



CENTER FOR DATA-INTENSIVE CYBER-PHYSICAL SYSTEMS

Smart Signalized Intersections

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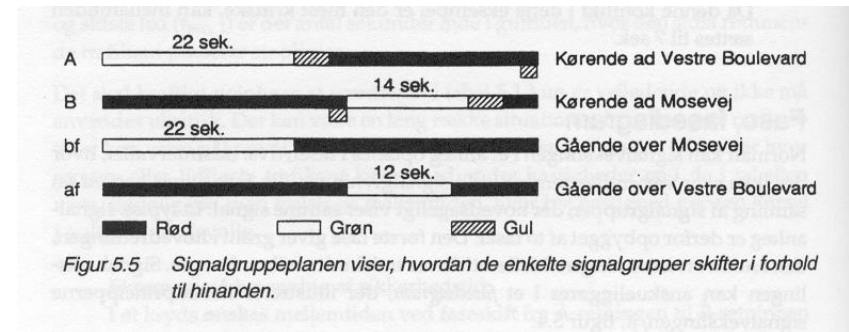
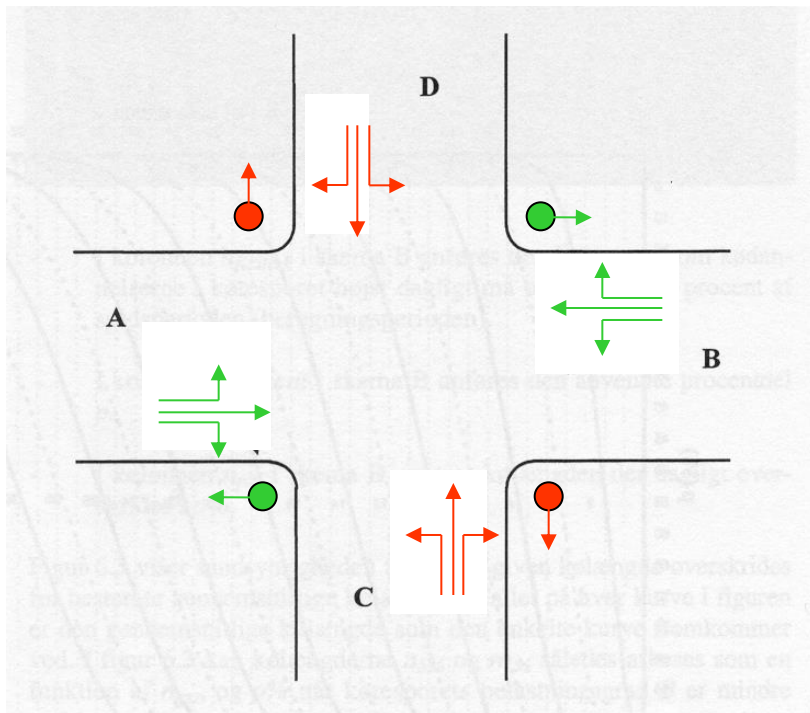
Mikkel Færgemand Hansen

Signalanlæggenes samfundsmæssige omkostninger

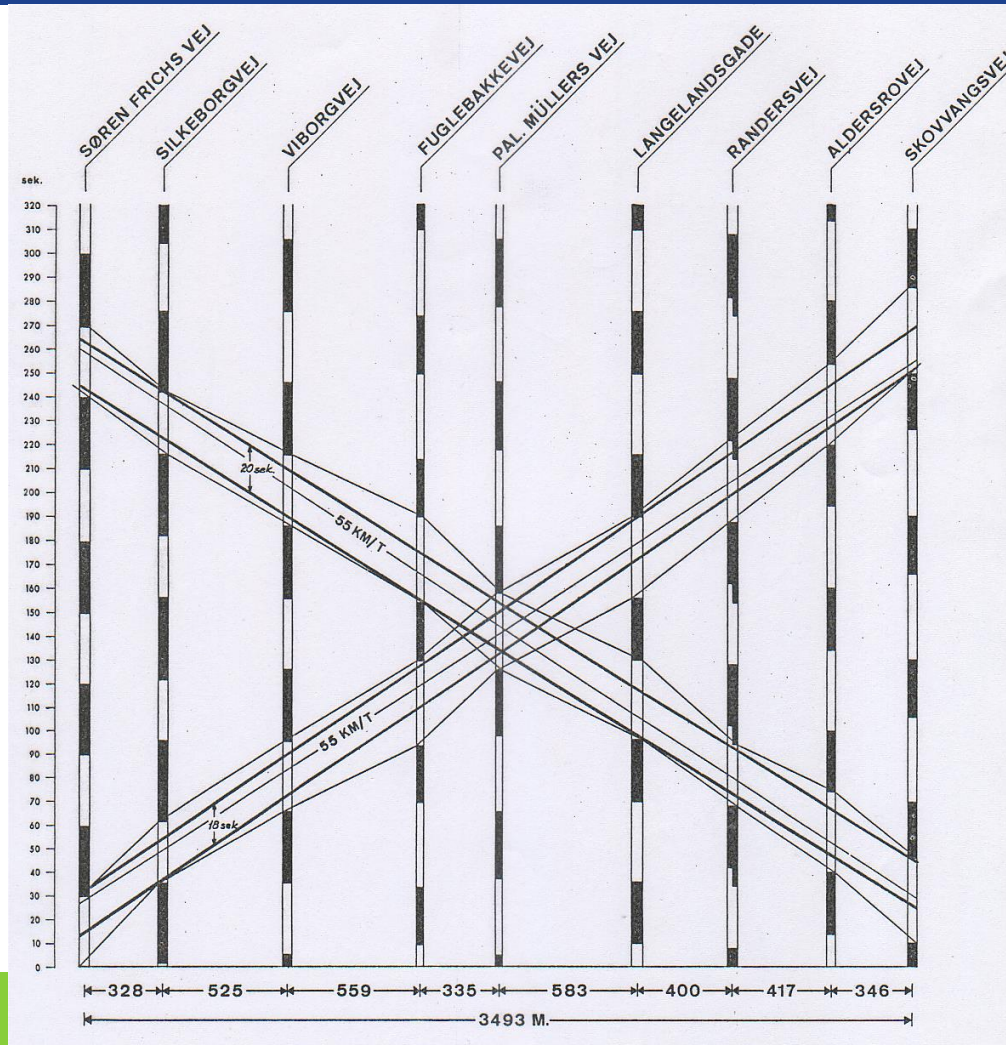
- Årlige samfundsomkostninger i danske signalanlæg:
14 mia. kr.
- Trafikanternes spildtid (69%).
- Brændstof (13%)
- Trafikulykker (18%)
- Drift og vedligehold af signalanlæggene (0,5%).
- 40 tons lastbil: 0,5 l diesel for at standse og accelerere igen



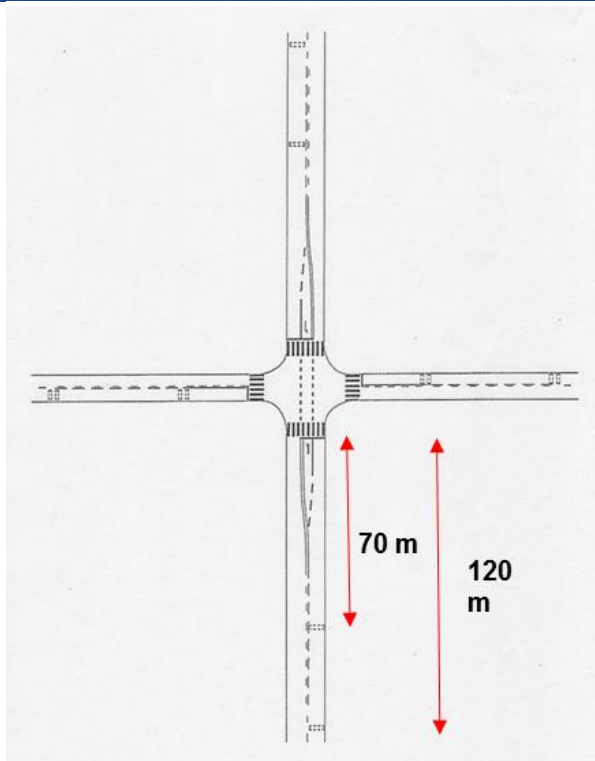
Traditionel styring af signalanlæg – tidsstyring – fast omløbstid



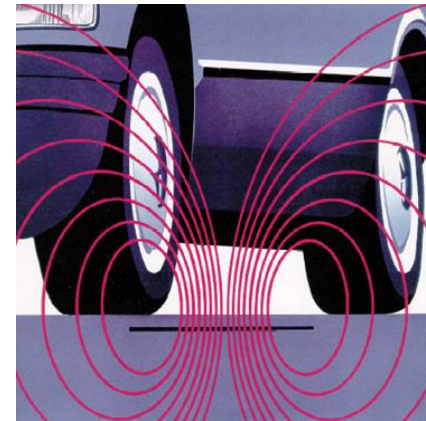
Grønne bølger – fast omløbstid

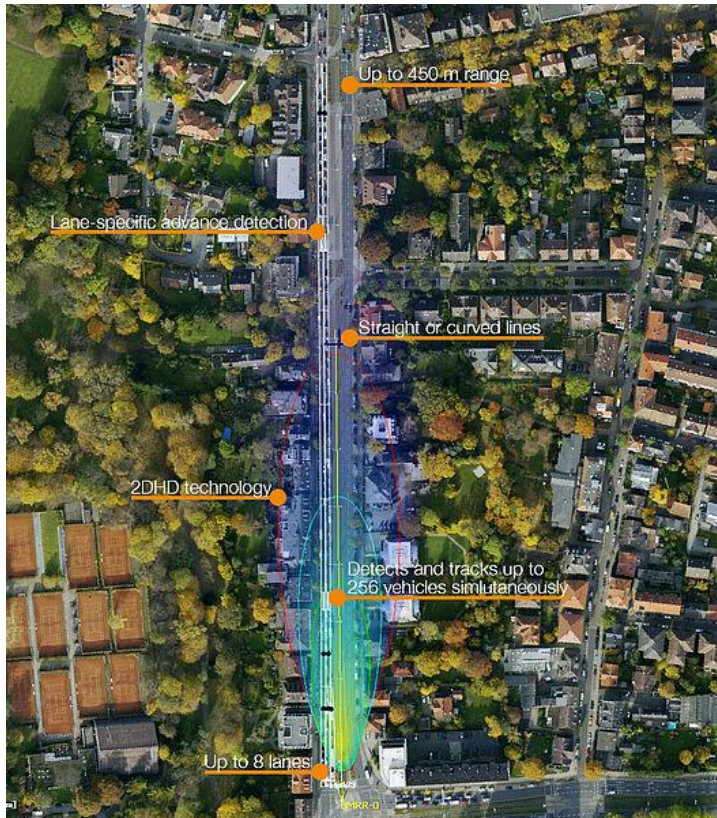


Trafikstyrede signalanlæg

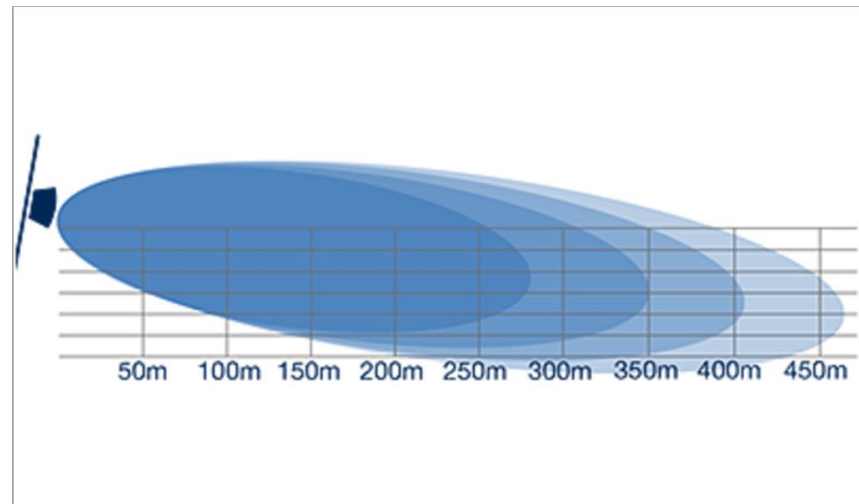


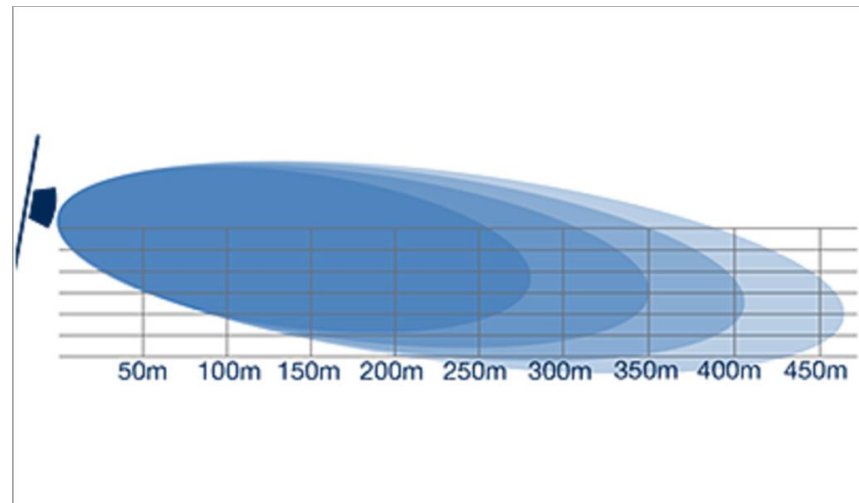
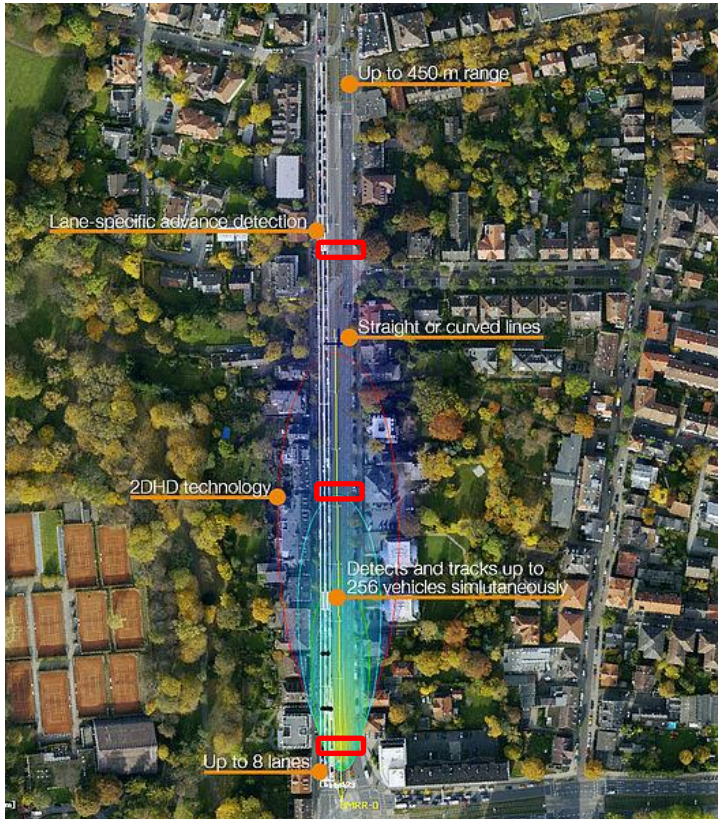
Forlængelsestid = 3,2 sek
V = 56 km/t
Gult = 20 meter før stopstreg





[Video](#)





Tværfagligt samarbejde i DiCyPS - Uppaal Stratego

- Optimeringessoftware Uppaal Stratego
- Kan udnytte den kontinuerte datastrøm fra radaren

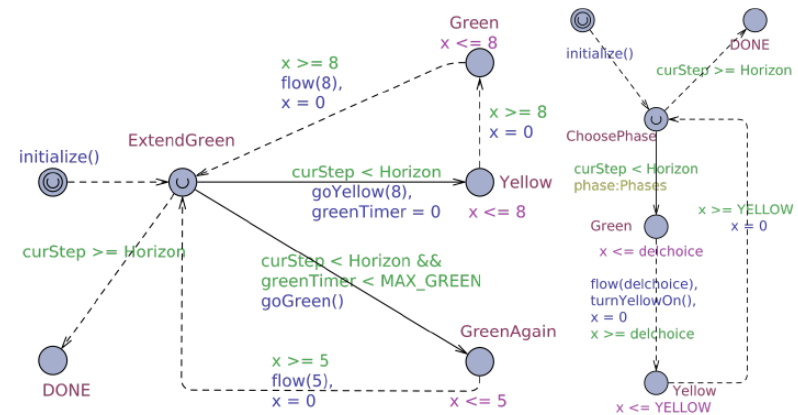


Fig. 5: UPPAAL STRATEGO Controller for green phase and yellow phase.

Uppaal Stratego for Intelligent Traffic Lights

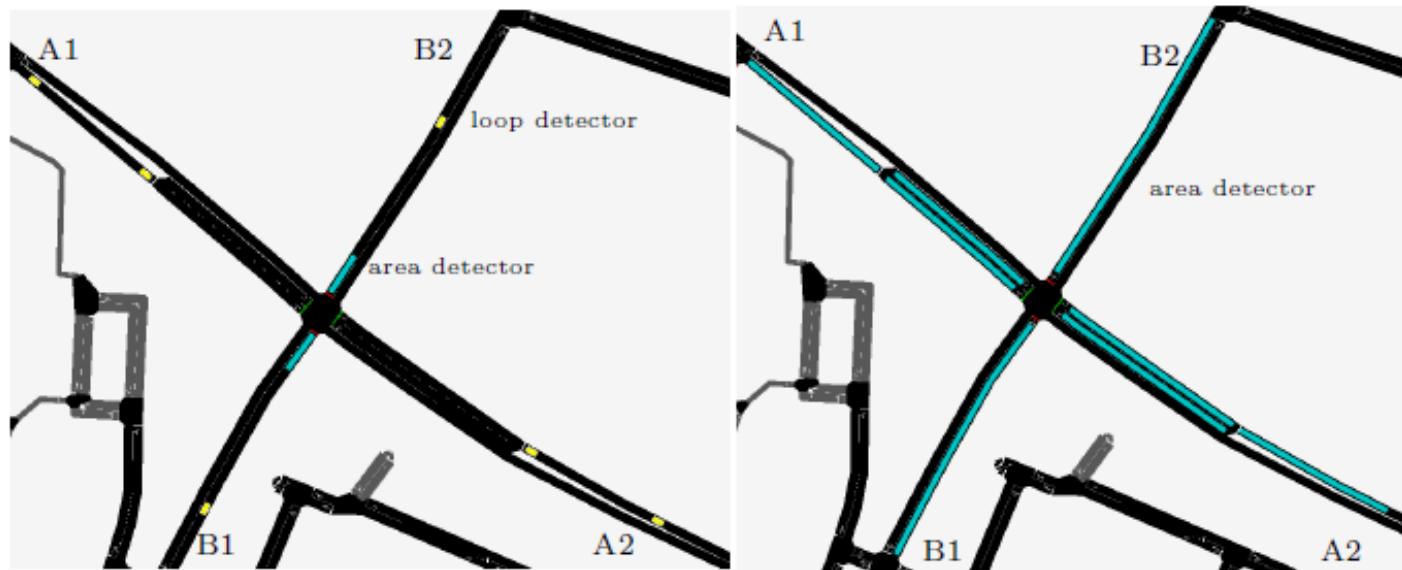


Fig. 4: Left) SUMO model for the loop controller. Right) SUMO model for the UPPAAL STRATEGO controller, the length of the area detectors coincide with the radars from the real crossing in Køge.

Uppaal Stratego for Intelligent Traffic Lights

Scenario	Direction	Delay in Seconds (Waiting Time)						Queue Length in Meters					
		Mean			95p			Mean			95p		
		Static Loop	STRATEGO		Static Loop	STRATEGO		Static Loop	STRATEGO		Static Loop	STRATEGO	
MAX	A1	19	7	10	69	49	52	23	10	13	67	45	60
	A2	25	8	9	87	50	47	31	11	12	105	45	54
	B1	69	89	25	221	300	77	24	31	8	142	188	45
	B2	108	169	28	263	389	88	44	68	11	188	286	53
	ALL	38	37	13	162	242	61	31	30	11	144	195	52
MID	A1	13	8	8	40	36	32	17	11	11	52	38	39
	A2	13	10	7	49	42	33	17	14	10	54	52	37
	B1	15	25	21	43	63	57	5	8	7	22	30	30
	B2	26	38	25	82	105	64	10	15	10	37	52	30
	ALL	15	14	11	48	61	44	12	12	10	45	45	37
LOW	A1	7	6	5	22	25	23	6	5	4	23	22	22
	A2	5	4	5	22	21	22	4	4	4	15	15	22
	B1	11	11	16	33	38	45	2	2	2	7	15	15
	B2	13	9	16	35	30	45	3	2	3	15	15	15
	ALL	7	6	8	29	26	30	4	3	4	15	15	15

Table 2: Results of the experiments. We show the mean and the 95 percentile for respectively the waiting time of the cars and the queue length. This is done for each controller in all scenarios.

Det videre arbejde

- Fra SUMO til VISSIM?
- Optimering af ”grønne bølger” (i VISSIM)
- Implementering i praksis – udvikling af controller baseret på Uppaal Stratego og input fra radar (Smart Micro)