Guidelines to Utility Work and Asset Management Process to SAP PM Process Mapping

Applies to:

It applies to all SAP PM functional consultants want to map utility processes like Maintenance, Emergency, Repair and construction through SAP PM. SAP ERP with EhP 5 with Operation account Assignment. For more information, visit the Business Process Expert homepage.

Summary

This document aims at explaining the approach and triggers thought while mapping utility processes like Maintenance, Emergency, Repair and construction through SAP PM. It also gives an insight to the consultants for a typical Gas distribution company which tries to transform its business processes.

Author: Shiba S Mishra

Company: Wipro Technologies – Hyderabad-India

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Author Bio

Shiba has an experience of 13 years in manufacturing and 5 years of SAP implementation in the Plant Maintenance module. Presently he is working as an Lead Consultant in Wipro Technologies – Hyderabad-India

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Company Profile

This is an Energy distribution company in the field of Electricity and Gas in UK and USA. To be competitive in the process efficiency, it transforms following business processes.

1. Emergency – This process takes care of the response to emergency call like gas escapes inside and outside of the property.
2. Maintenance – This process takes care of the planned maintenance jobs for above ground maintainable assets
3. Repair – This process takes care of the repair emerging out of the emergency process for all escapes out side of the property.
4. Construction – This process takes care of the constructions of new pipe lines either planned or customer driven.

Overview

While mapping various business processes in a Gas distribution utility company for its work management and asset management, as a consultant in the process and design team, we brainstormed, discussed with various process experts, vendors, SMEs, Business analysts, Field engineers and supervisors and arrived at certain feasible solutions for the requirement. This document will highlight some of them and will help in triggering similar thought process while mapping similar other requirements.

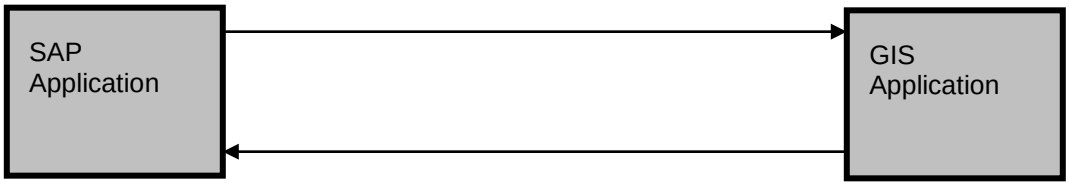
This document is structured to give guidelines to SAP Processes which fits into the above business processes in order to map its work and asset management.

- Asset Life Cycle
- Work Management Life cycle

Asset Life Cycle

Assets are considered to be above ground and below ground installations. This includes pipelines, its pressure control equipments, instrumentation and so on.

Asset is considered as either linear or non-linear. As a rule, all linear assets are mastered (created, changed, marked for deletion) in GIS and are synched to SAP and all non linear assets are mastered (created, changed, marked for deletion) in SAP. This is achieved through 2 interfaces as depicted below. This is finalized just to ensure that asset design and creation happens in GIS application as part of construction process.



Asset Hierarchy and EQPT/FLOC fields

Assets are structured with a specific levels based on the type of asset like linear, Non linear etc. This helps in structuring of the asset and their parent child relationships.

All assets are mapped to SAP functional location/Equipment. Additional legacy fields are mapped to the class, characteristics and characteristics values. Asset address is mapped to SAP FLOC/EQPT address. XY co-ordinates of the address is mapped as single XY coordinates of the non linear asset and in case of linear asset start XY and end XY coordinates are mapped. As there is no standard address Field to map XY co-ordinates, an enhancement which stores XY co-ordinates a concatenated string which is mapped to Street4 field of address. Standard address inheritance from parent to child is utilized for address maintenance.

Assets are planned, designed, created, changed and managed through EQPT/FLOC user status and the interface concerned is used to update the correct one.

Central Address Management

Work address, Asset address, Customer (Property) address etc were managed in different application differently and it was a big pain for the client.

A central mapping sheet for the address for different interface to SAP is maintained for uniform and consistent source to target mapping. A GIS based application with central address maintenance is used for all correct address verification while creating SAP address for work order creation or asset creation process. Web service based address search are implemented for address verification. Street or post code based or XY coordinate based address search is used during foreground or background processing. ADDRESS_CHECK Badi is used to invoke this address search. As none of the standard SAP BAPI is capable of creating assets with address or work order with address, hence a custom function module is developed using standard address creation function module to invoke the address search web-service.

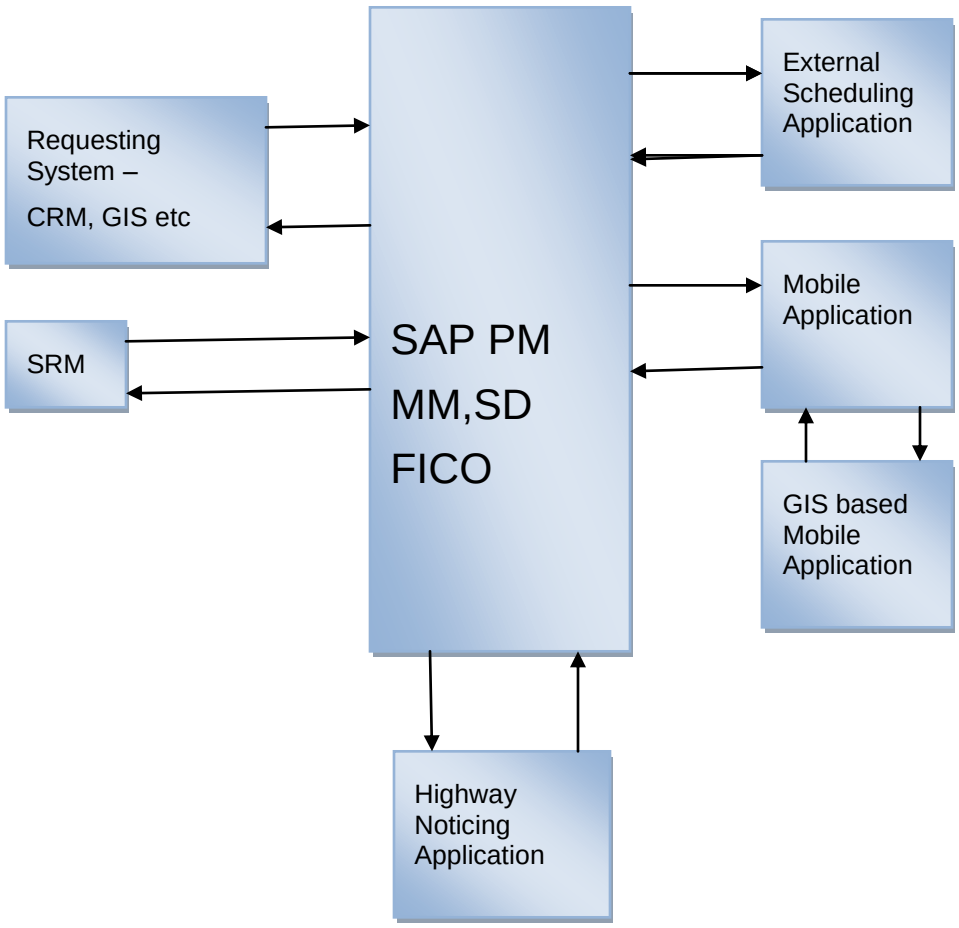
Triggering address search is controlled through a custom configuration (Z)table having Tcodes like IE01, IE02, IL01, IL02, IW31, IW32 as 1st level of control and for work order address search, order type is used to control next level of address search.

If during any time address search is not required, then standard SAP address field ‘ADDR1_DATA-DONT_USE_S - Street Address Undeliverable Flag’ was used which is updated by interface/enhancement dynamically.

Work Management Life Cycle

To plan, schedule and execute any work at an address by field engineer(s) a work order required and a notification is created for any work order to store forms details sent from mobile device from Field work.

A typical system landscape is as below for work management.



Following is life cycle of the work order.

1) Work order is **created** through various interface either because of customer call (reactive), planned job or follow on to any of the above scenarios. Following parameters are determined though various enhancement.

Below table details the work order creation methodology in different process of client.

Scenario	Source System	Method
Emergency: Controlling gas escape in side or out side property	SAP CRM -> SAP PM	Custom interface
Maintenance – Maintenance of above ground installation with regular interval	SAP PM from maintenance plan	Standard SAP (IP30)
Repair: Repair of gas escapes outside property	SAP PM -> SAP PM	Follow on enhancement
Planned construction- Designing, Laying of new pipes as policy replacement	GIS based Designer -> SAP Compatible Unit Design-> SAP PM	Custom Interface
Custom Driven Construction: Laying of pipes based on customer request	SAP SD Sale order -> SAP PM	Custom interface

Field/parameter of SAP	**Method of determination** **Significance in the work order**
Address	As explained in central address management, address is verified by GIS based database and updated in the work order. Some interface directly updates the address without verification as the source systems send the verified address. In case of follow on work order creation, either address is copied form parent work order or address is determined if the follow on work order intended to be created in a different address from the parent.
Dates	An enhancement is developed to automatically determine during work order save following dates of the work order at header level. i) Basic start date/time ii) Late start date /time iii) Basic finish date/time These dates were calculated based on SLA for late start (maintained in number of

	Hrs) and finish tolerance(maintained in number of calendar Days) maintained in a control Ztable at task list group and group counter level. As dates were handled at header level, and Late start date is not available at header level as standard field, late start date /time was created as Enhancement tab Field with Extended structure CI_AUFK. All dates are required to be calculated with respect to a datum field. For each scenario it was differently managed, hence we created two extra Extended structure CI_AUFK field as 'Reported date' and 'Reported Time'. All interface used to update these date/time fields based on the scenario and logic. A simple example is given below for the date calculation. SLA for Late start date: Reported Date/Time : 25/04/2011 and 10.05 AM SLA maintained in for task list grp/Grp Ctr is 4 Hrs i) Basic start date/time = 25/04/2011 and 10.05 AM iv) Late start date /time = 25/04/2011 and 02.05 PM ii) Basic finish date/time = 25/04/2011 and 11.59 PM This kind of calculation used to happen in reactive job which has SLA for late start date was important for scheduling system not Finish date and time. Tolerance based finish date : Reported Date/Time : 25/04/2011 and 10.05 AM Finish Tolerance maintained in for task list grp/Grp Ctr is 30 Days iii) Basic start date/time = 25/04/2011 and 10.05 AM v) Late start date /time = 24/05/2011 and 11.59 PM iv) Basic finish date/time = 24/05/2011 and 11.59 PM In this scenario, late start date was not important, but the job was to be executed within Basic start date and basic finish date. This is a maintenance scenario and reported date was considered to be the planned date for each call after dead line monitoring (IP30). Late start date Material availability date was calculated automatically determined. Like above there are lot of scenarios for which date determination is developed in SAVE event. Whenever the date of execution is not known during work order, the order is created as open ended (basic start date = current date and basic finish date = Current date + finish tolerance). The open ended date was further planned though bulk planning process as described in bulk planning section
Order type	Interface/enhancement determines the order type as this happen to be at higher level than task list group /group counter.
Work Centers /Plant	Main work centre at header are required for cost centre/ profit centre determination Operation Work centers are required to determine resource(s) which will execute the job. Work centers are master data(PM-HR) which depict the group of resources having one or multiple skills (SAP HR).This helps in scheduling the resource which

	are assigned to an operation work centre. Work centre plant is same as maintenance plant. As Work centers are defined and maintained geographically with trade (Emergency, Maintenance, Repair etc), hence it is decided to maintain the data with respect to a post and XY coordinates in GIS data base. If you send a post code or XY coordinates to GIS through a web service call, it returns available work centers for all trade and in SAVE event of work order in SAP PM, we determine the correct work centre as per the DUMMY work centre maintained in work order while integrating task list into the work order. E.g for Post code XXXXXX, Actual work centers are EMRG0001, MAIN0003, REPA0005 with its plant (Maintenance Plant), if in the work order DUMMYEMR is maintained when an emergency task list is inserted(an emergency work order is being created) then EMRG0001 is determined. In case of multiple operation of the work order of different skill, GIS used to give the corresponding work centre list (main & operation) in a structure and in SAP, we manage to determine the operation based on the dummy maintained at operation level and the main work centre based on the dummy work centre maintained in task list header. Naming convention of the work centre was done at 5 levels. Company – Level1 Trade – Level2 Geographical Group – Level3 Geographical SubGroup – Level4 Running Serial Number - Level5 This naming convention helps in developing a work center structure in external scheduling system. This structure is shown to scheduler as a hierarchy, which is very easy for scheduler to quickly take decision. As Main work centre is mandatory, as part of an enhancement, we manage to pass DUMMY and planning plant to work order screen.
PM activity type	This is maintained in a Ztable at Task list group / group counter level and is determined at save event.
Task list Group/Grp Ctr	This is updated by the interface or control table. As this determines the type of job to be carried out, program (interface, enhancement) which creates work order gets the Task list Group/Grp Ctr . This is mandatory for any work order creation process.
Control Key	Interface/enhancement determines the control key as part of task list group /group counter. This controls the work order to be scheduled in external scheduling system.
User Status	Work order header status: These are configured to set flag for reporting, control work order release, set flag for end of processing etc. These are without numbering. Work order operation user status: This user status is set based on the confirmation variance reason as per the configuration of OPK5. During work order creation it is not

	set, but it is set as default initial status like 'INIT'. These are numbered.
Planning Indicator	Planning indicator is set to its default value as part of configuration, however interface/enhancement sets this to 'Unplanned' when a open ended work order is created whose planning is not done and when planning is done through Bulk planning, planning indicator is changed form 'Unplanned' to 'Planned'.
IM position	It is determined at header level through an enhancement based on the task list group/group ctr and cost centre of the main work center.
User defined fields	Specific logic in interface/enhancement updates the same.
Enhancement fields	Specific logic in interface/enhancement updates the same.

Bulk Planning of work orders

There are two scenarios for bulk planning.

A) Bulk date planning for emergency jobs

B) Bulk date and notice planning for repair jobs where excavation is envisaged to be carried during job execution.

Work order creation process with open ended dates and planning indicator as 'Unplanned' is set.

Solution is to plan these work orders with specific dates in bulk as per below detail.

Planning parameter: From Date= D1

To date = D2

No of order per day= N

This report produces an output of the work orders from the database based on selection criteria and planning parameter and planning indicator as 'Unplanned'. The number of work orders should be less than or equal to (D2-D1)*N.

Example: From date= 10.05.2011

To date = 15.05.2011

No of order per day= 3

It will select 15 work orders from data base and populate basic start date as 10.05.2011 for the 1st 3 orders and 11.05.2011 for the next 3 orders. Once the date panning is completed the planning indicator is changed from 'unplanned' to 'planned'.

If we want to do date panning as well as notice planning (i.e to inform the highway authority about the job details with a notice electronically) in addition to above date planning, we get street data for each work order, prepare the data based on the street details and default values and then create independent notification and set user status at its task level to trigger an interface which sends the details of the Notice to Highway authority. At the end of the status update, we change the planning indicator from 'unplanned' to 'planned'.

2) After work order is created, following action is possible.

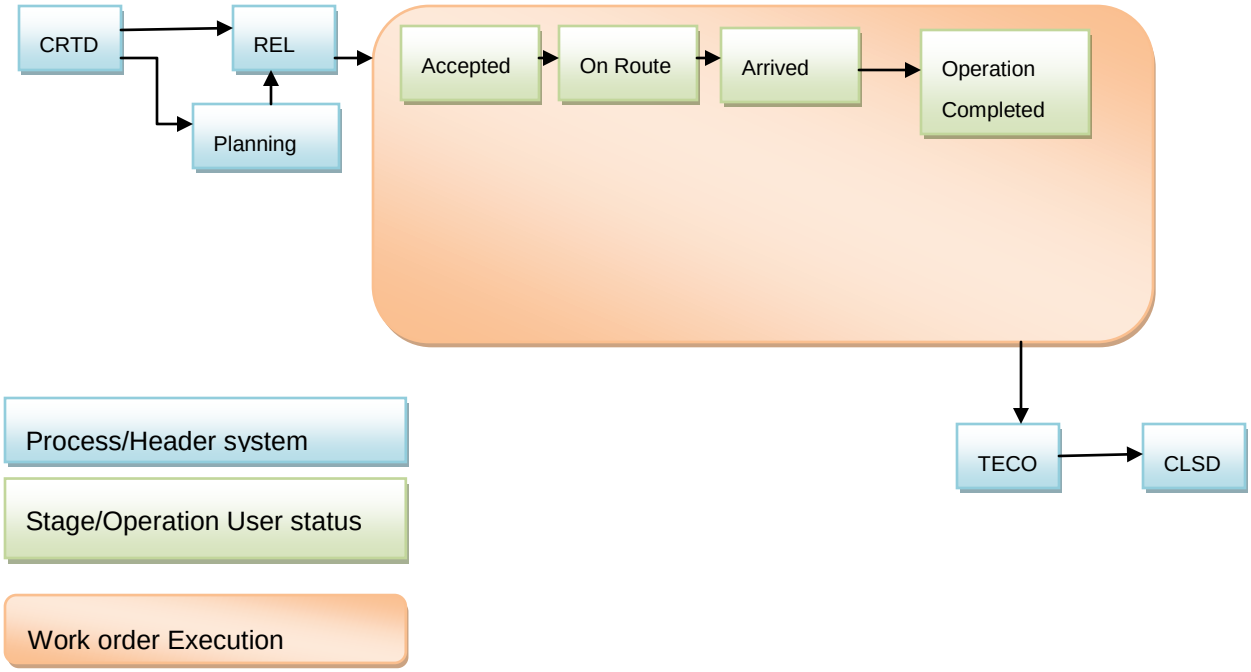
   a. Immediately release if it is reactive (immediate) job. This is achieved through an enhancement.

b. Plan the work order with respect to date, material, and notices and then release the work order as per release horizon. This is achieved through batch process.

Planning indicator of the work order plays an important role while releasing work. It acts as parameter which is set from 'unplanned' to 'planned' at the end of either date planning or date planning with notice planning. Work order creation process sets it to 'planned' if no further planning is required and to 'Unplanned' if further planning is required. For all immediate job, it is set to 'Immediate'.

During work order release, following work order parameters are determined.

Field/parameter of SAP	**Method of determination** **Significance in the work order**
Settlement Parameter	Settlement parameter (WBS element) is determined from based task list group/group ctr and cost centre of the work centre.



3) After work order is released, it goes to external scheduling system and scheduling system tries to schedule the work based on the date window (Basic start date/time, Late start date/time, Basic finish date/time). External scheduling system tries to find a suitable resource/crew based on the skill (mapped as a HR requirement profile) in the task list operation and data and time of execution.

   a. Once the job is scheduled a resource is assigned and SAP is updated with an operation user status and work order operation is dispatched based on the dispatch rule configured scheduling system. A user status is updated in work order operation user status through interface.

   b. Once work order operation user status is dispatched, the date, resource allocation is fixed and mobile application will pick the work order operation and sends it to mobile device of the

resource. Resource accepts the work order and then start travelling to site specified in the work order address in the mobile device and operation status is updated in SAP.

c. Scheduling system from mobile device and then reaches to the site and sends a operation user status update to SAP and Scheduling system both and after reaching at site, executes the job and then sends completion status to again SAP and Scheduling system both.

If field engineer is unable to complete the job and needs a follow up work order need to be created then automatically a follow on work is created though an enhancement. This will be further described in section below.

All operation user status update between Mobile devices, SAP to External scheduling system happens though SAP confirmation with time stamp and confirmation reason for variance though OPK5 configuration. This is illustrated as per below table.

Plant	Reason code	Description of the reason code	Work order operation		Remarks
			Status profile	Status Code	
9001	ACPT	Accepted	ZWORKOP	ACPT	One to one reason code to operation user status mapping
9001	STTR	Started travelling	ZWORKOP	STTR	
9001	REAC	Reached	ZWORKOP	REAC	
9001	COMJ	Completed Job	ZWORKOP	COMJ	
9001	COUF	Complete-Unable to find	ZWORKOP	COMJ	Because the field engineer is unable to find, he completes the current job, but a follow on work order is created by submitting a confirmation this reason code.
9001	RETI	Requesting team Immediately			No operation user status is updated as the current work need not to be closed(COMJ), however one more follow on work order is created to go to site.
9001	TRVL	Travel duration			Difference between time stamp of REAC and STTR. This is done through an enhancement in confirmation and duration is calculated and posted
9001	EXDU	Work execution duration			Difference between time stamp of COMJ and REAC. This is done through an enhancement in confirmation and duration is calculated and posted

In addition to this, rejection of work order and partial completion of the work order is separately handled.

Follow on work order creation

The solution is to create a follow on work order from mobile application if due to any reason the job needs a new sub/ separate work order. This is achieved though a confirmation with variance reason codes. Confirmation is posted from mobile application, by custom BAPI using standard BAPI BAPI_ALM_CONF_CREATE. In this custom confirmation BAPI another custom BAPI using standard BAPI_ALM_ORDER_MAINTAIN is embedded which creates the follow on work order. This scenario of confirmation and follow on order creation or only confirmation is based on a control table with reason code and requesting work order task list group/grp ctr combination (key field). Various other controls are also included in this table to make the scenario as configurable as possible. A typical table structure is as below.

Confirmation variance Reason code	Task list group	Grp Ctr	Release control	Work order type	Planning indicator	Basic start date control	Late start date control	Basic finish date control	Task list group for follow on work order
COUF	EMRG0001	01	R	Z001	IMM	0	4	0	COPY
COUF	EMRG0002	01	R	Z002	UNP	0	0	365	NOCO
Grey fields are key fields									

Notification Structure

When a work order is created, a notification is automatically created as part of standard SAP work order to Notification integration functionality. This notification is used to store all form details from mobile application whatever field engineer has submitted. In addition to this independent notifications are also created to store data related to noticing to highway authority. This is either mapped to work order(s) in enhancement tab fields or in its object list.

In mobile applications user updates form field values as per the screen flow and submits the form and upon submission, it updates notification item activity based on the following mapping table.

Mobile Application			SAP Notification Item		
Form 1	Field 1	Values 1	Catalog: B Code group: Form1 Code : FRM1	Catalog: A Code group : FRM1 Code : 0001	Activity Text VIQMMA-MATXT
Team required form	Team	Emergency	Catalog: B Code group: TEAMREQ Code : TRQ	Catalog: A Code group : TRQ Code : TEAM	Emergency
Team required form	Date	05/05/2011	Catalog: B Code group:	Catalog: A Code group : TRQ	05/05/2011

			TEAMREQ Code : TRQ	Code : DATE Code description: Required on	
Injury from	Injury type	Minor	Catalog: B Code group: INJURYFO Code : INJ	Catalog: A Code group : INJ Code : INJT Code description: Injury type	Minor

Each form is a code group of notification item with catalog as 'B' and it has one code which is same as activity code group of the same item having catalog as 'A'.

Each field in the form is mapped to one activity catalog code of the item

Field value in the form updated by field engineer is mapped to MATXT (item activity text).

Field values which is more than 40 character at source (Mobile application) is entirely updated in long texts of the item activity line with short text as 'Refer Long text'.

Settlement, TECO and Closure: Work orders are 'operation completed' from mobile device after execution. Individual batch processes are run periodically to 'settle', 'technically compete' and business close the work order. Cost in the work order is either material cost (maintenance process) or internal labor cost confirmed as work time and travel time and is settled periodically.

Z table approach

During design, control tables are made to make design more configurable. This approach is considered the same way SAP does the configuration in design. These are of three types.

Type	Delivery class	Explanation
Custom configuration Table	C	This involves any control table whose attributes are only configuration values. It is rarely changed like SPRO setting. This creates a transport requests while maintaining and will be maintained in each environment through transport request. Attributes like Order type, notification type, equipment category, PM activity type, Control key, Authorization group, planner group, class group, material group etc
Custom master table	A	This involves any control table whose attributes configuration values and master data. This could be extension of any master data. This does not create a transport requests while maintaining and will be maintained in each environment manually or upload program. Attributes like Task list group, Grp Ctr, Work centre, Personnel Number, equipment number, FLOC number, Measurement point, class, characteristics, material etc
Custom Transaction table	A	This is to store transaction data. Any interface or enhancement should update the same. Attributes like work order number, date, external reference number etc

Conclusion

This document does not contain any screenshots but it gives some ideas how scenarios are mapped. It may help functional consultants regarding design considerations, best practices followed during design of a big front office implementation of a utility industry.

Related Content

http://www.sdn.sap.com/irj/scn

For more information, visit the Business Process Expert homepage.

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