Declarative Process Models in Government Centric Case and Document Management

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Abstract. In 2016 KMD, a leading supplier of mission critical software, solutions and IT services to Denmark's public sector, recognized the need for expert end-user process modelling and customization features in the next iteration of its WorkZone offering. KMD contracted with Danish Adaptive Case Management vendor Exformatics A/S, developer of declarative process modelling and simulation tools, who has solutions based on Dynamic Condition Response Graphs, DCR, developed together with the IT University of Copenhagen. This paper describes the integration of Exformatics' DCR Graphs Engine product as a component of KMD WorkZone, an integration which has (a) solved hard otherwise unsurmountable problems of maintainability of models, and (b) enabled end-user modelling. This paper should be of interest equally for audiences interested in the application of declarative process modelling technologies in particular and process modelling technologies in general.

Keywords: DCR, Government, Adaptive Case Management

1 Introduction

This paper is based in the area of government centric Document and Case management as delivered by a leading standard software vendor in the Danish public sector. The paper is focused on the challenges in finding a good model for implementing adaptive case management on government sector business processes using various process models and tools.

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1.1 KMD – IT with insight

KMD's position as one of Denmark's leading IT and software companies is based on insight. This insight derives from and is rooted in the Danish public sector, but today is also available to the business community.
KMD is among Denmark's largest IT companies, with branches in Copenhagen, Aarhus, Odense and Aalborg. Most of KMD's business originates from our own software development and we develop, deliver and operate IT solutions for municipalities and the State, and for private companies and organizations.

KMD – previously Kommunedata – was established in 1972 and up to 2009 was owned by the Danish public sector. Today, KMD is a private IT Group owned by Advent International and Sampension. KMD's annual revenue exceeds DKK 5 billion.

1.2 KMD in the Danish public sector

For more than 40 years, KMD has played a vital role in the digitization of the Danish welfare society, and the company has helped to ensure that the Danish public sector is one of the best run, most effective, digital and modern public sectors in the world.
KMD has developed and today operates 400 IT systems that support Denmark's welfare society and follow Danes throughout their lives. Every year, KMD's systems handle triple-digit billion-kroner amounts equivalent to over 20 per cent of Denmark's GDP.
KMD's systems help to ensure that Danes receive key social security payments such as child benefits, maternity/paternity benefits, unemployment benefits and old-age pensions. KMD's systems are also used for registration for places in nurseries, nursery schools and lower secondary schools. KMD is also a key player when elections are held in Denmark.
The public sector faces some considerable challenges: fewer hands need to help more citizens and budgets need to be stretched even further. KMD considers welfare technology and digitization to be the response to the question of how society can at one and the same time improve the service to its citizens and release resources for the public sector.
KMD is in close dialog with municipal, regional and State customers to create new digital solutions, for the benefit of Danish society. In close cooperation with customers, KMD develops IT solutions that, for example, improve teaching in schools, allow the elderly to receive better care, and ensure a more effective healthcare sector.
The "KMD in several markets" strategy means that today – besides municipalities – KMD also cooperates with Danish regions, the Danish State and a large number of Denmark's many private companies. KMD is also reaching out beyond Denmark's borders, primarily to Norway and Sweden.
In order to develop our offering to our customers in both the solution and expertise areas, in recent years KMD has acquired a number of exciting enterprises. These are all companies that are helping to boost our activities and the Group's growth opportunities.

Today, KMD is Denmark's largest IT company measured by number of employees. The KMD Group has over 3,000 employees in Denmark, at offices on Zealand and Funen, and in Jutland. In total, the KMD Group has around 3,500 employees, including our subsidiaries in Norway, Sweden and Poland. KMD has around 1,000 employees working on our proprietary software development.

1.3 KMD WorkZone

In 2014 Scanjour A/S a leading Software company in the Danish State and University sector for Case and Document Management solutions was acquired by KMD. The purpose was to extend KMD's market share in the Danish State and University sector and potentially use the product suite today known as KMD WorkZone in some of the other KMD business verticals.
In its market segments KMD WorkZone has approx. 40.000 seats, which makes it the leading Case and Document management suite in the Danish State sector. Major customers are e.g. The Danish Tax Authority and The Danish Defense and in the University sector the 3 universities in Copenhagen, Aarhus and Aalborg.
The suite facilitates the case work for knowledge workers, managers and top-level management in these sectors. This is done providing clients suiting the needs of various roles being rich web clients, MS office integrations, File explorer integration and tailor made mobile apps. The platform offers relevant business logic and open interfaces for third party integrations.
The suite includes a traditional process suite WorkZone Process. The product includes standard business process for e.g. approval, submission and hearings and allows the customer to make custom processes. Core to the product is support of Ministerial processes in Ministerial Agencies and Departments. The generic process types supported are phases process, workflows and service workflows. As of late 2016 KMD partnered with Exformatics to introduce their declarative process modelling technology DCR to extend the existing process offerings.

2 Danish Governmental IT Challenges

The Danish Government sector has over the past decade been through a huge digital transformation. In 2004 the Danish Government sector defined a set of shared requirements known as FESD (Shared public sector requirements for Electronic Case and Document management). Scanjour was one of three companies winning the tender on FESD, ending up having a market share of 70% in the State sector.
Even though based on the shared FESD requirements, many customers spend a lot of effort and money in implementing deep business specific requirements on top of the standard FESD platforms. This locked a lot of customers on specific platform versions with major costs in maintenance and adapting for new legislations. Learning from this the trend over the past 5-6 years has been moving to less customization into more configurable and maintainable models.

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3 The WorkZone approach for business processes

Looking at business process the trend has been going from very strictly defined processes to more flexible and simple to maintain process models. However in a market where the laws under which the state institutions operate are dense, complex, and changes substantially every 6-12 months, it has been difficult to support this requirement in the traditional workflow solutions. KMD found that to gain competitive advantage in that space, their offering had to encompass end user specification of processes, in the interest of allowing domain experts to define and update core workflows.

3.1 Implementing a phase based process model

The first approach was to introduce “Phase processes” to model the overall business process phases, milestones and rules. Keeping it simple allowing for flexibility to the knowledge worker while keeping track of milestones and allowing a toolbox of reusable workflows to be used when more strict business rules where required. These being approval flows, distributions or hearings. But also more complex workflows where possible. The general idea was value driven, as a business process with a frequency of 10 might not be as relevant to fully digitize as a process with a frequency of 2000. (Fig 1)

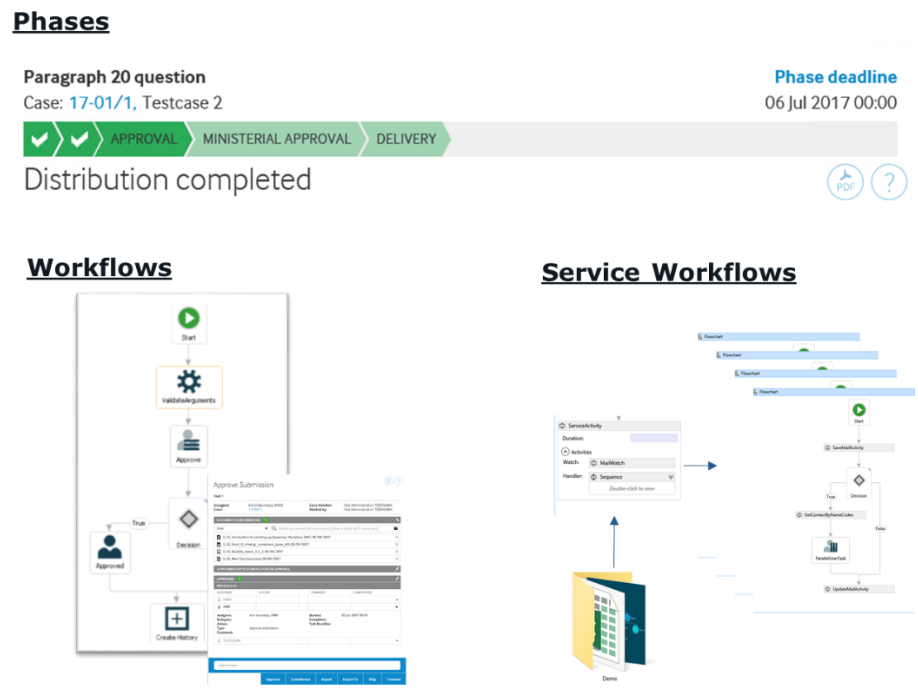

Fig. 1. The three process types supported prior to implementation.

However pragmatic and simple the approach was lacking something in between phases and workflows providing better assistance to the knowledge worker. Phase workflows was simple to configure and use while workflows was expensive to implement and maintain.

4 Adding a declarative model

In 2016 KMD recognized the need for expert end user process modelling and customization features in the next iteration of its highly anticipated KMD WorkZone offering. KMD contracted with Danish Adaptive Case Management vendor Exformatics A/S, who has developed the declarative process modelling and simulation tools Dynamic Condition Response Graphs, DCR, with IT University of Copenhagen.

4.1 Implementing a third party DCR engine

KMD approached Exformatics A/S, a Danish vendor of adaptive case management systems whom,through its extensive collaboration with Thomas Hildebrandt's Models group at the IT University of Copenhagen, is at the forefront of implementation of declarative process modelling and execution tools. In collaboration with Exformatics,

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KMD embedded Exformatics' DCR Process Engine in its WorkZone offering, while at the same time making its DCR Process Modelling and Simulation portal, dcrgraphs.net available to both KMD developers and state government domain experts. Thus, KMD and Exformatics together solve the dual problems of allowing domain experts to specify declarative workflows in sufficient detail that the resulting workflows can be executed by machines during actual case handling. (Fig 2)

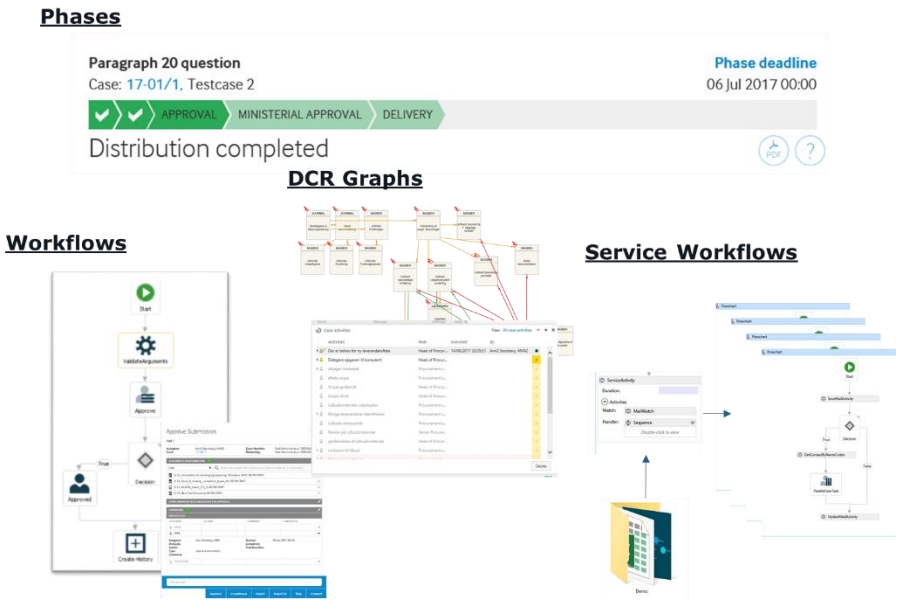

Fig. 2. The supported process types including the new DCR graph capability.

Due to the nature of the DCR engine it was a fairly easy to integrate the engine to WorkZone.

The DCR process model was added as a new process type side by side with the existing process types phases and workflows. The existing WorkZone Process engine was updated to use the DLL version of the DCR engine from Exformatics when interpreting DCR graphs. Instantiating the graph on actions and persisting the resulting graphs and changes in the WorkZone Process datamodel, only requiring smaller adjustments. (Fig 3)

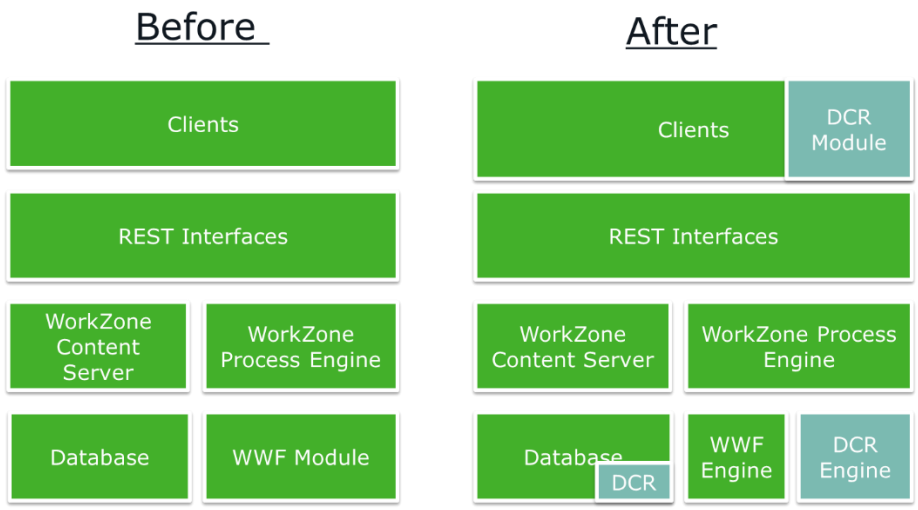

Fig. 3. Right side showing the changes done in the WorkZone stack to include the DCR capability.

The existing WorkZone forms model and rest interfaces was reused thus making it easy to add display of DCR graph capabilities inside WorkZone's clients (fig.4) below).

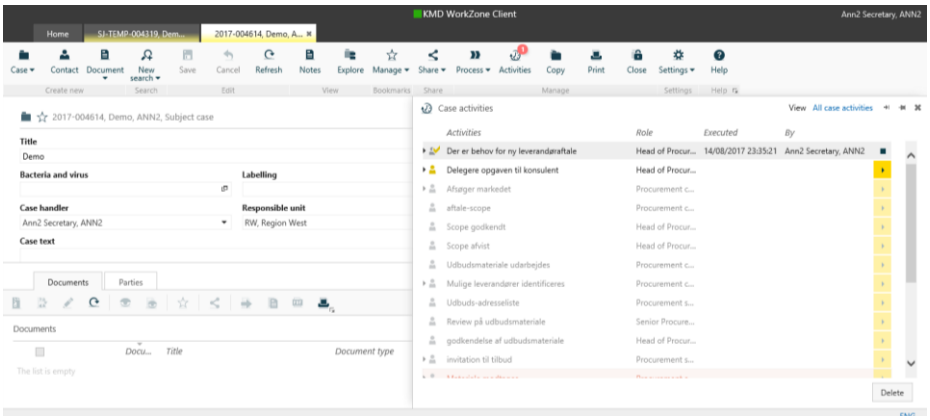

Fig. 4. Screen shot from WorkZone Client. Showing DCR activities on the right.

4.1 Enabling third party Adaptive Case Management system to leverage DCR

In order to enable third systems to leverage DCR graphs Exformatics have created a standard API to manipulate graphs and execute events. The API can be accessed as a

RESTful API, or as a DLL that can be embedded into the system such as KMD WorkZone.

The API offer the following four functions, which is all that is needed to support business processes leveraging DCR graphs:

a) Initialize(<dcr graph>) → <dcr graph>
b) ExecuteEvent(<dcr graph>,<eventId>[,<eventData>]) → <dcr graph>
c) GetEnabledOrPending(<dcr graph>) → <list of enabled or pending events>
d) AdvanceTime(<dcr graph>,<time tick>) → <dcr graph>

A <dcr graph> is an XML structure containing a DCR graph. KMD did not need to know the internals of this XML, but only eventId's to be executed and details about the events, i.e. event descriptions and roles. This has simplified integration of DCR graphs as the function GetEnabledOrPending calculates which events are relevant for the process in KMD WorkZone at a given time. AdvanceTime was added later to support time in DCR graphs.

Initially, KMD WorkZone invokes Initialize and then GetEnabledOrPending to retrieve the relevant events that are available from process start. Every time a user executes an event, ExecuteEvent is invoked, and then GetEnabledOrPending is invoked to retrieve the new list of relevant events. DCR graphs are stored by KMD WorkZone locally.

A process is considered completed, when no pending events exists in the graph. The attribute *isAccepting* is used to indicate that the process is complete.

The enabled or pending events are returned as an XML structure as outlined on http://wiki.dcrgraphs.net/wiki/50/dcr-repository. This logic makes integration of DCR graphs easier as synchronizing events from the DCR graph to the ACM system is much simpler and does not require understanding of the underlying DCR graph XML structure.

The first meeting with KMD about integration was held in the start of September 2016, followed up by one other physical meeting as well as a few Skype calls and email exchanges. On November 1st 2016 KMD presented an early beta version of WorkZone with DCR graphs. The fact that KMD could integrate DCR graphs in such a short period with relative little assistance from Exformatics, indicates that DCR graphs can easily be integrated into other solutions as well.

A follow up meeting was held in March 2017 where KMD asked for a few new features in order to empower business consultants to finalize process configuration on the portal thus avoiding configuration within KMD WorkZone after importing the DCR graph, which would have made maintenance and upgrade much more difficult.

a) Ability to search graphs using a RESTful API from DCRgraphs.net, thus avoiding manual export and import of graphs, as was used in the initial implementation.
b) Ability to provide a KMD WorkZone template for new graphs supporting specific event types with various parameters. This enables business user to configure specific elements on WorkZone that are unknown to DCR graphs directly from DCRgraphs.net. By adding custom event types and parameters

data about a specific event, i.e. a specific form, can be configured in the DCR graph at design time, and the data read and the specific form displayed to the user at runtime from KMD WorkZone.

c) Sequence Editor providing an easy way to editor activity descriptions in a rich text format (html) as well as changing the sequence of events so KMD WorkZone can present events in a specific sequence.

These functions were delivered to KMD during April and was embedded in the first KMD WorkZone release in July 2017.

5 Process types and Modelling approaches today

5.1 Supported business areas in existing workflow solution

Some business examples to exemplify the capabilities of WorkZone without DCR graph support. Most customers are governmental authorities, which in Denmark means that mails, notes and documents influencing case handling and decisions must be archived. The public may ask for access to such documents in order to examine the decision making.

Decisions

In this context customers use "WorkZone Classic Workflows" for sequential decision chains, for example a case handler creates a draft paper that is going to be used for a law regulation. She starts a sequential WorkZone Decision workflow in which her team leader, the section manager, the deputy director one after one receives a user task for approval. This workflow supports:

a) Ensuring (and documenting) that the paper has been reviewed and approved by the right people in the right order,
b) transparency in the business, as stake holders and other interested colleagues or managers at any time can trace the workflow progress,
c) timely handling of the task, as milestone dates can be set and monitored
d) flexibility, as actors dynamically can be added or removed (while changes are logged)

Teamwork

A case handler may also want to involve a number of colleagues to review or contribute to a certain document in progress. In this case, she starts at parallel WorkZone Hearing workflow where for example six colleagues simultaneously receives a user task for review (or contribution). This workflow supports:

a) An easy method for such kind of teamwork
b) transparency in the business because the workflow owner can monitor any activity in the workflow, and because the actors are able to see each other's contributions,
c) timely handling of the task, as milestone dates can be set and monitored

Distribution
An Executive board secretary may want to ensure that a case handler or team leader takes responsibility for a certain task. In this case, she starts a WorkZone distribution workflow where a team leader receives a user task regarding taking responsibility for delivering the requested work at the requested date. The team leader may forward the user task to somebody else, or reject the task. This workflow supports:

a) An easy and fast method for task distribution,
b) transparency in the business, as stake holders and other interested colleagues or managers at any time can trace the workflow progress,
c) timely handling of the task, as milestone dates can be set and monitored

5.2 Business areas with challenges in existing workflow solution

In the governmental sector, many tasks are regulated by laws which may change in irregular intervals. Workflows may require that case handling takes certain aspects of laws into consideration. However, a law change may have the consequence that new user tasks must be performed, or that other kind of actors has to be involved.

As "WorkZone Classic Workflows" mainly supports Distribution, Decision and Team Work workflow types, it is not possible for a stakeholder easily to change a workflow to support more dynamic business processes where the requirements are often changed as e.g. areas regulated by political law making.

5.3 How is workflow modelling performed by customers using WorkZone?

A workflow modelling process at a customer starts by pinpointing a business area to work with. This might be a business area characterized by many repetitive tasks performed by many persons, or a business area with complex processes running for several months involving a variety of actors.
The purpose for introducing digital workflow support could be to uniform the way tasks are performed for quality reasons, or to guide and control both experienced and inexperienced employees for efficiency reasons. In general, it is also required to establish transparency in the state of work, enabling management to ensure that milestones and KPIs are met.
When a suitable business area has been selected, a project group with employees representing the full workflow is established. During a number of workshops the employees presents the processes they work with, the tasks involved, milestones, time restrictions and approvals required, actors and stakeholders involved.
The product of these initial workshops are a common language for the processes minimizing misunderstandings, and the possibility to remodel the processes for digitalization in order not just to maintain the non-digital procedures that were performed before.
Next step is to model and document the workflow and to implement it in WorkZone. A workflow may consist of a "mother"-process divided into **Phases** representing high-

level steps and milestones. Each "mother"-process phase may have one or more "child" processes (**Workflows**).
KMD has experienced that it is beneficial to supplement the Workflow model with so-called "scenario-descriptions" with step-by-step illustrations of a possible way through a workflow. Such scenarios are very useful for acceptance test before releasing a digital workflow, and for education of end-users.

6 Results Achieved with DCR Graphs

WorkZone Case Activities utilizing DCR graphs has been available for customers in a beta version since early spring 2017, and has been received very positively by KMD's customers. A number of customers has already acquired Version 1.0 which was released in June 2017. Implementation at these customers are in progress, so despite the relatively short period with the new Adaptive Case Management product on the market, KMD has already gained experiences in a number of workflow utilizations with various customers handling tasks involved in:

- contract management
- producing topographical maps
- control of electrical plants related to safety of equipment and installations
- issuing taxi driver licenses

This indicates that very different business challenges may have potential to gain from the new WorkZone Case Activities. End users have been able to amend and update models after receiving only single digit number of hours of instruction. The implementation efforts have focused on several possibilities that were not available in the "WorkZone Classic Workflow", such as:

- the customer being in control of modelling and deploying workflows
- modelling can be performed by domain experts. No IT-specialists required.
- easy maintenance of instructional texts.
- easy change of workflow conditions and actions

Some of the features from the existing workflow systems are still valid and appreciated, such as:

- transparency in the business, as stake holders and other interested colleagues or managers at any time can trace the workflow progress

7 General Lessons Learned

The WorkZone product team are enthusiastic about finally having arrived at a reasonable and sustainable solution to the problem of updating process models when laws and regulations change, without having to redo an entire requirements development cycle.
The lessons from the rollout are at the time of submission unknown; they will be available at the time of the conference. However, we can report on the experience of the

product team on both integrating Exformatics' process modelling technology, as well as developing the core, "starting point" models of the WorkZone offering. Principally, KMD developers found DCR graphs and Exformatics implementation to be an excellent fit for WorkZone—the DCR process model is modular and simple enough that the principal integration of DCR graphs into WorkZone was undertaken in less than two calendar months. We speculate that this is in large part because of the executable nature of DCR graph ("the model is the runtime") and the existing WorkZone frameworks core components.

During the first beta trials, it was quickly recognized that ease of distribution of the graphs from dcrgraps.net to WorkZone was important. This logic was implemented in the released version in July, increasing the ease of use considerable. Thus, allowing any graph produced in dcrgraphs.net to run in WorkZone by a simple export/import operation.

However, while KMD customers were soon comfortable producing DCR models, it is noted that they had a tendency to produce somewhat linear models, especially compared to previous experiences with domain experts.

This indicates to us, that customers tend to address their current business challenges. It is interesting to experience that even though presentations of DCR Graph modelling and WorkZone case Activities have focused on the modelling flexibility and the dynamic runtime workflow (possible actions dynamically changing according to the actions performed), customers are still mostly interested in a solution to their current business challenge. However, as customers start to work with their first implementation, they seem gradually to recognize that the new product has features to support a wider specter of business challenges.

The lesson learned from this is, that it is important to let interested customers begin utilizing the product relatively linear in order to solve relatively simple challenges. Only with the gradually increased understanding of the product's opportunities through the implementation of the first project, the customer's Domain experts achieve understanding of the product's many opportunities.

Future challenges are e.g. to embed the Role model further with WorkZone, handle deadline rules, using WorkZone data in the graph and do WorkZone specific operations in the graph.

7.1 Combinations of workflow types

Working on process modelling with customers has also identified a need to combine the different workflow types included in the KMD WorkZone product suite.

The combination of **Phases** and **WorkFlows** has been utilized in a number of implementations, mainly to support business areas with workflows characterized by strictly monitored start and end dates, a number of hand-overs of responsibilities, and including both **Decision workflows** and **Teamwork workflows**.

Recently we have also included a **Service workflow** to monitor certain events in (for example incoming mail in a mailbox, a specific state change on a case or document, a specific value in a case or document attribute, a new entry in a database table). Based

on such an event, the **Service workflow** can be configured to trigger start of either a **Phase process** or a **Workflow** or a **DCR Graph** Case Activity. For example, when a new case is created in order to handle "issuing a license", a **Service Workflow** can trigger the start of a Decision Workflow to manage and document the approval process, and a DCR Graph Case Activity with instructions and checklist.
Customers working with **DCR Graphs** are now starting to study how a **DCR Graph** Case Activity would benefit from starting a **Decision Workflow.** This seem to be most relevant in business areas where management requires strictly and compliant execution of tasks in order to support equal handling of similar cases for all citizens.
We expect that combining workflow types will be an area with much attention in forth-coming implementations.

7.2 Conclusion

Putting together a toolbox of various process models, and having a declarative tool for business processes still needs to prove its full potential. We do however see that a more pragmatic approach than the normal BPMN mapping and implementation of business processes is required in the market.
We have seen many customers break their neck in trying to do full implementation of BPMN flows. Where the BPM consultant is trying to adapt the complete real world picture into a BPM system. This approach is usually more expensive than expected, covering all scenarios on implementation is unrealistic and testing all possible flows is difficult. Thus the final cost is quite high, and the users tends to be locked in hard to change processes.