How academic IT departments manage changing IT environments

Some of the methods that academic IT department use to handle changes in the future IT environment are discussed by ***Prof. Bill Buchanan***, Professor of Computing, Edinburgh Napier University plus how they can interpret trends and spot new capabilities

Matching what industry wants with what applicants want

A major problem for any IT academic department is matching jobs market requirements to courses which appeal to applicants. There is currently massive industry demand for software and embedded engineers, but IT academic departments have generally struggled to recruit candidates to these types of courses.

At present, courses focused on gaming, computer security, digital forensics, cybercrime, and digital design, are seeing a fast growth in applications. These hotspots, though, can create considerable problems for departments, especially as popular courses are often initially starved of teaching resources, because staff cannot, or do not want to, move quickly enough into the new areas. Overall this tends to be the problem for the head of school who must judge whether something is a short-term 'flash in the pan' or a long-term trend. Good examples of courses which had a peak and then settled down well to good amounts of long-term recruitment have been in software engineering, computer networking, and multimedia.

A major problem is in creating courses which are appealing to applicants and any existing student base, but which might not match the requirements of industry. The way that academia often deals with this is to focus a great deal of attention on the programme title, making it attractive to candidates, while also being useful in defining the scope of the programme to recruiters. Buried within the programme, though, are the areas of study which are key things that industry actually needs. This is why many IT programmes often do not mention the words software development, business studies, project management, and ethics within the programme title, but still teach them. Useful within the title would be things such as media design, digital forensics, and gaming, as these are likely to attract candidates.

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Within many programmes in IT there can be a marginalisation of the subject area due to demands of students currently on the courses. This has been seen with computer networks, where programmes were created with a wide range of modules, in areas such as business studies and software development, which generally enrich the scope of the programme. Over the year, though, students often demand more modules in their focus, which can be to their disadvantage when they join the jobs market.

The push of the major vendors

In the IT industry one of the major moves over the last few years has been from vendors such as Cisco Systems, Microsoft and Juniper, providing a wide range of professional certification, intended to match training to the actual needs of industry. Academia has a difficulty in whether to adopt and integrate the professional certification into their programmes, or to continue to focus on core academic skills development. Applicants, though, are now becoming generally savvy in spotting where this type of infrastructure has been created, which makes programmes which integrate the material more attractive in future job potentials. Thus many programmes now highlight the integration with Microsoft and Cisco Systems, in providing relevant professional skills.

A major worry for many, though, is that academic programmes are far too focused on material produced by the major vendors, which limits the scope of knowledge that students can gain. While there has been a reduction in the focus of vendor derived material on their own product range, there still seems to be a lack of strong academic underpinning in much vendor-produced material. A good academic department will understand the importance of following parts of the vendor certification, but giving a wide coverage of the key academic principles behind any topic. Along with this it is important that academic departments encourage their

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students into continual professional study, to gain advantage in the jobs market.

Differing departmental profiles

One thing for sure is that every IT academic department has a different profile in terms of its focus, and it is often this focus which can define how innovative a department is, and how much they need to be.

In traditional research areas, there are many distinguished seats of learning, which have long track records for excellence and innovation in research and teaching. Medical and Business Schools, for example, have generally built up their expertise over many decades, and continue to be known for their lead in their domain. Computing and IT, though, is ever-changing, and each department has the opportunity to gain a lead over others by gaining a first-mover advantage. Over the past few decades this has happened with digital electronics, signal processing, microprocessor design, and so on. Each new technology brings opportunities to move and gain an advantage. Often this movement can fit into various profiles:

- Old School, Slow Mover. Often a traditional learning institution, which does not need to adapt to new teaching environments and subjects, as it can easily recruit without showing new innovations. Over time it will generally adopt new subject areas depending on factors such as their research profile.
- New School, Fast Mover. This is a department which bases its growth on identifying new and exciting areas, and has key innovators who can move quickly and change their environments and subjects to match. If they move fast enough they can gain a significant lead on the rest of academia, and gain a significant reputation, especially if they can support the development of a research infrastructure with the growth of the newly developed teaching area. This profile can be further split into schools which pick the right things, and then move in resources to expand the area, and ones which fail to sustain the investment, and lose out in the long term as the resources do not follow the initial lead. Some new subject areas can be slow burners, where a significant growth in applications is not seen for a year or two, while other can sparkle for a short time, and then fail in the medium term.
- Old School, Late Mover. This is a department which generally does not innovate, but watches how other departments are performing in terms of recruitment, and adopts ideas that have been proven to be successful. There is generally less risk, but it can suffer from general down-turns in recruitment in the short-term, as there are no programmes giving a recruitment spike to overcome the general downturn.

IT has been shown to be ever-changing, with new technologies springing up on a regular basis. This often leaves great opportunities for first movers, which could prove a winner in gaining a reputation in certain technological areas. The University of Abertay with Computer Games, and the University of Glamorgan with Computer Forensics, are good examples of how leadership can be gained with departments which move quickly and focus their resources into appealing areas. Without a sustained investment in research and knowledge transfer the first mover advantage can often lead to very little overall advantage, but the benefits can be great, in terms of the long-term sustainability of the whole department. Often, subjects which do not recruit well need the new areas to be able to justify their long-term base. Any department needs bright sparks, the people who are willing to move into new areas and take risks. Thus it is likely that new blood needs to be brought in on a regular basis, as departments can often stagnate around their existing expertise, leading to a long-term decline.

Generally it is unusual to see new programmes filled with completely new modules. The most common is to see one or two new modules, often in the later years of courses, which start to show some

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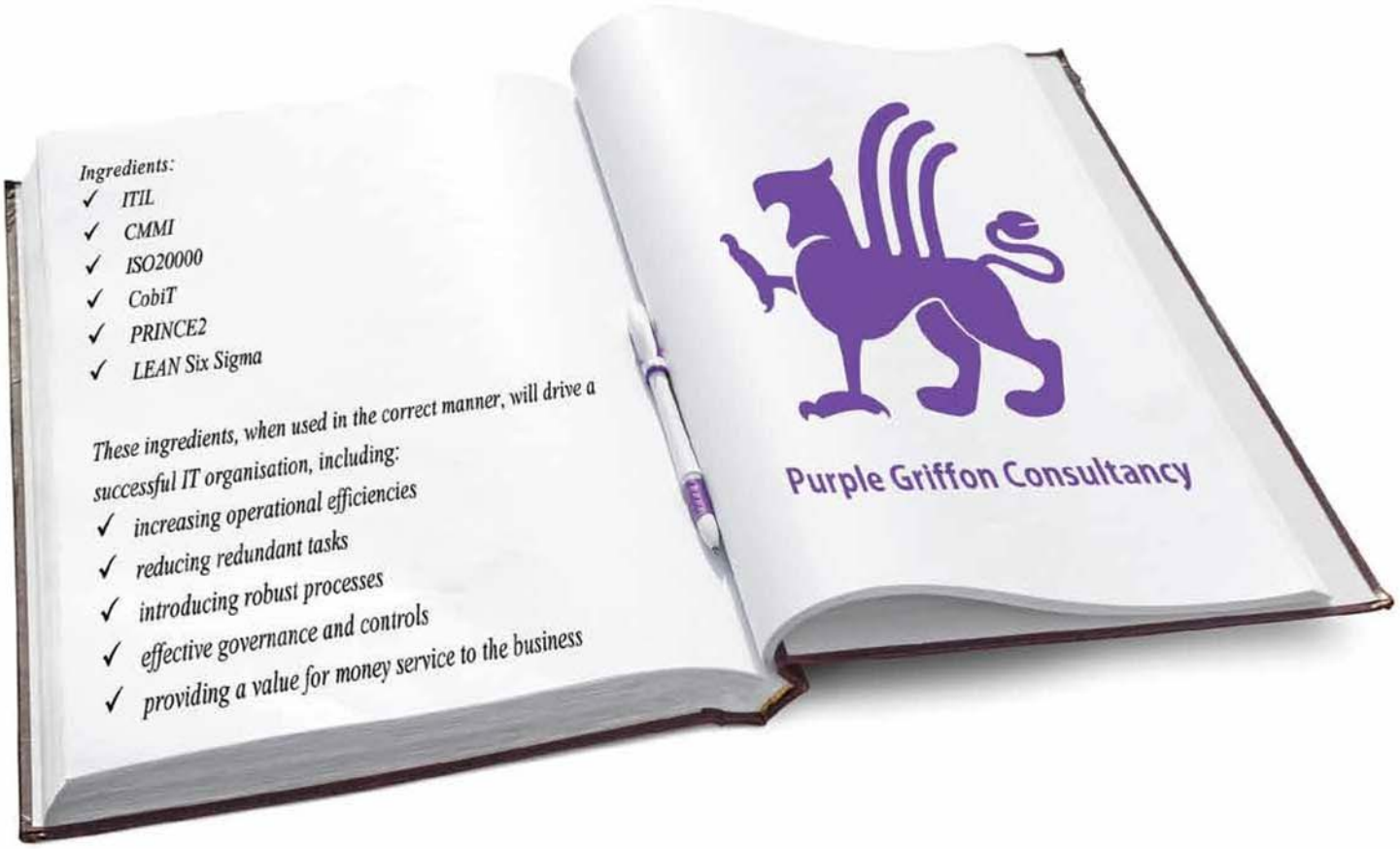

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appeal to existing students or to industry. This appeal is then often used to justify the development of a programme of study, in which the department needs to decide whether it can be sustained, given a few years to prove itself. Academia in the UK has often seen the creation of programmes which have failed due to a lack of market demand. A major problem is that it is often difficult to get real-life market assessments, and most departments will typically try an idea, and see if it attracts students. If it does, the resources will generally follow.

Cloud-based Teaching

A major problem in academia is to try and keep up-to-date with subjects and technologies, so that it often lags industry. The use of virtualised and cloud-based environments, though, provides an excellent opportunity to enhance learning and to provide students with skills which exactly match the requirements of industry, along with integrating with professional certification. At Edinburgh Napier University, a VMware vCenter Cloud infrastructure has been created to teach computer security and digital forensics, where students can learn on an enhanced infrastructure which would not have been possible before the extensive development of virtualised and cloud-based infrastructures.

For enhanced methods used within computer security, a private cloud can be used, and for more general teaching, such as in databases and operating systems, a public cloud can be used. This then provides exposure to a wide range of environments which are pre-build, or which are built-up throughout the module, and thus supports the students within a safe environment in which they can learn without any danger, and where errors can be easily undone. The environments can thus be created to use industry-standard tools and infrastructure, and these can be joined together to create collaborative work, along with the continuation of work after the practical lab work has been done. In fact virtualisation offers academia the opportunity to create infrastructures that would be difficult within a real-world, and also match-up with the requirements of professional certification, as illustrated in Figure 1.

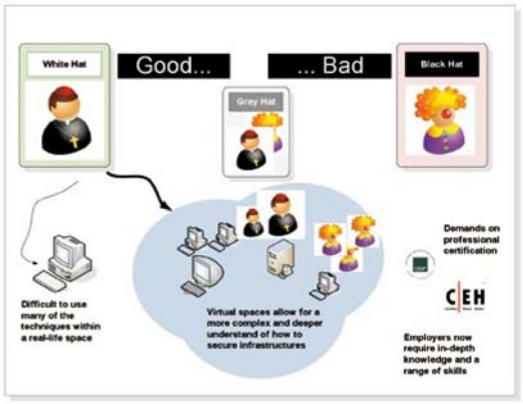

Figure 1: Creating virtualised infrastructures allow for more complex and in-depth analysis of how intruders might attack a system

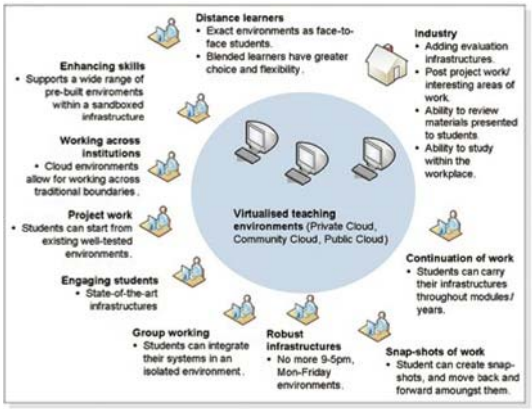

Figure 2: Using virtualised environments

A survey of student perceptions has shown one of the key factors is that they can work in real-life and complete environments, and on a range of systems, which are well matched to the needs of industry. It also supports both blended and distance learning students, using the same labs which are accessed within a face-to-face practical session, but done through a virtualised environment, all through a Web browser or remote desktop connection.

The usage of virtualised environments could thus give academia the possibility to catch-up with industry and use state-of-the-art infrastructures, along with having other advantages, as illustrated in Figure 2. It may also give academia the opportunity to share resources across traditional boundaries, and even start to engage further with industry in creating community clouds. VitAL

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