#### Title:

Towards a scaled system for ingest, analysis, manipulation, and deployment of multiple HEVC streams with HPC and iRODS

Abstract:

High End Video Codec (HEVC) streams, at 4K, 8K, and 16K pixels per frame (perhaps arising from autonomous mobile agents, at the 96 frames per second necessary for potential 3D Virtual viewing) provoke real concerns of scalability, both for performance and throughput, if they are to be ingested, analyzed, manipulated, and deployed at scale for multiple dozens, hundreds, or thousands of streams simultaneously. If analysis across multiple frames in a stream, across multiple streams, and/or conditioning (as in on-the-fly editing of frames in and out from multiple streams) are desirable, the existing networks, processors, memory, and data management schemes are likely to be insufficient.

From COTS High Performance Computing design techniques, software and hardware for ingest and analysis, and employing iRODS as a data system control, we propose a design scalable to the potential demands of intelligent agents which must observe and report across such a large domain of HEVC inputs.

# Predator UAV ( "Avenger" )



## HumVee



# Autonomous Vehicle





Mobile Agents to Provide Situational Awareness



Mars Rover

Satellite

# Gorgon Stare (13 HEVC / pod) \* 3 pods = 39 HEVC camera





HEVC camera





Lynx SAR





## Radar



# **HPC Cluster Analysis**













HPC Data Sharing

HPC Data Cache



# Sensor DATA to provide situational awareness = HEVC (ITU-T Rec. H.265)

### **Gorgon Stare**

In Greek mythology a look from Medusa and her sisters turned victims to stone. BAE's system of drone-mounted infrared and conventional cameras turns hidden insurgents into targets.



HEVC camera

#### The Gorgon Stare system consists of two pods: one for cameras, the other for

software stitches together into a single

scene much broader than what any single

filed screens show a composite picture to commanders. If an

attacker runs out of view on one, he'll simply pop up on the next.

Gorgon Stare (13 HEVC / pod) \* 3 pods = 39 HEVC camera

VIEW A single unmanned Reaper drone outfitted with the system can monitor anything that moves within a 4square-kilometer area.

TRACKING

operator can follow as many as 64 separate targets, compared with just one now

# **HPC Cluster Analysis**



Stationary Agents to Interpret Situational Awareness



HPC Data Sharing

HPC Data Cache

# HPC Cluster I/0



**HPC** Visualization





We are going to consider affecting analysis on 10's, 100's 1000's 10,000's streams of HEVC to	
operate on frames ( quantities configurable ) both within and BETWEEN streams.	
Analysis will entail operations on incoming, outgoing	
streams as well as cache captured and archived HEVC data sets. Lustre, Ceph, and iRODS.	
System will comprise of a ground based ANALYSIS engine and a mobile ANALYSIS engine, on differing	
hardware, but entailing the SAME SYSTEM design implementing the SAME software set	

	PURPOSE: To support situational awareness METHOD: automate analysis of (and across)								
	ALL relevant HEVC frames								
	GORGON STARE: 4K frame * 96 frames per second * 40 hour flight time * 1 stream								
	per camera * 39 camera								
	4096 pixel/frame * 96frame/sec = 393216 p/s								
	* 3600 sec/nour = 1415577600 p/n * 40 hour = 56623104000 pixel								
	<ul> <li>* 30 stream = 2208301056000 pixel/mission</li> <li>* 3 bytes/pixel ( color ) =</li> </ul>								
	6624903168000 bytes/mission 6.46 TB								
	52999225344000 b / 12mb/s * 3600 s/h = 146 hours								



Configurable sample of HEVC is folded into a Data structure (HDF5) HDF5 structs are then chained and passed through MPI-2 RDMA To computation agents for processing



Pipeline of HDF5 carry HEVC Frames through node, or across nodes to various agents for full analytical treatment









	configure	select	analysis					Meta Data	
		<b></b>						Extract to RDBS:	
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								Check Certify	
			• <u> </u>					HEVC Stream	
	configure	select	analysis					Store:	
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	configure	select	analysis <sup> </sup>						
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# ITU-T TELECOMMUNICATION STANDARDIZATION SECTOR OF ITU H.265 (12/2016) :

https://www.itu.int/rec/dologin\_pub.asp?lang=e&id=T-REC-H.265-201612-S!!PDF-E&type=items

A complete, cross-platform solution to record, convert and stream audio and video :

https://www.ffmpeg.org/



https://www.ddn.com/



https://irods.org/



http://www.iera-lj.com/

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https://www.ga-asi.com/remotely-piloted-aircraft/predator-c-avenger