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White Paper

Featuring CODIS, CMC ELECTRONICS and TREALITY Products

Display and NetViz technology inside Air Traffic Management architecture

ABSTRACT

NetViz technology offers real At-The-Glass recording capabilities, built in or retrofitted into Esterline's 2Kx2K air-traffic control (ATC) display, the Codis MDP-471/4 main radar display. Images are captured at the display, and both compressed and uncompressed data can be streamed losslessly for recording or real-time remote viewing. NetViz technology offers system integrators an easy-to-package way to reduce air-traffic management (ATM) costs and optimize ATM operations. This white paper discusses the implications of integrating NetViz technology into ATM operations, including several use cases, such as recording and playback, training, simulation, and collaboration at multiple remote positions.

INTRODUCTION

Esterline innovates and delivers more and better tools for the air traffic controller working position and beyond.

We all understand the needs for new technology and features in the domain of ATC centers and towers. In addition, we understand that legacy support remains a key requirement. Continuity, minimum impact and safety are what the business is about.

WHAT ATM REQUIREMENTS HAVE CHANGED?

The basic need for a controller remains the same. The traffic must be separated in space and time, and efficiently guided to the next waypoint or destination runway. The air traffic control officer (ATCO) has different roles, and the MDP-471/4 main radar display provides visual comfort for all of them.

An ATM system is expected to deliver more functions, with the recording aspect becoming predominant. “At The Glass” (ATG) recording is described as an aid and requirement for radar traffic. ATG recording serves the increasing needs for evidence building, investigations, and training/education sessions.

Apart from the legal requirement, system integrators and end-users are searching for the most efficient system architectures. Reliability, redundancy, expandability, and cost are key.

Esterline is introducing a unique network-streaming feature into its MDP-471/4 main radar display, and sibling components for tower and ancillary displays.

HOW DO ESTERLINE AND NETVIZ FIT INTO THE PICTURE?

NetViz technology brings capabilities. It makes it easy and safe to comply with the ATG requirement. A compliant air traffic management system consists of a multitude of technologies. A system integrator is often handling the controller working position, HMI software(s), and voice systems, among others.

Esterline respects the architectures in place, and provides a new component to the recording part of an ATM installation. We ensure NetViz is easy to integrate in new and/or existing systems. Esterline does not aim to build another recorder/playback platform. Many industry suppliers have successfully fielded solutions; we aim to be part of those.

2KX2K AIR TRAFFIC CONTROLLER DISPLAY MDP-471/4/NS

The /NS update to Esterline‘s fourth-generation 2Kx2K MDP-471/4 LCD display has been carefully planned. The upstream marketing activities Esterline conducted with its customers paved the way for a unique feature.

Prior to the product definition and specification phase of the new display, Esterline conducted several interactive customer sessions to identify requirements and features for the new product. Among others, the embedded recording feature was put forward as most valuable.

Consequently, we prepared for the future and implemented from the start the needed electronics and mechanical hooks for the so-called LVDS recording. This means Esterline can now retrofit and upgrade installed display units with the ATG recording feature.

ATG - Network visualization and Streaming

At The Glass refers to what’s seen at the LCD-glass of a display. The closest situation is grabbing the digital data that’s travelling over the LVDS cable into the LCD module inside the display.

Esterline’s engineering group developed an interface board that sits between the display electronics and the LCD module. What is shown on the screen is grabbed and made available to the connected network interface. Esterline provides multicast streams of different formats, and has developed a codec that is perfectly suited for recording and playback of ATC image content. Next to the codec stream there is also the H.264 (2Kx2K) and the uncompressed stream.

Having access to all streams simultaneously opens a wealth of opportunities.

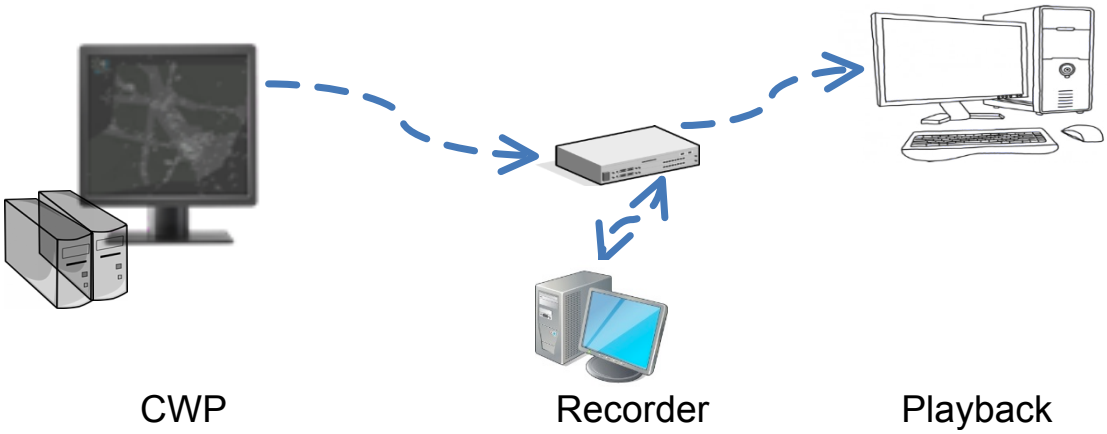
THE CODEC SPECIFICS ARE UNIQUE

- Mathematically lossless recording for ATC content
- Traffic shaping – no uncontrolled traffic peaks
- Configurable hard maximum peak bandwidth
- Start of recording without initial bandwidth peak
- Start of recording without prior information
- Recreation of a lost frame/package
- Low bandwidth IP stream
- Multicast stream for multiple simultaneous receivers

THE EMBEDDED SOLUTION – GRABBING AT THE GLASS – BRINGS:

- ALL displayed information is grabbed.
- Independent of the selected video input, all HMI systems are recorded when viewed by using the input switching capability of the display itself.
- On Screen Display (OSD) will no longer obscure information without being identified during playback.
- META data parameters are sent (CWP identification, display status, lifetime counters, color/brightness setting, etc.) and optionally re-enabled on the playback position.
- The encoding and compression are done on the display side. Low IP traffic stream between the display and receiving equipment(s).

2KX2K RECORDING AND PLAYBACK: A FIRST-USE CASE



The display image is generated by the typical HMI servers located inside the console. The display video-network connection is cabled – via a copper cable – to a network switch, where a recorder server and a 'playback system' are connected.

The display also accepts audio input. This allows for ambient sound recording on the console working-position level.

The recorder can be any system currently in use. The output network-stream of the screen is an easy to understand IP stream that can be integrated into an existing system.

Several ATM solution providers have integrated this Esterline technology into their system-architecture and/or software platform. Implementation went flawlessly.

The encoding and compressing of the image is done through the high-performing codec inside the display. This offloads the overall recording system's computing and storage needs. Even more important, it does not impose any specific requirements on the networking infrastructure.

A dynamic linkable library (Windows/Linux) is delivered to integrators and end users. This allows decoding the image inside a recording-playback environment and visualizing the content of the recorded stream – the data displayed on the 2Kx2K screen - in a software player.

Esterline demonstrates this functionality through our sample “AtcCodecPlayer” which is actually subscribing to the multicast stream of a monitor and shows the display content immediately. The AtcCodecPlayer does not archive the IP stream to disk.

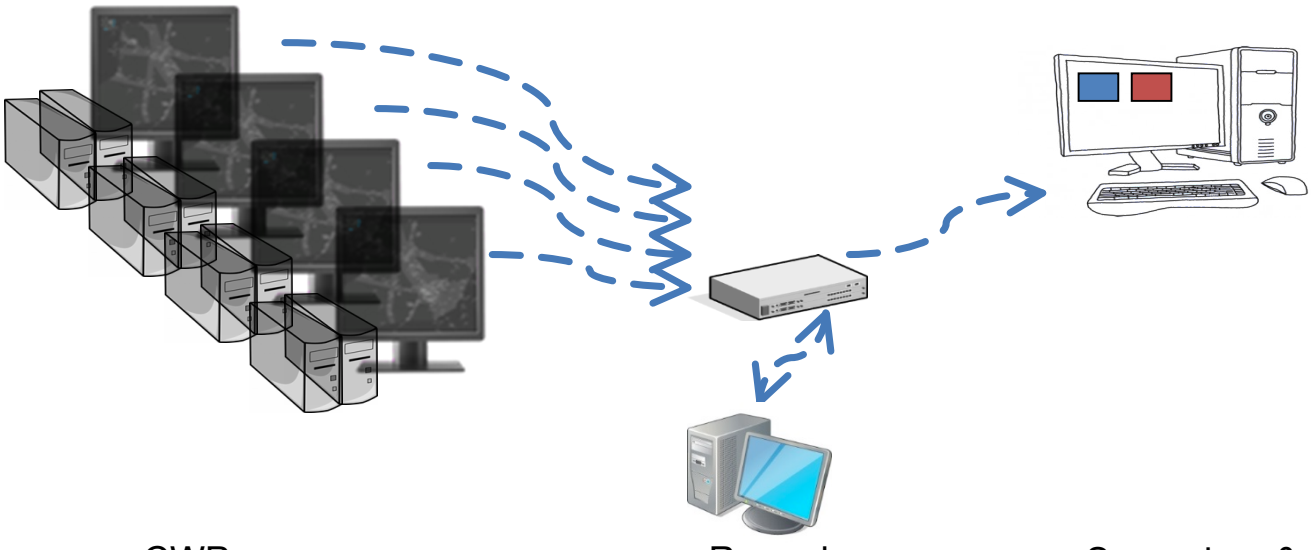
The efficiency of the Esterline codec guarantees one can dimension a network infrastructure upfront. The limited bandwidth usage of typically <1 Mb/s for one single 2Kx2K stream is easy to route. The bandwidth control feature of the codec ensures an unexpected high network peak is not shocking the network. For instance, the bandwidth usage can be limited to 15Mb/s per system – no matter what happens on the screen. This is accomplished by controlling the frame rate of the image data sent over the network, with the guarantee that all information on the receiver side is 100 percent mathematically lossless. That is the most important feature.

SUPERVISOR AND SHADOW MODE

All MDP-471/4/NS displays have a unique multicast address whereto the compressed/encoded video data is streamed. This means that multiple systems can subscribe to the same stream. This allows recording of all streams and simultaneous viewing of a set of streams through remote player software.

The function does not extra-load the recording system; the amount of information travelling to the supervisor or shadow position is only x-times the bandwidth of typically <1 Mb/s.

The supervisor position can easily change the setup of displayed data by un-subscribing or subscribing to an IP stream of choice.



PLAYBACK AT THE GLASS: TRAINING AND SIMULATION

The above diagram shows the functionality of streamed display data on an MDP-471/4/NS display position. The strength of embedding the solution onto the display can be seen.

The display can receive an IP stream and decode the information. In other words, the operator can have a playback session on the exact system that has recorded the information.

The decoding capability of the display allows setting up training and simulation sessions for immediate reviews and evaluations without the need for dedicated additional hardware.

REAL-TIME ASPECTS: REMOTE VIEWING / COLLABORATION

The Esterline NetViz technology inside the display provides multiple multicast streams, primarily with the compressed/lossless stream for recording purposes. By providing uncompressed streams of information, Esterline NetViz offers the real-time aspect of video distribution over network into air traffic management architectures.

The display content is streamed real-time multicast, using a 10Gb network interface and via an open standard protocol (RFC4175).

Not only is the video data handled, but also the USB is routed to ensure the input devices are remote as well.

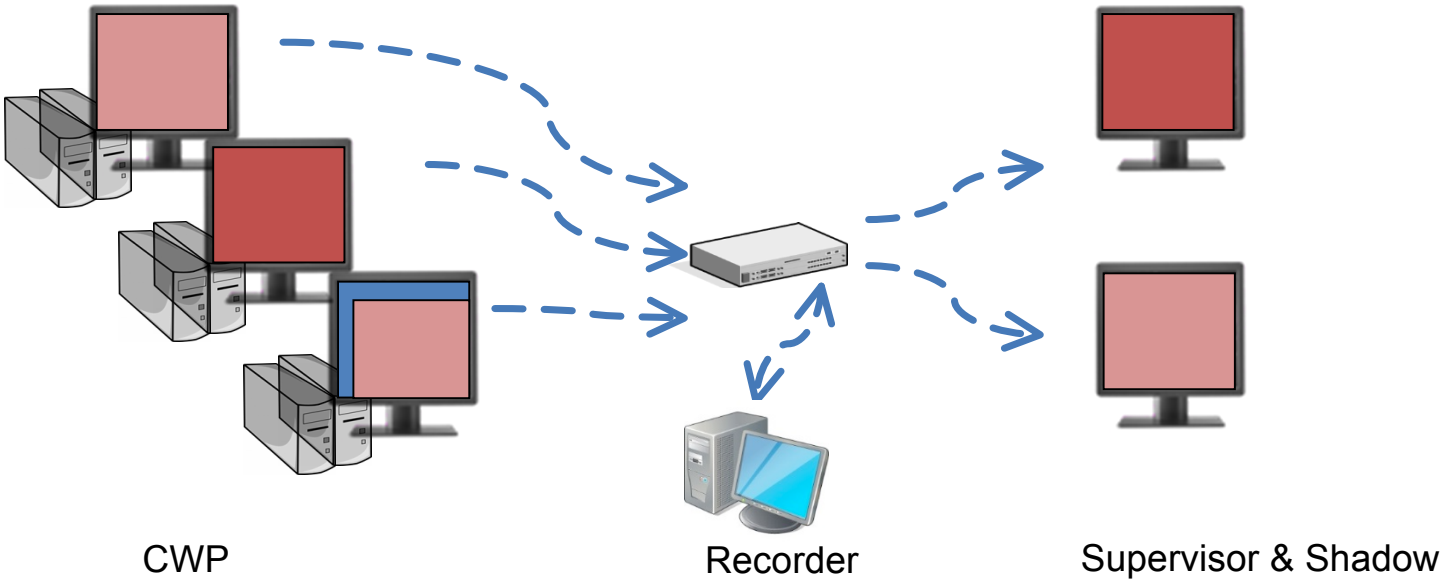
This is a reuse of Esterline’s real-time network adaptor technology. By implementing this capability inside the display, we have created a next video input, so the uncompressed network stream can be shown as a video input.

Real-time remote viewing for Supervisor and Shadow mode

The following diagram highlights how a supervisor can subscribe to any of the CWPs and receive the content in real time.

Collaboration between ATCOs

An air traffic controller can subscribe to a neighboring position and view that specific content. For example, the third position (blue) could view the content of the first position and collaborate in order to solve a situation. Once the situation is cleared out, the blue position continues to work as “normal.”



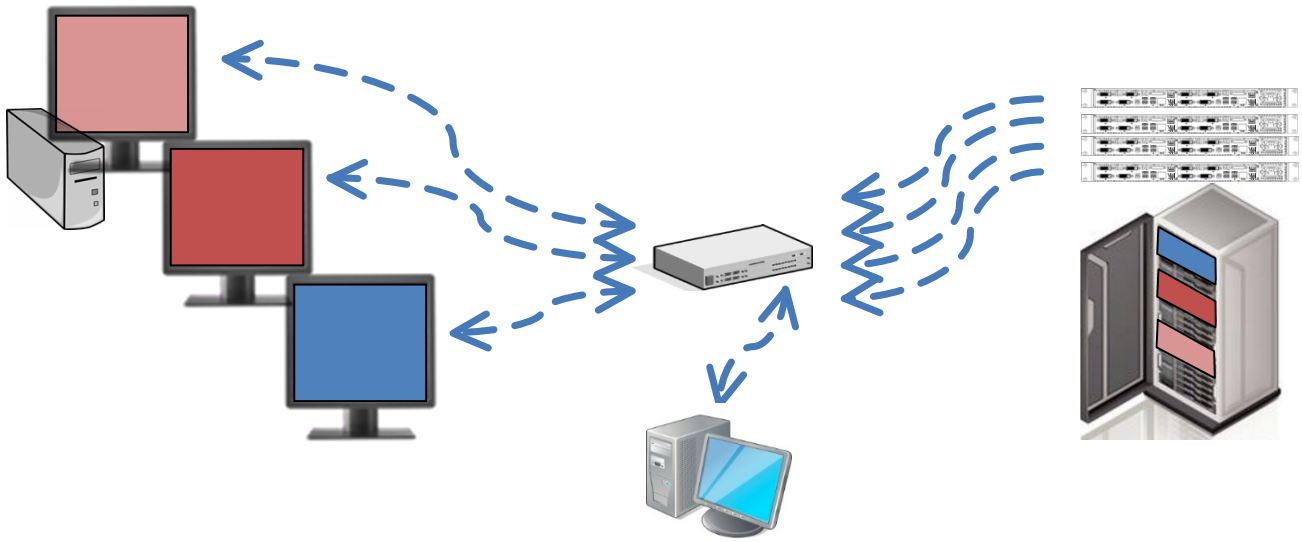
REAL-TIME ASPECTS….. REMOTE SERVER / MATRIX

The Esterline NetViz technology inside the display provides an additional video input to the MDP-471/4. This contributes to the remote server system architectures and at the same time leaves room for the ‘local’ video input if desired.

The diagram shows the rack-mounted remote HMI servers. Each of the controller working positions can subscribe to a server output. The server video outputs are put onto the network via an RNA (real-time network adapter) module. Typically, the rack-mounted RNA is used in the server rack.

The displays themselves receive their inputs directly from the network and are decoding the real-time uncompressed stream within sub-frame latency.

The local peripherals are treated through the network links as well, and are ‘logically’ connected to the corresponding server.



THE MATRIX FUNCTIONALITY

Through the use of multicast and standard networking components, we implement a high-end matrix function at the same time.

Any of the controller working positons can subscribe to any of the sources on the server rack-side. This enables quick re-sectoring, fallback solutions and collaboration possibilities, among others.

THE SUPPORT AND THE TOWER CONTROL SCREENS

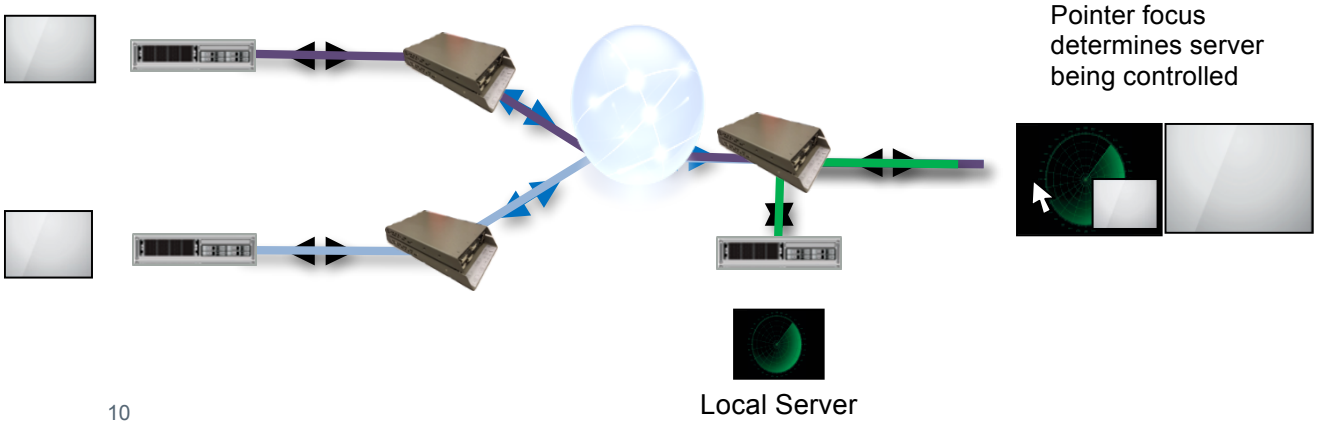
Controller working positions typically use support screens. Very often, the Esterline 24-inch screen is used in portrait mode to flank the main radar display on the left and right sides. Knowing that the support display value is somewhat lower, it might not (yet) be opportune to equip a support screen with the same networking features.

Piggybacking on the RNA experience, a more industrial variant is available.

This RNA-310 network adaptor is able to drive four WUXGA screens. Possible configurations are loop-through, encode. and decode.

Use case of controlling multiple remote desktops

This diagram shows how a remote position can be driven by multiple computers with different operating systems. The keyboard/mouse 'logical' connections to the computer follow the remote mouse pointer.



SUMMARY

- Esterline continues to invest in the field of air traffic control and sustains its technology leadership in the controller working position for the air traffic market.

- The role of system integrator, end-user implementation, or industry partner remains respected. Esterline provides an efficient building block with proven technology.

- The Esterline At The Glass recording feature for the ATC main radar display provides an important component to system compliance for legal recording requirements.

- Esterline offers simultaneous multicasting of different video IP-streams.
    - Lossless – compressed
    - H.264 commercial
    - Uncompressed

- Multicast of voice and META-data IP-streams are used.

- ATM architecture is enabled while respecting legacy installation options.

- NetViz is pre- or post-installed into the 2Kx2K MDP-471 display, leading to reduced costs and optimized operations.

For more information, please contact sales.codis@esterline.com.