



BIGDATA AND SMARTGRID

BigFoot project

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Contents

SmartGrid applications for BigData

- Grid monitoring
- Smart metering
- Intelligent home
- BigFoot research project
 - Consortium
 - Platform
 - Objectives
- Conclusions



« kWh » to « Energy Services » paradigm shift



New needs and opportunities:

Data Services for Energy



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<mark>grid</mark>pocket

Smart Grid data analytics market will generate \$11.3 billion cumulative from 2011 to 2014 (*Pike Research 2011*)

Data sources in SmartGrid

Grid monitoring

Smart Meters

Intelligent home / M2M









Grid Monitoring

Synchrophasors data

- Phaser Measurement Units provide phaser information (magnitude and phase angle) in real time
- Reporting rate of up to 60 frames per second to Phaser Data Concetrators



Source : Siemens.com





Source : Siemens.com

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Example projects

- Tennessee Valley Authority (TVA) Hadoop
 - OpenPDC (data from Phaser Measurement Units) standard
 - project done by Claudera
- Data volumes :
 - Serving 9 million consumers
 - Planning 1000 PMDs
 - 30 readings per second
 - 4.2 billion samples per day
 - Need 500TB storage
- Application
 - MapReduce oscillation scan : detection of power grid anomalies, creating power grid maps and evaluating power consumption history







Smart meters

Smart metering deployments



Smart metering projects world-wide (Engage Consulting)



Electricity, Gas and Water markets 270 millions smart meters in 2013 (ABI, Gartner) \$200 billion investment by 2015 (Pike)

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Volumes of data

- For 35 million meters (France), data reading every 10,30, or 60 minutes
 - Generates : 40-200 TB per year (depending on reading frequency and format)
- Gas and water grid under deployment





Example projects with metering data

- Ontario Power Authority (OPA) experimentation planned 4.5 million meter collecting data every hour – system wide analysis
- Southern California Edison with Teradata 100TB warehousing for user metering data
- Itron partners with IBM, SAP and Teradata to form Active Smart Grid Analytics – enabling applications such as Settlements, Network Loss, and Revenue Protection
- Opower 56 billions meter reads per year, planning to use Hadoop



Intelligent home

Intelligent home applications



- Security (detection, camera)
- Smart metering
- Lighting control
- Smart appliances
- Comfort control / HVAC
- Multimedia
- And more...

Volumes of data

- Multiple standards for sensors interconnectivity
- ETSI M2M framework
- For 35 million meters,
 - 4-20PB per year in the future (100 sensors per HH)



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The BigFoot research project

BIG Data Analytics of Digital FOOTprints

BigFoot project consortium

- Eurecom (France) *Project leader*
- Ecole Polytechnique Fedérale de Lausanne (Switzerland)
- TU Berlin / Deutsche Telecom Lab (T-Lab) (Germany)
- Symantec (Ireland)
- GridPocket (France)
- Funded by EU FP7 Call 8



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BigFoot – Use case

SmartGrid data storage and processing

- Consumer billing
- Consumer Dashboard Web applications: personalized customer reports;
- Load analysis: mix, detection of anomalies, consumer behavioral analysis
- Consumer segmentation: execution of complex algorithms to classify consumers based on their consumption patterns and produce, for example, personalized contract;
- Assets usage analysis: analysis of geographical consumption patterns and design of predictive algorithms to help operators in provisioning of their electric network.



BigFoot SmartGrid scenario



R&D:

Workload suites **High-level languages** Batch and interactive engines **Distributed Data stores**

Stack

Beyond "best-effort": Virtualization Deployment

Contributions: ASF 2.0 Hadoop **OpenStack**



Eurecom experimental platforms



8 High-end servers

single ARM v5, 1.2GHz,

512MB RAM, 64GB

5 watts per node

- 160 Cores
- 512 GB RAM

100 nodes

Power efficient

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- 100 TB disk
- GB network

Conclusions

Smart Grid and big data

- Generates significant amounts of data
- New needs and applications are coming

• Hadoop technology

- Promising, however still need to gain on maturity
- Complex setup and maintenance
- Interoperability
- Limited skills and support available in Europe
- Next steps
 - BigFoot and other BigData projects
 - GridPocket and BigFoot are open for cooperation
 - Looking for comments and suggestions

