

Microsoft Database Solutions

MEETING THE FULL RANGE OF
DATA MANAGEMENT NEEDS
IN YOUR ORGANIZATION

A Microsoft White Paper

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CONTENTS

- Who Should Read This Paper?4**
- Executive Summary4**
- Meeting the Varied Database Needs of an Organization5**
 - Varied data management requirements..... 5
 - Varied data management roles..... 5
 - Balancing management and empowerment 6
- Microsoft Data Management Tools and Technologies.....6**
 - One word of advice..... 7
 - Microsoft SQL Server 7
 - Microsoft SQL Azure..... 9
 - Microsoft Visual Studio and the .NET Framework 11
 - Microsoft SharePoint Server..... 11
 - Microsoft Access..... 13
- Evaluating Database Requirements..... 14**
 - Business requirements of today and of the future..... 14
 - Time to Value and Resource Availability 14
 - Agility and Central Administration 15
 - Application Deployment 16
 - Maintenance, Backup and Availability 16
 - Scalability 17
 - Security 17
- Case Studies..... 19**
 - State Transportation department saves lives with Better Insights..... 19
 - GIS Provider Opens New Markets with Hosted Services 19
 - Microsoft Patent Group Uses Access Services to Avoid Fees..... 19
 - Equipment Maker Cuts Change-Order Cycle by 84 Percent 20
- Conclusions.....20**
- Additional Resources20**

WHO SHOULD READ THIS PAPER?

This paper is addressed to business and technology decision makers and information technology professionals who are planning, implementing, or managing database solutions in their organization. The paper provides an overview of Microsoft database tools and technologies and discusses the relative strengths of these products and how they can be combined to address the diverse data management challenges of an organization, balancing the need for control, reliability and security with the need for cost effectiveness, productivity and agility.

EXECUTIVE SUMMARY

Organizations face a broad set of business challenges that database technologies can help address, from running mission-critical applications to enabling the productivity of business users tracking personal and team-specific data. Information Technology (IT) groups often lack the staff and resources to solve all these problems.

Due to these resource limitations and the inherent desire of many business users and teams to solve many problems without having to rely on IT assistance, conflicts often arise between the need to empower business users and the need to control govern enterprise information. Microsoft's database tools and technologies help address many of these conflicts through the use of end-user tools that are supported on an enterprise platform centrally managed by IT.

Microsoft provides a rich set of complementary technologies, from tools in Microsoft Access for personal, team and departmental do-it-yourself data tracking and reporting needs, to an integrated collaborative platform for enterprise and web needs in SharePoint Server, and to SQL Server, SQL Azure and Visual Studio tools for the creation and management of enterprise mission-critical applications. With these technologies, Microsoft addresses the range of needs across a diverse set of roles, from business users and departmental developers to corporate developers and database administrators, as well as the different circumstances, budgets, timelines, and technical skills required.

The selection of one or more of these technologies to solve a specific business problem cannot be made without careful evaluation by technical and business personnel of many factors, some of which include availability of time and resources, scalability, administration, application deployment, backup, maintenance, availability, and security, among others, not to mention the business needs and long term requirements.

MEETING THE VARIED DATABASE NEEDS OF AN ORGANIZATION

Relational database technologies have had an immense impact on business in the few decades since they were first developed. The vast majority of business transactions are now recorded, tracked, and analyzed using data stored in relational systems. However, organizations are faced with a multitude of circumstances that require different information management needs. These span the spectrum from simple tracking needs of end users, to collaborative solutions, and finally to enterprise-level database applications such as customer relationship management and enterprise resource planning.

Varied data management requirements

There are many factors that affect the requirements for an information management solution.

One of these factors, for example, is the number of people who depend on that information. Some data is used only by individuals; some is used by small work groups, some by entire departments, and some by larger cross-departmental groups within the organization or in the wider community of partners and customers. Another key factor in platform selection is the impact of an interruption in the availability of the data. In some cases, data needs to be reliably available at all times and is critical to the overall mission of an organization, while in other cases information has a more localized effect on smaller team and departmental areas and a lesser impact on the organization overall.

As organizations evolve, there is also an evolution in the usage patterns for different collections of data. Data that was stored in a spreadsheet might move to a relational database to support multi-user processes, or to make it easier to organize the data and relate it to other data in the organization.

Moreover, non-functional requirements such as security, scalability, and manageability also vary. For example, data stored in a desktop database on an individual user's computer may need to migrate to a database server to meet a need for increased security or more reliable availability.

Varied data management roles

Another significant variable in data management is the role of the people managing the data. When data is under the control of IT staff, the choice for storage is usually a robust database server such as Microsoft SQL Server, which can be administered by professional database administrators (DBAs). Applications developed to provide user interfaces to the data are created by professional developers using tools such as Microsoft Visual Studio, in many cases under the direction of architects and the leaders of the IT application development organization.

Because of resource constraints, however, it is difficult for IT groups to directly service all the data management needs in an organization. A triage process occurs, sometimes formally and often informally, that allocates IT resources to certain applications based on the criticality of the business need. Some projects may be put on hold or they may be contracted out to professional IT vendors, but in many cases they are handled on an ad-hoc basis by business users

using tools that accommodate their own capabilities. The business users who create these self-service database applications tend to vary widely in their technical skills as they have a business role to fulfill and are not expected to be professional developers.

It is common for business units or departments to resort to a few information workers who are either formally trained or even self-taught in a few technical areas such as database design and basic programming. In addition to their line-of-business duties, these individuals often provide great value to their workgroups by creating and refining applications used by other members of their workgroups for entering, tracking, and analyzing data. There are also many more business users who lack any programming skills but who are able to use UI tools and wizards to create simple data tracking applications. They perform queries or create charts and reports, often combining data from multiple data sources.

Balancing management and empowerment

Due to limited IT budgets and resources, self-service data applications created by business users may be inevitable because these applications can be both cost effective and productive. However, it is also possible to introduce potential risks, from data security and availability to inefficient use of computing and networking resources. In addition, IT may be required to unexpectedly step in and dedicate precious resources supporting applications created by business users and departments. That is a paradox: IT would like to enable other parts of the organization with self-service, but it must do that while at the same time maintain control and stewardship over the infrastructure, the data, and the applications.

Microsoft's data management solutions attempt to break this paradox and help organizations accomplish these two seemingly disparate goals.

MICROSOFT DATA MANAGEMENT TOOLS AND TECHNOLOGIES

In the early days of computing there was a clear division between database management systems (which handled only storage and query processing) and tools for building applications that interact with the database. Database administrators (DBAs) created and maintained the databases and developers built the applications for users. As organizations' needs became more complex, the technology and tools have also had to evolve.

For example, Microsoft SQL Server is not only a powerful data storage engine and query processor, but also provides services for data analysis, enterprise reporting and integration with full support for .NET development. SQL Azure provides many capabilities of SQL Server on the cloud. SharePoint Server provides a collaborative platform for enterprise and web solutions and includes capabilities for the creation of custom collaborative applications that can be customized by developers with SharePoint Designer or by end users directly through a browser, while isolating users from the complexities of the underlying SQL Server database upon which SharePoint runs. Finally, Microsoft Access provides a versatile desktop storage engine and query processor for self-service solutions and for

departmental applications that can interact with SQL Server databases and SharePoint lists, and that can be shared with others through SharePoint.

One word of advice

Each of the solutions mentioned above (Microsoft SQL Server, Microsoft SQL Azure, Microsoft SharePoint Server, and Microsoft Office Access) address fundamentally different needs within an enterprise, but they are commonly used as complementary solutions. In many cases, the decision of which solution to use for a given problem is rather obvious, especially to technical experts. For example, if a corporate IT organization is implementing a major re-architecture of their supply chain backend system, it is rather clear that a database management system with the power of SQL Server may be part of the technical solution, as is SQL Azure if the database capabilities are required as a cloud service. If a corporation is looking at deploying a new global intranet with hundreds or thousands of sites across the globe, then clearly a collaborative platform such as SharePoint Server may be part of the solution. Or if departments in that organization need to create rapid local solutions for teams and groups, then they may leverage Microsoft Access.

But there may be business needs where the decision is not as easy as one would expect.

In those situations where the decision is not as easily made, it may be tempting to look for an easy-to-use recipe or cheat sheet. But in practice, such simplistic approaches fail to account for the variety of business needs enterprises face, and the myriad of business and technical considerations that should be part of the decision-making process. Deciding how to best solve data-centric business problems in those cases requires careful consideration and participation of technical and business experts that are able to articulate multiple angles of the technical and business requirements, and are able to make an informed decision that best solves the business needs as well as the technical needs for today and for the future.

This document should not be seen as a cheat sheet or as a replacement of the advice of such experts, both from inside and outside of an organization. This article aims to be an educational tool that summarizes Microsoft data management tools and technologies, their focus and strengths, and that highlights a basic list of considerations that are typically core to the decision that an organization faces.

We now discuss each one of these technologies separately.

Microsoft SQL Server

Microsoft SQL Server is a leader among database management systems. It provides:

- **A mission-critical platform:** A mission-critical platform represents the foundation for line-of-business applications (LOB), those applications that are the critical foundation for a business and which require the ability to securely and reliably store, centralize, manage and distribute data to users. SQL Server provides organizations with a high performance database platform that is reliable, scalable, and easy to manage, and helps IT

departments provide even more cost-effective scalability on today's most advanced hardware platforms using familiar administration tools.

- **IT and developer efficiency:** As we discussed before, there is a great demand for IT to provide more value with existing budgets and resources. To achieve this, IT needs tools and capabilities that help them maximize efficiency across the application lifecycle with streamlined management, rapid development, and predictable deployment. SQL Server includes tools and capabilities to help IT administrators and developers make the best possible use of time and resources, and to allow them to focus on higher value activities. A sample of these tools are dashboard views, policy based management, resource management, data compression, single deployment packages for applications, and rapid provisioning and configuration.
- **Rapid development of rich, connected applications:** SQL Server includes tools in Visual Studio and the .NET Framework for developers to create connected applications and rich experiences. With tools like the ADO.NET Entity Framework, LINQ extensions to Microsoft Visual C# and Microsoft Visual Basic.NET, and support for relational, XML, Filestream and geo-location-based data, developers have at their disposal a comprehensive data platform to access and manipulate business-critical data from a variety of devices, platforms and data services.
- **Self-Service Business Intelligence:** SQL Server includes a wealth of BI components and delivers them through familiar and intuitive tools to make BI accessible to all employees, leading to better, faster, more relevant decisions. These tools include an enterprise-scale data warehouse, data integration into a Unified Dimension Model, Master Data Management and end-user tools such as PowerPivot for interactive modeling and analysis of massive amounts of data in Excel, Reporting Services Report Builder, and sharing and collaboration tools delivered on SharePoint Server.

Next, we discuss in more detail how SQL Server delivers the capabilities to address those needs by highlighting a few key technologies:

- **Analysis Services** enables organizations to build comprehensive, enterprise-scale analytic solutions that deliver actionable insights. SQL Server includes a multidimensional online analytical processing (OLAP) engine, along with the Business Intelligence Development Studio integrated design environment. For developers, Unified Dimensional Models provide consolidated business views for relational and multidimensional data that include business entities, business logic, calculations, and metrics. Advanced data mining algorithms enable both short-term and long-term predictive insights, supported by the intuitive Data Mining Wizard and Data Mining Designer. Interoperability with the Microsoft Office System, including Excel, PerformancePoint Server, and SharePoint Server, enables business users to access multidimensional data directly from within familiar tools. PowerPivot is a data analysis add-in to Excel that empowers business user to create self-service business intelligence (BI) solutions and collaborate through SharePoint sites.
- **Reporting Services** provides a server-based platform designed to support a wide variety of reporting needs, enabling organizations to deliver relevant information where needed across the entire enterprise. With Visual

Studio-based report development tools, developers can take advantage of intuitive design interfaces and wizards to quickly build reporting solutions from a wide variety of data sources. Microsoft Report Builder enables business users to create their own reports and to explore corporate data in an intuitive and familiar Microsoft Office-optimized authoring environment. Report Builder enables users to re-use existing report components from a shared library, empowering them to build reports without deep technical understanding of the underlying data structures. Through integration with SharePoint and the Web-based Report Manager, administrators can schedule report execution, manage report subscriptions, and control access to reports. Rendering options support a variety of formats including HTML, PDF, CSV, XML, and Image (TIFF), as well as Microsoft Office Word and Excel. In addition, subscriptions enable automated delivery at specific times and locations, through e-mail or by posting them to a shared network folder.

- **Integration Services** provides a scalable enterprise data integration platform with Extract, Transform, Load (ETL) and integration capabilities, enabling organizations to manage data from a wide range of data sources. The SQL Server Import and Export Wizard enables code-free creation of highly customizable and efficient data transfer packages. Business Intelligence Development Studio supports shared solutions with Analysis Services and Reporting Services, including source control, metadata integration, and the design, testing, deployment, and maintenance of end-to-end business intelligence applications. For developers, the code design environment of Visual Studio supports authoring of integration tasks in C# and Visual Basic. Data integration packages are able to perform operations such as data and character conversions, creation of calculated columns, conditional operations for partitioning and filtering, lookups, sorting, aggregation, and merges. Typical uses of Integration Services include combining data from heterogeneous data stores, populating data warehouses and data marts, cleaning and standardizing data, and automating data backups and transfers. In addition, Microsoft offers a separate product, Host Integration Server, which provides smooth integration of data, business rules, security credentials, and messaging from IBM mainframe systems.

Microsoft SQL Azure

Microsoft SQL Azure Database is a cloud-based relational database service that is built on SQL Server technologies and runs in Microsoft data centers on hardware that is owned, hosted, and maintained by Microsoft. SQL Azure relieves organizations of the need to install, maintain or update data server software, and therefore appeals to those companies or departments that need powerful, highly available database features without high startup or administrative costs. In this section, we discuss some of the similarities and differences of SQL Azure and SQL Server.

With increased IT infrastructure costs and greater challenges related to provisioning, deploying and managing servers at scale, customers are demanding increased flexibility in platform choices to allow them to innovate faster. SQL Azure extends the information platform vision to the cloud, to offer these platform capabilities as services. The key principles of SQL Azure are:

- **Managed Service:** delivering information platform capabilities as fully managed services which consumers can consume, without having to worry about provisioning, deploying and managing underlying hardware and software;
- **Scale on Demand:** flexibility to scale out depending on needs and a pay-as-you-grow business model;
- **Faster innovation:** ability to build cloud based solutions utilizing existing skills and the large ecosystem of developer and management tools.

Next, we discuss in more detail how SQL Azure delivers the capabilities to address those needs by highlighting a few key technologies:

- **SQL Azure Database** provides relational database capabilities as a service. Customers do not have to install, setup, patch, or manage any software. High availability and fault tolerance is built-in and no physical administration is required. Additionally, customers can use existing knowledge in T-SQL, and data access code, for symmetry with existing on-premises databases. From an application perspective, using SQL Azure for the most part involves little more than changing a connection string and migrating databases is usually straightforward. Another key feature is that it supports “scale-out” deployments for high utilization and user loads, and is useful for customers with applications that need high availability and redundancy at a lower cost than traditional scale-up architectures.
- **SQL Azure Reporting** (currently in CTP) enables developers to enhance their applications by embedding cloud based reports on information stored in SQL Azure databases, thereby allowing the users of these applications to gain greater insight on their line of business data without having to worry about installing software and setting up machines or instances. Developers can author reports using familiar SQL Server Reporting Services tools and then easily provision and deploy reports into the cloud.
- **SQL Azure Data Sync** (currently in CTP) enables customers to synchronize their on-premises and cloud databases. With the Data Sync service customers can synchronize multiple SQL Azure databases (entire databases or specific tables) for scenarios such as geo-replication and read-write scale-out. Data Sync also enables synchronization between on-premises SQL Server and SQL Azure, giving customers greater flexibility in building solutions that span on-premises and the cloud, or synchronize multiple on-premises databases located in datacenters, corporate offices, or with partners.

Similar to an instance of SQL Server on premises, SQL Azure exposes a tabular data stream (TDS) interface for Transact-SQL-based database access. This allows database applications to use SQL Azure in the same way that they use SQL Server. It also means that customers can use existing knowledge in T-SQL development and a familiar relational data model for symmetry with existing on-premises databases. Customers can get productive on SQL Azure quickly by using the same development and management tools they use for on-premises databases services.

Microsoft Visual Studio and the .NET Framework

Microsoft Visual Studio is a comprehensive set of tools for application development and application life cycle management. Visual Studio 2010 Ultimate provides deployment and change-management tools targeted specifically at database development. Templates and wizards in Visual Studio target SQL Server and SharePoint development tasks, guiding architects and programmers toward successful project completion.

The .NET framework is a set of base class libraries that solve common programming problems, increasing developer productivity and easing code maintenance. These libraries can be accessed using any of a variety of programming languages, such as C# and Visual Basic, which all work with the .NET Common Language Runtime (CLR). ADO.NET is a set of class libraries in the .NET framework that support data-oriented programming tasks, such as connecting to databases and reading or manipulating data.

The Entity Framework is a part of ADO.NET that enables developers to create data access applications by programming against a conceptual application model instead of programming directly against a relational storage schema. The goal is to decrease the amount of code and maintenance required for data-oriented applications. Entity Framework applications can work in terms of a more application-centric conceptual model, and they are freed from hard-coded dependencies on a particular data engine or storage schema. Mappings between the conceptual model and the storage-specific schema can change without changing the application code.

Microsoft SharePoint Server

SharePoint Server is Microsoft's collaboration platform for the enterprise and the internet. With SharePoint Server, people can share ideas, expertise, manage documents and content, find the right business information to make better decisions, and create custom do-it-yourself collaborative solutions. Because SharePoint delivers many of these capabilities in a single platform, it helps organizations cut training and infrastructure costs, save time and effort, and focus on higher business priorities.

SharePoint is a great choice of technology for those information needs that require:

- **A collaborative platform:** This helps people in an organization connect with colleagues in new and creative ways and to easily find and work with people who have the right skills, expertise, and shared interests.
- **A familiar and intuitive user experience:** This helps people be more productive, working seamlessly with Microsoft Office, Exchange Server, and Unified Communications, or directly through a browser.
- **Do-it-yourself collaborative data management needs:** Helping people solve problems on their own through lists, document libraries, connectivity to enterprise data, workflows, and a rich set of building blocks that people can use to assemble, connect, and configure collaborative business solutions, from simple sites to even more complex applications.

SharePoint does that by providing the following capabilities:

- **Sites:** SharePoint Sites provides portal and collaboration capabilities across intranet, extranet, and Internet sites, bringing users together to share information, data, and expertise across teams, departments, and organizations. Users are able to work more efficiently and effectively by easily accessing critical information and collaborating with co-workers and partners. IT professionals are able to save time and resources enabling this sharing environment with a host of built-in tools and standardized development. Organizations are able to cut costs and increase agility with a holistic solution for their content and collaboration needs. Users can easily share and publish Information, developing pages, adding or changing content, applying design themes, or simply providing feedback. In addition, SharePoint helps users personalize their experience, making it easier to find and use the right content, or customize their solution to target and communicate with specific audiences, tag content to improve visibility and distribution, and/or work in the language of their choice. And organizations can ensure broad adoption because users can view and edit content directly from the browser through SharePoint's enhanced connections with Microsoft Office and Office Web Applications.
- **Communities:** SharePoint Communities lets people work together in ways that are most effective for them by providing great collaboration tools that anyone can use to share ideas, find people and expertise, and locate business information. Some of the functionality delivered through SharePoint Communities includes Blogs, Colleague Suggestions, My Content, My Profile, Organization Browser, Ratings, Recent Activities, Tags, and Wikis. A single, flexible platform makes it easy to manage these tools and design the right collaborative experiences for different business needs.
- **Content:** SharePoint Content makes Enterprise Content Management (ECM) easy for everyone. SharePoint Content provides a familiar user experience making people comfortable with the system and helping them find the information they need more easily. SharePoint Content manages documents, records, Web content, and rich media on a single platform, helping organizations reduce IT costs. It supports interoperability through standards like CMIS, XML, and REST to connect to legacy ECM systems. With SharePoint Content, users can tag content, enforce retention schedules, declare records, and apply legal holds, helping organizations address the need for compliance and reduce the risk of mistakes when information is archived or disposed.
- **Search:** SharePoint Search helps people find the information they need to get their jobs done. It provides intranet search, people search, and a platform to build search-driven applications. SharePoint Search is unique because it combines relevance, refinement, and people. SharePoint Search provides an experience that is highly personalized, efficient, and effective, through contextual search, meta-data driven refinement to narrow search results and find content faster, and people and expertise search to find people by name or associated terms.
- **Insights:** SharePoint Insights lets users access the business information they need to make good decisions. Some of the functionality provided includes Excel Services, which helps users use, share, secure, and manage Excel workbooks as interactive reports in a consistent way throughout the enterprise and create dashboards; Visio Services which provides the capability to create web-based Visio visualizations, improving the process of

conveying the status of a process or flowchart to business users and key decision makers; and PerformancePoint Services, which helps people deliver rich, dynamic and context-driven dashboards and scorecards that display information from company-wide strategy to operations, create charts directly in SharePoint or from Excel workbooks. Simple dashboards can be created quickly and easily with Status Indicator Lists and Key Performance Indicators (KPIs).

- **Composites:** SharePoint Composites enables people to rapidly create collaborative solutions by assembling, connecting and configuring the building blocks of functionality available in SharePoint, via browser-based tools, or advanced no-code tooling in Microsoft SharePoint Designer, or through Visio Services and Access Services which help users share diagrams and desktop database applications using SharePoint. It also allows organizations to connect with enterprise data through Business Connectivity Services, which helps users interact with these systems as easily as with traditional SharePoint data, or directly in the rich experience of Microsoft Word 2010, Microsoft Outlook, and Microsoft SharePoint Workspace, delivering search, read and write capabilities, whether offline or when connected. More important to IT personnel, SharePoint Composites helps IT professionals maintain control over the platform, allowing them to centralize desktop-based applications, manage custom code with sandboxed solutions and to maintain operational insight with health monitoring and controls.

Finally, with Visual Studio 2010, .NET developers have at their disposal professional-grade tools and templates for development, testing, and management of SharePoint custom applications that allow them to leverage their current technical skills.

Microsoft Access

Microsoft Access has achieved broad market acceptance by enabling information workers with little or no formal training in programming or database design to be successful in using wizards and graphical tools to develop useful database applications. Even for professional developers, Access is a handy tool for prototyping applications or for exploring and updating data. Access is best applied in scenarios that require:

- **User friendliness and rapid solutions:** Access includes a friendly, full-featured application development environment, as well as an easy-to-use relational database engine and query processor.
- **Easy queries and reports against other data sources:** Access is capable of working with data stored in its own native files or linking to server-based data such as data in SQL Server or Oracle tables, or data in SharePoint lists. To Access users and developers, all these types of data look and act the same and can easily be combined in queries, data entry forms, and reports. Non-programmers can automate common tasks by building multi-step declarative macros in a friendly macro editor that presents progressive lists of available options. Programmers can create more advanced customizations using Visual Basic for Applications (VBA) code.
- **Sharing of databases:** Access Services, a feature of SharePoint 2010 Enterprise, supports close integration and added capabilities for Access. Access Services enables Access objects such as queries, macros, forms and reports,

as well as Access data, to be stored in a SharePoint site. This aids deployment by ensuring that all users get the latest versions of the data and objects, while also allowing users to work offline with local versions that automatically synchronize when they reconnect with the SharePoint site. Performance is maintained because Access works against local data that is continuously synchronized with the server in the background when connected. Multi-user conflict resolution handles concurrency issues when they occur. In addition, Access Services enables creation of Web forms and reports that render in any browser or in the rich Access client, providing an easy way for business users to create Web-enabled applications.

EVALUATING DATABASE REQUIREMENTS

As we have discussed before, evaluating the business requirements of a database application requires careful analysis in many cases. In addition to considering which data items must be tracked and how they relate to each other, analysts must also consider how the data will be used and by whom, when the application must be ready for deployment, and what resources are available to create it, among other factors. All of these considerations play a part in deciding which tools are appropriate to the task, and sometimes compromises in one area become necessary to meet other requirements. Next we list a number of considerations that are typically part of the decision process.

Business requirements of today and of the future

Articulating the needs of the business is a great way to establish a common baseline for conversations among business and technical personnel, and it represents an opportunity to think not just about the short-term requirements, but also about how those requirements may evolve over time.

It's also a good idea to define these requirements ahead of time, and before the discussions get too deep into technical requirements. It is always a good idea to initially separate complexities stemming from the business side from those coming from technical reality.

Once the requirements are defined, it is easier to then identify the relative size of the effort, the relative importance and mission criticality, and the complexity of the business changes involved and the technical challenges ahead.

Time to Value and Resource Availability

An application's required timetable for deployment and the resources available to complete the task have a big influence on technology decisions. Self-service solutions are often selected when little time is available for development and when professional IT resources are scarce or unaffordable.

The ease-of-use features in Microsoft Access, SharePoint Server, SQL Server PowerPivot, and SQL Server Report Builder are designed to allow non-technical information workers to get simple solutions up and running quickly. As the expertise of the information worker increases or as additional resources become available, advanced features allow the complexity and power of the application to grow.

When applications developed with these tools expands in scope, or when the original developer leaves the group, professional IT support may be required. At that time, a database professional may discover flaws in the original design. In self-service databases, data types may have been selected improperly, primary keys or indexes may be missing, and tables may be organized in ways that don't conform to the rules of relational normalization. For this reasons, even when timelines are short and resources are limited, a professional review of the data schema early in the project will often prevent the need for rework later. Standardized templates or sample applications can also be useful in guiding projects toward efficient designs.

Agility and Central Administration

Requirements always change over time as data tracking needs evolve and as users think of new uses for the data. When control of an application's data schema and application objects remains within the workgroup that is consuming the application, the workgroup can frequently adapt to changing requirements by making any necessary changes. If all change requests must to be submitted to an IT department or an external developer, often flexibility is diminished in exchange for better IT control and improved technical architecture.

Centralized administration of data may, however, be required when multiple applications share the same data or when security and availability are important. The extra flexibility that results from allowing a workgroup to control its own data can in some cases lead to data loss or interruption of service, if proper security or maintenance procedures are not enforced.

When applications perform purely reporting and analysis functions, the data can be centrally controlled and workgroups can freely modify the objects used for viewing the data. Even in this case, however, controls may be advisable to limit the burden that the reporting application places on server and network resources.

Workgroup applications often need to combine data that requires central storage and control with local data that is less critical. Microsoft Access provides versatile support for these scenarios by enabling information workers to link to IT-managed central data as well as to less critical local data under the control of their workgroup, combining the data as needed with distributed queries. If the local data eventually takes on greater mission-criticality, then it can be moved to centralized control, either in SharePoint lists or in SQL Server or SQL Azure tables. The data can then be re-linked with minimal change to existing client applications.

Agility and centralization are not always in conflict. Given adequate resources, highly centralized data management applications can also be extremely adaptable, even more so than applications controlled by line-of-business workgroups, because of more capable tools and technicians. For example, performance problems in a SQL Server database can be quickly and effectively addressed by a DBA using SQL Server Management Studio, while an Access database developer might have a harder time isolating and solving the problem. So even from the point of view of agility, it is often preferable to use centralized storage and professional IT assistance when it is available.

Application Deployment

For applications developed with Visual Studio, web-based deployment has become the norm, even for Windows client applications, and Visual Studio 2010 provides rich support to programmers and administrators for deploying applications, settings, and databases.

SharePoint Server also enables rich-client Office products like Access and Excel to deliver the convenience and manageability of deployment through centralized services and web-based services.

Access applications using native ACE database engine files for storage are often deployed using standard file copy operations. To ease versioning, the recommended practice is to consolidate all front-end application objects, including forms, reports, queries and macros, in one database and to distribute separate local copies to each user. These front-end databases link to tables stored in a separate database on a file share. Additional links may exist to connect to other remote data sources, such as SQL Server tables or views. To distribute applications updates to users, developers working with versions prior to Access 2010, either manually replace the old front-end files or write code to detect and download new versions automatically.

Access 2010 introduced a new deployment option. With Access Services running on SharePoint 2010, developers of Access 2010 applications can publish their front-end applications to SharePoint and be assured that users will automatically receive the latest version when running the applications, even if the applications do not use Web forms and reports, and even if the data is not stored in SharePoint lists. The applications can operate without a connection to the SharePoint server, and when connected they can automatically pick up any design changes. Using Web forms and reports that work with data in SharePoint lists provides additional deployment options by supporting the use of browsers for data entry and reporting, as an alternative to the rich Access client.

Maintenance, Backup and Availability

Database solutions using SQL Server or SQL Azure for storage, or data stored in SharePoint lists, benefit from SQL Server's advanced data maintenance and availability features. DBAs can develop and refine scheduled maintenance plans that automatically recalculate statistics for query execution plans, perform full or incremental backups, check database integrity, recover unused disk space, or rebuild indexes. Transaction logs ensure reliable data recovery, and mirroring can add automatic failover. When data is mission-critical or when availability is important, SQL Server or SQL Azure may be the appropriate data storage engines.

For workgroup applications with less critical data, Microsoft Access databases provide an economical alternative. The Access database engine does not automatically log transactions and does not have any built-in capability to backup data. For backups, users must rely on the operating system to make a copy of the file when the database is not in use. In addition, Access databases must be compacted periodically to recover space freed up by deleted data, improving performance in dynamic databases, not only because it shrinks the physical size of the data file, but also because it signals queries to refresh their execution plans based on the latest statistics. In addition, certain kinds of data

inconsistency are detected and repaired during Compact and Repair operations. This maintenance procedure can only be performed when a database is not in use, and scheduled script execution can be used to run it automatically.

Because essential Access database backup and maintenance operations can only occur when the database is offline, Access databases cannot meet the storage requirements of applications that must be continuously available. However, Access can still be used to create front-end application objects such as queries, forms, and reports for applications that store data in SQL Server or in SharePoint lists, which are backed by SQL Server and therefore share its maintenance capabilities.

New multi-tenant, hosted cloud services for data storage using Microsoft SQL Azure or SharePoint Online provide high levels of reliability and availability without requiring an investment in hardware, software, and maintenance.

Scalability

The need to handle large amounts of data or large numbers of concurrent users often determines the choice of tools and technologies. These concerns affect the choice of both the storage engine and the application platform.

SQL Server is engineered and tested to handle the most extreme scalability requirements and it is the clear choice when working with very large databases that contain hundreds of related tables or millions of rows per table. SQL Server can also scale to handle large amounts of transactions per second.

Microsoft SharePoint lists are optimized to perform well with thousands of rows, but they are not intended for larger datasets. Where SharePoint excels is in its ability to handle large numbers of users creating and modifying the designs of lists. This contrasts with SQL Server database tables, which are intended for design management by a small number of database administrators.

The Access database engine is very capable for workgroups, providing reasonable performance even for large tables. For applications that perform mainly data retrieval and reporting, the Access engine can accommodate a maximum of 255 users. However, Access also supports creation of applications that link to more capable database servers, such as SQL Server, for data storage. When linked to SQL Server, Access applications can handle larger data sets and large populations of users. For best results with such applications, however, professional design of the database and application is recommended.

Security

Security requirements vary considerably depending on the criticality and sensitivity of data, as well as the roles and numbers of users who have access. As with scalability, the need to protect data in some cases emerges only after an application is in production or after an adverse incident occurs. To avoid costly and disruptive design changes following deployment, it is important to anticipate security challenges and make appropriate choices in advance.

Access applications that use the Access database engine for storage, rather than linking to server data, must depend on Windows security to limit access to the database files. Any users of the applications must have Windows read-write permissions to the data files can potentially copy, tamper with, or even delete the data. Access supports several ways of obscuring data through encryption and passwords. However, these can be defeated by a determined and educated user who has a copy of the data file. For this reason, using the Access database engine for data storage is not recommended when data privacy or accuracy is critical and when users with file-based access to the data cannot be fully trusted. In these cases, Access applications should link to server data, such as SQL Server tables or SharePoint lists, relying on server-based security.

Access applications that connect to SQL Server data can provide more security against data theft or tampering than applications that use the Access database engine for data storage, but there are still limitations to consider. The most appealing ease-of-use features in Access often require giving users full read-write permissions to the data tables or to updateable views. SQL Server stored procedures work well for reporting applications, but Access data entry forms require insert, update, and delete rights to the underlying tables or views. Advanced programming techniques are required to build Access applications that use stored procedures for data modifications. The close integration between Access and SharePoint, whereby a user's Windows identity is automatically passed to SharePoint, may be a good way to enable agile development of Access applications without compromising security or requiring advanced programming.

By default, SQL Server data files are completely protected from application users by being located on file shares with restricted permissions. The computer process that interacts with the data runs on the server, not on client machines as is the case with Access. All client requests are authenticated either with user names and passwords stored in SQL Server or with Windows credentials. Data encryption in SQL Server can provide further protection against users who do gain direct access to the data files.

SharePoint intranet applications usually rely on Windows Active Directory security for authentication and authorization. In addition, SharePoint manageability features enable administrators close control over the types of files that can be uploaded and the activities that users can perform. Configurable throttles protect network and server resources.

SharePoint extranets and public sites can alternatively employ ASP.NET forms-based security, using a custom SQL Server, LDAP, or other type of identity repository, so that users are not required to have Active Directory accounts. Additionally, ASP.NET supports the use of independent, single sign-on, federated identity management systems.

CASE STUDIES

Microsoft has published case studies that highlight the advantages of working with the Microsoft information management platform to meet a wide range of data management challenges. The following sections briefly summarize several of these studies. To search for additional case studies, visit <http://www.microsoft.com/casestudies>.

State Transportation department saves lives with Better Insights

http://www.microsoft.com/casestudies/Case_Study_Detail.aspx?CaseStudyID=4000007073

As part of its mission to enhance the safety and efficiency of Mississippi's highways, the Mississippi Department of Transportation (MDOT) collects vast amounts of data about accident trends and roadwork projects. Because this data is spread across multiple sources, MDOT needed a solution that would empower its employees to find and share information more easily so they can identify trends, develop strategies, connect with colleagues, and reduce decision cycles. MDOT uses Microsoft FAST Search Server 2010 for SharePoint to help people find information across disparate sources, and it uses Microsoft SharePoint Server 2010 and Microsoft SQL Server 2008 R2 to analyze traffic accidents and evaluate the agency's safety initiatives. Now, MDOT can make more effective use of its employees' knowledge and experience to develop policy and funding priorities that will enhance transportation safety in Mississippi.

GIS Provider Opens New Markets with Hosted Services

http://www.microsoft.com/casestudies/Case_Study_Detail.aspx?CaseStudyID=4000007771

Since 1969, Esri has led the development of Geographic Information System (GIS) software. Governments and businesses in dozens of industries use Esri products to connect business, demographic, research, or environmental data with geographic data from multiple sources. The company wanted to expand the reach of its GIS technology by offering a lightweight solution called MapIt that combines software plus services to provide spatial analysis and visualization tools to users unfamiliar with GIS. Esri began offering MapIt as a cloud service with the Windows Azure platform, and now Esri customers can deploy MapIt with Windows Azure and store geographic and business information in the Microsoft SQL Azure database service. By lowering the cost and complexity of deploying GIS, Esri is reaching new markets and providing new and enhanced services to its existing customers.

Microsoft Patent Group Uses Access Services to Avoid Fees

http://www.microsoft.com/casestudies/Case_Study_Detail.aspx?CaseStudyID=4000007677

The Patent Group within Microsoft Legal and Corporate Affairs coordinates thousands of patent applications every year. To improve productivity, it deployed a Microsoft Access Services solution that delivers patent-tracking data to a Microsoft SharePoint 2010 site. With browser-based access to all their information, employees have better visibility into the progress of patent applications, so they can work more efficiently and avoid late filing fees.

Equipment Maker Cuts Change-Order Cycle by 84 Percent

http://www.microsoft.com/casestudies/Case_Study_Detail.aspx?CaseStudyID=4000007798

For Teradyne—the U.S.\$1.2 billion a year maker of automatic test equipment—the recession posed the same challenge that many other manufacturers faced: cut costs while boosting customer service, the better to weather the bad times and position itself for growth during the inevitable recovery. The company's multipronged approach to the challenge included the adoption of new processes for managing the requirements of product development projects, collaboration on project team documents, and change orders, implemented through Siemens PLM Software's Teamcenter® software and Microsoft Office SharePoint Server 2007. Now, personnel have faster and easier access to more accurate data, which has led to less manufacturing rework, lower scrap costs, faster change-order cycles, lower project scheduling slip rates, lower change-order processing costs, and higher customer satisfaction.

CONCLUSIONS

All organizations have data management needs that vary from simple ad-hoc lists used by individuals, to team-based solutions that work with shared data, to enterprise-wide applications. Microsoft tools and technologies can add significant value to organizations by addressing the full range of these needs, from the simplest departmental and workgroup solutions to advanced enterprise requirements.

Solutions such as Microsoft SQL Server, Microsoft SharePoint Server, and Microsoft Office Access address fundamentally different needs within an enterprise, and are commonly used as complementary solutions. While the decision as to which solution to use for a given problem is clear in many cases, there may be business needs where the decision is not as easy. Those decisions cannot be made without careful evaluation by technical and business personnel of many factors, some of which include availability of time and resources, scalability, administration, deployment, backup, maintenance, availability, and security, among others, and by carefully analyzing the business needs and long term requirements of the organization.

ADDITIONAL RESOURCES

For more information and updates, please refer to the following resources:

- SQL Server: (<http://www.microsoft.com/sql>)
- SQL Azure: (<http://msdn.microsoft.com/en-us/library/ee336279.aspx>)
- SharePoint: (<http://www.microsoft.com/sharepoint>)
- Access: (<http://www.microsoft.com/access>)