TCAP: Transforming Commercial-off-the-shelf (COTS) routers for Airborne Platforms

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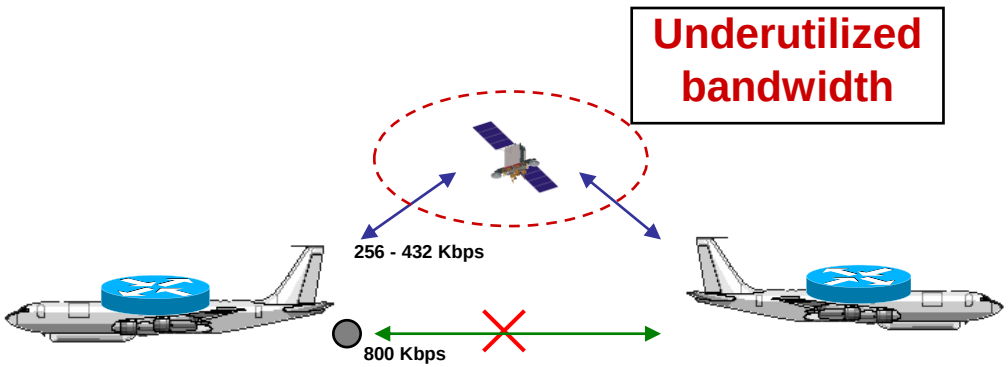
AF MOIE

Problem

- Department of Defense (DoD) wants to enable netcentric operations to the tactical edge, which will require Internet Protocol (IP) networking on airborne platforms.
- How the airborne platforms connect to the IP network will greatly impact the performance of netcentric applications.
  - Static vs. dynamic routes
  - Many configuration options for COTS routers and dynamic routing protocols.
- Right now COTS routers are the only option, but COTS routers were not designed for airborne networks.
  - Limited bandwidth
  - Unreliable links
  - Varying link capacities

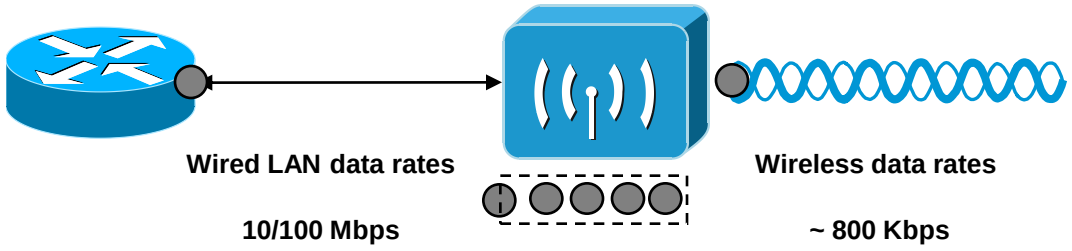
Background



- COTS routers allow for the use of multiple communication links off an airborne platform, improving application availability.
- COTS routers are designed for stable environments and need to be optimized for airborne platforms.

- COTS routers do not have a radio specific interface which causes problems with flow control and detecting link state.
- The nature of RF communications on airborne platforms causes time-varying link capacities and frequent link outages.

Buffers on the radio terminal will fill causing packets to be dropped at the terminal instead of stored at the router.



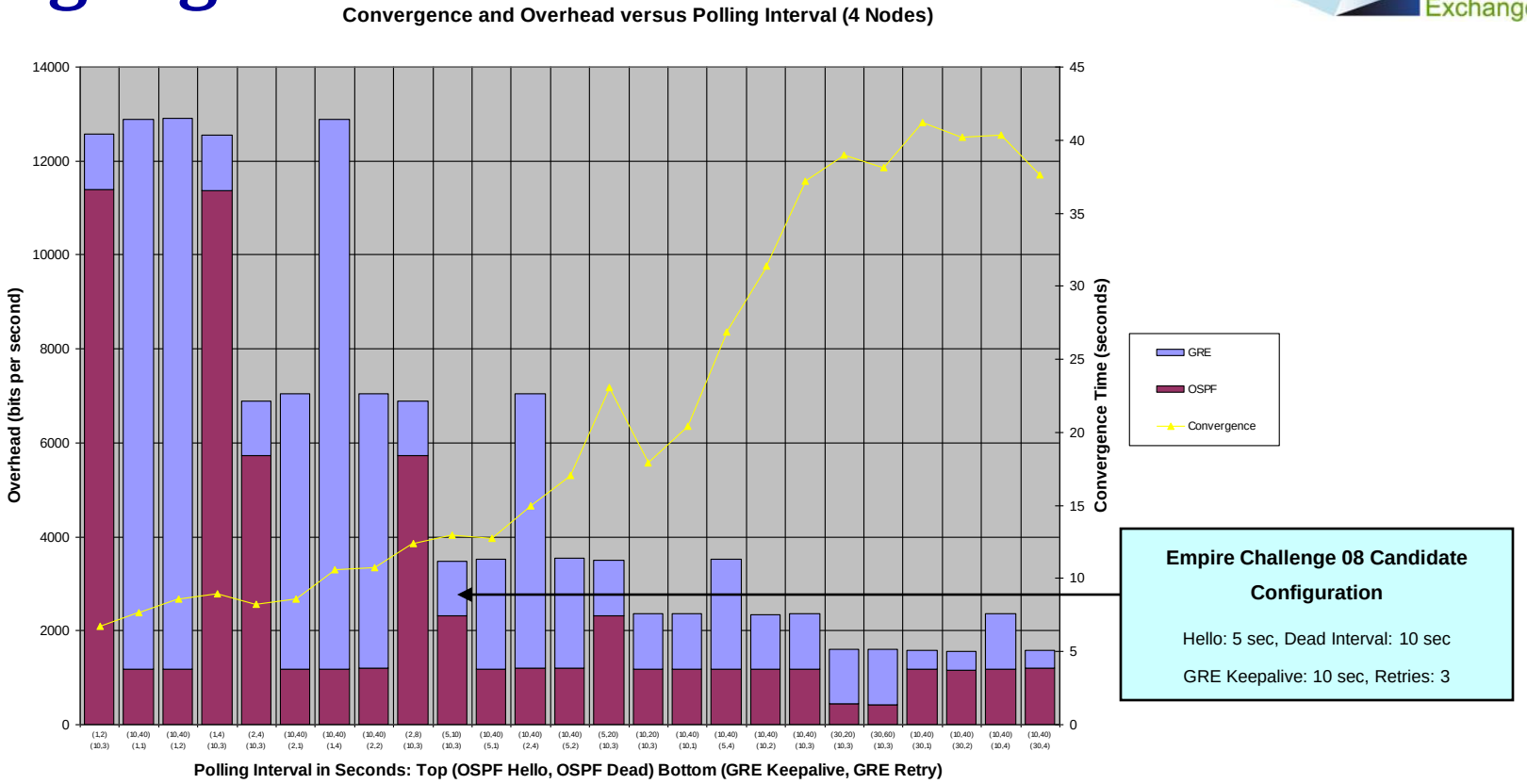
Objective

- **Improve availability of netcentric applications on airborne platforms by utilizing COTS routers and dynamic routing to access all available platform communication links.**

Activities

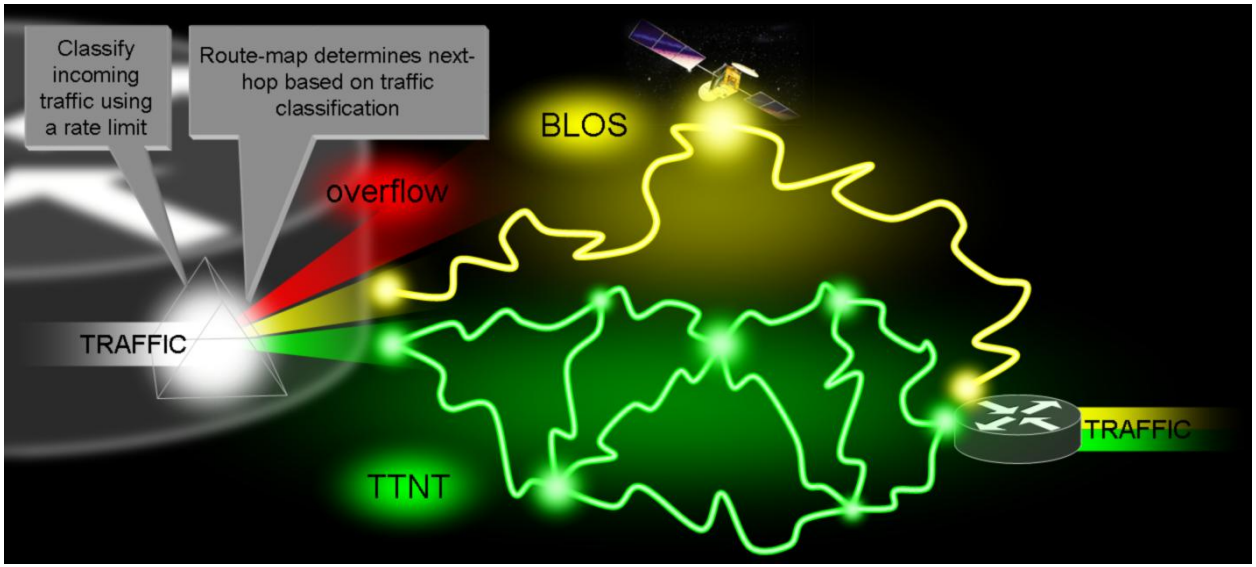
- Test OSPF protocol to identify optimal router configurations that will minimize overhead and detect link outages in a timely manner.
- Develop “Non-Equal-Cost Multipath” routing feature which will provide load balancing across heterogeneous links.
- Investigate options for a router-to-radio interface with the goal of determining appropriate next steps for creating such an interface.
- Transition MOIE results onto E-3 AWACS, E-2 XHawk, and Paul Revere during ESC LOS/BLOS Airborne Networking Initiative at Empire Challenge 08.

Highlight



- **Increasing the frequency of OSPF & GRE messages improves network convergence time but at a cost of increased overhead.**
- **Plot shows the OSPF & GRE settings that produce the best convergence time with the least amount of overhead, which will offer the best possible application availability.**

Highlight

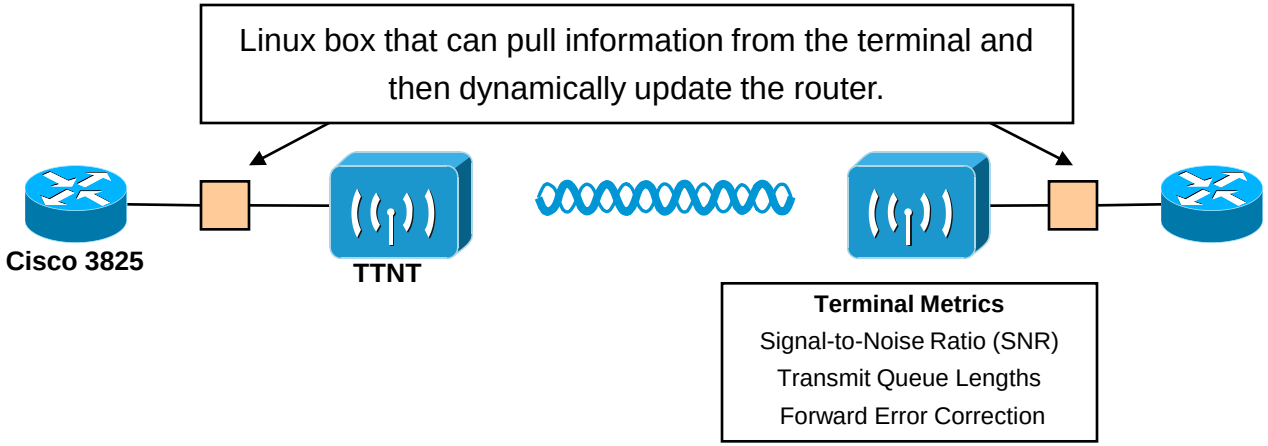


- **Non-Equal Cost Multipath (Non-ECMP) Routing will provide load balancing across line-of-sight (LOS) and beyond line-of-sight (BLOS) links.**
- **Implement Non-ECMP Routing using Cisco IOS features**
  - **Rate-Limiting**
  - **Policy-based routing**

Impacts

- **Improve operational mission on airborne platforms by furthering netcentric operations.**
- **Gain valuable experience using COTS routers with emerging IP capable radios (TTNT).**
- **Increase knowledge base of MITRE staff in critical Airborne Networking area.**

Future Plans



- **Further develop router-to-radio interface.**
  - **Utilize TTNT metrics captured during Empire Challenge 08.**
- **Investigate scalability of COTS router enhancements in larger networks.**
- **Develop strategies to minimize impact of GRE tunnels on scalability.**