Sustainably Faster: Accelerating Innovation in Transportation Systems Research and Application

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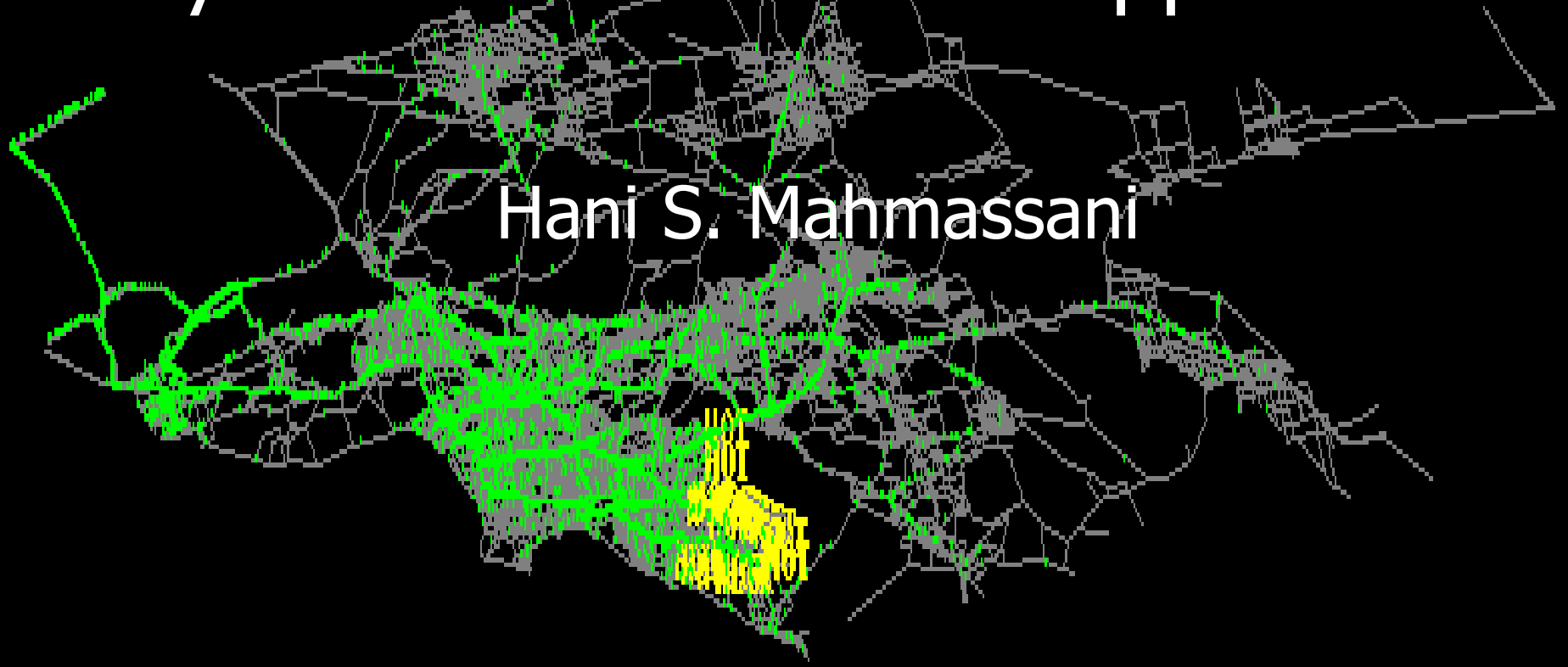

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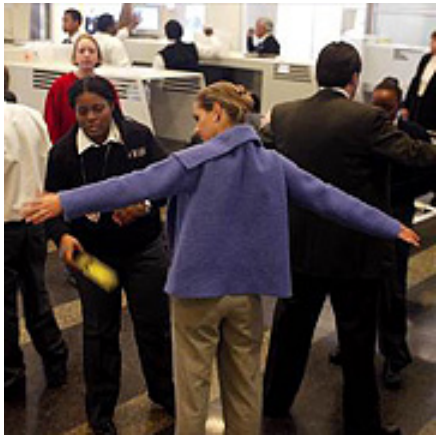


SECURITY
CHECK
POINT
LINE

TRANSPORTATION: PHYSICAL MOBILITY OVER SPACE

- Limited growth in capacity, and in output (compared to information –voice and data--traffic)
- Social expectations and public policy: *diminished expectations* of curtailed access, limited over time and space
- Subject to considerable inefficiencies, high congestion, arbitrary rules for allocation and use of capacity

TWO STAGES OF ITS DEPLOYMENT

Like any application of computers and communications to complex systems, the process is moving through two major stages:

- The first stage mainly applies technology to specific tasks, but without changing their character or basic sequence.

- In the second stage, entirely new approaches to solving problems and conducting business begin to appear.

Technological Drivers

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Information & Communication Technologies (ICT)

ITS for Commercial Vehicle Operations (CVO)

2-way Communication Systems

Automatic Vehicle Localization (AVL); GPS

and Supply Chain Management (SCM)

EDI; ERP; MRP; RFID

=> Large amounts of **real-time information** on state of system at lower cost

Development trend # 1:
Handset Capabilities, Wireless Internet

Precise Location Enables Wide Variety of LBS Apps

Development trend # 2:

Inexpensive wireless sensor networks

Coming to markets near you in next few months…

Relative low cost and high performance of such systems would enable deployment at larger scale than envisioned originally.

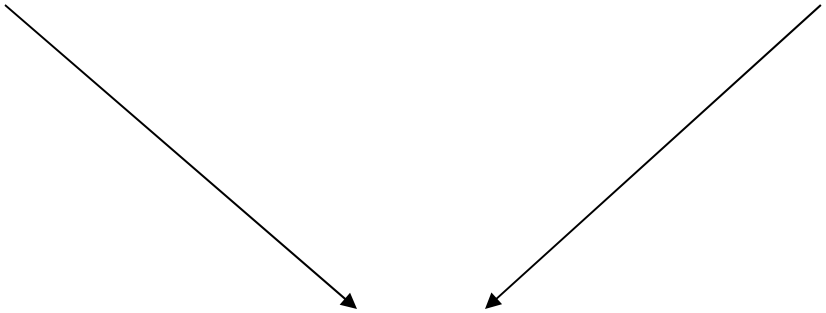
In the limit, nano-scale sensors with massively parallel deployment.

Mobile units + wireless internet:

Provides particle (user-centric) views of system

Inexpensive wireless sensors

Provides view from perspective of infrastructure or fixed assets



REAL-TIME INFORMATION

Explosion of real-time information on system state

➔ Calls for methods geared for shorter term engineering and business applications

➔ Calls for methodologies for real-time decision making under real-time information

REAL-TIME DECISION-MAKING METHODOLOGIES, e.g. DYNASMART-X for traffic estimation and prediction.

➔ Calls for methods to extract knowledge from undifferentiated data

KNOWLEDGE EXTRACTION, e.g. through data mining

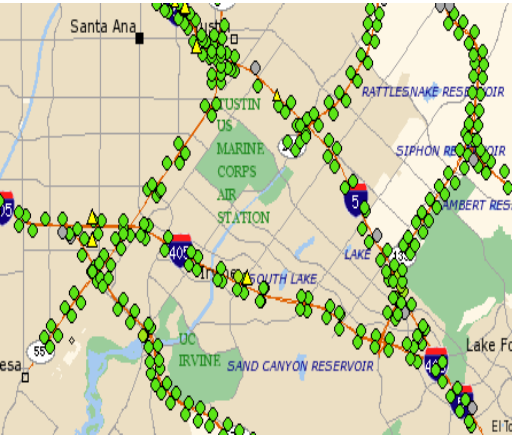
Development trend # 3:

Network Simulation-Assignment Modeling for Advanced Traffic System Management

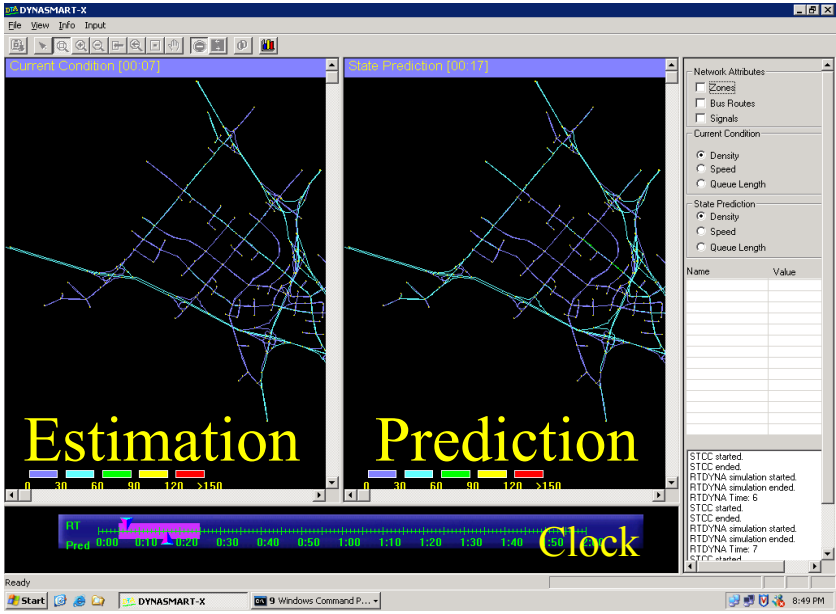
DYNASMART-X

REAL TIME DYNAMIC TRAFFIC ASSIGNMENT SYSTEM

- Irvine network overview:
  - 326 nodes and 626 links.
  - 70 actuated-controlled urban intersections.
  - 61 traffic demand zones



- Morning peak period (4:00 AM – 10:00 AM)
- 30-second observation intervals on 19 freeway links
- 5-minute observation interval on 28 arterial links



Development trend # 4: Dynamic Decision Support Tools for Vehicle Routing, Fleet Management and Collaborative Logistics

Subject to considerable academic development in the area of algorithm development and testing

Rapidly coming to market, in conjunction with asset tracking and management technologies

Prospect for tie-ins with predictive traffic management tools, e.g. DYNASMART-X

EIGHT BIG THEMES FOR RESEARCH

- **EXPLOSION OF REAL-TIME INFORMATION and REAL-TIME DECISION METHODOLOGIES for OPERATIONS: DYNAMIC NETWORK MANAGEMENT (incl. PRICING), INTERMODAL SYSTEMS, COLLABORATIVE LOGISTICS**

- WIRELESS INTERNET, PERSONAL MOBILE DEVICES, RF TAGS, E_SEALS:
  - *TELEMOBILITY* and *TELELOGISTICS* (CHANGES IN DEMAND), AND
  - PEOPLE/VEHICLES/SHIPMENTS AS PROBES (SOURCE OF REAL-TIME DATA FOR OPERATION, SURVEY DATA FOR PLANNING)

- AUCTIONS and REAL-TIME INTERACTIVE MARKET-BASED MECHANISMS (INCL. PRICING) FOR PROCUREMENT AND CAPACITY ALLOCATION

- PEER-TO-PEER, AD-HOC NETWORKING AS SYSTEM MANAGEMENT APPROACHES: IMPLICATIONS FOR SYSTEM RESILIENCY

- UNDERSTANDING SYSTEM VULNERABILITY AND RESILIENCY; IMPLICATIONS OF OPERATIONAL CONSIDERATIONS FOR PLANNING AND DESIGN

EIGHT BIG THEMES FOR RESEARCH (ctd.)

- USER BEHAVIOR AND RESPONSE: KEY BUILDING BLOCK FOR USE OF INFORMATION AS TOOL FOR POLICY AND CONTROL; BEHAVIOR CHANGE TOWARDS SUSTAINABLE PATTERNS
- NEW BUSINESS MODELS FOR INFRASTRUCTURE DEVELOPMENT, OWNERSHIP AND OPERATION; FOR SYSTEM AND SERVICE DEVELOPMENT AND MANAGEMENT.
- STRATEGIC MOBILITY, ENERGY AND SUSTAINABILITY

LIGHT AT THE END OF THE TUNNEL?

Thank you
Q & A

BAC Meeting
Transportation Center
Northwestern University
October 3, 2007