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CITIESData: Towards Cloud Based Big Data Management for Smart Cities

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Introduction

With the increasing presence of Internet of Things (IoT) and future internet technologies in smart cities, a large amount of data are generated. The data need to be properly managed and analyzed for various application using integrated ICT approach. The ICT technologies for a smart city will deal with the data from different domains, including environmental, energy, transportation and many others. We present a cloud-based ICT platform that can collect, store, share/publish, analyze, and visualize scalable data from city environment.

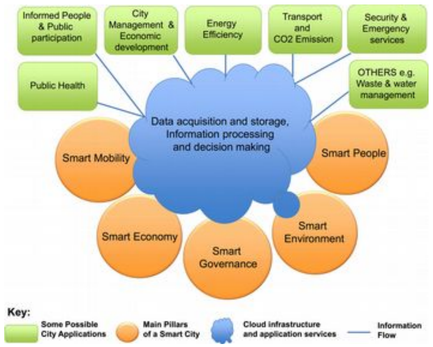


Fig 1. Using the Cloud to store data generated from different smart city components [1]

Smart city data characteristics (5Vs but more Vs are possible):

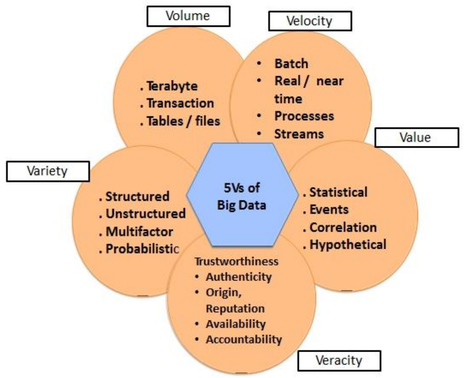


Fig. 2 The characteristics of big data

Methods

The goals:

- Data quality checking and improvement
  - Cleansing data before publishing
  - Instruction of data quality
- Security and privacy protection
  - Classify data according to different risk levels
  - Using different sharing/publishing strategies

The architecture:

- Apply the virtual machine (VM) based secured environment for using highly sensitive data
- Use the cloud-based data management system, *OwnCloud*, for semi-sensitive data sharing
- Use the open data platform, Zenodo, for indexing, and sharing

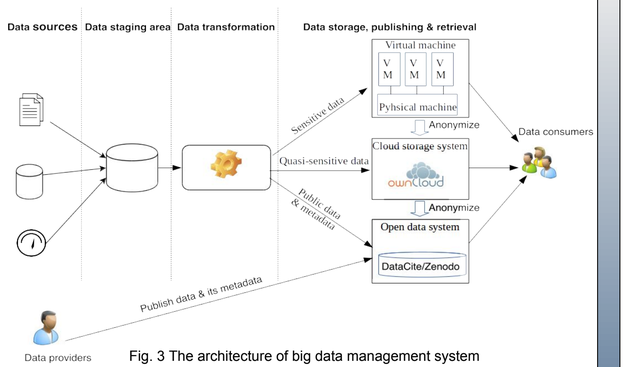
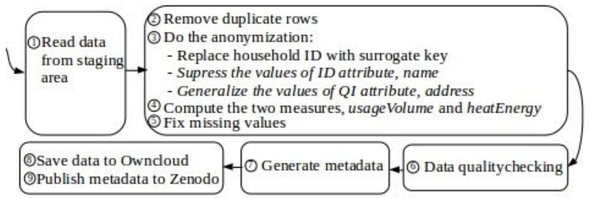


Fig. 3 The architecture of big data management system

The process:



Results

- **Data quality checking model**

$$f = \sum_{i=0}^{n-1} \omega_i * y_i, \quad \omega_0 + \omega_1 + ... + \omega_{n-1} = 1.0 \qquad (1)$$

where f is the overall data quality score, y_i is the data quality of determinate attribute i, and ω_i is its weight.

- **Anonymization methods and software package**

- **CITIES data management system**
  a. A scalable data processing platform
  b. Data cleansing, analytics and visualization

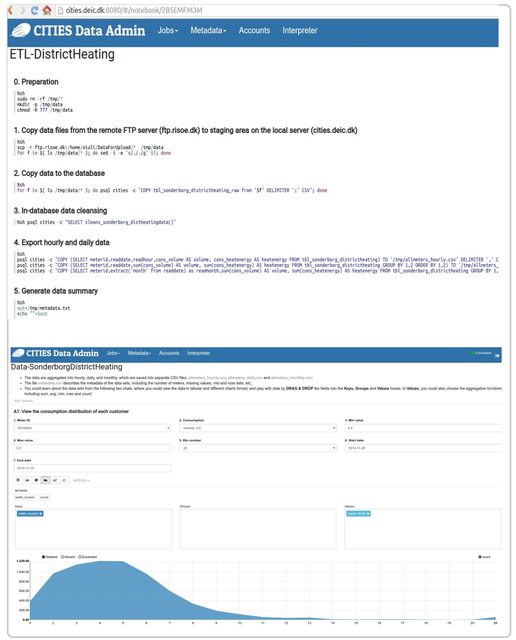
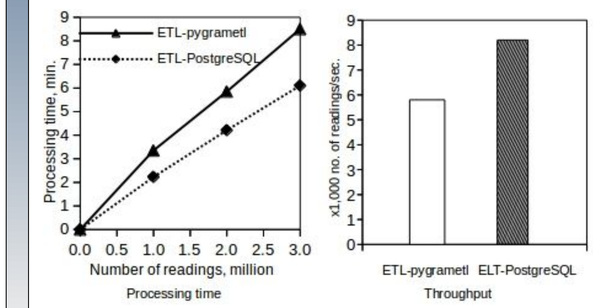


Fig. 4 CITIES data management system

- **Performance**
  The time and throughput of processing 3 million hourly smart meter readings



Conclusions

- We have proposed a smart cities data management framework
- Proposed the method of publishing/sharing data according to different data sensitivity levels.
- Proposed linear regression based data quality checking method
- Implemented a smart cities data platform for streamlining the data management process
- The cities data platform has good performance supporting big data management towards the Cloud

Acknowledgements

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2. CITIES Data Platform. http://cities.deic.dk