SET 6

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EXPERT TECHNICAL GUIDE

IT & INFRASTRUCTURE

GUIDE 1: INTRODUCTION

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DIGITAL WORLDS

Today's Information Technology (IT) is like driving 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. They have gone from feats of engineering that demand extreme skill to keep functioning, to tools that anyone can use and fully exploit.

Whether it's pencils or an abacus or a digital device, IT is what we have always used to get things done. In the past we could see and touch most of our information tools, but in the digital age we face anonymous processes working unseen and mysteriously, and which many people find about as accessible as quantum physics. But basic IT is not difficult, even though it mostly functions invisibly. Accept IT's nonphysical nature and you will find it easier than you think to embrace your inner geek and take control. You determine IT's impact on your business, good and bad. Understanding some basic digital principles and processes gives you the means to manage your IT and digital infrastructure effectively.

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 1s and 0s, 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 of the Roman alphabet, so it was 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. A computing language, such as C++ or Java, 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. This is why we have dedicated categories of software, such as tools for crunching numbers or managing databases.

Operating systems control the computer's functions and software or application tools work in tandem with the operating system. Together they provide you with the technology to get things done. If you have only the operating system's functions, you cannot perform unsupported tasks. If you have too many software applications running, plus a desktop littered with open files, the operating system will struggle. It will be unable to manage efficiently the data you want to process and associated tasks. 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, Random Access Memory (RAM) that passes data to the CPU. The CPU executes a computer program's instructions and controls the input and output (I/O) operations. Systems can include additional hardware such

as graphics boards and extra processors for dedicated tasks. For example, Application Specific Integrated Circuits (ASICs) are chips that control specific behaviours of external devices. 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 ASICs.

The CPU is a computer's brain. It processes instructions a software program provides and which are held in RAM for processing. 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. Depending on their speed, capacity and configuration CPUs cost from as little as €25 to €2000 for a top end CPU, and this 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 this law constrained by physical size, but inventors keep coming up with ways to make processors smaller, so Moore's Law still goes.

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, 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 that are not much different 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. Similarly if you lack sufficient RAM for the applications you run, your computer won't perform instructions at acceptable speeds. If you run many heavy duty applications, such as PhotoShop, Illustrator, InDesign and Quark XPress, you need much more RAM than if you just run Word and Excel.

Configuration possibilities for your IT infrastructure are endless. The only absolute is that the infrastructure works for what you want to achieve, who's doing the work and of course the nature of the work. If you are a one man band who subcontracts printing device support, accounting, layout and all other services, you can manage with a laptop for emailing and web access. This is however too meagre a set up for you to fully exploit your capital equipment investment. If you have several employees who need to share common resources, such as software and output devices you need to manage this using a client/server architecture configured to support your team and production throughput requirements.

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.

CLIENT/SERVER SET UPS

The idea is to use one powerful computer, the server, to manage tasks and workloads so that resources are shared with connected clients. The clients request services which the server provides across a network. How many clients a server can support depends on its capacity and the data intensity clients feed the server to manage.

Computers exchange data across a network, so networks are fundamental to IT infrastructures. The network can use cable or wireless media to connect different nodes, including 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 used to manage network traffic. Without the network it's impossible for computers to run applications that depend on communicating with another device. This includes such things as accessing the internet, sharing application tools, storage servers, remote device data storage, printers, use of email and instant messaging applications.

Look at the work being done throughout your company to make sure computing resources available match the tasks you expect staff to perform. Make sure everyone is using the same software versions, both for applications and operating systems and the same defaults. If you have a mess of incompatibilities, come up with a cunning plan to evaluate and upgrade the tangle, step by step. This will substantially improve your basic infrastructure performance. Do not forget to factor in storage and back-up systems; make sure retrieval works by testing regularly.

STORAGE OPTIONS

You will have basic storage in your client computers and can augment this with additional offline storage. This is also the best way to ensure that all data is backed up regularly and provides a model for disaster recovery. Disaster recovery systems should obviously be located off-site. If your plant suffers a catastrophic failure, you can reboot from the offsite mirror system. This is a common model for the newspaper industry, although it's relatively rare for printing companies.

It's important to remember the distinction between different types of memory. RAM is short term memory accessible to the CPU but the data disappears when the computer is switched off. Data that you keep is most commonly stored on a hard drive, and is not accessible to the CPU. You can also store and back up data on optical storage media such as CDs and DVDs. You can store data in flash memory, such as a USB drive, but this is not recommended for data that you want several users to be able to access regularly and conveniently. These different classes of memory can be online, as is the case with your computer's hard drive, nearline so that you can access the device easily from your computer, or offline which requires you to physically connect the storage device. Of these three only online storage is immediately available. Another alternative is to do your backups to the cloud which has the benefit of being off of the premises and is usually inexpensive.

REDUNDANT ARRAY OF INDEPENDENT DRIVES (RAID)

This data storage technology is commonly used to provide data redundancy as well as improved system performance. The collection of drives stores data using one of several schemes, depending on the performance and level of redundancy required. Different RAID levels balance these requirements according to the level of protection you need, including complete drive failures. The data distribution is managed either in software, generally as part of the OS all of which support RAID implementations. Data distribution can also be controlled with additional hardware or through the device drivers.

DATA COMPRESSION

A common method for distributing shared files is to use data compression. This process encodes data to use fewer data bits by one of two means. The software can eliminate data that it considers to be statistically redundant, a lossless process. Alternatively the software will identify data that it considers unnecessary and remove it to reduce the file size. Data compression is useful because it saves storage space and creates smaller files that are more easily transmitted. However you must be sure that the data can be decompressed and that the required computing resources are available to do so.

OPERATING SYSTEMS (OS)

Ensuring your hardware is robust enough and that you have the right systems architecture for what you want to do is simple enough. A more difficult decision is your selection of the best operating system for your business. Years ago the graphics industry gave the Apple a promising future because the Mac's operating system was visual and followed the Windows, Ikons, Mouse and Pointing (WIMP) principles pioneered by Xerox. At the time the alternative was a code line interface, the Microsoft Disk Operating System (DOS), or expensive workstations that ran the UNIX operating system, none of which were easy to use.

However after some life-threatening stumbles by Apple and a few false starts Microsoft's Windows operating system soon eroded Apple's position in the graphics industry to become the dominant OS. That seems to have been changing over the last couple of years, with Apple resurgent and starting to claw back ground. The attractions of Windows are its ubiquity and the fact that so many people are familiar with it. The Mac on the other hand is more stable, less vulnerable to security breaches and Apple's rules on application behaviour and quality control strict. You must decide to what extent you can expect your system to be most productive: Windows or Mac OS?

These are the main OSs used in the graphics industry, and there are many more although none with such reach. There are also numerous Open Source options, freely available operating systems such as Linux which is based on Unix. We are seeing growth particularly in mobile operating systems, with such things as Google Android and iOS gaining ground. Chrome OS is a browser and cloud storage based desktop OS, probably not recommended for graphics professionals as it won't run any graphics software, yet. As mobile computing comes to the graphic arts, it will be more important to understand what these OSs offer.

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 XP 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 can be painful, because once you change one thing, you invariably find that something else stops working as you expect. Besides being annoying for users, disruptions can undermine their productivity as they come to terms with differences and new features. Modern applications are written to be to some extent backwards compatible, however it doesn't work the other way around. Don't expect to be able to use an old software version to open files created with the latest one. The older software will not have the commands to process instructions in support of new features. Keep this in mind when working with client files. What they think they have created and what your operators see on screen might not be the same, and this could be why. The same applies for fonts, colours, trim and bleed all of which might have been supported differently in your client's version of the software and associated OS.

We used to say software and now apps may be the preferred expression to use, although it generally refers to little software packages used in mobile devices. As can be seen in the explosion of mobile apps, there is software for just about any application you can think of. There are no rules as to which applications you should use, but in the graphics industry there are some basic must-haves. The Adobe applications are most important, as without them it is unlikely that you will be able to process client files. Acrobat, Illustrator, Indesign and Photoshop, are basic tools that every print service provider encounters every day. They are the engines that get ideas in peoples' heads onto the printed page and although there are alternatives, such as QuarkXPress for layout, Adobe's Creative Suite dominates totally.

Adobe was one of the first companies serving the graphics industry to sell its software, not as an application package but as a service. Creative Suite includes tools for graphics, web and media applications and is only available through annual or monthly subscription to Adobe's Creative Cloud.

IN THE CLOUDS

Computing is moving rapidly to the cloud as more and more companies set up large server farms to deliver software and related services to their customers on a subscriptions basis. Think Internet Service Providers (ISPs). The idea of these converged servers is to provide resources that are always available anywhere to armies of users. Cloud computing also ensures that services and application software are always current. Using a third party data service turns computing into a utility benefiting from economies of scale. It also takes companies away from investing in their own equipment, depending instead on a cloud service provider.

The idea is not completely new to the graphics industry in that system developers have provided Software as a Service (Saas) for many years. They have long used remote computing techniques to

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

provide software updates to clients. SaaS and the cloud assume that you effectively rent rather than buy the software you use, and services can be scaled up or down as needed. This is a convenient means of managing IT expenditure, however you should consider carefully the implications of such a model. If you cancel your subscription or move to a new service provider you may not be able to open files created under a previous subscription. This is one of the concerns printers have with moving job files to Adobe's Creative Cloud: control over documents and jobs.

DATA MANAGEMENT BASICS

The management of your IT infrastructure is a vital element in the management and control of your business. As such it is a resource that you can optimise to deliver the best possible performance results. Make sure that you know what data volumes are passing through your production system, for instance. Keep track of updates to hardware and software and establish routines for backups and data housekeeping. When you set up your backup routines, make sure that you include safeguards that prevent new files being inadvertently overwritten by old data. Make sure your staff understand the importance of running data checking routines, know how to scan for viruses and can defragment their disk drives. They should also be able to recognise when things aren't quite right and be alert to the possibilities of malware, which is invasive software with malicious intentions.

You should also encourage good IT practices amongst your staff, such as saving regularly, following naming conventions and entering data consistently. Ask them to keep track of software errors as this could indicate badly written software code, for which there might be a fix. 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 should also be established. Naming conventions help to keep track of files and versions. They can also be used to route files to hot folders for subsequent processing. Be aware of how clients send you files and where possible specify your preferred data format, such as PDF or one of the PDF/X formats.

If clients send you native files without suffixes, you may have difficulty processing them. 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 the PC. These are the types of irritating missteps that can occur and they are generally not difficult to solve. But they slow down operations and cumulatively negatively affect your digital environment.

KEEP AHEAD OF THE GAME

Whether you like living in the digital world or not, computing is a basic business 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.

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

TROUBLESHOOTING

When things go wrong, start with the basics: is it a hardware or a software problem? Is the problem between OS and a particular application? Is it a memory problem and if so is it related to disk space or RAM? Are your networks set up to cope with the data load? Is your RIP overloaded and causing a bottleneck? And most importantly do you have an inhouse case of UUS? Useless User Syndrome is one of the most likely causes of errors in a modern IT set up. 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.

Ensure that you have training programmes in place to support new and existing employees and that whenever you upgrade some part of the system that you do it in an controlled way. Do this by isolating part of your network and testing performance of new software and hardware versions before letting them run amok across your entire system. Most important of all, respect the need for regular training and basic understanding of how a computer works for yourself and for your staff.