vs. the small market size
- The Draft too broad in scope was seen as conflicting with existing regulations. Recommendations were provided for the draft be targeted at access/sharing of towers, sites and underground facilities only.
- Lack of focus on the activities of the dominant operator, i.e. LIME and burdensome for competitors
- LIME considered the Draft disproportionate and unnecessary. They disagreed on three fundamental points:
    - Too broad definition of facilities. The inclusion of submarine cables was considered particularly disproportionate.
    - Rates for facilities that according to the draft should be cost based rather than negotiated. This according to LIME posed a constraints on networks rollout: why build when regulations allow you to take?
    - That all facilities identified are considered essential facilities. LIME consented to be considered dominant in respect of the provision of retail fixed networks only, as part of the negotiations pertaining the first Price CAP Regime for ECTEL Countries. This does not mean that LIME can be considered as dominant in any other market.

In November 2011 ECTEL started a new consultation on 'Guidelines for Pricing of Access To Facilities in the ECTEL Member States".

These new guidelines were more focused on access to towers and underground facilities: and particularly on how to resolve issues related to the pricing of access to mobile infrastructure.

The pricing model adopted in the EU was proposed. The proposal was rejected by regional operators favoring private negotiations as allowed by current regulations.

(Source: Elaboration from ECTEL web site)

Regulation	**Best Practices**

Licensing	• Ease of market Entrance • Simple Licensing Process • Transparency • Clear Articulation of Penalties and Methods of Enforcement
Interconnection	• All Operators must offer Interconnection to their networks on a Transparent and non-discriminatory basis. • Clear articulation of NTRC's role and powers. • Regulated Process for Interconnection, timeframes in which negotiations must be completed and permits the Commission to intervene if the parties do not reach an agreement were not retrieved (Interconnection to be established as soon as reasonably possible in Interconnection Regulation). • Possibility to make the determination of a Dominant Interconnection Provider. • Cost oriented pricing
Infrastructure Sharing	• Regulation ensures that that operators are given access to passive facilities to deploy their networks in the most cost effective way • Obligations under conditions of fairness, non-discrimination and equality of access • Mandatory access to all types of infrastructure is avoided • Cost based pricing, commercial negotiations between interested parties, possibility for the Commission to intervene • Reasonable terms and conditions aiming at protecting investments through the use of the LRIC model • Sharing with other infrastructure industries. • Dispute resolution mechanisms are in place.
Wholesale	• Obligations for a public network operator to make available all of its retail services as wholesale services, non-discriminatory conditions. • Regulatory intervention in the form of ex ante regulation only in the case of dominance • Retail minus model for wholesale pricing • Competitive safeguards for leveraged dominance into

	vertical markets
Universal service	• Clear institutional framework • Specific reference to persons with disabilities and special needs • Scope includes Internet and broadband • The Commission seeks to promote demand for universal access and service through digital literacy programs. • Funded primarily through operator levies so as to be able to finance projects in a competitive market • Development and presentation of project proposals open to all entities with an interest in the fulfillment of universal service/access • Open competitive bidding procedure • OBA disbursement

3.9. Conclusions and recommendations

A Modern Regulatory Framework is implemented in the three Islands with practices developed to achieve the overall fundamental objectives of:

- Allowing a liberalized and non discriminatory entry into the sector
- Enabling a robust competitive environment
- Fairness, transparency, accountability on the part of the Regulator

Implemented best practices in the overall regulatory approach include:

•Ex ante regulation only in the case of dominance to ensure that a dominant operators cannot use their market power either to restrict or distort competition on the relevant market, or to leverage such market power onto adjacent markets.

• Regulation does not mandate access to all available infrastructure. Over-regulation, which would stifle competition and market development is avoided and where feasible, Regulation tends to promote commercial negotiations between Operators with minimal regulatory intervention.

On the *supply* side of broadband (i.e. networks), in all of the three Countries the ability of the backbone network to reduce costs was indeed considered as one of the key determinants of providing affordable broadband connectivity that boosts service adoption.

This implies having open access wholesale networks that all operators can access under fair pricing conditions.

Open access plays a key role in facilitating consumers getting broadband service, as it:

- Facilitates new players
- Relies on time-tested competition principles
- Allows markets to work and close the existing market gaps

Open Access offers gradations of implementation depending on the context (availability of networks, investments, market maturity). There is no simple choice between open access (competition) and exclusive access (investment returns) and a balance between the two options thus needs to be carefully constructed. Any approach should try to balance (a) short term objectives such as benefits for the user in terms of choice, price and quality; ensuring that there's no distortion in competition, with (b) promoting investment and innovation.

Much of the instruments to promote open access (e.g. interconnection, sharing) are already in place in contemporary regulatory frameworks. For this reason the regulatory review was carried out with focus on interconnection, sharing and wholesale access.

We provide below a summary of the main findings from the analysis.

Wholesale

Major steps are taken in the wholesale regulatory regime towards application of generic competition law:

•The regulation provides obligations for a public network operator to make available all of its retail services as wholesale services, non discriminatory conditions and without limitations.

•Regulatory intervention in the form of ex ante regulation occurs only in the case of dominance.

Gaps have been identified in the following areas of wholesale regulation:

Determination of dominance

• Lack of provision in the regulation for the determination of joint dominance

- Triggers and frequency for the determination of dominance: what triggers the determination and how often does it occur?

•Criteria used to determine dominance (with a forward looking perspective based on existing market conditions, and not based on the existence of an agreement or concerted practice) and evaluated factors, which might include:

  - Market Share
  - Overall Size
  - Barriers to entry, Control of infrastructure not easily duplicated
  - Technological advantages
  - Economies of scale, scope
  - Vertical integration
  - Other matters that NTRCs may consider relevant

- Lack of an operational framework to react to timely requests from service providers (process that allows NTRC to intervene if the parties do not reach an agreement)

Wholesale Pricing

The *Retail minus* model is applied for the pricing of wholesale service, appropriate according to international best practices when a broadband market is immature and it is difficult to forecast accurately demand and the rates of adoption. The model does not attempt to control the absolute level of prices but the margin between wholesale and retail prices: Modeling of costs of broadband access required and for a proper implementation of the model it is necessary to gain as much information as possible about costs, at the earliest possible stage.

Regulated pricing based on retail minus has potential disadvantages:

•Neither party has an incentive to reduce wholesale costs and pass on to end-users the associated savings in the form of lower retail prices or better service.

•Risk for ambiguities in pricing and the need to guard against *margin squeeze*

Given the above risks, there must be sufficient competitive safeguards on the downstream retail operations of the vertically integrated operator.

Competitive safeguards are implemented for Special Wholesale Services. These represent a valuable measure as leveraged dominance into vertical markets is considered of importance by regulation. Competitive safeguards as formulated capture the feature of a margin squeeze that the abuse may occur in a different market from the market where dominance is exercised.

In recent years there was some movement in ECTEL member Countries to improve Open Access to existing facilities, promote more effective sharing and improve wholesale access and pricing regulations.

The findings from the telecommunications sector analysis supports the regulatory review and highlights the importance to implement proper wholesale regulations that uses cost base models to set wholesale rates in ECTEL member states within a practical operational framework that can react to timely requests from service providers.

The scenario in the three Countries is characterized by the presence in the broadband access market of Operators with no structural linkages and the following characteristics that may hinder effective competition, competitive and sustainable wholesale broadband pricing (risk of margin squeeze).

- Almost comparable networks,
- Similar cost structures
- Almost homogeneous products
- Barriers to market entrance.
- Broadband access scenario and the current framework

The need for wholesale reform was spoken most loudly especially from emerging service providers in need of infrastructure owned and controlled by the 'dominant' service providers.

Furthermore, recent past dynamcs (Box 1) have shown how diffciult it would be to make a determination of dominance in a market other than traditional voice.

Current wholesale consisting merely a fix amount off a retail rate results in ambiguity in what a carrier can charge; hence, the cost of wholesale can in some cases exceed the cost of retail.

The analysis is supported by the practice emerged duing field visits by existing wholesale providers (LIME and FLOW) to overcharge small and new entrants competitors. A T-1 line can cost more than $5000 per month which makes the business sustainability difficult for a small new entrant.

Wholesale access to the undersea infrastructure is as well controlled by the two landline-based service operators, LIME and FLOW. This presents a perceived barrier to new entrants. FLOW has primary operational control of GCN including sales and marketing. It's perceived by smaller operators that FLOW selects who can access this undersea fiber-optic cable and at what costs, potentially keeping new entrants and smaller operators from access this infrastructure and potentially from entering the market and/or being competitive.

LIME has the same type of relationship with the Eastern Caribbean Fiber System ("ECFS").

The smallest amount of bandwidth that Grencomm, a small operator in Grenada, could secure on the GCN cable (through his competitor FLOW) was an STM1 (155 Mbps) at a price of US $40k per month, far more than needed and hardly sustainable in the business plan.

In Saint Lucia Karib Cable claimed they pay approximately $40/mb for upstream Internet access that is, based on Team experience, about 40 times greater than what's paid in the U.S .

In conclusion, in markets other than the traditional fixed voice/narrowband market which was traditionally dominated by the monopolist, it would be difficult to run consultations about dominance and make a determination of dominance.

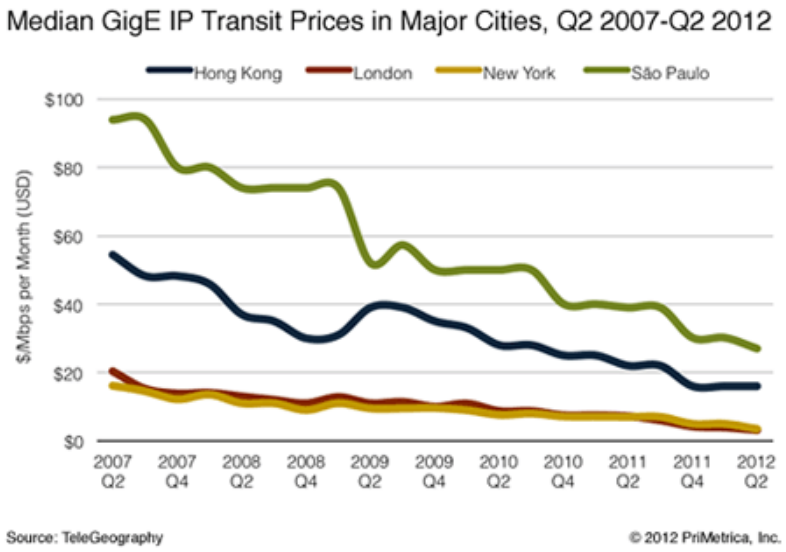

Figure 1 Median IP Transit Costs

Improvements are strongly recommended for the following areas of wholesale regulation:

- Introduction of a framework for the determination of dominance
- Provision of joint dominance
- Introduction of a clearly stated and well described process for the intervention of NTRC when two parties do not reach a commercial agreement
- Setting of wholesale pricing through an efficient use of the Retail minus model

4. Intra - Country and regional assessment

4.1. Grenada

The Team visited the Country of Grenada in early May, 2012 to inventory the current status of broadband infrastructure within the Country, including Carriacou and Petite Martinique. Meetings were held with Government Stakeholders and Service Providers in order to develop a clear understanding of embedded infrastructure, technologies and the current Broadband services offered by this infrastructure as well as future plans and projects.

4.1.1. Sector Performance

During the ECTEL review period April 2010 –March 2011, sector performance remained flat during 2010 or declining; with the notable exception of Internet service subscription, which shot up 17 per cent. Overall, operators reported revenue contracted six per cent to roughly $142 million or eight per cent of GDP. The overall reduction in revenue was mainly due to falling fixed line service revenue, which accounted for 28 per cent of total revenue, down from 36 per cent in the previous ECTEL review period (April 2009 – March 2010).

Investment in the sector also fell an estimated 50 per cent to $18 million. Fixed and mobile penetration remained stable (25.8 percent and 105.8 percent). There was a notable increase in Internet and broadband subscribers for the year ending March 2010, which was largely due to aggressive marketing and promotional campaigns and the presence of a second provider of Internet services, Columbus Communications (FLOW). The major development in the sector during the period was the launch of fixed voice service by Columbus Communications (FLOW), which added the provision of fixed voice to its existing line-up of cable TV and Internet access services.

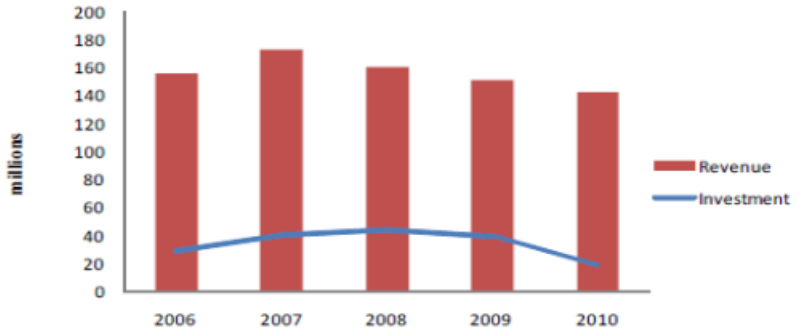

Figure 2 - Revenue and Investment in Grenada[1]

4.1.2. Domestic Fixed Voice Service

The launch of FLOW voice service brought an alternative to the incumbent in all major telecommunications markets in Grenada. Despite this, activity in the fixed voice market was relatively subdued. A small increase was mainly due to an increase in business subscribers, which offset the continued fall in residential subscriptions. Rates for the fixed line service which are set under a Price Cap plan (PCP) for the incumbent LIME remained unchanged during the review period.

4.1.3. Domestic Mobile Market

The mobile market continues to be dominated by LIME and Digicel. The number of mobile subscribers in Grenada was recorded at 116,800 at the end March 2010, an increase of just 1.2 percent; despite the modest subscriber growth, there was continued activity in the mobile market in Grenada as operator reported revenue rose 18 percent. With this increased activity, mobile increased its share of total local traffic to 87 per cent up from 77 per cent.

[1] *ECTEL and Operators, including ECTEL's estimates*

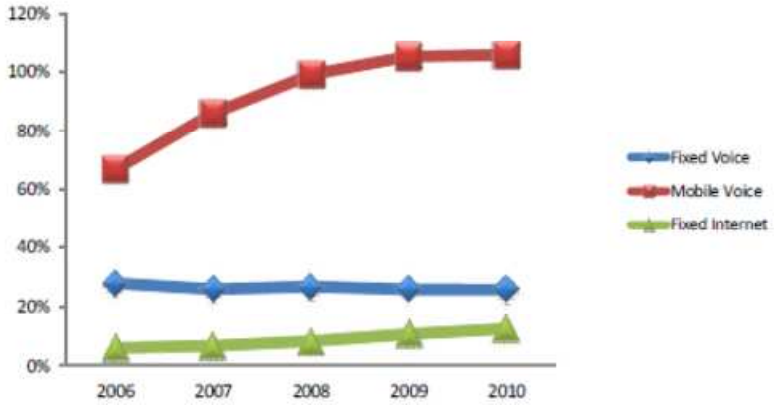

Figure 3 - Telecom Service Penetration in Grenada, Period ending March 2010[2]

4.1.4. Broadband Internet Services

A 17 percent growth to an estimated 13,600 subscribers at the end of 2010 was attributable to the growth in the number of cable modem subscribers, which almost doubled in the period 2009-2010. Broadband is now the main platform used to access the Internet and only a handful of subscribers, 1.4 percent, still have dialup access. The market for Internet access is becoming increasingly important to the overall sector but it is still a relatively small segment accounting for just 9 percent of sector revenue. There was limited data on the use of mobile Internet service in Grenada, and though providers offer mobile Internet service to their customers, it has not generally been sold as a front line service, but as part of their regular mobile subscription. Mobile operators offer data bundles to both prepaid and postpaid subscribers who can access this service with GPRS and EDGE enabled handsets.

[2] *ECTEL / Operators, includes ECTEL's estimates where ECTEL does not receive data from Operators*

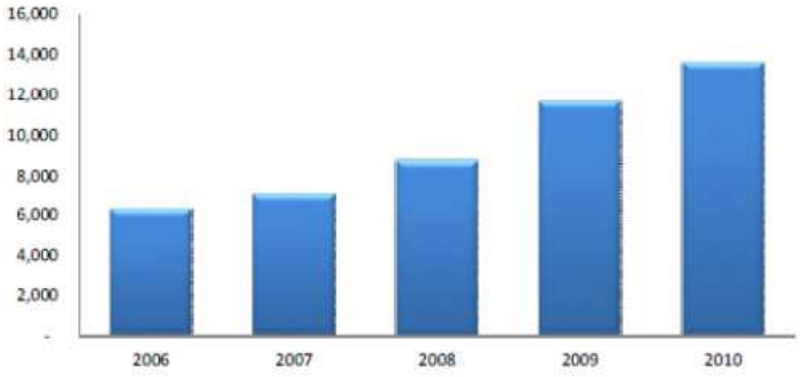

Figure 4 - Internet Subscribers, in Grenada, Period ending March 2010[3]

4.1.5. Service Providers - Fixed

The Country of Grenada is serviced by two primary land-based telecommunications service providers (LIME, Flow) and two primary wireless / cellular service providers (LIME, Digicel). Though there are other, smaller telecommunications and Internet Service Provider license holders, providers of primarily local Wi-Fi services, only telecommunication providers with high-capacity terrestrial, submarine or wireless telecommunications infrastructure were our primary focus.

In the Internet and fixed services segment the incumbent C&W (LIME) remained the sole provider of Internet services until the entrance of Columbus (FLOW) in 2008. Competition led to a reduction of prices for C&W offer via ADSL.

Main Service Providers	International	C&W (ECFS) Southern Caribbean Fiber
	Fixed line	C&W (LIME) Columbus Communications (FLOW)
	Mobile	C&W (LIME) Digicel AIsleCom
	Internet	C&W (LIME) Columbus Communications (FLOW) Grencomm Limited

Figure 5 - Grenada – Active Service Providers[4]

[3] *ECTEL/Operators, includes ECTEL's estimates where ECTEL does not receive data from* Operators
[4] *ECTEL*

LIME, an acronym for 'Landline, Internet, Mobile, Entertainment', is a communications provider owned by the British based Cable & Wireless Communications plc operating as the native incumbent landline telecommunications service provider in Grenada. In addition to operations in Grenada, LIME operates in Anguilla, Antigua & Barbuda, Barbados, British Virgin Islands, Cayman Islands, Dominica, Grenada, Jamaica, Montserrat, St. Kitts & Nevis, St. Lucia, St. Vincent & the Grenadines and Turks & Caicos.

The company is formed from the integrated businesses of Cable & Wireless in the Caribbean, which adopted the LIME name on 3 November 2008. In 2010, Cable & Wireless Worldwide demerged Cable & Wireless Communications into an independently listed company. The Government of Grenada owns approximately 27% of the equity in LIME (Cable & Wireless) Grenada.

LIME offers local and International telephony services, Broadband services for residential subscribers and telephony, dedicated Internet Access, Hosting, Global MPLS and Metro Ethernet for businesses subscribers. Below is a rate card for Broadband Internet services. LIME claims to have 79% of the broadband market and 95% of the telephony market.

LIME Broadband Internet Rate Card (Grenada)[5] *(in US $)*			
2.0 / .256 Mbps	**4.0 / 512 Mbps**	**8.0 / 1 Mbps**	**4.0 / .768 Mbps**
$29.39	**$54.94**	**$59.20**	**64.46**

Figure 6 - LIME Internet Rate Card (Grenada)

Plan	Speed DL (Mbps)	Speed UL (Mbps)	Monthly Charge
Mega	2	0.25	$79.35
Mega MAX	4	0.50	$148.35
Mega Optimum	8	1	$159.85
Premier	4	0.75	$171.35
Premier MAX	8	0.75	$286.35

LIME Broadband Plans

[5] *LIME, Grenada Web Site, 2012*

Plan	Speed DL (Mbps)	Speed UL (Mbps)	Monthly Charge
Broadband Plus	4	512 kbps	$75.00
Broadband Extreme	8	1	$135.00
Broadband Overdrive	12	1.5	$229.99

Flow Broadband Plans

Columbus Communications Grenada Ltd made its entry to the Grenada market in April 2008 following the acquisition of the assets of the previous cable service provider, Grenada Cablevision. Cablevision owned a nationwide backbone network deployed and had a portfolio of 15,000 subscribers.

Columbus Communications Grenada Ltd. is wholly-owned by Columbus Communications[6]. Columbus Communications is an International Business Corporation (IBC) incorporated in the fall of 2004 under the Companies Act of Barbados. Its shares are privately held. Columbus Communications operates in 23 countries throughout the greater Caribbean, Andean and Central America region. It markets its broadband triple play (cable, Internet and telephony) under the brand name Flow.

Columbus immediately initiated a capital program to enable its network to offer the full triple play suite of services including digital TV, high speed Internet and digital voice services. Flow launched the first competitive high speed Internet service in Grenada in December 2008 and then launched digital landline phone service in the fourth quarter of 2009.

Flow is the primary cable television provider in Grenada and has grown its customer base to over 25,000 video, Internet and voice subscribers. In addition to retail broadband services, Columbus operates wholesale broadband networks throughout the greater Caribbean and Central American region. According to the Columbus, Flow is the only company in Grenada providing triple play services.

[6] *Columbus Communications Web Site, http://coulmbuscommunications.com*

4.1.6. Service Providers – Mobile

The mobile market continues to be dominated by LIME and Digicel. Digicel acquired assets and operations of Grenada Wireless Holdings Ltd (AT&T) which had operated just for one year until Hurricane Ivan in 2004.

Mobile competition started in 2003, when Digicel and AT&T entered the market. These operators were also allowed to provide International services, which lead to a significant drop in call prices.

In 2004, AT&T Wireless sold its Caribbean operations to Cingular Wireless which in turn sold operations to Digicel the following year. As a result, there are only two mobile providers in the Country.

LIME (previously Cable & Wireless) with TDMA and GSM 850 network and Digicel operating its own GSM 900/1800/1900 and the GMS 900/1900 network acquired from Cingular.

4.1.7. Service Providers – Independents

In 2011 Affordable Island Communication Inc., also known as AIsleCom, launched its 3G in Grenada. With this new service, customers including roamers with a CDMA handset can now use their phone and 3G data dongles in Grenada. According to the Company, customers can now enjoy wireless broadband services on AIsleCom's 3G Network, with download speeds of up to 2.1Mbps.

Aisle Communications is a small wireless operator providing CDMA roaming servings (other carriers only offer GSM roaming service). Aisle Communications has limited coverage, primarily the population and tourist centers. Aisle has been providing services for about 1 year. They had a lengthy process of securing spectrum from the Government.

Grencomm Limited has received a license to provide Internet network services and currently is offering Internet based TV and VoIP. GrenComm is a small fixed wireless broadband operator. They also have a media service, offering an Internet-based news television channel, web site and newsletter under the name RUSH.

4.1.8. Telecommunications Licenses

Class licenses have been issued covering a range of services that include International Simple Voice Resale, Internet Service Provider and Value Added Services are.

These developments have broken monopolies that C&W had in Grenada's telecommunications sub sectors, and competition in the Internet network services has produced a reduction in rates by the incumbent.

The following operators have been awarded licenses but have not started operations:

- Global Network Partners Inc Ltd has been awarded licenses in 2002 for:
  - The establishment and Operation of a Fixed Public Telecommunications Network and the Provision of Certain Fixed Telecommunications Services
  - The establishment and Operation of a Public Cellular Mobile Telecommunications Network and the Provision of Public Cellular Mobile Telecommunications Services
- Trans-World Telecoms Caribbean Ltd has been awarded license for fixed and mobile telephony in for:
  - The Establishment and Operation of a Fixed Public Telecommunications Network and the Provision of Certain Fixed Telecommunications Services in Grenada
  - The Establishment and Operation of a Public Cellular Mobile Telecommunications Network and the Provision of Public Cellular Mobile Telecommunications Services in Grenada
- Emerging Technology limited has been awarded in 2002 a license to provide Internet services.
- Blue Stream Communications (based in the British Virgin Islands, a subsidiary of the Data State Group in Bermuda) has been awarded in 2002 a license to provide Internet services. It announced in 2002 it had approval from the Royal Bank of Trinidad & Tobago to borrow more than $1.5 million to expand its Caribbean services as countries in the region open their markets to competition) and plans to build a US$150 million fiber optic network throughout the region.
- Grenada Wireless Holdings has been awarded in 2003 the license for the establishment and operation of a public cellular mobile telecommunications network and the Provision of Public Cellular Mobile Telecommunications Services. Assets and operations were acquired by Digicel.
- In the international connectivity segment, Southern Caribbean Fibre Grenada Ltd has been granted in 2006 one license to land a submarine cable.

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Type of Licence	Applicant	Licence Effective Date
Fixed Public Telecommunications	Cable & Wireless Grenada Ltd	October 12, 2001
	Global Network Providers Grenada Inc	January 25, 2002
	Trans-World Telecoms Caribbean Ltd	May 29, 2002
	Digicel Grenada Limited	October 4, 2006
	Colombus Communications	February 1, 2008
	Grenada Cablevision Limited	September 1, 2006
Public Mobile Telecommunications	Cable & Wireless Grenada Limited	October 12, 2001
	Global Network Providers Grenada Inc	January 25, 2002
	Trans-World Telecoms Caribbean Ltd	May 29, 2002
	Digicel Grenada Limited	May 20, 2003
	Grenada Wireless Holdings Ltd	May 26, 2003
	21st Century Telecom Network (Caribbean) Ltd	October 10, 2008
	Affordable Island Communications Inc	November 4, 2008
Internet Network and Services	Cable & Wireless Grenada Ltd	October 12, 2001
	Global Network Providers Grenada Inc	January 25, 2002
	Caribbean Knowledge and Learning Network	March 7, 2006
	Digicel Grenada Limited	October 4, 2006
	Grenada Cablevision Limited	September 1, 2006
	Grencomm Limited	October 11, 2006
	21st Century Telecom Network (Caribbean) Ltd	October 10, 2008
	Colombus Communications	February 1, 2008
Submarine Cable Landing	Southern Caribbean Fibre Grenada Ltd	November 24, 2006
	Cable & Wireless Grenada Ltd	June 1, 2003

Revision completed by ECTEL

As at January 2011

Figure 7 - Grenada - License Register[7]

[7] *ECTEL*

Box 3 - Incumbent Network Access and Wholesale

One way of fostering competition is to ensure that new entrants can use the infrastructure of existing operators. These new entrants, such as ISPs and other network operators, then become *wholesale* customers of the existing operators. The new entrants and the existing operators might compete with one another for the same retail customers, setting up a scenario where existing operators might seek to discriminate against the new entrants and act in favour of their own retail arms. The regulator needs to prevent discrimination to make service-based competition effective. This regulatory intervention is often most critical to ISPs that may feel that the incumbent is both overcharging for the national backbone and acting in an anti-competitive manner in its retail pricing for Internet customers.

Incumbent operators may lack interest in serving wholesale customers on a non-discriminatory basis and may point to the investment made in network facilities and the economies of scale and scope due to their vertically integrated operations. Incumbents may even have genuine technical difficulties in avoiding discrimination because of their vertically integrated operations.

Under good regulatory practice, operators should be prevented from discriminating against wholesale customers that are also their competitors, especially in cases where incumbents have monopoly or dominant powers or have used public funds in constructing their networks.

(*Source: Regulator Toolkit)*

4.1.9. Broadband Adoption

A report with the results of a National Survey and an Analysis of Broadband Gaps and Adoption Trends was available for Grenada. This report, commissioned by the NTRC, suggests broadband rates as a major deterrent to service adoption. (See Box 4).

As shown below (Figure 9), only 10 percent of the population had no Internet coverage in their community at the time of the survey. When compared with the number of Internet subscribers, it appears that the availability of Internet coverage within the community did not hinder many households from subscribing to the service. 65 percent of the households acknowledged Internet coverage within the community, while only 32 percent actually subscribed to the Internet. This is less than half the total population, although 41 percent of the homes owned a computer, not all were connected to the Internet and just 2 percent

of the population declared they did not subscribe to the service because of the lack of network coverage in their community.

Broadband prices emerged as the major deterrent to service adoption (See Figure 9 and Box 4 for details). Among households categorized as Internet subscribers, the majority had broadband connection, with ADSL recorded at 50 percent. This is a reverse from previous trends when dial up service was the most widely utilized option and in some cases the only option available. Today, although still in existence, it is only utilized by 6 percent of the population as broadband service is now readily available. This trend would continue as the cost of the network infrastructure decreases. Cable Internet accounted for 35 percent of households.

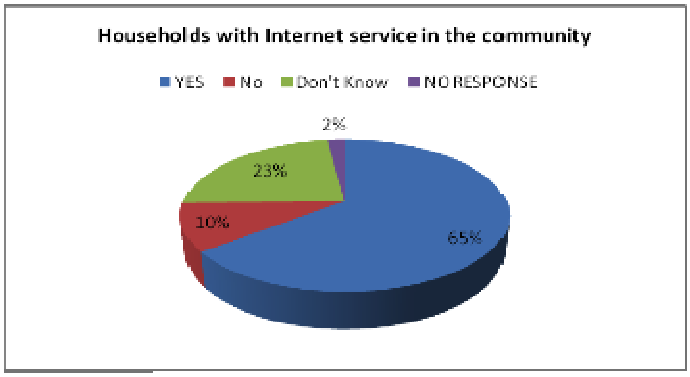
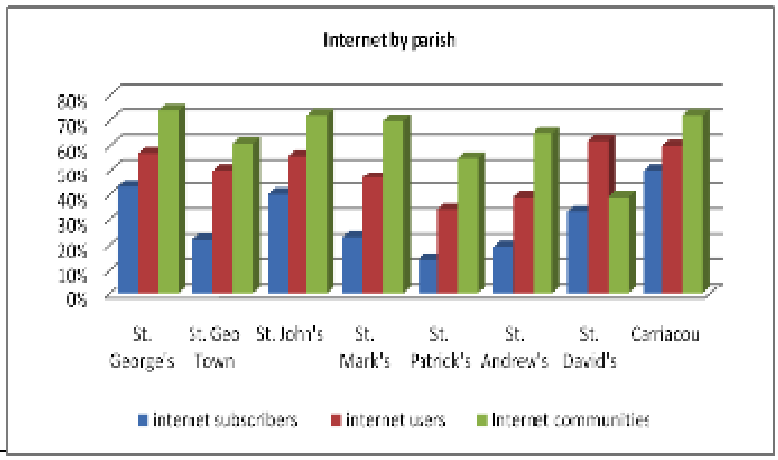


Figure 8 - Households with Internet Coverage in their Community[8]



[8] *NTRC, Grenada*

Figure 9 - Internet Communities, Users and Subscribers by Parish

Policy makers have developed comprehensive medium term ICT strategies and annual Universal Service Fund operating plans that include supply and demand considerations. On the supply side, the building of networks to carry broadband services to unreached population, public institutions (schools, health centers and government offices) is the top priority. National and regional policies are making efforts to drive demand for broadband services, whether by plans for putting more services online or educating users about the benefits of broadband and the skills needed to use the new services effectively.

Box 4 – Broadband Adoption in Grenada

With an Internet penetration by household (*Proportion of Households with Internet Access at home*) around 32 percent, in Grenada the number of communities with Internet coverage far exceeds the number of households within the communities with an active Internet subscription. Thus, although Internet coverage hinders some households from acquiring the service, this is not the case in the majority of communities within the various parishes in Grenada. Some areas recorded at least 20 percent gap between households with Internet subscription and those who use the Internet (web users) with Internet users greatly exceeding households with Internet subscriptions.

A similar situation was recorded within the various parishes as the number of households with Internet users exceeds the number of households that subscribe to the Internet. Only 10 percent of the national surveyed population had no Internet coverage in their community. When compared to the number of Internet subscribers, the availability of Internet coverage within the community did not hinder many households from subscribing to the service. 65 percent of the households acknowledged Internet coverage within the community, while only 32 percent actually subscribed to the Internet. Furthermore, although 41 percent of the homes owned a computer, not all were connected to the Internet.

It is worthy to note that just 2 percent of the population declared they did not subscribe to the service because of the lack of network coverage in their community. This proves that while network coverage is a contributory factor to the availability of Internet service, this is not the case for many communities. While over 50 percent of the population is computer literate, a fairly large number still lack the basic computer knowledge; this like network coverage is also a contributory factor to the low level of penetration.

Most respondents identified the cost as the main reason for no Internet in the home.

4.1.10. Technology Assessment

Terrestrial Infrastructure

Columbus Communications – FLOW

Flow is the primary cable television provider in Grenada and has grown its customer base to over 25,000 video, Internet and voice subscribers. Flow has a high fiber count fiber optic network that circumvents the Country of Grenada. Flow operates a Hybrid Fiber Coaxial Network in that the primary backbone would be based on fiber optic technology and the service distribution and drops or "last mile" would typically be coaxial cable.

Flow utilizes a Cable Modem Terminating System or CMTS to provide Internet and digital or Internet Protocol Telephone services ("VoIP"). The CMTS is currently operating within the Data over Cable Systems Interface Specification (DOCSIS) version 2.0 and deliver data rates of 50 megabits per second downstream and 27 megabits per second upstream and typically shared with up to 1,000 households or connections.

Flow is the only provider on the Island that offers a "triple-play" service in that they provide television, broadband Internet and digital telephone services (Voice over Internet Protocol or "VoIP").

LIME

LIME has a significant fiber optic network throughout the Country. Though this network does not completely circumvent the Island, due primarily to lack of an east -west Road system in the north part of the Island, the fiber network deployed by LIME appears to have multiple self-healing geo-diverse rings. It appears from field visits that a 48 count fiber cable has been installed along all primary roads utilizing what appeared to be a legacy underground telecommunications duct bank, possibly installed prior to the liberalization of telecommunications services with the Country.

LIME currently has a meshed fiber-optic backbone (more resilient / higher quality than "ringed" topologies), operating a 10 Gbps MPLS core. This is "state-of-the-art" Ethernet network (or Next Generation Network "NGN") is cost effectively upgradeable to 40 Gbps or even 100 Gbps or greater should traffic demands warrant.

The fiber backbone is approximately 50% underground (southern part of the Island) and above ground (northern parts of the Island). LIME has a Point of Presence or "POP" in every major population center within the Country.

During our field visit, the Team did not notice any significant fiber-optic infrastructure gaps within the Island of Grenada. Additional study is presented within Section 4.8 “Gap Analysis” to understand the capacity limitations and timing of the exhaustion of the microwave network serving the Island of Carriacou and Petit Martinique.

Wireless Infrastructure

LIME

LIME is one of try mobile operators in Grenada. Currently they operate a GSM network with approximately 39 tower sites. Lime owns the majority of their tower sites and from visits it appeared that most sites had significant redundant power systems, including on-site generators and battery back-up.

The mobile backbone is a ring topology between 4 major central offices with a basic hub and spoke architecture serving each site. It appeared that LIME had a mix of sites backhauled with traditional copper-based T-1/E-1, fiber optic networks and microwave.

The Islands of Carriacou and Petite Martinique were both served with microwave technology.

Digicel

Digicel is the second primary mobile provider in Grenada also operating a GMS network. Digicel does not own a significant fiber optic network and the majority of their sites are backhauled with microwave.

This could present some challenges for Digicel as they migrate to faster wireless data platforms such as 4G / LTE technologies as microwave has limited capacity. Without a robust wholesale regime where Digicel can purchase fiber optic networks at competitive prices could significantly change the market dynamics.

4.1.11. Gap Analysis

The only significant telecommunications infrastructure gap identified in Grenada was the absence of a submarine fiber-optic system serving Carriacou and Petite Martinique. These Islands are currently served with microwave radios. The team performed an extensive demand study to determine the expected life of the existing microwave system. It appears that for the study period, through 2020, that ample microwave capacity was available. However, this assumes an ITU-type standard microwave spectrum channel plan is in place.

Additional information with regards to infrastructure gaps related to a Government Network and an expanded IXP strategy can be found in Section 7.2.

4.1.12. Grenada to Carriacou and Petit Martinique – Submarine Fiber Optic System

Carriacou and Petit Martinique are both currently served with microwave radio technology. Both landline-based providers as well as the wireless carriers utilize microwave technology to serve this region as described within the Existing Infrastructure Assessment Section of this Report.

As part of the gap analysis, a study of the available microwave spectrum was preformed, irrespective of the current systems deployed. Radio frequency spectrum, currently in use or reserved, is the primary limiting factor in expanding capacity into the Islands. The study determined that this particular route (Grenada to Carriacou and Petit Martinique) , including multiple site locations on each of the route and traversing through the inhabited Islands of the Grenadines, could support up to 9 x OC3 or approximately 1.395 Gigabit per second of Internet Protocol ("IP") traffic. As part of this study and to account for the inefficiencies of a multi-carrier network, the forecasted capacity was discounted by 30% ("Realized Microwave Capacity") to account for traffic inefficiencies with 3 discrete circuits, one for each of the service providers in the region.

In addition to microwave spectrum analysis, a thorough demand analysis was preformed to ascertain current and forecasted IP traffic demands for the Islands of Carriacou and Petite Martinique. This study is similar to the Country-Wide demand forecast as presented in the Financial and Economic Assessment of this Report. As part of the Demand Forecast analysis, current households as well as projected households were considered as well as existing Internet and telecommunications services (including DSL, Cable Broadband, landline telephony and mobile services) and their required bandwidth and forecasts.

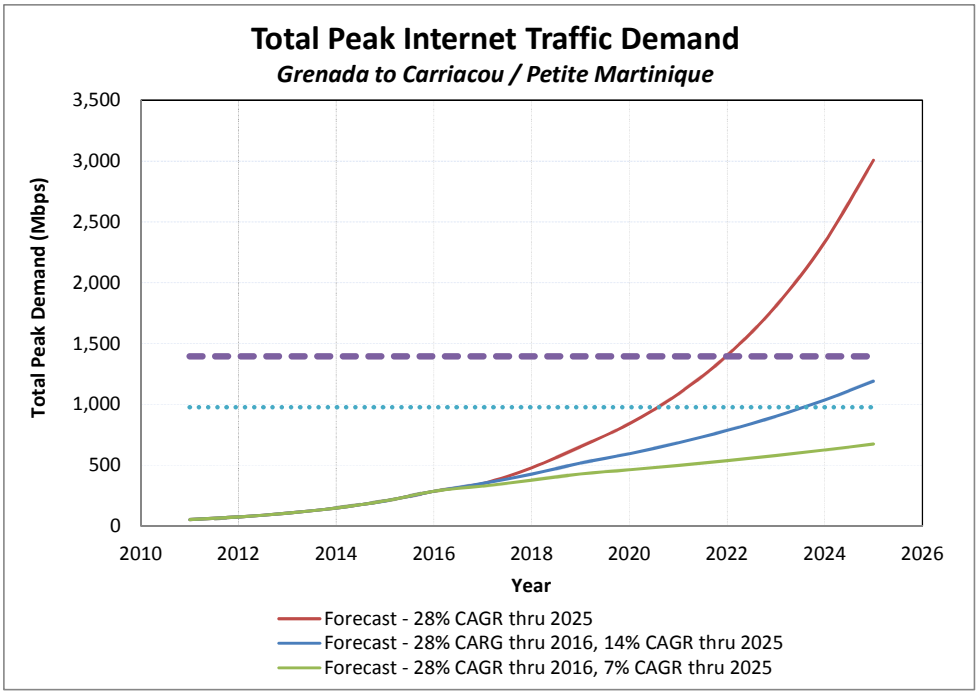


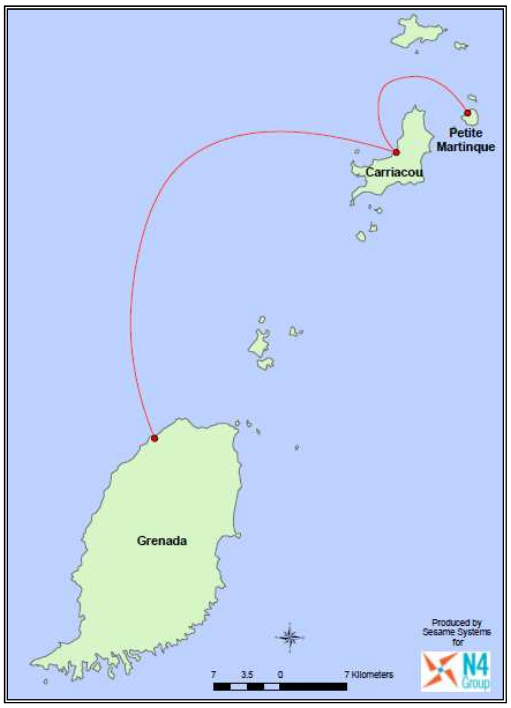
Figure 10 - Total Peak Internet Traffic Demand (Grenada to Carriacou)

It was determined as part of this two-prong capacity analysis that the existing microwave spectrum could support the traffic requirement between Grenada and Carriacou and Petite Martinique through the year of 2021 (see chart above). Again, the study looked specifically at spectrum and not the current microwave systems designs, radios or topologies currently deployed. To meet the forecasted capacity of 1.2 Gbps on this route, spectrum rechanneling, radio upgrades and topology changes may be required to meet these capacity forecasts.

Submarine Fiber Optic System

To relieve the eventual capacity constraints on the microwave systems between Grenada and Carriacou and Petite Martinique, a new submarine fiber optic cable is proposed. This proposed cable could land at existing cable points (specifically in Grenada) and travel north to Carriacou. From Carriacou the cable system would continue 2.6 miles to Petite Martinique.

This system should be able to be deployed as a non-repeated system, supporting wave division multiplexing with minimal fiber strands. Below is an estimated cost to deploy new submarine fiber optic cable system as described.



A Site	B Site	Total Miles	Estimated Cost
Grenada	Carriacou	41.0	$4,436,323
Carriacou	Petite Martinique	2.6	$281,328
	Totals	**57.3**	**$4,717,650**
Annual Operating Expenses			**$117,950**
Annual Projected Revenue (@ yr5)			**$577,988**
Projected Break-Even (in Years)			**10.2**

Figure 11 - Carriacou Submarine Costs Analysis

4.2. Saint Lucia

In early March 2012, the Team visited the Country of St. Lucia to inventory the current status of broadband infrastructure within the Country. Meetings were held with Government Stakeholders and Service Providers in order to develop a clear understanding of imbedded infrastructure, technologies and the current Broadband services offered by this infrastructure as well as future plans and projects.

4.2.1. Sector Performance

Following an estimated 5.19 per cent decline in real GDP in 2009, the Saint Lucian economy shows signs of recovery as estimates from the Eastern Caribbean Central Bank indicated economic growth of 1.38 per cent for the year ended 2010. The decline in real GDP in 2009 was largely attributed to the effects of the global economic slowdown. At the end of 2009, the communications sector contributed 11.85 per cent to GDP. With signs of economic recovery, the sectors contribution was 11.92 per cent at the end of 2010.

St. Lucian households on average spent in 2011 $274 monthly on ICT services; $40 on fixed lines, $198 on cellular service and $ 36 on internet.

A 32 per cent decline marked a second year of reduced capital investment in the Saint Lucian telecommunications sector.

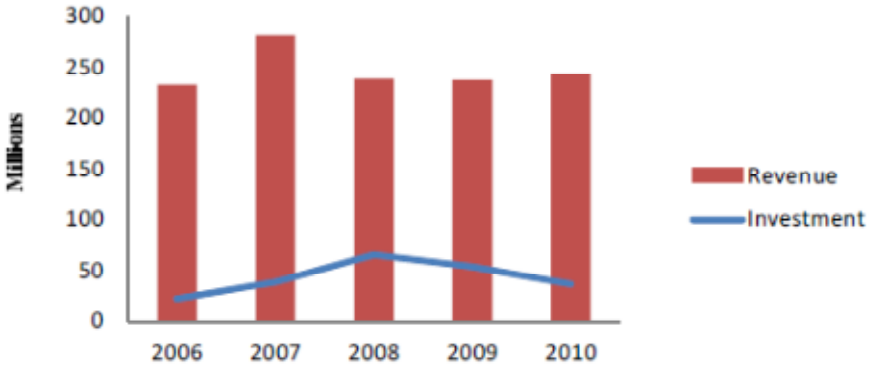


Figure 12 - Revenue and Investment in St. Lucia[9]

The use of Information and Telecommunications Technology equipment increased significantly in St. Lucia over the last ten years with the exception of fixed line telephony which decreased during the period as a result of the massive breakthrough of cellular technology.

Computer ownership at the household level has grown from 13 percent in 2001 to over 40 percent to 2011. Fixed lines proportions decreased from 60 percent in 2001 to less than 50 percent in the same period. The proportion of cell phones users increased more than six fold from 14 percent to over 90 percent in the same period. This coincides with the period of liberalization of the telecommunications sector, resulting in customers switching away from fixed lines to use of cell phones.

4.2.2. Domestic Fixed Voice Service

Karib Cable launched the fixed voice and Internet service in 2009.

Despite the introduction of service by a second provider, activity in the fixed voice market was relatively subdued in 2009-2010.

The overall decline was largely due to an eight per cent decrease in residential subscribers, which was offset to some extent by the 10 per cent growth in business subscriptions. Rates for the fixed line service set under a Price Cap plan (PCP) remained unchanged during the review period.

[9] *ECTEL / Operators, includes ECTEL's estimates where ECTEL does not receive data from operators*

4.2.3. Domestic Mobile Market

The mobile sector recorded positive growth in ECTEL review period 2009 - 2010, albeit at a considerably slower rate than in previous periods. Subscriber totals grew four per cent as a result of increases in both prepaid and postpaid subscriptions.

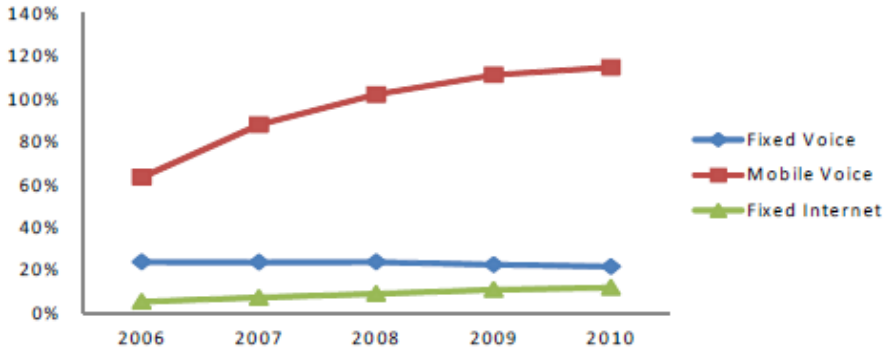


Figure 13 - Telecom Service Penetration in Saint Lucia[10]

[10] *ECTEL / Operators, including ECTEL's estimates where ECTEL does not receive data from operators*

4.2.4. International Voice Service

Total international minutes originating from Saint Lucia fell 16 per cent. This overall reduction in outgoing international minutes was driven by declines in calling volumes from both fixed and mobile networks. As was seen with outgoing international calls, the overall reduction in incoming international minutes resulted from declines in minutes to both fixed and mobile networks.

4.2.5. Internet Broadband Services

Internet access at the household level continues to grow. In just over ten years, the proportion of households subscribing to an internet service has grown from 7 percent as reported in the 2001 Census to 52 according to a NTRC survey in 2011. Consistent with the growth in subscription, revenue generated from activity in the Internet market was 32 percent more than in the previous period. Internet service contributed 11 percent to total sector revenue, which was up from a contribution of 8.5 per cent in the previous period.

The overall upswing in activity in the Internet market is worth noting, as the presence of a new operator offering Internet access via cable modem since 2009, resulted in a widening of the options for fixed Internet and broadband services in Saint Lucia. Second generation mobile Internet is available via GPRS and EDGE but it remains difficult to track the true number of mobile Internet users on the island as any mobile subscriber with an Internet ready handset could access mobile Internet service without a separate subscription for data services.

Figure 14 - Active Telecom Service Operators in Saint Lucia

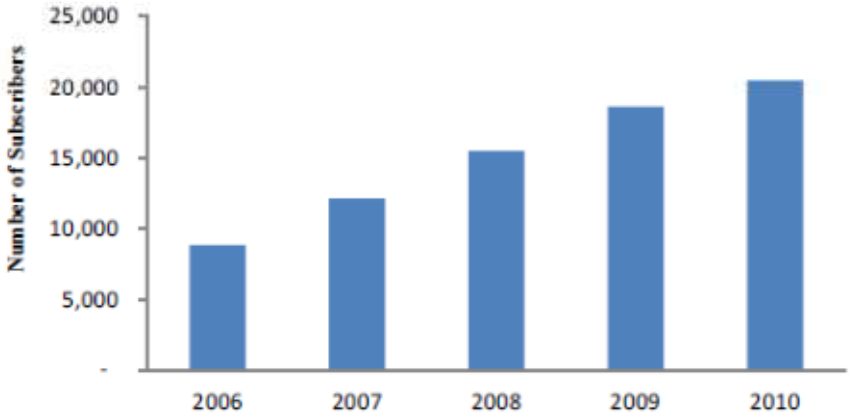


Figure 15 - Internet Subscribers, in Saint Lucia, Period ending March 2010[11]

4.2.6. Service Providers - Fixed

The Country of St. Lucia is serviced by two primary land-based telecommunications service providers LIME and Karib Cable, providing fixed telephony and Internet services to the users in Saint Lucia.

Main Service Providers	International	Antilles Crossing C&W Southern Caribbean Fiber
	Fixed line	C&W Karib Cable
	Mobile	C&W Digicel
	Internet	C&W Karib Cable (plus cable TV) Tele St. Lucia Inc (plus leased circuits)

The fixed line voice telephony market is dominated by the incumbent LIME. Karib Cable fixed lines were only reported in Castries Suburban, Castries Rural, Vieux Fort, Dennery and Gros Islet where they represented 3 percent, 8 per cent, 2 percent, 5 percent and 3 percent of the total fixed line subscribers in these communities respectively.

[11] *ECTEL/Operators, includes ECTEL's estimates where ECTEL does not receive data from operators.*

LIME, an acronym for 'Landline, Internet, Mobile, Entertainment', is a communications provider owned by the British based Cable & Wireless Communications plc operating as the native incumbent landline telecommunications service provider in St. Lucia. In addition to operations in St. Lucia, LIME operates in Anguilla, Antigua & Barbuda, Barbados, British Virgin Islands, Cayman Islands, Dominica, Grenada, Jamaica, Montserrat, St. Kitts & Nevis, St. Lucia, St. Vincent & the Grenadines and Turks & Caicos.

The company formed from the integrated businesses of Cable & Wireless in the Caribbean which adopted the LIME name on 3 November 2008. In 2010, Cable & Wireless Worldwide demerged Cable & Wireless Communications into an independently listed company.

LIME offers local and International telephony services, Broadband services for residential subscribers and telephony, dedicated Internet Access, Hosting, Global MPLS and Metro Ethernet for businesses subscribers. Below a rate card from Broadband Internet services.

LIME Broadband Internet Rate Card (St. Lucia)[12] *(in US $)*			
1.0 / .256 Mbps	**2.0 / 512 Mbps**	**3.0 / 768 Mbps**	**4.0 / 768 Mbps**
$7.40	**$31.48**	**$57.41**	**94.44**

Figure 16 - LIME Internet Rate Card (St. Lucia)

Karib Cable ("Karib") began offering telecommunications services in St. Lucia in 2007. Karib Cable is owned by St. Vincent-based KelCom International and in addition to their network in St. Lucia; they operate telecommunications systems in St. Vincent, Antigua and Barbados.

Karib aggressively built new fiber optic cable infrastructure around the majority of the Island, originating at their Cable TV Head-End located on Millennium Road just south of Castries City, both northbound and southbound, nearly completing a ring around the Country. Karib's primary backbone travels the primary road circumventing the Island, utilizing primarily LUCILEC's utility pole infrastructure.

According to a NTRC survey held in 2011, LIME is the major internet provider with a slight advantage over Karib Cable. The average monthly payments for internet services provided by carriers that offer home based services are basically the same. Karib Cable users pay

[12] *LIME, St. Lucia Web Site, 2012*

$81.30 and LIME users $83.24. Included in the LIME payments are the cost of cellular internet access.

Karib Cable Broadband Internet Rate Card (St. Lucia) *(in US $)*			
1.1 Mbps	**2.2 Mbps**	**3.3 Mbps**	**4.4 Mbps**
$29.26	**$31.48**	**$55.19**	**92.22**

Figure 17 - Karib Cable Internet Rate Card

Plan	Speed DL (Mbps)	Monthly Charge
Gold	1.1	$90.85
Silver	2.2	$97.75
Gold	3.3	$171.35
Platinum	4.4	$286.35

LIME Plans

Plan	Speed DL (Mbps)	Speed UL (kbps)	Monthly Charge*
Mega	1	256	$90.85/ $113.85
Mega PLUS	2	512	$171.35/$194.35
Mega MAX	3	768	$286.35/$309.35

KaribPlans

4.2.7. Service Providers – Mobile

Mobile competition started in 2003, when Digicel entered the market. In 2004, the AT&T Wireless sold its Caribbean operations to Cingular Wireless, which in turn sold operations to

Digicel the following year. As a result, there are only two mobile companies in the country: C&W (LIME), with a TDMA and GSM 850 network, and Digicel, operating its own GSM 900/1800/1900 and the GSM 900/1900 network acquired from Cingular.

Subscriber to Digicel only receives cellular Internet

In the mobile market segment, Digicel leads the market in terms of subscribers: about 36percent of all cell phone users choose LIME as their service provider and 80 percent subscribed to Digicel with 16 percent subscribing to both companies. While Digicel leads the cellular phone market in terms of number of subscribers, LIME has the advantage in terms of average customer expenditure.

In the International connectivity segment, The Antilles Crossing, ECFS, and SCF submarine cables have landing points in St. Lucia.

4.2.8. Telecommunications Licenses

During ECTEL review period one new license was granted, for Internet Network and Services, but the company had not commenced operations at the end of the review period.

The Power utility Company, LUCELEC also has a private, non-commercial fiber optic route that traverses the Country from North to South utilizing an electric transmission utility tower / pole infrastructure. Though there are other, smaller telecommunications and Internet Service Provider license holders, providers of primarily local Wi-Fi services, only telecommunication providers with high-capacity terrestrial, submarine or wireless telecommunications infrastructure were our primary focus.

Licence Register - Saint Lucia

Type of Licence	Applicant	Date Granted	Date Frequency Granted
Fixed Public Telecommunications	Cable & Wireless (West Indies) Limited	October 10, 2001	October 10, 2001
	Tele (St. Lucia) Limited	June 24, 2008	
	Digicel (St. Lucia) Limited	April 17, 2008	
	Kelcom International Limited	April 17, 2008	
Public Mobile Telecommunications	Cable & Wireless (West Indies) Limited	October 10, 2001	October 10, 2001
	Digicel (St. Lucia) Limited	September 6, 2002	
	Wireless Ventures (St. Lucia) Limited	September 10, 2002	
	21st Century Telecom Network (Caribbean) Ltd	December 18, 2007	November 3, 2008
	AWS Caribbean Holdings Ltd	September 10, 2002	
Internet Network and Services	Cable & Wireless (West Indies) Limited	October 10, 2001	
			November 3, 2008
	Antilles Crossing	April 22, 2006	September 11, 2008
	21st Century Telecom Network (Caribbean) Ltd	December 19, 2007	November 3, 2008
	Link Technologies Limited	February 15, 2003	February 15, 2003
	Digicel (St. Lucia) Limited	April 17, 2008	
	Kelcom International Limited	April 17, 2008	
	Tele (St. Lucia) Limited	June 19, 2008	
Submarine Cable Landing	Antilles Crossing	April 22, 2006	
	Southern Caribbean Fibre Limited	August 2, 2007	

Figure 18 - License Register - St. Lucia[13]

4.2.9. Broadband Adoption

We provide below a summary of the analysis contained in a national ICT survey carried out by the NTRC in Saint Lucia in 2011.

On average, 70 percent of the persons surveyed had knowledge of computers and ICT. Seven out of the twelve districts recorded levels of computer and ICT knowledge at or above the national average, while rural districts recorded levels of computer and ICT knowledge at well below the national average. This seems to suggest that digital literacy is adequate in urban districts while there's the need for improvements in rural districts.

Mean monthly internet service costs were $83, $81 and $47 for LIME, Karib Cable and Digicel users respectively. Digicel only offers cellular mobile while Karib Cable provides only home based services. 52 percent of households in St. Lucia have internet access. The main

[13] *ECTEL (March 2010)*

reasons for not having Internet at home among the remaining 48% of surveyed population are affordability (43 percent) and no need for the service (35 percent). Roughly six per cent of respondents, representing 2.3 per cent of the households in the sample, cited unavailability and inaccessibility of the service as reasons for not subscribing to an internet service. The average monthly fee that survey respondents reported that they were willing to pay was $51.76 which was over 35 percent less than what is currently being paid for home based and slightly more than the figure for cellular services.

Computer ownership at the household level has grown from 13 percent in 2001 to over 40 percent over the period.

Satisfaction rates among Internet users are high (85% for Karib Cable and 89% for LIME). Less than 10 percent of Internet Subscribers were very dissatisfied with the service.

With regards to access patterns, 71 percent of persons using the internet do so at least once a day. This fluctuates between a high of 94 percent in Castries City to a low of 49 percent in Vieux Fort. Users access the internet mostly to receive and send emails. Accessing social networks and downloading, listening and viewing content are next on the list. Educational activities are ranked fourth in reasons why persons accessed the Internet. Payment of utility bills and job vacancy listing were among the local services that respondents wanted access to.

An analysis of findings summarized above seems to suggest that:

- Satisfaction rates among Internet users are high (85% for Karib Cable and 89% for LIME). This seems to confirm the good quality of broadband infrastructure assessed during field visits.

- **High costs for broadband rates** can be raised as a challenge to broadband service adoption. The analysis confirms the finding that subscribers are generally willing to pay less than what they currently pay for internet services, The high percentage of persons citing affordability as a reason for not having internet services, adds to the fact that many persons are willing to pay substantially less than what they currently pay for the service Dissatisfaction with the service is not mentioned and the availability of broadband service is not cited as a major issue. This again tends to confirm the availability of good quality broadband infrastructure.

- The use of the internet for business purposes lags behind the use for social and personal use and for the procurement of information and education. This suggests

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that the business community St Lucia has perhaps not gravitated to the internet as a method for delivery of goods and services. However, internet usage on the island is very high, and therefore the business community and central government may benefit from efficiency by using the internet to deliver some of their services.

- Digital literacy seems to be a barrier in rural districts. The need emerges for improving the availability and accessibility of Internet ready Resource Centers and Computer Learning Institutes to raise the digital literacy level in rural areas.

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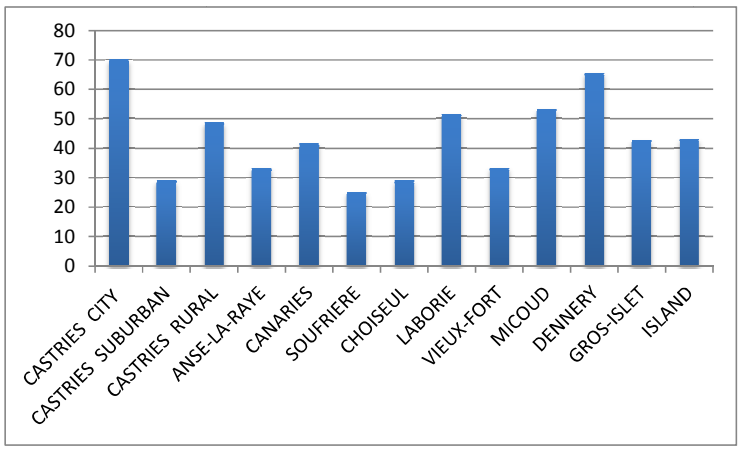

Figure 19 - Reasons (%) for not having Internet by District -- "Cannot Afford the Service"

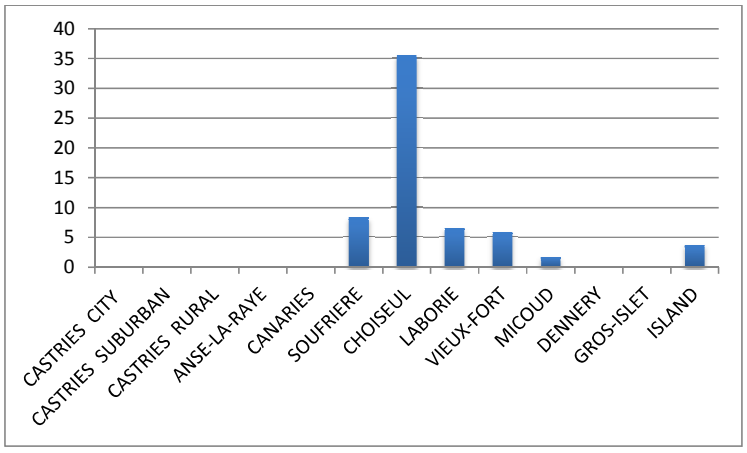

Figure 20 - Reasons (%) for not having Internet by District – "Service Not Available"

4.2.10. Technology Assessment

Interestingly, the two primary public fiber optic cable infrastructures are deployed in two uniquely different methods with one being predominately aerial and the other mostly underground through legacy duct / conduit system. These deployment methods provide for a distinctive resiliency whereas the aerial infrastructure might be susceptible to winds and flying debris in harsh weather and the underground infrastructure is susceptible to landslides and road washouts during heavy rains.

The chances of failures of both networks within the same geographical area are low. This unique placement of fiber optic infrastructure, coupled with self-healing ring architecture, should provide the Country with a highly-resilient fiber optic backbone infrastructure. This resiliency uniqueness should be considered as part of detail designs of Government networks where high availability is required.

Terrestrial Backbone Infrastructure

Karib operates a Hybrid Fiber Coaxial Network in that the primary backbone would be based on fiber optic technology and the service distribution and drops or "last mile" would typically be coaxial cable.

Karib utilizes a Cable Modem Terminating System or CMTS to provide Internet and digital or Internet Protocol Telephone services ("VoIP"). The CMTS is currently operating within the Data over Cable Systems Interface Specification (DOCSIS) version 2.0 and deliver data rates of 50 megabits per second downstream and 27 megabits per second upstream and typically shared with up to 1,000 households or connections.
Karib is the only provider on the Island that offers a "triple-play" service in that they provide television, broadband Internet and digital telephone services (Voice over Internet Protocol or "VoIP").

Figure 21 - Karib Cable Fiber Network

LIME has a significant fiber optic network throughout the Country. It appears from field visits that a 48 count fiber cable has been installed along all primary roads utilizing what appeared to be a legacy underground telecommunications duct bank, possibly installed prior to the liberalization of telecommunications services with the Country.

Based upon field visits, it can be assumed that the fiber optic backbone supports a Next Generation Network ("NGN") Asymmetrical Digital Subscriber Line or "ADSL" broadband network. From our discussions with Country Leaders and LIME personnel it was understood that the majority of the Country was serviced with Asymmetrical Digital Subscriber Line ("ADSL") services with download speeds of 4 megabits per second download and 768 kilobits per second upload speeds.

By referencing network details from field studies and documents provided by LIME, it can be assumed that this backbone is currently design to support more than 1 Gigabit of backbone capacity (STM-16) with some 10 Gigabit services in select areas. In general, this fiber optic backbone circumventing the Country has the ability to scale beyond any foreseeable traffic demands utilizing currently available technologies, including wave division multiplexing (WDM).

Wireless Infrastructure

LIME currently operates a TDMA and GSM 850 Network with approximately 79 tower sites serving almost the entire Country with mobile wireless services. As evidenced by a site visit with LIME personnel in Grenada, it can be assumed that the same design principals are deployed in all markets within the region.

It was learned during the site visit that LIME installs emergency generators, at least in critical sites, with battery back-up to provide continuous service in the event of a commercial power outage. The equipment also appeared to have resiliency in that standby hardware was used in critical elements of the network. The tower infrastructure itself appeared to be designed to standards appropriate to high wind zone as expected within the region.

In St. Lucia, approximately 60% of the tower sites are served with copper-based backhaul services such T1/E1 or other TDM based transport services. At the time of this study, 17 sites were served with fiber optics and 15 served with microwave. As the market demands and LIME moves to higher capacity wireless technologies such as LTE and LTE plus, sites served with copper and microwave will need to be upgraded to fiber optic services as the previous technologies have limitations in capacity.

LIME indicated that they anticipate deploying HSPA+ or Evolved High Speed Packet Access technology on a select number of sites by the end of 2012. It was understood that approximately 20% of LIME's existing sites would be upgraded to HSPA+ technology serving the population centers of Castries, Rodney Bay (including Bay Walk Mall), Corinth, Margot, Soufriere and Vieux Fort. This should begin to stimulate the mobile data market and smart phones as it would be expected Digicel to deploy similar services to remain competitive.

Figure 22 - LIME Fiber Optic Network (St. Lucia)

Though LIME is planning to market this new technology as 4G service, technically it doesn't meet the minimum requirements as 4th Generation Wireless Services or 4G. In March 2008, the International Telecommunications Union-Radio communications sector (ITU-R) specified a set of requirements for 4G standards, named the International Mobile Telecommunications Advanced (IMT-Advanced) specification, setting peak speed requirements for 4G service at 100 megabits per second (Mbit/s) for high mobility communication (such as from trains and cars) and 1 gigabit per second (Gbit/s) for low mobility communication (such as pedestrians and stationary users).[14]

HSPA+ provides theoretical data rates up to 168 Megabits per second (Mbit/s) to the mobile device and 22 Mbit/s from the mobile device. Technically these are achieved through the use of a multiple-antenna technique known as MIMO (for "multiple-input and multiple-

[14] ITU, *global standard for international mobile telecommunications ´IMT-Advanced´*, Circular letter, ITU-R March 2008.

output") and higher order modulation schema (64QAM) or combining multiple cells into one with a technique known as Dual-Cell HSDPA.

In general, HSPA+ offer higher bitrates only in very good radio conditions (very close to cell tower) or if the terminal and network both support either MIMO or Dual-Cell HSDPA, which effectively use two parallel transmit channels with different technical implementations. The actual speed for a user will be lower.

4.3. St. Vincent and the Grenadines

The Team visited the Country of St. Vincent and the Grenadines in late April, 2012 to inventory the current status of broadband infrastructure within the Country, including the Grenadine Islands. In addition to meetings and field visits in St. Vincent, the Team spent a day in the Grenadine Islands meeting with Government Leadership to understand the current state of Broadband Infrastructure throughout the Islands as well as some of the current services offered. Meetings were held with Government Stakeholders and Service Providers in order to develop a clear understanding of imbedded infrastructure, technologies and the current Broadband services offered by this infrastructure as well as future plans and projects.

4.3.1. Sector performance

With an 11.49 per cent contribution to GDP, the communication sector was the fifth most significant economic activity on Saint Vincent and the Grenadines in 2010 (latest ECTEL review period).

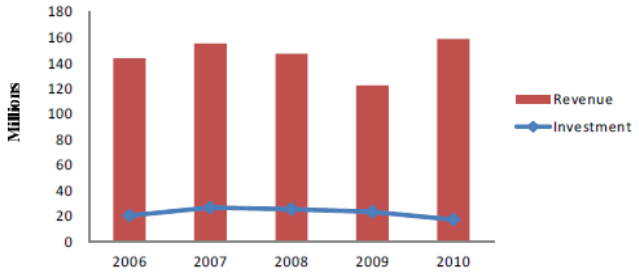

Figure 23 - Revenue and Investment in St. Lucia[15]

4.3.2. Domestic Fixed Voice Service

[15] *ECTEL/Operators, includes ECTEL's estimates where ECTEL does not receive data from operators*

Karib Cable launched its fixed voice service in 2008 resulting in two fixed voice operators offering service in St Vincent and the Grenadines. Despite the presence of an alternative provider in the fixed voice market, overall fixed voice subscription numbers continued to fall.

Despite the small reduction in the overall number of fixed lines market, there was a modest increase in revenues. The rates for fixed line access and calls offered by the incumbent LIME are regulated under a Price Cap Plan (PCP).

4.3.3. Domestic Mobile Service

Domestic mobile services grew a further six per cent to more than 123,000 in 2010. This rise in subscriptions was influenced by a four per cent growth in the prepaid subscribers and a 44 per cent rise in postpaid subscriptions which accounted for four per cent of total subscriptions. The increase in subscriptions moved the mobile penetration rate up 7.6 per cent to 123.6 per cent.

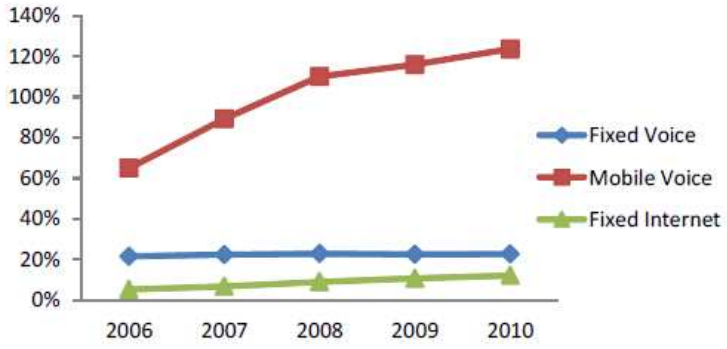

Figure 24 - Telecom Service Penetration in St. Vincent, Period Ending March 2010[16]

4.3.4. International Voice Service

Recent trends in volumes have shown a general decline in activity from fixed and mobile networks for outgoing international calls.

4.3.5. Broadband Internet Services

[16] *Source ECTEL/Operators, includes ECTEL's estimates where ECTEL does not receive data from operators*

Number of subscribers of fixed Internet and broadband showed at March 2010 a 12 percent increase from the period ended March 2009. The overall increase in subscription was fuelled by increased subscriptions to cable and ADSL broadband Internet services.

The number of subscribers to dial-up service dropped to fewer than 300 by the end of March 2010, a 21 percent reduction from the number of subscribers to the service at March 2009. This trend reflected continued customer demand for faster Internet access service.

Second generation mobile Internet access was available to mobile subscribers using to mobile subscribers using GPRS and EDGE technology, and by late 2010 mobile operators offered customers the option of purchasing data bundles by sending a text message to the provider to activate the service. However, it remained difficult to track the true number of mobile Internet users on the island, as any mobile subscriber with an Internet ready handset could access mobile Internet service without needing a separate subscription for data services.

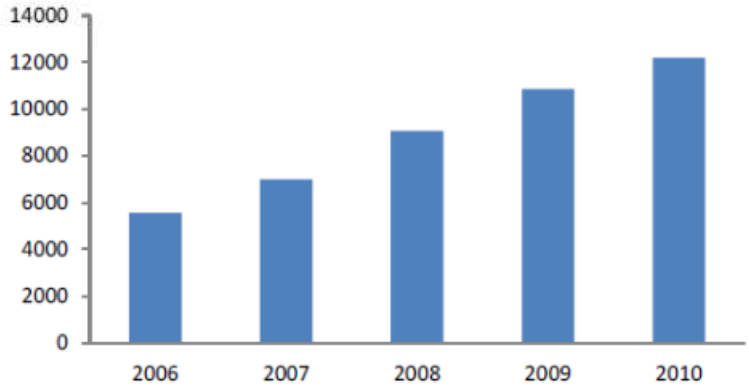

Figure 25 - Internet Subscribers in St. Vincent, Period ending March 2010[17]

4.3.6. Service Providers - Fixed

St. Lucia is served by two primary fixed telephony service providers, LIME and Karib Cable.

[17] *ECTEL/Operators, includes ECTEL's estimates where ECTEL does not receive data from operators*

LIME, an acronym for 'Landline, Internet, Mobile, Entertainment', is a communications provider owned by the British based Cable & Wireless Communications plc operating as the native incumbent landline telecommunications service provider in St. Vincent. In addition to operations in St. Vincent, LIME operates in Anguilla, Antigua & Barbuda, Barbados, British Virgin Islands, Cayman Islands, Dominica, Grenada, Jamaica, Montserrat, St. Kitts & Nevis, St. Lucia, St. Vincent & the Grenadines and Turks & Caicos.

Main Service Providers	International	C&W (LIME) Southern Caribbean Fiber
	Fixed line	C&W (LIME) Karib Cable
	Mobile	C&W (LIME) Digicel
	Internet	C&W (LIME) Karib Cable

Figure 26 - Active Service Providers - St. Lucia

The company is formed from the integrated businesses of Cable & Wireless in the Caribbean which adopted the LIME name on 3 November 2008. In 2010, Cable & Wireless Worldwide demerged Cable & Wireless Communications into an independently listed company.

LIME offers local and International telephony services, Broadband services for residential subscribers and telephony, dedicated Internet Access, Hosting, Global MPLS and Metro Ethernet for businesses subscribers. Below a rate card from Broadband Internet services.

LIME Broadband Internet Rate Card (St. Lucia)[18] *(in US $)*			
1.0 / .256 Mbps	**2.0 / .512 Mbps**	**3.0 / .768 Mbps**	**4.0 / .768 Mbps**
$7.40	**$31.48**	**$57.41**	**94.44**

Figure 27 - LIME Internet Rate Card (St. Lucia)

[18] LIME, St. Lucia Web Site, 2012

Plan	Speed DL (Mbps)	Speed UL (kbps)	Monthly Charge*
Mega	1	256	$90.85/ $113.85
Mega PLUS	2	512	$171.35/$194.35
Mega MAX	3	768	$286.35/$309.35

LIME Plans (** 1 year contract vs. no contract)*

Plan	Speed DL (Mbps)	Monthly Charge
Bronze	1.1	$90.85
Silver	2.2	$182.85
Gold	3.3	$309.35
Platinum	4.4	$573.85

Karib Plans

Karib Cable ("Cable") is the only fixed wired base provider of Triple-Play services or Telephone, TV and Broadband Internet services.

Karib Cable is owned by St. Vincent-based KelCom International and in addition to their network in St. Lucia; they operate telecommunications systems in St. Vincent, Antigua and Barbados.

In the mobile segment, mobile competition started in 2003, when Digicel and AT&T entered the market. These operators were also allowed to provide International services, which lead to a significant drop in call prices. In 2004, AT&T Wireless sold its Caribbean operations to Cingular Wireless which in turn sold operations to Digicel the following year. As a result, there are only two mobile providers in the Country; LIME (previously Cable & Wireless) with TDMA and GSM 850 network and Digicel operating its own GSM 900/1800/1900 and the GMS 900/1900 network acquired from Cingular.

4.3.7. Telecommunications Licenses

Type of Licence	Applicant	Date Granted	Date Frequency Granted
Fixed Public Telecommunications	21st Century Telcom Network (Caribbean) Ltd	February 19, 2008	
	Digicel Limited	October 13, 2006	
	Kelcom International Ltd. (Karib Kable)	November 21, 2003	February 5, 2004
	Cable & Wirelss (West Indies) Ltd	October 9, 2001	February 11, 2002
			October 7, 2003
			June 4, 2002
Public Mobile Telecommunications	Cable & Wireless Caribbean Cellular (St. Vincent and the Grenadines) Ltd	October 9, 2001	October 9, 2001
			July 10, 2003
	Wireless Ventures (St. Vincent) Ltd	October 29, 2002	May 29, 2003
	Digicel Limited	September 12, 2002	
Internet Network and Services	Cable & Wireless (West Indies) Limited	October 9, 2001	
	21st Century Telecoms Network (Caribbean) Ltd	January 18, 2008	
	Digicel Limited	October 12, 2006	
Submarine Cable Landing	Southern Caribbean Fiber	December 29, 2006	

Figure 28 - License Register, St. Vincent[19]

4.3.8. Broadband Adoption

No report or national survey identifying broadband gaps and adoption patterns was available for St. Vincent and the Grenadines. Extensive discussions with public and private stakeholders during field visits led to important conclusions about current levels of broadband availability and adoption.

- Coverage does not seem a problem; broadband access is available island-wide.
- Rates might be a problem, and especially the issue may be the paying model, i.e. post paid compared to pre-pay. VAT is 15% years ago was removed for voice (fixed and mobile) telephony on the basic package with little effect on service uptake.

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According to NTRC, the national Regulator, the best option to bring broadband in all homes, may consist in the use of some financial incentives to push mobile providers to 4G or at least 3G. The government has issued frequencies; LIME has a Next Generation Network

[19] ECTEL

(NGN) in place that could be turned on providing broadband access to 20,000 households (Two thirds of St. Vincent households).

Wireless carriers still make 85% of their revenue from (mobile) voice so there is no incentive to spend money to upgrade to 4G, which would provide free voice to customers via VOIP application. A strategy may be raising USF and license fees on non-data revenue in a phase approach.

4.4. Technology Assessment

The Country of St. Vincent and the Grenadine Islands are serviced by two primary land-based telecommunications service providers (LIME and Karib Cable) who both appear to offer the majority of the Country (including the inhabited Islands of the Grenadines) with ADSL and Cable Modem (DOCSIS 2.0) broadband services and two primary wireless / cellular service providers (LIME and Digicel). Though there are other, smaller telecommunications and Internet Service Provider license holders, providers of primarily local Wi-Fi services, only telecommunication providers with high-capacity terrestrial, submarine or wireless telecommunications infrastructure were the primary focus of this Study.

Grenadines are currently served with microwave radio. Karib Cable, LIME and Digicel all have microwave links from St. Vincent into Bequia and continuing through the inhabited Islands (6 main Islands) of the Grenadines.

Terrestrial Infrastructure

As in both Grenada and St. Lucia, the two primary public fiber optic cable infrastructures are deployed in two uniquely different methods with one being primarily aerial and the other fiber optic system being mostly underground through legacy duct / conduit system. These deployment methods provide for a distinctive resiliency whereas the aerial infrastructure might be susceptible to winds and flying debris in harsh weather and the underground infrastructure is susceptible to landslides and road washouts during heavy rains. The chances of failures of both networks within the same geographical area are low. This unique placement of fiber optic infrastructure, coupled with self-healing ring architecture, should provide the Country with a highly resilient fiber optic backbone infrastructure. This resiliency uniqueness should be considered as part of detail designs of Government networks where high availability is required.

There are local fiber networks within the Grenadines as well, though transport to the Islands is via microwave. The electric utility has some fiber throughout the Island to support electric grid control, though none of this fiber optic infrastructure has been made available for general broadband services.

Karib operates a Hybrid Fiber Coaxial Network in that the primary backbone would be based on fiber optic technology and the service distribution and drops or "last mile" would typically be coaxial cable.

Karib utilizes a Cable Modem Terminating System or CMTS to provide Internet and digital or Internet Protocol Telephone services ("VoIP"). The CMTS is currently operating within the Data over Cable Systems Interface Specification (DOCSIS) version 2.0 and deliver data rates of 50 megabits per second downstream and 27 megabits per second upstream and typically shared with up to 1,000 households or connections.
Karib is the only provider on the Island that offers a "triple-play" service in that they provide television, broadband Internet and digital telephone services (Voice over Internet Protocol or "VoIP")

LIME has a significant fiber optic network throughout the Country. Though this network does not completely circumvent the Island, due primarily to lack of an east -west Road system in the north part of the Island, the fiber network deployed by LIME appears to have multiple self-healing geo-diverse rings. It appears from field visits that a 48-count fiber cable has been installed along all primary roads utilizing what appeared to be a legacy underground telecommunications duct bank, possibly installed prior to the liberalization of telecommunications services with the Country.

LIME has deployed a Next Generation Network Platform allowing LIME operators to rapidly provision a multitude of services, including telephony and Broadband. LIME has deployed 11 Core IP Switches throughout the Country with Multi-Service Access Nodes ("MSAN") to deliver business and residential service. There appears to approximately 31 MSANs deployed with more than 25,000 subscriber ports, typically located in population centers throughout the Country. MSANs connect customers' telephone lines to the core network, to provide telephone, ISDN, and broadband such as DSL all from a single technology platform.

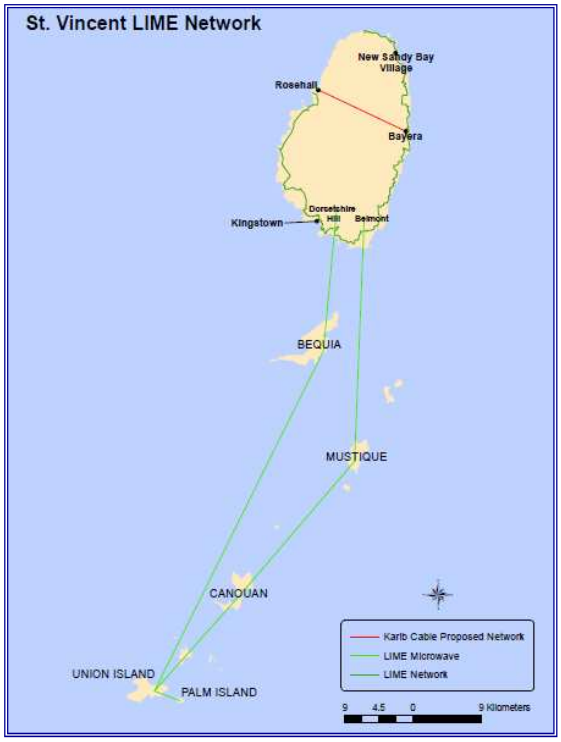


Figure 29 - Grenadines Microwave Network

LIME's core network in the Country is based on primarily on STM-16 (or 900 Mbps Synchronous Optical System) transport systems connecting each of the core switches (mentioned above) with some Gigabit Ethernet transport circuit serving some of the core / MSAN's.

LIME uses microwave radio technology to serve the Grenadine Islands. LIME has two diverse tower sites (Belmont and Dorsetshire) in St. Vincent with diverse microwave routes to Bequia and Mustique. The microwave system creates a ring through the Grenadine Islands, continuing south to Canouan, Union Island and back to Bequia with spurs serving Mayreau, Palm Island and Petit St. Vincent. This microwave system and capacity analysis is further addressed within the Section 6.6 "Gap Analysis".

LIME has a robust network throughout the Grenadine Islands with fiber optic systems in Bequia, Mustique and Canouan.

By referencing network details from field studies and documents provided by LIME, it can be assumed that the Country backbone within St. Vincent is currently design to support more than 1 Gigabit of backbone capacity (STM-16) with some Gigabit services in select areas. In general, this fiber optic backbone within the Country has the ability to scale beyond any foreseeable traffic demands utilizing currently available technologies, including wave division multiplexing (WDM), though technology upgrades maybe required for higher capacity platforms.

Wireless Infrastructure

LIME currently operates a TDMA and GSM 850 Network with approximately 35 GSM tower sites serving almost the entire Country with mobile wireless services. As evidenced by a site visit with LIME personnel in Grenada, it can be assumed that the same design principals are deployed in all markets within the region.

It was learned during the site visit that LIME installs emergency generators, at least in critical sites, with battery back-up to provide continuous service in the event of a commercial power outage. The equipment also appeared to have resiliency in that standby hardware was used in critical elements of the network.

The tower infrastructure itself appeared to be designed to standards appropriate to high wind zone as expected within the region.

In St. Vincent, approximately 40% of the tower sites are served with copper-based backhaul services such T1/E1 or other TDM based transport services. At the time of this study, 12 sites were served with fiber optics and 9 served with microwave. As the market demands and LIME moves to higher capacity wireless technologies such as LTE and LTE plus, sites served with copper and microwave will need to be upgraded to fiber optic services as the previous technologies have limitations in capacity.

LIME indicated that they anticipate deploying HSPA+ or Evolved High Speed Packet Access technology on a select number of sites by the end of 2012. This should begin to stimulate the mobile data market and smart phones as it would be expected Digicel to deploy similar services to remain competitive.

Though LIME is planning to market this new technology as 4G service, technically it doesn't meet the minimum requirements as 4th Generation Wireless Services or 4G. In March 2008, the International Telecommunications Union-Radio communications sector (ITU-R) specified a set of requirements for 4G standards, named the International Mobile Telecommunications Advanced (IMT-Advanced) specification, setting peak speed

requirements for 4G service at 100 megabits per second (Mbit/s) for high mobility communication (such as from trains and cars) and 1 gigabit per second (Gbit/s) for low mobility communication (such as pedestrians and stationary users).[20]

HSPA+ provides theoretical data rates up to 168 Megabits per second (Mbit/s) to the mobile device and 22 Mbit/s from the mobile device. Technically these are achieved through the use of a multiple-antenna technique known as MIMO (for "multiple-input and multiple-output") and higher order modulation schema (64QAM) or combining multiple cells into one with a technique known as Dual-Cell HSDPA.

In general, HSPA+ offer higher bitrates only in very good radio conditions (very close to cell tower) or if the terminal and network both support either MIMO or Dual-Cell HSDPA, which effectively use two parallel transmit channels with different technical implementations. The actual speed for a user will be lower.

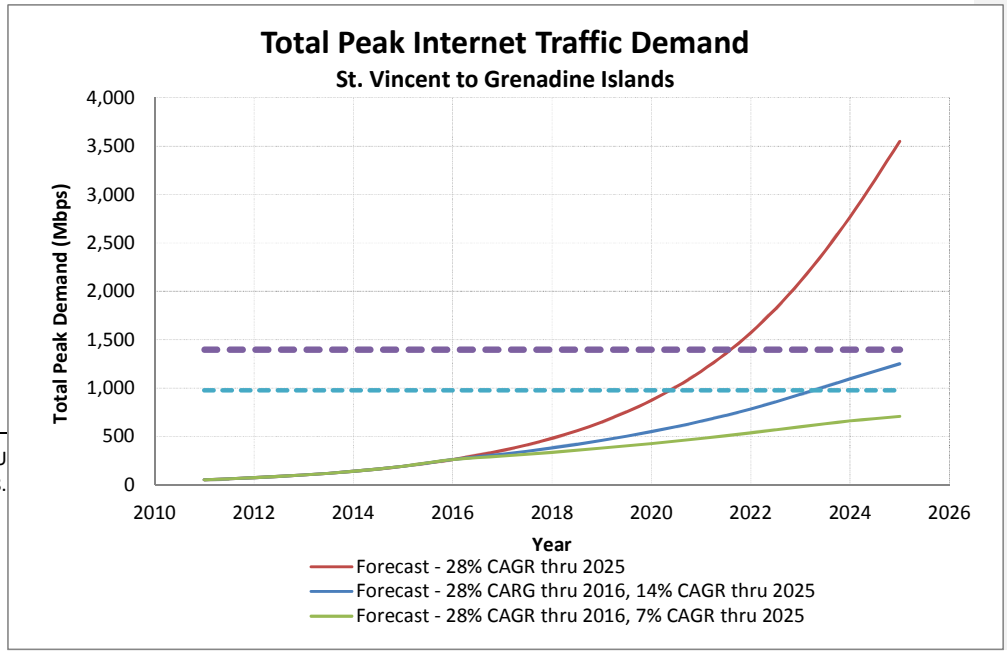
4.4.1. Gap Analysis

St. Vincent to Grenadines Islands – Submarine Fiber Optic System

The Grenadine Islands are presently served with microwave radio technology. Both landline based providers as well as the wireless carriers utilize microwave technology to serve this region as described within the Existing Infrastructure Assessment Section of this Report.

As part of the analysis, a study of the availa

ble microwave spectrum was preformed, irrespective of the current systems deployed. Spectrum, currently in use or not, is the limiting factor in expanding capacity into the Islands.



[20] ITU 2008.

The study determined that this particular route, including multiple site locations on each of the route and traversing through the inhabited Islands of the Grenadines, could support up to 9 x OC3 or approximately 1.395 Gigabit per second of Internet Protocol ("IP") traffic. This forecasted capacity was further discounted by 30% (Realized Microwave Capacity) to account for traffic inefficiencies with 3 discrete circuits, one for each of the service providers in the region.

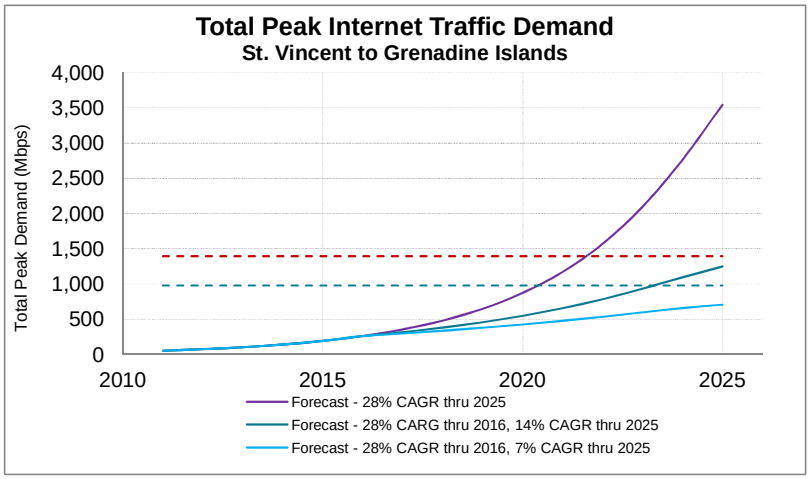


Figure 30 - Total Peak Internet Traffic Demand (St. Vincent to Grenadines)

In addition to microwave spectrum analysis, a thorough demand analysis was performed to ascertain current and forecasted IP traffic demands for the Grenadine Islands. This study is similar to the Country-Wide demand forecast as presented in the Financial and Economic Assessment of this Report. As part of the Demand Forecast analysis, current households and projected households were considered as well as existing Internet and telecommunications services (including DSL, Cable Broadband, landline telephony and mobile serves services) and their required bandwidth and forecasts.

It was determined as part of this two-prong capacity analysis that the existing microwave spectrum could support the traffic requirement between St. Vincent and the Grenadines through the year of 2019 (see chart below). Again, the study looked specifically at spectrum and not the current microwave system designs, radios or topologies currently deployed. To meet the forecasted capacity of 1.395 Gbps on this route, spectrum rechanneling, radio upgrades and topology changes may be required to meet these capacity forecasts.

New Submarine Fiber Optic System

To relieve the eventual capacity constraints on the microwave systems between St. Vincent and the Grenadine Islands, a new submarine fiber optic cable is proposed. This proposed cable could land at existing cable points (specifically in St. Vincent) and travel south to Bequia. From Bequia, the cable system would route to Mustique, then on to Canouan, Mayreau and terminate in Union Island.

A Site	B Site	Total Miles	Estimated Cost
St. Vincent	Bequia	10.7	$1,157,774
Bequia	Mustique	20.0	$2,164,064
Mustique	Canouan	15.2	$1,644,688
Canouan	Mayreau	7.3	$789,883
Mayreau	Union Island	4.1	$443,633
	Totals	**57.3**	**$6,200,042**
Annual Operating Expenses			**$155,000**
Annual Projected Revenue (@ yr5)			**$540,000**
Projected Break-Even (in Years)			***16.1***

Figure 31 - Grenadines Submarine Costs Analysis

We provide below the proforma of the proposed submarine fiber optic cable, connecting Grenada and Saint Vincent.