Zetaris



Lights-on Migration

Instant Analytics, Any Data, Anywhere

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Introduction

Data migration is the process of moving data from one location to another, one format and structure to another, or one application to another. Generally, this is the result of introducing a new system or location for the data. The business driver is usually an application migration or consolidation in which legacy systems are replaced or augmented by new applications that will share the same datasets. Contemporary data migrations are often started as firms move from on-premises infrastructure and applications to cloud-based storage and applications to optimise or transform their company.

This White Paper outlines the many challenges presented by data migration projects and shows how Zetaris: The Networked Data Platform:

a. Ensures connection visibility of both the source and target environments

b. Enables sight and removal of duplicates

c. Optimises resource usage

d. Allows architectural optionality

e. Expedites data product development

f. Ensures business continuity

g. Constitutes insurance of the data migration project itself.



The Topic

Data migration takes four main forms:

a. Cloud migration, which means the migration of some of or all an organisation's data centre capabilities to the cloud,

b. Application migration, which involves the transfer of application programs to the cloud or between clouds

c. Storage migration, which is the process of transferring data from outdated arrays to a modern platform, and

d. Business process migration, which is the replacement of business management tools and the migration of the data they use from the old systems to the new.

Particularly in recent years, the business drivers of data migration have been the perceived cost savings and efficiency gains derived from the movement of on-premises infrastructure and applications to cloud-based storage and applications.[1]

Data migration is undertaken because it promises to keep an organisation agile while avoiding being locked-in to specific vendors and platforms. It is undertaken to reduce hardware and labour costs. It is undertaken because it promises to break down data silos, facilitating intra-organisational collaboration and improving visibility across the organisation

These are sound reasons for undertaking data migration, but research in the area paints a rather dispiriting picture of the results.[2] It is clear that the problems lie not within the concept itself but within the execution of the concept. Data migration projects are highly problematic.



[1] Big Data analytics in a distributed cloud environment, of course, presents fresh challenges. See Qiufen Xia, Weifa Liang and Zichuan Xu, 'Data Locality-Aware Big Data Query Evaluation in Distributed Clouds', The Computer Journal, Vol. 60, 6 (June 2017): 791–809. Zetaris: The Networked Data Platform is one of the very few technologies capable of meeting these challenges.

[2] It should be noted, however, that the statistic still doing the rounds on social media and in industry white papers, '83% of data migration projects fail', derives from a Gartner report published thirteen years ago: Ted Friedman, 'Risks and Challenges in Data Migrations and Conversions', Gartner Report ID: G00165710, 25 February 2009. The more enthusiastic alarmists will augment this dramatic figure with statistics taken from an even older Bloor report: Philip Howard, 'Data Migration', Bloor White Paper, 24 September 2007. A more up-to-date picture is given by Lyn Robison, 'Migrating Enterprise Databases and Data to the Cloud', Gartner Report ID: G00735346, 10 February 2021, and by Friedman himself: Ted Friedman, 'Make Data Migration Boring: 10 Steps to Ensure On-Time, High-Quality Delivery', Gartner Report ID: G00448218, published 13 December 2019, refreshed 8 April 2021. See also Henry Cook, Donald Feinberg, Robert Thanaraj, Rick Greenwald and Adam Ronthal. 'How to Succeed at Database and DBMS Migration', Gartner Report ID: G00719580, 1 May 2020.

The Specific Problems

The challenges of data migration projects can be summarized under three major headings (which are themselves interlinked):

a. The quality of the data
b. The planning process
c. Infrastructure requirements

Moving data from one place to another solves nothing if the data itself is flawed. It is very unlikely that an organisation that has been accumulating data over time will not have duplicates, misspellings, omissions from and errors in its data. [3] Related to this is the phenomenon of 'shadow IT', meaning that business users have devised workarounds to obtain the data they need. A proliferation of spreadsheets is a common symptom of this. Spreadsheet-derived data will not be documented or governed by a central system. [4]

Thorough data analysis prior to migration, however, will not ensure the desired result if the target system contains more sophisticated features than the old, which is usually the case and usually the reason the migration is being undertaken in the first place. For example, if the source system cannot validate a bank account number but the target system can, based on the customer's regional details, the import will fail.

The questions of both the ownership and the use of the data matter, too. Migrating data without a clear understanding of who uses it and for what purpose, an understanding that necessarily entails knowing what applications are connected to the data, can lead to data load failures or failures in user acceptance testing due to the target system being unable to complete a required task.

It is essential to understand the true source of the data, including the business process that captures the data and its meaning.

[3] For example, when transferring approximately 750,000 electronic health records (EHRs) to a new system in 2017, Holy Spirit Hospital in Pennsylvania, U.S.A., discovered that many were more than 10 years old, approximately 50,000 represented patients who had died, many were of patients with only outpatient tests (some performed as many as 10 years earlier) and many did not contain any inpatient data. Richard Schreiber and Lawrence Garber, 'Data Migration: A Thorny Issue in Electronic Health Record Transitions—Case Studies and Review of the Literature', ACI Open, Vol. 4, 1, (2020).

[4] In the U.K., 26% of surveyed executives said they had experienced issues related to shadow IT. Core Technology, '2020 Was a Year of Change: How Ready Was the Market and How Ready Were You?' (https://www.core.co.uk/2020-was-a-year-of-change-a-core-research-report). It is noteworthy that the literature on shadow IT focuses almost exclusively on cybersecurity issues: scant attention has been paid to the internal effect on an organisation's data.

The Specific Problems

A related problem is data governance. Who owns the data? Who is authorized to access, edit, and remove it? [5]

Thorough data analysis is the necessary preliminary to validated data transformation specifications. If the operating system is changing, some files will eventually become inaccessible and some access controls will be difficult to implement in the target system. This is a particular danger when data is being moved from legacy systems to a more modern platform. In extreme cases, it can cause the entire system to crash. [6]



Degradation of system performance is another risk of data migration. What are the system requirements? Are the applications running as fast as they should? Are they handling large volumes of transformed data?

Finally, organisational problems can be a feature of data migration projects which, of their nature, tend to be on a large scale. External parties may be involved. It is likely that the source data will reside in more than one geographical location. It is likely that IT personnel and business users will be geographically separated. These factors give rise to the phenomenon of silos, which defeats one of the primary purposes of a data migration project.

[5] The essential text on this subject is Steve Sarsfield, The Data Governance Imperative: A Business Strategy for Corporate Data (Ely: IT Governance Publishing, 2009).

[6] Detailed accounts of data migration failure are hard to find, for obvious reasons, but Timothy King, 'Did We Just Witness the Biggest Data Migration Fail in History?' Solutions Review, 20 March 2019 (https://solutionsreview.com/data-integration/did-we-just-witness-the-biggest-data-migration-fail-in-history/) provides a spectacular example.

Summary of Consequences

The consequences of these problems are failure to achieve the desired result and the almost synonymous ones of time and cost overruns.

A domino effect will occur. Throwing resources at problems as Go Live nears seldom keeps a project on schedule, but it will blow the budget and degrade the quality of the outcome. Pushing back testing events or even the Go Live date means that people expected to roll onto other projects will be unable to do so. The timings of those other initiatives will need to be adjusted.

In these circumstances the business can lose patience. It is not unheard-of for a vendor to be abandoned mid-project in favour of another because of the desired outcome does not otherwise seem capable of achievement. [7]

The solution may prove inoperable if the underlying data is not right. Incorrect data may cause the system to behave in unexpected ways or even not work at all if certain constraints are violated.

If data has not migrated correctly, or at all, the organisation faces potential revenue loss and/or legal impact. Missing data can become a public relations disaster. [8]

Inaccurate data leads to inaccurate forecasting and flawed decision-making. Metrics based on inaccurate data do not present a realistic picture.

Data issues identified after Go Live will need to be corrected and the corrections can cause costly downtime as they are applied. Downtime not only impacts profitability and productivity but can also breed a lack of trust in the new solution.

Data loss, flawed decision-making and extended system downtime all contribute to lost revenue. If the system is not available to take orders, or if products are not properly defined, the bottom line suffers.

If there are audit or regulatory statutes that dictate the depth of history that must be retained, issues with the data migration may cause these requirements to be inadvertently violated, making the organisation liable for non-compliance. [9]

If the new system does not act as expected and does not deliver the promised results, it will be seen as untrustworthy. Business users will lose confidence and may again start building their own workarounds.

[7] A useful perspective on this topic is provided by Will Yen, 'Software Implementation Successes and Failures—The Tale of Two Perspectives', 3 August 2018 (https://michaelskenny.com/points-of-view/software- implementation-successes-and-failures-the-tale-of-two-perspectives/).

[8] Some historical examples of data loss are given by Rebecca Moore, '4 real-life examples of data loss', 17 January 2019 (https://strongholddata.com/4-real-life-examples-of-data-loss/).

[9] There is, of course, an ethical dimension to these considerations. In February 2021 it was revealed that the on-line mental health service, BetterHelp, was selling client data to third parties.

The Solution

As with any major undertaking, careful planning is the key. The objectives of the data migration project must be clearly stated and quantifiable. Scope must be clearly defined. Critical success factors must be identified and made measurable. Acceptance criteria must be fully explained. Assumptions, constraints, and risks must be identified. The communication strategy must be determined. Business requirements and expectations must be identified fully. Technology and infrastructure considerations must be documented, as must data security and privacy requirements. A complete analysis of the current environment must be undertaken and documented. [10]

The following features are essential to the technology employed to conduct the data migration.



a. It must act as a migration staging platform to enforce data quality control. A migration staging platform that allows querying and analysis of the data in real time enables immediate identification of questions and needed corrections.

b. It must enable business rules to be configured and applied automatically to the data.

c. It must be capable of creating an exploratory environment for processing sample datasets for business user review.

d. It must be capable of building and automating the migration logic in steps to allow data discovery and exception handling.

e. It must employ data virtualisation wherever possible to avoid data loss and/or corruption.

Zetaris: The Networked Data Platform fulfils all these requirements.

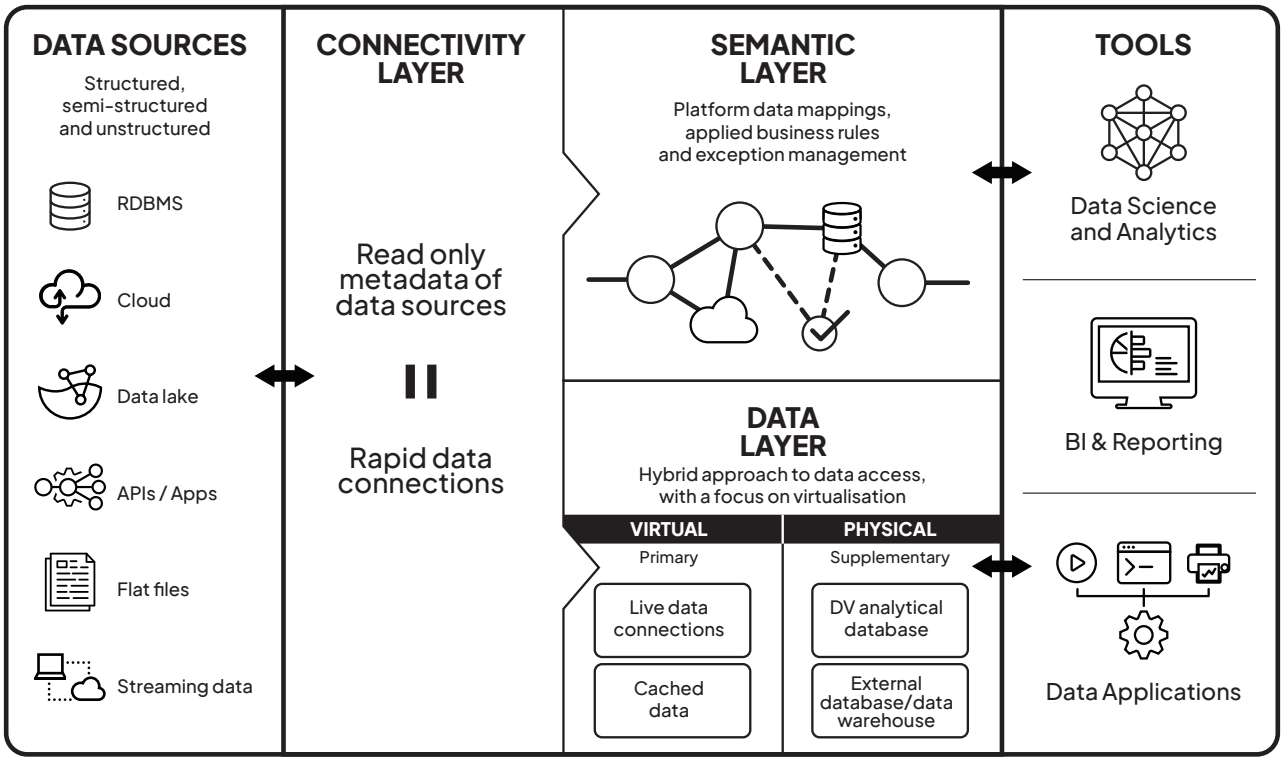
[10] An important article on the managerial implications of this subject is Jakob Heumann, Martin Wiener, Ulrich Remus and Magnus Mähring, 'To Coerce or to Enable? Exercising Formal Control in a Large Information Systems Project', Journal of Information Technology, Vol. 22, 3 (2015): 257–64.

The Technical Details

Zetaris: The Networked Data Platform is a technology enabling all organisational data to be analysed in any combination. It is not a tool: it is infrastructure, designed to reduce time and duplication and capable of performing deep analytics over the largest data volumes quickly.

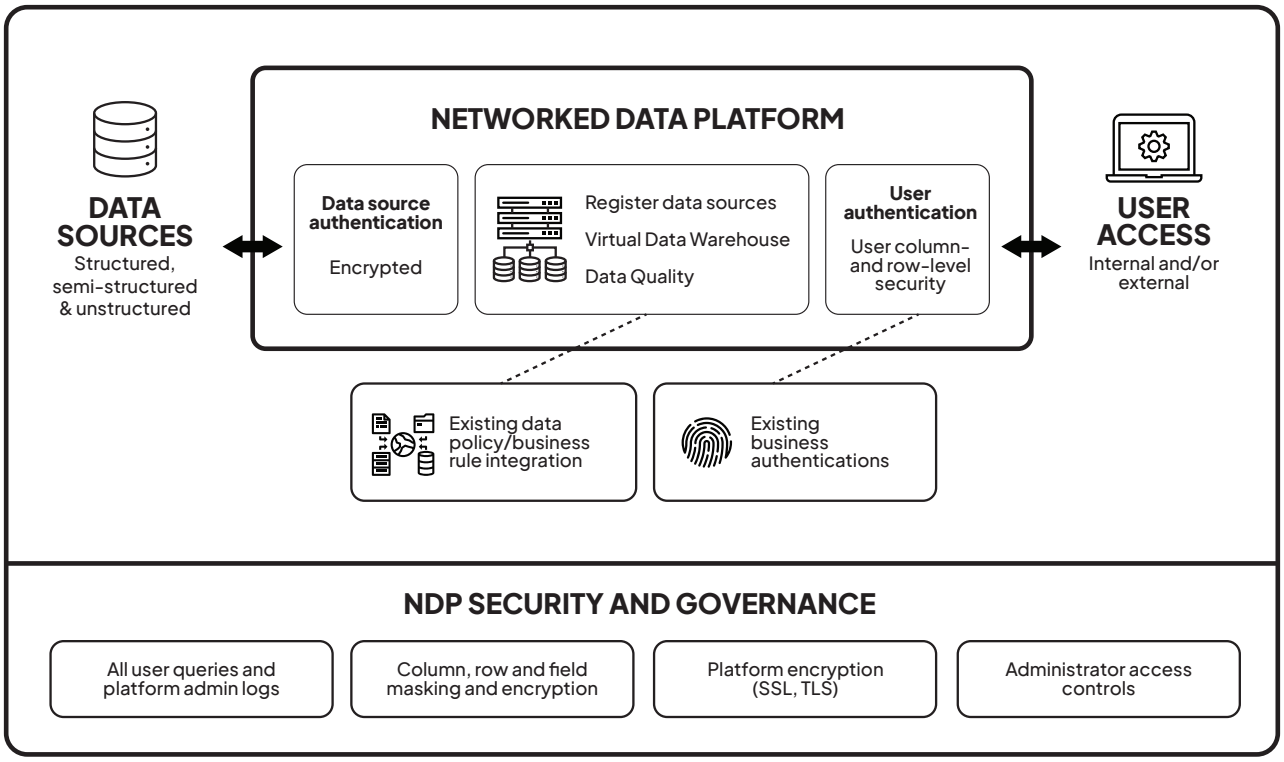
The Networked Data Platform represents speed, scalability, and platform independence. It realizes the latent power of the organisation's existing IT infrastructure to enable informed decisions on all the available data in real time.

Zetaris: The Networked Data Platform is biased towards Analytical Data Virtualisation (ADV). Analytical Data Virtualisation employs Massively Parallel Processing (MPP), allowing very large volumes of data to be interrogated by a single query, which avoids multiple trips back and forth between the application server and the database server. It can process different types of data: structured, unstructured, semi-structured, and ad hoc. ADV breaks down large tasks into smaller, independent parts that can be executed simultaneously by multiple processors communicating through a shared memory. This increases available computing power for faster processing. ADV also exploits dynamic partitioning, a technique by which multiple processes can be run simultaneously by a single CPU, to increase processing speed and maximize the efficiency of available computing resources.



The Analytical Data Virtualisation Layer

The Technical Details



The ADV layer is a bridge across data warehouses, data marts, and data lakes that substitutes for an integrated physical data platform. It can ingest and store the data itself where necessary (historical data, for example), but there is usually no need for this. ADV operates by ingesting metadata to create a federated metadata layer that enables different data types in different locations to be accessed and analysed as though they were consolidated in a single format. The data itself is neither copied nor moved. The Networked Data Platform allows 'lights-on' data migration because all the data being extracted from the source systems, transformed, and loaded into the target system can be accessed and checked throughout the migration journey. With Zetaris: The Networked Data Platform, the organisation can, throughout the migration process, compare data in the source and data in the target environment with Zetaris' reference information architecture and reference business data models for that organisation. This capability speeds up the migration process as both the source and target environments' data are compared to the one consistent business architecture.

The flexibility of the Networked Data Platform allows it to address all the problems specific to data migration projects.

a. Data governance. Zetaris: The Networked Data Platform acts as a virtualised data catalogue. Unstructured sources of information can be transformed into structured information sources through entity extraction and linking. Further, through its Policy-based Governance (PBG) feature, Zetaris: The Networked Data Platform not

The Technical Details

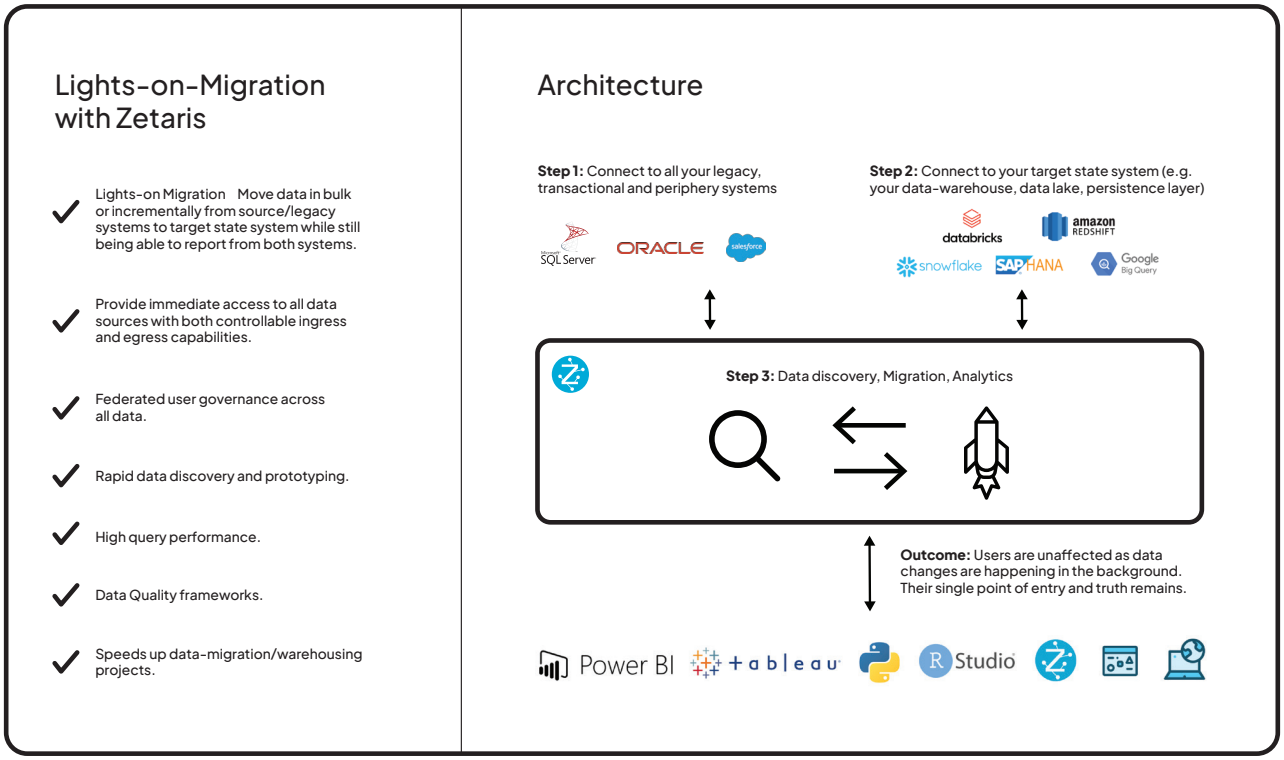
only integrates all the organisation's existing security and access controls but enforces business rules to ensure that no regulation (e.g., privacy) is breached.

b. Data quality. The ADV layer enables Zetaris: The Networked Data Platform to provide real-time automated exception handling. The Networked Data Platform completes a Data Quality Metrics Assessment (DQMA) on each field out-of-the-box on source application data and datasets. Zetaris' business data models are refined to incorporate the specific business rules of the organisation, defining the target business data model, the business architecture.

c. Exception handling. Data exceptions are identified and captured in a unified exception management schema which generates exception reports and dashboards automatically to enable root-cause analysis.

d. Processing speed. Zetaris: The Networked Data Platform is built on Apache Spark, the largest open-source community in Big Data. Scalable both horizontally and vertically, Spark is up to one hundred times faster than other Big Data processing engines, and its distributed DBMS, Ignite, delivers leading in-memory speed through MPP.

e. System reconciliation. Zetaris: The Networked Data Platform allows the information from the source systems and the target system to be reconciled continuously and checked for data loss during the migration process.



The Business Benefits

a. Connection visibility. Zetaris: The Networked Data Platform enables an organisation to hover over both the source and target environments to allow connection to all the different data sources, whether in the source data warehouse or elsewhere. This provides visibility of the metadata and the business rules (or the lack thereof). The organisation is provided with an environment in which hidden data bases and data objects can be discovered, analysed, prototyped, and documented.

b. Duplicate elimination. Zetaris: The Networked Data Platform offers quality control by acting as a migration staging platform. It enables the organisation to see and remove duplicate processing, duplicate data, duplicate storage, duplicate support personnel, and duplicate equipment.

c. Resource optimization. By connecting to all the data, Zetaris: The Networked Data Platform enables the organisation to discover what the applications really need and to build virtual data warehouses or virtual data products specific to the desired outcomes. In an environment where everything becomes visible, the organisation can determine what data needs to be moved. The business users and the data team can interact and agree that a particular table should be the support for part of a particular application. If business rules are missing, the fact will be detected and the business rules developed prior to re-locating the data in the target.

d. Architectural optionality. Zetaris: The Networked Data Platform allows the organisation to ask an important question: What does not need to be migrated? There may be some tables in the enterprise data warehouse, for example, that are unique source tables. If it is reasonably cheap and efficient to run them where they are they should stay. Not everything has to be physically moved to the target environment. By enabling the organisation to discover the business rules behind imperfectly documented data bases or data warehouses, Zetaris: The Networked Data Platform enables the organisation to arrive at a 'best-in-class' architecture. Some data can be left where it is because it is working well, it is processing quickly, and it is low cost.

The Business Benefits

e. Data product development. Zetaris: The Networked Data Platform allows the organisation to prototype data products rather than a new data platform. It enables the organisation to focus on the products that business users want. With Zetaris: The Networked Data Platform, the focus of the organisation shifts from IT domain systems to business domain data products. [11]

f. Business continuity. With Zetaris: The Networked Data Platform, the organisation can, throughout the migration process, compare data in the source and data in the target with user expectations of how the applications will perform once the migration is complete. Every day, every week, business users can check the migrated data to ensure that the transformations have been applied correctly. Similarly, if a report is urgently required, the fact that the migration is incomplete will not matter, because Zetaris: The Networked Data Platform can run the same query over both the source systems and the target system to provide the necessary information. Zetaris: The Networked Data Platform ensures no break in business continuity and continuing business value throughout the migration process.

g. Project insurance. The danger of the business losing patience with the migration process is eliminated. Wherever the organisation is in its migration journey, Zetaris: The Networked Data Platform ensures that the data can be queried. With Zetaris: The Networked Data Platform, the business is served from Day One, and receives incrementally better service as the migration progresses to its conclusion.

[11] The competitive advantages derived from Big Data analytics are well documented. See, for example, Nadine Côrte-Real, Pedro Ruivo and Tiago Oliveira, 'Leveraging Internet of Things and Big Data Analytics Initiatives in European and American Firms: Is Data Quality a Way to Extract Business Value?' Information & Management, Vol. 57, 1 (January 2020), Patrick Mikalef, John Krogstie, Ilias O. Pappas and Paul Pavlou, 'Exploring the Relationship Between Big Data Analytics Capability and Competitive Performance: The Mediating Roles of Dynamic and Operational Capabilities', Information & Management, Vol. 57, 2 (March 2020), and Samppa Suoniemi, Lars Meyer-Waarden, Andreas Munzel, Alex Ricardo Zablah and Detmar Straub, 'Big Data and Firm Performance: The Roles of Market-directed Capabilities and Business Strategy', Information & Management, Vol. 57, 7 (2020).

Conclusion

Data migration is a complex undertaking replete with traps and pitfalls. There is no silver bullet, and thorough planning is essential, but Zetaris: The Networked Data Platform provides an enabling technology, a staging platform, and a quality control mechanism that simplify, expedite, and facilitate the data migration journey. Zetaris: The Networked Data Platform:

a. Ensures connection visibility of both the source and target environments

b. Enables sight and removal of duplicates

c. Optimises resource usage

d. Allows architectural optionality

e. Expedites data product development

f. Ensures business continuity

g. Constitutes insurance of the data migration project itself.

Appendix: Data Migration Checklist [12]

Phase 1: Pre-Migration Planning

- Have you assessed the viability of your migration with a pre-migration impact assessment?
- Have you based project estimates on guesswork or a more accurate assessment?
- Have you made the business and IT communities aware of the need for their involvement?
- Have you formally agreed the security restrictions for your project?
- Have you identified your key project resources and when they are required?
- Have you determined the optimal project delivery structure?
- Have you created a structured task workflow so each member will understand what tasks are expected and in which sequence?
- Have you created the appropriate training documentation and designed a training plan?
- Do you have a configuration management policy and the appropriate software in place?
- Have you planned for a secure, collaborative working environment to be in place?
- Have you created an agreed set of data migration policy documents?

Phase 2: Project Initiation

- Have you created a stakeholder communication plan and stakeholder register?
- Have you tweaked and published your project policies?
- Have you created a high-level, first-cut project plan?
- Have you created your standard project document templates?
- Have you defined and formalised your 3 rd -party supplier agreements and requirements?
- Have you scheduled your next phase tasks adequately?
- Have you resolved any security issues and gained approved access to the legacy datasets?
- Have you defined the hardware and software requirements for the later phases?

[12] This checklist is derived from Data Migration Pro, 'Data Migration Project Checklist: A Template for Effective data migration planning' (https://www.datamigrationpro.com/data-migration-checklist-planner).

Appendix: Data Migration Checklist

Phase 3: Landscape Analysis

- Have you created a detailed data dictionary?
- Have you created a high-level source to target mapping specification? [13]
- Has the risk management process been shared with the team and are they continuously updating the risk register as issues are discovered?
- Have you created a data quality management process and impact report?
- Have you implemented Privacy Impact Assessment (for customer/contact datasets, GDPR-related)
- Have you created and shared a first-cut system retirement strategy?
- Have you created conceptual/logical/physical and common models associated with the source-to-target mapping specification?
- Have you refined your project estimates?

Phase 4: Solution Design

- Have you created a detailed mapping design specification? [14]
- Have you created an interface design specification?
- Have you created a data quality management specification? [15]
- Have you defined your production hardware requirements?
- Have you agreed the service level agreements for the migration?

[13] Often overlooked is that fact that direct mapping from source to target is impossible because the data structures are typically very different, meaning that the data definitions, meanings, and business rules are very different. Zetaris: The Networked Data Platform enables an organisation to compare the metadata defined in the source with the metadata defined in the target. This is achieved through Zetaris' reference information architecture and reference business data models for the organisation, known collectively as the business architecture. This capability accelerates the migration process because the architectures of both the source and the target environments are compared with a single, consistent business architecture.

[14] Zetaris employs its reference business architecture to drive the mapping and transformational design.

[15] Zetaris' reference business architecture drives the quality management specification.

Appendix: Data Migration Checklist

Phase 5: Build and Test

- Has your build team documented the migration logic?
- Have you tested the migration with a mirror of the live environment?
- Have you developed a reconciliation testing strategy?
- Have you defined your reporting strategy and associated technology?
- Have you created a data migration fall-back policy?
- Have you confirmed and planned your legacy de-commission strategy?
- Have you completed all relevant execution training?
- Have you obtained sign-off for anticipated data quality levels in the target?
- Have you defined the data migration execution strategy?
- Have you created a gap analysis process for measuring actual versus current progress?

Phase 6: Execute and Validate

- Have you kept an accurate log of SLA progress?
- Have you independently validated the migration?

Phase 7: Decommission & Monitor

- Have you completed your system retirement validation?
- Have you handed over ownership of the data quality management environment?

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