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WHY DATA CENTER DESIGN & CONSULTANCY PROJECTS NEED AN ICT-LED DESIGN BASIS

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A governance, design-basis and delivery argument for ICT-led data center programs, with energy, sustainability and architecture as critical enabling disciplines

Conceptual camps topology illustrating dual carrier entries, modular white-space blocks, and future command center provisions.

Executive Summary

A data center is not primarily a building, a power plant, or a sustainability asset. It is a digital production facility whose purpose is to process, store, protect, transmit and operate mission-critical digital workloads. For that reason, the governing design basis must start with ICT: workload demand, availability class, network topology, data sovereignty, cybersecurity, latency, operational continuity, scalability and commissioning logic.

Energy, sustainability and building architecture are indispensable to data center performance. Their role is to translate the ICT mission into resilient power, environmental control, efficient resource performance and a secure architectural envelope. When these disciplines lead without an ICT-controlled design basis, projects risk optimized buildings that cannot support the required IT density, route diversity, telecommunications demarcation, operational model, integrated systems testing or future AI/HPC growth.

The objective is not ICT dominance, but ICT-led integration. In this model, ICT establishes the design basis, aligns the interfaces between disciplines, and maintains a consistent technical baseline, while every discipline remains accountable for the accuracy, compliance, and quality of its own scope.

The delivery principle is therefore simple: the ICT design basis should govern systems integration, while MEP, energy, sustainability, architecture, security, civil and cost disciplines remain fully accountable for engineering their domains against that basis.

Core thesis

- **ICT defines the business mission:** what workloads, tenants, cloud/interconnection services, latency targets, availability levels and operating model the facility must support.
- **ICT defines the topology:** carrier entry, meet-me rooms, MDA/HDA/ZDA hierarchy, structured cabling, network fabric, route diversity, security zoning and operational monitoring.
- **ICT defines downstream engineering loads:** rack density, white-space growth, power path resilience, cooling class, cable pathway capacities, floor loading, fire compartments and testing scripts.
- **ICT leads the integration risk:** data centers fail as integrated systems, not as isolated architectural, electrical or sustainability calculations.

Conceptual illustration showing how an ICT-led design basis aligns engineering decisions, coordination, and assurance across the data center project lifecycle.

Standards-Based Basis for ICT-Led Integration

The strongest standards signal is that modern data center frameworks are multidisciplinary but anchored in telecommunications, availability, operational and digital infrastructure performance. TIA describes ANSI/TIA-942 as a globally adopted telecommunications infrastructure standard for data centers that specifies minimum requirements and covers site location, architectural, electrical, mechanical, fire safety, telecommunications, security and related requirements. EN 50600 is explicitly a multi-part data center facilities and infrastructure framework covering general concepts, building construction, power distribution, environmental control, telecommunications cabling, security, management and KPIs. Uptime Institute Tier Standard: Topology differentiates site infrastructure topology by redundancy and distribution paths, which means design certification is fundamentally about integrated topology and maintainability, not standalone discipline excellence.

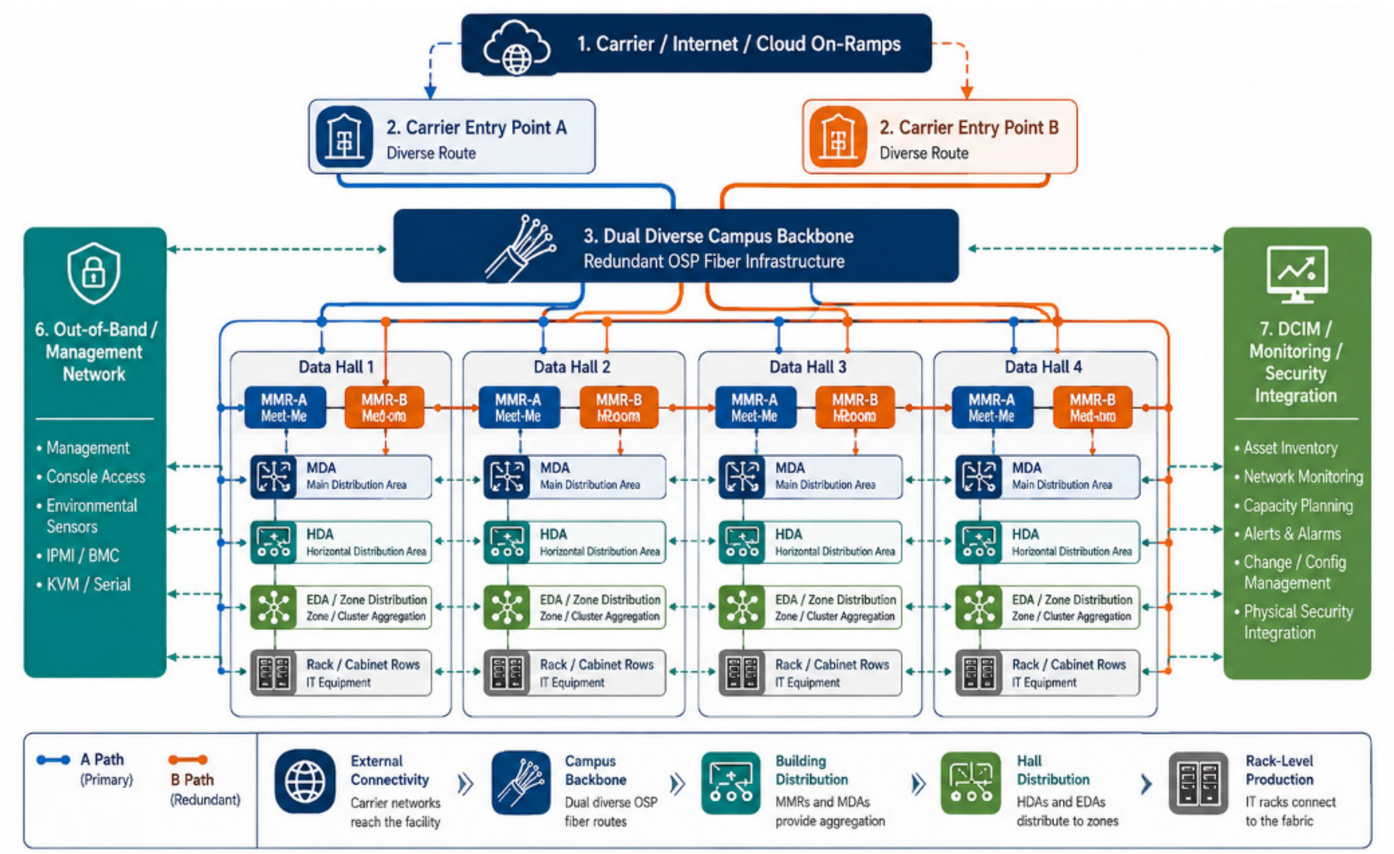
Implication: these standards do not support a single-discipline silo. They support an integrated delivery model in which the digital mission, topology, resiliency and operational behavior control all enabling engineering disciplines.

Why Data Center Design Should Start with the ICT Mission

2.1 Data centers are digital production systems

The architectural form, energy system and sustainability targets are essential to performance, but they do not define the service output.

The service output is defined by the ICT mission; therefore, the design basis should be owned through an ICT-led integration process.



Conceptual illustration showing how carrier connectivity, backbone cabling, meet-me rooms. distribution areas. and rack-level networks form the digital production fabric of the facility.

2.2 Energy is a derived requirement, not the primary mission

Energy systems determine whether the ICT mission can operate reliably and efficiently. However, the required power topology is derived from ICT workload assumptions: critical IT load, kW per rack, redundancy level, battery autonomy, utility diversity, planned maintenance philosophy, black-start approach, expansion modules and expected tenant load profiles. If the energy strategy is developed before the ICT service model is fixed, the project may optimize grid connection, generation or energy transition narratives before confirming the IT load, redundancy, phasing and tenant requirements that determine the electrical architecture.

Figure 1. ICT-led data center campus topology with dual carrier entries, modular white-space blocks, and campus command center provisions.

Figure 2. The ICT design basis drives downstream engineering and project governance.

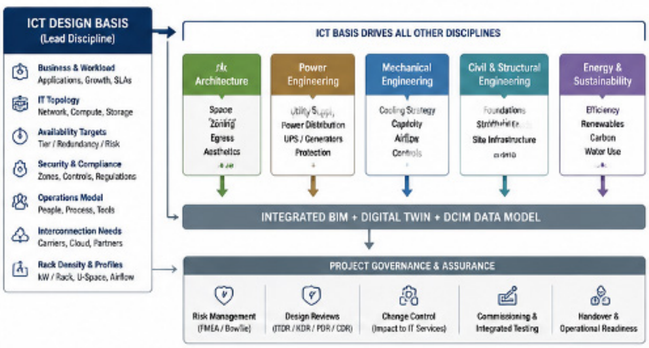


Figure 3. Digital production fabric: the network and structured cabling hierarchy defines the technical anatomy of the facility.

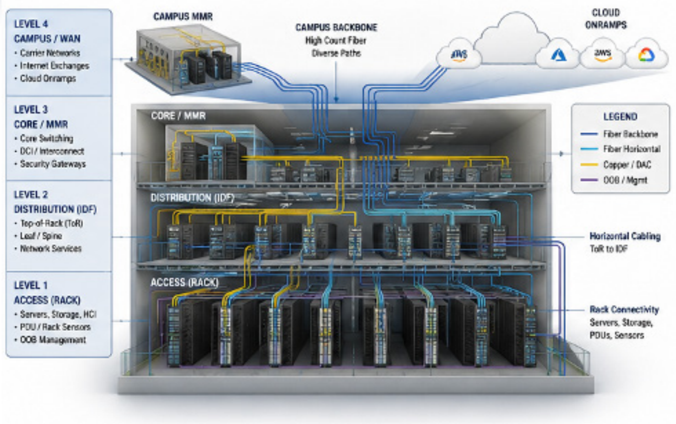
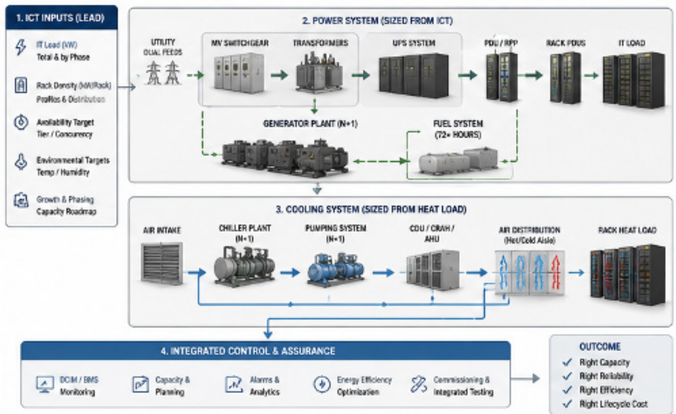


Figure 4. Power and cooling systems must be sized and sequenced from ICT load, rack density and availability requirements.



Sustainability KPIs optimize the ICT mission; they do not replace it.

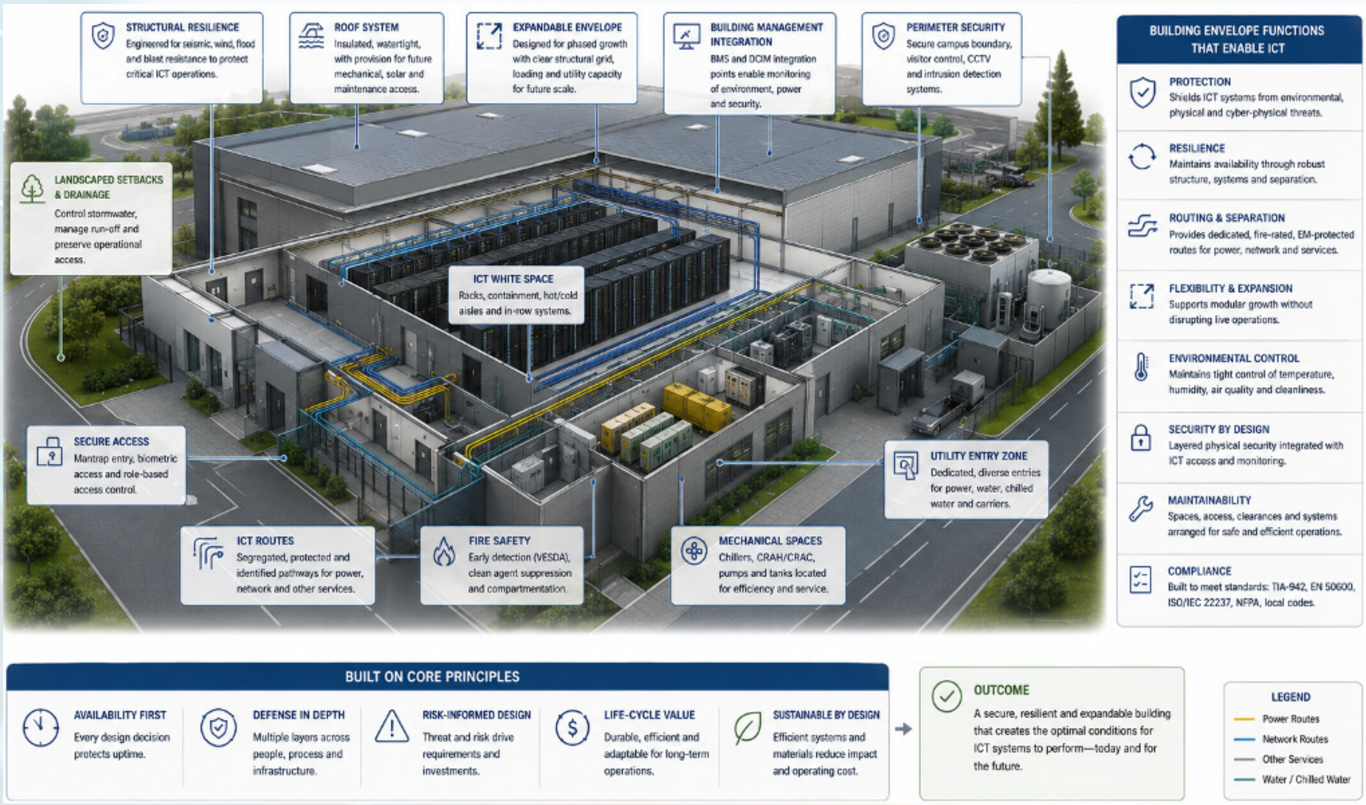
2.3 Sustainability is a performance outcome and constraint

Sustainability is essential, particularly for hyperscale, AI and high-density data center campuses. However, sustainability metrics such as PUE, WUE, CUE, REF and heat reuse are optimization outcomes applied to a defined ICT workload. A low-carbon facility that cannot meet latency, redundancy, interconnection, security or computational density requirements is not a successful data center. Sustainability must therefore be embedded into the ICT-led design basis rather than treated as a competing lead discipline.

Power and cooling systems must be sized and sequenced from ICT load, rack density and availability requirements.

2.4 Architecture is the protective and expandable shell

Architecture shapes the building, access, massing, fire strategy, circulation, envelope and human experience. In a data center, however, the critical planning grid is driven by white space, rack rows, hot/cold aisle or liquid-cooling strategy, MMR/MDA/HDA rooms, security layers, equipment replacement paths, loading docks, plant yards, cable risers and maintainability. If architectural planning advances before the ICT basis is fixed, the project may produce a strong physical concept that later requires costly redesign for clear heights, floor loading, cable diversity, secure routes, MMR adjacency, commissioning isolation and future capacity blocks.



The building is the secure, resilient and expandable envelope around ICT white space and routes.

What the ICT Lead Discipline Actually Owns

ICT leadership is not about replacing MEP, architecture, sustainability or security expertise. It is about owning the integrated design basis that translates the owner's business mission into coordinated technical requirements.

ICT Lead Responsibility	Design Impact
Demand and business model	Workload types, tenant strategy, AI/HPC/enterprise/colocation mix, service catalogue, latency and interconnection needs.
Availability and topology	Target availability class or tier logic, concurrent maintainability, fault tolerance, single points of failure, route diversity and compartmentalization.
Telecom and network architecture	Carrier entries, meet-me rooms, MMR diversity, MDA/HDA/ZDA layout, structured cabling, spine-leaf fabric, cloud/IX connectivity and capacity growth.
Security and cyber-physical zoning	Security zones, access control philosophy, CCTV/VMS integration, SOC/NOC/CCC relationships, OT/IT segmentation and cyber governance.
Power and cooling design inputs	Critical load blocks, rack density, cooling class, high-density/liquid-cooling readiness, power path mapping and phased expansion assumptions.
Operational readiness	DCIM/BMS/EPMS integration, alarm model, maintenance isolation, integrated systems testing, failure scenarios, handover and SOP requirements.
Certification alignment	TIA-942, EN 50600/ISO-IEC 22237 and Uptime Tier interpretation into design deliverables and evidence packs.

ICT-Led Governance Model

The correct project model is not ICT dominance. It is ICT-accountable integration: a model where ICT defines the design basis, coordinates multidisciplinary interfaces, and controls the technical configuration baseline, while each discipline remains accountable for its own calculations, codes, deliverables and professional sign-off.

ICT-led governance clarifies accountability while preserving discipline authority.

Recommended RACI principle

Workstream	ICT	Electrical/ Energy	Mechanical/ Cooling	Architecture/ Civil	Operations/ Security
Owner business requirements	**A/R**	C	C	C	C
ICT design basis and capacity model	**A/R**	C	C	C	C
Carrier entry, MMR, MDA/HDA/ZDA	**A/R**	C	C	C	C
Electrical topology and protection	C	**A/R**	C	C	C
Cooling topology and environmental class	C	C	**A/R**	C	C
Building shell, massing and code compliance	C	C	C	**A/R**	C
PUE/WUE/CUE and energy strategy	C	**A/R**	**A/R**	C	C
SOC/NOC/CCC, DCIM and BMS integration	**A/R**	C	C	C	**A/R**
Integrated Systems Testing scripts	**A/R**	**A/R**	**A/R**	C	**A/R**

Risks When Data Center Projects Are Not ICT-Led

- Late redesign of power rooms, cooling plant, cable routes, risers, telecom rooms and floor heights after the IT load and tenant model become clearer.
- Carrier diversity compromised because building or utility planning fixed entrances before telecom route diversity and meet-me room strategy were established.
- White-space inefficiency because architectural grids and columns do not match rack, containment, liquid-cooling or equipment replacement requirements.
- Energy strategy misalignment because sustainability narratives are developed without realistic rack density, load ramp-up, redundancy and workload utilization assumptions.
- Certification gaps because design evidence is fragmented across disciplines rather than controlled through a single topology and availability matrix.
- Commissioning gaps because MEP tests prove component performance but not end-to-end ICT service continuity, failover, alarm propagation and operational recovery.
- Operational handover weakness because NOC/SOC/DCIM/BMS/EPMS interfaces and SOPs are treated as post-design add-ons rather than primary design drivers.

Recommended ICT-Led Delivery Sequence

ICT-led delivery sequence from workload demand to integrated systems testing and operational readiness.

1. **Establish the owner digital mission:** workload profile, tenants, latency, security, data sovereignty, resilience, growth and commercial model.
2. **Define the ICT design basis:** critical IT load blocks, rack density, topology, carrier strategy, security zones, operations model and certification target.
3. **Freeze planning reservations:** site entries, MMR locations, white-space modules, plant adjacencies, corridors, risers, loading paths, command center and future expansion zones.
4. **Engineer enabling systems:** power, cooling, building, fire, security, sustainability and civil infrastructure against the ICT-controlled basis.
5. **Validate integration:** design reviews, BIM coordination, single-points-of-failure analysis, failure mode mapping, operations scenarios and integrated systems testing.
6. **Handover for operation:** DCIM/BMS/EPMS/SOC/NOC integration, SOPs, training, maintenance isolation procedures, capacity

ICT-Led Consultancy Scope for Data Center Programs

Consultancy Stage	ICT-Led Deliverables
Strategic advisory	Business case, demand forecast, market positioning, owner requirements, cloud/AI/colocation strategy, certification pathway.
Concept design	Site and campus topology, carrier-neutral model, ICT master plan, availability option studies, spatial reservations, command center concept.
Design development	MMR/MDA/HDA/ZDA design, structured cabling, network architecture, security/OT integration, ICT room layouts, integration matrices.
Detailed design support	Design basis reports, specifications, drawings, BOQ inputs, interface control documents, discipline review and value engineering.
Procurement support	RFP packages, technical evaluation criteria, vendor-neutral specifications, bidder clarification support and compliance matrices.
Construction and commissioning	Shop drawing review, FAT/SAT/IST planning, witness testing, defect tracking, as-built validation and operational readiness.
Operations enablement	DCIM/BMS/EPMS integration strategy, NOC/SOC/CCC workflows, SOPs, capacity dashboards, KPI governance and continuous improvement.

Conclusion

Data center projects should be governed by an ICT-led design basis because the facility exists to deliver digital capacity, resilience and operational continuity.

Energy, sustainability and building architecture are fundamental to achieving that mission, but they should be developed around a clear ICT basis that defines workload, topology, availability, security, interconnection and operations.

ABOUT THE WRITER

Dr. Houssam al Masri, Smart City Design Lead with 30+ years of experience, has managed broadband communication networks and smart city infrastructure projects. He was the Smart City Design Senior Project Manager at Khatib & Alami and led the master planning of the Jeddah Central Development Smart City project in Saudi Arabia.

Houssam managed telecommunication projects such as Smart Cities and Solutions, Smart Buildings and Smart Homes, Fiber to Homes, and Broadband Access in the MENA region. As a senior project manager for Alpinada Telematics, he increased market share by winning and completing various projects in Saudi Arabia and the UAE. Houssam holds a PhD in Computer Engineering from MIT and has been Chairman of the Smart City Opt. and App Committee in FiberConnect Council MENA since 2019. He is a member of the ESRI GIS community professionals, IEEE IT Society, and the Green Buildings Association. Houssam is also a member of the ISO Smart City Technical Committee.

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ABOUT THE COMPANY

Khatib & Alami (K&A) is an international multidisciplinary consultancy comprising architects, engineers, planners, and other specialists. We have vast experience working at the forefront of fast-changing urban environments, with a deep understanding of delivering complex and significant projects within agreed timeframes and budgets.

K&A was founded more than 50 years ago by two university professors who shared the same vision: to create an organization through which talent could thrive, built on the foundations of professional excellence, integrity, and social responsibility. While today, K&A employs more than 6,000 experts in more than 30 international offices, our people are the custodians of these values. We are driven by curiosity, with a firm belief in the importance of delivering exceptional quality to make a positive and sustainable contribution to the communities in which we work.