Using Continuous Models as “Dynamic and Specific Staged Models” for Process Improvement

Clenio F. Salviano (1,2) and Mario Jino (2)

(1) CenPRA-MCT and (2) FEEC-UNICAMP (Brazil)
clenio.salviano@cenpra.gov.br - jino@dca.fee.unicamp.br

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Software Industry and SPI in Brazil

- about 5000 software intensive organizations
- growing usage of SPI
- software and SPI are integral part of Brazilian Industrial Policy (2004-2007) (www.mdic.gov.br)

- dominant model: SW-CMM / CMMI-SE/SW staged

<table>
<thead>
<tr>
<th>current maturity profile (2004)</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>level</td>
<td>24</td>
<td>6</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

- alternative: ISO/IEC 15504-5 (SPICE)
- 200+ serious SPI projects in progress (*my estimation*)
- many SPINs, conferences, courses and R&D in SPI
“Renato Archer” Research Center, IT R&D institution from the Ministry of Science and Technology
Founded in 1982, located in Campinas, SP, Brazil
300+ people, 12 Divisions in IT related R&D, including a Software Process Improvement Division
Background

• Software (and System) Process Improvement (SPI) based on Process Capability/Maturity Models

• Model architecture or representation:
  - Staged: SW-CMM, CMMI-SE/SW staged
  - Continuous: ISO/IEC 15504-5, CMMI-SE/SW continuous

• ISO/IEC 15504 (SPICE) (www.isospice.com):
  - Framework for process assessment (and improvement)
  - 1998: TR version: for software engineering (SE)
  - 2003: IS version: generic, including 15504-5 as an Exemplar Process Assessment Model for SE
  - More than 3000 utilization worldwide

• Traditional view Staged versus Continuous (S&C):
  - Staged: proven path for organizational maturity
  - Continuous: flexible, for individual process improvement
  - Equivalent staging in continuous described in CMMI Models, [Ahern et al., CMMI Distilled, 2001] and others
Three key points of this presentation

- Insights from helping 20+ SPI projects using continuous (and staged) models since 1998

A view on staged vs. continuous debate, proposing three generations of Process Capability Models

A proposal for “using continuous models as dynamic and specific staged models for process improvement“ or PRO2PI: “process capability profile for process improvement”
PCP: Staged/Continuous Unification

PA: Process Area  PCL: Process Capability Level

PCP: Process Capability Profile

PCP = set of PAs, each one at a PCL

Example of a PCP (in ISO/IEC 15504-5)

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Staged vs. Continuous: Our vision

Staged Model: A (very good) example of an hierarchy of (4) fixed PCPs (“maturity levels”)

Continuous Model: Although structured by individual processes, should be used by defining appropriate PCPs for organizational improvement

Therefore: Continuous as an evolution from Staged

Actually: Three generations of Process Capability Models and Frameworks, based on variations on stability and flexibility of PA, PCL and PCP, going for more flexibility
<table>
<thead>
<tr>
<th>Generations of Process Capability Models and Frameworks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main framework and release year</strong></td>
</tr>
<tr>
<td><strong>Other models</strong></td>
</tr>
<tr>
<td><strong>Architecture</strong></td>
</tr>
<tr>
<td><strong>Alternative Name</strong></td>
</tr>
<tr>
<td><strong>Major fixed elements</strong></td>
</tr>
<tr>
<td><strong>Major variable elements (flexibility)</strong></td>
</tr>
<tr>
<td><strong>comment</strong></td>
</tr>
</tbody>
</table>
PRO2PI

towards a methodology to define, use and update “useful and effective” Process Capability Profile ("dynamic and specific staged models")
to Process Improvement based on multiple reference models

Methodology major elements:

- proposal and rationale
- metamodel to integrate models and support PRO2PI
- PRO2PI properties
- method for define, use and update PRO2PI
Overview: Current Situation

“good practices” from generic process models (9001, SW-CMM, 12207, 15504-5, PMBoK, OPM3, CMMI, ...) and other sources
PRO2PI Overview: Proposal

PRO2PI Methodology =

ISO/IEC 15504 Framework for Process Assessment and CMMI + Extensions for Process Improvement

“good practices” from generic process models (9001, SW-CMM, 12207, 15504-5, PMBoK, OPM3, CMMI, ...) and other sources

Process Improvement Actions and Results at an Organization

Business Goals, Strategy and Context of an Organization

Business Context of a Segment or Domain

Segment or Domain Model

Dynamic Specific Profiles

Process Capability Profiles

create model

create

update

use

R&D effort

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Properties of a PRO2PI

In order to be useful and effective for process improvement, i.e., to be a PRO2PI, a PCP should possess, to a sufficient extent, at least the following seven properties:

- Relevant to the organization’s business context
- Systemic to support steady improvement
- Abstraction of the target process system
- Specific to the organization current characteristics
- Attainable given potential investment and constraints
- Dynamic to be modified as appropriate and needed
- Traceable to relevant process models
- Opportunistic to use resources currently available
SPI in Org.a (1999-2002)

Context: Medium size, software product oriented, 10 years of success, started small (5 people), informal style not working well anymore


Target PCP1999: (Customer Sup., Quality Assur., Project Man., Org. Alignment, and Proc. Established ):CL 2, selected using our experimental method. [note: they were assessed as CL0/1]

Target PCP2001: include “ISO 9001:2000 requirements”

Result PCP2002: plus Sw.Req and Measurement, assessed as CL2

Results: more systematic style of work; organizational management with data, better knowledge about the clients

**SPI in Org. b [2002-...]**

**Context:** small size (8 people), (small) project oriented, success

**Reference:** 15504-5 (and RUP, PMBoK, IEEE829, CMMI-SE/SW)

**PCP:**

- Supply

**Software Factory Process:**

- Prospect -> Contract -> Development -> Deliver -> Close

- Requirements Elicitation
- Project Management
- Software Testing
- Measurement

(five 15504 processes, selected based on business context, without a formal method, and assessed in 2002 as CL.1)

**Results:** software factory process as CL.2 (partial CL.3), better customer satisfaction, better control of requirements and product

**Ref:** Silva et al., An ISO/IEC 15504-Based SPI Project in a Small Brazilian Software Organization, SPICE Conference, Netherlands, 2003;
SPI in Org_c [2003 ...]

Context: sw. development for internal use (governmental org.)
Reference: SW-CMM (and Rational Tools, 15504-5)
PCPs: started as SW-CMM ML.2 and made changes:

<table>
<thead>
<tr>
<th>Step</th>
<th>Operation</th>
<th>Result PCP</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>P1 = Create</td>
<td>{RM, SPP, SPTO, SSM, SQA, SCM}:CL2</td>
<td>based on SW-CMM level 2</td>
</tr>
<tr>
<td>2</td>
<td>P2 = P1 + SwTest:CL2</td>
<td>{RM, SPP, SPTO, SSM, SQA, SCM, SwTest}:CL2</td>
<td>add Software Test, reference for an assessment</td>
</tr>
<tr>
<td>3</td>
<td>P3 = P2 – {SPP, SPTO, SSM, SQA}</td>
<td>{RM, SCM, SwTest}:CL2</td>
<td>after assessment, reduce scope to be feasible</td>
</tr>
<tr>
<td>4</td>
<td>P4 = P3 + Infrastr:CL2</td>
<td>{RM, SCM, SwTest, Infrastr}:CL2</td>
<td>add Infra-structure for software tools</td>
</tr>
</tbody>
</table>

Comment: example of breaking (and expanding) ML 2 to better address org. context.
SPI Method for Small [2003..]

**Goal:** develop and apply a process assessment method to start a SPI in small size organizations using 15504 (and CMMI)

**Strategy:** include a method to define a useful and effective PCP for each organization


SPI for Group of Orgs. [2003 ..]

**Goal:** cooperation of 9 sw. orgs. for CMMI-SE/SW ML.2

**Strategy:** share training and process knowledge, but each one define and use their own processes; and breaking ML.2 into two:

a1: RM, PP and PMC for basic project management, and

a2: include SAM, CM, PPQA and MA for institutionalization

**Ref:** projeto cooperativa CMMI (http://www.its.org.br)
Conclusions

insights from helping 20+ SPI projects using continuous (and staged) models since 1998

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Contact

Centro de Pesquisas Renato Archer - CenPRA
Divisão de Melhoria de Processos de Software - DMPS

Clenio F. Salviano
e-mail: Clenio.Salviano@cenpra.gov.br
phone: +55 19 3746-6109
Rodovia Dom Pedro I, km 143,6
Campinas SP – CEP 13082-120 - Brazil

Thanks for your attention!