**Content Design** (Web Design #Part 1)

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| **Topic**: AMD Ryzen Processor |
| **Reference**:  <https://en.wikipedia.org/wiki/Ryzen>  <https://www.techpowerup.com/cpu-specs/> <https://www.gamersnexus.net/hwreviews/2822-amd-ryzen-r7-1800x-review-premiere-blender-fps-benchmarks/page-6> <https://www.guru3d.com/articles_pages/amd_ryzen_7_2700x_review,16.html> <https://www.guru3d.com/articles_pages/amd_ryzen_7_3800x_review,18.html> |

### **P1. Homepage**

Ryzen is a brand of x86-64 microprocessors designed and marketed by Advanced Micro Devices, Inc. (AMD) for desktop, mobile and embedded platforms based on the Zen microarchitecture and its successors. It consists of central processing units marketed for mainstream, enthusiast and workstation segments and accelerated processing units (APUs) marketed for mainstream and entry-level segments and embedded applications. Ryzen is especially significant for AMD, since it is a completely new design, and since it marks the corporation's return to the high end desktop CPU market. AMD's competitor Intel has controlled this section of the market for almost ten years, back when Intel released the Conroe/Core microarchitecture, which overtook AMD's Athlon 64 as the cutting edge of performance in the market.

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### **P2. History**

In the five years before the release of Ryzen, AMD's direct competitor in the x86 and x86-64 consumer-level CPU marketspace, Intel, had continued to grow its market share with the tick-tock improvement cycle of its Core series of microprocessors. Since the release of its Bulldozer microarchitecture in 2011, AMD's CPUs had fallen progressively behind those from Intel in both single- and multi-core performance. Despite a die shrink and several revisions of the Bulldozer architecture, performance and power efficiency failed to catch up with Intel's competing products.

Ryzen is the consumer-level implementation of the newer Zen microarchitecture, a complete redesign that marked the return of AMD to the high-end CPU market, offering a product stack able to compete with Intel at every level. Having more processing cores, Ryzen processors offer greater multi-threaded performance at the same price point relative to Intel's Core processors. The Zen architecture delivers more than 52% improvement in instructions-per-clock cycle over the previous-generation Bulldozer AMD core, without increasing power consumption. The changes to instruction set also makes it binary-compatible with Intel's Broadwell, smoothing the transition for users.

Threadripper, which is geared for high end desktops (HEDT), wasn't developed as part of a business plan or a specific roadmap; instead, a small enthusiast team inside AMD saw an opportunity that something could be developed between the Ryzen and Epyc CPU roadmaps that would put the crown of performance on AMD. After some progress was made in their spare time, the project was greenlit and put in an official roadmap by 2016.

Since the release of Ryzen, AMD's CPU market share has increased while Intel appears to have stagnated.

### **P3. Initial reception**

The first Ryzen 7 (1700, 1700X, and 1800X) processors debuted in early March 2017 and were generally well received by hardware reviewers. Ryzen was the first brand new architecture from AMD in five years, and without very much initial fine-tuning or optimization, it ran generally well for reviewers. Initial Ryzen chips ran well with software and games already on the market, performing exceptionally well in workstation scenarios, and well in most gaming scenarios. Compared to Piledriver-powered FX chips, Zen-powered Ryzen chips ran cooler, much faster, and used less power. IPC uplift was eventually gauged to be 52% higher than Excavator, which was two full generations ahead of the architecture still being used in AMD's FX-series desktop predecessors like the FX-8350 and FX-8370. Though Zen fell short of Intel's Kaby Lake in terms of IPC, and therefore single-threaded throughput, it compensated by offering more cores to applications that can use them. Power consumption and heat were found to be highly competitive with Intel, and the included Wraith coolers were generally competitive with higher-priced aftermarket solutions.

Ryzen 1800X's multi-threaded performance, in some cases while using Blender or other open-source software, was around four times the performance of the FX-8370, or nearly double that of the i7 7700K. One reviewer found that Ryzen chips would typically outperform competing Intel i7 processors for a fraction of the price when all eight cores were utilized.

One complaint among a subset of reviewers, however, was that Ryzen processors fell behind their Intel counterparts when running older games, or running certain newer games at mainstream resolutions such as 720p or 1080p. AMD acknowledged the gaming performance deficit at low resolutions during a Reddit "Ask Me Anything" thread, where it explained that updates and patches were being developed. Subsequent updates to Ashes of the Singularity: Escalation and Rise of the Tomb Raider increased frame rates by 17 to 31% on Ryzen systems. Publisher id Software announced in April 2017 it would optimize its future games to make use of the greater parallelism available on Ryzen CPUs.

It has been suggested that low threaded applications often result in Ryzen processors being underutilized, producing lower than expected benchmark scores, due to the fact that Zen relies on its core count to make up for its lower IPC rating than that of Kaby Lake. However, AMD and others have argued thread scheduling is not the fundamental issue to Windows 10 performance. Early AM4 motherboards were also hindered by BIOS bugs and poor DDR4 memory support.

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### **P4. Performance**

We choose High-performance processor from each generation to compare its performance

#### **P4.1 1st Gen (1800X)** Performance with Adobe Premiere

Our video production workload is also a real-world test, pulling from files and export settings that we use every day for GN’s YouTube channel. The test is a render of our EVGA ICX review and includes dozens of audio, video, and image files loaded into it. Color correction, transforms, and other calculations (like Warp Stabilization) are included in the render, meaning that it is a precise representation of what we’d use Adobe Premiere CC for on a daily basis. This also means that the workload is computationally intensive, as the render is doing more than just encoding.

Our encoder settings are configured to 28Mbps target/max bitrate, with a “High” 5.1 profile. We are rendering at 1920x1080 and 60.0FPS (h.264).

Configured to its stock clocks, the AMD R7 1800X completes the render task in 67.4 minutes, with the 6900K completing the video render in 68.5 minutes. If you prefer percentages, that’s a change of 1-2%. In rendering terms, you’d be saving about one minute for every hour of encoding. Ignoring all context, that’s not impressive, but context is what matters.

The context of Ryzen and the R7 1800X is that it’s a $500 CPU, and that high-end motherboards can be had for $255. Intel’s i7-6900K is $1000, and high-end motherboards cost $300 plus. Quad-channel memory is lost, but it’s also not all that beneficial in this specific test. The i7-7700K drags behind, completing the render nearly 40 minutes later than the 6900K and 1800X CPUs.

#### **P4.2 2nd Gen (2700X)** Performance with MAGIX Vegas Pro

This professional video editing software Vegas Pro is a video editing software package for non-linear editing. Originally developed as an audio editor, it eventually developed into an NLE for video and audio from version 2.0. Vegas features real-time multitrack video and audio editing on unlimited tracks, resolution-independent video sequencing, complex effects and compositing tools, 24-bit/192 kHz audio support, VST and DirectX plug-in effect support, and Dolby Digital surround sound mixing. Up to version 10, Vegas Pro runs on Windows 7, Windows 8, and Windows 10 and is multi-threaded. For our benchmark session, we output towards XAVC S Long 3840x2160 - 59.94p, a very heavy encode. Video card assisted encoding is disabled. This is a real-world test, not a synthetic one and is based on our own content and preferences. We take a two-minute game recording, add an audio track. The content is created with that new audio-track mixed in there as well as applying two video fp32 enhancement filters for contrast and sharpening.

#### **P4.3 3rd Gen(3800X)**

Performance with MAGIX Vegas Pro

Vegas Pro is a video editing software package for non-linear editing. Originally developed as an audio editor, it eventually developed into an NLE for video and audio from version 2.0. Originally developed as an audio editor, it eventually developed into an NLE for video and audio from version 2.0. Vegas features real-time multitrack video and audio editing on unlimited tracks, resolution-independent video sequencing, complex effects and compositing tools, 24-bit/192 kHz audio support, VST and DirectX plug-in effect support, and Dolby Digital surround sound mixing. Up to version 10, Vegas Pro runs on Windows 7, Windows 8, and Windows 10 and is multi-threaded. For our benchmark session, we output to XAVC S Long 3840x2160 - 59.94p, a very heavy encode. Video card assisted encoding is disabled.

This software supports 16 threads

This is a real-world test, not a synthetic one and is based upon our own content and preferences. We take a two-minute game recording, add an audio track. The content is created with that new audio-track mixed in there as well as applying two video fp32 enhancement filters for contrast and sharpening.

### **P5. Product lineup**

#### **P5.1 1000 Series**

* Socket AM4 for Ryzen and Socket TR4 for Ryzen Threadripper.
* Based on first generation Zen. Ryzen CPUs based on Summit Ridge architecture. Threadripper based on Whitehaven architecture.
* 4.8 billion transistors per 192 mm2 8-core "Zeppelin" die with one die being used for Ryzen and two for Ryzen Threadripper.
* Stepping: B1
* Memory support:
* Ryzen dual-channel: DDR4–2666 ×2 single rank, DDR4–2400 ×2 dual rank, DDR4–2133 ×4 single rank, or DDR4–1866 ×4 dual rank.
* Ryzen Threadripper quad-channel: DDR4–2666 ×4 single rank, DDR4–2400 ×4 dual rank, DDR4–2133 ×8 single rank, or DDR4–1866 ×8 dual rank.
* Instructions Sets: x87, MMX, SSE, SSE2, SSE3, SSSE3, SSE4.1, SSE4.2, AES, CLMUL, AVX, AVX2, FMA3, CVT16/F16C, ABM, BMI1, BMI2, SHA.
* All Ryzen-branded CPUs (except Pro variants) feature unlocked multipliers.
* AMD's SenseMI Technology monitors the processor continuously and uses Infinity Control Fabric to offer the following features:
* Pure Power reduces the entire ramp of processor voltage and clock speed, for light loads.
* Precision Boost increases the processor voltage and clock speed by 100–200 MHz if three or more cores are active (five or more, in the case of Threadripper, and by 300 MHz); and significantly further when less than three are active (less than five, in the case of Threadripper).
* XFR (eXtended Frequency Range) aims to maintain the average clock speed closer to the maximum Precision Boost, when sufficient cooling is available.
* Neural Net Prediction and Smart Prefetch use perceptron based neural branch prediction inside the processor to optimize instruction workflow and cache management.
* Ryzen launched in conjunction with a line of stock coolers for Socket AM4: the Wraith Stealth, Wraith Spire and Wraith Max. This line succeeds the original AMD Wraith cooler, which was released in mid-2016. The Wraith Stealth is a bundled low-profile unit meant for the lower-end CPUs with a rating for a TDP of 65 W, whereas the Wraith Spire is the bundled mainstream cooler with a TDP rating of 95 W, along with optional RGB lighting on certain models. The Wraith Max is a larger cooler incorporating heatpipes, rated for a 140W TDP.

##### **P5.1.1 List of CPUs in table**

* + Entry-level
  + Mainstream
  + Performance
  + High-end desktop

#### **P5.2 2000 Series**

**P5.2.1 CPU** The first of the Ryzen 2000 series of CPU products based on the 12nm Zen+ microarchitecture, code named Pinnacle Ridge and featuring improved Precision Boost 2 technology, were announced for preorder on April 13, 2018 and launched six days later. Zen+ based Ryzen CPUs are based on Pinnacle Ridge architecture, while Threadripper CPUs are based on the Colfax microarchitecture. The first of the 2000 series of Ryzen Threadripper products, introducing Precision Boost Overdrive technology, followed in August. The Ryzen 7 2700X was bundled with the new Wraith Prism cooler.

##### **P5.2.1.1 List of CPUs in table**

* + Entry-level
  + Mainstream
  + Performance
  + High-end desktop

**P.5.2.2 APU**

In January 2018, AMD announced the first two Ryzen desktop APUs with integrated Radeon Vega graphics under the Raven Ridge codename. These were based on first generation Zen architecture. The Ryzen 3 2200G and the Ryzen 5 2400G were released in February.

##### **P5.2.2.1 List of APUs in table**

#### **P5.3 3000 Series**

**P5.3.1 CPU** On May 27, 2019, AMD launched its third generation of Ryzen processors using its chiplet-based Zen 2 architecture at Computex in Taipei. In this generation, Ryzen CPUs utilize the Matisse microarchitecture, while Threadrippers are based on the Castle Peak microarchitecture. The chiplet design separates the CPU cores, fabricated on TSMC's 7FF process, and the I/O, fabricated on GlobalFoundries' 12nm process, and connects them via Infinity Fabric. The Ryzen 3000 series uses the same AM4 socket as earlier models and is the first CPU to offer PCIe version 4 connectivity. The new architecture offers a 15% instruction-per-clock (IPC) uplift and a reduction in energy usage. Other improvements include a doubling of the L3 cache size, a re-optimized L1 instruction cache, a larger op. cache, double the floating point performance, improved branch prediction, and better instruction pre-fetching. The six-, eight- and 12-core SKUs became generally available on July 7, 2019. On September 20, 2019 AMD announced that third generation Ryzen Threadripper processors with core counts starting at 24 would be launched in November.

The Ryzen Threadripper 3990X, part of Castle Peak generation of CPUs, has currently the world's largest number of both cores and threads available in consumer-oriented CPUs - 64 and 128, respectively. The competing Intel Core i9-10980XE processor has only 18 cores and 36 threads. Another competitor, the workstation-oriented Intel Xeon W-3275 and W-3275M, has 28 cores and 56 threads and were more expensive when launched.

##### **P5.3.1.1 List of CPUs in table**

* + Entry-level
  + Mainstream
  + Performance
  + Enthusiast
  + High-end desktop

**P5.3.2 APU**

Both mobile and desktop APUs are based on the Picasso microarchitecture, a 12 nm refresh of Raven Ridge, offering a modest increase in clock speeds (up to an additional 300 MHz maximum boost), Precision Boost 2, an up to 3% increase in IPC from the move to the Zen+ core with its reduced cache and memory latencies, and newly added solder thermal interface material for the desktop parts.

##### **P5.3.2.1 List of APUs in table**

- Desktop

- Mobile

**P5.4 4000 Series**

**P5.4.1 APU**

The Ryzen 4000 APUs are based on Renoir, a refresh of the Zen 2 Matisse CPU cores, coupled with Radeon Vega GPU cores. They were released only to OEM manufacturers in mid-2020.

##### **P5.4.1.1 List of Desktop APUs in table**

**P5.4.2 Mobile**

Zen 2 APUs, based on the 7 nm Renoir microarchitecture, commercialized as Ryzen 4000.

##### **P5.4.2.1 List of Mobile APUs in table**

### **P6. Timeline**

##### **P6.1 1000 Series releases timeline**

##### **P6.2 2000 Series releases timeline**

- **P.6.2.1 CPU**

**- P.6.2.2 APU**

##### **P6.3 3000 Series releases timeline**

- **P.6.3.1 CPU**

**- P.6.3.2 APU**

**- P.6.3.2.1 Desktop**

**- P.6.3.2.2 Mobile**

##### **P6.4 4000 Series releases timeline**

**- P6.4.1 Desktop APU**

**- P6.4.2 Mobile APU**