ROADEF/EURO Challenge 2010

http://challenge.roadef.org

A large-scale energy management problem with varied constraints (EDF)

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ROADEF

http://www.roadef.org

- French Operations Research and Decision Support Society
- Created in 1998, 380 members in 2009
- Objective : promote OR in France
  - Research
  - Industry
  - Education
- 1 Annual conference, 2 international journal s (4OR, RAIRO-OR), working groups, the Robert Faure prize
- … and the CHALLENGE, organized jointly with EURO in 2010

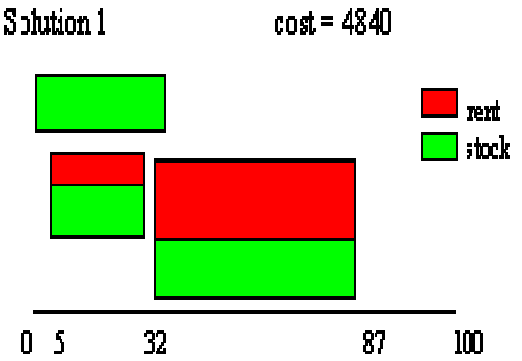
What is the ROADEF/EURO challenge ?

- International OR contest
- Organized jointly with a company which proposes an optimization problem and (close to) real-life data
- Objective for the participants : Design a method and implement it to obtain the best results on the proposed problem instances
- Open to (almost) everybody, 3 categories
  - Senior : no restriction on team but single-thread
  - Junior : only students (no PhD), single-thread
  - Multi-Thread : no restriction on team, multi-thread allowed

10 years of challenges

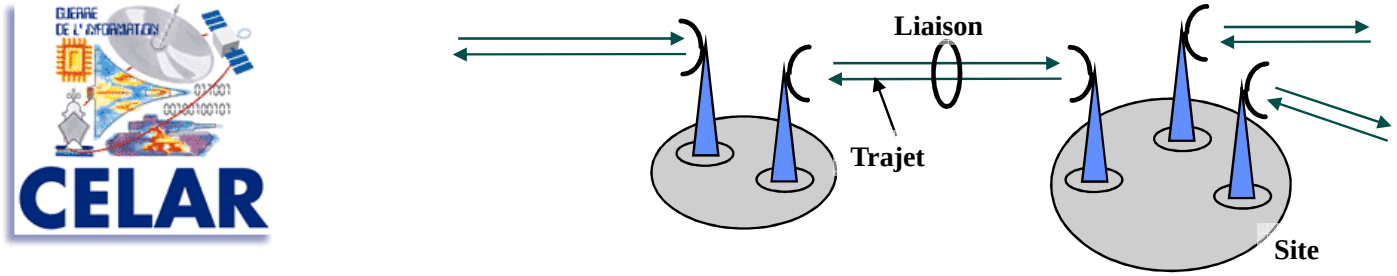
- 1999

  Company: Bouygues
  - Problem: Inventory management problem
  - Winner: IMAG, Grenoble Institute of Technology
  - Method: Linear programming and iterative improvement



10 years of challenges

- 2001
  Company: CELAR (Electronic Armament Center)
  - Problem: Frequency Allocation with polarization
  - Winner: Ecole des Mines d'Ales
  - Method : Tabu search and consistent neighborhood



10 years of challenges

- 2003

  Company: ONERA et CNES

  – Problem: photographs scheduling of an agile earth-observing satellite

  – Winner: TNO Physics and Electronics Laboratory (Netherlands)

  – Method : Simulated annealing

ONERA

cnes

ROADEF

EURO

EDF

10 years of challenges

- 2005
  Company: Renault
  - Problem: Car sequencing
  - Winner : LIF - University of Marseille (junior team !)
  - Method: Very fast local search

10 years of challenges

- 2007
  Company: France Télécom
  - Problem: Technician intervention scheduling
  - Winner: Eindhoven, University of Technology
  - Method : MILP

10 years of challenges

- 2009
  - Company: Amadeus
  - Problem: Disruption management for commercial aviation
  - Winner: HEC Montreal and CIRRELT (Canada)
  - Method: Large neighborhood search

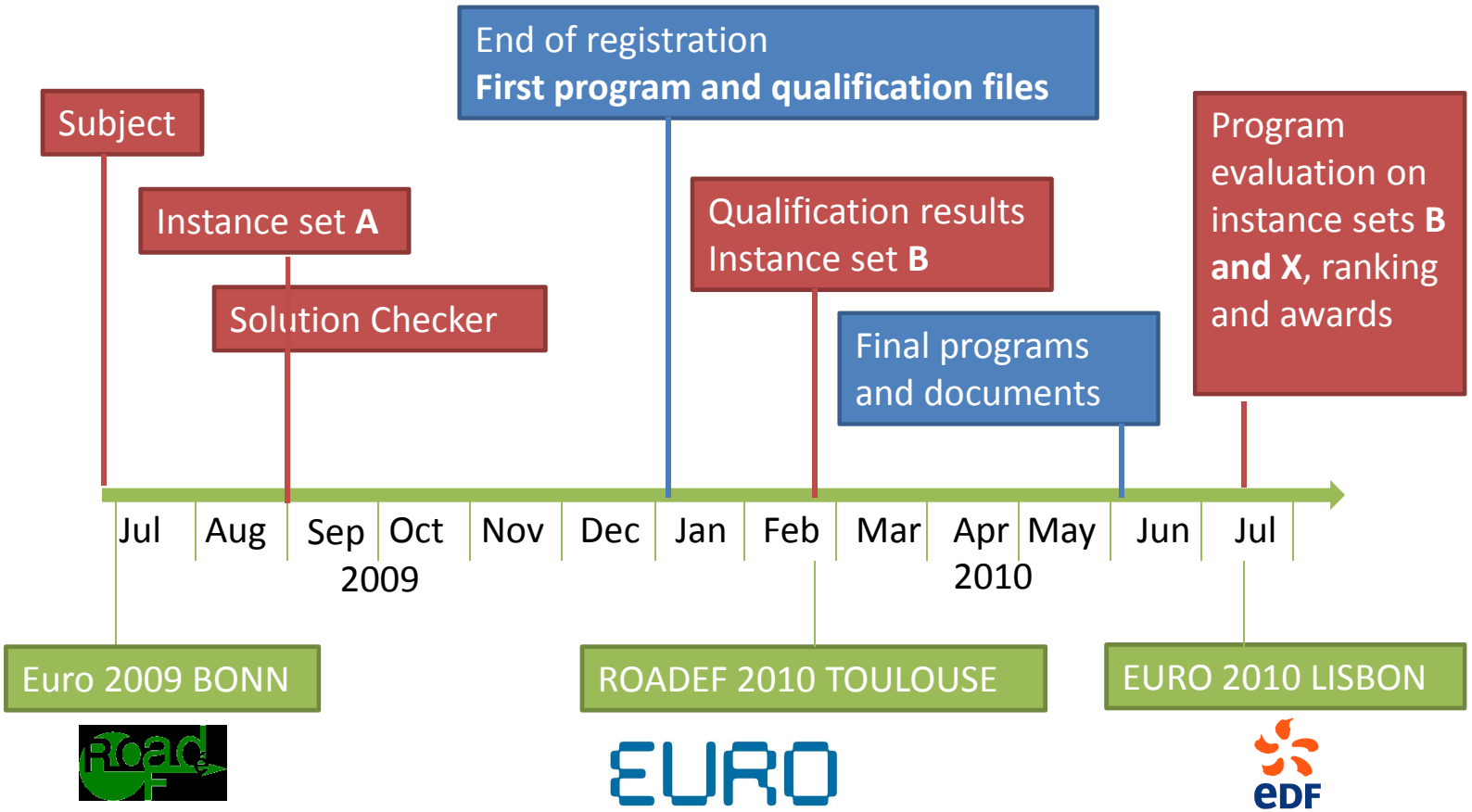
amadeus
Your technology partner

ROADEF

EURO

EDF

Schedule of the ROADEF/EURO challenge 2010



Prizes

- Senior Category

  4000 € for the winner team
- Junior Category

  4000 € distributed among the three first finalist teams
- Multi-thread category:
  2000€ for the winner team

ROADEF/EURO Challenge Stream

Six Sessions: room 6.2.48 (Building C6, Floor 2)

Tuesday: TF-25, 17:20-18:40, Wednesday: WA,B,C,D,E-25, 9:00-17:00

Finalist Teams

- J05 **Lauri Ahlroth, André Schumacher, Henri Tokola** (FI)
- J06 **Steffen Elberg Godskesen, Thomas Sejr Jensen, Niels Kjeldsen, Rune Larsen** (DK)
- J08 **Roman Steiner, Sandro Pirkwieser, Matthias Prandtstetter** (AT)
- J16 **Stefan Heinz**, **Thomas Schlechte**, **Michael Winkler** (DE)
- S04 **Mauro Dell'Amico , José Carlos Diaz Diaz** (IT)
- S08 **Cor Hurkens** (NL)
- S10 **Richard Martin Lusby, Laurent Flindt Muller, Bjørn Petersen** (DK)
- S11 **Davide Anghinolfi, Luca Maria Gambardella, Roberto Montemanni, Cristiano Nattero, Massimo Paolucci**, **Engin Toklu** (IT,CH)
- S14 **Julien Darlay, Louis Esperet, Yann Kieffer, Guyslain Naves , Valentin Weber** (FR)
- S16 **Hadrien Cambazard, Emmanuel Hebrard, Barry O'Sullivan** (IE)
- S17 **François Soumis, Guy Desaulniers, Michel Gendreau, Louis-Martin Rousseau, François Lessard, Vincent Raymond** (CA)
- S21 **David Savourey**, **Vincent Jost**, **Christoph Dürr**, **Nora Touati** , **Antoine Jeanjean** (FR)
- S22 **Frédéric Gardi**, **Karim Nouioua** (FR)
- S23 **Laurent Alfandari**, **Daniel Chemla**, **Lucas Létocart** , **Guillaume Turri**, **Antoine Rozenknop**, **Roberto Wolfler Calvo** (FR)
- S24 **Johan Peekstok**, **Eelco Kuipers** (NL)
- S25 **Haris Gavranovic**, **Buljubasic Mirsad**, **Catibusic Faik** (BA)

Methods

TEAM	METHOD
J05 **Ahlroth et al** (FI)	CP-based scheduling, local search /simulated annealing with repair
J06 **Godskesen et al** (DK)	Constraint programming (CP->Gecode) , local search and simulated annealing
J08 **Steiner et al** (AT)	Ant colony optimization, variable neighborood search
J16 **Heinz et al** (DE)	Constraint Integer Program, (SCIP) greedy algorithm
S04 **Dell'Amico & Diaz** (IT)	Preprocessing (CP), constructive heuristics, local search, ILP
S08 **Hurkens** (NL)	Preprocessing , dynamic programming, ILP, max-profit flow, iterative improvement
S10 **Lusby et al** (DK)	Benders decomposition, LB, repairing heuristic,
S11 **Anghinolfi et al** (IT,CH)	MIP, Local Search (greedy randomized + simulated annealing), LP
S14 **Darlay et al** (FR)	Functional programming (CSP-based scheduling, greedy algorithm)
S16 **Cambazard et al** (IE)	CP-based scheduling (NumberJack), solution guided search
S17 **Soumis et al** (CA)	ILP modelling, piecewise-linear approx, linearization, rolling horizon procedure
S21 **Savourey et al** (FR)	ILP (packing ct), surrogate obj and constraints, CT hypergraph, speed up techniques
S22 **Gardi** & **Nouioua** (FR)	Pure local search, first improvement, ad-hoc approx alg for continuous part, data struct.
S23 **Alfandari** et al (FR)	Column generation, aggregation model, LPs (refuel)
S24 **Peekstok** & **Kuipers** (NL)	Simulated annealing, several moves , infeasibiliy allowed with penalized violations
S25 **Gavranovic et al** (BA)	CSP (OPL/COMET)+ greedy algorithm (instead of LP)

Key points

- Local search / Metaheuristic / ILP / CP

- Decomposition scheme (sched -> refuel -> prod)
- Feedback loop (Benders, column generation)
- Surrogate measures / cuts

- Aggregation levels (time, scenario)
- Linearization / approximation

- Incrementality / speed-up technique
- Greedy vs LP
- Preprocessing
- Implementation choice (C++, Java, Ocaml)