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Chapter 5: Designing end-to-end data pipelines and governance frameworks for real-time supply chain optimization

5.1. Introduction

Supply chains are the backbone of the global economy. They are the physical and logical network of organizations, people, activities, information and resources involved in the source, production, and delivery of goods and services from suppliers to customers. Supply Chain Management (SCM) is the art or science of getting products from manufacturers to customers. Mastering Supply Chains is viewed as a key driver of sustainable competitive advantages, as it creates real value, differentiates the firm in the eyes of customers, and impacts positively the bottom line. Improving sustainability and performance of supply chains has become a major research and innovation asset for both academics and industries. Dealing with sustainability and performance issues by means of academic research, communication, dissemination, training and support from early stages of the research and innovation process are pivotal for creating an enabling environment and an innovative framework, as well as for removal of barriers requiring a fully integrated approach at the global, national and regional levels. Hence, there is an increasing need to address research and innovation at the supply chain level – the traditional unit of consideration has been the firm - above the level of individual companies, both in the analysis of supply chain performance as well as in the design of new business models, processes and supporting information technology systems.

Supply Chains are typically viewed and modelled as networks of integrated organizations interacting to meet end-user demand (Financial Times, 2024; Axios et al., 2025; LifeWire et al., 2025). They are composed of interrelated actors, with various roles and interdependencies, joined by interorganizational flows (of products, information and fees). They contextually span firms of various nature (size, location, legal form, etc.) and need to integrate the various ICT Systems of the different actors in order to provide real time end-to-end decision making. Supply Chain Actors may perform various activities. The primary activities concern the transformation processes such as: Pack, Make, Deliver, Store, and Source. Besides these primary activities, actors perform various support functions (like technology development, purchasing, marketing, human resource, and firm infrastructures) as well as strategic management. Listening to the end-user demands, a number of "Plan" activities insert some control within the chain.

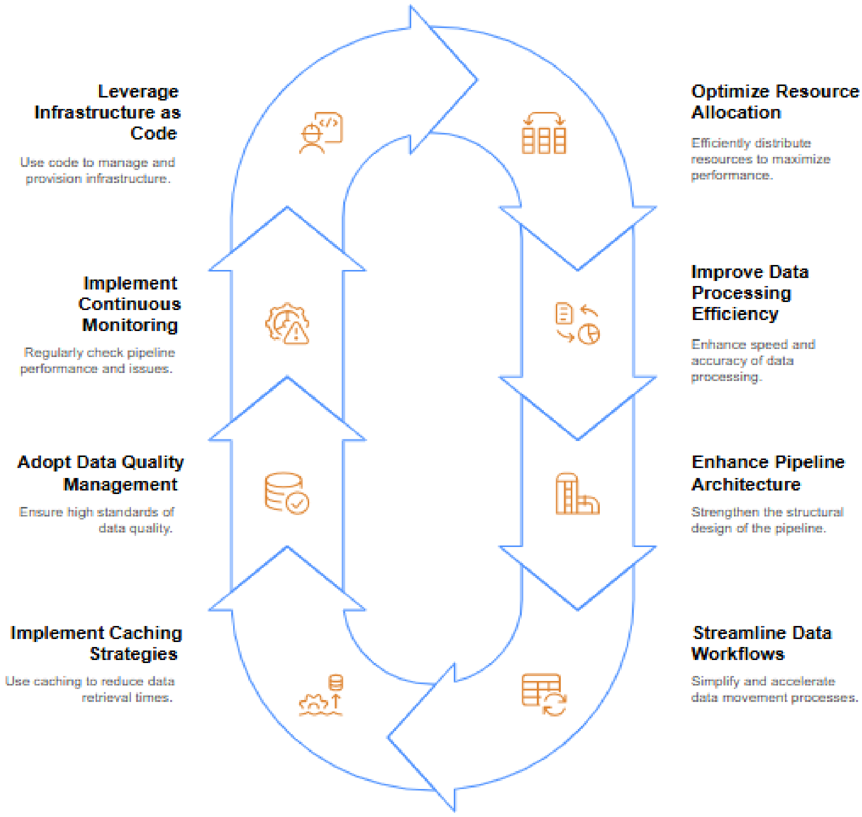

Fig 5.1: Data Pipeline Optimization

5.1.1. Background and Significance

The Logistics Information System (LIS) is designed to collect, manage, and optimize the supply chain information so as to improve the decision making process of different logistics actors. Communication between logistics actors relies on increased software, services and communication standards. But, issues appeared with added complexity related to the standards extension such as how to manage large volumes of information in real-time, how to ensure data confidentiality and security, how to have negotiations,... and how to perform decision making taking information from many sources. To face these issues, the Logistics Information System must be built according to the following criteria: Data confidentiality must be guaranteed, All information from actors must be accessible, in a centralized/aggregated way to optimize decision making. Improve Business processes with an Enterprise knowledge base approach. Minimize the number of data standards in use. The solution of the developed framework is to separate the data and the control layer. The mechanism of information sharing between the three main components (stakeholders locational/transportation/is sources), is presented. The data is expressed using an XML schema. Communication between the previous three main components is performed using data, control, update and external links: Data link (DL) allows data forwarding and broadcasting in the global supply chain. Control link (CL) allows transmission of requests and logistics network mapping between all framework components. Update link (UL) enables feeding the shards of the distributed database. External link (EL) collects information from the web on demand, which may be weather or traffic information. Data confidentiality aspect is also very important; the idea here is to provide management of the Frontend server to a trusted third party. Data shared by stakeholders to feed shards constitute the minimum necessary to operate the system. No one has access to others' information. When an actor needs information, he sends a request to the frontend server, which will contact the config servers via Control Links to get the location of information. It then gets necessary data from all related shards, aggregates the data, and uses the result to respond to the initial request via Data Link. The idea of the designed system is to empower logistics actors to ensure data confidentiality.

5.2. Literature Review

Until recently, most ideas in this research area were presented at diverse conferences without a central joint publication. By 2012 there was no basic publication or portal of information on hybrid control of supply chains and it was totally unclear how many initiatives on distinct parts of this subject were undertaken throughout the world.

This paper attempts a structured exploration of hybrid control of supply chains: it clarifies some concepts, relates them to existing schools of thought on supply chain management, and presents the first rudimentary overview of the state-of-the-art in this domain. By focusing on hybrids and (bit) control, the field is delineated from other research areas on supply chains.

Hybrid systems exhibit both continuous and discrete behaviour. In supply chain terms, hybrids are characterized by the concurrent use of continuous control, e.g. to keep inventory levels constant, and the scheduled/repaired on/off controlling of systems, e.g. to phase out suppliers in case of low quality and pace the production in case of large order spikes. In terms of the two aforementioned control schools of thought, hybrids are at the intersection of control theorists (who exclusively focus on continuous control) and researchers in intelligent systems (who have not studied the development of business and social networks and/or the concurrent use of different controllers).

This paper consists of sharpening concepts regarding supply chains, control, and hybrids and the first attempt at the systematic functional decomposition of supply chains regarding control aspects. This functional decomposition takes the form of a complexity tree hierarchy similar to the 5W hierarchies in system analysis. By presenting the basic first two levels of the decomposition the groundwork for future contributions to the body of knowledge on hybrid control of supply chains is laid.

5.2.1. Research design

The first research objective aims to define an end-to-end data architecture for network optimisation solutions in a general context, thus addressing research question 1. However, before presenting the high-level overview of the architecture, the research subclass of the investigated solutions is described next. According to the supply chain levels outlined in the prior section, several types of optimisation impact different areas or departments within a company. Network-related optimisation solutions particularly affect the supply chain design or knee area, and all the departments or entities involved therein.

This area of a company's supply chain typically requires the optimisation of fixed type parameters, such as transportation costs and inventory holding costs, in order to define the optimal location of manufacturing, distribution, and potentially all other non-obsolete plants. Accordingly, such optimisation problems are defined as network design or location-allocation problems, and it is assumed that all the parameters involved in the optimisation process are fixed (i.e. known) for a certain planning horizon, thus not subject to stochastic behaviour.

On the stakeholder corporate side, such a type of solution requires the involvement of the companies' headquarters and supply chain functions throughout the network design process, as well as a potential design solution presented to them (decision makers, the C-Level and senior vice president of the supply chain dept.). As regards the possible implementation of the solution, decision makers must also be involved in discussing the presented design scenario and having the opportunity to revise it multiple times until final approval is given. However, once the solution has been discussed, approved, and implemented, no further discussion is normally required unless some once-off event occurs that severely impacts the existing network. Accordingly, it is assumed that the outputs of the network design optimisation solution approved by the decision makers are all site-related and are directly incorporated into the respective databases.

5.3. Understanding Supply Chain Optimization

Supply Chain Optimization is a keyword recently coined by scientists in operations research and described as a sophisticated and quantitative set of methodologies that allow a Supply Chain Manager to assess and improve SC efficiency. Improving the efficiency of SC means assessing and optimizing the process of collecting raw materials, producing finished goods, and distributing those finished goods to customers. The reference to quantitative tools means relying on specific mathematical representations of real-life problems that allow for the exploration of much larger, more complex, or different scenarios than those generated by heuristic approaches. The term Supply Chain refers to the whole set of firms involved in the designing, production, and distribution of a final customer good or service. This means not considering profitable business units that simplify the process of optimization but directly challenge the added-value of the firm in the marketplace or network. This definition is more alive than ever, with multinational companies reporting billions of euros wasted every year in SC inefficiencies, exposing themselves to real competition, and entering on-the-field plays with new empirical competitors. As for the public sector, local governments, state authorities, and non-profit or for-profit public services are daily collecting data and running models to allocate scarce resources, build new public tenders, forecast service demand, and assess the performance of complex systems, ranging from hospital diagnostics to transports of citizens. Unfortunately, most of these initiatives rely on the artifacts of the interested analyst, making it impossible to reproduce or revise the analysis. The ISO 9000 standards would define as lost knowledge the topics tackled in these pages, as they are not recorded nor made these practices available to the public. As for the private sector, most of the current practices rely on Consultancy Business Units of the majors optimization and simulation tools, with appropriate vendors granting that their artifacts can only be run under their supervision. Current systems implemented in national public networks also have large room for outside scholars: the systems are often up and running, but only a handful of people are allowed to connect or manipulate them. In many cases this is publicly stated under public licenses, but not expressly recorded in archives or repositories.The logistics of supply chains becomes more complex and hence interesting as actors are allowed to become more disparate. Logistics information systems facilitate access to each other’s business systems enabling warnings early enough about supply disruptions to reschedule production and delivery in order to avoid costly disruptions. An ex ante management of savings and costs is thus possible that would otherwise be very costly if not impossible to take into account. The saving potential for more seamless supply chains is probably greater than hitherto acknowledged in academia. Supply chain management consists of the entire set of processes, procedures, institutions, and business practices that link buyers and sellers in a marketplace. A supply chain involves four distinct flows: product flow, information flow, money flow, and workload flow.

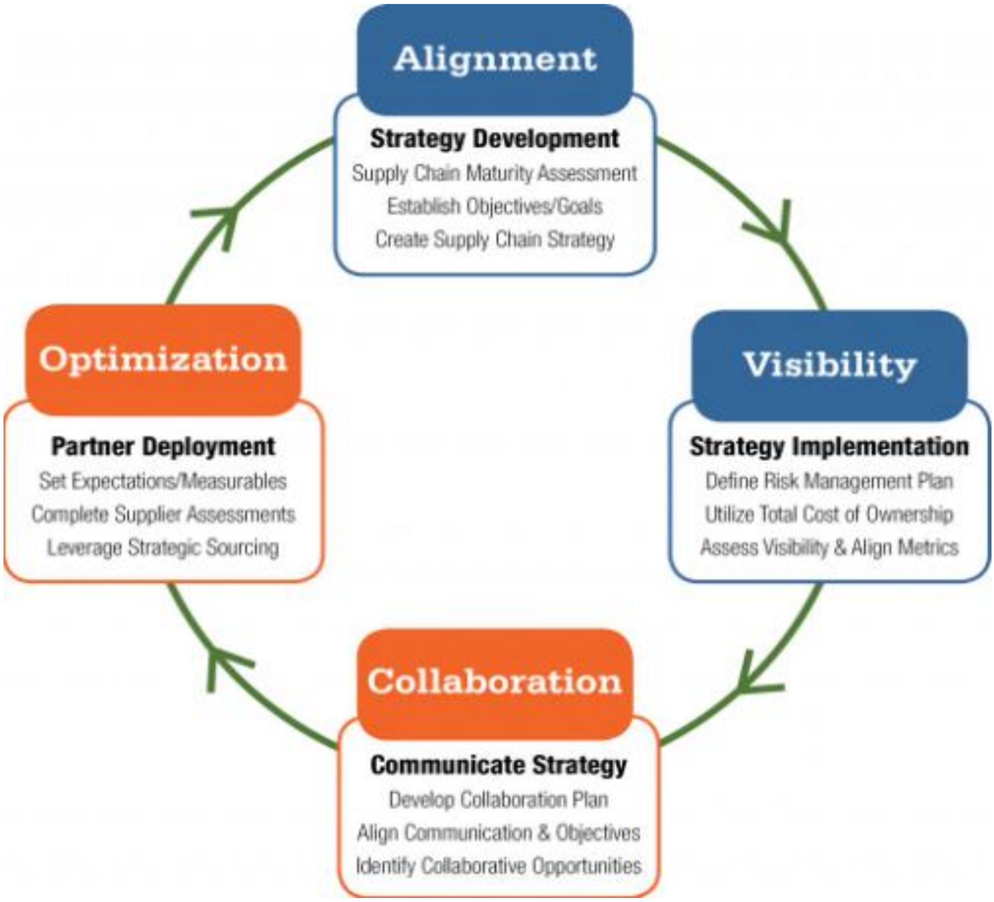

Fig 5.2: Supply Chain Optimization

5.3.1. Key Concepts in Supply Chain Management

Many companies view logistics as a competitive tool and an equal participant in the formulation of the business strategy. Some companies further this to include upstream (suppliers) and downstream (customers) partners and name this supply chain management. A supply chain consists of all activities associated with the flow and transformation of goods from raw materials to the end user, as well as the associated information flows. A supply chain is a network of facilities and activities that procure raw materials, transform these into goods and build final products, and make them available for consumption. In this sense a supply chain consists of the network of facilities and actors, which is involved in the on-going operation of the supply side. The emphasis is on the physical supply (inbound) side, i.e. the flow of crude materials to the input, and physical distribution (outbound) side, i.e. the flow of finished products to the output. However, as the result in this workshop makes clear, this typically also accounts for activities and relationships involving the suppliers' suppliers and the customers' customers.

5.3.2. Importance of Real-Time Data

Now, the need for real-time supply chain optimization is stronger than ever as companies aim to improve their operational performance by using data and powerful analytical algorithms on its derived insights. To better explain why this is the case, it is important to first clarify the importance of data and the importance of real-time data.

For decades, data has been seen as a special corporate asset, one that can be transformed into business insights through complex computational processes. In this regard, it is important to understand that data is an emerging corporate asset, a new factor of production that is believed to create business value in the same way as human capital, natural resources, technology, and working capital. Big data is seen as large, rapidly-growing stores of complex and variable information created by increasingly sophisticated information networks and devices. Its great potential can be harnessed by using powerful analytical algorithms to improve operational performance by optimizing decision-making processes in different business domains.

In logistics and supply chains, data that describe variables from strategic, tactical, and operational levels are generated daily, hourly, or in real-time from existing relational databases, legacy ERP systems, and spreadsheets. Also, new sources of data have emerged in recent years as a consequence of the integration of e-commerce in the logistics industry. New data sources include smartphones, sensors, GPS, and other devices that capture events that occur in physical and digital ongoing processes, and gradually describe them in detail and at a higher frequency. They produce huge amounts of high-velocity unstructured data that needs to be transformed into structured data sets in a format that can be further computed, mined, and modeled on powerful analytical algorithms.

5.4. Data Pipeline Architecture

The data pipeline encompasses a major category of methods and protocols for collecting raw data from various sources. It may involve data transmission over a network or the internal transfer of data between hardware such as storage devices. It may also mean a sequence of data processing, conversion, and analysis made by software. Pipelines can include data filtering and cleaning procedures or integrate identity resolution and reinforcement of data confidence. Considered the stages of information processing, the information pipelines span the data model, the workflow, and the analysis.

Any data application is only as valuable as the underlying data modelling. If the modelling of the data is too strict or other constraints are too formal, it may entrap the users into too constricting a process. Individual, personal-based interactions may circumvent data modelling formalisms altogether. If analysis is constrained too strictly, it may prevent exploration of new insights. This is particularly true in the early stages of much exploratory data analysis. Worked answerable data models are only just this, not completely answerable.

In this instance, there is just a data hypothesis that data outside the reported trend may support the case for developing new COVID vaccines. In this initial analysis of the case, no data exists on vaccinations or side effects or their correspondence in space and time with new strains or deficiencies in antibody development. As a consequence the charts must support a starker analysis than can be produced with conventional, interactive packages. Pipelines already exist for querying the appropriate data from the public domain stores and all data have been wrung from the original data sources using public-domain inference codes.

5.4.1. Overview of Data Pipelines

A data pipeline is a system used to automate the processing and transmission of data (Reuters, 2025; Snowflake et al., 2025). It can extract data from the source system, through cleaning, conversion, loading and other steps, and then transfer to the target system. Due to the increasing diversification and complexity of Data Sources and rapid growth of data volumes, building an efficient Data Pipeline has become crucial for improving work efficiency and solving complex problems. The main function of the data pipeline is to improve the efficiency of data processing, ensure the accuracy of data, and ensure the security of data. The data pipeline through the automatic way can greatly improve the efficiency of data processing.

With the rapid growth of data volumes, a smart data placement approach is essential to automate the process of transferring data between data sources and storage systems. The goal is to extract the analytics value while minimizing the involved costs. This is challenging due to various issues, such as unknown data sizes, data performance degradation and transfer violations. This presents an approach for real-time placement of new data to StaaS using a machine learning-based ranking method. This is demonstrated through the case of a big data pipeline.

5.4.2. Components of End-to-End Data Pipelines

The design of data pipelines must take into consideration the expected usability of the piped information in advanced analytics initiatives. Generally, data pipelines can be composed of three core elements: in-border extraction and transformation processes, outbound load processes, and monitoring and control processes. The first and third elements must support data extraction from data sources in their in-border format, data transformation for better usability across multiple applications primarily through a process of denormalization, and making the data inbound an integrated natural format for alleys. The data integration process is crucial as different applications have different ways of representation, and it is a process that must be widely context programmed. In output load processes, integrated data must be loaded to the long-term repositories on which the business intelligence or business-setting platforms runs. This generally represents the most time-consuming operation in the pipeline implementations, therefore, it has to be conducted in a differential approach. The outputs of the data pipelines can also be shared in different needs and views, which mandate that mounted systems must generally be targeted outputs by pipeline applications.

Generally, the notion of governance means a way of guiding information possibilities, as such to enhance potential ways of information use for the betterment of people's lives, and protect the information sources from misuse. Governance frameworks typically have a common task: they describe the relevant parts of the governable world, information assets, assess those assets, specifically establishing the opportunities and risks of amelioration or deterioration. Governance frameworks typically provide the means of the desired situations as far as the governable world gains direction towards opportunities and reduces risks or mitigates threats. Being informed is necessary and not enough on its own. Organizing has to mean establishing the reasonable order of governance so that governance tries to establish the relevant social transformational processes in their understanding, as well as realizing them realistically in installations of adequate devices.

5.5. Real-Time Data Processing

Real-time processing of streaming data has become a crucial challenge for organizations in recent years. A new generation of applications such as telemetry, clickstream analytics, and stock-market prediction systems produces vast amounts of data that need to be processed in a timely manner. Due to the increasing pressure on businesses to perform decision-making on increasingly short time frames, data warehouses must be updated in real-time to keep data current and make it available as soon as possible to decision support applications. In this context, the process of extracting, transforming and loading data from source systems into a data warehouse, generally termed ETL process, is required to be performed in real-time. At first, information is extracted from data sources and transformed by filtering out irrelevant data, annotating data to give context to them and aggregating/deriving data to produce higher-level information. Finally, results are loaded into a knowledge base for further processing.

However, developing ETL systems for minimizing latency and providing real-time data warehouses is a challenging and important topic of research. In this context, there is a new generation of systems termed real-time ETL or simply 'ReETL', aimed at making data source operational data available in data warehouses soon after its generation, combined with scheduling approaches capable of evicting old data from the data warehouse database in order to keep resource consumption under control. In this real-time business intelligence (BI) paradigm, streaming data from different sources are integrated, providing a unified representation of operational data to be analyzed by users. Effective data governance improves data quality and decreases operational costs. However, after a ReETL system has been developed, data governance for streaming data becomes a challenging task. Data quality, provenance and metrics are well-established concepts, but current solutions do not address the specific requirements for handling streaming data. Moreover, existing data governance tools do not address the specification of data governance for streaming data.

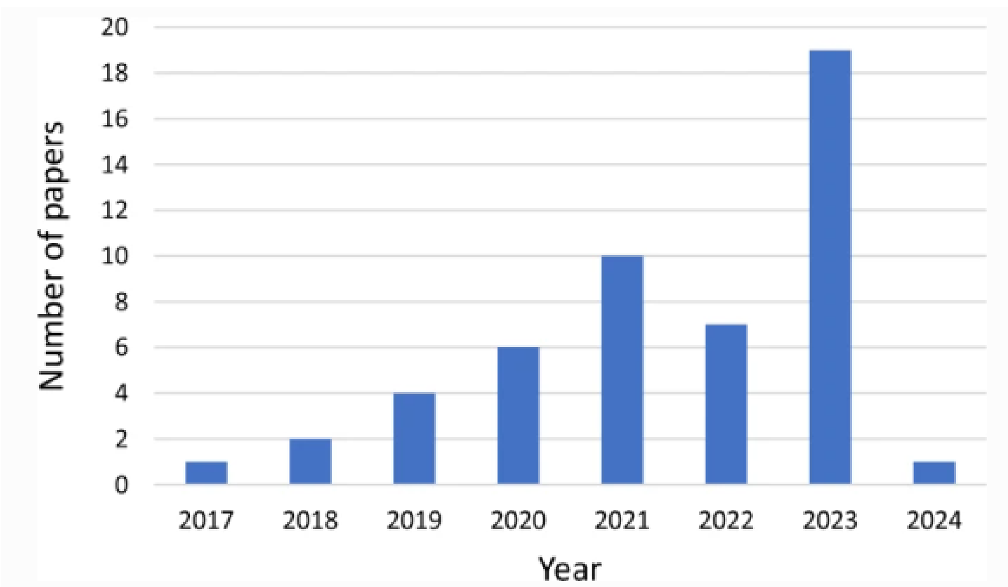

Fig : Data pipeline approaches in serverless

5.5.1. Stream Processing vs. Batch Processing

In both batch processing and stream processing, the same principles are involved in taking raw input data and transforming it into an enriched dataset. In batch processing, raw data files stored in a data lake are queried to produce aggregated datasets in an exterior destination. These designed queries run from an ETL program on the data lake on an on-demand basis and produce outputs stored in the data warehouse. In contrast, in stream processing, the goal is the same, but continuous queries run on the files produced in sub-second ingestion delays from a fast data exploration system on a 24/7 basis, generating aggregation outputs on Kafka queues or similar technologies. The development of queries is integrated into the same design document as the batch queries, but they are separate implementations and will hence be stored in a separate notebook.

Depending on external factors including the data volume and desired refresh rate of the destination data, the architecture of a data engineering solution can incorporate either of the two processing models. These need to be established at the very beginning of a project as they will affect the entire workflow including, etc. A distinct architecture can only be switched to with increased effort once implementation has commenced.

Batch processing is a mechanism for harvesting data stored in a data lake and producing aggregated datasets that are stored in an exterior destination. This data is raw but typically stored in raw parquet files. Queries are SQL statements defined in a pre engineered structured format for a data processing tool that run from a file on the data lake, retrieving the desired raw tables from the external data lake and producing output aggregation tables that are stored in the data warehouse in a destination as a .parquet file, ready to be queried by the business user. The aggregation queries will also trigger dependent queries that collapse their input data sets into the requested external destination.

The first thing to do when migrating to this processing model is to assess what output data is already estimated in the old environment. In most cases, there is an extensive assortment of aggregate datasets that with varying frequency produce valuable and often vital insights for the business user. In conjunction with formulating the requirements for the entire visualization segment, these datasets need to be migrated to the new environment. The methodology by which these observations are currently calculated needs to be well documented. An overview of each dataset's calculation should be provided in a standard structured format that specifies the source data set(s), the transformation(s) applied, the destination, and how often the data is consolidated. An effort needs to be made to gain full knowledge of the existing setup and reverse engineer from input to output data.

5.5.2. Real-Time Analytics Tools

Real-Time Analytics tools (RTM) have become an integral part of a growing number of companies that are trying to adopt real-time business models. These tools can analyze time-dependent, voluminous data from various streams of data sources as real-time and virtual valuations on a time window. They allow simple and deep monitoring of the business flows of interest and are fast, dynamic, and responsive. RTM tools provide an intuitive and often visual way to define the business metrics of interest in near real-time. The metrics can be monitored on the go by designers and users of the tool. These tools are fully automated after the business metric definition without requiring a machine learning and statistical approach. They often come up with an event-based and one-pass data filtering approach. They are designed to minimize I/O and aggregation data-cost and recognize the business flow change opportunities as soon as possible. Real-Time Analytics tools allow business management and monitoring on a smart phone/viewing devices. They can be efficiently integrated with big data platforms through tools. They are easier to use for practitioners in business and require low-end result viewing devices. The flexibility in building the metrics is also available in most RTM tools. The services offered by some RTM tools are completely free for the small scope of business scenarios even though the creating and viewing devices may require client software/hardware. The open-source versions of some RTM tools are also available.

5.6. Data Governance Frameworks

The management of data at high volume velocity under a real-time paradigm presents a new emerging challenge for traditional governance approaches. The proposed framework is built upon an end-to-end architecture that satisfies the data processing and analytics needs in a scalable, maintainable and governed way. The framework indicates a zoned Data Lake that allows rapid ingestion and access of new and evolving internal and external data sources, effectively parsing both structured and semi-structured data formats. A comprehensive set of predefined and extensible Data Operations allows rapid development of automated and governed data pipelines. The frameworks' innovative governance approaches leverage pre-existing metadata and governance insights, providing unique solutions to common data governance issues.

Governance of high volume event data sources in the Real-Time Data Lake is enabled by retaining pre-existing metadata, monitoring value ranges and cardinalities, and estimating update frequencies. Additionally, operators are documented in an extensible knowledge graph and querying against this graph is provided. Labeling mechanisms for datasets and operators allow users to find pipelines to filter and explore datasets of interest at all times.

Furthermore, a Data Governance Knowledge Graph allows to represent the relations between the various data artifacts of the E2E Data Pipelines and Decision Support frameworks allowing to query them in a semi-structured way to address questions like “What are the historical decisions made on a data artifact?” and “Which human users accessed and modified a certain dataset or operator artifact?”.

The end-to-end test and validation framework relies on shared runtime environments with aggregate synthetic data sources. It is structured under a knowledge graph, ensuring testing in isolation and in aggregate. The testing framework allows rapid maintenance of large testing scripts and easy adaptability of pre-staged test cases to newly added or modified pipelines and supports validation of all parts of the framework required by common end-users asking complex questions on event data, including monitoring, exploration, and forecasting of various KPI metrics.

5.6.1. Importance of Data Governance

The proposed architecture encapsulates everything that data producers need to do to make their data available and useful for ingestion by data scientists, who usually need to work with several data sources co managed by different stakeholders. As the majority of the action happens at the Source tier, it is important to formalize the expectations from this tier for a future successful collaboration with data scientists and providers. Long and exploratory queries involving partitioned data holders and cross-cutting attributes go beyond the current capabilities of traditional data warehouses as they cannot keep up with the proliferating operational systems and magnitude of data. Non-trivial unification of heterogeneous data held in distinct database models once again calls for a custom solution for data scientists. As one application of the generic data warehouse architecture, in one company, a dedicated team of data scientists compiled over the years a large post-processing pipeline to ingest data stored in plain text on local discs, and supporting an array of use cases ranging from the daily visualization of physical quantities to devising and tuning operational strategies. Data processing covered auxiliary data sources owned by data governance team whose exposure was out of the consideration as some i/o coordination effort with data governance team seemed unlikely to yield an advantage on decision-making horizon with regards to direct access provided to operation scientists. Ad hoc ingestion logic was crafted for each data source, hindering onboarding of new ones. A reference meta-architecture linking up all the specifications detailed in this paper is proposed to operationalize and automate data governance. Data sources’ exposure, access to data, datasets’ schema comprehension and conformance are illustrated, as well as the ways in which data ingestion is envisioned on a respective onboarding task.

5.6.2. Principles of Data Governance

A data governance framework is defined here to ensure data quality and compliance in its use throughout the organization. The defined framework follows the principles recommended by the Data Management Association (DAMA) and aims to be general so that it can be customized to the requirements of the organization. However, some principles may be more adapted or manageable for a smaller organization than others. It should be noted that the framework encompasses compliance with legislation, regulations, internal rules/policies/procedures regarding consumer rights, auditing bodies, retention/storage periods and procedures, processing criteria, and security/privacy. Particular aspects of the governance framework must be investigated with external lawyers, and the feasibility, tools, and processes of compliance must be determined on a broader scale than the data management team. Internal/readily accessible policies and procedures, including policy controls and asset inventory (data classification), must be reviewed and evaluated with the data stewards and domain owners. It should be determined and improved whether said controls have been implemented correctly, are effective, and have been operating continuously over time.

Data Governance Aspects (Information Security Tiers): Data Governance encompasses business responsibilities, procedures, and resources for ensuring the proper use of sensitive and regulated information and safeguarding these assets. The goal of Data Governance is to preserve the relative value of sensitive and regulated information to GoldenGate by ensuring compliance with applicable laws, regulations, internal policies, and the guidelines of the Data Governance Committee. Sensitive and regulated information may include but is not limited to personal data, financial data, trade secrets, and intellectual property. Data Governance is defined as the overall corporate framework that prescribes rules and procedures for the use of sensitive and regulated information in a standard and harmonized manner across all segments of GoldenGate.

5.7. Conclusion

This chapter underlined the challenge and necessity of disruption-proof supply chain governance considering the advent of digital twin technology. The objective is to design end-to-end data governance models and pipelines for real-time supply chain simulation, including data sources, data storage, data preparation, data analysis, and data visualization. Failure and success scenarios of supply chain disruptions and their operational KPIs were analyzed through exploratory data analysis, covariance-based structural equation modeling, and predictive modeling methods, respectively. The designed data governance pipelines and architectures leveraged data storage solutions online and in cloud systems and fully automated batch mode data preparation pipelines. The developed data governance models enable 1,500 times faster governance of information systems over 10 times larger scope and 5,000 more artifacts compared to traditional peer governance models around a "governor" stakeholder. An initial prototype of the informatization system was developed and confirmed of applicability in practice by pilot interviews.

The proposed pipeline design, governance framework, and provisioning architecture pave the way to expand the strategic landscape of SCTs fundamentally and stimulate development in the supply chain resilience modeling research field. Future research will be carried out in aligning their proposed frameworks with existing industrial standards. This would enable the capability of ensuring real-time dependability of extensive supply chain ecosystem simulations even in a seamless privacy-preserving sharing manner while preserving extension flexibility. Improving supply chain tracing and prediction solving efficiency on their platforms in multi-stakeholder scenarios with large amounts of raw monitoring and tracing information is also of interest.

5.7.1. Emerging Trends

The global Supply Chain Management (SCM) market is a foundation for total sales over 18,574 million Euros in 2013 and will reach 28,678 million Euros in 2018 at an annual growth rate of 8.56%. The focus is initially on the global SCM technology and market environment. The information is further art and introduced with typical technology like SaaS/Cloud-based architecture with supply chain intelligence. Advanced SCM technology with Supply Chain Performance Management (SCPM) at the level of prescriptive analytics and more automated decision processes is mapped on the SCM market with an emphasis on industry-specific features especially in food, drug and same-day delivery supply chains. In storage and delivering, research fronts of brand new design technology to augment the synchronous outcomes of overall productivity, accuracy, arrival time punctuality, and cost effectiveness of system operations are sketched. In this regard, complex structures like a 3-dimensional cage storage system and efficient handling with drones and robots will be a radically new approach. In the end of supply chain analysis, trends in supply chain monitoring with cost effective on-line and prediction abilities are mentioned and needs for the research are raised from a whole chain view. Optimization of the function is an important issue concerning achieving higher social welfare with an appropriate trade-off between rationality, efficiency, and social equity in considerations of the complex interactions behind vehicular transgressions and accident occurrences. It is important to build models for understanding the dynamics of a model by integrating real transport, traffic, and environment data for analyzing both historical events and current operations.

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