White Paper

Total Cost of Ownership (TCO)

Comparison of IP- and Analog-based Surveillance Systems

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1 Introduction

When the question is asked “Is a network camera more expensive than an analog camera” the answer is a resounding “yes”. It should be, since it includes more functionality than its analog counterpart. When the next question asked is “Is a network camera system more expensive than an analog/DVR system?” the answer will depend on who is in the room. Some say “absolutely” while others “maybe” and some “no”. Why is this?

To some extent it depends on lack of knowledge about the total cost of ownership for both analog as well as network video systems. Secondly it depends on what type of system that is being discussed; how many cameras, the location of the cameras, the facility the cameras are installed in, etc. In spring of 2007, research was conducted aiming at bringing some clarity in this area, which is presented in this white paper. The research was conducted by an independent researcher.

The white paper describes the procedures and findings of a total cost of ownership (TCO) study for two types of video surveillance systems:

- **Analog surveillance system:** Analog cameras and DVR based recording
- **IP-based video surveillance system:** Network cameras, IP infrastructure, Server, Software and Storage

The objective of this study was to develop an understanding of total cost of ownership in a typical ‘baseline’ surveillance scenario for these two types of systems. A structured research methodology was developed by an independent researcher and validated through interviews and a standard bid request process with non-vendor industry participants including Security Integrators, Value Added Resellers and Industry Analysts.

The research approach was divided into three phases:

- **Develop, validate and refine baseline surveillance scenario and cost comparison framework with research participants**
- **Collect quantitative cost data**
- **Review, validate and synthesize findings**

The results outlined in this white paper are based on data supplied by non-vendor study participants.

Results of the study are outlined in the Conclusion section of this white paper, along with a section outlining Detailed Findings.

Non-quantifiable observations and cost considerations differentiating the two types of surveillance systems that were not included in the total cost comparison are also compiled at the end of this white paper.

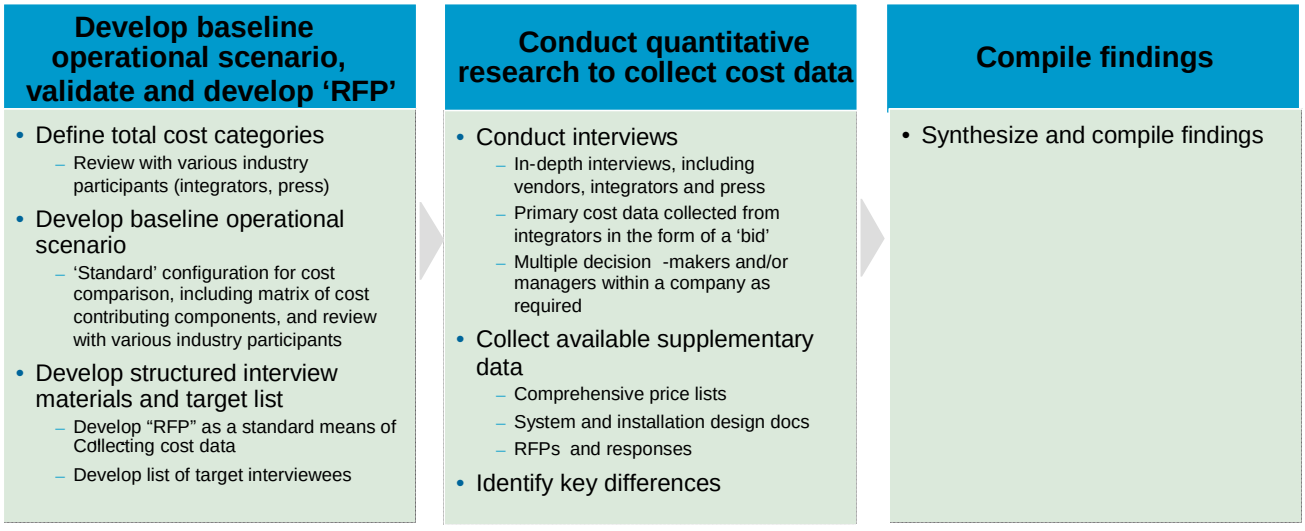
2 Research Approach

The primary objective of this study was to develop an unbiased understanding of the total cost of ownership (TCO) for two types of video surveillance systems: an Analog surveillance system (Analog cameras and DVR based recording), and a fully digital IP based surveillance system (Network cameras, IP infrastructure, Server, Video Management Software and Storage).

In order to make the study as impartial and balanced as possible, a structured research approach was developed that included step-by-step validation of each project phase by non-vendor industry participants including Security Integrators, Value Added Resellers and Industry Analysts. Definition of cost components, deployment scenarios, and assumptions were developed with, and scrutinized by, these study participants with the objective of making the research approach and study results as fair and unbiased as possible. In addition to interviews, an industry-standardized approach was used to collect cost data, which included development of an RFP (Request For Proposal), i.e. what an end user likely provide a security integrator to solicit a system proposal or project bid that would contain itemized costs components) and then soliciting responses or 'Project bids' to collect structured cost data.

The following outlines the basic research approach phases for development of a cost comparison framework used to develop this TCO comparison:

1. Develop, validate and refine baseline video surveillance scenario and cost comparison framework with non-vendor industry participants
2. Use structured interviews and standard methods (e.g. an RFP and bids) to collect quantitative cost data
3. Review, validate and synthesize findings



A dozen interviewees from different geographic regions in North America participated in the study by providing input on study components, feedback, validation, and cost data (in the form of bid responses).

3 Total Cost: Defining and Validating

The first phase of the project was to prepare for interviews and collection of various types of cost data, which required development and validation of an ‘industry typical’ baseline operational video surveillance scenario, after which structured materials for interviews with study participants could be defined and reviewed. Prior to development of this operational scenario to compare total cost, a definition of total cost of ownership had to be developed and validated.

Several preliminary interviews were conducted to develop and validate total cost of ownership definition for this study. The emphasis was on quantifiable “Hard Costs” that could be supplied by study participants with a minimum of interpretation or ambiguity.

Consideration was given to non-quantifiable costs including “Soft Costs” (productivity gains, depreciation costs) and “Hidden Costs”, however, the consensus was to exclude analysis of these types of costs from the study and final quantitative analysis, and instead capture these cost elements as observational points as provided by interview participants, and compiled as cost considerations that could not be directly quantified (see section: “Additional Observations and Considerations”).

4 Baseline Scenario: Defining and Validating

After developing and validating a definition for total cost of ownership; a typical industry surveillance configuration, or baseline operational scenario, needed to be developed and validated. Several scenarios were considered and discussed with study participants, including a small office/indoor surveillance scenario (e.g. 4-8 fixed cameras), a midsize ‘mainstream’ scenario (e.g. fixed and PTZ cameras, both indoor and outdoor), as well as a ‘large site’ scenario (up to several hundred cameras with multiple geographic locations).

Several observations were collected on the merits of each system, with consensus settling on the midsize scenario as a baseline that was both ideal for the study (scope, complexity), as well as a scenario that offered no clear cost advantages for either the IP or Analog based surveillances system. For example, several study participants shared the observation that a ‘large site’ scenario may have inherent cost advantages for an IP based system. This is due to the possibility to utilize a shared network infrastructure for various data types including control, video and audio; as well as perceived advantages of an all IP network based system for simplified remote ‘end to end’ management down to each individual camera location.

The next step was to define a midsize mainstream operational baseline scenario that was common in the field, and offered a sufficient 'apples to apples' framework for comparing individual cost components for the two cost categories and surveillance systems previously defined. The baseline that was selected was a surveillance system for a small to mid-size school campus. The "School Surveillance" baseline was defined and reviewed by study participants, and refined into as set of system requirements, operational assumptions, and individual cost elements that could be developed into a structured and unbiased interview material for collection of cost data. It was also determined that providing study participants with a request for proposal (RFP) for this baseline, would most efficiently facilitate collection of unambiguous and impartial cost data.

In order to make the comparison as unbiased as possible, the number of cameras for the installation should be selected to be advantageous for neither the analog system nor the IP-based system. Since analog systems are typically multiples of the 16 inputs on a DVR input, it was important not to select, 16, 32, or 48. At the same time IP based systems have an advantage at 17, 33, or 49. Therefore 40 cameras were selected as a fair case for both type systems, as well as a common system size, which was validated during the interviews. When collecting cost information from study participants, they were required only to meet the 'Customer requirements' for the School Facility installation. No existing cameras were said to be installed, and no premise wiring or infrastructure existed, i.e. all new data and power cabling was required. Otherwise the study participants had full autonomy to select equipment and set pricing for configuration, service, upgrades etc.

Highlights Customer requirements outlined in the RFP:

Facility

- Single building school
- Existing building

Number of cameras

- 30 indoor fixed dome cameras
- 5 Outdoor fixed dome cameras
- 5 Outdoor PTZ cameras
- All cameras needed to be vandal proof

Recording

- 12 hours of recording a day
- 4 fps continuous recording
- 15 fps recording on alarm/video motion detection
- CIF resolution
- Retention of video for 12 days

Wiring

- No existing data, coax or power wiring
- Network Switches (wiring closets) and/or Multi-Camera power supplies
- Plenum airspace above all areas (for cabling, plenum wiring required)
- Cat5e adequate for data wiring

- PoE switches can be located in storage area allowing for less than 250ft PoE cable runs for network cameras
- Coax will have to be a home run from cameras to DVR

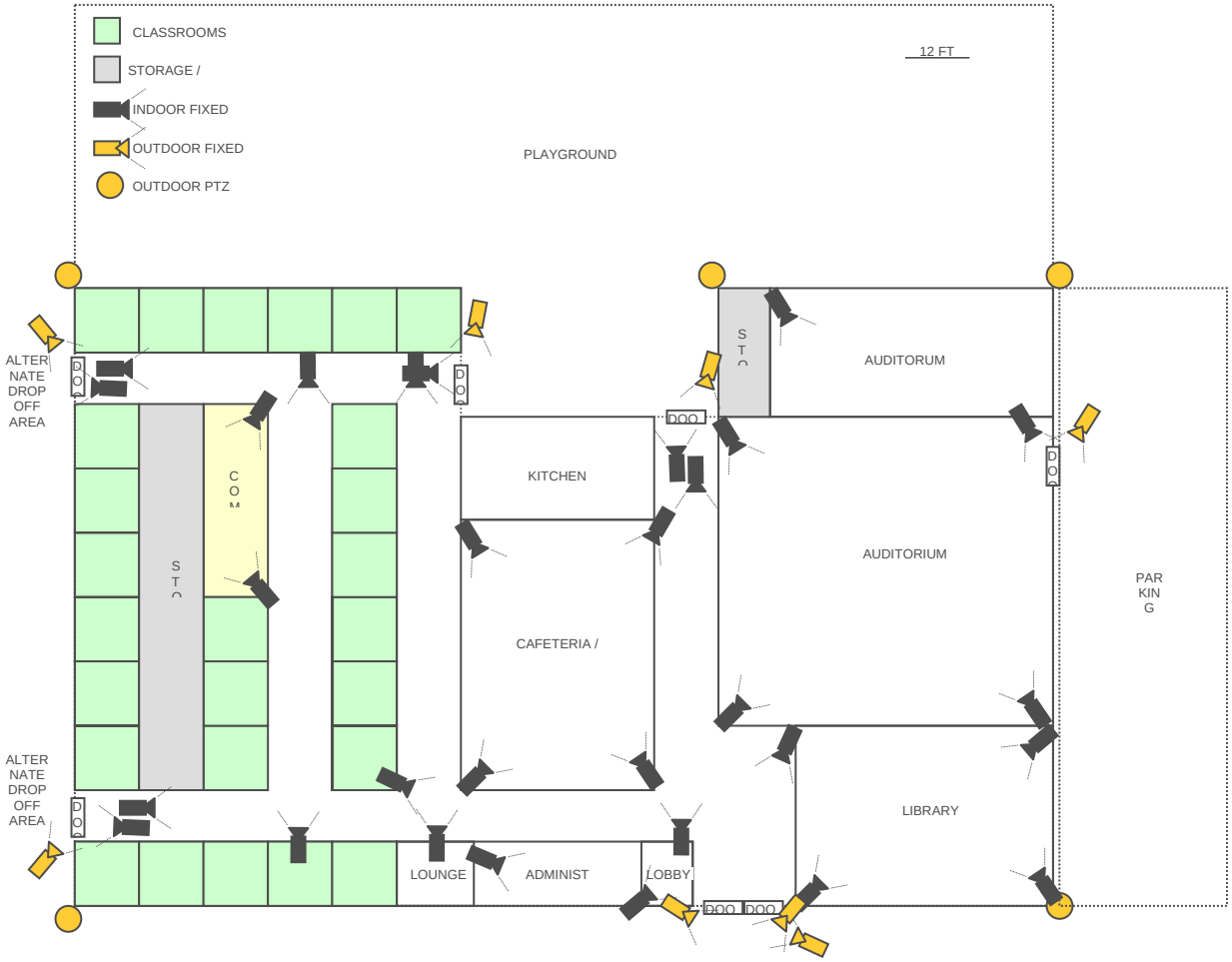
Monitoring Location and Equipment Placement

- Main Network Hub and Camera Viewing (location of Monitor, Server/DVR) in area labeled Administration (these are several offices).
- Network Switches (wiring closets) and/or Multi-Camera power supplies can be placed in any “Gray Shaded” Areas on diagram

Other

- No special illuminators required
- No audio surveillance required

And below is the drawing of the school facility along with the camera placements:



Outdoor Cameras

Entrances and Exits
Student Pickup and Drop off locations
Parking Lot
Playground

Indoor Cameras

Hallways
Library
Dining / Cafeteria
Auditorium
School administration lobby

Now that a baseline operational scenario was defined, validated and refined, the next steps were to develop and define a list cost contributing components for the two cost categories previously defined.

5 Cost to Purchase and Install

The next question: What specific elements contribute to the total cost to put an IP or analog surveillance system into service within the previously defined baseline scenario (School facility)?

In order to answer this question, and develop a structured 'request for bid' that could be used to collect individual costs from study participants, a set of purchase and installation cost contributing components was developed. First, costs that were considered to be equivalent for either the IP or Analog system were determined and validated. Second, a basic grouping of cost components was defined and validated as follows:

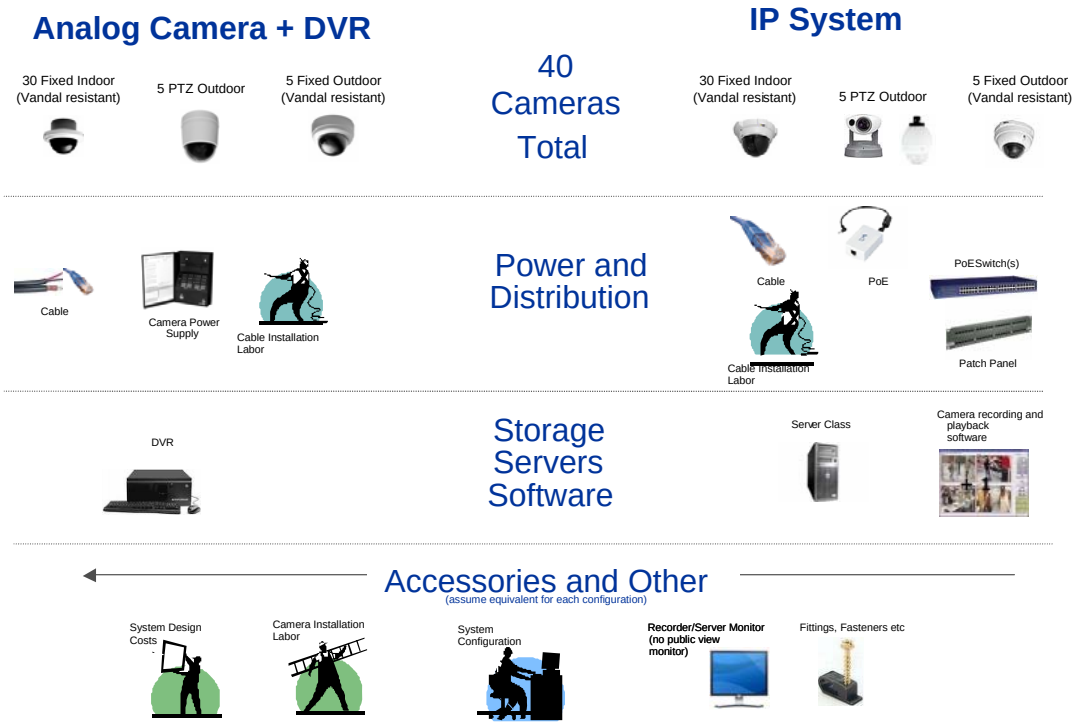


Figure 4 – Purchase and Installation Cost Components
(Product and Cost component Photos and Diagrams are for illustration purposes only)

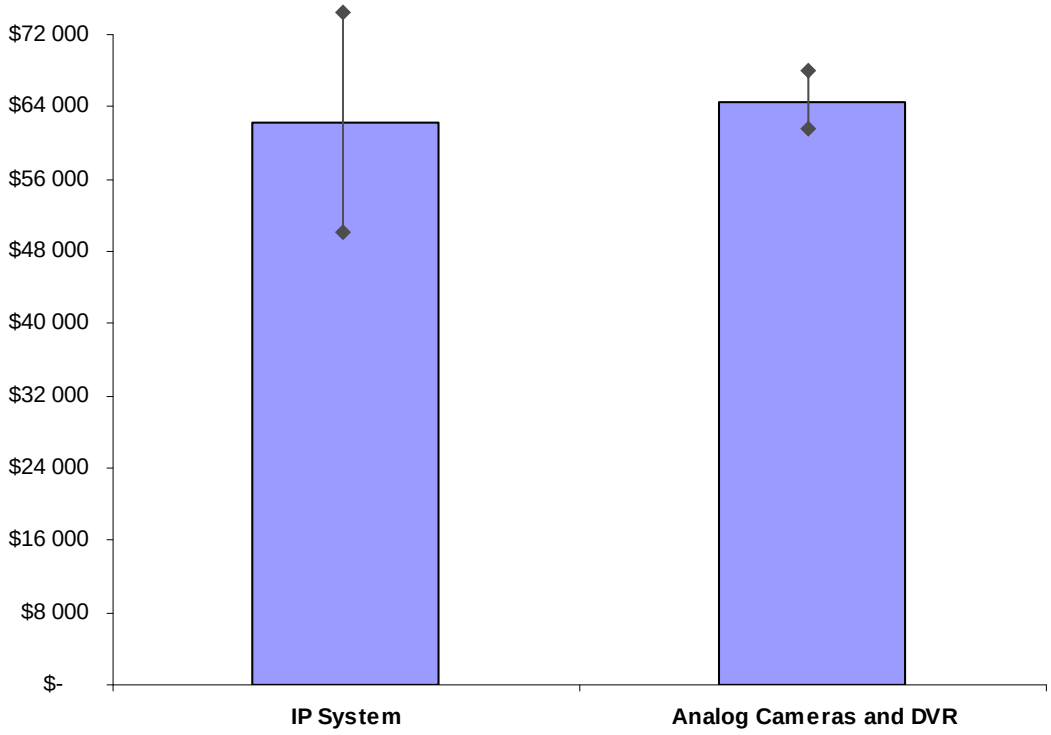
Note: as stated previously, when collecting cost information from study participants, they were required only to meet the 'Customer requirements' for the School Facility installation, as well as specify Axis cameras for use in the IP system. Otherwise the study participants had full autonomy to select equipment and set pricing for configuration, service, upgrades etc. supplied in the form of quotes and/or 'bids'.

6 Detailed Findings

The resulting quotes from the participating systems integrators revealed some interesting information. The quoted costs included the cost to acquire and install the equipment, and using the average value of all quotes the findings were the following:

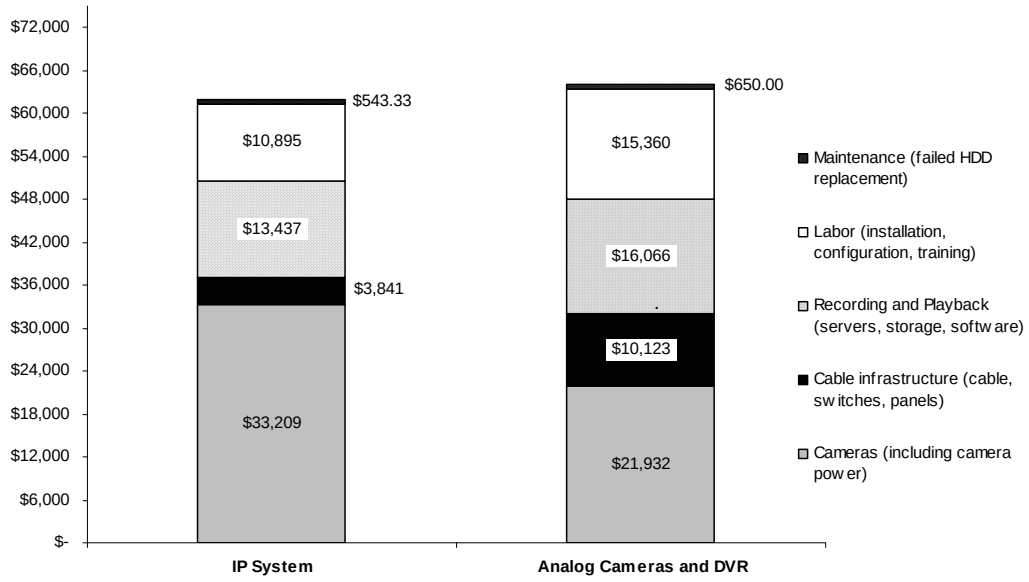
- The total cost for the IP System had a 3.4% *lower* total cost of ownership
- Lowest cost IP system had a 25.4% lower TCO than lowest cost Analog/DVR system
- Highest cost IP system had a 11.5% higher cost than the highest cost Analog/DVR system

The findings are also presented in the chart below:



It is interesting to note the flexibility of the IP based system, represented by the wide spread in the quotes. The reason is the wide flexibility using IP technology represented by using POE, different cabling types, network and server platforms. In an analog system, there is very little flexibility; hence most quotes came in close to the same cost. That is quite typical for a mature market.

The split of the cost in the IP based system showed to be quite different from the analog/DVR system as outlined in the graph below:

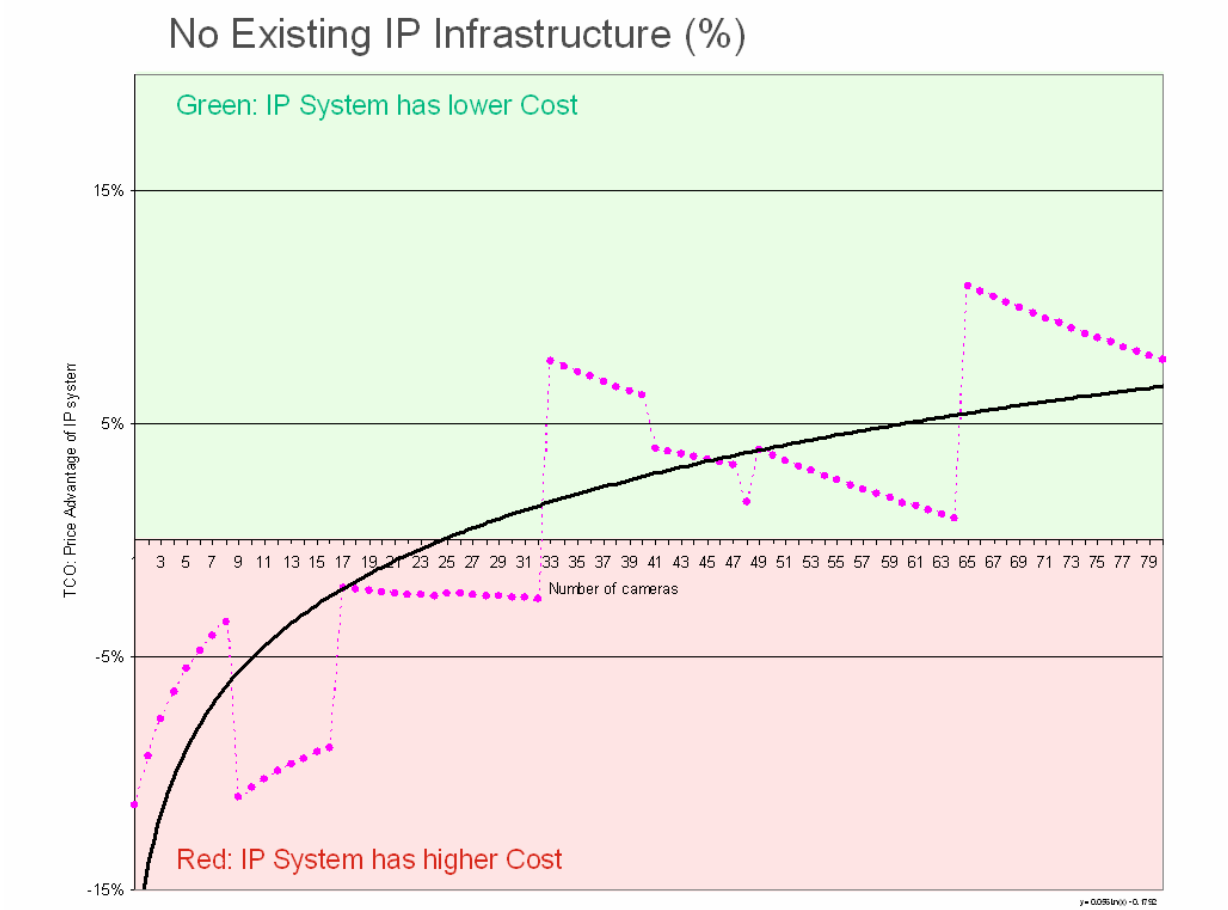


Comparing the details costs the conclusions were:

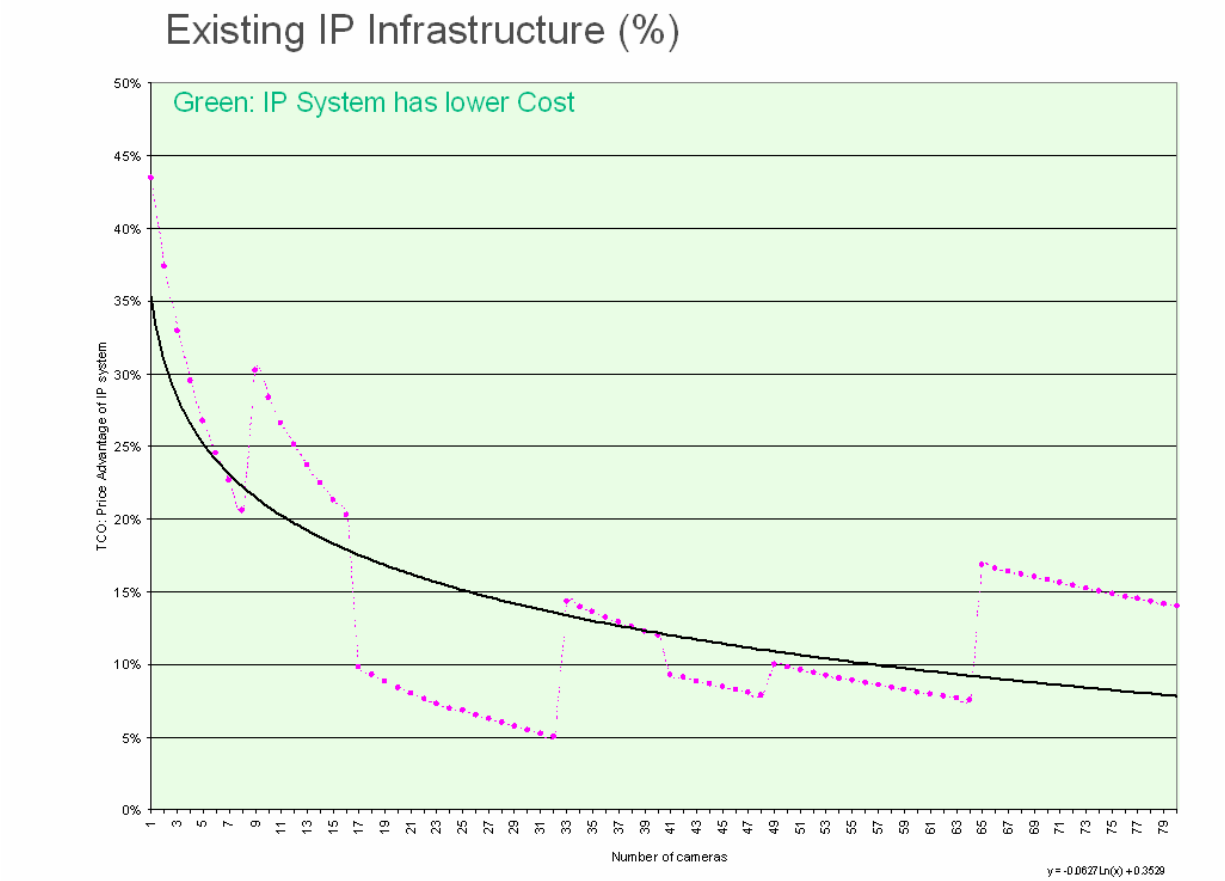
- The network cameras can half of the system cost in the IP based system, while only a third of the cost in the Analog/DVR system
- The network cameras were 50% more expensive than their analog counter parts
- Cabling is almost three times as expensive in the analog system compared to the IP based system. The main reasons are that separate power cable has to be used, while PoE is used in the IP system, and separate cabling is also needed to control analog PTZ cameras.
- Recording and monitoring is similar cost. The quality and available service and maintenance contracts for a PC server used in the IP systems are often superior to the DVR.
- Installation, configuration and training is almost 50% higher cost in the analog system

7 Cost as a function of the number of channels

A general consensus around IP based system is that the larger the system the more favorable the cost of the IP system will be compared to the analog. So what would be the breakpoint, i.e. for what size system is IP lower cost than analog, and does the difference increase as the size of the system increases? Based on the research data, and additional information, the cost as a function of the number was calculated, as shown in the graph below.



The result shows that beyond 32 cameras the IP based system is lower cost, and between 16 and 32 the cost is quite similar. In the case above the assumption was that no infrastructure was in place. In many buildings today an IP infrastructure already exists, which the surveillance system can piggyback on. So in another cost simulation the cost of the cabling, and installation of it, was removed.



Without the cost of the cabling and infrastructure the IP-based system proved to always be lower cost.

8 Additional Observations

During the research portion of the study, several interview participants provided additional non-quantifiable observations and cost considerations differentiating the two types of video surveillance systems that were not included in the total cost comparison. These factors were considered to be important baseline differences by the interview participants, and are therefore listed here:

- Scalability is superior in IP based systems, where one camera at a time can be added
- Flexibility is greater in IP based system, when moving a camera means only moving a network drop if PoE is used
- The image quality of network cameras is superior to analog
- Megapixel cameras are beginning to be specified, which can only be addressed by network cameras
- IP infrastructure is often already in place, and can be used by the network video system
- Analog Coax cabling much harder to troubleshoot than IP
- System design costs typically included at no additional cost
- IP system can be remotely serviced, e.g. adjusted / diagnosed over the network

- Brand name PC servers used in IP systems often have superior warranty and service plans compared to DVRs
- IT equipment likely to drop faster in price than analog

9 Conclusion

Research conducted with industry participants including Security Integrators, Value Added Resellers and Industry Analysts, including interviews and cost data, yielded some major findings:

- **IP based systems of 40 cameras have a lower total cost of ownership than analog based systems**. Based on a typical deployment scenario; the cost to acquire, install, and operate an IP based system is 3.4% lower than an Analog based solution.

- **32 cameras is the break even point for IP systems versus analog.** Based on common scenarios for costs scenarios, beyond 32 cameras the IP based system is lower cost, and between 16 and 32 the cost is quite similar even though slightly lower for analog systems.

- **If IP infrastructure is installed the IP system is always lower cost.** For any size system IP system will always be lower cost if IP infrastructure by means of cabling already exists.

- **Many non-quantifiable advantages for IP systems.** Improved images quality, better maintenance and service, increase flexibility, easier to trouble shooting, are just some of the advantages that exist but were not quantified. Additionally, IT equipment is expected to fall in price faster than analog CCTV equipment, making the comparison even more favorable in the future.

10 About Axis

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 18 countries and cooperating with partners in more than 70 countries. Founded in 1984, Axis is listed on the OMX Nordic Exchange, Large Cap and Information Technology. For more information about Axis, please visit our website at www.axis.com.