Education Briefing:

SCHOOLING YOUR NETWORK FOR BRING YOUR OWN DEVICE

TP-LINK®

Management Summary

Unlike many emerging technology concepts, Bring Your Own Device (BYOD) is as simple in principle as its name suggests; all the more so for a model being touted by many commentators as potentially the most influential and disruptive educational development since the blackboard.

In essence BYOD is 'just' a platform for allowing students and faculty members to connect to education campus networks and resources via their personal digital devices.This belies an enormous and very real potential for transforming the foundations of education as we know it.

In fact it is no exaggeration to say that BYOD has already heralded in a revolutionary new 1-to-1 learning paradigm via which all manner of new content and media can be brought to bear alongside an array of new teaching methods and techniques. All this while offering educational institutions a powerful yet cost effective way to bring their technology up to speed and their budgets into line.

However, whether taken as part of a strategic plan or under duress, the decision to embrace the BYOD ideal throws up a whole range of tough new challenges for under-pressure education administrators; not least in the context of IT management wherein it will ask searching questions of any campus ICT department's financial, technological, and logistical resources.

These challenges are many and varied, but first and chief among them is the network, without which, after all, even the smartest most powerful device has nothing with which to connect.

Network overload. Security. Scalability. Bandwidth. Integration. Support and maintenance. Future proofing. ROI. All should be among the earliest and most critical considerations when considering and implementing a campus BYOD program.

This paper examines the issues, trends and benefits supporting BYOD-driven mobile learning in schools and universities. It highlights the key requirements and best practices for a fruitful BYOD network deployment.

BYOD in Education: An Overview

The global technology market has habitually only ever flowed in one direction: where businesses lead, consumers follow. This has been the natural order of things since the very beginnings of the information technology age.

Or at least it has been until quite recently.

Thanks largely to the ongoing and accelerating 'consumerisation' of IT, this 'natural order' is undergoing an enormous sea change and will likely never be the same again. For where corporate technology adoption used to eventually filter downwards to the consumer, the polar opposite is now true. More and more it is now the consumer influencing and shaping – even dictating – the habits, behaviours, and practices of the organisations in which they work.

This has never been more clearly evident, pronounced, or embodied than in the case of BYOD – Bring Your Own Device – a concept that has, in the few short years since its emergence, exploded from theory into trend, from trend into established practice, from practice into necessity, and from necessity into full-blown phenomena.

With industry analysts estimating that there are now well in excess of 1 billion smartphones in use worldwide, tablet computer sales now outstripping demand for desktops, and shipments of both continuing to ramp unabated, mobile devices truly are more ubiquitous and pervasive than ever before.

Moreover, the associated bell-curve looks to have a long way to go before reaching its zenith.

BYOD's increasing influence is being felt the world over as a direct result; even in areas traditionally slower to adopt new technologies and trends than others.

The education sector for example.

As consumers in and of themselves – drawn by the appeal of new 'live', interactive, digital learning techniques, apps, and content – students and teachers are increasingly seeking to bring their own devices into the classrooms, labs and libraries.

Effectively being railroaded by increasingly sophisticated users and still further by ever-tightening budgetary constraints and the appeal of cutting capital expenditure, more and more educational institutions are finding themselves with little choice but to accede and start down the BYOD path – even in the face of the enormous disruption it may cause.

A recent report from industry analyst Forrester cites the provision of mobile access to campus resources as the number one priority for IT decision makers in education today. Another, based on a survey of IT leaders in education ranks "supporting the trend toward IT consumerisation and BYOD" second in their list of Top Ten IT Issues.

These are just two examples from a whole slew of recent statistics that provide irrefutable confirmation of just how much traction and sway BYOD has already gained in the education space – and how much more momentum it is likely to gain in the coming months and years.

A Perfect Storm for a BYOD Reign

According to IDC:

Upwards of 1 billion smartphones were sold worldwide in 2014.

The global smartphone market is growing at 33 per cent annually… While selling prices are falling at 8 to 10 per cent per annum on average.

Global tablet shipments hit more than 240 million in 2013, exceeding sales of notebook PCs for the first time.

90 per cent of organisations will be supporting BYOD in some form by 2017.

BYOD in Education: The Impact

BYOD's growing traction in the education arena is hardly surprising given the compelling range of headline benefits tempting institutions into adoption…

1. The Impact on Learning

Anecdotal and qualitative evidence from BYOD-centric classrooms strongly suggests that enabling (or at least allowing) students to engage with teaching materials via their own internet-connected devices affords a deeper, richer more engaged learning experience and helps encourage more conceptual, analytical, and creative thinking.

Several quantitative studies are also underway that promise to back up these findings and provide other pointers as to BYOD's efficacy in various learning scenarios.

Moreover, with smartphone and tablet technologies – hardware, software, and services – continuing to evolve at a frenetic rate, mobile devices and content are now beginning to influence the very nature of the learning process.

Driven on by burgeoning BYOD programs, this is already proving effective in, for instance:

- Boosting student engagement with 'real world' scenarios and technology
- Delivering more tailored, personalised coaching and instructions
- Shaping and redefining learning communities: i.e. where, when, and how learning takes place, and with whom
- Opening up new virtual links and 'synapses' between students and subject specialists beyond the traditional confines of the classroom
- Encouraging new disciplines and areas of study outside conventional curricula and subject matter
- Creating more collaborative learning environments wherein students are able to work on projects with counterparts or experts in other parts of the campus, other schools, and even other countries

These are just a handful of the earliest and most obvious learning benefits; the tip of what many believe could prove a truly monumental iceberg.

2. The Impact on Teaching

Fundamentally shifting the entire teaching model, BYOD affords educators the opportunity to teach in a more personalised, tailored, collaborative manner, using varying techniques, media, apps and content to meet the varying needs of individual students. With pupils able to study and learn at their own pace, in their own 'style', and with greater control and authority over their own learning, this encourages greater engagement not only with teaching materials but with teachers themselves, in turn fostering a closer teacher/student relationship.

A recent poll of IT leaders in the sector revealed a particular optimism about the emerging opportunities BYOD affords to facilitate student engagement, extend teaching and learning environments, and foster positive and productive environments, for example:

- Enable students to conduct research and pose questions 'on the fly'; listening to and participating in lessons dynamically rather than passively
- Empower educators to dynamically monitor and track the progress of individual students live in real-time
- Enable educators to accommodate and support varying learning speeds and styles…
- Empower individuals with special requirements. These might include foreign language support or physically or sight-impaired students with translation or spoken-word apps, thereby levelling the playing field and providing individuals a better chance of reaching their true potential.

3. The Financial Impact

The allure of BYOD in education – wherein schools are able to divest the capital expense of the device hardware to students and staff – is clear and compelling based on the potential upfront and device maintenance savings alone.

It is a simple equation: every laptop, tablet, or smartphone paid for by a student or staff member is a capital expense for which the school doesn't have to find budget. Devices lost or accidentally damaged? No longer the school's responsibility.

Other factors – and cost implications – must also be considered however.

BYOD, by definition, hinges on students or their families meeting device purchase and maintenance costs, which can give rise to a number of issues. It can, in both a practical and social sense for instance, create damaging schisms between the 'haves' in the student body and the 'have nots'.

There is also weighty socio-political resistance in some quarters to the very idea that parents should be asked contribute to the cost of what is ostensibly public education. (Indeed such requests are illegal in some Nordic countries.)

Also, while BYOD typically drives down capital ICT expenditure, it may have the opposite effect on operational budgets. The dramatic upturn in the number and variety of devices in turn leads to significant performance (and therefore cost) implications across the entire IT infrastructure, and in particular for the network.

Here, while the school no longer funds the device hardware, it will need to fund any improvements necessary to ensure its networking infrastructure is properly BYOD ready, as well as ongoing operational, maintenance, support and upgrade expenses.

In fact, in some scenarios, where networking has not taken priority or specified in a managed, cost-effective manner, the total cost of ownership (TCO) for BYOD-based deployments has been estimated to be between 25 and 30 per cent higher than in the case of 'conventional' non-BYOD network topologies.

BYOD – A no-Bull Market

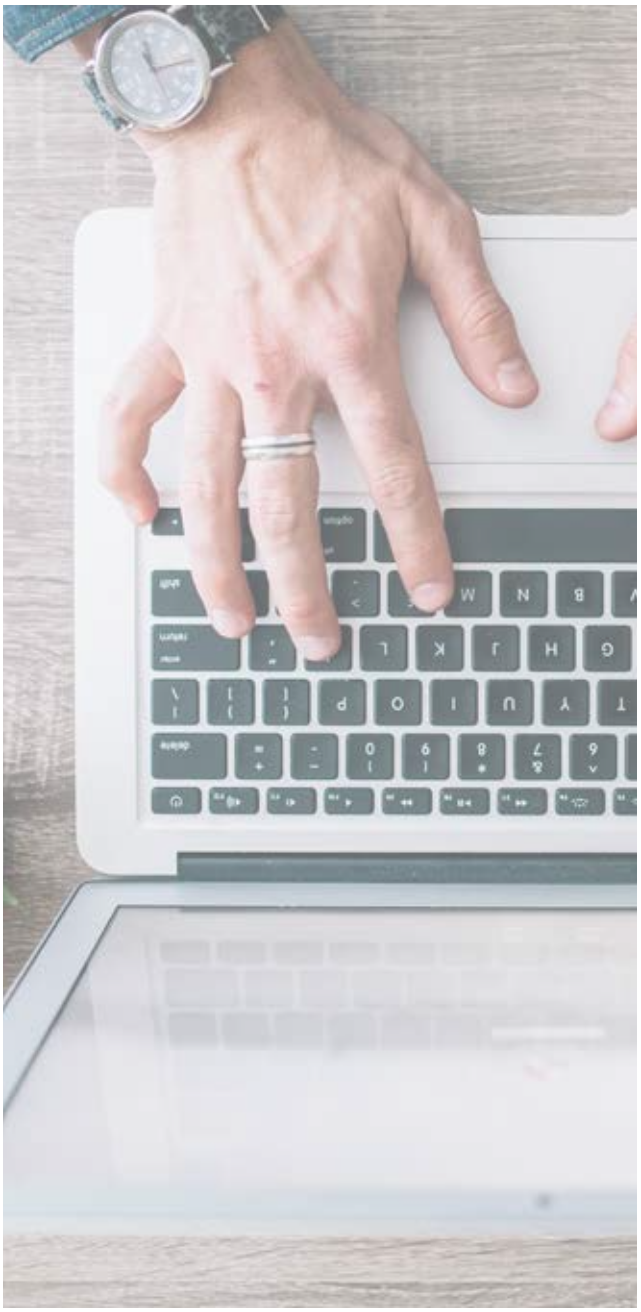
Statistics show that the BYOD market continues to rise with no end in sight. And because of the BYOD boom, ancillary disciplines such as wireless LAN (WLAN) networking.

The global market for BYOD will increase from $67.21 billion in 2011 to about $181.39 billion by the year 2017.

North America has the largest market share of BYOD adopter with 36.10 per cent of the global market in 2011. That 36.10 percentile is expected to grow from $24.26 billion in 2011 to $58.6 billion in 2017.

67 per cent of workers already use their personal devices in the workplace according to Microsoft (as reported by CBS MoneyWatch).

60 per cent of organisations supported BYOD in 2013 and 90 per cent by 2014.



4. The Operational & Technological Impact

BYOD also offers numerous operational benefits, enabling institutions to:

- Link with outside agencies and partner institutions more quickly and seamlessly
- Access learning materials much more rapidly than possible traditionally and at a lower cost
- Deliver greater collaboration and interconnectivity; not just between students but also staff, management and governors
- Deliver materials faster and more intuitively
- Begin future proofing their infrastructures and start down the upgrade path early; accelerating networking infrastructure upgrades that, sooner or later, will be a necessity in any case
- Attract higher calibre students and staff – conversely, establishments without BYOD facilities are likely to find themselves at a clear disadvantage in the very near future. Not only will students demand BYOD but, faced with the choice between an institution that offers BYOD and one that doesn't, parents will soon begin demanding it too
- Self-driven learning: Students, parents and teachers alike will increasingly expect their schools of choice to provide not just the necessary technology, but the right guidance, advice, and expertise too.

The Importance of Buy-In

One of the key early steps (and ongoing policies) in planning and implementing a cohesive BYOD program is to properly engage and reach consensus with all the stakeholders and communities due to be affected. Unfortunately, this initial step is often the most misunderstood and most underestimated in the whole process.

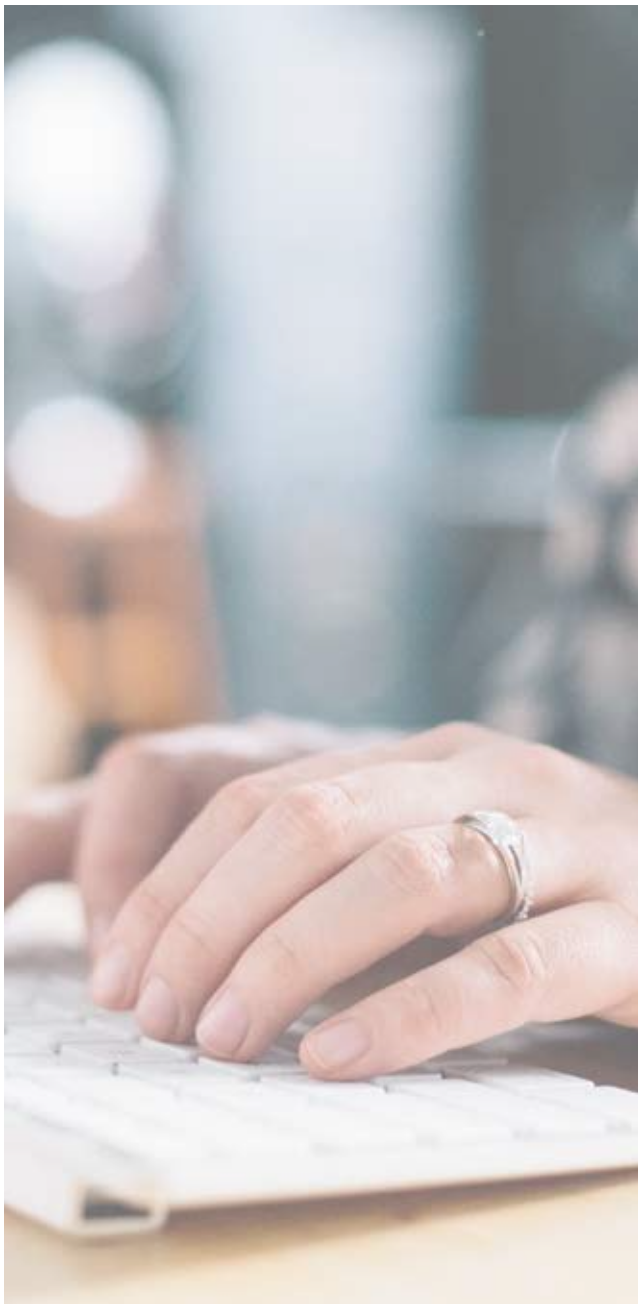
True buy-in must encompass not only students and staff, but parents, administrators, governing boards and possibly selected outside agencies too. Indeed, failure to engage such people and bodies in the appropriate manner has been demonstrated to hinder and even prevent successful buy-in – pivotal if the BYOD implementation is to succeed in the longer term.

In the interests of achieving true engagement, all the parties concerned should be asked (and be seen to be asked) for their input and feedback on proposed roll-out plans, which should in turn be laid out in a formal BYOD 'prospectus'.

BYOD for Educators: The Key Networking Considerations

To date, the majority of BYOD-centric literature and press coverage has focused on headline issues such as mobile device management, data protection, and security policy enforcement. Consequently, so have most BYOD plans. This is understandable up to a point: all are, of course, important considerations.

In truth though, BYOD quite literally begins and ends with the network. Without a network flexible yet robust enough to handle the dynamic requirements brought to bear by the demands of diverse use of personal devices, all other factors are moot. Where there is no network, there is no connectivity. If there is no connectivity then even the smartest device is, in every practical sense, little more than an isolated shell.



The challenges are, once again, many and varied, but central to the entire issue will be the sheer weight of traffic present on the network post roll-out.

BYOD means more people connecting to the network, and as a general rule, easily predicted and managed. What is often overlooked however, is that users will typically carry and connect via not one device but two or more. In most cases devices outnumber users by between two and three to one.

The greater the number of smartphones and tablets on the WLAN, the greater the load and stress on network resources like DHCP and authentication servers.

Careful thought must therefore be given to issues such as:

- Network design
- Coverage
- AP numbers, locations, and positioning
- Bandwidth
- Public / private IP address space
- The use of subnets / broadcast domain sizes
- IPv4 exhaustion and IPv6 adoption / transition
- Wireless controllers
- ACLs
- Switch configuration
- Support and maintenance

Indeed, among the biggest concerns cited by IT leaders' are how to address the impact of BYOD on bandwidth, network connectivity, and security.

BYOD in Education: Drivers

Several factors are contributing to the popularity of encouraging students to bring their own personal technologies to school and use them for learning:

Tablets, netbooks, laptops, multipurpose e-book readers, and smartphones have become affordable for an increasing number of families.

Adults are embracing the power of ubiquitous communication and information access in their own lives.

Students are digital natives.

Teachers are becoming aware of applications and teaching strategies that use personal technologies to increase student engagement.

Councils are recognising that they may never have adequate funding to provide a school-owned device to every child.

BYOD: The Networking Pain Points

With BYOD placing considerable strain on traditional campus network architectures and WLAN management strategies, the challenges of rapidly changing security, capacity, bandwidth and performance requirements are considerable:

- Network Overload

With potentially hundreds or even thousands of mobile devices connecting to campus wired and wireless networks, overload can quickly become a major problem and a threat to the entire BYOD program; especially where networks are not properly designed and provisioned as is the case with many school network infrastructures currently. Some users won't even know their devices are connected. The latest Macbooks, for example, stay connected even while 'asleep', waking up at regular intervals to ping the network for news, email and other updates.

- Solution

One way to protect against overload is the adoption of the new 802.11ac wireless standard – a set of physical layer enhancements that dramatically improves throughput so delivering greater reliability and robustness.

But even organisations that choose to upgrade, replacing their 802.11a/b/g/n infrastructures with later versions and deploying extra APs for optimum bandwidth and coverage, may find their BYOD plans running aground thanks to improper planning and provisioning.

In any event therefore, a wireless site survey is vital.

A further measure is network monitoring. Who is connecting? Where? When? Why? For how long? What resources are they using? Some solutions also offer an measure of control, giving administrators visibility over router status – of who is online, what they are doing, what their privileges are, and enabling any nefarious users or activity to be blocked.

It is also important to be able to designate which devices and/or users hold sway over the routers, permissions and privileges. Others allow you to decide which websites and resources can and can't be accessed and what times of the day or week the network will be accessible and via what devices, thus allowing for greater control over issues such as AP saturation.

- Bandwidth & Coverage

Even if your campus has a good wireless signal throughout, administrators need to consider whether there is sufficient bandwidth to support dozens of devices at one time. As resources and activities move online, an establishment's digital pipeline may need to be increased. Remember too that any major increase in the number of web-enabled devices will have performance implications across the entire IT network, not just the wireless infrastructure.

Firewalls and other security measures must be re-evaluated to ensure access is both safe and secure. Institutions should consider restricting or at least limiting access to social networking hubs such as Facebook, Twitter, Instagram and WeChat and to, say, online gaming applications that sap vital bandwidth resources and potentially threaten the network in other ways.

The convergence of voice, video, and data may also have an adverse impact on network performance. Increased traffic at the edge may necessitate upgrading the backbone, from say 1 Gigabit to 10 to 40 Gigabit hardware. Even in the classroom itself, the streaming of multimedia content from the likes of YouTube and MOOCs (Massive Open Online Courses) may demand a move from Fast Ethernet to Gigabit network at the edge.

Security

A recent report from analyst Gartner found that one-fifth of BYOD policies fail because users are either uninformed as to the rules governing usage or because they find them too restrictive and so circumvent or ignore them altogether.

Institutions should therefore consider:

• Ringfencing Key Data & Apps

Safeguarding sensitive data and applications should be prioritised, and achieved via security policies and mechanisms that impose tight controls on who has access to what from where, and what privileges and changes there are able to make therein.

• Securing Devices

Where employees (and even certain students) have access to key resources (and possibly valuable intellectual property or confidential information), protective steps will be needed against unauthorised access, malicious attacks, or inadvertent disclosure due to device loss or theft. This demands an ability to lock down such data via multi-factor authentication, access control, containerisation, and possibly the ability to track and remotely lock and wipe certain content.

• Personal Privacy

Users are unlikely to take kindly to security policies that monitor or perhaps even end up wiping personal materials as well as campus resources, and this will need careful handling. Personal communications, contacts, apps and data should therefore be either limited, placed outside the remit of the network monitoring function, or possibly a combination of both. Rigidly 'blacklisting' and blocking apps should be avoided where possible too, and instead be controlled on campus using geo-fencing controls.

• Proactive Monitoring & Action

Real-time monitoring will help contain and mitigate most of the risks associated with BYOD, but will be of limited use without automated alerts and notifications that warn users and administrators of policy violations. Analysis of usage patterns will help reveal potential threats and breaches ahead of time.

Infastructure & Integration

Supporting multiple devices and operating systems will present a range of compatibility, support, and integration challenges. Numerous platforms are available to help manage traffic and user access. Options include:

- Restricting the number of devices given network connectivity permission via MAC authentication, secured SSID, guest authentication/captive portals and so on
- Regulating the type of device allowed to connect – e.g. tablets may be allowable, but not smartphones. Smartphones may be allowed, but with preset bandwidth restrictions
- Using dual band access points to balance network usage – e.g. placing heavy/priority users on the 5GHz wireless spectrum and lighter/less important users on 2.4GHz

• Support & Maintenance

Few schools, if any, have the IT manpower to program hundreds or even thousands of mobile devices. Also, with all those different types of devices come all different types of issues. Then, the teachers start losing class time to tech support and troubleshoot.

IT just simply doesn't have the man power to put their hands on every device to program settings. There needs to be an automated device registration process. Users should be able to enter in their active directory credentials and register themselves, which can be done with a mobile device management solution.

When it comes to tech support and troubleshooting, realistically its too big a task for any school's IT team to handle. Best practice here is to put a section in the BYOD policy that states exactly what will and will not be supported. It should be up to the students to get their devices fixed and serviced. Make sure every user knows this, otherwise you will have people lined up for free IT support.

In its latest quarterly report on "The State of Enterprise Mobile Security", Forrester reports that 70 per cent of organisations across Europe and North America expect to provide more mobile support to their staff over the next 12 months as a high or critical priority.

"The service desk… has to be good at figuring out if it's a problem with an application… or with the device", commented Gartner's Willis. "It requires a new set of scripts [for the service desk]. It also means application delivery people need to think about how they can deliver applications without assuming the device itself is secured. To give the service desk a fighting chance, the IT organisation should outline which devices and software versions are supported as part of a BYOD user agreement."

A policy that mandates a limited range of acceptable, supported devices is often also advisable, as is, where appropriate, a self service approach: some organisations launch support wikis or blogs that allow users to source their own solutions to problems.

Cost, TCO & ROI

One reason many educational institutions are to ready to embrace BYOD is the opportunity to reduce the TCO (Total Cost of Ownership) of their ICT. As noted previously, BYOD does eliminate a large item from capital expenditures. Unlike with cloud computing models however, BYOD presents real-world capital savings – budget that will never have to be spent – rather than simply shifting focus from the capital expenditure column to the operational expenditure column. Operational expenses are generally easier to manage than capital expenses of course but no expense is most preferable of all.

Put slightly differently, the traditional 'break/fix' service changes when you introduce a BYOD environment, and this begs some important questions. What kind of support will be needed as your campus shifts to BYOD? What are the legitimate limits? iPhone and Android apps are supported differently than traditional software for example. Will your service and support function need to take a lesson from the app stores? More than likely.

Conclusion

Ubiquitous use and ownership of mobile devices such as smartphones and tablets is driving a rapid and all pervading consumerisation of technology in educational environments with students and employees increasingly bringing their own devices to bear in enhancing teaching, learning, and productivity.

BYOD offers many benefits, driving transformational change and shifting learning from a solely teacher led activity to one that is inherently and intrinsically centred on the student, and fostering much closer collaboration between student, parent, and educator. But it also presents a major challenge in ensuring the resulting technology centric learning is safe, secure and properly supported.

Key to both sides of this coin however, is that whatever deployment model is selected, it is of vital importance to understand that the associated wireless networking platform cannot be viewed as some manner of bolt on 'accessory' to the main BYOD platform.

It is critical therefore, that the wireless element of your BYOD model should not be viewed as an overlaid afterthought to the main network, but as one of its most critical enablers.

BYOD is challenging traditional ideas about teaching and learning; but it is also vital to realise that BYOD decisions must be made with educational, technological, financial and operational benefits in mind. Any cohesive BYOD plan must deliver tangible benefits for all of the above if it is to succeed in real terms, in the real world, and with any real longevity.

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What next?

There's no doubt that schooling your network for BYOD can present a major learning curve. But with the help of TP-LINK it's a test you can pass with flying colours.

Take the first step towards the higher learning your network needs with the free TP-LINK Wireless Survey. It's quick, easy, completely free of charge, and could deliver precisely the intense revisions that will give your BYOD strategy some real smarts.

Simply call TP-LINK on **0118 327 1135**
or email **VAR.UK@tp-link.com**.

Alternatively visit **uk.tp-link.com** for more information about the TP-LINK product range.

About TP-LINK

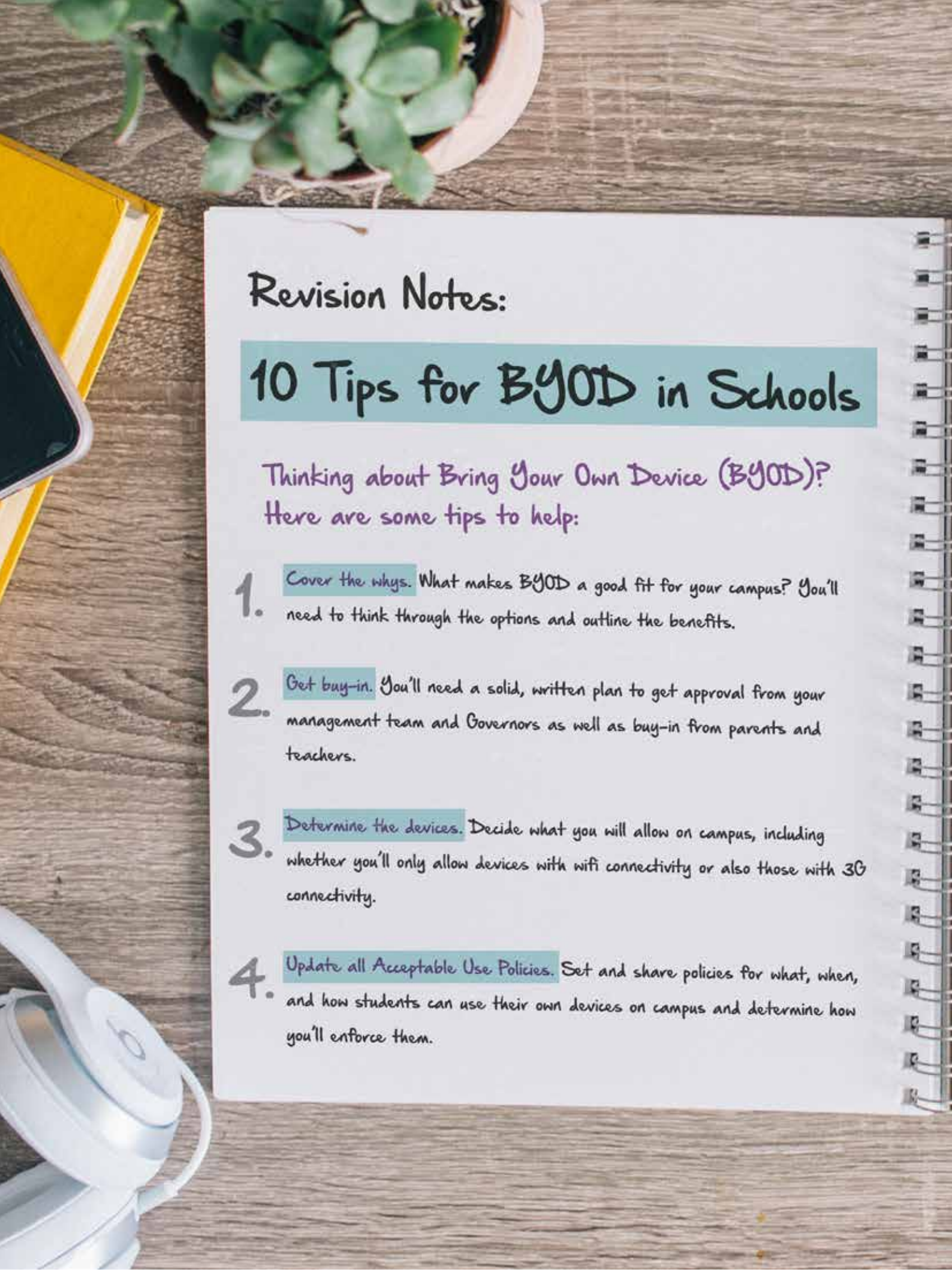
Founded in 1996, TP-LINK has become one of the world's leading providers of SOHO & SMB networking products, offering both innovative and award winning solutions to the market. Ranked No. 1 provider of WLAN products, TP-LINK supply to over 120 countries, serving tens of millions of consumers worldwide.

TP-LINK is a company that is fully committed to developing its products, services and consumer relations through extensive R&D, strict Quality Assurance practices, and effective outreach initiatives. Customer loyalty through interaction, focus and feedback are policies that help form the TP-LINK culture, as well as a commitment to achieve, and a dedication to innovate.

In their efforts, TP-LINK's global achievements in the industry have received both recognition and respect, proving their level of quality and commitment time and time again. TP-LINK continue to develop award-winning products, offering a complete range of networking solutions consisting of Routers, Adapters, Cameras, Switches, and many other Wired and Wireless devices for both Home and Office use.

Through technological advancements and the power of imagination, TP-LINK is continuing to grow, endlessly striving to achieve their goal of becoming one of the top 3 networking providers in the world. While continuing to develop their global market share, TP-LINK will never cease to promote opportunities to further advance through the world of networking and innovation.

TP-LINK - The Reliable Choice.



Revision Notes:

10 Tips for BYOD in Schools

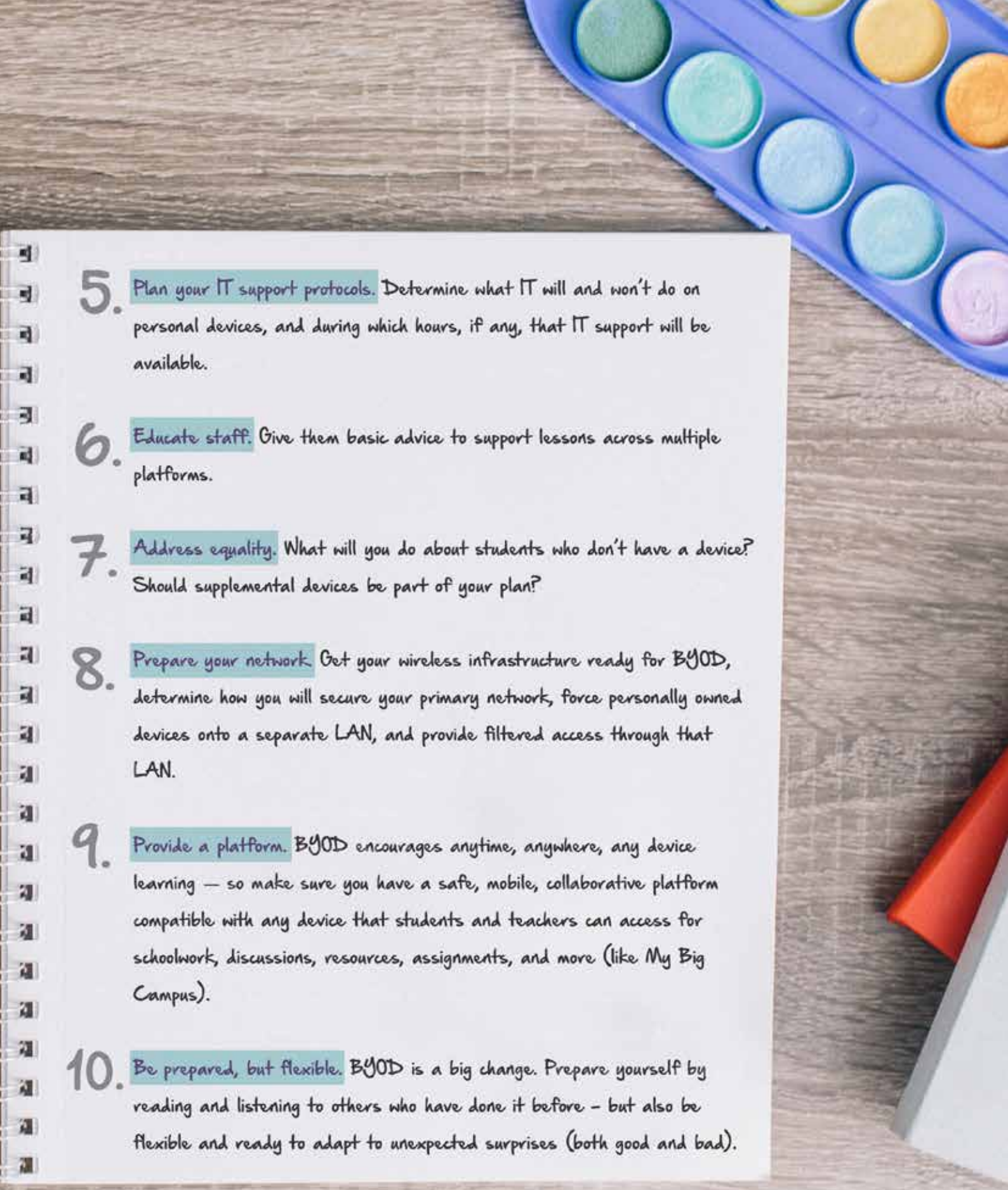
Thinking about Bring Your Own Device (BYOD)? Here are some tips to help:

1. **Cover the whys.** What makes BYOD a good fit for your campus? You'll need to think through the options and outline the benefits.

2. **Get buy-in.** You'll need a solid, written plan to get approval from your management team and Governors as well as buy-in from parents and teachers.

3. **Determine the devices.** Decide what you will allow on campus, including whether you'll only allow devices with wifi connectivity or also those with 3G connectivity.

4. **Update all Acceptable Use Policies.** Set and share policies for what, when, and how students can use their own devices on campus and determine how you'll enforce them.



5. **Plan your IT support protocols.** Determine what IT will and won't do on personal devices, and during which hours, if any, that IT support will be available.

6. **Educate staff.** Give them basic advice to support lessons across multiple platforms.

7. **Address equality.** What will you do about students who don't have a device? Should supplemental devices be part of your plan?

8. **Prepare your network.** Get your wireless infrastructure ready for BYOD, determine how you will secure your primary network, force personally owned devices onto a separate LAN, and provide filtered access through that LAN.

9. **Provide a platform.** BYOD encourages anytime, anywhere, any device learning — so make sure you have a safe, mobile, collaborative platform compatible with any device that students and teachers can access for schoolwork, discussions, resources, assignments, and more (like My Big Campus).

10. **Be prepared, but flexible.** BYOD is a big change. Prepare yourself by reading and listening to others who have done it before – but also be flexible and ready to adapt to unexpected surprises (both good and bad).