

数据仓库服务
9.1.0.100

性能白皮书

文档版本 02
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1 9.1.0 版本性能测试概述

目的

GaussDB(DWS)是云端托管的PB级高并发实时数据仓库，专注于服务OLAP领域，提供按量付费和包年包月两种付费方式。

本次性能测试基于华为云基础环境，分别在同等硬件配置和同等数据规模下，基于TPC-H、TPC-DS标准测试集，对DWS 9.1.0版本和8.3.0版本进行性能对比测试。基于SSB-Flat测试集，对DWS 9.1.0版本和开源OLAP产品ClickHouse进行对比测试。本次性能测试时间为2024年7月。

TPC-H

TPC-H由国际事务处理性能委员会（Transaction Processing Performance Council）制定发布，用于评测数据库的分析查询能力。TPC-H查询包含8张数据表和22条复杂SQL查询，大多数查询包含多表Join、子查询和Group By等。

TPC-DS

TPC-DS由国际事务处理性能委员会（Transaction Processing Performance Council）制定发布，用于决策支持系统测试基准，主要用于衡量大数据产品的分析性能。TPC-DS查询共包含24张表，99个查询测试语句。

SSB

SSB（Star Schema Benchmark）是一种在学术界和工业界广泛应用的数据库系统性能评估基准测试方法。它能够对比不同数据仓库在处理星型模型查询时的性能，帮助数据库管理员和决策者选择最符合需求的数据库系统。此外，参考OLAP行业的做法，将SSB中的星型模型展平转化为宽表，还可以改造成单一表测试Benchmark（SSB Flat）。

2 9.1.0 版本测试结论

2.1 性能总览

在9.1.0版本，我们实现了很多性能优化特性，提升整体开箱的SQL查询性能。以TPC-H、TPC-DS 1TB作为性能测试对比的基准，重点对比最新9.1.0版本与8.3.0版本的性能提升。集群规模为6节点，其中各节点的规格为16U 64G，累计96U 384G。从以下测试结果可以看到：

- 9.1.0版本存算一体架构TPC-H总查询耗时为234.23秒，相较8.3.0版本的533.05秒，性能提升127%。
- 9.1.0版本存算分离架构与存算一体架构性能劣化在10%以内。
- TPC-H 1000x测试基准22个SQL中，9.1.0版本相比8.3.0版本有19个SQL性能提升达到1.5~5倍，特别是Q19提升达13.5倍。
- TPC-DS 1000x测试基准99个SQL中，9.1.0版本相比8.3.0版本75个SQL有明显提升，10个SQL性能提升有2~8倍。
- 不论是简单的过滤、排序、聚集，还是复杂的多表关联、窗口计算、CTE查询，9.1.0版本都有明显性能优势。

表 2-1 TPC-H 和 TPC-DS 性能总览

1000x	DWS开箱性能		
版本	8.3.0	9.1.0	
-	存算一体 (s)	存算一体 (s)	存算分离 (s)
TPC-H	533.05	234.23	261.19
TPC-DS	1321.76	971.45	1035.80

在9.1.0版本，我们使用存算分离架构指定二级分区，基于ssb-flat 100 GB测试基准，对比DWS和ClickHouse的性能表现，同时固定并行度参数query_dop为16。从以下测试结果可以看到：

- 开箱性能相比开源厂商ClickHouse有30%性能优势。
- 固定并行度为16调优的效果性能提升是ClickHouse的3.64倍。

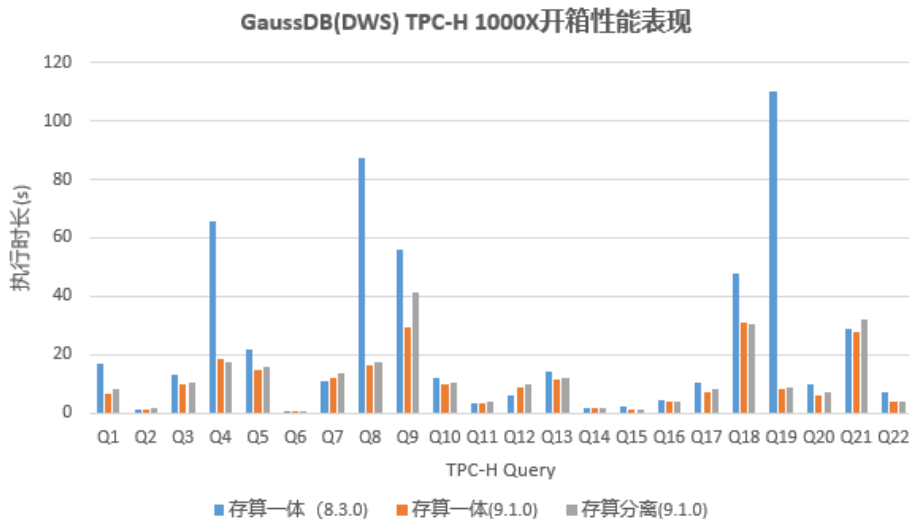
表 2-2 SSB 性能总览

100x	DWS		ClickHouse
ssb-flat	开箱 (s)	query_dop=16 (s)	2.73
	2.10	0.75	

3 TPC-H 性能测试

3.1 TPC-H 测试结果

DWS测试了使用存算一体和存算分离两种部署架构下，TPC-H 1T规模数据集的开箱查询性能，共22个查询。存算一体查询总耗时为234.23s，存算分离查询总耗时为261.19s。



详细性能数据见下表。

表 3-1 TPC-H 测试结果

版本	8.3.0	9.1.0	
	存算一体	存算一体	存算分离
Q1	16.97	6.58	8.29
Q2	1.44	1.51	1.76
Q3	13.02	10.13	10.51

版本	8.3.0	9.1.0	
Q4	65.56	18.59	17.65
Q5	21.90	14.55	15.64
Q6	0.84	0.52	0.68
Q7	11.08	11.92	13.59
Q8	87.18	16.49	17.22
Q9	55.98	29.42	41.29
Q10	12.20	9.67	10.35
Q11	3.57	3.22	3.94
Q12	5.92	8.73	9.96
Q13	14.28	11.62	12.15
Q14	1.87	1.66	1.83
Q15	2.24	1.23	1.45
Q16	4.52	3.75	4.09
Q17	10.54	7.38	8.45
Q18	47.97	31.27	30.74
Q19	110.03	8.13	8.74
Q20	10.07	6.23	7.18
Q21	28.82	27.93	31.83
Q22	7.04	3.70	3.83
总时长 (s)	533.05	234.23	261.19

3.2 TPC-H 测试环境

硬件环境

每个测试环境6个节点，配置如下：

- CPU 16核：Intel Ice Lake
- 内存：64GB
- 网络带宽：9Gbit/s
- 磁盘：SSD云盘，每块600GB，共2块

软件环境

- 内核版本：Linux 3.10.0-862.14.1.5.h757.eulerosv2r7.x86_64
- 操作系统：EulerOS release 2.0 (SP5)
- 数据库版本：DWS 3.0

3.3 TPC-H 测试过程

3.3.1 TPC-H 测试数据

表 3-2 TPC-H 测试数据

序号	表名	行数	表大小
1	region	5	294KB
2	nation	25	298KB
3	supplier	10,000,000	1020MB
4	customer	150,000,000	8226MB
5	part	200,000,000	5216MB
6	partsupp	800,000,000	29GB
7	orders	1,500,000,000	43GB
8	lineitem	5,999,989,709	171GB

3.3.2 TPC-H 数据生成

步骤1 从[官网](#)获取TPC-H工具。

步骤2 登录ECS云服务器，执行如下命令创建TPC-H存放目录。

```
mkdir -p /data1/script/tpcds-kit/tpch1000X
mkdir -p /data2/script/tpcds-kit/tpch1000X
```

步骤3 将获取的TPC-H工具上传到ECS的/data1/script/tpch-kit目录执行以下命令解压。

“tpch_3.0.1.zip” 替换为实际的软件包名。

```
cd /data1/script/tpch-kit && unzip tpch_v3.0.1.zip
```

步骤4 执行如下命令编译生成数据构建工具dbgen。

须知

编译之前需要修改dbgen目录下的两个文件：makefile.suite和tpcd.h

1. 修改makefile.suite文件。

```
#makefile.suite的更改参数如下 ( 103行-111行) :  
CC = gcc  
# Current values for DATABASE are: INFORMIX, DB2, TDAT (Teradata)  
#                               SQLSERVER, SYBASE, ORACLE, VECTORWISE  
# Current values for MACHINE are: ATT, DOS, HP, IBM, ICL, MVS,  
#                               SGI, SUN, U2200, VMS, LINUX, WIN32  
# Current values for WORKLOAD are: TPCH  
DATABASE = POSTGRESQL #程序给定参数没有postgresql , 修改tpcd.h 添加POSTGRESQL脚本  
MACHINE = LINUX  
WORKLOAD = TPCH
```

2. 修改tpcd.h文件。

```
//在tpcd.h文件增加如下语句:  
#ifdef POSTGRESQL  
#define GEN_QUERY_PLAN "EXPLAIN"  
#define START_TRAN "BEGIN TRANSACTION"  
#define END_TRAN "COMMIT;"  
#define SET_OUTPUT ""  
#define SET_ROWCOUNT "LIMIT %d\n"  
#define SET_DBASE ""  
#endif /* POSTGRESQL */  
$ cd TPC-H_Tools_v3.0.1/dbgen  
$ cp makefile.suite makefile  
$ make -f makefile  
$ cp -R /data1/script/tpch-kit/TPC-H_Tools_v3.0.1/ /data2/script/tpch-kit/
```

步骤5 登录ECS，执行如下命令生成TPC-H 1000X数据，本示例分两个数据盘同步生成TPC-H 1000x数据。

须知

TPC-H 1000X数据文件总大小约1100GB，请确认ECS的磁盘空间足够。

1. 进入/data1/script/tpch-kit/TPC-H_Tools_v3.0.1/dbgen目录后，执行如下命令。

```
for c in {1..5};do ./dbgen -s 1000 -C 10 -S ${c} -f > /dev/null 2>&1 &;done
```

2. 进入/data2/script/tpch-kit/ TPC-H_Tools_v3.0.1/dbgen目录后，执行如下命令。

```
for c in {6..10};do ./dbgen -s 1000 -C 10 -S ${c} -f > /dev/null 2>&1 &;done
```

其中：

- -s 指定数据规模，本例为1000。
- -C 指定分成几个chunk，本例为10。
- -S 指定当前是第几个chunk，此处不需修改。

步骤6 执行以下命令，判断数据文件的生成进度。也可以通过`ps ux|grep dbgen`，查看生成数据文件的进程是否退出。

```
du -sh /data1/script/tpch-kit/TPC-H_Tools_v3.0.1/dbgen/*.tbl*  
du -sh /data2/script/tpch-kit/TPC-H_Tools_v3.0.1/dbgen/*.tbl*
```

步骤7 将TPC-H 1000X数据转移至指定目录。

```
mv /data1/script/tpch-kit/TPC-H_Tools_v3.0.1/dbgen/*.tbl* /data1/script/tpch-kit/tpch1000X  
mv /data2/script/tpch-kit/TPC-H_Tools_v3.0.1/dbgen/*.tbl* /data2/script/tpch-kit/tpch1000X
```

---结束

3.3.3 建表与导入 TPC-H 数据

创建 TPC-H 目标表

连接DWS数据库后执行以下命令创建目标表。

```
CREATE TABLE REGION
(
  R_REGIONKEY INT NOT NULL
  , R_NAME VARCHAR(25) NOT NULL
  , R_COMMENT VARCHAR(152)
) WITH (orientation=column, colversion=2.0, enable_hstore=true, enable_hstore_opt=true)
DISTRIBUTE BY replication;
CREATE TABLE NATION
(
  N_NATIONKEY INT NOT NULL
  , N_NAME VARCHAR(25) NOT NULL
  , N_REGIONKEY INT NOT NULL
  , N_COMMENT VARCHAR(152)
) WITH (orientation=column, colversion=2.0, enable_hstore=true, enable_hstore_opt=true)
DISTRIBUTE BY replication;
CREATE TABLE SUPPLIER
(
  S_SUPPKEY BIGINT NOT NULL
  , S_NAME VARCHAR(25) NOT NULL
  , S_ADDRESS VARCHAR(40) NOT NULL
  , S_NATIONKEY INT NOT NULL
  , S_PHONE VARCHAR(15) NOT NULL
  , S_ACCTBAL DECIMAL(15,2) NOT NULL
  , S_COMMENT VARCHAR(101) NOT NULL
) WITH (orientation=column, colversion=2.0,enable_hstore=true,enable_hstore_opt=true)
DISTRIBUTE BY hash(S_SUPPKEY)
PARTITION BY RANGE(S_NATIONKEY)
(
  PARTITION S_NATIONKEY_1 VALUES LESS THAN(1),
  PARTITION S_NATIONKEY_2 VALUES LESS THAN(2),
  PARTITION S_NATIONKEY_3 VALUES LESS THAN(3),
  PARTITION S_NATIONKEY_4 VALUES LESS THAN(4),
  PARTITION S_NATIONKEY_5 VALUES LESS THAN(5),
  PARTITION S_NATIONKEY_6 VALUES LESS THAN(6),
  PARTITION S_NATIONKEY_7 VALUES LESS THAN(7),
  PARTITION S_NATIONKEY_8 VALUES LESS THAN(8),
  PARTITION S_NATIONKEY_9 VALUES LESS THAN(9),
  PARTITION S_NATIONKEY_10 VALUES LESS THAN(10),
  PARTITION S_NATIONKEY_11 VALUES LESS THAN(11),
  PARTITION S_NATIONKEY_12 VALUES LESS THAN(12),
  PARTITION S_NATIONKEY_13 VALUES LESS THAN(13),
  PARTITION S_NATIONKEY_14 VALUES LESS THAN(14),
  PARTITION S_NATIONKEY_15 VALUES LESS THAN(15),
  PARTITION S_NATIONKEY_16 VALUES LESS THAN(16),
  PARTITION S_NATIONKEY_17 VALUES LESS THAN(17),
  PARTITION S_NATIONKEY_18 VALUES LESS THAN(18),
  PARTITION S_NATIONKEY_19 VALUES LESS THAN(19),
  PARTITION S_NATIONKEY_20 VALUES LESS THAN(20),
  PARTITION S_NATIONKEY_21 VALUES LESS THAN(21),
  PARTITION S_NATIONKEY_22 VALUES LESS THAN(22),
  PARTITION S_NATIONKEY_23 VALUES LESS THAN(23),
  PARTITION S_NATIONKEY_24 VALUES LESS THAN(24),
  PARTITION S_NATIONKEY_25 VALUES LESS THAN(25)
);
CREATE TABLE CUSTOMER
(
  C_CUSTKEY BIGINT NOT NULL
  , C_NAME VARCHAR(25) NOT NULL
  , C_ADDRESS VARCHAR(40) NOT NULL
  , C_NATIONKEY INT NOT NULL
  , C_PHONE VARCHAR(15) NOT NULL
  , C_ACCTBAL DECIMAL(15,2) NOT NULL
  , C_MKTSEGMENT VARCHAR(10) NOT NULL
```

```

, C_COMMENT VARCHAR(117) NOT NULL
) WITH (orientation=column, colversion=2.0,enable_hstore=true,enable_hstore_opt=true)
DISTRIBUTE BY hash(C_CUSTKEY)
PARTITION BY RANGE(C_NATIONKEY)
(
PARTITION C_NATIONKEY_1 VALUES LESS THAN(1),
PARTITION C_NATIONKEY_2 VALUES LESS THAN(2),
PARTITION C_NATIONKEY_3 VALUES LESS THAN(3),
PARTITION C_NATIONKEY_4 VALUES LESS THAN(4),
PARTITION C_NATIONKEY_5 VALUES LESS THAN(5),
PARTITION C_NATIONKEY_6 VALUES LESS THAN(6),
PARTITION C_NATIONKEY_7 VALUES LESS THAN(7),
PARTITION C_NATIONKEY_8 VALUES LESS THAN(8),
PARTITION C_NATIONKEY_9 VALUES LESS THAN(9),
PARTITION C_NATIONKEY_10 VALUES LESS THAN(10),
PARTITION C_NATIONKEY_11 VALUES LESS THAN(11),
PARTITION C_NATIONKEY_12 VALUES LESS THAN(12),
PARTITION C_NATIONKEY_13 VALUES LESS THAN(13),
PARTITION C_NATIONKEY_14 VALUES LESS THAN(14),
PARTITION C_NATIONKEY_15 VALUES LESS THAN(15),
PARTITION C_NATIONKEY_16 VALUES LESS THAN(16),
PARTITION C_NATIONKEY_17 VALUES LESS THAN(17),
PARTITION C_NATIONKEY_18 VALUES LESS THAN(18),
PARTITION C_NATIONKEY_19 VALUES LESS THAN(19),
PARTITION C_NATIONKEY_20 VALUES LESS THAN(20),
PARTITION C_NATIONKEY_21 VALUES LESS THAN(21),
PARTITION C_NATIONKEY_22 VALUES LESS THAN(22),
PARTITION C_NATIONKEY_23 VALUES LESS THAN(23),
PARTITION C_NATIONKEY_24 VALUES LESS THAN(24),
PARTITION C_NATIONKEY_25 VALUES LESS THAN(25)
);
CREATE TABLE PART
(
P_PARTKEY BIGINT NOT NULL
, P_NAME VARCHAR(55) NOT NULL
, P_MFGR VARCHAR(25) NOT NULL
, P_BRAND VARCHAR(10) NOT NULL
, P_TYPE VARCHAR(25) NOT NULL
, P_SIZE BIGINT NOT NULL
, P_CONTAINER VARCHAR(10) NOT NULL
, P_RETAILPRICE DECIMAL(15,2) NOT NULL
, P_COMMENT VARCHAR(23) NOT NULL
) WITH (orientation=column, colversion=2.0,enable_hstore=true,enable_hstore_opt=true)
DISTRIBUTE BY hash(P_PARTKEY)
PARTITION BY RANGE(P_SIZE)
(
PARTITION P_SIZE_1 VALUES LESS THAN(11),
PARTITION P_SIZE_2 VALUES LESS THAN(21),
PARTITION P_SIZE_3 VALUES LESS THAN(31),
PARTITION P_SIZE_4 VALUES LESS THAN(41),
PARTITION P_SIZE_5 VALUES LESS THAN(51)
);
CREATE TABLE PARTSUPP
(
PS_PARTKEY BIGINT NOT NULL
, PS_SUPPKEY BIGINT NOT NULL
, PS_AVAILQTY BIGINT NOT NULL
, PS_SUPPLYCOST DECIMAL(15,2) NOT NULL
, PS_COMMENT VARCHAR(199) NOT NULL
) WITH (orientation=column, colversion=2.0,enable_hstore=true,enable_hstore_opt=true)
DISTRIBUTE BY hash(PS_PARTKEY)
PARTITION BY RANGE(PS_AVAILQTY)
(
PARTITION PS_AVAILQTY_1 VALUES LESS THAN(1000),
PARTITION PS_AVAILQTY_2 VALUES LESS THAN(2000),
PARTITION PS_AVAILQTY_3 VALUES LESS THAN(3000),
PARTITION PS_AVAILQTY_4 VALUES LESS THAN(4000),
PARTITION PS_AVAILQTY_5 VALUES LESS THAN(5000),
PARTITION PS_AVAILQTY_6 VALUES LESS THAN(6000),

```

```
PARTITION PS_AVAILQTY_7 VALUES LESS THAN(7000),
PARTITION PS_AVAILQTY_8 VALUES LESS THAN(8000),
PARTITION PS_AVAILQTY_9 VALUES LESS THAN(9000),
PARTITION PS_AVAILQTY_10 VALUES LESS THAN(10000)
);
CREATE TABLE ORDERS
(
O_ORDERKEY BIGINT NOT NULL
,O_CUSTKEY BIGINT NOT NULL
,O_ORDERSTATUS VARCHAR(1) NOT NULL
,O_TOTALPRICE DECIMAL(15,2) NOT NULL
,O_ORDERDATE DATE NOT NULL
,O_ORDERPRIORITY VARCHAR(15) NOT NULL
,O_CLERK VARCHAR(15) NOT NULL
,O_SHIPPRIORITY BIGINT NOT NULL
,O_COMMENT VARCHAR(79) NOT NULL
) WITH (orientation=column, colversion=2.0,enable_hstore=true,enable_hstore_opt=true)
DISTRIBUTE BY hash(O_ORDERKEY)
PARTITION BY RANGE(O_ORDERDATE)
(
PARTITION O_ORDERDATE_1 VALUES LESS THAN('1993-01-01 00:00:00'),
PARTITION O_ORDERDATE_2 VALUES LESS THAN('1994-01-01 00:00:00'),
PARTITION O_ORDERDATE_3 VALUES LESS THAN('1995-01-01 00:00:00'),
PARTITION O_ORDERDATE_4 VALUES LESS THAN('1996-01-01 00:00:00'),
PARTITION O_ORDERDATE_5 VALUES LESS THAN('1997-01-01 00:00:00'),
PARTITION O_ORDERDATE_6 VALUES LESS THAN('1998-01-01 00:00:00'),
PARTITION O_ORDERDATE_7 VALUES LESS THAN('1999-01-01 00:00:00')
);
CREATE TABLE LINEITEM
(
L_ORDERKEY BIGINT NOT NULL
,L_PARTKEY BIGINT NOT NULL
,L_SUPPKEY BIGINT NOT NULL
,L_LINENUMBER BIGINT NOT NULL
,L_QUANTITY DECIMAL(15,2) NOT NULL
,L_EXTENDEDPRICE DECIMAL(15,2) NOT NULL
,L_DISCOUNT DECIMAL(15,2) NOT NULL
,L_TAX DECIMAL(15,2) NOT NULL
,L_RETURNFLAG VARCHAR(1) NOT NULL
,L_LINESTATUS VARCHAR(1) NOT NULL
,L_SHIPDATE DATE NOT NULL
,L_COMMITDATE DATE NOT NULL
,L_RECEIPTDATE DATE NOT NULL
,L_SHIPINSTRUCT VARCHAR(25) NOT NULL
,L_SHIPMODE VARCHAR(10) NOT NULL
,L_COMMENT VARCHAR(44) NOT NULL
) WITH (orientation=column, colversion=2.0,enable_hstore=true,enable_hstore_opt=true)
DISTRIBUTE BY hash(L_ORDERKEY)
PARTITION BY RANGE(L_SHIPDATE)
(
PARTITION L_SHIPDATE_1 VALUES LESS THAN('1993-01-01 00:00:00'),
PARTITION L_SHIPDATE_2 VALUES LESS THAN('1994-01-01 00:00:00'),
PARTITION L_SHIPDATE_3 VALUES LESS THAN('1995-01-01 00:00:00'),
PARTITION L_SHIPDATE_4 VALUES LESS THAN('1996-01-01 00:00:00'),
PARTITION L_SHIPDATE_5 VALUES LESS THAN('1997-01-01 00:00:00'),
PARTITION L_SHIPDATE_6 VALUES LESS THAN('1998-01-01 00:00:00'),
PARTITION L_SHIPDATE_7 VALUES LESS THAN('1999-01-01 00:00:00')
);
```

安装和启动 GDS

- 步骤1** 参见[工具下载](#)下载GDS客户端（与gsql客户端在一个包）。
- 步骤2** 将GDS工具包上传至ECS的/opt目录中，本例以上传Euler Kunpeng版本的工具包为例。
- 步骤3** 在工具包所在目录下，解压工具包。

```
cd /opt/  
unzip dws_client_8.1.x_euler_kunpeng_x64.zip
```

步骤4 创建用户gds_user及其所属的用户组gdsgrp。此用户用于启动GDS，且需要拥有读取数据源文件目录的权限。

```
groupadd gdsgrp  
useradd -g gdsgrp gds_user
```

步骤5 修改工具包以及数据源文件目录属主为创建的用户gds_user及其所属的用户组gdsgrp。

```
chown -R gds_user:gdsgrp /opt/  
chown -R gds_user:gdsgrp /data1  
chown -R gds_user:gdsgrp /data2
```

步骤6 切换到gds_user用户。

```
su - gds_user
```

步骤7 执行环境依赖脚本（仅8.1.x版本适用）。

```
cd /opt/gds/bin  
source gds_env
```

步骤8 启动GDS。

```
/opt/gds/bin/gds -d /data1/script/tpch-kit/tpch1000X/ -p 192.168.0.90:5000 -H 192.168.0.0/24 -l /opt/gds/  
gds01_log.txt -D #TPC-H使用  
/opt/gds/bin/gds -d /data2/script/tpch-kit/tpch1000X/ -p 192.168.0.90:5001 -H 192.168.0.0/24 -l /opt/gds/  
gds02_log.txt -D #TPC-H使用  
/opt/gds/bin/gds -d /data1/script/tpcds-kit/tpcds1000X/ -p 192.168.0.90:5002 -H 192.168.0.0/24 -l /opt/gds/  
gds03_log.txt -D #TPC-DS使用  
/opt/gds/bin/gds -d /data2/script/tpcds-kit/tpcds1000X/ -p 192.168.0.90:5003 -H 192.168.0.0/24 -l /opt/gds/  
gds04_log.txt -D #TPC-DS使用  
/opt/gds/bin/gds -d /data1/script/ssb-kit/ssb100X/ -p 192.168.0.90:5004 -H 192.168.0.0/24 -l /opt/gds/  
gds05_log.txt -D #SSB使用
```

须知

- 命令中的斜体部分请根据实际填写，如果数据分片存放至多个数据盘目录，需要启动对应目录数量的GDS。
- 如果TPC-H和TPC-DS数据同时测试，需要启动以上4个GDS，如果只测试TPC-DS或TPC-H数据，请根据后面的“#xxx”备注启动对应的GDS服务即可。
- -d dir: 保存有待导入数据的数据文件所在目录。
- -p ip:port: GDS监听IP和监听端口。IP替换为ECS的内网IP，确保GaussDB(DWS)能通过此IP与GDS的通讯；端口对于TPC-H取5000、5001，对于TPC-DS取5002、5003。
- -H address_string: 允许哪些主机连接和使用GDS服务。参数需为CIDR格式。此地址配置成GaussDB(DWS)的集群内网网段（即GDS所在的ECS与GaussDB(DWS)在同一个VPC下，以内网通讯即可），例如192.168.0.0/24。
- -l log_file: 存放GDS的日志文件路径及文件名。
- -D: 后台运行GDS。仅支持Linux操作系统下使用。

----结束

创建 TPC-H 数据集的 GDS 外表

连接DWS数据库后执行以下SQL语句创建。

须知

以下每个外表的“**gsfs://192.168.0.90:500x/xxx | gsfs://192.168.0.90:500x/xxx**”中的IP地址和端口，请替换成安装和启动GDS中的对应的GDS的监听IP和端口。如启动两个GDS，则使用“|”区分。如果启动多个GDS，需要将所有GDS的监听IP和端口配置到外表中。

```
DROP FOREIGN TABLE IF EXISTS region_load;
CREATE FOREIGN TABLE region_load
(
  R_REGIONKEY INT,
  R_NAME CHAR(25),
  R_COMMENT VARCHAR(152)
) SERVER gsmpp_server
OPTIONS(location 'gsfs://192.168.0.90:5000/region.tbl* | gsfs://192.168.0.90:5001/region.tbl*',
format 'text',
deLIMITer '|',
encoding 'utf8',
mode 'Normal'
);
DROP FOREIGN TABLE IF EXISTS nation_load;
CREATE FOREIGN TABLE nation_load
(
  N_NATIONKEY INT,
  N_NAME CHAR(25),
  N_REGIONKEY INT,
  N_COMMENT VARCHAR(152)
) SERVER gsmpp_server
OPTIONS(location 'gsfs://192.168.0.90:5000/nation.tbl* | gsfs://192.168.0.90:5001/nation.tbl*',
format 'text',
deLIMITer '|',
encoding 'utf8',
mode 'Normal'
);
DROP FOREIGN TABLE IF EXISTS supplier_load;
CREATE FOREIGN TABLE supplier_load
(
  S_SUPPKEY INT,
  S_NAME CHAR(25),
  S_ADDRESS VARCHAR(40),
  S_NATIONKEY INT,
  S_PHONE CHAR(15),
  S_ACCTBAL DECIMAL(15,2),
  S_COMMENT VARCHAR(101)
)
SERVER gsmpp_server
OPTIONS(location 'gsfs://192.168.0.90:5000/supplier.tbl* | gsfs://192.168.0.90:5001/supplier.tbl*',
format 'text',
deLIMITer '|',
encoding 'utf8',
mode 'Normal'
);
DROP FOREIGN TABLE IF EXISTS customer_load;
CREATE FOREIGN TABLE customer_load
(
  C_CUSTKEY INT,
  C_NAME VARCHAR(25),
  C_ADDRESS VARCHAR(40),
  C_NATIONKEY INT,
  C_PHONE CHAR(15),
  C_ACCTBAL DECIMAL(15,2),
  C_MKTSEGMENT CHAR(10),
  C_COMMENT VARCHAR(117)
)
SERVER gsmpp_server
OPTIONS(location 'gsfs://192.168.0.90:5000/customer.tbl* | gsfs://192.168.0.90:5001/customer.tbl*',
format 'text',
```

```

deLIMITer '|',
encoding 'utf8',
mode 'Normal'
);
DROP FOREIGN TABLE IF EXISTS part_load;
CREATE FOREIGN TABLE part_load
(
P_PARTKEY INT,
P_NAME VARCHAR(55),
P_MFGR CHAR(25),
P_BRAND CHAR(10),
P_TYPE VARCHAR(25),
P_SIZE INT,
P_CONTAINER CHAR(10),
P_RETAILPRICE DECIMAL(15,2),
P_COMMENT VARCHAR(23)
)
SERVER gsmpp_server
OPTIONS(location 'gsfs://192.168.0.90:5000/part.tbl* | gsfs://192.168.0.90:5001/part.tbl*',
format 'text',
deLIMITer '|',
encoding 'utf8',
mode 'Normal'
);
DROP FOREIGN TABLE IF EXISTS partsupp_load;
CREATE FOREIGN TABLE partsupp_load
(
PS_PARTKEY INT,
PS_SUPPKEY INT,
PS_AVAILQTY INT,
PS_SUPPLYCOST DECIMAL(15,2),
PS_COMMENT VARCHAR(199)
)
SERVER gsmpp_server
OPTIONS(location 'gsfs://192.168.0.90:5000/partsupp.tbl* | gsfs://192.168.0.90:5001/partsupp.tbl*',
format 'text',
deLIMITer '|',
encoding 'utf8',
mode 'Normal'
);
DROP FOREIGN TABLE IF EXISTS orders_load;
CREATE FOREIGN TABLE orders_load
(
O_ORDERKEY BIGINT,
O_CUSTKEY INT,
O_ORDERSTATUS CHAR(1),
O_TOTALPRICE DECIMAL(15,2),
O_ORDERDATE DATE,
O_ORDERPRIORITY CHAR(15),
O_CLERK CHAR(15),
O_SHIPPRIORITY INT,
O_COMMENT VARCHAR(79)
)
SERVER gsmpp_server
OPTIONS(location 'gsfs://192.168.0.90:5000/orders.tbl* | gsfs://192.168.0.90:5001/orders.tbl*',
format 'text',
deLIMITer '|',
encoding 'utf8',
mode 'Normal'
);
DROP FOREIGN TABLE IF EXISTS lineitem_load;
CREATE FOREIGN TABLE lineitem_load
(
L_ORDERKEY BIGINT,
L_PARTKEY INT,
L_SUPPKEY INT,
L_LINENUMBER INT,
L_QUANTITY DECIMAL(15,2),
L_EXTENDEDPRICE DECIMAL(15,2),

```



```
L_DISCOUNT DECIMAL(15,2),
L_TAX DECIMAL(15,2),
L_RETURNFLAG CHAR(1),
L_LINESTATUS CHAR(1),
L_SHIPDATE DATE,
L_COMMITDATE DATE,
L_RECEIPTDATE DATE,
L_SHIPINSTRUCT CHAR(25),
L_SHIPMODE CHAR(10),
L_COMMENT VARCHAR(44)
)
SERVER gsmpp_server
OPTIONS(location 'gsfs://192.168.0.90:5000/lineitem.tbl* | gsfs://192.168.0.90:5001/lineitem.tbl*',
format 'text',
deLIMITer '|',
encoding 'utf8',
mode 'Normal'
);
```

导入 TPC-H 数据

执行以下SQL语句导入数据。

```
INSERT INTO region SELECT * FROM region_load;
INSERT INTO nation SELECT * FROM nation_load;
INSERT INTO supplier SELECT * FROM supplier_load;
INSERT INTO customer SELECT * FROM customer_load;
INSERT INTO part SELECT * FROM part_load;
INSERT INTO partsupp SELECT * FROM partsupp_load;
INSERT INTO orders SELECT * FROM orders_load;
INSERT INTO lineitem SELECT * FROM lineitem_load;
```

3.3.4 TPC-H 查询测试

TPC-H由国际事务处理性能委员会（Transaction Processing Performance Council）制定发布，用于评测数据库的分析查询能力。TPC-H查询包含8张数据表和22条复杂SQL查询，大多数查询包含多表Join、子查询和Group By等。

包含Q1~Q22共22个查询，具体的查询SQL代码如下显示，仅供参考。

了解更多内容，请访问TPC-H官网。

Q1

```
SELECT
L_returnflag,
L_linestatus,
sum(L_quantity) as sum_qty,
sum(L_extendedprice) as sum_base_price,
sum(L_extendedprice * (1 - L_discount)) as sum_disc_price,
sum(L_extendedprice * (1 - L_discount) * (1 + L_tax)) as sum_charge,
avg(L_quantity) as avg_qty,
avg(L_extendedprice) as avg_price,
avg(L_discount) as avg_disc,
count(*) as count_order
FROM
lineitem
WHERE
L_shipdate <= date '1998-12-01' - interval '90' day (3)
GROUP BY
L_returnflag,
L_linestatus
ORDER BY
L_returnflag,
L_linestatus;
```

Q2

```
SELECT
s_acctbal,
s_name,
n_name,
p_partkey,
p_mfgr,
s_address,
s_phone,
s_comment
FROM
part,
supplier,
partsupp,
nation,
region
WHERE
p_partkey = ps_partkey
and s_suppkey = ps_suppkey
and p_size = 15
and p_type like '%BRASS'
and s_nationkey = n_nationkey
and n_regionkey = r_regionkey
and r_name = 'EUROPE'
and ps_supplycost = (
SELECT
min(ps_supplycost)
FROM
partsupp,
supplier,
nation,
region
WHERE
p_partkey = ps_partkey
and s_suppkey = ps_suppkey
and s_nationkey = n_nationkey
and n_regionkey = r_regionkey
and r_name = 'EUROPE'
)
ORDER BY
s_acctbal desc,
n_name,
s_name,
p_partkey
LIMIT 100;
```

Q3

```
SELECT
l_orderkey,
sum(l_extendedprice * (1 - l_discount)) as revenue,
o_orderdate,
o_shippriority
FROM
customer,
orders,
lineitem
WHERE
c_mktsegment = 'BUILDING'
and c_custkey = o_custkey
and l_orderkey = o_orderkey
and o_orderdate < date '1995-03-15'
and l_shipdate > date '1995-03-15'
GROUP BY
l_orderkey,
o_orderdate,
o_shippriority
ORDER BY
```

```
revenue desc,
o_orderdate
LIMIT 10;
```

Q4

```
SELECT
o_orderpriority,
count(*) as order_count
FROM
orders
WHERE
o_orderdate >= date '1993-07-01'
and o_orderdate < date '1993-07-01' + interval '3' month
and exists (
SELECT
*
FROM
lineitem
WHERE
l_orderkey = o_orderkey
and l_commitdate < l_receiptdate
)
GROUP BY
o_orderpriority
ORDER BY
o_orderpriority;
```

Q5

```
SELECT
n_name,
sum(l_extendedprice * (1 - l_discount)) as revenue
FROM
customer,
orders,
lineitem,
supplier,
nation,
region
WHERE
c_custkey = o_custkey
and l_orderkey = o_orderkey
and l_suppkey = s_suppkey
and c_nationkey = s_nationkey
and s_nationkey = n_nationkey
and n_regionkey = r_regionkey
and r_name = 'ASIA'
and o_orderdate >= date '1994-01-01'
and o_orderdate < date '1994-01-01' + interval '1' year
GROUP BY
n_name
ORDER BY
revenue desc;
```

Q6

```
SELECT
sum(l_extendedprice * l_discount) as revenue
FROM
lineitem
WHERE
l_shipdate >= date '1994-01-01'
and l_shipdate < date '1994-01-01' + interval '1' year
and l_discount between .06 - 0.01 and .06 + 0.01
and l_quantity < 24;
```

Q7

```

SELECT
  supp_nation,
  cust_nation,
  l_year,
  sum(volume) as revenue
FROM
  (
  SELECT
    n1.n_name as supp_nation,
    n2.n_name as cust_nation,
    extract(year FROM l_shipdate) as l_year,
    l_extendedprice * (1 - l_discount) as volume
  FROM
    supplier,
    lineitem,
    orders,
    customer,
    nation n1,
    nation n2
  WHERE
    s_suppkey = l_suppkey
    and o_orderkey = l_orderkey
    and c_custkey = o_custkey
    and s_nationkey = n1.n_nationkey
    and c_nationkey = n2.n_nationkey
    and (
      (n1.n_name = 'FRANCE' and n2.n_name = 'GERMANY')
      or (n1.n_name = 'GERMANY' and n2.n_name = 'FRANCE')
    )
    and l_shipdate between date '1995-01-01' and date '1996-12-31'
  ) as shipping
GROUP BY
  supp_nation,
  cust_nation,
  l_year
ORDER BY
  supp_nation,
  cust_nation,
  l_year;

```

Q8

```

SELECT
  o_year,
  sum(case
    when nation = 'BRAZIL' then volume
    else 0
  end) / sum(volume) as mkt_share
FROM
  (
  SELECT
    extract(year FROM o_orderdate) as o_year,
    l_extendedprice * (1 - l_discount) as volume,
    n2.n_name as nation
  FROM
    part,
    supplier,
    lineitem,
    orders,
    customer,
    nation n1,
    nation n2,
    region
  WHERE
    p_partkey = l_partkey
    and s_suppkey = l_suppkey
    and l_orderkey = o_orderkey

```

```

and o_custkey = c_custkey
and c_nationkey = n1.n_nationkey
and n1.n_regionkey = r_regionkey
and r_name = 'AMERICA'
and s_nationkey = n2.n_nationkey
and o_orderdate between date '1995-01-01' and date '1996-12-31'
and p_type = 'ECONOMY ANODIZED STEEL'
) as all_nations
GROUP BY
o_year
ORDER BY
o_year;

```

Q9

```

SELECT
nation,
o_year,
sum(amount) as sum_profit
FROM
(
SELECT
n_name as nation,
extract(year FROM o_orderdate) as o_year,
L_extendedprice * (1 - L_discount) - ps_supplycost * L_quantity as amount
FROM
part,
supplier,
lineitem,
partsupp,
orders,
nation
WHERE
s_suppkey = L_suppkey
and ps_suppkey = L_suppkey
and ps_partkey = L_partkey
and p_partkey = L_partkey
and o_orderkey = L_orderkey
and s_nationkey = n_nationkey
and p_name like '%green%'
) as profit
GROUP BY
nation,
o_year
ORDER BY
nation,
o_year desc;

```

Q10

```

SELECT
c_custkey,
c_name,
sum(L_extendedprice * (1 - L_discount)) as revenue,
c_acctbal,
n_name,
c_address,
c_phone,
c_comment
FROM
customer,
orders,
lineitem,
nation
WHERE
c_custkey = o_custkey
and l_orderkey = o_orderkey
and o_orderdate >= date '1993-10-01'
and o_orderdate < date '1993-10-01' + interval '3' month

```

```
and l_returnflag = 'R'  
and c_nationkey = n_nationkey  
GROUP BY  
c_custkey,  
c_name,  
c_acctbal,  
c_phone,  
n_name,  
c_address,  
c_comment  
ORDER BY  
revenue desc  
LIMIT 20;
```

Q11

```
SELECT  
ps_partkey,  
sum(ps_supplycost * ps_availqty) as value  
FROM  
partsupp,  
supplier,  
nation  
WHERE  
ps_suppkey = s_suppkey  
and s_nationkey = n_nationkey  
and n_name = 'GERMANY'  
GROUP BY  
ps_partkey having  
sum(ps_supplycost * ps_availqty) > (  
SELECT  
sum(ps_supplycost * ps_availqty) * 0.0000001000  
FROM  
partsupp,  
supplier,  
nation  
WHERE  
ps_suppkey = s_suppkey  
and s_nationkey = n_nationkey  
and n_name = 'GERMANY'  
)  
ORDER BY  
value desc;
```

Q12

```
SELECT  
l_shipmode,  
sum(case  
when o_orderpriority = '1-URGENT'  
or o_orderpriority = '2-HIGH'  
then 1  
else 0  
end) as high_line_count,  
sum(case  
when o_orderpriority <> '1-URGENT'  
and o_orderpriority <> '2-HIGH'  
then 1  
else 0  
end) as low_line_count  
FROM  
orders,  
lineitem  
WHERE  
o_orderkey = l_orderkey  
and l_shipmode in ('MAIL', 'SHIP')  
and l_commitdate < l_receiptdate  
and l_shipdate < l_commitdate  
and l_receiptdate >= date '1994-01-01'
```

```
and l_receiptdate < date '1994-01-01' + interval '1' year
GROUP BY
l_shipmode
ORDER BY
l_shipmode;
```

Q13

```
SELECT
c_count,
count(*) as custdist
FROM
(
SELECT
c_custkey,
count(o_orderkey)
FROM
customer left outer join orders on
c_custkey = o_custkey
and o_comment not like '%special%requests%'
GROUP BY
c_custkey
) as c_orders (c_custkey, c_count)
GROUP BY
c_count
ORDER BY
custdist desc,
c_count desc;
```

Q14

```
SELECT
100.00 * sum(case
when p_type like 'PROMO%'
then l_extendedprice * (1 - l_discount)
else 0
end) / sum(l_extendedprice * (1 - l_discount)) as promo_revenue
FROM
lineitem,
part
WHERE
l_partkey = p_partkey
and l_shipdate >= date '1995-09-01'
and l_shipdate < date '1995-09-01' + interval '1' month;
```

Q15

```
WITH revenue (supplier_no, total_revenue) as
(
SELECT
l_suppkey,
sum(l_extendedprice * (1 - l_discount))
FROM
lineitem
WHERE
l_shipdate >= date '1996-01-01'
and l_shipdate < date '1996-01-01' + interval '3 month'
GROUP BY
l_suppkey
)
SELECT
s_suppkey,
s_name,
s_address,
s_phone,
total_revenue
FROM
supplier,
```

```
revenue
WHERE
s_suppkey = supplier_no
and total_revenue = (
SELECT
max(total_revenue)
FROM
revenue
)
ORDER BY
s_suppkey;
```

Q16

```
SELECT
p_brand,
p_type,
p_size,
count(distinct ps_suppkey) as supplier_cnt
FROM
partsupp,
part
WHERE
p_partkey = ps_partkey
and p_brand <> 'Brand#45'
and p_type not like 'MEDIUM POLISHED%'
and p_size in (49, 14, 23, 45, 19, 3, 36, 9)
and ps_suppkey not in (
SELECT
s_suppkey
FROM
supplier
WHERE
s_comment like '%Customer%Complaints%'
)
GROUP BY
p_brand,
p_type,
p_size
ORDER BY
supplier_cnt desc,
p_brand,
p_type,
p_size
LIMIT 100;
```

Q17

```
SELECT
sum(L_extendedprice) / 7.0 as avg_yearly
FROM
lineitem,
part
WHERE
p_partkey = l_partkey
and p_brand = 'Brand#23'
and p_container = 'MED BOX'
and l_quantity < (
SELECT
0.2 * avg(l_quantity)
FROM
lineitem
WHERE
l_partkey = p_partkey
);
```


Q18

```

SELECT
c_name,
c_custkey,
o_orderkey,
o_orderdate,
o_totalprice,
sum(L_quantity)
FROM
customer,
orders,
lineitem
WHERE
o_orderkey in (
SELECT
L_orderkey
FROM
lineitem
GROUP BY
L_orderkey having
sum(L_quantity) > 300
)
and c_custkey = o_custkey
and o_orderkey = L_orderkey
GROUP BY
c_name,
c_custkey,
o_orderkey,
o_orderdate,
o_totalprice
ORDER BY
o_totalprice desc,
o_orderdate
LIMIT 100;

```

Q19

```

SELECT
sum(L_extendedprice* (1 - L_discount)) as revenue
FROM
lineitem,
part
WHERE
(
p_partkey = L_partkey
and p_brand = 'Brand#12'
and p_container in ('SM CASE', 'SM BOX', 'SM PACK', 'SM PKG')
and L_quantity >= 1 and L_quantity <= 1 + 10
and p_size between 1 and 5
and L_shipmode in ('AIR', 'AIR REG')
and L_shipinstruct = 'DELIVER IN PERSON'
)
or
(
p_partkey = L_partkey
and p_brand = 'Brand#23'
and p_container in ('MED BAG', 'MED BOX', 'MED PKG', 'MED PACK')
and L_quantity >= 10 and L_quantity <= 10 + 10
and p_size between 1 and 10
and L_shipmode in ('AIR', 'AIR REG')
and L_shipinstruct = 'DELIVER IN PERSON'
)
or
(
p_partkey = L_partkey
and p_brand = 'Brand#34'
and p_container in ('LG CASE', 'LG BOX', 'LG PACK', 'LG PKG')
and L_quantity >= 20 and L_quantity <= 20 + 10
)

```

```
and p_size between 1 and 15
and l_shipmode in ('AIR', 'AIR REG')
and l_shipinstruct = 'DELIVER IN PERSON'
);
```

Q20

```
SELECT
s_name,
s_address
FROM
supplier,
nation
WHERE
s_suppkey in (
SELECT
ps_suppkey
FROM
partsupp
WHERE
ps_partkey in (
SELECT
p_partkey
FROM
part
WHERE
p_name like 'forest%'
)
and ps_availqty > (
SELECT
0.5 * sum(l_quantity)
FROM
lineitem
WHERE
l_partkey = ps_partkey
and l_suppkey = ps_suppkey
and l_shipdate >= date '1994-01-01'
and l_shipdate < date '1994-01-01' + interval '1' year
)
)
and s_nationkey = n_nationkey
and n_name = 'CANADA'
ORDER BY
s_name;
```

Q21

```
SELECT
s_name,
count(*) as numwait
FROM
supplier,
lineitem l1,
orders,
nation
WHERE
s_suppkey = l1.l_suppkey
and o_orderkey = l1.l_orderkey
and o_orderstatus = 'F'
and l1.l_receiptdate > l1.l_commitdate
and exists (
SELECT
*
FROM
lineitem l2
WHERE
l2.l_orderkey = l1.l_orderkey
and l2.l_suppkey <> l1.l_suppkey
)
```

```

AND NOT EXISTS(
SELECT
*
FROM
lineitem l3
WHERE
l3.l_orderkey = l1.l_orderkey
and l3.l_suppkey <> l1.l_suppkey
and l3.l_receiptdate > l3.l_commitdate
)
and s_nationkey = n_nationkey
and n_name = 'SAUDI ARABIA'
GROUP BY
s_name
ORDER BY
numwait desc,
s_name
LIMIT 100;

```

Q22

```

SELECT
cntrycode,
count(*) as numcust,
sum(c_acctbal) as totacctbal
FROM
(
SELECT
substring(c_phone FROM 1 for 2) as cntrycode,
c_acctbal
FROM
customer
WHERE
substring(c_phone FROM 1 for 2) in
('13', '31', '23', '29', '30', '18', '17')
and c_acctbal > (
SELECT
avg(c_acctbal)
FROM
customer
WHERE
c_acctbal > 0.00
and substring(c_phone FROM 1 for 2) in
('13', '31', '23', '29', '30', '18', '17')
)
AND NOT EXISTS(
SELECT
*
FROM
orders
WHERE
o_custkey = c_custkey
)
) as custsale
GROUP BY
cntrycode
ORDER BY
cntrycode;

```

4 TPC-DS 性能测试

4.1 TPC-DS 测试结果

本测试主要包括使用存算一体和存算分离两种部署架构下，TPC-H 1T规模数据集的开箱查询性能，共99个查询。存算一体查询总耗时为971.45s，存算分离查询总耗时为1035.80s。详细结果见下表。

表 4-1 TPC-DS 测试结果

TPC-DS查询	8.3.0	9.1.0	
	存算一体 (s)	存算一体 (s)	存算分离 (s)
-			
Q1	2.03	1.21	0.59
Q2	9.14	4.00	5.10
Q3	1.52	1.40	1.96
Q4	200.44	173.61	181.80
Q5	3.11	2.26	3.48
Q6	0.39	0.29	0.43
Q7	1.85	1.74	2.23
Q8	0.72	0.42	0.58
Q9	11.14	15.36	17.16
Q10	1.08	1.07	1.05
Q11	92.20	62.56	66.79
Q12	0.20	0.13	0.22
Q13	2.50	2.86	3.63
Q14	74.98	23.45	24.90

TPC-DS查询	8.3.0	9.1.0	
Q15	2.11	0.56	0.45
Q16	6.51	3.28	4.28
Q17	2.93	3.74	5.29
Q18	2.16	1.16	2.06
Q19	0.70	0.69	0.84
Q20	0.18	0.10	0.17
Q21	0.18	0.27	0.17
Q22	5.84	2.00	14.78
Q23	144.71	44.33	48.74
Q24	8.55	4.76	6.74
Q25	3.10	3.34	4.17
Q26	0.63	0.53	0.62
Q27	2.03	1.79	2.77
Q28	13.32	13.20	14.74
Q29	2.50	2.96	3.61
Q30	0.73	0.38	0.44
Q31	3.73	2.85	3.08
Q32	0.18	0.91	0.20
Q33	1.28	1.06	1.22
Q34	2.13	2.51	3.27
Q35	3.00	1.89	2.30
Q36	6.21	1.67	17.93
Q37	0.34	0.39	0.51
Q38	52.24	37.43	37.78
Q39	5.57	3.51	3.11
Q40	0.66	0.13	0.24
Q41	0.04	0.03	0.09
Q42	0.70	0.73	0.60
Q43	1.99	1.35	1.79
Q44	3.25	3.66	4.27

TPC-DS查询	8.3.0	9.1.0	
Q45	0.82	0.56	0.79
Q46	4.63	4.44	4.62
Q47	6.91	4.83	6.22
Q48	2.37	2.45	3.55
Q49	3.01	3.13	4.64
Q50	5.82	6.70	5.09
Q51	10.67	5.07	5.25
Q52	0.70	0.72	0.68
Q53	0.88	0.86	1.05
Q54	3.96	3.20	4.21
Q55	0.66	0.53	0.59
Q56	0.84	0.76	0.94
Q57	3.12	2.26	2.09
Q58	0.76	0.49	0.69
Q59	17.30	8.75	10.42
Q60	1.75	1.31	1.46
Q61	1.10	1.03	1.45
Q62	1.29	0.83	1.07
Q63	0.86	0.84	1.05
Q64	14.20	11.57	16.54
Q65	6.92	4.09	4.84
Q66	1.50	1.16	1.35
Q67	153.90	131.56	196.11
Q68	3.65	3.13	3.66
Q69	0.93	0.69	0.82
Q70	23.13	3.07	32.01
Q71	2.33	2.34	2.60
Q72	3.69	4.24	3.81
Q73	1.40	1.72	2.32
Q74	37.27	24.38	27.55

TPC-DS查询	8.3.0	9.1.0	
Q75	11.85	5.99	7.91
Q76	3.37	3.21	3.65
Q77	1.30	1.07	1.56
Q78	152.21	97.02	42.98
Q79	4.49	4.25	5.15
Q80	3.56	2.35	3.93
Q81	0.64	0.33	0.42
Q82	0.75	0.70	1.31
Q83	0.15	0.09	0.26
Q84	0.24	0.26	0.42
Q85	2.78	1.81	2.16
Q86	2.59	0.35	3.07
Q87	78.17	123.22	56.21
Q88	6.90	9.40	11.20
Q89	2.61	1.85	1.92
Q90	0.64	0.60	1.13
Q91	0.15	0.12	0.26
Q92	0.20	0.26	0.24
Q93	7.53	7.44	5.84
Q94	3.49	1.93	2.72
Q95	29.57	31.04	28.55
Q96	1.49	1.96	2.66
Q97	8.49	5.31	5.81
Q98	1.09	0.85	0.93
Q99	2.37	1.76	1.82
SUM	1321.757	971.45	1035.80

4.2 TPC-DS 测试环境

硬件环境

每个测试环境6个节点，配置如下：

- CPU 16核：Intel Ice Lake
- 内存：64GB
- 网络带宽：9Gbit/s
- 磁盘：SSD云盘，每块600GB，共2块

软件环境

- 内核版本：Linux 3.10.0-862.14.1.5.h757.eulerosv2r7.x86_64
- 操作系统：EulerOS release 2.0 (SP5)
- 数据库版本：DWS 3.0

4.3 TPC-DS 测试过程

4.3.1 TPC-DS 测试数据

表 4-2 TPC-DS 测试数据

序号	表名	行数	表大小
1	customer_address	6,000,000	126MB
2	customer_demographics	1,920,800	11MB
3	date_dim	73,049	11MB
4	warehouse	20	1200KB
5	ship_mode	20	864KB
6	time_dim	86,400	1520KB
7	reason	65	720KB
8	income_band	20	720KB
9	item	300,000	23MB
10	store	1,002	2400KB
11	call_center	42	1968KB
12	customer	12,000,000	519MB

序号	表名	行数	表大小
13	web_site	54	1824KB
14	household_demographics	7,200	1208KB
15	web_page	3,000	2208KB
16	promotion	1,500	2112KB
17	catalog_page	30,000	3536KB
18	inventory	783,000,000	2499MB
19	catalog_returns	143,996,756	8454MB
20	web_returns	71,997,522	3990MB
21	store_returns	287,999,764	13GB
22	web_sales	720,000,376	54GB
23	catalog_sales	1,439,980,416	104GB
24	store_sales	2,879,987,999	142GB

4.3.2 TPC-DS 数据生成

步骤1 登录ECS云服务器，执行如下命令创建TPC-DS存放目录。

```
mkdir -p /data1/script/tpcds-kit/tpcds1000X
mkdir -p /data2/script/tpcds-kit/tpcds1000X
```

步骤2 从[官网](#)获取TPC-DS数据构建工具dsdgen最新版本，并通过SFTP工具上传到ECS的/data1/script/tpcds-kit目录。

步骤3 执行如下命令解压tpcds的包并编译生成数据构建工具dsdgen。

“tpcds_3.2.0.zip” 替换为实际的软件包名。

“DSGen-software-code-3.2.0rc1” 替换为实际解压的文件夹名。

```
cd /data1/script/tpcds-kit && unzip tpcds_3.2.0.zip
cd DSGen-software-code-3.2.0rc1/tools && make
```

步骤4 进入/data1/script/tpcds-kit/DSGen-software-code-3.2.0rc1/tools目录后，执行以下命令生成数据。

```
for c in {1..5};do (./dsdgen -scale 1000 -dir /data1/script/tpcds-kit/tpcds1000X -TERMINATE N -parallel 10 -child ${c} -force Y > /dev/null 2>&1 &);done
for c in {6..10};do (./dsdgen -scale 1000 -dir /data2/script/tpcds-kit/tpcds1000X -TERMINATE N -parallel 10 -child ${c} -force Y > /dev/null 2>&1 &);done
```

其中：

- -scale 指定数据规模，本例为1000。
- -dir 指定生成数据文件存放的目录，本例为/data1/script/tpcds-kit/tpcds1000X/data2/script/tpcds-kit/tpcds1000X。

- -TERMINATE 控制每行记录的末尾是否需要分隔符。
- -parallel 指定分片数，本例为10片。
- -child 指定当前是生成分片中的第几片，本例不需修改。

步骤5 执行以下命令，判断数据文件的生成进度。也可以通过`ps ux|grep dsdgen`，查看生成数据文件的进程是否退出。

```
du -sh /data1/script/tpcds-kit/tpcds1000X/*.dat
du -sh /data2/script/tpcds-kit/tpcds1000X/*.dat
```

----结束

4.3.3 建表与导入 TPC-DS 数据

创建 TPC-DS 目标表

连接DWS数据库后执行以下SQL语句。

```
CREATE TABLE customer_address
(
ca_address_sk      integer      not null,
ca_address_id      varchar(16)   not null,
ca_street_number   varchar(10)   ,
ca_street_name     varchar(60)   ,
ca_street_type     varchar(15)   ,
ca_suite_number    varchar(10)   ,
ca_city            varchar(60)   ,
ca_county          varchar(30)   ,
ca_state           varchar(2)    ,
ca_zip             varchar(10)   ,
ca_country         varchar(20)   ,
ca_gmt_offset      decimal(5,2)  ,
ca_location_type   varchar(20)
) WITH (orientation = column, colversion=2.0,enable_hstore=true,enable_hstore_opt=true)
DISTRIBUTE BY hash (ca_address_sk);
CREATE TABLE customer_demographics
(
cd_demo_sk         integer      not null,
cd_gender          varchar(1)    ,
cd_marital_status  varchar(1)    ,
cd_education_status varchar(20)  ,
cd_purchase_estimate integer    ,
cd_credit_rating   varchar(10)   ,
cd_dep_count       integer      ,
cd_dep_employed_count integer    ,
cd_dep_college_count integer
) WITH (orientation = column, colversion=2.0,enable_hstore=true,enable_hstore_opt=true)
DISTRIBUTE BY hash (cd_demo_sk);
CREATE TABLE date_dim
(
d_date_sk          integer      not null,
d_date_id          varchar(16)   not null,
d_date             date          ,
d_month_seq        integer      ,
d_week_seq         integer      ,
d_quarter_seq      integer      ,
d_year             integer      ,
d_dow              integer      ,
d_moy              integer      ,
d_dom              integer      ,
d_qoy              integer      ,
d_fy_year          integer      ,
d_fy_quarter_seq   integer      ,
d_fy_week_seq      integer      ,
d_day_name         varchar(9)    ,
d_quarter_name     varchar(6)    ,
```

```

d_holiday          varchar(1)
d_weekend          varchar(1)
d_following_holiday varchar(1)
d_first_dom        integer
d_last_dom         integer
d_same_day_ly      integer
d_same_day_lq      integer
d_current_day      varchar(1)
d_current_week     varchar(1)
d_current_month    varchar(1)
d_current_quarter  varchar(1)
d_current_year     varchar(1)
) WITH (orientation = column, colversion=2.0,enable_hstore=true,enable_hstore_opt=true)
DISTRIBUTE BY hash (d_date_sk)
PARTITION BY Range(d_year) (
partition p1 values less than(1950),
partition p2 values less than(2000),
partition p3 values less than(2050),
partition p4 values less than(2100),
partition p5 values less than(3000),
partition p6 values less than(maxvalue)
);
create table warehouse
(
w_warehouse_sk      integer          not null,
w_warehouse_id      varchar(16)       not null,
w_warehouse_name    varchar(20)
w_warehouse_sq_ft   integer
w_street_number     varchar(10)
w_street_name       varchar(60)
w_street_type       varchar(15)
w_suite_number      varchar(10)
w_city              varchar(60)
w_county            varchar(30)
w_state             varchar(2)
w_zip               varchar(10)
w_country           varchar(20)
w_gmt_offset        decimal(5,2)
)
WITH (orientation = column, colversion=2.0,enable_hstore=true,enable_hstore_opt=true)
DISTRIBUTE BY replication;
create table ship_mode
(
sm_ship_mode_sk      integer          not null,
sm_ship_mode_id      varchar(16)       not null,
sm_type              varchar(30)
sm_code              varchar(10)
sm_carrier           varchar(20)
sm_contract          varchar(20)
)
WITH (orientation = column, colversion=2.0,enable_hstore=true,enable_hstore_opt=true)
DISTRIBUTE BY replication;
create table time_dim
(
t_time_sk           integer          not null,
t_time_id           varchar(16)       not null,
t_time              integer
t_hour              integer
t_minute            integer
t_second            integer
t_am_pm             varchar(2)
t_shift             varchar(20)
t_sub_shift         varchar(20)
t_meal_time         varchar(20)
)
WITH (orientation = column, colversion=2.0,enable_hstore=true,enable_hstore_opt=true)
DISTRIBUTE BY hash (t_time_sk);
create table reason
(

```

```

r_reason_sk      integer      not null,
r_reason_id      varchar(16)  not null,
r_reason_desc    varchar(100)
)
WITH (orientation = column, colversion=2.0,enable_hstore=true,enable_hstore_opt=true)
DISTRIBUTE BY replication;
create table income_band
(
ib_income_band_sk integer      not null,
ib_lower_bound    integer
,
ib_upper_bound    integer
)
WITH (orientation = column, colversion=2.0,enable_hstore=true,enable_hstore_opt=true)
DISTRIBUTE BY replication;
create table item
(
i_item_sk        integer      not null,
i_item_id        varchar(16)  not null,
i_rec_start_date date
,
i_rec_end_date   date
,
i_item_desc      varchar(200)
,
i_current_price  decimal(7,2)
,
i_wholesale_cost decimal(7,2)
,
i_brand_id       integer
,
i_brand          varchar(50)
,
i_class_id       integer
,
i_class          varchar(50)
,
i_category_id    integer
,
i_category       varchar(50)
,
i_manufact_id    integer
,
i_manufact       varchar(50)
,
i_size           varchar(20)
,
i_formulation    varchar(20)
,
i_color          varchar(20)
,
i_units          varchar(10)
,
i_container      varchar(10)
,
i_manager_id     integer
,
i_product_name   varchar(50)
)
WITH (orientation = column, colversion=2.0,enable_hstore=true,enable_hstore_opt=true)
DISTRIBUTE BY hash (i_item_sk);
create table store
(
s_store_sk       integer      not null,
s_store_id       varchar(16)  not null,
s_rec_start_date date
,
s_rec_end_date   date
,
s_closed_date_sk integer
,
s_store_name     varchar(50)
,
s_number_employees integer
,
s_floor_space    integer
,
s_hours          varchar(20)
,
s_manager        varchar(40)
,
s_market_id      integer
,
s_geography_class varchar(100)
,
s_market_desc    varchar(100)
,
s_market_manager varchar(40)
,
s_division_id    integer
,
s_division_name  varchar(50)
,
s_company_id     integer
,
s_company_name   varchar(50)
,
s_street_number  varchar(10)
,
s_street_name    varchar(60)
,
s_street_type    varchar(15)
,
s_suite_number   varchar(10)
,
s_city           varchar(60)
,
s_county         varchar(30)
,
s_state         varchar(2)
,
s_zip            varchar(10)
,

```

```

s_country      varchar(20)      ,
s_gmt_offset   decimal(5,2)     ,
s_tax_percentage decimal(5,2)
)
WITH (orientation = column, colversion=2.0,enable_hstore=true,enable_hstore_opt=true)
DISTRIBUTE BY replication;
create table call_center
(
cc_call_center_sk integer      not null,
cc_call_center_id varchar(16)  not null,
cc_rec_start_date date          ,
cc_rec_end_date   date          ,
cc_closed_date_sk integer      ,
cc_open_date_sk   integer      ,
cc_name           varchar(50)   ,
cc_class         varchar(50)   ,
cc_employees      integer      ,
cc_sq_ft         integer      ,
cc_hours         varchar(20)    ,
cc_manager       varchar(40)    ,
cc_mkt_id        integer      ,
cc_mkt_class     varchar(50)    ,
cc_mkt_desc      varchar(100)   ,
cc_market_manager varchar(40)   ,
cc_division      integer      ,
cc_division_name varchar(50)    ,
cc_company       integer      ,
cc_company_name  varchar(50)    ,
cc_street_number varchar(10)    ,
cc_street_name   varchar(60)    ,
cc_street_type   varchar(15)    ,
cc_suite_number  varchar(10)    ,
cc_city         varchar(60)    ,
cc_county       varchar(30)    ,
cc_state        varchar(2)     ,
cc_zip         varchar(10)     ,
cc_country      varchar(20)    ,
cc_gmt_offset   decimal(5,2)   ,
cc_tax_percentage decimal(5,2)
)
WITH (orientation = column, colversion=2.0,enable_hstore=true,enable_hstore_opt=true)
DISTRIBUTE BY replication;
create table customer
(
c_customer_sk integer      not null,
c_customer_id varchar(16)  not null,
c_current_demo_sk integer   ,
c_current_hdemo_sk integer  ,
c_current_addr_sk integer   ,
c_first_shipto_date_sk integer ,
c_first_sales_date_sk integer ,
c_salutation   varchar(10)   ,
c_first_name   varchar(20)   ,
c_last_name    varchar(30)   ,
c_preferred_cust_flag varchar(1) ,
c_birth_day    integer       ,
c_birth_month  integer       ,
c_birth_year   integer       ,
c_birth_country varchar(20)   ,
c_login        varchar(13)    ,
c_email_address varchar(50)    ,
c_last_review_date varchar(10)
)
WITH (orientation = column, colversion=2.0,enable_hstore=true,enable_hstore_opt=true)
DISTRIBUTE BY hash (c_customer_sk);
create table web_site
(
web_site_sk integer      not null,
web_site_id varchar(16)  not null,

```

```

web_rec_start_date    date           ,
web_rec_end_date     date           ,
web_name             varchar(50)        ,
web_open_date_sk     integer          ,
web_close_date_sk    integer          ,
web_class            varchar(50)        ,
web_manager          varchar(40)        ,
web_mkt_id           integer          ,
web_mkt_class        varchar(50)        ,
web_mkt_desc         varchar(100)       ,
web_market_manager   varchar(40)        ,
web_company_id       integer          ,
web_company_name     varchar(50)        ,
web_street_number    varchar(10)       ,
web_street_name      varchar(60)        ,
web_street_type      varchar(15)       ,
web_suite_number     varchar(10)       ,
web_city             varchar(60)        ,
web_county           varchar(30)        ,
web_state            varchar(2)         ,
web_zip              varchar(10)        ,
web_country          varchar(20)        ,
web_gmt_offset       decimal(5,2)      ,
web_tax_percentage   decimal(5,2)      ,
)
WITH (orientation = column, colversion=2.0,enable_hstore=true,enable_hstore_opt=true)
DISTRIBUTE BY replication;
create table household_demographics
(
hd_demo_sk          integer          not null,
hd_income_band_sk  integer          ,
hd_buy_potential    varchar(15)       ,
hd_dep_count        integer          ,
hd_vehicle_count    integer          ,
)
WITH (orientation = column, colversion=2.0,enable_hstore=true,enable_hstore_opt=true)
DISTRIBUTE BY hash (hd_demo_sk);
create table web_page
(
wp_web_page_sk      integer          not null,
wp_web_page_id      varchar(16)       not null,
wp_rec_start_date   date           ,
wp_rec_end_date     date           ,
wp_creation_date_sk integer          ,
wp_access_date_sk   integer          ,
wp_autogen_flag     varchar(1)        ,
wp_customer_sk      integer          ,
wp_url              varchar(100)       ,
wp_type             varchar(50)        ,
wp_char_count       integer          ,
wp_link_count       integer          ,
wp_image_count      integer          ,
wp_max_ad_count     integer          ,
)
WITH (orientation = column, colversion=2.0,enable_hstore=true,enable_hstore_opt=true)
DISTRIBUTE BY replication;
create table promotion
(
p_promo_sk          integer          not null,
p_promo_id          varchar(16)       not null,
p_start_date_sk     integer          ,
p_end_date_sk       integer          ,
p_item_sk           integer          ,
p_cost              decimal(15,2)    ,
p_response_target   integer          ,
p_promo_name        varchar(50)        ,
p_channel_dmail     varchar(1)        ,
p_channel_email     varchar(1)        ,
p_channel_catalog   varchar(1)        ,
)

```

```

p_channel_tv      varchar(1)      ,
p_channel_radio  varchar(1)      ,
p_channel_press  varchar(1)      ,
p_channel_event  varchar(1)      ,
p_channel_demo   varchar(1)      ,
p_channel_details varchar(100) ,
p_purpose          varchar(15)   ,
p_discount_active varchar(1)
)
WITH (orientation = column, colversion=2.0,enable_hstore=true,enable_hstore_opt=true)
DISTRIBUTE BY replication;
create table catalog_page
(
cp_catalog_page_sk integer      not null,
cp_catalog_page_id varchar(16)  not null,
cp_start_date_sk   integer      ,
cp_end_date_sk     integer      ,
cp_department      varchar(50)  ,
cp_catalog_number  integer      ,
cp_catalog_page_number integer  ,
cp_description     varchar(100) ,
cp_type           varchar(100)
)
WITH (orientation = column, colversion=2.0,enable_hstore=true,enable_hstore_opt=true)
DISTRIBUTE BY hash (cp_catalog_page_sk);
create table inventory
(
inv_date_sk      integer      not null,
inv_item_sk      integer      not null,
inv_warehouse_sk integer      not null,
inv_quantity_on_hand integer
)
WITH (orientation = column, colversion=2.0,enable_hstore=true,enable_hstore_opt=true)
DISTRIBUTE BY hash (inv_item_sk)
partition by range(inv_date_sk)
(
partition p1 values less than(2451179),
partition p2 values less than(2451544),
partition p3 values less than(2451910),
partition p4 values less than(2452275),
partition p5 values less than(2452640),
partition p6 values less than(2453005),
partition p7 values less than(maxvalue)
)
);
create table catalog_returns
(
cr_returned_date_sk integer      ,
cr_returned_time_sk integer      ,
cr_item_sk          integer      not null,
cr_refunded_customer_sk integer    ,
cr_refunded_cdemo_sk integer      ,
cr_refunded_hdemo_sk integer      ,
cr_refunded_addr_sk integer      ,
cr_returning_customer_sk integer   ,
cr_returning_cdemo_sk integer      ,
cr_returning_hdemo_sk integer      ,
cr_returning_addr_sk integer      ,
cr_call_center_sk  integer      ,
cr_catalog_page_sk integer      ,
cr_ship_mode_sk    integer      ,
cr_warehouse_sk   integer      ,
cr_reason_sk       integer      ,
cr_order_number    bigint       not null,
cr_return_quantity integer      ,
cr_return_amount   decimal(7,2) ,
cr_return_tax      decimal(7,2) ,
cr_return_amt_inc_tax decimal(7,2) ,
cr_fee            decimal(7,2)
)

```

```

cr_return_ship_cost    decimal(7,2)      ,
cr_refunded_cash      decimal(7,2)      ,
cr_reversed_charge    decimal(7,2)      ,
cr_store_credit       decimal(7,2)      ,
cr_net_loss           decimal(7,2)
)
)
WITH (orientation = column, colversion=2.0,enable_hstore=true,enable_hstore_opt=true)
DISTRIBUTE BY hash (cr_item_sk)
partition by range(cr_returned_date_sk)
(
partition p1 values less than(2450815),
partition p2 values less than(2451179),
partition p3 values less than(2451544),
partition p4 values less than(2451910),
partition p5 values less than(2452275),
partition p6 values less than(2452640),
partition p7 values less than(2453005),
partition p8 values less than(maxvalue)
)
)
;
create table web_returns
(
wr_returned_date_sk    integer          ,
wr_returned_time_sk   integer          ,
wr_item_sk            integer          not null,
wr_refunded_customer_sk integer        ,
wr_refunded_cdemo_sk  integer          ,
wr_refunded_hdemo_sk  integer          ,
wr_refunded_addr_sk   integer          ,
wr_returning_customer_sk integer        ,
wr_returning_cdemo_sk integer          ,
wr_returning_hdemo_sk integer          ,
wr_returning_addr_sk  integer          ,
wr_web_page_sk        integer          ,
wr_reason_sk          integer          ,
wr_order_number       bigint          not null,
wr_return_quantity    integer          ,
wr_return_amt         decimal(7,2)    ,
wr_return_tax         decimal(7,2)    ,
wr_return_amt_inc_tax decimal(7,2)    ,
wr_fee               decimal(7,2)    ,
wr_return_ship_cost  decimal(7,2)    ,
wr_refunded_cash     decimal(7,2)    ,
wr_reversed_charge   decimal(7,2)    ,
wr_account_credit    decimal(7,2)    ,
wr_net_loss          decimal(7,2)
)
)
WITH (orientation = column, colversion=2.0,enable_hstore=true,enable_hstore_opt=true)
DISTRIBUTE BY hash (wr_item_sk)
partition by range(wr_returned_date_sk)
(
partition p1 values less than(2450815),
partition p2 values less than(2451179),
partition p3 values less than(2451544),
partition p4 values less than(2451910),
partition p5 values less than(2452275),
partition p6 values less than(2452640),
partition p7 values less than(2453005),
partition p8 values less than(maxvalue)
)
)
;
create table store_returns
(
sr_returned_date_sk    integer          ,
sr_return_time_sk     integer          ,
sr_item_sk            integer          not null,
sr_customer_sk        integer          ,
sr_cdemo_sk           integer          ,
sr_hdemo_sk           integer          ,

```



```

sr_addr_sk      integer      ,
sr_store_sk     integer      ,
sr_reason_sk    integer      ,
sr_ticket_number bigint      not null,
sr_return_quantity integer    ,
sr_return_amt   decimal(7,2) ,
sr_return_tax   decimal(7,2) ,
sr_return_amt_inc_tax decimal(7,2) ,
sr_fee         decimal(7,2)  ,
sr_return_ship_cost decimal(7,2) ,
sr_refunded_cash decimal(7,2) ,
sr_reversed_charge decimal(7,2) ,
sr_store_credit decimal(7,2) ,
sr_net_loss    decimal(7,2)
)
WITH (orientation = column, colversion=2.0,enable_hstore=true,enable_hstore_opt=true)
DISTRIBUTE BY hash (sr_item_sk)
partition by range(sr_returned_date_sk)
(
partition p1 values less than (2451179) ,
partition p2 values less than (2451544) ,
partition p3 values less than (2451910) ,
partition p4 values less than (2452275) ,
partition p5 values less than (2452640) ,
partition p6 values less than (2453005) ,
partition p7 values less than (maxvalue)
)
);
create table web_sales
(
ws_sold_date_sk      integer      ,
ws_sold_time_sk     integer      ,
ws_ship_date_sk     integer      ,
ws_item_sk           integer      not null,
ws_bill_customer_sk integer      ,
ws_bill_demo_sk     integer      ,
ws_bill_hdemo_sk    integer      ,
ws_bill_addr_sk     integer      ,
ws_ship_customer_sk integer      ,
ws_ship_demo_sk     integer      ,
ws_ship_hdemo_sk    integer      ,
ws_ship_addr_sk     integer      ,
ws_web_page_sk      integer      ,
ws_web_site_sk      integer      ,
ws_ship_mode_sk     integer      ,
ws_warehouse_sk     integer      ,
ws_promo_sk         integer      ,
ws_order_number     bigint      not null,
ws_quantity         integer      ,
ws_wholesale_cost   decimal(7,2) ,
ws_list_price       decimal(7,2) ,
ws_sales_price      decimal(7,2) ,
ws_ext_discount_amt decimal(7,2) ,
ws_ext_sales_price  decimal(7,2) ,
ws_ext_wholesale_cost decimal(7,2) ,
ws_ext_list_price   decimal(7,2) ,
ws_ext_tax          decimal(7,2) ,
ws_coupon_amt       decimal(7,2) ,
ws_ext_ship_cost    decimal(7,2) ,
ws_net_paid         decimal(7,2) ,
ws_net_paid_inc_tax decimal(7,2) ,
ws_net_paid_inc_ship decimal(7,2) ,
ws_net_paid_inc_ship_tax decimal(7,2) ,
ws_net_profit       decimal(7,2)
)
WITH (orientation = column, colversion=2.0,enable_hstore=true,enable_hstore_opt=true)
DISTRIBUTE BY hash (ws_item_sk)
partition by range(ws_sold_date_sk)
(

```

```

partition p1 values less than(2451179),
partition p2 values less than(2451544),
partition p3 values less than(2451910),
partition p4 values less than(2452275),
partition p5 values less than(2452640),
partition p6 values less than(2453005),
partition p7 values less than(maxvalue)
)
;
create table catalog_sales
(
cs_sold_date_sk      integer      ,
cs_sold_time_sk     integer      ,
cs_ship_date_sk     integer      ,
cs_bill_customer_sk integer      ,
cs_bill_cdemo_sk    integer      ,
cs_bill_hdemo_sk    integer      ,
cs_bill_addr_sk     integer      ,
cs_ship_customer_sk integer      ,
cs_ship_cdemo_sk    integer      ,
cs_ship_hdemo_sk    integer      ,
cs_ship_addr_sk     integer      ,
cs_call_center_sk   integer      ,
cs_catalog_page_sk  integer      ,
cs_ship_mode_sk     integer      ,
cs_warehouse_sk    integer      ,
cs_item_sk          integer      not null,
cs_promo_sk         integer      ,
cs_order_number     bigint       not null,
cs_quantity         integer      ,
cs_wholesale_cost   decimal(7,2) ,
cs_list_price       decimal(7,2) ,
cs_sales_price      decimal(7,2) ,
cs_ext_discount_amt decimal(7,2) ,
cs_ext_sales_price  decimal(7,2) ,
cs_ext_wholesale_cost decimal(7,2) ,
cs_ext_list_price   decimal(7,2) ,
cs_ext_tax          decimal(7,2) ,
cs_coupon_amt       decimal(7,2) ,
cs_ext_ship_cost    decimal(7,2) ,
cs_net_paid         decimal(7,2) ,
cs_net_paid_inc_tax decimal(7,2) ,
cs_net_paid_inc_ship decimal(7,2) ,
cs_net_paid_inc_ship_tax decimal(7,2) ,
cs_net_profit       decimal(7,2)
)
WITH (orientation = column, colversion=2.0,enable_hstore=true,enable_hstore_opt=true)
DISTRIBUTE BY hash (cs_item_sk)
partition by range(cs_sold_date_sk)
(
partition p1 values less than(2451179),
partition p2 values less than(2451544),
partition p3 values less than(2451910),
partition p4 values less than(2452275),
partition p5 values less than(2452640),
partition p6 values less than(2453005),
partition p7 values less than(maxvalue)
)
;
create table store_sales
(
ss_sold_date_sk      integer      ,
ss_sold_time_sk     integer      ,
ss_item_sk          integer      not null,
ss_customer_sk       integer      ,
ss_cdemo_sk         integer      ,
ss_hdemo_sk         integer      ,
ss_addr_sk          integer      ,
ss_store_sk         integer      ,

```

```

ss_promo_sk          integer          ,
ss_ticket_number     bigint          not null,
ss_quantity          integer          ,
ss_wholesale_cost    decimal(7,2)    ,
ss_list_price        decimal(7,2)    ,
ss_sales_price       decimal(7,2)    ,
ss_ext_discount_amt  decimal(7,2)    ,
ss_ext_sales_price   decimal(7,2)    ,
ss_ext_wholesale_cost decimal(7,2)    ,
ss_ext_list_price    decimal(7,2)    ,
ss_ext_tax           decimal(7,2)    ,
ss_coupon_amt        decimal(7,2)    ,
ss_net_paid          decimal(7,2)    ,
ss_net_paid_inc_tax  decimal(7,2)    ,
ss_net_profit        decimal(7,2)
)
WITH (orientation = column, colversion=2.0,enable_hstore=true,enable_hstore_opt=true)
DISTRIBUTE BY hash (ss_item_sk)
partition by range(ss_sold_date_sk)
(
partition p1 values less than(2451179),
partition p2 values less than(2451544),
partition p3 values less than(2451910),
partition p4 values less than(2452275),
partition p5 values less than(2452640),
partition p6 values less than(2453005),
partition p7 values less than(maxvalue)
)
;

```

创建 TPC-DS 数据集的 GDS 外表

连接DWS数据库后执行以下SQL语句。

须知

以下每个外表的“**gsfs://192.168.0.90:500x/xxx | gsfs://192.168.0.90:500x/xxx**”中的IP地址和端口，请替换成安装和启动GDS中的对应的GDS的监听IP和端口。如启动两个GDS，则使用“|”区分。如果启动多个GDS，需要将所有GDS的监听IP和端口配置到外表中。

```

DROP FOREIGN TABLE IF EXISTS customer_address_ext;
CREATE FOREIGN TABLE customer_address_ext
(
ca_address_sk          bigint          ,
ca_address_id          char(16)         ,
ca_street_number       char(10)         ,
ca_street_name         varchar(60)      ,
ca_street_type         char(15)         ,
ca_suite_number        char(10)         ,
ca_city                varchar(60)      ,
ca_county              varchar(30)      ,
ca_state               char(2)          ,
ca_zip                 char(10)         ,
ca_country              varchar(20)     ,
ca_gmt_offset          decimal(5,2)     ,
ca_location_type       char(20)
)
SERVER gsmpp_server
OPTIONS(location 'gsfs://192.168.0.90:5002/customer_address.dat* | gsfs://192.168.0.90:5003/customer_address.dat*',
FORMAT 'TEXT',
DELIMITER '|',
encoding 'utf8',

```

```

mode 'Normal'
)WITH customer_address_err;
DROP FOREIGN TABLE IF EXISTS customer_demographics_ext;
CREATE FOREIGN TABLE customer_demographics_ext
(
cd_demo_sk          bigint          ,
cd_gender           char(1)         ,
cd_marital_status  char(1)         ,
cd_education_status char(20)        ,
cd_purchase_estimate bigint         ,
cd_credit_rating   char(10)        ,
cd_dep_count       bigint          ,
cd_dep_employed_count bigint        ,
cd_dep_college_count bigint
)
SERVER gsmpp_server
OPTIONS(location 'gsfs://192.168.0.90:5002/customer_demographics.dat* | gsfs://192.168.0.90:5003/
customer_demographics.dat*',
FORMAT 'TEXT',
DELIMITER '|',
encoding 'utf8',
mode 'Normal'
)
WITH customer_demographics_err
;
DROP FOREIGN TABLE IF EXISTS date_dim_ext;
CREATE FOREIGN TABLE date_dim_ext
(
d_date_sk          bigint          ,
d_date_id         char(16)         ,
d_date            date             ,
d_month_seq       bigint          ,
d_week_seq        bigint          ,
d_quarter_seq     bigint          ,
d_year            bigint          ,
d_dow             bigint          ,
d_moy             bigint          ,
d_dom             bigint          ,
d_qoy             bigint          ,
d_fy_year         bigint          ,
d_fy_quarter_seq  bigint          ,
d_fy_week_seq     bigint          ,
d_day_name        char(9)          ,
d_quarter_name    char(6)          ,
d_holiday         char(1)         ,
d_weekend         char(1)         ,
d_following_holiday char(1)      ,
d_first_dom       bigint          ,
d_last_dom        bigint          ,
d_same_day_ly     bigint          ,
d_same_day_lq     bigint          ,
d_current_day     char(1)         ,
d_current_week    char(1)         ,
d_current_month   char(1)         ,
d_current_quarter char(1)         ,
d_current_year    char(1)
)
SERVER gsmpp_server
OPTIONS(location 'gsfs://192.168.0.90:5002/date_dim.dat* | gsfs://192.168.0.90:5003/date_dim.dat*',
FORMAT 'TEXT',
DELIMITER '|',
encoding 'utf8',
mode 'Normal'
)
WITH date_dim_err
;
DROP FOREIGN TABLE IF EXISTS warehouse_ext;
CREATE FOREIGN TABLE warehouse_ext
(

```

```

w_warehouse_sk      bigint          ,
w_warehouse_id      char(16)         ,
w_warehouse_name    varchar(20)       ,
w_warehouse_sq_ft   bigint          ,
w_street_number     char(10)        ,
w_street_name       varchar(60)     ,
w_street_type       char(15)        ,
w_suite_number      char(10)        ,
w_city              varchar(60)     ,
w_county            varchar(30)     ,
w_state             char(2)         ,
w_zip               char(10)        ,
w_country           varchar(20)     ,
w_gmt_offset        decimal(5,2)
)
SERVER gsmpp_server
OPTIONS(location 'gsfs://192.168.0.90:5002/warehouse.dat* | gsfs://192.168.0.90:5003/warehouse.dat*',
FORMAT 'TEXT',
DELIMITER '|',
encoding 'utf8',
mode 'Normal'
)
WITH warehouse_err
;
DROP FOREIGN TABLE IF EXISTS ship_mode_ext;
CREATE FOREIGN TABLE ship_mode_ext
(
sm_ship_mode_sk      bigint          ,
sm_ship_mode_id      char(16)         ,
sm_type              char(30)        ,
sm_code              char(10)        ,
sm_carrier           char(20)        ,
sm_contract          char(20)
)
SERVER gsmpp_server
OPTIONS(location 'gsfs://192.168.0.90:5002/ship_mode.dat* | gsfs://192.168.0.90:5003/ship_mode.dat*',
FORMAT 'TEXT',
DELIMITER '|',
encoding 'utf8',
mode 'Normal'
)
WITH ship_mode_err
;
DROP FOREIGN TABLE IF EXISTS time_dim_ext;
CREATE FOREIGN TABLE time_dim_ext
(
t_time_sk           bigint          ,
t_time_id           char(16)         ,
t_time              bigint          ,
t_hour              bigint          ,
t_minute            bigint          ,
t_second            bigint          ,
t_am_pm             char(2)         ,
t_shift             char(20)        ,
t_sub_shift         char(20)        ,
t_meal_time         char(20)
)
SERVER gsmpp_server
OPTIONS(location 'gsfs://192.168.0.90:5002/time_dim.dat* | gsfs://192.168.0.90:5003/time_dim.dat*',
FORMAT 'TEXT',
DELIMITER '|',
encoding 'utf8',
mode 'Normal'
)
WITH time_dim_err
;
DROP FOREIGN TABLE IF EXISTS reason_ext;
CREATE FOREIGN TABLE reason_ext
(

```

```

r_reason_sk      bigint      ,
r_reason_id      char(16)    ,
r_reason_desc    char(100)
)
SERVER gsmpp_server
OPTIONS(location 'gsfs://192.168.0.90:5002/reason.dat* | gsfs://192.168.0.90:5003/reason.dat*',
FORMAT 'TEXT' ,
DELIMITER '|',
encoding 'utf8',
mode 'Normal'
)
WITH reason_err
;
DROP FOREIGN TABLE IF EXISTS income_band_ext;
CREATE FOREIGN TABLE income_band_ext
(
ib_income_band_sk  bigint      ,
ib_lower_bound    bigint      ,
ib_upper_bound    bigint
)
SERVER gsmpp_server
OPTIONS(location 'gsfs://192.168.0.90:5002/income_band.dat* | gsfs://192.168.0.90:5003/income_band.dat*',
FORMAT 'TEXT' ,
DELIMITER '|',
encoding 'utf8',
mode 'Normal'
)
WITH income_band_err
;
DROP FOREIGN TABLE IF EXISTS item_ext;
CREATE FOREIGN TABLE item_ext
(
i_item_sk      bigint      ,
i_item_id      char(16)    ,
i_rec_start_date  date      ,
i_rec_end_date  date      ,
i_item_desc    varchar(200) ,
i_current_price decimal(7,2) ,
i_wholesale_cost decimal(7,2) ,
i_brand_id     bigint      ,
i_brand        char(50)    ,
i_class_id     bigint      ,
i_class        char(50)    ,
i_category_id  bigint      ,
i_category     char(50)    ,
i_manufact_id  bigint      ,
i_manufact     char(50)    ,
i_size         char(20)    ,
i_formulation  char(20)    ,
i_color        char(20)    ,
i_units        char(10)    ,
i_container    char(10)    ,
i_manager_id   bigint      ,
i_product_name char(50)
)
SERVER gsmpp_server
OPTIONS(location 'gsfs://192.168.0.90:5002/item.dat* | gsfs://192.168.0.90:5003/item.dat*',
FORMAT 'TEXT' ,
DELIMITER '|',
encoding 'utf8',
mode 'Normal'
)
WITH item_err
;
DROP FOREIGN TABLE IF EXISTS store_ext;
CREATE FOREIGN TABLE store_ext
(
s_store_sk      bigint      ,
s_store_id      char(16)

```

```

s_rec_start_date    date           ,
s_rec_end_date      date           ,
s_closed_date_sk    bigint          ,
s_store_name        varchar(50)     ,
s_number_employees  bigint          ,
s_floor_space       bigint          ,
s_hours             char(20)        ,
s_manager           varchar(40)     ,
s_market_id         bigint          ,
s_geography_class   varchar(100)    ,
s_market_desc       varchar(100)    ,
s_market_manager    varchar(40)     ,
s_division_id       bigint          ,
s_division_name     varchar(50)     ,
s_company_id        bigint          ,
s_company_name      varchar(50)     ,
s_street_number     varchar(10)     ,
s_street_name       varchar(60)     ,
s_street_type       char(15)        ,
s_suite_number      char(10)        ,
s_city              varchar(60)     ,
s_county            varchar(30)     ,
s_state             char(2)         ,
s_zip               char(10)        ,
s_country           varchar(20)     ,
s_gmt_offset        decimal(5,2)    ,
s_tax_precentage    decimal(5,2)    ,
)
SERVER gsmpp_server
OPTIONS(location 'gsfs://192.168.0.90:5002/store_[^rs]* | gsfs://192.168.0.90:5003/store_[^rs]*',
FORMAT 'TEXT',
DELIMITER '|',
encoding 'utf8',
mode 'Normal'
)
WITH store_err
;
DROP FOREIGN TABLE IF EXISTS call_center_ext;
CREATE FOREIGN TABLE call_center_ext
(
cc_call_center_sk    bigint          ,
cc_call_center_id    char(16)         ,
cc_rec_start_date    date           ,
cc_rec_end_date      date           ,
cc_closed_date_sk    bigint          ,
cc_open_date_sk      bigint          ,
cc_name              varchar(50)     ,
cc_class             varchar(50)     ,
cc_employees         bigint          ,
cc_sq_ft             bigint          ,
cc_hours             char(20)        ,
cc_manager           varchar(40)     ,
cc_mkt_id            bigint          ,
cc_mkt_class         char(50)        ,
cc_mkt_desc          varchar(100)    ,
cc_market_manager    varchar(40)     ,
cc_division          bigint          ,
cc_division_name     varchar(50)     ,
cc_company           bigint          ,
cc_company_name      char(50)        ,
cc_street_number     char(10)        ,
cc_street_name       varchar(60)     ,
cc_street_type       char(15)        ,
cc_suite_number      char(10)        ,
cc_city              varchar(60)     ,
cc_county            varchar(30)     ,
cc_state             char(2)         ,
cc_zip               char(10)        ,
cc_country           varchar(20)     ,

```

```

cc_gmt_offset      decimal(5,2)
cc_tax_percentage  decimal(5,2)
)
SERVER gsmpp_server
OPTIONS(location 'gsfs://192.168.0.90:5002/call_center.dat* | gsfs://192.168.0.90:5003/call_center.dat*',
FORMAT 'TEXT',
DELIMITER '|',
encoding 'utf8',
mode 'Normal'
)
WITH call_center_err
;
DROP FOREIGN TABLE IF EXISTS customer_ext;
CREATE FOREIGN TABLE customer_ext
(
c_customer_sk      bigint
c_customer_id      char(16)
c_current_cdemo_sk  bigint
c_current_hdemo_sk  bigint
c_current_addr_sk   bigint
c_first_shipto_date_sk  bigint
c_first_sales_date_sk  bigint
c_salutation       char(10)
c_first_name        char(20)
c_last_name         char(30)
c_preferred_cust_flag  char(1)
c_birth_day         bigint
c_birth_month       bigint
c_birth_year        bigint
c_birth_country     varchar(20)
c_login             char(13)
c_email_address     char(50)
c_last_review_date_sk  char(10)
)
SERVER gsmpp_server
OPTIONS(location 'gsfs://192.168.0.90:5002/customer_[^ad]* | gsfs://192.168.0.90:5003/customer_[^ad]*',
FORMAT 'TEXT',
DELIMITER '|',
encoding 'GBK',
mode 'Normal'
)
WITH customer_err
;
DROP FOREIGN TABLE IF EXISTS web_site_ext;
CREATE FOREIGN TABLE web_site_ext
(
web_site_sk        bigint
web_site_id        char(16)
web_rec_start_date  date
web_rec_end_date    date
web_name            varchar(50)
web_open_date_sk   bigint
web_close_date_sk  bigint
web_class           varchar(50)
web_manager         varchar(40)
web_mkt_id          bigint
web_mkt_class       varchar(50)
web_mkt_desc        varchar(100)
web_market_manager  varchar(40)
web_company_id      bigint
web_company_name    char(50)
web_street_number   char(10)
web_street_name     varchar(60)
web_street_type     char(15)
web_suite_number    char(10)
web_city            varchar(60)
web_county          varchar(30)
web_state           char(2)
web_zip             char(10)
)

```



```

web_country      varchar(20)
web_gmt_offset   decimal(5,2)
web_tax_percentage decimal(5,2)
)
SERVER gsmpp_server
OPTIONS(location 'gsfs://192.168.0.90:5002/web_site.dat*' | gsfs://192.168.0.90:5003/web_site.dat*',
FORMAT 'TEXT',
DELIMITER '|',
encoding 'utf8',
mode 'Normal'
)
WITH web_site_err
;
DROP FOREIGN TABLE IF EXISTS store_returns_ext;
CREATE FOREIGN TABLE store_returns_ext
(
sr_returned_date_sk    bigint
sr_return_time_sk     bigint
sr_item_sk            bigint
sr_customer_sk        bigint
sr_cdemo_sk           bigint
sr_hdemo_sk           bigint
sr_addr_sk            bigint
sr_store_sk           bigint
sr_reason_sk          bigint
sr_ticket_number      bigint
sr_return_quantity    bigint
sr_return_amt         decimal(7,2)
sr_return_tax         decimal(7,2)
sr_return_amt_inc_tax decimal(7,2)
sr_fee                decimal(7,2)
sr_return_ship_cost   decimal(7,2)
sr_refunded_cash      decimal(7,2)
sr_reversed_charge    decimal(7,2)
sr_store_credit       decimal(7,2)
sr_net_loss           decimal(7,2)
)
SERVER gsmpp_server
OPTIONS(location 'gsfs://192.168.0.90:5002/store_returns.dat*' | gsfs://192.168.0.90:5003/store_returns.dat*',
FORMAT 'TEXT',
DELIMITER '|',
encoding 'utf8',
mode 'Normal'
)
WITH store_returns_err
;
DROP FOREIGN TABLE IF EXISTS household_demographics_ext;
CREATE FOREIGN TABLE household_demographics_ext
(
hd_demo_sk          bigint
hd_income_band_sk  bigint
hd_buy_potential    char(15)
hd_dep_count        bigint
hd_vehicle_count    bigint
)
SERVER gsmpp_server
OPTIONS(location 'gsfs://192.168.0.90:5002/household_demographics.dat*' | gsfs://192.168.0.90:5003/
household_demographics.dat*',
FORMAT 'TEXT',
DELIMITER '|',
encoding 'utf8',
mode 'Normal'
)
WITH household_demographics_err
;
DROP FOREIGN TABLE IF EXISTS web_page_ext;
CREATE FOREIGN TABLE web_page_ext
(
wp_web_page_sk      bigint

```

```

wp_web_page_id      char(16)      ,
wp_rec_start_date   date           ,
wp_rec_end_date     date           ,
wp_creation_date_sk bigint         ,
wp_access_date_sk   bigint         ,
wp_autogen_flag     char(1)        ,
wp_customer_sk      bigint         ,
wp_url              varchar(100)   ,
wp_type            char(50)       ,
wp_char_count       bigint         ,
wp_link_count       bigint         ,
wp_image_count      bigint         ,
wp_max_ad_count     bigint         ,
)
SERVER gsmpp_server
OPTIONS(location 'gsfs://192.168.0.90:5002/web_page.dat*' | gsfs://192.168.0.90:5003/web_page.dat*',
FORMAT 'TEXT',
DELIMITER '|',
encoding 'utf8',
mode 'Normal'
)
WITH web_page_err
;
DROP FOREIGN TABLE IF EXISTS promotion_ext;
CREATE FOREIGN TABLE promotion_ext
(
p_promo_sk          bigint         ,
p_promo_id          char(16)       ,
p_start_date_sk     bigint         ,
p_end_date_sk       bigint         ,
p_item_sk           bigint         ,
p_cost              decimal(15,2) ,
p_response_target   bigint         ,
p_promo_name        char(50)       ,
p_channel_dmail     char(1)        ,
p_channel_email     char(1)        ,
p_channel_catalog   char(1)        ,
p_channel_tv        char(1)        ,
p_channel_radio     char(1)        ,
p_channel_press     char(1)        ,
p_channel_event     char(1)        ,
p_channel_demo      char(1)        ,
p_channel_details   varchar(100)  ,
p_purpose             char(15)       ,
p_discount_active   char(1)        ,
)
SERVER gsmpp_server
OPTIONS(location 'gsfs://192.168.0.90:5002/promotion.dat*' | gsfs://192.168.0.90:5003/promotion.dat*',
FORMAT 'TEXT',
DELIMITER '|',
encoding 'utf8',
mode 'Normal'
)
WITH promotion_err
;
DROP FOREIGN TABLE IF EXISTS catalog_page_ext;
CREATE FOREIGN TABLE catalog_page_ext
(
cp_catalog_page_sk  bigint         ,
cp_catalog_page_id char(16)       ,
cp_start_date_sk    bigint         ,
cp_end_date_sk      bigint         ,
cp_department       varchar(50)    ,
cp_catalog_number   bigint         ,
cp_catalog_page_number bigint     ,
cp_description       varchar(100)  ,
cp_type            varchar(100)    ,
)
SERVER gsmpp_server

```

```

OPTIONS(location 'gsfs://192.168.0.90:5002/catalog_page.dat*' | gsfs://192.168.0.90:5003/catalog_page.dat*',
FORMAT 'TEXT',
DELIMITER '|',
encoding 'utf8',
mode 'Normal'
)
)
WITH catalog_page_err
;
DROP FOREIGN TABLE IF EXISTS inventory_ext;
CREATE FOREIGN TABLE inventory_ext
(
inv_date_sk          bigint          ,
inv_item_sk         bigint          ,
inv_warehouse_sk    bigint          ,
inv_quantity_on_hand integer
)
SERVER gsmpp_server
OPTIONS(location 'gsfs://192.168.0.90:5002/inventory.dat*' | gsfs://192.168.0.90:5003/inventory.dat*',
FORMAT 'TEXT',
DELIMITER '|',
encoding 'utf8',
mode 'Normal'
)
WITH inventory_err
;
DROP FOREIGN TABLE IF EXISTS catalog_returns_ext;
CREATE FOREIGN TABLE catalog_returns_ext
(
cr_returned_date_sk  bigint          ,
cr_returned_time_sk  bigint          ,
cr_item_sk           bigint          ,
cr_refunded_customer_sk  bigint          ,
cr_refunded_cdemo_sk  bigint          ,
cr_refunded_hdemo_sk  bigint          ,
cr_refunded_addr_sk  bigint          ,
cr_returning_customer_sk  bigint          ,
cr_returning_cdemo_sk  bigint          ,
cr_returning_hdemo_sk  bigint          ,
cr_returning_addr_sk  bigint          ,
cr_call_center_sk    bigint          ,
cr_catalog_page_sk   bigint          ,
cr_ship_mode_sk      bigint          ,
cr_warehouse_sk      bigint          ,
cr_reason_sk         bigint          ,
cr_order_number      bigint          ,
cr_return_quantity    bigint          ,
cr_return_amount      decimal(7,2)    ,
cr_return_tax         decimal(7,2)    ,
cr_return_amt_inc_tax decimal(7,2)    ,
cr_fee               decimal(7,2)    ,
cr_return_ship_cost   decimal(7,2)    ,
cr_refunded_cash      decimal(7,2)    ,
cr_reversed_charge    decimal(7,2)    ,
cr_store_credit       decimal(7,2)    ,
cr_net_loss          decimal(7,2)
)
SERVER gsmpp_server
OPTIONS(location 'gsfs://192.168.0.90:5002/catalog_returns.dat*' | gsfs://192.168.0.90:5003/
catalog_returns.dat*',
FORMAT 'TEXT',
DELIMITER '|',
encoding 'utf8',
mode 'Normal'
)
WITH catalog_returns_err
;
DROP FOREIGN TABLE IF EXISTS web_returns_ext;
CREATE FOREIGN TABLE web_returns_ext
(

```

```

wr_returned_date_sk    bigint    ,
wr_returned_time_sk   bigint    ,
wr_item_sk            bigint    ,
wr_refunded_customer_sk  bigint    ,
wr_refunded_cdemo_sk   bigint    ,
wr_refunded_hdemo_sk   bigint    ,
wr_refunded_addr_sk    bigint    ,
wr_returning_customer_sk  bigint    ,
wr_returning_cdemo_sk   bigint    ,
wr_returning_hdemo_sk   bigint    ,
wr_returning_addr_sk    bigint    ,
wr_web_page_sk        bigint    ,
wr_reason_sk          bigint    ,
wr_order_number       bigint    ,
wr_return_quantity    bigint    ,
wr_return_amt         decimal(7,2) ,
wr_return_tax         decimal(7,2) ,
wr_return_amt_inc_tax decimal(7,2) ,
wr_fee                decimal(7,2) ,
wr_return_ship_cost   decimal(7,2) ,
wr_refunded_cash     decimal(7,2) ,
wr_reversed_charge    decimal(7,2) ,
wr_account_credit     decimal(7,2) ,
wr_net_loss          decimal(7,2)
)
SERVER gsmpp_server
OPTIONS(location 'gsfs://192.168.0.90:5002/web_returns.dat* | gsfs://192.168.0.90:5003/web_returns.dat*',
FORMAT 'TEXT' ,
DELIMITER '|',
encoding 'utf8',
mode 'Normal'
)
WITH web_returns_err
;
DROP FOREIGN TABLE IF EXISTS web_sales_ext;
CREATE FOREIGN TABLE web_sales_ext
(
ws_sold_date_sk    bigint    ,
ws_sold_time_sk   bigint    ,
ws_ship_date_sk    bigint    ,
ws_item_sk        bigint    ,
ws_bill_customer_sk  bigint    ,
ws_bill_cdemo_sk   bigint    ,
ws_bill_hdemo_sk   bigint    ,
ws_bill_addr_sk    bigint    ,
ws_ship_customer_sk  bigint    ,
ws_ship_cdemo_sk   bigint    ,
ws_ship_hdemo_sk   bigint    ,
ws_ship_addr_sk    bigint    ,
ws_web_page_sk     bigint    ,
ws_web_site_sk     bigint    ,
ws_ship_mode_sk    bigint    ,
ws_warehouse_sk    bigint    ,
ws_promo_sk        bigint    ,
ws_order_number    bigint    ,
ws_quantity        bigint    ,
ws_wholesale_cost  decimal(7,2) ,
ws_list_price      decimal(7,2) ,
ws_sales_price     decimal(7,2) ,
ws_ext_discount_amt decimal(7,2) ,
ws_ext_sales_price decimal(7,2) ,
ws_ext_wholesale_cost decimal(7,2) ,
ws_ext_list_price  decimal(7,2) ,
ws_ext_tax         decimal(7,2) ,
ws_coupon_amt     decimal(7,2) ,
ws_ext_ship_cost  decimal(7,2) ,
ws_net_paid       decimal(7,2) ,
ws_net_paid_inc_tax decimal(7,2) ,
ws_net_paid_inc_ship decimal(7,2) ,

```

```

ws_net_paid_inc_ship_tax decimal(7,2)
ws_net_profit decimal(7,2)
)
SERVER gsmpp_server
OPTIONS(location 'gsfs://192.168.0.90:5002/web_sales.dat* | gsfs://192.168.0.90:5003/web_sales.dat*',
FORMAT 'TEXT',
DELIMITER '|',
encoding 'utf8',
mode 'Normal'
) WITH web_sales_err ;
DROP FOREIGN TABLE IF EXISTS catalog_sales_ext;
CREATE FOREIGN TABLE catalog_sales_ext
(
cs_sold_date_sk bigint
cs_sold_time_sk bigint
cs_ship_date_sk bigint
cs_bill_customer_sk bigint
cs_bill_cdemo_sk bigint
cs_bill_hdemo_sk bigint
cs_bill_addr_sk bigint
cs_ship_customer_sk bigint
cs_ship_cdemo_sk bigint
cs_ship_hdemo_sk bigint
cs_ship_addr_sk bigint
cs_call_center_sk bigint
cs_catalog_page_sk bigint
cs_ship_mode_sk bigint
cs_warehouse_sk bigint
cs_item_sk bigint
cs_promo_sk bigint
cs_order_number bigint
cs_quantity bigint
cs_wholesale_cost decimal(7,2)
cs_list_price decimal(7,2)
cs_sales_price decimal(7,2)
cs_ext_discount_amt decimal(7,2)
cs_ext_sales_price decimal(7,2)
cs_ext_wholesale_cost decimal(7,2)
cs_ext_list_price decimal(7,2)
cs_ext_tax decimal(7,2)
cs_coupon_amt decimal(7,2)
cs_ext_ship_cost decimal(7,2)
cs_net_paid decimal(7,2)
cs_net_paid_inc_tax decimal(7,2)
cs_net_paid_inc_ship decimal(7,2)
cs_net_paid_inc_ship_tax decimal(7,2)
cs_net_profit decimal(7,2)
)
SERVER gsmpp_server
OPTIONS(location 'gsfs://192.168.0.90:5002/catalog_sales.dat* | gsfs://192.168.0.90:5003/catalog_sales.dat*',
FORMAT 'TEXT',
DELIMITER '|',
encoding 'utf8',
mode 'Normal'
) WITH catalog_sales_err ;
DROP FOREIGN TABLE IF EXISTS store_sales_ext;
CREATE FOREIGN TABLE store_sales_ext
(
ss_sold_date_sk bigint
ss_sold_time_sk bigint
ss_item_sk bigint
ss_customer_sk bigint
ss_cdemo_sk bigint
ss_hdemo_sk bigint
ss_addr_sk bigint
ss_store_sk bigint
ss_promo_sk bigint
ss_ticket_number bigint
ss_quantity bigint

```

```
ss_wholesale_cost    decimal(7,2)    ,
ss_list_price        decimal(7,2)    ,
ss_sales_price       decimal(7,2)    ,
ss_ext_discount_amt  decimal(7,2)    ,
ss_ext_sales_price   decimal(7,2)    ,
ss_ext_wholesale_cost decimal(7,2)    ,
ss_ext_list_price    decimal(7,2)    ,
ss_ext_tax           decimal(7,2)    ,
ss_coupon_amt        decimal(7,2)    ,
ss_net_paid          decimal(7,2)    ,
ss_net_paid_inc_tax  decimal(7,2)    ,
ss_net_profit        decimal(7,2)
) SERVER gsmpp_server
OPTIONS(location 'gsfs://192.168.0.90:5002/store_sales.dat* | gsfs://192.168.0.90:5003/store_sales.dat*',
FORMAT 'TEXT',
DELIMITER '|',
encoding 'utf8',
mode 'Normal'
) WITH store_sales_err;
```

导入 TPC-DS 数据

执行以下命令导入数据。

```
INSERT INTO customer_address SELECT * FROM customer_address_ext;
INSERT INTO customer_demographics SELECT * FROM customer_demographics_ext;
INSERT INTO date_dim SELECT * FROM date_dim_ext;
INSERT INTO warehouse SELECT * FROM warehouse_ext;
INSERT INTO ship_mode SELECT * FROM ship_mode_ext;
INSERT INTO time_dim SELECT * FROM time_dim_ext;
INSERT INTO reason SELECT * FROM reason_ext;
INSERT INTO income_band SELECT * FROM income_band_ext;
INSERT INTO item SELECT * FROM item_ext;
INSERT INTO store SELECT * FROM store_ext;
INSERT INTO call_center SELECT * FROM call_center_ext;
INSERT INTO customer SELECT * FROM customer_ext;
INSERT INTO web_site SELECT * FROM web_site_ext;
INSERT INTO household_demographics SELECT * FROM household_demographics_ext;
INSERT INTO web_page SELECT * FROM web_page_ext;
INSERT INTO promotion SELECT * FROM promotion_ext;
INSERT INTO catalog_page SELECT * FROM catalog_page_ext;
INSERT INTO inventory SELECT * FROM inventory_ext;
INSERT INTO catalog_returns SELECT * FROM catalog_returns_ext;
INSERT INTO web_returns SELECT * FROM web_returns_ext;
INSERT INTO store_returns SELECT * FROM store_returns_ext;
INSERT INTO web_sales SELECT * FROM web_sales_ext;
INSERT INTO catalog_sales SELECT * FROM catalog_sales_ext;
INSERT INTO store_sales SELECT * FROM store_sales_ext;
```

4.3.4 TPC-DS 查询测试

您可以通过[命令生成方法](#)生成TPC-DS测试集，也可以直接通过[脚本生成方法](#)生成，另我们已经给出前面20个的TPC-DS[测试集](#)供您参考。

命令生成方法

TPC-DS标准99个SQL查询语句可用如下方法生成：

步骤1 准备工作。生成TPC-DS查询语句前需要修改query_templates目录下的文件：

1. 登录测试过程申请的ECS，进入/data1/script/tpcds-kit/DSGen-software-code-3.2.0rc1/query_templates目录：
`cd /data1/script/tpcds-kit/DSGen-software-code-3.2.0rc1/query_templates`
2. 新建文件hwdws.tpl，内容为：

```
define __LIMITA = "";  
define __LIMITB = "";  
define __LIMITC = "limit %d";  
define __BEGIN = "-- begin query " + [_QUERY] + " in stream " + [_STREAM] + " using template " +  
[_TEMPLATE];  
define __END = "-- end query " + [_QUERY] + " in stream " + [_STREAM] + " using template " +  
[_TEMPLATE];
```

3. 因TPC-DS工具中SQL语句生成模板有语法错误，需修改query77.tpl，将135行的
' , coalesce(returns, 0) returns' 改为 ' , coalesce(returns, 0) as returns' 。

步骤2 执行以下命令生成查询语句：

```
cd /data1/script/tpcds-kit/DGen-software-code-3.2.0rc1/tools  
./dsqgen -input ../query_templates/templates.lst -directory ../query_templates/ -scale 1000 -dialect  
hwdws
```

执行后会生成query_0.sql文件，里面放着99个标准SQL语句，需要手动去切分成99个文件。

步骤3 生成的标准查询中如下日期函数语法在GaussDB(DWS)暂不支持，需要手动进行修改：

```
Q5: and (cast('2001-08-19' as date) + 14 days)  
修改为  
and (cast('2001-08-19' as date) + 14)  
  
Q12:and (cast('1999-02-28' as date) + 30 days)  
修改为  
and (cast('1999-02-28' as date) + 30)  
  
Q16:(cast('1999-4-01' as date) + 60 days)  
修改为  
(cast('1999-4-01' as date) + 60)  
  
Q20:and (cast('1998-05-05' as date) + 30 days)  
修改为  
and (cast('1998-05-05' as date) + 30)  
  
Q21:and d_date between (cast ('2000-05-19' as date) - 30 days)  
修改为  
and d_date between (cast ('2000-05-19' as date) - 30)  
  
and (cast ('2000-05-19' as date) + 30 days)  
修改为  
and (cast ('2000-05-19' as date) + 30)  
  
Q32:(cast('1999-02-22' as date) + 90 days)  
修改为  
(cast('1999-02-22' as date) + 90)  
  
Q37:and d_date between cast('1998-04-29' as date) and (cast('1998-04-29' as date) + 60 days)  
修改为  
and d_date between cast('1998-04-29' as date) and (cast('1998-04-29' as date) + 60)  
  
Q40:and d_date between (cast ('2002-05-10' as date) - 30 days)  
修改为  
and d_date between (cast ('2002-05-10' as date) - 30)  
  
and (cast ('2002-05-10' as date) + 30 days)  
修改为  
and (cast ('2002-05-10' as date) + 30)  
  
Q77:and (cast('1999-08-29' as date) + 30 days)  
修改为  
and (cast('1999-08-29' as date) + 30)  
  
Q80:and (cast('2002-08-04' as date) + 30 days)  
修改为  
and (cast('2002-08-04' as date) + 30)
```

```
Q82:and d_date between cast('1998-01-18' as date) and (cast('1998-01-18' as date) + 60 days)
修改为
and d_date between cast('1998-01-18' as date) and (cast('1998-01-18' as date) + 60)
```

```
Q92:(cast('2001-01-26' as date) + 90 days)
修改为
(cast('2001-01-26' as date) + 90)
```

```
Q94:(cast('1999-5-01' as date) + 60 days)
修改为
(cast('1999-5-01' as date) + 60)
```

```
Q95:(cast('1999-4-01' as date) + 60 days)
修改为
(cast('1999-4-01' as date) + 60)
```

```
Q98:and (cast('2002-04-01' as date) + 30 days)
修改为
and (cast('2002-04-01' as date) + 30)
```

----结束

脚本生成方法

建议使用如下脚本直接生成GaussDB(DWS)可用的SQL语句:

```
# -*- coding: utf-8 -*-
import os
import sys
import re
import stat

def gen_thp_seq(dsqgen_file, scale, query_dir):
    flags = os.O_WRONLY | os.O_CREAT | os.O_EXCL
    modes = stat.S_IWUSR | stat.S_IRUSR
    if not os.path.exists(query_dir):
        os.mkdir(query_dir)

    cmd = dsqgen_file + ' -input ../query_templates/templates.lst -directory ../query_templates/ -scale ' +
    str(scale) + ' -dialect hwdws'
    os.system(cmd)
    with open('query_0.sql', 'r') as f1:
        line = f1.readline()
        queryname = ""
        while line:
            if '-- begin' in line.strip():
                #line:-- begin query 1 in stream 0 using template query96.tpl\n'
                queryname = line.split(' ')[-1][5:-5]
                fquery = os.fdopen(os.open(query_dir + '/Q' + queryname, flags, modes), 'w+')
                line = f1.readline()
                continue

            if not queryname or line == '\n':
                line = f1.readline()
                continue

            if '-- end' in line.strip():
                fquery.close()
                line = f1.readline()
                continue

            if 'days' in line:
                line = line.replace('days', "")
                fquery.write(line)
                line = f1.readline()

    print("TPCDS Q1-Q99 query store at " + query_dir)
```



```
os.system('rm -rf query_0.sql')

if __name__ == '__main__':
    if len(sys.argv) != 4:
        print('Wrong number of parameters! ')
        print('Usage: python3 gen_tpcds_thpseq.py dsqgen_file_path scale query_dir')
        print('Parameter:')
        print('    qgen_file_path: tpcds dsqgen文件路径')
        print('    scale: 生成查询对应的数据规模')
        print('    query_dir: 生成文件的存放路径')
        print('Example:')
        print('python3 gen_tpcds_thpseq.py ./dsqgen 1000 tpcds_query1000x')
        sys.exit(1)

    dsqgen_file_path = sys.argv[1]
    scale = sys.argv[2]
    query_dir = sys.argv[3]
    try:
        if not re.match(r'^\.\?\\(\w+\/?)+$', dsqgen_file_path):
            print('error param qgenfilepath:', dsqgen_file_path)
        if not re.match(r'\d+', scale):
            print('error param scale:', scale)
        if not re.match(r'^\.\?\\(\w+\/?)+$', query_dir):
            print('error param query_dir:', query_dir)
    except Exception as ex:
        print('exception: invalid param!')

    if not os.path.isfile(dsqgen_file_path):
        print('The file %s is not exist!' % dsqgen_file_path)
        sys.exit(1)

    gen_thp_seq(dsqgen_file_path, int(scale), query_dir)
```

将以上脚本保存在/data1/script/tpcds-kit/DSGen-software-code-3.2.0rc1/tools/gen_tpcds_thpseq.py，执行如下命令可获得99个SQL语句，其中1000为数据规模，代表TPCDS 1000x，tpcds_query1000x为生成的SQL语句存放的位置：

```
cd /data1/script/tpcds-kit/DSGen-software-code-3.2.0rc1/tools/
python3 gen_tpcds_thpseq.py ./dsqgen 1000 tpcds_query1000x
```

测试集

TPC-DS测试集共包括99个SQL查询，本章节仅体现前20个SQL。其他请根据以上方法生成。

SQL1

```
with customer_total_return as
(select sr_customer_sk as ctr_customer_sk
,sr_store_sk as ctr_store_sk
,sum(SR_RETURN_AMT_INC_TAX) as ctr_total_return
from store_returns
,date_dim
where sr_returned_date_sk = d_date_sk
and d_year =2001
group by sr_customer_sk
,sr_store_sk)
select c_customer_id
from customer_total_return ctr1
,store
,customer
where ctr1.ctr_total_return > (select avg(ctr_total_return)*1.2
from customer_total_return ctr2
where ctr1.ctr_store_sk = ctr2.ctr_store_sk)
and s_store_sk = ctr1.ctr_store_sk
```

```
and s_state = 'PA'
and ctr1.ctr_customer_sk = c_customer_sk
order by c_customer_id
limit 100;
```

SQL2

```
with wscs as
(select sold_date_sk
,sales_price
 from (select ws_sold_date_sk sold_date_sk
,ws_ext_sales_price sales_price
 from web_sales
 union all
 select cs_sold_date_sk sold_date_sk
,cs_ext_sales_price sales_price
 from catalog_sales)),
wswscs as
(select d_week_seq,
 sum(case when (d_day_name='Sunday') then sales_price else null end) sun_sales,
 sum(case when (d_day_name='Monday') then sales_price else null end) mon_sales,
 sum(case when (d_day_name='Tuesday') then sales_price else null end) tue_sales,
 sum(case when (d_day_name='Wednesday') then sales_price else null end) wed_sales,
 sum(case when (d_day_name='Thursday') then sales_price else null end) thu_sales,
 sum(case when (d_day_name='Friday') then sales_price else null end) fri_sales,
 sum(case when (d_day_name='Saturday') then sales_price else null end) sat_sales
 from wscs
,date_dim
 where d_date_sk = sold_date_sk
 group by d_week_seq)
select d_week_seq1
,round(sun_sales1/sun_sales2,2)
,round(mon_sales1/mon_sales2,2)
,round(tue_sales1/tue_sales2,2)
,round(wed_sales1/wed_sales2,2)
,round(thu_sales1/thu_sales2,2)
,round(fri_sales1/fri_sales2,2)
,round(sat_sales1/sat_sales2,2)
 from
(select wswscs.d_week_seq d_week_seq1
,sun_sales sun_sales1
,mon_sales mon_sales1
,tue_sales tue_sales1
,wed_sales wed_sales1
,thu_sales thu_sales1
,fri_sales fri_sales1
,sat_sales sat_sales1
 from wswscs,date_dim
 where date_dim.d_week_seq = wswscs.d_week_seq and
 d_year = 1999) y,
(select wswscs.d_week_seq d_week_seq2
,sun_sales sun_sales2
,mon_sales mon_sales2
,tue_sales tue_sales2
,wed_sales wed_sales2
,thu_sales thu_sales2
,fri_sales fri_sales2
,sat_sales sat_sales2
 from wswscs
,date_dim
 where date_dim.d_week_seq = wswscs.d_week_seq and
 d_year = 1999+1) z
 where d_week_seq1=d_week_seq2-53
 order by d_week_seq1;
```

SQL3

```
select dt.d_year
,item.i_brand_id brand_id
```

```

,item.i_brand brand
,sum(ss_ext_sales_price) sum_agg
from date_dim dt
,store_sales
,item
where dt.d_date_sk = store_sales.ss_sold_date_sk
and store_sales.ss_item_sk = item.i_item_sk
and item.i_manufact_id = 125
and dt.d_moy=11
group by dt.d_year
,item.i_brand
,item.i_brand_id
order by dt.d_year
,sum_agg desc
,brand_id
limit 100;

```

SQL4

```

with year_total as (
select c_customer_id customer_id
,c_first_name customer_first_name
,c_last_name customer_last_name
,c_preferred_cust_flag customer_preferred_cust_flag
,c_birth_country customer_birth_country
,c_login customer_login
,c_email_address customer_email_address
,d_year dyear
,sum(((ss_ext_list_price-ss_ext_wholesale_cost-ss_ext_discount_amt)+ss_ext_sales_price)/2) year_total
,'s' sale_type
from customer
,store_sales
,date_dim
where c_customer_sk = ss_customer_sk
and ss_sold_date_sk = d_date_sk
group by c_customer_id
,c_first_name
,c_last_name
,c_preferred_cust_flag
,c_birth_country
,c_login
,c_email_address
,d_year
union all
select c_customer_id customer_id
,c_first_name customer_first_name
,c_last_name customer_last_name
,c_preferred_cust_flag customer_preferred_cust_flag
,c_birth_country customer_birth_country
,c_login customer_login
,c_email_address customer_email_address
,d_year dyear
,sum(((cs_ext_list_price-cs_ext_wholesale_cost-cs_ext_discount_amt)+cs_ext_sales_price)/2) year_total
,'c' sale_type
from customer
,catalog_sales
,date_dim
where c_customer_sk = cs_bill_customer_sk
and cs_sold_date_sk = d_date_sk
group by c_customer_id
,c_first_name
,c_last_name
,c_preferred_cust_flag
,c_birth_country
,c_login
,c_email_address
,d_year
union all
select c_customer_id customer_id

```

```

,c_first_name customer_first_name
,c_last_name customer_last_name
,c_preferred_cust_flag customer_preferred_cust_flag
,c_birth_country customer_birth_country
,c_login customer_login
,c_email_address customer_email_address
,d_year dyear
,sum((((ws_ext_list_price-ws_ext_wholesale_cost-ws_ext_discount_amt)+ws_ext_sales_price)/2) )
year_total
,'w' sale_type
from customer
,web_sales
,date_dim
where c_customer_sk = ws_bill_customer_sk
and ws_sold_date_sk = d_date_sk
group by c_customer_id
,c_first_name
,c_last_name
,c_preferred_cust_flag
,c_birth_country
,c_login
,c_email_address
,d_year
)
select
t_s_secyear.customer_id
,t_s_secyear.customer_first_name
,t_s_secyear.customer_last_name
,t_s_secyear.customer_preferred_cust_flag
from year_total t_s_firstyear
,year_total t_s_secyear
,year_total t_c_firstyear
,year_total t_c_secyear
,year_total t_w_firstyear
,year_total t_w_secyear
where t_s_secyear.customer_id = t_s_firstyear.customer_id
and t_s_firstyear.customer_id = t_c_secyear.customer_id
and t_s_firstyear.customer_id = t_c_firstyear.customer_id
and t_s_firstyear.customer_id = t_w_firstyear.customer_id
and t_s_firstyear.customer_id = t_w_secyear.customer_id
and t_s_firstyear.sale_type = 's'
and t_c_firstyear.sale_type = 'c'
and t_w_firstyear.sale_type = 'w'
and t_s_secyear.sale_type = 's'
and t_c_secyear.sale_type = 'c'
and t_w_secyear.sale_type = 'w'
and t_s_firstyear.dyear = 2000
and t_s_secyear.dyear = 2000+1
and t_c_firstyear.dyear = 2000
and t_c_secyear.dyear = 2000+1
and t_w_firstyear.dyear = 2000
and t_w_secyear.dyear = 2000+1
and t_s_firstyear.year_total > 0
and t_c_firstyear.year_total > 0
and t_w_firstyear.year_total > 0
and case when t_c_firstyear.year_total > 0 then t_c_secyear.year_total / t_c_firstyear.year_total else null
end
> case when t_s_firstyear.year_total > 0 then t_s_secyear.year_total / t_s_firstyear.year_total else null
end
and case when t_c_firstyear.year_total > 0 then t_c_secyear.year_total / t_c_firstyear.year_total else null
end
> case when t_w_firstyear.year_total > 0 then t_w_secyear.year_total / t_w_firstyear.year_total else
null end
order by t_s_secyear.customer_id
,t_s_secyear.customer_first_name
,t_s_secyear.customer_last_name
,t_s_secyear.customer_preferred_cust_flag
limit 100;

```

SQL5

```

with sssr as
(select s_store_id,
    sum(sales_price) as sales,
    sum(profit) as profit,
    sum(return_amt) as returns,
    sum(net_loss) as profit_loss
from
    ( select ss_store_sk as store_sk,
        ss_sold_date_sk as date_sk,
        ss_ext_sales_price as sales_price,
        ss_net_profit as profit,
        cast(0 as decimal(7,2)) as return_amt,
        cast(0 as decimal(7,2)) as net_loss
    from store_sales
    union all
    select sr_store_sk as store_sk,
        sr_returned_date_sk as date_sk,
        cast(0 as decimal(7,2)) as sales_price,
        cast(0 as decimal(7,2)) as profit,
        sr_return_amt as return_amt,
        sr_net_loss as net_loss
    from store_returns
    ) salesreturns,
    date_dim,
    store
where date_sk = d_date_sk
    and d_date between cast('2002-08-05' as date)
        and (cast('2002-08-05' as date) + 14 )
    and store_sk = s_store_sk
group by s_store_id)
,
csr as
(select cp_catalog_page_id,
    sum(sales_price) as sales,
    sum(profit) as profit,
    sum(return_amt) as returns,
    sum(net_loss) as profit_loss
from
    ( select cs_catalog_page_sk as page_sk,
        cs_sold_date_sk as date_sk,
        cs_ext_sales_price as sales_price,
        cs_net_profit as profit,
        cast(0 as decimal(7,2)) as return_amt,
        cast(0 as decimal(7,2)) as net_loss
    from catalog_sales
    union all
    select cr_catalog_page_sk as page_sk,
        cr_returned_date_sk as date_sk,
        cast(0 as decimal(7,2)) as sales_price,
        cast(0 as decimal(7,2)) as profit,
        cr_return_amount as return_amt,
        cr_net_loss as net_loss
    from catalog_returns
    ) salesreturns,
    date_dim,
    catalog_page
where date_sk = d_date_sk
    and d_date between cast('2002-08-05' as date)
        and (cast('2002-08-05' as date) + 14 )
    and page_sk = cp_catalog_page_sk
group by cp_catalog_page_id)
,
wsr as
(select web_site_id,
    sum(sales_price) as sales,
    sum(profit) as profit,
    sum(return_amt) as returns,
    sum(net_loss) as profit_loss

```

```

from
( select ws_web_site_sk as wsr_web_site_sk,
  ws_sold_date_sk as date_sk,
  ws_ext_sales_price as sales_price,
  ws_net_profit as profit,
  cast(0 as decimal(7,2)) as return_amt,
  cast(0 as decimal(7,2)) as net_loss
from web_sales
union all
select ws_web_site_sk as wsr_web_site_sk,
  wr_returned_date_sk as date_sk,
  cast(0 as decimal(7,2)) as sales_price,
  cast(0 as decimal(7,2)) as profit,
  wr_return_amt as return_amt,
  wr_net_loss as net_loss
from web_returns left outer join web_sales on
( wr_item_sk = ws_item_sk
and wr_order_number = ws_order_number)
) salesreturns,
date_dim,
web_site
where date_sk = d_date_sk
and d_date between cast('2002-08-05' as date)
and (cast('2002-08-05' as date) + 14 )
and wsr_web_site_sk = web_site_sk
group by web_site_id)
select channel
, id
, sum(sales) as sales
, sum(returns) as returns
, sum(profit) as profit
from
(select 'store channel' as channel
, 'store' || s_store_id as id
, sales
, returns
, (profit - profit_loss) as profit
from ssr
union all
select 'catalog channel' as channel
, 'catalog_page' || cp_catalog_page_id as id
, sales
, returns
, (profit - profit_loss) as profit
from csr
union all
select 'web channel' as channel
, 'web_site' || web_site_id as id
, sales
, returns
, (profit - profit_loss) as profit
from wsr
) x
group by rollup (channel, id)
order by channel
, id
limit 100;

```

SQL6

```

select a.ca_state state, count(*) cnt
from customer_address a
, customer c
, store_sales s
, date_dim d
, item i
where a.ca_address_sk = c.c_current_addr_sk
and c.c_customer_sk = s.ss_customer_sk
and s.ss_sold_date_sk = d.d_date_sk

```

```

and s.ss_item_sk = i.i_item_sk
and d.d_month_seq =
  (select distinct (d_month_seq)
   from date_dim
    where d_year = 1998
      and d_moy = 7 )
and i.i_current_price > 1.2 *
  (select avg(j.i_current_price)
   from item j
    where j.i_category = i.i_category)
group by a.ca_state
having count(*) >= 10
order by cnt, a.ca_state
limit 100;

```

SQL7

```

select i_item_id,
       avg(ss_quantity) agg1,
       avg(ss_list_price) agg2,
       avg(ss_coupon_amt) agg3,
       avg(ss_sales_price) agg4
from store_sales, customer_demographics, date_dim, item, promotion
where ss_sold_date_sk = d_date_sk and
      ss_item_sk = i_item_sk and
      ss_cdemo_sk = cd_demo_sk and
      ss_promo_sk = p_promo_sk and
      cd_gender = 'M' and
      cd_marital_status = 'U' and
      cd_education_status = 'College' and
      (p_channel_email = 'N' or p_channel_event = 'N') and
      d_year = 1999
group by i_item_id
order by i_item_id
limit 100;

```

SQL8

```

select s_store_name
       ,sum(ss_net_profit)
from store_sales
     ,date_dim
     ,store
  (select ca_zip
   from (
        SELECT substr(ca_zip,1,5) ca_zip
        FROM customer_address
        WHERE substr(ca_zip,1,5) IN (
            '74804','87276','13428','49436','56281','79805',
            '46826','68570','20368','28846','41886',
            '68164','68097','16113','18727','96789',
            '63317','57937','19554','69911','83554',
            '84246','61336','46999','25229','15960',
            '61657','28058','64558','39712','74928',
            '34018','87826','69733','26479','73630',
            '88683','61704','81441','42706','54175',
            '45152','49049','30850','63980','40484',
            '71665','63755','23769','79855','24308',
            '28241','16343','25663','85999','46359',
            '93691','34706','99973','74947','60316',
            '58637','48063','81363','19268','66228',
            '78136','16368','99907','58139','17043',
            '89764','14834','25152','70158','76080',
            '81251','83972','48635','54671','35602',
            '10788','57325','46354','92707','41103',
            '89761','31840','69225','76139','18826',
            '12556','51692','20579','50965','32136',
            '71357','16309','82922','59273','40999',
            '73273','93217','65679','12653','16978',

```

```
'27319','41973','65580','56237','17799',
'53192','63632','37089','65994','58048',
'14388','58085','80614','40042','79194',
'42268','61913','97332','37349','72146',
'52681','18176','39332','89283','69023',
'84175','11520','33483','60169','93562',
'10097','14536','70276','64042','22822',
'87229','51528','70269','44519','48044',
'78170','81440','60315','14543','30719',
'13240','62325','35517','51529','98085',
'79007','16582','95187','15625','88780',
'38656','74607','75117','62819','31929',
'27665','88890','98611','53527','48652',
'10324','62273','17726','36232','38526',
'50705','61179','30363','54408','58631',
'23622','50319','33299','78829','91267',
'25571','60347','44750','62797','10713',
'46494','91163','20973','42007','54724',
'89203','12561','71116','60404','70589',
'66744','46074','69138','34737','25092',
'59246','74778','40140','89476','71030',
'89861','93207','44996','34850','48752',
'79574','29570','76507','79728','43195',
'47596','46415','42514','68144','14169',
'17041','75747','33630','19378','32618',
'78704','75807','76800','80916','87272',
'37109','21714','14867','83806','33895',
'80637','20658','75224','92772','55791',
'58603','31681','38788','91922','42465',
'74371','72854','75746','80383','75909',
'37151','82077','80604','66771','46075',
'58723','15380','83174','53615','50347',
'98340','68957','63361','18705','47629',
'76013','68572','50588','31168','41563',
'38936','88746','19052','75648','46403',
'24332','54711','28218','80432','53870',
'25049','32562','94211','99803','49133',
'21202','50005','17953','14324','85525',
'51984','37304','69870','64321','66962',
'66453','40619','91199','54400','28804',
'65544','27059','31143','20303','52429',
'24476','91458','52514','55145','99015',
'51657','10001','96434','38325','39628',
'83338','62381','67697','61542','86076',
'89833','32657','56881','93983','85031',
'57530','56318','46934','34740','79458',
'88443','15861','56034','24808','32336',
'34312','96450','12923','91876','53509',
'30241','35816','52377','23946','23644',
'16413','35796','59100','21689','49199',
'40062','82510','14072','78823','49158',
'99933','75399','11365','44799','77549',
'19569','39186','78909','68143','70468',
'14944','33047','98329','42262','68647',
'65754','27357','56372','18073','12363',
'64467','26221','32914','70431','42436',
'55316','33335','27701','44687','22360',
'76124','44007','59525','51574','71555',
'43130','64199','19616','94285')
intersect
select ca_zip
from (SELECT substr(ca_zip,1,5) ca_zip,count(*) cnt
FROM customer_address, customer
WHERE ca_address_sk = c_current_addr_sk and
c_preferred_cust_flag='Y'
group by ca_zip
having count(*) > 10)A1)A2) V1
where ss_store_sk = s_store_sk
and ss_sold_date_sk = d_date_sk
```



```
and d_qoy = 1 and d_year = 1999
and (substr(s_zip,1,2) = substr(V1.ca_zip,1,2))
group by s_store_name
order by s_store_name
limit 100;
```

SQL9

```
select case when (select count(*)
  from store_sales
  where ss_quantity between 1 and 20) > 40845849
then (select avg(ss_ext_tax)
  from store_sales
  where ss_quantity between 1 and 20)
else (select avg(ss_net_paid)
  from store_sales
  where ss_quantity between 1 and 20) end bucket1 ,
case when (select count(*)
  from store_sales
  where ss_quantity between 21 and 40) > 5712087
then (select avg(ss_ext_tax)
  from store_sales
  where ss_quantity between 21 and 40)
else (select avg(ss_net_paid)
  from store_sales
  where ss_quantity between 21 and 40) end bucket2,
case when (select count(*)
  from store_sales
  where ss_quantity between 41 and 60) > 30393328
then (select avg(ss_ext_tax)
  from store_sales
  where ss_quantity between 41 and 60)
else (select avg(ss_net_paid)
  from store_sales
  where ss_quantity between 41 and 60) end bucket3,
case when (select count(*)
  from store_sales
  where ss_quantity between 61 and 80) > 46385791
then (select avg(ss_ext_tax)
  from store_sales
  where ss_quantity between 61 and 80)
else (select avg(ss_net_paid)
  from store_sales
  where ss_quantity between 61 and 80) end bucket4,
case when (select count(*)
  from store_sales
  where ss_quantity between 81 and 100) > 29981928
then (select avg(ss_ext_tax)
  from store_sales
  where ss_quantity between 81 and 100)
else (select avg(ss_net_paid)
  from store_sales
  where ss_quantity between 81 and 100) end bucket5
from reason
where r_reason_sk = 1
;
```

SQL10

```
select
  cd_gender,
  cd_marital_status,
  cd_education_status,
  count(*) cnt1,
  cd_purchase_estimate,
  count(*) cnt2,
  cd_credit_rating,
  count(*) cnt3,
  cd_dep_count,
```

```

count(*) cnt4,
cd_dep_employed_count,
count(*) cnt5,
cd_dep_college_count,
count(*) cnt6
from
customer c,customer_address ca,customer_demographics
where
c.c_current_addr_sk = ca.ca_address_sk and
ca_county in ('Clark County','Richardson County','Tom Green County','Sullivan County','Cass County') and
cd_demo_sk = c.c_current_demo_sk and
exists (select *
        from store_sales,date_dim
        where c.c_customer_sk = ss_customer_sk and
              ss_sold_date_sk = d_date_sk and
              d_year = 2000 and
              d_moy between 1 and 1+3) and
(exists (select *
        from web_sales,date_dim
        where c.c_customer_sk = ws_bill_customer_sk and
              ws_sold_date_sk = d_date_sk and
              d_year = 2000 and
              d_moy between 1 AND 1+3) or
exists (select *
        from catalog_sales,date_dim
        where c.c_customer_sk = cs_ship_customer_sk and
              cs_sold_date_sk = d_date_sk and
              d_year = 2000 and
              d_moy between 1 and 1+3))
group by cd_gender,
         cd_marital_status,
         cd_education_status,
         cd_purchase_estimate,
         cd_credit_rating,
         cd_dep_count,
         cd_dep_employed_count,
         cd_dep_college_count
order by cd_gender,
         cd_marital_status,
         cd_education_status,
         cd_purchase_estimate,
         cd_credit_rating,
         cd_dep_count,
         cd_dep_employed_count,
         cd_dep_college_count
limit 100;

```

SQL11

```

with year_total as (
select c_customer_id customer_id
      ,c_first_name customer_first_name
      ,c_last_name customer_last_name
      ,c_preferred_cust_flag customer_preferred_cust_flag
      ,c_birth_country customer_birth_country
      ,c_login customer_login
      ,c_email_address customer_email_address
      ,d_year dyear
      ,sum(ss_ext_list_price-ss_ext_discount_amt) year_total
      ,'s' sale_type
from customer
      ,store_sales
      ,date_dim
where c_customer_sk = ss_customer_sk
      and ss_sold_date_sk = d_date_sk
group by c_customer_id
       ,c_first_name
       ,c_last_name
       ,c_preferred_cust_flag

```

```

,c_birth_country
,c_login
,c_email_address
,d_year
union all
select c_customer_id customer_id
,c_first_name customer_first_name
,c_last_name customer_last_name
,c_preferred_cust_flag customer_preferred_cust_flag
,c_birth_country customer_birth_country
,c_login customer_login
,c_email_address customer_email_address
,d_year dyear
,sum(ws_ext_list_price-ws_ext_discount_amt) year_total
,'w' sale_type
from customer
,web_sales
,date_dim
where c_customer_sk = ws_bill_customer_sk
and ws_sold_date_sk = d_date_sk
group by c_customer_id
,c_first_name
,c_last_name
,c_preferred_cust_flag
,c_birth_country
,c_login
,c_email_address
,d_year
)
select
t_s_secyear.customer_id
,t_s_secyear.customer_first_name
,t_s_secyear.customer_last_name
,t_s_secyear.customer_birth_country
from year_total t_s_firstyear
,year_total t_s_secyear
,year_total t_w_firstyear
,year_total t_w_secyear
where t_s_secyear.customer_id = t_s_firstyear.customer_id
and t_s_firstyear.customer_id = t_w_secyear.customer_id
and t_s_firstyear.customer_id = t_w_firstyear.customer_id
and t_s_firstyear.sale_type = 's'
and t_w_firstyear.sale_type = 'w'
and t_s_secyear.sale_type = 's'
and t_w_secyear.sale_type = 'w'
and t_s_firstyear.dyear = 2001
and t_s_secyear.dyear = 2001+1
and t_w_firstyear.dyear = 2001
and t_w_secyear.dyear = 2001+1
and t_s_firstyear.year_total > 0
and t_w_firstyear.year_total > 0
and case when t_w_firstyear.year_total > 0 then t_w_secyear.year_total / t_w_firstyear.year_total else
0.0 end
> case when t_s_firstyear.year_total > 0 then t_s_secyear.year_total / t_s_firstyear.year_total else 0.0
end
order by t_s_secyear.customer_id
,t_s_secyear.customer_first_name
,t_s_secyear.customer_last_name
,t_s_secyear.customer_birth_country
limit 100;

```

SQL12

```

select i_item_id
,i_item_desc
,i_category
,i_class
,i_current_price
,sum(ws_ext_sales_price) as itemrevenue

```

```

        ,sum(ws_ext_sales_price)*100/sum(sum(ws_ext_sales_price)) over
          (partition by i_class) as renumeratio
from
  web_sales
  ,item
  ,date_dim
where
  ws_item_sk = i_item_sk
  and i_category in ('Music', 'Shoes', 'Children')
  and ws_sold_date_sk = d_date_sk
  and d_date between cast('2000-05-14' as date)
    and (cast('2000-05-14' as date) + 30 )
group by
  i_item_id
  ,i_item_desc
  ,i_category
  ,i_class
  ,i_current_price
order by
  i_category
  ,i_class
  ,i_item_id
  ,i_item_desc
  ,renumeratio
limit 100;

```

SQL13

```

select avg(ss_quantity)
  ,avg(ss_ext_sales_price)
  ,avg(ss_ext_wholesale_cost)
  ,sum(ss_ext_wholesale_cost)
from store_sales
  ,store
  ,customer_demographics
  ,household_demographics
  ,customer_address
  ,date_dim
where s_store_sk = ss_store_sk
and ss_sold_date_sk = d_date_sk and d_year = 2001
and((ss_hdemo_sk=hd_demo_sk
  and cd_demo_sk = ss_cdemo_sk
  and cd_marital_status = 'U'
  and cd_education_status = '4 yr Degree'
  and ss_sales_price between 100.00 and 150.00
  and hd_dep_count = 3
) or
  (ss_hdemo_sk=hd_demo_sk
  and cd_demo_sk = ss_cdemo_sk
  and cd_marital_status = 'D'
  and cd_education_status = '2 yr Degree'
  and ss_sales_price between 50.00 and 100.00
  and hd_dep_count = 1
) or
  (ss_hdemo_sk=hd_demo_sk
  and cd_demo_sk = ss_cdemo_sk
  and cd_marital_status = 'S'
  and cd_education_status = 'Advanced Degree'
  and ss_sales_price between 150.00 and 200.00
  and hd_dep_count = 1
))
and((ss_addr_sk = ca_address_sk
  and ca_country = 'United States'
  and ca_state in ('IL', 'WI', 'TN')
  and ss_net_profit between 100 and 200
) or
  (ss_addr_sk = ca_address_sk
  and ca_country = 'United States'
  and ca_state in ('MO', 'OK', 'WA')

```

```

and ss_net_profit between 150 and 300
) or
(ss_addr_sk = ca_address_sk
and ca_country = 'United States'
and ca_state in ('NE', 'VA', 'GA')
and ss_net_profit between 50 and 250
))
;

```

SQL14

```

with cross_items as
(select i_item_sk ss_item_sk
from item,
(select iss.i_brand_id brand_id
,iss.i_class_id class_id
,iss.i_category_id category_id
from store_sales
,item iss
,date_dim d1
where ss_item_sk = iss.i_item_sk
and ss_sold_date_sk = d1.d_date_sk
and d1.d_year between 2000 AND 2000 + 2
intersect
select ics.i_brand_id
,ics.i_class_id
,ics.i_category_id
from catalog_sales
,item ics
,date_dim d2
where cs_item_sk = ics.i_item_sk
and cs_sold_date_sk = d2.d_date_sk
and d2.d_year between 2000 AND 2000 + 2
intersect
select iws.i_brand_id
,iws.i_class_id
,iws.i_category_id
from web_sales
,item iws
,date_dim d3
where ws_item_sk = iws.i_item_sk
and ws_sold_date_sk = d3.d_date_sk
and d3.d_year between 2000 AND 2000 + 2)
where i_brand_id = brand_id
and i_class_id = class_id
and i_category_id = category_id
),
avg_sales as
(select avg(quantity*list_price) average_sales
from (select ss_quantity quantity
,ss_list_price list_price
from store_sales
,date_dim
where ss_sold_date_sk = d_date_sk
and d_year between 2000 and 2000 + 2
union all
select cs_quantity quantity
,cs_list_price list_price
from catalog_sales
,date_dim
where cs_sold_date_sk = d_date_sk
and d_year between 2000 and 2000 + 2
union all
select ws_quantity quantity
,ws_list_price list_price
from web_sales
,date_dim
where ws_sold_date_sk = d_date_sk
and d_year between 2000 and 2000 + 2) x)

```

```

select channel, i_brand_id,i_class_id,i_category_id,sum(sales), sum(number_sales)
from(
  select 'store' channel, i_brand_id,i_class_id
    ,i_category_id,sum(ss_quantity*ss_list_price) sales
    , count(*) number_sales
  from store_sales
    ,item
    ,date_dim
  where ss_item_sk in (select ss_item_sk from cross_items)
    and ss_item_sk = i_item_sk
    and ss_sold_date_sk = d_date_sk
    and d_year = 2000+2
    and d_moy = 11
  group by i_brand_id,i_class_id,i_category_id
  having sum(ss_quantity*ss_list_price) > (select average_sales from avg_sales)
  union all
  select 'catalog' channel, i_brand_id,i_class_id,i_category_id, sum(cs_quantity*cs_list_price) sales,
count(*) number_sales
  from catalog_sales
    ,item
    ,date_dim
  where cs_item_sk in (select ss_item_sk from cross_items)
    and cs_item_sk = i_item_sk
    and cs_sold_date_sk = d_date_sk
    and d_year = 2000+2
    and d_moy = 11
  group by i_brand_id,i_class_id,i_category_id
  having sum(cs_quantity*cs_list_price) > (select average_sales from avg_sales)
  union all
  select 'web' channel, i_brand_id,i_class_id,i_category_id, sum(ws_quantity*ws_list_price) sales , count(*)
number_sales
  from web_sales
    ,item
    ,date_dim
  where ws_item_sk in (select ss_item_sk from cross_items)
    and ws_item_sk = i_item_sk
    and ws_sold_date_sk = d_date_sk
    and d_year = 2000+2
    and d_moy = 11
  group by i_brand_id,i_class_id,i_category_id
  having sum(ws_quantity*ws_list_price) > (select average_sales from avg_sales)
) y
group by rollup (channel, i_brand_id,i_class_id,i_category_id)
order by channel,i_brand_id,i_class_id,i_category_id
limit 100;
with cross_items as
(select i_item_sk ss_item_sk
from item,
(select iss.i_brand_id brand_id
 ,iss.i_class_id class_id
 ,iss.i_category_id category_id
from store_sales
 ,item iss
 ,date_dim d1
where ss_item_sk = iss.i_item_sk
 and ss_sold_date_sk = d1.d_date_sk
 and d1.d_year between 2000 AND 2000 + 2
intersect
select ics.i_brand_id
 ,ics.i_class_id
 ,ics.i_category_id
from catalog_sales
 ,item ics
 ,date_dim d2
where cs_item_sk = ics.i_item_sk
 and cs_sold_date_sk = d2.d_date_sk
 and d2.d_year between 2000 AND 2000 + 2
intersect
select iws.i_brand_id

```

```

,iws.i_class_id
,iws.i_category_id
from web_sales
,item iws
,date_dim d3
where ws_item_sk = iws.i_item_sk
and ws_sold_date_sk = d3.d_date_sk
and d3.d_year between 2000 AND 2000 + 2) x
where i_brand_id = brand_id
and i_class_id = class_id
and i_category_id = category_id
),
avg_sales as
(select avg(quantity*list_price) average_sales
from (select ss_quantity quantity
,ss_list_price list_price
from store_sales
,date_dim
where ss_sold_date_sk = d_date_sk
and d_year between 2000 and 2000 + 2
union all
select cs_quantity quantity
,cs_list_price list_price
from catalog_sales
,date_dim
where cs_sold_date_sk = d_date_sk
and d_year between 2000 and 2000 + 2
union all
select ws_quantity quantity
,ws_list_price list_price
from web_sales
,date_dim
where ws_sold_date_sk = d_date_sk
and d_year between 2000 and 2000 + 2) x)
select this_year.channel ty_channel
,this_year.i_brand_id ty_brand
,this_year.i_class_id ty_class
,this_year.i_category_id ty_category
,this_year.sales ty_sales
,this_year.number_sales ty_number_sales
,last_year.channel ly_channel
,last_year.i_brand_id ly_brand
,last_year.i_class_id ly_class
,last_year.i_category_id ly_category
,last_year.sales ly_sales
,last_year.number_sales ly_number_sales
from
(select 'store' channel, i_brand_id,i_class_id,i_category_id
,sum(ss_quantity*ss_list_price) sales, count(*) number_sales
from store_sales
,item
,date_dim
where ss_item_sk in (select ss_item_sk from cross_items)
and ss_item_sk = i_item_sk
and ss_sold_date_sk = d_date_sk
and d_week_seq = (select d_week_seq
from date_dim
where d_year = 2000 + 1
and d_moy = 12
and d_dom = 17)
group by i_brand_id,i_class_id,i_category_id
having sum(ss_quantity*ss_list_price) > (select average_sales from avg_sales)) this_year,
(select 'store' channel, i_brand_id,i_class_id
,i_category_id, sum(ss_quantity*ss_list_price) sales, count(*) number_sales
from store_sales
,item
,date_dim
where ss_item_sk in (select ss_item_sk from cross_items)
and ss_item_sk = i_item_sk

```

```

and ss_sold_date_sk = d_date_sk
and d_week_seq = (select d_week_seq
                   from date_dim
                   where d_year = 2000
                        and d_moy = 12
                        and d_dom = 17)
group by i_brand_id,i_class_id,i_category_id
having sum(ss_quantity*ss_list_price) > (select average_sales from avg_sales) last_year
where this_year.i_brand_id= last_year.i_brand_id
   and this_year.i_class_id = last_year.i_class_id
   and this_year.i_category_id = last_year.i_category_id
order by this_year.channel, this_year.i_brand_id, this_year.i_class_id, this_year.i_category_id
limit 100;

```

SQL15

```

select ca_zip
       ,sum(cs_sales_price)
from catalog_sales
       ,customer
       ,customer_address
       ,date_dim
where cs_bill_customer_sk = c_customer_sk
   and c_current_addr_sk = ca_address_sk
   and ( substr(ca_zip,1,5) in ('85669', '86197', '88274', '83405', '86475',
                              '85392', '85460', '80348', '81792')
       or ca_state in ('CA','WA','GA')
       or cs_sales_price > 500)
   and cs_sold_date_sk = d_date_sk
   and d_qoy = 2 and d_year = 1999
group by ca_zip
order by ca_zip
limit 100;

```

SQL16

```

select
  count(distinct cs_order_number) as "order count"
  ,sum(cs_ext_ship_cost) as "total shipping cost"
  ,sum(cs_net_profit) as "total net profit"
from
  catalog_sales cs1
  ,date_dim
  ,customer_address
  ,call_center
where
  d_date between '1999-2-01' and
             (cast('1999-2-01' as date) + 60 )
  and cs1.cs_ship_date_sk = d_date_sk
  and cs1.cs_ship_addr_sk = ca_address_sk
  and ca_state = 'TX'
  and cs1.cs_call_center_sk = cc_call_center_sk
  and cc_county in ('Barrow County','Luce County','Mobile County','Richland County',
                   'Wadena County'
  )
  and exists (select *
             from catalog_sales cs2
             where cs1.cs_order_number = cs2.cs_order_number
                and cs1.cs_warehouse_sk <> cs2.cs_warehouse_sk)
  and not exists(select *
                from catalog_returns cr1
                where cs1.cs_order_number = cr1.cr_order_number)
order by count(distinct cs_order_number)
limit 100;

```

SQL17

```

select i_item_id
       ,i_item_desc

```



```

,s_state
,count(ss_quantity) as store_sales_quantitycount
,avg(ss_quantity) as store_sales_quantityave
,stddev_samp(ss_quantity) as store_sales_quantitystdev
,stddev_samp(ss_quantity)/avg(ss_quantity) as store_sales_quantitycov
,count(sr_return_quantity) as store_returns_quantitycount
,avg(sr_return_quantity) as store_returns_quantityave
,stddev_samp(sr_return_quantity) as store_returns_quantitystdev
,stddev_samp(sr_return_quantity)/avg(sr_return_quantity) as store_returns_quantitycov
,count(cs_quantity) as catalog_sales_quantitycount ,avg(cs_quantity) as catalog_sales_quantityave
,stddev_samp(cs_quantity) as catalog_sales_quantitystdev
,stddev_samp(cs_quantity)/avg(cs_quantity) as catalog_sales_quantitycov
from store_sales
,store_returns
,catalog_sales
,date_dim d1
,date_dim d2
,date_dim d3
,store
,item
where d1.d_quarter_name = '2000Q1'
and d1.d_date_sk = ss_sold_date_sk
and i_item_sk = ss_item_sk
and s_store_sk = ss_store_sk
and ss_customer_sk = sr_customer_sk
and ss_item_sk = sr_item_sk
and ss_ticket_number = sr_ticket_number
and sr_returned_date_sk = d2.d_date_sk
and d2.d_quarter_name in ('2000Q1','2000Q2','2000Q3')
and sr_customer_sk = cs_bill_customer_sk
and sr_item_sk = cs_item_sk
and cs_sold_date_sk = d3.d_date_sk
and d3.d_quarter_name in ('2000Q1','2000Q2','2000Q3')
group by i_item_id
,i_item_desc
,s_state
order by i_item_id
,i_item_desc
,s_state
limit 100;

```

SQL18

```

select i_item_id,
ca_country,
ca_state,
ca_county,
avg( cast(cs_quantity as decimal(12,2))) agg1,
avg( cast(cs_list_price as decimal(12,2))) agg2,
avg( cast(cs_coupon_amt as decimal(12,2))) agg3,
avg( cast(cs_sales_price as decimal(12,2))) agg4,
avg( cast(cs_net_profit as decimal(12,2))) agg5,
avg( cast(c_birth_year as decimal(12,2))) agg6,
avg( cast(cd1.cd_dep_count as decimal(12,2))) agg7
from catalog_sales, customer_demographics cd1,
customer_demographics cd2, customer, customer_address, date_dim, item
where cs_sold_date_sk = d_date_sk and
cs_item_sk = i_item_sk and
cs_bill_cdemo_sk = cd1.cd_demo_sk and
cs_bill_customer_sk = c_customer_sk and
cd1.cd_gender = 'M' and
cd1.cd_education_status = 'Primary' and
c_current_cdemo_sk = cd2.cd_demo_sk and
c_current_addr_sk = ca_address_sk and
c_birth_month in (10,1,8,7,3,5) and
d_year = 1998 and
ca_state in ('NE','OK','NC',
'CO','ID','AR','MO')
group by rollup (i_item_id, ca_country, ca_state, ca_county)

```

```
order by ca_country,
        ca_state,
        ca_county,
        i_item_id
limit 100;
```

SQL19

```
select i_brand_id brand_id, i_brand brand, i_manufact_id, i_manufact,
       sum(ss_ext_sales_price) ext_price
from date_dim, store_sales, item, customer, customer_address, store
where d_date_sk = ss_sold_date_sk
and ss_item_sk = i_item_sk
and i_manager_id=62
and d_moy=11
and d_year=2000
and ss_customer_sk = c_customer_sk
and c_current_addr_sk = ca_address_sk
and substr(ca_zip,1,5) <> substr(s_zip,1,5)
and ss_store_sk = s_store_sk
group by i_brand
       ,i_brand_id
       ,i_manufact_id
       ,i_manufact
order by ext_price desc
       ,i_brand
       ,i_brand_id
       ,i_manufact_id
       ,i_manufact
limit 100 ;
```

SQL20

```
select i_item_id
       ,i_item_desc
       ,i_category
       ,i_class
       ,i_current_price
       ,sum(cs_ext_sales_price) as itemrevenue
       ,sum(cs_ext_sales_price)*100/sum(sum(cs_ext_sales_price)) over
         (partition by i_class) as revenueratio
from catalog_sales
       ,item
       ,date_dim
where cs_item_sk = i_item_sk
and i_category in ('Sports', 'Shoes', 'Women')
and cs_sold_date_sk = d_date_sk
and d_date between cast('2001-03-21' as date)
and (cast('2001-03-21' as date) + 30)
group by i_item_id
       ,i_item_desc
       ,i_category
       ,i_class
       ,i_current_price
order by i_category
       ,i_class
       ,i_item_id
       ,i_item_desc
       ,revenueratio
limit 100;
```

5 SSB 性能测试

5.1 SSB 测试结果

经过针对SSB宽表场景对DWS和开源OLAP产品ClickHouse的对比测试发现：

- 使用hstore_opt表，配合turbo存储、turbo引擎，DWS查询性能整体优于开源产品ClickHouse 1.3倍。
- 固定query_dop=16调优后，DWS查询性能全面超越ClickHouse，是该产品的3.73倍。

表 5-1 SSB 测试结果

SSB	DWS		ClickHouse
-	开箱性能	query_dop=16	-
Q1.1	0.0670	0.05	0.059
Q1.2	0.0264	0.022	0.021
Q1.3	0.0836	0.057	0.022
Q2.1	0.2309	0.041	0.254
Q2.2	0.3015	0.163	0.281
Q2.3	0.2398	0.05	0.214
Q3.1	0.3182	0.074	0.434
Q3.2	0.1823	0.042	0.348
Q3.3	0.1759	0.081	0.299
Q3.4	0.0239	0.014	0.025
Q4.1	0.2951	0.103	0.456
Q4.2	0.0942	0.037	0.171

SSB	DWS		ClickHouse
Q4.3	0.0645	0.02	0.146
总时长 (s)	2.1032	0.754	2.73

5.2 SSB 测试环境

硬件环境

每个测试环境6个节点，配置如下：

- CPU 16核：Intel Ice Lake
- 内存：64GB
- 网络带宽：9Gbit/s
- 磁盘：SSD云盘，每块600GB，共2块

软件环境

内核版本：Linux 3.10.0-862.14.1.5.h757.eulerosv2r7.x86_64

操作系统：EulerOS release 2.0 (SP5)

数据库版本：DWS 3.0

5.3 SSB 测试过程

5.3.1 SSB 测试数据

表 5-2 SSB 测试数据

序号	表名	行数	表大小
1	supplier	200000	-
2	customer	3000000	-
3	part	1400000	-
4	lineorder	60037902	-
5	lineorder_flat	60037902	-

5.3.2 SSB 数据生成

步骤1 下载ssb工具包并编译。

```
git clone http://github.com/vadimtk/ssb-dbgen.git  
cd ssb-dbgen && make
```

步骤2 生成数据。

📖 说明

文件生成路径最好符合[安装和启动GDS](#)中SSB所使用的路径，否则需要修改[安装和启动GDS](#)中GDS的启动路径。

```
./dbgen -s 100 -T c  
./dbgen -s 100 -T l  
./dbgen -s 100 -T p  
./dbgen -s 100 -T s  
./dbgen -s 100 -T d
```

----结束

5.3.3 建表与导入 SSB 数据

创建 SSB 目标表

连接DWS数据库后执行以下SQL语句。

```
CREATE TABLE CUSTOMER  
(  
  C_CUSTKEY  BIGINT NOT NULL,  
  C_NAME     VARCHAR(25) NOT NULL,  
  C_ADDRESS  VARCHAR(40) NOT NULL,  
  C_CITY     VARCHAR(25) NOT NULL,  
  C_NATION   VARCHAR(25) NOT NULL,  
  C_REGION   VARCHAR(25) NOT NULL,  
  C_PHONE    VARCHAR(15) NOT NULL,  
  C_MKTSEGMENT VARCHAR(10) NOT NULL  
)  
WITH (orientation=column, colversion=2.0,enable_hstore=true,enable_hstore_opt=true)  
DISTRIBUTE BY hash(C_CUSTKEY);  
CREATE TABLE SUPPLIER  
(  
  S_SUPPKEY  BIGINT NOT NULL  
, S_NAME  VARCHAR(25) NOT NULL  
, S_ADDRESS VARCHAR(40) NOT NULL  
, S_CITY   VARCHAR(25) NOT NULL  
, S_NATION VARCHAR(25) NOT NULL  
, S_REGION VARCHAR(25) NOT NULL  
, S_PHONE VARCHAR(15) NOT NULL  
)  
WITH (orientation=column, colversion=2.0,enable_hstore=true,enable_hstore_opt=true)  
DISTRIBUTE BY hash(S_SUPPKEY);  
CREATE TABLE PART  
(  
  P_PARTKEY  BIGINT NOT NULL  
, P_NAME  VARCHAR(55) NOT NULL  
, P_MFGR  VARCHAR(25) NOT NULL  
, P_CATEGORY VARCHAR(25) NOT NULL  
, P_BRAND  VARCHAR(10) NOT NULL  
, P_COLOR  VARCHAR(20) NOT NULL  
, P_TYPE  VARCHAR(25) NOT NULL  
, P_SIZE  BIGINT NOT NULL  
, P_CONTAINER VARCHAR(10) NOT NULL  
)  
WITH (orientation=column, colversion=2.0,enable_hstore=true,enable_hstore_opt=true)  
DISTRIBUTE BY hash(P_PARTKEY);  
CREATE TABLE lineorder  
(  
  LO_ORDERKEY  BIGINT NOT NULL,  
  LO_LINENUMBER  BIGINT NOT NULL,  
  LO_CUSTKEY    BIGINT NOT NULL,
```

```

LO_PARTKEY          BIGINT NOT NULL,
LO_SUPPKEY          BIGINT NOT NULL,
LO_ORDERDATE        DATE NOT NULL,
LO_ORDERPRIORITY    VARCHAR(15) NOT NULL,
LO_SHIPPRIORITY     BIGINT NOT NULL,
LO_QUANTITY         BIGINT NOT NULL,
LO_EXTENDEDPRICE    BIGINT NOT NULL,
LO_ORDTOTALPRICE    BIGINT NOT NULL,
LO_DISCOUNT        BIGINT NOT NULL,
LO_REVENUE          BIGINT NOT NULL,
LO_SUPPLYCOST       BIGINT NOT NULL,
LO_TAX              BIGINT NOT NULL,
LO_COMMITDATE       DATE NOT NULL,
LO_SHIPMODE         VARCHAR(10) NOT NULL
)
WITH (orientation=column, colversion=2.0,enable_hstore=true,enable_hstore_opt=true)
DISTRIBUTE BY hash(LO_ORDERKEY)
PARTITION BY RANGE(LO_ORDERDATE)
(
PARTITION LO_ORDERDATE_1 VALUES LESS THAN('1992-04-01 00:00:00'),
PARTITION LO_ORDERDATE_2 VALUES LESS THAN('1992-07-01 00:00:00'),
PARTITION LO_ORDERDATE_3 VALUES LESS THAN('1992-10-01 00:00:00'),
PARTITION LO_ORDERDATE_4 VALUES LESS THAN('1993-01-01 00:00:00'),
PARTITION LO_ORDERDATE_5 VALUES LESS THAN('1993-04-01 00:00:00'),
PARTITION LO_ORDERDATE_6 VALUES LESS THAN('1993-07-01 00:00:00'),
PARTITION LO_ORDERDATE_7 VALUES LESS THAN('1993-10-01 00:00:00'),
PARTITION LO_ORDERDATE_8 VALUES LESS THAN('1994-01-01 00:00:00'),
PARTITION LO_ORDERDATE_9 VALUES LESS THAN('1994-04-01 00:00:00'),
PARTITION LO_ORDERDATE_10 VALUES LESS THAN('1994-07-01 00:00:00'),
PARTITION LO_ORDERDATE_11 VALUES LESS THAN('1994-10-01 00:00:00'),
PARTITION LO_ORDERDATE_12 VALUES LESS THAN('1995-01-01 00:00:00'),
PARTITION LO_ORDERDATE_13 VALUES LESS THAN('1995-04-01 00:00:00'),
PARTITION LO_ORDERDATE_14 VALUES LESS THAN('1995-07-01 00:00:00'),
PARTITION LO_ORDERDATE_15 VALUES LESS THAN('1995-10-01 00:00:00'),
PARTITION LO_ORDERDATE_16 VALUES LESS THAN('1996-01-01 00:00:00'),
PARTITION LO_ORDERDATE_17 VALUES LESS THAN('1996-04-01 00:00:00'),
PARTITION LO_ORDERDATE_18 VALUES LESS THAN('1996-07-01 00:00:00'),
PARTITION LO_ORDERDATE_19 VALUES LESS THAN('1996-10-01 00:00:00'),
PARTITION LO_ORDERDATE_20 VALUES LESS THAN('1997-01-01 00:00:00'),
PARTITION LO_ORDERDATE_21 VALUES LESS THAN('1997-04-01 00:00:00'),
PARTITION LO_ORDERDATE_22 VALUES LESS THAN('1997-07-01 00:00:00'),
PARTITION LO_ORDERDATE_23 VALUES LESS THAN('1997-10-01 00:00:00'),
PARTITION LO_ORDERDATE_24 VALUES LESS THAN('1998-01-01 00:00:00'),
PARTITION LO_ORDERDATE_25 VALUES LESS THAN('1998-04-01 00:00:00'),
PARTITION LO_ORDERDATE_26 VALUES LESS THAN('1998-07-01 00:00:00'),
PARTITION LO_ORDERDATE_27 VALUES LESS THAN('1998-10-01 00:00:00'),
PARTITION LO_ORDERDATE_28 VALUES LESS THAN('1999-01-01 00:00:00')
);
SET enable_hstoreopt_auto_bitmap=true;
CREATE TABLE lineorder_flat
(
LO_ORDERKEY          BIGINT NOT NULL,
LO_LINENUMBER        BIGINT NOT NULL,
LO_CUSTKEY           BIGINT NOT NULL,
LO_PARTKEY           BIGINT NOT NULL,
LO_SUPPKEY           BIGINT NOT NULL,
LO_ORDERDATE        DATE NOT NULL,
LO_ORDERPRIORITY    VARCHAR(15) NOT NULL,
LO_SHIPPRIORITY     BIGINT NOT NULL,
LO_QUANTITY         BIGINT NOT NULL,
LO_EXTENDEDPRICE    BIGINT NOT NULL,
LO_ORDTOTALPRICE    BIGINT NOT NULL,
LO_DISCOUNT        BIGINT NOT NULL,
LO_REVENUE          BIGINT NOT NULL,
LO_SUPPLYCOST       BIGINT NOT NULL,
LO_TAX              BIGINT NOT NULL,
LO_COMMITDATE       DATE NOT NULL,
LO_SHIPMODE         VARCHAR(10) NOT NULL,
C_NAME              VARCHAR(25) NOT NULL

```

```

,C_ADDRESS VARCHAR(40) NOT NULL
,C_CITY VARCHAR(25) NOT NULL
,C_NATION VARCHAR(25) NOT NULL
,C_REGION VARCHAR(25) NOT NULL
,C_PHONE VARCHAR(15) NOT NULL
,C_MKTSEGMENT VARCHAR(10) NOT NULL
,S_NAME VARCHAR(25) NOT NULL
,S_ADDRESS VARCHAR(40) NOT NULL
,S_CITY VARCHAR(25) NOT NULL
,S_NATION VARCHAR(25) NOT NULL
,S_REGION VARCHAR(25) NOT NULL
,S_PHONE VARCHAR(15) NOT NULL
,P_NAME VARCHAR(55) NOT NULL
,P_MFGR VARCHAR(25) NOT NULL
,P_CATEGORY VARCHAR(25) NOT NULL
,P_BRAND VARCHAR(10) NOT NULL
,P_COLOR VARCHAR(20) NOT NULL
,P_TYPE VARCHAR(25) NOT NULL
,P_SIZE BIGINT NOT NULL
,P_CONTAINER VARCHAR(10) NOT NULL
, Partial Cluster Key(s_region,s_nation,s_city)
) WITH (orientation=column,
colversion=2.0,enable_hstore=true,enable_hstore_opt=true,secondary_part_column='p_mfgr',
secondary_part_num=8)
DISTRIBUTE BY hash(LO_ORDERKEY)
PARTITION BY RANGE(LO_ORDERDATE)
(
PARTITION LO_ORDERDATE_1 VALUES LESS THAN('1992-04-01 00:00:00'),
PARTITION LO_ORDERDATE_2 VALUES LESS THAN('1992-07-01 00:00:00'),
PARTITION LO_ORDERDATE_3 VALUES LESS THAN('1992-10-01 00:00:00'),
PARTITION LO_ORDERDATE_4 VALUES LESS THAN('1993-01-01 00:00:00'),
PARTITION LO_ORDERDATE_5 VALUES LESS THAN('1993-04-01 00:00:00'),
PARTITION LO_ORDERDATE_6 VALUES LESS THAN('1993-07-01 00:00:00'),
PARTITION LO_ORDERDATE_7 VALUES LESS THAN('1993-10-01 00:00:00'),
PARTITION LO_ORDERDATE_8 VALUES LESS THAN('1994-01-01 00:00:00'),
PARTITION LO_ORDERDATE_9 VALUES LESS THAN('1994-04-01 00:00:00'),
PARTITION LO_ORDERDATE_10 VALUES LESS THAN('1994-07-01 00:00:00'),
PARTITION LO_ORDERDATE_11 VALUES LESS THAN('1994-10-01 00:00:00'),
PARTITION LO_ORDERDATE_12 VALUES LESS THAN('1995-01-01 00:00:00'),
PARTITION LO_ORDERDATE_13 VALUES LESS THAN('1995-04-01 00:00:00'),
PARTITION LO_ORDERDATE_14 VALUES LESS THAN('1995-07-01 00:00:00'),
PARTITION LO_ORDERDATE_15 VALUES LESS THAN('1995-10-01 00:00:00'),
PARTITION LO_ORDERDATE_16 VALUES LESS THAN('1996-01-01 00:00:00'),
PARTITION LO_ORDERDATE_17 VALUES LESS THAN('1996-04-01 00:00:00'),
PARTITION LO_ORDERDATE_18 VALUES LESS THAN('1996-07-01 00:00:00'),
PARTITION LO_ORDERDATE_19 VALUES LESS THAN('1996-10-01 00:00:00'),
PARTITION LO_ORDERDATE_20 VALUES LESS THAN('1997-01-01 00:00:00'),
PARTITION LO_ORDERDATE_21 VALUES LESS THAN('1997-04-01 00:00:00'),
PARTITION LO_ORDERDATE_22 VALUES LESS THAN('1997-07-01 00:00:00'),
PARTITION LO_ORDERDATE_23 VALUES LESS THAN('1997-10-01 00:00:00'),
PARTITION LO_ORDERDATE_24 VALUES LESS THAN('1998-01-01 00:00:00'),
PARTITION LO_ORDERDATE_25 VALUES LESS THAN('1998-04-01 00:00:00'),
PARTITION LO_ORDERDATE_26 VALUES LESS THAN('1998-07-01 00:00:00'),
PARTITION LO_ORDERDATE_27 VALUES LESS THAN('1998-10-01 00:00:00'),
PARTITION LO_ORDERDATE_28 VALUES LESS THAN('1999-01-01 00:00:00')
);
SET enable_hstoreopt_auto_bitmap=false;

```

创建 SSB 数据集的 GDS 外表

连接DWS数据库后执行以下SQL语句。

须知

以下每个外表的“**gsfs://192.168.0.90:500x/xxx | gsfs://192.168.0.90:500x/xxx**”中的IP地址和端口，请替换成安装和启动GDS中的对应的GDS的监听IP和端口。如启动两个GDS，则使用“|”区分。如果启动多个GDS，需要将所有GDS的监听IP和端口配置到外表中。

```
DROP FOREIGN TABLE IF EXISTS customer_load;
CREATE FOREIGN TABLE customer_load
(
  C_CUSTKEY    BIGINT NOT NULL
, C_NAME      VARCHAR(25) NOT NULL
, C_ADDRESS   VARCHAR(40) NOT NULL
, C_CITY      VARCHAR(25) NOT NULL
, C_NATION    VARCHAR(25) NOT NULL
, C_REGION    VARCHAR(25) NOT NULL
, C_PHONE     VARCHAR(15) NOT NULL
, C_MKTSEGMENT VARCHAR(10) NOT NULL)
SERVER gsmpp_server
OPTIONS(location 'gsfs://192.168.0.90:5004/customer.tbl*',
format 'text',
delimiter '|',
encoding 'utf8',
mode 'Normal'
);
```

```
DROP FOREIGN TABLE IF EXISTS supplier_load;
CREATE FOREIGN TABLE supplier_load
(
  S_SUPPKEY    BIGINT NOT NULL
, S_NAME      VARCHAR(25) NOT NULL
, S_ADDRESS   VARCHAR(40) NOT NULL
, S_CITY      VARCHAR(25) NOT NULL
, S_NATION    VARCHAR(25) NOT NULL
, S_REGION    VARCHAR(25) NOT NULL
, S_PHONE     VARCHAR(15) NOT NULL)
SERVER gsmpp_server
OPTIONS(location 'gsfs://192.168.0.90:5004/supplier.tbl*',
format 'text',
delimiter '|',
encoding 'utf8',
mode 'Normal'
);
```

```
DROP FOREIGN TABLE IF EXISTS part_load;
CREATE FOREIGN TABLE part_load
(
  P_PARTKEY    BIGINT NOT NULL
, P_NAME      VARCHAR(55) NOT NULL
, P_MFGR      VARCHAR(25) NOT NULL
, P_CATEGORY  VARCHAR(25) NOT NULL
, P_BRAND     VARCHAR(10) NOT NULL
, P_COLOR     VARCHAR(20) NOT NULL
, P_TYPE      VARCHAR(25) NOT NULL
, P_SIZE      BIGINT NOT NULL
, P_CONTAINER VARCHAR(10) NOT NULL)
SERVER gsmpp_server
OPTIONS(location 'gsfs://192.168.0.90:5004/part.tbl*',
format 'text',
delimiter '|',
encoding 'utf8',
mode 'Normal'
);
```

```
DROP FOREIGN TABLE IF EXISTS lineorder_load;
CREATE FOREIGN TABLE lineorder_load
(
```



```

LO_ORDERKEY          BIGINT NOT NULL,
LO_LINENUMBER        BIGINT NOT NULL,
LO_CUSTKEY           BIGINT NOT NULL,
LO_PARTKEY           BIGINT NOT NULL,
LO_SUPPKEY           BIGINT NOT NULL,
LO_ORDERDATE         DATE NOT NULL,
LO_ORDERPRIORITY     VARCHAR(15) NOT NULL,
LO_SHIPPRIORITY      BIGINT NOT NULL,
LO_QUANTITY          BIGINT NOT NULL,
LO_EXTENDEDPRICE     BIGINT NOT NULL,
LO_ORDTOTALPRICE     BIGINT NOT NULL,
LO_DISCOUNT         BIGINT NOT NULL,
LO_REVENUE           BIGINT NOT NULL,
LO_SUPPLYCOST        BIGINT NOT NULL,
LO_TAX               BIGINT NOT NULL,
LO_COMMITDATE        DATE NOT NULL,
LO_SHIPMODE          VARCHAR(10) NOT NULL)
SERVER gsmpp_server
OPTIONS(location 'gsfs://192.168.0.90:5004/lineorder.tbl*',
format 'text',
delimiter '|',
encoding 'utf8',
mode 'Normal'
);

```

导入 SSB 数据

执行以下命令导入数据。

```

INSERT INTO customer SELECT * FROM customer_load;
INSERT INTO supplier SELECT * FROM supplier_load;
INSERT INTO part SELECT * FROM part_load;
INSERT INTO lineorder SELECT * FROM lineorder_load;

INSERT INTO lineorder_flat
SELECT
I.LO_ORDERKEY AS LO_ORDERKEY,
I.LO_LINENUMBER AS LO_LINENUMBER,
I.LO_CUSTKEY AS LO_CUSTKEY,
I.LO_PARTKEY AS LO_PARTKEY,
I.LO_SUPPKEY AS LO_SUPPKEY,
I.LO_ORDERDATE AS LO_ORDERDATE,
I.LO_ORDERPRIORITY AS LO_ORDERPRIORITY,
I.LO_SHIPPRIORITY AS LO_SHIPPRIORITY,
I.LO_QUANTITY AS LO_QUANTITY,
I.LO_EXTENDEDPRICE AS LO_EXTENDEDPRICE,
I.LO_ORDTOTALPRICE AS LO_ORDTOTALPRICE,
I.LO_DISCOUNT AS LO_DISCOUNT,
I.LO_REVENUE AS LO_REVENUE,
I.LO_SUPPLYCOST AS LO_SUPPLYCOST,
I.LO_TAX AS LO_TAX,
I.LO_COMMITDATE AS LO_COMMITDATE,
I.LO_SHIPMODE AS LO_SHIPMODE,
c.C_NAME AS C_NAME,
c.C_ADDRESS AS C_ADDRESS,
c.C_CITY AS C_CITY,
c.C_NATION AS C_NATION,
c.C_REGION AS C_REGION,
c.C_PHONE AS C_PHONE,
c.C_MKTSEGMENT AS C_MKTSEGMENT,
s.S_NAME AS S_NAME,
s.S_ADDRESS AS S_ADDRESS,
s.S_CITY AS S_CITY,
s.S_NATION AS S_NATION,
s.S_REGION AS S_REGION,
s.S_PHONE AS S_PHONE,
p.P_NAME AS P_NAME,
p.P_MFGR AS P_MFGR,
p.P_CATEGORY AS P_CATEGORY,

```

```
p.P_BRAND AS P_BRAND,  
p.P_COLOR AS P_COLOR,  
p.P_TYPE AS P_TYPE,  
p.P_SIZE AS P_SIZE,  
p.P_CONTAINER AS P_CONTAINER  
FROM lineorder AS l  
INNER JOIN customer AS c ON c.C_CUSTKEY = l.LO_CUSTKEY  
INNER JOIN supplier AS s ON s.S_SUPPKEY = l.LO_SUPPKEY  
INNER JOIN part AS p ON p.P_PARTKEY = l.LO_PARTKEY;
```

5.3.4 SSB 查询测试

SSB (Star Schema Benchmark) 是一种在学术界和工业界广泛应用的数据库系统性能评估基准测试方法。它能够对比不同数据仓库在处理星型模型查询时的性能，帮助数据库管理员和决策者选择最符合需求的数据仓库系统。此外，参考OLAP行业的做法，将SSB中的星型模型展平转化为宽表，还可以改造成单一表测试Benchmark (SSB Flat)。

共包含Q1.1~Q1.3、Q2.1~Q2.3、Q3.1~Q3.4、Q4.1~4.3的查询样例，以下为SQL查询语句，仅供参考。

了解更多SSB数据测试，请访问SSB官网。

Q1.1

```
SELECT SUM(LO_EXTENDEDPRICE * LO_DISCOUNT) AS revenue  
FROM lineorder_flat  
WHERE  
LO_ORDERDATE >= date '19930101'  
AND LO_ORDERDATE <= date '19931231'  
AND LO_DISCOUNT BETWEEN 1 AND 3  
AND LO_QUANTITY < 25;
```

Q1.2

```
SELECT SUM(LO_EXTENDEDPRICE * LO_DISCOUNT) AS revenue  
FROM lineorder_flat  
WHERE  
LO_ORDERDATE >= 19940101  
AND LO_ORDERDATE <= 19940131  
AND LO_DISCOUNT BETWEEN 4 AND 6  
AND LO_QUANTITY BETWEEN 26 AND 35;
```

Q1.3

```
SELECT SUM(LO_EXTENDEDPRICE * LO_DISCOUNT) AS revenue  
FROM lineorder_flat  
WHERE  
weekofyear(to_date(LO_ORDERDATE)) = 6  
AND LO_ORDERDATE >= 19940101  
AND LO_ORDERDATE <= 19941231  
AND LO_DISCOUNT BETWEEN 5 AND 7  
AND LO_QUANTITY BETWEEN 26 AND 35;
```

Q2.1

```
SELECT  
SUM(LO_REVENUE), div(LO_ORDERDATE,10000) AS YEAR,  
P_BRAND  
FROM lineorder_flat  
WHERE P_CATEGORY = 'MFGR#12' AND S_REGION = 'AMERICA'  
GROUP BY YEAR, P_BRAND  
ORDER BY YEAR, P_BRAND;
```

Q2.2

```
SELECT
SUM(LO_REVENUE), div(LO_ORDERDATE,10000) AS YEAR,
P_BRAND
FROM lineorder_flat
WHERE
P_BRAND >= 'MFGR#2221'
AND P_BRAND <= 'MFGR#2228'
AND S_REGION = 'ASIA'
GROUP BY YEAR, P_BRAND
ORDER BY YEAR, P_BRAND;
```

Q2.3

```
SELECT
SUM(LO_REVENUE), div(LO_ORDERDATE,10000) AS YEAR,
P_BRAND
FROM lineorder_flat
WHERE
P_BRAND = 'MFGR#2239'
AND S_REGION = 'EUROPE'
GROUP BY YEAR, P_BRAND
ORDER BY YEAR, P_BRAND;
```

Q3.1

```
SELECT
C_NATION,
S_NATION, div(LO_ORDERDATE,10000) AS YEAR,
SUM(LO_REVENUE) AS revenue
FROM lineorder_flat
WHERE
C_REGION = 'ASIA'
AND S_REGION = 'ASIA'
AND LO_ORDERDATE >= 19920101
AND LO_ORDERDATE <= 19971231
GROUP BY C_NATION, S_NATION, YEAR
ORDER BY YEAR ASC, revenue DESC;
```

Q3.2

```
SELECT
C_CITY,
S_CITY, div(LO_ORDERDATE,10000) AS YEAR,
SUM(LO_REVENUE) AS revenue
FROM lineorder_flat
WHERE
C_NATION = 'UNITED STATES'
AND S_NATION = 'UNITED STATES'
AND LO_ORDERDATE >= 19920101
AND LO_ORDERDATE <= 19971231
GROUP BY C_CITY, S_CITY, YEAR
ORDER BY YEAR ASC, revenue DESC;
```

Q3.3

```
SELECT
C_CITY,
S_CITY, div(LO_ORDERDATE,10000) AS YEAR,
SUM(LO_REVENUE) AS revenue
FROM lineorder_flat
WHERE
C_CITY IN ('UNITED K11', 'UNITED K15')
AND S_CITY IN ('UNITED K11', 'UNITED K15')
AND LO_ORDERDATE >= 19920101
AND LO_ORDERDATE <= 19971231
```

```
GROUP BY C_CITY, S_CITY, YEAR  
ORDER BY YEAR ASC, revenue DESC;
```

Q3.4

```
SELECT  
C_CITY,  
S_CITY, div(LO_ORDERDATE,10000) AS YEAR,  
SUM(LO_REVENUE) AS revenue  
FROM lineorder_flat  
WHERE  
C_CITY IN ('UNITED K11', 'UNITED K15')  
AND S_CITY IN ('UNITED K11', 'UNITED K15')  
AND LO_ORDERDATE >= 19971201  
AND LO_ORDERDATE <= 19971231  
GROUP BY C_CITY, S_CITY, YEAR  
ORDER BY YEAR ASC, revenue DESC;
```

Q4.1

```
SELECT div(LO_ORDERDATE,10000) AS YEAR,  
C_NATION,  
SUM(LO_REVENUE - LO_SUPPLYCOST) AS profit  
FROM lineorder_flat  
WHERE  
C_REGION = 'AMERICA'  
AND S_REGION = 'AMERICA'  
AND P_MFGR IN ('MFGR#1', 'MFGR#2')  
GROUP BY YEAR, C_NATION  
ORDER BY YEAR ASC, C_NATION ASC;
```

Q4.2

```
SELECT div(LO_ORDERDATE,10000) AS YEAR,  
S_NATION,  
P_CATEGORY,  
SUM(LO_REVENUE - LO_SUPPLYCOST) AS profit  
FROM lineorder_flat  
WHERE  
C_REGION = 'AMERICA'  
AND S_REGION = 'AMERICA'  
AND LO_ORDERDATE >= 19970101  
AND LO_ORDERDATE <= 19981231  
AND P_MFGR IN ('MFGR#1', 'MFGR#2')  
GROUP BY YEAR, S_NATION, P_CATEGORY  
ORDER BY  
YEAR ASC,  
S_NATION ASC,  
P_CATEGORY ASC;
```

Q4.3

```
SELECT div(LO_ORDERDATE,10000) AS YEAR,  
S_CITY,  
P_BRAND,  
SUM(LO_REVENUE - LO_SUPPLYCOST) AS profit  
FROM lineorder_flat  
WHERE  
S_NATION = 'UNITED STATES'  
AND LO_ORDERDATE >= 19970101  
AND LO_ORDERDATE <= 19981231  
AND P_CATEGORY = 'MFGR#14'  
GROUP BY YEAR, S_CITY, P_BRAND  
ORDER BY YEAR ASC, S_CITY ASC, P_BRAND ASC;
```