

Effectively Managing Process Compliance

Systems Engineering in the Face of Multiple Models, Standards and Best Practices

1 Intro

Every organization strives to have processes intended to meet business objectives. Many are required to demonstrate compliance with multiple standards or best practice models (e.g. CMMI-DEV, ISO standards for safety and security, COBIT). Some would like to draw from these sources in implementing and improving their processes to achieve better business performance. Regardless of the motivation, managing costs associated with these activities poses a serious challenge to management. This paper describes an existent framework and supporting tooling which can dramatically contribute to meeting that challenge.

2 Current Challenges

Building large complex systems with world class quality does not work without using appropriate development processes. Corporations producing systems with poor quality run into the risk of losing reputation, customers and revenue and even endanger the whole enterprise. But defining the appropriate processes and implementing them in a sustained way does not come without cost. To adapt quickly to new business requirements, processes need to be continuously monitored, controlled and improved. In a lot of corporations, these activities are currently performed by writing process documents, drawing process diagrams and filling out spreadsheets. To make things even more challenging, almost all organizations - building complex systems are required to comply with specific models or standards, e.g. regarding safety, security, quality, reliability or all of the above at the same time. For these organizations, this means frequent audits, appraisals or assessments to prove effective process implementation and standards compliance and to improve the identified process weaknesses. Preparing for these audits using typical techniques requires a lot of effort from all participants. In some cases, projects are spending more than 25% of their work hours for audit preparation and performance. Effectively reducing these efforts would save organizations valuable resources, time and costs that could better be invested into process improvement efforts resulting in higher productivity and product quality.

3 Goals

An approach that helps organizations to reduce their efforts and costs required for process definition, deployment and audits, needs to fulfill the following goals:

- Allow organizations to focus on the definition and implementation of process in terms meaningful to the members of the organization.
- Provide easy access to a wealth of best practice sources for use in the process definition.
- Provide automated support to facilitate enactment of the processes.
- Provide support for continuously monitoring adherence to the processes.
- Automatically provide views of current compliance and supporting evidence in terms of any required model or standard.
- Support appraisal preparation and performance by automating evidence collection.
- Effectively collect, manage and track non-conformances to closure in order to improve processes and secure future audit success.

4 Key Concepts

The key idea is to link the actively used development processes to the models or standards that need to be fulfilled (e.g. CMMI, ISO). By actively using the development processes in projects, i.e. by creating work products in projects, measuring process and product performance and quality, managing defects, and continuously performing PPQA activities, evidence data will automatically be collected in the background.

This requires the following steps:

- Define organizational and project processes.
- Map process definitions to reference models.
- Instantiate and tailor process definition to project's requirements.
- Create and manage specific work products in connection with the process definition.
- Continuously assure process adherence through ongoing quality assurance activities.
- Use the mapping of process definition and reference models to automatically extract evidence data (e.g.

- input for CMMI PIIDs) for a specific target model (e.g. CMMI-DEV).
- Use the evidence data for appraisals and improvement findings.
 - Feed back improvement findings into next version of process definition.

Figure 1 shows the interaction between the two continuous cycles of process definition/execution/improvement and process quality/compliance assurance.



Figure 1: Interaction between Process Performance and Process Quality Assurance

The appropriate tools will provide organizations the help they need to implement these steps in an effective way.

5 Implementation

As a first step organizations need to define their organizational and project processes using a structured methodology. Modern process management tools like Method Park's "Stages" and Integrated System Diagnostics' "Model Wizard" or others support these process analysis and definition tasks. By using a database oriented approach, each process element (e.g. activity, role, work product, phase) can be modeled as a separate object and connected to other elements via associations (e.g. a role is responsible for a specific work product). This provides a powerful infrastructure for process modeling. A key

success factor when modeling an organization's processes is to use the appropriate process architecture. This means applying the appropriate levels of detail in the different process hierarchies, e.g. process maps on the highest level, process flows on intermediate levels and techniques like RASIC or SIPOC to describe the exact process steps. Because processes are a crucial part of an organization's DNA, there is no generic recipe to successfully perform this. But it is essential to use the right model for the final process acceptance amongst the end users. Therefore Stages supports different process metamodels to be used on different hierarchy levels and flexibly adapts to the organization's requirements regarding process levels, descriptions or diagrams. To build a bridge from the processes to the standards that need to be implemented, standards like CMMI, SPICE or ISO references can also be modeled by creating an element for each CMMI practice/subpractice or ISO requirement. Using this approach, the process descriptions can then be mapped to the elements of the reference models. For example, a particular process step fulfills a specific requirement of one or more reference models. Therefore, mapping these processes is not an easy task because this requires knowledge of both the process and the reference model. So normally it should be done by people with deep expertise in both areas. Tooling needs to support weighting these mappings, e.g. to express full, medium or weak coverage of a standard by a specific process description.

As a next step, using these processes in projects enables process users to create real work products (e.g. requirements specifications, test plans) and store them in connection with the process definition. Modern process enactment tools allow users to access and modify work products directly from the process definition. When creating work products in projects, the evidence data for process compliance approval is collected automatically in the background. By exploiting the mapping from the project's defined process to the reference models, this works without requiring users to manually tag work products as evidences. Preparing for an appraisal or performing quality assurance is now supported by extracting the necessary evidence. Using the mapping again, a CMMI PIID containing direct evidence data (e.g. work products, process definitions) can automatically be generated. Figure 2 shows how the mapping is used for maintaining the

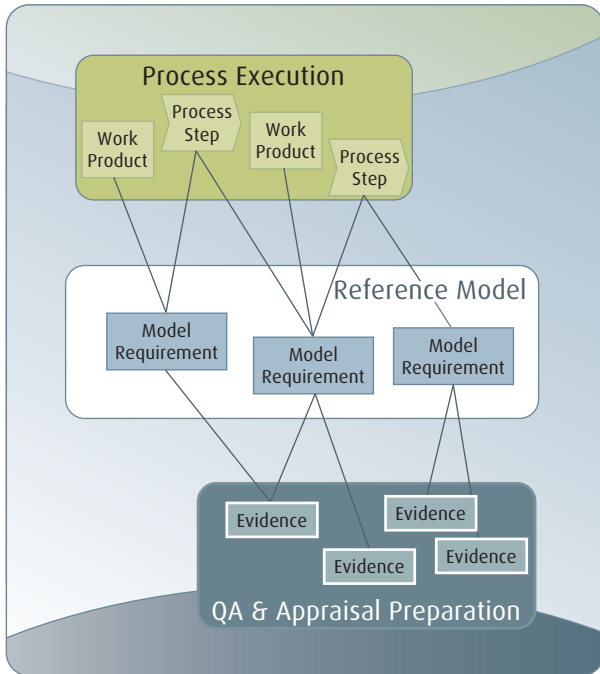


Figure 2: Reference Models as the „glue“ between the two worlds

required relationships. By using the seamless interface between “Stages” and ISD’s “Appraisal Wizard”, the collected evidence data can be directly loaded into the appraisal tool. Appraisers will be able to understand the process implementation and judge on model compliance. Evidence can directly be accessed by just clicking on the links in the appraisal tool. Appraisers can record detailed comments regarding the applicability or shortcomings of the evidence in relation to a particular reference model or standard in a way that makes them easily accessible and actionable. Appraisal Wizard will collect all improvement findings identified during the appraisal. This information can then be directly fed back into process management to allow organizations to continuously improve their processes. Using the mapping again, improvement findings can automatically be attached to the respective process definitions.

6 Advanced Concepts: Multimodels

For organizations that are required to follow more than one standard, the idea described above can be extended. By mapping standards to other related standards (e.g. CMMI to ISO 9001 or SPICE), overlapping parts of the standards will be identified. This will reduce efforts when organizations implement processes that have to comply with multiple standards. Another example is to build a

CMMI cross-constellations model that consists of all three current CMMI constellations (DEV, SVC, ACQ). Figure 3 and Figure 4 show two sample multimodels for the Automotive and Defense industry sectors. Both Stages and Model Wizard fully support this and provide valuable guidance in setting up these multimodels.

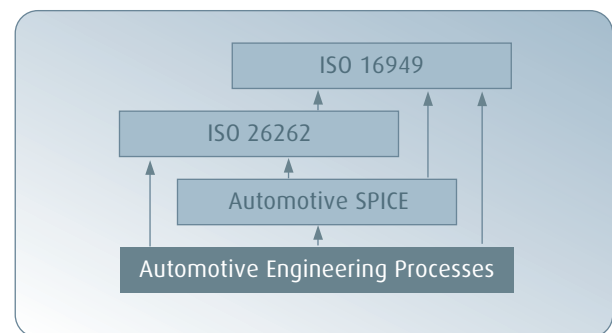


Figure 3: Sample Multimodel for Automotive

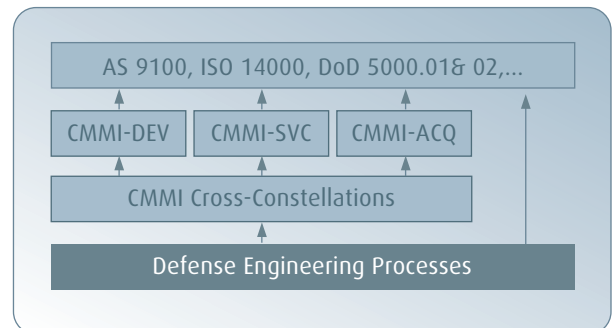


Figure 4: Sample Multimodel for Defense

Utilizing multiple models requires extensive expertise which in turn means bringing together experts for different standards and agreeing on reasonable mappings. Creating maps from an organization’s process to each of the underlying models or between each pair of published models and standards is an enormous undertaking. It is also an on-going maintenance burden as the models or standards evolve. The “Integrated System Framework (ISF) for Excellence” is a framework for organizing and correlating components of best practice reference models and industry standards across all organizational areas. Following an Open Source approach, experts in each model or standard are able to establish an agreed mapping of components within the ISF framework. The framework can be extended as needed to accommodate new concepts. Consequently, an organization drawing upon ISF in the creation or improvement of it’s own processes, can

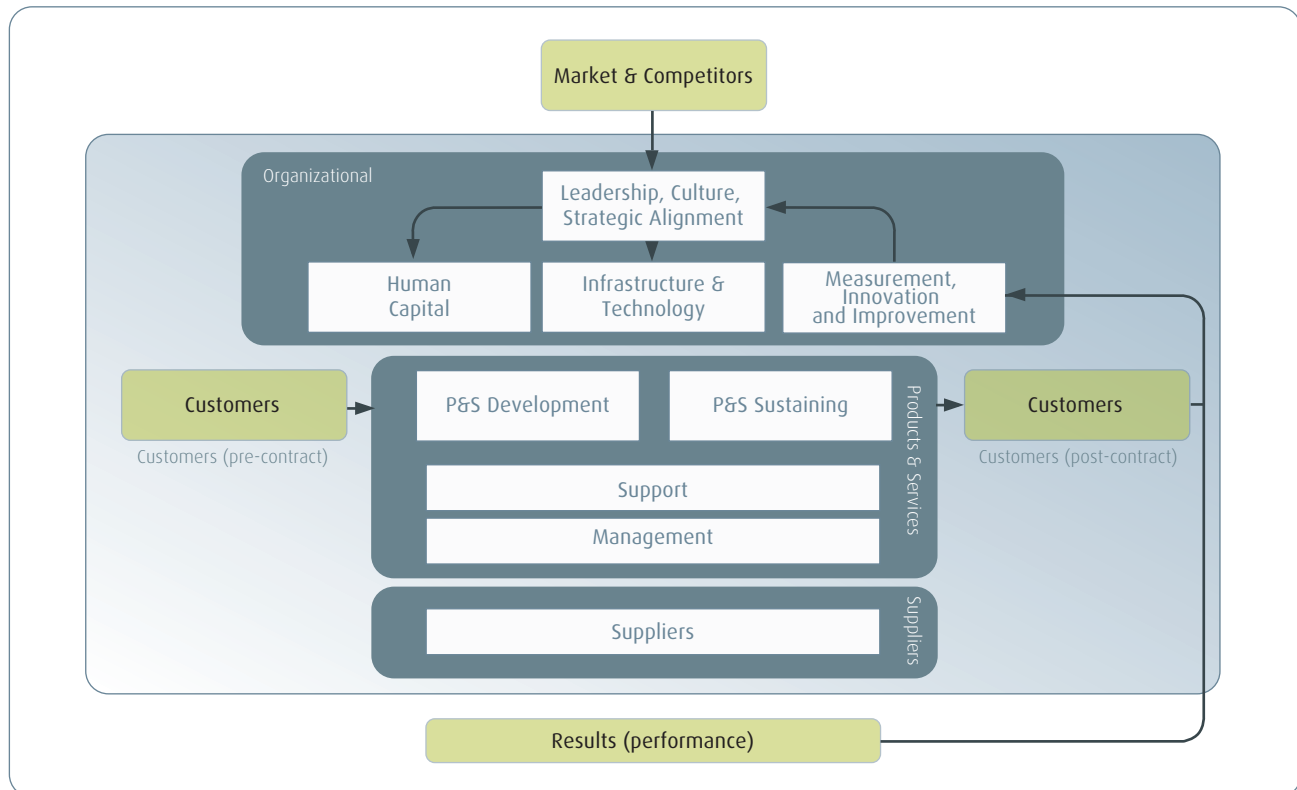


Figure 5: Integrated System Framework (ISF) Systemic View

develop a single mapping from that set of processes to ISF which in turn can be automatically mapped to each underlying model or standard. Figure 5 shows an overview of the ISF system structure. Having these multimodel mappings available, automated evidence data extraction works even indirectly. For example, using a mapping from CMMI to ISO 9001, evidence data for ISO 9001 can be generated even for processes only mapped to CMMI. This saves organizations valuable resources because they are not required to constantly check the compliance of their processes against all standards. By using ISF processes and mappings, these savings become even more immanent.

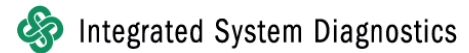
7 Results and Benefits

Now what are the benefits for an organization taking this automated evidence collection approach towards process compliance? There are mainly two aspects: effort savings and mastering complexity. Organizations that implemented the described approach noticed immediate savings in managing their process assets. Additionally, process definitions became consistent, understandable and lean. One large engineering corporation reported up to 60% of effort savings for appraisal preparation and

performance. This was realized by using process mappings against CMMI-DEV. One important factor was that there was no need to interrupt operational project work because of preparations for appraisals. It is clear that the numbers will become even more impressive when multiple standards are considered. The second big advantage of the described approach is that the complexity of multimodel mappings is hidden from the process managers and, even more important, from normal process users. Processes are defined using the organization's terminology, no "CMMI or ISO speak" or specific knowledge is required for end users.

8 Summary

Corporations developing large complex products face a lot of challenges. Innovative products need to be market-ready in time, in budget and with world class quality. Optimally suited processes are an important asset in meeting these goals. Being able to efficiently prove the compliance to a number of market relevant standards is an additional competitive advantage for organizations. Closely integrated process definition, implementation and PPQA activities enable organizations to reach these goals in a cost effective way. The key is to map the defined and



implemented processes against those standards where compliance needs to be proven. Seamlessly integrated process management and PPQA tools will support organizations in implementing this approach. Find more info on this topic on the websites:

- <http://stages.methodpark.com> and
- <http://www.isd-inc.com>.

To evaluate the described approach for your organization, please contact info@methodpark.com or info@isd-inc.com for product trials and evaluations. To contribute to the Open Source evolution of ISF e.g. to create official mappings, contact Renato Vasques [renato@isdbrasil.com.br] and you will be added to the community.

About Method Park

Method Park's engineers and consultants are experts in the field of software development for automotive and medical systems, especially where high demands on quality and safety are made. We are your experienced partner for engineering services, coaching, training and consulting in software development processes and process maturity models. Method Park, which was founded in 2001 in Erlangen, Germany, currently has more than 100 employees. Method Park has subsidiaries in Erlangen and Munich in Germany, as well as Detroit and San José in the USA. For further information please contact:

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About Integrated System Diagnostics, Inc.

Integrated System Diagnostics, Incorporated (ISD) is a US-headquartered, multinational corporation dedicated to the dissemination and successful application of model-based processed improvement technology. Our founders, full time personnel and affiliated consultants are all noted experts and accomplished practitioners in the field of model-based process improvement. ISD was founded in 1994 as an original, fully endorsed spin-off of Carnegie Mellon University's Software Engineering Institute (CMU/SEI), a Federally Funded Research and Development Center (FFRDC) sponsored by the US Department of Defense. For further information please contact:

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