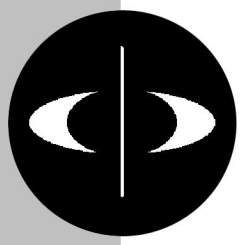

The IBM e-Business Portal Software Solution

Prepared for IBM

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Cheshire, England

Version 1, November 2000

DATABASE ASSOCIATES INTERNATIONAL

About DataBase Associates International, Limited.

Database Associates International is a consulting company specialising in leading-edge technologies in the fields of database, business intelligence, analytic applications, intelligent e-business, CRM, and Web e-business portals.

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WHAT IS A PORTAL?

A Portal is an integrated and personalised web based interface to information, applications and collaborative services

For most organizations in business today, commercial pressures demand faster decision making, action taking and increased productivity from employees amid a business climate where people are drowning in a sea of content that continues to deepen and threatens to overwhelm them. This increasingly competitive business climate has fueled an acute demand by people to have a cost effective, easy to use means of rapidly accessing relevant *applications* and *information* specific to their job function. They also want to be able to share information, and to communicate and *collaborate* easily with other *people*. These basic needs apply whether a person works in a front office, corporate or back office role. The same is true for business partners, prospects and customers who are interacting with a company to supply products, obtain product information, purchase products and to get customer service and support.

The challenge in providing such a service is complicated by the fact that different people have different requirements. Each person needs access to different applications and different types of information distributed across internal and external systems on a range of disparate platforms. Access is also required from a variety of devices from any location with most people needing to collaborate with a unique *community* of people.

The solution to this challenge is an E-Business Portal that provides users inside and outside the organization with a common *integrated* and *personalized web-based* interface to a broad range of business content that comprises information, business applications and expertise. E-business portals are accessible from wired as well as wireless devices and are therefore *network and device independent.* In addition, they can support data and voice based user interface. E-Business Portals also allow users to find people, collaborate with them and to uncover and organize business information for both *ad hoc* access and off-line delivery. This paper provides an introduction to portals, differentiates between types of portals, reviews requirements and architecture for an e-business portal and takes a detailed look at IBM's portal strategy and product offering for both enterprises and service providers.

THE EVOLUTION OF INFORMATION PORTALS – THE MOVE TOWARDS THE E-BUSINESS PORTAL

Three generations of portal technology

The demand for portal technology evolved initially out of the need to help consumers in finding information on the public Internet. Very soon after this, the same requirement appeared inside organisations as intranets took hold and employees sought a means of organising internal information, web pages and links. Since that time the scope and functionality of portal technology advanced to second-generation vertical portals. These products focussed on indexing and organising specific types of information and application services primarily for corporate use. Today, portal technology is progressing further to third generation E-business portal products that are able to provide a common framework of services upon which to build vertical portals and integrate a very broad range of business information and applications both inside and outside the organisation. E-business portals are designed for enterprises and service providers. Figure 1 below shows the different types of portals and how each phase in portal evolution has built on the previous phase to broaden the range of content available and to integrate portal technologies. There are however important differences between the three generations of portal technology shown.

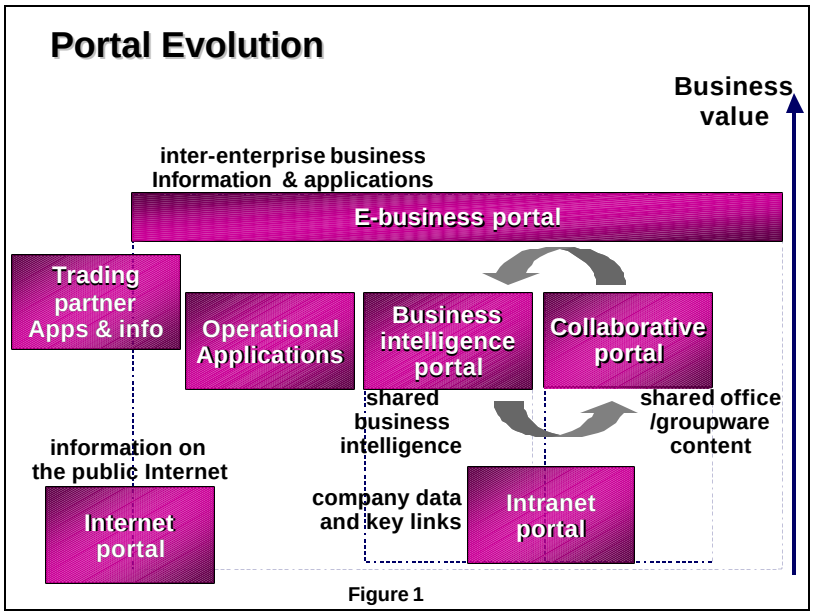

Figure 1

First Generation: Intranet and Internet Portals

Internet and Intranet portals are limited to web documents and live feeds

Internet portals employ a profile of a user's information requirements and the services of a search engine to help consumers quickly find information that matches their needs on the public Internet. They provide consumers with a single interface to the vast network of servers that constitute the Internet. Today these portals also support personalisation of content and services as well as user customisation of screen layout. Typically the scope of information supported by Internet portals is limited to web documents and live feeds. Examples of Internet portals include: Yahoo, Lycos and Excite.

Personalisation uses collaborative filtering and rules based software to enhance end user interactions

Customisation is a manual process often performed by the end user

Intranet portals in the corporate environment had a similar objective – to provide business users with a single interface to corporate information scattered throughout the enterprise. The scope of information supported in intranet portals has typically been limited to web documents containing general corporate data including company news, telephone numbers, company policy, events, information feeds, and key web links.

Second Generation: Collaborative Portals and Business Intelligence Portals

Second generation portals focussed on specific types of information and applications

Second generation portals were aimed at corporate users by expanding the scope of business content available to portals and focusing on specific types of processing mainly inside the organisation to provide a set of services as well as access to information. These 'vertical' portals fall in two main categories, collaborative portals and business intelligence portals.

Collaborative portals help business users organise, find and share *unstructured* office and groupware content, e.g. e-mail, discussion group material, office documents, forms, memos, meeting minutes, web documents and some support for live feeds. They differ from Internet and Intranet Portals not only in supporting a wider range of information, but also by providing a rich set content management and collaborative services. Content management services include text mining and clustering of related unstructured information, information categorisation to classify it and make it easy to find, summarisation to generate abstracts for documents, publish and subscribe, finding people, and tracking expertise. Collaborative services allow users to chat, organise meetings, share calendaring information, define user communities, participate in net meetings, and share information in discussion groups and on white boards etc. Collaborative portals are mainly used internally as a corporate facility although business-to-business use is increasing.

Collaborative portals organise and track unstructured content and allow people to collaborate and share information

BI portals organise and track intelligence for making key business decisions

Business intelligence (BI) portals provide executives, managers, and business analysts with easy access to business intelligence for making key business decisions. BI portals typically index business intelligence reports and analyses, canned queries, etc. associated with financial management, customer relationship management, supply chain performance management etc. They also provide seamless access to BI tools (reporting, OLAP, data mining), and packaged analytic applications and support alerting, publish and subscribe etc. The main suppliers of BI portals are BI tool vendors who have extended their product lines to add a portal product. As such these products are often limited to indexing intelligence produced by a single vendor BI tool set. These portals are mainly used internally as a corporate facility although they are increasingly being deployed in trading exchanges, for example, to make demand intelligence available to suppliers to help optimise supply chains.

Market demand for integration of unstructured information and business intelligence is causing BI and Collaborative portal vendors to provide support for both in a single portal offering indicating that these two types of portals are beginning to merge.

Third Generation: The E-business Portal

E-Business portals offer a broad range of access to applications, information and expertise inside and outside the organisation

Next generation portal technologies are aimed at full function e-business and are intended to move portals beyond the corporate boundary for use by employees, business partners and customers alike. This makes them key technology for both enterprises, trading communities and service providers. Users may access the portal from web browsers and pervasive devices via a data or voice user interfaces. E-Business portals support personalised easy to use access to a broad range of integrated applications, information and expertise inside and outside the organisation. This generation of portals builds upon and leverages second generation technologies by providing an open framework of common services that makes it possible to build and deploy vertical portals and share these services. Collaborative and Business Intelligence portals can therefore be built, deployed and integrated using a common framework. Vertical portal offerings from multiple suppliers can also be integrated and can exploit framework services. A significant addition to this generation of portals is integration with web application servers which means that the E-business portal is not only providing a single point of access to applications and content but also becomes the new platform for 'portal ready' web application development. E-Business portals therefore differ significantly from Internet portals, and vertical collaborative or BI portals. E-Business Portals:

- Offer the richest set of information and application services through a single user interface to browser based and pervasive device users
- Support data and voice based user interfaces
- Help collect, categorize, and integrate business content from operational systems, e-business systems, content management systems, external Internet sources, and business intelligence systems
- Help both internal and external business users to search, access, publish, subscribe to, and deliver business content in support of an e-business community
- Provide advanced collaborative capabilities that allow users to create and share knowledge
- Provide access to operational, analytical and collaborative applications including business-to-consumer and business-to-business e-commerce
- Provide a rules manager, rules engine and rules directory for automated alerts and actions
- Provide an open framework of common services for deploying and integrating vertical portals
- Provide a new platform for device and network independent portal application development
- Will become a key underpinning of e-business exchanges/ marketplaces and service providers

PORTAL IMPLEMENTATIONS – VERTICAL VS HORIZONTAL PORTALS

Vertical portals focus on specific application or departmental needs.

It is fair to say that most companies are looking at portals as a single user interface to everything – the new 'Web top' and the access point to information and services from all computing devices. However the way that portal technology has evolved and the difficulty surrounding the business case to access everything via one portal, has meant that departments have so far started with smaller portal projects and grown into collaborative or business intelligence *vertical* portals that are associated with their area. In addition most IT organisations have restricted these to internal use.

Horizontal portals connect to most sources of business content and provide common services to enable and integrate vertical portals

Now there is a need to expand these vertical portals and to integrate them with e-commerce 'stand-alone' web sites, core operational applications and other types of content to create the virtual enterprise. E-business portals are the new generation of *horizontal* portals that provide this solution because they offer a broad range of connectivity options and deep integration with enterprise systems. This includes e-business, operational, analytical and collaborative applications plus data from disparate systems. They allow users to customise layout, personalise content and application components to suit their needs and also support access from pervasive devices. Furthermore by providing an open portal framework that offers access to common portal services, E-business portals can provide support for deep integration of vertical portals on a common open framework.

REQUIREMENTS FOR THE E-BUSINESS PORTAL

E-BUSINESS PORTAL BUSINESS REQUIREMENTS

Three main types of e-business systems

There are three main types of e-business systems. Business-to-employee e-business covers most business activity including CRM, financial management, HR, Supply Chain Management etc. Business-to-business e-business systems support supply chain, trading exchanges and value added re-sellers. Business-to-consumer e-business systems support consumer e/m-commerce, customer self-service and support. Each type of application has specific business needs.

Business-to-Employee (B2E) e-business must allow all employees in front office, corporate and back office functions to have personalised access to relevant, up-to-date business content all via the same user interface. This includes access to operational, business intelligence and collaborative systems and external information. Mobile employees e.g. sales and field service employees, also require access to content from wireless devices and data synchronisation services between mobile 'lite' databases and enterprise systems.

Business-to-Consumer (B2C) e-business requirements include consumer direct access to extensive content, front and back office operational applications, e/m-commerce applications permission marketing, search, and collaborative tools to support product information serving, product availability, secure purchasing, order status, shipping status, self service requests, marketing choice, reduce customer service and support operating costs and offer collaborative assisted service when needed e.g. via email or voice. Access via browser and multiple other wired and wireless devices must be supported for consumer convenience. Confirmation of e/m-commerce transaction completion is also needed.

Business-to-Business (B2B) e-business requirements include personalised access by suppliers and resellers to operational, analytic and collaborative applications and information as well as access to trading partner systems by employees. In addition, there is a need to define how business documents such as purchase orders, invoices, statements, confirmations etc. can be mapped between businesses. Application integration is required to integrate processes across businesses in procurement, billing, supply chain management and distribution areas. Collaborative tools, self-satisfied service and collaborative assisted service are also needed.

Service providers have additional business requirements

Internet and Application Service provider e-business requirements include providing businesses with device and network independent personalised access to applications and content. In particular they have a need to manage large numbers of subscribers, manage billing, offer comprehensive set of applications and manage application availability and scalability. They also need to support self-configuration of multiple devices. Reliability, availability and scalability are paramount to a service provider who may be integrating content and applications from its own and from multiple 3rd party organisations. To support these needs, portal functionality may need to be distributed across multiple servers in the service provider e-business portal. Integrated B2C and B2B functionality, described separately above, are also needed here but on a much larger scale.

To support all three types of e-business and service provider needs, portals must offer network and device independent personalised access to appropriate applications and content whether structured or unstructured, web-based or in any repository. This includes:

Need to support device independent access to all business content

1. Job-specific business intelligence (BI) for effective decision making
2. Office documents - spreadsheets, memos, presentations, reports, e-mail, multi-media
3. Operational applications (e.g. ERP, front office, back office, legacy...) to record transactions, provide real-time information, take action and conduct e/m-business
4. Web information – Web documents, live feeds to monitor trends and external events and other digital business information
5. Collaborative tools to shared information and collaborate with other business users

E-BUSINESS PORTAL TECHNICAL REQUIREMENTS

In order to meet these business needs, any portal solution has to offer a robust set of integrated portal services in a single e-business portal solution. The technical requirements associated with an e-business portal therefore include the need to:

- Provide tools to create a personalized Web-interface to information and applications
- Provide advanced personalization including usage monitoring and pattern categorization
- Provide a collaboration facility that supports user-to-user interaction
- Provide facilities to search, access, publish, subscribe to, and deliver business information, and run the business applications that produce business information
- Provide tools that access, categorize, and integrate content from widely dispersed systems
- Index and categorize business content available on internal and external systems in an information directory by business topic and keep that index up-to-date
- Provide services to manage, secure and administer shared business content and user communities
- Provide a rules engine and rules directory for automated alerts, actions, content categorisation and personalisation
- Asynchronous messaging for efficient, reliable B2B process integration and guaranteed transaction integrity for m-commerce and between businesses
- Provide voice and data interfaces to existing and new applications
- Provide multiple predefined portal applications (PIM, email, news, weather, sports, etc.)
- Support XML and XML transformation for data and metadata interchange
- Support an application integration server for process integration
- Provide an easy to use device-independent application development environment to build new portal applications and extend existing applications to the portal.
- Support m-commerce, by allowing financial transactions to be accessed from any device
- Provide location based services, enabling applications to take a devices' location into account
- Provide unified messaging, allowing integrated voice mail, email, and fax to be accessed from voice or data interfaces
- Support instant messaging, extending inter-device communication to multiple devices
- Provide intelligent notification, alerting users of important events, taking into account the many devices the user may have
- Provide dynamic content transformation and navigation services to dynamically adapt content to the devices being used to access the portal
- Provide access to applications and content appropriate for the device in use
- Support over-the-air provisioning, allowing users to self-configure devices and applications without having to rely on a centralized operator
- Support for distributed portal function and distributed server request dispatching load balancing and session pooling, and content caching for scalability
- Support for end-to-end security services including virtual private networks

AN END-TO-END PORTAL ARCHITECTURE

A PORTAL ARCHITECTURE FOR E-BUSINESS

In order to support these business and technical requirements, an E-Business portal needs to offer five main components depicted in the portal architecture shown in figure 2. These components are explained in more detail below and are as follows:

Five main portal components

- A presentation services component
- A user services component
- An information management component
- A portal adapters component
- A web infrastructure component

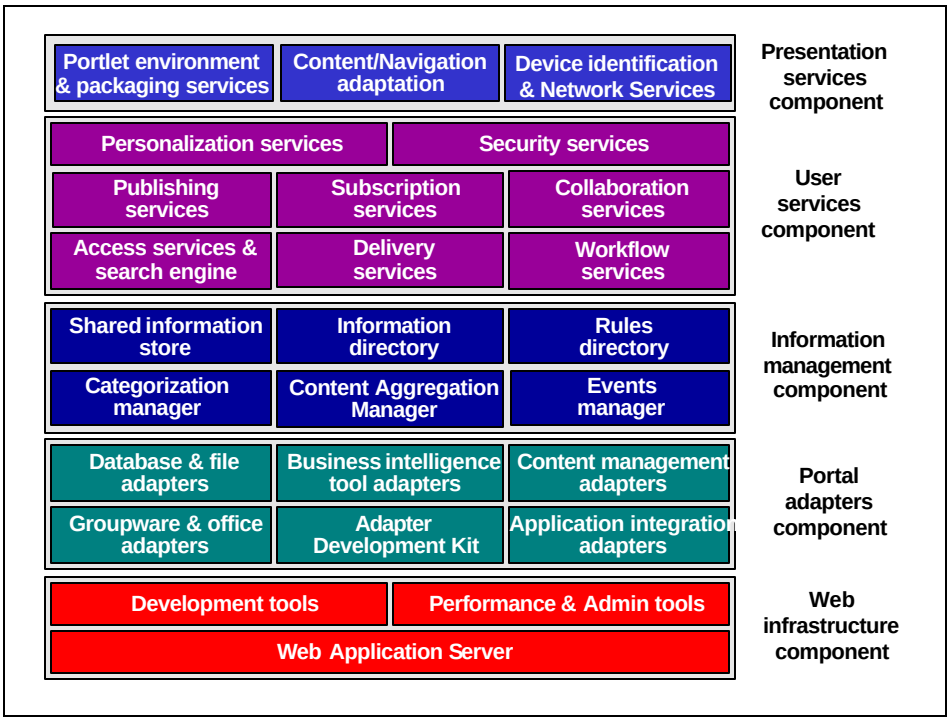

Figure 2 – E-Business Portal Architecture

E-BUSINESS PORTAL COMPONENTS AND THE FUNCTIONS THEY PERFORM

Presentation Services Component

***Portlets* are the visible services that end users choose to have in their portal screen layouts**

Presentation services allow the user to manage the layout of the portal user interface and the portal to dynamically adapt the presentation and navigation of content to the device being used to access it. *Data and voice*-based user interfaces are supported. Devices that can access the portal include desktops and laptops with any web browser, interactive televisions and pervasive devices such as personal data assistants (PDAs) and wireless devices e.g. mobile phones, personal organisers. Automatic device identification and wired/ wireless network transparency are also supported. Portlet environment and packaging services allow the user to define what business content is deemed 'appropriate to the device' being used since not all applications and content may be suitable to certain devices.

User Services Component

The user services component helps users easily find information and people, control what applications and information content they want to access and to collaborate with others. The user services that make this possible are:

Personalisation matches business content to specific user needs

- **Personalisation services** match business content (information, applications and expertise) to specific user needs. This process is managed by allowing users to define content preference rules, as part of their user *profile.* They can subsequently adjust this profile to keep it in step with any changes to their requirements. The portal can also adjust user profiles dynamically by observing information and application usage and behavioural click stream data. Using collaborative filtering (inference) and rules allows a portal to assemble only relevant information to personalise and enhance end user interactions. This differs from customisation which is a manual process often performed by the end user.

Security supports single sign-on and content protection

- **Security Services** provide users with single sign-on access to all authorised business content (applications, information and expertise). Security also ensures portal users are not exposed to data or applications they are not authorized to use.

Search engines search across multiple sources

- **Access Services** allow users to have access to information and applications via portal adapters and URLs. **Search engines** provide an ideal interface for users to search across multiple internal and external sources for the business content they require.

Manual and automatic publishing of content

- **Publishing Services** support manual and automatic publishing. Manual publishing allows authorised users, to publish business content to share with others. This includes office documents, discussion content, business intelligence, external information (e.g. URLs, real-time data feeds), business rules, workflows, expertise, and transactions. Publishing involves placing an entry in the portal *information directory* in an appropriate category with other related information so that others can easily find it. In addition, publishing private content automatically may result in moving that content to a *shared information store* where it can be managed and accessed by multiple users or allowing it to be dynamically rendered from its original repository. Publishing can also be done automatically, by applications (via an API) and by the portal categorization manager during automatic content tracking on various sites.

Users and applications can subscribe to receive content or be alerted/notified

- **Subscription Services**– allow users and applications to subscribe to receive information of interest and be notified/alerted of changes to data or any new information. Subscriptions can be *schedule based* e.g. receive a report every day at 9:00am, or *event based* e.g. be alerted/notified/take action when a particular event occurs e.g. demand is forecast to exceed inventory.

Content delivery to any device or application

- **Delivery Services** – manages the delivery of content to subscribing users or applications when instructed to do so as part of subscription management. Content may be delivered in whatever format is required to any device or application.

Tools to collaborate with others

- **Collaboration Services** – provides the collaboration tools to allow internal and external users to collaborate with others and to share business content e.g. to make decisions.

Workflow to define business processes and control content flow

- **Workflow Services** – allow authorised users to define business processes that they wish to perform (or gain access to common business processes) or that they want to be triggered as an action when a subscription, decision or personalisation rule is deemed true.

Information Management Component

Information management services include:

The information directory is a roadmap to business content

- The **information directory** is a roadmap to business information and applications viewed through a portal. It contains references (meta data) to business content categorized by topic. It indexes structured and unstructured business information, business applications, and other business objects. References can be placed in the information directly via a manual publishing facility (discussed under Publishing Services) and via external applications, tools and the portal categorization manager that make use of import/export and/or programmatic interfaces. This facility is a key distinguishing factor when selecting information portal products. It can be implemented as a simple file system with basic function or as a database to take advantage of rich organisation and indexing that database systems provide.

Content is organised into categories and automatically kept up to date

- **Categorisation Manager** provides services associated with grouping business content into categories, often called a taxonomy. Scheduled and user-driven *information crawlers* crawl web sites automatically gathering meta data about business information and applications. New content and updated content identified is then passed to the categorization manager to be placed in the information directory.

Rules that govern personalisation, subscription, workflow and categorisation are stored in a rules directory

- **Rules Directory**
  Business rules are defined and maintained via rule editors in personalization, subscription, and workflow services, plus the categorization manager. These rules are stored in the rules directory and include:
  - Personalisation rules - to govern the business content they want to see
  - Categorisation rules – to group related content into categories for ease of use
  - Decision/action rules – to govern automatic decisioning and recommendation and trigger action taking e.g. executes a workflow
  - Subscription rules - for scheduled and event driven information delivery, or for alerting people or applications when changes to information occur.

Actions are triggered by an events manager

- **Events Manager**
  The Events Manager is responsible for triggering tasks based on some of the rules defined in the rules directory. Rules that are associated with a decision can trigger actions that include the generation of reports, e-mail messages, invocation of operational/e-business transactions, etc. and may generate a personalised response. In the case of event based subscription rules, the Events Manager takes responsibility for monitoring for those conditions. When an event occurs, it alerts the user on the device specified and delivers specified content in the format requested via delivery services and/or takes other automatic action e.g. notifies others, or allows the user to take action.

Published content is accessed through a shared information store

- **Shared Information Store**
  This is a logical store used to manage information content authored and published by collaborating users. Not all published information will be stored in the shared information store, however information that is authored on a personal platform and then published may be moved here by publishing services to allow others to use and access it. There are often many shared information stores in an enterprise comprising a federation of shared data repositories. The vast majority of business information will exist in other repositories and be published dynamically.

- **Content Aggregation Manager**

The content aggregation manager is responsible for the assembly of application components and content (voice and data) for presentation over wireless and wired channels. It is driven by personalisation services during the personalisation process.

Portal Adapters Component

Portal adapters provide access to a broad range of business content

In order to connect to the broad range of applications, data and people, the E-business portal provides adapters to interface to disparate information and systems. Portal adapters can be pre-built and shipped as part of an E-business portal product, purchased from third party suppliers or developed using web development tools to extend portal connectivity to new business content. There are different types of portal adapters to connect to different content e.g.

- **Database and file adapters** – database and file based APIs to access data in a variety of information stores holding structured business information (customer records, BI analysis information, OLAP etc). This also includes synchronisation services to synchronise data held on pervasive devices with enterprise and application specific databases.
- **Business Intelligence (BI) tool adapters** – APIs to access business intelligence tools, analytic application packages and BI portals.
- **Content Management adapters** – APIs to access and integrate content management systems holding unstructured business information (images, audio, video etc.) into the e-business portal. This includes syndicated content as well as addition content management services such as text mining services to scan the content of unstructured information, clustering services to identify similar and related content, summarisation services to meaningfully abstract content. In addition affinity services to identify people's affinity to information is also included here
- **Groupware and Office adapters** – APIs to allow access and integrate groupware and office systems into the e-business portal to access office documents, email, discussions, and collaborative services.
- **Real-time data adapters** –APIs to allow access and integrate real-time data feeds such as securities ticker-tape, video, and audio
- **Application integration adapters** – allow access to packaged applications and legacy systems. This includes support for transaction management
- **Adapter Development Kit** – In order to develop your own adaptors, an adapter development kit must be included.

Web Infrastructure Component

Development tools integrate content into a portal

- **Web development tools** include the tools, portal components and business application components that can be used with development tools to portal enable business content. At a minimum, this includes web page design tools, business rules editors, and Java Beans development environments.

Performance and administration tools are used to manage the portal

- **Performance & Administration tools** allow administrators to manage users and user communities, security, performance, content (e.g. keep it up-to-date) and usage analysis. Portal administration should be integrated into open systems management frameworks to easily integrate into an organizations systems management environment. Performance management includes content caching control, session management, distributing portal services to multiple servers, load balancing, application instance management, etc.

The web application server is the foundation of a portal

- **Web application server** is a standard web infrastructure component that supports web enterprise application integration. A robust web application server supports
  - Multiple application and data APIs e.g. Servlets, JSPs, Java Beans, EJBs, Corba etc.
  - Multi-threading, multi-processor and multi-server clustering for scalability
  - Any HTTP server e.g. Apache, Netscape or Microsoft IIS
  - Hardware platform independence

- Synchronous and asynchronous transaction management

MANAGING MULTIPLE PORTALS

With many new products being announced, the marketplace has become very confusing. Indeed, any product or application that provides a web interface to business content could be classified as a portal. For this reason portals come in many flavours and have many different uses e.g. business-to-employee, business-to-consumer and business-to-business.

Mutiple portals will exist in your enterprise caused by both technical and business reasons

It is clear that multiple portals are likely to be developed in different parts of the organization as a result of business needs or technical constraints. However, imposing multiple portals on business users, each managing access to "islands" of content, can lead to enormous confusion if not anarchy. Most users only want one portal that allows them access to all applications, information and people. Furthermore, having too many portals can cause unrealistic expense, administration, and complexity for an IT organisation.

Open portal frameworks tie together portal technologies and business content to deliver an integrated portal solution

Given that multiple portals will exist in an organisation, each of which may be based on different portal products, there is a real requirement to be able to integrate these and offer a federated portal service across the enterprise. Vendors are responding to this requirement by announcing open *portal frameworks* that make it possible to integrate portal offerings. However, since the portal concept and market is so new, there are not yet any standards that define how one portal interoperates or synchronises with another portal. Consequently, portal frameworks are providing non-standard ways to allow portal vendors and IT organisations to building bridges between portals and the metadata repositories they utilise. With this in mind, some recommendations concerning multiple portals can be helpful.

Try to build the multiple vertical portals on a common infrastructure to minimise expense and complexity

- **Minimise the divergence of portal infrastructures**: try to build most if not all portals using the same horizontal portal infrastructure.
- **Look for "federated" capabilities**: Federated services can be within a portal or across portals. In search engines and collaborative tools, some portal products connect to myriad data repositories making them appear as one logical portal. Avoid portal products that can service only documents or only databases but not both, for example. In addition, multiple physical portal implementations can be *federated* into one logical view for the end user.
- **Leverage Role based personalisation**: in some organisations, a single portal can exist but the users perceive multiple portals based on their own view of the portal. For example, the Sales Portal and Marketing Portal may actually be the same physical implementation since they share many applications, people, and content. Using role based templates and personalisation models, a new sales employee would register with the portal for "My Home Page" and be offered portal services appropriate to his sales role. Similarly, a marketing professional would also register in the same portal but be offered a collection of portal services – i.e. portlets – appropriate to her role. Both individuals would be interacting with the same portal.

E-business portals that include portal frameworks, can integrate other portal products to delivery an integrated portal solution, and provide the interfaces and common services for vertical portal applications.

THE IBM PORTAL SOLUTION – WHAT'S INCLUDED?

IBM'S PORTAL SOFTWARE STRATEGY

IBM provides a single E-Business portal framework that embeds and integrates complementary components

IBM's portal strategy is to provide organisations with a single E-business portal framework called **WebSphere Portal Server (WPS).** This offering is targeted towards providing enterprise portal solutions. It is an easy to use *horizontal* E-business portal framework that can connect to a broad range of internal and external business content. WebSphere Portal Server can be deployed as an enterprise e-business portal to employees, business partners and customers to support the full range of business-to-employee, business-to-business and business-to-consumer e-business.

IBM leverages several mature products from its existing software portfolio by incorporating them into its portal offering. To be specific, WPS is based on WebSphere Advanced Edition, WebSphere Personalization, Enterprise Information Portal V7.1, WebSphere Everyplace Suite, and software from Lotus Corporation. IBM's strategy is to integrate these existing components while adding the new portal specific functionality, shipping WPS in the spring of 2001. This strategy gives customers with these existing components a progressive path of technology investment.

WEBSPHERE PORTAL SERVER – A HORIZONTAL PORTAL FRAMEWORK

Access to a broad range of business content

WebSphere Portal Server (WPS) is a horizontal E-Business portal offering that allows access to a broad range of business content (applications, data, and expertise) via software modules (adapters) known as "portlets". This breadth of content covers syndicated content providers, unstructured information, 3rd party application packages, legacy applications, IBM and non-IBM databases and file systems, content management systems, groupware and office systems and business intelligence. A diagram of WebSphere Portal Server is shown in Figure 3. A number of portal services are included in WebSphere Portal Server to assist users in finding and organizing content, searching, categorization, security, personalization, collaboration, and workflow. These services are classified by the components defined Figure 3 and discussed below.

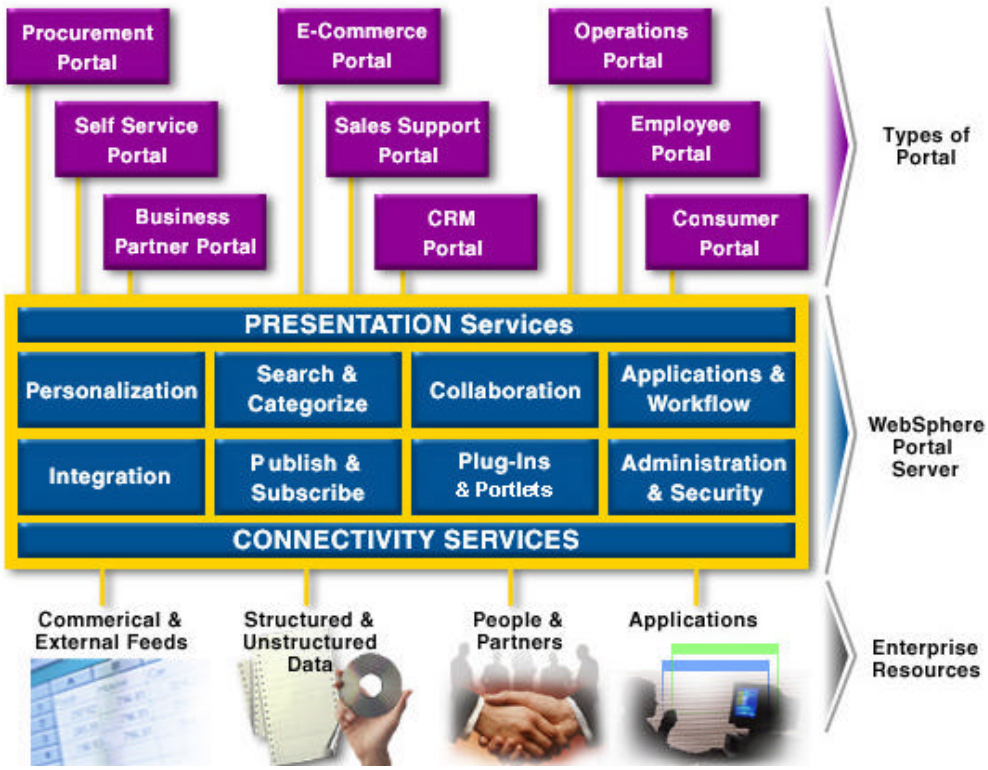

Figure 3 – IBM's WebSphere Portal Server

WebSphere Portal Server Presentation Services Component

WebSphere Portal Server **presentation services** provide an easy to use thin client web based user interface that allows browser-based users to customise the layout of the portal and search and access business content. Layout customisation tools provided include a Page editor, a Template editor and themes.

Support for browser, voice and pervasive device access

WebSphere Portal Server presentation services works in conjunction with WebSphere Everyplace Suite to adapt the user interface to accommodate pervasive devices e.g. personal data assistants (PDAs – Palm and Windows CE), personal organisers, Wireless Application Protocol (WAP) enabled hand held devices such as mobile phones, etc.

WebSphere Portal Server User Services Component

Users can personalise content to suit their needs

WebSphere Portal Server **personalisation services** are a comprehensive set of services that match business content (applications, information and expertise) to individual user needs. This includes adhering to user-defined preferences to filter content and personalisation based on on-line behaviour observations to improve the content relevance. Personalisation is achieved by a number of elements that together constitute WPS personalisation services. These are as follows:

- Personalisation matching technology
  - A rules engine to interpret rules that govern personalisation matching
  - A recommendation engine that makes content recommendations based on analysis of a users' behaviour and their user profile, i.e. collaborative filtering for consumer cross-selling recommendations
  - These engines match the user to the "right" content
  - Graphical tools are provided to define and edit rules

Organisations can personalise content to dynamically drive customer experiences

Personalisation can take account of a users preferences, observed web behaviour and other information

Profile information can be assembled from different systems

- Resource Engine
  - Assembles user profile information and content for use in matching. User profile information is assembled from data collected by WPS and from other systems e.g. Human Resource and Customer Intelligence systems etc.
  - Assembles content from disparate systems as part of personalisation process
  - Manages groups of users and any user hierarchies
  - Manages groups of content and content hierarchies
  - Attributes about users e.g. user-defined preferences to filter content
- Content
  - Related content from the disparate external and internal applications and information systems that can be accessed via the portal
- Feedback on personalization effectiveness via click stream analysis tools (i.e. WebSphere Site Analyzer)

Users can define filtering rules themselves, or this can be done by domain experts who want to specify how to drive the personalised experiences of customers or prospects in particular customer segments. Personalisation in WPS works by obtaining a users' profile and then interpreting it to classify the user. Rules are then interpreted to decide what content to present to the user. The relevant content is then assembled and passed to presentation services to present a personalised web experience to the user.

It is an IBM direction to offer customers the option to choose 3rd party recommendation engine technology to be used by WebSphere Portal Server.

Security

Integration with Tivoli is also an option to enforce common security policies

WebSphere Portal Server **security services** are designed around support for common security policies. The reasons for this strategy are to help minimize implementation time, reduce management complexity and lower the cost of secure computing. To integrate with an organisation's existing security environment and inherit account information, WPS security services can access a central LDAP based user registry to validate and authenticate users. For organisations with Tivoli, WebSphere Portal Server can leverage Tivoli SecureWay Policy Director to enforce common security policies.

Single Sign-on is supported

Security services support single sign-on, common authentication and authorisation when controlling access to protected business content viewable through the portal. This includes internal and external web information URLs, scripts, data, enterprise applications, and traditional Internet services such as Telnet and FTP etc. In, addition, security services can also control access from wireless application protocol (WAP) devices. IBM has also incorporated self-registry and self-initiation for users of pervasive devices. For single sign-on, WPS security services will transparently pass a user's login information to the appropriate protected application.

Access services and search engine

A single search can be done across multiple sources to find all relevant business content

This includes full text and image searching

IBM have invested heavily in research and development to build search engine technology that allows users to search across a number of different distributed sources (connected to the portal via adapters) to find all relevant content that matches any search criteria. Connecting IBM EIP V7 to the portal framework provides this functionality in WebSphere Portal Server. The federated search engine enables users to conduct a single search that simultaneously searches multiple information sources in real time and produces results in a combined hit list. It is capable of full text search and image search to accurately identify unstructured information that matches a users search criteria. Content that users are not entitled to see are filtered out of search results prior to presentation to the user.

Collaboration Services

WebSphere Portal Server provides access to collaborative services by integrating with Lotus and Microsoft products to offer an extensive set of collaborative tools via portlets. WebSphere

Portal Server includes "portlet" adapters to Lotus Notes View, E-mail, Calendar, To Do lists, and discussion threads. Products such as Lotus Quickplace, Sametime, LearningSpace, and Domino.Doc can be purchased and added to WPS as portlets. Similarly, WPS includes portlets for Microsoft Exchange Calendar, Inbox, Contacts, and Office Library.

Publishing Services

Content can be published automatically

Automatic publishing of content into the WebSphere Portal Server information directory is managed by the automatic crawling, summarization and categorisation services discussed below. Manual publishing is a two-stage process whereby users publish content in a particular system that WebSphere Portal Server crawlers have access to. WebSphere Portal Server crawlers can then automatically detect this new content and categorize it under a particular topic in the information directory taxonomy. It is an IBM direction to support manual publishing directly in WebSphere Portal Server.

Subscription Services

Similarly, IBM have recognised the importance of users wishing to subscribe to information on a timer or event driven basis and it is an IBM direction to extend the functionality of WebSphere Portal Server with integrated subscription services. Generally, IBM expects to integrate existing publish and subscribe vendor products into WPS, in addition to its own offerings in this area (Content Manager and Domino.Doc). We anticipate IBM will leverage their existing alliances with Interwoven, Vignette, and Open Market in this regard.

Delivery Services

Services to manage automatic delivery of information together with alerting will be introduced into WebSphere Portal Server to coincide with the introduction of subscription services.

Workflow Services

Full transactional workflow is supported

WebSphere Portal Server workflow services support full business transaction workflow to control the execution of transactions across multiple systems that together form a business process. This functionality is provided via integration with MQSeries Workflow. An easy to use workflow builder tool is included to allow users to create and maintain workflows associated with the categorisation/taxonomy building. IBM intends to support any workflow engine in the future using industry standard workflow APIs.

WebSphere Portal Server Information Management

The information directory contains a roadmap to content

WPS has its own **information directory** that acts as a roadmap to business content. The directory metadata is stored into a JDBC database, with IBM's preference being DB2. In order to maintain the portal information directory, IBM offers several **categorisation services**. These include web crawling facility, automatic categorization and summarization services. The 'ready to run' web crawler is used to find, index and monitor content. To speed things up, parallel crawling can be done with the results combined. The categorisation manager then takes these results and, based on categorization rules, decides where (under what topic) in the WebSphere Portal Server information directory to publish this content (register it). IBM makes use of text mining technology taken from its Intelligent Miner for Text product to help in this process. By using text mining, WebSphere Portal Server can group related documents based on their content, without requiring predefined classes. It can also assign documents to one or more user-defined categories in the directory taxonomy as part of the categorization process and extract key information from a document to create a summary. Significant items in text including names, technical terms, abbreviations, etc, are recognised by the text mining process.

Text mining helps in accurately categorising content

Rules are held in a rules directory

Personalisation rules, decision/recommendation action rules, categorisation rules and workflow rules are held in the WebSphere Portal Server **rules directory**. Users and administrators maintain these rules using rules editor tools associated with different user services.

WebSphere Portal Server Adapters

WebSphere Portal Server supports an open portal framework to integrate a broad range of business content

WebSphere Portal Server provides access to a broad range of business content (applications, information and expertise) via adapters known as "portlets". A portlet is usually associated with a browser screen service to the user, is usually written in Java, and typically accesses some form of data. IBM offers a range of pre-built portlets with the framework and a development toolkit to add additional ones.

In order to simplify the connectivity, WPS incorporates a unified content application programming interface (API). This allows developers to quickly deploy new business content and to create adapters for access to one-of-a-kind local data structures. IBM has provided much of this functionality by adding IBM's EIP V7 technology to WPS. The following business content can be accessed via the WPS adapter component:

- Unstructured information sources, IBM Content Manager, IBM OnDemand, IBM Image Plus, Domino.Doc, scanned documents, syndicated content providers, external web information, Microsoft Office information, Notes databases and rich media such as audio and video
- ERP content e.g. SAP R/3
- Structured data, including DB2 and Oracle, other relational databases, and using IBM DataJoiner technology, IMS, VSAM, file systems
- Business intelligence, starting with access to the IBM DB2 Warehouse Manager information catalog and Crystal Enterprise Reporting
- Connections to all popular search engines, i.e. Yahoo!, Lycos, etc.

Since WPS is built on a WebSphere foundation, inclusion of enterprise application integration (EAI) services from MQSeries middleware is fairly easy and well understood to many installations. Also, because WebSphere Portal Server is built on the WebSphere Application Server, some sites will couple it on site with the WebSphere B-to-B Integrator product, which is often used to link buyers and sellers in a procurement environment. While WebSphere B-to-B Integrator is a subsystem rather than an adapter or connector, it can provide a significant amount of connectivity between the portal and processes associated with trading exchanges and strategic supplier applications and processes.

Connectivity to so many different sources gives organisations the flexibility to build personalised custom portals for different types of users. For example, a marketing user's personalised portal may provide access to front office applications; customer intelligence from a data warehouse, external competitor web site information, industry news and Lotus groupware (to collaborate) all via a single web user interface.

WebSphere Portal Server Web Infrastructure Component

WebSphere Portal Server (WPS) leverages a number of existing IBM **development tools** to allow organisations to 'portal enable' information and applications. Developers can make use of a number of IBM development tools including:

- WebSphere Studio
- VisualAge Generator – for non object-oriented skilled developers
- Lotus Sametime for developing portal enabled real-time collaborative applications

- WebSphere Home Page Builder - for static and dynamic Web content
- WebSphere Business Components – for rapid development of business applications
- WebSphere Host Publisher Studio – for enabling legacy "green screen" applications

Of course, IT departments can use existing tools other than the WebSphere offerings as long as they are Java and CORBA compatible.

Tools for usage analysis, performance management and controlling scalability

WPS also provides a number of **administration tools** for portal performance management, usage analysis etc. The Site Analyser tool includes, content analysis, structural analysis (e.g. broken links), usage analysis (pages accessed, visitor counts, visit duration), visitor analysis and performance analysis (e.g. download rates) etc. For high performance, availability and scalability WPS leverages the Edge Server tool that allows administrators to support local and wide area load balancing, web content caching and filtering. The **web application server** foundation supported by WebSphere Portal Server is the IBM's WebSphere Application Server, a proven robust web application server available on numerous platforms. WebSphere Application Server is an e-business application deployment environment based on open standards. It supports clustering, failover, multi-server administration, different HTTP servers (Apache, Netscape, Microsoft), Java Servlets, JSPs, EJBs, DB Connection Manager, Composed business components, and a transaction application environment (CICS, Encina).

A proven web application server foundation

Finally, it should be pointed out that many of the WebSphere family of products can be incorporated into WebSphere Portal Server either through on site integration or in future releases of WebSphere Portal Server. This is possible primarily because of the WebSphere Application Server foundation of WPS. Thus, products such as WebSphere Commerce Suite, WebSphere B-to-B Integrator, MQSeries Integrator, MQSeries Workflow, WebSphere Everyplace Suite, etc. can all be coupled with WebSphere Portal Server. IBM's strategy therefore importantly involves reuse of products that have been in use in the marketplace to build on existing investment.

LOTUS K-STATION – A VERTICAL COLLABORATIVE PORTAL APPLICATION

K-station organises and manages expertise and multi-lingual unstructured content

A second component of IBM's portal software strategy is Lotus K-station. Lotus K-station is a ready-made collaborative portal application that organizes and manages multi-lingual unstructured business content by community, interest, task or job focus. It is offered by IBM specifically to maximize knowledge sharing, and collaboration. K-station differs from WebSphere Portal Server (WPS) in that it is a finished application as opposed to WPS which is a horizontal portal infrastructure for *building* many kinds of portals. K-station is targeted at internal corporate use in Lotus Domino and non-Domino environments. It works together with Lotus Discovery Server which automatically catalogs expertise and content and personalizes and organizes knowledge for individuals and communities. Users can join communities to interact with others, find expertise, create, publish and collaborate over shared content. In addition, they can personalize content to suit their needs. Future releases will support deployment to external users such as business partners and customers. It is IBM's stated direction to leverage portlets from K-station and Discovery Server into WPS. Figure 4 shows both components.

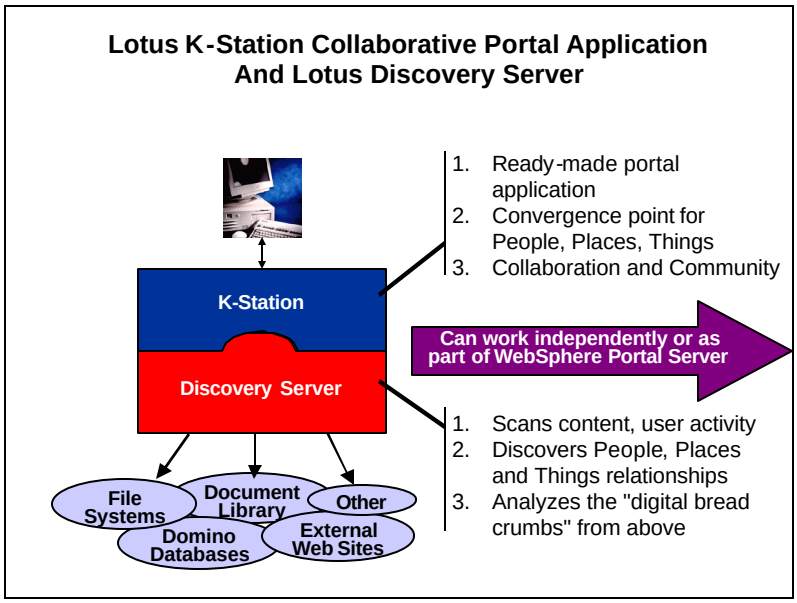

Figure 4 – Lotus K-station and Discovery Server

Lotus K-station

K-station is a browser based collaborative portal application based on the theme, "People, Places and Things". *People* throughout the organisation have virtual *places* where they can congregate to collaborate on particular content and manage the *things* they need to achieve their business tasks – all from a personalised single user interface. K-station provides collaborative tools to assist work groups, leveraging concepts from Lotus QuickPlace (team rooms across the web) and Lotus Sametime (real time instant messaging). Therefore any knowledge management or team based collaborative activity can be served well by K-station. Sales teams, systems integrators, and R&D groups all fall into this category. End-users can access their own personal place as well as multiple public or private community places. Users can join communities to interact with others, find expertise, create, publish and collaborate over shared content. In addition, they can personalize content to suit their needs.

K-station will be added to WebSphere Portal Server as a series of portlets in the future in addition to operating in an independent K-station portal.

Lotus Discovery Server

Discovery Server's information directory documents references to content and expertise. It also supports personalisation of content and search

The Lotus Discovery Server is used to organise, classify and manage content plus people's expertise. Users can then utilise the Discovery Server "Find" facility to find out what places exist, what content is available at a particular place or across multiple places, where specific content is located etc. They can opt to restrict or focus searching to find places or documents that hold information about a particular subject and can also bookmark content and share those bookmarks with others.

Discovery Server also supports subject matter expert detection

In addition to content, users can also search for people with the relevant expertise in their organisation to help with a task. The Discovery Server expertise locator supports *affinity mining* to discover relationships between people and topics based on authorship and activity. To do this, Discovery Server will collaborate with users to request declaration of their expertise and to request confirmation of expertise. Besides, specific user declaration of skills, Discovery Server can also deduce expertise based on observations of persons usage of information such as frequent search or email topics. Because of privacy concerns, users have the opportunity to "opt-out" of having their profile updated with Discovery Server

observations. The observation may be incorrect, short lived, or it may be a private issue; either way the user is always asked before his or her profile is updated.

Discovery Engine will be a portlet within WebSphere Portal Server in the near future in addition to operating in an independent K-station portal.

CONCLUSION

WHY USE IBM PORTALS FOR E-BUSINESS?

Looking at the IBM portal product offerings in combination with other WebSphere infrastructure technology, IBM provides a range of portal components and a framework that can be used to build easy to use:

- Vertical portals that focus on specific integrated business content (applications, information and expertise)
- Business-to-employee corporate portals that offer a broad range of access to business content optionally integrated with Lotus K-station for full collaboration support
- Business-to-business e-marketplace portals with integrated business-to-business e-commerce for supply chain optimization, improved cash flow and services for re-sellers
- Business-to-consumer e-business portals with integrated e-commerce for web enables marketing, sales, self-service, support and two-way customer collaboration
- Service provider portal solutions
- All of the above with integrated support for pervasive devices to support consumers, mobile employees and trading partners who require wireless access to business content

This flexibility makes IBM a leading contender as a supplier of e-business portal technology for any organization.

