

Data Center Design

by

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WEMA/Brainstorm

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Elert & Associates

Technology Consultants

- **22 years**
- **Hundreds of public clients**
- **Wired, wireless, voice, video**
- **Planning and budgetary estimates**
- **Design and bid documents**
- **Project management**



Terms

- **Data Center**
- **NOC**
- **Main Equipment Room (MER)**
- **EIA/TIA 942**
- **HVAC**
- **UPS**



What's in a Data Center?

- **Servers**
- **Legacy mini-computers**
- **SAN and NAS equipment**
- **Tape backup systems**
- **Network equipment**
- **Phone system (switch and/or servers)**
- **Video equipment/encoders**
- **Audio/paging system**
- **Security control system/server**



Design Issues



- **Location**
- **Size**
- **Cooling**
- **Electrical and UPS**
- **Fire protection**
- **Security**
- **Disaster recovery**



Location

- **Access and proximity to cable pathways**
- **Telecom provider requirements**
- **Proximity to electrical service and electro-magnetic interference (EMI) sources**
- **Space now and for future expansion**
- **HVAC issues**
- **Adjacency to operations center**
- **Adjacency to elevator(s) and/or loading dock**



Avoid Locations with:

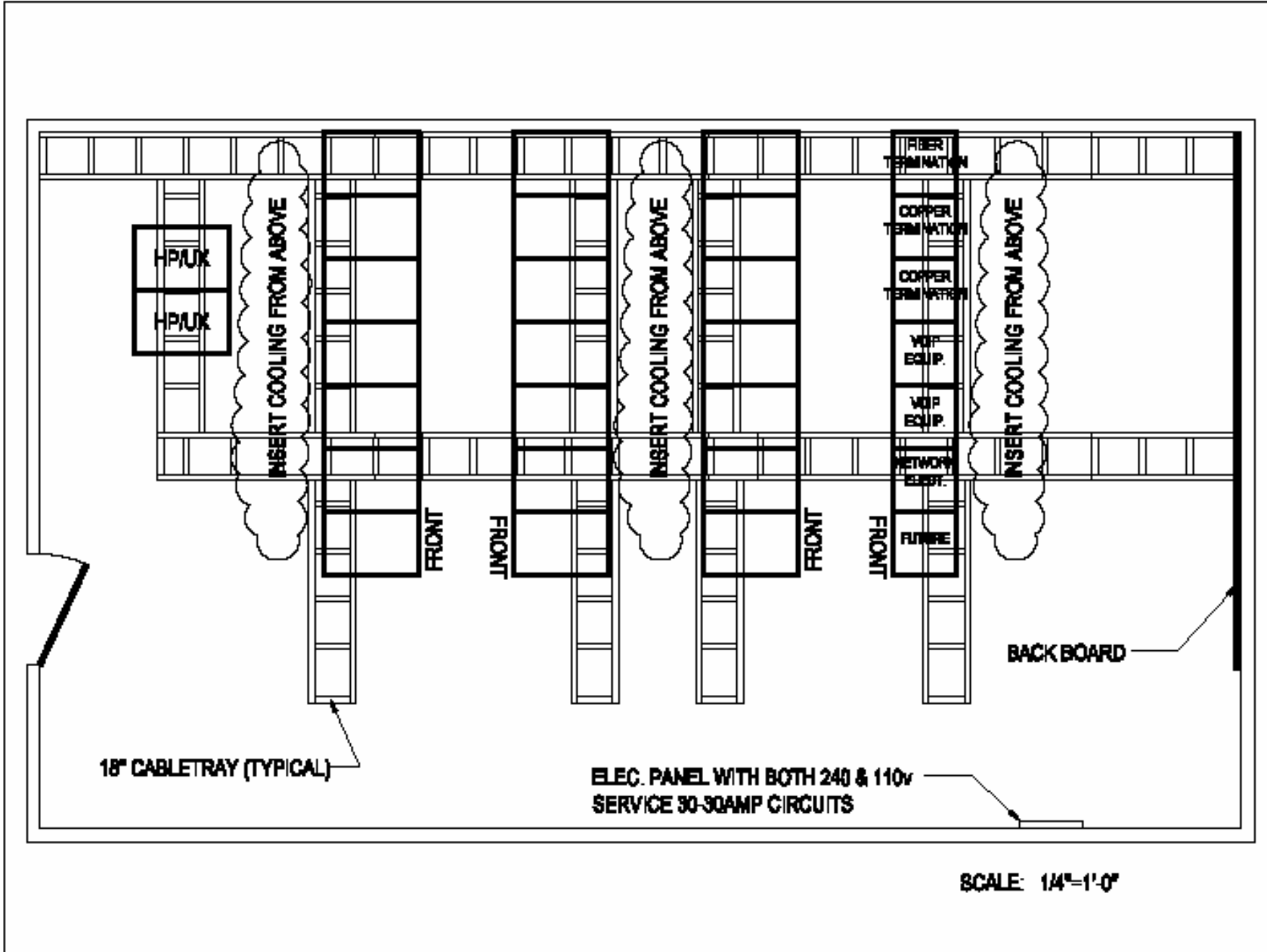
- **Water Infiltration**
- **Steam Infiltration**
- **High humidity from nearby sources**
- **Heat (e.g., direct sunlight)**
- **Adjacency requiring access through other areas**
- **Potential for flooding (or below water table)**



Physical Space

- A minimum of 280 sq. ft. (~ 17' x 17')
- Square is preferable to long and narrow
- Measure physical sizes of all items - height in rack units (1 RU = 1.75 inches)
- Account for HVAC equipment, power distribution, and UPS systems
- Clearances - NEC Section 11016 requires three feet of clear working space around equipment with exposed live parts
- High voltage electrical panels and transformers must be at least 36" from racks & equipment





HPIUK
HPIUK

INSERT COOLING FROM ABOVE

FRONT

FRONT

INSERT COOLING FROM ABOVE

FRONT

FRONT

FIBER
TERMINATION
COPPER
TERMINATION
COPPER
TERMINATION
48 P.
EQUIP.
48 P.
EQUIP.
NETWORK
DIST.
FIBER

INSERT COOLING FROM ABOVE

BACK BOARD

18" CABLETRAY (TYPICAL)

ELEC. PANEL WITH BOTH 240 & 110v
SERVICE 30-30AMP CIRCUITS

SCALE: 1/4"=1'-0"

Physical Features

- **A minimum ceiling height of 10'-0" clear (below light fixtures)**
- **Floor load rating under distributed loading must be > 250 lb/ sq. ft.**
- **Door at least three feet (3') wide and should swing open out of the room (double doors preferable)**
- **No tight turns to get into room**



Finishes

- **Interior walls should be painted with fire retardant paint**
- **Flooring should be static free -- tile or painted concrete is preferred over carpet**
- **No lay-in ceiling, if possible**
- **Ceiling should be painted white**



HVAC

- **Temperature 64°F - 72°F, own zone**
- **Positive air flow**
- **Hot and cold aisles**
- **Humidity of 55 - 30%, non-condensing**
- **Continuous cooling (24 hours x 365)**
- **Cooling independent of building automatic shutdown system and not subject to building power-saving shutdowns**



Electrical

- **To determine electrical and cooling load, add up power draw of all equipment/ systems known (including UPS systems in room) and multiply by 1.5 – 2 for growth**
 - **NOTE: Blade servers and high density rack-mount servers have extra needs for electricity and cooling**
- **Lighting, HVAC, and convenience receptacles should be fed from different branch circuits than the telecommunication equipment**



Server	Max Power Output
MIS1	330W
MIS2	540W
MIS3	330W
MIS4	600W
MIS5	330W
TWS	330W
GSMS1	750W
GSMS2	750W
IEP Web	330W
IEP Db	330W
CD Tower	250W
Tape Backup	100W
CNS	330W
Trans1	330W
Trans2	540W
HPUX	1700W
HP Raid Array	1000W



Item	Qty	Watts each (estimated)	BTU/hr each	Total Watts	Total BTU/hr
Servers	70	800	2,700	56,000	189,000
UPS systems for servers	70	N/A	465	N/A	32,550
HP UX systems	2	1,000	3,000	2,000	6,000
Cisco Chassis switch	1	880	3,000	880	3,000
UPS for chassis switch	1	1,000	3,400	1,000	3,400
Cisco VoIP equipment (set)	1	unknown	5,652	unknown	5,652
Workgroup switches	3	120	500	360	1,500
UPS system for WG switches	1	1,000	3,400	1,000	3,400
Cisco router (3745)	1	880	3,000	880	3,000
Totals				62,120	247,502





BXL

CD

TRAN TM EDP2
10 400A 4P 5W

C30

C20

BL

BL

BL

BL

BL

BL

BL

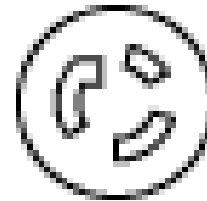
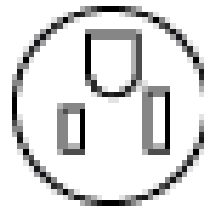
Electrical Design

- **Provide sub-breakers per rack**
- **Typical 60 watts/ sq. ft.**
- **Establish a high-density area of 100-200 watts/sq. ft. for enclosures rated at 3-6 kW per enclosure**



Plugs and Amps

- **Consider electrical outlet types and amps needed per circuit**



Lighting

- **50 foot-candles 3 feet above floor**
- **Account for light loss due to full cable trays and light blocked by equipment and racks**
- **Coordinate positions of light fixtures with layout, particularly cable trays & cabinets**
- **Emergency lighting consistent with emergency system for the building**

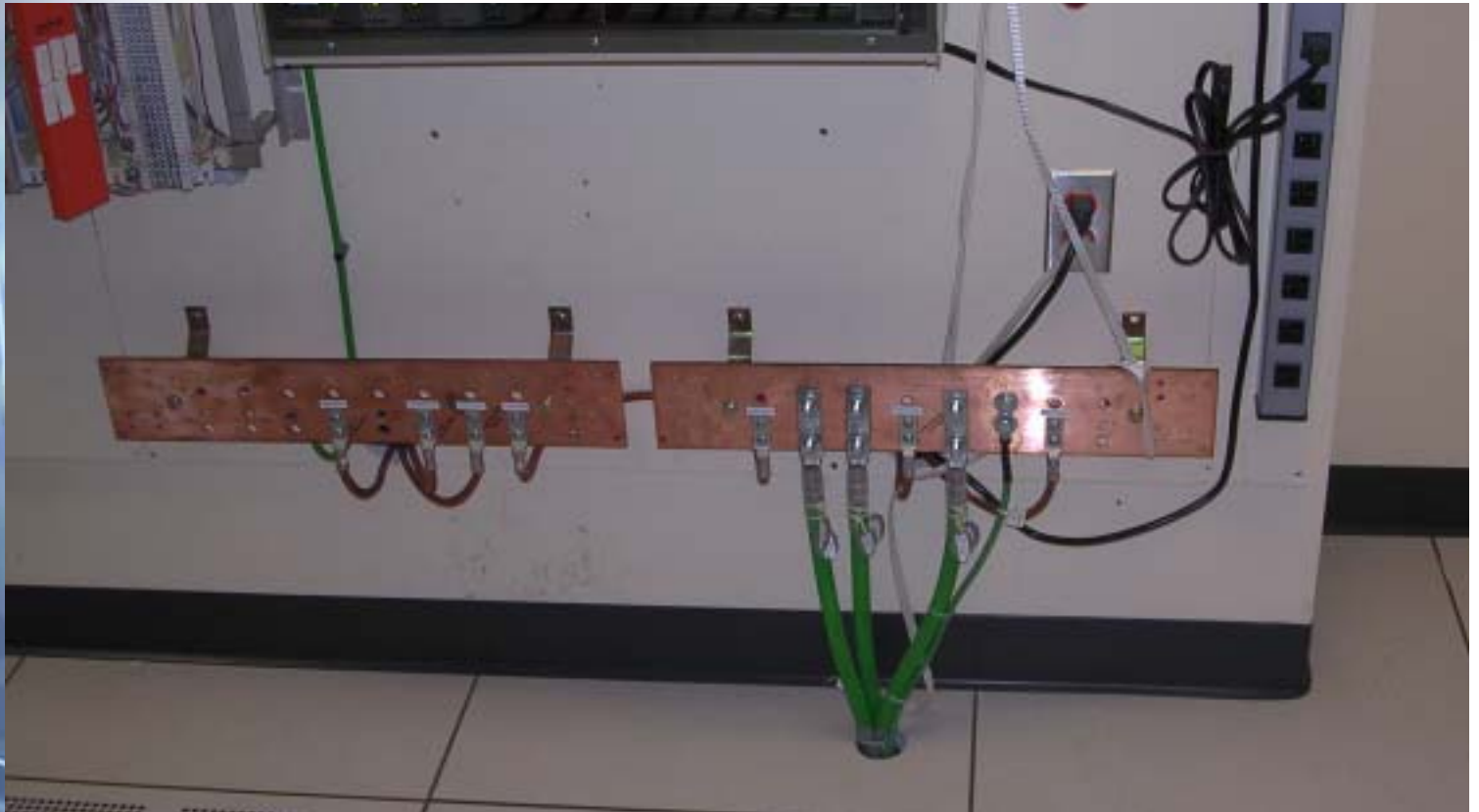




Cable Tray/Wireway



Grounding



Fire Protection

- **Non-water based preferred (FM-200)**
- **If sprinklers required by code, place troughs above the most expensive equipment to shunt water**
- **Install pre-action system (dry pipe)**
- **Consult with Fire Protection Engineers for sprinkler placement and required clearances between sprinklers, conduit and/or cable trays**
- **All penetrations must be sealed with smoke and flame stop materials**



Physical Security

- **All doors should be controlled**
- **Door access**
 - proximity card/badge or biometric
 - No keyed locks or numbered keypads
 - Door should alarm if left open
- **Interior room (no windows)**
- **Walls up to deck (demising walls)**



Disaster Recovery

- **Prevent and mitigate risks**
- **Generator w/48 hours of fuel**
- **UPS (see next slide) – test monthly**
- **Redundant cooling**
- **Alternate/backup data center site**
 - hot
 - warm
 - cold



UPS specs

- **Double conversion (or “true on-line” service) to protect equipment from all power disturbances including blackouts, brownout, sags, etc.**
- **Overload protection of 125% for 10 minutes**
- **Software to automatically initiate supported systems shutdown if incoming AC power fails and generator does not engage**
- **Software that permits UPS to be monitored from a desktop, preferably via web browser**
- **Ability to interface to the Building Automation System/Environmental Control System is preferable**
- **Noise level of below 60dB is preferable**



Preferable, but not required

- **Gaseous fire protection**
- **Raised floor**
 - **Electric power and cooled air below**
- **Emergency power off**

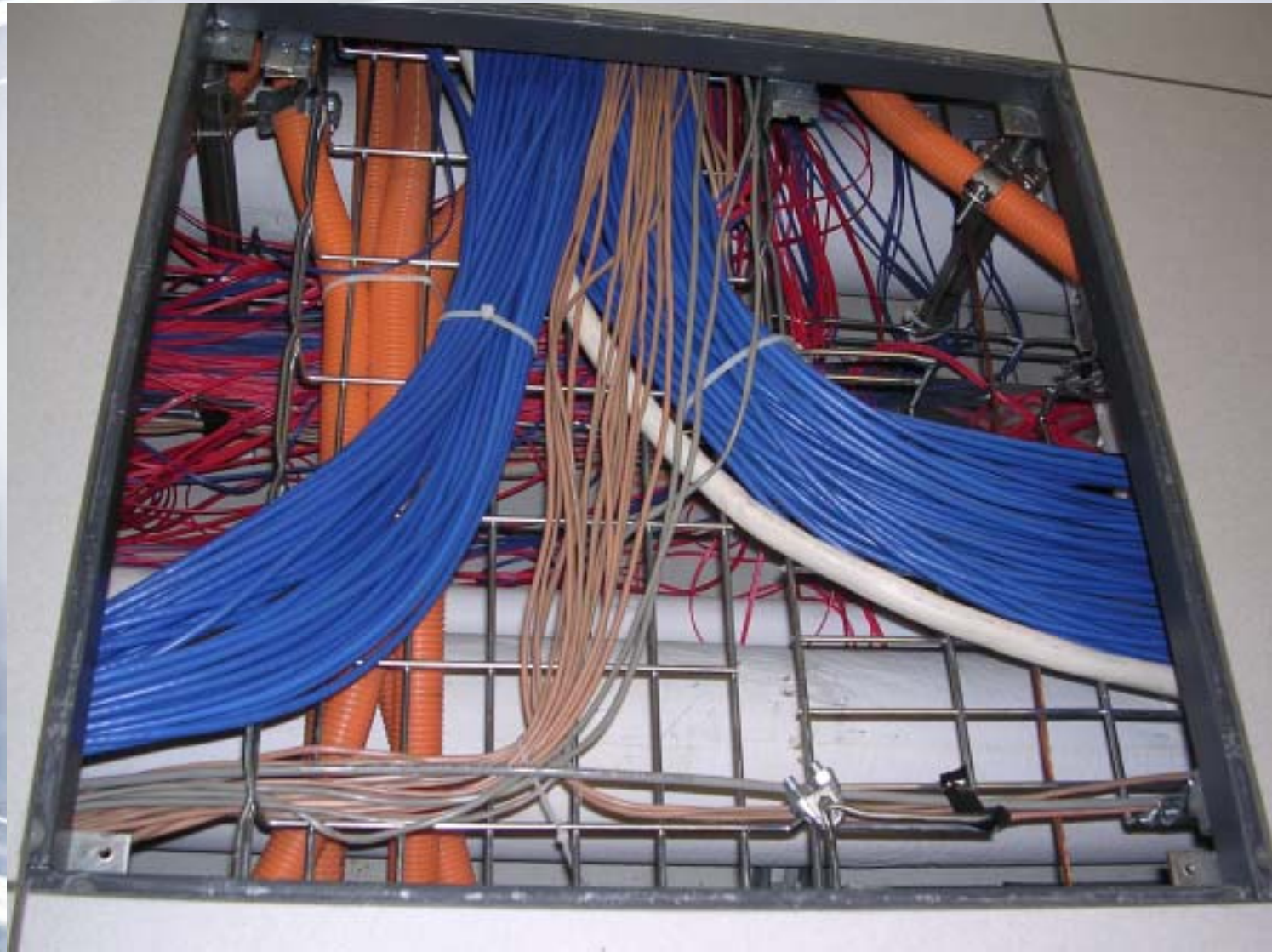


Costs?

- **Per square foot (rough) \$400 – not incl. radical structural changes**
- **If adding generator, \$ depend on type of fuel and capacity (KVA)**
- **Add'l cooling costs if there are blade servers**



Don'ts







Thank you!

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