Denuvo says its new kernel-level anti-cheat driver is minimally invasive

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- *Insert Tarzan scream*
- Just a glance at this image has me planning my next movement and weapon choice in my head.
- If you feel like that open mouth is just asking for a grenade to be inserted, you would be right.
- Blasting grunts with a flamethrower results in armor drops in a process that doesn’t even make “video game” sense.
- The balance between aerial and ground-based enemies really forces you to be situationally aware in three dimensions.
- Playing *Doom Eternal*, you’ll see gory eviscerations like this so often they’ll cease to have any real impact.
- Yes, that’s a sword, not a gun. Yes, it’s still a *Doom* game.
- These guys aren’t as bad as they look, but only if you can aim correctly.
- The armor on this Cyber Mancubus requires a charged-up Blood Punch to remove. After that, he’s a cupcake.
- Each of these enemies requires a different weapon and a different strategy to take out effectively.
- I love the look of surprise on the Mancubus’ face in this shot.
- One of the most relentless enemies in the game.

Doom Eternal has become the latest game to use a kernel-level driver to aid in detecting cheaters in multiplayer matches.

The game's new driver and anti-cheat tool come courtesy of Denuvo parent Irdeto, a company once known for nearly unbeatable piracy protection and now known for somewhat effective but often cracked piracy protection. But the new Denuvo Anti-Cheat protection is completely separate from the company's Denuvo Anti-Tamper technology, which uses code obfuscation to hinder crackers (and which was already mooted for *Doom Eternal* anyway shortly after launch).

The new Denuvo Anti-Cheat tool rolls out to *Doom Eternal* players after "countless hours and millions of gameplay sessions" during a two-year early access program, Irdeto said in a blog post announcing its introduction. But unlike *Valorant*'s similar Vanguard system, the Denuvo Anti-Cheat driver "doesn't have annoying tray icons or splash screens" letting players monitor its use on their system.

"This invisibility could raise some eyebrows," Irdeto concedes.

No running outside the game

To assuage any potential fears, Irdeto writes that Denuvo Anti-Cheat only runs when the game is active, and Bethesda's patch notes similarly say that "use of the kernel-mode driver starts when the game launches and stops when the game stops for any reason." That's a major difference from *Valorant*'s Vanguard system, which requires the driver to be loaded from system startup in order to "monitor system state for integrity."

"No monitoring or data collection happens outside of multiplayer matches," Denuvo Anti-Cheat Product Owner Michail Greshishchev told Ars via email. "Denuvo does not attempt to maintain the integrity of the system. It does not block

cheats, game mods, or developer tools. Denuvo Anti-Cheat only detects cheats.”

Enlarge / Denuvo announced a partnership with the Esports Integrity Coalition when first announcing its anti-cheat technology in 2018.

Greshishchev added that the company’s driver has received “certification from renown[ed] kernel security researchers, completed regular whitebox and blackbox audits, and was penetration-tested by independent cheat developers.” He said Irdeto is also setting up a bug bounty program to discover any flaws they might have missed.

And because of Denuvo Anti-Cheat’s design, Greshishchev says the driver is more secure than others that might have more exposure to the Internet. “Unlike existing anti-cheats, Denuvo Anti-Cheat does not stream shell code from the Web,” Greshishchev told Ars. “This means that, if compromised, attackers can’t send down arbitrary malware to gamers’ machines.

“These same gaming machines already have a sea of subpar (security-wise) administrative services with active Internet connections,” he continued. “Drivers from mouse and keyboard vendors, lighting and overclocking services, etc. If attackers

really wanted to compromise gamers' machines, they would go through them—not through the world's strongest anti-tamper software."

If a driver exploit is discovered in the wild, Greshishchev told Ars that revocable certificates and self-expiring network keys can be used as "kill switches" to cut them off. "No security expert can claim their solution is infallible, but our penetration testing, certification, and security auditing is significantly higher than any reasonable standard," he said.

Time to kernel panic?

The use of kernel-mode drivers is actually pretty common in multiplayer game anti-cheat tools, helping to ensure that lower-privileged "user-mode" tools that try to modify the game code can be detected and stopped. While cheaters can still get around this by using code-signing exploits to install their own kernel-level cheat tools, the process is more difficult.

Loading a kernel-mode anti-cheat driver only when a game is running, as Denuvo does, is also very different from running a rootkit-style anti-cheat driver from startup, from a security perspective. The latter introduces much more exposure for system-level exploits that can run without the user's knowledge, creating "a large attack surface for little benefit," as independent security researcher Saleem Rashid told Ars regarding *Valorant*'s Vanguard security driver.

Still, some members of the *Doom Eternal* community are not happy about the way the Denuvo Anti-Cheat tool was rolled out, or with the security risks they feel it creates on their systems.

"No piece of software, especially an anti-cheat, should have kernel-level access to your system and if it is we should have been informed before purchasing it," Reddit user extant_dinero

wrote in a popular thread on the *Doom* subreddit urging people to delete the game. “I would not have purchased it had I known it would be added. Just because other pieces of software do it doesn’t make it right.”

But Greshishchev tells Ars such fear is misplaced. Denuvo Anti-Cheat is “designed to be no different than Nvidia’s graphic drivers or Steam’s Client Service,” he said. “Unlike anti-cheats of the past, there are no filesystem hooks, no requirement to start with the OS, no annoying tray icons or splash screens.”

“It’s human nature to have a fear of the unknown, and no amount of technical claims by us could address that. Trust is built up over time, and we think that when Denuvo Anti-Cheat bans a player in your favorite game, we will gain your trust.”

https://arstechnica.com/?p=1676322

Star Trek will go to Strange New Worlds in new spinoff series

Enlarge / Sometimes things explode on the bridge.
CBS/All access

reader comments

169 with 95 posters participating, including story author

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Star Trek fans who finished season 2 of *Discovery* and are clamoring to see more of Capt. Christopher Pike helming the original starship *Enterprise* are getting their way, as CBS has announced a new series putting Pike, Spock, and Number One back on screen.

Star Trek: Strange New Worlds will come to CBS' All Access streaming service, the network said today. Ethan Peck will reprise his role as Spock, the Vulcan science officer originally portrayed by Leonard Nimoy from the 1960s. Anson Mount, who played Pike in *Discovery*, and Rebecca Romijn, who played first officer Number One, will also reprise their roles.

Many Star Trek fans began clamoring for a new spinoff set on the original NCC-1701 since Mount, Peck, and Romijn appeared in *Discovery* as well as several "short Trek" episodes.

The official Star Trek Twitter account shared a video of the three actors, clearly shot from their homes, describing the fan feedback that led to the green light.

[embedded content]
"Speaking just for myself, I have never received more love from a fanbase than I have from the Star Trek family," Mount said in the video.

"Without you, this wouldn't be happening," Peck added. "It is a huge honor."

Executive Producer Alex Kurtzman said in January that such a series was under consideration. Kurtzman will serve as executive producer on *Strange New Worlds* alongside Akiva Goldsman, Jenny Lumet, Henry Alonso Myers, Heather Kadin, Rod Roddenberry, and Trevor Roth. Goldsman, Kurtzman, and Lumet co-wrote the series premiere episode.

"When we said we heard the fans' outpouring of love for Pike,

Number One, and Spock, we meant it," Kurtzman said. "These iconic characters have a deep history in Star Trek canon, yet so much of their stories have yet to be told."

"This is a dream come true, literally," Goldsman said. "I have imagined myself on the bridge of the *Enterprise* since the early 1970s. I'm honored to be a part of this continuing journey along with Alex, Henry, and the fine folks at CBS."

https://arstechnica.com/?p=1676321

How a rejected My Little Pony game helped save a historic tournament

Enlarge / These aren't exactly ponies, but we'll get to that

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This is a coronavirus story but with a happy ending. We could all use a happy ending right now, remember those? It all really starts over seven years ago, long before "pandemic" was a word you had to hear every day, with a group of fans of *My Little Pony: Friendship Is Magic* TV series.

Back in this more innocent time, you might have hopped on the

Internet, not to read the latest virus news, but instead to find an article earnestly explaining to you about bronies and how young adults were really connecting with this cartoon about ponies and friendship. You might have rolled your eyes a bit, but don't judge!

(Full disclosure, my youngest daughter is a super fan, and I've probably seen just about every episode in bits and pieces by now. It's the polar opposite of the Hasbro toy commercials masquerading as shows from my childhood; well-written, thoughtful, and nuanced, with themes that don't insult your intelligence. I can understand how anyone would want to connect with a world like that. The cartoons I watched frankly suck in comparison.)

These particular fans had an interest in things like gaming, storytelling, and animation, and they thought what better way to express their fandom than to making a *My Little Pony*-themed fighting game? They called themselves Mane6, and using an off-the-shelf package called *Fighter Maker 2k*, they started building a game. As they released development footage, their game picked up buzz with the pony fan community, and they got encouraged to take it seriously and try to deliver as polished a product as they could with their limited experience and the limitations of the tool they were using.

Before I spoil the rest of the story, I highly recommend this documentary about what happened next if you have a free 40 minutes to spare in quarantine:

[embedded content]
Making Them's Fightin' Herds: The Story of Mane6.
On with the spoilers, but I think we all see this plot twist coming: Hasbro's lawyers get word of the game, and out comes the lawyers and the cease-and-desist. Years of work down the drain, game over. Their fan IP is off limits, and the old janky game engine they were using wasn't very good to begin with. It feels like there isn't anything to salvage, and Mane6

was ready to just give up.

Then Mane6 got an offer of help from an unexpected source. On February 8, 2013 Lauren Faust, the creator of *My Little Pony: Friendship Is Magic* reaches out to the superfans over Twitter. She'd been following the game's progress along with the rest of the community, she knew what it was like to work that hard on a passion project, and she asked them, "[Do you] want some original characters to make a new game with?"

I'd like to pause the story for a moment to really appreciate what an awesome thing Lauren did here. She didn't know these guys, she didn't owe them a thing, and they were playing with intellectual property she created without permission. We've seen time and time again what normally happens in these situations, and it's not "creator offers to draw new art for fan project," let alone assist with all of the work that goes into not just original character design, but all of the animation a fighting game requires.

How could the people at Mane6 not take Lauren up on this offer? They had to. Lauren talks about exactly how much work it was in the documentary above—suffice it to say it was a lot, but she followed through on her promise.

So that's one half of the puzzle saved in an amazing way, but they're still stuck with this old game creator and all of the limitations it comes with. The solution arrives when Lab Zero Games, creator of indie fighting game *Skullgirls*, offers to give Mane6 their engine for free as part of a stretch goal on a kickstarter for *Skullgirls* DLC. Fans step up, and Mane6 has a modern game engine to work with, and no more limitations.

- Llama on sheep violence
- Rope that deer
- Bear boss battle
- This pixel art adventure mode is called the Salt Mines
- Get some swag

This is where we get to the part where Mane6 gets to help save the day. With Lauren's help and the *Skullgirls* engine they make a new, original fighting game called *Them's Fightin' Herds*. Characters are still animals, but they now include species like a sheep, a llama, a cow, a deer, and a dragon. There's a deep and free form combo system, an in-depth tutorial to teach you how to play, a slick pixel art based single player adventure mode, and, most importantly for this story, the engine gives them GGPO.

GGPO, which stands for Good Game, Peace Out, is an open source software development kit that gives your game peer-to-peer networking called rollback. For the most comprehensive and nerdy explanation of exactly how rollback works on the Internet you can read our guest feature here: Explaining how fighting games use delay-based and rollback netcode.

("Fantastic article," says long time Ars reader and subscriber Ragashingo. "I don't care for fighting games, but the detail here and the examples of how designing animations properly can hide network lag was a lot of fun to read.")

For those who don't want the deep-dive explanation here's what the GGPO documentation says:

> *Traditional techniques account for network transmission time by adding delay to a players input, resulting in a sluggish, laggy game-feel. Rollback networking uses input prediction and speculative execution to send player inputs to the game immediately, providing the illusion of a zero-latency network. Using rollback, the same timings, reactions visual and audio queues, and muscle memory your players build up playing offline translate directly online.*

So rollback games let you play fighting games, online, and have them feel essentially the same as offline. The other style of network code in fighting games, delay based, doesn't allow that. And unfortunately delay based games are more

common, especially with the bigger, more popular titles.

That’s when this becomes the coronavirus story I promised.

Every summer, fighting game fans from around the world gather in Las Vegas for Evo, the biggest fighting game tournament of the year. Thousands of people enter the games being featured.

In 2020 the main games were to be *Super Smash Bros. Ultimate*, *Street Fighter V*, *Tekken 7*, *Under Night In Birth*, *Samurai Shodown*, *Soul Calibur VI*, and *Grandblue Fantasy Versus*.

These games all have one thing in common: their network code sucks. Street Fighter at least uses rollback, but unfortunately not a very good version, and is prone to issues with unstable network connections. The rest are all delay based, and quickly feel terrible under anything but the most ideal network states.

The pandemic has canceled Evo, like every other event. The biggest and most storied tournament series of the fighting game community wasn’t immune to the virus. Evo promised an online event to help fill the void, but everyone wondered, how could they possibly do that when the netcode for every game they were to feature is garbage? There’s not much prestige in winning a game of skill because your opponent saw your character stuttering around the stage.

The answer came last night as Evo announced their online tournament would now feature four new titles instead. *Mortal Kombat 11* and *Killer Instinct*, both based around robust, in-house rollback code, and *Skullgirls* and *Them’s Fightin’ Herds*, with their GGPO rollback framework.

The original titles (minus *Smash Bros* which is dropped entirely) will have some kind of exhibition component, the details still unannounced, but the real online play will fall on the shoulders of the newly added games, which were all clearly chosen for their superior online matches. The event

info and signup details are coming soon, but it appears to be spread over five consecutive weekends.

It won't be the same as the offline Evo experience, but thanks to rollback netcode, and some *My Little Pony* fans who didn't give up in the face of adversity, there's a solid lineup of games that can represent real, competitive online play, where the rest of the big games failed. I know I'll be tuning in, and while the other three games are all solid in their own right, I'm familiar with their play already. Having a new game that's relatively unexplored being played by high level players on a world stage for the first time is a welcome treat.

A happy ending is the kind of magic we could all use more of right now.

(As an aside, Mortal Kombat 11 is the only currently supported AAA fighting game to feature really good rollback network code, and it was all done in-house. If you're interested in the process behind how they did that this GDC talk on the topic is a great watch.)

https://arstechnica.com/?p=1675891

Nintendo's first rumored Mario game for 2020 has come true: Paper Mario in July

reader comments

12 with 11 posters participating, including story author

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- Something about Princess Peach seems different.
- Mario looks like he normally does in *Paper Mario* games, as a neatly illustrated sticker. Peach appears to beckon him to this new, creepy origami style.
- You chose… poorly. (Notice here the papercraft stylings attached to the familiar castlegrounds. *Paper Mario* games are full of this sorta stuff.)
- The apparent Origami King attacks Princess Peach's castle.
- In most Nintendo games, this explosion of colorful ribbons would be a happy thing. Not so in this one.
- Unlikely companions unite to take on a new foe.
- Some of the game's overworld platforming will look familiar.
- But other exploration sequences look far more ambitious this time, including a *Wind Waker*-like ocean sequence.
- Papier Mache baddies on Nintendo's most powerful console yet.
- Nintendo loves toying with the *Paper Mario*'s papercraft systems, and Mario's new "1000-Fold Arms" let him grab, fold, and rip various things in the world.
- 1000-Fold Arms, being used to reveal secrets, paths, and items.
- A hint of a new stealth system. We see Mario sneak up on this corner and wait for a shadow in the distance to fade before continuing.
- If Nintendo knows what it's doing, it'll end this sequence with Mario reaching back to grab his hat at the last second.
- I hope we get to talk to this Bob-Omb a lot.
- Creepy papercraft monsters.

- Formidable airship battle against paper airplanes.
- The Bowser Clown Car has never looked cuter.
- Pick a pipe, any pipe.
- A hint of the next major Nintendo reveal to come? Or just a fun Easter egg for Nintendo's devoted?

After a Mario-filled game-rumor bonanza earlier this year, Nintendo appears to be paying those rumors forward with its first Mario game announcement of 2020. Thursday morning saw Nintendo issue a YouTube announcement—without its usual 48-hour tip-off to fans—for its first *Paper Mario* game in four years.

Paper Mario: The Origami King is slated to launch digitally and physically on July 17 for Nintendo Switch consoles, and it sees the series wildly expand upon its action-RPG roots—as opposed to the more straightforward 2016 Wii U game *Paper Mario: Color Splash*.

Unlike a "mainline" Super Mario action game, *Paper Mario* games stand out with an emphasis on plot, dialogue, and family-friendly humor, and today's *Origami King* reveal sees the series continue that streak. One minute, a "flat," sticker-shaped Mario is leaping and flying over an overwhelmed Mushroom Kingdom castle, which is being attacked by an origami warlord set on "folding the world," along with Bowser as an unlikely ally (apparently already origami-folded to assumably tamp down his evil abilities). The next moment, Mario is chilling on a train while a classic Bob-omb sits near him as a passenger, dryly remarking, "Me? Well… I'm Bob-omb."

The above gallery includes a look at the varied traversal you can expect in the upcoming game, which includes JRPG tropes like an airship (only this one is attacked by rival paper airplanes) and hints of the series' first "open-world" sections, which range from a desert-romping wagon to an ocean-spanning boat. The latter looks remarkably like something out of Nintendo's classic GameCube game *The Legend of Zelda: The*

Wind Waker.

Meanwhile, the below gallery, captured from a pair of Nintendo videos, shows off a new battle system. Like in prior *Paper Mario* games, Mario is controlled in classic run-and-jump fashion in the "overworld," but when he bumps into a bad guy in those moments, Mario is transported to a JRPG-styled, turn-based battle but with button-timing twists. This time, Mario will contend with enemies surrounding him on all sides, and he'll get the option to rotate those enemies' positions on a disc. Should any enemies be lined up front to back, then Mario can use a "jump and keeping jumping" maneuver to hit them all at once (assuming you perfectly time a tap of the "jump" button when landing on each one). Other games in the series included many other attack types, and we imagine those will have additional clever impacts on this rotating-grid interface (perhaps a fireball that scorches all enemies standing side by side).

- The battle begins with Mario selecting vertical slices of the round grid.
- Since this is an entry-level battle, the solution here is simple enough. Let's get them in a neat row.
- With that one errant Goomba moved, Mario will pick the boot icon as an attack.
- Tap a button at the right time when landing on each Goomba to hop to the next one and get them all in one turn.
- Later battles will require that Mario arrange and contend with more enemies across the entirety of this grid interface. We have not yet seen how his allies and their attacks will work in this system.

Paper Mario originally launched on the N64 in 2001 as the spiritual successor to the unlikely smash hit *Super Mario RPG*, an action-RPG series co-developed by Nintendo and Square for the Super Nintendo. *Super Mario RPG* (and its cast of original

characters) has been dead and gone ever since, while Nintendo has since maintained two of its mascot-filled action-RPG series: the console-minded *Paper Mario* and the handheld-minded *Mario & Luigi*. Now that Nintendo has streamlined its hardware business with a single console, instead of a home/handheld split, it remains to be seen whether *Mario & Luigi* has also been retired as a concept.

Today's reveal included a possible hint of Nintendo's next announcement: a cheeky moment in which paperized Mario dons a Samus Aran helmet from *Metroid* and fakes like a gun-toting hero. Whether this means Nintendo is ready to reveal a new *Metroid* game, either the long-in-development *Metroid Prime 4* or a rumored 2D *Metroid* callback, remains to be seen. Either way, the reveal did *not* hint to any other rumored classic-Mario launches in 2020, particularly remakes of popular 3D platformers like *Super Mario 64* and *Super Mario Galaxy*.

[embedded content]
Paper Mario: The Origami King reveal trailer.
Listing image by Nintendo

https://arstechnica.com/?p=1675913

How Epic got such amazing Unreal Engine 5 results on next-gen consoles

reader comments

66 with 50 posters participating, including story author

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[embedded content]
Watch this in full screen at 4K if at all possible.
After last week’s somewhat blasé showcase of in-development Xbox Series X software, our expectations for the coming generation of new game consoles were somewhat tempered. But those expectations got a significant boost this week with Epic Games’ unveiling of a jaw-dropping real-time demo of its Unreal Engine 5 technology.

The engine, which Epic says will launch next year, was shown running on PlayStation 5 development hardware, though the company said the same general level of fidelity should be possible on the Xbox Series X and high-end PCs as well. And it shows how the state-of-the-art in graphical quality on those platforms is quickly advancing past resolution and frame rate counts and toward new levels of lighting and modeling detail.

Lighting

The first pillar of Epic’s new engine is what it’s calling the Lumen system, a “fully dynamic global illumination solution that immediately reacts to scene and light changes.”

Those kinds of effects aren’t all that new in the gaming space. Nvidia has been pushing the real-time ray-tracing capabilities of its PC graphics card line for years now, and those effects are currently making even games like *Minecraft* look spectacular with the right PC hardware. But we haven’t yet seen anything like this kind of real-time lighting on console hardware, much less with what Epic says is “diffuse inter-reflection with infinite bounces and indirect specular reflections.”

Epic says this kind of dynamic lighting will save developers time by removing the need to design light-maps by hand and to wait for the engine to "pre-bake" that static lighting during development, as in current engines. Instead, artists will simply be able to place a light source with the engine and immediately see how the game will look when running on console hardware.

"We're really trying to empower developers here to make next-generation experiences that are unbelievably realistic but also economical and practical to create without a 1,000 person team," Epic founder and CEO Tim Sweeney said in a "Summer Game Fest" interview attached to the demo's unveiling.

- Epic says the "tens of billions of polygons" that make up this scene need to be streamed from high-speed SSDs to avoid overwhelming system memory.
- The demo shows that this light source can be moved in real time, changing all the ambient reflection in the process.
- Someone really needs to vacuum in here.
- This would have been more impressive with a bunch of *different* statues, but the effect is still pretty impressive.
- Epic says Unreal Engine 5 can generate the appropriate level-of-detail model for this statue automatically from a high-end "movie quality" model.
- Don't mind me, just dropping by for a visit.
- It's been decades, but everyone still wants to be Indiana Jones.

Using dynamic lighting also means that developers can move light sources around more easily during the course of gameplay and see light bend around obstructions in ways that don't really work with the static light sources found on current engines. Besides just looking nice, Epic sees this kind of lighting leading to new gameplay ideas—a player-held candle

light-bending around a corner to reveal a hidden enemy, for instance.

Real-time lighting also means an entire universe of user-generated content can take advantage of these kinds of effects without special coding. With Lumen, “things change beyond the release of the game,” Epic CTO Kim Libreri said. “Things can grow and change, and that can all be calculated live.”

Scaling

While real-time lighting effects are getting more common these days, Unreal Engine 5’s most unique features seem focused on the idea of massive, automatic scalability of in-game art assets. What Epic is calling the Nanite system is designed in part to reduce the “cost for an artist to manufacture a major new piece of content for a game,” as Sweeney puts it.

In current game design, game artists usually squash their in-game 3D models down to a few different levels of detail (LODs), each with fewer polygons and smaller textures than the last. Those low-poly models can be subbed in when an object is far away from the in-game camera, saving both memory space and rendering time in complex scenes, without much loss in apparent frame quality.

With Nanite, Epic says artists can instead just directly import raw “movie quality” 3D models from a library like Quixel Megascans into the engine, without the need to specifically design lower LOD models for use in the game. The engine can then automatically create LOD models that are appropriate for the scene and the target hardware, from a next-gen console on down to a mobile phone. The idea, as Epic VP of Engineering Nick Penwarden puts it, is to “build content once and deploy it across all devices.”

“The artist doesn’t even have to think about it,” Libreri added. “You pick a high-resolution asset you want, you load it

in, you don’t have to think about making levels of detail or normal maps or any of the usual stuff that goes with making game content. It’s a pretty freeing experience for anybody trying to tell a story or make an experience.”

Streaming

On high-end hardware, Epic says the top end of those LOD models can now be detailed enough so that each polygon only takes up a single pixel on the screen. At 4K resolutions, that level of “Render Everything Your Eye Sees” detail can require tens of billions of polygons for even a moderately complex scene (though Epic concedes that its demo drops to 1440p at points to preserve performance).

On existing hardware, putting that many polygons in a frame would overload the system memory and overwhelm the “draw count” budget needed to render the scene in time for the next frame. Unreal Engine 5 gets around those limitations by making use of the ultra-fast bulk storage SSDs that will be standard on next-generation consoles.

The idea of streaming graphics content from storage to RAM has been around for decades now—the original *Crash Bandicoot* utilized that basic method to create environments with 20 to 30 times the level of detail of contemporary PlayStation games. In the past, though, such streaming usually meant loading in the next area as the player approached and using game design tricks to hide the “pop in” effect of that loading from the player.

- Watch your step.
- Dynamic lighting means being able to walk around with an ambient light source and see its effects on the environment in real time.
- The polygons in this scene are so small that each one only takes up a single pixel, Epic says.

- The monkey will see you now.
- Hey, can you quiet down? I'm trying to meditate here.
- Right now, the far-off elements here can have very small models. But soon they're going to need highly detailed models for up-close camera work.
- The speed at which the scenery flies past the protagonist in this part of the demo likely wouldn't be possible with slower-loading storage technology in previous consoles.

With ultra-fast SSDs as a standard, that concept can now be extended to stream in art assets *as the camera pans and turns* around a single scene, essentially getting the polygons and textures players need to see in to RAM just in time for display. "There are ten of billions of triangles in that scene, and we simply couldn't have all of them in memory at once," Penwarden said. "You end up needing to stream in triangles as the camera is moving around the environment."

Freeing developers from "loading data off a spinning mechanical device that had its roots in the 1950s… will have a much larger impact on gaming than people are expecting right now," Sweeney said. "The world of loading screens is over. The days of geometry popping up in environments is ended."

(This also means that PC players may have to upgrade to high-end NVMe drives in their gaming rigs to get the best graphical detail from games going forward.)

Tempering expectations

For now, we're trying not to get too excited about the potential shown in this short demo. There will likely be some constraints and tradeoffs necessary to get from even a playable demo to a full game complete with AI, physics simulations, multiple animated actors, and more.

It's also not clear just how much storage is necessary for

these high-quality streaming assets or how big games can comfortably get on relatively expensive SSD storage. And despite the promise, we'll have to wait until next year for outside developers to report on just how much the engine lives up to Epic's "build content once and deploy it across all devices" promise.

All that said, this is the first showcase that has gotten us really excited for the potential advantages of the next generation of gaming hardware. The improvements in environmental detail, lighting, and loading speed on display here are definitely more interesting than the usual resolution pissing contests and careful frames-per-second splicing that have characterized next-gen gaming "advancements" in recent years. We can't wait to see how this potential translates to actual games when Unreal Engine 5 actually rolls out to outside developers next year. https://arstechnica.com/?p=1675926

Unreal Engine is now royalty-free until a game makes a whopping $1 mill

Epic Games / Getty Images / Aurich Lawson

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Since the rise of *Fortnite* as a popular game and Unreal Engine 4 as a popular game-making toolkit, Epic Games, the studio behind both, has been keen to capitalize on this momentum. That has included an aggressive push to lock down game makers in its ecosystem, and Tuesday saw Epic announce its most generous developer-specific offer yet: a massive increase to its "royalty-free" grace period.

As of today, any game or software maker who uses Unreal Engine for commercial purposes doesn't owe Epic Games a penny until a single piece of software exceeds *one meeeeeeellion dollars* ($1,000,000) in gross revenue. This is on top of the company's existing policy to not charge Unreal Engine users a monthly fee, whether they're using the software suite for commercial or educational purposes.

Previously, Epic offered a royalty-free grace period for a game or app's first $50,000 of revenue, then began requiring payment of 5 percent of the software's "worldwide gross revenue" from that point on, including DLC, crowd-sourced fundraising related to the software, and other related revenue streams. That 5 percent fee still applies, but it now leaves game makers unaffected until a $1 million threshold is hit.

Today's news applies no matter where you launch an Unreal Engine-developed game—Steam, Epic Games Store, Humble, console storefronts, et al. And this doesn't change an existing perk for games published at EGS: that Unreal Engine's 5 percent fee is waived in that case. As Ars' Kyle Orland has previously reported, thanks to combined, existing promotions, an Unreal Engine game's launch on EGS can garner a whopping 23 percent more revenue after fees than on Steam. Today's news doesn't change that.

Hence, today's royalty promotion may have its sights set less on Windows/Mac developers and more firmly on indie game teams

who have begun eyeing the next generation of pricey consoles. As we've now seen, Unreal Engine 5's handsome new features, slated to launch in 2021, appear to target the processing boons expected on systems like PlayStation 5 and Xbox Series X. (The existing Unreal Engine 4 toolset will also receive updates with new consoles in mind, as will cross-platform APIs like DirectX 12 Ultimate.)

Retroactive perk—and reminders on Unity, Oculus

Did your new Unreal Engine game or app already launch as far back as January 1, 2020? Epic Games has good news for you: this $1 million-revenue grace period has been retroactively extended to your product automatically.

Speaking of January: Epic's Wednesday news follows a decision by Unreal's largest 3D-engine rival, Unity, to increase the cost of its paid subscription tiers as of the beginning of this year, though those subscription plans include a complete waiving of required royalty payments no matter how much gross revenue a game makes (with the exception of Unity's nebulous "Enterprise" tier, whose prices are determined on a case-by-case basis).

Today's update is a reminder that Epic is still maintaining its cozy relationship with the Oculus Store, as any Oculus-exclusive games or apps made with Unreal Engine still enjoy a royalty-free grace period to the tune of $5 million. When this initiative was announced in 2016, Facebook confirmed that it would foot the royalty bill up until the $5 million threshold, and it's unclear whether today's news means Facebook will owe Epic Games less money for big VR earners.

https://arstechnica.com/?p=1675518

Some Xbox Series X games won’t hit 60fps “performance target”

Enlarge / This *Assassin’s Creed Valhalla* screenshot is running at one frame per all of time (or 1 fpat).

reader comments

99 with 76 posters participating

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With the added power of the Xbox Series X, Microsoft has been touting 4K resolution gaming at 60 frames per second as a new console standard. In recent days, though, we’ve been learning that not all Series X titles will be achieving that standard.

Back in March, Microsoft announced that 4K/60fps level as the “performance target” for Series X games. Microsoft wanted to “build a next generation console that could run games in 4K at 60fps with no compromises for developers,” the company said. And Microsoft’s Aaron Greenberg later tweeted that 60fps should be considered the “standard output” for Series X games.

But that target isn’t a guarantee that all Series X games will run at 60fps. Ubisoft made that much clear in a recent statement to IGN:

> *Assassin’s Creed Valhalla will run at a minimum of 30 fps. On Assassin’s Creed Valhalla, we are committed to offer the best*

> *experience to our players by immersing them in the most beautiful worlds and environments we could create, and leveraging not only the graphics enhancements offered by the next generation of consoles, but also faster loading times and the new architectures.*

Microsoft further clarified the situation in a series of tweets to the Verge's Tom Warren. "Ultimately, it is up to individual developers to determine how they leverage the power and speed of Xbox Series X," the company said. "Developers always have flexibility in how they use the power, so a standard or common 60 fps is not a mandate."

How many frames do you need?

Measuring how fast the human visual system can actually perceive changes is a pretty tricky business. There's a robust debate over precisely how fast a display's refresh rate can get before you hit a point of diminishing returns as far as letting an average player detect less apparent motion "flicker."

That said, Professor Thomas Busey told PC Gamer in 2017 that going from 30fps to 60fps is "demonstrably better" as far as motion perception. For games where quick reactions are important, 60fps has long been considered a common target.

When playing on PC, frame rates are usually "unlocked," meaning players with strong enough hardware can push the performance as fast as their display allows. But frame rates on consoles are usually locked to a set rate meant to optimize performance on known hardware.

In recent years, that has meant a number of high-profile games running at only 30fps on consoles, even as the PC versions of those games usually allow for much smoother frame rates. The mid-generation hardware upgrades of the Xbox One X and PS4 Pro

helped more games achieve hit that 60fps rate, but many console games still struggled to reach that level of performance consistently (while other games offered enhanced-console players a choice to prioritize frame rate or resolution in the settings menu).

With the Xbox Series X's "performance target," Microsoft seems to be saying that any decision to not reach 60fps on the system is a distinct choice by the developer, not a reflection on the hardware itself. Xbox Series X development chief Jason Ronald made this explicit in an interview with Eurogamer earlier in the month.

> *Ultimately, we view resolution and frame rate as a creative decision. Sometimes, from a pure gameplay aspect, 30 [fps] is the right creative decision they can make. But in previous generations, sometimes you had to sacrifice frame rate for resolution. With this next generation, now it's completely within the developers' control.*
>
> *And even if you're building a competitive game, or an esports game, or a twitch fighter or first-person shooter, 60 frames is not the ceiling anymore. As we've seen on PC and other ecosystems, ultra high frame rates and ultra low latency input, that is the precision they prefer to prioritize. So we've designed the system to put that creative control in developers' hands.*

This isn't a new issue for *Assassin's Creed* games. Back in 2014, *Assassin's Creed Unity* Senior Producer Vincent Pontbriand said developer Ubisoft locked all versions of the game at 30fps "to avoid all the debates and stuff," setting off intense debate among the usual subjects on the Internet. "We could be running at 100 fps if it was just graphics, but because of AI, we're still limited to 30 frames per second," Pontbriand said at the time, highlighting the tradeoffs involved in graphical fidelity.

We'll see just how many developers end up making a similar "creative decision" on next-generation consoles going forward. What's clear for now, though, is that the newly emerging 60fps *standard* for modern games falls short of a heavy-handed *requirement* for all games to hit that mark.

https://arstechnica.com/?p=1675470

Neil Gaiman confirms celeb cast, July launch for Sandman audio drama [Updated]

reader comments

31 with 17 posters participating

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- Kat Dennings has been cast as one of the Endless.
- McAvoy lands the central role of Morpheus, aka Dream, aka many other names.
- Unsurprisingly, the top billing includes some major names in the geek acting world.
- More Endless named in the lower ranks of the cast.
- If you know any of these cast members, call them and wish them congratulations!

Update, May 13: Neil Gaiman has confirmed more tantalizing

details about the first-ever adaptation of *Sandman* outside of comic pages, including the all-important release date: July 15, exclusively on Audible. Fans can pre-order the collection as a standalone $35 purchase or receive the whole thing as part of a paid, ongoing Audible subscription.

While no audio samples have yet been released, Gaiman took the opportunity to confirm the cast's principal players, with Gaiman making an unsurprising turn as the story's narrator. The massive cast reveal begins with celebrities such as Riz Ahmed (*Venom*, *Rogue One*), Kat Dennings (*2 Broke Girls*), Taron Egerton (*Rocketman, Kingsman* series), Andy Serkis, and Michael Sheen, with James McAvoy in the middle of it all as Morpheus. The full announced cast is embedded in the above gallery, and you can learn more about the comic's unique audiobook adaptation below.

Original story:

[embedded content]
Neil Gaiman narrates the teaser for *The Sandman* audio drama coming this summer from Audible and DC Comics.
Last summer, we reported that a TV adaptation of Neil Gaiman's seminal graphic novel series, *The Sandman*, was in development at Netflix. Now comes news that we'll be getting a multi-part audio drama adaptation of the series in the interim, via Audible Original. Audio adaptations of beloved properties used to be a rare occurrence—NPR's 1981 radio drama of the original *Star Wars* trilogy springs to mind. But in an era where we're all plugging into podcasts on a regular basis, such adaptations make a new kind of sense.

The audio drama is being directed by Dirk Maggs, who also directed the audio drama adaptations of *Good Omens*—which Gaiman co-authored with the late Terry Pratchett, and Amazon adapted into a miniseries last year—and Gaiman's novel, *Anansi Boys*. The author himself will narrate, as well as serve as creative director and executive producer. No voice cast has

been announced yet, but given Gaiman's bona fides, expect to see (erm, hear) a lot of big names in the mix. Here's Gaiman's official statement (via Nerdist) about the project:

> *"Almost 30 years ago, Dirk Maggs approached DC about adapting The Sandman into audio form. It didn't happen (although it was how Dirk and I first crossed paths) and I'm glad it didn't happen, because we are in a Golden Age of audio drama right now, and Dirk and I are much better at what we are doing.*
>
> *This is a rich audio adaptation of The Sandman graphic novels, brilliantly crafted by Dirk Maggs, with an all-star cast. I've loved being there to talk casting, there to read the scripts and offer occasional advice, and there in the studios, watching magic get made and recording the narration. I can't wait until the world hears what we've done."*

For the uninitiated, the titular "sandman" is Dream, also called Morpheus, among other names. He is one of seven entities known as the Endless, and he is seeking to set right his past mistakes. The other Endless are Destiny, Destruction, Despair, Desire, Delirium, and Death, portrayed as a perky punk/goth young woman—they became almost as popular as Dream himself and were featured in several spinoff comics.

The audio drama will cover the first of the series' ten volumes, *Preludes and Nocturnes*, in which Morpheus, the King of Dreams, escapes from a 70-year imprisonment by an occultist (who actually wanted to capture Dream's sibling Death but trapped the Sandman by mistake). From there, per the official synopsis, "Morpheus goes on a quest to reclaim his lost objects of power and rebuild his realm."

That should tide Lord Morpheus acolytes over until the Netflix series finally sees the light of day. Of course, there are still those who maintain *The Sandman* is essentially unfilmable, even given today's cutting-edge technology. An

earlier film adaptation was so bad that Gaiman deemed it “not only the worst *Sandman* script I’ve ever read, but quite easily the worst script I’ve ever read.” But the Netflix project sounds more promising, since Gaiman will serve as an executive producer for the series, along with David Goyer, whose filmography is nothing to sneeze at.

Listing image by YouTube/DC Comics

https://arstechnica.com/?p=1658227

Newly redesigned Dell XPS 15 inspired by popular XPS 13

reader comments

86 with 62 posters participating

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- One of Dell’s product shots of the Dell XPS 15.
- The back and bottom of the XPS 15.
- Here are the keyboard and trackpad in the XPS 15.
- This image shows the screen-to-body ratio of the XPS 15.
- The Dell XPS 17.
- Dell says it has a new thermal design.
- Here’s a look at the screen and bezels on this one, too.
- A side view of the XPS 17.
- Here’s the XPS 17’s lid.

Today, Dell announced a significant redesign to its XPS 15 laptop—which is now marketed primarily at creatives who perform tasks like video or photo editing—as well as a new XPS 17 model. The former is available today; the latter is coming in the summer.

Dell says the XPS 15 is slimmer than its predecessor and has a number of design changes oriented around a higher screen-to-body ratio (more on that in a moment). It also has a new audio solution (four speakers). The company says it took cues from the popular XPS 13 design to make "the first major redesign" to the XPS 15 "in almost five years."

Meanwhile, the XPS 17 shares most of the same design principles and materials, and even mostly the same specs, with upgraded ports and an optional, faster GPU to go with the bigger screen and chassis.

Both laptops offer the exact same lineup of 10th-generation Intel CPUs, ranging from a Core i5-10300H (4-cores, 8MB cache) at the bottom end up to a Core i9-10885H (8 cores, 16MB cache) at the top, with the i7-10750H and i7-10875H available in between. RAM ranges from 8GB to 64GB at 2933MHz. Solid-state storage is standard, with 256GB, 512GB, 1TB, and 2TB options. There's also Wi-Fi 6 and Bluetooth 5.

The XPS 15 and 17 both have "InfinityEdge" displays that offer very small bezels that measure equally on all sides. The screen-to-body ratio lands at 92.9 percent, and there's a small HD webcam in the top bezel but no notch. The display is available in 4K or FullHD and has a 16:10 aspect ratio.

Dell claims 100 percent of the Adobe RGB color gamut and 94 percent of DCI-P3 in the 4K display, which also has a 1600:1 contrast ratio, a maximum brightness of 500 nits, HDR 400, and Dolby Vision. The 1,920×1,200 display option also maxes out at 500 nits, but it offers a 1650:1 contrast ratio, and Dell hasn't made any claims about Adobe RGB or DCI-P3 in its spec

sheets for that screen.

The two laptops offer the same two display options, with identical specs except for the sizes: the XPS 15's display measures 15.6 inches and the XPS 17 measures, well, 17 inches.

The big spec distinction between the two sizes is, predictably, in graphics. The XPS 15 offers Intel UHD Graphics or an Nvidia GeForce GTX 1650 Ti with 4GB of GDDR6. The XPS 17 adds the option to upgrade to Nvidia's GeForce RTX 2060 with 6GB of GDDR6. There are some port differences, too. The XPS 15 has two Thunderbolt 3 and one USB-C 3.1 ports, along with an SD card reader and a headphone jack. The 17 instead offers four Thunderbolt 3 ports, plus the SD card reader and headphone jack.

The new XPS 15 is available beginning today, with a starting price of $1,299.99. The XPS 17 will land sometime in summer of 2020, starting at $1,499.99.

Listing image by Dell

https://arstechnica.com/?p=1675290

Netflix's first interactive sitcom: Good for laughs, deserves a better app

Enlarge / In Netflix's latest interactive special, you can tell Ellie Kemper to wield a bazooka. Seriously. It's one of

many reasons comedy fans should endure the special's quirks and annoyances.

reader comments

26 with 25 posters participating, including story author

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Sixteen months after *Black Mirror: Bandersnatch* toyed with Netflix viewers, the streaming service is back with its newest live-action interactive TV special. This year, instead of a dark spin on '80s video games, we get a "breakable" version of the oddball comedy *Unbreakable Kimmy Schmidt*.

If you come to this new interactive special hoping for one of the series's best episodes, you're out of luck. But if you're less interested in wacky New York comedy exploits and more interested in how interactive television is evolving, *Unbreakable Kimmy Schmidt: Kimmy vs. the Reverend* might merit must-watch status—with the caveat that Netflix's app could use an update before it streams another "choose-your-own-comedy" special.

Some people are still *Schmidt* out of luck

For the *Schmidt*-less among you: the series spent four seasons following Kimmy (Ellie Kemper), a cult escapee, as she re-acclimated to the modern world with a group of odd, new friends. While the series has officially concluded, this comeback special fast forwards to an entirely new, out-of-nowhere plot point and is therefore easy to watch for novices. She's about to wed a British prince (Daniel Radcliffe) who had previously never appeared in the series, but the wedding planning is interrupted by a discovery that her cult captor (Jon Hamm) may have imprisoned other people.

As Kimmy goes on a journey to unravel this mystery, two other plots play out simultaneously: the prince participates in a bachelor party while Kimmy's away, and Hollywood agent Jacqueline (Jane Krakowski) has to stall for time while her client Titus (Tituss Burgess) helps Kimmy.

- A normal pedestrian choice for most people, but choosing to wait for a very, very distant driver could be the difference between life and laughs in *Unbreakable Kimmy Schmidt: Kimmy vs. the Reverend*.
- I think most women on the verge of marrying Daniel Radcliffe would have appreciated a "why not both" option here, but, alas.
- No matter what you pick, Titus will break into song. Which song, however, is up to you.
- Certain plot points, on the other hand, won't appear at all unless you make certain choices, which requires a complete do-over of the special.
- Chris Parnell will appear as a tripped-out festival organizer no matter how you complete this special. Well, except for one particular difference.
- How will you get from point A to point B? Maybe on bikes!
- Maybe on rider mowers!
- Maybe with Johnny Knoxville giving you the stinkeye!
- Jon Hamm and Jack McBrayer are each hilarious in this special, no matter which choices you make.

Thus, this special's first major divergence from *Bandersnatch* is that viewers are asked to make decisions on behalf of pretty much everyone, instead of a single lead character. What exactly does Jacqueline do to stall for time? How does Titus deal with a crowd of unruly rednecks? Whom does Kimmy call first with a question about her old cult life? At each divergence point, a two-option menu pops up at the bottom of the screen, which you can toggle with your remote or a touchscreen on most devices. (Sorry, Apple TV users. Even 16

months after *Bandersnatch* came and went, you're still *Schmidt* out of luck.)

At its best, *UKS* revels in the moments when one of the two choices is "wrong." Wait for a taxi that will clearly never arrive or sing an intentionally botched version of "Freebird" and a ridiculous sequence plays out before rewinding time. These moments are the golden stuff. Viewers are given no-brainer hints that these choices lead to silly, laugh-filled dead ends, and the show's writers get the freedom to write their characters into wacky sequences that wouldn't otherwise organically play out.

The interactive gimmick gives the writers a get-out-of-jail card for jokes that wouldn't otherwise work outside of an animated series, and it doubles-down on *Bandersnatch*'s brief WTF moments of dark comedy. Explaining these moments any further would dampen their hilarity for a first-time viewer, so please forgive my vagueness.

Comedy, now loading…

But in order to make room for these moments, *UKS:KvtR* is forced to build a bunch of "real" plot sequences to sew the timeline together. These sometimes dull the special's comedic punch, particularly when characters must travel from one location to the next, as if the comedy was held up behind a game console's "loading" sequences.

Some of the special's decisions create massive forks in the story (and, thus, the gags and jokes you'll see), which might have been fine if Netflix's interactive format included nimbler rewind and fast-forward options. Sadly, even when you use some platforms' built-in "go back to a specific choice" seeking functions, you're still forced to re-watch a *lot* of the decision-making scenes that you've already seen. (These last approximately 15 seconds while the decision-making menu appears.) If you're a completionist, you'll have to watch some

of these sequences three times to “unlock” every piece of footage in the special.

It works like an ancient Hypercard sequence.

And there’s a good-news-bad-news twist to one of my favorite decision-making moments. Sometimes, when you pick the “wrong” choice in the special, time will rewind and you’ll automatically choose the “right” thing. But other times, you’ll get to manually pick again after the rewind, and the wrong choice will still be in the menu. Sometimes, when you pick this, the results are nuts—we’re talking about the golden era of *The Simpsons* in terms of inspired wackiness. When those surprises hit, I found myself belly-laughing in ways I didn’t expect.

But other times, re-selecting the same choice over and over led to… the same result playing out over and over. This exposes an inherent weakness in Netflix’s system: it basically works like an ancient Hypercard sequence. Each choice links to full-motion video for both the on-screen action and your menu choices, as opposed to a dynamic menu placed on top of a separate video feed. And sometimes, Netflix doesn’t go to the trouble of building an entirely new if-then sequence. In these cases, viewers can expect a redundant feed of “pick this again and the same thing happens” choices.

An interactive drama can absorb some of these momentum-dampening moments as we watch characters ruminate or while we enjoy refreshes of stirring scenery. But a comedy set in the classic TV-sitcom mold of gags and punchlines isn’t nearly as amenable, so it’s frustrating to see some of *UKS*‘ most refreshing and hell-yes comedic moments hampered by this format—even though on a few occasions, the laughs are likely doubled by the effort required to dig them out.

As a comedy nerd—a devotee who ascribes to everything from the Dick Van Dyke series in the ’60s to anti-comedy vanguards like

The State and *Mr. Show*—I was charmed enough by *UKS:KvtR* to recommend it to anybody in a similar boat. As a kick-back-and-laugh diversion, on the other hand, the special is tougher to recommend, but most of that boils down to Netflix's ho-hum app experience, not the cast and crew's ambition. Go back to the interactive drawing board, Netflix, and help your next specials be a little less bitter to explore and enjoy.

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