Edge computing investments are just beginning

With all the hype, it's difficult to determine how important edge computing is right now. How much money is being invested relative to other technologies? How might investment change going forward? Are we at 'peak' investment or will it continue to grow?

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March 2020

Edge computing hype in 2019 wasn't as bad as it seemed

For those in the telecoms and technology industries, 2019 seemed like the year of edge computing. From 2015 to 2018, most edge-related articles referred to the concept theoretically – what edge computing *should* be able to do for enterprises and consumers – whereas 2019 saw a rash of companies announcing specific edge investments or product launches.

But there is always a danger of bias here – placing more weight on a new technology – and incorrectly assuming it is more important than it really is. So, how important is edge computing right now? How much money is being invested relative to other technologies? How might investment change going forward? Are we at 'peak' investment or will it continue to grow?

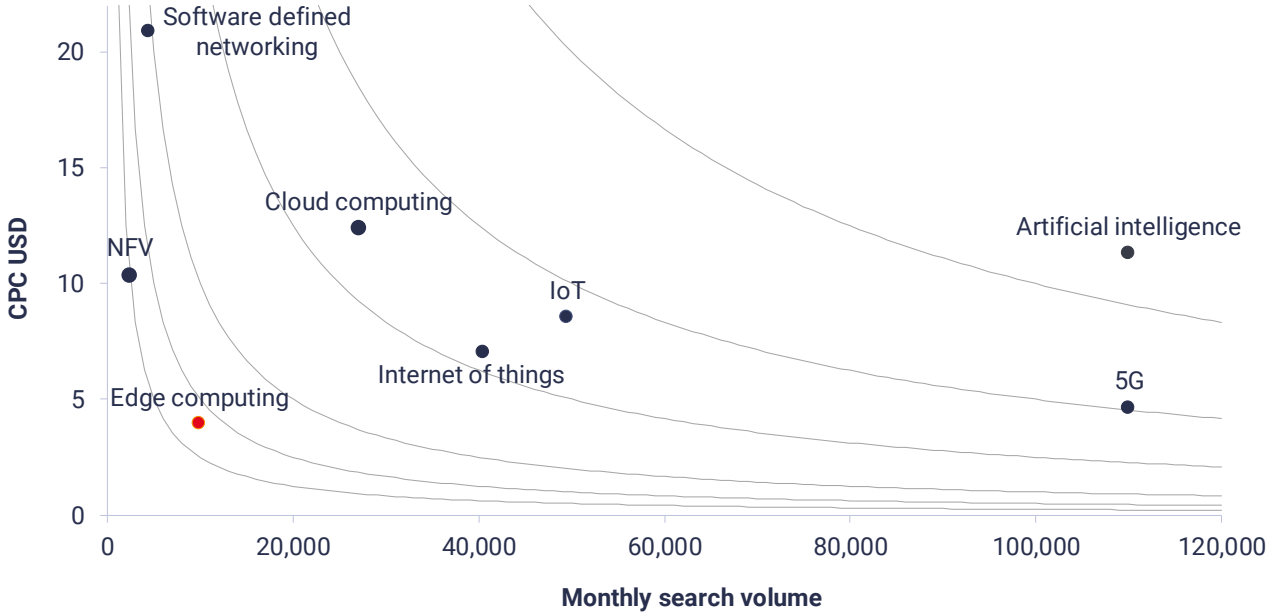
Making such measurements is extremely challenging since many investments are made organically by corporations and not made public in the way that venture capital or private equity deals are announced. Nevertheless, in this article, we'll try and give some pointers on how important edge computing is now in investment terms, relative to other technologies, and how this might change going forward.

If we start by looking at Google searches in the US, 'edge computing' as a term generates approximately 10,000 searches a month. This is less than 10% of the volume from '5G' and 'artificial intelligence' and around 25% of 'IoT' and 'Internet of things' – see the horizontal axis of the chart below. If we turn to a more closely related term, 'cloud computing', then edge computing still only generates around one third of the volume of searches. Interestingly, it does generate twice the volume and four times the search volume of telecoms-specific terms 'software defined networking' and 'NFV' respectively.

Searches only tell half the story of course. How much advertisers are willing to pay for a sponsored posting also gives some idea as how much value they believe they can derive from a technology. For example, 'artificial intelligence' and '5G' both generate around 110,000 searches a month in the US but advertisers are prepared to pay $11.29 per click on their sponsored post for the former term whereas they'll only pay $4.64 for the latter. Why? Probably because 5G is also searched for by consumers (seeking 5G plans and phones) where the transaction value is low. By contrast, it is likely that artificial intelligence is more likely to attract corporations seeking AI-driven solutions – something that is highly valuable to advertisers. Interestingly, as well as having much lower search volumes, 'edge computing' CPC (cost per click) levels are around 70% lower than for 'cloud computing' – at $3.94 versus $12.98. Assuming one sponsored click per search, we can see that 'edge computing' generates around $40,000 in advertising revenue per month compared with nearly $350,00 for 'cloud computing' – see the grey contour lines on the chart.

What does this tell us? I believe it implies that edge computing is not at hyped as we might think – it just feels like it because the term is new and there is almost certainly a long way to go. Investments, product and service launches will accelerate in the next few years.

Estimated US monthly cost per click (CPC) revenue from technology search terms



Source: SEMrush 10th February 2020; STL Partners estimates and analysis

Investment levels are currently low

If we turn our attention to funding and investment announcements made by companies found in the STL Partners' Edge Computing Ecosystem Tool during 2019, it indicates both the scale and nature money flowing 'to the edge'.

The tool breaks the edge computing ecosystem into seven sections:

1. Facility: The physical site that includes the land/location for the edge data centre, the data centre itself, power and cooling to support it and additional services to maintain and operate the site.
2. Network: Connectivity infrastructure to and from the edge site, as well as traffic routing controls and types of networks to optimise the delivery of content (e.g. CDN).
3. Hardware: This includes the hardware inside the data centre (racks, servers, processors and the maintenance and operators for these) as well as end-devices.
4. Cloud Infrastructure: Virtual infrastructure supporting the edge workloads and applications, from the operating system, the virtualisation layer (which may be container-based), and the platforms for developers to access and manage the storage and compute infrastructure.
5. Application/Software: Applications that run on edge computing infrastructure, including network functions, and the application-specific tools that support these, for example analytics capabilities or APIs and platform-as-a-service products.
6. Integration & Services: Services that provide support to the customer employing and integrating edge computing at any stage of the value chain – including design and engineering services to create platforms for edge computing applications, or more traditional integration into existing (enterprise) systems.

7. Open Source & Forums: Communities that seek to accelerate edge computing – either by creating forums for discussion across stakeholders and industry partners or open platforms to enable developers to build technology.

The theory is that you build the foundations first – you see investments in facilities, network, hardware and cloud infrastructure initially – and then applications, software, and services follow. Of course, things rarely work out like this as there is a chicken and egg problem: why build infrastructure without applications being present and why build applications without the infrastructure to run them on?

Consequently, most of 2019 (and before) has seen relatively small amounts of capital flowing into the first five sections of the ecosystem - facilities, network, hardware, cloud infrastructure, and applications/software - as companies and investors validate and scale the market. Open source and forums don't, by definition, attract much capital investment and systems integration tends to be opex-based and grow (as an easily identifiable segment at least) after the market has reached greater maturity.

30 companies in the ecosystem tool have attracted a total of $2.6billion in external funding (a tiny number compared with the roughly $60 billion of capital investment each year by Amazon, Microsoft, and Google – much of which flows into hyperscale data centres). The companies attracting larger amounts of funding tend to be those such as vXchnge and DataBank, both of which are building integrated edge data centres and co-location facilities in the US. It is important to realise that there will also be a significant volume of investment being made organically by regional data centre companies that we are not capturing here. Other larger investments in our table below include those made to established cloud computing software companies looking to extend their solutions to the edge – Docker and D2iQ (formerly Mesosphere) fall into this category. There is, even in this small selection of companies, a long tail of early-stage investments in firms with 'point solutions' that will look to expand their offering as they attract more capital. Either way, early-stage capital will likely continue to flow in 2020 before larger volumes of later-stage capital kicks in from 2022 or so as the market consolidates dramatically.

Edge investments from 30 companies up to 2019

Company	Facility	Hardware	Network	Cloud Infrastructure	Application /Software	Systems Integration	Funding $ Million
DataBank	x						410
vXchnge	x						405
Compass Datacenters	x						403.4
C3.ai					x		331
Docker				x			307.9
D2iQ				x	x		247.3
Mavenir					x		159.2
EdgeConneX	x						122
Big Switch Networks			x				119.5
Vapor IO	x						90
FogHorn			x	x	x		72.5
Iguazio					x	x	72
Qwilt			x		x		65.1
Zephyr (Vasona Networks)					x		36.6
Flexenclosure	x						35.9
Kontron		x					38.67
EDGE (DADI)				x	x		30
VANTIQ					x		28.3
Wirepas			x				20.4
Rigado		x	x	x			20.2
Golem					x		17.2
iExec					x		12
Litmus Automation				x	x		10.7
Swim.ai					x		10
ClearBlade			x		x		9.05
AirMap (Hangar Technology)					x		6.5
EdgeMicro	x						6
DartPoints	x						5.5
Crosser					x		5.2
Camgian Microsystems		x			x		1.6
Total	**8**	**3**	**6**	**6**	**17**	**1**	**3,098.72**

Source: STL Partners edge ecosystem tool, data from public announcements, Crunchbase

Future edge computing investments

Private equity might drive some of the consolidation among edge computing technology vendors, but the hyperscalers and other established technology companies will also seek to acquire successful start-ups. Microsoft announced $5billion of investment over four years in IoT and edge computing in 2018 and continues to ramp up its edge efforts, while HPE announced it will fund edge computing tech with $4billion over 4 years starting in 2018. Google and AWS will be doing the same. Apple acquired Xnor.ai, a Seattle-based startup focused on delivering AI capabilities at the edge, for $200million in January 2020. As well as organic solutions and M&A, the hyperscalers are also partnering heavily with telecoms operators that can provide both facilities and connectivity. Recent announcements of edge computing deals include:

- AWS and Verizon with the latter deploying AWS Wavelength in its edge sites in Chicago;

- Vodafone partnering with AWS to deliver edge solutions to developers in Germany and the UK;
- Microsoft Azure being deployed in AT&T's edge locations on its virtualised 5G network;
- Alibaba establishing a strategic partnership with China Tower to leverage its 1.9 million tower sites in China;

Some telecoms operators aspire beyond being a facilities and network connectivity provider and are looking to provide platform services themselves rather than (solely) rely on hyperscalers. For example, Deutsche Telekom has co-funded MobiledgeX, a PaaS start-up, to develop an aggregation layer that can link together edge computing locations from different telecoms operators to provide a seamless service to developers. MobiledgeX is signing deals with operators including SK Telecom (South Korea), Telus (Canada), NTT Docomo (Japan), Telefonica (Spain), and several others.

We have four pools of capital flowing into edge computing:

1. VCs and private equity (PE) and other investment firms (e.g. infrastructure funds);
2. Hyperscalers looking to exploit the physical locations of telecoms operators (and others);
3. Tech companies;
4. Telecoms operators themselves looking to build positions beyond basic infrastructure.

Although 2019 seemed to be full of edge hype, this isn't a bubble about to burst anytime soon. Investment in edge computing will accelerate over the next few years as the market grows and consolidates and we see a battle for supremacy between the three investment and operating models above.

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Or visit STL Partners' Edge Hub

www.stlpartners.com/edge-computing