Green wireless: closing the loop between Vehicles and Navigators

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Green Wireless: Problem and Solution

- *Wireless - **the problem***
  - ICT uses .3-.6 of global energy, i.e. 2%-5% of global electricity
  - Mobile Wireless is 1/3 of ICT usage (most usage due to radio stations)

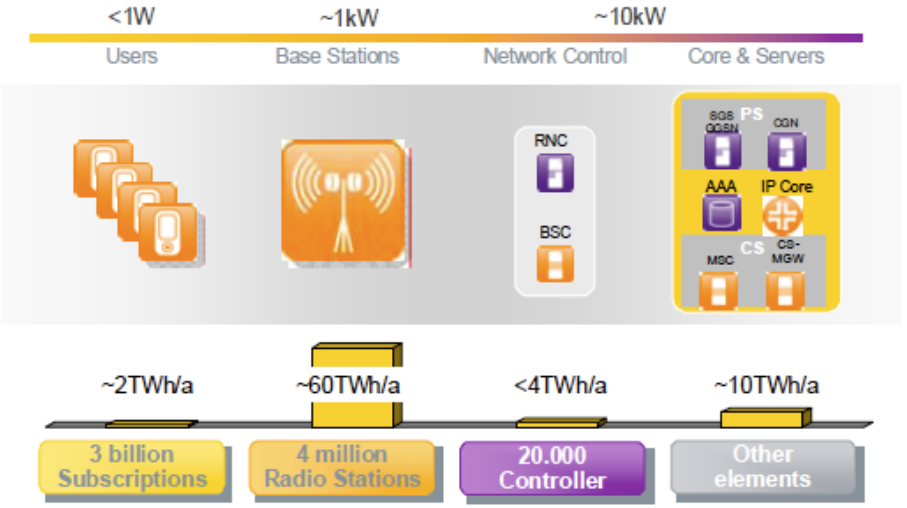


Figure 3 – Global energy consumption of cellular networks

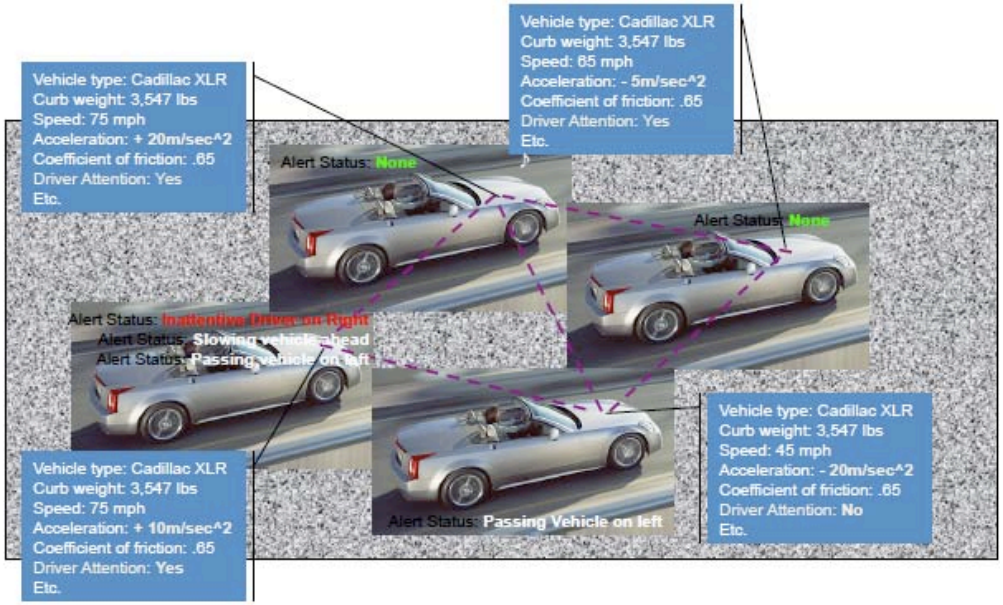
- *Wireless – **the solution***
  - Urban Intelligent Transport System

The Three Urban Nightmares: time, fuel, pollution

- Traffic congestion leads to **time** and **fuel** waste
- Air **pollution** caused by vehicles reduces city livability
  - Street canyon effects cause exposure to traffic pollutants in NYC
- Existing traffic control through “green wave” is not enough
  - Municipalities begin to realize the importance of congestion & pollution fees
- Nitric Oxide (NO) concentration exhibits high spatial and temporal variability (Environmental Health Perspectives, Nov 2009)
  - How to implement dynamic congestion and pollution control ?

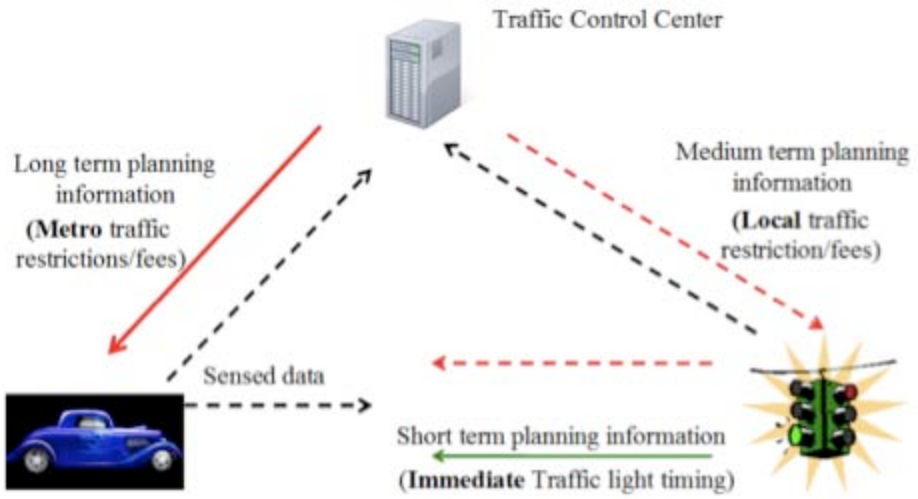
The players: the Vehicles

- Goal: optimize driving experience (delay, pollution, etc)
- Mobile sensors: GPS, cameras, chemical, iPhone, etc
- Mostly traffic information but air quality also measured
- Sensing is not enough: how to utilize the collected data?



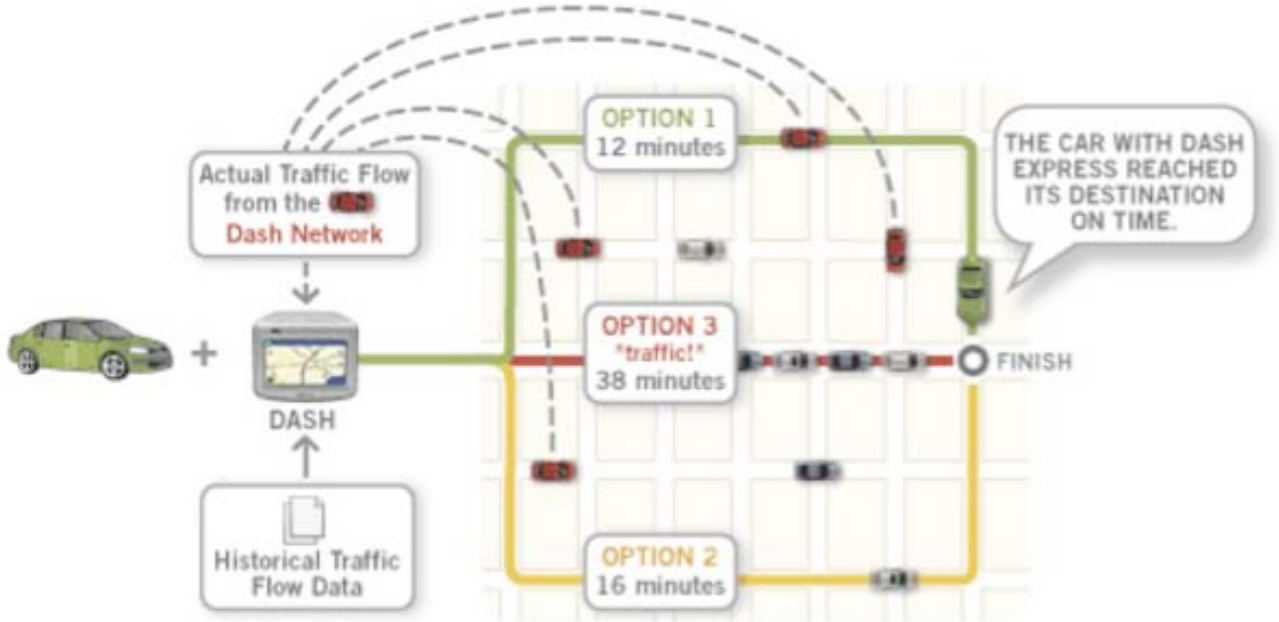
The players: Urban Planning Dept

- Goal: minimize traffic congestion
- Collects traffic info from road sensors, video cameras
- Current vehicle traffic control methods:
  - Adjust traffic lights to improve traffic flow
  - Green wave, Congestion fees



The Players: Car Navigator

- Goal: maximize customer satisfaction
  - Low delay , low congestion fee routes, etc
- Provide individualized route planning

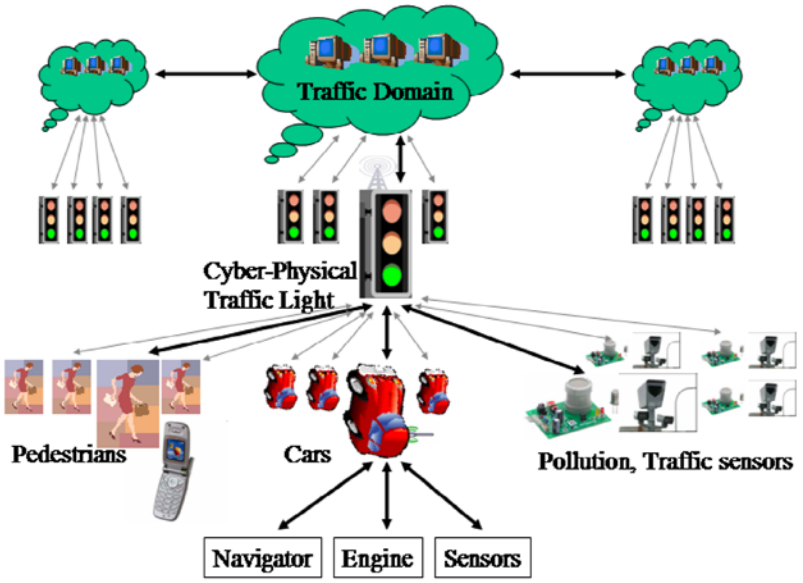


More Players

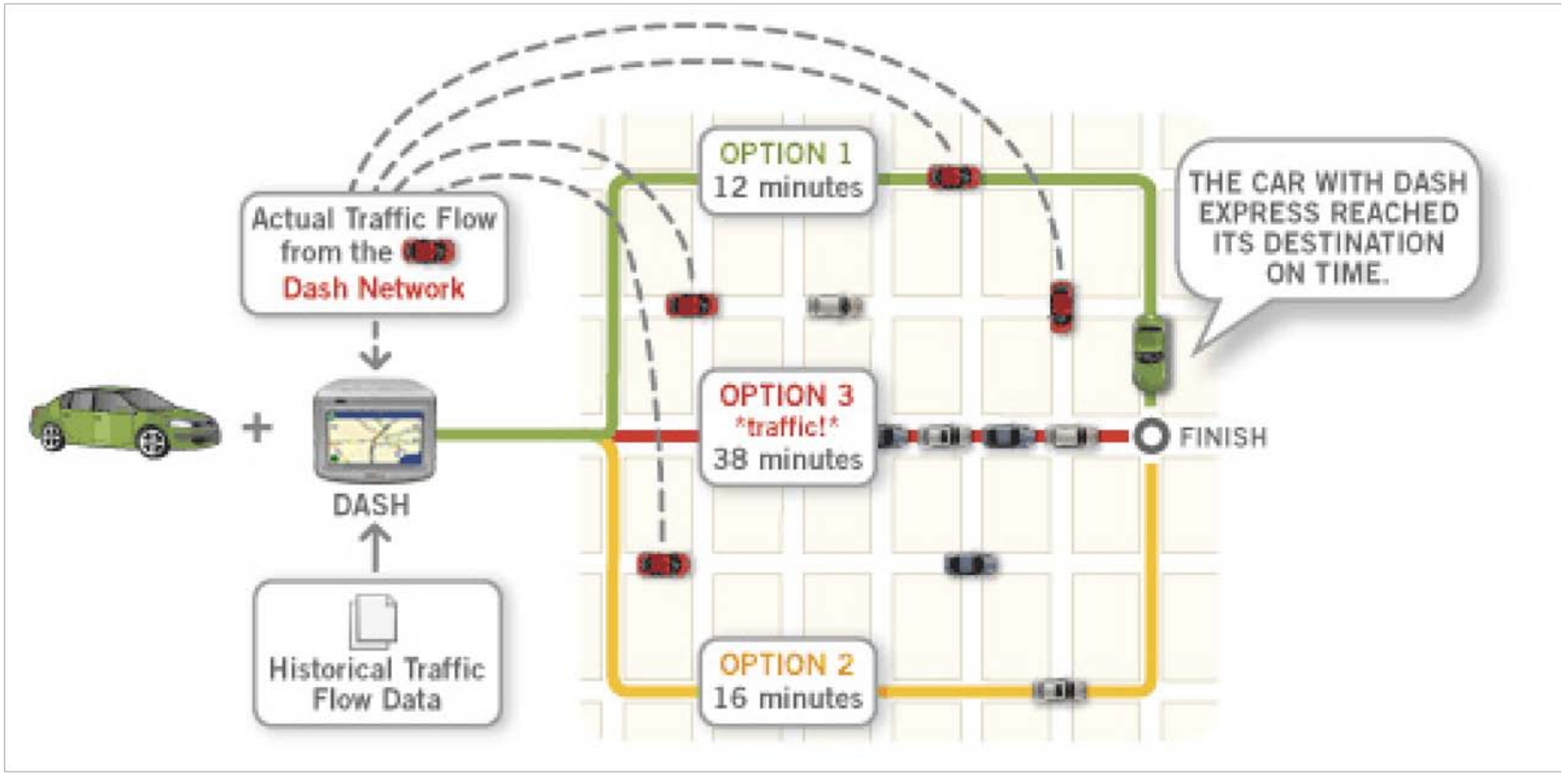
- Environmental Protection Agency:
  - Goal: keep environment safe and residents healthy
  - Minimize pollution exposure
  - Atmospheric, micro climate modeling
- Global warming “police”
  - Minimize petrol consumption & CO_2 emission
  - Minimize greenhouse gas effects

Our Vision – ICT Closes the Loop

- Four critical players: Car Sensors, Traffic Planners, Atmospheric modeling and Car Navigators
  - They must talk to each other
- ICT close the loop by connecting Cars with Navigator, Urban planners, traffic lights, congestion fees/incentives
  - WiFi/SDRC wireless mesh
  - WiMAX, LTE



Closing the Loop
Car + Navigator + Traffic planner
via WiFI, 3G, WiMAX, LTE



Navigator feed traffic info to City planners

The Closed Loop Green Urban Future

- Vehicles help Navigators monitor congestion
- Vehicles help climate/pollution modeling
- Urban planners optimize routes and congestion fees
- Navigators send vehicles on safe, least congested economical, least polluting paths

SAVE TIME, FUEL, POLLUTION, PLANET

C-VeT

Campus - Vehicular Testbed

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C-VeT Plannned Configuration

- We are installing our radio equipment in:
  - 30 Campus operated vehicles (including shuttles and facility management trucks).
    - Exploit “on a schedule” and “random” campus fleet mobility patterns
  - 30 Commuting Vans: Measure urban pollution, traffic congestion etc
  - 12 Private Vehicles: controlled motion experiments
  - Cross campus connectivity using 10 node Mesh (Politecnico Milano).

Thank You!