ASIA 2008

Taiwan, Japan, China, and Korea

Travel Schedule and Planned Talks

Company meetings are confidential and are not listed in this schedule

Edmund W. Schuster
Laboratory for Manufacturing and Productivity
Massachusetts Institute of Technology

Email: edmund_w@mit.edu

Personal Web Site: www.ed-w.info

c.v. http://www.ed-w.info/c.v.%20_5-21-07_%20EWS.pdf

Expanded list of speaking topics:
http://www.ed-w.info/SpeakingTopics2008.pdf

(Note: Schedule and speaking information will be updated periodically)

Laboratory for Manufacturing and Productivity
30 YEARS OF ENGINEERING THE REAL WORLD

All times local

Sat, Jun 14

UNITED AIRLINES, UA 0173

BOSTON	8:18am
SAN FRANCISCO	11:45am

UNITED AIRLINES, UA 0871

SAN FRANCISCO	1:15pm
TAIPEI	5:30pm Sun, Jun 15

Mon., June 16 (Afternoon)

Sponsor: Epoch foundation

THE OPEN SYSTEM FOR MASTER PRODUCTION SCHEDULING (OSMPS)

Target audience: the electronics and food and consumer goods industries, repetitive manufacturing such as the production metal parts, and the software industry, specifically the Enterprise Resource Planning providers

Seminar Length: 3 hours

Data: Seminar attendees and encouraged to submit real scenarios for OSMPS in advance. For a specific list of data requirements please contact Ed Schuster at edmund_w@mit.edu All data will be confidential. For public demonstrations, the data will be disguised.

Abstract

For manufacturing firms, the master production schedule (MPS) often represents a critical planning function that has a great deal of influence on customer service and cost. A critical component of Enterprise Resource Planning (ERP) systems, the MPS typically is the interface between forecasting, material requirements planning systems and shop floor control, and provides plant management with a schedule for manufacturing products.

This presentation will deal with a special case of the MPS, namely high volume, make-to-stock manufacturing. Examples of this type of manufacturing include the electronics

industry, food and consumer goods, and repetitive manufacturing of all types. For these industries and situations it is critical to sequence production in the most efficient manner for a critical resource such as a production line or machine, while also maintaining customer service levels (percentage of time in-stock) and controlling inventory.

The OSMPS is a research program at the MIT Laboratory for Manufacturing and Productivity with the goal of offering sophisticated modeling capabilities for manufacturing systems and other types of mathematical models. Specifically, the M Language in conjunction with other web standards enable the Modified Dixon-Silver Heuristic (MODS) to be delivered to users with a new method called Software as a Service (SaaS). This approach allows anyone access to the MODS algorithm located on a remote server using only a Microsoft Excel spreadsheet. There is no implementation of MODS on local computing systems and access is immediate. Essentially, the algorithm serves as a calculator and does not store any data from the spreadsheet on the server.

The MODS algorithm has been applied at Welch's, Inc., a leading United States producer of grape juice products. Unilever, H-P, and Intel have used similar approaches to reduce inventory and improve customer service. All examples presented will be from real data and situations experienced in industry.

The MODS algorithm is a powerful way to calculate a master production schedule for make-to-stock manufacturing. Tested for over ten years, MODS consistently finds feasible solutions involving the trade-off between choice of products to produce and capacity, inventory carrying cost, set-up cost, and set-up time. Solve times for large planning problems are less than ten seconds. MODS is robust enough to become the standard for make-to-stock manufacturing worldwide. One of the goals of OSMPS is to give small and medium sized companies access to sophisticated models. Large companies will also benefit from the OSMPS.

This 3 hour seminar is organized into the following parts:

1. The Big Picture (20 minutes)
2. Master production planning, ERP, and the Modified Dixon Silver heuristic (55 minutes)
    - Details of the MODS algorithm
    - Safety Stock Planning
    - Schedule Stability

   Break (15 minutes)

3. Elements of the Information Architecture for OSMPS (45 minutes)
4. Demonstrations and approaches to reducing cost (20 minutes)
5. Additional applications of the Open Systems information technology architecture (25 minutes)

W/O June 16

Sponsor: Epoch Foundation

Audience: Taiwan Government

AN INTRODUCTION TO THE MIT FIELD INTELLIGENCE LAB

RESEARCH PROJECTS IN AGRICULTURAL SYSTEM PRODUCTIVITY

The newly formed Field Intelligence Lab, under the leadership of Prof. Sanjay Sarma, has several different research concentrations involving various aspects of sensing, data, mathematical modeling and supply chain management. All these topics deal in some way with spatial data and information. One area of concentration is agricultural systems productivity, which deals with various applications of computer science, mechanical and other technologies to agriculture. This presentation explores some of the work currently being done at MIT in the following areas

I. **Information Technology Frameworks for Precision Farming**

   a. Drop Sensing - Prof. Sanjay Sarma and his graduate students are working on a new way to deploy sensors. Rather than placing sensors on moving pieces of machinery, such as a yield monitor, or fix placement (a weather station), a third way is to drop sensors into place. This will require new types of technology and a way to determine exactly where to place sensors in a field.

   b. Information Technology Backbone - as a way to gather and analyze the large amounts of data expected from efforts in precision agriculture, there will need to be new types of infrastructure. A way is needed to inter operate data and mathematical models. The M Language is a candidate.

   c. Web 2.0 - The rate of scientific advancement is thought to depend on the ability to collaborate and share data, information, and insights. A move to "open science" in agriculture can be facilitated through the application of Web 2.0 methods.

   d. Geospatial Data Integration – an open system for integrating agricultural information into maps.

   e. Semantic Analysis - The overwhelming amount of information available within journal articles makes it difficult to find associations between related technologies. Many believe that it is the weak associations between various technologies that leads to technological advancement. Some capabilities of the M Language might provide the capability to perform semantic analysis on journal articles, looking for various types of associations. This can be as specific as associations between paragraphs in two different articles.

f. A Method for Delivering Mathematical Models – Many agricultural decisions can be modeled, however, it is not always the case that these models are applied at the farm level. This research involves an application of the M Language to deliver models directly to growers using a Microsoft Excel spreadsheet.

g. Data Integration – Precision agriculture depends very much on the integration of many different types of data. This research area uses the M Language to bring data from many different sources, and different data formats, together very quickly for analysis.

II. Agricultural Supply Chains: Track and Trace for Improved Food Safety

a. Safety has emerged as an issue for the fresh fruit and vegetable industry with reports of several recent food poisoning outbreaks traced to E. Coli. Although these outbreaks generate a great deal of attention, probably many more fresh food contamination instances go undetected. By one account, 76 million illnesses and 5,000 deaths occur each year in the United States from food contaminated with various pathogens. While the agricultural supply chain is complex, new technologies are available that hold the promise of better track and trace for fresh foods. This research examines the trends and applications of RFID and related information technologies as a means of improving the safety for fresh foods in addition to being a platform for other innovations in agriculture. Part of the talk will focus on fundamental research already conducted to address the track and trace problem in other businesses such as the pharmaceutical industry. The overall theme for the talk is that data and information technologies will gain increasing importance in agriculture, affecting diverse areas such as food safety, logistics, and marketing.

III. Harvest Risk: An Introduction to Quantitative Modeling and Optimization in Agriculture

a. Since the dawn of agriculture about 12,000 years ago, farmers have dealt with several categories of risk in producing the food needed to sustain their lives and to build urban centers of industry and learning. In this presentation, I examine quantitative methods for modeling the risk associated with the harvest of Concord grapes and other specialty crops such as oranges. The technique involves a real-world problem in capacity planning and was implemented at a large agricultural cooperative. Our work in the harvest risk area spans 12 years and has been applied in industry. Along with my co-author Stuart J. Allen, we have defined the emerging area of harvest risk. Given climate change, doubling of the world's population during the next 30 years, and current surging commodity prices along with food shortages, the study of harvest risk should be a pivotal area in agriculture during the next 10 years.

Fri., Jun 20

ALL NIPPON AIRWAYS, NH 1084

TAIPEI	9:45am
TOKYO NARITA	1:55pm

Sun., Jun 22

ALL NIPPON AIRWAYS, NH 0063

TOKYO HANEDA	12:00pm
SAPPORO CHITOSE	1:35pm

Mon., June 23

Sponsor: Hokkaido University

CONTROLLING THE RISK FOR AN AGRICULTURAL HARVEST

The emerging area of harvest risk deals with the application of mathematics to optimize agricultural operations. This presentation will involve a mathematical treatment of the topic along with extensions to other areas of agricultural risk management.

Tue., Jun 24

ALL NIPPON AIRWAYS, NH 2152

SAPPORO CHITOSE 7:50am
TOKYO NARITA 9:25am

Wed., Jun 25

Sponsor: MIT Industrial Liaison Program, Japan Office

Audience: MIT ILP Members and General Public

INTRODUCTION TO THE MIT FIELD INTELLIGENCE LAB AND DROP SENSING

Under the leadership of Prof. Sanjay Sarma of the Laboratory for Manufacturing and Productivity and the Dept. of Mechanical Engineering, the MIT Field Intelligence Lab (FIL) derives its name from the engineering definition of a field, namely the presence of a physical quantity at every point in space and time. The primary goal of FIL involves various aspects of sensing and sampling to determine the nature of a field and to identify variability or "hot spots." This capability has many applications in business, engineering, and science.

The FIL focuses on four areas, agricultural system productivity, environmental sampling, the megalopolis program, and marketing spatial diffusion. The common thread from all of these activities involves various aspects of spatial analysis across a wide range of situations.

With the population of the Earth projected to double in the next 30 years, the agricultural systems productivity program of FIL concentrates on food production and natural resource management with an emphasis on computer science and information technology applications. This topic is very important to the future of the world in terms of sustainability.

Other areas of concentration for FIL include *Drop Sensing*, a new approach to sensor networks; the megalopolis program, which examines increasing population densities along with land use; and marketing spatial diffusion for consumer products in advanced economies.

The FIL has 8 faculty, research staff, and graduate students with Prof. Sanjay Sarma as founder and leader.

This seminar is divided into 7 sections. It provides a non-mathematical treatment of the topic. The appropriate audience includes those from business, specifically electronic, automotive, materials, and chemical along with those from engineering and science disciplines, and government agencies. Generally, the seminar will explore sensor networks, environmental sensing, and urban sensing. Any organization interested in the application of sensors through space will find this seminar of value.

Part I (1.0 hr)

1. Introduction to the Field Intelligence Lab
    a. The "big picture"
    b. Underlying engineering theory of FIL
    c. Topic areas of FIL
    d. People involved with FIL

2. Sensor Networks
    a. Definition and business potential
    b. Current state of technology
    c. Gaps and opportunities for innovation
    d. Drop sensing along with fixed and mobile sensors

3. Spatial Sampling
    a. Underpinnings of sampling and importance in spatial analysis
    b. A new approach based on engineering mathematics
    c. Application to the optimal deployment of sensors

Break (10 min.)

Part II (1.0 hour)

4. Establishing standards for sensing (hardware, software, and math models)
    a. The need for an information technology architecture
    b. Parallel the development of the EPCglobal Network
    c. The advancement of ubiquitous computing
    d. Lessons learned (1998 – 2008), Laboratory for Manufacturing and Productivity
        - Auto-ID Center and Labs
        - The Data Center Program
        - Field Intelligence Lab

5. Applications in industry
    a. Drop sensing and environmental sampling
    b. Urban sensing

c. Agriculture
d. Marketing

6. The future and industry participation in FIL
    a. Hardware research and development, and decreasing cost/unit
    b. Establishing standards for different types of sensing
    c. Develop the information technology infrastructure needed to integrate the data from sensors
    d. Formulate mathematical models to make sense of the data for business and scientific decision-making
    e. Industrial applications on a large scale

7. Question and Answer

<u>Fri., Jun 27</u>

ALL NIPPON AIRWAYS, NH 0905

TOKYO NARITA	10:35am
BEIJING	1:25pm

<u>Sat., Jun 28</u>

BEIJING JIATONG UNIVERSITY

<u>Tue., Jul 1</u>

AIR CHINA LIMITED, CA 0123

BEIJING	8:50am
SEOUL INCHEON	11:50am

Thurs., Jul 3

Sponsor: U-Center, Seoul National University

MIT LABORATORY FOR MANUFACTURING AND PRODUCTIVITY

ACTIVITIES IN UBIQUITOUS COMPUTING

- **MIT제조 및 생산성 연구소(LMP)를 중심으로 살펴 본 유비쿼터스 컴퓨팅 연구**

Edmund W. Schuster and Hyoung-Gon Lee
Laboratory for Manufacturing and Productivity
Massachusetts Institute of Technology

발표자 소개

1. Edmund W. Schuster (주발표자 – 영어로 진행)
- RFID분야의 세계적인 베스트셀러 "Global RFID: The Value of the EPCglobal Network for Supply Chain Management (Springer Verlag; 홍릉과학 출판사에서 번역서 출간 예정)"의 제1저자.
- MIT Auto-ID Center(前), Data Center Program(現), Field Intelligence Lab(現)에서 Research Engineer로서 연구를 이끌고 있음.
2. Hyoung-Gon Lee (부발표자 – 필요에 따라 영어, 한국어 동시 진행)
- 서울대 유비쿼터스 컴퓨팅 센터 전임 연구원으로서, 현재 MIT Data Center Program에서 박사후 연수 수행 중.

국문초록

새로운 IT혁명으로 회자되며 우리들 곁으로 성큼 다가 선 유비쿼터스 컴퓨팅 분야에 대한 논의는 흔히 하드웨어, 소프트웨어 및 관련 표준으로 대별되는 기술 중심적인 이슈가 주류를 이루지만, 근저에 있는 비즈니스 및 역사학적인 측면을 거시적인 관점에서 고찰하여야 향후 이 분야의 추세 또한 가늠할 수 있을 것입니다. 유비쿼터스 컴퓨팅은 작동 원리상의 측면에서 기존의 전산학의 연원과 비교해 보면 오히려 단순해 보이나, 이를 실세계의 네트워크에 통합 적용하고 비즈니스 가치를 창출한다는 견지에서는 해결해야 할 난점과 다른 한편으로는 이로 인해 가능하게 될 기존에 없었던 기회가 동시에 존재함을 보게 됩니다. 따라서 유비쿼터스 컴퓨팅의 성공여부는 종래의 공학적 연구개발 측면 못지않게 새로운 기술들간의 융합, 창의적인 관점에서의 응용 연구 및 비즈니스 적용 연구 등이 수반된 진정한 혁신을 이루어 낼 수 있는지에 달려 있을 것입니다.

Laboratory for Manufacturing and Productivity
30 YEARS OF ENGINEERING THE REAL WORLD

MIT 제조 및 생산성 연구소 (약칭 LMP: Laboratory for Manufacturing and Productivity)에서 수행하고 있는 유비쿼터스 컴퓨팅 연구는 RFID기술을 물리적인 객체에 ID(identification)를 부여하는 방식으로 적용하여 유일한 인식성을 광범위하게 실현하고자 했던 Auto-ID 센터의 초창기(1998년도)의 시도로 거슬러 올라갑니다. 이러한 근저에서 시작된 노력의 결실이 EPCglobal 네트웍을 창안해낸 GS1의 설립으로 나타났으며 이는 RFID기술을 실제 비즈니스에 적용하고자 하는 범세계적인 가장 큰 동인으로 등장하게 됩니다. Auto-ID 센터의 설립 이래로 LMP에서는 새로운 연구흐름들이 다시 등장하게 되는 바, Auto-ID Lab (세계 7개 대학들과의 컨소시엄), Data Center Program, Field Intelligence Lab이 유비쿼터스 컴퓨팅 분야를 다시금 개척해 나가고 있습니다. 이들 그룹은 모두 3인의 정교수, 5인의 학자 혹은 엔지니어, 5인의 교환 교수 및 교환학자들과 20명의 대학원생으로 구성되어 있습니다.

본 세미나는 어느덧 10주년을 맞이한 MIT의 RFID 및 관련 연구들을 살펴봄으로써, 유비쿼터스 컴퓨팅 분야의 미래를 조망하는 것을 목표로 합니다. 지난 과정에 있었던 성공 뿐만 아니라 실패했던 점도 솔직히 나누며, 현재의 연구역량을 어디에 집중하고 있는지 또한 밝히고자 합니다. 전반부의 개괄적인 내용에 이어 후반부에서는 유비쿼터스 컴퓨팅의 향방을 인터넷의 발달과 관련지어 현재의 Web of Information(인터넷)이 Web of Things(RFID)를 거쳐 Web of Abstractions(데이터, 수리모델, 상호작용성)으로 나아가는 과정으로 바라보고자 하며, 그 일환으로서 새로운 인터넷 기술로 각종 분야에 파급될 것으로 기대되고 있는 M Language에 대하여 논하고자 합니다. M Language의 구체적인 응용분야로는 미국의 첨단기술 산업, 소비자 제품 산업 및 농업 분야 까지를 포괄합니다. 저희 LMP는 미래의 비즈니스에 대한 성공의 열쇠는 마케팅 과학, 공학기술 및 공급사슬관리 분야의 절묘한 결합에 달려 있을 것으로 믿고 있으며, 유비쿼터스 컴퓨팅은 바로 이러한 융합을 가능하게 하는 가장 기본적인 인프라가 될 것으로 보고 서울대학교 유비쿼터스 원천기술 지원센터를 비롯하여 관련 분야에 종사하시거나 연구하고 계신 여러분들과 생각을 나누고자 합니다.

Abstract

Although ubiquitous computing is a technical area that depends on engineering research and advances in hardware, software, and standards, there is also a need to view this discipline from both business and historical standpoints to understand the underlying philosophy and factors that will drive the future course of the technology. Fundamentally different as compared to the historical foundations of computer science, ubiquitous computing often operates in a simpler way as compared to traditional, large-scale computing; however, through integration into everyday life, the complexities of how to manage large networks and to create business value represent significant challenges and great opportunities. Beyond the traditional aspects of engineering research and development, success for ubiquitous computing will depend on new forms of innovation and

the ability to make connections between evolving technologies, applied research, and business application.

Most of the work in ubiquitous computing at the *MIT Laboratory for Manufacturing and Productivity (LMP) traces* to early efforts by the *Auto-ID Cen*ter to develop RFID technology as a means of achieving unique identification for physical objects on a grand scale. Through this foundational work, GS1 created the EPCglobal Network and became a driving force in the application of RFID to real-world problems. Since the formation of the Auto-ID Center, other new research efforts at LMP, namely *Auto-ID Labs*, *The Data Center Program*, and the *Field Intelligence Lab* continue to conduct research broadly related to ubiquitous computing. As a group, these programs include 3 tenured faculty members, 5 research scientists, 5 visiting professors and scholars, and over 20 students conducting graduate level research.

This presentation focuses on the past ten years of RFID and related topics as a guide to what the future holds for ubiquitous computing. Successes, failures, and current research trends will be features of discussion. The last segment of the talk will address the direction of the Internet in relation to ubiquitous computing, starting with the web of information (current), moving to the web of things (RFID), and finally to the web of abstractions (data, mathematical models, and interoperability). Part of this segment includes discussion of the M Language, a new internet technology with potential for applications in many different areas. Concrete examples of the M Language include the US high tech industry, consumer goods manufacturing, and agriculture. As a concluding remark, the future of business will very much depend on the integration of marketing science, engineering technology, and supply chain management. Ubiquitous computing will become the primary engineering technology enabling this integration.

Part I (1 hour)

The Auto-ID Center and Related Technologies - A Ten Year Retrospective (1998 – 2008)

1. Definition of *Ubiquitous*.
2. Historical Background of the MIT Auto-ID Center
    a. Initiative – connecting physical objects to the Internet
    b. Emergence as a leader in RFID research
        i. The organizational distinctiveness of MIT
    c. The EPCglobal Network - status
    d. GLOBAL RFID: The Value of the EPCglobal Network for Supply Chain Management
    e. Lessons learned (1998 – 2003)
3. Post 2003
    a. Auto-ID Lab
    b. Data Center
    c. Field Intelligence Lab

10-minute break

Part II – (1 hour)

The Data-Driven Economy

4. The Internet as Fundamental Infrastructure
    a. *Web of things* and *Web of Abstractions*
    b. Core Aspects of M Language
        i. M Dictionary
        ii. Data Interoperability: M Converter Factory
        iii. Semantic Disambiguation: Natural Language Processing
        iv. Model Composibility: M Machine
    c. Applications
        i. Geo Spatial
        ii. Precision Agriculture
        iii. Semantic Classification of Research
        iv. OSMPS

Fri, Jul 4

UNITED AIRLINES, UA 0892

SEOUL INCHEON	2:10pm
SAN FRANCISCO	8:52am
SAN FRANCISCO	1:00pm
Boston	9:46pm