INTERNET2

August 9th 2011, OSG Site Admin Workshop

Jason Zurawski – Internet2 Research Liaison

Diagnostics vs Regular Monitoring

Agenda

- Tutorial Agenda:
  - Network Performance Primer - Why Should We Care? (**30 Mins**)
  - Introduction to Measurement Tools (**20 Mins**)
  - Use of NTP for network measurements (**15 Mins**)
  - Use of the BWCTL Server and Client (**25 Mins**)
  - Use of the OWAMP Server and Client (**25 Mins**)
  - Use of the NDT Server and Client (**25 Mins**)
  - perfSONAR Topics (**30 Mins**)
  - Diagnostics vs Regular Monitoring (**20 Mins**)
  - Use Cases (**30 Mins**)
  - Exercises

Performance Monitoring Motivation

- Finding a solution to network performance problems can be broken into two distinct steps:
  - Use of *Diagnostic Tools* to locate problems
    - Tools that actively measure performance (e.g. Latency, Available Bandwidth)
    - Tools that passively observe performance (e.g. error counters)
  - *Regular Monitoring* to establish performance baselines and alert when expectation drops.
    - Using diagnostic tools in a structured manner
    - Visualizations and alarms to analyze the collected data
- Incorporation of either of these techniques must be:
  - *ubiquitous*, e.g. the solution works best when it is available everywhere
  - seamless (e.g. *federated*) in presenting information from different resources and domains

On Demand vs Scheduled Testing

- On-Demand testing can help solve existing problems once they occur
- Regular performance monitoring can quickly identify and locate problems before users complain
  - Alarms
  - Anomaly detection
- Testing and measuring performance increases the value of the network to all participants

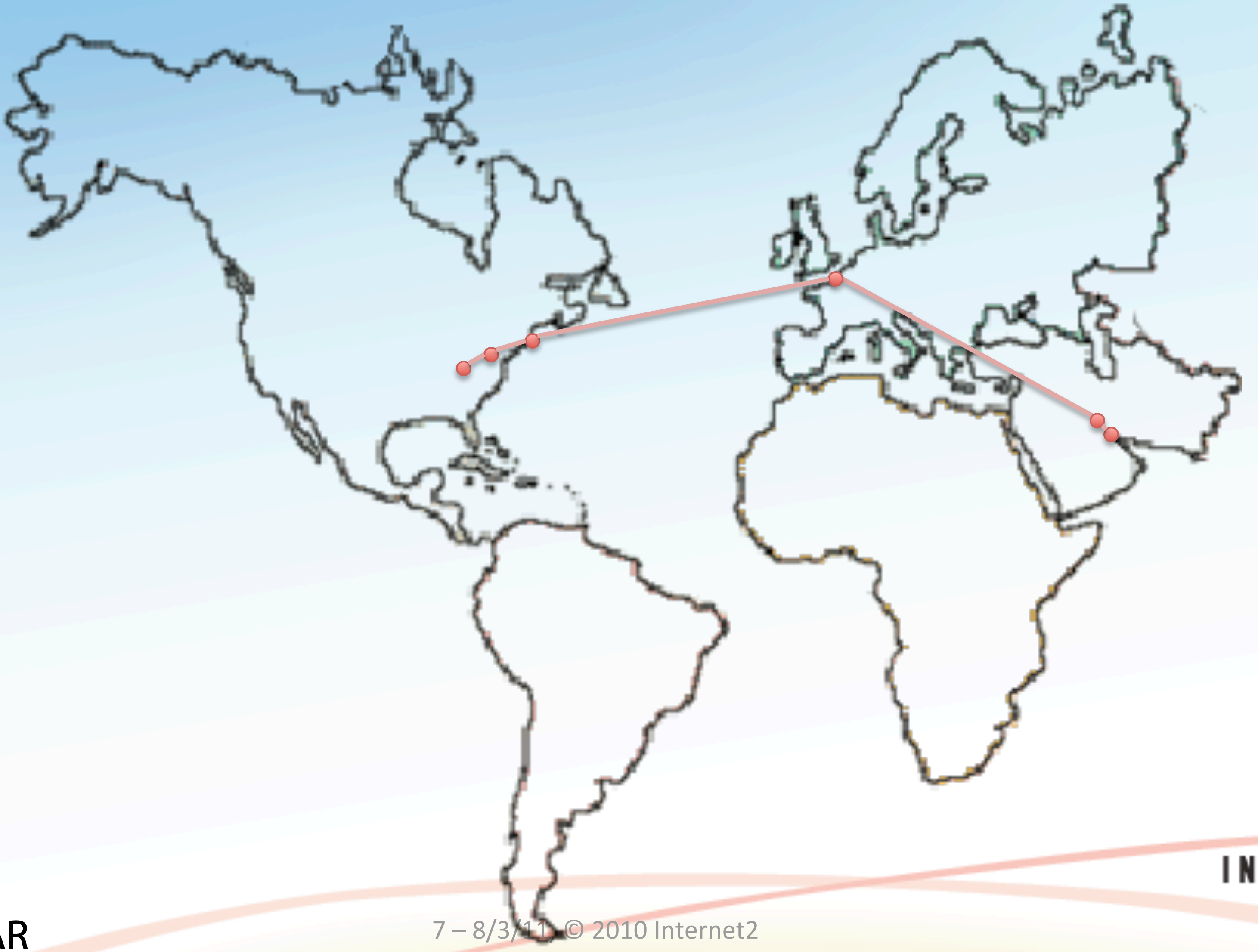
How it ***Should*** Work

- To accurately and swiftly address network performance problems the following steps should be undertaken
  - Identify the problem: if there a user in one location is complaining about performance to another, get as much information as possible
    - Is the problem un-directional? Bi-directional?
    - Does the problem occur all the time, frequently, or rarely?
    - Does the problem occur for only a specific application, many applications, or only some applications?
    - Is the problem reproducible on other machines?
  - Gather information about the environment
    - Hosts
    - Network Path
    - Configuration (where applicable)
    - Resources available

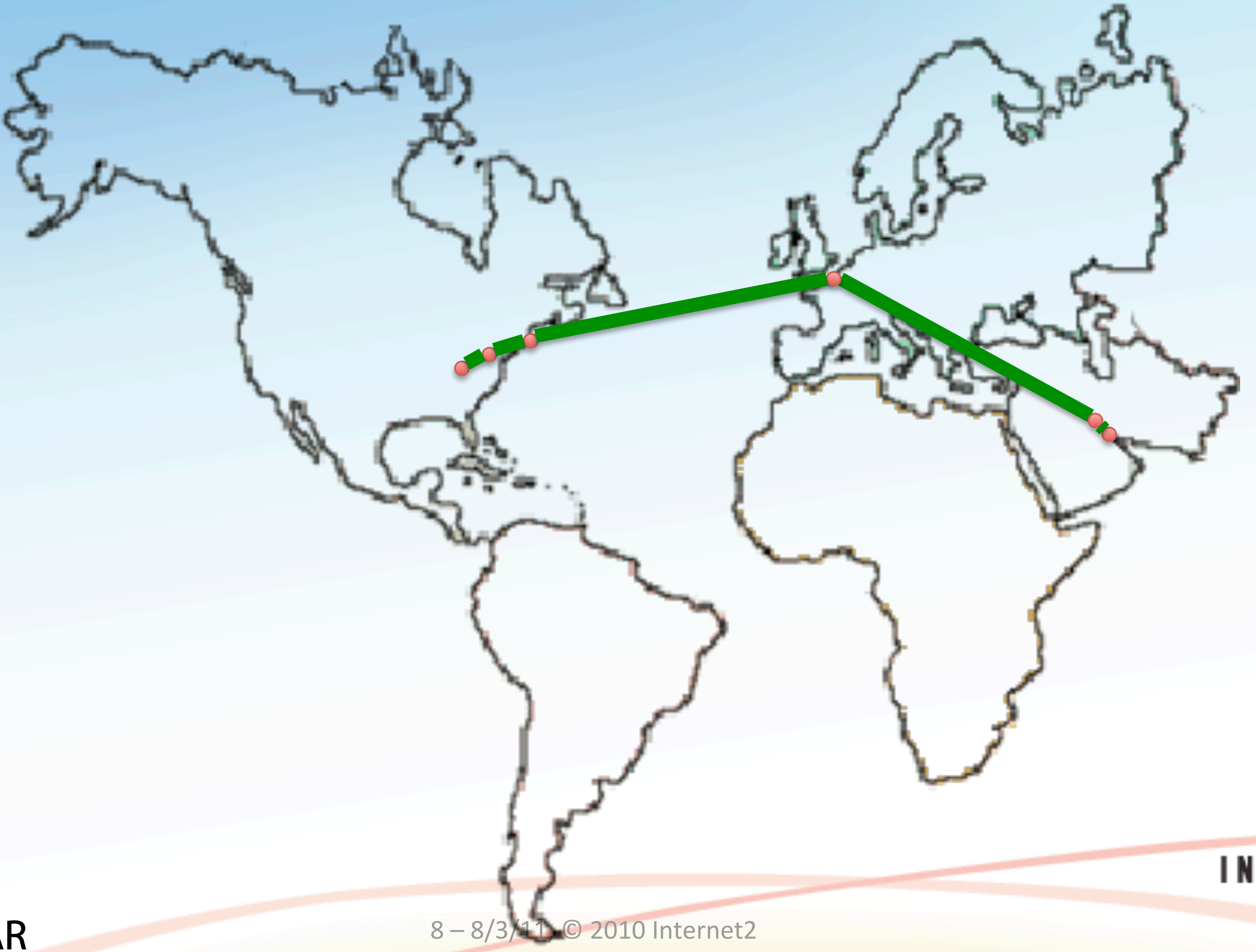
How it ***Should*** Work

- Cont.
  - Methodically approach the problem
    - Test using the same tool everywhere, gather results
    - Before moving on to the next tool, did you gather everything of value?
    - Are the results consistent?
  - After proceeding through all tools and approaches, form theories
    - Can the problem be isolated to a specific resource or component?
    - Can testing be performed to eliminate dead ends?
- Consider the following example:
  - International path
  - Problems noted
  - We know the path
  - We have tools available

Scenario: Multi-domain International Path



Desirable Case: Expected Performance



Typical: Poor Performance … Somewhere

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Solution: Test Points + Regular Monitoring

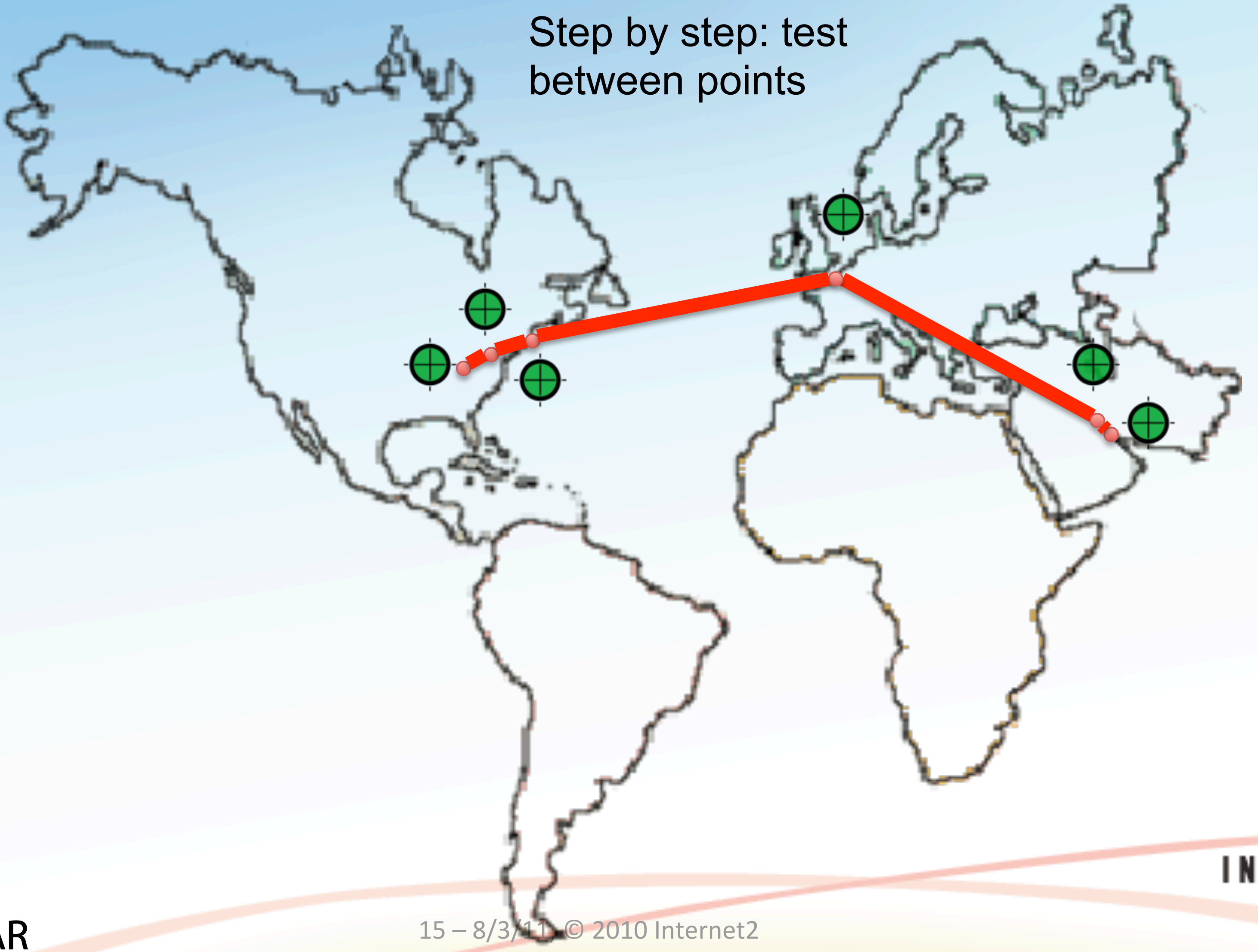
perfSONAR: Backbone and Exchanges

perfSONAR: Regional Networks

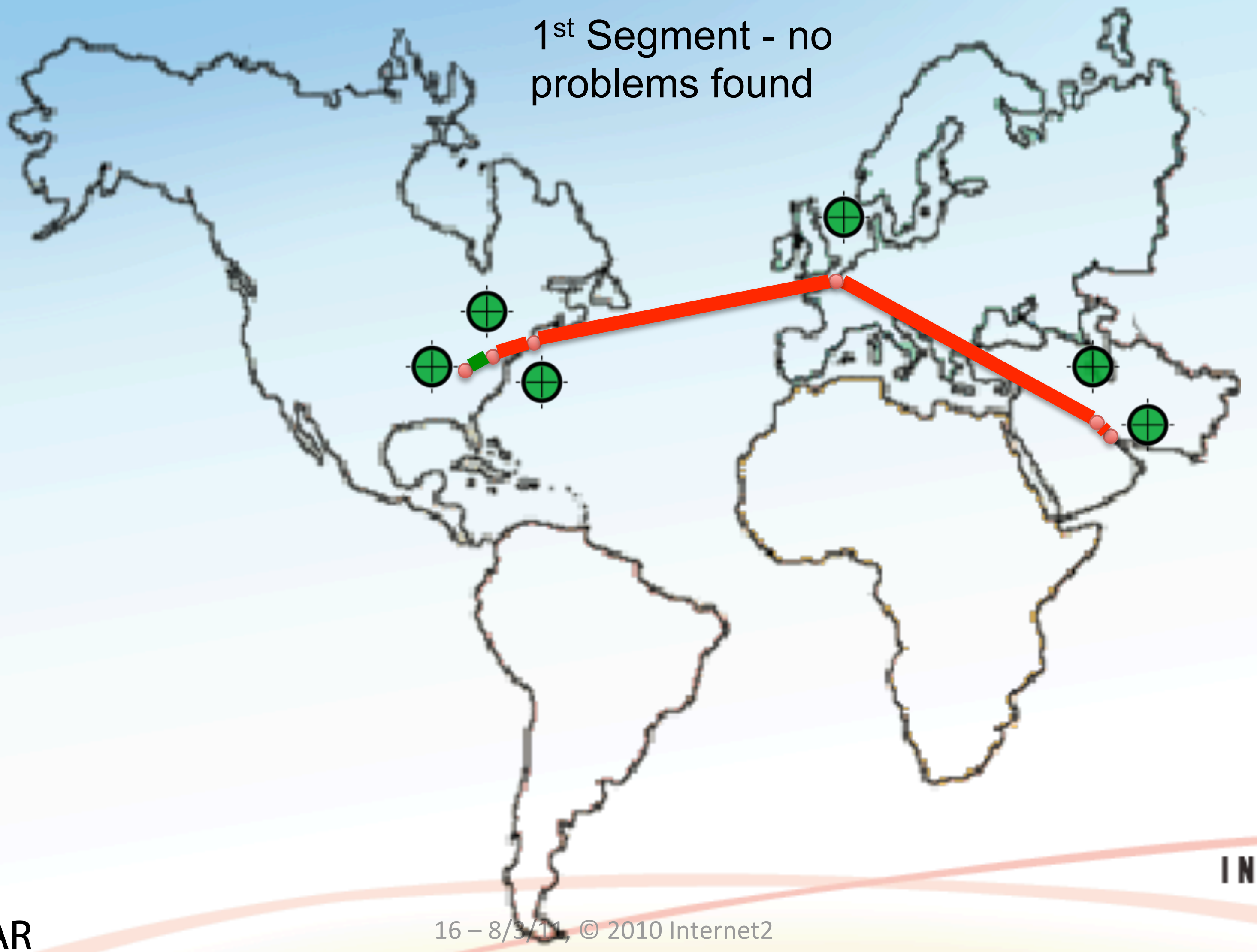
perfSONAR: Campus

Path Decomposition – Isolate the Problem

Step by step: test between points



Path Decomposition – Isolate the Problem



1st Segment - no problems found

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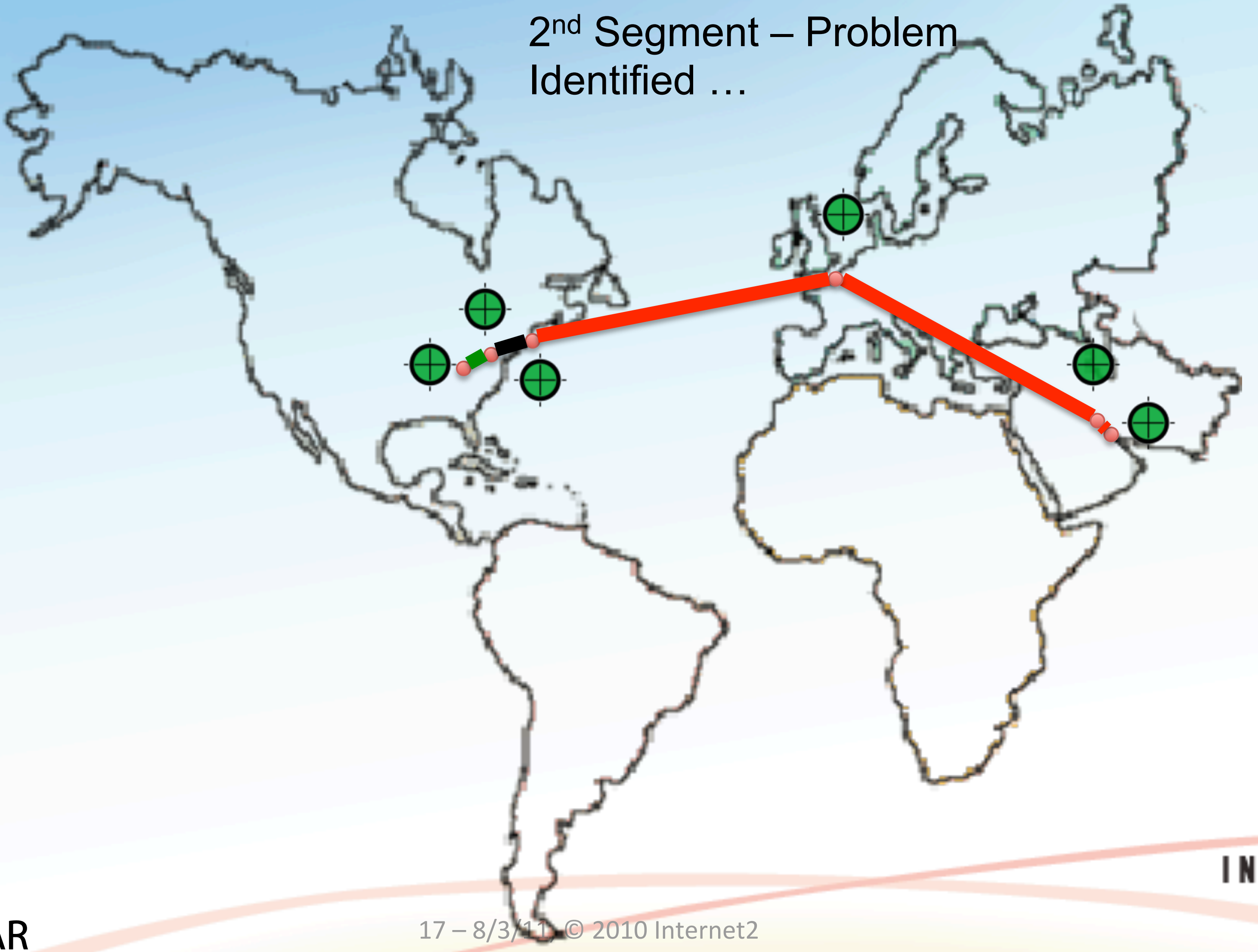
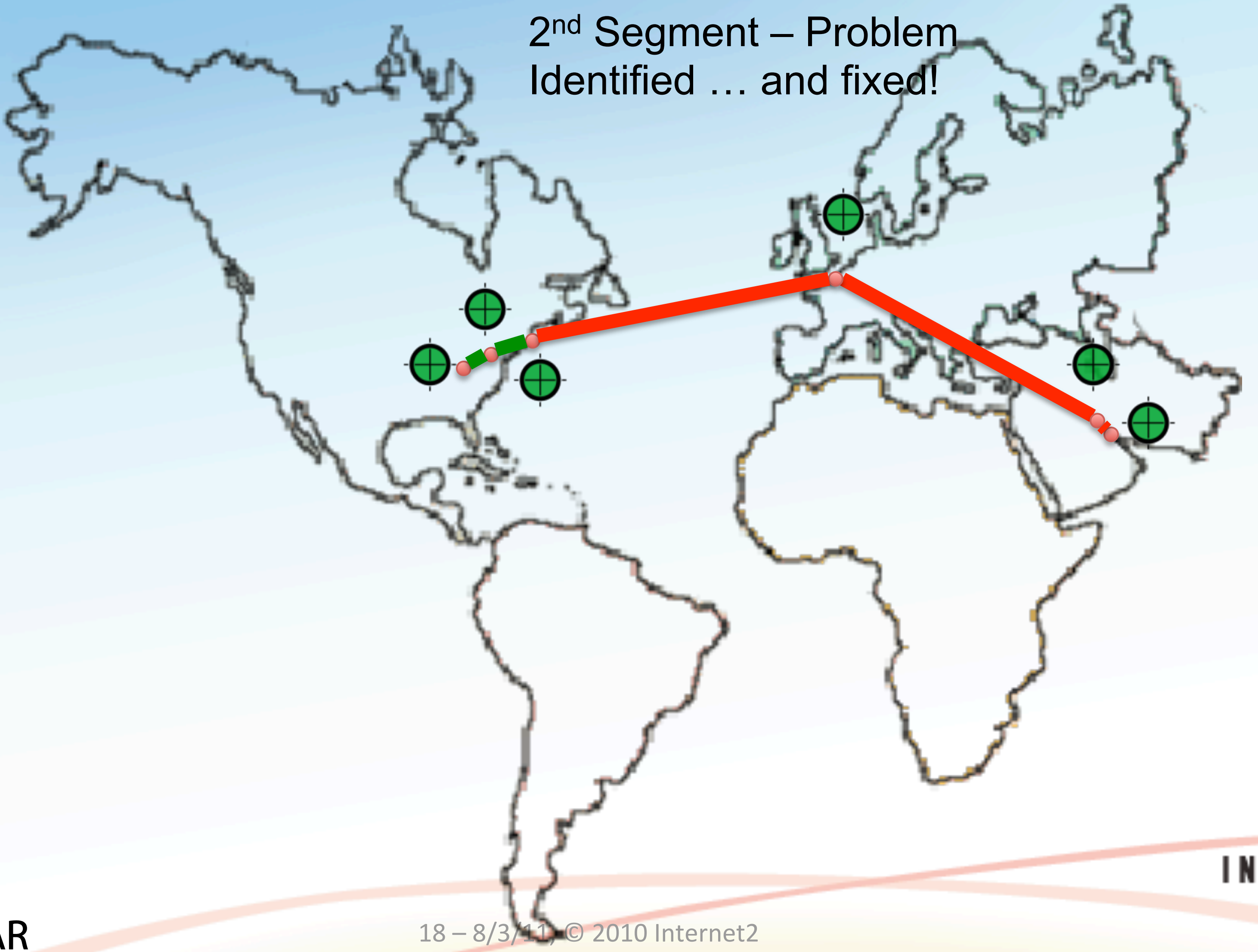
Path Decomposition – Isolate the Problem



2nd Segment – Problem Identified …

Path Decomposition – Isolate the Problem



2nd Segment – Problem Identified … and fixed!

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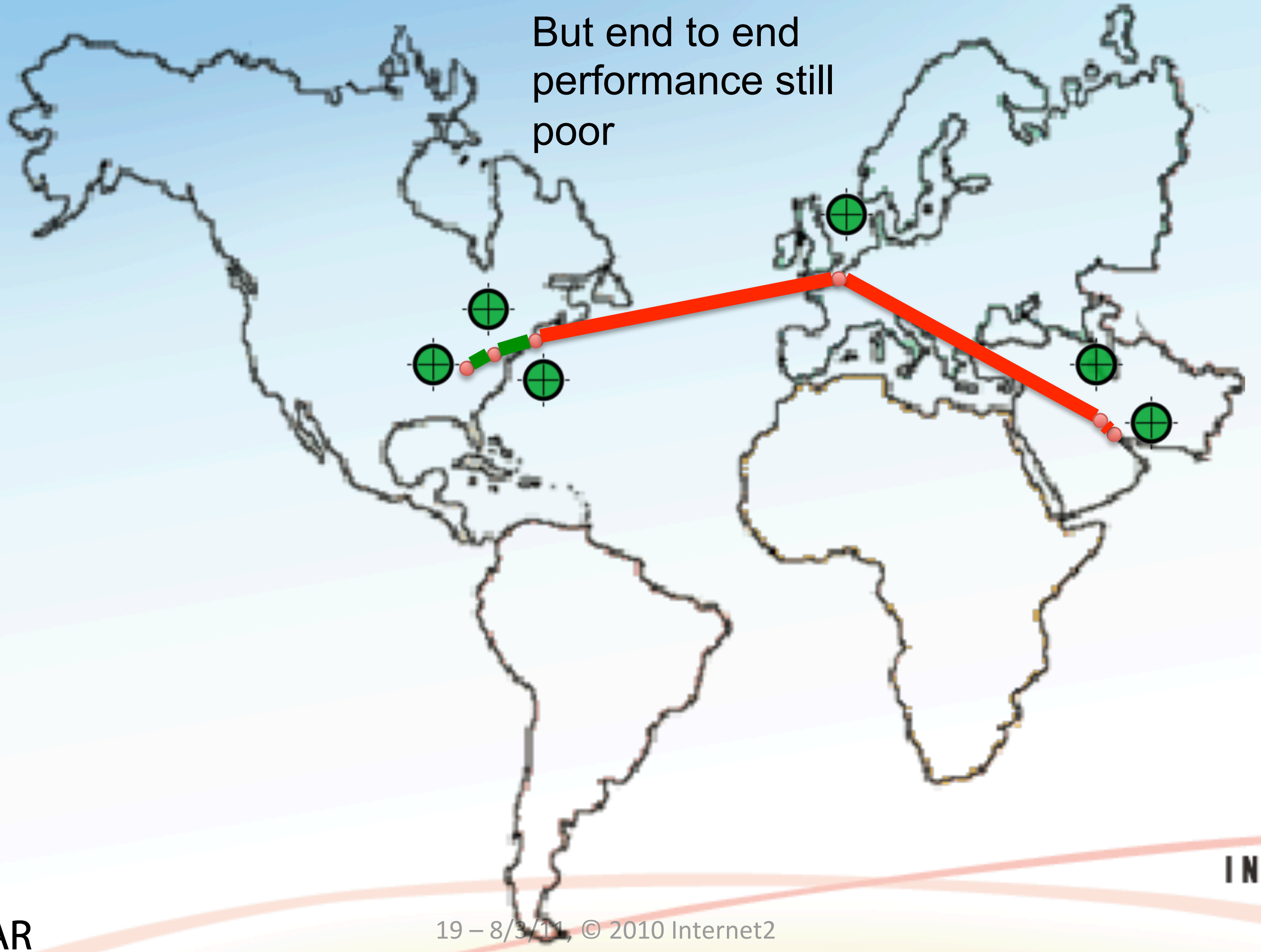
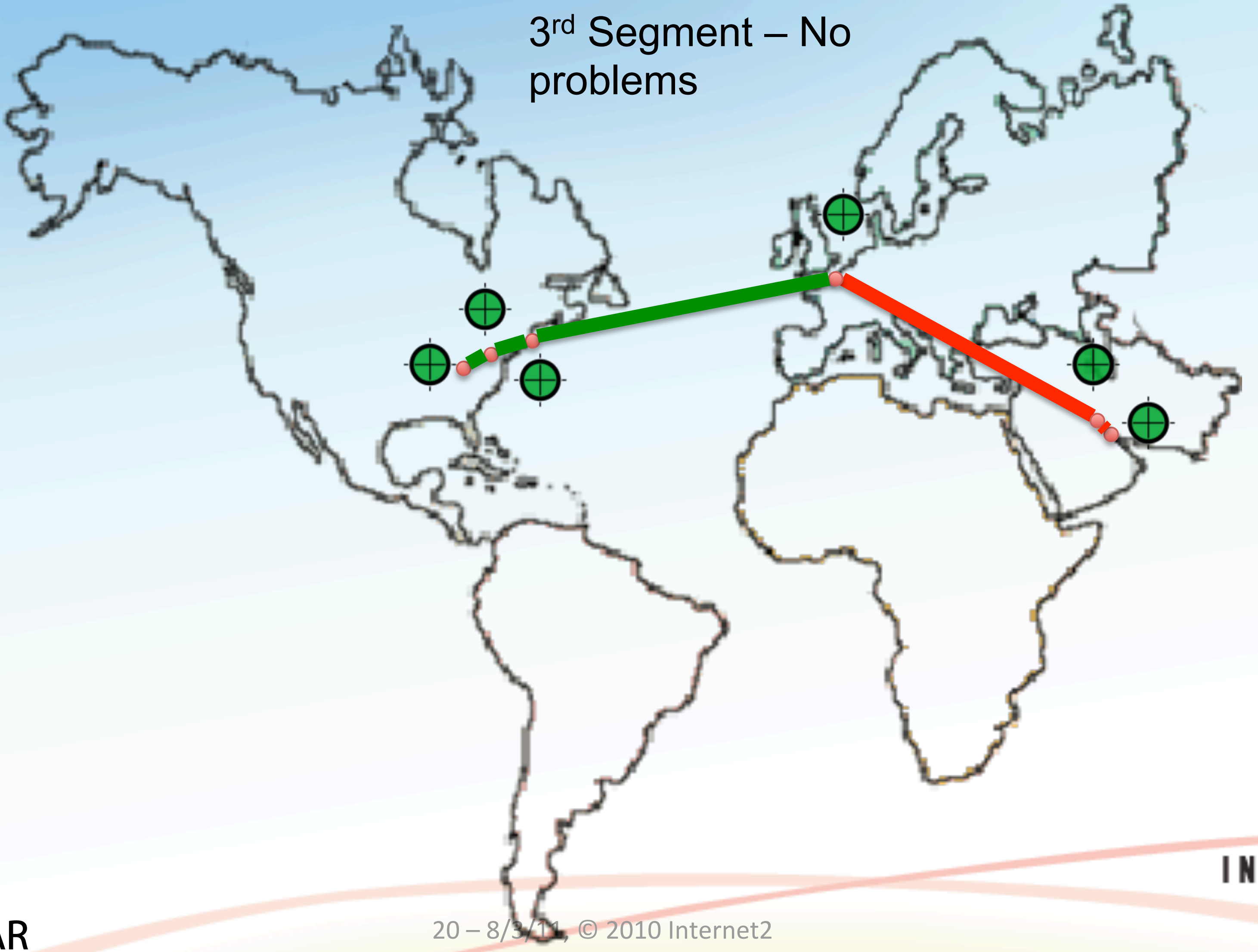
Path Decomposition – Isolate the Problem



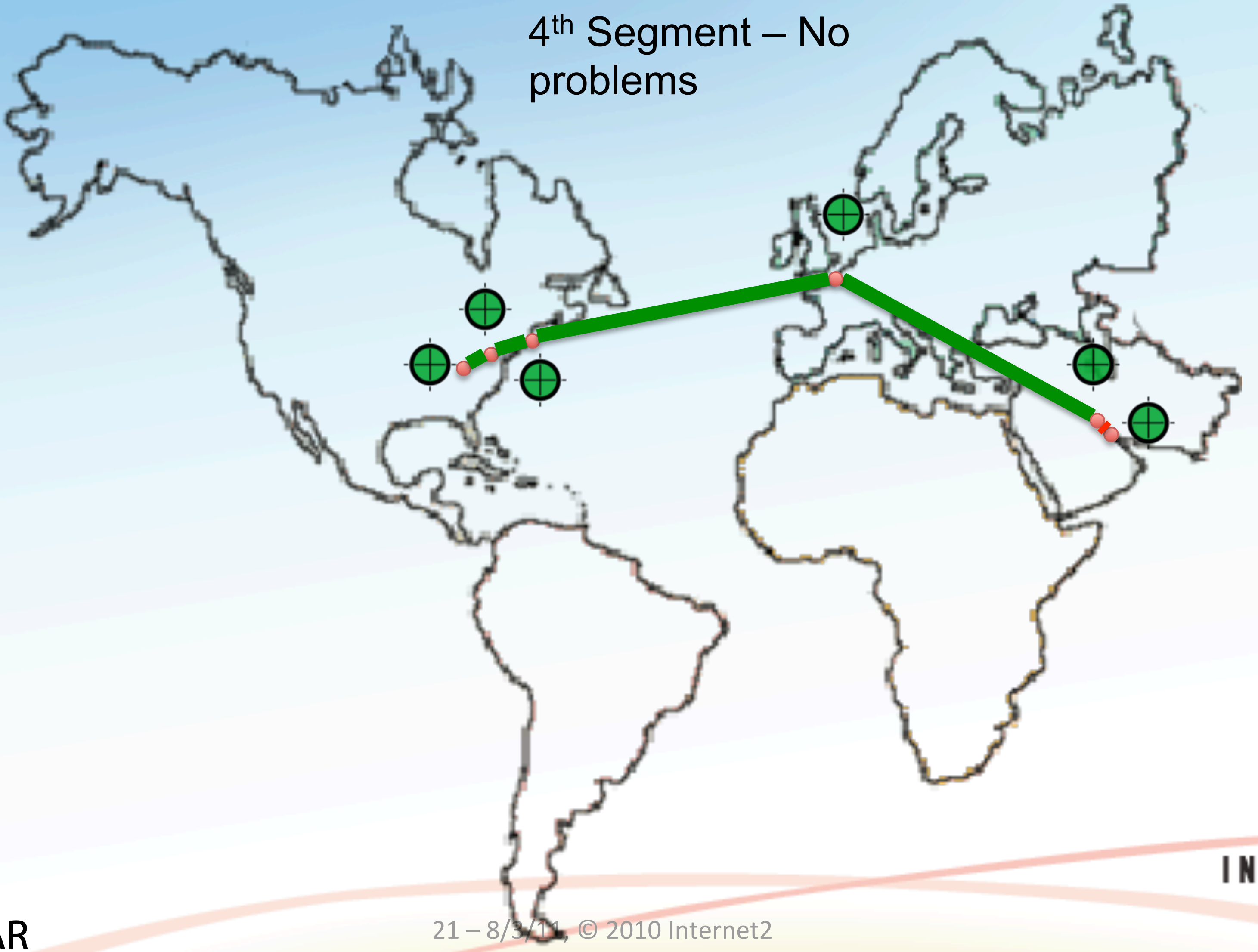
But end to end performance still poor

Path Decomposition – Isolate the Problem



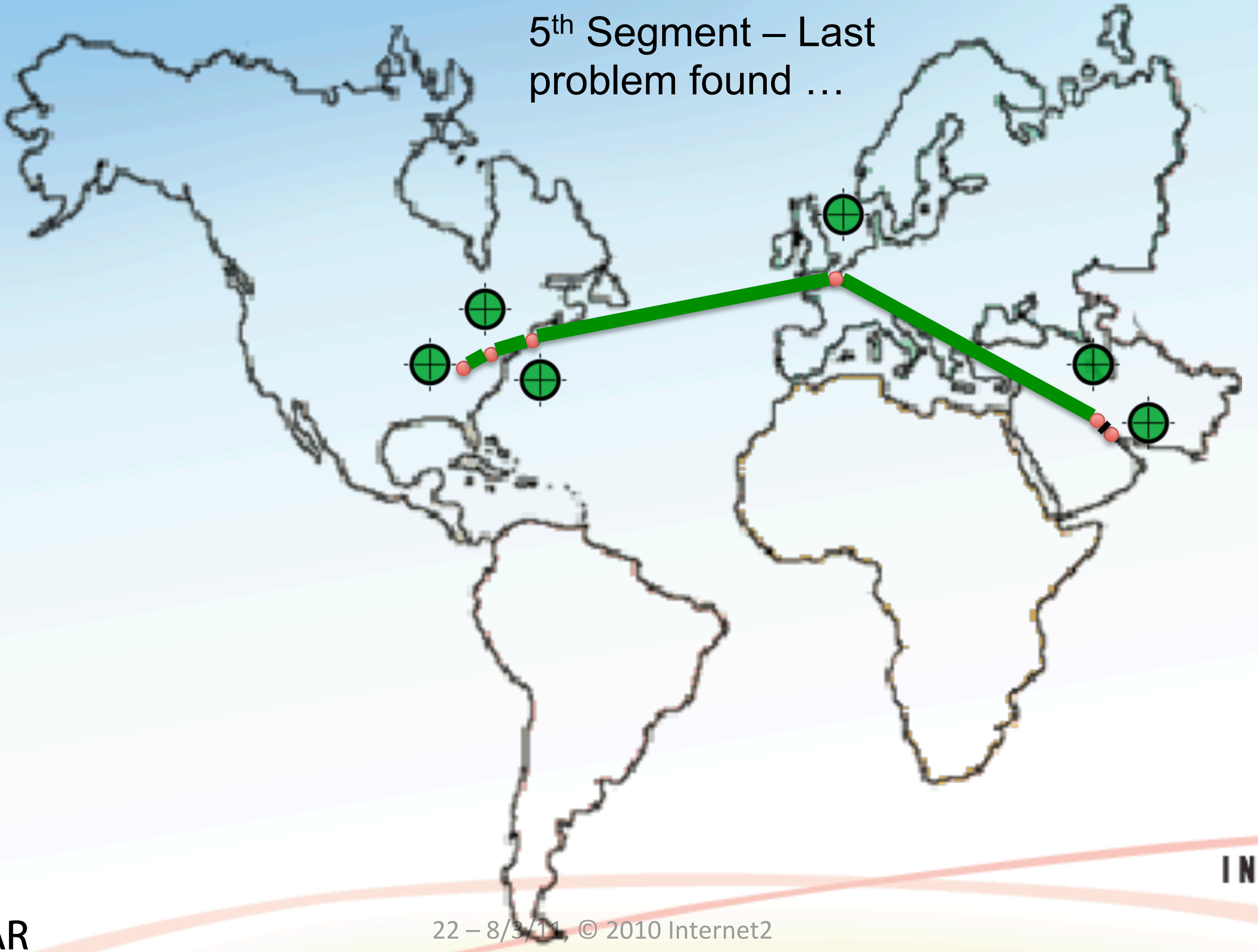
3rd Segment – No problems

Path Decomposition – Isolate the Problem



4th Segment – No problems

Path Decomposition – Isolate the Problem



5th Segment – Last problem found …

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Path Decomposition – Isolate the Problem

5th Segment – Last problem found … and fixed!

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Lessons Learned

- Problem resolution requires proper tools
  - Specialized to given task (e.g. Bandwidth, Latency)
  - Widely available where the problems will be
- Isolating a problem is a well defined, multi-step process
  - Rigid set of steps – systematic approach to prevent causing new problems
- Diagnostics, as well as regular monitoring, can reveal true network performance

How it *Probably* Works

- If the suggested steps aren't taken (or followed in an ad-hoc manner), results will vary.
  - Skipping steps leads to missing clues
- Deployment and participation may vary, this leads to some gaps in the debugging process
- Consider the following example:
  - International path
  - Problems noted
  - We know the path
  - We have tools available - almost everywhere

Scenario: Multi-domain International Path

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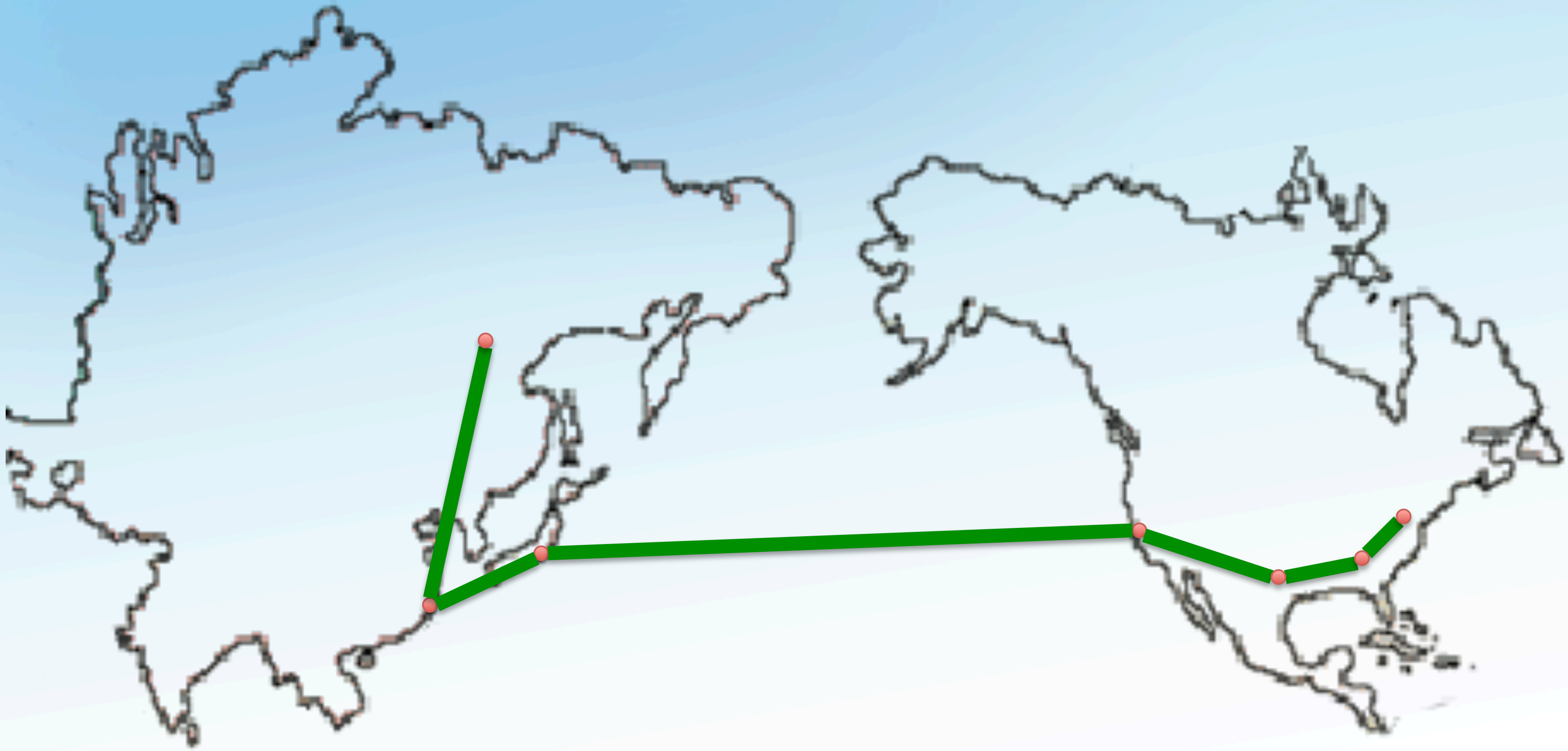
Desirable Case: Expected Performance



Typical: Poor Performance … Somewhere

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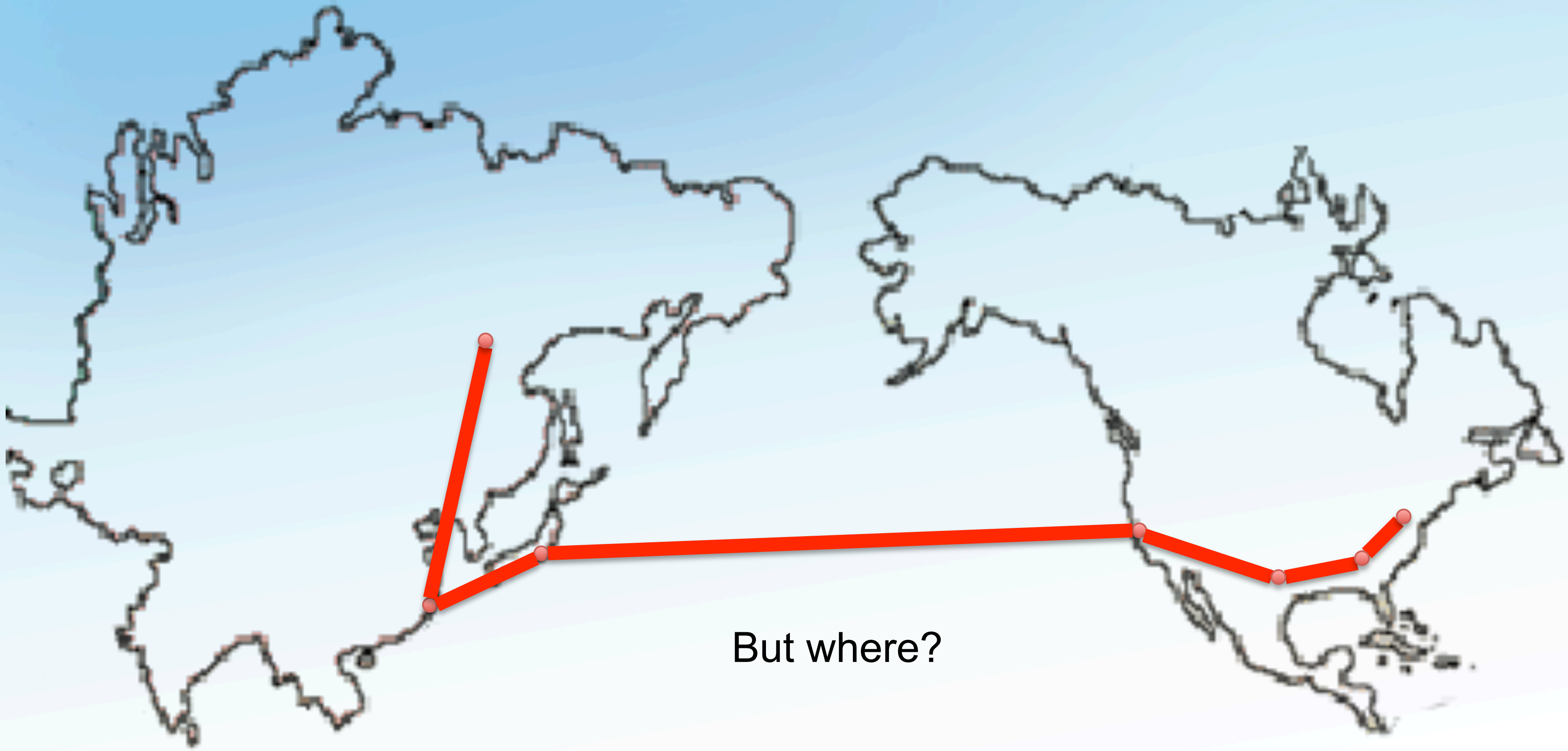

But where?

Solution: Test Points + Regular Monitoring

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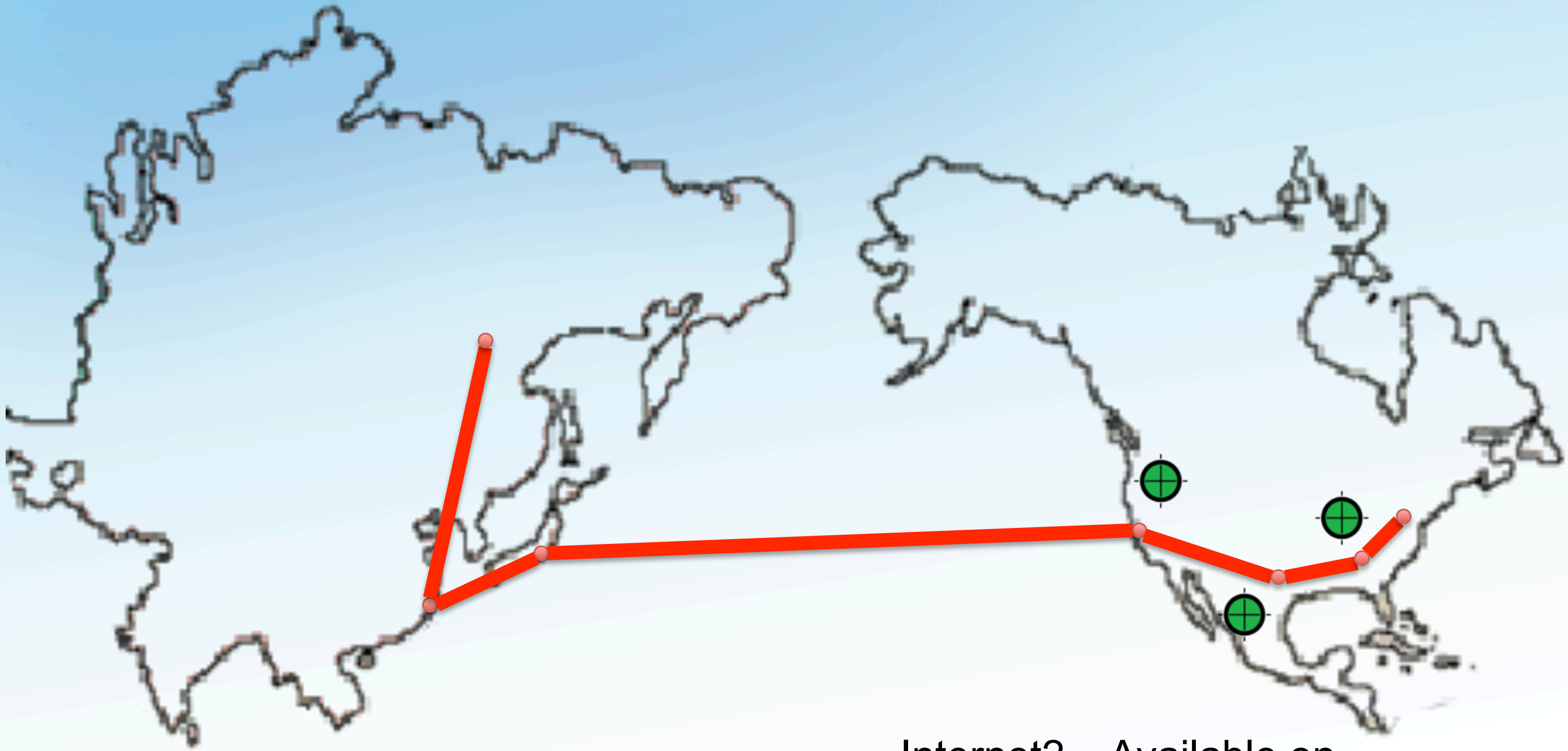
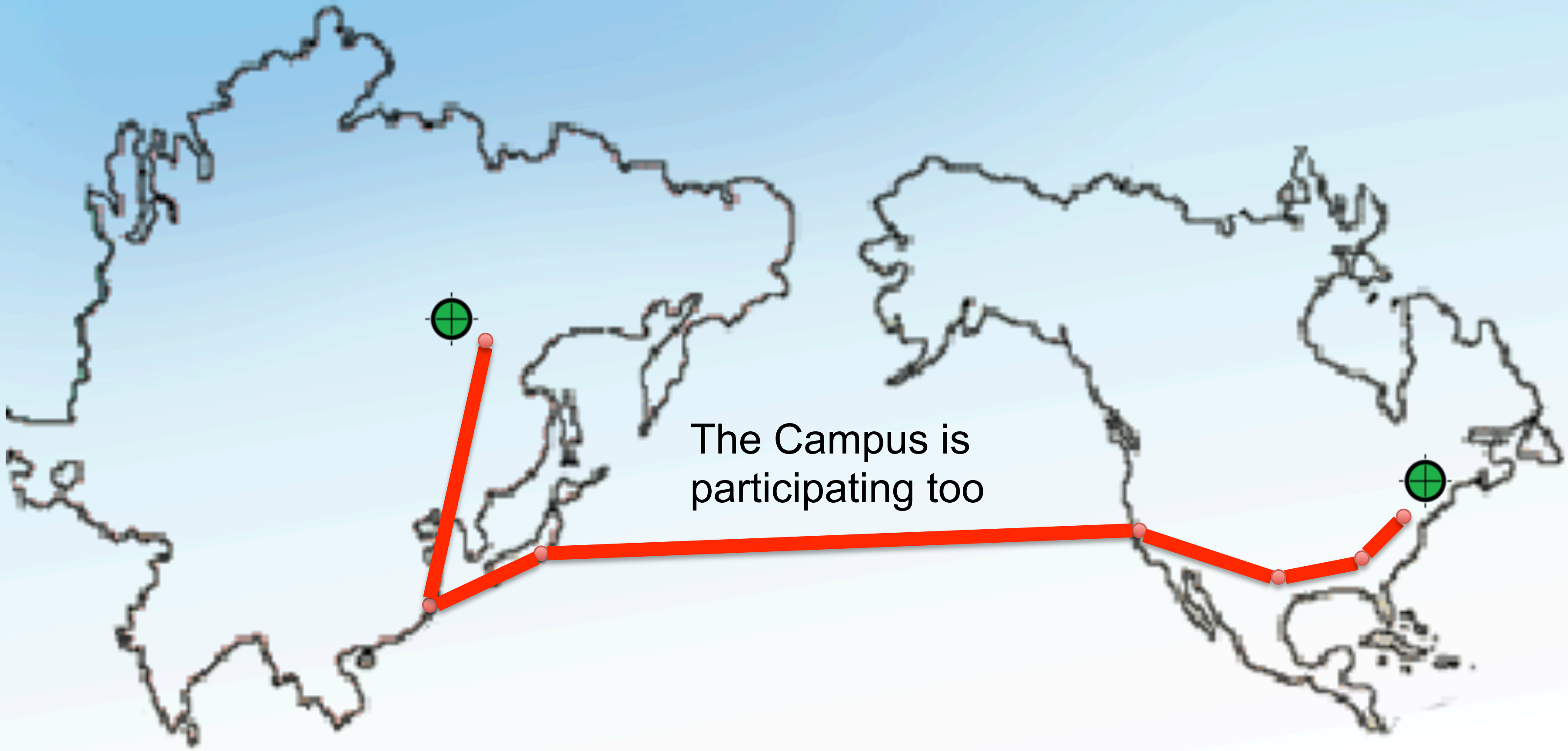
Key Point: End to end monitoring Requires participation from all domains

Typical: Poor Performance … Somewhere



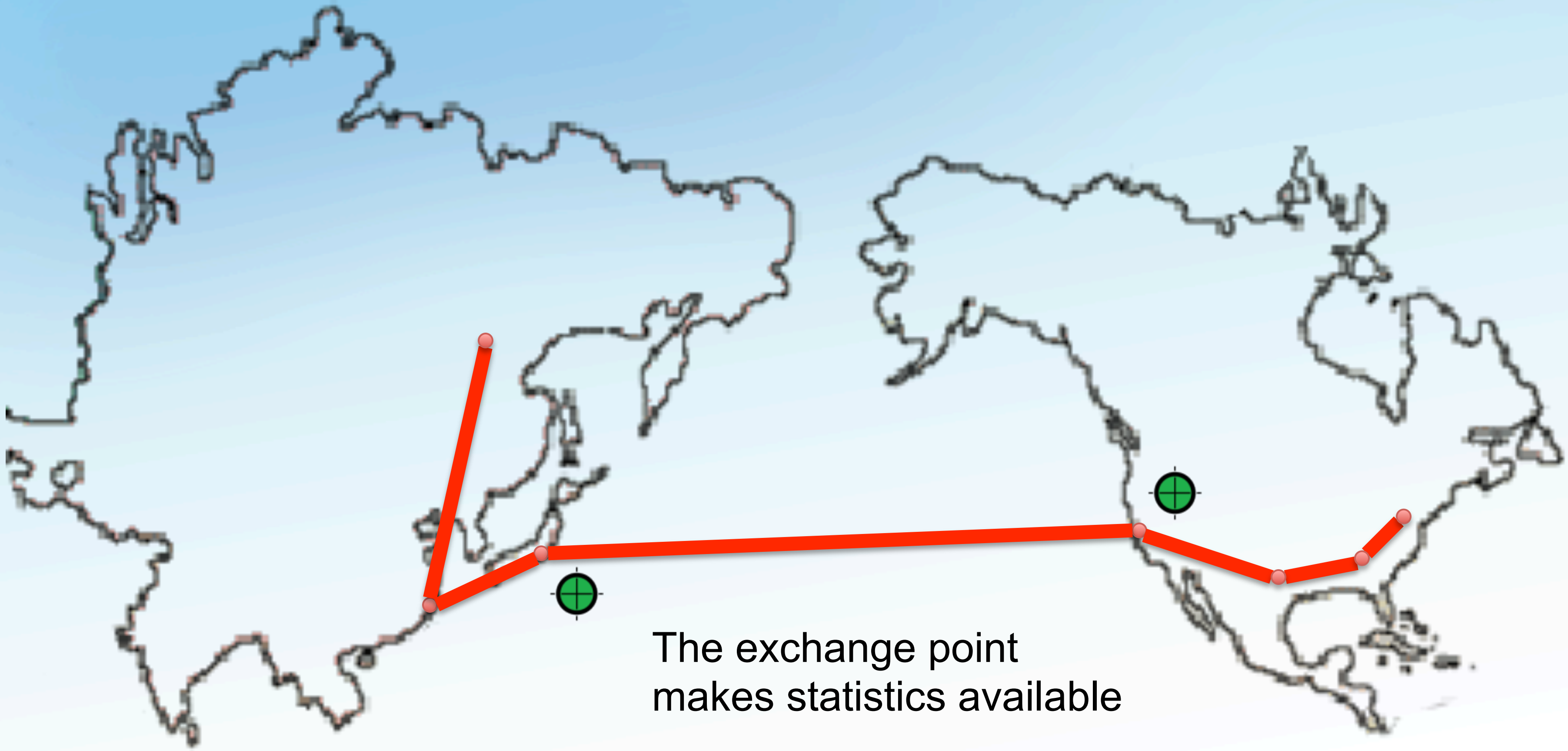
Internet2 – Available on the backbone

Typical: Poor Performance … Somewhere



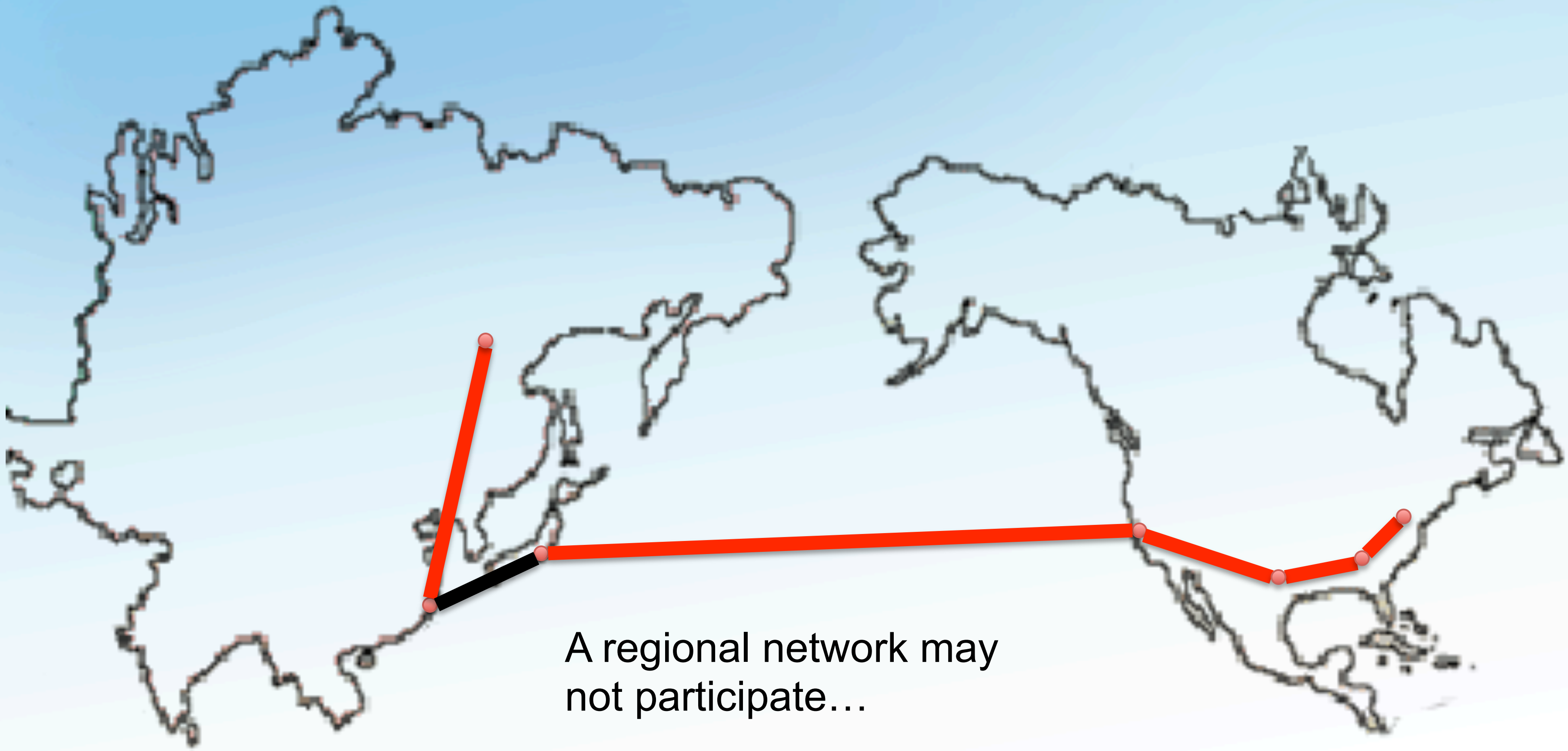
The Campus is participating too

Typical: Poor Performance … Somewhere



The exchange point makes statistics available

Typical: Poor Performance … Somewhere



A regional network may not participate…

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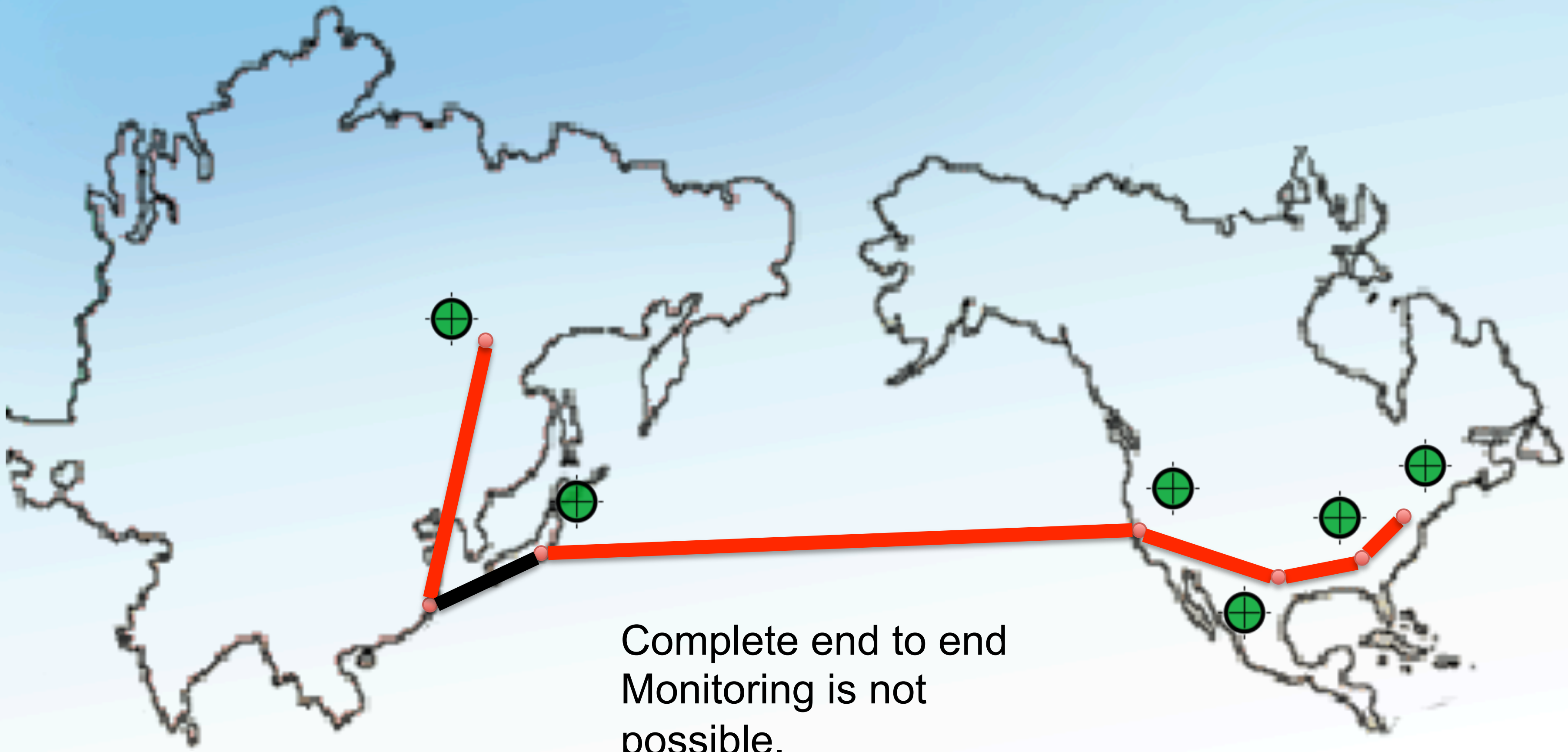
Typical: Poor Performance … Somewhere



Complete end to end Monitoring is not possible.

Lessons Learned

- Missing part of the path leaves us with a huge disadvantage
- May discover some problems through isolation on the path we know, could miss something
  - Most network problems occur on the demarcation between networks
  - Testing *around* the problem won't work (we still have to transit this network)

Diagnostics vs Regular Monitoring

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For more information, visit http://www.internet2.edu/workshops/npw