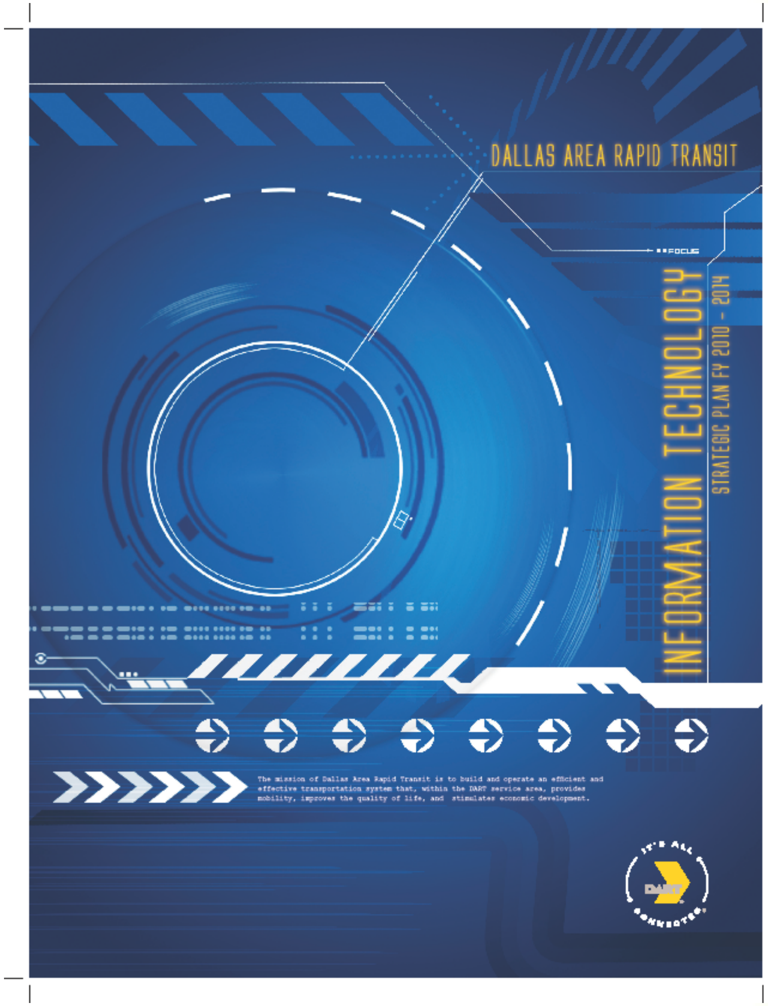
Appendix

Background Slides

Technology Strategy

Technology Strategic Plan

- Background and Context
- Vision and Principles
- IT Department Operational Practices
- Technology Deployment
  - The user experience
  - Infrastructure
  - Applications Systems
  - Information Management and Delivery
  - ITS Technology



Technology Governance

Technology Steering Committee

- All TSC members are from the Executive Management Team
- Review all projects over $50,000
  - >$250,000 requires Board approval
- Review grant applications for technology
- Realign unsanctioned projects
- Resolve priority conflicts
- Via sub-committees, approve:
  - Technology standards
  - Operational service levels
  - Enterprise Architecture

IT Department
65 people, $11M Operating budget
Infrastructure Operations
Applications Management
Web Development
Intelligent Transportation Systems Tech
Program Management Office

Application of Technology to Transportation Operations

Enterprise Class Applications Systems

Trapeze

- Route planning, design and scheduling for buses
- Operator scheduling and work assignments
- Route performance management
- Trip planning for riders via web site or call center

SPEAR

- Maintenance logistics and work orders
- Materials Management

Lawson

- Finance and Human Resources Systems
  - Adding Procurement and Contract Management

IT Infrastructure

Primary Data Center – all systems hosted internally

Secondary Data Center for DR

- Real time data replication, virtual servers for very fast transfer

MPLS WAN connecting 25 sites

Gigabit LAN in all facilities

Oracle is primary DBMS

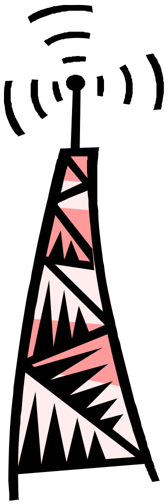
SAN storage architecture

2000 desktop PCs, 400 laptops

Technology in Transportation Operations

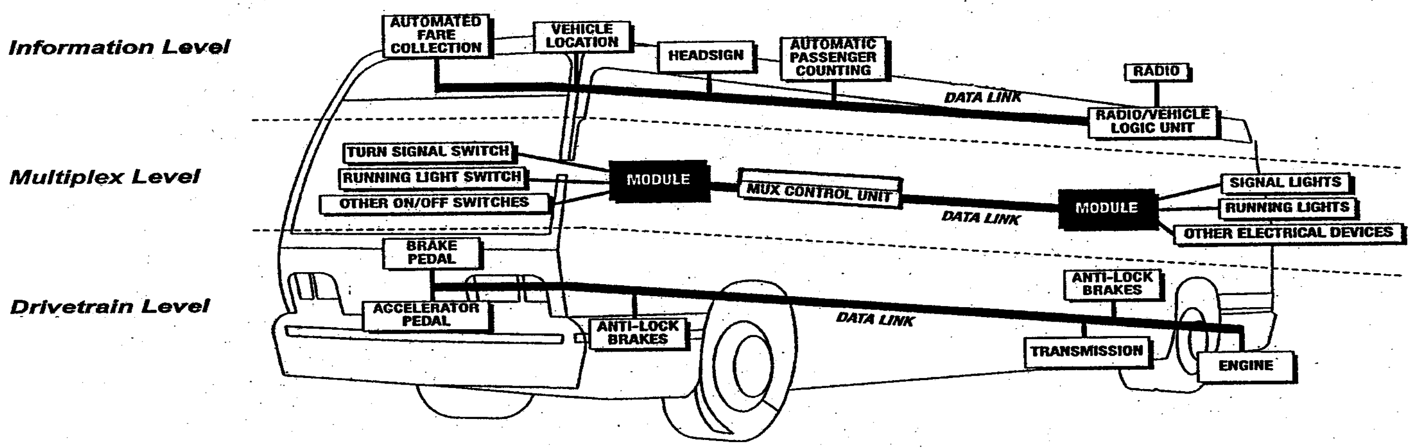
Bus Based Systems

- Vehicle monitoring
- Fare Collection
- Passenger information display
- GPS based Automatic Vehicle Location (AVL)
- Automatic Passenger Counting
- Security cameras



Buses and trains equipped with a private radio system for operator voice communications to Dispatch, and vehicle location data every 90 seconds

4G wireless under consideration



Technology in Transportation Operations

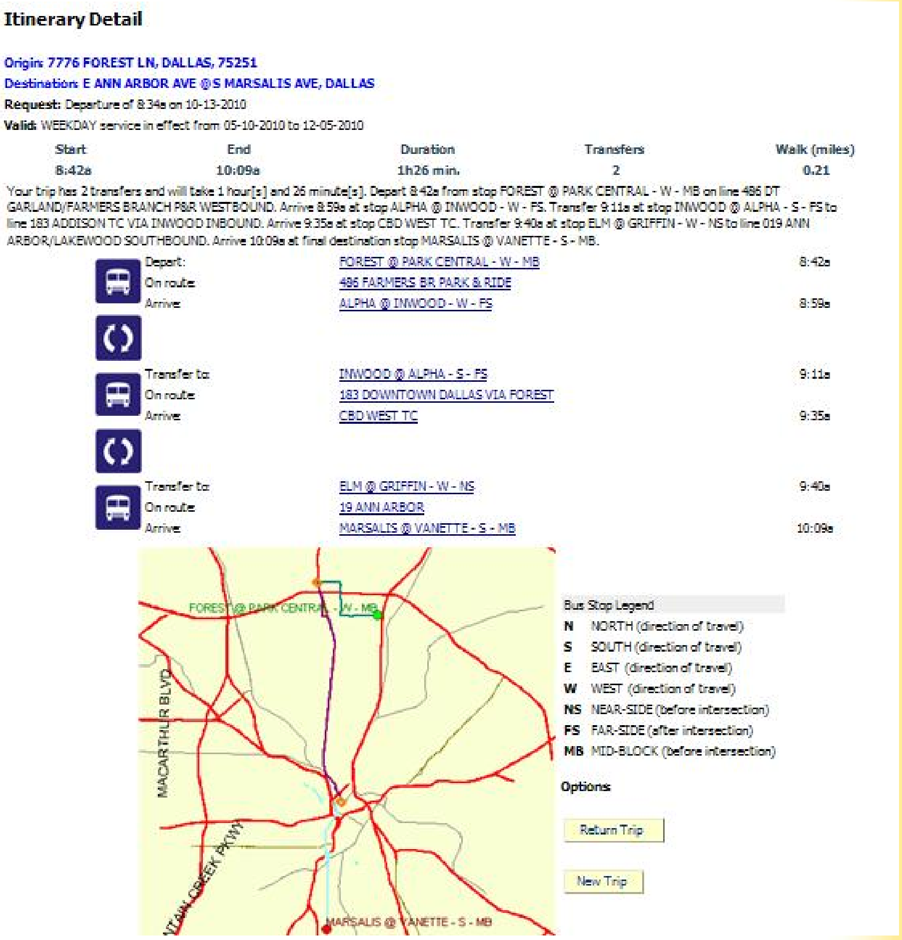
Train Based Systems

- Vehicle control
  - Train to wayside control (TWC) signaling
  - Track circuit detection and monitoring
  - Cab signaling system
- Vehicle Business System
  - Route and location, automated announcements, header signs, operator login, door control
  - WiFi updates in rail yard
- GPS based AVL
- Security cameras

Technology in Transportation Operations

Trip Planning - Options

- DART web site www.dart.org
- DART mobile site www.m.dart.org
- Customer call center 214 979 1111
- The above use routes and schedules built into Trapeze, and a trip planning algorithm. Call Center agents can offer alternatives and specific suggestions.
- Google Maps>directions>public transit http://maps.google.com/
- DART provides a feed to Google in a standard format and Google has its own algorithms to calculate routes.



Traffic Signal Prioritization in Downtown Dallas

Traffic Signal Priority in Downtown Dallas The Challenge

- Running light rail on city streets has the inherent conflict of rail vs vehicular traffic.
- With two lines (Red & Blue) normal traffic signal timing was sufficient to maintain headways – 18 trains per hour
- Opening a third line (Green) increased throughput to a train every 2.5 minutes at peak, or 24 trains per hour in each direction
- Standard signal timing was no longer adequate so a dynamic signaling system was needed

TSP Goals and Benefits

Goals

- Headways of 2.5 minutes in each direction
- Non-stop station-to-station travel
- Minimize queuing of street traffic
- Adapt to variations in train operation

Benefits

- Reduce train stops between stations
- Reduce travel time through downtown for trains and vehicles
- More efficient train operations to maintain schedule

System Overview 1/2

The TSP system components are:

- Train detection system
  - Phase I magnetometers and infrared detectors
  - Phase II TWC at all stations, IR, Magnetometers
- Communications network:
  - Between detectors, traffic signals and monitoring stations
  - Wireless with double redundancy (fiber and twisted pair)

System Overview 2/2

The TSP system components are:

- TSP Traffic Signal Logic
  - Station to station operation
  - Holding of trains at mid-block when needed
- Peer to peer messaging solution
  - To send detection signals to downstream and upstream signal controllers

- Phase IIA will include a new traffic signal control system for CoD

TSP Operation

- As a train enters the station, detector is activated and message is sent back to previous intersections indicating the station is occupied.
- Detector also calls transit phase (all green) at downstream intersections.
- Early green or green extension are given to the train if necessary.
- Countdown timer will alert the operator to get ready to depart.
- As train departs, detector sends message back to previous intersection that station is about to clear.
- “Go” indications are provided for trains departing stations provided the next acceptable downstream stop is clear.
- Trains can be held at selected non-station blocks if necessary

Current Status

- TSP is working as designed since the Green Line opening in September 2009
- Fine tuning of logic is ongoing
- Phase II continues
  - Adding TWC loops at all stations
  - Extending detection signals to junctions at each end of the central business district
  - Opening of the rest of the Green Line December 2010 changes berthing points and LRT consists

Projects to Improve Customer Experience

1. Customer Communications
2. Fare Collection
3. Integrated Corridor Management

CUSTOMER COMMUNICATIONS

Customer Communications

Goal:

Deliver information of value to customers while in transit

Situation:

Multiple small projects addressing point solutions

Approach:

Single program to pull all projects together, executive sponsorship, consolidated solutions (and technologies) where possible, added new solutions

Customer Communications – Many Types

Information Types	Examples
Near real time, highly dynamic, usually location or route specific	Schedule delays; connection protection; detours; emergencies; vehicle location
Current information that changes with some frequency	Public service announcements; Special events; holiday schedules
Static information	Rules of conduct; phone contact numbers
Third party and multi media – can be location specific	Advertising – location and ToD specific; TV feeds; DART videos
Social media	E-mail; twitter; RSS; text message
Printed media	Schedules; advertising posters

Customer Communications – Delivery Media

<u>Delivery media:</u>

Cell phones - text

Smart phones – text, browser, apps

PC's - browser, e-mail

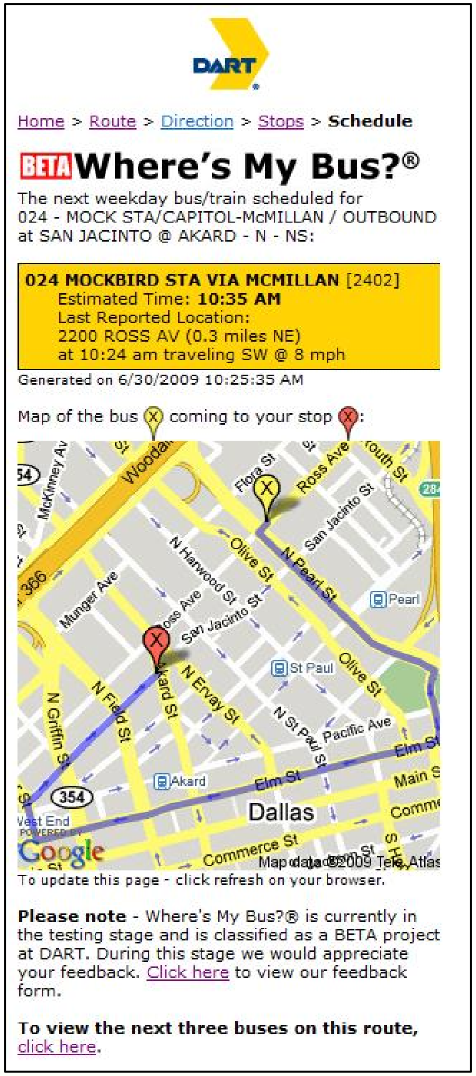
In-vehicle screens

Transit center screens

Station signs and screens

Retail establishment screens?

Third party applications?



Customer Communications - Status

Facebook; YouTube; Twitter and RSS feeds all in place

Mobile web site – www.m.dart.org

“Where’s my bus?” mobile app – others in development

Publish schedule and route data in Google format, plan to publish real time vehicle data for third party app developers

RFI issued for new screens in vehicles, stations and transit centers – investment for advertising rights

Study of 4G wireless for vehicle

ELECTRONIC FARE COLLECTION

Electronic Fare Collection

Goal

improve customer experience and increase fare policy possibilities while collecting better ridership data.

Situation

Fare media today are cash, magnetic stripe paper tickets and period passes of various types. $4 fare gives all day access to the system.

Approach

Touchless RFID based fare media needed. Requires policy and technology decisions and high capital investment

Electronic Fare Collection Challenges

Challenge	Considerations
Light rail is an “open” system – no barriers in or out of stations.	Will passengers “tap off” for reduced fare for shorter distances?
Fare media distribution – ease of acquisition by customers.	Proprietary card vs. open credit/debit card media.
Fare policies – transfers, equity, frequent riders.	Cash customers (unbanked), fair fare, rider rewards.
Infrastructure - readers, communications, back office.	Standards based, software as a service, ridership analytics.
Capital investment	Operational savings, public-private partnership

Electronic Fare Collection - Status

Consultant feasibility study completed this year.

Comparisons with other transit agencies, domestic and foreign

Participation in Smart Media forum

Collaboration with other local agencies, member cities, retail for common system

Plan to issue RFI to gauge PPP interest and terms in February

INTEGRATED CORRIDOR MANAGEMENT (ICM)

Integrated Corridor Management (ICM)

Goal

Integrated incident management of multi-modes of transport in a single corridor for most efficient operation

Situation

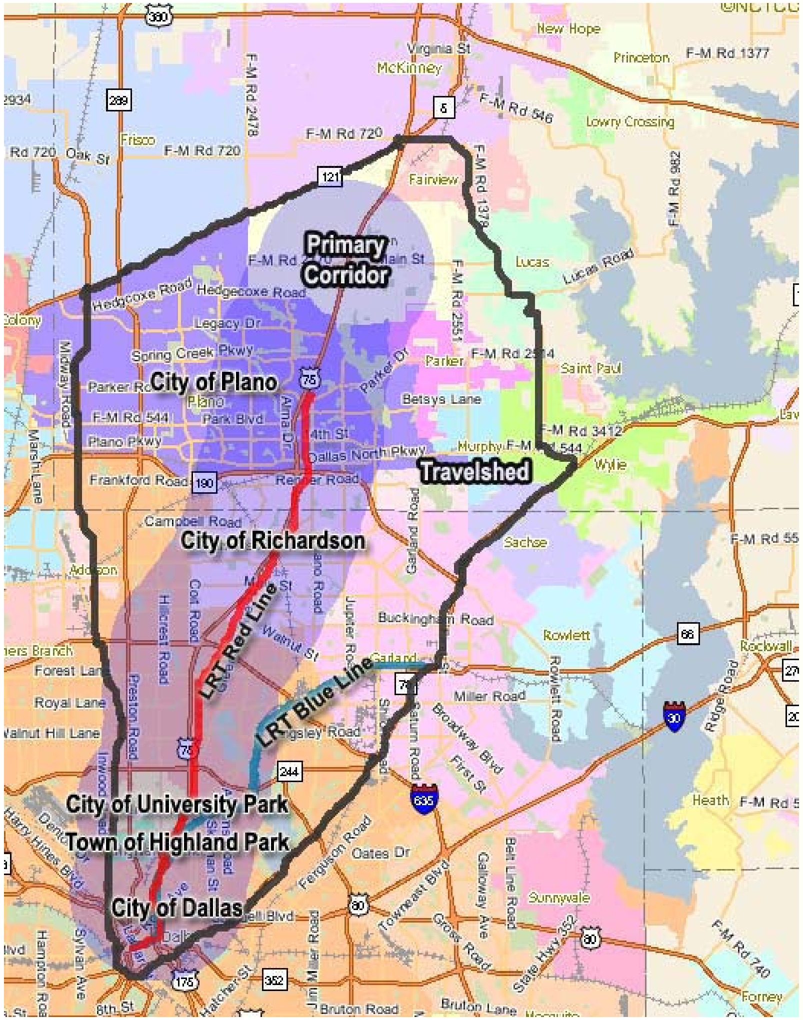
US DOT ITS grant funding for two proof of concept projects on US 75 corridor and in San Diego on I 15

Approach

DART management of a project with cities, NTTA, universities, TXDOT, NTCOG, consultants to develop infrastructure and processes for dynamic mode shifting and rerouting of commuters in the corridor

ICM - Modes in US 75 Corridor

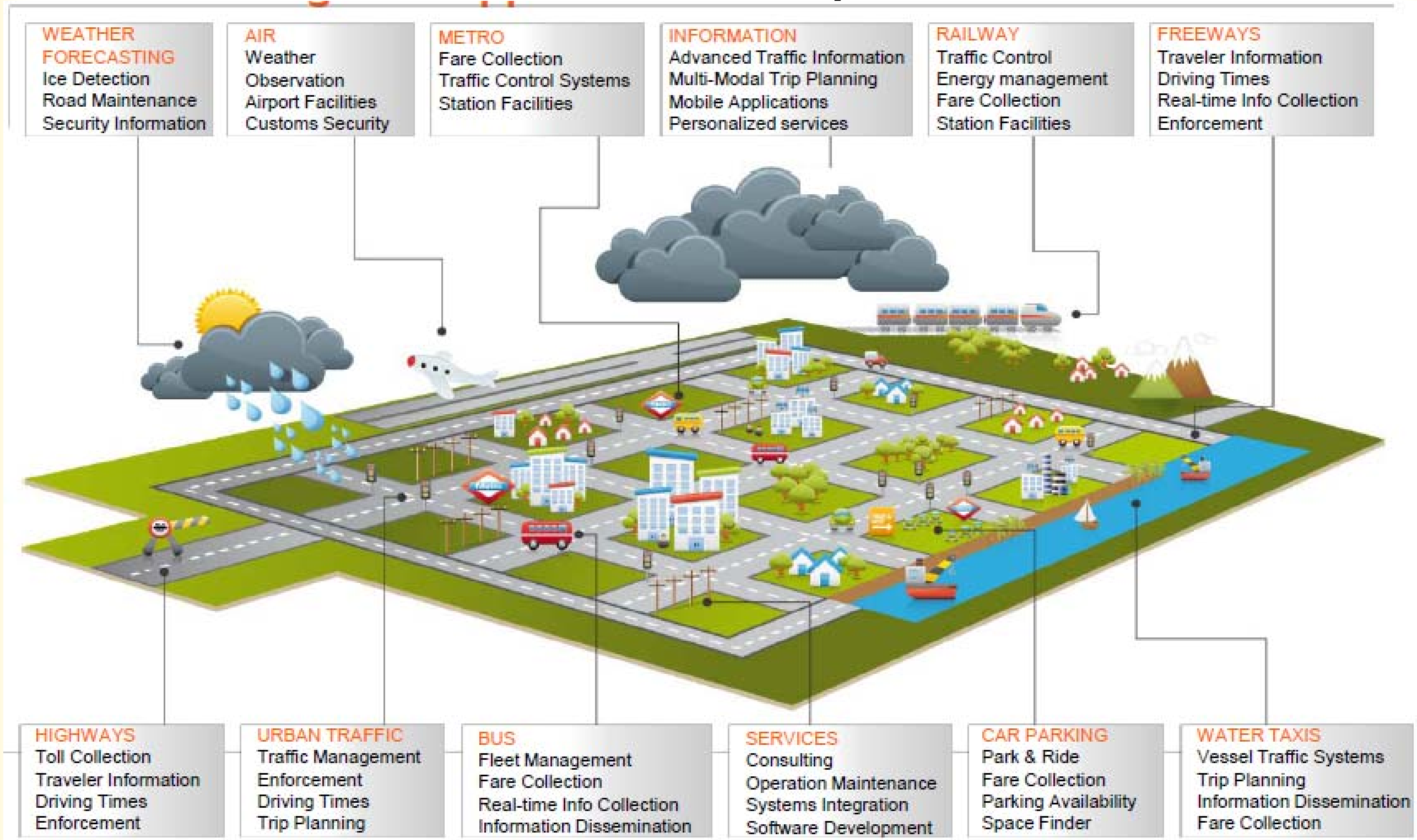
- US-75 Service Roads
- US-75 Freeway
- HOV Lanes
- Toll Facility
- 167 Miles of Arterials
- 900+Signals
- Bus Network
- Light Rail Network
- Multiple TMCs
- Regional ATIS
  (Advanced Traveler Information System)



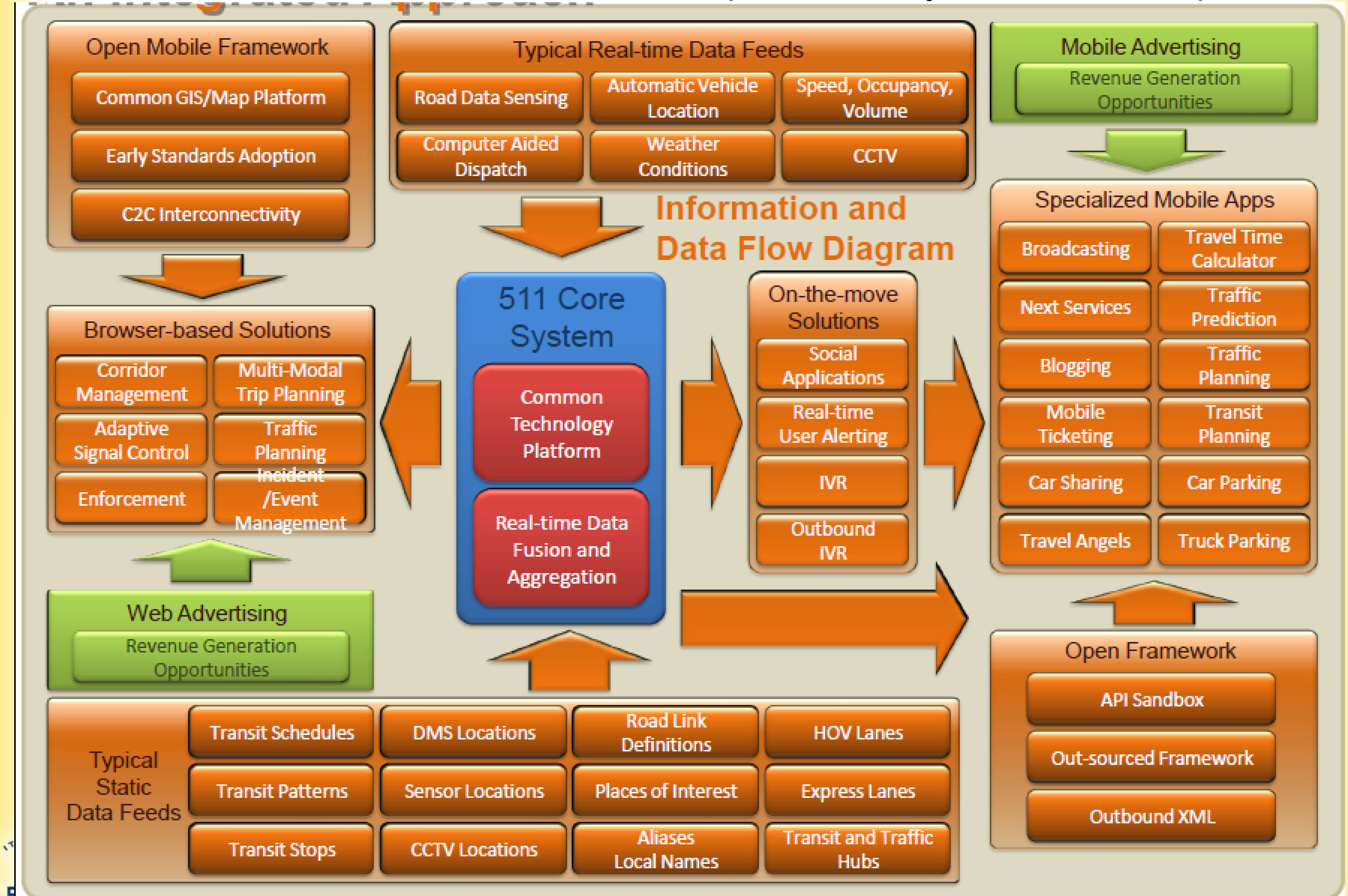
ICM – Challenges

Challenge	Considerations
Multiple independent systems need to interconnect and interchange data in intelligible formats	Development of a "smart net" web based utility to view and manage incidents, special events and construction etc.
Decision support and predictive analysis systems	Multiple monitoring and data gathering points, heuristic modeling software
Traveler communications and behavior modification	Multiple modes from PDAs to dynamic road signs; reliable alterative rerouting; 511 regional information system

ICM – An integrated Advanced Transportation Information System



ICM – ATIS Architecture (Courtesy of Telvent)



ICM - Status

- Project established with Federal grant funding, participating regional agencies, consultants.
- Component networks and capabilities identified
- Initial architecture designs and standards proposed
- Previous generation solutions reviewed for lessons learned (e.g. metropolitan NYC area)
- Discussions with State of TX for regional 511 implementation

In Conclusion …….

Concluding Points

- Public transit is an important asset for the 4th largest SMA, with economic impact exceeding $10 bn
- Non-member cities seeking ways to join DART as road congestion is forecast to continue to deteriorate
- More comprehensive application of technology will improve the rider experience and potentially increase ridership
- Technology will improve interoperability of different modes of transportation
- The technology department challenge is to maintain pace with the rapid changes in technology to deliver lower costs and improved rider experience while protecting investments.