Axxon One Performance and Validation Report on Dell Technologies PowerEdge* R750 and R650 with Intel® Data Center GPU Flex 140

Report

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Contents

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Revision History

Date	Revision	Description
November 2023	1.2	Added Section 2.0 System Configuration.
October 2023	1.1	Added Section 5.2 Intel® Data Center GPU Flex 140. Updated Section 6.0 Conclusion.
August 2023	1.0	Initial release.

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1.0 Overview

This document provides an overview and performance results for validation of a production ready version of Axxon One by AxxonSoft running on an enterprise server solution; Dell Technologies PowerEdge* R750 and R650 with Intel® Data Center GPU Flex 140.

The focus of this report will be performance results running Axxon One software on only the CPU and GPU configurations.

Configuration for multi-stream in-process analytics includes a pipeline process of video decode, video analytics via AI model with video analytics metadata creation, and injection of metadata into reporting and visualization platform.

1.1 Objective

The objective of the validation process is to:

i. Validate and Size the system configuration for concurrent multi-stream video analytics.
ii. Validate that the application's inferencing model is evenly distributed across all compute units:
    - The balancing load across all CPU and GPU (when applicable) cores are validated.
iii. Confirm that maximum video analytics channel density is achieved at about 60% of maximum compute capacity:
iv. Confirm that overall software/hardware solution is steady and operates without fail(s) for the duration of the testing.
v. Measure and log key system running parameters:
    - Overall system CPU load: average and standard deviation.
    - Video analytic inference performance in frames per second and inference time captured in milliseconds.

1.2 Axxon One Overview

Axxon One is a limitlessly scalable video management software that combines comprehensive support for 10,000+ IP devices and a streamlined user interface.

Axxon One supports the latest ONVIF standards, such as Profile M, and delivers unique value through integrated solutions, customizable AI video analytics, and fast, intelligent search in video footage from multiple cameras.

2.0 System Configuration

Table 1. System Configuration for Recording and Video Analytics

CPU-only Configuration	
Chassis	Dell Technologies PowerEdge R750
CPU	2x Intel® Xeon® Gold 6338N CPU @ 2.20 GHz, 32 Core(s), 64 Logical Processor(s)
Memory	Installed Physical Memory (RAM) of 256 GB
Hard drives	512GB Total Storage but not leveraged for storage
Network card	Intel® Ethernet Network Adapter E810-DA4 QP 25GbE SFP28 OCP 3.0

CPU with GPU Configuration	
Chassis	Dell Technologies PowerEdge R650
CPU	2x Intel® Xeon® Gold 6338N CPU @ 2.20 GHz, 32 Core(s), 64 Logical Processor(s)
Memory	Installed Physical Memory (RAM) of 256 GB
Hard drives	512GB Total Storage but not leveraged for storage
Network card	Intel® Ethernet Network Adapter E810-DA4 QP 25GbE SFP28 OCP 3.0
GPU	Intel® Data Center GPU Flex 140
Firmware version	6.4.0.0
Driver version	31.0.101.4642 Windows Server 2022 Datacenter

Software	
BIOS	Dell Inc. 1.11.2
iDRAC	7.00.00.00 (Build 22)
Operating System	Microsoft Windows Server 2019 v.10.0.17763, x64
Video Analytics Application	Axxon One VMS Version 2.0.0.102 DetectorPack Version 3.10.2.117 Drivers Pack Version 3.76.28

OpenVINO™	OpenVINO™ Toolkit v.2021.3 LTS
Others	Disabled Hyper-Threading (Logical Processor in BIOS)
Others	Enabled Dynamic CPU Frequency

2.1 Processor Details

System	Name	Processor	Current Speed	Core Count
Dell R750	CPU1	Intel® Xeon® Gold 6338N CPU @ 2.20 GHz	2.20 GHz	32
	CPU2	Intel® Xeon® Gold 6338N CPU @ 2.20 GHz	2.20 GHz	32

System	Name	Processor	Current Speed	Core Count
Dell R650	CPU1	Intel® Xeon® Gold 6338N CPU @ 2.20 GHz	2.20 GHz	32
	CPU2	Intel® Xeon® Gold 6338N CPU @ 2.20 GHz	2.20 GHz	32

2.2 Dell BIOS Settings

Dell iDRAC Processor Settings	
Logical Processor	Enabled
CPU Interconnect Speed	Maximum data rate
Virtualization Technology	Disabled
Directory Mode	Enabled
Adjacent Cache Line Prefetch	Enabled
Hardware Prefetcher	Enabled
DCU Streamer Prefetcher	Enabled
DCU IP Prefetcher	Enabled
Sub NUMA Cluster	Disabled
MADT Core Enumeration	Linear
UPI Prefetch	Enabled
XPT Prefetch	Enabled

LLC Prefetch	Disabled
Dead Line LLC Alloc	Enabled
Directory AtoS	Disabled
AVX P1	Normal
RAPL Prioritization (line18)	Disabled
AVX ICCP Pre-Grant License	Disabled
Number of Cores per Processor	All
Local Machine Check Exception	Disabled
Controlled Turbo (line 22)	Disabled
Optimizer Mode (line 23)	Auto
Embedded SATA Mode (line 24)	AHCI
Security Freeze Lock	Enabled
Write Cache	Disabled
BIOS NVME Driver	Dell Qualified Drives
Boot Mode (line 28)	UEFI
Boot Sequence Retry	Enabled
Generic USB Boot	Disabled
HDD Placeholder	Disabled
SysPrep Clean	None
SetBootOrderEn	AHCI.SL.6-2,Disk.USBBack.1-1
SetBootOrderDis	NIC.PxeDevice.1-1
PxeDev1EnDis	Enabled
PxeDev2EnDis	Disabled
PxeDev3EnDis	Disabled
PxeDev4EnDis	Disabled
HttpDev1EnDis	Disabled
HttpDev2EnDis	Disabled
HttpDev3EnDis	Disabled
HttpDev4EnDis	Disabled
USB Ports	All On
USB Managed Port	On
IntegratedNetwork1	Enabled
EmbNic1Nic2	Enabled
IoatEngine	Disabled
EmbVideo	Enabled
SnoopHldOff	Roll256Cycles

SriovGlobalEnable	Disabled
OsWatchdogTimer	Disabled
PCIRootDeviceUnhide	Disabled
MMIO Above 4GB	Enabled
MemoryMappedIOH	56TB
DellAutoDiscovery	Platform Default
Slot1	Enabled
Slot2	Enabled
Slot3	Enabled
Slot4	Enabled
Slot5	Enabled
Slot6	Enabled
Slot7	Enabled
Slot8	Enabled
SerialComm	Off
SerialPortAddress	Com1
FailSafeBaud	115200
ConTermType	Vt100Vt220
RedirAfterBoot	Enabled
SysProfile	PerfOptimized
PasswordStatus	Unlocked
TpmSecurity	On
Tpm2Hierarchy	Enabled
MemoryEncryption	Disabled
PwrButton	Enabled
AcPwrRcvry	Last
AcPwrRcvryDelay	Immediate
AcPwrRcvryUserDelay	60
UefiVariableAccess	Standard
InBandManageabilityInterface	Enabled
SmmSecurityMitigation	Disabled
SecureBoot	Disabled
SecureBootPolicy	Standard
SecureBootMode	DeployedMode
TpmPpiBypassProvision	Disabled
TpmPpiBypassClear	Disabled

Tpm2Algorithm	SHA1
RedundantOsLocation	None
MemTest	Disabled
MemOpMode	OptimizerMode
NodeInterleave	Disabled
MemoryTraining	MemoryTrainingFast

NOTES:

1. iDRAC = Integrated Dell Remote Access Controller.

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3.0 Axxon One System Configuration

3.1 Video Stream Configuration(s)

Component	Settings	Comments
Video Analytic Input video stream parameters	See section 5.1 Analysis Single-stream RTSP cameras are used to emulate real-world VMS configuration. RTSP cameras are receiving the video streams from remote RTSP server via network interface. Streams are constantly being recorded in any profile.	Each type of analytics is tested separately using various resolutions and codecs. Stream frame rate is set to 25 FPS. For each camera, 1 analytics instance is initialized, except for the **"RTSP streams recording to archive"** profiles – in that case no analytics is used, but the constant recording is still enabled.
Number of input video streams for analytics (virtual cameras)	See section 5.1 Analysis	Equals to the total number of currently active input video streams (each virtual camera stream has a single video stream)
Video analytic inference framerate per video channel	Depends on the type of analytics: Motion detection: 20 FPS Neural tracker: 6 FPS Personal protective equipment detection: 1 FPS Pose detection: 3 FPS Neural counter: 1 FPS Fire detection: 0.1 FPS Object tracker, tracker with neural filter: 25 FPS	Each AI service is set to process a certain portion of the total frames. These are the default (optimal) processing frame rate values for particular analytics tools. The processing frame rate should match these specified values during testing.
Number of active video analytics streams at maximum testing	See section 5.1 for details	Maximum Number of Streams where video analytics were applied.

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4.0 Profiling

4.1 Validation Steps

1. Deploy and Configure Dell Technologies* PowerEdge* R750/R650 Server.
2. Install Windows* Operating System and Analytics Platform with Testing Criteria.
    a. Set up maximum virtual video streams with specified video sources for high-resolution streams.
    b. Set up Axxon One video analytics to process the virtual video streams.
3. Run the profiler tools to record hardware usage and other metrics over a given period of time.
4. Process results to generate tabulated data using multiple readings.
5. Analyze results and report.

4.2 Checklist for Results Validation

i. Axxon One is utilizing about 60% of the CPU without compromising the system accuracy.

ii. Processing frame rate is matching the expectations.

iii. CPU usage and Memory consumption values are consistent during the test.

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5.0 Performance Test Results

To measure system scalability, we sequentially increased the number of streams being processed in parallel while keeping records about hardware utilization and processing time for each stream.

5.1 Analysis – R750 CPU only

Test Profile	# of Video Streams based on CODEC	
	h.264	**h.265**
RTSP streams recording to archive (1920x1080)	1400	1500**
RTSP streams recording to archive (640x360)	2197	3300**
Motion Detection (1920x1080)	133	91
Motion Detection (1280x720)	280	228
Motion Detection (640x360)	590	494
AI Neural tracker (ResNet34) (1920x1080)	8	8
AI Neural tracker (ResNet34) (1280x720)	10	10
AI Neural tracker (ResNet34) (640x360)	10	10
AI Neural tracker (MobileNetV2) (1920x1080)	26	23
AI Neural tracker (MobileNetV2) (640x360)	32	32
Personal protective equipment detection (1920x1080)	15	14**
Personal protective equipment detection (1280x720)	22	21**
Pose Detection (1920x1080)	17	16
Pose Detection (640x360)	18	17
Object tracker (1920x1080)	65	63
Object tracker (640x360)	350	292
AI tracker with neural filter (1920x1080)	31	28**
AI tracker with neural filter (640x360)	33	32**
Fire detection (1920x1080)	110	80**
Fire detection (640x360)	250	205**
AI neural counter (1920x1080)	47	45**
AI neural counter (640x360)	56	55**

**theoretical calculation

5.2 Intel® Data Center GPU Flex 140

The Intel® Data Center GPU Flex Series is flexible, robust, and the industry's most open GPU solution for the intelligent visual cloud. The GPU will support a diverse range of workloads in the industry starting with media streaming and cloud gaming, followed by support for AI visual inference and virtual desktop Infrastructure workloads.

It supports an open, standards-based software stack optimized for density and quality with critical server capabilities for high reliability, availability, and scalability. This helps reduce the need for data centers to use disparate solutions and manage heterogenous or proprietary environments.

The profiles specified in table 5.2.1 represent the most demanding workloads for AxxonSoft video analytics.

5.2.1 Analysis – Video Analytics Only

Test Profile		h.264	
Decode	**Inference**	**Inferences per second**	**Channels**
AI Neural tracker (1920x1080)	ResNet34 (300x300)	204	34 [1]
Smoke / Fire / Object detector (1920x1080)	EfficientNetB6 (224x224)	340	340 [2]

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6.0 Conclusion

Based on the analysis in this report, we have defined the specifications required per stream/camera to be deployed using the Dell Technologies PowerEdge R750 with dual socket Intel® Xeon® Gold 6338N CPU and the Dell Technologies PowerEdge R650 with dual socket Intel Xeon Gold 6338N and Datacenter Flex 140 GPU accelerator.

The R750 was tested using only CPU for all workloads noted in table 5.1 and the R650 was tested using the Flex 140 only for AI inferencing workloads with AxxonSoft's video analytics as specified in section 5.2.1.

Results confirm that the Flex 140 GPU level of performance is suitable for system requirements for video analytics in production environments.

To determine server hardware specifications for a given number and parameters of video streams, one can use the online AxxonSoft Hardware Calculator or this document for sizing purpose. Please consult with AxxonSoft technical sales to confirm sizing for specific requirements.

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