The Mobility Services-Oriented Development Architecture of Transport Digital Infrastructure for Smart City

Allen C. Su
Vice President, Director of Overseas Department
THI Consultants Inc.
October 18, 2019
Table of Contents

■ Why Mobility Service-Oriented Development
  ● Services Requirements for Smart Life
■ Re-thinking of the Infrastructure Investment
■ Sustainable Financial Support
Why Mobility Service-Oriented Development

- Services Requirements for Smart Life
Public Transport Services

Diversity

Density

Design

Advanced Public Transport Services
Traffic Information Services

Real-time traffic information
Traffic Management Services

Smart traffic control system

Cloud Computing

Data Collection
Data Processing & Prediction

Dynamic Traffic Light Control

CCTV Monitoring

Real-Time Roadway Guidance

Main road Green-Wave

Traffic Detector
Parking Services

On-street Geomagnetic Sensor

Off-street Parking Information
Smart Payment Services

Customization service for needs

Smart GUI for easy and user-friendly operation

Antenna + eTag detection + eTag Payment Platform
Features of Smart Life

- Digitalization
- Personalization
- Mobility

Digital infrastructure in Traffic Composition
Re-thinking of the Infrastructure Investment
Traditional ITS Framework – Duplicated Investment
The Issues of Deploying Various and Independent Applications

- Deployment and Operation cost mostly rely on government budget, lacking viable and profitable business model and without stable funding, operations could not be sustained.

- Specific type of technology causes the integration with other systems is problematic and difficult to provide innovative services in meeting user demands.

- Specific projects are limited in geographic scope, difficult to expand spatially.

- Specific projects prone to have duplicated software development and repeated investment in hardware infrastructure, and potential cause for wasted resources.

- Specific projects could be effective in resolving short-term issues, but could not take into account much of the future technology trends and lack system scalability.

- Data are stored in various organizations, where barriers exist against data exchange and sharing. Difficult for systems to be integrated and seldom applied effectively to other new ITS services.

- Over-anxious in introducing ITS to resolve all traffic problems could on the contrary overlook the actual expectations of road users for better mobility services.
## Integrated Smart Transport System Framework

- **Vehicle Digital System Platform (VDSP) Framework**

<table>
<thead>
<tr>
<th>Services</th>
<th>Based on specific development objectives of intelligent transport, user’s requirements of mobility can be satisfied by these services.</th>
</tr>
</thead>
<tbody>
<tr>
<td>UI Components</td>
<td>UI components allow different users to operate systems and obtain services with ease.</td>
</tr>
<tr>
<td>Business Solutions &amp; Modules</td>
<td>Based on Services, develop or purchase all needed modules and integrate these modules into solutions.</td>
</tr>
<tr>
<td>System Integration Modules</td>
<td>SI Modules also called Common IT Modules, they are integration tools for components of Business Solutions &amp; Modules.</td>
</tr>
<tr>
<td>Common Components</td>
<td>Provide functions of cache, data access, security, rule, cryptography, logging and validation to make operation smoothly.</td>
</tr>
<tr>
<td>IT Infrastructure</td>
<td>Include web services, mail services, edge server, reporting services, database integration, operation system, database system, and cloud/on premises.</td>
</tr>
</tbody>
</table>
# Integrated Smart Transport System Framework

- **Services**
  - Intelligent Traffic Control
  - Traveler Information
  - Public Transportation Information
  - Safety and Surveillance
  - Vehicle Pollution Control
  - Usage Based Insurance
  - Precision Marketing
  - Sharing Services
  - Speed/Weight Enforcement
  - Commercial Vehicle Enforcement

- **Solutions**
  - Services Gateway
    - DMV
    - ATIS/ATMS
  - Customer Services
    - Billing
    - Mediation
  - Security Gateway
    - Value-added
    - Big Data
    - A.I.

- **Sensor Infrastructure**

- **Central Back Office**

- **Interpretation of VDSP Framework** – Proposed Service Categories and Services for DVSP
Integrated Smart Transport System Framework

- Proposed Business Solutions & Modules for VDSP
  - Based on Services, develop or purchase all needed modules and integrate these modules into solutions.
Integrated Smart Transport System Framework

- Proposed Functions of UI Components, SI Modules, and Common Components for VDSP
  - **UI components** allow different users to operate systems and obtain services with ease.
  - **System Integration Modules** also called Common IT Modules, they are integration tools for components of Business Solutions & Modules.
  - **Common Components** provide functions of cache, data access, security, rule, cryptography, logging and validation to make operation smoothly.

![Diagram of Integrated Smart Transport System Framework]

- **Form Designer & Generator**
- **Common Web Controls**
- **AJAX UI Control**
- **UI Styles, Format, and Validation**
- **Web Parts**
- **UI Flow**
- **Multi Language**

- **Services**
  - **UI Components**
  - **System Integration Modules**
  - **Common Components**

- **Business Solutions & Modules**

- **IT Infrastructure**
  - **Cache**
  - **Data Access**
  - **Security**
  - **Exceptional Handling**
  - **Rule**
  - **Cryptography**
  - **Logging**
  - **Validation**

- **Batch Notification**
- **Data Visualization**
- **System Integration**
- **File Processing**
- **Services Gateway**
- **Flow**
- **Identity Gateway**
- **External System Adapter**
- **Role Based Layering Authorization**
- **Reporting**
- **User Profile**
- **System Monitoring**
- **Alert**
- **User Profile**
- **System Monitoring**
- **Alert**
Integrated Smart Transport System Framework

- Proposed IT Infrastructure for VDSP

**Services**

**UI Components**

**Business Solutions & Modules**

**System Integration Modules**

**Common Components**

**IT Infrastructure**

**Vehicle Censors**

**CVP Data - OD/Travel Time**

**Big Data A.I. Analysis**

**Dates**
- Special Holidays
- Days of Holidays

**Activities**
- Google Trends
- Mobile Data
- Passenger Volume at Scenic Spots

**Weather**
- Weather Forecast
- Rainfall
- Air Quality
- Ultraviolet Index
- Temperature
- Extreme Climate

**Incidents/Events**
- Location
- Summary
- Recovery Schedule

**Traffic**
- eTag Data
- CVP Data
- Vehicle Detector
- Passenger Volume of Public Transport
- Parking Lots Data

**Services**
- Operation System
- Database System
- Reporting Services

**IT Infrastructure**
- Cloud / On Premises
- Database Integration
- Edge Server
- Mail Services
- Web Services
- Censor
Integrated Smart Transport System Framework

- Example of VDSP Framework for Smart Parking Services

<table>
<thead>
<tr>
<th>Services Gateway</th>
<th>Security Gateway</th>
</tr>
</thead>
<tbody>
<tr>
<td>DMV</td>
<td>Central Back Office</td>
</tr>
<tr>
<td>ATIS/ATMS</td>
<td>Traffic Management Center</td>
</tr>
<tr>
<td>Customer Services</td>
<td>Enforcement Office</td>
</tr>
<tr>
<td>Billing</td>
<td>Violation Center</td>
</tr>
<tr>
<td>Mediation</td>
<td>Call Center</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sensor Infrastructure

- Edge Server
- Sensor for weather/disaster
- Traffic signals
- Road lamp
- CMS
- CMS/VMS Display
- CCTV
- CMS/VMS Display
- TrainMRT Station
- Bus stop
- Security Center Device
- Barrier
- LIDAR
- LiDAR Sensor
- Doppler Radar
- VDI (Laser, Loop, Radar)
Sustainable Financial Support
Digital Economy vs Digital Vehicle Economy

- **Digital Economy and Platform Economy**
  - The Digital Economy (DE) is innovative economic activities generated by an array of digital technologies.
  - Under the Digital Economy, the Platform Economy linking organizations and resources has emerged to provide intermediate corresponding services.

- **Digital Vehicle Economy**
  - The Digital Vehicle Economy (DVE) refers specifically to the new mode of economic industry created from digital computing through vehicles.
  - DVE’s main technology comes from the IoV. The IoV back-end platform integrates all information on people, vehicles and roads.
VDSP Enables the DVE and DE

- DVE Applications Requires **digitalization** and **validation** of Vehicle’s Identification, Transaction, and Location.
- The VDSP (Vehicle Digital System Platform) owns the core features of DVE.

Traffic Big data
- GPS, Mobile Device, Smart Card

Programmatic Buying
- Audience Targeting
- Precision Marketing

Digital (Vehicle) Economy
- Billions of Online Connections

Vehicle Tracking / Person Count
Flow rate Hotspot Analysis
Opportunities and Benefits

- Stakeholders: End user, Government, Industry, Academic institutions

- Digital Vehicle Economy (DVE)
  - Travel
  - Transportation Logistics
  - Banking Insurance
  - Loan/Insurance
  - Fleet Management
  - Smart Governance
  - Vehicle Manufacturing/Sales/Services/Rental
  - Payment
  - Gas Station / Charging Station
  - Depot/Dealer
  - Tourism
  - Parking
  - Drive-through
  - Navigation
  - Maintenance / Auto Detailing
  - In-vehicle Electronics
  - Auto Parts Store
  - Internal Affairs
  - Transportation
  - Police
  - Customs
  - Taxation and Finance
  - Environmental Protection
  - Tourism
  - Parking
  - Drive-through
  - Navigation
  - Maintenance / Auto Detailing
  - In-vehicle Electronics
  - Auto Parts Store
THANK YOU
FOR
YOUR ATTENTION

Allen C. Su / Vice President / Director of Overseas Dept.
Email: su@thi.com.tw