

Testing the reachability of (new) address space

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Outline

- **Problem statement**
- **Checking reachability**
- **Experiments**
- **Conclusion**

Bogon Filters

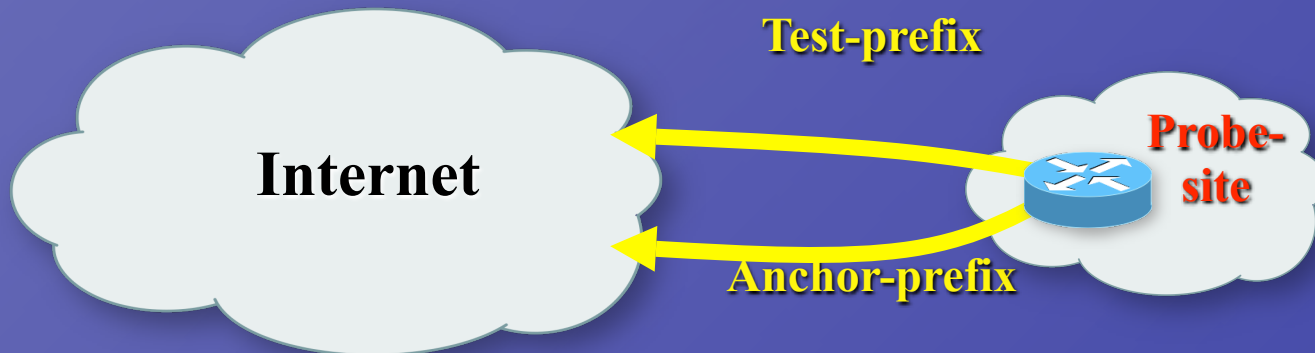
- ISPs often filter unallocated address space to protect themselves from malicious attacks and unwanted traffic
- Over time unallocated address space may become allocated and legitimately announced address space...
- Problem: Filters need to be updated but seem often not to be

Objective

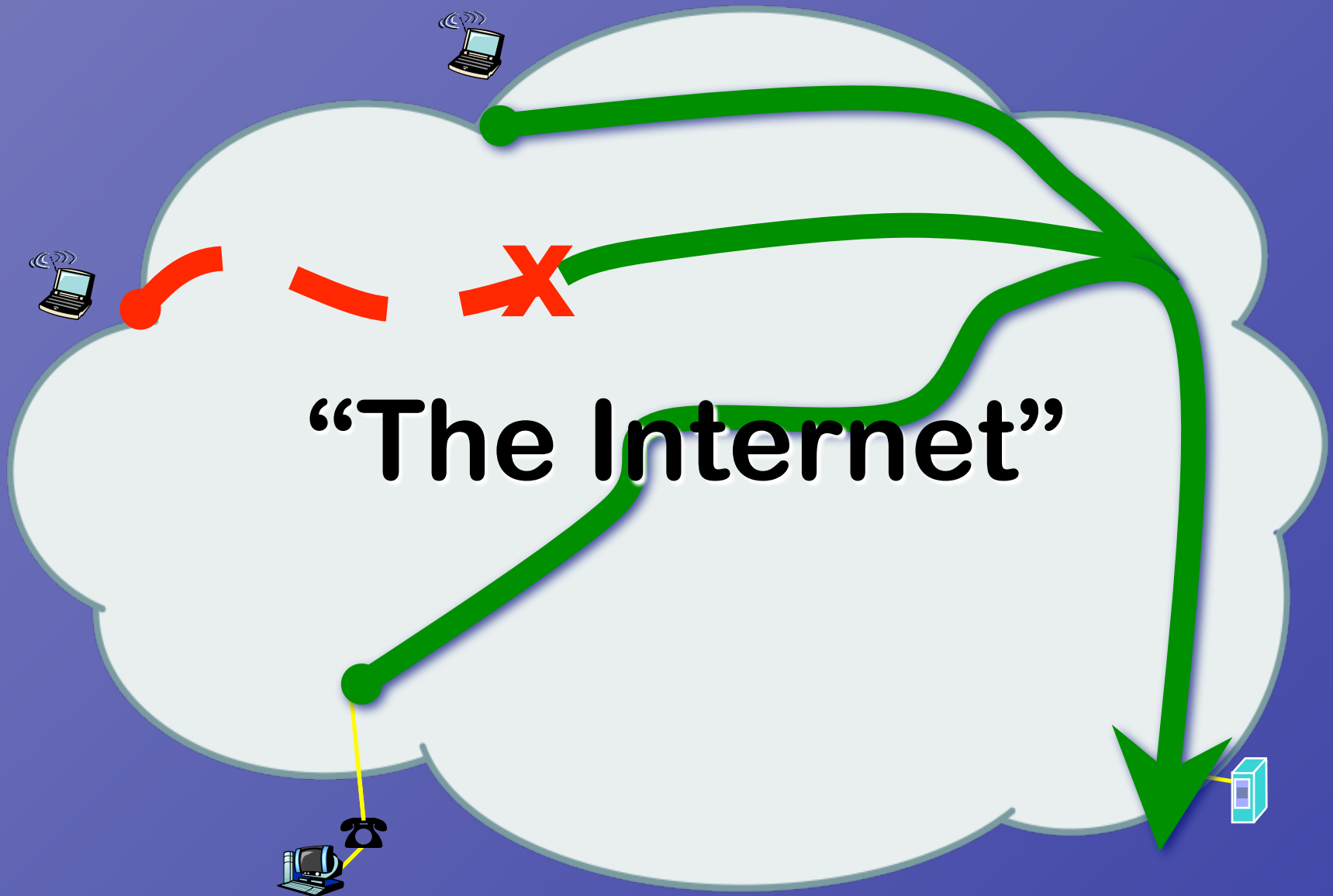
- Develop methodology that is capable of detecting and locating **bogon filters**, filters that are blocking newly allocated address space
- Advertise test and anchor prefixes from 4 probe-sites: Seattle (USA), Munich (DE), Wellington (NZ), Tokyo (JPN)
- Analyze reachability status of a newly allocated prefix

Terminology

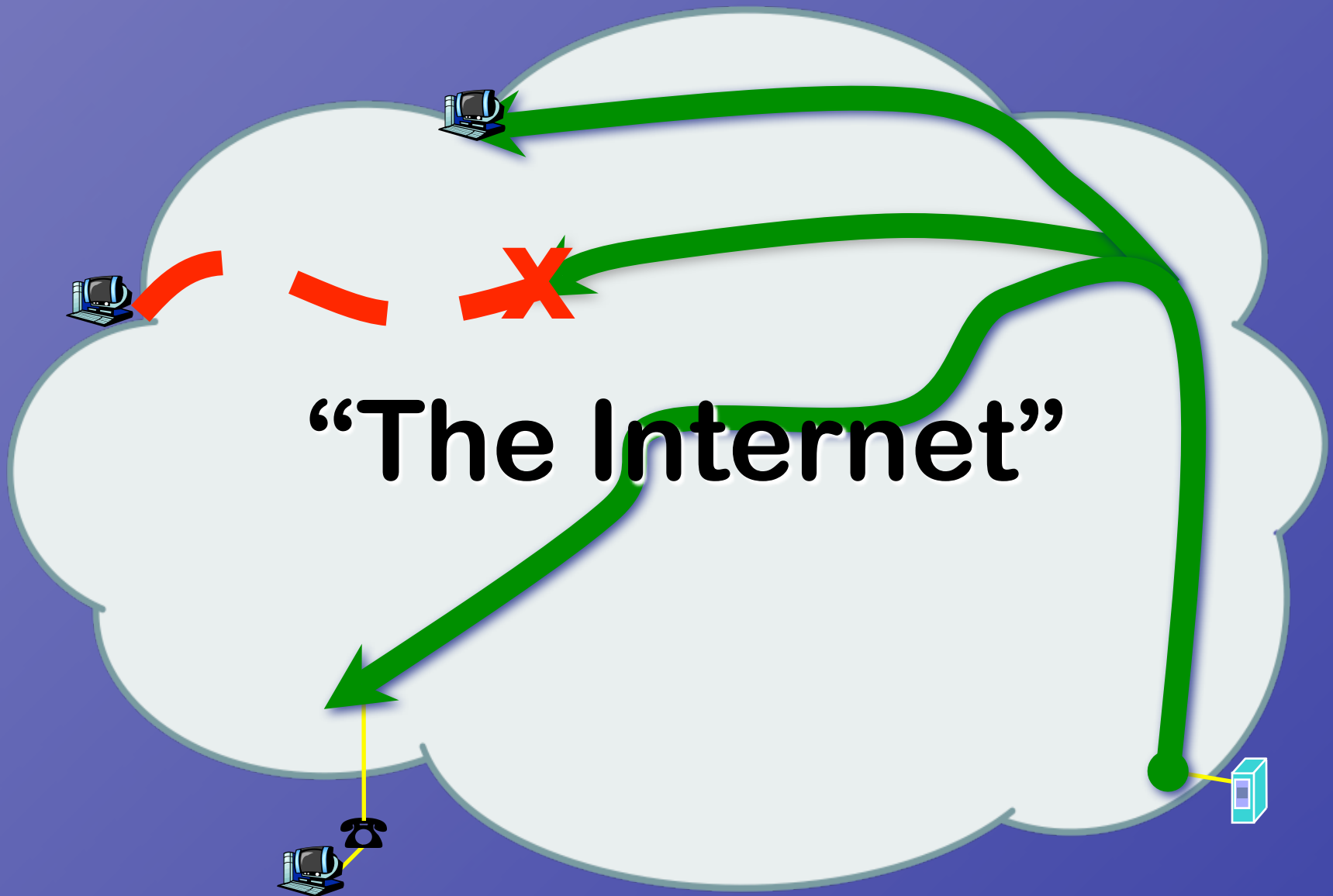
- **Test-prefix:** newly allocated prefix to be tested
- **Anchor-prefix:** well-established prefix whose reachability should be fine
- **Probe-site:** router that announces both the test-prefix and the anchor-prefix



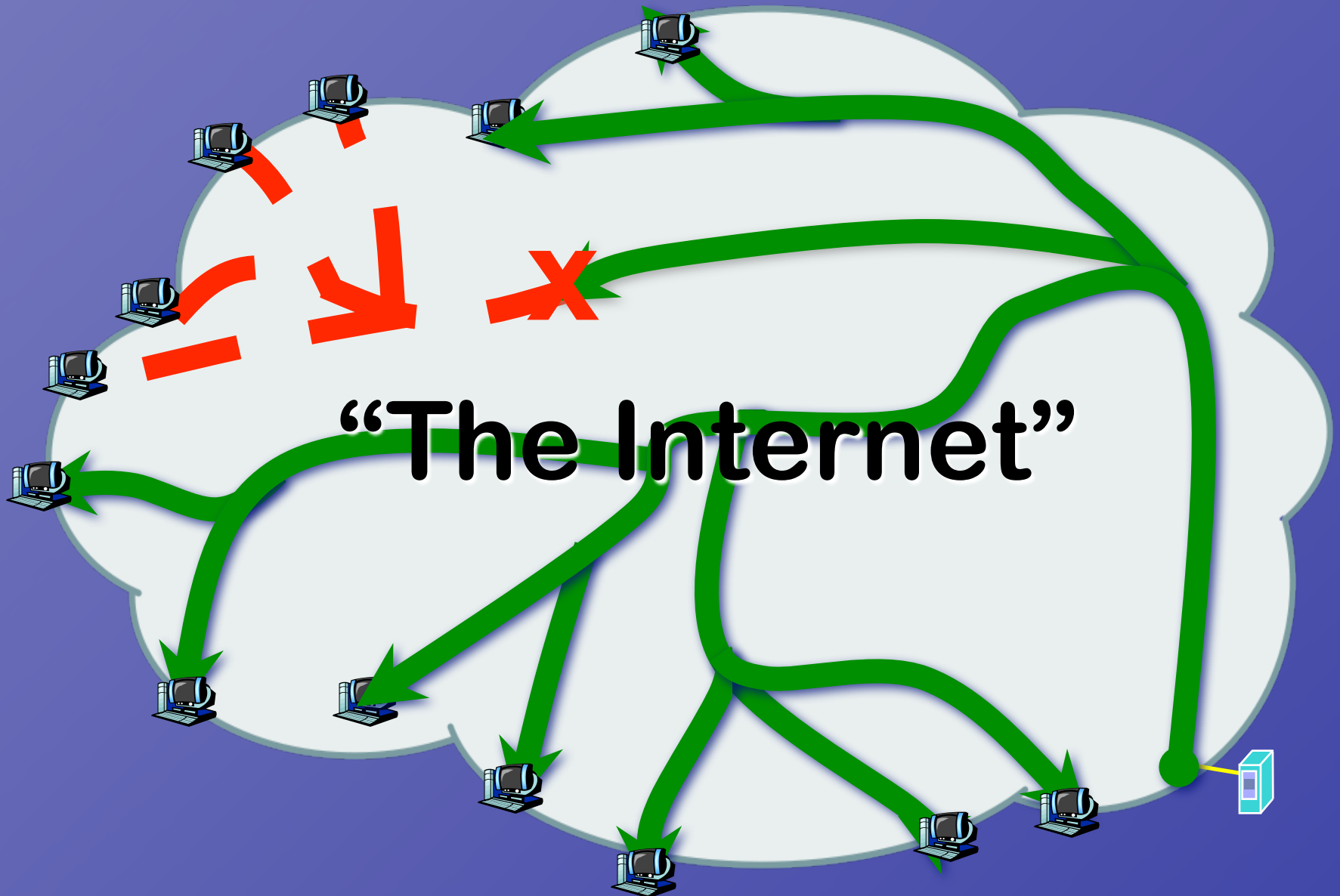
Filters and Reachability



Improving AS Coverage



Improving AS Coverage



Out-probes: Evaluation

- Advantages:
 - Positive reachability exists for target IP
 - Probing of large fraction of AS topology
- Disadvantages:
 - Building target IP addresses to be probed not trivial
 - Probe return path is most interesting but unknown

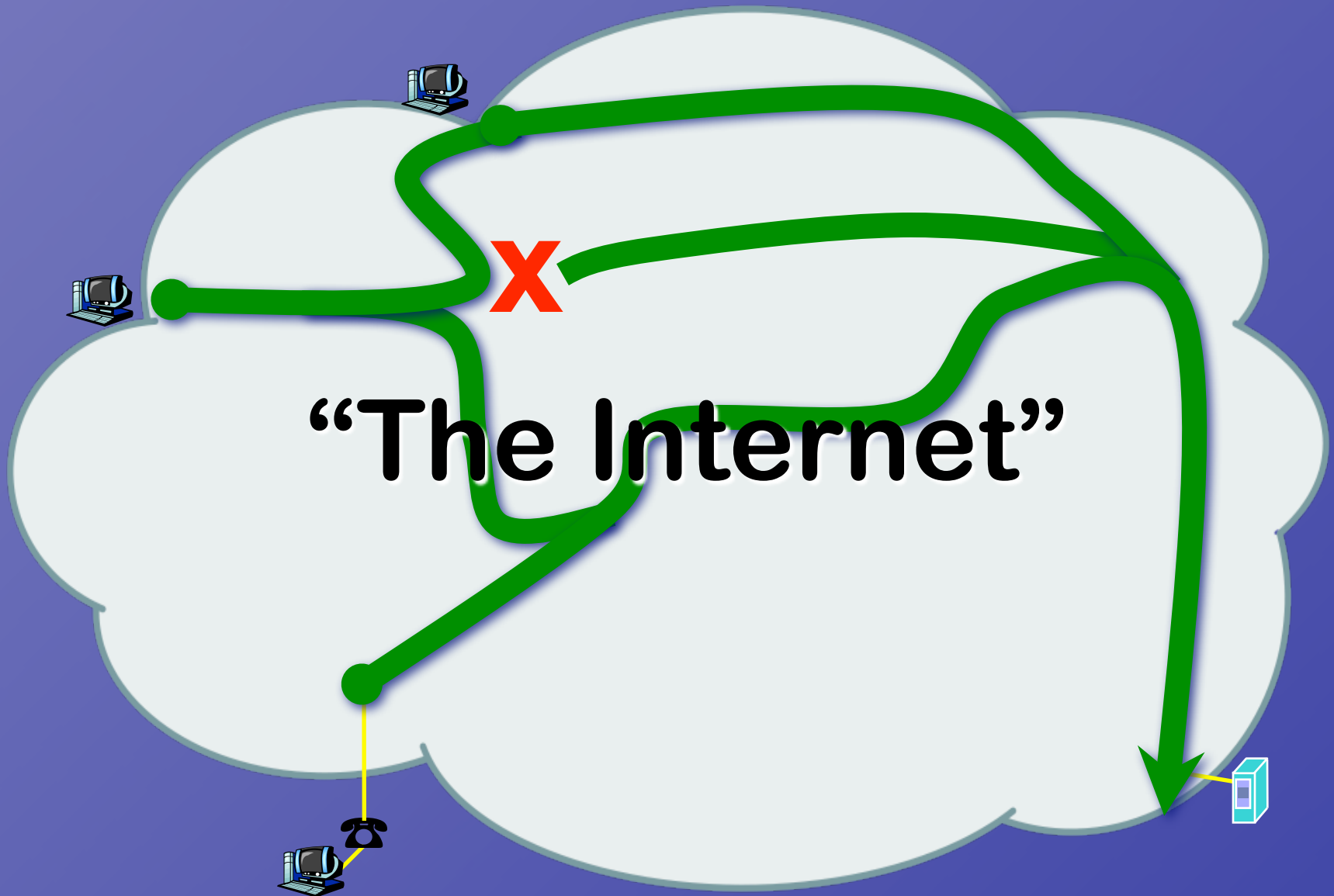
Out-Probes: measurements

- Send probe from test-sites (test-IP and anchor-IP) towards a large set of pingable-IP addresses (46,569) in 18,574 different ASs
- If probe comes back => reachability exists
 - ~85% of all probes
- If probe does not come back => use heuristic to find out likelihood that AS contains bogon filter
 - ~10% of all probes
 - ~5% not pingable anymore, e.g., dial-up

Out-Probes: Initial validation

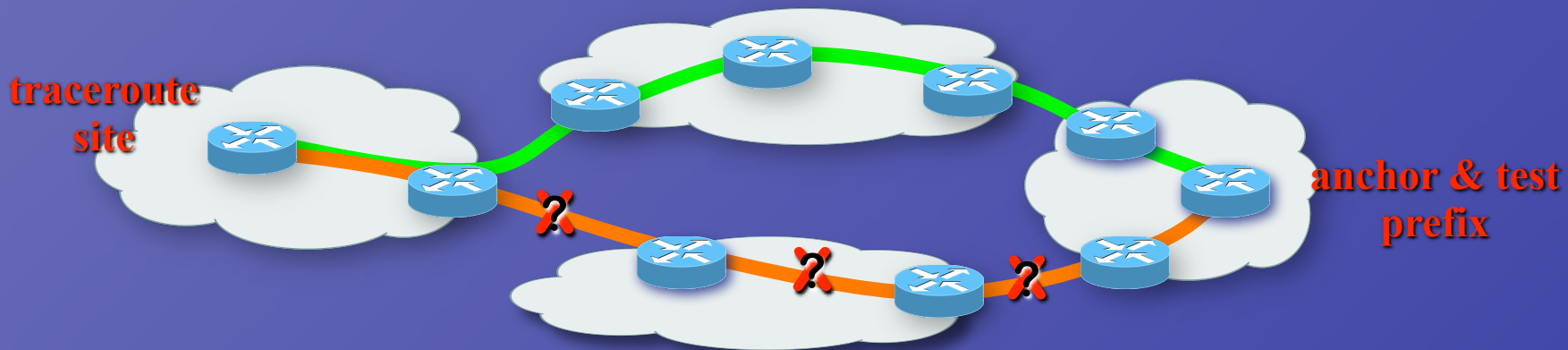
- We derived 443 candidate ASs that are likely to filter
 - Manual search for 15 traceroute servers within those 443 candidate ASs:
 - 7 filter
 - 5 do not filter themselves, but have no usable [up-stream] connectivity
- ⇒ 12 out of 15 (80%) correctly identified
- 3 failed, but validation was taken at different time so ASs might have changed filter in the meantime

Limitation



In-probes: Principles

- **In-probe** : traceroute performed from external IP addresses towards the test and anchor prefixes
- In-probes give reachability information towards the test and anchor prefixes
- If traceroute from test-prefix address diverges at some point, we conjecture that some **bogon filter** is responsible



In-probes: Evaluation

- Advantages:
 - Filter-independent reachability
 - Details about IP-level path
- Disadvantages:
 - traceroute site **MUST** be “behind” filter
 - Not many traceroute sites available

In-Probes: results

- Raw results:
 - 66.9% good (anchor and test take exactly same path)
 - 20.6% diverging paths (anchor and test take different paths)
 - 8.6% test stops, but anchor ok
 - 3.9% failure (either anchor or anchor and test failed)
- Derive candidate links, eliminate unlikely candidates, then based on remaining candidate links:
 - ~ 34 ASs that may contain incorrectly configured filters

<http://psg.com/filter-candidates.txt>

Summary: In- and Out-Probes

- **Out-probes tell about reachability:**
 - + Find areas of non-reachability
 - + Larger topological coverage (currently > 85% of Internet ASs)
 - No information about: return path and thus non-optimal paths
- **In-probes tell about filters on the path:**
 - + Reachability available
 - + goal: detect intermediate filters
 - Limited topological coverage
 - Many traceroute servers are needed at the “edge”

Conclusion

- We can identify regions in the Internet that do not have reachability
- It is possible to achieve a reasonable coverage of the Internet
- We don't only check reachability: we also detect places where there is "non-optimal" connectivity

Thanks To

- ARIN for IP space and commissioning research
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