



The Data Center Must Evolve

An Aligned Data Centers Insight Report

What's Inside

3 Evolutionary Trends

- A sea change in how we consume and pay for things
- Rising data center infrastructure costs and falling IT costs
- Exponentially increasing demand for IT capacity

The Evolved Data Center Model

- Reliability and efficiency co-exist
- - Supply and demand are aligned
- Density is aligned to your business needs
- Consumption-based, pay-for-use pricing



Just because data centers have always been designed, built, and operated one way doesn't mean they can't change. The data center should and will evolve.

You should be able to control data center capacity to meet your business needs.

| The Traditional Data Center | The Evolved Data Center Model | Made Possible By |
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| Delivers reliability by building two or more of everything, sacrificing efficiency for reliability | Delivers 100 percent uptime while reducing energy consumption and cutting costs (1.15 PUE guaranteed) | A conductive cooling system - "the most reliable cooling system in the marketplace" according to Steve Fairfax Advanced DCIM software - a data- driven feedback loop for continuous improvement |
| Forces you to predict supply years into the future | Enables you to align supply with demand - take data center capacity as you need it, not before | An integrated global supply chain enables just-in-time deployment of scale power and cooling capacity Plug and play, hyper- scale infrastructure available in 300 kW increments Lower upfront contract commitment Capacity planning tools and support |
| Forces you to take more data center capacity than you need | Capable of supporting high and mixed density environments in order to support future IT advances and business needs | The latest cooling technology supports higher densities |
| Ties up capital, taking funds away from the rest of your business | Consumption-based, pay- for-use pricing | Lower upfront commitment = less risk An advanced DCIM that enables you to see more and save more |



The traditional data center model is like the old cable TV and music models, which forced you to buy and pay for all 189 channels and all 10 songs, even if you only wanted a few.

The evolved data center model, in contrast, is like the new TV and music models – you only buy the show or the song you want. Where the traditional colocation model locks you into long-term contracts for power you may not use, the evolved pay-for-use model eliminates the need to forecast IT demand and provides control over capacity. As a result,

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you reduce waste and align your data center to the needs of your business.

Aligned Data Centers is the first to bring this evolved data center model to the marketplace. The pages that follow explain how.



Evolutionary trend #1: A sea change in how we consume and pay for things.

The change in how we consume entertainment is part of a broader evolution in how we consume - and, accordingly, pay for most things at home and at work.

Consider that one of the largest providers of compute capacity doesn't sell physical infrastructure in a data center. and one of the largest enterprise software companies doesn't actually sell software.

Each of these companies provide access to hardware and software on a pay-per-use, on-demand, accessible-from-anywhere service basis. As we move from pay-to-own to pay-for-access, we get more choices, more control. Paying just for what you use feels right.

Indeed, there's something profoundly unfair - and wasteful - about a model in which the provider tells you what you will consume, when and where, and how much you will pay for it. Yet as long as the industry has existed, that's been the data center model. Traditional data centers force you to predict how much power you might consume 5-10 years from now (an impossible feat) - and pay for it today, regardless of how much power you actually consume.

Evolutionary trend #2: Rising data center infrastructure costs and falling IT infrastructure costs.

Twenty-five years ago, when power and cooling infrastructure was a fraction of the total capital outlay required for a data center, the efficiency of that infrastructure – and how you paid for it - didn't keep many people up at night. Reliability was paramount, and because the relative cost of data center infrastructure was so low. adding an extra chiller plant for redundancy was practically a rounding error.

But that focus on reliability regardless of efficiency. combined with rising energy and facility costs, set data center

Energy and Infrastructure is Now a Major Cost Driver for IT Initiatives



infrastructure costs on a steep upward growth curve.

Now it's an issue that keeps many IT and finance leaders up at night, according to a report from consulting firm McKinsey. At the same time as the cost of power and cooling infrastructure has risen, the combination of Murphy's Law and the rise of Asia as a chip manufacturing powerhouse has continued to drive down the cost of IT infrastructure. It was in the late 1990s that the cost of the power and cooling infrastructure actually outstripped the cost of the IT infrastructure. The gap has continued to grow.

"With average data center costs now threatening to crowd out other technology investments. the matter has become a board level concern."

-McKinsey

Year

At the same time that the cost of IT infrastructure has fallen, it has become more efficient as well. Processors have become exponentially more powerful. As these chips run faster, though, they run hotter. Chips designed today can run at 180 degrees Fahrenheit. Yet the infrastructure built to cool that IT infrastructure was designed in 1910 to cool people.

From cost to capability, the mismatch between IT infrastructure and data center infrastructure is painfully clear.

90% of all the data in the world today was created in the last two years alone. In this kind of environment, the traditional data center model is simply unsustainable.

Evolutionary trend #3: Exponentially increasing demand for IT capacity.

There has to be a way to change the data center infrastructure cost and efficiency trajectories - bring costs down and efficiencies up - or else the Internet of Things, cloud, and the other trends driving increasing capacity demand could become too heavy for enterprises to bear.

Consider the perspective shared by analysts at the consulting firm Booz & Company: "There is only one future for companies whose data centers continue to be traditionally operated: a world of rapidly rising costs. Only by reinventing how they run their centers...can providers of data center services hope to thrive despite the pressures they face."

The data center must evolve

Given these evolutionary trends – from the changes in how we consume and pay for things to the changes in IT and data center cost structures to the exponentially increasing demand for IT capacity – the data center needs to evolve, too.



What does an evolved data center look like? Broadly, it's a data center that rationalizes costs with modern power and cooling infrastructure. It's a data center that is aligned with the needs of the business and its environment. It's a data center that is flexible, so the infrastructure can scale to meet IT demand today and tomorrow. And it's a data center that is consumed on a pay-for-use basis.

The pages that follow are devoted to exploring that evolved data center model in more detail – what it means for you as a data center consumer, and how it can be delivered.

Reliability and efficiency can co-exist

You do not need to sacrifice efficiency to have redundancy. You can reduce cost and maintain uptime.

The data center, evolved.

Supply and demand are aligned

Data center capacity can be deployed quickly and in increments that match demand. You no longer need to overprovision ahead of current demand.

Power densities can scale within your existing footprint

There is no need to move out of your data center to support your new power-hungry IT gear. Stay right where you are – your data center is now future-proof.

You pay for what you use

If you use less than you need, you won't be penalized. Payfor-use is the modus operandi for most "as-a-service" offerings today. The data center is no longer the exception. With Aligned, you can do more while using less. Our infrastructure is engineered to reduce waste while improving reliability and supports densities up to 25 kW per rack. Our global supply chain enables you to scale just-in-time, in increments that match the demands of your business. And best of all, we provide you with consumption-based pricing, so you only pay for what you use.

At Aligned Data Centers, we give you the flexibility and control you need so you can better align your data center to the demands of your business.

Reliability and efficiency can co-exist.





When it comes to an always-on, always-available expectation, 100 percent uptime defines customer satisfaction and business success. That makes sense, given how expensive downtime is.

The 2011 National Study on Data Center Downtime revealed that the mean cost for any type of data center outage is \$505,502 with the average cost of a partial data center shutdown being \$258,149. A full shutdown costs more than \$680,000.

There was a time when the only way to deliver 100 percent uptime reliability in the data center was to build two or more of everything.

Consider, for example, Gartner's perspective on data center cooling: "Gartner generally finds that most multi-tenant data center operators have an extremely diverse array of IT equipment operating within their facilities and generally take a 'lowest common denominator' approach to their environments operating them cooler than may be necessary – just to be safe."

It doesn't need to be that way. We can have our cake and eat it, too. The evolved data center can deliver 100 percent uptime while reducing energy consumption and cutting cost. How? Using the latest cooling infrastructure and advanced data center infrastructure management (DCIM) software.



A conductive cooling system – "the most reliable cooling system in the marketplace"

At Aligned Data Centers, we leave the circa 1910 chiller plant in the past and instead use a proven, conductive cooling system to remove heat from the data center. This conductive cooling system is both highly efficient and reliable.

Steve Fairfax, the president of MTechnology and a specialist in data center reliability, calls Aligned Data Centers' cooling infrastructure "the most reliable cooling system in the marketplace." Specifically: a mean time between before failure of 400 years and a reliability rating of six 9s (that is, 99.9999 percent). What about the conductive cooling system is so reliable? There are a number of factors:

- It's sophisticatedly simple. This simple system eliminates most of the valves, switches, compressors, and chiller plants that cause data centers to fail. Where a traditional cooling system might have 100 moving parts, the conductive cooling system has one.
- The primary system requires no scheduled maintenance. A sophisticated Reliability Centered Maintenance system maximizes infrastructure durability.



- The heat rejection is closed to the environment on the air side as well as the fluid exchange. No outside air means no more elaborate filters or humidity controls as are typical with all other open water cooled or large air systems.
- 2N resiliency is built in. The system is designed to run active, so in the case of a failure the other unit is already running and is able to ramp to full load immediately.
- Free cooling delivers resiliency. The system utilizes compressors to trim the available cooling capability of the environment. In most environments the system will always be partially freecooling the load. Therefore, unlike a traditional mechanical system, which cannot continue to handle any load during a compressor failure, our system

will always maintain the load within ASHRAE A1 Allowable standards.

- Conductive cooling is fast. The system recovery and ability begin absorbing heat after a full power shutdown is approximately 20 seconds. The cycle will absorb all heat and return to a "normal state" of approximately 75 degrees Fahrenheit at the aisle within 1.5 minutes. (A large, global network equipment supplier tested the cooling system by holding the inlet air temperature at 130 degrees Fahrenheit for 15 minutes. When our cooling system was switched on, it took the room down to 77 degrees Fahrenheit in 1.5 minutes.)
- The result is a massive increase in reliability, with a corresponding decrease in energy cost. So you don't have to trade reliability for cost.

DCIM: data-driven feedback loop for continuous improvement

Aligned Data Centers' DCIM provides a "knowledge base" for data center operators and measures equipment performance against operating parameters.

Research shows that most data center outages are caused by people introducing a change of state – such as adding equipment or performing maintenance – and not following proper procedures. Often, that's because "proper procedures" were determined in the design and construction phases, and the data center operator didn't get the memo.

Aligned Data Centers' DCIM gathers information at each stage and passes it on to the next – from engineering to construction to operations. Data center operators know what to do by having knowledge at their fingertips and a full understanding of equipment design and policy. This knowledge base enables data center operators to predict issues before they arise and take corrective action, proactively.

DCIM provides feedback to Aligned Data Centers' electrical and mechanical suppliers to inform future innovations.

We have built a tightly integrated supply chain with our global data center infrastructure suppliers. Our DCIM software feeds the supply chain real-time data on equipment performance relative to design standards. Our partners use that data to iteratively improve both equipment design and system processes.

Aligned Data Centers' DCIM feeds back actionable intelligence in real time.

Every data center produces hundreds of thousands of streaming data points. Our software has been developed to quickly ingest and process this data so that it can feed back actionable intelligence to data center operators in real time.

Higher reliability and lower cost - 1.15 PUE guaranteed

Most data centers today still operate relatively inefficiently. According to the Uptime Institute, the average Power Usage Effectiveness (PUE) is 1.7 - meaning that 70 percent of the energy going into the data center is used for cooling and things other than powering the servers, storage devices, and networking equipment inside.

A recent IDC survey found that more than 90 percent of respondents reported PUEs of 1.7 (industry average PUE is 1.5) or higher with more than 60 percent reporting PUEs of 2.0 or higher.

Aligned Data Centers' conductive cooling system, which green building pioneer John Picard calls "a flash of genius" is currently deployed in

multiple production data center environments throughout the world including the TELUS data center in Rimouski, Quebec, The TELUS data center has been able to achieve a mechanical PUE ranging from 1.02 to 1.05.

Testing by the University of Maryland's Department of Mechanical Engineering found the Aligned Data Centers' cooling system achieved a 1.012 PUE reading. Dr. Ming Zhang, who led the team of researchers in performing the tests, had this to say: "We test systems from manufacturers across the globe. The efficiency, robustness and automation of the [conductive cooling] system are truly unique. These PUE readings are at least four times more efficient than simply moving air under ideal conditions, and much more efficient than traditional systems designed to the same level of reliability."



- Dr. Ming Zhang, University of Maryland

Aligned Data Centers' ultra-low PUE is made possible by the following:

- A superhighway for heat Conductive cooling uses much transfer. the thermal bus is less energy. Ultra-efficient much more efficient at moving continuous-flow heat sinks remove massive amounts of heat than forced air systems. data center heat using just In conjunction with energy a fraction of the energy of savings, the conductive cooling conventional cooling systems system uses much less water that suck in huge quantities of than a traditional cooling system. outside air.
- One thermal hub rated for 100 tons in passive cooling mode draws only 500 watts, compared with 90,000 watts for a traditional chiller and chiller pumps at the same outdoor and aisle temperatures. (The system works in super-efficient passive mode most of the

"These PUE readings are at least four times more efficient than simply moving air under ideal conditions, and much more efficient than traditional systems designed to the same level of reliability."

> time in most of the world. Active cooling ramps up gradually when necessary.)

And that efficiency isn't just at high utilization; the system delivers a consistent mechanical PUE from 10 to 100 percent load.

As a result of having this cooling infrastructure deployed in our data centers, we are able to offer you a guaranteed 1.15 PUE - regardless of power density or utilization. When compared

to the industry average of 1.5 or higher, a guaranteed PUE of 1.15 translates into a much lower monthly power bill.

At Aligned Data Centers, we believe in doing more while using less. Less energy + greater reliability = Aligned Data Centers.

Under-utilization of IT infrastructure is a significant problem. According to a 2015 enterprise data center survey by 451 Research, the average data center is utilized at 63 percent capacity from a square-footage perspective, and 56 percent from a power perspective.

Under-utilization can be very expensive - stranding millions of dollars in capital - especially for organizations using multimegawatts of power. According to Gartner, "With many colocation providers, power delivered to customers is often billed on a 'power provisioned' basis, rather than paying for actual power consumed. For example, if your organization requests a 30-amp circuit, but only uses 12 amps in one month and 15 amps the next, you will still be billed for all 30 amps each month."

The end result: "Enterprises not using metered power could be buying three times as much electricity as their IT equipment uses."

And as McKinsey points out, "With average data center costs now threatening to crowd out other technology investments, the matter has become a board level concern."

What causes under-utilization? Risk mitigation. An IT leader deciding how much capacity he needs to deploy in a new data center will err on the side of over-provisioning because he won't get fired for that, but he could get fired if he underestimates demand and runs out of capacity too soon. That's changing, as business leaders and boards - put more scrutiny on data center costs and seek to reduce waste there.

In the evolved data center, supply and demand are aligned.



could be buying three times as much electricity as their IT equipment uses." - Gartner analyst Bob Gill

Average Data Center Utilization

44% of the power that enterprises are allocated and paying for is unused.



An integrated global supply chain enables just-in-time deployment of scale power and cooling capacity

Aligned Data Centers has built a global supply chain comprised of industry-leading electrical and mechanical system partners that are equipped to deliver just-in-time data center capacity. From power generation and distribution to cooling infrastructure, our partners facilitate the deployment of new data center capacity, at any scale, in a fraction of the time

of traditional providers. For an organization that is growing quickly, being able to better align power, cooling and space "supply" with an increased demand can be the difference between success and failure.

Plug and play infrastructure speeds time-to-market

Aligned Data Centers has engineered its electrical and mechanical infrastructure to be plug and play. The ability to add new capacity with a simple connection significantly

increases the speed by which organizations can bring new applications and systems online.

Lower upfront contract commitment

The way data center contracts are written today, the provider will require you to commit, upfront, for power that you will use over a 5- or 10-year period (and sometimes longer).

Most organizations forecast what their power requirements will be over this period of time, but in a world where technology change is constant and IT innovation is a daily occurrence, forecasting a data center power requirement even two years into the future is nearly impossible.

Aligned Data Centers eliminates the guesswork. We do not require you to make a longterm commitment for capacity you don't need today. With a consumption-based, pay-for-use pricing model, we allow you to secure the capacity you need for growth at a much lower cost and only pay for the capacity you actually use. This translates into a smaller contract commitment. which is better aligned to your current capacity requirements.

Better capacity planning

McKinsey recommends data center customers "closely align data center capacity required with true business need in order to eliminate excess."

Aligned Data Centers' DCIM software enables us - and you - to closely monitor power utilization so that, together, we can better align power allocation with the needs of your business.

By gathering and consolidating utilization data across from the power delivery network. our DCIM software can identify historical trends and deliver actionable intelligence. Your capacity planning dashboard gives you visibility into the power, cooling, and space demand curve and time to maximum capacity. In addition, each month our data center experts will sit with you to review your utilization and discuss your upcoming needs so that you always have the capacity to grow your business profitably.

The future-proof data center aligns density to your business needs

In the traditional data center model, when you want to run higher IT loads you have to spread the load across multiple low density racks, or you have to buffer high density racks with white space to provide more cooling capacity. Either way, you're forced to take more data center space than you need, and wasted space equals wasted energy and wasted capital.

Advances in computing, storage, and networking are challenging legacy data center infrastructure. High performance computing is now essential in industries from financial services to oil and gas. The Internet of Things is creating mountains of new data from machines and sensors. According to Forrester, "Converged infrastructure offerings are more power-intensive and require more cooling than their data center is prepared to handle." 19 tons 23 kW

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At the same time that IT infrastructure increasingly requires high density environments, being able to align density to your business needs is important from a scalability perspective as well. If you can increase density within the rack, you can scale vertically. If you can run multiple densities within the same row, you can flexibly scale horizontally. According to Gartner, "Data center managers should optimize data center space usage from both horizontal and vertical perspectives."

The latest cooling technology supports higher densities

At Aligned Data Centers we're able to support densities up to 25 kW per rack. Unlike traditional data centers that are constrained by older cooling technologies, our conductive cooling system removes the density cap and frees up stranded space and electrical infrastructure.

The peak power draw is much less than most systems, so electrical infrastructure normally reserved for the hottest day of the year can instead be used for IT. This, combined with the ability to handle higher rack density than traditional fixed systems, significantly increases the capacity of our data centers.

Multiple densities - same row

High density IT infrastructure requires additional considerations for power and cooling. Most data center providers are confined to creating static power zones for different densities. When you have to commit to a fixed density across an entire zone, you're forced to choose whether to spread IT workloads across low

density racks or run everything in a high density zone, which may be overkill for many applications.

At Aligned Data Centers, our cooling technology enables you to deploy variable densities within the same row so you can have a low density rack right next to a high density rack.

So whether it's leveraging big data to gain a competitive advantage, discover a new source of natural gas or find the gene that causes cancer, the data center must be capable of supporting multiple densities, including high densities, in order to support future IT advances and business needs. According to Gartner, "The life cycle of a data center should not be determined by depreciation schedules, facilities problems or space issues. If designed and maintained correctly, a data center built today could satisfy compute growth within the same footprint indefinitely."



"A more transparent and usage-based model is sorely needed."

- Gartner analyst Bob Gill

According to McKinsey, "The portion of the IT budget consumed by infrastructure and facilities is significantly reshaping the economics of many businesses. In information intensive businesses like investment banks, telecoms. and business information. data center costs are diverting capital from new product development,

making some products and segments uneconomical and materially affecting margins. Without radical changes in operations, many companies with large data centers face reduced profitability."

Most "as-a-service" offerings today are priced on a consumption basis, meaning you pay for what you use. The data center. which serves as the foundation layer for many of these services, has not kept pace. The traditional approach to paying for the data center is based on an antiquated realestate paradigm of paying for space. Some progressive data center providers charge based on the power the customer consumes, but still require the customer to "ramp into" a power commitment that they make upfront. As discussed earlier, many of these contracts are written based on a best guess for future power growth.



The current approach to data center pricing needs to evolve

Aligned Data Centers provides the first consumption-based. pay-for-use pricing model, which gives you greater flexibility and control over how you deploy and pay for the capacity you need. This model takes the guesswork out of the equation. You can secure the capacity you need today and pay based on what you use.

The traditional pricing model does not support this flexibility. Regardless of what you use, you

are required to pay the price you committed to in the contract. This translates into wasted capital and wasted opportunity.

If you are like most organizations that, according to 451 Research, only use 56% of the power they have been allocated, then you are paying a lot more than you need to.



Lower upfront commitment = less risk

Instead of guessing how much power you will need 5-10 years from now, we allow you to take just what you need today. For example, if your forecast shows that you will need 1 MW of power over the next five years, but you only use 300kW today, then that is all you to need to commit to – no more. A lower upfront commitment also means less risk for your organization. With Aligned Data Centers, you are not placing your organization's capital at risk by tying it up in a long-term contract for IT capacity that you may not ever use.

See more, save more

As the saying goes "you can't manage what you can't measure." Aligned Data Centers' DCIM software measures actual power consumption. This data is available to you and our team, so collectively we can determine the best way to scale your data center. And since you are charged based on how much power you use, this visibility will ensure you are not paying more than you need to.

In addition, greater visibility opens opportunities to institute an IT chargeback model within your own organization. Less than one-third of enterprises today have such a model in place. But with greater visibility into power allocation and usage, you can better allocate data center costs to business units based on their consumption. According to the Uptime Institute, this "improves IT investment decisions and incentivizes efficiency."

Take control of your data center

You no longer need to be confined by the constraints of traditional data center infrastructure, providers, and pricing. With Aligned Data Centers you now have an option. You can deploy the data center capacity you need when you need it and pay for what you use. You can improve reliability and cut cost. You can reduce the risk of making longterm commitments based on the unknown. You can free up stranded capital that could add value to other areas of your business. With Aligned Data Centers, you are in control of your data center.

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About Aligned Data Centers

Aligned Data Centers, a division of Aligned Energy, is the first pay-for-use data center provider to offer consumptionbased pricing for on-demand data center capacity to enterprises, service providers, and governments who require greater control of data center cost and faster time-to-market.

Aligned Data Centers' evolved approach eliminates the need to forecast future IT demand so its clients waste less and can better align the data center to the needs of their business.



Join the Evolution

Schedule a tour of one our data centers today and allow our team to better understand your capacity requirements so we can show you how you can benefit from having greater control of your data center.

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