BEHAVIORAL ASSUMPTION-BASED PREDICTION FOR HIGH-LATENCY HIDING IN MOBILE GAMES

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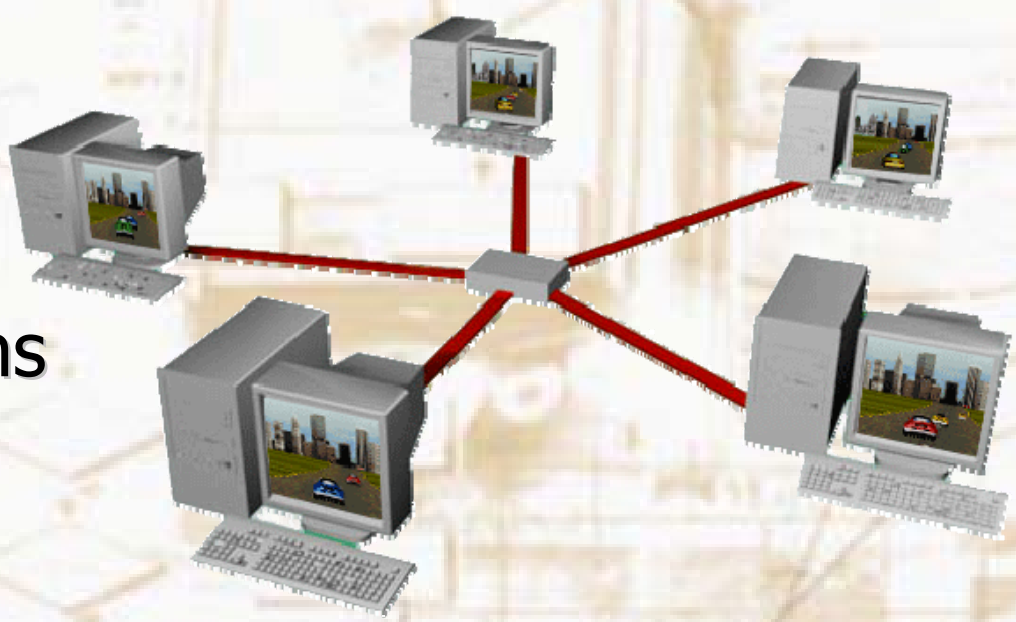
The problem

- Multi-player games
  - Fast-paced racing
- Network connections
- Latency



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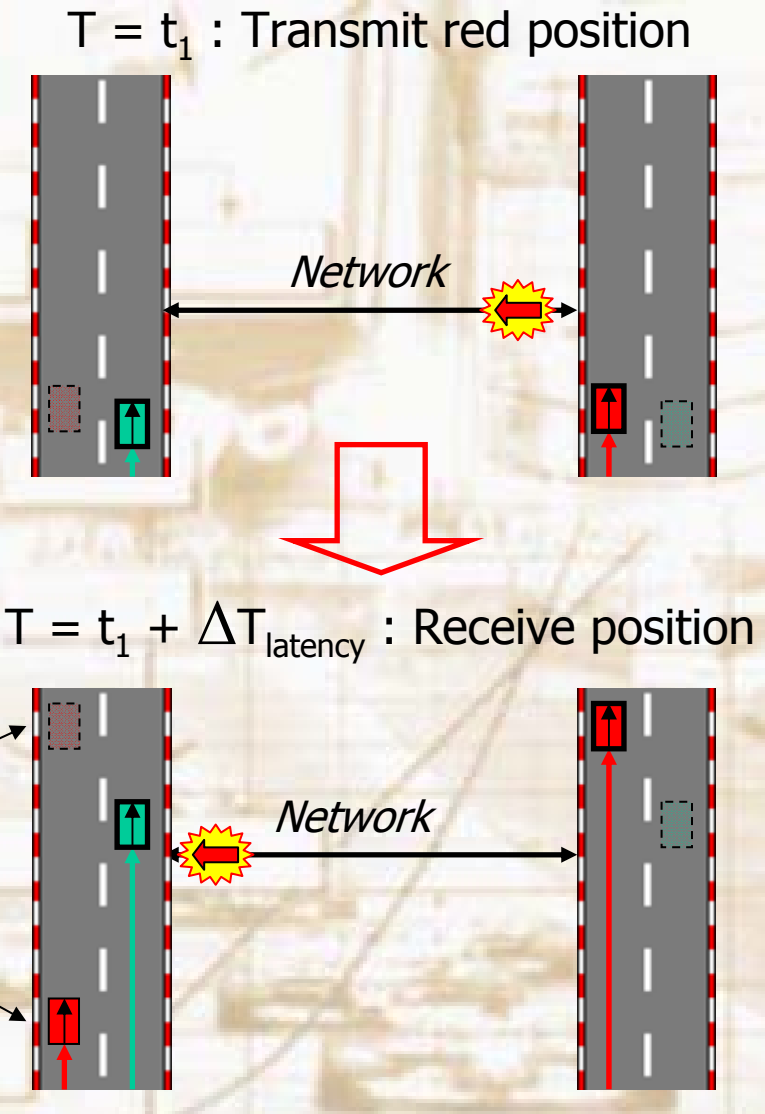
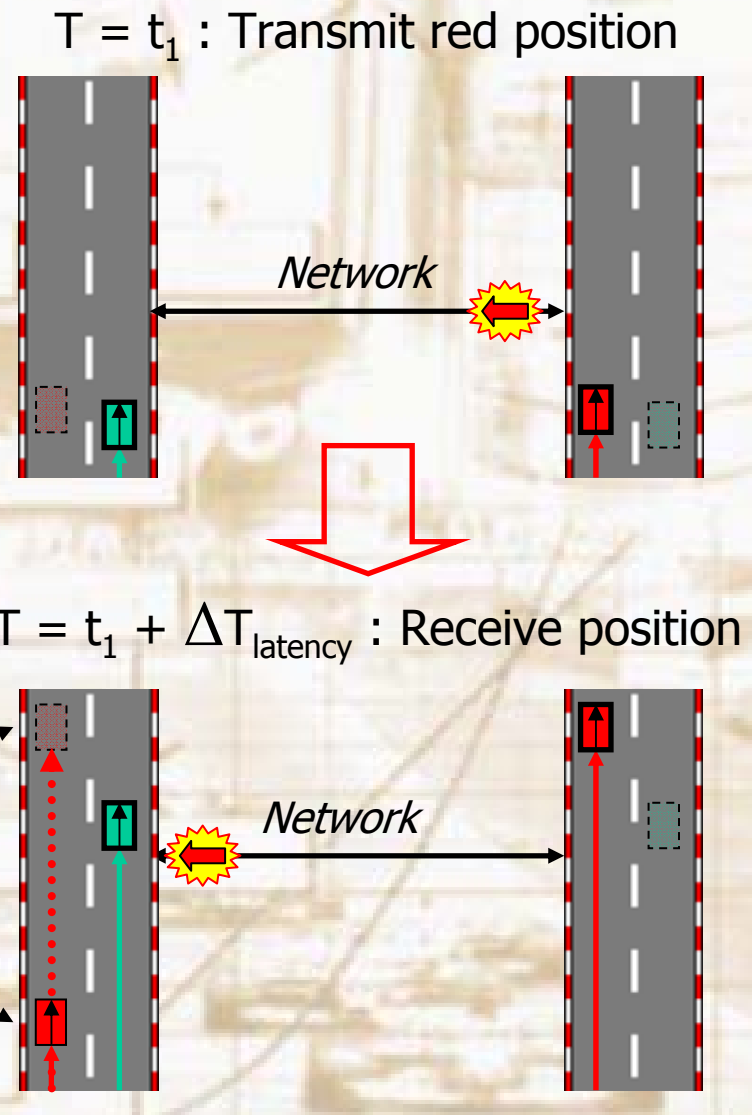


A common technique

- Prediction
- Prediction errors
- Dead reckoning



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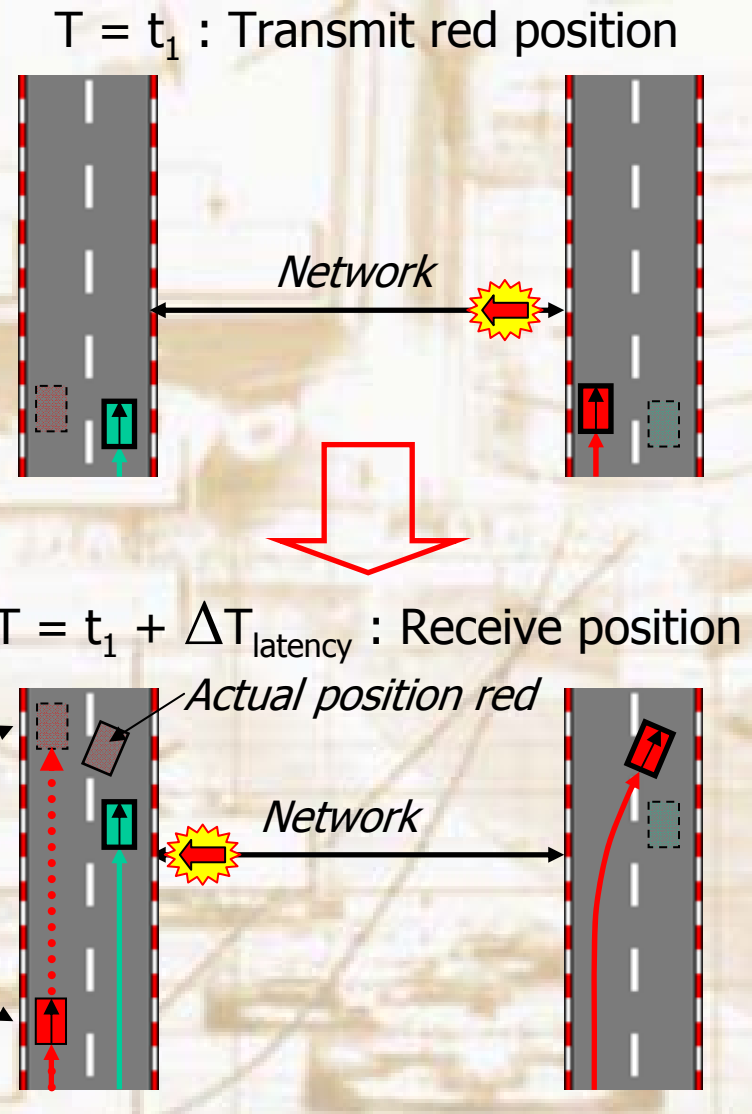


Mobile games

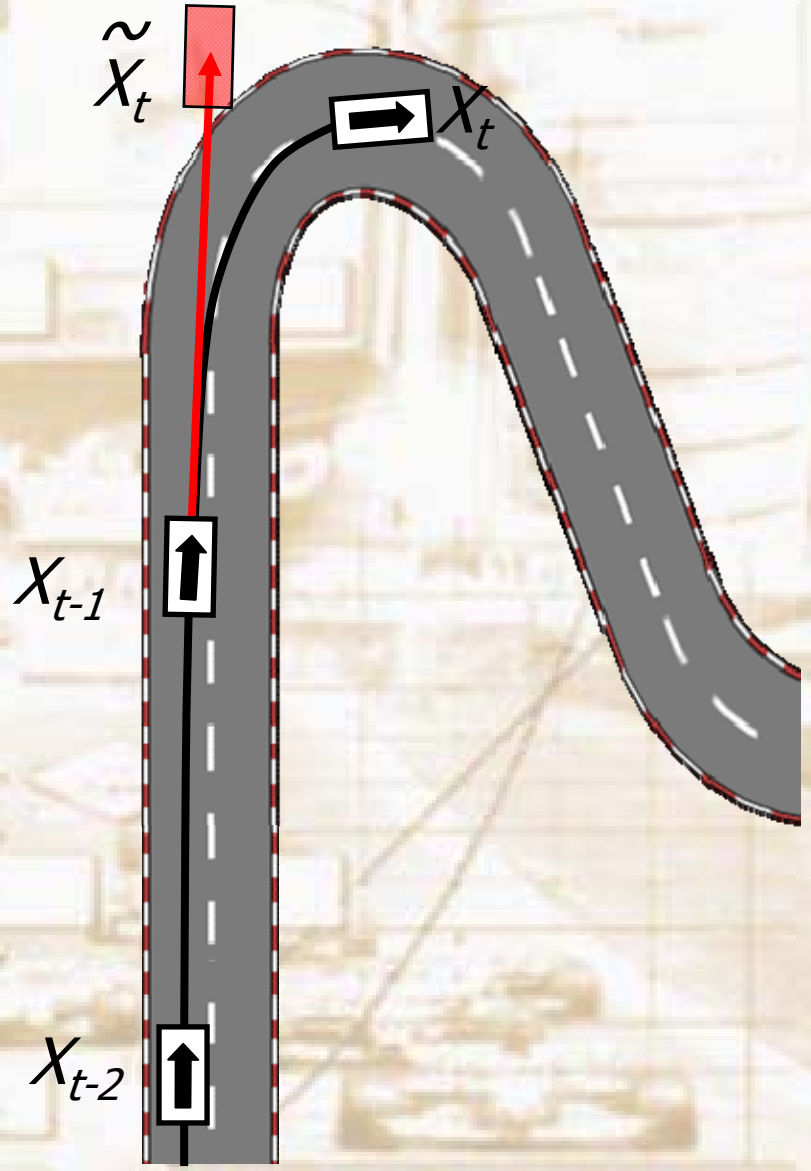
- Platform: Java, BREW, Symbian, …
- Network: GPRS using HTTP/TCP/IP stack

	LAN network (PC game)	Internet (PC game)	**GPRS network (Mobile game)**
Network latency	1 - 5 ms	50 - 200 ms	1500 - 3500 ms
Prediction distance in a race game @ 100 km/h	0.03 – 0.14 meter	1.4 - 5.6 meter	42 – 97 meter
Prediction error, assuming a max. of 10% deviation.	< 2 cm	< 0.6 meter	< 10 meter
Results Dead-reckoning	Good.	Medium. Interactions like collisions can be problematic.	Bad. Errors as large as the width of a track are unacceptable.

Prediction models

- Standard strategy:
  - Only extrapolate from older data

- Our approach:
  - Assume track following behavior
  - Or assume racing line optimizing behavior



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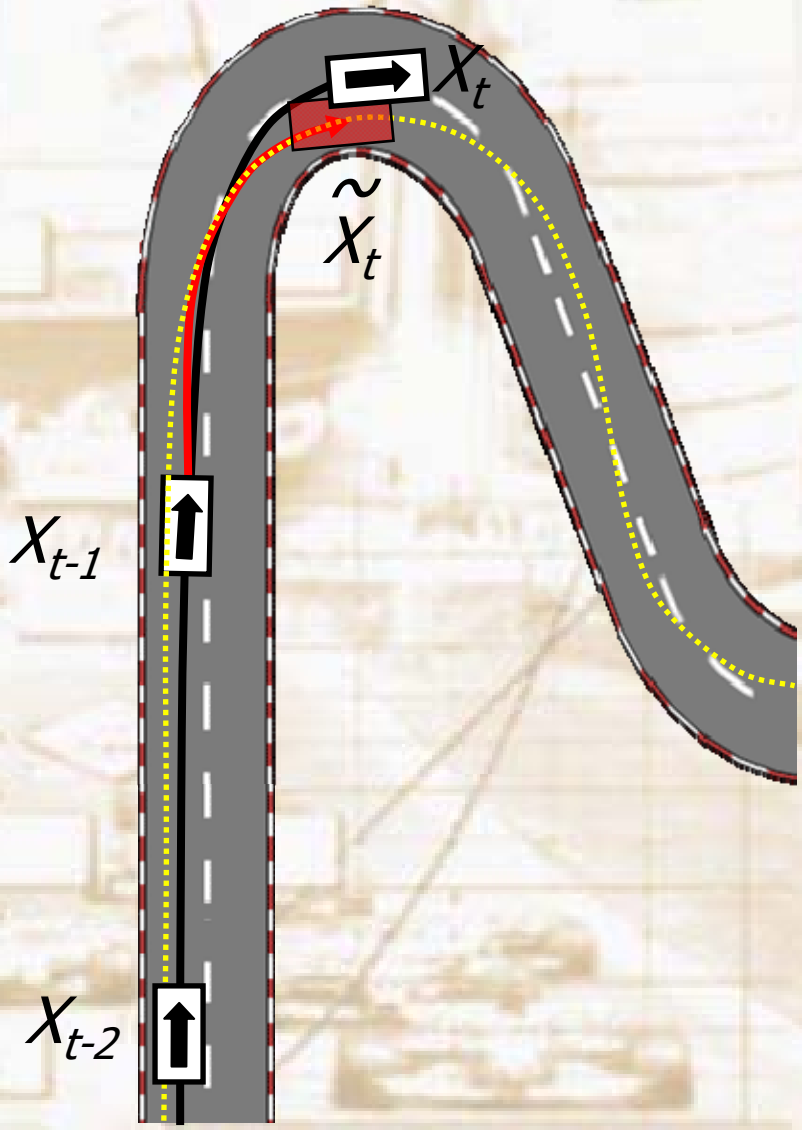
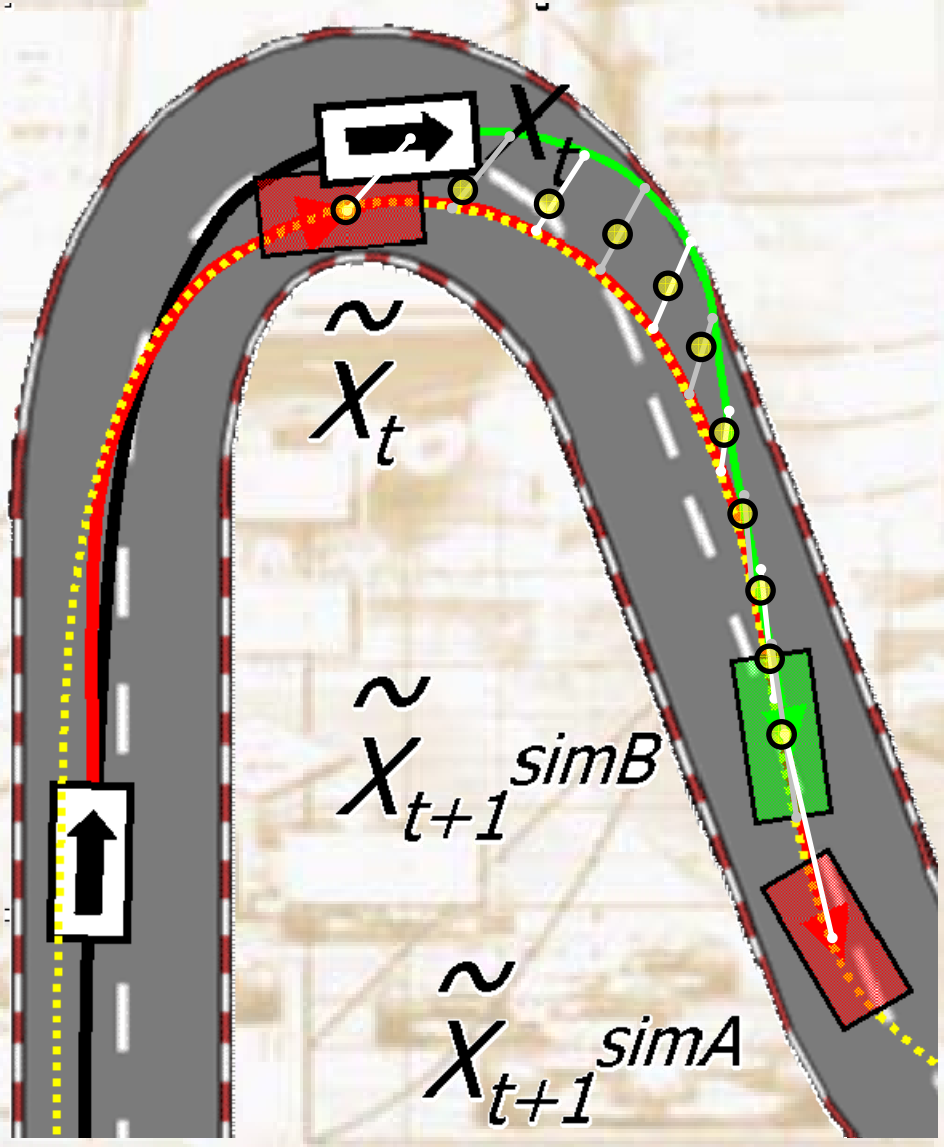


Continuity

- Multiple simulations
  - Running 2 or 3 real-time simulations
  - Linear interpolation between simulations
  - Round robin



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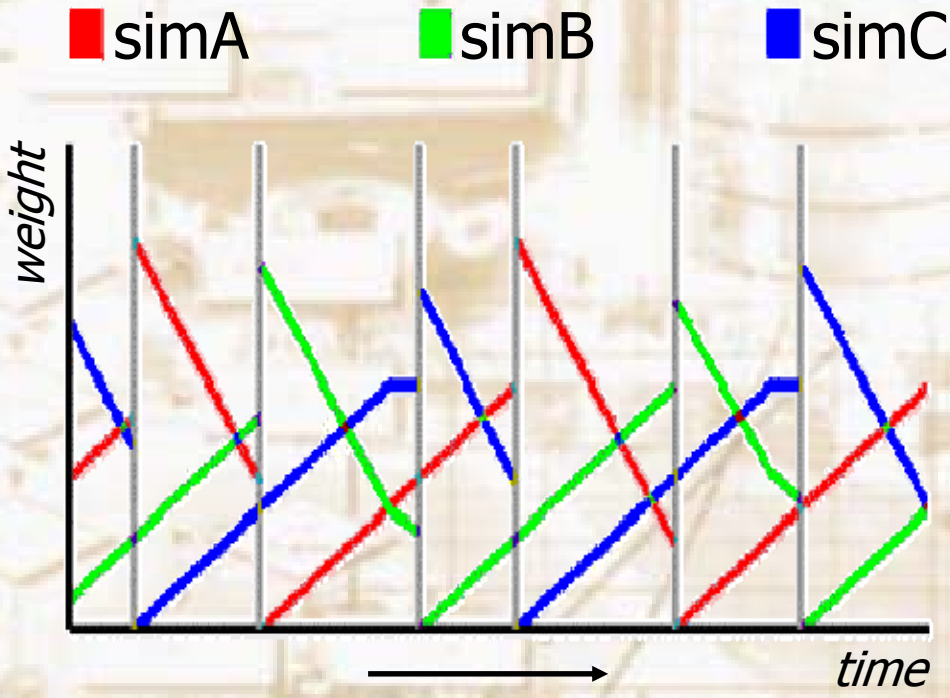
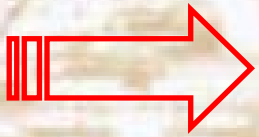


A Test Drive

- Creating a testbed
- Comparing results
- Razor



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ExMachina

http://www.exmachina.nl

Conclusions

- Mobile 2.5G networks: a problematic domain
- Standard dead reckoning is insufficient
- Behavioral assumptions improve prediction
- Running multiple simulations: a good fit