IOT SENSING FRAMEWORK WITH INTER-CLOUD COMPUTING CAPABILITY IN VEHICULAR NETWORKS

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CONTENT

- Introduction
- Terms To Know
- Related Work
- Business model
- Model cloud computing
- Inter-cloud architecture
- VMS event processing flow
- Conclusion
- References
INTRODUCTION

- Iot can improve quality of life
- Representative application
- Iot components
- Location based services
**Terms to know**

- PPS – Platform Production Services [1]
- VNA – Vehicular network application
- VMS – Vehicular maintenance service [1]
RELATED WORK

- Iot four layer architecture
- Vehicular network
- Cloud computing
- Event based architecture [1]
IOT FOUR LAYER ARCHITECTURE

Application and services layer
- Code-centric and situation-aware system, agent intelligence

Information handing layer
- Cloud computing, data mining, intelligent agent system

Information delivering layer
- Internet, mobile communication, cellular, WLAN, P2P, social network

Object sensing and information gathering layer
- WSNs, body area networks, RFID

[1]
VEHICULAR NETWORK

[2]
CLOUD COMPUTING

[1]
EVENT BASED ARCHITECTURE

- SoFia – Smart Object for intelligent applications
- SIB – Semantic information broker
- KBP – Knowledge based processors
- SSAP – Smart space access protocol

[1]
BUSINESS MODEL
BUSINESS MODEL – DIGITAL PLATFORM

Table 1 Properties of different types of AD Hoc networks

<table>
<thead>
<tr>
<th>Property</th>
<th>VANET</th>
<th>WSNs</th>
<th>WMN</th>
<th>MANET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network size</td>
<td>Large</td>
<td>Large</td>
<td>Moderate</td>
<td>Medium</td>
</tr>
<tr>
<td>Energy limitations</td>
<td>Very low</td>
<td>Very high</td>
<td>Very low</td>
<td>High</td>
</tr>
<tr>
<td>Node’s mobility</td>
<td>High, nonrandom</td>
<td>Mostly static</td>
<td>Static</td>
<td>Random</td>
</tr>
<tr>
<td>Location dependency</td>
<td>Very high</td>
<td>High</td>
<td>Very low</td>
<td>Low</td>
</tr>
<tr>
<td>Node’s computation power</td>
<td>High</td>
<td>Very low</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Node’s memory capacity</td>
<td>High</td>
<td>Very low</td>
<td>High</td>
<td>High</td>
</tr>
</tbody>
</table>
BUSINESS MODEL - SCOPE
BUSINESS MODEL – CUSTOMER SERVICE
Mobile cloud computing

- Semantic Operation - SPARQL
- Inter-Cloud Service – XMPP based protocol
- Capabilities of Inter-Cloud
- Semantic model in inter-cloud
**Mobile Cloud Computing**

```xml
<?xml version="1.0"?>
<!DOCTYPE rdf:RDF [<!ENTITY xsd "http://www.w3.org/2001/XMLSchema#">]>  
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"  
         xmlns:exterms="http://www.example.com/terms/>
   <rdf:Description rdf:ID="vehicle123">  
      <exterms:brand rdf:datatype="&xsd;string">HongQi</exterms:brand>
      <exterms:speed rdf:datatype="&xsd;decimal">60</exterms:speed>
      <exterms:longitude rdf:datatype="&xsd;decimal">113.4</exterms:longitude>
      <exterms:latitude rdf:datatype="&xsd;decimal">23.2</exterms:latitude>
   </rdf:Description>
</rdf:RDF>
```

### Table 4: Examples of semantic queries for the vehicle network

<table>
<thead>
<tr>
<th>Type</th>
<th>Query</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>SQWRL</td>
<td>Road(?r) ∧ hasTraffic (?r, ?t) ∧ hasType (?t, ?type) ⇒ sqwrl: select (?type)</td>
<td>Select the type of the road traffic</td>
</tr>
<tr>
<td>SQWRL</td>
<td>NationalRoad(?r) ⇒ sqwrl:select (?)</td>
<td>Select the national road</td>
</tr>
</tbody>
</table>
| SPARQL | PREFIX foaf: <http://xmlns.com/foaf/0.1/>  

```
SELECT ?name ?type  
WHERE {  
?road a foaf:Road.  
?road foaf:name ?name.  
}
```
INTER-CLOUD ARCHITECTURE
INTER-CLOUD ARCHITECTURE

Sensing information determining the service types

- Automotive manufacturer create a data center to store all related information about single produced car.
- Main cloud is located in manufacturer headquarter, while cloud cluster can be dispersed among car maintenance service center.

Vehicle problem identification, analytics system

Vehicle using semantic operation to define specific data that query from several cloud data center. Data the queried to inter-cloud system using an resource description framework called SPARQL Service querying function (SPARQL)

OSGi/UPnP/Jini Service gateway

Inter-cloud root

XMPP-based inter-cloud transport protocol

Location-based service cloud

Automotive multimedia resources cloud

Extensive inter-cloud service

These clouds have unique contents that will be query to join service framework by invoking information inter-cloud root. The cloud responds the query using XMPP-based inter-cloud transport protocol
VMS EVENT PROCESSING FLOW

[6]
CONCLUSION

- Tried to give social networking form to VNA.
- Needed more explanation on included diagrams
- Promotional paper
REFERENCES


Thank you!