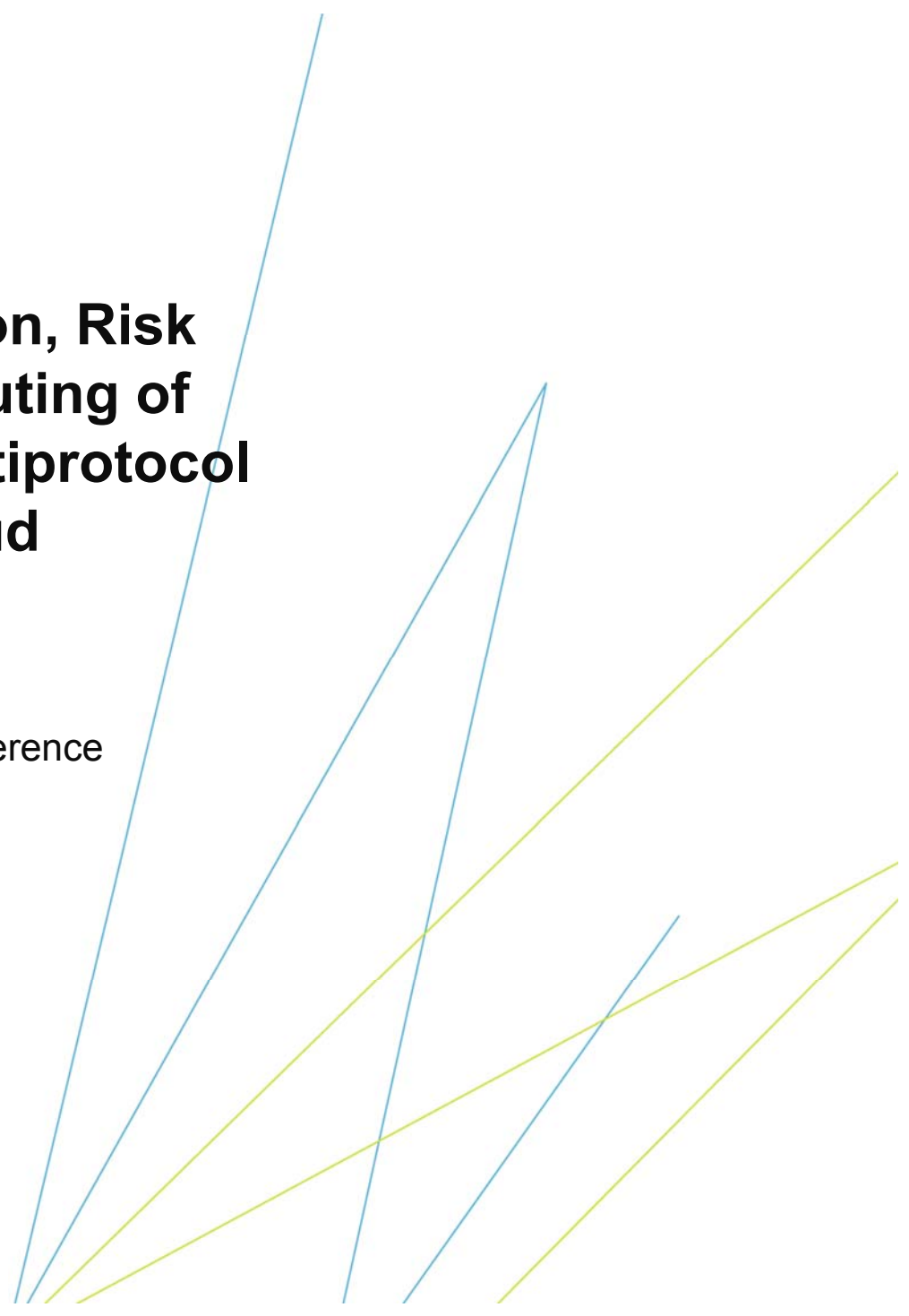# Short Case Study: Automation, Risk Reduction, and Fail Over Routing of Imagery Products Using Multiprotocol Label Switching (MPLS) Cloud

Olga Aparicio & Mun-Wai Hon

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For the best of reasons

Overview

- Background & Problem Definition Objectives

- Current Situation : Script Automation

- Two Components with Hosted Clouds: Failover Node Configuration & Virtualization (Virtual Routers / VPN)

- General Comparison of Cloud Based CIP Potential Scenarios

- Implementation Operating Costs of Connectivity to CIP Potential Scenarios ~ Estimated Costs

- Recommendations and Next Steps

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Background

- A Critical Infrastructure Protection Network effort was developed and operated at the primary facility while a Backup Facility exists in another state

  - Functions supported at the Backup Facility are:
    - Data ingest from satellites imagery products
    - Product generation and distribution to all major users in the event of a natural or man-made disaster disabling the primary facility
    - Provides fully independent end-to-end data stream
  - During failover testing, subscribers were unable to obtain imagery products

- Primary Facility Uses MPLS cloud and has transition plans to shift more functions to cloud-based services

- Cloud hosting would solve a lot of issues regarding legacy and stove piped, replicated functions among programs

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Problem Definition and Objectives

- Problem Scenario and Definition
    - The primacy facility is rendered inoperable and the Critical infrastructure Protection Network at Backup Facility will be activated.
    - A fail-over using MPLS cloud technology and the Critical Infrastructure Protection Network will allow personnel to have full access for data retrieval, subsequently the problem is expected to be solved
- Objectives of Solution:
    - Analyze procedures, which include configurations of firewalls and routers, used for the failover and leverage MPLS cloud Virtual Route Forwarding (VRF) functions to ensure that all satellite products are available to end-users
    - In the process, more automated solution with less manual processing will be favored as it will reduce risk and errors due to human intervention
    - Automated monitoring and synchronization will reduce time to recover from failover

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Current Situation : Script Automation
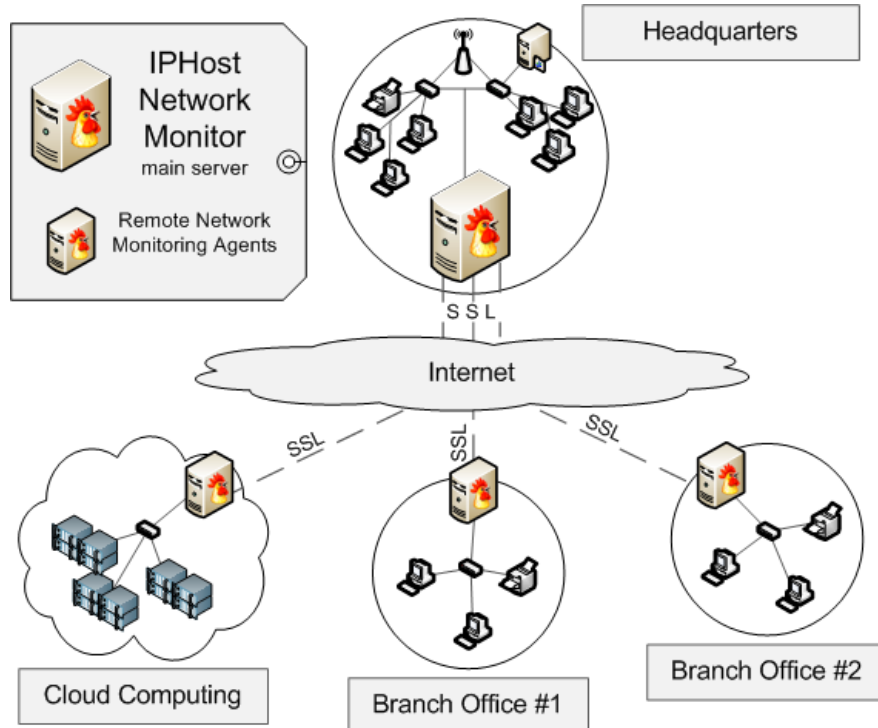
- Automated monitoring program for detecting unresponsive connections
- Upon detection monitoring program would invoke scripts to change routing
- Detection of network restoration would trigger scripts to restore normal operations
- Very Manual Process
  - Requires High Labor Support
  - Prone to Human Error
  - Slow reaction time

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Failure Event Occurs → Primary Facility is Out of Commission, Establish Subscriber Connectivity during CIP Failover Using The MPLS Cloud

- The following are the possible solutions:
  - **Scenario 1** — Subscriber System Infrastructure connects to CIP over the MPLS cloud performing configuration changes to already installed routers
  - **Scenario 2** — Subscriber System Infrastructure connects to CIP over the MPLS cloud by establishing a direct connection to the MPLS Cloud
  - **Scenario 3** — Subscriber System connects to CIP over the MPLS cloud via a Metropolitan Area Network Connection
- The objective is to provide a solution with no disruption and while being economically effective
- Two main components for working with the hosted Cloud: Node Configuration and Virtual Route Forwarding (VRF)

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Component 1: Failover Node Configuration
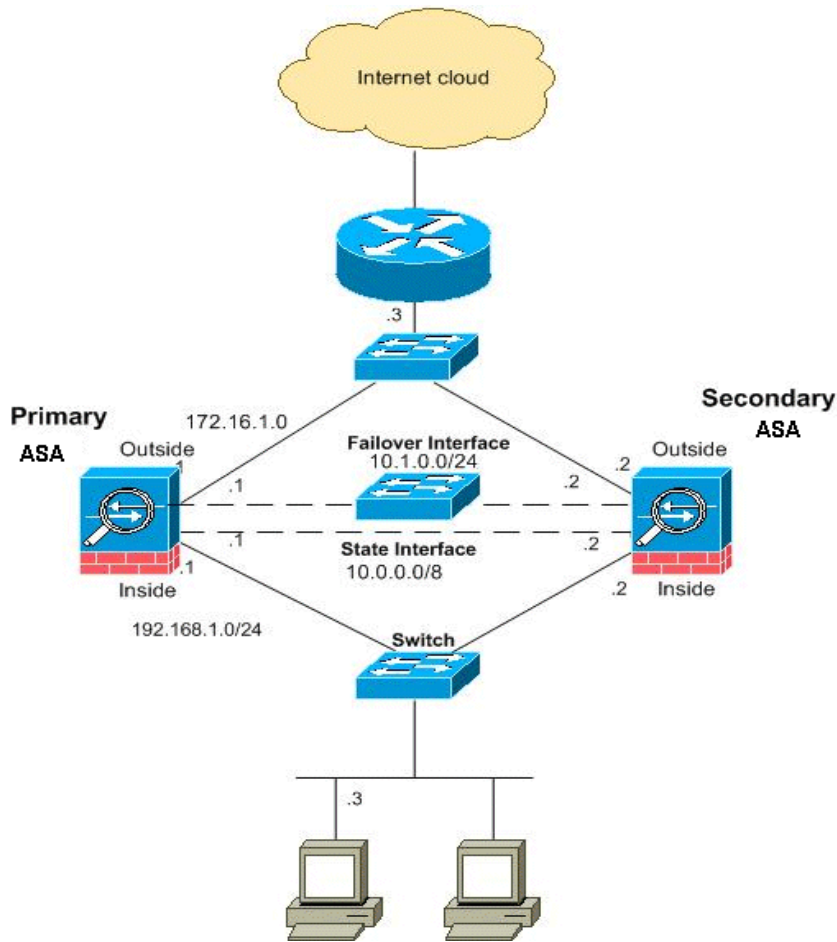
- Introduce additional nodes for failover automation
- A proxy or router that would eliminate scripting and manual route changes
- Heart beat protocol for synchronization of LAN based devices vs cable direct connect

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Component 2: Virtualization (Virtual Routers / VPN)
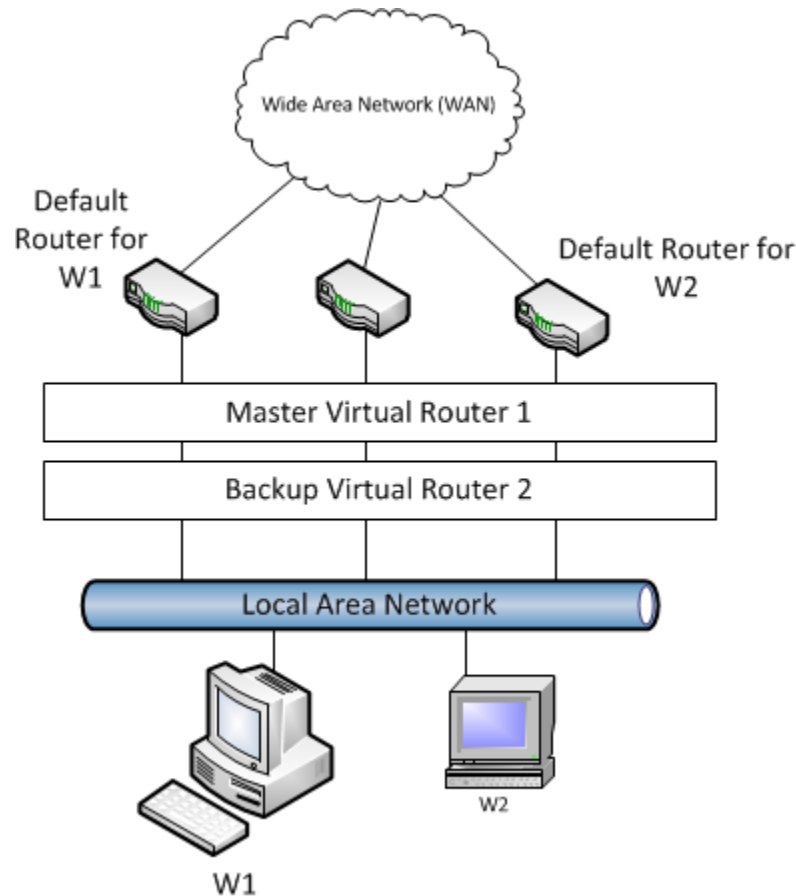
- Introduce Virtual Routing and Forwarding (VRF) Supported by CISCO
- Two Virtual Routers consisting of separate routing tables
- Issue may be with PIX type firewalls and the support of multicasting protocols

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General Comparison of Cloud Based CIP Potential Scenarios

Satellite Product Subscriber access to CIP network during failover	Scenario 1 — Over the MPLS cloud enabling configuration changes Only	Scenario 2 — Over the MPLS cloud via a direct connection	Scenario 3 — Over the MPLS cloud via a Metropolitan Area Network (MAN) connection
Potential Human Errors	No	No	No
Manual Procedures	No	No	No
Fully Automated	Yes	Yes	Yes
Additional CAPEX required	Maybe not	Yes	Yes
Additional OPEX required	Yes	Yes	Yes
Improves Availability	No	No	Yes
Increases Failover Time	Maybe not	No	No
Increases Latency	No	No	No

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Implementation Schedule Comparison of Subscriber Connectivity to CIP Potential Scenarios

Activities Required	Scenario 1 — Over the MPLS cloud enabling configuration changes Only	Scenario 2 — Over the MPLS cloud via a direct connection	Scenario 3 — Over the MPLS cloud via a Metropolitan Area Network connection
Bandwidth study	3 weeks	3 weeks	3 weeks
Determine ports' availability	4 weeks	N/A	N/A
Provision connectivity routers	4 weeks	N/A	N/A
Determine housing for main router	N/A	2 weeks	2 weeks
Purchase New Router	N/A	N/A	4 weeks
Re-provisioning of VRF	8 weeks	8 weeks	8 weeks
Continuity test from BF to Primary Facility	4 weeks	4 weeks	4 weeks
Total provisioning schedule	17 Weeks [end March 2014]	17 Weeks [end March 2014]	21 Weeks [end April 2014]

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Implementation Operating Costs of Connectivity to CIP Potential Scenarios ~ Estimated Costs

Activities Required	Scenario 1 — Over the MPLS cloud enabling configuration changes Only	Scenario 2 — Over the MPLS cloud via a direct connection	Scenario 3 — Over the MPLS Cloud via a MAN connection
Bandwidth study	No Additional Cost	No Additional Cost	No Additional Cost
Determine ports' availability @ Primary Site	No Additional Cost	N/A	N/A
Provision connectivity Primary Site routers	No Additional Cost	N/A	N/A
Determine housing for the Upgraded Router	No Additional Cost	No Additional Cost	No Additional Cost
Purchase New Router	N/A	N/A	~$20,000.00
Move and Re-Configure Routers to Support VRFs	N/A	~$5,339.75	~$5,339.75
Re-provisioning of VRF to MPLS Cloud	~$1,500.00	~$1,500.00	~$1,500.00
Continuity test from BF to Primary Site	No Additional Cost	No Additional Cost	No Additional Cost
Total Cost	~$1,500.00	~$6,839.75	~$26,839.75

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Recommendations and Next Steps

- Summary Recommendation of Scenario 3
  - Provides direct connection for Subscriber Connections to the MPLS cloud
  - Provides ability to provide enterprise services like Active Directory and Tripwire

- Tactical Plan In Progress
  - As functions shift to the cloud, the following activities should be considered to reduce risks:
    - Verify and Test all the CIP component routing and operations
    - Verify routes as documented using network analysis tools
    - Conduct traffic analysis given data sources to ensure current lines can support load during failover given time window requirements
    - Continue reducing points of manual operations
    - Update documentation with correct diagrams, network information, and data flows

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