

Data Centre Design Professional

Introduction to Data Centre

- The data centre stack
- Types of data centre

The Design Planning Process

- Main design considerations
- Developing a project plan

Scoping the Requirement

- Identifying key stakeholders
- Market and political drivers
- National and international standards
- Availability and resilience classifications
- Introduction to Availability Models (Uptime Tier, TIA 942-B Rating, BICSI Classes & Syska Hennessy Critical Levels)
- Recommendations for location, size, heights, floor loading, lighting and décor

Whitespace Floor

- National and international standards
- Structural and load requirements
- Recommended floor heights
- Airflow and sealing
- Ramps and access
- Seismic protection
- Slab floor construction considerations

Cabinets

- Requirements of a cabinet
- Security, safety and stabilisation
- Clearance, accessibility and ventilation
- Cable management
- Seismic stability considerations
- Design specifications

Power

- Regulations and codes
- The meaning of N, N+1 2(N+1), etc
- Power delivery and distribution losses
- Uninterruptible Power Supply (UPS) options
- Generator considerations
- Power distribution units
- Power distribution to, and in a rack
- Remote Power Panels (RPPs)
- Emergency Power Off (EPO)
- Estimating power requirements

Cooling

- National and international standards
- Basics of air conditioning principles
- CRAHs and CRACs
- ASHRAE Operational parameters
- Under floor plenum approach
- Hot aisle/cold aisle layout principle
- Hot and cold aisle containment
- Psychrometric charts
- Min and max throw distances for under floor air
- Bypass and recirculation
- Airflow management
- Chilled water racks, CO₂, free air cooling

Earthing & Bonding

- Applicable standards
- The terminology of earthing, grounding & bonding
- Equipotential bonding
- Electrostatic Discharge (ESD)
- Functional earths
- The Signal Reference Grid (SRG)

Cable Containment, Management & Protection

- Applicable standards
- Separation of power and data cables
- Administration and labelling
- Types of conduit, trunking, tray, etc, available
- Earthing and bonding
- Containment fill ratio
- Underfloor v overhead containment
- Cable management, in and to a rack
- Fire stopping

Delivering the IT Strategy

- Data centre equipment
- Functions and protocols, current and future
- Data centre connections
- Cabling requirements
- Cabling standards
- Cabling options
- The impact of 40G and 100G
- The impact of virtualisation

Copper and Optical Fibre Cabling Connectivity

- Cabling standards
- Cable standards, 10GBASE-T, CAT6A & Cat 7A & Cat 8
- Screened vs unshielded cables
- High density patching
- Alien crosstalk
- Copper test requirements
- Design for growth management
- Channel connections
- Connection topologies
- Optical connectors, past and present
- Optical fibre management

- Types of optical cable
- Pre-terminated cabling
- Advantages/disadvantages of pre-terminating cables
- Optical component loss and link power budgets
- Application link loss
- Optical testing requirements
- Pre-terminated cabling

Safety and Manageability

- Local codes and regulations
- Fire safety plan
- ASD and detection systems
- Fire suppression systems
- Fire safety cable requirements
- Security and access control

Commission and handover

- Benefits of commissioning
- Commission process and test sequence
- Handover process and training
- Lessons learned

Power Review

- Power consumption trends
- Energy availability, security and cost
- Energy challenges facing the data centre

Power Regulations

- Which regulations affect data centres?
- Environmental regulations and pressures
- Energy and environmental programs

Power Basics

- Ohm's law, Joule's law, the Kirchhoff laws
- Electrical parameters
- AC and DC

- Single phase and three phase
- Residual currents
- Harmonics

Power to the Data Centre

- Where does the electricity come from?
- Electrical supply options
- Transformers
- Surge suppression devices
- Costs of electrical power
- Types of tariff available
- Alternate power supply options

Distribution in the Data Centre

- Electrical circuit requirements
- Switching devices
- Power factor correction units
- Automatic and static transfer switches
- Main, feeder, sub-main circuits
- Power distribution units
- Remote power panels
- Final circuits
- Cable and fuse sizing
- Power distribution and associated losses
- TN-S systems
- Energy efficiency

Standby Power

- UPS components, batteries and redundant systems
- UPS options and considerations
- Static and maintenance bypasses
- Standby generators

Cooling Review

- Data Centre limiting factors

- Sources of cooling inefficiencies
- Cooling trends

Regulatory Climate

- Which regulations affect data centres?
- Environmental pressures
- Cooling efficiency
- Design considerations & planning redundancy
- Overview of Computational Fluid Dynamics (CFD)
- Periodic review process

Environmental Parameters

- Standards, NEBS, ETSI, ASHRAE
- Operating environment ranges
- Rate of change
- ASHRAE psychrometric charts
- Humidification systems
- The need for sensors
- Measuring and monitoring

Collecting the Heat

- Cooling system overview
- CRACs and CRAHs
- Maximising existing investment
- Rack v row options
- Dynamics and problems of air flow
- Liquid cooling
- Comparison of high-density cooling
- Available cooling options

Heat Rejection Or Reuse

- Heat transfer considerations
- DX systems
- Chilled water CRAHs
- Chiller options

- Adiabatic cooling
- CWS and CHWS plant
- Design considerations
- Free cooling and free – air cooling
- Commissioning maintenance
- Planned preventative maintenance

Energy Use Systems

- Energy efficiency issues
- Layers of inefficiency
- Power system provision
- Cooling system provision
- Understanding areas of improvements

IT Infrastructure

- Extending the operating envelope
- Environment zones
- Accurate IT calculations
- Energy use in the IT equipment
- Software and storage considerations
- Transformation options
- Energy efficient IT equipment

Power Systems

- Energy use in the data centre
- DC power train
- Matching the support to the IT load
- Transformer efficiencies
- UPS & motor efficiencies
- DCiE for modular provisioning
- Maximising the power factor
- Measuring and monitoring
- Infrared inspections
- Planned electrical safety inspections

- Implementing data centre electrical efficiency

Cooling Efficiency

- Cooling, a cascade system
- Affinity laws and cooling equation
- CRAC and CRAH efficiencies
- Optimising air-side systems & water-side systems
- DCiE for cooling options
- Diagnostic and site specific monitoring
- Design considerations

Data Centre Metrics

- Where and what can we measure?
- The metric stack
- Metric characteristics
- Current industry metrics (PUE, CUE, WUE, ERE, RCI & RTI)
- Chained value metrics (CADE)
- Proxy metrics (FVER, DPPE, DCeP)

Efficiency Models & Best Practices

- Energy calculations
- Levels of modelling
- Modelling tools
- Sources of guidance
- Effective v Efficient
- The DC language barrier
- the multi-functional team
- Design for efficiency, operability & flexibility
- Industry recognised best practices

Design Management

- Characteristics of project management
- Key project processes
- Identifying and engaging with key stakeholders
- Setting goals

- Prioritisation of activities
- Cornerstones of project management

Managing the Design Process

- What is to be delivered?
- What constraints are there?
- Managing dependencies
- Managing the tribes
- Managing conflict
- Identifying risk
- Risk and issue management
- Change management
- Reporting and communication

Managing the Design Implementation Process

- Project charter and specification
- Risk assessment and management
- Scope management
- Float and critical path
- Human resource management
- Project integration and work breakdown structure
- Time and cost management
- Handover and progressive acceptance