

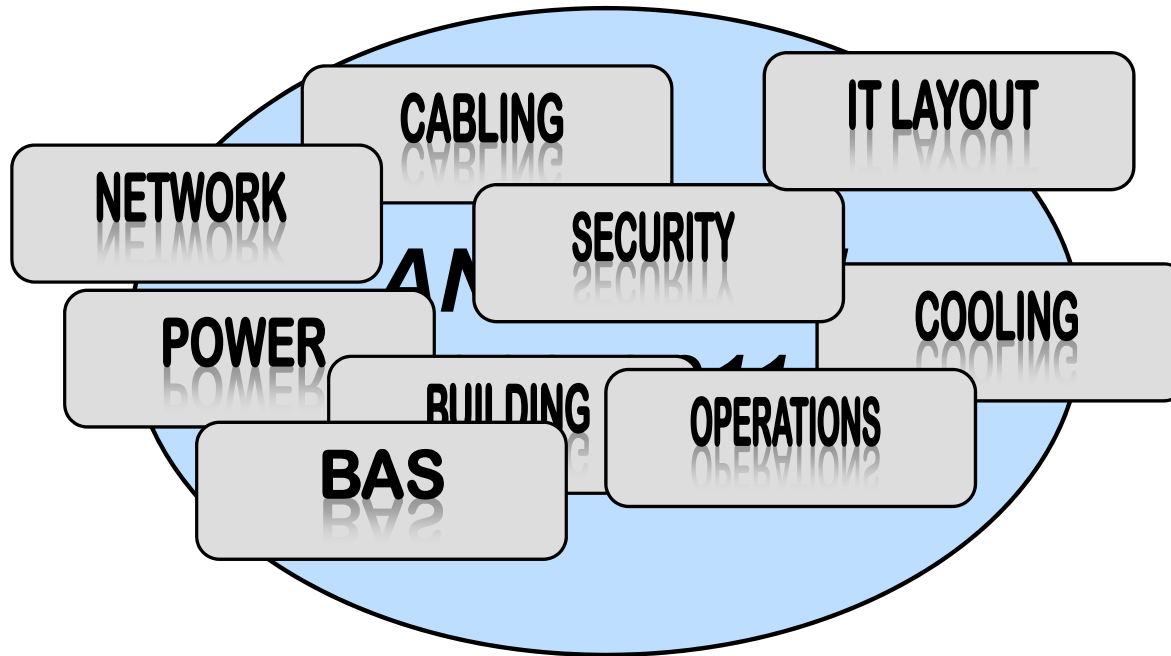
Using the ANSI/BICSI 002 Data Centre Design and Implementation Best Practices for a Real Project

Barry Shambrook
BICSI UK and Ireland Chair
RCDD, DCS



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A Comprehensive Standard



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How Does BICSI 002 Fit?

- Written to be used in conjunction with other standards/publications, such as
 - TIA: 942, 568C, 569B,
 - ISO/IEC:11801, 24764
 - CENELEC: EN 50173, 50174
 - NFPA: 70 (*NEC*®), 75
 - ASHRAE: Datacom and Data Centre
 - IEEE: 493, 1100 (Gold and Emerald Books)
 - EN 50600



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- Space Planning
 - Site Selection
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 - Maintenance
- Annexes*
- Design Process
 - Reliability



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Setting the Strategy

- What do we want
 - Resilience
 - Efficiency
- How much of it do we want
- When do we want it



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Requirements of Business

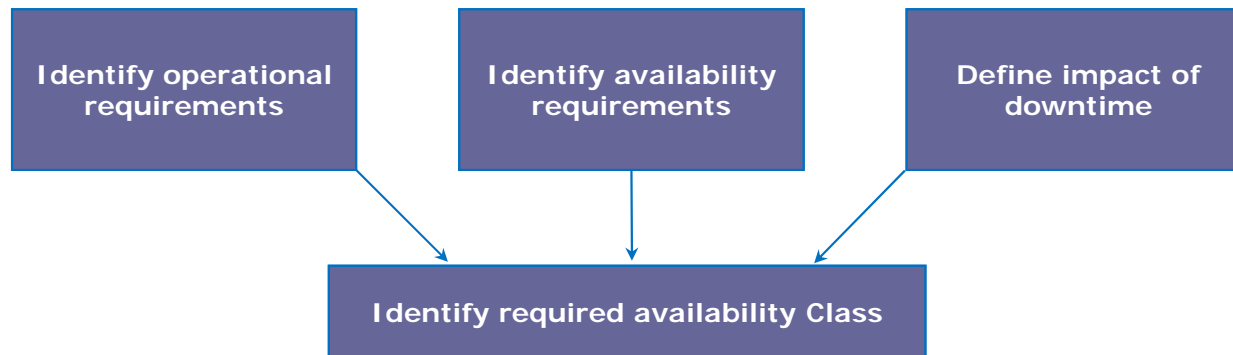
Item	Recovery Priority Order	Recovery Point Objective	Recovery Point Objective (data loss)
Bank KK Central System Services	1	120 mins	Based on the differential replication (1-5 min)
Bank ATM Centre System Services	2	120 mins	Based on the differential replication (1-5 min)
Bank Central Banking System Services	1	120 mins.	0
Bank Wide Area Network Backbone Layer Management and Operation Services	2	20 mins.	0
Bank Institutions Online Connectivity Services (RTGS and SWIFT services)	3	Finart + 60 mins.	EFT (1-10 mins) SWIFT (0-24 hours)
Bank Internet Banking Services	4	Finart + 120 mins.	0
Bank Institutions Online Connectivity Services (tax, social security, Bağkur)	5	Finart + 60 mins.	0
Bank Messaging Systems Services	6	120 mins.	0-24 hours



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Annex B - Reliability

- Risk Analysis
- Reliability Planning
- Data Centre Classes



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Lets Consider a Single Data Center



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Annex B - Reliability

Operational Classifications

Description	Annual Allowable Maintenance Hours	Operational Level
Functions are operational less than 24 hours a day and less than 7 days a week. Scheduled maintenance "down" time is available during working hours and off hours	> 400	0
Functions are operational less than 24 hours a day and less than 7 days a week. Scheduled maintenance "down" time is available during working hours and off hours	100 – 400	1
Functions are operational up to 24 hours a day, up to 7 days a week, and up to 50 weeks per year. Scheduled maintenance "down" time is available during working hours and off hours	50 – 99	2
Functions are operational 24 hours a day, 7 days a week for 50 weeks or more. — No scheduled maintenance "down" time is available during working hours	0 – 49	3
Functions are operational 24 hours a day, 7 days a week for 52 weeks each year. No scheduled maintenance "down" time is available	0	4



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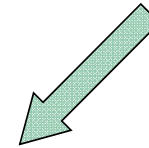
Annex B - Reliability

Availability Ranking

Operational Level	Allowable Maximum Annual Downtime (Minutes)				
	> 5000	500 to 5000	50 to 500	5 to 50	0.5 to 5.0
0	0	0	1	2	2
1	0	1	2	2	2
2	1	2	2	2	3
3	2	2	2	3	4
4	2	3	3	4	4

Availability Ranking

Operational Level	Allowable Availability (Expressed as 9's)				
	< 99%	99% to 99.9%	99.9% to 99.99%	99.99% to 99.999%	99.999% to 99.9999%
0	0	0	1	2	2
1	0	1	2	2	2
2	1	2	2	2	3
3	2	2	2	3	4
4	2	3	3	4	4

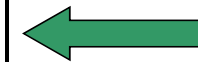


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Annex B - Reliability

Impact of Downtime

Description	Impact of Downtime
Local in scope, affecting only a single function or operation, resulting in a minor disruption or delay in achieving non-critical organizational objectives.	Sub-local
Local in scope, affecting only a single site, or resulting in a minor disruption or delay in achieving key organizational objectives.	Local
Regional in scope, affecting a portion of the enterprise (although not in its entirety) or resulting in a moderate disruption or delay in achieving key organizational objectives.	Regional
Multiregional in scope, affecting a major portion of the enterprise (although not in its entirety) or resulting in a major disruption or delay in achieving key organizational objectives.	Multiregional
Affecting the quality of service delivery across the entire enterprise, or resulting in a significant disruption or delay in achieving key organizational objectives.	Enterprise



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Annex B - Reliability

Determine Data Center Class

Impact of Downtime	Availability Rank				
	0	1	2	3	4
Sub-local	Class F0	Class F0	Class F1	Class F2	Class F2
Local	Class F0	Class F1	Class F2	Class F3	Class F3
Regional	Class F1	Class F2	Class F2	Class F3	Class F3
Multiregional	Class F1	Class F2	Class F3	Class F3	Class F4
Enterprise	Class F1	Class F2	Class F3	Class F4	Class F4

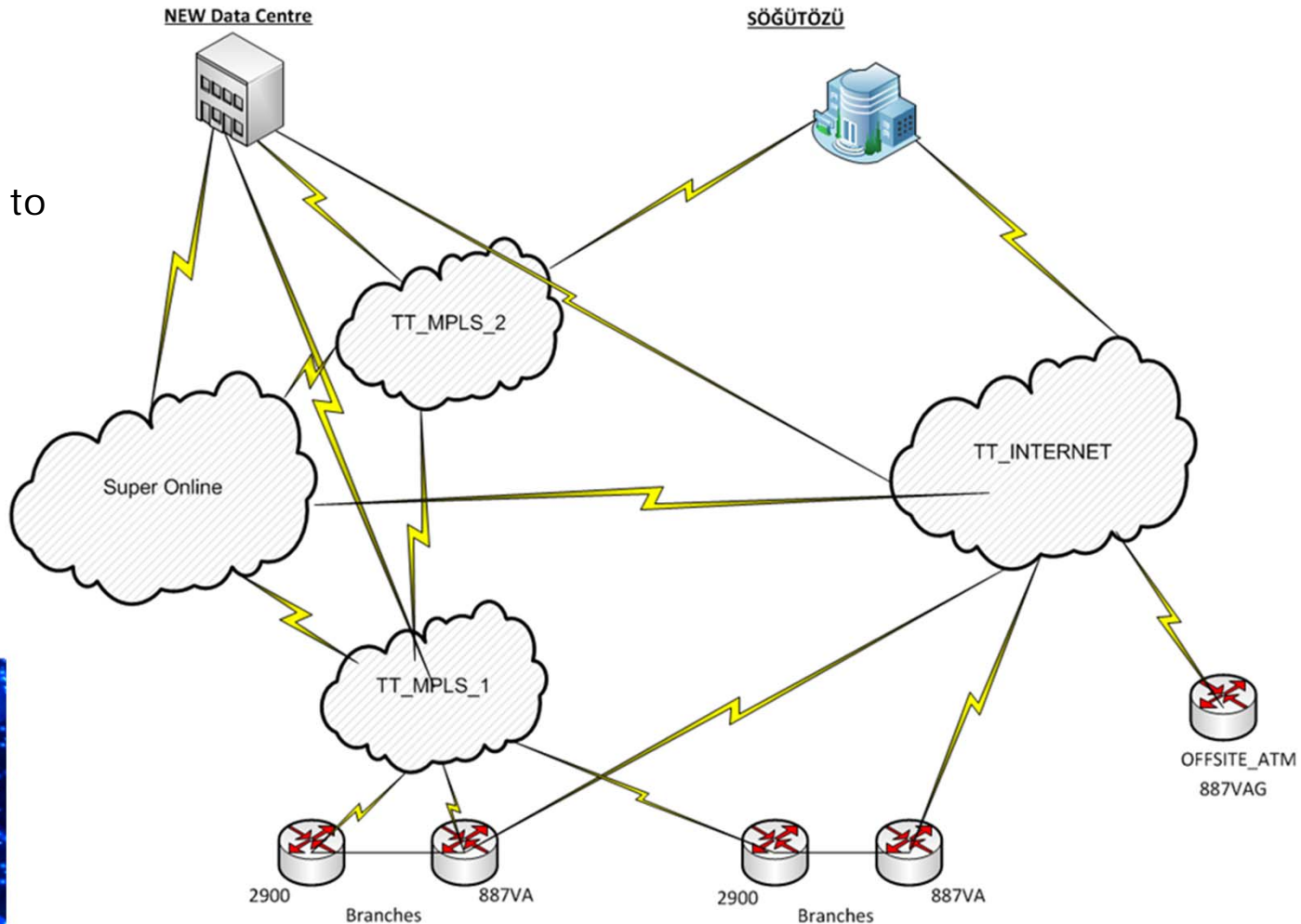
Two green arrows are present: one pointing to the '4' column header and another pointing to the 'Enterprise' row header. The 'Class F4' cell in the bottom-right corner is circled in green.



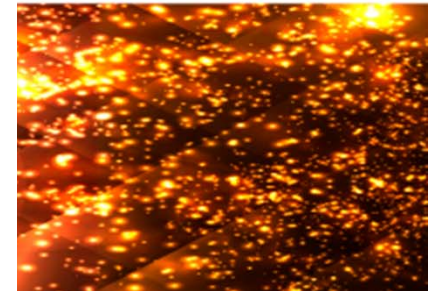
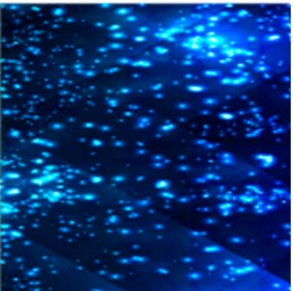
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Consider Multiple Data Centers

Diverse connections to each DC



DC 1 and 2 close enough for synchronous back-up



Annex B - Reliability

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Annex B - Reliability

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3	2	2	2	3	4
4	2	3	3	4	4

Availability Ranking

Operational Level	Allowable Availability (Expressed as 9's)				
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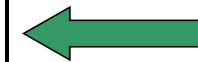


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Annex B - Reliability

Determine Data Center Class

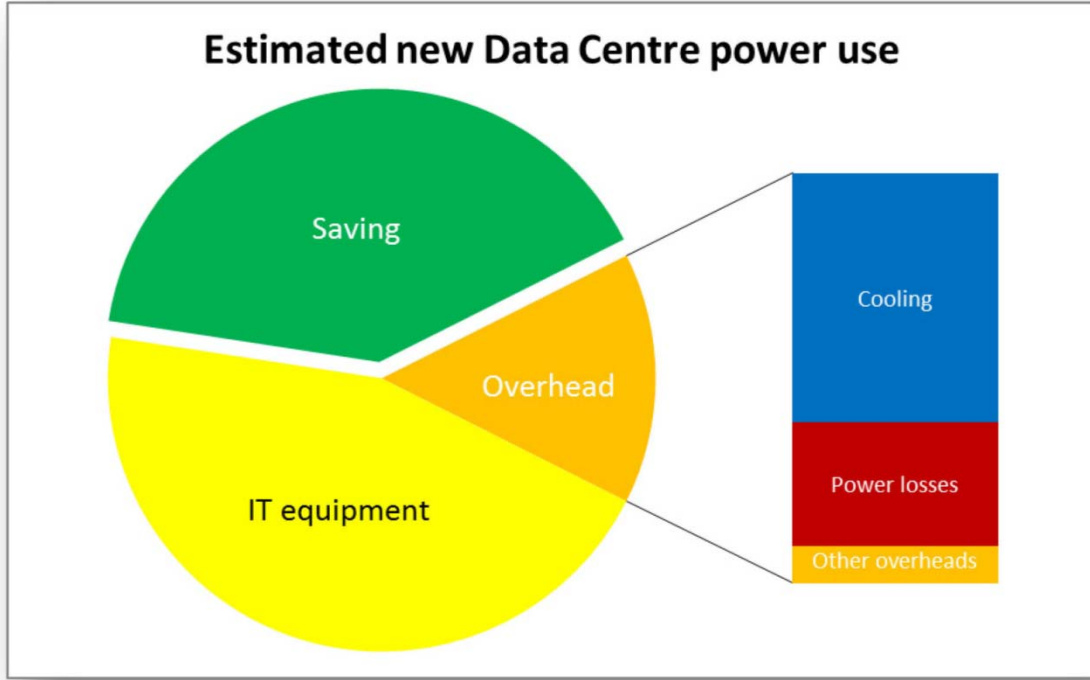
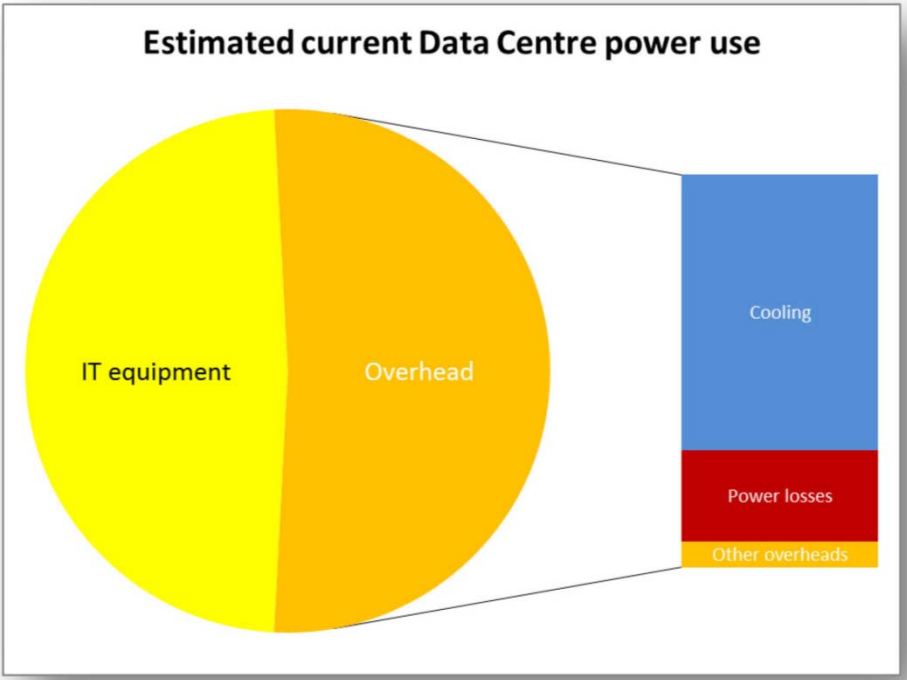
Impact of Downtime	Availability Rank				
	0	1	2	3	4
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Local	Class F0	Class F1	Class F2	Class F3	Class F3
Regional	Class F1	Class F2	Class F2	Class F3	Class F3
Multiregional	Class F1	Class F2	Class F3	Class F3	Class F4
Enterprise	Class F1	Class F2	Class F3	Class F4	Class F4

Two green arrows are present: one pointing to the '3' column header and another pointing to the 'Enterprise' row header. The cell containing 'Class F3' at the intersection of the 'Enterprise' row and '3' column is circled in green.



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Efficiency Target



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Expansion Factor Calculation

Item	Current number	Future number	Factor	Note
ATM	100	200	2.00	Assumed number will increase by 100% over 10 years
Branches	1600	2250	1.41	Includes Islamic bank branches
Card use	100	350	3.50	Increase of 25% per year
Countries	16	32	2.00	
Employees	24300	27100	1.12	
Subsidiaries	3	8	2.67	Appears some current subsidiaries are not currently located in DC's, assume they will in future

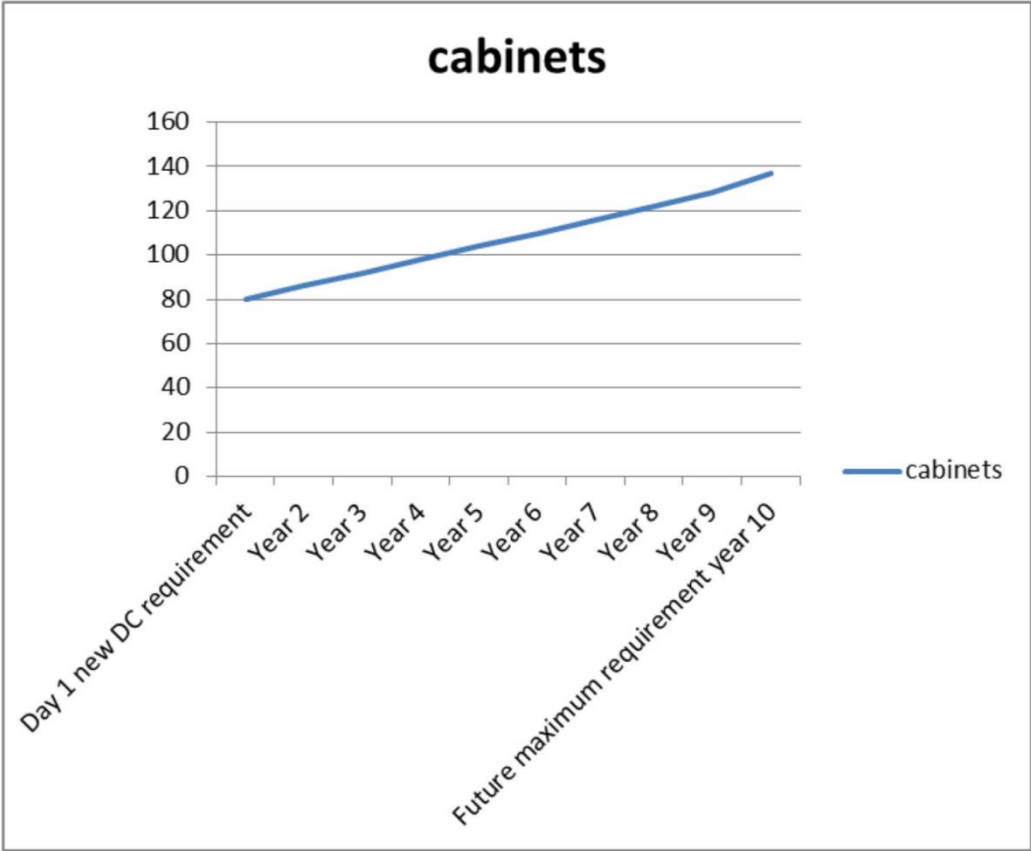


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Required Capacity

System	Existing cabs Istanbul	Existing cabs Ankara	Total cabs	Consolidation/ technology efficiency factor	Factor ref	Expansion factor	Day 1 new DC requirement	Future maximum requirement year 10
ATM	1	0	1	0.7	ATM's	2	1	2
Bosnia branches	1	0	1	0.7	Countries	2	1	2
Core banking	1	4	5	0.5	Branches	1.41	3	5
Core switches	3	3	6	0.5	Total cabs	1.71	3	6
Credit cards	1	1	2	0.5	Card use	3.5	1	4
Database	4	3	7	0.5	Branches	1.41	4	6
Domain controllers	0	2	2	0.5	Employees	1.12	1	2
DR – Core Banking	3	0	3	0.7	Branches	1.41	3	5
E-learning	0	1	1	0.7	Employees	1.12	1	2
Fintek	2	1	3	0.5	Total cabs	1.25	2	3
Firewall & security	3	5	8	0.5	Total cabs	1.25	4	5
Mail	3	5	8	0.5	Employees	1.12	4	5
Military credit card	2	0	2	0.7	No change	1.12	2	3
Money transfer	0	1	1	0.7	Branches	1.41	1	2
MS Office Communicator	1	0	1	0.5	Employees	1.12	1	2
Network LAN	6	10	16	0.5	Total cabs	1.25	8	10
Property database			1	1	New requirement	2	1	2
SAN	2	2	4	0.5	Branches	1.41	2	3
Security	2	2	4	0.5	Employees	1.12	2	3
SMS Production	1	0	1	0.7	ATM's	2	1	2
Storage	4	10	14	0.7	"Mushroom"	4	10	40
Subsidiary	3	1	4	0.5	Subsidiaries	2.67	2	6
Telephone Banking	4	0	4	0.5	Branches	1.41	2	3
Various	6	2	8	0.5	Employees	1.12	4	5
VM servers	0	1	1	0.5	Employees	1.12	1	2
VOIP	5	1	6	0.5	Employees	1.12	3	4
WAN	5	3	8	0.7	Services	1.12	6	7
Web server	0	1	1	0.5	Employees	1.12	1	2
Total cabs (active)	63	59	123				75	143

Capacity Graph



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Audit of Existing Facilities

- Location
- Building
- Power
- Cooling
- Layout
- Security
- Protection
- Network

Existing Istanbul Data Centre Audit - Location

Data required	Result	Notes	Flag
Are there secure (underground) electric and communications utility service entries?	No	See comments on incoming comms services	Red
Does the building layout present the ability to limit or restrict physical access to the data center?	Yes	Rear door is left open!	Red
Is there nearby public transportation available?	Yes		Green

Existing Istanbul Data Centre Audit - Power

Data required	Result	Notes	Flag
Sub-main conductor type	Multi-core cables		Red
UPS manufacturer/type/model/age	Siemens 6ES200 1999 and Socomec Delphys MP elite 2005	Major concern of age of Siemens unit	Red
UPS capacity	2 x 200kVA, 2 x 120kVA	Siemens unit also feeds other areas to have ample capacity	Red
UPS resilience	N+N?	Would be good but sub-distribution!	Red
UPS input capacity	630A (Siemens)		Red
UPS input type	MCB	Single supply	Red
UPS maintenance bypass?	Yes		Red
UPS location/security	Basement switchroom, vulnerable to flood	Also evidence of vermin	Red
UPS load	160kVA assuming 2 x load on smaller UPS	Current/historic if available	Red
UPS battery autonomy	Unknown	Appears to be a lot of batteries and than half capacity so at least 20 min	Red
Final distribution type	POU	POU or bus-bar	Red
Final distribution resilience	Design is N+N but very difficult to confirm implementation	Labeling unclear, no schematic, int	Red
Final distribution capacity	Mixture of 10A and 16A	See notes	Red
Rack supply type/location	Underfloor IEC sockets	See notes	Red
Rack supply resilience	Design is N+N but very difficult to confirm implementation	See notes	Red
Rack supply capacities	Design is N+N but very difficult to confirm implementation	See notes	Red
Rack supply conductors	Multi-core cables	See notes	Red
Sub metering/rack metering?	Appears to be various items	See notes	Red
Seismic protection measures main switchgear, UPS etc	None	Batteries in UPS room are particularly vulnerable	Red
Discrimination of main fuses and breakers	Unknown	Not possible to check due to lack of information	Red

Existing Istanbul Data Centre Audit - Network

Data required	Result	Notes	Flag
External WAN link provider(s)	Turkish Telecom	See notes	Red
External WAN link capacity and resilience	Copper and fibre	See notes	Red
Diverse routing of WAN links?	None	Single route for each service	Red
Protection of WAN links	Floor	See notes	Red
Location of demarcation point	Not located!		Red
Protection of demarcation point?	?		Red
Location of MDA	Currently in 1st floor	Major risk	Red
Structured system, topology	No structure		Red
Backbone cable type, manufacture and warranty	n/a		Red
Horizontal cable type, manufacture and warranty	Various patch cords, not warranted		Red
Labelling of patch panels and outlets	Very poor		Red
Separation of data cables from power	Often touching		Red
Data cable installation standards	Unstructured, poor installation		Red
Redundant cabling under floors or on cable trays?	Lots!		Red
Data cable sheath material	PVC	No plenum rated, increased fire risk	Red
Core switches type/capacity/speed	See notes		Red
Edge switches type/capacity/speed	See notes		Red
SCSI links to SAN?	See notes		Red
Patch cable types - copper	Ad-hoc		Red
Patch cable types - fiber	Ad-hoc		Red
Patching records?	Not seen		Red
Automated patching system?	No		Red



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As-is Data Centers – WAN Execution

- Poor protection of WAN connections to buildings
- Two connections per location but if one damaged the other becomes critical

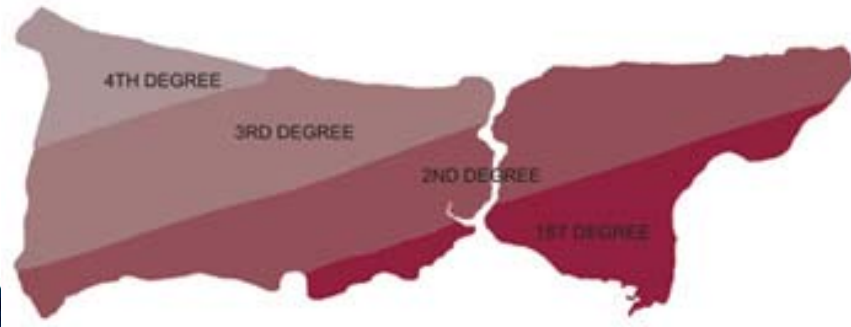


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As-is Istanbul Data Center Location



- Building has limited seismic strengthening
- Under main office
- Other risks from nearby petrol stations and main road

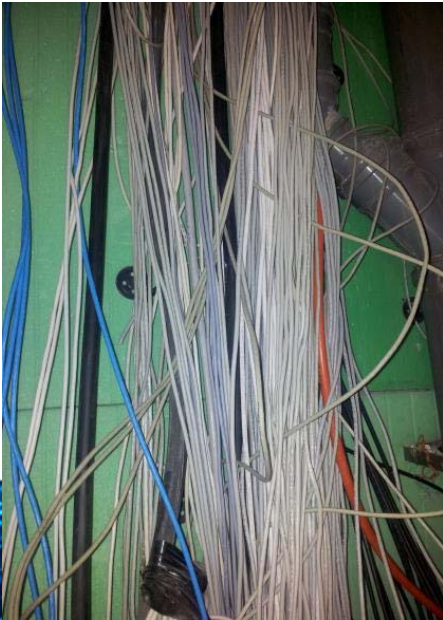


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As-is Network Both Data Centers

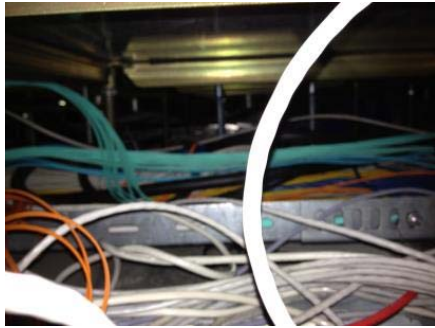


- No structure to cabling
- Very vulnerable to flood or other damage



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As-is Istanbul Data Center Building

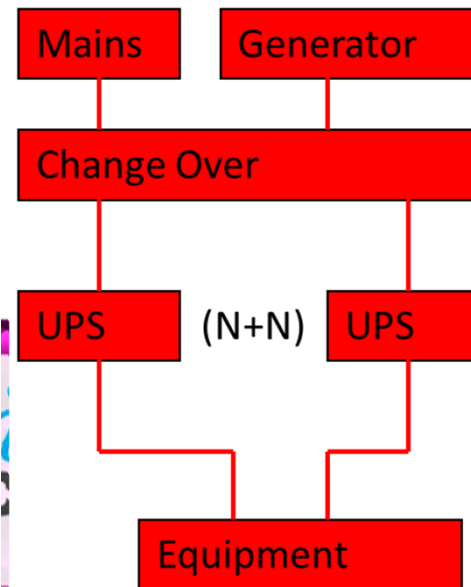


- Holes in raised floor, not deep enough
- No bonding or seismic protection to raised floor
- Sprinklers in surrounding areas
- Poor fire separation to surrounding areas



As-is Istanbul Data Center Power

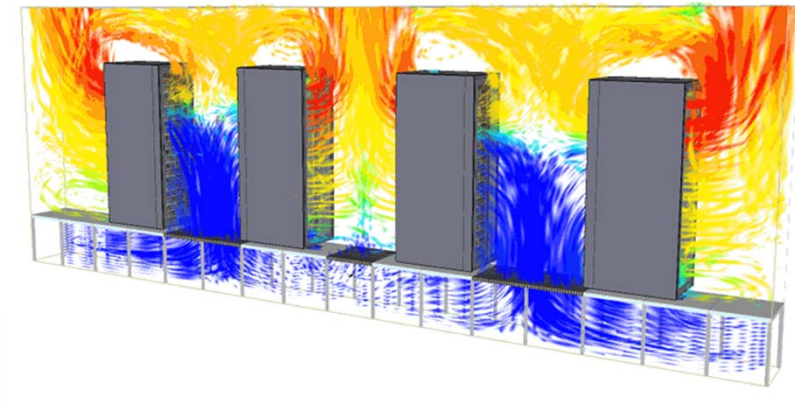
- Single point of failure at mains/generator changeover
- Overall class 1, 99% available (planned down time >86 hours per year)
- Suspect lifetime of UPS system on one side and batteries on other
- Poor labelling, no diagram
- Some servers not connected to diverse supplies
- UPS batteries vulnerable to seismic event



As-is Cooling Both Data Centers



- Ample capacity, at least 2 x load
- Resilience of cooling systems good but reliant on single power supply
- Poor air flow management, bypass and recirculation
- Resulting in very poor efficiency

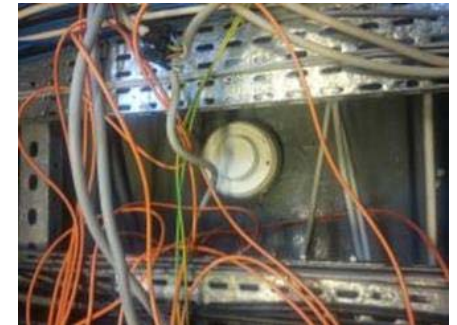


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As-is protection Both Data Centers



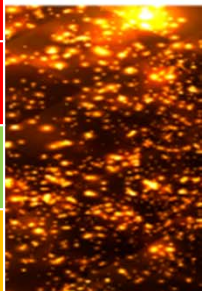
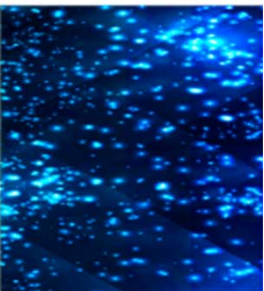
- No leak detection
- No high sensitivity smoke detection, detectors at bottom of raised floor
- Rooms not sealed, doubts on gas extinguishing operation
- Gaps in security



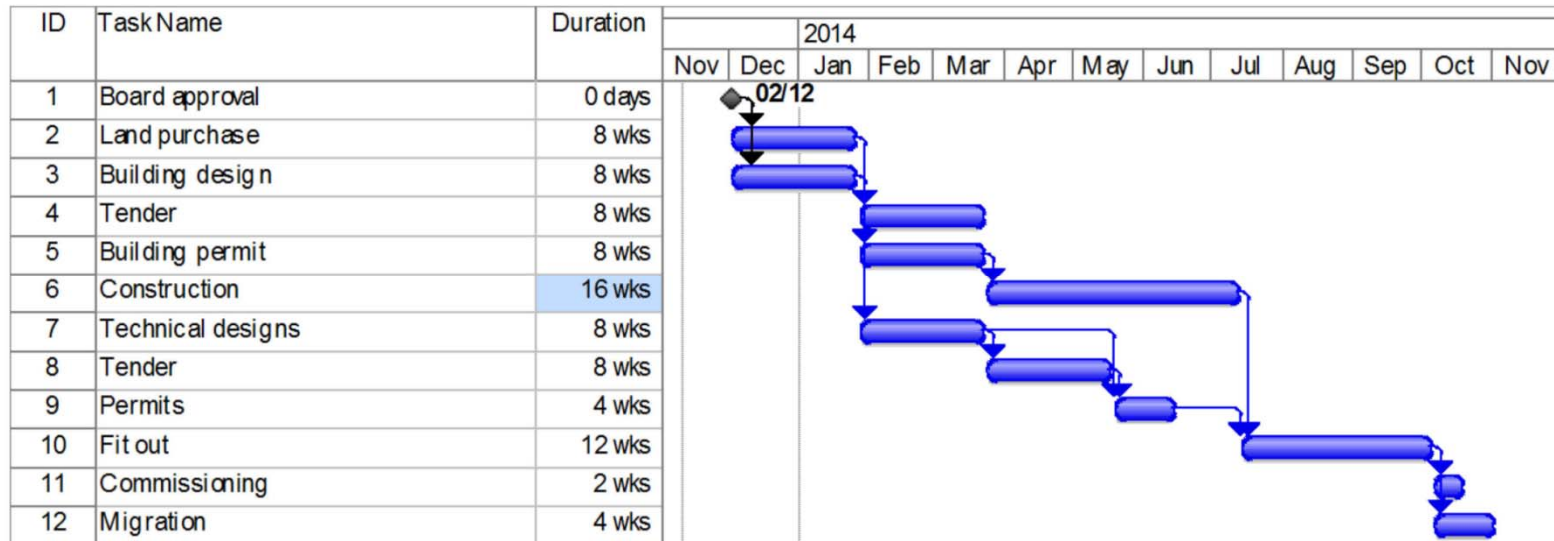
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Summary of Discrepancy Analysis

Item	Requirement	Istanbul	Ankara	Mitigation in present locations
WAN	Distance for synchronous replication	Over 500km – too far for current technology		Not possible in present locations
WAN	Diverse connections	Poor separation and protection		Can be improved by better protection
Location	Separate from main offices	Contained in main office buildings		Not possible in present locations
Location	Seismic risk and hardening	High risk area, some hardening	Lower risk area but no hardening	Not possible in present locations
Building physical protection	Protection against seismic, fire and flood risks	Various issues	Various issues	Can be improved in some areas but some risks will remain
Power capacity	200kW	Ample	Ample	Not required
Power resilience	BICSI 002 Class 3	BICSI 002 Class 1	BICSI 002 Class 1	Can be improved in some areas but will remain class 1 overall
Cooling capacity and efficiency	200kW, good efficiency	Ample capacity but very poor efficiency	Ample capacity but very poor efficiency	Some improvements can be made but limited by space
Cooling resilience	BICSI 002 Class 3	Single power supply	Single power supply	Not possible
Network	BICSI 002	No structure, very vulnerable to flood		Could be done but not planned at this stage
Protection	Fire, flood and security	Poor fire detection and gas extinguishing operation, no leak detection, gaps in security		Can be improved
Efficiency	Target PUE 1.3	PUE >2	PUE >2	Could be improved to around 1.8



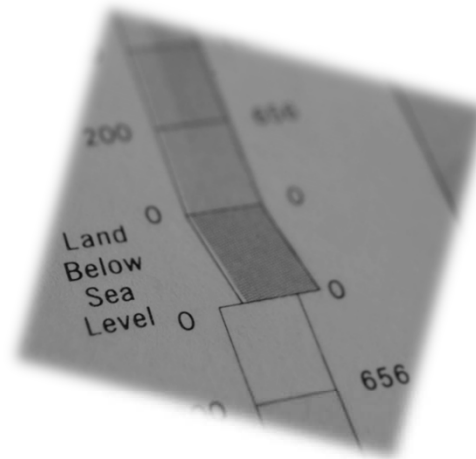
Target Timescale



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Site Selection

- Site Issues
 - Utility
 - Transportation
- Regulations
 - Noise
 - Exhaust
- Natural Environment



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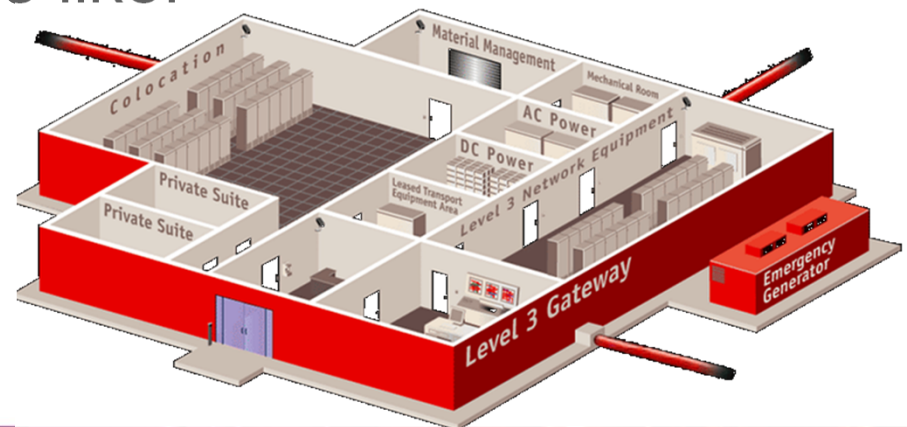
Shortlisted Selections



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Space Planning

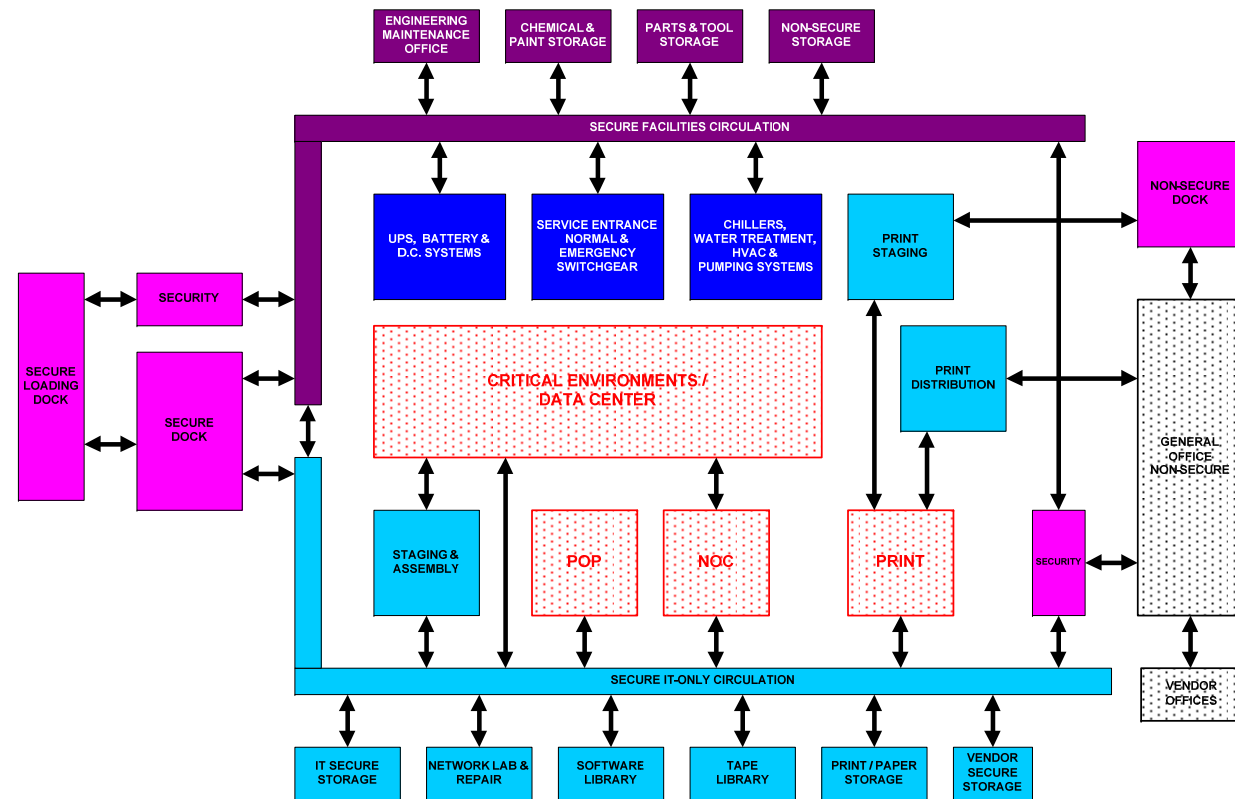
- Space, Power & Cooling Capacities
- Power & Cooling Topologies
- DC support space adjacencies like:
 - *Operations Centre*
 - *Loading dock*
 - *Storage/Staging*



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Space Adjacencies

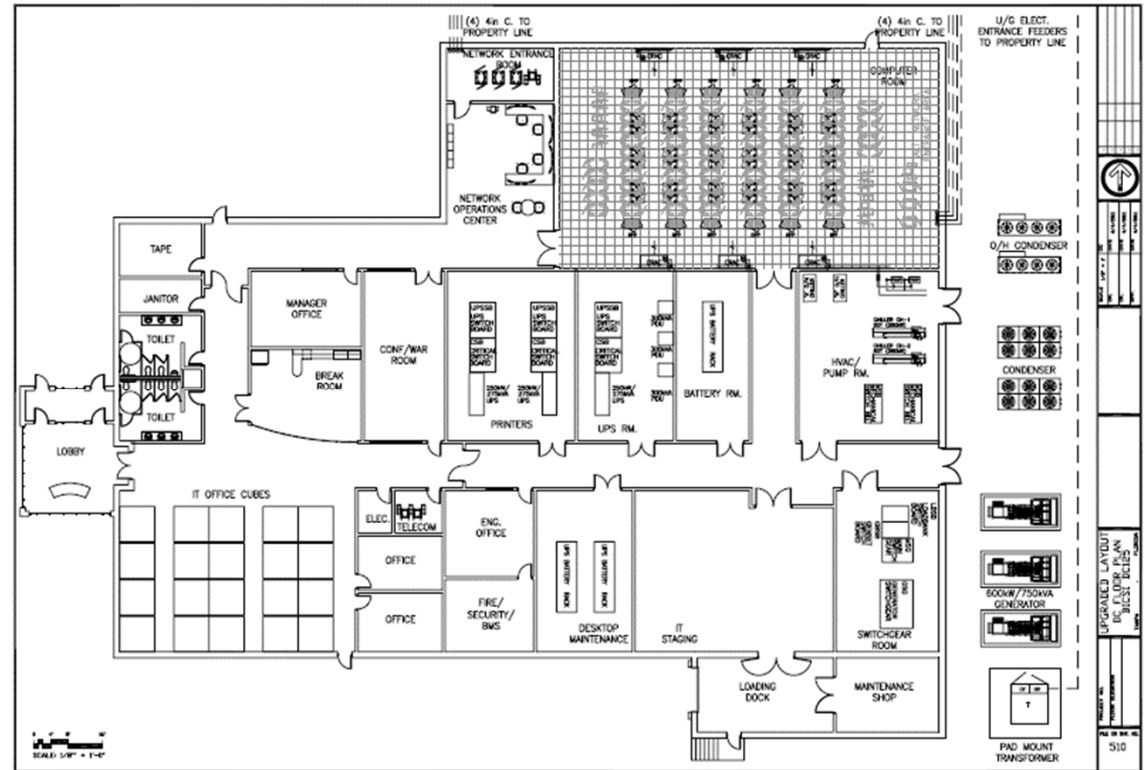
Flow of High Value Equipment and Staff



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Architectural

- Design Concepts
 - Efficiency
 - Access Paths
- Fire Rated Materials
- Building Elements
 - Walls, Doors
 - Floor
 - Ceiling, Roof



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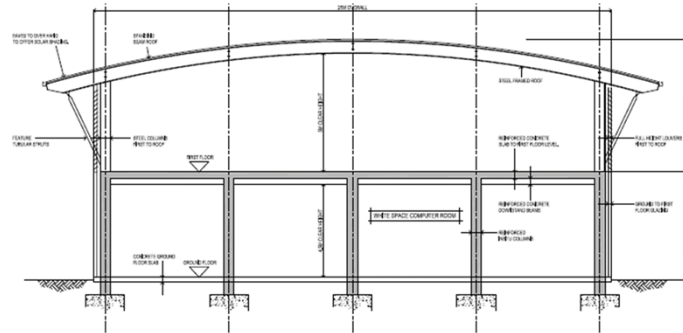
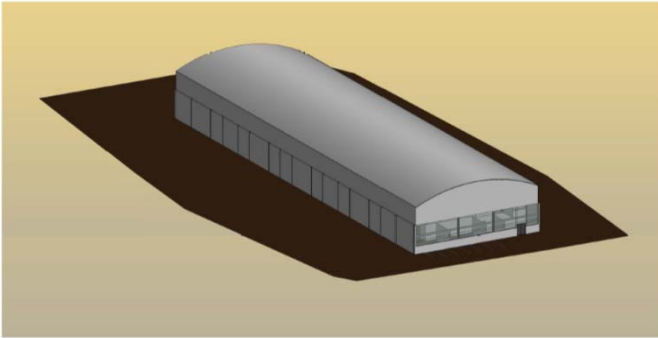
Structural

- Wind resistance
- Floor loading
- Ceiling hanging loads
- Seismic considerations

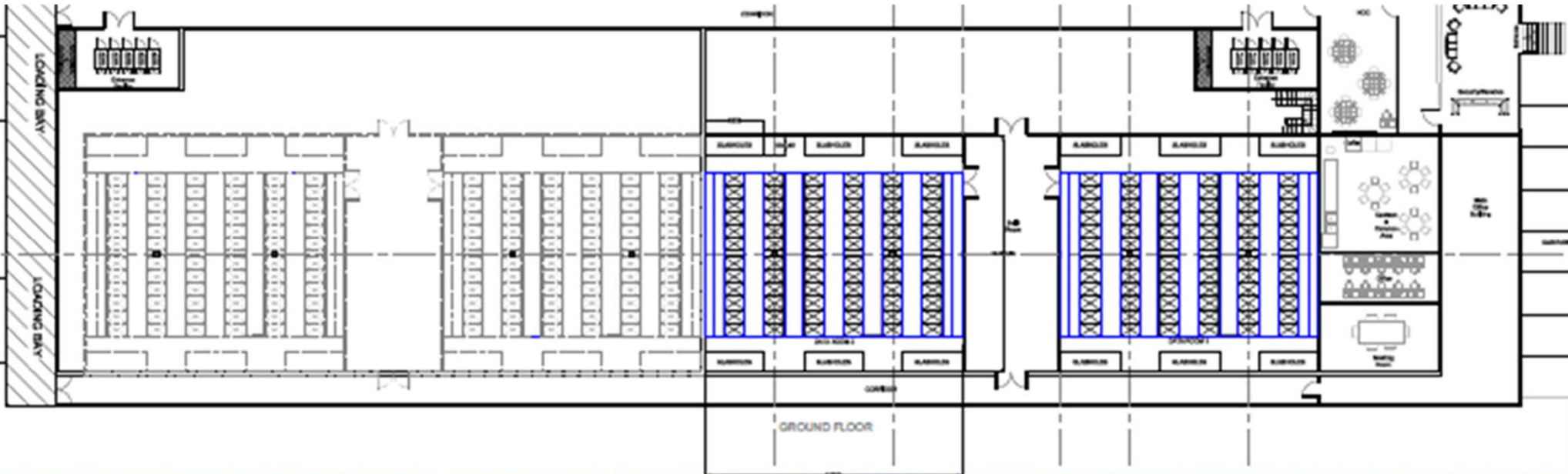


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Building and Construction

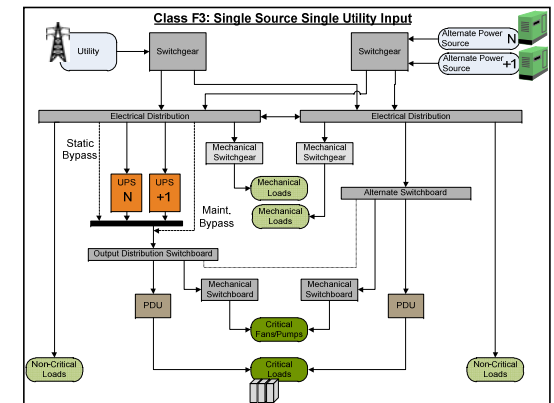
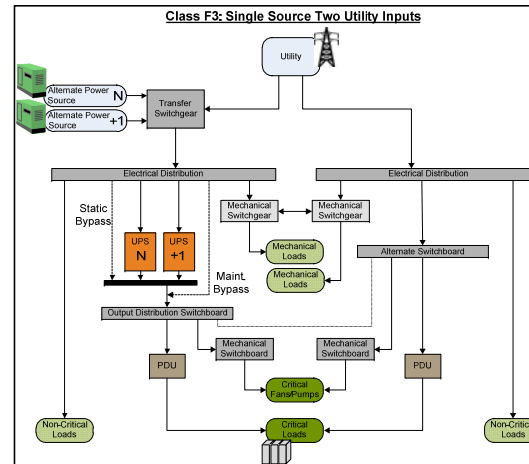


TYPICAL SECTION THROUGH PROPOSED DATA CENTRE



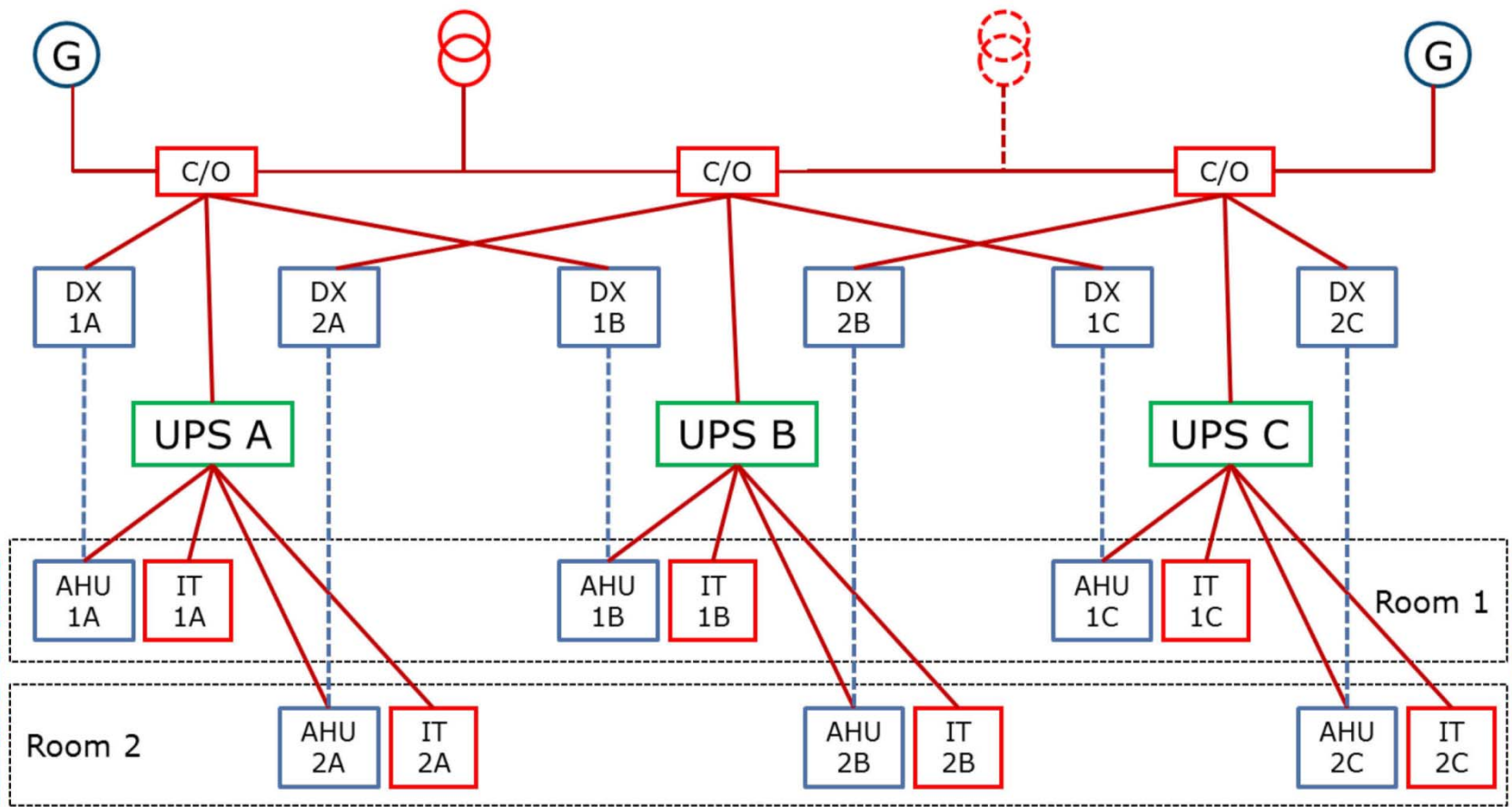
Electrical

- Classes of DC's
 - Introduces F0 concept
 - Performance based
- Backup Power
- UPS
- Distribution
- Power Monitoring



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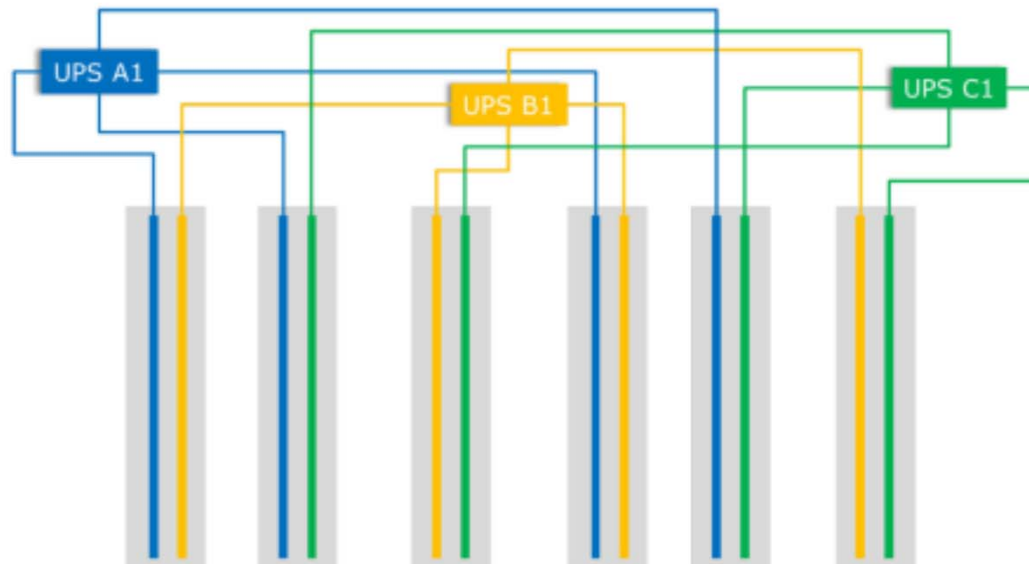
Main Power Strategy





Power Distribution

Power supplies to cabinets from bus bars from alternate UPS's



Item	Total load	UPS A	UPS B	UPS C
Computer room IT load	640 kVA	427 kVA	427 kVA	427 kVA
Entrance facilities	56 kVA	28 kVA	42 kVA	28 kVA
Tape store	11 kVA	11 kVA	0 kVA	11 kVA
Control room	11 kVA	11 kVA	11 kVA	0 kVA
Offices and crisis room	7 kVA	0 kVA	7 kVA	7 kVA
Comms room	9 kVA	9 kVA	0 kVA	9 kVA
Computer room cooling fans	120 kVA	60 kVA	60 kVA	60 kVA
Total	853 kVA	546 kVA	546 kVA	541 kVA

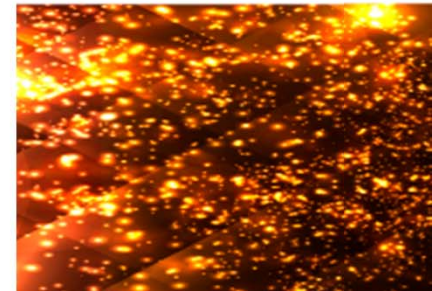
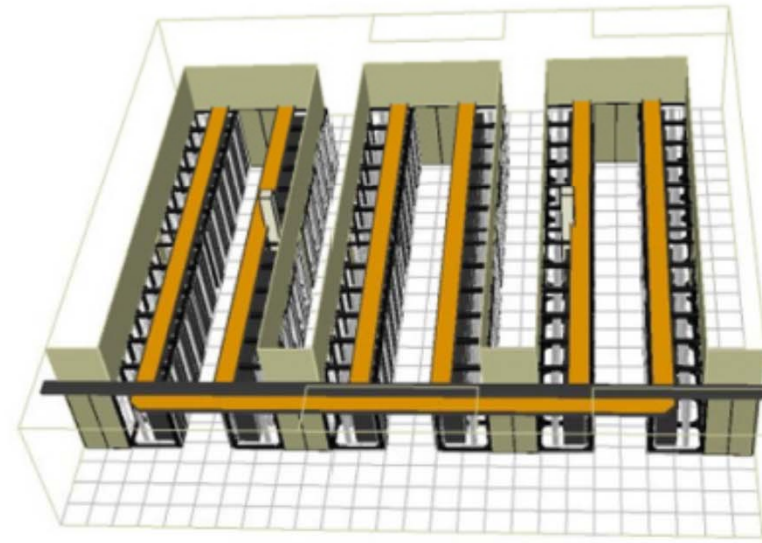
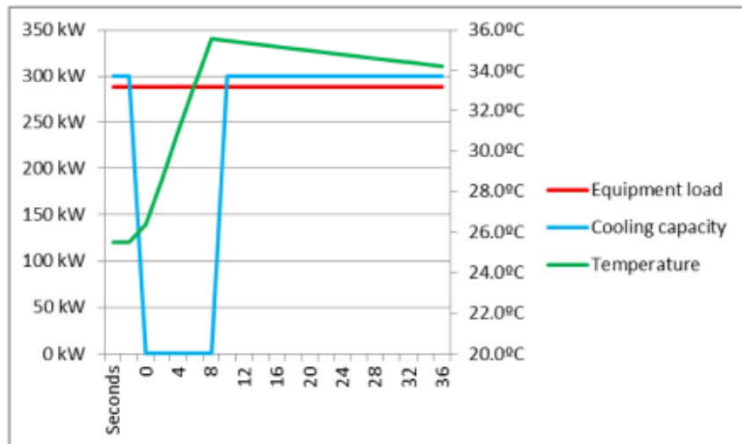
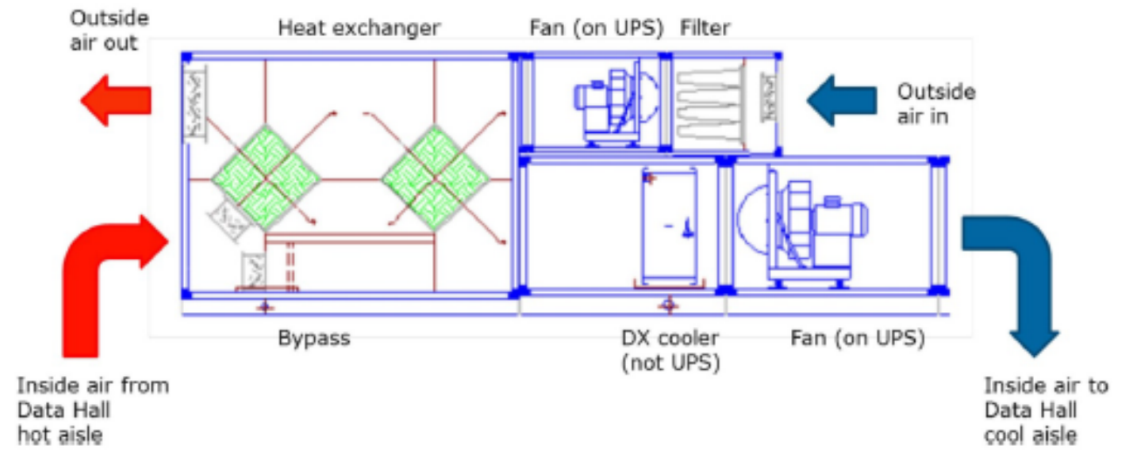
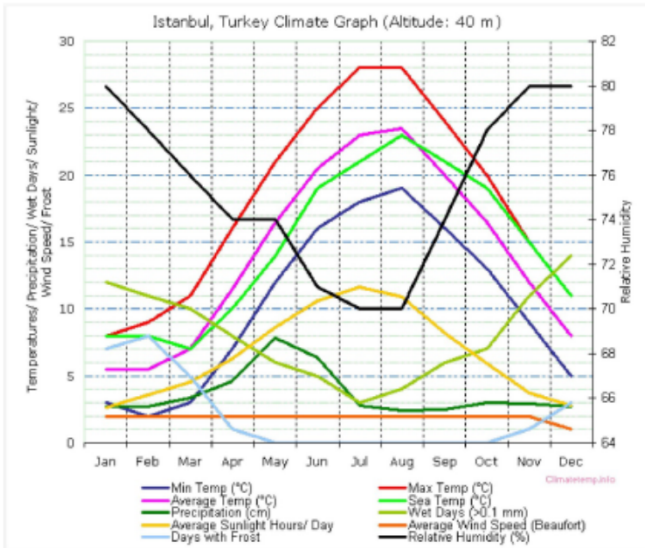
Mechanical

- Environmental Conditions
- Thermal Management
 - Equipment & Spaces
 - Hot / Cold Aisles
 - Supplemental Cooling
- Mechanical Solutions
 - CRAC / Chiller
 - In-Row / Above Row
 - Containment Systems



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Cooling Strategy



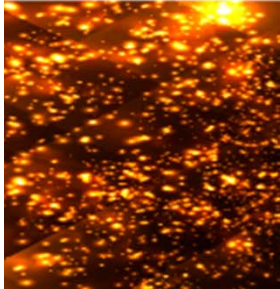
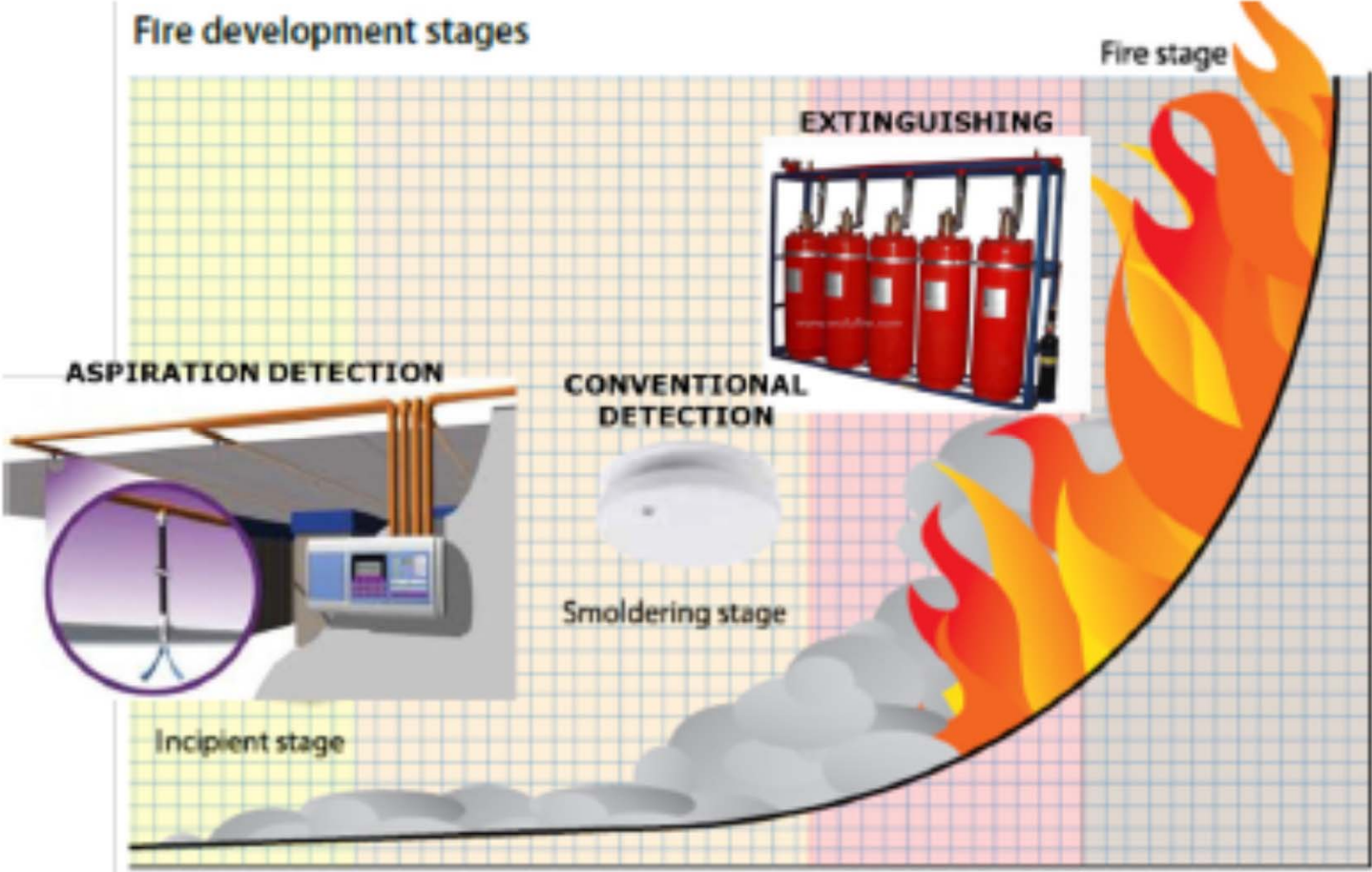
Fire Protection

- Design Elements
 - Construction materials
 - Equipment space needs
- Fire Detection
- Fire Suppression
- Early Warning Systems



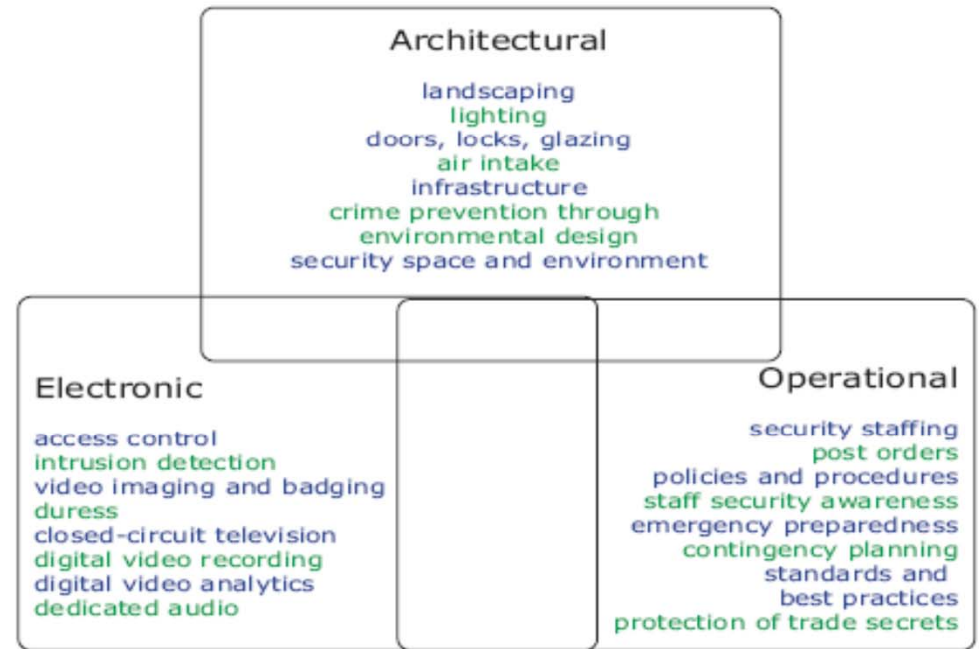
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Fire Growth



Security

- Risk & Threat Assessment
- Surveillance & Alarms
- Access Control
- Operations



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Building Automation Systems

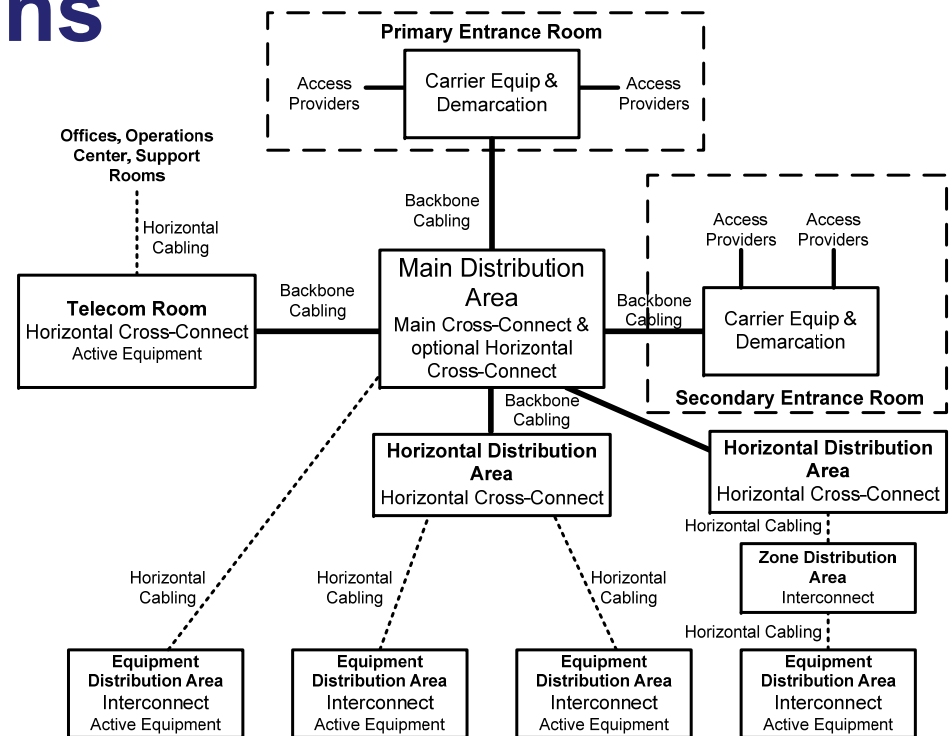
- Focuses on structured solutions
- Applicable to:
 - HVAC and environment controls
 - Access controls
 - Building management
 - Cameras and surveillance
 - Lighting



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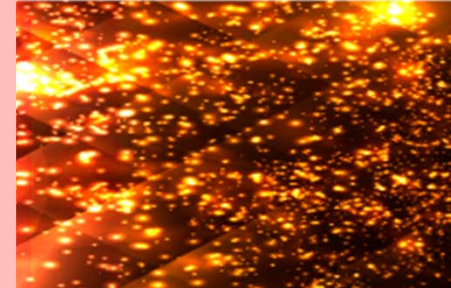
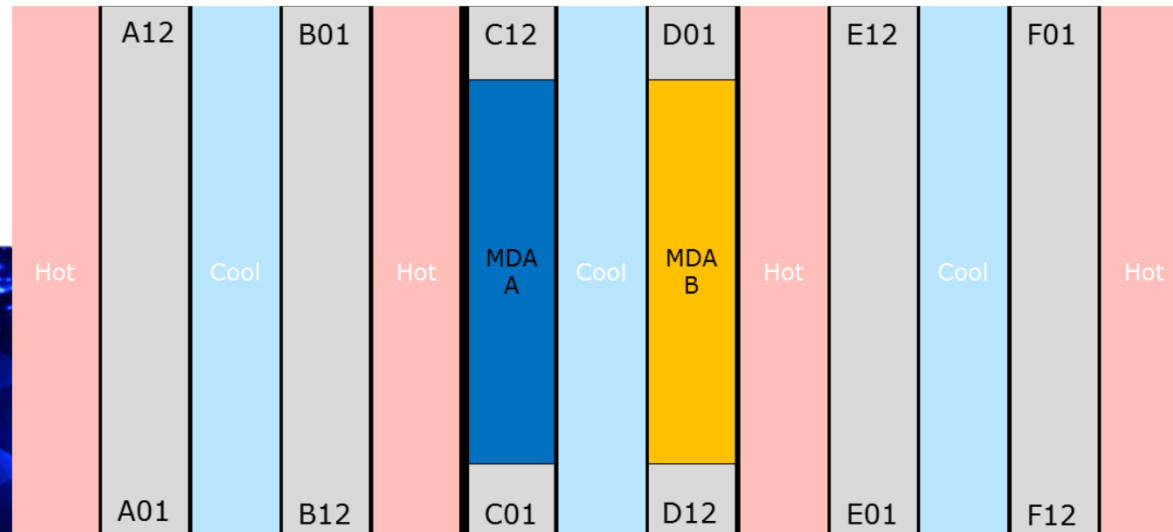
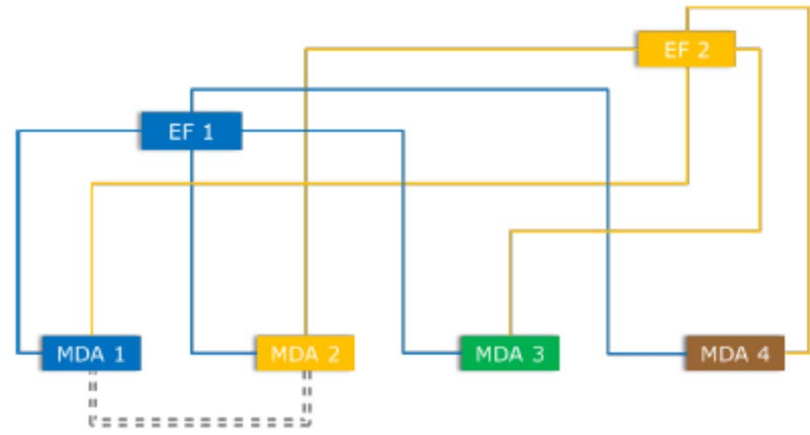
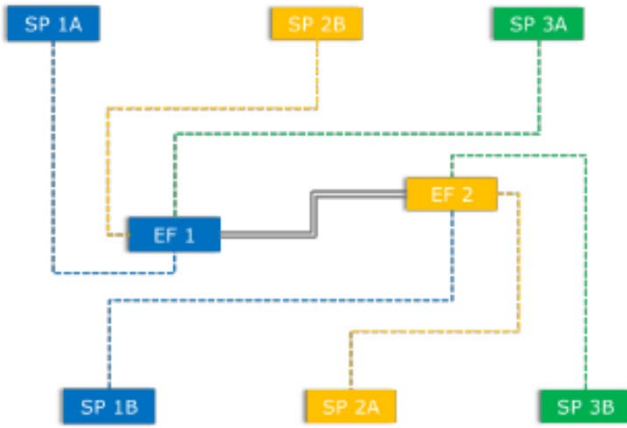
Telecommunications

- Infrastructure & Redundancy
- Pathways & Spaces
- Cabling Media
- Cabinets & Racks
- Administration



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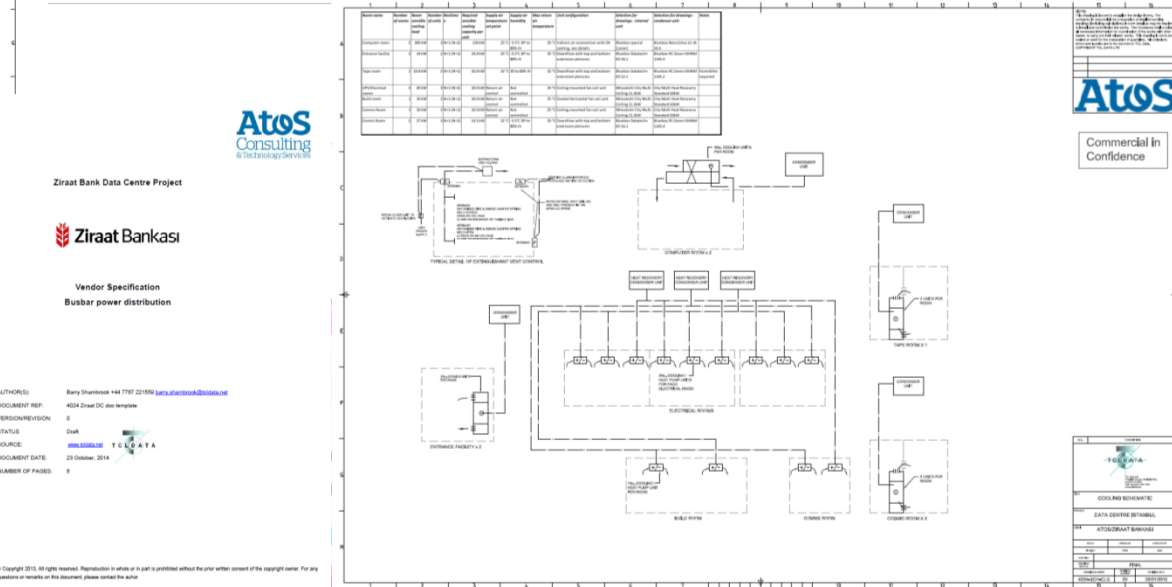
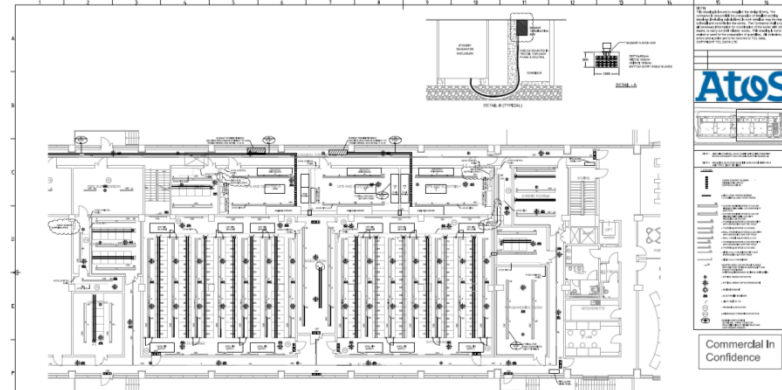
Network Design Concept



And then the detail design!



Drawing/document register and record of issues										
Client	Atos/Ziraat Bankasi				Issue date					
Project name	Data Centre Istanbul				13/01/2015	19/01/2015	30/01/2015	12/02/2015	13/02/2015	19/02/2015
Appointment number/prefix	4024				20/02/2015	23/02/2015				
Drawing/ document ref	Description	Revision/version								
G-SW-CC	Ground floor south west cable containment	2	3	4	6	7				
G-NE-CC	Ground floor north east cable containment	2	3	4	6	7				
G-ME	Ground floor mechanical and electrical equipment layout	2	3	4	6	7	8			
G-ITS&SEC	Ground floor IT and security	2	3	4	6	7	8			
G-SW-FALP	Ground Floor outh west fire alarm, lighting and power	2	3	4	5	6	7			
G-NE-FALP	Ground floor north east fire alarm, lighting and power	2	3	4	5	6	7			
O1-SW-CC	First floor south west cable containment	2	3	4	6					
O1-NE-CC	First floor north east cable containment	2	3	4	6	7				
O1-ME	First floor mechanical and electrical equipment layout	2	3	4	6	7				
O1-ITS&SEC	First floor IT and security	2	3	4						
O1-SW-FALP	First floor outh west fire alarm, lighting and power	2	3	4	5	6				
O1-NE-FALP	Ground floor north east fire alarm, lighting and power	2	3	4	5	6				
O1-PEN	Slab Penetrations	1	2	4	5	6	3			
O1-SW-WW	Walkway layout and details	1	2							
G-EXT	External Services Equipment	2	3	4	5	6	7			
CLG	Cooling Schematic	2	3							
SCH-LVE	Low voltage electrical schematic	3	4	6	7					
SCH-MVE	Medium voltage electrical schematic				3					
SCH-EG	Earthing and grounding schematic				3					
SCH-FA	Fire detection, alarm and extinguishing schematic	3	4							
DET-SEIS	Seismic protection details									
SP-SOW	Specification and scope of work									
	Distribution Board Diagrams 290115		B	C						
	Cable Calculation Report 290115		B	C						
	Cable Schedule 290115		B	C						
	Distribution Board Circuit Diagrams 280115		B	C						
	Electrical Model Issue B		B	C						
	Lighting Calculations Corridors		A							
	Lighting Calculations		A							
	Load Summary 290115		B	C						



Ziraat Bank Data Centre Project
Ziraat Bankası
 Vendor Specification
 Busbar power distribution
 AUTHOR: Barry Swainbank +44 (0)1753 221550 barry.swainbank@atos.com
 DOCUMENT REF: 4024 Data DC doc template
 VERSION/REVISION: 0
 STATUS: Draft
 SOURCE: **ATOS**
 DOCUMENT DATE: 23 October 2014
 NUMBER OF PAGES: 9

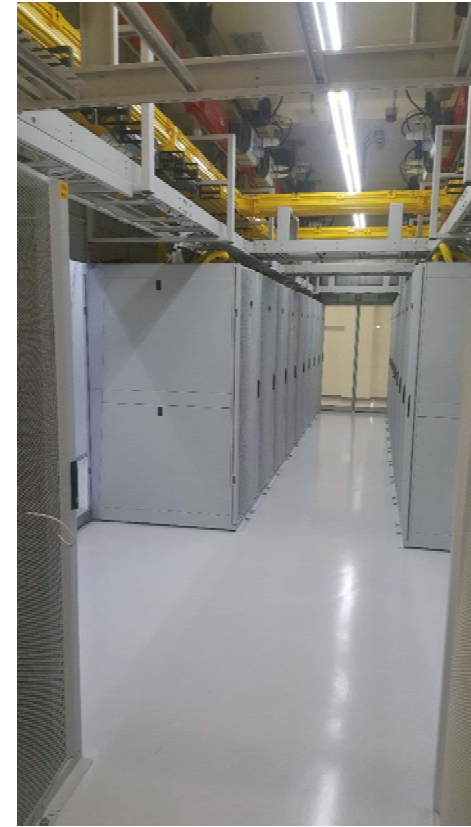
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Results



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