NEXCOM
Committed to Customer Success

White Paper

# Vehicle Servers Bring Intelligence to Edge

Existing mobile NVRs have hit a bumpy road because the technology landscape changes.

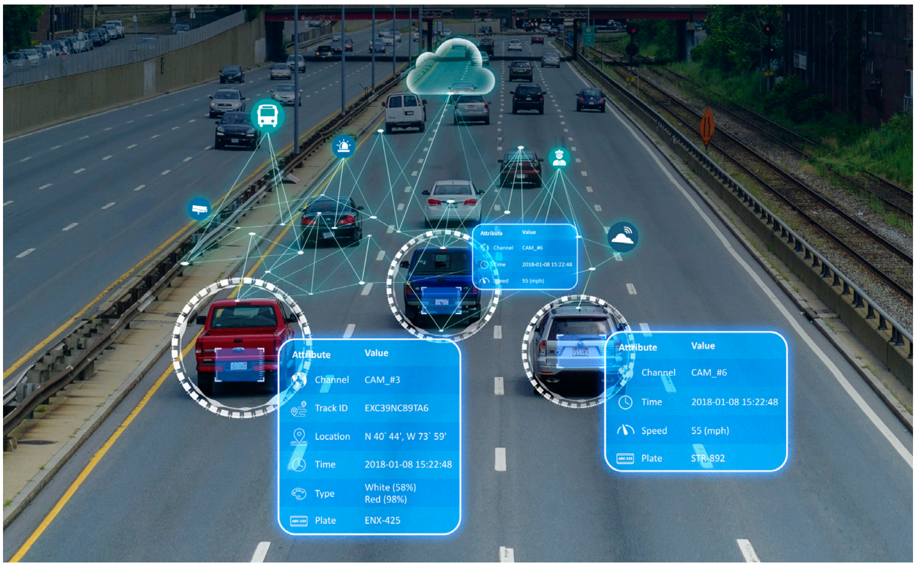
Mobile network surveillance recorders (Mobile NVRs) are facing steep challenges. Demands for higher resolutions and the number of cameras in vehicles are increasing. 5G technology and cloud services are building market hypes for nascent video surveillance applications. And Deep Learning (DL) is another promising technology whose efficiency can be improved with preliminary data processing and analysis at the edge. The changing technology landscape is rendering existing mobile NVRs obsolete (Figure 1).

This article discusses a new type of rugged vehicle servers which addresses prime considerations for not only a mobile NVR but also other systems used in mobile applications. To be specific, the article explains how NEXCOM's MVS series of vehicle servers powered by Intel® Core™ and Intel Atom® processors meet system requirements in various application scenarios. The article suggests a multi-layer security mechanism leveraging NEXCOM's and Intel® Technologies to strengthen data security when sensitive data and privacy could be at risk. Let's not neglect the influence of mobile environments on system reliability and issues must be taken into account to enhance system availability.

## The Changing Technology Landscape

Formerly used as a storage server, mobile NVRs aggregate video feeds from several cameras, convert a video feed into a digital format, save it to a hard disk, and, if needed, decode a compressed video feed from a hard drive to display it on a screen or send to a data center where video analysis is performed.

This practice has hit a bumpy road as camera resolutions continue to improve with the advent of 4K IP cameras promising to provide sharp crisp images. While 4K IP cameras are still at an early stage of adoption, cameras are receiving wider acceptance for security and operational reasons. With more video feeds from more cameras, relying video analysis solely on data centers can put a tremendous strain on data bandwidth, not to mention that poor connection quality can delay the transmission of video feeds



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| Speed | 55 (mph) |

| Attribute | Value |
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| Type | White (58%)<br>Red (98%) |
| Plate | ENX-425 |

| Attribute | Value |
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| Speed | 55 (mph) |
| Plate | STR-892 |

Figure 1 Existing mobile NVRs have hit a bumpy road because the technology landscape changes.

New systems must support the latest video codec standards, multiple camera configuration, video analysis, and system function consolidation.

and analysis results. At the same time, concerns over security and privacy are growing.

Compounding the issue is that there are other systems in vehicle—for routing and navigation, fleet management, in-vehicle infotainment, automated license plate recognition (ALPR), and more. These systems are usually purpose-built appliances working as silos not interoperating with each other, vying for power and space in vehicle, and even taking room from drivers and passengers. In this regard, users are seeking for new technology (Figure 2).

A new system must support the latest video codec standards, have a system architecture that enables a multiple camera configuration, share the burden of video analysis for a data center, and provide system headroom to consolidate functions of different systems into one hardware unit. Dedicated to mobile applications, NEXCOM's MVS series of vehicle servers checks all requirements.

## Vehicle Servers on The Move

### Enhanced Media Processing

NEXCOM's MVS series provides scalable performance with MVS 5603 powered by Intel® Core™ i7-6600U or i3-6100U processor, and MVS 2623 powered by Intel Atom® x7-E3950 Processor. Making use of the accelerated media codecs, NEXCOM's MVS series of vehicle servers can encode/decode video feeds into/from High Efficiency Video Coding (HEVC), also known as H.265. HEVC supports 8K resolution and doubles the data compression ratio compared to Advanced Video Coding (AVC), or H.264, improving the usability of more high-resolution IP cameras in mobile applications. With H.265 capability and integrated graphics engines in Intel processors, NEXCOM's MVS series can aggregate six to eight channels of video feeds using Power over Ethernet (PoE) connections and transcode them smoothly to offer live views on two independent displays.

This means MVS series can save compute power for other application functions and more valuable workloads, such as video analysis. Fabricated using Intel's latest 14 nanometer silicon technology, Intel processors have excellent performance and a unique set of features. These features include up to quad-core processing performance, fast memory

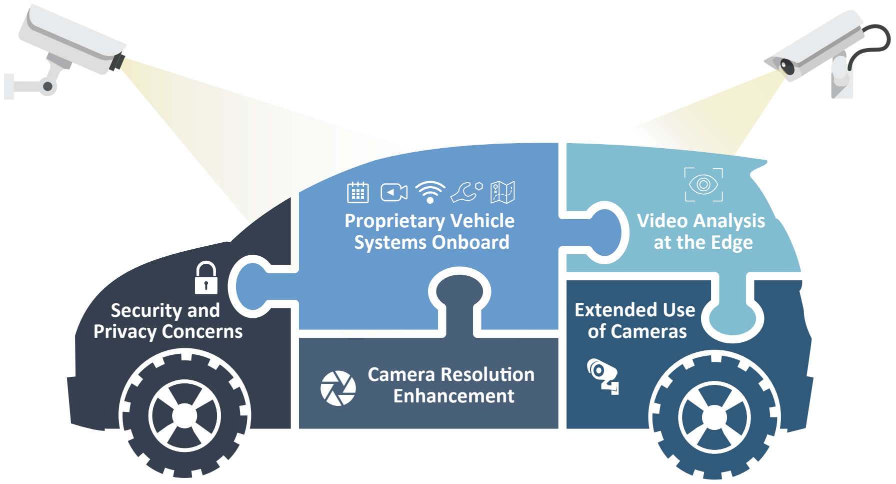
Proprietary Vehicle Systems Onboard
Video Analysis at the Edge
Security and Privacy Concerns
Extended Use of Cameras
Camera Resolution Enhancement

Figure 2 Mobile network surveillance recorders (Mobile NVRs) are facing steep challenges.

Media and compute enhancements give the MVS vehicle servers an extra boost in video analysis .

speeds, and a maximum of 32 GB memory at small thermal design power of 12W to 15W, making MVS vehicle servers ideal for mobile applications where performance and power are at a premium. Moreover, Intel® Advanced Vector Extensions 2 (Intel® AVX2) on Intel Core processors (MVS 5603 models) provides optimized instructions to deliver enhanced performance on media and floating-point computation. These media and compute enhancements give the MVS vehicle servers an extra boost in video analysis (Figure 3).

On top of performance, the MVS vehicle servers are geared with a variety of connectivity to interface with automotive microcontrollers and to establish high-speed internet communication, so they can act as an ALPR system, mobile NVR system, vehicle switch and gateway, Wi-Fi router, fleet management system, and public address system.

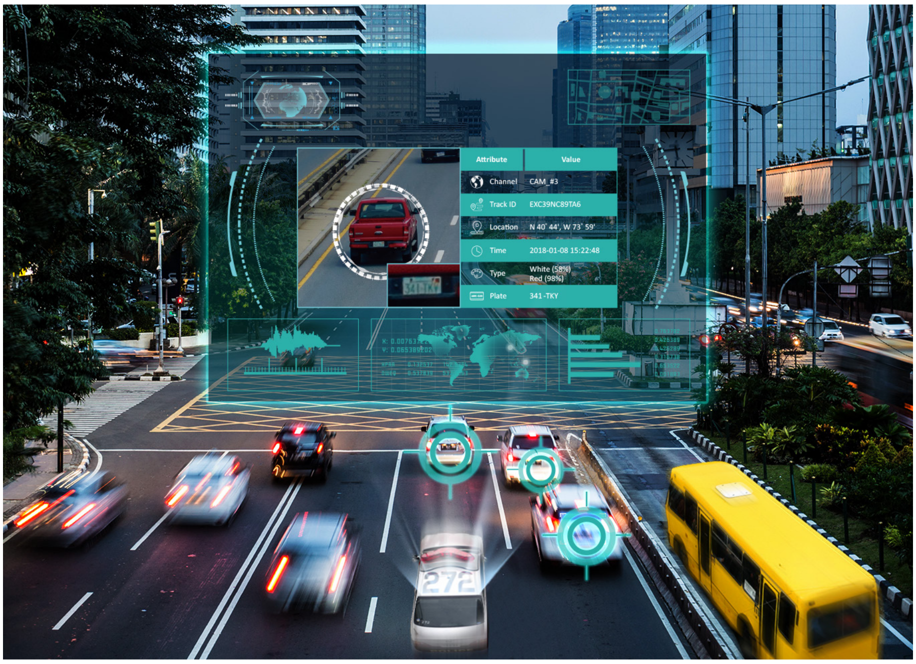

Figure 3 Multimedia, computing, and video analysis boost on a vehicle server.

### Vehicle Server in Police Patrol

To illustrate with law enforcement as an example, consider a police car is out on duty. Two to four ALPR cameras mounted on the rooftop and the trunk automatically take images of license plates (LP) coming into view and send the compressed images to a NEXCOM's MVS vehicle server. The MVS vehicle server decodes images, segments individual alphanumeric characters from each image, and compares identified LPs with lists of vehicles of interest. A warning and a live view of a vehicle in question pop up on a vehicle display when a LP is matched with the database.

Then, the police car approaches the vehicle with a dashboard camera recording the scene to the MVS vehicle server. The vehicle server tags the recording with vehicle information—time, location, speed, acceleration, orientation, and brakes usage—and streams live in high resolution to an operation center when the incident escalates to

In a police car, a vehicle server can handle ALPR, mobile NVR, public addressing, vehicle switch and gateway, and fleet management at the same time.

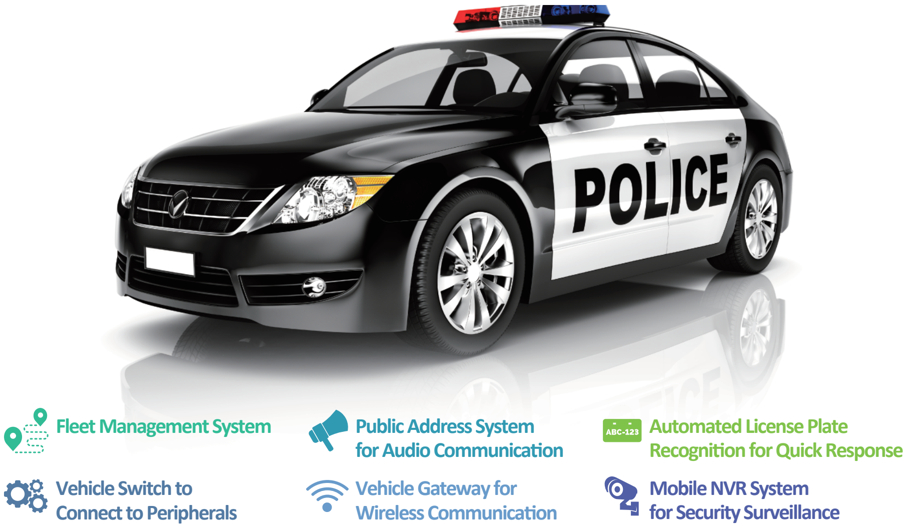
POLICE
Fleet Management System
Public Address System for Audio Communication
ABC-123
Automated License Plate Recognition for Quick Response
Vehicle Switch to Connect to Peripherals
Vehicle Gateway for Wireless Communication
Mobile NVR System for Security Surveillance

Figure 4 In a police car, a vehicle server can handle ALPR, mobile NVR, public addressing, vehicle switch and gateway, and fleet management at the same time.

a car chase. Although GPS signals are intermittent due to interference and blockage, the MVS vehicle server keeps updating its whereabouts to the operation center by recalculating the location based on the last GPS data, vehicle speed, moving direction, and acceleration. In the meanwhile, a police officer reports to the operation center over the radio, and the other officer talks to the driver with a speaker—all communications recorded. Also recorded are front and back seat cameras if an arrest is made (Figure 4).

## Vehicle Server in Bus Service

The bus service is another application that can benefit from the MVS series. In addition to security surveillance, the MVS vehicle servers can help monitor ridership trends and construct a profile of travel behavior by counting the number of passengers getting on and off a bus with cameras and collecting transportation statistics from such as door sensors and ticket machines. It is worth mentioning that Dynamic Host Configuration Protocol (DHCP) is enabled on MVS vehicle servers for static IP addressing. Changing cameras or other IP-based peripherals is quick and easy without the need to reconfigure the IP address for new devices.

From the aspect of driving safety, driving behavior, vehicle status, and diagnostic message can be amassed over Control Area Network (CAN) and the SAE J1939/ J1708 protocols. Accordingly, operators can implement safe driving guidelines and predictive maintenance schedules to reduce risks of road accidents and maximize bus utilization.

While vehicle telematics data is processed in the background, the MVS vehicle servers display signage contents, make bus stop announcement, and offer driver-passenger intercom. More importantly, multiple internet connections at up to 600 Mbps can be set up through mini-PCIe and M.2 expansion. That is to say that quality passenger Wi-Fi services can be delivered and vehicle telematics data exchanged in real time without the need of a discrete Wi-Fi router (Figure 5).

## Steer Clear of Security Risks

Data security is a must rather than an option when sensitive data and even people's privacy is at stake. To alleviate

In a bus, a vehicle server can handle mobile NVR, fleet management, vehicle router, public addressing, and passenger infotainment display.

security concerns, the MVS vehicle servers take a holistic approach by managing security risks at the layer of vehicle, system, and data.

At the vehicle layer, iButton authentication validates a driver's identity and prevents unauthorized personnel from starting a vehicle. The 24/7 tracking function combines location tracking and motion sensing to detect unexpected movements of a vehicle and alerts relate personnel by text message. Following the steps on a built-in utility GUI, users can create emergency contact lists based on the severity of an incident.

At the system layer, Inter® Trusted Execution Technology (Intel® TXT) can guard the MVS vehicle servers from system-level attacks by verifying the integrity of BIOS, operating systems (OS), and software. Rootkit and system-level attacks can persist after a system is rebooted or hard drive wiped, installing an invisible backdoor on a system. Therefore, Intel TXT can play an essential role in booting the MVS vehicle servers into a "trusted" execution state and deterring unauthorized system modification.

At the data layer, Intel® Advanced Encryption Standard New Instructions (Intel® AES-NI) offers a fast, secure AES engine for a variety of encryption applications including whole-disk encryption, file-storage encryption, and Internet security. Trusted Platform Module (TPM) which blocks unauthorized systems from accessing hard disks avoids data theft in case a hard disk is misplaced or stolen.

## Fight the Harshness

The MVS vehicle servers are developed to last despite challenges posed in mobile environments. Taking meticulous engineering, the rugged MVS vehicle servers are designed with vibration and shock endurance by the MIL-STD-810G

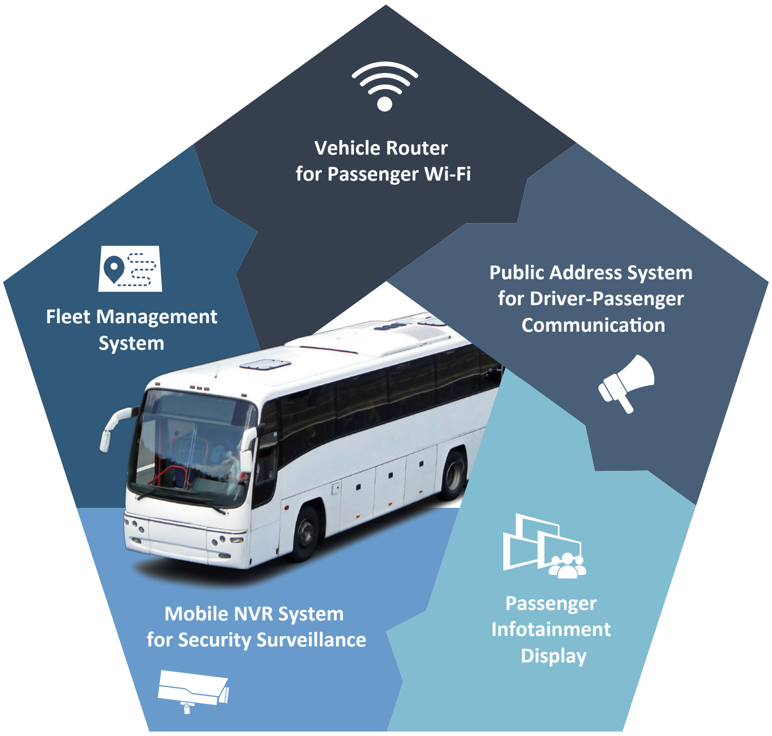

Figure 5 In a bus, a vehicle server can handle mobile NVR, fleet management, vehicle router, public addressing, and passenger infotainment display.

Taking advantage of NEXCOM's MVS vehicle servers, digital security and surveillance has versatile potential applications.

standards for use with hard disk drives in data-intensive applications. For data-critical use cases, high data availability can be assured by full data backup of RAID 1 which allows data to be restored in the case of a single disk failure, and steady data transmission can be guaranteed by connectors with lock on selected models.

Unstable power supply is another factor that can undermine system stability. In view of transient voltage fluctuations and spikes of vehicle batteries, NEXCOM's Power Management incorporates ignition on/off delay, startup and shutdown voltage setting, and a wide power range from 9V to 36V altogether to protect against overvoltage and undervoltage. If sudden power loss occurs, an internal battery can sustain 15 minutes. Alternatively, an additional external battery is intended to cover the need for an independent power supply.

## Conclusion

Digital security and surveillance has versatile potential applications. Taking advantage of edge computing, video feeds integrated with vehicle telematics data can give more context and translate into tangible intelligence to assist with law enforcement and elevate bus services. As intelligence at the edge is more of a reality than a theory, NEXCOM is sparking the technology adoption with its rugged mobile computing solutions, helping users gaining new perspectives on daily operations and implementing continuous operational improvement.

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