Scalable Transcoder-Encoder Platform

Supreme Streaming

Elite Encoding

Dynamic Transcoding
Scalable Transcoder-Encoder Platform

Introduction

☐ Our goal is to provide cost effective and solution based products for our customers in today’s fast paced and ever changing competitive environment.

☐ We have over 60 years of history in engineering and manufacturing reliable high-quality products for cable, broadcast, and satellite operators as well as custom solutions for the hospitality, education, healthcare, government, sports and enterprise markets.

☐ We have the unique ability to help bring the broadcast video industry into video over IP distribution using a cost effective approach while maintaining low operational costs with our new software-based Scalable Transcoder Encoder Platform product line, aka STEP.
Scalable Transcoder-Encoder Platform Overview

- STEP is a software based scalable product supporting Encoding, Transcoding and Adaptive Bit-Rate Live streaming for any-screen video deployments

- The flexible software architecture allows us to tailor solutions to overcome technical challenges due to multi-vendor products, constantly changing design requirements, and the introduction of new standards

- The STEP is available in either the 1RU, 2RU, or 3RU integrated system to perform video processing in a scalable manner to satisfy your current video requirements and migrate to your next generation video network architecture
Scalable Transcoder-Encoder Platform Overview

- Each processing block can route output signals to the neighboring blocks for further processing. It is possible to loop a single media stream multiple times through the system if needed.
Scalable Transcoder-Encoder Platform Overview

The Platform is composed of 3 separate Functional components:

- **Splitter**: This block provides a mechanism to split incoming ASI or IP based MPEG2-TS streams and re-route them, or the individual programs in a MPTS. For example, a MPTS with 4 programs in it, can be split into 4 separate SPTS MPEG2-TS streams which can be processed and/or pass through the platform.

- **Media Processing Engine (MPE)**: The MPE provides the video and audio processing functions required for applications such as decoding, encoding, transcoding and format conversion. In addition, AES scrambling, logo insertion, and a plethora of other media processing functions are available in the MPE.

- **Mux**: The Mux can pass through and/or merge SPTS streams into MPTS streams. For example, 4 different SPTS MPEG2-TS streams created by the MPE can be combined into 1 MPTS MPEG2-TS stream here.
Scalable Transcoder-Encoder Platform

Product Highlights

- MPEG-2 or H.264/AVC Encoding
- Option for Low latency encoding (100ms)
- High quality 2-pass multi-core video encoding technology
- Supports multiple video quality encoding bitrates
  - Depending on CPU usage, bitrate and video quality requirements
- Video Codec Transcoding
  - SD/HD MPEG-2 to SD/HD AVC (H.264)
  - SD/HD AVC (H.264) to SD/HD MPEG-2
  - HD to SD downscaling
- Multi-channel Audio support, Audio Leveling Control or CALM Support
- Text Scrolling Support
- Apple HLS HTTP Live Streaming to iPhones, iPads, Apple TV, and Android devices
- Microsoft HTTP Smooth Streaming with H.264 PlayReady DRM
  - Xbox and windows phones
- Adobe HTTP Dynamic Streaming for desktops
Scalable Transcoder-Encoder Platform

Products

- **Elite Encoder**
  - HD/SD MPEG-2 + H.264/AVC Encoder

- **Dynamic Transcoding**
  - SD/HD MPEG-2 to SD/HD AVC (H.264)
  - HD MPEG-2 to SD MPEG-2 down-scale
  - SD/HD AVC (H.264) to SD/HD MPEG-2

- **Supreme Streaming**
  - Creating of up to 16 Adaptive bit-rate profiles

  - **HTTP Streaming Protocols**
    - HLS – Apple’s HTTP Live Streaming
    - HDS - Adobe’s HTTP Dynamic Streaming
    - IIS - Internet Information Services (Microsoft’s Smooth Streaming)
Scalable Transcoder-Encoder Platform
Chassis components

- **Node**
  - A node contains a MAC address and a assigned IP address
  - The IP address keeps track of where data is being transferred to and from a network.

- **CPU (Central Processing Unit)**
  - is the hardware within a computer that carries out the instructions of a computer program by performing the basic arithmetical, logical, and input/output operations of the system

- **PCIe (Peripheral Component Interconnect Express) slot**
  - It is a hardware bus to add functionality to your computer
  - PCIe is not tied to any particular family of microprocessors
## Scalable Transcoder-Encoder Platform - Hardware

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEP-1-D</td>
<td>1 RU&lt;br&gt;Single Power Supply&lt;br&gt;2 Full Profile PCIe slots</td>
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<tr>
<td>STEP-1-S</td>
<td>1 RU&lt;br&gt;Redundant Power Supply&lt;br&gt;2 Full Profile PCIe slots</td>
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<tr>
<td>STEP-2-S1N</td>
<td>2 RU&lt;br&gt;Single Power Supply&lt;br&gt;4 Full Profile PCIe slots &amp;&lt;br&gt;2 Low Profile PCIe slots</td>
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## Scalable Transcoder-Encoder Platform Hardware

<table>
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<th>Model Number</th>
<th>Hardware Features</th>
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<tbody>
<tr>
<td>STEP-2-D4N</td>
<td>2 RU Redundant Power Supply</td>
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<tr>
<td>STEP-3-D12</td>
<td>3 RU Redundant Power Supply</td>
</tr>
<tr>
<td>STEP-3-D24</td>
<td>3 RU Redundant Power Supply</td>
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</table>
Scalable Transcoder-Encoder Platform
Summary of Hardware Capacity

<table>
<thead>
<tr>
<th>Platform</th>
<th>Size</th>
<th>BT Stock #</th>
<th>Nodes</th>
<th>CPU</th>
<th>Full</th>
<th>Low</th>
<th>SD-to-SD</th>
<th>HD-to-SD</th>
<th>HD-to-HD</th>
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<tr>
<td>STEP-1-S</td>
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<td>6531 S</td>
<td>X</td>
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<td>2</td>
<td>X</td>
<td>16</td>
<td>10</td>
<td>4</td>
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<td>6531 D</td>
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<td>1</td>
<td>2</td>
<td>X</td>
<td>16</td>
<td>10</td>
<td>4</td>
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<tr>
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<td>6532 S1N</td>
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<td>2</td>
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<td>2</td>
<td>10</td>
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<tr>
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<td>STEP-3-D24</td>
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<td>6533 D24</td>
<td>12</td>
<td>24</td>
<td>X</td>
<td>X</td>
<td>384</td>
<td>256</td>
<td>96</td>
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</tbody>
</table>
### Scalable Transcoder-Encoder Platform

**PCIe SDI and ASI cards**

| SDI SD/HD PCI input card | SDI SD-HD input  
| PCI input card           | SMPTE 259M-C & SMPTE 292M  
| 4, 6, or 8 input ports   | Low Profile card  
|                          | DIN 1.0/2.3 connector  
|                          | Optional DIN to BNC cables |

| SDI SD/HD PCI input card | SDI SD-HD input  
| PCI input card           | SMPTE 259M-C & SMPTE 292M  
| 1 or 2 input ports       | Low Profile card  
|                          | BNC connector |

| ASI PCI input card       | ASI input  
|                          | Low Profile PCI card  
| 1, 2, 4, 6, or 8 ports   | BNC connector |
## Scalable Transcoder-Encoder Platform

**PCI HDMI, VSB/ QAM, & Composite**

<table>
<thead>
<tr>
<th align="left">HDMI (unencrypted) PCIe input card 2 input ports</th>
<th align="left">HDMI in the clear HDMI 2.0 4:2:0 formats</th>
</tr>
</thead>
<tbody>
<tr>
<td align="left">VSB/QAM 1 and 2 input ports</td>
<td align="left">Cable TV or TV antenna Low Profile card TV, broadcast “in the clear”, or Clear QAM.</td>
</tr>
<tr>
<td align="left">Composite PCI input card 3 ports</td>
<td align="left">30 frames/second NTSC 640 x 480 NTSC Low Profile PCI card</td>
</tr>
</tbody>
</table>
Scalable Transcoder-Encoder Platform

Elite Encoding
Scalable Transcoder-Encoder Platform

**Elite HD and SD Encoder**

- HD and SD MPEG-2 and MPEG-4 (H.264) Encoding
  - 1, 2, 4, 6, 8, 16 channel SD and HD MPEG-2 Encoder configurations
  - VBR and Capped VBR
  - Low latency option (<100 ms)
  - SPTS or MPTS

- Audio Processing
  - Supports AC-3, AAC-LC, AAC-HE, AAC-HEv2, and MP3
  - Audio Gain Control – allows automatic dynamic audio level adjustment for individual channels
  - Second Audio Program (SAP) and
  - CALM (Commercial Advertisement Loudness Mitigation) ACT

- Additional Video Processing
  - Cropping, Anti-Aliasing, Scaling
  - MCTF Noise Filtering to correct video quality
Scalable Transcoder-Encoder Platform

**Elite HD and SD Encoder**

- **Input**
  - Digital SD/HD SDI
  - VSB or Clear QAM
  - HDMI
  - Analog (Composite or Component)
  - EAS – composite input

- **Output**
  - IP/RTP/MPEG2-TS
  - Optional (FEC) Forward Error Correction
  - ASI
Scalable Transcoder-Encoder Platform

Elite HD and SD Encoder

- Web based GUI
  - Able to monitor individual program via thumbnail
  - Provides graphical feedback of bitrate of programs configured
    - 2 HD MPEG-2 channels
    - 1 HD + 3 MPEG-2 SD channels
  - Supports HD and SD AVC/H.264 channels in a VBR statmux
- Closed Caption
  - Via SDI input, Composite, or Component
- Text Scrolling Feature per channel
- PIP support
Scalable Transcoder-Encoder Platform

Elite HD and SD Encoder

- **Statistical Multiplexing**
  - Supports HD and SD MPEG-2 channels in a VBR statmux
    - 2 HD MPEG-2 channels
    - 1 HD + 3 MPEG-2 SD channels
  - Supports HD and SD AVC/H.264 channels in a VBR statmux

- **PSIP Interfaces**
  - Interfaces for a variety of dynamic PSIP generators
  - Dynamic PSIP supported as an integrated function within encoder
  - Static PSIP module internally available

- **Emergency Alert System (EAS) Support**
  - Support for emergency signaling using an additional analog input along with cue signal from EAS generators
  - Can automatically detect an EAS signal from an external EAS source and switch all channels to Video/Audio signal of the EAS generator
Scalable Transcoder-Encoder Platform
Elite HD and SD Encoder

**Low Latency option**

- The Elite low latency MPEG-2/H.264 encoder utilizes multi-core video encoding technology to perform real-time transmission of content at low bit rates over broadband IP networks.

*Low latency option*
*100ms input to output*
Scalable Transcoder-Encoder Platform
Elite HD and SD Encoder

Text scrolling feature

- On screen text scrolling: Advertising, company logos
  - Symbols
  - Sports or Stock tickers
Scalable Transcoder-Encoder Platform
Statistical Multiplexing

- The output mux creates a single MPTS composed of any of the encoded channels
  - IP or ASI

### Output Mux Configuration

**Input Streams**

<table>
<thead>
<tr>
<th>Channel</th>
<th>Program #</th>
<th>PMT PID</th>
<th>Video PID</th>
<th>Audio PID</th>
<th>Rate (bps)</th>
<th>Enable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel 0</td>
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<td>480</td>
<td>481</td>
<td>482</td>
<td>5000000</td>
<td>Yes</td>
</tr>
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<td>Channel 1</td>
<td>2</td>
<td>580</td>
<td>581</td>
<td>582</td>
<td>5000000</td>
<td>Yes</td>
</tr>
<tr>
<td>Channel 2</td>
<td>3</td>
<td>680</td>
<td>681</td>
<td>682</td>
<td>5000000</td>
<td>Yes</td>
</tr>
<tr>
<td>Channel 3</td>
<td>4</td>
<td>780</td>
<td>781</td>
<td>782</td>
<td>5000000</td>
<td>Yes</td>
</tr>
<tr>
<td>Channel 4</td>
<td>5</td>
<td>880</td>
<td>881</td>
<td>882</td>
<td>5000000</td>
<td>Yes</td>
</tr>
<tr>
<td>Channel 5</td>
<td>6</td>
<td>980</td>
<td>981</td>
<td>982</td>
<td>5000000</td>
<td>Yes</td>
</tr>
<tr>
<td>Channel 6</td>
<td>7</td>
<td>1080</td>
<td>1081</td>
<td>1082</td>
<td>5000000</td>
<td>Yes</td>
</tr>
<tr>
<td>Channel 7</td>
<td>8</td>
<td>1180</td>
<td>1181</td>
<td>1182</td>
<td>5000000</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Video over IP is very sensitive to packet drops

- Loss of an I-Frame, results in a loss of a reference frame from which subsequent P and B frames depend on.
- This I-Frame dependency can cause picture degradation until the arrival of the next valid I-Frame

FEC is a form of error correction that adds extra data that is sent over the network link in order to correct transmission errors at the receiving end

RTP re-orders the packets while FEC restores the lost packets
Scalable Transcoder-Encoder Platform

Dynamic Transcoding
Scalable Transcoder-Encoder Platform

Dynamic Transcoder

- Video Transcoding
  - MPEG-2 HD/SD to AVC/H.264 HD/SD
  - AVC/H.264 HD/SD and to MPEG-2 HD/SD
  - HD to SD down-conversion

- Audio Transcoding
  - AC-3, AAC-LC,
  - AAC-HE, AAC-HEv2,
  - MP3 supported

- Input/output
  - IP/RTP/MPEG2-TS
    - Optional (FEC) Forward Error Correction
  - ASI
    - Auto detect on ASI inputs, 1, 2, 4 or 8 channels available
Scalable Transcoder-Encoder Platform
HD to SD down-scale

Digital Off-Air

8VSB

AQT8-QAM
Off-Air Receiver

GigE

STEP
HD to SD down-convert

Statmux SD content

Edge QAM

GigE

QAM
Scalable Transcoder-Encoder Platform
Transcode HD MPEG-2 to HD H.264
Scalable Transcoder-Encoder Platform

Supreme Streaming
Scalable Transcoder-Encoder Platform
Multi-Screen Delivery Overview

Content
- Studio
- Sports Event
- Premium Content
- Local Content

Preparation /Staging
- Multi-bitrate Encoding
- DRM

Distribution
- Origin Server
- CDN
- Caching Servers

Consumption
- Consumption devices (e.g., tablets, smartphones, laptops)

Scalable Transcoder-Encoder Platform
Scalable Transcoder-Encoder Platform

Supreme Streaming

☐ Transcode
  ☐ Creating of ABR steams (live or file ingest)
  ☐ Transcode MPEG-2 to H.264 ABR streams
  ☐ Transport stream output

☐ Streaming format
  ☐ HLS - Apple’s HTTP Live Streaming
  ☐ HDS - Adobe’s HTTP Dynamic Streaming
  ☐ IIS – Internet Information Services (Microsoft’s Smooth Streaming)

☐ Content Protection – DRM/CA
  ☐ Nagra – world leading content protection technologies
  ☐ BuyDRM
  ☐ Verimatrix

☐ Scrambling DVB-CSA ECB1/ECB2
  ☐ Common Scrambling Algorithm or (CSA) used in Digital Video Broadcasting (DVB) digital television broadcasting
  ☐ Electronic codebook (ECB)
Scalable Transcoder-Encoder Platform

Supported HTTP Streaming Protocols

HTTP - Hypertext Transfer Protocol

HTTP traffic is capable of traversing firewall or proxy servers. It enables video streaming content to be delivered by CDNs

- HLS - Apple’s HTTP Live Streaming
  - Apple proprietary based on MPEG-2 Transport stream
  - Only way to deliver advanced streaming to iOS devices
  - Android Devices running Android 4.x and above support HLS
  - It is not part of HTML5 standard

- HDS - Adobe’s HTTP Dynamic Streaming
  - Adobe’s format to fragmented MPEG-4

- IIS Internet Information Services (Microsoft’s Smooth Streaming)
  - Microsoft’s implementation of HTTP-based adaptive streaming
  - Silverlight clients
  - Based on MPEG-4 file specification
Scalable Transcoder- Encoder Platform

Backup slides
1 RU Platform, Dual PCI Slot, Single CPU, Single Power Supply

Model Number: STEP-1-S
Stock Number: 6531-S

Dimensions (W x H x D): 483 x 43 x 220mm (19" x 1.7" x 8.7")

Weight: 3.8 kgs / 8.4 lbs
1 RU Platform, Dual PCI Slot, Single CPU, Dual Power Supply

Model Number: STEP-1-D
Stock Number: 6531-D

Dimensions (W x H x D): 483 x 44 x 386mm (19" x 1.7" x 15.2")

Weight: 7.3 kgs / 16.1 lbs
2 RU Platform, 4 Full/ 2 Low PCI Slots, 1 node, 2 CPU, Single Power Supply

Model Number: STEP-2-S1N
Stock Number: 6532 S1N

Dimensions (W x H x D): 438 x 88 x 724mm (17.25" x 3.47" x 28")
2 RU Platform, 4 PCI Slots, 2 node, 4 CPU, Dual Power Supply

Model Number: STEP-2-D2N
Stock Number: 6532 D2N

Dimensions (W x H x D): 438 x 88 x 724mm (17.25" x 3.47" x 28")
2 RU Platform, 4 Low PCI Slot, 8 CPU, Redundant Power Supply

Model Number: STEP-2-D4N
Stock Number: 6532 D4N

Power Supply: 1280 W Max

Dimensions (W x H x D): 438 x 88 x 724mm (17.25" x 3.47" x 28")
3 RU Platform, 12 Node, 12 CPU
Redundant Power Supply

Model Number: STEP-3-D12
Stock Number: 6533 D12

Dimensions (W x H X D): 444.5 x 132.5 x 746.3mm (17.5" x 5.2" x 29.5")

Weight: 43.09 kgs / 95 lbs
3 RU Platform, 12 Node, 24 CPU
Redundant Power Supply

Model Number: STEP-3-D24
Stock Number: 6533 D24

Dimensions (W x H X D): 444.5 x 132.5 x 749.3mm (17.5" x 5.2" x 29.5")

Weight: 43.09 kgs / 95 lbs

Packing: W x H x D 720 x 409 x 1076mm
Connect:

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