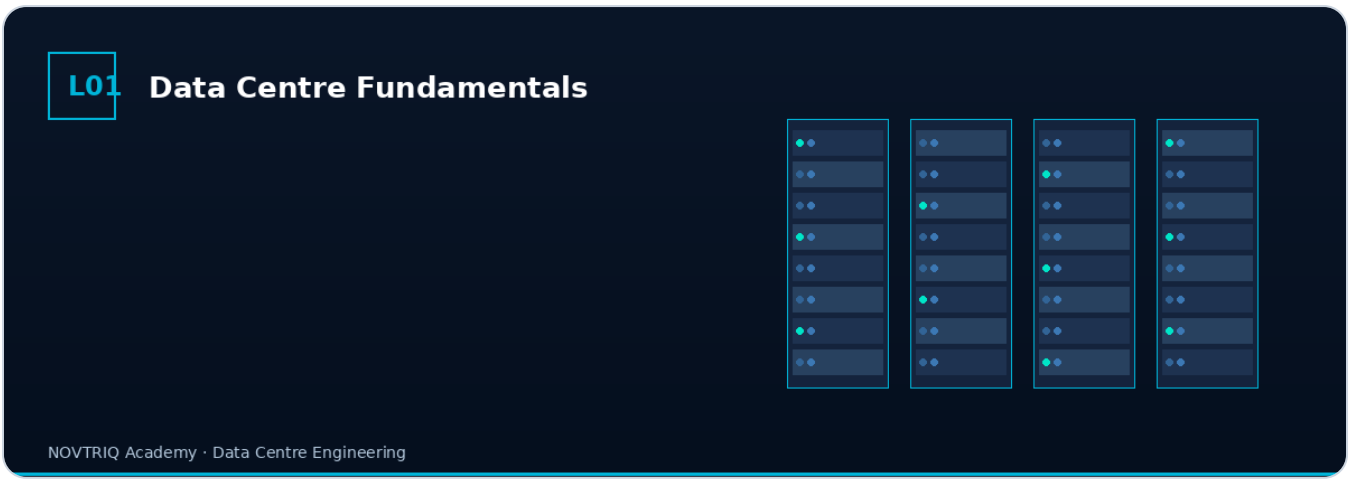
FREE

DATA CENTRE ENGINEERING

Data Centre Fundamentals — What Makes a DC

What makes a data centre — the four pillars.



· **Data Centre Engineering** Lesson 1 of 12

A data centre is an enclosed facility designed to host IT infrastructure with high availability, controlled environment, and secure access. The four pillars: power, cooling, connectivity, security.

This lesson sets the language and the building blocks before deeper drill-downs in subsequent lessons.

Learning objectives

Remember	Key terms and concepts.
Understand	How the system works.
Understand	Standards and selection logic.
Apply	Apply to a project brief.

1 · Power as the dominant constraint

DC density measured in kW per rack (typical 5–10 kW; high density 20–40 kW; AI workloads 50–100 kW+). Multiple supply paths, UPS, generators. Power capacity often the binding constraint on growth.

2 · Cooling — the heat rejection problem

Servers convert ~all electricity to heat. Cooling system must reject this heat reliably. Air cooling (CRAC, in-row), liquid cooling (rear-door, direct-to-chip), increasingly immersion cooling for AI.

3 · Connectivity and resilience

Multiple fibre routes from different telcos. Internal fabric: leaf-spine topology, increasingly 400G/800G interconnect. Latency to major peering points matters for hyperscale.

4 · Tier and resilience model

Uptime Institute Tiers I–IV (covered Lesson 2) define resilience expectations. TIA-942 parallel framework. ANSI/BICSI 002 operational guidance.

5 · What this looks like on a real project

UK London Metro DC

Tier III, 5 MW IT load, N+1 cooling, 2N power. Connection: 22kV ring main from two substations, dual Tier-1 fibre carriers.

EU EU CoC for DC efficiency

EU Code of Conduct for Data Centre Energy Efficiency — voluntary, self-reported, framework for best-practice operations and metrics.

UAE **Dubai DC growth**

UAE National Data Centres strategy, Khazna Data Centres expansion. High ambient temperatures stress cooling design — selecting chillers for 50°C+ outdoor.

6 · Why this matters

Data centres are unlike any other building — redundancy reasoning, density, regulatory framing, and operating tempo are all different. You now understand the IT-load / facility-load split, the rack-and-row model, and the reliability vocabulary the industry uses. That foundation lets every later DC discussion land.

Quiz

Your score 0 / 5

1. Typical AI workload rack power density:

a) 1–5 kW

b) 5–10 kW

c) 50–100+ kW

d) <500 W

2. A data centre primarily serves:

a) Office workers

b) IT infrastructure with high availability requirements

c) Manufacturing equipment

d) Vehicles

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3. A "leaf-spine" topology is:

a) A type of UPS

b) A network architecture for DC fabric

c) A cooling distribution scheme

d) A rack layout

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4. TIA-942 is published by:

a) ISO

b) Telecommunications Industry Association (US)

c) IEEE

d) BSI

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5. A DC connection from two physically separate fibre routes is for:

a) Higher bandwidth

b) Resilience against single fibre cut

c) Cost reduction

d) Faster latency

Answers (for print): 1c · 2b · 3b · 4b · 5b

Resources

PRIMARY SOURCES

- Uptime Institute publications.
- TIA-942 (Telecommunications Industry Association).
- ANSI/BICSI 002 — DC design and implementation.

STANDARDS AND GUIDANCE

- ASHRAE TC 9.9 — Mission Critical Facilities thermal guidelines.
- EN 50600 series (European DC standards).

INDEPENDENT COMMENTARY

- EU Code of Conduct for Data Centre Energy Efficiency.
- Uptime Intelligence Annual Survey.

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