GAMS

General Algebraic Modeling System

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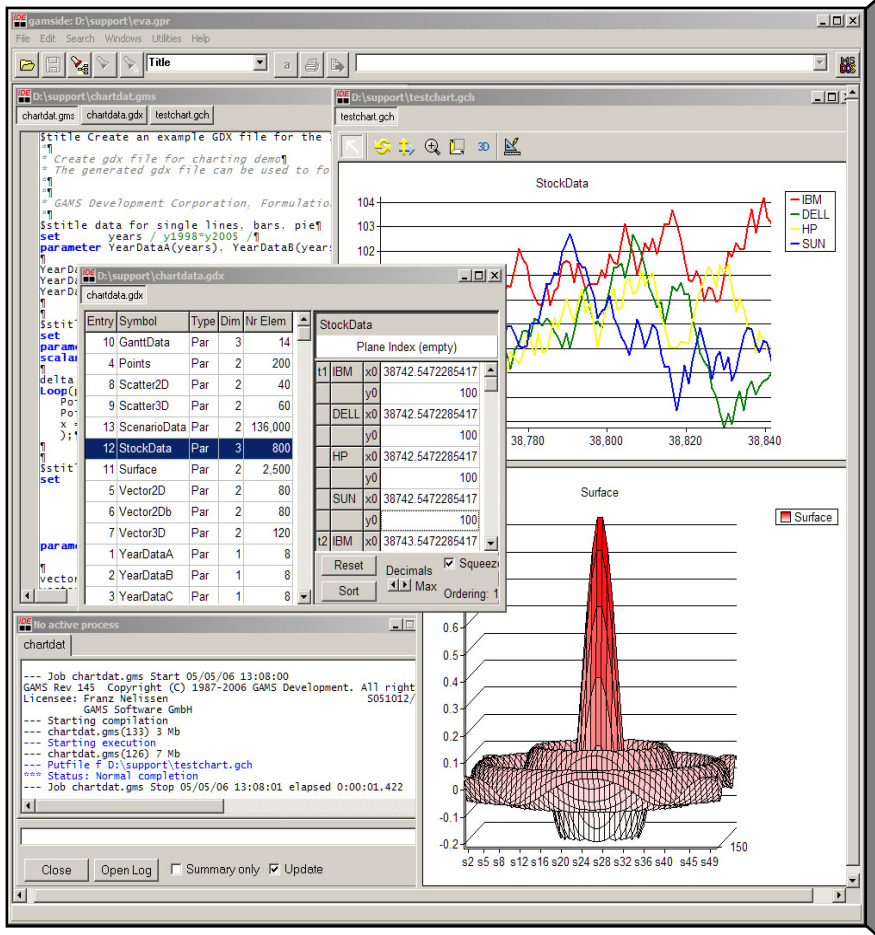
Algebraic Modeling Languages

- High-level programming languages for large scale mathematical optimization problems
- Algebraic formulation
  - Syntax similar to mathematical notation
  - Does not contain any hints how to process it
- Do not solve optimization problems directly, but call appropriate external algorithms

Goals

- Efficient handling of mathematical optimization problems
- Simplify model building and solution process
- Increase productivity and support maintainable models
- Support of decision making process

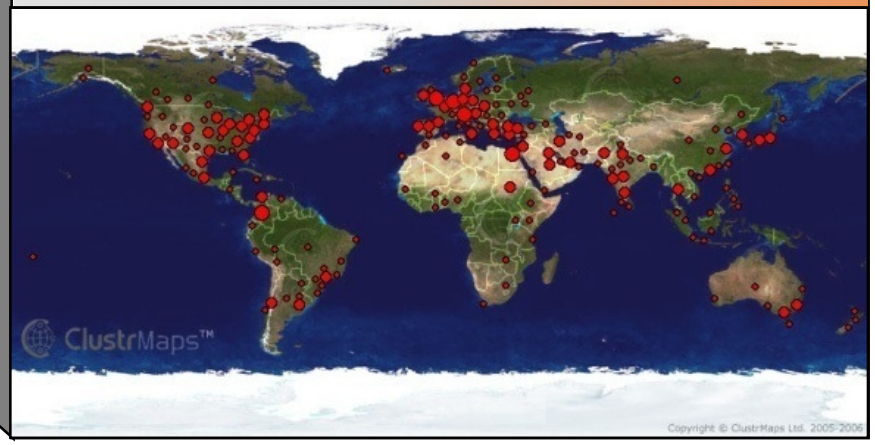
GAMS at a Glance



General **A**lgebraic **M**odeling **S**ystem

- Roots: World Bank, 1976
- Went commercial in 1987
- GAMS Development Corp.
- GAMS Software GmbH

- Broad academic & commercial user community and network



GAMS' Fundamental concepts

- Different layers with separation of
  - model and data
  - model and solution methods
  - model and operating system
  - model and interface

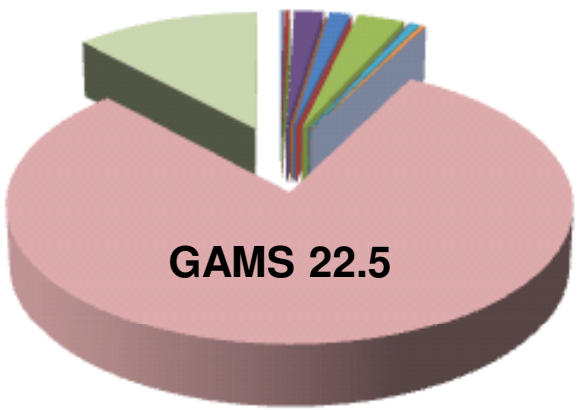
- Balanced mix of declarative and procedural elements
- Open architecture and interfaces to other systems
- Platform independence

Typical Application Areas *

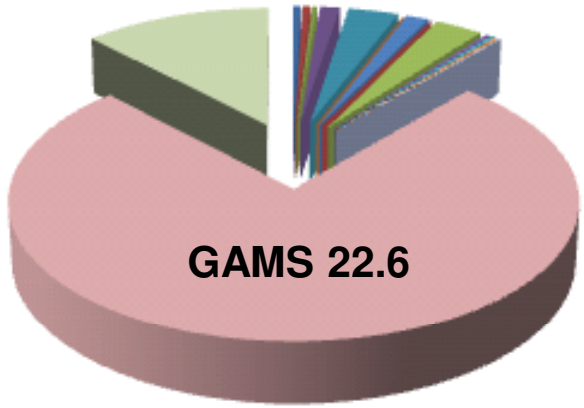
- Agricultural Economics
- Chemical Engineering
- Econometrics
- Environmental Economics
- Finance
- International Trade
- Macro Economics
- Management Science/OR
- Micro Economics
- Applied General Equilibrium
- Economic Development
- Energy
- Engineering
- Forestry
- Logistics
- Military
- Mathematics
- Physics

*** Illustrative examples in the GAMS Model Library**

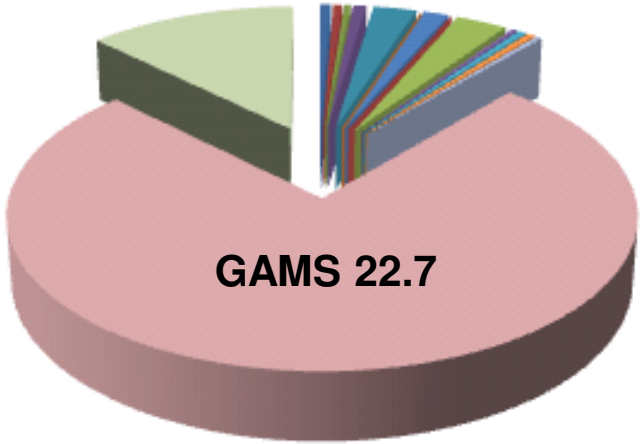
Downloads by Platform



~525 downloads/week

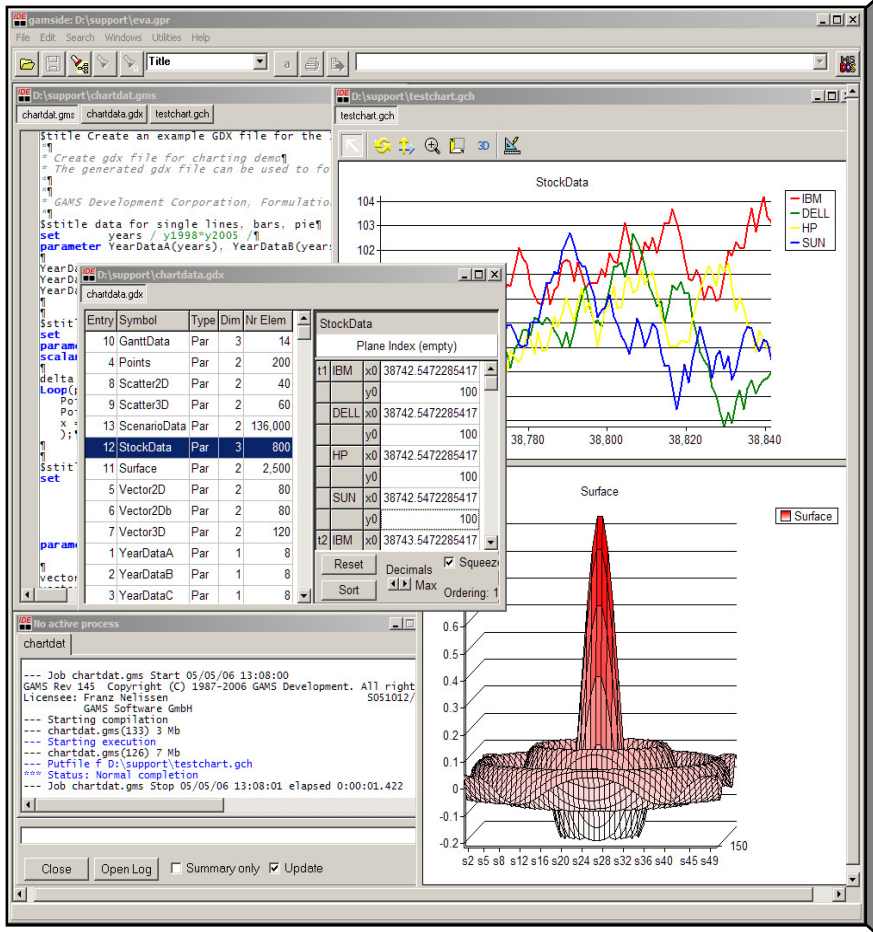


~590 downloads/week



~590 downloads a week

GAMS at a Glance

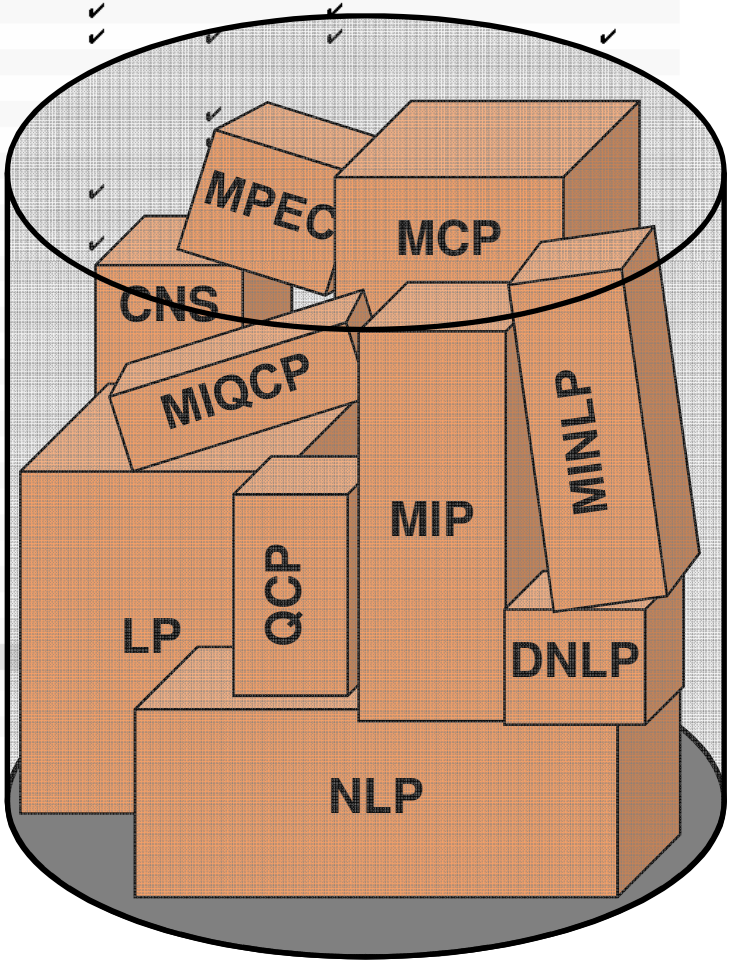


General **A**lgebraic **M**odeling **S**ystem

- Algebraic Modeling Language
- 25+ Integrated Solvers
- 10+ Supported MP classes
- 10+ Supported Platforms
- Connectivity- & Productivity Tools
  - IDE
  - Model Libraries
  - GDX, Interfaces & Tools
  - Grid Computing
  - Benchmarking
  - Compression & Encryption
  - Deployment System
  - …

Supported Model Types (GAMS 22.8)

Solver/Model type availability - 22.8 Aug 1, 2008	LP	MIP	NLP	MCP	MPEC	CNS	DNLP	MINLP	QCP	MIQCP	*Stoch.*	*Global*
ALPHAECP								✔		✔		
BARON 8.1	✔	✔	✔				✔	✔	✔	✔		✔
BDMLP	✔	✔							✔			
COIN	✔	✔	✔									
CONOPT 3	✔		✔			✔	✔		✔			
CPLEX 11.1	✔	✔										
DECIS	✔											
DICOPT								✔				
KNITRO 5.1	✔		✔				✔					
LINDOGLOBAL 5.0	✔	✔	✔				✔					
LGO	✔		✔				✔					
MILES				✔								
MINOS	✔		✔				✔					
MOSEK 5	✔	✔	✔				✔					
MPSGE												
MSNLP			✔				✔					
NLPEC				✔	✔							
OQNLP			✔				✔					
OSL V3	✔	✔										
OSLSE	✔											
PATH				✔		✔						
SBB												
SNOPT	✔		✔				✔					
XA	✔	✔										
XPRESS 18.00	✔	✔										
Contributed Plug&Play solvers												
AMPLwrap	✔	✔	✔	✔	✔	✔	✔					
DEA	✔	✔										
Kestrel	✔	✔	✔	✔	✔	✔	✔					



Supported Platforms (GAMS 22.8)

Solver/Platform availability - 22.8 August 1, 2008	x86 MS Windows	x86_64 MS Windows	x86 Linux	x86_64 Linux	Sun Sparc SOLARIS	Sun Sparc64 SOLARIS	Sun Intel SOLARIS	HP 9000 HP-UX 11[1]	DEC Alpha Digital Unix 4.0[3]	IBM RS-6000 AIX 4.3	Mac PowerPC Darwin	Mac Intel32 Darwin	SGI IRIX[2]
ALPHAECP	✔	✔	✔	✔	✔	✔	✔		✔	✔	✔	✔	
BARON 8.1	✔	32bit	✔	32bit						✔			
BDMLP	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
COIN	✔	✔	✔	✔			✔				✔	✔	
CONOPT 3	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
CPLEX 11.1	✔	✔	✔	✔	✔	✔	✔	10.0	8.1	✔		✔	9.1
DECIS	✔	✔	✔	✔	✔	32bit		✔	✔	✔			✔
DICOPT	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
KNITRO 5.1	✔	32bit	✔	✔	✔	32bit					✔	✔	
LINDOGLOBAL 5.0	✔	✔	✔	✔	✔	✔					✔	✔	
LGO	✔	✔	✔	✔	✔	✔	✔	✔	✔		✔	✔	✔
MILES	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
MINOS	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
MOSEK 5	✔	✔	✔	✔	✔	✔	✔	3.2			✔	✔	
MPSGE	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
MSNLP	✔	✔	✔	✔	✔	32bit		✔			✔	✔	
NLPEC	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
OQNLP	✔	32bit	✔	32bit									
OSL V3	✔	32bit	✔	32bit	✔	32bit		V2		✔			V2
OSLSE	✔	32bit	✔	32bit	✔	32bit				✔			
PATH	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
SBB	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
SNOPT	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
XA	✔	32bit	✔	✔	✔	32bit		✔	✔	✔			
XPRESS 18.00	✔	32bit	✔	32bit	✔	32bit		16.10		✔			

[1)]GAMS distribution for HP 9000/HP-UX is 22.1.

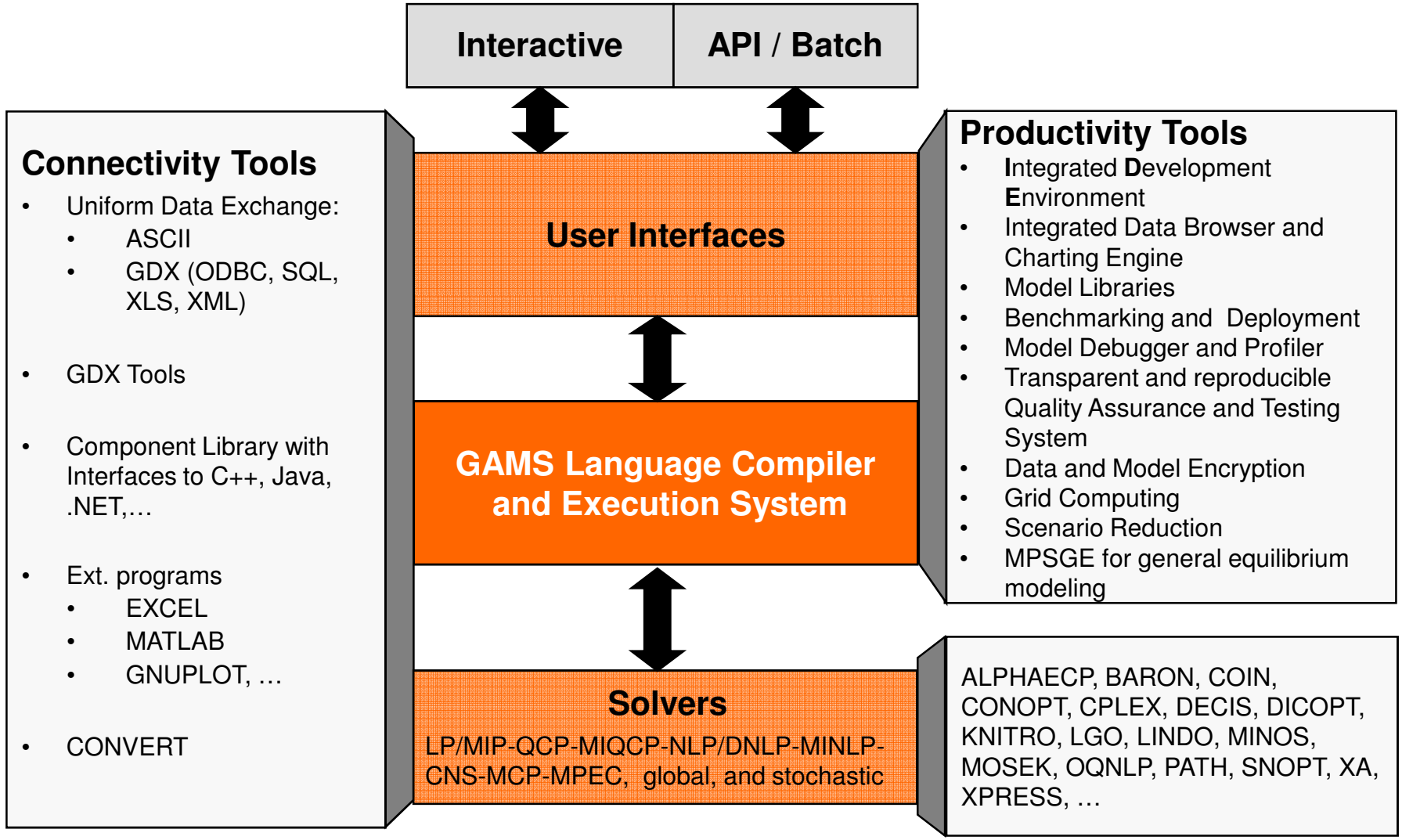
[2)]GAMS distribution for SGI IRIX is 22.3.

[3)]GAMS distribution for DEC Alpha is 22.7.

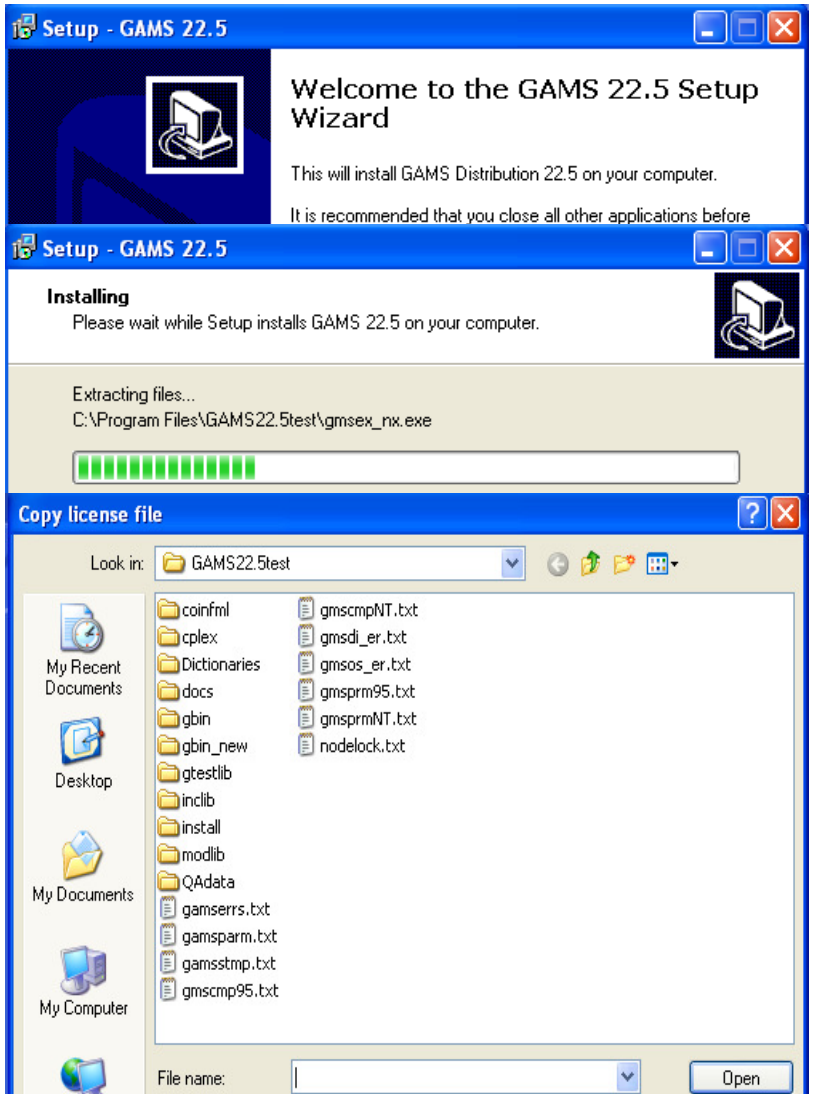
Contributed Plug&Play solvers										
AMPLwrap	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
DEA	✔	✔	✔	✔	✔	✔		✔	✔	
Kestrel	✔	32bit	✔	32bit	✔					

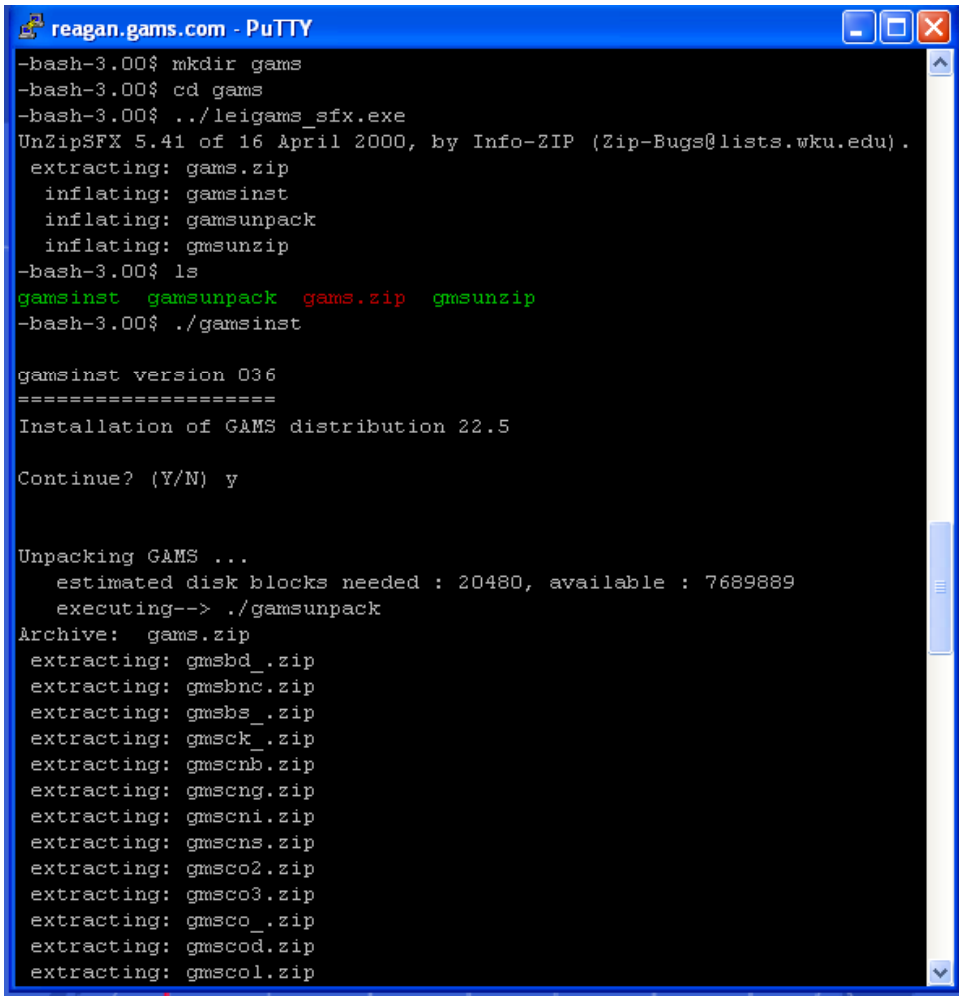
For backward compatibility we maintain older versions of operating systems and solvers. Please call.

System Overview



Hands-on! Installing GAMS





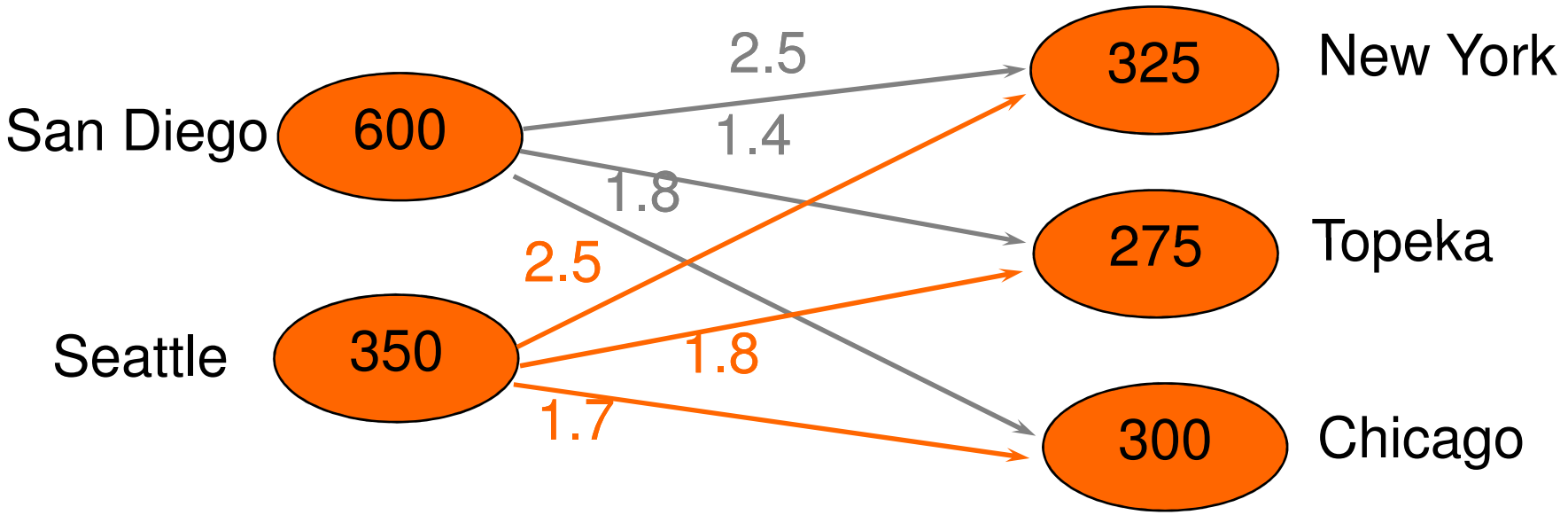
export PATH=/home/jhjagla/gams:$PATH

What is a Model?

- Mathematical Programming (MP) Model
  - List of Equations

- Collection of several intertwined MP Models
  - Data Preparation
  - Data Calibration
  - “Solution” Module (e.g. sequential, parallel, loop)
  - Report Module

A Transportation Model



Minimize	Transportation cost
subject to	Demand satisfaction at markets
	Supply constraints

Mathematical Algebra

$$\sum_{\substack{c,p:\\(c,p)\in\mathcal{N}}} tcost \cdot dist(c,p) \cdot x_p^c \quad \rightarrow \quad \min$$

$$\sum_{\substack{c,p:\\(c,p)\in\mathcal{N}}} x_p^c \quad \leq \quad sup(c) \qquad \forall c$$

$$\sum_{\substack{c,p:\\(c,p)\in\mathcal{N}}} x_p^c \quad \geq \quad dem(p) \qquad \forall p$$

$$x_p^c \quad \geq \quad 0 \qquad \forall c,p:\ (c,p)\in\mathcal{N}$$

GAMS Algebra

gamside: C:\Documents and Settings\bussieck\My Documents\gamsdir\project.gpr - [c:\documents an...

File Edit Search Windows Utilities Help

call

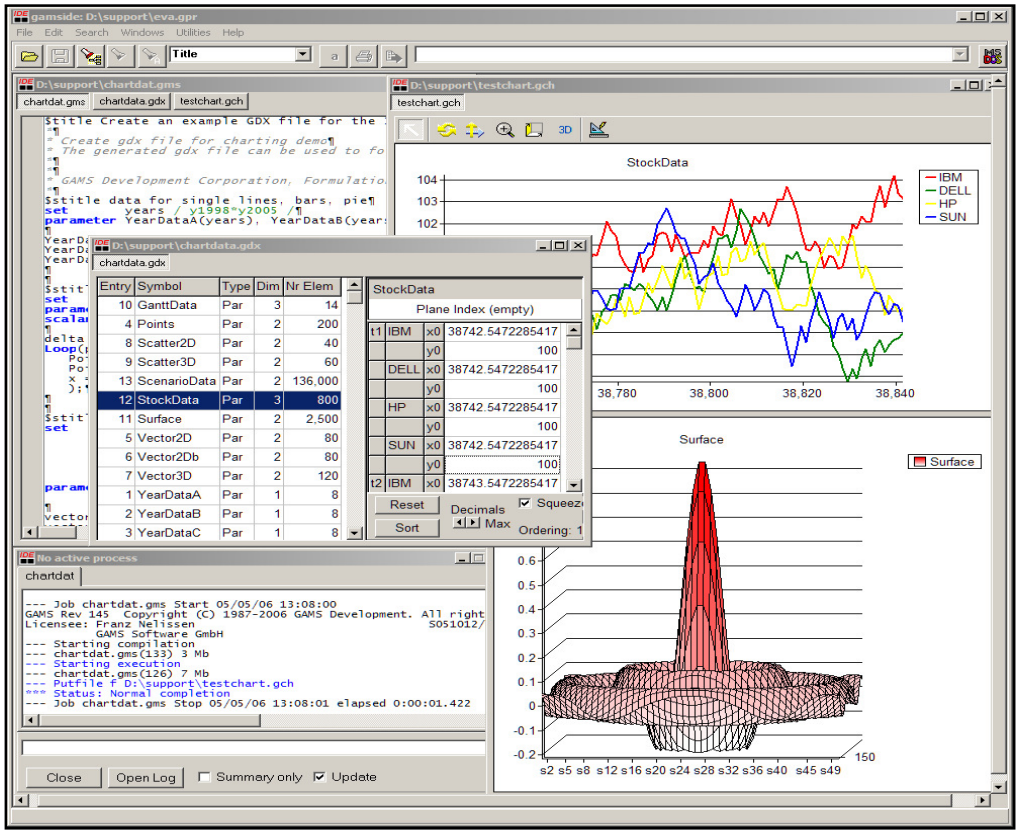
trnsport.gms

```
Variables
     x(i,j)  shipment quantities in cases
     z       total transportation costs in thousands of dollars ;

Positive Variable x ;

Equations
     cost         define objective function
     supply(i)    observe supply limit at plant i
     demand(j)    satisfy demand at market j ;

cost ..         z  =e=  sum((i,j), c(i,j)*x(i,j)) ;

supply(i) ..    sum(j, x(i,j))  =l=  a(i) ;

demand(j) ..    sum(i, x(i,j))  =g=  b(j) ;

Model transport /all/ ;
```

1: 1 Insert

Hands-on! IDE - A Guided Tour

- Project Management
- Documentation
  - User's Guide
  - McCarl User's Guide
  - Solver Manuals
- Model Library
- Solver Selection
- Option Editor
- Listing file
  - Tree view
  - Error navigation
- Spell checking



GAMS Talks at OR 2008

GAMS' Extended Mathematical Programming Framework

Jan-Hendrik Jagla
Wednesday, 14:45 - 16:15
J 2101

Is Utility Computing suitable for providing Mathematical Programming Resources

Franz Nelissen
Friday, 13:15-14:45
K 1004

GAMS on the Web

Download	www.gams.de www.gams.com

Help and Support

Support Wiki	http://support.gams-software.com
Interfaces Wiki	http://interfaces.gams-software.com
McCarl's News	http://www.gams.com/maillist/newsletter.htm
User Group	http://www.gams.com/maillist/gams_l.htm
Google Group	http://groups.google.de/group/gamsworld

Search all GAMS Websites http://www.gams.com/search.htm

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