

## **Java and E-Services for Electronic Marketplaces**

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electronic  
marketplaces,  
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If the first chapter of the Internet was about the dissemination of information, chapter two is about services. In the past, the Internet strategy of a company was about using a web site for advertising products. Today the concept of product becomes almost indistinguishable from the concept of service, and the Internet becomes a key component of any type of channel. Electronic marketplaces and e-services are two of the main drivers for the change from chapter one to chapter two for the Internet, both from a business and technology perspective. E-services are about assets made available efficiently over the Internet. Electronic marketplaces are about demand for services being put in contact with the best offer. The two concepts naturally complement each other. The objective of this paper is to introduce the concepts behind both e-services and electronic marketplaces, and to show an example of the use of Java as enabling technology. The example focuses on a novel approach to mediated service delivery, and the Java-based prototype developed to implement it.

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# Java and E-Services for Electronic Marketplaces

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## Abstract

If the first chapter of the Internet was about the dissemination of information, chapter two is about services. In the past, the Internet strategy of a company was about using a web site for advertising products. Today the concept of product becomes almost indistinguishable from the concept of service, and the Internet becomes a key component of any type of channel.

Electronic marketplaces and e-services are two of the main drivers for the change from chapter one to chapter two for the Internet, both from a business and technology perspective. E-services are about assets made available efficiently over the Internet. Electronic marketplaces are about demand for services being put in contact with the best offer. The two concepts naturally complement each other.

The objective of this paper is to introduce the concepts behind both e-services and electronic marketplaces, and to show an example of the use of Java as enabling technology. The example focuses on a novel approach to mediated service delivery, and the Java-based prototype developed to implement it.

## Electronic Marketplaces

The notion of electronic marketplace (e-marketplace) derives from the aggregation of a number of integrated business services, enabled and delivered via the Internet (Blodget, 2000). The characteristics of an electronic marketplace (e.g. membership, regulations, service offer) depend on the organization that offers the e-marketplace itself. Such organization is referred to as e-market maker. E-market makers are business-to-business re-intermediaries. They operate in the supply chains in various vertical (Ferrara, 2000) and horizontal (Rugullies, 1999) industries, with the aim of introducing new efficiencies and new ways of selling and purchasing products and services (Timmers 1998).

An e-market maker provides content, value-added services, and often (but not always) commerce capabilities. E-market makers aggregate content, provide value-added services, and offer multiple vendor alternatives. The following three aspects of e-marketplaces make them different from more traditional extranets:

- Management by independent third-party
- Multiple seller participation
- The relative ease with which buyers and sellers can participate

E-marketplaces operate in the open sourcing and traditional supplier market space. The model behind e-market makers aims at changing the way organizations purchase and sell strategic and non strategic products, the way they purchase and deploy software, and the way they evaluate professional services companies, financial institutions, and Internet service

providers (ISPs). Research activities conducted by specialized companies like GartnerGroup, Dataquest, Forrester, and Giga (Bartels, 1999; Reilly, 1997) suggest that the shift towards e-marketplace models will begin to occur globally in a significant way over the next five to seven years. Major investments will be in the United States, likely to be followed by substantial investment in the Asia/Pacific region, and then Europe.

At a very high level, e-marketplaces can be segmented into three types. These three types include the following:

- Vertical marketplaces
- Horizontal marketplaces (also known as "functional marketplaces")
- Enabling technologies

Vertical marketplaces, as the name suggests, serve a specific vertical industry, such as chemicals, electronic components, bandwidth, and so on. These marketplaces focus on understanding industry practices, and automating the inter-company interaction aspects of business processes (Gipson, 1999). They automate vertical supply chains by digitizing and normalizing product catalogs; they create market opportunities by developing product exchanges.

Horizontal marketplaces span across industries and automate functional processes, such as maintenance, repair, and operations procurement, project management, human resource services, advertising, IT services, and so on. Horizontal marketplaces aim at making these processes more efficient; often these horizontal marketplaces are an extension of enterprise software or services (such as buy-side software or IT outsourcing services).

The enabling technologies provide a platform upon which vertical and horizontal marketplaces are built. These technologies are marketed by organizations such as Ariba, CommerceOne, TRADEX Technologies, BusinessBots, Trading Dynamics, Moai, and so on. These companies sell products that provide information publishing tools, catalog software, business process workflow features, transactional capabilities, auction/reverse auction capabilities, translation capabilities for multiple standards and formats, transaction and payment services, and customer relationship management functionality. Vendors of the enabling technologies usually employ a business model based on a combination of software licensing, custom consultancy, and installation services, and, significantly for traditional software vendors, on transaction fees for the goods and services negotiated (Lief and Dolberg, 1999). The e-market makers operating the horizontal and vertical marketplaces employ business models based on advertising revenue, subscription fees, and/or transaction fees.

## **E-Services**

Until recently, the Internet was about the creation of e-business and e-commerce systems, and it was dominated by web sites and storefronts. We have now entered the next Internet evolution: the proliferation of e-services. E-services (HP, 1999) are modular, nimble, electronic services that perform work, achieve tasks, or complete transactions. Almost any asset can be turned into an e-service and offered via the Internet to drive new revenue streams and create new efficiencies. Chapter 1 of the Internet was about:

- Thousands of businesses getting wired to their employees, customers and partners . . .

- Key business processes getting linked to the Net...
- A critical mass of consumers coming online

Chapter 1 was about the creation of e-business and e-commerce systems that form a critical foundation. Now, the Net is primed for its next evolution. It won't be about businesses working the web. It will be about the Internet working for businesses. Chapter 2 of the Internet will be about the mass proliferation of e-services.

These services will be modular and combine and recombine to solve problems, complete transactions, and make life easier. Some will be available on web sites, but others will be delivered via TV, phone, pager, car, email in-box, or virtually anything with a microchip in it. Some will even operate behind the scenes, automatically working on behalf of consumers and providers.

**A definition:**

*An e-service is any asset that you make available via the Net to drive new revenue streams or create new efficiencies.*

In Chapter 2, successful companies will be those that determine how to turn their assets into services delivered via the Net. Successful companies will adopt an entrepreneurial approach to looking at their assets—figuring out how to best leverage not only their core business offerings, but also their proprietary processes, data, relationships, knowledge, experience. In Chapter 2, we will see more companies turn these assets into services and offer them via the Net. From a technology perspective, there is a proliferation of initiatives in the industry and within standard bodies aimed at better exploiting the potential that the Internet has for businesses. Leveraging these efforts, HP (HP, 1999) is promoting a comprehensive framework oriented towards making the e-service vision become a reality. The ability to expose services in a way that they can be automatically visible and accessible to potential customers is the focus of this service framework specification (SFS). The work described in the next sections of this paper is based on such framework.

The SFS (HP, 1999) defines standard business and technical conventions that allow e-services to dynamically interact with each other. These interactions which include discovery, negotiation, composition, measurement and monitoring are based on a common interaction model and enables disparate business processes (whether RosettaNet or ebXML) to be represented as a standard SFS conversation on the Internet. Using a common means of defining and implementing Internet e-services, companies can deploy e-services that can collaborate across organizational and market boundaries. Market makers, aggregators, and auction services can freely interact in a dynamic, yet secure open services marketplace. In such a dynamic market place the SFS adds value in the form of cross-platform interaction, componentisation, diverse business models and end-to-end service provisioning.

Open electronic marketplaces represent a big opportunity as a channel to market for e-services. In the case of e-services, electronic marketplaces will be able to offer a number of value added services on top of the basic offer-demand matching. Mediating the service delivery acting as trusted third party is a particularly interesting feature that an electronic market can offer. In the next section we present a novel approach to mediation in service delivery.

## Mediation in Service Delivery

Interaction management plays a fundamental role in the overall service provision process. In particular, two important aspects need to be considered: management of users and management of their interactions with services. The classic approach to the problem is based on the access control list (ACL) paradigm, which associates the users of a service to the actions they are allowed to take. Despite proven advantages in terms of efficiency for low-level services, we propose that for business level services (e-services) the ACL approach may be problematic as a modelling framework. Far from arguing the expressiveness of the ACL model, we just suggest that mapping the interaction logic of business services to an ACL schema can be difficult, and error prone. Moving from the observation that behind a business service there is a set of inter-related business processes, we propose to use more directly the customer view on these processes as a modelling framework for service interaction. Anticipating an observation from the next section (prototype), access control lists represent an effective implementation vehicle for higher-level abstractions.

As presented in the previous sections, the delivery of an e-service is likely to be mediated by third parties like electronic marketplaces. Linking capabilities of the users to different stages in the evolution of a service delivery process has a considerable impact in terms of management and mediation capabilities. Identity-related issues are resolved in terms of membership to the e-marketplace, and the interaction logic exposed by the service provider can focus more on the core aspects of the service. Flexibility is an imperative for e-services, and this is reflected in particular on the adaptability required for the delivery process. As it happens in normal business contexts, the delivery of a service follows from a negotiation process between service consumer and service provider. The service provider may need to adapt the service delivery to the needs of specific customers, and for specific service instances. This implies that the rules for the interaction between service consumer and service provider must be easy to capture and to adapt. Following our approach, the mediator would receive the specification of the interaction processes agreed for each service instance. The mediation work simply requires maintaining the state of the agreed process instances, and verifying the actions of the parties against it.

The role of intermediaries is very peculiar in the case of business transactions, and in particular for service delivery. Exposing the interaction between customer and supplier may have important implications in terms of exposing business data, and operational procedures. The intermediary (e.g. the e-market maker) should provide satisfactory evidence to all the parties of its trustworthiness in the first place. Nevertheless, our model is by any means prescriptive in terms of the aspects of the service delivery that should be mediated. The idea is to provide a set of generic capabilities that can be easily adapted to specific business requirements.

From a technology standpoint, the role of a mediator can be crucial in terms of how to implement an e-service infrastructure. For both service provision and service consumption, e-service enabling a company can have an impact on legacy systems. The core value generation of an e-service is very likely to be driven by existing applications within a company. What is required is a set of corollary functions, and the use of third-party services can reduce the need for internal infrastructure. We propose that mediated service delivery can be an option to consider, especially for companies offering services that are not electronic by nature.

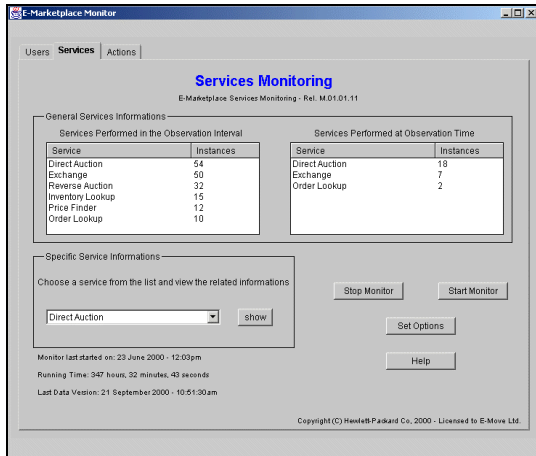


Figure 1: Monitoring Interface

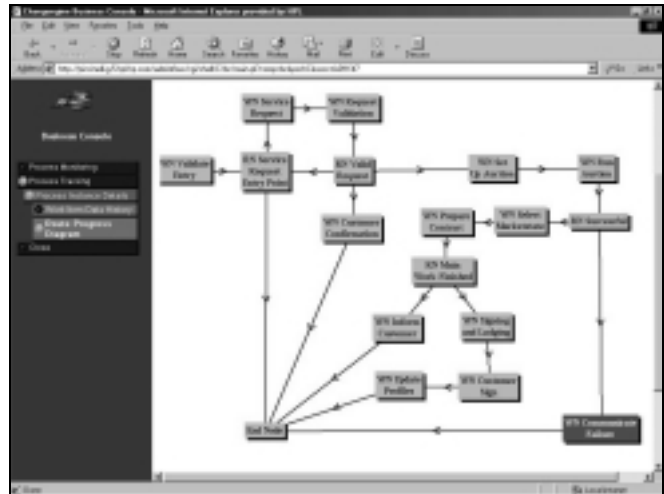


Figure 2: Auction Service

## Java-based Prototype

As part of the DySCo (Dynamic e-Service Composition) programme, a Java-based prototype has been developed in order to explore the concept of mediated e-service delivery. The prototype was developed in a joint effort by Hewlett-Packard Laboratories, and the University of Ferrara.

The infrastructure for DySCo reproduces a real-world scenario, with a number of e-service providers relying on an electronic marketplace for the offering their services. Each e-service exposes different types of information (meta-data), ranging from a functional description of the service to availability and pricing models. In order to enable mediated service delivery, we included in the meta-data information describing the customer view on the service delivery process. This information can be generated automatically, applying a role based projection algorithm to the description of the business processes implemented by the service provider. The algorithm dynamically adapts the definition of the interaction process between customer and service provider based on the roles that the customer accepts to play (e.g. receiver of the service, receiver of the invoice, quality assurance monitor). The interaction process becomes part of the service contract between customer and service provider. The electronic marketplace mediates the interaction between the parties enforcing the processes specified in the service contract.

Concerning the technology used, the platform for DySCo is based on the HP business process management system Changengine. Changengine (HP, 2000) is a comprehensive system that covers all aspects of business process lifecycle, from the definition to the enactment. Motivating factors in the choice of Changengine were its high-performance process engine, the web based management interface, and its wide range of adapters to databases and legacy applications. The purpose of DySCo is to define a reference framework to turn business services into e-services; therefore the infrastructure used aims at reproducing a real-world environment. Federation capabilities based on open protocols and programmatic interfaces for access to process instances are also major features of Changengine. The Java API provided with Changengine for process interaction is the main building block for the mediation system we developed for service delivery.

In DySCo each service provider is equipped with Changengine. This is particularly important for dynamic composition of services (which is outside the scope of this paper), but we mention it here mainly as an indication of the fact the automated process management is a prerequisite for the e-economy. The electronic marketplace is also equipped with Changengine that, among other activities, runs the interaction processes between customer and service provider. Having all the work related to the execution of the interaction processes taken care of by the process engine (Figure 2), the high-level management (Figure 1) was then automated with a specific Java-based module. User access and profile management is the focus, but aggregation, trend analysis, and similar features are also implemented. An advanced Java-based authorisation server (ACSIS) is used as the main component of the module (Casassa Mont, 2000).

## Conclusions

The objective of this paper was to introduce the concepts behind both e-services and electronic marketplaces, and to show an example of the use of Java as enabling technology. The example focuses on a novel approach to mediated service delivery, and the Java-based prototype developed to implement it.

In the e-service world, flexible and dynamic business models make businesses demand the same flexibility from their IT infrastructure. In the development of our solution, Java certainly proved a valuable tool in order to design flexible and maintainable systems.

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