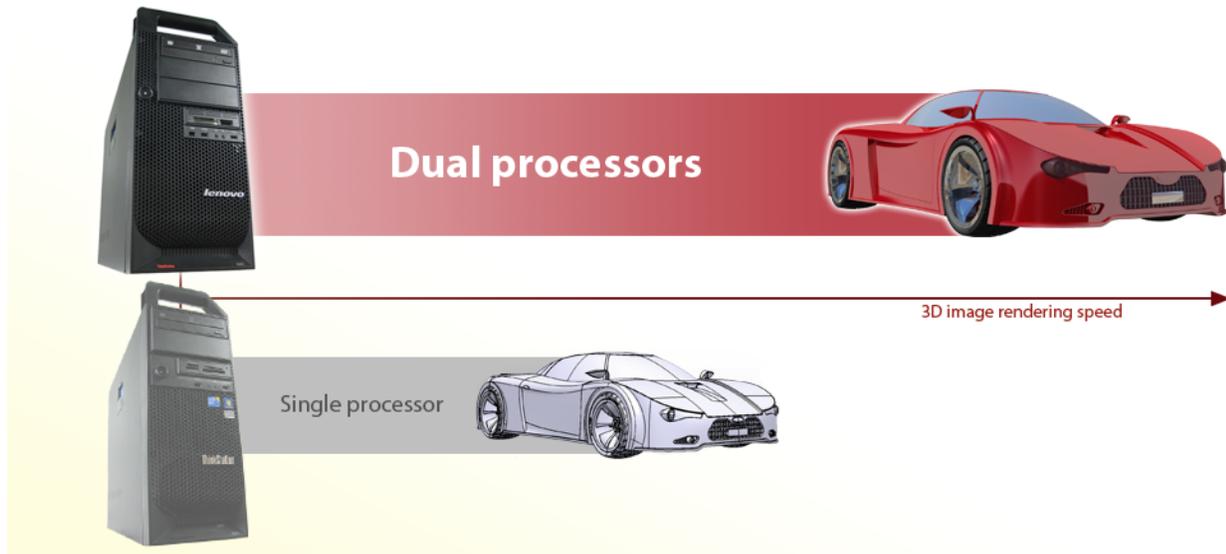


Lenovo® ThinkStation® D20

Rendered up to twice as fast as a single-processor workstation



A high-performing workstation can boost productivity in the workplace. How do you decide which new system to purchase? While upgrading to a newer workstation with a single powerful processor will deliver performance benefits, investing in one with two processors will deliver even more. But just how much more productive would that dual-processor workstation let you be? And what return on your investment does the dual-processor workstation provide? To answer these questions, we tested the performance of two systems running CAD software CATIA V5. Because CATIA V5 is a powerful tool, and rendering images in CATIA can be very time-consuming, this activity puts a workstation's capability to the test .

We tested the Lenovo ThinkStation S20, powered by a single Intel® Xeon® processor X5677, and the Lenovo ThinkStation D20, powered by two of the same processors. While both workstations successfully handled the heavy workloads, the two-socket Lenovo ThinkStation D20 completed the 3D image rendering tasks in as little as half the time as the single-processor based workstation. In our tests, two processors delivered twice the performance of one, which translates directly to productivity and an excellent return on your investment.

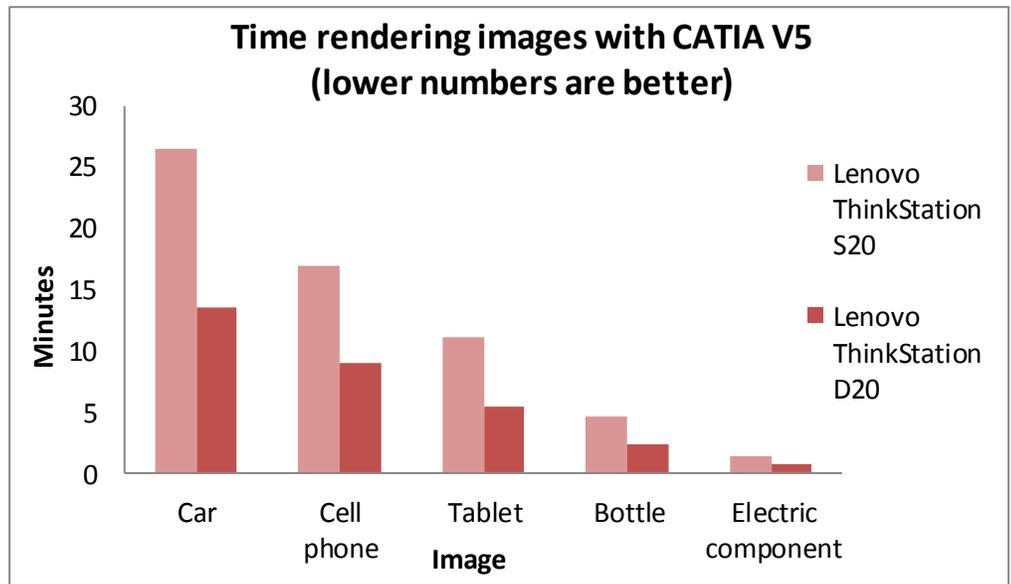
DUAL PROCESSORS DRAMATICALLY REDUCE WAIT TIME

For those who handle heavy workloads on a daily basis, selecting the right workstation is vital. Older systems need so much time to complete the tasks that you can spend a good portion of your workday waiting instead of working. Upgrading to a new system with a single powerful processor, such as the Intel Xeon processor X5677, which adjusts performance according to application demand to maximize performance, can reduce your wait time and boost your productivity. For a larger investment, a new system with two of these processors can save you even more time.

We had our two test systems render five images that varied considerably in size and complexity. Figure 1 shows the amount of time each system needed to complete the task. While the amount of time ranged widely depending on the size and complexity of the image, the two-socket Lenovo ThinkStation D20 consistently rendered each image far more quickly than the one-socket Lenovo ThinkStation S20, showing that a dual-processor based system can double the performance of a single-processor based system.

As Figure 2 shows, the time savings ranged from 46.4 percent to 51.4 percent.

Figure 1: The dual-processor Lenovo ThinkStation D20 was up to 51.4% faster at rendering images than a workstation with a single processor.



| Image | Lenovo ThinkStation S20 | Lenovo ThinkStation D20 | Time saved with Lenovo ThinkStation D20 (minutes) | Time saved with Lenovo ThinkStation D20 (percentage) |
|--------------------|-------------------------|-------------------------|---|--|
| Car | 0:26:28 | 0:13:30 | 0:12:58 | 49.0% |
| Cell phone | 0:16:57 | 0:08:55 | 0:08:02 | 47.4% |
| Tablet | 0:11:05 | 0:05:23 | 0:05:42 | 51.4% |
| Bottle | 0:04:33 | 0:02:14 | 0:02:19 | 50.9% |
| Electric component | 0:01:24 | 0:00:45 | 0:00:39 | 46.4% |
| Total | 1:00:27 | 0:30:47 | 0:29:40 | |

Figure 2: Median times, in hours:minutes:seconds, it took the system to render each image.

Increased return on investment

The savings that this dramatic increase in productivity can bring to your business are substantial, and more than make up for the higher price of a dual-processor system. Calculating actual ROI is complicated and depends on a number of factors, including the possibility that a CAD user has a secondary system dedicated to rendering. The calculations that follow represent one sample scenario that shows how a dual-processor system might quickly pay for itself.

Assuming a CAD designer making an average salary of \$58,000¹ per year, for a burdened salary of \$83,333.33,² renders each of these five images twice a day, the dual processor system would save almost an hour a day (59.4 minutes), which is the equivalent of \$44.41.³ Over the course of a year, the Lenovo ThinkStation D20 would lower the cost of completing those tasks by \$10,299⁴ per employee.

When purchasing new workstations for your company, considering how increased performance translates into saving money is crucial. While a dual-processor workstation requires a larger initial investment, the greater productivity it makes possible can add up to a net savings for your company.

HOW WE TESTED

As we mention above, we used five models of varying size and complexity to test rendering performance on both machines. To do so, we began by launching CATIA V5, importing the model to be rendered, and then allowing the machine to sit idle for 5 minutes. The images we used were courtesy of <http://www.grabcad.com>.

We then selected a scene from the CATIA scene library, staged the model, and adjusted rendering settings (we set the rendering settings to high quality, realistic lighting, and 300 PPI [pixels per inch]). We simultaneously started the stopwatch and started execution of the rendering. When the rendering was complete, we stopped the stopwatch and recorded the time. We then restarted the machine under test and performed the other runs. For detailed information on our testing process, see [Appendix B](#).

Figure 3 presents information on the images the systems rendered, from most to least complex. Across all images, the dual-processor Lenovo ThinkStation D20 was roughly twice as fast.

¹ Average salary in USD as of September 1, 2011, from <http://www.simplyhired.com/a/salary/search/q-CAD+Designer>.

² Burdened salary calculated as salary plus benefits of 43.68 percent of salary.

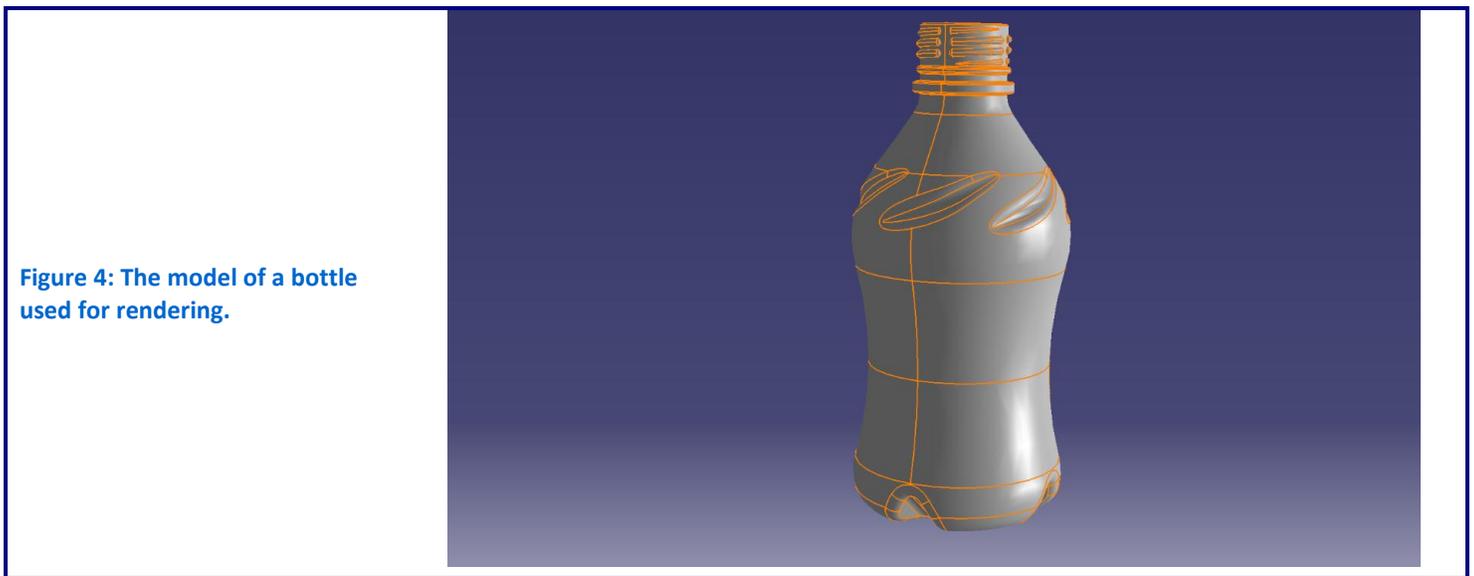
³ Based on 234 eight-hour workdays per year (assumes 27 days off for vacation and holidays).

⁴ Burdened salary times percentage of time saved per day (12.36%).

| Size and complexity of the images | | | | | |
|-----------------------------------|---------|------------|--------|--------|--------------------|
| | Car | Cell phone | Tablet | Bottle | Electric component |
| Number of parts | 336 | 117 | 7 | 1 | 6 |
| Size (KB) | 247,814 | 43,638 | 14,469 | 15,264 | 147 |

Figure 3: File size and number of parts for each image the workstations rendered.

Figure 4 shows the model CATIA V5 used to begin rendering the image of a bottle, and Figure 5 shows the fully rendered image of the bottle in front of a pre-selected background. Rendering blends aspects from the scene and the model to produce a photo-realistic image. For the final renderings of the other images we tested, see [Appendix C](#).



WHAT THIS MEANS FOR YOU

When you use taxing workloads such as image rendering, you need a powerful system that can execute your tasks quickly, minimizing the time you spend waiting. As our testing shows, choosing a workstation with two processors instead of one can increase your productivity dramatically.

Lenovo offers multiple options to meet your needs. The single-processor Lenovo ThinkStation S20 gives you the power to handle the tough workloads. The dual-processor Lenovo ThinkStation D20 provides even more power, letting you complete tasks up to 51.4 percent faster than with the single-processor system. Investing in a dual-processor based Lenovo ThinkStation D20 may cost more initially, but the time savings it brings to your employees can translate directly into long-term savings for your business.

APPENDIX A – SYSTEM CONFIGURATION INFORMATION

Figure 6 provides detailed configuration information for the test systems.

| System | Lenovo ThinkStation S20 | Lenovo ThinkStation D20 |
|---|-------------------------------|-------------------------------|
| General | | |
| Number of processor packages | 1 | 2 |
| Number of cores per processor | 4 | 4 |
| Number of hardware threads per core | 8 | 8 |
| System dimensions (height x width x depth) | 16.5" x 6.8" x 17.7" | 16.9" x 8.2" x 22.5" |
| System weight | 33.06 lbs. | 55.11 lbs. |
| CPU | | |
| Vendor | Intel | Intel |
| Name | Xeon X5677 | Xeon X5677 |
| Stepping | B0 | B0 |
| Socket type and number of pins | Socket 1366 LGA | Socket 1366 LGA |
| Core frequency (GHz) | 3.46 | 3.46 |
| L1 cache | 32 KB + 32 KB (per core) | 32 KB + 32 KB (per core) |
| L2 cache | 1 MB (256 KB per core) | 1 MB (256 KB per core) |
| L3 cache | 12 MB | 12 MB |
| Platform | | |
| Vendor | Lenovo | Lenovo |
| Motherboard chipset | Intel X58 | Intel 5520 |
| BIOS name and version | Lenovo 60KT41AUS (01/04/2011) | Lenovo 61KT36AUS (03/24/2010) |
| Memory module(s) | | |
| Total RAM in system (MB) | 8,192 | 8,192 |
| Vendor and model number | Hynix HMT125U7TFR8C-H9 | Kingston KVR1333D3E9S/4G |
| Type | PC3-10600E | PC3-10600E |
| Speed (MHz) | 1,063 | 1,333 |
| Speed running in the system (MHz) | 1,063 | 1,333 |
| Timing/Latency (tCL-tRCD-tRP-tRASmin) | 7-7-7-20 | 9-9-9-24 |
| Size (MB) | 2,048 | 4,096 |
| Number of memory module(s) | 4 x 2,048 MB | 2 x 4,096 MB |
| Chip organization (single-sided/double-sided) | Double | Double |
| Hard disk | | |
| Vendor and model number | Seagate ST3500418AS | Hitachi HPD725050GLA380 |
| Number of disks in system | 1 | 1 |
| Size (GB) | 500 | 500 |
| Buffer size (MB) | 16 | 16 |
| RPM | 7,200 | 7,200 |
| Type | SATA 3.0 Gb/s | SATA 3.0 Gb/s |
| Controller | Intel 82801JR (ICH10R) | Intel 82801JR (ICH10R) |
| Operating system | | |
| Name | Windows® 7 Professional | Windows 7 Professional |
| Build number | 7601 | 7601 |

| System | Lenovo ThinkStation S20 | Lenovo ThinkStation D20 |
|-----------------------------|---|---|
| Service Pack | SP1 | SP1 |
| File system | NTFS | NTFS |
| Kernel | ACPI x64 – based PC | ACPI x64 – based PC |
| Language | English | English |
| Microsoft DirectX® version | DirectX 11 | DirectX 11 |
| Graphics card | | |
| Vendor and model number | NVIDIA® Quadro® 4000 | NVIDIA Quadro 4000 |
| Type | Discrete | Discrete |
| Chipset | Quadro 4000 | Quadro 4000 |
| BIOS version | 70.00.37.00.03 | 70.00.37.00.03 |
| Dedicated video memory (MB) | 2,048 | 2,048 |
| Resolution | 1,920 x 1,200 | 1,920 x 1,200 |
| Driver | NVIDIA 8.17.12.6866 (05/19/2011) | NVIDIA 8.17.12.6866 (05/19/2011) |
| Audio | | |
| Vendor and model number | SoundMAX Integrated Digital High Definition Audio | SoundMAX Integrated Digital High Definition Audio |
| Driver | Analog Devices 6.10.2.6635 (05/11/2010) | Analog Devices 6.10.2.6635 (05/11/2010) |
| Network card | | |
| Vendor and model number | Broadcom® NetXtreme® 57xx Gigabit | Broadcom NetXtreme 57xx Gigabit |
| Driver | Broadcom 12.2.2.1 (08/06/2009) | Broadcom 12.2.2.1 (08/06/2009) |
| Optical drive | | |
| Vendor and model number | Samsung TS-H653J | LiteOn GSA-H30N |
| Type | CD/DVD-RW | CD/DVD-RW |
| USB ports | | |
| Number | 8 | 8 |
| Type | 2.0 | 2.0 |
| Other | eSATA | eSATA, 1394 |
| Monitor | | |
| LCD type | ThinkVision® L2440p | ThinkVision L2440p |
| Screen size (inches) | 24 | 24 |
| Refresh rate (Hz) | 60 | 60 |

Figure 6: Configuration information for the two workstations we tested.

APPENDIX B – DETAILED TEST METHODOLOGY

Setting up the workstations

Installing Windows 7 Professional X64

1. Insert the Microsoft Windows 7 disk into the DVD drive, and reboot the system.
2. Boot from the DVD drive.
3. Enter your language preferences, and click Next.
4. Click Install.
5. Accept the license terms, and click Next.
6. Select Custom, and select the drive that will contain the OS.
7. Click Install. The setup will begin.
8. Type user for the username, type user-PC for computer, and click Next.
9. Enter no password, and click Next.
10. For system protection, select Use recommended settings, and click Next.
11. Enter your time zone, and click Next.
12. Select the appropriate Network setting, and click Next.

Installing system updates in Windows 7

We used the Windows Update feature to install the following updates:

- Security Update for Microsoft .NET Framework 4 Client Profile (KB2539636)
- Security Update for Microsoft .NET Framework 4 Client Profile (KB2518870)
- Security Update for Microsoft .NET Framework 4 Client Profile (KB2478663)
- Security Update for Microsoft .NET Framework 4 Client Profile (KB2446708)
- Security Update for Microsoft Windows (KB2305420)
- Security Update for Microsoft Windows (KB2393802)
- Security Update for Microsoft Windows (KB2425227)
- Security Update for Microsoft Windows (KB2446710)
- Security Update for Microsoft Windows (KB2476490)
- Security Update for Microsoft Windows (KB2487662)
- Security Update for Microsoft Windows (KB2479943)
- Security Update for Microsoft Windows (KB2491683)
- Security Update for Microsoft Windows (KB2503665)
- Security Update for Microsoft Windows (KB2506212)
- Security Update for Microsoft Windows (KB2507618)
- Security Update for Microsoft Windows (KB2507938)
- Security Update for Microsoft Windows (KB2508272)
- Security Update for Microsoft Windows (KB2509553)
- Security Update for Microsoft Windows (KB2510531)
- Security Update for Microsoft Windows (KB2511455)
- Security Update for Microsoft Windows (KB2524375)
- Security Update for Microsoft Windows (KB2525694)
- Security Update for Microsoft Windows (KB2530548)
- Security Update for Microsoft Windows (KB2532531)
- Security Update for Microsoft Windows (KB2536275)
- Security Update for Microsoft Windows (KB2536276)

- Security Update for Microsoft Windows (KB2539635)
- Security Update for Microsoft Windows (KB2544893)
- Security Update for Microsoft Windows (KB2555917)
- Security Update for Microsoft Windows (KB2556532)
- Security Update for Microsoft Windows (KB2559049)
- Security Update for Microsoft Windows (KB2560656)
- Security Update for Microsoft Windows (KB2562937)
- Security Update for Microsoft Windows (KB2563894)
- Security Update for Microsoft Windows (KB2567680)
- Service Pack for Microsoft Windows (KB976932)
- Update for Microsoft Windows (KB971033)
- Update for Microsoft Windows (KB976902)
- Update for Microsoft Windows (KB982018)
- Update for Microsoft Windows (KB2484033)
- Update for Microsoft Windows (KB2487426)
- Update for Microsoft Windows (KB2488113)
- Update for Microsoft Windows (KB2492386)
- Update for Microsoft Windows (KB2505438)
- Update for Microsoft Windows (KB2506014)
- Update for Microsoft Windows (KB2509928)
- Update for Microsoft Windows (KB2511250)
- Update for Microsoft Windows (KB2515325)
- Update for Microsoft Windows (KB2522422)
- Update for Microsoft Windows (KB2529073)
- Update for Microsoft Windows (KB2533552)
- Update for Microsoft Windows (KB2533623)
- Update for Microsoft Windows (KB2534366)
- Update for Microsoft Windows (KB2541014)
- Update for Microsoft Windows (KB2545698)
- Update for Microsoft Windows (KB2547666)
- Update for Microsoft Windows (KB2552343)
- Update for Microsoft Windows (KB2563227)
- Windows Internet Explorer 9

Installing CATIA V5R20

1. Insert installation media, and double-click Setup.exe.
2. At the Welcome screen, click Next.
3. On the License screen, click Next.
4. Select the destination folder, and click Next.
5. Click Yes to confirm creation of directory.
6. On the Environment Directory screen, click Next.
7. Click Yes to confirm creation of directory.
8. Select Complete as the type of setup, and click Next.
9. On the Orbix Configuration screen, click Next.
10. On the Server Timeout screen, click Next.
11. Uncheck Yes, I want to set up the ENOVIA Vault Client, and click Next.

12. Check Set up communication ports, and leave the defaults unchanged. Click Next.
13. At the Startup/Shortcut screen, click Next.
14. On the Online Documentation Installation, click Next.
15. Review the installation settings, and click Install.
16. If Windows Firewall blocks the Orbix installation, click Allow access.

Installing CATIA V5R20 online documentation

1. Insert the documentation media, and double-click Setup.exe.
2. At the Welcome screen, click Next.
3. Select CATIA P3 is not installed, and click Next.
4. Select the destination folder, and click Next.
5. On the Select Documentation screen, click Next.
6. Click Install to start copying the documentation files.

Installing CATIA V5R20 licenses

1. Click Start→All Programs→CATIA→Tools, and click Nodelock Key Management V5R20.
2. Select File→Import.
3. Browse to the license location and double-click license(s).
4. On the license imported prompt, click OK.
5. Once all licenses have been imported, restart the workstation.

APPENDIX C – RENDERED IMAGES

Figures 7 through 11 show the images the workstations rendered for our productivity testing.



Figure 7: The finished image of the car⁵ that the workstations rendered.

⁵ The rendering of the car courtesy of Stelu Harsan, <http://grabcad.com/stelu.harsan>.



Figure 8: The finished image of the cell phone that the workstations rendered.



Figure 9: The finished image of the tablet that the workstations rendered.



Figure 10: The finished image of the bottle that the workstations rendered.

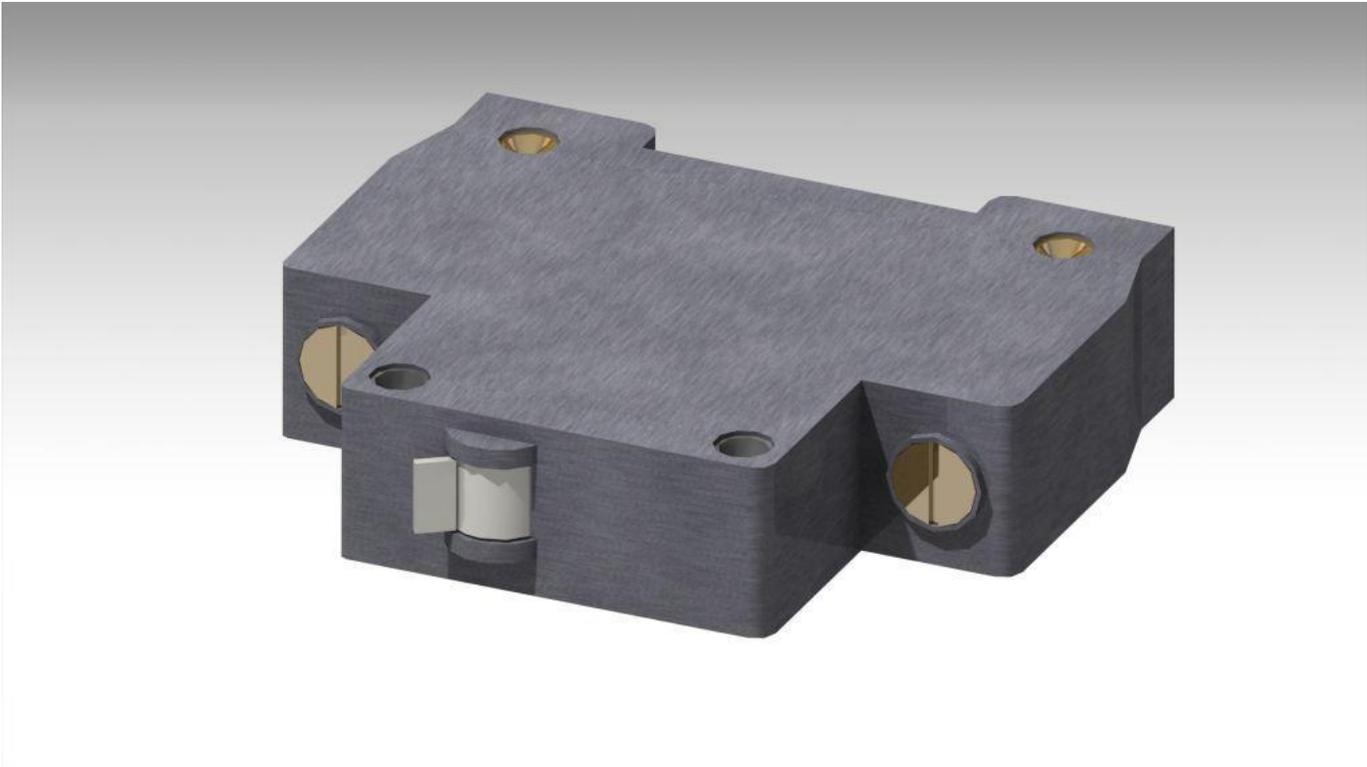


Figure 11: The finished image of the electric component that the workstations rendered.

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