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Post Graduate Diploma in Construction Informatics
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Computer Mediated Construction.

Online Technologies for Construction SME's

Document Sharing

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Abstract

The Architecture, Engineering, and Construction (AEC) industry and the related processes employed during planning, designing, building, manufacturing, occupying, maintenance, as well as the demolition of facilities all involve data and information that is used for a wide variety of purposes during the project lifecycle. With the complex nature of Educational AEC projects today, these processes engage multiple organisations, numerous stakeholders, such as interdisciplinary professionals such as Architects, Civil Engineers, Mechanical and Electrical Engineers, Quantity Surveyors, Landscape Architects and specialists suppliers, often spread around the world, utilising specialist and diversified computer applications and systems. These various stakeholders can be classified as Small to Medium Enterprises (SME's). In order to effectively support the use of information, SME's need to be able to represent their project data in a common interoperable format, which provides a facility of an accurate exchange of data among different computer systems and platforms.

This report has investigated current state of document sharing between software applications used in the Design Process for the Department of Education and Skills in Ireland and how digital information formatted and shared for projects by interdisciplinary teams within the AEC industry. The methodology to investigate the research in this report involved the examination of the existing software platforms and the use of Autodesk Building Design Suite Premium 2014. The work has adopted a comparative approach by identifying the software cost, platform cost, training, and security requirements utilised by the SME stakeholders for a typical school design project.

The report is intended to clarify the potential investment required for Construction SME's for Document Sharing for the construction of school projects in Ireland.

Key Words;

Integration, interoperability, BIM, collaboration, hardware, software.

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Introduction

This report has investigated current state of software applications and platforms used in conjunction with collaborative delivery of projects by interdisciplinary teams within the AEC industry. The report focuses on the use of Autodesk Design Suite Premium 2014 and Windows 7 Platform for sharing documents with SME's for school projects.

In Ireland most AEC companies utilise CAD based programs. Autodesk is one the most common software suppliers used for the design of schools in Ireland. This report shall look at the potential of Autodesk Design Suite Premium 2014 to share documents collaboratively between the Department of Education and Skills (DOES) and external design team Consultants (SME's).

Microsoft Windows is the most common software platform for the AEC sector that design schools in Ireland. It is intended to explore it's potential using Windows 7, 64bit Architecture and some of the new feature app's that are now available to aid a document sharing environment.

The choice of the subject was driven by Author's observations of the AEC industry while being involved in educational design development, design and construction management of school projects. These observations have resulted with the view that the AEC industry greatly lacks efficiency and it is in a desperate need of improvement mainly in the training area. This is in light of the current economic climate, attention to sustainability, cost control measures, budgetary constraints, and the patterns indicating a trend of deepening single-person's professional responsibility the use of BIM software is progressing slowly in the government sector.

This work is not without limitations. Vast amount of software and management approaches in existence today has allowed only a handful of scenarios to be evaluated. As there is no agreed one set of methods in place to determine the best way to share documentation, each discipline of the design team will have its' own data sharing protocols and in some cases these will need to change in order to facilitate document sharing in an open BIM environment. Finally, the time frame allowed for the Report and the volume limitation of the report has permitted for investigation of selected areas only.

Review of Previous Work

Theoretical Background

This chapter informs the reader what is already known about the research problem by identifying Online Technologies and identifying the software used in the Irish SME sector for document sharing.

Report Literature

Historically design teams would produce their information using pencil or ink hard format paper drawing and exchange these sheets of paper capturing their designs. Together with the agreed set of standard drawing conversions and person-to-person office or site communication they formed very interoperable system. With the widespread adoption of digital technology data sharing system was exchanged for a system incorporating new methods and tools that substituted the proven ways of working. The drive for adoption of new technologies is explained by companies' desires - and pressure - to become more productive, cost effective, quality conscious, creative, and innovative in designing, building, and operating facilities.

Software Applications Utilised in the Research

There have been a number of criteria considered to select the software applications utilised in this research. The key criterion has been the popularity of the software packages among the varying professionals involved in the AEC industry in Ireland. The choice was based on Author's experience and knowledge gained through his involvement in architecture, engineering and construction during the design and construction of educational facilities.
The software applications utilised for the purposes of this report are summarised in Table 1.

Table 1 - Software utilised in the research

USER	SOFTWARE	WEBSITE	DESCRIPTION
SL	Windows 7 Windows 8	http://www.microsoft.com/	Platform Software
SL	**Microsoft Office – Office 365 Small Business Premium includes:**	http://holiday.microsoftstore.com/store/msusa/en_	Get the latest version of Office plus business-class email, a public website, web conferencing, and

	Office applications Microsoft Word Microsoft PowerPoint Microsoft Excel Microsoft OneNote Microsoft Outlook Microsoft Access Microsoft Publisher Microsoft Lync	US/list/Office-for-SMB/categoryID.63466500	document sharing—all easy to manage, without IT expertise. Works with the Office[1] you already have. Get business-class email, a website, web conferencing, and document sharing, with no IT skills needed to manage it at all.
SL	Autodesk Building Design Suite Premium 2014 AutoCAD® AutoCAD® Architecture AutoCAD® MEP AutoCAD® Structural Detailing Showcase® SketchBook® Designer AutoCAD® Raster Design ReCap™ 3ds Max® Design Navisworks® Simulate Revit® Commercial Version	http://www.autodesk.com/suites/building-design-suite/included-software	Autodesk Design Suite Premium 2014 Premium: All the functionality of the Standard edition, plus the power of Building Information Modeling (BIM) and additional tools to create compelling visualizations.

Windows 7 and Windows 8/8.1

Windows is the most prevalent Operating Platform in the Irish AEC sector. This research as determined that there is a trend by Microsoft Corporation to make Windows 7 less available to purchase and instead have the users migrate to Windows 8/8.1.

There are many programmes and apps that can be utilised by Windows but it is essential to have an operating platform that not only permits the user to develop their work streams it should also permit collaboration with other stakeholders that can contribute to the projects' success. Currently it is difficult to purchase Windows 7 as Microsoft would prefer that system platforms are upgrades to Windows 8 or 8.1. However it is possible to purchase hardware with Windows & preinstalled from third party vendors such as Dell, Lenovo, Hewlett Packard and the majority of hardware suppliers. The network used by the Department of Education and Skills is Windows 7 based with 64bit Architecture.

Cost €279.00 incl. VAT

Microsoft Office – Office 365 Small Business Premium includes:

Office applications

Microsoft Word

Microsoft PowerPoint

Microsoft Excel

Microsoft OneNote

Microsoft Outlook

Microsoft Access

Microsoft Publisher

Microsoft Lync

Office on more devices

Enjoy a consistent and familiar Office experience across PCs, Macs, Windows tablets, and most mobile devices.

Plus these online services:

Email and calendars

Use business-class email through a rich and familiar Outlook experience you can access from your desktop or from a web browser using Outlook Web App. Get a 50 GB mailbox per user and send attachments up to 25 MB.

Simple file sharing

SkyDrive Pro provides 25 GB of storage for each user for virtually anywhere access to their documents. Share files with others inside and outside the organization, control who can see and edit each file, and easily sync files with PCs and devices.

Public website

Design and maintain your own public website with no additional hosting fees. Use your own domain name to promote your brand.

Team sites

Enable easy access and sharing of documents with 10 GB baseline storage plus 500 MB of storage per user.

Web conferencing

Host online meetings with audio and video using one-click screen sharing and HD video conferencing.

Instant messaging and Skype connectivity

Connect with other Lync users via instant message, voice calls, and video calls, and let people know your availability with your online status. Share presence, IM, and audio calling with Skype users.

Office Mobile Apps

Stay productive and never miss a meeting, even on the go. Access, edit, and view Word, Excel, and PowerPoint documents on iPhones, Android phones, and Windows Phones. Use the OneNote, Lync Mobile, and SharePoint Newsfeed apps on most devices.

Reliability

Get peace of mind knowing your services are available with a guaranteed 99.9% uptime, financially backed service level agreement (SLA).

Security

Your data is yours. We safeguard it and protect your privacy.

Administration

Deploy and manage Office 365 across your company, no IT expertise required. You can add and remove users in minutes.

Support

Microsoft Support provides telephone and online answers, how-to resources, and connections with other Office 365 customers for setup and quick fixes.

(Microsoft Corporation, 2013)

File sharing essentials

Windows 7/8/8.1 makes it easier than ever to share documents, music, photos, and other files with people at home or at the office.

Introducing homegroups: easy sharing at home or work.

The easiest way to share files on a home network is to create or join a homegroup. A homegroup is a group of computers that share pictures, music, videos, documents, and even printers. The computers must be running Windows 7/8/8.1 to participate in a homegroup. When setting up or joining a homegroup, you tell Windows which folders or libraries to share—and which to leave private. Windows then works behind the scenes to toggle between the appropriate settings. Other people can't change the files you share unless you give them permission. You can also protect your homegroup with a password, which you can change at any time.

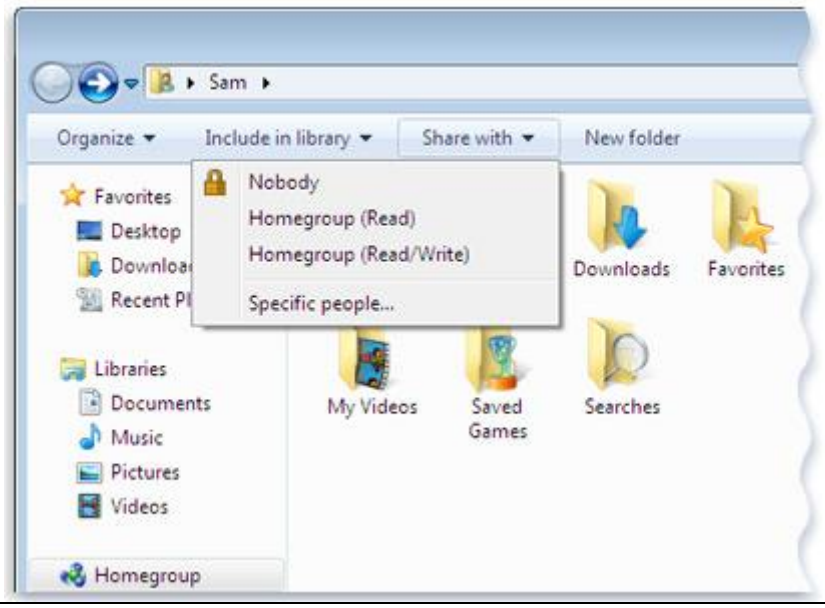


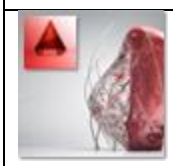
Figure 1- Share with menu

You can use the Share with menu to select individual files and folders and share them with others. The options you'll see in the menu depend on what type of item you've selected and what type of network your computer is connected to.

Autodesk Building Design Suite Premium 2014

Below in table 3 are the programs that comprise the Autodesk Building Design Suite Premium 2014 that the Department of Education and Skills utilise for the design process of school construction projects.

Table 2- Autodesk Building Design Suite Premium 2014

	**AutoCAD®** Speed documentation, share ideas, and explore 3D concepts with powerful design and documentation tools.
	**AutoCAD® Architecture** Get the power and familiarity of AutoCAD with features designed specifically for architectural design.
	**AutoCAD® MEP** Get the power of AutoCAD with features designed specifically for MEP designers and drafters.

	**AutoCAD® Structural Detailing** Get the power of AutoCAD with features designed specifically for structural drafting.
	**Showcase®** Easily transform AutoCAD designs and Revit models into compelling imagery, movies, and presentations.
	**SketchBook® Designer** Explore design concepts and produce stunning illustrations with digital sketchbook software
	**AutoCAD® Raster Design** Add powerful raster editing and raster-to-vector conversion tools to AutoCAD-based software.
	**ReCap™** Visualize, clean, and organize reality capture data in a powerful preparation environment.
	**3ds Max® Design** Create cinematic-quality visuals and movies to communicate and sell your design ideas.
	**Navisworks® Simulate** Integrate multiple models to improve collaboration, simulate construction, quantify scope, and enhance reviews.
	**Revit®** BIM tools for architectural design, MEP engineering, structural engineering, and construction
	**Autodesk 360** Get additional capacity (25GB) to store and share large design files in the cloud
	**Rendering in Autodesk 360** Move compute-intensive rendering to the cloud to create photorealistic images and panoramas

	**Green Building Studio** Perform whole building energy analysis, optimize energy efficiency, and work toward carbon neutrality.
	**Energy Analysis for Autodesk Revit** Analyse design concepts and increase the sustainability of building designs.
	**Remote** Use your remote computer or iPad® to conveniently drive any Autodesk software installed on your primary computer.

Open BIM

> OPEN BIM is a universal approach to the collaborative design, realization and operation of buildings based on open standards and workflows. OPEN BIM is an initiative of buildingSMART International (bSI) and several leading software vendors using the open buildingSMART Data Model.

(BuildSMART, 2013)

The literature review has provided information related to software programs from a range of vendors. It is not the intention of this report to thoroughly assess each individual programme but to make the reader aware of their potentials when utilising them for document sharing.

Aims of the report.

To provide a broad and sound conceptual framework for construction informatics, its role, classification of its topics, and core knowledge on the three main areas: computation, information representation and interpersonal communication.

Table 3 - Project Aims

Report Aim:	Completed
1. Define the role of informatics in society in general and in AEC in particular	✓
2. Describe the strategic importance on the informatisation of the AEC sector.	✓
3. Explain the potentials of construction informatics in general and of various specific application areas.	✓
4. Discuss critically the specific problems of construction informatics.	✓
5. Identify the software associated with BIM for Government Projects based on the existing software platform.	✓
6. Identify the Hardware associated with BIM for Government Projects based on existing hardware resources.	✓
7. Security of sensitive data distribution - Firewall - Autodesk 360 – Features and Access.	✓
8. Identify Potential communication channels for design team members - 8.1. Mobile Technology – Telephone - Smart phones 8.2. Email/Text	✓

Achieving the Aims.

Informatics in Society:

Informatics is the systematic study of Information and the application of research methods to study Information systems and services. It deals primarily with human aspects of information, such as its quality and value as a resource. Informatics also referred to as Information science, studies the structure, algorithms, behaviour, and interactions of natural and artificial systems that store, process, access and communicate information. It also develops its own conceptual and theoretical foundations and utilizes foundations developed in other fields. The advent of computers, its ubiquity and ease to use has led to the study of informatics that has computational, cognitive and social aspects, including study of the social impact of information technologies.

The characteristic of informatics' context is amalgamation of technologies. For creating an informatics product, it is necessary to integrate many technologies, such as mathematics, linguistics, engineering and other emerging new fields.

(Informatics Society, 2013)

Today's AEC's collaborative working environment is gradually trending towards a reliance on construction Informatics due to the dependence on new hardware and software technologies. It has been long argued that computers are more efficient than humans. This only applies to repetitive tasks or task that require large volume processes in a structured environment. The AEC sector has developed to point where the majority of software programmes utilised to preform designs tasks is now parametric or object based. This in turn creates and environment were objects can contain a significant volume of information. This information can be utilised by the designer and all of the stakeholders that are engaged in the construction project.

Informatisation of the AEC sector.

Informatics in the AEC sector is currently undergoing a revolution regarding the various processes for procuring construction projects. There are three mains areas where informatics has a significant impact and they are as follows;

1. Computation.
2. Information representation.
3. Interpersonal communication.

Computation:

Computers have helped architects, engineers and contractors in solving larger and larger models, saving them a lot of time in the process. This also created a library of information on which information could be retrieved easily for future projects.

Computers replaced drawing boards with Computer Aided Design (CAD) software which moved the boundaries of design to model space and parametric based designs that could be viewed by clients without a technical background.

Personal computers became ubiquitous tool and are used in everyday work. Just by using a computer each day most people are learning new skills and developing more and more confidence in their ability to make their day to day tasks easier to complete.

The public adoption of the Internet has meant that more and more people are becoming familiar with using computers and software programs.

Normally these analysis can be demanding on hardware resources and can tie up the use of certain computers for days at a time. The use of online technologies such as Virtual Box, Autodesk 360 and cloud computing can significantly reduce the demand on Local IT networks thus reducing overhead cost and maximising the existing Hardware environment within an SME's business.

Information Representation

The drive by designers to create a platform for information to be interpreted visually and represent the reality of a proposed design is key to how information is used to inform clients of the potential reality of projects. This is known as Augmented Reality and the information that is conveyed is normally visual and/or interactive.

There are several different definitions for Augmented Reality such as;

Mixed Reality, Amplified Reality, Augmented Reality, Mediated Reality, Diminished Reality, Augmented Virtuality, Virtualized Reality.

All of which can convey information visually.

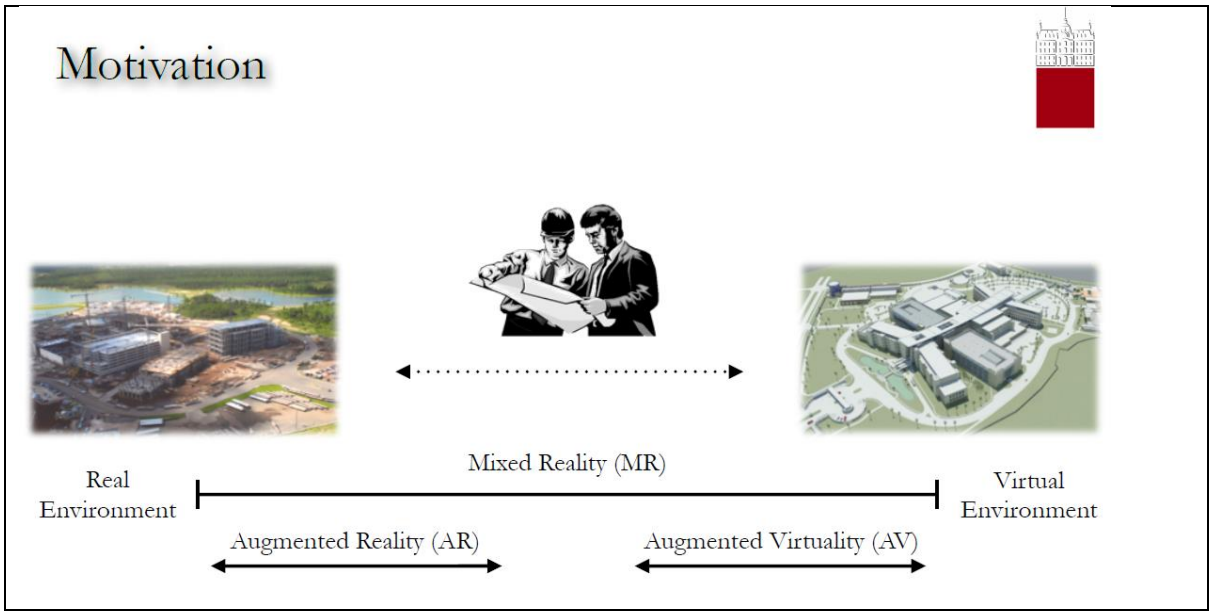


Figure 2 - Motivation for Augmented reality (Dolenc, 2012)

Interpersonal Communication:

Communication in the AEC sector in general is the key to successful projects delivered on time and on budget. Harnessing the potential of modern technologies is a desire for the AEC sector as it has a fragmented structure where Design, Construction, Disposal and Operational functions can sometimes overlap.

Invariably the AEC sector don't have the time, knowledge or resources to manage the ICT infrastructure effectively and communications can be lost.

The AEC sector is perceived to deliver 1 of a kind products, processes or are a group of partners (virtual organisations) not willing to share information due to the competitive nature of the industry. However, all was not lost, along came the communications revolution which radicalised the AEC sector with simple solutions to communicating collaboratively.

Asynchronous collaboration

a. e-mail
b. discussion boards/forums

Synchronous collaboration

a. Chat
b. instant messaging
c. audio/tele/video conferencing
d. application sharing

For these method to be effective there is a precedence of trust between stakeholders to work together to achieve the same goal.

The communication model that work best is where the sender generates a signal and the receiver is notified immediately. Figure 3 below shows how early forms of communication are effective albeit with a modern twist.

Figure 3 - Real Time Communication

Specific problems of construction informatics.

The AEC sector is genetically fragment in Ireland and this in turn creates an environment where information is ambivalently shared.

Architects, Engineers and Contractors are reluctant to share information for the good of the project because they feel they must protect themselves. This is one of the main reasons that BIM has not taken off here as quickly as it has in America.

There is a need for some form of government intervention to eliminate all of the taboo about BIM and if a collaborative open BIM approach is used BIM will demonstrate its own success. This creates an even bigger reluctance to move to BIM as personnel feel intimidated by the unknown.

Investment is required from the SME's in order to facilitate BIM. This is always a touchy subject as most SME want to know when they will see a return on their investment. There need to be a more positive approach taken by the SME's and commit to the use of technology to improve the design and build process utilising BIM.

Software utilised for School Projects.

The software associated with BIM for Government Projects based on the existing software platform have been identified in Table 2 of the literature review. Most AEC SME's use of have software compatible with this table. It is a requirement of the Appointments of Consultants for projects that they have sufficient software and hardware resources to interact with the Departments technical staff for effective collaboration. Further information is available at http://www.education.ie/en/School-Design/Appointment-of-Consultants/ depending on the appointment procedure adopted.

The hardware associated with BIM for Government Projects based on existing hardware resources has been identified below.

Hardware Specification:

Workstation (Design PC) Lenovo ThinkStation E31

- Intel Core i7 3770 3.40GHz-iGFx
- 2 x 8GB PC3 Non-ECC 1600MHz UDIMM (total 16 GB)
- Nvidia Quadro K600 1GB DL DVI-I+DP
- Win 8 Pro 64 with full Win 7 64 Pro downgrade option
- 1st HDD: 2.5" 128GB SATA 3 SSD
- 2nd HDD :
- 3.5" 250GB SATA HDD | 7200 rpm
- Lenovo Keyboard & Mouse
- DVD Recordable
- 3 Years on Site NBD Parts & Labour Warranty.
- 21" Lenovo HD widescreen monitor.
- Cost excluding VAT €1265.00 – upgrade in September 2013 to this spec

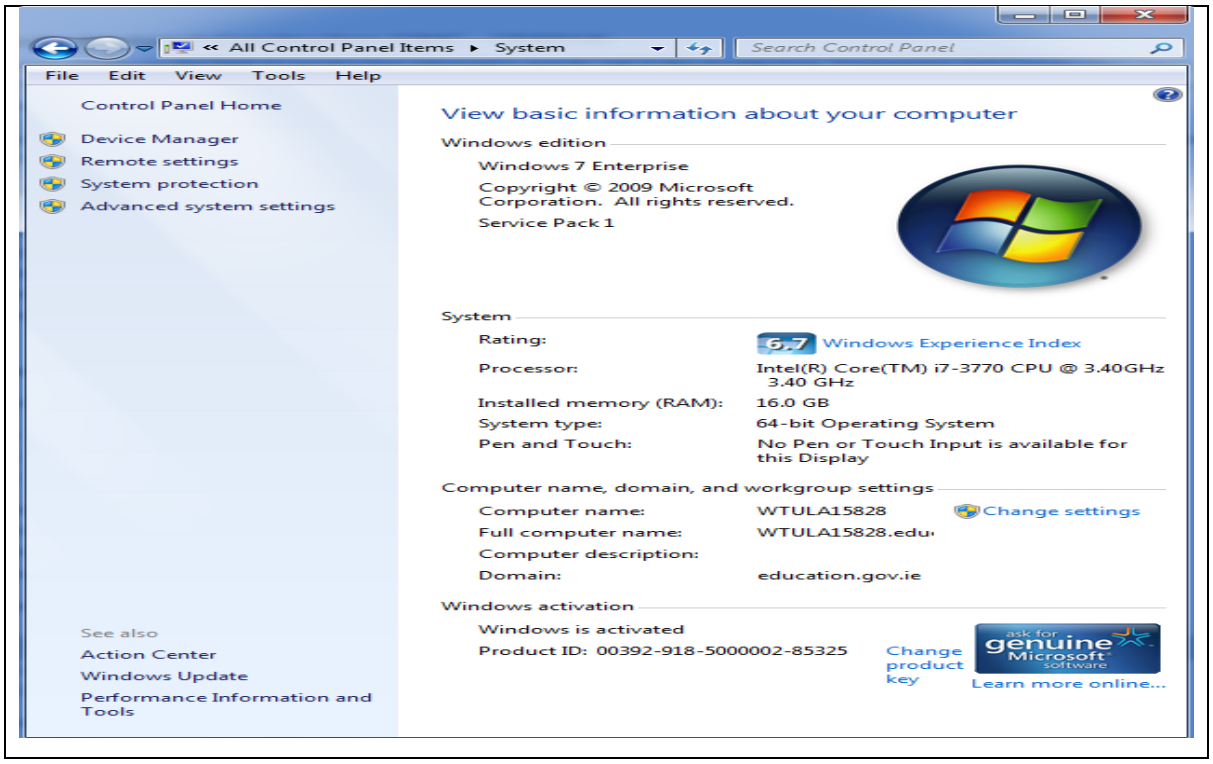


Figure 4 DOES Workstation System Specification

Hardware Specification:

Administrative PC Lenovo Standard.

- Intel Core i3 2120T 2.6GHz
- 8GB PC3 Non-ECC 1600MHz UDIMM
- Nvidia Quadro K600 1GB DL DVI-I+DP
- Win 8 Pro 64 with full Win 7 64 Pro downgrade option
- HDD: 2.5" 297GB SATA HDD | 7200 rpm
- Lenovo Keyboard & Mouse
- DVD Recordable
- 3 Years on Site NBD Parts & Labour Warranty.
- Cost excluding VAT €513.00 – existing systems are sufficient.

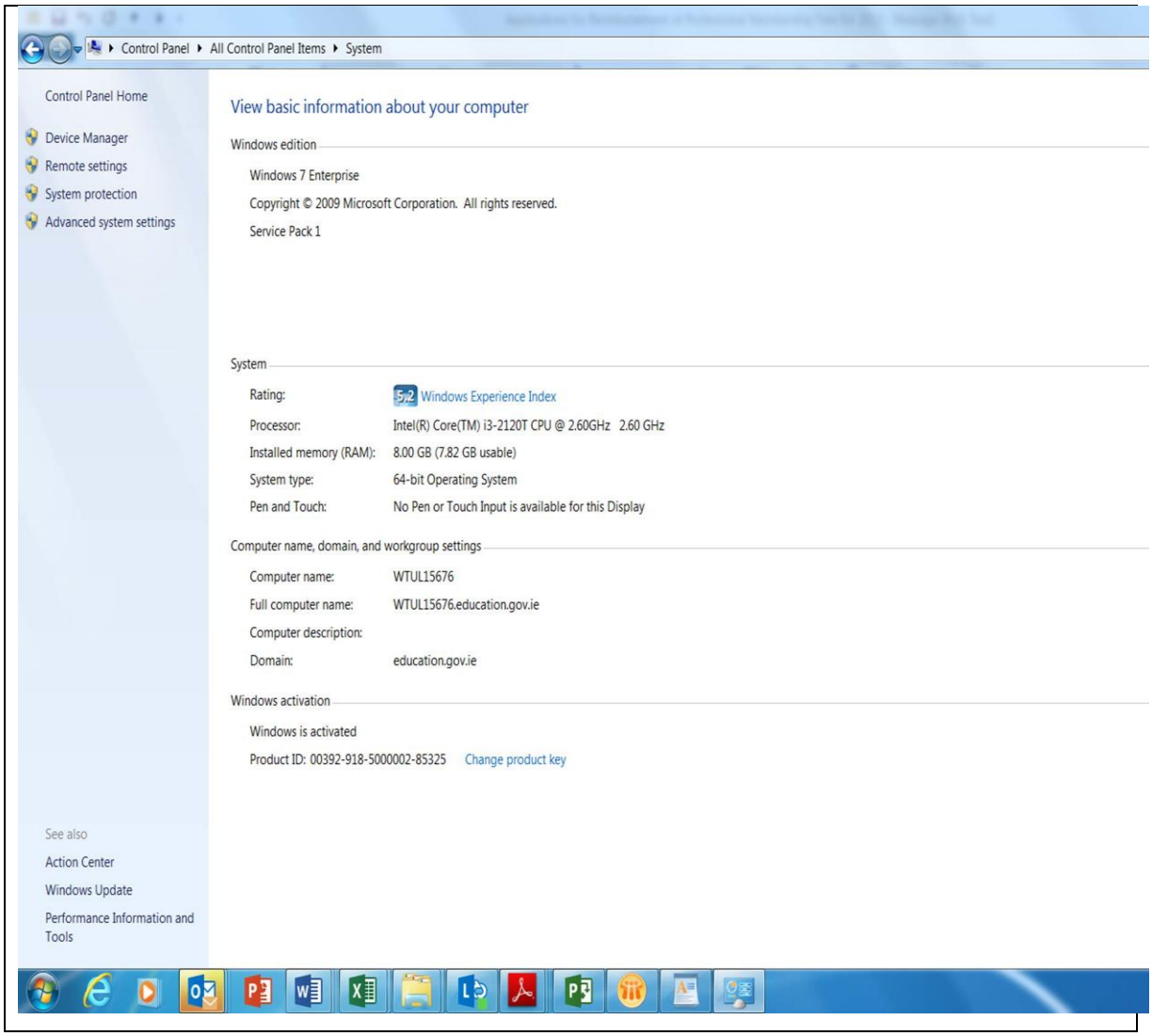


Figure 5 DOES Administration PC System Specification.

Security.

Security of sensitive data distribution - Firewall - Autodesk 360 – Features and Access

There are two security platforms (Firewall) for data transfer for the DOES.

1. Inward bound data.
2. Outward bound data.

Inward bound data is controlled by Symantec™ Endpoint Protection. This controls all information that is sent to the DOES. It has a very strict policy for users. Below is a typical Status report for a workstation, it is controlled by the IT unit and can prevent legitimate data accessing the Departments servers.

Figure 6 - Inward Bound Security

Outward bound data is subject to an Encryption Policy for all Government Departments. Essentially all data that is transferred by media devices is required to be encrypted. This is difficult to manage when sharing large volumes of data as not all SME are comfortable with the idea of having devices encrypted to share data. The reason for this is that once the transfer device is encrypted it remains encrypted unless it's reformatted.

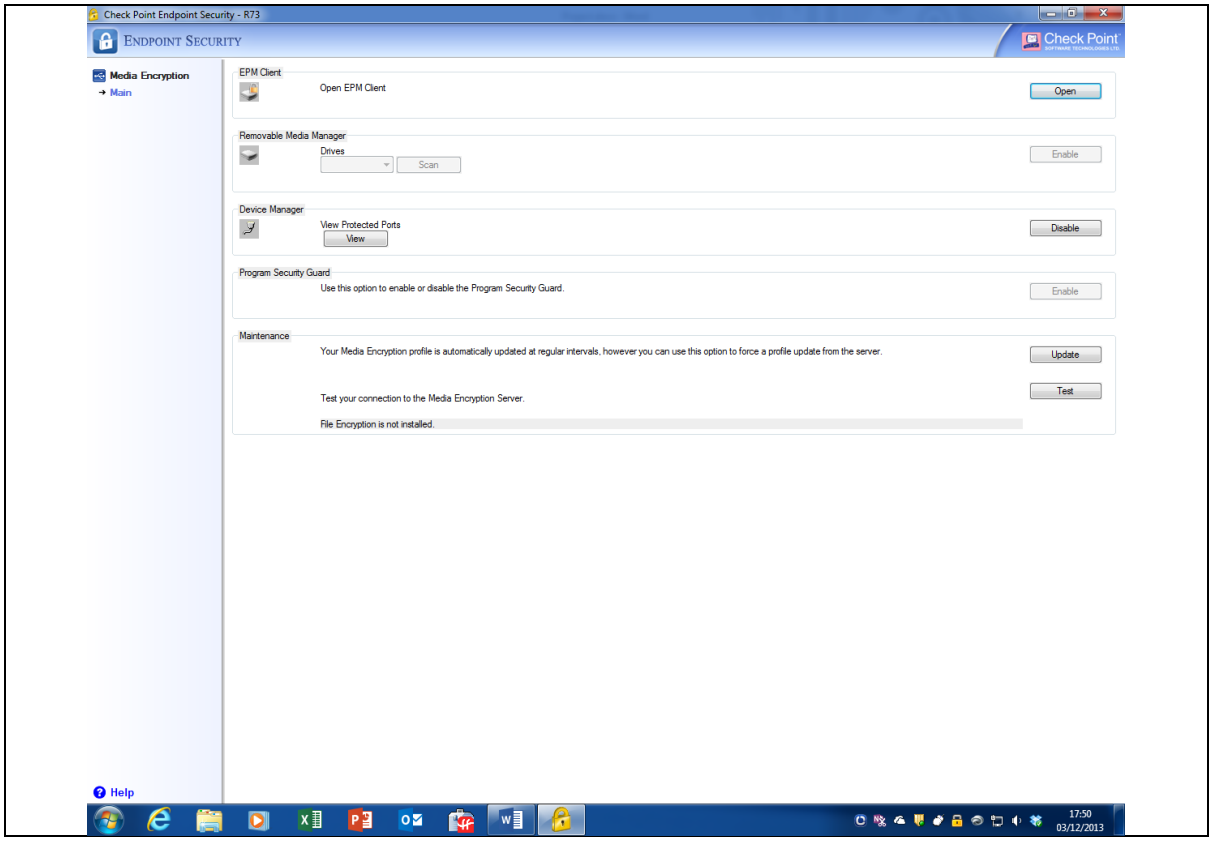


Figure 7 - Outward Bound Data Encryption

Autodesk 360

Autodesk 360 is included with Subscription Customers accounts. It provides a platform for sharing information where the user can control access to the cloud by inviting stakeholders to share information (upload, download or view only). It stores project information in one secure place and reduces the demand on office servers. Information is accessible from almost any location that can connect to the internet.

Autodesk 360 Cloud Services
Easy access to powerful cloud services.
With your Autodesk® 360 account you can save files to the cloud. View and edit them using any web browser or mobile device.
Basic access includes:

Storage - Receive 5 GB of free storage.
Viewing - View and edit 2D and 3D design files through a web browser using Autodesk 360 or via a mobile device using Autodesk® 360 or AutoCAD® WS mobile apps.

Collaboration and Sharing - Share files with your team. Invite them to view, mark up, share, and download designs directly in a web browser or mobile device. Follow user comments with the ongoing activity stream.

Rendering
Autodesk® 360 provides powerful cloud rendering capabilities that reduce time and costs by enabling users to produce compelling, photorealistic visualizations without tying up the desktop or requiring specialized rendering hardware.
(AutoDesk 360, 2013)

Subscription cost vary depending on the design software package that an SME would require. For the purposes of this report the design package costed was Autodesk Building Design Suite Premium 2014. The upgrade cost to Revit Architecture Suite NLM upgrade from AutoCAD Architecture NLM x 4 licences €4500.00 or €1500.00 per license

Revit Architecture Suite annual subscription - no cost until next subscription renewal (Dec 2013), then €795.00 per licence per year. Quotes were obtained from Amicus Technology Ltd an official Autodesk Agent.

Potential communication channels for design team members are as follows:

Mobile Technology –

Telephone is the most direct way to communicate with Stakeholders in the AEC sector. Most stakeholders have the use of company mobile phones and are contactable during the working week to discuss issues that may arise on site and normally results in decisions being made to progress the construction or design.

Smart phones have all of the advantages of the telephone but with a range of applications that can convey data almost instantly. They now have the ability to run operating systems such as windows 8.1 and seamlessly can connect to network servers to permit truly mobile design. They also can be used to track the flow of information and communication between stakeholders.

Email/Text

The most common type of communication in the Irish AEC SME sector. Software programs such as Microsoft Outlook can track and trace information exchanges. The Lync program is especially useful for sharing calendar events like scheduling meetings and site visits.

Results.

Having reviewed the information that collated during the research for this report the overwhelming statistic is that the majority of AEC SME's in the Irish market have already got the potential to adopt and implement BIM technology.

The financial implications that pertain to the implementation of BIM per user is broken down as follows:

Table 4 - Hardware and Software Costs

Document Sharing and BIM Implementation Costs per user							
		Software					
	Hardware	Operating system	Microsoft Office	Microsoft office 365	Autodesk BDSP	Training	Total
Setup Cost	€ 1,265.00	€ 226.83			€ 1,500.00	€ 580.00	€ 3,571.83
Perennial Cost			€ 124.80	€ 49.20	€ 750.00		€ 924.00

Hardware cost:

For the purpose of the report it was assumed that there was no hardware available to facilitate parametric design software. The cost shown for hardware is Value Added Tax (VAT) exclusive for a Lenovo ThinkStation E31 with the specification previously identified in Hardware Specifications. VAT rate 23%

The cost of software is VAT exclusive. VAT rate 23%

The cost of Training is not VAT chargeable. VAT rate 0%

Based on the figures above an SME with a technical staff of five personnel, four Technicians and one Architect would incur setup costs of €3571.83x5= €17859.15 assuming that the SME is upgrading from an existing Autodesk Software package.

The perennial annual cost for maintaining the software is €924.00x5 = €4620.00

Tenders:

A total of 5 companies were requested to submit a cost proposal for the 2 module training in Revit 2014 Essentials and Revit Families.

Module 1 – Autodesk Revit 2014 – Essentials 3 Days for 6 people.

Module 2 – Autodesk Revit 2014 – Families 2 Days for 6 people.

Table 5 - Tender Breakdown

Training Company	Contact	Address	Phone No.	Module 1 - Revit Essentials, 3 days	Module 2 - Revit Families, 2 days	Total (No VAT applicable)	Cost per person
Diatec	Laura Farrell	Unit 17 The Seapoint Building, 43-44 Clontarf Road, Dublin 3	00353 (0)1 8530661	€2,280.00	€1,200.00	€3,480.00	€580.00
Amicus Technology	Mark Green	Block 6, Galway Technology Park, Parkmore, Co Galway	(091) 773113	€2,502.00	€1,692.00	€4,194.00	€699.00
AKAD	Aidan Kelly	Ellison Street, Castlebar, Co. Mayo	00353 9425562	€2,495.00	€1,995.00	€4,490.00	€748.33
Archdox	Ralph Montague	508 Q-House, Furze Road, Sandyford, Dublin 18	+353 (0)1 4371200	€2,850.00	€2,250.00	€5,100.00	€850.00
Paradigm Technology Ltd	Breda Corrigan	Paradigm House , Dundrum Office Park Dundrum, 14	(01) 2960155	€3,360.00	€1,960.00	€5,320.00	€886.67

Conclusions.

Having delivered the aims of the report the conclusion drawn from the results above there is a major advantaged for SME's in the Irish AEC sector in preparing for BIM.
With some investment in Hardware, Software and Human Resources there is a serious competitive edge to be gained over competitors in the AEC market. Having personally experienced the transformation from paper to digital and then to parametric design the journey is not as daunting as one might expect. Sure, we learn about new Technologies and Collaborative working environments but all to produce a better product. It is also prudent to examine how fast that you may wish to integrate with BIM and prepare a business plan that will over a reasonable time conclude with a full integration of Open BIM and Collaborative working environments. There is a saying "Invest in people is to invest in the future". The Irish AEC sector will need to invest in its' ability and resource the industry to promote Open BIM or face the consequences of a struggling market sector.

Many believe that the problems of current design team practices and badly coordinated documentation will be greatly reduced through the adoption of Building Information Modelling (BIM). BIM is all about structured information that is coordinated. This is information that flows through the construction process from design brief through to facility management. For this to work successfully, interoperability and communication are the critical components of a successful BIM project.

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