THE SECOND ANNUAL
European Software Engineering
Process Group Conference 1997

EUROPEAN SEPG
Delegate Material
CONFERENCE

18-19th JUNE 1997
GRAND HOTEL KRASNAPOLSKY
AMSTERDAM
### Morning

**Introduction**

Wednesday Programme

**C301**

**How Competitive is the European Software Industry?**
Jaap van Scheijen

**C302**

**Professional Software Development in Europe - A Brief Assessment**
David Talbot

**C303**

**Models of SPI: Getting Beyond Case Studies**
Bill Curtis

**C304a**

**Competence in Software and Engineering - Siemens' Software Initiatives**
Axel Völker & Gerd Wackerbarth

**C304b**

**Managing Culture Change**
Ken Taylor

**C305a**

**Software Measurement Across a Global Enterprise**
Gerry Pasternack & David Zubrow

**C305b**

**Ethics and the Software Process**
Michael Cavanagh

### Afternoon

**C306a**

**Setting up SPI in a Multi-Cultural and De-Centralised Engineering Company**
Winifred Menezes & Bernhard Eschenmann

**C306b**

**Capability Maturity Model for Software, Version 2.0**
Bill Curtis

**C306c**

**Using SPI Principles to Improve the Value of Legacy Systems**
Ashley Travis

**C307a**

**Experiencing Software Process Improvement at the Sharp End**
Paul Hookham

**C307b**

**Requirements for Winning Software Teams**
Bill Curtis

**C307c**

**Challenges and Solutions for SPI in a Small Company**
Romana Vajde Horvat & Ivan Rozman

**C308a**

**PANEL: Approaches to Process Improvement Support**
Moderator: Lieuwe de Jong

**C308b**

**SPICE and ISO/IEC 15504**
Steve Masters & Bob Smith

**C308c**

**Assessment and Optimization of System Architectures: Experiences with Industrial Applications at Siemens**
Michael Gloger, Stefan Jockusch & Norbert Weber

**C309b**

**Understanding and Improving your Suppliers**
Mick Bennett & Chris Amos

**C309c**

**Implementing and Enhancing a Quality Management System using TQM Principles and the CMM as a Framework**
Stefan Lytwyn
CONFERENCE - Thursday 19th June

Morning
Introduction Thursday Programme
C402 SEI Process 2000: Building on Strength
Steve Cross
C403 The Improvement Engine of the Ericsson Systems Software Initiative
Jorma Mobrin & Anders Wästerlid
C404a Software Process Improvement Journey from Level 1 to Level 5
John Vu
C404b Highlights and Report Back from The Measurement Symposium
Paul Goodman
C405a A Quarter Century of Software Process Improvement
Terry Snyder
C405b Continuous Quality Improvement in Software Development on the Basis of Measurement and Assessment
Holger Günther

Afternoon
C406a Overcoming Resistance to Change to Become a True ‘Learning Organisation’
Alistair Watters
C406b A Co-ordinated Approach to Identifying Software Development Risk in MoD Projects
Llewelyn Jones & John Hamilton
C406c Five Years’ Experience with SPI: Lessons Learnt
Gilles des Rochettes
C407a From Chaos to Control
Debbie Hellmann & Alf Pilgrim
C407b The Complementary Aspects of Process Capability and Re-Use Capability
Sergio Bandinelli & Álvaro Sanz Monasterio
C407c Software Best Practice: Benefits to the Business
Alejandro Moya
WEDNESDAY 18TH JUNE

**Welcome and Introduction**

Hans Sassenburg, Head of the Netherlands SPIN (SPider) will extend a welcome to the conference.

Jaap J. van Scheijen, Ministry of Economic Affairs, The Netherlands, will then open the conference on behalf of the conference organizers; the Software Engineering Institute (SEI); the European Software Institute (ESI); and the European Software Process Improvement (ESPI) Foundation.

The conference will be co-chaired on both days by Bill Peterson and Chris Lamer of Lloyds TSB Group.

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
<td>09.00</td>
<td>Welcome: Hans Sassenburg, Netherlands SPIN (SPider); Co-Chair: Bill Peterson, SEI &amp; Chris Lamer, Lloyds TSB Group</td>
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<tr>
<td>09.15</td>
<td>How Competitive is the European Software Industry?</td>
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<td>Jaap J. van Scheijen, Ministry of Economic Affairs, The Netherlands</td>
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<td>Professional Software Development in Europe - A Brief Assessment</td>
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<td>David Talbot, European Commission</td>
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<td>09.55</td>
<td>Models of SPI: Getting Beyond &quot;Ouch&quot; and &quot;Win&quot;</td>
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<td></td>
<td>Bill Curtis, TeraQuest Metrics</td>
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<td>10.30</td>
<td>Keynotes - Track A</td>
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<tr>
<td>11.00</td>
<td>Competence in Software and Engineering - Siemens' &quot;Ouch&quot; Software Initiatives</td>
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<td>Axel Volker &amp; Gerd Wackerbarth, Siemens AG</td>
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<td>11.45</td>
<td>Software Measurement Across a Global Enterprise</td>
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<td>Gerry Pasternack, Citicorp &amp; David Zubrow, SEI</td>
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<tr>
<td>12.30</td>
<td>Lunch</td>
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<td>14.00</td>
<td>Setting up SPI in a Multi-Cultural and De-Centralised Engineering Company</td>
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<td>Paul Hookham, Lloyds TSB Group</td>
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<tr>
<td>15.30</td>
<td>Break</td>
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<tr>
<td>16.00</td>
<td>PANEL: Approaches to Process Improvement Support</td>
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<td></td>
<td>Moderator: Lieuw de Jong, Philips</td>
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<td></td>
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<td>Keith Jackson, TBL</td>
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<td>Understanding and Improving Your Suppliers</td>
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<td></td>
<td>Mick Bennett &amp; Chris Aron, British Telecom</td>
</tr>
<tr>
<td>17.30</td>
<td>Bar and Exhibits</td>
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**OPENING SPEAKERS**

- C300: Welcome: Hans Sassenburg, Netherlands SPIN (SPider); Co-Chair: Bill Peterson, SEI & Chris Lamer, Lloyds TSB Group
- C301: How Competitive is the European Software Industry?
  - Jaap J. van Scheijen, Ministry of Economic Affairs, The Netherlands
- C302: Professional Software Development in Europe - A Brief Assessment
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- C303: Models of SPI: Getting Beyond "Ouch" and "Win"
  - Bill Curtis, TeraQuest Metrics
- C304a: Competence in Software and Engineering - Siemens' "Ouch" Software Initiatives
  - Axel Volker & Gerd Wackerbarth, Siemens AG
- C304b: Managing Culture Change
  - Ken Taylor, Post Office IT SERVICES
- C305a: Software Measurement Across a Global Enterprise
  - Gerry Pasternack, Citicorp & David Zubrow, SEI
- C305b: Ethics and the Software Process
  - Michael Cavanagh, Balmoral Consulting
- C306a: Setting up SPI in a Multi-Cultural and De-Centralised Engineering Company
  - Winifred Menezes & Berndt Eschermann, ABB Corporate Research
- C306b: Capability Maturity Model for Software, Version 2.0
  - Bill Peterson, SEI
- C307a: Experiencing SPI at the Sharp End or "Ouch"
  - Paul Hookham, Lloyds TSB Group
- C307b: Requirements for Winning Software Teams
  - Bill Curtis, TeraQuest Metrics Inc.
- C307c: Challenges and Solutions for SPI in a Small Company
  - Romana Vajde Horvat & Ivan Rozman, University of Maribor
- C308a: PANEL: Approaches to Process Improvement Support
  - Moderator: Lieuw de Jong, Philips
  - Panelists: Filip A.L. Halsey, Alcatel
  - Keith Jackson, TBL
  - Tim Kaise, ISPI
- C308b: SPI/CE and ISO/IEC 15504
  - Steve Masters, SEI & Bob Smith, European Software Institute
- C309a: Understanding and Improving Your Suppliers
  - Mick Bennett & Chris Aron, British Telecom
- C309b: Assessment and Optimization of System Architectures: Experiences with Industrial Applications at Siemens
  - Michael Gloger, Stefan Jockusch & Norbert Weber, Siemens AG
- C309c: Implementing and Enhancing a Quality Management System using TQM Principles and the CMM as a Framework
  - Stefan Lyons, PanCredit Systems
How competitive is the European Software Industry?

Jaap van Scheijen
Director
Electronics, Services & IT department
Ministry of Economic Affairs

Outline of presentation

• Position of European ICT industries

• Embedded software in The Netherlands

• Conclusions
Key findings and Recommendations in Brief

Information and Communication Technology (ICT) industries are critical for the Information Society.

Europe is consistently falling behind competitors in most ICT sectors.

ICT reform has to be dramatically accelerated.

Packaged Software: Production Share versus Customer Share

<table>
<thead>
<tr>
<th></th>
<th>Production Share</th>
<th>Customer Share</th>
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</thead>
<tbody>
<tr>
<td>RoW</td>
<td>80%</td>
<td>15%</td>
</tr>
<tr>
<td>Europe</td>
<td>6%</td>
<td>80%</td>
</tr>
<tr>
<td>USA</td>
<td>15%</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td>20%</td>
<td>40%</td>
</tr>
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</table>

Wednesday 18 June
Requirements for the Application of Embedded Software

Importance and Need for improvement

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Importance</th>
<th>Improve*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliability</td>
<td>4.8</td>
<td>2.9</td>
</tr>
<tr>
<td>Quality</td>
<td>4.7</td>
<td>3.2</td>
</tr>
<tr>
<td>Standardization</td>
<td>4.0</td>
<td>3.1</td>
</tr>
<tr>
<td>Higher programming productivity</td>
<td>3.9</td>
<td>3.1</td>
</tr>
<tr>
<td>Lower sw development costs</td>
<td>3.9</td>
<td>3.2</td>
</tr>
<tr>
<td>Maintainability</td>
<td>3.8</td>
<td>2.9</td>
</tr>
<tr>
<td>Compatibility</td>
<td>3.5</td>
<td>2.9</td>
</tr>
<tr>
<td>Reusability</td>
<td>3.1</td>
<td>2.7</td>
</tr>
</tbody>
</table>

*) Scale of 1 to 5

Process Management Strategy

<table>
<thead>
<tr>
<th>Stages of Process Management</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>No guidelines</td>
<td>35.2%</td>
</tr>
<tr>
<td>There are guides and standards</td>
<td>30.9%</td>
</tr>
<tr>
<td>Strict guides and standards</td>
<td>8.4%</td>
</tr>
<tr>
<td>Process is measured</td>
<td>5.0%</td>
</tr>
<tr>
<td>Process measured, improved</td>
<td>16.9%</td>
</tr>
<tr>
<td>&quot;Don't know&quot;</td>
<td>3.6%</td>
</tr>
</tbody>
</table>
Conclusions

- European software industry is competitive in embedded software and specific applications
- even in market-niches of packaged software
- special care and chances for innovative starting companies
Professional Software Development in Europe

- The "economic dimensions"

- A (personal) view of strengths and weaknesses

- EC support for improving our capabilities

The "Traded" Market in Europe (1996)

- Professional Services (not including "support" services) 37.8 becu 52%
- Application solutions 16.8 becu 23%
- Application tools 10.9 becu 15%
- System Software 7.2 becu 10%

Total Market = 72.7 becu

Source: IDC
The "Hidden Market" in Europe

- Non IT ("User") Industries - producing 60-70% of all software
- "Enterprise" systems - control of costs, improve quality of service, optimise processes, reduce distance between customers and suppliers...
- Embedded systems - (aircraft to shavers) - provide more features, increase usability, differentiate product...

Increasingly a "core competence" in all developed sectors of the economy

Strengths (+) and Weaknesses (-) in The "Traded" Market

- Professional Services (not including "support" services) 52%
- Application solutions 23%
- Application tools 19%
- System Software 10%

The European Commission - Software Systems and Best Practice
Software Capabilities in Europe

"... Recently an analysis was made of the productivity of software professionals and the quality of the resulting software by country. Six of the top ten most productive countries in the world are EU member states, and six of the top ten suppliers of software with the lowest defect levels are also EU member states ...."

Kerry Hanson, Director TI ex White House OST

The Fourth Framework Programme: "ESPRIT"
Underpinning Technologies and Long Term Research

Software Technologies 14%
Multimedia Technologies 8%
IT Programme
Long-term Research 10%

The European Commission - Software Systems and Best Practice
Software Technologies: Objectives

- To ensure that European software developers in both vendor and user organisations continue to have the skills and tools necessary to build the increasingly complex and varied systems demanded by the market
- Widen the spectrum of IT supported applications
- Make future systems more attractive and acceptable to the user
Current challenges

- Current technologies inadequate to deal with new challenges
- Current practice makes inadequate use of available technologies
- New R&D

Several constraints to the deployment of leading-edge technologies

Technology Transfer

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Technology Adoption Cycle

- Trial Applications
- Early majority
- Early adopters
- Innovators

- Technology validation
- User-supplier partnership
- (re)deployment

Risk: applicability
Risk: perceived benefits

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The European Commission - Software Systems and Best Practice
Useful addresses

- ESPRIT Information Desk
  Tel. +32 2 2968596
  Fax +32 2 2968388
  http://www.cordis.lu/esprit/home.html

- Info packages
  http://www.cordis.lu/esprit/src/info97.htm

- Software Technologies
  http://www.cordis.lu/esprit/src/sthome.htm
Models of SPI: Getting Beyond Case Studies

Bill Curtis
TeraQuest Metrics
Austin, Texas
&
Software Engineering Institute
Carnegie Mellon University

This talk can be accessed at http://www.teraquest.com

Dialogue at SEPG Conferences

<table>
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<td>ROI reports</td>
<td>IDEAL</td>
<td>Empirical studies</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>4</td>
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</tbody>
</table>
Recent History of Change Models

- Diffusion of innovation (Rogers)
- Total quality management (Deming; Juran; Crosby)
- Process maturity (Humphrey)

|------|------|------|------|------|------|

- Organization development (Berkhard; Bennis; French & Bell)
- Corporate culture (Schein; Deal & Kennedy; Peters & Waterman)
- Business process reengineering (Hammer & Champy)

Alternate Approaches for SPI

- Top-down vs. Bottom-up
- Technology focus vs. Process focus
- Organizational change vs. Process change
- Organization focus vs. Project focus
Issues in Designing SPI Programs

Top-down vs. Bottom-up
who drives the change process?

Technology focus vs. Process focus
where is the leverage for improved results?

Organizational change vs. Process change
how much supporting infrastructure is needed?

Organization focus vs. Project focus
global vs. local problem solving?

Seven TQM Tools

Powerful tools for process change

Inconsistent with software
Wrong version
No training
Poor CM
Misunderstandings
Lack of standards
Formatting errors
Document errors

May have less power for some organizational changes

Defects reported by customers
SEI's IDEAL Model

Learning
- Revise organizational approach
- Document & analyze lessons

Acting
- Plan, execute, & track installation
- Define processes & measures
- Establish action teams & action plans

Initiating
- Stimulus for improvement
- Set context & establish sponsorship
- Establish improvement infrastructure
- Appraise & characterize current process
- Develop recommendations & document results

Diagnosing
- Set strategy & priorities

Establishing
- Win-win solutions

Organizational Development

Focuses on culture and processes
Collaboration between leaders and members
Teams are intervention targets
Emphasizes human and social side of organizations
Create participatory culture
Change a complex social system
Consultants are facilitators and co-learners
Develop sustainable problem-solving capability
Action research with client participation

What Is the Role of OD in SPI?

If the intervention is a project by project implementation of project management, is there a role for Process Action Teams?

Establishing Organizational development-based interventions

‘Establishing Phase’ Alternatives

Alternatives for implementing level 2 practices:
- process actions teams
- management action teams
- project action teams

Issues:
- is management actively leading or benignly supporting?
- who knows and uses the process being improved?
- are projects at different states of readiness?
- do projects vary widely in their maturity or problems?
- who has adequate responsibility and authority?
Technology Diffusion

Cumulative rate of adoption

- Innovators
- Early adopters
- Early majority
- Late majority
- Laggards

Time


Intervention or Behavior?

IDEAL

Acting

Technology diffusion

100%

Does this curve describe the effects of personality types, or the match between the project's life cycle stage and the technology being adopted?

TeraQuest 12
IStages of Change Commitment

<table>
<thead>
<tr>
<th>Commitment Phase</th>
<th>Acceptance Phase</th>
<th>Preparation Phase</th>
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<tbody>
<tr>
<td>8. Internalization</td>
<td>7. Institutionalization</td>
<td>6. Adoption</td>
</tr>
<tr>
<td>7. Institutionalization</td>
<td>6. Adoption</td>
<td>5. Installation</td>
</tr>
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<td>5. Installation</td>
<td>4. Decision</td>
</tr>
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<td>5. Installation</td>
<td>4. Decision</td>
<td>3. Understanding</td>
</tr>
<tr>
<td>2. Awareness</td>
<td>1. Contact</td>
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</tbody>
</table>


Integrating Change Models

IDEAL

Acting

Establishing

Are the change commitment phases an alternative to IDEAL, a description of change processes within an IDEAL cycle, or an implementation of Technology Change Management at level 5?
### Organizational Change - 'Big 3' Model

<table>
<thead>
<tr>
<th>Level of change</th>
<th>Focus of change</th>
<th>Type of change</th>
</tr>
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<tbody>
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</tr>
<tr>
<td>Revolutionary</td>
<td>Political</td>
<td>Power &amp; control</td>
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### Recent Research on Org. Change

**Scope of research:**
- 34 organizations surveyed by U. of Michigan
- 5 in depth case studies

**Organizational change driver:**
- change driven by demands of business environment
- not by intention to change the internal organization
- literature emphasizes internally driven change (little support)

**Change leadership:**
- change described as conversion of a top leader
- however change driven a change in the leaders

'Big 3' Model Revisited

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Some Testable SPI Hypotheses

- Software processes cannot be improved if they are constantly being sacrificed to schedule pressure
- Process learning occurs faster when there is a common process framework against which to compare results
- SPI will not be sustained if projects do not experience benefits after reasonable time and effort
- Sophisticated processes or methods must be adopted and mastered in stages
- The full benefits of an individual process cannot be realized if it is improved in isolation
Conclusions

The SPI community needs to begin studying the effectiveness of the models that guide their implementation of improvement programs.

- what tools are relevant to what approaches?
- what assumptions underlie how the approach is applied?
- does the model describe the intervention or resulting behavior?
- what organizational state is most conducive to the approach?

The SPI community needs to:
- measure the results of assumptions underlying SPI programs
- characterize the capability of different improvement models
- describe how they can be integrated in SPI programs

A Vision of the Future at SEPG?

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Siemens' Software Initiatives:

- Impact of Software & Engineering on Siemens' businesses
- Goals and approaches
- Focus Areas
- Standards of Excellence top3x
- Conference "Competence in Software and Engineering"
- Group-specific initiatives

Experience at Siemens' Public Communication Networks Group:
"Cut Cycle Time by 50% by Comprehensive Redesign of the Entire Product Life Cycle Process"
Software Status at Siemens

Software Development has become a significant success factor in most of Siemens' business transactions.

60% of Siemens' sales are based on products/systems utilizing software developed in-house.

25,000 Software designers are employed worldwide.

Fundamental changes made to improve both quality and efficiency in software development are becoming prime competition factors.

Software is a core competence for our business.

Software competence has become a strategic goal for Siemens.

The C-p Software Initiative - Goals and Approaches

Keep software expertise at Siemens among the best world-wide through:

- focussing and bundling the current activities of the groups
- derive group-specific software initiatives that focus on business-specific goals
- build up and access both internal and external knowledge bases (including benchmarking and the recognition and speedy adoption of "best practices") to enable us to innovate faster and with less risk
- continuous exchange of information and experiences regarding ways to increase software expertise, e.g. through inter-group workshops
- actively using an electronic forum on the Intranet to support the exchange of information in the "software community"
- making the software expertise of Siemens more visible externally
Siemens' Software Initiatives

Focus Areas

- Project Management and Organization
- Architectures for Software Products
- Architectures for Embedded Software and Systems
- Processes (process chains, process assessments, process improvement, innovative processes)
- Engineering for Industrial and Power Plants
- Human Resources Management
- Software Marketing / Software Service
- topSix: the Siemens' Standards of Excellence

Successful Software Competence is Influenced by many Factors
topSix - a "Thermometer" for the Software Business

- Costs => via administrative reporting
- Customer satisfaction
- Time-to-market
- Quality
- Productivity
- Process Maturity
- Technology Maturity
- Human factors
- Communication
- "Skills"
- Infrastructure

How healthy are we?
- Improvements must be measured and traced,
- for controlling purpose,
- to make visible successes and benefits.
- This requires management and controlling instruments at both project and management level.

Purposeful pursuit of objectives produces the leverage required
SIEMENS

**topSix Charts - Example**

- **Chart 1:** Customer Satisfaction Goal:
- **Chart 2:** Quality (Process and Product) Goal:
- **Chart 3:** Cycle Time Goal:
- **Chart 4:** Productivity Goal:
- **Chart 5:** Process Maturity Goal:
- **Chart 6:** Technology Maturity Goal:

*topSix provides the basis for measuring and controlling software activities and initiatives*

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SIEMENS

**International Siemens Conference and Exhibition**

**Competence in Software and Engineering**

- **1000 attendees,** Siemens' employees and customers from around the world
- **Plenary sessions**
- **Panel discussions**
- **180 contributions,** talks, poster sessions, demos
- **in 24 pavilions**
- **10-11 June '97**
- **Munich Airport**
- **Siemens' groups and their operating companies, corporate divisions, Siemens International Companies**

*To promote:*
- **exchange on info and best practices**
- **further improvement**
- **further innovation**
- **a motivational boost to the initiatives**
- **make our competence more visible to our customers***
The Software Initiatives of the Groups and the Siemens International Companies

Cut Cycle Time by 50% by Comprehensive Redesign of the Entire Product Life Cycle Process

The story of the creation of optimized processes within Siemens' Public Communication Networks Group (OEN) and their successful application to the switching system EWSD.
1. Basic Situation and Requirements for the Processes
   About products, organization and telecommunication markets

2. The Process Redesign Project PEPP
   About goals, phases, time frame of an ambitious project

3. The results: New Core Processes and Optimized Process Steps
   About Business Opportunity Scanning, Product Line Management and Product Provisioning Processes and "levers"

4. Successful Introduction of the New Life Cycle Process
The broad product portfolio and the decentralized organization require:

- The product life cycle process
  - must be generic in essential parts and allow to create variants for different project classes
  - must allow seamless continuity across the business units in case of joint developments
  - must include clear strategic target setting

Customer requirements for telecom equipment are extremely challenging

- e.g. customer requirements for switching systems
  - System availability >99.99943% (3 min. downtime/year)
  - Permanent operating time 10 - 20 years
  - System modification and expansion during operation
  - New versions fully downward-compatible
  - Adaptation to operator-specific standards (customer projects)
  - ...
SIEMENS

Siemens' EWSD is the world's best selling switching system

- Installed ports today
  - 710 million ports worldwide
  - EWSD market share:
    - 130 million ports
    - 92 countries
    - 300 operating companies

- The prognosis
  - 1.8 billion ports worldwide in 2010

- EWSD success factors
  - Annual release of an extended SW version
  - Hardware modernization every 3 years
  - Use of the most modern and efficient microelectronic components
  - Setting of standards with fully customized chipsets (ISDN)
  - Highest reliability

To stay competitive and to increase market share require:

- The product life cycle process must include
  - search for new business opportunities independent from operational sales task
  - customer-oriented evaluation of realization alternatives
  - close cooperation with the customer
  - a maximum of parallelism of the subprocesses
  - cross-functional project control with overall responsibility
The situation in the telecommunication market has changed dramatically in the past few years ...

- Traditional markets are saturated
- Considerable price-pressure in young markets
- New operators and globalized activities of traditional operators because of market deregulation
- Globalization of competitors
- Telecommunication and information technology are growing together

... and will remain turbulent in the foreseeable future

The dramatic changes in the telecommunication market requires:

- The product life cycle process
  - must shorten the time to market
  - must drastically reduce the throughput times
  - must increase productivity to reduce investment for new products
  - must target the product life cycle to design to cost, design to service and design to customers need
Overview

1. Basic Situation and Requirements for the Processes
   About products, organization and telecommunication markets

2. The Process Redesign Project PEPP
   About goals, phases, time frame of an ambitious project

3. The results: New Core Processes and Optimized Process Steps
   About Business Opportunity Scanning, Product Line Management and Product Provisioning Processes and "levers"

4. Successful Introduction of the New Life Cycle Process

PEPP should optimize the processes in order to cope with the of product, organization, and market requirements

- The most important goals of the PEPP project:
  - More accurate product definition to guarantee market success
  - Shorter cycle times to accelerate innovation
  - Reduced cost and increased productivity to set resources free for new products

PEPP = Produkt Erschaffungs Prozess Plan
The PEPP project has been subdivided into 3 phases

**Phase 1:**
- Project definition

**Phase 2:**
- Work out improvements

**Phase 3:**
- Realisation

- Detection of problem areas
- Definition of "levers" (areas of improvement)
- Installation of cross-functional teams and of a steering committee
- Detailed analysis of quality, cost and throughput time of existing process steps
- Work out of improvement measures in teams, resulting in:
  - new processes,
  - optimized steps of existing processes
  - new or improved methods
- Verification of improvements in pilot projects
- Tuning of measures according to the experiences
- Full roll-out, including provision of process documentation

The PEPP project was started 12/94, the new processes were introduced for EWSD in 1/96
Overview

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4. Successful Introduction of the New Life Cycle Process

The new product life cycle consists of 3 closely interacting core processes

- Product Line Management Process (PLP)
- Product Provisioning Process (PPP)
  - Development (PPP:D)
  - Market Introduction (PPP:M)
  - Production Introduction (PPP:P)
  - OEM Integration (PPP:O)
- Business Opportunity Scanning Process (BOS)
The BOS process involves continuously and proactively searching for new business opportunities.

The 4 phases of the Business Opportunity Scanning Process (BOS):

1. Recognize business opportunities
2. Formulate business opportunities
3. Conduct business feasibility studies
4. Draw up a business plan

In the PLP process an entrepreneurial product line strategy is formulated and implemented.

The phases and process steps of the Product Line Management Process (PLP):

1. Plan product line strategy
2. Evaluate business opportunities
3. Select a feasibility alternative
4. Version packaging
5. Product phase-out

Controlling

PLP ensures cross-functional project control
The BOS and PLP processes run in parallel and are closely linked

**BOS process**
- Recognize business opportunities
- Formulate business opportunities
- Conduct feasibility studies
- Draw up a business plan

**PLP process**
- Plan product line strategy
- Evaluate business opportunities
- Select a feasibility alternative
- Version packaging

Baseline decisions made by:
- Process owners of BOS, PLP and PPP
- Managers of development departments involved

The development process is optimized by different "levers" each of them having effect on one or more phases

The phase model of the development process (PPP:D):
- Analysis
- Design
- Implementation
- Integration test
- System test

Examples for levers and the phases they influence:
- EWSD 2-cycle model
- Fast analysis process
- Reduction of design spec.
- Reduction of test spec.
- Early detection and correction of errors
- Efficient testing by test teams
The lever "fast analysis process" accelerates the analysis phase by 50%

**Basic principles / goals:**
- Redesign and acceleration of analysis phase
- Link between BOS / PLP processes and the development process

**Process modifications:**
- Direct information passing by business opportunity handover workshops
- Reduction of documentation volume (Delta feature specs. instead of complete system functional specs.)
- Non-urgent activities in later phases (e.g. updating of system specs.)

The lever "efficient testing by test teams" reduces throughput time and costs for the test phases

**Basic principles / goals**
- Redesign and more efficient processing of the test phases
- Formation of feature-group-oriented test teams out of development and system test staff
- Reduction of testing volume by elimination of redundancies
- Cost saving by reduction of test beds

**Process modification:**
- "Clearing out" of milestones in test phases
- More parallelism between integration test and system test
- Use of testing teams for common test steps of test phases
The "EWSD 2-cycle model" is a strategy to apply the development process to series of EWSD versions.

**Principle of EWSD 2-cycle model: Sequence of 2 versions**

- Version n: application software
- Version n+1: basic system software
- Version n+1: hardware

**Basic principles / goals:**
- Decoupling of basic system SW and application SW, and of HW
- Basic system SW and HW modifications only in every second version

**Process modifications:**
- Sequential start of HW, basic system SW and application SW in combined version
- Defined milestones for synchronizing HW, basic system and application SW

**Synchronization points allow seamless continuity across the business units in case of joint development**

**PLP**
- Development (PPP:D)
- Market Introduction (PPP:M)
- Production Introduction (PPP:P)
- OEM Integration (PPP:O)

**BOS**
- Business Opportunity Study & Proposal
- Business Plan & Requirements
- Feasibility Analysis
- Definition Analysis
- Bring-up
- Beta Release
- Customer Support

**Schedule:**
- B10: Start of Business Study & Proposal
- B50: Start of Business Plan & Requirements
- B100: Feasibility Analysis
- B130: Definition Analysis
- B200: Bring-up
- B410: Beta Release
- B550: Customer Support
- B600: End of contractual obligations

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SIEMENS

Overview

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   Process Steps
   About Business Opportunity Scanning, Product Line Management
   and Product Provisioning Processes and "levers"

4. Successful Introduction of the New Life Cycle Process

The new product life cycle process has been successfully introduced

- More accurate product definition
  Exceptions at system release: 90%
  Modified features per version: 72%
  Redesign probability for ASICs: 50%

- Shorter cycle times
  New products/Versions: 50%
  Customer projects: 48%

Customer requirements are fulfilled better, faster and more economically.
For EWSD customer projects throughput times have been cut by an average of 48%.

Before optimization: average of 11.3 months

After optimization: average of 5.9 months

Success factors of the process redesign project:
- Many of the people who now have to live with the new processes were involved in the cross-functional project teams
- High identification with the project goals caused by intensive communication and careful explanation
- Good support by the management
- Up-to-date electronic documentation system with hyperlinks
- Training courses held by people involved in the project
- Clear responsibility for the new core processes (process owners)
- Continuous improvement process integrated

The real goal is not a dramatic, but unique increase of efficiency but a continuous process improvement.
SIEMENS

The Industry Creates Challenges to Software and Systems Engineering and Engineering of Industrial Plants

top Quality Just in Time

Software Initiative at reasonable cost

Business structure, organization by developing sound: skills, innovations, social environment, etc.
KEN TAYLOR

PEOPLE AND RESOURCES DIRECTOR

POST OFFICE SERVICES

THE POST OFFICE

PARCEL FORCE
MANAGING CULTURE CHANGE

Why do it?

It's Fun!

Everyone's doing it!

I'm a bored executive!

outside looking in

MANAGING CULTURE CHANGE

Why do it?

It leads to competitive advantage

outside looking in
MANAGING CULTURE CHANGE

Who makes the change work?

The managers?

The Customers?

Not the staff.

outside looking in

MANAGING CULTURE CHANGE

The Approach

Boring - We’re drawing up a process map of the organisation

Interesting - We’re finding out how things work round here

WOW.

outside looking in
MANAGING CULTURE
CHANGE

The Approach

Boring - We’re embarking on a programme of continuous improvement
  YAWN

Interesting - We’re going to make a few things better round here.
  ZAP
outside looking in

MANAGING CULTURE
CHANGE

The Approach

Boring - The Executive Committee are having a 3 day workshop to develop the programme
  Here we go again

Interesting - You’re going to have to tell us the best things to attack
  Do they mean us?
outside looking in
MANAGING CULTURE CHANGE

outside looking in

MANAGING CULTURE CHANGE

outside looking in

Competencies
Behaviours
Empowerment
Old issues, new themes

Wednesday 18 June
MANAGING CULTURE CHANGE

Evolved with the Customer
The right name
Change programmes change
Change is continuous

outside looking in

MANAGING CULTURE CHANGE

Better business solutions
Service excellence
Responsiveness
Personal leadership
Performance management

outside looking in
MANAGING CULTURE CHANGE

Better business solutions means -

- Change the culture
- Understand the customer
- Understand their business
- Customer obsessed behaviours

outside looking in

MANAGING CULTURE CHANGE

Service excellence means -

- Listen to customer concerns
- Do something about it
- Get customer approval
- Stick to the priorities

outside looking in
MANAGING CULTURE
CHANGE

Responsiveness means -

Skills groups
Assignment based working
Flexible organisation

outside looking in

MANAGING CULTURE
CHANGE

Personal leadership means -

We’re all being watched
Define good behaviours
Reward the good ones correct the bad

Get feedback
outside looking in
MANAGING CULTURE CHANGE

Performance management means -

Proper measurement
Proper feedback
Proper coaching
Done by the capable

A continuous process

outside looking in

SUMMARY

Change is continuous
Customer expectations grow
Old behaviours need examination
People need help to respond

outside looking in
MANAGING CULTURE
CHANGE

We all know that we need to change the culture

The secret is to do it with the organisation
not to the organisation

outside looking in
Overview

- Background information
  - why enterprise-wide measures
  - infrastructure

- Enterprise measures selected

- Challenges, obstacles, & solutions

- Status
  - pilot implementation
  - next steps
**Objective**

To establish an enterprise metrics program which characterizes software progress and performance across a global enterprise.

To establish initial, simple set of metrics that can be used across the enterprise to serve as the common "meter stick".

To deploy this so that all organizations (at CMM Level 3 and higher) can utilize this program as part of their ongoing improvement efforts.

---

**Citicorp Overview**

A full service global bank -- 85,000 staff, with more than 3,500 locations in 96 countries.

Strong technology thrust:
- 6,000 developers across the world
- wide range of development projects

Strong commitment to elevating the level of software maturity. Using CMM as roadmap.

More than 50 Assessments to date:
- 63% at L1; 17.4% at L2; 15.2% at L3; 4.4% at L4
- challenge is for all Organizations to be at L3 (or higher)
Citicorp as a Global Enterprise

Multiple Business Units each drive development via associated Technology Units (TU)
Each TU may have several multi-national teams (Work Groups)
Senior Technology Officer (STO) provides technical oversight via Citicorp Technology Office (CTO)

Why Enterprise-Wide Measures

Ability to answer questions about the enterprise
  • are we getting better or getting worse
  • is an enterprise-wide improvement program having an effect

Powerful ability to evaluate new technologies, methods, and practices by:
  • collecting identical measures to enable meaningful comparisons and trend analysis
  • creating a large pool of project data from which similar projects can be chosen for comparison purposes

Establish a visible ongoing enterprise focus for software engineering excellence
Benefits To The Enterprise -1

Establishes a "baseline" from which to measure
Provides a basis for inter-organizational comparisons
Identification of "best practices" and a starting point for enterprise communication and contacts
Organizational alignment around common measurement processes and objectives
 Begins to build an enterprise metrics database for benchmarking comparisons

Benefits To The Enterprise -2

Measure progress towards Corporate improvement goals
- increase Productivity by a factor of 2 over 5 years
- improve Quality by a factor of 10 over 7 years
- improve Predictability to within 5% over 7 years
- reduce Development time by 40% over 7 years
- reduce Maintenance effort by 40% over 7 years
Benefits to the Technology Units

Augments measurement work already in progress within individual organizations

Provides closer alignment to business goals

Able to more easily track progress, priorities, and trade-offs in a systematic manner

Serves as a datum point for technology upgrade

Shares the workload in developing detailed measurement standards

Business Strategy Mapped to Metrics

Traceability table

Example Indices for Business Goals
Established a Software Metrics Council (SMC)
- Steering Committee
- Working Group

**Software Metrics Council**

Chartered for the benefit of Technology Units across Citibank to provide an enterprise focus on fundamental software metrics.

SMC Membership invited from Citibank's highest maturity Organizations (Level 2+, 3, and higher)
- each Unit participates both as a member of Steering Committee and Work Group
- augmented by CTO and SEI consultants

SMC builds upon CMM, as well as the work of the individual Units. Extends this to establish a corporate metrics baseline.
Enterprise Metrics Program
Participating Citicorp Sites

* Participating Sites

Overview

Background information
- why enterprise-wide measures
- infrastructure

Enterprise measures selected

Challenges, obstacles, & solutions

Status
- pilot implementation
- next steps
**Goal Driven Metrics**

**Objective**
Establish initial, simple set of metrics that can be used across Citibank to serve as the common "meter stick".

**Goals**
- STO Improvement Goals
- Technology Units Goals

**Evaluation Areas**

**Selection of Indicators**

**Evaluation areas**
- can indicator be interpreted correctly?
- does it provide an accurate and high-level view?
- could you collect the data in your organization?
- are there any major barriers?
- do the definitions provide enough information?

**Other considerations**
- number of indicators in each measurement area
- total number of indicators
Enterprise Profile

Initial Core Measures

**Schedule predictability.** Indicator designed to answer questions about the enterprise(s) ability to plan well and deliver the products on schedule.

**Effort predictability.** Indicator designed to improve cost estimation and the ability to bring projects in on budget.

**Cycle time.** Indicator used to track improvements in getting products to market as quickly as possible.

**Quality.** Indicator for the quality of the development and testing process as well as the quality of the software in the field.

**Maintenance Effort.** Indicator used to track non discretionary maintenance, enhancements, and defect corrections as well as the number of open trouble reports.

---

Customer satisfaction. An indicator to track two components of customer satisfaction - satisfaction with the implemented solution and the working relationship with the implementing team.

**Cost of Quality.** An indicator that breaks overall costs (effort hours) into:

- rework - effort for fixing defects discovered prior to release
- appraisal - effort for inspection and testing
- prevention - effort incurred by process improvements aimed at preventing defects
- performance - effort associated with building the product
Citcorp Enterprise Metrics

**Project Size:**
- **Small**
- **Medium**
- **Large**

**Cost of Quality:**
- **Rework**
- **Appraisal**
- **Prevention**
- **Performance**

**Overview**

**Background Information**
- why enterprise-wide measures
- infrastructure

**Enterprise measures selected**

**Challenges, obstacles, & solutions**

**Status**
- pilot implementation
- next steps
Challenges, Obstacles, & Solutions

- Precise definitions
- Culture differences
- Trying for the 100% solution
- Keeping senior management involved
- Working open issues

Precise Definitions

Problem
- different business concerns, processes, native languages, cultures
- what is a project

Approach/Solution
- heavy reliance on
  - checklists
  - templates
  - graphics
  - handbook
  - education -> metrics course
Precise Definitions - 2

Key dates - start and end times

Project Phases

<table>
<thead>
<tr>
<th>Phases</th>
<th>Feasibility Study</th>
<th>Analysis</th>
<th>Functional Specification</th>
<th>Design</th>
<th>Codes &amp; Unit Test</th>
<th>Integration Test</th>
<th>UAT</th>
<th>Deployment</th>
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</thead>
<tbody>
<tr>
<td>Initiation</td>
<td>Definition</td>
<td>Design</td>
<td>Build</td>
<td>Verification</td>
<td>Implementation</td>
<td></td>
<td></td>
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</tbody>
</table>

Effort & Schedule Estimate

Project Start Date

Estimation Start Date

End Date (ship date)

Staff-Hour Definition Checklist

<table>
<thead>
<tr>
<th>Activity</th>
<th>Hours (include)</th>
<th>Report (include)</th>
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<tbody>
<tr>
<td>Development</td>
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<tr>
<td>Primary development activities</td>
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<tr>
<td>Development support activities</td>
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<td></td>
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<tr>
<td>Concept prototypes</td>
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<td></td>
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<tr>
<td>Tests &amp; development, acquisition, manipulation &amp; support</td>
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<td></td>
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<tr>
<td>Non-delivered software &amp; test drivers</td>
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<tr>
<td>Maintenance</td>
<td></td>
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<tr>
<td>Non-delivery</td>
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<td>Support activities</td>
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<td>Regulatory compliance</td>
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<td>Inspections</td>
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<td>Compliance enforcement</td>
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<tr>
<td>Enhancements</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Legacy Systems</td>
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<td></td>
</tr>
<tr>
<td>Legacy Systems</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Employment Status

- Corporate employees
- Full time
- Part time
- Temporary employees
- Subcontractors
- Consultants
**Indicator Templates**

**Indicator Template**

<table>
<thead>
<tr>
<th>Objective</th>
<th>Questions</th>
<th>Visual Display</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</table>

**Input(s)**

<table>
<thead>
<tr>
<th>Data Elements</th>
<th>Responsibility for Reporting</th>
<th>Form(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</table>

**Algorithm**

<table>
<thead>
<tr>
<th>Assumptions</th>
<th>Interpretation</th>
<th>X-reference</th>
<th>Probing Questions</th>
<th>Evolution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

---

**Example of Indicator Template**

**Objective**

To monitor trends in development elapsed time as input towards improvement at the technical unit level and across the Enterprise.

**Questions**

- What is the cycle time trend for each of the project size categories?
- Are the trends the same for the different project size categories?
- What is the rate of change from year to year?
- How does the rate of change compare between the different project size categories?

**Indicator/Display**

- Calendar Days per Data Unit
- Project Size: small, medium, large

---

*Wednesday 18 June*
Handbook Contents
- Citicorp Enterprise Metrics
- Indicator templates
- Definitions
- Definition checklists
- Pilot Deployment Indicator Assignments
- Pilot Deployment Expected Output
- Charter

Metrics Course (First Draft)

Purpose:
- ensure common understanding, implementation, and interpretation of the metrics across the Organization
- broadcast feedback & lessons learned from pilot implementation

Components
- description of template for each indicator
- definitions & checklist
- outline of Data Analysis module
  - evaluating technology and process changes
  - using the indicators to guide actions
  - analyzing trends
Culture Differences

Problem
• what is accepted in one culture, may not be accepted in another (e.g. measurement of effort)
• acceptance of measurement
• English not native language for all

Approach/Solution
• education/training
• frequent meetings
• expanded scope of involvement

Trying for 100% Solution

Problem
• so much diversity, can not capture everything
• if waiting for 100% solution, may never get there

Approach/Solution
• concentrate on 80% solution
• find out how common everything is (languages, etc.)
• expect several iterations
• start with easy metrics
• expand to meet business needs
### Example: Selection of Unit of Size

<table>
<thead>
<tr>
<th>PRO</th>
<th>SLOC</th>
<th>CON</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Relatively inexpensive to count</td>
<td>- Many different languages</td>
<td>- 4GL, visual actions, code generators, etc.</td>
</tr>
<tr>
<td>- Tools fairly easy to write</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PRO</th>
<th>Function Point</th>
<th>CON</th>
</tr>
</thead>
<tbody>
<tr>
<td>- language-independent</td>
<td></td>
<td>- Higher training cost</td>
</tr>
<tr>
<td>- comparability issues minimized</td>
<td></td>
<td>- Possible higher counting costs</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PRO</th>
<th>Local Choice</th>
<th>CON</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Measure will fit local environment</td>
<td>- Comparability is major headache</td>
<td></td>
</tr>
<tr>
<td>- generally low cost initial implementation</td>
<td>- Little opportunity for sharing</td>
<td></td>
</tr>
</tbody>
</table>
Working Open Issues

Problem
• no common reporting structure
• no mechanism in place to track, work, or coordinate solutions
• timely communication
  - different time zones
  - no common "connectivity" for Working Group members

Approach/Solution
• the CTO office and SEI consultants played this coordination role
• frequent communication via FAX, Federal Express, Email, conference calls, internet

Overview

Background information
• why enterprise-wide measures
• infrastructure

Enterprise measures selected

Challenges, obstacles, & solutions

Status
• pilot implementation
• next steps
## General Timeline

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Dec</td>
<td>Jan</td>
<td>Apr</td>
</tr>
<tr>
<td>WG Meeting</td>
<td>Santa Monica</td>
<td>London</td>
</tr>
</tbody>
</table>

- **WG Meeting**
- **Santa Monica**
- **London**
- **NY**
- **SEI**
- **Hong Kong**

### Pilot Deployment Goals

- Use and refine the set of measurement templates
- Standardize detailed definitions across organizations and templates
- Solicit feedback on operational characteristics and implementation issues (e.g., effort, cost)
- Gain a better understanding of effectiveness and interaction of the proposed measures
- Develop supporting automation
- Consolidate working documents, processes, and tool kit to be used for training and future implementations
Develop Operational Aspects

- Procedures for data collection and recording
- Forms for collecting and recording data
- How data will be stored and accessed
- Who will collect, store, and access data
- Tools to aid in collection and analysis
- Roll up procedures

Data Roll-up

- Enterprise View
- Technical Unit View
- Work Group Level
- Site Specific Measures
- Site Specific Measures
- Core Metrics
- Core Metrics
Automation Support

Features of support program
- visual display of all the indicators
- description and algorithm used for the display
- number of projects included in each data point
- interpretation guidelines
- definitions
- display of data used in indicator
- side by side comparison charts
- own contributions vs enterprise

Example Output

<table>
<thead>
<tr>
<th>Month</th>
<th>Large</th>
<th>Medium</th>
<th>Small</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jun</td>
<td></td>
<td></td>
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<tr>
<td>Jul</td>
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<td>Aug</td>
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<td>Nov</td>
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<tr>
<td>Dec</td>
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</table>

Schedule Predictability
The objective is to understand the effectiveness of our ability to estimate schedule. The input are the scheduled dates when the user acceptance test (UAT) needs to be completed and the actual dates when the UAT was completed along with the start date of coding. The percentage deviation in schedule for different categories is calculated as follows:

\[ \text{Percentage Deviation} = \frac{|\text{Actual Start Date} - \text{Planned Start Date}|}{\text{Planned Start Date}} \times 100 \]

A downward trend predicts improvement in the predictability and an upward trend shows a decline in predictability. This will allow us to improve the quality of project scheduling for completion of projects if the metric is maintained over a period of time.
## Pilot Implementation

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
<th>Group 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dates, planned &amp; Actual</td>
<td>Schedule Predictability</td>
<td>Quality</td>
<td>Maintenance Effort</td>
<td>Customer Satisfaction</td>
</tr>
<tr>
<td>Effort, code-&gt; testing</td>
<td>Effort Predictability</td>
<td>Cost of Quality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Defects, UAT &amp; field</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effort, development</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effort, Maintenance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Survey Data</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Next Steps

- Report to Steering Committee
  - definitions & templates
  - lessons learned
  - training & deployment plans
- Establish governance, centralized administration of the program, forum for sharing the information
- Deploy enterprise wide
Summary

Culture is a major issue, plan to address it throughout

Impossible to obtain the 100% solution, 80% may be good enough

Return value to every level from individual to enterprise

Implementation may take a long time

Use pilot implementation to verify feasibility

Process -> procedures -> tools -> presentations -> analysis
Ethics and the Software Process

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Manchester
+44-161-304-9997

commonsense@balm.demon.co.uk

---

Asimov’s three laws of robotics

1. A robot may not injure a human being or through inaction allow a human being to come to harm
2. A robot must obey orders from a human being provided those orders do not conflict with the first law
3. A robot must protect itself provided this does not conflict with either of the first two laws
The 0th law

A robot may not injure humanity or through inaction allow humanity to come to harm.

The way stuff *really* happens

Objective /motivation

- domain knowledge
- values
- consensus
- rules
- standards

Current situation

- facts
- data
- experience
- options
- unknowns

Decision

Outcome

operational domain

Balmoral Consulting

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Balmoral Consulting
A hierarchy of understanding

Data
Order
Information
Experience
Knowledge
Integration
Wisdom

Software is ...

Invisible
Intangible
Intolerant
Indispensable
..... and totally amoral

Which makes it bloody dangerous.

Wednesday 18 June

(C305b) 5-3
Ethics is ..... 
Doing good 
Being honest, trustworthy and loyal 
Not screwing people 
Only screwing the competition 
Letting the competition screw you 
Doing the right thing 
Doing things right 

Project Success(1) 

<table>
<thead>
<tr>
<th>Doing things right</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RR</td>
<td>RW</td>
</tr>
<tr>
<td>Doing the right thing</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>WR</td>
<td>WW</td>
</tr>
</tbody>
</table>
### Project Success (2)

**Compliance with procedures**

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>RR</td>
<td>RW</td>
</tr>
<tr>
<td>WR</td>
<td>WW</td>
</tr>
</tbody>
</table>

**Fitness for purpose**

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>RR</td>
<td>RW</td>
</tr>
<tr>
<td>WR</td>
<td>WW</td>
</tr>
</tbody>
</table>

---

### Process and Product quality

**Process Axis**

**Process Axis**

- Doing things the right way - i.e. complying with 'best practice'

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>The right thing done the right way</td>
<td>The right thing done the wrong way - good product produced by poor process</td>
</tr>
</tbody>
</table>

**Product Axis**

- Doing the right thing - i.e. delivering product which is fit for its intended purpose

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>The wrong thing done the right way - useless product produced by good process</td>
<td>The wrong thing done the wrong way - good product produced by poor process</td>
</tr>
</tbody>
</table>

---

*Wednesday 18 June*
Light the blue touchpaper and stand well clear...

The dilemma

The release of atom power has changed everything except our way of thinking....

If only I had known to what my research would lead I would have become a watchmaker

Albert Einstein
Operational States

- Use
- Abuse
- Failure

Problems of use
- CFCs
- Credit reporting
- Social change

Problems of abuse
- Diamorphine
- Internet
- ‘Chipping’
- System intrusion

- Tobacco
- Lotus 'Households'
- Nuclear fission
- SABRE
- 'Tagging'

\[\text{Wednesday 18 June}\]
Failure to understand the problem
iatrogenics
Year 2000
Failure of the Software
AT & T ! DSC Switch
Failure of the System
London Ambulance
Intel's 'Chipwreck'
USS Vincennes

Conflicts
Ethics of duty
vs.
Ethics of consequence
Omission and commission.

We have left undone those things which we ought to have done, and we have done those things which we ought not to have done, and there is no health in us...

To whom do you owe the duty?

The company
The customer
The regulator
The user
Your grandchildren
The Stakeholders

You          Line Management
Passers by    Shareholders
Users         Suppliers
Society       Me
Customers     Environment
Employees

Effect / Probability / Action Grid
(by stakeholder)

Effect
Fatal       Severe       Slightly Negative
Slightly       None       Favourable
Negative     Highly       Beneficial

Probability
Very likely  Possible  Unlikely  Negligible

Extreme Prevention
Prevent
Promote
Extreme Promotion

© Michael Carvagh 1987

Balmoral Consulting
A Key Process Area
- Ethics Management

To establish a process whereby the probability and severity of effects of use, abuse and system failure of the software under development are assessed from the viewpoint of every stakeholder and that outstanding risks are managed appropriately.

System proving

Proving that the system will behave in the intended way does not mean that it will do what you intended it to do.
Risk

How much risk do you *like* taking?

Attitudes to disaster

From the dawn of time until a few years ago -  
"Act of God"

From a few years ago to the foreseeable future -  
"Who can I sue?"
Consumer Protection Act 1987

Unnecessary to show negligence
Only requirements are:
the product was defective
the defect caused the damage

... liability is imposed on the producer of the product (DTI guide to the act)

Negligence (1)

In defence, the burden is on the manufacturer or designer to show that they took reasonable care.
... 'best efforts'....
.... the 'state of the art' defence' ...

(Standards & practices)
Negligence (2)

"A design which departs substantially from relevant engineering codes is prima facie a faulty design...."

Some other concerns

CIA (Confidentiality, Integrity & Availability)
Ownership
Power and Monopoly
Professional ethics / Codes of Conduct
Professional ethics

First, do no harm
Be competent
Uphold the law
Be honest
... and contribute ...
Agenda

- ABB - the company
- History of SPI initiatives within ABB
- CMM assessments the ABB way
- TOPP - the Swedish SPI initiative
- SWITCH - the Swiss SPI initiative
- TOPP - SWITCH similarities and differences
- Lessons learnt

Winifred Menezes

ABB Corporate Research

ABB: A Short Summary

- Employees: 215,000 in more than 100 countries
- Revenues: 34 MUSD
- Example Products
  - Power Generation: Power Plants
  - Power Transmission and Distribution: High-Voltage Substations
  - Industrial and Building Systems: Drives, Process Automation Systems
  - ADtranz (50:50 joint venture with Daimler-Benz): High-Speed Trains

ABB Corporate Research
ABB’s Matrix Organisation

ABB Corporate Research

Most R&D is carried out within the business areas. Corporate Research (CR) spending is only a small part of overall R&D spending.

CR Programs: “Key technologies that improve ABB’s competitive advantage.”

CR Centers: “Central resources, experience transfer, catalysts for change.”

Wednesday 18 June
Software trends within ABB

1984
1 person year

1994
approx. 20 person years

3 % of the order value
30 % of the development costs

ABB Corporate Research

Situation at ABB

BC - AC

80 % av 200 top managers
65 % av 5 000 middle managers
50 % av 50 000 engineers

have not used computers during training

ABB Corporate Research
Software developed and used by ABB

- software delivered to customers
  - basic/platform software
  - branch specific software
  - customer specific software
- engineering & production support
  - computational & scientific software
  - software tools
  - data & information management software
  - production & logistic support
    - order-entry
    - payroll systems
    - financial systems
    - MIS-type software

ABB Corporate Research

CMM Assessments at ABB

- History
  - Started in 1993 by Corporate Research Germany together with Power Plant Control
  - Questionnaire/process refined in cooperation between research centers
  - Questionnaires for levels 2, 3 and 4 exist
  - Since then more than 30 assessments performed

- Process
  - 1-hour introduction for all SW developers of an organisation
  - half-day interviews with 2-3 senior members of development groups/projects
  - half-day interview with manager
  - 2 weeks to summarise results and recommend improvement activities
  - 1-hour summary presentation plus kick-off for SPI work

ABB Corporate Research

Wednesday 18 June

(C306a) 5-4
From CMM to SPI

- After a CMM assessment ...
  - Initiation of SPI activities
  - Software development managers supportive

- When customer projects run late ...
  - Senior management gives SPI lower priority
  - SPI activities are "postponed" (often means abandoned)

- What is needed ...
  - Convince management top-down
  - Initiate activities with the right incentives and resources

The Need for Top-Down SPI

- Less than successful software projects
- Suboptimal development processes
- Efficient money spending in software (rework)
- Top-Down SPI
- Improved development processes
- Strategic use of software (reuse)
- Successful software projects

ABB Corporate Research
Country-Driven SPI Activities

SWITCH: SoftWare process Improvement Thrust for CH

IGR PCSEMotorolar0

NOCR~'P

Prgrmmar Pmcesen.CMUS

T50~SAA

Och:T5 Prga vauPohe

50 % yearly improvement

Quality
- in process
- post delivery

Timeliness

Lead time

Each company identifies own specific objectives

ABB Corporate Research

Wednesday 18 June

(C306a) 5-6
TOPP organisation

19 companies
Contact person at each company

TOPP

3 people central
TOPP group

- Management consultants
- Corporate Research
- Rotating company representative

Target audience for TOPP

ABB Corporate Research
TOPP planning

- Vision: ABB has world class software development in 2000
- Work backwards from vision to objectives and activities 99, 98, 97
- Objectives and activities for process, technology, competency (people) and communication/acceptance
- The TOPP 4 - companies with maturer software processes committed to being role models
- Support interests of all TOPP companies

Planning Tool

ABB Corporate Research

Wednesday 18 June
TOPP Activities 1997

- Top management informed
- Software processes understood
- TOPP 4 have improvement data
- All TOPP companies have a metrics program
- P-CMM used by at least one of the TOPP 4
- Competency profiles defined
- Training available
- Survey of development tools and environments
- Discussion database and WEB-pages

ABB Corporate Research

SWITCH: SoftWare process Improvement Thrust for CH

- Getting management interest
  - Early 96: presentation to member of executive board
  - Summer 96: data collection to show importance of software development
  - Presentation of results to "cross-company team technology" responsible for technology coordination
  - Autumn 96: proposal to and decision by executive board

- Getting SWITCH off the ground
  - December 96: Kick-off seminar with one representative of each company
  - January 97: Decisions by companies to participate, responsible people named
  - March 97: All companies have improvement programs in place
  - End of 97: First reevaluation of activities → continuation decision

ABB Corporate Research
Goals of SWITCH

- Company-specific activities, e.g.
  - Improved software development processes
  - Improved project planning and tracking (effort, schedules)
  - Improved quality assurance
  - Introduction of metrics

- Swiss activities
  - Foster and support company-specific activities
  - Keep management attention and support
  - Experience sharing between companies
  - Exchange of checklists, templates, process descriptions, ...
  - Common seminars, courses ...

SWITCH Implementation Structure

- Exec. Committee
- Segments
- Companies
- SWITCH Teams
- Proposal
- Decision
- Company
- Project Leader

company-specific activities
overall SWITCH activities
### TOPP and SWITCH

<table>
<thead>
<tr>
<th>Similarities</th>
<th>Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driven by Corporate Research</td>
<td>No. of people impacted</td>
</tr>
<tr>
<td>Supported by member of country management board</td>
<td>Age of initiative</td>
</tr>
<tr>
<td>Software not considered main business</td>
<td>Level of country wide cooperation</td>
</tr>
<tr>
<td>Necessity of using local language</td>
<td>Degree of openness to new ideas and central initiatives</td>
</tr>
</tbody>
</table>

### Lessons learnt

- Easy to say yes - difficult to get real commitment
- Patience and perseverance
- Management of expectations
- Need of stable point, despite organizational or personal change
- Cooperation and open exchange of information, not competition
- Allow for different implementations, with same high level goals
- Business needs must drive SPI, not CMM
- Use advanced parts of organisation to pull others along
The Capability Maturity Model for Software, Version 2

Mark C. Paulk
Bill Peterson

Software Engineering Institute
Carnegie Mellon University
Pittsburgh, PA 15213

This work is sponsored by the U.S. Department of Defense.

Topics

Change – Going to Version 2 of the Software CMM

Using Templates

The Level 2 Key Process Areas

The Level 3 Key Process Areas

The Level 4 and 5 Key Process Areas

Conclusion
Drivers for SW-CMM v2

Address change requests from users

Continual improvement of the SW-CMM
- respond to growing/changing needs
- improved understanding of "best practices"
- improved understanding of levels 4 and 5
- make the implicit explicit

Harmonize with relevant national and international standards (and other CMMs)
- provide mappings
- minimize unnecessary differences

CMM Integration


Software CMM v2 is an "early adopter" of CMM Integration criteria.
- piloting CMM Integration proposals as part of the v2 effort
- v2 will satisfy CCF requirements
- reassignment of resources significantly impacted Software CMM schedule
Global Changes

The name of level 4 will be changed from "Managed" to "Quantitatively Managed."

Key practices will be rewritten in active voice.

Templates will be used systematically.
- templates provide consistency and highlight exceptions

Key Process Area Changes

Software Supplier Management at level 2
- major revision of Software Subcontract Management

Software Risk Management at level 3
- draft key process area released for review
- final decision on incorporation will be made in May

Significant revision of levels 4 and 5
Other Significant Changes

Focused Integrated Software Management on differences from Software Project Planning and Software Project Tracking & Oversight rather than similarities.

Expanded scope of Software Product Engineering on both ends of life cycle.
- requirements elicitation and systems analysis
- delivery and installation
- operations
- support
- maintenance

Revise Goals

Goals are primary SW-CMM rating components.
- need to capture institutionalization explicitly in rating

Systematically revise goals to incorporate maturity level principles.
- institutionalization embedded in definitions of maturity level principles
- implies replacing current "planning" goals
Systematic Key Practice Changes

Plan moved from Activity to Ability.

Training and orientation key practices combined.

Measurement key practices reworded to focus on use for control and improvement.

Review and/or audit key practices split into process assurance and product assurance.
  • audit terminology removed

Rejected Proposals

Many proposed major changes, i.e., add a key process area, will be implemented as minor changes.
  • key practices
  • subpractices
  • examples

Examples include:
  • test management
  • requirements elicitation
  • packaging, delivery, installation, operations
  • maintenance
Topics

Change – Going to Version 2 of the Software CMM

Using Templates

The Level 2 Key Process Areas

The Level 3 Key Process Areas

The Level 4 and 5 Key Process Areas

Conclusion

Templates

Express common concepts using common terminology.

Especially true for the "institutionalization" key practices (i.e., Commitment, Ability, Measurement, Verification).

Some templates need to change at different maturity levels to capture maturity principles accurately.
Maturity Level Principles:
Organizational Capability

Initial Level

Maturity level 1 implies software engineering and management processes are performed in an ad hoc manner.

No further description of maturity level 1 is necessary.
- broad range of engineering and management practices possible
- consistency across time and across the software organization problematic
Repeatable Level

Emphasis is on qualitative process control by applying basic project management.

In SW-CMM v1, we used "according to a documented procedure" at level 2 (and higher).

"Perform {KPA} according to a repeatable process."

Defined Level

Emphasis is on qualitative process improvement by organizational learning.

- build on concept of "repeatable process"

In SW-CMM v1, we used "according to a defined process" sporadically, beginning at level 3.

Perform {KPA} according to a defined process.

Perform {KPA} according to the project's defined software process.
Quantitatively Managed Level

Emphasis is on quantitative process control by the systematic use of measurement.
- build on concept of "defined process"
- implies management by fact, predictability

"Perform {KPA} to support quantitatively managed processes."

Optimizing Level

Emphasis is on continual process improvement based on a quantitative understanding of the implications of process change.
- build on concept of quantitatively managed process

"Perform {KPA} to support optimizing processes."
Institutionalization Goals

Institutionalization is at least as important as implementation for building process maturity and capability.

V2 will have an "institutionalization goal" for each key process area.
- capture the principle of the maturity level concisely
- map all of the institutionalization practices (i.e., Commitment, Ability, Measurement, Verification)
- explicitly and separably capture institutionalization as a rating component

Commitment to Perform

Describes the actions the organization must take to ensure that the process is established and will endure

Typically includes
- policy
- sponsorship (for organization KPAs)
Ability to Perform

Describes the preconditions that must exist in the project or organization to implement the software process competently

Typically includes
- plan
- resources and funding
- responsibility and authority
- training

Activities Performed

Describes the roles and procedures necessary to implement a key process area

Implement the institutionalized process

Subpractice templates for
- configuration management
- reviews
- peer reviews
- etc.
Measurement and Analysis

Describes the need to measure the process and analyze the measurements

Typically includes
• control
• improvement
  *(level 3 and higher)*

Verifying Implementation

Describes the steps to ensure that the activities are performed in compliance with the process that has been established

Typically includes
• process assurance
• product assurance
• project manager review
• senior management review
Topics

Change – Going to Version 2 of the Software CMM

Using Templates

The Level 2 Key Process Areas

The Level 3 Key Process Areas

The Level 4 and 5 Key Process Areas

Conclusion

Requirements Management (RM)

The purpose of Requirements Management is to establish a common understanding between the customer and the software project of the customer’s requirements that will be addressed by the software project.

Interface between software project and "customer" is fuzzy.

- systems engineering
- marketing
- external customer

Important that allocated requirements be documented and controlled.
**Software Project Planning (PP, SPP)**

The purpose of Software Project Planning is to establish reasonable plans for building the software product and for managing the software project.

"Plan the plan" was a controversial template to apply.
- *concept is valid, although may be out of scope*

---

**Software Project Tracking and Oversight (PT, PTO)**

The purpose of Software Project Tracking and Oversight is to provide adequate visibility into actual progress so that management can take effective actions when the software project's performance deviates significantly from that planned.

*Key practices changed to make PTO more consistent with SPP.*
Software Supplier Management (SM, SSM)

The purpose of Software Supplier Management is to effectively manage the acquisition of software obtained externally to the software project.

Major expansion of v1.1's Software Subcontract Management KPA to include non-developmental software included in product:
- commercial-off-the-shelf software
- customer-supplied software

Tools in software engineering environment is considered a risk rather than in scope of this key process area.

Software Quality Assurance (QA, SQA)

The purpose of Software Quality Assurance (SQA) is to ensure that the software project's activities and work products comply with the applicable requirements, process descriptions, standards, and procedures.

Lowered the visibility of the SQA group:
- alternative implementations in some organizations

Separated process and product assurance:
- SQA goals
- Verification practices
Software Configuration Management (CM, SCM)

The purpose of Software Configuration Management (SCM) is to establish and maintain the integrity of the products of the software project throughout the software life cycle.

Terminology remains a challenge.

Topics

Change – Going to Version 2 of the Software CMM

Using Templates

The Level 2 Key Process Areas

The Level 3 Key Process Areas

The Level 4 and 5 Key Process Areas

Conclusion
Maturity Level 3 Issues

Using "defined process" versus "project's defined software process"

Distinguish between level 3 concepts and level 2 concepts (particularly in Integrated Software Management)

Organization Process Focus (PF, OPF)

The purpose of Organization Process Focus is to establish and maintain an understanding of the organization's software processes and coordinate the organization's software process improvement activities.

Should the focus be "software process management" or "software process improvement?"
Organization Process Definition (PD, OPD)

The purpose of Organization Process Definition is to establish and maintain a usable set of software process assets that improve process performance across the organization, and provide a basis for cumulative, long-term benefits to the organization.

Set of standard software processes for organization

Changed “organization's software process database” to “organization's software measurement database.”
• placed under change control

Organization Training Program (TP, OTP)

The purpose of the Organization Training Program key process area is to develop the skills and knowledge of individuals so they can perform their software roles effectively and efficiently.

Re-focused on organizational training perspective.

Name change to include “Organization” also applies to other key process areas at higher levels.
Integrated Software Management (IM, ISM)

The purpose of Integrated Software Management is to integrate the software engineering and management activities into a coherent, defined software process that is tailored from the organization’s standard software process family, which is described in the Organization Process Definition key process area.

Revised to focus on level 3 nature of planning and managing software projects.
- emphasize differences with level 2 rather than similarities

Software Product Engineering (PE, SPE)

The purpose of Software Product Engineering is to consistently perform a well-defined engineering process that integrates all the software engineering technical activities to produce correct, consistent software products effectively and efficiently.

"Software engineering" includes management practices; "software product engineering" is jargon...

Expanded to capture overall life cycle.
Intergroup Coordination (IC)

The purpose of Intergroup Coordination is to actively participate with the other groups involved in the software project to address the system-level and intergroup aspects of the project in order to better satisfy the customer's needs.

Still has bias towards "groups" that we've tried to remove or demote elsewhere.

- renaming as "Collaborative Work" proposed

Still written from software perspective.

Peer Reviews (PR)

The purpose of Peer Reviews is to remove defects from the software work products early and efficiently. An important corollary is to develop a better understanding of the software work products and of defects that might be prevented.

New goal: "Establish a shared understanding of the software work products through participation in peer reviews."

Wednesday 18 June
Software Risk Management (SR, SRM)

The purpose of Software Risk Management is to identify and mitigate software risks throughout the life cycle of a software product.

The most controversial proposal in Draft A...

If adopted, the risk management goals and key practices in ISM will be deleted.

Decision will be made in May at joint CMM Advisory Board/Software CMM Change Control Board meeting.

Topics

Change – Going to Version 2 of the Software CMM

Using Templates

The Level 2 Key Process Areas

The Level 3 Key Process Areas

The Level 4 and 5 Key Process Areas

Conclusion
In Process...

Maturity levels 4 and 5 are still under development.
• key process area names will change!

Using the templates consistently and meaningfully at levels 4 and 5 is challenging.
• for example, “Perform quantitative process management according to a quantitatively managed process.”

The level 4 and 5 key process areas will be distributed in Draft B'.

Clarify Level 4

Major focus is clarifying the rigorous and systematic use of statistics at level 4.
• quantitative management is more than just measurement
• understanding what data means – what to control and what not to control

Proposed level 4 key process areas
• Statistical Process Management
• Organization Process Performance
• Organization Product Alignment
Build on Quantitative Understanding of Process

Need to communicate that level 5 builds on level 4 capability.
- concepts of measurable improvement, agility, innovation poorly expressed

Proposed level 5 key process areas
- Incremental Improvement
- Innovative Improvement
- Process Opportunity Analysis
- Participative Deployment

Topics

Change – Going to Version 2 of the Software CMM

Using Templates

The Level 2 Key Process Areas

The Level 3 Key Process Areas

The Level 4 and 5 Key Process Areas

Conclusion
Drafts

Draft A is now available for review and pilot testing.
- level 2 and 3 key process areas

Draft B will contain the level 4 and 5 key process areas.
- two separate releases: B' and B
- selected front matter and appendices
- incorporate draft CMM integration criteria

Draft C will be the “final draft.”
- additional drafts may be necessary, depending on feedback received

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Web page http://www.sei.cmu.edu/technology/cmm
ESPI - European SEPG

Using SPI Principles to Improve the Value of Legacy Systems

Bank of America, UK
Global Systems Development

"Legacy" Systems

Does "Legacy" mean anything? Example:

"JavaStations are designed to coexist with legacy desktop applications"

Does "Heritage" mean anything?
Systems as humanity!

We spend most of our life cycle in a stage called "Maturity"

Systems spend most of theirs in a stage called "Maintenance"

"Legacy" is a stage of the maintenance cycle

What are the Classes of Maintenance?

- Perfective
  - Enhancements to meet changing business requirements or functions; business-driven
- Adaptive
  - Upgrades to meet changing technical requirements or functions; technology-driven
- Preventative
  - Improving quality, reliability, maintainability and preventing errors from occurring; a proactive process
- Corrective
  - Fault diagnosis and correction; a reactive process
**Within these classes we have choices**

- Discretionary
  - Prioritised business enhancements
- Perfective
  - A new operating system feature
- Adaptive
  - The Millennium
- Preventative
  - Minor irritating problems
- Corrective
  - Non-discretionary
    - Regulatory
    - Audit/compliance
    - External agencies
    - Head Office needs

It will help focus your management of maintenance, and thus "legacy", if you can construct your plans to reflect these classes.

---

**Ten Ticklist Topics**

- System is subject to active perfective maintenance
- Majority of perfective maintenance is discretionary
- System is subject to active adaptive maintenance
- Majority of adaptive maintenance is discretionary
- System is subject to active preventative maintenance
- Development productivity improving
- Internal quality improving
- Simple integration with other technologies
- Reuse at least 30%
- Active market in development skills

Against how many of these can you place a tick?
**The Four Stages of Maintenance**

- Endowment: tick 10 - 8
- Heritage: tick 7 - 5
- Legacy: tick 4 - 2
- Liability tick 1 - 0

- Longer, and better quality, life cycle with higher maintenance investment; systems which are:
  - Strategic, long-term business operations
  - Critical business functions
  - Subject to rapid technology evolution

---

**Any questions?**
You take too long and cost too much!

Projected Productivity for Legacy Systems
“Perceived Wisdom” Q1/1992 = 100
- Increase in application size and complexity
- Adverse pressure on design and code quality
- Increasing business pressure

System rate of growth = 7% per annum
“Replacement cost increases as software quality decreases”
**Strategy Decision - 1990 - SPI**

*Process, Product and People Improvement*

- Establish measures, publish to IT and business
- Improve software quality
- Declare the mainframe development environment “Legacy”
- Invest in new development technologies
- Endow the GBS/IMS system through into the new millennium
- Ensure millennium compliance
- Evolve the ability to integrate with emerging and converging technologies
Global Banking System
Some general information

- IMS/TM
- Some 25,000 “components”
- 6,000 COBOL components
- 1,600 ADF components
- 110+ physical databases; 250+ db datasets
- Across each of 10 IMS “hosts”
- 40 countries supported
- “The sun never sets”; 7-day x 24-hour
- 15-17,000 changes per year; 70 projects
- Consolidated change every month
- Developer population c. 40
Development Environment
Mainframe - VM/ISPF Clients, VM and MVS Servers

- Productive platform, but: plenty of text editing
- No ability to integrate workstation tools
- A large list of required enhancements
- Sound basic client/server architecture
- Classified as "Legacy"

Development Environment
"The New" is:-
Developer 2000

- The COBOL quality programme
- Developer 2000
  - Developer LAN
  - Simple application population
  - Complex application population
- ADF migration
  - Developer Dialogue
# Development architecture

**The “Software Factory”**

<table>
<thead>
<tr>
<th>Workstation services</th>
<th>LAN services</th>
<th>Mainframe services</th>
</tr>
</thead>
<tbody>
<tr>
<td>OS/2</td>
<td>Token ring/Novell</td>
<td>VM</td>
</tr>
<tr>
<td>3270 emulation</td>
<td>Network for SAA</td>
<td>GPPA</td>
</tr>
<tr>
<td>Source control</td>
<td></td>
<td>MVS</td>
</tr>
<tr>
<td>Developer Dialogue</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module re-engineering</td>
<td></td>
<td></td>
</tr>
<tr>
<td>COBOL Workbench</td>
<td>DB2 LAN executables</td>
<td>DB2 executables</td>
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<tr>
<td>Unit testing</td>
<td>Test Manager</td>
<td>Integration testing</td>
</tr>
<tr>
<td>Local file handling</td>
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<td>ISO tools</td>
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<tr>
<td>Test data (update)</td>
<td>DB2/PS/2 library</td>
<td>C3 block transfer</td>
</tr>
<tr>
<td></td>
<td>Test data (read)</td>
<td>Data transfer</td>
</tr>
<tr>
<td>Impact analysis</td>
<td>LAN Workbench</td>
<td>Test data (update)</td>
</tr>
<tr>
<td>Office automation</td>
<td>Message Manager</td>
<td>Impact analysis</td>
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<tr>
<td>Project control</td>
<td>Project Repository</td>
<td>LIBRARIAN</td>
</tr>
<tr>
<td>Reference manuals</td>
<td>BookManager</td>
<td></td>
</tr>
</tbody>
</table>

## Any questions?
Global Systems Development
Key Performance Measures

Key Performance Measures
What is a "component"?

- It is a piece of GBS which passes through the Production Release System, where it can be counted, as we do a release each month.
- It is a basic building block which everybody understands, and which has remained constant over time, e.g.:
  - A COBOL module
    - COBOL COPYbooks
  - An ADF transaction
    - ADF dynamic rules
    - ADF Special Processing Routines
  - A JOB
    - A PROCedure
%age Components with Production Problems (Annually Smoothed)

Wednesday 18 June
MVS Components per Programmer/Month (Annually Smoothed)

Addressing Legacy Productivity
Q1/1992 = 100
MVS Components Gross Productivity (Annually Smoothed)

Continuing to output at the Q1/92 rate of 18.86 per month
Continuing to output at the Q1/92 rate, less 7 percent

Any questions? (Internal Measures!)
Business Partner Quality Survey "TRACK"

% Transaction System Down Time (Compass) 1993/4/6 (1 week)
Any questions?

ADF (3270 Interface) Migration
Wrapping "Legacy" functions
A very pure OO Application!
Deal Ticket

Manual Intervention, Error, Delay

3270 ADF GBS Business Function

HLLAPI Gateway "Screen Painting"

Traditional Solution

Deal Ticket
How do we move this object? How do we give it meaning to "the Legacy"?

But we don't want to talk "3270".

What have we done about the "closed" GBS?

We have used Messaging Middleware.

We have made it OPEN!

The object boys call this a "flattened" object!
Facilitated by ADF Migration. The same functions for Open Interface. GBS as a Server with 1,600 Stored Procedures.

GBS - the Open Perspective
Integration of many technologies

- SNA
- Workflow
- Object
- File-based Networks
- Real-time Networks: SWIFT
- EIS & DSS Relational
- Messaging
- Client/Server
Final questions?
Experiencing Software Process Improvement at the Sharp End

Paul Hookham
Head of Project & Technical Services
Information Systems
Lloyds TSB Group

Agenda

- Today's Objectives
- About our company
- Reasons for SPI in Lloyds / TSB
- Some Mistakes
- Good Practice
- Curved Balls
- Successes
- Blueprint - 10 Critical Success Factors
- What Next?
Today's Objectives

- A Personal Viewpoint
- Resistance encountered
- Interesting behaviour
- What didn't work
- What worked well
- Some things to watch out for

Why it's working now
The Next Steps

About our company

- Provision of Financial Services
- Lloyds / TSB merged 28 December 1995
- 2,810 High Street branches
- 82,000 employees
- Group assets: £147 billion
- Top 5 UK quoted company with a market capitalisation of £33 billion (11/05/97)
- Merger benefits to be accrued
- Significant other challenges ahead
About our company

Information Systems:

- Software Development and Support
- 1,400 employees
- 9 UK sites

Reasons for SPI in Lloyds / TSB

- Productivity - (Function Point per £)
- Predictability - (Function Point per month)
- Flexibility & Responsiveness - (Resource Pools)
- Demonstrate competitiveness - (Assessments)
- Improve Defect Detection & Removal Rate
  - (Inspection)
- Improve Benchmark position - (Credibility)
- Focus on the Quality System
**Some Mistakes**

- Lack of skilled resource
- Tick in the box mentality
- Lack of ownership
- Inadequate training / awareness
- Too concerned about Business Case
- Too concerned about Automation
- Resistance - No targeting policy
- Did not win hearts & minds

---

**More Mistakes**

- Too Many Wise Men
- SPI or Product? - your choice
- Executive Commitment waned
- Consultants - succession plans?
- Many gaps after 2Q96 assessment
- Not seen as important - no impact on PRP
- Early Adopters / Early Majority Chasm
**Good Practice**

- Involve everybody
- Ensure management commitment is sustainable
- Integrate SPI activities in product issue logs
- Plan to have regular assessments
- Use external help effectively
- Keep it simple
- Local processes

**More Good Practice**

- Harvest existing knowledge
- Target points of pain - Priority 1
- Go for the quick win - Priority 2
- Use CMM as a framework
- Ownership in the projects
- Encourage & support Special Interest Groups
- Involve your customers
Improvement at the Sharp End

Curved Balls

TREAT WITH UNDUE CARE & ATTENTION
'I am fully committed to this initiative'

'Level 5 by '95'

expect you to do SPI in your own time - in addition to your real work'

More Curved Balls

SOME COMMON COMPLAINTS
'Metrics - they can wait until Level 4'

'I have no time to implement my action plan'

Don't worry - it will go away soon'
**Successes**

- Configuration Management **
- Requirements Management
- Risk Management **
- FULL TIME INVOLVEMENT IS KEY

---

**More Successes**

- Realistic Scheduling
- Senior Management Commitment
- Project Awareness
- Intro to CMM - 3 day training
**Blueprint - 10 Critical Success Factors**

**STEP 1**
ESTABLISH SENIOR MANAGEMENT STEERING GROUP: -

- SET POLICY
- LAUNCH TRAINING & COMMUNICATIONS
- MONITOR PROGRESS
- PUBLICISE BUSINESS GOALS

**STEP 2**
ESTABLISH SENIOR MANAGEMENT COMMITMENT: -

- INTERNAL COMMUNICATIONS
- SOCIAL EVENTS
- TRAINING COURSE DINNERS
- PUBLICISE SPI AT EVERY OPPORTUNITY
**Blueprint - 10 Critical Success Factors**

- **STEP 3**
  ESTABLISH AN AGREED TRAINING AND ASSESSMENT SCHEDULE WITH SENIOR MANAGEMENT & IMPLEMENT IT

- **STEP 4**
  MANAGEMENT TEAMS ATTEND TRAINING AND PRODUCE ACTION PLANS FOR GAP CLOSURE

---

**Blueprint - 10 Critical Success Factors**

- **STEP 5**
  MANAGEMENT TEAMS PRESENT THEIR ACTION PLANS TO THEIR TEAMS & DELIVER A CMM OVERVIEW TO THEM - TO SHOW COMMITMENT
STEP 6
SCHEDULES FOR IMPLEMENTATION
OF ACTION PLANS ARE PRODUCED
3-4 WEEKS AFTER TRAINING
FORWARDED TO SEPG FOR TRACKING,
CONSOLIDATION & ONWARD SUBMISSION
TO STEERING GROUP

STEP 7
ISSUES AND PROGRESS ARE TRACKED
AND MONITORED BY STEERING GROUP,
VIA STANDARD PROGRESS REPORTING

STEP 8
EXTERNAL CBA-IPI, BY FUNCTION, 3-4
MONTHS AFTER TRAINING USING SEI
LEAD ASSESSOR
**Blueprint - 10 Critical Success Factors**

- **STEP 9**
  REVISE ACTION PLANS AND SCHEDULES TAKING INTO ACCOUNT ASSESSMENT FINDINGS

- **STEP 10**
  PERFORM AN INTERNAL RE-ASSESSMENT 6-9 MONTHS AFTER EXTERNAL CBA-IPI

**What Next?**

- Automation
- Software Acquisition CMM
- Train the Trainer
- Internal SEI Lead Assessor
- Sub Contractor Evaluations
- Peer Reviews

WHO KNOWS?
QUESTIONS ???

QUESTIONS ???

QUESTIONS ???

ARE YOU GOING MAD? TSB

ONE FINAL THOUGHT FROM ANON.

'INSANITY EXISTS WHEN YOUR MANAGEMENT EXPECT YOU TO REPEAT THE SAME PROCESS OVER AND OVER AND OVER AGAIN BUT GET DIFFERENT RESULTS EVERY TIME'
Requirements for Winning Software Teams

Bill Curtis
TeraQuest Metrics
Austin, Texas
&
Software Engineering Institute
Carnegie Mellon University

This talk can be accessed at http://www.teraquest.com

From Individuals to Teams

This presentation assumes there is a progression of steps through which many organizations must pass to install empowered teams.

Craft

Individuals

Traditional organization

Workgroups

Team-based organization

This progression underlines the staging of some key practices, key process areas, and maturity levels in the People Capability Maturity Model.
## Advantages of Workgroups

<table>
<thead>
<tr>
<th>Advantage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load levelling</td>
</tr>
<tr>
<td>Coordination of tasks</td>
</tr>
<tr>
<td>Reduced span of control</td>
</tr>
<tr>
<td>Improved performance</td>
</tr>
<tr>
<td>Shared learning</td>
</tr>
</tbody>
</table>

## Interpersonal Communication Skill

Teams require a solid foundation in interpersonal communication and coordination skills.

<table>
<thead>
<tr>
<th>Skill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Listening and interpreting</td>
</tr>
<tr>
<td>Group dynamics</td>
</tr>
<tr>
<td>Multicultural sensitivity</td>
</tr>
<tr>
<td>Problem resolution</td>
</tr>
<tr>
<td>Negotiation</td>
</tr>
</tbody>
</table>
Participatory Culture

Decisions about performing work
Decisions shifted to lowest level appropriate
Team decisions are supported

Commitments regarding work
Involvement

Decisions regarding work environment

Workgroups Do Not Guarantee

- Shared agenda
- Specialization of skills
- Effective processes
- Control over internal team affairs
- Empowerment to act on judgement

Wednesday 18 June
Team Building Pre-Conditions

Formal team building should only be used where conditions are favorable for team implementation:
- interdependency of action
- participatory culture
- effective control over work
- shared goals
- measurable team performance
- commitment by each individual
- complementary skills
- facilitative management
- aligned with organizational goals

Initiating Software Teams

1. Organize work around teams
2. Select structure
3. Identify competencies
4. Team formed from complementary mix of skills
5. Assign responsibilities
6. Knowledge and skill shortfalls
7. Train as required
Characteristics of Teams

**Empowered** — "...they do not have to go through hierarchical approval for many of their decisions about how to do their work." (Mohrman et al., 1995)

**Self-Managed** — "...they perform for themselves many of the tasks that management used to perform..." (Mohrman et al., 1995)

**Warning** — empowerment and self management do not mean that teams are free to pursue their own agendas. With empowerment comes responsibility.


Empowered Execution

- Provide facilitation
- Establish relationships with other teams
- Tailor standard processes
- Plan commitments
- Define measures
Providing Standard Team Processes

Teams should be given a process they can tailor rather than be forced to thrash for months creating their own

Team Software Process coming from Watts this August at the SEI Symposium

Team Workforce Practices

Team-Based Workforce Practices

- Team recruiting
- Selection methods
- Team orientation
- Performance mgt.
- Training needs
- Compensation
- Workforce planning

Workforce practices adjusted for use with teams

Team members involved in performing some practices
Team Performance Management

Supervisory input and awareness

Team performance criteria → Team performance review → Team recognition and reward

Team development needs → Compensation decisions

Team-Based Compensation

Performance discussion

Team Individual:
- personal performance
- competency growth
- contribution to team

Recognition or reward

Compensation decision

Compensation Strategy

Motivate performance alignment:
- Organizational performance
- Unit performance
- Team performance
- Individual performance
Conclusions

Teams do not replace individuals and their performance

Workgroups coordinate the work of individuals

Teams empower individuals to better integrate complementary skills and more fully utilize their judgement in executing interdependent tasks

An excellent source...

Challenges and solutions for SPI in a small company

Romana Vajde Horvat, Ivan Rozman
University of Maribor,
Faculty of Electrical Engineering and Computer Science
Institute of Informatics

Content

- Introduction
- Types of small companies
- Challenges for SPI in small companies
- PROCESSUS SPISC model
- Conclusion
Introduction

* 1986-1996: a decade of SPI in large companies
* results and consequences:
  - experiences, knowledge
  - mature SPI and SP assessment models
  - higher quality criteria on SW market

Types of small companies

* definition of term “small company”: depends on type of company
* Types of small companies:
  - branch company
  - independent company
  - IT department within enterprises
Types of small companies...

Branch company

- establishment: supported by partner - large company
  - financing,
  - equipment,
  - training
- SPI projects conducted according to policy of large company
  - defined procedures, required results of each procedure

Independent company

- establishment:
  - enthusiasm of individuals,
  - insufficient budget, equipment, ...

<table>
<thead>
<tr>
<th>NO. OF EMPLOYEES</th>
<th>SIZE OF COMPANY</th>
</tr>
</thead>
<tbody>
<tr>
<td>up to 15</td>
<td>small independent company</td>
</tr>
<tr>
<td>15 to 50</td>
<td>medium-sized independent company</td>
</tr>
<tr>
<td>over 50</td>
<td>large independent company</td>
</tr>
</tbody>
</table>
Types of small companies ...

**IT department**

- organizational unit within enterprise
- process of work is defined within IT department, but it should be **compliant** with **global policy** of enterprise
- customers: other departments within enterprise

**Challenges for SPISC**

- great dependency on individuals
- disposition of roles
- large impact of the human factor
- dependence on few projects
- importance of communication with customers
- difficulties with investing into SPI
PROCESSUS SPISC model

models for SPI in small companies (SPISC) should:
- be easy to understand
- provide firm guidance using a supporting documentation
- provide SPI results compliant with market requirements

Background

- based on:
  - detailed comparison and integration of ISO 9001, ISO 9000-3 (ISO model) and CMM
  - experiences with SPI in small companies
PROCESSUS SPISC model...
Comparison of ISO model and CMM

<table>
<thead>
<tr>
<th>ID</th>
<th>EM</th>
<th>Key process area</th>
<th>Consistency degree for the activity</th>
<th>Respective clause from ISO 9001</th>
<th>Respective clause from ISO 9000-3</th>
<th>Running item No. for the activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td></td>
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<td></td>
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<td>2</td>
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<td>3</td>
<td>3</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

CD-value | Meaning
---|---
-2 | Activity is defined only in CMM
-1 | Activity is defined in both models although CMM is more extensive
0  | Activity is equally defined in both models
1   | Activity is defined in both models but ISO adds new aspects
2   | Activity is defined only in ISO model

PROCESSUS SPISC model...
Integration of ISO model and CMM

- According to the results of comparison
  - new KPAs
  - new activities
  - enhanced activities
  are incorporated into framework of original CMM

- Characteristics of small companies require change of sequence for some KPAs
PROCESSUS SPISC model...
Framework

- For introducing of each procedure following activities should performed:
  - analysis
  - definition
  - training
  - enactment
  - tracing

Wednesday 18 June
PROCESSUS SPISC model...

Introduction phase

- assignment and training of quality manager
- definition of SPI plan
- definition of organizational structure
- definition of process documentation structure
- introduction of SPI concepts to personnel
- definition of few simple metrics

PROCESSUS SPISC model...

Process definition phase

- Customer relationship management
  - contract management
  - requirements management
  - product delivery
  - maintenance
- Project management
  - project plan
  - quality management activities
  - reviews of input and output of phases
PROCESSUS SPISC model...

Process definition phase

- Software engineering
  - definition of procedures for software engineering, considering used methodologies and tools
- Supporting activities
  - training
  - document control
  - included product management

PROCESSUS SPISC model...

Process optimization phase

- Process management
  - metrics
  - internal reviews
  - corrective actions
- Process automation
  - supporting and automation of activities - internal applications, groupware, etc..
  - PSEEs (Process-centred software engineering environments)
PROCESSUS SPISC model...

Process documentation

- structure:
  - QM - Quality Manual
  - SP - Standard Procedure (17)
  - SD - Standard Documents (forms, templates, manuals - app. 2 for each SP)

<table>
<thead>
<tr>
<th>No.</th>
<th>Standard Procedure</th>
<th>Standard Document</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Contract management</td>
<td>F Contract review checklist, T Contract</td>
</tr>
<tr>
<td>2</td>
<td>Requirements</td>
<td>F Requirements change request, T Requirements specification</td>
</tr>
<tr>
<td>3</td>
<td>Product Delivery</td>
<td>F Acceptance checklist, F Acceptance report</td>
</tr>
<tr>
<td>4</td>
<td>Maintenance</td>
<td>F Maintenance request, F Maintenance report</td>
</tr>
</tbody>
</table>

PROCESSUS SPISC model...

Disposition of roles

M - manager
PM - project manager
QM - quality manager
D - developer
DC - developer coordinator

<table>
<thead>
<tr>
<th>No.</th>
<th>Standard Procedure</th>
<th>Roles</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Contract management</td>
<td>M, PM, QM, QM</td>
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<tr>
<td></td>
<td>Requirements management</td>
<td>PM, M, D, QM</td>
</tr>
<tr>
<td></td>
<td>Product Delivery</td>
<td>D, PM, QM, M</td>
</tr>
<tr>
<td></td>
<td>Maintenance</td>
<td>D, PM, QM</td>
</tr>
</tbody>
</table>
Conclusion

- Process definition and application in projects: app. 18 month
- Influence of human factors on the SPI project is important
- Process and project documentation are significant burden - the need for support and automation is evident
Software Process Improvement Support

Lieuwe Sytse de Jong
SPI Manager
Philips Business Electronics
E-Mail: LSdeJong@compuserve.com

Software is critically important to Philips

Changing and new competitors ➔ Philips' revenues are affected ➔ Many parts of the company are involved

Key Modules:
- Semiconductors
- Components
- Business Electronics
- Consumer
- Communications
- Medical Systems
- Sound & Vision
- Industrial Electronics
- Philips Media
- PolyGram
**Embedded Software in Philips**

- 2500 - 3500 Software Engineers in 110 Groups
- Fast Growing in Complexity
- Maturity varies from Level 1 to Level 3
- Have experienced several Software Crises
- Application Areas vary from Software Systems: Video Communication, Telecom, Medical, ... to Software Products: Speech Processing
to Firmware: Television, Audio, Set Top Box, Cameras,...

**PHILIPS' SPI Approach**

Management Awareness → Define Objectives, Targets → General Agreement → Assess Current Situation

Evaluate Results → Define Improvement Plan → Implement Improvements → Improving

Improvements can be taken from:
- Process
- People
- Architecture
- Technology
- Organisation
Overall Targets 1997

Software quality
Improve current Post-release and Final Test Defect Density by factor 2

Software maturity
Improve at least one CMM-level

Software education
Participation in 2-day workshop ‘Software Business’ for management teams where software is strategic

SPI Support Organization

- SPI Task Force
  (PHILIPS CTO is Chairman)
- SPI Steering Committee (operational Tasks)
- SPI Management at PD Level
- SPI Coordination at BU Level
- SPI Steering Committees at BU Level
- SPI Consultation in Philips’ Origin

Let's make things better
Philips' SPI Support

- The Business Unit is the Owner of the SPI Process
- First Improvement Steps need to be practical
- "Plan, Do, Check, Act" Cycles are essential
- Every Organisation is different, for example:
  - Nationality
  - Position at the learning Curve
  - Flexibility
- Assessment is relatively easy
- Deployment of the new Processes is the most difficult Part

SPI Support Experiences

- SPI is dealing with Management of Change
- Roadblocks that are often encountered in Philips:
  - Lack of Management Awareness/ Direction
  - Culture of an Organisation (Hardware Oriented)
  - Competition of real Projects
  - Lack of Change Management Skills
  - Lack of Involvement of non-technical Roles
Approaches to Process Improvement Support

## SPI Results

- Senior Management Awareness has grown
- Most Software Groups have running SPI Programs
- Process Maturity and Software Knowledgability grow
- Metrics are essential to demonstrate Improvement
- Collective learning Mechanisms work well
Approaches to Process Improvement Support

Fillip A.L. Halsey
Software Process Improvement Manager
Alcatel Telecom Norway AS

Wednesday 18th June

European SEPG '97

- Assessment November 1995
- Process improvement based on the Capability Maturity Model (CMM)
- (Software) Process Improvement - project started Jan. 1996
- Reports directly to senior mgmt.
- Process improvement organised through small groups - Task Forces
  - 3-5 people part-time (20-50%)
  - Focused on relatively small improvements
- One person full-time — Project Manager

Alcatel Telecom Norway
Defence Communications Division
- Part of Alcatel Telecom Norway (legal entity)
- Part of Alcatel Alsthom/Alcatel Telecom, Radio Space & Defence group (- business)
- 280 employees + ~40 consultants
- ~200 involved in development (85% SW related)
- Develop, produce and sell tactical and strategic military telecommunications systems, including cryptographic and message handling systems
- Attempts on doing process improvement before 1995
- Small and relatively large scale
- Attempts not classified as successful
- Lack of org & mgmt. support one reason
European SEPG '97
Identified Challenges

- Creating a process improvement organisation that works...
- Obtaining and keeping both senior management and organisational support
- Obtaining qualified people for doing process improvement
- (Creating action plans and maintaining these)
- Once working groups (we call these task forces) are established, assure that they do something sensible....

European SEPG '97
Process Improvement Organisation

- Senior management has a specified responsibility
  - Prioritising improv.
  - Go/no go, tracking
  - Sponsoring task forces

- SEPG (as we have defined it) is responsible for:
  - Establishing and running a metrics program
  - Identifying potential improvements through metrics, assessments and def. prev.
  - Define and present the improvement for SMRB
Approaches to Process Improvement Support

**European SEPG '97**

**Process Improvement Organisation**

- Process Improvement (PI) is responsible for investigating the improvements through task forces:
  - What & how to improve
  - Conducting the experiment
  - Establishing new procedures and a training program
  - The Process Control Board is an "impartial" group who will evaluate the output from the task force

- Resource development (RU) is the organisation responsible for methods & technology and they are therefore the customers of the project PI. RU are responsible for implementation and tracking of implemented improvements.

**Obtaining Support**

- Senior Management (SMRB) support is obtained through:
  - Establishing cost/benefit analysis per improvement
  - SMRB prioritising improvements (which to run, which to delay, ...)
  - SMRB sponsoring each task force (one from SMRB per TF) - special responsibility vs tracking, helping etc. the TF
  - Regular progress report meetings

- Organisational support is obtained through:
  - Participation in assessment
  - Meeting with everybody (every 6 months) in small groups to discuss the organisations needs, prioritisation, plans for improvement etc.
  - Releasing news bi-monthly, giving updates on progress, future plans, prioritisation, ...
  - Having as many as possible participate in PI — TF’s, reference groups, PCB

**SUCCESS**
European SEPG '97

Obtaining Qualified People

Identifying smaller improvements which can be done in ~6 months in a project with 3-4 people 20-50%:

- It is possible to release "good" people from "important" projects <50% for <6 months.

Working Groups

We call our working groups task forces, and we try to obtain good progress by:

- Running kick-offs (focus on establishing a common set of goals, CMM, detailed planning next 2 months)
- Doing a workshop on the topic in question (e.g. requirements management)
- Having bi-weekly progress report meetings
- Arranging monthly/bi-monthly meetings with a reference group for advice, discussions etc.
- Arranging 1 till 2 meetings with senior management for advice, discussions etc.
- Employing external consultants, specialising in the topic in question, to help in addressing the right questions, going through the right process, obtaining an overview sooner, etc.
Approaches to Process Improvement Support

European SEPG '97
What We Should Improve

▼ Support for the project manager of PI to:
  • Improve the current process (running TF's, obtaining support, "seeing other ways of doing things", etc.)
  • Have somebody to discuss issues with
  • Employing a "devils attorney"
▼ Arrange mini-assessments and relate findings to current business status/goals - re-establish/strengthen senior management support/commitment
Practical Implementation of Process Improvement

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Objectives

To provide guidance and support to an organisation that has completed an assessment and needs to deploy improvement activities.

To provide do's and don'ts on how to successfully establish and deliver an improvement programme.

To discuss lessons learned from software process improvement experiences.
Why bother?

- 80% of Process Improvement initiatives fail

(Based on SEI data 1996)
Why do they fail?

- Management back out
- Wrong time
- Staff inexperience
- No management of change
- Ineffective implementation

After the Assessment

Many organisations

- Stall after an assessment
- Do not have an action plan
- Fail to implement any improvement tasks
- Fail to realise the benefit of software process improvement
When applied properly, Process Improvement delivers:

- Measurable improvements in time to market, predictability, productivity and delivered quality
- Survival (which is of course not compulsory!)
- Improvement of bottom line performance

Organisations Have a Common Dilemma

- How do we move to a level 2 or level 3 maturity level when we are a level 1 organisation?
- Because we don’t have a level 2 or level 3 infrastructure and level 2/level 3 KPA experience it will take us an average of 3-5 years to move from level 1 to level 2 and 2 years from level 2 to level 3.
- Using external help, we can move from level 1 to level 2 with lower risks and lower costs in 2 years - sometimes quicker
Successful SPI Initiatives Have Five Common Features

1) Executive management commitment and direction.
2) Management of change - Culture and communication.
3) Proven SPI model.
4) Education and training.
5) Measurement and metrics.

Six Principles of Process Improvement

1) Improvement direction must **start at the top**
2) **Everyone must be involved** in the improvement process
3) **Effective improvement requires knowledge of current process**
4) Improvement is **continuous**
5) Improvement requires **investment**
6) **Use external help** to reduce risks and shorten timescales
How, in practical terms?

1 Customer focus
   "Any Process Improvement initiative exists to serve the business needs of the organisation. It is not the other way around."

2 A project based approach
   initiate
   diagnose
   establish
   action
   learn

The IDEAL Model℠

Initiating → Diagnosing → Establishing
Learning ← Acting
How, in practical terms?

3 Delivering results
- clear phases
- fixed deliverables
- management buy-in and sign-off
- quick wins
- measurable results

How, in practical terms?

4 Recognise difficulties of change
- think *strategically*
- plan *tactically*
- deliver *operational processes*

5 Recognise that we do not all start from the same point
- tell
- sell
- involve
- delegate
We have to manage change

External Change Initiative

Deny Problem  Commitment
(Who, us?)    (I know it works)

Resist Change  Pilot
(Yes, but)    (OK - Prove it)

Internal Management View

We have to reduce risk of failure

Commitment
High return
focused projects

Confusion
No go

Comfort
Acknowledgment
that Process Improvement works and can be profitably applied in many areas

Caution
Scoping
planning
quick-result pilot
Low spend

Risk of failure
LO
HI

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Ref: KJ SEPG 97 15
Cost of Implementation Failure

Each time an improvement effort fails to achieve its stated objectives, it incurs both short-term and long-term costs.

<table>
<thead>
<tr>
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<tr>
<td>Direct</td>
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<td>• Time</td>
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<td>• People</td>
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<td>Business goal not achieved</td>
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<tr>
<td>Indirect</td>
<td></td>
</tr>
<tr>
<td>• Morale suffers</td>
<td>• Lower confidence in leadership</td>
</tr>
<tr>
<td>• Job security threatened</td>
<td>• Resistance to change increased</td>
</tr>
<tr>
<td></td>
<td>• Next change more likely to fail</td>
</tr>
</tbody>
</table>

Lessons Learned from Success and Failure

Business Process
- Product and service definition
- Different assessment vehicles give different returns

Measurement and Control
- Simple metrics programme definitions

Human Resources
- Review your training needs early
- Recognise the value of SPI training
Lessons Learned from Success and Failure (cont)

Management of Change
- Business mission and goal definition
- Market scoping
- Strategic/Tactical Planning

Management Commitment
- Conferences such as SEPG can provide significant impetus
- Use workshops to involve management
European Software Engineering Process Group Conference

Amsterdam - June 18 1997

Tim Kasse
Institute for Software Process Improvement Inc.
## Agenda

- ISPI Background
- Process Improvement Infrastructure
- Up Front Expectation Setting
- Business Objectives
- Guidance for Action Planning
- Incremental Approach
- Process Mentors
- Training, Action Planning, Incremental Approach, with Process Mentors Package

## ISPI Background

Institute for Software Process Improvement Inc. (ISPI)
- Founded in 1991 by Tim Kasse and Jeff Perdue
- Incorporated in 1996

Spin-off of the Software Engineering Institute's Process Program

ISPI is an international, full service, process improvement consulting company, assisting organizations in implementing process improvements that support their Business Objectives
ISPI's process improvement consulting services include:
- Process improvement implementation support
- Action planning guidance and support
- Process improvement related training
- Assessments and Evaluations
- Process improvement awareness and expectation setting
Process Improvement Model
(Up Front Expectation Setting)

1. Commitment to Software Process Improvement

2. Appraisal of the Software Process

3. Software Process Improvement - Infrastructure and Plans

4. Implementation of Software Process Improvements

Business Objectives

A continuous process improvement initiative is one that encourages and supports change.

It includes:
- Setting expectations
- Training
- Conducting assessments
- Action planning
- Implementing the process improvement processes and procedures

First and foremost it supports an organization's Business Objectives.
The goal of the GAP is to prepare the foundation for an Action Plan by framing the process improvement program in terms of the assessment or evaluation results.

Benefits of the GAP

The GAP provides management with the 'big picture'
- What needs to be done
- Who needs to be involved
- What it might take to accomplish true and lasting improvements

The GAP is the basis for management decision-making
- Determining priorities in light of corporate vision and current business environment
- Establishing visible commitment for the program
The GAP identifies process improvement roles and responsibilities for all levels of management and staff. The GAP provides important information for everyone involved in the development of the action plan:

- Major initial steps in developing the Focus Area sections of the overall Action Plan
- Input into the context area of the Action Plan—the section that is generic to all of the Focus Areas
- Planning considerations when implementing fundamental change

Divide the process improvement activities into incremental phases that deliver improved practices every 3-4 months. Each phase is composed of:

- Preparation
- Pilot
  - implementing the practices on a pilot project
  - evaluating and refining the practices if necessary
  - refining the overall plan if necessary
- Diffuse practices to other appropriate projects until it is institutionalized throughout the organization
Incremental Approach - 2

Each phase is designed to deliver one or more specific improvement activities or practices. These practices:

- Are managerial, organizational, technical, or mechanical
- Must be introduced in functionally coherent sets
- Must be linked to the business objectives and priorities of the business unit
- Must be appropriately trained with coaching available during initial implementations
- Must be practical, proved, and adaptable to the business unit's needs

Process Mentoring

Process Mentors are experts in a Focus Area (e.g., Project Management) with a proven track record.

Provide guidelines and constraints for the Working Groups or Process Action Teams to work within.

Provide action planning and implementation guidance to focus area Working Group with possible support from in-house experts:

- Expert mode
- Sharing mode
- Supporting mode
**Process Mentoring**

- Provide samples, checklists, and starter kits from asset library and experience.
- Coach project leaders and practitioners in the use and adaptation of these assets.
- Monitor progress and provide continuous feedback (to projects and Process Action Teams).

Technology transfer should always be the Process Mentors' objective.

---

**Training, Action Planning, Incremental Approach, Process Mentor Package**

- Training is provided to the Process Action Team to provide necessary background in a focus area and a framework for the subsequent action planning.
- Process Mentors are either the ones who present the training or are in attendance when the training is presented.
- Process Mentors work with the Process Action Team to develop Guidance for Action Plan detail for the Focus Areas.

Process Mentors work with the Process Action Teams to refine the Implementation Tasks into implementable increments.

Process Mentors work with the Process Action Teams to support projects for 2-3 increments.

Progress is checked and the need for further Process Mentor involvement is determined.

Summary

Process Improvement Initiatives can be enhanced and accelerated through:

- Establishing a SPI Infrastructure
- Taking more time to properly set expectations up front
- Tying the process improvement actions to the business objectives
- Providing a bridge between assessment or evaluation results and the Action Planning and Implementation
  - Help management to prioritize process improvement focus
  - Provide a starter kit for the Process Action Teams
Implementing the process improvements using an incremental approach
Using Process Mentors to coach and guide
Combining training, action planning, and the incremental approach, with process mentors
ESEPG 1997
Amsterdam 16-19 June 1997

SPICE and ISO/IEC 15504

Bob Smith - European Software Institute
Steve Masters - Software Engineering Institute
ESI

Agenda

- Introduction and Background
- SPICE Trials Organisation
- Phase 2 Trials Objectives and Status
- Market Transition
- Report from Working Group 10
- Conclusion

ESI

What is SPICE?

- Development of an International Standard on Software Process Assessment
- The SPICE project created to:
  - ensure fast development route
  - solicit opinions and input of world experts
  - carry out early trials
  - provide early feedback
  - create awareness of the new standard
- SPICE - Software Process Improvement and Capability Determination
SPICE - the reference model

- Two-dimensional model for processes and process capability
- Capability Levels
  - Process Attributes
- Process Categories
  - Processes

Part 1 Concepts and introductory guide
Part 2* A reference model for processes and process capability
Part 3* Conducting an assessment
Part 4 Guide to conducting assessments
Part 5 A model for assessing processes
Part 6 Guidance for qualification of assessors
Part 7 Guide for use in process improvement
Part 8 Guide for use in determining supplier process capability

** normative
ESI Trials Organisation

SPICE Project Manager
Alec Doring, IVF CSE

International Trials Coordinator
Bob Smith

USA RTC
SEI

Canada RTC
ASEC

Europe RTC
ESI

S Asia Pacific RTC
SOA

Northern Pacific RTC
SOKA UNIV

Local Trials Coordinators

ESI Phase 2 Objectives

- Adequacy of
  - Reference Model
  - Requirements for Conducting an Assessment

- Usefulness of guidelines for
  - Process Improvement
  - Capability Determination
  - Assessor Qualification and Training
  - Conducting a Software Process Assessment

Wednesday 18 June
Trials Questions

- Does the Reference Model provide:
  - a correct and well-defined set of processes
  - a well-constructed system of process capability
  - a usable rating scale
  - a means for assessment model compatibility

- Does the Assessment Model provide:
  - a good mapping to the Reference Model
  - a well-defined set of process indicators
  - a well-defined set of process management indicators

- Are the Requirements for Assessment:
  - well-defined and understandable

More Trials Questions

- Who has used SPICE and what do they think?
- What is the cost of performing an assessment?
- How does process maturity relate to project performance?
- Does assessment aid process improvement?
Phase 2 Trials Studies

- Repeatability
- Comparability
- Process Capability Determination
- Process Improvement
- Applicability
- Assessment Model
- Assessment Performance

Can Results be Compared?

![Comparison Chart]

SPICE

\[ \begin{array}{c}
1 \\
2 \\
3 \\
4 \\
5 \\
\end{array} \]

PROCESS

CMM

\[ \begin{array}{c}
1 \text{ Initial} \\
2 \text{ Repeatable} \\
3 \text{ Defined} \\
4 \text{ Managed} \\
5 \text{ Optimizing} \\
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Wednesday 18 June
**ESI SPICE PROCESS PROFILE**

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**ESI CMM Assessment Output**

- Configuration Management
- Quality Assurance
- Subcontract Management
- Project Tracking and Oversight
- Project Planning
- Requirements Management

**Wednesday 18 June**

(C308b) S-7
Are the Results Repeatable?

Reliability - method design
ESI

Trials Status

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<td>43</td>
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</table>

ESI

Who Can Participate

- Organisations
- Assessors
- Model Providers
- Method Providers
- Assessment Tool Providers

Wednesday 18 June

(C308b) S-9
Market Transition - 1

- Compatible Assessment Models
  - Process Professional, Bootstrap
- Training Courses
- Assessor Registration and Certification
- Computer-based Assessment Tools

Market Transition - 2

- Benchmarking Database
- Process Assessment Body of Knowledge
- New Model development
  - Systems Engineering
  - Product-Line Reuse
  - EFQM
ISO/IEC 15504 is a preliminary draft technical report (PDTR) in the area of software process assessment.

The first PDTR was released by ISO in November, 1996 for a 3 month ballot ending February 27, 1997.

A meeting of ISO/IEC JTC1/SC7/WG10 was held in Singapore on April 7-11, 1997 to dispose of the ballot comments on the PDTR.
ESI

SPICE Reference Model
Part 2

Compatibility Requirements

BOOTSTRAP Model
CMM Model
SPICE Assessment Model

BOOTSTRAP Assessment Method
CMM Assessment Method
Assessment Method

Requirements for Conducting an Assessment
Part 3

Assessment Model
Assessment Method
Assessment Scope
Assessment Responsibility
Assessment Process
Assessment Ratings
### Voting on the 9 documents

The voting for each of the parts, including late votes, was as follows*:

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* Includes 1 vote after comment report

---

### Key Issues Identified in Ballot Comments

- Relationship to ISO/IEC 12207 is weak.
- Level 4 and 5 attributes are not clearly articulated.
- Process attribute scale does not provide a suitable basis for repeatable assessments.
- Compliance requirements are not clear.
- Overall size of the document set is too large.
- Certification/registration intent of 15504 is not clear.
Key Agreements at Singapore meeting

ISO/IEC 12207 was fully embraced as the defining document for software processes.
Clause was added in documents that makes clear that 15504 is not intended for certification.
The project agreed in principle to a broader interpretation of the process instance concept.
Part 3 will now contain requirements for an assessment method.

Other Issues

A proposal was made to restructure the document set.
Size of the document set was dismissed as a non-issue.
Phase 2 trials were extended.
US proposal to limit part 5 to a single example was deferred.
A proposal was made to separate part 5 from the rest of the document set.
Areas of Continuing Concern

The role of part 5 (exemplar model) in the product set is a contentious issue. Certification/registration of methods, models, and assessors is desired by some. Ballot progression is unclear.

PDTR ballot conclusions

Singapore meeting resulted in some key breakthroughs which bode well for the CMM community as well as the global software engineering community and for widespread acceptance of the emerging standard.

However, agreements must be fully implemented in the product set and then subjected to the normal balloting process for full confirmation and acceptance.
For further information

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- Luciano Guerrero, Applied Software Engineering Center, Canada
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Assessment and Optimization of System Architectures
Experiences with Industrial Applications at Siemens

Dr. Michael Gloger, Dr. Stefan Jockusch, Norbert Weber
Siemens AG
Technology Group
Munich

The Role of Architectures for SW-Development

- A good architecture is an essential precondition for market success
  - Major characteristics of a system are determined by its architecture
    - Efficiency, changeability, reliability, ...
  - Principle design decisions are made in various engineering scenarios, e.g.
    - In the early phases of development projects: balancing market needs and technical possibilities
    - For harmonizing architectures of different products in order to re-use common components
    - To adapt a system architecture to distributed development
  - Today architecture definition and evolution is an ad hoc process
    - No systematic analysis of alternative solutions
    - No regular assessment and optimization of architectures
    - No active and controlled evolution of architectures
System Architecture Analysis (SAA)

Goals

- Supply method for analyzing and optimizing architectures
  - Verify design decisions
  - Identify optimization potential

- Objective decisions
  - Structure decision space
  - Direct comparison of competing design decisions

- Effective communication
  - Describe architecture without usage of special notation
  - Concise description of pros and cons of competing solutions

Characteristics of SAA

- Considers all relevant perspectives:
  - Technological/engineering view
  - Customer and market demands
  - Organization requirements (Time, Costs, ...)
  - Quality criteria

- Indicates to which degree an architecture fulfills the criteria

- Identifies possible optimizations
  - Based on evaluation of alternative solutions
  - With consideration of resulting benefit

- Involves experts from Development, Marketing, Sales, Service
  - To guarantee acceptance and internal communication of results
Example: Assessment of Architecture Framework for Multimedia Communication System

Situation
- Dynamic and rapidly expanding telecommunication industry
- New competitors
- Very early development stage
- Framework developed by cross-functional, geographically distributed team

Requirements
- Flexibility and scalability w.r.t. capacity and features
- Integration of existing PBX
- Supply open standardized interfaces
- Cooperate with LAN/PC world

Goals of Assessment
- Is the concept suited to meet all these requirements?
- What are the possible optimizations, open issues and risks?

System Architecture Analysis (SAA)
Overview

Evaluation Criteria
- based on all requirements

Architecture
- Investigation focuses on system aspects and realization concepts for these system aspects
  - How well is each realization concept suited to fulfill each of the requirements?
  - How well do the concepts fit?
System Architecture Analysis (SAA) Procedure

Step 1: Identify Evaluation Criteria
Team: Marketing/Service/Sales

Evaluation criteria

Step 2: Identify Design Dimensions & Alternatives
Team: Developers

Step 3: Evaluation of Realization concepts
Team: Marketing/Service/Sales Development

Step 4: Results & Optimizations
Strength/Weakness Profiles
Optimizations

Week 1 - 2
Week 3
Week 4
Week 5
Week 6 - 8

SAA - System Architecture Analysis

Step 1: Structure and prioritize requirements

Procedure
- 2 to 3 workshops with experts from marketing, sales, service, and development
- Identification, hierarchical organization and prioritization of requirements

Results
⇒ Hierarchy of requirements from organization, market, customers and development
⇒ One hierarchy level becomes set of evaluation criteria (about 30)
⇒ Weights for criteria

Goal: reach consensus about the priority of requirements
Prioritization of requirements is an essential precondition for deriving a representative set of evaluation criteria from requirements

SAA - System Architecture Analysis
### Step 2: Identify system aspects and realization concepts

**Procedure**
- 2 to 4 workshops with developers and system architects
- Build description of architecture in terms of underlying design decisions and chosen realization concept
- Find alternative realization concepts for each system aspect

**Results**
- Set of about 20 basic system aspects (design dimensions)
- 2 to 5 alternative realizations for each system aspect
- Common understanding of each system aspect and realization

- Design space supports abstract and concise view of architecture concepts
- Many design decisions are "unconscious": no documentation, but accepted by all involved experts
- Design space concept inspires formulation of completely new solutions

### Step 3: Evaluation

**Procedure**
- 2 workshops with developers, system architects, and experts from marketing, sales, and service
- Detailed evaluation of two aspects
  - How well is each realization concept suited to fulfill each requirement?
  - How well do realization concepts fit?

**Results**
- Evaluation of each realization with respect to each criterion and of each realization with each other

- "Localized evaluation" (one concept, one criterion) supports efficient evaluation procedure
- Tradeoffs become transparent and conscious
- Discovery of interactions and implications which were overseen

---

**SAA - System Architecture Analysis**
### Step 4: Optimization

**Strength/Weakness Profile**
- To which degree does the architecture meet the requirements?
- Which requirements are being supported only badly?

**Evaluation of Design Decisions**
- How have the realization concepts been evaluated regarding special criteria?
- Which realization concepts have to be improved?

**Optimization Measures**
- How can the architecture be improved?
- What does the strength/weakness profile of the improved architecture look like?

---

### Assessment of MM System Architecture: Results

**Evaluation of the Architecture**
- Precise judgement on suitability of the architecture for fulfilling the requirements based on strength-weakness profile
- Identification of "design trade-offs". Example:
  - Conflict "standards vs. distinctive features"
- Identification of open or unspecified design decisions

**Optimizations**
- Improved software layering structure in order to optimize both performance and encapsulation of low level functions

**Further Benefits**
- Representation supplies transparency to experts and is suited for communication to management

---

SAA - System Architecture Analysis
Application within different scenarios, Example 1
Harmonization of Architectures

Situation
- Several systems of an application domain have been developed independently
- Similar components are developed and maintained several times
- Re-use of components is hindered: no standardized interfaces, different software platforms

Goal
- Reduce development time and effort by re-using common components
- Standardize platform, architecture and interfaces
- Homogenous user interface
- Transparent basis for decision making: demonstrate benefits

Challenge: Effort spent for architecture harmonization must be balanced to expected benefits
- Common architecture must be suitable to meet future requirements
- Architecture must be able to incorporate new and upcoming technologies

SAA - System Architecture Analysis

Harmonization of Architectures
Extending the SAA procedure

Mapping to SAA steps
- Step 1: Requirements and evaluation criteria
- Step 2: Identify realization concepts
- Step 3 & 4: Evaluation & Optimization

Inventory of actual systems and their architectures
Investigation of benefits and definition of goals
- Actual requirements
- Future market scenarios and product roadmap
- Analysis of upcoming technologies
- Definition of a common architecture
- Migration and introduction procedure

SAA - System Architecture Analysis
Application within different scenarios, Example 2
Adapting architecture and process to distributed development

**Situation**
- First product developed for local market with small number of customers
- Small centralized development site
- Challenge: globally expanding market, increasing number of customers
- Communication overhead for clarification of requirements
- Several product variants required for different markets

**Goal:** globally distributed software development
- Several distributed development sites: short cycle time for customer segment specific features
- One development site responsible for common components and platform

---

**Solution**
- Restructuring of the development process
  - Splitting the platform process from variant process
  - Synchronization points for stabilizing the overall architecture using SAA
- Restructuring of the architecture
  - Definition of common components
  - Interface to variant parts

---

SAA - System Architecture Analysis
Summary and next steps

- SAA is suited for a variety of application domains
  - Medical Systems, Automation, Communication
- SAA can be adapted to different engineering scenarios
  - Architecture definition, restructuring projects, architecture harmonization
- SAA improves communication between involved functions
  - Communication and negotiation between functional areas (Marketing, Sales, Service)
  - Compact documentation of design decisions
  - Objective decision making
- Satisfactory results achieved with qualitative judgements
  - SAA well suited for early phases of architecture definition
- Future focus: procedures and organizational implications for architectural design

Ongoing Research

- Organization and procedures for development of architectures
- Procedural model for architecture definition
  - Architecture platforms for families of products for an application domain
  - Common component definition based on reference architectures
- Documentation of architectures
  - Focused on supporting communication between different functional areas
- Metrics for Architectures
Understanding and Improving Your Suppliers

Chris Amos and Mick Bennett
Software Supplier Assessment Team

Summary

The practical adaptation and enhancement by BT's Software Supplier Assessment Team of existing methods and models for understanding and improving our Suppliers.
Why BT Need To Assess Suppliers

- We are totally dependent upon software for our commercial survival
- We have some of the world's biggest programmes.

The Track Record Is Not Good

- 80% of projects are delivered late and over budget
- 40% of systems fail or are abandoned
- only 10-20% of systems meet all of their success criteria
- failures are rarely purely technical in origin

The performance of Information Technology and the role of human and organisational factors. Institute of Work Psychology, Sheffield University - January 1996
The Track Record Is Not Good

- 51% do not use effective project management
- 77% do not have a tried and tested method of estimation
- 63% do not adhere to any recognised quality standards

Supplier Assessment In BT

- We use two different methods at present:
  - The Healthcheck for internal suppliers only and
  - Software Supplier Assessment (SSA) for internal and external suppliers
- Less formal 'project firefighting' reviews and assessments
What's in it for BT?

- A better understanding of BT's Supplier base
- More manageable risks to BT through better project preparation
- Less 'troubleshooting'
- Tender adjudication speeded
- More objective Supplier selection
- More appropriate contracts
- 'BT lessons' fed back for internal improvement

What's in it for our Suppliers?

- 'Free' consultancy based around the group's extensive experience
- A catalyst for improvement within the Supplier
- A better understanding of BT's needs, concerns and expectations
- An opportunity to raise issues with BT
- Increased visibility within BT
Software Supplier Assessment Team

- Team of specialists first formed in 1990
- Multi-disciplinary
- Providing a portfolio of services

Assessment History #1

- Started with proprietary 'best practice' audit technique
- Operated for two years
- Problems:
  - Too large
  - Audit
  - Proprietary
**Assessment History #2**

- The solution is SSA:
  - An assessment rather than audit approach
  - Method gives re-use of supplier data, flexible, scaleable and tailorable assessments
  - Model based on CMM which gave Best Practice, good training material, staged levels and focus
  - However Model expanded to fully address BT's needs

**SSA Ethos**

- It is an *assessment*, not an audit
- All data collected will be visible *only to the assessment team*
- All feedback/information is *non-attributable* to individuals
- To be of any real benefit, there needs to be an *open and honest* flow of information
- We need the *support* of the Supplier's Senior Management
Assessment Process

The 4 Viewpoints

Wednesday 18 June
Tools

- Process description and guidelines
- Database
- Questionnaires
- Checklists
- Spreadsheets
- Project Management

Tools - Questionnaire

- Use pre on-site visit to focus assessment
- SSA initially used CMM Questionnaire
Tools - Questionnaire

- SSA currently uses:
  - STARTS-based questionnaire - 4 pages, 50 questions, 20 minutes
  - Larger sample (typically 35+)
  - Completed by all levels
  - Not process bound - gives 'cultural feel'
  - Statement based with Strongly Agree to Strongly Disagree scale
**Capability - the 3 P's**

Capability = Process + People + Performance

---

**Process Rating**

**Key**
- Non Compliant
- Partially Compliant
- Limited Compliant
- Full Compliant
- Process not assessed

**Process Rating Matrix**

**Level 5:** Optimising
- Process Change Management
- Technology Change Management
- Data Practices

**Level 4:** Managed
- Reliability Management
- Software Quality Management
- Organisation Process Management
- Development Environment
- Verification, Validation & Testing
- Reviews
- Inter group Co-ordination
- Software Product Engineering
- Integrated Software Management
- Testing Programme
- Organisations Process Definition
- Organisations Process Focus
- Customer Support

**Level 3:** Defined
- Software Configuration Management
- Software Quality Assurance
- Software Enhancement Management
- Software Project Planning & Oversight
- Software Project Planning

**Level 2:** Repeatable

---

Wednesday 18 June
**Capability Score - People**

- An indicator of the quality of the supplier's software development people and their ability to 'do the job'
- The rating profiles:
  - Company policy & strategy
  - Leadership & management style
  - Project level people management
  - Company culture
  - Application and Environment

**People Scoring**

![Bar chart showing ratings for different aspects: Application & Environment, Company Culture, Project level people management, Leadership & management style, Company policy and strategy.]
**Capability Score - Performance**

- An indicator of the supplier's ability to develop and deliver quality software rich systems
- The rating profiles:
  - Pre-contract performance
  - In-contract performance
  - Post-contract performance

**Performance Scoring**

- Post Contract: Rating
- In Contract: Rating
- Pre Contract: Rating

---

*Wednesday 18 June*
**Current Perception**

The people score has been assessed as 3. The average is 3.1.

A statement is made regarding the confidence we have in the accuracy of the data. Values are High, Medium, and Low.

A detailed supplier assessment was carried out in January 1997.

**Distributions**

Frequencies for Capability Score, Performance Score, Process Score, and People Score are shown in the graphs.

**BT**
Where To Now?

- Evolve Model, Method and Toolset
- Migrate from CMM to become SPICE compliant
- Increase effectiveness of People and Performance elements
- Increase (broaden) use of Supplier Assessments within BT

Thank you
Software Quality

- Implementing and Enhancing a Quality Management System using Total Quality Management Principles and the Capability Maturity Model as a Framework
- Based on Practical Experience (1992-97)

Objectives

- Share my Experiences
- Provident
  - In-House Development
- PanCredit
  - Software House
- An Approach that Works
Branch Info. System

- 200 Branches
- Unsecured Loans
- Domination of Mkt (60%)
- In-House Development
- 60 Staff
- Mentality to Develop Everything
- Emphasis on Selecting Cheapest Solution

Effort on B.I.S.

GRAPH 4.3 DISTRIBUTION OF EFFORT ON BIS

- Enhancements 1%
- Analysis/Design 12%
- Programming 15%
- Rework 15%
- Testing 8%
Reasons

- Unplanned Commitments
- Poor Requirements Capture
- Problems of Scale
- Culture of Fear
- Gurus
- Silver Bullet
- No Quality Assurance and Control
- Poor Configuration Mgt.

Effort on C.D.

GRAPH 4.4 DISTRIBUTION OF EFFORT ON CD

- Enhancements 11%
- Strategy 6%
- Analysis 5%
- Prototyping 2%
- Physical Design 26%
- Programming 15%
- Testing 5%
- Reuse 15%
Process Improvements

- Methods
- Project Management
- Change Control
- Process Improvement Teams
- Culture Change
- Quality Assurance
- Configuration Mgt.

Re-Work

<table>
<thead>
<tr>
<th>PROJECT</th>
<th>PROJECT DEVELOPMENT (WEEKS)</th>
<th>PROJECT RE-WORK (WEEKS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIS</td>
<td>840</td>
<td>1356</td>
</tr>
<tr>
<td>CD</td>
<td>948</td>
<td>240</td>
</tr>
</tbody>
</table>
Key Comparisons

- Re-Work (60% to 18%)
- Effort before Build
  - (12% to 44%)
- Enhancement
  - (1.5 yrs to .25 yrs)
- Requirements Capture
- Management of Scale
  - Staff
  - Programs

Return On Investment

- Crosby Model
  - Do It (Performance)
  - Test It (Appraisal)
  - Review It (Prevention)
  - Fix It (Re-work)
- Cost of Improvements
  - approx. 500 days
- Reduced Re-work
  - approx. 5,000 days
- R.O.I = 1:10
Who Are PanCredit?

- S.M.B.E - £5m T/O
- Software House
- Financial Lending Systems
- 120 Staff
- Outskirts of Leeds
- V, OO Methodologies
- Oracle\G.U.I

Foundations - T.Q.M

- Customer Requirements
- Prevention not Detection
- Continuous Improvement
- Leadership/Culture
- Teamwork
- Process Control
Approach

- Management Commitment
- Assess Effectiveness
- Identify Objectives
- Determine Strategy
- Determine Resources
- Select Methods/Tools
- Educate, Implement and Evaluate

Mgt. Commitment

- Use Crosby's Model
- Gather Data
- Present Status
- Frighten the Help Out of Everyone
- 60-80% Re-Work
- Losing Key Customer
- Show Them How to Get Out of the Mess

Wednesday 18 June
Assess Effectiveness

- TickIT
  - Desk Study Reports
  - Pre-Assessment

- C.M.M Assessment
  - Questionnaires
  - Results Profile
  - Findings, Action Plan

Identify Objectives

- Get Out of Chaos
Determine Strategy

- Select Framework
  - TickIT
  - C.M.M
- Configuration Mgt.
- Project Mgt.
  - Estimating
  - Risk
  - Planning and Control
- Quality Management
  - QC and QA

Determine Resources

- Management Responsibility
- Quality Assurance
  - Peers
- Process Improvement Group
  - Life Cycle
- Quality Circle
Select Methods\Tools

- V, OO
- Project Planning
  - MS-Project
- Resource Planning
  - Spreadsheets
- Configuration Mgt.
  - D.C.S (In-House)
- Fault Management
  - Supp (In-House)
- Select
  - Analysis\Design

Educate, Implement, Evaluate

- Education\Training
  - Seminars
  - Walkthroughs
- Evaluation
  - Project Reviews

Wednesday 18 June
Results

- TickIT
  - Pass
  - 6 Minor Actions

- C.M.M
  - Chaotic
  - Compliance in 11 out of 12 Relevant Key Performance Areas
  - Good in Comparison

CMM Assessment Findings

PROJECT: CMNIM
Level 2, 3, 4 and 5

Wednesday 18 June
Typical Profile

<table>
<thead>
<tr>
<th>Requirements Management</th>
<th>Software Project Planning</th>
<th>Project Tracking and Oversight</th>
<th>Software Subcontract Management</th>
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</thead>
<tbody>
<tr>
<td>Software Quality Assurance</td>
<td>Software Configuration Management</td>
<td>Organization Process Focus</td>
<td>Organization Process Definition</td>
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<tr>
<td>Training Program</td>
<td>Integrated Software Management</td>
<td>Software Product Engineering</td>
<td>Intergroup Coordination</td>
</tr>
<tr>
<td>Peer Reviews</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Results

- **Customer** (30% re-Work)
  - Implementation Issues

- **D.C.S (1.2)**
  - No Major Faults after Implementation

- Independent Q.A of O.O Process - no Major Issues
Key Success Factors

- Management Commitment
- T.Q.M Principles
- TickIT and C.M.M as Framework

Key Challenges

- Leadership
  - Delivery vs Quality
- Teamwork
- People Affairs
- Customer Pressure
- Over Commitment
Summary

- Experiences
- Provident
- PanCredit
- Approach
- Key Success Factors
THURSDAY 19TH JUNE

Introduction

Chris Lamer, Head of Development Process Improvement for the Lloyds TSB Group, will introduce the Morning's opening speakers.

<table>
<thead>
<tr>
<th>Time</th>
<th>OPENING SPEAKERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>09.00</td>
<td>Co-Chair: Chris Lamer, Lloyds TSB Group &amp; Bill Peterson, SEI</td>
</tr>
<tr>
<td>09.10</td>
<td>SEI Process 2000: Building on Strength</td>
</tr>
<tr>
<td></td>
<td>Steve Cross, SEI</td>
</tr>
<tr>
<td>09.50</td>
<td>The Improvement Engine of the Ericsson Systems Software Initiative</td>
</tr>
<tr>
<td></td>
<td>Jorma Mobrin &amp; Anders Wåsterlid, Ericsson</td>
</tr>
<tr>
<td>10.30</td>
<td>Break</td>
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<table>
<thead>
<tr>
<th>Time</th>
<th>Keynotes - Track A</th>
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<tbody>
<tr>
<td>11.00</td>
<td>C404a</td>
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<tr>
<td></td>
<td>SPI Journey from Level 1 to Level 5</td>
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<tr>
<td></td>
<td>John Vu, The Boeing Company</td>
</tr>
<tr>
<td>11.45</td>
<td>C405a</td>
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<tr>
<td></td>
<td>A Quarter Century of Software Process Improvement</td>
</tr>
<tr>
<td></td>
<td>Terry R. Snyder, Hughes Aircraft Company</td>
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<tr>
<td>12.30</td>
<td>Keynotes - Track B</td>
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<tr>
<td></td>
<td>C404b</td>
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<tr>
<td></td>
<td>Highlights and Report Back from The Measurement Symposium</td>
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<tr>
<td></td>
<td>Paul Goodman, TBL</td>
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<tr>
<td></td>
<td>C405b</td>
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<tr>
<td></td>
<td>Continuous Quality Improvement in Software Development on the Basis of Measurement and Assessment</td>
</tr>
<tr>
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<td>Holger Gunther, Allianz Life</td>
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<td>12.30</td>
<td>LUNCH</td>
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<table>
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<th>Track B</th>
<th>Track C</th>
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<tr>
<td>14.00</td>
<td>C406a</td>
<td>C406b</td>
<td>C406c</td>
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<td>Overcoming Resistance to Change to Become a True 'Learning Organisation'</td>
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<td></td>
<td>Alistair Watters, Warwick Consulting Ltd</td>
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<tr>
<td></td>
<td>A Co-ordinated Approach to Identifying Software Development Risk in MoD Projects</td>
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<td>Llewelyn Jones, MoD &amp; John Hamilton, DERa</td>
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<td>14.45</td>
<td>C407a</td>
<td>C407b</td>
<td>C407c</td>
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<td></td>
<td>From Chaos to Control</td>
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<td></td>
<td>Debbie Hellmann &amp; Ali Pilgrim, Digital</td>
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<td></td>
<td>The Complementary Aspects of Process Capability and Re-Use Capability</td>
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<td></td>
<td>Sergio Bandinelli &amp; Álvaro Sanz Monasterio, European Software Institute</td>
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<tr>
<td></td>
<td>Software Best Practice: Benefits to the Business</td>
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<tr>
<td></td>
<td>Alejandro Moya, European Commission</td>
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<td>15.30</td>
<td>Break</td>
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<tr>
<td>16.00</td>
<td>C408 PANEL - Chaired by Colin Tully, Colin Tully Associates</td>
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<td></td>
<td>Panelists: Bill Peterson, SEI; Chris Lamer, Lloyds TSB Group; Hans-Jürgen Kugler, ESL; Keith Jackson, TBL; Alejandro Moya, European Commission; Hans Sassenburg, Netherlands SPIN (SPIder)</td>
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<td>17.00</td>
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EUROPEAN SEPG
Mission

Provide leadership in advancing the state of the practice of software engineering to improve the quality of systems that depend on software.
Outline

SEI overview

Trends impacting software engineering

A vision of the future

Case study (in the future tense)

Challenges and opportunities

Software Engineering Institute

U.S. Department of Defense (DoD) federally funded research and development center (FFRDC)

College level unit at Carnegie Mellon University (CMU)

Applied research, education, and technology transition programs
Software Engineering Handles "Precedented" Systems Well

Precedented systems are characterized by
- an experienced development team
- well defined processes
- known requirements
- domain experience
- system
- architecture
- technology

Trends in a Rapidly Changing World

Explosive growth and use of the Internet & Intranet
Large companies downsizing and outsourcing
Increase in number of smaller software companies
Rise of the virtual organization
Increasing number of "knowledge workers"
No end in sight to advances in computer speed, memory size, decreased hardware costs, etc.
Age of information appliances and network-centered computing
Demand for software escalating
Surviving in marketplace means first to market
Towards a Vision for SWE 2000+

Support higher maturity organizations.
Realize many of these will be virtual organizations operating as Integrated Product Teams (IPTs).
The number of such organizations will increase.
The SWE challenge is to
- support the definition and design of processes to meet business objectives
- respond to user needs at Internet time (three to six month cycles)
- provide "finger tip" access to "online, how-to" knowledge
Engineered Software Systems

Component-based, evolvable product lines, built and acquired with predictable and improved cost, schedule, and quality.

Will the following case study be possible by the year 2001?
Press Release

* Amsterdam — Today, June 19, 2001, the 21st Century Corporation (TFC) announced that it has joined the elite 25% of organizations assessed at or above SEI Maturity Level 4 relative to an integrated reference model based on the Software/People/Integrated Product Development CMMs.

Annual Report

* The fiscal year-end 2001 results for TFC were released today, and they reflect the following improved results:
  - Delivery cycle-time reduced 43% AND customer acceptance of new product introductions UP 57%.
  - Field maintenance activity reduced 84% AND customer satisfaction survey results of 99.4%, UP from 88% in 1997.
  - Productivity improvement of 54% AND employee morale index UP 34% to a mean of 9.4 out of 10.
The impact on the business bottom line is:
- more than a doubling of profits
- 3-for-1 stock split
- 25% increase in dividend payments
- 10,000 ECU bonus for all employees

TFC, an adopter of the SEI's major initiatives for several years, has been contacted to renegotiate the contract for a product in its procurement systems product line.

The product is currently in design stage, having already passed through architecture review. The Integrated Product Team (IPT) is called together for a meeting.
Subject of Renegotiation

* TFC's customer has had one of its business systems invaded by cyber-thieves.
* Thanks to CERT®, were able to repel invasion.
* TFC's Automated Buying System (ABS) not hit, because the version was in a secure facility (local-area). Concerned that security requirements are inadequate for a broad-based version.
* Bottom line: customer wants to add security requirements to existing contract.

Relevant Requirements

* Security Trust Level X for ABS.
* Zero downtime for security upgrades.
  - customer is a global operation with 24-hour activity on its ABS.
* Minimize additional cost to reach Security Level X.
* No degradation to security level because of geographical distribution of the new system.
Architecture Tradeoffs

Add security around entire system.

Or, add only around component identified as vulnerable.

Considerations

* How do security enhancements fit with rest of product line?
* What is our process capability, and what are the risks to dependability requirement?
* What improvements are coming that might change current approach/capability?
* What is the interaction between wide-area collaboration, upgrading a system, and maintaining current level of security.
Product Line Notes

* Vendor A and TFC discussed opportunities for enhancing security on Vendor A's component before the last architecture revision; prohibitive development cost based on current market potential, productivity/quality rates for new technology additions, and early prototypes caused shelving of the effort.

* TFC has other business system product lines with emerging security issues; one question is whether TFC should start up another product line of security add-ins.

Process Capability Notes

* PSP/TSP data for entering a new technology area (security) is available for both TFC and its vendors.

* Organizational process capability for the product line accounts for technology enhancement as a risk factor.

* Consideration of a security product line would necessitate piloting a prototype to get some initial productivity baselines to map against the organizational standards for creating a new product line.
As an SEIR subscriber, TFC has access to online comparison data; industry standards for productivity, quality, and cost by maturity level; business sector/application type; and advanced information on piloting opportunities with the SEI.

TFC's intranet, based on the SEI's IDEALSM repository concept, contains information on TFC initiatives in technology and process improvement, allowing them to access potential internal pilot solicitations.

A specific approach to wide-area communications and information sharing has already been designed. How will this be affected by the stringent security requirements?

How does the interaction between the activity during global collaboration and new system synchronization during the system upgrade effect the current processes?

How will improvements and collaborations be tailored in conducting future business in a global marketplace?
Results

Challenges and Opportunities

How can we accelerate process improvement?

Can we design processes to meet the business needs of dynamic organizations?

Can we support process definition and improvement in small companies? For integrated product teams?
Qualitative CBA-IPI Trends

Accelerated SPI
Basis of a New Process Model

User

envision what is possible
(scenario-based, prototyping, new concept of ops)

21st Century Program Office
(A Virtual Organization)

deliver what is needed, evolve it during the life cycle

Acquirers

Developers

integrated process models
insert what is missing
(technology base)

Summary

SW-CMM has had a profound impact.

There is a continual need to anticipate and be proactive in a rapidly changing world.

SEI's strategic plan is a basis for the next generation of process improvement.
The Improvement Engine of the Ericsson System Software Initiative

Jorma Mobrin  Anders Wästerlid
VP Product and System  ESSI programme
Development  manager

Basic facts about Ericsson

- Major telecom system and mobile phone vendor
- Turn over ~16 billion $
- Total R&D spending ~3 billion $
- Present in >100 countries
- 94 000 employees
The role of software

Today we spend about 14 billion SEK on SW development and we have more than 10,000 SW engineers.

And the importance of SW continues to increase in terms of:
- Fraction of the total development
- Key enabling technology
Our History

The various efforts we have put in do fit together!

ESSI

PQT Measurements

SW Metrics

Process Management

PROPS - Project Management


ESSI Purpose:
improve customer satisfaction and software development efficiency by radical improvement of software quality, lead-time precision and lead-time
Building ESSI...

Data & Facts

Benchmark

SEI CMM

TQM, Policy deployment

Management

Commitment

Go-Ahead

SW Action Team (SWAT)

SV Seminar June, 1993

Ericsson Executive Team, Sep 1993

ESSI Improvement Engine

Performance monitoring

CMM

PQT

Provisioning process

Drive (Policy Deployment)

Support

Diagnosis VFA

Deployment

Monitoring

Progress

Peer review

Good practice

Thursday 19 June
Reduced faults in all phases!

Fault found in operation reduced
Reduced Delays

ESSI Improvement Engine

Performance monitoring
Drive (Policy Deployment)
Support

CMM
PQT

Diagnosis
VFA
Deployment
Monitoring
• Progress
• Peer review

Good practice
The use of CMM

*In general* CMM is used as a tool to achieve performance. It is not as a goal in itself.

*Specifically* CMM is used to:
- Find areas for improvement
- Set a basic principle for prioritizing improvements
- Follow-up on improvements before results can be measured
- Provide a guideline to an excellent software organisation

CMM Light & Ultralight

**Purpose:** get a snapshot of the CMM status

**Recommended use:**
- Between full assessments for improvement tracking purposes, e.g. quarterly
- Prior to full assessment
CMM experience

- CMM levels come as a confirmation of improved performance
- All reassessments have yielded a higher CMM level

ESSI Improvement Engine

Performance monitoring
- CMM
- PQT

Drive (Policy Deployment)
- Diagnosis
- VFA

Support
- Good practice

Deployment
- Monitoring
  - Progress
  - Peer review
PQT

PQT is the corporate metrics system to monitor performance on:
- Productivity
- Quality
- Time

**Improvement objective**

**Target Attributes**
Efficiency: Productivity, Time, Cost, Precision, Quality
"The ability to produce the right product to the right cost in the right time"
ES&PG J,.

ESSI Improvement Engine

Performance monitoring

Drive (Policy Deployment)

Support

Good practice

CMM

PQT

Diagnosis VFA

Deployment Monitoring

• Progress
• Peer review

Policy Deployment Diagnosis

CMM Assessment Results

Lead time Precision

1. Identify the performance Gap vs. the 50% improvement goal
   \[ \text{The Gap} \]

2. Root Cause Analysis of the Gap
   \[ \text{The Gap} \]

3. Force Field Analysis
   \[ \text{Helps} \]
   \[ \text{Hinders} \]

4. Brainstorm VFA Vital Few Actions
   \[ \text{Vital Few Actions} \]

5. Select VFA based on assessed contribution to gap reduction, taking synergies between precision and quality into account.

SW Quality

1. Identify the performance Gap vs. the 50% improvement goal
   \[ \text{The Gap} \]

2. Root Cause Analysis of the Gap
   \[ \text{The Gap} \]

3. Force Field Analysis
   \[ \text{Helps} \]
   \[ \text{Hinders} \]

4. Brainstorm VFA Vital Few Actions
   \[ \text{Vital Few Actions} \]

5. Select VFA based on assessed contribution to gap reduction, taking synergies between precision and quality into account.
Vital Few Actions

The limited set (3+3) of high leverage actions that will give maximum contribution to improved performance in the short to medium term

Breakthrough Improvement Actions (0-1):
- New organisation
- Re-engineered processes
- New infrastructure

Continuous Improvement Actions (2-3):
- Improvements within given infrastructure
- Moderate process changes

Business as Usual!

Deployment of VFA
Monitoring
- progress reports
- peer reviews

EXM ESSI progress report Q1 1996

SUMMARY
It seems that we have managed to counter the recent set backs and that our collective actions are finally paying off. Yet we have some problems with some of the older products that need immediate action.

QUALITY
![Quality chart]

The recent trend is promising, yet, the FT-figures from the AM6 project was not good. Some of the different product had fault densities as high as 1.5 faults per 100CCS. One of the products was redesigned and the two others will have reviewed desk checks and inspections to counter that.

No of participating organisations

<table>
<thead>
<tr>
<th>MD110</th>
<th>TMOS</th>
<th>AXE10</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
<tr>
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<td>10</td>
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</tr>
</tbody>
</table>

-94 -95 -96 -97

Level of deployment

<table>
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<tr>
<th>Strong</th>
<th>Weak</th>
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<tbody>
<tr>
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<td>1</td>
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<tr>
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</table>

-94 -95 -96 -97

PD process lead-time

<table>
<thead>
<tr>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
</tr>
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<td>5</td>
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<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

-94 -95 -96 -97

No of Peer Reviews

<table>
<thead>
<tr>
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<th>40</th>
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<th>20</th>
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<td>30</td>
<td>20</td>
<td>10</td>
<td>0</td>
</tr>
</tbody>
</table>

-94 -95 -96 -97

Goal
**ESSI Improvement Engine**

- Performance monitoring
- Drive (Policy Deployment)
- Support
- Good practice
- CMM
- PQT
- Diagnosis
- VFA
- Deployment
- Monitoring
  - Progress
  - Peer review

**ESSI Good Practice process**

- Identification:
  - Collect
  - Define
  - Package
- Transfer:
  - Plan
  - Implement
  - Promote

**Difficulty**

**Thursday 19 June**
**ESSI Good Practice characteristics**

- supports a Vital Few Actions or a CMM Key Process Area
- is a packaged collection of practices from good performing design centres
- has performance indicators (facts) which show better than average performance
- is recognized by others (than the practice supplier) as a "better than most" practice
- is established and documented, *before* packaging starts
- has a support organisation
- is promoted by means of ESSI Policy Deployment
- has a Transfer support package

---

**Organisation**

- VP technology
- ESSI program manager
- ESSI Steering Group
- Policy deployment
- CMM
- PQT
- Good practices
- Design centre
- Design centre
- Business unit

---

*Ericsun 

---

Thursday 19 June
Summary

- The ESSI Improvement Engine delivers significantly improved business results
- Practices are now transferred to other areas in Ericsson
Software Process Improvement Journey
(From Level 1 To Level 5)

Keynote Presentation at
The 2nd European Software Engineering Process Group Conference
Amsterdam June 16-19, 1997

Presenter: John D. Vu
Associate Technical Fellow
Software Engineering
Research & Technology
The Boeing Company

What Does Capability Maturity Levels Means?

Level 2 by 1992 ... and Level 3 by 1993 ... and ...

The Boeing Company
Maturity Levels Are Meaningless ... If They Cannot Be Explained In Terms Of Business Objectives

→ Improve the quality, cycle time, and reduce the cost of software activities

→ Provide faster service, deliver higher quality products, and achieve customer satisfaction

Boeing Software Organizations

The Boeing Company
Maturity Levels At The Boeing Company

Capability Mature Levels are expressed in terms of

- Assessment results (CBA/IPI)
- Business Improvement Data:
  - Quality
  - Cost
  - Cycle Time
- Customer Satisfaction

Institutionalization At The Boeing Company

To be considered "Institutionalized" a process must be

- Defined
- Documented
- Practiced
- Measured
- Verified
- Maintained
- Continuously Improved
## Level 1: Our Lessons Learned

<table>
<thead>
<tr>
<th>Things we left behind</th>
<th>Things we learned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schedule, Schedule, Schedule</td>
<td>Commitment, Commitment, Commitment</td>
</tr>
<tr>
<td>Guesstimate</td>
<td>Estimate</td>
</tr>
<tr>
<td>Undocumented practices</td>
<td>Documented practices</td>
</tr>
<tr>
<td>No measurement</td>
<td>Basic project measurements</td>
</tr>
<tr>
<td>No data</td>
<td>Begin data collection</td>
</tr>
<tr>
<td>Hurry, reactive-mode</td>
<td>Be patient, pro-active mode</td>
</tr>
</tbody>
</table>

Without management commitment, we never get out of this maze

The Boeing Company

---

## Level 2: Our Lessons Learned

<table>
<thead>
<tr>
<th>Things we left behind</th>
<th>Things we learned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project mismanagement</td>
<td>Project management</td>
</tr>
<tr>
<td>Schedule is fixed</td>
<td>Schedule is based on estimates</td>
</tr>
<tr>
<td>One way to do things</td>
<td>Variation exists</td>
</tr>
<tr>
<td>Heroic effort</td>
<td>Sharing of practices</td>
</tr>
<tr>
<td>No facts &amp; data</td>
<td>Systemic data collection</td>
</tr>
<tr>
<td>Unique situation</td>
<td>Common process</td>
</tr>
<tr>
<td>Takes too long</td>
<td>Maintain commitment</td>
</tr>
</tbody>
</table>

We know where we are, we know how to get there, and we can repeat it

The Boeing Company
Level 3: Our Lessons Learned

Things we learned

- Project management robustness
- Product management
- Identify and share “best practices”
- Knowledge transfer
- Common measurements across projects
- Product quality focus
- Begin tracking product performance

We are becoming a learning organization via sharing of “best practices”

The Boeing Company

Level 4: Our Lessons Learned

Things we learned

- Project management robustness
- Product management robustness
- Correlation between process and product performance
- Focus on cycle time and productivity
- Additional measurements
- Process Management: Managing by facts and data
- Begin Product Line Management

We are using data to refine organization process and improve product performance

The Boeing Company
Level 5: Our Lessons Learned

Things we learned

- Project management robustness
- Product management robustness
- Process management robustness
- Product line management
- Focus on organizational capability
- Improve market share
- Technology transfer
- Begin to look outside current business

We are using organization capability to improve market share and to explore new business opportunities.

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Journey From Level 1 to Level 3

Boeing Information Systems:

- Technology Planning
- Application Development and Maintenance
- Telecommunications Engineering
- Computer and Network Operations
- Multimedia Services
- Document and Records Management

Assessment History:

- Level 1 in 1991
- Level 2 in 1994 (120 Projects Participated)
- Level 3 in 1996

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Software Estimates

(Efforts = Labor Hours)

Without Historical Data
Variance between +20% to -140%
(Mostly Level 1 & 2)

With Historical Data
Variance between -20% to +20%
(Level 3)

(Based on 120 projects involving Information Systems)

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Schedule Performance

Number of Milestones/Deliverables

Level 1 Level 2 Level 3
Time

(Based on 120 projects in Boeing Information Systems)

The Boeing Company

Thursday 19 June

(C404a) S-7
Defect Management

Level 1 Level 2 Level 3

Req. Design Code Test Post-Release

(Based on 120 projects in Boeing Information Systems)

Defect Containment Effectiveness

Measure of Defects Contained Prior To Software Production Release

Level 1 Level 2 Level 3

31% 34% 49% 54% 65% 72% 80%

Percent of Defects Found & Fixed

Actual Goal

(Based on 120 projects in Boeing Information Systems)

The Boeing Company

Thursday 19 June
Cost Savings
(Documented through company approved cost savings program)

Cost Savings

<table>
<thead>
<tr>
<th>Year</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992</td>
<td>1.5</td>
<td>2.0</td>
<td>4.0</td>
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<tr>
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<td>2.5</td>
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<td>4.5</td>
<td>5.0</td>
<td>7.0</td>
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<tr>
<td>1996</td>
<td>5.5</td>
<td>6.0</td>
<td>8.0</td>
</tr>
</tbody>
</table>

(Based on 120 projects in Boeing Information Systems)

Cycle time
(Average time to complete a request for services)

Cycle time

<table>
<thead>
<tr>
<th>Year</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992</td>
<td>100</td>
<td>90</td>
<td>80</td>
</tr>
<tr>
<td>1993</td>
<td>90</td>
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<td>70</td>
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<tr>
<td>1995</td>
<td>70</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>1996</td>
<td>60</td>
<td>50</td>
<td>40</td>
</tr>
</tbody>
</table>

36% Faster

(Based on 120 projects in Boeing Information Systems)

The Boeing Company

Wednesday, June 19

Software Process Improvement Journey
From Level 1 to Level 5
The Boeing Company

Productivity

Reduced Staff Support per System = Increase Productivity

<table>
<thead>
<tr>
<th>Year</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992</td>
<td>100</td>
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<td>1993</td>
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<td></td>
<td>-62%</td>
</tr>
<tr>
<td>1996</td>
<td></td>
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</tbody>
</table>

Based on 120 projects in Boeing Information Systems

Customer Satisfaction Survey

Based on bi-annual survey of customers

<table>
<thead>
<tr>
<th>Year</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
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</tr>
<tr>
<td>1996</td>
<td>100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Based on 120 projects in Boeing Information Systems

The Boeing Company
Overall Performance

- Number of applications reduced < 10%
- Customer satisfaction survey increased > 10%
- Cost and schedule performance increased 38%
- Number of staff reduced 31%


The Boeing Company

Journey to Level 5: Boeing Defense & Space

Space Transportation Systems

- IUS Program: 18 years
- AOA Program: 4 years
- NLV Program: 2 years

Successful transition of Level 5 processes to Space Transportation Systems in Boeing Defense & Space proves that development programs can start at Level 5

The Boeing Company
Defect Management: Benefit Ratio

Implementing Formal Review/Inspection increased design effort by 4% and decreased rework effort by 31%.

Cost: Benefit ratio is 4% : 31% or 1 : 7.75

Employee Satisfaction

Before Process Improvement

<table>
<thead>
<tr>
<th>Satisfaction Level</th>
<th>Number of Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely Satisfied</td>
<td>10</td>
</tr>
<tr>
<td>Highly Satisfied</td>
<td>9</td>
</tr>
<tr>
<td>Very Satisfied</td>
<td>8</td>
</tr>
<tr>
<td>Satisfied</td>
<td>7</td>
</tr>
<tr>
<td>Not Quite Satisfied</td>
<td>6</td>
</tr>
<tr>
<td>Neutral</td>
<td>5</td>
</tr>
<tr>
<td>Not Excited About It</td>
<td>4</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>3</td>
</tr>
<tr>
<td>Very Dissatisfied</td>
<td>2</td>
</tr>
<tr>
<td>Highly Dissatisfied</td>
<td>1</td>
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</tbody>
</table>

Mean = 5.7

After Process Improvement

<table>
<thead>
<tr>
<th>Satisfaction Level</th>
<th>Number of Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely Satisfied</td>
<td>10</td>
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<tr>
<td>Highly Satisfied</td>
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<tr>
<td>Very Dissatisfied</td>
<td>2</td>
</tr>
<tr>
<td>Highly Dissatisfied</td>
<td>1</td>
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</table>

Mean = 8.3

The Boeing Company
Our Success Factors

+ Management Commitment
+ Funding and Resources for Process Improvement
+ Ability, Skills, Knowledge
+ Measurement and Metrics
+ Monitoring Mechanism
+ Training (both Formal and Informal)
+ Culture of Engineering Excellence
+ Customer Participation

(Based on our Lessons learned on Software Process Improvement)

The Boeing Company

Process Maturity Levels:
What Have They Improved?

Continuous Improving Process
Predictable Process
Consistent Process
Disciplined Process

Optimizing (5)
Managed (4)
Defined (3)
Repeateable (2)
Initial (1)

New Business Opportunities
Cost/Cycle time
Quality (i.e. # Defects)
Schedule

(Based on our Lessons learned on Software Process Improvement)

The Boeing Company
Our Observations

- Market share
- Product Line
- Organization
- Project
- Schedule
- Cost/Cycle Time
- Quality
- Process Management
- Product Management
- Reduce Variations/Risks
- Product Line Management

(Passed on our Lessons learned on Software Process Improvement)

The Boeing Company

Our Approach

- Integrate SWE-CMM and P-CMM assessment
  Pilot completed Jan. 97 successfully

- Apply Personal Software Process (PSP) to Level 3 organizations
  On-going pilots in 2 Level 3 organizations

- Acquisition-CMM
  On-going study

- Advanced Quality Systems (AQS) for software suppliers
  45 suppliers participated
  25 suppliers advancing to next stage
We Believe

- There is a systematic approach to improve the way software is developed and maintained.
- There are stages of process maturity in which the organization will improve by following a recommended sequence to decrease risk and increase software performance.
- By following an evolutionary path the organization will continuously improve their business objectives by producing better, faster, and higher quality products, and achieve customer satisfaction.

The Boeing Company

Conclusion

The software industry must express process improvement in terms of
- Business Improvement Data:
  - Quality
  - Cost
  - Cycle Time
- Customer Satisfaction

And use Capability Maturity Levels only as street signs on the process improvement journey
Highlights and Report Back from
The Measurement Symposium

Paul Goodman, TBL

This presentation will be developed at the conference following the Measurement Symposium on Tuesday 17th June. The material will be made available to delegates at the start of the session for inclusion in the handout folder.

Paul Goodman, Chairman of Tuesday's Measurement Symposium, will present highlights from the day's proceedings. Drawing from the rich variety of presentations which feature many of the leading experts in the field of metrics, Paul will extract lessons learnt, latest thinking and current best practice.
# Reflections on a Quarter Century

**What We Did: It's a Long Story...**

<table>
<thead>
<tr>
<th>The Early Years:</th>
<th>Establishing the Culture:</th>
<th>Transition to SEI CMM Level 3:</th>
<th>Growing the Culture:</th>
</tr>
</thead>
</table>

**Hard Learned Lessons: Truths**

- Culture Deployment Discipline

**Future**

<table>
<thead>
<tr>
<th>Systems Engineering</th>
<th>Project Mgmt and IPT</th>
<th>Other Disciplines</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMM Level 5</td>
<td>Specific Concerns</td>
<td>Technology</td>
</tr>
</tbody>
</table>
It's a long story ...

The Early Years: 1972 - 1976 (CPL)

Measurement
- Lessons Learned Reports
- Historical Data Notebook
- Feedback With Early Cost Models

Action
- SPM Course
- Templates/Checklists
- Lessons Learned
- Completion/Project Issues

Results
- Lessons Learned
- Improved Cost and Schedule Predictability
- Lessons Learned
- Improved

Thursday 19 June
COMBAT GRANDE: 1974 - 1976

Establishing the Culture: 1977 - 1986 (SED)

Thursday 19 June
Transition to CMM Level 3: 1987 - 1990 (SED)

The Transition to CMM Level 3 involved significant improvements in SED process maturity relative to industry standards. The transition was initiated in 1987 and continued through 1990, with several key actions and improvements.

**The First Assessment**
- SEI Conducted
- Level 3
- SEI/SEI SED Article
- Jan 1987

**The Second Assessment**
- SEI Conducted
- Level 3
- SEI/SEI SED Article
- Jan 1990

**SED Management Commitment**
- Action Plan
- Acceptance
- Commitment
- Oct 1987

**Paradigm Shift**
- The SED Decision to
- Transition to CMM
- Mar 1988

**SED Process Maturity Relative to Industry**

The graph illustrates the percent of total respondents from SEI-Assisted Assessments. The transition showed a significant increase in process maturity from initial (Level 1) to repeatable (Level 2) and defined (Level 3) levels. The improvement is evident from November 1987 to January 1990.
Example Results of Process Improvement

- CPI (Cost Performance Index) = Earned / Actual
- SPI (Schedule Performance Index) = Earned / Planned (or Scheduled)
- Values over 1.0 are below cost & ahead of schedule
- In 1990 (first year after Level 3 process maturity), saving of $2 Million on an annual basis
- One-year ROI of 5:1 based on process improvement investment

Growing the Culture: 1991 - Present (Hughes)

The Growth
- Predictability (CPI/SPI -> 1.0)
- Higher Quality and Productivity

The Payoff
- How We Operate
- Common Software Process (CSPW)
- Project Management
- Quality Management

Thursday 19 June
How We Operate:
Systems and Software Engineering

Project Reporting with
Metrics is a Key Issue

<table>
<thead>
<tr>
<th>Practice</th>
<th>Project Reporting</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.2.1</td>
<td>Project Overview</td>
</tr>
<tr>
<td>3.2.2</td>
<td>Accomplishments Summary</td>
</tr>
<tr>
<td>3.2.3</td>
<td>Problem Summary</td>
</tr>
<tr>
<td>3.2.4</td>
<td>Project Schedule</td>
</tr>
<tr>
<td>3.2.5</td>
<td>Risk Status</td>
</tr>
<tr>
<td>3.2.6</td>
<td>Milestone</td>
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<td>3.2.7</td>
<td>Rate Chart</td>
</tr>
<tr>
<td>3.2.8</td>
<td>Earned Value</td>
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<tr>
<td>3.2.9</td>
<td>Target System Resource Usage</td>
</tr>
<tr>
<td>3.2.10</td>
<td>Software Project Resource Forecast</td>
</tr>
<tr>
<td>3.2.11</td>
<td>Financial / Staffing</td>
</tr>
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<td>3.2.12</td>
<td>Quality Indicators</td>
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<td>Scope Change</td>
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<td>3.2.14</td>
<td>Lessons Learned</td>
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<td>3.2.15</td>
<td>Software Problems Status</td>
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<td>3.2.16</td>
<td>Productivity Measurement</td>
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<td>3.2.17</td>
<td>Size Trend</td>
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<td>3.2.18</td>
<td>Defect Density Tracking</td>
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<tr>
<td>3.2.19</td>
<td>Requirements Volatility</td>
</tr>
<tr>
<td>3.2.20</td>
<td>Software Management Effectiveness</td>
</tr>
</tbody>
</table>

Many "Practices" Each with Supporting "Procedures"
Results of cmi: Process Improvement Over Time

Number of Users at Known Milestones

"Spreading the Wealth"
Peace Shield Performance

Cost Performance Index (Cum)

Schedule Performance Index (Cum)

Time Now:
Schedule VAR (3,662)
Cost VAR (3,798)
Current SPI 1.02
Current CPI 0.98
Cumulative SPI 0.98
Cumulative CPI 1.07

Truths ...

Process
Disciplined Deployment
Quality
Culture
Best Practice

Thursday 19 June
Truth 1:
Cultural Changes Take Time

* More specifically, you can't immediately go from CMM Level 1 to CMM Level 3, or even to Level 2
* No matter what your boss says!
* And no matter how eager your staff.

Truth 2:
Process Definition is Easy - Deployment Hard

* You can buy or adopt a set of great processes
* But teaching them and ensuring their use is tough
* Project reviews are a key issue
  - Much of the CSWP devoted to project reviews
  - Conduct by the right managers with authority
* Train, Train, Train
* Measure the deployment process itself
Truth 3:
Key Process Characteristics

- Metrics are a requirement
  - Capture trend and cumulative data
  - Use metrics that are meaningful to project and business
- Measure schedule day by day, every week
- Reuse is a must: systematic and technology-based
- Control requirements growth and volatility
- Map all audits to a single system

Truth 4:
Pick Best Practice

- Take some existing standard and just adopt it... then improve it
- Don't try to innovate, at least not right away
- Don't try to “combine the best” of several practices
- Do improve; after deployment and project experience
- Do adopt; internal, benchmarking or from the literature
- Do share; benchmarking and publishing gets feedback
Truth 5: Quality

Quality is:
- A pervasive way of life
- A measure of individual integrity and pride
- An organization of quality people
- What it takes to meet our customers' expectations
- What it takes to meet our employees' expectations
- What it takes for others to acknowledge us as a leader

Quality is not:
- Quality cops
- A quality assurance organization

Build quality into the process!

Truth 6: Discipline is Key

- Reward the followers, especially problem-avoiders
- Admonish the naysayers
- Project reviews are vital
- Reviews must be by managers who:
  - Have authority to cause change
  - Believe in disciplined software process
  - Are relentless
Focus on Process for Success

- There is a process
- The process has a responsible owner
- The process is documented
- There is training for the process
- The process is under control
- The process has a mechanism for continuous improvement
- The process is followed
- The process is part of the organizational culture.

If the process becomes an integral part of the organizational discipline, success is theirs.

Current Issues and Concerns

- Systems Engineering → One Discipline → Software Engineering
- Project Management → One Strategy → Product Development Process
  Integrated Product Development (IPD)
- Technology Investment → Process → Methods, Tools, Techniques
  Tailor for Project Size
  Large
  Medium
  Small

Thursday 19 June

(C405a) S-13
Systems and Software Engineering Council (SSEC)

**HUGHES**

**The Next Quarter Century ...**

**HUGHES**

We Are Feeling Pretty Good, But...
Continuous Quality Improvement in Software Development on the Basis of Measurement and Assessment

Holger Günther, Allianz Life

Galilei: "Measure what is measurable and what's not measurable try to make it measurable"

Lord Kelvin: "The degree to which you can express something in numbers is the degree to which you really understand it"

Tom DeMarco: "You can not control what you can not measure" (You can't manage what you can't control)"
Allianz Lebensversicherungs-AG

Magic Triangle of AD

Time

year
month
day

Quality

Metrics?

Cost

DM
$
Motivation for AZL

- huge investments in C/S-Application Development
  - technology
  - process
  - people

acceleration of the maturity-process

philosophy

- first understand then make changes

- process changes must be driven by
  - specific goals!
  - characteristics of the environment
  - product attributes
  - experimental approach

- incremental and provable changes!
**prodecure**

- quantify the quality of products and processes with help of metrics
- understand the current situation
- identify and implement improvements
- evaluate progress
- structure experience
- improve continuously the maturity of products and processes

**basic approaches**

- SEI-CCM, bootstrap
- ISO 9001 benchmarks "best practices"
- QIP, GQM experience factory
GQM Method

- definition
- determine goals
- determine questions
- determine metrics

- assess progress
- answer questions
- analyse data
- interpretation

Principles

- clear
  - what is measured and why?
  - who is interested or affected by it?

- interpretation
  - primarily by application-developers
  - (self-)assessment

- consciousness about data sensitivity
  - definition of aggregation levels
  - access protection
  - anonymity
GQM-Catalogue of AZL

1. analysis of the AD-process
   - effort distribution
2. stability of business-requirements
3. flexibility in the development and administration of insurance products
4. maintainability
5. analysis of the AD-products

Goal: G200: Increase stability of business requirements

Question: Q208: How many changes were requested in the implementation phase

Metrics:
- M245: Number of defects concerning program changes
- M246: Number of defects concerning specification
- M247: Number of defects concerning environment
distribution of defects

- Project A (43PM, 88 DEF)
  - Specification: 60% (7%)
  - Program: 21.3%
  - Environment: 1%

- Project B (13PM, 35 DEF)
  - Specification: 54.3% (8.6%)
  - Program: 21.3%
  - Environment: 1%

- Project C (11PM, 10 DEF)
  - Specification: 70%
  - Program: 30%
  - Environment: 0%

- Project D (171PM, 225 DEF)
  - Specification: 60.4%
  - Program: 21.3%
  - Environment: 1%

- Project E (158PM, 391 DEF)
  - Specification: 53.5%
  - Program: 46.5%
  - Environment: 14.8%

F210: How was the business preparation of the project?

<table>
<thead>
<tr>
<th>Metrics</th>
<th>(+) profile of stability</th>
<th>(-)</th>
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<tbody>
<tr>
<td>M235 (months)</td>
<td>4</td>
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<td>M236 (number)</td>
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<tr>
<td>M237 (number)</td>
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<tr>
<td>M238 (number)</td>
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<td>1</td>
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<td>kick-off-meeting</td>
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<td>M244 (number)</td>
<td>0</td>
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<td>internal cooperation</td>
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<tr>
<td>M253 (number)</td>
<td></td>
<td></td>
<td>external cooperation</td>
</tr>
</tbody>
</table>
use of tools

structure of project group
risk-profile

R11 critical deadlines (time boundaries)
R13 knowledge monopoly at project critical positions
R14 still pending decisions
R15 influence of parallel projects
R16 cooperation with externals
R23 performance requirements
R25 reusability
R42 premises unclear

Allianz Lebensversicherungs-AG

Goal-Definition-Scheme:

- Object: Application Development Process
- Purpose: Characterize
- Aspect: effort distribution including rework
- Viewpoint: Project leader
- Context: Allianz Life (Host-AD)
Abstraction sheet

Qa (Quality aspect): effort distribution including rework in:
- Analysis (A)
- Design (D)
- Realization (R)
- Implementation (I)

Influence factors (IF):
- Experience of project group (IF1)
- Availability of resources (IF2)
- Stability of business-requirements (IF3)

Influence on Quality?
1. Qa ~ 1/IF1
2. Qa ~ 1/IF2
3. Qa ~ 1/IF3

QIP-Process

1. Characterize, identify models
2. Define, set goals, questions, metrics
3. Choose appropriate techniques for improvement
4. Execute process and collect data
5. Analyze and interpretation
6. Generalize and extract experience base

Thursday 19 June
The Experience Factory

Characterize Project
Set Goals
choose Process
Plan
Execute Project
collect data

(use) models, processes, goals
(record) experiences
baselines, tools
Data, Lessons learned

Reuse
Analyse and store
Experience Base

resources bound for measurement in AZL

Experience factory
1 person year in the role of consultant and Service Support
at the moment we are able to support 4 projects in parallel

Projects:
about 2 % of project effort
3-4 days establishment and tailoring, hypothesis
2-3 days collection of data
2-3 days analysis and interpretation, feedback

optimization is possible through better tool support:
- Experience-Database
- automatic transfer of data from project management,
data dictionary etc.
- Reuse of models
Focus on projects with the following characteristics

- similar projects/applications in the future, which can profit from experience
- Pilot projects, which introduce new technologies, processes or methodologies
  - Goal: Shorten the maturity period

Summary

- approach is widely accepted
- it brings value even to the pilot-projects
- we are now in the phase of improvement
- we have developed tools (experience database, etc.)
- we want to establish basic metrics for all projects
- we even want to establish the QIP- and GQM-approach outside the application-development-environment
Overcoming Resistance

Overcoming resistance to change in SPI environments to become a true 'learning organisation'.

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Introduction

... I went to the woods because I wished to live deliberately, to front only the essential facts of life, and see if I could not learn what it had to teach, and not, when I came to die, discover that I had not lived. I did not wish to live what was not life, living is so dear; nor did I wish to practise resignation, unless it was quite necessary. I wanted to live deep and suck out all the marrow of life, to live so sturdily and Spartan-like as to put to rout all that was not life, to cut a broad swath and shave close, to drive life into a corner, and reduce it to its lowest terms, and, if it proved to be mean, why then to get the whole and genuine meanness of it, and publish its meanness to the world; or if it were sublime, to know it by experience, and be able to give a true account of it in my next excursion. For most men, it appears to me, are in a strange uncertainty about it, whether it is of the devil or of God, and have somewhat hastily concluded that it is the chief end of man here to "glorify God and enjoy him forever."...

Henry David Thoreau

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Introduction

- Resistance is a problem in all change initiatives.
- Resistance can be both covert and overt.
- Resistance to change costs organisations millions of pounds each year.
- Implementation 'models' do not, and cannot, solve the problem.

Chaos, Systems and Change

- Each element of a system embodies and reflects every other element.
- A chaotic element cannot be stabilised by another chaotic element.
- Chaos found at one level of a system will be present at all other levels within the system.
- Human thought and cognition is a central element of any changing system.
The ongoing problem of resistance

- ‘Static Mechanisms’
  - Homeo-static;
  - Socio-static;
  - Enviro-static; and
  - Cognito-static.

- Levels of Change
  - 1st Level Change - Evolutionary Change;
  - 2nd Level Change - Revolutionary Change; and
  - 3rd Level Change - Changing the Change Process.

Why Levels of Resistance Are Increasing
Why is the Rate of Change Increasing?

- Information Technology
- Communications
- Transportation
- Media

Control of Resistance

- Resistance is under perceptual and cognitive control.
- The perceptual and cognitive apparatus of an individual can be 're-tuned'.
- 3rd Level Cybernetic Change abolishes resistance and establishes learning by changing the process of changing.
The Structure and Process of Resistance

- Resistance has a definite structure and process that can be elicited and 'mapped' like any other business process.
- The structure and process of resistance is absolutely unique to an organisation.
- This structure and process is the same regardless of the type of change being implemented.

Mapping the Structure & Process of Resistance

- Resistance is a combination of 'real' things not just an abstract term. Deal with specifics that can be measured.
- If you have 'the right' information, change becomes simpler and quicker.
- A complete set of data is needed including:
  - 'The What' - Descriptions & Behaviours;
  - 'The How' - Explanations & Processes; and
Culture, Resistance & SPI

- Culture plays a central role in SPI.
- CMM / P-CMM / ‘IDEAL’ / SPICE are all retrospective construct models. They cannot be used to implement cultural change - no generic ‘model’ can.
- The only ‘how to’ implementation model that will work is one that is specific to an individual organisation.

Why Bother?

- All forms of change including SPI are expensive to implement.
- Resistance increases the cost of change implementations on average by 400%.
- Change becomes increasingly more difficult after each ‘failure’.
- Measurement and tracking of change becomes possible.
Tools for Overcoming Resistance

- Training with ‘covert’ change;
- Distracted change; and
- Recursive Benchmarking™.

Benchmarking

- Benchmarking is no longer confined in scope and attention to metrics and metrics objects.
- If Benchmarking is seen as solely metrics it is the cause of significant resistance.
- Benchmarking is the ‘reach-out’ activity of comparing yourself and your organisation against others.
4 Types of Benchmarking

- Process Benchmarking:
  - Work Processes & Operating Systems
  - Most Effective Operating Practices
  - Increased Performance & Bottom Line Results

- Performance Benchmarking:
  - Assessment of Competitive Position
  - Widely Used in Business and SPI e.g. FPA

- Strategic Benchmarking; and
  - Examining How Others Compete
  - Cross-Industry Strategies, Structures & Processes
  - Requires Considerable Investment
  - Produces Significant Results

- Recursive Benchmarking™.

7 Levels of Benchmarking

- Learning from Past Successes;
- ‘Borrowing’ Good Ideas;
- Best in Organisation;
- Industry Standard;
- Industry Leadership;
- Best in Country Leadership; and
- World Class Leadership.
Recursive Benchmarking™

- Recursive Benchmarking™ is a set of tools, processes and corrective interventions to assist with
  - Measuring Change;
  - Mapping & Modelling Change;
  - Initiating Change;
  - Driving Change; and
  - Improving the Process of Changing.

Applications and Benefits of Recursive Benchmarking™

- Setting & Refining Strategy;
- Reengineering Work & Business Processes;
- Problem Solving;
- Education & Idea Enrichment;
- Market Performance Comparisons;
- Catalyst for Change; and
- Reduction of Overt and Covert Resistance.
How Recursive Benchmarking™ Reduces Resistance

- It acts as an example of the processes that the organisation is seeking to adopt.
- It ‘opens up’ individuals and teams by involving them at an early stage.
- It ‘sets up’ individuals and teams to accept change as positive and to integrate it.

Conclusion.

- Recursive Benchmarking™
  - Is one of a number of tools that can be used to drive the cultural changes and learning that are required for a successful implementation of SPI.
  - Provides business driven quantitative and qualitative metrics data.
  - Is a method for increasing organisational learning and changing the change process itself.
Finally...
Co-operative Change Is Effective and Produces Results

Leaving It To Chance Is A Recipe For Disaster.
A Co-ordinated Approach to Identifying Software Development Risk in MoD Projects

Speakers

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  fax: + 44 117 91 33917
  email: isis42b@pe.mod.uk

- John Hamilton
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  phone: + 44 1684 896292
  fax: + 44 1684 895616
  email: jmhamilton@sec.dra.hmg.gb
Agenda

- Background
- Method Selection & Enhancement
- Benefits
- Implementation

Background
The Problem

- House of Commons Defence Committee Concerns
- Difficulty in Evaluating Software Bids
  - software characteristics
    - lack of visibility
    - intangible
- Process method required to identify risks

Process

- "...the integration of people, procedures and methods, equipment and tools to produce the desired end result..."
SCE

- '...independent team evaluation of an organisation's software process...'
- '...using the CMM...'
- '...in the context of a particular acquisition...'

- Preparation
  - Site visit to each supplier
    - Personnel interviews
    - Document reviews
  - Analysis and reporting

Sampling

- Team determine:
  - Which projects to review
  - Which KPAs to assess
  - Which goals to rate
  - Which topics to probe
  - Which staff to interview
Method Selection and Enhancement

Selection

- Process orientated method required
- Investigation of available techniques
  - non-proprietary
  - supported
  - track record
  - evaluation technique
- CMM and SCE selected for further investigation
UK Trial of SCE Method

- **Aim**
  - to establish applicability within UK
  - 3 volunteering UK Defence contractors
  - feedback solicited

- **Successful outcome**
  - required live application

Pilot SCE

- Major UK procurement
- Three consortia bidding
- Three software subcontractors visited
- SEI involvement
- Team of 6
- Five weeks of effort
Lessons Learned

- Data collection successful
- Company cooperation good
- Team composition significant
- Management of expectations important
- Need for UK Training

Enhancements

- Not used routinely on all projects
  - risk primary decision driver
- Reduce disruption on bidding companies
  - short-listed contractors only
- More context specific
  - context domain experience
  - project specific risks form input
Risk focus

Project → Project Risk Register → Process Profile for Project

KPA
KPA
KPA
KPA
CMM Boundary

Re-use of Results

- Re-use of previous SCE encouraged
  - previous results
  - elapsed time
  - similar product attributes/requirements
  - boundaries of SEPG organisation
- But only
  - with bidding company's consent
Consultation

- **Aim**
  - to ensure smooth introduction of SCE
- **Internal discussions**
- **Industry**
  - UK Trades Associations, US contractors and DoD
- **Capture and action concerns**

Consultation with Industry

- **SIP Consultation Study**
- **Initial Method Selection**
- **SCE Trial**
- **SCE Consultation**
- **SCE Awareness Seminar**
- **Pilot SCE**
- **Policy Preparation**
- **Policy Promulgated**

European SEPG '97 - 18
Benefits

Benefits to MoD

- Addresses original concern
  - forms an input to contractor selection process
- Well-defined method for identifying and managing software process risks
- Method provides in-depth, reliable, repeatable information with audit trail
- Consistent with MoD's established use of Pre-Contract Award Evaluations (PCAE)
Benefits to Industry

- Incentive towards Internal Process Improvement
- IPI model not mandated
- Recognition of business needs
- Quantitative understanding of process

Implementation
Policy Promulgation

Chief of Defence Procurement
Instructions TECH/490

Defence Procurement Management Guide
TECH/490

Guidance material

- CMM & SCE overview
- Selection criteria
- When to use
- Planning
- Tailoring
- ITT preparation
- Team selection

- Training
- Briefing of bidders
- Performing evaluation
- Use of results
- Learning from experience
- Documentation & training
DERA focus

- Provision of:
  - Advice to MoD project managers
  - Qualified Evaluators
  - Team Leadership
  - SCE and CMM Training
  - Expertise in process assessment and supplier capability determination
  - Consistency in evaluation

MoD focus

- Point of contact between DERA and MoD(PE)
- Infrastructure
  - lessons learned
  - feedback
  - continuity
- Maintain SEI liaison
Summary

- Trials and consultation
- SCE now selected and enhanced
- Significant benefits anticipated
- MoD(PE) and DERA working closely
- Arrangements in place for implementation

A Co-ordinated Approach to Identifying Software Development Risk in MOD Projects

The End !!!
Five years experience in SPI: lessons learned

European SEPG'97
Amsterdam - juin 1997

Agenda

- The Thomson-CSF Context
- The Thomson-CSF maturity profile
- SPI at corporate level
- Experience and assets sharing
- Improvement results
SOFTWARE is one of the main (and increasing) added values in our systems (between 13% and 90% of the total of our principal projects).

More than 5000 software engineers.

Software Intensive System trends

Every 5 years, mean size is x5 to x10

(Nos. CURTISS WRIGHT)

Thomson-CSF figures
The Thomson-CSF corporate actions

**Human resources**
- Training: IFGL
  (Training Institute for SW engineering): 1987
- Management of the software population:
  disciplines and functions: 1993

**Methodology and Tools**
- ATGL (THOMSON SW engineering development environment): 1991
- RDL (Software Development Reference System): 1990
- MCPA (Method for managing proposals and programs): stabilized in 1993
- MIST (System engineering Method): 1993

**Software Development Process**
- SPICE-Th (\(^\star\)): 1992

\(^{\star}\) Different from ISO-SPICE

---

The Thomson-CSF organization for SW

**Software Engineering CET (\(^\star\))**

- Pilot Team
- SPICE-Th/Reuse Technical Committee
- SPIN-Thomson

\(\Theta\) Common Efficiency Team
\(\Theta\) SEPGs at ENTERPRISE or Business Unit level

---

Thursday 19 June
The Thomson-CSF maturity profile

**Maturity profiles repartition (December 96)**

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</tr>
<tr>
<td>2→3</td>
<td>25</td>
<td>17 *</td>
<td>17 *</td>
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* Estimate and actual

**Mean time to reach a level (in months)**

**Difficulties for level 2**

- Most of the time, formalization of the estimation practices (costs, schedule and sizing parameters...at the domain level);
- Remaining cases with weaknesses on System Requirements Allocated to SW, commitment on a concurrent definition...;
- For some Units, responsibilization of the SW Project Manager (PM) & a synthetic commitment;
- A trend where too much delegation on work products audit by SOA;
- A corporate guideline that defines the process and methods, + awareness of the best examples;
- Focus on the System Eng. process or simple formalization of the RM process... + a simple commitment form between PM & SW PM;
- A focus on involvement of the SW PM in Syst. & SW spec. (& the benefits) + the commitment form;
- Focus on the task of tracking the raised action items...
Difficulties for level 3

- Generalization of Peer Reviews,
  - tailoring when Req. unstability,
  - former practices on document reviews;
- Keep the data-base simple;
- Tailoring,
  - which approach,
  - difficulty to think "risks" and "efficiency"...!
  - small projects.

- A lot of training sessions & some benchmarks,
  - core specifications and design,
  - several types (high & low...);
- concrete assessed example;
- A continuous focus with,
  - a current working group.
  - the company assets catalog.
  - ...

THOMSON-CSF

SPI at corporate level: SPICE-Th II

93-94 Process Action Teams (PAT)

<table>
<thead>
<tr>
<th>SW Indicators</th>
<th>Unit 1 in charge</th>
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<tbody>
<tr>
<td>SW planning, tracking</td>
<td>Unit 2 in charge</td>
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<tr>
<td>SW Quality Assurance</td>
<td>Unit 3 in charge</td>
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<td>Requirements Management</td>
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<td>Peer Reviews</td>
<td>Unit 7 in charge</td>
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<td>SW Rules</td>
<td>Unit 8 in charge</td>
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<td>SW Risks management</td>
<td>Unit 9 in charge</td>
</tr>
<tr>
<td>SW Estimation</td>
<td>Unit 10 in charge</td>
</tr>
</tbody>
</table>

After # 10 months for PAT, 3 months for designing a corporate training module for each

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Thursday 19 June
SPI at corporate level: training by Campus-Th

- Presently 14 courses (# one day, across both level 2 & 3),
  - Understanding the level (2 or 3),
  - Conducting an SPI,
  - Requirement Management & Engineering,
  - Advanced Planning & Tracking, Managing Risks,
  - SW Estimation & Capitalization, Capitalization & SPI,
  - SW Subcontract Management,
  - SCM process,
  - SW products/systems engineering, SW tests & verification,
  - Peer Reviews,
  - Teamworking.

- SW Project Management, SOA (Courses with mentoring), 300 students (1996)

SPI at corporate level: SPICE-Th III (1/2)

Goals:
- minimize guides writing/rewriting costs
- speed up the dissemination process
- shorten the time to reach level 3
- insure that guidelines are closer to the field
SPI at corporate level: SPICE-Th III (2/2)

An assessment process made more and more reliable, after 5 years of experience and 33 official assessments.
SPI at corporate level: assessments (2/2)

An assessment process based on a pool of 50 experienced team members, with 2 Thomson-CSF and 2 US SEI authorized "lead assessors".

**SPI at corporate level: The Std Reference System**

Introduction and policies (GDL, POL, procedures)
- TH-CSF management principles
- Meet standards
- Operational organization of the company
- Software Development Methodology

GDL 204: Subject Engineering

Policies

<table>
<thead>
<tr>
<th>GDL 10-1 (spec.)</th>
<th>GDL 11-1</th>
<th>GDL 76-0 (SPI plans)</th>
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<tbody>
<tr>
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<td>GDL 70-1</td>
<td>GDL 70-4</td>
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Standards

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<td>GDL 100-1 (TRD)</td>
<td>GDL 115-0 (RAC)</td>
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<tr>
<td>GDL 120-0 (SCMSP)</td>
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Processes

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Procedures

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<td>GDL 201-1 (Tools)</td>
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<td>GDL 205-5 (Unit)</td>
<td>GDL 310 Ris 237</td>
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Training

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<th>RDL 101</th>
<th>RDL 103, 104</th>
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Tools

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<tr>
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<td>GDL 50-1</td>
<td>GDL 40</td>
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<tr>
<td>ATGL tools manuals</td>
<td>GDL 205</td>
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</table>

(*) In each user manual is not a grade, however it is located under "training" because of its educational quality.

**THOMSON-CSF**

TTM SOFTWARE AND SYSTEMS DEPARTMENT

Thursday 19 June

(C406c) S-8
Experience and assets sharing

- SPIN-Th meets every month, the topics are planned for several months, based on:
  ◊ the needs of SEPGs (regular survey by the chairman),
  ◊ the assets catalog,
  ◊ the recent reach of a level by a Unit;
- The assets catalog is filled at the end of each assessment, by the members of the team; there are other opportunities;
- The Standard Reference System and the assets catalog are electronically available on an internal server.

Getting to level 2 benefits (1/2)

- (Program/Project Managers and Senior Managers) "we have a better visibility of what's going on in the SW project",
  ◊ ... Project Managers analyse the indicators....
- Easier commitment with the customer for major changes in the contract,
  ◊ file of rationales....
- (SW Project Managers) "we feel completely responsible of the SW part",
- "better stabilization of the baselines";

Thursday 19 June
Getting to level 2 benefits (2/2)

- A mean improvement of 17% of Cost Performance Index in 2 years, while reaching level 2 (measured on 3 Units; # 800 Sw eng.).
- Several Units where the Schedule Performance Index,
  ♦ improve from 60% to 5%,
  ♦ and concurrently, for example:

A level 2 Business Unit

+ * a project with no defect at acceptance

Getting to level 3 benefits (1/2)

- Getting to level 3:
  ♦ in one domain (2 major projects with # 100 persons each),
    ♦ no over costs,
    ♦ in time acceptance (with no defects found),
    ♦ high customer satisfaction,
    ♦ rapid staffing examples,
      • + 180 persons within 2 years, including
      • + 100 persons within 10 months;
  ♦ willingness not only of the SW managers (larger buy-in among the SW developers).
Getting to level 3 benefits (2/2)

- **PR benefits:** for a level 3 Unit, cost of defect detection and correction 4 time less if done before any tests, with
  - a efficiency of 50 % and,
  - a benefit of 12 % on SW development costs (when 80 % PR on code);
- **ROI, getting to level 2:** this Unit has worked out a ROI of 3.6 to 1.
From Chaos to Control

A Case Study of Software Process Improvement at Digital

Debbie Hellmann/Alf Pilgrim
Digital Equipment Corporation
June 1997

debbie.hellmann@x400.reo.dec.com

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Topics

- Background
- Results
- Assessment Strategy
- Learnings and Experiences
- Next Steps
- Questions

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The Company

Digital Equipment Corporation

- Digital is a world-wide supplier of computer solutions: hardware, software, networks, and services
- Corporate headquarters in Maynard, Massachusetts
- 66K employees world-wide

http://www.digital.com

The Site

Digital Equipment Corporation, Inc.
Corporate Engineering

Digital Equipment Company, Ltd.
Reading Engineering

© Digital Equipment Corporation 1997
**The Organisation**

Integrated Office Services Group

- ~ 60 engineering staff
- Part of a 3-site (110-person) organisation in England, the US, and Ireland
- Responsible for groupware products
- Experienced in large scale integration projects

**The Major Product**

ALL-IN-1

- Multi-function integrated office system
- Size:
  - >10K modules
  - >2.5M high-level LOC
  - 2-3K changes per release
- Installed base of 5 million users
- Evolved from timeshared to client-server
Problems

- Major software release has significant problems
- Software builds out of control
- Classic chaotic organisation
- Need for improvement seen by management staff and engineers

The Improvement Effort

- First Phase (1988-1992)
  - not oriented around any particular methodology
  - guided by Capability Maturity Model (CMM) and self-assessment process
- Significant corporate restructuring and downsizing during this period
**Why the CMM?**

- Consistent with work done
- Addressed requirements
- Guide to improvements
- Benchmark against industry

... And the associated assessment method

![CMM Stages Diagram]

The CMM

- Optimizing
- Managed
- Defined
- Initial (I)
- Repeatable

**Topics**

- Background
- Results
- Assessment Strategy
- Learnings and Experiences
- Next Steps
- Questions

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SEI CMM Assessment Results

1993 Assessment
- At Initial level with some projects running at the
  Repeatable level. Some processes in place for
  Defined level.

1996 Assessment
- At Defined level.

Defects Found after Release

Problem reports by version, starting from release date

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Code Resubmissions

% Resubmissions ALL-IN-1 IOS ICOs

Comparing Projects

- **Diamond**
  - 24 month project
  - 50 engineers
  - 22 failures
  - 484 resubmissions
  - 20% rework
  - 2931 days of rework

- **Sapphire**
  - 18 month project
  - 17 engineers
  - 2 failures
  - 93 resubmissions
  - 13% rework
  - 565 days of rework
Developers on ALL-IN-1

Single to Multi-Product Responsibilities

- Increased span of product responsibilities
- Bandwidth to exploit new opportunities
- Increased capacity for survival

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Topics

- Background
- Results
- Assessment Strategy
- Learnings and Experiences
- Next Steps
- Questions

Assessment Strategy

- Targeted high-visibility projects only
- Cross-functional assessment team
- Two distinct functional group types
  - development engineers
  - others
- Aimed for 100% participation
- Expectation of 24 month cycle
Assessment Experiences

- Hard work!
- Requires investment...management support
- Expectations must be set realistically
- Training essential for everybody
- Some interpretation and tailoring required
- New assessment technique is better

Post-Assessment Experiences

- Commitment requires constant reinforcement
- Effective change management is critical
- Must treat improvement as a bona-fide project(s)
- Dealing with organisations at the Initial level can be frustrating
- Need to manage the management line
- Results have wholly justified investment

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Most "bang for the buck"

- Formal configuration management
- Regular cross-project reviews
- Better integration of quality assurance
- Formal reviews
- Statistics publication
- Document and process templates
- Base-level planning

Topics

- Background
- Results
- Assessment Strategy
- Learnings and Experiences
- Next Steps
- Questions

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Next Steps

- Implement actions from '96 assessment
- More extensive use of metrics for continuous improvement
- ISO 9001 / TickIT registration
- Assist partner groups

Summary

- Improved customer confidence
- Improved productivity
- Greater predictability
- Improved communications
- Higher group morale
- Catalyst for change

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A Case Study of CMM Software Process Improvement at Digital

Questions ???

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The complementary aspects of process capability and reuse capability

Sergio Bandinelli
Sergio.Bandinelli@esi.es
European SEPG
June 19, 1997

Overview
- Product-line engineering
- ROADS project
- ROADS preliminary results
- ROADS lessons learned
- Reuse and process capability
- R-SPICE and SPLICE models
Product-line engineering

- A product-line is a collection of (existing and potential) products that addresses a coherent business area or domain.
- Product-line engineering is concerned with the efficient development of a product-line that delivers high quality products tailored to the specific needs of each customer.

Transitioning to product-line engineering

One of-a-kind
- family view
- assembly-line style

Many of-a-kind
- Changes required
  - to the development process
  - to the organisation
- Management commitment is essential
Changes in the process

Changes in the organisation:
conflicting forces

Deliver products
Update practices
Keep projects going
Improve processes
Short-term profit
Long-term benefit
The experience of ROADS

- ROADS: Reuse Oriented Approach for Domain based Software
- Partners:
  - Thomson-CSF
  - European Software Institute (ESI)
  - Prosperity Heights Software (PHS)
- PIE (Process Improvement Experience) under the ESI programme.

Four pilot experiments

- Air traffic control
  - decrease time-to-market to 1/3 of current.
- Control and command of short range air defence systems.
  - improve the reliability
- Training simulators
  - Obtain significant reduction of costs
- Traffic Management (planning of traffic)
  - Improve the flexibility and robustness
Project baseline

- Diagnosis of current situation
  - to evaluate potential profitability
  - to understand existing strengths and weaknesses in the organisation
  - to set the appropriate priorities
- Issues considered:
  - domain potential
  - organisation's reuse capability

Incremental approach

- Each increment involves performing domain engineering activities that bring support to projects
- Typical increment time: 3 months

Perform increment  Plan increment

Review increment
Assessment experience

- Reuse capability assessment using RCM.
- Domain potential assessment using DAM
- Assessment characteristics
  - Self-assessments (3 to 8 persons in assessment team, incl. facilitator)
  - One day duration
  - Results presented in the form of profiles and assessment findings

Assessment results

- Adaptation introduced to RCM and DAM
  - Duration reduced
  - Translation to French
  - Graphical representation of profiles changed.
  - Modification of rating scale
- Participation of key business development experts turned out to be essential in the successful development of assessments
Preliminary improvement results

- Identification of new opportunities for improvement.
- Creation of awareness in the organisation of the range of applications it is capable of building by capitalising of past project experience.
- Initial support to projects: e.g., additional support for negotiating and setting new contracts or to support decision on whether to bid for a contract or not.

Lessons learned

- Reuse adoption requires some level of process maturity.
- Established processes are much difficult to change.
- Difficulties and resistance encountered when the reuse adoption programme follows other quality improvement actions (such as obtaining ISO 9000, achieving a certain CMM level, etc.).
Reuse and process capability

- **Process capability**: is the ability of a process to achieve a required goal.
- **Product-line capability**: is the ability of an organisation to deliver products that satisfy specific customer needs, using a common domain-specific support of tailorable processes and assets.
- **Domain reuse potential**: is a measure of the potential of profitability from applying reuse in a domain (intended as a business area).

Synergy between reuse capability and process capability

![Synergy diagram](image)

**Process capability**
- LEVEL 5
- LEVEL 4
- LEVEL 3
- LEVEL 2
- LEVEL 1

**Product-line capability**
- STAGE 1
- STAGE 2
- STAGE 3

Synergic growing of process and product-line capability
Assessment models

- **R-SPICE**: an extended SPICE process capability model enriched with a new product-line process category.
- **SPLICE (Staged Product-Line Capability Evaluation)**: a staged model for transitioning to product-line engineering.
- **DAM**: a domain assessment model.

---

The SPICE Reference Model
R-SPICE process dimension

Preliminary set of LIN processes in R-SPICE

- LIN.1 Manage the product-line
- LIN.2 Define the product-line
- LIN.3 Engineer the product-line
- LIN.4 Define product-line production process
- LIN.5 Provide project support
The SPLICE model

- The SPLICE model identifies a set of stages in the transition to product-line engineering.
- Each SPLICE stage
  - corresponds to one coherent set of goals and practices to achieve those goals
  - constitutes a step in the direction of product-line engineering.

R-SPICE process dimension and product-line capability

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer</td>
<td>Support</td>
<td>Organisation</td>
<td></td>
</tr>
<tr>
<td>Product-line</td>
<td>Management</td>
<td>Engineering</td>
<td></td>
</tr>
</tbody>
</table>

Product-line capability stages

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(C407b) 5-11
Conclusions and future work

• Preliminary results on experiences about transitioning to product-line engineering
• Capability models support this transition
• Next steps:
  • Build consensus
  • Further develop models and explore synergy
  • Validate, validate, validate...
Software Best Practice: Benefits for the Business

SEPG'97
Amsterdam 19/6/97

Mr. A. Moya
European Commission
DG III F

Overview

✓ Software Best Practice: Why?
✓ A Few Case Studies
✓ Conclusion
A Strategic Challenge for Europe

Software Best Practice

Emphasis on Quality

Making use of the best practices in management and software engineering methods and technology

The European Commission - DG III IT Programme.

Quality and Community Policies

- Industrial Policy
  Industrial Competitiveness

- Internal Market
  Free movement of goods and services (in particular)

The European Commission - DG III IT Programme.
Quality, market share and profit

Source: PIMS 94, Competitiveness report

Quality and Competitiveness (i)

World Competitiveness Report

The European Commission - DG III. IT Programme.
Quality and Competitiveness (ii)

- Quality: Critical in gaining an increased competitive edge
- A lot remains to be done

Actors in SBP

- Economic operators
  Main responsibility
- European Union
  Facilitator ➔ overall favorable economic environment
  AWARENESS POLICY
  SUPPORTING IMPROVEMENT
- National Activities

The European Commission - DG III. IT Programme.
Best Practice. Critical?

CREDIT CARD

- 55,000 cards issued
- People queuing to get 100 Guilders for free

Your Best Practice

Different Business Environments Require Different Priorities

The European Commission - DG III. IT Programme.
Different Priorities

**BUSINESS DRIVER**

- Time to market
  - XIOSBANK: 20% consumer credit
  - CLAAS: 5 MECU sales boost

- Safety / Reliability
  - B&K: 75% less error reports

---

Case Studies

**5 CASE STUDIES**

SHOWING BUSINESS BENEFITS

FROM THE ESPRIT INITIATIVE ESSI

---

The European Commission - DG III. IT Programme.
Quality vs Process

CUSTOMER SATISFACTION

<table>
<thead>
<tr>
<th>QUALITY IMPROVEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case studies show correlation</td>
</tr>
<tr>
<td>B&amp;K 75% error reduction</td>
</tr>
<tr>
<td>Surveys show correlation</td>
</tr>
<tr>
<td>IBM survey</td>
</tr>
<tr>
<td>HOWEVER, this is a statistical truth unless ......</td>
</tr>
<tr>
<td>DRIVEN BY BUSINESS NEEDS</td>
</tr>
</tbody>
</table>

What is actually done?

Is SBP a Big Issue for you?
Indeed !!

What do you actually do? Little ?

• Any practical activities?
  process improvement, education,...?
  e.g. 53% of Irish companies have no QMS (Forbait 1995)
CONCLUSION

SBP: Esprit contributes

- Esprit CALL FOR PROPOSALS
  OPEN NOW FOR:
  - Technology Transfer
  - ESSI

For further information:
http://www.cordis.lu/esprit/arc/sthome.htm
Software Best Practice: Benefits for the Business

I. Purpose

The purpose of this paper is to show the substantial and quantifiable business benefits to be gained from adopting Software Best Practice.

This paper arose from a study of a number of Software Best Practice projects which have been carried out over the last two years in different types of organisations with a variety of different goals. This means that the information relates to "real-life" case studies.

From Business Needs to Customer Satisfaction. Software Best Practice

Making use of the best practices in management and software engineering methods and technologies.
II. The Business Messages

There are two key business messages, one for companies using software in their products or in their business support systems, "the clients", and one for "the providers" (either software companies or internal informatic departments). In other words, key messages for the vast majority of businesses in Europe.

The message for "the providers" is that Software Best Practice has proved that productivity, quality, customer satisfaction, and speed of delivery can be significantly improved through Software Best Practice.

The message for "the clients" is that the software supplier's professionalism will materially affect the quality, the timeliness and the cost of what is delivered. Clients should, in their own interest, monitor their suppliers and determine the level of professional software engineering employed.

This paper focuses on case studies. In every one of them a modest investment in adopting Software Best Practice principles to improve software engineering practices has produced significant business benefits. For example:

- at BBV, the largest Spanish bank, migration of applications programs to a new platform was 6.5 times more efficient;
- at Brüel & Kjaer, a Danish manufacturer of high precision instruments, systematic unit testing reduced the number of errors in products released to the market by 75%;
- at CDC, a major French public finance company, software maintenance cost is being reduced by 50%;
- at Claas, Europe's largest manufacturer of harvest machinery, better specification and software management brought a significant product enhancement to market a year early, boosting sales by at least 5 Million ECU;
- at ENEL, the world's second largest electricity supplier, a formal specification method reduced project development cost by 18%.

<table>
<thead>
<tr>
<th>Company</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>BBV</td>
<td>6.5 times more efficient migration.</td>
</tr>
<tr>
<td>B &amp; K</td>
<td>75% less errors in released products.</td>
</tr>
<tr>
<td>CDC</td>
<td>50% reduction in maintenance cost.</td>
</tr>
<tr>
<td>Claas</td>
<td>5 Million Ecu sales boost.</td>
</tr>
<tr>
<td>ENEL</td>
<td>18% cost reduction.</td>
</tr>
<tr>
<td>Engineering</td>
<td>60% improvement in accuracy.</td>
</tr>
</tbody>
</table>
- at Engineering, a software company, a professional approach to estimating project costs, effort, duration, etc. improved the accuracy of their estimating by 60%.

In each case, not only have the efficiency and quality of software production and maintenance improved: the real good news is that there have been clear business benefits. In seven of the cases the competitiveness of the company as a whole has been materially uplifted. In five cases, close attention to the specification and communication of requirements has enriched customer satisfaction and customer-supplier relationships. In four cases, the company's quality image has improved. In another two, the high profile success achieved through improved software engineering has substantially developed senior management's appreciation of what Information Technology can do for its business.

Recent studies performed by a number of well known organisations confirm the business benefits gained through Software Best Practice. Among others, it is worth mentioning an IBM\(^1\) survey of 363 European companies from different sectors, reports published by the ESI\(^2\) (European Software Institute) and the paper published by Ovum\(^3\) based on experience drawn from the European Software and Systems Initiative (ESSI).

Note should be taken of the general trend observed in the World Competitiveness Report (sketched in Fig 1) concerning the use of Quality Management. The USA are progressing. Europe is progressing but at a slower rate and a regression is observed in Japan. Europe still has much business benefit to gain.

This paper identifies the potential benefits in the field of software best practice. Neither the software engineering approaches it describes nor the nature of the benefits achieved are peculiar to the individual companies discussed. Their experience indicates that, by intelligent use of the large repertoire of management methods and software tools available, any software development operation (whether in a software company or in-house in a user) can make significant improvements in what it delivers, in how soon it delivers it, in its cost of delivery, and above all, in its customers' satisfaction. To achieve this requires leadership and professionalism. No software developing company can afford to ignore this finding.

\(^1\) References can be found in the annexes.
A. Summary

CASE STUDY 1  SPECIFICATION AND SOFTWARE MANAGEMENT RETHOUGHT

"5 Million Ecu Boost to sales"
Claas KGaA and their software supplier, Müller-Elektronik, radically revised their processes for drawing up and communicating requirement specifications and for implementation management. Claas's product came to market a year earlier as a result, well before any direct competition, and is likely to bring in 5 MECU + of sales in that year. Management understanding of the business contribution of electronics has leapt forward.

CASE STUDY 2  EFFICIENT MIGRATION OF APPLICATIONS

"Sixfold Productivity Gain"
PROFit Gestión Informática S.A. offers a service for converting software from one environment to another. By using software engineering techniques to analyse the suitability of application for conversion - recommending redevelopment of the application where it was not suitable - and to semi-automate the conversion process, they were able to improve their productivity from one programme converted per week to 6.5, and also to improve post-conversion maintenance productivity by at least 10%.

CASE STUDY 3  INTRODUCTION OF CONFIGURATION MANAGEMENT

"Gaining a Competitive Edge"
By introducing configuration management into the development process of their financial application products, Datamat Ingegneria dei Sistemi S.p.A. vastly decreased the time-to-market and the number of errors in their software products. The overall effect was to decrease development costs in order for Datamat to gain a competitive edge.
CASE STUDY 4  FORMAL SPECIFICATION METHOD

"Up to 18% Cost Reduction"
After introducing a formal specification method into their software development process, ENEL has experimented a reduction of the overall development effort (18%) and an increment of the company outsourced control system.

CASE STUDY 5  IMPROVED PROJECT ESTIMATION

"60% reduction in average project estimation errors"
Engineering Ingegneria Informatica S.p.A. succeeded in improving the accuracy of their project estimation (manpower, cost and elapsed time) through improving their software engineering. This was achieved by building a database compiling their experience gained in earlier projects. The result was to reduce the average estimation error from 25% to 8%.

CASE STUDY 6  A FRESH START WITH NEW IT TECHNOLOGIES

"10% in Overall Company Costs Savings"
By using innovative software engineering techniques and taking advantage of the new IT and Communication technologies, RACE ASISTENCIA has been able to build a brand new integrated service system to support their mother company's core business. While cutting the Software Development costs by 20%, the new system also reduces by 10% the cost of the company main business operations.

CASE STUDY 7  TACKLING QUALITY MANAGEMENT

"Drastic Reduction in Maintenance Cost"
By adopting new tools for Quality measurement of software projects and Quality improvement of existing applications, Informatique CDC has achieved an important reduction in maintenance costs (up to 50% cost decrease) and gain in productivity (5-10%) and has increased the motivation of the software development work force.

CASE STUDY 8  ESTABLISHING WHEN THE BUGS OCCUR

"Reducing Bugs in Released Systems by 75%"
By introducing systematic unit testing procedures to verify the software (some 80% of the added value in their products), Brüel & Kjær was able to reduce the number of error reports by 75% in the new version of an electronic measurement product.
CASE STUDY 9  TACKLING THE DOCUMENTATION HEADACHE

"10-20% Performed Improvement as a Consequence"
By implementing a rational documentation system, accordingly to company needs, VBI has achieved 10% schedule reduction and 18% budget savings. VBI has shown that small projects can be documented without adding overheads.

CASE STUDY 10  QUALITY CONTROL SYSTEMS CHANGE THE WAY SOFTWARE IS DEVELOPED

"Achieving ISO-9000 certification"
Due to customer demand the company has made software quality an integral part of the development lifecycle and significantly changed the way in which customer releases are approved.

CASE STUDY 11  OBJECT ORIENTED DESIGN REDUCED TESTING TIME

"Changing the software development process"
After adopting an object oriented design methodology, the company have reduced the amount of time required for testing and provided greater opportunities for code re-use.

CASE STUDY 12  EXPERIMENTING CHANGES THE DEVELOPMENT PROCESS

"40% Schedule & Effort reduction"
After experimenting with object-oriented technology the Regional Government Services group with TT Tieto Oy have implemented a working system to ensure take-up of new technologies through the rest of the group.

CASE STUDY 13  ADOPTION OF KNOWLEDGE MODELLING METHODOLOGY

"Using a methodology to gain ISO9001, wins new business"
By adopting a methodology to record knowledge elicited for the development of knowledge based software systems, the artificial intelligence section of Rolls-Royce and Associates have been able to achieve ISO9001 certification in an area without established methodologies. This has won them new contracts with their major customer.
Annexes

A. References

(1) Ensuring profitable investment in software process improvement. IBM. 1996.
(2) Software Engineering Practices in Europe 1995
(3) Best Practice in software development. Ovum. 1996.

B. Useful organisations

In examining your software processes you may find the following organisations of use, many organise conferences, seminars and workshops on a variety of related topics.

**ESSI: Software Best Practice**
The ESSI office
European Commission
DGHF F4 (N105 3/43), rue de la Loi 200, B-1049 Brussels
e-mail: essi@dg3.cec.be
fax: +32 2 296 83 64

**European Software Institute, Spain**
http://www.esi.es

**Software Engineering Institute (SEI), Carnegie Mellon University, US**
http://www.sei.cmu.edu

**Software Process Improvement Networks**
http://www.sei.cmu.edu/spins.html

**Bootstrap Institute**
Pasi Kuvaja +358 852 05 399
http://www.iol.ie/~iscn/homepages/bootstrap/index.html

**SPICE**
http://www.compita.co.uk

**European Software Process Improvement Foundation**
http://www.espi.co.uk
-44 (0) 1908 630500

**National Computer Societies**
British Computer Society (BCS) Software Process Improvement Network (UK)
Brian Chatters b w.chatters a man0523.wins.iel.co.uk
-44 (0) 161 230 5718
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  - Mr. E. Crivelli
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- Brüel & Kjaer
  - Mr. O. Vinter
  - Mr. K. S. Jorgensen
- RACE Asistencia
  - Mr. R. Calvo
- Informatique CDC
  - Mrs. E. Crespin
- VBI
  - Mr. Moller
- LMS International
  - Mr. T. Vanmunster
- TT Tieto Oy
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