Managing Congestion in Real Time

Approach Introduction

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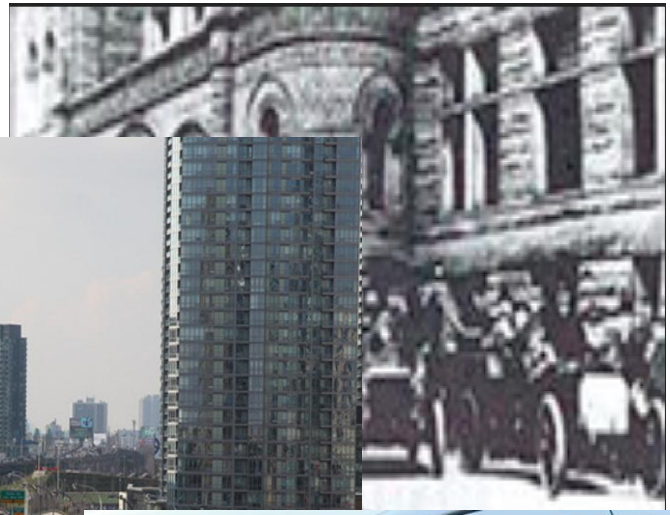
The Era of Metropolises

Immobility!

The New Household Challenge

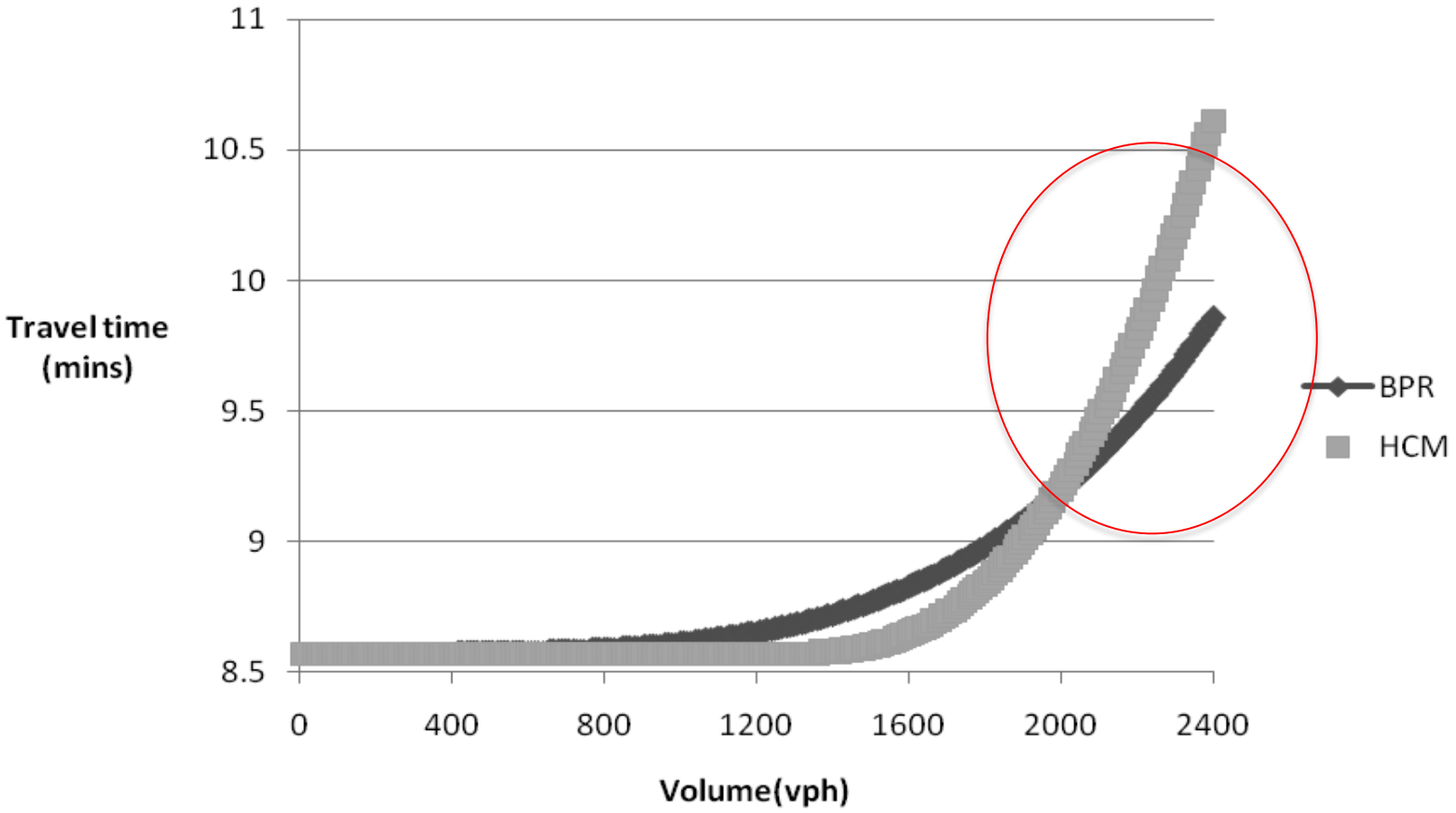


100 years ago: Rally for 10 mph speed limit

Today (2014), Queen's Park to the Gardiner Expressway in 30-60 minutes, 2-4 km/hr speed!

Two hours to cross the GTA each way, i.e. 50% of your work day!

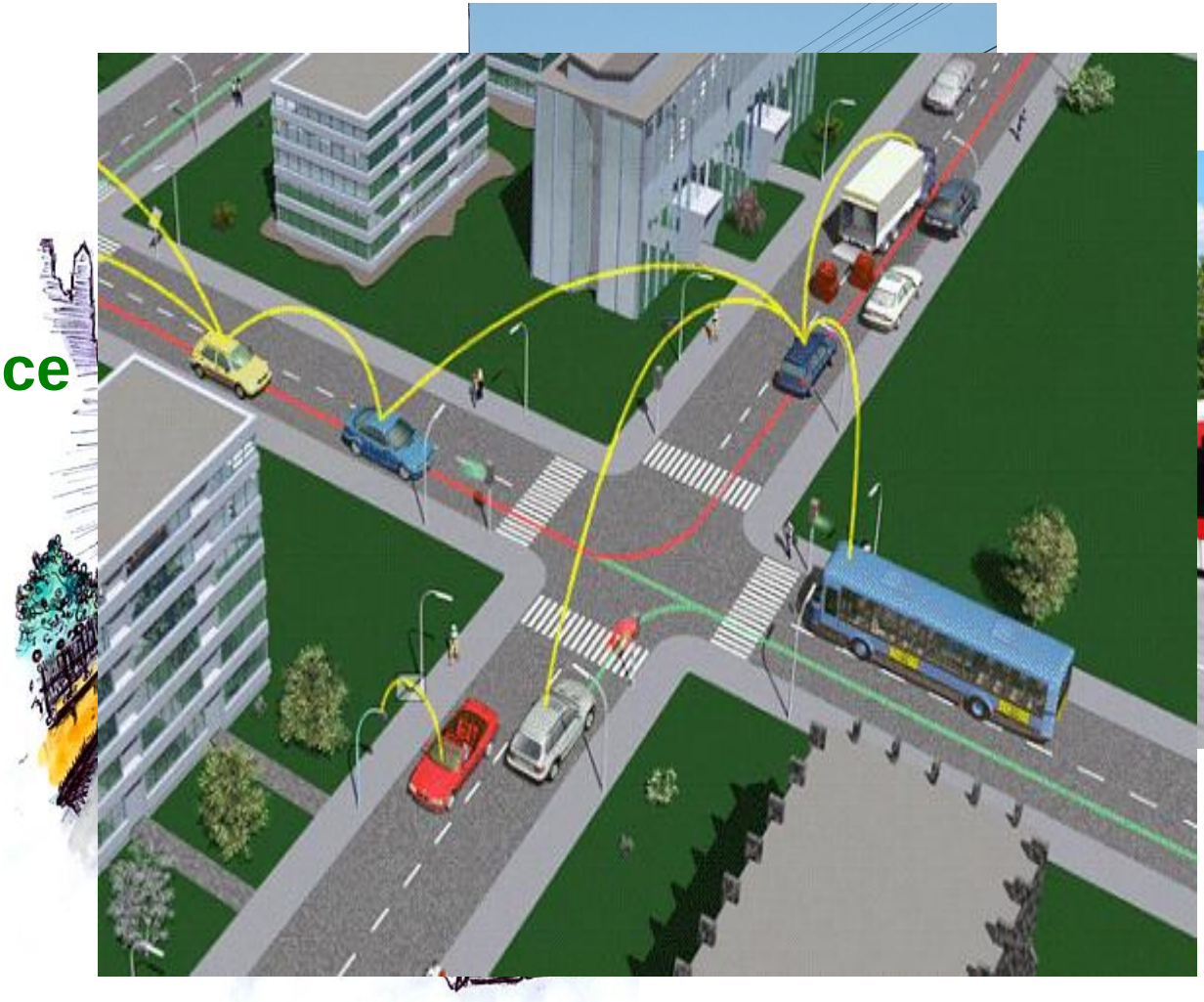
Congestion: Exponential Crisis



Congestion Solutions

More Supply

Intelligence



Less Demand

Approach Pillars

1. “Pacing” Beats “Rushing”
2. Closed Loop Optimal Control
3. Artificial Intelligence
4. Scientific Rigor + Practicality

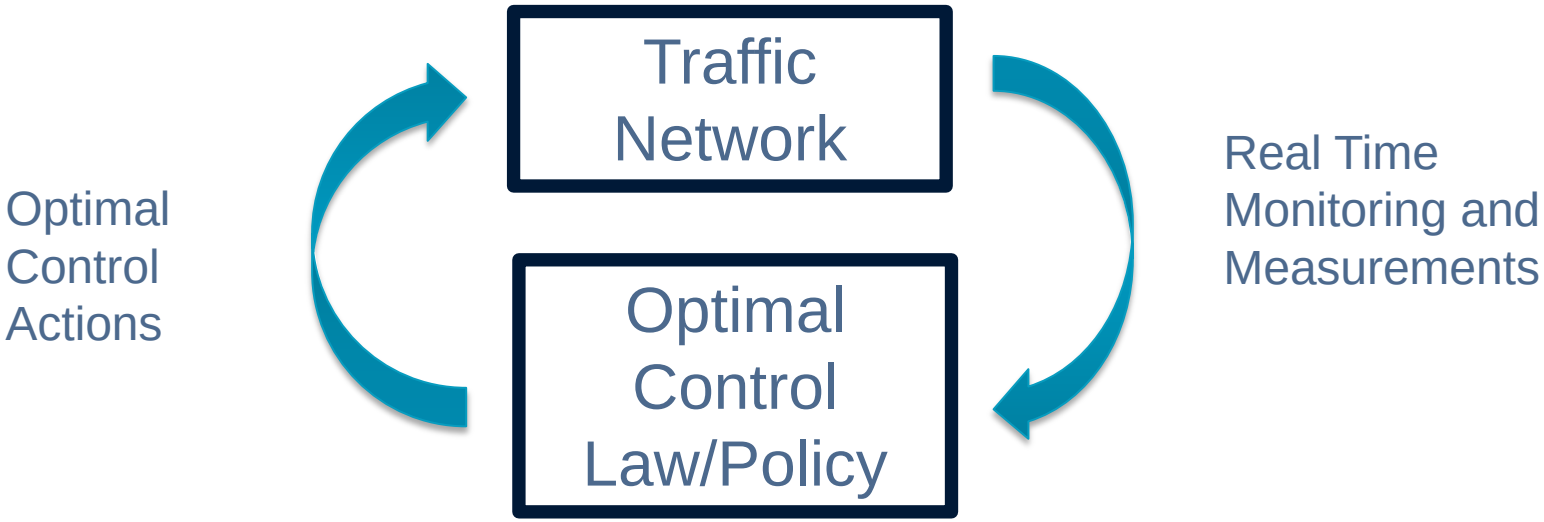
2. Closing The Loop in Real Time

- Open Loop Optimal (Traffic) Control
- Closed Loop Optimal (Traffic) Control

Open Loop Optimal Traffic Control

- Simple(r)
- Calculate Once, Set and Forget
- But:
  - Inaccuracies in demand estimation
  - Unexpected disturbances
  - Can go astray

Closed Loop Optimal (Traffic) Control



- Always measuring and Mapping System State to Optimal Actions
- Better chance to be on top of changes
- But:
  - How to get the optimal control policy
    - Possibly let the controller learn it: Machine Learning and AI

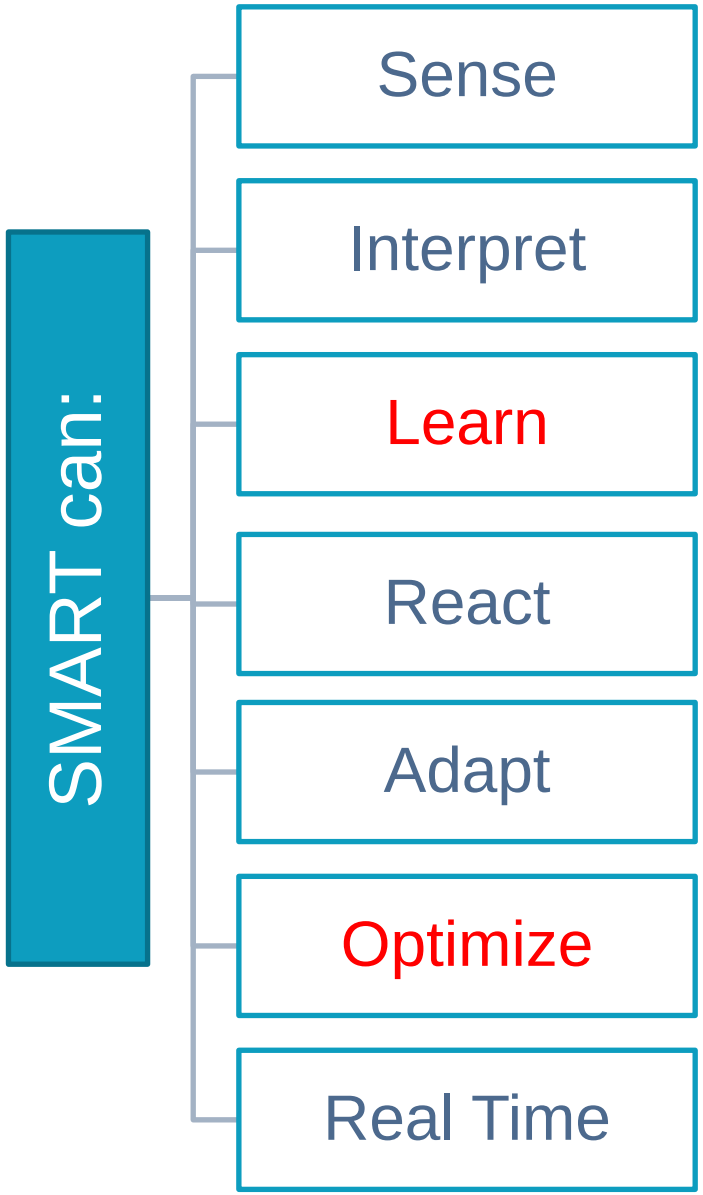
3. Artificial Intelligence:

Self-Learning the Optimal Control Law

Intelligence

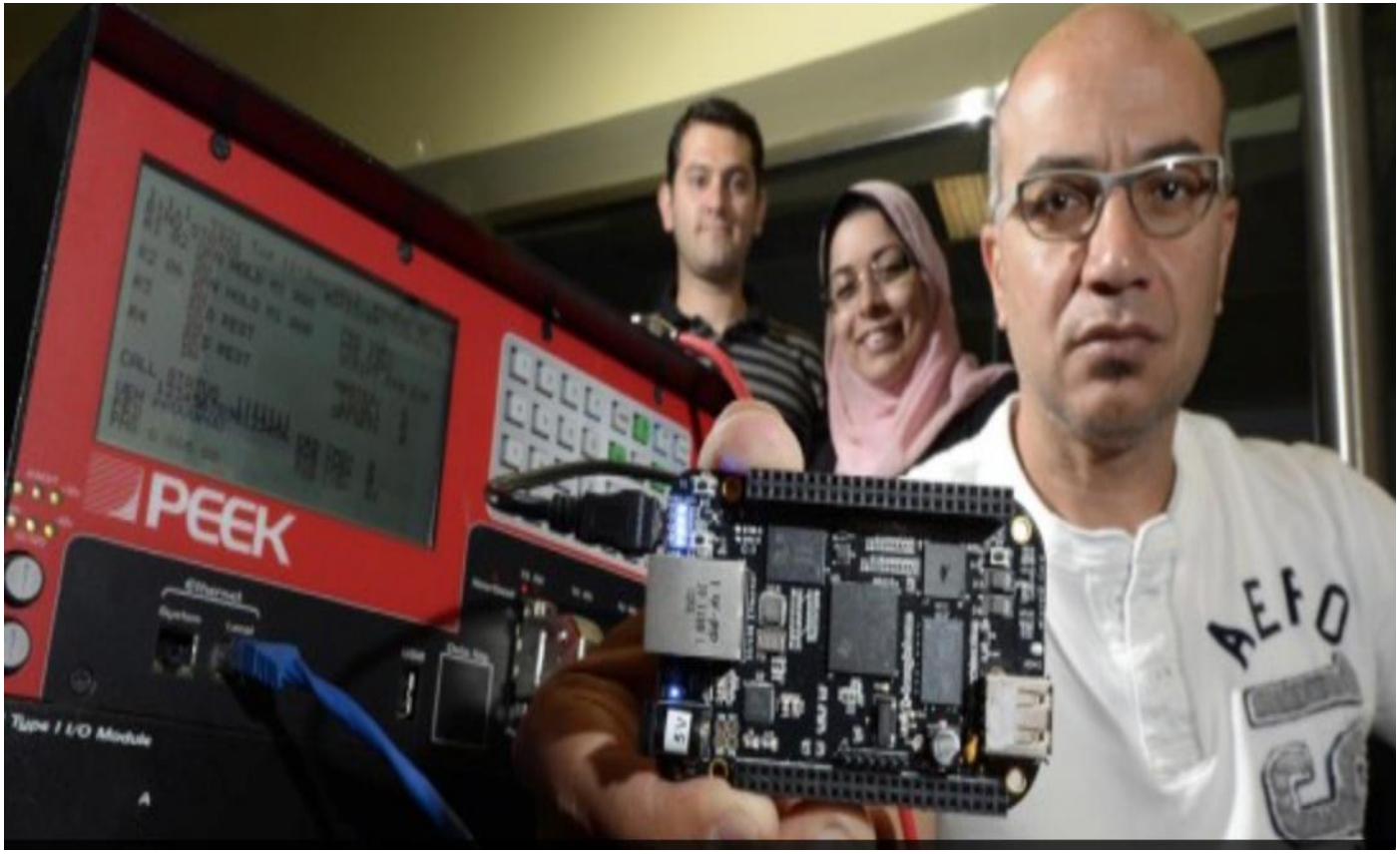
Smart X

Smart?


SMART can:
Sense
Interpret
Learn
React
Adapt
Optimize
Real Time

4. From Science to Practice

Bridging the Gap Via Partnership With You



Next

- Adaptive Traffic Signal Control for Streets
- Adaptive Ramp Metering for Freeway
- Dynamic Congestion Pricing