


The logo for AGENT, featuring the word "AGENT" in a bold, white, sans-serif font. To the right of the text is a blue circular icon containing a white stylized 'V' shape. The logo is set against a dark blue gradient background.

Automated Analytics : Emerging Video Surveillance

Private & Confidential, AgentVI Belgium – Online Distribution, 2009

The AGENT logo is positioned in the top right corner of the slide.

Video Analytics : Emerging Video Surveillance

Agenda :

- ✓ What are Video Analytics
 - ✓ Definition
 - ✓ From CCTV to IP Surveillance
 - ✓ Some issues with Video Analytics
- ✓ Real Time Surveillance Video Analysis
 - ✓ Mass Transit Systems (subways)
 - ✓ City Center
- ✓ Post Processing : Investigative solutions for recorded video
- ✓ Other Cases
- ✓ The future ?

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Emerging Video Surveillance

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What are video analytics?

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✓ Definition :

Video Analytics is a **technology** that is used to **analyze video** for specific data, behavior, objects or attitude. It has a wide range of applications including **safety and security**.

The software algorithms run on processors inside a computer or on an embedded computer platform in video cameras, recording devices, or specialized video processing units.

Video analytics algorithms together are integrated with video and called Intelligent Video Software systems that run on standard off-the-shelf computers or embedded into small chips called digital signal processors (DSPs) that run in IP cameras or encoders.

The technology can evaluate the contents of video to determine specified information about the content of that video.

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What are video analytics?

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- ✓ Video Analytics are not :
 - Video Motion Detection (VMD) : is a technology that has been available for over 20 years, that uses simple rules whereby a pixel change in an image is a reason for alarm
 - (yet) capable of correctly identifying identities
 - the solution to all of your problems
 - there to replace the watchguard
 - a nice to have technology, it resolves a business problem ...

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Migration of CCTV to IP Surveillance

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- ✓ We are in an era of IP video surveillance
- ✓ A majority of new surveillance systems deployed are IP-based
- ✓ IP systems open the surveillance market beyond pure security applications into the broader business intelligence market

HOWEVER

- ✓ IP surveillance systems poses tremendous constraints and challenges on VCA solutions due to:
 - ✓ Lack of available computing resources in the field
 - ✓ Restricted network bandwidth
 - ✓ Limited flexibility of embedded VCA solutions
 - ✓ High Total Cost of Ownership (TCO) – e.g.-additional servers, power consumption, maintenance contracts, etc.

Traditional VCA solutions were not designed to answer the challenges of IP surveillance systems

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Video Surveillance is emerging : Video Analytics

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Video surveillance technology progression

- Traditional CCTV
 - Direct video from camera to monitor
 - Analog video, coax cable
 - Central control room contains controllers, recorders, monitors, staff

- Analog recording
 - Record on VHS tapes (running slowly)
 - Time division multiplexing: e.g. 10 chan
 - Manual tape changing every day
 - Reuse the tapes every month
 - Pull tapes to investigate incidents



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Video Surveillance is emerging

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Digital Video recording : Embedded/Linux/Windows device

- 4-16-32 channels capture
- Storage on hard disk
- Encrypted
- Access is password protected
- More configurable
- Buy bigger hard drives
- Trade off space: duration/fps/channels/resolution
- Instant access (from timestamp)

More advanced DVRs may have

- Network access for control
- Record from ethernet
- Better compression for static scenes
- More configurable
- Schedules (more detail during the day)
- Motion detection
- Alert and “record on motion”
- Integration of inputs/outputs
- Record on Infra-red (PIR) sensor
- Steer PTZ on infrared sensor
- Still ‘appliances’



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Video Surveillance is emerging

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The Result :

Recordings frequently used for evidence

- And for TV news broadcasts
- Deterrent effect on crime
- “Force multiplier” is indispensable
- Is it cost-effective?

Manual surveillance impractical

- Increasing number of channels
- lack of attention span
- Increasing “situational awareness” needs



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Video Surveillance is emerging

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By consequence :

1. Need for Automation : Have computers watch the video
 - Scalable
 - More channels: just buy more servers & licenses
 - Cheaper than people
 - People still have to deal with the (false) alarms
 - Indexing
 - Real-time alerts
2. All IP
 - Possibly wireless
 - Possibly independent of data network for QOS needs
 - All data encrypted
 - Convergence of IT & security departments
 - Convergence of physical and electronic security
 - Central, dynamic, computer-based control
 - Increasingly automated
3. Video storage and processing at the camera
 - DSP encodes, encrypts and interprets video
 - DSP on same wafer as imager
 - Video is not transmitted except when someone needs to view it
 - Metadata in distributed clustered content manager

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What are video analytics?

- ✓ Major negative presumptions with Video Analysis : ?
 - False Alerts : (false positives)
 - System Maintenance Too Difficult
 - Cost of System Too High

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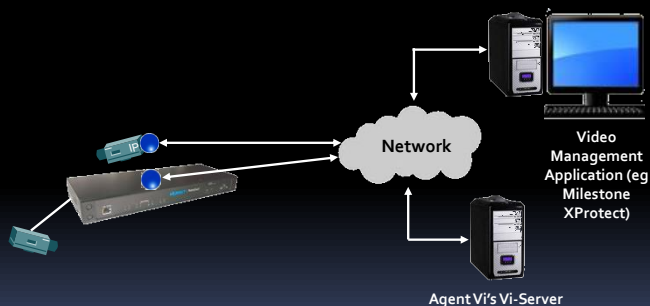
Intelligent Surveillance for Mass Transit Systems

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Concept : Distributed IPoIP Architecture

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- Patented IPoIP (Image Processing over IP) system architecture
- Distributes analysis between:
 1. Field-based feature extraction (Vi-Agent)
 2. Server-based feature analysis (Vi-Server)



- ✓ Consumes only 25-50 Kbps bandwidth
- ✓ More processing power


 = Vi-Agent Embedded in Edge Device

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Video Analytics System Requirements

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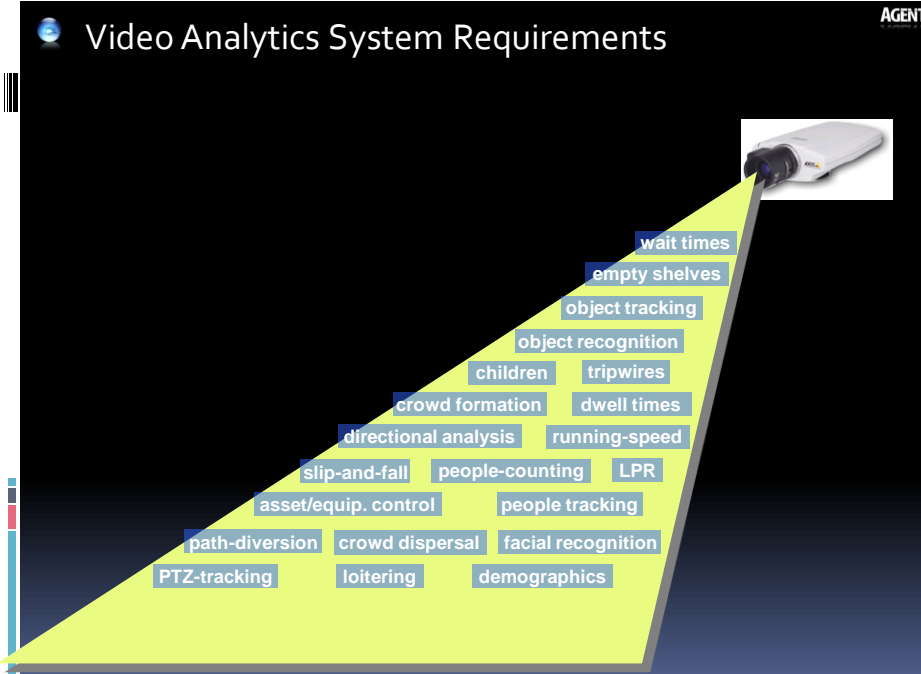
- ✓ Monitors continuously any number of cameras for predefined events
- ✓ Unlimited number of rules per camera
- ✓ Rules activated on a time basis, rule-chaining basis, and/or by external digital input
- ✓ Most versatile rules suite in the market for detecting behaviors of people, vehicles and objects
- ✓ Extends its rule types offering continuously, without requiring massive equipment upgrades
- ✓ Short time for new analytics rules to reach the market
- ✓ Supports all environments, weathers & light conditions



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Video Analytics System Requirements

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- wait times
- empty shelves
- object tracking
- object recognition
- children
- tripwires
- crowd formation
- dwelt times
- directional analysis
- running-speed
- slip-and-fall
- people-counting
- LPR
- asset/equip. control
- people tracking
- path-diversion
- crowd dispersal
- facial recognition
- PTZ-tracking
- loitering
- demographics

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Analytics Rules – Person


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-  Person moving in an area
-  Person crossing a line
-  Crowding
-  Person tailgating
-  Loitering
-  Grouping
-  Count people
-  Measure stickiness

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Analytics Rules – Object










-  Suspicious object
-  Object removal
-  Assets protection
-  Traffic obstacle

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AnalyticsRules - Vehicle






-   Vehicle moving in an area
-  Vehicle crossing a line
-  Stopped vehicle
-  Tailgating vehicle
-  Count vehicles
-  Moving water vessel

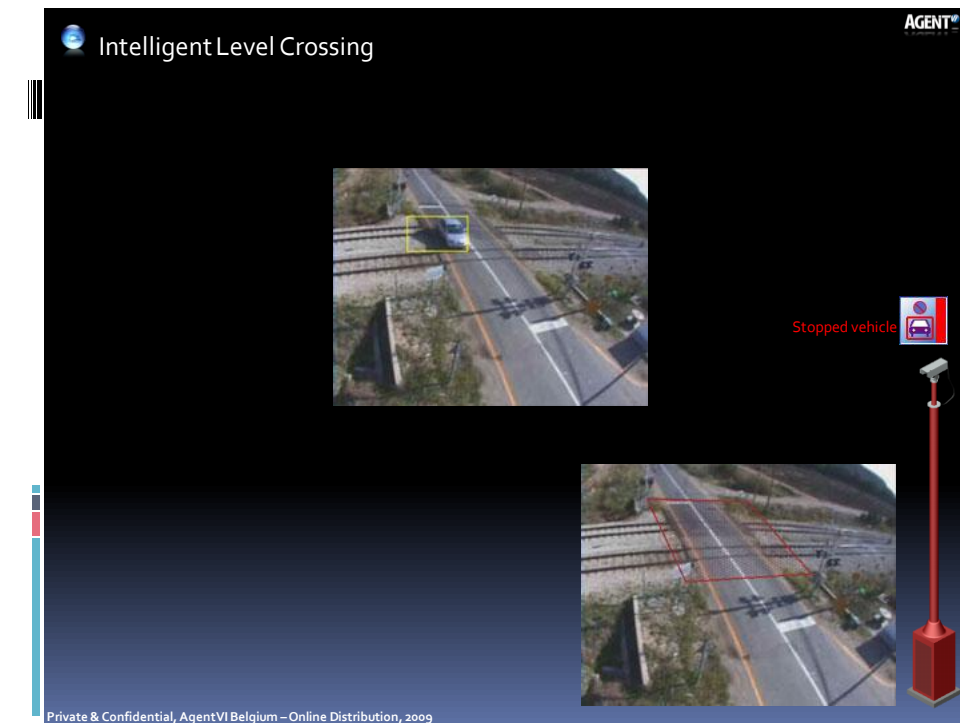
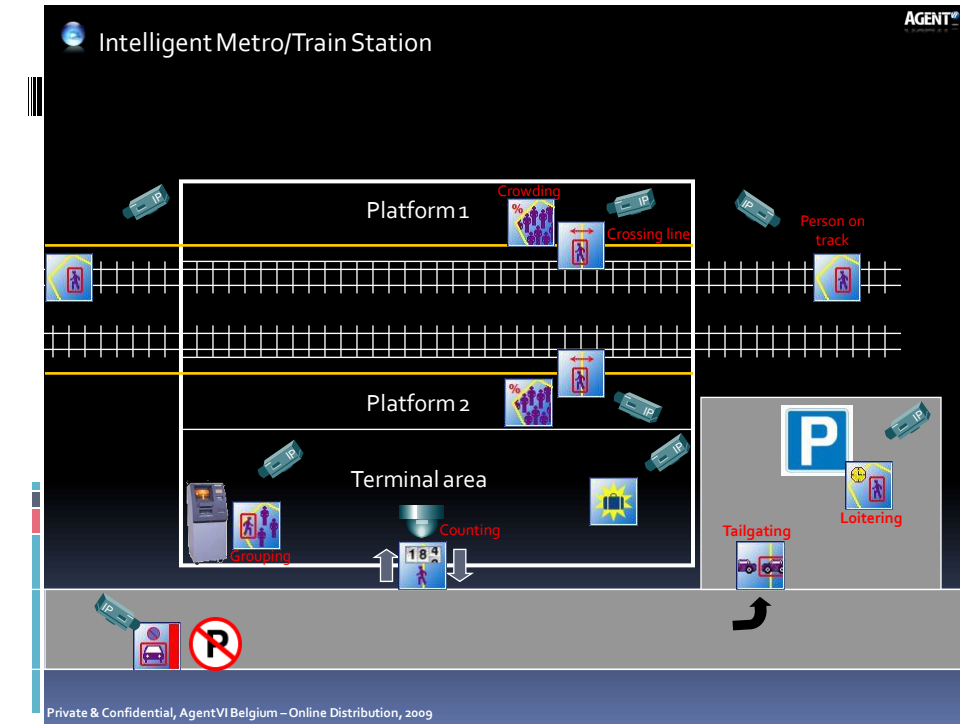
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AnalyticsRules - PTZ



-  Virtual Tour (VMD-PTZ)
-  Vi-Track
-  3D Masking

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Mass Transportation – Houston Metro

Existing Infrastructure

- ✓ 476 cameras
- ✓ 26 distributed sites
- ✓ 1 central alarm center
- ✓ Multiple rules on each camera

About the Houston Metro

The Houston Metro sought an enterprise-grade video analytics solution to protect all 'park-and-ride' parking stations in the city's metro network and surrounding environs.

Challenge

To install 476 cameras across 26 transit facilities, in order to monitor access and egress, crowd control, unattended packages (suspicious objects) and loitering

Results

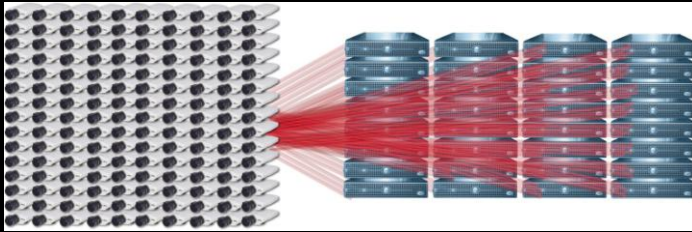
According to project integrator Charles L. Pfeiffer: "Overall, this project has been a resounding success for our company and the Houston Metro. It has been reported that **crime is down 80% at the facilities where we installed the security system.**"




Unattended object Loitering Unattended object Unattended object / loitering

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Traditional Approach

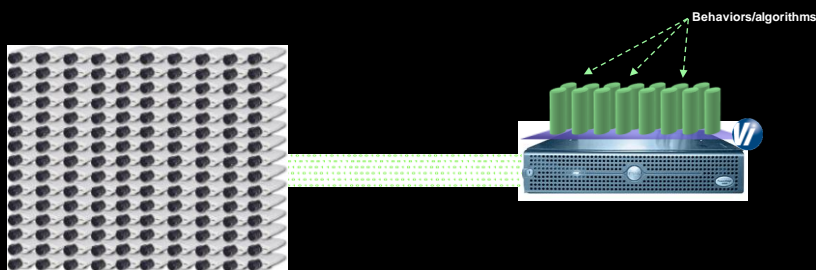


- Server intensive (4-16 cameras each)
- Network bandwidth intensive (dual streams)
- Scalability and life cycle challenges

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Distributed Approach

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- 150+ analytics cameras per server
- Ultra-low bandwidth consumption (20 Kbps/camera, no video)
- Unlimited behaviors/algorithms per camera
- No need for dual-stream video for event – only data streaming


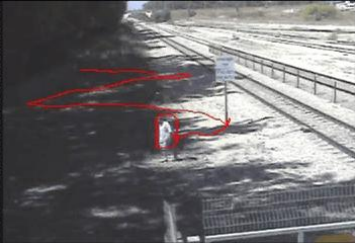


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Analytics-Enabled 3rd Party Video Management Systems

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Case Study: Israel Railways

Existing Infrastructure

- ✓ Approximately 70 analog cameras
- ✓ 20 distributed sites (railway stations)
- ✓ 1 central control room

About Israel Railways

Israel Railways is a national company responsible for all passenger and freight railway traffic in the country.

Challenge



Israel Railways sought a video analytics solution to protect train stations and railways against terrorist attacks. Specifically, the goal was to protect the stations against terrorists approaching from the train tracks and the area adjacent to the tracks.

Results

IR approved Agent Vi as its analytics vendor. The analytics system has been up and running for 3 years. IR continues to deploy Agent Vi analytics at all its stations.

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Case Study: Hong Kong APM (Advanced People Mover)

About Hong Kong APM

- ✓ Driverless light train within Hong Kong International Airport
- ✓ Speed – 62 Km/h
- ✓ Capacity – 300 people
- ✓ Length: Line 1 = 750 m, Line 2 = 430 m

Challenge

- ✓ Hong Kong APM needed an analytics solution to automatically detect abandoned objects in cars when the train was empty
- ✓ The APM travels through tunnels and open spaces which causes communication losses, posing a problem for analytics
- ✓ The analytics solution was required to detect an abandoned object within 30 seconds after the doors close

Solution

Agent Vi teamed up with Vigilant Technology to develop a solution that includes the following components:

- ✓ Axis IP cameras (Axis 216FD) – certified by Agent Vi
- ✓ Vigilant's NetVu – video and event management system
- ✓ Agent Vi – Obstacle Detection based on unique Reference Image technology
- ✓ RFID system to trigger the analytics on/off
- ✓ WiFi communications network between the cars and the control center

Results

Hong Kong APM tested Agent Vi's analytics solution for several months. The solution is now deployed and fully operational.

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Intelligent Video Surveillance for City Centers

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Nan-Hai City Center (Southern China)

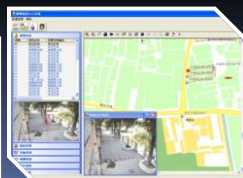
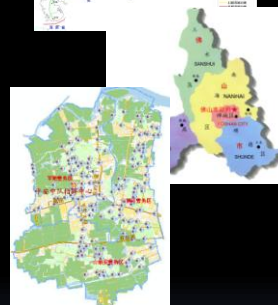
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Required Applications


- ✓ intrusion detection
- ✓ loitering detection
- ✓ suspicious objects (NMD)
- ✓ object classification (car, motorcycle, people)
- ✓ crowd detection
- ✓ irregular car behavior – wrong direction, acceleration, etc.
- ✓ High-end outdoor motion detection

Results

For almost 2 years the system has been up and running. There is a full integration with GIS system. All video is streamed and viewed by the local police station.



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Challenges


Application-level

- outdoor environments – sun/rain, day/night
- overcrowded – too many people, vehicle, bicycles and motorcycles
- different needs for different locations across a city (critical infrastructure protection, crime prevention, traffic control)

Infrastructural

- large number of cameras
- widespread distribution of cameras (can be several hundred square kms)
- network communication issues
- high cost of ownership (dedicated servers, dedicated cameras, limited functionality)

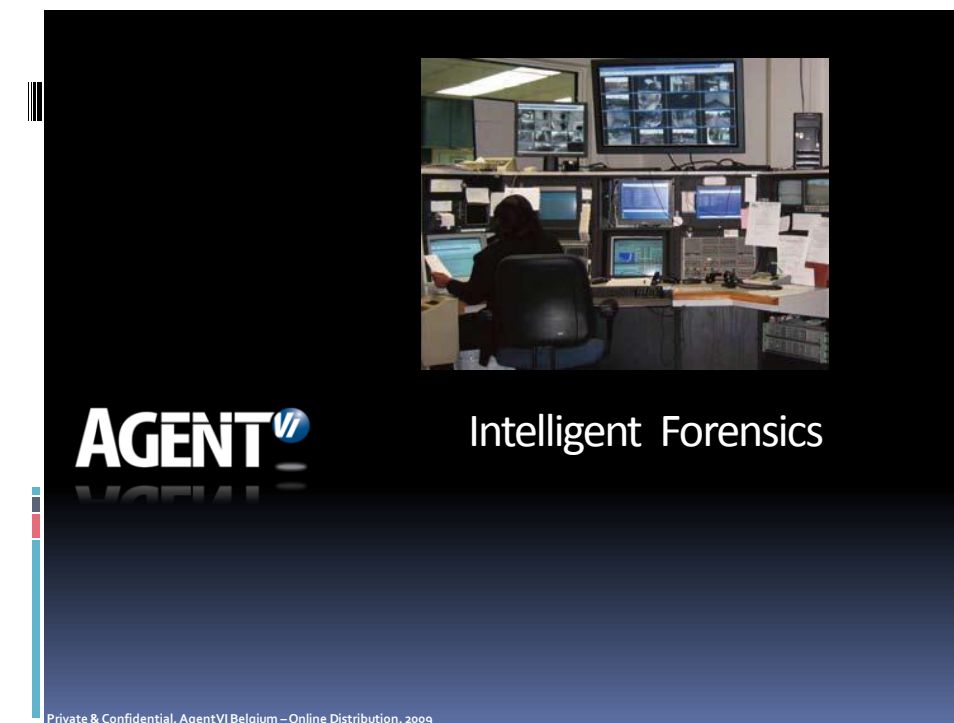
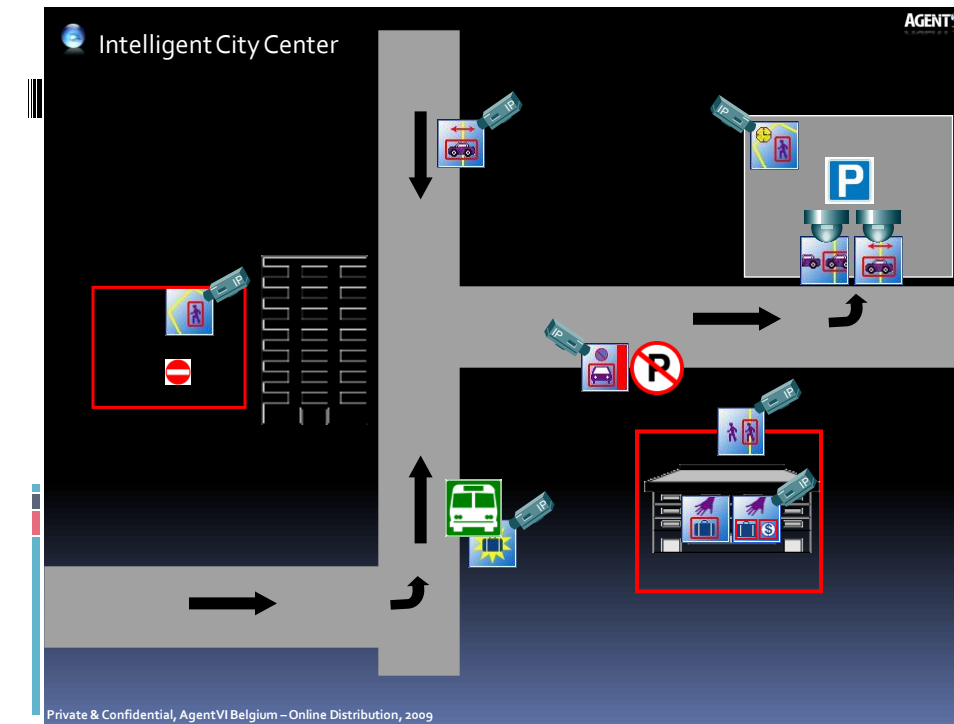
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Application Requirements

- Intrusion detection along perimeters and secured gates
- Tailgating through secure access areas and parking garages
- Vehicles traveling in unauthorized directions
- Stopped vehicles in restricted areas
- Missing objects or object removal
- Objects left unattended in or near sensitive areas
- People or vehicles attempting to access restricted areas
- People loitering in an area of interest
- Camera blocking

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Instant Search : Intelligent Forensics

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- ✓ Finding *all events* triggered by a *moving person* that occurred within a specific time-period on specific cameras
- ✓ Finding *all cameras* that caught a person on video in the past 2 hours, on the basis of an image of the person retrieved from a single camera
- ✓ Finding on all outdoor cameras *any vehicle* that parked for more than one minute
- ✓ Generating a *statistical report* on the people flow at all entrances during the past month
- ✓ Finding out *when* specific items were removed from shelves at a store
- ✓ Finding a *yellow pickup truck*
- ✓ Searching for *adults loitering* near a school playground during school hours

Rules/behaviors do not need to be defined in advance. They can be defined after real-time video streaming.

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GUI Example

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The screenshot displays the AgentVI search interface. At the top, there are tabs for 'File', 'My Queries', and 'My Search Results'. Below this is a search configuration panel with the following settings:

- Sensors:** All (selected), Select
- Time:** Past 12 hours, Use Time Range (checked)
- Type:** Vehicle
- Behavior:** Moving
- Sensitivity:** A slider control.
- Search:** A button to execute the search.

The main area shows a grid of 12 video thumbnails, each titled 'Access from Railroad' and timestamped. The third thumbnail in the first row is highlighted with a blue border. A large red 'Preliminary' watermark is overlaid diagonally across the grid. To the right of the grid is a larger preview window showing a video frame with a timestamp of '1/20/2009 9:58:50 AM' and 'Pre 5 sec' / 'Post 15 sec' controls.

Results Found: 12

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Integrating with VMS

- ✓ Integrated with 3rd party VMSs
- ✓ Easily adapted to any 3rd party VMS
- ✓ Provides an API for VMS providers
- ✓ Search requested in VMS; findings displayed in VMS
- ✓ Findings displayed both as *single images* and as *video playback*

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Milestone and Axis integration

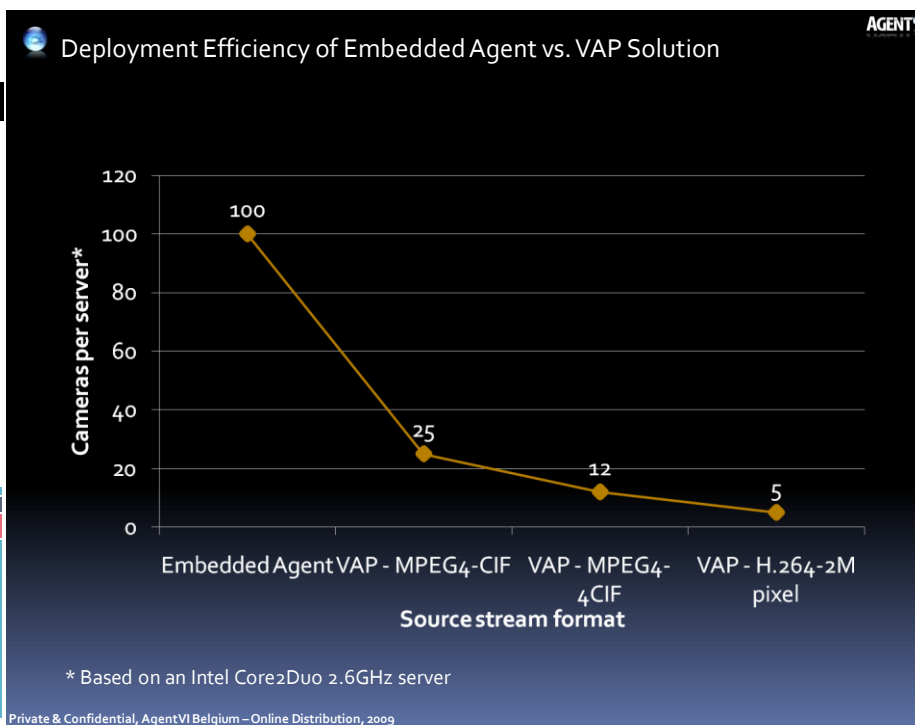
- Axis – Agent embedded cameras for indoor/outdoor
- Milestone – Xprotect Cororate/Enterprise fully integrated with VI-System

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Milestone and Axis integration

The screenshot shows the Agent-VI software interface. On the left, there is a tree view with three red boxes and arrows pointing to 'Camera Area', 'Agent-VI Alert Image Area', and 'Alert List'. The main window displays a camera feed of an office interior. Below the feed is a table with columns for 'Alert', 'Camera', 'Time', and 'Status'. To the right of the interface is a certificate titled 'Certification of the Axis 211A Network Camera' with the AGENT logo.

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Other Cases

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Potomac Basin Security System

Existing Infrastructure

- ✓ 300+ cameras
- ✓ several distributed sites
- ✓ servers, network connectivity, etc.
- ✓ high-end outdoor motion detection

About PBSS

- ✓ Combines biometrically enabled access control, geospatial technology, radar surveillance, video analytics, and other sensor technologies to protect transportation facilities, secure areas, and critical infrastructure.
- ✓ The area, including Ronald Reagan Washington National Airport, Bolling Air Force Base and Washington Navy Yard is of critical strategic importance given its proximity to Washington DC.

Challenge

To provide a cost-effective video analytics solution that will run high-end analytics over the existing infrastructure with the possibility of ramping up to hundreds of cameras – without having to increase server capabilities

Results

Michael Borcharding, President of Abeo Corporation, the integrator at PBSS, stressed (1) computing requirements (2) scalability and (3) accuracy as the key factors in selecting Agent VI's software. "Video analytics has stalled in the market due to lack of scalability and high false alarm rates", said Borcharding. "Agent VI's architecture enabled PBSS to run high-end analytics with validated alarms over its existing infrastructure - with the flexibility to ramp up into hundreds of cameras - without having to increase server capabilities".



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National Museum – Dolmabahce Palace, Turkey

Existing Infrastructure

- ✓ 160 cameras
- ✓ Vi-Agent embedded on Axis 221
- ✓ Multiple rules on each camera
- ✓ Single server for the analytics

About the Palace

- ✓ One of the largest national museums in Istanbul
- ✓ Includes 285 rooms and 46 halls
- ✓ Hosts tens of thousands tourists annually
- ✓ One of the largest collections of Bohemian crystal chandeliers in the world.

Challenge

The palace authority sought a video analytics solution that would enable them in a challenging environment to:

- ✓ Deploy all types of analytics **WITHOUT** changing its newly-installed surveillance system
- ✓ Simultaneously preserve high detection performance

Results

The system was installed on existing Axis 221 cameras, enabling these cameras to perform multiple detection capabilities such as motion detection, line-crossing, left object, crowd formation, and tailgating. According to Dolmabahce Palace IT director Rusten Coskun: **"With Agent Vi, we gain unsurpassed detection capabilities and scheduling flexibility without requiring us to change existing hardware or purchase additional equipment".**








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Port of Singapore Authority

Existing Infrastructure

- ✓ 57 cameras

About PSA

- ✓ Biggest container transshipment hub in the world

Challenge

The PSA sought a video analytics solution for:

- ✓ Intrusion detection
- ✓ Truck queue management












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About Agent Vi

- Agent Vi, Inc. founded in 2003
- Software company focusing on video content analysis for the surveillance and control markets. Video Intelligence software provider for enterprise-grade video surveillance networks, based upon Patented IPoIP™ technology
- Winner of the Israel Hi-Tech award 2004 and Frost & Sullivan innovative Security Product for 2006
- More than 20 Technology Partners
- Successful Deployments in over 20 countries, 60 customers over 2000 channels. Used by Retail, Airlines, Railways, Prisons and Government Security Forces : deployed in leading projects worldwide: Huston Metro, Reagan Airport, NTTA Highway, Iberia Airlines, Singapore Port, Amtrak, Israel Railways
- Deployed in USA, UK, Greece, Spain, France, Netherlands, China, Israel, ...
- Offices in the U.S. and Israel

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Thank you

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