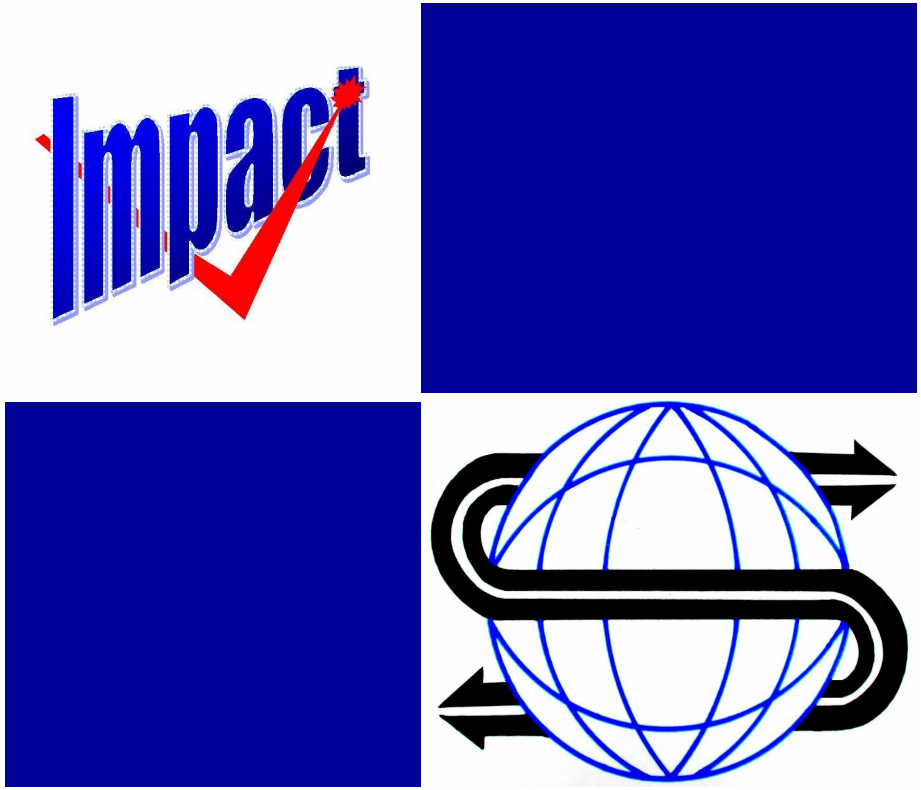


IMPACT Solver for Optimization Services

Huanyuan(Wayne) Sheng

Joint work with Professor Sanjay Mehrotra and Jun Ma

Outline

- Brief Introduction
- Impact solver
- Optimization Services And Impact
- Demo of Impact Solver Service
- Conclusion

IMPACT -- **I**ntegrated **M**athematical **P**rogramming **A**dvanced **C**omputational **T**ools

- Research code for testing optimization algorithms
- Current focus is on Mixed Integer Nonlinear Programming
- It has a solver-side framework component for testing Optimization Services

Impact Solver
Research Motivation

Mixed Integer Nonlinear Programming
(Mehrotra and Li, presented on Monday)

- Generalized branch and bound using adjoint lattice
- LLL and GBR basis reduction
- Interior point based search for relaxed solution

Impact Solver

work in progress

- LLL and GBR implementation
  - High quality reduced basis
  - Integrated with ellipsoidal rounding and analytical center computation

- Mixed Integer Solver
  - Mehrotra and Li's Version of Lenstra's and GBR algorithm in a branch and cut framework
  - More effective than branching on variables
  - Efficient tree management

Impact and Optimization Services

- Research Motivation
  - Solver service
    - distribution is not required.
  - Need standard problem instance (OSiL), result (OSrL) and option (OSoL) representation.
  - Need a standard local interface (OSInstance, OSOption, OSResult)
  - Need a standard communication interface for optimization over distributed system
    - Hooking up with solver – OShL
    - Call up a simulation or function evaluation – OScL
    - Discover solver services in OS Registry -- OSdL

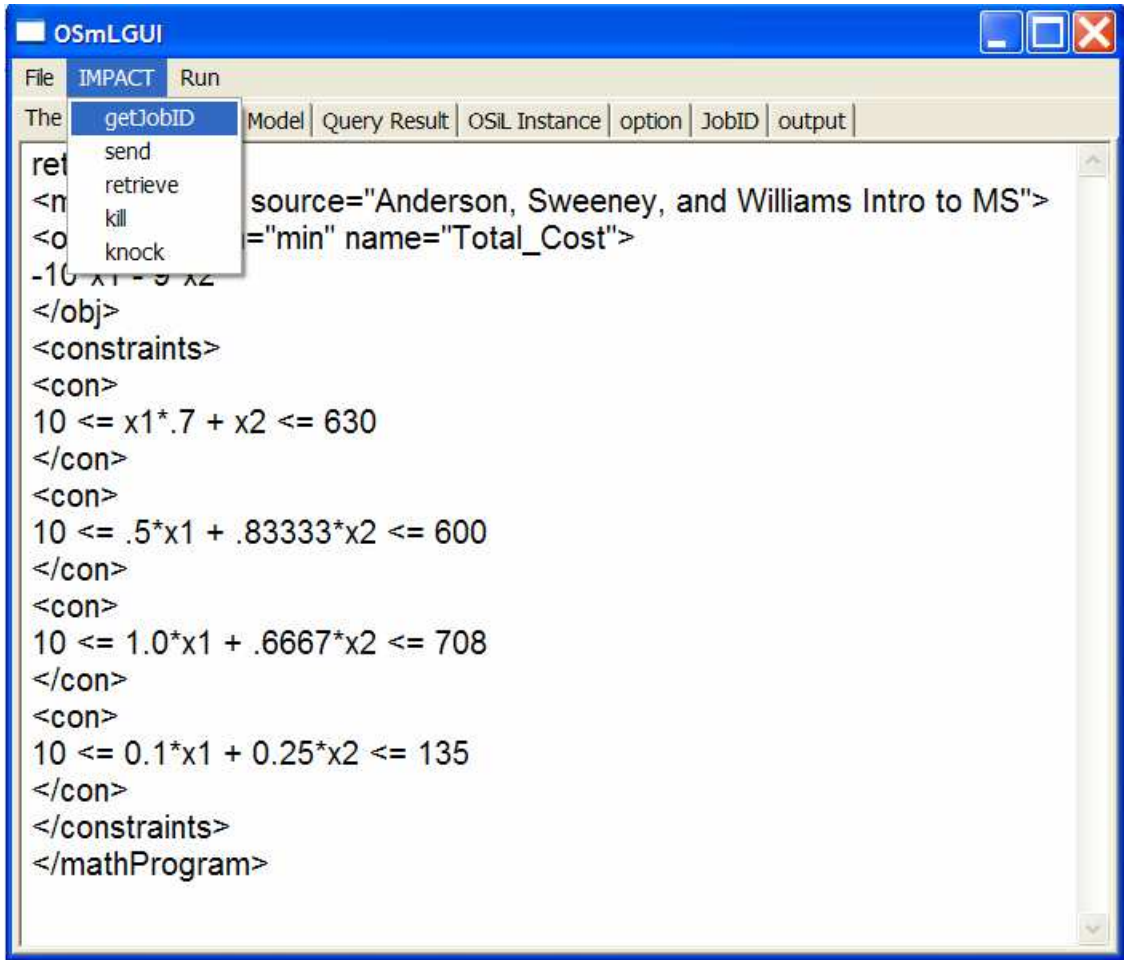
Impact Solver Service

- Built for standard instances
  - OSiL: xml string/file for an optimization instance
  - OSoL: xml string/file for an optimization option
  - OSrL: xml string/file for an optimization result
- Natively uses standard local interface (in memory problem data structure)
  - OSInstance: data structure for optimization instance
  - OSOption: data structure for optimization option
  - OSResult: data structure for optimization result
- Callable from client agent implemented in any language on any platform
  - C/C++
  - Java
  - .net

Impact Solver Service

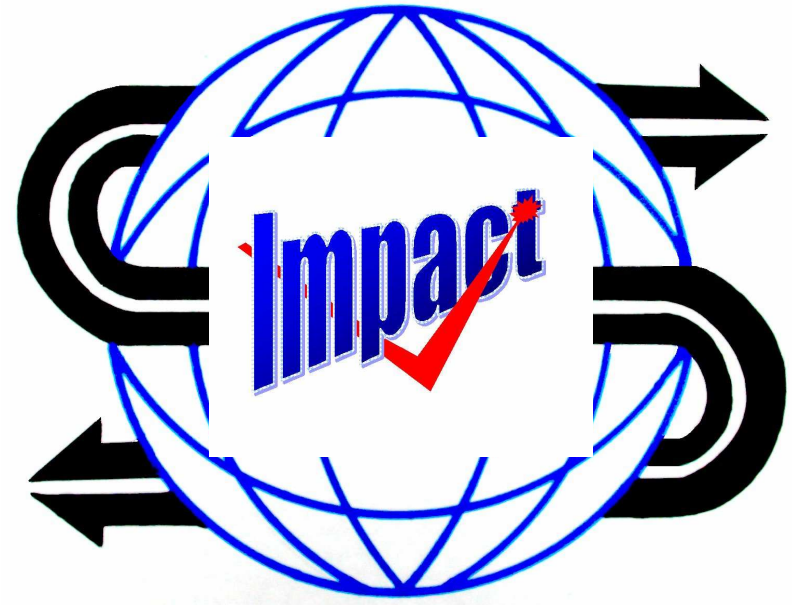
- solve
  - Takes OSiL and OSoL and returns OSrL (string/file version)
  - Synchronous call, blocking request/response,
- getJobID
  - Gets a unique job id generated by the solver service
  - Critical for maintaining session and state on a distributed system
- send
  - Same input signature as the solve function but only returns a boolean
  - Asynchronous (server side), non-blocking call
- retrieve
  - Retrieving result from anywhere and anytime.
- kill
  - Kill remote optimization jobs
  - Critical in long running optimization jobs
  - Plays an important role in fathoming tree nodes that are solved over remote computers
- knock
  - Get and set instant messages from the remote optimization services

Demo


OSmLGUI
File
IMPACT
Run
getJobID
send
retrieve
kill
knock
Model
Query Result
OSiL Instance
option
JobID
output
source="Anderson, Sweeney, and Williams Intro to MS">
="min" name="Total_Cost">
</obj>
<constraints>
<con>
10 <= x1*.7 + x2 <= 630
</con>
<con>
10 <= .5*x1 + .83333*x2 <= 600
</con>
<con>
10 <= 1.0*x1 + .6667*x2 <= 708
</con>
<con>
10 <= 0.1*x1 + 0.25*x2 <= 135
</con>
</constraints>
</mathProgram>

Conclusion

- Impact Solver Service is natively OS-Compatible.
  - Impact solver is a scalable platform for testing research algorithms.
- Optimization Services provides a comprehensive and convenient framework for developing optimization software



Huanyuan Sheng, Sanjay Mehrotra and Jun Ma
Impact Solver for Optimization Services, November 15, 2005