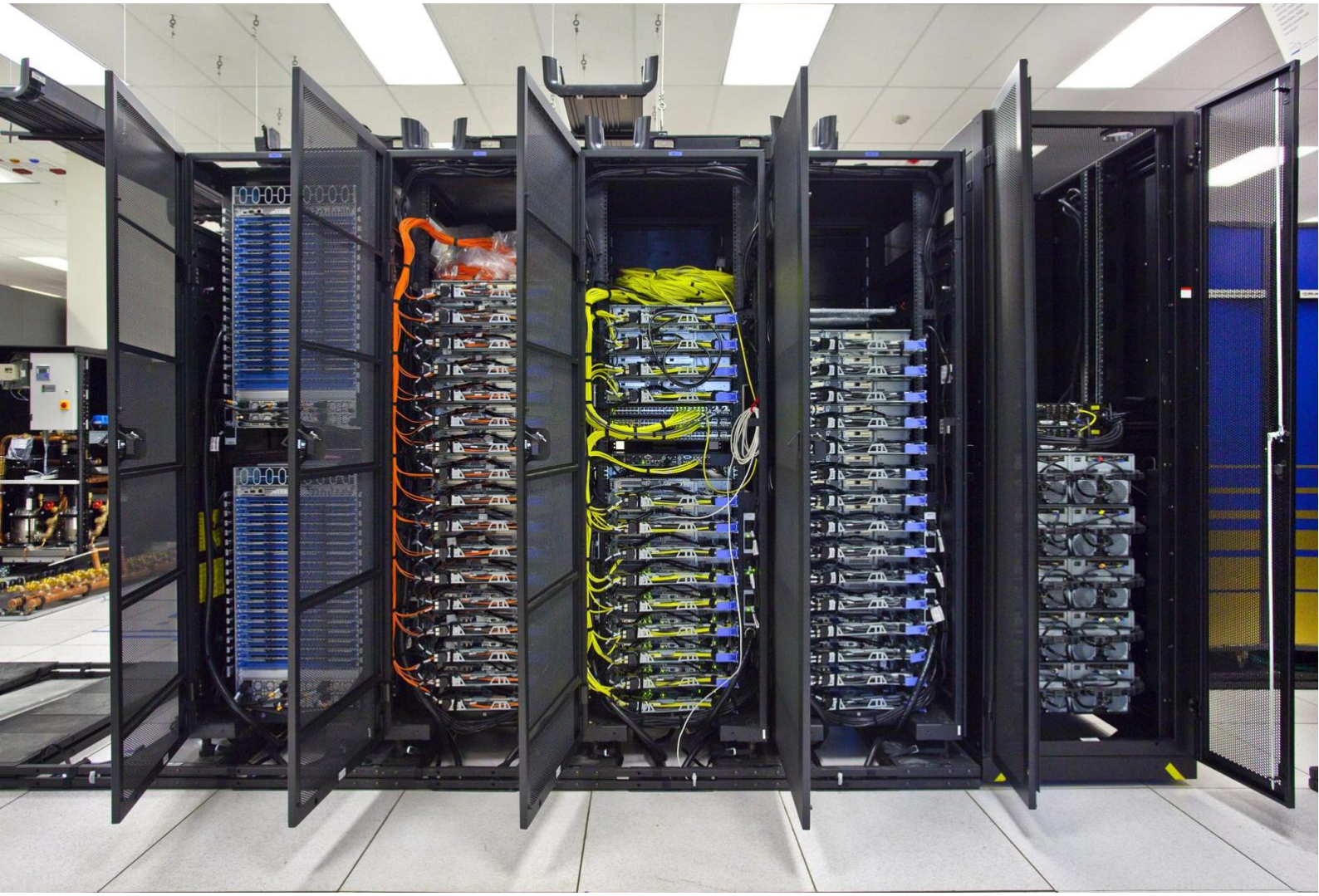

Edge computing devices: what are they?

There are five main types of edge computing devices: IoT sensors, smart cameras, uCPE equipment, servers and processors. IoT sensors, smart cameras and uCPE equipment will reside on the customer premises, whereas servers and processors will reside in an edge computing data centre.

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Defining the edge computing device ecosystem

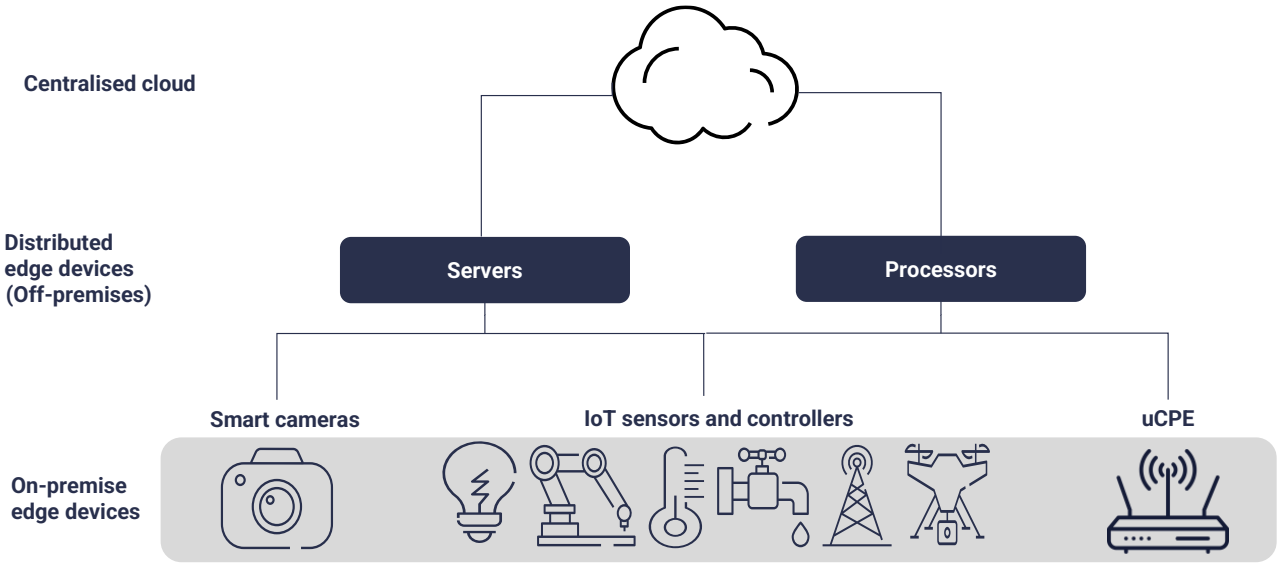
We have observed a growing trend for infrastructure to be placed outside of the data centre, physically closer to the end user. STL forecasts that the edge addressable market will reach US$543 billion by 2030, highlighting the ever-increasing importance of edge computing and the devices that support it.

We define edge computing devices as pieces of physical hardware connected to an edge computing platform that serve to collect and transmit data. They are used to accomplish a variety of tasks depending on the software they've been provisioned with.

We have identified the following five key devices which shape the edge ecosystem:

1. IoT sensors
2. Smart cameras
3. Servers
4. Processors
5. uCPE

Figure 1: The edge computing device ecosystem



Source: STL Partners

We have classified these devices as either sitting in the edge data centre (distributed edge device) or at the customer premise (on-premises edge device). Devices sitting at the customer premise will often send information to distributed edge devices for data processing.

Edge computing device 1: IoT sensors

The IoT industry has seen exponential growth with Statista stating that it could grow to as large as 1,500 billion USD in 2025. At STL, we consider any IoT device to be part of the edge ecosystem when the processing does not happen on the device or in the cloud.

IoT sensors monitor a variety of metrics such as temperature, pressure, motion, and water quality. As part of the edge ecosystem, the IoT device collects all the relevant information from an object before sending it to a local edge server instead of a central cloud server. Using edge computing can provide a real benefit to IoT sensors as the data is processed locally in real time. For example, in the case of an IoT device monitoring machinery in a factory, the data being processed locally means that if the machine starts to malfunction it can be shut down in real-time before any wider damage is caused.

Find out more in our article: IoT and Edge Computing – requirements, benefits and use cases

Edge computing device 2: Smart cameras

Smart cameras are another integral part of the edge ecosystem. We are all aware of traditional cameras which simply capture visual information however they become 'smart' when they can process the information and perform analysis. Smart cameras use AI, pattern recognition and other machine learning technologies to perform visual processing like object tracking, monitoring scene changes and deciphering colours/text. The use of edge computing means that there is no need to transfer all the high-volume data generated through vast quantities of footage to the centralised cloud. Instead, footage can be analysed on the edge cloud. For use cases where there is a large and fixed premise (e.g. a stadium), the analysis is likely to be run on on-premises edge servers whilst in use cases where the premises are not easily defined (e.g. smart cities) the distributed edge will instead be leveraged.

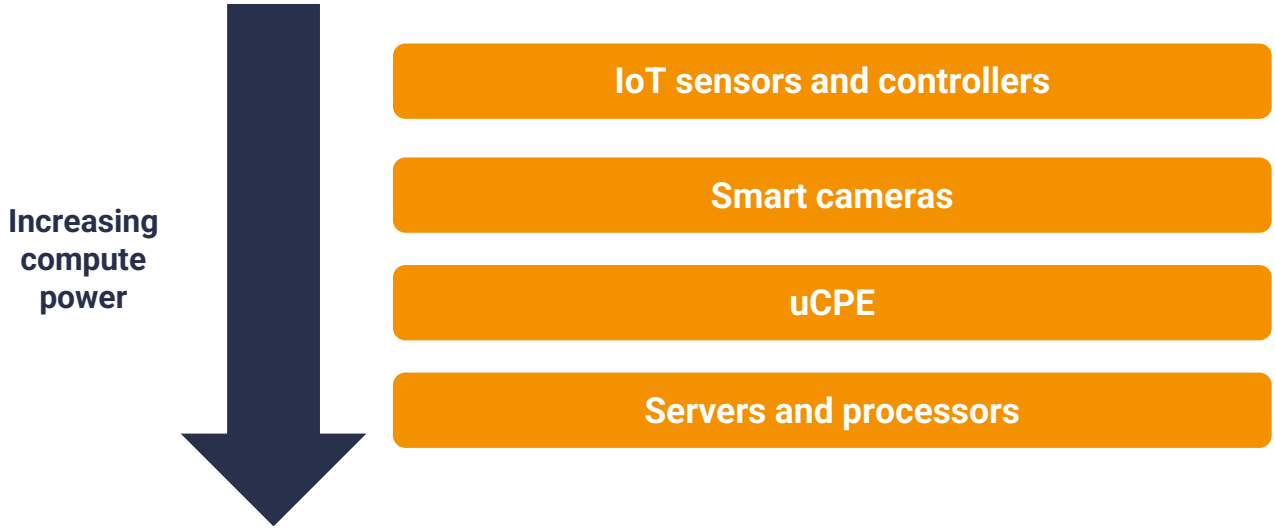
Smart cameras have been used in a variety of use cases across several verticals from retail to security, manufacturing or in smart cities. For example, smart cameras within retail outlets can use video footage to analyse customer behaviour and optimise product placement and store layout. By aggregating and analysing the information from video streams at the on-premises edge, this means raw footage can be filtered and key data points abstracted before being sent to the cloud.

Edge computing device 3: Servers

An edge server is essentially a powerful computer. Edge servers can be placed anywhere along the edge spectrum from the regional to on-premises edge. They are much more

powerful and have more compute than other edge devices (smart cameras, IoT sensors etc.) which has helped drive advances in AI and machine learning.

Figure 2: Devices in edge data centres (like servers and processors) are typically more powerful than those that reside on the customer premise



Source: STL Partners

Edge servers can either be single tenant (dedicated for one customer) or multi-tenant (multiple customers using the same hardware). Since all a customer's data is separate, single tenant servers provide security and customisation benefits. In comparison, multi-tenancy servers are more affordable, have lower maintenance costs and enable easy sharing across different customers.

Find out more about edge servers in our article: What is an edge server?

Edge computing device 4: Processors

Processors are integrated electric circuits located within a server, responsible for the maintenance, operation, and repair services to ensure that the edge computing hardware is working adequately.

Processors can be composed of different cores:

- **Central Processing Unit (CPU):** general purpose processing unit responsible for the performance of an edge computing system (typically called the 'brain' of the computer). They have between 4-16 multiple processing cores to operate and complete complex tasks at high speeds.
- **Graphic Processing Unit (GPU):** specialised processing unit allowing for enhanced performance, ideal for high-load applications such as graphics rendering, machine learning and video analytics (smart cities, security monitoring etc.)

- **Specialised Processers and Silicon like FPGAs and ASICs:** customisable processing units used in high speed and performance operations. Most enterprises will try to avoid using these specialised cores as they are expensive to deploy.

Figure 3: Different processing cores will be used to support different types of edge applications

	CPU	GPU	FPGA	ASICs
Computing performance	Low	Medium	High	High
Power consumption	Medium	High	Low	Low
Cost	Low	Medium	High	High
Size	Small	Small	Large	Small
Latency	High	Medium	Low	Low

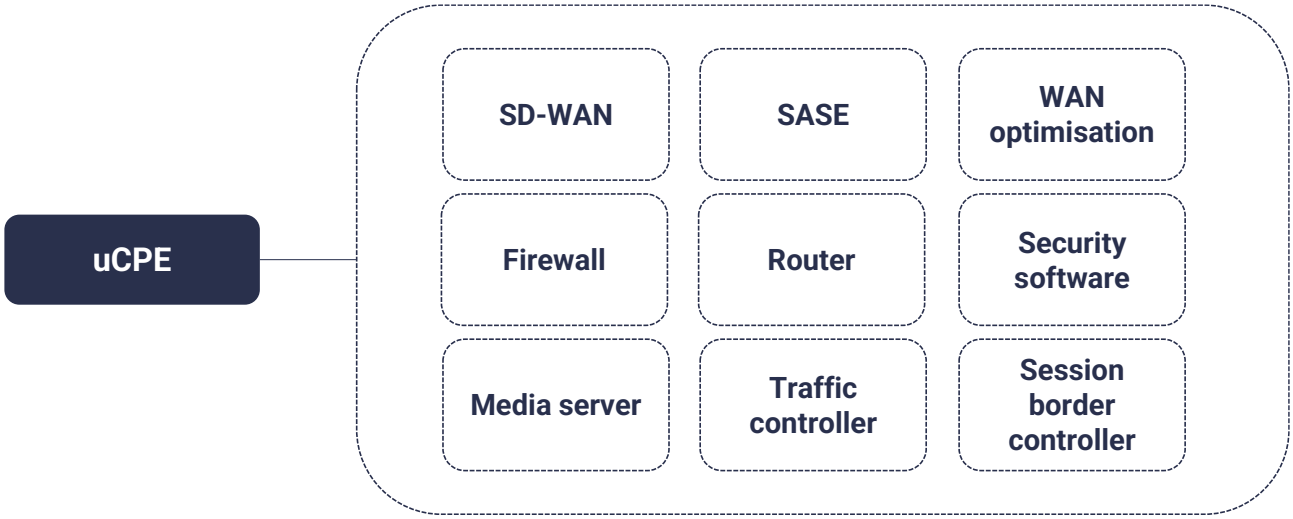
Source: STL Partners

These cores can be used individually, or two or more types of cores can be combined. This can enable a wider range of applications and help deliver innovation for AI at the edge.

Edge computing device 5: Universal customer premises equipment (uCPE)

Rounding out our list of edge computing devices is the uCPE box which has been designed as the solution to substitute legacy Customer Premises Equipment (CPE). A uCPE replaces the network functions and services that had to be stored on physical devices with software in the form of Virtual Network Functions (VNFs). This essentially involves replacing multiple hardware devices such as firewalls, routers, traffic controllers and WAN optimisation devices into one general purpose box. These boxes can also have spare capacity giving the ability to run enterprise applications alongside VNFs on the device.

Figure 4: uCPE allows multiple enterprise and networking workloads to run on a single device



Source: STL Partners

Enterprises either focus on providing the actual physical hardware (uCPE Box) or the software to be deployed on the box. Enea for example have launched Enea Edge, a software platform focused on edge use cases like security, 5G, IoT and SD-WAN designed for deployment on any white box uCPE.

Henry Osborne is a Consultant at STL Partners, specialising in edge computing, media technology and telco consumer strategy

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Or visit STL Partners' Edge Hub

www.stlpartners.com/edge-computing