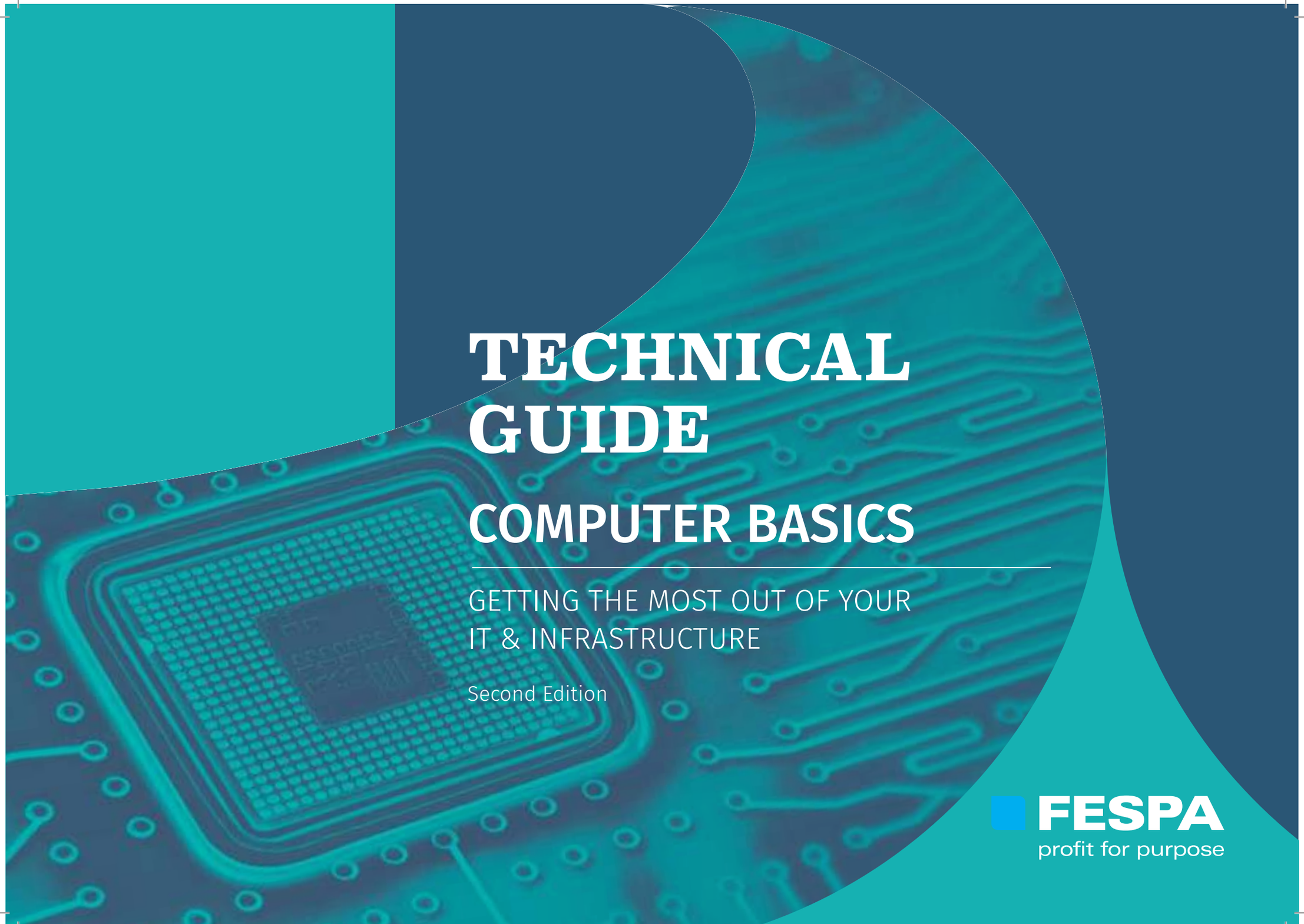


TECHNICAL GUIDE

COMPUTER BASICS

GETTING THE MOST OUT OF YOUR IT & INFRASTRUCTURE

Second Edition

FESPA
profit for purpose

Getting The Most Out Of Your IT & Infrastructure

Digital Worlds

Today's Information Technology (IT) is like having a modern car instead of a machine that required you to be mechanic, engineer and driver all rolled into one. Computers have evolved in much the same way as cars having gone from scary feats of engineering wonder, to tools anyone can use and exploit. And nowadays you don't even need a conventional computer because your phone can do everything from managing your bank account to press diagnostics.

Trending positive

Just a glance around any railway station, bar, shopping centre or pavement shows you how effectively communications and computing technologies have converged. From apps on a mobile phone to the much vaunted internet of things, virtually every interaction we have with each other and the world around us can be computer assisted in some way. This convergence has

created dependencies and often overengineered processes to the extent that people are borderline addicted to their devices. App dependency has turned many simple tasks into processes that are often way too complicated. In the graphics industry the pervasiveness of digital technology creates opportunities for process control, order taking and management, and new applications that function across channels. Exploiting the digital foundation is however not simple and if current trends can be trusted, will continue to get more complex.

Big data & artificial intelligence

The days when printing was just about putting ink on substrates are long gone. Todays graphics professionals are in the data business, delivering data throughout the supply chain to substrates, websites and other applications for new communications models. That is the reality for the graphics industry's most successful companies. The importance of big data and data analytics cannot be underestimated, even though it seems a world away from the daily business of print production. Artificial Intelligence (AI), using software to make decisions based on data analysis, allows publishers and printers to anticipate target audience needs and expectations, tailoring content accordingly. This is a big step forwards from variable data media production, since with AI the variable data elements are determined in a much more sophisticated way. AI takes into account complex factors and their interplay making optimised decisions on content components. Instead of matching data to a predefined profile for instance, AI considers information such as historic sales patterns and values, demographics, local weather or whatever, to determine the tightest match between source content and target readers and the highest probability of response.

Artificial intelligence also has an important role in the roboticization of the graphics industry. Robots are already used for things such as loading printing plates onto platesetters as for Agfa Avalon N36 and N40 VLF output devices. Inca's Onset X series can be fitted with a robotic board loading system and Heidelberg's Omnifire technology combines advanced inkjet printing with high precision robotics to print on 3D objects. And Zund combines automatic tool changers and collaborative robotics for automated material handling.

Cyber security

Cybersecurity is perhaps the most important trend in computing these days. The business risks range from financial, compromising data and intellectual property, messing up equipment and software settings to the business's reputation. Hacks into websites and payment services can have extremely serious consequences, particularly in view of GDPR regulations and associated penalties. Breaches have serious implications for printing companies who handle customer databases, so any company working with delivery of peoples' data should be ISO 27001 (information security) certified.

The digital world is plagued by different categories of security threat. Malware is any sort of unwanted or damaging computer code, and includes viruses, so named because they replicate and spread. Ransomware, a type of malware is less common but just as annoying and potentially damaging. Ransomware encrypts data or makes it inaccessible until a ransom is paid, most commonly in the form of Distributed Denial of Service Attacks (DDOS).

Antivirus software takes care of about 45% of attacks, but your best security is a secure network and robust digital data policies for the organisation.

The world has changed considerably since early process digitisation started gaining traction. But it's the technology that has changed, not the underlying principles of data driven decision making. Whether it's pencils or an abacus or a digital device, IT is what we have always used to get things done, to manage processes. In the past we could see and touch most of our information tools, but in the digital age anonymous processes work unseen and mysteriously. Basic IT is not difficult, even though it mostly functions invisibly but what has changed in the last few years is that you no longer need to understand the details of how it works, although you probably should. Today's IT has moved from the desktop, local area network and inhouse servers with RAID arrays to remote servers, mobile WiFi and the cloud. What has not changed is the fact that you determine IT's impact on your business, good and bad wherever and however your IT operates. Understanding the basics gives you the means to manage your IT and digital infrastructure effectively. It will also equip you to better appreciate the digital world and distributed cloud computing accessed via mobile devices.

Binary Choices

Binary numbers, 0 and 1, are the simplest form of mathematical expression and the basis of all computing. Binary digits, or bits, express an on or off state, like a light switch, so they are used in digital electronic circuitry to control hardware and software functions. Images, text, numbers, sound, and any other type of information can be expressed as a series of ones and zeros, with bits collected in groups of eight, as a series of bytes. Eight bits to a byte was chosen because this is the minimum number of bits needed to describe all the characters in the Roman alphabet: 8 bit data enables 256 different characters so it became the smallest unit of memory in early computers.

The bits and bytes store encoded information as data and the bits and bytes are manipulated to perform the complex calculations we need. Programming languages, made up of commands, control the calculations passing processing instructions to the Central Processing Unit (CPU) which does the computations necessary to achieve a particular task, such as opening a file. There are several categories of programming language and compilers, depending on what the language will be used for, such as procedural or functional programming, object orientated programming, scripting, or specific applications commonly written in C++ or Java. Code

communicates instructions to the CPU to control the behaviour of a machine and data. Computing languages also determine collected sets of operations called algorithms.

Algorithms are the basis of all software. They define a series of operations using a set of rules, taking data from an input source and writing it to an output device, such as your computer monitor, hard drive, printer or digital press or another peripheral device. However what happens to the data as it is processed, depends on how the algorithm's rules are written and their complexity. Hence categories of software, such as tools for crunching numbers or managing databases.

Operating systems (OS) control the computer's functions and software or application tools and together with the operating system get things done. An operating system alone cannot do anything except run the machine. If you have too many software applications running, plus a desktop littered with open files, the OS will struggle to manage the data and processes efficiently. The net result is likely to be a system crash, literally an overload.

Hardware vitals

All computing systems share basic common denominators. They are integrated devices that comprise Read Only Memory (ROM) which stores data that cannot easily be changed, and Random Access Memory (RAM) that passes data to the CPU. To this add accelerator boards, dedicated processors, network and peripheral device controls. The CPU executes a computer program's instructions and controls the input and output (I/O) operations. Additional hardware such as graphics boards and Field Programmable Gate Arrays. (FPGA) These chips have field programmable hierarchies of reconfigurable interconnects, so they can be updated to implement different software demands. Like programming languages and operating systems, computing electronics are constantly evolving to be more powerful or specialised for different purposes. This is why you come across different types of RAM, CPUs and semiconductors.

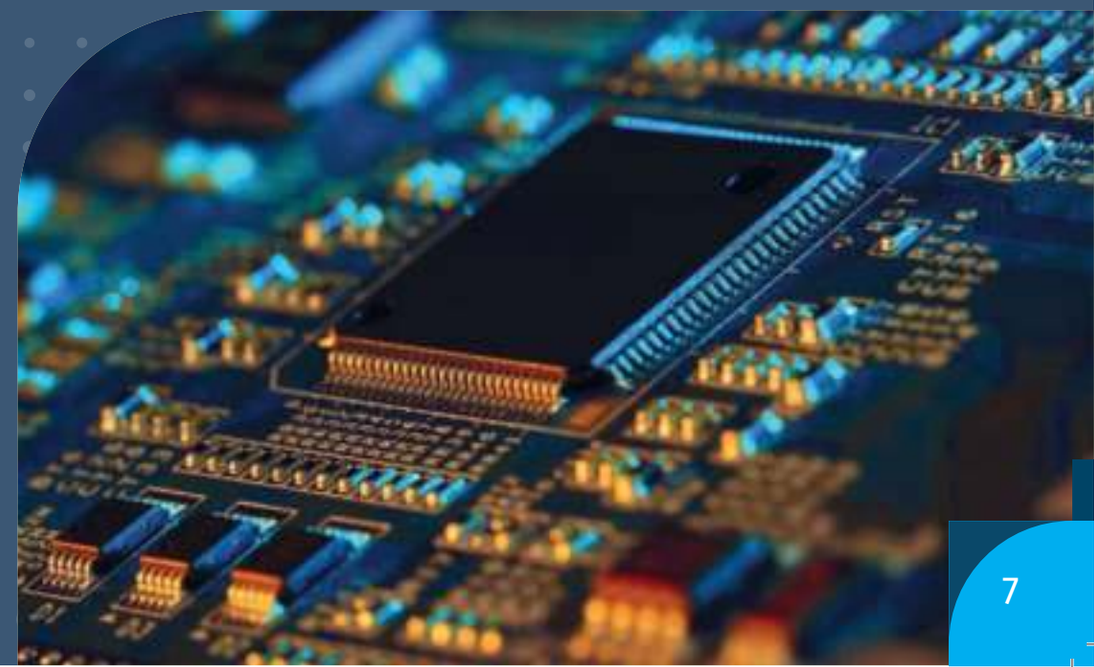
The CPU is a computer's brain. It processes instructions held in RAM requested from application software. The CPU controls everything the computer does and is distinct from external components, such as memory and input/output circuitry. Modern CPUs are based on multiple microprocessor units, or cores combined into single chips, for processing across components. The number of cores and capacity determines price and performance. For instance AMD's Ryzen Threadripper processors are available in 24-core and 32-core versions. Depending on their speed, capacity and configuration CPUs cost from as little as €25 and up for a top end CPU: Intel's 28-Core Xeon W-3175X costs $3000. Currently priceless, the CS-1 developed by Cerebras is powered by a Wafer Scale Engine (WSE) with 400,000 cores and more than one trillion transistors. It's 215mm x 215mm and shifts nine petabytes of data per second. A petabyte is one thousand million million bytes (250).

Interestingly CPU technology is still subject to Moore's Law. Gordon Moore co-founded Intel and predicted that the size of transistors in a computer chip would shrink over time so that the number of them that could fit on a chip would double every two years, effectively doubling the computing power. You might think physical size constrains this law, but inventors keep coming up with ways to make processors smaller. Moore's Law may cease to apply within the next decade because CPUs must be cooled which will eventually require more energy than the energy passing through the transistors. Moore himself said in 2015 "I see Moore's law dying here in the next decade or so."

Other vital components for a computer are data storage devices such as hard drives or CDs, cables to connect everything together, monitors, keyboards, a mouse or trackpad or equivalent pointing device, such as your finger or your eyes (not yet but soon), plus additional input and output devices for instance digital cameras or extra monitors. All of these components and more are controlled in a digital environment governed by some very basic principles not dissimilar from those of the physical world. For instance if you don't have enough storage space you can have difficulty keeping track of your stuff and accessing it, and its the same with data storage. If your radiators are too small for your house it will take ages to warm up and similarly if you lack sufficient RAM for the applications you run, it will take ages to process application instructions. Heavy duty applications, such as Photoshop, Illustrator, InDesign and Quark XPress, need much more RAM than tiddlers like Word and Excel.

Configuration possibilities for your IT infrastructure are endless. The only absolute is that the infrastructure should work for what needs doing, the operators and of course the nature of the work. For a one man band subcontracting printing device support, accounting, layout and all other services, a laptop for emailing and web access will do, although full exploitation of capital equipment is unlikely with such a set up. Several employees needing to share common resources, such as software and output devices should be managed with a client/server architecture configured to support the team and production throughput requirements.

Even if companies like Apple have done a lot to make it easy to use computers, you shouldn't underestimate the need for training staff on how to use both operating system functions and key software.



Client/Server Set Ups

One powerful computer, the server, can manage common tasks and workloads and share resources with connected clients. Services are provided to clients across a network and the number of clients a server supports, depends on its capacity and the data traffic.

Networks are fundamental to IT infrastructures because computers exchange data across them. Networks use cables or wireless channels to connect different desktop and laptop computers, servers, mobile devices and additional network hardware such as routers and signal boosters. How signals are carried is a network's defining feature, WiFi say or Ethernet, as are the communications protocols that manage network traffic. A network allows computers to run distributed applications and communications with other devices. Accessing the internet, sharing application tools, servers communications, remote device data storage, printers, email and instant messaging applications all depend on networks.

Look at the work being done throughout your company to make sure computing resources and network capacities meet its needs. Make sure

everyone uses the same software versions, both for applications and operating systems and the same defaults. A mess of incompatibilities requires review, re-evaluation and upgrading to improve basic infrastructure performance. Storage and back-up systems should be included along with regular data retrieval drills.

Storage Options

Basic storage is available in all computers but this should be augmented with additional offline storage. This also ensures capacity for regular data back-ups, an added extra for disaster recovery systems which should obviously be located off-site as a mirrored system. This is a common model in newspaper publishing, although relatively rare in printing companies.

Storage can be within the computer, on a connected device or in the cloud. Data is commonly stored on a hard drive or on optical storage media such as CDs and DVDs. Capacity and speed determine what works best: data stored in flash memory, such as a USB drive is convenient for one, but not for many. Conversely backing up in the cloud puts data off of the premises and carries a cost.

Servers are typically configured to use a RAID system (Redundant Array of Independent Drives), to improve both performance and safety.

Redundant Array of Independent Drives (RAID)

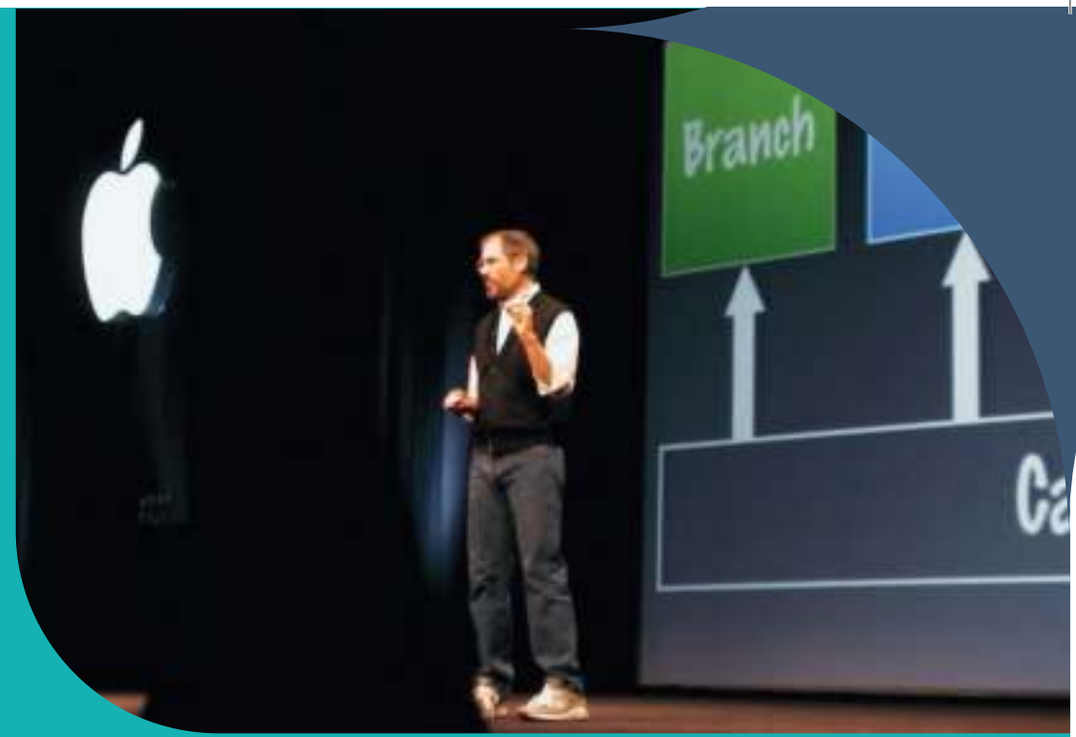
This data storage virtualisation technology provides data redundancy and improved system performance. RAIDs use various schemes to deliver the required levels of performance, redundancy and security, for instance against complete drive failures. Data distribution is managed either in software, generally as part of the OS, with additional hardware or through device drivers.

Data Compression

A common method for distributing shared files is to use data compression, encoding data to use fewer data bits. Compression software either eliminates data it considers statistically redundant, a lossless process, or identifies and removes data considered unnecessary. Data compression reduces file sizes and creates smaller, more easily transmitted files, and saves storage space. Be sure the data can be decompressed and that resources are available to do so.

Operating systems (OS)

Ensuring hardware has sufficient capacity and scope and buying the necessary software is simple enough, but more difficult is choosing the best operating system for a business. The graphics industry once gave Apple a promising future because the Mac's intuitive operating system was visual, following the Windows, Ikons, Mouse and Pointing (WIMP) principles Xerox had pioneered with its Star computer. The alternatives were the Microsoft Disk Operating System (DOS) a code line interface, or expensive workstations running the UNIX operating system. Neither was easy to use.



Even if companies like Apple (Steve Jobs pictured here) have done a lot to make it easy to use computers, you shouldn't underestimate the need for training staff on how to use both operating system functions and key software in your company. Photo by Paul Lindström.

Following numerous stumbles by Apple and after a few false starts Microsoft's Windows operating system rapidly overtook Apple's position in the graphics industry. For many years it was the dominant OS however Apple has resurged and clawed back ground. Windows is ubiquitous, cheap and familiar, but the Mac is more stable, more secure and rules on application behaviour and quality control are strict. The choice of Windows or Mac OS depends on which will be most productive for a given environment.

These are the main OSs used in the graphics industry, but there are many more. Open Source options, such as Linux which is based on Unix, are freely available. Mobile operating systems, such as Google Android and Apple iOS are gaining ground. As the graphic arts further embraces mobile computing, understanding what these OSs offer will become more important.

Virtual Worlds

You may want to run more than one OS at a time, and this is entirely possible. Virtual computing emulates a particular system and virtual environments can be set up using software, additional hardware or both. Virtual environments can provide complete emulation, for instance the Windows 10 OS running independent of the host Mac's OSX. Or you can have a virtual machine that's specific to a process, such as renaming incoming files created on a Mac but needing processing on a PC.

Software

Upgrading software invariably stops something else in the system working as expected. Annoying and disruptive for users unplanned or chaotic upgrades can undermine productivity. Training is vital to help operators come to terms with differences and new features. Most applications are backwards compatible, however older software versions won't open files created with the latest one and will be unable to process instructions that support new features or were designed for a later OS.What they think they have created and what operators see on screen might not be the same. The same applies for fonts, colours, trim and bleed all of which might have been supported differently in a client's version of the software and associated OS.

As can be seen in the explosion of mobile apps, there is software for just about any application possible. However in the graphics industry there are some basic must-haves, particularly Adobe Creative Cloud. Acrobat, Illustrator, InDesign and Photoshop, are basic tools that every print service provider encounters every day. They are the engines that get ideas from

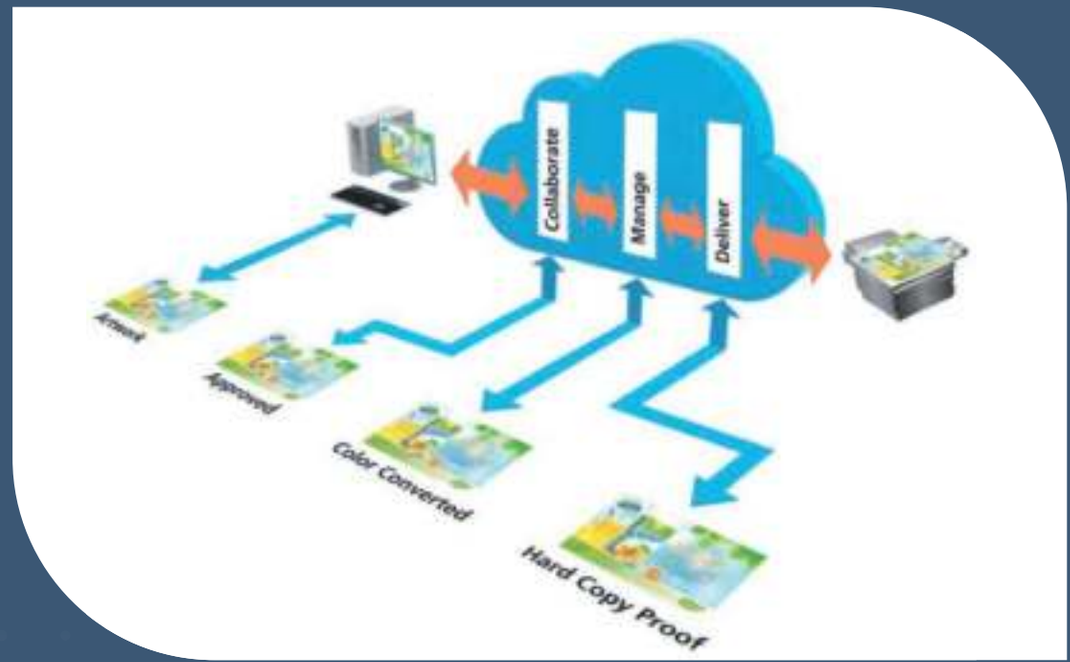
peoples' imaginations onto the printed page and although there are alternatives, such as the Affinity Suite consisting of the apps Photo, Designer and Publisher, Adobe's Creative Cloud remains dominant.

Adobe was one of the first companies serving the graphics industry to sell its software, not as an application package but as a service. It has tools for graphics, web and media applications but they are only available through annual or monthly subscription.

In the clouds

Computing increasingly happens in the cloud. Ever larger server farms deliver software and services to customers on a subscriptions basis. Converged servers provide resources that are always available anywhere to armies of users. Cloud computing ensures that services and application software are always current and, using third party data services, turns computing into a utility. Cloud computing benefits from economies of scale and companies no longer need to invest in computing, depending instead on a cloud service provider.

System developers have provided Software as a Service (SaaS) for many years, using remote



Caption: More and more software vendors offer cloud based solutions, for example GMG with their CoZone colour management solution.

computing to provide software updates to clients. SaaS and the cloud assume that services are effectively rented rather than purchased outright and can be scaled up or down as needed. This is convenient for managing IT expenditure, but there are downsides. Service providers might go out of business; moving to a new service provider could be complex particularly for opening files created under a previous subscription. Moving job files to Adobe's Creative Cloud means losing control over documents and jobs to some extent, although it is possible to work offline on files opened from the Adobe Creative Cloud servers.

Data Management Basics

Managing IT infrastructure is a vital part of managing and controlling a business. The resource must be optimised to deliver the best possible performance, tuned for data volumes, production processes and operator expectations. Updates to hardware and software, plus following reliable routines for backups and data housekeeping are mandatory to keep the IT foundation in good health. Training and processes make this easier so that backup routines, for instance, are designed to prevent new files being inadvertently overwritten by old data. Staff should know how to run data checking routines, scan for viruses and defragment their disk drives. They must recognise when things aren't quite right and be alert to the possibilities of malware.

IT best practices include regular saves, consistent naming conventions and consistent data entry. Software errors should be tracked and reported, as a fix might be available. Some applications are riddled with inconsistencies that undermine operator efficiency, so you want to know if you have this problem because it will influence future investment decisions.

Data format routines and naming conventions must be consistent and meaningful. Naming conventions help keep track of files and versions and support automation by routing files to hot folders for subsequent processing. Client files should be in the preferred data format, such as PDF or one of the PDF/X formats. The Mac OS doesn't automatically assign suffixes to saved files, but versions of Windows prior to Windows 7 cannot open files without a suffix, such as .pdf or .docx to tell Windows what to do with the file. Mac OS and later versions of Windows can open files even without a suffix. Also if your clients use the latest version of Microsoft Word, but you do not, be prepared to be unable to open .docx files on a PC. These are the types of irritating missteps that can occur. They are generally not difficult to solve, but they slow down operations and negatively affect production.

Keep Ahead of the Game

Whether you like living in the digital world or not, computing is an unavoidable necessity, much the same as any other utility. Fortunately you have plenty of flexibility in setting up your IT infrastructure, but you must understand your options and have some idea of the general trends in computing such as AI and mobile.

The effectiveness of your digital set up determines how quickly work gets through the system to output, from initial customer contact through to printed, finished and installed jobs. System maintenance and device calibration are key because the IT infrastructure affects all aspects of production from colour management, preflight checking, nesting and imposition, Raster Image Processing (RIP), to finishing and everything else. It is the foundation for task processing, so keep current with new developments in networks and computing. Remember the web is a public extension of your own private network, so make sure servers are secure.

Troubleshooting

When things do go wrong, and they will, start with the basics of what you know: is it a hardware or a software problem? Is the problem between the OS and an application? Which one? Is it a memory problem and if so is it related to disk space (check disk fragmentation) or RAM? Are your networks coping with authentications and data loads? Is your RIP overburdened and causing a bottleneck? And most importantly do you have an inhouse cases of UUS? Useless User Syndrome is one of the most likely causes of errors in modern IT set ups. The good news is that it's not terminal. It develops when operators lack the knowledge to manage their bit of the system and this is easily fixed. Having training programmes in place support new and existing employees helps ensure that upgrades are managed in a controlled way. Manage upgrades by isolating part of your network and testing performance of new software and hardware versions before letting them run amok across the entire system.

Computers continue to evolve much as cars do, and as with cars we can expect ever more autonomy and automation. Like the driverless car, digital system autonomy is not so far away. For communications professionals this has complex implications for staff and business models, even for technology ownership and management. Understanding the possibilities and opportunities integrated digital systems offer is the first step in building a business fit for the needs of the digital age.

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