Solutions… from the Data Up

Presented by

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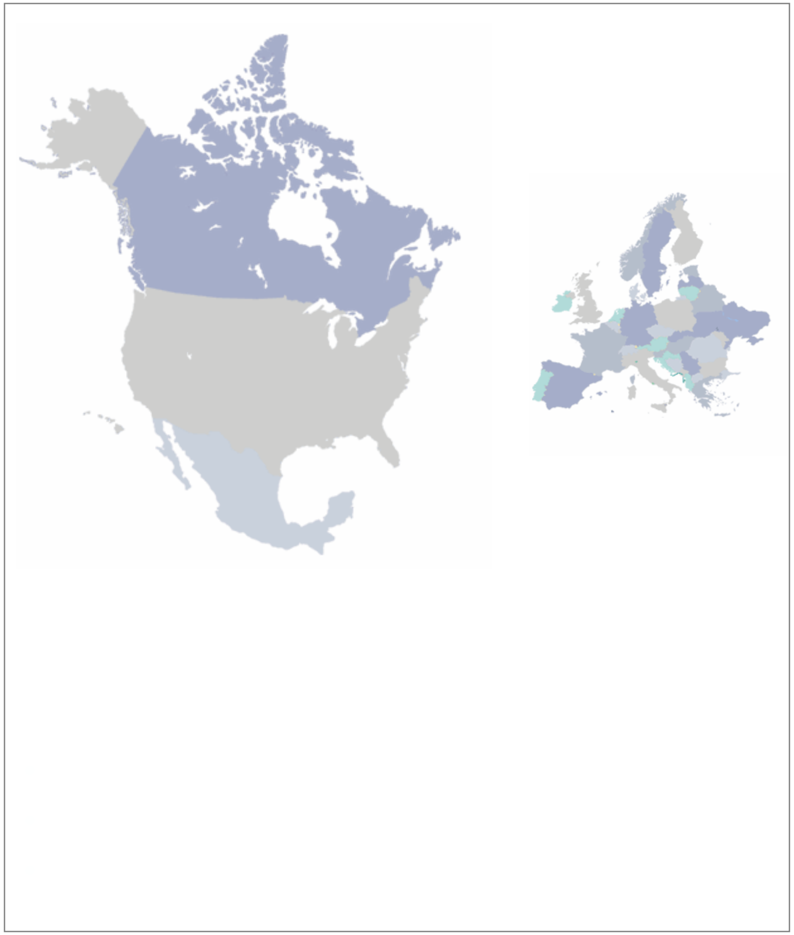
Agenda

- About Qbase
- Solutions… from the Data Up
- Data Strategy
- Data, Information and BI
- Data Challenges
- Profiling Data
- Rapid Data Analysis
- Summary

About Qbase

- Technology and leadership team from LexisNexis, Lockheed Martin, Cox Publishing, and national premier nonprofits
- We serve nonprofit organizations, state and federal government agencies, US military, higher education institutions, healthcare facilities and provide direct marketing solutions.
- Markets built around industry expertise



"…it was estimated that poor quality customer data costs U.S. businesses a staggering $611 billion a year in postage, printing, and staff overhead."

The Data Warehousing Institute's (TDWI) 2002 Data Quality and The Bottom Line Report

"Clean data is the key to focused campaigns and will prevent you from spending money on dead-end leads. Unfortunately, only 61% of companies believe their data is accurate enough for decision-making, and 27% agree that the information they need isn't there."

The Direct Marketing Association's 2005 Annual Report

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Solutions… from the Data Up

- Data/information have a critical role in business
- Data usually gets the least focus in an enterprise
- Data challenges can make it very difficult to leverage significant investments in infrastructure and operations
- Planning for data quality and data’s role in operations can help avoid pitfalls
- Building solutions “from the data up” ensures appropriate focus on data’s role

Enterprise data collections are numerous and diverse

- Customer database
- Transactions (e.g., sales)
- Accounting systems
- Personnel
- Regulatory (e.g., audit trails)
- And many more…

- Data is often in “stovepiped” systems
- Data integration amplifies data value

Data Strategy

- Data collections in enterprises are built over time, and rarely are they organized holistically
- It makes sense to approach enterprise data *strategically:*
  - Consider future information needs
  - Engineer data solutions to solve specific needs
  - Keep an eye on extensibility
- Develop a data governance strategy
  - Determine how and when data interacts
  - Ensure data sources can be integrated
- Data governance is a must for Business Intelligence

- High level data mining process:

✓ Define what is to be mined… the goal.
✓ Decide on appropriate modeling type, if necessary
✓ Analyze and prepare data sources
✓ Conduct data mining
✓ Interpret results
✓ Take action

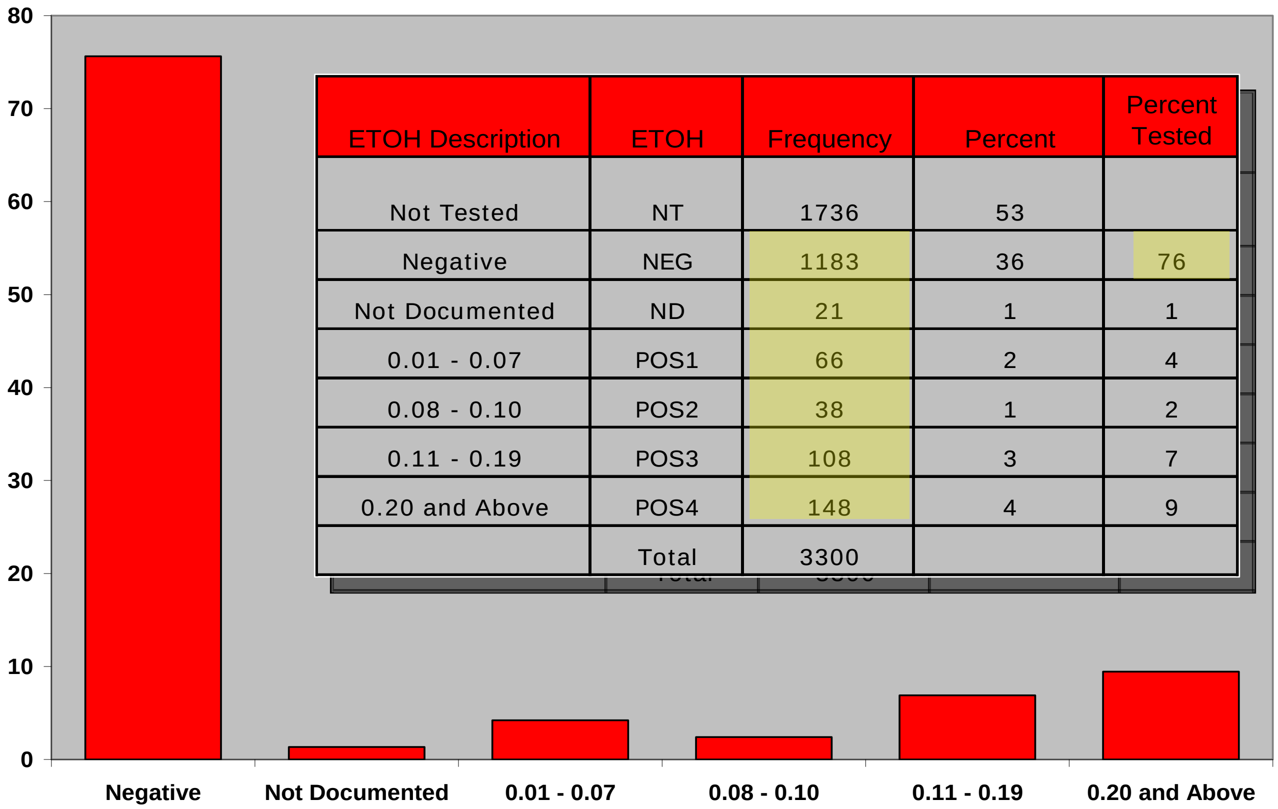
- Data quality is critical!

- Enterprises that deploy data mining without first understanding their data run the risk of being seriously misguided

Data Challenges

- **Impact of poorly captured data**
- From a study of events captured in a trauma registry

Conclusion: 76% tested negative for ETOH



ETOH Description	ETOH	Frequency	Percent	Percent Tested
Not Tested	NT	1736	53	
Negative	NEG	1183	36	76
Not Documented	ND	21	1	1
0.01 - 0.07	POS1	66	2	4
0.08 - 0.10	POS2	38	1	2
0.11 - 0.19	POS3	108	3	7
0.20 and Above	POS4	148	4	9
	Total	3300		

Data Challenges

Data was an issue

- There were *actually* 3,818 cases (not 3,300)
  - 518 cases had incorrectly recorded ETOH value
  - ETOH should be 1 of 7 values, instead found 135 values

20 MOST FREQUENT VALUES (ALL VALUES)				
135 UNIQUE VALUES				
NUMBER	VALUE	COUNT	% COUNT	CUMULATIVE % COUNT
1	NT	1,736	45.47%	45.47%
2	NEG	1,183	30.98%	76.45%
3	[empty]	348	9.11%	85.57%
4	POS4	148	3.88%	89.44%
5	POS3	108	2.83%	92.27%
6	POS1	66	1.73%	94.00%
7	POS2	38	1.00%	95.00%
8	ND	21	0.55%	95.55%
9	NT#POS1#NEG#RNA#ND#NT#POS1#POS2#POS3#POS4#RNA	7	0.18%	95.73%
10	24	4	0.10%	95.84%
11	RNA	4	0.10%	95.94%
12	224	3	0.08%	96.02%
13	175	3	0.08%	96.10%
14	67	3	0.08%	96.18%
15	Y#NEG#RNA###NT##ND#NT#POS1#POS2#POS3#POS4	3	0.08%	96.25%
16	204	3	0.08%	96.33%
17	130	2	0.05%	96.39%
18	397	2	0.05%	96.44%
19	215	2	0.05%	96.49%
20	167	2	0.05%	96.54%

Impact: Instead of 76% being negative, it is actually **57%**

(Excludes not-tested, includes incorrect cases)

Data Challenges

- Impact of disconnected systems/stores
- Frequency of occurrence of patient safety adverse events

NUMBER	VALUE	COUNT	% COUNT	CUMULATIVE%
1	Emergency	461,009	57.74%	57.74%
2	Service Delays	136,325	17.08%	74.82%
3	Medical	34,909	4.37%	79.19%
4	Surgical	27,823	3.48%	82.68%
5	Maternal	27,723	3.47%	86.15%
6	Medication Errors	22,962	2.88%	89.02%
7	Laboratory	17,347	2.17%	91.20%
8	Service Feedback	15,466	1.94%	93.13%
9	Patient Falls	12,875	1.61%	94.75%
10	Device Complications	7,805	0.98%	95.72%
11	Nosocomial Infections	7,571	0.95%	96.67%
12	Env Safety / Security	6,586	0.82%	97.50%
13				
14				
15				
16				
17				
18				
19				
20				

- Problem: Cost data not captured or connected to adverse events in information system
- Result: Unable to prioritize actions to achieve best cost/benefit

Profiling Data Sources

- Data profiles - establish a *baseline* for data sources
  - Completeness
    - Missing records?
    - Missing fields?
  - Timeliness
    - Is the data current?
    - What is the update nature of the data?
  - Pedigree
    - Is this data *the* master source?
    - What data sources contribute to this?

Profiling Data Sources

- Data profiles - establish a *baseline* for data sources
  - Field characteristics
    - Type (string, integer, etc.)
    - Semantic type (date, dollar amount, etc.)
    - Population
    - Shape/distribution
    - High & low values
    - Minimum and maximum length
    - Conformity (normalized, standardized)
    - Composite or *atomic* field?

Profiling Data Sources

- Data profiles - establish a *baseline* for data sources
  - Integrity
    - Are there duplicate records?
    - Is this a redundant store?
  - Modifications/Permissions
    - Who can change the data?
    - Are there access restrictions?
  - Storage
    - Where is the data kept?
    - What sort of file structure?

Profiling Data Sources

- Data profiles - establish baseline for data sources
  - Bonus analysis:
    - From an enterprise perspective, document how each data source is linkable to others
    - Determine which fields can serve as foreign keys and ensure their integrity
    - Force linkability among sources, or recognize that isolated sources exist

- *Data baselines are necessary for successful ETL and support effective BI*

Summary

- Data quality issues are costly, prevalent and becoming more intense
- Establish a data governance policy – enterprise-wide if possible
- Plan ahead to avoid discovering data issues after significant investment has already been made
- Baseline data sources and keep baselines current; know your data

- Building business solutions “from the data up” ensures appropriate focus on data quality

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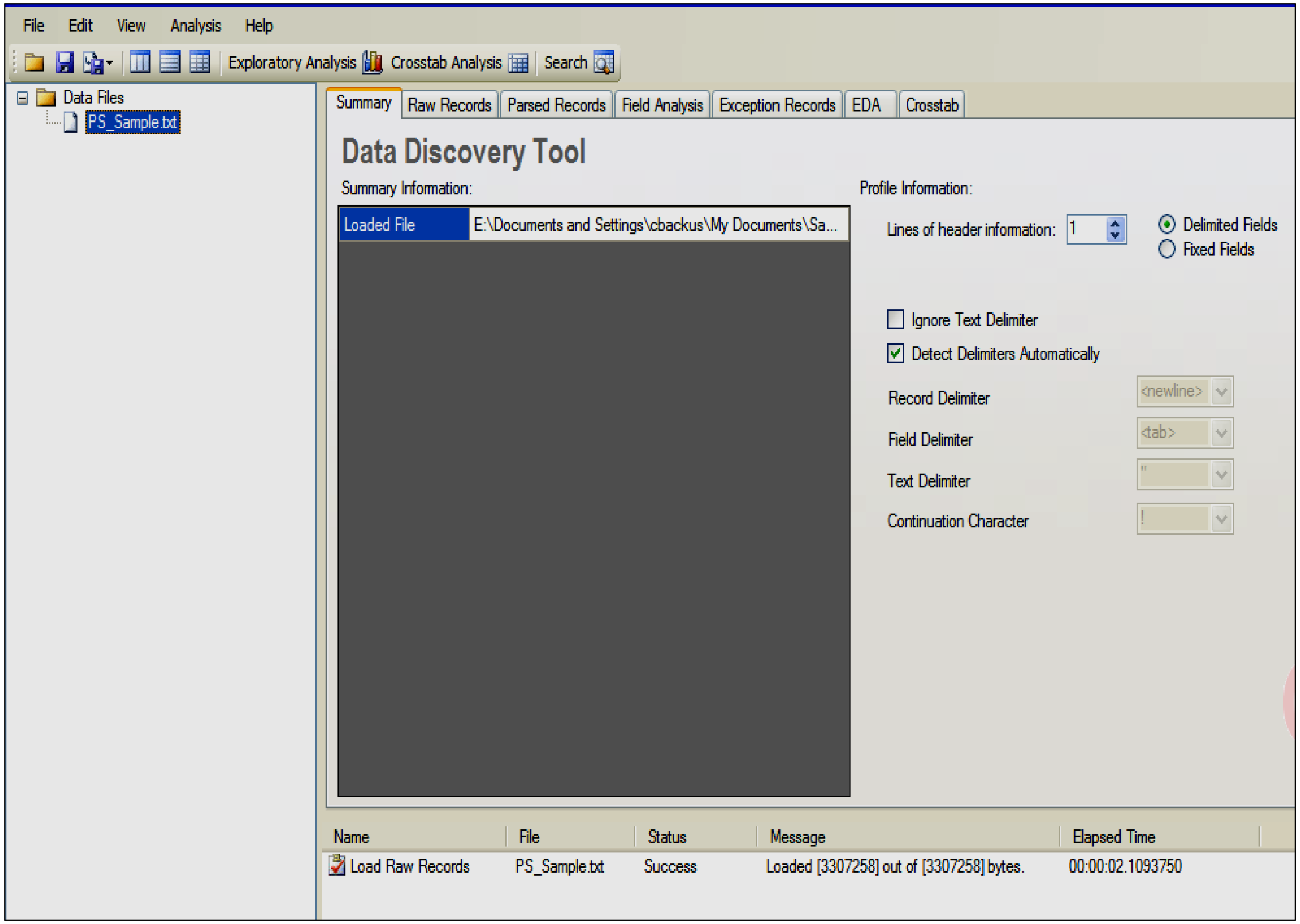
Rapid Data Analysis

- Data analysis can be achieved quickly and inexpensively
- Qbase uses proprietary Data Discovery Tool (DDT)
- A quick tour…



Data Discovery Tool

Summary Information:

Loaded File	E:\Documents and Settings\cbackus\My Documents\Sa...

Profile Information:

Lines of header information: 1

● Delimited Fields
○ Fixed Fields

□ Ignore Text Delimiter
☑ Detect Delimiters Automatically

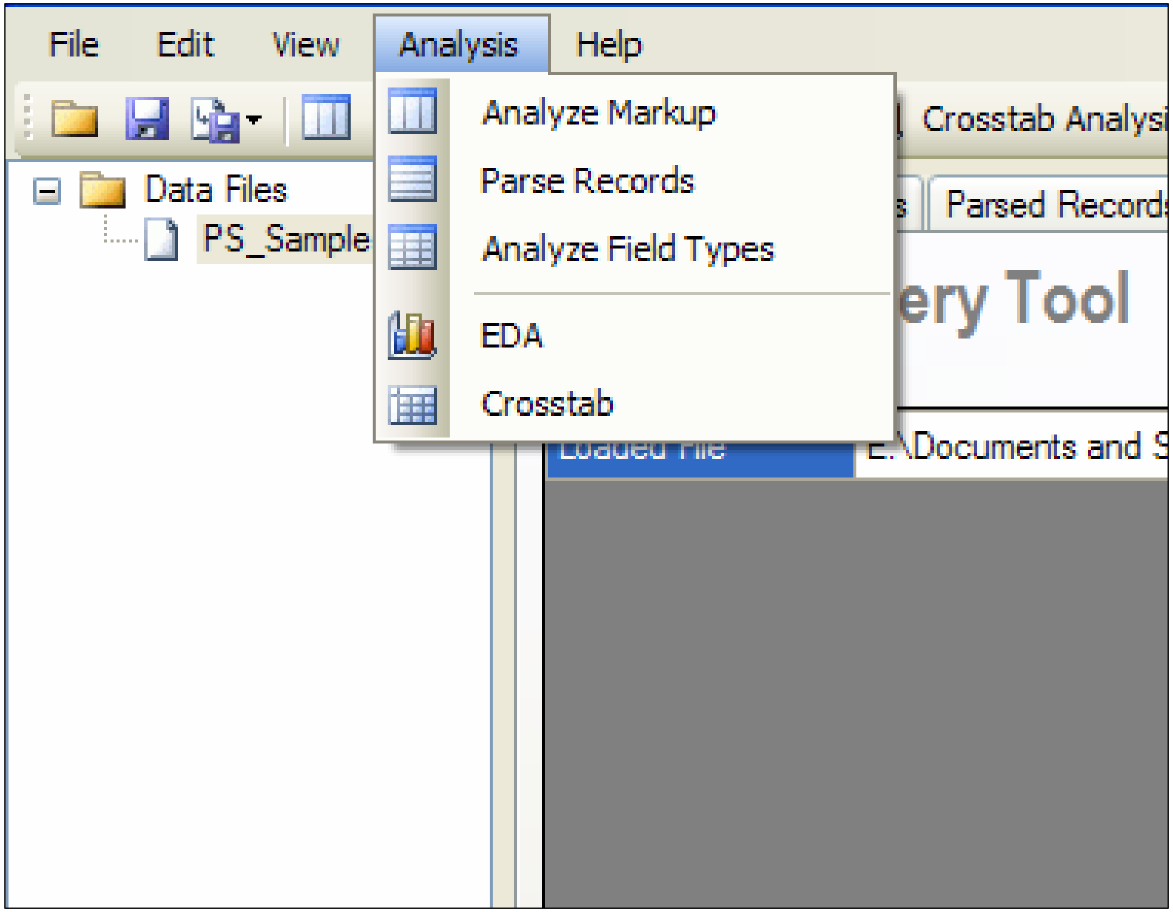
Record Delimiter	<newline>
Field Delimiter	<tab>
Text Delimiter	"
Continuation Character	!

Name	File	Status	Message	Elapsed Time
Load Raw Records	PS_Sample.txt	Success	Loaded [3307258] out of [3307258] bytes.	00:00:02.1093750

Rapid Data Analysis

Typical steps include:

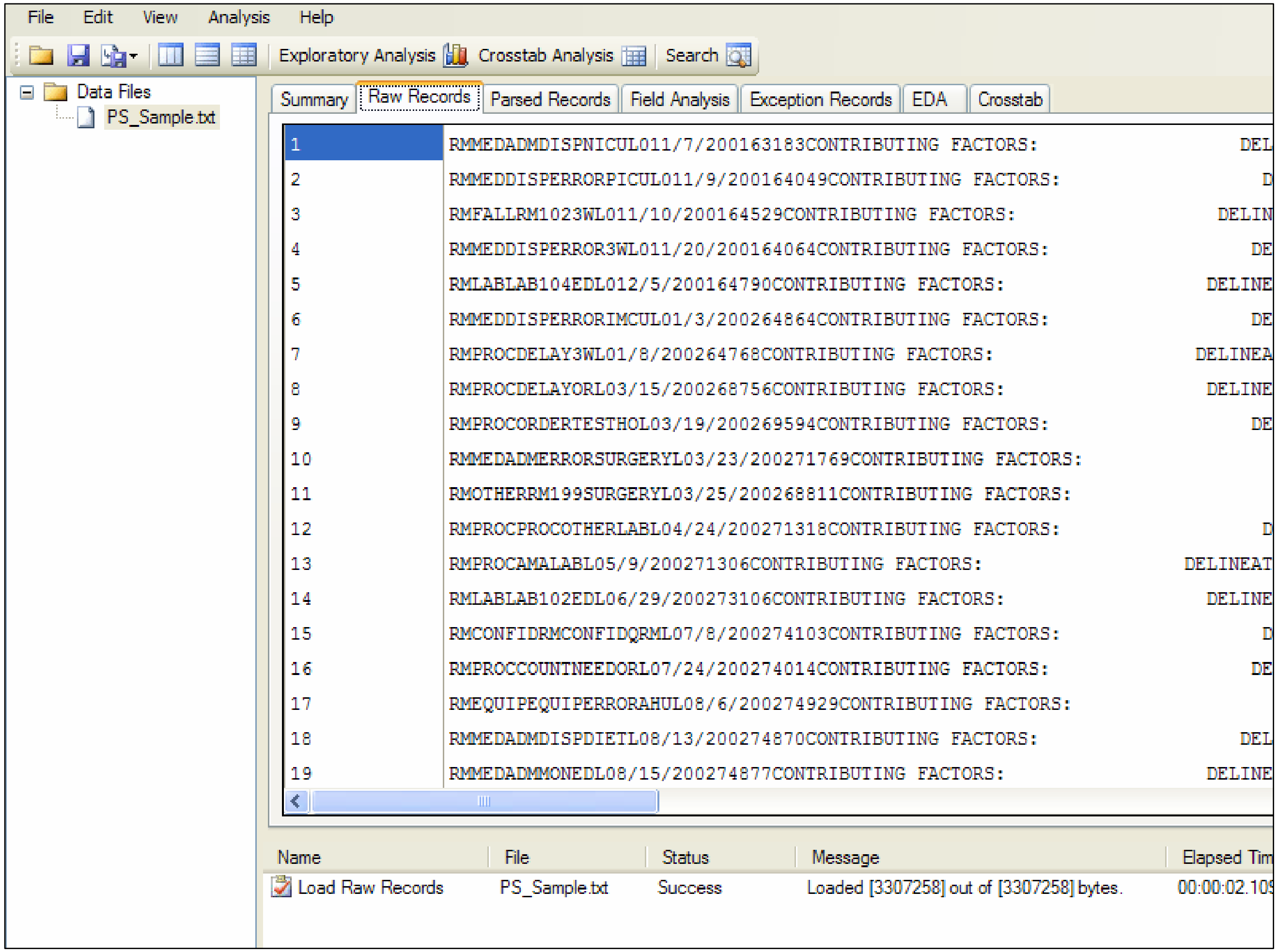
- ✓ Analyzing markup
- ✓ Parsing records
- ✓ Analyzing field types
- ✓ Exploratory analysis



Rapid Data Analysis

Open data file

- ✓ point to file
- ✓ DDT shows *raw data*
- ✓ see every row and column
- ✓ not much fun to look at raw data



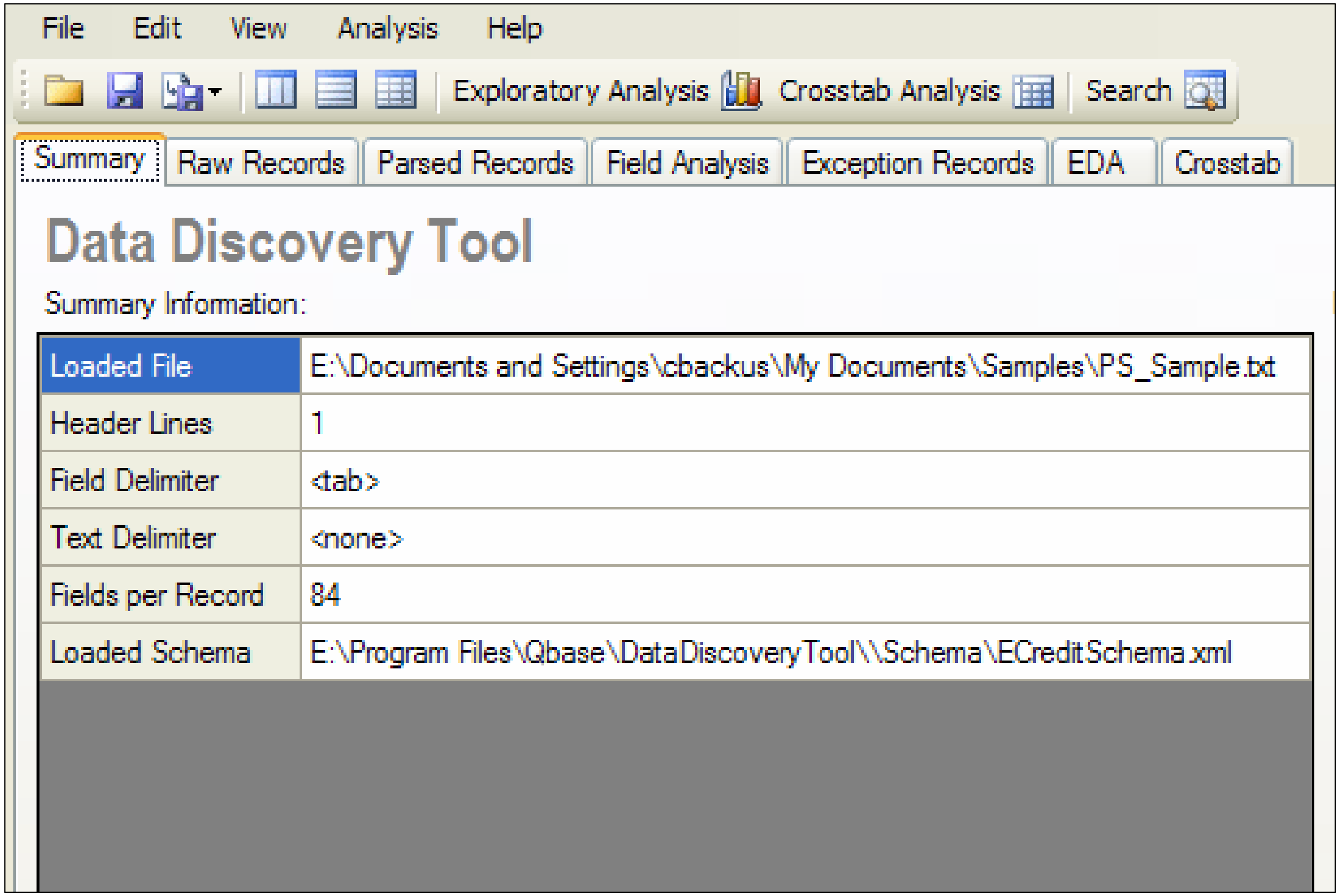
1	RMMEDADMDISPNICUL011/7/200163183CONTRIBUTING FACTORS: DEL
2	RMMEDDISPERRORPICUL011/9/200164049CONTRIBUTING FACTORS: D
3	RMFALLRM1023WL011/10/200164529CONTRIBUTING FACTORS: DELIN
4	RMMEDDISPERROR3WL011/20/200164064CONTRIBUTING FACTORS: DE
5	RMLABLAB104EDL012/5/200164790CONTRIBUTING FACTORS: DELINE
6	RMMEDDISPERRORIMCUL01/3/200264864CONTRIBUTING FACTORS: DE
7	RMPROCDELAY3WL01/8/200264768CONTRIBUTING FACTORS: DELINEA
8	RMPROCDELAYORL03/15/200268756CONTRIBUTING FACTORS: DELINE
9	RMPROCORDERTESTHOL03/19/200269594CONTRIBUTING FACTORS: DE
10	RMMEDADMERRORSURGERYL03/23/200271769CONTRIBUTING FACTORS:
11	RMOTHERRM199SURGERYL03/25/200268811CONTRIBUTING FACTORS:
12	RMPROCPROCOTHERLABL04/24/200271318CONTRIBUTING FACTORS: D
13	RMPROCAMALABL05/9/200271306CONTRIBUTING FACTORS: DELINEAT
14	RMLABLAB102EDL06/29/200273106CONTRIBUTING FACTORS: DELINE
15	RMCONFIDRMCONFIDQRML07/8/200274103CONTRIBUTING FACTORS: D
16	RMPROCCOUNTNEEDORL07/24/200274014CONTRIBUTING FACTORS: DE
17	RMEQUIPEQUIPERRORAHUL08/6/200274929CONTRIBUTING FACTORS:
18	RMMEDADMDISPDIETL08/13/200274870CONTRIBUTING FACTORS: DEL
19	RMMEDADMMONEDL08/15/200274877CONTRIBUTING FACTORS: DELINE

Name	File	Status	Message	Elapsed Tim
Load Raw Records	PS_Sample.txt	Success	Loaded [3307258] out of [3307258] bytes.	00:00:02.10

Rapid Data Analysis

Analyzing markup

- ✓ detect file structure
- ✓ use layout for fixed-field
- ✓ list number of fields per record



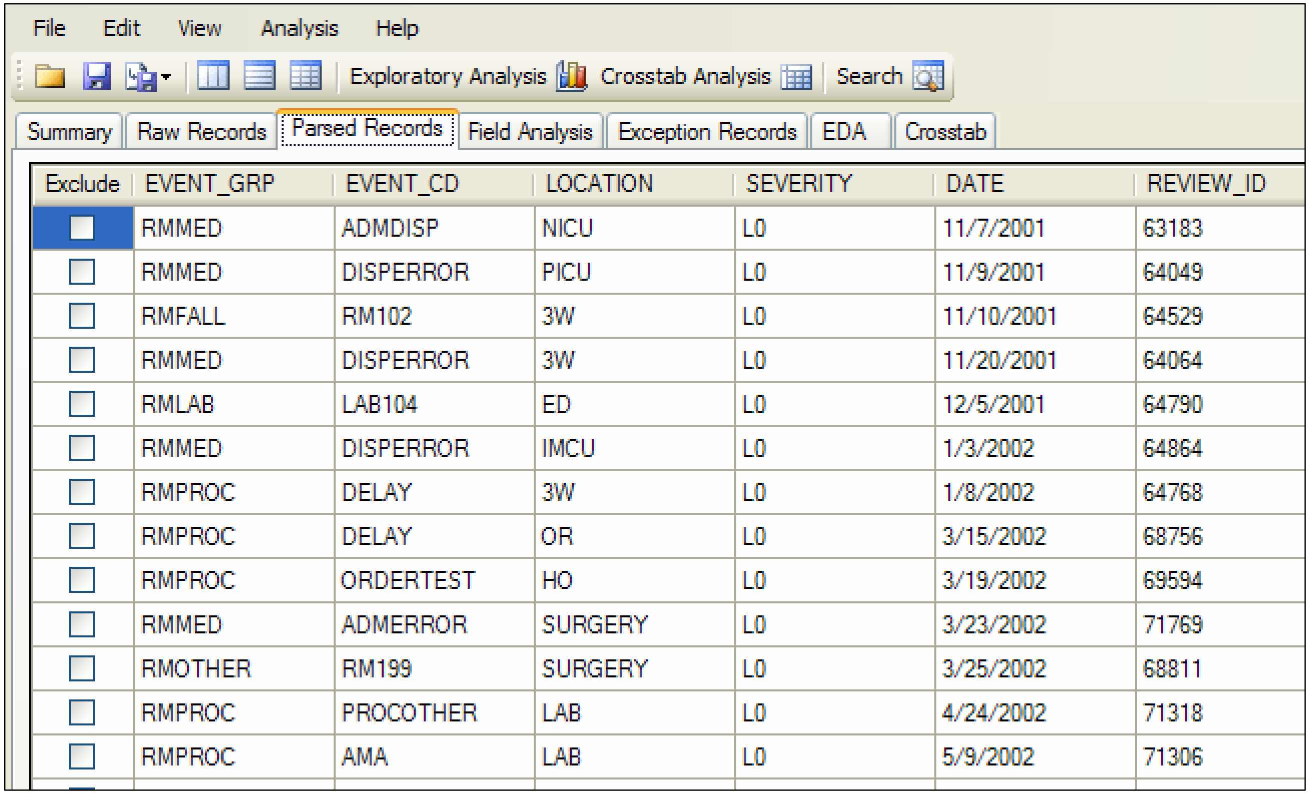
Data Discovery Tool

Summary Information:

Loaded File	E:\Documents and Settings\cbackus\My Documents\Samples\PS_Sample.txt
Header Lines	1
Field Delimiter	<tab>
Text Delimiter	<none>
Fields per Record	84
Loaded Schema	E:\Program Files\Qbase\DataDiscoveryTool\\Schema\ECreditSchema.xml

Parse Records

- ✓ use header if provided
- ✓ organize data for easy browse
- ✓ all columns and rows
- ✓ sortable columns



Exclude	EVENT_GRP	EVENT_CD	LOCATION	SEVERITY	DATE	REVIEW_ID
□	RMMED	ADMDISP	NICU	L0	11/7/2001	63183
□	RMMED	DISPERROR	PICU	L0	11/9/2001	64049
□	RMFALL	RM102	3W	L0	11/10/2001	64529
□	RMMED	DISPERROR	3W	L0	11/20/2001	64064
□	RMLAB	LAB104	ED	L0	12/5/2001	64790
□	RMMED	DISPERROR	IMCU	L0	1/3/2002	64864
□	RMPROC	DELAY	3W	L0	1/8/2002	64768
□	RMPROC	DELAY	OR	L0	3/15/2002	68756
□	RMPROC	ORDERTEST	HO	L0	3/19/2002	69594
□	RMMED	ADMERROR	SURGERY	L0	3/23/2002	71769
□	RMOTHER	RM199	SURGERY	L0	3/25/2002	68811
□	RMPROC	PROCOTHER	LAB	L0	4/24/2002	71318
□	RMPROC	AMA	LAB	L0	5/9/2002	71306

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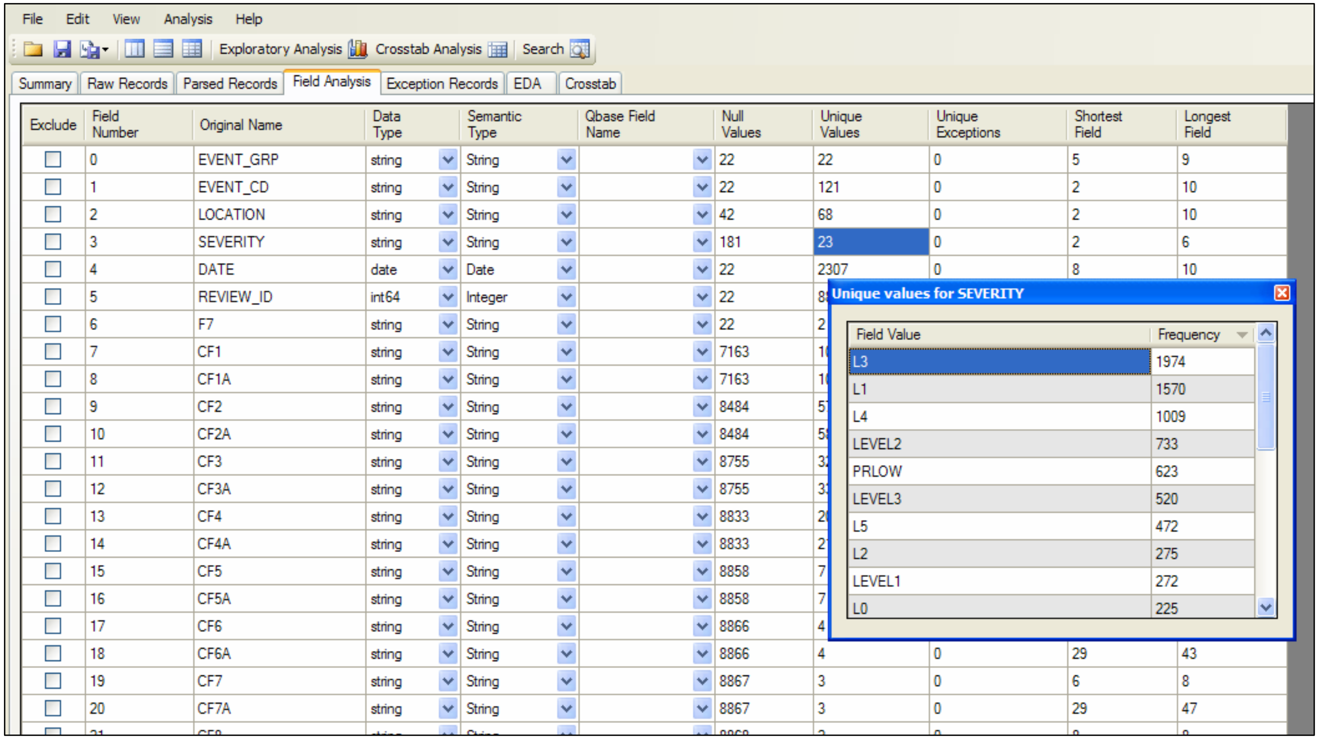
Rapid Data Analysis

Analyze Fields

- ✓ detect types
- ✓ count nulls
- ✓ count unique values
- ✓ count exceptions
- ✓ min, max field length
- ✓ sortable columns



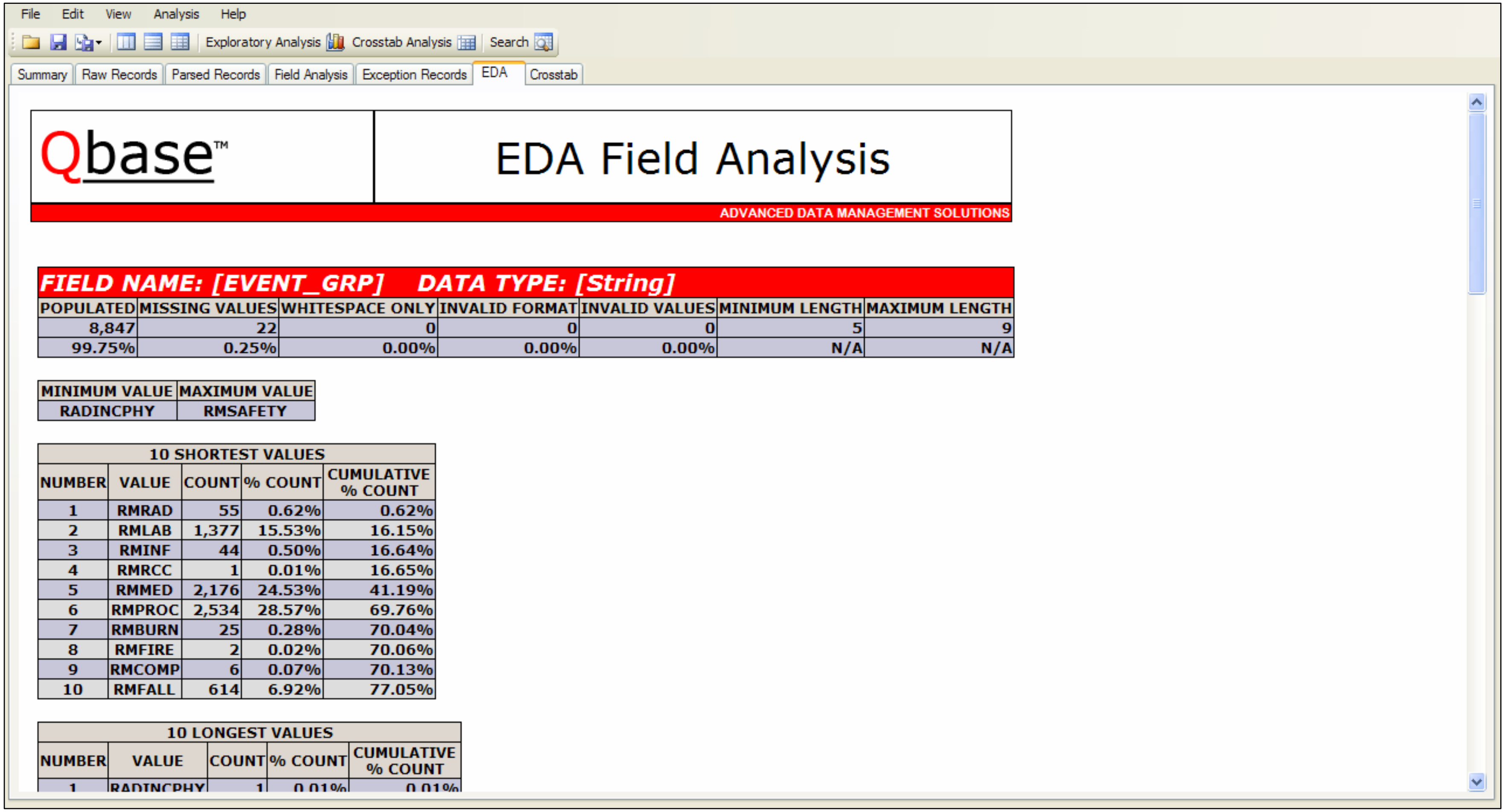
Exclude	Field Number	Original Name	Data Type	Semantic Type	Qbase Field Name	Null Values	Unique Values	Unique Exceptions	Shortest Field	Longest Field
☐	0	EVENT_GRP	string	String		22	22	0	5	9
☐	1	EVENT_CD	string	String		22	121	0	2	10
☐	2	LOCATION	string	String		42	68	0	2	10
☐	3	SEVERITY	string	String		181	23	0	2	6
☐	4	DATE	date	Date		22	2307	0	8	10
☐	5	REVIEW_ID	int64	Integer		22	8			
☐	6	F7	string	String		22	2			
☐	7	CF1	string	String		7163	1			
☐	8	CF1A	string	String		7163	1			
☐	9	CF2	string	String		8484	5			
☐	10	CF2A	string	String		8484	5			
☐	11	CF3	string	String		8755	3			
☐	12	CF3A	string	String		8755	3			
☐	13	CF4	string	String		8833	2			
☐	14	CF4A	string	String		8833	2			
☐	15	CF5	string	String		8858	7			
☐	16	CF5A	string	String		8858	7			
☐	17	CF6	string	String		8866	4			
☐	18	CF6A	string	String		8866	4	0	29	43
☐	19	CF7	string	String		8867	3	0	6	8
☐	20	CF7A	string	String		8867	3	0	29	47
☐	21	CF8	string	String		8868	3	0	8	8

Unique values for SEVERITY

Field Value	Frequency
L3	1974
L1	1570
L4	1009
LEVEL2	733
PRLOW	623
LEVEL3	520
L5	472
L2	275
LEVEL1	272
L0	225

Thank You

Exploratory Data Analysis



EDA Field Analysis

FIELD NAME: [EVENT_GRP]   DATA TYPE: [String]

POPULATED	MISSING VALUES	WHITESPACE ONLY	INVALID FORMAT	INVALID VALUES	MINIMUM LENGTH	MAXIMUM LENGTH
8,847	22	0	0	0	5	9
99.75%	0.25%	0.00%	0.00%	0.00%	N/A	N/A

MINIMUM VALUE	MAXIMUM VALUE
RADINCPHY	RMSAFETY

10 SHORTEST VALUES

NUMBER	VALUE	COUNT	% COUNT	CUMULATIVE % COUNT
1	RMRAD	55	0.62%	0.62%
2	RMLAB	1,377	15.53%	16.15%
3	RMINF	44	0.50%	16.64%
4	RMRCC	1	0.01%	16.65%
5	RMMED	2,176	24.53%	41.19%
6	RMPROC	2,534	28.57%	69.76%
7	RMBURN	25	0.28%	70.04%
8	RMFIRE	2	0.02%	70.06%
9	RMCOMP	6	0.07%	70.13%
10	RMFALL	614	6.92%	77.05%

10 LONGEST VALUES

NUMBER	VALUE	COUNT	% COUNT	CUMULATIVE % COUNT
1	RADINCPHY	1	0.01%	0.01%

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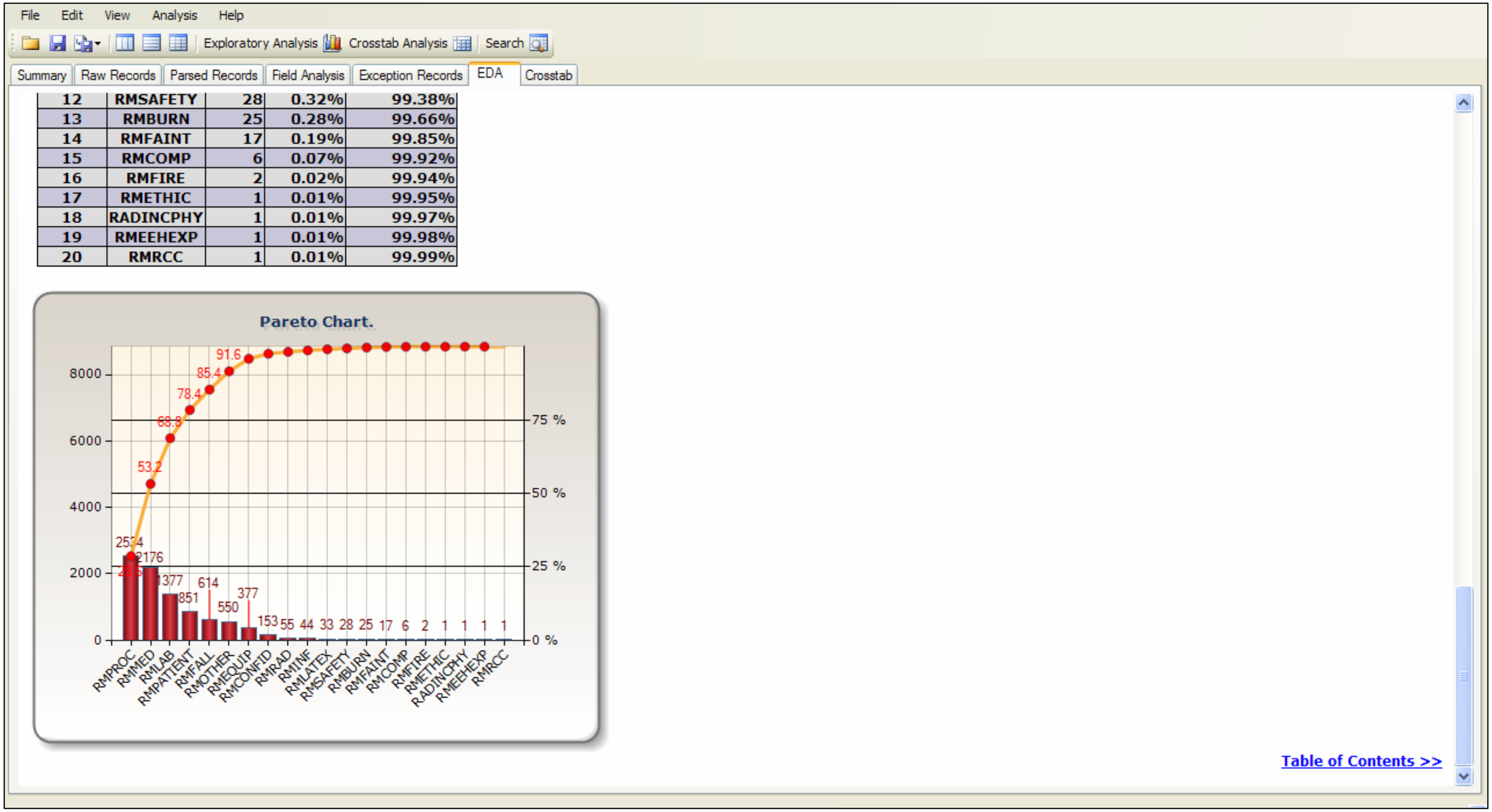
Exploratory Data Analysis



12	RMSAFETY	28	0.32%	99.38%
13	RMBURN	25	0.28%	99.66%
14	RMFAINT	17	0.19%	99.85%
15	RMCOMP	6	0.07%	99.92%
16	RMFIRE	2	0.02%	99.94%
17	RMETHIC	1	0.01%	99.95%
18	RADINCPHY	1	0.01%	99.97%
19	RMEEHEXP	1	0.01%	99.98%
20	RMRCC	1	0.01%	99.99%

Table of Contents >>

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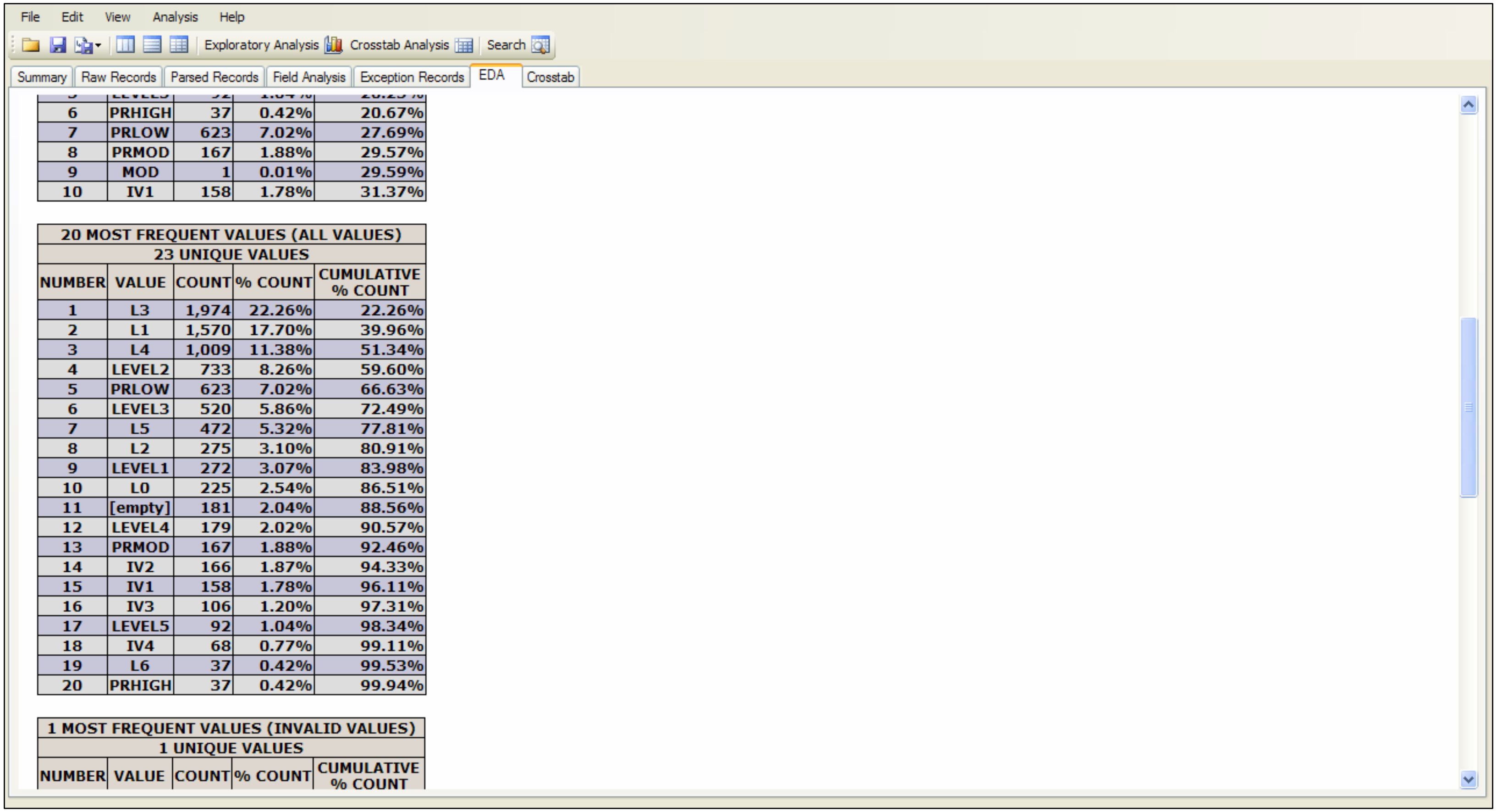
Exploratory Data Analysis



5	LEVEL5	92	1.04%	20.25%
6	PRHIGH	37	0.42%	20.67%
7	PRLOW	623	7.02%	27.69%
8	PRMOD	167	1.88%	29.57%
9	MOD	1	0.01%	29.59%
10	IV1	158	1.78%	31.37%

20 MOST FREQUENT VALUES (ALL VALUES)

23 UNIQUE VALUES

NUMBER	VALUE	COUNT	% COUNT	CUMULATIVE % COUNT
1	L3	1,974	22.26%	22.26%
2	L1	1,570	17.70%	39.96%
3	L4	1,009	11.38%	51.34%
4	LEVEL2	733	8.26%	59.60%
5	PRLOW	623	7.02%	66.63%
6	LEVEL3	520	5.86%	72.49%
7	L5	472	5.32%	77.81%
8	L2	275	3.10%	80.91%
9	LEVEL1	272	3.07%	83.98%
10	L0	225	2.54%	86.51%
11	[empty]	181	2.04%	88.56%
12	LEVEL4	179	2.02%	90.57%
13	PRMOD	167	1.88%	92.46%
14	IV2	166	1.87%	94.33%
15	IV1	158	1.78%	96.11%
16	IV3	106	1.20%	97.31%
17	LEVEL5	92	1.04%	98.34%
18	IV4	68	0.77%	99.11%
19	L6	37	0.42%	99.53%
20	PRHIGH	37	0.42%	99.94%

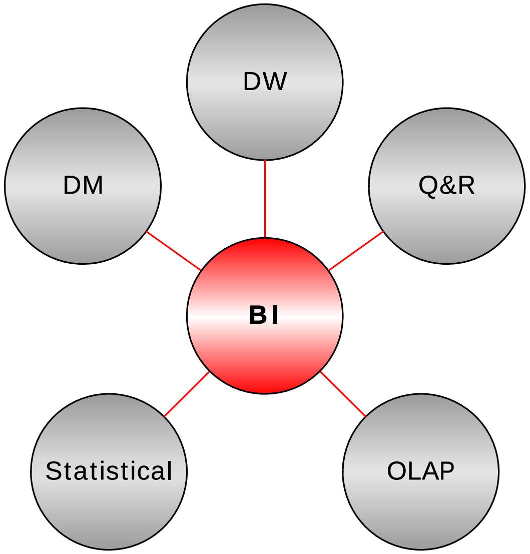
1 MOST FREQUENT VALUES (INVALID VALUES)

1 UNIQUE VALUES

NUMBER	VALUE	COUNT	% COUNT	CUMULATIVE % COUNT

Data, Information and BI

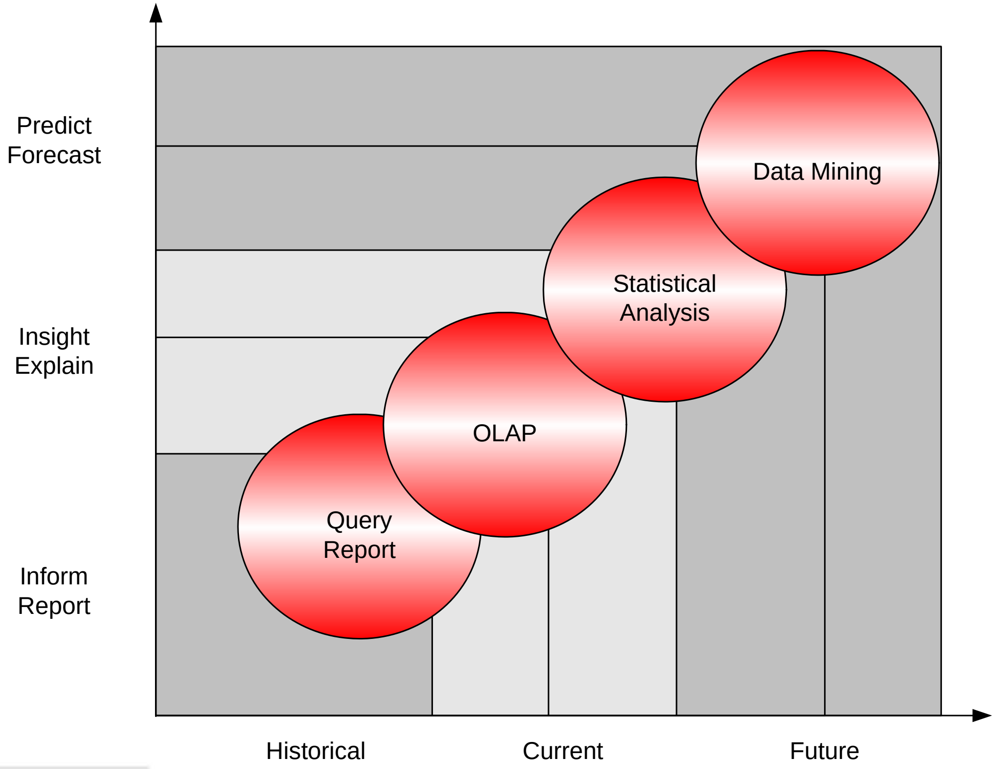
- Data is a key, critical asset of an enterprise
- Careful planning drives creation of *strategic information assets…* (think this way!)
- Business Intelligence (BI) - drawing full value from strategic information assets



The BI Umbrella
(DW) Data Warehousing
(DM) Data Mining (DM)
(Q&R) Query and Reporting
(OLAP) On-Line Analytics Processing
Statistical Analysis

Data, Information and BI

- BI provides the complete temporal spectrum: from historical to future perspective



BI useful for:

•Informing and reporting

•Explaining and insight

•Forecasting and predicting