

BUSINESS PLAN IDEAS

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HARNESSING DATA ACROSS THE INTERNET



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WHAT I WILL DISCUSS TODAY

- I. The Big Picture (the idea; highlights)
- II. A Demonstration of the Open System for Master Production Schedule (OSMPS)
- III. A Deeper Look at the Open System Components
- IV. Business Issues
- V. Licensing Ideas
- VI. Conclusion

PUBLICATIONS IN PROGRESS

“The Open System for Master Production Scheduling: Information Technology for Semantic Connections between Data and Mathematical Models,”

under review for the *Supply Chain Management Educators' Conference*:
Denver, CO (October 2008).

Authors: E.W. Schuster, H.G. Lee, S.J. Allen, P. Kar, and P. Wang

- An introduction to the OSMPS information technology infrastructure
- No code for web services published
- Available online
 - http://www.ed-w.info/SCMEC2008V7%20_2_.pdf

PUBLICATIONS IN PROCESS (CONT.)

“Master Production Schedule Stability Under Conditions of Finite Capacity,”

under review, *International Journal of Production Research*.

Authors: E.W. Schuster, S.J. Allen, H.G. Lee, C. Unahabhokha

- Working paper (2005)
- Over 150,000 copies downloaded from my personal web site
- Design of experiments approach involving simulation
- No code published
- Available online
 - http://www.ed-w.info/IJPR_stability_-Ver9.pdf

I. THE BIG PICTURE

THE IDEA

A supply chain for mathematical models that is searchable across the Internet with precision.

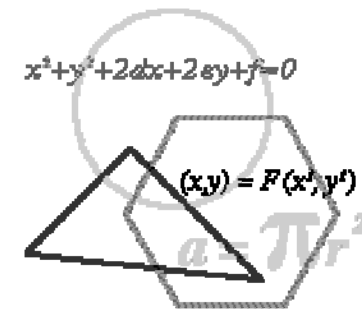
Overall, the SaaS approach, combined with the M Language, quickly puts state-of-the-art modeling in the hands of many users with no local computer implementation other than downloading an Excel spreadsheet.

Origin of Idea: Mar. 2003 (Data Center Program) and early thinking 1998 and 1999 by E.W. Schuster and S.J. Allen

FULL DOCUMENTATION AVAILABLE

THE HIGHLIGHTS

- Master Scheduling Model along with Open Systems
 - Open source versus open systems
 - Powerful trend in the computer industry
- M Language and other web standards
 - Semantic connections for models and data via the Internet
 - mlanguage.mit.edu
- Software as a Service
 - Access a sophisticated scheduling model on a remote server using an Excel spreadsheet interface that can reside on any microcomputer with Internet link
 - Match a specific model to a specific problem
 - Create a world-wide standard for a specific MPS problem
- No implementation of model on local system, access is immediate
 - No storage of data on remote database



II. DEMONSTRATION

MIT Laboratory for Manufacturing and Productivity (LMP)

Interdepartmental Research Lab

- Article and link for download
 - http://web.mit.edu/lmp/news/news_03_07_08.html
- Code for both MODS and web services is protected from open view

III. A DEEPER LOOK AT THE OPEN SYSTEM COMPONENTS

PHILOSOPHY

- *Integrate* existing IT standards in new ways, combine with new ideas
 - OSMPS uses web services technology and the M Language
- *Inductive* – examine a specific technical problem, then formulate a solution
 - Approach is robust for industry, less deductive
- *Separate* model code from user
 - Code runs at MIT, end-user could be anywhere in the world
- *Replication* – get specific model to exact application quickly, at zero cost
 - Remove friction from the modeling process

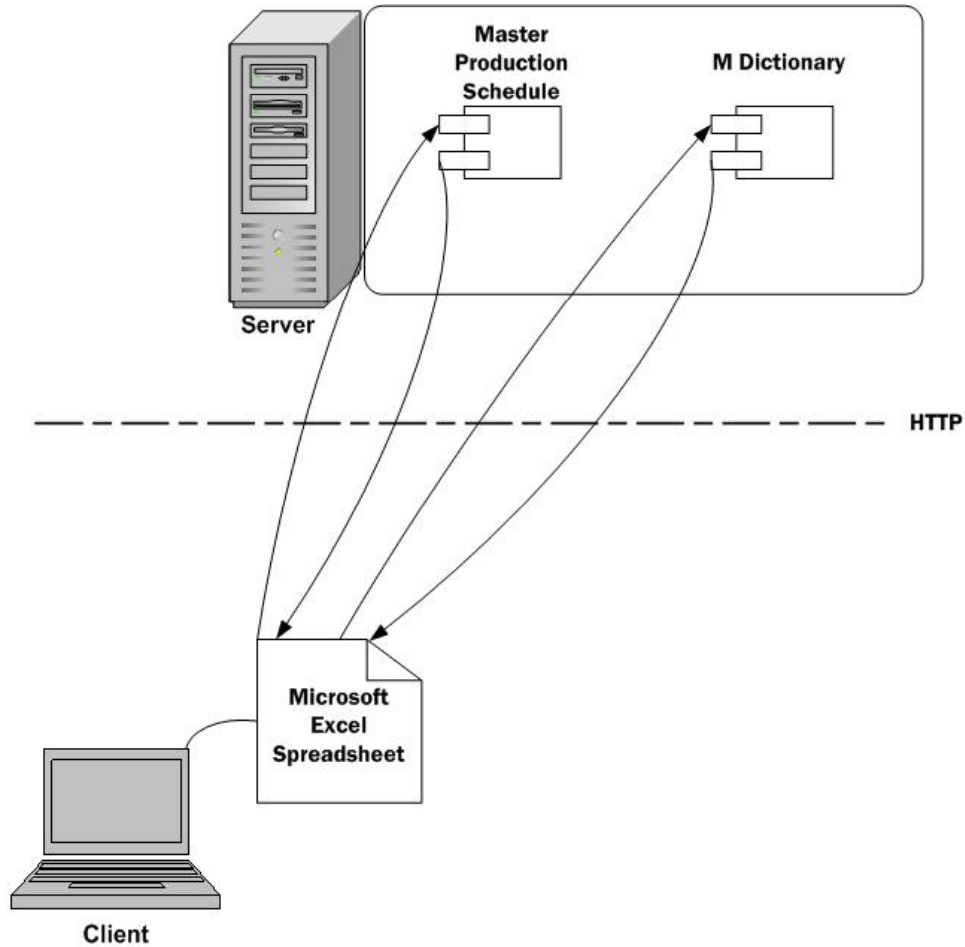


TWO ELEMENTS

- The model
 - Modified Dixon Silver heuristic (MODS)
 - Highly sophisticated approach for make-to-stock production scheduling
 - Very fast calculation speed (seconds) as compared to traditional OR approaches
 - Comprehensive and robust, a candidate for a world standard
 - Typical application, scheduling for the manufacture of food products
- The delivery
 - Excel spreadsheet based modeling
 - Search and download from Internet
 - Use M Language to provide a model “self identification” capabilities
 - Use M words as part of web services and Java programs
 - New approach to Internet and programming



THE OVERALL ARCHITECTURE OF OSMPS



SOFTWARE AS A SERVICE (SAAS)

- **ERP Systems**
 - Packaged software, complex, limited functionality
 - Extensive Business Process Engineering to Implement
 - Cost is high, long implementation
 - Replacement of modules
 - The peak, 2009?
- **SaaS**
 - Perhaps the mode of delivery for all new software in the future
 - SAP, delivery of select modules to small and medium sized companies
 - Browser based
 - Salesforce.com and NetSuite

Why do MPS calculations need to be done locally?

MANUFACTURING SYSTEMS

- Enterprise Resource Planning (ERP) is the exclusive system for decision making in manufacturing firms
- Critical in asset management, highly complex
- Important role in delivering customer service
 - Some argue that this is the most important part of the marketing mix
- ERP is essentially a large data base combined with models
- Delivery by packaged software
 - Maturing technology



HIERARCHY OF PRODUCTION DECISIONS

Forecasts of Demand

Aggregate Plan

Master Production Schedule

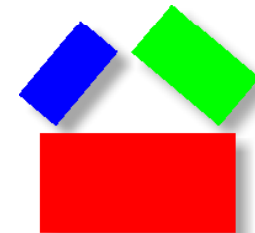
Schedule of Production Quantities by production and time period

Materials Requirements Planning System
Explore master production schedule to obtain requirements for components

Detailed Job Shop Schedule
To meet specification of production quantities from the MRP system

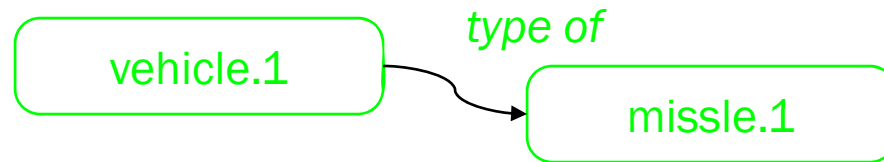
CONNECTING MODELS AND DATA

- Semantics remains a difficult issue for the Internet
- Most approaches to machine understanding of Internet words depend on inferential methods
- M Language incorporates a way to identify the exact meaning of a word or noun phrase
- This capability is helpful in search and sharing information
- The M Language concentrates in the following areas
 - Model composition
 - Data integration and interoperability
 - Semantic analysis of free form text



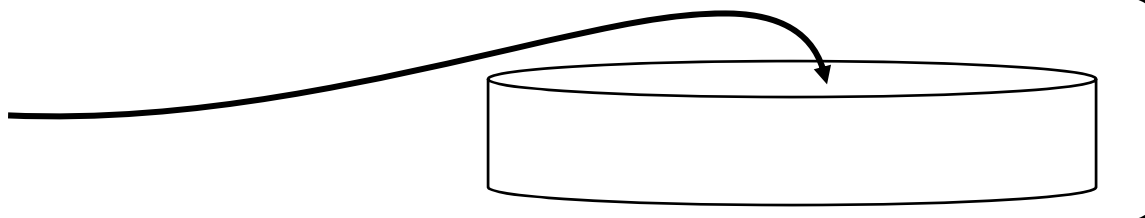
M TECHNOLOGIES

M Ontologies



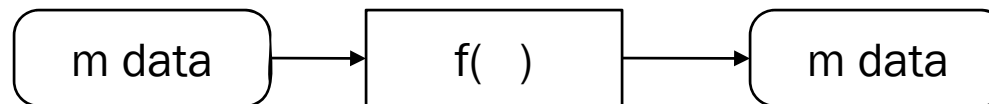
A “centralized dictionary;” with unambiguous semantic relationships

M Data



Interoperable data; understanding what data tags mean

M Machines



Interoperable mathematical modes, one model with many different applications

MICROSOFT ISSUES

- As a general note, users of the OSMPS should download and install [MSXML 6.0 Service Pack 1 from Microsoft](#).
- If your company has a firewall, a connection to the MIT server might be blocked.
- If you use a wireless router, the connection has to be good for the web services interface to work properly .
- This spreadsheet does not work in Microsoft Excel for Apple computers

FUTURE MODELS FOR OSMPS

- **Bias adjusted safety stock**
 - For consumer goods manufacturers, 10 – 30% decrease in safety stock with no decrease in customer service
 - HP, Unilever, and Intel use similar approach
 - Important enhancement to finite capacity planning systems
- **Schedule stability**
 - Very popular topic
 - New way to reduce instability without freezing part of the schedule
- **Sequence dependent set-ups**
- **Other models can use the OSMPS architecture**
 - USDA, agricultural models

IV. BUSINESS ISSUES

PEOPLE

- **Edmund W. Schuster**
 - Corporate management and academic experience (20 years in food industry), manufacturing systems experience in high volume manufacturing
 - M.P.A. from Gannon University, B.S. from The Ohio State University
 - Employed by MIT Laboratory for Manufacturing and Productivity (Data Center Program, Field Intelligence Lab, Auto-ID Lab)
 - c.v. [http://www.ed-w.info/c.v.%20 5-21-07 %20EWS.pdf](http://www.ed-w.info/c.v.%205-21-07%20EWS.pdf), start-up experience
- **Stuart J. Allen**
 - Professor Emeritus, Penn State Erie – The Behrend College
 - Ph.D. in engineering mechanics, University of Minnesota; M.S. in ME, Seattle University; B.S. in ME, University of Wisconsin
 - Extensive pure and engineering math background, plus statistics
 - Owned and operated three businesses in Wisconsin and New York State

Stuart and Ed have worked together for more than 20 years

PEOPLE (CONT.)

- **Pinaki Kar**
 - Extensive background in the computer industry working as a consultant
 - MIT Alumni (M Eng in Logistics, MLOG), MBA from New York University, B Tech from Indian Institute of Technology, Kanpor in ME
 - Currently a Wall Street analyst for an investment firm in Westchester County
 - Highly refined quantitative skills ranging from finance to operations research

- **Hyoung-Gon (Ken) Lee**
 - Post Doc Associate at the MIT Laboratory for Manufacturing and Productivity
 - Ph.D. in industrial engineering from Seoul National University
 - Extensive background in manufacturing systems, especially ERP
 - Accomplished in web services programming

Pinaki and Ken have worked with Ed for a combined 8 years

Stuart, Pinaki, Ken and Ed form an integrated group with diverse backgrounds and abilities

OWNERSHIP

- **MODS**
 - S.J. Allen and E.W. Schuster began work in 1995
 - Completed product, 1996
 - Implemented as VB in a spreadsheet, tested and used at Welch's, inc.
- **Java**
 - P. Kar converted MODS into Java, 2003
- **Java (current version)**
 - H.G. Lee used P. Kar's work as a base for program conversion to the most recent version of Java, 2008
- **Open System**
 - H.G. Lee programmed the Java Web Services and the interface with M Dictionary
 - E.W. Schuster formulated system architecture

OWNERSHIP (CONT.)

- Roughly equal shares of effort
 - S.J. Allen perhaps has spent the most time working on MODS
 - Joint ownership – *Schuster, Allen, Kar, and Lee*; some work outside of MIT
- Publications
 - Two early research articles, 1997 and 1999
 - Diagram of program logic
 - No publication of code
- Implementation
 - OSMPS now ready for use in business as a commercial product
 - Licensing strategy to speed use in practice, reduce involvement of owners
 - Establishing an operating business, *Data Spawn*, is an option
 - Extensive market worldwide exists

THE MARKET – PROCESS INDUSTRIES

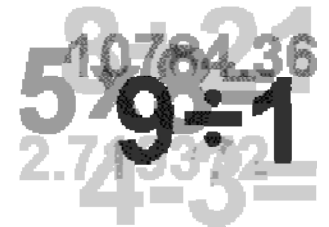
- Have manufacturing operations that include:
 - Mixing
 - Separating
 - Forming
 - Chemical reactions
 - High speed manufacturing lines (example, bottle filling)
- Major industries
 - Food
 - Chemical
 - Pharmaceutical
 - Paper
 - Biotechnology
- The sector is probably 50% of worldwide manufacturing

THE MARKET - OTHER

- Repetitive manufacturing
 - Production of similar productions using a common machine
 - An example is the production of metal parts such as screws
 - Multiple productions, high volume
 - Key concept: fixed capacity for a production process involving multiple products
- Non manufacturing
 - Agriculture, defense, publishing, services
 - Delivery of mathematical models

V. LICENSING THROUGH MIT TLO

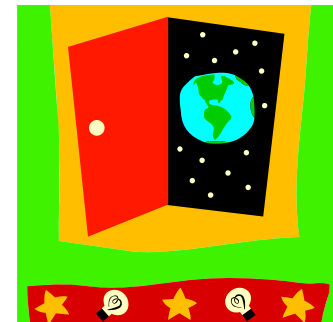
- Take a new approach in solving large-scale, practical business problems that require quantitative analysis
- Every business has hundreds of applications for mathematical models
 - The matching process is inefficient
- *The Data-Driven Economy* will depend on new means of delivering models to practitioners
 - Search cost will become even more important
 - Overall cost of modeling must decrease
- Innovations like the printing press are fundamental to progress
 - Reduction of printing cost by 100 fold (late 18th century)*
 - OSMPs is a fundamental technology like the printing press



*Gibbon, Edward (1910). *The Decline and Fall of the Roman Empire* – Volume 4, New York: Alfred A.Knopf, p. 449.

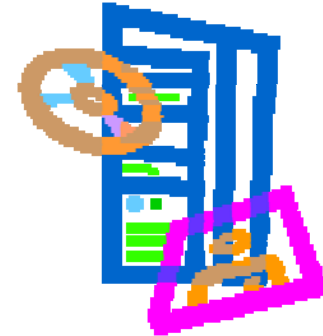
RED HAT APPROACH

- License the technology to a third party software vendor
- Vendor provides a version of MODS (or any other model) for free online
 - Open system approach
- Sources of revenue
 - *customize* MODS for larger problems,
 - *Consulting* for production planning markets
 - charge for *documentation*
 - charge for educational *seminars* on master scheduling and other topics
 - *Services*, schedule stability and safety stock planning



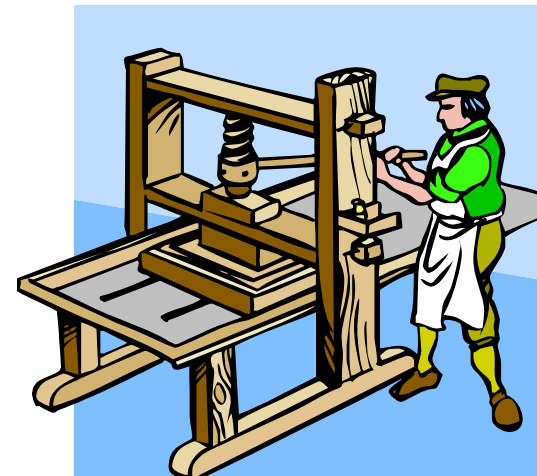
LICENSE SOURCE CODE

- License the MODS program code to software company
 - No spreadsheet application
 - The code can be adapted as part of an existing packaged software ERP offering
 - Full documentation required
 - Likely, an exclusive license required
- License the OSMPS to private companies
 - Run internally using spreadsheets, no public access
 - Web services architecture
 - Inside the firewall of a company
 - Non exclusive license situation
 - Large company opportunity
 - Customize to different languages using the M Dictionary
 - Capable of *internal company search* for spreadsheets



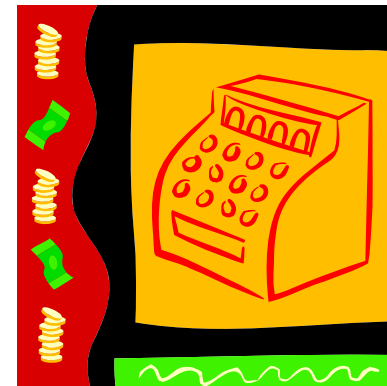
PUBLISHING MATHEMATICAL MODELS

- License OSMPS architecture to a modeling company like MatLab
- Use book publishing model
 - Just as a book publisher, solicit models from outside authors to load on a server
 - Then charge a fee each time the model is used
 - Pay royalty to the author in addition to profit for licensing company
 - Solicit models from INFORMS members, deliver to APICS members



OTHER IDEAS

- Integrate into MIT OpenCourseWare
- Sell to Microsoft as an Excel add-in
- Focus on the educational market, textbook publishers that include mathematical models
- Examine alternative markets - agriculture



V. CONCLUSION

OVERSEAS TRIP

- Starting June 14, I am visiting Taiwan, Japan, China, and S. Korea
- Full details of the trip are at the following link:
 - <http://www.ed-w.info/Asia2008FinalSchedule.pdf>
 - General seminar on OSMPS in Taiwan
- A tremendous need exists for low cost scheduling software
 - Typical ERP scheduling packages cost more than \$100,000 including installation
- Former alumni from Taiwan, Japan, and China are interested in becoming involved in *Data Spawn*. Ken has contacts in S. Korea

mlanguage.mit.edu

datacenter.mit.edu

fil.mit.edu (Aug. 1, 2008)

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