IMPACT Solver for Optimization Services

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Outline

• Brief Introduction
• Impact Solver Design
• Impact Solver Features
• Conclusion
IMPACT -- Integrated Mathematical Programming Advanced Computational Tools

• Comprehensive computational packages.

• Mathematical programming algorithms testing code.

• Web services based solver tool.
Impact Solver
General Design

Impact Solvers

- Continuous Solver
- Integer Solver
- Others
Impact Solver
General Design

• Extension of OSSolver

• Unified input and output interface

• Self contained and highly customized internal routines.
Impact Solver
General Design

Input Instance, Solver options

SOLVE

Output Result

Convert to Internal Instance

Internal Solve

Convert to Result
Impact Solver Features

• Impact Solver Service
  – solve, getJobID, send, retrieve, kill, knock functions
  – Callable from client agent implemented in any language on any platform, e.g. C/C++, Java, .net

• Impact Standalone Modules
• Impact Algorithms
Impact Solver Features

Standalone Functions

- Modules

- Number Theory Computations
- Linear Algebra
- Processing
- Integer Solver
- Continuous Solver
Impact Solver Features

Algorithms

• Research Focus
  – Mixed Integer Nonlinear Programming
  – Parallel computing for MINLP

• Algorithm Studies
  – Heuristics for generalized branch and bound methods
  – Web service based distributed parallel, e.g. communications, load balance handling.
  (See talk On Implementing a Parallel Integer Solver Using Optimization Services)
Impact Solver Features

Algorithms

- Starting Node

Root Node

- Add $u$

Proper Branching
Hyperplane being $u$

Left child

$u^T x = \mu_l$

Generate Children

Right child

$u^T x = \mu_l + 1$

Generate Children

Growing Left

Growing Right
Impact Solver Features

Algorithms

• Subsequent Node

\[ u^T x = \mu_i - 1 \]

Add new \( u \) prime

Proper Branching
Hyperplane being \( u \) prime

Growing Left

\[ u'^T x = \mu'_i \]

Generate Children

Growing Right

\[ u'^T x = \mu'_i + 1 \]

Generate Children
Impact Solver Features

Algorithms

• Generate Proper Branching Hyperplanes

  – Basis Reduction Based (Mehrotra and Li)
    • LLL
    • GBR

  – Heuristics (ongoing)
Conclusion

• Impact Solver Service is natively OS-Compatible.
  – Impact solver is a scalable platform for testing research algorithms.
  – Impact Solver is a web service based solver tool.
• Novel branch and bound approaches for MINLP are studied by using Impact solver service framework.
• Parallel computing for integer programming is being developed under Impact and OS framework.