



Leveraging SMPTE-2110 for Virtual Production in UE 5.5

Introduction

Virtual production has redefined filmmaking, merging real-time graphics with practical cinematography to create seamless digital environments. One of the biggest challenges in virtual production is the efficient and synchronized delivery of high-quality video data across complex workflows. Traditionally, SDI-based pipelines have dominated broadcast and film production, but the rise of SMPTE 2110—an IP-based video transmission standard—offers a superior alternative.

With Unreal Engine 5.5 officially supporting SMPTE 2110, the industry is on the brink of a major transformation. This paper explores how SMPTE 2110 optimizes virtual production pipelines, enables high-fidelity real-time rendering, and enhances asynchronous frustum rendering, improving upon traditional NVIDIA Sync Policy 2 setups.

What is SMPTE 2110?

SMPTE 2110 is a set of standards developed by the Society of Motion Picture and Television Engineers (SMPTE) to enable professional IP-based media transport. Unlike traditional SDI, which carries video, audio, and metadata over a single cable, SMPTE 2110 decomposes these elements into separate IP streams.

Key Benefits of SMPTE 2110 in Virtual Production

- **Uncompressed, Low-Latency Video** – High-bandwidth transmission ensures pristine quality without SDI compression artifacts.
- **Greater Flexibility & Scalability** – IP-based workflows allow dynamic routing and multi-destination streaming without additional hardware.
- **Synchronization Across Devices** – PTP (Precision Time Protocol) maintains



frame accuracy across all components, ensuring a frame-perfect experience.

- **Optimized Resource Allocation** – By separating video, audio, and metadata, rendering nodes can process elements more efficiently.

With Unreal Engine 5.5 incorporating SMPTE 2110 as a production-ready feature, it is now possible to seamlessly integrate high-quality video feeds into virtual production workflows without relying on SDI-based switchers.

SMPTE 2110 in Unreal Engine 5.5: A Game Changer

Epic Games has enhanced Unreal Engine 5.5 with native support for SMPTE 2110, making it a direct player in broadcast and film production pipelines. Some of the key enhancements include:

- **True IP-Based Workflows** – Eliminate SDI hardware dependencies, reducing infrastructure costs.
- **Direct Ingestion of Live Video Feeds** – Live-action plates can be streamed directly into Unreal for real-time compositing.
- **Asynchronous Processing Support** – SMPTE 2110 enables distributed rendering across multiple machines.
- **Frame-Accurate Synchronization** – Ensures that real-world camera movements align perfectly with the virtual scene.

By leveraging GPU-based rendering and IP-based delivery, SMPTE 2110 in UE 5.5 unlocks new creative possibilities for LED volumes, XR stages, and hybrid virtual productions.

Traditional NVIDIA Sync Policy 2 vs. Asynchronous Frustum Rendering

One of the primary challenges in virtual production is synchronizing multiple render nodes for a smooth, photorealistic output. NVIDIA's Sync Policy 2 has been a widely used method for synchronizing multiple GPUs across a network, but it comes with limitations.

Limitations of NVIDIA Sync Policy 2

- **Fixed Timing Requirements** – Requires all render nodes to match the same frame rate, limiting flexibility.
- **Higher Latency** – Each node must process the inner frustum individually, leading to redundant GPU load.
- **Scalability Issues** – The need for frame-locked processing reduces efficiency in large, multi-machine setups.

The Advantages of Asynchronous Frustum Rendering with SMPTE 2110

- **Decouples Frustum Processing from Rendering** – The inner frustum can be pre-rendered on a dedicated node and streamed to other machines.
- **Lower GPU Overhead** – Reduces redundant rendering operations, improving overall system efficiency.
- **Higher Frame Rates & Resolution** – Allows render engines to allocate more resources to final pixel output rather than synchronization.
- **More Responsive Camera Tracking** – Reduces motion blur and ghosting in fast-moving scenes by eliminating frame latency delays.

With SMPTE 2110, render nodes can receive pre-rendered frustums over IP without requiring all nodes to synchronize via NVIDIA Sync Policy 2, greatly improving performance and visual quality.

Implementing SMPTE 2110 in a Virtual Production Pipeline

1. Network Infrastructure Setup

To implement SMPTE 2110, a 10GbE or 25GbE network is recommended to support uncompressed video feeds. Key components include:

- **PTP Grandmaster Clock** – Ensures frame accuracy across all devices.
- **IP Video Switchers & Routers** – Dynamically routes feeds between cameras,

render nodes, and LED walls.

- **SMPTE 2110-Compatible Capture Cards** – Cards such as AJA KONA IP or NVIDIA Rivermax provide seamless video ingestion.

2. Unreal Engine 5.5 Configuration

Unreal 5.5 has a dedicated SMPTE 2110 input/output system, enabling native IP-based video streaming. Steps for setup:

1. Enable SMPTE 2110 in Project Settings
2. Set Up Virtual Cameras & LED Wall Inputs
3. Configure PTP Timing for Frame-Accurate Synchronization
4. Assign Render Nodes for Asynchronous Frustum Processing

3. Optimizing Asynchronous Frustum Performance

To fully optimize performance, studios should:

- Use GPU-based encoding to transmit inner frustum streams with minimal latency.
- Assign dedicated machines for frustum and non-frustum rendering tasks.
- Leverage SMPTE 2110 multicast streams to distribute video data efficiently.

The Future of Virtual Production with SMPTE 2110

The shift from SDI to SMPTE 2110 represents a fundamental evolution in virtual production technology. By enabling low-latency, high-quality IP video transport, SMPTE 2110 unlocks:

- More scalable, flexible workflows
- Higher-fidelity real-time rendering
- Efficient resource allocation for photorealistic cinematography

With Unreal Engine 5.5 now supporting SMPTE 2110 as a production-ready standard, studios can transition to full-IP workflows, improving efficiency, creativity, and visual fidelity like never before.



Consulting & Integration Services

Want to implement SMPTE 2110 and asynchronous frustum rendering in your LED volume or XR stage?

At **VFX Studios**, we specialize in:

- **Virtual Production Systems** – Custom Unreal Engine 5.5 & LED Volume integrations.
- **SMPTE 2110 Consulting** – Seamless transition from SDI to IP-based workflows.
- **Custom Control Systems for IBL & Virtual Lighting** – Optimize lighting & rendering for maximum realism.

✉ Contact us today at info@vfxstudios.com or visit www.vfxstudios.com to learn more!

#VirtualProduction #SMPTE2110 #UnrealEngine55 #AsynchronousFrustum #IPVideo
#LEDVolume #Filmmaking #VFXStudios