Scaling Smart Appliances for Spatial Data Synthesis

Luis Pineda-Morales, Balaji Subramaniam, Kate Keahey, Gabriel Antoniu, Alexandru Costan, Shaowen Wang, Anand Padmanabhan, Aiman Soliman

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Problem

- *Spatial data streams* have grown considerably in size and complexity
- Volatility and growing number of user requests through CyberGIS Gateway [1]

Challenges

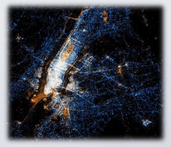
- How to deal with data and user requests volatility?
- How can we provision appliances quickly and efficiently?

Approach

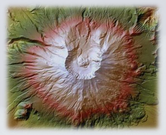
- Scale the computer resources in order to meet volatility
- *Smart* Appliances

Dynamic Data Streams

Social Networks

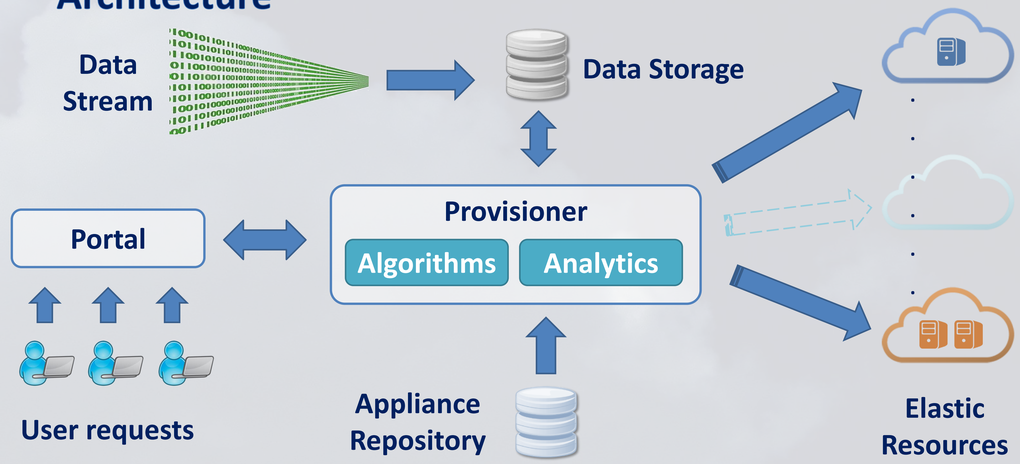


Sensors



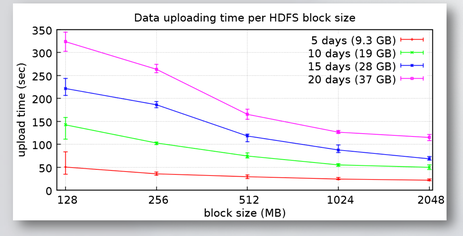
Scanners

Architecture

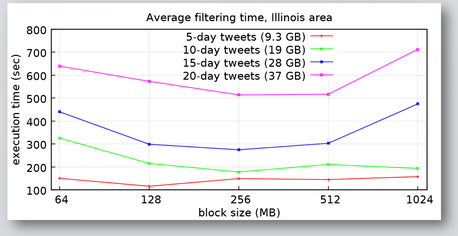


Developing a Statistical Model

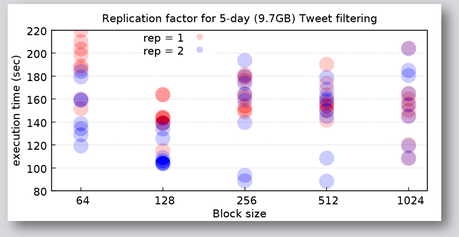
- **Data Upload**
  - 70%+ improvement with larger block size, compared to the default 128 MB



- **Execution Time**
  - "Sweet spot" more evident in larger datasets



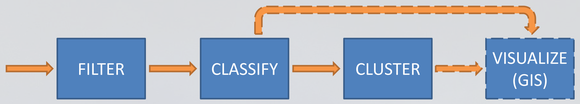
- **Data Replication**
  - Large dataset: disk saturation



CyberGIS

- Software integration for sustained geospatial innovation
- Achieve *scalability* for large geospatial problems and number of users

- *Use Case:* Spatial index for estimating home and work relocation, and unemployment rates using geo-located twitter data



Experimental Setup

- 2 bare-metal Chameleon nodes: 24 cores (48 VCPUs), 256 GB disk, 128 GB RAM
- Hadoop 2.7 (YARN): 128 MB default HDFS block size, up to 192 containers
- Up to 20 days of geo-located tweets (~1.9GB/day)

Future Work

- Scale out to months of geo-located tweets
- Test in other [virtualized] infrastructures
- Define models for elastic appliances
- Support for new job releases of the use case involving Phantom elastic provisioner [2]

References

[1] CyberGIS Software Integration for Sustained Geospatial Innovation http://cybergis.cigi.uiuc.edu/
[2] Infrastructure Outsourcing in Multi-Cloud Environment, Keahey, K., et al. Workshop on Cloud Services, Federation, and the 8th Open Cirrus Summit. 2012

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