Data Virtualization Goes Mainstream

Solving key data integration challenges with more agility than traditional technologies for structured, unstructured, Web, Cloud and Big Data sources
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Denodo’s innovative and long-term vision on enterprise data management foresees organizations transforming the way they manage and leverage their data assets. Companies and governments are moving from largely siloed and vertical-focused data management solutions into architectures that offer a common unified data layer for the agile delivery of data services across an increasing number of physical data sources and to multiple applications and users. In addition, they are evolving new business-driven capabilities to deal with more data types, ubiquitous data and bigger data volumes, reduce data latencies, data replication and costs.

In our commitment to this broader vision, we have never forgotten the essence of data integration: an abstraction process to generate new executable data structures from dispersed heterogeneous sources. This fundamental premise takes on extraordinary importance when data integration moves from internal corporate data stores and core enterprise applications into the arena of the NoSQL, Web, Cloud, SaaS and unstructured content. Denodo Data Virtualization delivers enterprise-class data services and automated interaction capability to all data sources so they can be leveraged by applications and data consumers alike.

Our customers do not differ in size or vertical focus from other integration customers. They differ in their attitude towards data: they recognize that it is important to access, combine and process live data using flexible architectures to accommodate to their changing business needs. And they care about missing data that may damage business performance for market response. They are also at the forefront of a modern trend in IT, focusing budgets more on acquiring business capabilities to manage actionable information quickly and efficiently and less on building heavy technical infrastructures that take too long to implement are labor intensive and hard to change. Data Virtualization is helping them to deliver integration projects incrementally and rapidly and completing stalled projects that will take too long with traditional methods alone.

In summary, they recognize the strategic value of information, regardless of its location or structure, and have embraced Denodo’s leading Data Virtualization Platform to become more competitive, more agile and are becoming leaders in their own markets.

We are very excited about the direction the market is taking in acknowledging the need for Data Virtualization technology and the benefits we are helping deliver to organizations across the globe.

Sincerely,

Angel Viña
Founder & CEO
Denodo Technologies
Data Virtualization Goes Mainstream

Over the past 25 years, the revolution of business information systems and their corresponding data stores have transformed how global organizations produce and use information. This has happened in three parallel realms across overlapping time frames – enterprise business applications, personal productivity and content applications, and the Web.

Enterprise wide business applications such as enterprise resource planning (ERP), supply chain management (SCM), customer relationship management (CRM), and business intelligence (BI) tools have all emerged and matured to help organizations improve operational processes and management decision-making. These are heavily reliant on structured data stored in relational databases. Some have evolved into specialized vertical and application suites and moved to private and public cloud and SaaS-based offerings.

A parallel evolution was the use of personal productivity, content and collaboration applications to document information and conduct communications between individuals, groups and organizations. Email systems, word processing and office suites, PDF documents, multimedia and a variety of other digital content based applications evolved to enhance personal and group productivity. The innovations on the Web for collaboration and social media have moved to workplace Enterprise 2.0 systems. The information in these systems is mostly unstructured and is stored in file systems and content repositories, but largely ignored for enterprise purposes.

The third and perhaps the most powerful, was the evolution of the Web, with the rise of a new generation of information service providers offering data and business applications over the Internet without the need for on-premise infrastructure. The Web has become a major information processing resource, B2B/B2C channel, and social media platform for interaction, collaboration and publishing in the form of Internet services, SaaS applications, blogs, reviews, wikis etc. Huge amounts of new information have been made public through data.gov and similar initiatives. The Web encompasses a wide range of data formats and structures, from fully structured to fully unstructured, and every shade in between.

The above three overlapping realms have produced a dramatic increase in data diversity inside and outside corporate data centers. These challenges have become more evident with the success of two new trends: the proliferation of a new class of structured repositories for high performance analytics and NoSQL repositories (Hadoop, columnar data bases, massively parallel databases, data warehouse appliances etc.), and the shift from on-premise to cloud-based storage solutions and applications.
**DATA VIRTUALIZATION** is enabled by technology innovation. However, the true drivers of this trend are business imperatives: to increase information agility and transparency while reducing costs, to maximize data management flexibility in an increasingly diverse IT infrastructure, and a shift towards greater use of Web 2.0 and public data in conjunction with new forms of enterprise and partner data for competitive advantage.

**AS ENTERPRISE DATA CHALLENGES CONTINUE TO GROW**, traditional technologies fall short for structured, unstructured, Web, Cloud and Big Data Sources.

Business users have clearly recognized the value of using this combined data, regardless of source, location or structure, and are pressuring their IT counterparts to deliver more of it when and where needed, and are no longer willing to accept constraints imposed by technology or architectural choices made by IT. Integration technologies that were designed long ago to transform, integrate, move or synchronize data in the more conventional data centers are struggling to produce the agile and integrated data services needed to satisfy multiple business applications and users. This is forcing companies to revisit how they access, integrate and operate data and how they provision data to business applications and users and evaluate modern capabilities that they lack.

With the emergence of data virtualization technologies, particularly those platforms inclusive in support for diverse structured, semantic, unstructured and Web data, innovative organizations have started to leverage the immediacy and relevance of all new types of data to enrich enterprise applications and processes, and in the reverse scenario, bring real-time enterprise data to collaborative and edge of enterprise applications.

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**IT CHALLENGES**

- Exponential data growth
- Data silos
- IT complexity, rigidity
- Inherent latency
- Move to Cloud
- Unstructured, Web & Big Data
- High costs

**BUSINESS NEED**

- Business capability and value driven
- Access all information of value
- Fast, iterative, self-service, pervasive
- Virtualized & unified semantic business views of data
- Right information to right user at right time

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**Figure 1: Enterprise data challenges continue to grow**
Solving key data integration challenges where traditional technologies fall short for structured, unstructured, Web, Cloud and Big Data sources.

Data Virtualization Goes Mainstream.

Data Virtualization and Information-as-a-Service (IaaS) go beyond data integration: it can support multiple requirements, including "single version of the truth," real-time business intelligence, enterprise wide search, high-performance transactional applications, federated views across multiple lines of business, and improved security for access to sensitive data."

Bloor Research

"DATA INTEGRATION TOOLS are evolving towards the unification of structured and unstructured data and will begin to include semantic capabilities. Gartner envisions data services guided by an enterprise information management strategy to maximize the value and accessibility of information."

Forrester

"DATA VIRTUALIZATION is now a mainstream technology with a significant number of major organizations employing it for a variety of purposes."

Bloor Research

What makes information truly strategic? It is the ability to gain unique insights or provide relevant and comprehensive information in a timely manner to promote innovation, improve customer service, streamline operations, reduce operating costs, enable better decisions, and expose opportunities and threats before it is too late. However this is not possible if the vast majority of information available to decision makers is ignored and information management initiatives focused only on a limited set of enterprise applications and databases.

Take the example of customer information. Many companies still have a disconnected view of their customers across products, divisions, applications, and time and are struggling to unify these many fragments into a complete picture. Some have succeeded in integrating internal structured data sources to provide a "Single View" of customers using technologies such as Customer Data Integration (CDI) or Enterprise Information Integration (EI1). This is a step forward, but still falls short of what is ultimately needed. Industry leaders and innovators have managed to assemble a truly "Unified View" of the customer including competitive choices available to each specific customer, customer feedback, preferences and lifestyle information that might indicate future sales opportunities or provide ideas for product improvement. They have done so by rapidly integrating and building relevance across structured customer application data, partner data, unstructured call notes and emails, competitor and public websites and user generated data in blogs, reviews, etc.

How does this deliver measurable ROI? Delivering strategic information needs to consider the cost and actual benefit of information integration. IT departments have become wary of multiyear integration projects with dubious ROI. It is therefore critical to ensure "payasyougo" value in implementing data integration. It is here that Data Virtualization truly delivers value in that it provides immediate access to integrated data without incurring the cost of moving it and tangible benefits to the business in providing consuming applications the right information and at the right time.

Data Virtualization serves the business and IT agenda by making information a strategic asset while reducing costs. This is done by:

- Providing access to relevant business information on demand from any source, anywhere unconstrained by technology architectures
- Building relationships across heterogeneous data structures to provide new business views and insights not possible before
- Leveraging existing information assets and technologies with a flexible virtual integration model
- Creating reusable data services that can feed enterprise and web applications, portals and dashboards, for internal, partner or customer use.

In short, organizations that are using Data Virtualization to combine structured, unstructured, Web, Cloud and Big Data from internal and external sources, create competitive advantage through information agility and lower costs and will be the future leaders. This trend has been emphasized by Gartner in “The Emerging Vision for Data Services: Becoming Information-Centric in an SOA World” and “The New Data Integration Frontier: Unifying Structured and Unstructured Data” and by Forrester in “The Top 15 Technology Trends EA Should Watch: 2011-2013”, “Information Fabric 2.0: Enterprise Information Virtualization Gets Real”, and “The Forrester Wave: Information-as-a-Service.”
The Data Virtualization Platform

The Data Virtualization Platform has emerged to create a unified data layer that virtualizes underlying internal and external data sources and delivers valuable integrated business information in the form of on-demand data services to multiple applications and users with managed security, service levels and governance.

**BUSINESS SOLUTIONS**
Access Information-as-a-Service

**DENODO PLATFORM**
Right Information at the Right Time

**DISPARATE DATA**
Any Source, Any Format

Six fundamental attributes have materialized to define the capabilities of a true Data Virtualization platform:

- **UNIVERSAL DATA ACCESS** to Any source or data type: Data engines that automatically connect, navigate and extract data from any internal or external source and all data types - structured, unstructured, and Web.

- **UNIFIED VIRTUAL DATA LAYER**: Builds powerful transformations and relationships using an integrated modeling and execution environment to normalize, transform, improve quality and relate data across heterogeneous source types using common metadata and semantics. An extended relational data model allows disparate data types to be represented natively in the virtual layer minimizing effort and maximizing performance.

- **UNIVERSAL DATA PUBLISHING**: Publish the combined information as reusable data services in multiple formats (SQL query, SOA and REST web services, messaging, mobile feeds, search, semantic query etc.) and supporting hybrid delivery modes (virtual real-time, cache, batch, message-based physical movement) to consuming applications.

- **AGILE HIGH PERFORMANCE**: Advanced real-time optimization supplemented by intelligent Caching and Scheduled Batch for flexible mixed workloads. Support read/write access with enterprise class reliability and scalability– even for web and unstructured sources.

- **UNIFIED DATA GOVERNANCE**: Enterprise-wide single entry-point for data and metadata management, security, audit, logging and monitoring enabled through built-in tools and instrumentation as well as integration to external data management tools.

- **AGILE DEVELOPMENT OF PERSVATIVE, SELF-SERVICE DATA SERVICES**: Hide complexity to application developers and business users; Decouple consuming applications and data sources; Allow easy creation, extension and use of data services.

In its full scope the Data Virtualization Platform is used to create a Unified Data Layer in the enterprise in conjunction with other SOA and Enterprise Integration tools. In a more narrow sense, the Data Virtualization Platform is used to create and manage virtual data sources for agile data access and delivery, and complements traditional technologies such as ETL and EAI.
The Unified Data Layer

To accomplish the triple goals of high performance, agility and lower costs in data access and delivery, organizations must both leverage existing technology investments and unify them using Data Virtualization. Therefore the Data Virtualization Platform is designed to be more and uniquely different than the sum of key capabilities found in separate technology stacks for Data Federation, Batch Integration, Messaging, Web/Cloud integration, Search/Indexing, and Data Quality and Governance tools. Data Virtualization unifies and improves the common aspects of access, integration, delivery, and governance across data types, in order to combine disparate sources in a unified data model, while leveraging the strengths of these other technologies when required. The following are some of the areas where Data Virtualization has improved on the component technologies to deliver its promise:

- **EXTENDED DATA MODEL** - Most Data Integration platforms use a primary integration model based on either relational or XML data types. Advanced Data Virtualization Platforms use an extended integration data model that have the ability to store and read/write all types of data in their native format – e.g. relational, multi-dimensional, hierarchical, semantic data, index files, etc.

- **ADVANCED WEB AUTOMATION** - Search and web extractors typically use crawlers to access hundreds of web pages efficiently. Data Virtualization supports crawling, but more importantly the precise emulation of human browsing and navigation using authentication, forms, popups etc. to access only the required data and also submit or write data back to web applications and forms.

- **HIDDEN WEB DATA** - Web scraping tools only grab information on the surface of websites. Data Virtualization allows iteration through navigation and extraction sequences to build a database out of the data hidden behind Web forms.

- **STRUCTURING UNSTRUCTURED DATA** - Search engines help find the most relevant content but the results are still presented as unstructured content that must be read individually. Data Virtualization on the other hand can convert an index of unstructured content into summary data that can be queried like a database using keyword and taxonomy filters, fuzzy text matching, etc.

- **DATA QUALITY CONSISTENCY** - Several tools for textual similarity, data normalization, data clean-sing, transformation and rewriting rules, etc. allow data from heterogeneous sources to be made consistent before they are merged. And provide the ability to integrate with specialized data quality and semantic/language tools support transparent extensibility.

- **DATA GOVERNANCE** - The Data Virtualization Platform provides a unified entry point for data governance at the “virtual” data layer using data and metadata discovery, lineage, change impact analysis and propagation, metadata sharing, and support for mapping physical to logical and canonical data models or contract-first web services.

- **OPTIMIZED DATA FEDERATION AND EXECUTION** - Query optimization across federated databases is a refined science. Data Virtualization optimizes query execution across heterogeneous sources by remaining aware of the idiosyncrasies of each source like databases, web services, unstructured and hidden web data. It deleges actions to sources to leverage their strengths (for example natural language capabilities in an indexing engine) and optimizes perceived performance using asynchronous and parallel execution across sources.

- **MULTI-MODE ACCESS** - The access paradigm for each individual data type is different – query for databases, service request/reply for a web service, search for unstructured content etc. Data Virtualization makes all access methods applicable to any type of data – for example the ability to use query language against unstructured and web data or to search structured data.

- **DATA SERVICES PUBLISHING** - Data Virtualization not only creates and manages the integrated “virtual” data views, but also includes built-in components to publish them as Data Services, JMS Access, Widgets, Portlets, RSS and Data Feeds, Excel Plugins, a Scheduler to handle batch delivery via email, ftp, etc.

- **SECURITY AND MANAGEMENT** - Data Virtualization provides policy-based data services security integrated with user/role management systems with granular read/write and row/column access control. Service levels can also be differentiated and tracked based on users and roles. Finally, a complete suite of real-time monitoring, audit and logging capabilities ensure enterprise readiness.
Applications of Data Virtualization

We have already discussed the strategic value of a unified enterprise data layer that provides agile data delivery across heterogeneous sources to multiple applications. Variously referred to as Data Services, Information-as-a-Service, Data Integration Hubs and Information Fabric, this constitutes the primary strategic use case for Data Virtualization that delivers broad impact in creating an agile business information architecture.

However due to its horizontal nature, Data Virtualization adds new capability to the integration toolkit that can benefit many discrete projects and vertical applications. As organizations become aware of the unique capabilities of Data Virtualization to merge disparate information sources and types into a unified data layer, they are discovering new uses and even new business models to enhance their competitive position. The following are some common scenarios where Data Virtualization has proven to deliver faster results and business value compared to traditional integration.

**AGILE BUSINESS INTELLIGENCE** - One of the most common uses of Data Virtualization is for agile reporting, operational BI and real-time dashboards that require timely aggregation, analysis and presentation of the most relevant data from multiple sources. Both individuals and managers need to monitor performance to help make daily operational decisions in key business processes such as sales, support, manufacturing, logistics, finance, legal and compliance.
Solving key data integration challenges where traditional technologies fall short for structured, unstructured, Web, Cloud and Big Data sources.

**DATA WAREHOUSE EXTENSIONS** - Data Virtualization complements data warehousing that is used for strategic and predictive analysis of historical data. Existing data warehouses can be extended with real-time data accessed directly from source systems, including integration of external data for holistic intelligence. Also several data marts or warehouses can be federated to create a virtual “enterprise” data warehouse quite easily.

**COMPETITIVE INTELLIGENCE** - Competitive and market intelligence is often gathered manually and sporadically making it less useful in daily business decisions. Automating the extraction of context sensitive competitive information and pricing to integrate with internal applications can create actionable insights.

**HOLISTIC VIEW OF SINGLE ENTITY** - Currently, information about a customer, supplier, product or project is dispersed among various systems and sources. They must be brought together into a ”Holistic View” to conduct business more efficiently and trigger innovation. The most common implementation of this use case is “single customer view” data services for call center and customer self-service portals.

**CLOUD AND SaaS INTEGRATION** - For midsize organizations the popularity of Software-as-a-service and public cloud applications (Salesforce.com, Google Apps, Amazon, etc.) have soared and larger companies use them in addition to private cloud. Data virtualization provides an easy way to gain consolidated view of data in the data center applications with these new systems. The abstraction provided by “virtual” data views also enables easy data exchange across systems using disparate data models that are not controlled by the client organization.

**B2B INTEGRATION AND WEB AUTOMATION** - In several cases, useful information must be exchanged between departments or business partners. Often, the only way to access or share that information is by periodically logging in through a web interface or by emailing back and forth content such as price lists, promotions, sales reports, order status, etc. Data Virtualization provides a flexible solution to reliably extract or post data via the web and integrate with internal enterprise systems.

**EXTERNAL WATCH FOR OPPORTUNITIES AND THREATS** - Web 2.0 and online communities have created an explosion of information that grows every second – on patents, regulations, competitors, social media, and customer reviews/blogs. Further, a large amount of business and consumer information is available through data.gov and similar initiatives. Data Virtualization can automate navigation, extraction and maintenance of relevant snippets of information using business rules unique to each constituency. This allows business users and law enforcement agencies, for example, to focus on analysis, exceptions and alerts instead of tedious data collection.

**DATA SERVICES** – Data Virtualization creates a unified data services layer that offers a more flexible way to architect the Enterprise IT ecosystem, decoupling applications from information repositories and fostering reusability. Data services can be consumed by any application (finance, marketing, reporting, etc.) internal users or partners and can easily evolve by creating connections to new data sources or data combinations to attend new business requests.

**INFORMATION EXTRACTION, CONSOLIDATION AND ORGANIZATION** - Knowledge management, vertical portals, account aggregation, price comparisons – all have the common problem of constantly collecting, organizing and interrelating information for downstream use. Content management systems and enterprise search can find the information, but Data Virtualization is uniquely capable of building relationships between multiple source/data types and supporting structured queries against the composite information.

**SUPPORT FOR PRAGMATIC, REGISTRY STYLE MASTER DATA MANAGEMENT** - The Denodo Platform provides progressive support for MDM initiatives starting from a “Virtual MDM” solution and evolving to Registry-style or Federated MDM using high performance Data Virtualization to complement across the broadest range of data sources (structured, web, SaaS and unstructured) for operational data and integrates them with mastered entity data in leading MDM hubs to deliver unified 360 views in real-time to applications.

**DATA ABSTRACTION FOR APPLICATION MIGRATION AND MODERNIZATION** - Both applications and data sources go through periodic modification, migration, modernization causing a ripple effect on connected systems that can be both costly and risky to the business. Data Virtualization provides a buffer layer to minimize the impact of these changes by creating ”logical” data views of underlying sources and delivering ”contract-first” web services or “canonical” data services to the application consumers.
The Complete Data Virtualization Vision

A Data Virtualization platform can be used to create, publish and manage virtual data views across disparate data sources. But its promise is much greater in creating a Unified Data Layer that delivers Information agility to the enterprise in the service of various types of applications and users. To do this, any new platform must leverage existing investments in data integration infrastructure and integrate with key business applications. The newest generation Data Virtualization platforms are well suited to be easily integrated into the enterprise infrastructure using these capabilities:

- **OPEN ARCHITECTURE FOR EXPANSION** – at all layers in the platform makes it simple to use legacy and packaged application connectors, to federate across taxonomy and keyword indices, to leverage enhanced data cleansing and semantic processing tools, integrate with data governance, security, and systems monitoring, and to provide packaged integrations with business intelligence, reporting and portal applications.

- **CUSTOM DEVELOPMENT TOOLS AND WIZARDS** – Plug-ins to popular development tools like Eclipse provide for full lifecycle development and testing of custom connectors, custom functions and extensions with available templates for common patterns. Other plug-ins allow data services to be exposed and further manipulated in end-user tools like Microsoft Excel.

- **DATA ORCHESTRATION ACROSS VIRTUALIZATION AND EXTERNAL COMPONENTS** – allows users to flexibly automate data integration and Web automation processes within and across components of the Data Virtualization platform and external applications both in real-time and scheduled batch mode.

- **POWERFUL VERTICAL APPLICATIONS AND TEMPLATES** – that leverage Data Virtualization in competitive intelligence, external watch, homeland security, and “single view”, etc.

![Figure 4: Data Virtualization: enabling a unified virtual data layer](image-url)

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Data Virtualization Goes Mainstream.
Solving key data integration challenges where traditional technologies fall short for structured, unstructured, Web, Cloud and Big Data sources.

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THE GOAL of making information a strategic asset can no longer be limited to the subset of data contained in enterprise data bases and applications. Business and government organizations are forced to deal with the reality of the information explosion driven by heterogeneous data types, Web 2.0 and user-generated content. More useful and relevant data now resides outside internal enterprise applications than within them. But currently business applications are unable to access, let alone integrate this information.

CIO’s AND EXECUTIVES who recognize the unique business value and competitive advantage that can be derived from merging internal and external information and data from all types of sources will be the next business leaders. Denodo, the performance, flexibility and ROI leader in Data Virtualization, offers configurations to suit large and small enterprises to address a specific business pain point while building towards a broader solution.

A Growth Path to Success

The opportunity for companies to benefit from Data Virtualization is enormous. Unlike earlier waves of disparate data integration technologies, Data Virtualization is a unifying and accretive technology, not a disruptive one. It brings sustainable benefits by creating reusable data services coming from all relevant sources of information. This creates unique business insights not possible before. The realization of this value can proceed along several paths.

One approach is to build a project-specific solution using on-demand technology to minimize upfront investments and accelerate time-to-value. Another approach is to pick one functional area or department to create reusable data services that accelerate delivery of business value and future projects in that area, which can then be slowly expanded to the broader enterprise.

The key to long term success using either approach is to look for solutions that can fit into the larger Data Virtualization vision, that support the basic principle of reusing access points to data, adding value through integration and data quality across multiple sources, minimizing replication and consolidation of data unless absolutely necessary, and publishing data services for agile delivery of information to multiple applications when and where needed.

As a starting point, business and IT leaders must ask themselves the following questions:

- What new information sources can add immediate value to my business or function and the absence of which can threaten my competitive position?
- With what other sources must this information be combined to create unique insight?
- What is the fastest and most cost-effective way to deliver the required results?
- How else can this information be used to increase flexibility and make future projects faster?
- What performance and scalability requirements must be met and how to leverage best-of-breed Data Virtualization vendor experience to achieve this?

This simple exercise can quickly get organizations started down the path of creating value from Data Virtualization and ensuring future leadership. Ultimately, business and IT leaders are responsible for making information a strategic asset and must act now to harness:

- **Big data:** the explosion of new data that is being produced faster
- **Any data:** new data sources, new formats, internal and external
- **Right-time data:** growing demand for integrated data with lower latency, real time
- **Agile data:** connecting producers and consumers of data quickly, efficiently and cost effectively
- **Quality data:** The need to govern disparate data islands, minimize replication and create unified semantic business views of data

To do this, disparate data integration technologies must be wrapped into a unified Data Virtualization infrastructure that delivers role-based applications that provide deep functionality in specific areas while also creating a unified data layer leveraging the breadth of data and information sources available to the organization.
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Data Virtualization Use Case Examples

**Telefonica**
Telecommunications – Real-time Single View of the Network

Telefonica is one of the world’s leading integrated operators in the telecommunications sector, providing communication, information and entertainment solutions, with presence in 25 countries in Europe, Africa and Latin America and serving over 290 million customers. The Group is the top-ranked European integrated operator and ranks fifth in the Telco sector worldwide in terms of market capitalization.

Some Telefonica business units needed an Operational Business Intelligence solution for their network inventory department that combined offline reports built on preloaded data from different systems and applications, and real-time information views of operational data. The biggest hurdle to overcome was data source heterogeneity and variability and the addition of real-time information to the monitoring of operating processes.

Telefonica selected Denodo because it provided a flexible and unified solution for their network inventory department that combined offline reports built on preloaded data from different systems and applications, and real-time information views of operational data. The biggest hurdle to overcome was data source heterogeneity and variability and the addition of real-time information to the monitoring of operating processes.

Telefonica selected Denodo because it provided a flexible and unified solution that was easier to build and maintain than other separate technologies. Denodo was able to extract disparate data from inventory systems, version control applications, system probe logs, and from multiple files being used in the management tasks to feed a real-time portal for unified, universal access to all the required sources. The solution requires minimal maintenance as the system repairs itself as sources change. The Denodo solution automated manual tasks which resulted in significant operational cost savings, better data quality and improved customer service for problem incidents.

“Denodo shares this vision and is unique in its ability to deliver strategic value from any kind of information source, whether structured or unstructured. Denodo has afforded us the agility required to meet our key data requirements on any type of operational data, often dispersed and under-utilized.”

Jose Maria Tavera  
Chief Information Officer,  
Telefonica

“After a 4-month evaluation of leading vendors in the market, we selected Denodo as our enterprise data virtualization platform.”

Wilson Hung  
Director of Enterprise Architecture,  
Biogen Idec

Biogen Idec is a global leader in the discovery, development, manufacturing and commercialization of innovative therapies. Patients in more than 90 countries benefit from Biogen Idec’s significant products that address diseases such as multiple sclerosis (MS), lymphoma and rheumatoid arthritis.

The Denodo Data Virtualization Platform is being used as the platform to; avoid the cost and time of building more Data marts; move away from expensive point-to-point integration; leverage structured and unstructured / internal and external data in one platform and to support their critical SOA and MDM initiatives.

Biogen started using Data Virtualization for real-time sales reporting across disparate internal ERP systems, distributors and resellers combining structured and semi-structured data. The success of this initial project allowed Biogen Idec to adopt an agile reporting methodology across many other areas using Denodo Data Virtualization - human resources reporting combining internal and SaaS HR applications, virtual inventory management, clinical trials and compliance reporting etc.

Confident of the agility and performance of Data Virtualization, Biogen Idec expanded its use of Denodo for building an Agile Data Services layer that would be complementary to transaction and business services developed on a leading SOA and Process Integration Middleware. This significantly accelerated SOA adoption while also providing a new tactical capability for data virtualization.
“DENODO’S FLEXIBLE data integration capabilities allowed us to automate the processing of thousands of invoices a month and deliver integrated intelligence that helps our customers save money. The Denodo platform improved the efficiency of our business processes. We are looking to expand its usage at Cass.”

Carl Friedholm
VP of Information Technology,
Cass Information Systems

“TO ACHIEVE THIS GOAL, we needed to extract and integrate relevant information from multiple heterogeneous sources both inside and outside the company.”

“WE NEEDED a process that would allow us to access and consolidate structured data (data stored in our enterprise applications such as CRM systems, billing systems, trouble ticketing systems, spreadsheets), with unstructured internal and external data (notes stored in our CRM system, emails, Word documents, static HTML), and semi-structured data sitting behind a Web interface (competitor pricing and customer reviews).”

Oscar Fafian
Data Integration Architect,
R Cable

Data Virtualization Use Case Examples

Cass Information Systems
Data Integration and Web Automation

Cass Information Systems is the leading provider of payment and information services for financial, accounts payable, transportation, logistics, utility and telecom expense management needs to major corporate clients.

They process bills that are provided in various formats (from electronic to manual), check against billing statements and execute the required financial transactions. Just in their telecom division, they receive 12,000 bills to process daily from their customers. They must then validate, analyze and pay these bills to telecom vendors while providing business intelligence on expense management back to the customers. The challenge was that many customers/vendors do not have EDI capability and deliver invoices in multiple ways such as file transfer, pdf, paper bills, etc. They needed a way to connect to the customers’ telecom vendor applications, extract the billing information out of Web-based information, XML, and PDF files and upload the data to their SQL database. Other divisions providing services for Utility and Transportation bills faced similar challenges.

Denodo Data Virtualization enables them to automate the extraction of data, validate, normalize and integrate data in disparate formats so that data can be fed into the CASS payment systems for proper handling. The new process results in significant reduction in the time and labor required, as well as creating more opportunities for business expansion through automation.

R Cable
Telecommunications/Cable —Single Customer View Case Study

R Cable’s competitive advantage is its customer responsiveness and innovation in products to serve emerging needs. To retain and further grow their 53% market share, R Cable needed to provide access to real-time information about account activities and competitive product and pricing details to customers and internal business teams.

Using Denodo’s Data Virtualization platform, R Cable is now able to leverage the huge amounts of data accessible through the Web and integrate them with enterprise data to create more intelligent business applications.
Data Virtualization Use Case Examples

Reintegra
Financial Services

Reintegra has specialized in credit and receivables collection management since 1999. Experiencing unprecedented growth during financial crises they needed to automate their search process for information regarding debtors, in particular when trying to locate untraceable contacts. Both the amount and speed of debt recovery is accelerated by identifying valid telephone numbers and enabling direct contact, in addition to background information and business links. Up until the implementation of Denodo Data Virtualization, this task was carried out by Reintegra agents by manually navigating through countless screens and directories, resulting in significant resource investment, both in time and money. Every day of delay would reduce the value of collections.

Given that speed of tracking is one of the main factors in debt recovery, the decision to use Denodo was taken to significantly speed up the search process of finding untraceables using public sources via the Internet.

Using Denodo Data Virtualization, Reintegra has increased its debt collection rate by 5% within the first few months, and improved the productivity of its search processes 40 times, increasing its agents’ capacity allowing them to process over 800 files an hour from an original 15.

Reintegra is further evaluating the use of Denodo Data Virtualization for locating information across several internal applications and databases, with the aim of eliminating the significant amount of time currently spent locating internal information.

The Phone House
Telecommunications - B2B Integration and Web Automation

The Phone House is the world’s largest independent telecommunications retailer serving over 100 million customers under the Phone House, Carphone Warehouse and Best Buy Mobile brands with over 2300 stores in 10 European and North American countries. The Phone House works with the leading telecom operators like Vodafone, Virgin, Orange, Telefonica, and ATT, and equipment providers including Apple, Samsung, Nokia, and Blackberry.

In The Phone House’s retail model, completing customer phone activations or migrations in the minimum time, with no errors and at the lowest possible cost is key to customer satisfaction and revenue growth. This used to require cumbersome manual operations by store clerks to synchronize data with service provider systems over the extranets.

With the objective of improving the B2B business model across multiple partners, The Phone House developed a Web Automation solution to bidirectionally integrate Phone House retail systems with activation systems and web-based portals of service partners such as Vodafone synchronizing customer, product and order information in a transparent, agile and efficient way.
Data Virtualization Use Case Examples

The Phone House realized a significant improvement of 50% in overall in-store efficiency, reduced errors 87% due to manual tasks, and focused the attention of store clerks on customer service and on reducing wait times instore. Further, it enabled them to onboard new partners in one-third the time using agile integration.

This B2B Web Automation solution was built using Denodo Data Virtualization Platform which enables virtualized access and integration of any and all data sources and delivers agile Data Services with lower deployment costs and faster time to solution.

Law Enforcement - Security and Criminal Intelligence Case Study

A more secure Europe through prevention of terrorism and organized crime is the vision that the EU-funded HiTS/ISAC project aims to fulfill. Superior situation awareness and cross-border interoperability are key enablers, leading to new technical and operational methods to work, train and cooperate across Europe. HiTS/ISAC enables information analysis and fusion from many different sources, through secure cross-border on-line group cooperation between law-enforcement authorities, in order to detect and provide early warnings for suspicious activities, be it communication between suspected criminals, or anomalous movement of persons, goods or money, etc.

A European-wide consortium led by the Defense, Navigation and Space giant Saab, and composed by EADS, Nokia and Denodo among others, has developed a Problem Solving Environment, demonstrated in a Virtual Operations Room which can be established anywhere, at any time.

“DENODO has played a key role in providing database and unstructured content interoperability, acknowledged by the consortium as one of the most technically complex and critical issues in the project.”

“THIS TECHNOLOGY is making it possible to connect without costly reprogramming, organizationally and geographically distributed data sources with structured or unstructured formats, into a single homogeneous and secure system.”

Jan Larsson
Project manager HiTS/ISAC and Director of Civil Security, Saab AB
Denodo Technologies is a leader in Data Virtualization – the only platform that delivers Information-as-a-Service across disparate structured, Web and unstructured sources. Innovative leaders in every industry use Denodo to dramatically increase flexibility and lower costs of data integration for agile BI and reporting, call center unified desktops, customer portals, Web and SaaS data integration, and enterprise data services. Founded in 1999, Denodo is privately held.

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