Truck CACC System Development and Testing

under FHWA Exploratory Advanced Research Project: Partial Automation for Truck Platooning (PATP)

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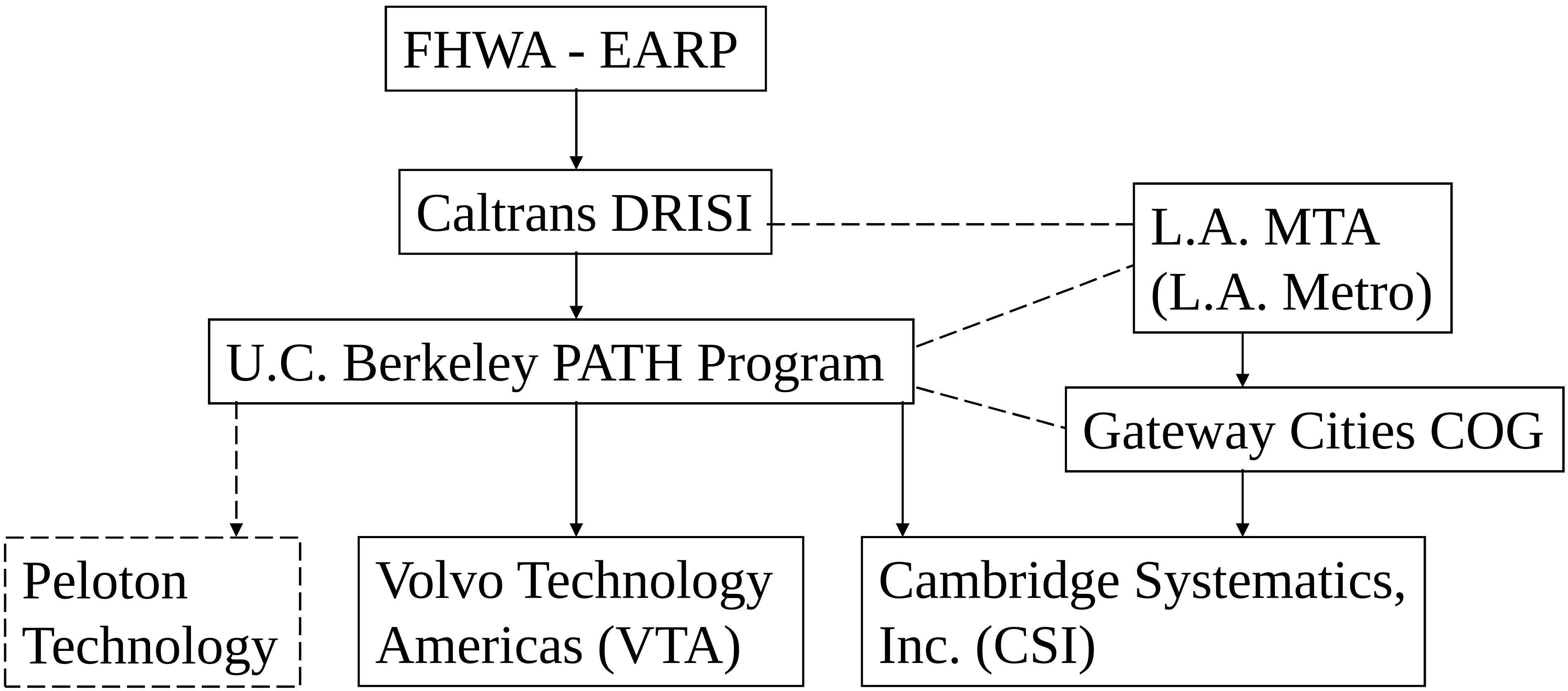
2015 ITFVHA – Bordeaux – October 4, 2015

Project Team



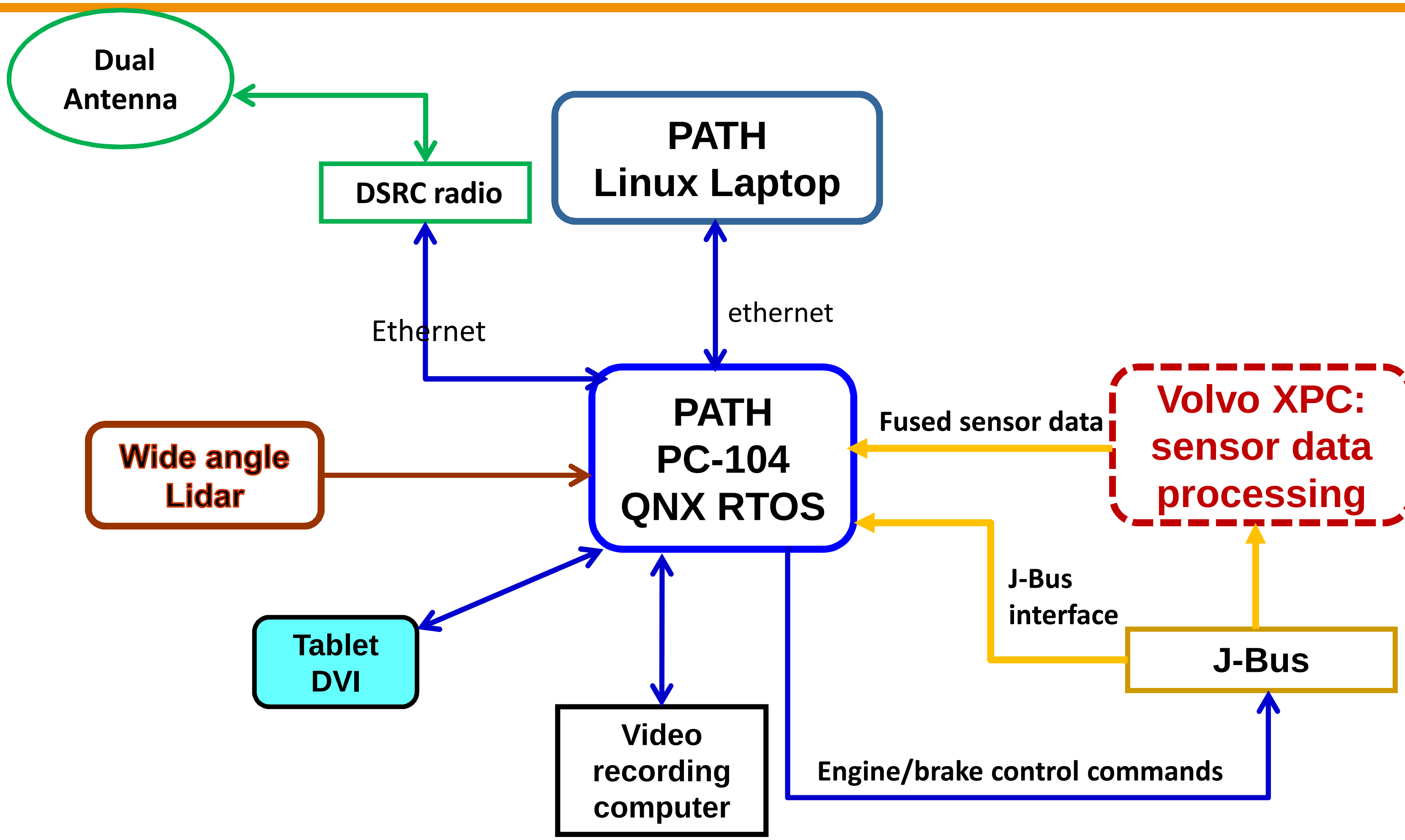
Project Goals

- Develop truck CACC system that can be deployed in near term, coexisting with other highway traffic
- Implement the CACC on three tractor-trailer trucks
- Test truck driver preferences among different CACC gap settings
- Measure energy savings when trucks are driven in the preferred gap setting range
- Estimate broader traffic and energy impacts in simulation

Recent Progress

- **Preliminary analysis tasks completed**
  - **User needs survey (jointly with Auburn project)**
  - **Concept of operations, focused on driver interactions**
  - **Infrastructure support opportunities**
  - **Adding intelligence to trailers/chassis**
- **Three trucks delivered to PATH for modification**
  - **Adding computers, DSRC radios, secondary displays**
- **CACC use cases defined in detail to support definition of V2V messages and driver interfaces**
  - **Activity diagrams**
- **Two-truck platoon tested at low speeds**

Overall Truck CACC System Structure



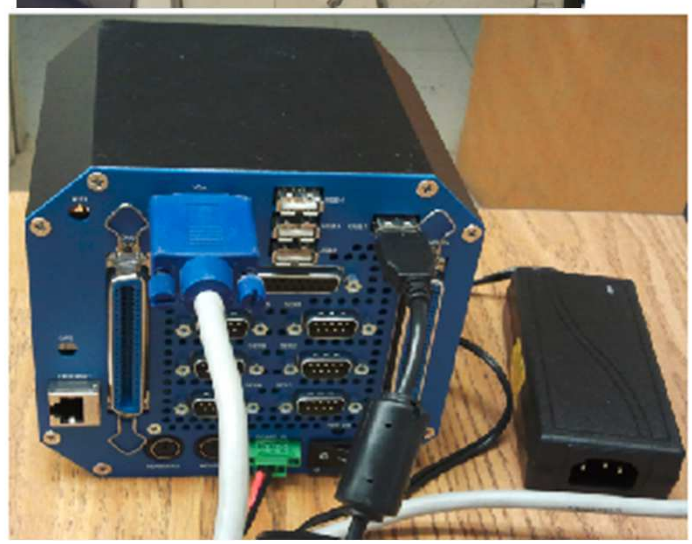
Hardware Installed on Trucks

Emergency switch to cut-off link with J-Bus

PATH Laptop for system development

DSRC Antenna mounted
On each side mirror

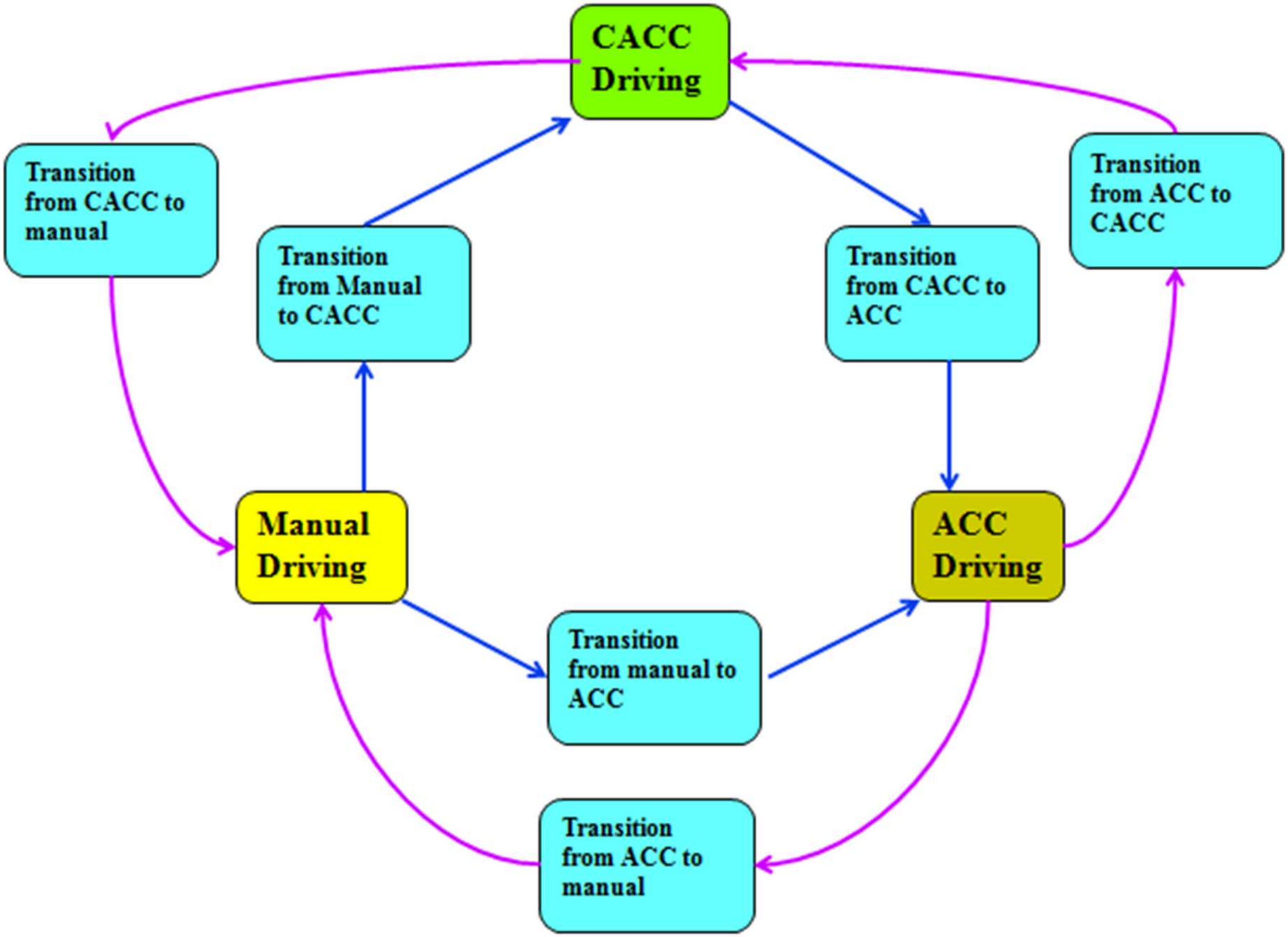
5 Hz GPS



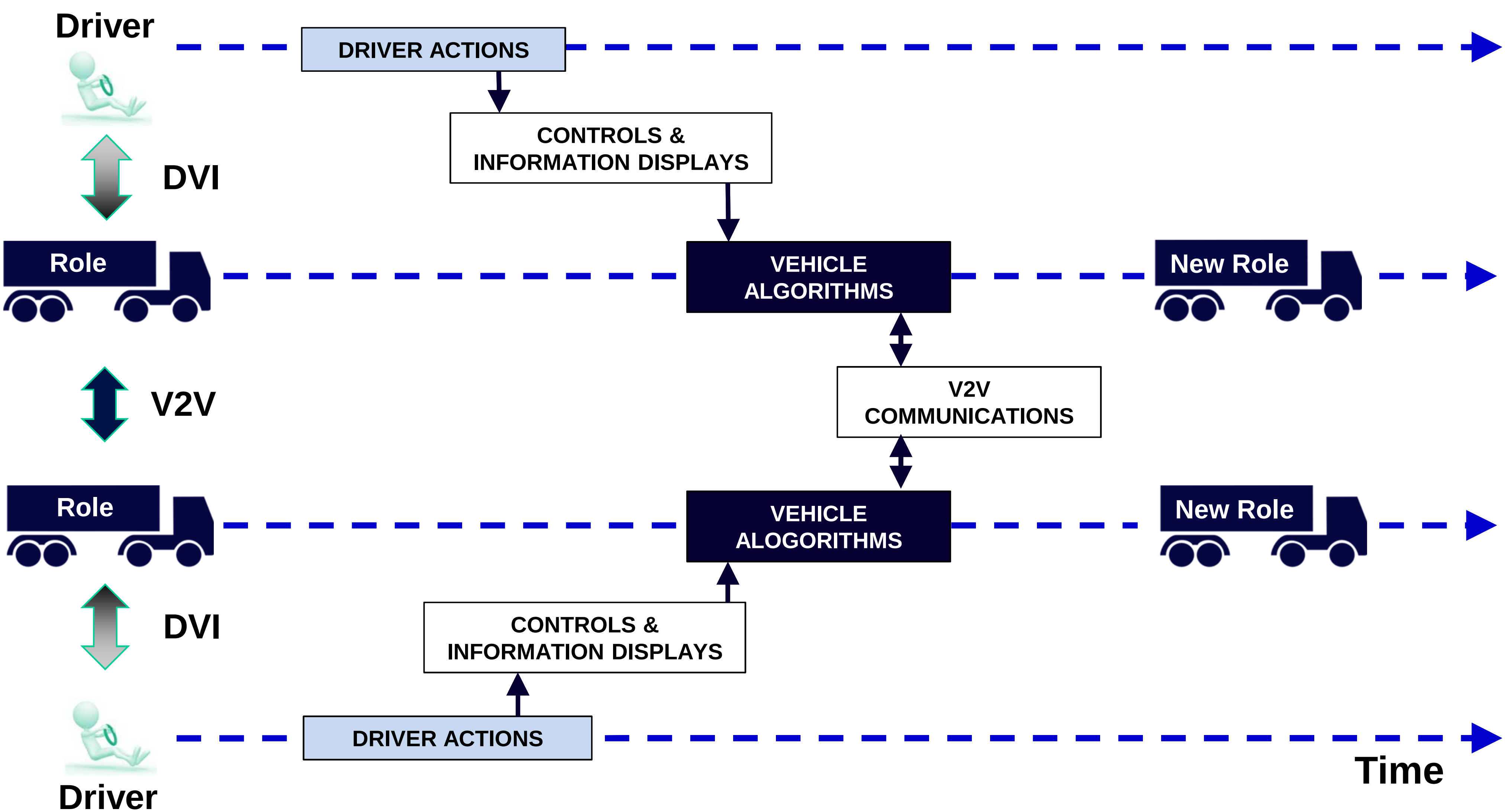
New PC-104 computer to run QNX real-time operating system

Control Logics for Different Scenarios

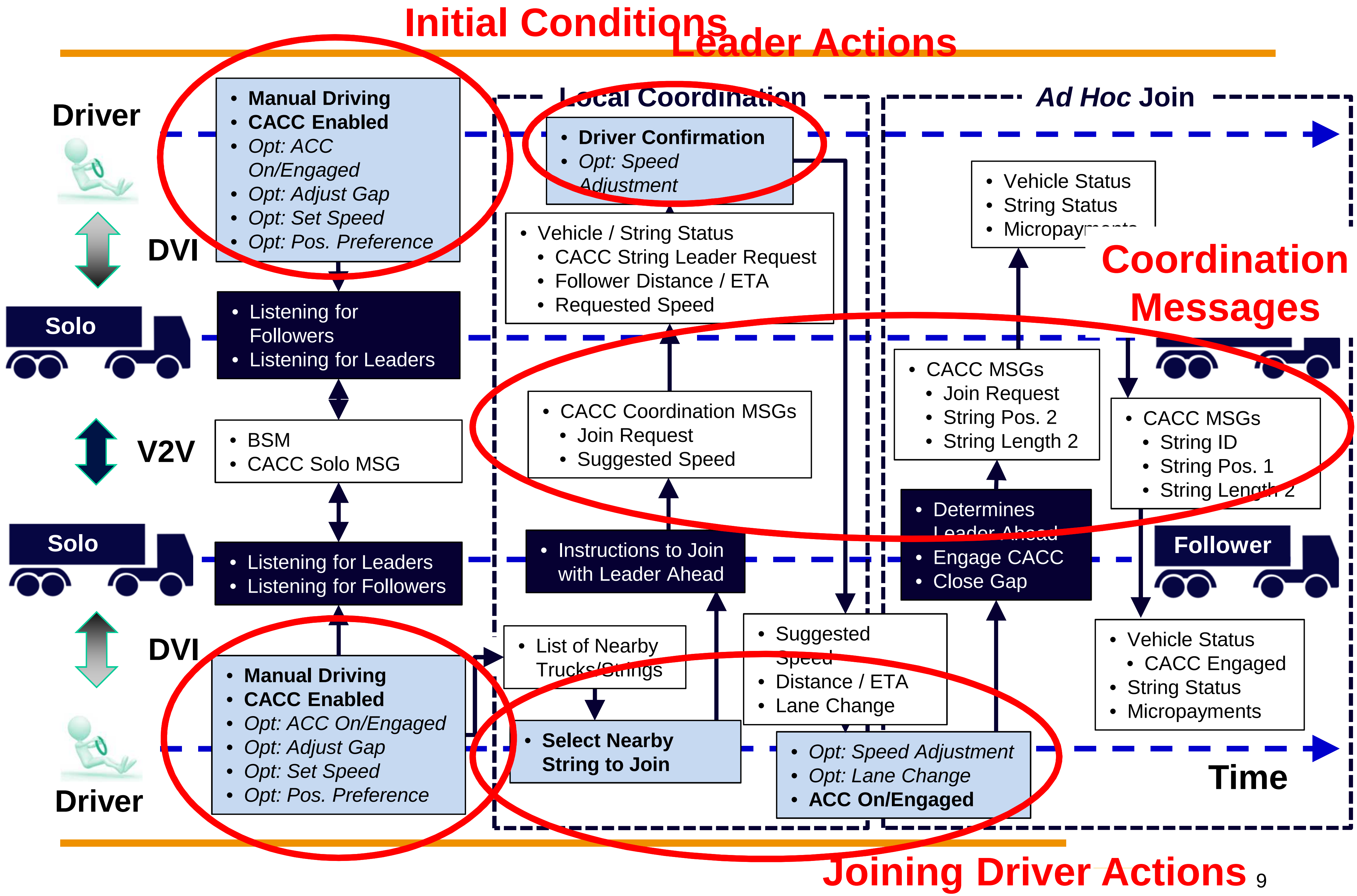
Transitions between Driving Modes



Activity Diagrams



CACC String Formation



CACC Human Factors Experiments

- **Volvo Truck Simulator**
  - **Testing HMI for joining/leaving a CACC string**
    - **Situational awareness during cut-ins**
  - **Performance at gap settings from 1.0 to 0.4 s**
    - **Lane keeping / workload / fatigue impact**
- **California On-the-Road Experiments**
  - **Conferring with CHP on test sites – freeways with moderate traffic density, at least 3 traffic lanes and mixture of flat and grades**
  - **Testing driver comfort at gaps from 1.0 to 0.6 or 0.4 s**
  - **Previous passenger car studies saw cut-ins at 0.6 s, mostly near entrance/exit ramps**
  - **Surveying drivers regarding gap preferences**