Higher Dimensional Timed Automata

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Joint work with

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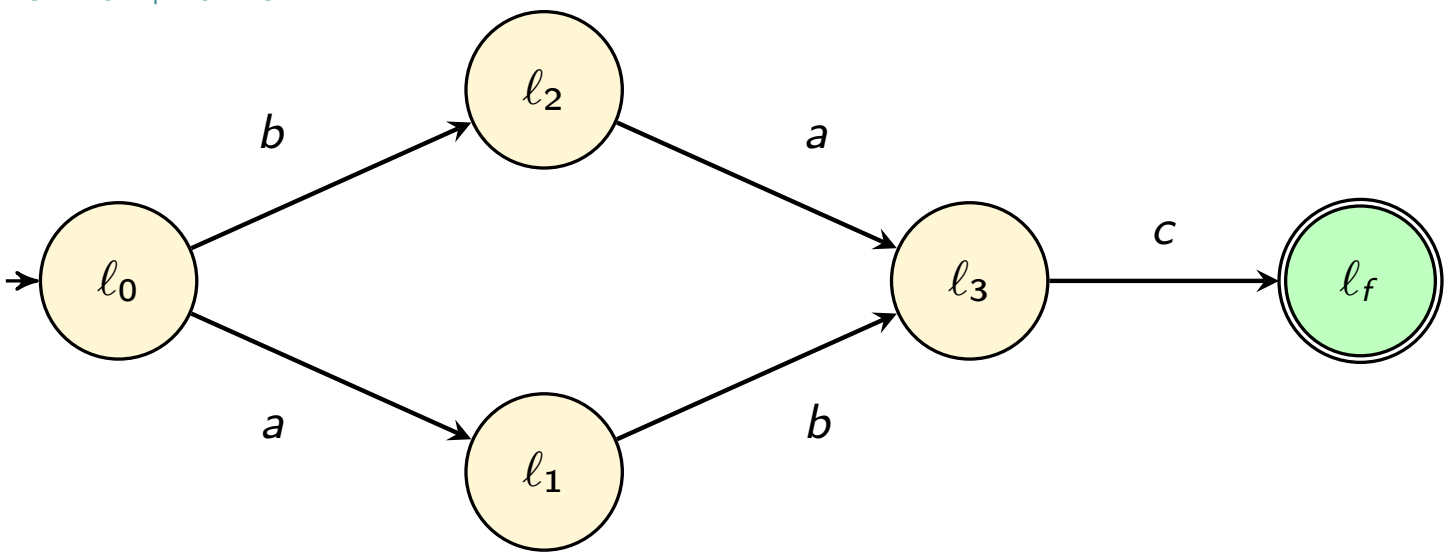
Amazigh Amrane

Hugo Bazille

Concurrency in Automata: interleaving concurrency

- $a \cdot b + b \cdot a$:



Higher Dimensional Automata: represent $n-$ary parallel events

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  Represent several events $a, b, c \cdots$ and their order

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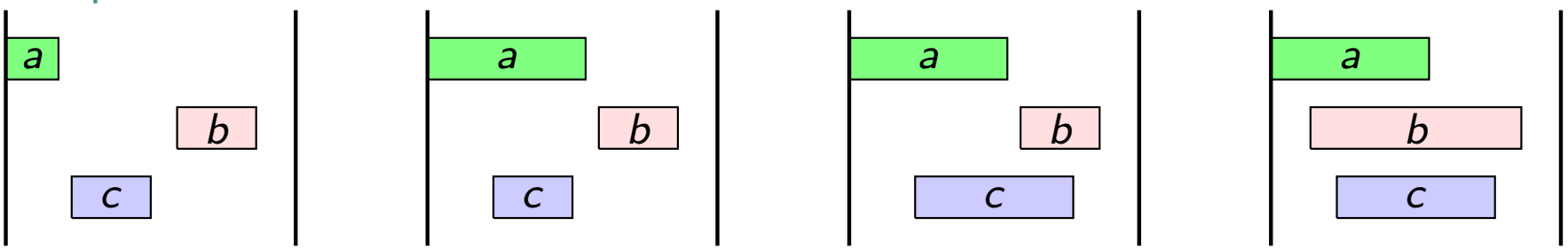
  While c happens before the end of b and a !

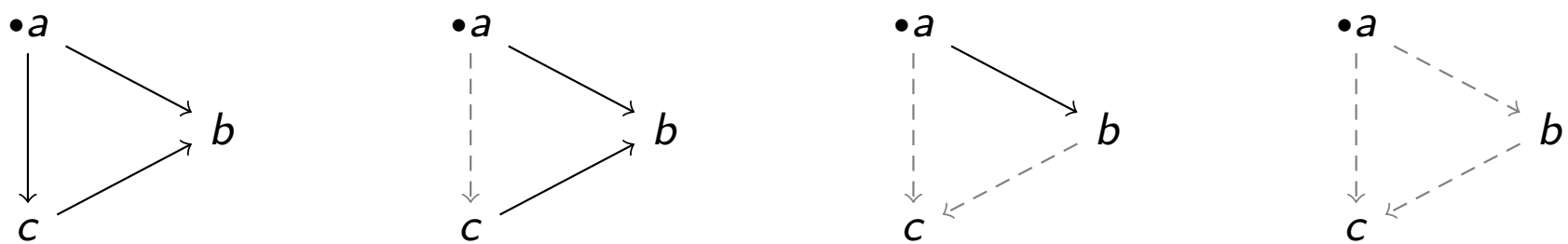
How to represent $n-$ary parallel events? Ipomset

- Two partial order events
  - $<$: precedence order (rep with $\longrightarrow$)
  - $\dashrightarrow$: event order.
  - $< \cup \dashrightarrow$: **total**.
- Interfaces

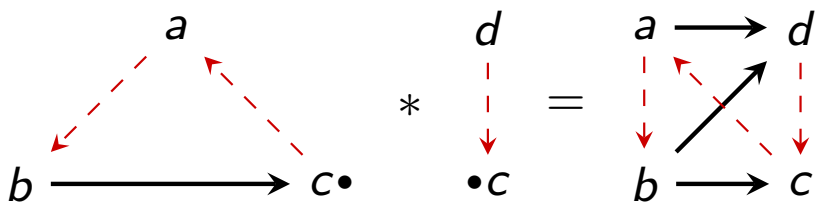
Source/Target interfaces: S/T: $<-$minimal/maximal.

- Representation of events as interval

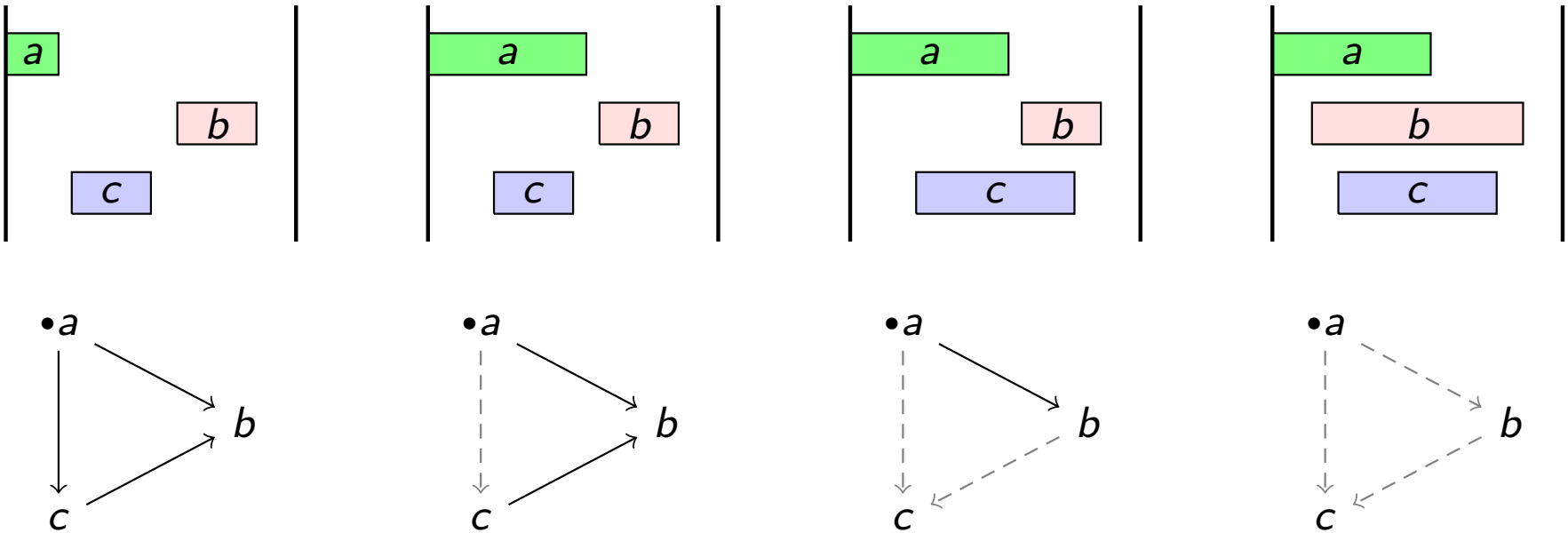




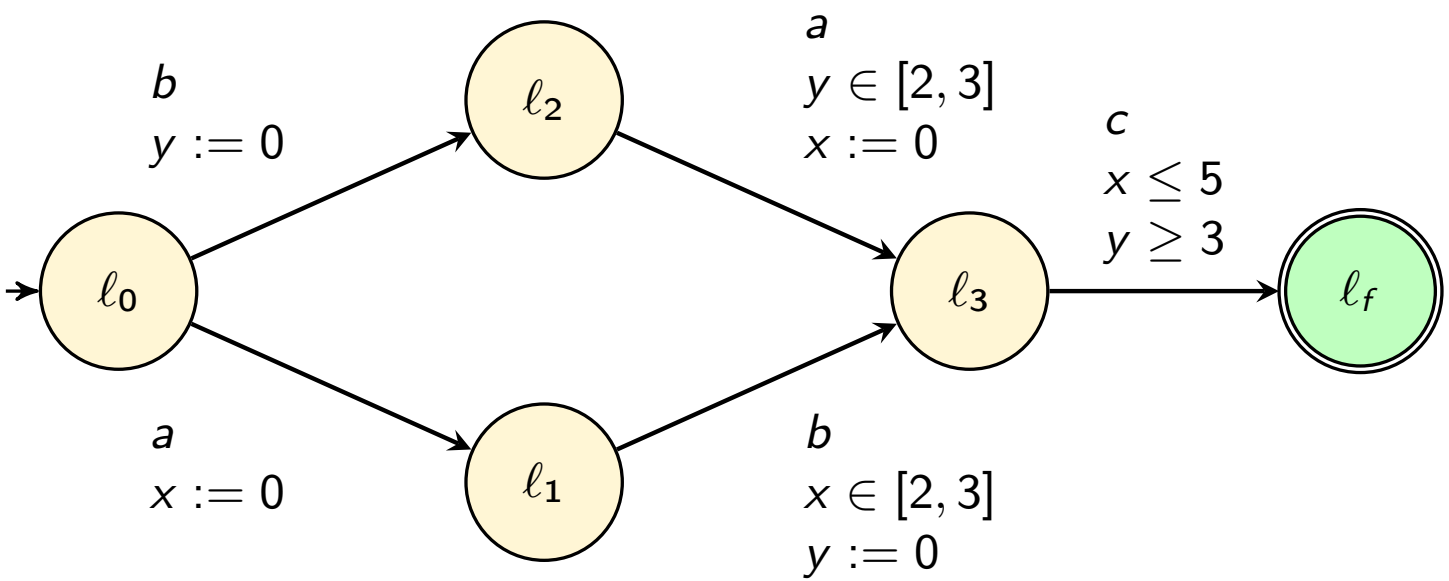
Example of operation: gluing



What about the time duration of events?



Interleaving concurrency with Timed Automata



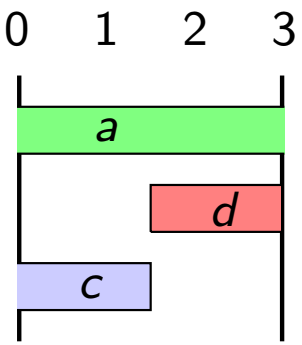
Interest in Higher Dimensional Timed Automata

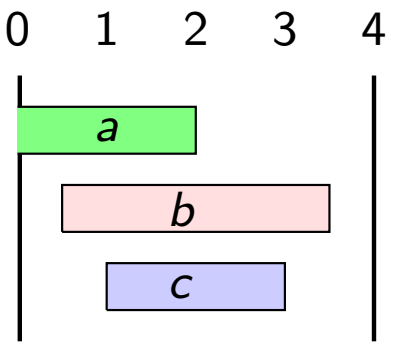
- HDA:
  - Representation concurrency relation
  - Extension of some properties of classic Automata
- Issues:
  - No information about time duration of each events
  - How to represent timing perturbation ?

Our goal

- Goals:

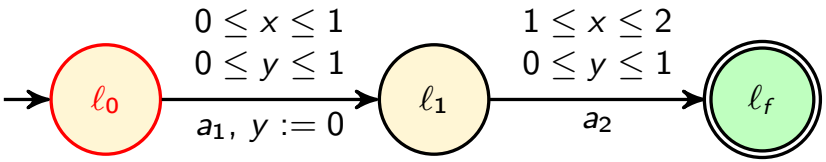
Extend the objects/operation/results from HDA to HDTA: adding information on the start/end dates of each event.



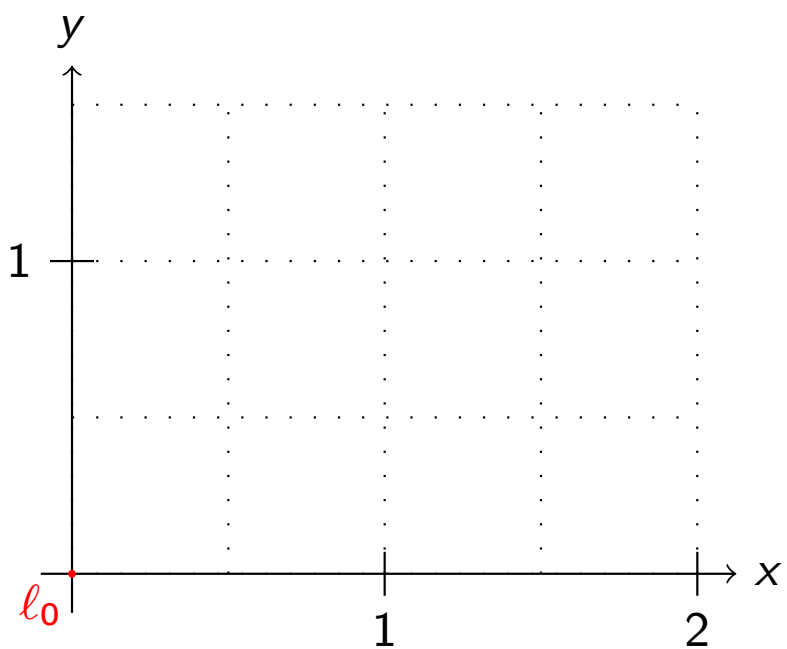


What about the robustness?

- Timed automaton $\mathcal{A}$:



- Run with delay perturbations of at most $\delta = 0.2$



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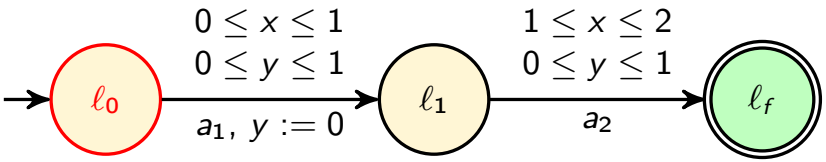

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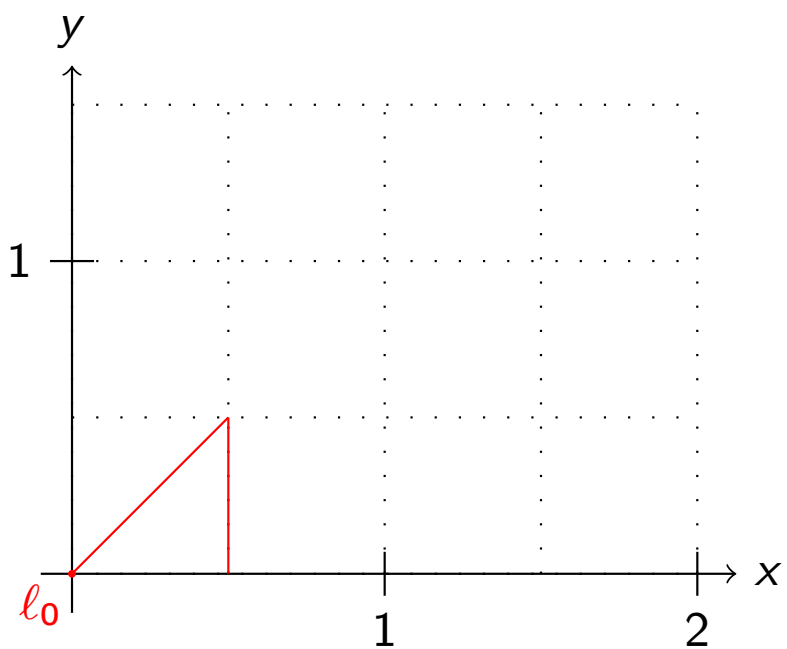

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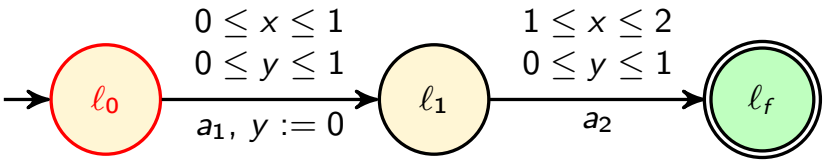

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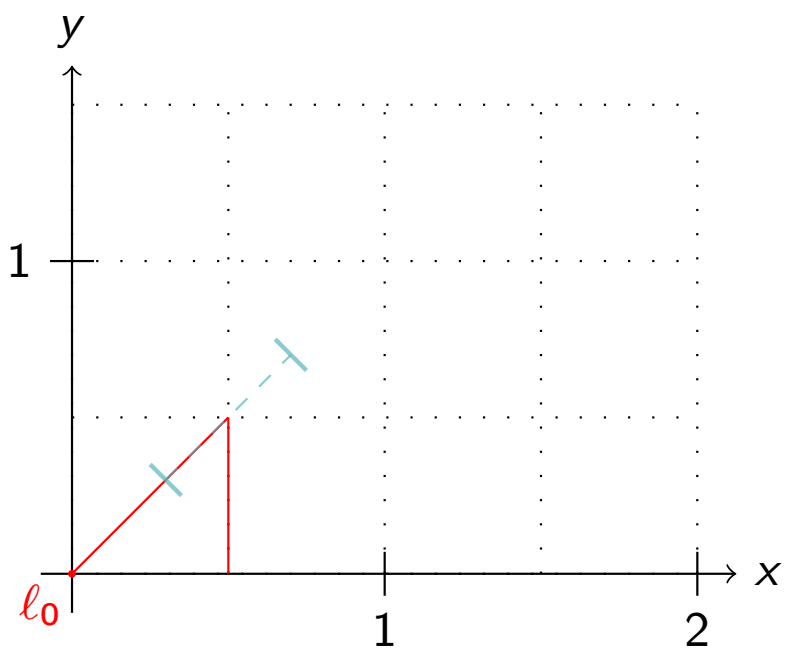

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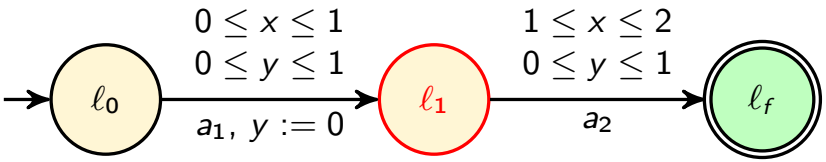

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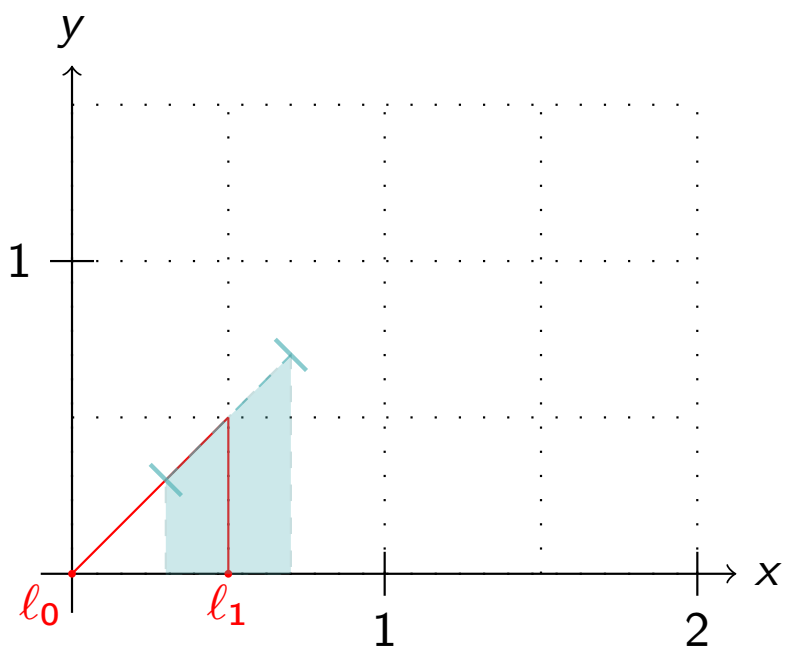

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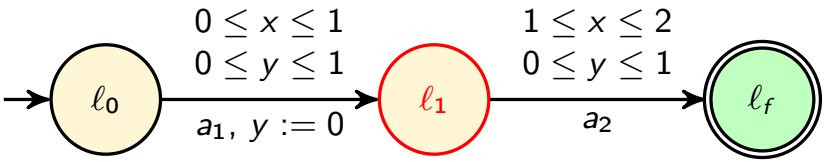

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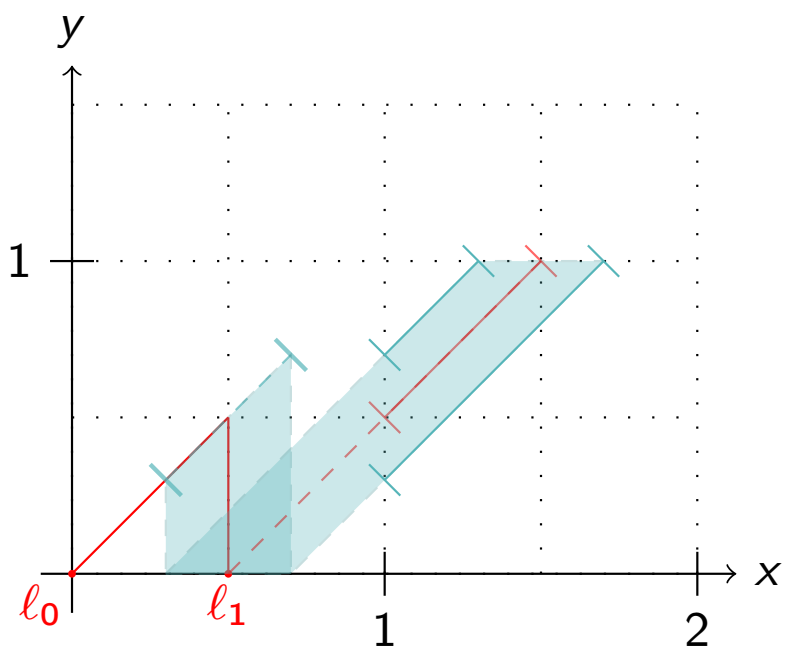

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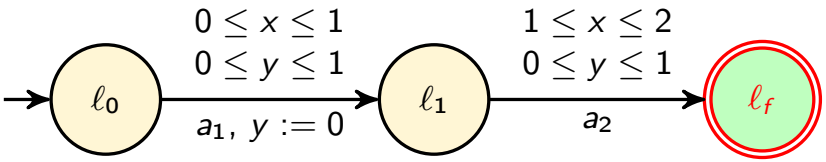

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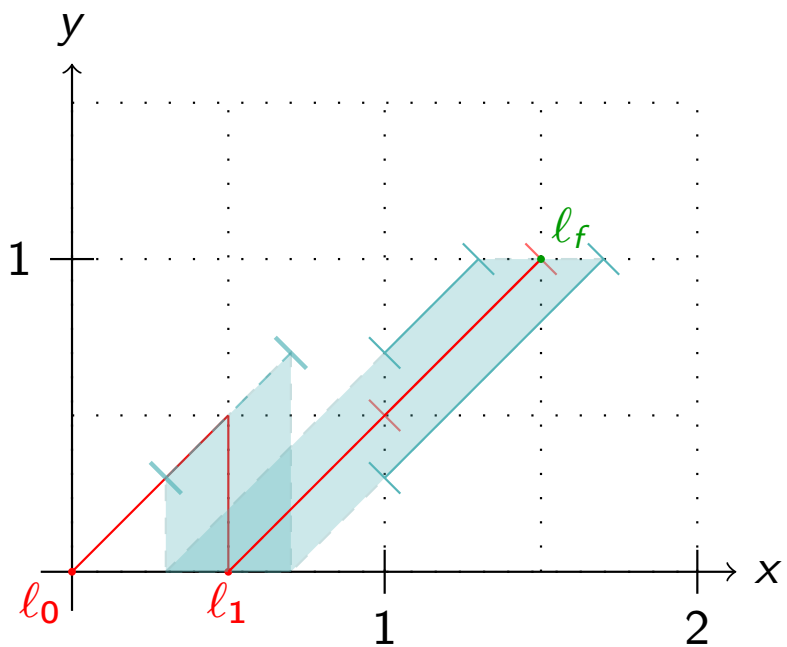
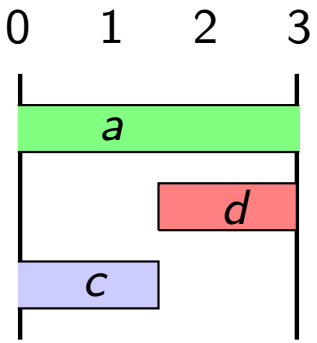
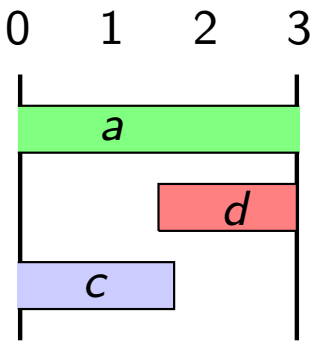


A future work: robustness on HDTA

- No timing perturbation: c and d are not in concurrency



- timing perturbation. Let us introduce a 0.1 delay on the end date of c: