Consumers are increasingly watching video content in a time-shifted, on-demand, mobile and personalized manner on a growing variety of devices. To enable this “any video to any device” environment, service providers need a cost-effective and scalable solution — one that can mesh with their current infrastructure, seamlessly adapt to codec changes, and repurpose content from different sources and formats, all while maximizing their subscribers’ quality of experience.

Enter the best-in-class Harmonic ProStream® 1000 with ACE® real-time SD/HD processing and transcoding system. Featuring award-winning multiplexing, scrambling and transcoding capabilities, ProStream 1000 with ACE is the industry’s first truly converged solution for advanced processing and transcoding of SD and HD MPEG-2 and MPEG-4 AVC (H.264) video and audio for broadcast and over-the-top (OTT) mobile/web applications. The highly versatile and ultra-dense processing platform is ideal for functions including:

- Any-to-any and any-to-many video/audio transcoding
- Jünger Level Magic™ automatic audio level adjustment
- Statistical multiplexing
- Advanced remultiplexing
- Scrambling and descrambling
- Forward error correction

ProStream 1000 with ACE leaps over competing stream-processing platforms by enabling the cost-effective deployment of next-generation SD and HD broadcast and OTT multiscreen services from a single, highly scalable, 1-RU device. It can simultaneously transcode video content for both broadcast and OTT mobile and web applications while providing unmatched video quality. In addition, the ProStream 1000’s power-efficient design helps operators reduce OPEX — and their carbon footprint, as it draws only 10 watts per HD channel and less than 3 watts per SD channel.
**BUSINESS BENEFITS**

**Best CAPEX Investment**
ACE transcoding functionality enhances the already extensive stream processing capabilities of the ProStream 1000 platform. The industry’s first video processor with DVB-CSA and AES scrambling, remultiplexing and splicing capabilities, ProStream 1000 with ACE can be easily repurposed via firmware upgrades to support new applications driven by the ongoing evolution of video service delivery.

**Simulcast for Cable**
Operators increasingly need to re-encode the same content for multiple consumer devices across multiple distribution mechanisms, such as linear broadcast, switched digital video (SDV) or IPTV over cable. ProStream 1000 with ACE can simultaneously generate 3:1 HD statmux, SD MPEG-2 for legacy STBs, SD/HD H.264 for IPTV, and a CBR version for time-shifted TV, all from a single HD input.

**Edge Transcoding and Statmux for Hybrid Operators**
Primary and secondary distribution networks are migrating to H.264 to enable significant bandwidth savings. With the transcoding capabilities of ProStream 1000 with ACE, service providers can cost-effectively transcode at the edge of their network to any codec and format, without compromising video quality.

**Dense Transcoding for IPTV**
ProStream 1000 with ACE can transcode up to 60 SD or 20 HD MPEG-2 channels to superior-quality H.264, making it an ideal choice for IPTV operators.

**Optimized Multiscreen Workflows**
ProStream 1000 with ACE fits seamlessly into a Harmonic multiscreen workflow, providing an optimized system for preparing content for adaptive bitrate streaming to IPTV and OTT devices. This flexibility helps users maximize the value of their content by providing the ability to simultaneously generate broadcast television services and mobile/web device profiles from a single compressed SD or HD input.
TECHNICAL BENEFITS

Any-to-Any Transcoding
ProStream 1000 with ACE accommodates up to four ACE audio/video processing modules per chassis. The platform enables any-to-any transcoding of:
- 60 SD or 20 HD MPEG-2 or H.264 broadcast services per RU
- Up to 20 SD/HD inputs with 80 multiscreen output profiles per RU
- Dolby® E, Dolby Digital (AC-3), Dolby Digital Plus (E-AC-3), AAC, HE-AAC, MPEG-1 Layer II audio codecs

Multi-Function Stream Processing
In addition to unmatched transcoding performance, the ProStream 1000 advanced stream processing core provides multiplexing, scrambling, PSIP and DVB table manipulation, and digital ad insertion over IP and ASI. A complete range of IP and ASI remultiplexing functionality is supported, including PID remapping, PID prioritization and filtering, DVB-EIT and PSIP table regeneration, PCR generation, TS and mirroring.

Advanced Statistical Multiplexing
Statmux options for ProStream 1000 with ACE include the integrated DiviTrackMX™ engine, a “statmux-in-a-box” capability that enables the creation of up to 16 pools of transcoded channels for digital turnaround (DTA) services; and DiviTrackIP™, an IP-based feature for LAN or distributed WAN environments that enables statmuxing of up to 16 pools, 64 channels per pool.

Enhanced Audio Processing
Able to transcode any broadcast audio codec, ProStream 1000 with ACE addresses the most complex audio processing scenarios, such as transcoding from MPEG-1 Layer II to AC-3 or AAC+. For U.S. service providers, integrated Jünger Level Magic™ audio level adjustment enables compliance with the CALM Act by automatically eliminating audio level changes both within a channel (such as during commercial breaks) and when switching from one channel to another.

Reliable Scrambling
Fully compliant with widely implemented industry protocols, ProStream 1000 scrambling technology delivers speed and stability. The platform supports DVB SimulCrypt versions 1, 2 and 3, and allows for the simultaneous connection of up to 30 different conditional access (CA) systems from all leading vendors. It also supports AES encryption technologies for scrambling and descrambling applications.

Built-In Broadcast Down Converting
ProStream 1000 with ACE features integrated HD-to-SD down conversion, making the launch of differentiated services, such as an all-HD broadcast of the SD lineup, simple and cost effective.

Control and Management
ProStream 1000 with ACE is easily configured and operates either through a stand-alone web interface or with Harmonic’s NMX™ Digital Service Manager for mass configuring, monitoring and automated redundancy in either centralized or distributed architectures.

Broadcast and Multiscreen Workflows
Featuring ProStream 1000 with ACE
## GIGABIT ETHERNET I/O CARD

<table>
<thead>
<tr>
<th>Type</th>
<th>IEEE 802.3z</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP Ports</td>
<td>Two independent</td>
</tr>
<tr>
<td>Connectors</td>
<td>Two 1 GbE SFP (multi mode, single mode, copper)</td>
</tr>
<tr>
<td>I/O Speed</td>
<td>1,000 Mbps per port</td>
</tr>
<tr>
<td>IP Encapsulation</td>
<td>MPEG TS over UDP/IP/MAC</td>
</tr>
<tr>
<td>MPEG Format</td>
<td>188 B per TS</td>
</tr>
<tr>
<td>MPEG Transport Streams</td>
<td>MPTS and SPTS</td>
</tr>
<tr>
<td>I/O Processing</td>
<td>Up to 128 sockets</td>
</tr>
<tr>
<td>Maximum Bitrate per Input Socket</td>
<td>160 Mbps</td>
</tr>
<tr>
<td>Maximum Bitrate per Output Socket</td>
<td>80 Mbps</td>
</tr>
<tr>
<td>Addressing</td>
<td>Unicast and multicast</td>
</tr>
<tr>
<td>Management</td>
<td>IGMPv1, IGMPv2, IGMPv3, ARP, ICMP</td>
</tr>
<tr>
<td>Forward Error Correction</td>
<td>SMPTE 2021-1 and SMPTE 2021-2</td>
</tr>
</tbody>
</table>

## ASI I/O CARD

<table>
<thead>
<tr>
<th>Type</th>
<th>ASI input/output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector</td>
<td>Four BNC, 75 Ω</td>
</tr>
<tr>
<td>I/O Direction</td>
<td>Configurable, input or output, per port</td>
</tr>
<tr>
<td>MPEG Format</td>
<td>188/204 B per TS</td>
</tr>
<tr>
<td>I/O Processing</td>
<td>One MPTS/SPTS per port</td>
</tr>
<tr>
<td>Up to 180 Mbps per port</td>
<td></td>
</tr>
<tr>
<td>ASI I/O Ports</td>
<td>4-20 (each ASI card has four ports)</td>
</tr>
</tbody>
</table>

## 8VSB I/O CARD

<table>
<thead>
<tr>
<th>Type</th>
<th>8VSB input</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connectors</td>
<td>Four F, 75 Ω</td>
</tr>
<tr>
<td>MPEG Format</td>
<td>188 B per TS</td>
</tr>
<tr>
<td>Input Processing</td>
<td>One MPTS/SPTS per port</td>
</tr>
<tr>
<td>19.39 Mbps per port</td>
<td></td>
</tr>
<tr>
<td>8VSB Input Ports/ ATSC Tuners</td>
<td>4-16 (four inputs per card, up to four cards)</td>
</tr>
<tr>
<td>Tuner Channels</td>
<td>2-59</td>
</tr>
</tbody>
</table>

## MANAGEMENT INTERFACES

| Ethernet            | 100Base-TX                                      |
| Connector           | Three RJ45 (one management, one CAS, one unused) |

## REMULTIPLEXING

| Routing             | Any input to any output                        |
| Redundancy          | Device 1:1, N:M, HHP                           |
| Input service       |                                               |
| IP Port             |                                               |
| PID                 | Remapping, filtering, multicasting             |
| PID Multicasting    | Any input PID can be multicasted to multiple TS |
|         | outputs with different remapping and processing |
|         | (different CW, if scrambled)                   |
| PSI/SI, PSIP        | Extraction, injection, spooling, regenerating  |
| Output Mirroring    | Any to any (ASI/IP to ASI/IP)                  |
| Advanced Stream     | Intelligent service substitution, PID prioritization, PCR |
| Processing          | generation, PID range                          |

## SCRAMBLING

| SCS                 | Internal                                        |
| Standards           | DVB common scrambling                            |
|                     | Open CAS                                        |
|                     | DVB SimulCrypt v3                                |
|                     | AES-CBC, AES-NSA2 scrambling algorithms          |
|                     | Fix key scrambling                               |
|                     | Selective encryption for trick modes             |
|                     | BISS mode 1                                      |
|                     | AES descrambling                                 |
| CAS Connections     | Simultaneous connections to 30 different CA systems |
| Number of ECMs      | 900 ECMs per platform                           |
## Transcoding/Re-Encoding, Broadcast

<table>
<thead>
<tr>
<th>Re-Encoding/Transcoding</th>
<th>Full decoding and encoding</th>
</tr>
</thead>
</table>

### Scalability

<table>
<thead>
<tr>
<th>SD/HD Re-Encoding/Transcoding</th>
<th>Up to 60 SD services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transcoding</td>
<td>Up to 20 HD services</td>
</tr>
<tr>
<td>SD/HD Re-encoding/Transcoding with Microsoft Picture-in-Picture</td>
<td>Up to 20 HD services + 20 PIP</td>
</tr>
<tr>
<td>HD-to-SD Down Conversion</td>
<td>Up to 20 HD-to-SD services + 20 PIP</td>
</tr>
</tbody>
</table>

### AFD Handling

- Force letterbox
- Force center-cut
- Follow AFD (fallback to letterbox)
- Follow AFD (fallback to center-cut)

### Video Re-Encoding and Transcoding (CBR/VBR) 4:2:0

- MPEG-2 MP @ ML
- MPEG-2 MP @ HL
- MPEG-4 AVC MP @ L3
- MPEG-4 AVC HP @ L4

### Video Input Filtering

Motion compensated temporal filtering (MCTF)

### Aspect Ratios

4.3 and 16:9

### SD Resolutions and Frame Rates

- **625 lines (PAL), 50 Hz**
  - 720 x 576 @ 25 Hz
  - 704 x 576 @ 25 Hz
  - 544 x 576 @ 25 Hz
  - 528 x 576 @ 25 Hz
  - 480 x 576 @ 25 Hz
  - 352 x 576 @ 25 Hz
  - 720 x 480 @ 29.97 Hz
  - 704 x 480 @ 29.97 Hz
  - 544 x 480 @ 29.97 Hz
  - 528 x 480 @ 29.97 Hz
  - 480 x 480 @ 29.97 Hz
  - 352 x 480 @ 29.97 Hz

- **525 lines (NTSC), 60 Hz**
  - 720 x 576 @ 25 Hz
  - 704 x 576 @ 25 Hz
  - 544 x 576 @ 25 Hz
  - 528 x 576 @ 25 Hz
  - 480 x 576 @ 25 Hz
  - 352 x 576 @ 25 Hz
  - 720 x 480 @ 29.97 Hz
  - 704 x 480 @ 29.97 Hz
  - 544 x 480 @ 29.97 Hz
  - 528 x 480 @ 29.97 Hz
  - 480 x 480 @ 29.97 Hz
  - 352 x 480 @ 29.97 Hz

### HD Resolutions and Frame Rates

- **720p, 50 Hz**
  - 1280 x 720 @ 50 Hz
  - 960 x 720 @ 50 Hz
  - 1920 x 1080 @ 25 Hz
  - 1440 x 1080 @ 25 Hz
  - 1280 x 1080 @ 25 Hz
  - 1280 x 720 @ 59.94 Hz
  - 960 x 720 @ 59.94 Hz
  - 1920 x 1080 @ 29.97 Hz
  - 1440 x 1080 @ 29.97 Hz
  - 1280 x 1080 @ 29.97 Hz

- **1080i, 50 Hz**
  - 1920 x 1080 @ 25 Hz
  - 1440 x 1080 @ 25 Hz
  - 1280 x 1080 @ 25 Hz
  - 1280 x 1080 @ 59.94 Hz
  - 960 x 720 @ 59.94 Hz
  - 1920 x 1080 @ 29.97 Hz
  - 1440 x 1080 @ 29.97 Hz
  - 1280 x 1080 @ 29.97 Hz

### Conversions (SD/HD)

- Horizontal Resolution: Any to any
- Vertical Resolution: Follow the input Frame Rate; Follow the input Interlaced only

### Video Bitrate

- **100-550 Kbps**
- **96 x 96**
- **192 x 192**
- **128 x 96**
- **192 x 192**

### Frame Mode

- Progressive

### Audio

- Audio passthrough and synchronization with processed video streams (lip sync)
- Up to four VBI PIDs per output service

### Video Input Bitrate

- **HD MPEG-2**: 0.5-50 Mbps
- **SD MPEG-4 AVC**: 0.5-12 Mbps
- **HD MPEG-4 AVC**: 0.5-30 Mbps

### VBR Video Output Bitrate

- **DiviTrackMX**
  - SD: 0.5-8 Mbps
  - HD: 1-20 Mbps

### CBR Video Output Bitrate

- **HD MPEG-4 AVC**: 2-8 Mbps
- **HD MPEG-2**: 3-18 Mbps
- **SD MPEG-4 AVC**: 1-8 Mbps
- **HD MPEG-4 AVC**: 3-18 Mbps

### Audio Transcoding

- Output Coding Modes
  - MPEG-1 Layer II
  - AC-3 2.0 & 5.1
  - E-AC-3 2.0 & 5.1
  - AAC, HE-AAC (v1 & v2) 2.0 & 5.1
- Audio Formats
  - Stereo (2/0)
  - Joint stereo
  - Dual mono
  - Multichannel (3/2 + LFE, 3/2)
- Density
  - Up to four MPEG-1 Layer II audio streams per video service
  - Up to two AAC/HE-AAC stereo audio streams per video service
  - One AC-3 stereo audio streams per video service
  - One multichannel (5.1) stream per video service
- Sampling Frequency
  - 48 kHz

### Audio Bitrates

- MPEG-1 Layer II Stereo (2.0): 32-384 Kbps
- AAC Stereo (2.0): 32-384 Kbps
- AAC Multichannel (5.1): 224-640 Kbps
- HE-AAC v1 Stereo (2.0): 32-128 Kbps
- HE-AAC v1 Multichannel (5.1): 96-192 Kbps
- HE-AAC v2 Stereo (2.0): 32-64 Kbps
- AC-3 Stereo (2.0): 96-640 Kbps
- AC-3 Multichannel (5.1): 32-640 Kbps
- E-AC3 Stereo/Multichannel: 32-1024 Kbps

### Audio Level Control

Jünger Level Magic
## TRANSCODING/RE-ENCODING, MULTISCREEN

<table>
<thead>
<tr>
<th>Re-Encoding/Transcoding</th>
<th>Full decoding and encoding</th>
</tr>
</thead>
</table>

**Multiscreen Scalability**
- **HD and SD Inputs:** Up to 20 SD/HD services
- **Output Profiles:** Up to 80 output profiles
- **Output Profile per Input:**
  - Four SD
  - Two HD
  - One HD + three SD

**Video Transcoding Options (H.264)**
- MP @ L3
- HP @ L4
- BP @ L1.2, 1.3, 2.1, 3.0

**Bitrate Mode**
- CBR
- ABR

**SD Resolutions and Frame Rates**
- **Sub SD:** 0.3-1 Mbps
- **SD:** 1-2.5 Mbps
- **HD:** 1-5 Mbps

<table>
<thead>
<tr>
<th>Resolution</th>
<th>Frame Rate</th>
<th>Bitrate</th>
</tr>
</thead>
<tbody>
<tr>
<td>720 x 576</td>
<td>29.97 &amp; 25</td>
<td>0.3-1 Mbps</td>
</tr>
<tr>
<td>720 x 404</td>
<td>29.97 &amp; 25</td>
<td>1-2.5 Mbps</td>
</tr>
<tr>
<td>704 x 576</td>
<td>29.97 &amp; 25</td>
<td>1-5 Mbps</td>
</tr>
<tr>
<td>704 x 396</td>
<td>29.97 &amp; 25</td>
<td>1-5 Mbps</td>
</tr>
<tr>
<td>640 x 480</td>
<td>29.97 &amp; 25</td>
<td>1-5 Mbps</td>
</tr>
<tr>
<td>640 x 360</td>
<td>29.97 &amp; 25</td>
<td>1-5 Mbps</td>
</tr>
<tr>
<td>576 x 324</td>
<td>29.97 &amp; 25</td>
<td>1-5 Mbps</td>
</tr>
<tr>
<td>512 x 288</td>
<td>29.97 &amp; 25</td>
<td>1-5 Mbps</td>
</tr>
<tr>
<td>480 x 360</td>
<td>29.97 &amp; 25</td>
<td>1-5 Mbps</td>
</tr>
<tr>
<td>480 x 320</td>
<td>29.97 &amp; 25</td>
<td>1-5 Mbps</td>
</tr>
<tr>
<td>480 x 270</td>
<td>29.97 &amp; 25</td>
<td>1-5 Mbps</td>
</tr>
<tr>
<td>416 x 240</td>
<td>29.97 &amp; 25</td>
<td>1-5 Mbps</td>
</tr>
<tr>
<td>400 x 224</td>
<td>29.97 &amp; 25</td>
<td>1-5 Mbps</td>
</tr>
<tr>
<td>384 x 216</td>
<td>29.97 &amp; 25</td>
<td>1-5 Mbps</td>
</tr>
<tr>
<td>352 x 288</td>
<td>29.97 &amp; 25</td>
<td>1-5 Mbps</td>
</tr>
<tr>
<td>320 x 240</td>
<td>29.97 &amp; 25</td>
<td>1-5 Mbps</td>
</tr>
<tr>
<td>320 x 180</td>
<td>29.97 &amp; 25</td>
<td>1-5 Mbps</td>
</tr>
<tr>
<td>288 x 162</td>
<td>29.97 &amp; 25</td>
<td>1-5 Mbps</td>
</tr>
<tr>
<td>256 x 144</td>
<td>29.97 &amp; 25</td>
<td>1-5 Mbps</td>
</tr>
<tr>
<td>240 x 180</td>
<td>29.97 &amp; 25</td>
<td>1-5 Mbps</td>
</tr>
<tr>
<td>176 x 144</td>
<td>29.97 &amp; 25</td>
<td>1-5 Mbps</td>
</tr>
</tbody>
</table>

**HD Resolutions and Frame Rates**
- **Sub SD:** 0.3-1 Mbps
- **SD:** 1-2.5 Mbps
- **HD:** 1-5 Mbps

<table>
<thead>
<tr>
<th>Resolution</th>
<th>Frame Rate</th>
<th>Bitrate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1280 x 720</td>
<td>29.97 &amp; 25</td>
<td>0.3-1 Mbps</td>
</tr>
<tr>
<td>1024 x 576</td>
<td>29.97 &amp; 25</td>
<td>1-2.5 Mbps</td>
</tr>
<tr>
<td>960 x 540</td>
<td>29.97 &amp; 25</td>
<td>1-5 Mbps</td>
</tr>
<tr>
<td>852 x 480</td>
<td>29.97 &amp; 25</td>
<td>1-5 Mbps</td>
</tr>
<tr>
<td>768 x 432</td>
<td>29.97 &amp; 25</td>
<td>1-5 Mbps</td>
</tr>
</tbody>
</table>

## SYSTEM MANAGEMENT
- **NMX™ Digital Service Manager**
- **Stand-Alone Web User Interface**

## POWER
- **Input Voltage Range:** 85-264 VAC
  - 48 VDC
- **Line Frequency:** 47-63 Hz
- **Input Power:** Single source AB power switch
- **Power Consumption:** 160-380 W

## ENVIRONMENTAL
- **Cooling:**
  - Inhale: Front
  - Exhale: Right
- **Operating Temperature:**
  - 32º-122º F
  - 0º-50º C
- **Storage Temperature:**
  - -4º to +158º F
  - -20º to +80º C
- **Operating Humidity:** < 95% non-condensing

## PHYSICAL
- **Dimensions (W x H x D):**
  - 19 in x 1.75 in x 24 in (1 RU)
  - 48.26 cm x 4.45 cm x 60.69 cm
- **Weight:**
  - 32 lbs/14.5 kg

## COMPLIANCE/REGULATORY
- **Emission:**
  - EN55022/CISPR 22 Class A
  - EN61000-3-3:1995
  - FCC 47 CFR part 15 Class A
- **Immunity (Radiation):**
  - EN50082-1:1997
  - EN55024
- **UL/ES (Electrical Safety):**
  - EMC compliant to EU directive 89/336/EEC and 47 CFR part 15, subpart B
  - Safety compliant to low-voltage directive 72/23/EEC and EN 60950-1 standard
  - EN 60950 (EC)
  - UL 60950 (USA/Canada)
- **RoHS Directive:**
  - Directive 2002/95/EC