Scalable Transcoder-Encoder Platform

Elite Encoding

Supreme Streaming

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
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>RU</th>
<th>Power Supply</th>
<th>PCIe Slots</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEP-1-D</td>
<td>1</td>
<td>Single Power Supply</td>
<td>2 Full Profile PCIe slots</td>
</tr>
<tr>
<td>STEP-1-S</td>
<td>1</td>
<td>Redundant Power Supply</td>
<td>2 Full Profile PCIe slots</td>
</tr>
<tr>
<td>STEP-2-S1N</td>
<td>2</td>
<td>Single Power Supply</td>
<td>4 Full Profile PCIe slots &amp; 2 Low Profile PCIe slots</td>
</tr>
<tr>
<td>STEP-2-D2N</td>
<td>2</td>
<td>Redundant Power Supply</td>
<td>4 Full Profile PCIe slots</td>
</tr>
</tbody>
</table>
## Scalable Transcoder-Encoder Platform

### Hardware

<table>
<thead>
<tr>
<th>Model Number</th>
<th>2 RU Redundant Power Supply</th>
<th>4 Low Profile PCIe slots</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEP-2-D4N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STEP-3-D12</td>
<td>3 RU Redundant Power Supply</td>
<td>12 Node 12 CPU</td>
</tr>
<tr>
<td>STEP-3-D24</td>
<td>3 RU Redundant Power Supply</td>
<td>12 Node 24 CPU</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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</thead>
<tbody>
<tr>
<td>STEP-1-S</td>
<td>1 RU</td>
<td>6531 S</td>
<td>X</td>
<td>1</td>
<td>2</td>
<td>X</td>
<td>16</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>STEP-1-D</td>
<td>1 RU</td>
<td>6531 D</td>
<td>X</td>
<td>1</td>
<td>2</td>
<td>X</td>
<td>16</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>STEP-2-S1N</td>
<td>2 RU</td>
<td>6532 S1N</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>10</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>STEP-2-D2N</td>
<td>2 RU</td>
<td>6532 D2N</td>
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<td>6</td>
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<tr>
<td>STEP-2-D4N</td>
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<tr>
<td>STEP-3-D12</td>
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<td>12</td>
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<td>X</td>
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<td>128</td>
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<tr>
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<td>3 RU</td>
<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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</table>
Scalable Transcoder-Encoder Platform
PCI e SDI and ASI cards

<table>
<thead>
<tr>
<th>SDI SD/HD</th>
<th>SDI SD-HD input</th>
<th>SMPTE 259M-C &amp; SMPTE 292M</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCI input card</td>
<td>Low Profile card</td>
<td>DIN 1.0/2.3 connector</td>
</tr>
<tr>
<td>4, 6, or 8 input ports</td>
<td>Optional DIN to BNC cables</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SDI SD/HD</th>
<th>SDI SD-HD input</th>
<th>SMPTE 259M-C &amp; SMPTE 292M</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCI input card</td>
<td>Low Profile card</td>
<td>BNC connector</td>
</tr>
<tr>
<td>1 or 2 input ports</td>
<td>BNC connector</td>
<td></td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>ASI</th>
<th>ASI input</th>
<th>Low Profile PCI card</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCI input card</td>
<td></td>
<td>BNC connector</td>
</tr>
<tr>
<td>1, 2, 4, 6, or 8 ports</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Scalable Transcoder-Encoder Platform

<table>
<thead>
<tr>
<th>Platform</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td><strong>HDMI</strong></td>
<td>HDMI in the clear</td>
</tr>
<tr>
<td><strong>PCI HDMI</strong></td>
<td>HDMI 2.0 4:2:0 formats</td>
</tr>
<tr>
<td><strong>VSB/QAM</strong></td>
<td>Cable TV or TV antenna</td>
</tr>
<tr>
<td></td>
<td>Low Profile card</td>
</tr>
<tr>
<td><strong>Composite</strong></td>
<td>TV, broadcast “in the clear”, or Clear QAM</td>
</tr>
</tbody>
</table>

### HDMI (unencrypted)
- PCIe input card
- 2 input ports

### VSB/QAM
- 1 and 2 input ports

### Composite
- PCI input card
- 3 ports
- 30 frames/second NTSC
- 640 x 480 NTSC
- Low Profile PCI card
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
Scalerable 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.
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

<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>
</tr>
</thead>
<tbody>
<tr>
<td>Channel 0</td>
<td>1</td>
<td>480</td>
<td>481</td>
<td>482</td>
<td>5000000</td>
</tr>
<tr>
<td>Channel 1</td>
<td>2</td>
<td>580</td>
<td>581</td>
<td>582</td>
<td>5000000</td>
</tr>
<tr>
<td>Channel 2</td>
<td>3</td>
<td>680</td>
<td>681</td>
<td>682</td>
<td>5000000</td>
</tr>
<tr>
<td>Channel 3</td>
<td>4</td>
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<td>781</td>
<td>782</td>
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<tr>
<td>Channel 4</td>
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<td>881</td>
<td>882</td>
<td>5000000</td>
</tr>
<tr>
<td>Channel 5</td>
<td>6</td>
<td>980</td>
<td>981</td>
<td>982</td>
<td>5000000</td>
</tr>
<tr>
<td>Channel 6</td>
<td>7</td>
<td>1080</td>
<td>1081</td>
<td>1082</td>
<td>5000000</td>
</tr>
<tr>
<td>Channel 7</td>
<td>8</td>
<td>1180</td>
<td>1181</td>
<td>1182</td>
<td>5000000</td>
</tr>
</tbody>
</table>

IP or ASI
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

AQT8-QAM Off-Air Receiver

8VSB

STEP
HD to SD down-convert

Statmux SD content

Edge QAM

GigE

GigE

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

Digital Off-Air

8VSB

AQT8-QAM Off-Air Receiver

GigE

Transcode MPEG-2 HD to H.264 HD

GigE

Or

mpeg-2

H.264

Or

H.264

mpeg-2
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
  - Encapsulation
  - DRM

- Distribution:
  - Origin Server
  - CDN
  - Caching Servers

- Consumption:
  - Mobile Devices
  - 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

Dimensions (W x H x D): 438 x 88 x 724mm (17.25" x 3.47" x 28")

Power Supply: 1280 W Max
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
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