White paper

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Driving sustainability in the data center with Fujitsu PRIMEFLEX Integrated Systems

While still in the middle of mastering their digital transformation journey, companies are increasingly facing the need to also meet sustainability goals. With data center operations being the backbone of digitization, the challenge is to find the right balance between these two initiatives.

Digitization and sustainability are closely linked. On the one hand, the transformative power of digital technologies makes it possible to achieve sustainability goals in a way that hitherto unthinkable. On the other hand, digital infrastructure consumes valuable resources both for its production as well as in operation. For this reason, data center managers need to review the efficiency of their infrastructure to avoid a boomerang effect, where supposed benefits through increased use of digitization can lead to an increase in resource consumption.

In addition to the challenge to balance digitization and sustainability goals, the cost of energy is increasingly becoming a hard business factor. The times when enterprises could obtain their electricity comparatively cheap are over. With an increase of 58% for enterprise data center owners and 64% for colocation providers, Uptime Institute's Data Center and IT Spending Survey 2022 showed power to be driving the greatest unit cost increases – the result of high gas prices, the transition to renewable energy, imbalances in grid supply, and the war in Ukraine. The UK and the EU have been most heavily affected by these increases. Despite all the recent governmental countermeasures, electricity prices will probably never reach the pre-corona level again, they are likely to remain well above the average levels of the past two decades.

The question of how to improve energy efficiency comes up in almost every IT project today. According to IDC, by 2026, ESG performance will be viewed as a top 3 decision factor for IT equipment purchases and over 50% of RFPs will include metrics regarding carbon emissions, material use, and labor conditions[1].

This white paper outlines how PRIMEFLEX integrated systems from Fujitsu help IT operations to introduce a more efficient infrastructure – regardless of whether deployed in the core data center or at the edge. Besides the great impact of introducing the latest energy-efficient server systems, it shows the benefits of modern architectural concepts such as hyper-converged infrastructures or hybrid clouds and also explains the value of adopting an "as a service" IT consumption model.

[1] IDC FutureScape: WW Sustainability/ESG 2023 Predictions | IDC Blog

Replacing older systems

Servers are the number one energy consumers in IT. A study by the Borderstep Institute commissioned by Bitkom 2022[2] in Germany found that servers accounted for almost 40% of the overall data center energy consumption. Thus, they offer the greatest potential for energy-efficiency gains and footprint compression.

For this reason, it is worth looking at a tech refresh because modern servers are not only more powerful than older systems: they are also far more efficient. A single server of the current generation can take over the tasks of several legacy systems simultaneously, which reduces your data center footprint. And because modern systems also include more efficient hardware components and optimized power-saving functions, a tech refresh leads to significant savings in power consumption in your data center and is therefore crucial for sustainable data center operations.

Table 1 illustrates the concrete performance advantage and power saving potential by using the latest Fujitsu PRIMERGY RX2540 M7 server models in a PRIMEFLEX integrated system. The comparison of the SpecPower benchmark results[3] shows that the M7 models consistently deliver double performance at the same CPU loads as the predecessor model PRIMERGY RX2540 M6. This means that you now only need one M7 server for a workload that previously required two M6 servers, which presents a server consolidation potential of 2:1. Moreover, the energy consumption of the single M7 system is even less than the consumption of the former two M6 systems (i. e. 15% at 30% CPU load).

CPU load (%)	Operations M7	Power M7 (W)	Operations M6	Power M6 (W)	Performance advantage (%) of M7	Power advantage (%) (1xM7 vs. 2xM6)
0	0	184	0	137		33
10	1,630,320	335	798,865	199	104	16
20	3,258,335	382	1,605,244	225	103	15
30	4,882,953	427	2,399,228	250	104	15
40	6,512,849	474	3,195,994	275	104	14
50	8,142,534	528	3,997,496	304	104	13
60	9,768,180	586	4,791,610	340	104	14
70	11,400,544	677	5,593,093	387	104	13
80	13,026,390	810	6,393,133	438	104	8
90	14,659,192	937	7,186,063	492	104	5
100	16,290,837	1043	7,972,718	550	104	5

Table 1: SpecPower - PRIMERGY RX2540 M7 versus PRIMERGY RX2540 M6

[2] https://www.bitkom.org/Bitkom/Publikationen/Rechenzentren-in-Deutschland-2022

[3] SpecPower - Fujitsu Server PRIMERGY RX2540 M7,
SpecPower - Fujitsu Server PRIMERGY RX2540 M6

Given the potential 2:1 server consolidation ratio when replacing M6 with M7 models, Table 2 shows the savings for a sample server refresh project that consolidates 50x M6 servers to 25x M7 servers taking also the required cooling infrastructure into account (PUE: 1.56). For example, at a server utilization rate of 70%, the yearly savings would account for 33,139 kW of electricity and 9 tons of CO_2 (275 g of CO_2 per kWh) and reduce your energy bill by €16,570 (€0.5 per kWh).

CPU load (%)	Savings kW/y	Savings CO_2 t/y	Savings costs €/y
0	30,748	8	15,374
10	21,523	6	10,762
20	23,232	6	11,616
30	24,940	7	12,470
40	25,965	7	12,982
50	27,331	8	13,666
60	32,114	9	16,057
70	33,139	9	16,570
80	22,548	6	11,274
90	16,057	4	8,029
100	19,473	5	9,737

Table 2: Savings – 2:1 server consolidation from PRIMERGY M6 to M7

Selecting the right data center architecture

When undertaking a tech refresh, it is often quite sensible to also review the effectiveness of the underlying data center architecture. For decades, a traditional 3-tier architecture comprising server, external storage, and networking gear has been a proven foundation to run data center workloads. Converged infrastructure approaches powered by server virtualization technology brought a great leap forward in terms of sustainability. However, cutting edge architectural approaches like hyper-converged infrastructures promise to further improve efficiency gains.

Not so long ago, it was common in data centers around the world to run applications directly on physical servers that often sat mostly idle. Within a decade, the use of software-defined compute, storage, and networking approaches have become common industry practice. For example, server virtualization improves resource utilization, accelerates resource provisioning, enables workload mobility, and makes it possible to implement affordable high-availability solutions. But more importantly, it also reduces server sprawl and data center footprint, which brings major improvements when it comes to reducing energy consumption and cooling requirements.

Nowadays, in "converged infrastructure approaches," server virtualization is a key element of the solution stack. A converged infrastructure is a pre-packaged bundle of 3-tier systems, including servers, storage, networking, and management software. Companies usually purchase these systems from one company, instead of buying the hardware and software components separately from different suppliers. The beauty of a converged infrastructure system is that it typically comes pre-configured and pre-tested, making it easier and faster to deploy when building out a data center.

As shown above, a classic converged data center infrastructure consists of servers, external storage systems, network components, and software. While using server virtualization software optimizes the compute part, there are still all the individual components of the storage infrastructure (storage arrays and network) that consume energy for power and cooling.

This is not the case with hyper-converged infrastructures: by combining software-defined compute and storage technology, hyper-converged infrastructures tightly integrate all compute and storage resources in a cluster of commodity x86 server nodes, making a dedicated physical storage area network (SAN) with its management superfluous. Instead, storage is spread across the local disks of the server nodes. As there is no external storage involved, the data center footprint is reduced, as are energy consumption and cooling requirements.

With PRIMEFLEX, Fujitsu provides a broad range of integrated systems that have been specifically designed to streamline the deployment, operation, and maintenance of converged as well as hyper-converged infrastructures based on VMware, Microsoft, Nutanix, or SAP technology. Thanks to the unique combination of a pre-integrated and certified technology stack, new standardized implementation, and infrastructure support services providing technical solution support with a single point of contact, Fujitsu PRIMEFLEX systems offer a significant better life cycle experience in operating data center infrastructure.

Now, let's have a look at three concrete PRIMEFLEX scenarios and their impact on sustainability. "Scenario 1: CI" describes a classical converged infrastructure of six PRIMERGY M6 systems with an external ETERNUS AF250 S3 storage system. "Scenario 2: HCI-1" describes the move to a hyper-converged infrastructure by simply replacing the external storage system with a HCI configuration based on six PRIMERGY M6 servers. And finally, "Scenario 3: HCI-2" shows an HCI configuration after a tech refresh to M7. As outlined in the section above, this configuration provides the same performance as the M6 configuration with six servers. All scenarios use flash disks because these deliver better IOPS per watt than traditional hard disks.*

	Scenario 1: CI	Scenario 2: HCI-1	Scenario 3: HCI-2
Server	6x PY RX2540 M6 10x 3.5'	6x PY RX2540 M6 24x 2.5' w/ Expander	3x RX2540 M7 24x 2.5' w/ Expander
Storage	AF250S3 25x AF250S3 Value SSD SAS 1.92TB 2.5	6x SSD SATA 6G 1.92TB Mixed-Use 2.5' H-P EP	6x SSD SATA 6G 1.92TB Mixed-Use 2.5' H-P EP
CPU	2x Intel Xeon Gold 6326 16C 2.9 GHz	2x Intel Xeon Gold 6326 16C 2.9 GHz	2x Intel Xeon Gold 6442Y 24C 2.6 GHz
Memory	8x 32GB (1x 32GB) 2Rx4 DDR4-3200 R ECC	8x 32GB (1x 32GB) 2Rx4 DDR4-3200 R ECC	8x 32GB (1x 32GB) 1Rx4 DDR5-4800 R ECC
Used capacity	36.65 TB	32.11 TB	32.11 TB
Active power	555 W	663 W	800 W

* All specs per single server node

Table 3 shows the savings you can expect when moving from a converged infrastructure to a hyper-converged infrastructure. While merely replacing the external storage system in the HCI-1 scenario already brings a 9% reduction of power, carbon emissions, and costs, the real big step forward with savings of 45% is achieved with the additional refresh to the latest server systems in the HCI-2 scenario.

Scenario	Power (kW/y)	CO_2 (t/y)	Costs (€/y)
CI (6xPY M6+AF250 S3)	61,267	17	30,634
HCI-1 (6xPY M6)	55,757	15	27,879
HCI-2 (3xPY M7)	33,638	9	16,819
Savings HCI-1 vs. CI – 9%	5,510	2	2,755
Savings HCI-2 vs. CI – 45%	27,629	8	13,815

Table 3: Savings of HCI versus CI *CO_2 per kWh: 275g, Price per KWh: €0.5, PUE: 1.6

Adopting an "as a Service" IT consumption model

Another opportunity to build sustainability considerations into your digital agenda lies in the way you procure and consume IT. The market is currently seeing a significant shift toward the adoption of as-a-service IT consumption models for on-premises IT infrastructure. IDC predicts that by 2026, 65% of tech buyers will prioritize as-a-service consumption models for infrastructure purchases to help restrain IT spending growth and fill ITOps talent gaps[4]. Alongside the flexibility and cost control of as-a-service models, their environmental benefits that help companies achieve their sustainability goals are often underestimated.

Below are some reasons to shift to an "as-a-service" IT consumption model from a sustainability point of view:

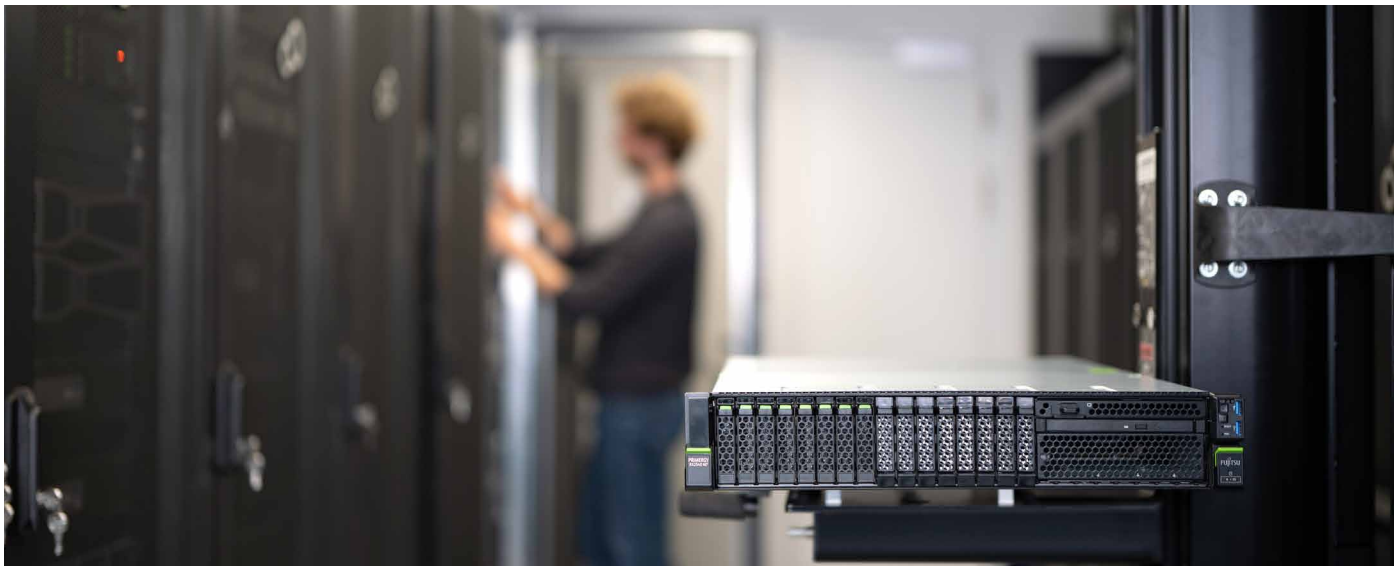
1. Eliminate overprovisioning
Many enterprises struggle with on-premises capacity planning of their IT resources resulting in IT production environments statically overprovisioned by 30% to support growth[5]. These inefficiencies not only result in redundant CapEx and OpEx costs, but also negatively impact power, space, and cooling requirements. By adopting an "as-a-service" IT consumption model like Fujitsu uSCALE, enterprises can overcome the challenges of overprovisioning. Based on an in-depth review of your needs, you'll receive appropriately dimensioned IT capacity from the start including built-in buffer capacity calculated according to your growth plans. In addition to significant CapEx savings, Fujitsu uSCALE helps companies avoid the waste of resources and costs associated with both unused equipment and unnecessary maintenance contracts and licenses.

2. Increase resource utilization
Low resource utilization is another common problem IT organizations are facing. Industry-wide utilization levels are still estimated to be around just 25%[6]. This means that three-quarters of IT resources are not being used effectively, leading to additional wasted costs and resources. Fujitsu uSCALE addresses these issues by assigning a Customer Success Manager (CSM) to each customer. The CSM is responsible for managing the ongoing relationship with the customer. Being a single point of contact for any issues or escalations, this individual also works closely with the customer to review current and future resource requirements and make recommendations on how to optimize resource usage. Customers will be also provided with access to a uSCALE Portal. Besides important information on billing, support, contacts, and order updates, this portal also gives an overview on current consumption data.

[4] IDC FutureScape: „Worldwide Future of Digital Infrastructure 2023 Predictions," October 2022. Doc # US48376222.)
[5] Gartner: 7 Reasons Cloud Budgets Don't Stay in Check
[6] https://middleware.io/blog/efficient-server-utilization/

3. Accelerate access to latest energy-efficient equipment
Consuming IT on an as-a-service basis also takes the burden of IT lifecycle management off your hands while ensuring you get accelerated access to the latest technologies, which typically consume less power than the previous generation. As outlined in the sections above, a tech refresh reduces the performance lags and inefficiencies in power and space consumption that often accompany aging data center technology.

4. Extend life of retired systems
In order to manufacture IT equipment, you need enormous amounts of raw materials and energy which pollutes the climate with carbon emissions. This is why we should take any effort to extend the product life cycle to conserve natural resources and reduce emissions. Depending on the customer contract conditions, Fujitsu retains ownership of the IT equipment upon termination of a uSCALE contract. Fujitsu is working with regional partners who are specialized in picking up used IT devices, which will then be refurbished and remarket for reuse after a certified data deletion. Devices that are no longer marketable will be handed over to a certified recycling company.



Taking advantage of hybrid cloud

It is common knowledge that the carbon efficiency of the data centers of the big hyper-scalers is significantly better than most of the company-owned data centers. Although the average annual power usage effectiveness (PUE) of data centers has seen a massive decline from 2.5 in 2007 to 1.55 in 2022, new data center builds of the big hyper-scalers routinely outperform the average, achieving PUEs of 1.3 and below using facility designs and more advanced equipment that are optimized for lower energy use[7]. More than two-thirds of this advantage is attributable to the combination of a more energy-efficient server population and much higher server utilization. Moreover, hyper-scalers usually have comprehensive efficiency programs in place that touch every facet of the facility. They can afford to deploy a dedicated team of engineers which can entirely focus on energy efficiency – something which is often not possible in company-owned data centers due to budget and operating expenses constraints.

For this reason, it also makes sense from a sustainability point of view to review your application landscape and introduce a hybrid cloud approach by moving selected workloads to the cloud. Fujitsu PRIMEFLEX integrated systems offer you a choice of different platforms on VMware, Microsoft, and Nutanix technology to integrate your on-premises deployments with cloud systems from the major hyper-scalers like Amazon, Microsoft, and Google.

For companies looking for the best hybrid cloud approach, Fujitsu provides services helping companies to find the right place for their workloads, whether on-premises or in the cloud. For example, with Fujitsu BestPlace – a data-driven cloud advisor service for SAP workloads – we provide data-driven decision support to identify the best-suitable operating environments for given SAP workloads. Based on customer-specific requirements, existing constraints, measured workloads, resource demands, and cost estimations, a placement recommendation is provided for each assessed SAP system.

[7] Uptime Institute Global Data Center Survey 2022

Summary

Indubitably, the operation of IT whether deployed in the core data center or at the edge requires significant energy and resources. But at the same time they are a necessary prerequisite that many sustainability goals can be achieved at all. The digital applications running in data centers do not only allow savings in energy and greenhouse gases in almost all areas of life and work. Moreover, they support a resource-saving industrialization and drive innovation, thus making them a critical part of a sustainable and resilient infrastructure. In light of their growing importance, it is necessary to make the operation of data centers as energy efficient and climate friendly as possible.

In the future, more stringent sustainability regulation and reporting requirements will force IT to deliver improved performance in energy efficiency. Ongoing price pressures – unlikely to abate, even in the long term – are a further driver. Compared to other measures, IT still has considerable scope for delivering improved energy efficiency. In fact, every watt saved by IT reduces pressures elsewhere.

By introducing state-of-the-art architectural approaches supported by highly efficient hardware along with flexible IT consumption models, Fujitsu PRIMEFLEX Integrated Systems help you balance digitization and sustainability goals while keeping your energy costs under control.

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