abstract

In this talk, we will tell you everything you need to know about how to do table partitioning in the OpenEDge RDBMS. We look at 4 different examples where we used table partitioning. In each one we provide complete details of exactly how to do it. We cover enabling partitioning, defining, partitions, moving data, checking status, etc.

Armed with this information, you will be ready to try it on your own system at home.

Of course, you will try first on a test box, right?

right?

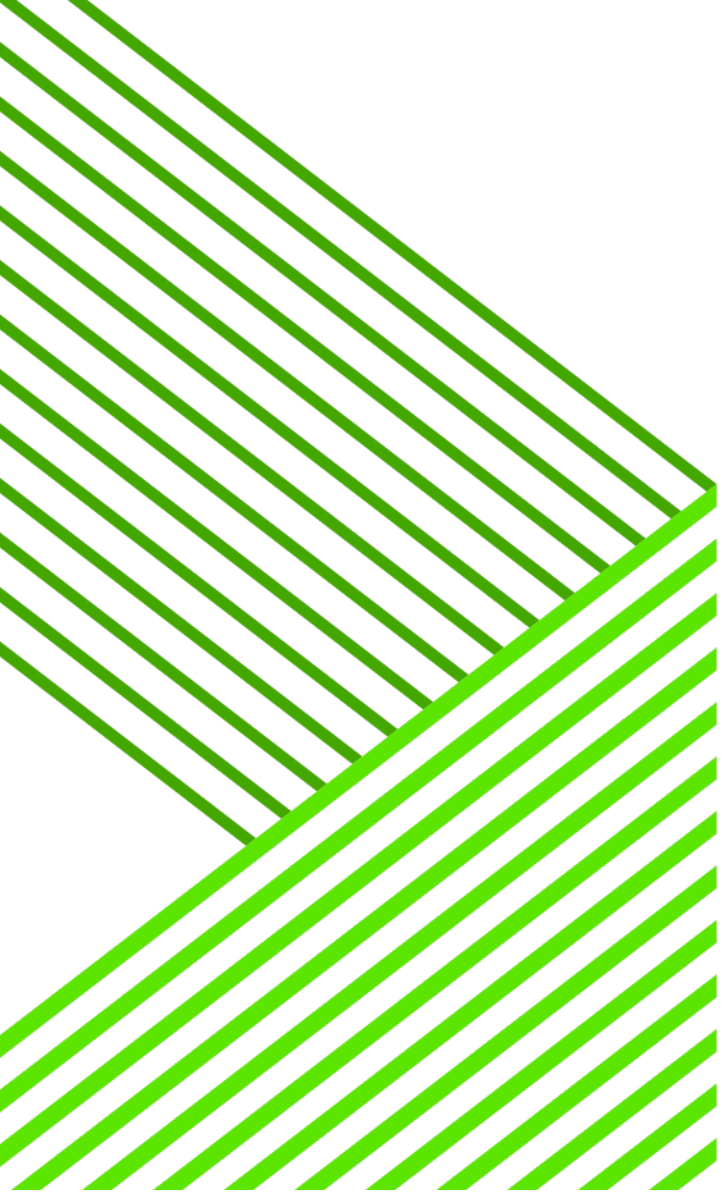

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Table Partitioning Case Studies

Gus Bjorklund – DBA

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PUGCHALLENGE AMERICAS EXCHANGE

Notices

- Please ask questions as we go

What is OpenEdge RDBMS Table Partitioning ?

OpenEdge Table Partitioning (v11.4 and later)

The OpenEdge RDBMS Table Partitioning feature allows you to organize the rows of a table into multiple physical storage objects (i.e. partitions), based on one or more column values, in an application-transparent manner.

By using this feature you can achieve increased data availability and make maintenance operations easier, quicker, and more efficient.

You can partition data of existing tables quickly and gradually move data into the new storage objects. When all are moved, truncate previous areas to recover disk space.

How to do it

partition setup: 4 possible ways

0) OpenEdge Explorer
1) OpenEdge Management
2) write programs to call 4GL API
3) SQL DDL !!!

partition setup: 4 possible ways

0) OpenEdge Explorer
1) OpenEdge Management
2) write programs to call 4GL API
3) SQL DDL !!!

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Example 1: isports database (order date range partitions)

steps:

0) enable partitioning

1) add areas

2) define partitions

3) move data

enable table partitioning

```
proutil foo -C enabletablepartitioning

Adding Table Partitioning file _Partition-Policy
Adding Table Partitioning file _Partition-Policy-Detail
Enable Table Partitioning successful.
Table Partitioning has been successfully enabled
```

```
proutil foo -C enabletpidxbuild

TP Index Rebuild has been enabled for \
database foo. (12479)
```

define partitions

```
proserve foo -S 1234 -B 10000

sqlexp -db foo -S 1234 < part.sql
```

define partition to cover the existing data

```
set schema 'pub';
alter table pub.order
  partition by range "Order-Date"
    using table area "Customer/Order Area"
    using index area "Order Index Area"
    (
      partition "orderp1" values <= ( '12/31/2018' )
    )
    using index "Order-Date";
commit;
```

define partitions for old and new data

```
alter table pub.order
  prepare for split pro_initial
  (
    partition "orderp1" values <= ( '12/31/2016' )
              using table area "old_orders",
    partition "orderp2" values <= ( '12/31/2017' )
              using table area "2017_orders",
    partition "orderp3" values <= ( '12/31/2018' )
              using table area "2018_orders"
  );
commit;

quit;
```

Quiz:

Where are the data now?

proutil foo -C partitionmanage view table order status

```
PROGRESS Partition View


Database: /home/gus/pug/orders/foo
Date: Mon Jun 27 14:40:07 2016

PARTITION STATUS
----------------------
Table                                          Rows
PUB.Order
  initial:0                                     207
  orderp1:1                                       0
  orderp2:2                                       0
  orderp3:3                                       0
```

move the data into the partitions we defined

```
proutil foo -C partitionmanage split table \
     pub.order composite initial \
     useindex "Order-Date"
```

move the data into the partitions we defined

```
proutil foo -C partitionmanage split table \
     pub.order composite initial \
     useindex "Order-Date"
```

```
. . .

     Target partition: orderp1[1], records moved: 207.
     Target partition: orderp2[2], records moved: 0.
     Target partition: orderp3[3], records moved: 0.
     Source partition: initial[0], contains no records.
     Total records processed: 207.

END: Split Operation For Table pub.order[0]
Split Operation finished successfully. (17359)
```

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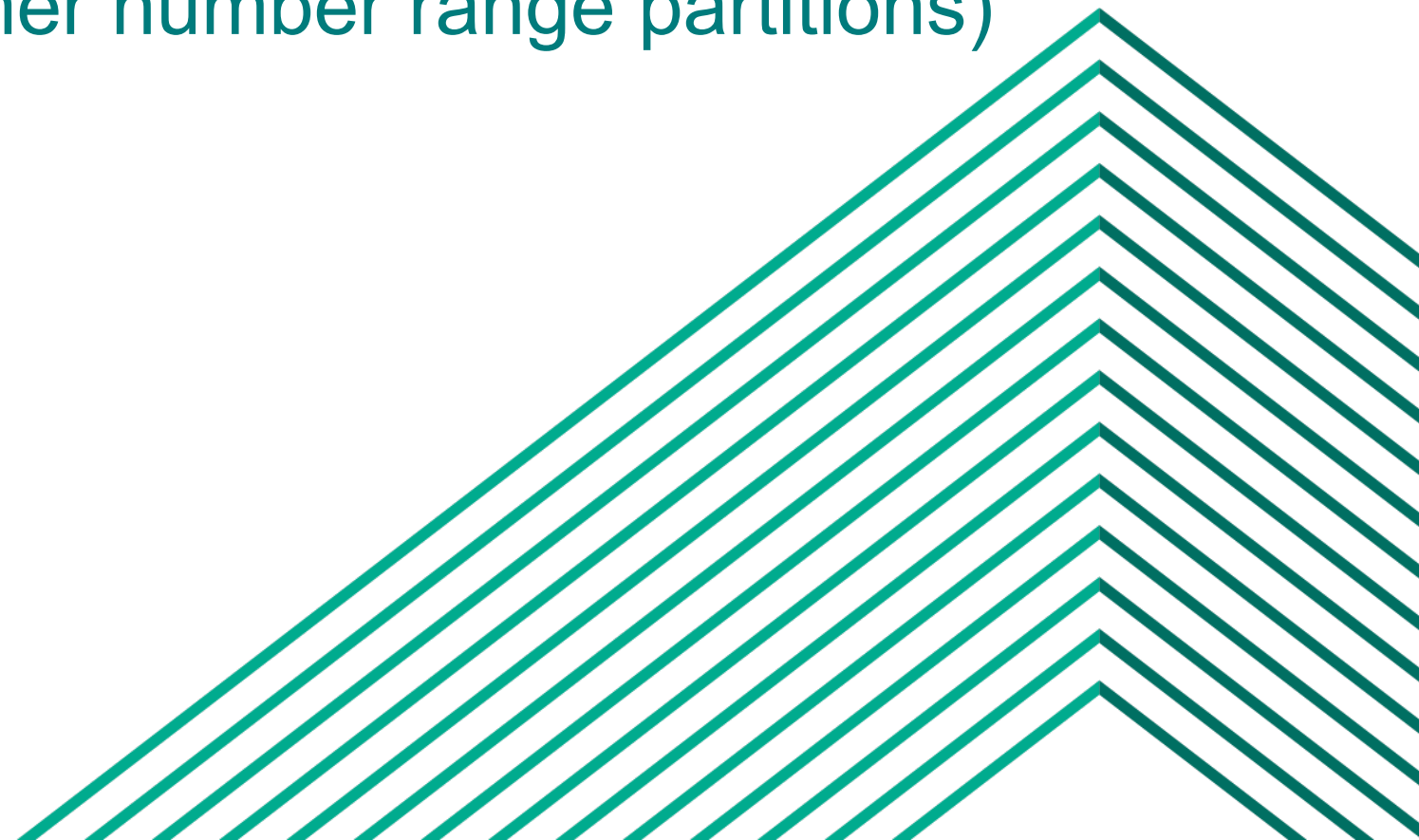
Example 2: 650 GB pm database (customer number range partitions)



Partitioning procedure, part 1

- Generate dbanalys report
- Backup ?
- Enable table partitioning and partition index build
- Add areas and extents for partitions
- Designate tables as partitioned
- Define partitions
- Split data into partitions
- Rebuild or compress indexes

Partitioning procedure, part 2

- Generate partitionmanage view table status reports
- Drop now empty initial partitions
- Truncate empty areas
- Remove extents of empty areas
- Generate dbanalys report
- Compare before and after reports
- Mark some partitions read-only ?
- Backup ?

partition setup

enable table partitioning

```
proutil pm -C enabletablepartitioning

Adding Table Partitioning file _Partition-Policy
Adding Table Partitioning file _Partition-Policy-Detail
Enable Table Partitioning successful.
Table Partitioning has been successfully enabled


proutil pm -C enabletpidxbuild

TP Index Rebuild has been enabled for \
database pm. (12479)
```

4 simple steps:

0) add areas for new partitions

1) define composite partition for existing data

2) define new partitions

3) move data from existing to new partitions

script to create data extents

```
DB_PATH="/opt/db/gus3/pm/data"
echo "#" > add.st
for AREA_NUM in {201..210}
do
    PART_NR=$(( AREA_NUM - 200 ))
    AREA_NAME=areastats_tb_p${PART_NR}
    EXT_NAME=${DB_PATH}/pm_${AREA_NUM}.d1
    echo d \"${AREA_NAME}\":${AREA_NUM},64\;8 ${EXT_NAME}\
 >> add.st
done

prostrct add pm add.st
```

partition setup

define partition for the existing data

```
set schema 'pub';
alter table pub.stats
      partition by range "s-mdba-site-id"
      using table area "Data-stats"
      using index area "Index-stats"
      (
         partition stats_p0 values <= ( 9999 )
      )
      using index "date-sample",
                  "stats-date",
                  "db-date-sample",
                  "s-sample#" ;
commit;
quit;
```

FAIL !

define partition for the existing data

```
set schema 'pub';
alter table pub.stats
      partition by range "s-mdba-site-id"
      using table area "Data-stats"
      using index area "Index-stats"
      (
         partition stats_p0 values <= ( 9999 )
      )
      using index "date-sample",
                  "stats-date",
                  "db-date-sample",
                  "s-sample#" ;
commit;
quit;
```

define partition for the existing data

```
set schema 'pub';
alter table pub.stats
      partition by range "s-mdba-site-id"
      using table area "Data-stats"
      using index area "Index-stats"
      (
         partition stats_p0 values <= ( 'zzzz' )
      )
      using index "date-sample",
                  "stats-date",
                  "db-date-sample",
                  "s-sample#" ;
commit;
quit;
```

define new target partitions

```
set schema 'pub';
alter table pub.stats prepare for split pro_initial
(
    partition stats_p1 values <= ( '107' )
        using table area "stats_tb_p1"
        using index area "stats_ix_p1"
);
```

define new target partitions

```
set schema 'pub';
alter table pub.stats prepare for split pro_initial
(
    partition stats_p1 values <= ( '107' )
        using table area "stats_tb_p1"
        using index area "stats_ix_p1"
);

. . . . repeat for the other partitions . . . .

alter table pub.stats prepare for split pro_initial
(
    partition stats_p9 values <= ( 'zzzz' )
        using table area "stats_tb_p9"
        using index area "stats_ix_p9"
);
commit;
quit;
```

define new target partitions

```
set schema 'pub';
alter table pub.stats prepare for split pro_initial
(
    partition stats_p1 values <= ( '107' )
        using table area "stats_tb_p1"
        using index area "stats_ix_p1"
);

. . . . repeat for the other partitions . . . .

alter table pub.stats prepare for split pro_initial
(
    partition stats_p9 values <= ( 'zzzz' )
        using table area "stats_tb_p9"
        using index area "stats_ix_p9"
);
commit;
quit;
```

partitions defined.

move existing data.

move data with split utility

```
proutil pm -C partitionmanage \
     split table areastats composite initial \
     useindex date-sample
```

```
proutil pm -C partitionmanage \
     split table stats composite initial \
     useindex date-sample
```

split utility output

```
BEGIN: Split Operation For Table areastats (17384)
            Source Partition initial[0]
            Target Partition AREASTATS_P1[1]
            . . .
            Target Partition AREASTATS_P9[9]
Index date-sample has been identified as the scanning inde

A non-unique index has been selected as the useindex index
Additional locking is required with the use of this index
Number of Records per Transaction (recs): 100

Do you want to continue (y/n)?
1000000 records processed. (15165)
2000000 records processed. (15165)
. . .
      Total records processed: 1276802814.
END: Split Operation For Table areastats[0]
Split Operation finished successfully. (17359)
```

proutil –C partitionmanage view table areastats status

```
PROGRESS Partition View
Database: /opt/db/gus3/pm
Date: Thu Jun  4 12:55:17 2015
PARTITION STATUS
----------------------
Table                                          Rows
PUB.AreaStats                                     0
  areastats_p1:1                           54652873
  areastats_p2:2                           28465470
  areastats_p3:3                           56881593
  areastats_p4:4                          207241438
  areastats_p5:5                          159970866
  areastats_p6:6                          217269832
  areastats_p7:7                          390946904
  areastats_p8:8                          104965394
  areastats_p9:9                           56408444
```

delete original disk storage

```
prostrct remove pm d "data-areastats"
You must use the proutil truncate bi command before doing


proutil pm -C truncate bi
OpenEdge Release 11.5 as of Fri Dec  5 18:20:55 EST 2014


prostrct remove pm d "data-areastats"
/opt/db/gus2/db/pm_110.d2 successfully removed. (6968)
prostrct remove pm d "data-areastats"
/opt/db/gus2/db/pm_110.d1 successfully removed. (6968)
gus@bunker15:gus2 $
```

areastats table partitions

partition	range	nr. of rows	extent size
areastats_tb_p1	→ 107	54,652,873	6.5 G
areastats_tb_p2	107 → 118	28,465,470	3.4 G
areastats_tb_p3	118 →18	56,881,593	6.8 G
areastats_tb_p4	18 → 33	207,241,438	24.7 G
areastats_tb_p5	33 → 50	159,970,866	19.0 G
areastats_tb_p6	50 → 66	217,269,832	25.9 G
areastats_tb_p7	66 →81	390,946,904	46.6 G
areastats_tb_p8	81 → 90	104,965,394	12.5 G
areastats_tb_p9	90 → zzzz	56,408,444	6.72 G

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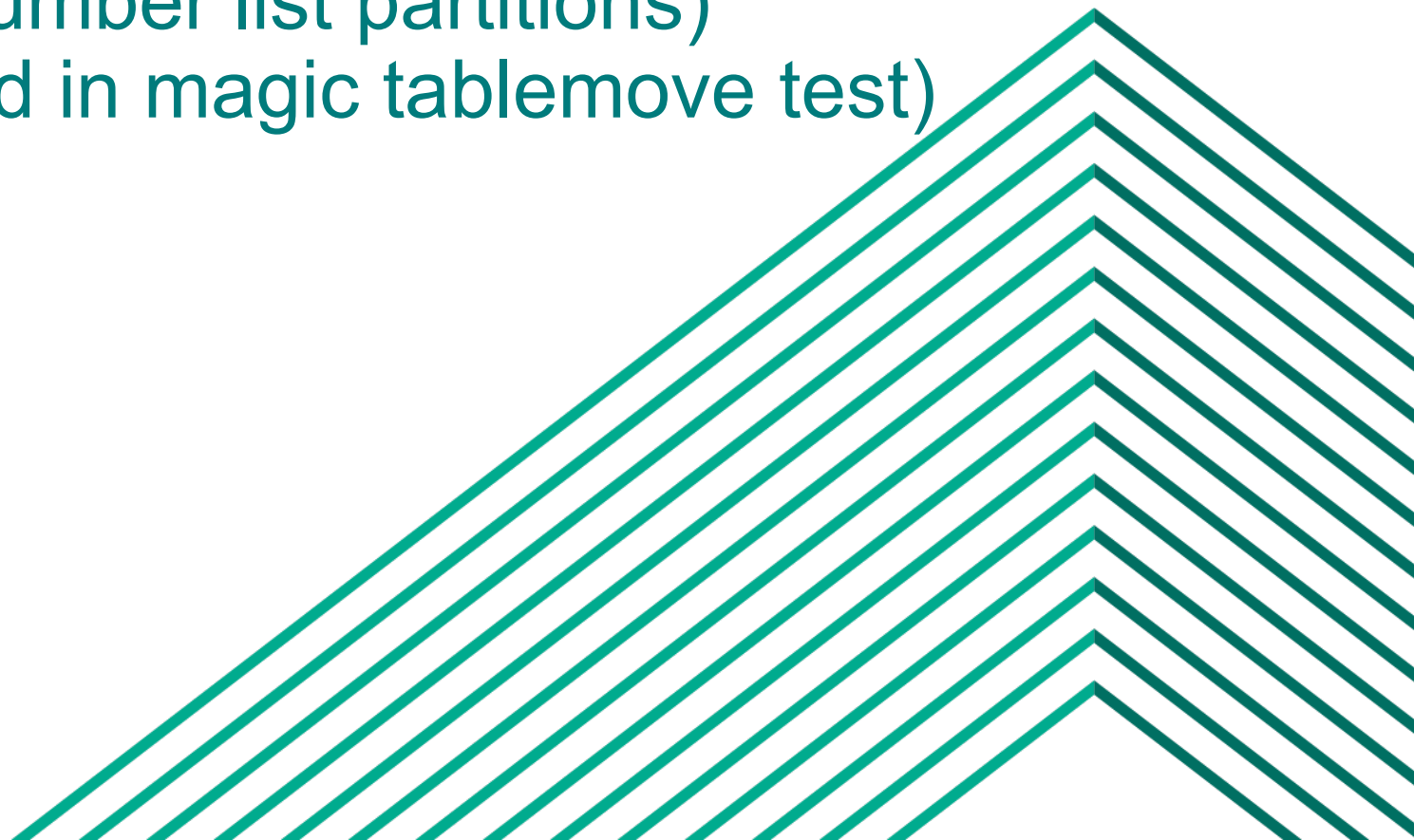
Example 3: atm database (area number list partitions) (as used in magic tablemove test)



enable table partitioning

```
proutil atm -C enabletablepartitioning

Adding Table Partitioning file _Partition-Policy
Adding Table Partitioning file _Partition-Policy-Detail
Enable Table Partitioning successful.
Table Partitioning has been successfully enabled


proutil atm -C enabletpidxbuild

TP Index Rebuild has been enabled for \
database atm. (12479)
```

partition setup

define partition for existing

```
set schema 'pub';
alter table pub.account
      partition by list area51
                using table area "accounts"
      (
          partition "part51" values in (0)
                    using table area "accounts"
      )
      using index "area";
commit;
```

add move target partition

```
alter table pub.account
      add partition "part52" values in (1)
          using table area "area52";
commit;
quit;
```

Quiz:

Where are the data now?

move data

use a 4GL program, maybe like this

```
def var n      as int no-undo.
def var cn     as int no-undo.

find first customer.
cn = cust-num.
find last customer.
mainloop:
  do while (true) transaction:
    do n = 1 to 1000:
      customer.myarea = 1.
      if cust-num = cn then leave mainloop.
      find prev customer.
    end.
  end.
end.
```

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Example 4: 650 GB pm database (customer number range partitions) (dump and load method)

5 simple steps:

0) dump,
1) make new db,
2) partition,
3) load,
4) build indexes

Full dump and load partitioning procedure

- Generate "before" dbanalys report
- Backup ?
- Dump data definitions from source
- Binary dump tables from source database
- Create new target database from empty
- Enable table partitioning and partitioned index build
- Load data definitions
- Define partitions on empty database
- Binary load the data
- Build the indexes - 1 partition at a time, or 1 table at a time
- Generate partitionmanage view table status reports
- Generate "after" dbanalys report
- Compare before and after reports

partition setup

define partition key

```
set schema 'pub';
alter table pub.stats
set partition using index
      "date-sample",
      "stats-date",
      "db-date-sample",
       "s-sample#" ;
commit;
quit;
```

define partition ranges

```
set schema 'pub';
alter table pub.stats
      partition by range "s-mdba-site-id"
      using table area "Data-stats"
      using index area "Index-stats"
(
    partition "stats_p1" values <= ( '107' )
    using table area "stats_tb_p1"
    using index area "stats_ix_p1",
```

define partition ranges

```
set schema 'pub';
alter table pub.stats
      partition by range "s-mdba-site-id"
      using table area "Data-stats"
      using index area "Index-stats"
(
    partition "stats_p1" values <= ( '107' )
    using table area "stats_tb_p1"
    using index area "stats_ix_p1",

. . . . for the other partitions . . . .

    partition "stats_p9" values <= ( 'zzzz' )
    using table area "stats_tb_p9"
    using index area "stats_ix_p9"
) ;
commit;
quit;
```

load data

```
proutil pm -C load /opt/tmp/dump/AreaStats.bd \
  -i -B 81920 >>binload.log

echo "areastats loaded."

(repeat as needed for other tables)
```

don't forget to load the tables you *didn't* partition !

build indexes: (4 indexes, 9 partitions)

```
echo `date +"%H:%M:%S"` "bulding indexes for stats table"

for IX_NAME in "stats-date" "db-date-sample" \
               "date-sample" "s-sample#"
do
  for P_NUM in {1..9}
  do
    echo "building index ${IX_NAME}, partition ${P_NUM}"
    echo y | \
    proutil pm -C tpidxbuild table stats \
       index ${IX_NAME} partition STATS_P${P_NUM} \
       -i -TB 64 -TM 32 -TMB 32 -B 1000
  done
done

echo `date +"%H:%M:%S"` "stats table done"
```

4gl code to show partition objects for a table

```
find _file where _file-name = "stats".

for each _storageobject
    where _object-number = _file-num and
          _object-type = 1:

  find _partition_policy
  where _storageobject._object-number =
        _partition_policy._object-number.

  display _partition-policy-name
          _object-number
          _partitionid
          _Object-attrib
          _object-state
          .
end.
```

4gl code to show partitions

```
for each _partition-policy NO-LOCK:
  display _Partition-Policy-Name    label "PName"  format "x(16)"
    _Num-Columns                 label "Cols"   format ">9"
    _Has-Range                   label "Range"
    _partition-policy._object-number
                                      label "File#"  format "->>,>>9"
    _Column-Name[1]               label "Cname" format "x(12)"
    _Column-Name[2]               label "Cname" format "x(12)"
    _Column-Name[3]               label "Cname" format "x(12)"
    with title "Partition Policy".

  for each _partition-policy-detail of _partition-policy NO-LOCK:
    display _partition-id            label "PartId" format "->>,>>9"
      _Partition-name         label "Partition Name" format "x(12)"
      _Partition-Column-Value[1]  label "V[1]"
      _Partition-Column-Value[2]  label "V[2]"
      _Attributes[1]              label "Attr[1]"
      _Attributes[2]              label "Attr[2]"
      with title "Partition Policy Detail".
    end.
end.
```

partition setup times *

operation	areastats	stats
table size	93.7 G	28.4 G
nr of rows	1,276,802,814	76,601,749
define partitions & areas	1 minute	1 minute
split into 9 parts	77 hours	9.2 hours
table.bd file size	110.4 G	29.5 G
binary dump	~ 1.25 hours	~ 0.4 hours
binary load	2.66 hours	0.31 hours
index rebuild table	3.2 hours	0.22 hours
index rebuild 9 partitions	4.3 hours	0.30 hours
pm view table status	956 seconds	35 seconds

* YMMV, **mistakes**, transportation, meals, and accomodations not included

partition setup times *

operation	areastats	stats
table size	93.7 G	28.4 G
nr of rows	1,276,802,814	76,601,749
define partitions & areas	1 minute	1 minute
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table.bd file size	110.4 G	29.5 G
binary dump	~ 1.25 hours	~ 0.4 hours
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index rebuild table	3.2 hours	0.22 hours
index rebuild 9 partitions	4.3 hours	0.30 hours
pm view table status	956 seconds	35 seconds

* YMMV, **mistakes**, transportation, meals, and accomodations not included

Partitioning is easy.

Try it when you get home.

You'll like it !

Answers

Email:

gus@progress.com