Compute the total cost of building a data center that houses 10 ExaBytes of HDD.

Factors to consider –

- HDDs
- Networking
- Racks
- Building (real-estate),
- Power
- Cooling etc

4U box –

Cost : 20,000 $ per unit

1 '4U box' can hold 64 HDD

Storage in 1 '4U' box = 64 X 8 TB

Number of 4U boxes required = 19,532 units

Totals cost = 20,000 X 19,532 = 390,640,000 $

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48U Rack –

1 Rack can hold up to 10 '4U' units

Tripp Lite SmartRack SR48UB Rack (ventilated)

$1,545 online

★★★★☆ 1 review | Write a review | Save to Shortlist

Black · 27.7 in x 47 in x 95 in

Tripp Lite's SR48UB SmartRack enclosures are designed for secure, high density server and networking applications in IT environments. Designed with provisions to integrate cooling, power distribution and cable management, SmartRack enclosures make ideal homes for mission-critical ... more »

Tripp Lite SmartRack SR48UB Rack (ventilated) 1545 $

Storage in 1 rack = 10 X 64 X 8 TB

(number of $U boxes in 1 rack X number of HDDs in 1 4U box X storage in 1 HDD)

Number of racks needed = [10 X 10^{18} / (10 X 64 X 8 X 10^{12})] = 1954

Number of racks needed = 1954

Total cost for racks 1545 $ X 1954

3,018,930 $

Total cost 393,658,930 $

4U chassis -

ARK IPC-4U600 Black 1.2mm SECC Zinc-Coated Steel 4U Rackmount Server Chassis 3 External 5.25" Drive Bays

(42) | Write a Review

In stock.

- 3 External 5.25" Drive Bays
- 1 80mm Fans 1 120mm Fans

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1 Chassis / 1 Rack

Number of 4U Chassis required = 1954

Total cost = 1954 X 87.99 $

171,932.46 $

Total cost = 393,658,930 $ + 171,933 $

393,830,863 $

Networking –

Intra rack communication : Infini band switch

A network switch (also called switching hub, bridging hub, officially MAC bridge) is a computer networking device that connects devices together on a computer network, by using packet switching to receive, process and forward data to the destination device. Unlike less advanced network hubs, a network switch forwards data only to one or multiple devices that need to receive it, rather than broadcasting the same data out of each of its ports. [Source – Wikipedia]

Mellanox InfiniScale IV IS5022 QDR InfiniBand Switch – 1665.99 $ X 2 X 1954

(Cost per unit X number of units needed per rack X number of racks)

Total cost = 6,510,728 $

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Inter rack communication : Access switch

Cisco Meraki Cloud Managed Switch MS220-48 Switch - 48 ports - managed

$2,559 online

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48 · 9.7 lbs · 19.1" x 17.3" x 1.7"

The Cisco Meraki Cloud Networking architecture enables Plug and Play branch deployments and provides centralized visibility and control across any number of distributed locations. The Cisco Meraki MS is the industry's cloud managed switch, combining the benefits of cloud-based ... more »

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1 Access switch / 40 racks

Number of units required = 1954 / 40 = 49 units

Cost = 49 X 2559 $ = 125,391 $

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Total cost = 6,636,119 $

Land :

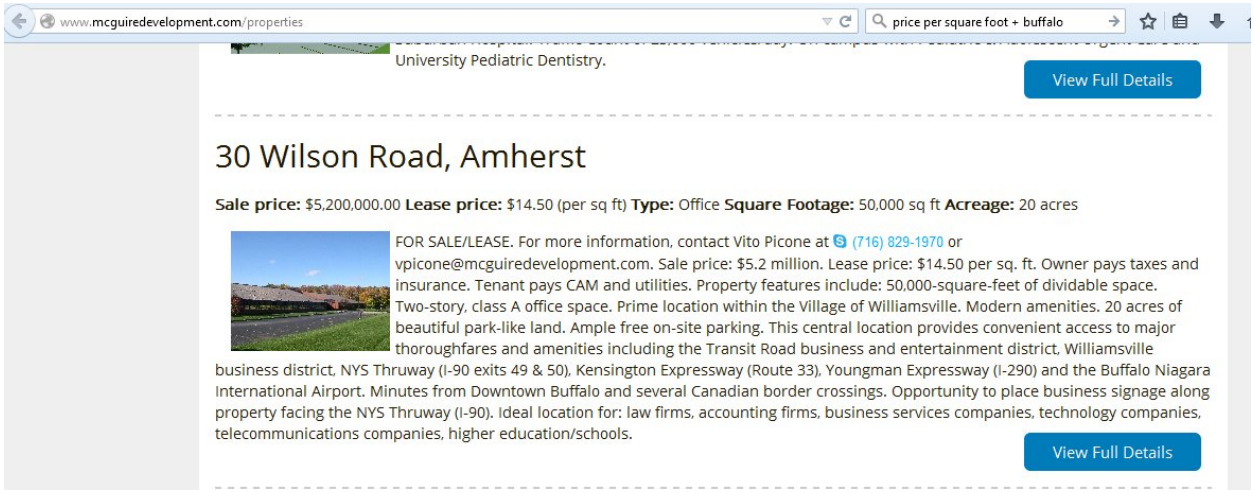
Dimension of 1 rack : 27.7 in X 47 in X 95 in

Area occupied by all the racks = 27.7 X 47 X 1954 = 2,543,912.6 sq inches = 17,667 sq feet

Provide adequate gaps between racks and include area for other facilities.

Total area = 35,334 sq feet

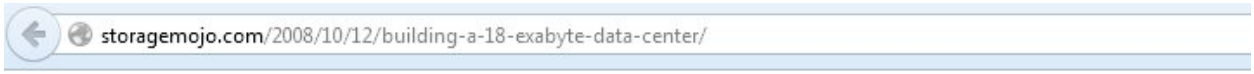
Lease : Avg price per sq foot for business in Buffalo - ~ 14.5 $ / sq ft / year



Total cost = 35,334 X 14.50 $ = 512,343 $

Power :

(Includes cooling)



At $500/sq. ft. the data center would cost an additional $60 million. YMMV.

Oh, and redundancy is extra.

Power

The drive's operational power consumption is 10 watts. Drives alone eat 20 megawatts. Side note: disk power consumption is the reason that storage vendors find differentiation on power consumption elusive.

Assume 1 250W server for every 100 drives means another 5 MW for servers – a low-side estimate. Leaving aside network infrastructure and lighting, the HVAC load for 25 MW is around 12.5 MW, according to some rules of thumb.

Let's round up and call it 40 megawatts. You'll want to locate this facility near the Columbia River to get cheap hydropower – maybe next door to Google in The Dalles, Oregon.

I haven't deciphered BPA power pricing, but I'd guess 40 MW would run about $2 million a month. Copan, much less.

Power required for a 1.8 Exa byte data centre = 40 MW

(approx) power required for a 10 Exa byte centre = 40MW X 5 = 200 MW

Electricity rates in Buffalo –

https://power2switch.com/NY/Buffalo/

price per square foot + bu

$ 37 BUFFALO ELECTRIC RATES

Plan Name	Plan Length	Rate
Champion Energy Champ Saver-12	12 months	$0.09872 / kWh
Just Energy Buckeye 12 Price Guard	12 months	$0.0735 / kWh
Just Energy Buckeye 24 Price Guard	12 months	$0.076 / kWh
Champion Energy Green Energy-12	12 months	$0.095275 / kWh
Bounce Energy Express Move 6	6 months	$0.089 / kWh
ConEdison Solutions 12 Month Wind	12 months	$0.1316 / kWh
Just Energy 1-Year Price Protection	12 months	$0.115 / kWh
Bounce Energy Terrific 12	12 months	$0.065 / kWh
Bounce Energy Terrific 12	12 months	$0.066 / kWh
TriEagle Energy Green Eagle 9	9 months	$0.089 / kWh
Constellation 12 Month Default	12 months	$0.0489 / kWh
Constellation 12 Month Fixed Default	12 months	$0.0749 / kWh
Bounce Energy Terrific 12	12 months	$0.109 / kWh
TriEagle Energy Green Eagle 12	12 months	$0.093 / kWh

Total power cost = 200 X 1000 X 0.07 = 2800 $ per day

Total Cost of the data center :

Networking costs : 6,636,119 $

Data storage : 393,830,863 $

Land : 512,343 $

400,979,325 $