

# V2V and V2I – Fundamentals of Future Intelligent Traffic Information Systems (ITS)

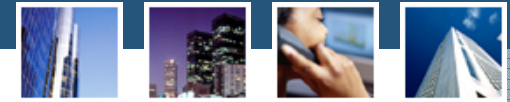
Advanced Transportation Information Systems Research Center  
City University of Hong Kong

Aug.26.2011





# Agenda



- **(1) An overview of vehicle-to-vehicle (V2V) communication's & vehicle-to-infrastructure (V2I) communication's roles in future ITS;**
- **(2) CityU's attempts in developing V2V prototypes for traffic condition collection and distribution;**
- **(3) CityU's attempts in developing data platform for real-time traffic information display & multi-source traffic information fusion.**





## (1) An Overview of V2V & V2I in ITS



- **Road congestion has become a world-wide problem (\*). For example, in Hong Kong there are about 591,510 licensed vehicles in total (May 2010), which makes around 290 (240 Int.s) vehicles/km.**
- **Intelligent transportation system (ITS) is regarded as the best solution to alleviate the congestion problem (\*\*).**
- **Real-time traffic information collection & dissemination is a critical issue in ITS.**
- (\*) Congestion: A National Issue, Federal Highway Administration, Department of Transportation, U.S., 2008-08-29.
- (\*\*) Intelligent Transportation Systems Market Review, Research Report, ABI Research, 2009.





## (1) An Overview of V2V & V2I in ITS



- **V2V & V2I would play key roles for real-time traffic information collection and dissemination in future ITS in following aspects:**
  - (1) Traffic safety applications (Anti-collision, Road construction reminding, Control of vehicles transporting hazardous materials);**
  - (2) Traffic condition collection and distribution;**
  - (3) Traffic service information dissemination;**
  - (4) Etc.**



# (1) An Overview of V2V & V2I in ITS

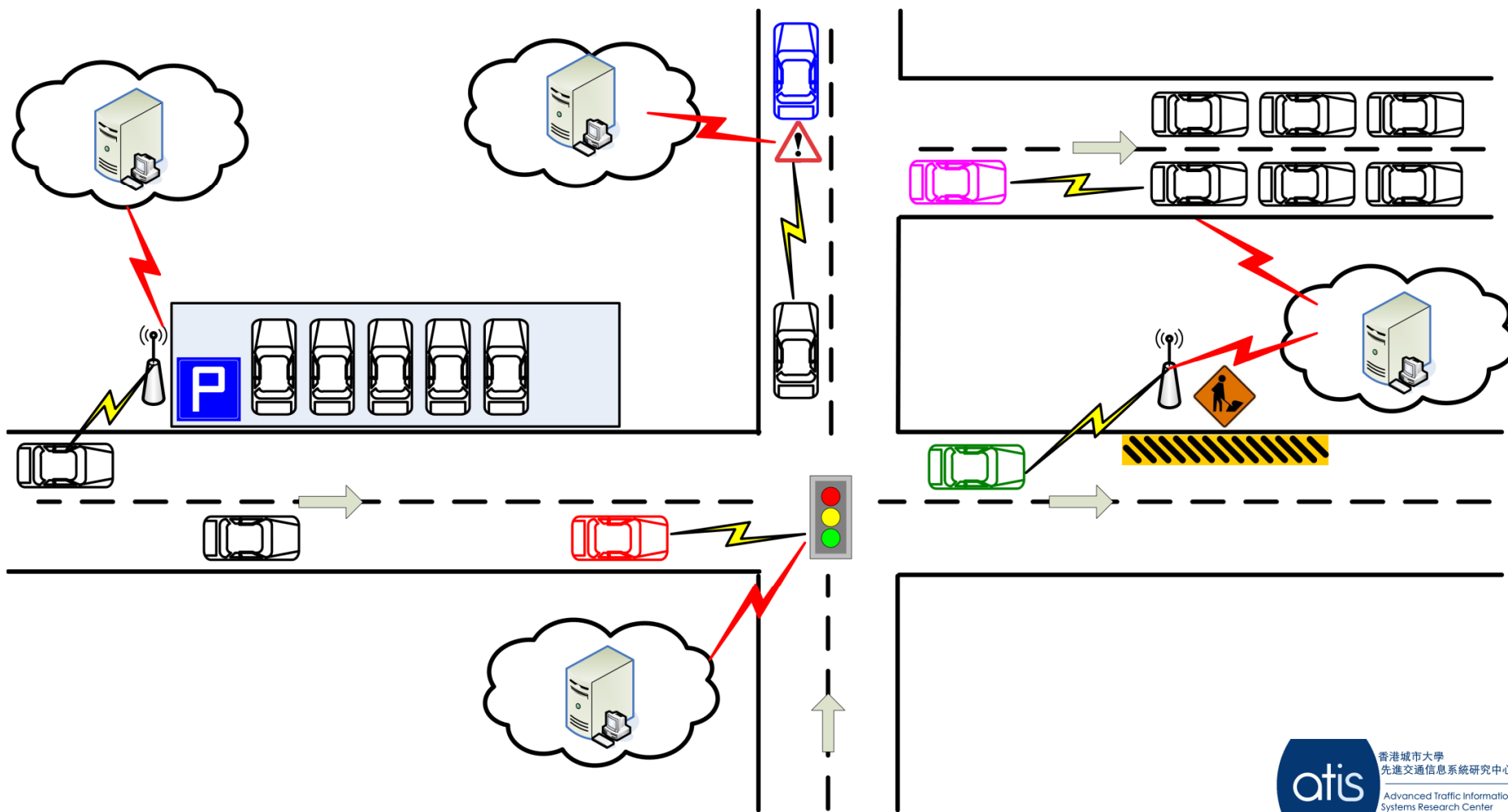


Fig. 1 An overview of V2V & V2I in ITS



## (2) V2V Prototype for Traffic Condition Collection and Distribution



- **Traditional methods** for traffic condition collection and distribution:

### Collection:

Video camera systems, automatic vehicle detectors, toll station traffic flow data, floating cars.

### Dissemination:

Website, electronic traffic information board, radio broadcast (**TMC**), telephone hotline.

- **Limitations:**

(1) Budget is high;

(2) No tailor-made traffic information;

(3) Efficiency is low.





## (2) V2V Prototype for Traffic Condition Collection and Distribution



- **Is there a more flexible way to carry out this task?**
- **Can we use vehicles on road to collect & disseminate information in an ad-hoc way?** [Wischhof et al. 2005]
- **Developments of mobile computing capability, positioning techniques, wireless communication technology support the idea.** [IEEE 802.11/P]
- **A project of vehicle-based traffic information system is so proposed.**

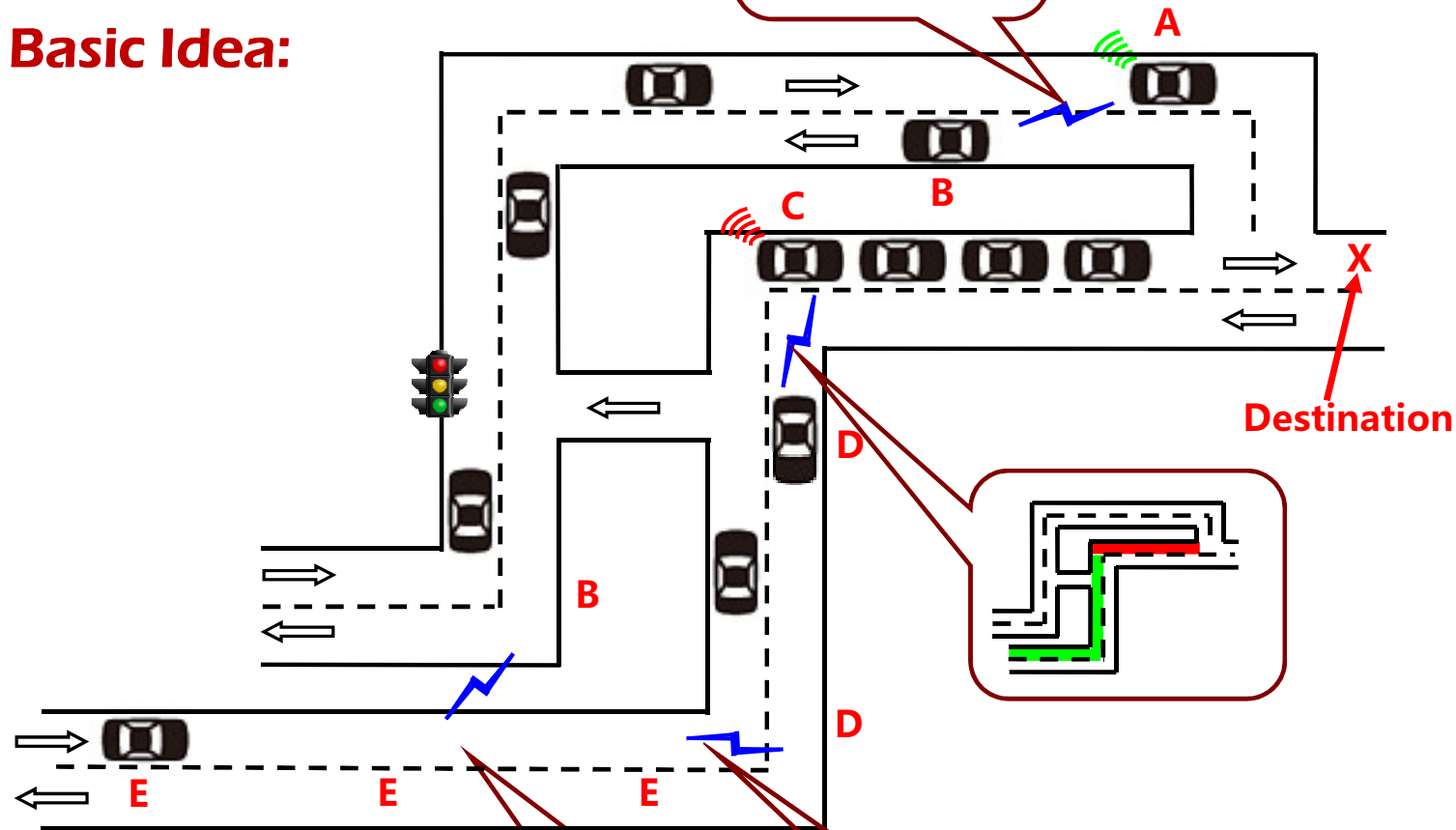




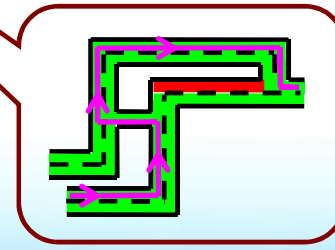
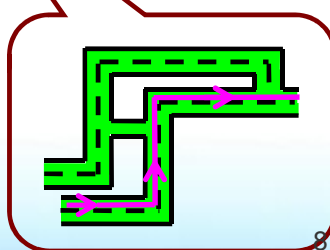
## (2) V2V Prototype for Traffic Condition Collection and Distribution



**Basic Idea:**



**Fig. 2 Basic idea of using V2V for traffic condition collection & distribution**





## (2) V2V Prototype for Traffic Condition Collection and Distribution (Cont.)



- V2V Communication protocol is based on IEEE 802.11a because it is close to IEEE 802.11p settings.

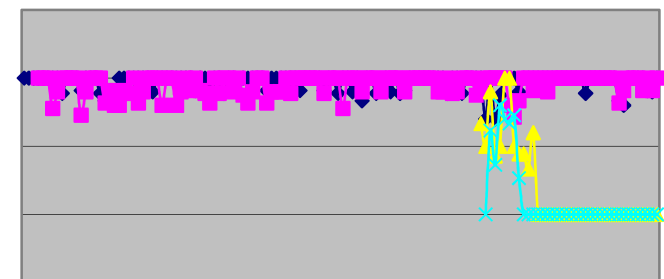
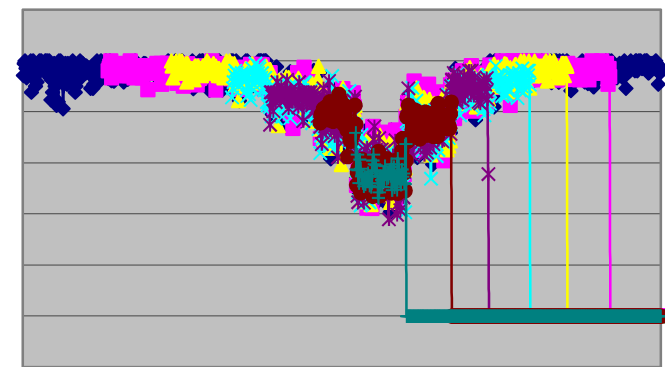
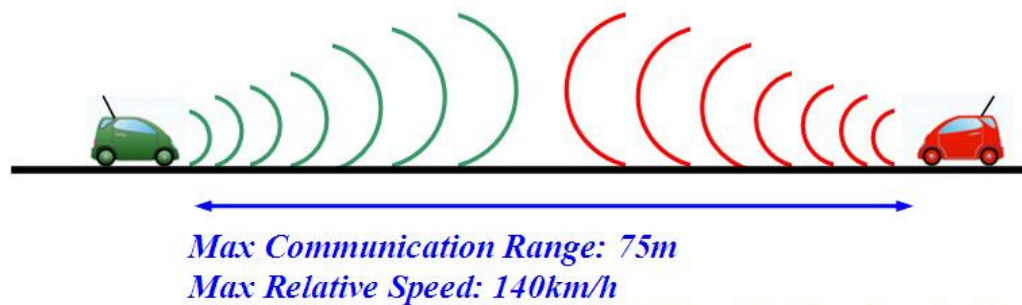


Fig. 3 V2V communication test scenario and results



## (2) V2V Prototype for Traffic Condition Collection and Distribution (Cont.)



Fig. 4 Prototype user interface – dynamic navigation



## (3) Traffic Data Fusion Platform



- Traffic data are collected from **multiple sources** include:
  - (1) Floating-vehicle data
  - (2) Detector data
  - (3) Video data and etc;
- **How to fuse these data** to illustrate an more accurate traffic-condition picture is a problem to be solved?
- A **data platform** for real-time traffic information display & multi-source traffic information fusion is thus designed.



### (3) Traffic Data Fusion Platform

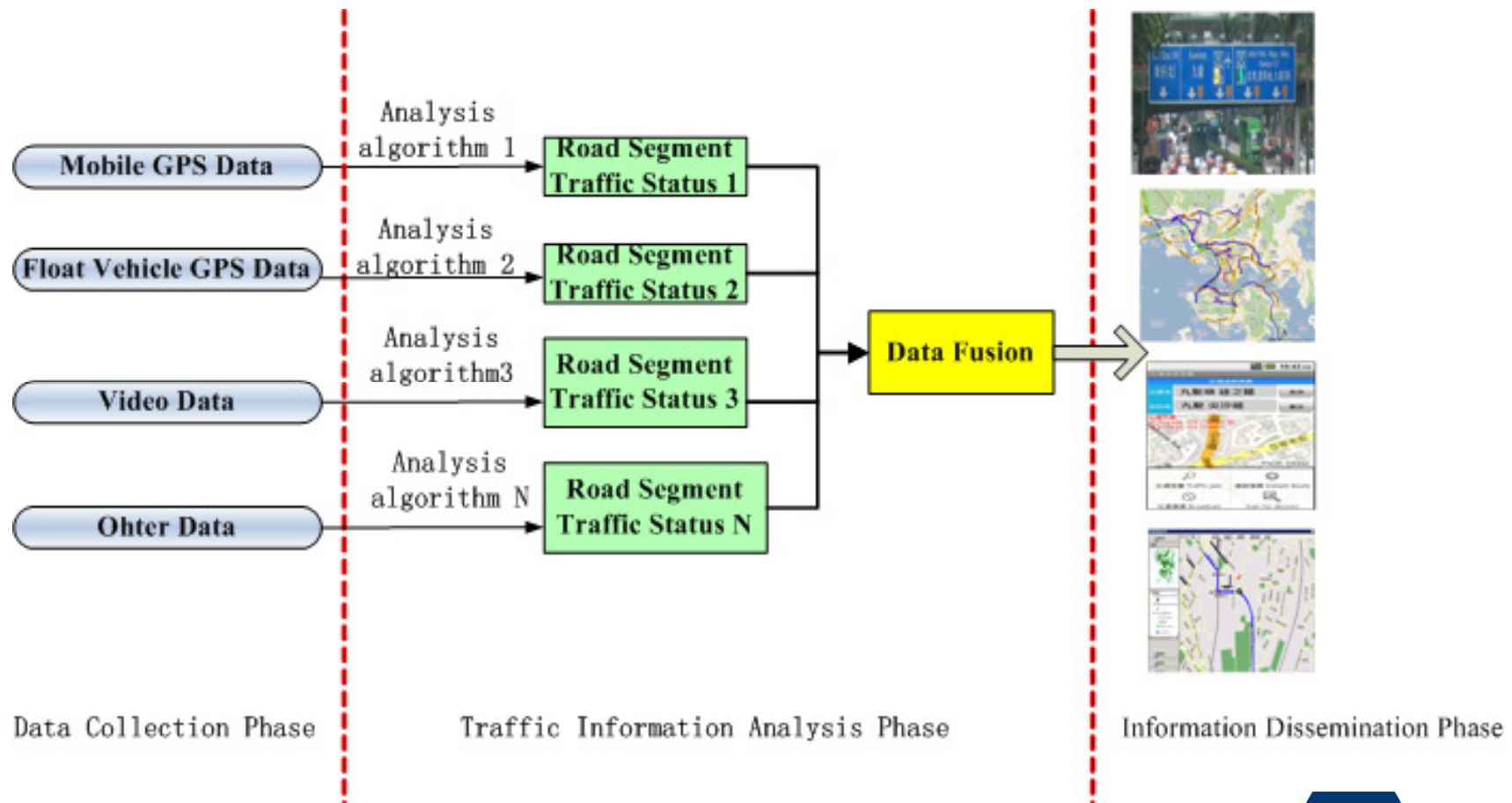


Fig. 5 System Framework of the Data Platform



# (3) Traffic Data Fusion Platform



**Fig. 6 System Interface of the Data Platform  
(ArcGIS Based)**



# (3) Traffic Data Fusion Platform



On / Off Path of Traffic

View the historial traffic

Indicator	Traffic Description
0~5 km/h	High-congestion
5~20 km/h	Low-congestion
20~80 km/h	Good condition
> 80 km/h	Excellent condition

Fig. 7 System Interface of the Data Platform (Google Map Based)





# Thank you !

