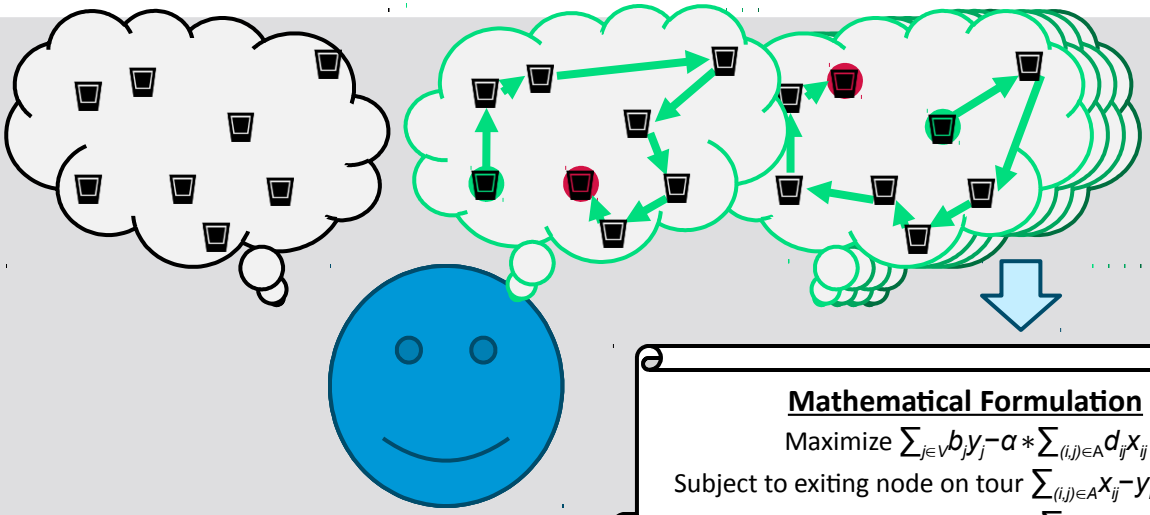
Optimizing Your World

neos: Network-Enabled Optimization System



Mathematical Formulation

Maximize $\sum_{j \in V} b_j y_j - \alpha * \sum_{(i,j) \in A} d_{ij} x_{ij}$

Subject to exiting node on tour $\sum_{(i,j) \in A} x_{ij} - y_i = 0, \forall_i \in V$

Subject to entering node on tour $\sum_{(i,j) \in A} x_{ij} - y_i = 0, \forall_j \in V$

AMPL Model

```
set V;
set LINKS := {i in V, j in V: i <> j};
param alpha >= 0;
param d{LINKS} >= 0;
param b{V} >= 0; #default benefit of visiting a bar
param c{V} >= 0; # default cost of one drink
param B default 30; # default maximum budget for drinks
```

neos

http://www.neos-guide.org/content/bar-crawl-optimization

neos Workflow

Optimization Job

Solver Categories

bco	lp	sdp
co	milp	sio
cp	minco	slp
go	miocp	socp
kestrel	nco	uco
lno	ndo	

Solver Names

AlphaECP	csdp	LOQO	PGAPack
ASA	ddsip	LRAMBO	proxy
BARON	DICOPT	MILES	PSwarm
BDMLP	Domino	MINLP	QSopt_EX
BiqMac	DSDP	MINOS	RELAX4
BLMVM	feaspump	MINTO	SBB
bnbs	FilMINT	MOSEK	scip
Bonmin	filter	MUSCOD-II	SD
bpmpd	filterMPEC	NLPEC	SDPA
Cbc	Gurobi	NMTR	SDPLR
Clp	icos	nsips	SDPT3
concorde	Ipopt	OOQP	SeDuMi
CONDOR	KNITRO	PATH	SNOPT
CONOPT	LANCELOT	PATHNLP	SYMPHONY
Couenne	L-BFGS-B	PENBMI	TRON
CPLEX	LINDOGlobal	PENSDP	XpressMP

Solver Inputs

AMPL	jpg	OSIL	SPARSE
C	LP	RELAX4	SPARSE_SDPA
CPLEX	MATLAB_BINARY	SDPA	TSP
Fortran	MOSEL	SDPLR	ZIMPL
GAMS	MPS	SMPS	

Browser

Email

Custom

Kestrel
(AMPL or GAMS)

neos

Web

Email

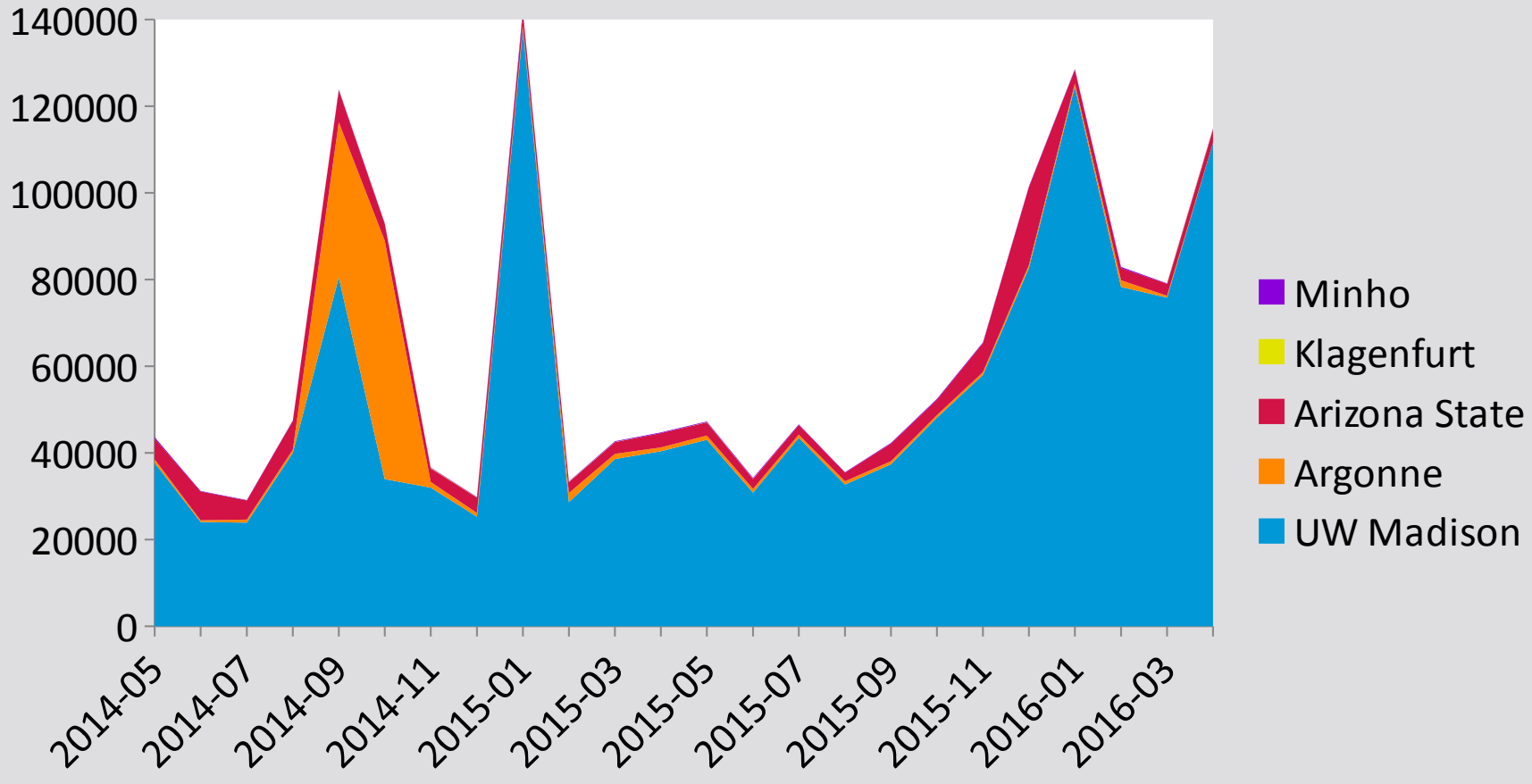
XMLRPC

Results

HTCondor
Solver Pool
at UW-Madison

Off-Site Solvers
Argonne National Lab
Arizona State University
University of Klagenfurt
University of Minho

Jobs Per Month

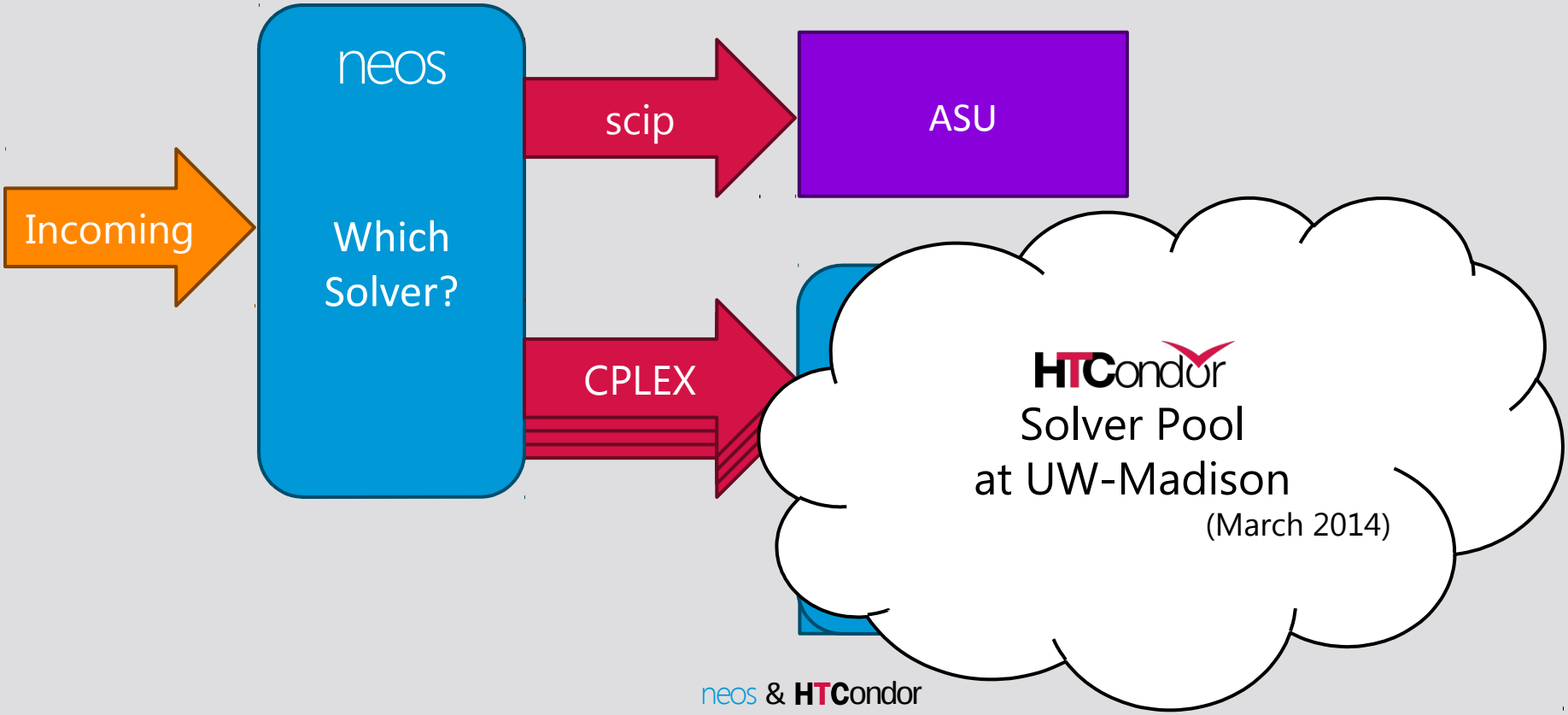


neos & HTCondor

Our HTCondor Pool

- Rackmount Dell Servers running RedHat
  - Managed via puppet: http://puppet.com/
  - Usage Reports in Ganglia: http://ganglia.info/
- 1 Central Manager
- 1 Submit Node
- 5 Execute Nodes with specialized solvers

Started Homegrown



Problems HTCondor Solves

- Resource Allocation
  - 3G memory per job
  - 8 hour maximum
  - 1-4 cores dependent on solver
  - Adjust priority by length of job
- Rapid solver additions with load balancing
  - New node has over 2x CPU and memory
  - Smaller servers were overloaded

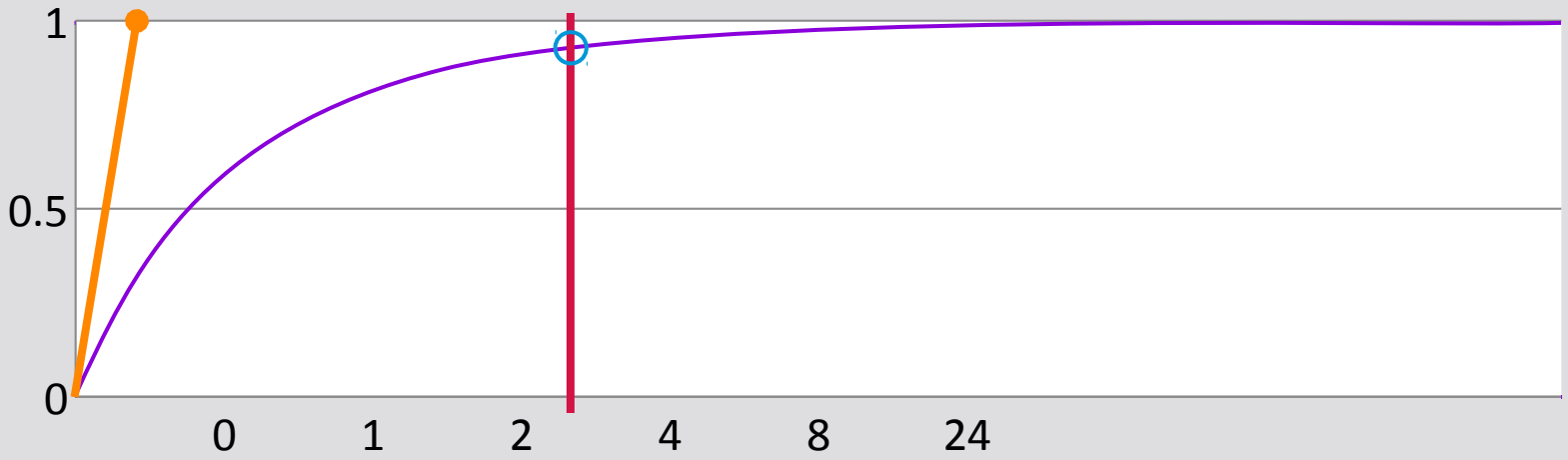
```
# Original – don't overload one by one
# APPEND_RANK = ( -1 * TARGET.TotalLoadAvg )

# Updated (slightly overloads largest)
APPEND_RANK = (TARGET.TotalCpus – TARGET.TotalLoadAvg)
```

User Authentication

- Wishlist
  - Provide additional resources and priority to some
  - Allow users to track, easily access jobs
  - Better analytics, tracking, problem resolution
  - Monetize?
- Integrated 

user authentication code
  - Name, Username, Password, Email
  - LDAP, MySQL backend
  - PHP/JavaScript handler headers on existing pages
  - Server hooks to connect user to job, give priority

Solutions and Diminishing Returns



- 8 hour job limit
- **Partial Results** have value

Problem: Partial Results

1. **Streaming results**
   - Only on stdout, stderr
   - Doesn't pass files created by solvers

```
stream_output = true
stream_error = true
```

2. **Spool on evict**
   - Undocumented debugging option for evicted jobs
   - Didn't work through multiple HTCondor version updates

```
SpoolOnEvict = true
```

3. **Transfer Output**
   - First solution of Research Computing Facilitators
   - Works!

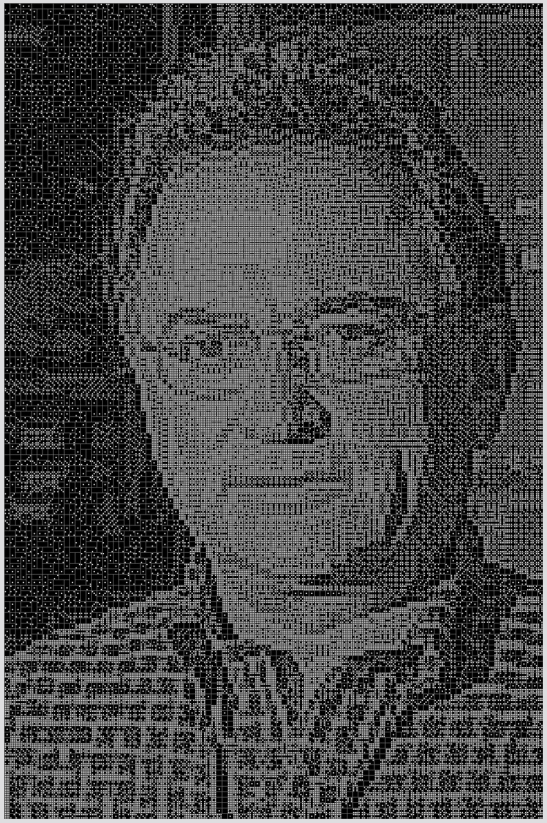
```
when_to_transfer_output = ON_EXIT_OR_EVICT
want_graceful_removal = true
+SpoolOnEvict = false
```

Ongoing Projects

- HTCondor
  - Migrate to Python bindings
  - Tie HTCondor job to neos job
- General
  - Adding Authenticated User to XMLRPC

Acknowledgements

Wisconsin Institute for Discovery
AT THE UNIVERSITY OF WISCONSIN–MADISON



HTCondor

MORGRIDGE INSTITUTE FOR RESEARCH

CENTER FOR HIGH THROUGHPUT COMPUTING

http://www.neos-guide.org/content/domino-art

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