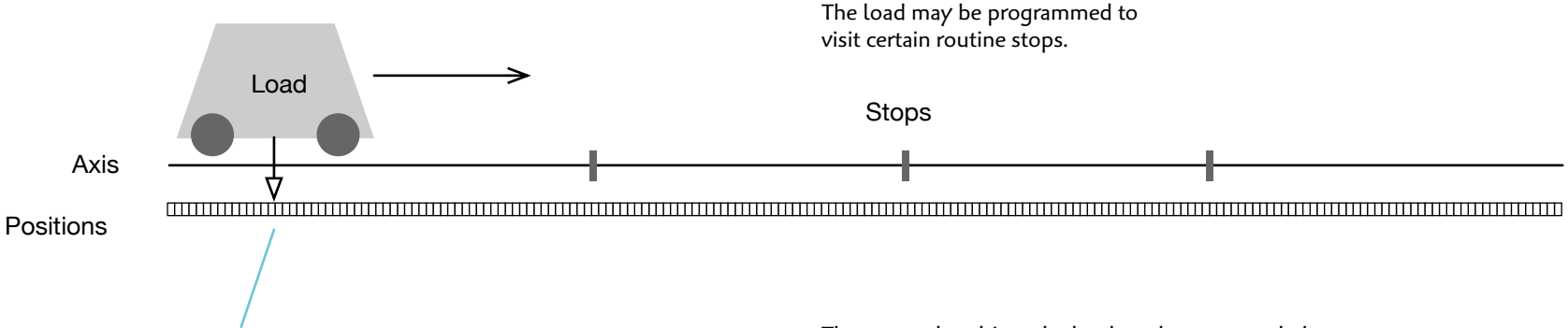
A simple transport domain concept

Leon Starr
August 18, 2017
mint.elev3.trans.tn.1
Version 0.1

MODEL INTEGRATION, LLC

Transport

A load can be moved along an axis



The load may be programmed to visit certain routine stops.

It's current position is reported by a sensor that detects some kind of increment. These could be stepper motor increments, optical markers, equally spaced sensors or some other technology that makes it possible to report the load's current position precisely.

The motor that drives the load can be commanded to a variety of speeds.

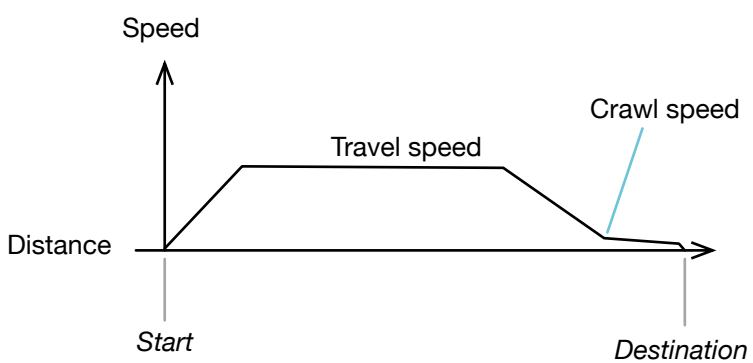
The crawl speed is a speed slow enough that we can guarantee that a brake command will stop the load precisely at a certain short distance. We must slow the load to crawl speed first and then command the braking at some point afterward.

Higher speeds are used to travel from one stop to the next. The further the distance between the origin and destination, the higher the speed that may be commanded.

By taking the speed and the mass into account we can compute the distance traveled before the crawl speed is attained.

Ramps can be precomputed for a variety of masses, speeds and distances.

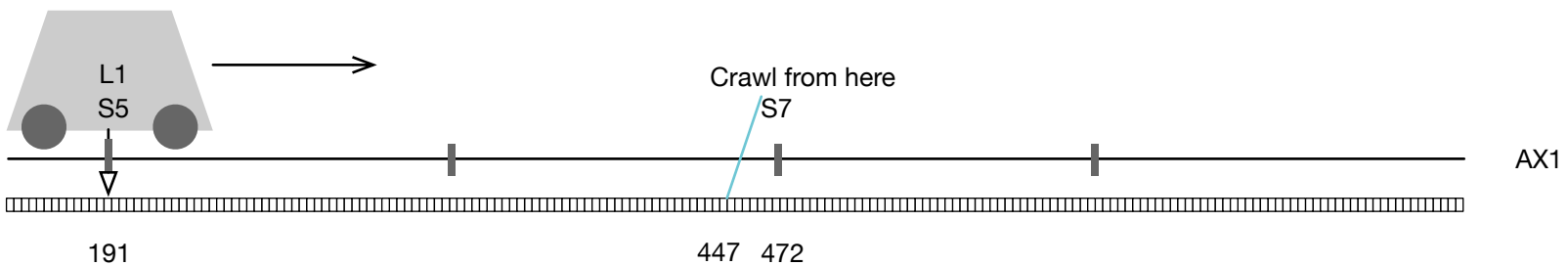
Motion Profile



Using a motion ramp

Now let's consider the process necessary to deliver a load to a stop position. Here load L1, currently at stop S5 which is at position 191 is commanded to move to stop S7 at position 472.

```
move( L1, S7)
```



We look up the distance between the two stops (472-191) = 281

We then look up the indicated travel speed for the appropriate distance range.

Distance range: 200-400 -> Travel speed 2

Now that we have the speed, we need to know the stopping distance. This is the distance that gets us down to crawl speed. The average mass of the load and other factors have been taken into account when pre-computing these values.

Travel speed 2: Braking 20 dist units

Adding the value for the minimum required crawl distance (to ensure a precise stop) and subtracting from the destination position we get the position where we need to command the crawl speed.

Min crawl distance = 5 dist units

472 - (20+5) = 447 dist units

We command the brakes when we arrive at the desired position, 472.

And we assume that the positions are spaced wide enough to enable precise control.

The ramp tells us to command speed setting 2 until position

Motor

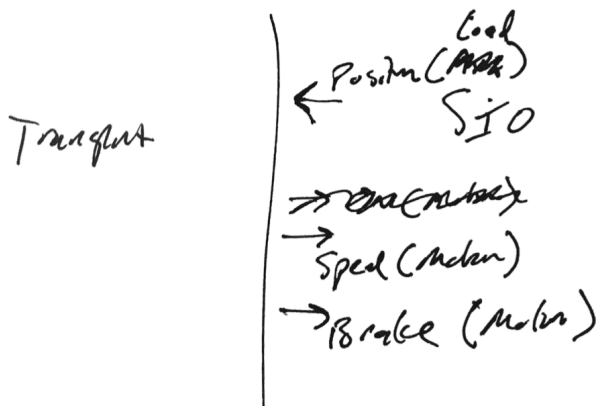
Damian
EV3

has various Speeds
including

Crawl speed
← moves slowly & quickly brakes

Cruise Speeds
↳ slow – short distance
↳ fast – long distance

Signal will tell us to brake
motor when at a floor
Position is reported by SIO



Big distance - f one floor

Each ramp specifies
a brake distance
a cruise speed

passing markers