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TECHNICAL BRIEFING

DO INDUSTRY STANDARDS HOLD BACK DATA CENTRE INNOVATION?

SCOPE

This brief provides an overview of industry standards relevant to data centre design and discusses their importance and impact on data centre innovation. It argues that although current data centre design, build and operating standards represent a solid foundation, organisations need to go beyond these standards in order to deliver a cost-efficient data centre design.

In reality, enterprises often sacrifice data centre efficiency to follow industry standards to the letter, resulting in significantly higher data centre building and operating costs. By optimising their data centre design beyond the industry standard and incorporating the latest innovations, they can significantly increase their efficiency and still achieve 8*9 (99.999999%) statistical availability.

A study by Interxion shows that for a 1,000 sq m data centre, an optimised data centre design, over and above industry standards, could save €3.3 million in construction and replacement capital expenses and €245,000 per year in energy costs.

DCD INTELLIGENCE AND INTERXION TECHNICAL BRIEF

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TECHNICAL BRIEF SERIES

This is the first in a series of four technical briefs produced by DCD Intelligence in collaboration with Interxion and The METISfiles.

Introduction

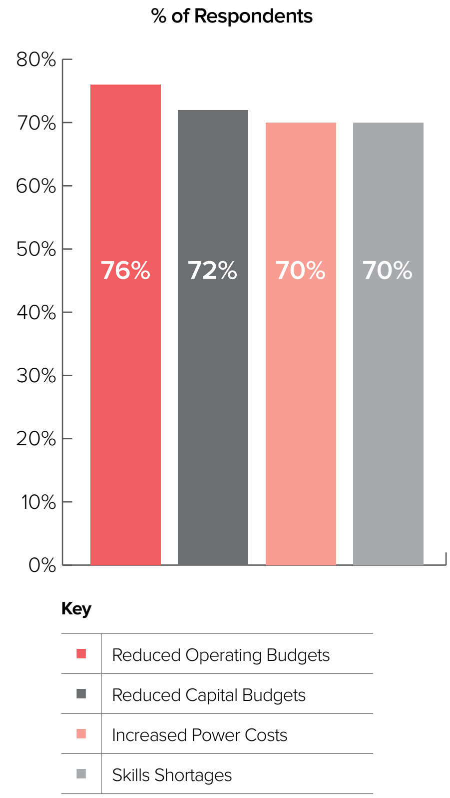
Mergers and acquisitions in the past decade have left many companies with a fragmented IT infrastructure. Many corporate data centres date back to the 00s. Large investments are required to make these facilities future-ready and capable of handling social networking, mobile enterprise, big data analytics and cloud workloads. However, because of the economic crisis, most data centre owners are under pressure to deliver new infrastructure despite decreasing budgets (see Figure 1).

Regulated industries such as banking, insurance and healthcare are under even greater pressure, as they are building Tier IV data centres in order to comply with stringent security, legislative and governance requirements. As a result, significant additional investments in redundant electrical equipment are required, resulting in higher capex and larger monthly energy bills.

Today, it is easy for companies to compare their in-house data centre efficiency with that of web-scale cloud providers, such as Microsoft, Amazon and Google. The business case for building in-house data centres is not helped by the fact that these companies typically operate at as little as one tenth of the cost of comparable in-house data centres.

But one does not have to be a web-scale company to achieve capex and opex benefits from advanced data centre design and innovation, while still achieving 8*9 data centre infrastructure availability. Enterprises can benefit from the use of data centres, provided by colocation providers that comply with most Tier IV demands whilst achieving near-hyperscale efficiencies. Colocation providers typically design and build multiple large-scale data centres each year, whereas a typical enterprise may build one every 8-10 years. These specialists use industry standards as a firm basis for data centre design, build and operation, but also incorporate the latest innovations to increase efficiencies further.

Figure 1: Top 4 Data Centre Owner and Operator Concerns Worldwide



Source: DCD Intelligence, 2014 Census.

What are Industry Standards and Why are they Important?

The European Telecommunications Standards Institute (ETSI) defines a standard as follows:

A standard is a document, established by consensus and approved by a recognised body that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context.

The purpose of standards is to ensure that products and services are safe, reliable and of good quality. Standards are strategic tools that reduce costs by minimising waste and errors and that increase productivity. They are frequently used by regulators and legislators to protect user and business interests and to support international policies.

Standards come in different forms: De jure standards are established by formal standard bodies; de facto standards are decided by market competition. They can be set by formal standard bodies or industry ▶

consortia. They apply globally, regionally, or locally. In Europe, European Standards (EN) are documents that have been ratified by one of the three European standards organisations: CEN, CENELEC or ETSI.

There is a difference between standards and regulations. Adhering to standards is a voluntary decision to follow recommendations that have been established by a consensus of interested parties. Complying with regulations is a mandatory requirement to follow rules that have been enforced by governments and public regulatory bodies.

Data Centre Industry Standards

In the data centre world, standards provide a methodology for comparing the capabilities of one data centre with another. Data centres differ from one another in the levels of redundancy, fault tolerance, operational procedures in place, efficiency and other factors. In the absence of standards, it would be hard to compare one data centre with another. Figure 2 provides an overview of relevant holistic and single-area-focused data centre standards and how they relate.

The Uptime Institute (TUI) pioneered the setting of data centre design, build and operate standards with the publishing of the white paper "Tier Classifications Define Site Infrastructure Performance" in 1995. Before that, standards for different IT areas did exist but neglected to fully address the connection between data centre facility uptime and the delivery of services by the business. Alongside TUI, ANSI/TIA 942, EN 50600 (in development), and ANSI/BICSI 002-2014 also provide standard references for the planning, building and operating of data centres.

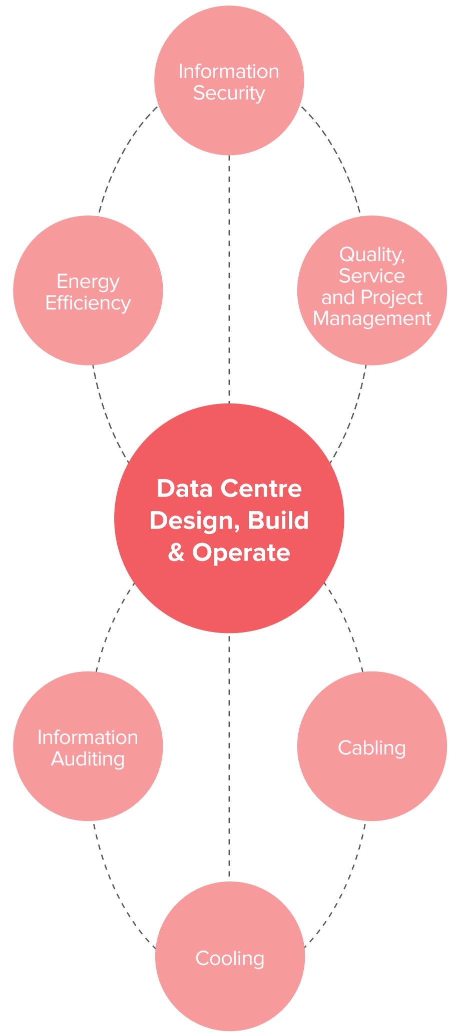
Table 1 categorises the most important IT and data centre standards by domain and lists their primary purpose.

Not all of these standards are affected equally by the rapid advances in IT and data centre technologies. Information management and information auditing standards, for instance, refer to standard processes that remain relevant even if the underlying technology and design of a data centre is changing. Within data centre design, build and operational standards, however, there is a need to keep up with the advances in technology and design that web-scale, cloud and colocation providers are constantly driving forward through innovation.

One example of how web-scale companies innovate data centre design is the Open Compute Project. This project was started by a small team of Facebook engineers that designed a data centre from the ground up using custom-designed servers, power supplies, server racks and battery backup systems. As a result, the data centre uses 38% less energy to do the same work as Facebook's existing facilities, while costing 24% less. Everyone has full access to these specifications, and the Open Compute Project is about sharing the technology with the community to make advances that Facebook would not have discovered if they had kept it secret.

Another spinoff from the Open Compute Project that is having an impact on data centre design was the introduction of IT containers. Docker containers observe a CPU peak – plotted on the same scale – of 25%, versus virtual machines peaking at 70%. With this knowledge, data centre overcapacity dealing with inrush and peak capacity can be decreased.

Figure 2: Data Centre Standards: Holistic and Single Area Focused



Source: DCD Intelligence.

Table 1: Relevant IT and Data Centre Standards and their Purpose

Area	Standards	Purpose
Information security	ISO 27001/27002/27031	Protection of data and information; high availability of IT services
	PCI DSS v3.0	Enhancement of payment-card data security
Quality, service and project management	ISO/IEC 20000; ITIL	Improve efficiency and achieve predictable service levels
	ISO 22301; ISO/PAS 22399; NFPA 1600	Prepare for, respond to and recover from disruptive events when they arise
	ISO 9001	Consistent provisioning of quality goods and services
	PRINCE2	Method to effectively, consistently, and verifiably organise, manage and control projects
Data centre	ANSI/TIA 942	Standard reference for planning and building of data centres
	EN 50600	European version of ANSI/TIA 942; under development
	TUI	Standard reference for operational sustainability and long-term data centre performance
	ANSI/BICSI 002-2014	Standard reference of common data centre terminology and design practice
Cabling	EN 50173-5; EN 50174-1/2; EN 50346; EN 50310	Providing specifications for balanced and fibre-optic cabling in a data centre
Cooling	ASHREA TC 9.9	Provide standards for design, operations, maintenance, and efficient energy usage of modern data centres and technology spaces
Information auditing	SSAE 16/ISAE 3402	Allow public accountants to issue a report on an organisation's system of internal control over financial reporting
Energy efficiency	The Green Grid	Improve IT and data centre resource efficiency
	EU CoC	Reduce data centre energy consumption in a cost-effective manner without hampering the mission-critical function

Source: DCD Intelligence.

Alternatives to Certification

Many organisations use certification by an independent and well-recognised certification institute to prove that their data centres are built and run according to industry standards. Another, equally good way of proving the statistical availability of a data centre is to conduct a Monte Carlo simulation of the design, followed by level 5 commissioning as described in the ASHRAE standards. The advantage of this approach is that it can be executed in-house and on an ongoing basis, whereas certification typically happens once a year and at significant cost.

It is not always feasible for engineering bureaus to carry out this alternative method of design and engineering. In cases where carrying out a Monte Carlo study is still cost prohibitive, a Markov simulation could be used as an alternative to determine the statistical availability of the design. In these cases, a Markov simulation could be used as an alternative to determine the statistical availability of the design.

Large data centre owners building beyond fixed standards prefer the Markov method, as it enables them to innovate and at the same time ensure availability and energy efficiency.

An example of a Tier IV Monte Carlo study, supplied by Interxion, is presented in the next section. To run such a study, in-depth engineering knowledge is required – knowledge of how the generator controllers work, what the grid behaviour is, how the various timers are set and so on.

38%

The proportion of energy saved by the Open Compute Project compared with Facebook's existing facilities.

Standards as a Foundation for Innovation

To achieve business agility and at the same time increase energy efficiency, Interxion is going beyond standard data centre design, build and operate requirements. Whilst recognising the importance of standards and incorporating elements of TUI, TIA, and BICSI, Interxion is constantly incorporating data centre innovations that enable enterprises to run their data centres more efficiently, whilst safeguarding 8*9 statistical availability of the design. For Interxion it is paramount that data centres are designed and built to achieve the most efficient technical design which achieves 8*9 availability. When talking to customers and prospects, Interxion often encounters examples of in-house data centres where standards have been followed to the letter at the expense of design excellence and efficiencies. Sometimes customers are not aware, but often efficiency is willingly sacrificed because industry standards ‘must’ be followed, resulting in significantly higher data centre building and operating costs.

The following are some examples of data centre standards that Interxion has improved upon in their designs.

1. Use of Sprinkler Systems

The current TIA 942 standard recommends pre-action water sprinkler systems:

"5.3.7 Fire protection – The fire protection systems and hand-held fire extinguishers shall comply with NFPA-75. Sprinkler systems in computer rooms should be pre-action systems."

Interxion’s view is that pre-action sprinkler systems are vulnerable to corrosion, because they are repeatedly refilled with air after action. If fire protection based on water is used, a full pipe system would be advised, because pipes are always filled with water and less vulnerable to corrosion. The preferred fire-protection method, however, is gas suppression, which fills rooms more efficiently and provides no damage to IT and systems after action. The only downside is that it is more prone to misfiring.

2. Emergency Power Off

TIA 942 also recommends
Emergency Power Off (EPO) systems at each exit:

"D1 General – EPO systems should be provided as required by National Electrical Code (NEC) Article 645. EPO stations should be located at each exit from each data centre space, and should be provided with protective covers to avoid accidental operation."

"EPO system control power should be supervised by the fire alarm control panel per National Fire Protection Association (NFPA) 75. The power to all electronic equipment should be automatically disconnected upon activation of a gaseous agent total flooding suppression system. Automatic disconnection is recommended, but not required, on sprinkler activation."

Interxion’s view is that a data centre should avoid any EPO system, if allowed by law. The exception should be for data centre equipment and rotating equipment, such as diesel generators. ▶

"Interxion often encounters examples of in-house data centres where standards have been followed to the letter at the expense of design excellence and efficiencies..."

"Often efficiency is willingly sacrificed because industry standards ‘must’ be followed, resulting in significantly higher data centre building and operating costs."

Imagine you are building a US$100 million data centre that does not have a single point of failure but uses sprinkler systems. In this case the sprinkler systems will be your single point of failure. During a fire alarm, power systems will not allow continued operation, to avoid having oxygen sucked through horizontally and thus igniting the fire. As a result, it will take longer for the sprinkler heads to heat up and respond.

With gas suppression, on the other hand, the gas is released by either fast-responding detectors or a double-knock very early smoke detection apparatus (VESDA), which will suck the gas through the IT equipment in order to suppress the starting fire.

3. Use of PVC Coated Cable

TIA 942 also recommends PVC coated cable:

"Under floor power distribution is most commonly accomplished using factory-assembled PVC coated flexible cable assemblies, although in some jurisdictions this may not be permitted and hard conduit may instead be required."

Interxion believes that PVC-coated cables must be banned from IT rooms altogether, as the residue from PVC would damage the IT system during a fire.

4. Alternative Designs for Tier-IV Statistical Availability

An excellent example that demonstrates the impact of data centre innovation that goes beyond the industry standard is the alternative design for Tier-IV statistical availability that Interxion introduced as early as 2000. This example proves that data centre design can save businesses a significant amount of money.

Until 2010 TUI used a single line diagram to show how Tier I, II, III and IV data centres should be built from an electrical perspective. Interxion, being a founding member of the Uptime Institute EMEA, proved through Monte Carlo studies that the same statistical availability can be achieved by using a different design (see graphic below). As a result, TUI changed the Tier Standard in 2010 to a more open approach that outlines the requirements rather than providing a single line diagram.

Assuming a 1,000 sq m data centre designed for 2 KvA/m2 customer load, this alternative design would save €3.3 million in construction and replacement capex, and save €245,000 per year in energy costs.

Conclusions

Companies do not have to be web-scale cloud providers to gain capex and opex benefits from advanced data centre design and still achieve 8*9 statistical availability. In-depth data centre design studies supported by statistical availability studies carried out in Monte Carlo simulation software coupled with ASHRAE level 5 commissioning present a viable alternative to Tier IV certification. If a company is under pressure to deliver new infrastructure despite decreasing budgets, it should challenge the status quo and use data centre industry standards as a firm base to improve and innovate upon design, build and operate requirements. Regulated industries, such as banking, insurance and healthcare, would achieve the same stringent security and governance requirements at a significantly lower cost and with the same reliability.

Table 2: A 2000 Monte Carlo Simulation of the Original Design

Component	Racks 1	Racks 2
No. Failures	2	3
MTBF (yrs)	114155	76103,5
MTTR (hrs)	4,77964	5,07108
AV (%)	99,99999952	99,99999924

Component	Cooling	Gensets A
No. Failures	2	77
MTBF (yrs)	114155	2965,07
MTTR (hrs)	5,67529	5,72399
AV (%)	99,99999943	99,99997796

Component	Gensets B	UPS-A
No. Failures	69	1723
MTBF (yrs)	3308,85	132,507
MTTR (hrs)	5,73348	2,97602
AV (%)	99,99998022	99,99974362

Component	UPS-B
No. Failures	1669
MTBF (yrs)	136,794
MTTR (hrs)	2,93457
AV (%)	99,99975511

Table 3: An Alternative 2000 Design with the same Statistical Availability

Component	Racks 1	Racks 2
No. Failures	41	43
MTBF (yrs)	5568,55	5309,55
MTTR (hrs)	0,43206	0,576087
AV (%)	99,99999911	99,99999876

Component	Gensets	Cooling
No. Failures	77	24
MTBF (yrs)	2965,07	9512,94
MTTR (hrs)	6,04903	0,653932
AV (%)	99,99997671	99,99999922

Component	UPS-A	UPS-B
No. Failures	613820	612185
MTBF (yrs)	0,371249	0,372238
MTTR (hrs)	6,02024	6,02481
AV (%)	99,81522568	99,81557608

Source: Interxion.

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Author Profiles

Pim Bilderbeek, Partner and Principal Analyst, The METISfiles
Pim is leading the METISfiles Elastic Enterprise research theme. The METISfiles is a market research and consulting firm dedicated to solving strategic problems for executives in the digital economy and digital infrastructure industry.

Lex Coors, Chief Datacentre Technology and Engineering Officer
Over the past 25 years, Lex has built exceptionally strong credentials in the design of versatile, cost-effective and energy-efficient data centre infrastructure.

During his time with Interxion he has pioneered several new approaches to data centre design and management, including in 2003 the improvement of power ratio efficiency between server load and transformer load, 2004 cold aisle containment and the 1999 modular approach to data centre architecture.

Lex is a founding member of the Uptime Institute EMEA. He also holds a global position as the vice chair of the Green Grid's Governmental Engagement Committee, the Advisory Council and The Technical Committee and works as a stakeholder for the European Commission DG Joint Research Committee on Sustainability and the European Data Centre Code of Conduct Metrics Group. Lex also received the 2010 Personal Judges Award in Nice for outstanding contribution to the data centre sector over the preceding 10 years.

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interxion (NYSE: INXN) is a leading provider of carrier and cloud-neutral colocation data centre services in Europe, serving a wide range of customers through over 35 data centres in 11 European countries. Interxion's uniformly designed, energy efficient data centres offer customers extensive security and uptime for their mission-critical applications.With over 500 connectivity providers, 20 European Internet exchanges, and most leading cloud and digital media platforms across its footprint, Interxion has created connectivity, cloud, content and finance hubs that foster growing customer communities of interest.

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