

Digital Business Ecosystem: The Internet's new Common Land

Arturo Di Corinto & Neil Rathbone

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While many may think that the Internet revolution has largely happened, we have as yet probably only seen the opening stages where it replaces pre-existing functions such as brochures, postal mail, and trips to the bank. It is often the case that radically new technology only really blossoms once human thinking can get to grips with the new possibilities it opens up.

A 3-year €14 million European collaborative project involving 120 researchers and several hundred small businesses is now getting under way that promises to deliver a new kind of Internet-based environment where business services will 'evolve' by mimicking natural phenomena such as self-organisation and selection by fitness. Called the Digital Business Ecosystem (DBE), it aims to establish the nature of the next generation of business software, and may be the first in a wave of such electronic ecosystems.

The project combines scientific research with software technology and business analysis. The objective is not to produce the end software, but to create an ecosystem within which businesses will operate using application software or application services provided by developers that will take advantage of the special functionalities of the ecosystem, in particular the ability for services to self-organise, self-optimize and evolve.

How evolving software works

The concept of evolving software is not as far-fetched as it seems. Already your Web browser that you use today is probably not exactly the one you installed: automatic on-line updates, add-ons, plug-ins, and the effect of cookies mean that it can already 'evolve' over time to adapt to changing technology and to suit your personal needs. Remote environments are also familiar as the 'Application Service Provider' model: put simply, if you access your bank on-line it is their software, in their environment, that you are using to manipulate your finances.

It is only one step, admittedly a big step, to a world where our interactions take place in special environments that have some form of evolutionary functionality built in to them. The possibilities are staggering. The researchers are confident that their 'ecosystem' will be able to assemble software and services in new ways, using the dynamics of the marketplace as a driving force, and rules drawn from observation of scientific and natural phenomena as mechanisms that can be electronically modelled and incorporated into the ecosystem.

The latest teaching from the business world is that the characteristic that most ensures long-term enterprise survival is flexibility. As natural organisms climb the evolutive stair, it is possible to observe that behaviours evolve in the direction of an ever-growing

variability, adaptability, and flexibility; features that in any complex system augment the fittingness of biological organisms. The DBE offers the prospect of flexibility without the need to continuously drive it through human initiative and energy.

Modelling is the key

The key to enabling the highly structured and human-designed world of electronic systems to mimic natural processes that operate without human intervention is modelling. Models can provide the building blocks that we can use to construct any specific scenario. Just as the human mind, on surveying a visual scene for example, deconstructs what it receives and understands it in terms of objects, which it can use for storage, recall, and processing, so can business processes be broken down into objects like enquiry, product, price, discount, order, and delivery date. These objects can then be manipulated within models.

Application software has already become ‘object-orientated’ and is increasingly moving towards Model Driven Architecture (MDA) which is the subject of internationally agreed standards published by the Object Modelling Group – a kind of standards organisation for modelling as a way of constructing software. One of the first tasks of the DBE project is to deconstruct real business situations into a set of elemental building blocks – the Business Modelling Language - that comply with the OMG standards.

By abstracting business process models into meta-models, that is models that tell you about the models they describe, in the same way that a contents page tells you what is in a book, it becomes possible to get software processes to interact at this conceptual meta-level with similar mathematical models of evolutionary processes. It is even possible to operate at the meta-meta level where models describe meta-models; rather like having ‘contents’ as alongside ‘index’ ‘summary’ and ‘review’ as a single concept of ‘book description’ objects.

Self-organization and self-optimisation

But what can be achieved by interacting software and services with natural phenomena? Certainly any dreams of software emerging spontaneously from some sort of primordial digital soup are way off the mark. Industry does not have the time to start with some random elements and wait for random mutation and simple Darwinian self-selection to produce something useful. The DBE is more concerned with identifying specific higher-level phenomena such as how collective behaviour can exhibit self-organisation and self-selection.

Studies of chaos, complexity theory, and the phenomena of emerging systems have demonstrated that complex activities can evolve from individual behaviours into something more than their simple addition. In his classic ‘The Wealth of Nations’ in 1776, Adam Smith coined the term ‘the invisible hand’ to describe the seemingly orchestrated order that emerges from the actions of individuals looking for things they

need in a free marketplace. From the behaviours of ants and bees, to communities of software developers, the principle of self-organization is a factor in the development of recognizable macro-behaviours that allows society at large to reach complex goals.

Complex adaptive systems show an emerging behaviour by transitioning from low-level rules to higher sophistications. These behaviours have the quality to become more intelligent and to respond to specific needs of the environment over time. Howard Rheingold, in his book '*Smart Mobs. The Next Social Revolution*' describes how smart mob behaviour has emerged in several areas of the world, enabled by use of the mobile phone and other information and communications technology to connect independent actors who share a common goal.

If within a ant colony individual behaviours are instructed by the DNA and the goal of cooperation is the preservation of the genetic pool of the colony - in a community of programmers the instructions are dictated by shared cultural rules, the goal being to embed more and more intelligence into the software.

In the action of software agents, which are programmed to act on behalf of their owner, we see the possibility to emulate collective behaviour when these agents are able to interact with each other within an ecosystem. Indeed, software that emulates ant behaviour has been show to perform better at the 'Travelling salesman's dilemma' of route planning than traditional top-down approaches using sophisticated algorithms.

The emergence of cooperation

But why should anyone in the cut-throat world of commerce collaborate like ants? Various studies about cooperation have shown that when two competing players have the possibility to cooperate, the effect of cooperation is an advantage for both. Game theory has proved that even in a highly competitive context such as the game defined as the 'Prisoner's Dilemma', cooperation based on reciprocity is always the win-win solution.

While in game theory cooperation is an economic choice aimed to maximize an individual result, the gift economy subordinates cooperation to a set of social duties and non-economic factors that are guaranteed by the beneficiary community. Here the gift is not associated with the idea of 'free of cost' but with a different model of exchange, based on reciprocity. Reciprocity is the missing link between competitive and generous cooperation.

Thus the reciprocity of the gift implies a triple obligation: giving, receiving, and returning. By implying a return, the gift tells us that there is a convenience in donating, although non-immediate. There is an obligation to donate as well as an interest in donating. Within a community, cooperation can protect itself from non-cooperative strategies through the assignment of scores and other indicators, or a system of attribution of the credits amongst peers that contribute to the formation of the reputation - a mechanism that influences the choice of who to cooperate with in the future.

The growth of the open systems movement, and the unexpected success of open systems software such as the Linux operating system, has shown that for software developers and their customers, the gifting and sharing of intellectual property has advantages over secrecy, protectionism, and monopoly. Open systems does not equal 'free', though that may often be the case, but it does mean cooperation and transparency that leads to cooperative and collaborative behaviour which in turn produces greater good for every individual than the destructiveness of adversarial competition.

In the Open Source model the 'Cooperate only if the other does the same' logic turns into 'I cooperate to make the other cooperate'. This strategy to donate to make the other donate implies confidence in the other's behaviour. The prerequisite for this to happen is that the involved parties communicate. How much simpler would be the prisoner's dilemma if the two parties could communicate? By providing its ecosystem as a platform for communication, resource sharing and interaction, the DBE can improve the kind of exchange underlying cooperation.

Ecosystems as the new e-commons

The DBE can be seen as creating, within the digital landscape of the Internet, a new form of the concept of 'Common Land' that existed in the agrarian past of most European countries. Unlike many other goods, knowledge does not deteriorate with circulation and use. In fact, its use and consumption contribute to improve its quality, its quantity, and its dissemination. This is exactly what happens with a commons: a common good is a good augmented by its use. Like the Internet itself, no one owns it or controls it. It is there for the world to use.

This does not mean that the DBE will be some form of idealistic or altruistic project. Right from the start it is intended to be a highly commercial environment where software developers, service providers and service users trade profitably and competitively on this new common land.

The DBE project is deeply rooted in the Open Systems philosophy, both in order that monopolistic interests cannot dominate the technology, as has happened with the personal computer, and in order to create this new common land that will draw in cooperative communities of applications developers and end users. While DBE is concentrated on business, and is starting with B-2-B transactions, it is also a test-bed for other potential forms of ecosystem where new insights and new functionalities, as yet the stuff of dreams, can be brought to reality.

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