Applying search technology to data matching, consolidation, and cleansing

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fast

All Data is Dirty

Forrt Lauderdale

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FORT LAUDERDALE FLA.

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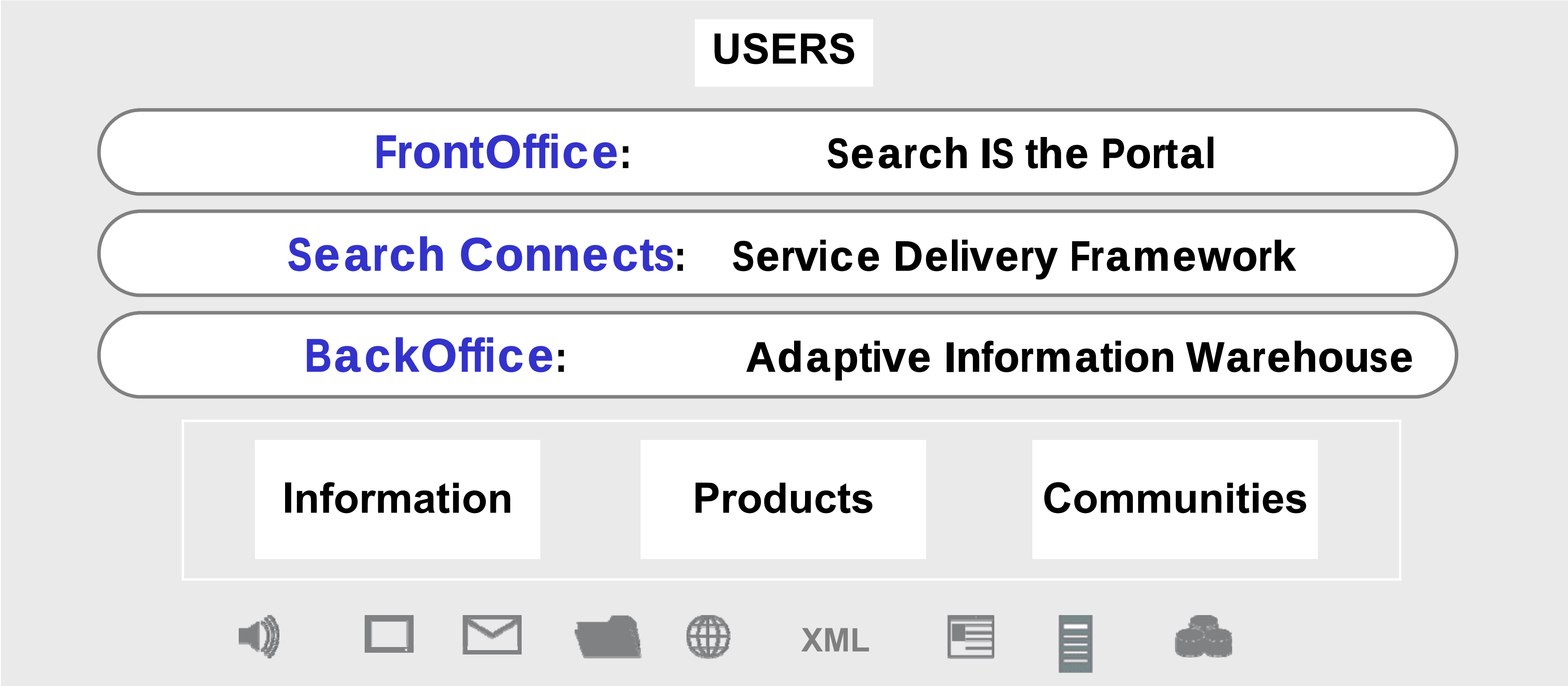
Search technology emphasizes connecting to the User

FAST Connects Users To Information, Products and Communities



USERS

FrontOffice: Search IS the Portal

Search Connects: Service Delivery Framework

BackOffice: Adaptive Information Warehouse

Information

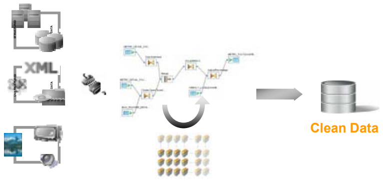
Products

Communities

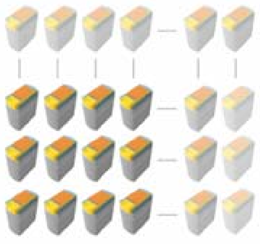
The Adaptive Information Warehouse

The first business intelligence solution built on search. Redefining how organizations access, interact with and exploit information.

The Adaptive Information Warehouse (AIW)



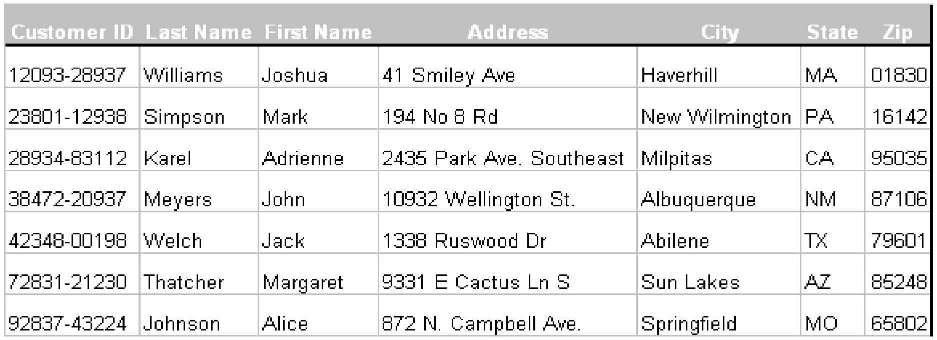
Advanced data integration and cleansing



Dynamic, real-time structured and unstructured data

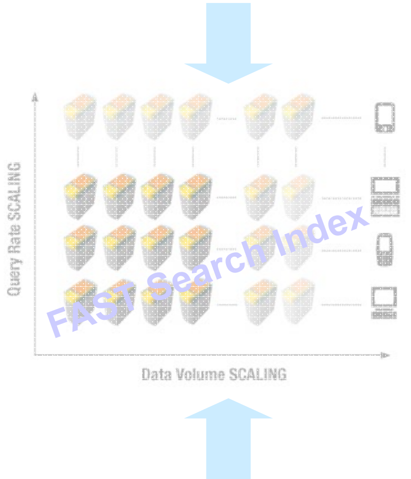
Integrated intuitive business intelligence portal

Data Cleansing | **FAST ESP** | **Radar**

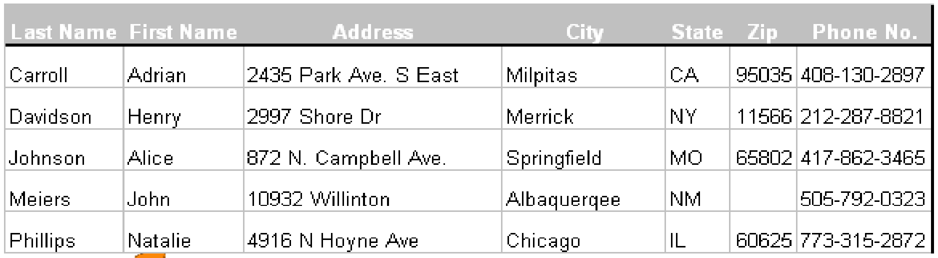


Customer ID	Last Name	First Name	Address	City	State	Zip
12093-28937	Williams	Joshua	41 Smiley Ave	Haverhill	MA	01830
23801-12938	Simpson	Mark	194 No 8 Rd	New Wilmington	PA	16142
28934-83112	Karel	Adrienne	2435 Park Ave. Southeast	Milpitas	CA	95035
38472-20937	Meyers	John	10932 Wellington St.	Albuquerque	NM	87106
42348-00198	Welch	Jack	1338 Ruswood Dr	Abilene	TX	79601
72831-21230	Thatcher	Margaret	9331 E Cactus Ln S	Sun Lakes	AZ	85248
92837-43224	Johnson	Alice	872 N. Campbell Ave.	Springfield	MO	65802

Customer Records from Corporate CRM Database



Match, merge, cleanse.



Last Name	First Name	Address	City	State	Zip	Phone No.
Carroll	Adrian	2435 Park Ave. S East	Milpitas	CA	95035	408-130-2897
Davidson	Henry	2997 Shore Dr	Merrick	NY	11566	212-287-8821
Johnson	Alice	872 N. Campbell Ave.	Springfield	MO	65802	417-862-3465
Meiers	John	10932 Willinton	Albaquerqee	NM		505-792-0323
Phillips	Natalie	4916 N Hoyne Ave	Chicago	IL	60625	773-315-2872

Regional Sales Call Center /

Customer Service Database

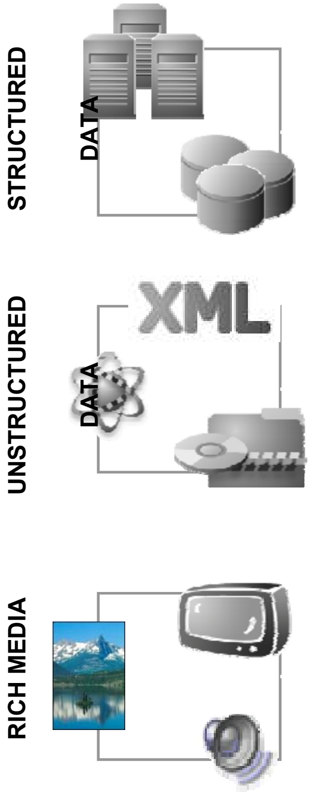
Data matching, cleansing, and consolidation

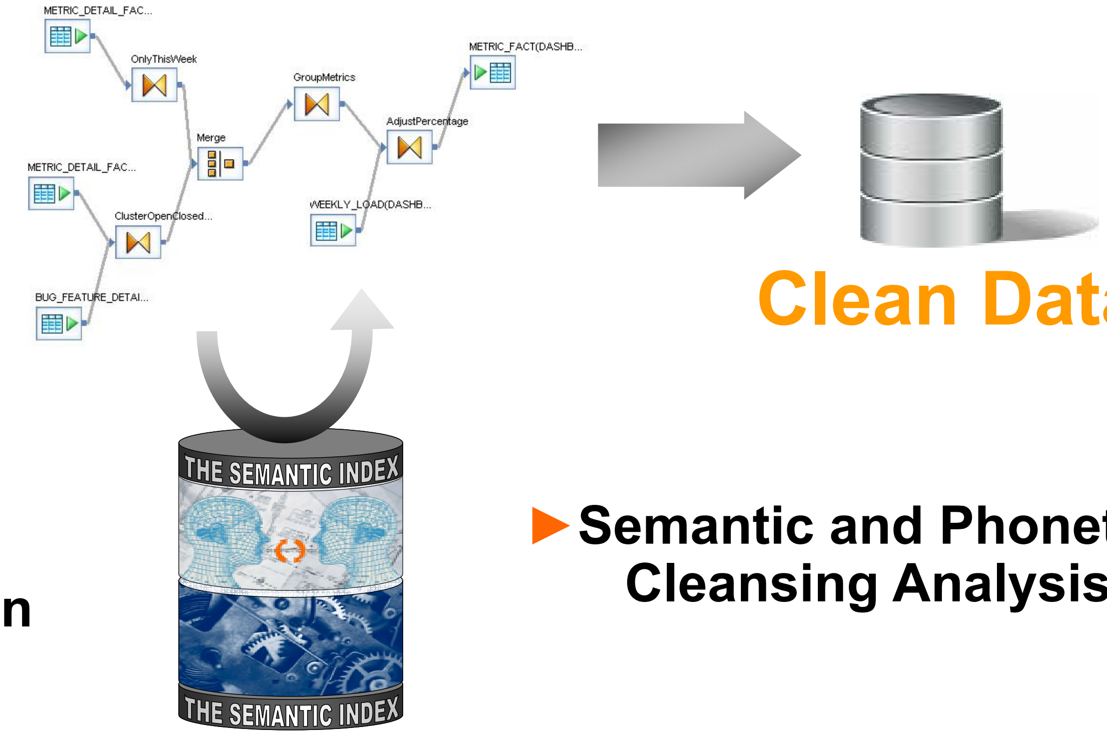
- Biggest problem for all data warehouses
  - Merge of multiple sources of data
  - No common key
- FAST solution: unique combination of traditional DWH logic (ETL) and fuzzy matching
  - Full ETL tool for the traditional ETL logic
  - Use search engine core for fuzzy match
  - Apply linguistic techniques to data quality issues

Cleansing Example:

Schibsted built Internet Yellow Pages and White Pages from scratch in 8 weeks outperforming existing providers on data quality

98 % Cleansing Precision



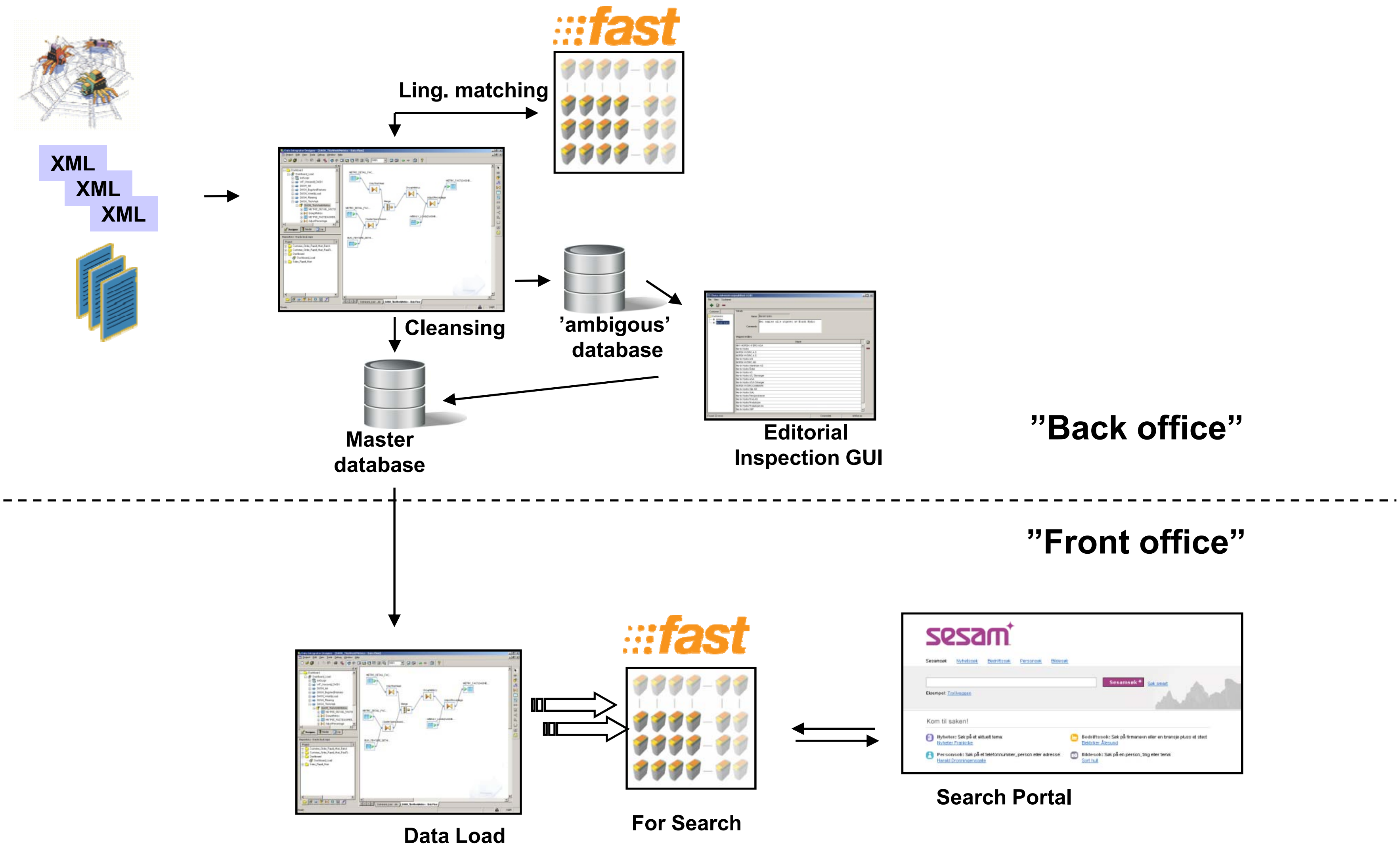


Clean Data

▶ **Semantic and Phonetic Cleansing Analysis**

▶ **Content Fusion**

Example system configuration



XML

XML

XML

Ling. matching

Cleansing

'ambigous' database

Master database

Editorial Inspection GUI

"Back office"

"Front office"

Data Load

For Search

Search Portal

Kom til saken!

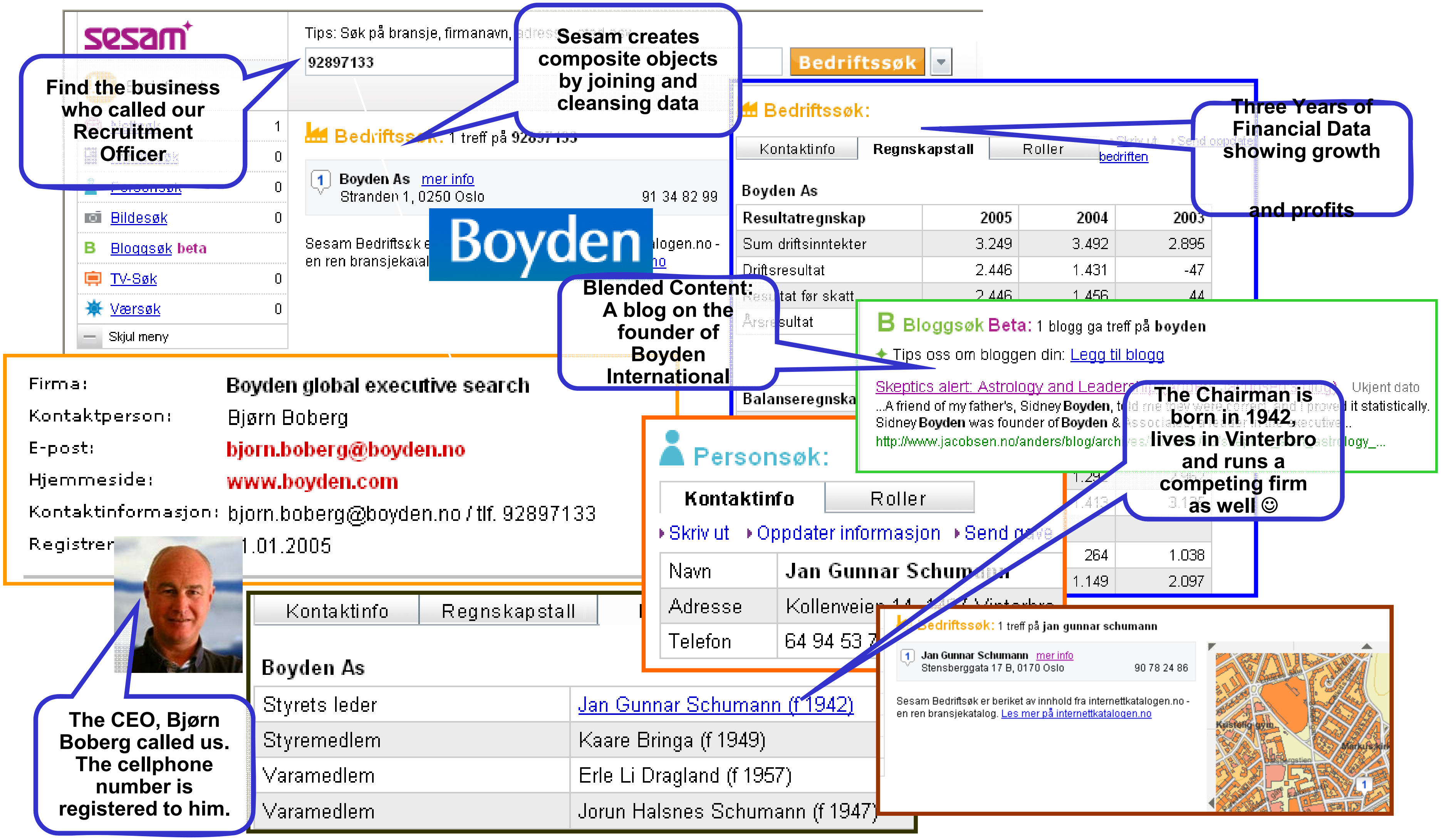
Nyheter: Søk på et aktuelt tema: Nyheter Frankrike

Bedriftssøk: Søk på firmanavn eller en bransje pluss et sted: Bektriker Ålesund

Personsøk: Søk på et telefonnummer, person eller adresse: Harald Dronningensgate

Bildesøk: Søk på en person, ting eller tema: Sort hull

Data Warehouse of the Year Award 2006



Find the business who called our Recruitment Officer

Sesam creates composite objects by joining and cleansing data

Three Years of Financial Data showing growth and profits

Blended Content: A blog on the founder of Boyden International

The Chairman is born in 1942, lives in Vinterbro and runs a competing firm as well ☺

The CEO, Bjørn Boberg called us. The cellphone number is registered to him.

Bedriftssøk: 1 treff på 92897133

1 Boyden As mer info
Stranden 1, 0250 Oslo 91 34 82 99

Sesam Bedriftsøk e… …logen.no -
en ren bransjekatal… …no

Bedriftssøk:

Kontaktinfo	Regnskapstall	Roller

Boyden As

Resultatregnskap	2005	2004	2003
Sum driftsinntekter	3.249	3.492	2.895
Driftsresultat	2.446	1.431	-47
Resultat før skatt	2.446	1.456	44
Årsresultat			
Balanseregnskap			
		1.29	
		1.413	3.1
		264	1.038
		1.149	2.097

B Bloggsøk Beta: 1 blogg ga treff på **boyden**

✦ Tips oss om bloggen din: Legg til blogg

Skeptics alert: Astrology and Leaders… Ukjent dato
...A friend of my father's, Sidney **Boyden**, told me they were correct, and I proved it statistically. Sidney **Boyden** was founder of **Boyden** & Associates, a leader in the executive...
http://www.jacobsen.no/anders/blog/archives/…astrology_...

Firma:	**Boyden global executive search**
Kontaktperson:	Bjørn Boberg
E-post:	bjorn.boberg@boyden.no
Hjemmeside:	www.boyden.com
Kontaktinformasjon:	bjorn.boberg@boyden.no / tlf. 92897133
Registrer	1.01.2005

Personsøk:

Kontaktinfo	Roller

▸ Skriv ut ▸ Oppdater informasjon ▸ Send gave

Navn	**Jan Gunnar Schumann**
Adresse	Kollenveien 14, [illegible] Vinterbro
Telefon	64 94 53 7

Kontaktinfo	Regnskapstall

Boyden As

Styrets leder	Jan Gunnar Schumann (f 1942)
Styremedlem	Kaare Bringa (f 1949)
Varamedlem	Erle Li Dragland (f 1957)
Varamedlem	Jorun Halsnes Schumann (f 1947)

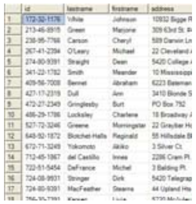
Bedriftssøk: 1 treff på **jan gunnar schumann**

1 **Jan Gunnar Schumann** mer info
Stensberggata 17 B, 0170 Oslo 90 78 24 86

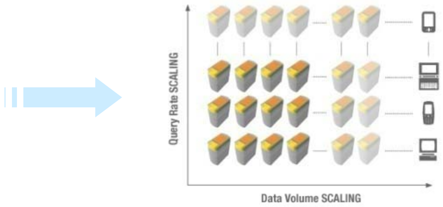
Sesam Bedriftsøk er beriket av innhold fra internettkatalogen.no - en ren bransjekatalog. Les mer på internettkatalogen.no

Data Cleansing Scenario One: ”Master” DB exists

One ’ Master’ exists, other datasources are cleansed towards it

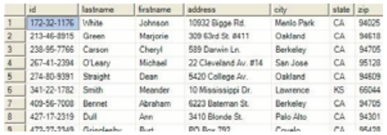


	id	lastname	firstname	address
1	172-32-1176	White	Johnson	10932 Bigge R
2	213-46-8915	Green	Marjorie	309 63rd St. #
3	238-95-7766	Carson	Cheryl	589 Darwin Ln
4	267-41-2394	O'Leary	Michael	22 Cleveland A
5	274-80-9391	Straight	Dean	5420 College A
6	341-22-1782	Smith	Meander	10 Mississippi
7	409-56-7008	Bennet	Abraham	6223 Bateman
8	427-17-2319	Dull	Ann	3410 Blonde S
9	472-27-2349	Gringlesby	Burt	PO Box 792
10	486-29-1786	Locksley	Charlene	18 Broadway A
11	527-72-3246	Greene	Morningstar	22 Graybar Ho
12	648-92-1872	Blotchet-Halls	Reginald	55 Hillsdale B
13	672-71-3249	Yokomoto	Akiko	3 Silver Ct.
14	712-45-1867	del Castillo	Innes	2286 Cram Pl.
15	722-51-5454	DeFrance	Michel	3 Balding Pl.
16	724-08-9931	Stringer	Dirk	5420 Telegrap
17	724-80-9391	MacFeather	Stearns	44 Upland Hts
18	756-30-7391	Karsen	Livia	5720 McAuley

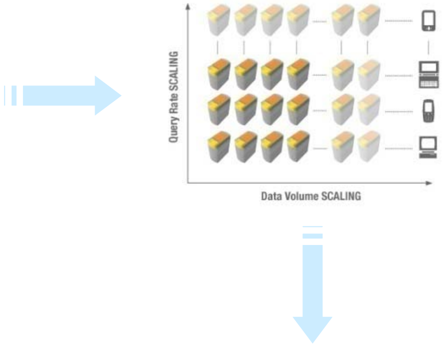


Step one:

- The Customer Master is indexed by FAST ESP

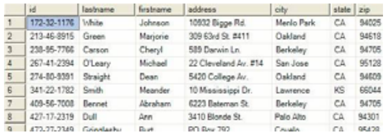


	id	lastname	firstname	address	city	state	zip
1	172-32-1176	White	Johnson	10932 Bigge Rd.	Menlo Park	CA	94025
2	213-46-8915	Green	Marjorie	309 63rd St. #411	Oakland	CA	94618
3	238-95-7766	Carson	Cheryl	589 Darwin Ln.	Berkeley	CA	94705
4	267-41-2394	O'Leary	Michael	22 Cleveland Av. #14	San Jose	CA	95128
5	274-80-9391	Straight	Dean	5420 College Av.	Oakland	CA	94609
6	341-22-1782	Smith	Meander	10 Mississippi Dr.	Lawrence	KS	66044
7	409-56-7008	Bennet	Abraham	6223 Bateman St.	Berkeley	CA	94705
8	427-17-2319	Dull	Ann	3410 Blonde St.	Palo Alto	CA	94301
9	472-27-2349	Gringlesby	Burt	PO Box 792	Covelo	CA	95428



Step two:

A datasource is cleansed according to the Master



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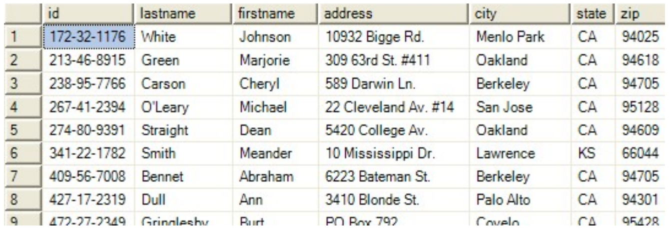
4	267-41-2394	O'Leary	Michael	22 Cleveland Av. #14	San Jose	CA	95128
5	274-80-9391	Straight	Dean	5420 College Av.	Oakland	CA	94609
6	341-22-1782	Smith	Meander	10 Mississippi Dr.	Lawrence	KS	66044
7	409-56-7008	Bennet	Abraham	6223 Bateman St.	Berkeley	CA	94705
8	427-17-2319	Dull	Ann	3410 Blonde St.	Palo Alto	CA	94301
9	472-27-2349	Gringlesby	Burt	PO Box 792	Covelo	CA	95428

Result: a corrected version of that datasource

Data Cleansing Scenario Two: No ”Master” DB

Two or more databases exist, and a merge is needed

Incident records from Central Region



	id	lastname	firstname	address	city	state	zip
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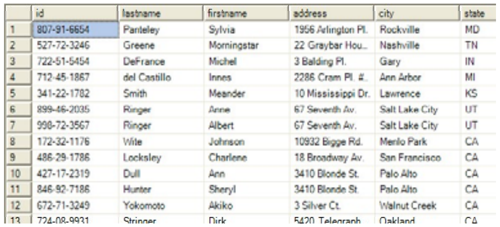
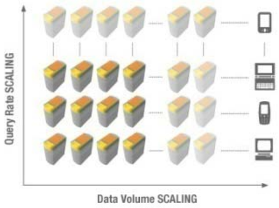
2	213-46-8915	Green	Marjorie	309 63rd St. #411	Oakland	CA	94618
3	238-95-7766	Carson	Cheryl	589 Darwin Ln.	Berkeley	CA	94705
4	267-41-2394	O'Leary	Michael	22 Cleveland Av. #14	San Jose	CA	95128
5	274-80-9391	Straight	Dean	5420 College Av.	Oakland	CA	94609
6	341-22-1782	Smith	Meander	10 Mississippi Dr.	Lawrence	KS	66044
7	409-56-7008	Bennet	Abraham	6223 Bateman St.	Berkeley	CA	94705
8	427-17-2319	Dull	Ann	3410 Blonde St.	Palo Alto	CA	94301
9	472-27-2349	Gringlesby	Burt	PO Box 792	Covelo	CA	95428

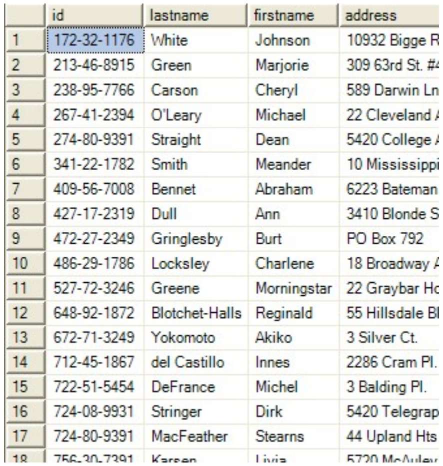
Incidents from East Region



	id	lastname	firstname	address	city	state
1	807-91-6654	Panteley	Sylvia	1956 Arlington Pl.	Rockville	MD
2	527-72-3246	Greene	Morningstar	22 Graybar Hou...	Nashville	TN
3	722-51-5454	DeFrance	Michel	3 Balding Pl.	Gary	IN
4	712-45-1867	del Castillo	Innes	2286 Cram Pl. #...	Ann Arbor	MI
5	341-22-1782	Smith	Meander	10 Mississippi Dr.	Lawrence	KS
6	899-46-2035	Ringer	Anne	67 Seventh Av.	Salt Lake City	UT
7	998-72-3567	Ringer	Albert	67 Seventh Av.	Salt Lake City	UT
8	172-32-1176	Wite	Johnson	10932 Bigge Rd.	Menlo Park	CA
9	486-29-1786	Locksley	Charlene	18 Broadway Av.	San Francisco	CA
10	427-17-2319	Dull	Ann	3410 Blonde St.	Palo Alto	CA
11	846-92-7186	Hunter	Sheryl	3410 Blonde St.	Palo Alto	CA
12	672-71-3249	Yokomoto	Akiko	3 Silver Ct.	Walnut Creek	CA
13	724-08-9931	Stringer	Dirk	5420 Telegraph	Oakland	CA



Cleansed Unioned Incident list



	id	lastname	firstname	address
1	172-32-1176	White	Johnson	10932 Bigge R
2	213-46-8915	Green	Marjorie	309 63rd St. #4
3	238-95-7766	Carson	Cheryl	589 Darwin Ln
4	267-41-2394	O'Leary	Michael	22 Cleveland A
5	274-80-9391	Straight	Dean	5420 College A
6	341-22-1782	Smith	Meander	10 Mississippi
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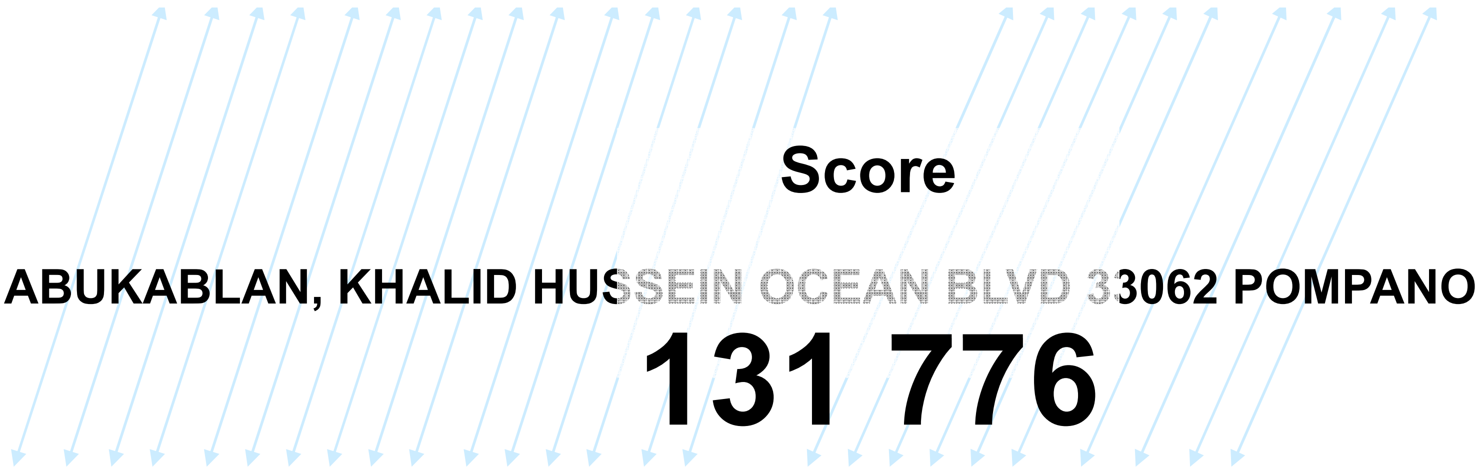
16	724-08-9931	Stringer	Dirk	5420 Telegrap
17	724-80-9391	MacFeather	Stearns	44 Upland Hts
18	756-30-7391	Karsen	Livia	5720 McAuley

- **Duplication identification and removal**
- **Approximate matching to help oversee minor errors**
- **Multi-field compare to ensure secure identification**
- **Tunable relative importance of each field**
- **More than 20 million names known by the plattform**
- **Spell checking and error correction included**

- **Private attributes from eiher source are merged to a super-set**

Search Is a Matching Service

3-Gram



Score

ABUKABLAN, KHALID HUSSEIN OCEAN BLVD 33062 POMPANO BEACH

131 776

3-Gram

Search improves Data Quality through de-duplication

Linguistic Capabilities Provide High Data Matching Accuracy

- Score strings on similarity
  - Lai Nancy, 501 N. Clinton St. ≈ Nancy J. Lai, 501 North Clinton

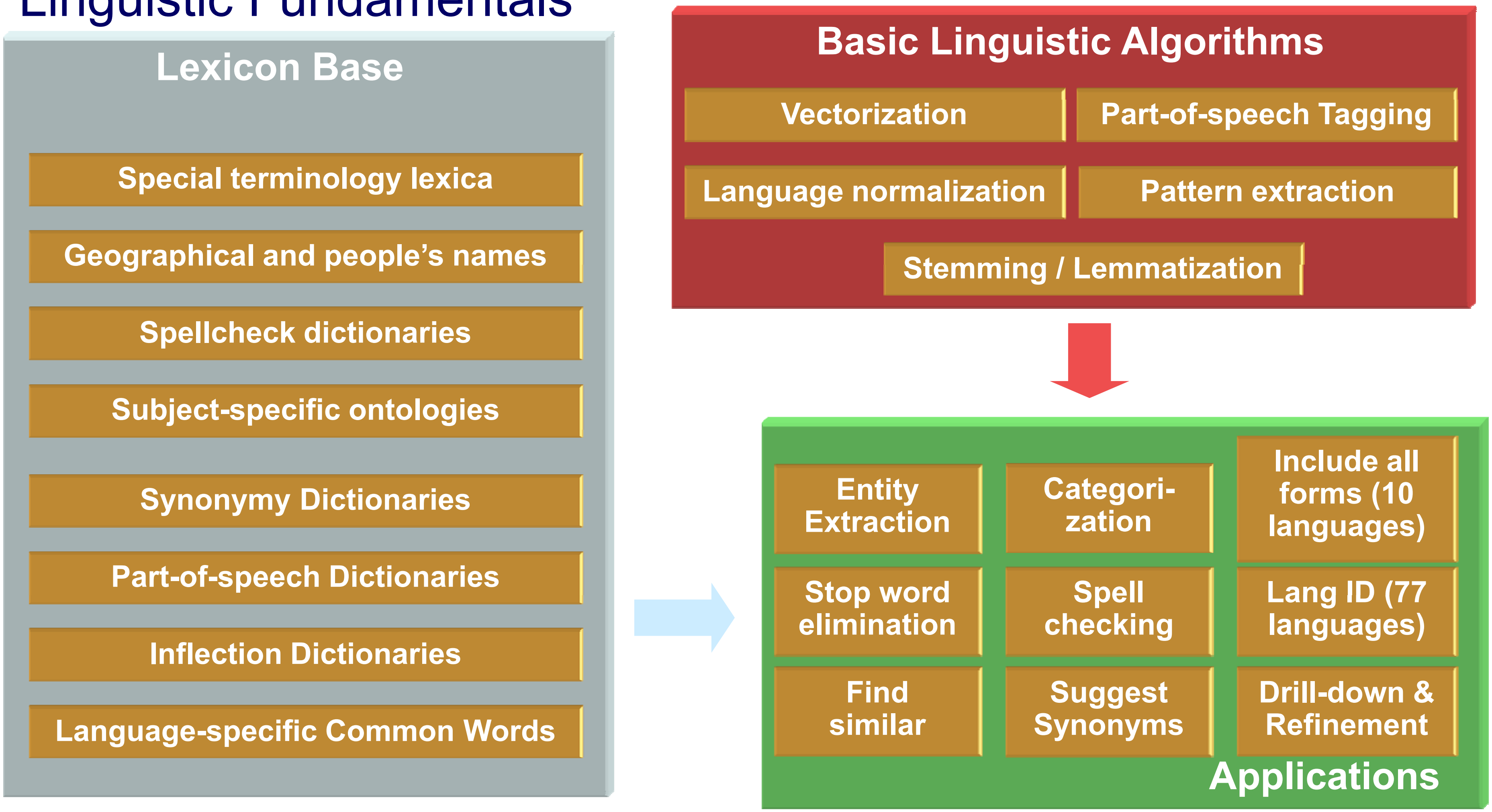
- Levenshtein edit distance algorithms
  - Calculates the difference on two strings (names)
  - John Meyers ≈ John P. Meiers; Britney Spears ≈ Britney Spaers

- Phonetic match
  - Calculates an integer from the strings, and matches on ’sounds like’
  - Christin ≈ Kristin; Kierkegaard ≈ Kierkegård

- Scope Fields (new in FAST Instream 4.1 and FAST ESP 5.0)
  - Finds relevancy in a scope or a context – for example ’Person’ vs. ’Address’.

- ’Charset’ normalization
  - For multinational chars and name combinations
  - André = Andre, Jürgen = Jurgen etc.

Linguistic Fundamentals



Lexicon Base

Special terminology lexica

Geographical and people’s names

Spellcheck dictionaries

Subject-specific ontologies

Synonymy Dictionaries

Part-of-speech Dictionaries

Inflection Dictionaries

Language-specific Common Words

Basic Linguistic Algorithms

Vectorization

Part-of-speech Tagging

Language normalization

Pattern extraction

Stemming / Lemmatization

Applications

Entity Extraction

Categori-zation

Include all forms (10 languages)

Stop word elimination

Spell checking

Lang ID (77 languages)

Find similar

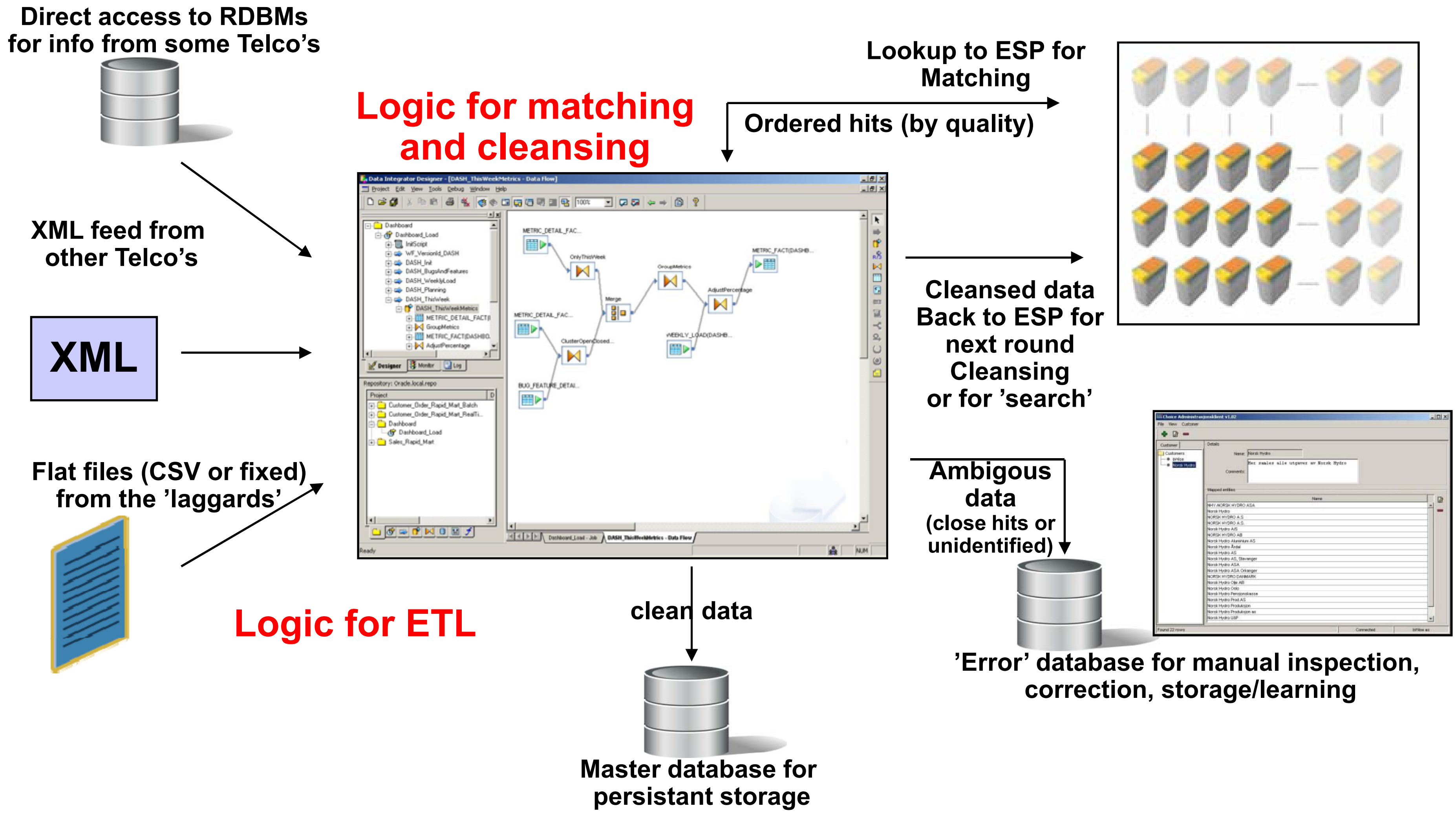
Suggest Synonyms

Drill-down & Refinement

Where do Linguistics and other search technologies apply to data quality?

- On textual and/or multimedia data
- In combination with other rules-based techniques
- In hard-to-match situations
  - Match and cleanse with significantly fewer rules
  - Match and cleanse with much higher accuracy
- Where structuring “blobs” of text is useful
  - Entity Extraction
  - Relationship Extraction

Data Consolidation and ETL Studio



Direct access to RDBMs for info from some Telco's

XML feed from other Telco's

Flat files (CSV or fixed) from the 'laggards'

Logic for matching and cleansing

Logic for ETL

Lookup to ESP for Matching

Ordered hits (by quality)

Cleansed data Back to ESP for next round Cleansing or for 'search'

Ambigous data (close hits or unidentified)

'Error' database for manual inspection, correction, storage/learning

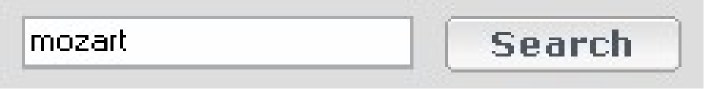
clean data

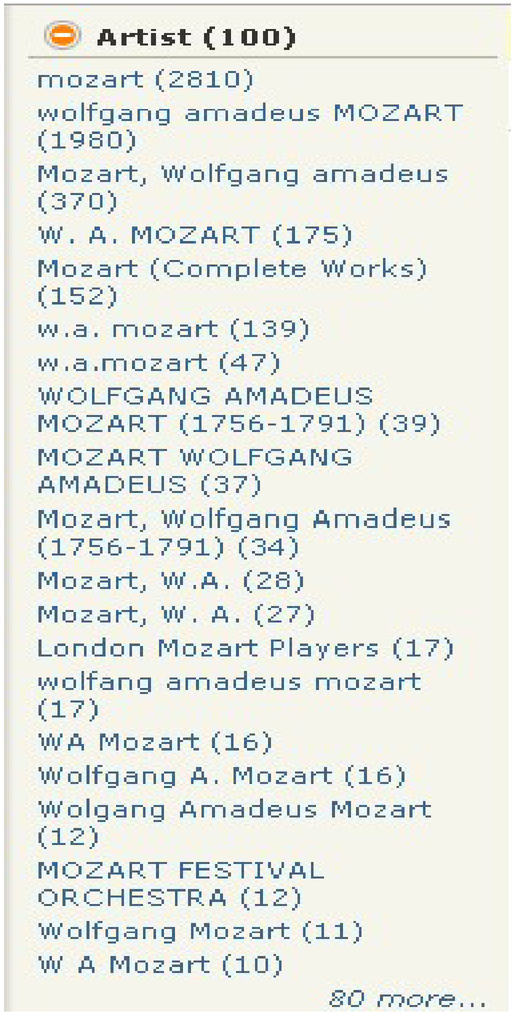
Master database for persistant storage

Key Cleansing Benefits

- Increased accuracy in search
- Improved entity recognition and relationship mapping
- Better analytics and intelligence
- Improvement and reuse of data for all applications

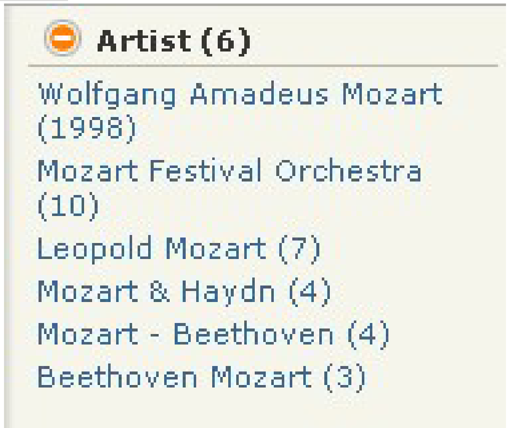
Cleansing: Impact on Discovery


mozart


Artist (100)

- mozart (2810)
- wolfgang amadeus MOZART (1980)
- Mozart, Wolfgang amadeus (370)
- W. A. MOZART (175)
- Mozart (Complete Works) (152)
- w.a. mozart (139)
- w.a.mozart (47)
- WOLFGANG AMADEUS MOZART (1756-1791) (39)
- MOZART WOLFGANG AMADEUS (37)
- Mozart, Wolfgang Amadeus (1756-1791) (34)
- Mozart, W.A. (28)
- Mozart, W. A. (27)
- London Mozart Players (17)
- wolfang amadeus mozart (17)
- WA Mozart (16)
- Wolfgang A. Mozart (16)
- Wolgang Amadeus Mozart (12)
- MOZART FESTIVAL ORCHESTRA (12)
- Wolfgang Mozart (11)
- W A Mozart (10)

80 more...


Artist (6)

- Wolfgang Amadeus Mozart (1998)
- Mozart Festival Orchestra (10)
- Leopold Mozart (7)
- Mozart & Haydn (4)
- Mozart - Beethoven (4)
- Beethoven Mozart (3)

The Largest BI Limitations Today

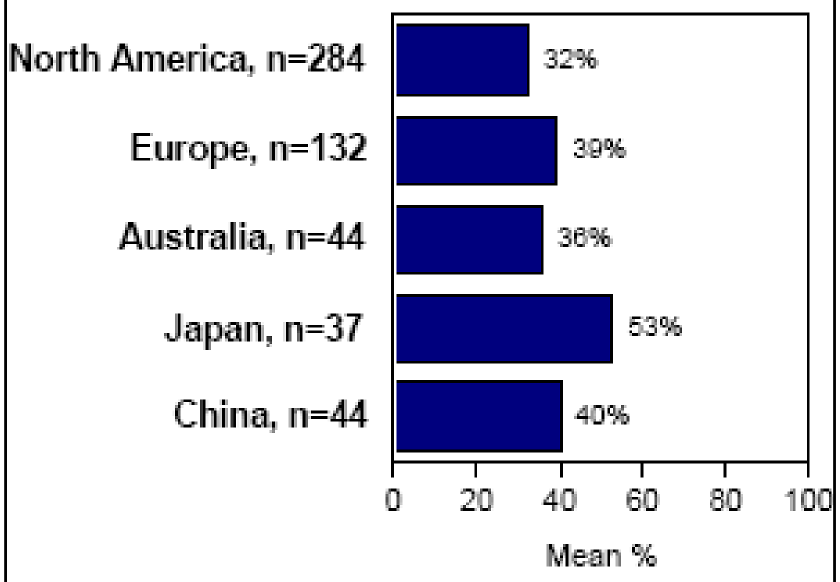
2007

If We Build It,

<50% of Them Will Come

What else is wrong with BI today?

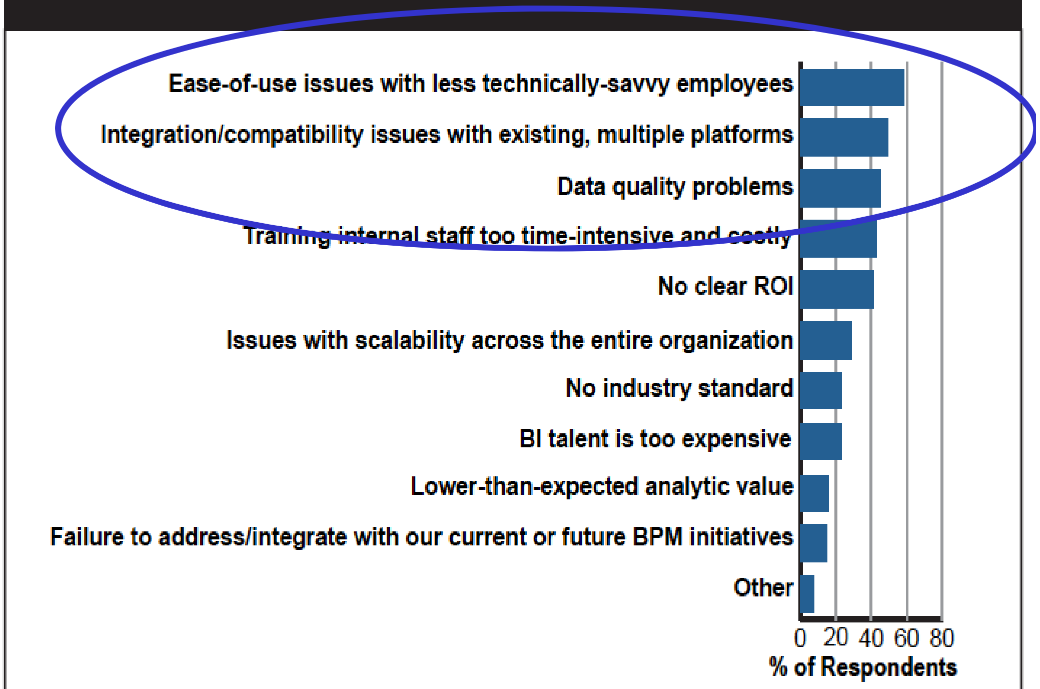
“Is everyone using BI who should be using BI?”



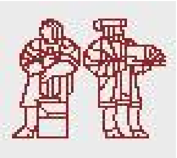
Source: Gartner

Deployment Challenges

What are the barriers to adopting BI tools enterprise-wide?



BI Built on Search Redefines How Organizations Access, Interact With and Exploit Business Intelligence



Drivers of Pervasive BI:

- Better business decisions with accurate, enriched data
- Increased productivity with ad-hoc, real-time performance
- Increased adoption with easy and intuitive access to intelligence

ease of use

democratize information

perform deeper analytics

currently just a handful of power users

high quality data

real-time information

break down silos

timely cross-enterprise information

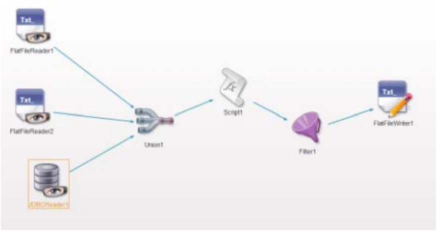
integrate structured and unstructured data

speed-up decision making

suppress noise in data

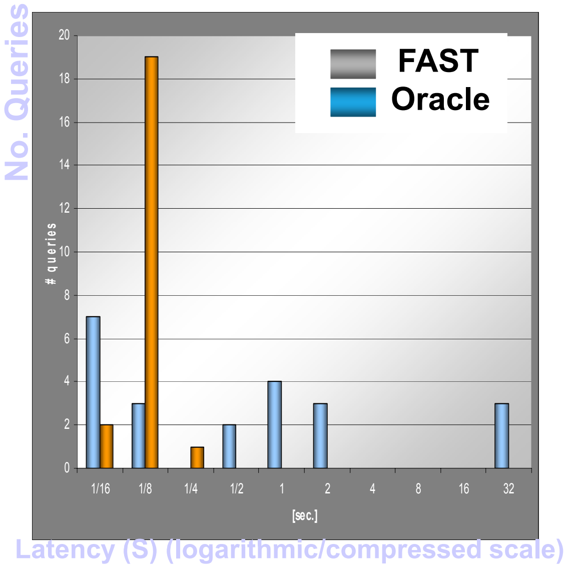
BI Built on Search Redefines How Organizations Access, Interact with and Exploit Information

1.



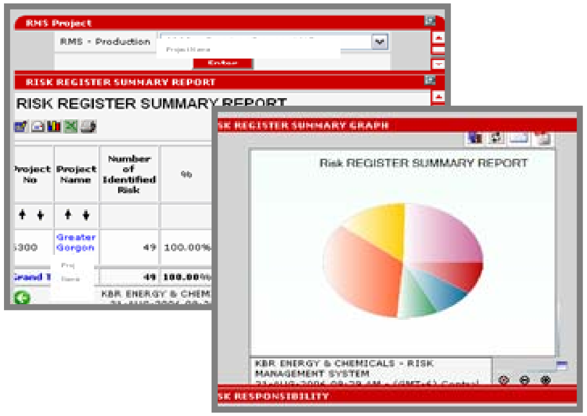
Better Business decisions with accurate data

2.



Increased productivity with ad-hoc, real-time performance

3.



RMS Project

RMS - Production

RISK REGISTER SUMMARY REPORT

RISK REGISTER SUMMARY REPORT

roject No	Project Name	Number of Identified Risk	%
300	Greater Gorgon	49	100.00%
Grand T		49	100.00%

KBR ENERGY & CHEM

SK REGISTER SUMMARY GRAPH

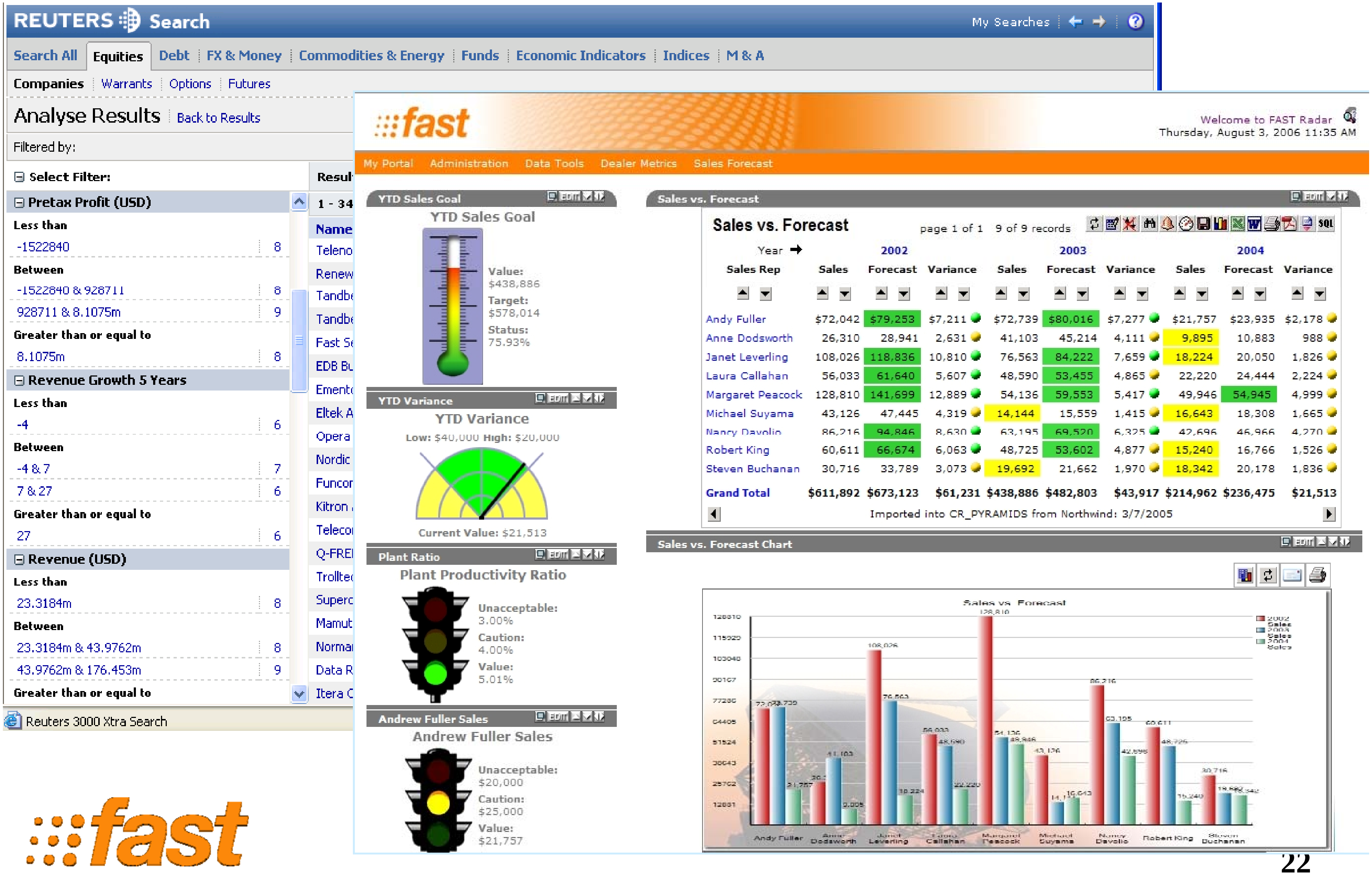
Risk REGISTER SUMMARY REPORT

KBR ENERGY & CHEMICALS - RISK MANAGEMENT SYSTEM

SK RESPONSIBILITY

Increased Adoption with easy and intuitive access to intelligence

Analytical Portals built on Search



REUTERS Search

My Searches
Search All | Equities | Debt | FX & Money | Commodities & Energy | Funds | Economic Indicators | Indices | M & A
Companies | Warrants | Options | Futures

Analyse Results | Back to Results

Filtered by:

⊟ Select Filter:

⊟ Pretax Profit (USD)

Less than	
-1522840	8
Between	
-1522840 & 928711	8
928711 & 8.1075m	9
Greater than or equal to	
8.1075m	8

⊟ Revenue Growth 5 Years

Less than	
-4	6
Between	
-4 & 7	7
7 & 27	6
Greater than or equal to	
27	6

⊟ Revenue (USD)

Less than	
23.3184m	8
Between	
23.3184m & 43.9762m	8
43.9762m & 176.453m	9
Greater than or equal to	

Resul

1 - 34

Name
Teleno
Renew
Tandbe
Tandbe
Fast Se
EDB Bu
Ement
Eltek A
Opera
Nordic
Funcor
Kitron .
Telecor
Q-FREI
Trollte
Superc
Mamut
Norma
Data R
Itera C

Reuters 3000 Xtra Search

:::fast

Welcome to FAST Radar

Thursday, August 3, 2006 11:35 AM

YTD Sales Goal

Value: $438,886

Target: $578,014

Status: 75.93%

YTD Variance

Low: $40,000 High: $20,000

Current Value: $21,513

Plant Ratio

Plant Productivity Ratio

Unacceptable: 3.00%

Caution: 4.00%

Value: 5.01%

Andrew Fuller Sales

Unacceptable: $20,000

Caution: $25,000

Value: $21,757

Sales vs. Forecast

page 1 of 1 9 of 9 records

Year →	2002			2003			2004		
Sales Rep	Sales	Forecast	Variance	Sales	Forecast	Variance	Sales	Forecast	Variance
Andy Fuller	$72,042	$79,253	$7,211 ●	$72,739	$80,016	$7,277 ●	$21,757	$23,935	$2,178 ●
Anne Dodsworth	26,310	28,941	2,631 ●	41,103	45,214	4,111 ●	9,895	10,883	988 ●
Janet Leverling	108,026	118,836	10,810 ●	76,563	84,222	7,659 ●	18,224	20,050	1,826 ●
Laura Callahan	56,033	61,640	5,607 ●	48,590	53,455	4,865 ●	22,220	24,444	2,224 ●
Margaret Peacock	128,810	141,699	12,889 ●	54,136	59,553	5,417 ●	49,946	54,945	4,999 ●
Michael Suyama	43,126	47,445	4,319 ●	14,144	15,559	1,415 ●	16,643	18,308	1,665 ●
Nancy Davolio	86,216	94,846	8,630 ●	63,195	69,520	6,325 ●	42,696	46,966	4,270 ●
Robert King	60,611	66,674	6,063 ●	48,725	53,602	4,877 ●	15,240	16,766	1,526 ●
Steven Buchanan	30,716	33,789	3,073 ●	19,692	21,662	1,970 ●	18,342	20,178	1,836 ●
Grand Total	**$611,892**	**$673,123**	**$61,231**	**$438,886**	**$482,803**	**$43,917**	**$214,962**	**$236,475**	**$21,513**

Imported into CR_PYRAMIDS from Northwind: 3/7/2005

Sales vs. Forecast Chart

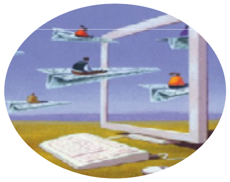
:::fast

FAST Vision For Pervasive Business Intelligence

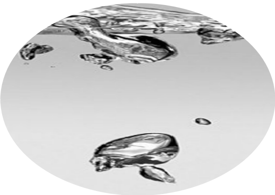
Ad-hoc, FAST access

VVV^{n} LDB

Exabyte scale information management
Structured/Semi-structured/Unstructured



EASY analytics



Data Improvement
“Content Capture and Refinement”

Connections across information
“Semantic Integration”

Real Time information

Thank you!

::fast

find the real value of search

Jeff Fried
VP Advanced Solutions
Jeff.Fried@fastsearch.com