

## “WICKED” PROJECT MANAGEMENT: AUTOMATING ACTIVITY REPORTS

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**ABSTRACT:** *We have been exploring ways to use traditional technologies (e.g., spreadsheets, databases, word processing) to provide automated assistance to the collection and persistence of staff activity metadata, which we call “activity bullets.” While our near-term goal is at least semi-automated report generation, our longer-term goals include knowledge management and reuse. This effort quickly proved to be a “wicked” problem characterized by ambiguous requirements, uncertain solutions and risky returns on investment. In this paper, we substantiate the “wicked” qualities of the problem, and share successes, shortfalls and lessons-learned from our current solution approaches. We also suggest alternative, state-of-the-art mechanisms such as semantic wikis and markup-aware mashups that are worth exploring as lightweight solutions to automated activity reporting and to persisting derived metadata for employment in knowledge sharing initiatives.*

### 1. Introduction

We are engaged in investigating lightweight approaches to capturing and organizing readily available information, making it easily accessible as reusable knowledge to our staff, customers and partners, and building and disseminating information as knowledge. We seek ways to accomplish these objectives that can benefit not only our own organization but also those of our stakeholders and collaborators.

#### 1.1 Information management precedes knowledge management

A major focus of knowledge management and sharing is to identify and gather content from documents, reports and other persistent enterprise sources as the basis for establishing best practices and to leverage lessons-learned

from others facing issues and working problems similar to our own.

Transforming ambient enterprise data and information via content search, markup and relationship tools – and even less sophisticated mechanisms – is challenged by disparate databases and non-interoperable repositories, poorly documented information processing systems, inconsistent product content (divergent syntax and semantics), and out-of-sync policies, procedures and documentation.

We believe that equipping staff at every hierarchical level with tools to help them contribute to, and hence become invested stakeholders in, our knowledge sharing environment is among the most important drivers of a “need-to-share” work culture.

### 1.2 The reporting “burden”

Engineering staff often are required to document their activities to one or more internal reporting processes, as well as customer-facing external reporting processes. In addition to frequency, the day of the week, month, quarter, or year on which reports are due varies, as do the specifics of content and level of detail expected.

For career enhancement, the staff may need to document their activities along yet another path: a performance and development (P&D) process. This information overlaps with that in activity reports. In addition, staff with multiple reporting requirements can find the “slicing-and-dicing” of information about their activities, which we call “activity bullets,” to meet the multiple documentation

Despite these challenges, the activity reporting process appears to be an obvious, “low fruit” opportunity to capture and organize potentially useful information together with context that poises it for employment as readily accessible knowledge across the enterprise. There are many ways this can potentially benefit engineering staff, their managers, clients and business partners.

### 1.3 The experimental premise

In this paper, we document our efforts to deploy a web-based activity bullet collection and report generation capability. Because our project generates weekly activity reports (WARs), we colloquially refer to this capability as the “WAR Tool.” Our experimental premise is to provide a lightweight “entry ramp” for the staff to coalesce their activity bullets into a central

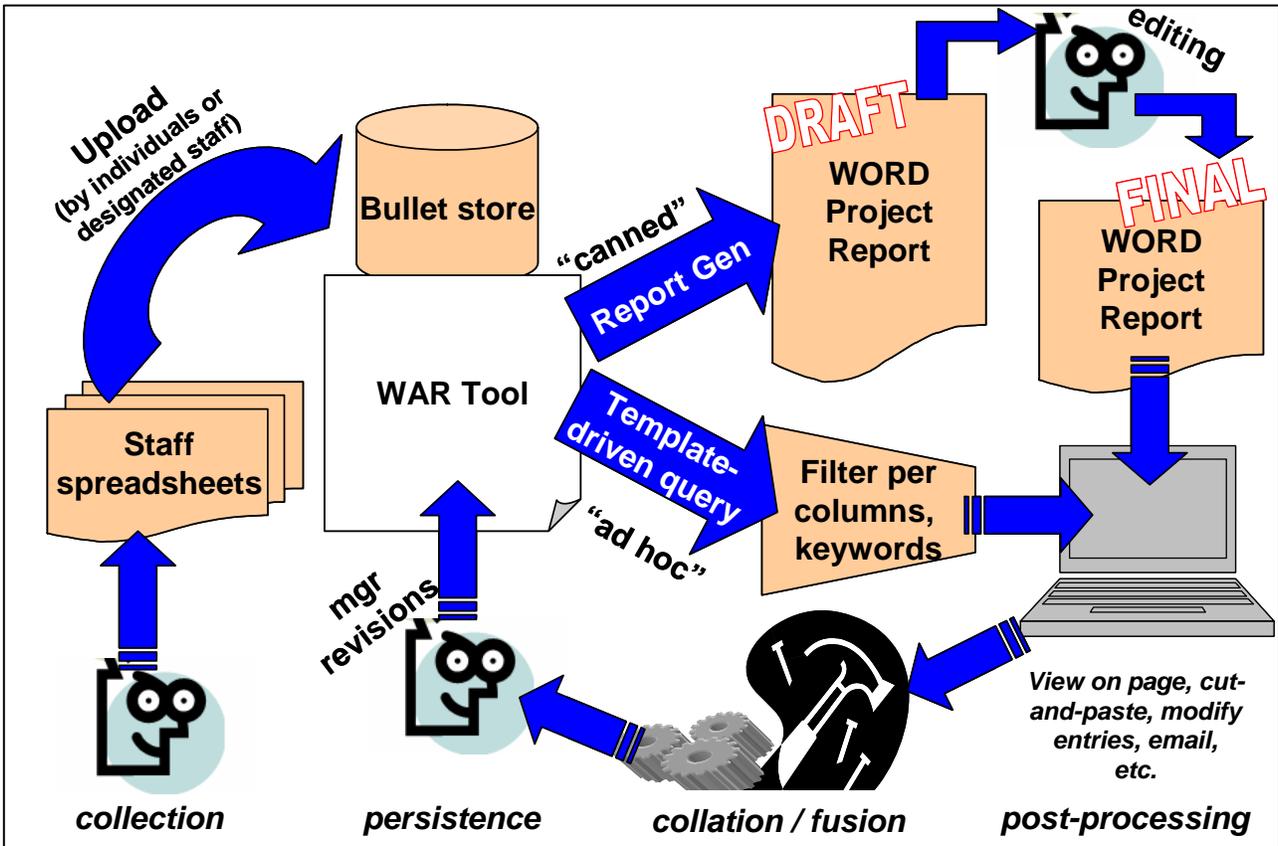


Figure 1.2 Activity reporting automation concept

formats and details of these alternative reporting processes complex and burdensome.

repository which they could feed using either a spreadsheet or a web-based menu- and template-driven interface, and from which

various formal and informal reports can be generated.

This has proven to be a “wicked” problem. We discuss the basic requirements that shaped our “first spiral” WAR Tool, illustrated in Figure 1.2, some of the challenges we faced in getting folks to do something *old* a *new* way; and lesson-learned from deployment and experimentation.

## 2. Wicked Reporting

A common method for regularly accounting to project managers and customers – whether internal or external to the organization – regarding spent resources is through enterprise reporting processes. As mentioned earlier, not only are such reporting processes readily accessible opportunities to capture and organize potentially useful information into reusable knowledge, but also attacking knowledge management from this “bottoms-up” direction fosters buy-in from the generators of the raw material that is fused into knowledge.

### 2.1 Re-engineering may involve “wickedness”

Our attempts to automate activity reporting and to poise its artifacts as knowledge management assets, have convinced us this *is* a wicked problem. Subject-matter experts acknowledge that choosing the best way to re-engineer a business process frequently falls into the “wicked” category. (Dobb, 2002)

### 2.2 Seven “deadly sins”

Rittel and Webber’s seminal article (Rittel & Webber, 1973) enumerates ten common characteristics of wicked problems. We were able to cite at least seven of these characteristics that align in obvious ways with our experiences automating activity reports and poisoning such metadata for knowledge management purposes.

- *A wicked problem is one that has incomplete, contradictory and changing requirements, and its solutions are often difficult to recognize because of complex interdependences.*

We found changing and competing requirements to be on-going challenges in our experiment as we added additional participating clients, solicited their reporting needs and considered their suggestions for the Tool.

- *Problems whose solutions require large groups of individuals to change their mindsets and behaviors are likely to be wicked.*

This is an inherent hurdle to automated report generation, since it requires both the engineering staff contributing inputs and the management staff consolidating reports from them to do business in a way different from their traditional, paper-driven manual approaches.

- *Wicked problems are symptomatic of other problems.*

The activity metadata management problem we are working underlies a larger enterprise information / knowledge management problem. We have to solve piecemeal data and information management problems first – as a migrational step to moving our workforce into a need-to-share mindset – before we can make significant headway on the broader knowledge management front.

- *Wicked problems require inventive, creative solutions.*

As we will point out later in this paper, a key lesson we learned is that traditional technologies (e.g., spreadsheets, databases, word processing) alone proved to have insufficient “technical bang” to produce a “good enough” solution to this problem.

Experts agree that is a typical conclusion when working wicked problems. (Dobb, 2002)

- ***Any implemented solution to a wicked problem has consequences and may cause or reveal additional, sometimes more complex, problems.***

As one example, our first spiral solution has splintered our community into the following groups: those who participate in the prototype solution, those who pretend to participate, those who want to participate but cannot due to constraints beyond individual control, and those who would prefer not to participate and therefore avoid engagement. This has revealed some underlying work culture effects that may be hard to overcome without directive intervention.

- ***Wicked problems have no perfect solution, but rather better, worse or “good enough” solutions.***

Even within our small pool of stakeholders (fewer than 50), each had individual ideas about operations that had to be supported by the solution to meet their needs. The Tool satisfied none of them completely.

- ***Stakeholders have divergent world views and different frames of reference for understanding the wicked problem.***

We especially observed differences in world views when trying to reach agreement on which activity metadata should be persisted. What is relevant to one group is not to another group, even when they both belong to the same larger organization. Stakeholders also disagree on terminology, such as *What constitutes an “issue?”*

### 3. WAR Tool Description

Table 3.1 summarizes key functionalities implemented in the first spiral WAR Tool, as well as some deferred to future spirals.

**Table 3.1 WAR Tool Capabilities**

<i>All user capabilities</i>
<ul style="list-style-type: none"> <li>• Join application (set up “account”), logon, logoff</li> <li>• Access “how-to” information</li> <li>• Download Excel spreadsheet for offline / non-real-time bullet composing</li> <li>• Upload / post bullets via Excel spreadsheet</li> <li>• Compose / post / edit bullets online / real-time via web GUI</li> <li>• View *any* posted bullets, filtered according to template-driven, metadata-based queries</li> <li>• Generate a canned report (modeled on standard template)</li> <li>• Bullet “roll-ahead” to future weeks</li> <li>• Bullet “promotion” to manager bullets</li> <li>• Log a problem report</li> </ul>
<i>Administrator only capabilities</i>
<ul style="list-style-type: none"> <li>• Edit / delete user accounts</li> <li>• Edit / delete *any* posted bullets</li> <li>• Maintain logs (problem reports and enhancement suggestions)</li> <li>• Automated broadcast email notifications</li> </ul>
<i>Requested capabilities (not implemented yet)</i>
<ul style="list-style-type: none"> <li>• Automated linkage of activity metadata to goals, measures and outcomes documented in staff P&amp;D plans.</li> <li>• Dynamically generated context-driven spreadsheet submenus</li> <li>• Notification when participant [does not] posts bullets by a specified date/time</li> <li>• Decouple / formalize appropriate business rules</li> </ul>

#### 3.1 Functional requirements discussion

We adopted a “post once, slice-and-dice many” philosophy. This enables the staff to post in a single operation all activities for the relevant reporting period, even when supporting multiple projects. Bullet posting was accomplished via a spreadsheet with context-sensitive pull-down menus. This ensured the staff provided the minimum metadata required, and enforced limited vocabulary choices for items that were used to sort and categorize during later operations.

#### 3.2 Standard metadata

To mitigate content inconsistencies, we developed standard metadata that outlines the expected content for activity bullets. The initial set of agreed metadata is shown in Table 3.2. The underlined metadata (first four rows) are required; all other items are optional in bullet entries.

**Table 3.2 Activity bullet metadata**

<i><u>Metadata</u></i>	<i><u>Explanation</u></i>
<i><u>Project or Role</u></i>	project account number, or role (e.g., Group Leader, Task Leader, Staff) for which the activity is reported
<i><u>Billable Task</u></i>	two-character code used within projects to distinguish charges
<i><u>Task Area</u></i>	task name associated with the activity information
<i><u>Current Activities</u></i>	describe what was done during the relevant period
<i><u>Key Division / Department Successes</u></i>	note how activity resulted in a major impact or real “win” for MITRE or the customer
<i><u>Major Milestones</u></i>	note how activity represents a major milestone for the project or personal plan
<i><u>Planned Activities</u></i>	document what is expected to happen during the next reporting period (e.g., meetings, briefings, travel)
<i><u>Additional Information</u></i>	amplifying details, such as a url to an attachment

### 3.3 Report generation

Without the ability to examine, retrieve and re-purpose a repository’s contents, it is nothing more than a “dumping ground.” The WAR Tool enables users to extract any relevant subset of the activity bullets using template-driven queries, where the retrievals are formulated around the metadata shown in Table 3.2. A “canned” report capability is also available that creates a standard draft report by collating all bullets specified for a given project per Task Area during a given time period. It is assumed that this draft report would be subjected to human editing to eliminate duplicative bullets, correct grammatical errors, etc. before delivering the report to its intended recipient.

Both flavors of report generators are aimed at minimizing the report creation burden, but they also present opportunities for unanticipated reuse of the persisted information.

### 3.4 Elements of a web-based solution

We hosted the WAR Tool on a server behind our corporate firewall and we made it accessible to the staff via browsing and through a hotlink from our department’s Community Share site. The repository is a Microsoft Access database designed by one of our technical staff.

## 4. Lessons-Learned

The first spiral WAR Tool, while clearly not an ideal solution, has added near-term value to our existing activity reporting processes. Breaking activity bullets into their constituent metadata components via the spreadsheet has helped increase engineering staff awareness of what content constitutes an informative activity bullet. This in turn has improved the quality of the report products that we deliver to our customers. The Tool’s shortfalls have taught us a number of lessons.

### 4.1 Activity report automation lessons

The top three lessons that apply to activity report automation in general are:

- ***Persist activity metadata only when it supports a known decision-maker information need.***

We incorporated several items of metadata into our collection process that non-invested future stakeholders insisted were important to *their* particular report generation efforts. We discovered later that the reporting staff in many cases did not understand what sort of information these “outsider” managers expected them to report in those facets of the activity bullet, so they consistently left them

blank. These metadata therefore never contributed to the knowledge base.

- ***Provide adequate training.***

The engineering staff generally limits self-directed learning to the minimum needed to get the job done. Regarding the WAR Tool, most of the staff spent little time exploring the Tool's capabilities beyond learning how to download a spreadsheet template and upload activity bullets to the repository. More live training and targeted on-line tutorial material are needed to fully exploit the Tool.

- ***Participation incentives must be clear.***

The WAR Tool was strongly supported by our division management; but there were no negative consequences for staff who failed to participate in the new process, nor any discernible benefits for doing so. This made it difficult to sustain participant support when rough spots were encountered, and to find additional participants to broaden the scope of the experiment beyond the initial pilot.

#### 4.2 Wicked problem lessons

The top three lessons that can be attributed to the “wicked” nature of the problem are:

- ***Non-invested future stakeholder requirements should have lower priority than invested current stakeholders.***

We tried to develop a middle ground solution that would be poised to accommodate alternative views (based on the results of a requirements call), particularly where collected metadata and desired functions were concerned. Attempting to satisfy too many competing requirements proved to be injudicious. It failed to reveal any new insights we could not have developed within a smaller scope. It certainly did not “tame” any of the wickedness. We learned it would have been better to defer more “wish list” items to

future spirals when and if the relevant stakeholders who advocated them joined the process.

- ***Expect less than unanimous grass-roots support when solutions require cultural change.***

After the first few weeks of deployment, we observed a falling away of about 20 percent of our participants. The reasons for this varied. The most common reason was that the staff member had encountered a bug several weeks into the experiment that required using a work-around method for the current reporting period, until the bug could be repaired. In some cases, the staff just continued using the work-around because they did not realize the bug had been repaired. Other times they simply fell back into old practices when they realized there were no negative consequences for failing to do things the “new way.”

- ***Revolutionary innovation is unlikely to result from simply “webifying” an existing wicked process.***

Small, incremental improvements – moving what was essentially a manual, paper-driven process to a semi-automated, web-based process – were neither revolutionary nor innovative enough to add extraordinarily to the knowledge management value proposition. This finding is consistent with other software development practitioners, who reason that many efforts fail due to applying traditional solutions where innovative, adaptive solutions were needed instead.

#### 5. Way Ahead

We still believe that persisting and automating activity reporting is worthwhile, but we suspect that the wicked characteristics of the problem mean different technologies

must be brought to bear to bring about revolutionary improvements to the process.

### 5.1 Stay the course?

There is some merit in simply considering further refinements of the current solution as a way-ahead. The current WAR Tool – while admittedly naïve and still clearly a laboratory model – nonetheless poise some information for more insightful inspection than previously possible. For example, simply being able to count the number of activity bullets posted per Task Area gives the manager an at-a-glance overview of how resources are distributed across the total project and may signal the need to redistribute them.

### 5.2 Better match solutions?

We also have begun investigating web-native technologies for alternative, better-match solutions to this wicked problem. We are concentrating our inspections on technologies that support adaptive, diversity tolerant solutions that we suspect are more suited to the alternative world views and needs of our process participants.

- *Semantic Wikis*

A better match solution to automated activity reporting and metadata persistence may well be based in the realm of semantic wikis. Semantic wikis such as Instiki (Richter, 2007) and SemperWiki (Oren, 2007) extend a simple note-taking idea so that the notes can be annotated with semantic markup that makes it easier to find and retrieve relevant information. By adding metadata to wiki content, users benefit by improved retrieval, information exchange and knowledge reuse. (Oren & Delbru, 2006) Extension, inspection and sharing of knowledge are natively built into the underlying technology.

An obvious benefit of a wiki-based solution is that staff would not be required to input their activities via a highly structured format.

Instead, they could enter their activities in a more natural, journal-like form. The potential benefits of a wiki-based approach may be limited depending on the types of annotations supported (whether informal, formal or truly ontological); whether [or not] terms with a related conceptual model are consistently employed; and how robust is the support for the notion of annotation context (e.g., provenance, temporal or spatial scoping) which can be critical to the appropriate reuse of knowledge.

- **Other markup-driven approaches**

Microformats and other forms of tagging represent another lightweight technology worth further investigation. For example, by standardizing a few key tags, microformats expose small pieces of common information (e.g., events, locations, points-of-contact) while minimally disrupting the web documents that contain them. Staff journals, deployed as web documents, could be injected with appropriate markup to expose the relevant metadata.

Mashups can aggregate information contained in multiple marked-up documents in a wide variety of ways, with no need for the original content designers to anticipate all of them *a priori*. Thus document markup, used in conjunction with mashups, is another solution path worth investigating due to its agility and extensibility. The degree to which markup injection can be automated, vice relying on manual attribution, is a mitigating factor that will impact the success of such markup-driven approaches.

## 6. Summary and Recommendations

We manage information because it is an enterprise commodity, and there is value in doing so. Unless we can migrate to a need-to-share work culture, populated with automated tools to enable all staff to easily contribute to

information capture, persistence and examination in appropriate and meaningful contexts, it will be difficult to achieve enterprise knowledge management goals. Staff activity reporting and the persistence of relevant metadata is an opportunistic entry ramp to instilling information sharing practices at every hierarchical level of the enterprise; however, it is a wicked problem.

Cobbling together traditional technologies – such as spreadsheets, databases, and word processing – adds near-term value; yet such approaches are unlikely to foster the revolutionary cultural changes needed or to yield a “good enough” solution to wicked problems like report automation.

To realize the potential benefits of knowledge management requires a true enterprise-wide commitment to cultural change and the investment of non-trivial resources. Alternative, better-match solutions to this wicked problem domain may be found in the realm of semantic wikis or achieved by combining appropriately marked up documents via mashups. We plan to investigate these state-of-the-practice approaches in future WAR Tool spirals.

## 7. Acknowledgements

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## 8. Disclaimers

The views, opinions, and conclusions expressed in this paper are those of the authors and should not be construed as an official position of the United States

Department of Defense. All information presented here is unclassified, technically accurate, contains no critical military technology and is not subject to export controls.

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