EnterpriseDB™

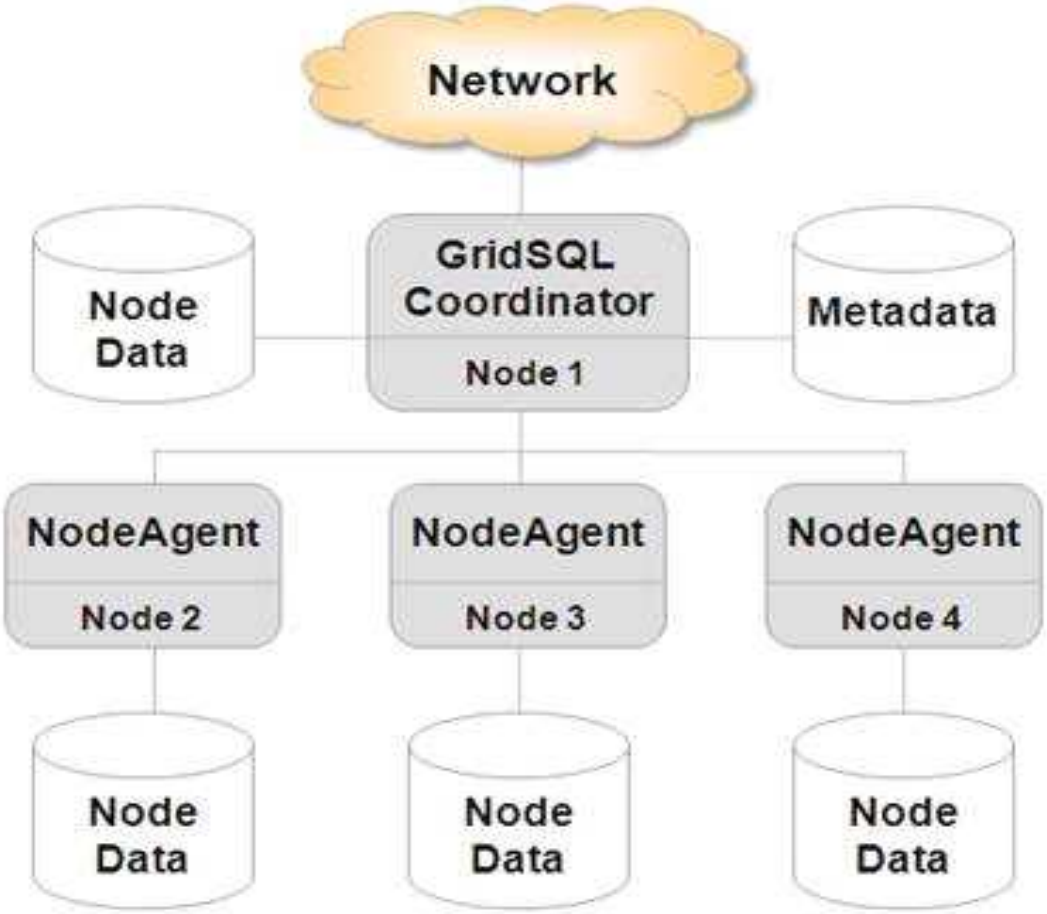
GridSQL

May 22, 2008

Overview

- Designed for parallel querying
- Shared-nothing architecture
- Appears as a single database to the application
- Utilizes PostgreSQL
- Data Loader for parallel loading
- Not just “Read-Only”, can execute UPDATE, DELETE, transactions
- Standard connectivity via PostgreSQL compatible connectors (supports PostgreSQL protocol): JDBC, ODBC, ADO.NET

GridSQL



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The Metadata Database

- Contains schema information including table partitioning and replication
- DDL issued to the GridSQL is recorded in the metadata database
- SQL requests made to the GridSQL interrogate the metadata database for partitioning and replication information to parallelize query plan

xsysindexkeys

xsyscolumns

xsystabspaces

xsysviews

xsysconstraints

xsystables

xsysindexes

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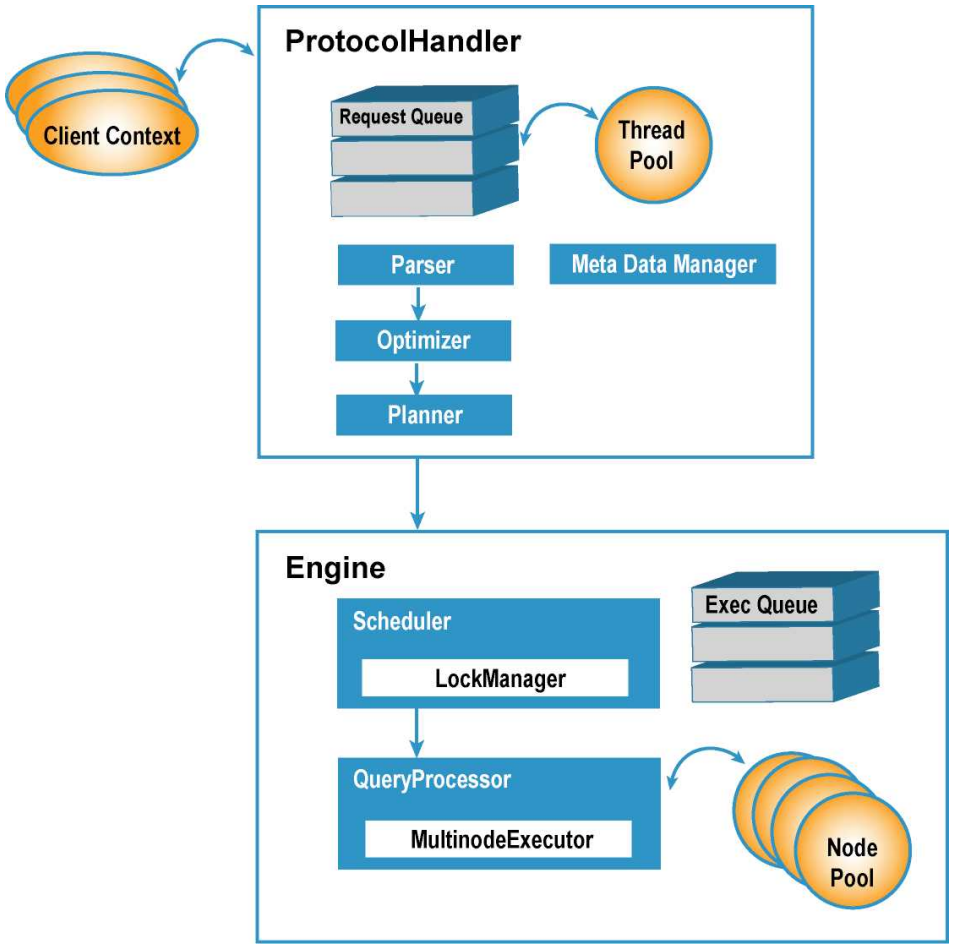
Central Coordinator

- Multi-threaded process running on designated node that manages and coordinates work between the nodes
- Makes use of metadata information
- Performs traditional DBMS functions and manages interactions with the node agents
  - Parsing and optimizing
  - Scheduling and execution



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DDL

- Tables are designated as being either
  - Partitioned by column
  - Round robin
  - Replicated
  - Single node

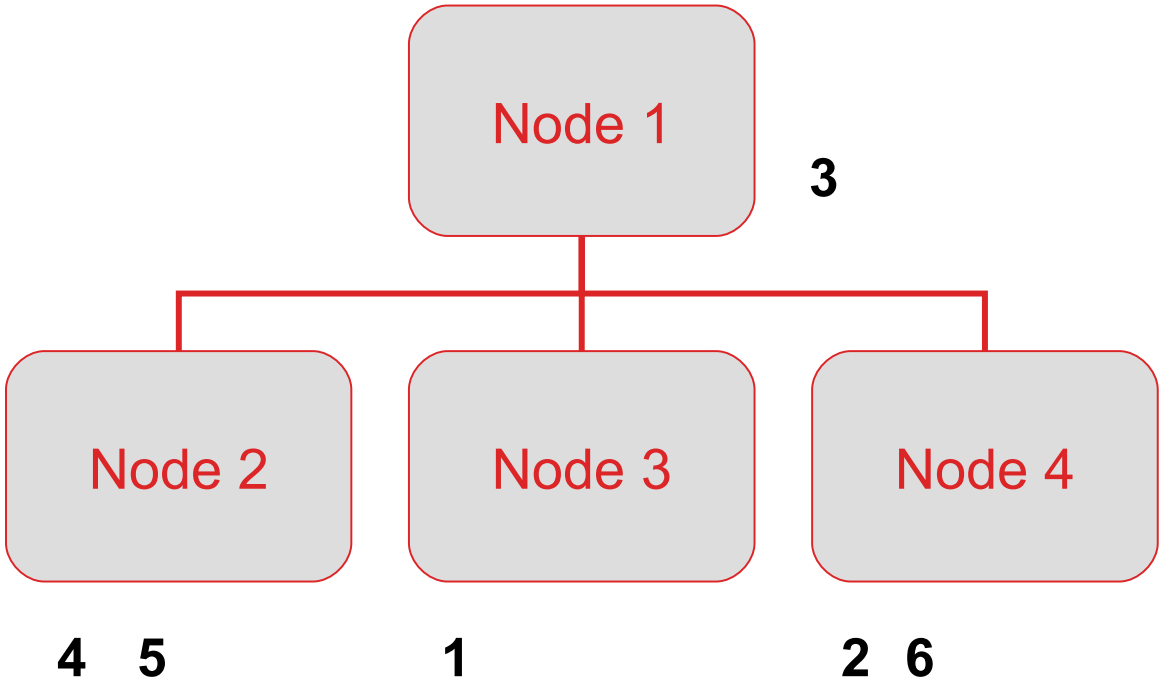
```
CREATE TABLE region
                    (r_regionkey  INTEGER NOT NULL,
                     r_name       CHAR(25) NOT NULL,
                     r_comment    VARCHAR(152))
  REPLICATED;
```

DDL

```
CREATE TABLE orders  (
                    o_orderkey       INTEGER NOT NULL,
                    o_custkey        INTEGER NOT NULL,
                    o_orderstatus    CHAR(1) NOT NULL,
                    o_totalprice     DECIMAL(15,2) NOT NULL,
                    o_orderdate      DATE NOT NULL,
                    o_orderpriority  CHAR(15) NOT NULL,
                    o_clerk          CHAR(15) NOT NULL,
                    o_shippriority   INTEGER NOT NULL,
                    o_comment        VARCHAR(79) NOT NULL)
   PARTITIONING KEY o_orderkey on all;
```

Data Distribution

- Inserted Data Distributed for Partitioned Tables



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Inserting Data

- INSERT INTO region VALUES (1, ‘North America’, ‘comment’);
- gs-loader
  - Uses COPY API
  - -b: basic checking like number of delimiters performed
  - -k: number of rows per “chunk” to try to load, percent reduction, smallest chunk size
  - Example:
    - **gs-loader.sh -d DEV -u admin -i /load/lineitem.tbl -t lineitem -b /load/bad/lineitem.bad -r # -k 100000,10,1 -y /load/bad**

Query Example - Processing

- Query Parsed
- Query Optimized
- Query Planned, Including Transformations
- Query Executed In Steps
  - Intelligently executes in parallel
  - First set of aggregates done in parallel at the nodes
  - Like groups of intermediate results shipped to same target node
  - Second aggregation done in parallel
  - Coordinator streams in node results, combining on the fly and sending to client result set, performing a merge sort if ORDER BY present

Query Example #1

- SELECT COUNT(*) FROM ORDERS;

Query Example #1

Step: 0

Target: CREATE TABLE TMPTT1_1 (XCOL1 INT) WITHOUT OIDS

Select: SELECT COUNT(*) AS XCOL1 FROM orders

Step: 1

Target:

Select: SELECT SUM(XCOL1) AS EXPRESSION1 FROM TMPTT1_1

Drop:

TMPTT1_1

Query Example #1, step 1

ExecutionStep
---
producerCount = 2
consumerCount = 0
isExtraStep = false
isFinalStep = false

aStepDetail

StepNo = 1
isProducer = true
isConsumer = false
queryString = SELECT COUNT(*) AS XCOL1
FROM orders
targetTable = TMPTT1_1
targetSchema =
DropList =
destType = DEST_TYPE_COORD
combineOnCoordFirst = false
consumerNodeList =

coordStepDetail

StepNo = 1
isProducer = false
isConsumer = true
queryString = null
targetTable = TMPTT1_1
targetSchema = CREATE TABLE TMPTT1_1
(XCOL1 INT) WITHOUT OIDS
DropList =
destType = (none set) -1
combineOnCoordFirst = false
consumerNodeList =

nodeUsageTable
---
nodeId = 2 isProducer = true isConsumer = false
nodeId = 1 isProducer = true isConsumer = false

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Query Example #1, step 2

ExecutionStep

---

producerCount = 0

consumerCount = 0

isExtraStep = false

isFinalStep = true

DropList = TMPTT1_1

coordStepDetail

StepNo = 2

isProducer = true

isConsumer = false

queryString = SELECT SUM(XCOL1) as EXPRESSION1 FROM TMPTT1_1

targetTable =

targetSchema =

DropList =

destType = DEST_TYPE_COORD_FINAL

consumerNodeList =

Query Example #2

```
SELECT n_name, SUM(l_extendedprice)
FROM customer INNER JOIN orders on c_custkey = o_custkey
    INNER JOIN lineitem ON o_orderkey = l_orderkey
    INNER JOIN nation ON c_nationkey = n_nationkey
    INNER JOIN region ON n_regionkey = r_regionkey
WHERE r_name = 'ASIA'
    AND c_mktsegment = 'BUILDING'
GROUP BY n_name
```

Replicated: nation, region

Partitioning columns: customer.c_custkey, orders.o_orderkey, lineitem.l_orderkey

Query Example #2

Step: 0

Target: CREATE TABLE TMPTT3_1 (n_name CHAR (25), c_custkey INT) WITHOUT OIDS

Select: SELECT nation.n_name AS n_name,customer.c_custkey AS c_custkey FROM **nation** INNER JOIN **region** ON (nation.n_regionkey = region.r_regionkey) INNER JOIN **customer** ON (customer.c_nationkey = nation.n_nationkey) WHERE (customer.c_mktsegment = 'BUILDING') AND (region.r_name = 'ASIA')

Step: 1

Target: CREATE TABLE TMPTT3_2 (XCOL1 CHAR (25), XCOL2 FLOAT (32)) WITHOUT OIDS

Select: SELECT TMPTT3_1.n_name AS XCOL1,sum(lineitem.l_extendedprice) AS XCOL2 FROM **TMPTT3_1** INNER JOIN **orders** ON (TMPTT3_1.c_custkey = orders.o_custkey) INNER JOIN **lineitem** ON (orders.o_orderkey = lineitem.l_orderkey) group by TMPTT3_1.n_name

Drop:
TMPTT3_1

Step: 2

Target: CREATE TABLE TMPTT3_3 (n_name CHAR (25), EXPRESSION1 FLOAT (32)) WITHOUT OIDS

Select: SELECT XCOL1 AS n_name,SUM(XCOL2) AS EXPRESSION1 FROM **TMPTT3_2** group by XCOL1

Drop:
TMPTT3_2

Query Example #2, step 2

ExecutionStep
---
producerCount = 2
consumerCount = 2
isExtraStep = false
isFinalStep = false
destNodeList = 1 2

nodeUsageTable
---
nodeId = 2
isProducer = true
isConsumer = true
nodeId = 1
isProducer = true
isConsumer = true

aStepDetail

StepNo = 2
isProducer = true
isConsumer = true
queryString = SELECT TMPTT3_1.n_name AS XCOL1,sum(lineitem.l_extendedprice) AS XCOL2 FROM TMPTT3_1 INNER JOIN orders ON (TMPTT3_1.c_custkey = orders.o_custkey) INNER JOIN lineitem ON (orders.o_orderkey = lineitem.l_orderkey) group by TMPTT3_1.n_name
targetTable = TMPTT3_2
targetSchema = CREATE TABLE TMPTT3_2 (XCOL1 CHAR (25), XCOL2 FLOAT (32)) WITHOUT OIDS
DropList = TMPTT3_1
destType = DEST_TYPE_HASH
hashColumn = null
hashColumnPosition = 1
combineOnCoordFirst = false
consumerNodeList = 1 2

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Thank you!