APPROACHES FOR ACHIEVING IT-SUPPORT FOR ASSET MANAGEMENT

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The last ten years have seen a steadily growing awareness across industries of the benefits of proper Asset Management. This is further accentuated in the Power Industry by challenges with an aging infrastructure and workforce and economic pressures enforced by re-regulation. Utilities seeking to improve their Asset Management capabilities are naturally considering implementation of IT-systems to support the strategic planning and operational processes. However, Asset Management is by its nature a process that encompasses several organisational units within the utility. As a consequence it also requires support from many different IT systems both in terms of data and functionality.

A parallel development is that many utilities currently strive for the vision of an Integrated Utility. This vision consists of seamlessly integrated IT systems that can easily be adapted to new requirements. This paper presents a set of approaches that utilities may consider when implementing the Integrated Utility vision. These approaches are then discussed with regards to their influence on the other goal of enhanced IT support for Asset Management. The discussion is concluded with some important aspects to be considered in order to achieve the desired improvements for Asset management regardless of chosen integration approach.

IS SUPPORT FOR ASSET MANAGEMENT

In [1] Asset Management is defined as the systematic planning and control of a physical resource throughout its life. This may include the specification, design, and construction of the asset, its operation, maintenance and modification while in use, and its disposal when no longer required. From the definition we have that Asset Management encompasses technical as well as administrative and financial activities. As a consequence, IS support for Asset Management is required from the technical as well as administrative and business domains. A survey underlining this aspect of Asset Management is presented in [2]. Based on the findings of the survey IS support for Asset Management can be categorised as follows:

- Asset Documentation
- Resource Management
- Production Management
- Workflow Management
- Maintenance Planning

With Asset Documentation we understand IS used for documenting all aspects of the grid, plant or facility being managed. This includes documentation of the geographic location of the equipment, its age, type, status, latest events, etc. Typically this involves support from business as well as technical information systems.

With Resource Management we understand activities such as budgeting and follow-up of use of resources in terms of expenditure but also internal resources such as vehicles, tools, spare parts and personnel. Again this spans business systems, such as time reporting and inventory management as well as technical systems such as project planning.

With Production Management we understand the activities of tracking the quality of the delivered power, including such aspects as event reporting, and outage management. This area of Asset Management spans both customer management and network operation again crossing the border between technical and business support systems.

With Workflow management we understand the activity of managing the propagation of work tasks through the organization. Typical examples are the chain of events that need to happen after a fault has been detected during an inspection and some kind of repair needs to be done.

With Maintenance planning we understand the activities related to planning of maintenance activities. The area includes budgeting, and ROI calculations as well as having up to data information about equipment status.

An alternate categorisation at a finer level of granularity is available in [3]. This categorisation is being used in the standardisation of information exchange mechanisms at utilities within IEC TC57. Regardless of categorisation however, it is apparent that Asset Management requires support from IT system from both technical and administrative domains. For other complementing views on the use of IS for Asset Management please see [4]. For an industry perspective on this topic see for instance [5].
Related developments in the manufacturing industry are reported on in [6].

From the above, it is clear that Asset Management would benefit greatly from an implemented Integrated Utility vision, described further in the next section. A utility that has implemented, at least partly, the Integrated Utility vision will clearly have IS that provide the cross-domain integration necessary for supporting Asset Management.

THE INTEGRATED UTILITY

For some years the ultimate goal of IS support at distribution utilities, as in other industries, have been an integrated suite of IT systems that are well aligned to the business processes. This, to some extent utopian, goal is sometimes referred to as the Integrated Utility. Such an Integrated Utility is characterised by having secure, high performance IT systems well aligned to current business process. The systems are additionally easily adapted to changes in the business processes or environment. Although it can be argued that this vision is just that, and that it will never be achieved, it is nevertheless a useful role model. For an elaboration of the vision, please see [7].

To fulfil the vision utilities are improving their existing system portfolio and introducing new systems. When doing so, utilities will work according to one major strategy, alternatively the effort is fragmented resulting in point to point integrations. Other utilities work towards the vision by means of and ERP solution, while a third group go about the task by integrating existing legacy applications, the EAI approach. This latter being the most favoured by utilities today. These approaches are described in brief below, for a more complete description of the approaches please see [8].

Point to Point

The point to point integration style is likely not chosen as a strategy in the long term. Integrating systems point to point as the need arises is a phase that most utilities have gone through and is now leaving behind them. Obviously, as also pointed out in [7] the approach leads to a large number of connections and interfaces that are difficult to manage in the long term. Additionally, the longer the “strategy” is followed the more costly changes will be since they require modifications in more and more systems. The obvious advantage of the Point to Point approach is of course its speed of execution and low up front costs.

Naturally the Point to Point integration approach may very well be suitable for smaller and mid-sized utilities. For these smaller utilities, the other approaches are too costly, and also do not offer the benefits since the IT architecture at smaller utilities is by nature more easily managed due to its limited size.

ERP

ERP, short for Enterprise Resource Planning, is an enterprise wide software solution designed to streamline the data flow between different functions in the enterprise [8]. The ERP type of solution was initially introduced in the manufacturing industry where use of IT-systems is transaction orientated, e.g. order entry, materials and inventory management and logistics. The ERP solution also incorporates financial functions like general ledger, purchasing etc. Although initially a design principle focussed on unifying data transactions in the enterprise the ERP solution has become identical to introduction of a specific software suite. The suites offer multiple modules supporting the aspects of ERP such as purchasing, inventory management etc. Software suites from companies like SAP, Oracle, Baan and J.D. Edwards are dominant on the market today. To utilise the benefits of introducing a ERP suite, utilities first re-engineer their business process to adapt them to the process supported by the specific software. The scope of such undertakings, and the costs associated make these types of projects critical to the success of the utility, likely there is no option to turn back once started.

A concern regarding the ERP approach is the ERP suite’s ability to support the needs of IS support in the technical domain. It is of course not feasible to expect that the ERP suites will incorporate functionality such as SCADA or EMS functionality. The question then arises how these systems shall be integrated with the ERP suite. If these interfaces are not considered early on in the project this may result in several Point to Point integrations between the technical systems and the ERP suite being necessary leading to a less than optimal solution.

Large scale ERP projects are relatively common among larger distribution utilities. As a consequence of mergers of smaller utilities, the system portfolio and business processes are often heterogeneous at large utilities. The ERP approach then offers a well defined path towards simplifying the IT portfolio and establishing uniform processes, not least in the financial and business control parts of the organisation.

EAI

If the ERP approach consists of replacing legacy systems with a new software suite and at the same time re-engineer the business process the EAI, short for Enterprise Application Integration, approach is less dramatic although not less encompassing in scope. The EAI approach is centred on the introduction of an information bus, which connects legacy as well as new systems. This bus is not only a conceptual model but also commercially available software products from companies such as Tibco, IBM and BEA. The information bus specifies a uniform data exchange mechanism which all system must adhere to, note...
that this is in line with the standardisation within IEC TC57 WG14, see for example [3]. New systems often have predeveloped interfaces to the bus, while legacy systems need to have specific adaptors developed. The strength of the EAI approach is its use of existing software systems which in turns means that many processes may remain virtually unchanged requiring less process re-engineering.

It is important to note that an EAI approach does not mean that an ERP suite of software will not be installed. Most ERP suites have already been successfully integrated with information bus types of software [8]. When contrasting the EAI approach to the ERP approach however, the EAI approach allocates more functionality to existing systems or systems from separate vendors. In short, the EAI approach allows the use of best of breed applications, and one of these applications may very well be a ERP suite that is used for e.g. accounting and purchasing.

**Summary**

It is important to note that the described approaches are templates, and that IS improvements at a distribution utility will evolve more or less according to one of these templates. The approaches should not be interpreted as a strict set of rules that are followed. They furthermore have different value to different distribution utilities. Currently EAI is seeing a more favourable treatment in academic and industry press than the ERP approach to integration.

Among utilities the EAI approach is currently the one most favoured, see for example [7] or [9]. The EAI approach is also being promoted by the standardisation efforts in IEC TC57 WG14. Where work is being done to standardise the information exchange mechanisms between system components on a utility information bus. The choice of the EAI approach is perhaps natural with utilities having so many domain specific engineering systems, e.g. Load flow, SCADA, short circuit calculation, etc. than for instance an insurance broker of logistics company. The heterogeneous system architecture at a utility can simply not be contained within one comprehensive ERP solution. Again, the EAI approach does not preclude the use of an ERP suite of software within the IS architecture.

As described in [9] EAI can very well be used to integrate systems from across the domains of business and technical support. The presentation in [9] recommends the use of the Common Information Model, see [10] and [11] and the information exchange mechanisms in [3] to enable this cross domain integration. By standardising data formats and information exchange, integration between technical and business systems is facilitated. For Asset Management this is very valuable since cross domain integration is required for successful IS support. In the following section some especially important aspects to consider for Asset Management are presented.

**IMPLICATIONS FOR ASSET MANAGEMENT IS SUPPORT**

IS support for the entire scope of Asset Management processes spans both business and operational support systems at a distribution utility. As a consequence it is not sufficient to study merely the integration of operational support systems or business support system. Instead an approach similar to that proposed in [9] is needed whereby systems from both domains are included in the integration effort. Most utilities and experts from academia and industry would agree that to achieve well aligned IS support for the entire Asset Management process the approaches described above need to be used in conjunction. Additionally any integration effort should be based on the standardised data and message specifications being created by EPRI and IEC.

A likely solution is to use an ERP suite to manage the financial and business control aspects of the utility and using the EAI approach to integrate technical support systems. However, specifying the areas of responsibility for the between the ERP suite and the technical support systems is not trivial and is discussed to some extent in [12]. Partly to address this challenge but mainly to ensure that whatever approach is used to integrate the IT systems that Asset Management receives proper support, we argue that the Asset Management processes interaction with different IT systems must be analysed. Since Asset Management spans so many systems and so many organisational units, this analysis is critical to success. Additionally we argue that this analysis should be made in such fashion that it is consistent with the CIM and the information exchange mechanisms described in [3].

Two especially important aspects that need to be considered are the relation between the business processes and the data on which they operate, and second how this data is allocated over physical systems. Analysis of these to aspects can be made using standardised methodologies and notation, i.e. UML and basing the architecture on the CIM.

**Relation between Processes and Data**

The relation between the Asset Management activities/processes and the data stored in the utility IS architecture must be analysed and documented. We argue that the documentation should be based on the standardised CIM framework and made using standardised UML notation. A suitable method for such analysis and documentation is to use UML extensions proposed by Eriksson and Penker in [13]. Specifically activity diagrams divided into “swimlanes” and Assembly line notation as suggested is useful when documenting the results of the analysis. A detailed presentation of how this can be achieved is given in [14]. Since process analysis and documentation requires involvement from end-users their participation and ensuing satisfaction with the system is
improved. This is important since end-user participation and end-user satisfaction are important criteria for reducing risk of failure in IS projects [15].

Allocation of data over systems

Second, the allocation of the data classes among existing systems needs to be analysed. This step is necessary to decide which legacy systems will be affected by the integration effort, which systems that may need to be modified and which may be replaced. The main rational for this analysis is that a commonly reported problem by many utilities is data duplication, i.e. that same or similar data is stored in separate systems. By analysing the allocation of classes among physical systems this problem can be addressed while at the same time adhering to the standardised CIM framework. Additionally, by analysing the allocation of data over systems the overall risk of the integration effort can be reduced. This reduction in risk is a result of having better control over which system that will be effected by the integration effort thereby reducing the risk of changing requirements. Changing requirements is an often reported risk in software projects [15].

CONCLUDING REMARKS

In this paper we have briefly introduced the challenges apparent when introducing IS support for Asset Management. Since Asset Management spans so many organisational departments and requires support from many systems it would benefit greatly from a truly Integrated Utility. However, when using current integration approaches to achieve this Integrated Utility vision, two additional aspects need to be considered. These are the relation between Business Process and data and the allocation of this data over the existing and new systems. We argue in this paper that analysis of these two aspects can and should be done using the standardised CIM framework and well established UML extensions.

Finally however, the largest challenge to successful IS integration is being able to manage the vast amounts of information generated during analysis. Documenting an entire utility’s business processes and IS is an enormous task. However, the task of maintaining the model and keeping it up to date is even more daunting. This last aspect is currently the topic of many Enterprise Architecture efforts world wide, see for instance [16].

REFERENCES


