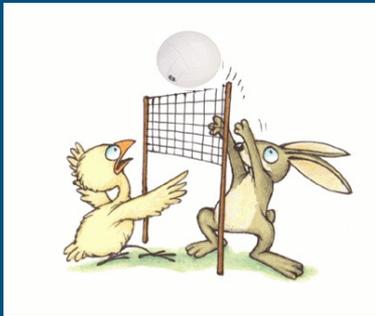


**Intelligent Multiagent Systems 2009**  
**Playing with a DCSP:**  
**Computing a Tournament Calendar with**  
**Asynchronous Backtracking**

**Nicola Basilico and David Laniado**



- The Problem: organizing a recreational volley tournament
  - $n$  teams
  - $m$  available days
  - each team has its own preferences over the days
- **Objective:** compute a consistent match schedule

- First natural approach:
  - $D$  = the set of  $m$  days over which the tournament can be distributed
  - Agent = team
  - For each agent  $i$ :  $canplay_i: D \rightarrow \{0,1\}$

TEAM A


 $(X_B^A, X_C^A)$ 

TEAM B


 $(X_A^B, X_C^B)$ 

TEAM C

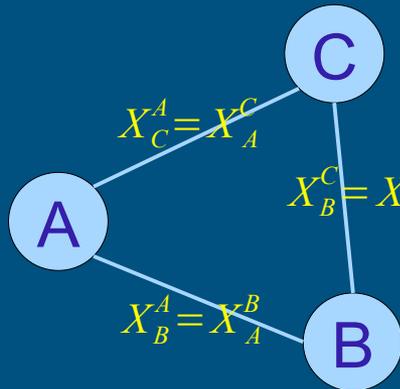

 $(X_A^C, X_B^C)$ 

Asynchronous  
Backtracking

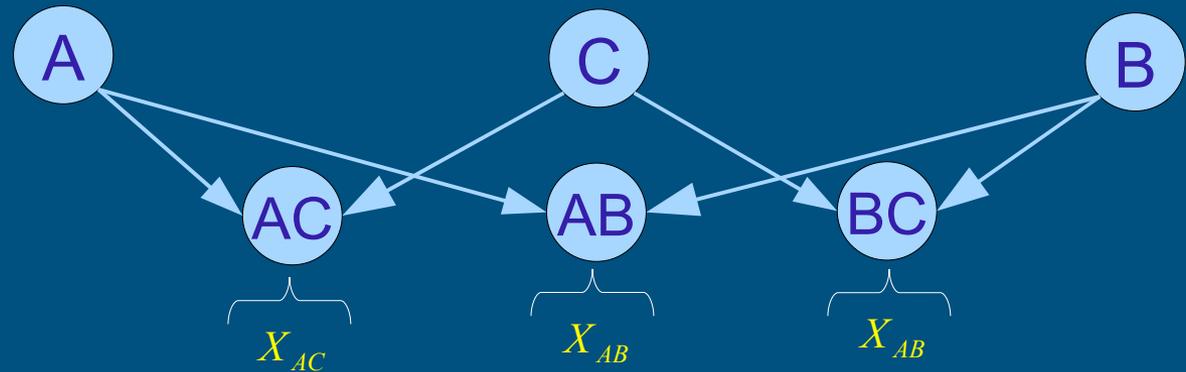
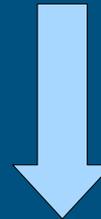
- Every agent has a vector of variables

- Constraints for agent  $i$ :

- $X_j^i \neq X_k^i \quad X_j^i, X_k^i \in \{d : canplay_i(d) = 1\}$

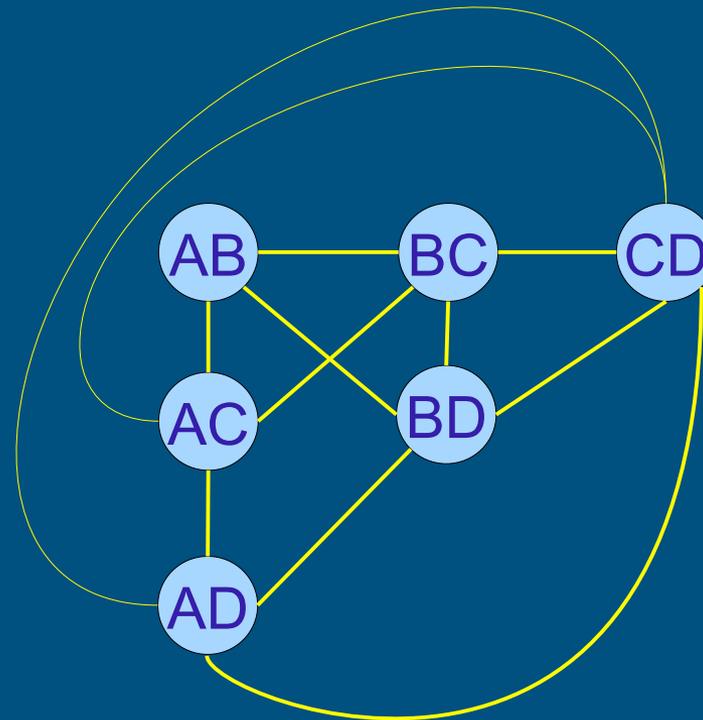


- DCSPs with multiple local variables can be in addressed in different ways
- We adopt the simplest one



- Agent  $ij$  = Match between teams  $i$  and  $j$
- Now each agent has only one variable

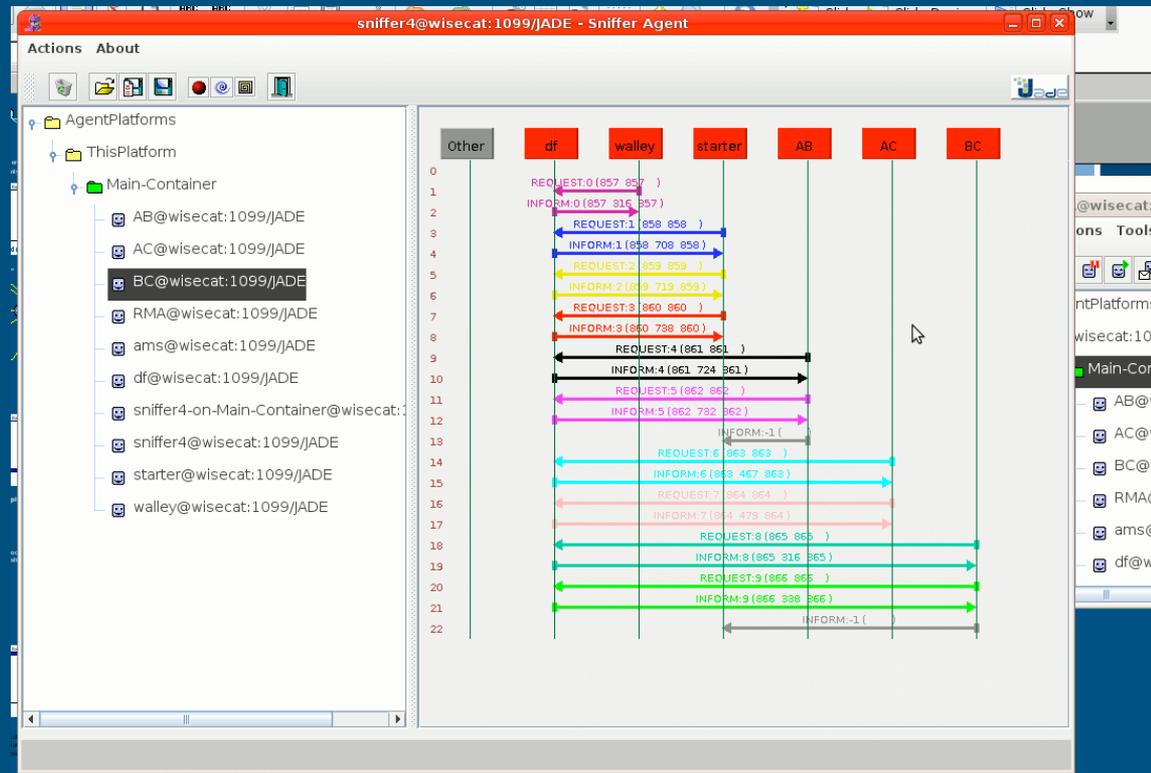
- Constraints for agent  $ij$ :
  - $X_{ij} \in \{ \{ d : canplay_i(d) = 1 \} \cap \{ d : canplay_j(d) = 1 \} \}$



- Return matches (if any) can be easily handled
- Matches involving different teams can be played in the same day (e.g. AD and BC)

## Agents on the JADE platform:

- **Starter:**  
it's the coordinator, it assigns priorities to agents following the “*first the busiest*” principle
- **MatchAgent:**  
the single match
- **Walley:**  
it “sniffs” all the *ok?* messages and prints out the current global solution (i.e., the variable value for each agent)
- **DF and AMS**



- Agents exchange the following messages:
  - *ok?* to communicate a new assignment to neighbors
  - *nogood* to communicate a new constraint to a higher priority agent
  - *requestNeighbor* to add a new neighbor
  - *terminate* to communicate that there is no solution

```
frisey@wisecat: ~/workspace/volley/bin - Terminator
frisey@wisecat: ~/workspace/volley/bin
frisey@wisecat:~/workspace/volley/bin$ java jade.Boot AB:MatchAgent AC:MatchAgent BC:MatchAgent CD:MatchAgent AD:MatchAgent BD:MatchAgent CA:MatchAgent walley:walley starter:Starter
Apr 6, 2009 5:13:31 PM jade.core.Runtime beginContainer
INFO: -----
This is JADE snapshot - revision $WCREV$ of $WCDATE$
downloaded in Open Source, under LGPL restrictions,
at http://jade.tilab.com/
-----

frisey@wisecat: ~/workspace/volley/bin
STARTER: MatchAgents found: 7
STARTER: received from AC content: 11
STARTER: received from BC content: 11
STARTER: received from CA content: 11
STARTER: received from BD content: 12
STARTER: received from CD content: 13
STARTER: received from AD content: 12
STARTER: received from AB content: 9

STARTER: Agent AB has priority 0
STARTER: Agent AC has priority 1
STARTER: Agent BC has priority 2
STARTER: Agent CA has priority 3
STARTER: Agent BD has priority 4
STARTER: Agent AD has priority 5
STARTER: Agent CD has priority 6

frisey@wisecat: ~/workspace/volley/bin
CD: 9 AD: 9
CD: 10 AD: 9
CD: 10 AD: 9 CA: 6
CD: 10 AD: 9 CA: 6 BC: 4
CD: 10 AD: 9 CA: 6 BC: 4 AC: 6
CD: 10 AD: 9 CA: 6 BC: 4 AC: 6 BD: 9
CD: 10 AD: 10 CA: 6 BC: 4 AC: 6 BD: 9
CD: 10 AD: 10 CA: 6 BC: 4 AC: 6 BD: 9 AB: 5
CD: 9 AD: 10 CA: 6 BC: 4 AC: 6 BD: 9 AB: 5
CD: 9 AD: 9 CA: 6 BC: 4 AC: 6 BD: 9 AB: 5
CD: 10 AD: 9 CA: 6 BC: 4 AC: 6 BD: 9 AB: 5
CD: 10 AD: 9 CA: 9 BC: 4 AC: 6 BD: 9 AB: 5
CD: 10 AD: 14 CA: 9 BC: 4 AC: 6 BD: 9 AB: 5

frisey@wisecat: ~/workspace/volley/bin
BD: posso esser giocata nei giorni:
9 10 14 (totale: 3 giorni)

AB: posso esser giocata nei giorni:
5 8 9 10 11 14 (totale: 6 giorni)

AC: posso esser giocata nei giorni:
6 9 10 11 (totale: 4 giorni)

BC: posso esser giocata nei giorni:
4 9 10 11 (totale: 4 giorni)

CA: posso esser giocata nei giorni:
6 9 10 11 (totale: 4 giorni)

AD: posso esser giocata nei giorni:
9 10 14 (totale: 3 giorni)

CD: posso esser giocata nei giorni:
9 10 (totale: 2 giorni)
```

Starter's output

Solution Found (printed by walley)

Agents' constraints

- Example:
- 4 Teams
- 7 Matches (in a strange combination :-)
- 15 Days