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Content Delivery Networks Market Update
Entering the Era of the Edge Platform

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Content delivery networks (CDNs) have begun offering edge computing, giving them new relevance to the DevOps community. This could start a new phase of life for CDNs, where the platforms become the vehicles for widely distributed applications that sit outside the cloud.

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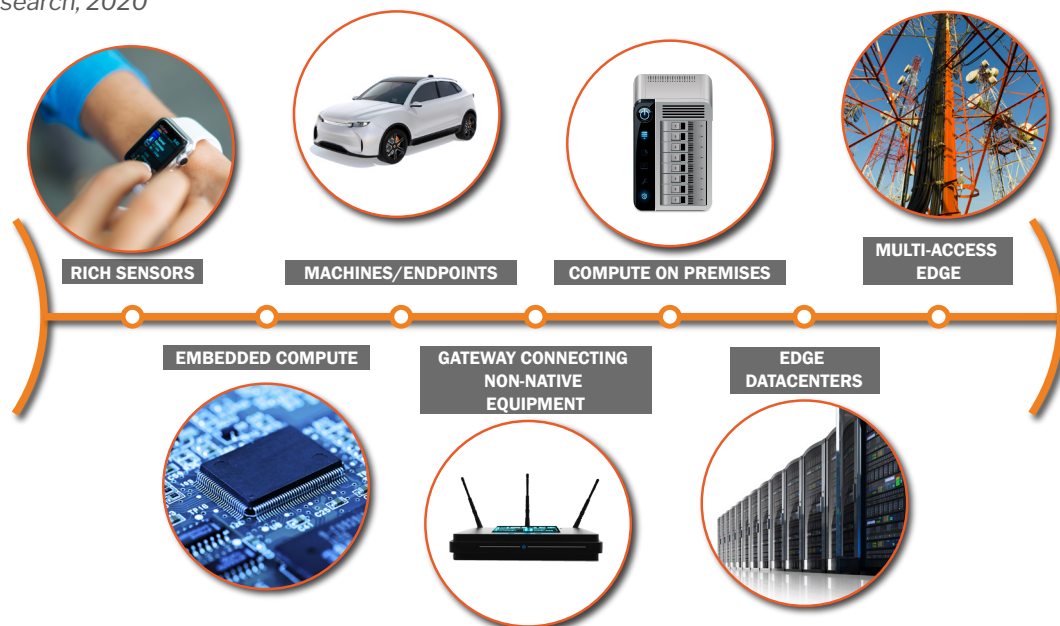
1. CDNs, Edge Computing and DevOps

CDN edge computing is a narrow subset of the greater edge computing picture, but, for the CDNs themselves, it could be the start of a new phase in which these platforms cater more heavily to application developers.

'Edge computing' generally refers to computing resources that sit outside the cloud, closer to the end user. In the context of CDNs, there is a more specific implication: Here, 'edge computing' refers to the ability for users to write their own code to run on the CDN platform. In a sense, they can program the CDN.

The edge is not a single location; rather, different edges have emerged in different parts of the network (see Figure 1). CDNs tend to be housed in edge datacenters that are closer to the cloud than to the end user. There are exceptions, of course. Akamai has a more widely distributed architecture than the others and sits in some access networks. And a given 'edge' datacenter might be very close to a user population (for example, Amazon Web Services [AWS] considers Los Angeles an 'edge' location). Either way, one basic function of a CDN is to sit between an origin server, which often sits inside a public cloud, and the end user.

Figure 1: Species of the Edge
Source: 451 Research, 2020

RICH SENSORS   MACHINES/ENDPOINTS   COMPUTE ON PREMISES   MULTI-ACCESS EDGE

EMBEDDED COMPUTE   GATEWAY CONNECTING NON-NATIVE EQUIPMENT   EDGE DATACENTERS

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Some CDN providers have long allowed users to configure the CDN with small amounts of programming. Others have written customized code for customers with specific needs. The growing wave of edge computing is more powerful, though. It has more of a free-form nature, letting customers discover what uses they can wring out of the CDN. That makes the CDN more relevant to application developers, as it can help optimize performance or infuse some geographically specific rules. For CDN providers, this is a way to expand the platform's importance to key customers by essentially becoming part of the DevOps cycle of application development and operations. It's also potentially a way to attract new customers that didn't previously need a CDN's caching ability.

The DevOps Audience

The most transformative trend for CDN providers recently has been the adoption of application developers as a user base. Applications and websites are already hosted and secured on CDNs; combine that with agile development practices that encourage rapid-fire changes to software, and it makes sense to try to bring CDNs and DevOps together.

Fastly was built to be a more programmable alternative to black-box CDNs, catering to the developer audience. Cloudflare likewise built up by focusing on developers. That was unusual at the time, but other CDNs have caught on. Akamai, for instance, made developer support a featured aspect of its Edge World 2019 customer conference.
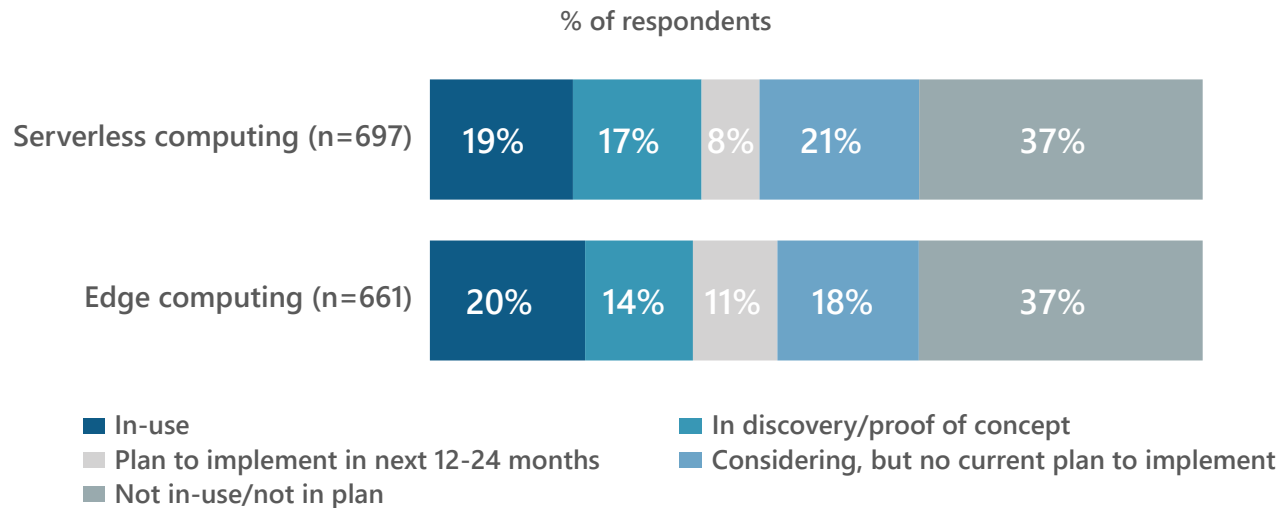
What does it mean to integrate a CDN with DevOps? Mostly, it's about control of the CDN. Customers have long been able to configure certain CDNs by picking from pre-written rules, but the emerging paradigm is to let users write their own code to program the CDN. This is usually done through serverless functions, or functions as a service (FaaS) — small, ephemeral jobs triggered by particular events, just as with AWS Lambda or Azure Functions. This capability is meant for altering the CDN's behavior, not for executing arbitrary applications (StackPath is one exception, and others are likely to follow).

Enterprise interest in serverless functions should continue to grow, as 451 Research's _VotE: Digital Pulse, Budgets & Outlook 2019_ survey finds approximately 44% of enterprises either using serverless already or planning to incorporate it during the next 24 months (see Figure 2). A comparable percentage is either using or considering edge computing in general.

Figure 2: Enterprise Interest in Serverless and Edge Computing
Source: 451 Research's Voice of the Enterprise: Digital Pulse, Budgets & Outlook 2019
Q. Please describe the level of usage within your organization for each of the following technologies.

% of respondents

Serverless computing (n=697)	19%	17%	8%	21%	37%
Edge computing (n=661)	20%	14%	11%	18%	37%

- ■ In-use
- ■ Plan to implement in next 12-24 months
- ■ Not in-use/not in plan
- ■ In discovery/proof of concept
- ■ Considering, but no current plan to implement

DevOps is an important direction for CDN providers. It gives them a hedge against the media delivery business, which is always under threat of commoditization (but continues to grow in overall revenues, due to increasing demand). Perhaps more importantly, as infrastructure becomes more invisible, dissolving into software form, much of the power in IT is shifting to developers. The software-defined networking movement, for instance, is turning network configuration into a software function, one that developers can write to. It only makes sense for CDNs to follow this trend.

Edge Computing: Use Cases

By inserting programming logic at the edge, users can change the CDN's configuration or give it instructions for 'if/then' scenarios. They can also groom the CDN to perform functions that might otherwise have run in the cloud. Motivations can include performance (reducing latency by running logic at a node closer to the user) or economics (saving the cost of transporting data to and from the cloud).

Users have already devised many use cases for this kind of edge computing.

- **A/B testing.** Altering routing rules so that a fraction of a user base sees a new version of a web page or experiences a new feature.

- **Image optimization.** Resizing images on a web page to suit a user's device type.

- **Ad insertion or customization.** Drawing different assets from an ad server based on a user's location or other characteristics.

- **Customized security or authentication rules.** Spotting special cases or detecting malware before traffic gets any deeper into the network.

Configuration-by-Code

Early versions of CDN programming were more about configuration than computing. One example of this is Fastly, which let customers run their own code on the CDN, using Fastly's version of the open-source Varnish Configuration Language (VCL).

Other CDNs provided such programming as a service rather than a product. That is, they would do customized scripting to handle customers' special requests. Examples included Cloudflare and Verizon. Naturally, this model doesn't scale. Cloudflare has noted that the demand for customized scripts was one motivation for developing Cloudflare Workers.

Serverless Functions

The most common implementation of edge computing on CDNs has been in the form of serverless functions, a relatively recent trend that has spread rapidly. Some of the products announced by major players are listed in Figure 3.

Figure 3: Comparison of CDN serverless functions

Source: 451 Research, 2020

COMPANY	PRODUCT	UNDERLYING TECHNOLOGY
AKAMAI	Akamai Edge Workers	V8
AWS	AWS Lambda@Edge	Containers
CDNETWORKS	Edge Computing Platform Service	Containers
CLOUDFLARE	Cloudflare Workers	V8, WebAssembly
FASTLY	Compute@Edge	WebAssembly
LIMELIGHT NETWORKS	EdgeFunctions	Containers
SECTION	Edge Compute Platform	Containers
STACKPATH	EdgeEngine	V8
VERIZON MEDIA PLATFORM	(Pending)	V8, containers

Many of the early CDN serverless offerings are based on V8 isolates, JavaScript workloads that can share an OS instance but are booted independently and kept isolated from one another. The use of V8 lets programmers write their serverless code in JavaScript.

Fastly's Compute@Edge and one variety of Cloudflare Workers are based on WebAssembly, a protocol that has become ubiquitous in browsers. Many but not all languages can be compiled to WebAssembly (Rust, C++ and Go are among those supported), and the protocol ensures isolation between operations. V8 isolates spin up faster than containers do, and WebAssembly-based programs can be launched even more quickly.

Containers and VMs

Others have gone a step further with edge computing. Their users can spin up containers, opening up possibilities of running truly arbitrary code, essentially putting IaaS onto the CDN. AWS Lambda is based on containers. CDNetworks, Section and StackPath have been taking this approach, and in November 2019, CenturyLink announced a partnership with Section, with the intention of eventually incorporating Section's capabilities onto the CenturyLink CDN. Verizon Media Platform plans to launch a managed container service in 2020.

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