
Cloud Strategies for Optimization Modeling Software

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WB-02, Modeling Systems I — Wednesday, 11:00-12:30

Computing in the Cloud

Client side

- Local computing device owned by the user
 - * Company, organization, university, individual
- Client application run by the user on the local device

Server side

- Remote computing facility owned by a provider
 - * Company, organization, university
- Service running automatically at the remote facility

Client does not own the server

AMPL

Optimization in the Cloud

Multiple solvers as a service

- **NEOS Server**
- Satalia SolveEngine

Modeling system + solvers as a service

- AMPL Online (*forthcoming*)

Dedicated solver as a service

- IBM Decision Optimization on Cloud
- **Gurobi Instant Cloud**

Distributed application development

- FICO Analytic Cloud
- IBM Data Science Experience
- **QuanDec for AMPL**

NEOS Server www.neos-server.org

Network Enabled Optimization System

- Originated 1995 at Argonne National Laboratory and Northwestern University
 - * U.S. Department of Energy
 - * National Science Foundation
- Since 2011 at University of Wisconsin, Madison
 - * Wisconsin Institutes for Discovery

Free “optimization on demand”

- Over 40 solvers
- Several optimization modeling languages

Architecture

Distributed workstations

- Offer varied inputs & solvers
- Process submissions on demand
- Contributed by varied organizations

Central scheduler

- Receives and queues submissions
- Sends submissions to appropriate workstations
- Returns results

Minimal hands-on management

- *Distributed*: Install NEOS software on workstations
- *Central*: Update server database
of workstation locations and abilities

Original Facilities

Local submission clients

- Email
- Website
- NEOS submission tool

Problem description formats

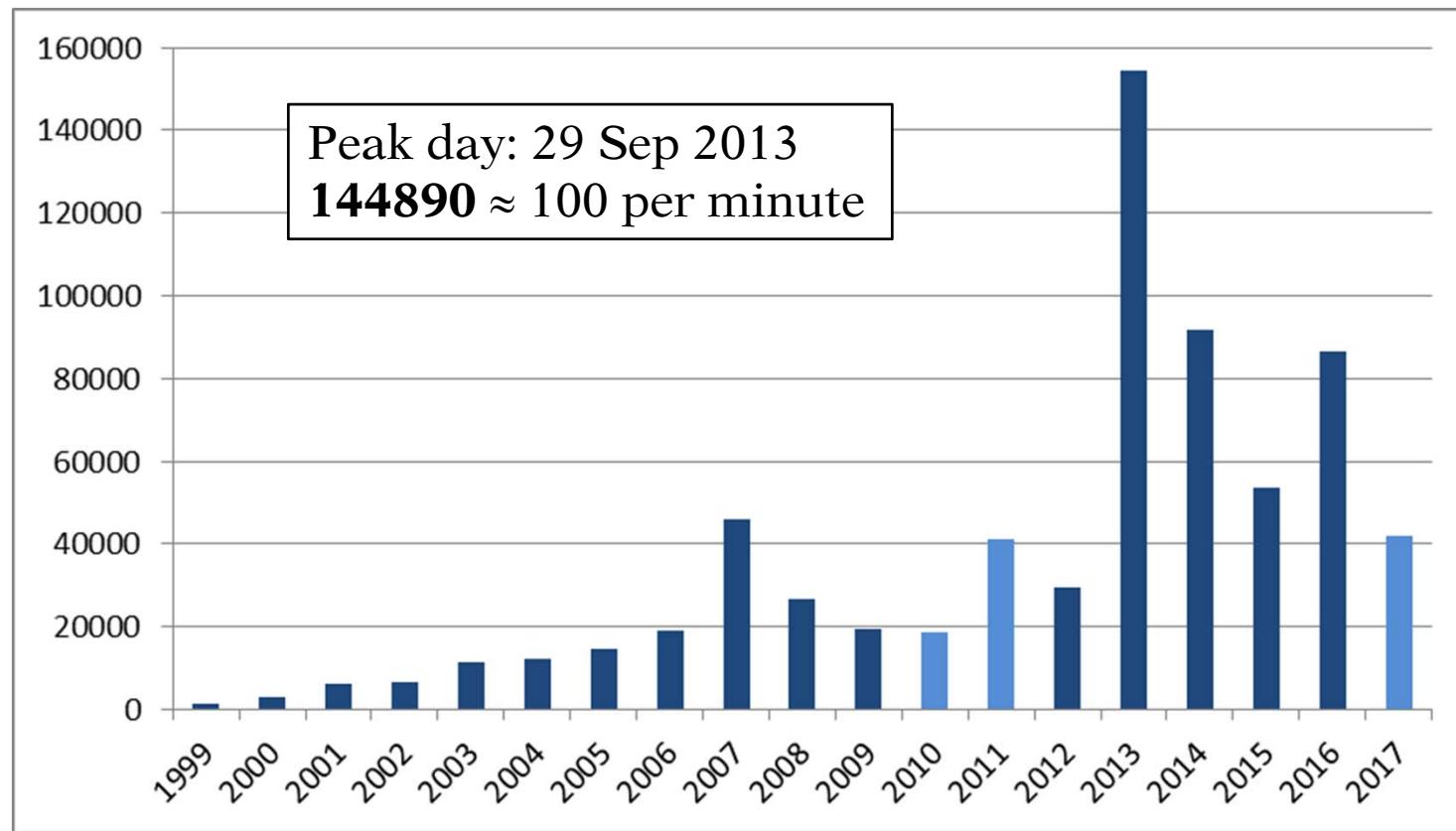
- Linear: MPS and other solver files
- Nonlinear: Fortran or C programs
 - * automatic differentiation of programs

W. Gropp and J.J. Moré, 1997. **Optimization Environments and the NEOS Server.** *Approximation Theory and Optimization*, M. D. Buhmann and A. Iserles, eds., Cambridge University Press, 167-182.

J. Czyzyk, M.P. Mesnier and J.J. Moré, 1998. **The NEOS Server.** *IEEE Journal on Computational Science and Engineering* **5**(3), 68-75.

Impact: Total Submissions

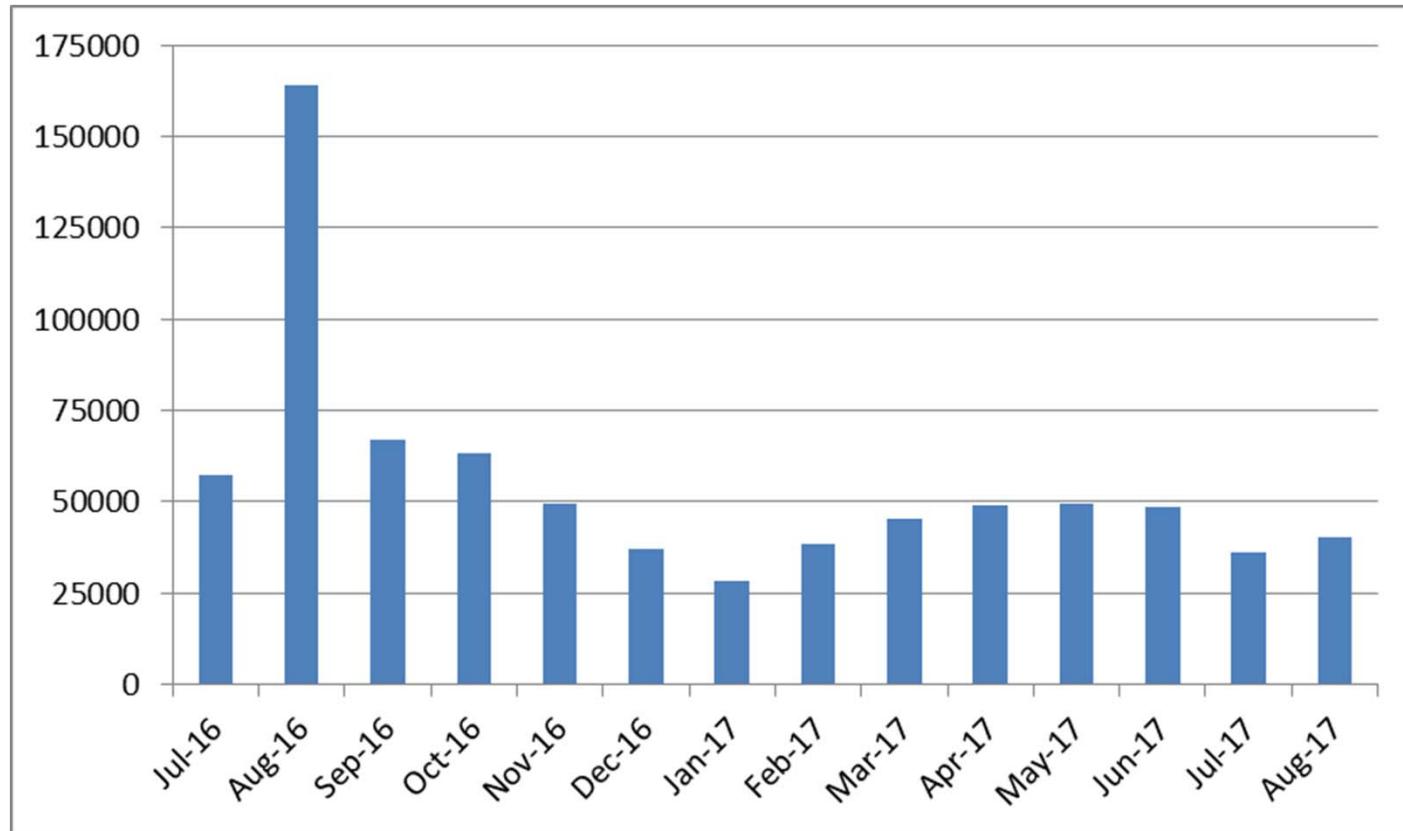
Monthly rates since 1999



45000/month ≈ one per minute

Impact: Recent Submissions

Monthly rates for past year



45000/month \approx one per minute

Assessment

Strengths

- Free
- Choice of solvers
 - * Every popular solver available
- Easy to use
 - * No account setup
 - * No advance scheduling

Weaknesses

- Stand-alone focus: submission of “solve jobs”
- Non-profit management
 - * Limited support & development
 - * No guarantee of confidentiality
 - * No guarantee of performance

Modeling Languages in NEOS

Modeling language inputs

- AMPL model, data, commands files
- GAMS model, options, gdx files

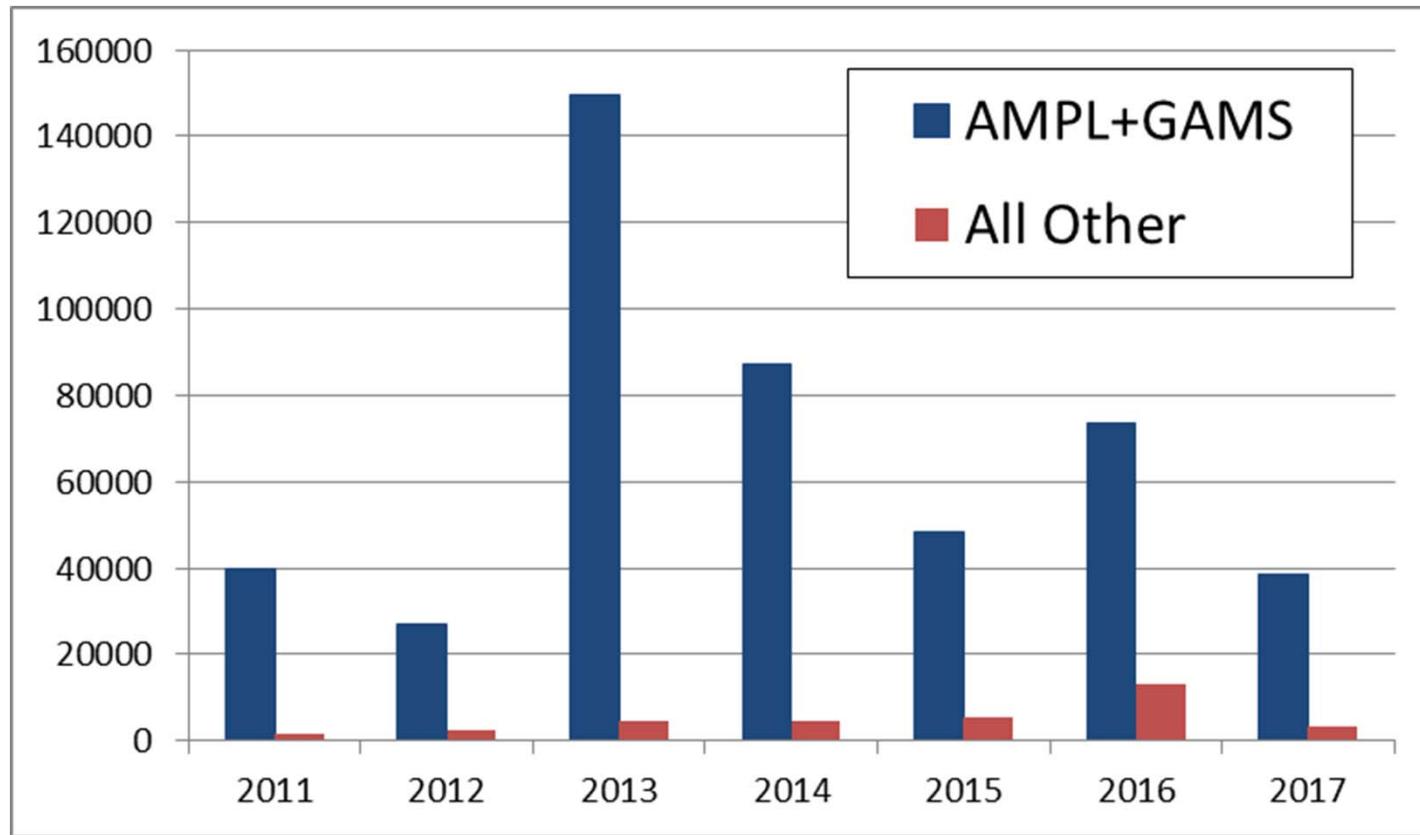
Modeling language operation

- User chooses a solver and a language
- NEOS scheduler finds a compatible workstation
- NEOS workstation invokes modeling language system with given inputs
- Modeling language system invokes solver

E.D. Dolan, R. Fourer, J.J. Moré and T.S. Munson,
Optimization on the NEOS Server. *SIAM News* **35**:6
(July/August 2002) 4, 8–9. www.siam.org/pdf/news/457.pdf

Impact: Modeling Languages

Monthly rates since 2011



Solver & Language Listing

The screenshot shows a web browser window titled "NEOS Solvers" with the URL <https://neos-server.org/neos/solvers/index.html>. The page lists solvers categorized by type:

- Linear Programming**
 - BDMLP [GAMS Input]
 - bmpmpd [AMPL Input][LP Input][MPS Input][QPS Input]
 - Clp [MPS Input]
 - CPLEX [AMPL Input][GAMS Input][LP Input][MPS Input]
 - FICO-Xpress [AMPL Input][GAMS Input][MOSEL Input][MPS Input]
 - Gurobi [AMPL Input][GAMS Input][MPS Input]
 - MOSEK [AMPL Input][GAMS Input][LP Input][MPS Input]
 - OOQP [AMPL Input]
 - SoPlex80bit [LP Input][MPS Input]
- Mathematical Programs with Equilibrium Constraints**
 - filterMPEC [AMPL Input]
 - Knitro [GAMS Input]
 - NLPEC [GAMS Input]
- Mixed Integer Linear Programming**
 - Cbc [AMPL Input][GAMS Input][MPS Input]
 - CPLEX [AMPL Input][GAMS Input][LP Input][MPS Input]
 - feaspump [AMPL Input][CPLEX Input][MPS Input]
 - FICO-Xpress [AMPL Input][GAMS Input][MOSEL Input][MPS Input]
 - Gurobi [AMPL Input][GAMS Input][MPS Input]
 - MINTO [AMPL Input]
 - MOSEK [AMPL Input][GAMS Input][LP Input][MPS Input]
 - proxy [CPLEX Input][MPS Input]
 - qsopt_ex [AMPL Input][LP Input][MPS Input]
 - scip [AMPL Input][CPLEX Input][GAMS Input][MPS Input][OSIL Input][ZIMPL Input]
 - SYMPHONY [MPS Input]
- Mixed Integer Nonlinearly Constrained Optimization**
 - AlphaECP [GAMS Input]
 - BARON [AMPL Input][GAMS Input]
 - Bonmin [AMPL Input][GAMS Input]

NEOS Server

AMPL Input Page

The screenshot shows a web browser window titled "NEOS Server: CPLEX". The URL in the address bar is <https://neos-server.org/neos/solvers/milp:CPLEX/AMPL.html>. The page header includes the NEOS logo, a "Contact" link, a "Help" link, and "Sign In" and "Sign Up" buttons. A sidebar on the right lists "NEOS Interfaces to CPLEX" options: "WWW Form & Sample Submissions", "Email", and "XML-RPC". The main content area features the NEOS logo and a large banner with the word "optimization" and mathematical expressions: $0 = \nabla_x \mathcal{L}(x, u) \perp x \text{ free}$ and $0 < -\nabla_u \mathcal{L}(x, y) \perp y > 0$. Below this, a section titled "CPLEX" provides information about the solver, links to IBM Decision Optimization and the Academic Initiative, and a section on using the NEOS Server with AMPL/CPLEX.

CPLEX

The NEOS Server offers the IBM ILOG CPLEX Optimizer for the solution of mixed-integer linear programming (MILP) problems that can be modeled in [AMPL](#) format.

For information on IBM Decision Optimization products, including the CPLEX Optimizer, visit [IBM Decision Optimization](#).

For information on all IBM software available to academics, visit the [IBM Academic Initiative](#).

Using the NEOS Server with AMPL/CPLEX

The user must submit a model in [AMPL](#) format to solve a mixed-integer linear program. The [examples section](#) of the AMPL website provides examples of models in AMPL format.

The MILP problem must be specified by a model file with the options of a data file and a commands file. If the commands file is specified, it must contain the AMPL solve command. However, the command file must *not* contain the model or data commands. The model and data files are renamed internally by NEOS.

The commands file may include option settings for CPLEX. To specify solver options, add

AMPL Input Page

The screenshot shows a web browser window titled "NEOS Server: CPLEX". The URL in the address bar is <https://neos-server.org/neos/solvers/milp:CPLEX/AMPL.html>. The page has a dark header with "NEOS", "Contact", "Help", "Sign In", and "Sign Up" buttons. The main content area is titled "Web Submission Form". It contains four sections: "Model File" (with a file input field showing "cut.mod"), "Data File" (with a file input field showing "cut.dat"), "Commands File" (with a file input field showing "No file chosen"), and "Comments" (a large text area). At the bottom is an "Additional Settings" section with two checkboxes: "Dry run: generate job XML instead of submitting it to NEOS" and "Short Priority: submit to higher priority queue with maximum CPU time of 5 minutes".

Model File
Enter the location of the AMPL model (local file)
 cut.mod

Data File
Enter the location of the AMPL data file (local file)
 cut.dat

Commands File
Enter the location of the AMPL commands file (local file)
 No file chosen

Comments

Additional Settings

Dry run: generate job XML instead of submitting it to NEOS

Short Priority: submit to higher priority queue with maximum CPU time of 5 minutes

NEOS Server

AMPL Input Page

The screenshot shows a web browser window titled "NEOS Server: CPLEX". The URL in the address bar is <https://neos-server.org/neos/solvers/milp:CPLEX/AMPL.html>. The page has a dark header with "NEOS", "Contact", "Help", "Sign In", and "Sign Up" buttons. Below the header is a "Comments" section with an empty text area. Under "Additional Settings", there are two checkboxes: "Dry run: generate job XML instead of submitting it to NEOS" and "Short Priority: submit to higher priority queue with maximum CPU time of 5 minutes". There is also a field for "E-Mail address". A note at the bottom says "Please do not click the 'Submit to NEOS' button more than once." with "Submit to NEOS" and "Clear this Form" buttons. A blue bar at the bottom states "By submitting a job, you have accepted the [Terms of Use](#)". At the bottom of the page are logos for the University of Wisconsin-Madison and the Wisconsin Institutes for Discovery, along with copyright information: "Copyright © 2017, Wisconsin Institutes for Discovery at the University of Wisconsin, Madison · [Terms of Use](#) · [Questions and Comments](#)".

APIs

Application programming interfaces

- Access NEOS from a local program

Implementations

- Version 1: XML-RPC remote procedure call
- Version 5: full Python API

Uses

- NEOS submission tool
- NEOS option in Solver Studio for Excel
- **NEOS as a “solver” for modeling systems**

Modeling Systems as NEOS Clients

New “solvers”

- Kestrel for AMPL
- Kestrel for GAMS

Familiar operation

- Choose Kestrel as the local “solver”
- Set an option to choose a real solver on NEOS
- Initiate a solve and wait for results

E.D. Dolan, R. Fourer, J.-P. Goux, T.S. Munson and J. Sarich,
**Kestrel: An Interface from Optimization Modeling Systems
to the NEOS Server.** *INFORMS Journal on Computing* **20**
(2008) 525–538. dx.doi.org/10.1287/ijoc.1080.0264

AMPL Interactive Session

```
ampl: model sched1.mod;
ampl: data sched.dat;

ampl: let least_assign := 16;

ampl: option solver kestrel;
ampl: option kestrel_options 'solver=cplex';

ampl: solve;

Connecting to: neos-server.org:3332
Job 4679195 submitted to NEOS, password='JMNRQoTD'

Check the following URL for progress report :

http://neos-server.org/neos/cgi-bin/nph-neos-
solver.cgi?admin=results&jobnumber=4679195&pass=JMNRQoTD

Job 4679195 dispatched
password: JMNRQoTD

----- Begin Solver Output -----

Job submitted to NEOS HTCondor pool.
```

AMPL Interactive Session

```
----- Begin Solver Output -----
```

```
Job submitted to NEOS HTCondor pool.
```

```
CPLEX 12.6.2.0: optimal integer solution; objective 265.9999999999943  
135348 MIP simplex iterations  
17430 branch-and-bound nodes
```

```
ampl: option omit_zero_rows 1, display_1col 0;
```

```
ampl: display Work;
```

```
Work [*] :=
```

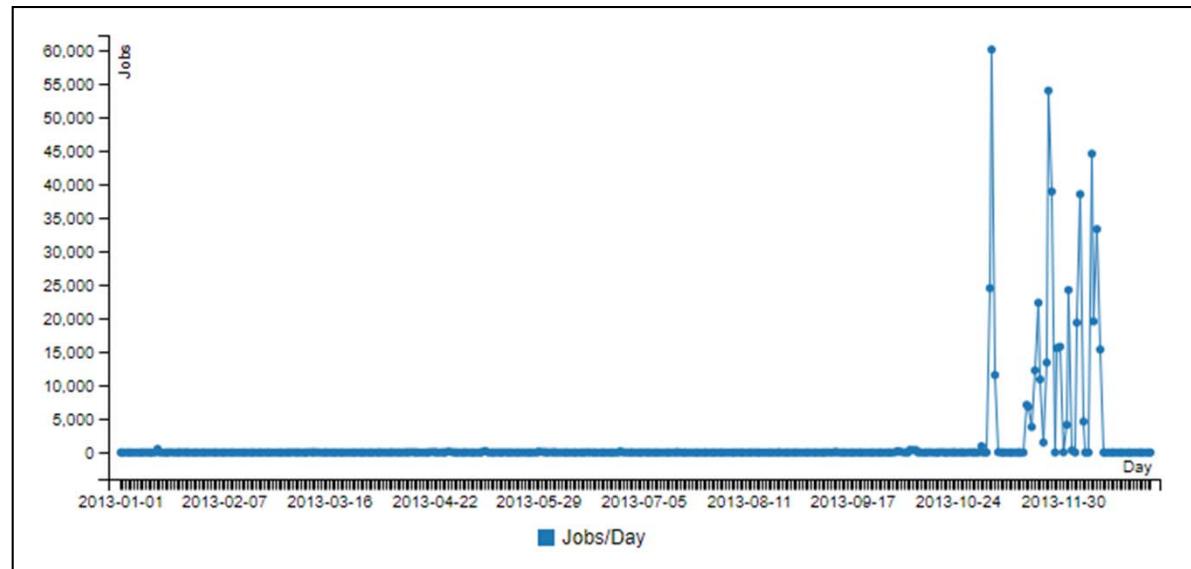
```
 1 16    11 16    36 19    72 20    82 20    106 16   114 20    125 20  
 3 16    29 16    66 17    79 19    104 19    112 16   121 16  
;
```

```
ampl:
```

Kestrel Impact

Some success

- Intensive use in short bursts
 - * Peaks of 10,000-60,000 per day
- Modest use on average
 - * Average of 1,750 per month
 - * Mostly AMPL/CPLEX



Kestrel Assessment

Strengths

- Powerful local client for modeling
- NEOS facilities for solving

Weaknesses

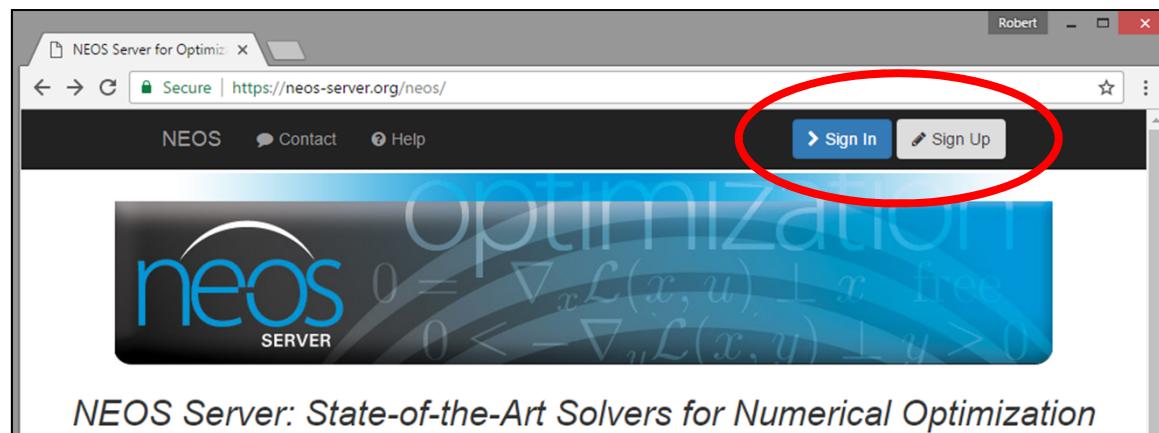
- Not all NEOS solvers available
- Local solver software is strong competition . . .
 - * Bundled with modeling languages
 - * Free for trial use
 - * Free for course and academic use
- Limited support & development
 - . . . *Kestrel for AMPL new release forthcoming*

Recent Developments

Intensified support

- Shift to HTCondor “high-throughput” platforms
- Updated Kestrel client
- Updated solver offerings

User accounts



- Higher priority for job scheduling
- “My Jobs” tab listing recent jobs & links to results

Satalia SolveEngine www.satalia.com

Like a commercial NEOS

- Range of inputs and solvers
- Royalties to clients and to solvers
 - * Planned Kestrel-like support of AMPL, GAMS
- Automated solver choice
- Free, pay-as-you-go, and subscription services

AMPL Online (*forthcoming*)

AMPL command line in a browser

- Interactive AMPL + solvers as a service
- User's files saved between sessions

```
ampl: model diet.mod;
ampl: data diet.dat;
ampl: option solver minos;
ampl: solve;
MINOS 5.51: optimal solution found.
6 iterations, objective 88.2
ampl: display Buy;
Buy [*] :=
BEEF      0
CHK       0
FISH      0
HAM       0
MCH    46.6667
MTL   1.57618e-15
SPG   8.42982e-15
TUR      0
;

ampl:
```

IBM Decision Optimization on Cloud

www.ibm.com/us-en/marketplace/decision-optimization-cloud

Commercial NEOS-like functions for CPLEX

- “DropSolve” service similar to NEOS
 - * .lp files and OPL model/data files
- “DOcplexcloud API” like NEOS API
- Pay-as-you-go, committed hours, “flex tier” services



Gurobi 7.5 Instant Cloud cloud.gurobi.com

Client side

- Standard Gurobi installation
- Cloud license

Server side

- Compute server for Gurobi solver
 - * Single-machine solves
 - * Distributed MIP solves
 - * Distributed tuning
- Server pools with load balancing

... hosted on Amazon Web Services

*"Cloud computing technology is changing quickly.
Please check these documents periodically to ensure
you have the latest instructions for the Gurobi Cloud."*

Gurobi Instant Cloud for AMPL

Client side

- AMPL installation (command-line or IDE)
- Standard Gurobi-for-AMPL installation

Server side

- Gurobi compute server
- Gurobi optimizer

Gurobi Instant Cloud for AMPL

ngcloud.gurobi.com

The screenshot shows the Gurobi Instant Cloud homepage. At the top, there's a dark header with the Gurobi logo, navigation links (PRODUCTS, DOWNLOADS, RESOURCES, ACADEMIA, SUPPORT, ABOUT), a user icon, and a "Get Gurobi" button. Below the header is a large blue banner featuring a world map composed of dots and the text "Gurobi Instant Cloud" and "Instant access to powerful optimization software and fast machines". To the right of the banner are two red buttons: "Open Cloud Manager" and "Discuss Your Needs". The main content area is divided into three columns: "Great for...", "Easy and Robust", and "Cost Effective", each with a list of benefits. At the bottom are three blue buttons: "Learn more", "Cloud Guide", and "Pricing".

Great for...

- Handling spikes in demand
- Solving challenging models
- Meeting periodic optimization needs
- Delivering cloud-based solutions
- Providing cloud-based failover

Easy and Robust

- Automatically start, manage and stop multiple machines
- Access from your existing applications
- Select dedicated machines from a data center near you
- Stay secure with built-in 256-bit AES encryption

Cost Effective

- Use and pay for only what you need
- Reduce or eliminate local data center costs
- Support Windows, Linux and Mac clients
- Access includes Gurobi Support

View Available Licenses

The screenshot shows a web-based interface for managing licenses. At the top, a blue header bar contains the title "Licenses". To the right of the title are three icons: a question mark, a refresh arrow, and a user profile. Below the header, there is a search bar with the placeholder "Search:" and a dropdown menu showing "Show 10 licenses".

License	Active Machines	Rate Plan	Credit (US Dollar)	Expiration Time			
142032	0	No Charge	\$25	10/30/2016 7:00:00 PM			
121420	0	No Charge	\$24.12	4/28/2016 7:00:00 PM			

At the bottom of the table, it says "Showing 1 to 2 of 2 licenses". To the right of the table are navigation buttons: "First", "Previous", a page number "1" (which is highlighted with a gray border), "Next", and "Last".

At the very bottom of the page, there are three blue buttons: "CONTACT SALES", "SUPPORT CENTER", and "GETTING STARTED".

Get Gurobi License File

```
# This is a license file created by the Gurobi Instant Cloud
# Created on Mon, 17 Oct 2016 20:46:26 GMT
# License Id: 142032
# Place this file in your home directory or one of the following
# locations where XXX is the Gurobi Optimizer version you are using:
#   * C:\gurobi\ or C:\gurobiXXX\ on Windows
#   * /opt/gurobi/ or /opt/gurobiXXX/ on Linux
#   * /Library/gurobi/ or /Library/gurobiXXX/ on Mac OS X
# Or set environment variable GRB_LICENSE_FILE to point to this file
# Do not share this license file because it contains your secret key
```

CLOUDACCESSID=fedf3901-04f1-44d7-9725-e36c1c3f70f6

CLOUDKEY=0v9XdWrDQLiE3EiAAEKtFw

CLOUDHOST=ngcloud.gurobi.com

Use with AMPL: Setup

```
ampl: model multmip3.mod;
ampl: data multmip3.dat;

ampl: option solver gurobi;

ampl: option gurobi_options
ampl?  'cloudid=fedf3901-04f1-44d7-9725-e36c1c3f70f6 \
ampl?    cloudkey=0v9XdWrDQLiE3EiAAEktFw';

ampl:
```

Use with AMPL: *Startup*

```
ampl: model multmip3.mod;
ampl: data multmip3.dat;

ampl: option solver gurobi;

ampl: option gurobi_options
ampl?  'cloudid=fedf3901-04f1-44d7-9725-e36c1c3f70f6 \
ampl?  cloudkey=0v9XdWrDQLiE3EiAAEktFw';

ampl: solve;

Gurobi 7.0.0: cloudid=fedf3901-04f1-44d7-9725-e36c1c3f70f6
cloudkey=0v9XdWrDQLiE3EiAAEktFw

Waiting for cloud server to start.....
```

Use with AMPL: Solve

```
ampl: model multmip3.mod;
ampl: data multmip3.dat;

ampl: option solver gurobi;

ampl: option gurobi_options
ampl?  'cloudid=fedf3901-04f1-44d7-9725-e36c1c3f70f6 \
ampl?  cloudkey=0v9XdWrDQLiE3EiAAEktFw';

ampl: solve;

Gurobi 7.0.0: cloudid=fedf3901-04f1-44d7-9725-e36c1c3f70f6
cloudkey=0v9XdWrDQLiE3EiAAEktFw

Waiting for cloud server to start.....
Capacity available on 'default' cloud pool - connecting...
Established 256-bit AES encrypted connection

Gurobi 7.0.0: optimal solution; objective 235625
289 simplex iterations
25 branch-and-cut nodes
plus 35 simplex iterations for intbasis

ampl:
```

Use with AMPL: *Continue*

```
ampl: display {i in ORIG, j in DEST} sum {p in PROD} Trans[i,j,p];  
:  
DET    FRA    FRE    LAF    LAN    STL    WIN    :=  
CLEV   625    375    550    0      500    550    0  
GARY     0      0      0      400    0      625    375  
PITT   525    525    625    600    0      625    0  
;  
  
ampl: reset data;  
ampl: data multmip3a.dat;  
  
ampl: solve;  
  
Gurobi 7.0.0: clouddid=fedf3901-04f1-44d7-9725-e36c1c3f70f6  
cloudkey=0v9XdWrDQLiE3EiAAEktFw  
  
Capacity available on 'default' cloud pool - connecting...  
Established 256-bit AES encrypted connection  
  
Gurobi 7.0.0: optimal solution; objective 238450  
163 simplex iterations  
plus 33 simplex iterations for intbasis  
  
ampl:
```

Gurobi Instant Cloud for AMPL

Manage Server Configuration

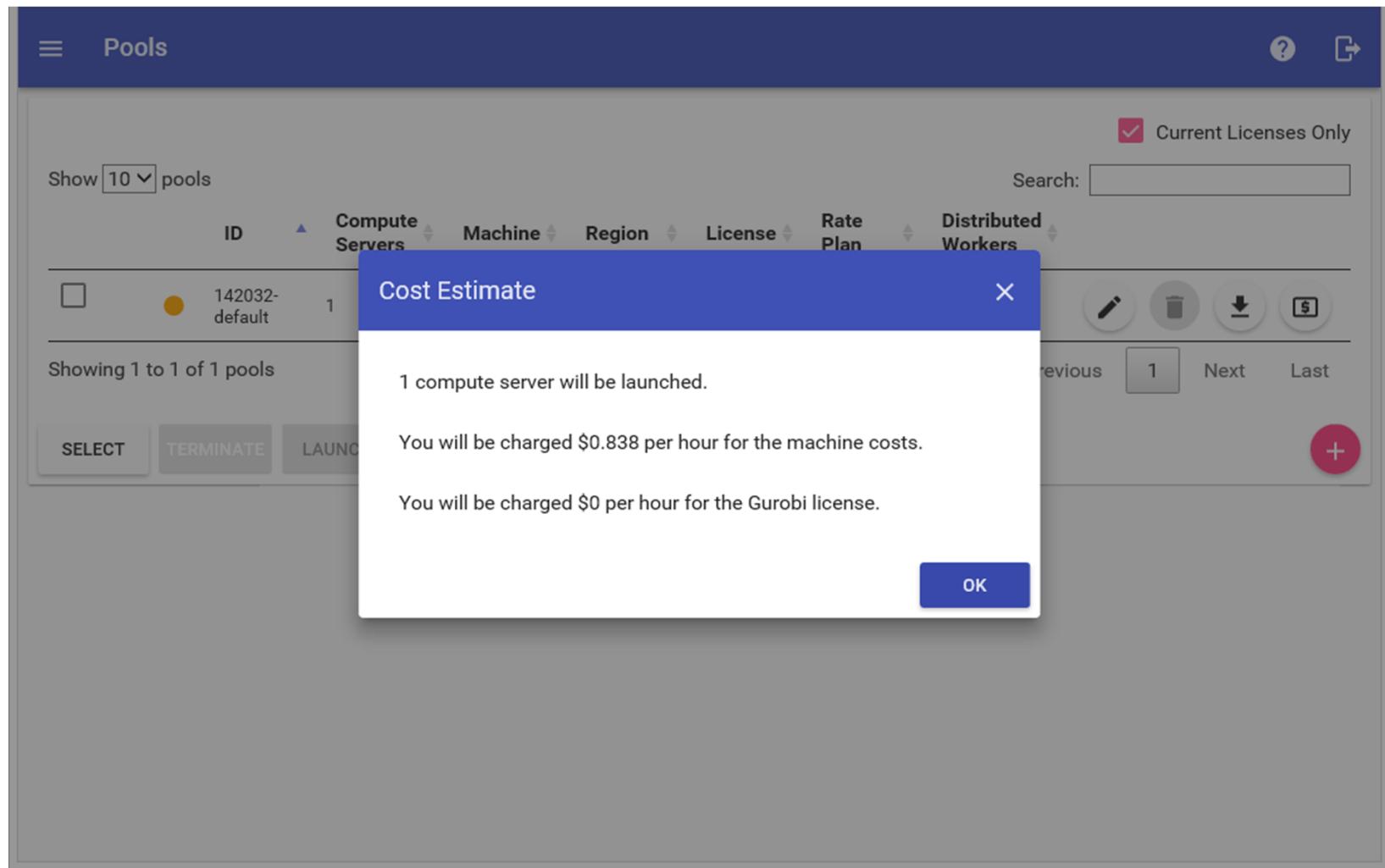
The screenshot shows the Gurobi Instant Cloud for AMPL web interface. On the left, a sidebar menu lists options: Instant Cloud (selected), LICENSES (highlighted in blue), POOLS, MACHINES, MANUAL LAUNCH, HISTORY, and SETTINGS. At the bottom of the sidebar are buttons for LOG IN, GETTING STARTED, and HELP. The main content area displays a table of server configurations. The columns are: Name, Type, Rate Plan, Credit (US Dollar), and Expiration Time. Two rows are visible:

Name	Type	Rate Plan	Credit (US Dollar)	Expiration Time
4er@ampl.com	Machine	No Charge	\$19.75	10/30/2016 7:00:00 PM
	Pool	No Charge	\$24.12	4/28/2016 7:00:00 PM

Below the table are navigation buttons: First, Previous, Next, Last, and a page number input field set to 1. There are also search and filter icons at the top right.

Gurobi Instant Cloud for AMPL

Check Costs



Gurobi Cloud Costs

Commercial plans

- Annual subscription fee, *plus*
- Hourly rates for use:
 - * Gurobi rate for compute servers
 - * Amazon rate for distributed workers

Trials, academic use, special grants

- Amazon rate only
 - . . . *set up through sales rep*

Gurobi Cloud for AMPL: Assessment

Strengths

- Security
- Reliability (via Amazon)
- Support for multi-server and/or multi-worker pools
- Support for local modeling clients

Drawbacks (compared to NEOS)

- Not free
 - * Budgeting can be complicated
- Solver-specific
- Not quite “optimization on demand”

QuanDec ampl.com/products/quandec

Server side

- AMPL model and data
- Standard AMPL-solver installations

Client side

- Interactive tool for collaboration & decision-making
- Runs on any recent web browser
- Java-based implementation
 - * AMPL API for Java
 - * Eclipse Remote Application Platform

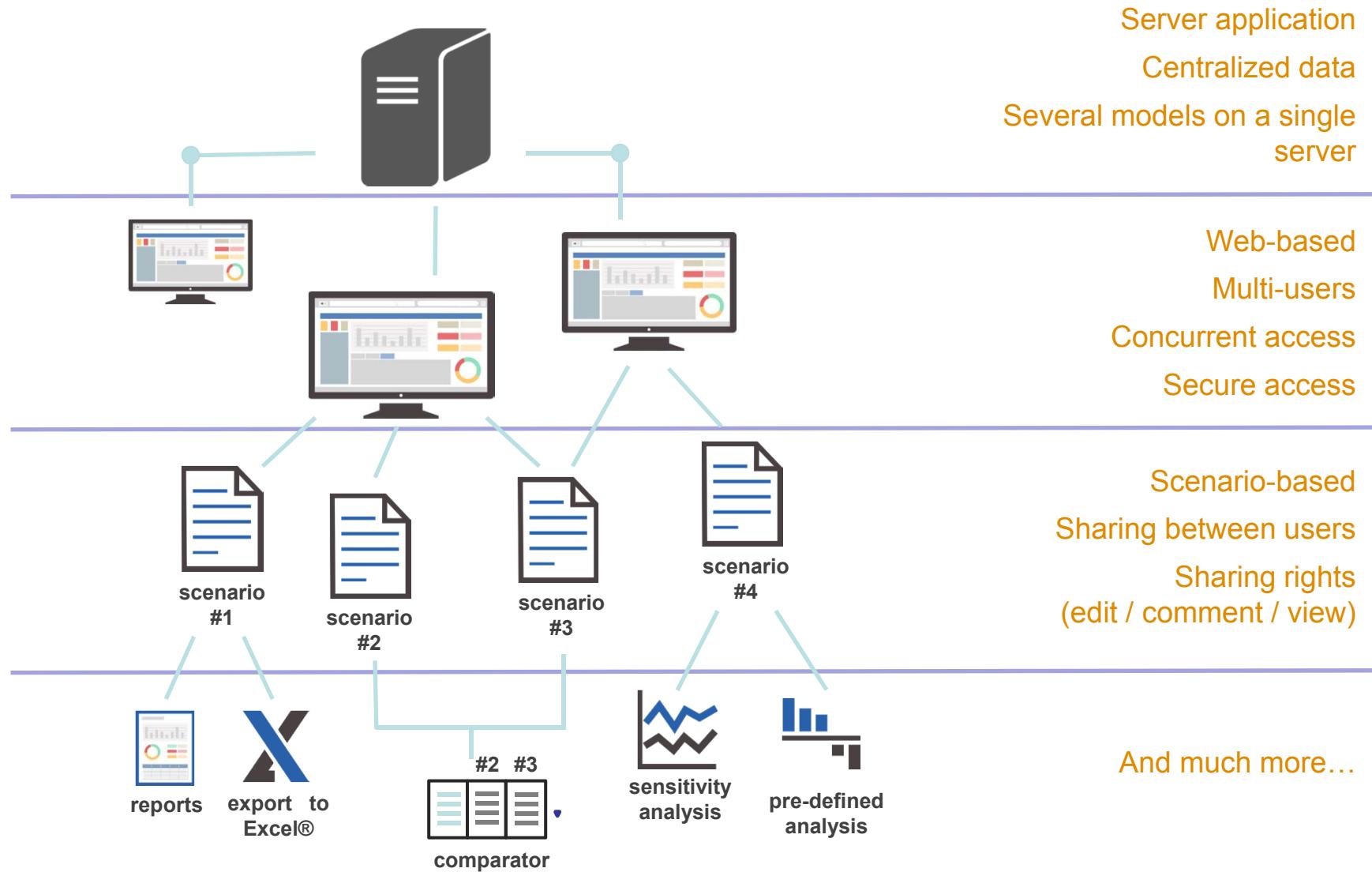
. . . developed / supported by Cassotis Consulting



The web-based graphical interface
that turns optimization models written
in AMPL into decision-making tools.



Features

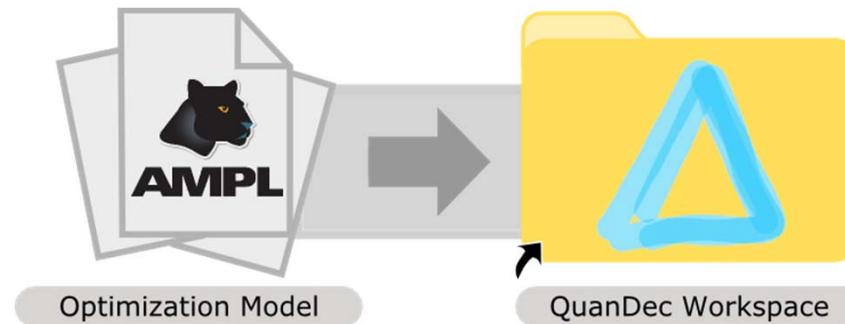


Getting started

step 1: install QuanDec on a server

step 2: copy & paste your model files (.mod and .dat) into
QuanDec's workspace

step 3: create AMPL tables and link them to QuanDec explorer





E-mail :

Password :

[Forgot?](#)

Enter your email to login

Version 2.3.1

CASSOTIS consulting

[Login](#)

Web-application

Multi-user

Secure access

Concurrent access

This week

Name	Owner	Last change
BUDGET 2016	Mary Torres	September 9, 2016 4:59 PM
My Scenario	Me	Today 10:54 AM

All

Name	Owner
BUDGET 2015	Mary Torres
BUDGET 2016	Mary Torres
My Scenario	Me
FORECAST 2017	Mary Torres

Share with others

Anyone can comment

People or groups

Robert Finn can edit X

OK

OK

Scenario-based environment

Sharing system

Permission:
Edit – Comment - View

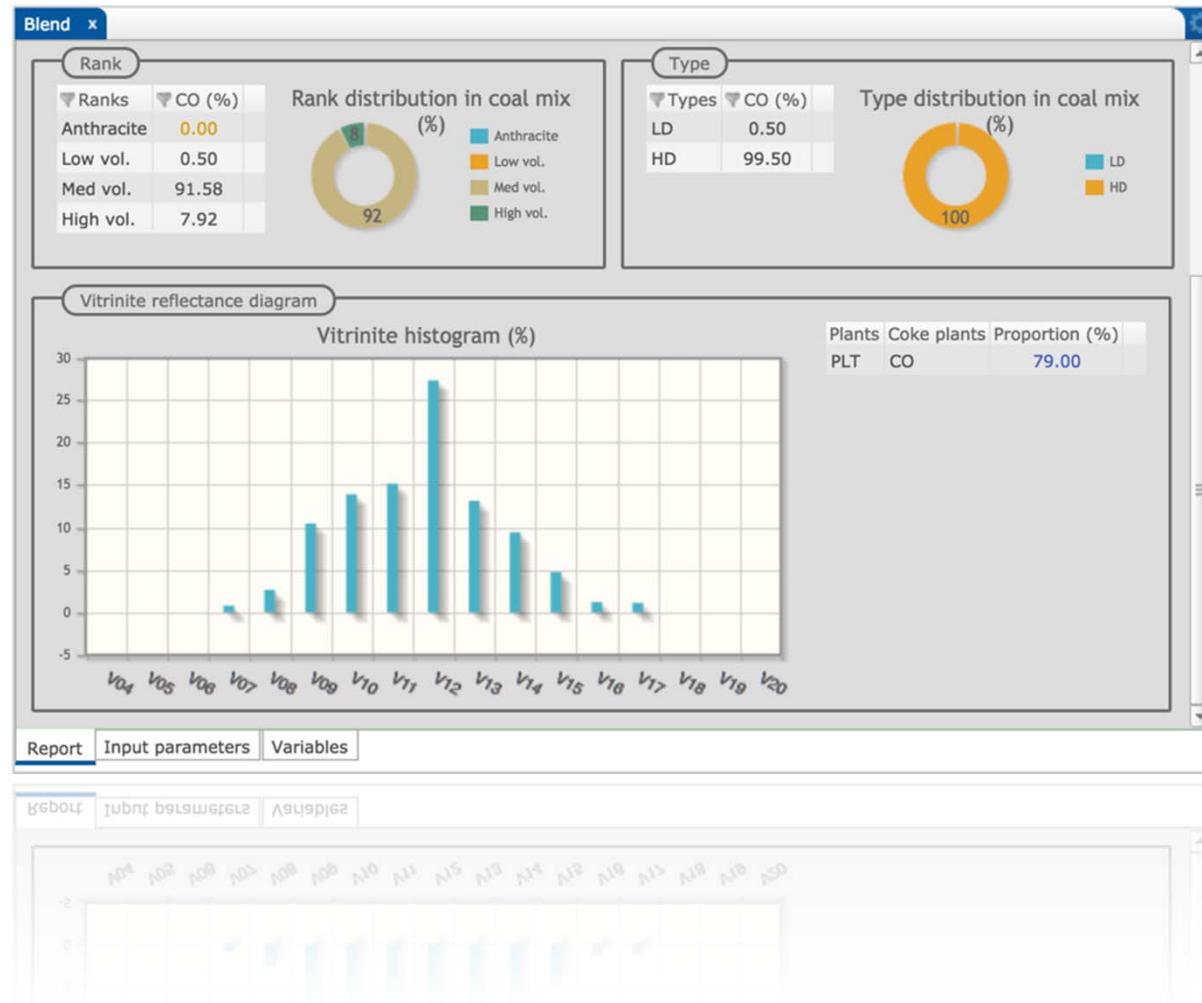
The screenshot shows the QuanDec software interface. At the top, there's a navigation bar with 'Workspace' and 'Admin' tabs, and buttons for 'Switch workspace', 'New Master', 'Import Master', and 'Compare'. The QuanDec logo is in the top right. Below the navigation, there are two tables: one for 'This week' and one for 'All'. The 'This week' table has one item: 'BUDGET 2016' owned by Mary Torres, last changed on September 9, 2016. The 'All' table lists four items: 'BUDGET 2015' (Mary Torres), 'BUDGET 2016' (Mary Torres), 'My Scenario' (Me, highlighted in blue), and 'FORECAST 2017' (Mary Torres). A modal dialog titled 'Share with others' is open on the right, showing 'Anyone can comment' and a list of 'People or groups' with 'Robert Finn can edit' checked. At the bottom left, three callout boxes highlight features: 'Scenario-based environment', 'Sharing system', and 'Permission: Edit – Comment - View'.

- 3 levels:**
- Report
 - Input parameters
 - Variables

Chart and tables

Colored values
for easier analysis

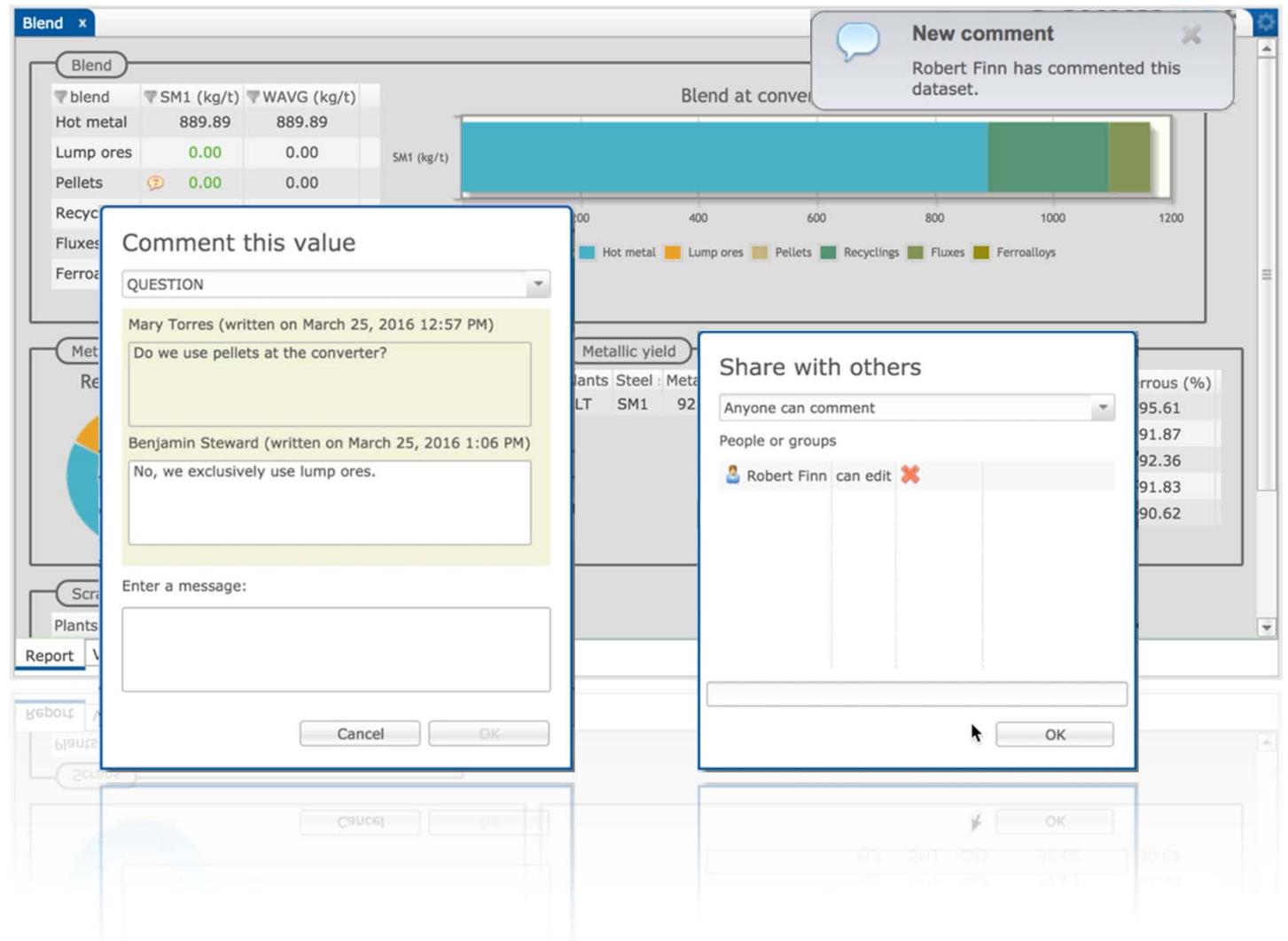
Constraint (min/max)
on any variable



Collaborative work

Notification system

Comments between users



Coke plants x

Operating costs

Plants	Coke plants	Costs	Fixed (MUS\$/year)	Variable (US\$/t)
PLT	CO	Maintenance	7.75	0.90
PLT	CO	Labour costs	3.95	0.00
PLT	CO	Utilities	0.05	0.11
PLT	CO	Water treatment	7.78	0.00
PLT	CO	Court yard	5.36	0.00
PLT	CO	Services	0.02	0.94
PLT	CO	Indirect costs	2.57	0.00
PLT	CO	Depreciation	4.92	0.00
PLT	CO	Electricity	0.00	0.03

Report Input parameters Variables

Scenarios with changes history

Traceability and undo system

Journal Bounds Regressions Comments Error Log

Operating cost at coke plant	PLT, CO1, co_elec, Variable	0.03	Today 11:26 AM	by Arthur Turner	
CO operational costs	PLT, co_elec	Electricity	Today 11:26 AM	by Arthur Turner	
CO operational costs	PLT	co_elec	Today 11:26 AM	by Arthur Turner	
Vitrinite reflectance inside of range at coke plant	PLT, CO1	MAX 79.00	Today 10:49 AM	by Arthur Turner	

Arthur Turner QuanDec STEEL BUDGET 2016 My Scenario

	Arthur Turner	QuanDec STEEL	BUDGET 2016	My Scenario
	Arthur Turner	QuanDec STEEL	BUDGET 2016	My Scenario

Workspace Admin

New Report Show/Hide differences Export to Excel

Comparator

Variable	Unit	BUDGET 2016	My Scenario	Diff
Executive summaries				
Costs and Revenues				
Profit and Sales				
Production costs				
Absolute costs	MUS\$			
Detailed costs	US\$/t			
Internal price of intermediate	US\$/t			
Net production level	kt			
'PLT' 'CO'	kt	1763.98	1764.25	0.02%
'PLT' 'SI'	kt	4085.77	4084.46	-0.03%
'PLT' 'BF'	kt	5062.62	5060.91	-0.03%
'PLT' 'ST'	kt	5258.29	5256.75	-0.03%
'PLT' 'PO'				
Production cost of product				
Production level				
Material blends				
Coke plants				
Sinter plants				
Blast furnaces				
Steel shops				
Power plant				
Raw materials				
Steel products				
Electrical power				
Water				
Gasoline				
Propane				
Hydrogen				
Ammonia				
Chemicals				
Metals				
Other products				

Select the scenarios to compare:

- BUDGET 2015
- BUDGET 2016
- My Scenario
- FORECAST 2017

Cancel OK

Economics and Production

Variable	Index	Unit	BUDGET 2016	My Scenario	Diff
Economics per int. plant	'PLT' 'costs'	MUS\$	1515.59	1515.20	-0.03%
Economics per int. plant	'PLT' 'revenues'	MUS\$	1762.23	1761.77	-0.03%
Economics per int. plant	'PLT' 'profit'	MUS\$	246.64	246.56	-0.03%
Economics per int. plant	'PLT' 'margin'	%	14.00	14.00	0.00%
Production cost of product	'PLT' 'coke'	US\$/t	164.48	164.54	0.04%
Production cost of product	'PLT' 'sinter'	US\$/t	77.55	77.50	-0.06%
Production cost of product	'PLT' 'hotmetal'	US\$/t	193.95	193.99	0.02%
Production cost of product	'PLT' 'slab'	US\$/t	286.27	286.28	0.00%
Production cost of product	'PLT' 'electricity'	US\$/MWh	125.75	125.75	0.00%
Production level of product	'PLT' 'coke'	kt	1818.54	1818.81	0.02%
Production level of product	'PLT' 'sinter'	kt	4085.77	4084.46	-0.03%

Reports

Name	User	Date	Action
Sulfur cycle	Benjamin Steward	March 18, 2016 3:45 PM	X
Metallic blend at CV	Me	February 21, 2016 4:51 PM	X
Raw material use at Reduction	Me	January 15, 2016 4:36 PM	X
Economics and Production	Mary Torres	September 13, 2016 4:53 PM	X
Flux consumption at Torpedo	Mary Torres	April 3, 2016 4:44 PM	X
Slab sales	Robert Finn	January 30, 2016 5:30 PM	X
Silicon cycle	Benjamin Steward	July 5, 2016 4:17 PM	X

Cancel OK

Scenario comparison

All variables can be compared

Display of relative difference

Custom reports

Sensitivity analysis

Parameter : Exchange rates

Index : 'brl'

From : 0.3

To : 1

#Pts : 3

Cancel OK

Sensitivity analysis

For both parameters
AND variables

Variable	Unit	0.30	0.65	Diff	1.00	Diff
Economics per int. plant	MUS\$					
'PLT' 'costs'	MUS\$	1515.39	1544.99	1.95%	1633.34	7.78%
'PLT' 'revenues'	MUS\$	1754.70	1679.96	-4.26%	1670.71	-4.79%
'PLT' 'profit'	MUS\$	239.31	134.97	-43.60%	37.37	-84.38%
'PLT' 'margin'	%	13.64	8.03	-41.09%	2.24	-83.60%
Global economics	MUS\$					
External costs per process	MUS\$					
External costs per type	MUS\$					
Detailed external costs	MUS\$					
External revenues per process	MUS\$					
External revenues per type	MUS\$					
Detailed external revenues	MUS\$					
Detailed revenues	MUS\$/t					
Production costs						
Material blends						
Coke plants						
Sinter plants						
Blast furnaces						
Steel shops						
Power plant						
Raw materials						
Gases						

Variable	Index	Unit	0.30	0.65	Diff	1.00	Diff
Economics per int. plant	'PLT' 'costs'	MUS\$	1515.39	1544.99	1.95%	1633.34	7.78%
Economics per int. plant	'PLT' 'revenues'	MUS\$	1754.70	1679.96	-4.26%	1670.71	-4.79%
Economics per int. plant	'PLT' 'profit'	MUS\$	239.31	134.97	-43.60%	37.37	-84.38%
Economics per int. plant	'PLT' 'margin'	%	13.64	8.03	-41.09%	2.24	-83.60%
Production cost of product	'PLT' 'coke'	MUS\$/t	164.51	161.52	-1.82%	162.71	-1.10%
Production cost of product	'PLT' 'sinter'	MUS\$/t	77.68	83.23	7.15%	88.16	13.50%
Production cost of product	'PLT' 'hotmetal'	MUS\$/t	194.23	198.43	2.16%	202.93	4.48%
Production cost of product	'PLT' 'slab'	MUS\$/t	287.62	307.33	6.85%	326.85	13.64%
Production cost of product	'PLT' 'electricity'	MUS\$/MWh	125.62	125.73	0.08%	125.74	0.09%
Production level of product	'PLT' 'coke'	kt	1818.81	1815.95	-0.16%	1815.95	-0.16%
Production level of product	'PLT' 'sinter'	kt	4115.36	4007.25	-2.63%	4006.24	-2.65%
Production level of product	'PLT' 'hotmetal'	kt	5105.94	5051.71	-1.06%	5052.00	-1.06%
Production level of product	'PLT' 'trhotmetal'	kt	5025.36	4972.09	-1.06%	4972.37	-1.05%
Production level of product	'PLT' 'crudesteel'	kt	5657.39	5402.17	-4.51%	5372.49	-5.04%

Reports			
Name	User	Date	Action
Sulfur cycle	Benjamin Steward	March 18, 2016 3:45 PM	X
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Arthur Turner QuanDec STEEL BUDGET 2016 My Scenario About QuanDec...

All variables can be compared

Display of relative difference

Predefined analyses

Script parameters



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