draft-jjmb-lmap-reference-implementation-guide-00

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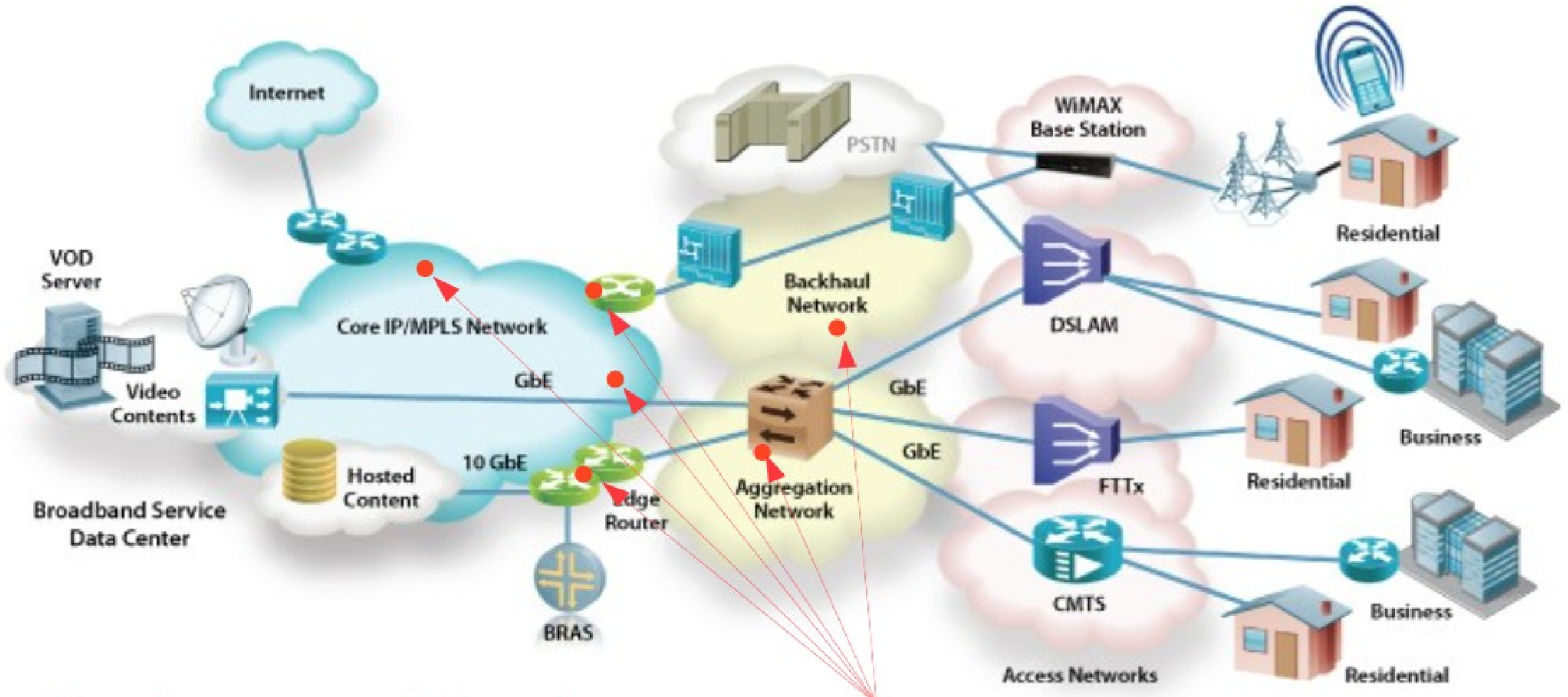
Background

- Based on Comcast/Villanova University joint R&D that began circa 2012
- Initially developed to measure the deployment of IPv6
- Developed an extensible and scalable system to support large scale measurements
  - Developed before LMAP was formed, mainly because there was a need

Architecture

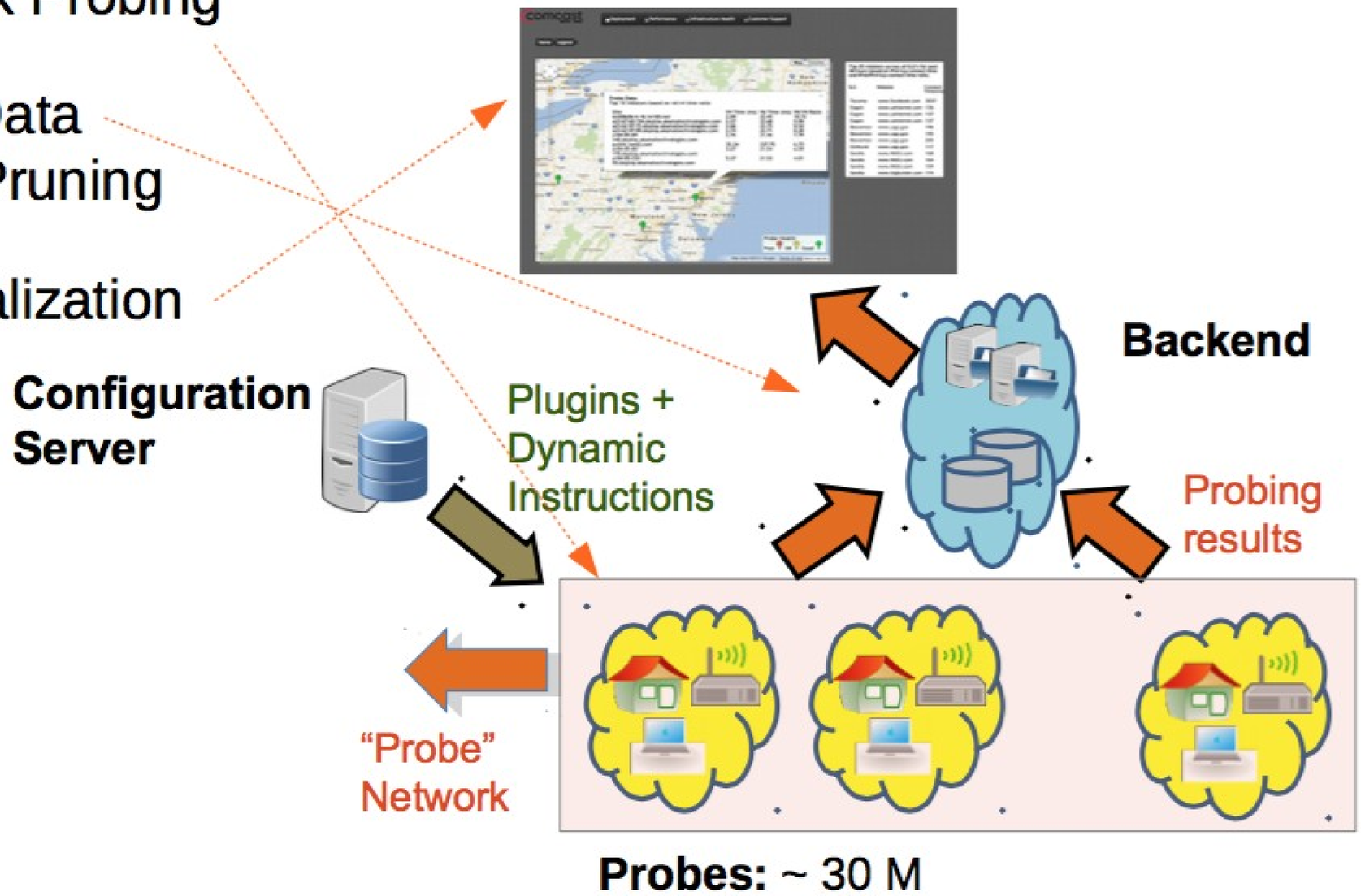


How to assess end-to-end network performance?

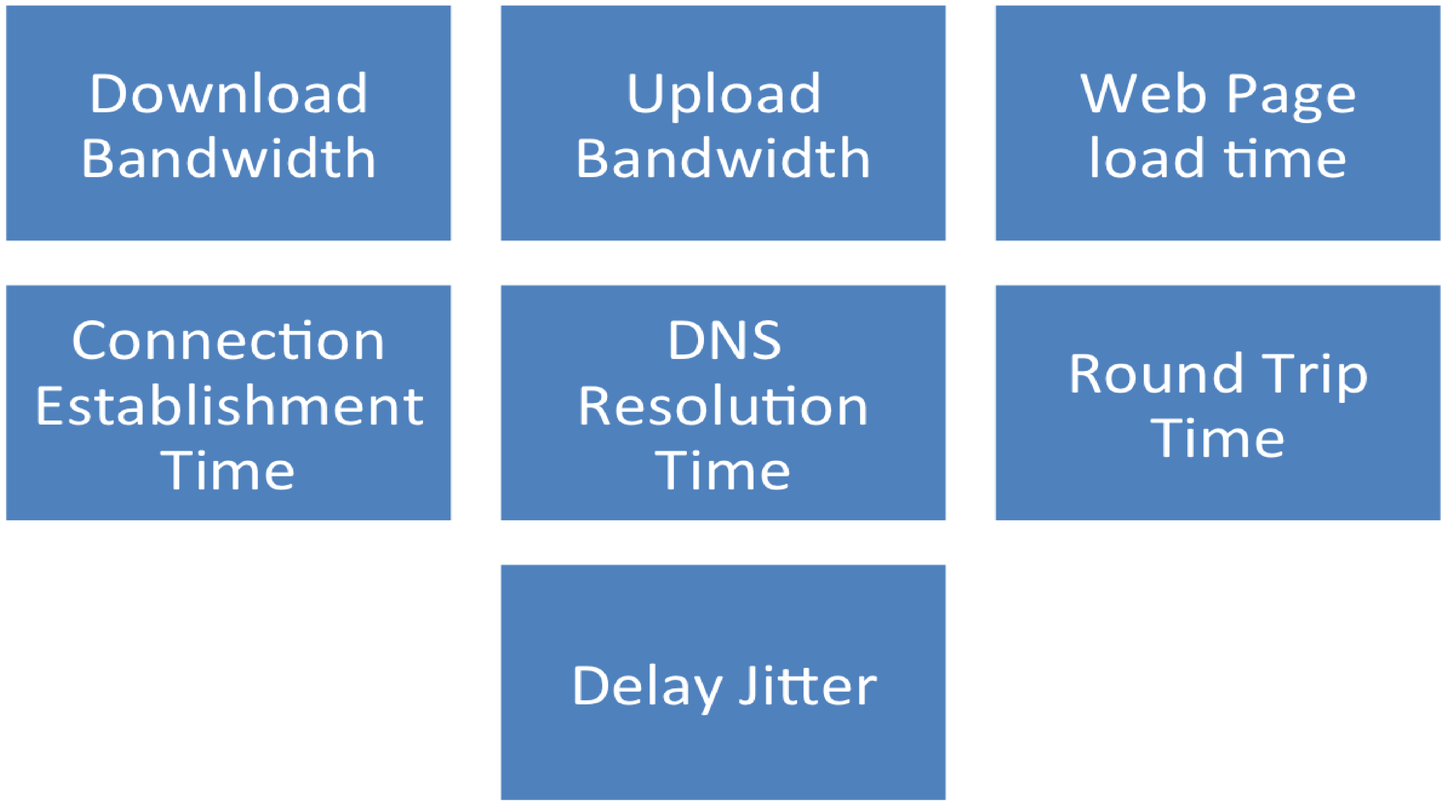
Perf data collection points

Our Network Monitoring Architecture

- Active Network Probing
- QoS Metrics Data Collection & Pruning
- Effective Visualization

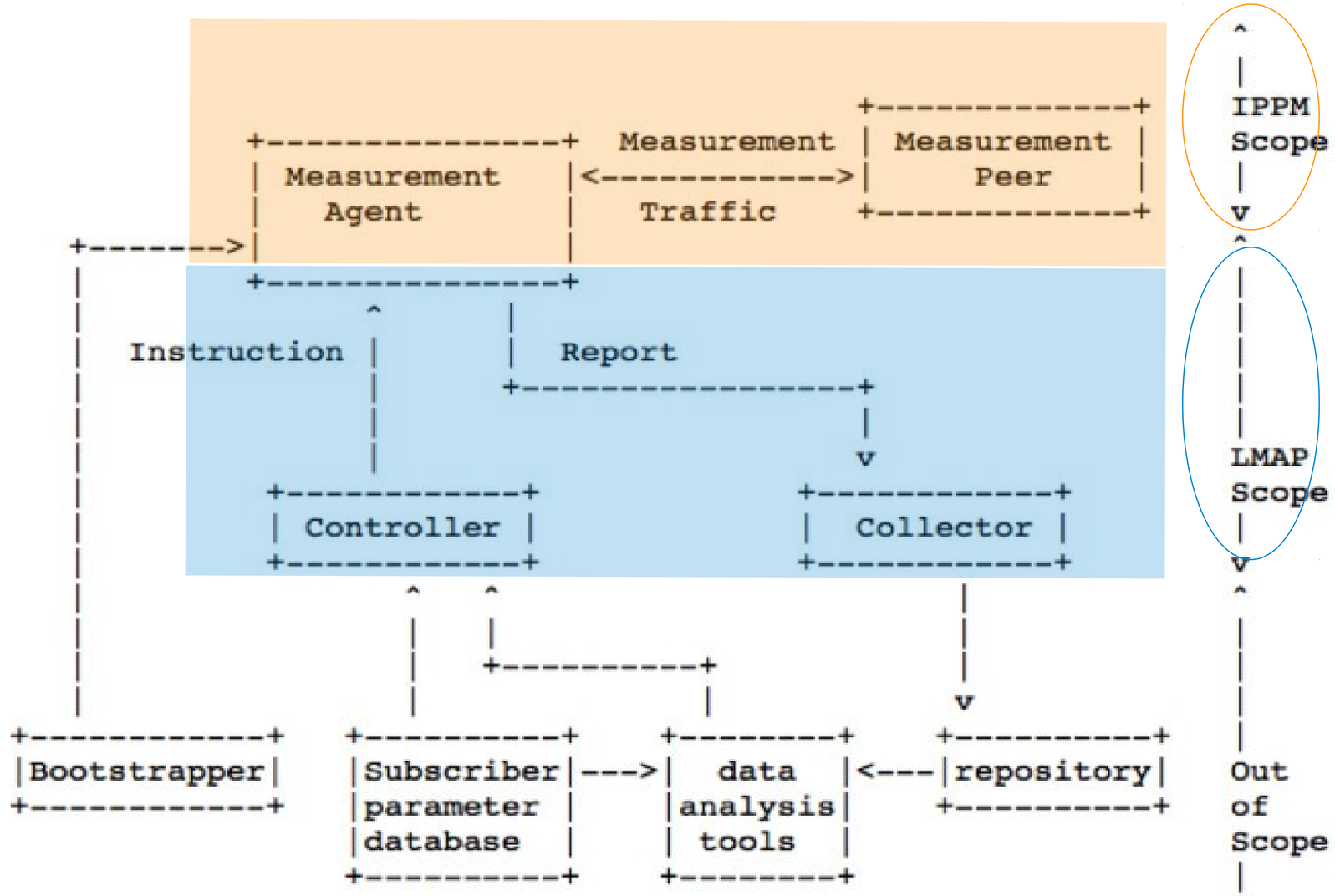


QoS Metrics Collected by Probe



- Distribute tests among probes, test top ~2000 servers across the world

How Our Work Relates to IETF IPPM & LMAP WG's Standardization Efforts



IPPM = IP Performance Metrics

LMAP = Large-Scale Measurement of Broadband Performance

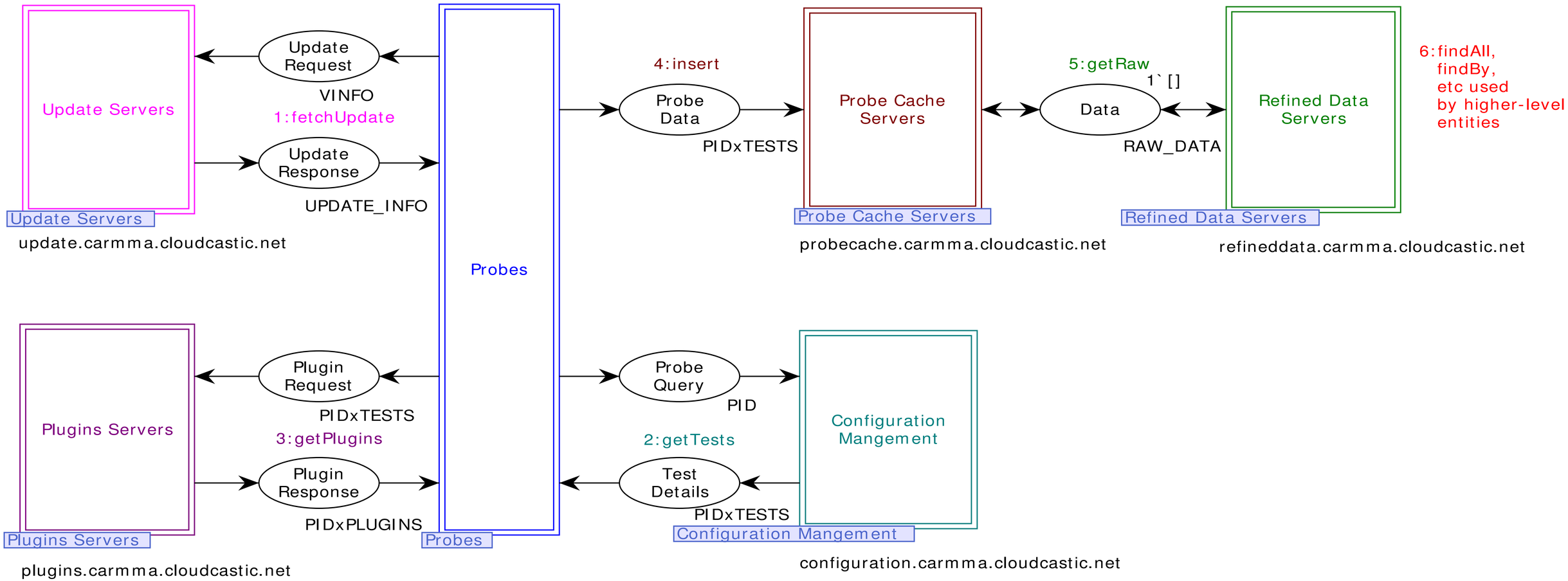
Probe Design

- Minimal resource usage on probe client
- Randomized delays to prevent DDoS
- Situation-dependent workload per probe
- Load balancing on servers easily possible
- Robust and lightweight messaging protocol

Back-end Design

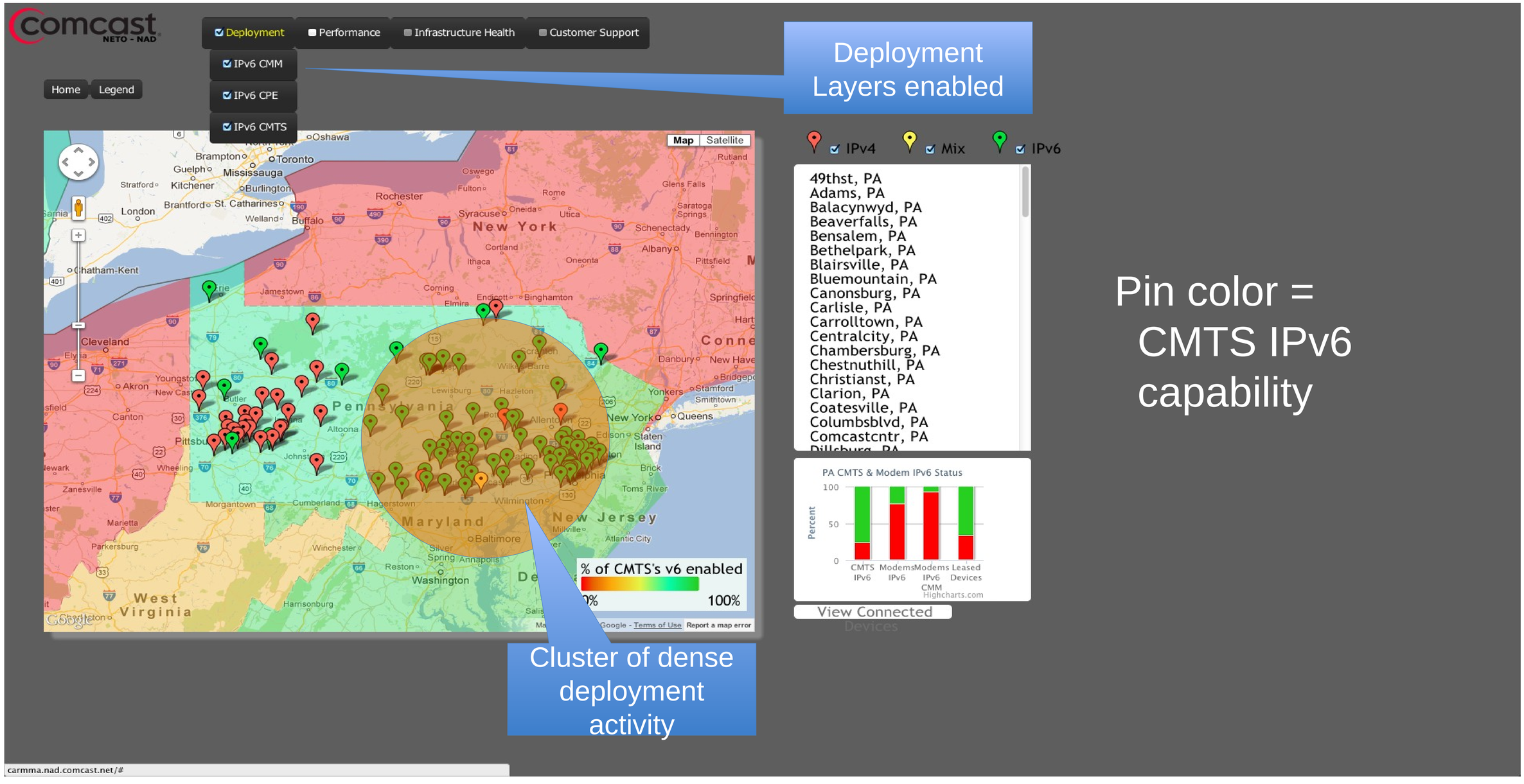
- Probes in one geographical area send data to local “Collectors”
  - Fast database insertions, avoid relational databases
  - In process of scaling-up performance
- Collectors “process” data for fault patterns, fault localization
- Scrub identifying info from data, upload highly reduced (aggregated) data set to Aggregation Server
  - Aggregated data ► trend analysis, fault forensics
- Data coherence is important

Colored PetriNet Models of Probe + Back-end

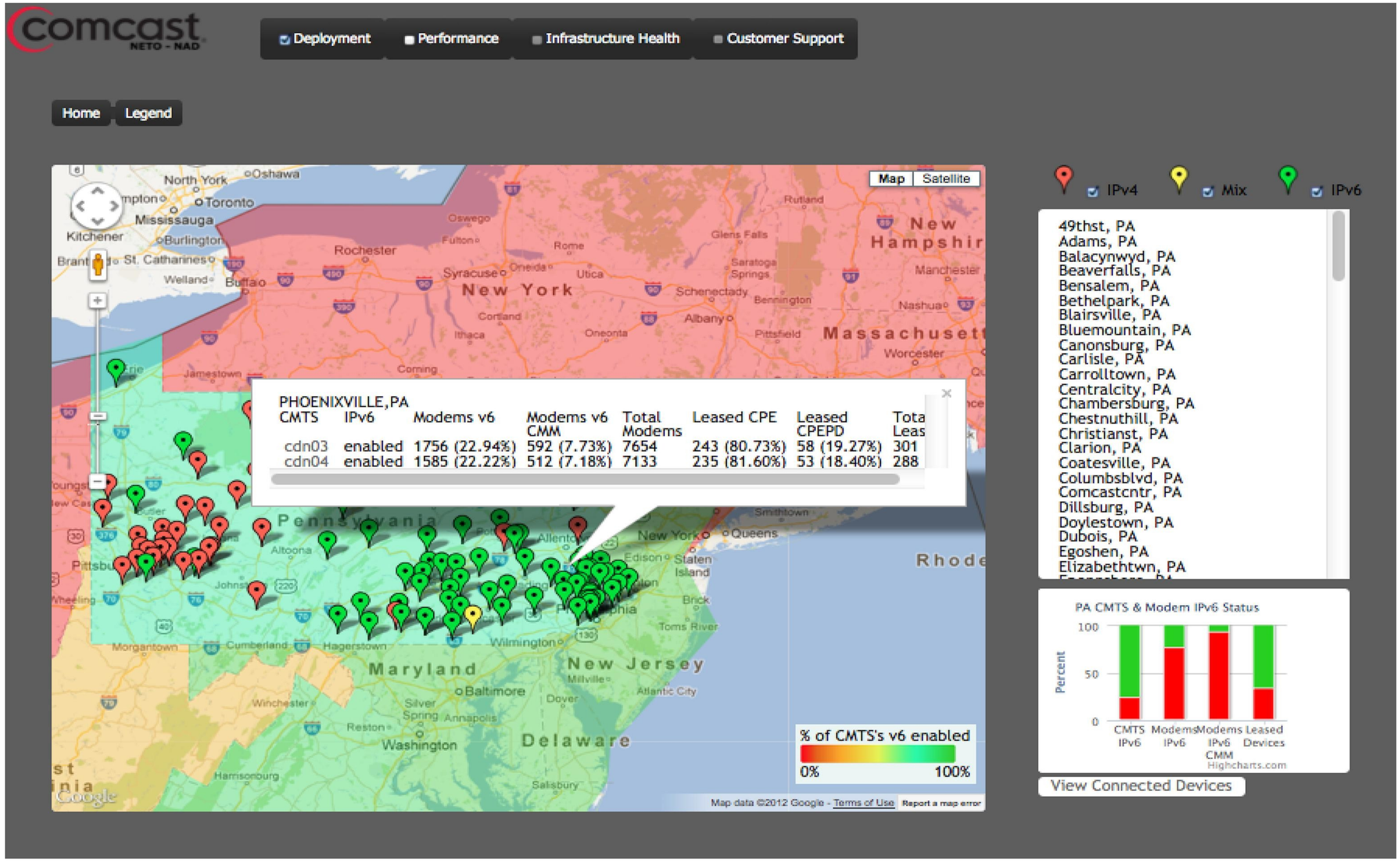


Note: Multi-level nesting of functional modules is possible

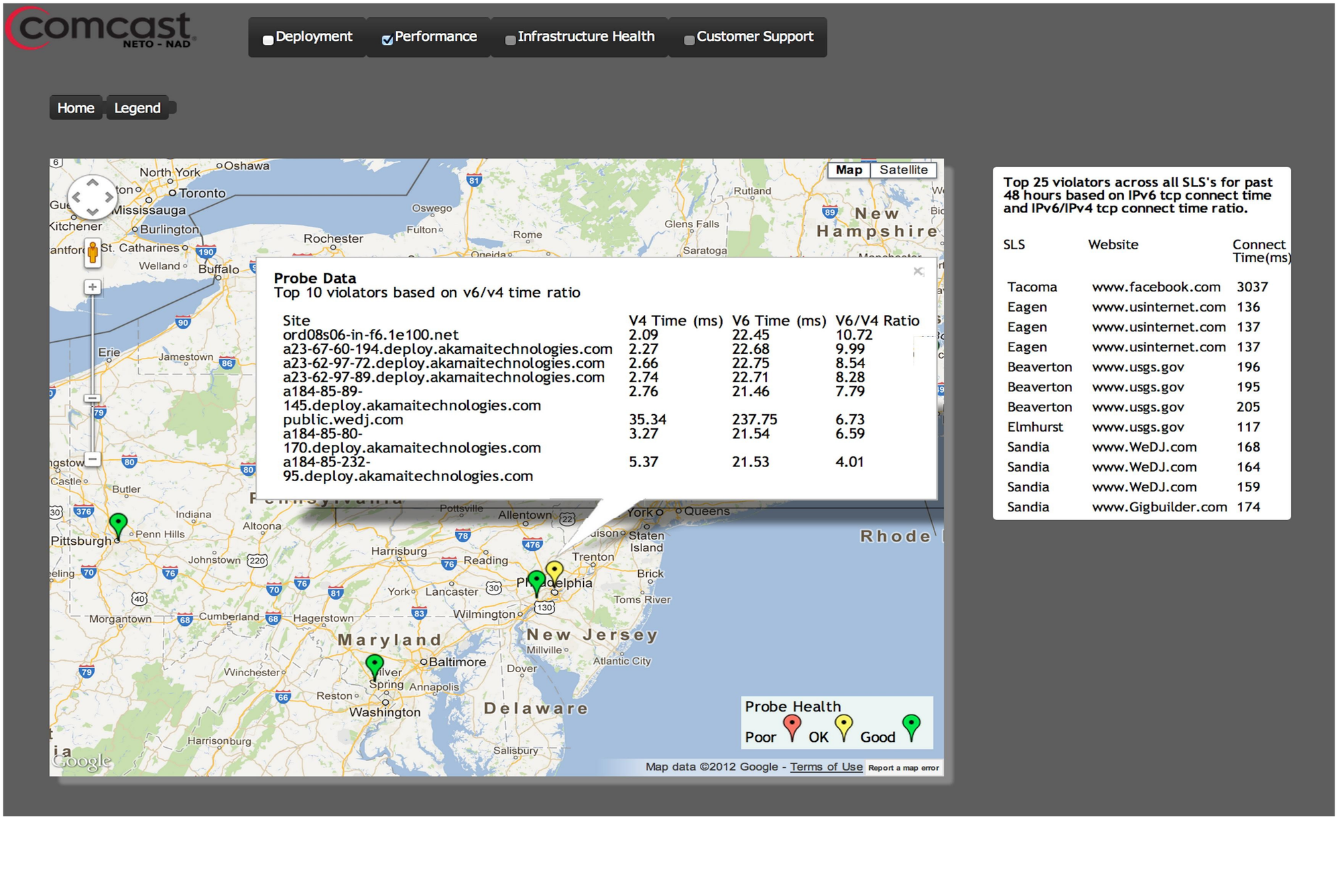
Visualization:
IPv6 Deployment, Region-wise



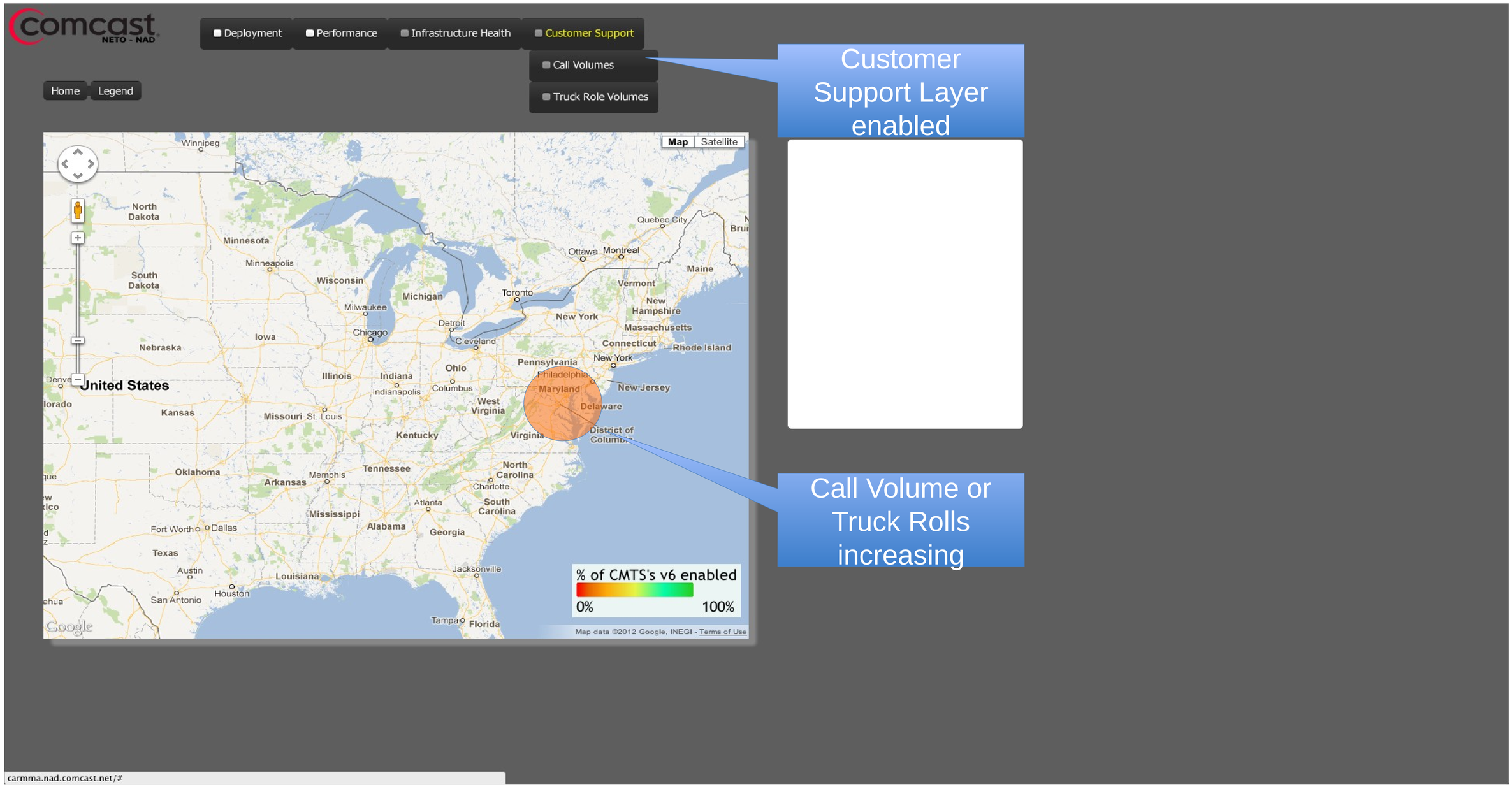
Visualization:
IPv6 Deployment, Zoomed-in



IPv6 Performance:
IPv6/IPv4 Site Latency Ratio



Visualization:
Cust. Support – Call Volumes, Truck Rolls



Conclusion

- Architectural framework for
  - Fine-grained, end-to-end QoS measurements (bandwidth, delay, etc.)
  - Back-end support architecture for metric storage, processing and aggregation
  - Visualization front-end for presentation at multiple levels (customer service, engineering, executive functions)
- Fits-in with IPPP, LMAP broad architecture
- Can be expanded to fiber, DSL access networks, not just cable
- Proof of concept with valuable implementation lessons

Related work

- "A Scalable Architecture for Performance Measurement in Broadband Networks", IEEE Conference on Standards for Communications and Networking (CSCN)", October 2015

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