A Smart City is a Green City

Policy based, context aware smart home/city energy management system

By

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Smart Cities start with Smart Homes

• A smart home is where we have Smart appliances:
  ➔ Appliances with smart meters + Embedded computers

• A green home is where we have several sources of energy
  ➔ Solar, wind, grid, etc...

• A smart home is where energy management is efficient
  ➔ Not minimal
  ➔ Not fixed
  ➔ It has to be personalized!
Context awareness + Software policies

• Clients need to be able to express their preferences in terms of energy management
  • Energy saving
  • Bill reduction
  • Comfort
• Decisions need to be made by the system depending on the context data collected
Proposed solution:
Where does it fit in the cloud?
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Research Interests

• Secure Databases
• Web Services (SOA Architectural Guarantees)
• Cloud PaaS
• Secure Software Engineering
• Cybersecurity (cIA)
• Heterogenous Integration
Smart cities/IOT Issues

• Process Authentication
• Message Delivery
  • Certificates
  • Public Clients
• Datastore Issues
  • ACID vs CAP
  • Guarantees
  • Durability
Authentication (C,I)

Accomplished

• Something you know for humans
• Something you have for humans
• Something about you for humans
• Someplace you are for machines

Missing

• Process Authentication
  • We do have Security Assertion Markup Language (SAML) for some use cases
Certificates (C,I)

Private Key Infrastructure (PKI)
Accomplished
• Machine to machine synchronous key exchange
• Validate the integrity of messages from machines

Outstanding Challenge
• Process identification
• How do clients get and store certificates
Cloud Clients Secure Messaging

• Clients may be public. Need a way to sign data sent to cloud without installing a certificate on client.
ACID vs CAP

• ACID Strong Properties
  • Atomic
  • Consistent
  • Isolated
  • Durable
Durability (I)

• Durability guarantees that we do not lose data after a transaction.
  • Server partitioning requires we update many machines synchronously to avoid lose.
  • Offline stores need to resolve conflicts based on many related factors
Database Guarantees

• Relational ACID databases do not scale well
• NoSQL (No ACID) do not work in all application domains
• We need new data architectures for cloud that provide real guarantees
  • Eventual consistently is not really consistent
  • GAE can do 1 trans/sec with consistency
• Streaming Data needs New Constraints
Smart Cities and Cloud Computing Panel

“Peer-to-peer sourced mediation cloud platform for multimedia streams”

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Background: PDA

- Low tech example: Google Maps on PDA

- What was PDA is now smart mobile device
  - smart watch, Google Glass, …

- High bandwidth connectivity: WLAN, LTE
  - plus: personal area networks

- Media out: video, audio, shaker, heater, …
- Media in: video, audio, geo-location, attitude, …
Application Scenarios

- Multi player games
  - game players wander game room
    - visualized from sensor streams (audio, video, …)
    - augmented with virtually-real objects and events
  - each player participates with mobile device
    - mobile device is source for additional multimedia
    - mobile device is presenting augmented reality

- First responders
  - enter burning building equipped with mobile devices
  - mobile devices gather and display augmented reality
Big Picture Idea
Mediator Architecture

CloudMediate

Homogenization  Integration  Presence

input streams

output streams

mediator  mediator  mediator  mediator  mediator  mediator
Questions & Issues

- Multitude of cloud-connected sensors
- Privacy
- Access control
- Bandwidth
- Standards: vendors