ON THE EDGE

INTELLIGENCE ON A CHIP VERSUS SERVER BASED SOLUTIONS

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By Dr. Rustom Kanga

There is plenty of hype in the market about video analysis on the edge (which is essentially analysis software that is ported to a chip which is then embedded into a device close to the camera). Several of the major players have ported their software into a DSP chip which is mounted onto an embedded platform such as an encoder or camera. Is this the ideal way to provide "intelligence" in a system? Is there is benefit over leaving the intelligence on a server in some more central location. When is one approach superior to the other? In this article I will provide a guide to the factors that need to be considered to assist the user in deciding whether to use a server-based solution or an edge device.

First Choose the Intelligence

Deciding on the architecture and platform has to be the second question. The first must always be whether the system chosen can perform the functions required. Without such an analysis it would be equivalent to worrying about whether a plane has the right coloured upholstery without first ensuring that it can fly. Choosing a system with the right level of intelligence is important. Intelligence can be rated using an IQ rating system (very similar to that used by humans) -- see SecurityWorld INT'L Sep/Oct 2006. The simplest motion detection systems (IQ 60) are available from a large number of suppliers but can be prone to false alarms. At the next level (IQ 100) we have systems that can do simple things like reliable perimeter protection or left object detection in an empty scene. At IQ 110 one can do counting and by IQ 115 one can analyze behavior (e.g., Slips and Falls). Even at this level there are only a handful of players who can perform effectively.

Of course beyond this one moves into the territory of counting and abandoned object detection in crowd scenes (IQ 120 and 140). And finally at IQ 180 one can perform left object detection even in scenes where the object is not visible to the human eye.

If your application requires analysis in a crowded scene (e.g., in a lobby area or railway station) one has to ensure that the product selected will operate there. Because of the limitations of the DSP chips used in edge devices many vendors often restrict the functionality that they port over to the device. Hence they might have a highly functional counting system on their server while offering a much more restricted version on their edge device.

Determining whether your environment is mission critical or whether it is acceptable to have less robust intelligence is extremely important and may make all the subsequent considerations irrelevant. It is important to understand the level of intelligence that you require as this may dictate the platform that is selected.

Understand the Needs of the Application

The major advantage of edge devices is that the intelligence is placed close to the sensor (which is usually a camera in the case of video based surveillance). This means that the analysis can continue even when the network connection is down. Note of course that if a number of alarms occur while the network is unavailable some of them could be lost as the edge device might have very limited local storage capability. Technically it is feasible to put very large storage capacity on each edge device but this greatly increases their cost relative to a server-based system where large storage capacity can be shared across many cameras. The major advantage of server-based systems (in addition to the relatively lower cost of storage just discussed) is that most of the original development is done on server-based platforms. This means that the server-based solution is usually several versions ahead of the edge solution and it is always more robust as it will have been through more prolonged testing. It is also much easier to customize server-based applications and this could be a determining factor if customization is important to the customer. One organization, a railway in Europe, needed to put a very large number of cameras on poles along the railway line. They wished to know if there was an incident on the track. Most of the time on most of the cameras nothing happens and it does not make sense to transmit large amounts of unnecessary data to a central control room. However, if an event occurs it is important for the central authority to receive the alarms immediately. This is a perfect application for an edge device. The intelligence sits on each pole but nothing is transmitted to the center network load would be unmanageable. Consider another application for the same customer. They want to protect their railway stations from abandoned bags or parcels, they want to count the number of people on their platforms to prevent overcrowding and they want to manage their public liability by using a Slip and Fall detection system. In theory they could use either an edge or server-based device. However, they have an additional requirement. They would like the system to check on whether the ticket vending machines are working (by keeping an eye on the little light on top of the machine to make sure it is green and not red). This requires a small amount of customization by the vendor and this would make a server-based system most appropriate.

A Slip and Fall detection system can be useful in that it permits the organization to see such events in real time and take immediate action to help a person who has fallen down. Studies have shown that such action significantly reduces the number of liability claims. However, these systems cannot be expected to capture a hundred percent of such incidents. The person may have been half hidden by a table when he fell down and a system may miss that event. In such cases it is useful to be able to return to the recording (based on date and time) if such an incident is reported to analyze it. Since edge devices are not suitable for continuous recording, a server based solution would be recommended. If one cannot be assured of 100% detection and network capacity is not a constraining issue a server based application may be preferred.

Consider the Recording Policy

Every organization has its own recording policy. In some airports for instance legislation dictates that they need to keep video footage for a certain number of days. In other situations (e.g., the rail organization described earlier which put thousands of cameras on poles along the track) they only required event based recording. Edge devices are ideally suited to event-based recording. The analysis can be done close to the camera. If all the video has to be transmitted and stored centrally then it may make more sense to take advantage of the more comprehensive offerings usually available on a server platform.

Is Real Estate Important?

Servers are usually placed in racks and these have a footprint that consumes expensive real estate in control rooms. Edge devices would usually have a higher footprint for the same number of cameras. However, since they can be mounted on walls and ceilings near the camera the real estate costs is often not easily edge devices (the previous factors will usually carry much more weight in the decision).

Does Distribution Mean Edge?

As a general rule the computing industry has moved towards distributed rather than centralized computing. Edge products are invariably distributed. This does not mean that server-based systems are centralized. Servers do not have to sit in racks in central control rooms. In modern facilities they can be distributed close to the cameras as well. However, since a single server can handle multiple cameras even a distributed server solution is likely to be somewhat more centralized than an edge based solution in the sense that many cameras feed into a single server.

This distinction is quickly vanishing as servers are available with very small form factors and embedded encoders are being developed to handle multiple cameras.

Making the Network More Reliable

A network can fail at many points. A server may stop working, individual cameras may fail or the network itself may stop working. There are different methods available for ameliorating such situations, usually by building in some level of redundancy into each element that has a risk of failure.

If an individual camera fails both edge and server-