The science behind the report:

Complete laptop and desktop component replacements with ease

This document describes what we tested, how we tested, and what we found. To learn how these facts translate into real-world benefits, read the report Complete laptop and desktop component replacements with ease.

We concluded our hands-on testing on October 23, 2023. During testing, we determined the appropriate hardware and software configurations and applied updates as they became available. The results in this report reflect configurations that we finalized on September 5, 2023 or earlier. Unavoidably, these configurations may not represent the latest versions available when this report appears.

Our results

To learn more about how we have calculated the wins in this report, go to http://facts.pt/calculating-and-highlighting-wins. Unless we state otherwise, we have followed the rules and principles we outline in that document.

Table 1: Results of our testing on laptops. We completed all replacements three times each and report the median result.

	Dell™ Latitude™ 7340	Apple® MacBook Air® 13.6"
Fan		
Removing and replacing fan (lower is better)	06:02.5	N/A
Number of steps required to remove and replace fan (lower is better)	16	N/A
Battery		
Removing and replacing battery (lower is better)	03:39.5	33:41.9
Number of steps required to remove and replace battery (lower is better)	10	52
Storage		
Removing and replacing storage (lower is better)	03:27.9	N/A
Number of steps required to remove and replace storage (lower is better)	12	N/A
Speakers		
Removing and replacing speakers (lower is better)	05:33.2	12:37.1
Number of steps required to remove and replace speakers (lower is better)	16	22

Table 2: Results of our testing on workstations. We completed all replacements three times each and report the median result.

	Dell Precision 5680™	Apple MacBook Pro® 16″
Fan		
Removing and replacing fan (lower is better)	05:31.1	45:27.9
Number of steps required to remove and replace fan (lower is better)	14	79
Battery		
Removing and replacing battery (lower is better)	05:58.9	29:10.3
Number of steps required to remove and replace battery (lower is better)	14	31
Storage		
Removing and replacing storage (lower is better)	04:15.1	N/A
Number of steps required to remove and replace storage (lower is better)	10	N/A
Heatsink		
Removing and replacing heatsink (lower is better)	04:18.4	43:38.4
Number of steps required to remove and replace heatsink (lower is better)	8	78

Table 3: Results of our testing on desktops. We completed all replacements three times each and report the median result.

	Dell OptiPlex™ Micro 7010	Apple Mac® mini (2023)
Fan		
Removing and replacing fan (lower is better)	00:50.9	04:47.0
Number of steps required to remove and replace fan (lower is better)	10	14
Memory (RAM)		
Removing and replacing memory (lower is better)	01:09.6	N/A
Number of steps required to remove and replace memory (lower is better)	14	N/A
Storage		
Removing and replacing storage (lower is better)	00:48.3	N/A
Number of steps required to remove and replace storage (lower is better)	8	N/A
Wireless Card		
Removing and replacing wireless card (lower is better)	01:42.6	N/A
Number of steps required to remove and replace wireless card (lower is better)	12	N/A

Table 4: Results of our testing on all-in-ones. We completed all replacements three times each and report the median result.

	Dell OptiPlex AIO 7410	Apple iMac® (2021)
Fan		
Removing and replacing fan (lower is better)	03:21.7	N/A
Number of steps required to remove and replace fan (lower is better)	16	N/A
Memory (RAM)		
Removing and replacing memory (lower is better)	00:50.8	N/A
Number of steps required to remove and replace memory (lower is better)	10	N/A
Storage		
Removing and replacing storage (lower is better)	03:24.8	N/A
Number of steps required to remove and replace storage (lower is better)	18	N/A
Wireless Card		
Removing and replacing wireless card (lower is better)	03:28.4	N/A
Number of steps required to remove and replace wireless card (lower is better)	16	N/A

System configuration information

Table 5: Detailed information on the systems we tested.

System configuration information	Dell Latitude 7340	Apple MacBook Air 13" (2023)
Processor		
Vendor	Intel®	Apple
Model number	Core™ i5-1345U	M2
Core frequency	1.6 – 4.70 GHz	3.49 GHz
Number of cores	10	8
Logical processors	12	N/A
Memory		
Amount (GB)	16	16
Type	LPDDR5	Unified
Graphics #1		
Vendor	Intel	Apple
Model number	Intel Iris® Xe Graphics	M2 8-core GPU
Storage		
Amount (GB)	256	256
Type	SSD	SSD
Connectivity/expansion		
Wireless internet	Intel Wi-Fi 6E AX211	Wi-Fi 6E (802.11ax)
Bluetooth	5.3	5.3
USB	1 x USB 3.2 Gen 1 Type-A port 2 x Thunderbolt™ 4 ports	2 x Thunderbolt 4 ports
Battery		
Type	Integrated Lithium-ion	Integrated Lithium-polymer
Rated capacity	57 Whr	52.6 Whr
Display		
Size (in)	16	13.6
Resolution	1920 x 1200	2560 x 1664
Dimensions		
Height (in)	0.69	0.44
Width (in)	11.77	11.97
Depth (in)	8.38	8.46
Weight (system) lbs.	2.17	2.7

Table 6: Detailed information on the systems we tested.

System configuration information	Dell Precision 5680 16"	Apple MacBook Pro 16" (2023)
Processor		
Vendor	Intel	Apple
Model number	Core i5-13600H	M2 Pro
Core frequency	2.8 – 4.80 GHz	3.49 GHz
Number of cores	12	12
Logical processors	16	N/A
Memory		
Amount (GB)	16	16
Type	LPDDR5	Unified
Graphics #1		
Vendor	Intel	Apple
Model number	Intel Iris Xe Graphics	M2 Pro 19-core GPU
Storage		
Amount (GB)	512	512
Type	SSD	SSD
Connectivity/expansion		
Wireless internet	Intel Wi-Fi 6E AX211	Wi-Fi 6E (802.11ax)
Bluetooth	5.3	5.3
USB	1 x SD card reader 1 x USB 3.2 Gen 2 Type-C port 2 x Thunderbolt 4 ports	1 x SDXC card 3 x Thunderbolt 4 ports
Battery		
Type	Integrated Lithium-ion	Integrated Lithium-polymer
Rated capacity	100 Whr	100 Whr
Display		
Size (in)	16	16.2
Resolution	1920 x 1200	3456 x 2234
Dimensions		
Height (in)	0.80	0.66
Width (in)	13.92	14.01
Depth (in)	9.46	9.77
Weight (system) lbs.	4.2	4.8

Table 7: Detailed information on the systems we tested.

System configuration information	Dell OptiPlex Micro 7010	Apple Mac mini
Processor		
Vendor	Intel	Apple
Model number	Core i5-13500T	M2
Core frequency	1.6 – 4.70 GHz	3.49 GHz
Number of cores	14	8
Logical processors	20	N/A
Memory		
Amount (GB)	8	8
Type	LPDDR5	Unified
Graphics #1		
Vendor	Intel	Apple
Model number	Intel UHD Graphics 770	M2 10-core GPU
Storage		
Amount (GB)	256	256
Type	SSD	SSD
Connectivity/expansion		
Wireless internet	Intel Wi-Fi 6E AX211	Wi-Fi 6E (802.11ax)
Bluetooth	5.3	5.3
USB	4 x USB 3.2 Gen 1 Type-A port 2 x USB 2.0 ports	2 x Thunderbolt 4 ports
Dimensions		
Height (in)	1.42	1.41
Width (in)	7.17	7.75
Depth (in)	7.01	7.75
Weight (system) lbs.	2.41	2.6

Table 8: Detailed information on the systems we tested.

System configuration information	Dell OptiPlex AIO 7410	Apple iMac
Processor		
Vendor	Intel	Apple
Model number	Core i5-13500T	M1
Core frequency	1.6 – 4.70 GHz	3.2 GHz
Number of cores	14	8
Logical processors	20	N/A
Memory		
Amount (GB)	8	8
Type	LPDDR5	Unified
Graphics #1		
Vendor	Intel	Apple
Model number	Intel UHD Graphics 770	M2 8-core GPU
Storage		
Amount (GB)	256	256
Type	SSD	SSD
Connectivity/expansion		
Wireless internet	Intel Wi-Fi 6E AX211	Wi-Fi 6 (802.11ax)
Bluetooth	5.3	5.0
USB	1 x USB 3.2 Gen 2 Type-C ports 2 x USB 3.2 Gen 1 Type-A port 3 x USB 3.2 Gen 2 Type-A ports	2 x Thunderbolt 3 ports
Display		
Size (in)	24	24
Resolution	1920 x 1080	4480 x 2520
Dimensions		
Height (in)	13.95	18.1
Width (in)	21.26	21.5
Depth (in)	2.28	5.8
Weight (system) lbs.	13.95 (without stand)	9.83

How we tested

Researching documentation

For all systems under test, we researched whether public-facing documentation was freely available for servicing the devices.

1. Note whether self-service repair or customer-replaceable parts documentation is or is not available online.
2. If documentation is available for a device, read through the documentation, and note whether it includes the following information:
   - Identification of the product (type of product, trademark, trade name, model, and serial number)
   - A disassembly map or exploded view of the device
   - Electronic boards diagrams
   - A list of necessary equipment for repair
   - Instructions for repair of specific parts
   - Diagnostic fault and error codes
   - Component and diagnosis information
   - Instructions for software and firmware reset
   - Information on how to access internal data records of reported failure incidents
   - Specific guidance for self-repair
   - How to contact authorized repairers
   - Failure detection and required action items
   - User and maintenance instructions
3. Report findings.

We referenced documentation at the following URLs on October 23:

- Dell Latitude 7340: https://dl.dell.com/content/manual35247903-latitude-7340-service-manual.pdf?language=en-us
- Dell Precision 5680: https://dl.dell.com/content/manual19946365-dell-precision-5680-owner-s-manual.pdf?language=en-us
- Dell OptiPlex Micro 7010: https://dl.dell.com/content/manual17424428-optiplex-micro-7010-owner-s-manual.pdf?language=en-us
- Dell OptiPlex 7410 AIO: https://dl.dell.com/content/manual15320332-optiplex-all-in-one-7410-owner-s-manual.pdf?language=en-us
- Apple MacBook Air 13": https://manuals.info.apple.com/MANUALS/2000/MA2146/en_US/macbookair-M2-2022-07300359A-repair.pdf
- Apple MacBook Pro 16": https://manuals.info.apple.com/MANUALS/2000/MA2086/en_US/macbookpro-16-2021-07300327A-repair.pdf
- Apple Mac mini: https://manuals.info.apple.com/MANUALS/2000/MA2115/en_US/macmini-M1-2020-07300300A-repair.pdf
- Apple iMac: https://manuals.info.apple.com/MANUALS/2000/MA2117/en_US/imac-24-2021-2ports-07300302A-repair.pdf

Overview: Completing disassembly and replacement of parts

For this section, we determined how easy it was to replace four components on each system. For laptops and mobile workstations, these parts include the speakers, heatsink, storage drive, battery, and fan. For desktop units and all-in-one units, these parts include the memory (RAM), storage drive, wireless card, and fan. We noted how many tools we needed, whether we could complete the replacements with basic tools or with proprietary tools, and, when necessary, why we could not replace parts.

For each replacement, we followed these steps:

1. Start with the system fully assembled.
2. Start the timer, and begin the process to replace that part.
3. Record the time and number of steps to replace that part.

Replacing components on the laptops

Replacing the fan on the Dell Latitude 7340

1. On the bottom of the system, unscrew eight captive Phillips-head screws.
2. Using a plastic scribe, lift and remove the bottom cover.
3. Remove the screws securing the WLAN and WWAN brackets from the system board.
4. Remove the WLAN and WWAN brackets.
5. Disconnect the WLAN cables, and release the cables from the cable routing.
6. Remove the Phillips-head screw securing the fan in place.
7. Disconnect the thermal fan cable from the connector on the system board.
8. Lift and remove the thermal fan from the system board.
9. Insert a new thermal fan onto the system board.
10. Connect the thermal fan cable onto the system board.
11. Add the Phillips-head screw to secure the fan in place.
12. Re-route the WLAN cables, and reattach them.
13. Place the WLAN and WWAN brackets back in their correct location.
14. Screw in the three Phillips-head screws that secure the WLAN and WWAN brackets back into place.
15. Attach the bottom cover, and snap it back into place.
16. To secure the bottom cover, on the bottom of the system, screw the eight Phillips-head screws back into place.

Replacing the battery on the Dell Latitude 7340

1. On the bottom of the system, unscrew eight captive Phillips-head screws.
2. Using a plastic scribe, lift and remove the bottom cover.
3. Remove the battery cable from the system board.
4. Unscrew the five Phillips-head screws that secure the battery in place (four captive screws, one non-captive).
5. Remove the battery from the enclosure.
6. Insert the new battery into the enclosure.
7. To secure the new battery in place, screw the five Phillips-head screws back in (four captive screws, one non-captive).
8. Connect the battery cable to the system board.
9. Attach the bottom cover, and snap it back into place.
10. To secure the bottom cover, on the bottom of the system, screw the eight Phillips-head screws back into place.

Replacing the storage on the Dell Latitude 7340

1. On the bottom of the system, unscrew eight captive Phillips-head screws.
2. Using a plastic scribe, lift and remove the bottom cover.
3. Remove the SSD shield mounting screw.
4. Remove the shield.
5. Remove the screw holding the M.2 SSD securely in place.
6. Remove the M.2 SSD.
7. Insert the new M.2 SSD into the M.2 SSD slot.
8. Attach the screw that holds the M.2 SSD securely in place.
9. Attach the SSD shield.
10. Attach the SSD shield mounting screw.
11. Attach the bottom cover, and snap it back into place.
12. To secure the bottom cover, on the bottom of the system, screw the eight Phillips-head screws back into place.

Replacing the speakers on the Dell Latitude 7340

1. On the bottom of the system, unscrew eight captive Phillips-head screws.
2. Using a plastic scribe, lift and remove the bottom cover.
3. Remove the battery cable from the system board.
4. Unscrew the five Phillips-head screws that secure the battery in place (four captive screws, one non-captive).
5. Remove the battery from the enclosure.
6. Disconnect the speaker cable from the connectors on the system board.
7. Peel the tape that secures the speaker cable in place.
8. Remove the speaker cables from the routing guides, and remove the speakers.
9. Insert a new speakers in place, and re-route the cables through the routing guides.

10. Attach the tape to secure the speaker cable in place.
11. Connect the speaker cable to the connectors on the system board.
12. Insert the battery back into the enclosure.
13. To secure the battery in place, screw the five Phillips-head screws back in (four captive screws, one non-captive).
14. Connect the battery cable to the system board.
15. Attach the bottom cover, and snap it back into place.
16. To secure the bottom cover, on the bottom of the system, screw the eight Phillips-head screws back into place.

Replacing the fan on the Apple MacBook Air 13"

The MacBook Air 13" did not include a fan, so we could not replace this component.

Replacing the battery on the Apple MacBook Air 13"

1. On the bottom of the system, unscrew the four non-captive P5 pentalobe screws (proprietary screws).
2. Using a plastic scribe, lift the bottom cover, and pull the bottom case to remove it.
3. Unscrew and remove the two T3 Torx screws securing the battery connector cover.
4. Remove the battery connector cover.
5. Disconnect the battery connector.
6. Unscrew and remove the two T3 Torx screws securing the trackpad cable cover.
7. Disconnect the trackpad cable press connector.
8. Remove the foam pad from the display cable cover, revealing a screw.
9. Unscrew and remove the 14 T3 Torx screws securing the cable covers.
10. Remove the six cable covers.
11. Remove the two T3 Torx screws securing the upper display cable cover.
12. Remove the two P2 pentalobe screws securing the same upper display cable cover.
13. Remove the upper display cable cover.
14. Disconnect the display cable connectors.
15. To the left of the display cable, disconnect the microphone connector.
16. Disconnect the left and right speaker connectors.
17. Disconnect the interconnect cable.
18. Disconnect the MagSafe port connector.
19. Disconnect the Thunderbolt connectors.
20. Disconnect the antenna cables.
21. Unscrew and remove the seven T5 Torx screws securing the logic board in place.
22. Unscrew and remove the two T3 Torx screws securing the logic board in place.
23. Remove the logic board.
24. Unscrew and remove the two T5 Torx screws securing the battery tray.
25. Unscrew and remove the two T3 Torx screws securing the battery tray.
26. Remove the eight adhesive tabs from the battery securing it in place. (Note: We could only perform this step on the first of the three times we performed the swap. This step took us 2 minutes 35 seconds. We account for that 2 minutes 35 seconds in the timings for our second and third times completing the swap.)
27. Remove the battery from the enclosure.
28. Insert the new battery into the enclosure.
29. Screw in the two T3 Torx screws that secure the battery tray.
30. Screw in the two T5 Torx screws that secure the battery tray.
31. Screw in the two T3 Torx screws that secure the logic board.
32. Screw in the seven T5 Torx screws that secure the logic board.
33. Connect the antenna cables.
34. Connect the Thunderbolt connectors.
35. Connect the MagSafe port connector.
36. Connect the interconnect cable.
37. Connect the left and right speaker connectors.
38. Connect the microphone connector.
39. Connect the display cable connectors.
40. Attach the upper display cable cover.
41. Screw in the two T3 Torx screws that secure the upper display cable cover.
42. Screw in the two P2 pentalobe screws that secure the upper display cable cover.

43. Apply the six cable covers.
44. Screw in the fourteen T3 Torx screws that secure the cable covers.
45. Apply the foam pad to the display cable cover.
46. Connect the trackpad cable connector.
47. Screw in the two T3 Torx screws that secure the trackpad cable cover.
48. Connect the battery cable.
49. Apply the battery cable cover.
50. Screw in the two T3 Torx screws to secure the battery connector cover.
51. Attach the bottom cover and snap it into place.
52. On the bottom of the system, screw in the four non-captive P5 pentalobe screws (proprietary screws).

Replacing the storage on the Apple MacBook Air 13"

The storage on the MacBook Air 13" was soldered to the board, so we could not replace it.

Replacing the speakers on the Apple MacBook Air 13"
1. On the bottom of the system, unscrew the four non-captive P5 pentalobe screws (proprietary screws).
2. Using a plastic scribe, lift the bottom cover, and pull the bottom case to remove it.
3. Remove the foam pad from the display cable cover, revealing a screw.
4. Unscrew the nine T3 Torx screws that secure the four metal cable covers in place.
5. Remove the metal cable covers.
6. Disconnect the left and right speaker cables.
7. Disconnect the antenna cables.
8. Unscrew the two T3 Torx screws that secure the left and right hinge cover in place.
9. Remove the left and right hinge cover.
10. Unscrew the six T5 Torx screws that secure the left and right speaker in place.
11. Remove the left and right speakers.
12. Insert a new left and right speakers.
13. Screw in the six T5 Torx screws that secure the left and right speaker in place.
14. Place the left and right hinge covers.
15. Screw in the two T3 Torx screws that secure the left and right hinge covers in place.
16. Connect the antenna cables.
17. Connect the left and right speaker cables.
18. Place the metal cable covers.
19. Screw in the nine T3 Torx screws that secure the four metal cable covers.
20. Apply the foam pad to the display cable cover.
21. Attach the bottom cover, and snap it into place.
22. On the bottom of the system, screw in the four non-captive P5 pentalobe screws (proprietary screws).

Replacing components on the mobile workstations

Replacing the fan on the Dell Precision 5680
1. On the bottom of the system, unscrew the eight T5 Torx screws (non-captive screws).
2. Using a plastic scribe, lift and remove the bottom cover.
3. Remove the two 00 Phillips-head screws that secure the right fan in place.
4. Remove the two 00 Phillips-head screws that secure the left fan in place.
5. Disconnect the right fan connector from the main board.
6. Disconnect the left fan connector from the main board.
7. Lift and remove the left and right fan from the system board.
8. Insert a new left and right fan onto the system board.
9. Connect the right fan connector to the main board.
10. Connect the left fan connector to the main board.
11. Screw in the two 00 Phillips-head screws that secure the right fan in place.
12. Screw in the two 00 Phillips-head screws that secure the left fan in place.
13. Attach the bottom cover, and snap it back into place.
14. To secure the bottom cover, on the bottom of the system, screw the eight Phillips-head screws back into place.

Replacing the battery on the Dell Precision 5680

1. On the bottom of the system, unscrew the eight T5 Torx screws (non-captive screws).
2. Using a plastic scribe, lift and remove the bottom cover.
3. Unscrew the two 00 Phillips-head screws from the battery cable shield cover (captive screws).
4. Remove the battery cable shield cover.
5. Remove the battery cable from the system board.
6. Unscrew the six 0 Phillips-head screws that secure the battery in place.
7. Remove the battery from the enclosure.
8. Insert the new battery into the enclosure.
9. Screw in the six 0 Phillips-head screws that secure the new battery in place.
10. Connect the battery cable to the system board.
11. Apply the battery cable shield cover.
12. Screw in the two 00 Phillips-head screws that secure the battery cable shield cover.
13. Attach the bottom cover, and snap it back into place.
14. To secure the bottom cover, on the bottom of the system, screw the eight Phillips-head screws back into place.

Replacing the storage on the Dell Precision 5680

1. On the bottom of the system, unscrew the eight T5 Torx screws (non-captive screws).
2. Using a plastic scribe, lift and remove the bottom cover.
3. Remove the SSD shield mounting screw.
4. Remove the shield.
5. Remove the SSD device.
6. Insert the new SSD device into the M.2 SSD slot.
7. Attach the SSD shield.
8. Attach the SSD shield mounting screw.
9. Attach the bottom cover, and snap it back into place.
10. To secure the bottom cover, on the bottom of the system, screw the eight Phillips-head screws back into place.

Replacing the heatsink on the Dell Precision 5680

1. On the bottom of the system, unscrew the eight T5 Torx screws (non-captive screws).
2. Using a plastic scribe, lift and remove the bottom cover.
3. In descending order, unscrew the three captive 00 Phillips-head screws that secure the heatsink in place.
4. Remove the heatsink.
5. Insert a new heatsink.
6. Screw in the three captive 00 Phillips-head screws that secure the heatsink in place.
7. Attach the bottom cover, and snap it back into place.
8. To secure the bottom cover, on the bottom of the system, screw the eight Phillips-head screws back into place.

Replacing the fan on the Apple MacBook Pro 16"

1. On the bottom of the system, unscrew the eight non-captive P5 pentalobe screws (proprietary screws).
2. Using a plastic scribe, lift the bottom cover, and pull the bottom case to remove it.
3. Unscrew and remove the two T3 Torx screws that secure the trackpad cable bracket.
4. Remove the trackpad cable bracket.
5. Disconnect the trackpad connector from the board.
6. Peel back the tape covering the battery data connector.
7. Unlatch the battery data cable from the main board.
8. Disconnect the battery data cable from the main board.
9. Peel back the tape covering the battery data cable connector on the battery board.
10. Unlatch the battery data cable on the battery board.
11. Disconnect and remove the battery data cable from the battery board.
12. Unscrew the T5 Torx screw that secures the battery connector.
13. Unscrew the three T3 Torx screws that secure the antenna cable cover.
14. Remove the antenna cable cover.
15. Disconnect the three antenna cables.
16. Unscrew the four T3 Torx screws that secure the display cable covers.
17. Remove the display cable covers.

18. Disconnect the three display connectors from the logic board.
19. Unscrew the nine P2 pentalobe screws that secure the antenna bar in place.
20. Unscrew the six T5 Torx screws that secure the antenna bar in place.
21. Remove the antenna bar.
22. Unscrew the eleven T3 Torx screws that secure the right cable covers in place.
23. Remove the right cable covers.
24. On the right side of the logic board, disconnect the six connectors.
25. Peel back the tape covering the microphone connector.
26. Disconnect the microphone.
27. Unscrew the six T3 Torx screws that secure the left cable covers in place.
28. Remove the left cable covers.
29. On the left side of the logic board, disconnect the three connectors.
30. Peel back the tape covering the keyboard connectors.
31. Disconnect the keyboard cables.
32. Peel back the tape covering the right fan connector.
33. Disconnect the right fan cable.
34. Peel back the tape covering the left fan connector.
35. Disconnect the left fan cable.
36. Unscrew the ten T5 Torx screws that secure the logic board.
37. Unscrew the two 4mm hex screws that secure the logic board.
38. Unscrew the two T6 Torx screws that secure the logic board.
39. Remove the logic board.
40. Remove the fan screw covers.
41. Unscrew the four T3 Torx screws that secure the fans.
42. Unscrew the four T5 Torx screws that secure the fans.
43. Remove the fans.
44. Place new fans.
45. Screw in the four T5 Torx screws that secure the fans.
46. Screw in the four T3 Torx screws that secure the fans.
47. Place the logic board.
48. Screw in the two T6 Torx screws that secure the logic board.
49. Screw in the two 4mm hex screws that secure the logic board.
50. Screw in the ten T5 Torx screws that secure the logic board.
51. Connect the left fan cable, and reapply the tape that covers the connector.
52. Connect the right fan cable, and reapply the tape that covers the connector.
53. Connect the keyboard cables, and reapply the tape that covers the connectors.
54. On the left side of the logic board, connect the three connectors.
55. Place the left cable covers.
56. Screw in the six T3 Torx screws that secure the left cable covers.
57. Connect the microphone cable, and reapply the tape that covers the connector.
58. On the right side of the logic board, connect the six connectors.
59. Place the right cable covers.
60. Screw in the eleven T3 Torx screws that secure the right cable covers.
61. Place the antenna bar.
62. Screw in the six T5 Torx screws that secure the antenna bar.
63. Screw in the nine P2 pentalobe screws that secure the antenna bar.
64. Connect the three display connectors to the logic board.
65. Place the display cable connector covers.
66. Screw in the four T3 Torx screws that secure the display cable covers.
67. Connect the three antenna cables.
68. Place the antenna cable cover.
69. Screw in the three T3 Torx screws that secure the antenna cable cover.
70. Screw in the T5 Torx screw that secure the battery connector.
71. Connect the battery data cable to the battery board.
72. Latch the battery data cable to the battery board.
73. Connect the battery data cable to the main board.

74. Latch the battery data cable on the main board.
75. Connect the trackpad back to the main board.
76. Place the trackpad cable bracket.
77. Screw in the two T3 Torx screws that secure the trackpad cable bracket.
78. Attach the bottom cover, and snap it into place.
79. On the bottom of the system, screw in the eight non-captive P5 pentalobe screws (proprietary screws).

Replacing the battery on the Apple MacBook Pro 16"

1. On the bottom of the system, unscrew the eight non-captive P5 pentalobe screws (proprietary screws).
2. Using a plastic scribe, lift the bottom cover, and pull the bottom case to remove it.
3. Unscrew and remove the two T3 Torx screws that secure the trackpad cable bracket.
4. Remove the trackpad cable bracket.
5. Disconnect the trackpad connector from the board.
6. Peel back the tape covering the battery data connector.
7. Unlatch the battery data cable from the main board.
8. Disconnect the battery data cable from the main board.
9. Peel back the tape covering the battery data cable connector on the battery board.
10. Unlatch the battery data cable on the battery board.
11. Disconnect and remove the battery data cable from the battery board.
12. Unscrew the T5 Torx screw that secure the battery connector.
13. Unscrew and remove the thirteen T5 Torx screws that secure the trackpad.
14. Remove the trackpad.
15. Unscrew the two T5 Torx screws that secure the battery board.
16. Remove the 14 adhesive strips that keep the battery in place. (Note: We could only perform this step on the first of the three times we performed the swap. This step took us 15 minutes. We account for that 15 minutes in the timings for our second and third times completing the swap.)
17. Remove the battery from the enclosure.
18. Insert a new battery into the enclosure.
19. Screw in the two T5 Torx screws that secure the battery board.
20. Insert the trackpad into the enclosure.
21. Screw in the thirteen T5 Torx screws that secure the trackpad.
22. Screw in the T5 Torx screw that secure the battery connector.
23. Connect the battery data cable to the battery board.
24. Latch the battery data cable to the battery board.
25. Connect the battery data cable to the main board.
26. Latch the battery data cable to the main board.
27. Connect the trackpad back to the main board.
28. Place the trackpad cable bracket.
29. Screw in the two T3 Torx screws that secure the trackpad cable bracket.
30. Attach the bottom cover, and snap it into place.
31. On the bottom of the system, screw in the eight non-captive P5 pentalobe screws (proprietary screws).

Replacing the storage on the Apple MacBook Pro 16"

The storage on the MacBook Pro 16" was soldered to the board, so we could not replace it.

Replacing the heatsink on the Apple MacBook Pro 16"

1. On the bottom of the system, unscrew the eight non-captive P5 pentalobe screws (proprietary screws).
2. Using a plastic scribe, lift the bottom cover, and pull the bottom case to remove it.
3. Unscrew and remove the two T3 Torx screws that secure the trackpad cable bracket.
4. Remove the trackpad cable bracket.
5. Disconnect the trackpad connector from the board.
6. Peel back the tape covering the battery data connector.
7. Unlatch the battery data cable from the main board.
8. Disconnect the battery data cable from the main board.
9. Peel back the tape covering the battery data cable connector on the battery board.
10. Unlatch the battery data cable on the battery board.
11. Disconnect and remove the battery data cable from the battery board.

12. Unscrew the T5 Torx screw that secures the battery connector.
13. Unscrew the three T3 Torx screws that secure the antenna cable cover.
14. Remove the antenna cable cover.
15. Disconnect the three antenna cables.
16. Unscrew the four T3 Torx screws that secure the display cable covers.
17. Remove the display cable covers.
18. Disconnect the three display connectors from the logic board.
19. Unscrew the nine P2 pentalobe screws that secure the antenna bar.
20. Unscrew the six T5 Torx screws that secure the antenna bar.
21. Remove the antenna bar.
22. Unscrew the eleven T3 Torx screws that secure the right cable covers.
23. Remove the right cable covers.
24. On the right side of the logic board, disconnect the six connectors.
25. Peel back the tape covering the microphone connector.
26. Disconnect the microphone.
27. Unscrew the six T3 Torx screws that secure the left cable covers in place.
28. Remove the left cable covers.
29. On the left side of the logic board, disconnect the three connectors.
30. Peel back the tape covering the keyboard connectors.
31. Disconnect the keyboard cables.
32. Peel back the tape covering the right fan connector.
33. Disconnect the right fan cable.
34. Peel back the tape covering the left fan connector.
35. Disconnect the left fan cable.
36. Unscrew the ten T5 Torx screws that secure the logic board.
37. Unscrew the two 4mm hex screws that secure the logic board
38. Unscrew the two T6 Torx screws that secure the logic board.
39. Remove the logic board.
40. Unscrew the four T5 Torx screws that secure the tension brackets to the logic board.
41. Remove the tension brackets.
42. Lift the logic board from the heatsink.
43. Place logic board on new heatsink.
44. Place the tension brackets.
45. Screw in the four T5 Torx screws that secure the tension brackets to the logic board.
46. Place the logic board.
47. Screw in the two T6 Torx screws that secure the logic board
48. Screw in the two 4mm hex screws that secure the logic board.
49. Screw in the ten T5 Torx screws that secure the logic board.
50. Connect the left fan cable, and apply the tape to cover the connector.
51. Connect the right fan cable, and apply the tape to cover the connector.
52. Connect the keyboard cables, and apply the tape to cover the connectors.
53. On the left side of the logic board, connect the three connectors.
54. Place the left cable covers.
55. Screw in the six T3 Torx screws that secure the left cable covers.
56. Connect the microphone cable, and reapply the tape to cover the connector.
57. On the right side of the logic board, connect the six connectors.
58. Place the right cable covers.
59. Screw in the eleven T3 Torx screws that secure the right cable covers.
60. Place the antenna bar.
61. Screw in the six T5 Torx screws that secure the antenna bar.
62. Screw in the nine P2 pentalobe screws that secure the antenna bar.
63. Connect the three display connectors to the logic board.
64. Place the display cable connector covers.
65. Screw in the four T3 Torx screws that secure the display cable covers.
66. Connect the three antenna cables.
67. Place the antenna cable cover.

68. Screw in the three T3 Torx screws that secure the antenna cable cover in place.
69. Screw in the T5 Torx screw that secures the battery connector.
70. Connect the battery data cable to the battery board.
71. Latch the battery data cable to the battery board.
72. Connect the battery data cable to the main board.
73. Latch the battery data cable to the main board.
74. Connect the trackpad back to the main board.
75. Place the trackpad cable bracket.
76. Screw in the two T3 Torx screws that secure the trackpad cable bracket.
77. Attach the bottom cover, and snap it into place.
78. On the bottom of the system, screw in the four non-captive P5 pentalobe screws (proprietary screws).

Replacing components on the desktops

Replacing the fan on the Dell OptiPlex Micro 7010
1. On the back of the system, unscrew and remove the single thumb screw.
2. Slide off the side panel of the system.
3. Un-route the speaker cable from the fan.
4. Press the two latches that secure the fan, and lift up the fan from the housing.
5. Disconnect the fan cable from the system board.
6. Connect the new fan's cable to the system board.
7. Place the fan back into the housing, and make sure is securely in place.
8. Route the speaker cable through the fan housing.
9. Slide on the side panel of the system.
10. To secure the side panel, screw the single thumb screw into the back of the system.

Replacing the memory on the Dell OptiPlex Micro 7010
1. On the back of the system, unscrew and remove the single thumb screw.
2. Slide off the side panel of the system.
3. Un-route the speaker cable from the fan.
4. Press the two latches that secure the fan, lift up the fan from the housing, and set it aside.
5. Press the latch that secures the speaker, remove the speaker, and set it aside.
6. Release the latches that hold the RAM in place.
7. Remove the RAM from the memory slot.
8. Insert a new RAM into the memory slot.
9. To secure the RAM into place, press down on it.
10. Place the speaker back into the housing, and make sure it is securely in place.
11. Place the fan back into the housing, and make sure it is securely in place.
12. Route the speaker cable through the fan housing.
13. Slide on the side panel of the system.
14. To secure the side panel, screw the single thumb screw into the back of the system.

Replacing the storage on the Dell OptiPlex Micro 7010
1. On the back of the system, unscrew and remove the single thumb screw.
2. Slide off the side panel of the system.
3. Unscrew the single Phillips-head screw that secures the SSD in place.
4. Remove the SSD.
5. Insert a new SSD into the slot.
6. Screw in the single Phillips-head screw that secures the SSD in place.
7. Slide on the side panel of the system.
8. To secure the side panel, screw the single thumb screw into the back of the system.

Replacing the wireless card on the Dell OptiPlex Micro 7010

1. On the back of the system, unscrew and remove the single thumb screw.
2. Slide off the side panel of the system.
3. Unscrew the single 0 Phillips-head screw that secures the plastic wireless card bracket.
4. Remove the plastic wireless card bracket.
5. Disconnect the two antennae from the wireless card.
6. Remove the wireless card.
7. Insert a new wireless card into the slot.
8. Connect the two antennae to the new wireless card.
9. Place the plastic wireless card bracket back into place.
10. Screw in the single 0 Phillips-head screw that secures the wireless card bracket.
11. Slide on the side panel of the system.
12. To secure the side panel, screw the single thumb screw into the back of the system.

Replacing the fan on the Apple Mac mini

1. Using a plastic scribe, lift and remove the plastic bottom cover.
2. Unscrew the six Torx T6 screws that the antennae plate.
3. Slightly move the antenna plate over, and unscrew the single Torx T6 screw that secures the bracket holding the antenna plate antenna to the board.
4. Disconnect the antennae plate antenna.
5. Remove the antenna plate.
6. Unscrew the four Torx T5 screws that secure the fan in place.
7. Lift the fan, and disconnect the fan cable from the system board.
8. Connect the new fan cable to the system board, and place the new fan into the housing.
9. Screw in the four Torx T5 screws that secure the fan.
10. Connect the antennae plate antenna back to the system board.
11. Screw in the one Torx T6 screw to secure the bracket holding the antenna plate antenna to the board.
12. Place the antenna plate back in place.
13. Screw in the six Torx T6 screws that secure the antenna plate in place.
14. Place the plastic bottom cover, and snap it back into place.

Replacing the memory on the Apple Mac mini

The memory on the Mac mini was soldered to the board, so we could not replace it.

Replacing the storage on the Apple Mac mini

The storage on the Mac mini was soldered to the board, so we could not replace it.

Replacing the wireless card on the Apple Mac mini

The wireless card on the Mac mini was soldered to the board, so we could not replace it.

Replacing components on the all-in-ones

Replacing the fan on the Dell OptiPlex AIO 7410

1. Press and hold down the tab that secures the stand to the display, and remove the stand.
2. Press down on the tab that secures the back cover, and lift off the back cover.
3. Unscrew the six 2 Phillips-head screws that secure the system board shield in place.
4. Remove the system board shield.
5. Unscrew the three 2 Phillips-head screws that secure the fan.
6. Disconnect the fan cable from the system board.
7. Un-route the fan cable.
8. Remove the fan.
9. Insert a new fan.
10. Route the fan cable.
11. Connect the fan cable to the system board.
12. Screw in the three 2 Phillips-head screws that secure the fan.
13. Place the system board shield.
14. Screw in the six 2 Phillips-head screws that secure the system board shield.
15. Place and secure the back cover.
16. Secure the stand.

Replacing the memory on the Dell OptiPlex AIO 7410

1. Press and hold down the tab that secures the stand to the display, and remove the stand.
2. Press down on the tab that secures the back cover, and lift off the back cover.
3. On the system board shield, remove the DIMM door.
4. Release the latches holding the RAM.
5. Remove the RAM from the memory slot.
6. Insert the new RAM into the memory slot.
7. To secure the RAM into place, press down on it.
8. Place and secure the DIMM door on the system board shield.
9. Place and secure the back cover.
10. Secure the stand.

Replacing the storage on the Dell OptiPlex AIO 7410

1. Press and hold down the tab that secures the stand to the display, and remove the stand.
2. Press down on the tab that secures the back cover, and lift off the back cover.
3. Unscrew the six 2 Phillips-head screws that secure the system board shield.
4. Remove the system board shield.
5. Unscrew the two 2 Phillips-head screws that secure the I/O cover.
6. Remove the I/O cover.
7. Unscrew the 0 Phillips-head screw securing the SSD.
8. Remove the thermal pad on the SSD.
9. Remove the SSD from the M.2 slot.
10. Connect the new SSD into the M.2 slot.
11. Apply the thermal pad onto the SSD.
12. Screw in the 0 Phillips-head screw that secures the SSD.
13. Place the I/O cover.
14. Screw in the two 2 Phillips-head screws that secure the I/O cover.
15. Place the system board shield.
16. Screw in the six 2 Phillips-head screws that secure the system board shield.
17. Place and secure the back cover back into place.
18. Secure the stand back into place.

Replacing the wireless card on the Dell OptiPlex AIO 7010

1. Press and hold down the tab that secures the stand to the display, and remove the stand.
2. Press down on the tab that secures the back cover, and lift off the back cover.
3. Unscrew the six 2 Phillips-head screws that secure the system board shield.
4. Remove the system board shield.
5. Unscrew the 0 Phillips-head screw that secures the plastic wireless card bracket.
6. Remove the plastic wireless card bracket.
7. Disconnect the two antennae from the wireless card.
8. Remove the wireless card.
9. Insert a new wireless card into the slot.
10. Connect the two antennae to the new wireless card.
11. Place the plastic wireless card bracket.
12. Screw in the 0 Phillips-head screw that secures the plastic wireless card bracket.
13. Place the system board shield.
14. Screw in the six 2 Phillips-head screws that secure the system board shield.
15. Place and secure the back cover.
16. Secure the stand.

Replacing the fan on the Apple iMac

The only way to get to the fan on the iMac was to go through the screen, breaking the seal between the screen and the rest of the display. We felt it was possible that we would irreparably damage the screen by doing this, so we chose not to attempt it.

Replacing the memory on the Apple iMac

The memory on the iMac was soldered to the board, so we could not replace it.

Replacing the storage on the Apple iMac

The storage on the iMac was soldered to the board, so we could not replace it.

Replacing the wireless card on the Apple iMac

The wireless card on the iMac was soldered to the board, so we could not replace it.

Read the report at https://facts.pt/5rBySJ6 ▶

This project was commissioned by Dell Technologies.