



How Can I Fix That?

Applied Use of ABL2DB on Real World Problems

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Let me begin by introducing myself. I have been a Progress Application Partner since 1986 and for many years I was the architect and chief developer for our ERP application. In recent years I have refocused on the problems of transforming and modernizing legacy ABL applications. This implies needing to understand what the existing legacy application is doing so that we can change or replace it with confidence. Today I am going to tell you about an open source tool I have been building.

Many of you will know James Palmer as Cringer from on-line forums like PSDN and ProgressTalk. James is an Application Developer and DBA for the Inenco Group, a company that assists companies with energy procurement and performance. They have a large Progress application which is one of the test beds we are using for ABL2DB.

James put in a lot of work on this project as my primary test site outside of my own code from my old Integrity/Solutions ERP package. Integrity/Solutions provided many interesting challenges and the Inenco code provided a whole new set. Happily, I was able to make changes to ABL2DB reasonably quickly to accommodate many of those differences and the issues that remain deal mostly with expanding Proparse to cover the needed syntax, which John Green has been helping with.



Agenda

- The Problem and the Opportunity
- Brief Introduction to ABL2DB
- Tracking and Fixing Shared Variables
- Identifying Unused Database Structures
- Migrating Integer to INT64
- Tracking Block Scopes
- Future Directions
- Summary

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Here is our agenda for today. First we are going to talk a little bit about the background, then look at four specific examples where ABL2DB can help us fix issues with our applications.



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First, a little bit about the problem which the tool is intended to address.



The Problem and the Opportunity

- There is lots and lots of legacy ABL code out there (You are not alone!).
- Very little of it is meaningfully documented.
- Knowledge of what is in the code is very often based only on experience, which can be incomplete, unavailable, or even gone.



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I'm sure that most of you who have been around for a while can identify the problem ... large legacy ABL systems, often millions of lines of code, documentation which could be written on three napkins, and typically a reliance on some old hand who has been around for years to help everyone else figure out where things are and how they work ... until he or she isn't there any more.

Moreover, often the code does not conform to what one would consider modern best practice ... or even best practice at any time in the history of ABL in some cases. No matter what you think someone would never do, chances are that somewhere someone has done precisely that.



The Problem and the Opportunity

- Making changes safely requires solid knowledge of impact.
- Mistakes can be very costly and fixing them can be even more expensive than the original work.
- Worst cases can impact the integrity of the data.
- Business impact often exceeds the technical cost.



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And we all know that when we make changes, we should understand what we are doing before we start ... what will be impacted by any given change. But, without documentation, there isn't really any way to do that and as a result we make mistakes. Those mistakes often have a big impact, even on running the business. Not knowing the impact, we don't really even know what to test — so the problem can be in some area unrelated to where we did the work. In the worst cases, the cost impact to business operations exceeds all of the technical expense invested in making the original change and in repairing the damage.



The Problem and the Opportunity

- Need to know and understand how all parts of the code are related to each other.
- Need to know and understand how all parts of the data are impacted by all parts of the code.

Having this information at your fingertips is a whole different world from having to figure it all out by reading code ... and a whole lot safer!

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To make changes safely we need to understand how all parts of the code interact with other parts of the code and how all parts of the data are impacted by all parts of the code. We don't necessarily need to know everything all the time, but we do need to know anything relevant to the current project, so somewhere we need to have that knowledge. Having this information at your fingertips is a whole different world from having to figure it all out by reading code.



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So, let's look briefly at the tool I have created to address this problem area.



Brief Introduction to ABL2DB

ABL2DB

- Tool for analyzing code and putting it in a database for reporting and analysis.
- Open Source.
- Highly modular, adaptable, and extensible.
- Likely needs for customization are identified and isolated.
- Extensive and growing.



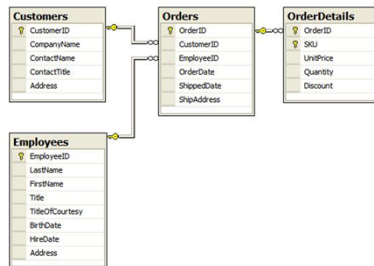
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Which brings me to ABL2DB, my own offering for tackling this problem. It is a tool which analyzes existing code and schema and creates a database of information extracted from that code and schema in a form suitable for easy reporting and analysis. It is open source and has been designed to be highly modular, highly adaptable, and easily extended. There are some components which, by necessity, need to be tailored to the individual code base, but these have been isolated, identified, and packaged for easy customization. As you will see, the current version is already collecting a substantial amount of information and the roadmap is in place for extensions soon.



Schema

- Full representation of application metaschema.
- In regular tables, not `_File`, `_Field`, etc.



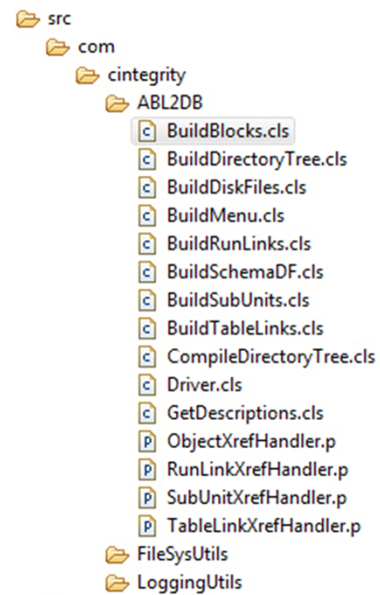
I created a set of database tables to mirror `_File`, `_Field`, etc. because those files will have the analysis schema in our target database. The fields provided are very complete and a program is provided to load these from a `.df`. The load program doesn't yet cover every possible option because I don't have a `.df` sample with everything to work from, but the structure is very easily expanded to any new dump syntax. I have already done a number of extensions as the tool is used at different sites and the changes have been quick and easy to make.



Brief Introduction to ABL2DB

Source Code Files of Application

- All disk files, controlled by extension as desired.



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Second, we are capturing basic information about all source code files in the application. Filters are provided so that you can define what is and isn't source in the same directory tree in case you have non-source files mixed in with the source. It even handles old Varnet systems where there are compile units with no extension.



Source Code SubUnits

- All functions, procedures, and methods contained in a Compile Unit.
- All references to an Include Unit in a Compile Unit.

Methods

- BuildBlocks
- BuildBlocks (character)
- Initialize
- Process
- ProcessBlockLine (character, character, character)
- ProcessBlocks (character, character)
- ProcessBufferLine (character, character, character)
- ProcessFrameLine (character, character, character)
- ScanAll
- ScanOne (character, character, character, character, charac

The next step breaks down Compile Units into sub components including procedures, methods and functions. It is this pass which also creates the links for empirical include files. For non-class Compile Units, a SubUnit corresponding to MainBlock is also created for code not otherwise enclosed in a SubUnit.



Brief Introduction to ABL2DB

Source Code Blocks



- All functions, procedures, and methods contained in a Compile Unit.
- All DO, FOR, REPEAT, PROCEDURE, FUNCTION, METHOD, TRIGGER and program main blocks.
- All FRAME and BUFFER scoping
- Resolve buffer names to DB and TT tables for block scoping.
- Transaction scopes.



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In addition to the functional decomposition of Compile SubUnits, a scan is also made to record all blocks of any type including DO, EDITING, FOR, FUNCTION, REPEAT, PROCEDURE, FUNCTION, TRIGGER and METHOD. In the process, it is recorded whether a transaction is scoped to the block and any frames and buffers scoped to the block. The full and accurate resolution of buffer names is a recent addition based on Proparse.



Shared Objects

- Capture information on all shared objects of all types - buffer, browse, dataset, frame, menu, query, stream, temp-table, variable, and work-table.
- Tracking include new, global, and other values appropriate to the object type.
- For variables, tracking of assigned to and assigned from is in process.

With the use of Proparse, I recently have added tracking of all forms of shared objects. This tracking includes where the definition is new, global, and a number of other parameters appropriate to each object type, including a field list for temp-tables and work-tables. I am currently working on tracking whether shared variables are involved in an assignment on the left or right side of the equals.



Run Links



- All Compile Unit to Compile Unit RUN and METHOD invocation links.
- Dynamic calls will require separate resolution.
- Plan to expand to Compile SubUnit links, but that also requires separate resolution or an alternate tool because the information is not in COMPILE XREF.



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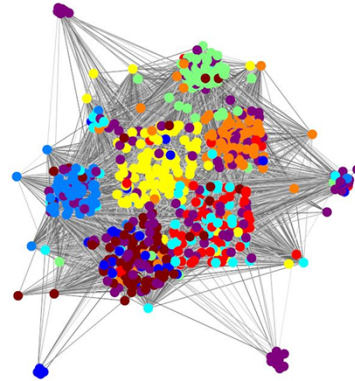
Now that we have identified all the static components, it is time to connect them. The first step is all the RUN relationships between pieces of the source code. The initial pass identifies all static Compile Unit to Compile Unit run connections. Not all can be resolved at this point because some calls are dynamic such as RUN VALUE() or RUN x IN handle. These dynamic calls will be resolved later. The data structure also provides for links between Compile SubUnits, i.e., a call located in an Internal Procedure, Method, or Function or a call to an Internal Procedure, Method, or Function from another Compile Unit, e.g., such as Method calls on classes or Internal Procedure calls to persistent procedures. Unfortunately, the information needed to make these connections is not in the COMPILE XREF data, so these connections will have to be identified by subsequent analysis or adding a new tool.



Table and Column Links



- All references to Tables and Columns in all Compile Units.
- Includes Create and Delete at the Table level.
- Includes Update and Access at the Column Level.



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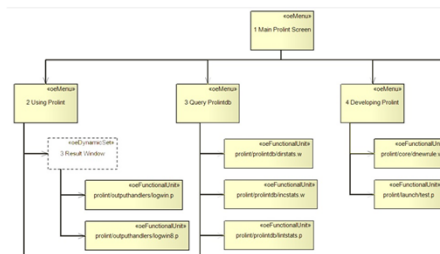
Next, we have links between the code and the data. This includes all references to tables and columns in all compile units. At the table level, it also includes flags for when the record is created or deleted. At the column level it has a flag for update, i.e., the value of the column is changed in that unit. Any column not changed is merely accessed. Only columns actually referenced are included.



Menus and Functional Units



- To relate code to actual use, it is useful to know the structure by which the code is used. To provide this we have a structure for the application menu.
- Each menu item calls a specific Compile Unit and all code reachable by that Compile Unit is known as a Functional Unit.



Finally, for the current version of ABL2DB, there are two additional stages. One loads descriptions for each disk file. Many code bases have some kind of standard description embedded in the source file and a tool is provided for extracting these according to the standards of the specific code base. The other is the loading of Menus and Functional Units. Menus provide us with a structure for the application as seen by the user, each selection of which runs a particular Compile Unit. From that Compile Unit, there is a body of code which can be reached including all sub programs, persistent procedures, and include files. We call this a Functional Unit. Functional Units may, of course, overlap.



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Now, on to some specific applications of the tool to real world problems.
First, shared variables.



Shared Variables

- Highly prevalent in legacy code.
- Considered bad practice compared to parameters because hard to track where set.
- Worse in many legacy applications because large numbers of shared variables are often defined in include files which are used whether or not all variables are referenced.

Anyone who has worked on legacy code is likely to have their own shared variable horror stories. In many applications, it was very common to define large blocks of shared variables in an include file and then to reference that include file routinely in all parts of an application or a specific function. This makes it very difficult to determine where a shared variable is set and used and clogs many files with large numbers of definitions which are not even referenced in that compile set. There are techniques for replacing shared variables with explicit parameter passing or with common reference objects, but first one has to know the landscape where the replacement will occur.



Shared Objects

- New function in ABL2DB uses Proparse to capture every shared object in every compile unit.
- Includes BROWSE, BUFFER, DATASET, FRAME, MENU, QUERY, STREAM, TEMP-TABLE, VARIABLE, WORK-TABLE.
- Include NEW and GLOBAL where relevant.
- Soon will also include whether assigned to or assigned from in that compile unit.

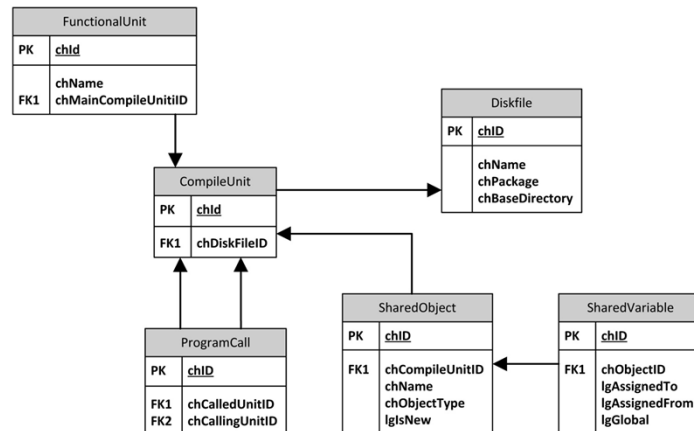
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The new function captures every shared object definition in every compile unit, along with many characteristics of that definition. I am working on also including whether or not the variable is assigned to or from in the compile unit.



Tracking and Fixing Shared Variables

Shared Variables Report



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Here is the schema involved in this report. We are going to start with the Functional Unit, a term in ABL2DB for an interconnected body of code which performs some function such as all of the code which one might reach starting with a particular selection on a particular menu or a particular batch process. From there we will go to the main CompileUnit. One can just start with the main compile unit. For example, at Inenco, there are no database tables with menus as there are in many applications and all menus are simply embedded in programs. This makes it difficult to extract functional unit and main compile unit pairs. Finding the main compile unit for any function thus requires reading code.

ProgramCall gives us the chain of all referenced CompileUnits from that base. We link to DiskFile to get the name of the CompileUnit on Disk. Then, we link to the SharedObjects in that CompileUnit. Here, we are looking only at shared variables for now, so we link to the SharedVariable table for additional information.



Tracking and Fixing Shared Variables

Shared Variables Report



List of shared objects for FunctionalUnit po.entry - Purchase Order Entry

```
| po\poentry
| *New add-subs (VARIABLE)
| *... alpha-mode (VARIABLE)
| *New blank-rel-ri (VARIABLE)
| *New buyer-name# (VARIABLE)
| *... can-select (VARIABLE)
| *... condition (VARIABLE)
| *New conv-money# (VARIABLE)
| *New conv-uom# (VARIABLE)
| *... dbox-bg (VARIABLE)
| *... dbox-fg (VARIABLE)
| *... dbox-fo (VARIABLE)
| *... demon (VARIABLE)
| *New descr# (VARIABLE)
| *New duty-desc# (VARIABLE)
| *New duty-pct# (VARIABLE)
```

Demo

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So, let's take a look at the results and the code.

Switch to desktop to look at sample output and code. These will be published with the talk on cintegrity.com.



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Now let's look at identifying unused database structures.



Identifying Unused Database Structures



Unused Schema

- It is not uncommon when an application evolves over a long period of time for columns and even tables to get created and then not used or for the application to change and them fall out of use.
- While not hurting the application, these structures do make the schema harder to understand because they look like they should mean something.

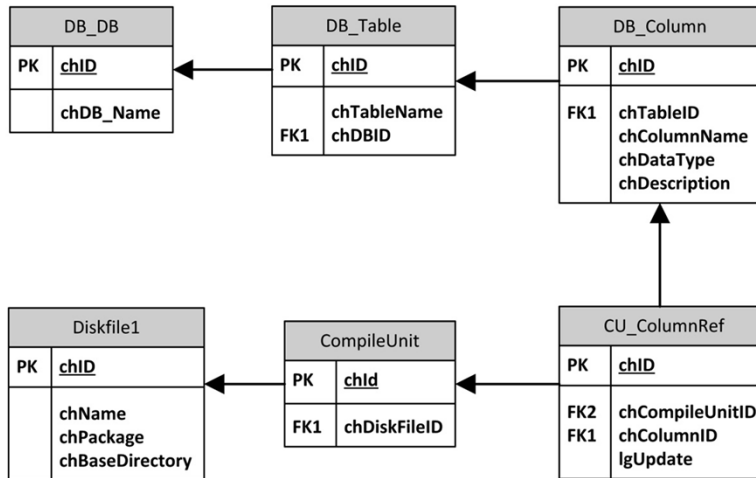
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With an application that evolves over 20 years, like both of the sample code bases used here, it is common for fields and even tables to get added in anticipation of some work that is never done or for usage to change to other fields, leaving behind the old fields, or even for whole modules to fall out of use. None of this hurts the running of the application, but can make the schema harder to maintain since the field looks like it should contain meaningful data.



Identifying Unused Database Structures

Unused Schema Report



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Here is the schema involved in this reporting. For all of the databases, all of the tables of each of those databases, and each of the columns in those tables, we look for column references, i.e., links between the column and a compile unit. In this case, we don't actually need to follow the link to the compile unit and diskfile, since we don't care about the names at the moment. We count these column references until we get more of them than some specified limit. For the sample, I used a limit of 1 on the theory that a column only referenced once is probably not really being used. So, any time there are 2 links, it moves on to the next column. Any column with the limit or fewer links is reported.

Note that we might want to follow the link to the compile unit name to find out where a reference occurs in order to evaluate the usage.



Identifying Unused Database Structures

Unused Schema Report



```
Act-Reason.Reason-code referenced 0 times
Act-Reason.Reason-desc referenced 0 times
Action.Action-code referenced 0 times
Action.Action-desc referenced 0 times
Address.in_TempOldSeq referenced 1 times
AP-Control.View-login referenced 1 times
AP-Control.Check-form referenced 1 times
AP-Control.Manual-chks referenced 1 times
AP-Control.Label-form referenced 1 times
AP-Control.F1099-form referenced 1 times
AP-Control-D.Bank-aud-no referenced 1 times
AP-Control-D.Cont-aud-no referenced 1 times
AP-Control-D.Term-aud-no referenced 1 times
AP-Control-D.RVI-jrnl-no referenced 1 times
AP-Hist-Item.Type-1099 referenced 1 times
AP-Hist-Tr.seq-no referenced 1 times
AR-Control.View-login referenced 1 times
```

Demo

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Now let's look at the problem of migrating a particular database field from integer to INT64.



Migrating Integer to INT64

Migrating Integers



- In a legacy application, it is common to have schema which includes integers for some columns which now need to be changed to INT64 to hold larger numbers.
- Examples are transaction numbers which 20 years of use have now made the number in danger of overflowing or, changing usage like a new currency or unit of measure.
- Programs need to be visited to check impact on local variables.

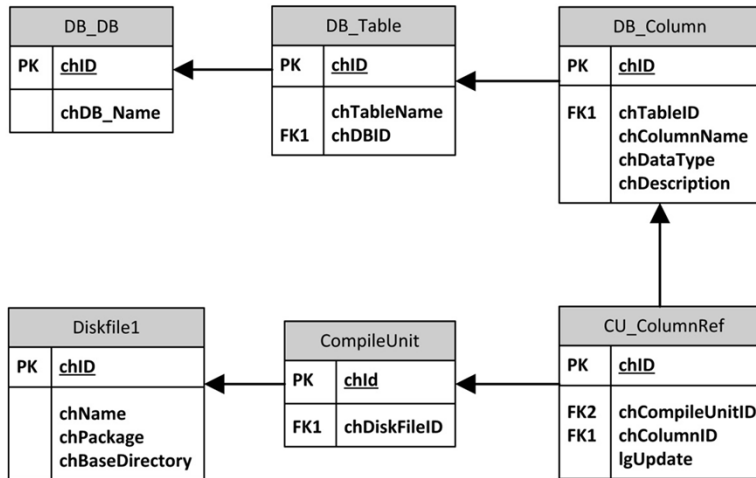
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Once upon a time we only had integer as a datatype, but since 10.1B we have also had INT64 to handle much larger numbers. As applications evolve, what was once satisfactory as a plain 32 bit integer may need conversion to 64 bit. For example, a counter used to sequence transactions might be in danger of overflowing or a new currency or unit of measure may lead to the need for a larger integer. While one can make this change in the dictionary easily enough, it is advisable to visit all the places the column is referenced to see if there are local variables which also need to be upsized.



Migrating Integer to INT64

Migrating Integers Report



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So, here is the relevant schema, which you will notice is the same tables as in the last example. This time, however, we will look for a specific database, specific table, and specific column. Then we will follow the column references for that column to the compile unit and on to the diskfile to get the disk filename of the compile unit.



Migrating Integer to INT64

Unused Schema Report



Compile units with references to ISSort.Sort-File.Int-Data

```
c:\work\IS\ISrel\src\ar\agen\agencp.p
c:\work\IS\ISrel\src\ar\agen\agensl.p
c:\work\IS\ISrel\src\in\abca\abcarp11.p
c:\work\IS\ISrel\src\in\cycl\cyclrp11.p
c:\work\IS\ISrel\src\in\vari\varirp.p
c:\work\IS\ISrel\src\op\bkor\bkorrp.p
c:\work\IS\ISrel\src\op\bkor\ibkorp.p
c:\work\IS\ISrel\src\op\bkor\ibkorp10.p
c:\work\IS\ISrel\src\op\cloa\cloarp11.p
c:\work\IS\ISrel\src\op\edim\padtrp11.p
c:\work\IS\ISrel\src\op\free\freels11.p
c:\work\IS\ISrel\src\op\free\freerp11.p
c:\work\IS\ISrel\src\op\free\freerp21.p
c:\work\IS\ISrel\src\op\free\freerp31.p
c:\work\IS\ISrel\src\op\invr\analrp.p
```

Demo

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Finally, let's look at tracking block scopes.



Tracking Block Scopes

Tracking Block Scopes



- Maintaining legacy code, one of the most common sources of problems is incorrect buffer or transaction scoping.
- Many programmers seem unaware of the tools which are available for discovering this scope (COMPILE LISTING).
- Even if aware, the tools are often not used because they require special set up.
- And yet, this information is very important!

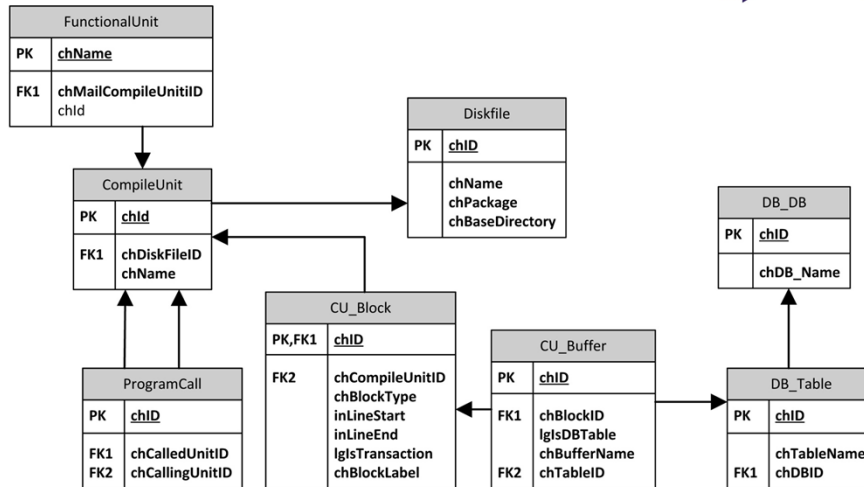
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Judging by what one sees on internet forums., one of the most common problems in development is incorrect buffer or transaction scoping. We have COMPILE LISTING to show us these scopes, but many programmers are either unaware of the tool or seem to forget to use it to check their work. But, this information is critical to understanding many issues of many problems.



Tracking Block Scopes

Tracking Buffer Scope



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Here we have the schema involved in this report. We start with the Functional Unit leading to the main Compile Unit which is called to start this function as discussed before.

From the main Compile Unit, we walk down the Program call link which connects Compile Units with the Compile Units they call. For each Compile Unit, we link to Diskfile to get the filename.

For each Compile Unit, we then look at each Block in that Compile Unit. This tells us whether there is a transaction scoped to that block. We then look to see if there are any buffers scoped to that block and what table is associated with that buffer if the buffer is for a database table.



Tracking Block Scopes



Tracking Buffer Scope

```

List of shared objects for FunctionalUnit po.entry - Purchase Order Entry
| po\poentry
|   0 - MainBlock Warehouse IN-Control PO-Control Entity Login
| 102 - Do          (TRX) PO-Control-D
|   po\poentry0
|     0 - MainBlock Receipt-Type IN-Tax Warehouse PO-Control
|   po\poentry1
|     0 - MainBlock PO-Control
|     70 - Repeat   (TRX) PO-Control-D PO-A Vendor PO Blank-PO
|    177 - Do       (TRX)
|    290 - Repeat   (TRX) FoB ship-Via
|    306 - For      (TRX)
|    400 - Do       (TRX)
|    462 - Do       (TRX)
|    483 - Repeat   (TRX)
|    503 - Repeat   (TRX) Blank-PO PO

```

Demo

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That concludes our examples for the day. Let's look forward a bit to what is coming next.



Future Directions

Future Directions



- Some cleanup on current code & Proparse issues on some code bases.
- Dynamic call resolution and reporting.
- More complete sub-Compile Unit tracking.
- Capturing WHERE clauses.
- Identifying locations of trigger action.
- Capturing index usage.
- ... Whatever people ask for!



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We still have a few things to finish in the current work like the involvement of shared variables in assignments. The biggest issue at the moment is extending Proparse to cover some of the Version 11.x syntax used by some code at Inenco. James and I were able to identify a couple of specific points of syntax that John Green has now added, but work is on-going to finish this project. Just Thursday James isolated another syntax issue which I am sure John will solve soon.

Among the other projects on the list is to improve the reporting on dynamic calls and provide a mechanism for automatic resolution of these calls in subsequent builds. We would also like to extend the tracking of calls and data links to sub-Compile Unit blocks, i.e. internal procedures and methods. We plan on capturing where clauses for all data accesses and possibly index usage. We are going to look at reporting on trigger action for when trigger maintenance is contemplated. This may simply be a report on data that is already there.

But, most importantly, what gets added next will depend more than anything else on what people need and ask for. No small part of what has been added from the initial release is there because James needed it. Simon Prinsloo and Stefan Drissen have also had direct impact. I might note that

as a part of implementing Proparse, there are now some Proparse utilities included.



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To summarize...



In Summary

ABL2DB provides:



- Important information about code and data and the relationships between them.
- A clear roadmap to further expansion and refinement of that information.
- A structure ideal for expansion with additional tools or further information from the same tools.
- Open source, designed for easy tuning to one's own code base.

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This initial version of ABL2DB covers a lot of information about the code and data in an application and their relationships. It is readily available and easy to use in building queries and reports.

We have a clear initial roadmap for adding more information and functionality and refining the information we have.

The design of the system is very modular and easy to expand with new functions or to expand the information currently collected.

The tool is open sourced and has been designed to make the adjustments needed to fit it to the characteristics of the local code base.



For More Information, go to...

- OpenEdge Hive
 - This project: <http://www.oehive.org/ABL2DB>

Contact me at thomas@cintegrity.com.

Related presentations at
<http://www.cintegrity.com>



Here are some links for more information.



Questions?





Thank You

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thomas@cintegrity.com

