FNT

// simplify complexity

GUIDE TO INVENTORY MANAGEMENT SYSTEM REPLACEMENT

HOW TO MIGRATE DATA WITHOUT IMPACTING BUSINESS

IN THIS WHITE PAPER:

The Inventory Management System is a central part of an operator's management infrastructure. It is used throughout the organization and has interfaces to many other data bases, OSS/BSS or NMS/EMS. Migrating to a new inventory management system is a big, often difficult undertaking. It does not have to be a source of hardship, however. A smooth, zero-downtime data migration and efficient go-live of a new solution is achievable. This white paper details how to change inventory management solutions in such a way that prevents disruption and keeps all processes that rely on inventory data operational.

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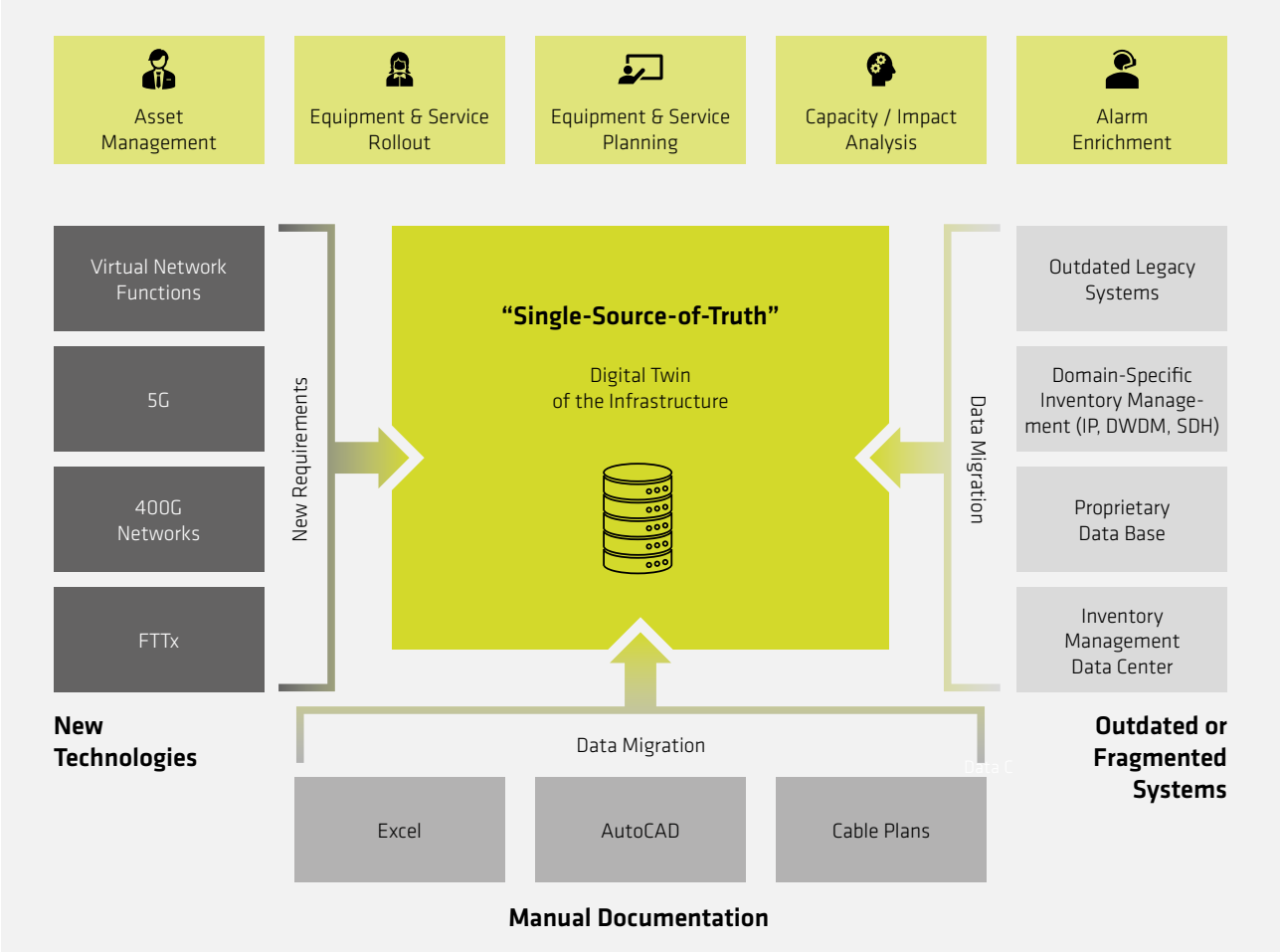
Why migrate data?

Network inventory management systems are vital for keeping track of IT and network assets. They make it possible to know what devices are on the network, what their configurations are and how they are interconnected, when software licenses will expire, and whether any assets are reaching end of life. They also allow planning of new equipment for new customers and planning of changes for network optimization, as well as dismantling of equipment when customers leave. Every telecommunications company will, at some time, need to consolidate inventory systems or replace a legacy inventory management solution. One common reason is to address new technology challenges such as 5G rollouts or hybrid, VNF-based networks. These technologies may span data center and network and add requirements that many current management systems are not able to handle. Virtual network functions, 5G, FTTx, and 400G networks all require more advanced methods than most older systems can provide.

Other reasons include the need to accommodate new, comprehensive planning and network automation use cases. Manual documentation, which includes Excel, AutoCAD, and cable plans are still in use but not compatible with the increasing dynamics in modern networks and the final goal of network automation. Eliminating fragmented systems that have accumulated over time is another frequently cited reason. Often such fragmented solutions "work in silos", with some combination of proprietary databases and specific inventory managements for data center IP Network and DWDM Network employed. Multiple systems existing in parallel within an organization is a drag on efficiency. Or the current system is simply outdated, maintenance has become uneconomical, or the vendor will discontinue support.

Whatever the trigger, the data within the inventory management system is an asset that must be properly tended. This data supports critical business functions such as asset management, capacity management, equipment and service planning and rollouts, impact analysis, alarm enrichment and many others. Important decisions are made based on this data, so the system's availability and its accuracy are of the utmost importance. A smooth, zero downtime data migration and efficient go-live of the new system is essential to prevent operational damages and business impacts.



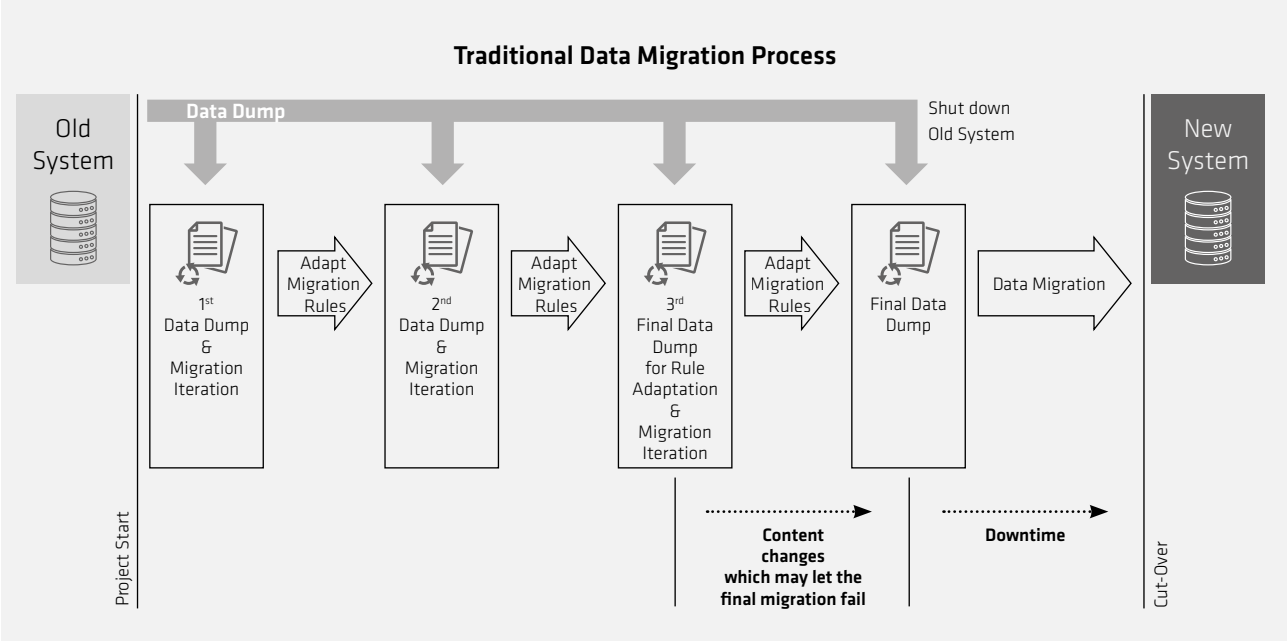
Moving data from its current location into a single source of truth digital twin of the infrastructure enables telcos to control data quality.

How you migrate systems matters

Data migration – the process of preparing, extracting, and transforming data and transferring it from one system platform to another – is known to be difficult. 40% of data migration projects are either over time, over budget or fail [1][2]. Data migrations have become even more complex in recent years due to new technologies, such as virtualized functions in the data center, and new use cases like automation. These make it even more challenging to extract data from the source, transform, and load it into the new target system.

Service Provider's and Telecom Operator's management systems are especially complicated and susceptible to the difficulties of data migration. Their networks have complex data models that encompass many different technologies from various suppliers. If you follow the right framework, however, a zero-downtime system replacement is achievable.

Traditional data migration processes have inherent flaws that jeopardize migration success. These frameworks are based on sequential data dumps and multiple migration iterations and adaptation of migration rules. Each time a migration sequence is performed, the risk of content changes corrupting the final migration run is a real threat. This type of migration process also requires system downtime between shutting down the old system and cutting over to the new. Any system downtime should be avoided at all costs, as the longer the system downtime, the higher the impact on operational processes and ultimately the business.



A traditional migration framework is prone to errors that jeopardize migration success.

[1] Practical Data Migration Second Edition, Johny Morris; [2] Howard, P., Data Migration Bloor Research

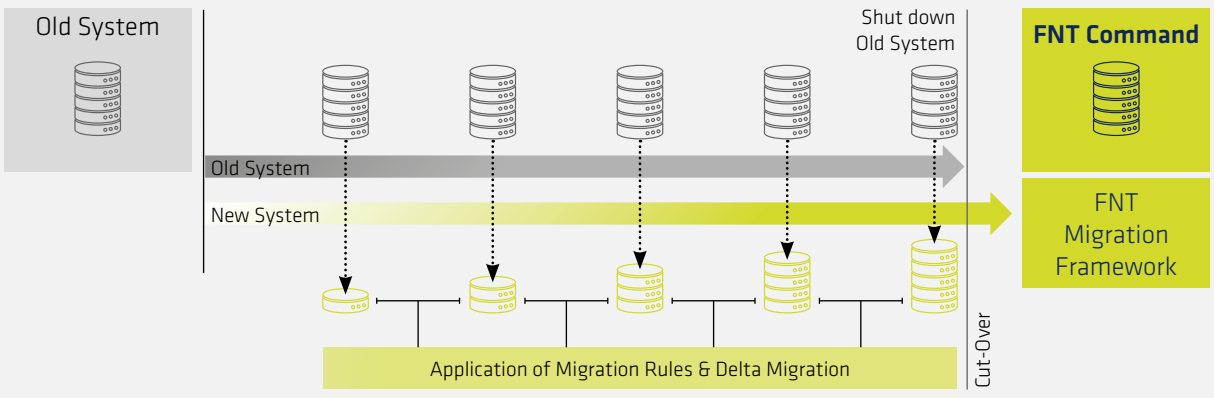
The preferred process uses a continuous delta migration methodology. In this approach the new system runs concurrently with the existing system, eliminating the need for downtime. Only new data sets or data that have been modified since the last migration was executed are adapted. This is done by comparing the full data between the source and destination platforms but only creating and changing data which are new or different. As the read and compare operation works much faster than the create and change operation, smaller, faster data transfers and migration cycles can occur to enable the continual adaptation of migration rules.

Since both systems run in parallel and data is continuously being aligned, the ongoing delta migration process does not require any downtime. When the migration quality reaches the required level, the old system can simply be switched off and users can proceed with using the data in the new system. A zero-downtime migration will have been achieved.

Having an integration framework available is a precondition to efficiently implement a continuous delta migration project, which makes a zero-downtime system replacement possible. Implementing all the mechanisms from scratch is far too time consuming and expensive an endeavor. The framework should support openness and configurability. Configurability is especially important because it eliminates the need for costly and time-consuming programming, a hallmark of the overall solution. It allows the user to adapt the new models in the target system to the models of the solution to be replaced. This significantly lowers the complexity for the data migration and makes the move of the end users to the new systems much smoother, as they easily can find the data in the new system according to their experiences with the old.

This framework also puts the user in control. When the new inventory data solution is standard off the shelf, open and configurable, the customer can decide how involved they want the solution provider to be. The customer can use their preferred integrator, do the integration work themselves, or take advantage of consulting services and professional development services of the solution provider for software extensions, if required. Execution flexibility is a desirable option to have available.

FNT Continuous Delta Migration Process



FNT's migration framework is based on a continuous delta migration process that yields a faster migration with fewer issues.

The challenges of a traditional migration project

Given what we know about traditional migration processes, five key challenges have surfaced that operators will need to address.

1

Downtime
Most system migrations need at least some off hours, days, or even weeks. Downtime is a critical issue for users, as the system is not available for planning or fault analysis during this time. Additionally, during downtime the system will be running out of sync with interfaced systems. Data errors can occur, which impacts the ability of the people who use it to do their job. Minimal system downtime should be a priority.

2

Data Quality
The quality of the data in the legacy system is often a challenging problem for the data migration. While quality issues may have already been present in the legacy system, users were accustomed to these issues and adopted workarounds to accommodate for them. During data migration these problems will surface, and they need to be fixed or, at least, handled properly so they do not contaminate the new system.

The most common data quality issues are caused by:

- The source system is an offline system, which almost always causes data inconsistent with the physical network.
- The source system is missing configuration rules and allows misconfigurations. This happens when the source system is an Excel file or a simple database without validation rules.
- The source system may allow incomplete documentation and users may not have documented all the required information.
- Data may come from several source systems and be duplicated and contradictory. Identifiers may not be set properly, so objects cannot be matched.

3

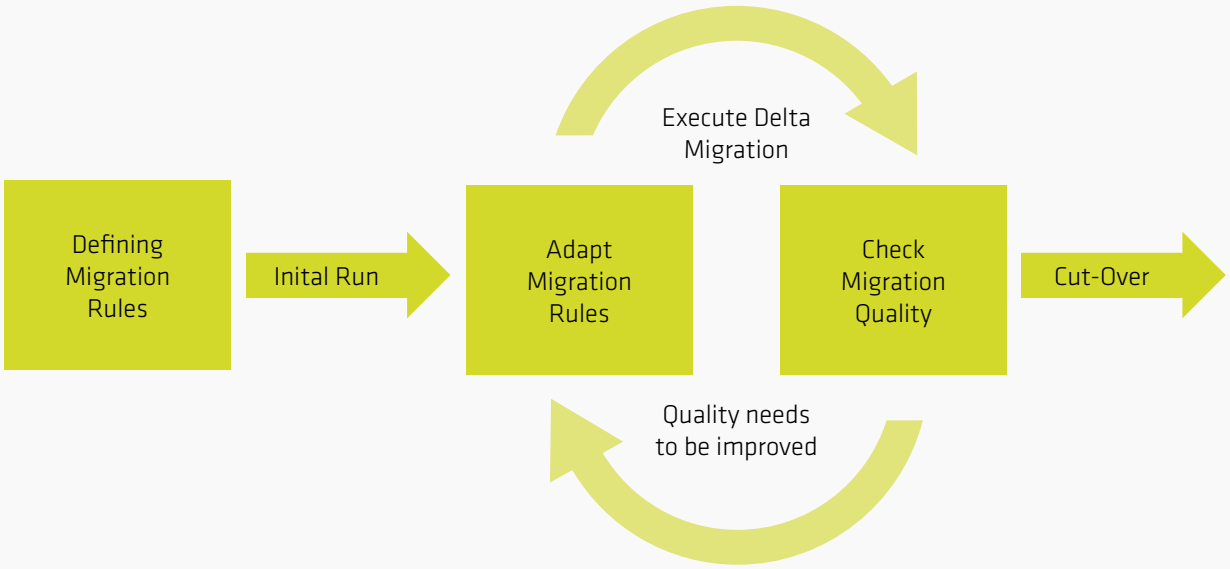
Know-how and Skill
Assembling the right team who understands the content of the database to be migrated, who have the right migration skills, and are capable of accurately setting up the migration project are all critical factors. A deficiency in any of these areas can derail the project and be very costly to the organization. These are among the most common reasons businesses cite for migration project failure, and they are also the most avoidable.

4

Interface Migration
Without fail, some legacy systems are tightly integrated with other systems. Most of the installations are based on a fragmented and homegrown tool landscape. There may be reconciliation from the network trough NMS/EMS or discovery systems to align data with the network reality, or there may be integrations into OSS/BSS systems to align higher layer systems with the inventory data. Looking in the daily praxis, most of the integrations are proprietary. Installing a new inventory solution requires these integrations be replaced. That requires a high degree of openness, flexibility and configurability of the new inventory solution to keep efforts and cost under control.

5

User Training & Acceptance
Ultimately, users must work with the new system. This new system will be competing with a legacy system that has grown over decades. Even if the new system provides high functionality, sophisticated features, and a user-friendly GUI, it is possible some old functions that users are accustomed to will not be present in early replacement steps. This can cause users to resist the new system. Without user acceptance the project will be delayed, and delays can cause tensions – and costs – to rise.



Continuous delta migration process

Components of a migration framework

A successful, zero-downtime system replacement can be realized with a framework that uploads and aligns data with the new application. The framework should encompass interfaces with data sources like NMS, EMS, Managers, BSS/OSS or any other database. This framework is a software concept that will govern the entire migration process, which encompasses the upload, transformation, and alignment of any kind of entities, attributes, or relations. The alignment process can be run based on a predefined schedule or on demand. The framework should log the results of the process and inform users of successful data uploads, data clashes or any other errors that may need to be handled by a planner or operator.

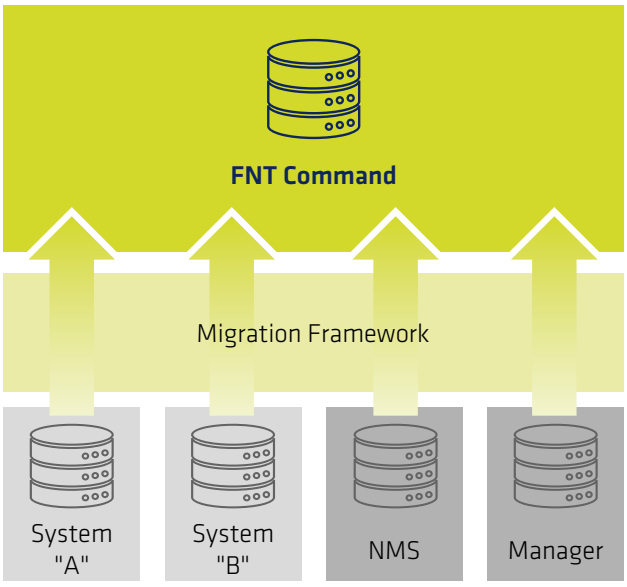
Beside alignment rules, which can be defined in a graphical ETL tool or written as JAVA code, the framework should provide configuration options. For example, mapping tables to map source data to the new system, or black-/whitelists to include and/or excluded entities from migration.

The most important feature of such a framework is the calculation of deltas between the source and the new target system. Such delta calculation would speed up the alignment process between the source systems and target system dramatically, as only missing entities must be created in the target system. This accelerated procedure allows the running of an alignment process several times a day. For each run migration rules and mapping tables can be adjusted according to the latest results. The process can be repeated until the required migration quality has been achieved.

Other migration challenges can be addressed by doing the following:

Inventory grouping
In practice migrations are more complex than the scenarios described above. Often several source data bases will need to be migrated, which means data from the different sources must be merged into one system. Even if there is only one migration source, in the future additional data will need to be reconciled from NMS/EMS. The incorporation of this data must be considered.

Besides delta reports, the migration framework should have the ability to match data from different sources via identifiers or rules based on matches between different attributes such as locations, slots or port numbers.



2

Logging and reporting migration progress

Logging and reporting enable data statistics to be created and the progress of the migration project tracked. This includes the number of migrated objects, but also the classification of errors and statistics about open migration bugs. This information allows the project leaders and migration architects to identify problem areas and to fix migration rules and data quality issues faster, which in turn enables faster attainment of the required migration quality.

3

Reconciling data from NMS / EMS

If the reconciliation of interfaces already exists in the legacy system, either a migration of these interfaces to the new system is required or the operator must add additional reconciliation interfaces to other NMS / EMS. Reconciliation is an important function for keeping the data in the inventory system, which is the digital twin of the network infrastructure, up to date. Reconciling as much data as possible from the network is a major goal of any inventory solution.

Since a zero-downtime migration approach is similarly implemented as a daily reconciliation interface from NMS/EMS systems, the same framework is used to support migration of data from a legacy system as well as reconciliation of data from NMS/EMS or any other management systems. The functions previously explained are applicable for both.

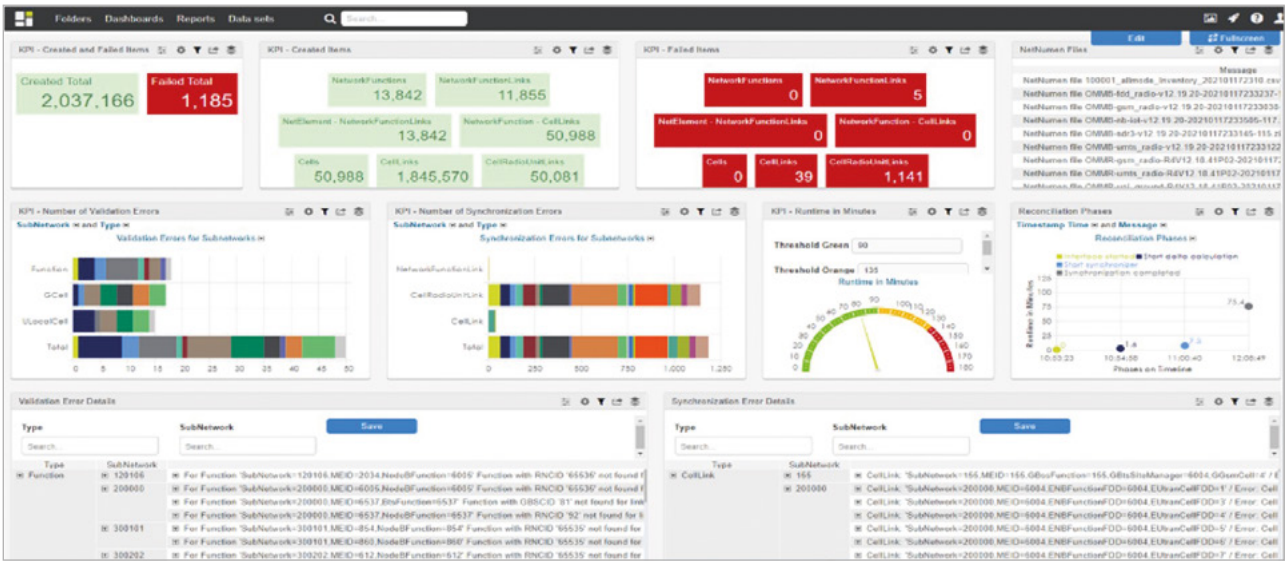
4

Migrating interfaces to new OSS/BSS

Depending on the situation, some operational or business support systems may have interfaces with the legacy inventory system. These interfaces must likely be migrated as well. There should be multiple options for OSS/BSS northbound integration as use cases can be very different. A broad interface with access to all data should be supported, self-extending in case of model changes in the data base as well as an option for event-driven updates of the northbound systems.

The first can be implemented as a standard REST interface which provides access to most of the objects in the new system's database. It should provide at a minimum query, create, update, and delete functionality for the different objects in the data base. The interface should be self-extending, so if the administrator adds new entities or attributes to the data base, the REST interface will be automatically extended and provide query, create, update, delete functionality for the new entity and corresponding attributes without programming.

A second is an Event API. This interface should be REST based as well and should be able to send information to configurable REST endpoints. The interface logic should be able to catch event generated by a user activity. For example, placing a new card in a shelf, enrich that event with additional data and send to the configured REST endpoint. The interface can also receive an event through a predefined REST interface and align it with the database of the new system via the delta framework or enrich the data and send them to another REST interface for use cases such as alarm enrichment.



FNT's dashboards are a key means of oversight throughout the course of the migration.

FNT's data migration framework

FNT supports the continuous delta migration approach for consolidating and migrating legacy inventory systems. FNT's extensive experience with data migration projects, its framework, and corresponding continuous migration concept mitigate many of the problems that plague complex migration projects. The novel concept, developed through extensive experience with data migrations, data reconciliation projects, and integration of its software with other systems, delivers significant benefits.

- **Continuous migration**
  FNT's solution supports switching over to the new system with no downtime. This minimizes the risk of organizational and the financial damages a flawed or failed migration project can cause. The framework allows the cutover to be done when the required quality has been reached, either by adapting the corresponding migration rules or by fixing data quality issues in the source system

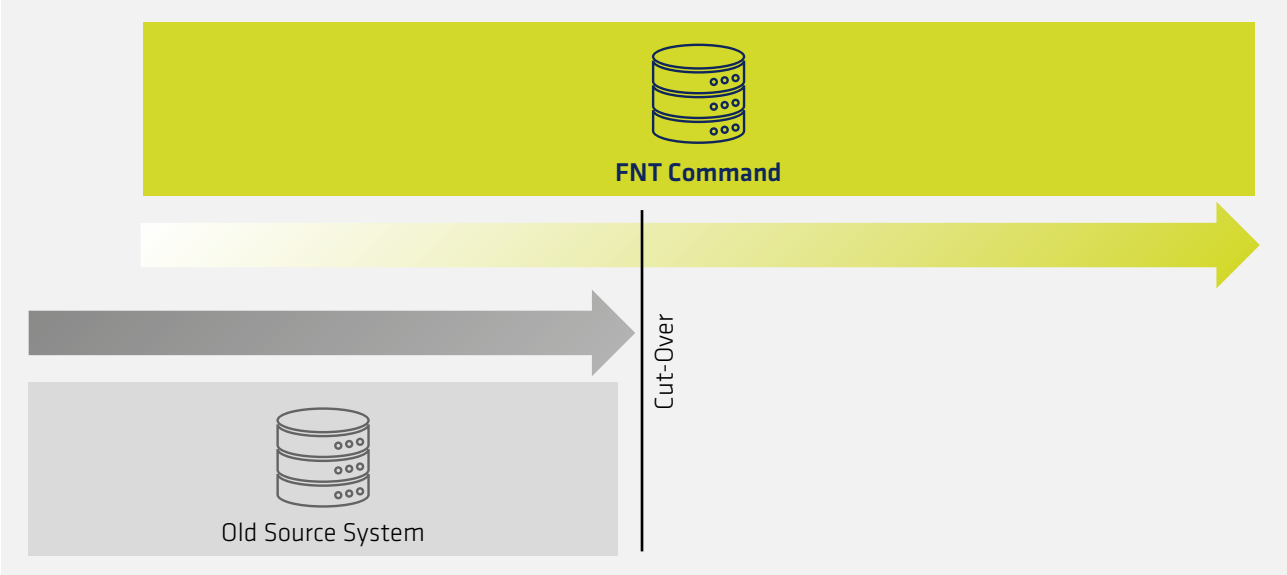
- **Short time to value**
  FNT's framework provides out-of-the-box functionality that begins delivering value almost immediately. The framework packages learnings gained from many migration projects into a set of pre-existing functions, including delta calculation and standard reporting functions.

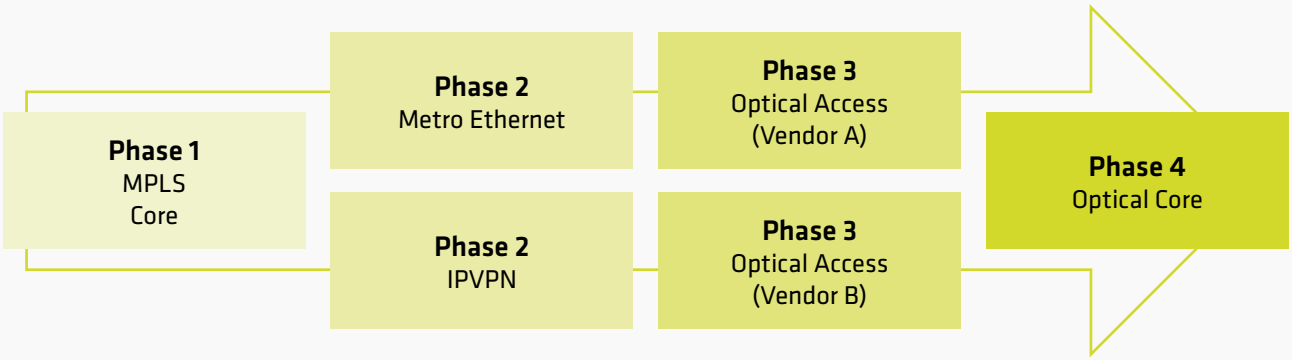
  FNT's framework is available as a Software Development Kit (SDK), which includes the software tool as well as trainings and professional services. The SDK gives organizations options for how to implement the migration and reconciliation projects. They can choose to implement it themselves, work with a preferred integrator, or partner with FNT's consulting team. Having options about how to execute gives organizations control over cost and scale.

- **High user acceptance**
  End user acceptance is necessary to stave off rejection of the new system, which can delay the rollout dramatically by sparking conversations based on perceptions rather than technical facts. User training and systems testing by users are precursors to user acceptance. With the delta calculation feature and corresponding continuous migration process, the system test can start early and run in parallel with other migration tasks. Even early crowd testing (end user testing on already migrated data) is possible. These accelerate the project and enable identification of bugs or mistaken concepts early in the project so they can be fixed, and damage is minimized.

  The same applies to user training and user acceptance. Training users early on already migrated data allows their feedback to be incorporated early in the software development. This in turn increases user acceptance. Typical complaints, such as those about the new GUI or missing functionalities, are minimized when users feel involved.

- **Crosses domains**
  FNT's solution overcomes the complexities of today's telecommunications networks, whose data is stored in several large databases containing millions if not billions of objects of vastly heterogeneous data. The best way to migrate data in these circumstances is to structure it into different domains and migrate it one domain at a time. FNT's framework supports the data migration by domain concept with features that support the independency of the data models for the different domains. A good example is the independency of telco services from the cabling layer, so services can be implemented without an end-to-end documentation of the cabling and vice versa. This means for migration





If the overall migration package gets too large, the migration tasks are split into network domains. Typically, per Technology and per Vendor.

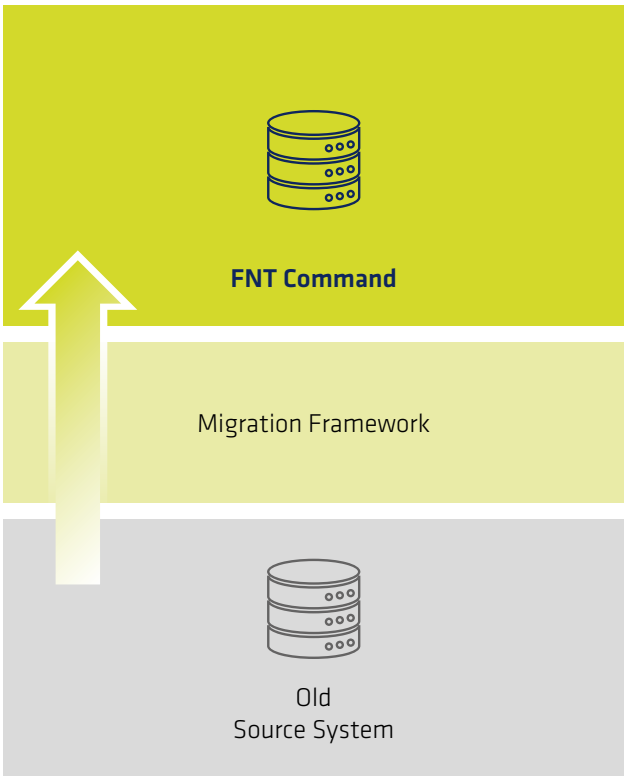
that both layers, the service layer and the cable layer, can be migrated independently. Features, such as black- and whitelists and implementation rules, cut the original database into different data domains. Such a data migration domain could correspond with the network domain with the same technology, or equipment coming from the same vendor. There are various ways to slice and organize the data to improve the migration process and result.

Other aspects of FNT's migration framework add significant value as well, such as its **standard reporting options** that give project leaders and migration architects the insight to oversee a controlled project implementation. Another topic is the framework's **open integration capabilities,** which support easy northbound integration. The easy to use, open and self-extending REST API, and flexible, adaptive, and configurable Event API is a functional block within the framework that simplifies the replacement, limits development efforts and costs, and mitigates overall project risks.

Beside using the framework for migration use cases, the same advantages also characterize reconciliation use cases and corresponding interfaces to NMS and EMS systems. The framework supports a large set of predefined functions that significantly simplify the implementation of the interfaces. Furthermore, existing basis adapters can be used as blueprints for new implementations. FNT offers these types of blueprints as "Adaptive Interface Packages" for the large range of interfaces for different NMS, EMS, and other management systems to further limit project risks, development efforts, and costs.

Finally, FNT's collaborative approach needs mentioning. Customers are an active partner in the definition and development of the migration, with consulting and professional services available on an as-needed basis. The degree of engagement is entirely dependent on the needs of the customer.

FNT's concept for replacing inventory management systems is novel. As an inventory systems vendor, FNT has years of experience with data migrations and data reconciliation projects as well as the integration of the software with other systems in telco operators, data centers and IT landscapes. FNT is well-versed in the challenges of such projects and has a long history of working closely with customers to successfully move them to a better system for their needs. The result of these collaborations is the development of a sound strategy that supports a smooth replacement of inventory management systems, with zero downtime.



A migration framework defines how to shift data from old source systems to a new one.

About FNT

FNT GmbH, headquartered in Ellwangen (Jagst), Germany, simplifies the management of highly complex digital infrastructures in companies and public authorities with its FNT Command Platform. With the cloud-enabled "software made in Germany", IT, telecommunications and data center infrastructures can be efficiently recorded as digital twins and documented across all levels from buildings to digital services. The software also offers open interfaces and numerous functions for planning, implementing and automating transformations and changes in an integrated manner. FNT's customers include more than 500 companies and government agencies worldwide, including more than half of the DAX-40 listed corporations. FNT operates offices in several locations in Germany as well as in New York, London, Singapore and Timisoara and has an international partner system with market-leading IT service providers and system integrators.

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