International Civil Aviation Organization

THE TWELFTH WORKING GROUP MEETING OF AERONAUTICAL TELECOMMUNICATION NETWORK (ATN) IMPLEMENTATION CO-ORDINATION GROUP OF APANPIRG (ATNICG WG/12)

5 – 8 August, Renton, WA, USA

Agenda Item 4:   **Ad-hoc Working Group: MPLS VPN support VoIP and Data (AMHS, ATFM, AIDC, OPMET databanks, etc.)**

PROPOSED ASIA/PACIFIC REGIONAL INTERNET PROTOCOL VIRTUAL PRIVATE NETWORK

(Presented by U.S.A./Federal Aviation Administration (FAA))

SUMMARY

This presentation proposes a regional Internet Protocol network and raises questions for discussion.

ACTION BY THE MEETING

The meeting is invited to:

a)   provide feedback on the information presented; and

b)   discuss any relevant matters as appropriate.

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PROPOSED ASIA/PACIFIC REGIONAL INTERNET PROTOCOL VIRTUAL PRIVATE NETWORK

ASIA/PACIFIC AERONAUTICAL TELECOMMUNICATION NETWORK IMPLEMENTATION COORDINATION GROUP
August 5-8, 2013
RENTON, WA, USA

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Issues Facing Aeronautical Fixed Service (AFS) Enhancement

Current Point-to-Point circuit arrangement between States to support AFS has the following issues:

- Half circuit arrangement between States is increasingly difficult to order and time consuming
- Would not support dynamic routing due to limit in bandwidth and no central administration of the network
- Incompatible network protocol would not support Extended Service as specified in ICAO Doc. 9880
- New features enhancement as recommended by ICAO 12th Air Navigation Conference such as Information Management Service (IMS) can not be supported
- Network security measures can not be implemented which leads many States to implement their own security measures and policy
- Requires each States to synchronize their upgrade before AFS data can be distributed seamlessly and usually it's not the case in Asia/Pacific region due to States' different budget cycle and priority
- Circuit upgrade is also impacted by the various pricing and bandwidth availability of the half circuit at each State

Recommendation

European region has implemented the Pan-European Network Service (PENS) and North American region has FAA Telecommunication Infrastructure (FTI) to support Canada and USA to distribute AFS data. In other ICAO regions -- South America has REDDIG and Caribbean has MEVA.

Asia/Pacific region should establish its own telecommunication network to:
* Reduce telecommunication cost
* Enhance information security
* Support new enhancements
* Provide a dynamic network
* Minimize coordination for network management and enhancement
* Respond to Air Traffic requirements in a timely manner

Recommendation (Cont'd)

In order to establish a private network, the following are required:

- The cost has to be equal or less than the current cost by utilizing existing commercially available infrastructure
- An entity (Organization/State) is designated as Network Administrator
- Other users can individually enter contract agreement for a local connection
- Any users of the network can be connected to one another as controlled by network Administrator

The FAA has been exploring a contract with Harris Corporation to establish a Virtual Private Network from its global telecommunication network infrastructure. Harris is using this global infrastructure to distribute data for banking and oil industries in addition to ATC data for the FAA. This network is based on MultiProtocol Label Switching (MPLS).

This is a Private Network not the public internet.

MPLS
(MultiProtocol Label Switching)
Network
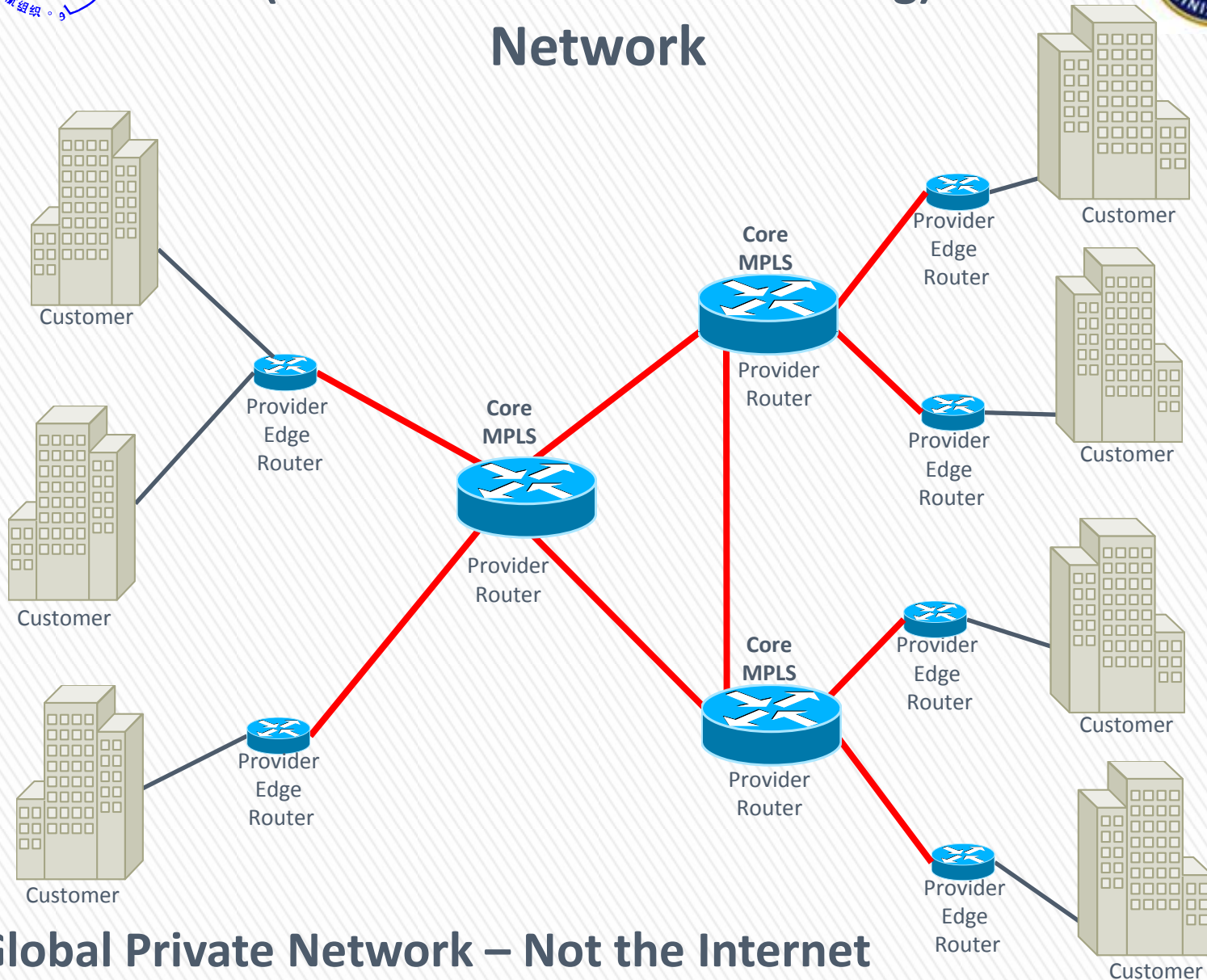
Global Private Network – Not the Internet

Proposal

Based on the recommendation, the FAA is proposing an Asia/Pacific Virtual Private Network (VPN) to the following States:
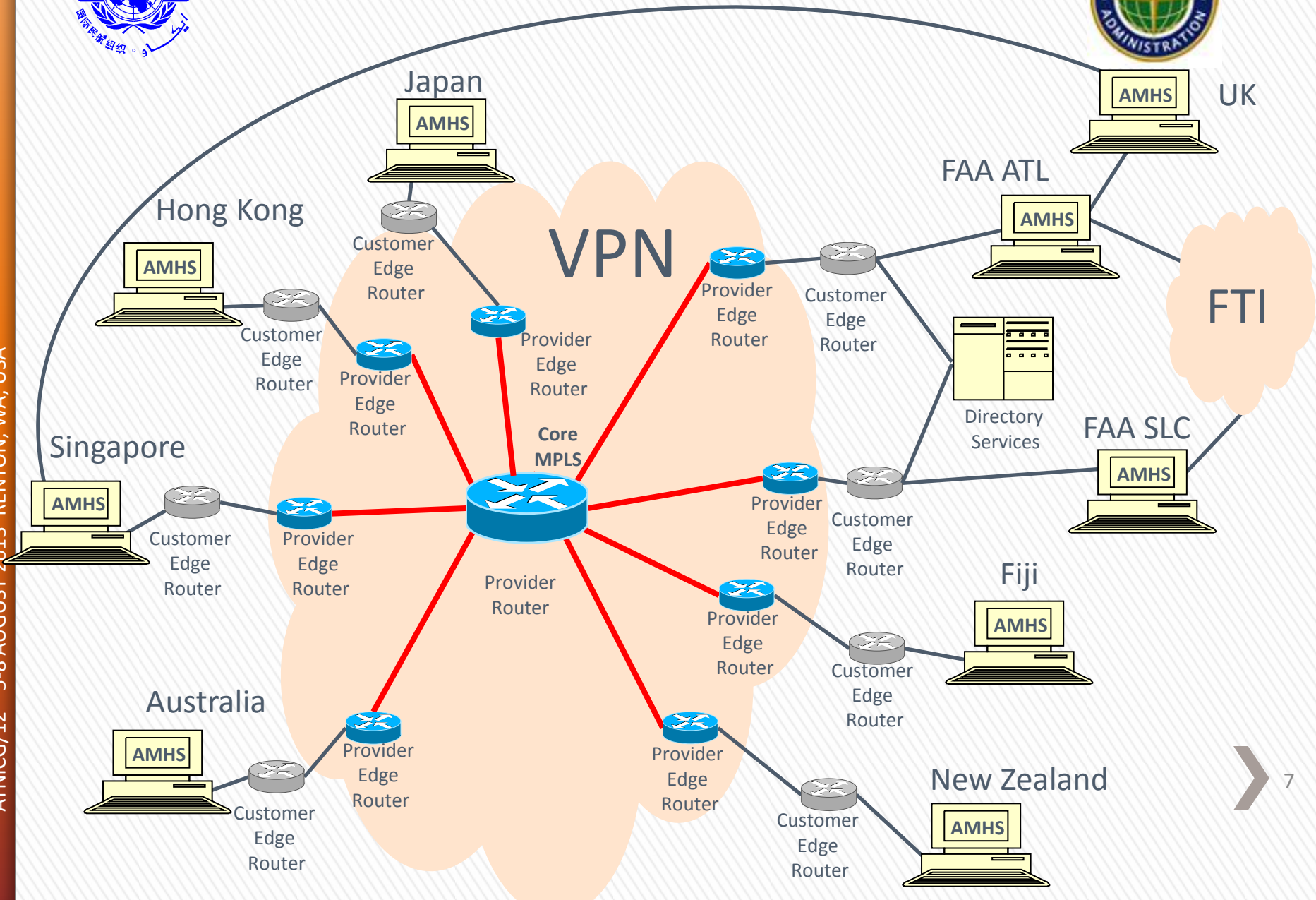
- Australia for its adjacent FIR with USA
- Fiji for its adjacent FIR with USA
- New Zealand for its adjacent FIR with USA
- Singapore for its connection to United Kingdom (UK also connects to USA)
- Hong Kong, China for planned AMHS connection for diversity
- The Asia/Pacific VPN is open for other members in the region based on bandwidth availability

This proposed network is a VPN from Harris' MPLS network. This means the bandwidth set aside is guaranteed by the contract and this VPN access is limited by its users and network administrator only.

The users can enter a contract agreement with Harris separately for local access to the Asia/Pacific VPN for a connection of 2 megabits/connection. This will be provided by local telecommunication provider through contract agreement with Harris Corp.

High-level Network Diagram

Japan

AMHS

UK

AMHS

Hong Kong

AMHS

FAA ATL

AMHS

VPN

Customer Edge Router

Provider Edge Router

Provider Edge Router

Customer Edge Router

FTI

Customer Edge Router

Provider Edge Router

Provider Edge Router

Directory Services

FAA SLC

AMHS

Core MPLS

Singapore

AMHS

Customer Edge Router

Provider Edge Router

Provider Router

Provider Edge Router

Customer Edge Router

Fiji

AMHS

Provider Edge Router

Customer Edge Router

Australia

AMHS

Provider Edge Router

Customer Edge Router

Provider Edge Router

Customer Edge Router

New Zealand

AMHS

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2 Meg IP Connectivity

- Each access circuit will provide 2 Meg of IP bandwidth
  - Exception of the U.S. where only 1.5 Meg due to T-1 limit
- Each 2 Meg circuit provides a fully meshed network
- It will be possible to setup numerous VPN connections
  - Effectively creating virtual circuits between each country
  - Each country will be free to interact with any other country passing data up to their 2 meg limitation
- Should any countries desire greater bandwidth additional 2 meg increments can be ordered.

Proposed Full Meshed Network Topology
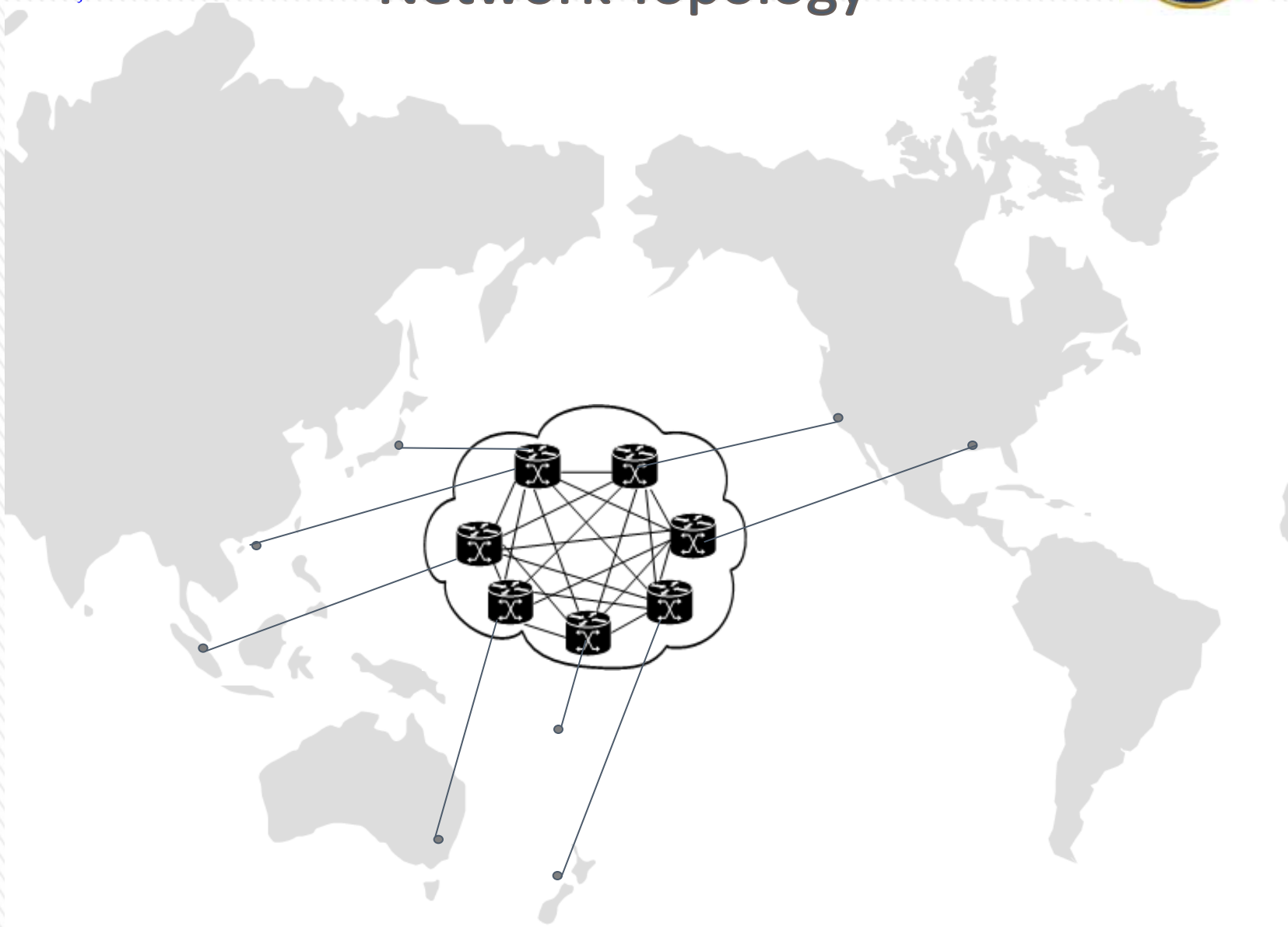
Network Administration

- Only one vendor can supply the MPLS network
  - Although in most cases the local in-country vendor will be used for connectivity access
  - Orders will be placed to the one vendor not to individual country access suppliers
- Certain key questions should be resolved prior to implementation
  - Who is the Network administrator ?
  - Is Quality of Service (QoS) desired ?
  - If QoS is selected how many classifications of service ?
  - Will you choose to attempt VoIP over the network ?
    - (Now or in the future)
  - Target programs to migrate
 - Agreed-to schedule

Harris CapRock Payment Model

- Harris CapRock would bill each country for the access cost
  - Harris CapRock is looking to become an approved government telecom provider for each country
- This is different from the MEVA model
  - In the MEVA model each member contributes to the total monthly network cost
  - The problem with the MEVA model has been individual countries having payment issues causes problems for the entire network
- Under this model payment issues by one country will not affect service to any other country
- Payment issues could result in that individual country's access being suspended, but would have no effect on any other country
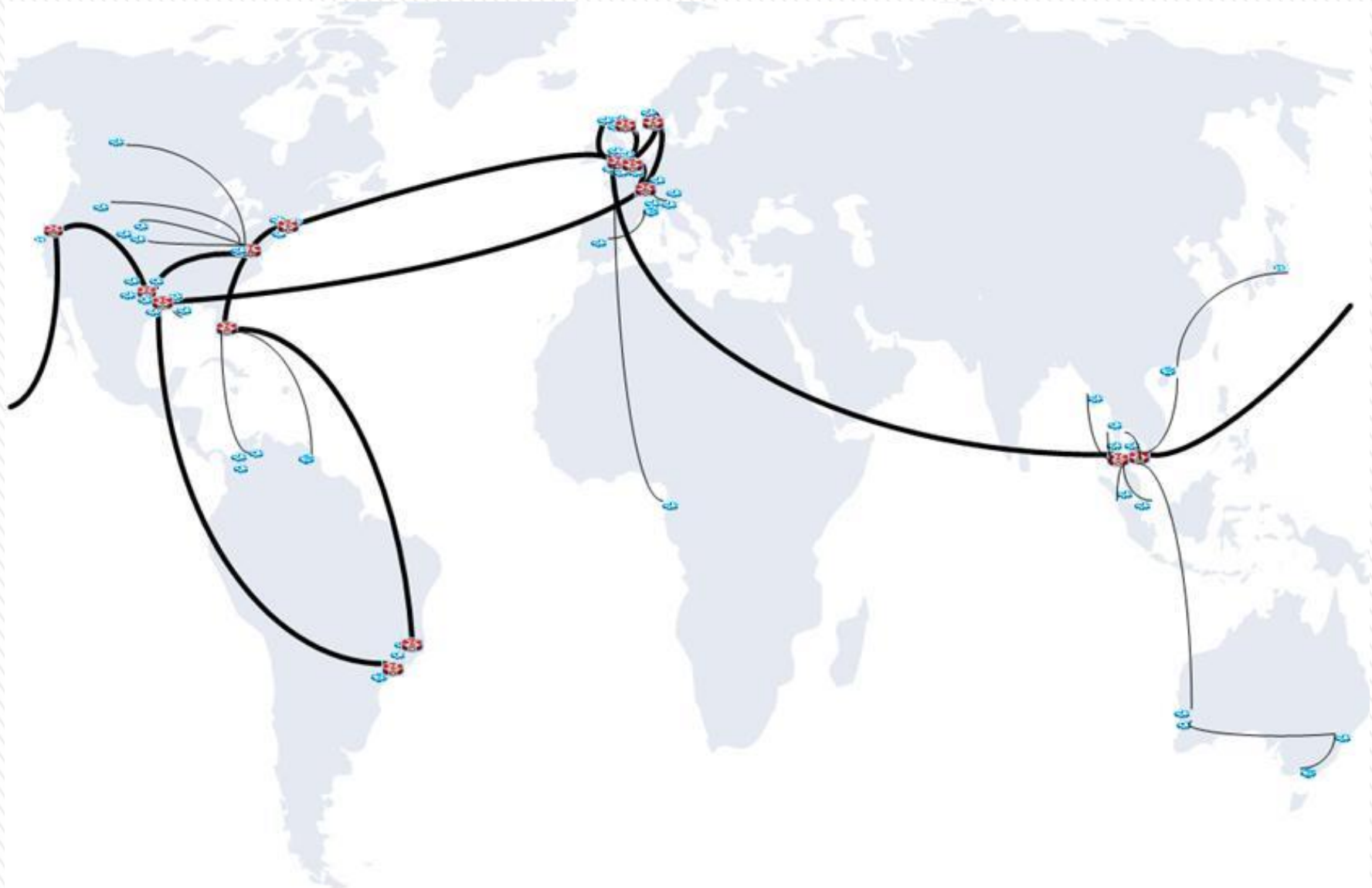
Lower Cost Lower Bandwidth Solution for Fiji
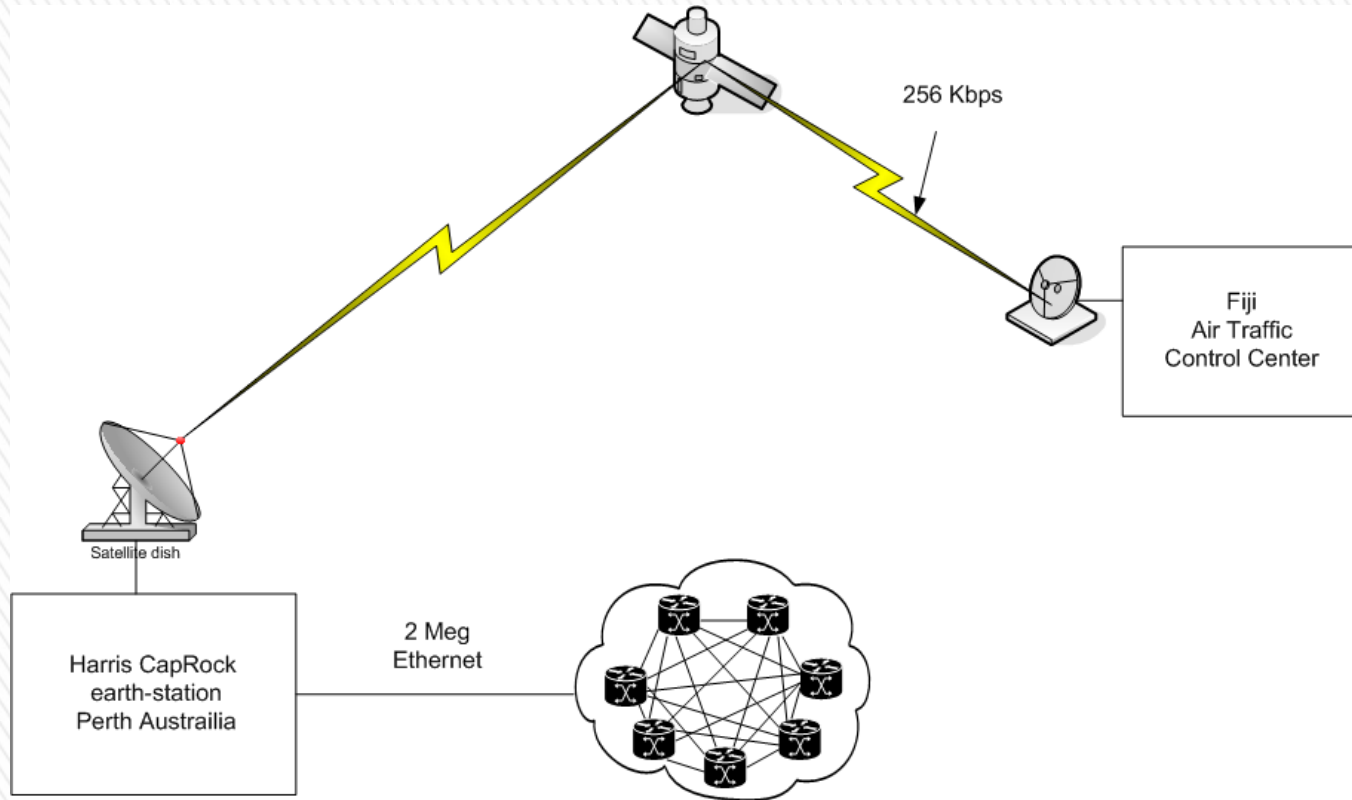
- Alternative TDMA VSAT solution
- Reduce bandwidth to 256 Kbps
- Lowers the MRC for Fiji
- Could be an alternative in other locations if 2 Meg Ethernet is too expensive

Some Information On MultiProtocol Label Switching (MPLS)

MPLS Basics

- Multiprotocol Label Switching (MPLS)

- MPLS operates between Layer 2 and Layer 3

- VPNs (Virtual Private Networks) are often used on MPLS networks

- Routing is established with VRFs
  - Virtual Routing and Forwarding

- Some web pages

- http://www.nanog.org/meetings/nanog49/abstracts.php?pt=MTU2OCZuYW5vZzQ5&nm=nanog49

- http://www.cisco.com/en/US/tech/tk436/tk428/technologies_q_and_a_item09186a00800949e5.shtml

How MPLS works

- MPLS works by prefixing packets with an MPLS header
  - containing one or more "labels"
- These MPLS-labeled packets are switched after a label lookup/switch instead of a lookup into the IP table
- Label Edge Routers (LER)
  - push an MPLS label onto an incoming packet
  - pop it off the outgoing packet
- Routers that perform routing are Label Switching Routers (LSR)
- MPLS-based Virtual Private Network (VPN)
  - LSRs that function as ingress and/or egress routers to the VPN are often called PE (Provider Edge) routers.
  - Devices that function only as transit routers are similarly called P (Provider) routers.
  - See RFC 4364.

- Author unknown

- ## P Router
  – In Multi-Protocol Label Switching (MPLS), a P Router or Provider Router is a Label Switch Router (LSR) that functions as a transit router of the core network. The P Router typically connected to one or more PE Routers.

- ## PE Router
  – Provider Edge router (PE router) is a router between one network service provider's area and areas administered by other network providers. A network provider is usually an Internet Service Provider as well (or only that).

- ## CE Router
  – Customer Edge router (CE router) is a router located on the customer premises that provides an Ethernet interface between the customer's LAN and the provider's core network.