Notebooks

Notebooks/ Laptops

December 2019 update

Notebook processors change continually, with pendulum swings from "lower power consumption" to "higher speed and capacity." However, the mid-higher-functioning processors of 2019 have power requirements similar to the low-end processors that were recommended for low-power language work in 2014-16. This is good, since language software has become more processor-hungry as well.

What to consider when choosing a laptop for use in low-power situations:

- Processor: I compared several laptops in a quick speed test—(I timed opening Paratext 9 with the same complex screen arrangement on each), and I measured power consumption also.
    - For "advanced" translation or language work, using Paratext 9-Fieldworks-Logos, I recommend **at least 8GB RAM** and an **i3 or i5** 8th-gen laptop processor; or a **Ryzen 3 or 5**. My Lenovo E495 (AMD **Ryzen 5 3500U**) and a similar Lenovo with Intel **i5-8250U** perform very similarly. These two processors used at least 30% less power than the older Lenoxo X131E machines that were recommended for several years.
    - For more basic translation or language work a **Lenovo 14W** with 4GB RAM and AMD A6-9220C processor performed a bit more slowly in my test. Or an older **N43xx** processors are even slower but adequate, and they use about 30% less power than the "5" processors above. Paratext 8 and 9 seem very slow, but read on for a tip.
    - *Important note about Paratext 8 and 9:* ***Turning off all internet access speeds up Paratext significantly!*** *Internet is required to register new users and projects or change project properties, and for send/receive operations. It can be turned off for everyday editing and checking operations.*
- Screen size still affects total power consumption: but price seems to be inversely proportional to screen size this year, except for some 11-in laptops with older N4xxx processors. With 14-15" screens available at lower prices than smaller ones, and with more translation resources available through Paratext 9, I feel that 14-inch (diagonal) screens are the sweet spot for laptops designed for language work.

January, 2018

Changes:

- Added new development with 15 inch models that are still low power, particularly the new 2018 Lenovo IdeaPad 32 model. built around Intel N-series processor family. These are still fast processors with the "turbo mode" which automatically "kicks in" when needed.

Note: *References to power, in watts, refers to average power consumption for a device with wifi turned on, and the display screen "half-bright". Display screens with full brightness usually add one more watt of power, which is a significant percentage for an already low-power consuming device.*

Guidelines for 2017-2018

The 2017 model year saw a bumper crop of suitable machines to purchase that were "low power consuming". Why? Because many of the models were based on Intel's new (2015) "Bay Trail" technology which had smaller geometries that translated into several processor types that were even less power hungry than ever before. Then by 2016, companies like Lenovo, Dell and Asus started placing them inside their boxes for sale.

Year 2016 popular models, like the Lenovo x140e were pushing 8-9 watts for comparison purposes here. These models are no longer for sale anyway. In the labs we easily sustained this type with a 55 watt solar panel, and sometimes we ran such computers for 16 hour work-days. The target for SCOS is a **sustained 8 working hours**.

Basically if you want astounding and awe-inspiring "low power" performance, then look for these processor models inside the box: **Intel N3700, N3050, N3150** (2015) These will be running at around 5 watts.

If you want good low power that still is amazing compared to last year's (say as found in the defunct Lenovo x140e): **Intel N2940, N3540, N3530** (2014) These notebooks/ laptops will be running around 7.0 watts.

And if you want "**flea power**" and **yet still have processor speed**, go for the fabulous **Intel M-5Y10c** or **M3-6Y30** processors, which we can now recommend. Evidently these have two speed modes, both 0.8 and 2.0 Ghz and in a recent field test by Kim Blewett comparing Lenovo 11e models but with different processor types, she reports that the M-5Y10c **was significantly faster** while doing a standard test under FLEx (SIL Linguistic Software), than other processors in the same 11e type machine. That is remarkable really, and welcome.

Also, for Linux users there are no reported issues under Ubuntu 16.04 and derivative OSs, as there has been reported by the N2940 box. This M-5Y10c processor should run well on a amazingly small 20 watt solar panel. Overall notebook power: **~3.6 watts** (Lab observed; Intel TDP is 4.5 watts) Go for a mere **20 watt solar panel** on this one. If significant village social pressures to "leech" power, then go for 30 watts.

Amazon Store: Lenovo with M-5Y10C processor[1]

By 2017 there was consider interest in "tablets as computers" which meant even lower power for fan-less slate-type devices that may or may not have an external keyboard. The Asus Transformer Book below, is an example.

Now the caveats: You should purchase a box with 4GB RAM.... so you are going to find other models for sale ($150-200) that are only 2GB RAM and much less expensive to purchase. Some boxes have the memory soldered on the motherboard and you cannot expand the memory. Others have modular memory modules that might allow expansion to 8 GB. FLEx users (SIL Linguistic software) are going to want that for heavy linguistic work. If you are thinking Paratext (UBS/SIL) and Word Processing applications then go for 4 GB minimum.

We are **no longer limited to 11 inch screen sizes**. We suspect that a 14 inch model with any processor above, is not going to be significantly higher power than any 11 inch model. Screen size is almost a "religious" like experience for some users. Note the Asus 14 inch Vivobook, far below. We tested one such unit in the labs and were able to confirm it's low-power consumption. In 2017 Lenovo sold a 15 inch notebook with the N3060 processor, listed below.

CPU Summary:

Modern CPUs and expected system wattage

Year	CPU	Typical Wattage	Speed (Ghz)	Cores
2014	N2940	6.1	1.83	4
2014	N3530	6.1	2.16	4
2014	N3540	6.1	2.16	4
2014 ?	M-5Y10C	3.7	0.8 / 2.0 (Turbo)	2
2015	N3050	4.9	1.6	2
2015	N3150	4.9	1.6	4
2015	N3700	4.9	1.6	4
2015	M3-6Y30	3.6	0.9/ 2.2 (Turbo)	2
2015	x5-z8500	2	1.44	4
2016	N3060	4.9	1.6/ 2.5 (Turbo)	2
2016	N3160	4.9	1.6/ 2.5 (Turbo)	4
2016	N3350	4.9	1.1/ 2.5 (Turbo)	2
2016	N4200	4.9	1.1/ 2.5 (Turbo)	4

Note: Processors manufacturered in 2015 arrive in notebooks for sale in the year 2016; 2016 processors in 2017

Special Note to Paratext Users: Don't ignore the M series of Intel processors here. When heavy processing like a Paratext Interlinear is required, turbo mode kicks in and actually beats the times of more expensive processors. Meanwhile for normal operations the box runs cool, without a fan, and waits for keypresses and for the user to think. That's most of the time. Same for the 2016 processors with their "turbo" mode.

2018: Breaking the 15 inch Barrier

The Lenovo IdeaPad 320 15 inch Notebook

Click to Enlarge Image

If the goal is to empower third-world, local-level church workers, well trained in Bible Translation skills, software, and back-translation methodologies, then you want to look below. Those smaller units are sometimes less expensive, and more affordable... at least for national ownership.

However, many expatriate workers are also looking for low-power solutions now for their work. These users are particularly interested in FLEx applications and also Paratext with many, many child windows open on a single desktop. They immediate ask for a 14 inch or 15 inch notebook display size.

Enter the year 2018, where we finally see such a box and with an ultra-low power consuming Intel processor. Note that "low power" consumption does not necessarily equate to "slow" anymore due to the N-series and the brilliant "turbo" mode. This indeed kicks in under Paratext while doing any CPU intensive work, such as building a new Interlinear of present vernacular text.

CPU: This box has the newer Intel **N3350** processor (Amazon.com) and **N4200** processor (Lenovo.com) and runs around **5 watts** using Paratext/ Word Processing. Approximate size of solar panel required: 30 watts (Calculated; not yet observed) An independent observer reported a true usable power in the field, of around **6.5 watts**, which could be due to the larger, 15 inch screen. We have yet to test one of these in the labs, however, even at 6.5 watts, a 30 watt solar panel from GTIS and a Half-Pint (72 Wh) 12v system will be sufficient. Note: do not order the Intel iCore variant if you want "low power consumption" on solar power. There is also the highly prized **Anti-Glare Display** (1366x768) which third-world village level workers (particularly expats) would "die for".

Price: $269-$300

See: Lenovo Store[2] Special Note: Do not opt for the iCore processor option if you want ultra-low power consumption

And: Amazon Store[3] Special Note: 4GB Ram, however a **1TB HD** included

2017: The Asus T100HA "Transformer Book"

Click to Enlarge Image

This amazing transformer book class machine is typical of many models produced by ASUS company. The one tested in the labs is officially called the T100HA-C4-GR and is special in that it has a very low power processor running about 2 watts (!) and is charged via a standard USB 5v charging cable. Suddenly a host of inexpensive, fold out solar panels with USB regulators can be used with varying amounts of success, so be warned. We will recommend here as the best so far found in the labs: the Dragon-X 20 watt solar panel. All such equipment can be purchased on amazon.com

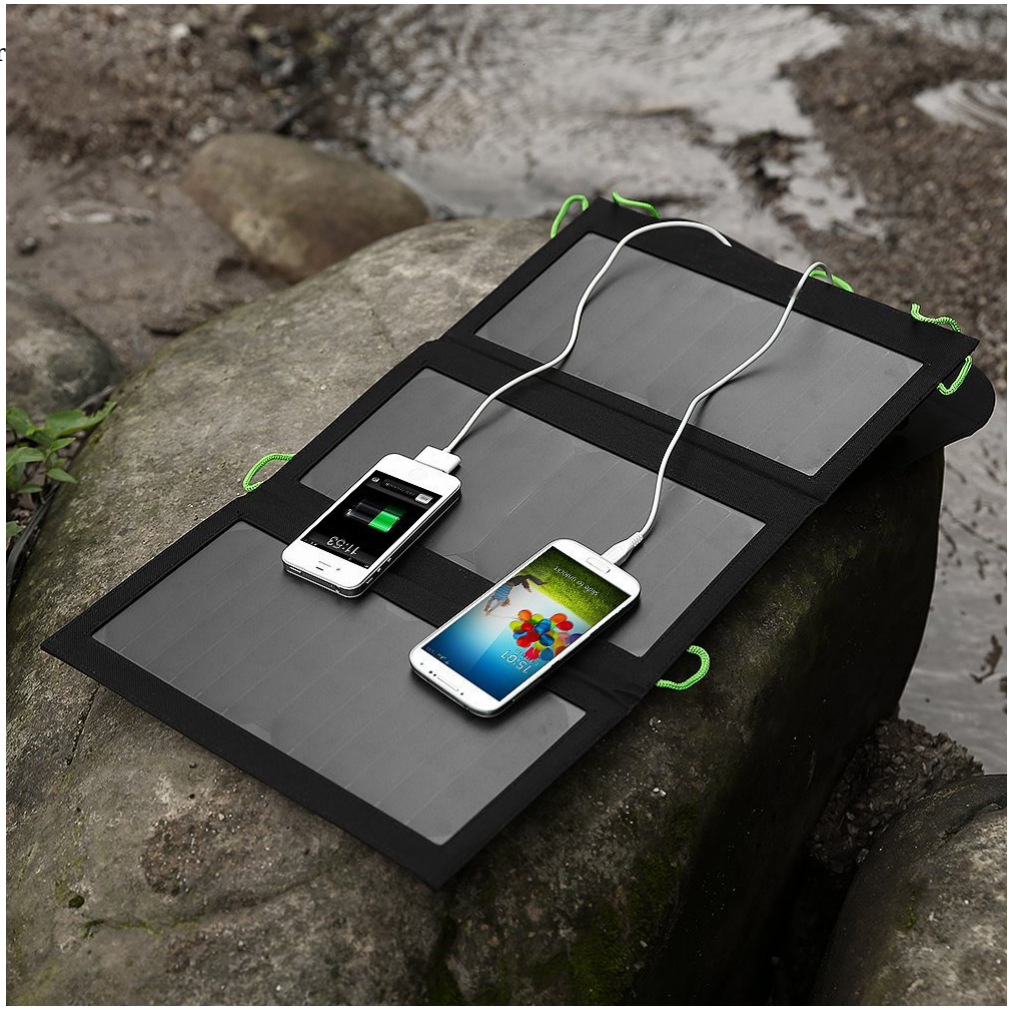
The T100HA-C4-GR is special in the ASUS standard offerings in that a full 4 GB of main memory was on board, which many feel is the optimum point for Paratext sotware users. We have not tried running Paratext in 2 GB of main memory which many, many Windows class tablet/ keyboard systems utilize. It is strongly encouraged to look for a 4 GB tablet/ transformer unit for your work.

There is considerable discussion and notes for the solar panel requirements for such a "direct connect" venture, so we will merely state that it is probably a good idea to puruse the solar section in this handbook before purchasing the solar panel part. Basically, not all solar panels with USB regulators are made alike and you have to try them out, before purchasing to make sure that they work with your particular device to charge, whether it be a smart-phone, iPhone, tablet, or transformer type machine. Details are in the solar panel section[4]. The short explanation is that USB technology has a special "PD power specification" that goes beyond simply stating USB v 2.0 and USB 3.0 devices. The USB power standards are there; it's just that power delivery can be complicated within the normal specification.

Field User Scenario: We are saying that we expect the user to work in the field for a typical 8 hour day, where some of the hours could be at night time. With the typical run time of this machine around 12 full hours, we can easily reach this goal with the internal 30 Wh battery inside the box. This then leads to the question of when to recharge in the typical daily work cycle. Obviously it's advantageous to recharge when the sun is most shining, from 10 a.m. to 2 a.m. The water-proof, 20 Watt Dragon-X fold out panel will easily "turn-on" in cloudly conditions, but due to the USB Power Distribution issues (see solar panel section[5]) at a slower rate than the standard ASUS power brick. The output charge current of the panel is more like 1.1 amps instead of 2.0 amps, but at least it is steady even in overcast conditions.

Click to Enlarge Image

But the general rule of thumb here is "2 for 1" usage to recharge rate. So for example if you used the machine for 4 hours of work last time, then expect the recharge time with the machine lid closed, to be 2 hours to regain the energy used. The four hour period from 10 a.m. to 2 a.m. wouid then translate out to 8 hours of "work energy" for the user.



Now if this is all too constraining for the user then facilitator/ advisor for such projects could include a smallish "power bank" as an option, to augment the charge cycle. All that is required is a 12,000 mAh or greater power bank and there are dozens of suppliers of such devices on the market right now. In the selection of a suitable power bank, better, but not necessary, is one that delivers a full 2.0 amp charge output to charge an external device, so look for that characteristic in the specs. So for the added cost of a small power bank, the user could then work during the day-time independent of the solar panel charging the power brick by day. At night, while the user finished work and went to sleep the transformer book, could be recharged from the energy stored in the power brick. This process is repeated the next day. Note that one does not need a long USB cable in either scenarios above.

BUT we must hasten to add here that the **power brick scenario is not necessary**. One can save the additional cost of the power brick. The power brick is totally optional. One can indeed "direct connect" the solar panel to the transformer book, and recharge the device directly, but obviously you must do this procedurally during the day, even in cloudy weather (which still works).

Weatherproof: Many of the solar panels sold are constructed with a water-proof, PET material, and probably do well in the rain. However, the better panels place the electronics behind one fold out section, covering and shielding that part from weather, and often there is a pocket to place your phone or power bank behind. The ASUS transformer book device, will need a roof eave, or plastic tent supplied by the user for this to work out. Or one can place underneath the solar panel, itself. It is not recommended to leave the Asus transformer device outside unattended, or unprotected from the elements. Actually this goes for most devices, including phones.

Intel x5-Z8500 quad-core processor. Approx. **2 watts** Tested in field with Paratext

Amazon.com ASUS Transformer Book[6] ~US$ 300

Amazon.com Dragon-X 20 W Fold-Out Solar Panel[7] US$ 50 or SoKoo 22 W panel[8]

Amazon.com Anker 2 Meter, USB cable[9] US$ 10

Amazon.com Optional ToHLo 20K Power Bank[10] US$ 26 or RAVpower 16K Power Bank with Light[11] US$ 30

2016: Lenovo Netbooks Preferred

Presently the recommended line of low-power consuming **notebooks** are the Lenovo Brand. The 2015 year's model of choice was the Lenovo x140e models, but that line was discontinued in 2016. Nowadays the best choice appears to be the Lenovo 11e machines. An example would be found below.

The Lenovo 11e inch model still sports a full RJ-45 ethernet port and normal HDMI port which might be advantageous to some. Wifi is included of course, but not with the new "ac" standard. Lenovo, like Dell makes several different "flavors" of 11e models so you need to be careful with the specifications if you purchase on Amazon.com for these units. For example, normally a Paratext software user would want a minimum of 4GB of RAM. A solid state drive (SSD) would be preferred over a mechanical rotating drive, but the latter offers significantly more storage if that is imporant. For Bible Translation and Language Development tasks a 128 GB SSD drive should be more than enough to purchase.

All newer 2016 11 inch models are now 64 bit processors, and every new machine uses the EUFI boot process, so beware if you are used to the older BIOS method of booting a machine from a USB stick. This has a bearing on future Wasta-Linux users, who install by booting up on a USB memory stick. It all works, but the boot process is different.

Note to Linux users: As of this writing (June, 2016) there appears to be a problem with Ubuntu 16.04 and derivatives, where the machine can lock up, related to the graphics processor on-board. This only seems to be a problem with designs based on the Intel N2940 processor and now witnessed with a N3540 machine. One fix was applied setting a flag at boot time, but the power consumption rises about 0.6 watts. If you are content with Wasta 14.04 there will be no problems. Newer models with even lower power consumption based on the N3700 and the N3050, have so far not reported any problems. Watch out for this with on-line purchases, for example the Lenovo 11e, which can have old or new processors and even AMD processors in the box.

Where do I Purchase a Notebook?

Eleven inch notebooks are pretty ubiquitous now, and there are several makes and models that qualify for ultra-low power. However, any store will really do, and many stores advertize on Amazon.com.

Be sure to work with a reputable store with 4 or 5 star ratings, and hopefully that you have worked with before: Good companies include: buy.com, bestbuy.com, newegg.com, frys.com, beyond amazon.com if you are so inclined. Also any major office supply store, dell.com, tigerdirect.com, mwave.com and B & H Photo. There are others of course. Also look for deals that include extra installed main memory, especially if you are doing Windows and not Linux. You will notice that most of the stores carry the same makes and models, and it's really all about price point as they compete for your dollars.

11 Inch Lenovo 11e

Lenovo 11e Model

An amazingly low powered box, and still not the lowest to be found today. It has the Intel **N3150** processor and runs around **5 watts** using Paratext/ Word Processing. The overal construction of these boxes seems stronger, at least in appearance, to the Dell and Asus models below, but they are heavier to carry. Approximate size of solar panel required: 30 watts (Calculated; not yet observed)

Price: $320

See: Lenovo Store[12]

And: Amazon Store[13] Special Note: 8GB RAM included $316

Highly Recommended:

And for the **M-5Y10C variant** which could be running at **3.6 watts**. Solar panel required: 20 watts (Lab observed)

Price: $370

See: Amazon Store[14] Note: Might have search around for this one

But the Amazon link might have changed by the time you read this. Just search "Lenovo 11e" under Amazon search bar. Be sure to check for the processor model inside the box of purchase, as not all Lenovo 11e models are made the same. I have now counted at least **4 different processor types found in the 11e series**. (Same with Dell line as well... beware!) **Always check the processor model number, before you purchase**.

11 Inch Dell Inspiron 3000 series

We have had very good success with an older Inspiron 3000 series (Model 3147) with the N3540 processor, however, we note that the Dell store now sells something similar but with a newer N3700 quad-core processor. It being a 2-in-1 model it has an advantage in a non-soldered RAM memory module, so if you purchase the 2GB RAM model from Dell, you should be able to expand to 4GB easily in the field. The touch-screen interface might be desireable, but some may still prefer a mouse and the touch-screen does not matter. The screen is glossy however, and for some that is a severe distraction in the village. The main advantage of this line over a similar non-touch screen Dell line, appears to be the easy RAM memory upgrade with a RAM module

socket. The other line has RAM soldered on the motherboard.

In the USA one can purchase in stores and units can be found with 4GB RAM preinstalled, commonly at $349. One older model purchased at the MicroCenter store, in Northern VA. has been tested. The older processor type was N3540 and runs at about **6 watts**. The newer N3700 should run at a mere **5 watts**. Approx solar panel: 25-30 watts (Lab: N3540 Linux: 7.5 watts; with TLP utility: 6.5 watts; N3700 model, not observed yet, however see Asus below)

Note: there is presently a kernel problem with N3540 processor, if you are planning for Wasta/ Ubuntu Linux at 16.04. No problems with older 14.04 versions. See Linux notes above.

Price: ~$300-$349 with 4GB upgrade

See: Dell Store[15]

Asus 14 inch Vivobook

Asus is a well known company and actually performs well under user surveys in terms of reliability and user satisfaction ratings. Sometimes they are the top of the second tier, below Apple, which is alone in the first tier.

This particular model sports a larger 14 inch, anti-glare, screen which is imporant for some Paratext users. The processor is the Intel **N3700**, 4GB RAM, and typically with 128 GB SSD (eMMc) drive.

This box was tested in the labs, (special thanks to translator, Jan Gossner) and measured a true **4.9 watts**. Approx solar panel: 20-25 watts. The predicted value for an 11 inch screen would have been 5 watts, and here is a machine with a much larger 14 inch screen at the same observed power spec in the lab.

Price: ~$389

See: Amazon Store[16]

12.5 Inch Lenovo x260

Back to the Lenovo line. This one is for the "power users" who want a faster processor and also have the extra money to spend for it. It still manages to weigh in with an acceptable wattage for solar. Any field testing and power data was provided by Nate Marti. This is probably the machine one would want if they were an avid FLEx user (SIL software) and doing a lot of processor intensive tasks, and the x260 starts with 8 GB RAM standard. Upgrade to 16 GB possible.

The 12.5 inch screen is a bit larger than the 11 inch models above, and the Intel Core i5-6300U is a good performer. The hardest spec to nail down is the battery run-time spec and hence the power consumption because there is a built-in internal battery that is non-removeable and then one of three extra battery packs that can clip onto the unit as well. (3 cell: 23 Wh; 6 cell: 46 Wh; 9 cell: 72 Wh) Hence various on-line reviews give different battery run-down results on the Internet, confusing the analysis.

We have now witnessed in the field that a model with 23 Wh built-in battery and then a clip-on second battery of 72 Wh runs for around 11.5 hours. This with screen half brightness and wifi on. Running normal chores for the 11.5 hours (please no videos here), the processor is humming along at a mere 6.8 watts. This combined with a Mil-Spec build by Lenovo will hopefully yield further field reports as to ruggedness in the field.

So with a power consumption of **6.8 watts**. Approx solar panel: 30 watts. (Predicted; No lab observations)

Price: $999   (there are various configurations for this unit)

See: Amazon Store[17]

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[1] https://www.amazon.com/Lenovo-Thinkpad-Business-Dual-core-Bluetooth/dp/B017WQITHK/

[2] https://www3.lenovo.com/us/en/laptops/ideapad/ideapad-300-series/Ideapad-320-15-Intel/p/88IP3000842

[3] https://www.amazon.com/Lenovo-IdeaPad-Celeron-Processor-Bluetooth/dp/B0785H4MT5/ref=zg_bs_13896615011_10?_encoding=UTF8&psc=1&refRID=F5BP55GX1GT63RWZF6E5

[4] https://lingtran.net/Solar+Panels

[5] https://lingtran.net/Solar+Panels

[6] https://www.amazon.com/Transformer-T100HA-C4-GR-10-1-Inch-Touchscreen-Quad-Core/dp/B014854RGK/ref=sr_1_3?ie=UTF8&qid=1496880293&sr=8-3&keywords=asus+t100ha+transformer

[7] https://www.amazon.com/X-DRAGON-Efficency-Technology-Smartphones-Foldable/dp/B00NGKPX4Y/ref=sr_1_1?ie=UTF8&qid=1497923168&sr=8-1&keywords=dragon-x+20+watt

[8] https://www.amazon.com/dp/B01HJKJVG2?psc=1

[9] https://www.amazon.com/Anker-Braided-Tangle-Free-Gold-Plated-Connectors/dp/B012A1VACS/ref=pd_sim_107_1?_encoding=UTF8&pd_rd_i=B012A1VACS&pd_rd_r=8X897F3P9PV3GDQWVR3T&pd_rd_w=O0E5d&pd_rd_wg=q5vZZ&psc=1&refRID=8X897F3P9PV3GDQWVR3T

[10] https://www.amazon.com/dp/B01N4C2ADB?psc=1

[11] https://www.amazon.com/dp/B00MQSMEEE?psc=1

[12] http://shop.lenovo.com/us/en/laptops/thinkpad/11e-series/11e-windows/

[13] https://www.amazon.com/Lenovo-Thinkpad-Generation-Quad-Core-Bluetooth/dp/B01EP2SLVS/ref=sr_1_3?ie=UTF8&qid=1471576896&sr=8-3&keywords=Lenovo+11e

[14] https://www.amazon.com/Lenovo-Thinkpad-Business-Dual-core-Bluetooth/dp/B017WQITHK/

[15] http://www.dell.com/us/p/inspiron-11-3157-laptop/pd?oc=fndorb1403b&model_id=inspiron-11-3157-laptop

[16] https://www.amazon.com/VivoBook-E403SA-US21-Quad-Core-Processor-Metallic/dp/B01B9APNG0

[17] https://www.amazon.com/Lenovo-ThinkPad-20F6006AUS-12-5-inch-Ultrabook/dp/B01DFD9IO2/ref=sr_1_2?ie=UTF8&qid=1468574601&sr=8-2&keywords=x260+lenovo