The science behind the report:

Dell PowerEdge server cooling: Choose the cooling options that match the needs of you and your workloads

This document describes what we tested, how we tested, and what we found. To learn how these facts translate into real-world benefits, read the report Dell PowerEdge server cooling: Choose the cooling options that match the needs of you and your workloads.

We concluded our hands-on testing on April 4, 2025. During testing, we determined the appropriate hardware and software configurations and applied updates as they became available. The results in this report reflect configurations that we finalized on March 14, 2025 or earlier. Unavoidably, these configurations may not represent the latest versions available when this report appears.

Our results

To learn more about how we have calculated the wins in this report, go to http://facts.pt/calculating-and-highlighting-wins. Unless we state otherwise, we have followed the rules and principles we outline in that document.

Table 1: Median results and statistics of our HammerDB testing, for both air-cooled and DLC configurations of the Dell PowerEdge R7625, at three different ambient temperatures. Source: Principled Technologies.

Inlet temp	25°C		30°C		35°C	
Cooling method	Air	DLC	Air	DLC	Alr	DLC
Time-to-complete (sec)	349	349	343	338	346	345
Power usage (W)	1,202	1,172	1264	1,175	1,356	1,244
Query sets per hour	392	392	399	405	395	397
Performance-per-watt	0.33	0.33	0.32	0.34	0.29	0.32
CPU1 temp	78.3	60.8	82.8	60.5	85.4	58.9
CPU2 temp	77.6	61.5	81.9	61.3	85.4	58.9
TPROCH win	0%		1%		0%	
PPW win	3%		9%		9%	
CPU temperature win	22%		26%		31%	

Table 2: Results and statistics for the air-cooled configuration of the Dell PowerEdge R7625 during HammerDB testing, at three different ambient temperatures, across three test runs. Source: Principled Technologies.

Air-cooled									
Inlet temp	25°C			30°C			35°C		
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3
Watts	1,288	1,202	1,293	1,283	1,264	1,297	1,348	1,373	1,356
Max TTC	349	349	344	341	343	358	344	354	346
CPU1 temp	80.1	78.3	803.5	83.3	82.8	80.9	84.8	86.3	85.4
CPU2 temp	78.9	77.6	80.2	83.1	81.9	80.8	84.3	85.7	85.4

Table 3: Results and statistics for the DLC-cooled configuration of the Dell PowerEdge R7625 during HammerDB testing, at three different ambient temperatures, across three test runs. Source: Principled Technologies.

DLC-cooled									
Inlet temp	25°C			30°C			35°C		
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3
Watts	1,165	1,158	1,172	1,172	1,175	1,161	1,221	1,230	1,244
Max TTC	363	339	349	335	338	364	331	345	346
CPU1 temp	61.5	61.7	60.8	58.9	60.5	59.8	59.4	59.1	58.9
CPU2 temp	61.2	61.7	61.5	60.3	61.3	60.7	60.4	60.6	59.9

System configuration information

Table 1: Detailed information on the systems we tested.

Server configuration information	Dell PowerEdge R7625
BIOS name and version	Dell 1.7.2
Non-default BIOS settings	System profile set to Performance
Operating system name and version/build number	VMware ESXi 8.0.3 24022510 Dell Customized
Date of last OS updates/patches applied	March 14, 2025
Power management policy	System Profile set to Performance
Processor	
Number of processors	2
Vendor and model	AMD EPYC™ 9654
Core count (per processor)	96
Core frequency (GHz)	2.4
Stepping	1
Memory module(s)	
Total memory in system (GB)	1536
Number of memory modules	24
Vendor and model	Micron® MTC40F2046S1RC48BA1
Size (GB)	64
Type	PC5-38400
Speed (MHz)	4,800
Speed running in the server (MHz)	4,800
Storage controller	
Vendor and model	BOSS-N1 Monolithic
Cache size (GB)	0 MB
Firmware version	2.1.13.2025
Local storage	
Number of drives	16
Drive vendor and model	Dell NVMe™ PM1745
Drive size (GB)	3.2 TB
Drive information (speed, interface, type)	PCIe® SSD NVMe
Network adapter #1	
Vendor and model	Broadcom NetXtreme® Gigabit Ethernet (BCM5720)
Number and type of ports	2 x 1Gb
Driver version	22.71.3

Server configuration information	Dell PowerEdge R7625
Network adapter #2	
Vendor and model	Mellanox ConnectX-5 EN 25GbE Dual-port SFP28 Adapter
Number and type of ports	2x25GbE
Driver version	16.27.61.20
Power supplies	
Vendor and model	DELL 0CYHHJA04 and 01CW9GA03
Number of power supplies	1 of each model above
Wattage of each (W)	1,400

About our testing

We tested using the following dual-socket solution:

> • Dell PowerEdge R7625 with AMD EPYC 9654 96-core processors and 1.5TB DDR5 memory

We tested the server with air-cooled and liquid-cooled hardware in three different ambient temperatures: 25, 30, and 35 degrees Celsius. We used VMware vSphere 8.0 as our hypervisor, creating 38 VMs with 10 vCPU each. We sized the memory on each VM to use up the memory on the host, leaving a few GB for hypervisor overhead. We installed Ubuntu 22.04 and PostgreSQL 16. We ran the HammerDB 4.11 TPROC-H workload, and report the time it took for the longest query to complete.

How we tested

Installing VMware vSphere 8

1. Boot to the VMware vSphere 8 installation media.
2. To continue, press Enter.
3. To accept the license agreement, press F11.
4. Select the OS installation location.
5. Select a language, and create the root password.
6. To install, press F11.

Creating the base VM

1. Use a web browser to connect and log into the vSphere instance.
2. Right-click the host, and click New VM.
3. Assign the VM the following properties:
   a. 10 virtual CPU
   b. 40GB memory
   c. 100GB VMDK
      i. Thick-provisioned
      ii. VMware Paravirtual controller

Installing the OS

1. Boot the VM to the Ubuntu Server 22.04 LTS installation media.
2. When prompted, select Install Ubuntu.
3. Select the desired language, and click Done.
4. Choose a keyboard layout, and click Done.
5. At the Network Connections screen, click Done.
6. At the Configure Proxy screen, click Done.
7. At the Configure Ubuntu Archive Mirror screen, click Done.
8. Select Use an entire disk, and click Done.
9. Click Continue.
10. Enter user account details, and click Done.
11. Enable OpenSSH Server install, and click Done.
12. At the installation summary screen, click Done.
13. When the installation finishes, unmount the installation media, and reboot the VM.

Configuring the OS

1. Boot the VM to the operating system, and log in with the configured user.
2. Update the system:

```
apt update -y
```

3. Upgrade the system:

```
apt upgrade -y
```

4. Install tuned and apply the PostgreSQL profile:

```
apt install -y tuned
tuned-adm profile postgresql
```

Installing and configuring PostgreSQL

1. Install PostgreSQL 16:

```
apt install -y postgresql
```

2. Edit /etc/postgresql/16/main/postgresql.conf to the following:

```
max_parallel_workers = 8
```

3. Restart the service:

```
systemctl restart postgresql
```

Installing HammerDB 4.11 and building the database

1. Download and extract the HammerDB files:

```
wget https://github.com/TPC-Council/HammerDB/releases/download/v4.11/HammerDB-4.11-Linux.tar.gz
tar -zxf HammerDB*
```

2. Navigate to the HammerDB-4.11 folder, and run the pg_tproch_build.tcl script from the Scripts section:

```
cd HammerDB-4.11
./hammerdbcli auto pg_tproch_build.tcl
```

Backing up and restoring the database

1. Stop the PostgreSQL service:

```
systemctl stop postgresql
```

2. Create an archive of the data folder:

```
sudo tar -cf- /var/lib/postgresql/16/main | pigz -9 -c > backup.tar.gz
```

3. Restore the database from the backup before every test run:

```
systemctl stop postgresql
rm -rf /var/lib/postgresql/16/main
tar -zxf backup.tar.gz -C /
systemctl start postgresql
```

Running the test

1. Use the steps above to restore a fresh copy of the database.
2. Shut down the VMs, reboot the host, start the VMs, and allow them to idle for 5 minutes.
3. Navigate to the HammerDB folder, and run the test script from the Scripts section:

```
cd HammerDB-4.11
./hammerdbcli auto pg_tproch_run.tcl
```

4. Repeat three times, and record the median score.

Scripts

```
pg_tproch_build.tcl
dbset db pg
dbset bm TPC-H
diset connection pg_host <IP_ADDRESS>
diset connection pg_port 5432
diset connection pg_sslmode prefer
diset tpch pg_scale_fact 10
diset tpch pg_num_tpch_threads 4
diset tpch pg_tpch_superuser postgres
diset tpch pg_tpch_superuserpass <PASSWORD>
diset tpch pg_tpch_defaultdbase postgres
diset tpch pg_tpch_user postgres
diset tpch pg_tpch_pass <PASSWORD>
diset tpch pg_tpch_dbase tpch
diset tpch pg_tpch_tspace pg_default
buildschema
pg_tproch_run.tcl
#!/bin/tclsh
dbset db pg
dbset bm TPC-H
diset connection pg_host <IP_ADDRESS>
diset connection pg_port 5432
diset connection pg_sslmode prefer
diset tpch pg_scale_fact 10
diset tpch pg_tpch_user postgres
diset tpch pg_tpch_pass <PASSWORD>
diset tpch pg_tpch_dbase tpch
diset tpch pg_total_querysets 1
diset tpch pg_degree_of_parallel 8
loadscript
vuset vu 3
vucreate
vurun
```

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