Introduction to Intelligent Vehicles
[13. Edge Computing]

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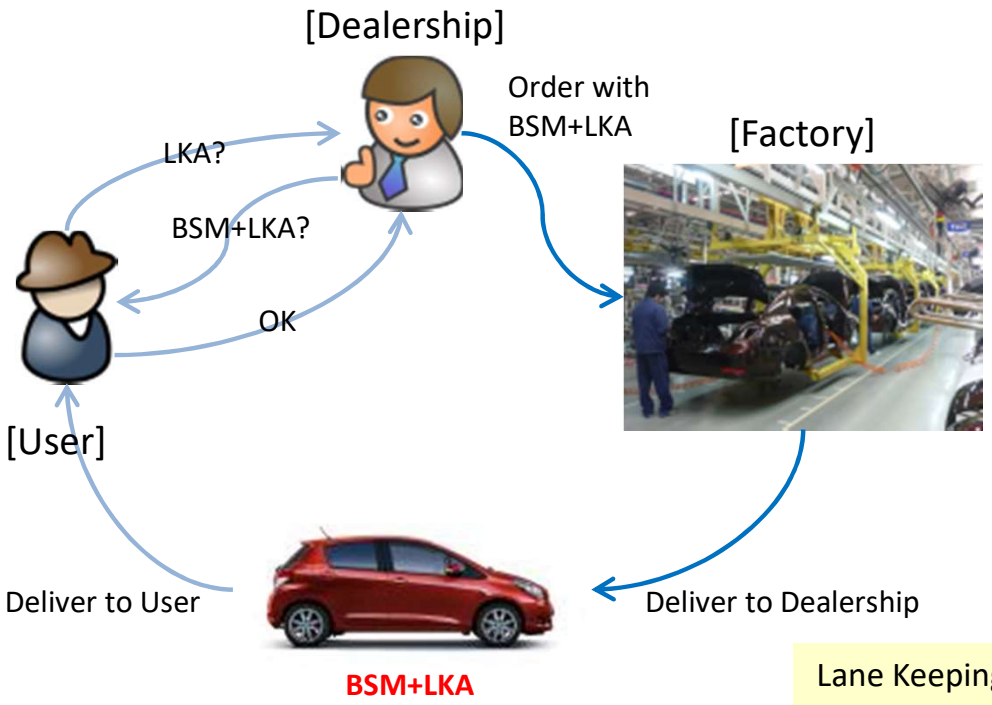
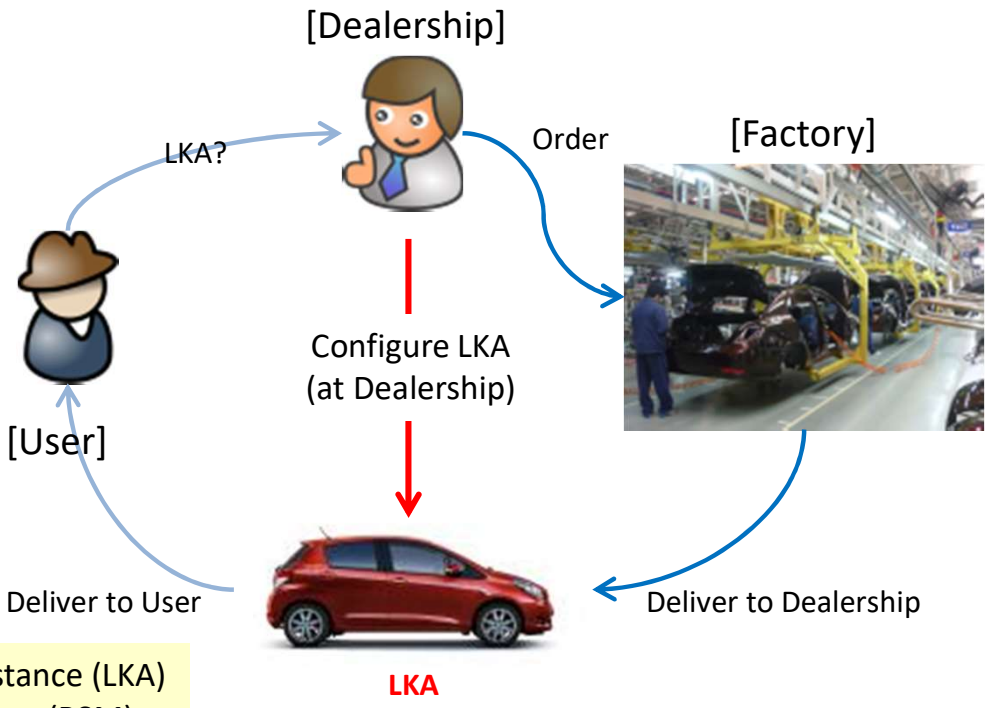
Fall 2019

Plug-and-Play Systems

- What if a vehicle is like a smart cellphone that applications can be downloaded, updated, and activated?
  - At dealership (customized vehicles)
  - Before driving or even during driving?

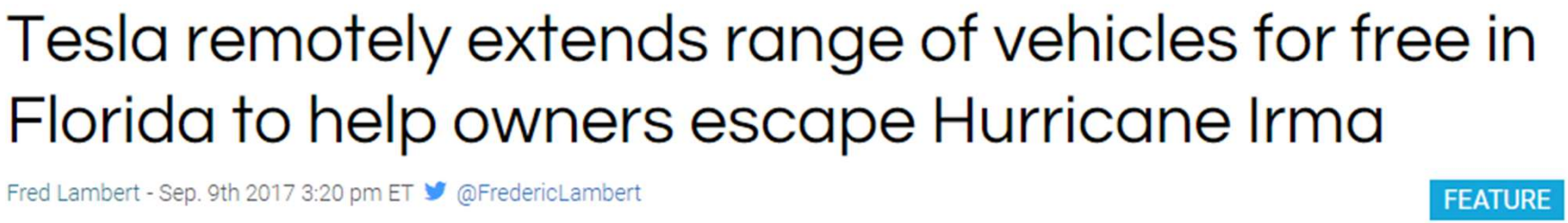




Lane Keeping Assistance (LKA)
Blind Spot Monitor (BSM)

Over-The-Air Update

- Over-The-Air (OTA) update


Tesla remotely extends range of vehicles for free in Florida to help owners escape Hurricane Irma

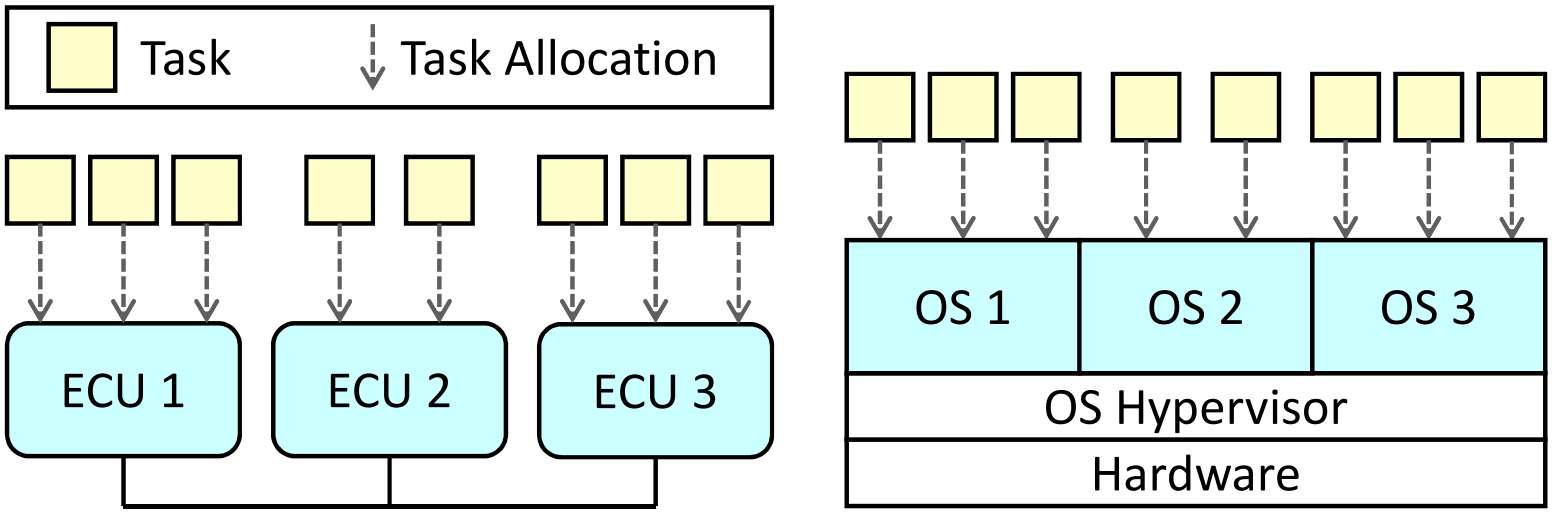
Fred Lambert - Sep. 9th 2017 3:20 pm ET @FredericLambert

FEATURE

- What are the safety risks?
  - Vehicles are not completely uniform
    - Some updates may affect some vehicles but not others
  - Time and location of an OTA update may have a safety risk
  - Automated testing of an OTA update is problematic without observers

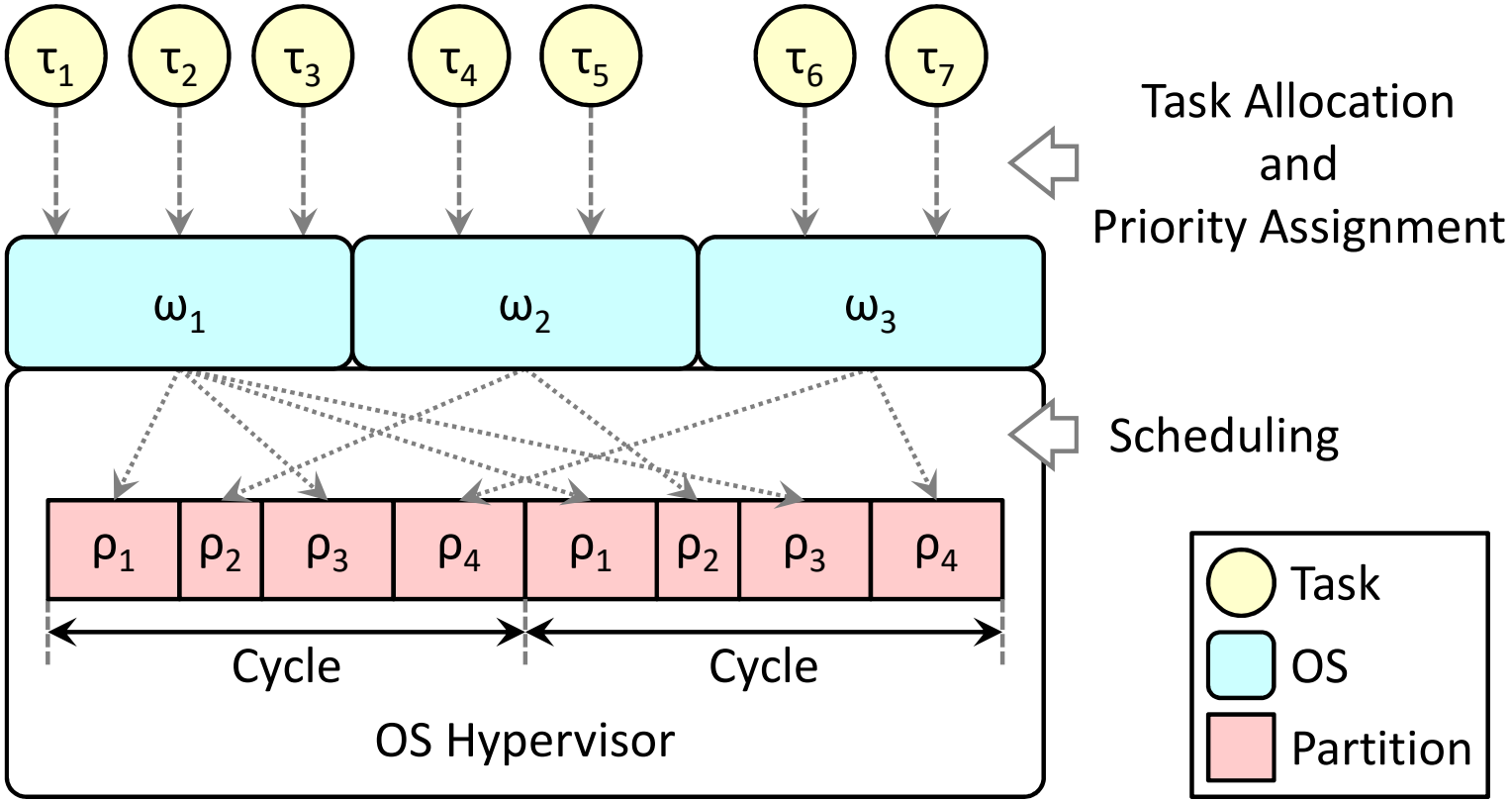
Plug-and-Play Mapping Problem

- Allocate software applications or sets of tasks to
  - Distributed Electronic Control Units (ECUs), or
  - Separated operating systems supported by virtualization techniques such as OS hypervisors

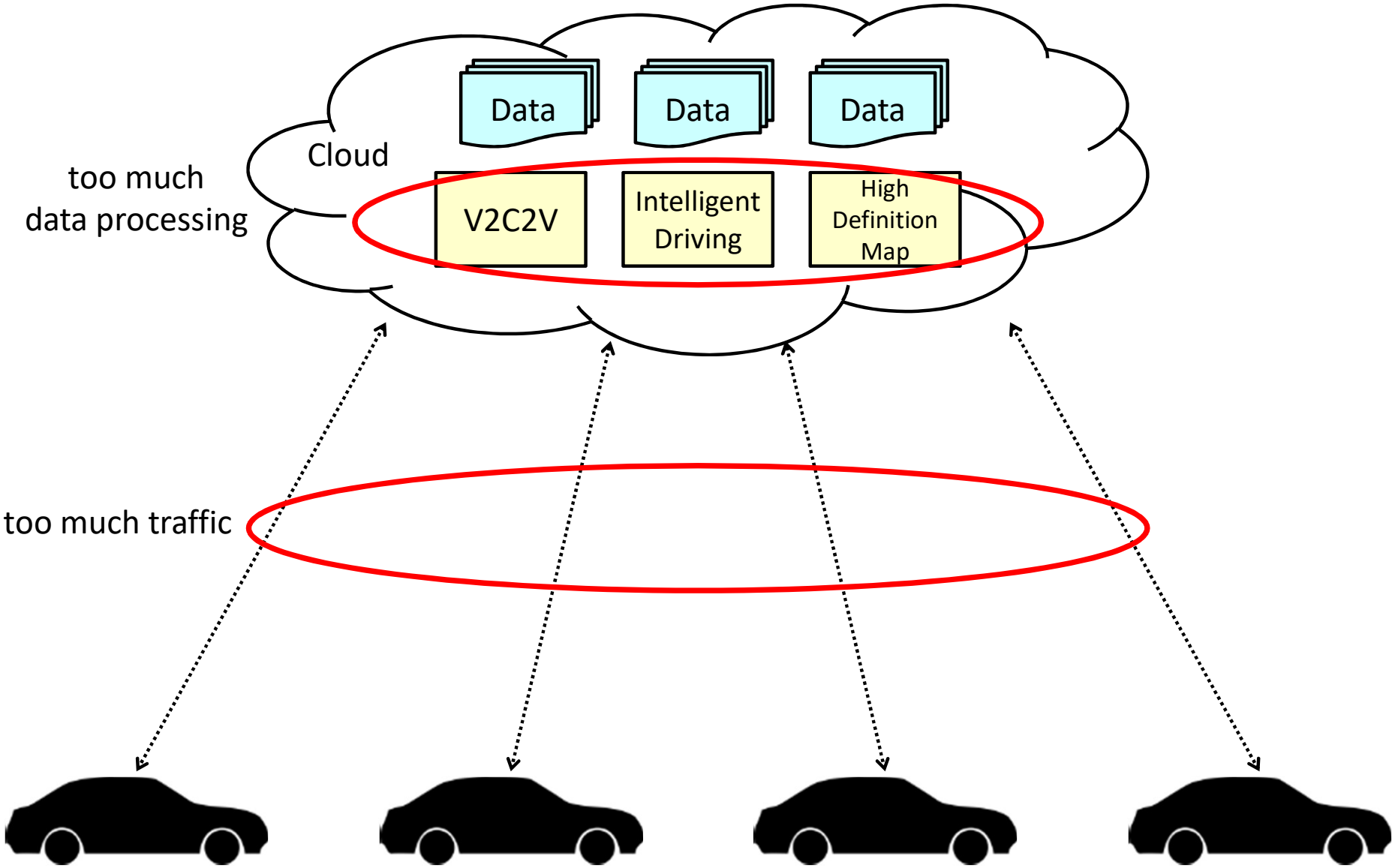


Formulation with OS Hypervisor

- Question: should we solve the problem during design time or during runtime?
  - A vehicle may not have sufficient computational resource

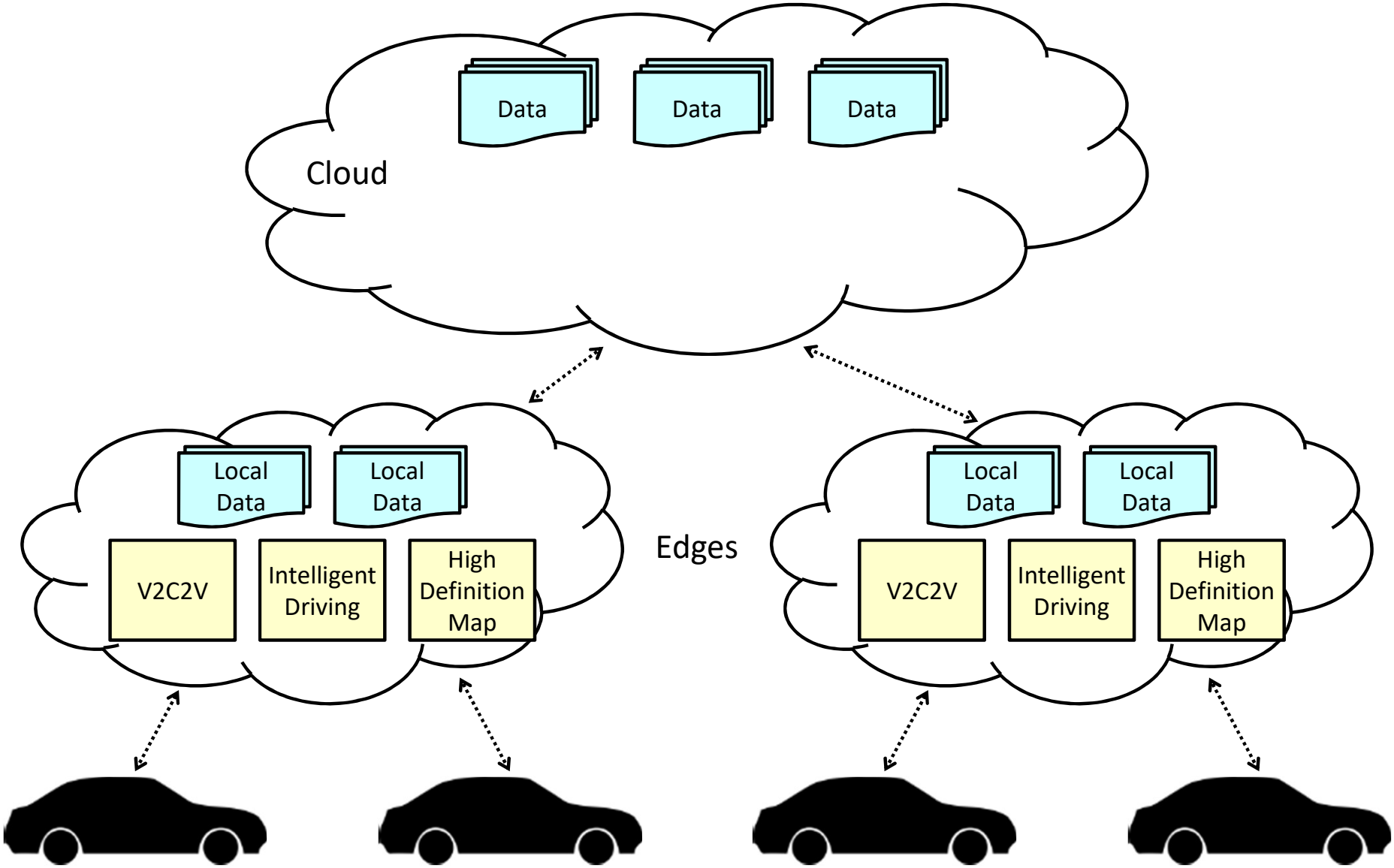


Edge Computing (1/2)



From Automotive Edge Computing Consortium

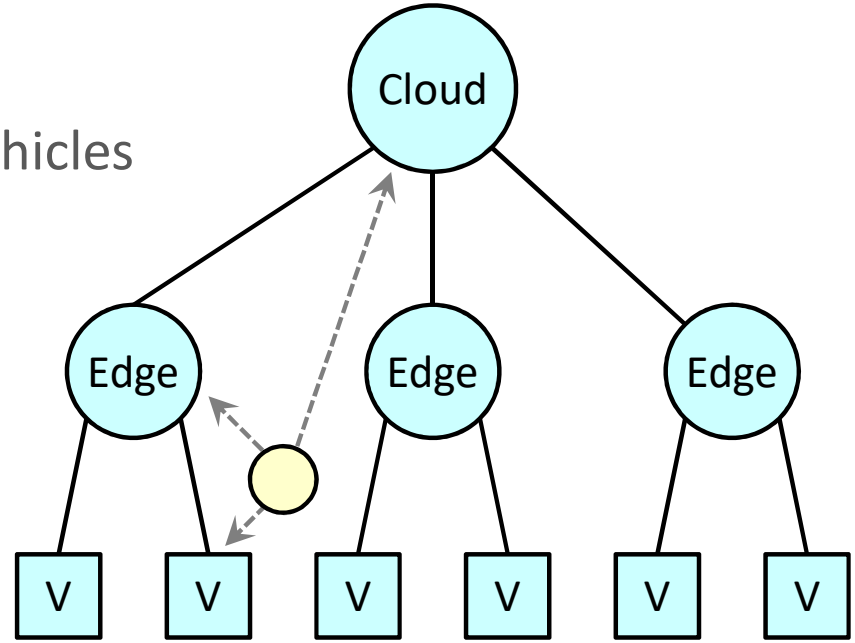
Edge Computing (2/2)



From Automotive Edge Computing Consortium

Formulation with Edge Computing

- **Architecture**
  - 1 cloud server, 3 edge servers, and 6 vehicles
    - Vehicles generate tasks to be executed
- **Decide the "location" of each task**
  - The vehicle generating the task
  - The vehicle's parent edge server, or
  - The cloud server
- **Cost**
  - Computation: cloud < edge < device
  - Communication: cloud > edge > device
- **Objective**
  - Minimize the total cost (of all tasks)



Short Summary

- A much more interesting problem
  - "Dual routing"
- It is not only the problem of task allocation
  - Programming model can be totally different
  - How about "cloudification"?

Q&A