Logical Execution Time (LET) Programming

Christoph Kirsch
Universität Salzburg

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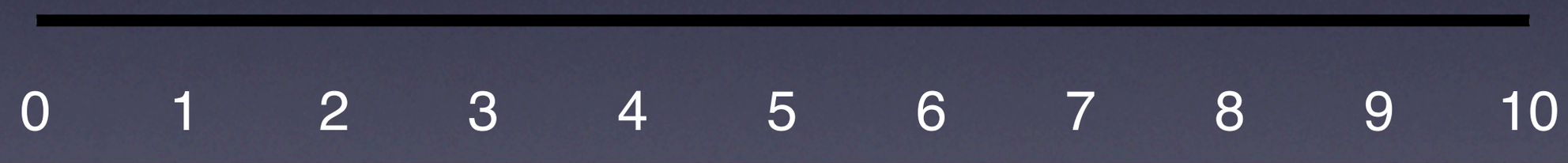
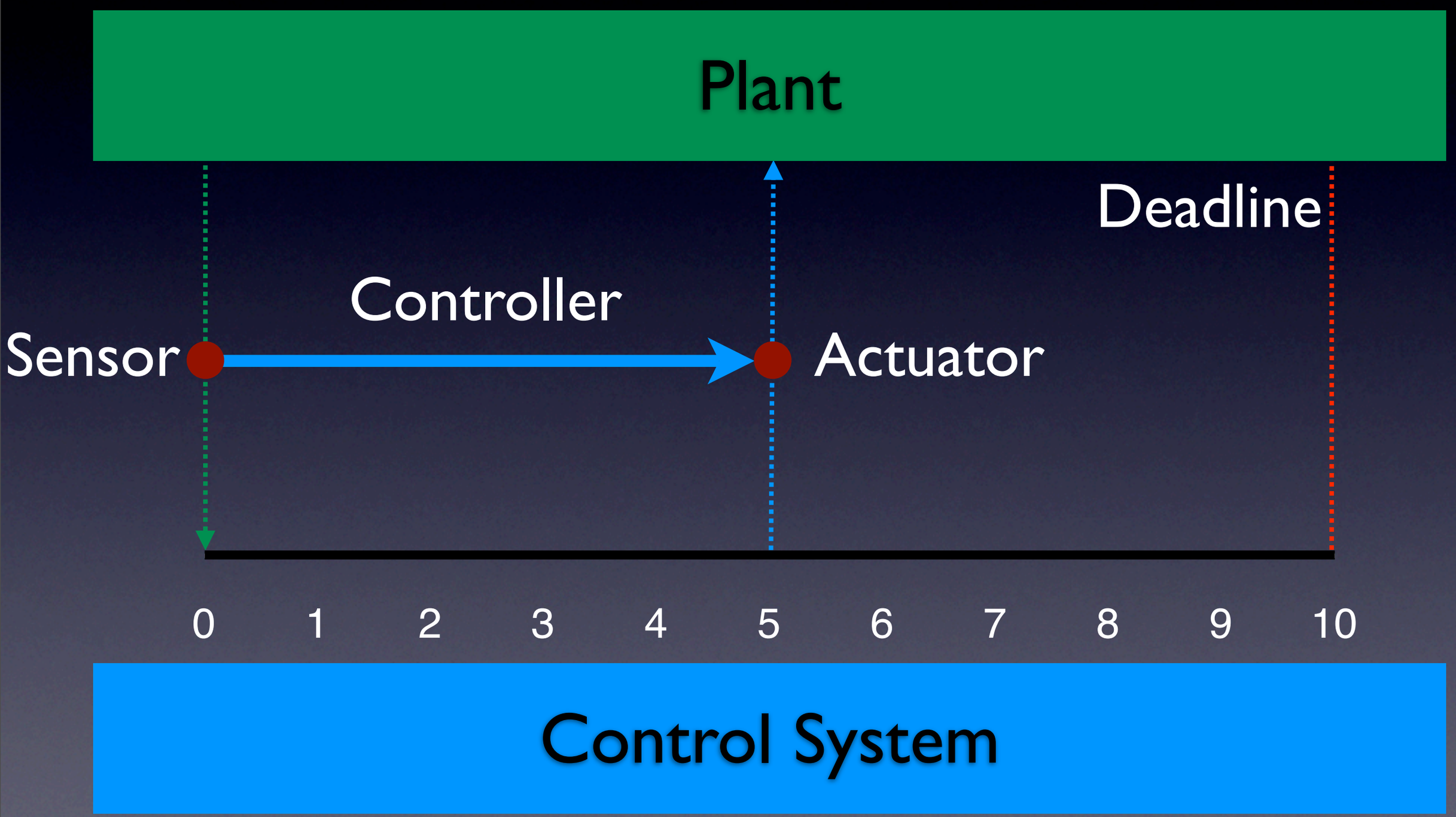
Control Software

Plant



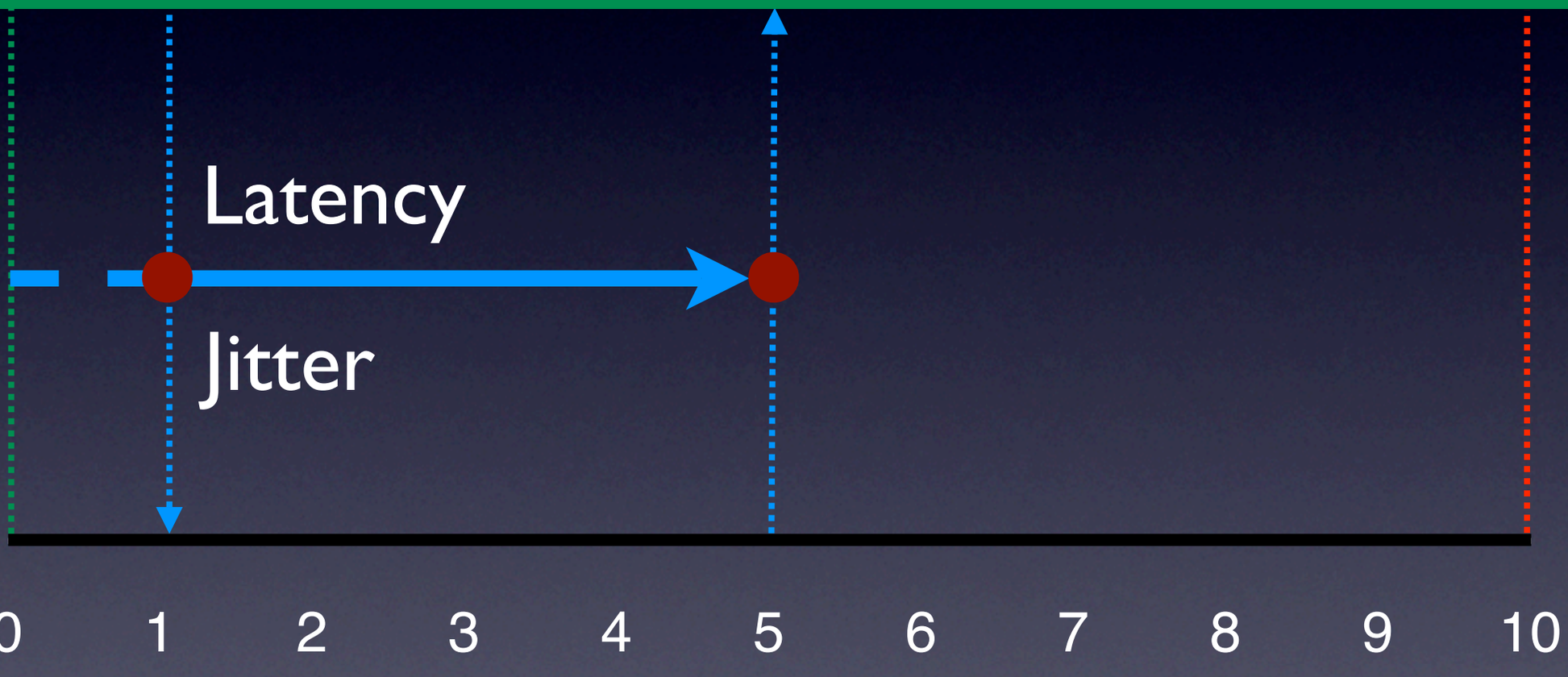
Control System

Control Software



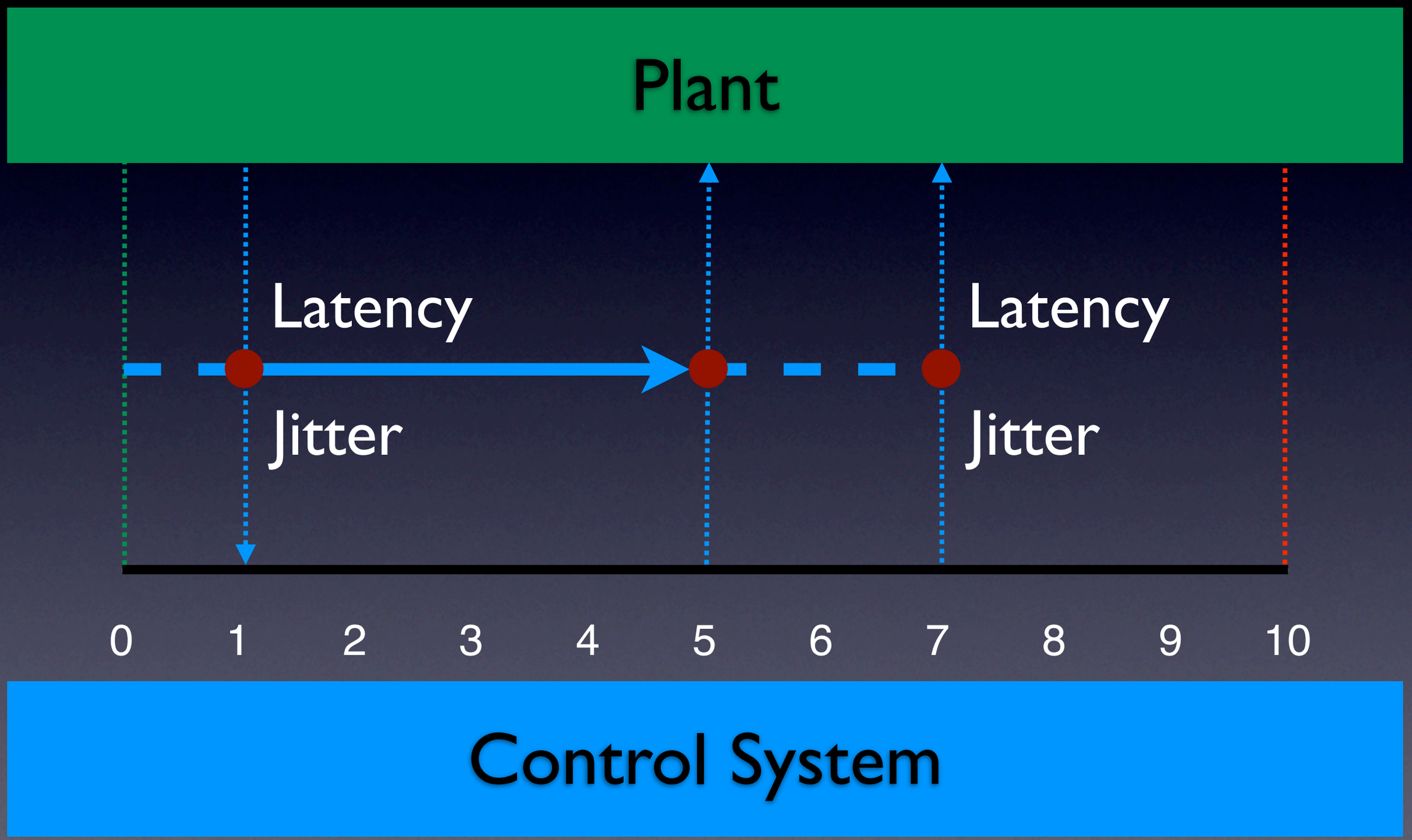
Control Software

Plant



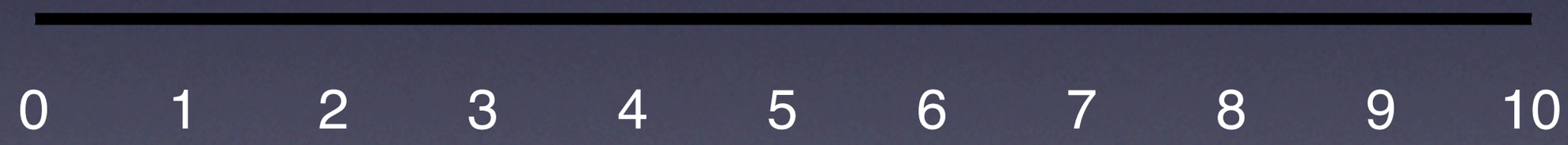
Control System

Control Software



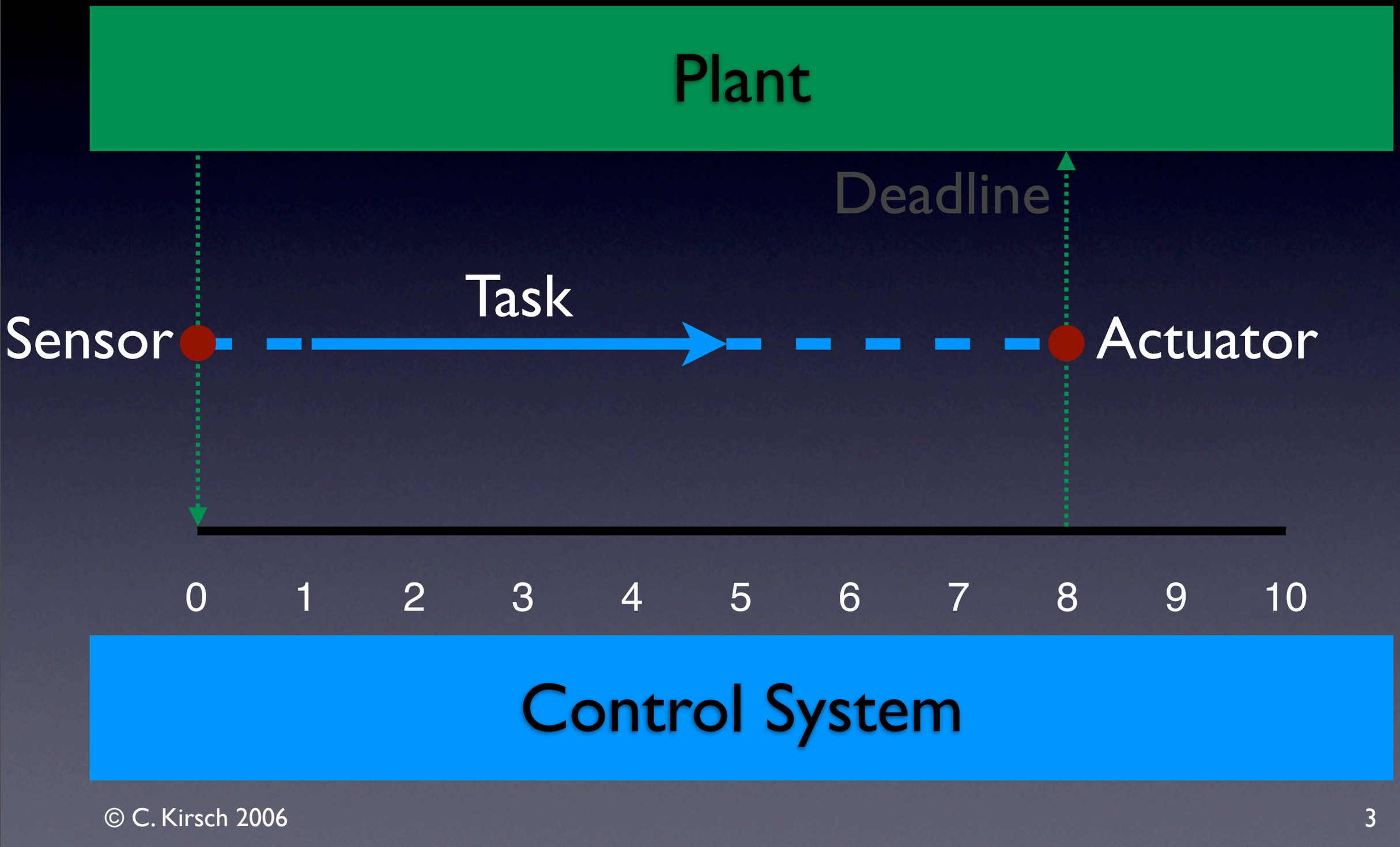
I/O Behavior

Plant

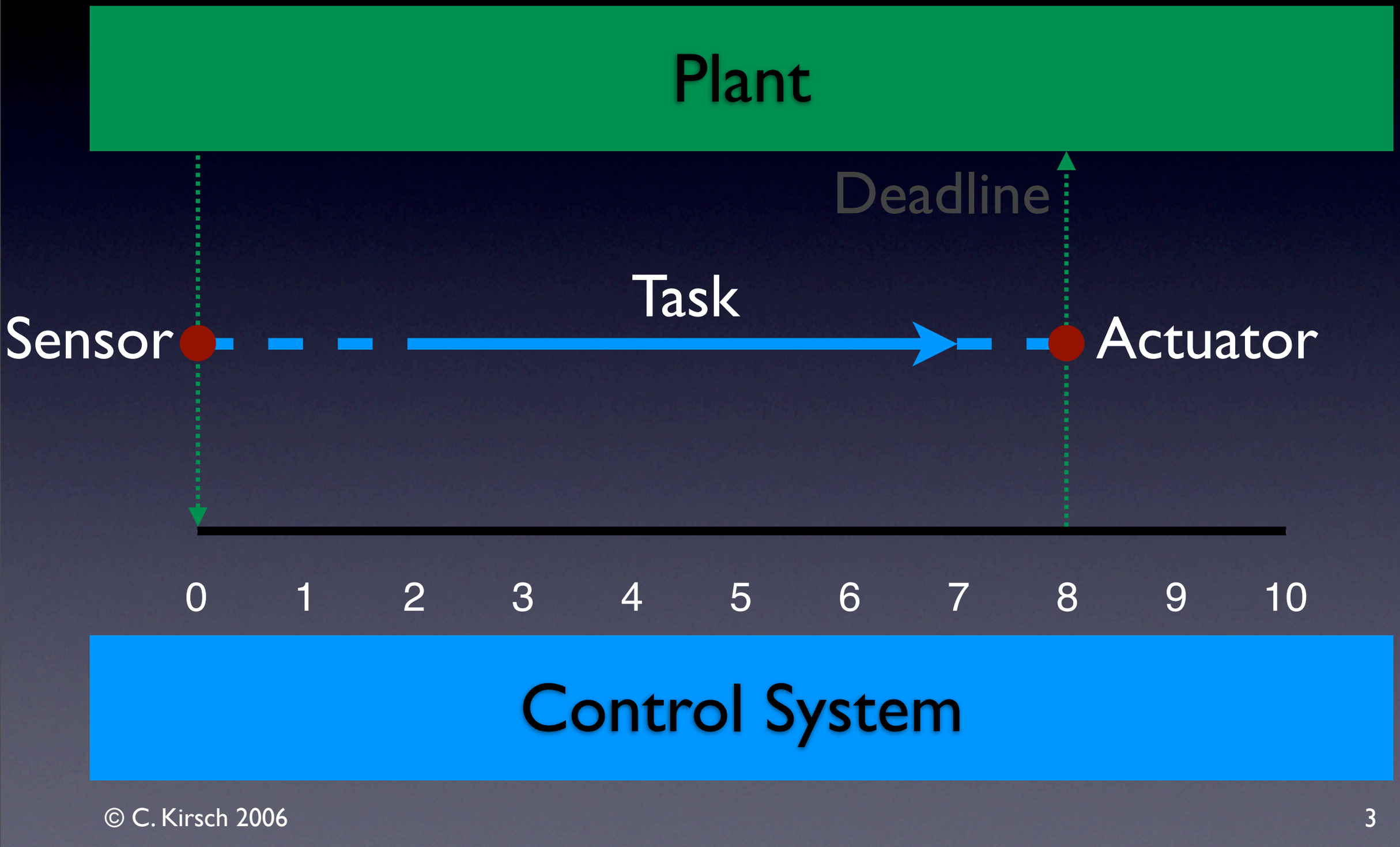


Control System

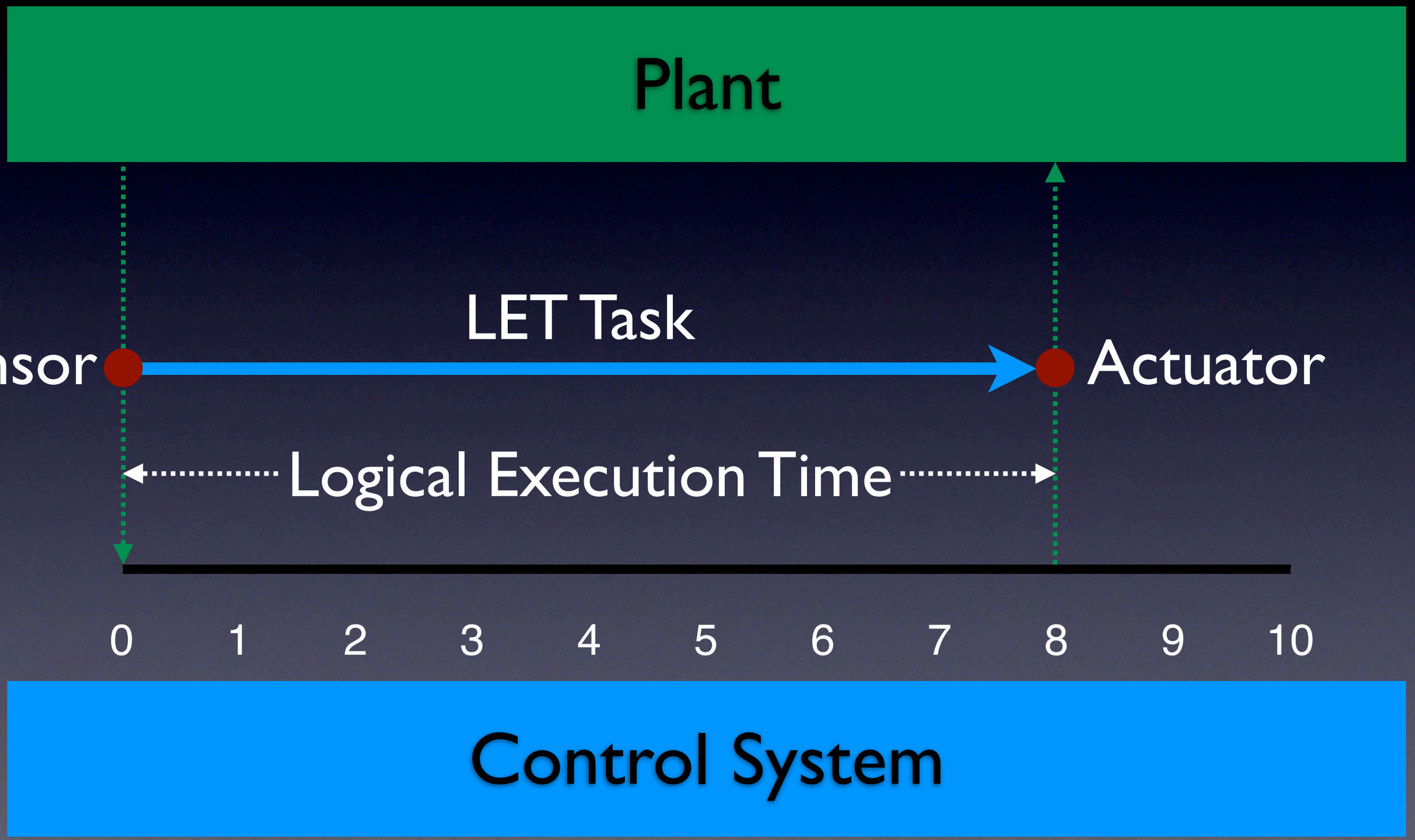
I/O Behavior



I/O Behavior



Logical Execution Time



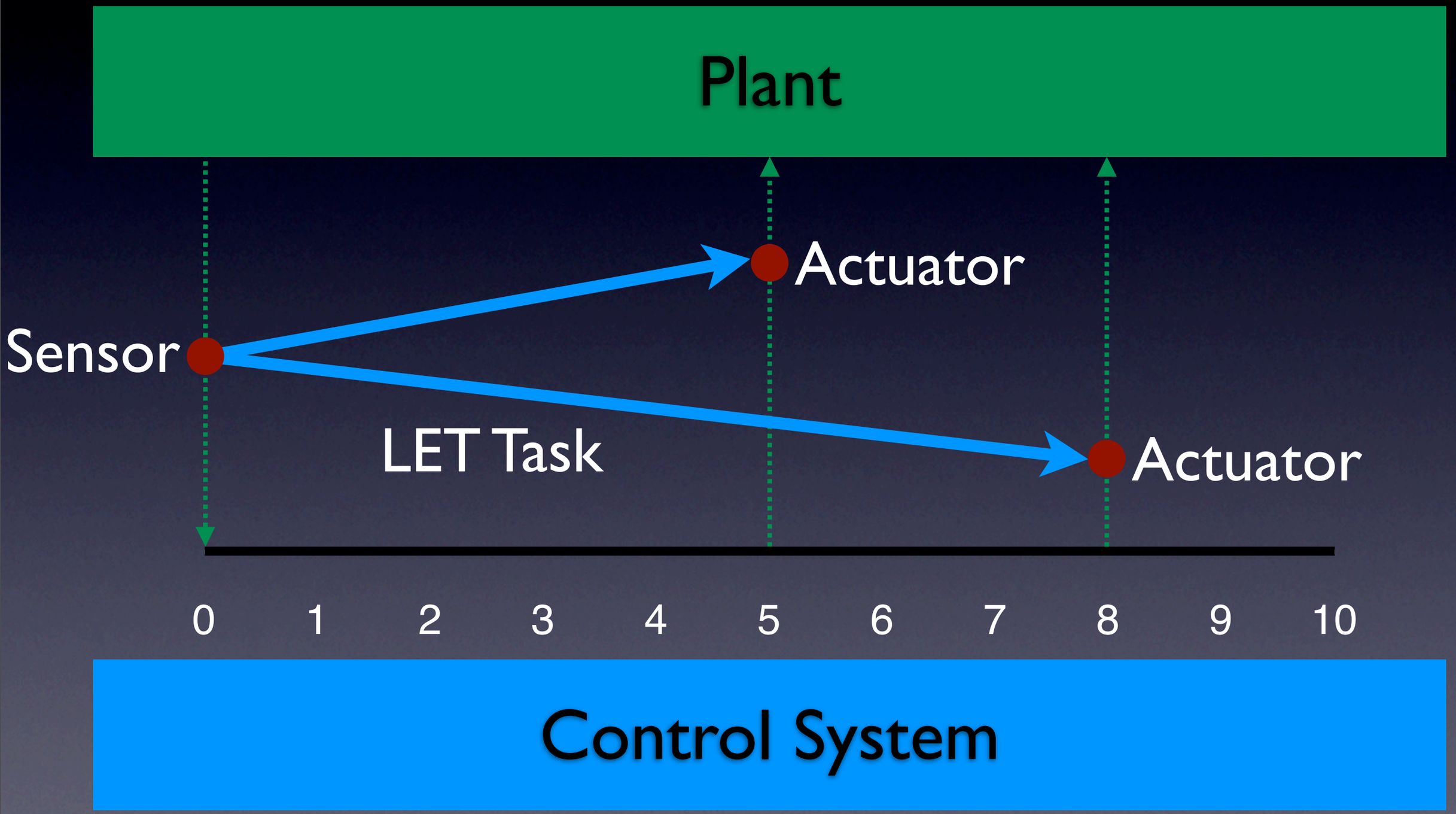
Definition

Plant

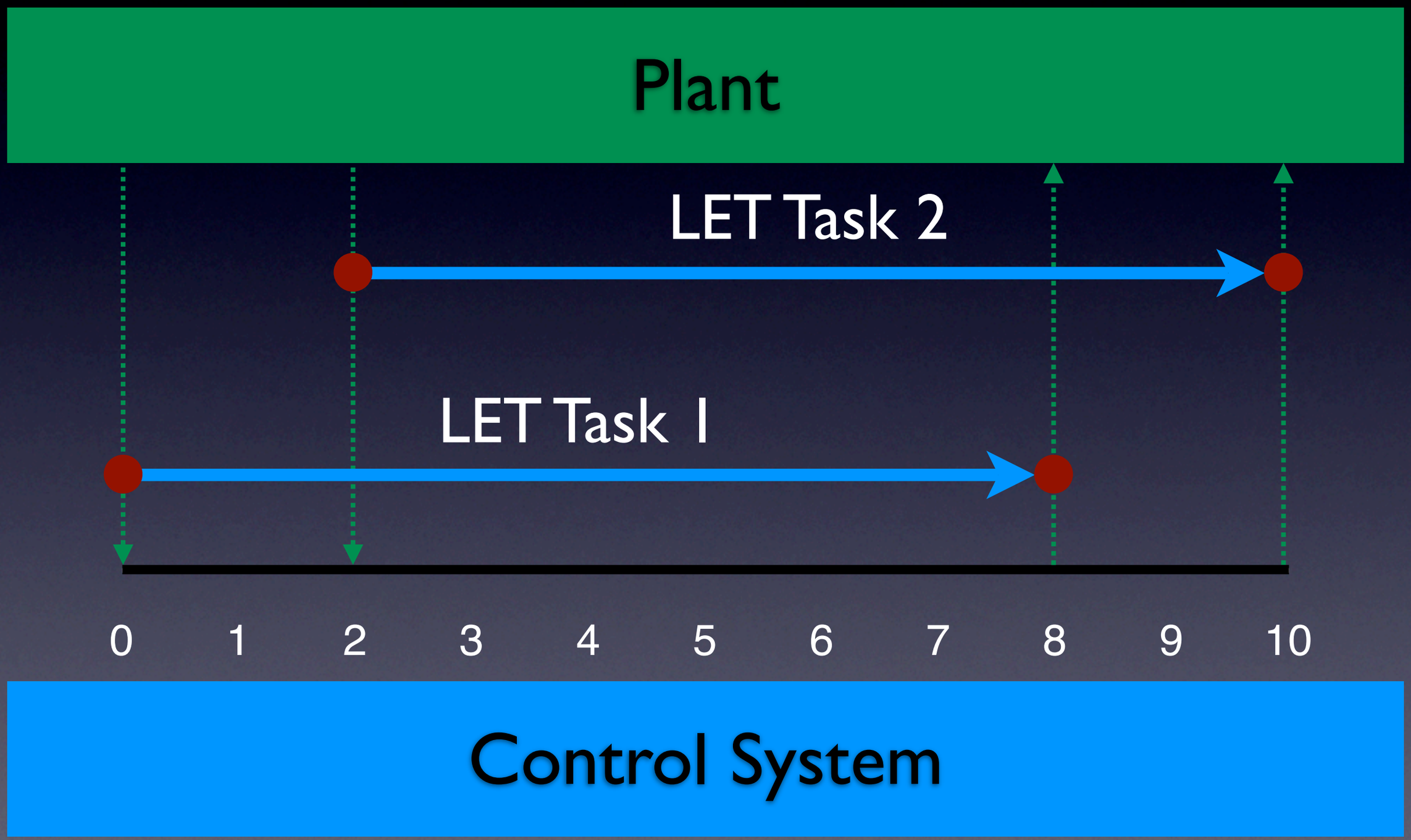
A system's I/O behavior is *input-determined* if,
for all sequences *I* of input values and times,
the system always produces
unique sequences *f(I)* of output values and times.

Control System

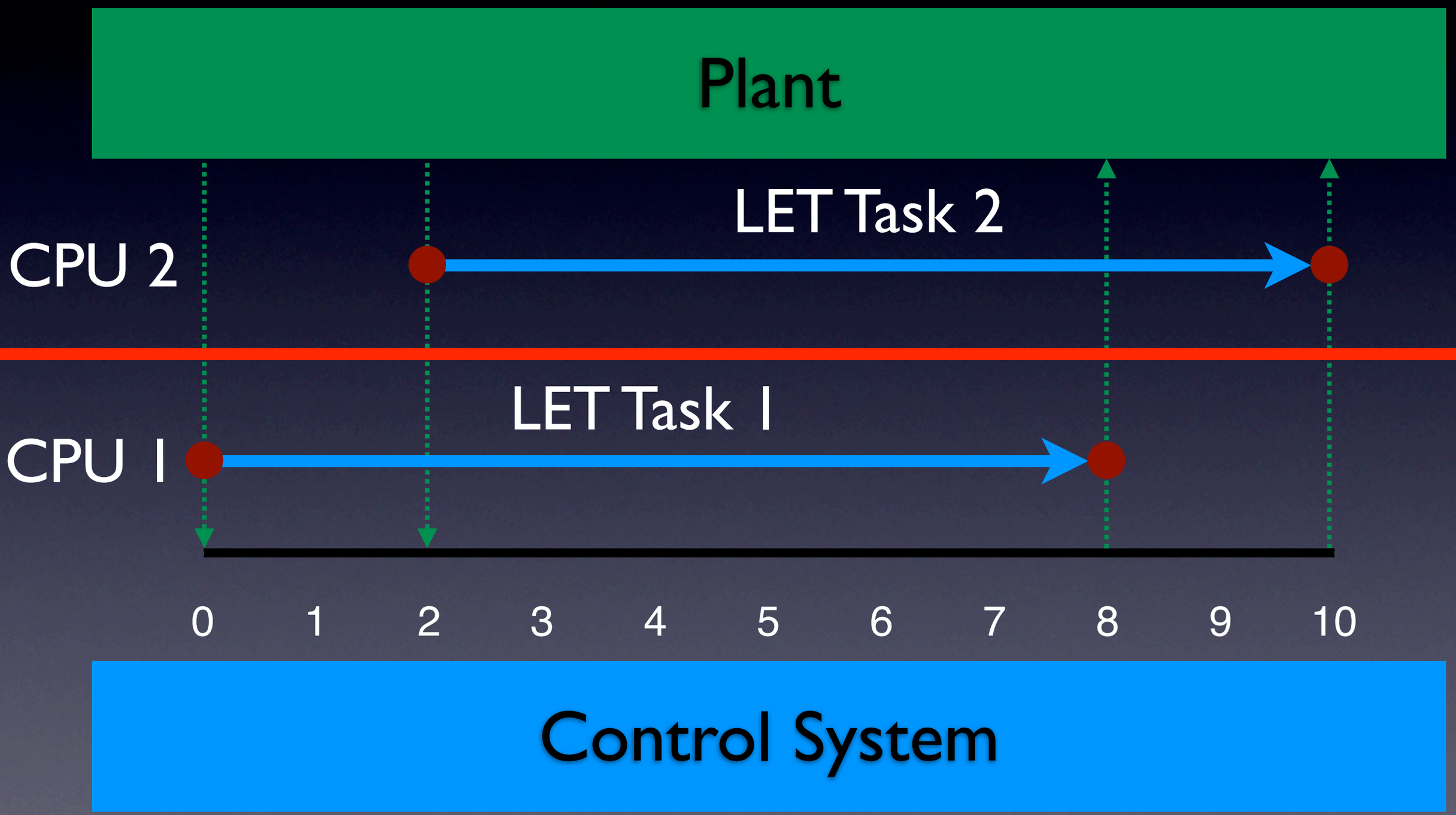
Choice



Concurrency



Distribution



Time Safety

Plant

Deadline

Time-Safe Task

Sensor

Actuator

Control System

Observation

Plant

A LET program's I/O behavior
is input-determined on any platform
that runs the program time-safely.

Control System

Giotto, 2001

From Control Models to Real-Time Code Using Giotto

[with Henzinger, Sanvido, Pree in the IEEE Control Systems Magazine, 2003]

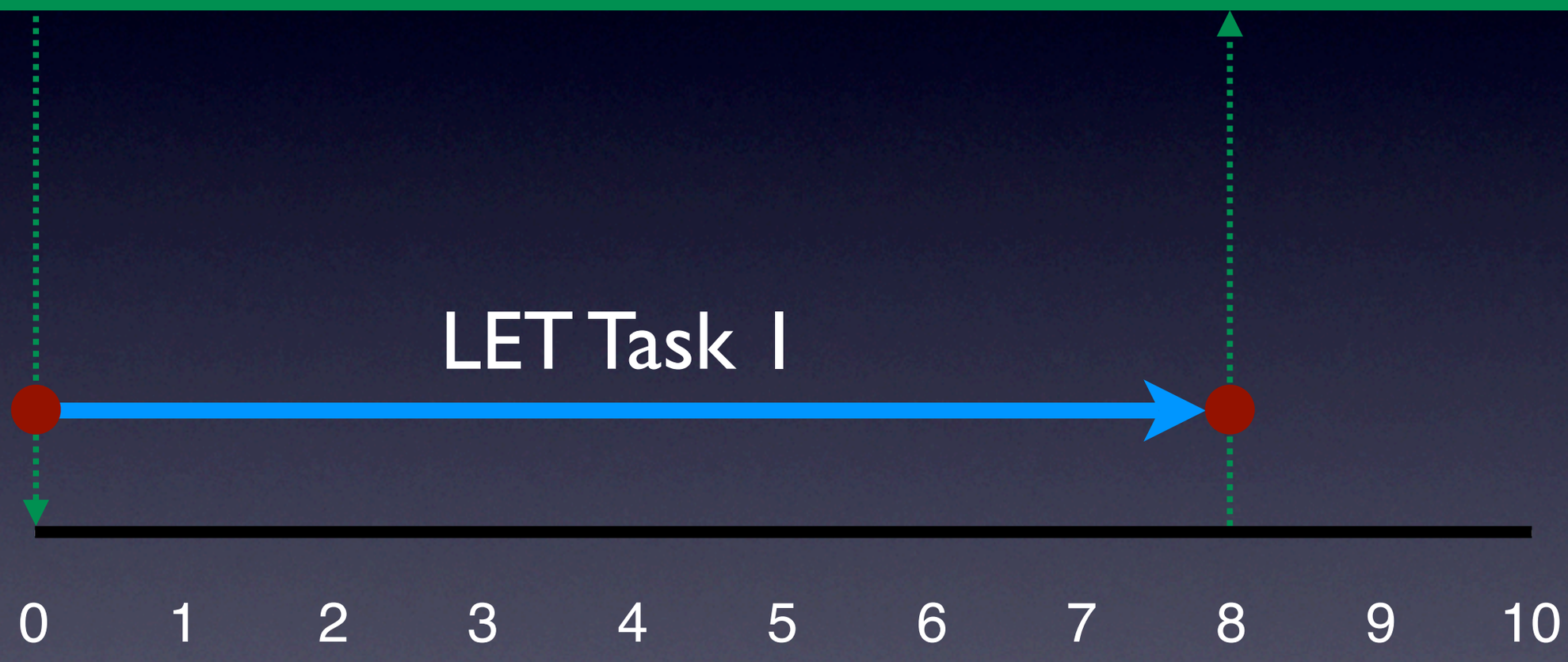
HTL, 2006

“Compositionality in design and analysis”

[with Ghosal, Henzinger, Iercan, and Sangiovanni-Vincentelli at EMSOFT, 2006]

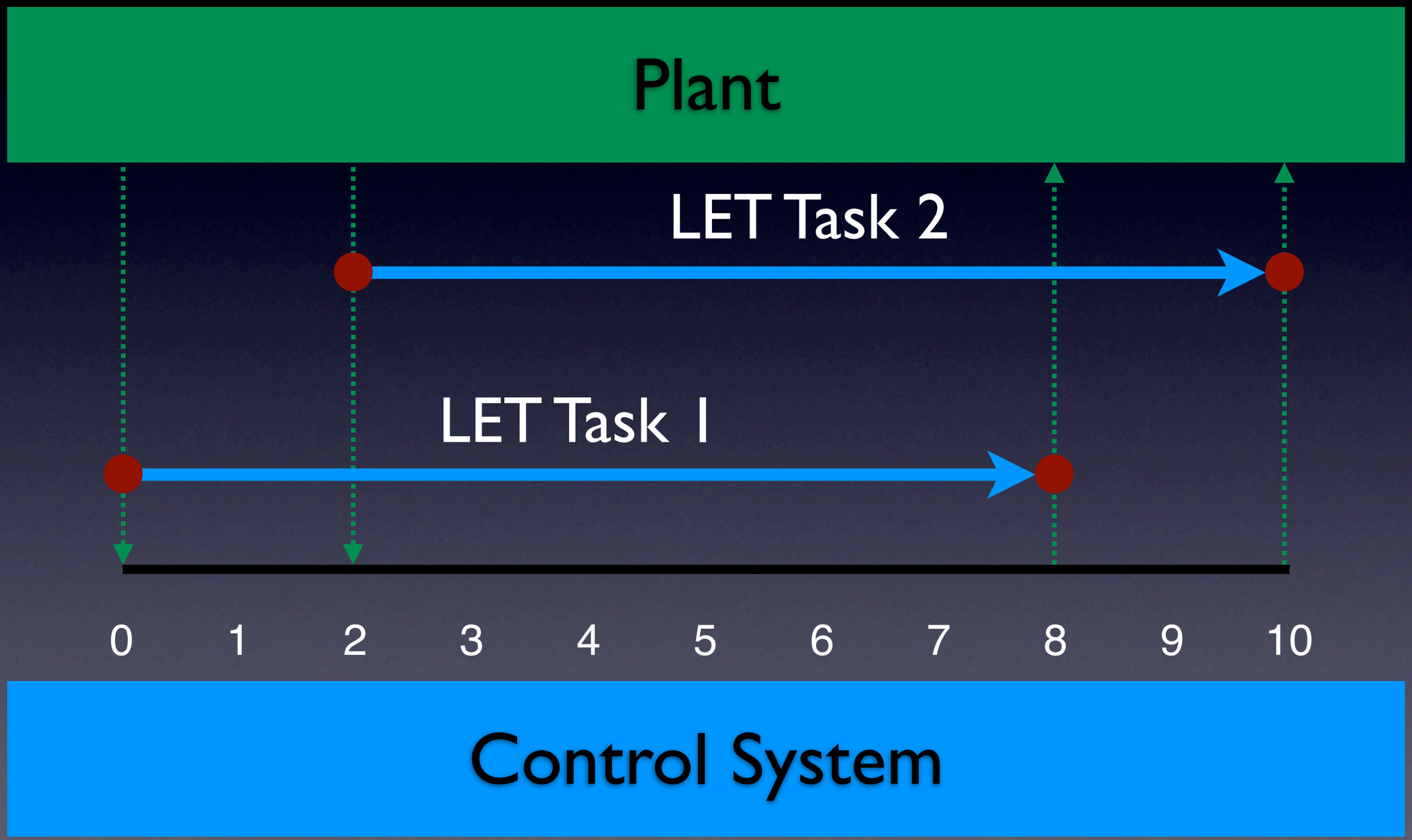
Design: Adding Tasks

Plant



Control System

Design: Adding Tasks



Observation

Plant

A LET program's I/O behavior
does not change by adding new tasks.

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Analysis: Refining Tasks

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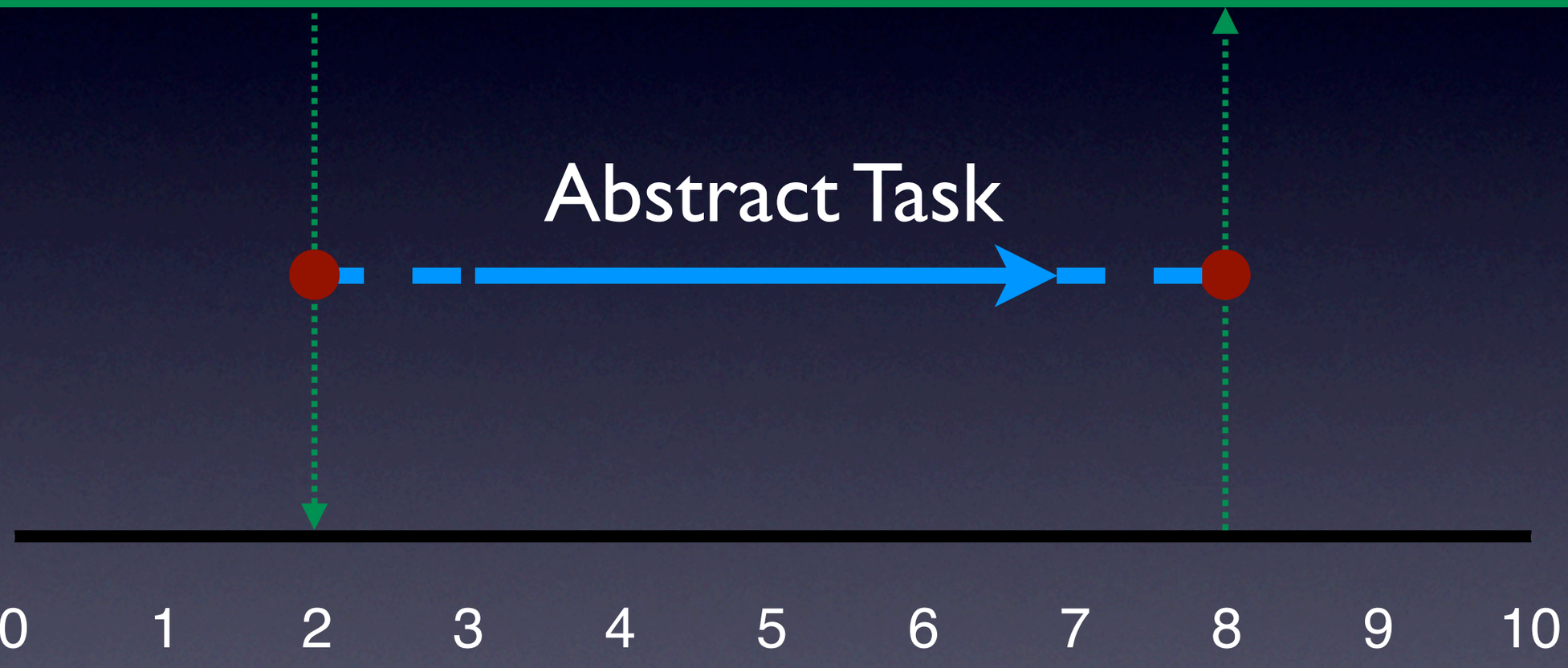


Control System

Analysis: Refining Tasks

Plant

Control System

Observation

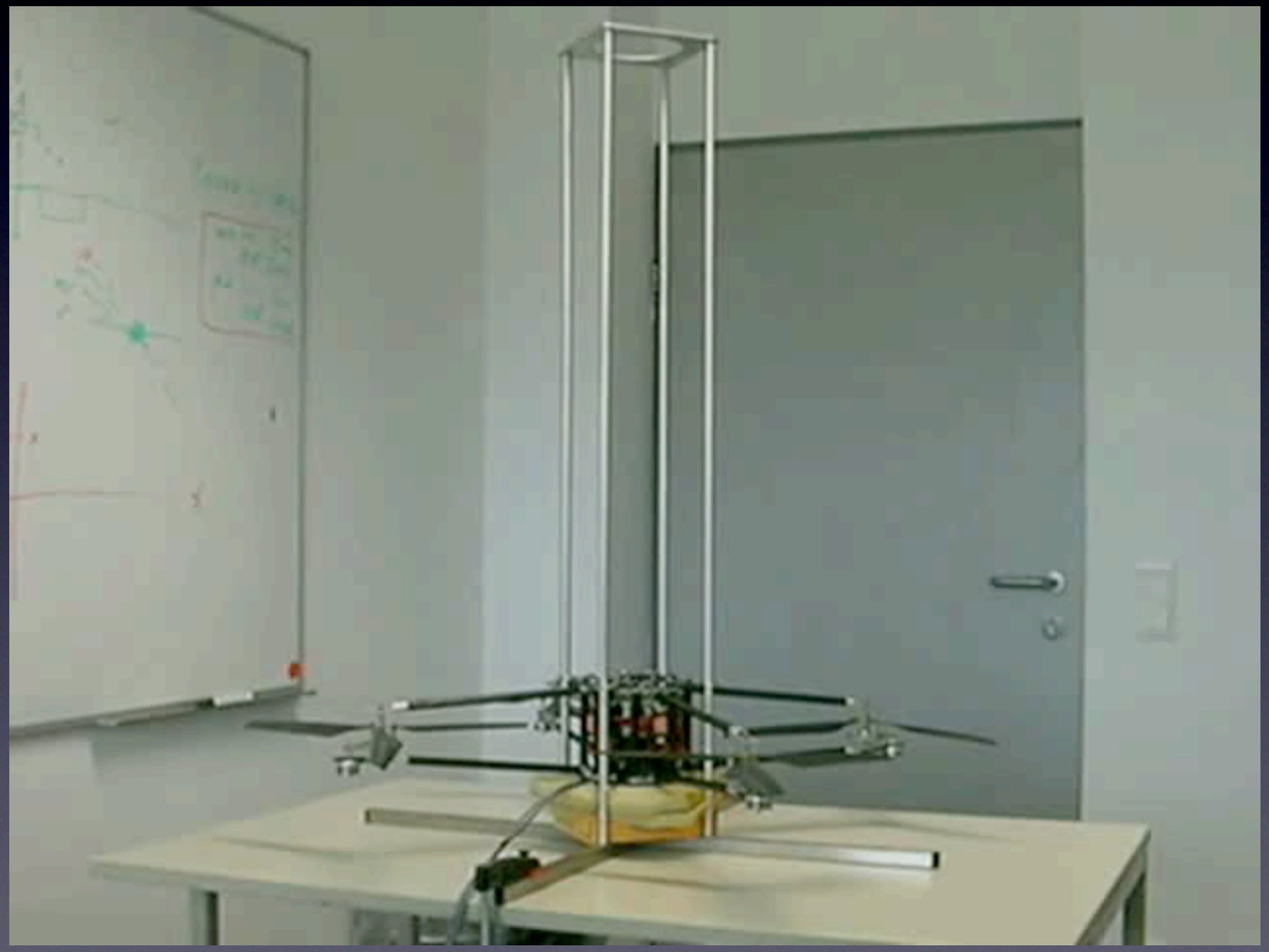
Plant

A concrete LET program is time-safe
if it refines a time-safe, abstract LET program.

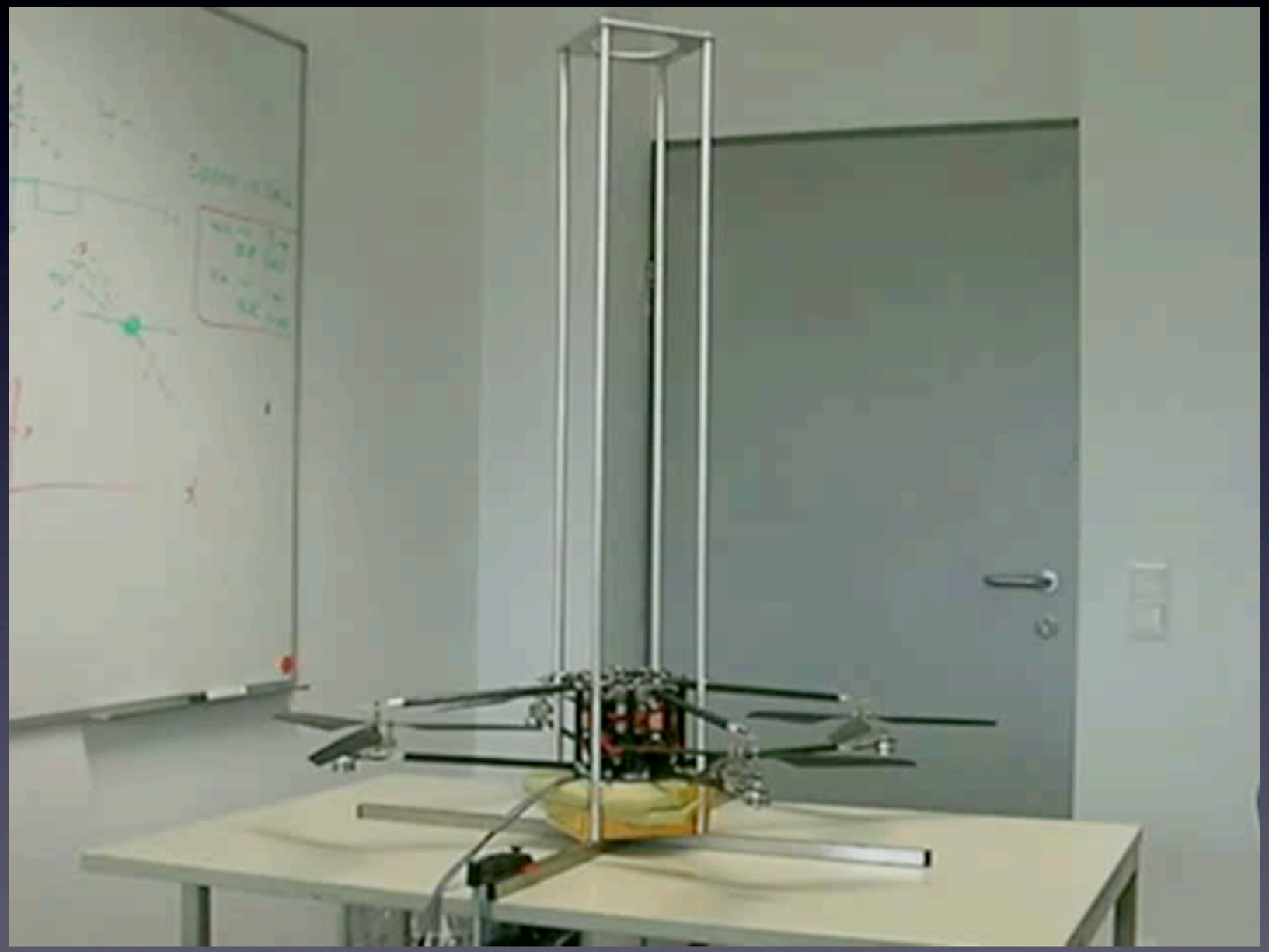
Control System

The JAviator Project

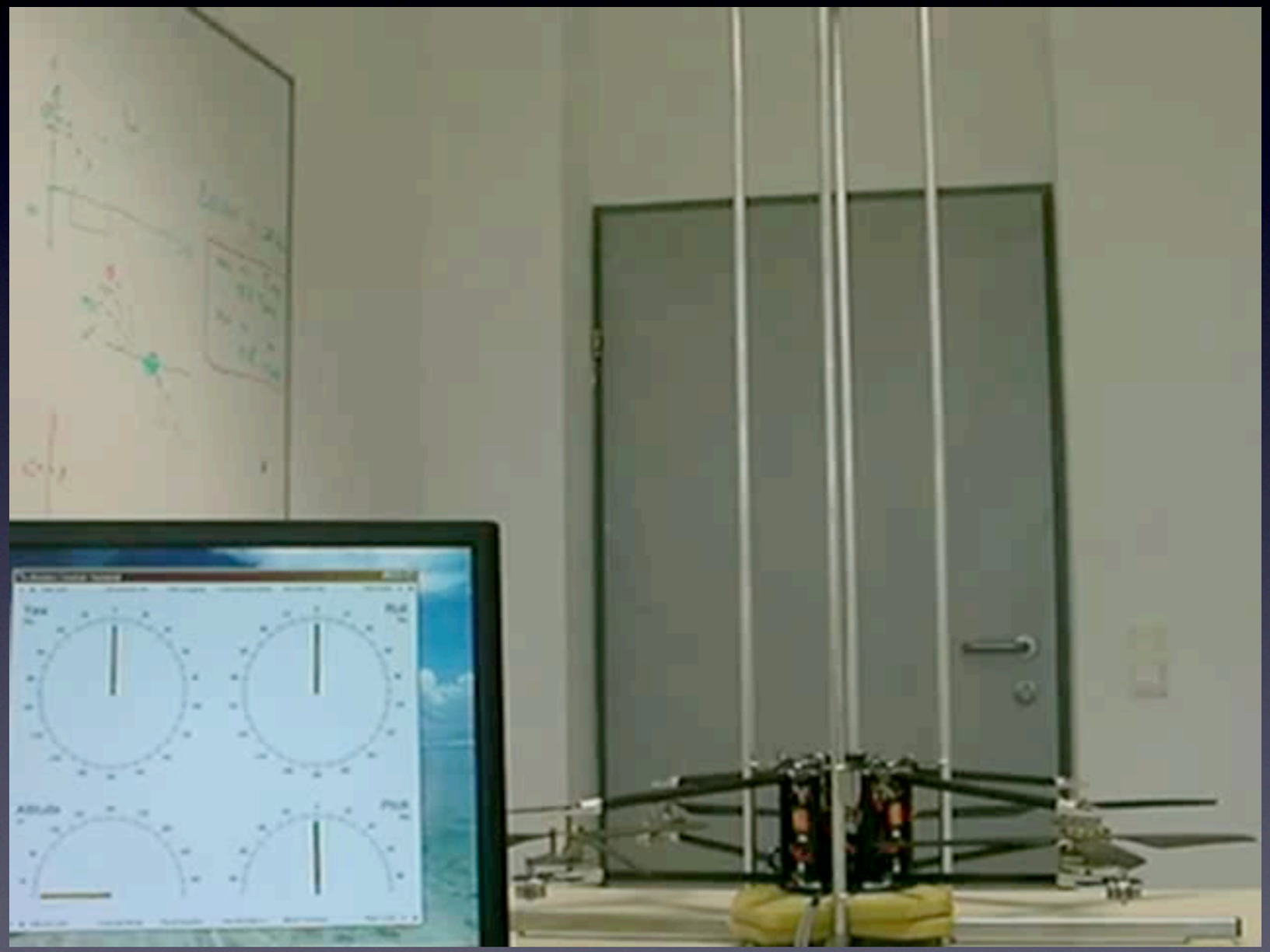
Manual Control



Oscillation



Altitude Control



Thank you