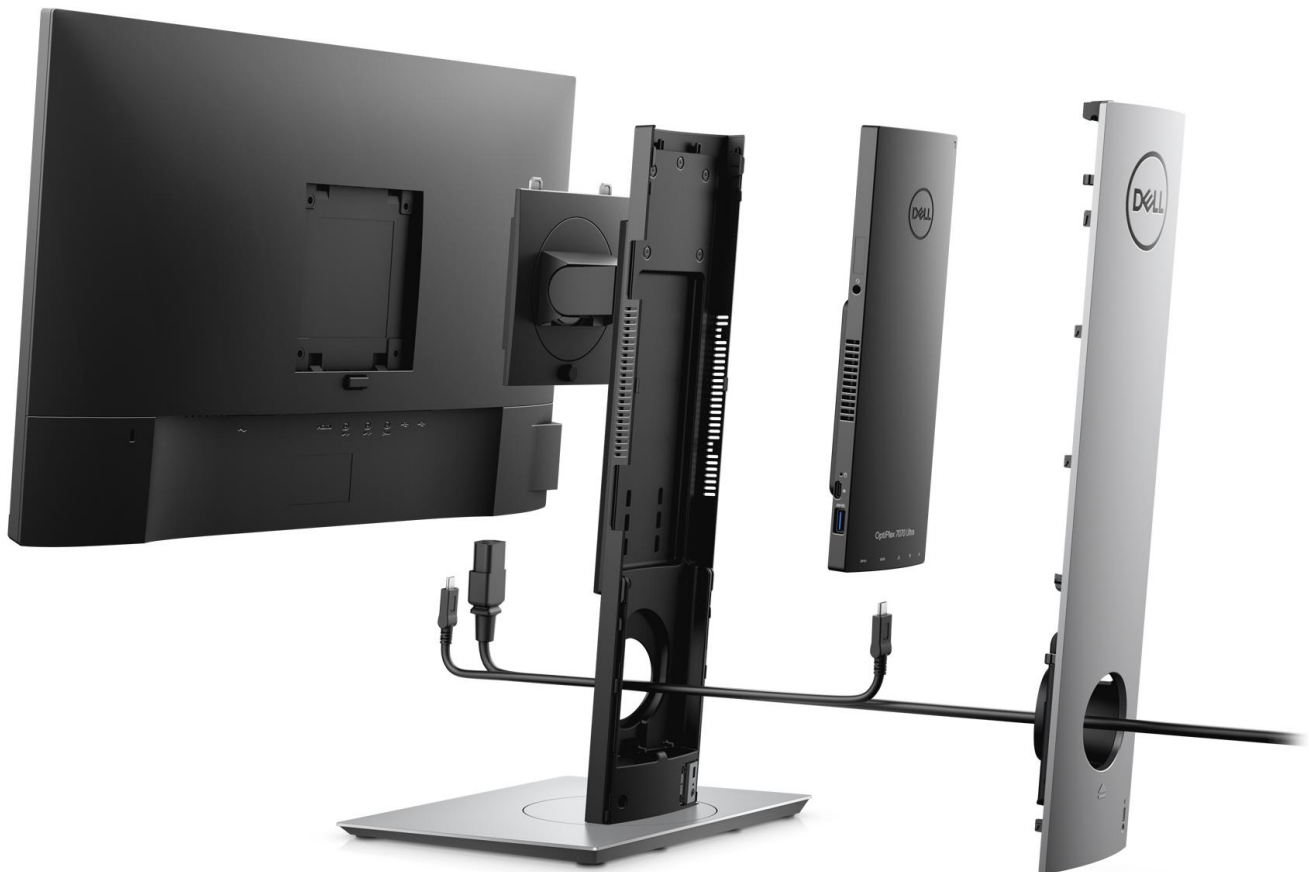


Dell OptiPlex 7070 Ultra

Design Innovation Leadership And Performance Analysis



HOTTECH

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AND
ANALYSIS

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Since the early '90s, when mid-towers and desktops ruled the PC landscape, the public has demanded ever-smaller designs. "Shoebox" or "cubic" designs vied with "book PCs" (the size of hardback novels), sometimes setup as thin clients. All-in-One (AiO) PC approaches followed, which appealed to style-conscious consumers and space-constrained businesses. Embedded systems based on form factors, such as mini-ITX and nano-ITX, showcased how application-specific platforms could fit what were essentially task-optimized PCs into remarkably small spaces.

Evolution continued, and nettops arrived in the mid- to late-2000s, which ultimately morphed into the ultra-compact form factors of today, perhaps best known in Intel's Next Unit of Computing (NUC) products and their many follow-ons. Not the least of which, just to bring the original AIO full circle, we now have legions of All-In-One PC designs that bury their computing and storage components inside a monitor's shell. Dell has participated in many of these form factor evolutions over the decades, and gained much in the way of design wisdom and savvy as a result of a significant install base in a myriad of enterprise and small business applications.



Like other evolutionary courses, some designs thrived while others failed. Broadly speaking, successful products resulted from component-level advancements that enabled full desktop-class performance in a markedly smaller system, often accompanied by less noise and lower power consumption as well. The failures — again, broadly speaking — attempted to deliver the smallest possible sizes but often compromised on performance and features. Lower performance meant less heat, which meant smaller, slimmer possible form factors. However, these tended to be solutions in search of a problem. Nettops never truly took off, and their successors, netbooks, similarly met with a common fate.

Traditional mobile computing platforms, meanwhile, spent those same years slowly closing the gap with their desktop brethren. In fact, once Intel's notebook CPUs went quad-core and Intel HD integrated graphics maturing to the point that they could power mainstream 3D graphics workloads, as well as high-definition video, with no trace of lag or dropped frames, the decades-long *Holy Grail* of a desktop experience on mobile platforms took on fresh promise. In addition, many of the small form factor designs we noted earlier began to integrate these same mobile PC platforms.

Without question, high-end gaming, video editing, virtual reality, and similar application groups will still rely on best-of-breed performance found in desktop computer platforms. However, now that mobile components can affordably satisfy many client computing needs, there is less of a question of compromising on speed or capability for smaller size, improved aesthetics and ergonomics. Instead, the discussion is shifting to what physical designs are most practical and mechanically optimal, with highly innovative industrial designs for different audiences and use cases.

Apparently, Dell scanned this evolutionary progression and saw a chance to leapfrog the traditional AIO landscape with an entirely new modular AIO desktop form factor. Previously, we had shoebox- and book-sized form factors. Now, Dell offers what we might well call the "pamphlet PC," because that's just about the size of the OptiPlex 7070 Ultra's footprint.



Open And Upgradeable Vs Limited And Sealed

Desktop PCs have always enjoyed the advantage of easy upgradeability. Even a motherboard upgrade, the most sweeping and foundational of system changes, can be performed by many tech-savvy users with basic PC experience and a reasonable amount of effort. Upgradeable components (principally CPU, RAM, storage drives, and graphics cards) adhere to industry standard designs for broad compatibility and volume cost advantages.

In contrast, laptops have varied from somewhat upgradeable to completely sealed and not serviceable by the user. The battle over highly upgradeable, industry-standard laptop form factors against a handful of proprietary ODM providers was fought and lost in the 2000s, and that sent a message to manufacturers: Buyers will tolerate limited upgradeability if they get what they want on other fronts.

There are happy mediums between fully upgradeable desktops and fully sealed notebooks. We can look at the embedded computing market, where form factors such as COM Express provide industry-standard specifications for how computer-on-module cards featuring the core computation components (for example, CPU and GPU memory slot(s) as well as PCI Express and other I/O buses) can plug onto a case-mounted carrier board featuring the usual lineup of slots and ports. When IT calls for a performance upgrade, it's easier to drop a new COM onto the carrier than extract the entire motherboard.

Or turn to one of the recent mainstream Intel NUCs. Removing the lid reveals a 4" x 4" motherboard. The soldered-on CPU (with integrated graphics) is somewhat hidden on the board's bottom side, but users can quickly add or swap the two SO-DIMM memory modules as well as an M.2 and/or SATA SSD on the motherboard's exposed top side. Most users are more likely to upgrade these components than the CPU/GPU, especially in corporate environments where the amount of data and number of concurrent active apps needing memory continue to climb at a pace steeper than the demands being placed on the host processor(s).



The AIO market illustrated that, within the desktop segment, a significant percentage of users wanted the ability to run their applications at full performance while maintaining the smallest possible footprint and cleanest aesthetic. Unfortunately, traditional AIO PCs tend to be inherently limited when it comes to upgrading. As with sealed notebooks, what you buy is generally all you get, and with the display factored in, that's no small commitment. Students, office workers, organizations deploying public terminals (as in libraries, etc.), and similar user types might not feel a pinch from legacy AIO restrictions, but many enterprise and small business users liable to have scaling needs over time will.

Dell OptiPlex 7070 Ultra & The Pamphlet PC Sweet Spot – Indeed You Can Have It All

While overall global desktop sales trends have flattened, rising and falling trends within the desktop segment continue. Most notable is the commercial sector's adoption of the smallest/most svelte designs. As CONTEXT noted in August 2019, *"Although total notebook sales only increased 3.1% year-on-year, ultra-slims soared 26%. And while desktop sales jumped 10.4%, the sub-category of mini-PCs increased by 12.3% to reach a share of over a third (37%)."* This mirrors IDC data, which shows consumer mini PC adoption staying largely unchanged year over year while business buying in the segment continues to climb.

Into this context steps Dell, which seems to have asked the question: How do we achieve the aesthetic benefits of an All-In-One PC combined with the upgradeability of a conventional small form factor desktop PC? The results of Dell's efforts in fact could change the entire commercial All-In-One landscape some day in the not so distant future.

The Dell OptiPlex Ultra measures 0.8 x 3.8 x 10.1 inches (19.7 x 96.1 x 256.2 mm), roughly the size of a tall literature pamphlet but thicker, and not much larger than a phablet style smartphone. When it arrived in our lab, we were so awe-struck by its dimensions that we immediately seized upon a concern: This PC was so small and light (1.43 lb., or 0.65 kg), it was liable to fly from our desk at the slightest nudge or tug from a cable. How would this survive in a busy environment just sitting beside the monitor? Then we saw the cover image on Dell's product spec sheet, and came to the realization that this tiny desktop PC slots *inside* the upright column of Dell's monitor stand, which affords it not just a minimal footprint, but essentially zero footprint.



Upgradeability works in two layers. First, a user can remove the stand's back panel to release and remove the Dell OptiPlex 7070 Ultra compute module. Slipping in a new Ultra would take a matter of seconds. Reconnecting the managed cables is the most laborious aspect, and even that takes only a few moments more. The second approach requires some sliding pressure along the PC's back plate to release its cover, exposing the system fan, two DDR4 SO-DIMM slots, a socketed M.2 NVMe SSD, and M.2 Wi-Fi adapter. Its CPU (and integrated GPU) are soldered onto the opposite side of the motherboard and are not user-serviceable.

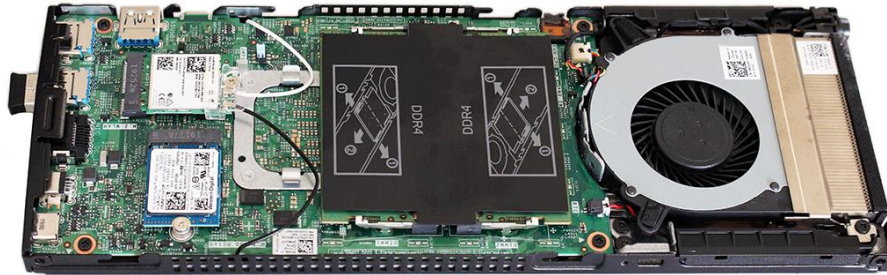
The more we thought about this design, the more ingenious it seemed. RAM and storage upgrades can be performed in under three minutes, with standard off-the-shelf components (SODIMMs for memory and M.2 sticks for storage). The M.2 2230 storage in our sample is secured by a single screw, though we cannot speak to the 2.5" hard drive option, which appears to mount where the single-screw panel is placed on the Ultra's bottom. However, there's also access to the system's Wi-Fi adapter, which can be replaced or upgraded in a standard M.2 PCIe slot as well.

Mechanically speaking, when used with the 27" Dell P2719HC that shipped with our system, the Ultra has effectively zero desktop footprint, and it eliminates the awkward, bolted-on-the-monitor's-back appearance common with many VESA-mounted mini PCs. However, Dell also supports Dell displays and 3rd party displays through an elegant offset VESA mounting for multi-hinged, single-arm stands as well as dual-display stands with up to 27-inch panels. In addition, the OptiPlex 7070 Ultra can deliver power over USB-C to drive a single USB-C cable-enabled monitor or alternatively it will function with older USB-C monitors using the monitor's included power adapter. In short, Dell's OptiPlex 7070 Ultra is so well optimized and flexible, that we can't envision a better approach to a modular AIO desktop.

Dell's OptiPlex 7070 Ultra Design Considered

In the 1990s, some users might have rejected a design such as the Dell OptiPlex 7070 Ultra. That was an era when component options were king and anyone with a shred of IT integrity knew the value of available expansion slots and easy upgradeability. As the OptiPlex 7070 Ultra brilliantly demonstrates, however, this is no longer the 1990s. These old priorities only matter to a niche of high-end workstation use cases.

Unlike traditional desktop PCs, the OptiPlex 7070 Ultra design needs no open PCI Express slots and users can quickly and easily perform a few key upgrades of primary components. Dell aims this system at mainstream business users with a very common set of priorities that range across a myriad of industries.



In terms of location and venue, users may never need to move a system like the OptiPlex 7070 Ultra, but they *could* — and with admirably little effort. With its small footprint, an OptiPlex Ultra can conveniently transplant anywhere there's an available VESA mount and a DisplayPort, and/or USB-C monitor (especially one with USB Power Delivery), with minimal need for cables or dongles. Further, with the USB-C ports on the OptiPlex 7070 Ultra and custom short cables that can be purchased with the Ultra, *any* monitor can be used with the Ultra, whether it be connected via USB-C, DisplayPort, DVI, VGA, or HDMI. If the user happens to be moving between locations that offer Dell OptiPlex 7070 Ultra-compatible monitor stands (and attached displays), then there's likely no need for additional cabling at all. The Ultra "pamphlet style PC" tucks inside the stand, complete with cable management. The system becomes effectively invisible. Further, a user can slip it into a jacket pocket or backpack and take it anywhere with ease.

Ultra-portability is nothing new. We've had ultralight laptops for many years, but these tend to offer much smaller displays that cramp productivity. One of the OptiPlex 7070 Ultra's best attributes is that it provides a recent-gen, fully configured mobile PC platform (Intel 8th Generation Core i7) in a form factor just waiting for a full-sized set of peripherals.

Basic Specs

- Processor: From 8th Generation Intel Core i3-8145U (4 MB Cache, dual-Core, 2.10 GHz to 3.90 GHz) up to 8th Generation Intel Core i7-8665U (8 MB Cache, quad-core, 1.90 GHz to 4.80 GHz, vPro)
- Graphics: Integrated Intel UHD Graphics 620
- Memory: 4 GB, 1 x 4 GB, DDR4-2400MHz up to 64 GB, 2 x 32 GB, DDR4-2400MHz
- Storage:
 - NVMe: M.2 2230, 128 GB, Gen 3 PCIe x4, Class 35 SSD (optional self-encryption) up to M.2 2230, 1 TB, Gen 3 PCIe x4, Class 35 SSD
 - SATA: 2.5-inch, 500 GB, 5400 RPM to 2.5-inch, 1 TB, SATA Class 20 SSD
- Ports:
 - 1 x RJ-45 Ethernet port 10/100/1000 Mbps
 - 1 x USB 3.1 Gen 2 Type-C port with DisplayPort Alt Mode (side)
 - 1 x USB 3.1 Gen 2 port with PowerShare (side)
 - 1 x USB 3.1 Gen 2 Type-C port with DisplayPort Alt Mode/Power Delivery (rear)
 - 1 x USB 3.1 Gen 1 port with SmartPower (rear)
 - 1 x USB 3.1 Gen 2 port with SmartPower (rear)
 - 1 x Universal Audio Jack
- Wireless: Qualcomm QCA61x4A, Dual-band, 2 x 2, 802.11ac with MU-MIMO, Bluetooth 4.2 or Intel Wi-Fi 6 AX200, 2 x 2, 802.11ax with MU-MIMO, Bluetooth 5.0
- Power: 65W

OptiPlex 7070 Ultra Specification Analysis

We're quite confident in Dell's range of Intel CPU offerings in the OptiPlex 7070 Ultra. There's a lot of capability here squeezed into such a small package, and resulting performance should remain more than ample for the office professional audience for which the Ultra seems well-tailored. Dell did the right thing by boosting Intel's 15 Watt TDP CPU power envelope to 25 Watts, to pull more performance from Intel's Core series processor platform. Even though the Ultra runs on a mobile platform, battery life concerns that would normally lead an OEM to constrain CPU power simply don't apply here, and that generally means good things for overall performance.

On the graphics side of the equation, we asked ourselves: is Intel's integrated UHD Graphics 620 GPU enough for its intended business-class audience? Weeks of use lead us to confirm that it indeed is, even in a dual-monitor configuration running productivity applications with occasional full-screen video streaming and even some light duty video transcoding with Intel Quick Sync technology. We never experienced any outward indications that the graphics subsystem was over-taxed. In addition, however, the 7070 Ultra can support up to three 2560x1600 resolution displays at 60Hz at once through MST (Multi-Stream Transport) or up to two 4K monitors at once - one from each port. Future Intel platforms are also likely to increase graphics performance significantly.

We appreciate how easy it is to upgrade the Ultra's memory and storage, and this is a very smart implementation for businesses that might want to a) equip mainstream office users with a streamlined computing solution and b) make it easy for IT departments to either upgrade those users as their needs scale, or pass those (upgraded) systems to more demanding users.

Businesses can apply this same "start small" memory upgrade philosophy to storage. The Ultra's base model starts with a 500GB 2.5" 7200 RPM SATA drive. However, as of this publication, storage upgrade options run through the following:

- 500GB 2.5" 5400RPM SATA drive
- 500GB 2.5" 7200 RPM Self-Encrypting HDD
- 1TB 2.5" 7200 RPM HDD
- 2TB 2.5" 5400 RPM HDD
- 128GB M.2 NVMe SSD
- 256GB M.2 NVMe SSD
- 256GB M.2 NVMe Self-Encrypting SSD
- 512GB M.2 NVMe SSD
- 1TB M.2 NVMe SSD

Secondary Storage SSD Options

- 512GB 2.5" SATA Class 20 SSD
- 1TB 2.5" SATA Class 20 SSD

Our test unit came with a WD SN520 512GB SSD, which uses the Ultra's requisite M.2 2230 slot and is a more premium config for fast system response times in heavier workloads. Buyers watching their CapEx might be well-served by ordering Ultras with its lower-cost HDD storage option, then upgrading to an M.2 SSD down the road.

We're quite happy with Dell's wireless choices, especially the Intel AX200 and its support for both 802.11ax (Wi-Fi 6) and Bluetooth 5.0, which marks a significant improvement in speed, range, reliability, and power consumption over its version 4.2 predecessor. Dell also struck a reasonable compromise between USB Type A and Type C ports.

Dell OptiPlex 7070 Ultra Physical Design Attributes And Use Case Performance

Size - For Dell's target audience, we love Dell's "less is more" philosophy. At these dimensions, it's hard to imagine how anyone could have crammed the same active cooling and copper heat piping, storage, dual-antenna wireless, storage and two SO-DIMM slots into a smaller package. Dell could have gone to a single memory slot, but that would have meant

forgoing the performance benefits of dual-channel memory access. (Note that those who order a configuration with only one SO-DIMM will run in single-channel mode.) Unless CPUs get significantly more power-efficient without sacrificing performance, or we move to wireless *everything* to eliminate IO ports, it's hard to imagine how a system like the OptiPlex 7070 Ultra could be much smaller.

Weight - At 1.10 to 1.43 lbs., the Ultra feels dense and substantial with excellent build quality, and no detectable flex in its chassis. We didn't drop test our unit, but the casing feels like it should take a fair amount of abuse, and we'd have no hesitation about toting it about in a backpack.

Triple-monitor readiness - In a laptop, we wouldn't point this out, but the OptiPlex 7070 Ultra is enabled such that it can be moved between workstations and potentially drop into a presentation environment. As such, Dell's decision to make sure that the CPU had strong enough graphics to fuel multi-monitor configs, combined with the USB-C functionality to make daisy chaining three desktops a reality, makes sense. It's not about whether a user could do triple display on a different system; it's that the 7070 Ultra makes it so *easy* to do so.

Configurability - Dell could have soldered 16GB of RAM on the motherboard and called it a day. The same goes for a 64GB or 128GB SSD. Fixed features would have trimmed size and cost. However, we applaud Dell for making the Ultra as user-configurable as it is, with industry standard components. The Dell OptiPlex 7070 Ultra can be configured for up to 64GB memory, and up to 1TB of SSD storage. In addition, it's dual-storage capable through a 2.5" bay on the back which can be configured with another up to 1TB SSD or up to 2TB hard drive. No doubt, users and IT techs everywhere will be grateful, but budget managers should appreciate that Ultra units should have at least one decent upgrade in them as user or software needs scale, thus staving off obsolescence and premature system replacement.

Acoustics - In general, the bigger the fan blades, the more air they move, and thus the slower they need to spin to move a certain volume of air. Because the Ultra essentially employs a mobile thermal solution, it has to compensate for small blades with faster fan speeds, which traditionally translates to more acoustic output. However, this doesn't crop up often with the OptiPlex 7070 Ultra and the system remains relatively tame under traditional office workloads and surprisingly cool. In addition, IT admins can cap the system's 25 Watt TDP CPU performance to keep heat and fan noise lower, should the need for even lower acoustic output arise. Regardless, practically speaking, we only found the 7070 Ultra's acoustic signature noticeable when working in a completely silent room. Most mainstream use cases should find the OptiPlex 7070 Ultra remains well-mannered in terms of its noise output.

USB and I/O port diversity - As noted earlier, Dell provides a mix of Type A and Type C ports with the OptiPlex 7070 Ultra to eliminate the need for dongles in support of legacy devices. Also, there's no strict need to pay for all ports to support all features (such as Power Delivery). In addition, further USB expansion is possible with Dell Professional Series and UltraSharp Series monitors.

Dell OptiPlex 7070 Ultra Performance Analysis

In benchmarking the OptiPlex 7070 Ultra, we selected the three tool suites we felt would most accurately address the use cases of a mainstream business audience:

- [PCMark 10](#) - This application runs scripted workloads or real-world apps, designed to mimic popular desktop PC use cases, especially for business and productivity.
- [CrystalDiskMark 7.0.0 x64 Standard Edition](#) - This benchmark measures sequential and random access storage performance with a variety of block sizes.
- [BootRacer 7.83](#) - This simple tool loads with Windows and provides boot time information and is also a handy way to assess whether new applications significantly hamper system loading.

With a freshly configured and fully updated Windows 10 installation, ran each application a minimum of three times to observe repeatability and variability. The results of our testing are discussed below.

PCMark 10

We have used PCMark for desktop benchmark testing for well over a decade and trust it as a broadly reliable indicator of overall system performance. Our chief concerns here are ensuring solid performance levels across standard business workloads and that results are fairly consistent. Inconsistency would be a red flag potentially signaling some sort of hardware or configuration issue.

Table 1. PCMark 10 Results

		Run 1	Run 2	Run 3
Essentials		9370	9288	9433
	App Start-up Score	12644	12585	12918
	Video Conference Score	7719	7550	7742
	Web Browsing Score	8429	8434	8394
Productivity		7109	7267	7365
	Spreadsheets Score	8124	8337	8412
	Writing Score	6221	6336	6450
Digital Content Creation		3494	3477	3475
	Photo Editing Score	4276	4247	4234
	Rendering and Visualization Score	2239	2243	2241
	Video Editing Score	4457	4415	4424
Overall		4410	4422	4464

For our best overall score (4464), PCMark informed us that this was “better than 46% of all results,” meaning that our 7070 Ultra performed just shy of the middle of PCMark’s bell curve of logged user results. This bell curve includes results from top-end gaming systems and workstations to older, low-end desktops and laptops. For further context, Underwriter’s Laboratories offers [this recommendation guidance](#) for the benchmark app:

- For general PC use, an Essentials score of 4100 or higher
- For typical office work and light media, a Productivity score of 4500 or higher
- For digital content editing, a Digital Content Creation score of 3450 or higher

While the 7070 Ultra also meets PCMark’s Digital Content Creation recommendation, the system handily exceeds all suggested performance levels for general PC and office use. This tells us that Dell’s choice of an 8th Gen Core i7 CPU, 16GB of RAM and NVMe SSD (in our configuration) is more than ample for the system’s target market of mainstream productivity users. In addition, the Intel CPU’s integrated graphics is also still serviceable for moderate content creation and editing. That said, we’ll offer one anecdote: While authoring this paper, we had the opportunity to switch between a 5th Generation Core i7 notebook, as well as the OptiPlex 7070 Ultra, for light photo and audio editing work in Adobe Photoshop and Audition. The difference in system responsiveness was visibly noticeable and made working on the 7070 Ultra far more preferable.

CrystalDiskMark

As our PCMark results show, the OptiPlex 7070 Ultra does very well on general business tasks. However, we wanted to test the NVMe storage subsystem and see how it fared. This is arguably not outside the 7070 Ultra’s wheelhouse, as these storage tests generally focus either on rapid handling of small files or sustained streaming and access of large files (as with video content creation), both of which we expect to be only random uses case demands in its target market segment.

Table 2. CrystalDiskMark Results

	Run 1	Run 2	Run 3	Average
Seq1M Q8T1 Read	1743.63	1741.66	1744.15	1743.147
Seq1M Q8T1 Write	1093.88	1128.65	1451.44	1224.657
Seq1M Q1T1 Read	1396.87	1398.18	1407.86	1400.97
Seq1M Q1T1 Write	1336.35	967.62	1347.25	1217.073
Rnd1M Q32T16 Read	1135.17	1139.22	1147.35	1140.58
Rnd1M Q32T16 Write	1111.37	1135.34	1029.39	1092.033
Rnd4K Q1T1 Read	46.26	46.5	46.25	46.33667
Rnd4K Q1T1 Write	142.89	142.75	140.35	141.9967

In short, these numbers reflect what we would expect to see from a modern, entry-level NVMe SSD. Dell isn't trying to outperform the likes of top-end storage solutions in desktop class workstations, but rather provide an efficient configuration for general-purpose business users. On that score, Dell delivers.

BootRacer

During benchmarking we recorded the following system boot time results (in seconds) from BootRacer, a simple utility that measure complete boot with full OS loading times from start to finish

- 34.187
- 31.578
- 34.656
- 33.062
- 33.562

These results yield an average boot time for a minimal Windows 10 configuration of 33.409 seconds. Note that once we configured the system with Microsoft Office, synchronized Google Chrome, and other common applications, our average boot time increased to roughly 48 seconds. This is in line with other benchmark results we've seen with similar mobile platforms with NVMe storage. It's important to note that these are the times it took the system to power-on, boot Windows 10, display the desktop, and finish loading any drivers, background apps, and processes. Actual OS boot times from completion of BIOS post, to a usable desktop, clocked in very speedy at around 5-6 seconds. Thus, we feel confident in noting that Dell's SSD-based storage subsystem is right where it should be with respect to performance, and will satisfy a myriad of use cases easily.

Conclusion

With the OptiPlex 7070 Ultra, Dell has given birth to an entirely new modular all-in-one desktop PC form factor and design for ultra-portable, modular and streamlined desktop computing. A wide swath of mainstream, commercial business use cases can take advantage of the 7070 Ultra's sleek, minimalistic design, without sacrificing flexibility due its modular design, excellent serviceability and future upgradability. Dell offers a truly innovative approach to making modern desktop computing more flexible, unobtrusive and streamlined than ever before, with the OptiPlex 7070 Ultra.

We leave this design evaluation and validation energized to see where Dell takes its "pamphlet PC" platform next. We'll share some thoughts on this in our Use Case Analysis paper, but in the end we think the OptiPlex 7070 Ultra design is exactly the sort of innovation the commercial desktop market needs. The Ultra all but eliminates desktop cable clutter, takes excellent advantage of new USB-C feature capabilities with displays, surpasses the performance needs of its target business user audience, and can dramatically simplify support for IT administrators. It can also extend typical product life cycle dramatically, versus legacy AIO designs that don't have the same modular upgradability of the 7070 Ultra. Organizations that adopt the Dell's new OptiPlex Ultra design will enjoy cleaner, simpler work environments and enable users with more productivity options than ever before.

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