Oaklands College
“oakCLOUD”
Cloud Computing Pilot

OAKLANDS COLLEGE

The Myths of Cloud Computing

Everyone can throw away their desktop PCs and Laptops and work on iPads

Cloud Computing will replace all our systems

All the Cloud systems will be better

All the Cloud systems will be faster

All the Cloud systems will be cheaper

All the Cloud systems will be more secure

I'll be able to reduce my CapEx expenditure and OpEx expenditure on IT (you might, you might not it depends)

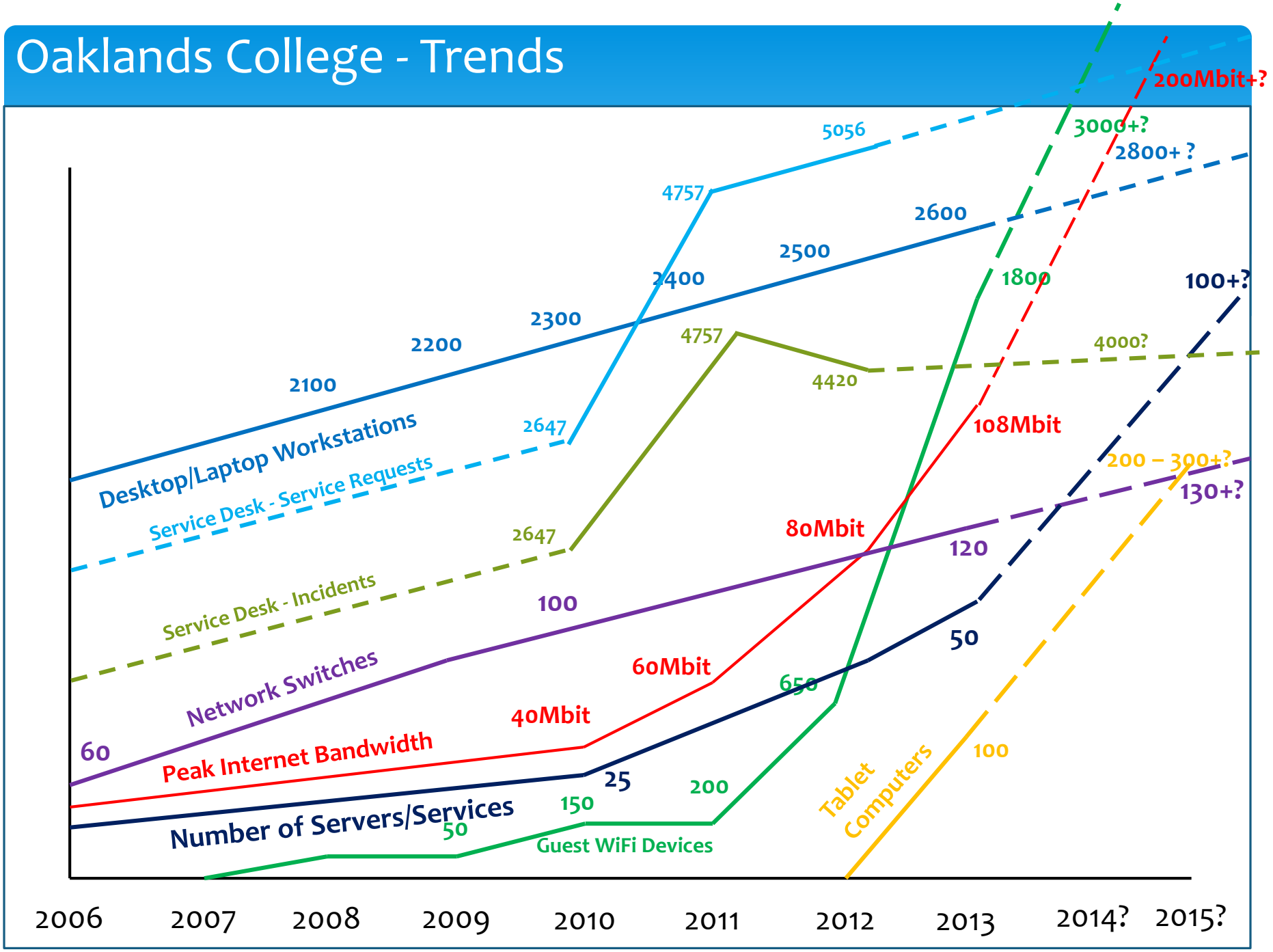
I don't need to spend any money on IT anymore

I can fire all my IT staff

I'll be able to buy a system with everything I need it to do out of the box

All the Cloud systems will be more functional, and can be changed to do whatever I want them to do, with a few clicks of a button.

Oaklands College - Trends

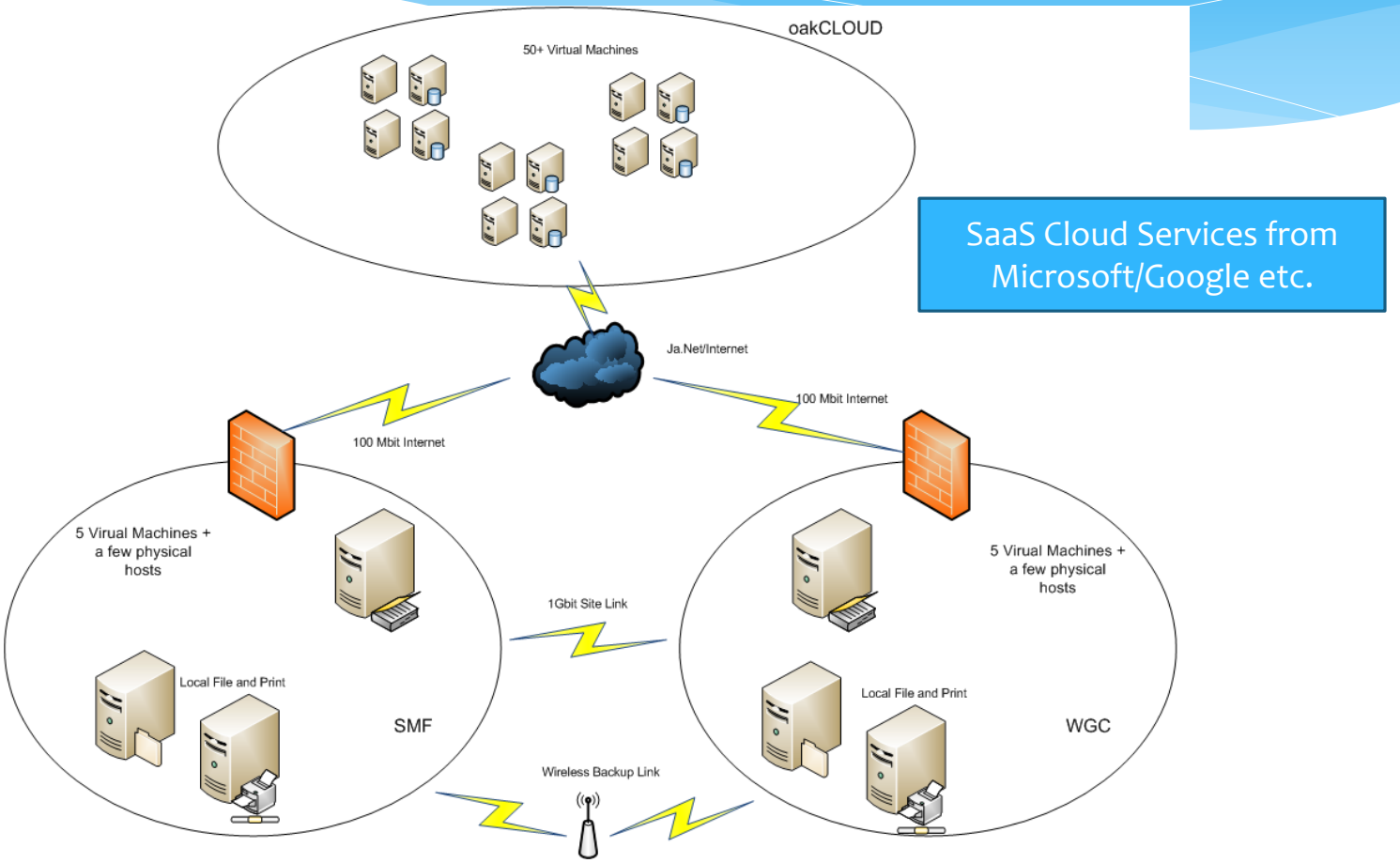


Scope of Trial

IaaS Trial Scope
Rental of: • 600GB Storage • 4Ghz CPU (equivalent of one physical server) • 16GB RAM • 100Mbit Internet Connection • IPSec VPN • VMWare vDirector Infrastructure (From the Dell Computer Corporation, using a datacentre based in the UK at Slough.)
On to which 6 virtual machines from the internal college network were uploaded and run for about 6 months before being brought back. The connection to the IaaS cloud computing resources by users is made via a site-to-site VPN (virtual private network) connection from the college network across the Internet to the cloud provider's resource. A VPN allows a secure "tunnel" across an untrusted network for our network traffic to flow without risk of security compromise and making the accessing of a cloud provided server transparent to the end user.

SaaS Trial Scope
Rental of: • 10,000 student email accounts using Microsoft Office365 • SharePoint 2010 using Microsoft Office365 • ADFS Federated Authentication (to allow for single sign on (SSO), i.e. users don't need to remember another set of usernames and passwords, nor do they need to enter them again after their first logon.)
Test the SaaS offerings, by ensuring that the SSO works, and those users can reliably access the email service. Also test the SharePoint 2010 environment and that it can be customised and users with a view to replacing our internal SharePoint system.

IaaS Cloud Trial



SaaS Cloud Services from Microsoft/Google etc.

IaaS Trial Results

Test Item	Result
Confidentiality	**Pass** - The supplier is ISO 27001 certified, their infrastructure is likely much more secure than the VMs and systems we use and can support.
Integrity	**Fail** – The supplier has a tier 4 data centre, but their contracts have no responsibility for loss of data, coupled with backup concerns this was problematic.
Availability	**Pass/Fail** – One weekend all our VMs stopped, we don't know why, they just seemed to be turned off.
VPN Connection	**Pass** – The VPN connection was easy to setup and worked well, there appears to be a 100Mbit bandwidth limitation though on the VMware vDirector infrastructure.
Network Performance	**Unknown** – Needs more investigation, we need to determine if this will work at a larger scale, performance was acceptable for the trial however.

IaaS Trial Results

Test Item	Result
Network Bandwidth Utilisation	**Unknown** – The supplier gave 100GB transfer free a month (download from them only metered), peak of 5Mbps.
Virtual Machine Performance	**Fail** – The performance of the VMs was fine sometimes then very poor at other times, we think this may be affected by other customers on the providers platform.
Setup Cost	**Pass** – The cost was small to setup, it was mainly staff time costs.
Running Costs	**Fail** – The costs are higher when we compare them directly with an in-house offering, although its not like for like comparison.
Backup	**Fail** – The agent based backups worked but, how this would operate at scale is unknown. We'd need a backup server in-house or in another cloud provider, bandwidth charges….

IaaS Trial Results

Test Item	Result
Disaster Recovery	**Pass/Fail** – No DR functionality was offered out of the box, if the suppliers DC fails, you lose your data, tough luck. DR was an option at least double the cost.
Virtual Machine Versioning	**Fail** – The VM versioning did exist but it required a support ticket and was not automatic, this was a limitation of Vmware vDirector at the time.
Sustainability of the Solution	**Pass/Fail** – Dell pulled out 6 months in, so we jumped ship too. They would migrate us free of charge to a partner, but this did highlight the volatility.
Bringing Data Back in House	**Pass** – We put servers out and brought them back in again between our internal and external clouds without any issue.

SaaS Trial Results

Test Item	Result
Confidentiality	**Pass** - The supplier is ISO 27001 certified, their infrastructure seems to be secure. This is Microsoft we were talking about, each SaaS provider needs to be looked at one by one.
Integrity	**Fail** – Limited responsibility for data loss from the supplier, this was fine for Student email, but for our SharePoint service this was a problem.
Availability	**Pass/Fai**l – Microsoft had a few service affecting problems where students couldn't log in for about a day due to an authentication problem at their end.
Federated Authentication	**Pass** – Microsoft's ADFS works well with our internal AD. A key part of any SaaS system is the use of federated authentication, without it you have the problems of managing two lists and the users get confused.

SaaS Trial Results

Test Item	Result
Setup Cost	**Pass** – For our trial this was free because it was a Microsoft service.
Running Costs	**Pass** – For Microsoft/Google "free" services SaaS is a good option, e.g. Student email, little hassle works well. **Fail** – We looked at a cloud based VLE environment, this was about £20k per year, in-house this was basically something else on our infrastructure, again not comparing like for like.
Backup	**Pass/Fail** – Although the Microsoft service would restore your data back to where it was in the event of their failure, there is no versioning (i.e. daily backups) with additional software which is clunky. SharePoint – Additional software required that did work okay for daily backups, but required somewhere for it to be backed up too, and cost about £2000 per year.

SaaS Trial Results

Test Item	Result
Disaster Recovery	**Pass** – The Microsoft offering gave a full restoration (of data) according to their materials in the event of a DR event, unlike IaaS. However there are still data responsibility concerns….. For other providers of SaaS services, this needs to be checked out before signing up!
Sustainability of the Solution	**Unknown** – Microsoft offer student email for free, so this makes it sustainable, however even a modest charge of £2 per user per month for 10,000 students would cost £240,000 (good bye IT budget!) For other suppliers, any cost increases they will incur will be passed onto you the customer.
Bringing Data Back in House	**Pass** – For email this appears to be possible with Exchange 2010/2013. For SharePoint again possible with specialist software to copy in bulk the sites down to a in-house infrastructure. (Problem of supporting twice as much problem.)

IaaS Costs

IaaS Cloud Resource Requirements - Virtual			
Component	Quantity	Resource Cost per Unit	Total cost (per month)
CPU:	40 vCPU	£20.19 per vCPU	£807.60
RAM:	160GB	£20.19 per GB	£3230.40
Storage:	5TB (5000TB) (Virtual Machine Storage)	£0.31p per GB	£1550
Bandwidth Usage:	500GB (estimated)	£0.18p per GB over first 100GB of transfer	£72
		Total OpEx cost per month:	£5660 per month
		Total OpEx cost over 5 years (no DR):	£339,600
		Total OpEx cost over 5 years (with DR):	**£679,200** **(estimate of DR is twice the price of standard offering)**

Dell – Prices correct at Jan 2013

IaaS - Conclusion

* Our Pilot revealed the following:
  * **Technically Sound -** Technically (for the Pilot) there were no "show-stoppers" at the scale at which we tested it.
  * **Communication Link Dependence** - You are utterly dependant on your communication links. Your ISP should peer with the Cloud provider directly.
  * **Not as Cheap as You'd Think** - Cloud isn't as cheap as you'd think.
  * Things you'd assume you'd get included, you have to pay for (e.g. DR)
  * **One Weekend all the VMs Stopped** - So on Monday morning they were all shutdown.
  * The "All your datum are belong to us" problem, the contracts say if "we lose it all we are not liable." We offer a service.
  * **Useful for Specific Tasks** - If you need high availability for a specific task like a web server that is where IaaS Cloud comes in.
  * Need to invest time and staff into managing the accounts and services with Cloud providers to avoid you being "cut-off" from services and/or losing data because a renewal date was missed.
  * Where do you take/keep your backups?

IaaS - Conclusion

* A Full Cloud setup won't work for our scale due to:
  * Bandwidth limitations, Bandwidth Charges
  * Data Security (Integrity) concerns,
  * Disaster Recovery Limitations,
  * Cost
  * Dependence on OpEx Expenditure (especially with budget cuts)
  * Vendor Lock-In (although VMware IAAS reduces this)
  * Software compatibility (specifically with SaaS offerings)
  * What if the supplier stops offering the service (we found this out with Dell during the pilot!)

Saas - Conclusion

* Student Email on Office365 was a success!
* Lync (IM only) on Office365 was a success! (Staff Confused)
* Staff Email on Office365 didn't get off the ground (too much loss of functionality, voicemail specifically.)
* SharePoint had poor performance from Microsoft Office365.
* SharePoint Backup of data was clunky, and required specialist software. No long-term backup for Outlook.
* ADFS worked flawlessly for Office365
* SaaS costs only stack up if its free! ☺ Moodle VLE Example….
* Concerns over what if it goes down, can we have a backup system onsite too, slightly defeats the point……

Points of Thought for Cloud Computing

To go for a "full hybrid" there are some advantages and disadvantages that are worth detailing, in addition some points of thought to educate decision making in future.

What do we gain? – We gain access to an enterprise grade infrastructure (accessible via the internet) and limitless expandability (at a price) to allow the college's IT provision to expand without the limitations of the physical environment (and associated costs) in which the college resides. Access to new software without needing to invest money and staff time to perform the upgrades (SaaS only.)

What do we lose? – We lose some control over some of the infrastructure and services. For example in-house hosted SharePoint can be customised to any degree the organisation wishes (staff resource dependant), however cloud hosted SharePoint is not as customisable, however it is perfectly suitable for our current needs. So in essence the greatest thing we'd lose is complete control, but in some cases that is a good thing.

Points of Thought for Cloud Computing

What about the risks? – We take on some additional risks but also transfer some to the cloud provider, the hope is that the cloud provider is better resourced and prepared to take on these risks.

What about security? – Assuming the cloud supplier is ISO 27001 certified (one of our requirements) and provides a decent level of security they can provide better security than we can provide as there are dedicated IT security staff and monitoring systems that we are unable to provide internally. On the flip-side however a cloud provider is a bigger more interesting target than a college. IaaS still has your same risks for your VMs…..

What about DR? – Disaster Recovery is a requirement of any in-house or cloud service; this will increase the cost of any solution, this will typically mean a doubling of any cloud service cost.

What about backup? – The need for granular data recovery of files is key to ensuring that college information is not lost due to accidental or deliberate events. Normally cloud providers don't provide this level of granularity so the college would still need to invest in this backup infrastructure or accept the loss of the functionality and accept the risk of loss.

Points of Thought for Cloud Computing

What about bailing out and getting my data back? – Any move of data and/or services to the cloud must mean there is an escape route, even if that escape route costs money, it must be a cloud supplier supportable method. Ensuring that the contract "small print" is properly examined to ensure that the college data and systems are safe with the cloud provider and it provides suitable methods for retrieval of data if the worst was to happen.

Dell decided after 6 months they were going to stop their IaaS cloud service, and offered a free migration to a partner. This shows the volatility.

What about bandwidth costs? – The increasing use of the cloud services means that the cost of bandwidth comes into consideration, as does access to stable and fast internet and network connectivity. Although the costs of bandwidth are relatively cheap in comparison to all the other costs, they are worth considering.

What about Internet connectivity and its reliability? – If the Internet connection becomes unavailable, so does the access to the cloud computing resources. This moves the reliability and scalability of the network and Internet connection to the fore, and will require investment in future to ensure its capacity and reliability to support cloud based applications.

Points of Thought for Cloud Computing

Do we actually save any money? – As discussed earlier, it is unlikely there will be significant cost savings either to CapEx, OpEx or staff costs, essentially because the current in-house provision provides very good value for money (as it's not a fair comparison) and spends most of its time conducting support or value adding project work, rather than supporting the technology which is what adoption of cloud computing seeks to reduce. The real benefits are a reduction of risk and access to more resources and systems that would be unaffordable to deliver using the in-house methods.

What if the supplier goes bankrupt or stops offering the service? – A big concern is that in a turbulent financial environment the cloud supplier could go bankrupt and our data and services may be lost or made unavailable for a period of time. This is something to consider when taking on the service with contractual agreements, that a service must be offered in a way that allows us sufficient time to arrange a pull-out strategy, coupled with choosing known suppliers who are unlikely to run into financial troubles.

Points of Thought for Cloud Computing

What if the supplier goes down? – What if our internal infrastructure goes down then? A risk of using any IT system is what happens if it breaks; if the in-house infrastructure is resourced to provide 98% availability. Cloud providers often provide 99%+ availability but we lose the control over the data and service when it is moved to the cloud. This means if the in-house service was to go down, you can walk down stairs and ask about it, if however a cloud service goes down, this is made more difficult. You are just one of many customers screaming for action!

Trust? – Is what cloud computing is about, trusting your supplier to deliver a service and keep your data safe.

Will I be tied into using it? – Yes, normally using cloud computing should be considered no different than taking on any other contract agreement. Use of cloud computing services ties the college into an OpEx expenditure, this gives less flexibility to IT spending because the expenditure on the service will be mandatory and thus will make up a chunk of the overall expenditure that cannot be changed easily.

Points of Thought for Cloud Computing

CapEx or OpEX? – Use of Cloud computing means what would normally be a periodic (e.g. 5 yearly) expenditure on a CapEx item with some OpEx expenditure over the 5 years to support.

Means that this expenditure is turned almost completely into an OpEx only expenditure paid yearly. This is an increasing trend in IT as a whole where the concept of "buy, build, support" is being changed to "buy, provision, use."

But for our organisation, the pressure is on OpEx spend to make this as small as possible which flies in the face of how Cloud Computing is billed! So further makes the case for it difficult.

So What Does this Mean?

* Cloud Computing for FE isn't the catch all utopian ideal you might be lead to believe!
* There's lots of things to think about and get confirmed before you make a commitment to use a service.
* However….
  * Cloud Computing has useful applications, functions and solutions for FE colleges, you just need to find what bits fit your business, budget and teaching offering the best.