

## Dossier “Innovation and Good Practices in University Government and Management”

### ARTICLE

# Information Technology Incident Management: A Case Study of the University of Oviedo and the Faculty of Teacher Training and Education

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Submitted in: December 2011

Accepted in: April 2012

Published in: July 2012

### Recommended citation

FOMBONA, Javier; RODRÍGUEZ, Celestino; BARRIADA, Carolina (2012). “Information Technology Incident Management: A Case Study of the University of Oviedo and the Faculty of Teacher Training and Education”. In: “Innovation and Good Practices in University Government and Management” [online dossier]. *Universities and Knowledge Society Journal (RUSC)*. Vol. 9, No 2, pp. 280-295 UOC. [Accessed: dd/mm/yy].

<<http://rusc.uoc.edu/ojs/index.php/rusc/article/view/v9n2-fombona-rodriguez-barruada/v9n2-fombona-rodriguez-barruada-eng>>

<<http://dx.doi.org/10.7238/rusc.v9i2.1399>>

ISSN 1698-580X

## Abstract

Since their introduction into higher education institutions, information technology (IT) resources have become an indispensable, dynamic and controversial component of teaching- and research-related activities. This article explores some of the complex issues surrounding such resources through a study of the most representative IT incidents that occurred at the University of Oviedo and in one of its faculties, specifically the Faculty of Teacher Training and Education. It also aims to provide some guidelines to improve decision making in this particular field, and also to disseminate a number of significant findings in relation to the use of such technologies by higher education centres.

To that end, incidents reported at the University of Oviedo (with 30,000 people across four campuses) over three consecutive academic years are analysed. Incidents occurring in computers (which may include software and peripheral devices) used by students and lecturers in the Faculty of Teacher Training and Education's classrooms are also analysed. The results obtained show that, while the number of IT devices has increased, the number of incidents has remained constant. This indicates that users are able to use them better. Most of the problems reported by the university and faculty alike were connected with software. This suggests that robust centralised services for program updating and maintenance are required.

## Keywords

new technologies; IT incidents; education centre management; higher education

## *Gestión de incidencias informáticas: el caso de la Universidad de Oviedo y la Facultad de Formación del Profesorado*

### **Resumen**

*Las instituciones educativas universitarias incorporan progresivamente los recursos informáticos, que se convierten en instrumentos indispensables, dinámicos y controvertidos en la acción docente e investigadora. Este trabajo ex post facto intenta descubrir algunos rasgos de tal complejidad, a través del estudio de las incidencias informáticas más representativas que tuvieron lugar en la Universidad de Oviedo y en una de sus facultades (Formación del Profesorado y Educación). También pretende aportar pautas para tomar mejores decisiones en este ámbito y difundir las actuaciones significativas de uso de estas tecnologías en los centros de educación superior.*

*Para ello se analizan las incidencias recogidas durante tres cursos sucesivos en la Universidad de Oviedo, institución que acoge a unas treinta mil personas, repartidas en cuatro campus. También se analizan las actuaciones de los equipos que utilizaron los estudiantes y profesores de las aulas de la Facultad de Formación del Profesorado y Educación. Los resultados obtenidos destacan que, aunque aumenta el número de dispositivos informáticos, la cantidad de incidencias generadas permanece constante. Esto apunta a que los usuarios saben emplearlos mejor. La mayoría de los problemas, tanto en cuanto a la institución universitaria como a la facultad, están relacionados con el software, por lo que se sugiere la implementación de potentes servicios centralizados de actualización y mantenimiento de los programas utilizados.*

### **Palabras clave**

*nuevas tecnologías, incidencias informáticas, gestión centro educativo, educación superior*

## 1. Introduction

Nowadays, education centres systematically incorporate information technology (IT) resources into every area of activity. They have become an indispensable component of teaching- and research-related activities. Rather than information processors, computers have become the cornerstones of most academic activities, both for content development and subject methodologies. Technology helps to bring the cost of such activities down, and computers (which, for the purposes of this article, may include software and peripheral devices) are ever-more accessible, powerful and portable. This evolution has a quantitative and qualitative impact on education institutions' processes (Gutiérrez, Palacios & Torrego, 2010a). Mobile telephony devices allow computer services to be used anywhere, thus blurring the boundaries between specific computing spaces and their configuration. The Internet also changes the substantial use of computers, which become media for communication and personal expression (Acikalin, 2010). Underlying this dynamic, complex phenomenon are the IT incidents that occur and the software updating and maintenance that is required.

Managers in charge of buying, distributing and maintaining computers and their network services have to re-adapt their spaces, times and educational methodologies. Such managers occasionally focus their efforts on buying resources and software; after doing so, they realise that it is not easy to find reports or comparative experiences that serve as guidance for the proper use, servicing and maintenance of such resources. This evolution marks the difference between those institutions that are able to manage technological advances and complexity effectively, and those that are not (Bozionelos, 2004)..

## 2. The unique, dynamic ecology of IT resources and spaces

While reviewing the literature on IT incidents, the authors considered works that analysed the following: the use of IT resources in higher education centres (Lowerison et al., 2006; Selwyn, 2007); experiences describing the unique relationship between IT resources and users in the field of education; and the direct impact of IT resources on curricular development (Biscomb, Devonport & Lane, 2008; Gutiérrez, Palacios & Torrego, 2010b; Inan et al., 2010). The authors also analysed the IT management designs of Gibert (2006) and Oyewole (2010), as well as works by Menchaca and Contreras (2009) on networked educational activities.

These studies underscore the fact that education centres are formed by people with diverse profiles and social and cultural backgrounds. As a result, IT resources have a variety of users and heterogeneous uses, thus making the phenomenon a unique case in each education institution (Shell & Husman, 2008). Moreover, the academic context dictates the handling of such resources in a unique environment of experimentation and learning, where many members of the community share the same computer. At one and the same time, this leads to innovative academic achievements and inappropriate uses, breakdowns and deviations from the educational objectives set. The close interaction between a person and a machine, and the high phenomenological potential associated

with that, means that operational guidelines are necessary. In this respect, institutions publish operational rules for IT in internal usage documents and regulations.

In the early days, computers were concentrated in specific rooms to which students had access at certain times, basically when their activities required the use of computers. They were conceived as enclosed, isolated spaces. Subsequently, they were connected via local networks so that printers and other services could be shared. Today, computers are everywhere and are open to external communications, to local interactions via Intranets and to global access via the Internet.

Many applications have become dynamic and are available on remote servers and from virtual libraries in the cloud (Witten et al., 2009); this means that users have no option but to be online, though it does relieve from having to install and maintain such programs.

While the initial goal of IT resources in education institutions is to allow users to do academic work or administrative tasks, it is easy to establish that computer users actually use such devices for other, occasionally ambiguous purposes, such as recreational activities. With access to the Internet, the choice of objectives multiplies while new activities emerge, such as visiting social networking sites or communicating via them. Although they provide a communicational dimension, they may lead to deviations from academic objectives and potential problems (Sureda et al., 2010), and that is the reason why some works suggest strict rules for the use of networked computers (Flowers & Rakes, 2000). In contrast, other works defend the unrestricted, open exploration and innovation that IT offers. In this respect, it would seem that a new profile for the 'superquick' student has emerged: the digital native (Bennett et al., 2008; Prensky, 2001; Selwyn, 2009) or the net generation (Carlson, 2005; Judd & Kennedy, 2011). This is the type of student that has the ability to multitask; he or she can do several tasks at the same time without losing attention on any of them or needing more time to do them (Bowman et al., 2010; Junco & Cotten, 2010; Willingham, 2010).

This new context is broad and hard to delimit, and centres should offer their members the opportunity to use hardware and software with certain restrictions and under specific rules, that is to say, an institution's own set of applications and computers, whether connected to a server or not, that is available to students, lecturers and administrative staff.

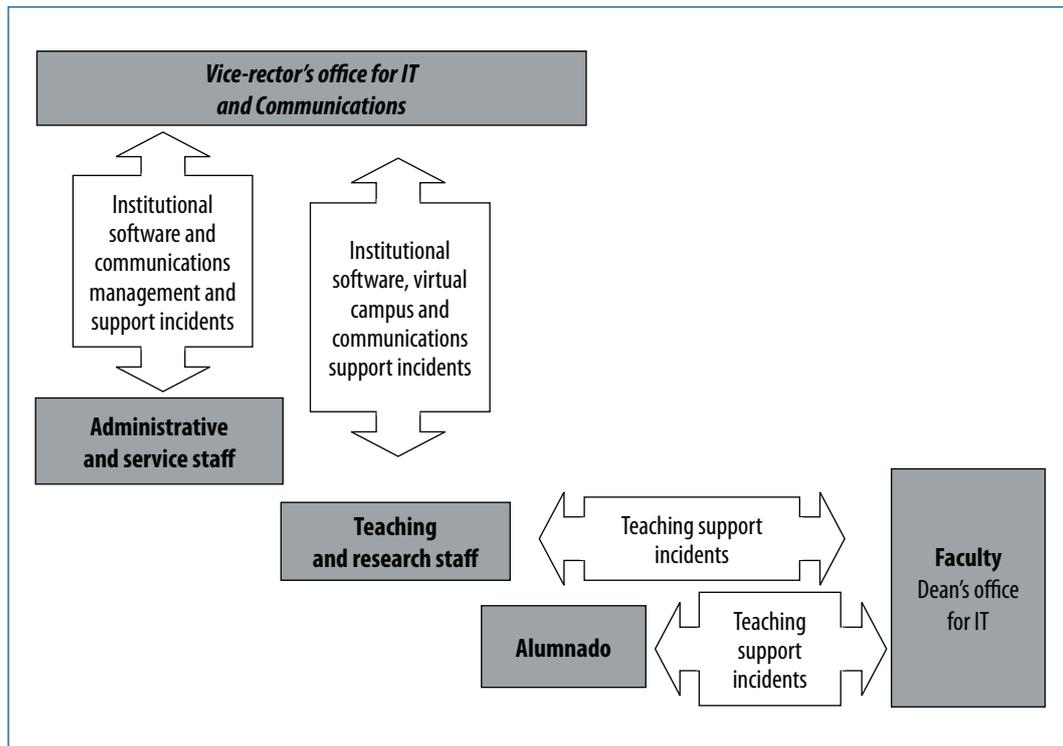
### 3. IT and communications incident management at the University of Oviedo and in its faculties

At the University of Oviedo, there are 30,000 people across four campuses: Oviedo, Gijón, Avilés and Mieres. It was essential to define the types of user of each IT resource, since software services and specific security levels vary accordingly. As a result, three types of user were defined: students (25,000), lecturers (2,020) and administrative and services staff (1,680). There are no strict boundaries between these three types of user because, on some occasions, students and lecturers may share computers and, on others, lecturers perform administrative and managerial tasks.

Incident management is performed at two action levels (Figure 1): institution level and education centre level. At institution level is the User Care Centre (UCC). This type of service is

commonplace in higher education institutions. It sorts out IT problems for the academic and administrative communities as a whole. At education centre level, which can be a specific faculty, the service provides lecturers and students with assistance for incidents arising from teaching-related activities.

Figure 1. Process of distributing IT incidents between the vice-rector's office and faculties.



At institution level, the UCC is formed by two coordinators, 11 technicians and three telephone operators, who deal with an average of 70 incidents a day, 25 of which require the staff to visit the place where the broken down computer is located. The centre receives 833 e-mails a month. There is an automated IT incident management tool (XPERTA), as well as an institutional website for support.

At faculty level, there is a service for sorting out problems and breakdowns connected with teaching-related activities, which collaborates very closely with the university's UCC. In this case, incidents occurring in computers used by students and lecturers in the Faculty of Teacher Training and Education's classrooms were also analysed. There were 1,912 students in this faculty in the 2010/11 academic year, during which it had 170 computers for teaching-related activities (Table 1) located in a number of different spaces, as well as the associated 48 flat-screen monitors, 123 CRT monitors and 13 printers.

Table 1. Educational spaces and resources in the Faculty of Teacher Training and Education

<i>IT resources</i>		<i>Non-IT resources</i>	
<i>Spaces</i>	<i>Number</i>	<i>Number of spaces</i>	<i>Resource</i>
For teaching the students (joint lectures and seminars)	37 spaces (with 1 PC)	30	1 VHS player
For lecturers' meetings	4 spaces (with 2 PCs each)	34	1 television
Open access to students	1 space (with 25 PCs)	15	1 DVD player
IT room for teaching (a)	With 44 PCs	13	1 audio amplifier for a public-address system
IT room for teaching (b)	With 21 PCs	37	1 overhead projector
IT room for teaching (c)	With 11 PCs	39	1 video projector
IT room for teaching (d)	With 24 PCs	11	1 interactive board
Total PCs managed	170		

## 4. Methodology

### 4.1 Aim

The aim of this descriptive study is to show the most representative IT incidents that occurred at the University of Oviedo and in one of its faculties, specifically the Faculty of Teacher Training and Education. It also aims to provide some guidelines to improve decision making in this particular field, and also to disseminate a number of significant findings in relation to the use of such technologies by higher education institutions.

### 4.2. Data management procedure

The study was carried out at two levels: institution level and education centre level. In order to analyse the institution-level incidents affecting the university's lecturers and administrative staff, reports of breakdowns and malfunctions of IT resources were collected for the 2008/09, 2009/10 and 2010/11 academic years.

For the compilation of the incident reports, the vice-rector's office for IT and Communications had an e-mail, telephone support and fax services, all of which were centralised in the UCC. Users also had the opportunity to report an incident directly via an automated IT incident management tool (helpdesk-XPERTA). These were the means through which a user was able to report an incident to IT Services, which would then send a technician to sort out the problem. The data about the user reporting an incident were included in a log. In addition, the incidents were classified by topic, response time and resolution time.

In order to analyse education centre-level incidents affecting the Faculty of Teacher Training and Education, a short incident report form was chosen, similar to the one used by the Polytechnic University of Valencia. The form contained the following eight items:

- Incident date
- Lecturer reporting the incident
- Incident location
- Description
- Person dealing with the incident
- Incident follow-up: resolved, with the date and a brief description of its origin
- Incident follow-up: pending further action
- Remarks

These incidents were dealt with by the respective members of staff from the dean's office and by four grant-holding IT students responsible for sorting out any problems with the computers in the first instance, and then for updating software and for performing inventories and preventive maintenance of IT resources.

## 5. Results

### 5.1 Institution-level data

The number of institution-level incidents reported between the 2008/09 and the 2010/11 academic years varied between a minimum of 181 in August 2009 and a maximum of 767 in March 2009: for the 2008/09 academic year, the mean (M) was 518.75 (with a standard deviation [SD] of 150.19; for the 2009/10 academic year, M=490.08 (SD=109.9); and for the 2010/11 academic year, M=501.83 (SD=98.66). With the distribution by the months shown in Table 2, there were no statistically significant differences in the aforementioned means between the 2008/09 and 2009/10 academic years ( $t(11)=1.283$ ,  $p=0.226$ ), between the 2009/10 and 2010/11 academic years ( $t(11)=0.655$ ,  $p=0.526$ ) or between the 2008/09 and 2010/11 academic years ( $t(11)=-0.549$ ,  $p=0.594$ )

Table 2. Incidents reported to the UCC at the University of Oviedo

<i>Incidents raised</i>	<i>2008/09 academic year (September-August)</i>	<i>2009/10 academic year (September-August)</i>	<i>2010/11 academic year (September-August)</i>
Total in the academic year	6,225	5,881	5,614
<i>Incidents raised</i>	<i>2008 calendar year (January-December)</i>	<i>2009 calendar year (January-December)</i>	<i>2010 calendar year (January-December)</i>
Total in the calendar year	6,078	6,014	5,910

Table 3 shows the incident data, by type: mechanical or hardware breakdowns such as problems with a computer's mother board, power source or internal devices; program problems; network and voice or data connection failures; problems with malware and viruses; and other atypical incidents difficult to classify. Having analysed the year-on-year evolution of each incident type, there were no significant differences in hardware, software, network or any other types of incident apart from viruses.

For that variable in the 2008/09 academic year,  $M=32.333$  ( $SD=15.86$ ); in the 2009/10 academic year,  $M=34.66$  ( $SD=16.42$ ); and in the 2010/11 academic year,  $M=15.58$  ( $SD=6.82$ ). There were statistically significant differences between the 2008/09 and 2009/10 academic years ( $t(11)=3.788$ ,  $p=0.003$ ) and between the 2008/09 and 2010/11 academic years ( $t(11)=4.010$ ,  $p=0.002$ ).

**Table 3.** Distribution of incidents reported to the UCC at the University of Oviedo, by type and academic year

Academic year	Hardware			Software			Network			Viruses			Others		
	2008/2009	2009/2010	2010/2011	2008/2009	2009/2010	2010/2011	2008/2009	2009/2010	2010/2011	2008/2009	2009/2010	2010/2011	2008/2009	2009/2010	2010/2011
TOTAL	1,166 (18.3%)	1,061 (18%)	1,140 (19.1%)	3,941 (61.8%)	3,612 (61.4%)	3,790 (63.6%)	213 (3.3%)	147 (2.5%)	207 (3.5%)	388 (6.1%)	416 (7.1%)	187 (3.1%)	668 (10.5%)	645 (11%)	634 (10.6%)

The number of IT incidents, by type (Table 3), remained constant over the period analysed. Most of the problems were found to be connected with software, maintenance and program installation issues (around 61-63%). To a much lesser extent, around 18-19% of the incidents were found to be connected with mechanical and component breakdowns, 3% with communications network failures and 6% with viruses.

The times taken to sort out the incidents were analysed by distinguishing between internal hardware and peripherals (printers and mice for example). A distinction was also made between issues connected with basic software (operating system, Microsoft Office and similar programs) and corporate software (Gauss, Sies, Sicalwin). In nearly 90% of the cases, the incidents were sorted out in a period of two weeks; those connected with corporate software were the quickest to be resolved, while those connected with a computer's hardware and basic software were the slowest.

The UCC's web-based service was visited 32,118 times in 2010; visits per month varied between 1,950 in August 2011 and 4,321 in September 2011. It should be noted that the section receiving the most visits was the one for obtaining software under the university's corporate licence, which accounted for 27.4% of all visits. There was also a high number of visits connected with the configuration of Wi-Fi access, which accounted for around 10% of the searches.

## 5.2 Education centre-level data for the Faculty of Teacher Training and Education

At the specific faculty level, it was calculated that each computer for teaching (which, as mentioned earlier, may include software and peripheral devices) had been in operation for 10 lecture hours a day for eight months per academic year, which represented around 1,600 hours of total operating time.

Among the incidents occurring in the 2010/11 academic year, which were specifically distinguished by type (Table 4), worthy of note are those connected with software, which accounted for 53%; the most frequently requested actions were the full or partial installation of programs connected with teaching and with a computer's basic operation.

Table 4. Incidents, by type, in the 2010/11 academic year in the Faculty of Teacher Training and Education

<i>Incident type</i>	<i>Number</i>	<i>%</i>
<b>Network incidents</b>	<b>140</b>	<b>11.1</b>
Network failures, IP or Proxy checking, network management system restart	60	4.8
Password changes, username unification and/or problems with user accounts	45	3.6
Wi-Fi and software installation or laptop configuration	32	2.5
Remote desktop configuration	3	0.2
<b>Software incidents</b>	<b>671</b>	<b>53.3</b>
Installation/uninstallation/partial update of software in classrooms	312	24.8
Installation/uninstallation/partial update of software in open access rooms	190	15.1
Video problems (projectors or monitors)	71	5.6
Audio problems	46	3.7
Full installation of software and disk cloning	38	3
Video problems (monitors)	14	1.1
<b>Hardware incidents</b>	<b>224</b>	<b>17.8</b>
Replacing/checking hardware in classrooms or open access rooms	155	12.3
Replacing/checking hardware in the meeting room or lecturers' room	44	3.5
Replacing network/mains/splitter cables	25	2
<b>Printer incidents</b>	<b>78</b>	<b>6.2</b>
Printer problems in the open access room (including toner replacement)	37	2.9
Printer problems in the lecturers' room (including toner replacement)	19	1.5
<b>Software and hardware incidents</b>	<b>78</b>	<b>6.2</b>
Repairing and/or checking computers in rooms	75	6
Viruses, internal hardware breakdowns, general check, memory	3	0.2
<b>IT management</b>	<b>90</b>	<b>7.2</b>
Recycling/replacing computers and/or materials	40	3.2
Inventory tasks and computer labelling	26	2.1
Orders for consumables (paper, etc.) and hardware (cables, splitters, etc.)	20	1.6
Requests for IP addresses	4	0.3
<b>Total</b>	<b>1,259</b>	<b>100%</b>

## 6. Discussion

A statistical analysis of the computer incidents and breakdowns showed what had happened over three academic years. On the basis of that analysis, it is possible to extract inferences about the strengths and weaknesses of IT resources, mainly to guide preventive action efforts to ensure that incidents do not occur.

The average number of incidents reported per day to the UCC at the University of Oviedo was 25. There were some months when the level of IT activity and number of incidents were low, such as the month of August, and there were others when they were high, coinciding with the start of each semester. The total number of incidents in each academic year remained constant at around 6,000; it dropped slightly in the period from 2008 to 2010, though not significantly. This data would seem to suggest that as the number of IT resources and applications increases, so too does the users' level of knowledge with respect to sorting out problems on their own.

In the faculty, of particular note are the incidents arising from software installation and maintenance. Monitor and projector problems should also be underscored.

Even though the design of operational rules should be precise and effective, in higher education such rules are usually minimal and open to interpretation. It would seem that, at this educational level, their design does not have an impact on the number of incidents (Garlan & Noyes, 2004); furthermore, such guidelines are actually enhanced by unexpected events that occur in academic life (Koh & Frick, 2009). On other occasions, rules are considered known and are adhered to in a self-regulated way (Schraw, 2010).

These premises are combined with the challenge of providing fast incident management. To that end, a small, clear protocol was designed, as was a free-flowing communication channel with the coordinator in order to achieve problem-solving speed. So, in the faculty analysed, the rules applied to computer users were reduced to the following guidelines:

For students:

- Access with credentials and identity documents
- Opportunity to save documents on the computer or server, and on user devices
- Quota of free printouts (50 pages)
- Initial and final obligation to check the state of the computer
- No penalties

For lecturers:

- In the event of a problem, an incident form must be completed and sent to the staff in charge of following it up.

These rules were complemented by online instructions on the web page of the vice-rector's office for IT, which provided guidance on the proper use of hardware devices and software.

The compulsory nature of the initial incident report, identifying both the problem and the user, helped to ensure that the user took responsibility for the proper handling of shared resources. The education institution provided usernames that were valid throughout the students' academic periods. Using computers that required personal password authentication by a server provided security and prevented any improper use. Four hierarchical user types were created according to their permissions:

- Username and password access for a personal user, authenticated by a central server, with administrative restrictions (guest user or student) or full software management and computer control rights (administrator or lecturer).
- Generic "SUBJECT" user, showing a subject's typical documents during a session.
- Specific username and password access for the computer used; easily accessible data that are repeated across all computers in the same activity area.
- Open access without a password

The users did not completely shut down the computers, but simply closed the sessions. This reduced the boot time and prevented new users from getting access to other people's profiles. Keeping computers on at all times meant that software could update automatically at night when they were not being used.

Of particular note are specific printer-related incidents. Due to the high cost of printing consumables, classroom computers were usually connected via a network to a single printer, which maximised resources in nearby rooms or offices that might also have shared a printer. A flexible control of the permitted number of free printouts for each student (limited to 50 pages a day) was also carried out. This had a dissuasive impact on excessive consumption. Now, the tendency is to manage all documents on digital media to avoid having to print them out.

## 7. Conclusions

The new technological ecosystem offers people greater flexibility in terms of how and where they work. The specific barrier of the IT room is vanishing while portable personal devices are being systematically incorporated (laptops, notebooks, PDAs, pocketPCs, iPads, etc.), all of which are connected to networks via Wi-Fi technology anywhere. This makes information and communication technology (ICT) management essential in any space, including the management of computers that do not belong to the institution.

The number and variety of IT devices is increasing yet the number of incidents remains constant, and this indicates that users are better able to manage them. Most of the problems reported by the university and faculty alike were connected with software. This suggests that robust centralised services for program updating and maintenance are required. This coincides with the increase in incidents in online spaces and servers. The education centre is expanding its scope of action, and

responds to incidents in virtual places, where students and lecturers coincide in asynchronous and synchronous real time, far from traditional academic infrastructures. As a result, incidents occur in study rooms, in corridors or recreational areas, where Wi-Fi access to networks is also provided, as is access to the power supplies required to keep students' portable devices working. Such openness can compromise IT security, so it is essential to effectively manage computer access protocols. Such protocols must also ensure that they do not prevent sessions from being quickly launched.

It is necessary to share solutions to IT challenges connected with new spatial needs and new uses, where personal and academic activities come together. The management of delocalised software and the influx of portable, interconnected hardware devices mean that responses to incidents have to be given anywhere, anytime. This involves the provision of versatile, fast solutions, with minimal, flexible rules and comprehensive online support.

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