



# IX.PR

Internet Exchange Puerto Rico  
“ in Peer we trust ”

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# Appendix

- The research
- The results
- Why IX.PR?
- Examples..
- The Real Problems
- How IX.PR was founded?
- How IX.PR is supported?
- Membership
- PR Internet
- Caribbean Internet



# The Research

- Six months of NetFlow statistics from several of Puerto Rico's large networks (>50Mbps).
  - University of Puerto Rico
    - One of the largest American universities.
    - Arecibo Observatory (SETI@HOME) is attached to this network.
  - A large ISP Serving Puerto Rico and the Dominican Republic
    - Large corporate and governmental customers, and %35 of the island's residential market via cable.
  - Smaller ISPs
    - These ISPs usually offer business services including VoIP, and hosting.



# The Results of the Research

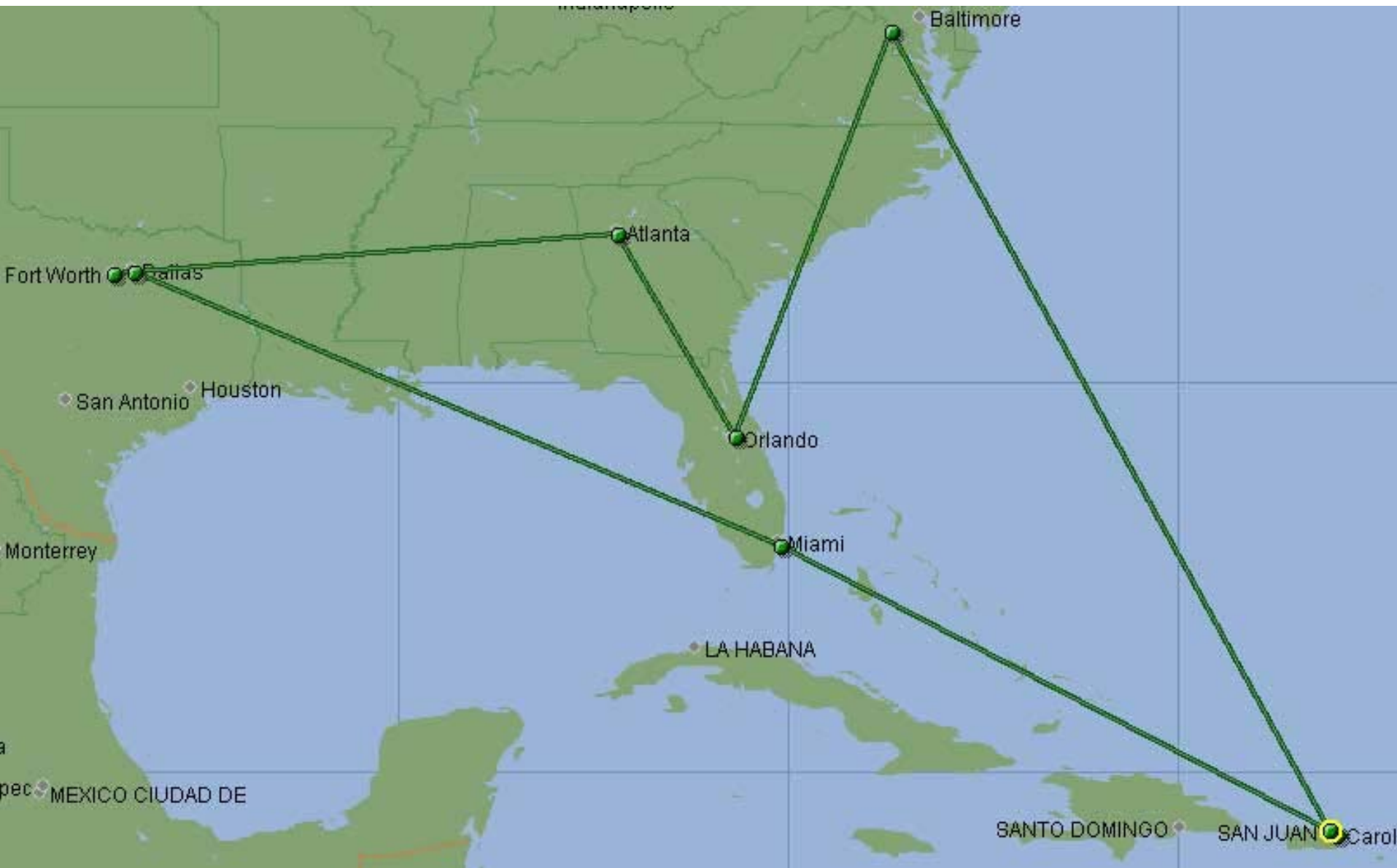
- As much as %50 of Puerto Rican ISPs' traffic leaves Puerto Rico before returning to another ISP on the island.
- Prior to the establishment of IX.PR, there was no peering on-island. All ISPs were peering in Miami.
- Very high demand of local communication tools that require a lot of bandwidth such as;
  - Peer to Peer Applications
  - Online Games
  - Voice / Video Conference
  - VoIP



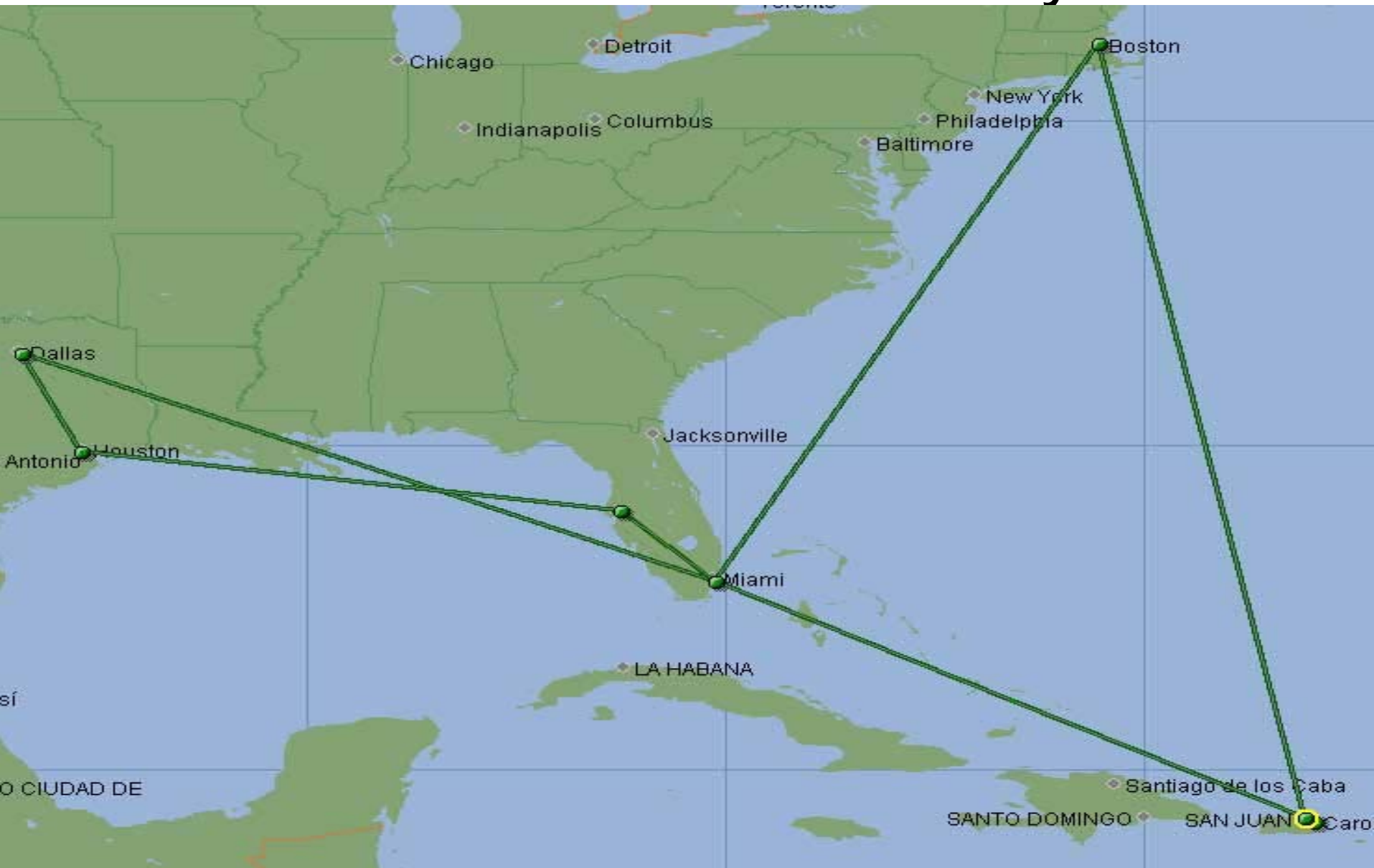
# Why IX.PR?

- The amount of bandwidth & fiber that's being wasted due to high demand of local communication and not having peering between service providers.
- High Latency between the networks.
- Let's see some examples...

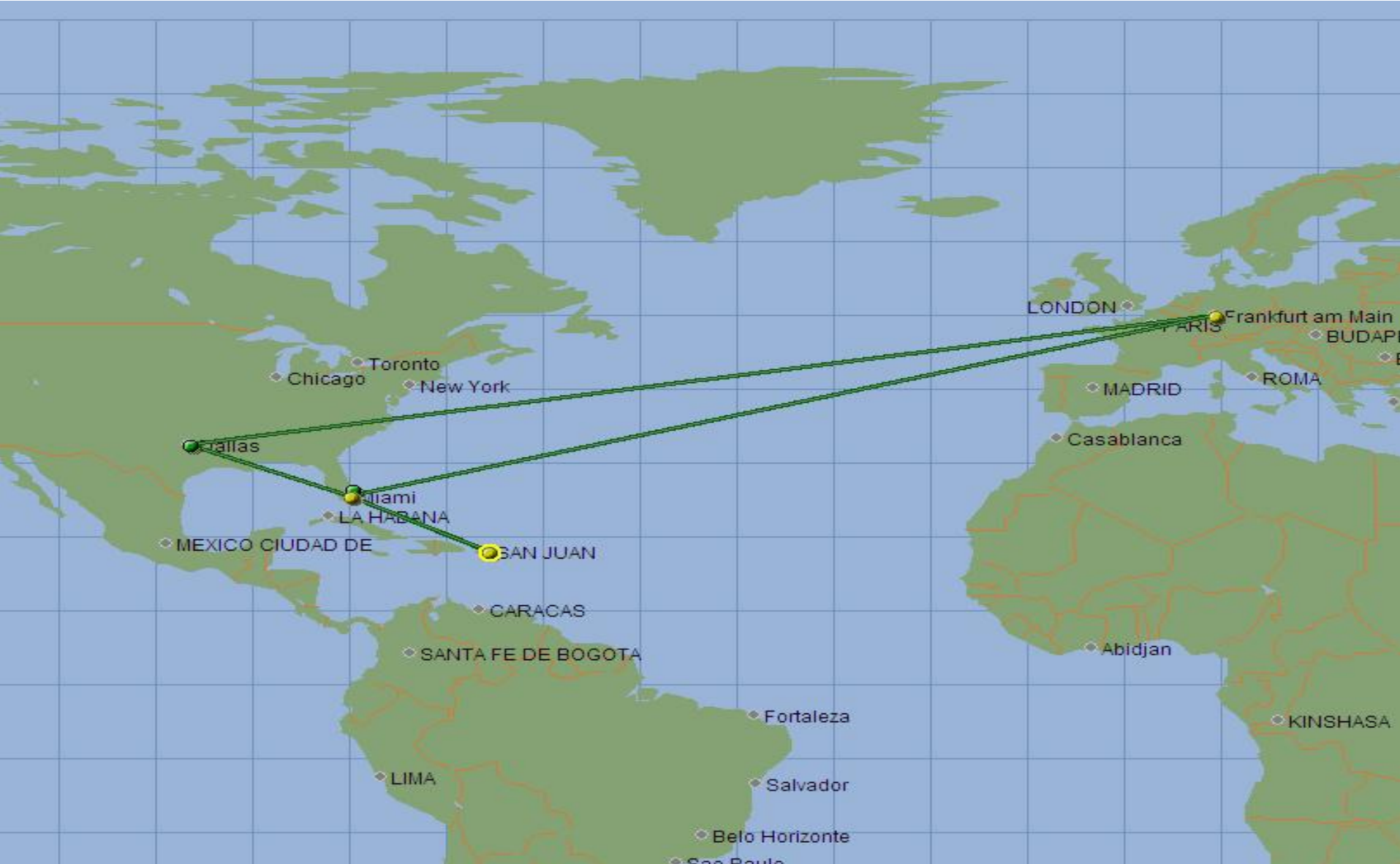
# A Large ISP to Government Site



# A Cable Internet to University of PR

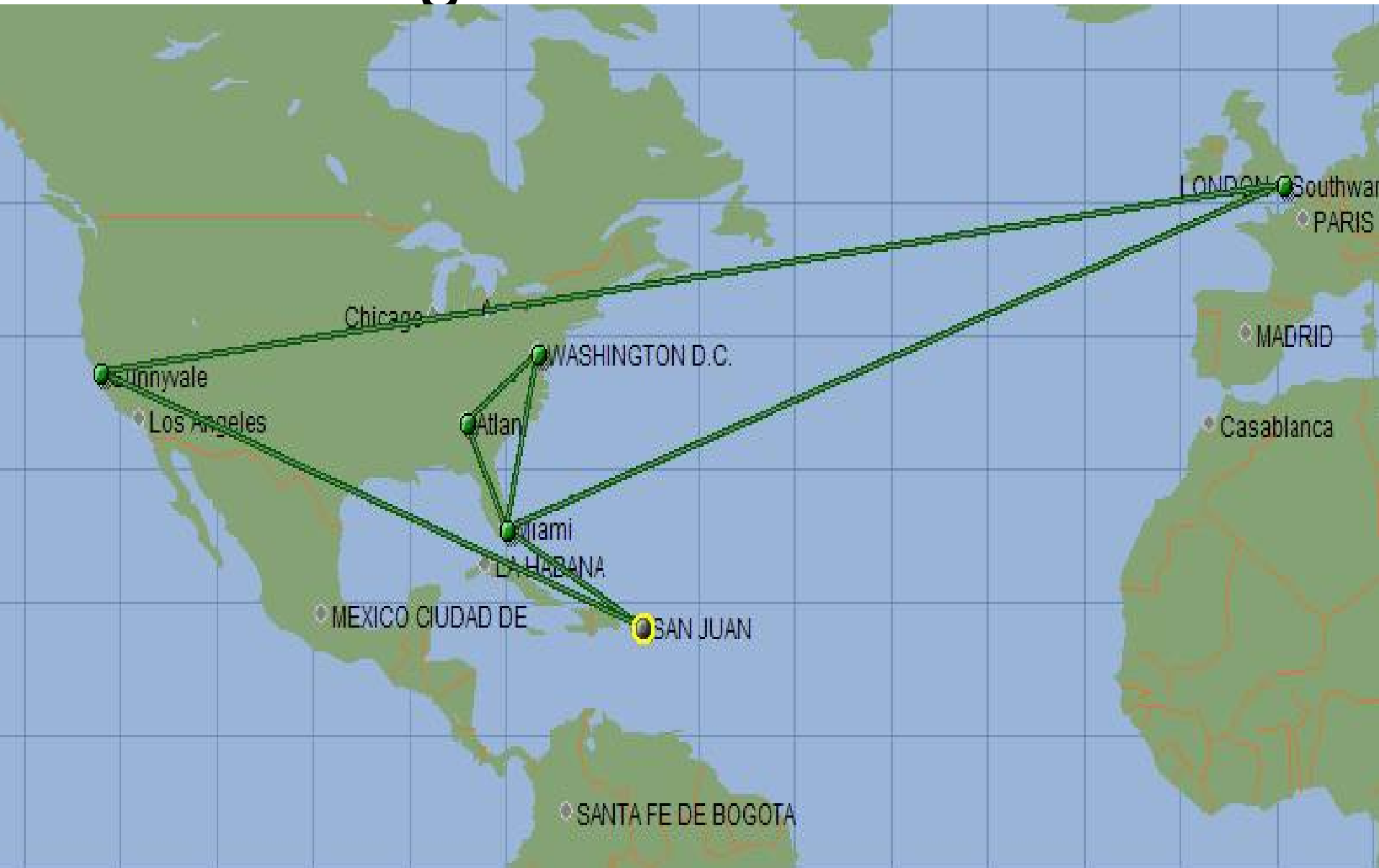


# Two Cable Internet Company





# Two Large ISPs in Puerto Rico





# The real problems:

- Some ISPs don't understand Internet economics and are afraid that their competitors will gain disproportionately.
- Many ISPs are dependent upon senior engineers who work remotely from the mainland U.S. or Europe, and are out-of-touch with the situation on the ground. Conversely, when local engineers gain experience, they often emigrate.
- There's a general misconception that most content consists of web pages hosted overseas, while in reality, local applications like peer-to-peer file sharing, VoIP, and online gaming consume a far larger share of bandwidth.



# The real problems:

- Both ISPs and customers in the Caribbean market tend to place a higher priority on reducing costs than on increasing reliability.
  - All the campuses of the University of Puerto Rico are single-homed through one OC-3 to a single ISP.
- Monopoly control is still prevalent in both local loop and international bandwidth, throughout the Caribbean. (Excluding PR)

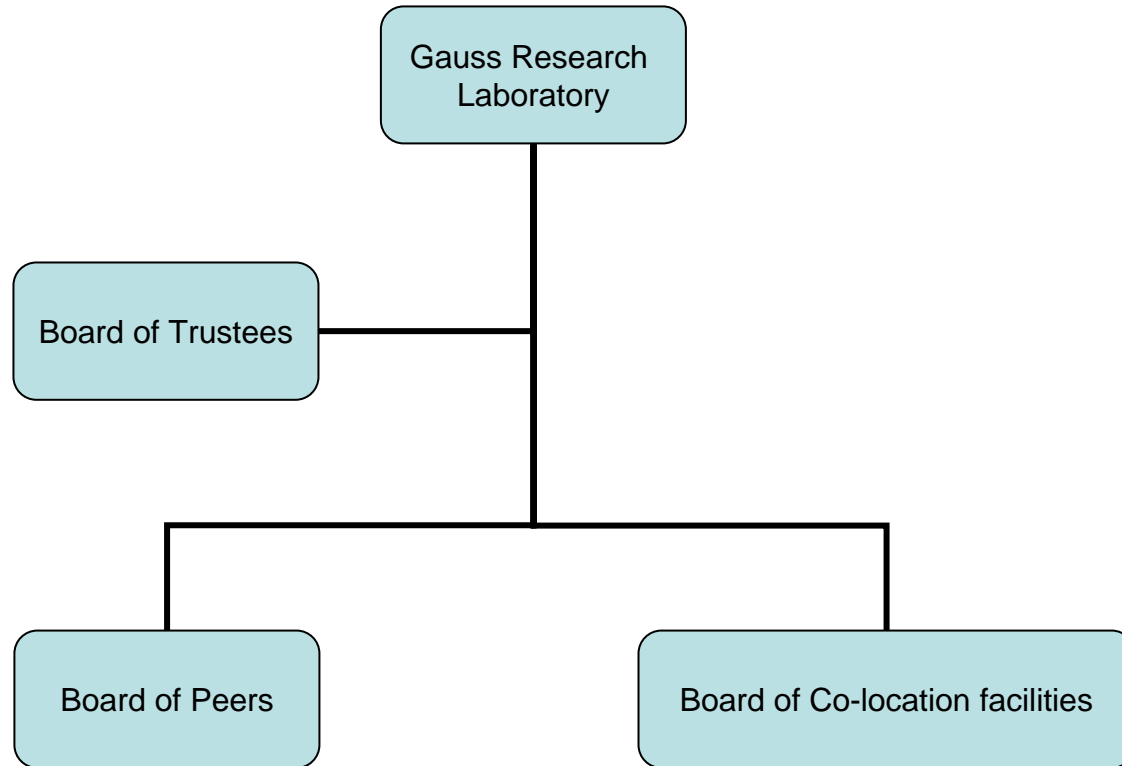


# How was IX.PR founded?

- Hosted by the Gauss Research Laboratory of the University of Puerto Rico
  - Dr. Oscar Moreno, the founder & director of Gauss Research Laboratory
    - Puerto Rican Internet pioneer
    - Connected UPR to Internet2
    - Provided institutional sponsorship for the IX.PR
  - Mehmet Akcin, manager of the Internet Exchange of Puerto Rico.
    - Developed and promoted the IX.PR
    - Day-to-day technical management of the exchange



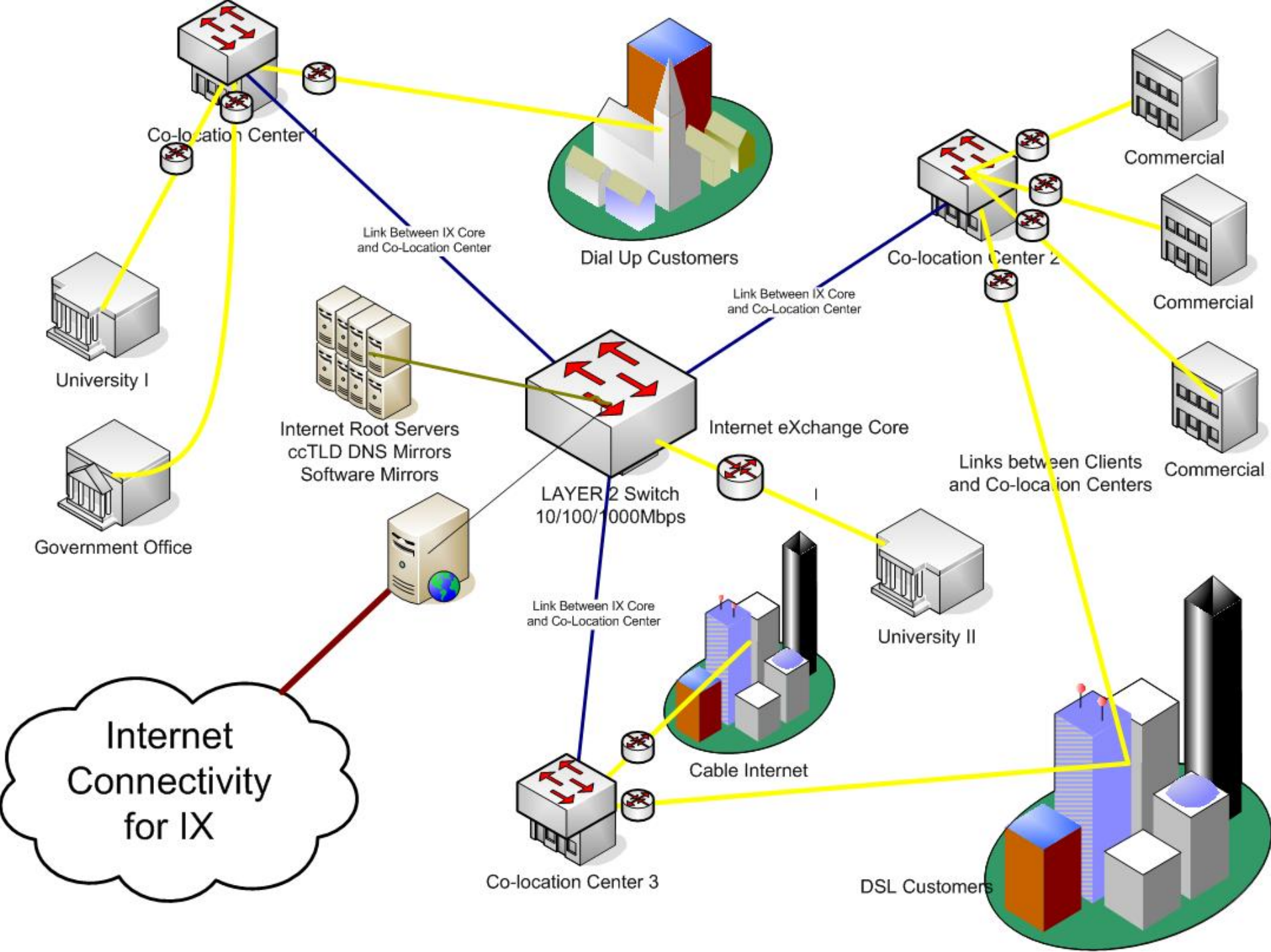
# Organizational Chart of IX.PR





# How is IX.PR supported?

- Not-for-profit organization.
- Core location and power are provided by University of Puerto Rico, Rio Piedras Campus, College of Natural Sciences, at no cost
  - A specially designed datacenter
  - Backup power to support two weeks of non-stop operation
  - Main and two backup air conditioning systems
  - Monitoring and alarm system
- Core Equipment was donated by Packet Clearing House (PCH)
  - 24-ports 10/100/1000Mbps Ethernet switch
- Monitoring servers donated and hosted by .PR ccTLD registry
  - E-mail Server
  - Web & Database Servers
- Labor, organizational assistance, and continuity are provided by Gauss Research Laboratory, the institutional sponsor.





# Membership

- Currently no membership fees
- NIC.PR ccTLD registry covering initial expenses
- Future costs to be shared among the members
  - The fee for monthly payments and joining fee will be decided by the members.
  - Everybody will be paying the membership fee even if they have joined earlier.
  - Fee will be based on the amount of the source they are using, definitely not for profit. Just for being able to operate the Internet Exchange daily operations properly.





# Participants

- Largest Puerto Rican ISPs are currently participating. (Or declared their intention of participating)
- Universities are in the process of connecting
- This will create a de-facto island-wide research & education network
- Those universities will also be able to get Internet2 access after making appropriate agreements with HPCF



# IX.PR Founding Members

- University of Puerto Rico – Biggest non-ISP network in Caribbean/PR
- Ultracom – The Company that owns %80 of fiber-optic cable which land to Puerto Rico
- Centennial – Large ISP
- Caribe.Net – Mid-Large ISP
- Prepa – The Power Company of Puerto Rico which will connect the government to the IX via fiber.



# Members in Process of Connecting

- Inter American University of Puerto Rico – 2<sup>nd</sup> largest University
  - Sagrado Corazon University - University
  - Polytechnic University – 2<sup>nd</sup> large Latin American Engineering University in US
  - University of Metropolitan – Another University
  - Puerto Rico Telephone Company – Largest PR ISP, Telephone Company
  - Adelphia Communications – Large Cable TV/Internet Company
  - Liberty Cable TV – Large Cable TV/Internet Company
  - University of Phoenix – a well known university
  - Banco Popular – The largest PR Bank, as well as largest PR Company
  - Ice Networks – A medium size ISP
  - Nustream Communications – A medium size ISP
  - Telefonica España – Who doesn't know them?
  - San Juan Cable, LLC – Medium Size ISP
  - Sprint – do I need to explain? ☺
  - Neptuno – A medium size ISP
- some small networks who are in the process of getting their AS numbers, and establishing links to us.



# Planned Services

- Route-server
- Looking-glass
- Measurement and instrumentation
- Network Time Protocol
- Web cache parent
- News server
- Root server mirror
- Software Mirrors
  - SourceForge
  - Linux Mirrors.



# Puerto Rican Internet

- Three main companies operate fiber networks:
  - PRTC
  - Centennial
  - PrePA
- High speed Internet is ubiquitous:
  - 120K + DSL Customers (2005 est.)
  - 80K + Cable Internet Customers (2005 est.)
- All schools, kindergarden through university, have computer laboratories with high speed Internet connections.
- More than 80% of students age 13 and up have e-mail and check it at least once per week.
- 1 Million Internet users in a total population of 4 million.



# Top 10 Networks Serving PR

- 1 NTT America [AS 2914]
- 2 Centennial [AS 11992]
- 3 UUNET [AS 701]
- 4 Level 3 [AS 3356]
- 5 University of Puerto Rico [AS 5786]
- 6 Sprint [AS 1239]
- 7 New World Network [AS 23520]
- 8 Qwest [AS 209]
- 9 San Juan Cable [AS 36423]
- 10 Telefonica [AS 12956]



# Puerto Rico in the Caribbean

- Statistics show Puerto Rico and Jamaica as the largest Caribbean Internet users. Jamaica has had tremendous growth in 2003-2005.
- More than 1 million Internet users in a total population of 4 million
  - More Internet users than some European countries: Lithuania , Slovenia , Latvia , Estonia , Moldova.

## Internet Usage in the Caribbean

<u>THE CARIBBEAN</u>	Population ( 2006 Est. )	Internet Users, Latest Data	% Population ( Penetration )	% Users in Carib.	Use Growth ( 2000-2005 )
<a href="#"><u>Anquilla</u></a>	13,155	3,000	22.8 %	0.1 %	226.4 %
<a href="#"><u>Antigua &amp; Barbuda</u></a>	71,823	20,000	27.8 %	0.5 %	300.0 %
<a href="#"><u>Aruba</u></a>	70,102	24,000	34.2 %	0.6 %	500.0 %
<a href="#"><u>Bahamas</u></a>	330,602	93,000	28.1 %	2.2 %	609.9 %
<a href="#"><u>Barbados</u></a>	266,731	150,000	56.2 %	3.5 %	2,400.0 %
<a href="#"><u>British Virgin Islands</u></a>	21,998	4,000	18.2 %	0.1 %	0.0 %
<a href="#"><u>Cayman Islands</u></a>	48,859	9,909	20.3 %	0.2 %	27.0 %
<a href="#"><u>Cuba</u></a>	11,326,354	150,000	1.3 %	3.5 %	150.0 %
<a href="#"><u>Dominica</u></a>	71,369	18,500	25.9 %	0.4 %	825.0 %
<a href="#"><u>Dominican Republic</u></a>	9,119,149	800,000	8.8 %	18.6 %	1,354.5 %
<a href="#"><u>Grenada</u></a>	100,429	8,000	8.0 %	0.2 %	95.1 %
<a href="#"><u>Guadeloupe</u></a>	453,877	79,000	17.4 %	1.8 %	887.5 %
<a href="#"><u>Haiti</u></a>	8,301,478	500,000	6.0 %	11.6 %	8,233.3 %
<a href="#"><u>Jamaica</u></a>	2,692,569	1,067,000	39.6 %	24.8 %	1,678.3 %
<a href="#"><u>Martinique</u></a>	397,928	107,000	26.9 %	2.5 %	2,040.0 %
<a href="#"><u>Monserrat</u></a>	4,798	-	-	-	n/a %
<a href="#"><u>Netherlands Antilles</u></a>	185,002	2,000	1.1 %	0.0 %	0.0 %
<a href="#"><u>Puerto Rico</u></a>	3,966,468	1,000,000	25.2 %	23.3 %	400.0 %
<a href="#"><u>St. Kitts &amp; Nevis</u></a>	39,487	10,000	25.3 %	0.2 %	400.0 %
<a href="#"><u>St. Vincent &amp; the Grenadines</u></a>	124,776	8,000	6.4 %	0.2 %	128.6 %
<a href="#"><u>Santa Lucia</u></a>	167,642	55,000	32.8 %	1.3 %	1,733.3 %
<a href="#"><u>Trinidad &amp; Tobago</u></a>	1,320,383	160,000	12.1 %	3.7 %	60.0 %
<a href="#"><u>Turks &amp; Caicos Islands</u></a>	32,337	-	-	-	n/a %
<a href="#"><u>Virgin Islands (US)</u></a>	112,320	30,000	26.7 %	0.7 %	150.0 %
<b>TOTAL the Caribbean</b>	39,239,636	4,298,409	11.0 %	100.0 %	668.4 %





# Caribbean-Wide Issues

- Many years ago companies made long term agreements with small island governments.
- They already offer the service that country needs. Usually in small Caribbean countries;
- Phone company = wireless company = cable TV company, and most of the time, they are the only provider in the country.
  - No real business growth possibility when you consider the population and market are quite small relative to other regions of the world
  - Many Caribbean countries still have anti-competitive regulatory regimes

# Thanks!

- RIPE(esp. Arife , Camilla , Joao) for allowing us to inform you people about the Internet in Caribbean and IX.PR
- PR ccTLD registry for financial support for us to travel and participate in this meeting.
- Bill Woodcock @ PCH.
- Todd Underwood @ Renesys for statistics.
- Mike @LINX.

# Questions

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