



A practical guide to data center design and planning

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Life Is On

Schneider
Electric

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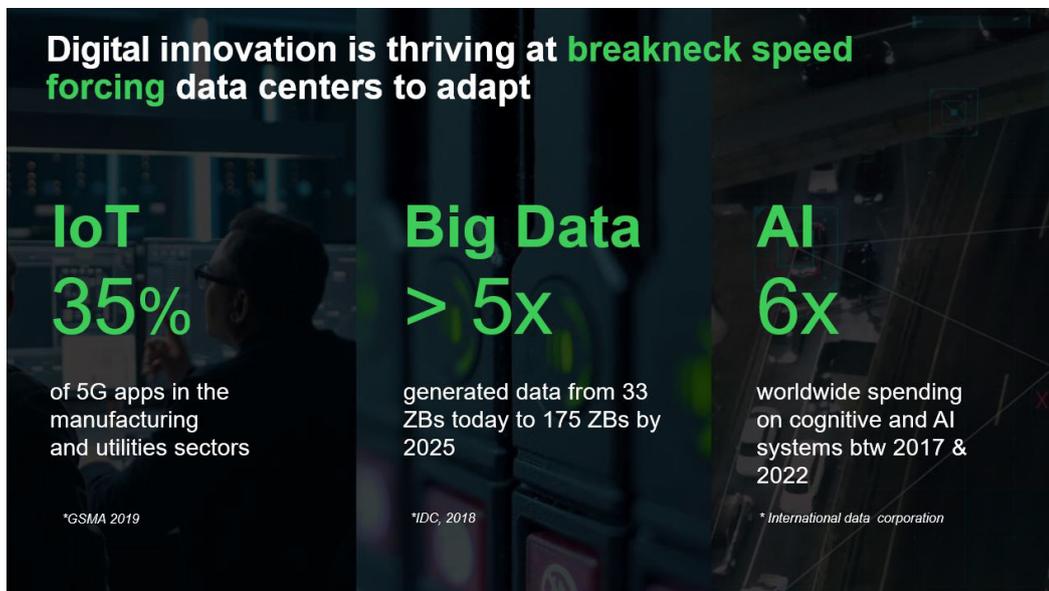
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In today's world of being "on" 24/7, data centers are at the core of business and viewed as the way to create competitive differentiation. Speed, efficiency, flexibility, and scale are now critical for winning the race to meet new connectivity and processing demands caused by the Internet of Things (IoT) and Big Data.

Data centers enable the right insight to make better business decisions. They have come a long way from simply keeping the lights on.

But while the value and role of data centers has changed, the way most people design them has not. Historically each build started from scratch and, while it's true that each data center project has unique needs, they also have a lot in common and there is much to be gained by taking advantage of these commonalities.



Still, planning data center projects remains a major challenge. Plans are often poorly communicated among stakeholders, and minor changes can result in major cost consequences further down the road. Planning mistakes often propagate through later deployment phases, resulting in delays, cost overruns, wasted time and, potentially, a compromised system.

Not to worry — Schneider Electric has put together practical steps that include clear methodologies, at-a-glance calculators and tools, and a comprehensive library of reference designs to simplify and shorten your planning process while improving the quality of the plan.

As data centers continue to expand and evolve, a flexible design approach will help grow business quickly without excessive capital outlay or overbuilding. Data center reference design tools will help you avoid many of the common pitfalls and with adaptable, modular options it's possible to future-proof your data center while meeting your current business goals (and budget).

Planning process

An obvious but often overlooked concept, data center planning and design must be done in the right order from the outset. When the right decision makers are given the right information in the right sequence the project will run more smoothly and possibly even exceed expectations.

Rather than presenting excruciating detail or an ambiguous outline without enough information, proper planning turns overwhelming or vague requirements into complete blueprints. And it doesn't have to be time consuming or frustrating. The Schneider Electric [project process](#) for the data center life cycle includes a standardized plan phase, which consists of four tasks around the physical infrastructure, laying the foundation for everything that follows.

1. Establish key project parameters to control the system architecture and budget.

Start by identifying a business need. Then determine the project parameters around criticality, capacity, growth, efficiency, density, and budget. These six key project factors set the high-level goals of the project.

Overall goal of step 1: Ensure scarce executive time is applied to important decisions.

Stakeholders: Finance, CEO, IT Executive, IT Operations Manager, Key Lines of Business Leaders

2. Develop a system concept.

The cornerstone of this task is the selection of a reference design. While there are a significant number of possible reference designs, the six key project parameters will quickly rule most of them out. Once you've narrowed it down to a few, review them for additional considerations such as logistics and vendor reputation.

Overall goal of step 2: Choose a general concept of physical infrastructure.

Stakeholders: IT Operations, IT Executive, Facilities Executives, Facility Engineer, Experienced Consultant

3. Incorporate user preferences and constraints.

These include technical design requirements that are not part of the six key project parameters. But, rather than collect these upfront and use them to drive the overall design, it's much more efficient to adapt user preferences and constraints after the design concept has been chosen. Otherwise, you're more likely to steer away from standard designs, driving up cost and deployment time.

Overall goal of step 3: Make concept adaptations to avoid reconsidering the system concepts.

Stakeholders: IT Operations, Network Engineers, Facilities Engineers, Data Center Managers, Experienced Consultant

4. Determine implementation requirements.

This involves collecting standards, codes, deadlines, resource assignments, and process requirements. Standard requirements include regulatory compliance standards, subsystem compatibility, safety, and best practices. Project requirements include deadlines, vendors that must be used, and special procurement or other administrative processes. Separating requirements into these two buckets will simplify the job of creating a detailed system design.

Overall goal of step 4: Create a set of rules to be followed above and beyond the outputs of the previous three tasks.

Stakeholders: Engineers, Architects

Reference designs

As outlined earlier, the approach to data center design hasn't changed much over the years. Historically, each build was considered custom and started from scratch. However, although each data center has exclusive needs, there are also a lot of commonalities.

With the call for faster planning and building and the reality of tighter budgets, fewer staff, uncertain IT loads, and a need for high availability, it's no longer practical or cost effective to engineer all aspects of a data center uniquely. There is much to gain from the reuse of proven, documented subsystems or designs.

Data center projects: Advantages of using a reference design

Reference designs are often used in home construction. Regardless of the level of customization, using a reference design can be beneficial, albeit to varying degrees.

Standard home plan

Reference design only



- Very fast
- Very repeatable
- Very predictable performance, cost, schedule

Semi-custom home plan

Reference design with custom finishing elements



- Fast
- Repeatable — but with custom finishes
- Predictable performance, cost, schedule

Custom home plan

Base design by domain, heavily adapted



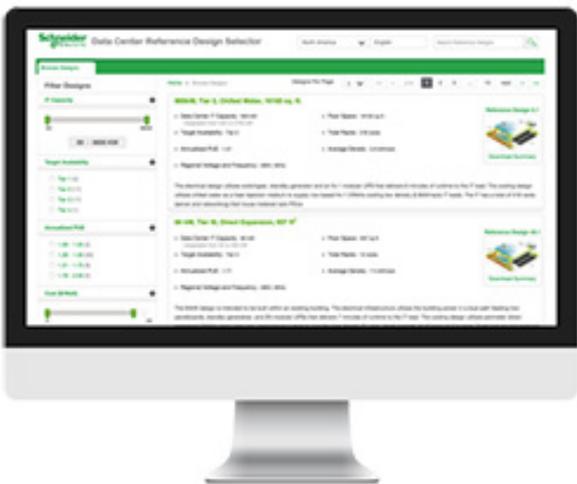
- Faster than starting from scratch
- Repeatable domains — kitchens, rooms, garage
- Less predictable performance, cost, and schedule

All three plans benefit from using a reference design.

PLAN

This is why Schneider Electric has mapped out a simplified way to plan, design, build, operate, and assess with [data center reference designs](#). A reference design is a system blueprint with a list of attributes, such as system-level performance specifications, along with materials and components. This design could be for a complete data center or for a subsection of the data center, such as an IT pod, IT room, power plant, or cooling plant.

After decades of thought leadership in building data centers, our reference designs are based on best practices — what has and hasn't worked in the thousands of data centers we've built over the years. Our catalog of designs enables you to quickly find those that best fit your requirements with minimal adaptations, helping you plan faster, reduce possible risks, and reliably predict future performance. You can mix and match elements — such as cooling, power, and redundancy — and see how these changes might impact your design.



[GO TO REFERENCE DESIGNS](#)

Adopting a well-conceived reference design can have a positive impact on both the project itself and on the operation of the data center over its lifetime. These high-level conceptual plans simplify planning by helping project teams quickly determine key project parameters, providing a head-start into the detailed design phase.

“These things aren't marketing tools with pretty pictures,” says Patrick Donovan, senior research analyst for the Schneider Electric Data Center Science Center, in [Customer Feedback on Our Data Center Reference Designs](#).

PLAN

Schneider Electric design documentation includes a high-level design summary and an engineering package with CAD drawings, piping diagrams, dimensioned floor layouts, a DCIM use-case, and an equipment list. And it's not just for engineers, either; it's designed for the layperson to understand.

Most importantly, these designs are malleable. Whether you're planning a new build, retrofit, or expansion, the flexibility of the power skids and IT pods allows for a range of configurations to be tailored to meet future needs. It's akin to playing with Lego® bricks.

"For decades, Lego has remained ahead of the market by producing millions of plastic blocks that all fit together," says Joe Reelee, vice president of data center solution architects at Schneider Electric, in a [blog post](#).

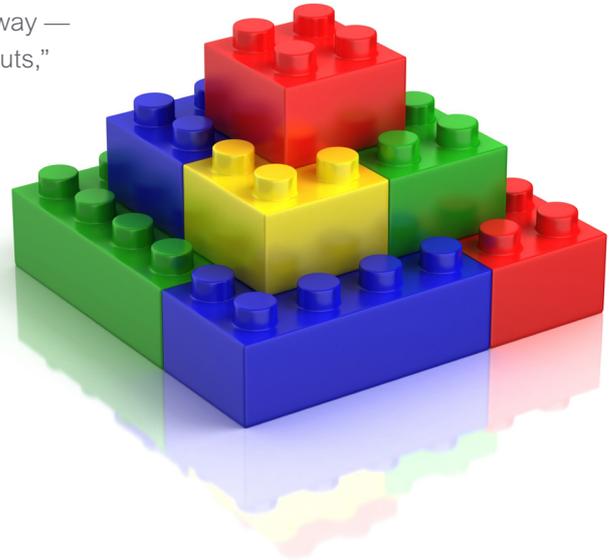
"When you buy a box of Lego, there may be instructions on how to build a race car, but really there's nothing stopping you from building any other sort of car," says Reelee.

"Reference design #21, for instance, is customizable in the same way — the different inputs you put into the model will create different outputs," Reelee explains.

This particular design is ultra flexible and utilizes modular building blocks, easily scalable from 200 kW to 3.6 MW of capacity (or more), which can be implemented in a piecemeal fashion.

"Ultimately, the data center is a purpose-built facility composed of prefabricated power and cooling modules joined with an IT space," says Reelee. Given the flexible architecture behind the design, the data center can be easily reconfigured to support a range of densities, build methods, tier levels, cooling architectures, and capacity ranges.

You can freely browse the Schneider Electric [library of reference designs](#) to select, compare, and choose the best design for your organization — whether you're involved in co-location, cloud/hosting, multitenant, or enterprise-level data centers.



Data center planning resources

White Papers

White Paper 147: [Data center projects: Advantages of using a reference design](#)

White Paper 81: [Site selection for mission-critical facilities](#)

Blogs

[A new way to think about data center design: Optimizing your data center like a box of Legos](#)

[Customer feedback on data center reference designs](#)

Webinar

[EcoStruxure for Data Centers: A Game Changer](#)

Resource

[Reference Design Library](#)

Cost analysis

Just as the needs of a data center vary, so do budgets, which can be the biggest obstacles when building or upgrading data centers. Using deep scientific research and data trending for a wider benchmark, we created several tools to make sure your data center requirements align with your project budget early in the planning stages.

These tools provide a general idea of costs (as opposed to a formal quote) and can set overall expectations around cost based on various options. Our cost calculators generate real, but estimated numbers so you can make appropriate decisions regarding capacity, criticality, and density. When all stakeholders understand the possible costs, you can avoid the time and additional expense of cycling through unnecessary changes.

The Data Center Capital Cost Calculator walks you through different scenarios of key data center design physical infrastructure parameters and calculates estimated costs based on the various parameter inputs.

Data Center Capital Cost Calculator



PLAN

By identifying load, redundancy, density, and key power and cooling requirements, the tool can project the number of racks, the floor space, and overall capital cost requirements. Higher redundancy, for example, is often a top priority, but budget has a direct impact on how much redundancy is feasible.

The primary value of this tool is to evaluate how architectures will perform relative to each other for a defined location and configuration. Schneider Electric offers efficiency assessments to obtain actual efficiency values for a specific data center.

Design cost analysis resources

Blog

[A tool to help align your data center business requirements with your project budget](#)

Tradeoff tool

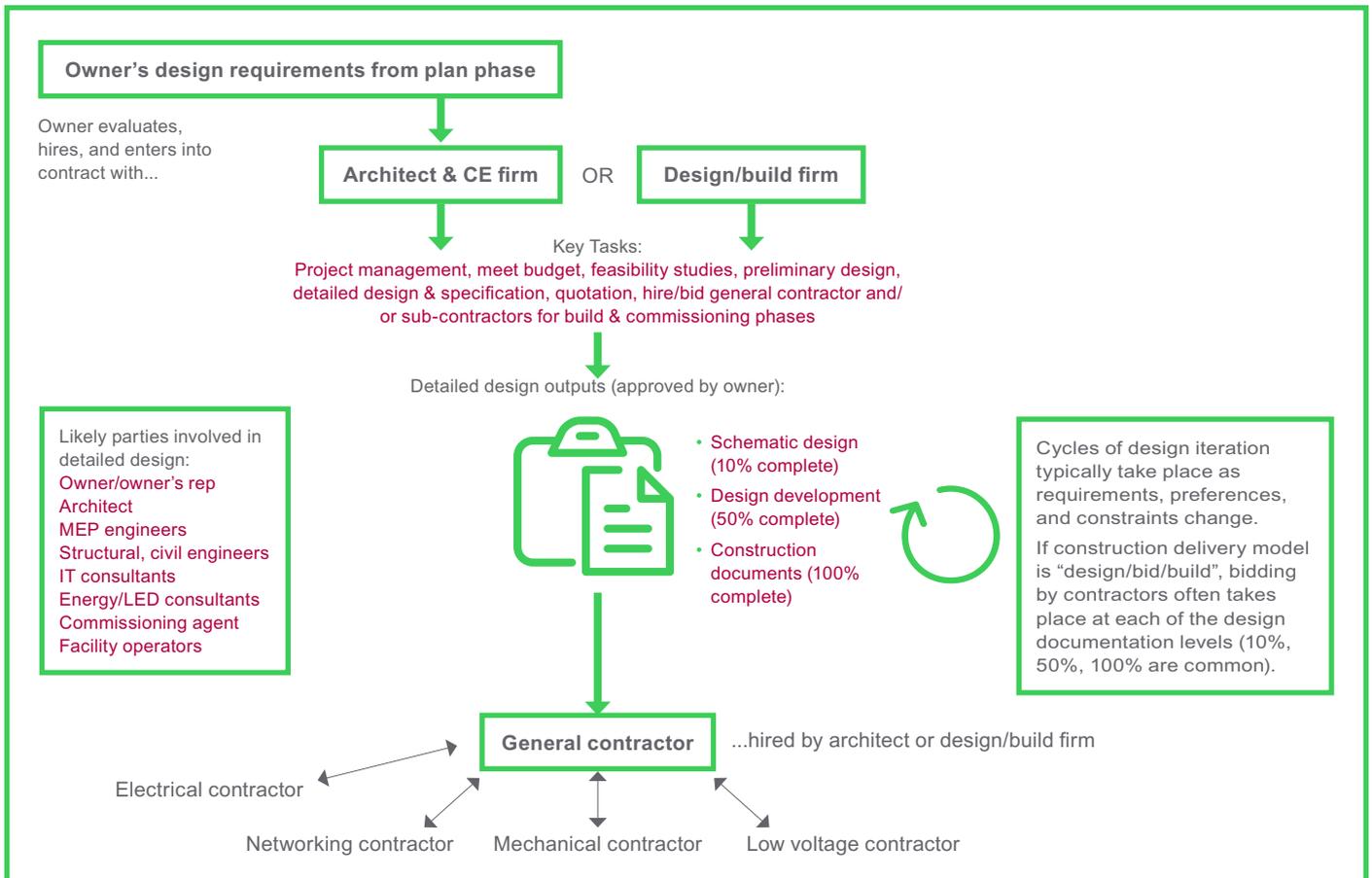
[Data center capital cost](#)

Process

At a high level, the following diagram illustrates what typically occurs during the design phase and the eventual transition to the build phase for a new data center project. This process is outlined in detail within [White Paper 195: Fundamentals of managing the data center life cycle for owners](#).

In this phase, the detailed design work takes place, resulting in site-specific schematics and buildable construction documents (drawings and specifications). It is all too common to go through multiple design iterations as requirements, preferences, and constraints change or surprises occur, which is why the early planning phase is so important. Managed properly ahead of time using the tools we have presented, these costly, time-consuming iterations will be minimized.

Design phase transitioning to build phase



DESIGN

Using a “design/bid/build” construction delivery model, construction general contractors and subcontractors are chosen through a process of bidding at each of the design documentation completion levels.

Within a data center project, stakeholders often refer to “design and construction teams.” The design group is typically composed of the architect, mechanical-electrical power (MEP) engineering, and IT. The construction team primarily includes the general contractor, subcontractors, and equipment vendors.

The project owner or his or her representative typically hires an architect who, in turn, hires a consulting engineering (CE) firm (if one is not already on staff or call) to begin to translate the high-level owner’s requirements into detailed design documents.

Alternatively, there are all-in-one “design/build” firms that specialize in data center projects and may also offer commissioning, facility operations, energy management, and even construction management services. The White Paper outlines a number of questions to ask when selecting a firm or contractor.

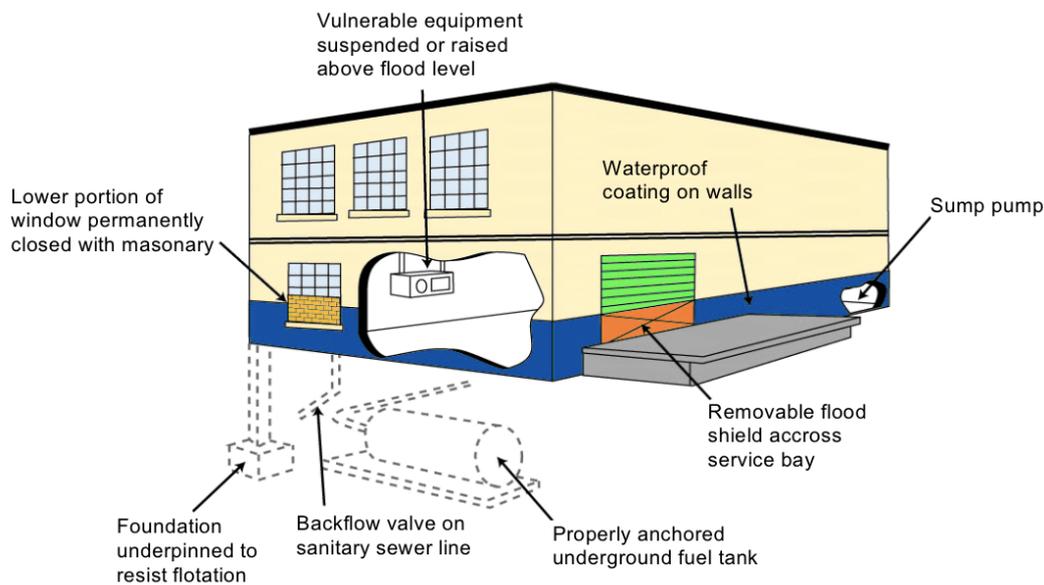
Since getting the right people involved, at the right time, and focused on the right things is so important for success, the contract should define and document key stakeholders’ roles and responsibilities by phase, define compensation and insurance requirements, describe the cost of work, dispute resolution methods, change order process and limitations, and termination grounds and processes. The scope of the contract should span both the design and construction phases. All teams must work hand-in-hand at all stages to ensure what’s been designed and planned comes to fruition.

Site selection

It's time to find a location for your data center. Organizations often start searching for the perfect space to build before having design criteria and performance characteristics in place. But, without this vital information it doesn't make sense to spend time visiting or reviewing potential sites.

When selecting a new site or evaluating an existing site, there are many risks and benefits that must be considered in order to optimize availability and keep control of cost.

Dry flood proofing



According to Wendy Torrell, strategic research analyst, Schneider Electric, “Geographic and regional, local and site-related, and building risks need to be understood and mitigated to lessen the downtime effects on your business. Meanwhile, site selection can offer financial benefits when a data center considers climate, electricity rates, and incentives.”

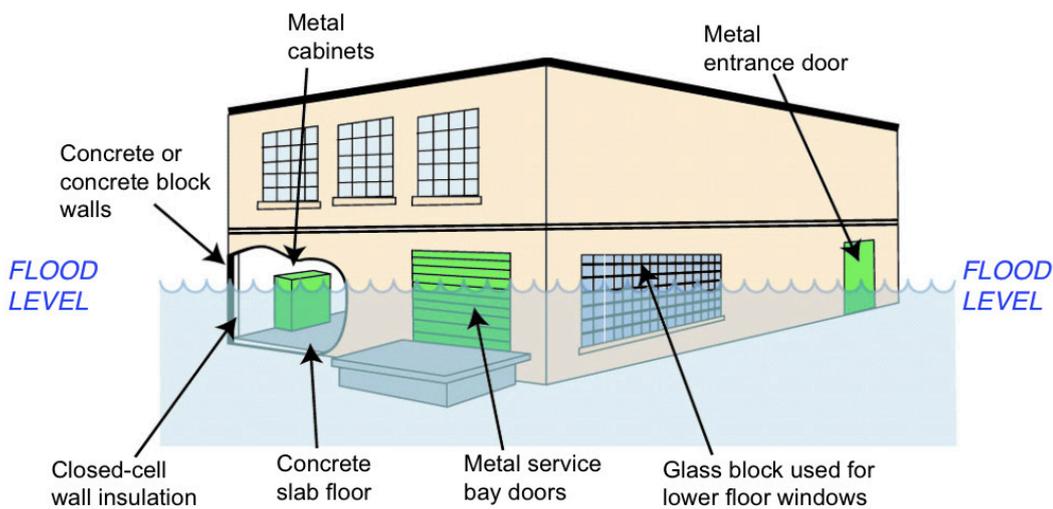
DESIGN

Wendy details three major categories of risks in her [White Paper 81](#):

1. Geographical risks are major availability threats including natural disasters, as well as man-made hazards.
2. Local risks are those that result from the municipal infrastructure, the local environment, local regulations, and employees.
3. Building risks are driven by building characteristics and constraints, such as age of the building, types of loads running, and the type and quality of the facility.

When a thorough site selection review process becomes part of a data center project, the business can expect both downtime risk-reduction and cost savings.

Flood-resistant materials



Mainfreight

New Zealand

No one can accuse Mainfreight of thinking small. You have to think big to take a local trucking company in New Zealand and grow it to a global logistics giant — one with warehouses around the world.

That bold thinking about growth means they don't just think five or 10 years down the road.

“The 100-year vision is something that our company founder came up with,” said David Hall, Group IT Infrastructure Manager of Mainfreight. “If we invest 50 million dollars in a new facility, we're not doing that thinking about it over the next 20 years — we're thinking about that over the next 50 years or so.”

Mainfreight at a glance:

- Global logistics provider
- International end-to-end freight service
- 239 branches across 21 countries
- 7,000 team members
- 51.1 million dollar IT investment

To understand why Mainfreight plans their growth with such a longterm strategy, it's important to understand the mentality that drives this ambitious company, from the bottom of the world, to reach the top of their industry.



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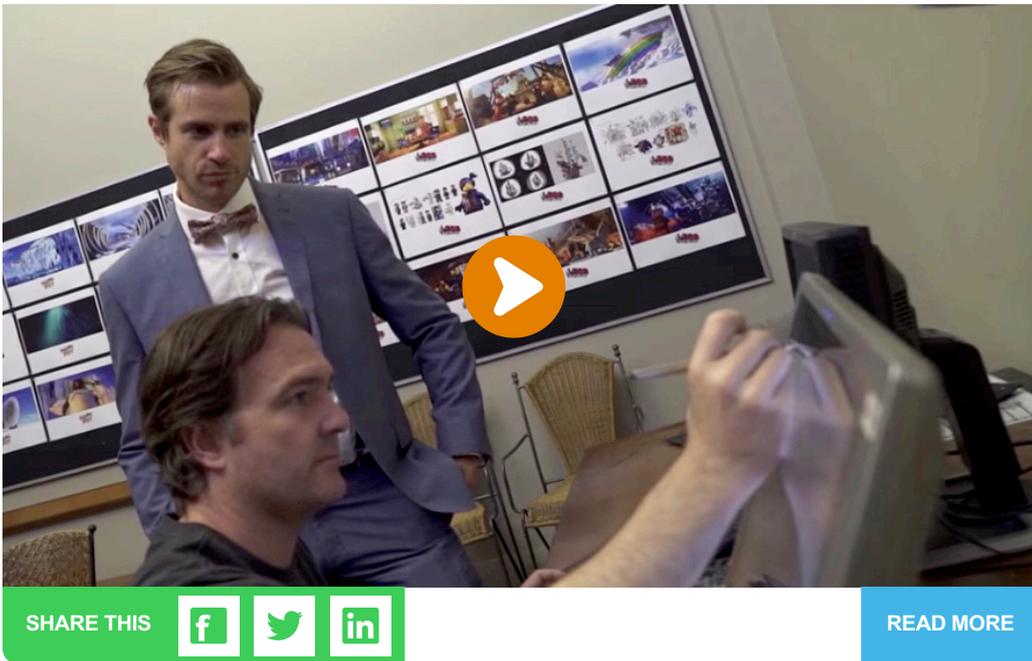
Animal Logic

Australia

With over 25 years experience, independent Australian company Animal Logic has been at the forefront of creating digital content, award winning visual effects and animation for the film and television industries.

Animal Logic prides itself on dreaming big for the big screen and as a result their data center solution needed to be equally as ambitious. They chose a Schneider Electric EcoStruxure modular data center because it was prefabricated, fully customizable and has a reputation for flexible engineering, and promises fast deployment.

Understanding Animal Logic's unique needs for capacity and delivery, Schneider deployed a custom modular data center in just under four and a half months. The new infrastructure delivered a major boost in data processing, which in turn enabled greater performance and operational agility.



DigiPlex

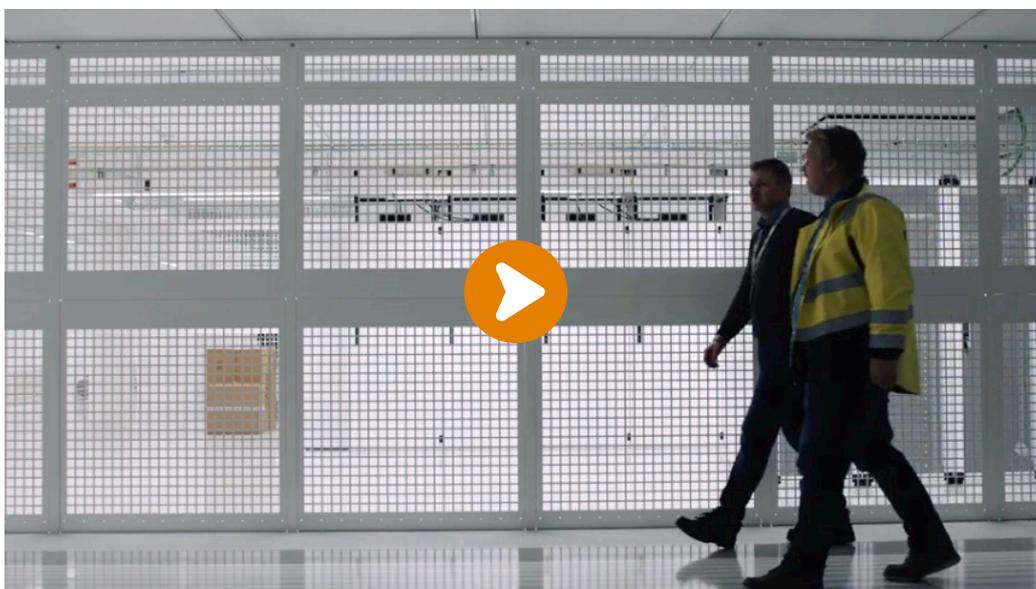
Norway

DigiPlex is a leading data center operator in the Nordics, dedicated to responsible, sustainable growth.

Innovative products that push efficiency benchmarks were needed in order to achieve ambitious goals in a power-intensive industry. Checking your account balance on your app. Watching the latest viral video. Uploading a selfie to social media. We take these actions for granted, but there's a lot going on behind the scenes.

Very little of what we do on our devices actually happens in them; data centers are the nerve centers of our connected world.

In a society that grows more connected every day, data centers are sources of enormous power consumption. This presents a formidable challenge for colocation providers like DigiPlex in Norway, which seeks to grow in a competitive business environment while being a responsible corporate citizen.



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Conclusion

Today's business needs can't wait for traditional disjointed data center planning processes, lengthy design phases, and long deployment times. So, tap into the Schneider Electric experience and take advantage of the services of our experts.

Use our proven methodologies and scientifically created standards for assessing your needs and costs. Make the most of our existing blueprints and take advantage of the latest technologies. Leveraging these tried and true successes will enable you to avoid failure now and ensure your data center is ready for what's next.

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