The CMMI Model

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Agenda

- Why CMMI?
- What is CMMI?
- Where does it come from and fit into?
- How does it look like?
- What can you achieve?

Improved Schedule and Budget Predictability

Results: Boeing Effort Estimation

**Improved Cycle Time**

![Project Cycle Times Graph](chart)

Source: Software Engineering Div., Hill AFB, Published in Crosstalk May 1999

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**Increased Productivity and Quality**

![Productivity Rate and Quality Performance Graph](chart)

Productivity Increased By 80% As Error Rates Decreased

*For Software Programs*
Why Base Your Organization’s Process Improvement Success on the CMMI?

- First and foremost the emphasis is on developing processes and changing cultures to show a measurable benefit for the organization’s business objectives and vision.
- Provides a framework from which to organize and prioritize engineering, people, and business activities.
- Supports the coordination of multi-disciplined activities that may be required to successfully build a product or application.
- Adds “Engineering Systems Thinking” back into building systems.

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**Models**

- "All models are wrong, but some are useful."
  
  George Box

- Simplified approximations of reality that provide insight.

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**What is a CMM?**

- Capability Maturity Model:
  A reference model of mature practices in a specified discipline, used to assess a group's capability to perform that discipline

- CMMs differ by
  - Discipline (software, systems, acquisition, etc.)
  - Structure (staged versus continuous)
  - How Maturity is Defined (process improvement path)
  - How Capability is Defined (institutionalization)

**NOT:**
- It is not a ready-made scheme or template for describing processes
- It contains no methods for the processes
Bridging the Divide

- Systems engineering and software engineering processes are integrated.
- Integrates systems and software disciplines into one process improvement framework.
- CMMI-SE/SW/IPPD/SS, V1.1
  - Systems Engineering
  - Software Engineering
  - Integrated Product and Process Development
  - Supplier Sourcing
- Provides a framework for introducing new disciplines as needs arise.

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The CMM Explosion

- The first CMM (CMM v1.0) was developed for software and released in August 1991
- Based on this success and the demand from other interests CMMs were developed for other disciplines and functions
  - Systems Engineering
  - People
  - Integrated Product Development
  - Software Acquisition
  - Software Quality Assurance
  - Measurement
  - Others…….
**ISO 9001:2000 vs CMMI**

- **ISO 9001:2000**
  - No explicit requirements for
    - Institutionalization
    - Creating and maintaining organizational process assets
      - Organizational Measurement Repository
      - Database of good and best practices
    - Misses details for the following process areas
      - Organizational Training (Lvl 3)
      - Risk Management (Lvl 3)
      - Decision Analysis and Resolution (Lvl 3)
      - Organization Process Performance (Lvl 4)
      - Quantitative Project Management (Lvl 4)
      - Organization Innovation and Deployment (Lvl 5)
      - Causal Analysis (Lvl 5)

**The Support of CMMI to ISO 9001:2000**

- Organizations at the CMMI Maturity Level 3 will be ready for ISO 9001:2000 registration with minor adjustments
- Organizations registered as ISO 9001:2000 compliant will require additional effort to reach the CMMI Level 2 or 3
  - The CMMI path leverages the investment an organization may have in ISO 9001
  - Provides additional benefits especially in institutionalizing the engineering discipline
  - Takes an organization to the quantitative management level of process improvements
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Comparing Model Representations

Staged

...for an established set of process areas across an organization

Continuous

...for a single process area or a set of process areas (PA)
## Management Visibility by Maturity Level

<table>
<thead>
<tr>
<th>Level</th>
<th>Process Characteristics</th>
<th>Management Visibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optimizing</td>
<td>Focus is on continuous quantitative improvement</td>
<td>In-Out</td>
</tr>
<tr>
<td>Quantitatively Managed</td>
<td>Process is measured and controlled</td>
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</tr>
<tr>
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<td>Process is characterized for the organization and is proactive</td>
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Structure of the CMMI Staged Representation

Commitment to Perform: creates policies and secures sponsorship for process improvement efforts
Ability to Perform: ensures that the project and/or organization has the resources it needs to pursue process improvement
Directing Implementation: collects, measures, and analyzes data related to processes
Verification: verifies that the projects and/or organization’s activities conform to requirements, processes, and procedures

Common Features

- **Commitment to Perform**: creates policies and secures sponsorship for process improvement efforts
- **Ability to Perform**: ensures that the project and/or organization has the resources it needs to pursue process improvement
- **Directing Implementation**: collects, measures, and analyzes data related to processes
- **Verification**: verifies that the projects and/or organization’s activities conform to requirements, processes, and procedures
The Maturity Levels

1. Process unpredictable, poorly controlled and reactive
2. Process characterized for projects and is often reactive
3. Process characterized for the organization and is proactive
4. Process measured and controlled
5. Focus on process improvement

Optimizing
Quantitatively Managed
Defined
Managed
Performed

Process Areas by Maturity Level

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<td>5 Optimizing</td>
<td>Continuous process improvement</td>
<td>Organizational Innovation and Deployment, Causal Analysis and Resolution</td>
</tr>
<tr>
<td>4 Quantitatively Managed</td>
<td>Quantitative management</td>
<td>Organizational Process Performance, Quantitative Project Management</td>
</tr>
<tr>
<td>2 Managed</td>
<td>Basic project management</td>
<td>Requirements Management, Project Planning, Project Monitoring and Control, Supplier Agreement Management, Measurement and Analysis, Process and Product Quality Assurance, Configuration Management</td>
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<td>1 Performed</td>
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**Process Capability Prediction**

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<th>Process Characteristics</th>
<th>Predicted Performance</th>
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<td>Focus on continuous quantitative improvement</td>
<td>Focus on “fire prevention”; improvement anticipated and desired, and impacts assessed</td>
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<td>Process is measured and controlled</td>
<td>Sense of teamwork and inter-dependencies</td>
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<td>Process is characterized for the organization and is proactive</td>
<td>Increased reliance on defined process; investment in people and process as corporate assets</td>
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<td>Process is characterized for projects and is often reactive</td>
<td>Overreliance on experience of good people – when they go, the process goes</td>
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<td>Focus on “fire fighting”; effectiveness low – frustration high</td>
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### Risk Implications of Process Maturity

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For More Information About CMMI

Go to CMMI Website
- http://sei.cmu.edu/cmmi
- http://seir.sei.cmu.edu/seir/
- http://jo.sei.cmu.edu/pub/english.cgi/0/323123
- http://dtic.mil/ndia (first annual CMMI Conference)
- http://www.faa.gov/aio

Assistance for government organizations:
- SW-CMM v1.1 to CMMI v1.1 Mappings
- Software Technology Support Center
- http://www.stsc.hill.af.mil