



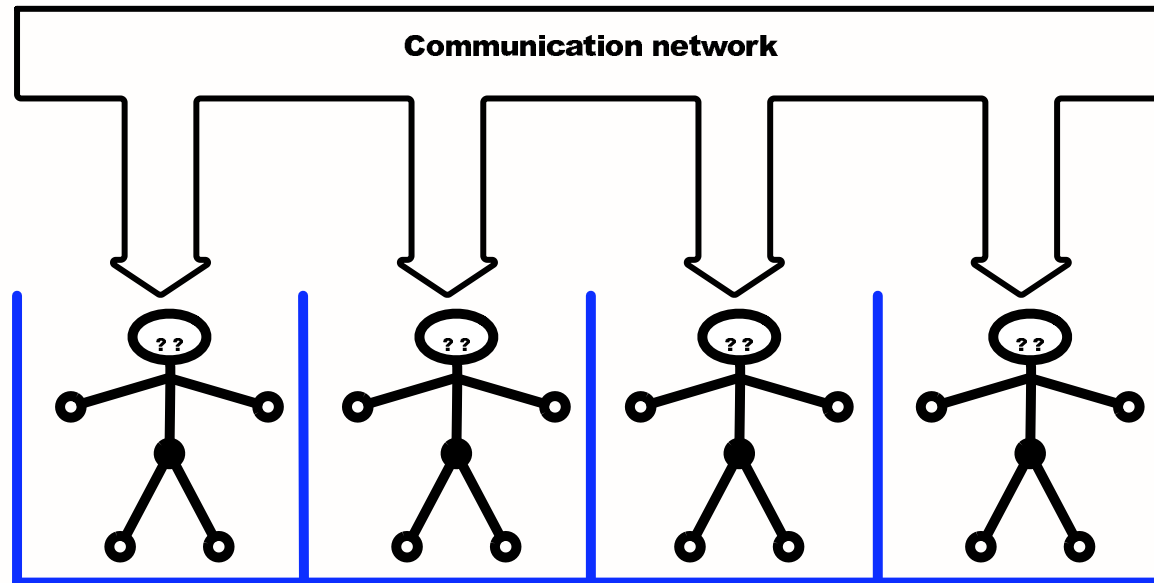
From asynchronous to synchronous specifications for distributed program synthesis

David Janin

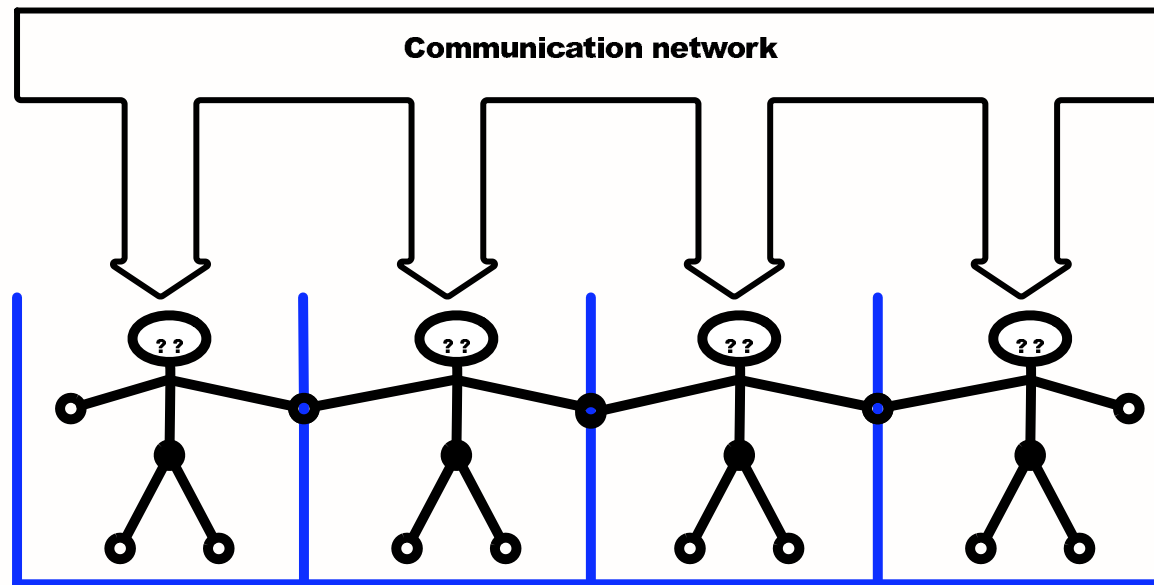
LaBRI, Bordeaux University

21st January 2008

Distributed process



Synchronous behaviors



Processes hand shake at every step !

A meta result

Observation

When mailboxes are of bounded size, asynchronous behaviors are (essentially) synchronous !

A question

Asynchronism in program synthesis

In the setting of distributed program synthesis, can we expect a similar reduction of asynchronous problems into synchronous one ?

The answer is yes as I'll show you !

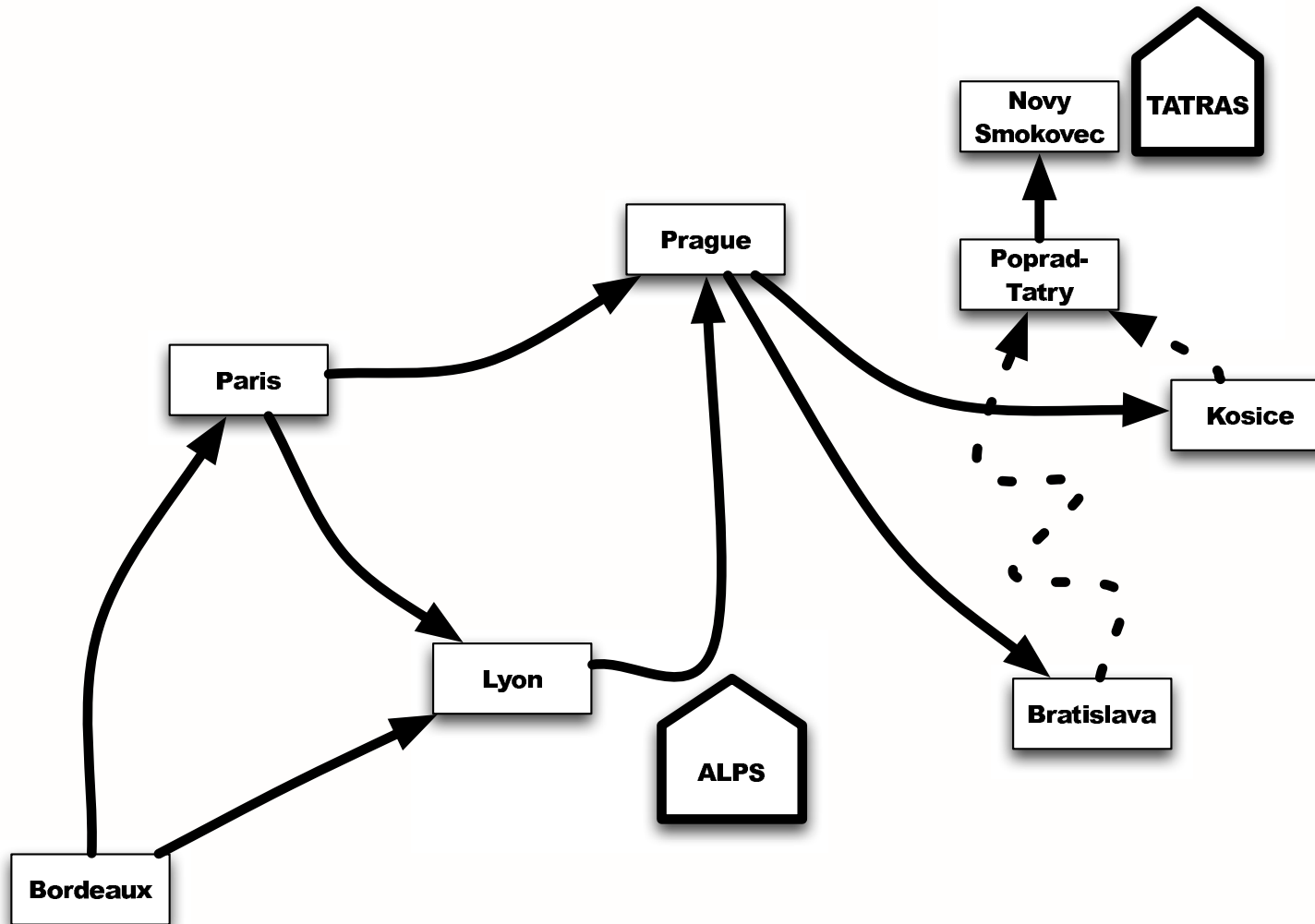
A question

Asynchronism in program synthesis

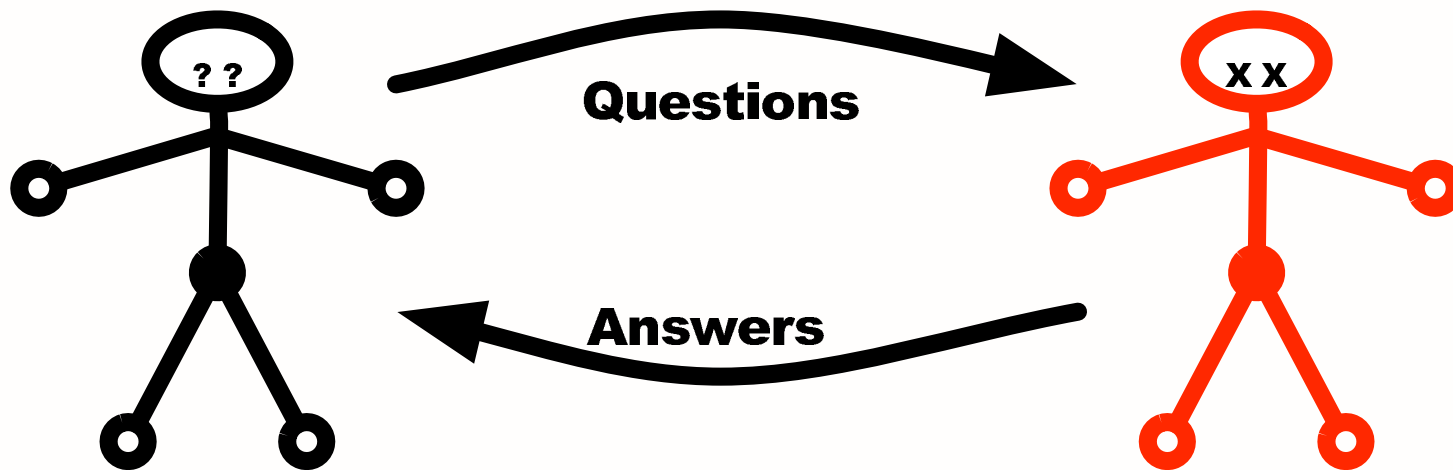
In the setting of distributed program synthesis, can we expect a similar reduction of asynchronous problems into synchronous one ?

The answer is yes as I'll show you !

The wandering (simple) rules

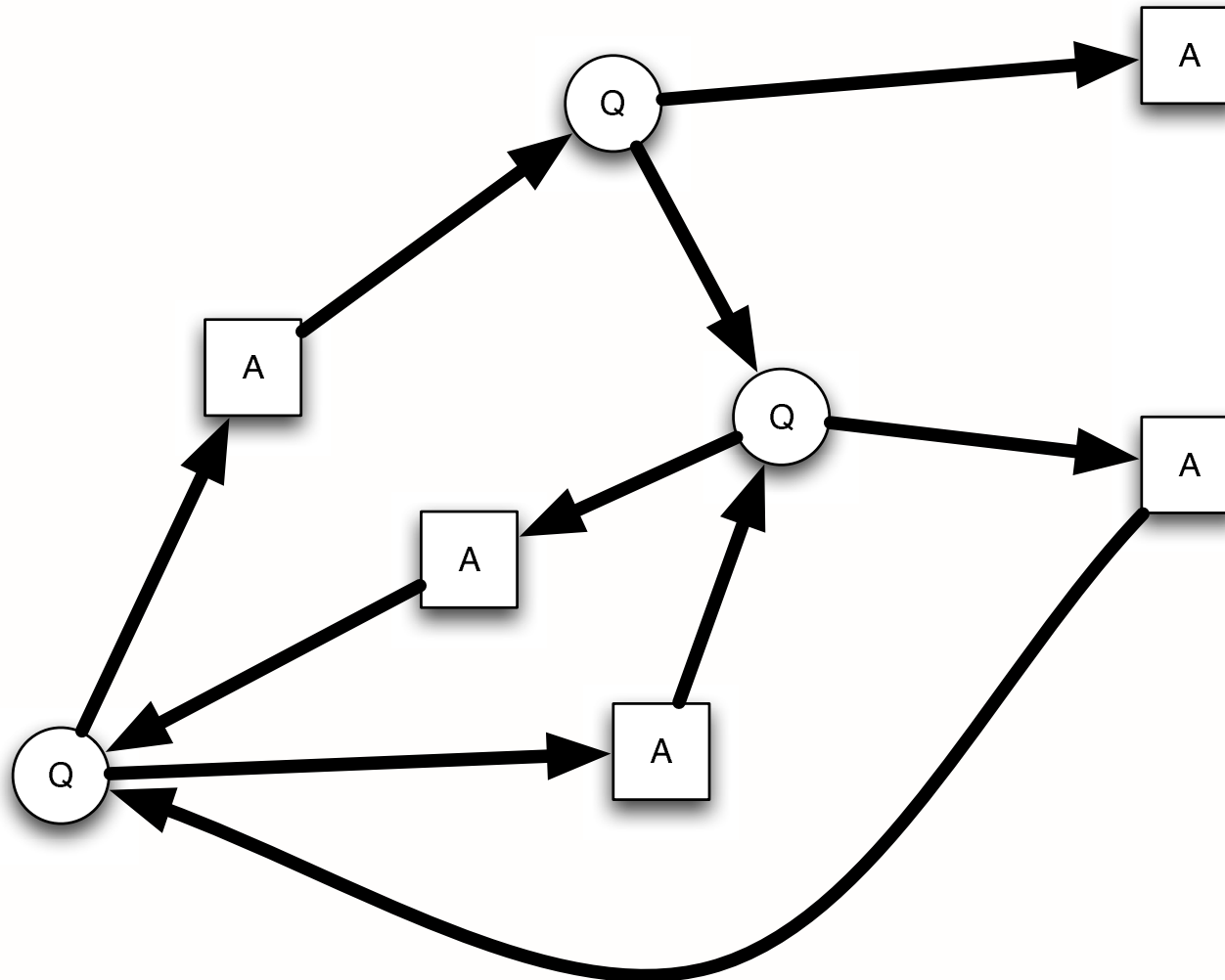


but with uncontrollable environment moves

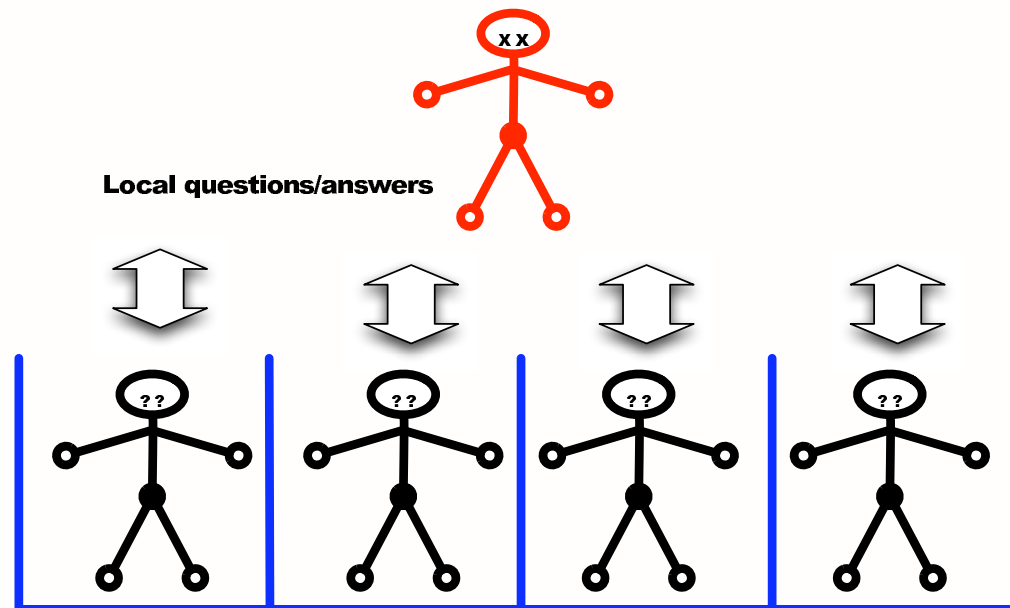


The Wanderer against the Tour operator

The wandering (real) game

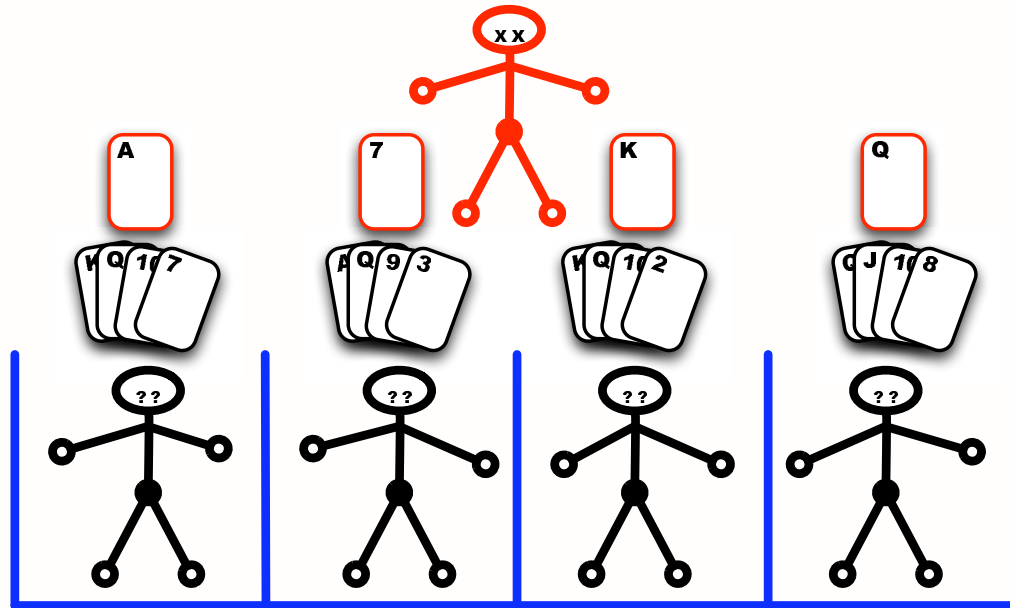


n against 1 distributed game

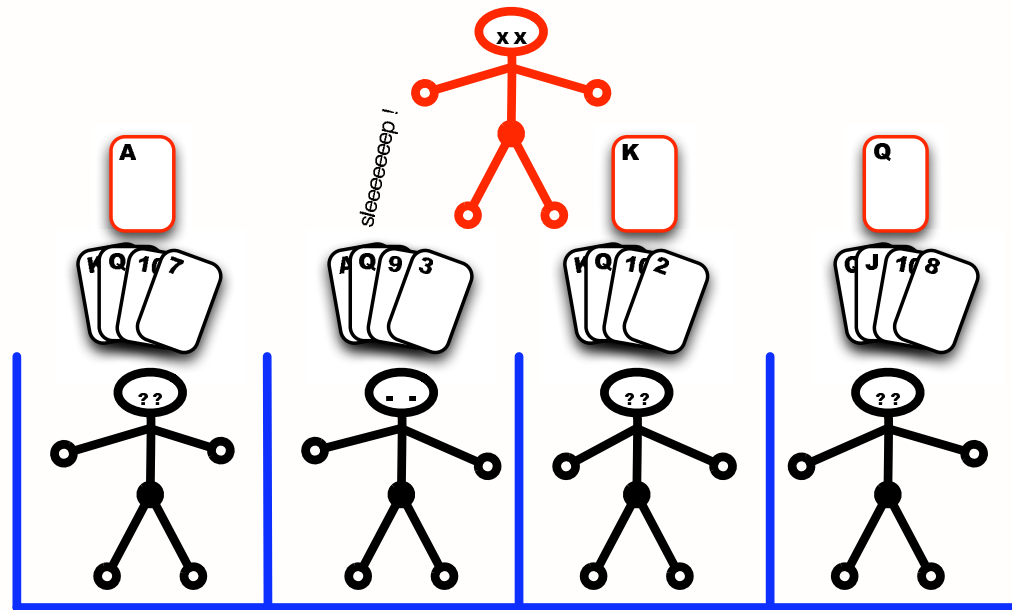


- Each process only sees his own local states.
- Environment may or may not transmit (depending on his allowed moves).

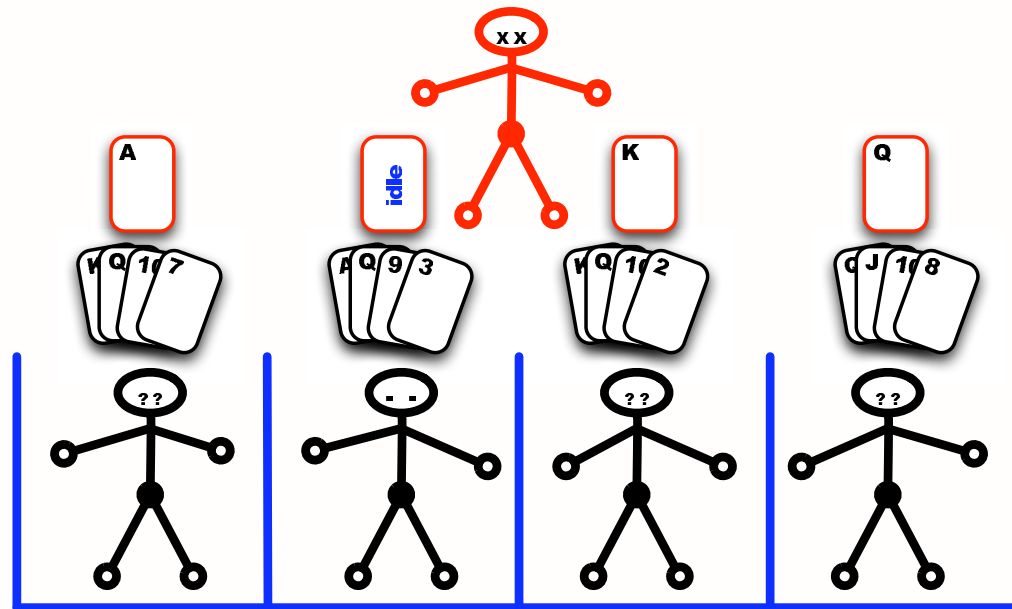
Synchronous scenarios



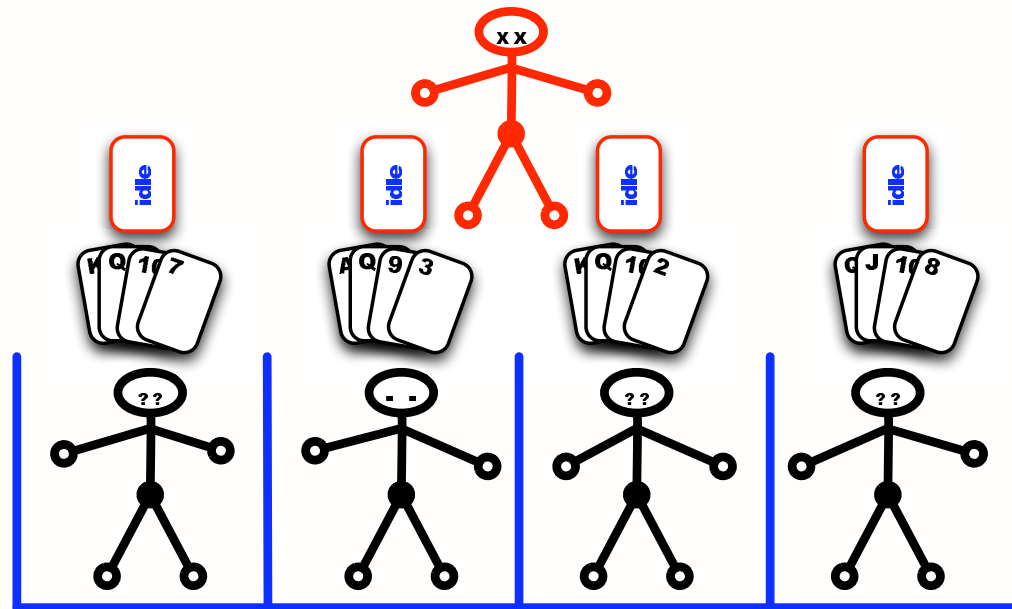
Asynchronous scenarios



Encoding async. into sync. (1)



Encoding async. into sync. (2)



Main results

Theorem

*For any finite distributed game \mathcal{G} there is a **synchronous** finite distributed game \mathcal{H} such processes do have a **finite state** winning distributed strategy in \mathcal{G} if and only if they have a finite state distributed strategy in \mathcal{H} .*

From asynchronous to synchronous specifications for distributed program synthesis

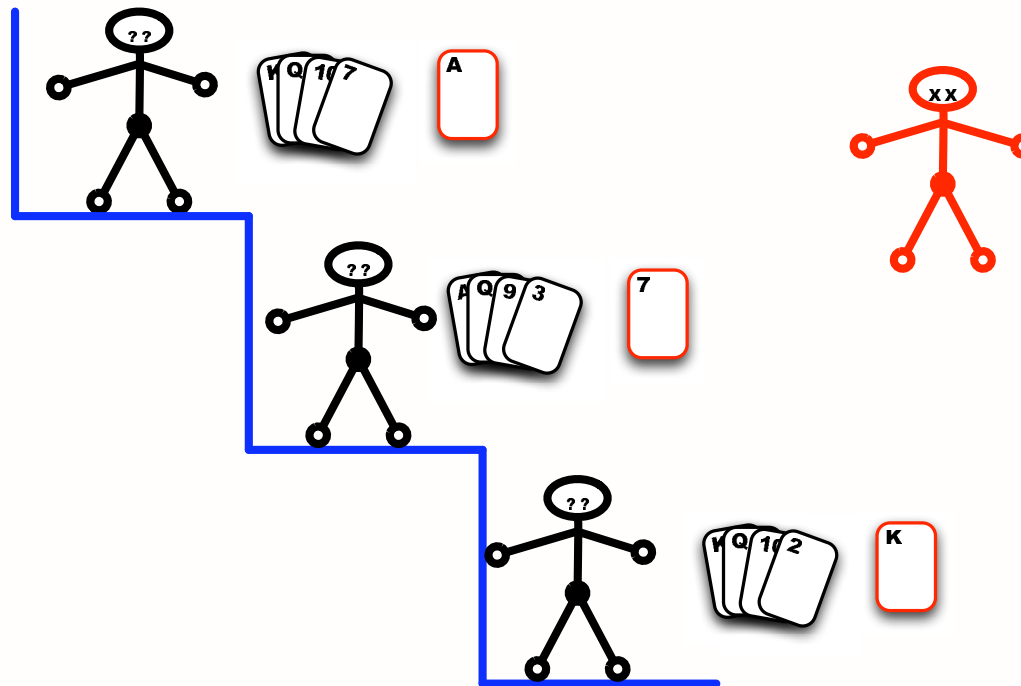
└ More on the decidable case (hierarchical game)

And what about decidability issues ?

The reduction from asynchronous to synchronous games may break structural decidability properties !

└ More on the decidable case (hierarchical game)

Hierarchical game



- Each process sees the local states of all processes on his right.

Known and new results

Theorem (Peterson and Reif, 80s)

Finite distributed game are undecidable (even Σ_1^1 -complete) but finite distributed hierarchical games are decidable !

Theorem

*Reduction of distributed game to synchronous distributed game can be **adapted** to the hierarchical case so that decidability is preserved.*

Welcome in Bordeaux from the 21st to the 23rd february

<http://stacs08.labri.fr/>
LaBRI, University of Bordeaux, France

STACS 2008