DCD INTELLIGENCE

THE NEED FOR A NEW DATA CENTER DESIGN STANDARD

PROPOSED CRITERIA OF AN INCLUSIVE DATA CENTER CLASSIFICATION STANDARD

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Authors:
Pim Bilderbeek, Principal Analyst, The METISfiles
Lex Coors, Chief Data Center Technology & Engineering Officer, Interxion

March 2016

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SCOPE

Following the technical briefing paper[1] on data center innovation, this briefing aims to start a discussion among data center operators about the need to review current data center classification standards.

The design standards most frequently used to classify data centers are not directly promoting innovation, sustainable energy use and energy efficiency. These standards include BICSI, ANSI/TIA 942 and UI, which are used to categorize data centers by class (e.g. BICSI 0-3 and UI Tier I to IV).

Because of the fixed availability classes and prescribed redundancy measures of these existing standards, a growing number of data centers in operation or in the construction process cannot be classified.

For example, innovative data center designs based on sustainable energy sources (as opposed to diesel generators and UPSs) or networked data center topologies cannot be properly classified. This is not because these designs cannot deliver a similar or higher availability. Instead it is because they do not fit the prescribed classes.

> *"MAINTAINING AN INFLEXIBLE CLASSIFICATION SYSTEM MAY UNINTENTIONALLY CONTRIBUTE TO THE GROWTH OF FOSSIL FUEL CONSUMPTION"*
>
> *Lex Coors, Interxion*

As a result, efficiency across all data center components is sometimes willingly sacrificed because industry standards must be followed for compliance reasons, potentially resulting in higher data center operating costs and energy usage.

This briefing argues that, alongside the existing “fixed harness” availability standards, the data center industry needs a more inclusive classification standard that will account for visionary designs that leverage resilience, sustainability and efficiency.

TECHNICAL BRIEF SERIES

- This is the second in a series of four technical briefing papers produced by DCD Intelligence in collaboration with Interxion and The METISfiles.

[1] http://www.interxion.com/Read/do-industry-standards-hold-back-innovation/

THE NEED FOR A REVIEW OF DATA CENTER DESIGN STANDARDS

Data center design, build and operational standards were pioneered by organisations such as the UI, TIA and BICSI approximately twenty years ago. The simplicity and clarity of these standards have made them the data center industry's design reference points.

Each of these standards are built on 4 progressive classes, only covering traditional designs based on redundant diesel generators and UPSs. Ranked for performance and uptime, each class listed below incorporates the requirements of the previous class:

- **Basic non redundant:** capacity requirements for a dedicated data center site
- **Basic redundant:** capacity components that increase data center availability
- **Concurrent maintainable:** increased level of redundancy which enables the data center subsystems to continue operating while parts of the power and cooling equipment are being replaced or maintained
- **Fault-tolerant:** data center with fully redundant subsystems

These standards limit data center design innovation, which is key to their industry sustainability, by virtue of their fixed harness per design setup.

In addition, an increasing number of data centers in operation or under construction today cannot be classified using the traditional standards. Three frequently-used types of unclassified designs are:

1. Designs exclusively using alternative energy sources such as grid, solar, wind, fuel cell and tidal
2. Designs based on multiple, networked data centers
3. Data center designs implementing availability features beyond their classification, but not fulfilling all requirements to be classified in the next class

Figure 1 contains examples of innovative data center designs that do not rely on diesel generators for their primary or secondary power source.

Figure 1: Data Centers That Run Exclusively On Green Energy

Data center connected to the European international grid as primary power source, situated close to a 110KV station. This international grid has been 100% available over the past six decades.
Data center with on-site solar or wind generator and grid or fuel cell back-up
Two remote data centres running one application, one data center running on solar and wind and one data center running on the electrical grid
Data center without diesel generators with single and double power feeds
Data center with fuel cells as the primary source and grid as backup

Source: Interxion

In summary, the simplicity that led to the acceptance of global classification standards now slows progress to a degree; it does not reflect the current data center industry drive for innovation and sustainability.

THE COST OF INERTIA

The data center industry faces a dilemma. Existing standards serve data center availability needs up to and including the point of fault tolerance. However, designs that deviate from the norm are not included. On top of the existing classification systems, there is space for a dynamic, flexibly and visionary model to foster investment in more sustainable data centers and to reward incremental investments in existing data centers.

Third-party research shows the data centers that power the digital economy are responsible for about 2% of global greenhouse gas emissions today[2], which is roughly equivalent to the aviation industry's output. This percentage is only expected to increase as the digital economy's growth continues unabated. To curb the potential data center greenhouse gas emission growth and improve resource efficiency, industry stakeholders collaborate in initiatives like The Green Grid, a non-profit industry consortium. Improving data center efficiency, however, will not slow emissions growth. A higher proportion of data centers need to use sustainable energy sources, such as wind and solar, to curb overall industry emissions.

> *"DESPITE THE UTILITY OF CURRENT DESIGN STANDARDS, NEW DATA CENTER CLASSIFICATION IDEAS ARE REQUIRED TO ALLOW FOR THE RECONFIGURATION OF INFRASTRUCTURE IN AN APPLICATION-CENTRIC WORLD"*
>
> *George Rockett, Datacenter Dynamics*

The current standards do not account for data centers that are exclusively designed to use renewable energy sources. The current standards only allow for sustainable energy sources, that work in conjunction with the grid and diesel generators. As a result, data center efficiency is often willingly sacrificed because industry standards must be followed for compliance reasons, resulting in significantly higher data center operating costs and energy usage. Maintaining a fixed standard that can be more flexible may therefore unintentionally contribute to the growth of fossil fuel consumption.

Another big shift within the data center industry is the growth of hybrid and public cloud architectures, which is resulting in a growing proportion of compute and storage capacity being located in commercial rather than corporate data centers. Many of the commercial data center operators, including colocation and cloud service providers, invest heavily in innovation to improve sustainability. These providers often make use of non-traditional data center topologies, such as interconnecting multiple data centers. Statistical availability studies by Interxion demonstrate that these networked data center topologies can achieve the same uptime as traditional data center designs, but they cannot be categorized when the current standards are applied. Some heavily regulated industries such as financial services are not comfortable with, or permitted to use data centers that are not accredited to an industry standard.

In summary, the industry needs a more inclusive standard that is open, flexible and accepted by all stakeholders. This will need to be a standard that fosters cross collaboration and innovation, and one that credits not only availability, but also sustainability and efficiency.

[2] Source: GeSI SMARTer2020: The Role of ICT in Driving a Sustainable Future
http://gesi.org/portfolio/report/72

BUILDING BLOCKS OF AN ALTERNATIVE SYSTEM

As a first step towards industry-wide support for a review of design standards, we propose a layered model based on 3 factors (see Figure 2):

1. **Resilience:** each component of the design can be scored on its resilience (i.e. resilient design of any component results in a higher score). The total score, based on the sum of components, will be an indicator of the resilience of the end-to-end design. In figure 2 we score resilience on a scale from 1 (low resilience) to 10 (high resilience) for each layer.

2. **Sustainability:** based on the energy sources used, the design can be classified based on an 'energy label' indicating the level of sustainability. In figure 2 we label sustainability from A (high level of sustainability) to F (low level of sustainability)

3. **Efficiency:** it is proposed to use PUE to classify the efficiency of the data center design, given its acceptance as an indicator of efficiency.

The importance of a sustainability classification is obvious, given the need to reduce environmental impact of the data center industry further. Whether the classification should integrate the PUE efficiency number and a score based on the use of energy sources is open for debate.

The reason resilience is proposed may be less obvious but is no less important. Resilience is needed instead of availability given that statistical availability calculations are both time-consuming and complicated therefore harder to use as part of a decision-making process. Conversely, it is relatively easy to classify the level of resilience of each individual component and attribute a score based on this. The industry would need to define a calculation method that ensures all designs are classified consistently. This method should incorporate existing availability standards. As PUE demonstrates, a globally agreed calculation method is an achievable goal.

To keep overhead costs low, any new standard could for instance include an easy-to-use, open-source tool and/or application, maintained by a non-commercial governing body. Data center engineering departments and consultants could use such a tool to upload designs ranked on 3 aforementioned criteria – resilience, sustainability and efficiency – facilitating industry collaboration and innovation.

The proposed model gives companies looking to build data centers the ability to select the design that best fits their resilience, sustainability, and efficiency requirements, or select a service provider with a data center design to deliver the required service level agreements.

NEXT STEPS

- The proposedmodel of an alternative data center classification system are intended as a basis for further discussion. We are calling for an industry-wide exchange to build support for a flexible and open standard, operated by a non-commercial organization which accepts input and welcomes cross-industry collaboration from all stakeholders.

For further information, please visit www.interxion.com/openstandards

Figure 2: Proposed Data Center Design Classification Model

DATA CENTER LAYERS	RESILIENCE SCORE
ENERGY SOURCE Including traditional and alternative energy sources such as solar, wind and fuel cells	1-10
ELECTRICAL SYSTEM Traditional combination of UPS with power aggregate or alternative setups	1-10
MECHANICAL SYSTEM Including but not limited to cooling methods such as mechanical, direct or indirect ventilation and sea water cooling	1-10
NETWORK TOPOLOGY Single, dual or multiple remote data center setups such as passive-active or active-active installations	1-10
IT IT hard- and software	1-10
TOTAL DESIGN CLASSIFICATION	
RESILIENCE SCORE (total layers)	*5-50
SUSTAINABILITY SCORE (total design)	** A,B,C,D,E,F
EFFICIENCY SCORE (total design)	PUE

*5 = lowest score, 50 = highest score;
**A = highest score, F = lowest score

Source: Interxion

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FOR MORE INFORMATION:

+44 (0)20 7426 4813
info@dcd-intelligence.com
www.dcd-intelligence.com