THE EVOLUTION OF

DATA CENTERS

From Room-Sized Mainframes to Hyperscale Powerhouses

A Journey Through Computing History & North Carolina's Rise

WHAT IS A DATA CENTER?

A data center is a dedicated physical facility that houses computing systems, storage devices, and networking equipment — along with supporting infrastructure such as power supplies, cooling systems, and security measures — designed to store, process, manage, and distribute data and applications.

Compute

Processing millions of transactions per second

Storage

Petabytes of critical business data

Networking

High-speed connectivity and distribution

Security

Physical and cyber threat protection

DATA CENTER TIER CLASSIFICATIONS

Established by the Uptime Institute — the international standard for data center performance

TIER I	**Single path power & cooling, no redundancy** *Small business, dev/test*	**99.671%** uptime	**28.8 hrs/yr** downtime
TIER II	**Single path with some redundant components (N+1)** *Mid-size organizations*	**99.741%** uptime	**22 hrs/yr** downtime
TIER III	**Multiple paths, concurrently maintainable** *Enterprise & commercial*	**99.982%** uptime	**1.6 hrs/yr** downtime
TIER IV	**Fully fault tolerant, 2N+1 redundancy** *Mission-critical / hyperscale*	**99.995%** uptime	**26 min/yr** downtime

THE COMPUTING THAT PUT US ON THE MOON

Apollo Guidance Computer (1969)

Processor Speed	0.043 MHz
RAM	32 KB
Storage (ROM)	72 KB
Weight	70 lbs
Transistors	~12,300

Modern Smartphone (Today)

Processor Speed	~3,000 MHz
RAM	8-16 GB
Storage	256-1,000 GB
Weight	~6 oz
Transistors	~16 Billion

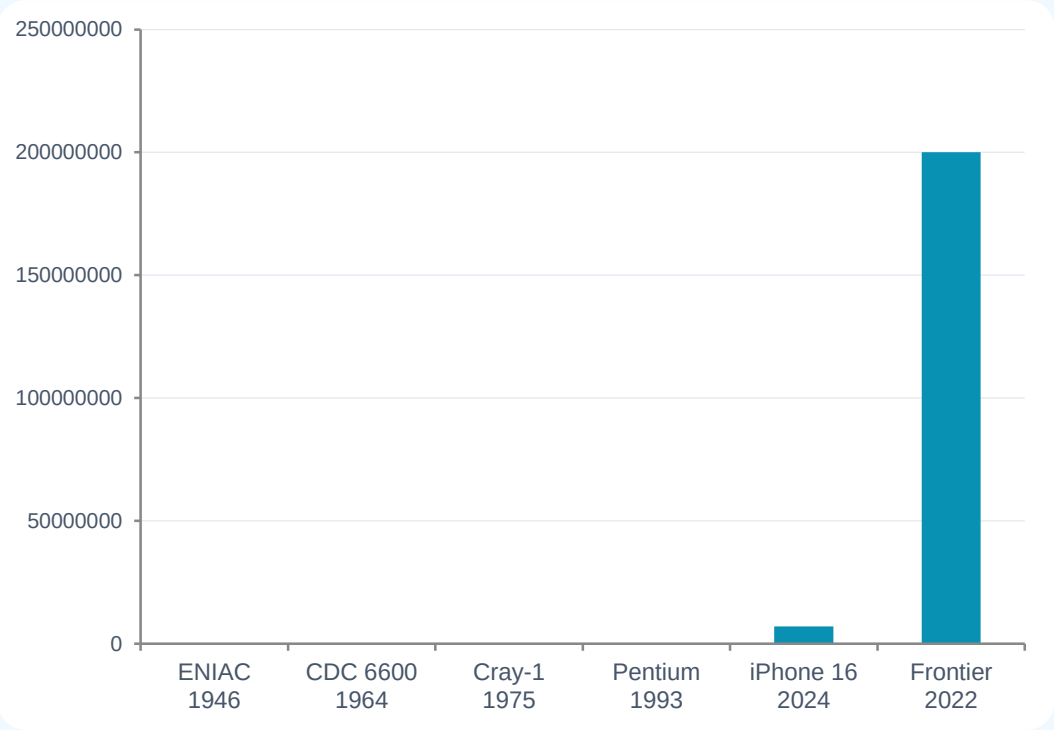
100,000x more processing power in your pocket today than what landed humans on the moon

SUPERCOMPUTERS: SMALLER SIZE, BIGGER POWER

1964	CDC 6600	3 MFLOPS	Room-sized	*First supercomputer*
1975	Cray-1	160 MFLOPS	C-shaped tower	*100 MFLOP barrier*
1985	Cray-2	1.9 GFLOPS	Liquid-cooled	*First liquid cooling*
1996	ASCI Red	1 TFLOPS	85 cabinets	*First teraflop*
2008	Roadrunner	1 PFLOPS	288 racks	*First petaflop*
2022	Frontier	1 EFLOPS	74 cabinets	*First exascale*

From 3 million ops/sec (1964) to 1 quintillion ops/sec (2022) — a 333 TRILLION-fold increase

PROCESSING POWER GROWS AS DEVICES SHRINK



Moore's Law: transistor count doubled every ~2 years for five decades

A smartphone is 100,000x faster than Apollo 11's guidance computer

Today's $10 microcontroller rivals 1960s supercomputers

Apple M1 chip: 2.6 TFLOPS — matching a 1990s supercomputer

THE ORIGINS OF DATA CENTERS

1940s-1950s The Mainframe Era

ENIAC (1946) — 30 tons, 1,800 sq ft, 18,000 vacuum tubes, 150 kW. The Pentagon, CIA, and West Point build dedicated computer rooms. Military secrecy demands physical security and environmental controls.

1960s-1970s Corporate Computing

IBM builds the first official data center. Transistors replace vacuum tubes, cutting size by 90%. IBM System/360 becomes the enterprise backbone. Temperature/humidity control becomes standard.

1980s-2000s PC & Internet Revolution

Client-server architecture replaces mainframes. The dot-com boom drives massive facility construction. VMware introduces virtualization (1999). Uptime Institute creates the tier classification system.

THE NEED FOR DATA CENTERS

402.74 million

TERABYTES OF DATA CREATED EVERY DAY

Always-On Reliability

99.995% uptime for mission-critical ops

Scalable Compute

Instantly scale from 1 to 1,000+ servers

Security & Compliance

Physical, cyber, and regulatory protection

Global Connectivity

Low-latency access for billions of users

Disaster Recovery

Geographic redundancy protects data

AI & Cloud Power

Enabling AI training, cloud, and IoT

TODAY'S DATA CENTER REQUIREMENTS

Massive Power

Hyperscale facilities need 100-400 MW — like powering a small city. Data centers consumed 4% of U.S. electricity in 2023, projected to double by 2030.

Cooling & Sustainability

Advanced liquid cooling, free-air economizers, water-efficient systems. Operators pursue carbon-neutral operations and renewable energy.

Fiber Connectivity

Dense fiber-optic networks, carrier-neutral interconnection. Low-latency to major internet exchanges and cloud on-ramps.

Physical Security

24/7 surveillance, biometric access, mantrap entry, perimeter fencing. SOC 2, ISO 27001, and HIPAA compliance.

Skilled Workforce

Electrical engineers, HVAC technicians, network architects, security specialists with mission-critical experience.

Strategic Location

Low natural disaster risk, available land, proximity to fiber routes and power, pro-business regulatory environment.

NORTH CAROLINA: THE NEW DATA CENTER CAPITAL

How Data Centers Spread Across North Carolina

WEST (2006-2015)

Google (Lenoir)
Apple (Maiden)
Meta (Forest City)

500+ MW

capacity

PIEDMONT (2015-2023)

Microsoft (Catawba)
Corning/CommScope
AT&T, Disney, Wipro

800+ MW

capacity

TRIANGLE & EAST (2020-Present)

Digital Realty, CyrusOne
American Tower
WhiteFiber (Madison)

1,200+ MW

capacity

EASTWARD EXPANSION: Amazon $10B in Richmond County | $19.2B campus in Tarboro | Microsoft's 1,385-acre Person County megasite | Power demand projected to double from 3 GW to 6 GW

WHY NORTH CAROLINA? THE COMPETITIVE EDGE

Reliable Power Infrastructure — 4.5 GW

Duke Energy contracts grew from 3 GW to 4.5 GW. Access to 2.24 GW power plants. Utility commitment to supporting growth.

Fiber Optic Leadership — 3,700 mi

NCREN spans 3,700 miles of fiber. CommScope and Corning produce 40% of world fiber supply. Dense carrier connectivity.

Pro-Business Economy — Top 10

Top 10 state for business tax climate. Electricity ~15.76% below national avg at ~8.5c/kWh. Special data center tax incentives.

World-Class Talent — 250+

RTP: 7,000 acres, 250+ companies. Duke, UNC, NC State produce top-tier engineering and IT graduates.

Low Natural Disaster Risk — Zone 1-2

Low seismic zone rating. Inland locations avoid major storm damage. Favorable climate reduces cooling costs.

Abundant Land & Infrastructure — 1000s acres

Massive tracts for hyperscale campuses. Strong highway, rail, airport, and deep-water port access.

BILLIONS POURING INTO NORTH CAROLINA

Amazon Web Services — $10B

Richmond County

1,200 acres, 20 buildings, 3.7M sq ft near 2.24 GW Duke Energy plant

Microsoft — $1B+

Person & Catawba Counties

1,385-acre megasite in Person County; 4 new Catawba facilities

Google — $1.2B

Lenoir, Caldwell County

Ongoing expansion of flagship NC campus, one of Google's earliest

Meta (Facebook) — $750M+

Forest City, Rutherford Co.

Three data center buildings with continued multi-building expansion

Apple — $175M

Maiden, Catawba County

237,600 sq ft expansion to 500,000+ sq ft flagship campus

Energy Storage Sol. — $38B

Tarboro & Fayetteville

Twin 900 MW campuses, 24 phases, 1,000+ employees each

DEPENDENCIES FOR CONTINUED GROWTH

Power Infrastructure Expansion

Duke Energy must scale from 4.5 GW to 6+ GW. New substations, transmission lines, and generation capacity critical. Operators pledging not to increase consumer electricity prices.

Workforce Development

Apprenticeship programs adding data-center-focused electrical and HVAC tracks. Community college partnerships near major sites. Siemens adding 350+ jobs in the Carolinas.

Community & Government Partnership

Balancing rapid development with community needs. Environmental impact assessments, water management, transparent engagement. Streamlined permitting while maintaining standards.

Sustainable Energy Solutions

Commitment to renewables and carbon-neutral operations. Heat-recovery, energy-efficient building envelopes, on-site renewable infrastructure. NC's 2025-2029 strategic plan includes sustainability.

THE FUTURE IS BEING BUILT
IN NORTH CAROLINA

From room-sized mainframes to hyperscale campuses worth billions, data centers are the infrastructure of our digital future — and North Carolina is leading the charge.

$50B+
Invested in NC

40+
Operating Facilities

6 GW
Projected Demand