ST 2110 Software Based Solutions Making the Transition

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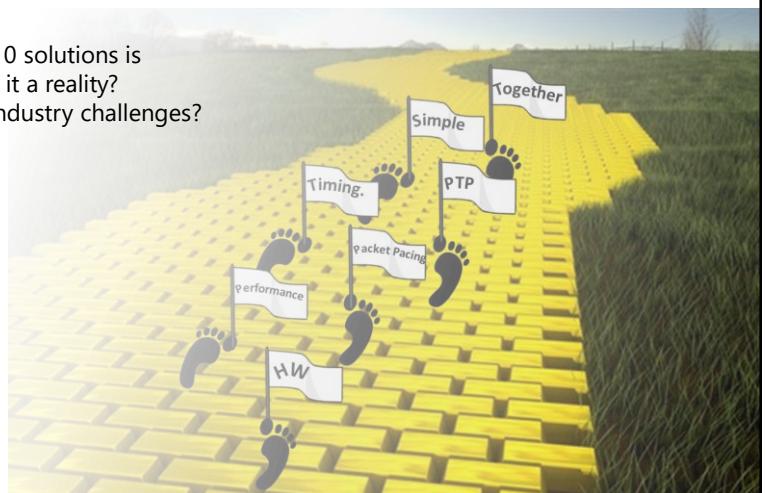
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Agenda

• Yellow Brick Road to ST2110 Software based solution

• A sneak peek to the future

The move to software-based SMPTE ST 2110 solutions is happening – but what does it take to make it a reality?
How do you bridge over the old and new industry challenges?

Let's build a check list -
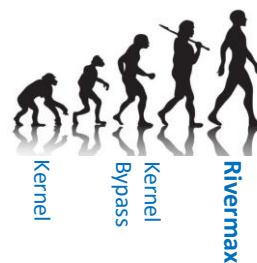
Selecting the right IP NIC

- NIC – All in the box
  - Standard: 40 years of IP networking
  - Flexibility: COTS infrastructure (NICs, Switches, Cables)
  - Scalability: Deployment in large data centers
  - Storage: Locally On Premise and Remote Cloud
  - Security: Built in HW defenses against security attacks
  - OS: Windows and Linux
  - Low Power: (<25W) and fit any PCI slot (any server ready)
  - Low Cost: reduced $CPU - $600 desktop can stream out 4K
  - **Future – Cloud ready (what is that?) , 8K (BW demands)**

Cloud Ready

Storage   Scalability   Flexibility

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Performance (The need for bits)

- **The Requirements:**
  - More bandwidth – ~1.5Gbps (HD) to 12.5Gbps (4K 60FPS) streams
  - More Streams – Transmit and Receive more uncompressed streams
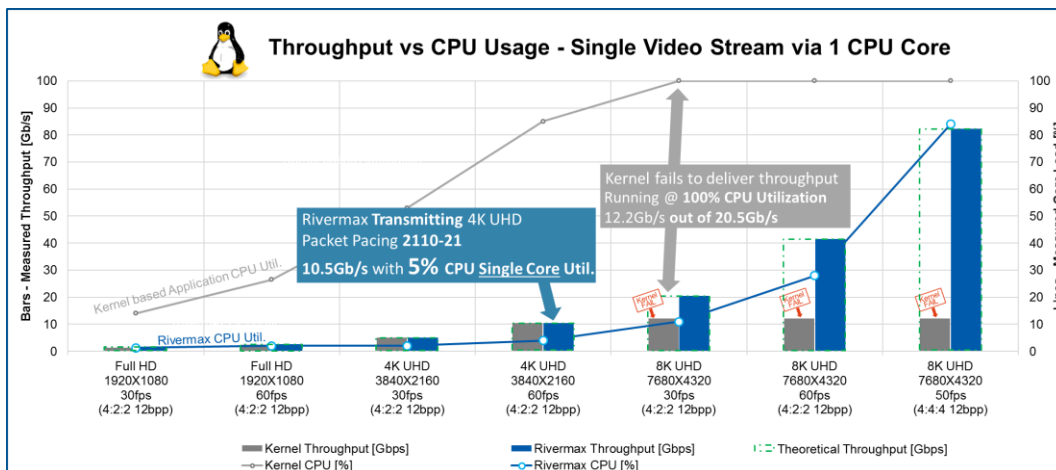 - Low cost solution – Lower CPU utilization, Less space
- **The Solution:**
  - Leave CPU for user application –10Gbps 85% of 1 Core Vs. **5% of 1 Core with Rivermax**
  - Single core can drive up to 85Gbps (Windows and Linux)
  - Utilize NIC HW accelerators to increase performance and simplify the solution – i.e. RTP header insertion/stripping
  - Packet Aggregation – Reduce CPU latency by keeping application at frame/line(s) level and allow the NIC HW to assemble the frame/lines(s) in memory

Kernel   Kernel Bypass   Rivermax

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Performance (The need for bits)

Step 2

Throughput vs CPU Usage - Single Video Stream via 1 CPU Core

Rivermax **Transmitting** 4K UHD Packet Pacing 2110-21 10.5Gb/s with **5%** CPU Single Core Util.

Kernel fails to deliver throughput Running @ 100% CPU Utilization 12.2Gb/s out of 20.5Gb/s


Step 3

SMPTE2110-21 - Packet Pacing

- **The Requirements:**
  - Compliance to SMPTE2110-21 (Video Shaping) spec
- **The Solution:**
  - Inter Packet Gap for 4K can be as low as 470nSec – Pacing must be done in HW
  - Transmit using the NIC hardware Packet Pacing with no dependency on CPU Strength, OS interrupt level or Application
  - No extra burden on the user application – clean wrapper to the HW through simple API
  - How to verify that the solution is SMPTE2110-21 compliant ?
    - We have built our own tool – **AnalyzeX** (Real time, multi streams, Linux, up to 4K)
    - Worked with EBU LIST , Nevion, Phabrix and JTNM Interop Events

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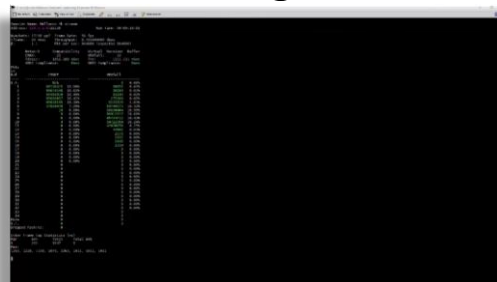
SMPTE2110-20 – Timing Model

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Step 4

- **The Requirements:**
  - SMPTE ST 2059-1:2015 Generation and Alignment of Interface Signals to the SMPTE Epoch
  - Support for 2110-20 TPNL (Narrow Linear Senders) and TPN (Narrow GAP Senders)
- **The Solution:**
  - The user application is committing a chunk of data with a time stamp indicating when it should be sent - TVD = (N * Tframe) + Troffset
  - It's enough to indicate the time of the first packet/chunk in the frame
  - Our requirement - Rivermax will free the application from real time restrictions making sure that the frame will be sent on the exact time

1000100101110101000 **IP Network**

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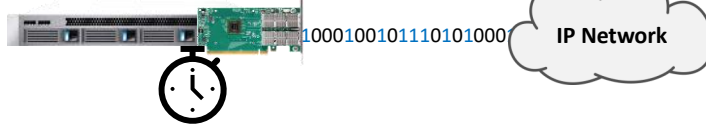
SMPTE2110-30 & SMPTE2110-40

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Step 5

2110-40 Ancillary · 2110-30 Audio · 2110-20 Video
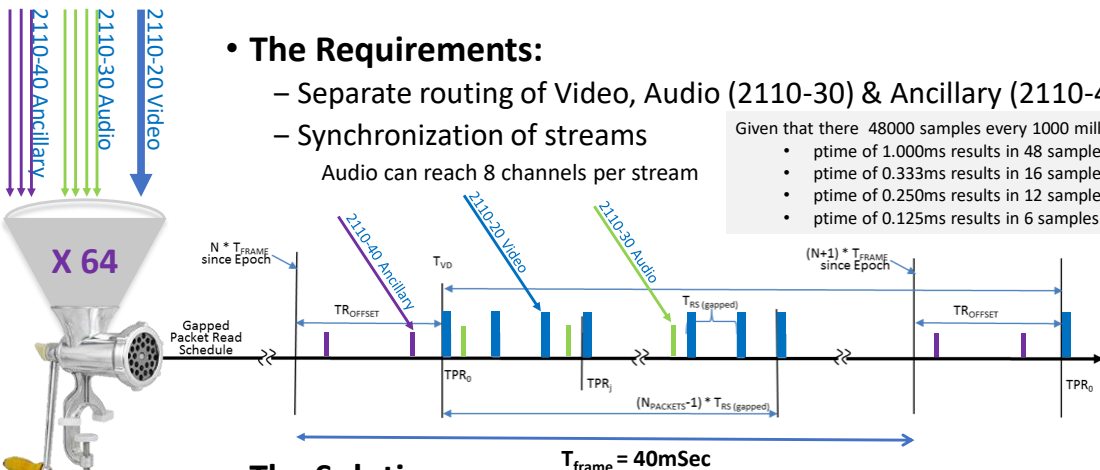
- **The Requirements:**
  - Separate routing of Video, Audio (2110-30) & Ancillary (2110-40) over IP
  - Synchronization of streams

  Audio can reach 8 channels per stream

  Given that there 48000 samples every 1000 milliseconds:
  - ptime of 1.000ms results in 48 samples per datagram
  - ptime of 0.333ms results in 16 samples per datagram
  - ptime of 0.250ms results in 12 samples per datagram
  - ptime of 0.125ms results in 6 samples per datagram

X 64

$N * T_{FRAME}$ since Epoch

2110-40 Ancillary · 2110-20 Video · 2110-30 Audio

T_{VD}

$(N+1) * T_{FRAME}$ since Epoch

TR_{OFFSET}

$T_{RS (gapped)}$

TR_{OFFSET}

Gapped Packet Read Schedule

TPR_0 · TPR_j · TPR_0

$(N_{PACKETS}-1) * T_{RS (gapped)}$

$T_{frame} = 40mSec$

- **The Solution:**
  - 2110-40 - very small BW is required – a delayed send
  - 2110-30 – very similar to Video scheduling less frequent/data

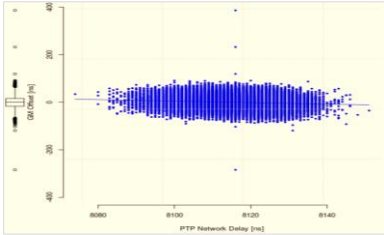**Mellanox** TECHNOLOGIES

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SMPTE ST 2110-10 2059/PTP

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Step 6

PTP Locked

- **The Requirements:**
  - PTP client is needed in order to sync the server system time
  - Off the shelf, cross platform solutions with best accuracy
  - For each stream, sampling-time is set in the packet RTP time-stamp
- **The Solution:**
  - Best accuracy - The NIC provides HW time stamping at port level
  - Linux – HW PTP - easy to integrate and allow PTP time and PHC (Sync time system clock to the PTP hardware clock on the network card)
  - Windows – SW PTP (less accurate) – working with 3rd parties to enable Mellanox PHC synchronization

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Simplify It

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Step 7

Make everything as simple as possible but not simpler

- **The Requirements:**
  - The SW should be easy to use and allow fast integration
  - The SW should works on multiple OSs (Linux & Windows) and be agnostic to HW
- **The Solution:**
  - Working closely with the leaders in the industry to define the SDK API and content
  - There is no software without hardware – leveraging the availability of our NIC on Windows and Linux and also providing a cross platform solution
  - The Rivermax SDK is providing a wrapper to the NIC HW
  - Adaptive roadmap – provide ongoing SW releases with the required features
  - Link speed agnostic – Same software for all Link speeds 10/25/40/50/100/200GbE
  - The SDK is ready for the next generation NIC **(Future compatible)**

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Collaborate

Step 8

- **The Requirements:**
  - A product that will fit the industry - connecting the Networking world to the Media and Entertainment world
- **The Solution:**
  - Our solution - work with the industry leaders:
    - Understand the industry leaders' needs and roadmap
    - Provide End 2 End solutions – NIC, Switch and cables
    - Fast response and quick solutions
    - Build joint solution and demos
    - **Be on time**

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Deliver It

Step 9

- **Deliver a package with all the goodies - that will work in hours** ☺

My Check List

- ☑ IP Network Card
- ☑ Performance
- ☑ Packet Pacing
- ☑ 2110-21 Timing
- ☑ 2110-30 2110-40
- ☑ 2059/PTP
- ☑ Simple
- ☑ Partner

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A Sneak Peek To The Future - 2019

- **More HW accelerators for the Media & Entertainment –**
  - Performance, Simplicity, Offload and Accuracy (i.e. 2022-7)
- **Virtualization**
  - Linux and Windows. Utilize Mellanox NIC's VM-support and adopt it to the M&E
- **Cloud**
  - Most deployed solution in the cloud (e.g. AZURE). Enable "bare metal" performance for a VM over SRIOV. The cloud is on the right path

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Thank You

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