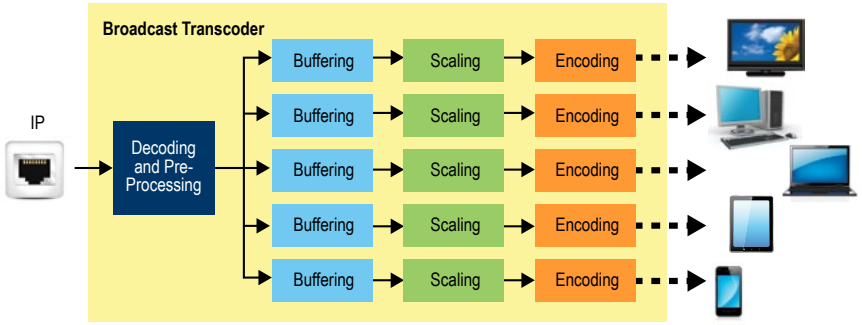
Video Scaling for Professional Multi-Resolution Applications

Multi-platform content delivery demands efficient provision of video content across a range of video formats. Fuelled by the consumer preference for "content anywhere, anytime", video-on-demand and mobile platforms continue to gain popularity.

Multi-Output Scaling Application Example: Broadcast Transcoding

The explosive growth of mobile video consumption implies a rapidly growing need to format video content for a variety of screens, such as smartphones and tablets. A common multi-platform distribution approach is to transcode finished content to the necessary formats, as illustrated below.

File-Based Transcoder System Block Diagram



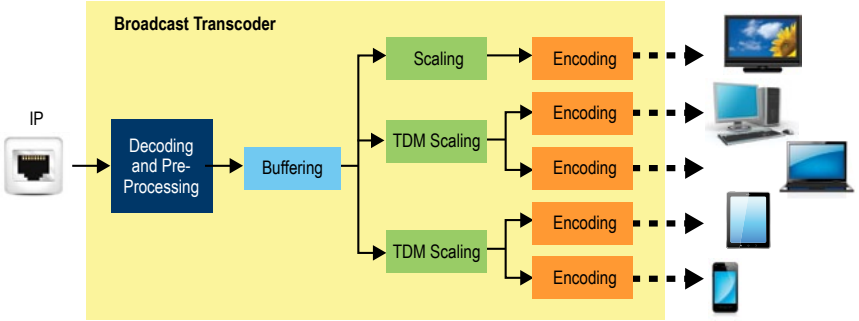
The various stages can be accomplished with many ASSPs/ASICs or integrated into fewer FPGAs with the same architecture. Either way, there are inefficiencies with this simple approach:

- For downscaling, the scaler is under-utilized and could be inactive for the majority of the time
- Each video path buffers the same video, adding unnecessary redundancy to the design

An Enhanced Architecture that Maximizes Efficiency

Instead of scaling one frame at a time, the scaling could be done on a per-line basis. In this case, the scaler generates a new, resized output video line after it receives sufficient input video lines. The smaller the output resolution, the more time the scaler waits idly. For downscale-heavy applications, this presents an opportunity to time-division-multiplex (TDM) the scaler across multiple outputs, instead of dedicating one scaler per output. Furthermore, the line buffer can be shared across multiple scalers by adding scheduling and control logic.

TDM Architecture for Transcoding Application Example



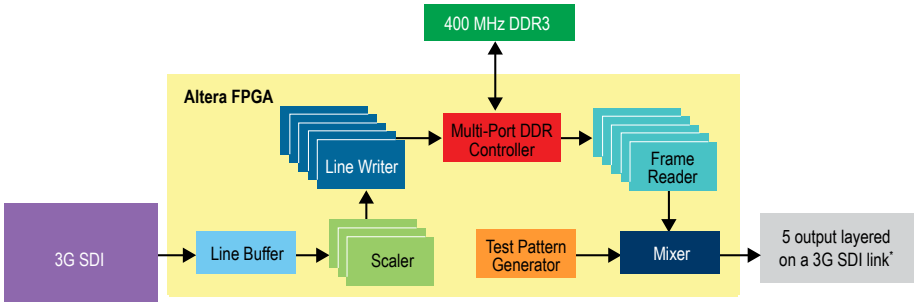
The number of outputs scaled with TDM depends on the ratio of input and output resolutions. The smaller the output resolutions, the more channels one TDM scaler can handle. If the encoder supports TDM as well, then the system can shrink further in size by removing the corresponding encoder instances.

Altera's Multi-Output Scaling Design Example

Using this efficient approach, Altera implemented a free example design for scaling a single input to multiple output resolutions. Features include:

- One 3G SDI input scaled to five different output resolutions
- Default outputs support up/down scaling and pass-through
- Flexible initialization and configuration via Nios® II embedded software
- Extensible to support more in/out channels, larger resolutions, and higher frame rates
- Targets the Stratix® IV audio/video development kit

Multi-Output Scaler Design's System Block Diagram



* Single mixed output stream for easy demonstration on the design can output each resolution independently as separate streams

Multi-Output Scaler Example Design's Resource Utilization

Usage	ALUTs	Logic Register	Memory Bits	18x18 Multipliers
On device	29,230	38,700	2,115,714	132

This example design can be applied in any application that deals with multi-resolution video scaling, such as video conferencing, multiviewers, network operation centers, educational/enterprise A/V systems, etc.

Want to dig deeper?

To learn more about Altera's video solutions, such as the Video and Image Processing IP Suite, the Avalon® Streaming video verification IP suite, and the various video reference designs, please visit www.altera.com/end-markets/broadcast/bro-index.html

Altera Corporation
101 Innovation Drive
San Jose, CA 95134
USA
www.altera.com

Altera European Headquarters
Holmers Farm Way
High Wycombe
Buckinghamshire
HP12 4XF
United Kingdom
Telephone: (44) 1494 602000

Altera Japan Ltd.
Shinjuku i-Land Tower 32F
6-5-1, Nishi-Shinjuku
Shinjuku-ku, Tokyo 163-1332
Japan
Telephone: (81) 3 3340 9480
www.altera.co.jp

Altera International Ltd.
Unit 11- 18, 9/F
Millennium City 1, Tower 1
388 Kwun Tong Road
Kwun Tong
Kowloon, Hong Kong
Telephone: (852) 2 945 7000
www.altera.com.cn