WHITE PAPER

Total cost comparison study

of analog and IP-based video surveillance

AXIS COMMUNICATIONS

Table of contents

1. Introduction

The shift towards IP-based video surveillance solutions has been going on since the first network camera was introduced in 1996. Despite the benefits of going IP, analog technology is still entrenched in some markets and segments. There could be numerous reasons for this, including long replacement cycles of security equipment, a tendency to do partial security system upgrades, IT knowledge gaps among installers, etc. One of the longest-standing arguments against going all-digital has been the perceived higher cost of IP cameras compared to their analog counterparts. However, cameras are only one part of a video surveillance solution, and the total cost of a complete system is dependent on a number of factors.

In the spring of 2007 a study was carried out by an independent research group – that was subsequently published as a White Paper by Axis Communications – with the aim of determining and comparing the up-front total cost of ownership (TCO) of deploying an IP-based and analog system in a school scenario with 40 cameras. Based on bids from real integrators, the study found that the TCO of the IP-based system was slightly lower than that of the analog system. Based on these findings, the break-even point where an IP system exhibits a lower TCO than a similar analog system was determined to be around 32 cameras.

Three years on, the video surveillance market has developed significantly, and a need was felt to update the TCO study to reflect current price points and the latest technological advances. Hence, the objective of the present study is to update and improve the previous study. The fundamental objective of the study, however, remains the same, namely to determine and compare the total cost of ownership of:

> An analog camera system using DVR(s)
> A fully digital system using network cameras and standard network and computer components

This study was carried out in the spring of 2010 and was administered by Lusax, a research group at the Lund University School of Economics & Management in Sweden, specializing in understanding the dissemination of new IP and IT-based technology systems within the global security industry.

2. Research method

The survey was run as a fictitious tender request for one analog and one digital solution to be installed at a retail site, with pre-specified conditions and technical requirements. The survey was distributed among a sample of US integrators that are actively selling and installing both analog and IP-based surveillance systems. All participating integrators were asked to provide bids for both types of system.

Before integrators were approached, a site plan and a realistic set of technological requirements had to be elaborated. This was done with input of several technical experts with experience in the design of both analog and IP-Surveillance systems in retail settings. All site and scenario details as provided to the integrators are outlined in section 5.

When a realistic scenario had been developed, survey documents were drafted. The survey – which had the form of an itemized request for proposal – and the accompanying technical documentation was then screened by the experts and by a pilot integrator participant. The feedback from this test round was used to further improve the survey and the supporting documentation.

The survey was then launched to the entire sample group of integrators through an e-mail which contained the request for proposal as well as all documentation. The initial e-mail was followed by several rounds of telephone calls to the integrators in order to verify that they had received the material as well as to answer any questions related to the survey.

Full survey replies, containing bids for both the analog and IP scenarios, were received from five integrators. These bids were scrutinized carefully to validate figures and identify potential inconsistencies in the material. If irregularities were found, integrators were contacted by phone and e-mail to provide clarifications. When all survey answers had been verified and double-checked with integrators as necessary, the final step was to compile all data in a structured manner and analyze the results.

Figure 1: Research method and process

In addition to the TCO survey, a parallel study focused on interviewing representatives from the same sample of integrators was carried out. In this study, integrators were interviewed by telephone and asked a broader range of questions relating to their views and experiences of working with different surveillance solutions and technologies. While there was some overlap between the two studies in terms of respondents, the majority of the integrators interviewed by telephone did not participate in the TCO study. The interview study provided further insights into the 'softer' aspects of the analog versus digital surveillance discussion.

3. Total Cost of Ownership (TCO): definition

For the purpose of this study, the total cost of ownership of a CCTV is narrowly defined as the "up-front" or "hard" costs of investing in a video surveillance system, i.e. the basic component costs and the labor involved in designing, installing and deploying the system. In the "real" world, a number of additional factors would naturally have an impact on the perceived cost and benefits of a particular video surveillance solution.

Examples of such factors may be ease-of-use and the ability to remotely monitor and control the system; future expandability and integration with other security systems; video quality, etc. Equally important is the temporal dimension of the TCO. Over time, total cost will be highly dependent on the costs and time associated with regular maintenance, component replacements and software upgrades. However, such factors are highly dependent on the specific conditions and the needs and preferences of end users in every particular case.

To get a complete picture of the TCO of a video surveillance system for a particular end user and site, one would thus need to consider a number of softer factors as well as take into account the maintenance and operating costs that accrue over time. However, due to the difficulty of assessing and defining these cost factors in a structured manner without resorting to speculations and conjecture, they were excluded from the study.

4. Case scenario

The fictitious case was set in a retail store context, where the purpose was to compare the total cost between a "greenfield" installation of an analog camera and DVR system and an all-digital IP-based solution. Given the cost focus, the case conditions were somewhat simplified and peripheral components and additional features that would not have a direct impact on the comparison (e.g. public view monitors) were left out.

The basic conditions of the case were:

> Medium-sized retail store site
> Greenfield installation: no pre-existing coax cabling, IP network infrastructure or power equipment for the video surveillance system
> Surveillance only: no additional analytics or integration with other systems
> Two technological scenarios:
    - Analog camera system with DVR recording
    - Fully digital system with network cameras, video management software and standard IT network and storage solution
> Three camera layout alternatives per scenario: 14, 25 or 40 cameras

Given these conditions and the detailed technical requirements listed in section 5 below, we asked integrators to provide itemized cost proposals for the three different camera layouts for both the analog and IP-based scenarios, covering a total of six alternatives. The reason behind including separate proposals for several camera layouts, was to provide a more detailed picture of how the analog and IP alternatives scale in terms of cost, as additional cameras are added.

The different camera layout alternatives were chosen as realistic alternatives that might be considered at a retail site, given different user needs and budgets. In order to provide an unbiased comparison, the number of cameras in each alternative was selected to avoid the known "sweet spots" of analog systems – 16, 32 and 48 cameras – and IP-based solutions – 17, 33 and 49 cameras – respectively.

In the network camera scenario, integrators were asked to specify pre-defined Axis Communications models. As for analog cameras, integrators were told to select reputable "brand name" suppliers that would provide a similar level of quality and feature sets as the Axis IP equivalents. Moreover, integrators were urged to apply any potential quantity discounts that might be applicable, as well as to perform realistic calculations of storage requirements for the different alternatives.

To facilitate for the integrators, given that it was a fictitious case with no real-world site to visit and inspect, all cable lengths were pre-calculated and specified in the technological requirements. This also improved consistency and comparability between the alternatives, as specification of arbitrary cable lengths by the integrators were avoided.

For the recording solution, AXIS Camera Station was specified, providing a fixed cost per server for systems using up to 50 cameras. In the analog scenario, video management software was assumed to be included in the DVR system. To be able to benefit from the latest video compression technology, both the analog DVR system and IP-based solution were required to be compatible with the H.264 standard.

5. Technological requirements used for the case

Camera layout alternatives: analog / IP cameras

14 camera layout:	12 indoor fixed dome
	2 outdoor fixed (day/night) incl. housing
25 camera layout:	16 indoor fixed dome
	9 outdoor fixed (day/night) incl. housing
40 camera layout:	29 indoor fixed dome
	2 indoor PTZ
	9 outdoor fixed (day/night) incl. housing

System specifications and requirements

	Analog scenario	IP scenario
Camera resolution	480 TV lines, 4CIF	Minimum SVGA (800x600 pixels
Cameras	Quality "brand" name cameras	Indoor fixed: AXIS M3203 Indoor PTZ: AXIS P5534 Outdoor fixed: AXIS P3343-VE
Cabling (video and power)	Coax from each camera to DVR plus power cables	CAT5E, incl. power via PoE
Average cable length per camera	100 ft/camera (video coax) 65ft/camera (power)	65 ft/camera (Cat5 incl. PoE)
Power supply	Camera power supply	PoE switch
Switches	n/a (all monitoring through DVR)	As needed
Server/storage	Mid-end "brand" name DVR (H.264 compatible incl. storage	PC (standard) incl. storage
Software	As included with DVR (H.264 compatible)	AXIS Camera Station
Monitor	Standard high resolution monitor (assume equivalent for analog/IP)	
Accessories	Fittings, fasteners, etc. (assume equivalent for analog/IP)	

Recording parameters: analog / IP

In-store

> Minimum 7 days @ 24 hours/day
> Open store: 15 fps (18 h/per day)
> Closed store: 1 fps (6 h/day)

Outside store

> Minimum 7 days @ 24 hours/day
> 10 fps avg. (24 h)

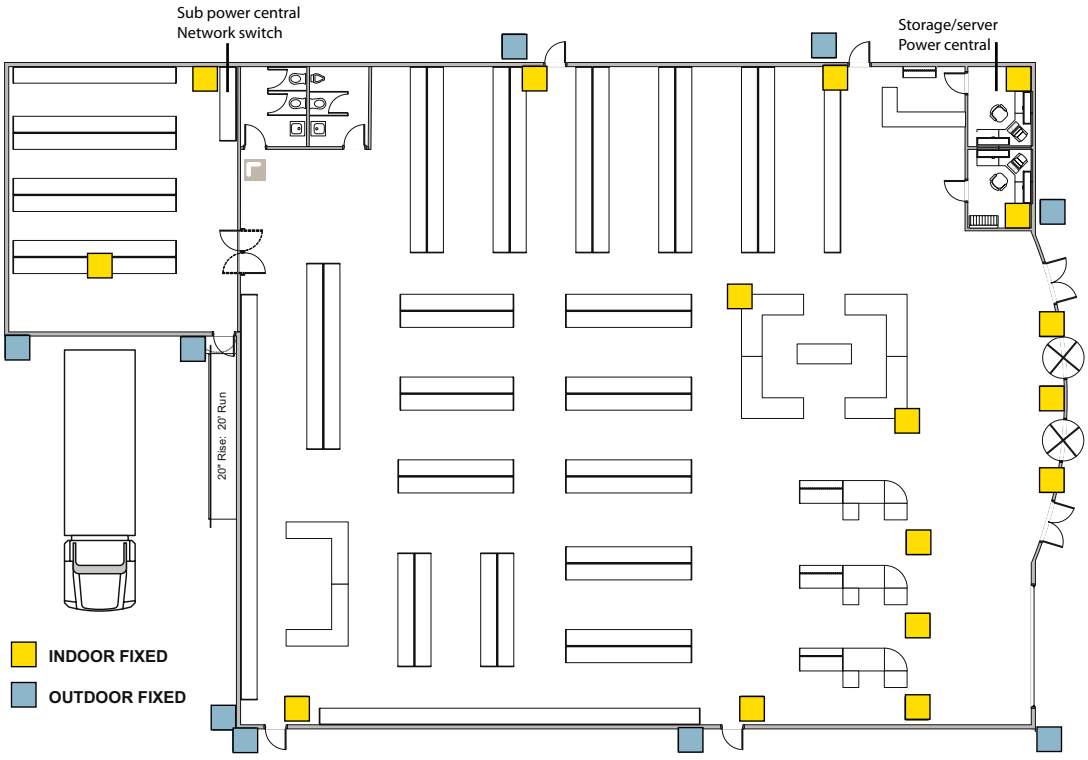

Figure 2: Store layout and camera placement in the scenario with 25 cameras

6. Cost breakdowns

As previously mentioned, only those system elements that have an up-front impact on the total system cost were included in the survey request for proposal. In addition to cameras and recording equipment, this includes all cabling, power supplies, network switches, monitor, fastenings and fittings.

Labor costs were itemized for system design time, and separate total installation cost for cameras and cabling. In addition, integrators were free to specify additional costs not covered elsewhere in the survey request for proposal. Integrators typically used this 'other costs' category for additional labor costs associated with training, system deployment, etc. In the final analysis, all labor costs including the 'other' category were bundled together.

Except for the pre-specified items (as outlined previously in sections 4 and 5) integrators were free to make their own decisions regarding equipment as long as the technological requirements and conditions were met. This particularly pertained to the selection and configuration of the recording solution, which represents a significant portion of the total cost for a video surveillance system.

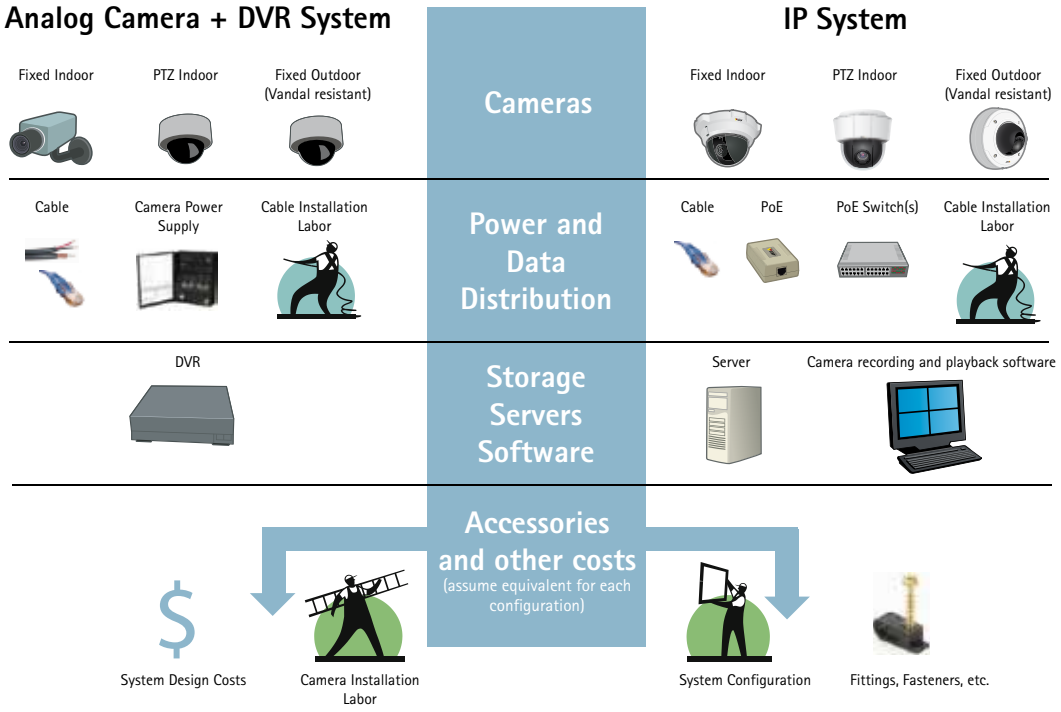

Figure 3: Itemized cost breakdowns

7. Results from TCO survey

The total costs provided in the integrators' bids were averaged in the six different camera layout alternatives. Cost categories where added together in four main groups: cameras (including analog power supplies), cabling (including network switches, fastenings and fittings), recording (DVR/PC, software and monitor) and labor. The average total cost for the different camera layouts and the spread of the bids are presented in Figure 4.

The IP alternative turns out to provide a lower TCO for all camera layouts. The IP cost benefit relative to analog is smallest in the 14 cameras alternative, but increases as more cameras are added, which is consistent with previous study. For 14, 25 and 40 cameras, the IP solution is on average 11%, 13% and 16% lower cost than the analog system, respectively. The spread of bids is quite wide across all camera alternatives, except in the case of 14 analog cameras, where all bids come in very close to each other. Interestingly, the analog 25 and 40 camera alternatives exhibit wider spreads than their IP counterparts. In both the IP and analog scenarios, most of the spread can be attributed to the recording cost category.

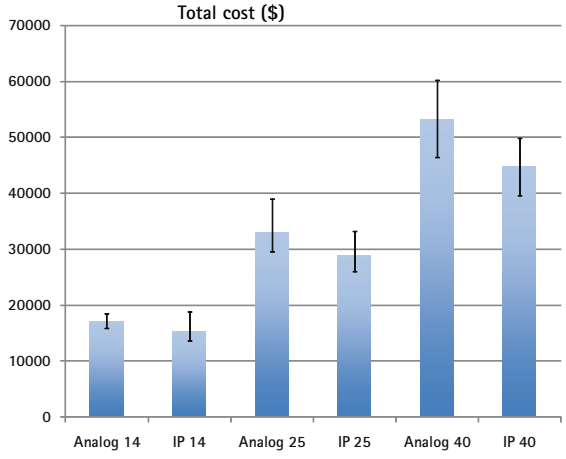

Figure 4: Total cost per camera layout alternative

Looking more closely at the cost breakdown between categories, the following can be noted:

> In the IP alternatives, camera cost represents between 38% and 51% of total system cost. In the analog alternatives, camera cost represents 23% to 27% of total cost.
> IP cameras are roughly 50% more expensive than their analog counterparts
> Cabling represents a slightly lower cost in the analog alternatives. However, it should be noted that the IP solution includes not just basic cabling but also accessories such as network switches. For the relatively short cable runs of the fictitious site, the difference in cost between a CAT5 and a Siamese cable (combined video coax and power) is negligible.
> The recording category is only half of the cost in the IP system compared to the analog system. Recording is the most significant cost category in the analog alternatives, representing more than 40% of the total cost in all camera layout alternatives, and its portion of the total system cost increases significantly as camera channels are added.
> Labor costs represent roughly 25% of total system cost and are slightly lower for the IP alternative across all the camera alternatives. This is mainly attributable to shorter cable runs in the IP scenario.

When scrutinizing the cost breakdowns, it thus becomes clear that it is mainly the lower cost of the recording solution that tips the scales in favor of IP, in terms of total cost. The outcome can be seen to highlight the drawback of the proprietary DVR model, which has increasingly become an expensive option for end-user. In the IP recording alternative, end users can benefit from downward price trends in the competitive IT hardware market by using off-the-shelf PC servers and storage.

It should also be noted that the spread between the least and most expensive recording option in the analog 40 camera layout alternative is $10,689, representing 23% of the average total cost for this alternative. However, across all six different camera layout alternatives, the least expensive analog recording system quoted still had a higher cost than the most expensive IP server solution.

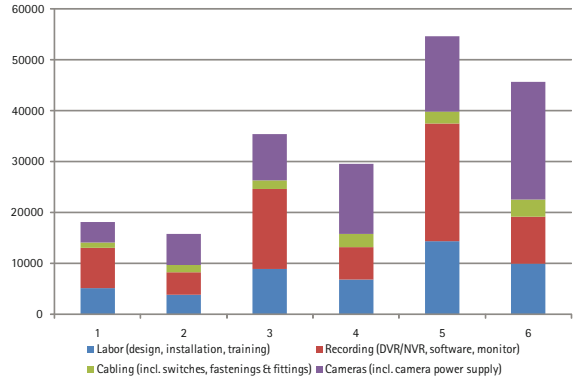

Figure 5: Itemized cost breakdowns

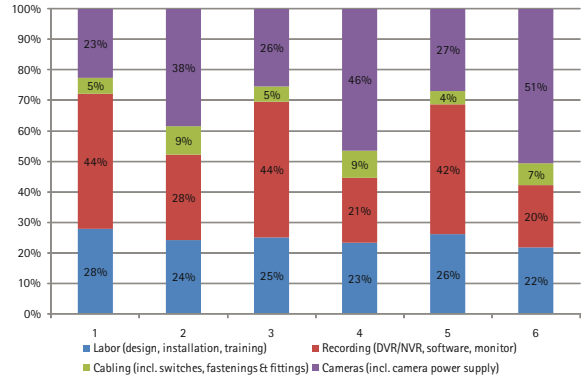

Figure 6: Itemized cost breakdowns, percentages

8. Results from interview study

The telephone interview study that was conducted concurrently with the TCO survey provided additional information and insights that are summarized below.

> Respondents reported that they are predominantly doing IP-based surveillance installations today, and that the number of analog projects is falling
> All agreed IP is the future for video surveillance, and recommend it for greenfield installations
> IP-based video surveillance has numerous benefits over analog, such as increased scalability and flexibility
> However, it is the tangible increase in picture quality of the latest generation of IP video camera systems (compared to analog) that has proven to be the most powerful argument when selling IP-systems to end users
> Analog is still well entrenched among certain customers, and integrators may still recommend analog systems under extreme budget constraints
> Working with IP-based security demands a certain degree of IT and networking knowledge, and this can be hard to attain for some integrators

9. Conclusions

The result from the TCO and interview studies can be summarized as:

> **IP-based systems of 14 cameras have a lower total cost of ownership than corresponding analog-based systems**
Whereas the 2007 TCO study showed a break-even point at around 32 cameras, an IP-based system can now be said to exhibit a lower cost than analog in a system with 14 cameras.

> **Savings derive from off-the-shelf IT and server recording equipment**
While IP cameras still exhibit a higher cost per unit than analog cameras, this is offset by a lower total system cost for IP. The TCO savings in the IP case mainly derive from using off-the-shelf IT and server recording equipment, as well as from installation and deployment, resulting in lower labor costs.

> **Integrators see several additional advantages in going IP**
According to the integrators, there is a clear market trend towards fully digital systems. Scalability and flexibility are mentioned as two main arguments favoring IP-based surveillance systems.

> **Superior image quality accelerates the shift from analog to IP**
The availability of network cameras with very high image quality has become a clear differentiating factor on the market and a powerful argument for IP-based surveillance. Video images of HDTV quality speak for themselves and have set a whole new standard for what is possible within video surveillance.

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About Axis Communications

Axis is an IT company offering network video solutions for professional installations. The company is the global market leader in network video, driving the ongoing shift from analog to digital video surveillance. Axis products and solutions focus on security surveillance and remote monitoring, and are based on innovative, open technology platforms.

Axis is a Swedish-based company, operating worldwide with offices in more than 20 countries and cooperating with partners in more than 70 countries. Founded in 1984, Axis is listed on the NASDAQ OMX Stockholm under the ticker AXIS. For more information about Axis, please visit our website at www.axis.com.

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