We asked camera companies why their RAW formats are all different and confusing

When you set up a new camera, or even go to take a picture on some smartphones, you're presented with a key choice: JPG or RAW?

JPGs are ready to post just about anywhere, while RAWs yield an unfinished file filled with extra data that allows for much richer post-processing. That option for a RAW file (and even the generic name, RAW) has been standardized across the camera industry — but despite that, the camera world has never actually settled on one standardized RAW format.

Most cameras capture RAW files in proprietary formats, like Canon's CR3, Nikon's NEF, and Sony's ARW. The result is a world of compatibility issues. Photo editing software needs to specifically support not just each manufacturer's file type but also make changes for each new camera that shoots it. That creates pain for app developers and early camera adopters who want to know that their preferred software will just work.

Adobe tried to solve this problem years ago with a universal RAW format, DNG (Digital Negative), which it open-sourced for anyone to use. A handful of camera manufacturers have since adopted DNG as their RAW format. But the largest names in the space still use their own proprietary files. And there's no sign of that changing anytime soon.

Why have some camera brands adopted native DNG files?

Some smaller camera manufacturers have been using the DNG format for years, while others like Sigma have adopted it more recently. The whole point of DNG is to offer flexibility, ease of use, and ideally, a little more futureproofing – since the format is open to use and royalty-free.

DNG was created in 2004 by Thomas Knoll, one of the co-creators of Photoshop, and was based on the even older TIFF image specification. DNG is capable of holding additional camera metadata embedded within it. While other RAW formats are usually coupled with an XMP sidecar file for storing metadata, DNG is slightly streamlined since it's just one file that allows nondestructive metadata edits within it.

DNG is nearly old enough to legally drink (in the US)

Regardless of which camera brand you use, a RAW processing workflow is mostly the same: you take a picture, import it to a computer, open and process the file using editing software, and then export a "finished" file in a universal format (like JPG) for sharing or printing. Where things often get the messiest is with software compatibility.

You can't use just any software or photo app to edit a RAW file – you generally need specialized apps that support your specific format. Widely used consumer apps like Apple's Photos and Google Photos have some RAW support, but it's frankly a bit janky. It's best to use software like Adobe's Creative Cloud, Capture One, Photo Mechanic, or Darktable.

Some camera manufacturers offer their own software. But ask most photographers, and they'll likely steer you toward the third-party apps.

And there's the big advantage for DNG. Because it's an open

standard, there’s wider third-party app support. That makes it a more turnkey solution for camera makers. It therefore makes sense that smaller manufacturers (Pentax, Ricoh, Leica, etc.) or ones with closer ties to Adobe (Apple) use it.

What are the advantages of a proprietary RAW format versus an open one like DNG?

Larger camera companies know that app developers will rush to support their latest features, letting them stick with their own RAW formats. A proprietary RAW format offers tighter control over the image pipeline direct from a manufacturer’s camera, from the point of capture to the files you’re editing on your computer.

That’s the sentiment I got from multiple camera company reps who gave me feedback when I asked them why they stuck with their proprietary format. Here are some of the answers I got when asked why they go with proprietary options:

Sony: Michael Bubolo and Ryoko Noguchi of Sony’s product teams tell *The Verge* that Sony Alpha cameras use a proprietary ARW format “to maximize performance based on device characteristics such as the image sensor and image processing engine.”

Panasonic: “A proprietary format enables better optimization and supports unique camera functions,” said Masanori Koyama of Panasonic’s Lumix division.

Sigma: “Adding proprietary data allows the camera information to be given more accurately to the developing software. However, it is less versatile,” Sigma said in a statement provided by US PR rep Jack Howard. (Some of its cameras use DNG, while others use the proprietary X3F format.)

Canon: “Canon uses a propriety RAW format because it allows our proprietary information to be added to RAW without being restricted by the standardization, and data can be handled freely, enabling optimum processing during image development,” said Drew MacCallum, senior manager of product planning at Canon USA.

Pentax: “The advantage of proprietary formats is that they can evolve on their own; the disadvantage is that they may not be supported by third-party applications,” said Shigeru Wakashiro, General Manager of Product Planning for Ricoh Imaging Company (which owns Pentax). Of course, Pentax is the lone manufacturer that gives users a choice between a proprietary PEF file and DNG. The Ricoh executive added, “The disadvantage of using DNG is that if all manufacturers use the DNG format, it will be difficult to manage the format separately for each manufacturer.”

Nikon: Did not answer *The Verge*’s questions by time of publication.

Fujifilm: Did not answer *The Verge*’s questions by time of publication.

What are all these formats?

Canon: CR3 (previously CR2 and CRW)

Nikon: NEF and NRW

Fujifilm: RAF

Panasonic: RW2

OM System: ORF

Hasselblad: 3FR

Pentax: PEF (option for DNG)

Ricoh: DNG

Leica: DNG (RWL on some point-and-shoots)

Sigma: DNG (previously X3F)

Samsung: DNG

Apple: DNG (Apple ProRAW)

Sony also says its format lets it offer unique features in its own editing software: “We can maximize its performance to achieve even higher image quality and enhance image details through features such as Composite RAW and Pixel Shift Multi.”

Sony’s software for processing ARW RAW files is called Imaging Edge. Like most first-party software from camera manufacturers, it’s terrible and unintuitive to use — and should be saved for situations like a high-resolution multishot mode where it’s the *only* method to use a camera’s proprietary feature. The same goes for other first-party apps like Canon Digital Photo Professional and Nikon NX Studio.

The only other time it may be necessary to use those apps is if you buy a camera as soon as it’s released and its RAW files aren’t yet supported by Adobe or other software makers. That moment of friction is when a proprietary RAW format is most annoying, primarily affecting early adopters. It’s a restriction that severely affects camera reviewers and YouTubers, who often can’t try out RAW files in any initial hands-on testing.

Getting that software support out to users as soon as possible takes a bunch of testing and work, and it’s not always completed as quickly as new camera owners would like. “For new cameras, this means making sure that we add support for new or changed behaviors in RAW file formats,” Eric Chan, a digital imaging fellow at Adobe, tells *The Verge*. “For example, new compression modes, capture modes such as High Dynamic Range

and more. In addition, measuring each new device sensor for characteristics such as color and noise.”

If all that isn’t done before a new camera is released and people start taking pictures, the interim choice becomes: shoot JPGs (an inferior format) or temporarily use the camera maker’s software (an inferior workflow).

Why is this so messy and confusing?

Even if multiple brands of cameras use the same off-the-shelf sensor — Nikon, Pentax, Leica, and others use sensors manufactured by Sony — the image processing pipeline and fine-tuning is all proprietary. It’s what gives brands their signature style, like the color science that Fujifilm is known for. But that doesn’t mean it’s *impossible* to do all of that with an open format like DNG.

“I have yet to hear a good reason for using proprietary RAW formats. The underlying data is the same. If a manufacturer comes up with additional data that isn’t included in the DNG standard, the format is extensible enough that a camera manufacturer can throw it in there, anyway.” That’s what Ben Sandofsky, developer at Lux Optics, makers of Halide, told me. So maybe some camera brands are set in their ways and like having full control. Ultimately, we’re sort of at their mercy and whether they choose to be more guarded with a proprietary format or use an open one like DNG.

I wish it weren’t like this, but ultimately, it’s mostly fine. At least, for now. As long as the camera brands continue to work closely with companies like Adobe, we can likely trudge along just fine with this status quo. As much as I’d personally prefer to see all cameras offer a common format like DNG, so at the very least you never have to worry about incompatibilities, it’s unlikely mainstays like Canon CR3 and Nikon NEF files will ever go away.

That means early adopters are stuck hoping their software is updated on time – and anyone with old gear needs to hope their format doesn’t go out of style.

https://www.theverge.com/tech/640119/camera-raw-spec-format-explained-adobe-dng-canon-nikon-sony-fujifilm