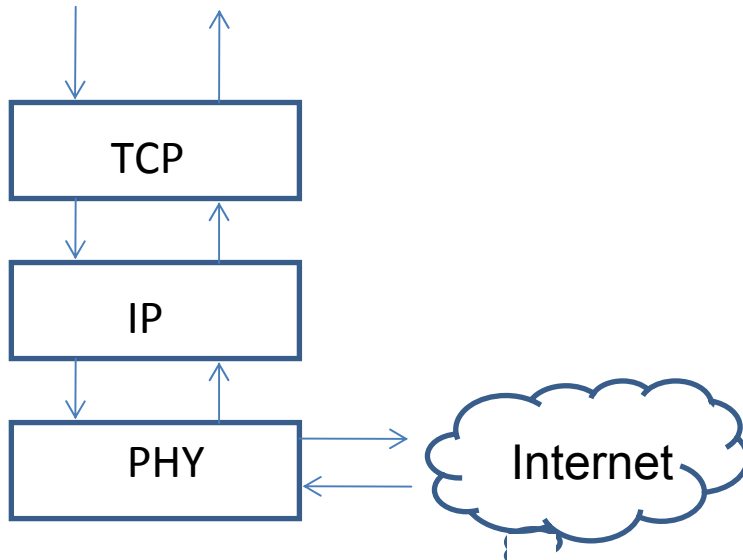# Composition of dynamical systems

Pravin Varaiya

An http request

↓Request: http://paths.lids.mit.edu/

TCP: start timer
        connect to paths.lids.mit.edu
        timeout
        start timer
        connect to paths.lids.mit.edu
        timeout
        start timer
        connect to paths.lids.mit.edu
        timeout

↑Response: paths.lids.mit.edu
        unreachable. Try again?

 Failure to fulfill request leads to notification and rollback of state.

Getting to LIDS

Find LIDS →

Found LIDS →

Go straight ←

Turn right ←

No signal ←

No signal

You are on your own!

↓Request: Find LIDS

↑Response: Found LIDS
        Go straight
        Turn right 100 yds

    No signal Start timer
    No signal

Failure to fulfill request leads to notification.

But there is no possibility of rollback

Composition of dynamical systems
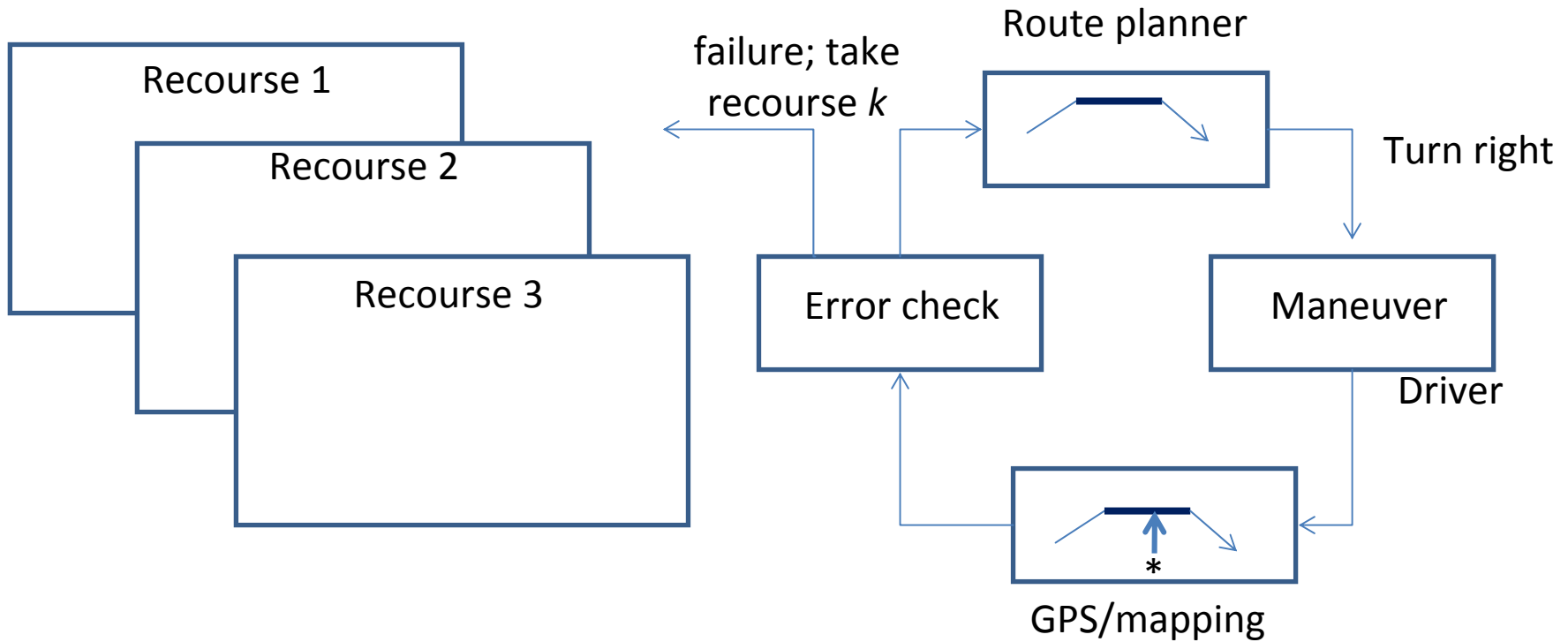
Route planner

GPS/mapping

Driver

Recourse 1

Recourse 2

Recourse 3

failure; take recourse *k*

Route planner

Turn right

Error check

Maneuver

Driver

GPS/mapping

*

Questions

- Should coordination of physical systems specify they jointly meet a sequence of state-time constraints?

- Since it may not be possible to roll back to some start state if the constraint is not met, should coordination design include recourse strategies?

- What architecture framework can provide performance guarantees?

- These questions grew out of conversations with Sanjoy Mitter ten years ago!