Introduction
Main Objectives of the Session
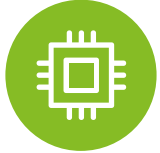
Present Trinidad and Tobago´s new Tier 4 Modular Data Centre

Provide a vision for a future regional collaboration model for improving access to Data Centre services in the Caribbean

Hold a Workshop session for reviewing and refining the proposed collaboration model

Introduction

Trinidad and Tobago has established digital development as a central part of its development, with a National ICT Plan with a clear set of objectives for the country
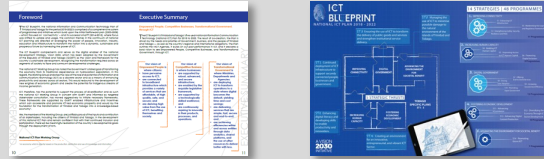
National Development Strategy 2016 - 2030, Vision 2030	National ICT Plan 2018 - 2022	Draft National Plan 2023 - 2027

Key Aspects

National Development Strategy 2016 - 2030, Vision 2030

T&T´s 2030 vision establishes people, good governance and excellence in services as **critical milestones for development:**

- The country aims to **strengthen ICT infrastructures** to improve **access to healthcare, education and other social services** in the country and **optimize the management of public services.**
- T&T will make greater use of **ICTs** to **increase the citizens´ degree of participation in public governance and decisions.**

National ICT Plan 2018 - 2022

The ICT blueprint was T**&T´s national ICT plan** and was driven by the **needs of the government, businesses and society** of T&T. It was conceived as a **support for the Vision 2030 document.**

- The strategy **set specific targets related to the adoption of ICTs** (e.g., 5% contribution of ICT to GDP)
- **5 strategic drivers to achieve the National Development Strategy 2016 – 2030** (Improving connectivity, increasing human capacity, digital government, fostering economic development, advancing the environment for societal benefit)

Draft National Plan 2023 - 2027

T&T has established **3 main aspirations for development** in line with the National ICT Plan:

- **Digital society**: Improve the population´s general IT skills and knowledge and adoption of emerging technologies.
- **Digital government**: Increase digital services in the public sector and facilitate access to citizens.
- **Digital economy**: Enhance productivity through digital technologies.

The Draft National Plan 2023 – 2027 establishes T&T´s ambition to position itself as a key actor in the Caribbean region´s digitalisation.

The Need For Advanced Data Solutions

Several aspects are driving the need for secure, reliable, and scalable data solutions in organisations

Operational Efficiency

Reliable and scalable data solutions enable organizations to **streamline their operations**. Efficient data management can lead to better decision-making, improved service delivery, and enhanced transparency and accountability.

Technological Advancements

Technology advancements like **cloud computing, AI, and big data analytics**, enable organizations to leverage data more effectively. Scalable solutions support adaption to evolving technological landscapes and integrate new tools and methodologies.

Data Volume & Complexity

Organizations handle vast and complex data from various sources, requiring sophisticated solutions to manage and analyze it effectively.

Security Concerns

With the rise in **cyber threats**, securing sensitive data is paramount. Organizations' data, often including individuals' information and financial details, must be protected to prevent severe consequences. Secure data solutions help guard against breaches and unauthorized access.

Regulatory Compliance

Organizations are subject to stringent regulations regarding data privacy and protection. **Data Sovereignty** and compliance with laws such as GDPR and other local regulations necessitates robust data management solutions that can ensure data is handled in accordance with legal requirements.

The Need For Advanced Data Solutions

Among these challenges, enforcing data sovereignty has become a major issue for service providers

CHALLENGES

- Data Volume and complexity
- Operational Efficiency
- Technological Advancements
- Security Concerns
- Regulatory Compliance

Data Sovereignty

Enforcing data sovereignty requires managing digital information according to the laws of the political jurisdictions where the data is collected or generated. In some cases, this enforcement requires not moving the data outside of the physical territory of origin or establishing a digital embassy.

Complex Data Management Technology	Cross-border Data Transfers	Large Data Loads	Ensuring Data Accuracy
Enforcing data sovereignty requires managing data differently depending on the original jurisdiction	**Sovereign data will be stored locally in the Tier 4 DC, requiring cross-border transfers**	**Managing large data volumes is challenging if the Data Center is not powerful enough**	**Maintaining data accuracy is a must when managing sovereign data of varied origins**
Complex technology is required to ensure data sovereignty when locally storing data with different sovereignties.	Cross border movement of sovereign data can lead to legal challenges, such as complying with both local and sovereign regulations.	Implementation must guarantee adequate scalability and flexibility, as well as top tier performance.	Complex sanity checks and frameworks need to be established in order to ensure the quality of the stored data.

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What is a Tier 4 Modular Data Center?

Tier 4 Data Centers stand out from other types of Data Centers, with the most relevant advantage being their significantly reduced downtime compared to the others

Tier 4 Data Centers offer the highest level of availability and redundancy:

- **Maximum protection** against failures and ensuring service continuity even under adverse circumstances
- **Complete redundancy** in power, cooling, network connectivity, and computing systems
- **Redundant** cooling **systems** and network equipment ensure continuous operation
- **99.995% or higher availability** (less than 0.4 hours of downtime per year)

Parameter	TIER 1	TIER 2	TIER 3	TIER 4
Uptime Guarantee	99.671%	99.741%	99.982%	99.995%
Annual Downtime	<28.8 hours	<22 hours	<1.6 hours	<26.3 minutes
Component Redundancy	None	Partial redundancy for power and cooling (partial N+1)	Complete N+1	Fault-tolerant (2N or 2N+1)
Simultaneous Maintenance	No	No	Partially	Yes
Price	$	$$	$$$	$$$$
Typical Client	Small businesses and startups with simple requirements	SMBs	Growing companies and large enterprises	Government entities and large corporations

The Government of T&T is currently designing and building a Tier 4 Modular Data Center in Phoenix Park that will complement the already existing Data Centers in T&T and the Caribbean to provide collaborative solutions to the region´s needs

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What is a Tier 4 Modular Data Center?

A Modular Data Center is a type of Container Data Center that is highly scalable and provides shorter delivery times when compared to traditional Data Centers

What Is The Difference Between a Container Data Center and a Traditional Data Center?

Reduced Implementation Time
Faster 'Time To Market' due to less civil work and quicker building permit acquisition

Lower CAPEX
Enables phased growth with optimized space, reducing upfront costs and avoiding overcapacity

Predictable Costs
Future costs are more predictable with fixed-module pricing and reduced depreciation

Flexible Availability
Different availability requirements can be met for each project's block/phase, with separate infrastructure

Easier Inspection
Factory pre-assembly ensures internal piping and electrical wiring are verified

The **global container Data Center market** reached **$10.8 billion** in **2023** and is projected to reach $59.5 billion by 2032, with an **annual growth rate of 20.9%** (2023 – 2032)

Modular Data Center
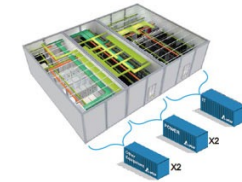
Scalable solution with shorter delivery times compared to traditional brick-and-mortar construction

- Offers **flexibility** in cabinets, size, power density, and future growth adjustments
- Suitable for **permanent use**, additional capacity, disaster recovery, or contingency sites for increased availability
- **Easier maintenance** and compliance with local regulations.
- **Transportable in standard** sizes similar to ISO containers, avoiding the need for special permits
- Can be two or three levels high for better land use
- Manufacturing and installation time depends on the number of modules

This provides a scalable solution with shorter delivery times compared to traditional brick-and-mortar construction

Benefits of a Tier 4 Modular Data Center

Tier 4 Modular Data Centers exhibit near complete availability throughout the year, as well as enhanced security and scalability that will leverage the hybrid cloud environment to amplify these benefits

Enhanced security features suitable for hosting sovereign data

Tier 4 Data Centers feature **outstanding security features**, such as biometric-enabled access. Leveraging hybrid cloud models provide the flexibility to securely manage data placement based on sensitivity.

High availability and fault tolerance ensuring continuous operations

Tier 4 Data Centers boast a **maximum downtime of 0.4 hour per year**. To achieve this, seamless maintenance and equipment redundance is necessary, supported with the integration of hybrid cloud services to enhance fault tolerance by distributing workloads.
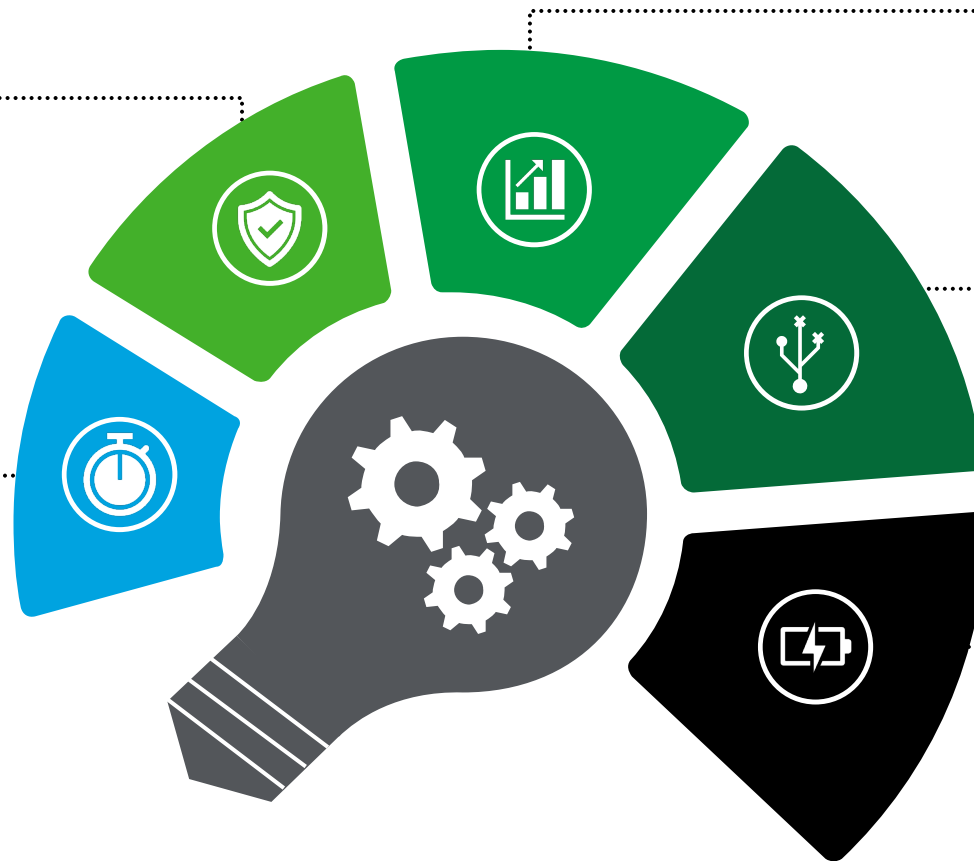
Scalability and flexibility to meet future demand

Modular Data Centers and hybrid cloud architecture are tailored to meet current demand but can be **scaled to tackle demand variations**.

Full redundancy, ensuring no single points of failure

Every process is fully redundant, ensuring the Data Center can **operate through failures** and malfunctions.

Capable of autonomous operation in case of outage

Generators and fuel tanks ensure autonomous operation of the Data Center for **4 days**, in case of power outage. Allowing critical applications and data to be mirrored or backed up in a geographically diverse cloud environment.

Why Consider a Data Embassy?

Data Embassies allow countries to distribute their critical data and information systems in co-operation with other states to increase their digital continuity and security

General Definition of Data Embassies[1]

What is a Data Embassy?

A data embassy is a solution traditionally implemented by nation-states to ensure a country's digital continuity with respect to critical databases. It consists of a **set of servers that store one country's data and are under that country's jurisdiction, while being in another country.**
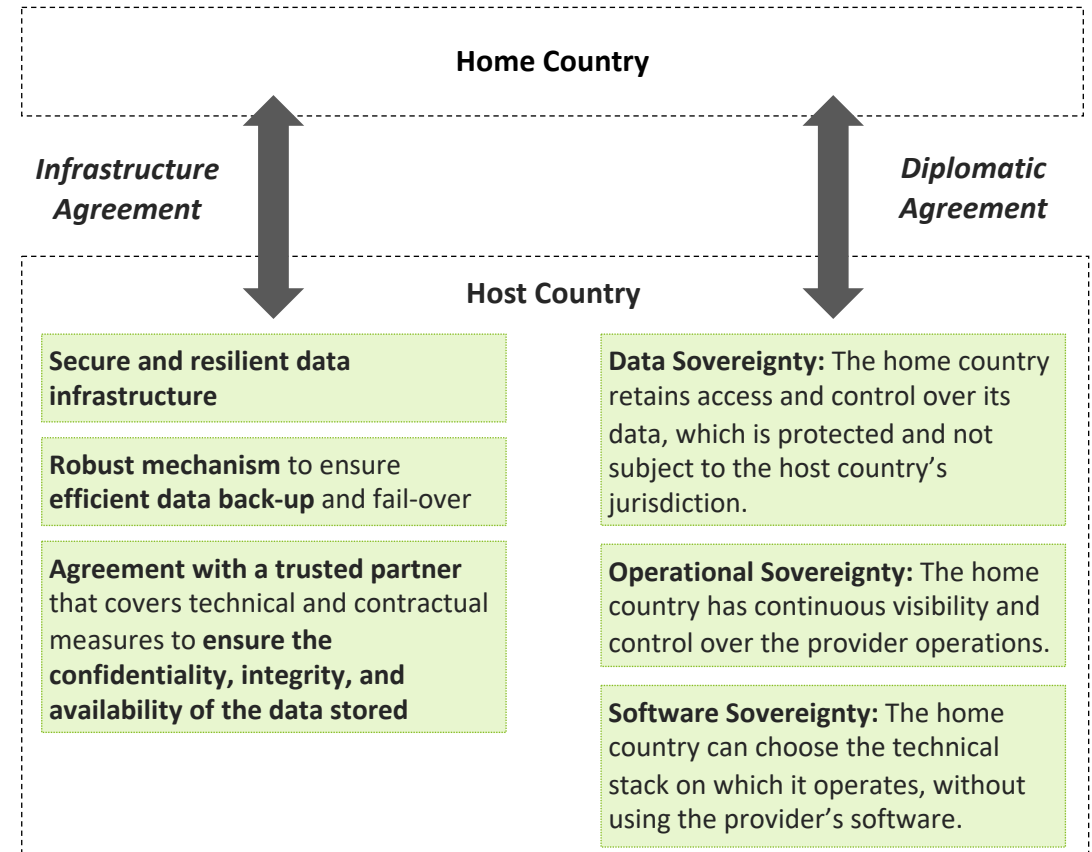
What is the purpose of a Data Embassy?

Data embassies are regarded as a **tool to ensure a government's digital continuity, meaning the survival of critical databases** to allow the continuation of government even in a situation where governing from within the country's borders is no longer an option

Who are they suited for?

Data embassies are **specially suited** for **countries** that:
1. Have **already digitalized their most critical operations**
2. Face **critical threat vectors**:
   - Natural disasters
   - Large scale cyber-attacks
   - Military invasion

Structure and components of a Data Embassy[2]

Home Country

Infrastructure Agreement

Diplomatic Agreement

Host Country

Secure and resilient data infrastructure

Robust mechanism to ensure **efficient data back-up** and fail-over

Agreement with a trusted partner that covers technical and contractual measures to **ensure the confidentiality, integrity, and availability of the data stored**

Data Sovereignty: The home country retains access and control over its data, which is protected and not subject to the host country's jurisdiction.

Operational Sovereignty: The home country has continuous visibility and control over the provider operations.

Software Sovereignty: The home country can choose the technical stack on which it operates, without using the provider's software.

Why Consider a Data Embassy?

Moreover, Data Embassies represent a cost-effective and secure solution for nations that lack the resources to build and operate their own Tier 4 Data Centers

Lower Cost

Setting up and maintaining Data Embassies is a **cost-effective solution** compared to building and managing redundant infrastructures locally.

Security and Resilience

Data embassies provide a **backup for swift recovery of government data** after suffering a natural disaster or a military invasion.

Sovereignty

The **home country retains full control of the data** in the Data Embassy. Data Embassies also operate as per the law of the home country.

Collaboration

Data Embassies foster **collaboration among nation-states and stakeholders**.

Why Consider a Data Embassy?

Although Data Embassies are still at an early stage of adoption, countries around the world are starting to realise the potential of these agreements

Examples of Data Embassy Initiatives

Estonia
Estonia entered a bilateral treaty with Luxembourg in 2017 for hosting data and information systems in Luxembourg.

Monaco
Monaco established its e-embassy in Luxembourg in 2021 for storing Monaco´s sovereign sensitive data

India
In its 2023 budget, the country proposed establishing Data Embassies to facilitate data continuity to smaller nations

Bahrain
In 2018 Bahrain passed a legislative decree to encourage foreign countries to establish Data Embassies in the country.

Estonia´s Data Embassy in Luxembourg[1]

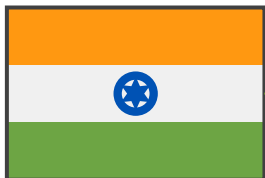| *Context*	*Solution*
Estonia is a leader in public sector digitalisation (>99% of public services are available 24 h) Due to military tensions in the region, the country decided to have a backup of its most critical data abroad.	• Tier 4 Data Center in Luxembourg providing storage and critical services • Data resources remain under Estonian control • Security against cyberattacks using Estonian Blockchain Technology

Setting up Data Embassies in India[2]

Context	*Policy Development*
India possesses strong IT skills and capabilities for hosting Data Centers The Finance Ministry detected a strong demand for Data Embassies from small countries	• The new policy will offer diplomatic immunity to client countries • The Government has implemented policies for facilitating the development of Data Centers, such as fiscal incentives or up to 100% foreign ownership of Data Centers

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Proposed Collaboration Model

This preliminary collaboration model will be based on a tiered services structure that will leverage T&T´s and the region´s strengths, providing users with a data centre offering that suits their needs

Main Characteristics of the Collaboration Model

Collaborative approach to leverage existing DCs and submarine cables to serve public and private clients based in the region and beyond
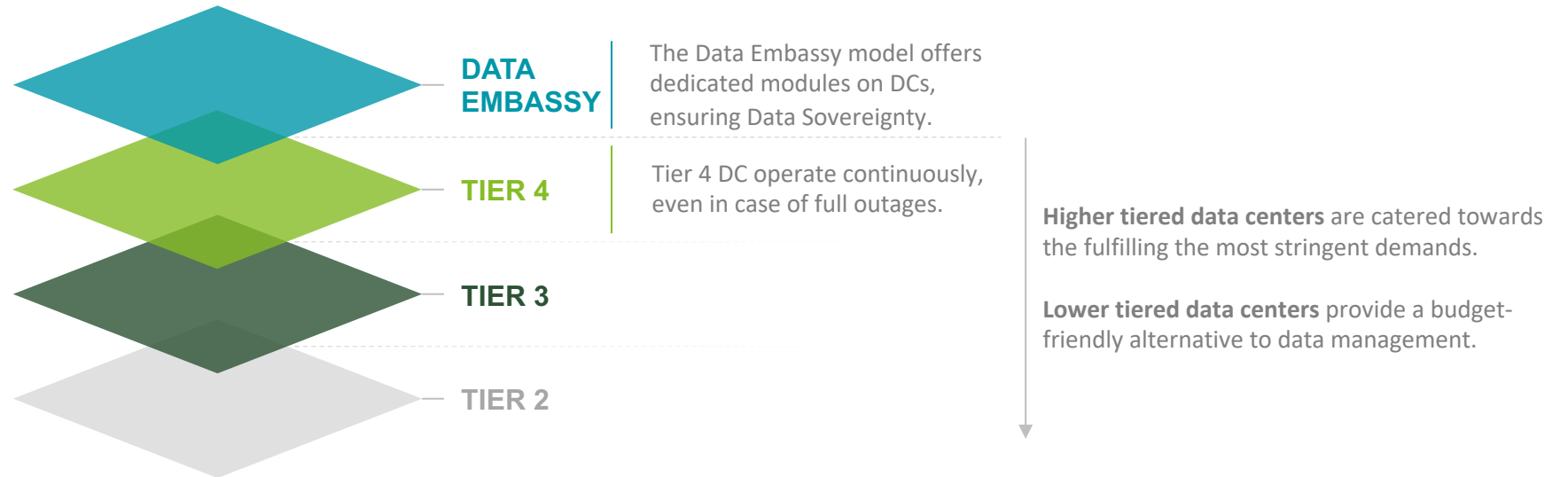
World-class facilities in Trinidad and Tobago and the Caribbean, leveraging Caribbean capabilities to deliver world-class services in world-class facilities

Flexible solutions tailored to the client´s specific needs, based on different DC security, resilience and service levels

Preliminary Collaboration Model´s Tier Structure

1 Firstly, the collaboration model will offer various DC options in T&T and the region, which will **allow organizations acquire services that are tailored to their specific needs**

DATA EMBASSY | The Data Embassy model offers dedicated modules on DCs, ensuring Data Sovereignty.

TIER 4 | Tier 4 DC operate continuously, even in case of full outages.

TIER 3

TIER 2

Higher tiered data centers are catered towards the fulfilling the most stringent demands.

Lower tiered data centers provide a budget-friendly alternative to data management.

2 Secondly, the client´s needs will be considered to determine how the Data Centre resources will be used.
- **Highly critical applications and data shall be stored in dedicated modules and servers to ensure dedicated computational resources and security**
- **Less demanding applications may use lower tier DCs as well as shared DC modules, rooms and servers**

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Proposed Collaboration Model

Our vision is to provide a flexible approach in which Data Centre resources are allocated optimally according to the user´s needs

|	OPERATIONAL MODELS[1]	
	Shared Hosting	**Dedicated Hosting**
Description	Many websites reside on a single server. This setup allows multiple website owners to share the resources and costs of maintaining a server, making it an affordable option for small businesses and personal sites.	Entire server is rented to a single user or organization. This server space is not shared with other users, allowing for greater control and customization.
Target users	Regional intergovernmental conference services, educational institutions and small businesses services	Businesses, public institutions or individuals who experience high website traffic and need a scalable solution.
Pros	• **Cost-efficient** • **Easy-to-use**: Shared hosting plans often have user-friendly control panels and one-click install features • **Managed services**: Most shared hosting providers offer managed services that handle backups, updates, and security. • **Customer support**: Many providers offer robust customer support to address issues or concerns	• **Exclusive access** • **Customization**: Server customization per client requirements, including the operating system, hardware, and software. • **Better computational performance** • **Security**: Dedicated hosting is typically more secure than shared hosting due to higher control over the server environment.
Cons	• **Limited computational resources** • **Less control** over server settings and software installations • **Lower performance**: Due to shared resources • **Limited scalability**: May not be suitable for rapidly growing websites • **Security concerns**: Shared hosting might need to be more secure as your website could be impacted by vulnerabilities on other sites on the same server	• **Higher cost** • **Higher technical knowledge required**: Managing a dedicated server requires more technical knowledge than shared hosting. • **Maintenance**: Client may be responsible for server maintenance and updates • **Waste of Resources**: Having a dedicated server can lead to wasted resources if the site receives low traffic.

(1)   Source: Cloud Panel

Proposed Collaboration Model

The collaboration can leverage the numerous submarine cables connecting the Caribbean region and the USA, although many of them have been in service for a considerable number of years
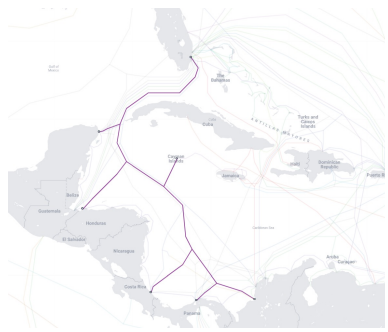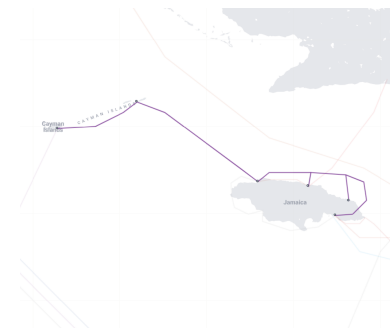
MAYA-1
2000 ▬▬▬ 2025
4.400 Km | 1910 Gbps

Cayman Islands, Colombia, Costa Rica, Honduras, Mexico, Panama, USA

SOUTH AMERICA-1
2001 ▬▬▬ 2026
25.000 Km | 20 Tbps

Argentina, Brazil, Chile, Colombia, Dominica Republic, Ecuador, Guatemala, Peru, Puerto Rico, USA

CJFS
1997 ▬▬▬ 2022
870 Km | 1,92 Tbps

Cayman Islands, Jamaica,

PAN-AMERICAN CROSSING
2000 ▬▬▬ 2026
10.000 Km | 6 Tbps

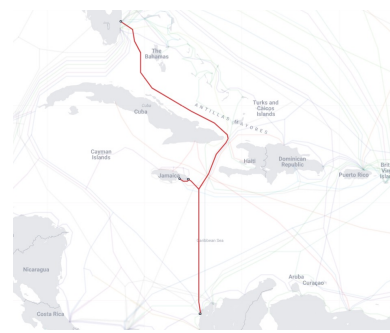Costa Rica, Mexico, Panama, USA

ARCOS
2001 ▬▬▬ 2026
8.600 Km | 8,4 Tbps

Bahamas, Belize, Colombia, Costa Rica, Curaçao, Dominican Republic, Guatemala, Honduras, Mexico, Nicaragua, Panama, Turks and Caicos Islands, USA, Venezuela

Fibralink
2006 ▬▬▬ 2031
1.000 Km | 320 Gbps

Dominican Republic, Haiti, Jamaica
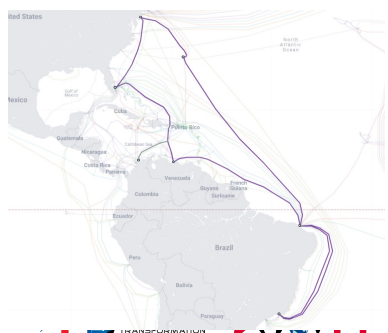
GLOBENET
2000 ▬▬▬ 2026
23.500 Km | 500 Gbps

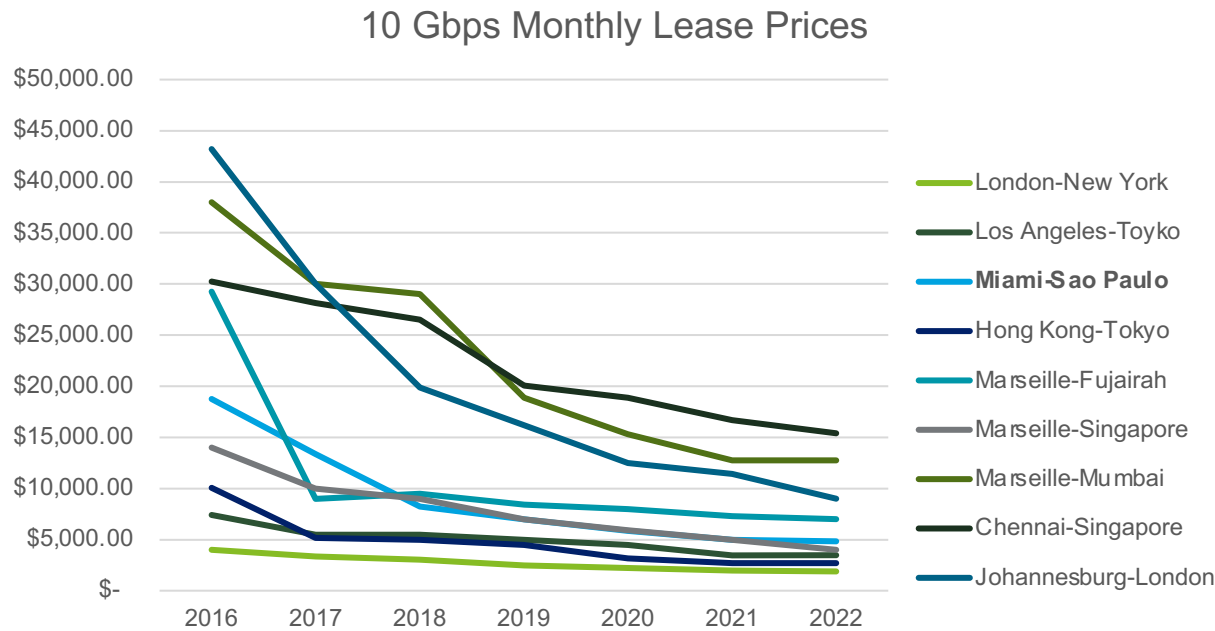Bermuda, Brazil, Colombia, USA, Venezuela

CFX-1
2008 ▬▬▬ 2023
2.400 Km | 12 Tbps

Colombia, Jamaica, USA

GCN
2006 ▬▬▬ 2032
890 Km | 320 Gbps

Guadeloupe, Saint Barthélemy, Saint Martin, Puerto Rico, Virgin Islands

Proposed Collaboration Model

Because of a lack of infrastructure development, international traffic prices for both 10 Gbps and 100 Gbps are higher than in other regions, although new cables will help drive down prices

10 Gbps Monthly Lease Prices

Legend:
- London-New York
- Los Angeles-Toyko
- **Miami-Sao Paulo**
- Hong Kong-Tokyo
- Marseille-Fujairah
- Marseille-Singapore
- Marseille-Mumbai
- Chennai-Singapore
- Johannesburg-London

- **In Latin America, internet capacity remains highly concentrated in South America**—home to some of the countries with the highest demand for international bandwidth in the entire region. In 2023, South America accounted for about 64% of the region's total capacity

- **International capacity in the Caribbean lags far behind when compared to Central and South America.** In 2023, international internet bandwidth connected to the Caribbean islands reached almost 5.0 Tbps[1]

- The **geographical layout of the Caribbean islands makes laying and maintaining submarine cables expensive**. Additionally, demand has increased faster than the supply of telecommunications infrastructures, thus resulting in higher prices than in other regions.

(1)   TeleGeography

NEW SUBMARINE CABLE DEPLOYMENTS IN THE CARIBBEAN   **NON-EXHAUSTIVE**
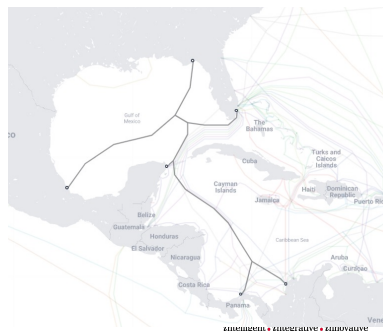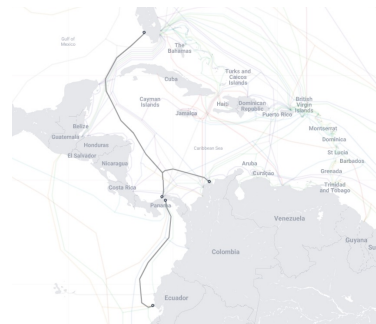

GD-1/LN-1
2027
2.333 Km

Colombia, Mexico, Panama, USA

To Be Implemented

CSN-1
2025
4.500 Km

Colombia, Ecuador, Panama, USA

To Be Implemented

TAM-1
2025
7.000 Km

Colombia, Costa Rica, Guatemala, Honduras, Mexico, Panama, USA, Puerto Rico, Virgin Islands

To Be Implemented

22

Proposed Collaboration Model

Trinidad and Tobago hosts landing points for seven different submarine cables, providing strong connections with large markets such as the USA and Brazil, as well as small islands in the Caribbean
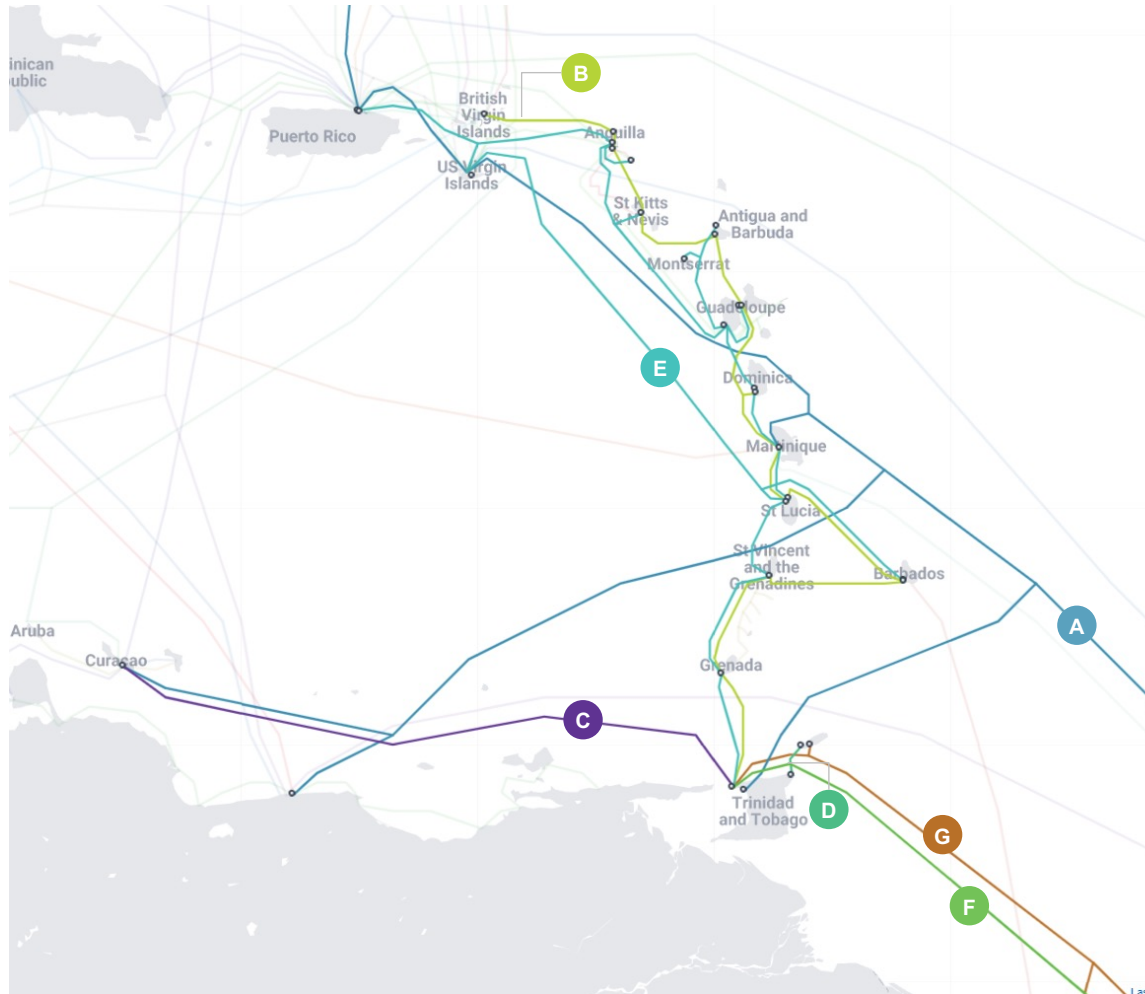
A **AMERICAS 2**
2000 | 6.1 Tbps

National · **International**
Caribean · USA

8.373 Km | Brazil, Curaçao, French Guiana, Martinique, USA, Venezuela, Virgin Islands, Puerto Rico

B **EASTERN CARIBBEAN FIBER SYSTEM**
1995 | 40 Gbps

National · **International**
Caribean · USA

1.730 Km | Anguilla, Antigua and Barbuda, Barbados, Dominica, Grenada, Guadeloupe, Martinique, Saint Kitts and Nevis, Saint Lucia, Saint Vicent and the Grenadines, Sint Maarten, Virgin Islands

C **EASTERN CARIBBEAN LINK**
2007 | 2.5 Gbps

National · **International**
Caribean · USA

987 Km | Curaçao

D **TT-1**
2012 | 15 Tbps

National · International
Caribean · USA

48 Km | Trinidad, Tobago

E **SOUTHERN CARIBBEAN FIBER**
2006 | 20 Gbps

National · **International**
Caribean · USA

3.000 Km | Antigua and Barbuda, Barbados, Dominica, Grenada, Guadeloupe, Martinique, Montserrat, Saint Barthélemy, Saint Kitts and Nevis, Saint Lucia, Saint Martin, Saint Vicent and the Grenadines, Puerto Rico, Virgin Islands

F **SURINAME-GUYANA SUBMARINE CABLE SYSTEM**
2010 | 1.28 Tbps

National · **International**
Caribean · USA

1.249 Km | Guyana, Suriname

G **DEEP BLUE ONE**
2024 | 96 Tbps

National · **International**
Caribean · USA

2.250 Km | French Guiana, Guyana, Suriname

Proposed Collaboration Model

Furthermore, T&T can provide additional DC facilities that can help enrich this solution, as well as a well-developed backbone network with two IXPs

T&T Existing Data Centres

Amplia DC 1
Port of Spain
Tier 3

Fujitsu DC
Barataria
Tier 3

Amplia DC 0
Port of Spain
Tier 3

TSTT Mausica
Mausica
Tier 3

Digicel / Informatics Engineering
Chaguanas
Tier 3

CCTL
Chaguanas
Tier 3

Amplia DC 2
San Fernando
Tier 2

Air Link DC
Princes Town
Tier 3

T&T Backbone Network

- 4G Coverage
- 3G Coverage
- 2G Coverage
- Core Netowork
- GRID
- Politic
- Population
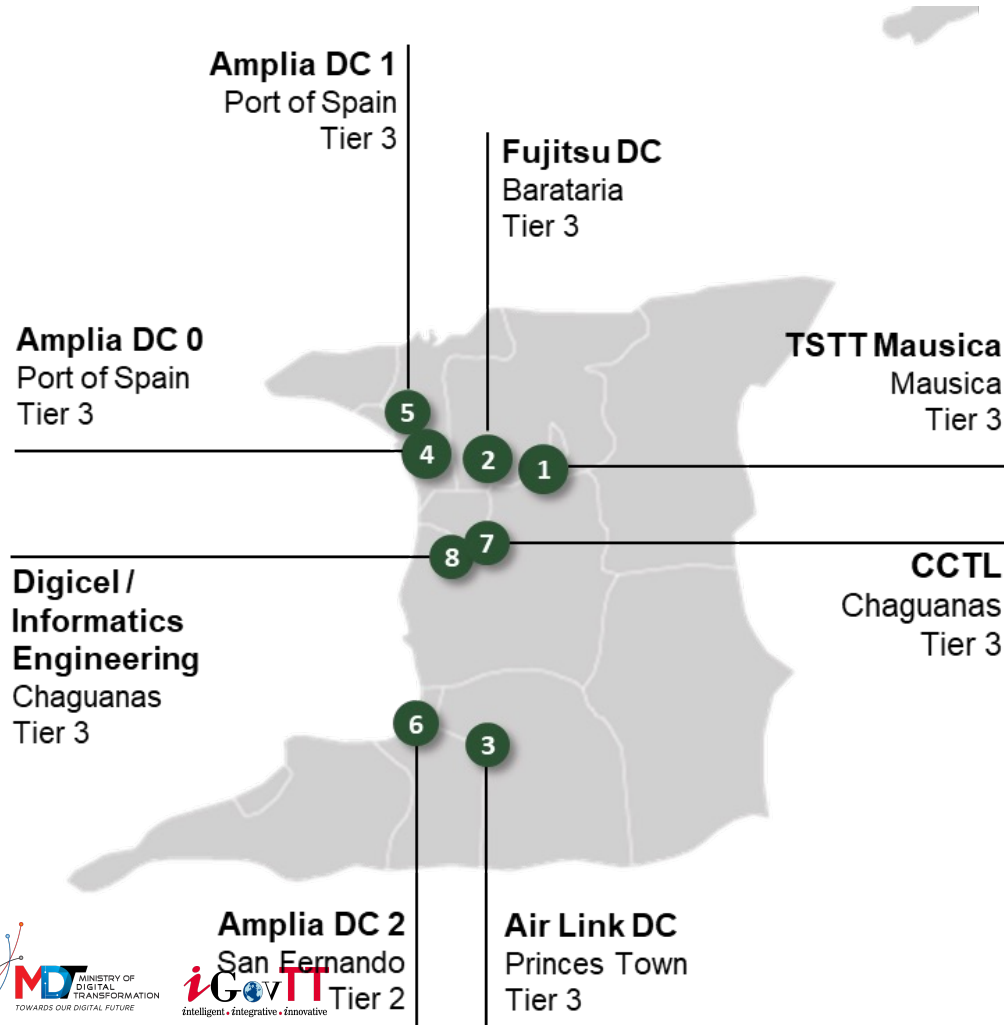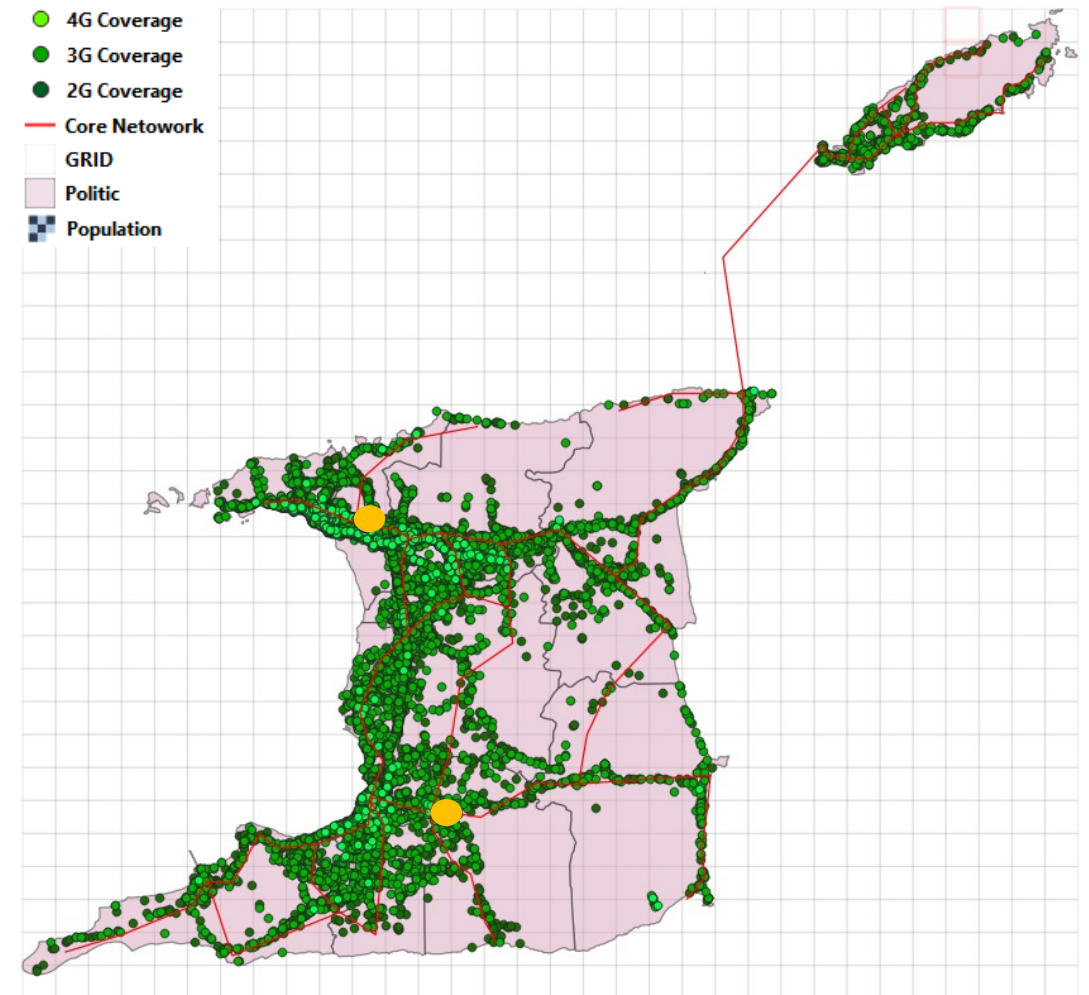
Proposed Collaboration Model

The proposed collaboration model will provide both financial and logistical advantages to Governments that decide to use T&T´s Tier 4 Data Centre as a Data Embassy

Main Advantages of the proposed collaboration model

Logistical

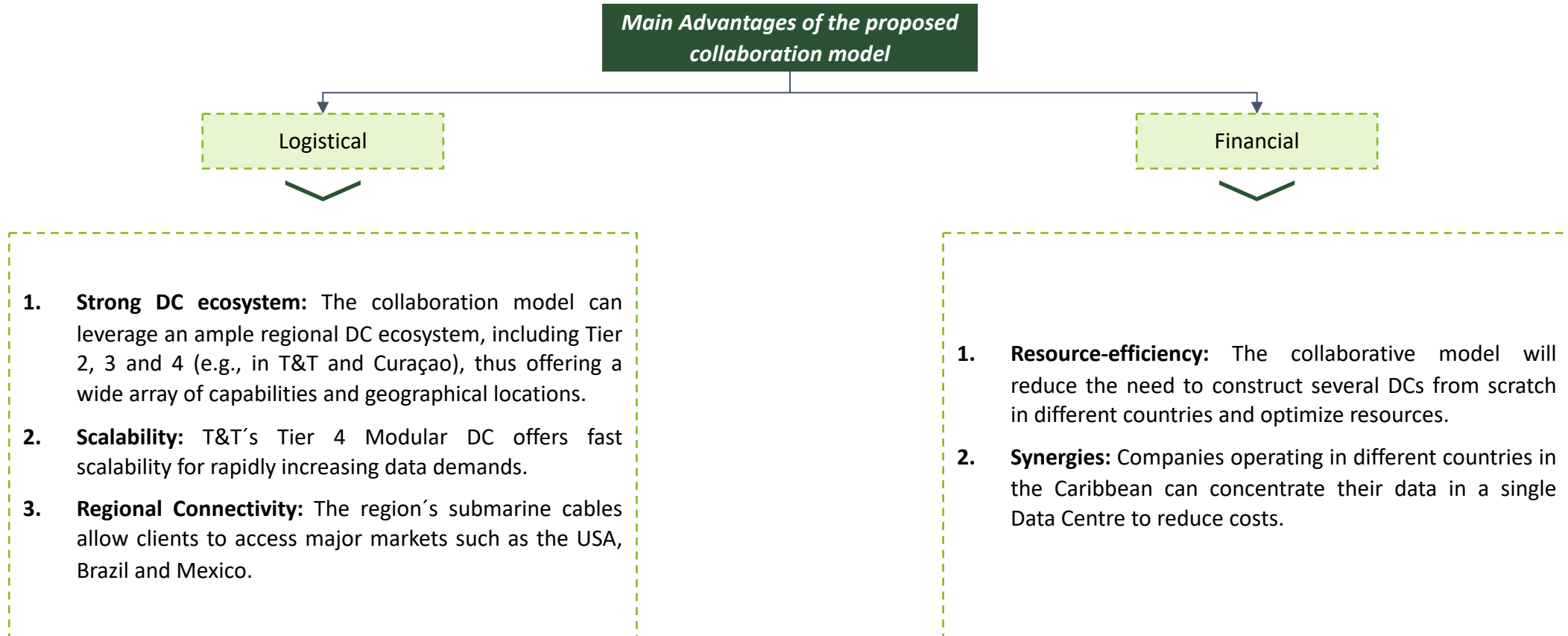1. **Strong DC ecosystem:** The collaboration model can leverage an ample regional DC ecosystem, including Tier 2, 3 and 4 (e.g., in T&T and Curaçao), thus offering a wide array of capabilities and geographical locations.

2. **Scalability:** T&T´s Tier 4 Modular DC offers fast scalability for rapidly increasing data demands.

3. **Regional Connectivity:** The region´s submarine cables allow clients to access major markets such as the USA, Brazil and Mexico.

Financial

1. **Resource-efficiency:** The collaborative model will reduce the need to construct several DCs from scratch in different countries and optimize resources.

2. **Synergies:** Companies operating in different countries in the Caribbean can concentrate their data in a single Data Centre to reduce costs.

Workshop Session

We propose to conduct a workshop session to refine our vision collaboration model using the feedback from different stakeholders in the Caribbean region

Main Aspects to Analyze in the Workshop Session

Situation Assessment

- Services required by the Member State (collocation, IaaS, PaaS…)
- Security and resilience levels needed
- Economic capacity of the Member State
- Expected scalability of the data and applications
- Connectivity requirements

Model Definition

- Preferred technical and cost-effective solution design
- Data centre selection – Single vs multiple data centre solution
- Consideration of potential synergies and access to target markets
- Identification of regulatory limitations

Solution Implementation

- Elaboration of service contract and SLAs
- Signing of diplomatic agreements for Data Embassies
- Maintenance and operation of the proposed solution

Workshop Session - **Developing a Collaborative Data Embassy Model**

We propose to conduct a workshop session to refine our vision collaboration model using the feedback from different stakeholders in the Caribbean region

OBJECTIVE

To facilitate a detailed exploration and discussion among Member States on implementing the proposed collaboration model for Data Embassies, focusing on the unique needs of Member States:
- Technical solutions
- Regulatory considerations
- Establishment of diplomatic agreements

ACTIVITY DESCRIPTION

This activity is structured as a workshop where participants work through the stages of the proposed collaboration model to tailor a data embassy solution that fits their specific needs and constraints.

BREAKOUT SESSIONS

Participants are organized in groups based on skills and geographical locations. Groups are assigned a section of the collaboration model to focus on: Definition, Implementation, or Assessment.

Workshop Session - **Developing a Collaborative Data Embassy Model**

Each group will be responsible of tackling one topic

Group 1	Group 2	Group 3

Situation Assessment

- Services required by the Member State (collocation, IaaS, PaaS…)
- Security and resilience levels needed
- Economic capacity of the Member State
- Expected scalability of the data and applications
- Connectivity requirements

Model Definition

- Preferred technical and cost-effective solution design
- Data centre selection – Single vs multiple data centre solution
- Consideration of potential synergies and access to target markets
- Identification of regulatory limitations

Solution Implementation

- Elaboration of service contract and SLAs
- Signing of diplomatic agreements for Data Embassies
- Maintenance and operation of the proposed solution

Next Steps and Q&A

Stakeholder Engagement	• Identify and engage with essential stakeholders to introduce the model and solicit feedback.
Technical and Legal Assessment	• Evaluate technical requirements and legal constraints for implementing data embassies across various jurisdictions.
Infrastructure Planning	• Plan the necessary physical and technical infrastructure, including site selection and security integration.

Financial Planning and Budget Allocation	• Estimate costs, secure funding, and manage budgeting for the project's capital and operational expenses.
Contract and SLA Development	• Draft and finalize service contracts and SLAs to define and manage relationships and obligations between all parties.
Implementation Roadmap	• Create a detailed schedule with phases, milestones, and responsible parties to guide the project's execution.

Pilot Testing

- Conduct initial testing with select member states to validate the setup and refine the model based on feedback.

Full-Scale Rollout

- Extend the service to all participating member states, monitoring the process for any needed adjustments.

Review and Continuous Improvement

- Continuously assess and enhance the operational aspects of the data embassies to meet evolving needs and incorporate technological advancements.

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Thank You!