

Enterprise Systems for R&D Companies

1 Introduction

We're interested in the product development process of the typical R&D or high-tech company – a company where the majority (>80%) of employees are engaged in the design and production of innovative products. High-tech companies can also exploit their technological strengths and product intellectual property (IP) without themselves entering into large-scale production.

What we see in the typical high-tech company is a variation on the “achieve through others” principle – very little of their output value is in finished goods for the end-consumer market. Instead, innovative ideas and designs become blocks of IP that are integrated by other companies (the customer) into end-user products. From the formation of an idea to commercial success through product design-in, there is a race to be first and/or fastest as well as best.

Some of the characteristic challenges of high-tech companies include:

- Introducing and managing a phased product development lifecycle
- Having to manage multi-disciplinary teams of 30 or more people
- Starting to experience difficulty in effective team communications
- Keeping hardware and software development in tandem
- Collaborating to manage project risks, issues and plans
- Working with offshore / outsourced development teams in different time zones
- Managing evolving requirements and change requests
- Moving from single to multiple project management
- Ensuring company is commercially-driven and customer-focussed
- Winning and retaining customer confidence during the design-in phase

For the knowledge-intensive R&D sector two critical success factors apply: (1) Companies who make it significantly easier for their technology to be designed-in to a final product will shorten their time-to-revenue and take an increasing market share; (2) Companies who succeed in becoming designed-in will stay designed-in for typically 80% of the time in the majority of high-tech markets.

At the centre of this is the “stuff” of knowledge content that the high-tech company generates and owns – the way that it manages and disseminates this will determine whether it offers stand-out products and ultimately affects market share, brand recognition, revenue growth, and profitability.

Companies who understand the 'flow' of knowledge through their product development lifecycle will quickly grasp that collaboration and improved communication between the different internal roles of the company (engineering, marketing, procurement, manufacturing, quality, sales, technical support, etc) is the foundation for better products. For the "achieve-through-others" aspect of IPR licensing to work it is also critical to include external roles as well: relationships with suppliers and outsourced partners as well as direct customer feedback. Designers working for high tech companies can't afford to follow a traditional silo approach, neither within their own hardware and software departments, nor externally to their peer groups in customer companies.

To understand this is one thing, but influencing and controlling it is quite another. And, even while we attempt to control it, the size of the problem increases. The volume of information we produce is now estimated at more than 60 billion e-mails per day and 7 billion office documents per year.

2 Managing Knowledge Flow

A high-tech company with requirements for managing its knowledge content via software tools often tries to find a solution from what it already uses.

Frequently, the solution will come from one of two sources:

1. Someone in Engineering will propose that the version control system used for software configuration would make a great 'engine' for document management, especially if combined with the Wiki software Engineering have experimented with for the past few months; or
2. The IT department may offer something based on shared directory folders using WebDAV or Microsoft Sharepoint, with access determined by user group permissions.

Neither of these approaches is wrong, but often there isn't a fully-thought out analysis behind them; and the implementation of an integrated solution is often so difficult and expensive that chunks of the company get excluded. Who hasn't known a company where Finance and Operations are based on one system while Engineering uses something completely different? Where the HR Department will adopt it (and buy the HR module) once the ROI for buying the licenses and finding time for training them has been justified? Or, where the Sales team either use nothing or go for a separate solution such as an on-demand CRM system?

Nobody envies the IT Director or CIO trying to pull all these systems together against a background of increasing complexity and decreasing budgets. The smaller company often can't even afford to have someone to get stressed about it.

Considering that the high-tech company needs to have all its processes working seamlessly end-to-end in order to win designs and keep customers, this seems a very risky way to proceed.

3 Open Source Enterprise Systems

So far, this seems to be leading to a familiar conclusion – that the costs of an Enterprise Information / Content Management system (or "e-Business suite") are justified given the business-critical nature of the role it plays.

However, as we have seen this moves the problem to a different area: small companies see the cost of these suites and decide they can't be afforded; and/or they see that the adoption success of these suites in other companies is very uncertain.

The problem with the business suite approach (apart from the expense) is that the user is obliged to use modules offered by the vendor. The data layer (database records and tables) can over-dominate both the application layer (what functions are supported?) and the presentation layer (what does the user interface look like?). It is hard for a single vendor to consistently provide best-in-class solutions for manufacturing, supply management, finance, project management, human resources, customer relationship management, etc.

Increasingly, companies are considering whether they need (or can afford) to work with a commercial software vendor at all, or whether they can find an equivalent solution using open source software.

There is certainly a lot to choose from. SourceForge (<http://sourceforge.net/>), the repository for open source software development, has over 2000 projects in its Enterprise category alone, with over 500 projects each in CRM and ERP, for example. Even if sorted by rank (an indicator of the activity and popularity of a project), it's still a random way to choose technology.

Of course, most people would search for their open source enterprise software systems using the Web. However, "CRM" returns a staggering 80,000,000 hits and even "open source CRM" returns 721,000 hits. That's just to find the software packages - there is still the matter of installing them let alone integrating them with any other software, whether open source or proprietary.

All in all, it's a dilemma: spend a fortune on an integrated proprietary suite from a single vendor or spend considerable time and expense finding and integrating diverse open source packages. It is usually better to (a) find recommendations on the best open source software, and (b) look for pre-integrated solutions.

But what types of software systems are needed by the high-tech company?

The correct answer is to perform a full requirements / business analysis to understand the user population involved, the organisational needs involved in the input/output of content and the lifecycle of that content from creation to obsolescence. However, this paper will try to shorten this on the grounds that high-tech companies have enough commonality in requirements to be able to make some generalisations.

We are going to try two simple techniques:

- First, a way of categorising the diverse systems that are used (or could be used) within the high-tech company;
- Second, what are the main questions we need answered in our high-tech company? Which answers will give us metrics that we can use as key performance indicators?

4 The Solution: Data Centred

In our categorisation of the myriad systems and software applications that a high-tech company might deploy we found that a 2x2 matrix was of benefit.

The dimensions are **Internal** (i.e. used by company employees only) versus **External** (i.e. used by both customers and employees); and **Technical** (i.e. used predominantly within the Engineering / R&D function) versus **Commercial** (i.e. used more by employees in Sales and Finance, for example).

This categorises the Enterprise system projects that the high-tech company might instigate, but some of these projects will be significantly larger and more expensive (cost of licensing, cost of implementation, cost of training, etc) than others.

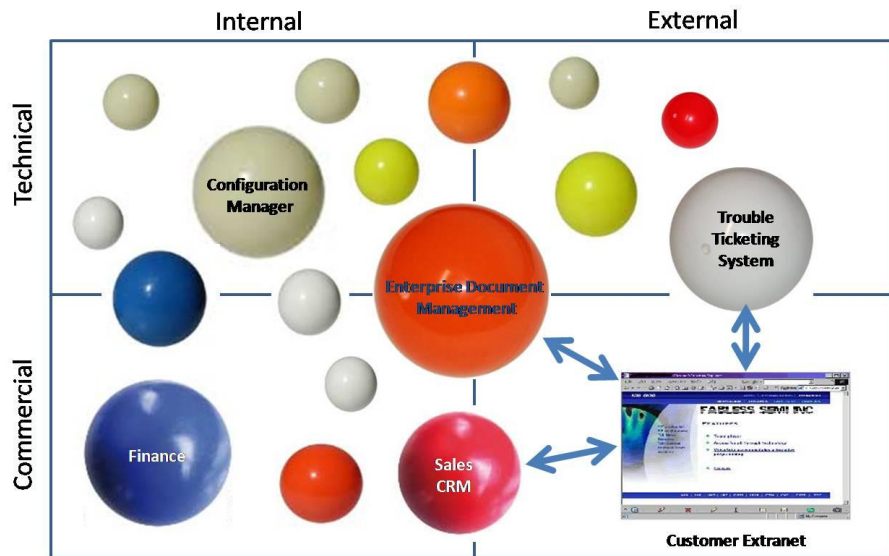
	Internal	External
Technical	<ul style="list-style-type: none"> • Software Configuration Management • Version Control System • Project Management tools • Bug Tracking System • Wiki Documents • Web Content Management • Engineering Change Orders 	<ul style="list-style-type: none"> • Customer Help Ticketing System • Release Management • Order Tracking & Fulfilment
Commercial	<ul style="list-style-type: none"> • Customer Relationship (CRM) • Marketing Campaign • Invoice Tracking • Digital Asset Management • Product Lifecycle Management • Finance / ERP Systems • Quality Accreditation • Legal (contracts & compliance) 	<ul style="list-style-type: none"> • Extranet / Authorised Customer Portal • Technical Library / Guides • Knowledge Base • Help Tickets

In keeping with the idea that the critical success factor for the high-tech company is to create an effective channel to its customers, the matrix can be re-worked to show how (a) an Extranet or Customer Support Portal is the logical system for the commercial/external cell; and (b) how the Enterprise software systems can be directed to serve this Extranet.

Each system has a different size to reflect its cost and/or importance to this mission:

There are three systems on the “front line” of the Customer Extranet.

The CRM system will be used to keep a record of the customers and all interactions with them, including a record of their design and the sales opportunity this represents for the high-tech company.



A Ticketing System is the method by which the Customer reports a fault and/or asks for help, and receives answers.

The Enterprise Document Management System holds a repository of the company’s documents, images, schematics, how-to videos and anything else that is needed to help the customer design their end-product. These systems provide the information that drives the Extranet – we show an imaginary example for a company called “Fabless Semi Inc.”.

This is a way of categorising the diverse systems that are used (or could be used) within the high-tech company.

Now, the second part, in which we consider which metrics are best for use as key performance indicators. Drawing from our experience in R&D management, we propose four key targets that should be the end-goal of our Enterprise system deployment.

1. We could manage the product release process as it left Engineering and before it reached our Customers?
2. We could measure the incidence of problems by product, release or component?
3. We could control what Customer has permissions to access different areas of the information and product releases that we make?
4. We know which of our products were causing problems and could proactively tell the Customer about it?

These targets do not imply that a company does not need functionality in other areas, but these are the ones that will deliver the maximum benefit for our customer-centric high-tech company.

Returning to our Enterprise systems graphic, there are four key interfaces between the systems that are of critical importance to this:



Interface ① is effectively the problem of release management. The goal here is to take the outputs of configuration management tools (the software team may use Subversion,

Perforce, CVS, Source Safe, etc) and combine them with hardware deliverables, technical documentation, legal agreements, etc. in an integrated release package.

Although software change and configuration management (SCCM) and enterprise document management systems (DMS) have some attributes (e.g. revision control) in common, it is the case that SCCM is not the same as document management. There are many additional attributes (e.g. use of metadata and categorisation) not used in SCCM but essential for document management. By the same token, good SCCM is not the same as good software release management. Software engineering teams using SCCM may have an excellent build process and be able to replicate a baseline, but this should not be confused with the packaging that goes into a good release, and ensuring that end-users take that package in a holistic manner. Otherwise, troubleshooting efforts for a customer will have to re-confirm the configuration every time before attempting a fix.

It is valuable to track the download behaviour of customers for a specific package – knowing that a software release has been downloaded by >80% of licensed users in the few days after release is very useful information.

The key message concerning this interface is that there is considerable value to be had in creating and controlling release packages from within the Enterprise DMS. These make dependencies in the product release easier to manage and more reliable. Normally, it requires a technical team of project managers or team leaders to control this step. They will use a high level, automated build process and the end result – a specification for how the software compiles and installs – is then carried into the DMS for release. Part of the automation process is creating new sub-categories in the DMS for the new release. It is also possible to create a release note (or part of one) to aid the user.

Interface ② is where the high-tech company controls which customer has access to what content. The sales team may be using a CRM system such as Salesforce.com, Oracle/Siebel or SugarCRM to manage new leads and their transformation into contacts/accounts/customers. At some point, when the purchase order is in and the technology license agreement is signed, it will be time to create a contact in the Enterprise DMS and assign a set of permissions that will determine what can be viewed and downloaded. The constraint may be because of financial reasons (only paid for certain license), or can be geographical (telecom standards vary for different regions), or based on technology.

The key message concerning this interface is that there is a 'handoff' between the CRM system and the Enterprise DMS during which a threat (data duplication, access permission errors) or opportunity (seamless integration between databases) occurs. As an example, in the CogniDox DMS we support a generic plug-in framework that allows data transfer to SugarCRM (a commercial open source CRM). This enables a smooth workflow from the Sales department to the Product Managers (typically in the Marketing department). The result is that customers (licensees) only see content on the Extranet that they are licensed to use.

Interface ③ is the means by which the customer sends a question or reports a bug. Both have value in determining what aspects of a product can be improved. Each time this happens, an incident or issue case log is started and the customer receives a ticket which is a unique identifier for the case. One of the ways the Enterprise DMS can assist is by keeping a record of the incidence of tickets by content – that way the high-tech company can quickly see which release packages (or any other item of content) is incurring the heaviest support load. It also allows the Engineering team to use a ticket ID as the reason why they are checking out a file from the SCCM. This is good practice and ensures a smooth end-to-end workflow.

Interface ④ is a variation on the above but directed towards the CRM system used by Sales – once the ticket counter has reached a certain level it can trigger a service level agreement (SLA) for that customer, or the sales team may proactively contact other customers also affected by the issue.

An example of this in the CogniDox CMS is the degree to which integrates with the OTRS (Open-source Ticket Request System) software package. One can examine a specific customer or contact

and see a count of open tickets or defects, for example. This is a highly effective way to synchronise sales, marketing, and customer support activities across their different points of contact.

5 Conclusions

High-tech companies and their customers are interdependent on each other and it is a critical success factor to be able to share information but at the same time preserve the integrity and security of that information. They need a "beyond and through the firewall" mentality in thinking about IT systems.

It is feasible for even a start-up high-tech company to acquire advantage through powerful Enterprise systems by considering use of open source software and by placing early emphasis on the need for a customer Extranet.

There is a high probability that the SCCM in use is open source – Subversion, CVS and Git are examples. Trac provides a web-based front end for them. [<http://trac.edgewall.org/wiki/TracProject>]

There are open source CRM systems available – SugarCRM is an excellent and popular example. This is also available as commercial open source in their Professional Edition. Commercial open source is where the source code is provided but the product is supported and maintained to the same standard as proprietary software. [<http://www.sugarcrm.com/>]

Open source trouble ticketing systems (such as OTRS) are also available. OTRS, incidentally, is the trouble ticketing tool used to manage the Wikipedia project. Again, it is possible to procure a higher level of support from the company behind OTRS. [www.otrs.org]

CogniDox is based on open source software stacks (Linux, Apache, MySQL, Perl) and is available on a low-cost commercial license.

Finally, building the Extranet web pages can be done using open source content management systems – Joomla and Drupal are widely used frameworks that can be quickly branded in the high-tech company's style.

There isn't a good excuse not to have a plan of action here. The way that a high-tech company connects with its customers during design-in is their commercial engine and makes for successful growth. We've tried to steer clear of unnecessary hype and offer practical, actionable advice to convert at least some from a state of confused indecision to an open source Enterprise software strategy.

In conclusion, bear in mind that the systems described here by and large represent "Enterprise 1.0" and many commentators now speak of the imminence of so-called "Enterprise 2.0" applications, in which collaboration will be based on social networking within the organisation. If that comes as quickly as predicted and delivers commercial advantage as promised, then it is even more a priority to sort out a strategy for the current generation of technology!



About Us

Cognidox Ltd is a privately held company based in the UK. It was founded in 2008 but with document management software now over ten years in active development.

CogniDox started as a document management system called "doxbox" created by Virata in 1998 to assist it in managing silicon and software design for its communications semiconductors business. As Virata successfully added dozens of OEM companies to its list of licensees, a need arose for a way of sharing design documentation with those customers using a secure "licensee server". Virata wanted to make sure that companies only saw documentation for the designs they had licensed, and it wanted to know which users from those companies had downloaded what documentation, and when.

Dobox was extremely useful to Virata in helping team collaboration as it acquired companies and added new R&D sites. Doxbox continued in use as the company merged to become GlobespanVirata and again later when it was acquired by Conexant Systems. It scaled effortlessly to 1000+ users at many worldwide locations. Finally, rights to the software were granted to us in 2005 to ensure that it could be commercialised as a product.

Cognidox Ltd was set up to make CogniDox the first choice document and content management system for high-tech companies.

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CogniDox helps Engineering, Marketing, Sales, Operations, and other departments capture, share and publish product and design documentation.

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