

Ingres Driver Notes

**Details about the libdbi driver providing
support for Ingres backends**

Toby Thain

`qu1j0t3@sourceforge.net`

Ingres Driver Notes: Details about the libdbi driver providing support for Ingres backends

by Toby Thain

Document revision: \$Id: dbd_ingres.sgml,v 1.15 2006/06/12 16:58:17 qu1j0t3 Exp \$ Edition

Published \$Date: 2006/06/12 16:58:17 \$

Copyright © 2006 Toby Thain

Permission is granted to copy, distribute and/or modify this document under the terms of the *GNU Free Documentation License*, Version 1.1 or any later version published by the Free Software Foundation; with no Invariant Sections, with no Front-Cover Texts, and with no Back-Cover Texts. A copy of the license is included in Appendix A.

Revision History

Revision 0.3 2006-06-08

Table of Contents

Preface.....	iv
1. Introduction.....	1
2. Installation	2
2.1. Prerequisites	2
2.2. Build and install the driver	2
3. Driver options.....	4
4. Ingres-specific Peculiarities	5
A. GNU Free Documentation License	7

Preface

libdbi (<http://libdbi.sourceforge.net>) is a database abstraction layer written in C. It implements a framework that can utilize separate driver libraries for specific database servers. The libdbi-drivers (<http://libdbi-drivers.sourceforge.net>) project provides the drivers necessary to talk to the supported database servers.

This manual provides information about the ingres driver, which provides support for Ingres databases. The manual is intended for programmers who write applications linked against libdbi and who want their applications to use this database backend.

Questions and comments about this driver should be sent to the libdbi-drivers-devel mailing list (see the website (<http://libdbi-drivers.sourceforge.net>)). Questions and comments about the libdbi library should be sent to the appropriate libdbi mailing list.

This driver is maintained by Toby Thain (<mailto:qu1j0t3@sourceforge.net>).

Chapter 1. Introduction

Ingres(R) (http://ingres.com/products/Prod_Ingres_2006.html) is an advanced relational database management system from Ingres Corporation. Notable features include C2 security certification, clustering, partitioning, transaction journaling, query optimisation, diverse programming bindings and flexible licensing from GPL community through to 24/7 enterprise level support.

More information can be found from the Ingres website (<http://www.ingres.com/>).

Chapter 2. Installation

This chapter describes the prerequisites and the procedures to build and install this driver from source code.

2.1. Prerequisites

The following packages must be installed on your system:

libdbi

This library implements the core database abstraction layer, which provides your application with database backend functionality when paired with this driver. More information about libdbi, including mailing lists, documentation, bug reports, and downloads, is available from the libdbi website (<http://libdbi.sourceforge.net>).

libpq

This is the C shared library to enable user programs to communicate with the Ingres(R) 2006 Community Edition RDBMS.

The current version of the dbd_ingres driver was written and tested with the 32-bit NPTL version II 9.0.4 for Linux/x86, running on Gentoo (see my installation notes (<http://slashdot.org/~toby/journal/136300>)).

2.2. Build and install the driver

First you have to unpack the libdbi-drivers archive in a suitable directory. Unpacking will create a new subdirectory with the version number, such as `libdbi-drivers-0.8.0`

```
$ tar xfvz libdbi-drivers-0.8.0.tar.gz
```

The libdbi-drivers project consists of several drivers that use a common build system. Therefore you *must* explicitly tell the configuration script that you want to build the ingres driver (you can list as many drivers as you want to build):

```
$ cd libdbi-drivers-0.8.0
```

```
$ ./configure --with-ingres
```

Run `./configure --help` to find out about additional options and other available drivers.

Then build the driver with the command:

```
$ make
```

Note: Please note that you may have to invoke **gmake**, the GNU version of make, on some systems.

Then install the driver with the command (you'll need root permissions to do this):

```
$ make install
```

To test the operation of the newly installed driver, use the command:

```
$ make check
```

This command creates and runs a test program that performs a few basic input and output tests.

Note: If for some reason you need to re-create the autoconf/automake-related files, try running `./autogen.sh`. In some situations, the current stable autoconf/automake/libtool versions (as found in FreeBSD 4.7 and Debian 3.0) do not cooperate well, so it may be necessary to run the older autoconf 2.13. If necessary, edit `autogen.sh` so that it will catch the older autoconf version on your system.

Chapter 3. Driver options

Before you can initiate a connection, you must usually specify options that tell the database driver what to connect to. This driver supports the standard options of `username`, `password` and `dbname`. The latter parameter is in Ingres syntax, `[node_id:]dbname[/svr_class]` - see Ingres documentation for details. (When running as the Ingres admin user on the same host as the DBMS, only the `dbname` is normally required.) Sensible defaults will be used for all unspecified options.

This driver also offers the following non-standard options, and/or redefines the meaning of the following standard options:

`ingres_autocommit`

Set this option to *string value* "0" to disable Ingres autocommit mode for the connection (it is enabled by default).

Chapter 4. Ingres-specific Peculiarities

This chapter lists known peculiarities of the ingres driver. Wherever possible, nonstandard driver behavior is hidden by libdbi's abstractions, but occasionally special considerations must be taken or extra functionality may be utilized for particular drivers.

Ingres environment variables must be set

The driver will not be loaded at all by `dbi_initialize()` if the Ingres environment variables are not set (e.g. by `~/ .ingresbash`). If the current user or specified user does not have appropriate Ingres privileges, the connection will fail ("User authorization check failed" or similar).

When connecting, the driver uses the values of the `dbname`, `username` and `password` options, if set.

Autocommit

'Autocommit' mode is enabled by default for the DBMS connection. In this mode, every query is committed as an individual transaction.

With autocommit disabled (see `ingres_autocommit` connection option), a transaction is begun by the first query statement after connection, commit or rollback. The transaction remains open until the next explicit commit, rollback or disconnection (which implies commit). Commit and rollback cannot be done using an OpenAPI query, but must use separate API functions. To work around this, the Ingres driver makes a specific check for COMMIT and ROLLBACK queries and calls the appropriate API function instead of issuing the query.

See Ingres OpenAPI and SQL documentation for more information.

Handling of result sets

In the Ingres OpenAPI, result sets must be accessed sequentially. Furthermore, Ingres does not provide the row count; this must be determined by fetching rows until no more is available. For this reason, the driver must fetch all result data into memory immediately after a query. Then libdbi functions can be used to get random access to rows as usual.

A workaround, for example if your result sets are very large, would be to use SELECT for random access; for example, query once to get a set of key values, then issue SELECTs on individual rows or smaller subsets of rows.

If your result set or BLOB data is likely to exhaust memory, and workarounds such as the above are not appropriate, then you will need to use OpenAPI directly to access them sequentially or by segments, instead of using libdbi and this driver.

SEQUENCE functions and autocommit

`dbi_conn_sequence_last()` is not usable in Ingres' autocommit mode (the default). To use sequences to identify INSERTed rows, first obtain the NEXT VALUE using `dbi_conn_sequence_next()` then use that sequence value directly in a separate INSERT transaction.

DATE parsing

Parsing DATE columns into timestamp values will only work correctly when returned values are in the default (US) date format; i.e. `dd-mmm-yyyy [hh:mm:ss]` where `mmm` is a partial month name. The parsing routine will accept any separators and either a numeric or named month, but the D-M-Y ordering is required. If needed, a workaround for date format incompatibility is to format into a string using a SQL function such as `date_gmt(date)`.

Version string format

`dbi_conn_get_engine_version_string()` returns a string like `II 9.0.4 (int.lnx/104)NPTL` (internally this is implemented as `SELECT dbmsinfo('_version')`).

Getting database and table lists

`dbi_conn_get_table_list()` returns matching objects of all types - tables, views, indexes and partitions - in the `iitables` catalog for the named database (except those beginning with `ii`, which are reserved for Ingres). These names are space padded fixed width fields.

Logging verbosity

The driver respects `dbd_set_verbosity()` level in reporting messages. At verbosity 1, only errors and abnormalities are reported; at 2, more information is shown; at 3, detailed debugging information is shown.

Blank handling

Blanks are preserved in column values (except that DECIMAL and MONEY columns are converted to strings, and then stripped of trailing blanks). Note that names returned by `dbi_conn_get_table_list()` and `dbi_conn_get_db_list()` are padded with blanks to a fixed width.

Error messages

The Ingres OpenAPI may return multiple error messages for a given query/operation. The `dbi_conn_error()` returns the error code only for the last error message, but the message text will include all relevant messages. At verbosity level 2, errors directly relating to libdbi function calls are logged. At verbosity 3, all errors are logged including those caused by API calls made internally by the driver.

Environment variables `II_API_TRACE` and `II_API_LOG` control logging by the API itself. See Chapter 6 of the Ingres OpenAPI User Guide for details.

Connection options

All Ingres option values are specified as *strings* (using `dbi_conn_set_option()`).

`ingres_blobsegment` option

This option specifies the size of individual segments returned for BLOB columns (by default this is approx 2000 bytes). If your BLOBs are large, increasing this value reduces the number of API calls required by the Ingres driver.

Appendix A. GNU Free Documentation License

Version 1.1, March 2000

Copyright (C) 2000 Free Software Foundation, Inc. 59 Temple Place, Suite 330, Boston, MA 02111-1307 USA Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed.

0. PREAMBLE

The purpose of this License is to make a manual, textbook, or other written document "free" in the sense of freedom: to assure everyone the effective freedom to copy and redistribute it, with or without modifying it, either commercially or noncommercially. Secondly, this License preserves for the author and publisher a way to get credit for their work, while not being considered responsible for modifications made by others.

This License is a kind of "copyleft", which means that derivative works of the document must themselves be free in the same sense. It complements the GNU General Public License, which is a copyleft license designed for free software.

We have designed this License in order to use it for manuals for free software, because free software needs free documentation: a free program should come with manuals providing the same freedoms that the software does. But this License is not limited to software manuals; it can be used for any textual work, regardless of subject matter or whether it is published as a printed book. We recommend this License principally for works whose purpose is instruction or reference.

1. APPLICABILITY AND DEFINITIONS

This License applies to any manual or other work that contains a notice placed by the copyright holder saying it can be distributed under the terms of this License. The "Document", below, refers to any such manual or work. Any member of the public is a licensee, and is addressed as "you".

A "Modified Version" of the Document means any work containing the Document or a portion of it, either copied verbatim, or with modifications and/or translated into another language.

A "Secondary Section" is a named appendix or a front-matter section of the Document that deals exclusively with the relationship of the publishers or authors of the Document to the Document's overall subject (or to related matters) and contains nothing that could fall directly within that overall subject. (For example, if the Document is in part a textbook of mathematics, a Secondary Section may not explain any mathematics.) The relationship could be a matter of historical connection with the subject or with related matters, or of legal, commercial, philosophical, ethical or political position regarding them.

The "Invariant Sections" are certain Secondary Sections whose titles are designated, as being those of Invariant Sections, in the notice that says that the Document is released under this License.

The "Cover Texts" are certain short passages of text that are listed, as Front-Cover Texts or Back-Cover Texts, in the notice that says that the Document is released under this License.

A "Transparent" copy of the Document means a machine-readable copy, represented in a format whose specification is available to the general public, whose contents can be viewed and edited directly and straightforwardly with generic text editors or (for images composed of pixels) generic paint programs or (for drawings) some widely available drawing editor, and that is suitable for input to text formatters or for automatic translation to a variety of formats suitable for input to text formatters. A copy made in an otherwise Transparent file format whose markup has

been designed to thwart or discourage subsequent modification by readers is not Transparent. A copy that is not "Transparent" is called "Opaque".

Examples of suitable formats for Transparent copies include plain ASCII without markup, Texinfo input format, LaTeX input format, SGML or XML using a publicly available DTD, and standard-conforming simple HTML designed for human modification. Opaque formats include PostScript, PDF, proprietary formats that can be read and edited only by proprietary word processors, SGML or XML for which the DTD and/or processing tools are not generally available, and the machine-generated HTML produced by some word processors for output purposes only.

The "Title Page" means, for a printed book, the title page itself, plus such following pages as are needed to hold, legibly, the material this License requires to appear in the title page. For works in formats which do not have any title page as such, "Title Page" means the text near the most prominent appearance of the work's title, preceding the beginning of the body of the text.

2. VERBATIM COPYING

You may copy and distribute the Document in any medium, either commercially or noncommercially, provided that this License, the copyright notices, and the license notice saying this License applies to the Document are reproduced in all copies, and that you add no other conditions whatsoever to those of this License. You may not use technical measures to obstruct or control the reading or further copying of the copies you make or distribute. However, you may accept compensation in exchange for copies. If you distribute a large enough number of copies you must also follow the conditions in section 3.

You may also lend copies, under the same conditions stated above, and you may publicly display copies.

3. COPYING IN QUANTITY

If you publish printed copies of the Document numbering more than 100, and the Document's license notice requires Cover Texts, you must enclose the copies in covers that carry, clearly and legibly, all these Cover Texts: Front-Cover Texts on the front cover, and Back-Cover Texts on the back cover. Both covers must also clearly and legibly identify you as the publisher of these copies. The front cover must present the full title with all words of the title equally prominent and visible. You may add other material on the covers in addition. Copying with changes limited to the covers, as long as they preserve the title of the Document and satisfy these conditions, can be treated as verbatim copying in other respects.

If the required texts for either cover are too voluminous to fit legibly, you should put the first ones listed (as many as fit reasonably) on the actual cover, and continue the rest onto adjacent pages.

If you publish or distribute Opaque copies of the Document numbering more than 100, you must either include a machine-readable Transparent copy along with each Opaque copy, or state in or with each Opaque copy a publicly-accessible computer-network location containing a complete Transparent copy of the Document, free of added material, which the general network-using public has access to download anonymously at no charge using public-standard network protocols. If you use the latter option, you must take reasonably prudent steps, when you begin distribution of Opaque copies in quantity, to ensure that this Transparent copy will remain thus accessible at the stated location until at least one year after the last time you distribute an Opaque copy (directly or through your agents or retailers) of that edition to the public.

It is requested, but not required, that you contact the authors of the Document well before redistributing any large number of copies, to give them a chance to provide you with an updated version of the Document.

4. MODIFICATIONS

You may copy and distribute a Modified Version of the Document under the conditions of sections 2 and 3 above, provided that you release the Modified Version under precisely this License, with the Modified Version filling the role of the Document, thus licensing distribution and modification of the Modified Version to whoever possesses a copy of it. In addition, you must do these things in the Modified Version:

- A. Use in the Title Page (and on the covers, if any) a title distinct from that of the Document, and from those of previous versions (which should, if there were any, be listed in the History section of the Document). You may use the same title as a previous version if the original publisher of that version gives permission.
- B. List on the Title Page, as authors, one or more persons or entities responsible for authorship of the modifications in the Modified Version, together with at least five of the principal authors of the Document (all of its principal authors, if it has less than five).
- C. State on the Title page the name of the publisher of the Modified Version, as the publisher.
- D. Preserve all the copyright notices of the Document.
- E. Add an appropriate copyright notice for your modifications adjacent to the other copyright notices.
- F. Include, immediately after the copyright notices, a license notice giving the public permission to use the Modified Version under the terms of this License, in the form shown in the Addendum below.
- G. Preserve in that license notice the full lists of Invariant Sections and required Cover Texts given in the Document's license notice.
- H. Include an unaltered copy of this License.
- I. Preserve the section entitled "History", and its title, and add to it an item stating at least the title, year, new authors, and publisher of the Modified Version as given on the Title Page. If there is no section entitled "History" in the Document, create one stating the title, year, authors, and publisher of the Document as given on its Title Page, then add an item describing the Modified Version as stated in the previous sentence.
- J. Preserve the network location, if any, given in the Document for public access to a Transparent copy of the Document, and likewise the network locations given in the Document for previous versions it was based on. These may be placed in the "History" section. You may omit a network location for a work that was published at least four years before the Document itself, or if the original publisher of the version it refers to gives permission.
- K. In any section entitled "Acknowledgements" or "Dedications", preserve the section's title, and preserve in the section all the substance and tone of each of the contributor acknowledgements and/or dedications given therein.
- L. Preserve all the Invariant Sections of the Document, unaltered in their text and in their titles. Section numbers or the equivalent are not considered part of the section titles.
- M. Delete any section entitled "Endorsements". Such a section may not be included in the Modified Version.
- N. Do not retitle any existing section as "Endorsements" or to conflict in title with any Invariant Section.

If the Modified Version includes new front-matter sections or appendices that qualify as Secondary Sections and contain no material copied from the Document, you may at your option designate some or all of these sections as invariant. To do this, add their titles to the list of Invariant Sections in the Modified Version's license notice. These titles must be distinct from any other section titles.

You may add a section entitled "Endorsements", provided it contains nothing but endorsements of your Modified Version by various parties--for example, statements of peer review or that the text has been approved by an organization as the authoritative definition of a standard.

You may add a passage of up to five words as a Front-Cover Text, and a passage of up to 25 words as a Back-Cover Text, to the end of the list of Cover Texts in the Modified Version. Only one passage of Front-Cover Text and one of Back-Cover Text may be added by (or through arrangements made by) any one entity. If the Document already includes a cover text for the same cover, previously added by you or by arrangement made by the same entity you are acting on behalf of, you may not add another; but you may replace the old one, on explicit permission from the previous publisher that added the old one.

The author(s) and publisher(s) of the Document do not by this License give permission to use their names for publicity for or to assert or imply endorsement of any Modified Version.

5. COMBINING DOCUMENTS

You may combine the Document with other documents released under this License, under the terms defined in section 4 above for modified versions, provided that you include in the combination all of the Invariant Sections of all of the original documents, unmodified, and list them all as Invariant Sections of your combined work in its license notice.

The combined work need only contain one copy of this License, and multiple identical Invariant Sections may be replaced with a single copy. If there are multiple Invariant Sections with the same name but different contents, make the title of each such section unique by adding at the end of it, in parentheses, the name of the original author or publisher of that section if known, or else a unique number. Make the same adjustment to the section titles in the list of Invariant Sections in the license notice of the combined work.

In the combination, you must combine any sections entitled "History" in the various original documents, forming one section entitled "History"; likewise combine any sections entitled "Acknowledgements", and any sections entitled "Dedications". You must delete all sections entitled "Endorsements."

6. COLLECTIONS OF DOCUMENTS

You may make a collection consisting of the Document and other documents released under this License, and replace the individual copies of this License in the various documents with a single copy that is included in the collection, provided that you follow the rules of this License for verbatim copying of each of the documents in all other respects.

You may extract a single document from such a collection, and distribute it individually under this License, provided you insert a copy of this License into the extracted document, and follow this License in all other respects regarding verbatim copying of that document.

7. AGGREGATION WITH INDEPENDENT WORKS

A compilation of the Document or its derivatives with other separate and independent documents or works, in or on a volume of a storage or distribution medium, does not as a whole count as a Modified Version of the Document, provided no compilation copyright is claimed for the compilation. Such a compilation is called an "aggregate", and this License does not apply to the other self-contained works thus compiled with the Document, on account of their being thus compiled, if they are not themselves derivative works of the Document.

If the Cover Text requirement of section 3 is applicable to these copies of the Document, then if the Document is less than one quarter of the entire aggregate, the Document's Cover Texts may be placed on covers that surround only the Document within the aggregate. Otherwise they must appear on covers around the whole aggregate.

8. TRANSLATION

Translation is considered a kind of modification, so you may distribute translations of the Document under the terms of section 4. Replacing Invariant Sections with translations requires special permission from their copyright holders, but you may include translations of some or all Invariant Sections in addition to the original versions of these Invariant Sections. You may include a translation of this License provided that you also include the original English version of this License. In case of a disagreement between the translation and the original English version of this License, the original English version will prevail.

9. TERMINATION

You may not copy, modify, sublicense, or distribute the Document except as expressly provided for under this License. Any other attempt to copy, modify, sublicense or distribute the Document is void, and will automatically terminate your rights under this License. However, parties who have received copies, or rights, from you under this License will not have their licenses terminated so long as such parties remain in full compliance.

10. FUTURE REVISIONS OF THIS LICENSE

The Free Software Foundation may publish new, revised versions of the GNU Free Documentation License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns. See <http://www.gnu.org/copyleft/>.

Each version of the License is given a distinguishing version number. If the Document specifies that a particular numbered version of this License "or any later version" applies to it, you have the option of following the terms and conditions either of that specified version or of any later version that has been published (not as a draft) by the Free Software Foundation. If the Document does not specify a version number of this License, you may choose any version ever published (not as a draft) by the Free Software Foundation.

How to use this License for your documents

To use this License in a document you have written, include a copy of the License in the document and put the following copyright and license notices just after the title page:

Copyright (c) YEAR YOUR NAME. Permission is granted to copy, distribute and/or modify this document under the terms of the GNU Free Documentation License, Version 1.1 or any later version published by the Free Software Foundation; with the Invariant Sections being LIST THEIR TITLES, with the Front-Cover Texts being LIST, and with the Back-Cover Texts being LIST. A copy of the license is included in the section entitled "GNU Free Documentation License".

If you have no Invariant Sections, write "with no Invariant Sections" instead of saying which ones are invariant. If you have no Front-Cover Texts, write "no Front-Cover Texts" instead of "Front-Cover Texts being LIST"; likewise for Back-Cover Texts.

If your document contains nontrivial examples of program code, we recommend releasing these examples in parallel under your choice of free software license, such as the GNU General Public License, to permit their use in free software.