

## Contents

<b>1</b>	<b>Getting Started</b>	<b>15</b>
1.1	The First Steps	15
1.1.1	Download and Install Firebird	15
1.1.2	Download and Install InterBase®	36
1.1.3	Download and Install IBExpert	39
1.1.4	Registering a database (using the EMPLOYEE example)	41
1.1.5	Working with a database	44
1.2	What is IBExpert?	45
1.3	IBExpert License	48
1.3.1	IBExpert Personal Edition	49
1.4	How to register IBExpert	50
1.5	IBExpert Screen	50
1.5.1	IBExpert Splash Screen	51
1.5.2	(1) Title Bar	52
1.5.3	(2) Menu	52
1.5.4	(3) Toolbars	53
1.5.5	(4) DB Explorer	68
1.5.6	(5) SQL Assistant	76
1.5.7	(6) Windows Bar	78
1.5.8	(7) Status Bar	79
1.5.9	Exit	79
<b>2</b>	<b>Database</b>	<b>81</b>
2.1	Database Design	82
2.1.1	Database Normalization	82
2.2	Inside InterBase/Firebird	85
2.2.1	Space management in InterBase	85
2.3	Database Registration Info	88
2.4	Register Database	89
2.4.1	General	90
2.4.2	Additional	92
2.4.3	Log Files	95
2.4.4	Backup/Restore	98
2.4.5	Default paths	102
2.4.6	Explorer Filters	103
2.4.7	Scripts	103
2.5	Unregister Database	104
2.6	Connect to an existing Database	104
2.6.1	Accessing a Firebird embedded database with Win1252 (or other character set)	105
2.6.2	Database login	106
2.6.3	Remote database connect using an alias	106
2.7	Reconnect to Database	108
2.8	Disconnect from a Database	108
2.9	Create Database	109
2.9.1	Charset / Default Character Set	111
2.9.2	Page Size	112
2.9.3	Structure of a data page	114
2.9.4	SQL Dialect	118
2.10	Drop Database/Delete Database	118

1

2

3

4

5

6

7

8

9

10

11

12

I

II

III

IV



	2.11	Recreate Database .....	119
	2.12	Recompute selectivity of all indices .....	119
	2.13	Recompile all Stored Procedures and Triggers .....	120
	2.14	Database Security .....	120
	2.15	Database Corruption .....	120
	2.15.1	How to corrupt a database .....	121
	2.15.2	Recovering corrupt databases .....	122
<b>1</b>			
<b>2</b>			
<b>3</b>	<b>3</b>	<b>Database Objects</b>	<b>135</b>
	3.1	Domain .....	136
	3.1.1	Domain Integrity .....	137
<b>4</b>	3.1.2	New Domain / Domain Editor .....	137
	3.1.3	Alter Domain .....	140
<b>5</b>	3.1.4	Drop Domain/Delete Domain .....	140
	3.1.5	Duplicate Domain .....	141
<b>6</b>	3.2	Table .....	142
	3.2.1	Keys .....	143
<b>7</b>	3.2.2	Data .....	150
	3.2.3	Data Set .....	150
<b>8</b>	3.2.4	Column .....	151
	3.2.5	Row .....	152
<b>9</b>	3.2.6	Constraints .....	153
	3.2.7	Check Constraint .....	155
<b>10</b>	3.2.8	Index/Indices .....	156
	3.2.9	New Table .....	162
<b>11</b>	3.2.10	Table Editor .....	165
	3.2.11	Alter Table .....	184
<b>12</b>	3.2.12	Create SIUD Procedures .....	185
	3.2.13	Drop Table/Delete Table .....	185
	3.3	Field .....	186
	3.3.1	Adding New Field (Insert Field) using the Field Editor .....	186
	3.3.2	Charset / Character Set .....	189
	3.3.3	Data Type .....	193
	3.3.4	Array .....	205
	3.3.5	Boolean .....	207
	3.3.6	Autoincrement .....	207
	3.3.7	Not Null .....	207
	3.3.8	Null .....	208
	3.3.9	Alter Field .....	209
	3.3.10	Drop Field/Delete Field .....	210
<b>I</b>	3.4	View .....	211
	3.4.1	New View / View Editor .....	212
<b>II</b>	3.4.2	Alter View .....	222
	3.4.3	Drop View/Delete View .....	222
<b>III</b>	3.5	Stored Procedure .....	222
	3.5.1	New Procedure .....	225
	3.5.2	Stored Procedure Editor .....	229
	3.5.3	Executing Stored Procedures .....	235
	3.5.4	Procedure using Substring() function (Substr Procedure) .....	236
<b>IV</b>	3.5.5	Debug Procedure or Trigger (IBExpert Debugger) .....	240
	3.5.6	Alter Procedure .....	244
	3.5.7	Drop Procedure/Delete Procedure .....	245

3.6	Trigger .....	245	
3.6.1	Trigger Types .....	247	<b>1</b>
3.6.2	New Trigger .....	248	
3.6.3	Trigger Editor .....	251	<b>2</b>
3.6.4	Alter Trigger .....	255	
3.6.5	Drop Trigger/Delete Trigger .....	256	<b>3</b>
3.7	Generator .....	256	
3.7.1	New Generator .....	258	<b>4</b>
3.7.2	Generator Editor .....	260	
3.7.3	Alter Generator .....	261	<b>5</b>
3.7.4	Drop Generator/Delete Generator .....	262	
3.8	Exception .....	263	<b>6</b>
3.8.1	New Exception/Exception Editor .....	263	
3.8.2	Raising an Exception .....	265	<b>7</b>
3.8.3	Alter Exception .....	266	
3.8.4	Drop Exception/Delete Exception .....	266	<b>8</b>
3.9	User-Defined Function (UDF) .....	267	
3.9.1	Drop External Function/Drop UDF .....	268	<b>9</b>
3.9.2	RFunc .....	269	
3.9.3	FreeUDFLib .....	270	<b>10</b>
3.9.4	FreeAdhocUDF .....	271	
3.10	Blob Filter .....	273	<b>11</b>
3.10.1	Declaring a blob filter .....	273	
3.10.2	Calling a blob filter .....	273	<b>12</b>
3.11	Role .....	273	
3.11.1	New Role .....	274	<b>I</b>
3.11.2	Alter Role .....	275	<b>II</b>
3.11.3	Drop Role/Delete Role .....	275	<b>III</b>
3.12	System Objects .....	275	
3.13	Text Editor / SQL Code Editor .....	276	<b>IV</b>
<b>4</b>	<b>IBExpert Edit Menu</b>	<b>279</b>	
4.1	Load from File / Save to File .....	279	
4.2	Cut / Copy / Paste / Select All .....	279	
4.3	Find / Search Again / Replace .....	279	
4.4	Incremental Search .....	281	
4.5	Print Preview .....	281	
4.6	Print .....	283	
4.7	Page Setup .....	283	
4.8	Convert Identifiers/Keywords .....	283	
<b>5</b>	<b>IBExpert Grid Menu</b>	<b>285</b>	
5.1	Apply Best Fit .....	285	
5.2	Save Grid Data as .....	285	
5.3	Copy Current Record to Clipboard/Copy All to Clipboard .....	286	
<b>6</b>	<b>IBExpert View Menu</b>	<b>287</b>	
<b>7</b>	<b>IBExpert Options Menu</b>	<b>289</b>	
7.1	Environment Options .....	289	
7.1.1	Preferences .....	290	
7.1.2	Confirmations .....	294	



<b>1</b>	7.1.3	Tools .....	295
	7.1.4	Font .....	298
<b>2</b>	7.1.5	Transactions .....	299
	7.1.6	Grid .....	300
<b>3</b>	7.1.7	Additional Help .....	305
	7.1.8	Additional Tools .....	305
<b>4</b>	7.1.9	Disabled Names .....	306
	7.1.10	Associations .....	306
<b>5</b>	7.1.11	IBExpert Direct .....	306
	7.1.12	IBExpert Bug Track .....	307
<b>6</b>	7.1.13	IBExpert User Database .....	308
<b>7</b>	7.2	Editor Options .....	309
	7.2.1	General .....	309
<b>8</b>	7.2.2	Display .....	311
	7.2.3	Color .....	311
<b>9</b>	7.2.4	Code Insight .....	312
<b>10</b>	7.3	Visual Options .....	314
	7.3.1	Bars and Pop-up Menus .....	314
<b>11</b>	7.3.2	Lists and Trees .....	315
	7.3.3	Edit Controls .....	316
<b>12</b>	7.3.4	Page Controls .....	317
	7.3.5	Splitters .....	317
<b>I</b>	7.4	Keyboard Templates .....	319
<b>II</b>	7.5	General Templates .....	320
<b>III</b>	7.6	Object Editor Options .....	321
	7.6.1	Domains Editor Options .....	321
<b>IV</b>	7.6.2	Tables Editor Options .....	322
	7.6.3	Views Editor Options .....	323
	7.6.4	Procedures Editor Options .....	323
	7.6.5	Triggers Editor Options .....	324
	<b>8</b>	<b>IBExpert Tools Menu</b>	<b>325</b>
	8.1	SQL Editor .....	325
	8.1.1	Query .....	326
	8.1.2	SQL Structured Query Language .....	327
	8.1.3	SQL Editor Menu .....	327
	8.1.4	(1) Edit .....	331
	8.1.5	(2) Results .....	334
	8.1.6	(3) Statements History .....	340
	8.1.7	(4) Plan Analyzer .....	342
	8.1.8	(5) Performance Analysis .....	342
	8.1.9	(6) Logs .....	352
	8.1.10	Optimizing an SQL statement .....	353
	8.1.11	Special features .....	353
	8.2	New SQL Editor .....	355
	8.3	Query Builder .....	355
	8.4	Data Analysis .....	359
	8.4.1	Data Analysis Cube Manager .....	364
	8.4.2	Data Analysis Calculated Measures Manager .....	365
	8.5	Script Executive .....	366
	8.5.1	Executing multiple scripts from a single script .....	369
	8.5.2	Create multiple CSV files from a script .....	369

8.5.3	Script Language Extensions .....	369
8.6	SQL Monitor.....	389
8.6.1	SQL Monitor Options .....	390
8.7	Dependencies Viewer .....	390
8.8	SP/Triggers/Views Analyzer .....	392
8.9	Database Comparer .....	396
8.10	Table Data Comparer .....	398
8.11	Log Manager.....	400
8.12	Search in Metadata.....	403
8.13	Extract Metadata .....	404
8.13.1	Metadata .....	410
8.13.2	Select Objects Tree.....	412
8.13.3	How does IBEExpert extract objects descriptions? .....	413
8.13.4	How does IBEExpert extract blobs?.....	413
8.13.5	Obtain current generator values .....	414
8.14	Print Metadata .....	414
8.15	Generate HTML Documentation .....	416
8.15.1	CSS – Cascaded Style Sheets.....	421
8.16	User Manager .....	421
8.16.1	Server security ISC4.GDB / SECURITY.FDB.....	424
8.16.2	Change user password per batch .....	425
8.17	Grant Manager.....	425
8.17.1	Granting access to stored procedures.....	428
8.17.2	Using the GRANT AUTHORITY option .....	428
8.18	Secondary Files Manager .....	429
8.18.1	Primary file .....	431
8.18.2	Secondary files.....	431
8.19	Localize IB Messages .....	432
8.20	Localize IBEExpert.....	433
8.20.1	Find IBEExpert Message .....	434
8.21	Report Manager .....	435
8.22	Blob Viewer/Editor .....	435
8.23	Database Designer .....	436
8.23.1	Database Designer right-click menus .....	438
8.23.2	Reverse Engineer.....	440
8.23.3	Generate Script .....	441
8.23.4	Export.....	442
8.23.5	Print .....	442
8.23.6	Manage Subject Areas.....	443
8.23.7	Manage Subject Layers.....	444
8.23.8	Model Options .....	445
8.24	Test Data Generator .....	448
8.25	IBEExpert Command-Line Tools.....	449
8.25.1	IBEBLOCK (EXECUTE IBEBLOCK).....	450
8.25.2	IBECmpare.....	502
8.25.3	IBEEExtract .....	504
8.25.4	IBEScript .....	505
8.26	InterBase and Firebird Command-Line Utilities .....	508
8.26.1	GBAK and GSPLIT.....	508
8.26.2	GFIX .....	512
8.26.3	GSEC .....	516
8.26.4	GSTAT.....	518

**1****2****3****4****5****6****7****8****9****10****11****12****I****II****III****IV**



	8.26.5	IBLOCKPR (Windows) and GDS_LOCK_PRINT (Unix) .....	518
	8.26.6	IBMGR.....	518
	8.26.7	ISQL .....	518
<b>1</b>			
<b>2</b>			
<b>3</b>			
<b>4</b>			
<b>5</b>			
<b>6</b>			
<b>7</b>			
<b>8</b>			
<b>9</b>			
<b>10</b>			
<b>11</b>			
<b>12</b>			
<b>I</b>			
<b>II</b>			
<b>III</b>			
<b>IV</b>			
	<b>9</b>	<b>IBExpert Services Menu</b>	<b>519</b>
	9.1	Backup Database.....	519
	9.1.1	Why is a database backup and restore important? .....	521
	9.1.2	Garbage collection .....	522
	9.2	Restore Database .....	523
	9.2.1	Database Shadow Files.....	525
	9.3	Server Properties/Log .....	532
	9.4	Server Activation Certificates .....	533
	9.5	Database Validation .....	534
	9.6	Database Statistics .....	536
	9.7	Database Properties.....	538
	9.7.1	General .....	538
	9.7.2	Active Users.....	541
	9.8	Database Shutdown .....	541
	9.9	Database Online .....	542
	9.10	Communication Diagnostics .....	542
	<b>10</b>	<b>IBExpert PlugIns Menu</b>	<b>545</b>
	<b>11</b>	<b>IBExpert Windows Menu</b>	<b>547</b>
	11.1	Windows Manager .....	547
	11.2	Close All.....	547
	11.3	Cascade / Tile / Minimize / Arrange .....	547
	<b>12</b>	<b>IBExpert Help</b>	<b>549</b>
	12.1	IBExpert Customer Area .....	550
	12.2	What Is New? .....	550
	12.3	Contents .....	577
	12.4	Additional Help Files.....	578
	12.5	Product Home Page .....	578
	12.6	Send bug reports to .....	578
	12.7	Bug Track System .....	578
	12.8	About.....	579
	12.9	IBExpert Direct .....	579
	12.10	Download Firebird / Purchase InterBase .....	580
	<b>I</b>	<b>SQL Language Reference</b>	<b>581</b>
	I.1	Firebird SQL.....	581
	I.1.1	String delimiter symbol .....	581
	I.1.2	Double-quoted identifiers .....	581
	I.1.3	Apostrophes in strings.....	582
	I.1.4	Concatenation of strings .....	582
	I.1.5	Division of an integer by an integer.....	582
	I.1.6	Expressions involving NULL.....	583
	I.2	DDL – Data Definition Language.....	583
	I.2.1	ALTER .....	584
	I.2.2	COMMIT .....	585

1.2.3	CONNECT .....	587	
1.2.4	CREATE .....	589	
1.2.5	DECLARE EXTERNAL FUNCTION (incorporating a new UDF library) .....	590	<b>1</b>
1.2.6	DESCRIBE .....	593	
1.2.7	DISCONNECT .....	594	<b>2</b>
1.2.8	DROP .....	595	
1.2.9	END DECLARE SECTION .....	596	
1.2.10	EVENT .....	596	<b>3</b>
1.2.11	EXECUTE .....	597	
1.2.12	GRANT .....	601	
1.2.13	PREPARE .....	604	<b>4</b>
1.2.14	REVOKE .....	605	
1.2.15	ROLLBACK .....	607	
1.2.16	SET .....	608	<b>5</b>
1.2.17	WHENEVER .....	613	
I.3	DML – Data Manipulation Language .....	614	
I.3.1	SIUD .....	614	<b>6</b>
I.4	Stored Procedure and Trigger Language .....	621	
I.4.1	Supported Firebird 2 features .....	622	
I.4.2	Using DML statements .....	622	<b>7</b>
I.4.3	Using SELECT statements .....	622	
I.4.4	SET TERM terminator or terminating character .....	623	
I.4.5	SUSPEND .....	624	<b>8</b>
I.4.6	BEGIN and END statement .....	624	
I.4.7	DECLARE VARIABLE .....	624	
I.4.8	IF THEN ELSE .....	624	<b>9</b>
I.4.9	WHILE and DO .....	625	
I.5	Comparison Operators .....	625	
I.6	JOIN .....	626	<b>10</b>
I.6.1	INNER JOIN .....	628	
I.6.2	OUTER JOIN .....	629	
I.6.3	Joining more than two tables .....	630	<b>11</b>
I.6.4	Self joins / reflexive joins .....	631	
<b>II</b>	<b>GLOSSARY .....</b>	<b>633</b>	<b>12</b>
II.1	*/Wildcard .....	633	
II.2	Alias .....	633	<b>I</b>
II.3	API (Application Program Interface) .....	634	
II.4	Application .....	634	<b>II</b>
II.5	ASCII .....	635	
II.6	BDE (Borland Database Engine) .....	635	<b>III</b>
II.7	Client/Server .....	635	
II.8	Comdiag .....	636	
II.9	Comments .....	636	<b>IV</b>
II.10	Compile and Commit / Rollback .....	637	
II.11	Conditional Test .....	637	
II.12	Constant .....	637	
II.13	DBMS (Database Management System) .....	637	
II.14	DDE (Dynamic Data Exchange) .....	638	
II.15	Default .....	638	
II.16	DLL (Dynamic Link Library) .....	639	



1	II.17 Event .....	639
	II.18 Expression .....	639
2	II.19 FBK Files .....	640
	II.20 FDB Files .....	640
3	II.21 FTP (File Transfer Protocol) .....	640
	II.22 GBK Files .....	640
	II.23 GDB Files .....	641
	II.24 GRC Files .....	641
4	II.25 HTML (HyperText Markup Language) .....	641
	II.26 HTTP (HyperText Transfer Protocol) .....	641
	II.27 IDE (Integrated Development Environment) .....	642
5	II.28 OAT (Oldest Active Transaction) .....	642
	II.29 ODBC (Open DataBase Connectivity) .....	642
	II.30 ODS Version .....	642
6	II.31 OIT (Oldest Interesting Transaction) .....	643
	II.32 OLAP (Online Analytical Processing) .....	643
	II.33 OLE (Object Linking and Embedding) .....	643
7	II.34 Operand .....	643
	II.35 Operator .....	643
	II.36 PIP (Page Inventory Page) .....	644
8	II.37 RDBMS (Relational Database Management System) .....	644
	II.38 Statement .....	645
	II.39 String .....	645
	II.40 TID (Transaction ID) .....	645
9	II.41 TIP (Transaction Inventory Page) .....	646
	II.42 Transaction .....	648
	II.42.1 Transaction Number Column .....	648
	II.42.2 Active Transactions .....	648
	II.42.3 Transactions in Limbo .....	649
10	II.43 Two-Phase Commit .....	649
	II.44 Variable .....	650

11	<b>III FAQs</b>	<b>651</b>
	III.1 How do I connect to a database? .....	651
	III.2 Why do I need to register a database? .....	651
12	III.3 How do I create a new database? .....	651
	III.4 How do I use the SQL Editor? .....	651
	III.5 What is the Performance Analysis for? .....	651
	III.6 What is the Query Plan? .....	651
	III.7 How can I optimize an SQL Statement? .....	651
I	III.8 How do I debug a stored procedure? .....	651
	III.9 Are there typical windows for all Object Editors? .....	652
II	III.10 How can I use the view and procedure version control? .....	652
	III.11 What is the Project View in the DB Explorer for? .....	652
	III.12 What is the Recent list in the DB Explorer for? .....	652
III	III.13 How do I use the integrated Report Manager? .....	652
	III.14 Why can I not see the index statistics in the Table Editor? .....	652
	III.15 Why does the index selectivity/statistics not change? .....	652
IV	III.16 Indices do not seem to work on my newly installed application .....	652
	III.17 How can I integrate the online Help files into IBExpert? .....	652
	III.18 Import CSV Files .....	652





<b>IV Database technology-related articles</b>	<b>655</b>
IV.1 Enterprise-wide data model.....	655

1

2

3

4

5

6

7

8

9

10

11

12

I

II

III

IV



Clear History	
Delete Statement	Del
Copy to Clipboard	
Copy All to Clipboard	

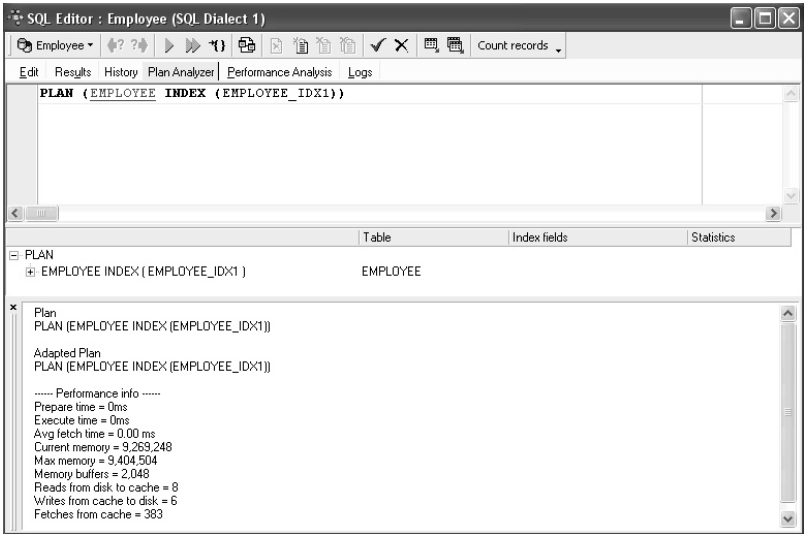
This menu also allows single statements (or all) to be copied to clipboard.

**8.1.7 (4) Plan Analyzer**

The SQL Editor Plan Analyzer (also a part of the Procedure Editor and Trigger Editor) shows how Firebird/InterBase approaches a query, e.g. with `SORTS`, `JOINS` etc, which tables and indices are used. This information is displayed in a tree structure: firstly what and which data quantities, and secondly what is carried out with this data and how.

The plan is an InterBase/Firebird description, showing how the optimizer uses tables and indices to obtain the result set. If the word `SORT` is displayed, you should check whether improvements upon the query or the indices are possible.

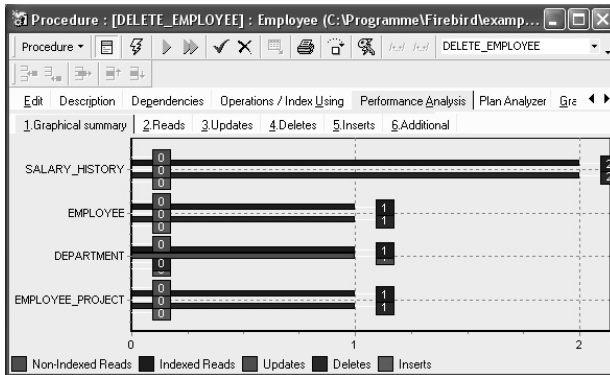
8



The Plan Analyzer provides information in the lower panel in a tree structure with statistics.

**8.1.8 (5) Performance Analysis**

The Performance Analysis is part of the SQL Builder, Visual Query Builder and Stored Procedure Editors. It displays information showing how much effort was required by InterBase/Firebird to carry out an executed query or procedure. The analysis is performed after a `SELECT` statement is opened or a stored procedure started.



It is possible to deactivate the Performance Analysis, by checking the Disable Performance Analysis option, found under Database / Register Database or Database Registration Info / Additional. This may be desirable, when working remotely with a slow modem connection.

It is however often interesting to know what exactly a procedure or query does and how; and all this can be viewed in the Performance Analysis.

The main advantage here is, of course, the possibility to compare the performance of different queries and procedures.

8

The performance can be viewed in 6 different ways:

1. Graphical summary
  - i) indexed reads
  - ii) non-indexed reads
  - iii) updates
  - iv) deletes
  - v) inserts
2. Reads (graphical representation)
3. Updates (graphical representation)
4. Deletes (graphical representation)
5. Inserts (graphical representation)
6. Additional
  - i) Enhanced Info
  - ii) Query Time
  - iii) Memory
  - iv) Operations

**SELECT** statements will only have a result on the Reads page, but some stored procedures will have results on all pages.

In the SQL Editor the lower panel displays the query plan, along with a summary of the performance information included under 6. Additional. For further information regarding the query plan, please refer to the Plan Analyzer.

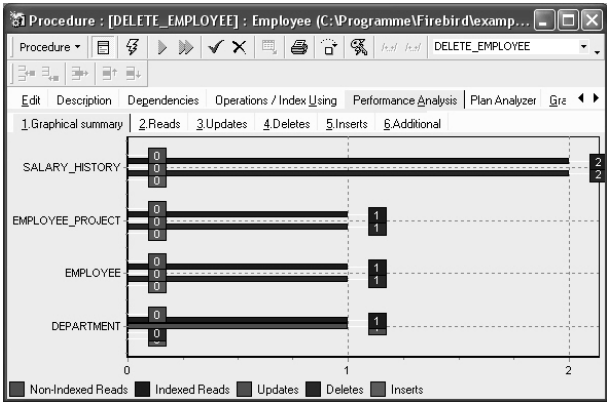


The analysis displayed in 6. Additional can also be documented using the Copy Analysis to Clipboard button.

**Graphical Summary**

This provides a graphical overview, broken down by the tables involved, of the number of operations performed by the query/procedure, including reads (indexed and non-indexed), updates, deletes and inserts. It shows whether indices have been used indicating the efficiency of the database's indices. The figures displayed refer to the number of data sets.

8

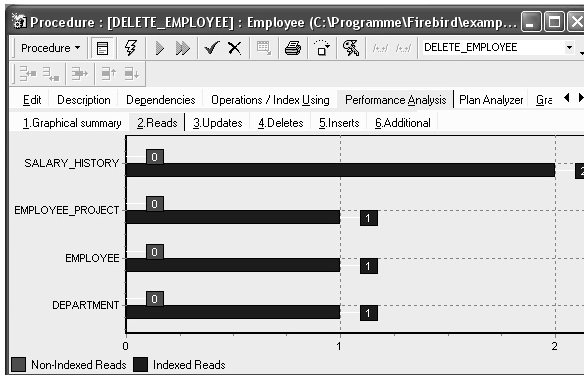


The x-axis lists the names of the tables consulted by the query/procedure, with the number of operations displayed graphically. The color key can be seen below the graphic. The operation types are as follows:

- Non-indexed reads
- Indexed reads
- Updates: The number and type of updating operations.
- Deletes: The number and type of deleting operations.
- Inserts: The number and type of inserting operations.

The graphical information displayed here can also be viewed in tabular format under 6. Additional.

## Reads



This displays the number and type of reading operations in an executed query/procedure. The figures displayed refer to the number of data sets and are broken down by table into the categories *indexed* and *non-indexed* reads.

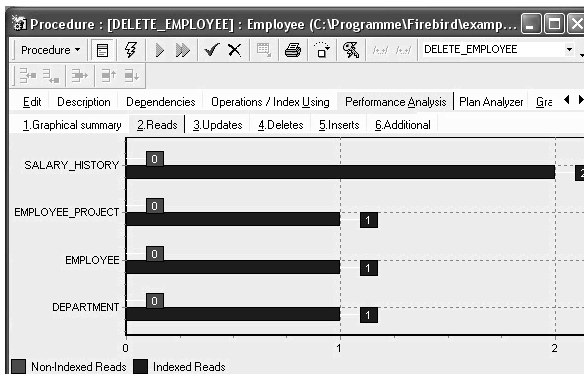
Those database indices used to perform an SQL query can be viewed in the SQL Editor in the Performance Analysis query plan.

This information can be used to evaluate the efficiency of the database's indices.

8

## Indexed Read

Indexed reads are displayed in the Performance Analysis, which can be found in the SQL Editor, Visual Query Builder and Stored Procedure Editors.

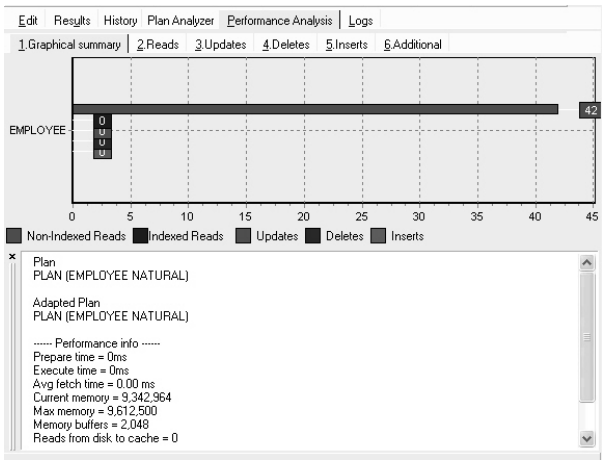


An indexed read indicates that the data was selected by the InterBase/Firebird server using one or more indices (named in the SQL Editor query plan in the lower panel). This results in many cases in a significantly lower number of data sets being consulted than with a non-indexed read, saving both time and memory.



## Non-Indexed Read

Non-indexed reads are displayed in the Performance Analysis, which can be found in the SQL Editor, Visual Query Builder and Stored Procedure Editors.

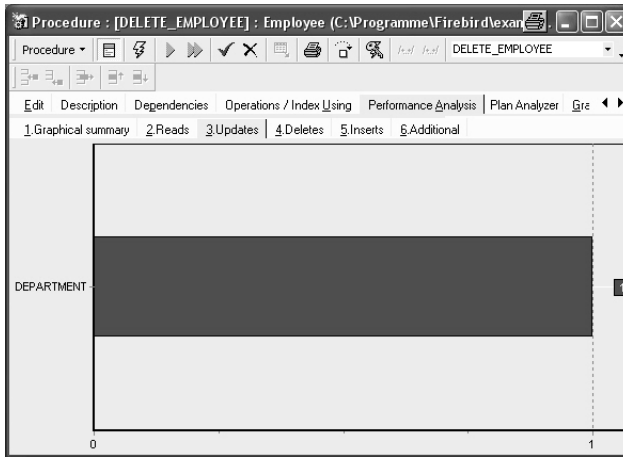


A non-indexed reads indicates that the data was read without the aid of an index. In most situations this can be both time- and memory-consuming. Non-indexed reads always include a large number of data sets, as the server needs to search through the whole table(s) to find the relevant information. All data pages from the corresponding table(s) need to be loaded.

The SQL Editor's query plan shows which tables were read without an index using the term `NATURAL`.

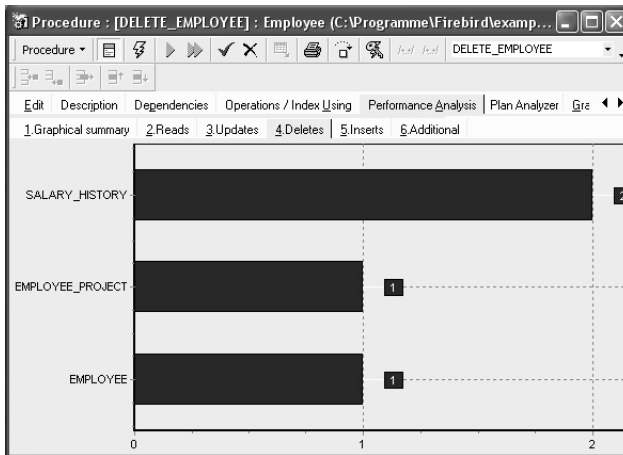
For further information regarding the use of indices, please refer to index.

## Updates



This displays the number and type of updating operations in an executed query/procedure. The figures displayed refer to the number of data sets, broken down by table.

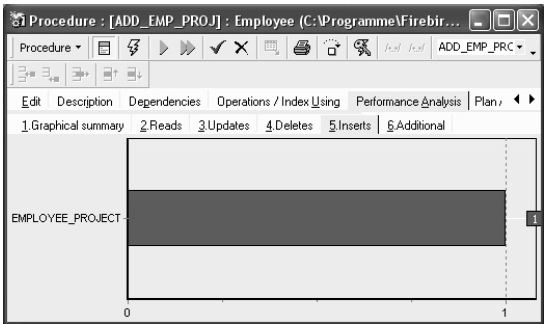
## Deletes



This displays the number and type of deleting operations in an executed query/procedure. The figures displayed refer to the number of data sets, broken down by table.



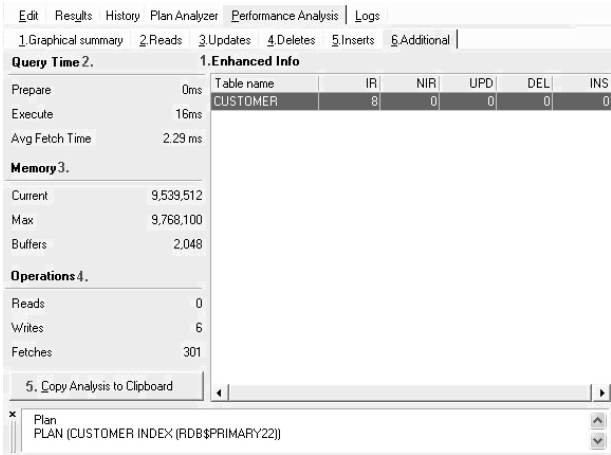
Inserts



This displays the number and type of inserting operations in an executed query/procedure. The figures displayed refer to the number of data sets, broken down by table.

Additional

This displays a statistical report. The *Enhanced Info* displays a statistical summary of the information shown in 1. Graphical Summary. Certain additional information, such as query time, memory and operations, is also included in this section.



There is furthermore a Copy Analysis to Clipboard button, to document the statistics if wished.

Enhanced Info

The Enhanced Info displays a statistical summary of the information shown in 1. Graphical summary.



Edit	Description	Dependencies	Operations / Index Using	Performance Analysis	Plan Analyzer	Grants	Ve
1 Graphical summary	2 Reads	3 Updates	4 Deletes	5 Inserts	6 Additional		
<b>Query Time</b>							
<b>Enhanced Info</b>							
Prepar	0ms	Table name	IR	NIR	UPD	DEL	INS
Execute	16ms	EMPLOYEE_PROJECT	1	0	0	1	0
Avg Fetch Time	0 ms	DEPARTMENT	1	0	1	0	0
		EMPLOYEE	1	0	0	1	0
		SALARY_HISTORY	2	0	0	2	0
<b>Memory</b>							
Current	9,474,048						
Max	9,522,296						
Buffers	2,048						
<b>Operations</b>							
Reads	16						
Writes	0						
Fetches	2,135						
Copy Analysis to Clipboard							

The names of tables consulted during execution of the query/procedure are listed in the first column, with the number of data sets listed according to the following criteria:

- IR = Indexed Read
- NIR = Non-Indexed Read
- UPD = Updates
- DEL = Deletes
- INS = Inserts

The information can be copied to clipboard, if wished, using the Copy Analysis to Clipboard button.

## Query Time

Query time shows the time needed to prepare for the execution of the query/procedure, along with the execution time and average fetch time.

Edit	Results	Description	Dependencies	Operations / Index Using	Performance Analysis	Plan Analyzer	Ve
1 Graphical summary	2 Reads	3 Updates	4 Deletes	5 Inserts	6 Additional		
<b>Query Time</b>							
<b>Enhanced Info</b>							
Prepar	0ms	Table name	IR	NIR	UPD	DEL	INS
Execute	406ms	JOB	109	22	0	0	0
Avg Fetch Time	406.00 ms						
<b>Memory</b>							
Current	9,638,912						
Max	10,271,168						
Buffers	2,048						
<b>Operations</b>							
Reads	5						
Writes	3						
Fetches	650						
Copy Analysis to Clipboard							



**Prepare:**

This measures the preparation time required by InterBase/Firebird to plan and prepare the query/procedure execution, i.e. from the moment when the source text is sent to the server and is compiled on the server in binary form (decides which indices, tables etc. need to be used to perform the query/procedure).

When a query/procedure is executed a second time, the query time is usually 0 ms, as it has already been prepared.

**Execute:**

This measures the direct execution time of the command.

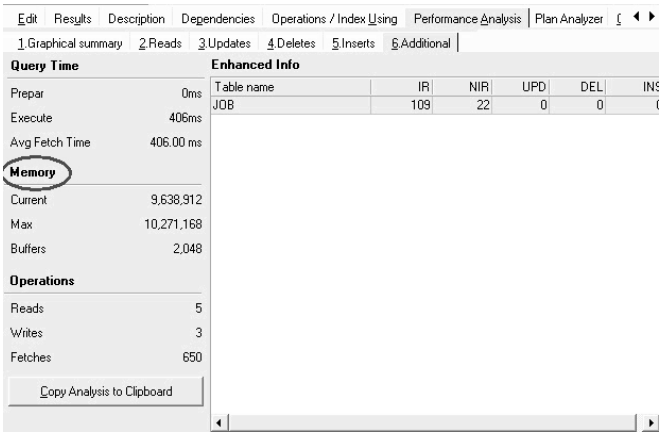
**Avg fetch time:**

This shows the average fetch time pro data set. This figure is calculated based only on those data sets that can be seen in the returns and does not include those that are not yet visible. An optimal analysis can be attained when the query/procedure is executed using [Shift + F9] = Execute and Fetch all.

**Memory**

This shows the memory development during and following execution of the procedure/query.

8



**Current:**

This displays the current memory used by the server.

**Max.:**

This displays the maximum memory used by the server during execution of the query/procedure.

**Buffers:**

This displays the number of data pages that are being held as cache on the server (from InterBase 6 onwards the standard is 2,048). This can be found in the corresponding configuration file: since Firebird 1.5 it is called `FIREBIRDCONFIG`; in older Firebird versions or InterBase, it is called `IBCONFIG`, found in the main InterBase folder.

This can be altered for the current database if wished, using the IBExpert menu item Services / Database Properties / Buffers. The total KB is calculated according to the current database page size. For an alteration to become effective, it is therefore necessary for all users to disconnect from the database and then reconnect. Buffers are only reserved if they are really necessary for pages loaded from the database file.

**Operations**

Operations displays the number of data pages that were read from the database file to the memory, written and fetched, while executing the query/procedure.

Query Time		Enhanced Info					
Prepar	0ms	Table name	IRI	NIR	UPD	DEL	INS
Execute	406ms	JOB	109	22	0	0	
Avg Fetch Time	406.00 ms						
Memory							
Current	9,638,912						
Max	10,271,168						
Buffers	2,048						
<b>Operations</b>							
Reads	5						
Writes	3						
Fetches	650						
Copy Analysis to Clipboard							

**Reads:**

This displays the number of pages read for the executed query/procedure. This is necessary when data sets have to be loaded, that are not already in the memory.

**Writes:**

This displays the number of pages written while executing the query/procedure. If the total cache buffers are too small to load subsequent pages, it may be necessary for the server to save altered pages to the hard drive, in order to make room for further pages to be loaded. If these values are very high, it may be wise to increase the buffers, providing of course, that physical memory is sufficient.



## Fetches:

When a query/procedure is started, the command (or series of commands) is sent to the database server. To obtain results, numerous data sets/pages need to be referred to (= fetch), in order to perform the operation. Fetches are, in other words, internal operations performed by InterBase/Firebird in order to successfully execute a query/procedure. This indicates, for example, if deleted data sets in a `SELECT` are recognized as deleted, they will still appear here in the number of fetches, as the server also searches through those data sets that have been marked as deleted. This can however offer an advantage over the number of indexed and non-indexed reads, as these only display operations on undeleted data sets. If the query is executed again, the result is quicker if the garbage collection is running simultaneously.

Using the Performance Analysis, the number of fetches in data pages could possibly indicate why one query is quicker than another with an equal number of data sets and the same index plan.

## Copy Analysis to Clipboard

The Copy Analysis to Clipboard button copies all information included in the Additional page, including both the grid contents (= Enhanced Info) and the statistics listed in the left-hand panel (= query time, memory and operations).

8

Edit	Results	Description	Dependencies	Operations / Index Using	Performance Analysis	Plan Analyzer	
1 Graphical summary	2 Reads	3 Updates	4 Deletes	5 Inserts	6 Additional		
Query Time							
Prepar	0ms	Enhanced Info					
Execute	406ms	Table name	IR	NIR	UPD	DEL	IN
Avg Fetch Time	406.00 ms	JOB	109	22	0	0	
Memory							
Current	9,638,912						
Max	10,271,168						
Buffers	2,048						
Operations							
Reads	5						
Writes	3						
Fetches	650						
Copy Analysis to Clipboard							

The Copy Analysis to Clipboard button can be found in the bottom left corner of the 6. Additional dialog in the Performance Analysis. Should this not be visible, it is probably because the windows in IBExpert are set to Cascading. This can be easily solved by clicking the SQL/Procedure Editor dialog window to full-size (right-hand blue icon in the dialog title bar).

### 8.1.9 (6) Logs

The Log page can be found in the SQL Editor and displays a list of qualified error messages etc. It shows what Firebird/InterBase did and when in each respective SQL window.