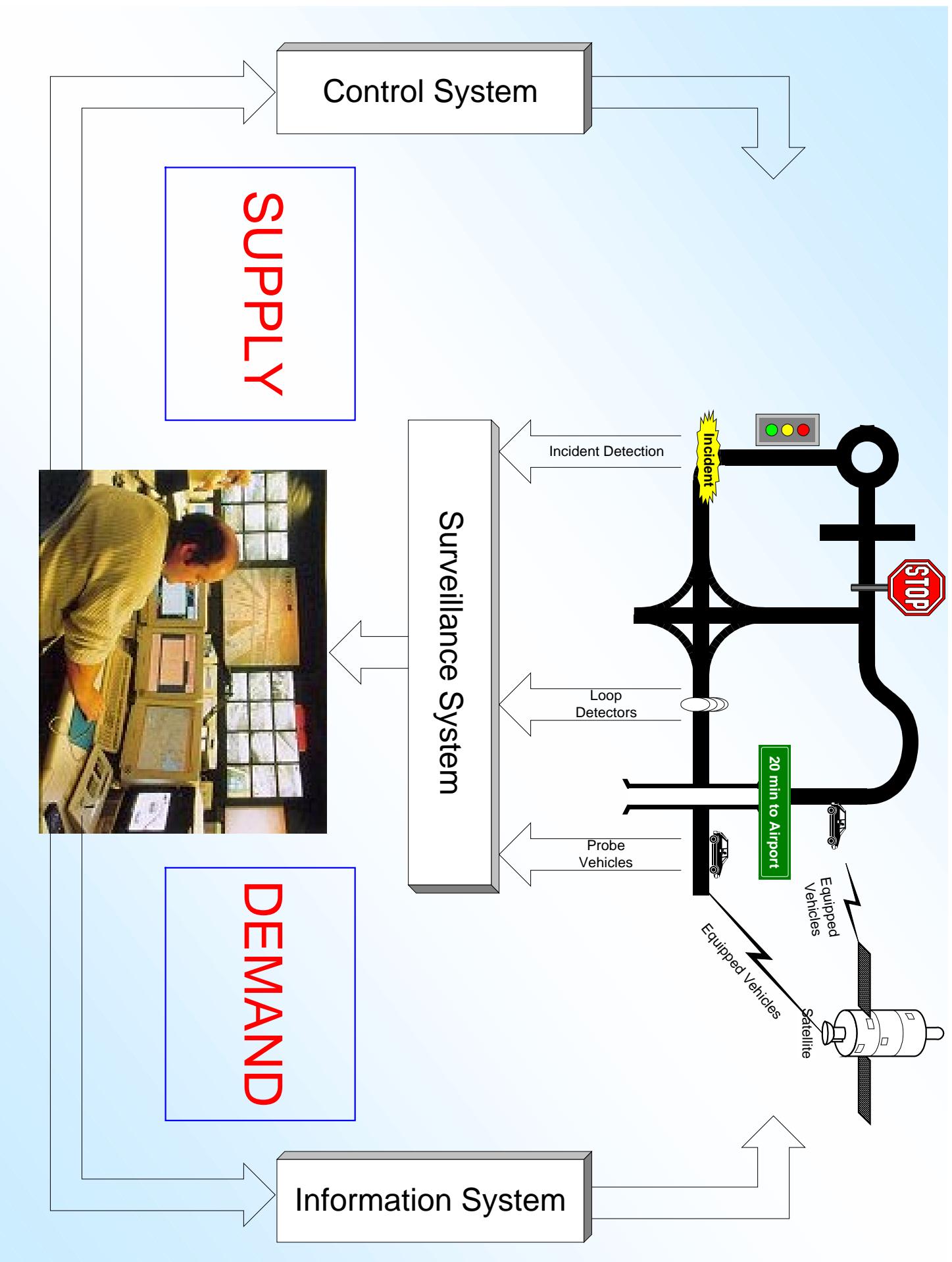


DynaMIT

DYnamic Network Assignment for the Management of Information to Travelers

Michel Bierlaire
Department of Mathematics
Swiss Institute of Technology, Lausanne



Control and Information

Control System

- Affects the supply
- Constraining
- Full compliance
- Main objective:
improve network performances

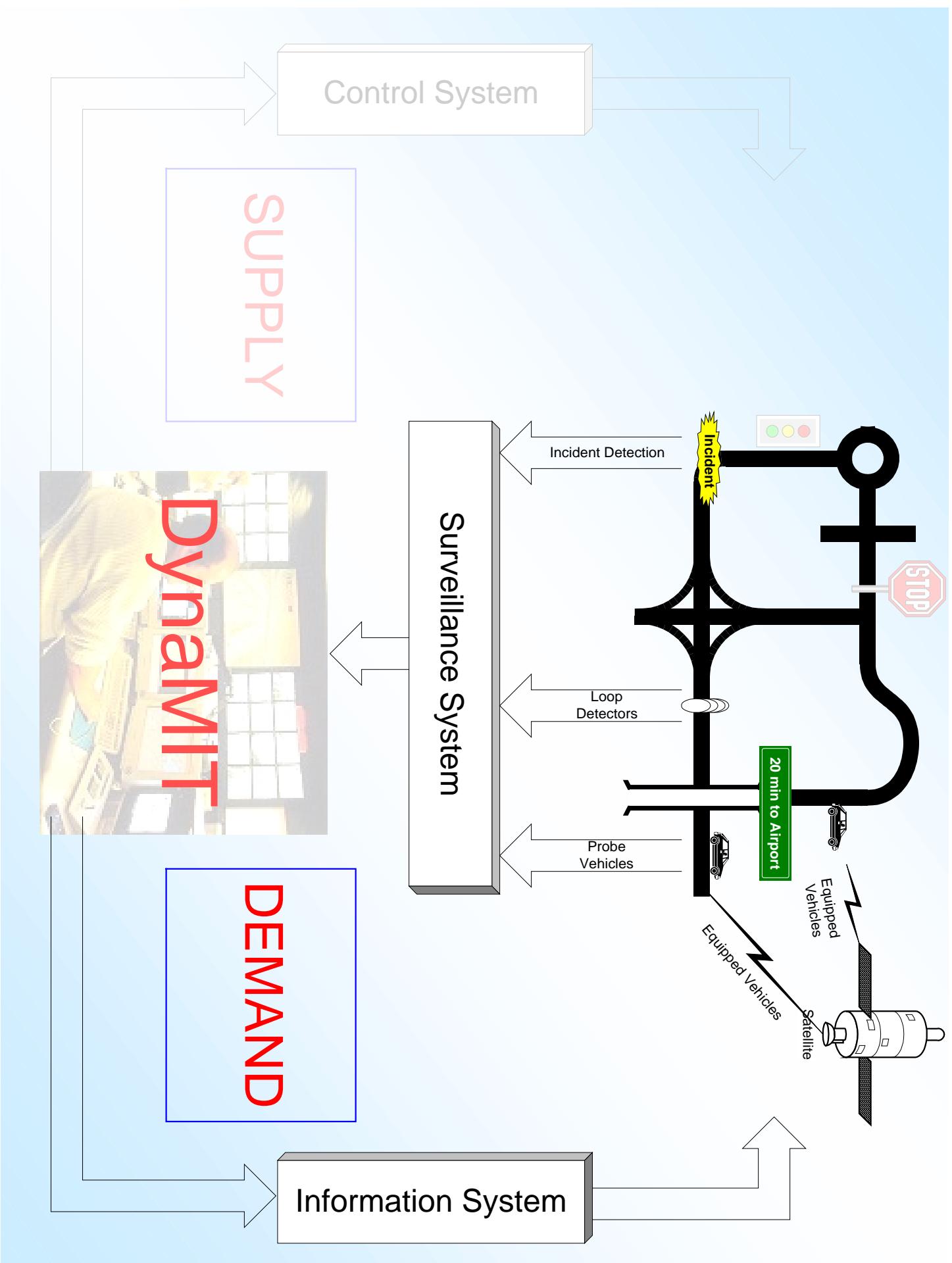
Information system

- Affects the demand
- Not constraining
- Partial compliance
- Main objective:
help individuals to make better decisions
- Second objective:
improve network performances

What is DynaMIT ?

Sponsors:

Federal Highway Administration
via Oak Ridge National Laboratory



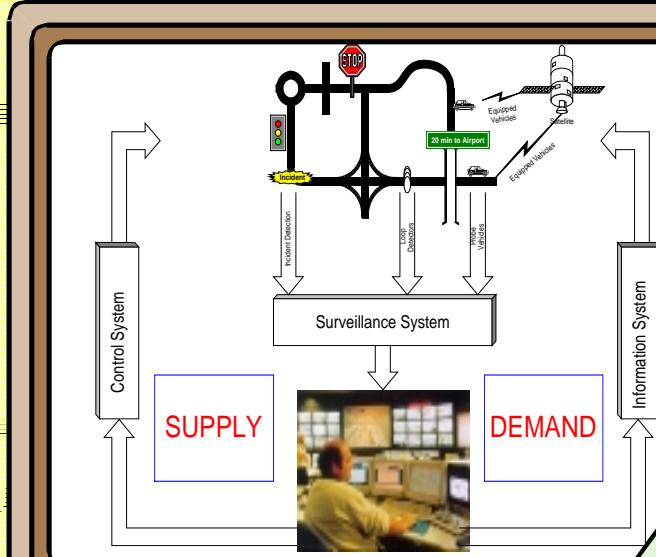
What is MITSIM Laboratory?

Sponsors:

Masachusetts Highway Department
via Bechtel/Parsons Brinkerhoff

MITSIM Laboratory

Simulation-based evaluation



Control System

Information System

SUPP

MIT ITS Program tools

DynaMIT

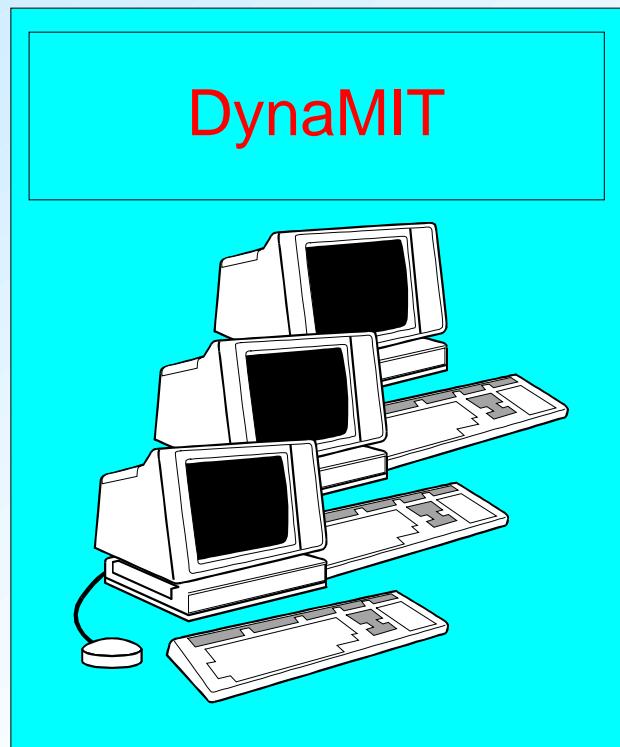
- operations
- online
- management
- within the TMC
- simulation-based

MITSIM

- evaluation
- offline
- design
- within the lab
- simulation-based

Outline

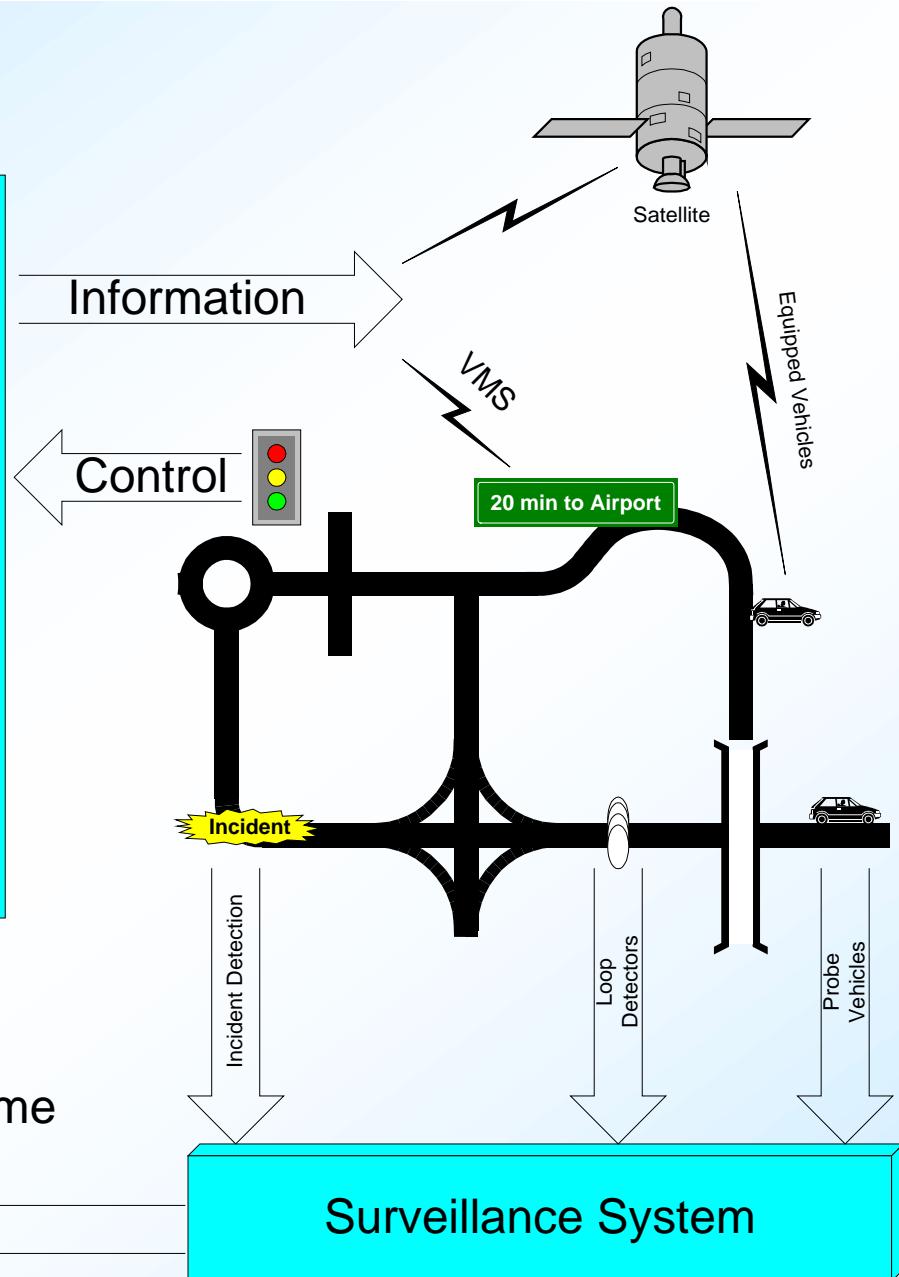
- Intelligent Transportation Systems
- MIT ITS Program :
 - DynaMIT
 - MITSIM Laboratory
- DynaMIT
- Evaluation of DynaMIT with MITSIM Laboratory



Historical Database

December 2nd, 1999

Real-Time Input



Michel Bierlaire ROSO-DMA-EPFL

10

DynaMIT is a



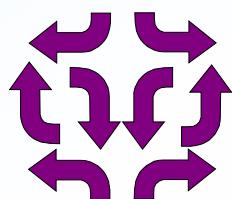
simulation-based



real-time system



with traffic prediction capabilities



providing travel information

Simulation

- Demand
 - Departure time choice
 - Route choice
 - Response to ITS
 - Origin-destination matrices
- Supply
 - Traffic simulators

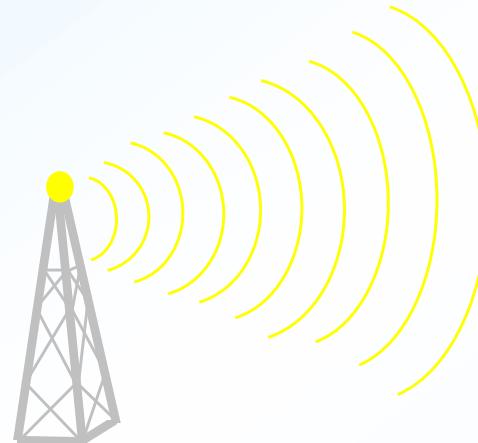
Real-Time

- Continuous data collection
- Fast processing
 - Distributed software
- Immediate dissemination

Traffic prediction

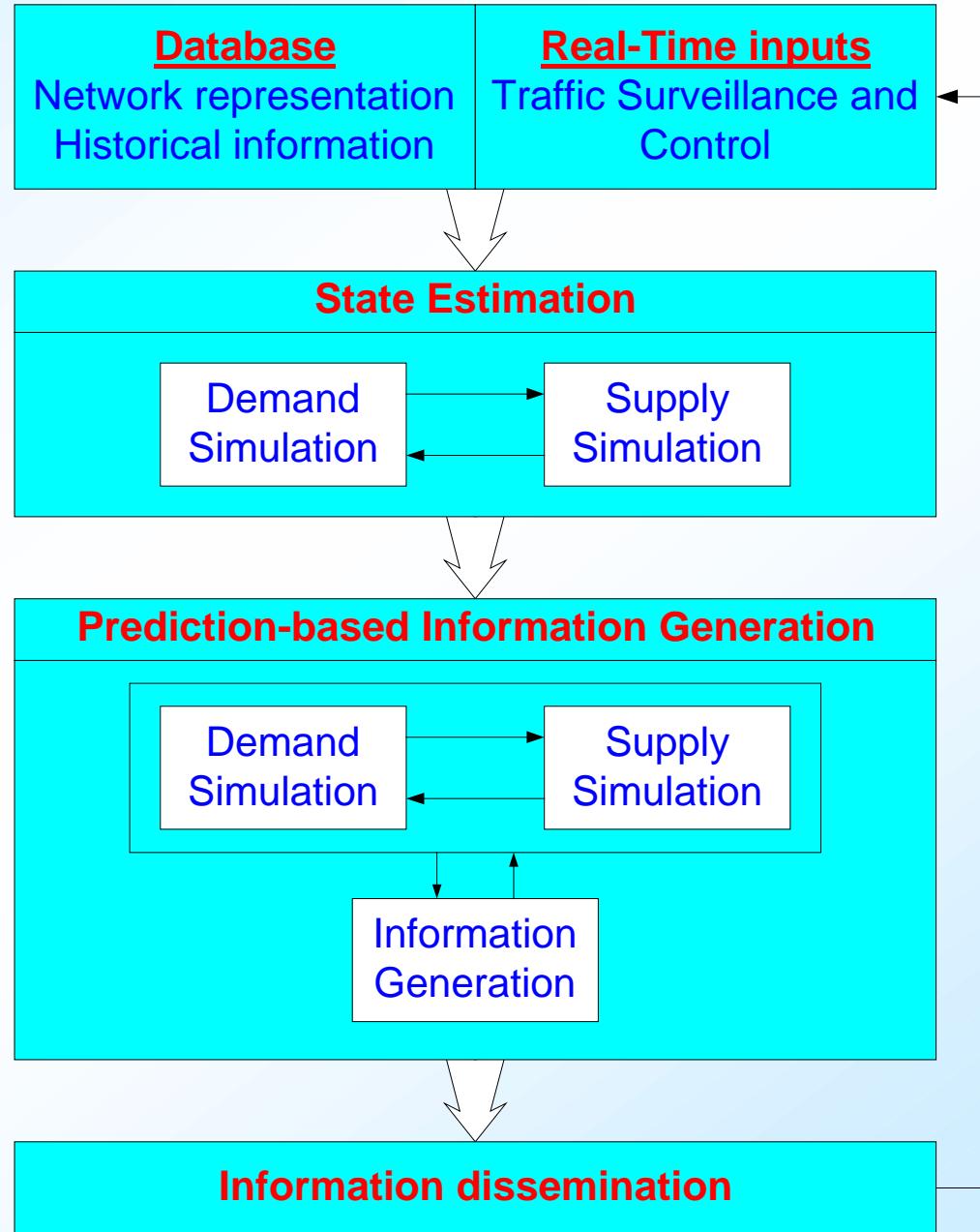
- Current vs anticipatory information
- No incident prediction
- Consistency
- Rolling horizon
- Importance of state estimation

Consistency



DynaMIT

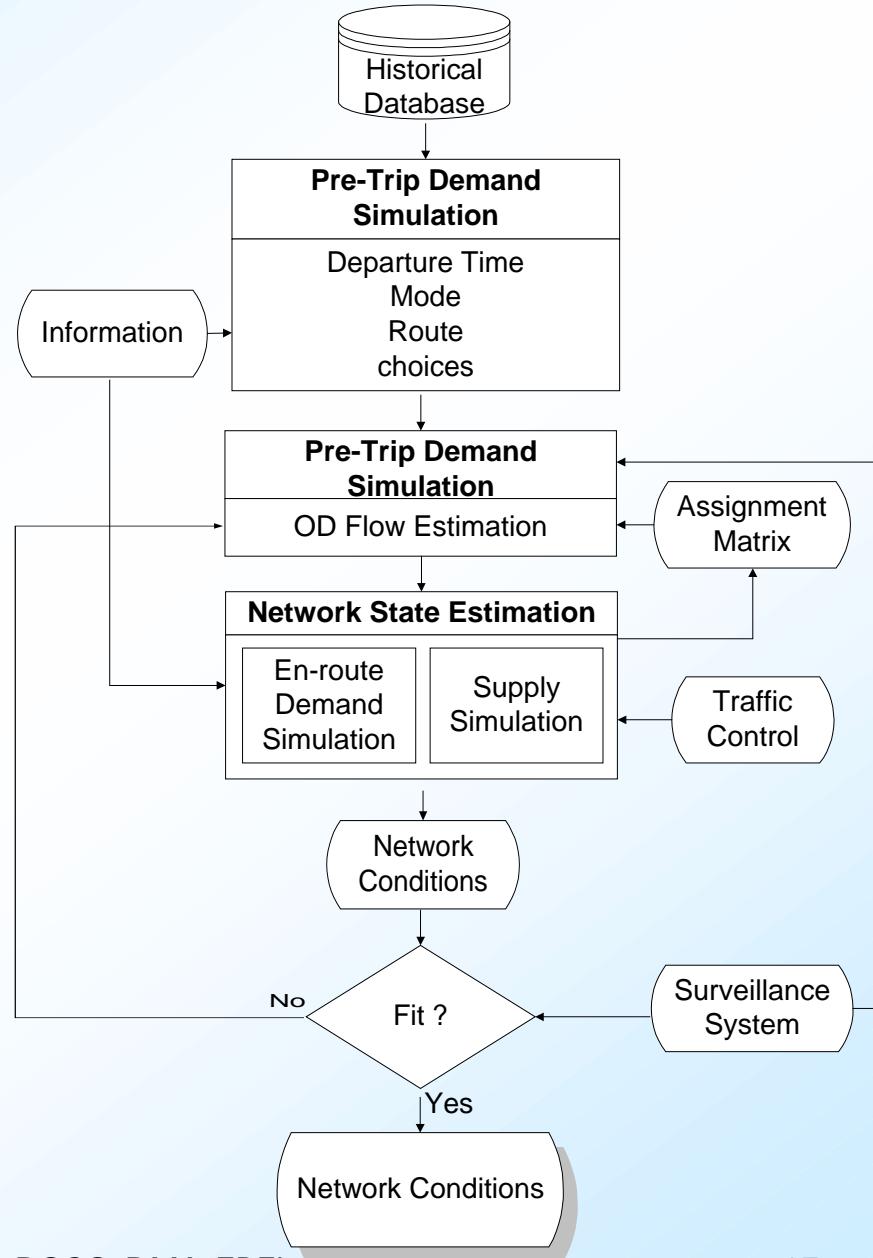
Overall Framework

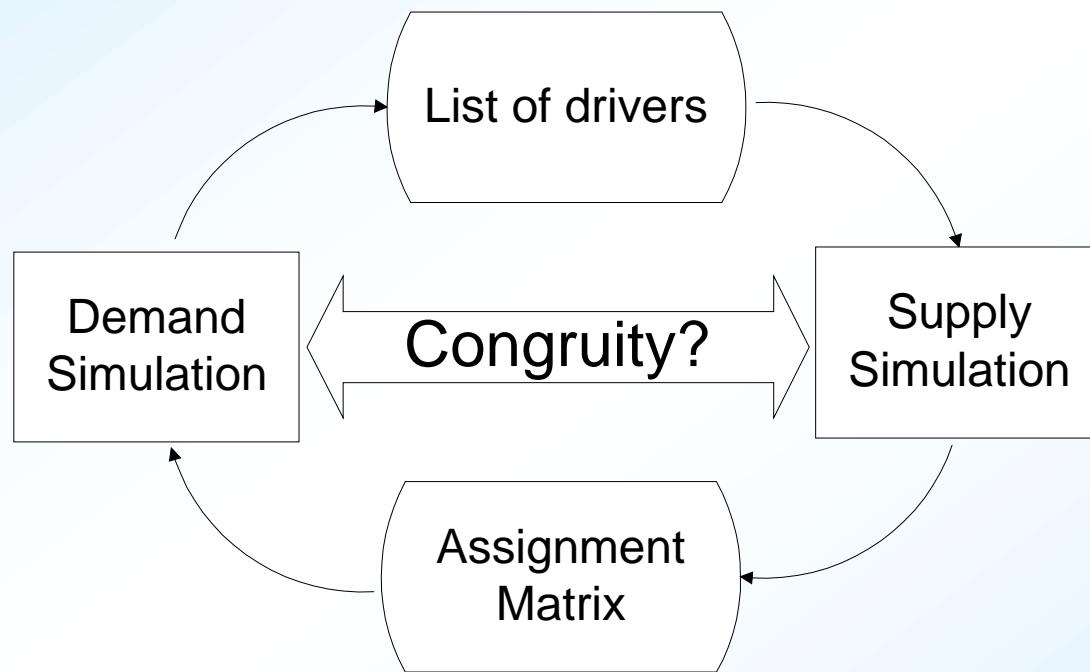


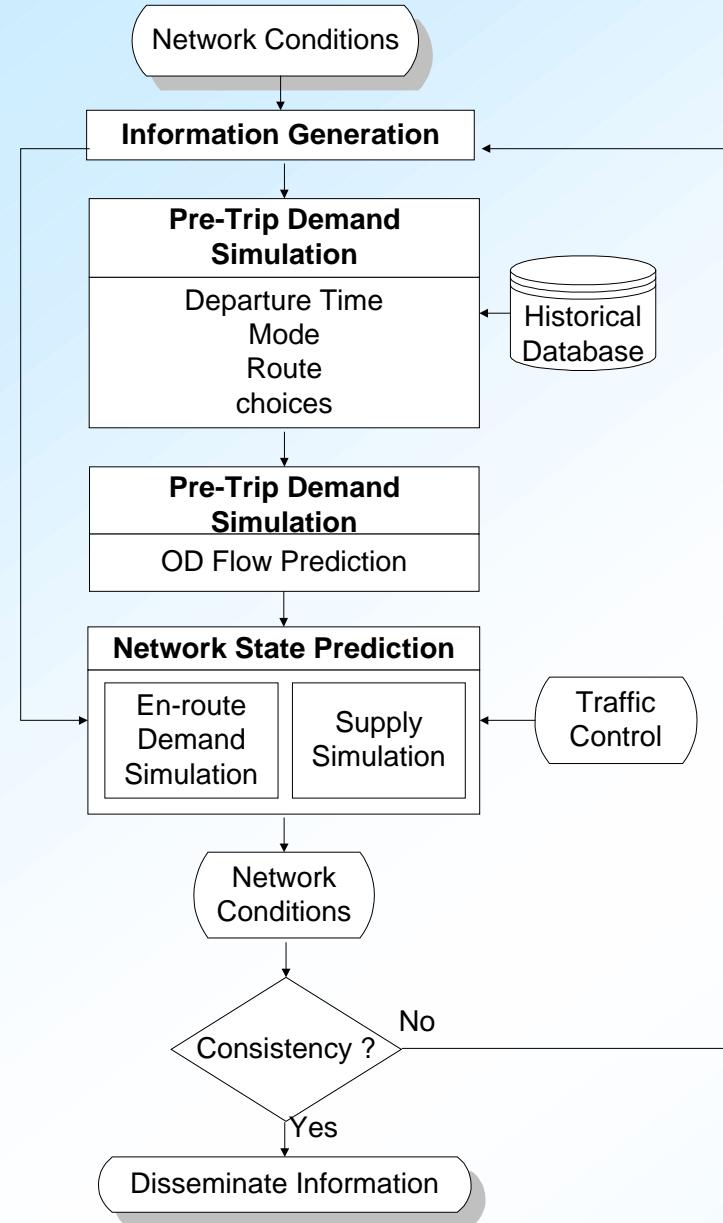
DynaMIT

State

Estimation

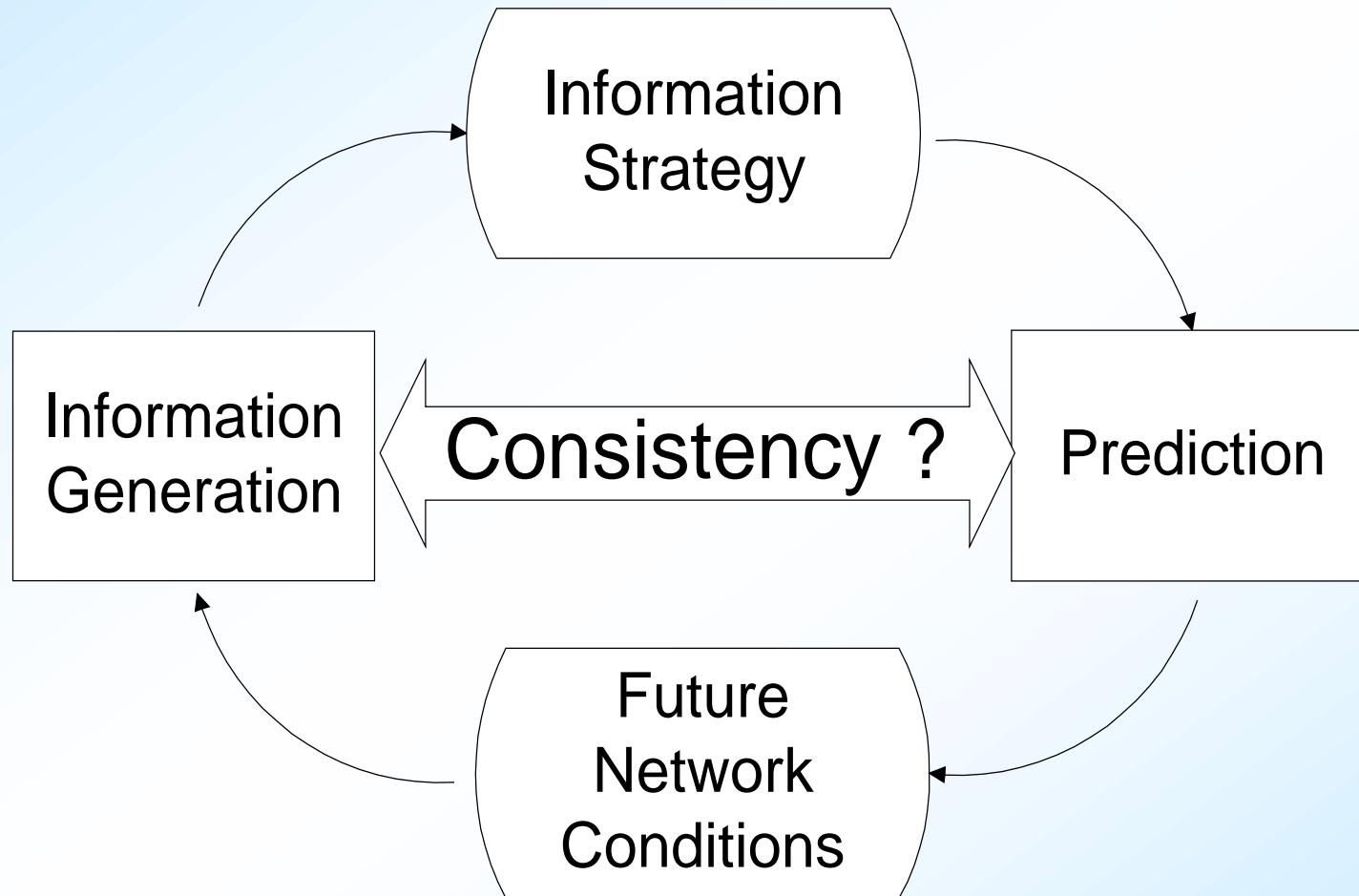






DynaMIT

Anticipatory Information Generation



Consistency

- Consider a network $G=(V,E)$
 - V : nodes (intersections, centroïds,etc.)
 - E : links (roads)
 - $O \subseteq V$: origins
 - $D \subseteq V$: destinations
 - $E^* \subseteq E$: links equipped to provide information
- Consider a discretized time horizon
 - $T = t_1 \cup t_2 \dots \cup t_N$
- \forall link $i \in E$, $\forall j=1,\dots,N$
 - λ_{ij} is the impedance of link i during time interval t_j

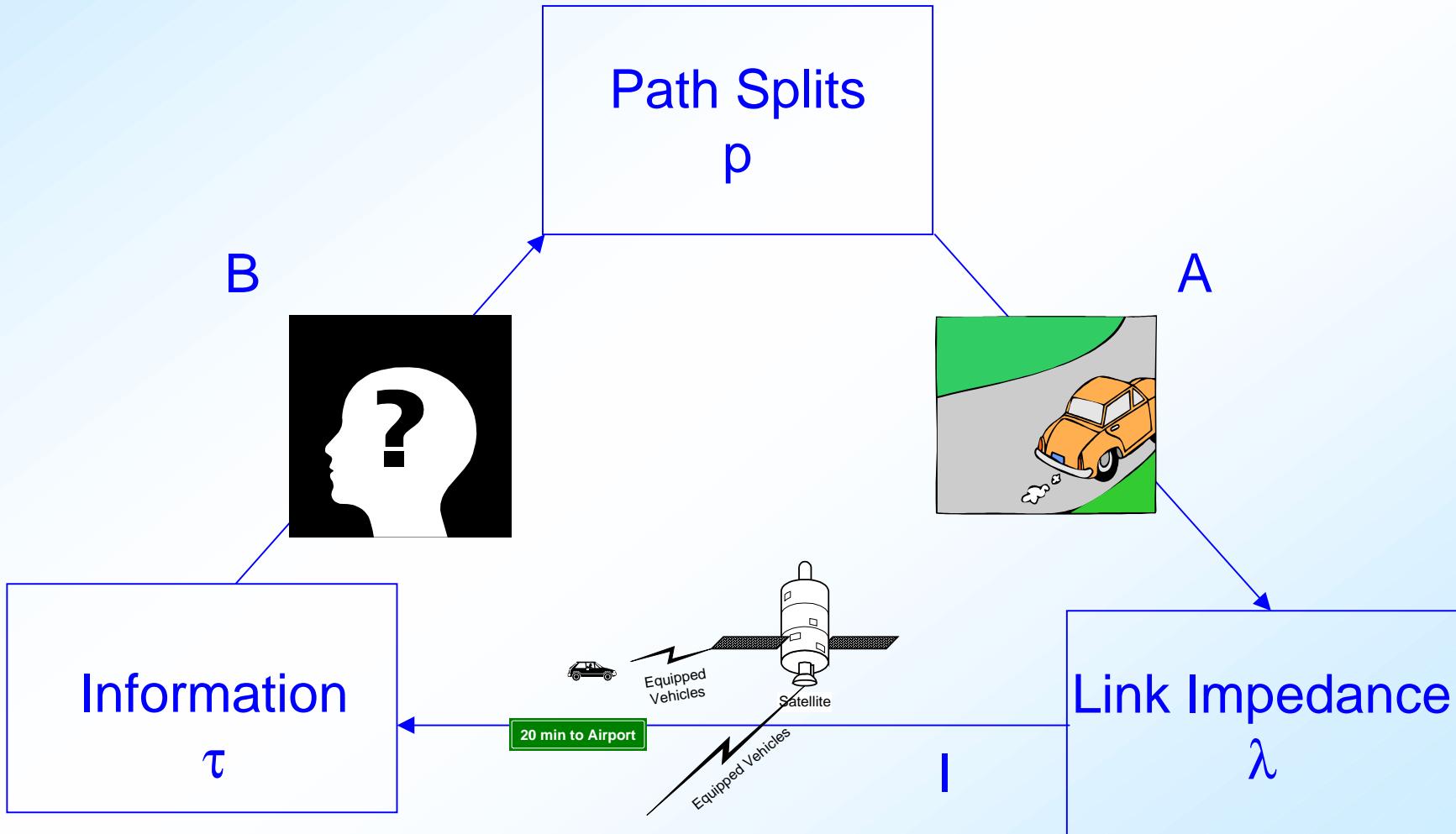
Consistency

- $\forall \text{ link } i \in E^*, \forall j=1, \dots, N$
 - τ_{ij} is the information about link i during time interval t_j
- $\forall o \in O, \forall d \in D, \forall \text{ link } i \in E$
 - p_{odi} is the proportion of vehicles traveling from o to d using arc i .
- $\forall o \in O, \forall d \in D, \forall \text{ link } i \in E, \forall j, k=1, \dots, N$
 - p_{odijk} is the proportion of vehicles traveling from o to d , departing during time interval j , using arc i during time interval k .

Consistency

- $\forall o \in O, \forall d \in D, \forall j=1, \dots N$
 - q_{odj} is the number of trips from o to d departing during time interval t_j .
 - represents the transportation demand.
 - is supposed to be given here.
 - common representation: origin-destination matrices.

Consistency



Consistency

- $p = B(\tau)$
 - Behavioral model
 - Route choice in response to information
- $\lambda = A(p)$
 - Traffic assignment
 - Usually $A(p) = f(A^*(p))$
where $A^*(p)$ are link flows
- $\tau = I(\lambda)$
 - Information infrastructure (VMS, etc.)
 - Information objectives (adjust impedances to reflect most likely reality)

The problem

The anticipatory
route guidance generation
problem

Determine information τ such that

$$\tau = I(A(B(\tau)))$$

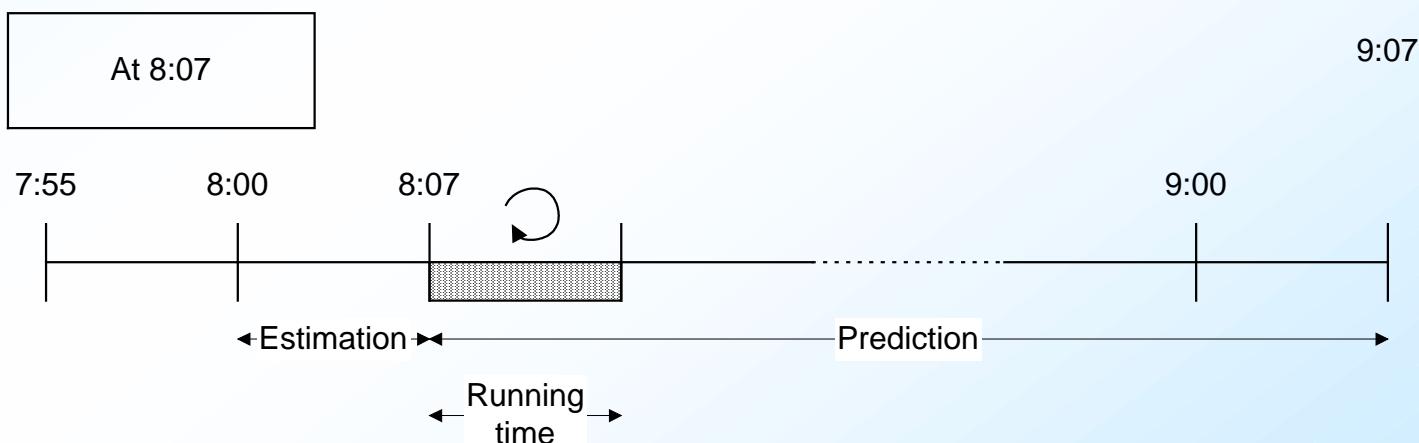
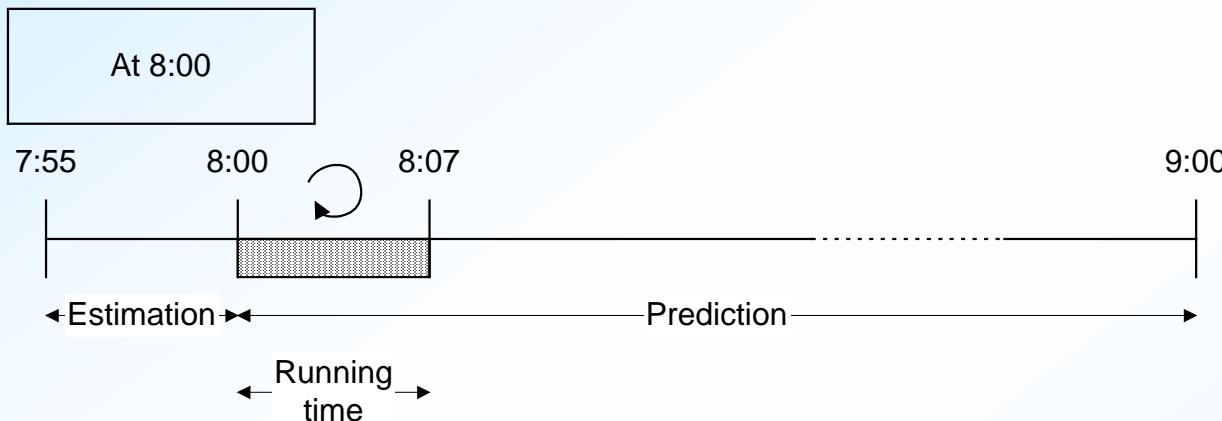
Objectives:

- Consistency
- Information system reliability
- User optimality

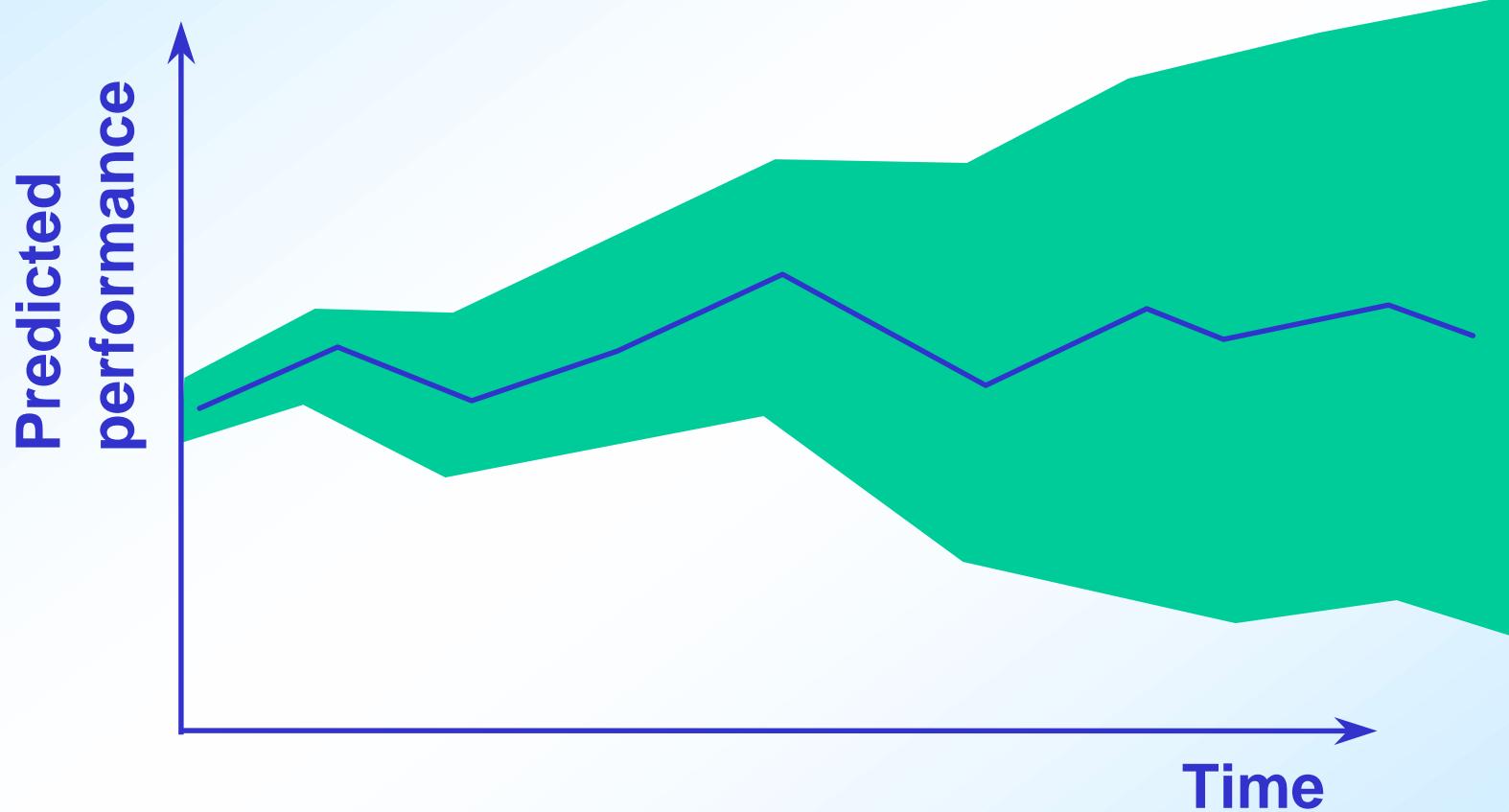
Traffic prediction

- Current vs. anticipatory information
- No incident prediction
- Consistency
- Rolling horizon
- Importance of state estimation

Rolling horizon



Importance of State estimation



Summary

DynaMIT is a



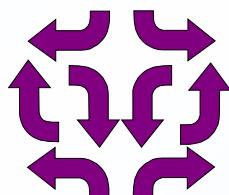
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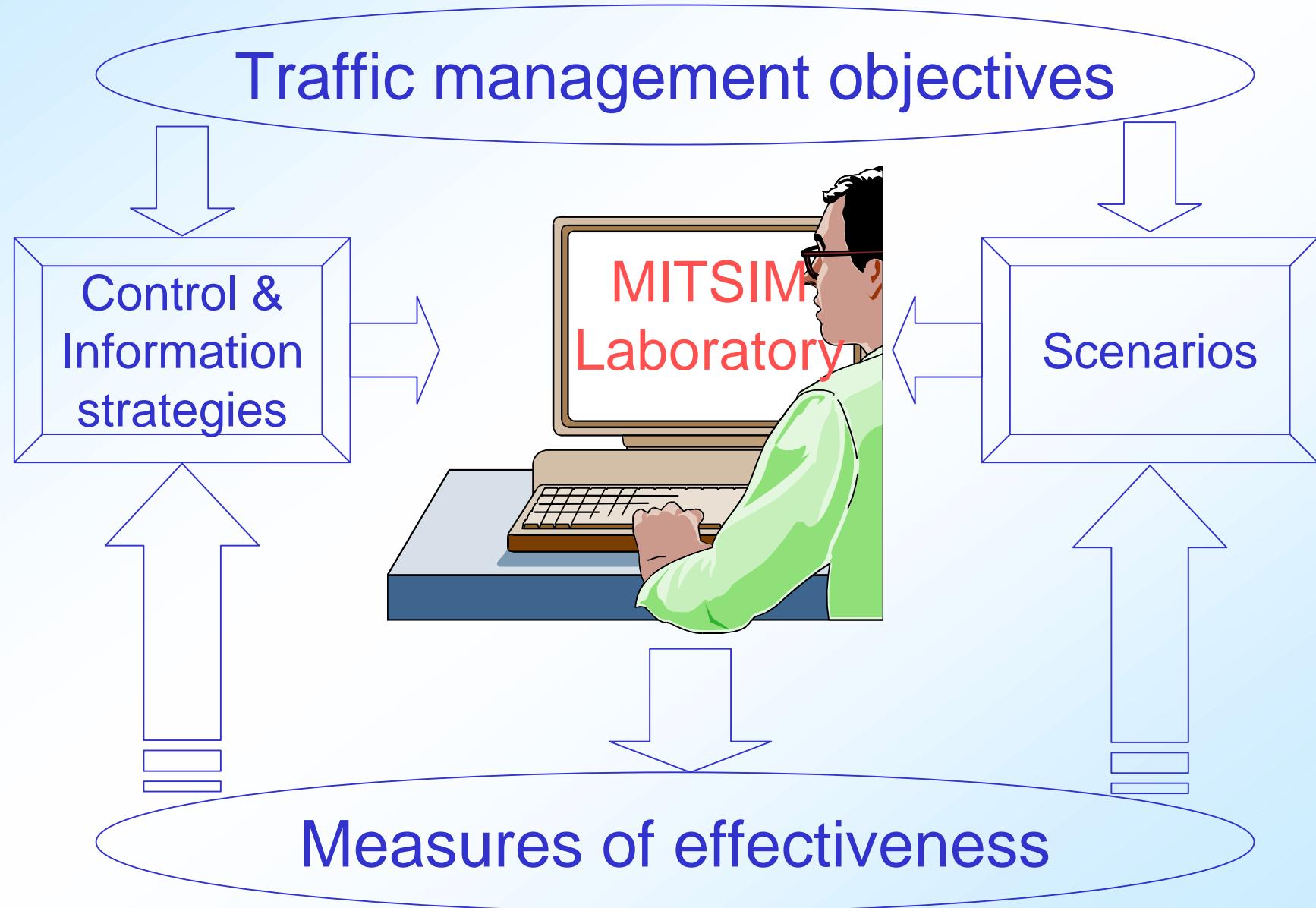


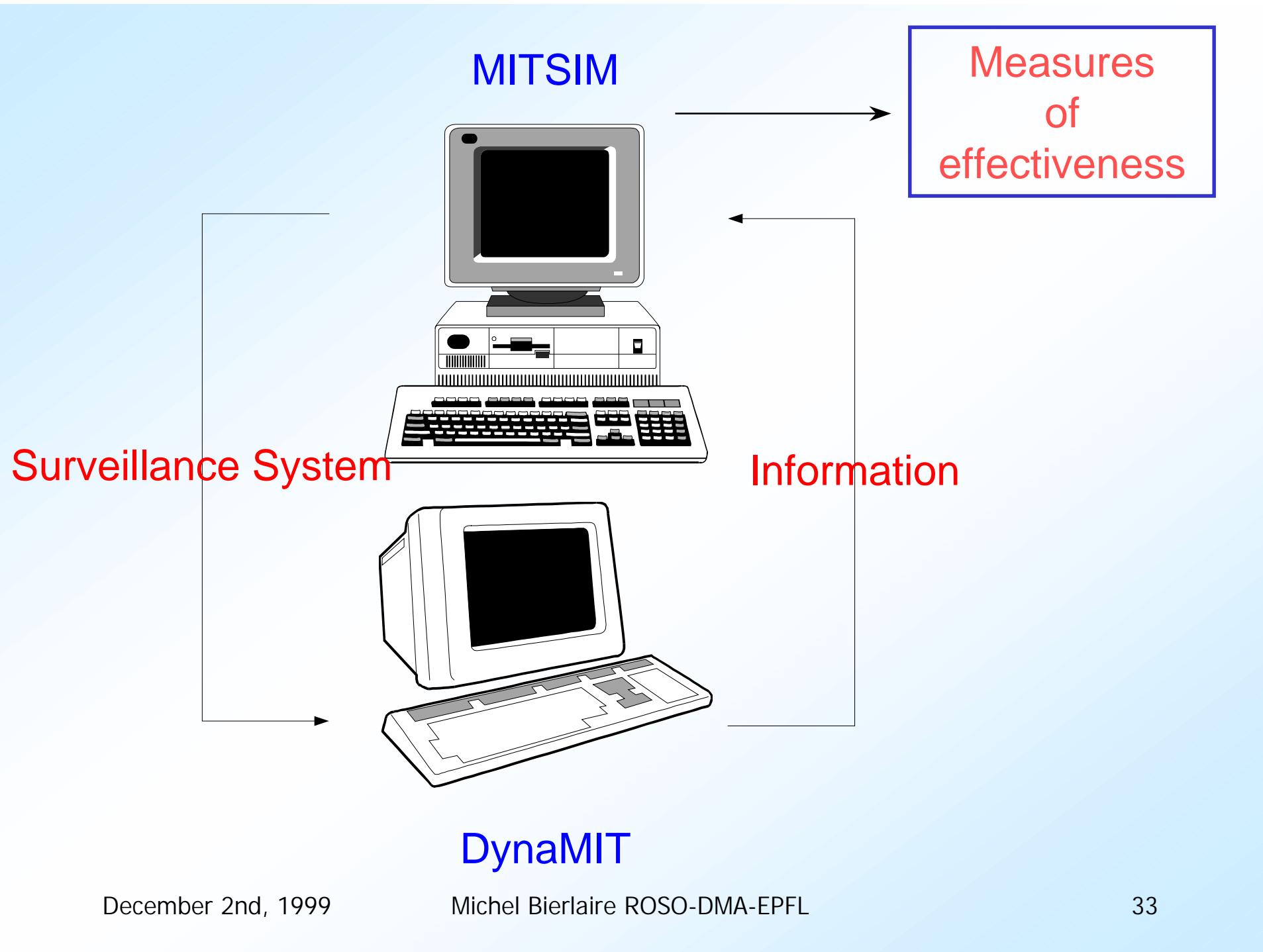
providing travel information

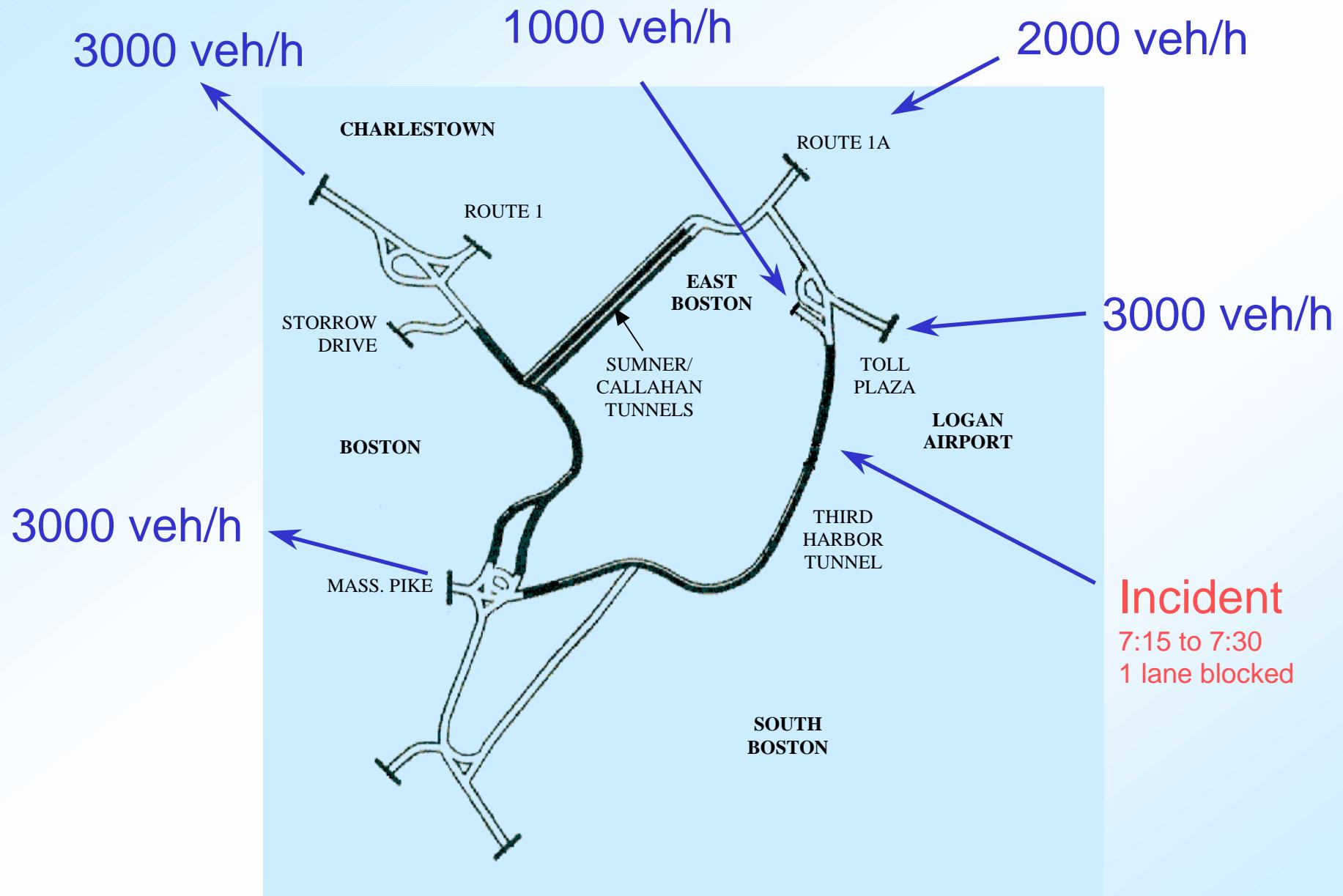
Outline

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- DynaMIT
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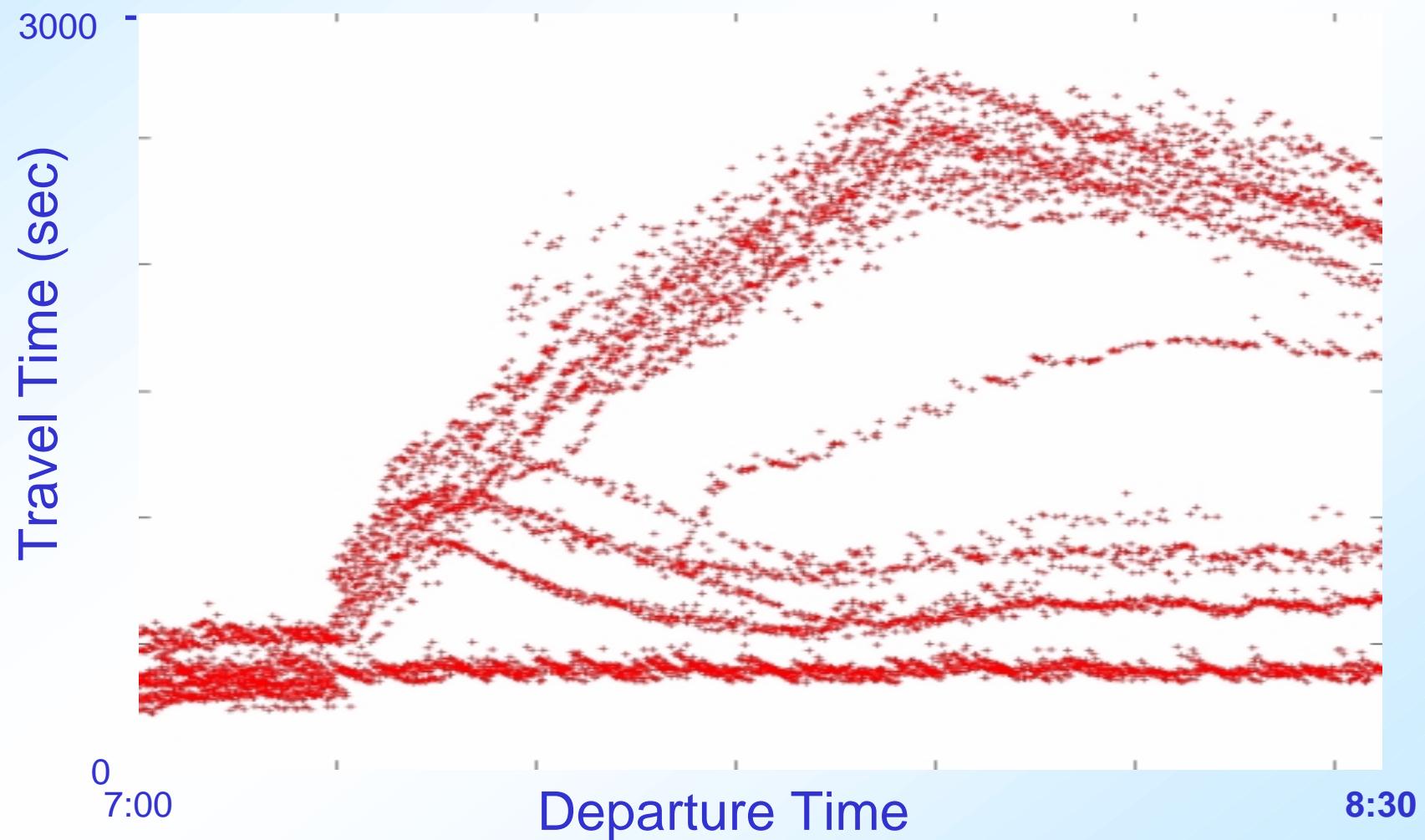
Evaluation framework



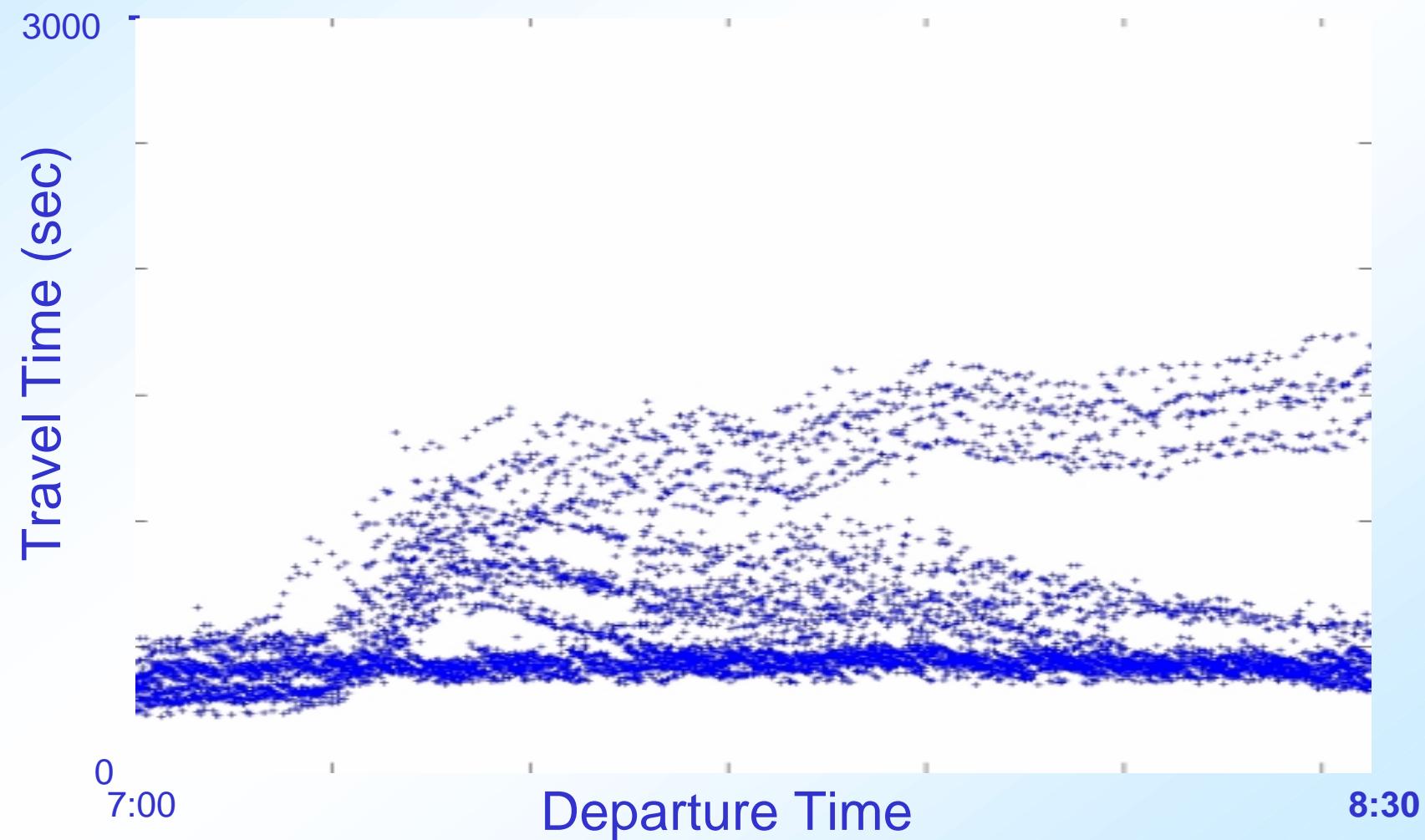




Without DynaMIT



With DynaMIT



Comparison

