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Disaggregated Storage Platform Delivers Reliability, Scalability, and Efficiency

Financial services and insurance companies can lower their total cost of ownership (TCO) by using disaggregated, software-defined storage.

finanz **informatik**
technologie service

lightbits

Both storage capacity and performance are often underutilized in data centers today. There's a logical reason for that. An infrastructure needs to be able to support the largest amount of storage and the highest performance demands that could potentially be required for any specific server or application. In fact, both storage performance-utilization and storage capacity-utilization rates are low to very low across a typical deployment. As a result, storage solutions are evolving quickly to address those shortfalls and meet each customer's specific requirements.

Finanz Informatik Technologie Service (FI-TS) is a cloud service provider (CSP) serving leading financial services and insurance companies in Germany. These large institutions have massive databases and offer services that demand high levels of performance and require secure infrastructure services that can meet those demands while decreasing costs. Eliminating underutilized storage capacity while being able to scale data efficiently—without compromising performance or flexibility—is critical to reaching that goal. Faced with these challenges, FI-TS turned to Lightbits Labs and Intel to help develop an effective solution.

The storage and container challenge

The FI-TS DevOps team was engineering the company's Kubernetes-based Finance Cloud Native production interface to deliver cloud-native services built on an internally engineered NVM Express (NVMe)-based infrastructure. The solution's most critical requirement was that it had to meet European Union (EU) and German data-compliance laws, including data-storage regulations and financial regulations set by Germany's federal financial supervisory authority, BaFin. Any persistent storage would need to meet those requirements.

Unfortunately, meeting those critical requirements was a substantial challenge within the FI-TS Kubernetes environment because of the direct-attached NVMe storage that the company was using at the time. Kubernetes orchestration allowed for local persistent volumes (on NVMe) but these afforded no data protection and required applications to offer their own high availability. Otherwise, containers that moved to another server would not have access to their previously written data. What was needed was a centralized, redundant storage solution that performed like local NVMe, worked with containers, and met BaFin requirements for data protection and retention.

FI-TS was also experiencing inefficiencies with storage and resource utilization because it isn't possible to scale storage independently from compute power with the legacy DAS that the company had in place. FI-TS had looked at several alternative solutions—including traditional data center storage solutions—to solve these problems, but the cost structures didn't align with the company's business case.

> Finanz Informatik Technologie Service (FI-TS) supports IT operations for some of the leading financial services and insurance companies in Germany, providing everything from mainframe hosting to public cloud services. With years of experience in the finance and insurance industries, FI-TS is a bridge builder for digital transformation. FI-TS delivers cloud technologies that meet regulatory compliance requirements and offers flexible IT security solutions.

Handling high availability

Given the industries it serves, FI-TS needed persistent storage that could deliver high availability at local flash performance rates. The solution also had to be engineered to integrate with the orchestration layer and tightly integrate with Kubernetes using the common storage interface (CSI) specification. Finally, because multiple institutional customers would be using the platform, the solution had to support multitenancy while still helping to ensure compliance with the stringent EU and German financial and privacy regulations.

With these needs in mind, FI-TS turned to Lightbits Labs, an Intel partner. Lightbits pioneered the NVMe over TCP (NVMe/TCP) standard embodied in LightOS, which enables full cloud-native persistent storage integration for Kubernetes, with unprecedented scaling and availability via clustering. With an optimized NVMe/TCP front end and an intelligent back-end flash management, LightOS delivers input/output operations per second (IOPS). That, from an application's perspective, is indistinguishable from direct-attached NVMe solid state drives (SSDs). Lightbits and Intel continue to work together to promote NVMe over TCP and deliver cloud-native storage for data centers that's scalable, efficient, and easy to use.

Defining success

Recognizing that Lightbits and Intel could help it overcome the obstacles it faced, FI-TS began the collaboration by defining the solution requirements, including:

- Reduced storage footprint, with the scalability to grow with evolving needs

- Persistent storage capabilities for cloud services that delivered high availability to institutional customers building their infrastructures

- A fully automated storage architecture that granted customers direct Kubernetes access using APIs— specifically the CSI specification

- Orchestration for a containerized-environment infrastructure-as-a-service (IaaS) offering

- NVMe technology to complement the existing infrastructure

After completing the initial in-depth proof-of-concept (PoC) process, FI-TS concluded that the resulting cloud-native disaggregated storage solution met its critical requirements for persistent storage functionality and high availability. From there, FI-TS continued to collaborate with Lightbits and Intel to shape the full Intel-based production environment.

Putting the puzzle pieces together

Because Lightbits uses NVMe over TCP, the solution was also able to run on FI-TS's existing infrastructure, built on Ethernet and TCP/IP. That made scaling simple and efficient compared to remote direct memory access (RDMA)-based protocols and other storage fabrics.

Lightbits and Intel were able to deliver on FI-TS's strict service-level agreement (SLA) requirements. And the resulting Finance Cloud Native services solution integrates
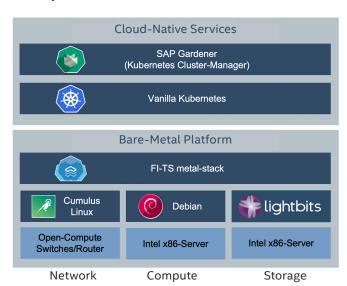

Figure 1. FI-TS Finance Cloud Native architectural overview

Lightbits LightOS high-performance software-defined block storage for container volumes with a wide range of Intel hardware, including the following:

- **3rd Generation Intel® Xeon® Scalable processors:** 3rd Generation Intel Xeon Scalable processors offer high performance and acceleration, are storage-software optimized, and include Intel Volume Management Device (Intel VMD) and enterprise-class SSD hot-plug capabilities.

- **Intel® Optane™ persistent memory (PMem):** Intel Optane PMem more than doubles the capacity of typical DDR4 DRAM DIMMs, which can help significantly lower TCO by increasing the utility of each server. Intel Optane PMem also expands the memory pool that resolves high input/output (I/O) bottlenecks by keeping data readily accessible in the memory tier to meet the Finance Cloud Native high-capacity data center demands as future needs grow.

- **Intel® QLC 3D NAND SSDs:** Intel QLC 3D NAND technology offers high-capacity storage with exceptional read performance and scalability for an affordable solution that can help shrink hard disk drive (HDD)-only or hybrid (HDD and triple-level cell [TLC] SSD) system footprints.

- **Intel Ethernet 800 Series with Application Device Queues (ADQ) technology:** ADQ technology enables NVMe over Fabrics (NVMe-oF)/TCP to achieve distributed storage performance in the same range as RDMA-based protocols, while NVMe-oF/TCP enables broad adoption because of its ease of deployment and scalability.

Innovation is only part of the story

The most important outcome for FI-TS was that it could now offer its customers persistent storage that enables portability while performing like local flash—a leap ahead in a containerized world—while staying aligned with the Finance Cloud Native services cost structure. But the results went far beyond that notable innovation, with Lightbits and Intel also delivering on the other key FI-TS requirements: high availability and tight integration with Kubernetes using CSI. And because Lightbits uses NVMe over TCP, the solution was

also able to run on FI-TS's existing infrastructure, built on Ethernet and TCP/IP. That made scaling simple and efficient compared to RDMA-based fabrics or other storage fabrics.

> **"The underlying FI-TS storage technology—LightOS software on top of the latest Intel hardware technologies —gives our customers a very simple, scalable way to run high-performance applications."**
>
> **— Kam Eshghi**
> Chief Strategy Officer
> Lightbits[2]

LightOS storage makes the difference

With the introduction of its Finance Cloud Native service, FI-TS was able to offer a key differentiator that made it clearly stand out from its competition: a fully automated, API-driven, flexible, and easy-to-use deployment model for provisioning customer environments. The service delivers high availability with high IOPS, low latency (even under load), high bandwidth, and consistent response times.

Intelligent flash management

The Finance Cloud Native service's intelligent flash management makes it possible for end customers to spin up services on bare metal in the Kubernetes environment in minutes instead of days.[1] The service also makes it easy to provision high-performance, software-defined volumes while enjoying the advantages of thin provisioning, compression, snapshots, thin clones, and storage quality of service (QoS). LightOS's ability to acknowledge random writes in Intel Optane PMem modules and then write sequentially to the QLC SSDs also extends flash endurance. Helped by Intel Optane PMem 200 series and 3rd Generation Intel Xeon Scalable processors, the solution also consolidated an 8-node cluster with 704 GB per node down to a 5-node cluster with 2,560 GB per node while sustaining the same number of containers and the same throughput.[4]

Reliability and scalability

LightOS automates the scaling of Kubernetes clusters. That gives Finance Cloud Native customers the agility they need, including a scale-out architecture that lets them independently scale storage performance or capacity, with dynamic rebalancing across the storage cluster and dynamic resizing of volumes. This disaggregated approach provides

complete flexibility for changing the ratio of storage to compute, as needed, to meet performance requirements. And reliability is built-in, with drive and server failure protection, highly available management and discovery services, and the ability to serve hundreds of thousands of clients with confidence.

Stepped up security and complete compliance

Every FI-TS customer can be confident that their production environment is security-enabled, as LightOS supports multiple projects and tenants with absolute separation between dedicated compute servers and Lightbits storage. Finance Cloud Native customers can also rest assured that their end customer's data is highly secured in compliance with European and German regulations.

Solution drives differentiation for FI-TS

FI-TS has made deployment easy for its customers, thanks to the Lightbits and Intel solution. That's because the Finance Cloud Native service provides simple application environment integrations and a standard TCP/IP network infrastructure without using any proprietary client software. Costs are also contained by allowing for industry-standard storage-server hardware.

Ultimately, FI-TS was able to improve resource utilization, drive better performance, scale data more efficiently, and reduce its TCO through its collaboration with Lightbits and Intel. Even better, FI-TS was able to offer a highly differentiated service that met its customers' most critical needs.

> **"With the platform built on LightBits OS software and Intel hardware we were able to deliver the performance our customers required and could be confident in telling them that their data was in safe hands."**
>
> **— Gero Skopinski**
> Head of Cloud Solutions
> Finanz Informatik Technologie Service[3]

Want to learn more?
Contact your Lightbits or Intel representative today.

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Intel® 3D NAND Technology

Intel® Optane™ Technology

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[1] Lightbits Labs. "Lightbits Labs Launches LightOS 2.0 With High Availability." June 2020. lightbitslabs.com/press-releases/lightbits-labs-launches-lightos-2-0-with-high-availability/.

[2] Adapted from a direct interview with Kam Eshghi, Chief Strategy Officer at Lightbits, conducted February 2021.

[3] From a direct interview with Gero Skopinski, Head of Cloud Solutions at FI-TS, conducted April 2021
See https://app.frame.io/reviews/582770ce-30e7-47ec-ab04-228a0dd9306c/c78356d1-f100-41d9-8327-d3deb59e77c4.

[4] Based on Lightbits testing for a highly available, scale-out storage cluster comparing an 8-node cluster with 2nd Generation Intel Xeon Scalable processors to a 5-node cluster with 3rd Generation Intel Xeon Scalable processors with Intel Optane technology, Intel Ethernet 800 Series, and 24 x 15 TB Intel QLC 3D NAND SSDs.