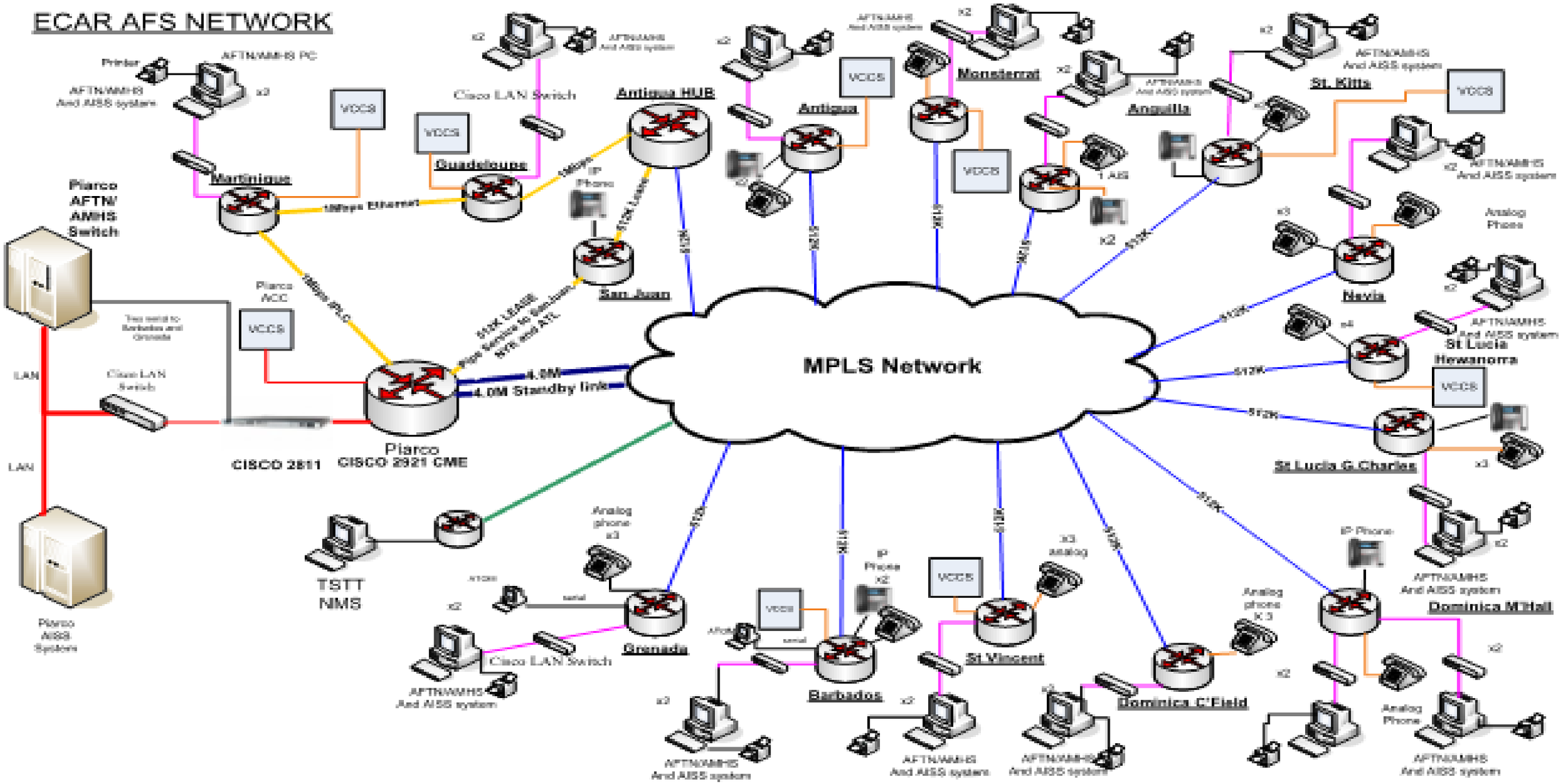
A PRESENTATION BY TELECOMMUNICATIONS SERVICES OF TRINIDAD AND TOBAGO (TSTT)

Sixth Eastern Caribbean Network Technical Group (E/CAR/NTG/6) and
Fourth Eastern Caribbean Radar Data Sharing Ad-hoc Group (E/CAR/RD/4) Meetings
Miami, United States, 13 - 14 July 2015

Agenda

- Overview of E/CAR AFS Network (14 countries, 16 airports)
- Challenges
- Maintenance Procedures
- Network Performance Analysis
- Radar Sharing Status
- On-going Network Activities
- Resiliency Measures


ECAR AFS NETWORK
Printer
AFTN/AMHS PC
AFTN/AMHS And AISS system
x2
VCCS
Cisco LAN Switch
Antigua HUB
Martinique
Guadeloupe
100bps Ethernet
IP Phone
San Juan
Antigua
Montserrat
Anguilla
St. Kitts
Nevis
St Lucia Hewanorra
St Lucia G.Charles
Dominica M'Hall
Dominica C'Field
St Vincent
Barbados
Grenada
Piarco AFTN/ AMHS Switch
Piarco ACC
LAN
Piarco AISS System
Piarco CISCO 2921 CME
CISCO 2811
4.0M
4.0M Standby link
MPLS Network
TSTT NMS
Analog phone x3
Analog Phone
IP Phone x2
x3 analog
Analog phone x 3
AFTN/AMHS And AISS system

Challenges

DOMINICA Melville Hall

- UPS at location faulty, to be replaced. Service not disrupted as temporary UPS being used.

ANGUILLA

- Adverse environmental conditions resulted in the failure of both routers and the UPS.
- Replacement routers configured and shipped. Installation planned immediately following the customs clearance of the equipment.

SAINT KITTS

- Adverse environmental conditions resulted in the failure of one of the routers. The second router also shows signs of deterioration due to environmental conditions.
- The Primary router needs to be replaced.
- This router is being powered by the RPS due to the power supply not being functional
- The fans, power supply and RPS module showed signs of corrosion.
- Recommended that the equipment be relocated to the equipment room under the tower.
- The internal temperature on this router is extremely high.

Challenges (Cont'd)

GUADELOUPE

- Adverse environmental conditions affected routers and UPS.
- The secondary router needs a spare RPS adapter .
- The fans, power supply and RPS module showed signs of corrosion.

ANTIGUA CLAREHALL (LIME)

- RPS module on order for the RPS to function properly.

BARBADOS

- Services were left on the primary router. Data Licenses to be loaded on next visit and configurations completed.

PUERTO RICO

- Both Verizon fractional T1 were on same fiber mux. Recommendation – one fractional T1 be moved to copper solution.

SAN JUAN ROUTER CONNECTION DIAGRAM

EHWIC 3

Ports	Circuit Connection
0	STX – ANU (MEVA)
1	STX – SKB (MEVA)
2	STX – AXA_1 (MEVA)
3	STX – AXA_2 (MEVA)

EHWIC 2

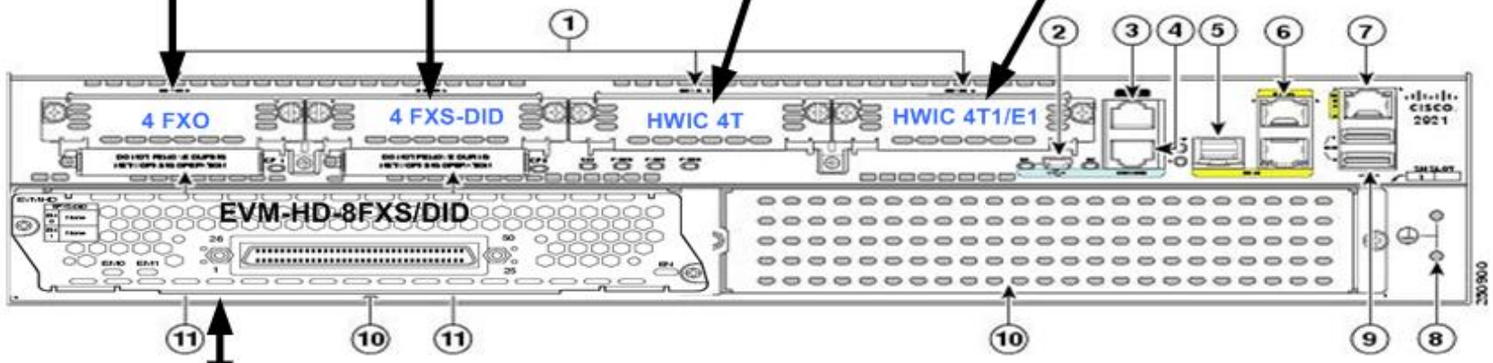
Ports	Circuit Connection
0	DN 1841 to ETVS
1	DN 1842 to ETVS
2	DN 1845 to ETVS
3	DN 1861 to ETVS

EHWIC 1

Ports	Circuit Connection
0	AFTN (RS-530)
1	AMHS (RS-530)
2	SPARE
3	SPARE

EHWIC 0

Ports	Circuit Connection
0	Trinidad (RJ-45)
1	Antigua (RJ-45)



Ports	Circuit Connection
0	DN 18xx to ETVS (BIX Pr 1)
1	DN 18xx to ETVS (BIX Pr 2)
2	DN 18xx to ETVS (BIX Pr 3)
3	DN 18xx to ETVS (BIX Pr 4)
4	DN 18xx to ETVS (BIX Pr 5)
5	DN 18xx to ETVS (BIX Pr 6)
6	DN 18xx to ETVS (BIX Pr 7)
7	DN 18xx to ETVS (BIX Pr 8)

Maintenance Procedures

- Proactive monitoring is in effect for this network
- Client portal access available via http://tsttmetroe.tstt.co.tt
- Regional notifications
- Regional field forces
- Scheduled maintenance visits
  - Switching of primary to secondary routers at visit
  - Ensuring environmental conditions are upheld

Maintenance Procedures (Cont'd)

ACTIVITIES	TIMELINES
Initial feedback on fault after the report is made to the Customer Service Operations Center (CSOC)	Within 30 minutes
TSTT to identify and isolate fault of notification to Customer	Within 90 minutes
Arrival on a /AFS site from when initial feedback is received after a report is made.	Within 1-3 hours
General fault resolution time. Note This is dependent on a) Access to TTCAA's premises b) Nature of the fault c) Availability of spare equipment	Within 2-4 hours
Escalation conditions	1. No status update in any 4 hour period 2. After the first 4-hour period with no response, the first escalation should be utilized. The first call should be to the Manager of the NOC. The ESOC Manager should then be advised of the problem. 3. After five (5) hours have elapsed with no response, the second escalation should be utilized, with the first call to The Manager, technical Solutions and Support , should be advised of the problem soon thereafter. 4. After seven (7) hours have elapsed with no response, the third escalation should be utilized.

Maintenance Procedures (Cont'd)

FIXED MAINTENANCE	DEFINITION
Routine Maintenance during normal working hours	TSTT staff providing maintenance for AFS NETWORK
Monitoring of the network (24 x 7 x 365)	TSTT for the Voice Network & CISCO DEVICES.
Dedicated Technical Support at Piarco	TSTT technical person to visit Piarco Monday to Friday from 8 am – 9 pm for the purpose of conducting maintenance on circuits, AFS communication equipment upon requirement of truck roll via incident report.
Biannual visits to sites	1. Bi-annual visits to Caribbean Territories Sites to conduct operational audit on MPLS circuits and demark end devices. 2. March and DECEMBER visits to Caribbean Territories to conduct operational audits on circuits and CISCO equipment.

CONTRACT MAINTENANCE	DEFINITION
Maintenance weekends and Public Holidays	Any maintenance conducted by TSTT and or Contractors between 8 am – 9 pm
Repair & Replacement of components.	Any Repair or replacement of TSTT Network elements or components within Network elements.

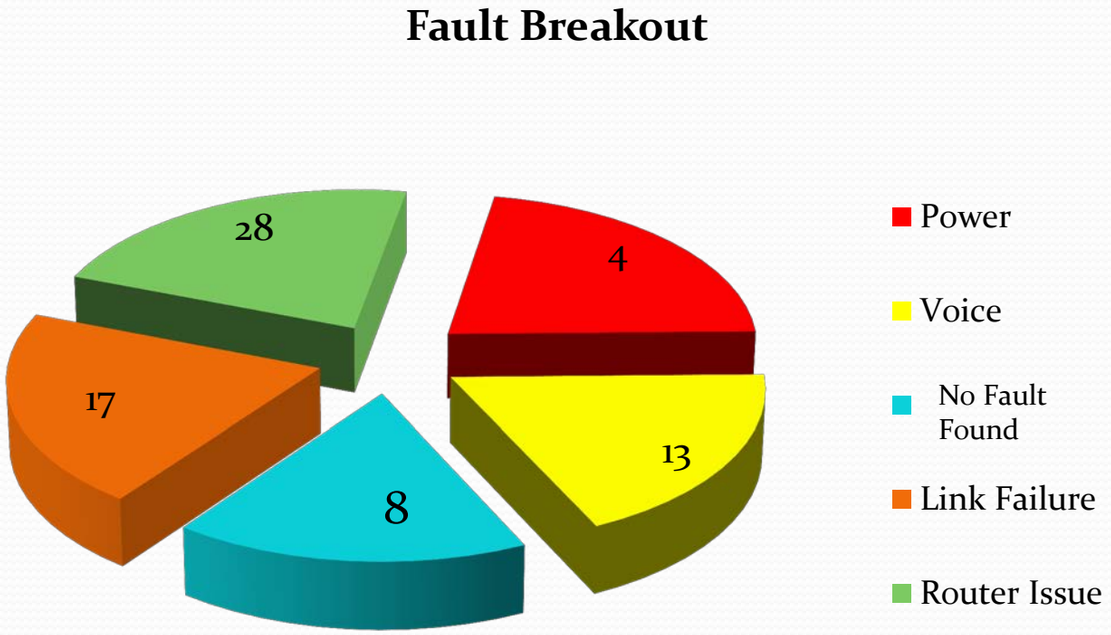
Maintenance Schedule

- Scheduled preventative maintenance of the network was deferred due to configurations for additional services to the TTCAA network.
- The last maintenance activity was in November-December 2014.
- The next maintenance visit is scheduled for September – October 2015.

Faults

TICKETS	
Month	# of Tickets Reported
October 2014	11
November 2014	9
December 2014	8
January 2015	4
February 2015	9
March 2015	8
April 2015	5
May 2015	11
June 2015	7
Total	72

Total Number of Tickets: 72
Total closed October 2014-June 2015: 70
Total pending as at June 2015: 2



Faults (Cont'd)

Country	Number of Faults
Anguilla	1
Antigua	15
Barbados	4
Dominica-Canefield	4
Dominica Melville Hall	1
Grenada	2
Guadeloupe	11
Martinique	6
Montserrat	2
Nevis	1
Saint Lucia	4
San Juan/ Puerto Rico	4
Saint Kitts	1
Tobago	6
Trinidad	9
United States of America- Atlanta	1

Node Availability Statistics October 2014-May 2015

Node	IP Address	Average Availability
CAA_ANU_AS01_S_3560.ttcaa.local	10.200.254.74	98.93%
CAA_ANU_CME01_P_2921.ttcaa.local- ANTIGUA	10.200.254.7	98.95%
CAA_AXA_CME01_P_2921.ttcaa.local- ANGUILLA	10.200.254.9	1.79%
CAA_BGI_AS01_S_3560.ttcaa.local	10.200.254.154	99.21%
CAA_BGI_CME01_P_2921.ttcaa.local- BARBADOS	10.200.254.17	99.01%
CAA_DCF_AS01_S_3560.ttcaa.local_DOMINICA_CANEFIELD	10.200.254.138	96.64%
CAA_DCF_CME01_P_2921.ttcaa.local- DOMINICA CANEFIELD	10.200.254.15	95.83%
CAA_DOM_AS01_S_3560.ttcaa.local-MELVILLE HALL	10.200.254.130	99.20%
CAA_DOM_CME01_P_2921.ttcaa.local- MELVILLE HALL	10.200.254.14	98.41%
CAA_FDF_CME01_P_2921.ttcaa.local- MARTINIQUE	10.200.254.4	98.56%
CAA_GND_CME01_P_2921.ttcaa.local- GRENADA	10.200.254.18	99.22%
CAA_MNI_AS01_P_3560.ttcaa.local	10.200.254.82	98.98%
CAA_MNI_CME01_P2921.ttcaa.local- MONSERRAT	10.200.254.8	99.00%
CAA_NEV_AS01_P_3560.ttcaa.local	10.200.254.106	98.23%
CAA_NEV_CME01_P_2921.ttcaa.local- NEVIS	10.200.254.11	98.37%
CAA_POS_AFTN01_P_2811.ttcaa.local- PIARCO	10.200.254.2	99.14%
CAA_POS_AS01_P_3560.ttcaa.local	10.200.254.37	99.18%
CAA_POS_AS01_S_3560.ttcaa.local	10.200.254.36	99.17%

Node Availability Statistics October 2014-May 2015 (Cont'd)

Node	IP Address	Average Availability
CAA_POS_CME01_S_2921.ttcaa.local	10.200.254.1	99.04%
CAA_PTP_CME01_P_2921.ttcaa.local- GUADALOUPE	10.200.254.3	98.39%
CAA_SJN_CME01_P_2921.ttcaa.local- SANJUAN	10.200.254.5	98.78%
CAA_SKB_AS01_P_3560.ttcaa.local	10.200.254.98	98.90%
CAA_SKB_CME01_P_2921.ttcaa.local- ST.KITTS	10.200.254.10	99.11%
CAA_SLU_CME01_P_2921.ttcaa.local- ST.LUCIA GF CHARLES	10.200.254.13	99.22%
CAA_STX_AS01_S_3560.ttcaa.local	10.200.254.68	99.24%
CAA_STX_CME01_P_2921.ttcaa.local - ANTIGUA HUB/ST MAARTEN	10.200.254.6	99.22%
CAA_SVD_AS01_S_3560.ttcaa.local	10.200.254.146	99.23%
CAA_SVD_CME01_P_2921.ttcaa.local- ST.VINCENT	10.200.254.16	99.21%
CAA_TGO_AS01_P_3560.ttcaa.local	10.200.254.170	99.23%
CAA_TGO_CME01_P_2921.ttcaa.local-TOBAGO	10.200.254.19	99.22%
CAA_UVF_AS01_S_3560.ttcaa.local	10.200.254.114	99.00%
CAA_UVF_CME01_P_2921.ttcaa.local- ST.LUCIA HEWANORRA	10.200.254.12	99.17%

Availability Statistics - Comparison

Country	% Availability 2014	% Availability 2015
Anguilla	98.9	1.79
Antigua	99.9	99.2
Barbados*	99.9	99.0
Dominica - Canefield	97.4	96.2
Dominica - Melville Hall	99.6	98.8
Grenada*	99.9	99.2
Guadeloupe	99.7	98.4
Martinique*	99.5	98.6
Montserrat	99.9	99.0
Nevis*	98.4	98.4
Saint Kitts	99.3	99.1
Saint Lucia -George F Charles	99.9	99.2
Saint Lucia- Hewanorra	98.7	99.2
St. Vincent and the Grenadines*	98.1	99.2
Tobago*	99.7	99.2
Trinidad*	99.8	99.1
United States of America (San Juan)*	99.7	99.0

Fault Summary

- Network has been stable & resilient and maintained availability statistics in almost every state.
- The time taken by LIME to respond to faults has been addressed and truck rolls will occur more quickly moving forward.
- Router issues has been addressed with Smartnet and all outstanding routers.

Radar Sharing

- Martinique sends Dacota Radar to Piarco via France Telecom IPLC (64k newbridge).
- Martinique also sends Dacota Radar to Piarco via E/CAR router using Layer Two Tunneling Protocol (l2tp).
- Piarco sends Dacota Radar currently(l2tp) to 9 E/CAR States. (ANU, BGI, DOM, FDF, GND, MNI, NEV, SKB, SLU, SVD and UVF).
- Multicasting of the Piarco MRT was tested and demonstrated at the last meeting but not deployed pending the acquisition of States' user end equipment.
- Two (2) additional routers were acquired as backup for the dedicated Radar routers for Piarco and Martinique.

On-going Network Activities

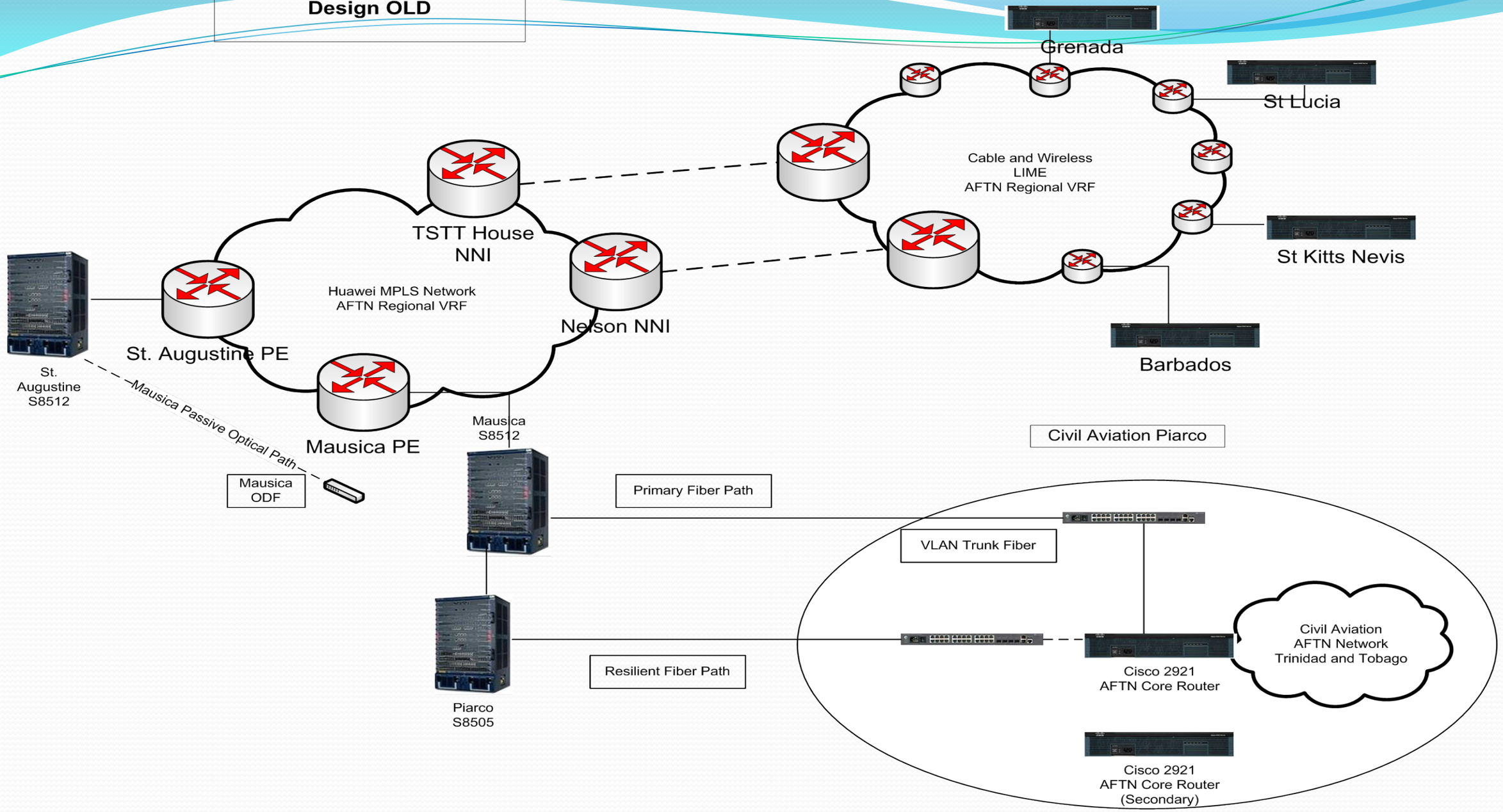
- Four (4) FXO ports were configured in San Juan for MEVA-E/CAR interconnection between Sint Maarten, Antigua, St Kitts and Anguilla

- AMHS testing on going between Atlanta and Piarco.

Resiliency measures

- TTCAA network was implemented with all services terminating at the Mausica Exchange.
- Mausica is the host Exchange for all TSTT services within the Piarco region.
- A resilient design was implemented to ensure continuous service to TTCAA in the event of any major failure at Mausica host exchange.

AFTN Core Resiliency Design OLD



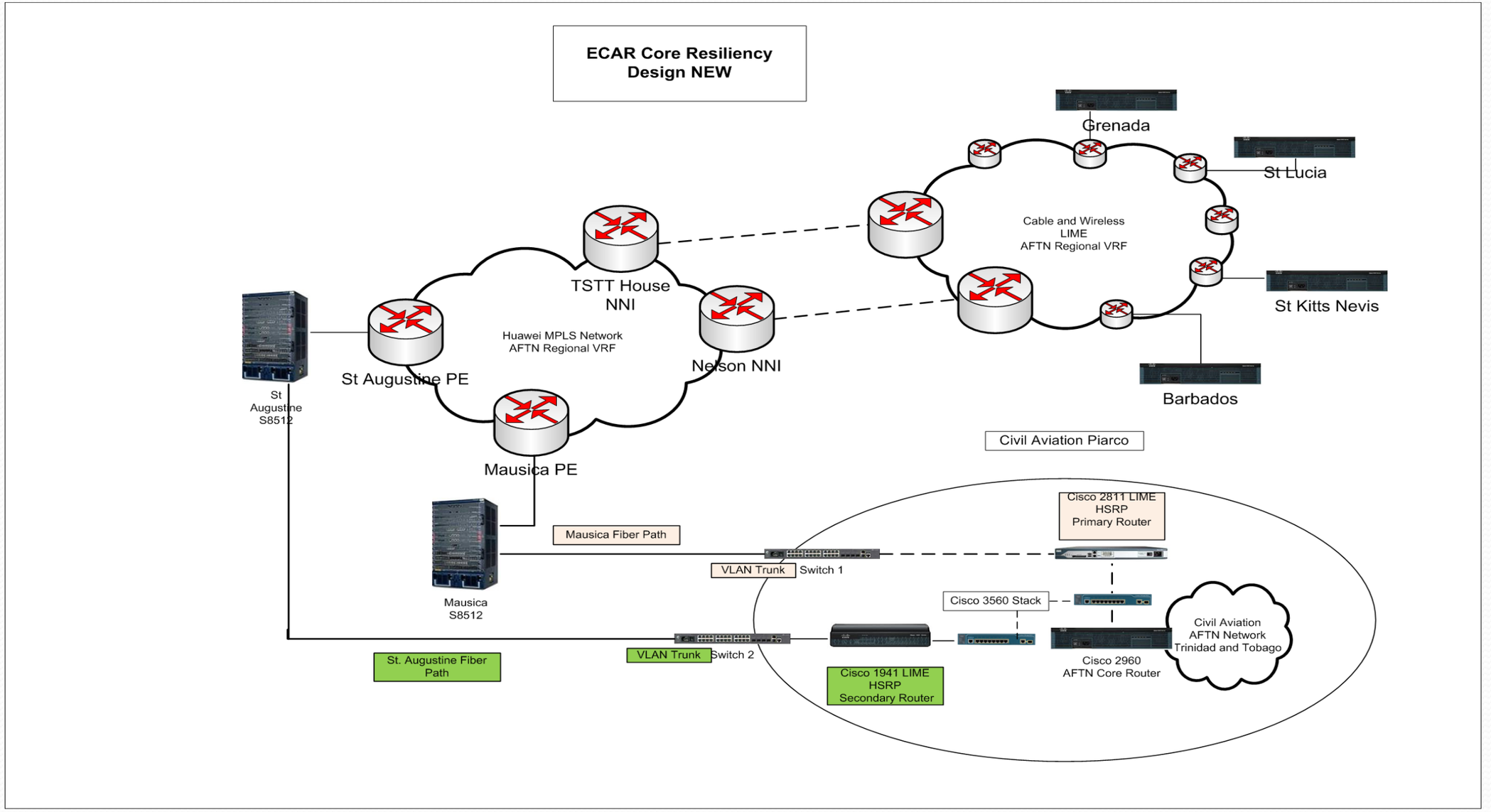
Resiliency measures

- A new network design was implemented to dual connect TTCAA services to two (2) geographically separate exchanges in different regions.

- The design required an additional router configured for all Layer 3 services and Cisco HSRP resilient routing protocol used to determine the automatic rerouting of the network.

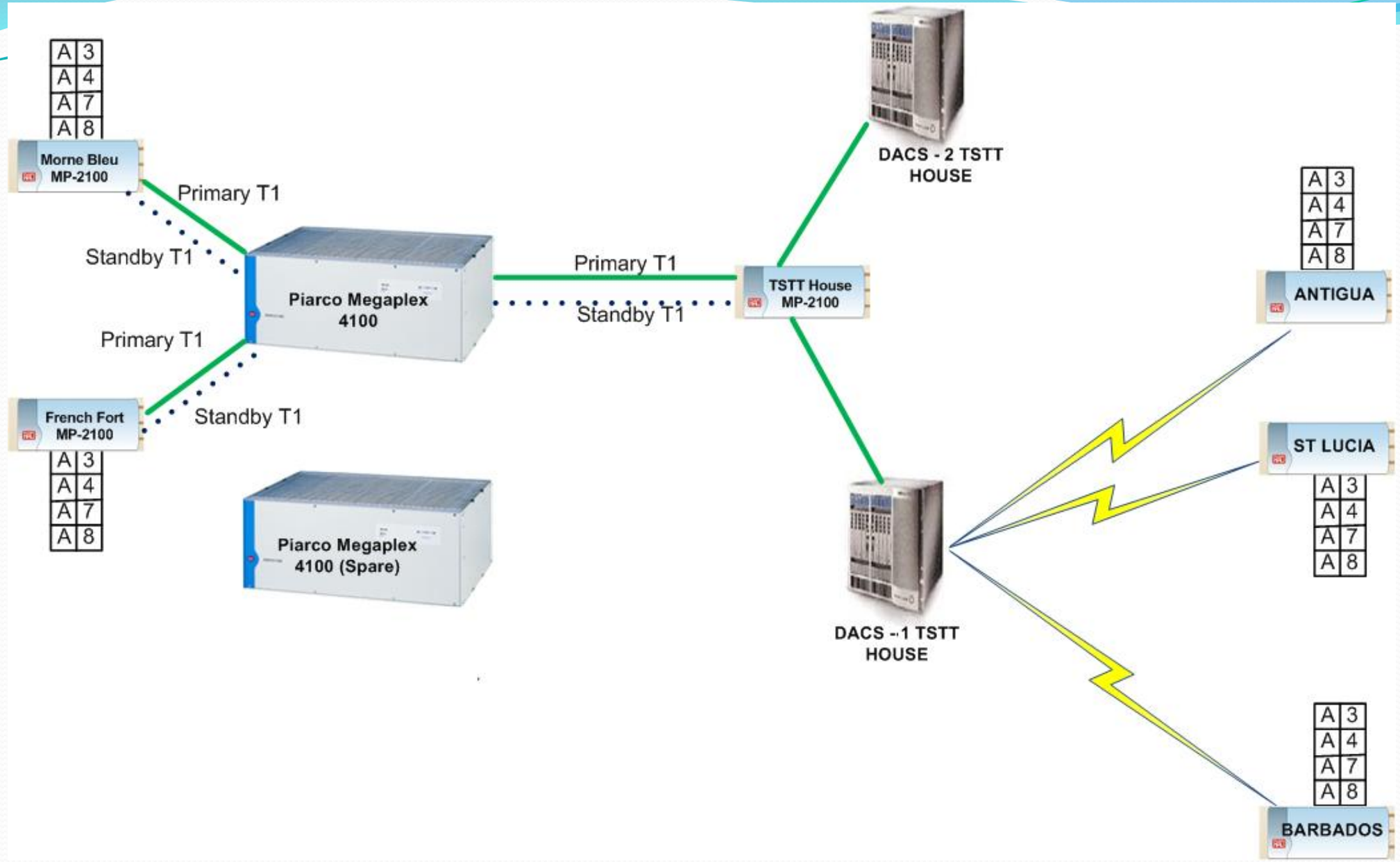
- Layer 2 services will be rerouted manually (Tobago & Martinique).

Resiliency measures



Resiliency measures - VHF

- Primary T1 links originate at TSTT's Mausica Exchange.
- Standby T1 links originate at TSTT's St. Augustine Exchange.
- The Megaplex 2100/4100 employs Dual Link Parallel Transmit. Identical traffic is transmitted on both the Primary and Standby T1 links but only the Primary is connected to the end user.
- Failure of the Primary link results in switch over of the standby to the end user.
- Switch over time is 50ms. Traffic is uninterrupted.


A 3
A 4
A 7
A 8
Morne Bleu MP-2100
Primary T1
Standby T1
Piarco Megaplex 4100
Primary T1
Standby T1
Primary T1
Standby T1
French Fort MP-2100
A 3
A 4
A 7
A 8
Piarco Megaplex 4100 (Spare)
DACS - 2 TSTT HOUSE
TSTT House MP-2100
DACS -1 TSTT HOUSE
A 3
A 4
A 7
A 8
ANTIGUA
ST LUCIA
A 3
A 4
A 7
A 8
A 3
A 4
A 7
A 8
BARBADOS

Thank You