Right To Repair submission to the Australian Productivity Commission

The time is right for change - we have a Right To Repair

Prepared by Peter Newman 29 July 2021

In regard to advocating changes to Right To Repair (RTR) there are many different facets depending on one's area of interest/concern.

My specific area of interest is MacBook laptop computer repair, but I am sure that this carries over into all different brands and types of consumer electronics. Macbooks are by far the most repaired laptops because of their extremely high initial cost.

In times past, manufacturers would actually supply a circuit schematic, that was attached to the inside of the back panel of televisions and many other electrical appliances sold for domestic use. In the 1960's it was common for people to remove the vacuum tubes from their TV and radio sets, take them to the local store where there was a tube tester (1) They could then test the tubes there, and also buy new ones to replace any ones that were faulty. This was a common and widespread practise. These days there is no such technical information like schematics or other literature available for the electronic goods that we own. Repair technicians and even the general public are forced to rely on illegally obtained schematics and boardviews that are either sold (2) or freely distributed online for the use of repair technicians. By way of explanation there are two files that repair technicians need to effect satisfactory and cost effective/safe repairs.

- Circuit schematics (3) are an electronic map that shows the electrical values and part numbers of all the components on a circuit board. It shows how they all connect together, and without them it can be extremely difficult to impossible to diagnose and repair these devices. Devices that we paid for and own, and have every right to repair by whoever we choose.
- Boardviews are pictorial representations of the physical location of all components of a circuit board and also show how they all connect together. They too are essential in affecting repair of these devices, and are ideally used in conjunction with software designed for this purpose. The most popular being FlexBoardView (FBV), extensively developed/improved by Australian Paul Daniels (4) from an open source project called OpenBoardView. This aids the technician in locating components on the PCB to satisfactorily affect repair.

Having a basic to moderate understanding of how the computer works, these two files are critical to allowing diagnosis and subsequent repair of the computer. For example a good amount of this repair work is checking voltages at specific places within a circuit. The schematic is referenced to see how all the components connect together. The boardview shows the physical relation of all these components on the circuit board. As such, both schematic and boardviews are critical to performing effective repair.

A common argument used by manufacturers is that these two files (schematics and boardviews) are the manufacturer's intellectual property and that they would somehow allow a competitor to create a

facsimile of the circuit board that they relate to. This is not true. If one was to take the time, and an immense amount of time, one could conceivably draw the schematic out by probing the logic board to work out and map all the connections. The information is there, and by extension when we buy that MacBook we have access to the means (theoretically) to draw that map. Of course this is totally unrealistic but I am just saying that it is theoretically, although not practically possible.

There is quite a bit of confusion in relation to this family of files prefixed by the word board. When a circuit board is first designed a CAD (Computer Aided Design) software package is used. A schematic is drawn in this program and then a board file is generated within that software CAD package. When the project is ready to submit to a PCB (Printed Circuit Board) fabricator, a Gerber file is generated within this software. This is the machine file that is used to control the PCB manufacturing process. The schematic file (in PDF format not CAD format - two different things) and boardview (as opposed to CAD board file) cannot be used to generate a Gerber file to facilitate manufacture of the PCB. This is a differentiation that is conveniently overlooked by manufacturers as they try and confuse the issue by perpetuating untruthful scenarios. They cloud the issue under the mistaken guise of intellectual property and security concerns.

In summary, PDF schematics and boardview files do not allow someone to manufacture a computer logic (mother) board. They purely show the physical position of all components so that the technician can switch between the circuit schematic and the boardview to help diagnose the problem, in order to repair the circuit board.

Quote from Valley Service Electronics “PCB manufacturer - Gerber files are open ASCII vector format files that contain information on each physical board layer of your PCB design. Circuit board objects, like copper traces, vias, pads, solder mask and silkscreen images, are all represented by a flash or draw code, and defined by a series of vector coordinates. These files are used by PCB manufacturers to translate the details of your design into the physical properties of the PCB” (5)

Paul Daniels the creator of FBV, the preferred software of MacBook repair technicians, put it much more succinctly than I can. Here are Paul’s thoughts on this particular differentiation in the files that are required.

“The reason boardfiles like the Testlink/Landrex (and by extension FBV files)BRD files aren't any good for cloning a PCB is because they contain only a very limited subset of information, specifically there's just two sets;

1) pin data, each pin has pin number, associated part, location (x,y) and network name.

2) outline data of the PCB, IE, physical outline.

The data is insufficient to build a PCB because it lacks part footprints, inner layers, routing/PCB-traces and all data associated with the traces/routing including thickness, length and shaping for ensuring proper timing and impedance control, of which on modern machines, lacking that will result in a nonfunctional board.

Gerbers are different again, they're just vector art/drawings and contain no information about parts/pins; we do not require Gerbers

The trouble with the term "boardview" file or "design file" is that naturally the manufacturers will immediately presume "full PCB design file with all the layer data"; this is not what we require, we only need the simplified Testlink/Landrex/FBV type board files which contain the absolute minimal data used only for diagnostics.

Being able to make the clarification of terminology will be paramount, else the tech corporations will drive that "full design file" angle of which will result in any reasonable "judge" (as in arbitrator of any legislative change to the RTR status quo) siding with them.

Eagle files are of course design files; so we don't want those levels either.

Our brd files are a logical mapping of the schematic in to a physical plane.

A parallel would be asking a car maker for their CAD files vs the exploded views and bolt placements"

The easiest and most cost effective way of obtaining replacement components is by the use of old logic boards called donor boards (6) Repair technicians us these boards as a source of generic parts, made by a variety of manufacturers and not limited in supply It can be hard to buy the vast number of different electrical values of these parts, so the use of old logic boards that are commonly called donor boards is widespread and the most cost and time effective method of electronic parts procurement for many parts on the board. These parts because of their ready availability are not a concern to us.

However some components have proprietary firmware embedded into them and the only way to procure replacement parts is by removing and reusing one from a donor board. On the whole this firmware is purely for functional, not security purposes. We would request that we have access to this non security firmware to effect repair of devices. From 2018 on Apple used a security chip called the T2 (7). I will not go into the function of this chip and associated systems but they do appear to be partially for security purposes (iCloud lock associated with find my Mac) but also have other non-security implications when it comes to the replacement of parts. Strangely enough this T2 seems to have allowed some security vulnerabilities which is interesting to say the least (8) This is called serialisation (9) and in most cases makes the substitution of a faulty part with a genuine Apple part, new or from another machine very problematic for owners and repairers. This effectively "marries" parts of the computer to one another for no good reason other than to possibly force an owner into taking their machine to Apple to have annoying pop up messages removed or in worst case scenario, limiting/stopping the correct functioning of the machine. There are as far as we know no security reasons why this should have been implemented.

Manufacturers such as Apple, specifically tell the manufacturer of some vital components (ISL9240 and CD3217) not to sell any of them to anyone outside Apple (10) (11). These are purely voltage control components with no firmware that we are aware of. This leaves two sources of supply for these two components. First being another usually damaged beyond repair donor board, which are in short supply,

seeing as these components typically did not begin to be used until around 2018 machines. In the case of one of these components, technicians are forced to buy another product that has this chip in it, disassemble the product to extract the $5 -10 component (12) and then have no use for the battery and myriad of other components in said product. So spend up to $189 AUD (13) to procure a $5 - 10 chip and add considerable time to procure a common, non-security related part to affect the repair. What a waste of resources and generation of needless E-waste for no good reason.

In regard to these growing mountains of E-waste see here. Source Planet Ark - In 2007/08 an estimated 16.8 million computers and televisions reached the end of their useful life in Australia (14) This amount can be reduced by the reclamation of unserviceable devices which also allows potential employment of a technical nature for interested parties.

Thank you for taking the time to read my thoughts on this important discussion. The time is right for change - we have a Right To Repair.

Footnotes

(1) https://www.earlytelevision.org/drug_store_tube_tester.html

(2) https://www.ebay.com/itm/113625718473

(3) https://www.nwengineeringllc.com/article/what-is-a-circuit-schematic.php

(4) https://pldaniels.com/flexbv/

(5) https://www.vse.com/blog/2019/10/29/gerber-files-explained-understanding-their-role-in-pcb-manufacturing/

(6)https://www.aliexpress.com/wholesale?catId=0&initiative_id=SB_20210719175313&SearchText=macbook+logic+boards+broken

(7) https://en.wikipedia.org/wiki/Apple_T2

(8) https://www.forbes.com/sites/ewanspence/2020/10/06/apple-macos-t2-security-exploit-mac-macbook-air-macbook-pro/?sh=19b31163676b

(9) https://therestartproject.org/podcast/smartphone-serialisation/

(10) https://www.youtube.com/watch?v=HJ2jyo7pAmE

(11) https://www.youtube.com/watch?v=G0pFVNNqZwQ

(12) https://www.youtube.com/watch?v=JLIWDKA-1Tw

(13) https://www.apple.com/au/shop/product/MU7M2ZA/A/iphone-xr-smart-battery-case-black?afid=p238%7CsJWJVHlpe-

dc_mtid_18707vxu38484_pcrid_339469667714_pgrid_75111492424_&cid=aos-au-kwgo-pla-btb--slid---product-MU7M2

(14) https://recyclingnearyou.com.au/computers/