

Deploying VSaaS and Hosted Solutions Using CompleteView

Understanding the benefits of CompleteView for hosted solutions and successful deployment architecture

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Video Surveillance as a Service (VSaaS) is quickly gaining interest as a viable method of deploying video security solutions.

The business model has been proven in conventional alarm monitoring security businesses. The service provider offers equipment and installation at a low or no cost to the customer. In return the customer commits to a monthly fee for monitoring over a minimum contract term. At a time before the contract term ends, the service provider has recouped the cost of equipment and installation from the monthly service fees paid. The benefit to the customer is a low installation and deployment cost and often little maintenance cost of the equipment because it is provided and maintained by the service company. The service provider receives profitable monthly recurring revenue and often a long term customer.

This type of service offering requires both equipment capable of transmitting video over long distances and a connection from the customer's location to the service provider's monitoring and recording equipment. Ever since the Internet has become widely available and IP cameras or networkable DVRs have been on the market, it has been theoretically possible to provide such a service for video surveillance.

Historical challenges with VSaaS offerings

The major challenge in providing a hosted video service offering has been the cost of transmitting video. Because video from the customer's site must be transmitted back to the service provider, both sites need to have a high speed Internet connection.

The customer's Internet connection not only needs to be high speed but more specifically needs to have a high upload speed. Most broadband or high speed Internet service offerings for the consumer have been asymmetric connections, meaning the download speed (used when retrieving information from the Internet) is significantly higher than the upload speed (used when transmitting to the Internet). When transmitting video from the customer's location to the hosted provider, the customer's upload speed is what counts. While this is still true today, consumer level Internet service upload speeds have increased dramatically. Additionally the service provider needs an Internet connection which can support the incoming aggregate bandwidth of all their customer's video feeds.

Because of these challenges, the cost of offering such a service has been prohibitive.

Technology and Market Trends are Overcoming Challenges

VSaaS service offerings are now more practical due to:

- H.264 video compression availability in a broad range of security products
- Declining price and wider availability of high speed Internet connections

An H.264 video feed requires approximately 10-20% of the bandwidth required for a video feed of comparable quality compressed with Motion JPEG. As an example a 640x480 resolution video feed at 6 frames per second will consume about 1266Kbit/s using Motion JPEG, 266Kbit/s using MPEG4 and 155Kbit/s using H.264.

Additionally, the cost of bandwidth has declined sharply. A consumer level high speed Internet connection could be two or more times faster at the same price as compared to just five years ago. A similar comparison can be made for business or carrier class Internet connections.

These factors together mean hosted video offerings can now be provided at a cost that makes sense.

Considerations for software platform selection

When a prospective service provider is selecting a software platform for their VSaaS offering, some key considerations include:

1. Does the system provide the necessary scalability and tools to manage growth?
2. How can bandwidth consumption be minimized?
3. In the event of a problem, how quickly can service be restored, and will customer video be affected?
4. How will software licensing impact servicing of equipment?
5. How will installers deploy equipment easily?

Selecting a video management software platform which can handle these challenges is critical for ensuring a successful VSaaS service offering.

Consideration #1: Scalability and management tools

A primary consideration for selecting a VSaaS software platform is scalability. CompleteView provides the capability to scale to any number of cameras and NVRs, as well as the tools to manage everything from a single desktop.

The advertised scalability of a system can mean many things. Any video recording platform can be installed many times at a single installation. The sum of the cameras managed by individual

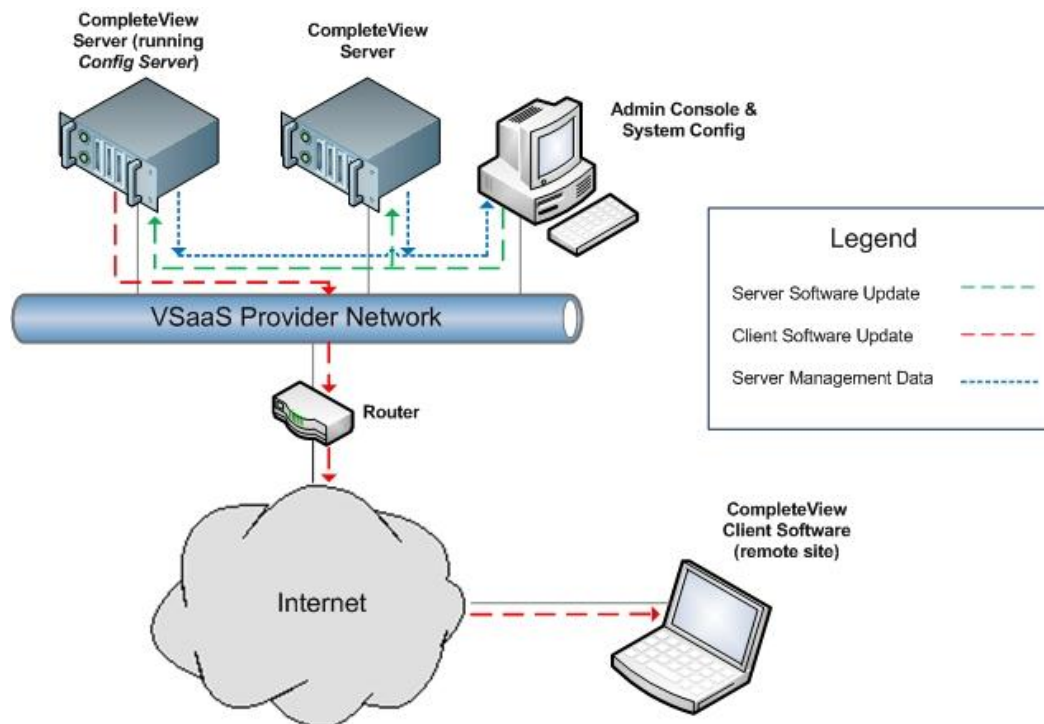
recorders may be high but that does not mean the system scales well. A truly scalable system goes beyond high camera counts and offers tools to manage growth.

The primary factor determining whether a system can scale is its ability to view and manage cameras from multiple recorders simultaneously. In addition, a truly scalable system will provide management tools to remotely monitor and maintain multiple NVRs and clients simultaneously. CompleteView includes the *Admin Console*, *Config Server* and *System Config* tools which together provide remote and simultaneous management of multiple systems.

Admin Console allows the administrator to view all the NVRs installed system wide, and instantly see the health and status of all NVRs, cameras and storage volumes. In addition, the Admin Console provides tools to perform mass software updates on NVRs and client viewing applications. System Config provides remote configuration capability for CompleteView NVRs and client viewing applications. Config Server stores client configuration centrally. When a client logs in, the software checks Config Server for an update, then downloads and installs it automatically if available.

These features combine to help avoid labor intensive updates and expensive service calls.

In the diagram below, the PC running Admin Console and System Config has pushed a software update to the two CompleteView Servers as indicated by the green line. Admin Console can also report on server and camera health because the servers are reporting this management data back to the Admin Console, as indicated by the blue lines.



Centralized management, software updating and configuration of clients and NVRs

Additionally, when CompleteView Client applications log in and retrieve their configuration from the CompleteView Server running Config Server, the client checks to see if it has the latest software. Because the server was recently updated, a software update is available for the client as well. The software update is automatically downloaded and installed without any further user or administrator intervention.

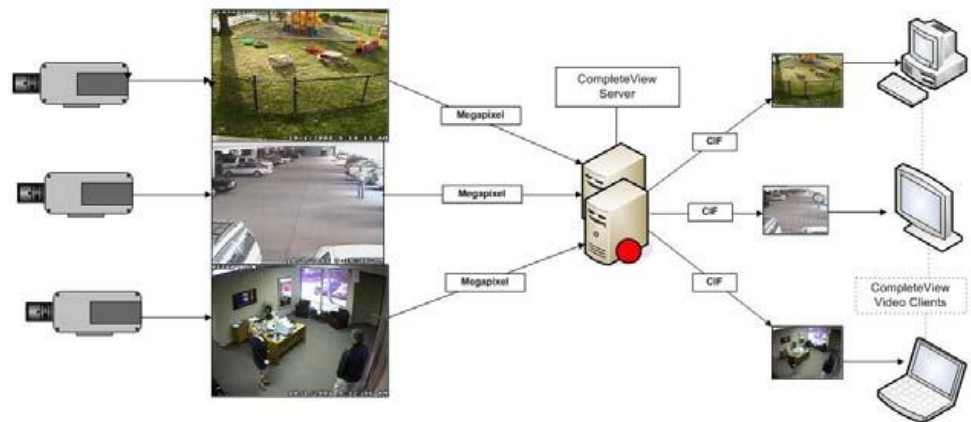
Consideration #2: Minimizing bandwidth using Dynamic Resolution Scaling

Dynamic Resolution Scaling is designed to reduce bandwidth consumption intelligently.

In a typical video management system, too much bandwidth is consumed when

transmitting video for

live display. This is because video recorded at high resolution is often displayed in a small area on the screen; however, the size of the video is not adjusted prior to transmission. Using a typical system, the client application will scale the high resolution video to fit in the area allocated for it on the screen.



Dynamic Resolution Scaling resizes resolution at the NVR before transmission to the client

As an example, a client application is configured to display a 3 x 3 layout of cameras on a 1080p (1920 x 1080) screen. Each camera is displayed at about .23 megapixels. If each of those cameras is recorded and transmitted at 1.3 megapixels, a total of 11.7 megapixels of data is being transmitted to the client. The effect of scaling the video at the client is about 9.7 out of 11.7 megapixels of transmitted video data is never displayed. In this example, about 80% of the transmitted video is removed prior to display and is simply wasting bandwidth.

The Dynamic Resolution Scaling feature built into CompleteView scales the video at the recording server, before transmitting it to the client. This saves a considerable amount of bandwidth. This processing occurs in the background without user intervention and *without affecting the originally recorded video*. Video is always stored at the original configured resolution. Using the above example, each of the 1.3 megapixel cameras would be transmitted at about .23 megapixels because the scaling takes place at the server. When recorded video is requested, it would be retrieved at the full 1.3 megapixel resolution. As the user resizes the live viewing area, the server automatically streams higher or lower resolution to provide the most appropriate quality level for the size of viewing area without any wasted bandwidth.

Consideration #3: Recovery and fault tolerance of video management recording architectures

The recording architecture a Video Management System uses to store video, audio and associated meta-data can have a big impact on the system's usability and the integrity of video data.

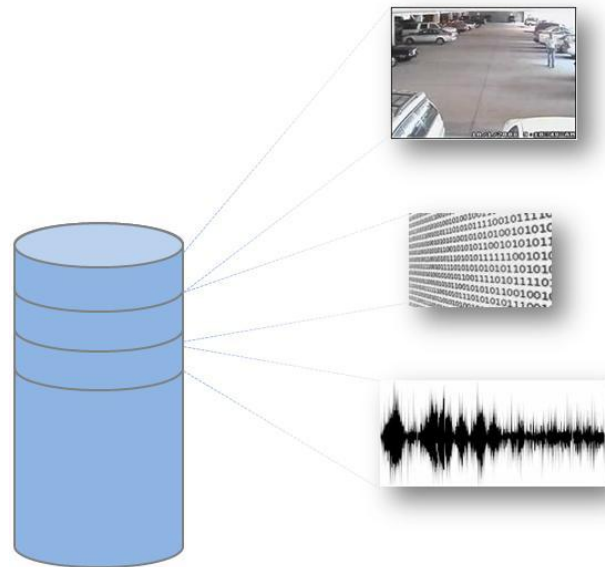
Most video management systems employ a database to record this information. A database keeps all the dissimilar data in a single file, or small set of files, and allows for easy indexing and association.

The database format can be problematic when used for video recording. Recording high frame rates over many cameras requires a high number of 'writes' to the database which can create opportunities for the database to become corrupted. Common factors which result in database corruption:

- Poor structuring of the software that interfaces with the database.
- Power outages.
- Interruptions or crashes during the writing of data.

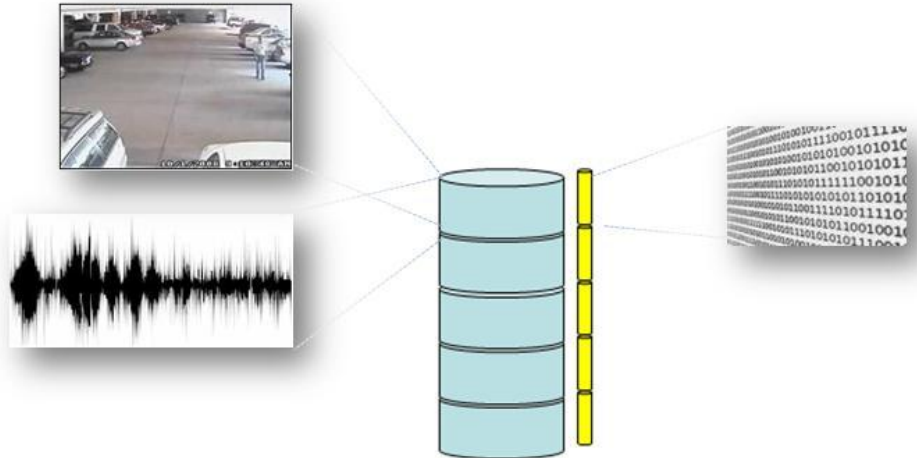
When a database becomes corrupt in a video management system the VMS must attempt to rebuild the database in order to access the recordings and to continue recording new video. This process involves reading all the data in the database in an attempt to repair or remove missing data or structural information. Video recordings take a lot of storage space, and therefore the database used to store the recordings is very large. Reading and processing large database files can cause the rebuild procedure to take hours. In addition, new video will often not be recorded while the repair is occurring.

If the repair process fails, all the information in the database may be deleted because it has become unusable.



Traditional VMS recording architecture

To avoid these issues CompleteView uses a unique recording architecture which stores video in a flat file structure outside of a database. CompleteView uses a database which is linked to the video for storage of meta-data. Video is also stored in small segments, lowering the possibility of any significant portion of a video clip becoming unreadable.



CompleteView's Stable Recording Architecture

Long database repairs and corruption of video after a power loss or other interruption of the video management application are not a problem with CompleteView. This means CompleteView can recover from problems fast and customer video data is not at risk if a recording database becomes corrupt.

Consideration #4: Flexible Licensing

The VMS licensing model can be a major consideration for VSaaS deployments. It is important to select a product with a licensing model that avoids dependence on the VMS manufacturer when making changes to the system.

Licensing models for VMS platforms vary greatly. Video management platform vendors could charge for any or all of the following items:

- Number of cameras connected to the system
- Number of recording servers the software is deployed on
- Client viewing or investigation software
- Number of user accounts configured
- Number of users connected for live viewing simultaneously

Licensing models that charge for simultaneous client connections, the number of user accounts or client software can be cost prohibitive as the service provider's customer base expands. In some cases, products that charge for the number of servers the recording software is deployed to can make the cost of adding customers prohibitive. For example, if a service provider adds a new customer whose cameras need to be recorded to a new server, the service provider will

experience a large jump in cost due to paying the VMS vendor the additional server licensing fee.

CompleteView uses a simple, per-camera licensing model. This allows for the greatest flexibility and simplest cost structure for service providers. The per-camera only licensing model provides the most predictable costs as a service expands.

In addition to predictable costs, the ease of managing and servicing licenses must be considered. Using many traditional video management platforms it is necessary to associate a camera license to a specific camera by the camera's MAC address. If the original camera associated with the license is replaced, the video management system will not record the new camera until the license is associated to the new MAC address. This requires coordination with the video management system vendor.

Using CompleteView, camera licenses are not associated specific to cameras or encoders by MAC address. The camera licenses can be reused and reconfigured at any point. This means if camera or encoder hardware needs to be switched out for servicing, the VSaaS provider does not need to coordinate the effort with Salient Systems. This avoids unnecessary complexity in the process and allows for faster service.

Having the ability to move cameras to different recording servers is also important. As the VSaaS customer base grows it becomes inevitable that recording servers will need to be load balanced. If one server is setup to manage a set of very active cameras and another server is setup with less active cameras, it makes sense to move some cameras from the active server to the less active server. Doing so means both servers will share the work load and storage more evenly. CompleteView provides this flexibility.

Consideration #5: Easy installation

Deploying VSaaS service requires IP based equipment installed at the customer site. The service provider may install IP cameras, encoders to convert analog cameras, or on-site NVRs which are connected to the IP network.

Installing IP connected devices requires a different skill set than what the service provider's current field technician staff may possess. Prospective service providers with a large field technician organization need to consider the cost and practicality of training the group in IP networking. This is why CompleteView integrates with multiple deployment technologies.

VSaaS offerings using CompleteView have been deployed successfully using both Clientless VPN products and Axis One Click Camera Connection which enables simplified setup without VPNs using Axis cameras. Both technologies are designed to connect the video capture equipment at the customer site back to the service providers recording equipment. Axis One Click Camera

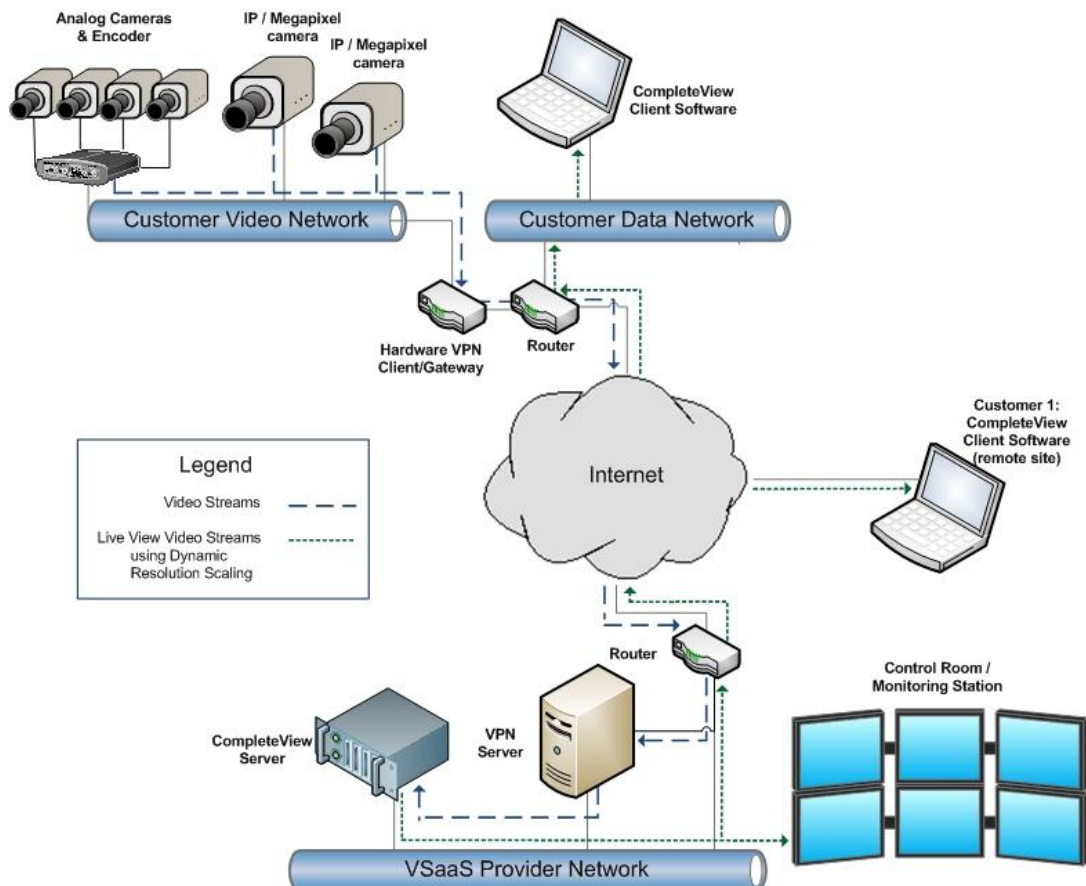
Connection offers the advantage of reducing installation time and complexity for deployments exclusively using Axis Communications cameras.

Methods of Deployment

Using CompleteView there are three recommended deployment methods. Using any deployment method it is important to keep in mind the system is used as if the cameras, client applications and recording servers are all on the same network, just as in a typical installation.

The difference in a VSaaS installation is the video capture equipment connects back to the recording servers over the Internet instead of a private network. For this reason, special measures must be used to enable an IP connection from the service provider's recording equipment through the customer's network to the cameras. Additionally it is recommended to use a method that allows the video to be encrypted over the Internet.

Method 1: Using a hardware VPN client to connect customer equipment to service provider's network



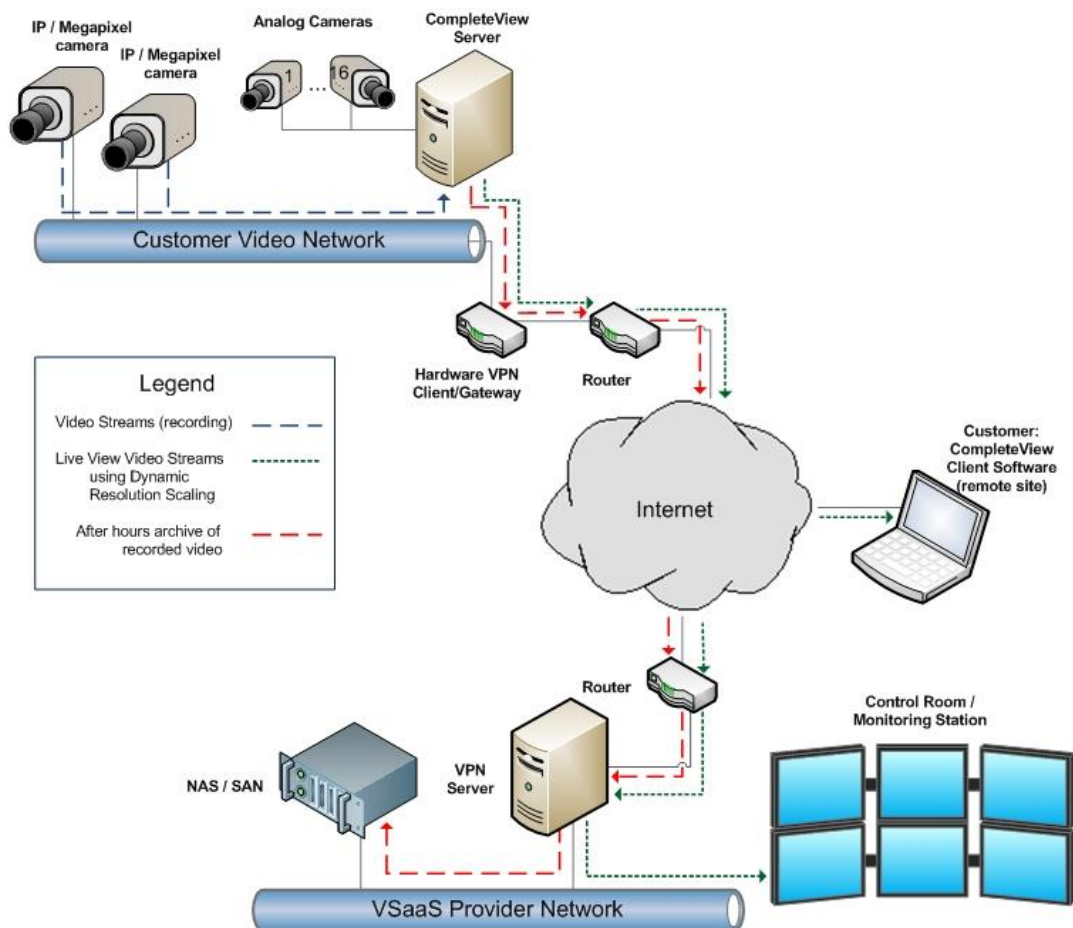
Using method 1, a hardware VPN client is used to create a virtual connection directly to the service provider's network. The hardware VPN client looks similar to a router, in that it is a hardware device with network connections. It automatically establishes an encrypted and virtual direct connection

between the networks. The segment of the customer's network used to connect cameras and encoders is created by the hardware VPN client. IP addresses on this segment match the IP addressing scheme on the service provider's network. Communication between the networks will work just as if the customer's cameras were connected directly to the service provider's network, without configuration of port forwarding or Dynamic DNS on the customer's router.

The connection between the hardware VPN client on the customer's network and the VPN server on the service provider's network is encrypted. Video and other data transmitted over this connection is protected from any 3rd parties which may attempt to access it.

The video is fed from the IP cameras and encoders on the customer's network to the CompleteView server on the service provider's network for recording. It is recommended that the cameras be set to record when motion is detected, and the compression format used be MPEG4 or H.264 depending on the capabilities of the cameras and encoders installed. Video feeds from the CompleteView server can be streamed to clients for live display. Any number of client's can be deployed at no extra cost, as client applications are provided for free and have no licensing requirements using CompleteView.

Method 2: Using an on-site recorder



It may be preferred in some instances to record video locally at the customer site, and transmit key recordings to the service provider only when the Internet connections are not in use. This strategy offers some advantages including:

- Less bandwidth is used on the customer's Internet connection during normal business hours preventing any noticeable degradation of connection speed.
- Recording video sequentially and at high frame rate becomes more practical because the customer's LAN is used to transmit video.
- The service provider can schedule the upload of recordings from multiple customers at different times, using less bandwidth at any one time.
- Using CompleteView the administrator can choose to archive specific types of recordings instead of all recordings. For example, CompleteView can be configured to upload only motion and alarm based recordings to the service provider's equipment, saving storage space and bandwidth.
- Analog cameras can be directly connected to the local CompleteView server, avoiding the need to purchase and install a separate encoder which reduces cost significantly.

In this scenario, IP cameras, encoders and other video equipment connect back to the service provider's network through the hardware VPN client. Recordings and live video are available locally and remotely.

A CompleteView server is installed at the customer's site and all video is recorded directly to the local CompleteView server. The local CompleteView server operates in the same way as a CompleteView server would operate at any local area network deployment. Scheduled, alarm-based and motion-based recordings can be configured without degradation of the customer's Internet connection, because video is not transmitted over the Internet in real time. Up to 16 analog cameras can be connected directly to the local CompleteView server and therefore do not require an encoder to be used.

Using CompleteView's built-in archiving feature, recordings from the local CompleteView server are moved to a remote storage system on the service provider's network. This allows the local CompleteView server to be configured with less storage space than may be required to store the recordings for the customer's desired time frame. The local CompleteView server can therefore be configured with less costly hardware, and the recordings are stored on a potentially more secure storage platform over the long term. The storage platform at the service provider's network could be a Network Attached Storage (NAS) server, a Storage Area Network (SAN) or a shared volume on an existing CompleteView server.

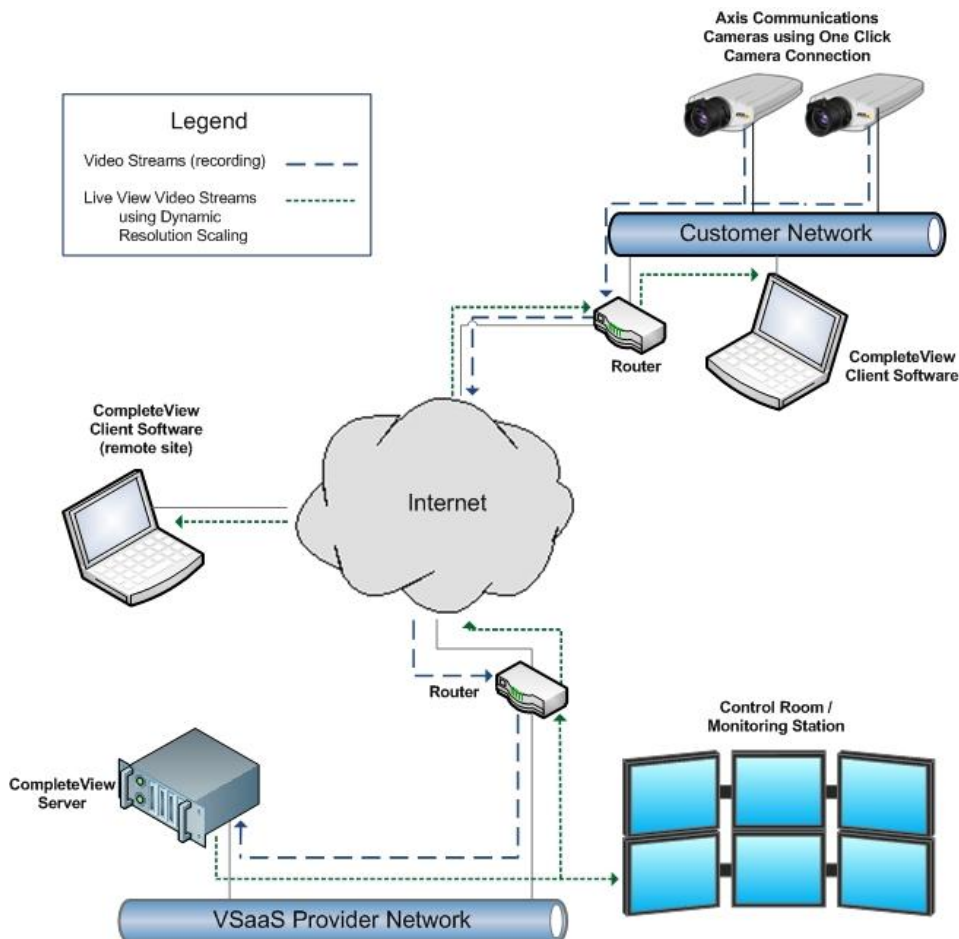
CompleteView's archiving features allows the video to be moved on a preconfigured schedule. This prevents the video from being transmitted over the customer's and service provider's Internet connections during peak use. Service providers may schedule different customers' CompleteView servers to transmit at different times, avoiding all customer recordings from

being uploaded to their network simultaneously. Using this configuration the service provider may be able to better plan the amount of bandwidth required for their offering and may need less bandwidth overall, saving cost.

Archiving also allows for specified types of recordings to be transmitted. For instance a customer may have a local CompleteView server capable of storing 3 days of recordings. The service provider can offer to have all video recorded locally for three days and have motion and alarm events archived for an additional 27 days. Archiving only the motion and alarm events ensures the most important recordings are kept but it reduces the amount of bandwidth required to transmit the recordings for long term storage. This also reduces the total amount of storage required.

Live video is always transmitted from the local CompleteView server to the clients requesting live feeds. Recordings that exist on the local CompleteView server are transmitted directly from the local server to the client requesting the recordings. Recordings that have been archived from the local CompleteView server to long term storage are first retrieved by the local CompleteView server from the NAS/SAN then transmitted to the client requesting the recording.

Method 3: Using Axis One Click Camera Connection Technology



When deploying solutions that use Axis Communications IP cameras and encoders exclusively, Service Providers can take advantage of the Axis One Click Camera Connection which is integrated with CompleteView. Using the Axis One Click Camera Connection technology has two distinct advantages:

1. Connection to the Service Provider's equipment is handled without the need for a hardware VPN client or gateway, reducing the equipment necessary and its associated cost.
2. Axis cameras' One Click Connection capability can be used to make installation faster and easier.

The One Click Camera Connection installation procedure has the benefit of making setup simple, even without a deep knowledge of IP networking. After an installer mounts the camera and provides power and a network connection only two steps are necessary to connect the camera to CompleteView:

1. Installer clicks a button on the camera which initiates the One Click Camera Connection procedure.
2. The CompleteView administrator registers the camera and completes setup using the camera's serial number and Owner Authentication Key (OAK) in the IP camera setup screen in CompleteView.

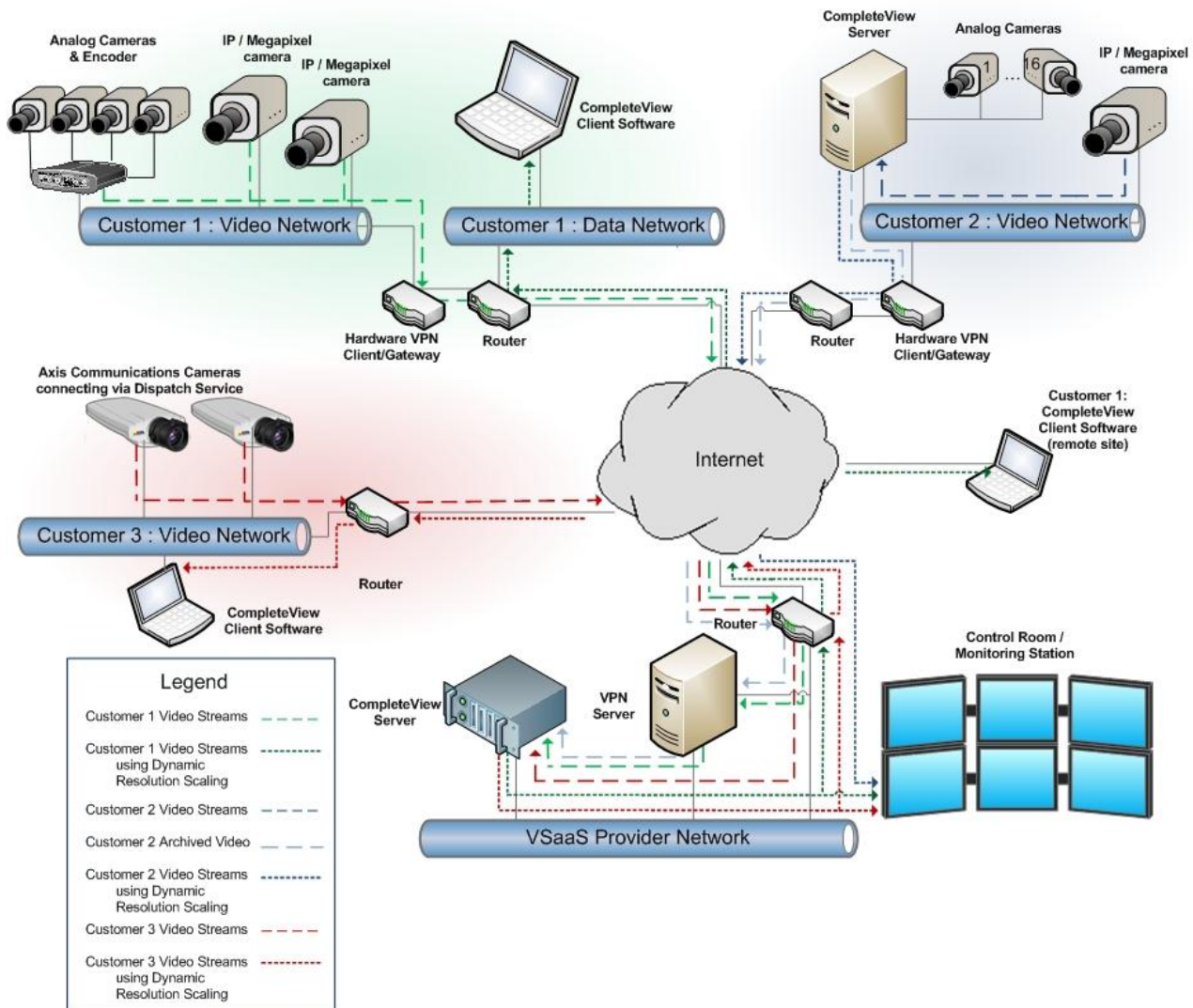
At this point the camera's video is being received by CompleteView. The installer was not required to perform any TCP/IP configuration or have IP networking knowledge to complete this installation.

The flow of video data works the same as in the other recommended deployment methods. Full resolution video can be transmitted to the service provider's equipment for recording. Video and recordings are available to both the customer and service provider at any time. Video transmitted for live display takes significantly less bandwidth as compared to alternative systems because of CompleteView's Dynamic Resolution Scaling.

Putting it all together

Multiple deployment strategies can be used simultaneously with CompleteView. This allows the service provider to offer a range of choices to customers, depending on their needs.

The image below depicts the flow of video with multiple customers using different deployment strategies.



In summary, advances in technology have now made VSaaS an attractive model for security integrators and alarm companies looking to add to their services portfolio and further differentiate their business. Selecting the correct technology for a VSaaS offering is critical for the service provider's long term success. CompleteView's unique feature sets, scalability and ease of administration make it a superior platform for deploying VSaaS service offerings.

ABOUT SALIENT SYSTEMS

Salient Systems offers network friendly, comprehensive IP and analog video surveillance management systems (VMS) built on open architecture. As the recognized transition leader from analog to digital video, Salient Systems' VMS, CompleteView™, is scalable and provides everything needed to manage a multi-server enterprise from a single desktop. Salient delivers simple and scalable security today...and tomorrow. For more information about Salient Systems and CompleteView, visit www.salientsys.com.

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