'The Cloud' has allowed airlines and MRO organisations to access their software-as-a-service (SaaS) from any physical location with a web browser or a mobile data connection. The providers, benefits & drawbacks of Cloud-based SaaS M&E IT systems are examined.

M&E systems in 'The Cloud': who provides it?

An airline's maintenance and engineering (M&E) IT system is fundamental to its operation. The 'Cloud' has allowed airlines and maintenance repair & overhaul (MRO) organisations to access their software-as-a-service (SaaS) anywhere that there is a web browser or a mobile data connection. This article looks at the benefits and drawbacks of Cloud-based SaaS M&E IT systems.

M&E systems come in various forms. This article focuses on the pureplay and best-of-breed systems that are available through Cloud services.

The solutions discussed here are replacing the legacy systems that some airlines have been running for decades. These systems are often homebuilt or have a high price tag, which has to be planned for within the organisation and recouped over many years through efficiency gains.

M&E systems have grown to encompass core systems such as staff management, financial and accounting functionality. While these systems are becoming more standalone, most of them need to be interfaced with other core airline systems, such as document management systems (DMS) or content management systems (CMS). This enables management of technical publications and documentation, with further support from the aircraft original equipment manufacturers (OEMs). They offer document management and task card creation production and other specialist services to health monitoring.

OEMs and MRO providers rely on M&E solutions to provide seamless links to airlines. The scope of work that can be carried out by these systems is vast, including: maintenance check progress monitoring; engine lifecycle management; maintenance-cost management and

planning optimisation; along with technical and maintenance records.

The Cloud originated from the world of computer networks, where certain functionality is not installed on computers, but lives within the network itself, the Cloud, from where it can be accessed by individual computers.

The Cloud

The Cloud is the combination of hardware, networks, storage, services and interfaces that delivers aspects of SaaS. SaaS includes delivery of software, infrastructure, and storage over the Internet (either as separate components or a complete platform) based on user demand. Cloud computing has four key characteristics: elasticity and the ability to scale up and down; self-service provisioning and automatic de-provisioning; application programming interfaces (APIs); and billing and metering of service usage in a pay-as-you-go model. This flexibility is attracting M&E software providers to move into the Cloud.

The Cloud can be further broken down into areas of responsibility:

1. The end user does not need to know anything about the underlying technology, and requires little IT infrastructure beyond basic PC and networking support.

2. The M&E providers are responsible for the governance of data or services living within the Cloud. These service providers must provide a predictable and guaranteed service level and security to all their constituents.

3. The service provider is responsible for the IT infrastructure assets and their maintenance. M&E providers host their own servers, or they use a hosting company, such as Rackspace.com.

Pay-as-you-go software

M&E software with Cloud capability is fast becoming a prerequisite for most providers when putting together bids. A monthly licensing fee structure is levied on a per user or a per tail basis. The minimal additional IT required, other than coalface IT equipment needed by the airline or MRO, such as tablet computers for engineers and technicians in a line environment, is the attraction of Cloud-based systems.
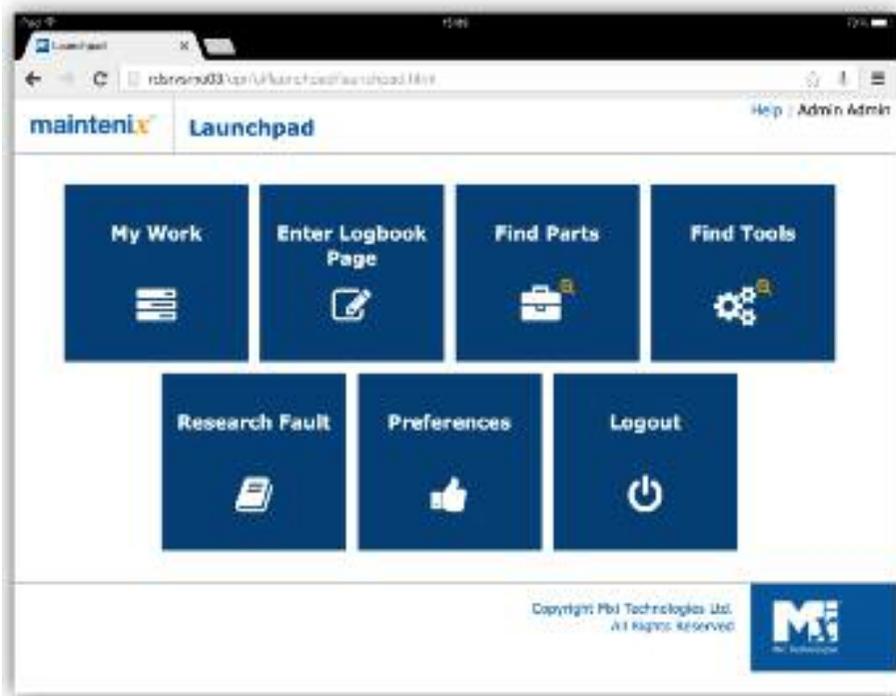
Who provides this service?

There are several main vendors of Cloud-based M&E systems. The providers examined here include Applied Database Technology (ADT), Aviation Intertec Services, Commsoft, EmpowerMX, Mxi Technologies, Trax and Ultramain.

AD Software

AD Software is based in Cluses and Lyons in France. It has developed a fleet management system and logistic package called AIRPACK. This meets the needs of aircraft and helicopter operators, as well as MRO and continuing airworthiness management organisation (CAMO) centres. AD Software's strength lies in the simplicity of its product (Microsoft Windows ready, Web-enabled, multilingual, 5 days training), its 24/7 online technical support and competitive pricing.

AIRPACK is offered as a pureplay M&E system through the Cloud, and can be used as a true pay-as-you-go offering, with full hosting solutions and access through the Cloud licensed either by concurrent users or fleet size. AIRPACK is used by over 110 customers, which

MXi's iPad interface for line engineers. Through this mobile device the line engineer has access to the full Maintenix programme.

include airlines with and without significant maintenance facilities, as well as MROs and some independent engine overhaul shops with specialised Helicopter support.

Aerosoft

Aerosoft Systems Inc. of Toronto, Canada, offers three systems. DigiMAINT and WebPMI are two pureplay M&E systems that are available on a pay-as-you-go basis and in the Cloud. The applications can be paid for based on the number of concurrent users, or the user's fleet size.

DigiMAINT is Java-based technology, and WebPMI is object-orientated language. Both are used by airlines with limited or extensive maintenance facilities, by independent MROs, by the engine shops operated by International Aero Engines and Pratt and Whitney (P&W), and by several of the OEMs' component repair facilities.

In October 2013 Aerosoft announced that it partnered with Hexaware Technologies to provide access to real-time updates to documents through DigiDOC for aviation MRO teams via iOS 7. By extending the mobile platform beyond Android and Windows 8, more MRO teams gained access to the Interactive Electronic Technical Publications (IETP) platform for AeroSoft's DigiDOC content management solutions on iPads and iPhones.

Digital data are available via a custom Web interface for replication of changes across documents, and revisions to content. It is a proven solution for the maintenance of modern commercial aircraft.

DigiDOC is a flexible interface that allows the airline or MRO team to assemble a customised package geared towards any specific need. It also provides advanced CMS solutions, which are being used for a new generation of aircraft like the 787 Dreamliner.

ADT

ADT (Applied Database Technology) is an M&E provider based in Turkey and the US, providing solutions to airlines and MROs. ADT's MRO solution, WINGS software, is based on Java, Ajax and J2EE technology.

WINGS is a comprehensive aviation maintenance management solution specifically developed for aerospace companies. It was designed around best practices in maintenance operations, and is used by over 40 MROs and passenger and cargo airlines, the largest being Turkish carrier Sun Express. WINGS is now available in a Cloud-based solution, licensed on a per user or per tail basis.

Aviation Intertec Services

Aviation InterTec Services (AIS) is based in Thunder Bay, Ontario, Canada. AIS has other offices around the world to allow 24-hour support. AIS offers RAAS, which provides the comprehensive integrated functionality of the best aviation maintenance management systems, at a cost that is within reach of the mid-tier market.

AIS's RAAS system is a best-of-breed M&E solution for mid-size operators, with functionality such as: signature at the task-step level; per-type parallel inspection program management; digital part certification handling; iPad/Android

tablet-based electronic flightbag (EFB); electronic maintenance status board; a centralised document library; and wireless off-line barcode scanning.

AIS's solution is 100% browser-based and tablet-friendly, compatible with all major browsers and operating systems.

Commsoft

Commsoft in Tiptree, Essex, UK, provides its Open Aviation Strategic Engineering System (OASES), which is available as a Java-based pureplay system supported by Oracle. It is offered on a pay-as-you-go, SaaS-hosted solution basis, licensed through concurrent user or by tail.

The OASES-hosted solution is ideal for small start-up airlines or clients that do not have an established IT department to set up and configure an on-site server.

All the OASES functional modules are available through the Cloud. OASES has a wide array of functions to provide the user with a professional and reliable service. These include: implementation support; user training; system tailoring; day-to-day help desk; maintenance support; and update release services.

OASES is constantly being refined in collaboration with airline, aircraft maintenance and supplies clients. It has been proven worldwide in a variety of live maintenance environments from large LINUX systems to PC networks and now hosted Cloud solutions.

EmpowerMX

EmpowerMX, from Frisco, Texas, offers a suite of applications under the banner of FleetCycle. It is available on a SaaS basis, and also through the Amazon Cloud. It is licensed on the basis of number of concurrent users, named users or on a per tail basis.

FleetCycle has extensive M&E functionality, including partial document management, HR, finance and manpower planning capability. It can receive data from electronic techlogs. The FleetCycle Execution Suite - Production Manager (FCPM) product, hangar floor/back-office PC workstations, wireless handheld 'smart' devices and advanced internet technologies are used at nearly every major airline in North America as their primary M&E solution.

Mxi Technologies

Mxi Technologies based in Ottawa, Canada, offers its Maintenix pureplay M&E system, which is a Java-based web application. Mxi's solutions are designed specifically for aviation maintenance. Mxi Technologies provides integrated and intelligent software, support, and services to commercial airlines, MROs, OEM aftermarket service providers, and defence operators. It has been chosen by Boeing to manage its GoldCare program for the 787.

Mxi Technologies' Maintenix software uses a modern architecture and provides advanced capabilities, such as a role-based web browser interface, long-range and automated line planning, automated workflow, electronic signatures, support for portable wireless devices, and a comprehensive range of integration APIs for user configuration. Mxi is licensed on a per user or a per tail basis.

Trax

Trax, which supports more than 130 airlines, is headquartered in Miami, FL, USA, and offers its pureplay M&E system of the same name.

Trax is offered on an application service provider (ASP) basis, available through the Cloud on a pay-as-you-go basis. Trax is licensed through numbers of concurrent users and by fleet size. The system is based on Java and .NET technology. It has a CMS module and can handle documentation in PDF, SGML and XML formats.

Trax users can integrate Airbus ADOC to perform CMS/DMS functions. Trax can also be interfaced with Boeing's Maintenance Performance Toolbox (MPT).

Trax recently added capability to support all electronic signatures in its production module. The Manpower planning system has undergone a major revision for this version. The new web-based version of Trax (which is supported in-line with the traditional version) and a revised graphical user interface (GUI) for the existing product has been released. Mobile access and PDA support have been added for many functions within Trax, particularly in the warehouse management area.

To keep this secure, biometric security (fingerprint recognition) and smart cards are available throughout the Trax system. Lightweight direction access protocol (LDAP) capability and further windows networking security has been added. Radio frequency identification (RFID) has been added for inventory functions.

Ultramain

Ultramain, based in Albuquerque, New Mexico, USA offers the latest version of Ultramain: Ultramain v9, a Java-based software with a number of different clients. It can be accessed using iOS, Android and Windows 8, as well as any browser. Ultramain is available on an ASP basis, and is paid for on the basis of the user's fleet size.

Mark McCausland, president of Ultramain Systems believes that Ultramain is the software industry technology leader in mobile computing with its mobile mechanic and mobile inventory software products. Its comprehensive electronic logbook (ELB) software and software product efbTechLogs delivers paperless tech log and cabin log functionality that fully replaces traditional paper logs.

Ultramain has more than five years hosting experience with Ultramain v9, which can operate over a WAN independently of Windows or Citrix. The previous version, v8, was dependent on these technologies. v9 can operate using Windows and/or Citrix as well, but does not need to. v9 also operates with open-source database management products, as well as Oracle and SQL Server. With v9 the entire technology stack can be open source.

Air Canada interfaces with Boeing's Maintenance Performance Toolbox through the TRAX system, enabling mechanics to work truly remotely.

Positives

With a Cloud-based M&E system, all that is potentially needed to connect to data anywhere in the world, is a web browser, whether through a mobile device, laptop or a PC.

Airline engineers and mechanics can update their reliability reports in-flight, even for the aircraft they are flying on, in real-time. An engineer can connect a laptop to the aircraft's on-board WiFi, access the M&E system through his web browser, and access the reliability module of the M&E system, before making live changes to the data at 30,000 feet.

Software costs are minimised in that M&E providers can schedule updates periodically, improvements to the services can be brought on seamlessly with minimal downtime for updates to take place, with upgrade costs factored into the monthly service costs.

A small airline may not have the capital to invest in a traditional ERP M&E system. This is where fully hosted solutions, such as the OASES offering come in. It offers a full M&E solution for small start-up airline operations or clients, which do not have an established IT department to set up and configure an on-line server.

Cloud-based solutions offer serious operating cost savings in terms of energy consumption, maintenance, configuring, upgrades, and other IT staff costs. These are the remit of the M&E provider.

Resource pooling and rapid resource elasticity of Cloud-based solutions make the infrastructure capacity highly elastic. New modules can be incorporated within the existing systems if, for example, a start-up airline manages its own reliability or technical records, rather than outsourcing them. The airline can

activate these modules, and reliability data can be extrapolated from the other modules. This expansion can be enabled with only a click of a button.

There is also improved system availability and disaster recovery: in many cases SaaS M&E providers ensure measures such as back-up routines, fall-back and recovery procedures.

Negatives

With any Web-based system, users are likely to be vulnerable to attack by unknown third parties interested in bringing down a server, purely for the challenge rather than as a direct result of anything the company may have done.

Unless hosted by the actual M&E vendor, most M&E providers host their servers with companies such as Rackspace.com or Amazon. Herein lies the problem: a user could be hosted on the same physical server as a shop or another company, which may attract adverse attention from hackers.

The most common of these is a distributed denial of service (DDoS) attack, in which the attackers typically begin by exploiting a vulnerability in one computer system, making it the DDoS master. The attack master, which will have nothing to do with the system, identifies and infects other vulnerable systems with malicious software, before instructing the controlled machines to launch a co-ordinated attack against a specified target.

There are two ways an attack can be carried out: a network-centric attack, which overloads a service by using up bandwidth; and an application-layer attack, which overloads a service or database with application requests.

The inundation of packets of data to

the target causes a denial of service, because legitimate requests on the server cannot physically get through, due to the sheer number of requests from the master and other infected systems.

Two of the largest antivirus companies in the world, Kaspersky Labs and Symantec, have identified DDoS attacks, rather than spam, viruses, or worms, as the biggest threat to internet security.

In terms of M&E, what is the impact if the system becomes unreachable, with a full aircraft, and a mechanic using a tablet computer attempting to sign off some turnaround defects to allow the aircraft to operate? How can the aircraft be enabled to operate? Would the mechanic speak to someone at the line station or at flight operations, and confirm that the aircraft is serviceable to carry on with normal operations, but fill out a manual tech log entry for processing at the next line station?

Chris Reed, managing director at Trax, explains that Trax is available with dual-redundancy at an additional charge, for high-dependency users. This is achieved through multiple servers in different geographical locations running simultaneous back-ups of each other.

Should one server 'fall down' for any reason, the level of service is not compromised. There could be less than 10 minutes' downtime to repeat the last few maintenance entries, but Reed explains that users would be notified of this. For a less operationally critical environment, such as an MRO, daily back-ups are made so at worst the last shift's entries have to be rechecked.

Service availability

Most systems require a stable internet connection and programme access through a browser-based environment. If an engineer is working remotely on the flight line with a tablet, and suddenly loses the Internet connection, in most cases he would have to re-establish this connection to continue working.

Trax's iPad OS-based offering allows maintenance personnel to carry on working and making changes on the system, even during a connection loss. When a connection becomes available again, the tablet automatically updates the Cloud system. This feature removes the loss of a signal as a potential barrier to using a Cloud-based system.

Security

Security is a potential issue. As James Elliot, product marketing manager at Mxi Technologies, explains: "Developers of M&E systems, which only need a web browser, have to be aware of the potential for customers to use shared computers. Our software uses automatic session expiry in these cases, similar to online banking. Should this occur, we have additional security measures, such as PIN code entries for making changes to the serviceability of assets and for digital signature entries."

Hosting costs

Typically the textualised data for an aircraft will take up about one gigabyte, depending on the level of trackable assets. Scanning job cards and check packs, makes this grow rapidly. For example, Air Canada has just broken the 1 terabyte (1,024GB) barrier. The cost of hosting all of this data is almost infinitely variable. The cost depends on the speed of access and the volume of stored data. The cost of speed and data volume can be offset against each other.

The costs are doubled if you want a dual redundancy system, but the trade-off it is actually unlikely to suffer from an outage.

Performance risks

Performance risks of Cloud-based M&E are related to threatened speed and reliability of network, limitations on data transfer, and outage risks. The main problem comes from the additional human factors elements that are introduced at every stage.

In the UK, for example, the issue is if an operator suddenly finds that it can no longer access its M&E programme. The connectivity issue could be within any of the following areas: the customer's hardware on the device from which it is trying to access the M&E programme; the customer's own internal IT network; and the company responsible for the customer's IT support.

The networks and servers are within the client's buildings. BT Openreach is responsible for maintaining the line before anything the M&E providers are responsible for.

The M&E provider may host its own servers or, which is more likely, outsource its own hosting space to find the problem.

Costings are an integral part of Cloud-based M&E additional costs, such as widely used periodic subscription fees that do not depreciate over time, in contrast to a capital investment in more traditional ERP software.

Finishing up

Airlines and MROs are now realising the true value of a Cloud-based IT infrastructure. Operating in the Cloud is not cheaper than an on-premise environment (consider how many SaaS applications an organisation uses in a year). At best, cost savings are negligible. Similarly, the Cloud is not just about being able to work from anywhere. The main drivers for using it are the efficiency gains across organisational departments, as disparate applications communicate and share data. The newest SaaS providers act as a glue holding together larger, more established platforms that used to fall under an ERP solution. As attitudes change with new staff joining airlines, and lower costs are driven by efficiency gains, there is more willingness to replace ERP solutions with radical new systems that are much more capable than the legacy ones of 15 years ago.

Cloud-based M&E systems change the way organisations, partners and employees interact and work together. Cloud technology enables collaboration, efficiency and effectiveness.

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