

Chapter 8

Improving Performance, Proxies, and the Render Cache

DaVinci Resolve is a high-performance piece of software designed to enable real time effects on a variety of workstations.

This section describes the various ways you can monitor your performance to make sure you're maintaining real time playback, along with different methods of optimizing real time performance, including using on-the-fly proxies and the background Render Cache.

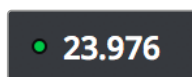
Contents

Understanding the GPU Status Display...	186	Using Optimized Media for Delivery	193
Prioritizing Audio or Video Playback in the Edit Page	187	Using the Smart or User Cache Improves Effects Performance	193
Performance Mode Improves Overall Performance	187	How Cached Media Is Organized	194
Adjusting Performance Mode	188	Choosing a Cache Format and Location	196
Timeline Proxy Mode Improves Effects Performance	188	When Caching Happens	196
Reducing Decode Quality Improves Raw Media Performance	189	The Difference Between the Smart Cache and User Cache Modes	197
Optimized Media Improves Overall Performance	189	Manually Controlling the Cache	199
Creating Optimized Media	190	Controlling Fusion Output Caching	199
Optimized Media for Raw Source Clips	191	Controlling Node Caching	199
Customizing the Type of Optimized Media You Create	191	Controlling Color Output Caching	199
Switching Between Optimized and Original Media	192	Controlling Edit Page Filter Caching	199
Sharing Optimized Media Between Projects	192	Using Cached Media When Rendering in the Deliver Page	200
Rediscovering Lost Optimized Media	193	Clearing Cached Media	200
Deleting Optimized Media	193	The Cache Manager	200
		Using Proxy Media	201
		Creating and Using Proxy Media	201
		Creating Proxy Files with the Blackmagic Proxy Generator	204

Generating Proxy Media in Other Applications.....	207	Working Remotely Using Proxy Media	210
Managing Proxy Media	207	Proxy Media vs. Other Playback Optimizations in DaVinci Resolve	211
Switching Between Proxy Media and Original Media	208	Using Optimized Media, Proxy Media, and Caching Together	211
Using Proxy Files for Delivery	209	Which Playback Optimization Method Should I Use?	212
Moving Proxies Using a DaVinci Resolve Archive (.dra).....	209	Other Project Settings That Improve Performance.....	212

Understanding the GPU Status Display

Every viewer in DaVinci Resolve exposes a GPU status indicator and a frame-per-second (FPS) meter, which appears in the Viewer's title bar, which shows you your workstation's performance whenever playback is initiated. Since DaVinci Resolve uses one or more GPUs (graphics processing units) to handle all image processing and effects, the GPU status display shows you how much processing power is being used by whichever clip is playing.



Frame rate and GPU indication,
green is good

A green status indicator shows there is plenty of GPU processing headroom available. As the GPU resources is increasingly taxed, this green graph eventually turns red to show that the available GPU power is insufficient for consistent real time playback.



Red indicates that playback is at
slower than real time

Eventually, as you add more and more effects and corrections, you'll reach the limits of available performance, forcing DaVinci Resolve to either drop frames, or play video at a slower speed in order to maintain high image quality, shown by the red FPS indicator.

When real time performance falls short, DaVinci Resolve provides a variety of controls and options that let you enhance real time playback and effects. Each is useful for different situations, and all can work together so you can choose the best trade-off between image quality and performance while you work. All of these methods can be set up to have no effect on your delivered output.

Prioritizing Audio or Video Playback in the Edit Page

When available processing power is insufficient to play the clip or clips at the position of the playhead due to the grade, transforms, or effects that are applied at that moment in the Timeline, you have the ability to choose exactly how performance in DaVinci Resolve degrades, by turning the “Show All Video Frames” on or off in the Option menu of the Edit page Viewers.

- **Show All Video Frames off:** The default setting, ideal for video editing. Prioritizes audio playback at the expense of dropping video frames when processing power is tight, resulting in a more conventional playback experience.
- **Show All Video Frames on:** An alternate setting that’s ideal when you’re doing effects work, for which you need to see every single frame play back, sequentially. Audio quality is compromised while every frame of video plays in slower-than-real-time, if necessary, to maintain playback.

Keep in mind that this setting only affects playback when GPU performance is lacking. In areas of the Timeline where performance is adequate, playback remains uncompromised.

Performance Mode Improves Overall Performance

Performance Mode, which is found in the Playback Settings of the User Preferences, analyzes your computer’s configuration, the CPU, GPU, connected video interface, and so on, and automatically tunes DaVinci Resolve’s under-the-hood image processing settings to provide the best interactivity on your machine. It’s set to Automatic by default, although you can choose to adjust its effect manually, or disable it altogether. When enabled, Performance Mode dramatically improves the experience of editing, mixing, and grading on less powerful computers.

While Performance Mode is turned on, DaVinci Resolve still outputs to video, renders in the Delivery page, and processes via the Media Management command at the highest quality. As a result, using Performance Mode makes no compromise in the quality of your output, so creative editors and audio mixers can leave this setting on always.

Finishing editors and colorists might notice subtle differences between the image on your computer monitor on less powerful computers when Performance Mode is on versus when it’s off, which is why this setting can be disabled, either entirely or in part using checkboxes in the Playback Settings panel of the User Preferences for instances where GUI interactivity is less important than your onscreen display.

Adjusting Performance Mode

A pair of radio buttons in the Playback Settings panel of the User Preferences let you choose between Automatic (default) and Manual behaviors when you turn on Performance Mode in DaVinci Resolve. Set to Automatic, Performance mode automatically optimizes a variety of operations in a bid to balance performance with the necessary level of image quality, for fast onscreen performance while always maintaining the highest level of quality for video output.

Set to Manual, there are three different settings you can choose to disable for instances where a particular performance tradeoff results in an undesirably noticeable reduction in image quality in Performance Mode:

- **Optimized Sizing:** Relates to how image resizing is handled.
- **Optimized Decode Quality:** Relates to how clip resolution vs. timeline resolution is handled.
- **Optimized Image Processing:** Relates to how image processing operations are handled.

Timeline Proxy Mode Improves Effects Performance

If you don't want to either drop frames or play at slower than real time speed whenever the GPU Status indicator is in the red, an immediate way of improving performance is to turn on the Use Timeline Proxies option in the Playback menu. Using timeline proxies reduces processing demands by taking advantage of the resolution independence of DaVinci Resolve to lower the resolution of your clips on-the-fly, thereby increasing real time playback performance without the need to spend time caching part or all of the timeline, or create optimized media (both discussed later).

To turn Use Timeline Proxies on and off:

- Choose Playback > Timeline Proxy Resolution > Half Resolution, Quarter Resolution, or None.

Turning on one of the proxy resolutions reduces the working resolution by either half or a quarter of whatever the current Timeline resolution is for your project. Working at a temporarily reduced resolution increases your workstation's real time performance, while the resolution independence of Resolve guarantees that every window you draw and sizing operation you make scales correctly to the actual resolution of your project.

Proxy Resolution	Width	Height
Full 8K UHD	7680	4320
Full UHD/Half 8K UHD	3840	2160
Full-HD/Half UHD/Quarter 8K UHD	1920	1080
Half-HD/Quarter UHD/Eighth 8K UHD	960	540
Quarter-HD/Eighth UHD/Sixteenth 8K UHD	480	270

Table of half and quarter proxy resolutions for different television frame sizes

IMPORTANT: Timeline Proxy Mode is entirely different and independent of the creation of Proxy Media as described later in this chapter. The two functions, Timeline Proxy Mode and Proxy Media, have no relation to each other.

Reducing Decode Quality Improves Raw Media Performance

The Use Proxy command will improve performance when grades and effects are responsible for your project's slower than real time playback, but Use Proxy won't help when real time performance is being used up by the need to debayer raw media. While you could improve playback performance by taking the time to either generate optimized media (see below) or render to the Fusion Output Cache by enabling the Smart Cache (see later in this chapter), the fastest solution is to open the Camera Raw panel of the Project Settings and reduce the Decode Quality of the raw media formats you're using:

- **Decode Quality:** Camera raw formats such as R3D and F65 can be debayered at different levels of quality. For higher real time performance, you can choose a lower quality setting while you work, and then switch to a higher quality when rendering the final output.

Options for reducing resolution vary by each raw format's differing capabilities, but at the very least include full, half, and quarter resolution (R3D and Sony Raw have options for full, half, quarter, eighth, and sixteenth). Exceptions include the Canon RAW, Panasonic Varicam RAW, and Phantom Cine formats, which only decode to full resolution.

If you reduce the decode quality of raw media formats in your project to improve performance, you can use the "Force debayer res to highest quality" checkbox in the Render Settings list of the Deliver page to ensure that DaVinci Resolve renders all raw formats at the highest quality available, so you don't have to worry about forgetting to change the decode quality back when it's time to render your deliverables.

Optimized Media Improves Overall Performance

If you're editing processor-intensive source formats such as camera raw, H.264, or 8K media, and your computer isn't fast enough to work with it easily in real time, you can create pre-rendered, low-overhead duplicate media to use instead, that's automatically managed alongside the original media. This is called "Optimized Media." Optimized Media lets you work more quickly by allowing you to edit with a more processor-efficient media format and resolution, while providing the ability to easily switch your project back to the original source media whenever you want. So, you can use Optimized media to edit, and switch back to the original source media when it's time to finish and output. Switching is as easy as choosing Playback > Use Optimized Media if Available to toggle Optimized media on and off.

The advantage of using optimized media to help you work faster is that it's pre-generated, meaning you can render it once and then use the files for the duration of your work in that project (unless you change the debayering settings of the raw media). Also, optimized media improves the playback performance of clips throughout DaVinci Resolve, including in the Media page and in the Media Pool and Source Viewer of the Edit page, whereas the similar but different Fusion Output Cache component of the Smart Cache only improves the performance of clips that are already in the Timeline by caching them at the Timeline resolution. This makes optimized media ideal for editing workflows of all kinds.

Choosing the Appropriate Optimized Media Format for Your Project

You have the option of choosing the Format of the optimized media you create, using controls in the Master Settings panel of the Project Settings. Be aware that the format you choose via the "Optimized Media Format" menu will determine whether out-of-bounds image data (also known as "overshoots") and Alpha Channels are preserved when the clip is cached.

- **Preventing Clipping:** You should use 16-bit float, ProRes 4444, ProRes 4444 XQ, or DNxHR 444 if you plan on grading using optimized media. This is particularly true for HDR grading.
- **Preserving Alpha Channels:** Also be aware that the format you choose will determine whether Alpha Channels will be preserved if they're present in the clips being optimized. Currently, the Uncompressed 10-bit, Uncompressed 16-bit Float, ProRes 4444, ProRes 4444 XQ, and DNxHR 444 formats preserve alpha channels.

Creating Optimized Media

Creating optimized media to work with is easy. Resolve automatically manages the relationship between source clips and the optimized media you create, so all you need to do is choose which clips to make optimized media for. You can manually choose which clips to optimize, or you can use a Smart Bin to collect all of the media corresponding to one or more formats you need to optimize to gather it procedurally. In either case, this gives you the option of only optimizing clips in formats that require optimization, saving you time.

For example, if you're editing a project that consists half of camera raw media, and half of DNxHD media, you probably only need to optimize the camera raw media, so you can create a Smart Bin that gathers all of it, based on Resolution, Codec, File Name, or whatever other metadata is appropriate. Once gathered, it's an easy thing to select all of these clips in preparation for the next step.

To create optimized media for one or more selected clips:

- Right-click one of the selected clips, and choose Generate Optimized Media from the contextual menu.

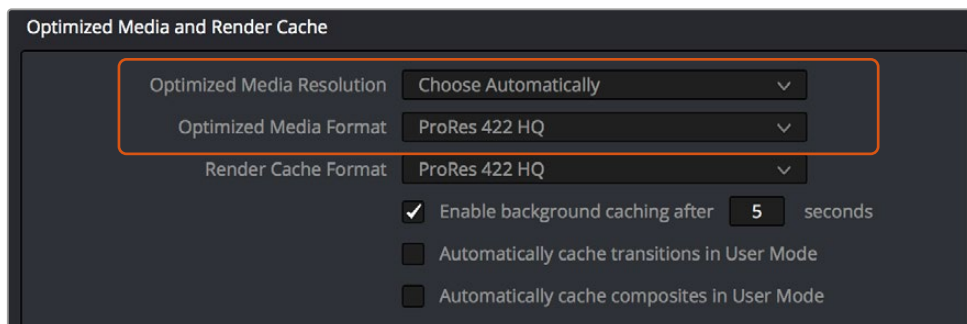
All optimized media is written to the same directory as the Cache files are written, which defaults to the first scratch disk listed in the Preference dialog's Media Storage panel. The location of Cache and Optimized files is also selectable via the "Cache files location" setting in the Master Settings panel of the Project Settings.

Optimized Media for Raw Source Clips

In general, once you create optimized media, DaVinci Resolve keeps track of it and continues using it regardless of whatever changes you make to your project, including changing the Timeline resolution. However, any change to the camera raw settings of optimized clips will automatically discard the optimized media, requiring you to re-generate optimized media for them.

Customizing the Type of Optimized Media You Create

The Master Settings panel of the Project Settings has a set of controls that govern what kind of media files are created when you create optimized media.



Options available for creating optimized media in the Master Settings panel of the Project Settings

There are two settings affecting Optimized Media in the Optimized Media and Render Cache section:

- **Resolution:** Lets you choose whether to create optimized media at the same size as your original media files (by choosing Original), or to reduce the bandwidth of your optimized media further by reducing its resolution by a Half, Quarter, Eighth, or Sixteenth. The “Choose automatically” option tries to balance visual quality with efficiency by only reducing the resolution of media files that are larger than the currently selected Timeline resolution, using whatever reduction ratio best matches the Timeline resolution.
- **Optimized Media Format:** Lets you choose the format and codec with which to generate optimized media. Options include Uncompressed 10-bit, and Uncompressed 16-bit float for maximum quality. Other options include ProRes Proxy through 4444 XQ, and DNxHR LB through 444. All options will store image data in the optimized and proprietary .dvcc image format. While smaller formats take less room on your scratch disk, there are two good reasons to use higher-quality formats for creating Optimized Media.

Preventing Clipping: Be aware that the format you choose will determine whether out-of-bounds image data is preserved when the signal is optimized. If you find that image data (typically super-white levels) are clipped after optimization, you should switch to 16-bit float, ProRes 4444, or ProRes 4444 XQ; in particular, any of these three codecs are appropriate optimized formats for HDR grading.

Preserving Alpha Channels: Also be aware that the format you choose will determine whether Alpha Channels will be preserved, if they're present in the clips being Optimized. Currently, the Uncompressed 10-bit, Uncompressed 16-bit Float, ProRes 4444, ProRes 4444 XQ, and DNxHR 444 formats preserve alpha channels.

Choosing Resolution Automatically

The “Choose automatically” option of the Resolution setting bears a bit more explanation. When selected, only source media with a higher resolution than the selected Timeline resolution will generate downsized optimized media. How much each clip will be downsized depends on how much larger each clip is than the Timeline resolution. For example, if you’re working within a 1080 resolution project, then 8K clips will generate quarter-resolution optimized media, and 4K clips will generate half-resolution optimized media, such that all optimized media is somewhere around 1080 resolution. All clips that are 1080 and smaller generate optimized media at the same resolution as the source clips.

In the example of a 4K project, 8K clips will generate half-resolution optimized media, and all other clips that are 4K and smaller will generate optimized media at the same resolution as the source clips.

Proxy Resolution	Width	Height
Full 8K UHD	7680	4320
Full UHD/Half 8K UHD	3840	2160
Full-HD/Half UHD/Quarter 8K UHD	1920	1080
Half-HD/Quarter UHD/Eighth 8K UHD	960	540
Quarter-HD/Eighth UHD/Sixteenth 8K UHD	480	270
Eighth-HD/Sixteenth UHD	240	135

Table of optimized resolutions for different television frame sizes

Switching Between Optimized and Original Media

Choosing whether or not you’re using optimized media is easy. Simply choose Playback > Use Optimized Media if Available to switch your entire project between using optimized media (if it’s been generated), or the original media. Furthermore, a checkbox in the Render Settings of the Deliver page lets you choose whether you want to use optimized media to speed up rendering, or render using the original media only.

NOTE: Optimized media is not included in Media Management operations, nor is it included as part of Archive operations in the Project Manager.

Sharing Optimized Media Between Projects

Optimized Media is shared across projects in the same project library (previously optimized media was confined to a single project). This means that if you create optimized media for a clip in one project, that same optimized media will be used for that clip in any other project that’s in the same project library. This happens automatically and requires no user input. This will dramatically cut down the space requirements for working with the same media across different projects.

Rediscovering Lost Optimized Media

It's difficult, but it is possible to lose track of optimized media you've generated in certain rare circumstances. For example, if you generate optimized media on another workstation, but failed to save the project, DaVinci Resolve may lose the relationship between the clips in the Media Pool and the optimized media files you created. In these cases, it's possible to rediscover the optimized media so you don't have to regenerate it.

To rediscover lost optimized media:

Select the clips in the Media Pool for which you know you have optimized media, then right-click one of the selected clips and choose Rediscover Optimized Media from the contextual menu.

Deleting Optimized Media

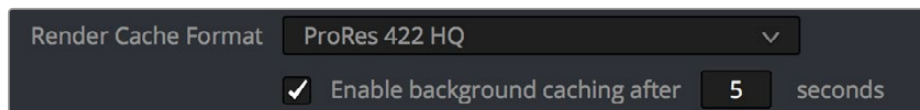
The optimized media you generate within a project is persistent; it's saved for future use even when the project is closed and later reopened. If you need to delete optimized media to free up space on your scratch volume (or wherever you've decided to locate your project's cache files), you must delete the optimized media manually in your OS. By default, the Optimized Media is stored in the first volume in the Media Storage tab of the System Preferences.

Using Optimized Media for Delivery

An option in the More options section of the Render Settings in the Deliver page, "Use Optimized Media," lets you output using Optimized Media, rather than the original media, in order to save rendering time. If you're planning on using this option, it's advisable to set the Optimized media format to a suitably high-quality HDR-capable format to guarantee the best results.

Using the Smart or User Cache Improves Effects Performance

Another option for achieving real time performance when the GPU Status indicator is in the red due either to Timeline effects, Color page grading, or processor-intensive media in the Timeline, is to use the Smart Cache or User Cache modes of the Render Cache. What DaVinci Resolve calls "caching" is sometimes referred to by other applications as "rendering." Both terms refer to the behind-the-scenes creation of new media, with all effects "baked in," which DaVinci Resolve plays back in real time in place of the original source media containing processor-intensive effects at the same time. This results in smooth playback without the risk of dropped frames.



The settings governing caching in the Master Settings panel of the Project Settings

The DaVinci Resolve Smart Cache and User Cache automatically render and cache clips, including simple video clips, compound clips, Fusion clips, and nested timelines that have processor-intensive grades and effects applied to them, or that you manually flag for caching by right-clicking any clip in

the Color page or Edit page timeline and enabling the Render Cache Clip Output option. When the Smart or User Caches are enabled, frames of each automatically or manually flagged clip are cached either during playback in the Timeline, or automatically whenever you pause work, to the “Cache files location” specified in the Master Settings panel of the Project Settings.

Once you’ve cached clips in the Timeline, they play back in real time until they’re modified, which automatically flushes the now out-of-date cache files for those modified clips and triggers the need to re-cache.

To use clip caching on any page, do one of the following:

- Choose Playback > Render Cache > Smart to set DaVinci Resolve to automatically cache computationally intensive effects and timeline clips in formats judged too processor-intensive to play in real time.
- Choose Playback > Render Cache > User to set DaVinci Resolve to cache clips and effects that you manually choose to cache, as well as automatically caching processor-intensive effects (transitions, composites, and Fusion Effects) you specify in the Master Settings of the Project Settings.
- Choose Playback > Render Cache > Off to disable all render caching.
- In the Color and Edit pages, press Option-R to cycle among Off, Smart, and User.

Choosing the Appropriate Cache Media Format for Your Project

You have the option of choosing the Format of the cached media you create, using controls in the Master Settings panel of the Project Settings. Be aware that the format you choose via the “Render Cache Format” menu will determine whether out-of-bounds image data (also known as “overshoots”) and Alpha Channels are preserved when the clip is cached.

- **Preventing Clipping:** You should use 16-bit float, ProRes 4444, ProRes 4444 XQ, or DNxHR 444 if you plan on grading using cached media. This is particularly true for HDR grading.
- **Preserving Alpha Channels:** Also be aware that the format you choose will determine whether Alpha Channels will be preserved, if they’re present in the clips being cached. Currently, the Uncompressed 10-bit, Uncompressed 16-bit Float, ProRes 4444, ProRes 4444 XQ, and DNxHR 444 formats preserve alpha channels.

How Cached Media Is Organized

The cache mechanism in DaVinci Resolve actually comprises three independently managed media caches that interact with one another. This is done to keep you working quickly by ensuring that changes you make to your timeline don’t require a grade to be re-cached, and that changes you make to a grade don’t require the timeline to be re-cached. The three levels of caching are:

First, Fusion Output Caching

Formerly called the “Source Cache” in previous versions of DaVinci Resolve. When enabled by turning on the Smart Cache, by individually turning on Render Cache Fusion Output for a particular clip, or by enabling the automatic caching of clips with Fusion Effects applied in the Project Settings, this caches the portion of each source media file that appears in the Timeline in its pre-graded state for clips that have the following characteristics:

- Clips in media formats DaVinci Resolve considers to be processor-intensive to decode, such as H.264, HEVC, and various raw camera formats
- Clips with Fusion Effects that have been added in the Fusion page

Effectively, this is a “pre-Color page” cache. By caching all processor-intensive clips in the Timeline, you’ll experience vastly improved trimming and grading performance. However, you also have the option to turn the Fusion Output Cache on or off for individual clips, or for multiple selected clips all at once. This lets you switch between using the native source of each clip with live effects, or the cached clip in the cache format you’ve chosen.

The advantage of the Fusion Output Cache over Optimized Media is that you only cache clips that are used in a timeline, which is ideal for finishing workflows. However, the Smart and User caches aren’t useful for speeding up work done with source media in the Media Pool and Source Viewer when you’re at the very beginning of an edit; that’s what Optimized Media is for (as described in the previous section).

If Optimized media exists for a given clip, and “Use Optimized Media if available” is turned on, then Optimized media will be used instead of the Fusion Output Cache if there are no Speed effects or Fusion Effects applied to a particular clip.

Second, Node Caching

The Node Cache, which is a separate level of caching from the Fusion Output Cache, can be triggered in several different ways, corresponding to the three different purposes it serves.

- When enabled by turning on the Smart Cache, nodes with processor-intensive operations (along with all nodes appearing upstream in that grade’s node tree) are automatically cached, meaning that, for example, if Nodes 1 and 2 are cached, you can continue adjusting Nodes 3, 4, and 5 to your heart’s content without needing to re-render your grade to the cache. Operations that trigger caching include Noise Reduction, Motion Blur, and any Resolve FX or OFX plugin that’s added to a node. If you’ve added a Resolve FX to a node that’s capable of playing in real time but that node is being flagged for caching anyway, you can force caching off for that node by right-clicking it and choosing Node Cache > Off from the contextual menu.
- You can manually force any node to cache if it and its upstream nodes are compromising performance but somehow not being automatically flagged, by right-clicking a node and choosing Node Cache > On from the contextual menu.
- You can also turn on the “Render Cache Color Output” option for a clip in the Timeline of either the Edit or Color pages. This forces that clip’s entire grade to be cached via the Node Cache, all the way through the Node tree’s output. This can result in higher real time performance in the Edit page, at the expense of needing to completely re-cache that clip whenever you adjust any part of its grade.
- If you apply Resolve FX or OFX filters to clips in the Edit page, these will also be cached via the Node Cache. You can choose which OFX to cache via the Render Cache OFX Filter submenu in the contextual menu for clips in the Timeline. This is useful when you have a combination of realtime and non-realtime filters applied to a clip; caching the non-realtime filters only enables you to continue adjusting realtime filters without the need to re-cache. However, be aware that making changes to a filter being cached in the Edit page timeline will force that clip’s grade to be re-cached in the Color page, and vice versa.

If multiple nodes are flagged for caching in a particular node tree, then each node will be individually cached. That way, you can turn a cached node off and on to get a before-and-after look without needing to re-cache the entire node tree. If a clip is part of a group in the Color page, you can enable a Group Cache in the Group Pre-Clip and Group Post-Clip Node Editor modes, which cache these parts of a group grade as part of the Node Cache.

Third, the Sequence Cache

The Sequence Cache is a separate cache for effects that are specifically applied within the Timeline in the Edit page. These include transitions, opacity adjustments, adjustment layers and composite mode superimpositions, as well as clips with Speed or Retime effects. Sequence Cache effects can be auto-cached in both the Smart and User caches.

Choosing a Cache Format and Location

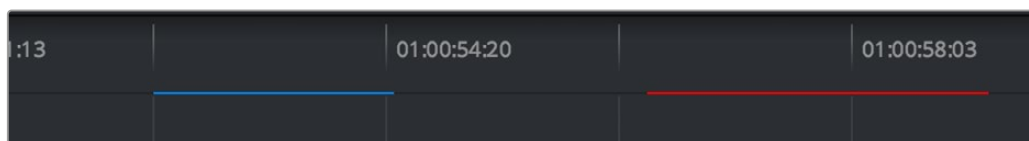
The cache format is user selectable by opening the Master Settings panel of the Project Settings, and using the “Render Cache Format” drop-down menu to choose one of the ProRes, DNxHR, or uncompressed 10- or 16-bit float uncompressed .dvcc formats. Selecting a higher quality cache format guarantees high quality image playback, but makes more demands on the throughput and size of your available disk storage. On the other hand, choosing a more highly compressed cache format makes real time playback possible on less capable computers with slower and smaller storage, at the expense of slightly compromised image quality. Ideally, you should choose the highest quality cache format that your workstation’s storage can accommodate.

The format you choose via the “Render Cache Format” menu will determine whether out-of-bounds image data (including “super white” or HDR strength highlights) is preserved when the signal is cached. Formats in this menu that end in “- HDR” preserve out-of-bounds image data, while formats that don’t, won’t. If you find that image data (typically bright highlights) is clipped after caching or optimizing, you should switch to 16-bit float, ProRes 4444, ProRes 4444 XQ, or DNxHR 444; in particular, any of these codecs are appropriate for HDR grading.

The Cache files location defaults to the first volume you add to the Scratch Disks list of the Media Storage panel of the System Preferences. If no scratch disk is specified, your System disk will be used, which may pose problems with capacity and/or performance depending on the size and type of System disk you’re using, and on the media format you choose to cache to. For this reason, it’s nearly always advisable to set your first scratch disk to the largest, fastest storage volume available to your workstation.

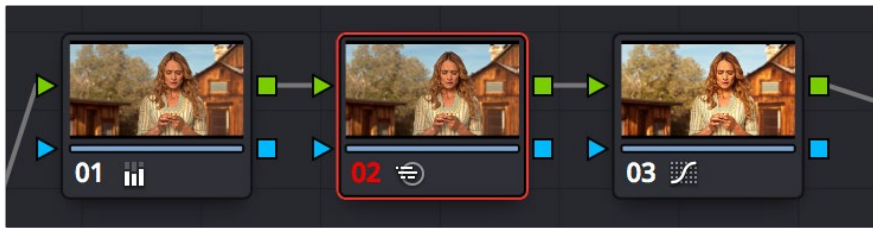
When Caching Happens

When caching is enabled, cache indicators along the bottom of the Timeline Ruler of the Edit page timeline shows the status of the cache. Red means “to be cached,” while blue means “has been cached.”



Source, Clip, and Sequence Cache bars seen in the Timeline of the Edit page; red bars show areas of the Timeline that need caching, blue shows areas that have been cached

In the Color page, cache indicators are node specific, showing the node in your grading node tree (including all upstream nodes) at which caching will take place.



Node Cache indicator seen as a red colored node number on node two of the Node Editor of the Color page

Caching happens in two ways. First, when either Smart or User caching is enabled, caching always happens whenever you play clips with red caching indicators.

Second, if background caching is enabled in the Project settings (it's turned on by default), and you don't make any changes to your project for a user-definable number of seconds (this is adjustable in the Master Settings panel of the Project Settings), caching will automatically begin during periods of user inactivity. So feel free to use this as an excuse to take those coffee, mate, or tea breaks; DaVinci Resolve will keep on working for you.

The Difference Between the Smart Cache and User Cache Modes

The Smart Cache option of the Render Cache submenu provides the easiest user experience when you want to “set it and forget it.” Choosing Smart triggers a variety of automatic caching behaviors designed to optimize playback in DaVinci Resolve by rendering clip formats, grading operations, and timeline effects that are known to be performance-intensive, while also letting you manually flag clips that you'd like to cache that the Smart Cache hasn't.

The User Cache, on the other hand, does not automatically cache clips in processor-intensive formats, so this is a good option to choose when your workstation is capable of playing all media formats you're using in real time. Ordinarily, the User cache relies on you to control what is cached and what is not by manually flagging specific clips and effects. However, the Master Settings panel of the Project Settings has three options you can enable for automatically caching transitions, composites, and Fusion Effects while in User Cache mode (these options are found in the Optimized Media and Render Cache group). Of these settings, only “Automatically cache Fusion Effects in User Mode” is turned on by default.

Here are the differences between the Smart and User cache modes for each type of caching DaVinci Resolve does.

Fusion Output Caching

- **In Smart mode:** For all clips with “Render Cache Fusion Output” set to either Auto (by default) or On, three types of effects are rendered. First, H.264, H.265, DCP, JPEG2K, or camera raw clips that have been edited into a timeline are cached. Camera Raw clips are cached using the currently selected project or clip debayer settings. Second, Speed effects are cached at the source level, which makes it possible to move cached speed effects clips on the Timeline without needing to re-cache them. Finally, Fusion Clips or clips with Fusion Effects applied to them are also cached, and manually flagged clips are also cached in Smart mode.

- **In User mode:** Clips with Render Cache Fusion Output set to On are cached, while clips set to Auto are ignored, except for clips with Fusion Effects, which are automatically cached in Auto mode when the “Automatically cache Fusion Effects in User Mode” Project Setting is on.

Caching Specific Nodes in the Color Page

- **In Smart mode:** DaVinci Resolve automatically caches all nodes that use Motion Blur, Noise Reduction, or Resolve FX and OFX plugins. Manually flagged nodes are also cached in Smart mode.
- **In User mode:** DaVinci Resolve only caches nodes that have been manually flagged by right-clicking them and choosing Node Cache > On to force that node to cache in User mode, along with all upstream nodes to the left of them.

Cache Color Output Is Actually Node Caching for the Whole Grade

- **In Smart mode:** Manually flagged clips with Render Cache Color Output turned on cache the entire output of the Color page node graph, effectively caching that clip’s entire grade. This is most useful when you want to improve trimming and playback performance in the Edit page. Flagging a clip for caching also causes EVERY SINGLE VERSION associated with that clip to be cached as well.
- **In User mode:** Manually flagged clips with Render Cache Color Output turned on also cache the entire output of the Color page node graph.

Caching of Resolve FX and OFX in the Edit Page Is Also Node Caching

Caching of Resolve FX and OFX filters applied to clips in the Edit page can only be set manually, whether you’re in Smart or User mode. Only filters that you have flagged to cache by right-clicking the clip they’re applied to and choosing them in the Render Cache OFX Filter submenu are cached.

Sequence Caching

- **In Smart mode:** DaVinci Resolve automatically caches all superimposed clips that use composite modes other than “Normal,” any clips with opacity or speed effects, and any transitions. Clips cannot be manually flagged for Sequence caching.
- **In User mode:** If you’ve enabled User mode and you find that your workstation does not have adequate performance to play composite and opacity effects in the Edit page, you can force these categories of effects to be automatically cached in User mode via a set checkboxes in the Optimized Media and Render Cache section of the Master Settings of the Project Settings. When these options are enabled, you also gain the ability to exclude specific tracks from being cached, by right-clicking the track header of any video track you want to exclude from caching, and choosing Exclude track from caching. Excluding an entire track from caching is a convenient way of keeping a track full of effects that are capable of playing in real time on your workstation, such as a track of titles, from wasting time and storage by being cached when it’s not necessary.

Manually Controlling the Cache

This section describes how to manually control each type of caching that is manually controllable in DaVinci Resolve.

Controlling Fusion Output Caching

You can manually control which clips in the Timeline are cached, and which are not. You can select one or more clips in the Timeline of the Edit page, or in the Thumbnail Timeline of the Color page, right-click one of the selected clips or thumbnails, and choose an option from the Render Cache Fusion Output submenu. There are three options:

- **Auto:** The clip will only be cached in Smart mode if it's a format designated for caching or if there's a speed effect applied. The clip will only be cached in User Mode if "Automatically cache transitions in User Mode" is enabled.
- **On:** The clip will be cached in either Smart or User mode, no matter what format or effects are applied.
- **Off:** The clip will not be cached at all, in either Smart or User modes.

Controlling Node Caching

You can manually control which nodes in a grade are cached, and which are not. Right-click any node in a node tree, and choose an option from the Node Cache submenu. There are three options:

- **Auto:** The flagged node and all upstream nodes will only be cached in Smart mode if it contains an operation that's designated for caching.
- **On:** The node will always be cached in either Smart or User mode, no matter what operations it performs.
- **Off:** The node will not be cached, in either Smart or User modes. This lets you exclude nodes from caching in Smart mode if they're capable of real time operation on your system.

Controlling Color Output Caching

Each clip in the Timeline (including Adjustment clips) has a Color Output setting that you can turn on or off by right-clicking that clip in the Timeline of the Edit page, and choosing Render Cache Color Output from the contextual menu. A check mark indicates when this setting is turned on.

Controlling Edit Page Filter Caching

You can choose which of the Resolve FX or OFX filters applied to a particular clip should be cached by right-clicking that clip in the Timeline of the Edit page, and choosing which of the filters in the Render Cache OFX Filter submenu you want to cache.

Each filter applied to that clip appears in this submenu in the order in which it's applied to the clip, and you can turn the caching of specific filters on and off (selected filters appear with a check mark to the left of their menu item).

Using Cached Media When Rendering in the Deliver Page

The “Use Render Cached Images” option in the “More options” section of the Video panel of the Render Settings in the Deliver page lets you write media directly from the cache, rather than re-rendering the effects from scratch, in order to save rendering time when you output your project. If you’re planning on using this option, it’s advisable to set the cache format to a suitably high-quality format to guarantee the best results.

Clearing Cached Media

Each project’s cache is persistent; the cache is saved for future use even when the project is closed and later reopened. If you need to delete a project’s cache to free up space on a storage volume, there are three options in the Delete Render Cache submenu:

- **All:** You can delete all media in the cache to reset every single cached clip.
- **Unused:** You can choose to delete only Unused cache clips that no longer correspond to clips or effects in the Timeline.
- **Selected clips:** You can make a manual selection of clips in the Timeline, and delete the cache corresponding to just those clips.

To clear a project’s cache:

Open the project, and choose Playback > Delete Render Cache > All, Unused, or Selected Clips.

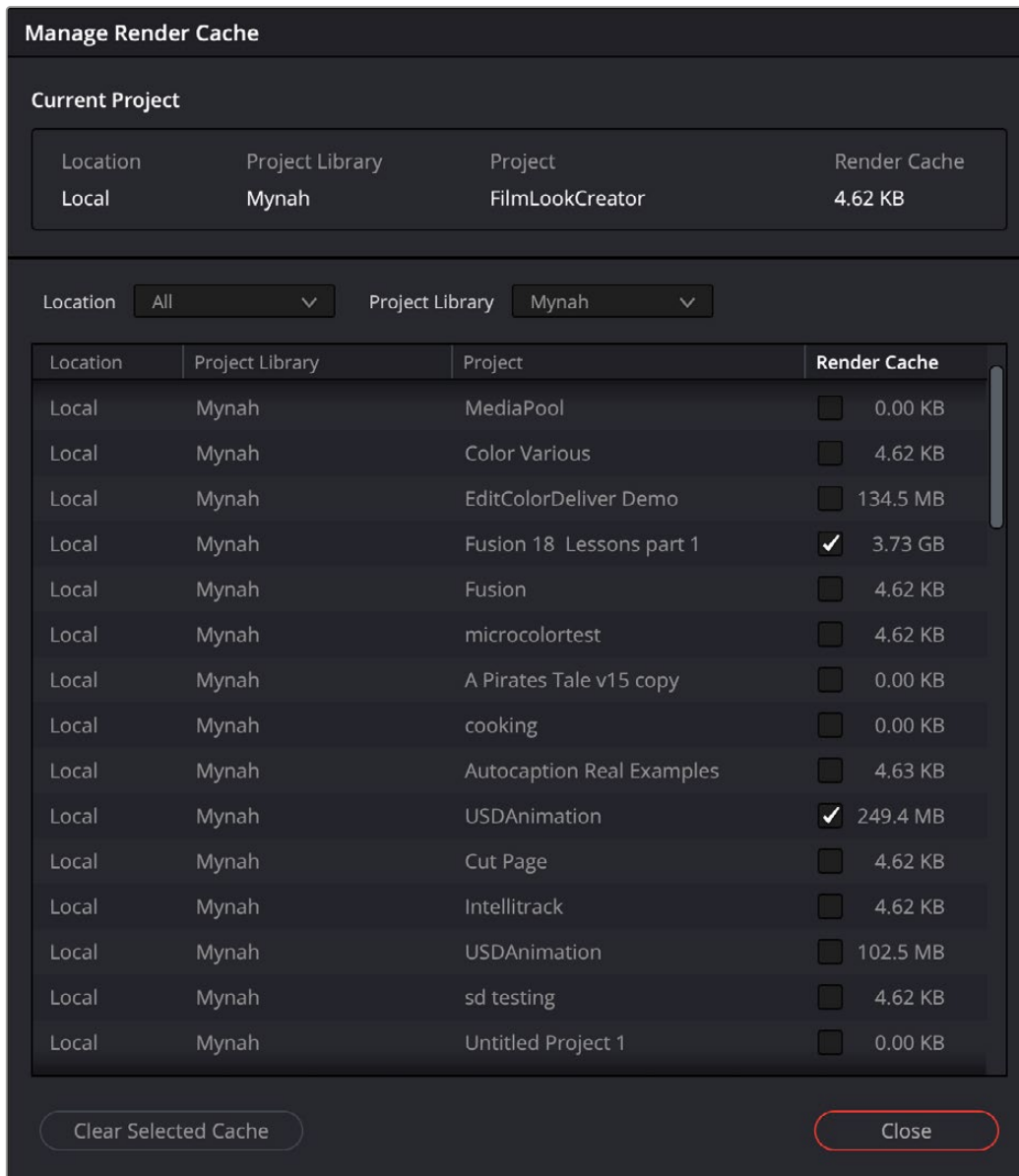
The Cache Manager

There is an advanced render cache management window to help you easily see the size and manage your cache data for various projects across all your project libraries. This cache manager can be accessed from Playback > Manage Render Cache.

The Cache Manager window ties in with the Project Manager, letting you select cached media from any library accessible from your system, not just the current project library.

The functions of the Cache Manager are:

- **Location:** This drop-down menu lets you choose the type of project library to connect to. Options are: Local, Network, Cloud, and All.
- **Project Library:** This drop-down menus lets you choose the project library whose projects you want to manage. This lists all the project libraries in the selected Location, and you can select one for management. You can also select All to reveal all project libraries in that location.
- **Project:** The main window shows all the projects in the Project Libraries selected above. It is categorized into sortable columns by Location, Project Library, Project Name, and Render Cache. Check the box in the Render Cache column to select any projects you want to delete the cache of.
- **Clear Selected Cache:** Click this button to delete the Cache for all the selected projects. As of this writing there is no warning dialog or undo for this function, so double check that you’ve selected the correct caches for deletion.
- **Close:** Closes the Cache Manager.



The Cache Manager

Using Proxy Media

DaVinci Resolve includes a Proxy Media workflow to provide a playback optimization option that makes it easier to exchange projects online, work on projects remotely, and work with external media asset management systems. It creates a simple and flexible system for editing collaboration that can be custom configured to your specific requirements.

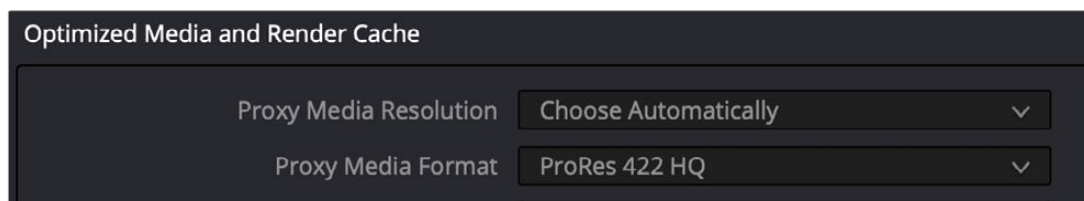
Creating and Using Proxy Media

Proxy Media is essentially more highly compressed (and potentially lower resolution) versions of your source media that are linked to your source media in DaVinci Resolve via metadata. This is done in such a way as to make it easy to switch back and forth between the original and proxy media as your needs require.

Typically, this lets you use lower bandwidth proxy media for increased real-time effects performance and full speed playback while editing, while easily reverting back to more bandwidth and processor-intensive source media for color correction, finishing, and final output. In addition to enabling better performance, these proxy files are fully portable, which lets you move your whole project easily from workstation to workstation, and even across the internet, accompanied by much more compact proxy media.

You set the resolution and format of your proxies in the Optimized Media and Render Cache section of the Master Settings panel in the Project Settings. There are two settings that control the actual media files created by the Generate Proxy Media command.

- **Proxy Media Resolution:** Choose “Original” to keep proxies the same resolution as the source media. If you prefer, reduce the resolution of the proxy media files by choosing Half, Quarter, Eighth, or Sixteenth to save bandwidth. The “Choose Automatically” option balances visual quality with efficiency by only reducing the resolution of media files that are larger than the currently selected Timeline resolution, using whatever reduction ratio best matches the Timeline resolution.
- **Proxy Media Format:** Lets you choose the specific QuickTime format and codec that the proxy files will be created with. There are several ProRes and DNxHR varieties to choose from, as well as H.264 and H.265 options. Which format you choose will be determined by the bandwidth and quality tradeoffs that you need for a particular project. For example, if you simply want better playback speed from RAW media while preserving image quality, you may want to pick a high-quality codec like ProRes 422 HQ, or DNxHR HQX. If your goal is to send your media across the internet to another editor, you may want to choose a more compressed format, such as ProRes Proxy, or even H.264 or H.265, to keep file sizes small.



The Proxy Media Resolution and Format settings

To generate proxy media in DaVinci Resolve:

- 1 Select all of the clips you wish to generate proxies for in the Media Pool.
- 2 Right-Click any selected clip and choose “Generate Proxy Media” from the contextual menu.

DaVinci Resolve will display a progress bar and give you a time estimate for completion as it renders out your selected clips to the format and codec determined by the Proxy Media Resolution and Format settings.

NOTE: If your source clip has a separate audio file synced to it in the Media Pool, any proxies generated from that clip will include the synced audio, but that audio will be embedded in the video clip instead of being created as a separate file.

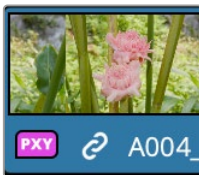
Where is Proxy Media Saved?

Proxy media is created in the “Proxy generation location” destination, found in the Working Folders section of the Master Settings of the Project Settings. The proxies are further organized into subfolders by original source clip location. It is important to have enough free space on this drive to contain the proxies. Once created, these proxy files can then be moved to any other drive location on the system, if you wish, and then re-linked to their source files.

This location can be overridden by adjusting the Proxy Generation Location options in the Media Storage settings in the DaVinci Resolve Preferences.

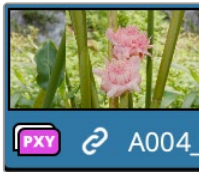
Proxy Handling Display

In both the Media Pool and on the Timeline in the lower left corner of a clip, there can be found a proxy status icon. This icon changes to let you know exactly which type of media DaVinci Resolve is currently using.



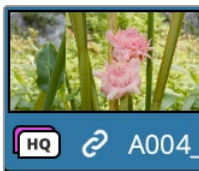
The Proxy Only icon

Purple PXY Only: This icon indicates that only proxy media is available; the camera original media is missing.



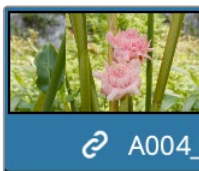
The Proxy Preferred icon

Purple PXY over a White Background: This icon indicates that both camera originals and proxy media for this clip exist, and that proxy media is being used.



The Camera Original Preferred icon

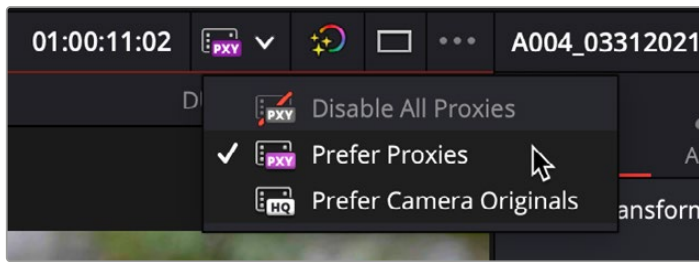
White HQ over a Purple Background: This icon indicates that both camera originals and proxy media for this clip exist, and that original media is being used.



The Camera Original Preferred icon

No Icon: No icon means that proxy workflow has been disabled, and all media is Camera Original.

You can select which media you prefer to use in the Proxy Handling selector in the top right of the Viewer. This is a global setting that changes proxy handling for all the viewers across DaVinci Resolve.



The Proxy Handling Selector in the Viewer lets you choose which type of media to use.

Creating Proxy Files with the Blackmagic Proxy Generator

The Blackmagic Proxy Generator is a separate program that can automatically generate proxy media from master video files placed in a watch folder. This is a small, lightweight application that can be left to run in the background while importing media. This frees up your DaVinci Resolve program to do more creative tasks while the proxies are generated.

Using Watch Folders

Watch folders are simply specific folders in your OS that are constantly monitored by the Blackmagic Proxy Generator. When new files are added to the watch folder, the Blackmagic Proxy Generator is notified, and it automatically transcodes those new files into proxy media, without any additional human interaction needed. You can have as many different watch folders as you want; the only requirement is that the storage media the watch folder is on has enough space to hold both the original media files and the new proxy media.

IMPORTANT: The proxy media is generated inside a subfolder named “Proxy” at the same level in the file hierarchy as the original media file. This means that if your original media is all in the same folder, you will have one “Proxy” folder containing all of the proxy clips. If your original media is all contained in separate folders (i.e., one folder for each video clip), you will have multiple “Proxy” folders, one inside every clip folder and containing one proxy clip each.

NOTE: You can not name a watch folder “proxy.” That name is reserved for the Proxy Generator.

To Add a New Watch Folder

You need to create at least one watch folder and can have as many different watch folders as you need. For example, you could have separate watch folders for each card, or scene, or date, or whatever makes the most sense for your workflow.

- 1 Select the Add button.
- 2 Create a new folder, or select an existing folder in the file system window.
- 3 Click on the open button.

The new watch folder will appear in the Watch Folders pane of the Blackmagic Proxy Generator and will display its location and current status.