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NEW ZEALAND

NEOS.jl (and other things)

Oscar Dowson

Department of Engineering Science, University of Auckland, New Zealand.

o.dowson@auckland.ac.nz

Overview

1. The NEOS Server
2. NEOS.jl interface with MPB
3. File Formats

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The NEOS Server

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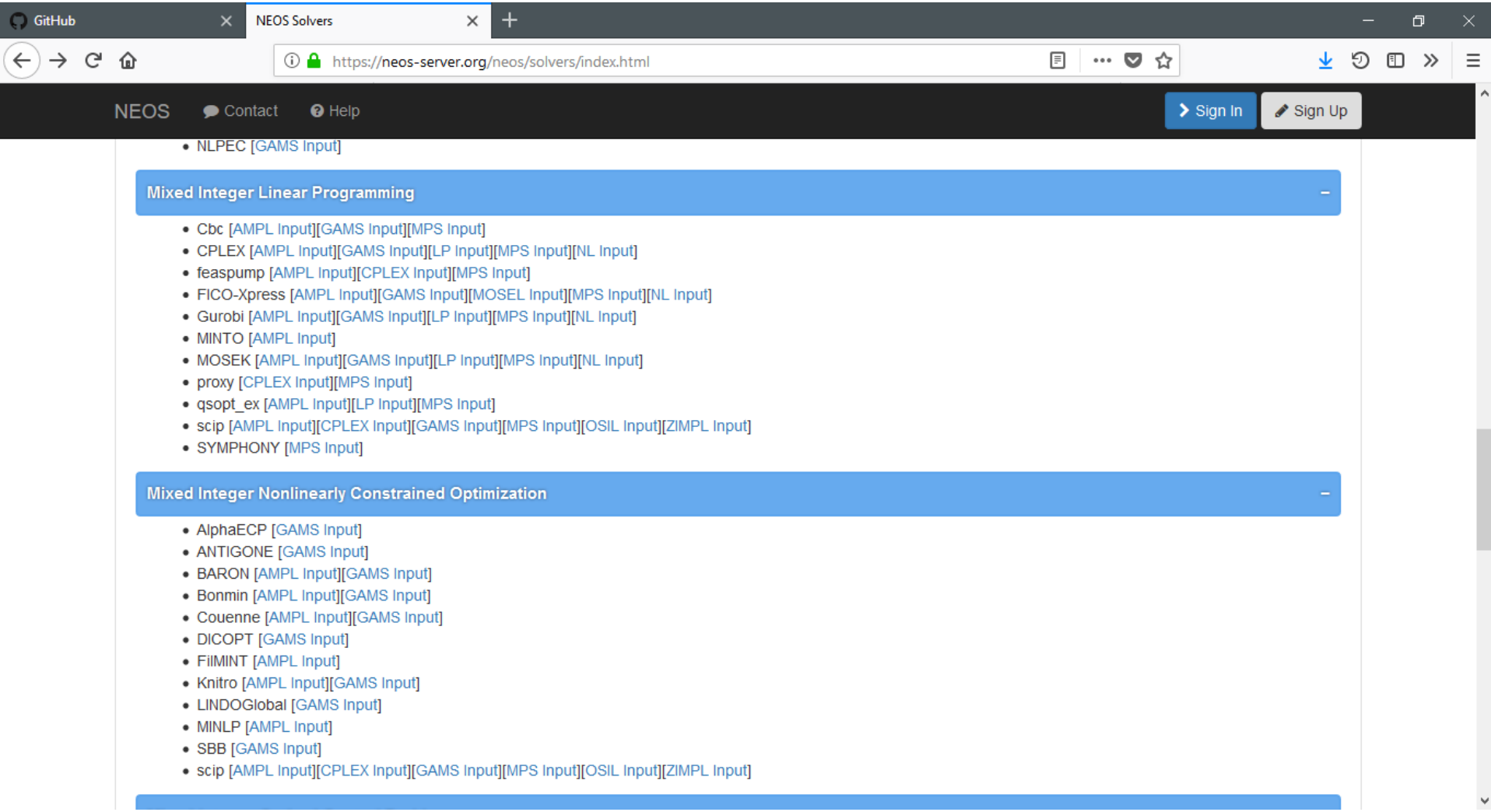
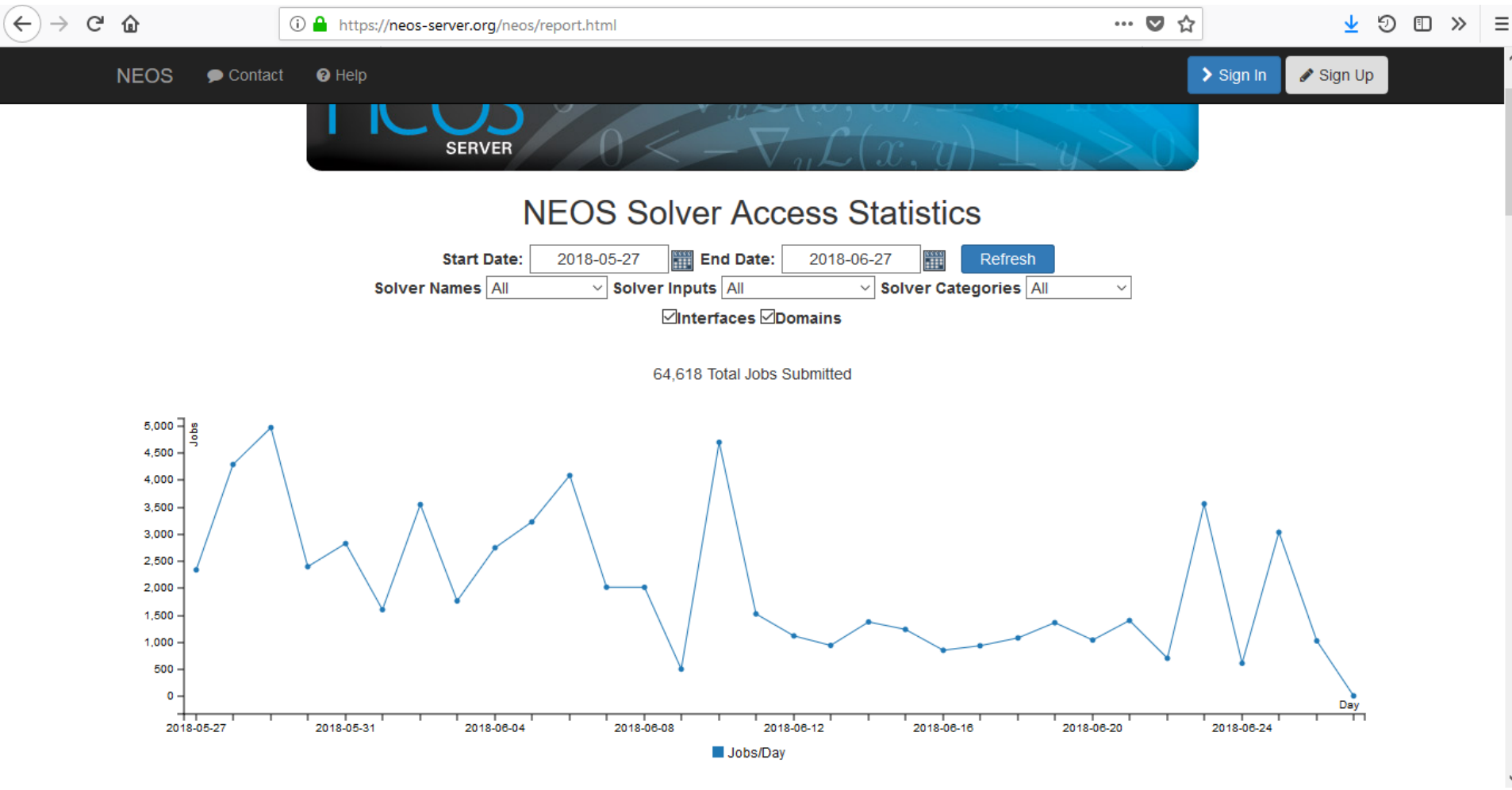
The NEOS Server

- Free internet-based service for solving numerical optimization problems.
- University of Wisconsin, Madison
- They provide and XML-RPC API!

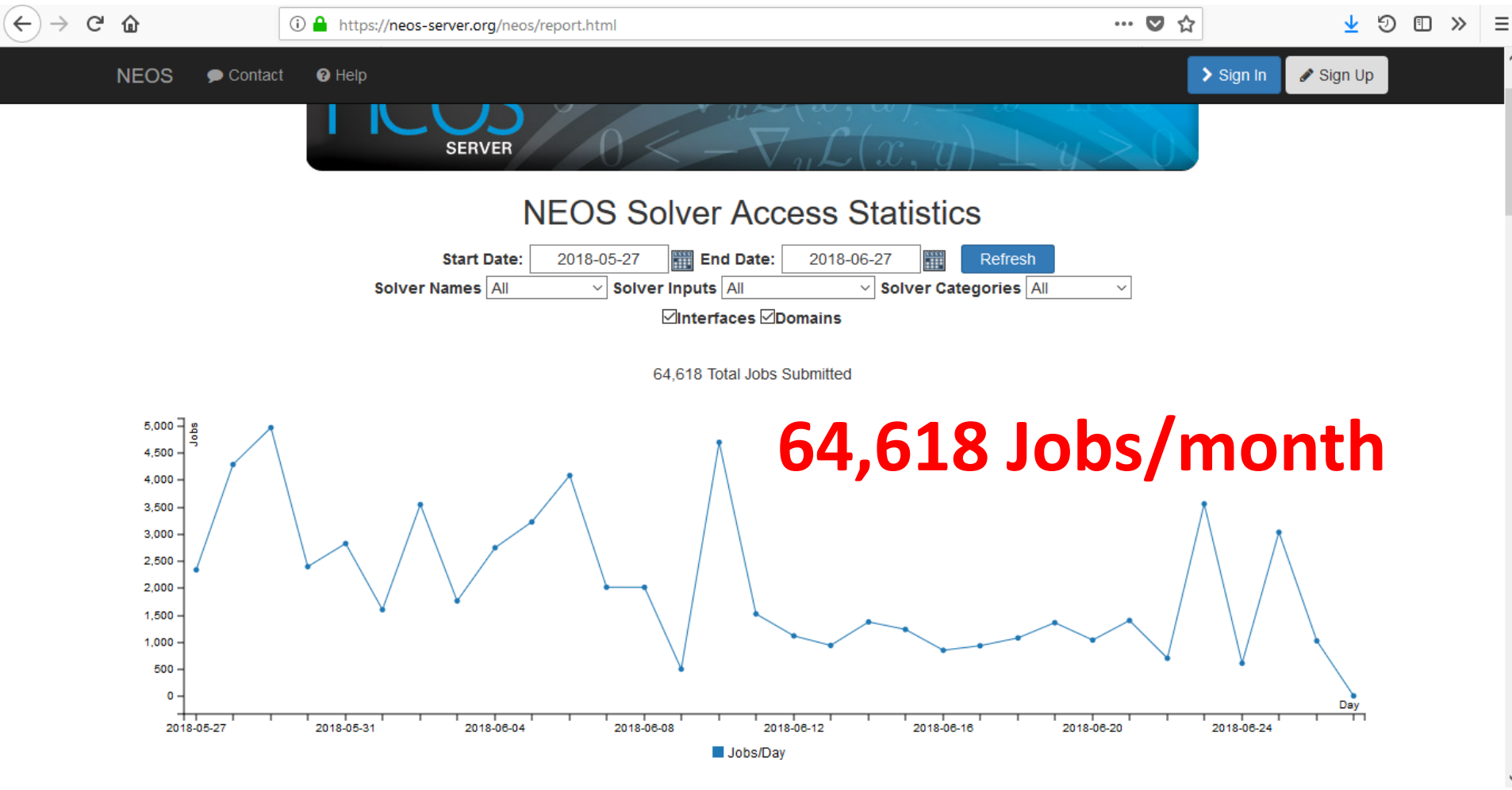
Lots of Solvers



Statistics


https://neos-server.org/neos/report.html
NEOS
Contact
Help
Sign In
Sign Up
SERVER
NEOS Solver Access Statistics
Start Date: 2018-05-27
End Date: 2018-06-27
Refresh
Solver Names All
Solver Inputs All
Solver Categories All
Interfaces Domains
64,618 Total Jobs Submitted
Jobs
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Day
2018-05-27
2018-05-31
2018-06-04
2018-06-08
2018-06-12
2018-06-16
2018-06-20
2018-06-24
Jobs/Day

Statistics



64,618 Jobs/month

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We can talk to the API

```
julia> using NEOS

julia> s = NEOSServer();

julia> NEOS.ping(s)
 "NeosServer is alive\n"
```

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We can talk to the API

```
julia> NEOS.printQueue(s)
```

```
Running:

  Job #    Cat    Solver      Input  Submitted    Started      Elapsed  Host
-------------------------------------------------------------------------------------------
6139717    go     BARON       GAMS   06/26 16:39  06/26 16:39  6:37:15  prod-sub-1.neos-server.org
6139718    minco  Couenne     AMPL   06/26 16:42  06/26 16:42  6:34:39  prod-sub-1.neos-server.org
...
6139769    minco  Couenne     AMPL   06/26 17:30  06/26 17:30  5:46:34  prod-sub-1.neos-server.org
6139991    go     scip        MPS    06/26 21:05  06/26 21:05  2:11:12  athene.la.asu.edu
6140015    minco  scip        MPS    06/26 21:05  06/26 21:06  2:10:45  thales.la.asu.edu
6140048    minco  BARON       GAMS   06/26 23:09  06/26 23:12  0:03:52  prod-sub-1.neos-server.org
```

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MathProgBase

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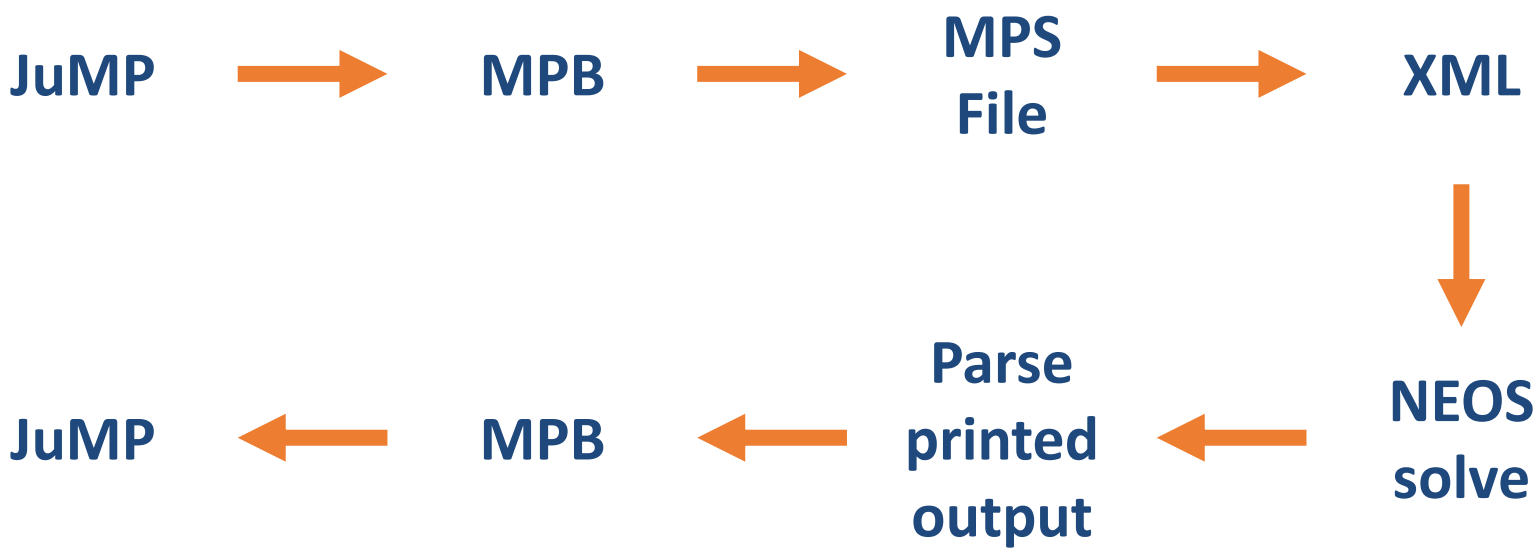
The MPB Interface



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An Example

```
using JuMP, NEOS

solver = NEOSSolver(
  solver = :CPLEX,
  format = :MPS,
  print_level = 2
)

m = Model(solver=solver)
@variable(m, x>=1.5, Int)
@objective(m, Min, x)
solve(m)
```

An Example

```
==================
NEOS Job submitted
number: 6140637
pwd:    wDTECumZ
==================
Job 6140637 dispatched
password: wDTECumZ
---------- Begin Solver Output -----------
Condor submit: 'neos.submit'
Condor submit: 'watchdog.submit'
Job submitted to NEOS HTCondor pool.


Executing on prod-exec-5.neos-server.org

Welcome to IBM(R) ILOG(R) CPLEX(R) Interactive Optimizer
12.7.0.0
  with Simplex, Mixed Integer & Barrier Optimizers
5725-A06 5725-A29 5724-Y48 5724-Y49 5724-Y54 5724-Y55
5655-Y21
Copyright IBM Corp. 1988, 2016.  All Rights Reserved.

Type 'help' for a list of available commands.
Type 'help' followed by a command name for more
information on commands.

CPLEX> New value for default parallel thread count: 4
CPLEX> Selected objective sense:  MINIMIZE
Selected objective  name:  OBJ
Selected bound      name:  BOUNDS
Warning:  Non-integral bound value 1.2 for integer
column 'V1'.
Warning:  Blank RHS name changed to 'rhs'.
Problem 'cplex.mps' read.
Read time = 0.00 sec. (0.00 ticks)
CPLEX> Warning:  Non-integral bounds for integer
variables rounded.
Tried aggregator 1 time.
MIP Presolve eliminated 0 rows and 1 columns.
All rows and columns eliminated.
Presolve time = 0.00 sec. (0.00 ticks)

Root node processing (before b&c):
  Real time             =    0.00 sec. (0.00 ticks)
Parallel b&c, 4 threads:
  Real time             =    0.00 sec. (0.00 ticks)
  Sync time (average)   =    0.00 sec.
  Wait time (average)   =    0.00 sec.
                          ------------
Total (root+branch&cut) =    0.00 sec. (0.00 ticks)

Solution pool: 1 solution saved.

MIP - Integer optimal solution:  Objective =
2.0000000000e+00
Solution time =    0.00 sec.  Iterations = 0  Nodes = 0
Deterministic time = 0.00 ticks  (2.11 ticks/sec)

CPLEX> MIP - Integer optimal solution:  Objective =
2.0000000000e+00
CPLEX> Incumbent solution
Variable Name           Solution Value
V1                            2.000000
CPLEX> Not available for mixed integer problems.
Use CHANGE PROBLEM to change problem type.
CPLEX> Not available for mixed integer problems.
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CPLEX>
```

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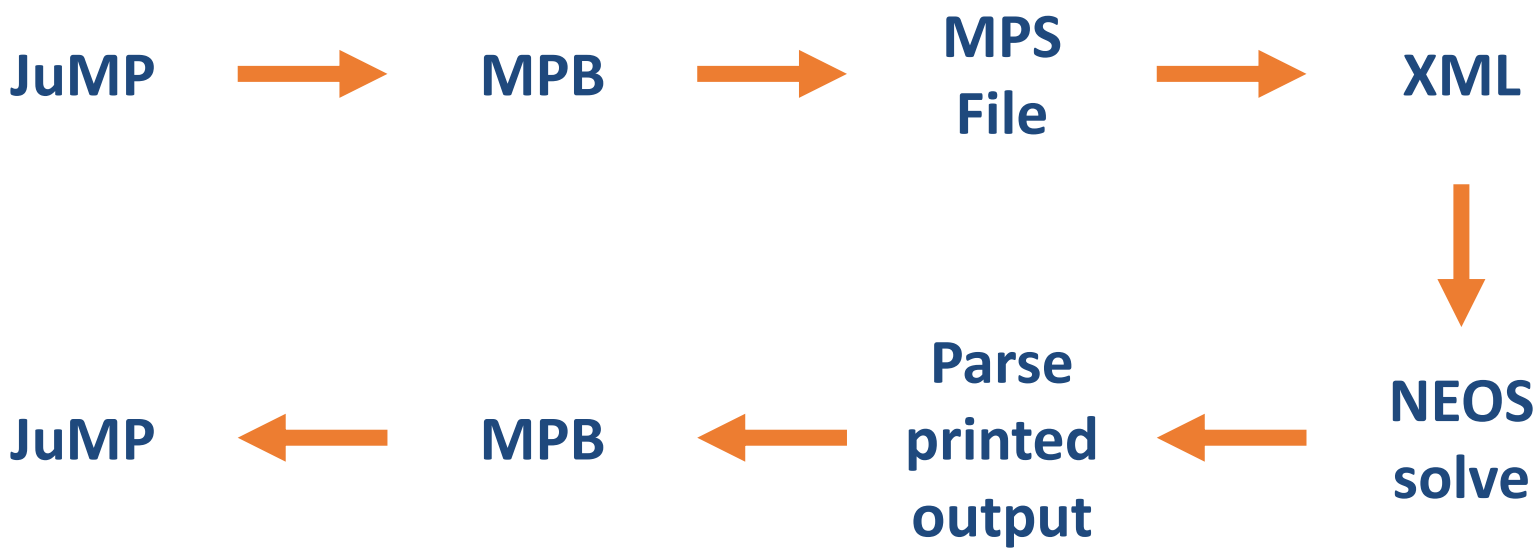

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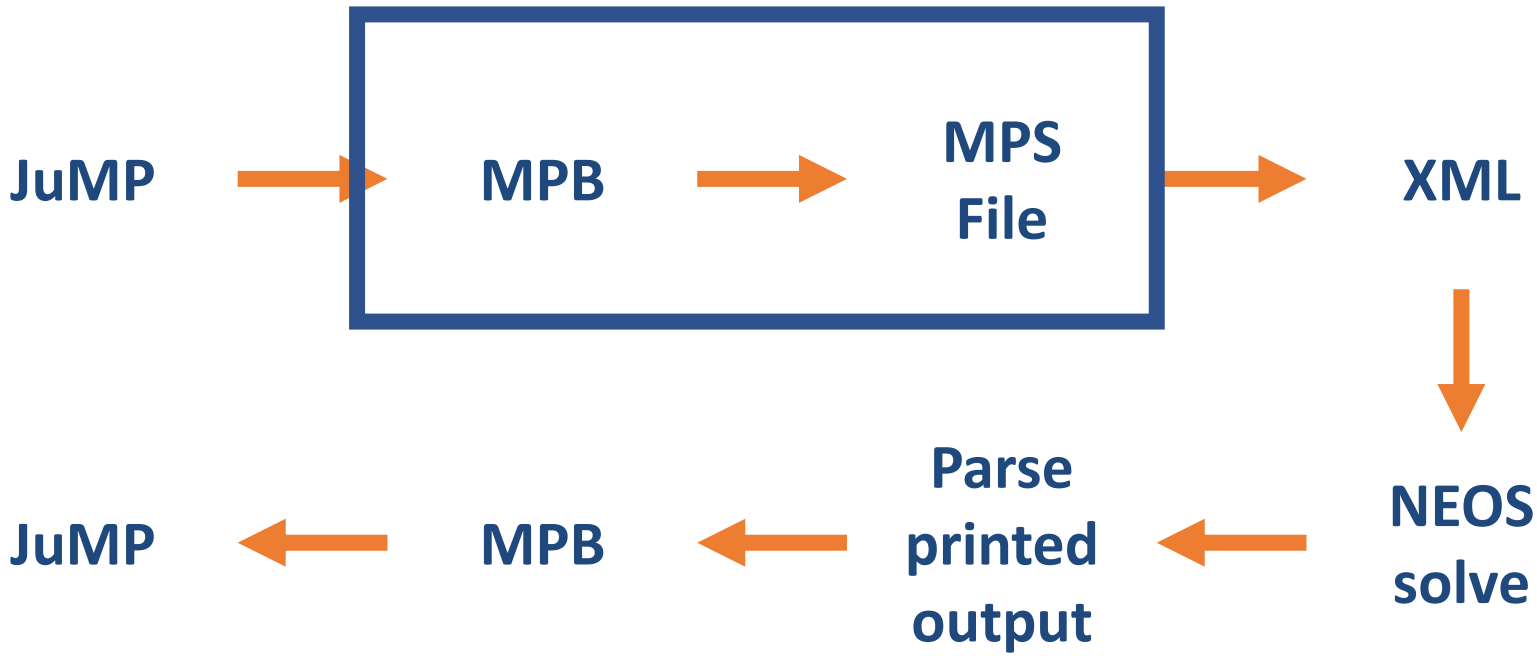
The MPB Interface



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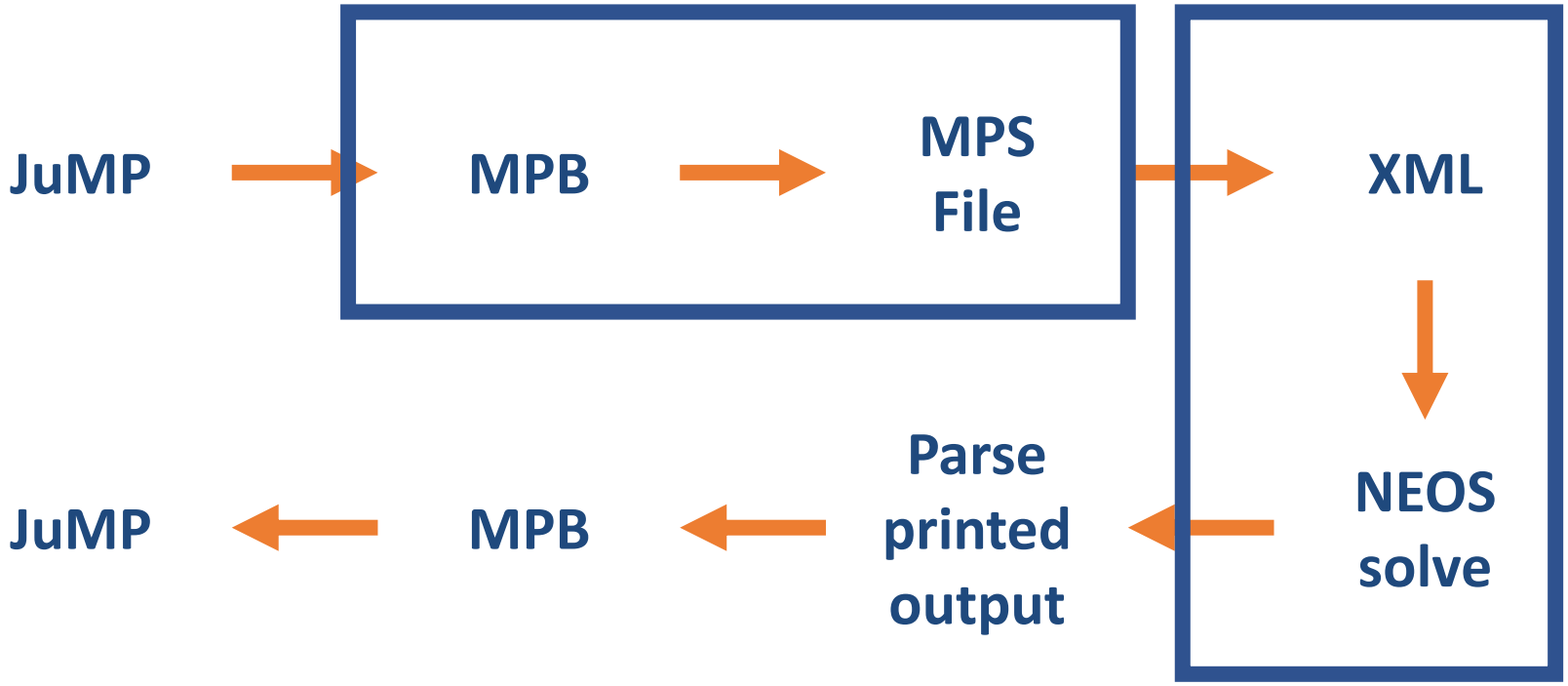

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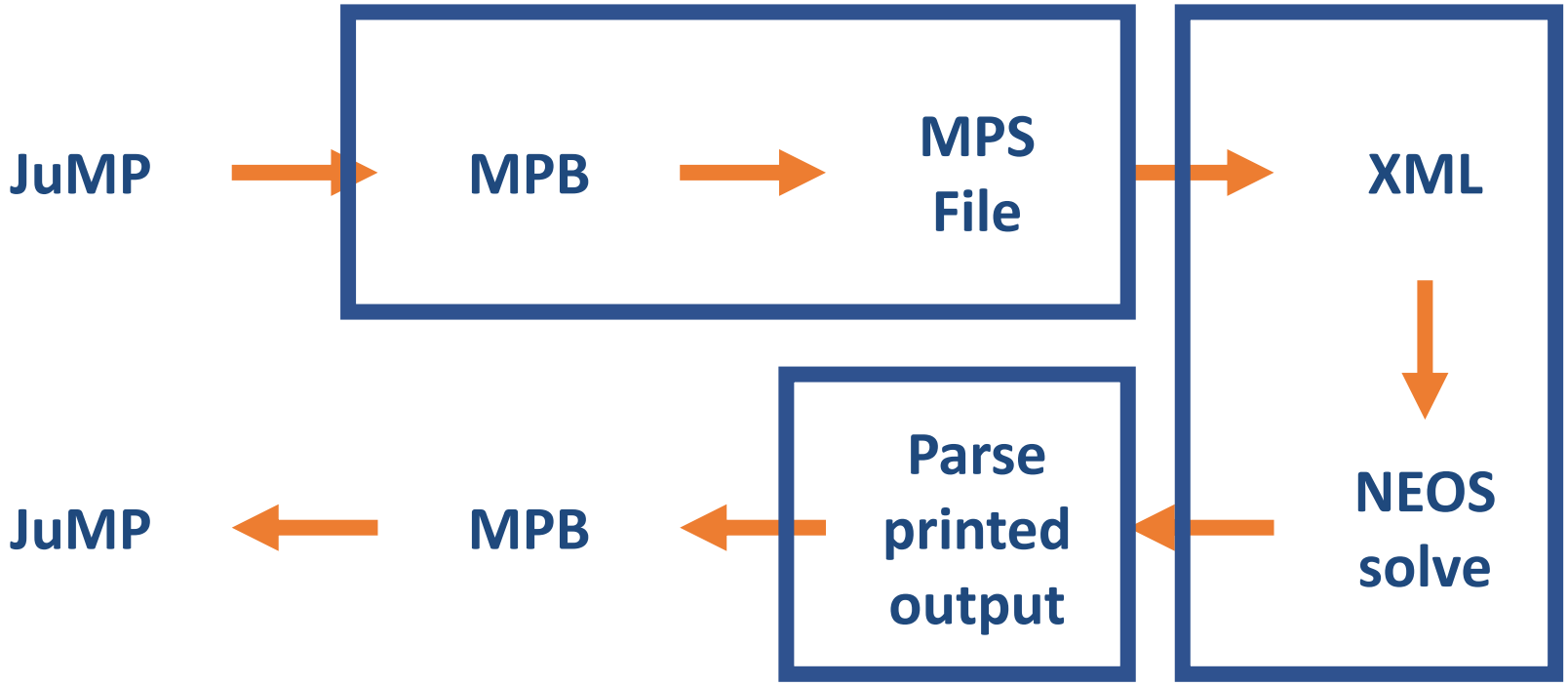

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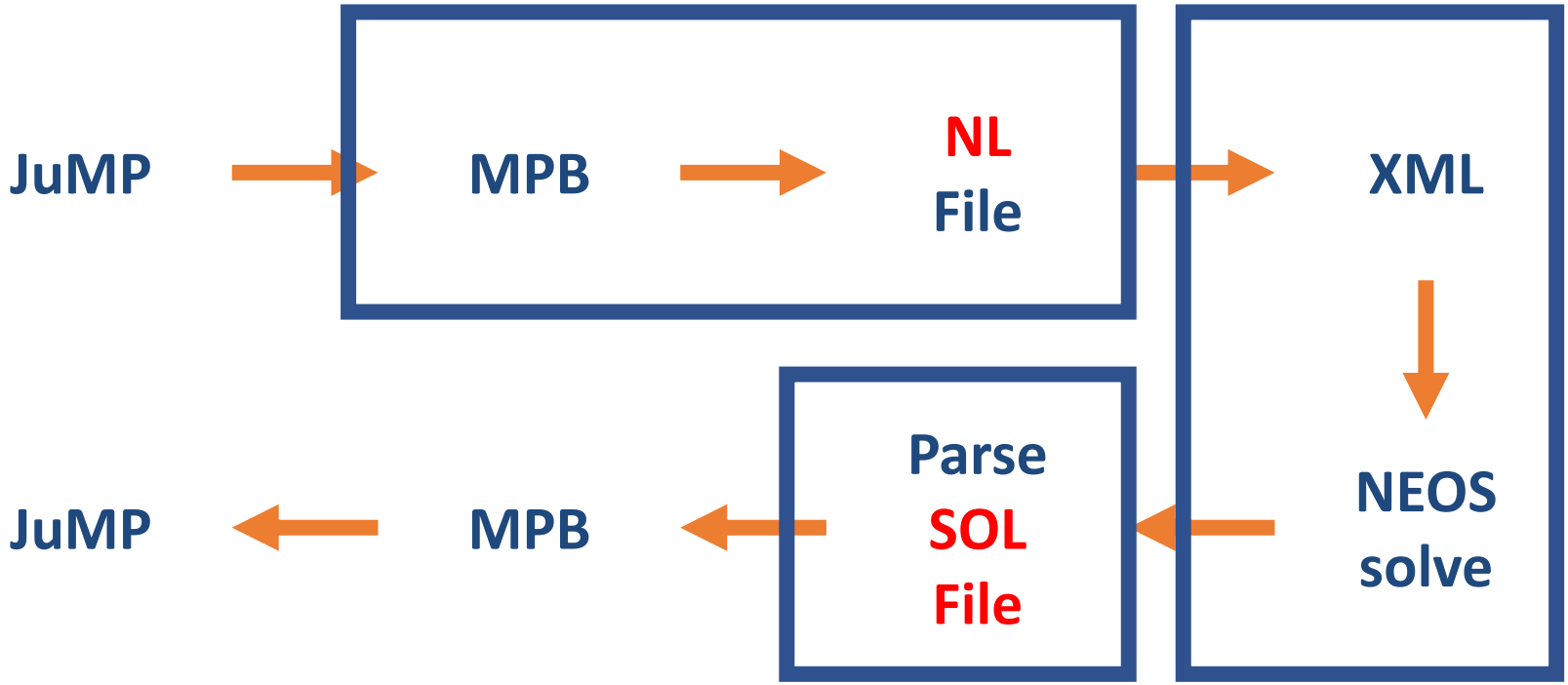

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File Formats

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Goals for a Format

1. Human-readable
2. Machine-readable
3. Standardized
4. Extensible

1. Human-readable

The format should be able to be read and edited by a human.

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2. Machine-readable

The format should be able to be read by a variety of different programming languages *without* needing to write custom parsers in each language.

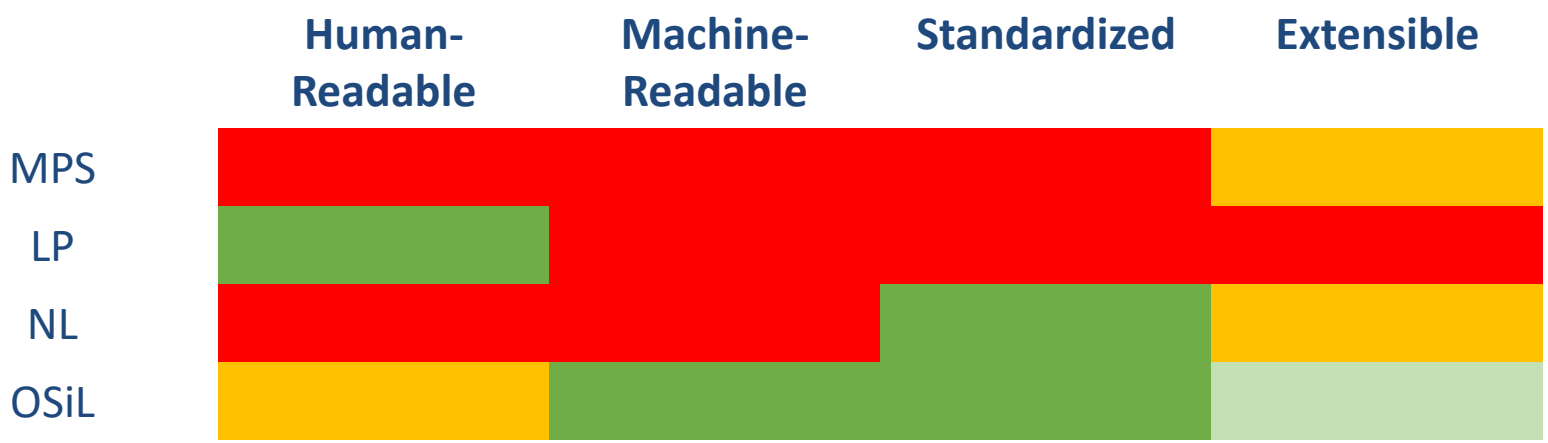
3. Standardized

The format should conform to a well described "standard-form" that is unambiguous.

4. Extensible

The format should be able to be easily extended to incorporate new problem-classes as they arise.

Current Formats



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Proposal: MathOptFormat

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Proposal: MathOptFormat

A one-to-one mapping to MOI in JSON

Or OSiL, just not in XML

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Proposal: MathOptFormat

```
{
    "author": "Oscar Dowson",
    "description": "A simple example",
    "version": 1,
    "sense": "min",
    "variables": [{"name": "x"}, {"name": "y"}],
    "objective": {
        ...
    }
    "constraints": [
        ...
    ]
}
```

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Proposal: MathOptFormat

```
"objective": {
        "head": "ScalarAffineFunction",
        "terms": [
            {
                "head": "ScalarAffineTerm",
                "variable": "x", "coefficient": 2
            },
            {
                "head": "ScalarAffineTerm",
                "variable": "y", "coefficient": 1
            }
        ]
        "constant": 0
    }
```

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Proposal: MathOptFormat

```
"constraints": [
      {
          "name": "x ∈ {0,1}",
          "set": {"head": "ZeroOne"},
          "function": {
              "head": "SingleVariable",
              "variable": "x"
          }
      }
  ]
```

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Things to work on

NEOS.jl
- update to MOI
- link to more NL solvers
- https://github.com/odow/NEOS.jl

AmlNLWriter.jl
- pull out NL writing from the solver
- https://github.com/JuliaOpt/AmplNLWriter.jl

MathOptFormat.jl
- everything.
- https://github.com/odow/MathOptFormat.jl

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Things to work on

NEOS.jl
- update to MOI
- link to more NL solvers
- https://github.com/odow/NEOS.jl

AmlNLWriter.jl
- pull out NL writing from the solver
- https://github.com/JuliaOpt/AmplNLWriter.jl

MathOptFormat.jl
- everything.
- https://github.com/odow/MathOptFormat.jl