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Evolving CDNs to Keep Pace with Capacity, Quality, and Efficiency Demands

The increasing size and competitiveness of the video delivery segment places new economic and technological pressures on content delivery networks (CDNs), especially as more premium content is live-streamed. Broadpeak® BkS400 video cache server handles massive CDN capacity for video streaming with highly efficient use of resources across adaptive standards. It offers cloud-native operation with certification for Red Hat® OpenShift® Container Platform, optimized for Intel® architecture.

Evolution of delivery models for visual entertainment continues to accelerate, with a crowded field of established leaders and relative newcomers competing for viewers across broadcast, cable, streaming, and other channels. Lean over-the-top (OTT) providers have set a new baseline for operational agility and efficiency. Customers' expectations for control, quality, and variety have never been higher, and subscribers become less loyal and dedicated to specific providers by the year.

> *CDN architectures must evolve to cost-effectively stream massive amounts of both live and on-demand content over the internet, to any type of device at a high standard of quality.*

Mainstream consumers now typically use a range of devices—such as smartphones, tablets, and connected TV sets—to consume content, embracing any combination of mobile, fixed wireless, wireline, and satellite delivery. The content itself has become richer and more complex, with higher resolutions and advanced audio today, as well as emerging requirements such as augmented/virtual reality and 360-degree/volumetric content tomorrow. Consumers expect to consume content anywhere, anytime, and monetizing personalized experiences will play an increasing role. CDN architectures must evolve as a key enabler for these transitions, responding to a range of challenges that include consumer adoption of streaming content, increased throughput requirements, and a highly competitive environment.

Consumer Transition to Streaming

Streaming quality must match that of traditional broadcast content
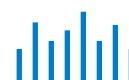
Increased Throughput Requirements

Throughput capacity required to handle massive transient usage peaks

Competitive Cost Pressure

Cost optimized with scalable, open, elastic capacity to better compete

Consumers are aggressively adopting streaming content, with Nielsen's The Gauge monthly snapshot reporting for the first time in June 2021 that viewer hours of streaming content had overtaken those of broadcast television.[1] Those viewers are unforgiving of quality degradations created by network congestion, making CDNs a more critical component of service delivery than ever before, even as they must handle unprecedented throughput requirements. Against that backdrop, flat average revenue per subscriber has created razor-thin margins for video delivery, forcing providers to innovate in an effort to do more with less.
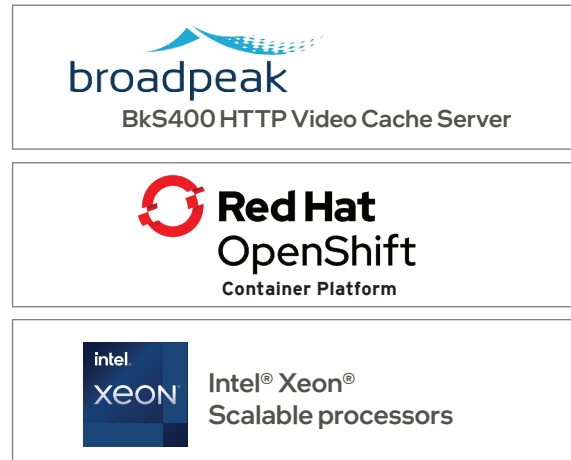
Cloud-Native Architecture for Content Caching

Transformative enterprise data center technologies such as cloud-native operation on software-defined infrastructure have become well established and mainstream. As these technologies have developed and become suitable even for latency-sensitive and critical workloads, communication service providers (CoSPs) such as internet service providers and OTT content providers have begun to realize the same benefits as enterprises, such as agility, elasticity, and cost-effectiveness. Accelerated by the build-out of 5G networks, cloud-native infrastructure and operations have become increasingly prevalent. The emerging class of cloud-native CDNs will provide new flexibility with the ability to run on the same platform as 5G and multi-access edge computing (MEC) services, for example.

In this software-defined environment, services such as caching, transcoding, and security services are instantiated using containerized network functions (CNFs) that are created and terminated as needed to handle workload demands. The container environment is centrally orchestrated for maximum efficiency, and because each container includes all of its dependencies, it can traverse any private, public, or hybrid cloud.

In addition to those infrastructure benefits, a cloud-native focus on microservices and containers enables forward-looking operational and development practices, including revenue-enhancing accelerated time to market for new service offerings. Continuous integration and continuous deployment (CI/CD) enables small, frequent software changes including patches and feature changes that make services more responsive while limiting the potential impact of any single software change. CI/CD is also a fundamental aspect of DevOps and DevSecOps, which improve system security, stability, and solution quality while making organizations more agile and efficient.

Broadpeak, Red Hat, and Intel have collaborated to build a technology stack capable of optimizing the shift to cloud-native CDNs for on-demand and live streaming.

broadpeak
BkS400 HTTP Video Cache Server

Red Hat
OpenShift
Container Platform

intel. XEON
Intel® Xeon®
Scalable processors

Adaptive Streaming with Broadpeak® BkS400 Video Cache Server

To enable massive HTTP adaptive streaming capacity with consistently high quality of experience, Broadpeak's BkS400 Video Cache Server caches content at the edge, reducing latency, resource contention on origin servers, and long-haul bandwidth requirements. The servers maintain awareness of live and on-demand assets and their recipients, correlating content chunks to composite sessions for accurate reporting and personalization of services.

System Architecture

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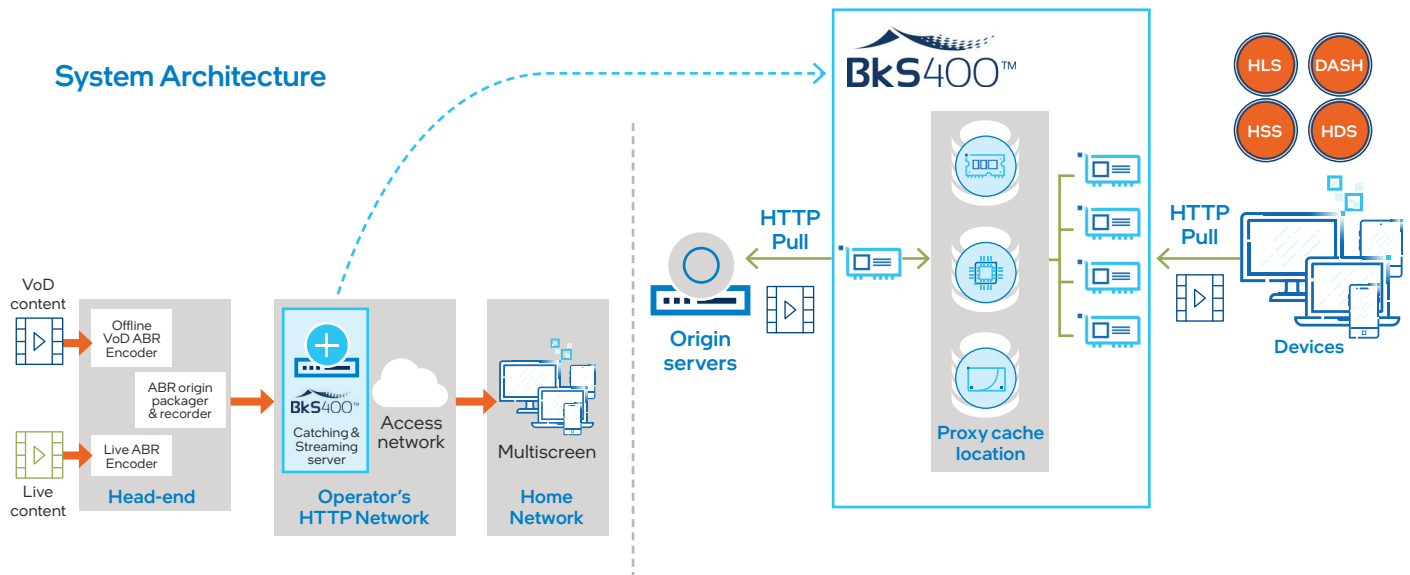
BkS400 systems support content in all popular HTTP adaptive streaming formats and standards, including HLS and MPEG-DASH. They employ multiple cache methods such as proxy cache, pre-caching, and inter-cache content fetching, together with a tiering mechanism that helps keep the most-requested content in the highest-performance storage tier.

Broadpeak powers CDN infrastructures for forward-looking CoSP network architects who demand content caching implementations to be defined entirely in software. Alongside containerized network functions such as those deployed for 5G networking, the BkS400 software is designed with microservice components built for optimized deployment, operation, and maintenance using containers in a cloud-native and CaaS environment.

To provide the most robust cloud implementation possible for its CDN software technology, Broadpeak has completed the certification process for the BkS400 cache server on Red Hat OpenShift Container Platform. As a result, coordinated support and proactive cross-validation of workloads and platforms as new product releases become available help protect the integrity of implementations and ensure a better customer experience. Certification of the BkS400 software for OpenShift required thorough testing of the solution to verify its stability and performance under a variety of network conditions. It provides enterprise-class stability for CDN operators as they adopt caching solutions based on the BkS400 software, as listed in the Red Hat Ecosystem Catalog.

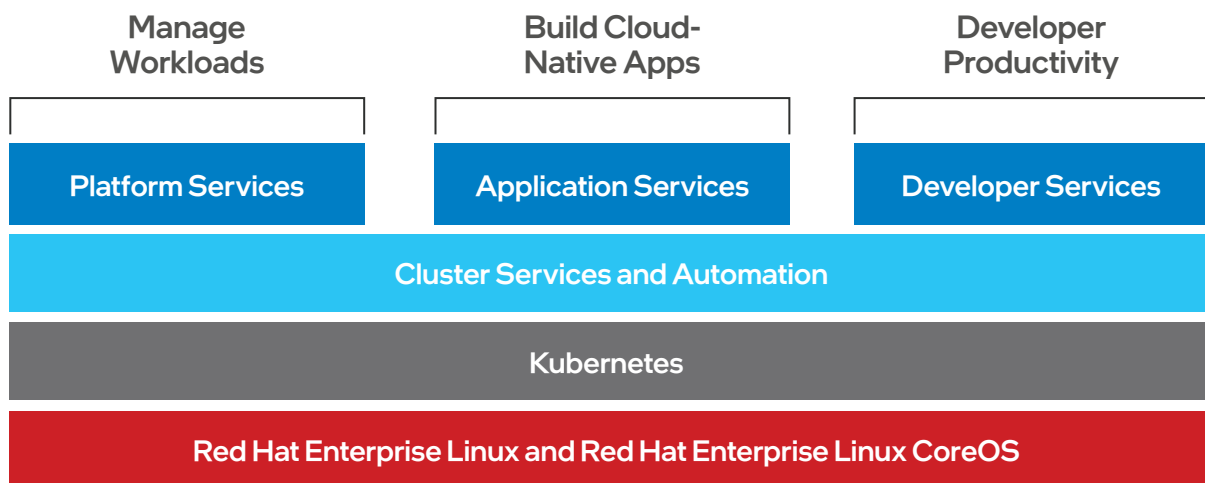## Proven Container Automation with Red Hat OpenShift

OpenShift is the industry's leading enterprise Kubernetes platform for cloud-native container development, deployment, and orchestration, with additional components for services such as authentication, monitoring, networking, and registry. Developed with an open source model, OpenShift integrates with the Red Hat tools portfolio and tools to optimize efficiency for software developers. Red Hat

technologies include hardened Red Hat Enterprise Linux® CoreOS and a protected container runtime environment. DevSecOps automation with OpenShift shifts security considerations to the left to help protect applications and data at runtime.

Deployed throughout the environment, from on-premise to the cloud and edge, OpenShift provides a consistent operations environment and experience for running and managing applications across hybrid and multicloud infrastructures. OpenShift can be consumed as a managed service on Amazon Web Services, Google Cloud, IBM Cloud, or Microsoft Azure. Customers can also maximize control by deploying OpenShift on any combination of hybrid cloud, bare metal, or virtualized infrastructure.

Red Hat OpenShift provides full-stack automated operations and self-service provisioning for developers to streamline the software lifecycle, from development to production. Fast, consistent workload handling, including at the edge, responds effectively to capacity spikes and other dynamic requirements with the reliability and flexibility needed to ensure an outstanding customer experience. The broad and deep Red Hat ecosystem provides a comprehensive set of solutions and services to build, deploy, and manage workloads at scale.

Broadpeak's BkS400 cache server running in a containerized environment based on Red Hat OpenShift disaggregates the dynamic CDN system from the underlying hardware, providing increased efficiency compared to scenarios where hardware is dedicated to specific functions. The cache platform also inherits OpenShift's optimizations for Intel architecture, including Intel® Xeon® Scalable processors. Deploying the cache server using OpenShift avoids exposing an attack surface with potential administrative access. In addition, its open source development model allows a broad community to examine and refine the code to reduce exposure and risk.

Manage Workloads	Build Cloud-Native Apps	Developer Productivity
Platform Services	**Application Services**	**Developer Services**
Cluster Services and Automation		
Kubernetes		
Red Hat Enterprise Linux and Red Hat Enterprise Linux CoreOS		

Flexible Performance with 3rd Generation Intel Xeon Scalable Processors

As the foundation for servers that host cloud-native CDN services based on Broadpeak's BkS400 cache server deployed in a containerized environment using OpenShift, 3rd Generation Intel Xeon Scalable processors enable flexible, deterministic performance. The platform scales from one to eight sockets per system and is available with a wide range of core counts, frequencies, feature sets, and power levels. This flexibility enables the environment to be tailored to specific implementations using a cost-effective open architecture that delivers unmatched interoperability and a broad choice of equipment vendors.

3rd Generation Intel Xeon Scalable processors help drive up the density of streams per node with a balanced, scalable platform architecture. They enhance computational throughput with CPU caches up to 50 percent larger than predecessors and up to 40 cores per socket, supporting up to 80 software threads for as many as 640 threads total in an eight-way server. Those execution resources are complemented by an advanced memory subsystem that supports up to eight channels of DDR4-3200 memory, with a capacity of up to 6 TB per socket. I/O enhancements include PCIe Gen 4 support for twice the bandwidth of the predecessor platform and reduced system latency that benefits CDN workloads.

Enhancements to Intel® Advanced Vector Extensions 512 (Intel® AVX-512) accelerate bit-processing kernels that move and reorder blocks of data, contributing to overall system performance. Intel® Advanced Encryption Standard New Instructions (Intel® AES-NI) accelerates resource-intensive parts of the AES algorithm in hardware. 3rd Generation Intel Xeon Scalable processors also feature Intel® Deep Learning Boost (Intel® DL Boost) to improve artificial intelligence training and inference performance. In addition, Intel® QuickAssist Technology (Intel® QAT) resident in the chipset or a PCIe card accelerates crypto and compression operations.

Conclusion

Edge-deployed CDN based on Broadpeak's containerized BkS400 video cache server using OpenShift gives providers a modern cloud-native approach to handling the CDN capacity gap, especially as live streaming continues to become more widespread. Proximity to the end customer helps meet demanding customer expectations, while the BkS400 server's network awareness and scalability help providers address quality engineering (QE) challenges and environmental sustainability objectives. Certification for OpenShift ensures compatibility with a robust cloud-native platform, while 3rd Generation Intel Xeon Scalable processors enhance stream density per node and security as the foundation for building a competitive advantage in the new world of adaptive internet streaming.

Optimizing the Carbon Footprint of Video Streaming

The individualized nature of unicast streaming makes it inherently less energy-efficient than older broadcast approaches to video delivery. To help mitigate this growth in video delivery's carbon footprint, Broadpeak deploys CDN capacity in software. This approach enables the CDN function to share server hardware with other applications, which typically reduces the number of nodes needed, and therefore the energy consumed.

The telco edge cloud locations emerging as part of the ongoing 5G network buildout provide a greenfield opportunity for deploying general-purpose servers for CDNs and other virtualized network functions. Elasticity provided by the Red Hat OpenShift Container Platform provides an energy efficient platform for Broadpeak solutions on Intel architecture that dynamically balances capacity with demand. Open Caching, a standardization initiative from the Streaming Video Alliance (SVA), in which Broadpeak is actively involved, complements the solution's climate sustainability with the energy efficiency of enabling multiple content providers to share a single CDN platform.

Intel® Xeon® Scalable processors offer high performance per watt, helping reduce the carbon footprint associated with CDNs and other video delivery functions. In particular, the network-optimized 3rd Gen Intel Xeon Scalable processors (N SKUs) are designed as energy-efficient platforms that deliver low latency and high throughput.

More Information

Broadpeak® Solutions for Advanced CDN: broadpeak.tv/advanced-cdn

Broadpeak® BkS400 HTTP Video Cache Servers Datasheet: broadpeak.tv/form/datasheet-bks400-http-video-cache-servers/

Broadpeak® e-Book, The Sprint to Scale Live Sports Streaming: broadpeak.tv/form/e-book-the-sprint-to-scale-live-sports-streaming/

Intel® Xeon® Scalable Processors: intel.com/xeon/scalable

Red Hat Ecosystem Catalog, Broadpeak BkS400 Video Cache Server: catalog.redhat.com/software/cnf/detail/broadpeak_bks400_video_cache_server

Red Hat OpenShift: redhat.com/en/technologies/cloud-computing/openshift

Solution provided by:

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