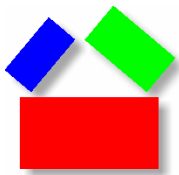


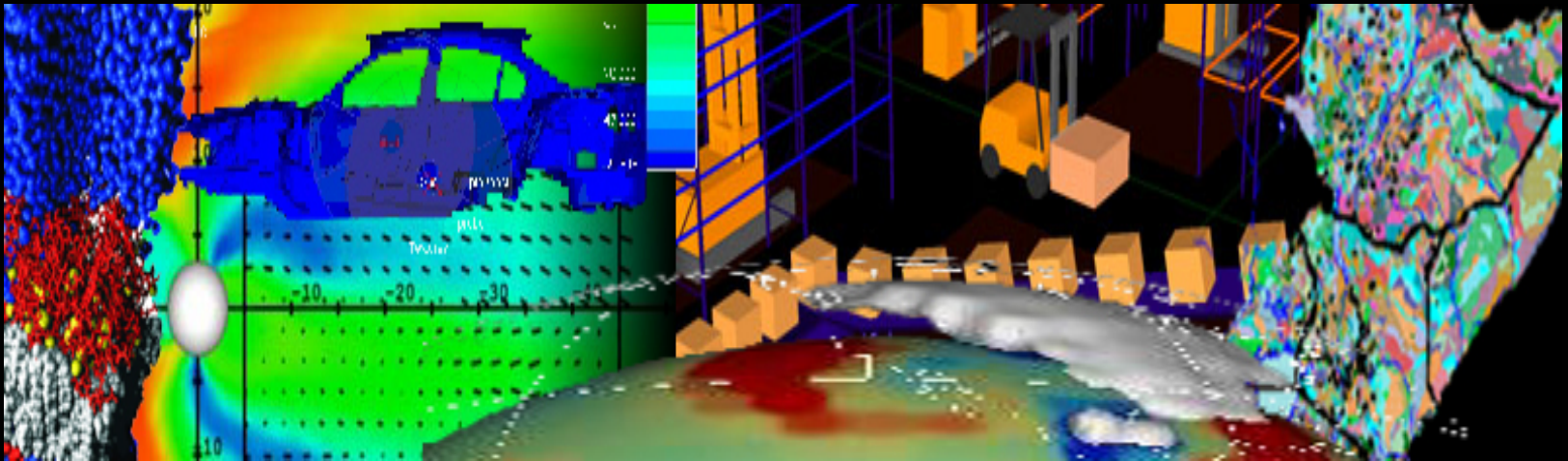


MASSACHUSETTS INSTITUTE OF TECHNOLOGY

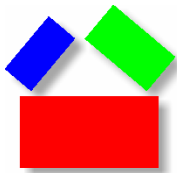


The Data-Driven Economy

Applications of the M Language in Manufacturing and Supply Chain Management

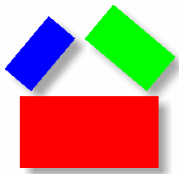


Edmund W. Schuster and David L. Brock
The Data Center Program
Laboratory for Manufacturing and Productivity
Massachusetts Institute of Technology



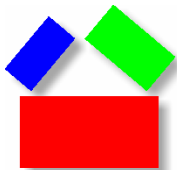
There are only several certainties in the world,
“death, taxes, and integration.”

Professor Grosf
MIT Sloan School of Management



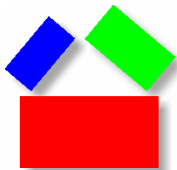
WHAT WE WILL DISCUSS TODAY

1. An **introduction** to the M Language
2. A partial list of **applications, prototypes, and projects** programmed for the future
3. **Engineering Marketing Science** – The integration of marketing science, engineering technology, and supply chain management



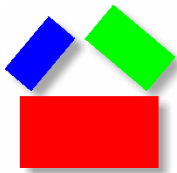
THE MIT DATA CENTER WEB SITE

www.mitdatacenter.org



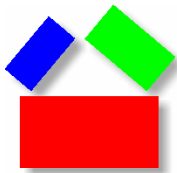
An Interactive Discussion is welcome

Please feel free to ask questions or add comments



MY RESEARCH BACKGROUND

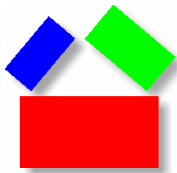
- **The Data Center – I work in applications research**
- **RFID and Related Technologies**
- **Harvest Analytics**
- The Comparative Logistics Project
- MODS Scheduling Lab
- Schedule Stability
- Process Manufacturing
- Supply Chain Management - statistics, and mathematical modeling



HARVEST RISK

- Understand how harvest operations can be optimized
- Establish a new discipline of study
- Looking to apply thinking across all areas of agriculture
- Extensions to other areas, such as fashion industry, airlines
- **"Controlling the Risk for an Agricultural Harvest"** by S.J. Allen and E.W. Schuster appeared in M&SOM
- **"Managing Risk for the Grape Harvest at Welch's"** by S.J. Allen and E.W. Schuster appeared in P&IMJ
- New models for risk in other industries, such as fashion and airlines



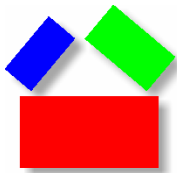


M – THE BIG PICTURE (GENERAL)

- A Network of Models
 - Capture 50 years of modeling
 - Something like eBay
 - The future of ERP...Packaged Software?
 - SAP and DEC, **Analog Devices**
- Connect to the customer, interact
- Interoperable Data
 - Something like Adobe Acrobat
- Sensors

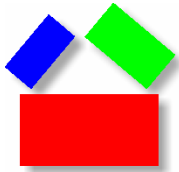
“the number of deployed sensors will dwarf the number of personal computers by a thousand fold in 2010”

Ferguson, Glover, Sanjay Mathur and Baiju Shah (2005), “Evolving From Information to Insight,” *Sloan Management Review* 46:2, p. 52.



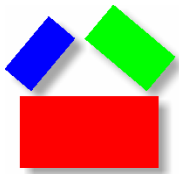
M – THE BIG PICTURE (COMPUTER SCIENCE)

- An open system
- M works with existing data
- The language is designed to be used with existing standards, including the W3C
- Achieve communication when target is un-known
- Address the “many-to-many” problem
- A way to deal with semantics that is different from previous Artificial Intelligence approaches



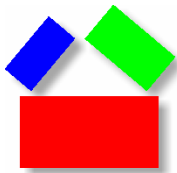
RFID TAG



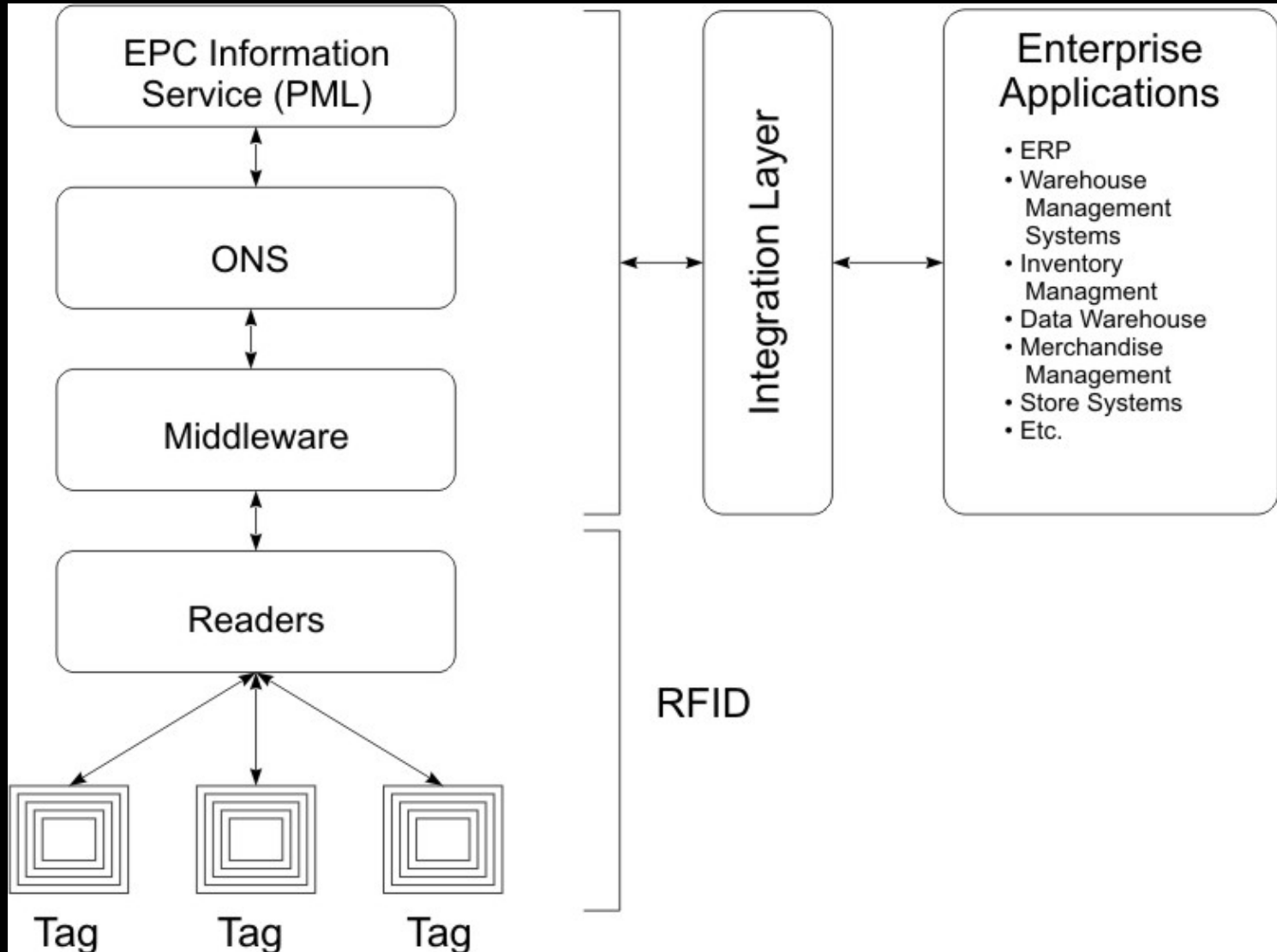


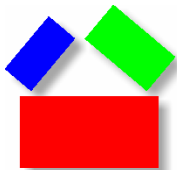
A READER



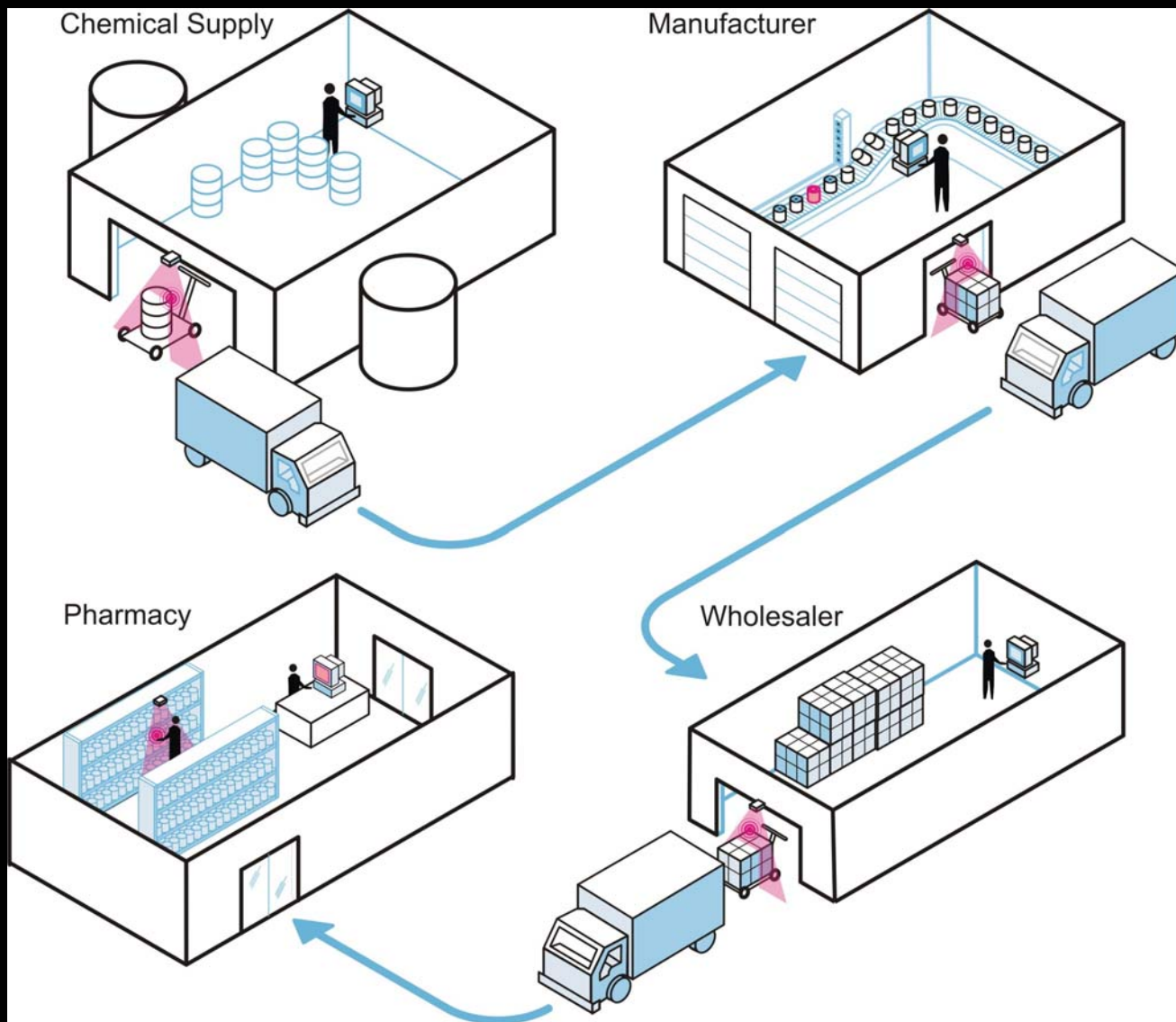


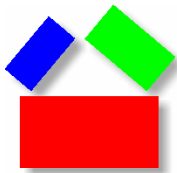
RFID DATA NETWORK





THE SUPPLY CHAIN

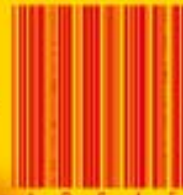




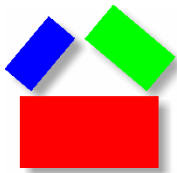
EDMUND W. SCHUSTER
STUART J. ALLEN
DAVID L. BROCK

Global RFID

The Value of the EPCglobal Network™
for Supply Chain Management



 Springer

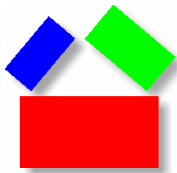


BOOK

- **GLOBAL RFID: The Value of the EPCglobal Network and RFID for Supply Chain Management**

Edmund W. Schuster, Stuart J. Allen, David L. Brock

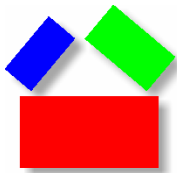
- Publisher: Springer Verlag, 335 pages
- 600 citations
- 41 figures and tables



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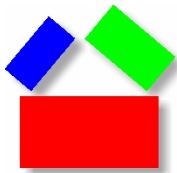
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Vizional Te



GOALS IN WRITING THE BOOK

- What does the capability of unique identification mean for supply chains and business in general?
- Insight into EPCglobal, Inc.
- Targeted for a wide audience
- Focus on implementation
- The role of data, and the future (MIT Data Center and the M Language)
- Foreword written individually by Kevin Ashton and Sanjay Sarma

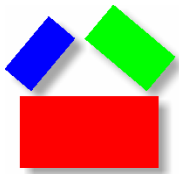


TABLE OF CONTENTS

List of Photographs, Figures, and Tables

Foreword

Preface

Part I: Introduction

- 1 - The Emergence of a New Key Technology
- 2 - Hardware: RFID-Tags and Readers
- 3 - Infrastructure: EPCglobal Network
- 4 - Data: What, When and Where?

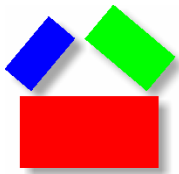


TABLE OF CONTENTS (CONTINUED)

Part II: Leveraging the Supply Chain: Case Studies

- 5 - Warehousing: Improving Customer Service
- 6 - Maintenance: Service Parts Inventory Management
- 7 - Pharmaceuticals: Preventing Counterfeits
- 8 - Medical Devices: Smart Healthcare Infrastructure

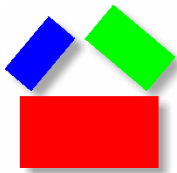


TABLE OF CONTENTS (CONTINUED)

Part II: Leveraging the Supply Chain: Case Studies

9 - Agriculture: Animal Tracking

10 - Food: Dynamic Expiration Dates

11 - Retailing: Theft Prevention

12 - Defense: Improving Security and Efficiency

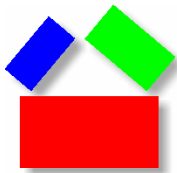


TABLE OF CONTENTS (CONTINUED)

Part III: Creating Business Value

13 - The Role of Data in Enterprise Resource Planning

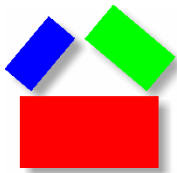
14 - Building a Business Case for the EPCglobal Network

15 - Enhancing Revenue Using the EPC

16 - Outlook: Navigating the Sea of Data

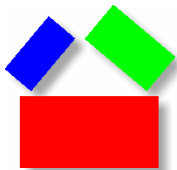
Notes

Glossary



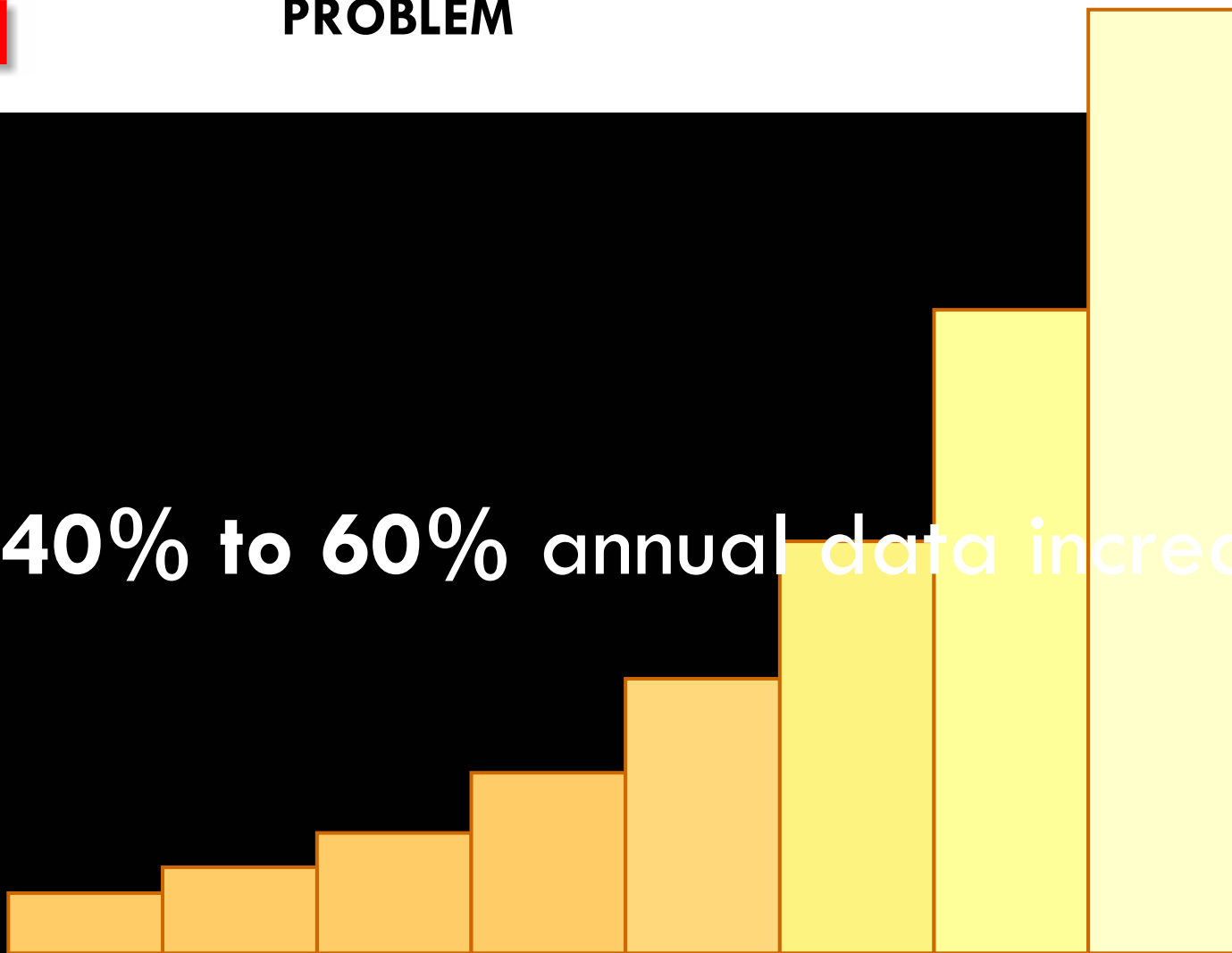
SEVERAL TYPES OF WEBS

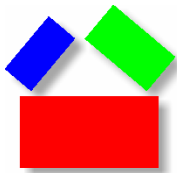
- The Web of Information
 - HTML and the World Wide Web
- The Web of Things
 - Linking physical objects together using the EPCGlobal Network and RFID
- The Web of Abstractions
 - Building a network of mathematical models
 - Link models together
 - Link data to models
 - Computer languages & protocols to create a free flow of models in a network (Internet or Intranet)



PROBLEM

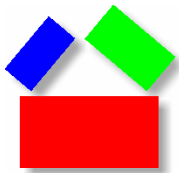
40% to 60% annual data increase





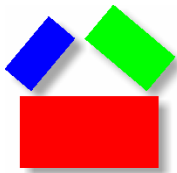
For 2004, shipments of storage devices equaled **four times** the space needed to store every word ever spoken during the entire course of human history.

Lyons, Daniel (2004), "Too Much Data," *Forbes*, December 13.



PROBLEM

What are you going to do
with all of your
Data?



THE IMPORTANCE OF WHAT WE ARE DOING...

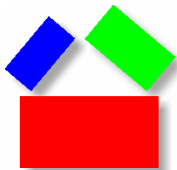
“Semantics is a hot industry sector right now – a \$2 billion per year market and projected to grow to over \$50 billion by the year 2010.”

“Leading analysts have estimated that 35-65% of our System Integration costs are due to Semantic issues.”

EDI – Daily Sales versus Cumulative Sales for the Week

And in every sector of the market...our biggest software challenges come down to creating and resolving meaning. In other words: semantics.

2006 Semantic Technology Conference
San Jose, Ca

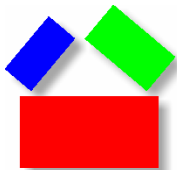


The market in semantics might be 10 times larger than RFID

This is a good area to add value, create new research, and make profits

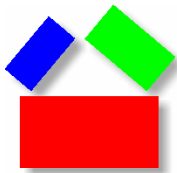
There are many internal company benefits as well

We think the MIT Data Center might be larger than the Auto-ID effort



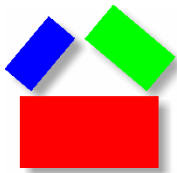
The market for mathematical models might be even larger

We want to become the “Henry Ford of Modeling”



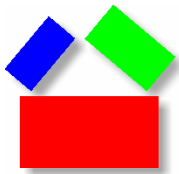
MIT DATA CENTER PROGRAM

- First work conducted in 2003
- Smartworld 2004 – over 300 attendees
- Administrative Unit within MIT 2005
- Laboratory for Manufacturing and Productivity
 - New Master of Engineering in Manufacturing
 - A number of high tech manufacturing experts
- First member, MorganFranklin Corporation, then LG, Raytheon, Siemens, and ReadyTouch



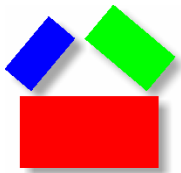
BREAK-THROUGH

- **“An Introduction to Semantic Modeling for Logistical Systems,”** D.L. Brock, E.W. Schuster, S.J. Allen and P. Kar.
- Winner of the 2004 **E. Grosvenor Plowman Award** given by the Council of supply Chain Management Professionals (CSCMP) for best contribution to the study of logistics.

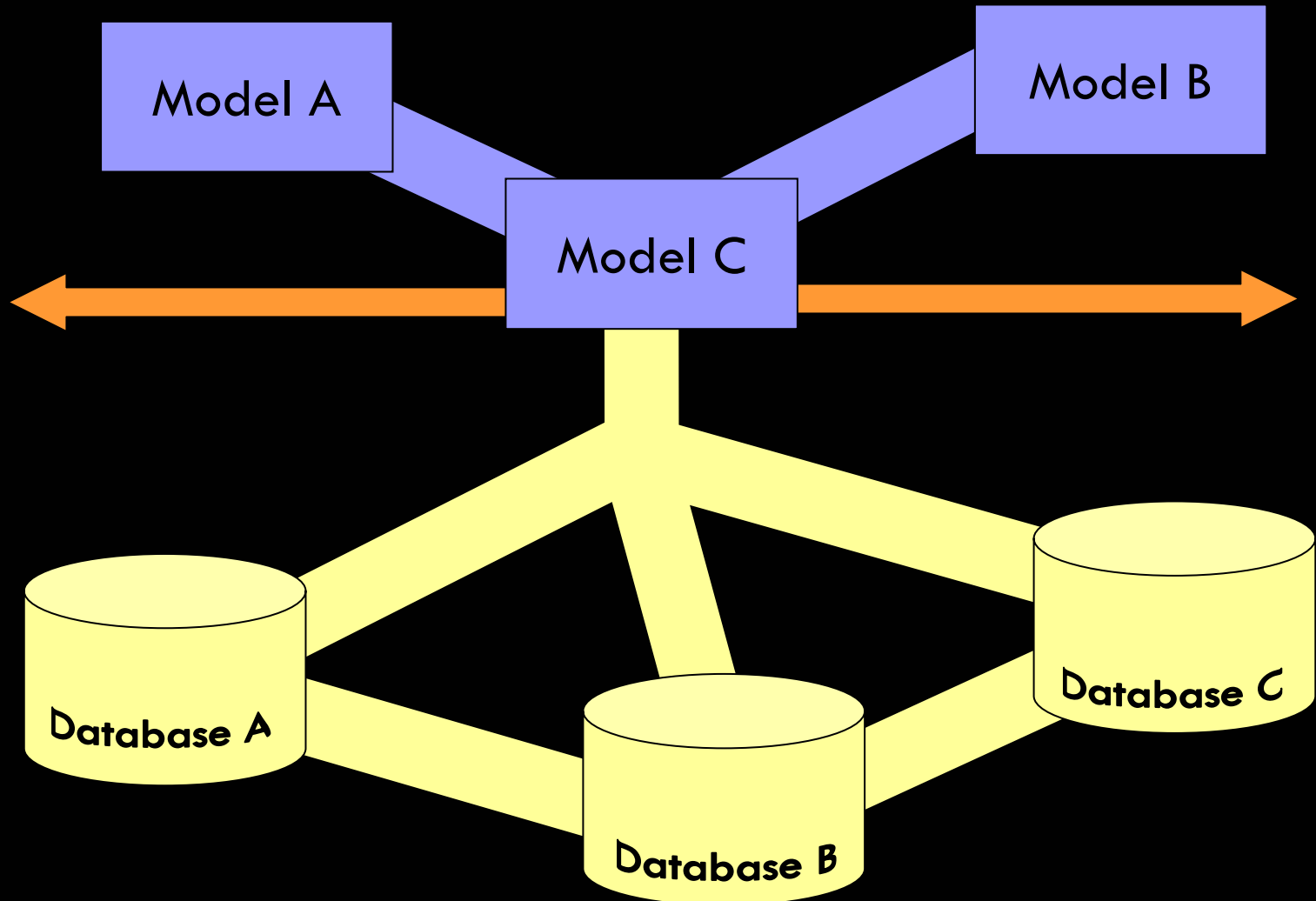


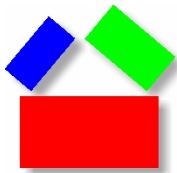
THE M LANGUAGE

- David Brock, Chief Architect
- Initial Design – Dictionary and Rules
- A way to link data together semantically

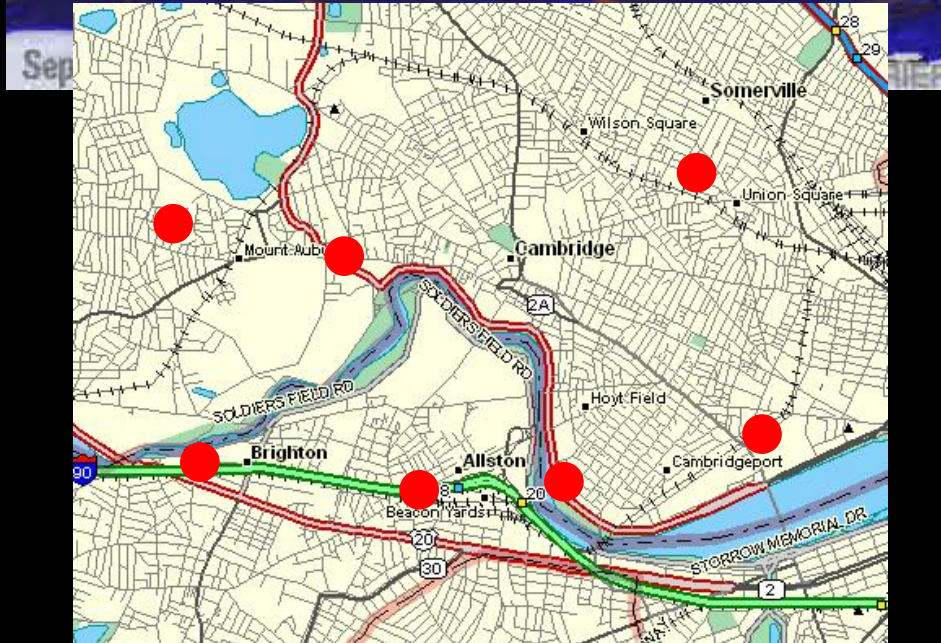
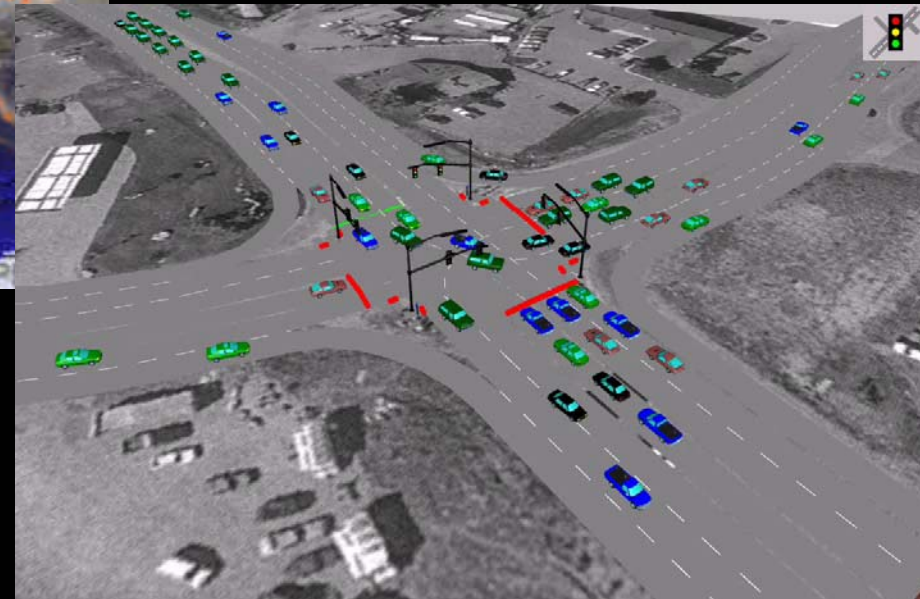
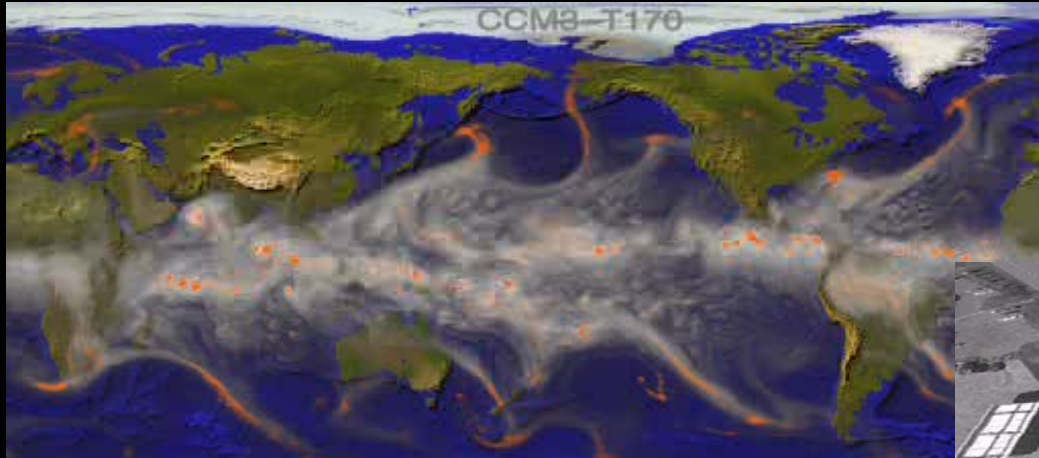


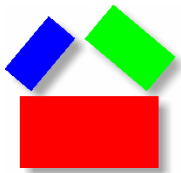
VISION





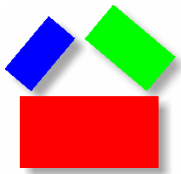
EXAMPLE - LOGISTICS





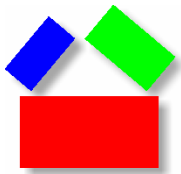
DATA



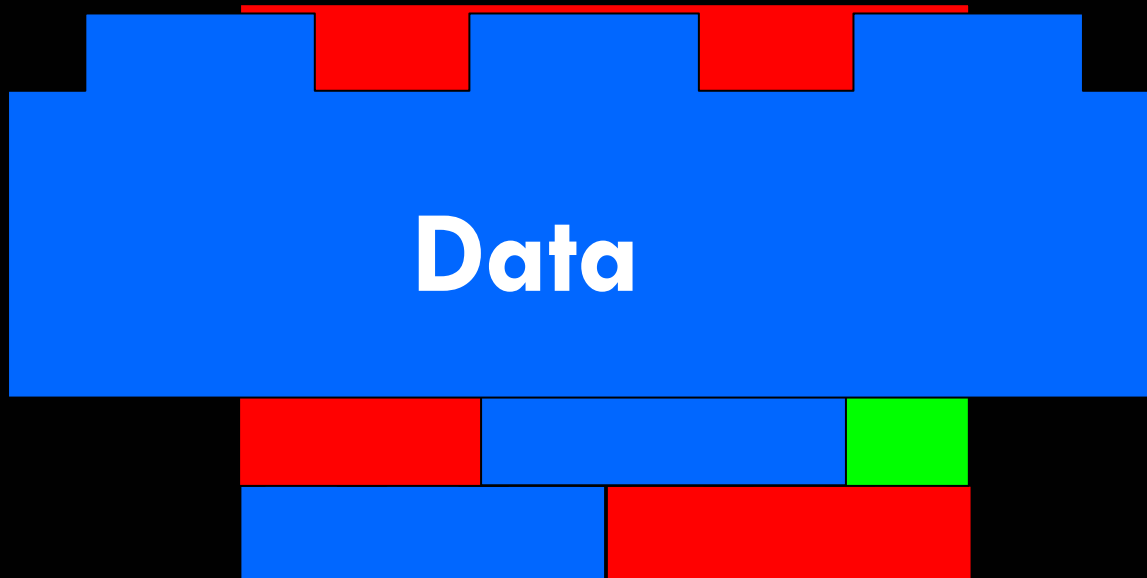


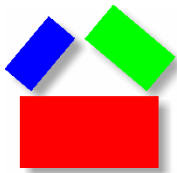
DATA

Data



DATA





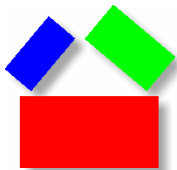
VISION

Mission

- **Make sense of your data**

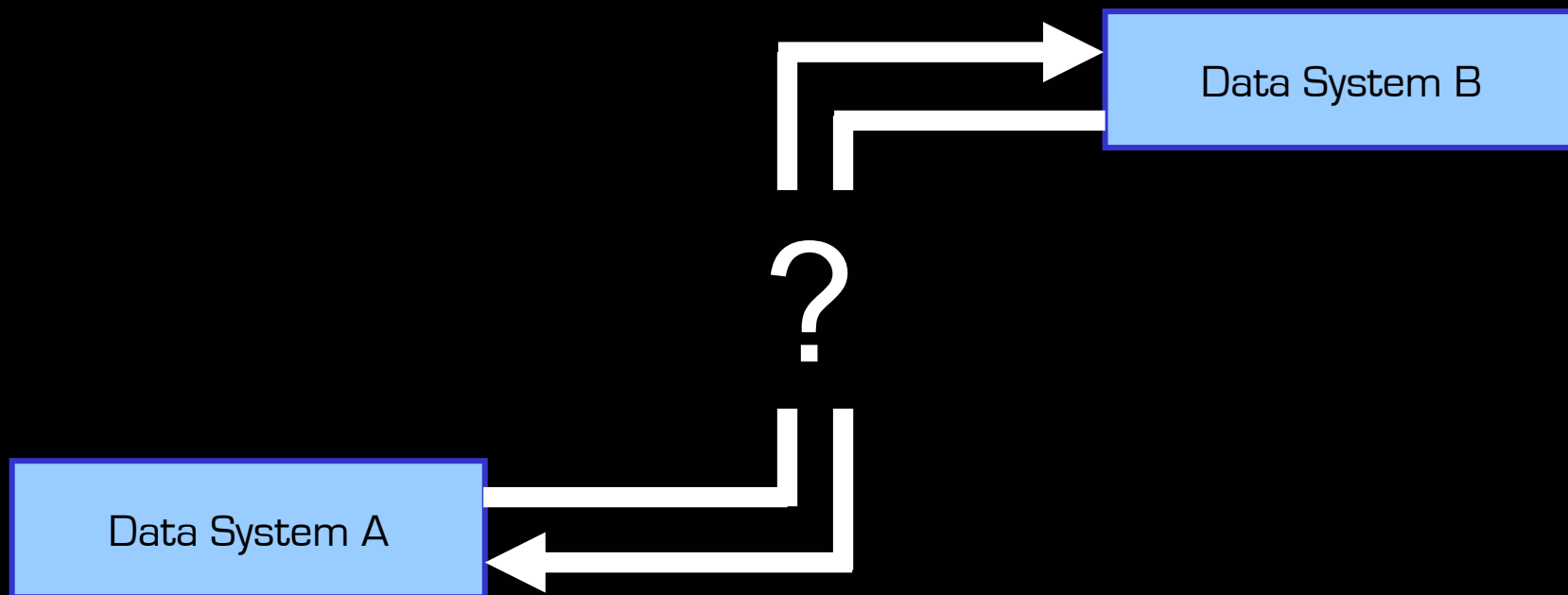
Task

- **Create the standards and systems for interoperable data and modeling**



VISION

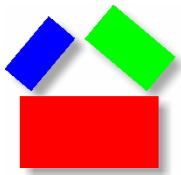
How do we synchronize data?



Data = Symbol

CONTEXT

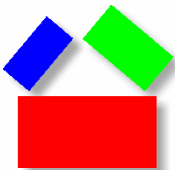
Target: Vocabulary and Syntax



SOLUTION

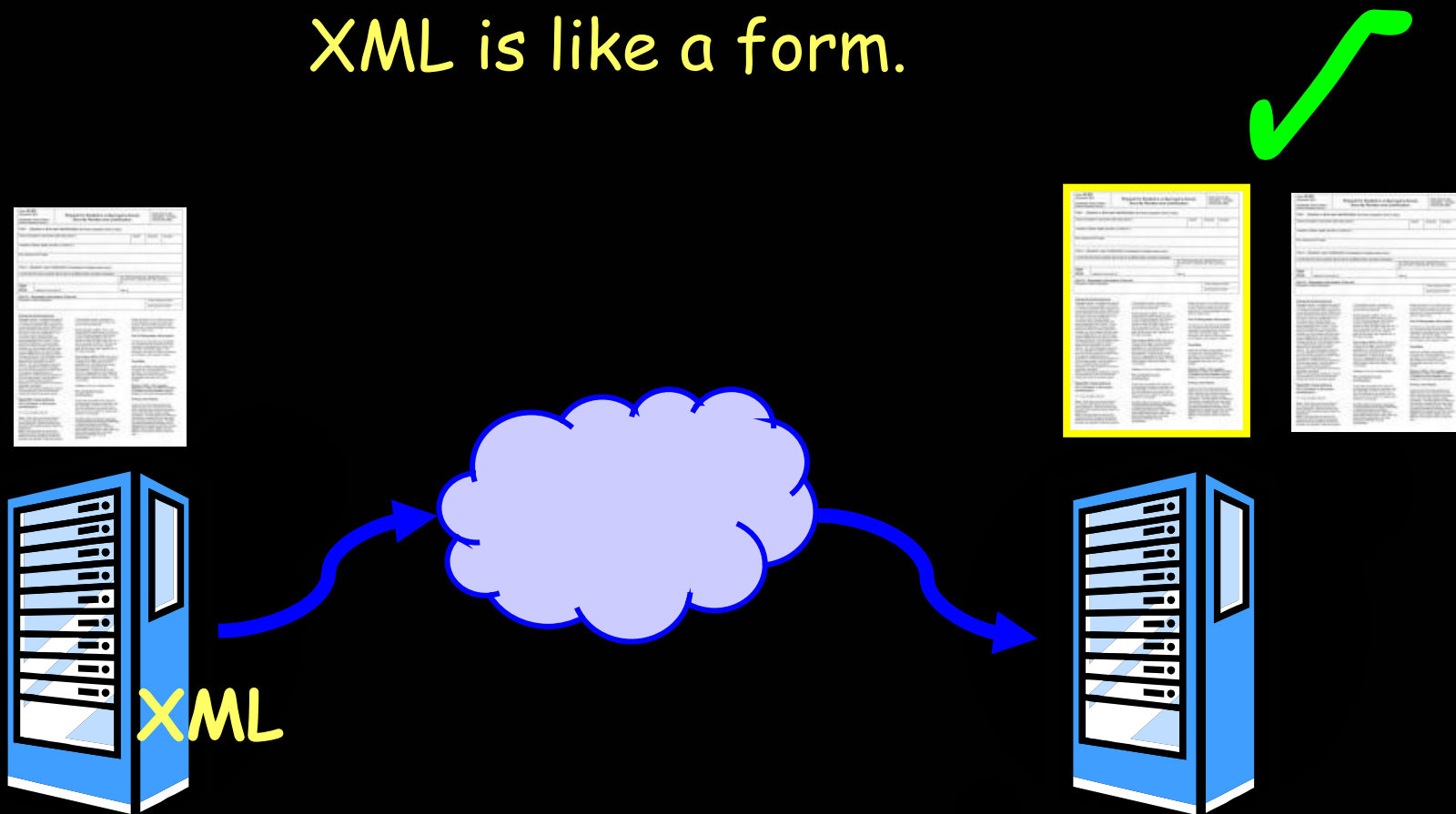
XML

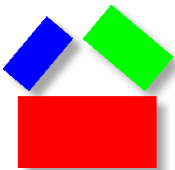
Must agree on vocabulary and syntax



XML

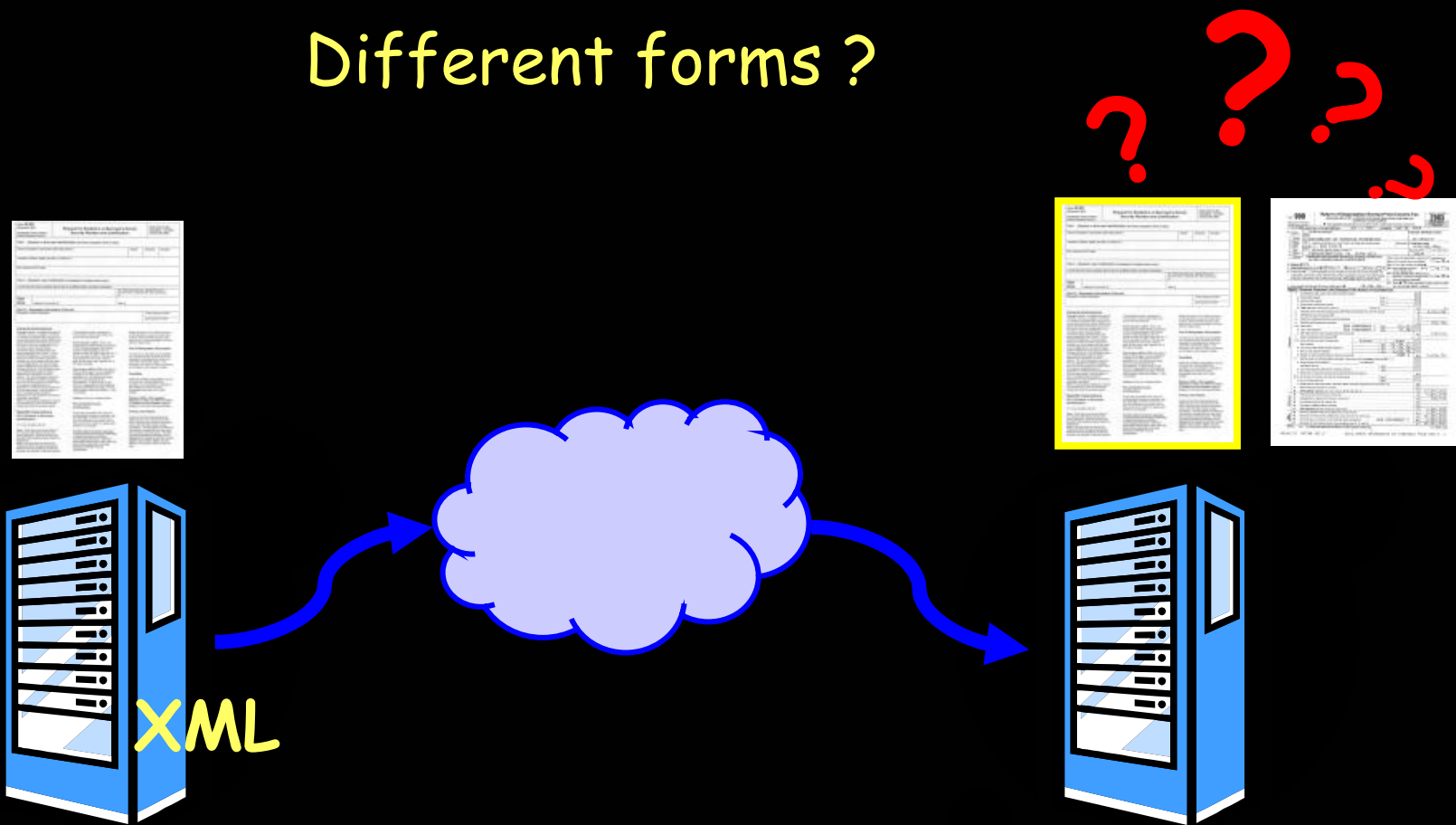
XML is like a form.

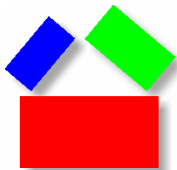




PROBLEM

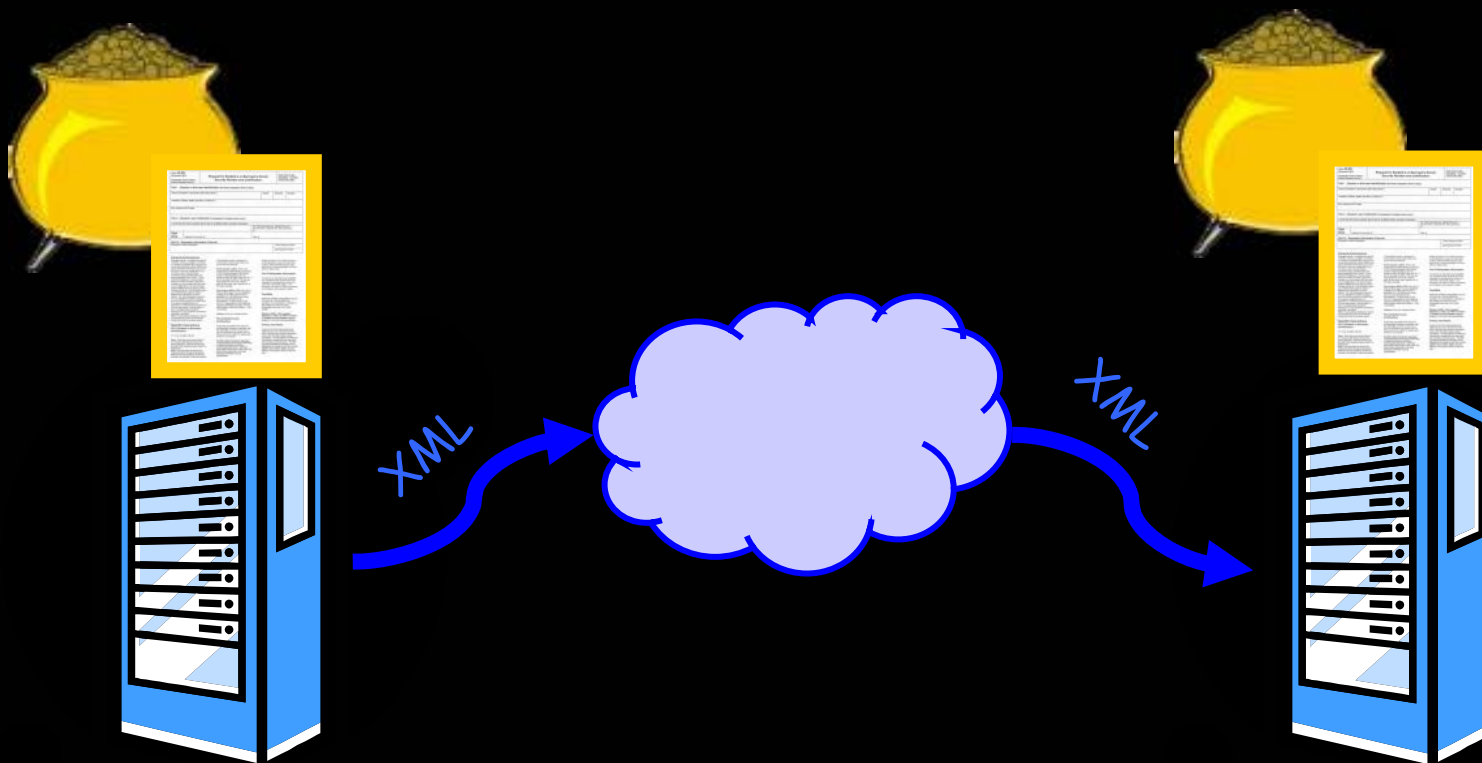
Different forms ?

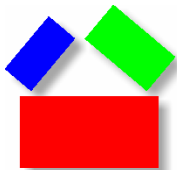




STANDARD

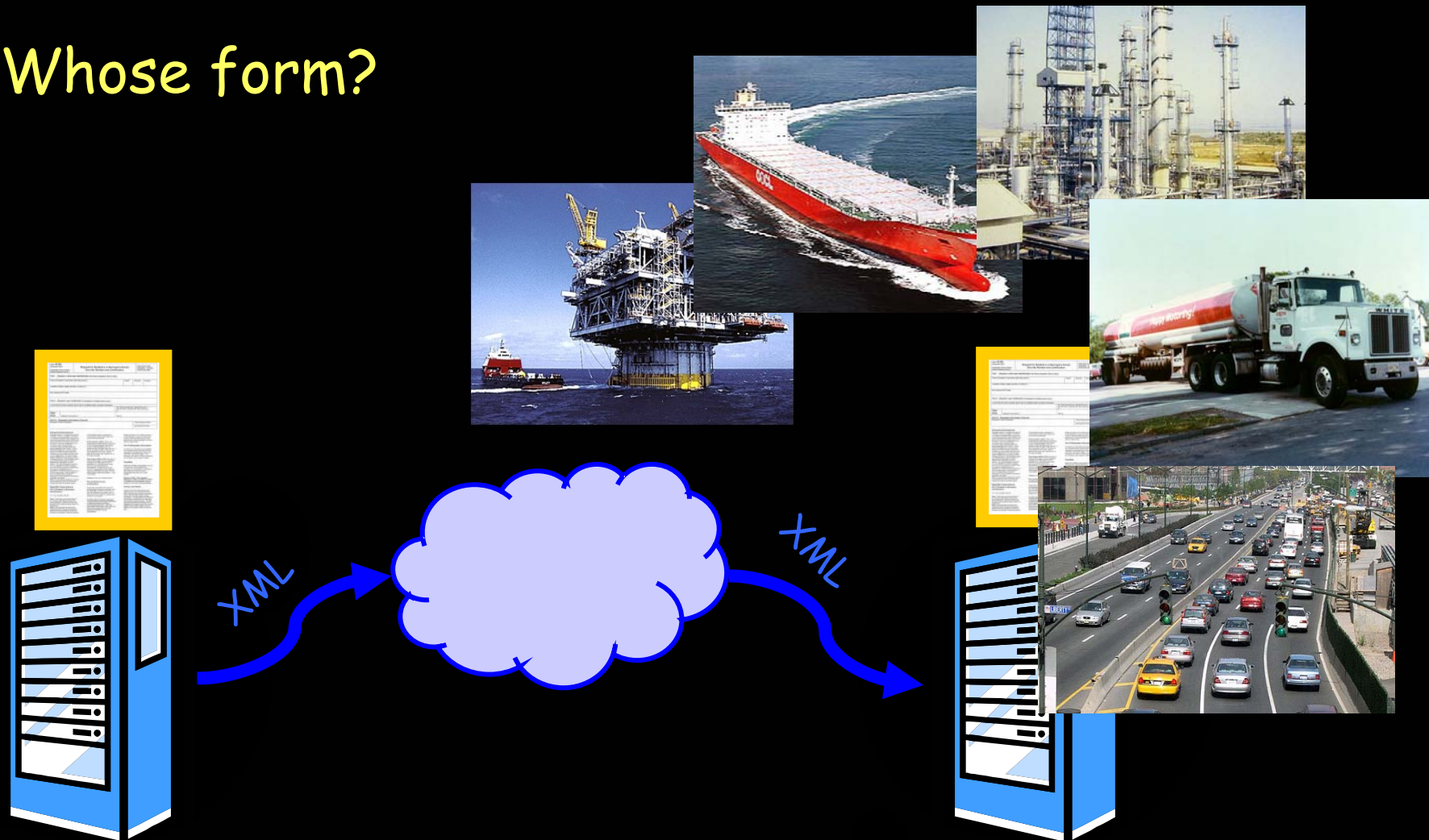
Can't we just agree on one form?

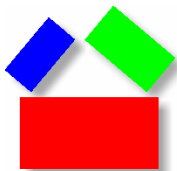




STANDARD?

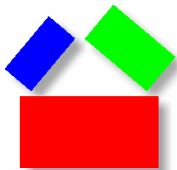
Whose form?





STANDARDS?

4ML	ARML	BiblioML	CIDX	eBIS-XML	HTTP-DRP	MatML	ODRL	PrintTalk	SHOE	UML	XML F
4AML	ARML	BCXML	xCIL	ECML	HumanML	MathML	OeBPS	ProductionML	SIF	UBL	XML Key
4AML	ASML	BEEP	CLT	eCo	HyTime	MBAM	OFX	PSL	SMML	UCLP	XMLife
4AML	ASML	BGML	CNRP	EcoKnow	IML	MISML	OIL	PSI	SMBXML	UDDI	XML MP
4AML	ASTM	BHTML	ComicsML	edaXML	ICML	MCF	OIM	QML	SMDL	UDEF	XML News
4AML	ATML	BIBLIOML	Covad xLink	EMSA	IDE	MDDL	OLife	QAML	SDML	UIML	XML RPC
4AML	ATML	BIOML	CPL	eosML	IDML	MDSI-XML	OML	QuickData	SMIL	ULF	XML Schema
4ABML	ATML	BIPS	CP eXchange	ESML	IDWG	Metarule	ONIX DTD	RBAC	SOAP	UMLS	XML Sign
4ABML	ATML	BizCodes	CSS	ETD-ML	IEEE DTD	MFDX	OOPML	RDDI	SODL	UPnP	XML Query
4ACML	AWML	BLM XML	CVML	FieldML	IFX	MIX	OPML	RDF	SOX	URI/URL	XML P7C
4ACML	AXML	BPML	CWMI	FINML	IMPP	MMLL	OpenMath	RDL	SPML	UXF	XML TP
4ACAP	AXML	BRML	CycML	FITS	IMS Global	MML	Office XML	RecipeML	SpeechML	VML	XMLVoc
4ACS X12	AXML	BSML	DML	FIXML	InTML	MML	OPML	RELAX	SSML	vCalendar	XML XCI
4ADML	AXML	CML	DAML	FLBC	IOTP	MML	OPX	RELAX NG	STML	vCard	XAML
4AECM	BML	xCML	DaliML	FLOWML	IRML	MoDL	OSD	REXML	STEP	VCML	XACML
4AFML	BML	CaXML	DaqXML	FPML	IXML	MOS	OTA	REPML	STEPML	VHG	XBL
4AGML	BML	CaseXML	DAS	FSML	IXRetail	MPML	PML	ResumeXML	SVG	VIML	XSBEL
4AHML	BML	xCBL	DASL	GML	JabberXML	MPXML	PML	RETML	SWAP	VISA XML	XBN
4AIML	BML	CBML	DCMI	GML	JDF	MRML	PML	RFML	SWMS	VMML	XBRL
4AIML	BML	CDA	DOI	GML	JDox	MSAML	PML	RightsLang	SyncML	VocML	XCFF
4AIF	BannerML	CDF	DeltaV	GXML	JECMM	MTML	PML	RIXML	TML	VoiceXML	XCES
4AL3	BCXML	CDISC	DIG35	GAME	JLife	MTML	PML	RoadmOPS	TML	VRML	Xchart
4ANML	BEEP	CELLML	DLML	GBXML	JSML	MusicXML	PML	RosettaNet PIP	TML	WAP	Xdelta
4ANNOTEAL	BGML	ChessGML	DMML	GDML	JSML	NAML	PML	RSS	TalkML	WDDX	XDF
4ANATML	BHTML	ChordML	DocBook	GEML	JScoreML	xNAL	P3P	RuleML	TaxML	WebML	XForms
4APML	BIBLIOML	ChordQL	DocScope	GEDML	KBML	NAA Ads	PDML	SML	TDL	WebDAV	XGF
4APPML	BIOML	CIM	DoD XML	GEN	LACITO	Navy DTD	PDX	SML	TDML	WellML	XGL
4AQL	BIPS	CIML	DPRL	GeoLang	LandXML	NewsML	PEF XML	SML	TEI	WeldingXML	XGMML
4APPEL	BizCodes	CIDS	DRI	GIML	LEDES	NML	PetroML	SML	ThML	Wf-XML	XHTML
4ARML	BLM XML	CIDX	DSML	GXD	LegalXML	NISO DTB	PGML	SAML	TIM	WIDL	XIOP
4ARML	BPML	xCIL	DSD	GXL	Life Data	NITF	PhysicsML	SABLE	TIM	WITSML	XLF
4ASML	BRML	CLT	DXS	Hy XM	LitML	NLMXML	PICS	SAE J2008	TMML	WorldOS	XLIFF
4ASML	BSML	CNRP	EML	HITIS	LMML	NVML	PMML	SBML	TMX	WSML	XLink
4ASTM	BCXML	ComicsML	EML	HR-XML	LogML	OAGIS	PNML	Schematron	TP	WSIA	XMI
4ARML	BEEP	CIM	DLML	HRMML	LogML	OBI	PNML	SDML	TPAML	XML	XMSG
4ARML	BGML	CIML	EAD	HTML	LTSC XML	OCF	PNG	SearchDM-XML	TREX	XML Court	XMTP
4ASML	BHTML	CIDS	ebXML	HTTPL	MAML	ODF	PrintML	SGML	TxLife	XML EDI	XNS

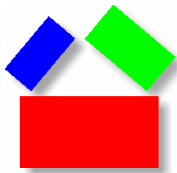


M

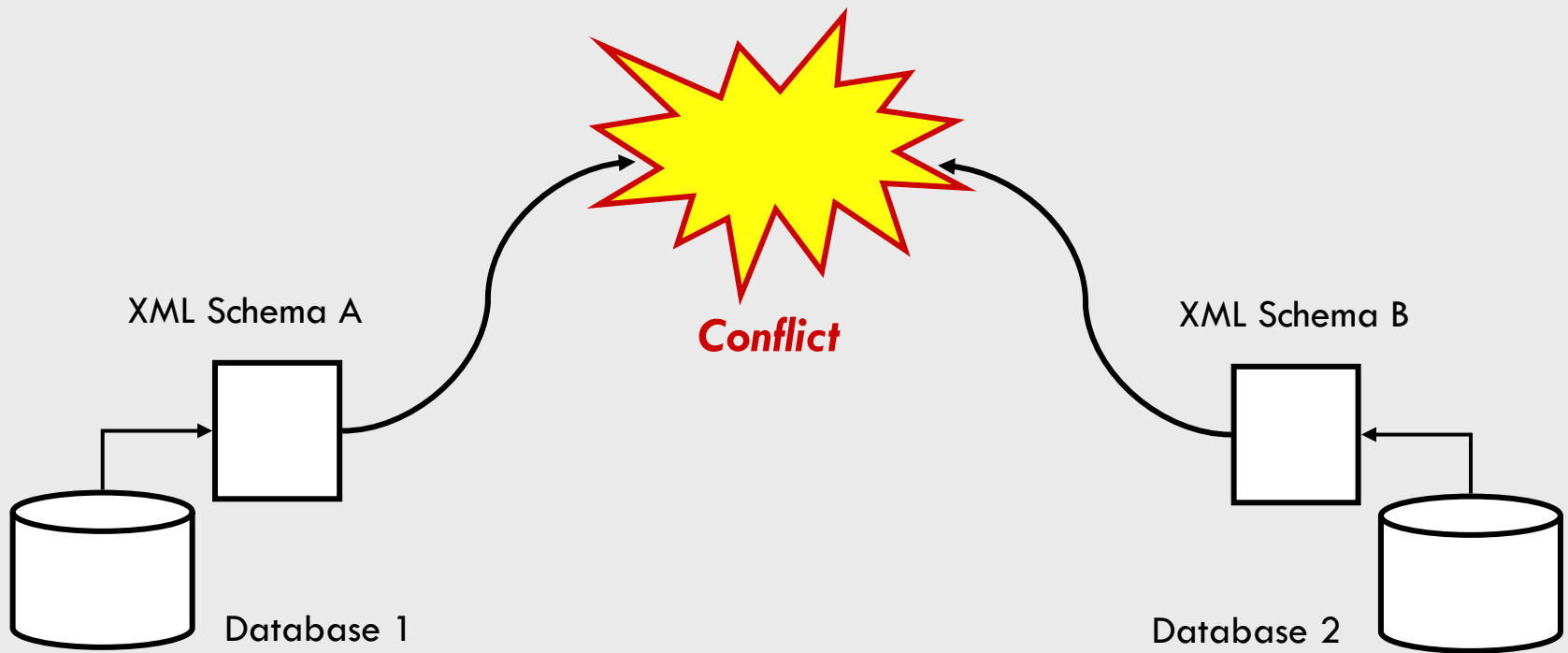
A Modeling Language

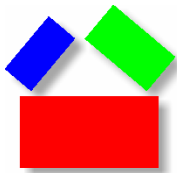
The Fundamental Idea:

Separate **vocabulary** and **grammar**

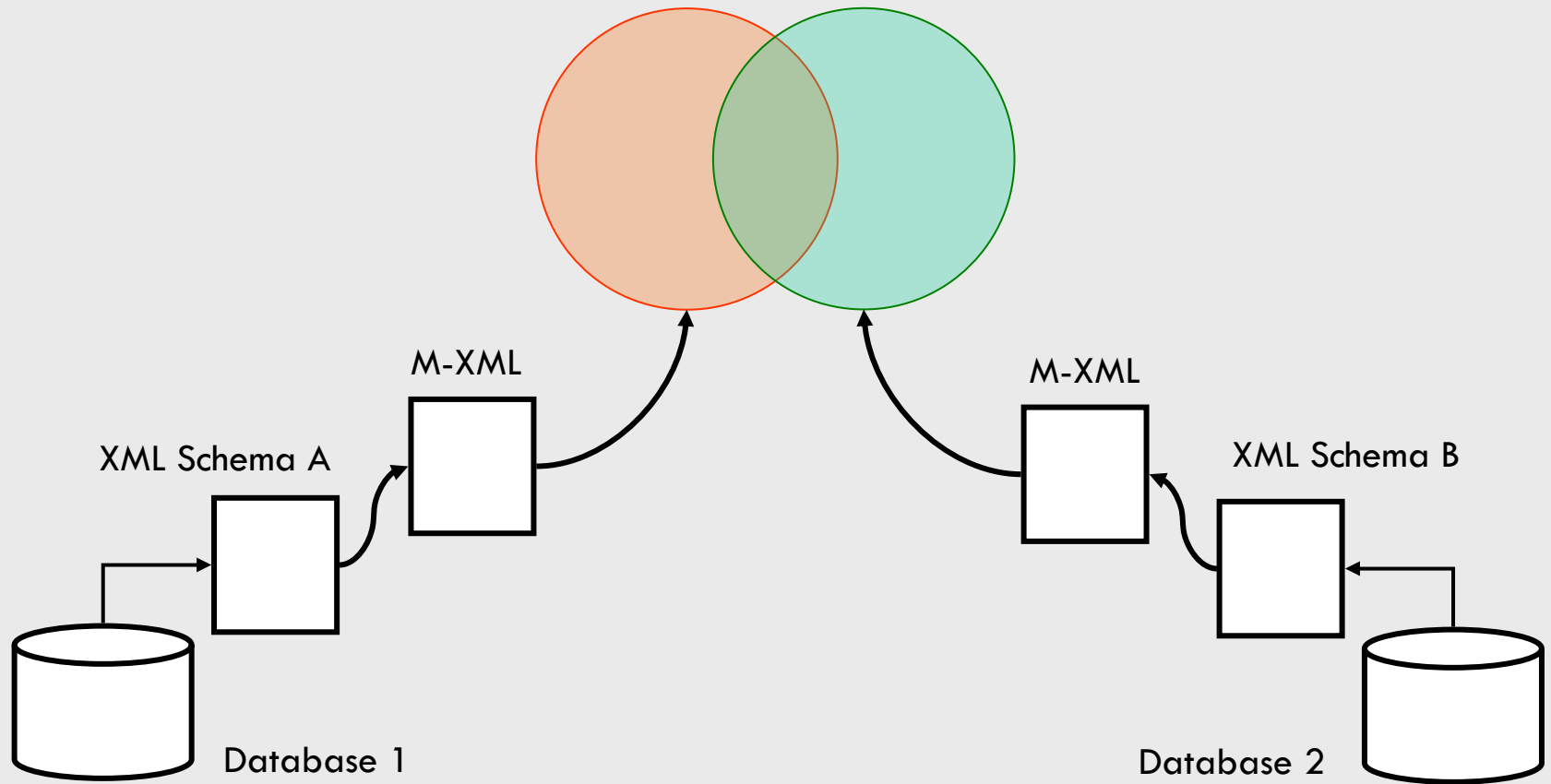


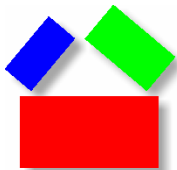
WEB SERVICE INTEGRATION





WEB SERVICE INTEGRATION



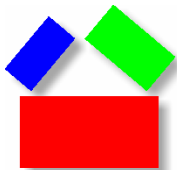


M

Words
Dictionary

+

Rules
Grammar

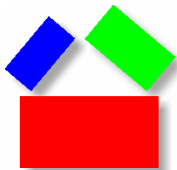


DATA "BLOCK"

Word



Data



DICTIONARY ENTRY

WORD

call.5

DEFINITION

call *n.* a telephone connection.

RELATIONS

Synonyms: phone_call.1, telephone_call.1

Type of: telephone.2, telephony.1

Part of:

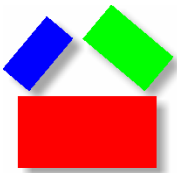
DATA

Data: $^{+}[0-9]\d{2}-\d{3}-\d{4}\$$

Attributes: party.5, duration.1, telephone_number.1

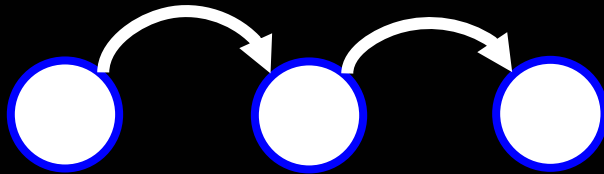
TRANSLATIONS

Data: 电话 , telefoongesprek , 전화 , телефонныйа вызов



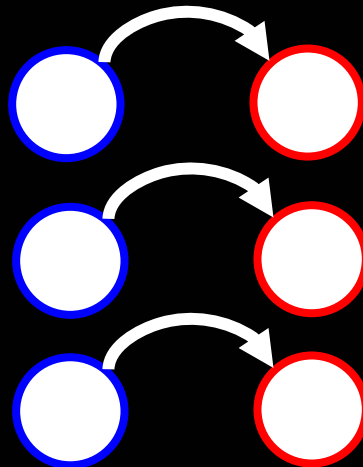
RULES

phrase

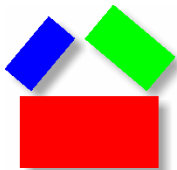


<senior.1_computer.1_engineer.1>

key-value pairs

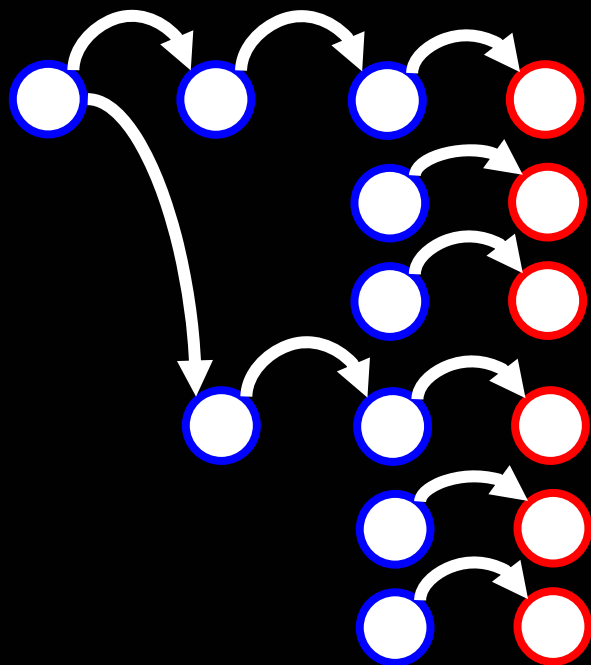


<ZIP_code.1>
02139
</ZIP_code.1>
<phone_number.1>
508-320-1289
</phone_number.1>
<SSN.1>
029-192-9981
</SSN.1>

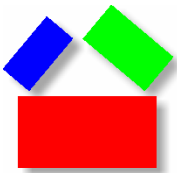


RULES

tables

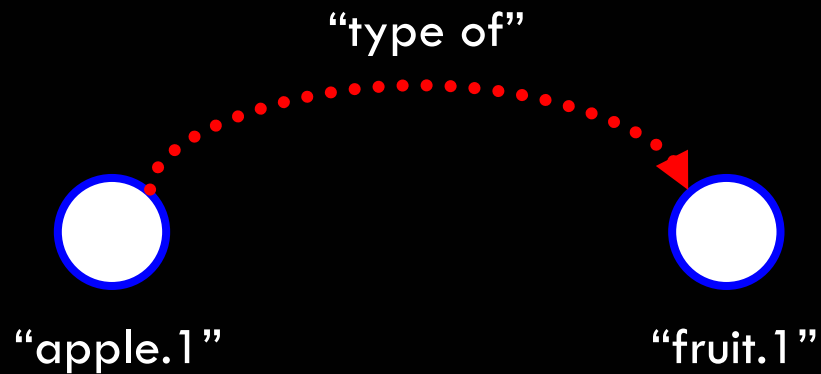
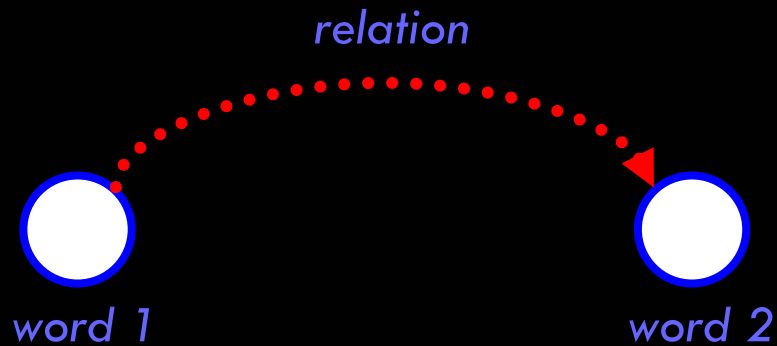


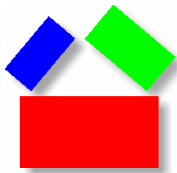
```
<observations.1 >  
<reading.1 >  
  <time.1 >  
    2006-09-18 9:50  
  </time.1 >  
  <wave.1_height.1 >  
    1.2 ft.1  
  </wave.1_height.1 >  
</reading.1 >  
<reading.1 >  
  <time.1 >  
    2006-09-18 10:50  
  </time.1 >  
  <wave.1_height.1 >  
    1.4 ft.1  
  </wave.1_height.1 >  
</reading.1 >  
</observations.1 >
```

ONTOLOGY

Ontology – relationships between words in the M Language.



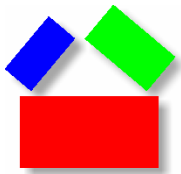


M LANGUAGE AND TECHNOLOGY

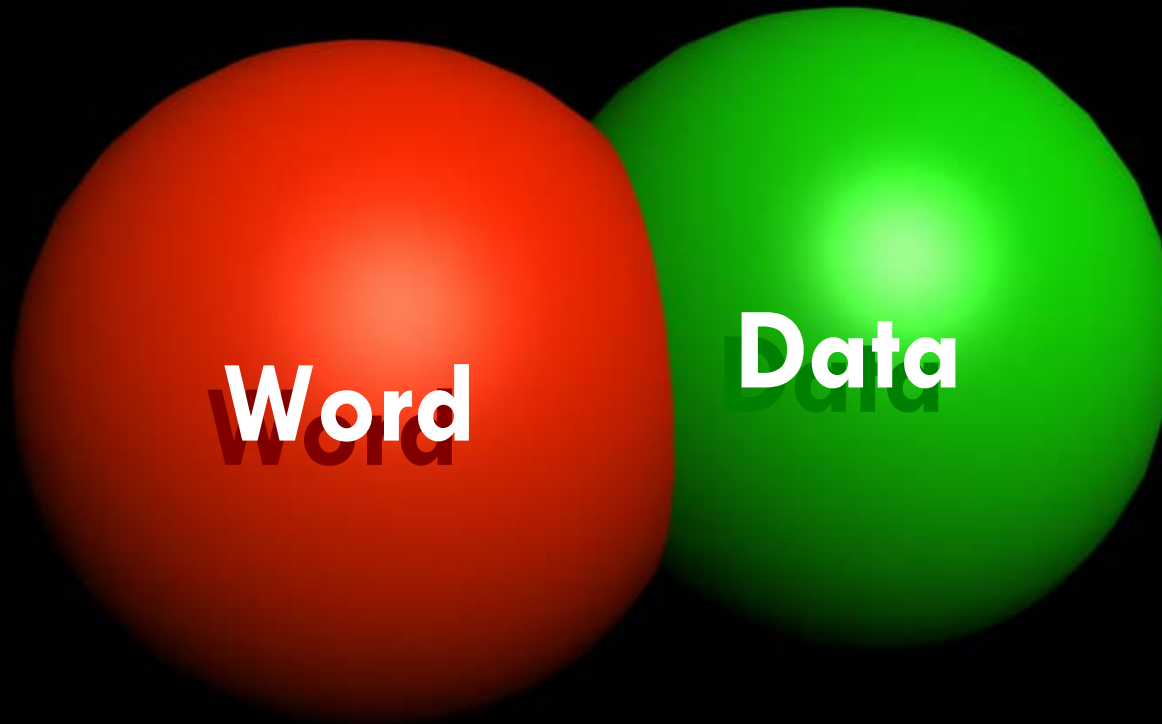
XML – uses XML for basic syntax and format

W3C – compatible with W3C Web standards

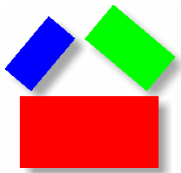
SOA – integrates with existing Web Services
and service oriented architectures (SOA)



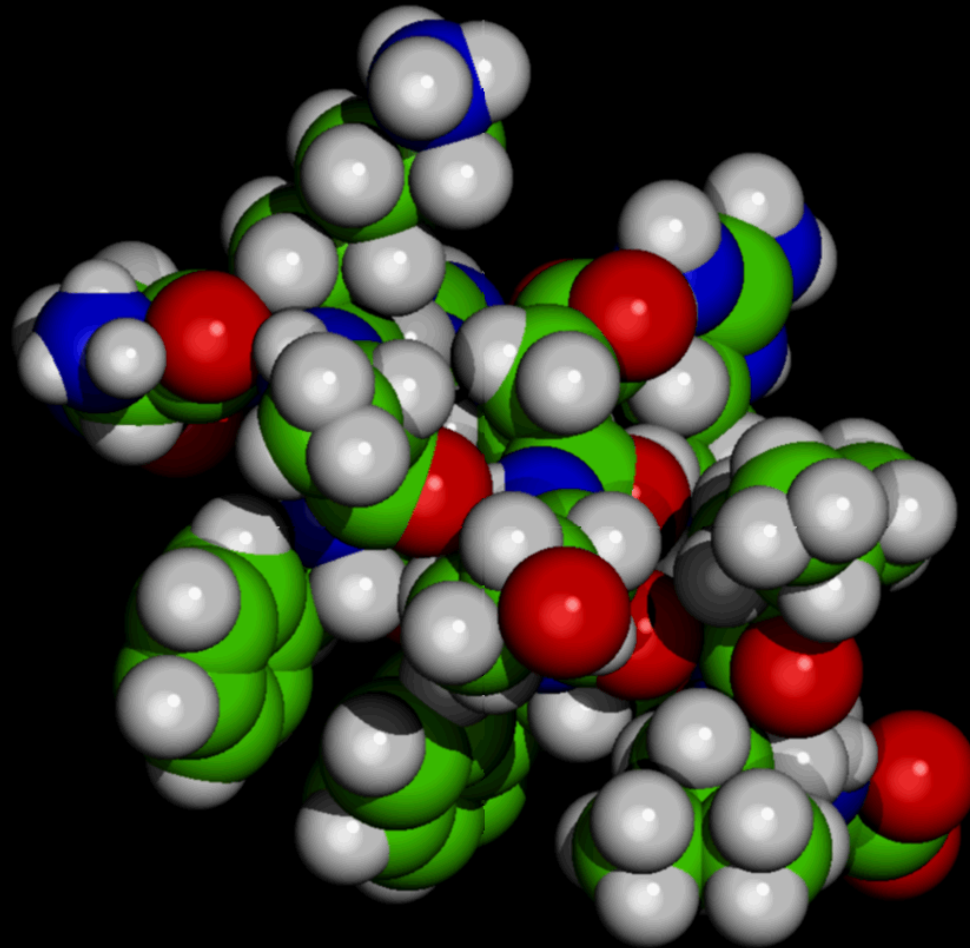
DATA "ATOM"

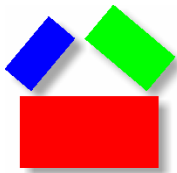


Data that "self identifies"



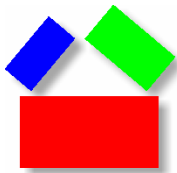
DATA "MOLECULE"





DICTIONARY AND GRAMMAR DEVELOPMENT

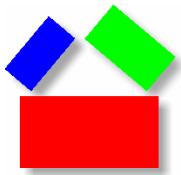
- Web accessible
- Web editable – A “wiki” dictionary
- Web community
- Staged approval
 - Proposal – Universal accessible and editable
 - Draft – Universal accessible and limited editable
 - Pre-approval – Universal accessible and limited comments
 - Recommendation – Universal accessible



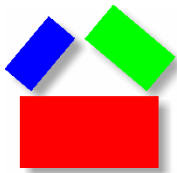
HOW DOES M COMPARE TO SEMANTIC WEB?

- The M Language works with W3C standards
 - XML
 - XSLT
- M focuses on atomic elements, Semantic Web focuses on creating an ontology
- M is designed for “many to many” communication, across industry disciplines
- Semantic Web plans to use some elements of Artificial Intelligence and Knowledge Management

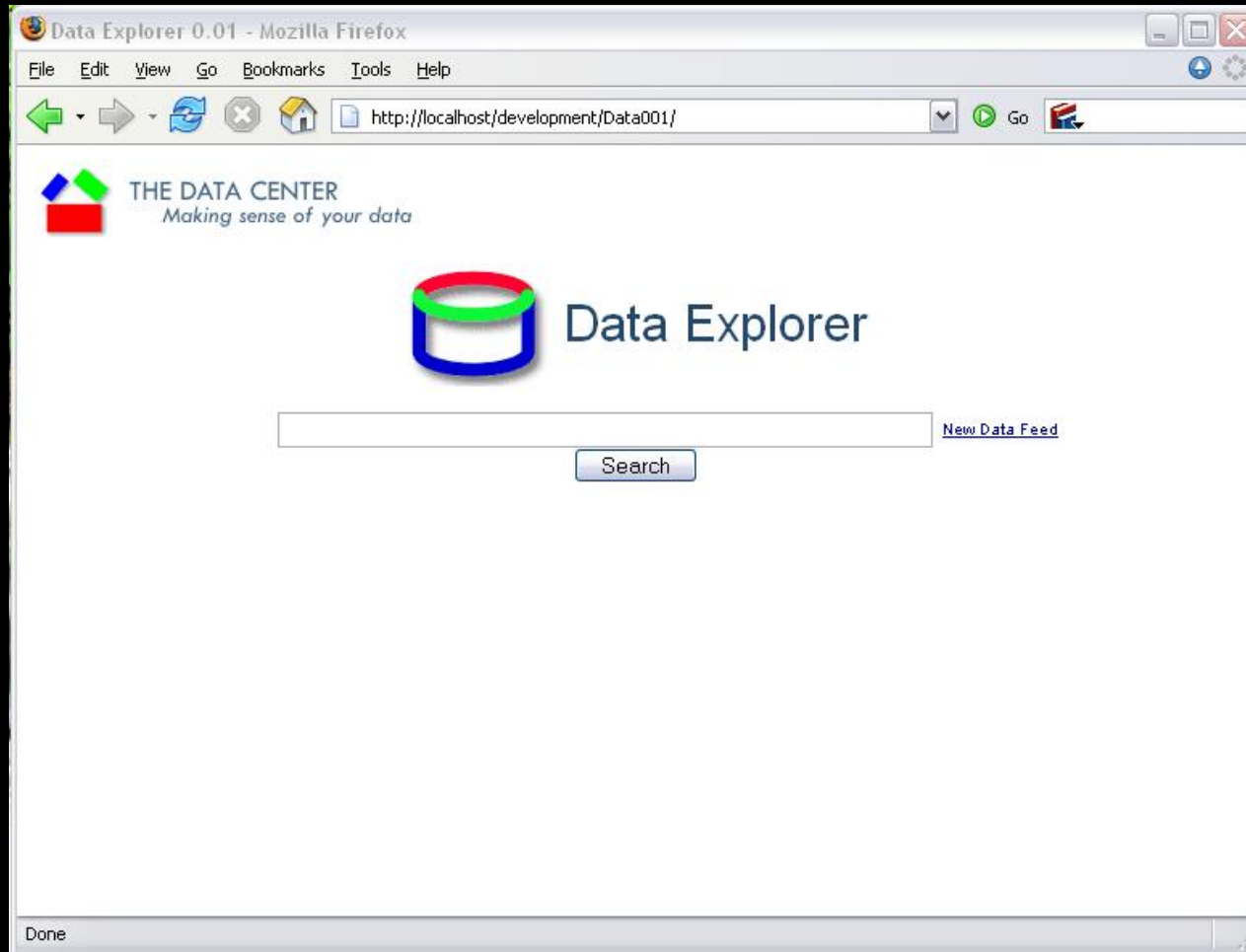


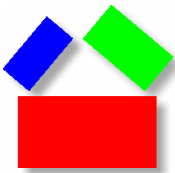


Applications



M DATA FEEDS





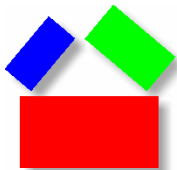
M NEWS FEEDS



M	1.0
---	-----



```
<M>
  <version>1.0</version>
  <channel4>
    <title>CNN.com</title>
    <link2>http://www.cnn.com/rssclick/?section=cnn\_topstories</link2>
    <description>
      CNN.com delivers up-to-the-minute news and information on the
      latest top stories, weather, entertainment, politics and
      more.
    </description>
    <language>en-us</language>
    <publication_date>Tue, 20 Sep 2005 18:01:37 EDT</publication_date>
    <managing_editor>editor@cnn.com</managing_editor>
    <webmaster>webmaster@cnn.com</webmaster>
  <item>
    <title> Rita.7 pounds.2 Florida_Keys.0 and.0 spawns.2 tornadoes.0 </title>
    <link>http://www.cnn.com/rssclick/2005/Weather/09/20/rita/
      Index.html?section=cnn\_topstories
    </link>
    <description>Hurricane Rita battered South Florida and the Keys with heavy rain
    and strong winds Tuesday after strengthening to a Category 2 storm. Gov. Jeb Bush warned
    residents to stay vigilant as the storm -- with maximum sustained winds of 100 mph --
    passed through the Straits of Florida without so far making official landfall. Radar
    indicated Rita spawned tornadoes near Hollywood, Florida, and a water spout or tornado
    near Islamorada, in the upper Keys.
    </description>
    <publication_date>Tue, 20 Sep 2005 16:13:49 EDT</publication_date>
  </item>
</channel4>
</M>
```



M DATA FEEDS

NOAA NDBC

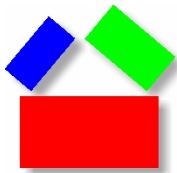
Raw Data Feed

```
YYYY MM DD hh mm  WD WSPD  GST  WVHT  DPD  APD MWD  BARO  ATMP  WTMP  DEWP  VIS  PTDY  TIDE
2005 07 11 17 50  MM  MM  MM  1.2  5  MM  MM 1011.8  16.2  13.8  13.6  MM -0.7  MM
. . .
```

'M' Data Feed

```
<timestamp.1>
  2005-07-11T17:50
</timestamp.1>
<wave.5_height.2>
  1.2
  <unit.5>foot.11</unit.5>
</wave.5_height.2>
```





M BROWSER

Fusion 0.7

File Edit View Tools Help

← → ↺ ↻ ↶ ↷ ⚙

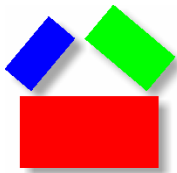
http://localhost/m/grocery.m

Sales Receipt
Company
Name Trade Fair Supermarkets
Address 23 Broadway, Astoria, NY

Item List	
Name	Price
▶ Cambell Chicken Noodle Soup	0.99
Elmherst Half-Half	0.89
Jones Liverwurst	1.50
Produce	2.85
Bakery	0.60

Receipt
Subtotal 6.83
Tax 0.00
Total 6.83
Cash 10.00
Change 3.17

Status Ready... M 1.0



Fusion 0.7

File Edit View Tools Help

http://localhost/m/grocery.m

Sales Receipt

Comparison

- sales.1 - income (at invoice values) received for goods and services over some given period of time
- receipt.2 - an acknowledgment (usually tangible) that payment has been made

Name

Address

Item List

Name	Price
Cambell Chicken Noodle Soup	0.99
Elmherst Half-Half	0.89
Jones Liverwurst	1.50
Produce	2.85
Bakery	0.60

Receipt

Subtotal 6.83

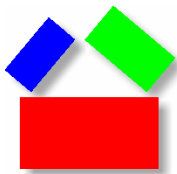
Tax 0.00

Total 6.83

Cash 10.00

Change 3.17

Status Ready... M 1.0



Fusion 0.7

File Edit View Tools Help

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http://localhost/m/grocery3.m

Sales Receipt

Company

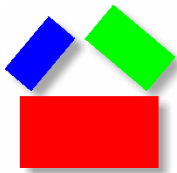
Name Trade Fair Supermarkets
Address 23 Broadway, Astoria, NY
ZIP Code 100121

Item List	
Name	Price
▶ Cambell Chicken Noodle Soup	0.99
Elmherst Half-Half	0.89
Jones Liverwurst	1.50
Produce	2.85
Bakery	0.60

Receipt

Subtotal 6.83
Tax 0.00
Total 6.83
Cash 10.00
Change 3.17

Status Ready... M 1.0



Fusion 0.7

File Edit View Tools Help

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http://localhost/m/order.m

Order

Customer

Name Bill Buckram

Credit Card 234 234 234 234

Manifest				
	Identification Number	Title	Quantity	Unit Price
▶	209	Band-Aid Standard Clear, 45 Pack	1	\$10.75
	208	Windex Original Spray, 32 oz	1	\$12.45
	204	Air Wick Harvest Spice, 0.71 oz	1	\$15.95
	202	Diet Coke with Lime, 2 liters	1	\$24.85
	210	Nestle CoffeMate Original 6 oz	1	\$8.85

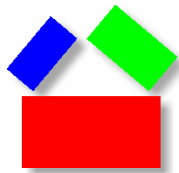
Receipt

Subtotal \$72.85

Tax \$4.74

Total \$77.59

Status Ready... M 1.0



Fusion 0.7

File Edit View Tools Help

http://localhost/m/order.m

购买订单

顾客
名字 Bill Buckram
信用卡 234 234 234 234

明显

标识号	标题	数量	单位
209	邦迪标准创可贴, 45 枚装	1	\$10.75
208	清洁喷雾剂, 32 盎司装	1	\$12.45
204	空气清新剂, 0.71 盎司装	1	\$15.95
202	无糖柠檬可乐, 2 升装	1	\$24.85
210	雀巢咖啡伴侣原味, 6 盎司装	1	\$8.85

收据

小结 \$72.85
税 \$4.74
共计 \$77.59

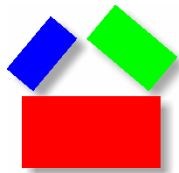
Options

General Security Language

Select Language

Chinese-simp

Status Ready...



Fusion 0.7

File Edit View Tools Help

← → ↺ ⏸ ↻ ↺ ⚙

MIT

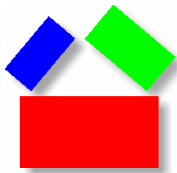
http://localhost/m/inventory.m

Inventory

Coffee Table	122
Floor Lamp	208
Desk	14
Divan	2
Vanity	38
Convertible	42
Sofa Bed	9
Runner	55
Bathtub	22
Shower Curtain	38
Bassinet	2

Status Ready...

M 1.0



Fusion 0.7

File Edit View Tools Help

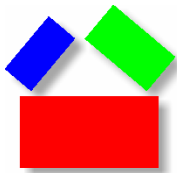
Navigation icons: back, forward, refresh, home, search, settings

Address bar: http://localhost/m/inventory.m table.1

Inventory

Coffee Table	122
Floor Lamp	208
Desk	14
Divan	2
Vanity	38
Convertible	42
Sofa Bed	9
Runner	55
Bathtub	22
Shower Curtain	38
Bassinet	2

Status Ready... M 1.0



Fusion 0.7

File Edit View Tools Help

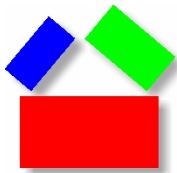
MIT

http://localhost/m/inventory.m furniture.1

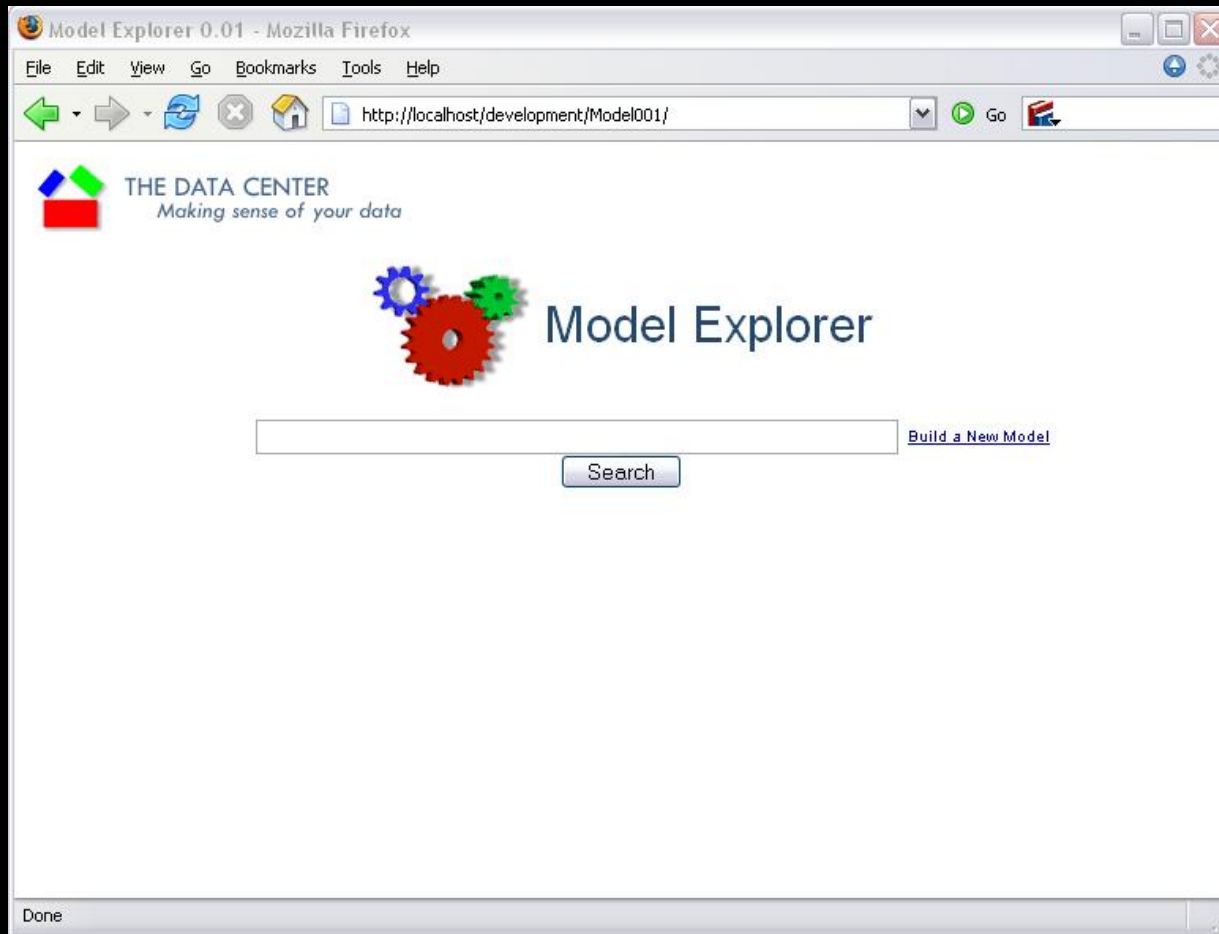
Inventory

Coffee Table	122
Floor Lamp	208
Desk	14
Divan	2
Vanity	38
Convertible	42
Sofa Bed	9
Runner	55
Bathtub	22
Shower Curtain	38
Bassinet	2

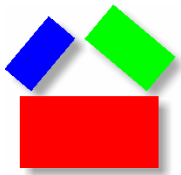
Status Ready... M 1.0



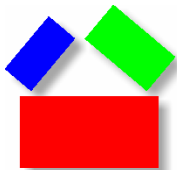
'M' MODEL EXPLORER







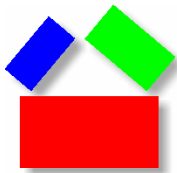
Engineering Marketing Science



Mass Advertising is taking a big hit

“Advertising is scary”

Prof. Duncan Simester
MIT Sloan School of Management

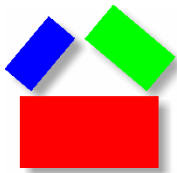


In practice, only about half of all advertising
is successful.

Prof. Mike Hanssens of UCLA

THE REASONS:

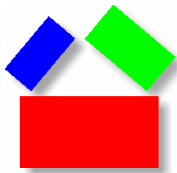
- TiVo,
- Fragmentation of viewers caused by cable television
- Video games
- The Internet – on demand programming



INTERACTIVE ADVERTISING

Billboards, Two-Dimensional Bar Codes, and the Consumer

Fowler, Geoffry (2005), "In Japan, Billboards Take Code-Crazy Ads to New Heights," *The Wall Street Journal*, October 10.



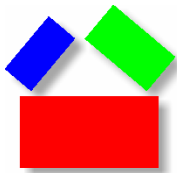
THE FUTURE...

The integration of marketing science, engineering technology, and supply chain management.

Supply chains that sense and respond to the physical world.

This requires an **Intelligent Infrastructure** for management, control, automation and interaction.

The **M Language** is an open system that will form the base.

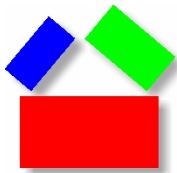


OBJECTIVE

Develop new ways of influencing customer decision-making at the point of sale

Interactive Marketing

Use the M Language as the data aggregator between vendors and retailers

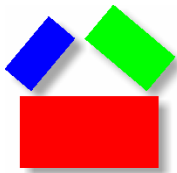


RELEVANCE

Research Question – measuring and modeling the effect of increased amount of data at the point-of-sale.

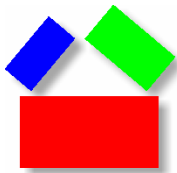
In General, understand the demographic, economic, and geographic forces influencing purchasing decisions.

Commercial Question – employ interactive marketing to increase sales at retail outlets.



M LANGUAGE APPLICATION

- Serve as a data aggregator
- Effective solution for the “many to many” problem
- Open source system
- Key Point – no standard exists today

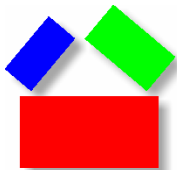


IN-STORE INFORMATIONAL KIOSK

Self-service, interactive,
networked terminals in the aisles
for:

- *Product information*
- *Comparisons*
- *Targeted marketing*
- *Promotions*

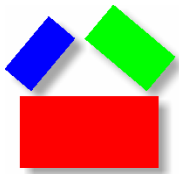




BRAND OWNER BENEFITS



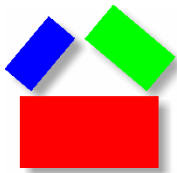
- Consistent messaging
- Direct access to retail shoppers
- Access to customer shopping metrics
- Highly creative marketing options
- Deliver timely promotions



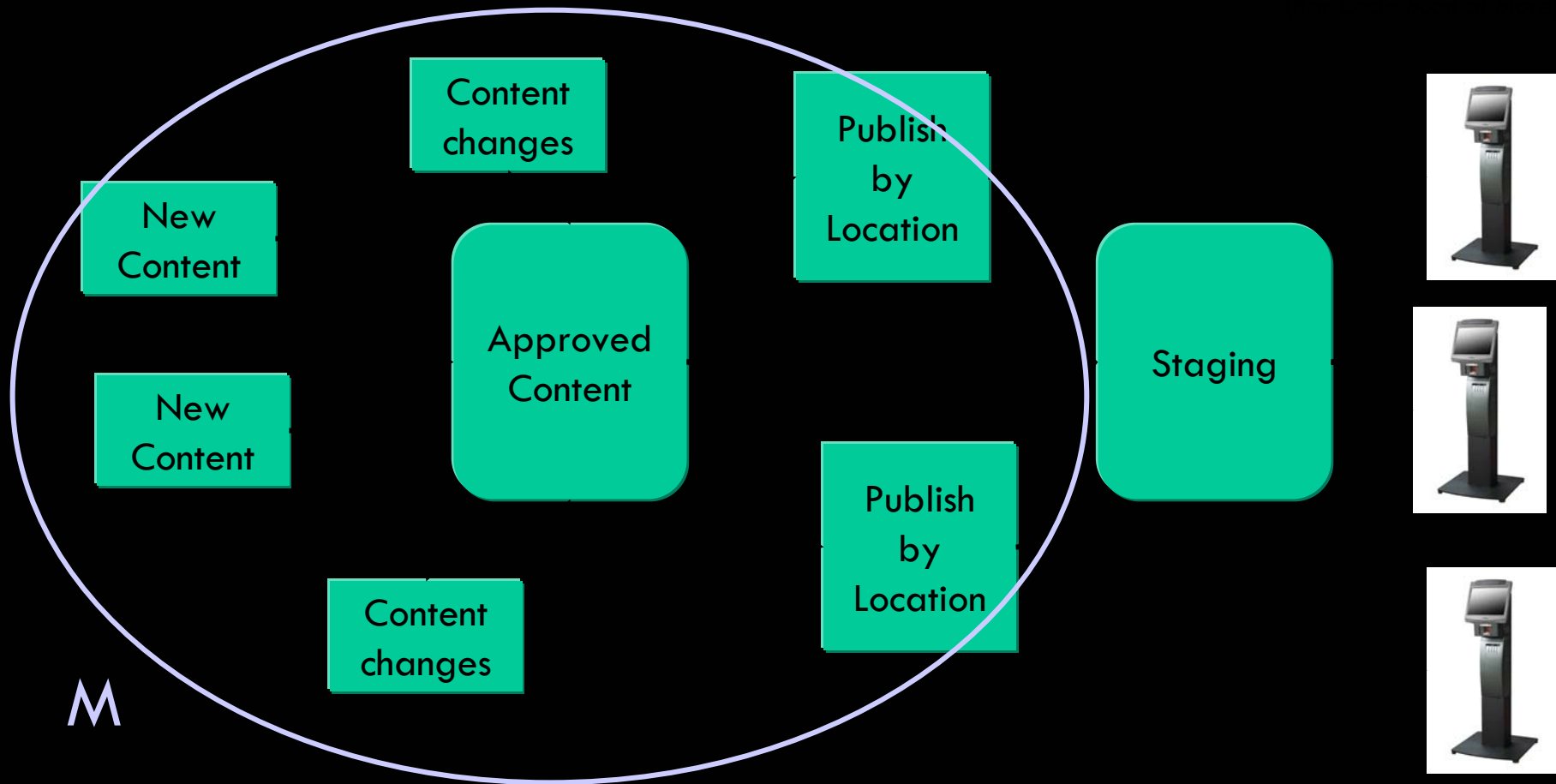
RETAILER BENEFITS

- Improve bottom line
 - More sales
 - Higher margin sales
- Improve customer service
 - More satisfied customer
- Hi-impact cross-promotions
 - Increase basket size
- Optimize staffing
 - Kiosk is product “expert”

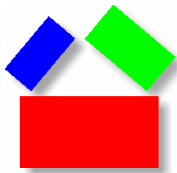




A SUPPLY CHAIN FOR PRODUCT INFORMATION

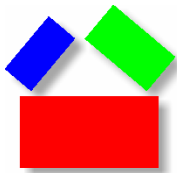


M



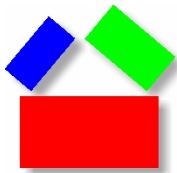
EXPANSION OPTIONS

- Put the information on a cell phone
- RFID enabled devices – auto detect
- Loyalty card tie-in
- Web history tie-in
- Blogs and customer reviews
- Reporting tools to show marketing trends

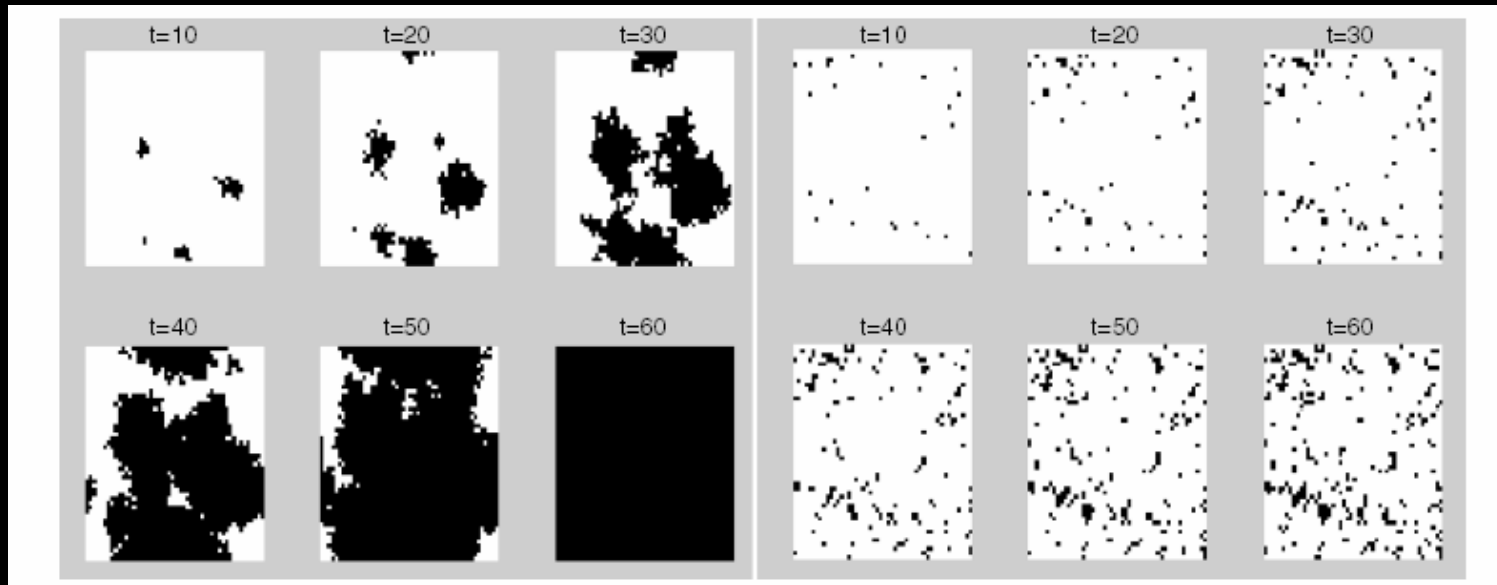


CHANGES IN THE SUPPLY CHAIN

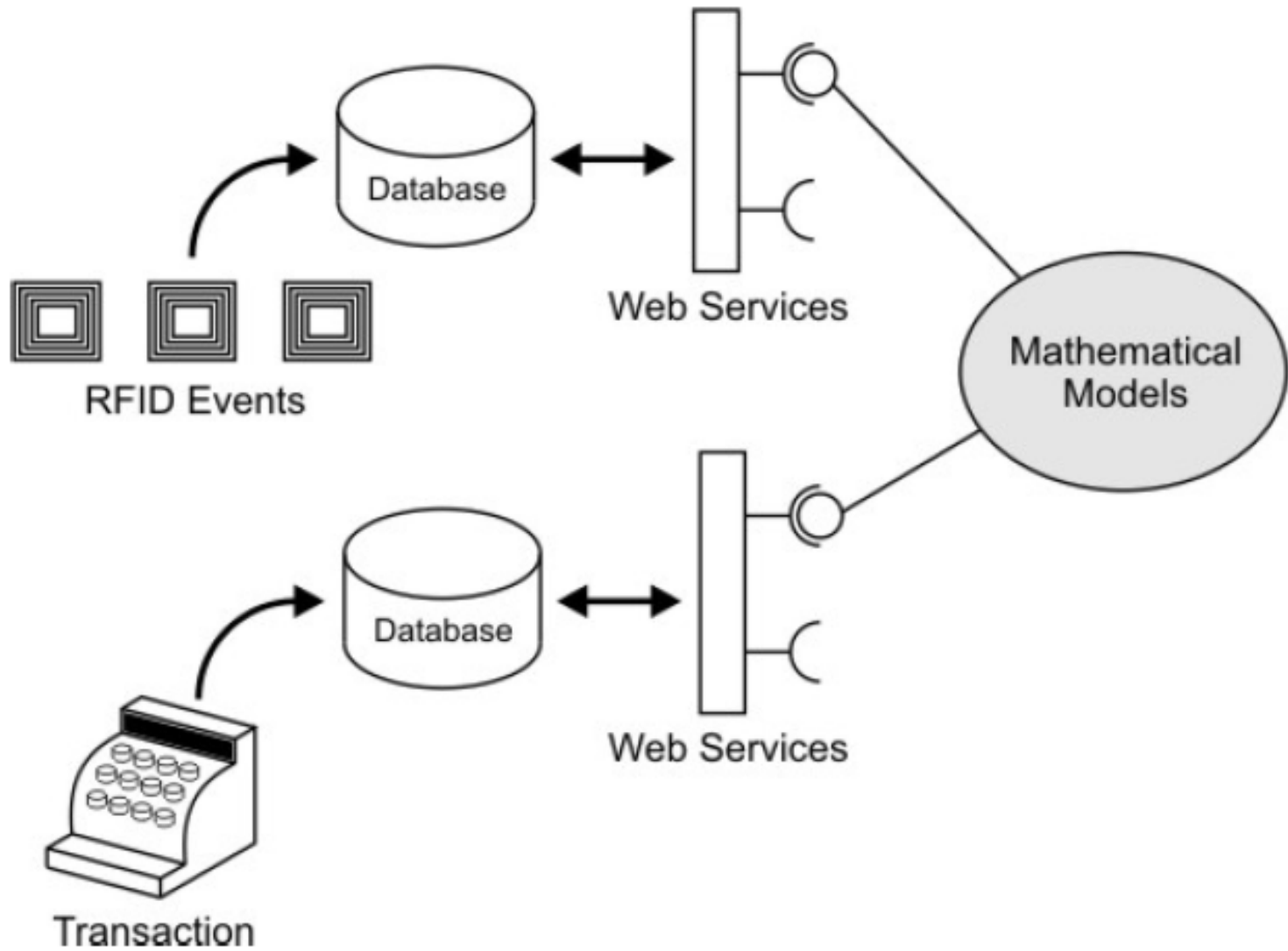
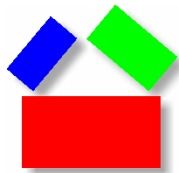
- Orientation 1 – Power to Retailer
 - Consumer has the ability to compare across brands at point of sale
- Orientation 2 – Power to Manufacturer
 - Control information flow about a brand
- Orientation 3 – Marketing Research Tool
 - Gain store level data on customer behavior

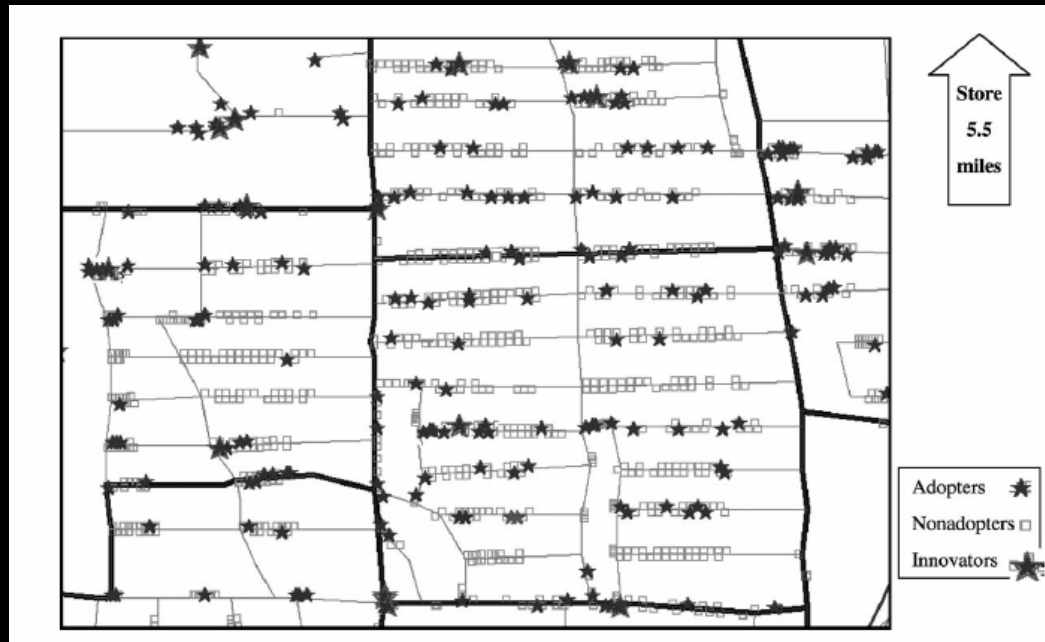
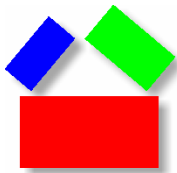


MARKETING SPATIAL DIFFUSION

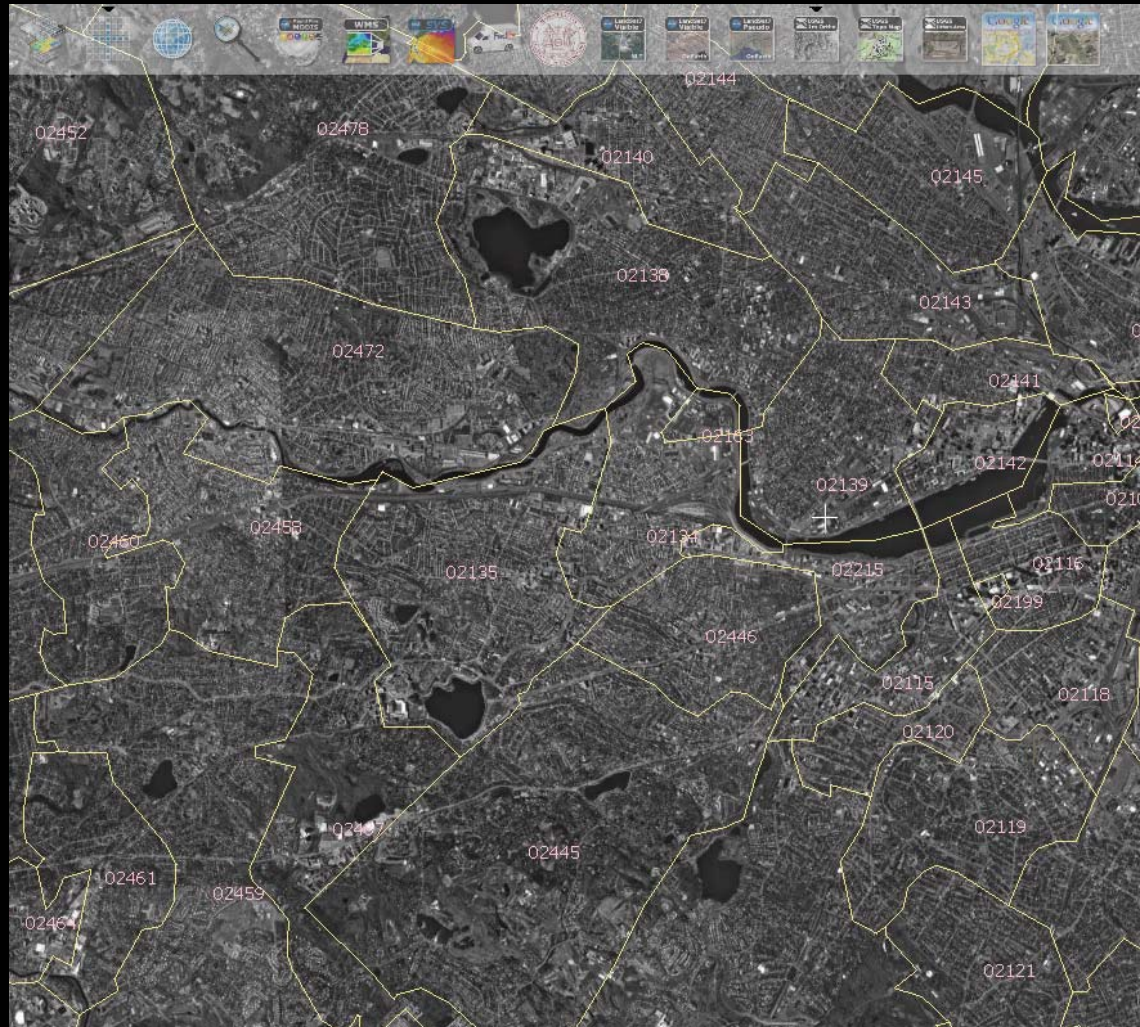
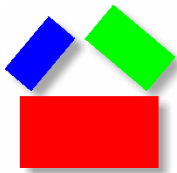


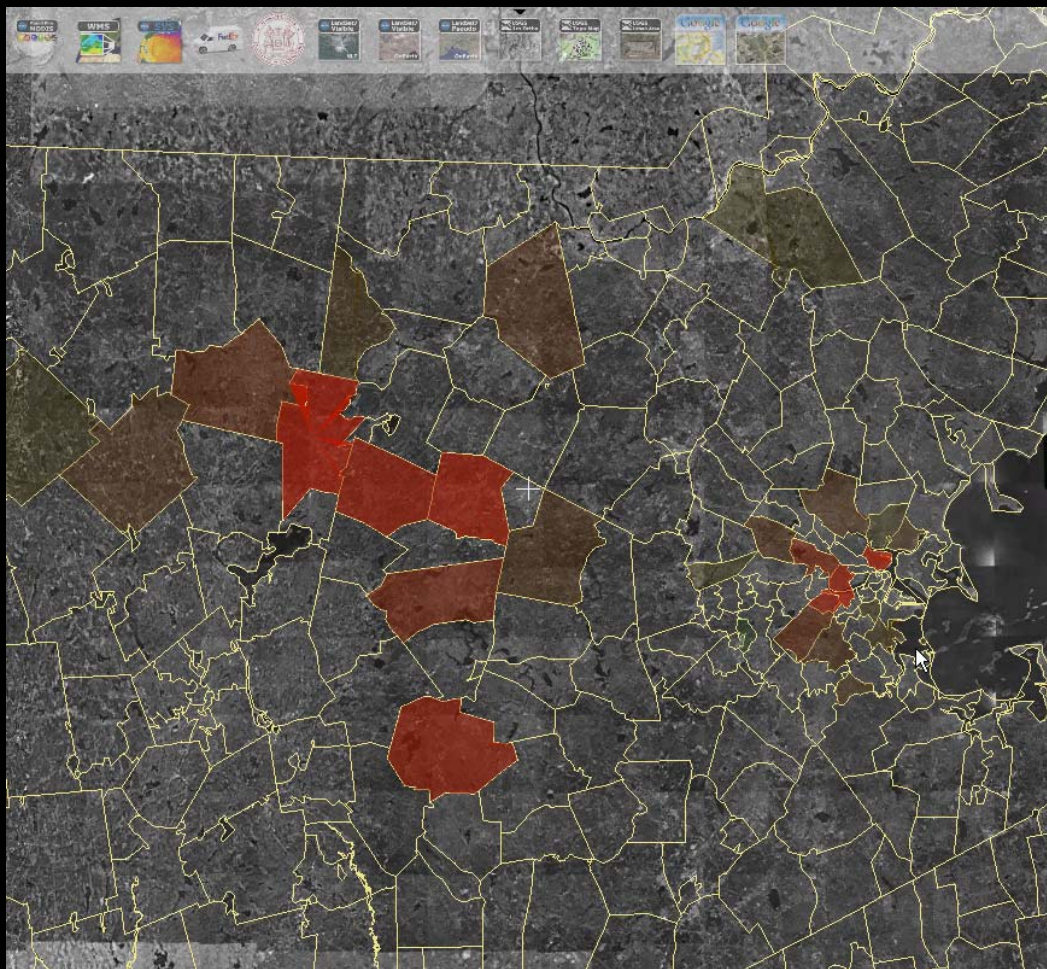
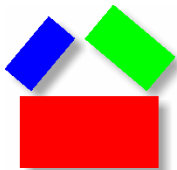
Garber, Tal, Jacob Goldenberg, Barak Libai, and Eitan Muller (2004), "From Density to Destiny: Using Spatial Dimension of Sales Data for Early Prediction of New Product Success," *Marketing Science*, Vol. 23, No. 3, pp. 419-428.

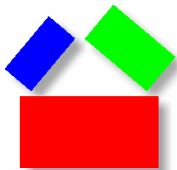




Allaway, Arthur W., David Berkowitz and Giles D'Souza (2003), "Spatial Diffusion of a New Loyalty Program Through a Retail Market," *Journal of Retailing*, Vol. 79, pp 137 – 151.

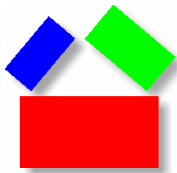






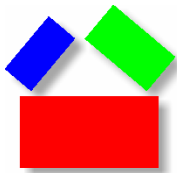
IMPLEMENTATION

- You can use the λ Language now!
- We are refining the Dictionary, Browser, and Rules
- Distributed dictionary approach
- Controlled “wiki” process
- Industry leaders of the MIT Data Center Program drive use and control future direction

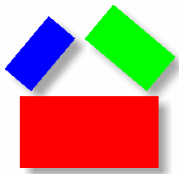


ELEMENTS OF THE M LANGUAGE

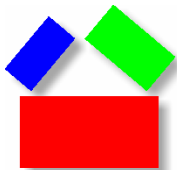
1. Building an intelligent network that links **models to data** (Alternative to ERP)
2. Translating data at the **edge** of computing systems (Data integration in supply chains)
3. Internet Search tool that uses the **definition** of the word (common understanding within MFG. organizations)
4. Various forms of **visualization** of data through a tangible user interface



5. A Standard for **Spatial** Data (impact of weather on logistical systems)
6. **Data Aggregation** (tech. manuals, maint. records)
7. **Human** Language Translation (SCM documents)
8. A standard for **sensors** (capital equipment)



9. A standard for **location** (general supply chain)
10. Improve data **quality** (general supply chain)
11. **Proper nouns** as part of mathematical modeling



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