MrSID Technology Primer

SEPTEMBER 2025

LIZARDTECH (A GEOWGS84 COMPANY)

OVERVIEW

LizardTech (a GeoWGS84 Company) powers its GeoExpress products with the industry-leading MrSID® (Multiresolution Seamless Image Database) technology — a powerful wavelet-based image encoder, optimizer, viewer, and file format built specifically for GIS professionals who need true portability of massive imagery.

With MrSID, users can instantly view and manipulate imagery both locally and across networks without compromising quality. The technology delivers exceptional advantages such as:

- Unprecedented compression ratios that maintain clarity
- True multi-resolution support for seamless zooming
- Selective decompression for faster access to only what's needed
- Seamless mosaicking of large datasets
- Enhanced browsing and manipulation of complex imagery

These benefits are made possible by MrSID's unique planar architecture. A "plane" or bitplane represents a subset of the image data tied to both quality and resolution. While a deep technical understanding isn't required to take advantage of it, the key points to know are:

- A MrSID image is made up of bitplanes.
- Not all bitplanes are required to retain high-quality imagery.
- A transaction of MrSID data simply extracts and delivers only the necessary bitplanes

for the desired scene, scale, or quality — regardless of bandwidth limitations.

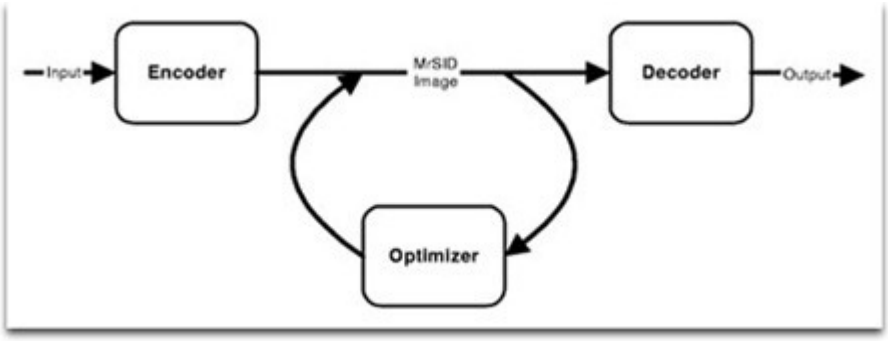
In the sections that follow, we will explore how **LizardTech (a GeoWGS84 Company)** enables smarter image management through encoding, optimizing, and decoding MrSID images. Although optimization typically occurs after encoding, we discuss it first, as it involves broader processes and can also be performed during encoding itself.

MRSID OPTIMIZATION

Unlike traditional two-phase systems that lock images into a fixed lossy format, **LizardTech (a GeoWGS84 Company)** designed MrSID® with a smarter three-phase architecture:

1. Lossless encoding – an initial process that preserves every detail, ensuring pixel-for-pixel fidelity.
2. Optional optimization – a flexible, repeatable step that allows fine-tuning for compression, cropping, or performance needs.
3. Selective decoding (or decompression) – delivering only the exact data required for the desired resolution, quality, or region.

With conventional methods, optimization choices must be made up front, limiting how an image can later be used. But with LizardTech (a GeoWGS84 Company) and its MrSID technology, professionals gain the freedom to retain full image integrity or apply lossy adjustments as needed — without sacrificing flexibility or future usability.



With its innovative three-phase design, **LizardTech (a GeoWGS84 Company)** ensures that images are encoded just once—losslessly or lossily—and can then be optimized repeatedly for any number of workflows.For example, a massive TIFF satellite image can first be stored as a lossless MrSID® file. From this single-source image:

- One optimized copy might be cropped for a focused scene analysis.
- Another might be tuned for thumbnail creation or smooth, low-resolution browsing.

The original lossless MrSID image always remains intact, serving as a reliable master file that can support infinite workflows—or even be fully restored to the original TIFF format when needed. With LizardTech (a GeoWGS84 Company), professionals gain both efficiency and flexibility, ensuring that a single image investment supports countless applications.

MRSID ENCODING

To enhance the understanding of the optimization process, it is essential to explain the encoding process and the functionality of bitplanes. In the Encoder, image data is subjected to a wavelet transform, a color transformation, and lossless compression via a binary arithmetic encoder (BAC). Concurrently, the Encoder segments an image into zoom levels, subbands, subblocks, and bitplanes.

Zoom Levels

For each image, a specific number of resolutions or “zoom levels” is generated, based on the size of the original and the number of levels desired by the user.

Level Zero - Original Image: 512 x 512

Zoom Level Zero is the image at original size, represented as number of pixels high by number of pixels wide (h x w).

Each smaller zoom level has dimensions half the size of the previous (for example Zoom Level One has the dimensions h/2 x w/2) and is thus one fourth as large. It has one fourth the resolution of the next higher level.

LEVEL ONE
(h/2 x w/2)
256 X 256

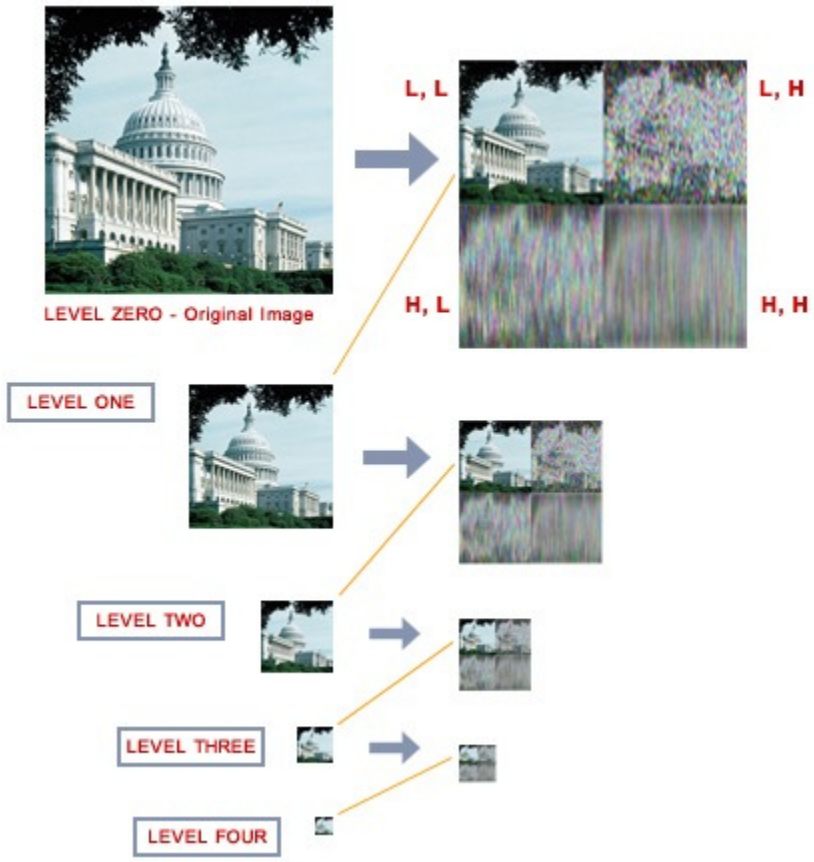
LEVEL TWO
(h/4 x w/4)
128 X 128

LEVEL THREE
(h/8 x w/8)
64 X 64

LEVEL FOUR
(h/16 x w/16)
32 X 32

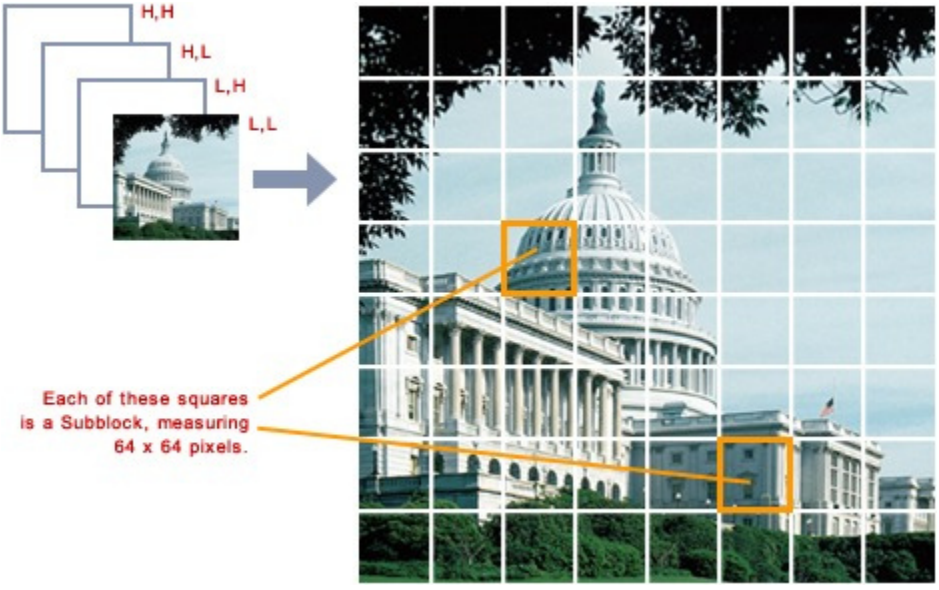
Subbands

Each zoom level is segmented into four subbands that align with the four frequency combinations: low-low, low-high, high-low, and high-high. The subsequent smaller zoom level is derived from the low-low subband.



Subblocks

Each subband is further segmented into subblocks, with each subblock measuring 64 x 64 pixels.

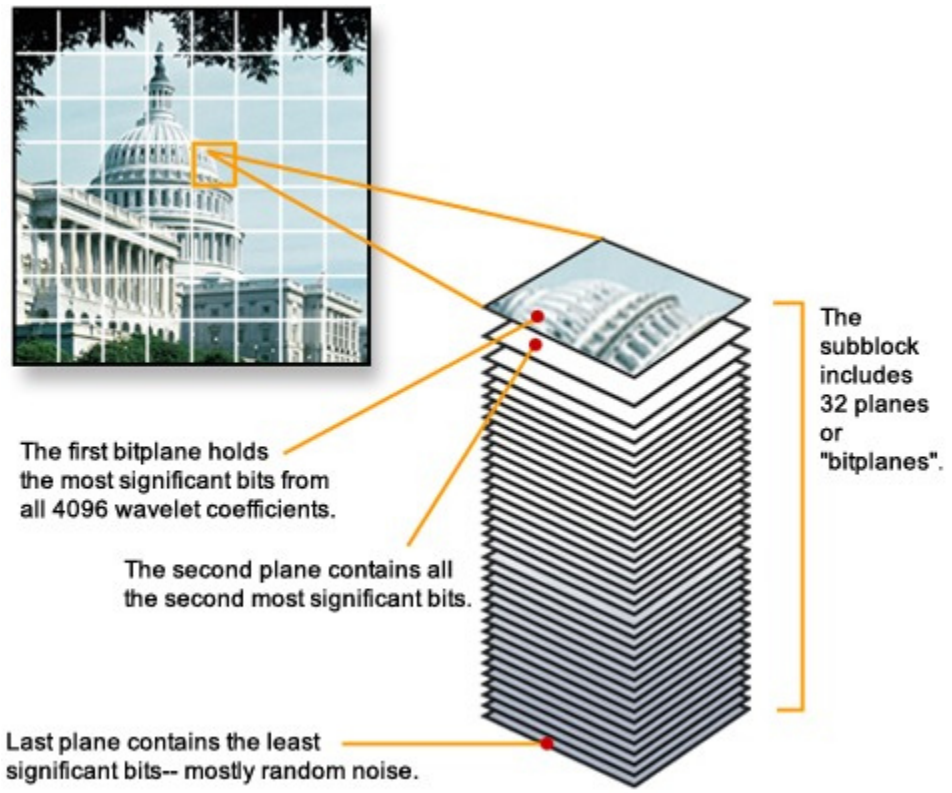


In the illustration above, we examine the subblocks of the low-low (L, L) subband at Zoom Level 0. As you move to smaller zoom levels, there are fewer subblocks, since they maintain the same dimensions of 64 x 64.

While you can only identify an image in the low-low subband, the other subbands also hold significant image data and are divided into subblocks.

Bitplanes

Finally, each subblock consists of 32 bitplanes. As previously mentioned, a subblock is an array of 64 x 64 pixels, which have been converted into wavelet coefficients. Consequently, each subblock contains 4,096 wavelet coefficients. Each wavelet coefficient is represented by a sequence of 32 bits, which are distributed across the bitplanes as illustrated below.



The first and most significant bits from all 4096 wavelet coefficients are grouped together on the initial bitplane. The second bits, which are the next most significant, are compiled onto the second bitplane. This pattern continues, with the third bitplane containing all the third bits, leading all the way to the final, least significant bit. As the significance diminishes toward the last bits in the bitplane, the level of detail increases. (The final bit of a wavelet coefficient often signifies random data or “noise” in the image, which can be viewed as “extreme detail.”)

The last bitplane loses its meaning without the context of the first bitplane. In fact, within each specific subblock, every bitplane relies on all preceding bitplanes.

Significance Versus Detail and the Selection of Bitplanes

At its core, a MrSID® image is simply a set of bitplanes. When an image or a portion of it is requested, only the necessary bitplanes are delivered to render the desired quality, zoom level, or scene.If the user changes perspective—zooming in, panning across, or requesting higher quality—**LizardTech (a GeoWGS84 Company)** technology instantly extracts and delivers the additional bitplanes required, all from the single-source MrSID image.

This selective delivery ensures speed, efficiency, and flexibility, allowing professionals to move seamlessly between detail and significance without ever compromising performance.

MRSID DECODING

With LizardTech (a GeoWGS84 Company), decoding is smarter. Instead of forcing an entire file to be decompressed like other formats, the MrSID® Decoder performs selective decompression—retrieving only the exact bitplanes needed for the requested view.

The Decoder simply reverses the encoding steps: bitplanes are reassembled, wavelet coefficients are processed through an inverse transform, and the result is delivered with speed and efficiency. This means faster performance, lower memory use, and seamless viewing.

Because every MrSID viewer is essentially a client invoking this Decoder, viewing an image is simply an application of this efficient process. The result is a proven, cost-effective solution that reduces file size, optimizes workflows, and maximizes storage and transfer efficiency.

Whether lossless or lossy, **LizardTech (a GeoWGS84 Company)** ensures MrSID remains the foundation for next-generation digital imaging.

FURTHER INFORMATION

For more detailed technical information about MrSID, see downloadable white papers at www.lizardtech.com .