Some Issues of Mulitilane CA Traffic

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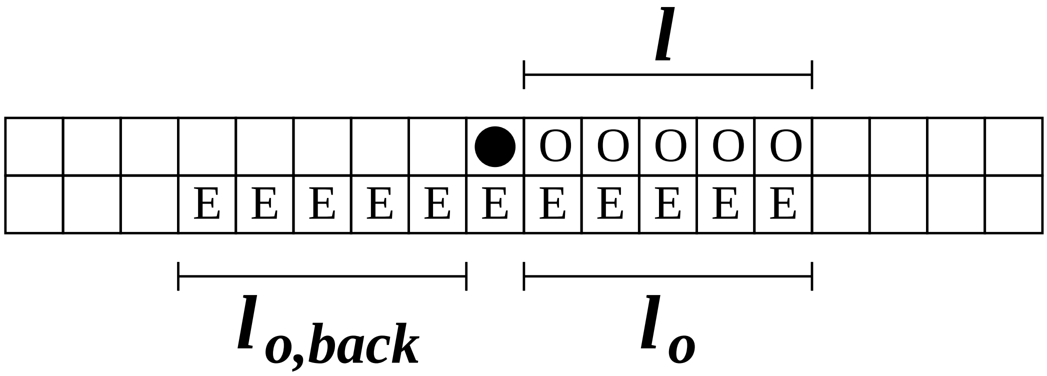
Lane Changing Rules for Timestep t_n



l	look ahead same lane
l_o	look ahead other lane
$l_{0,back}$	look back other lane

Rule Types

Rules subdivide into distinct types:

what	dependant on
wish	config at t_{n-1}, route plan
permission	config at t_{n-1}, route plan
permission	config at t_n

The last type only applies if $\#lanes > 2$.

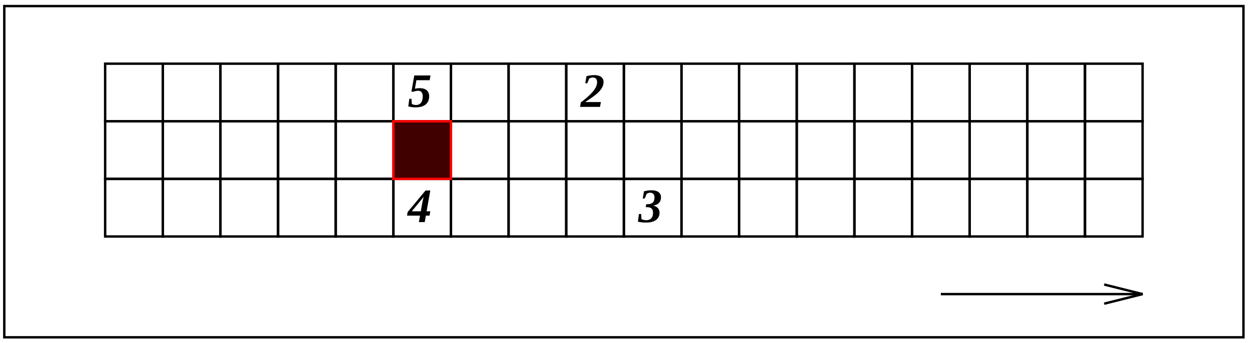
Multilane Update

time step	substep	action
t_n	a	take snapshot
		do lane change
	b	take snapshot
		do motion
t_{n+1}	$\ldots$	$\ldots$

$\#lanes = 2$: truly *parallel* because all decisions are based upon snapshot of t_{n-1}

$\#lanes > 2$: *collisions* caused by pairs of vehicles about to change to the same on the common neighbouring lane

Collisions



Possible Solutions:

- *Individual Random Decision* for each collision (additional marking, but realistic)
- *Biased Per Lane Update* (whole lanes are updated $L \rightarrow R$ or $R \rightarrow L$)
- *Random Per Lane Update* (whole lanes are update *randomly* $L \rightarrow R$ or $R \rightarrow L$)

Collisions

Questions

How big are the differences between the update types?

Is the effect generally negligeable due to the small actual number of collisions?

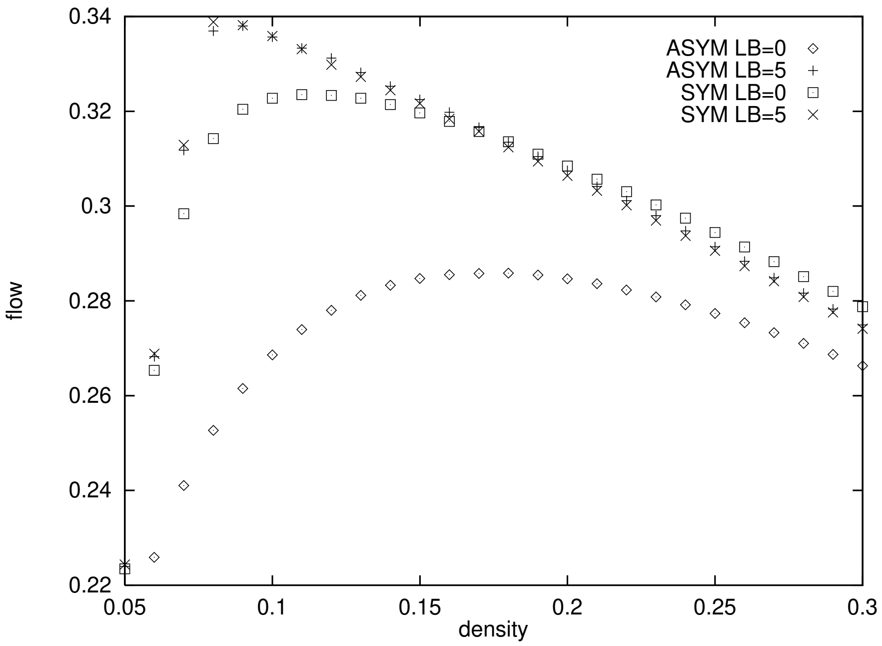
An Example: Latour II

symmetric	
asymm. $L \to R$	asymm. $R \to L$
$l = v + 1$	-
$l_o = v + 1$	$l_o = v + 1$
$l_{o,back}$	$l_{0,back} = v_{max}$

Observations

- $lookback > 0 +$ lane changing slightly improves throughput over single lane
- $lookback \sim 0$ seperates symmetric and asymmetric case
- *asymmetric:* density in right lane always higher than left lane

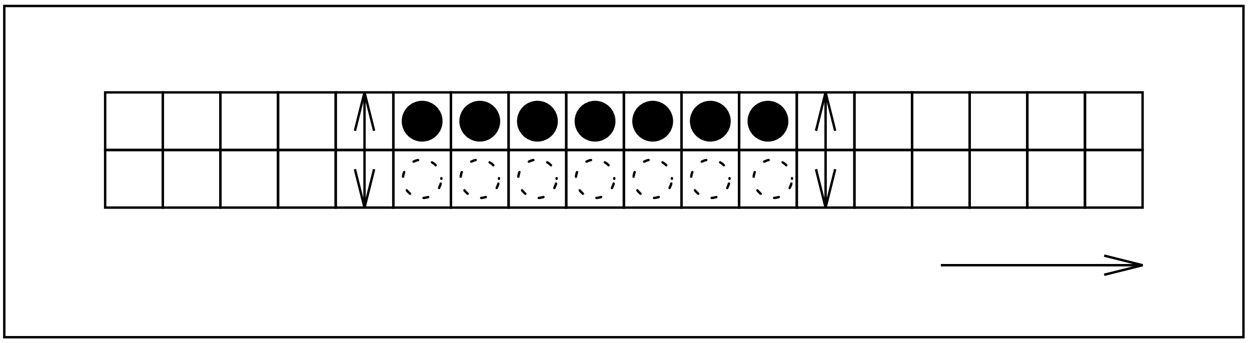
Importance of Lookback



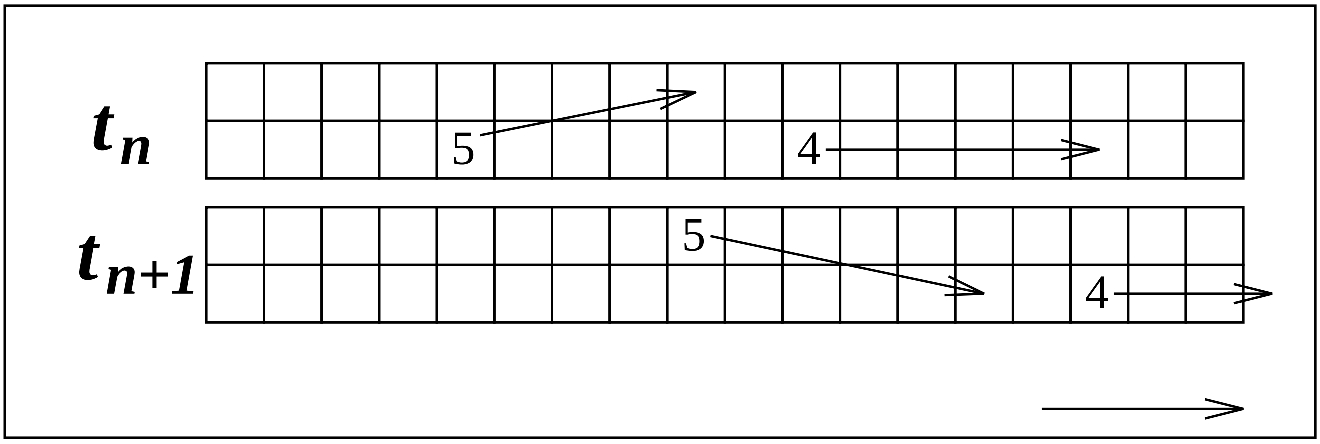
Artifacts

Ping Pong Lane Changes

At *high densities* vehicles cluster:

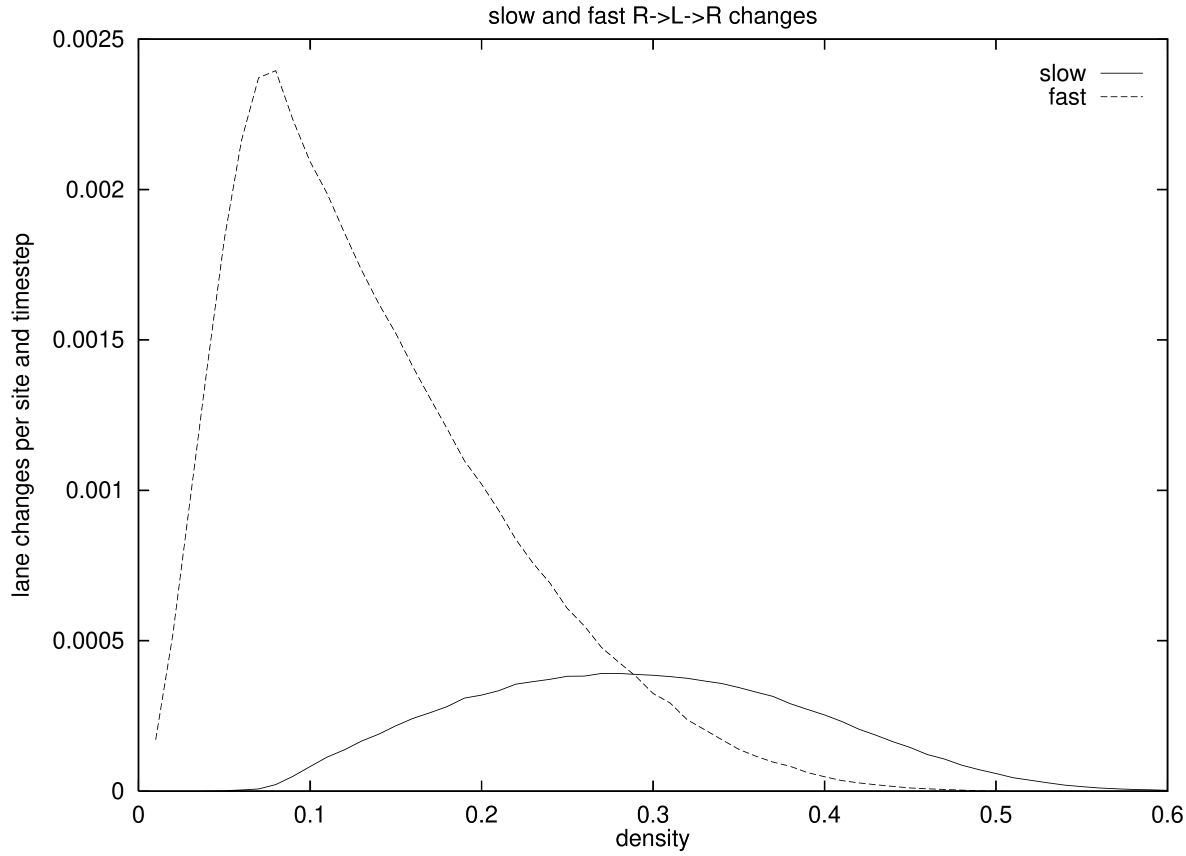


At free flow densities (asymmetric) passing often fails:



Introduction of stochasticity for lane changing considerably reduces ping pong lane changes!

Ping Pong Lane Changes at Low and High Densities



Multilane Traffic

Ping Pong Lane Changes