



When Logminer is not Enough

MAY 15 & 16, 2019

CLEVELAND PUBLIC AUDITORIUM, CLEVELAND, OHIO

WWW.NEOOUG.ORG/GLOC

When Logminer is not Enough



When Logminer is not enough

- Who Am I?

- Oracle DBA with 23 years of experience
 - Started with Oracle 7.3
 - SQL Server DBA with 8 years of experience
 - Primary interest: Oracle Internals
 - Additional interest: SQL Server internals
- Mark Adams
 - <https://markadamsoracleandsqlserver.wordpress.com>

Goals for Today

What Logminer does

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What Logminer does

How to dump a raw redo log into Human Readable format

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How to interpret the Human Readable format

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First by hand

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First by hand

Then using a tool I wrote

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What Logminer does

How to dump a raw redo log into Human Readable format

How to interpret the Human Readable format

- First by hand

- Then using a tool I wrote

I also have some examples (I have a few in my slide deck and some demos we can run through)

Logminer is Great

- Logminer is a product Oracle provides that is very useful.
- Can be used to investigate database activity
 - Maybe you want to see what tables were inserted into
 - Deleted from?
 - Dropped?



Helpful Logminer Output

OPERATION	DATA_OBJ#	COUNT(*)
INSERT	71175	1
DELETE	4	1

Unhelpful Logminer Output

OPERATION	DATA_OBJ#	COUNT(*)
-----	-----	-----
UNSUPPORTED	21	26
UNSUPPORTED	14	439

ALTER SYSTEM DUMP LOGFILE to the Rescue

- Julian Dyke has a great website about some neat stuff, ALTER SYTEM DUMP LOGFILE for example.

- <http://www.juliandyke.com/Presentations/Presentations.php>

```
alter session set  
  TRACEFILE_IDENTIFIER='dump_redo_demo';
```

```
ALTER SYSTEM DUMP LOGFILE  
' /opt/oracle/product/18c/dbhomeXE/dbs/arch1_18_990  
  220202.dbf
```

Lots of Good Stuff

DUMP OF REDO FROM FILE '/opt/oracle/product/18c/dbhomeXE/dbs/arch1_18_990220202.dbf'

Container ID: 0

Container UID: 0

Opcodes *.*

Container ID: 0

Container UID: 0

RBAs: 0x000000.00000000.0000 thru 0xffffffff.fffffff.ffff

SCNs: scn: 0x0000000000000000 thru scn: 0xffffffffffffff

.....

REDO RECORD - Thread:1 RBA: 0x000012.00000002.0010 LEN: 0x0138 VLD: 0x05 CON_UID: 1

SCN: 0x0000000000273693 SUBSCN: 1 03/10/2019 22:17:08

(LWN RBA: 0x000012.00000002.0010 LEN: 0x00000001 NST: 0x0001 SCN: 0x0000000000273693)

CHANGE #1 CON_ID:1 TYP:0 CLS:33 AFN:4 DBA:0x01000100 OBJ:4294967295 SCN:0x0000000000273643 SEQ:1 OP:5.2 ENC:0 RBL:0
FLG:0x0000

ktudh redo: slt: 0x0018 sqn: 0x00000539 flg: 0x0052 siz: 112 fbi: 0

uba: 0x010001db.0128.08 pxid: 0x0000.000.00000000 pdbid:1

CHANGE #2 CON_ID:1 TYP:0 CLS:34 AFN:4 DBA:0x010001db OBJ:4294967295 SCN:0x0000000000273642 SEQ:1 OP:5.1 ENC:0 RBL:0
FLG:0x0000

ktudb redo: siz: 112 spc: 6332 flg: 0x0012 seq: 0x0128 rec: 0x08

xid: 0x0009.018.00000539

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Interesting Items in the Redo Log

Beginning of Redo Record

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**Len = Size of Redo
Record**

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CON_UID: 1

- SCN: 0x0000000000273693 SUBSCN: 1 03/10/2019 22:17:08 Time Redo was generated

- (LWN RBA: 0x000012.00000002.0010 LEN: 0x00000001 NST: 0x0001 SCN:
0x0000000000273693)

- CHANGE #1 CON_ID:1 TYP:0 CLS:33 AFN:4 DBA:0x01000100 OBJ:4294967295
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Interesting Items in the Redo Log

- REDO RECORD - Thread 1 RBA: 0x000012.00000002.0010 LEN: 0x00000001 VLD: 0x05
CON_UID: 1 **SCN of Redo Record**
- SCN: 0x000000000273693 SUBSCN: 1 03/10/2019 22:17:08
- (LWN RBA: 0x000012.00000002.0010 LEN: 0x00000001 NST: 0x0001 SCN: 0x000000000273693)
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Change
Vector 1

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Change
Vector 1

Change
Vector 2

Interesting Items in the Redo Log

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CON_UID: 1
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XID=Transaction ID

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Data Object Id

Interesting Items in the Redo Log

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Data Object Id

4294967295 Means
Rollback (UNDO)
Segment

Interesting Items in the Redo Log

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- (LWN RBA: 0x000012.00000002.0010 LEN: 0x00000001 NST: 0x0001 SCN:
0x0000000000273693)
- CHANGE #1 CON_ID:1 TYP:0 CLS:33 AFN:4 DBA:0x01000100 OBJ:429496729
SCN:0x0000000000273643 SEQ:1 OP:5.2 ENC:0 RBL:0 FLG:0x0000
- ktudh redo: slt: 0x0018 sqn: 0x00000539 flg: 0x0052 siz: 112 fbi: 0
- uba: 0x010001db.0128.08 pxid: 0x0000.000.00000000 pdbid:1
- CHANGE #2 CON_ID:1 TYP:0 CLS:34 AFN:4 DBA:0x010001db OBJ:4294967295
SCN:0x0000000000273642 SEQ:1 OP:5.1 ENC:0 RBL:0 FLG:0x0000
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Opcode 5.2
Means
Update Rollback
Segment header
- KTURDH

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Opcode 5.2
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I know that because this website tells us
so:<http://www.askmaclean.com/archives/redo-opcode-reference.html>

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AFN=Absolute
File Number.
What file to
which the
change is
applied.

So what do We do with this Interesting Stuff?

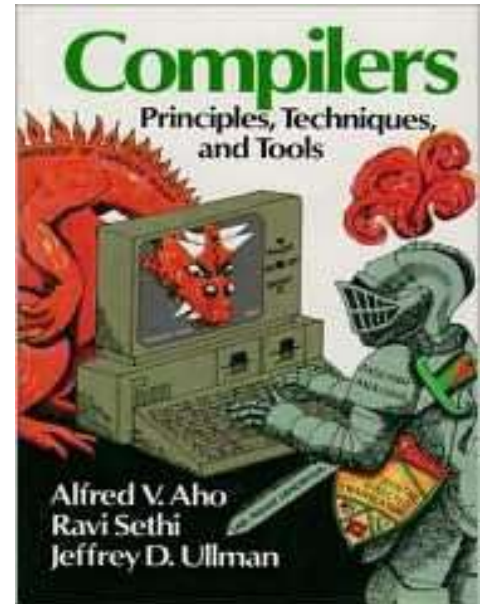
- REDO RECORD - Thread:1 RBA: 0x000012.00000002.0010 LEN: 0x0138 VLD: 0x05
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We Write a Parser

Does anybody here possess a Dragon Book?

Or maybe used to have one?

LEX + YACC



Here's the Parser I Wrote (It's free)

- https://github.com/madams51703/parse_redo
- Please feel free to download it and use it. I don't guarantee it doesn't have bugs. I fixed an issue with the opcodes for this presentation.

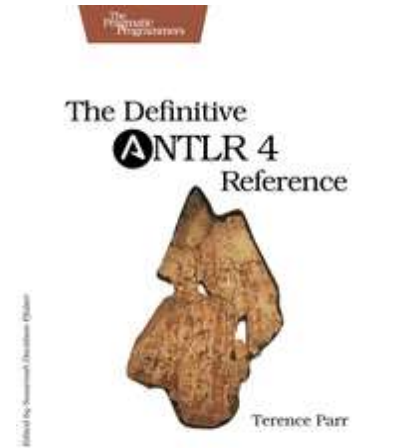
I Used Antlr4 to Write the Parser

- [HTTPS://WWW.ANTLR.ORG](https://www.antlr.org)

Replace the Dragon Book with Terrance Parr's book on Antlr4

Antlr = LEX + YACC in one tool

Antlr4 is cool



This is an snippet of the Lexical Definition

```
lexer grammar RedoLexer;
```

```
AFN:      'AFN';  
BEGIN:    'BEGIN';  
BCL:      'BCL';  
BDDBA:    'BDDBA';  
BIT:      'BIT';  
BLKS:     'BLKS';  
BLOCK:    'BLOCK';  
BUEXT:    'BUEXT';  
BUFFER:   'BUFFER';  
BRB:      'BRB';  
CACHE:    'CACHE';
```


This is an Snippet of the Grammar Definition

```
parser grammar RedoParser;

options { tokenVocab=RedoLexer; }

redo_file
  : redo_info* EOF
  ;

redo_info
  : redo_record change_records
  ;

redo_record
  : REDO RECORD MINUS thread rba len vld con_uid? scn subscn date_value
  ;

change_records
  : change+
  ;

change
  : CHANGE ( change_number con_id? chg_type chg_class chg_afn dba chg_obj
            scn seq layer_opcode enc rbl flg? xid?
            | change_number media_recovery_marker con_id? scn seq layer_opcode enc flg? xid?
            | change_number con_id? invld chg_afn dba blks chg_obj scn seq layer_opcode enc xid?
            )
  ;
```

What can You do with this parser?

Analyze abnormal redo generation workload

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Analyze abnormal redo generation workload

Investigate operations reported as Unsupported and Internal operations by Logminer

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Investigate operations reported as Unsupported and Internal Operations by Logminer

Explore “mundane” daily operations

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Analyze abnormal redo generation workload

Investigate operations reported as Unsupported and Internal operations by Logminer

Explore “mundane” daily operations

What happens when a table expands storage (allocates an extent)?

What can You do with this parser?

Analyze abnormal redo generation workload

Investigate operations reported as Unsupported and Internal operations by Logminer

Explore “mundane” daily operations

What happens when a table expands storage (allocates an extent)?

What happens when a row is deleted from a table?

What can You do with this parser?

Analyze abnormal redo generation workload

Investigate operations reported as Unsupported and Internal operations by Logminer

Explore “mundane” daily operations

What happens when a table expands storage (allocates an extent)?

What happens when a row is deleted from a table?

How about a truncate?

What can You do with this parser?

Analyze abnormal redo generation workload

Investigate operations reported as Unsupported and Internal operations by Logminer

Explore “mundane” daily operations

What happens when a table expands storage (allocates an extent)?

What happens when a row is deleted from a table?

How about a truncate?

How about adding a datafile?

What can you do with this parser?

Analyze abnormal redo generation workload

Investigate operations reported as Unsupported and Internal operations by Logminer

Explore “mundane” daily operations

What happens when a table expands storage (allocates an extent)?

What happens when a row is deleted from a table?

How about a truncate?

How about adding a datafile?

Many other operations...Does anybody have an operation in mind?

An Example of an Unsupported Operation

```
ALTER SYSTEM SWITCH LOGFILE;  
DROP TABLE mark_test;  
drop type MARK_TYPE;  
ALTER SYSTEM SWITCH LOGFILE;  
CREATE TYPE MARK_TYPE as object  
(  
    OWNER VARCHAR2(30)  
);  
/
```

```
create table mark_test  
( a number  
  ,b mark_type  
);
```

```
insert into mark_test (a,b) select object_id,mark_type('MARK') from dba_objects where rownum < 2;  
commit;  
ALTER SYSTEM SWITCH LOGFILE;
```

Unsupported Operation Viewed from V\$LOGMNR_CONTENTS

2019-03-25 23:32:17	0	START
2019-03-25 23:32:17	734	DELETE
2019-03-25 23:32:17	0	COMMIT
2019-03-25 23:32:17	0	START
2019-03-25 23:32:17	734	UNSUPPORTED
2019-03-25 23:32:17	0	COMMIT

Examples (this is from a create table as select...)

0x0003.010.00000729,03/17/2019 17:36:03,77152,19.1,Direct block logging - KCBLCOLB,8236,1
0x0003.010.00000729,03/17/2019 17:36:03,77152,19.1,Direct block logging - KCBLCOLB,8236,1

This is
an Insert

0x0003.010.00000729,03/17/2019 17:36:04,77152,14.1,Unlock Segment Header - KTECUSH,104,1
0x0003.010.00000729,03/17/2019 17:36:04,4294967295,5.2,Update rollback segment header - KTURDH,236,4
0x0003.010.00000729,03/17/2019 17:36:04,4294967295,5.1,Undo block or undo segment header - KTURDB,236,4
0x0003.010.00000729,03/17/2019 17:36:04,77152,14.2,Redo set extent map disk Lock - KTECRLK,68,1
0x0003.010.00000729,03/17/2019 17:36:04,4294967295,5.2,Update rollback segment header - KTURDH,196,4
0x0003.010.00000729,03/17/2019 17:36:04,4294967295,5.1,Undo block or undo segment header - KTURDB,196,4
0x0003.010.00000729,03/17/2019 17:36:04,4294967295,22.2,space header generic redo - KTFBHREDO,72,1
0x0003.010.00000729,03/17/2019 17:36:04,4294967295,22.5,bitmap block generic redo - KTFBBREDO,72,1
0x0003.010.00000729,03/17/2019 17:36:04,4294967295,5.24,Kernel Transaction Undo Relog CHanGe - KTURLGU,172,4
0x0003.010.00000729,03/17/2019 17:36:04,4294967295,22.2,space header generic redo - KTFBHREDO,172,1

0x0003.016.00000729,03/17/2019 17:36:04,4294967295,5.1,Undo block or undo segment header - KTURDB,248,4
0x0003.016.00000729,03/17/2019 17:36:04,77152,14.4,extent operation redo - KTEOPEMREDO,248,1

0x0003.016.00000729,03/17/2019 17:36:04,4294967295,5.4,Commit transaction (transaction table update) - KTURCM,104,4
0x0003.016.00000729,03/17/2019 17:36:04,77152,19.1,Direct block logging - KCBLCOLB,8280,1

Examples (this is from a create table as select...)

0x0003.010.00000729,03/17/2019 17:36:03,77152,19.1,Direct block logging - KCBLCOLB,8236,1
0x0003.010.00000729,03/17/2019 17:36:03,77152,19.1,Direct block logging - KCBLCOLB,8236,1

This is
an Insert

0x0003.010.00000729,03/17/2019 17:36:04,77152,14.1,Unlock Segment Header - KTECUSH,104,1
0x0003.010.00000729,03/17/2019 17:36:04,4294967295,5.2,Update rollback segment header - KTURDH,236,4
0x0003.010.00000729,03/17/2019 17:36:04,4294967295,5.1,Undo block or undo segment header - KTURDB,236,4
0x0003.010.00000729,03/17/2019 17:36:04,77152,14.2,Redo set extent map disk Lock - KTECRLK,68,1
0x0003.010.00000729,03/17/2019 17:36:04,4294967295,5.2,Update rollback segment header - KTURDH,196,4
0x0003.010.00000729,03/17/2019 17:36:04,4294967295,5.1,Undo block or undo segment header - KTURDB,196,4
0x0003.010.00000729,03/17/2019 17:36:04,4294967295,22.2,space header generic redo - KTFBHREDO,72,1
0x0003.010.00000729,03/17/2019 17:36:04,4294967295,22.5,bitmap block generic redo - KTFBBREDO,72,1
0x0003.010.00000729,03/17/2019 17:36:04,4294967295,5.24,Kernel Transaction Undo Relog CHanGe - KTURLGU,172,4
0x0003.010.00000729,03/17/2019 17:36:04,4294967295,22.2,space header generic redo - KTFBHREDO,172,1

Allocating new
Slot in the Undo
Segment

0x0003.016.00000729,03/17/2019 17:36:04,4294967295,5.1,Undo block or undo segment header - KTURDB,248,4
0x0003.016.00000729,03/17/2019 17:36:04,77152,14.4,extent operation redo - KTEOPEMREDO,248,1

0x0003.016.00000729,03/17/2019 17:36:04,4294967295,5.4,Commit transaction (transaction table update) - KTURCM,104,4
0x0003.016.00000729,03/17/2019 17:36:04,77152,19.1,Direct block logging - KCBLCOLB,8280,1

Examples (this is from a create table as select...)

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This is
an Insert

0x0003.010.00000729,03/17/2019 17:36:04,77152,14.1,Unlock Segment Header - KTECUSH,104,1
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0x0003.010.00000729,03/17/2019 17:36:04,4294967295,5.1,Undo block or undo segment header - KTURDB,236,4
0x0003.010.00000729,03/17/2019 17:36:04,77152,14.2,Redo set extent map disk Lock - KTECRLK,68,1
0x0003.010.00000729,03/17/2019 17:36:04,4294967295,5.2,Update rollback segment header - KTURDH,196,4
0x0003.010.00000729,03/17/2019 17:36:04,4294967295,5.1,Undo block or undo segment header - KTURDB,196,4
0x0003.010.00000729,03/17/2019 17:36:04,4294967295,22.2,space header generic redo - KTFBHREDO,72,1
0x0003.010.00000729,03/17/2019 17:36:04,4294967295,22.5,bitmap block generic redo - KTFBBREDO,72,1
0x0003.010.00000729,03/17/2019 17:36:04,4294967295,5.24,Kernel Transaction Undo Relog CHanGe - KTURLGU,172,4
0x0003.010.00000729,03/17/2019 17:36:04,4294967295,22.2,space header generic redo - KTFBHREDO,172,1

Allocating new
Slot in the Undo
Segment

0x0003.016.00000729,03/17/2019 17:36:04,4294967295,5.1,Undo block or undo segment header - KTURDB,248,4
0x0003.016.00000729,03/17/2019 17:36:04,77152,14.4,extent operation redo - KTEOPEMREDO,248,1

Notice we are
Now using slot16

0x0003.016.00000729,03/17/2019 17:36:04,4294967295,5.4,Commit transaction (transaction table update) - KTURCM,104,4
0x0003.016.00000729,03/17/2019 17:36:04,77152,19.1,Direct block logging - KCBLCOLB,8280,1

Examples (this is from a create table as select...)

0x0003.010.00000729,03/17/2019 17:36:03,77152,19.1,Direct block logging - KCBLCOLB,8236,1
0x0003.010.00000729,03/17/2019 17:36:03,77152,19.1,Direct block logging - KCBLCOLB,8236,1

This is
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0x0003.010.00000729,03/17/2019 17:36:04,77152,14.1,Unlock Segment Header - KTECUSH,104,1
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0x0003.010.00000729,03/17/2019 17:36:04,4294967295,5.1,Undo block or undo segment header - KTURDB,236,4
0x0003.010.00000729,03/17/2019 17:36:04,77152,14.2,Redo set extent map disk Lock - KTECRLK,68,1
0x0003.010.00000729,03/17/2019 17:36:04,4294967295,5.2,Update rollback segment header - KTURDH,196,4
0x0003.010.00000729,03/17/2019 17:36:04,4294967295,5.1,Undo block or undo segment header - KTURDB,196,4
0x0003.010.00000729,03/17/2019 17:36:04,4294967295,22.2,space header generic redo - KTFBHREDO,72,1
0x0003.010.00000729,03/17/2019 17:36:04,4294967295,22.5,bitmap block generic redo - KTFBBREDO,72,1
0x0003.010.00000729,03/17/2019 17:36:04,4294967295,5.24,Kernel Transaction Undo Relog CHanGe - KTURLGU,172,4
0x0003.010.00000729,03/17/2019 17:36:04,4294967295,22.2,space header generic redo - KTFBHREDO,172,1

Allocating new
Slot in the Undo
Segment

0x0003.016.00000729,03/17/2019 17:36:04,4294967295,5.1,Undo block or undo segment header - KTURDB,248,4
0x0003.016.00000729,03/17/2019 17:36:04,77152,14.4,extent operation redo - KTEOPEMREDO,248,1

Notice we are
now using slot16

0x0003.016.00000729,03/17/2019 17:36:04,4294967295,5.4,Commit transaction (transaction table update) - KTURCM,104,4
0x0003.016.00000729,03/17/2019 17:36:04,77152,19.1,Direct block logging - KCBLCOLB,8280,1

Back to the
User Insert

An Example Deleting One Row and the Corresponding Index Entry

SQL Commands:

```
ALTER SYSTEM SWITCH LOGFILE;  
DELETE FROM JUNK WHERE ROWNUM < 2;  
COMMIT;  
ALTER SYSTEM SWITCH LOGFILE;
```

Human Readable Dump:

```
REDO RECORD - Thread:1 RBA: 0x000036.00000003.0010 LEN: 0x038c VLD: 0x0d CON_UID: 1  
SCN: 0x00000000003e7d5c SUBSCN: 1 03/20/2019 19:55:12  
CHANGE #1 CON_ID:1 TYP:2 CLS:1 AFN:1 DBA:0x0041a1c9 OBJ:75223 SCN:0x00000000003e76bf SEQ:2 OP:11.3 ENC:0 RBL:0 FLG:0x0000  
CHANGE #2 CON_ID:1 TYP:0 CLS:31 AFN:4 DBA:0x010000f0 OBJ:4294967295 SCN:0x00000000003e7b30 SEQ:1 OP:5.2 ENC:0 RBL:0 FLG:0x0000  
CHANGE #3 CON_ID:1 TYP:0 CLS:1 AFN:1 DBA:0x0041bf02 OBJ:77952 SCN:0x00000000003e7d5a SEQ:1 OP:10.4 ENC:0 RBL:0 FLG:0x0000  
CHANGE #4 CON_ID:1 TYP:0 CLS:31 AFN:4 DBA:0x010000f0 OBJ:4294967295 SCN:0x00000000003e7d5c SEQ:1 OP:5.4 ENC:0 RBL:0 FLG:0x0000  
CHANGE #5 CON_ID:1 TYP:0 CLS:32 AFN:4 DBA:0x010004ae OBJ:4294967295 SCN:0x00000000003e7b2f SEQ:1 OP:5.1 ENC:0 RBL:0 FLG:0x0000  
  xid: 0x0008.003.000007db  
CHANGE #6 CON_ID:1 TYP:0 CLS:32 AFN:4 DBA:0x010004ae OBJ:4294967295 SCN:0x00000000003e7d5c SEQ:1 OP:5.1 ENC:0 RBL:0 FLG:0x0000  
  xid: 0x0008.003.000007db
```

Below is the parser output:

```
0x0008.003.000007db,03/20/2019 19:55:12,75223,11.3,Drop Row Piece - KDODRP,908,1  
0x0008.003.000007db,03/20/2019 19:55:12,4294967295,5.2,Update rollback segment header - KTURDH,908,4  
0x0008.003.000007db,03/20/2019 19:55:12,77952,10.4,Mark leaf row deleted - KDICLDE,908,1  
0x0008.003.000007db,03/20/2019 19:55:12,4294967295,5.4,Commit transaction (transaction table update) - KTURCM,908,4  
0x0008.003.000007db,03/20/2019 19:55:12,4294967295,5.1,Undo block or undo segment header - KTURDB,908,4
```


A photograph of a city skyline at night, with various skyscrapers and buildings illuminated by lights, set against a dark blue sky.

Thanks for Attending this Session

I can be reached at mark.adams.and.mssql@gmail.com

I hope the material today was interesting.

Questions/Answers/Demos

- Are there any questions or any particular commands that anybody wants to investigate? I've got an 18c database and my parser on my other laptop.