

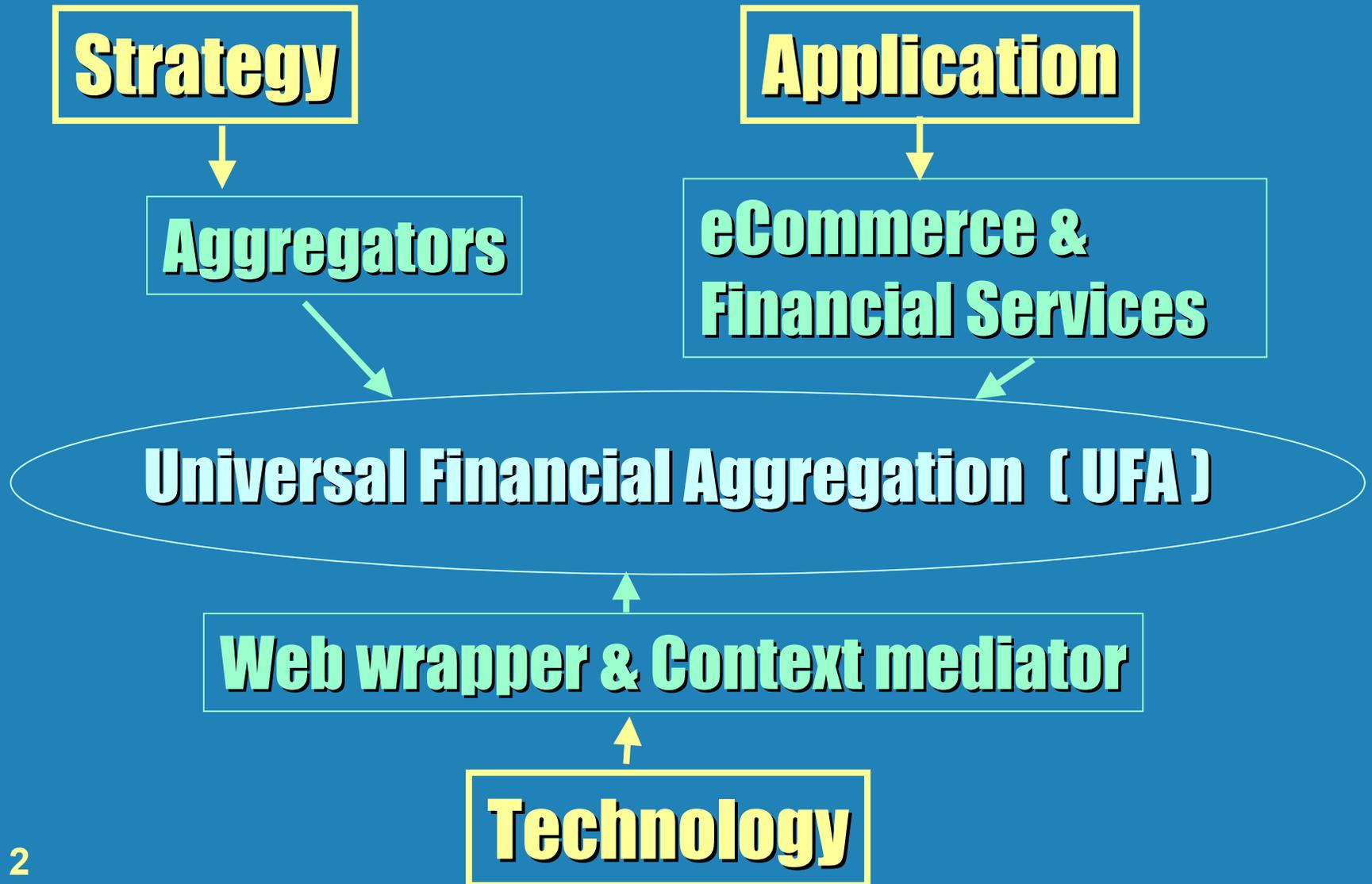


**Intelligent Aggregation of Information
or
Challenge of Semantic Heterogeneity
or**

**Where did NASA's Mars Climate
Orbiter go?**

**Stuart Madnick {smadnick@mit.edu}
Context Interchange Systems Laboratory (CISL)
MIT Sloan School of Management**

MIT eBusiness & Financial Services



Overview

- Ω **Aggregator definition, types & examples**
- Ω **Enabling technologies**
- Ω **New emerging aggregators**
- Ω **Summary**

Aggregator Definition

∩ Transparently collects information

- **with or without prior source arrangement**
- **resolves contextual differences**

∩ Performs analysis

- **not merely gather**

∩ Represents user

- **acts as agent for user**

Aggregator Types & Examples

∞ Comparison Aggregator

- aggregates book price information

∞ Relationship Aggregator

- aggregates frequent flier mileage programs

∞ Intra-organizational Aggregator

- aggregates separate departmental calendars

∞ Inter-organization Aggregator

- aggregates information about a company from multiple sources (financials, news, etc)

Amazon.com: A Glance: Microsoft Secrets : How the World's Most Powerful Software Company Creates - Microsoft Internet Ex...

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amazon.com

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Michael A. Cusumano
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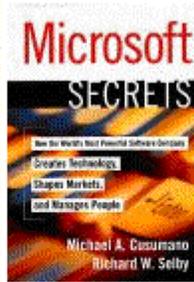
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ISBN: 0028740483
List Price: \$30.00



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<u>Merchant</u> ◀	<u>Price</u> ◀	<u>Shipping Method</u> ◀	<u>Shipping Time</u>	<u>Shipping Cost</u> ◀	<u>Total Price</u> ◀	
AllDirect.com	\$18.00	USPS Ground	7-21 days	\$3.45	\$ 21.45	<input type="button" value="BUY!"/>
Amazon.com	\$21.00	Standard Shipping	3-7 days	\$3.95	\$ 24.95	<input type="button" value="BUY!"/>
Borders.com	\$21.00	Standard	3-7 days	\$3.95	\$ 24.95	<input type="button" value="BUY!"/>
Fatbrain.com	\$21.00	Standard	3-7 days	\$3.95	\$ 24.95	<input type="button" value="BUY!"/>
Books Now	\$27.00	USPS Priority Mail	10-12 days	\$4.95	\$ 31.95	<input type="button" value="BUY!"/>
Big Words	\$18.51	USPS Fast (Less than \$35)	3-5 business	\$4.90	\$ 23.41	<input type="button" value="BUY!"/>

Netscape - [DealPilot.com, the Ultimate Comparison Shopping Engine: Price Comparison Results]

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Click on one offer (1st column) to proceed to the respective shop!

Displaying Top Ten offers:

Total Price	Shop	Item Price	Discount	US Sales Tax	Shipping Costs	Shipping Time	Shipping Service	Delivery Time
US\$ 19.55	barnesandnoble.com, USA, NJ/NY/VA	US\$ 15.60	40%	US\$ 0.00	US\$ 3.95	3-6 days	U.S. Postal Service	4-7 days
US\$ 20.95	A1 Books, USA, NJ	US\$ 17.00	35%	US\$ 0.00	US\$ 3.95	4-6 days	UPS Ground	9-11 days
US\$ 21.37	AlphaCraze.com, USA, NY/CA	US\$ 17.42	33%	US\$ 0.00	US\$ 3.95	3-7 days	UPS Regular Mail	n/a
US\$ 21.54	BCY Book Loft, USA, OH	US\$ 17.54	33%	US\$ 0.00	US\$ 4.00	14 days	USPS 4th Class	n/a
US\$ 21.58	Shopping.com, USA, CA	US\$ 17.68	32%	US\$ 0.00	US\$ 3.90	3-5 days	Economy	6-10 days
US\$ 21.68	Kingbooks.com, USA, WA	US\$ 19.24	26%	US\$ 0.00	US\$ 2.44	14 days	USPS Book Rate	16 days
US\$ 22.00	Books.com, USA, OH	US\$ 18.15	30%	US\$ 0.00	US\$ 3.85	14-42 days	USPS Book Rate	16-45 days
US\$ 22.10	Borders.com, USA, MI/TN	US\$ 18.20	30%	US\$ 0.00	US\$ 3.90	3-7 days	Standard	4-8 days
US\$ 22.10	Books.com, USA, OH	US\$ 18.15	30%	US\$ 0.00	US\$ 3.95	2-10 days	UPS	4-13 days
US\$ 22.15	Amazon.com, USA, WA/NV	US\$ 18.20	30%	US\$ 0.00	US\$ 3.95	3-7 days	USPS Priority Mail	4-8 days

Document: Done

Start Norton ... Eudora ... Explorin... Microsof... W Microsof... Palm De... Netsc...

10:15 PM

Mega - Aggregators

- Ω **Note: multiple book price aggregators**
 - **using differing sources**
 - **giving differing results !**
- Ω **What about an aggregator of aggregators**
 - **A Mega-Aggregator ... more later ...**
- Ω **Aggregators not just about prices ...**

Netscape - [US Airways: Current Dividend Miles Account Statement]

File Edit View Go Bookmarks Options Directory Window Help



US AIRWAYS HOME **DIVIDEND MILES**

Current Dividend Miles Account Statement

Member Name: DR. STUART E MADNICK

Dividend Miles Account Number: 561N1E6

Membership Level: Dividend Miles Member

Miles Posted as of : July 22, 1999

Account Statement

Current Balance:	36,216
Year-To-Date <u>Preferred Miles:</u>	2,000
Year-To-Date <u>Preferred Segments:</u>	4

Account Activity Since Your Last Statement

Date	<u>Transaction Description</u>	Actual Miles	Bonus Miles	Total Miles
08-11-99	08080100 1000000000	1000	100	1100

Document: Done

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MileageMiner Sample Report - Microsoft Internet Explorer provided by America Online

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[Messages](#) | [Account Summary](#) | [Expiration Summary](#) | [Activity Summary](#) | [Missing Flight Info](#) | [Offers](#)

Account Summary

Program	Account Balance	Program Status	Account-Last 4 Digits
American	16,890	Member	3694
Continental	N/A	N/A	8788
Delta	7,734	SkyMiles Member	8793
Hilton	3,875	Member	3909
Hyatt	34,373	Platinum	7746
Marriott	5,550	Red	5573
Northwest	4,528	Gold	9851
United	71,654	Premier Executive	9578
Midwest Express	500	Member	4355

[Messages](#) | [Account Summary](#) | [Expiration Summary](#) | [Activity Summary](#) | [Missing Flight Info](#) | [Offers](#)

Expiration Summary

Program	No Expiration	Expires 1998	Expires 1999	Expires 2000	Expires 2001 +
American	0	7,168	3,302	5,703	717
Continental	N/A	N/A	N/A	N/A	N/A
Delta	7,734	0	0	0	0
Hilton	3,875	0	0	0	0
Hyatt	34,373	0	0	0	0
Marriott	5,550	0	0	0	0
Northwest	0	0	0	0	4,528

Start Nor... Eu... Ex... Mic... W Mic... Pal... W Mic... Mi... Net... 10:45 PM

What is MaxMiles

- ⌚ **You give it all your frequent flyer info, it ...**
- ⌚ **Does mileage management for you ...**
- ⌚ **Gathers all your frequent flyer info**
- ⌚ **Sends a personalized report via email**
- ⌚ **Updates reports on web site daily**
- ⌚ **Searches for missing mileage credits**
- ⌚ **Analyzes most current milage offers**

From US Airways site

"Access to this information is subject to the rules in the Dividend Miles Membership Guide. In addition, by using this site to access your Dividend Miles account, you agree that you will use this site in a manner consistent with the Dividend Miles Membership Guide and you further agree not to allow access to this site to any third party by revealing your access code to any third party for any reason. Failure to comply with the foregoing restrictions on the use of this site shall be grounds for the termination of your access to this site and/or your membership in the Dividend Miles program."

“Power of Attorney” on MaxMiles Site

Enroll in MaxMiles - Microsoft Internet Explorer provided by America Online

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Frequency of email statements Monthly

Limited Power of Attorney

By clicking in this checkbox, I am indicating that I have read and that I accept the following terms and grant MaxMiles, Inc. (MaxMiles) the rights described below.

I authorize MaxMiles to access and obtain my frequent flyer account information from the frequency programs described on this registration form, as the same may be amended from time to time. For all purposes hereof, MaxMiles is granted a limited power of attorney, and I hereby appoint MaxMiles as my true and lawful attorney-in-fact and agent, with full power of substitution and resubstitution, for me and in my name, place and stead, in any and all capacities, to access such data from the frequency programs at all times as MaxMiles may determine in its sole discretion, with the full power and authority to do and perform each and every act and things requisite and necessary to be done in connection with such access, as fully to all intents and purposes as I might or could do in person. MaxMiles is further authorized to utilize such information in preparing reports regarding my accounts and can consolidate this information for MaxMiles' use as it determines in its sole discretion. I understand that MaxMiles acts solely as an intermediary, that my benefits are subject to the program sponsors' individual terms and restrictions, and that MaxMiles has no authority to access, direct or divert any program awards or other benefits. I further understand that MaxMiles has no relationship to or connection with any airline, hotel or other frequent traveler program sponsor, and agree that MaxMiles assumes no responsibility and shall incur no liability with respect to the acts, omissions or determinations of any program sponsor.

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Aggregators are your agents

- ⌚ **Note: MaxMiles is merely aggregating your information for you**
- ⌚ **More examples of relationship aggregators later**
- ⌚ **Many more types of aggregators ...**

Intra- and Inter-Organizational Aggregator

Integrated Spreadsheet

Sources

Real time
Tibco



Microsoft Excel - demo_rev.xls

File Edit View Insert Format Tools Data Window Help

Stock Portfolio

Available Portfolios: Portfolio #2, Portfolio #3

Attributes from Research Report: Investment Opinion, 52-Week Range

Attributes from Edgar SEC Filings: Net Income, Interest Expense

Update Clear

Portfolio Performance: Line chart showing performance for Portfolio #2, INTC, IBM, and GM from October to October.

Market Value: Pie chart showing market value distribution: GM 36%, INTC 23%, IBM 41%.

Stock	Ticker Symbol	Shares held	Purchase Price	Current Price	Market Value	Gain / Loss	Investment Opinion	Net Income
Intel Corp	INTC	15000	50	93.625	1404375	654375	B-1-17	1983
Intl Bus Machine	IBM	24000	65	105	2520000	960000	B-3-2-8	1,195
General Motors	GM	35000	50	64	2240000	490000	B-2-2-7	1,796
Total Value:					6164375			

Latest News:

- Intel Corp: [PRESS DIGEST - Wall Street Journal - July 29 - 2:12 am](#)
- Intl Bus Machine: [Florentin to offer presentation system for internet - Sunday November 2, 1997 - 12:32pm](#)
- General Motors: [Suzuki To Appeal Jury Award - Saturday November 1, 1997 - 12:13am](#)

Netscape

Free EDGAR

COMPANIES [FILINGS] WATCHLIST ANALYSIS REFERENCE CONTACT HELP

Interest income and other, net: 215 76

Income before taxes: 3,075 1,376

Provision for taxes: 1,092 482

Net income: 1,983 894

Earnings per common and common equivalent share: \$ 2.20 \$ 1.02

Cash dividends declared per common share: \$ 0.05 \$ 0.04

Weighted average common and common equivalent shares outstanding: 900 880

Item 1: Financial Statements

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Intel Corp

[Company Profile - Current Stock Price]

Tuesday July 29, 1997

[PRESS DIGEST - Wall Street Journal - July 29 - Reuters - 2:12 am](#)

Merrill Lynch Research Report: General Motors

Long Term Recommendation: ACCUMULATE

Price: \$57

12 Month Price Objective: \$68

Estimates (Dec): 1996A 1997E 1998E

EPS: \$7.44 \$7.5 \$8.23

P/E: 7.63x 7.5x 8.03x

Opinion & Financial Data

Investment Opinion: B-2-2-7

Mkt. Value / Shares Outstanding (mn): \$89,011

External

Internal

Aggregator Types & Examples

∩ Comparison Aggregator

- aggregates book price information

∩ Relationship Aggregator

- aggregates frequent flier mileage programs

∩ Intra-organizational Aggregator

- aggregates separate departmental calendars

∩ Inter-organization Aggregator

- aggregates information about a company from multiple sources (financials, news, etc)

Aggregatees

∞ **Books.com, MySimon.com, EvenBetter.com**

- **Barnes and Noble, Borders, Amazon, ...**

∞ **MaxMiles**

- **United, American, TWA, US Air, ...**

∞ **Universal Financial Aggregator (UFA)**

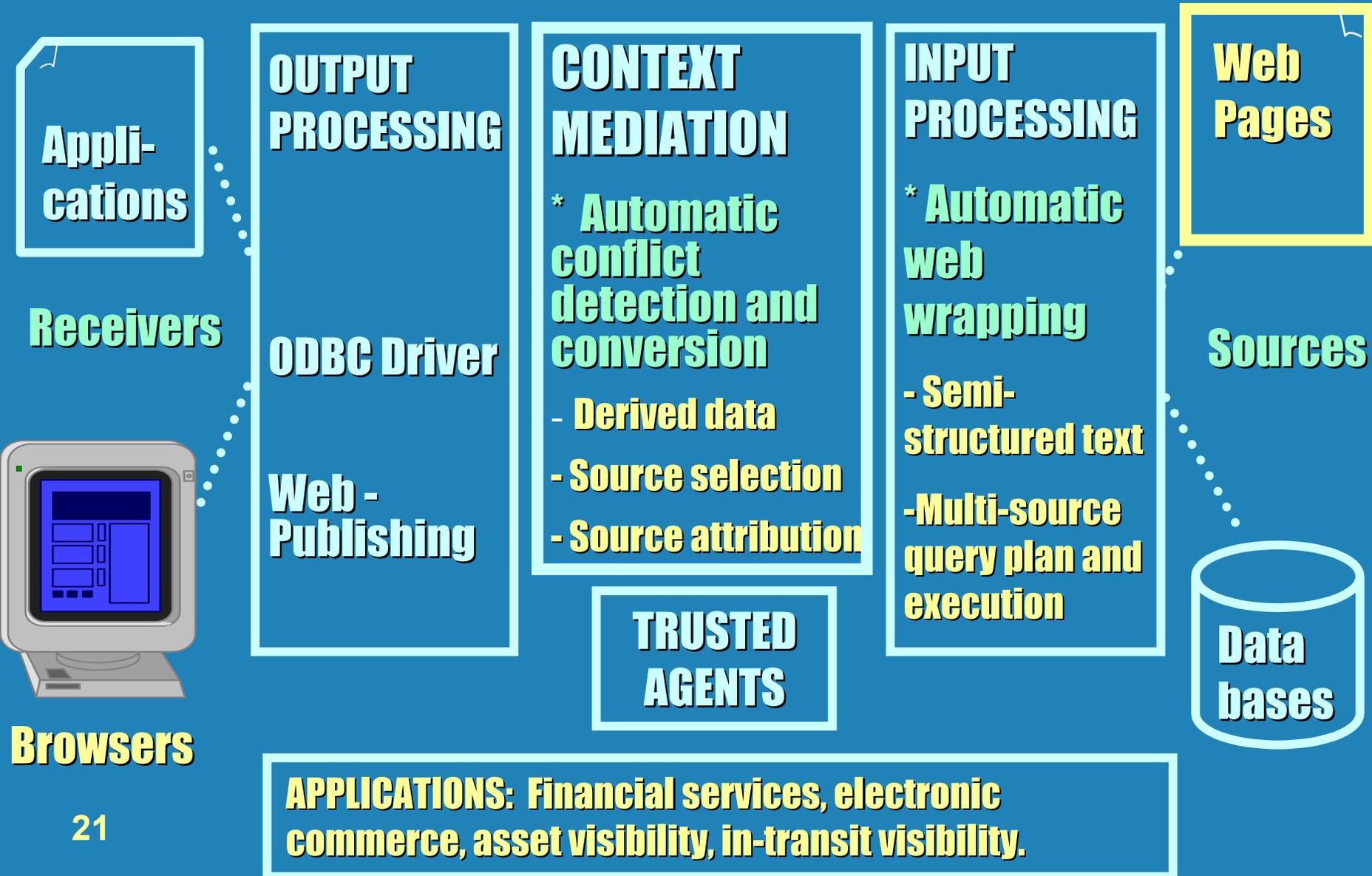
- **your banks, your brokers, your billers, ...**

Reality: Aggregatees -> Aggregators

Overview

- ⌚ **Aggregator definition, types & examples**
- ⌚ **Enabling technologies**
- ⌚ **New emerging aggregators**
- ⌚ **Summary**

MIT COntext INterchange (COIN) Project



Emerging Technologies

∞ Web wrappers

- Extract selected information from web (both HTML and XML)
- Allows web to be treated as large database

∞ Context mediators

- Resolve semantic (meaning) differences
- Enable meaningful aggregation & comparison

E.g., Semi-structured Web data: Intel SEC filing

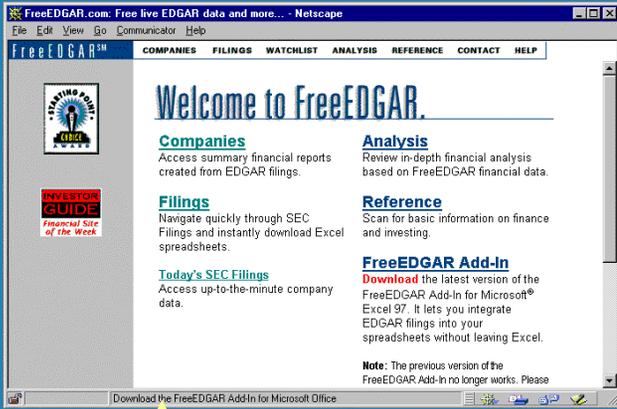
The screenshot shows a Netscape browser window displaying the FreeEDGAR website. The website has a navigation menu with options: COMPANIES, [FILINGS], WATCHLIST, ANALYSIS, REFERENCE, CONTACT, and HELP. The main content area shows a table of financial data for Intel Corp. The table has three columns: Description, and two numerical columns. The 'Net income' row is highlighted with a pink box. A pink arrow points from this row to a pink box containing the text 'Net Income'.

Interest income and other, net	215	76
Income before taxes	3,075	1,376
Provision for taxes	1,092	482
Net income	\$ 1,983	\$ 894
Earnings per common and common equivalent share	\$ 2.20	\$ 1.02
Cash dividends declared per common share	\$ 0.05	\$ 0.04
Weighted average common and common equivalent shares outstanding	900	880

Net Income

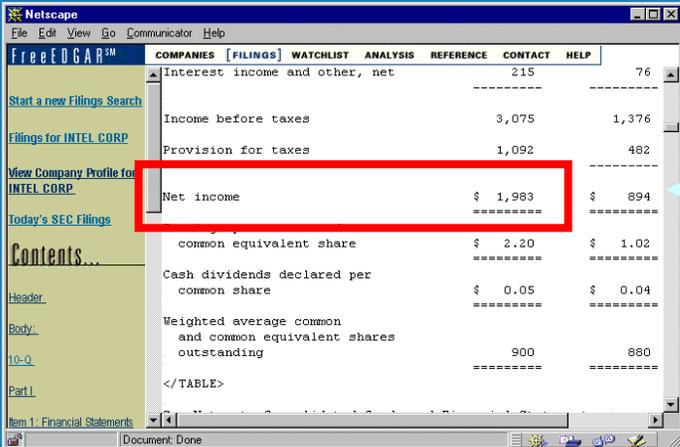
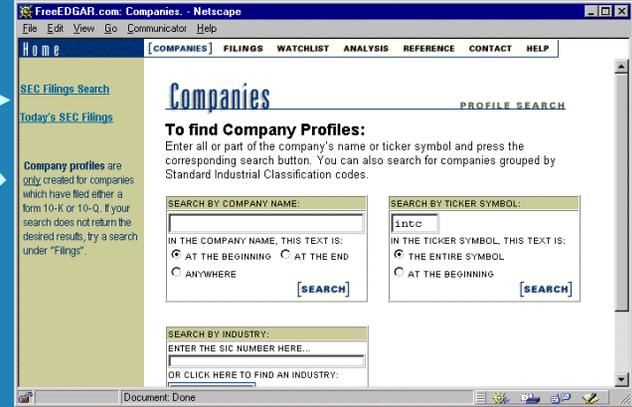
Home page

Web Navigation



SEC Site

Target page



Filing with Intel Net Income

User or Program (SQL Query)

Select Edgar.Net_income
From Edgar
Where Edgar.Ticker=intc
and Edgar.Form=10-Q

Web page spec file *

SQL side

Web Wrapper Generator

HTTP side

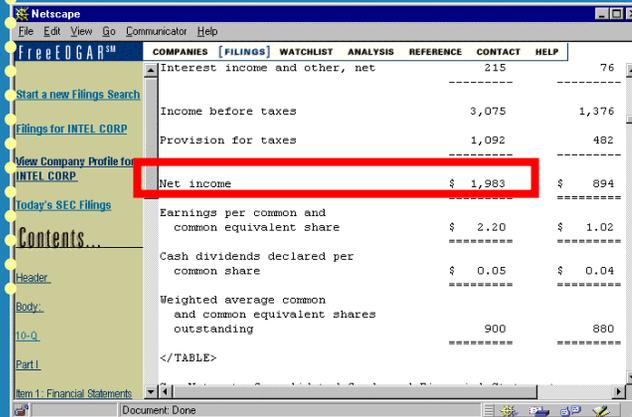
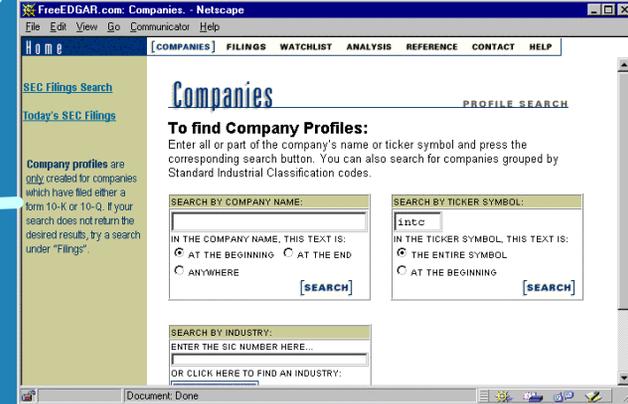
Ticker Net Income

INTC 1,983

Data record returned

Web-Wrapper Technology

Web site (HTML or XML)



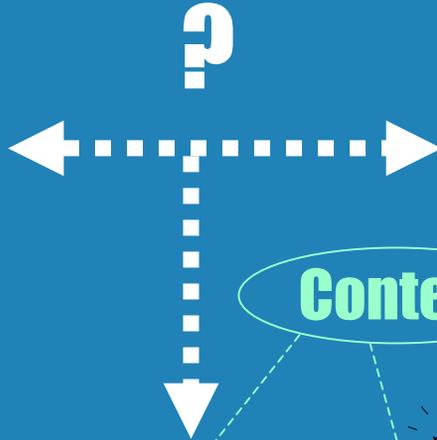
- * Spec file contains:
- Schema definition
 - Navigation rules
 - Extraction rules

Role Of Context

02-01-03

Context

\$



Context

01-02-03

£



Context

¥

03-02-01



Data:

Databases

Web data

E-mail

• CONTEXT VARIATIONS:

- GEOGRAPHIC (US vs. UK)
- FUNCTIONAL (CASH MGMT vs. LOANS)
- ORGANIZATIONAL (CITIBANK vs. CHASE)

Example : Context Differences

(from multiple web sources)

Daimler Benz (DAI) Key Ratios

	<u>P/E Ratio</u>	<u>EPS</u>	<u>Dividend</u>
ABC	11.6		0.29
Bloomberg	5.57	15.32	8.127
DBC	19.19	4.36	0.899
MarketGuide	7.46	10.83	0.47

The 1999 Overture

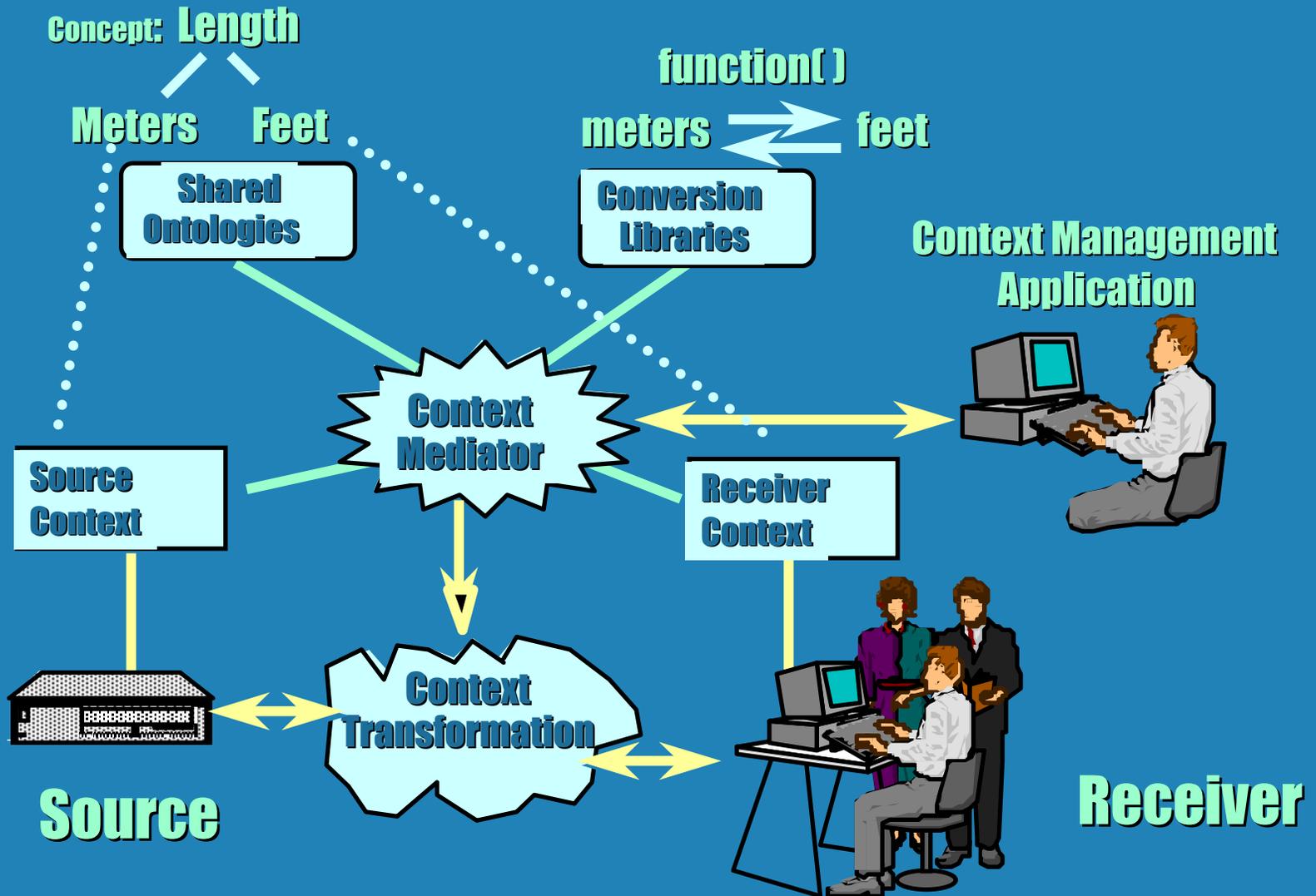
Unit-of-measure mixup tied to loss of \$125 Million Mars Orbiter

“NASA’s Mars Climate Orbiter was lost because engineers did not make a simple conversion from English units to metric, an embarrassing lapse that sent the \$125 million craft off course. ...

... The navigators (JPL) assumed metric units of force per second, or newtons. In fact, the numbers were in pounds of force per second as supplied by Lockheed Martin (the contractor).”

Source: Kathy Sawyer, *Boston Globe*, October 1, 1999, page 1.

Context Interchange Technology



Example: Multiple Sources of Financial Data

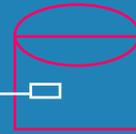
Company Name	DAIMLER-BENZ
Net Income	614,995
Sales	97,736,992

Company Name	DAIMLER-BENZ AG
Net Income	346,577
Sales	56,268,168

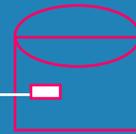
Company Name	DAIMLER BENZ CORP
Net Income	615,000,000
Sales	97,737,000,000

O&A DEM-USD Exchange Rate
1.00 German Mark= 0.58 US Dollar as 12/31/93

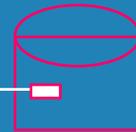
Context Mediation Services



Datastream

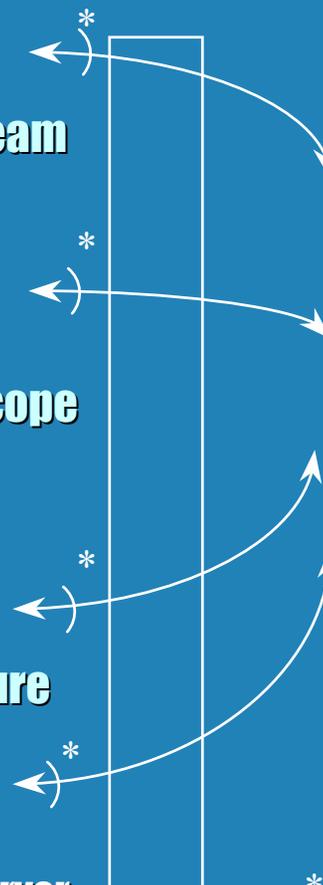


WorldScope



Disclosure

OANDA
Web Server



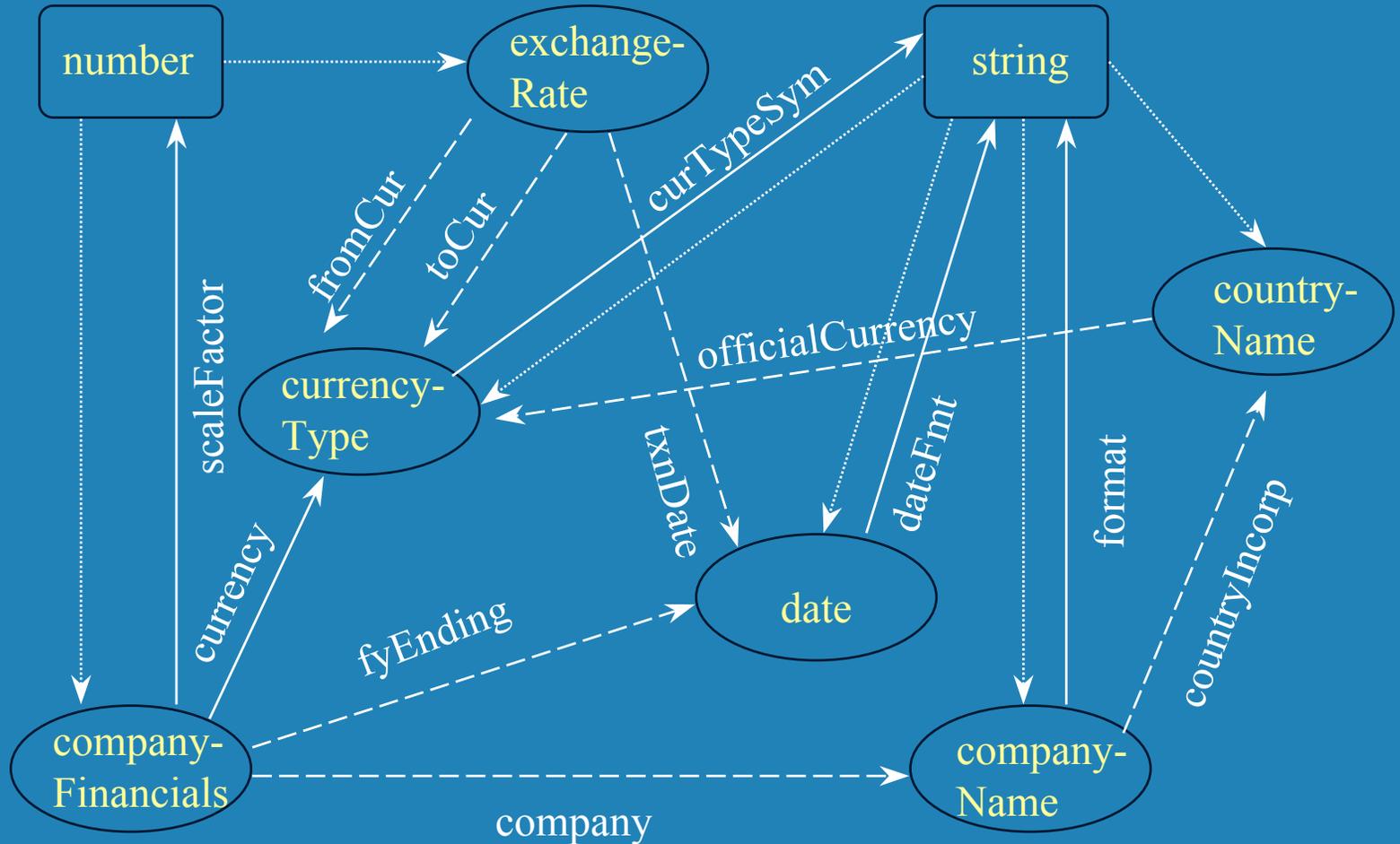
Users & Application Systems

* Wrapper Services

Some Context Differences

	Disclosure	Worldscope	DataStream
Currency Used	Country of Incorporation	USD	Country of Incorporation
Currency Symbols	3 Letters	3 Letters	2 Letters
Scale Factor	1	1000	1000
Company Names	Disclosure Names	Worldscope Names	DataStream Names
Date Style	American with '/' as separator	American with '/' as separator	European with '-' as separator

Domain Model (partial)



- Inheritance
- 32** Attribute
- Modifier

Some currency context possibilities:

- Currency is stated explicitly as part of record
- Current not stated, but the same for all (e.g., US \$)
- Currency not stated or constant, but inferred by country

System Demonstration

Single Source Queries with Mediation

Q6. Scenario: Using Context Interchange, the financial analyst can look at the Disclosure data using Datastream Context.

Query: Find out from Disclosure what Net Income for DAIMLER-BENZ was. Use Datastream Context.

Capabilities Demonstrated:

Ability to perform Scale Factor Conversion, Date Format Conversion, Company Name Conversion.

Demonstration – context2.mit.edu

GCMS Demo - Tasc06 SQL

Management: [[ontology](#) | [contexts](#) | [conversions](#) | [sources](#) | [elevations](#) | [integrity constraints](#)]
Currently Effective Internal Reps: [[ontology](#) | [context](#) | [conversion functions](#) | [sources](#) | [elevation](#)]

[[Start From Datalog](#) | [Enable Timing Log](#)]

Queries

- [New01](#)
- [New02](#)
- [New03](#)
- [New04](#)
- [New05](#)
- [New06](#)
- [New07](#)
- [New08](#)
- [Tasc01](#)
- [Tasc02](#)
- [Tasc03](#)
- [Tasc04](#)
- [Tasc05](#)
- [Tasc06*](#)
- [Tasc07](#)
- [Tasc08](#)
- [Tasc09](#)
- [Tasc10](#)
- [Tasc11](#)

Description select DiscAF.LATEST_ANNUAL_DATA, DiscAF.NET_INCOME from DiscAF where DiscAF.COMPANY_NAME = 'DAIMLER-BENZ';

SQL

```
select DiscAF.LATEST_ANNUAL_DATA, DiscAF.NET_INCOME
from DiscAF
where DiscAF.COMPANY_NAME = 'DAIMLER-BENZ';
```

Context Datastream ▾

Stage

Naive Datalog SQL Translation
 Context Sensitive Datalog Execution
 Conflict Detection
 Mediation

Conflict Detection and Mediation

Conflict Detection
 Mediation
 Submit Reset

Result

SemanticType	Column	Source	Modifier	Modifier value in source context	Modifier value in target context	Conversion Function
companyName	Name	DiscAF(Name, FYEnd, Shares, Income, Sales, Assets, Incorp)	format	c_ds : ds_name	c_dt : dt_name	name_map(V4, V3, V2, V1)
companyFinancials	Income	DiscAF(Name, FYEnd, Shares, Income, Sales, Assets, Incorp)	scaleFactor	c_ds : 1	c_dt : 1000	V5 is V4 / V3, V2 is V1 * V5
date	FYEnd	DiscAF(Name, FYEnd, Shares, Income, Sales, Assets, Incorp)	dateFmt	c_ds : American Style /	c_dt : European Style -	datexform(V4, V3, V2, V1)

Mediation
 Submit Reset

Mediated Query in Datalog

Result

```

answer('V9', 'V8') :-
  'DiscAF'('V7', 'V6', 'V5', 'V4', 'V3', 'V2', 'V1'),
  datexform('V6', "American Style /", 'V9', "European Style -"),
  'V8' is 'V4' * 0.001,
  'Name_map_Dt_Ds'("DAIMLER-BENZ", 'V7').
  
```

Date convert →
Scale factor convert →
Name convert →

Mediated SQL Query & Result

Mediated SQL Query

```
select datexfom.date2, discaf.net_income*0.001
from (select company_name, latest_annual_data, current_shares_outstanding, net_income, net_sales, total_as
      from discaf) discaf,
(select date1, 'American Style /', date2, 'European Style -'
 from datexfom
 where format1='American Style /'
 and format2='European Style -') datexfom,
(select 'DAIMLER-BENZ', ds_names
 from name_map_dt_ds
 where dt_names='DAIMLER-BENZ') name_map_dt_ds
where discaf.company_name = name_map_dt_ds.ds_names
and discaf.latest_annual_data = datexfom.date1
```

Adjust scale factor

Date format conversion

Name conversion

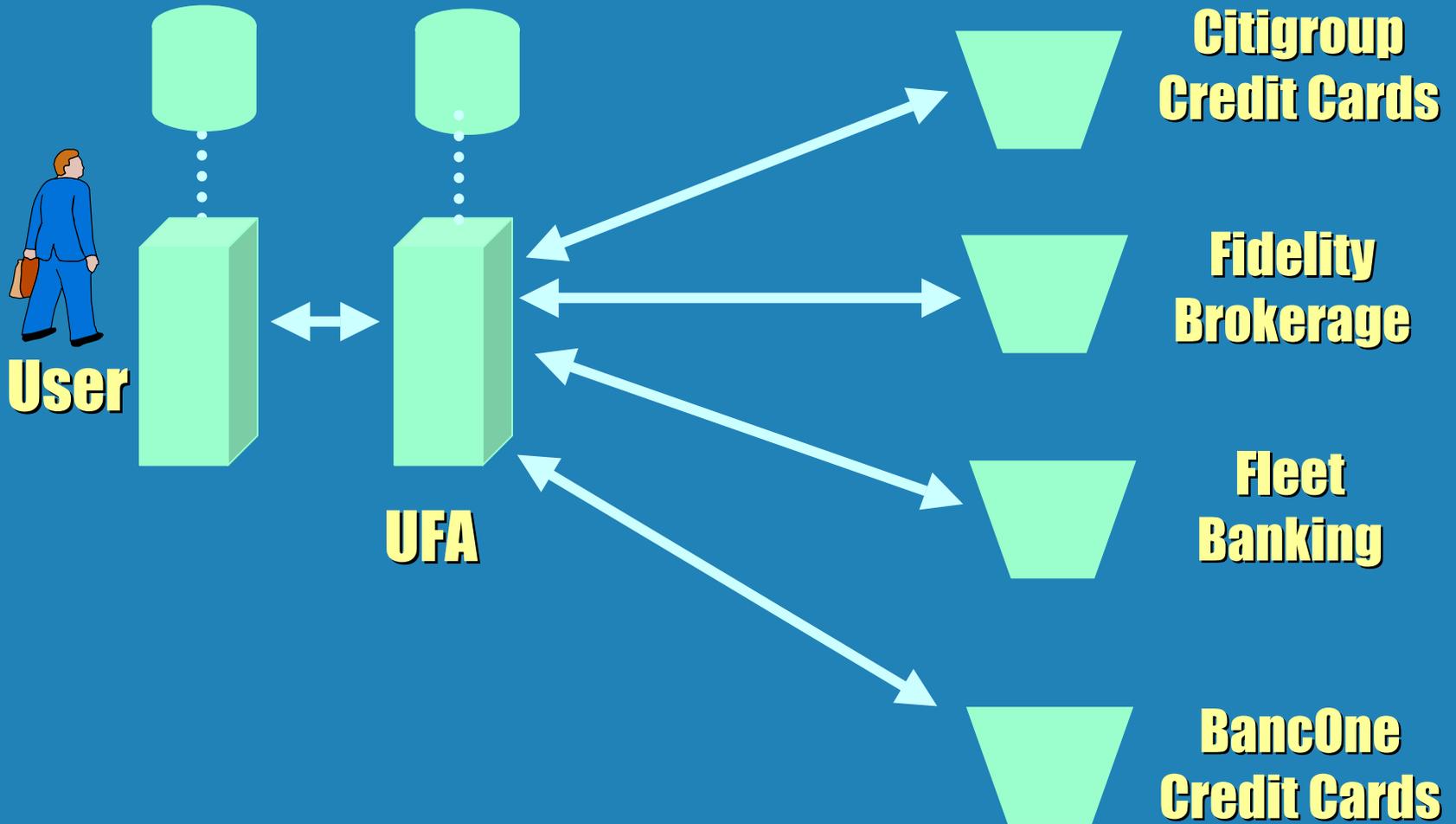
Final results – from Disclosure but in Datastream context

Result	DiscAF.LATEST_ANNUAL_DATA	DiscAF.NET_INCOME
	31-12-93	615000

Overview

- **Aggregator definition, types & examples**
- **Enabling technologies**
- **New emerging aggregators**
- **Summary**

Concept of a Universal Financial Aggregator (UFA)



Universal Financial Aggregator (UFA) Demonstration

Universal Banking Application - Microsoft Internet Explorer provided by America Online

File Edit View Favorites Tools Help

Universal Financial Application

Username:

Password:

About The Universal Financial Application

Ever since the deregulation of the financial industry in the 80s, individuals have been expanding the number of financial institutions that serve them. It is not uncommon to find a person with a credit card that comes from a different bank than the issuer of his/her checking account.

The Universal Financial Application (UFA) is a demonstration that provides integrated access to all of the user's financial accounts that are accessible online. Instead of only seeing individual accounts, the user can instantaneously view his/her financial status through a personalized balance sheet. In addition, the UFA also helps the user manage the plethora of logins and passwords. Moreover, given the user's financial information as well as knowledge of other available financial products, the UFA is capable

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Aggregated Report produced (top part)

UBA - Microsoft Internet Explorer provided by America Online

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Universal Financial Application

Advisors Wizards Agents
Edit Account Log Out

Deposit Accounts

Bank Name	Account Number	Nickname	Account Type	Available Balance
 BankOne	426842545	234234	Checking	2200.00
 Security First Network Bank	1298145662	My general account	MMA	2000.00
 Citibank	785149478	school 1	Checking	957.00
Total:				5157.00

Credit Cards Accounts

Issuer	Account Number	Nickname	Available Credit	Balance
 FirstUSA	413741589	Misc. Card	788.00	1212.00
 FirstUSA	312454584	Emergency Card	900.00	100.00

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Aggregated Report produced (bottom part)

UBA - Microsoft Internet Explorer provided by America Online

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[Advisors](#)
[Wizards](#)
[Agents](#)
[Edit Account](#)
[Log Out](#)

FIRST USA	FirstUSA	312454584	Emergency Card	900.00	100.00
Total:				1688.00	1312.00

Brokerage Accounts - click here to aggregate all your brokerage accounts

Broker	Account Number	Account Name	Nick Name	Total Value
	943856	SASHAM	Daydream Account	94168.75
	742841	Steven	Trading Account	61612.75
	545631	test1	test1	0.00
Total:				155781.50

Net Worth

Assets	Savings	5157.00
	Brokerage	155781.50
Liabilities	Credit Card Accounts	1312.00
Total:		159626.50

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Current UFA Offerings (examples)

Account Aggregation Technology Suppliers

- **Yodlee**
- **VerticalOne**
- **eBalance**

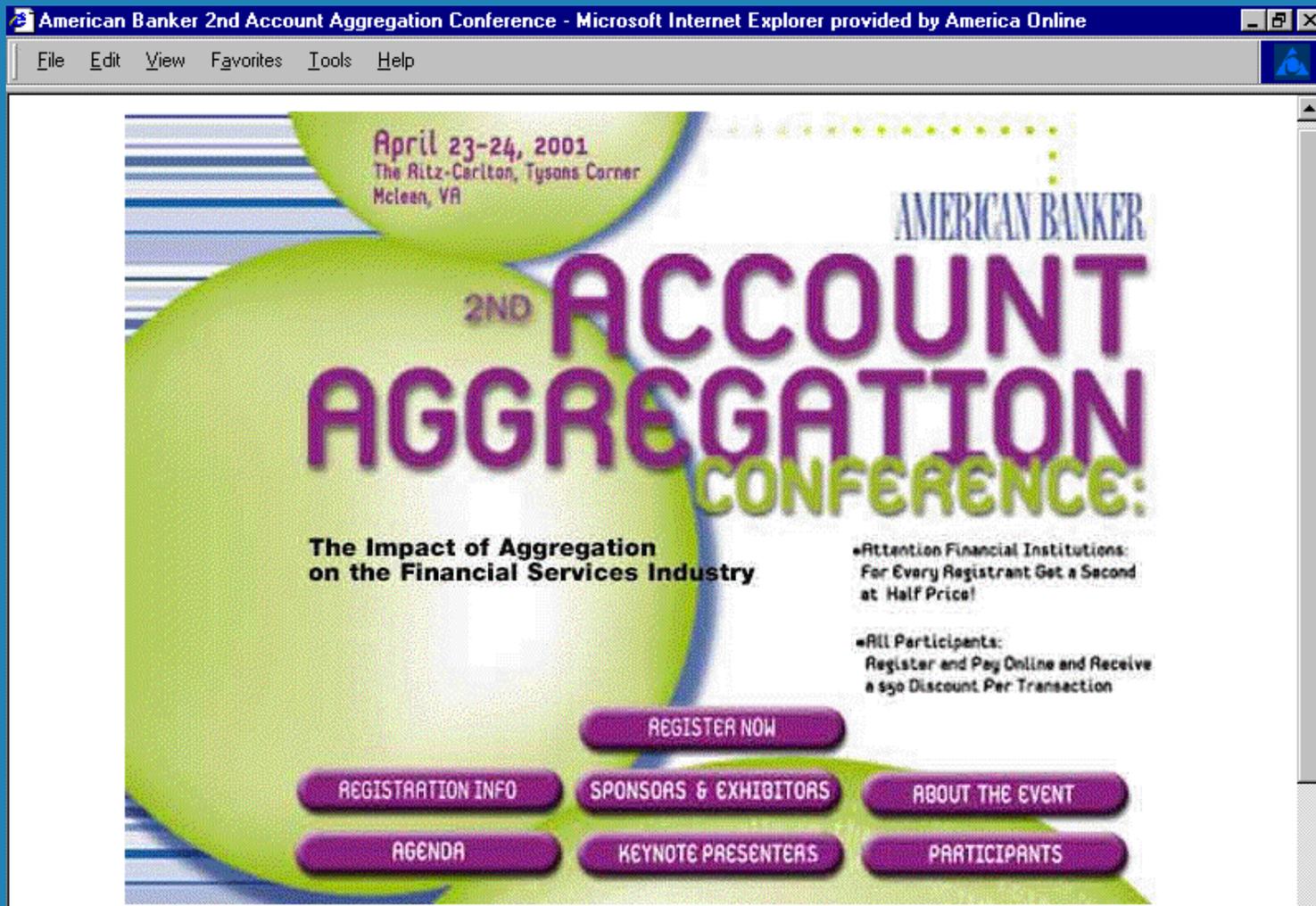
Account Aggregation Offerings

- **Chase, Fleet, Citibank (myCiti.com), ...**
- **Merrill-Lynch, Fidelity Investments, ...**
- **Yahoo, AOL, ...**

“Aggregation ... The ‘killer app’ in the e-finance revolution”

American Banker 2nd Account Aggregation Conference - Microsoft Internet Explorer provided by America Online

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April 23-24, 2001
The Ritz-Carlton, Tysons Corner
McLean, VA

AMERICAN BANKER

2ND ACCOUNT AGGREGATION CONFERENCE:

The Impact of Aggregation on the Financial Services Industry

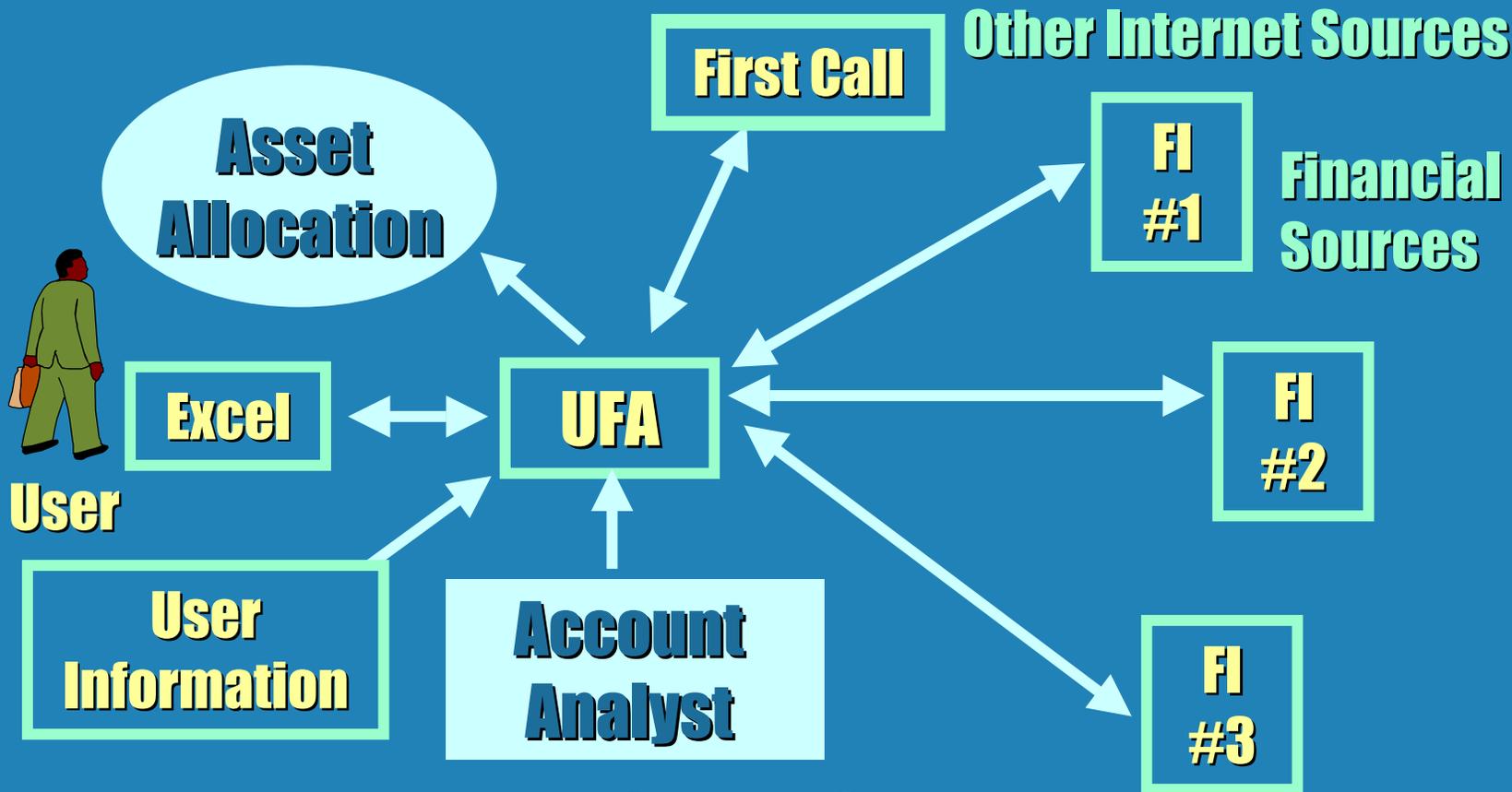
- Attention Financial Institutions: For Every Registrant Get a Second at Half Price!
- All Participants: Register and Pay Online and Receive a \$50 Discount Per Transaction

REGISTER NOW

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AGENDA KEYNOTE PRESENTERS PARTICIPANTS

"After Aggregation" Services



∞ **Advisors**

∞ **Wizards**

∞ **Agents**

**Intranet Sources
and applications**

• **Emergence of Open Aggregation**

Advisors: Stock holdings re-aggregate

Portfolio View - Microsoft Internet Explorer provided by America Online

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Account Summary

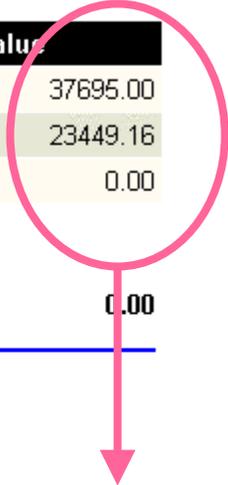
Brokerage	Account Number	Total Value
E*Trade	943856	37695.00
E*Trade	742841	23449.16
E*Trade	545631	0.00

Money Market Balance 0.00

Stocks

Symbol	Quantity	Price	Value
AXP	100.00	41.33	4133.00
C	256.00	49.87	12766.72
CNET	100.00	10.55	1055.00
COF	300.00	64.16	19248.00
FBF	100.00	39.13	3913.00
LU	300.00	7.74	2322.00
MSFT	200.00	71.56	14312.00
RHAT	0.00	5.21	0.00
SUNW	200.00	17.08	3416.00

Total: 61165.72



Wizards: Money Market (MMA) example

UBA - Microsoft Internet Explorer provided by America Online

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Universal Financial Application

Advisors **Wizards** Agents
Edit Account Log Out

My Account Summary

as of Thu, 10 Feb 2000 22:11:08 -0500

Deposit Accounts

Bank Name	Account Number	Nickname	Account Type	Available Balance
BankOne	426842545	234234	Checking	2200.00
Security First Network Bank	1298145662	My general account	MMA	2000.00
Citibank	785149478	school 1	Checking	957.00
Total:				5157.00

Credit Cards Accounts

Issuer	Account Number	Nickname	Available Credit	Balance
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MMA is also an aggregator, of MM rate sources

UBA - Microsoft Internet Explorer provided by America Online

Maintain your accounts with the help of electronic wizards

Wizards

Advisors Wizards Agents

Please select a wizard: Money Market Wizard Go!

The MMA Wizard has examined your account.
If you put your money in:

Republic Bank and Trust
for
12 months
you can make an extra:
\$173.38*

*at the current rates

Here's what you *would* have saved using the Money Market Aggregator!

The following are the Top 3 options available to you:

Bank Name	APY	Minimum Deposit	Possible Earnings	
Republic Bank and Trust	5.36	5000	\$173.38	Do IT
Domestic Bank	5.30	5000	\$163.04	Do IT

Better rates

47

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Multi- Mega- Aggregators !

∞ **The Universal Financial Aggregator (UFA) :**

∞ **Aggregates your financial information**

- **several ways: totals and stock holdings**

∞ **Also uses the Money Market Aggregator**

- **which draws on multiple MM sources**
- **including sources that are, in fact, aggregators of some MM sources**

There may be value in aggregation but...

The REAL VALUE is after aggregation services

∞ **Books.com - How to price my books?**

∞ **MaxMiles.com - Who flies where and when?**

∞ **Money Market/CD rates - Will my offering be effective? Are there holes in the market?**

∞ **UFA - Can I manage my finances better?**

Overview

- ⌚ **Aggregator definition, types & examples**
- ⌚ **Enabling technologies**
- ⌚ **New emerging aggregators**
- ⌚ **Summary**

Key Insights and Implications

Insights

- **Everyone impacted**
- **Aggs not limited to price comparison**
- **Aggs can be combined and aggregated**
- **Aggs create new info spaces**
- **After-agg even more important**
- **Business models and market conditions continue to change**
- **New technologies becoming available**

Implications

- **Be part of strategy planning**
- **Identify new Agg applications and business opportunities**
- **Entirely new types of applications can be defined**
- **Who will own this space**
- **This must be exploited**
- **Must be prepared for changes**
- **Start exploring them now**

The 1805 Overture

In 1805, the Austrian and Russian Emperors agreed to join forces against Napoleon. The Russians said their forces would be in the field in Bavaria by Oct. 20.

The Austrian staff planned based on that date in the Gregorian calendar. Russia, however, used the ancient Julian calendar, which lagged 10 days behind.

The difference allowed Napoleon to surround Austrian General Mack's army at Ulm on Oct. 21, well before the Russian forces arrived.

Source: David Chandler, *The Campaigns of Napoleon*, New York: MacMillan 1966, pg. 390.

Current Projects (partial list)

- **Aggregation strategies (e.g., Open aggregation)**
- **Regional & Global Aggregation: Cultural & legal**
- **Multi-enterprise eBusiness: Trust & relationships**
- **Financial services/Internet support for SME's**
- **Future Financial Services (e.g., Wireless aggregator)**
- **Context Mediation & Web data extraction ***
- **Data Quality & What XML will and will not do**
- **Internal data standards efforts (e.g., EDSI)**
- **Other new technologies (e.g., Mobile aggregation)**

* Patents awarded in 1999

For Further Information and Contacts

Ω MIT Research:

- <http://context2.mit.edu> and <http://context2.mit.edu/aggregation>
- <http://web.mit.edu/tdqm>

Ω MIT Technology Licensed Software:

- <http://web.mit.edu/smadnick/www/patents.html>

Ω Email Contact:

- Stuart Madnick at smadnick@mit.edu
- Michael Siegel at msiegel@mit.edu

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 - **Merrill Lynch**
 - **MITRE Corporation**
 - **PricewaterhouseCoopers**
 - **Singapore-MIT Alliance (SMA)**
 - **Suruga Bank**