ELECTRICITY DISTRIBUTION INFRASTRUCTURE MASTER DATA GOVERNANCE USING THE MASTERKEY TOOL

Author & Presenter: C Plüddemann BSc Mech Eng – Master Data Design & Administration City of Cape Town Electricity Distribution

1. Introduction
Prudent technical management decision making needs to be based on accurate facts. In a complex, distributed technical asset environment it is impossible to make sound management decisions without knowing exactly what equipment you have, where it is installed, what condition it is in and what its maintenance history is. From a financial perspective, the GRAP17 accounting standard for Property, Plant & Equipment similarly requires the componentisation of assets for financial reporting. This paper aims to explain what master data is, why it is important and how it is being established and maintained with the help of the Masterkey software tool in the City of Cape Town.

2. Background
The City of Cape Town is busy with an Enterprise Asset Management improvement initiative, which includes better use of the functionality available in its existing SAP ERP (Enterprise Resources Planning) system. This is being piloted in Electricity Distribution for the City and the initial project phases, focused on the Plant Maintenance part of the asset life cycle, cover master data design, nameplate data collection and corrective maintenance process design. Roll-out to the Maintenance users has commenced. Future phases include preventive maintenance and refurbishment.

3. Critical Success Factors
The most critical elements for a successful enterprise asset management improvement project include:

- A strong business drive to make it work
- A true, passionate business champion, not just someone appointed to fill the champion role
- Management support
- Accurate, trustworthy master data
- Effective business processes
- An organisation structure that is aligned with the needs of the business processes and master data management requirements, including dedicated people to manage and support master data
- User education, buy-in and support
- Effective software
- Understanding that data collection, maintenance and refinement is a long term commitment

4. Master Data and Data Governance
Master data, which may include reference data, is information that is key to the operation of an organisation and is the primary focus of the IT discipline of Master Data Management (MDM). Data governance is an emerging discipline with an evolving definition. It embodies a convergence of data quality, data management, data policies, business process management, and risk management surrounding the handling of data in an organisation. Through data governance, organisations aim to
exercise positive control over the processes and methods used by their data custodians and data stewards to handle data. **Data Custodians** are responsible for the safe custody, transport and storage of the data as well as implementation of the business rules. In the City, this role is being covered by the IS&T Department’s Enterprise Support Centre. **Data Stewards** are responsible for the actual content and timely capture of master data changes. These can be different people depending on the type of master data.

In the City of Cape Town, complex master data governance is being centralised. Examples of such centrally managed master data are reference functional locations, work centres, task lists, measuring points, maintenance plans and materials/bills of material (BOMs). Data Custodian/Steward overlap is inevitable and encouraged during early stages of development in data governance. In the City this straddling role has been formalised as the Master Data Administrator (MDA), and made possible because of the close working relationship between IS&T and Electricity Distribution.

In a Plant Maintenance environment, the core master data is the technical object structure (called the functional location structure in SAP). This functional location structure systematically defines and uniquely identifies each maintenance significant item of equipment (i.e. technical object) installed in the field. All equipment specific data (reference master data as well as transactional data) is assigned to this structure and retrieved from it for reporting and analysis.

Master data is the foundational backbone for sound, fact based management decision making. If the physical item of equipment in the field is not accurately and uniquely represented in the system by a master data element (called a functional location in SAP), maintenance transactions in the system can’t be accumulated against that technical object and hence no maintenance history can be built up for it. The result is that management decision making with regard to that technical object must be based on anecdotal information. The presence of accurate master data in the system also facilitates faster, more consistent processing of transactions such as

a) the notification of problems requiring maintenance intervention,
b) the planning and execution of work using work orders and
c) the confirmation of actual work done,

resulting in a complete record of the maintenance intervention in the system. With master data in place in the background, many data fields in the SAP Notification, Work Order and Confirmation transaction screens are automatically populated by virtue of the selection of the correct technical object in the system. Some examples of such automatically populated data fields are the main work centre responsible, the cost centre, the planner group, the plant, the address and the partners. Consistently accurate data upholds system integrity and facilitates data retrieval for analysis and reporting.

It is important not to tackle all possible master data elements at once. One should start with the most critical ones first and then add others as required, once the core is established and stable. Don’t waste time and resources on unimportant data that will never be used.

Examples of Master Data elements are:

- **Functional locations** – unique alphanumeric strings that uniquely represent the actual physical technical objects installed in the field.
- **Classes** – groupings of similar types of technical objects to facilitate horizontal reporting irrespective of where in the structure they are located.
- **Characteristics** – specific attributes or name plate data elements of the technical objects in a class, e.g. “transformer” might be a class and “rated voltage: secondary” a characteristic that is relevant to that transformer class. For each individual transformer in that class there would be a specific secondary rated voltage value.

See figure 1 in the appendix for further examples of master data.
Master data and its governance is important to:

- Facilitate standardisation of data
- Facilitate accuracy and completeness of data and system transactions
- Avoid duplication and have one version of the truth that everyone utilises
- Control data changes. Limit authorisation to change master data to a small central group of people
- Execute physical asset management functions such as condition assessment, Failure Mode and Effect Analysis (FMEA), reliability analysis, asset replacement programs, equipment value analysis and application of manufacturers’ bulletins
- Answer financial audit queries (GRAP17 statutory requirements)
- Have a complete, high quality structure to interrogate

5. Masterkey Software

For it to be trustworthy, only accurate, uncontaminated data must be uploaded to the ERP system. In addition, this data must be continuously updated and maintained as changes are made to technical objects installed in the field. The master data in the system must accurately reflect the true state of the technical objects in the field in as close to real time as possible.

The Masterkey software tool, developed by Martin Aldrich, is being continually enhanced in the City of Cape Town on the journey towards full master data management. Its core function is to stage and validate data to make sure it is pure before being transmitted to the SAP ERP system. Doing this manually would be a near impossible task.

Masterkey is a web application running on a MySQL database installed on a central Windows 2008 server and can be accessed from anywhere in the City's network. The data schemas are guided by SAP master data definitions and there is tight integration with SAP via the workflow API (Application Programming Interface). Business rules and definitions as well as rules for data formats are built into the tool and used for validation.

In addition to the central web application, there is also a Masterkey local application which is installed on portable devices for the collection of nameplate data off line in the field and subsequent synchronisation to the central database. Masterkey Local is used to maintain the as built configuration in the system by allowing users to build, delete and edit the technical object structure and capture the master data relevant to each technical object in the field. Figures 2 and 3 in the appendix show the master data capturing screens. The field devices currently being used are laptops for the data stewards and ruggedized YUMA hand held tablet PCs for the high volume nameplate data collection contractors. Figure 4 in the appendix shows how the field application, central database and SAP system interface with one another.

A prerequisite for utilizing a tool such as Masterkey is that there is suitably skilled capacity embedded in the organisation. Two key roles required are that of data steward and data custodian, as described in section 4. Without these, as well as a close and symbiotic working relationship between the business process owners and the IS&T department, the exercise would be futile.

There are two important aspects to having accurate master data. Firstly the initial mass data gathering exercise and secondly the on-going updating of data as changes are made to technical objects in the field. The latter is of fundamental importance and is often overlooked. A data collection exercise cannot just be a once off collection effort to determine what assets an organisation owns. Doing that alone results in accurate data on day one only. Thereafter its accuracy, and hence value to the organisation, decays until it is more of a hindrance than a help. Masterkey facilitates and manages both of these stages in the life of master data. A Take-over / Hand-over process with acknowledgement and approval steps has been developed using workflows in SAP to embed and ensure the accurate updating of master data via Masterkey every time a change is made to a technical object in the field.
6. The City of Cape Town’s Master Data Journey with Masterkey

6.1 Technical Object Structure
The first step was to design the technical object structure. The upper 6 levels of the structure are organisational/geographical and from level 7 down they are technical. This design facilitates both vertical reporting and master data maintenance. At each level there are defined, allowable alphanumeric codes. Figures 5 and 6 in the appendix show part of the structure and some of the allowable codes respectively. The design was developed based on principles in the international KKS (Kraftwerk Kennzeichen System) structuring standard for power generation plants, and is specific to Electricity Distribution. It also caters for extension to multiple Municipalities. Reaching a final structure design involved weekly workshops with the business’ data stewards, representative managers, master data administrator, EAM consultant and project champion over a period of about six months. The structure definitions have been codified in Masterkey and are used to validate what the data stewards build in the system.

Once the design was completed, the data stewards began compiling the actual technical objects on Excel spreadsheet templates, which were validated before being mass uploaded into Masterkey. This was an iterative process with post-validation error reports being made available via web interface for correction by data stewards. Only validated data was uploaded to Masterkey.

To date there are over 110 000 functional locations in the system, uniquely representing the Electricity Distribution infrastructure. These functional locations represent mostly medium voltage (MV) technical objects as the more numerous LV technical objects still need to be collected.

6.2 Classes and Characteristics
The class structure was designed after the functional location structure and is intended to be expanded to cover all City infrastructure. Initially only the classes relevant to Electricity Distribution technical objects have been identified. Each class has a defined type of functional location that it may be assigned to and this relationship is captured in Masterkey definition tables. Figure 7 in the appendix shows a snapshot of part of the class structure.

After the classes were established, design workshops were held to identify the characteristics needed for each class, i.e. what the various name plate data elements were for each type of technical object. Many of the characteristics have a set of possible values which were identified and codified. Masterkey users see these in drop down lists from which they can select values during the data collection process for each technical object in the field. This simplifies data collection and reduces the scope for errors during field collection.

Initially the design of the classes and characteristics with possible values was developed in Excel. Thereafter it was captured in an extensive set of tables in Masterkey. To date there are 86 classes specific to Electricity technical objects and 420 characteristics with a total of 195 drop down list selection tables.

The development of the classes and characteristics design took approximately 6 months.

6.3 Nameplate Data Capturing
A three year nameplate data capturing exercise is currently under way with nine data collectors in the field. Most of the MV technical object nameplate data has been captured, encompassing 950 000 line items of data as of the end of July 2011. The data capturing exercise includes taking photographs of the technical object and its nameplate as well as a visual condition assessment based on the rating scale in PAS 55 (BSI’s Specification for the optimised management of physical infrastructure assets). It is anticipated that once LV nameplate data has been collected, a total of 2.5 – 3.0 million line items of data will have been captured. It was important to design the technical object structure as well as
the classes and characteristics before commencement of data collection in order to know exactly what data needed to be collected at each specific technical object in the field and avoid wasted effort.

Transfer routines have been developed, which automatically transfer functional locations (representing the technical objects) and certain associated data to the live SAP system once they have been validated in Masterkey. This is already live in SAP and being used. Detailed nameplate data will only be transferred to SAP after completion of the data collection exercise and data purification workshops. All nameplate data collected thus far, as well as condition assessments and technical object photographs, are currently available in real time in Masterkey and can be interrogated and comprehensively reported on. See figures 8 – 11 in the appendix for examples of some of the reporting available in Masterkey.

7. Conclusions
   • Trustworthy, high quality master data is essential for making good management decisions. Become obsessive about data quality.
   • It takes a significant investment of time and effort to design, establish and continually maintain an organisation’s master data, but this must be done.
   • Complete the design for functional locations, classes and characteristics before beginning the nameplate data collection exercise so that it is clear exactly what data must be collected.
   • Dedicated and suitably skilled people must be embedded in the organisation to govern master data.
   • A governance software tool such as Masterkey is required to house the design standards and business rules to simplify staging, validation and reporting of master data. The large volumes of data make it impossible to do this manually.

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APPENDIX – DIAGRAMS & SCREEN SHOTS

Fig.1 Examples of master data elements and how they are updated in SAP

Fig.2 Masterkey Local technical object data capturing screen

Fig.3 Masterkey Local characteristic data capturing screen showing a field with drop down values
Reports and plans on:
- Equipment replacement schedules
- Problematic equipment (manuf/model in it)
- Basis for starting BOM’s using class profiling
- Equipment standard compliance via take-over/hand-over audit trail

Master Data Administrator
- Approves/Rejects Master data changes
- SAP workflow used for exception handling in inbound data
- Health checks
- Direct updates in SAP for centralized master data

Fig. 4 Relationships between, and functions of Masterkey Local, Masterkey Central and SAP

Field Data Collector
- Collection of: Tech. Obj. header data.
- Nameplate data
- Lat/Long
- Condition data (including photo)

Database running on laptop/tablet PC—only contains user’s data

Extract a subset of data
Sync changed data to central db

Fig. 5 Part of the functional location structure in the Masterkey Central database
Fig. 6 Sample of allowable codes at various levels of the functional location structure

Fig. 7 Part of the class structure in Masterkey Central database
Fig. 8 Masterkey Central report showing characteristics for the class: mini sub with RMU

Fig. 9 Masterkey Central report showing characteristic (nameplate) data for mini subs with RMU
Fig. 10 Masterkey Central condition assessment report for PAS 55 rating 6: very poor

Fig. 11 Masterkey Central condition assessment report photo