Why Would You Want to Use a Capability Maturity Model?
Capability Maturity Models Are Based on 1 Primary Concept

It’s very difficult to consistently deliver quality products to your customers, while also making a profit, if your development process is poor.

Improve your process and you improve your product.
What is a Capability Maturity Model (CMM)?

1. Describes the essential discipline-unique and common management tasks that any organization must perform

2. Road map for achieving improved product quality and schedule predictability

3. Periodic measurement tool to periodically evaluate the capability of the organization’s processes
Can a CMM Help You?

- Is your company successful at learning from past mistakes?
- Are you confident in your ability to deliver a high quality product on time and within budget?
- Do you know if you’re spending your limited improvement resources effectively?
- Do you find that there is rarely enough time to do the task right the first time, but always time to do the task over again (and again)?
- Does everyone agree which problems within the organization are the highest priority issues that need to be fixed first?

Unless you’re exceptional, your answer to most of the questions is “NO” and a Capability Maturity Model can help you.
Achieving Higher CMM Levels Will...

- make your processes repeatable and the outcome more predictable (e.g., Motorola Transmission Products);
- increase product quality and decrease rework levels (e.g., Raytheon Equipment Division and Motorola Systems Solutions);
- transition company from operating in “fire-fighting” mode to “operating according to plan” (e.g., Hughes Fullerton);
- generate an average return on investment of 8:1 (Motorola University survey);
- provide you with a roadmap and data for improving your product development processes (SEI industry survey).
Past Success Stories
Motorola Transmission Products

When they started on CMM-based process improvement
- “It was impossible to measure quality before the product hit the field”
- “…having great difficulty predicting ship dates”
- “Fixing the modems … in customers’ hands was difficult and expensive and consumed engineering resources…”

What they found when they achieved Level 2
- “Today, we predict schedules within 15% from the baseline”
- “Quality has improved to the point where less than 2 field problems are reported each month”

Source: Jed Johnson, “How We Climbed to Maturity Level 2”, Application Development Trends, April 1994
Past Success Stories
Raytheon Equipment Division

The transition from Level 1 to Level 3 brought:

- $7.70 return on every dollar invested in process improvement
  - tracked project costs and allocated them into 4 categories:
    - performance (doing it the 1st time)
    - appraisal (testing the product)
    - rework (fixing defects)
    - prevention (preventing fault from getting into the product)
  - found rework levels dropped from 41% of project cost to 11%
  - $4.48 million savings over 6 projects in 1 year
- Significant increase in productivity
  - tracked 11 projects and estimated productivity over 2 year time period
  - found a 140% increase in productivity during the time period

Past Success Stories
Motorola Systems Solution Group

- Measured defects, productivity, cycle time at each CMM Level

Source: Paul Dickerson, “Motorola Quality Culture”, SPIN Meeting, Sept. 1998
Past Success Stories
Hughes Fullerton

The transition between Level 2 and Level 3 brought:

- $2 Million annual net cost savings
  » reduced a 6% average cost overrun to 3% average
  » “...first-year benefits are 5 times the total improvement expenditures”

- Stabilized work environment
  » “...has seen fewer overtime hours, fewer gut-wrenching problems to deal with each day, and a more stable work environment”

- Improved morale and a coherent culture
  » “...the common culture helped foster an esprit de corps that reinforced team performance”

- “The only ones questioning the value of level 2 are those that have not achieved it”

Past Success Stories
“The Value of Software Improvement”

Results summarized by Karl Williams (Motorola University) in “The Value of Software Improvement”

- 11 countries
- 176 groups
- Overtime down 20X
- Released defects down 20X
- Cycle time improved 2X
- Productivity up 3.4X
- Development costs down 3X
- Schedule and cost overruns down more than 100X
- Return on investment from 16X to 4X: average is 8X

Source: Karl Williams, “The Value of Software Improvement”, SPIRE97, June 1997
Past Success Stories
SEI Industry Survey

- Software Engineering Institute surveyed 167 people representing 61 assessments.
- 86% of those surveyed believed the CMM provides a valuable improvement roadmap.

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<thead>
<tr>
<th></th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
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<tbody>
<tr>
<td>Schedule</td>
<td>40</td>
<td>58</td>
<td>80</td>
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<tr>
<td>Budget</td>
<td>40</td>
<td>58</td>
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<tr>
<td>Product quality</td>
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<tr>
<td>Productivity</td>
<td>58</td>
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<td>Customer satisfaction</td>
<td>80</td>
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<td>100</td>
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<td>Employee morale</td>
<td>25</td>
<td>50</td>
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% of people working for companies at a specific CMM level that believed their performance in that category was either “good” or “excellent”.
Number of Commercial Companies Adopting CMMS Continues to Grow

- Commercial/In-house: 43.4%
- DoD/Fed Contractor: 33.0%
- Military/Federal: 19.4%
- Other/Unknown: 4.2%

Based on 542 organizations SW-CMM Assessments

Source: Carnegie Mellon University/Software Engineering Institute- The Evidence for CMM-based Software Process Improvement - SEMA.5.97

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How Can CMMs be Used?

1. **Guidance**
   - develop documented or undocumented processes

2. **Measurement**
   - benchmark
   - baseline an organization
   - measure improvement

3. **Prioritization**
   - prioritize initiatives using assessment data and/or levels

4. **Risk Reduction**
   - a criteria in source selection
Applicable Regardless of Status in Improvement Lifecycle

- **Companies with limited to no experience in a specific discipline:**
  - develop processes
  - establish a common understanding of the discipline within the company

- **Companies with defined processes:**
  - evaluate the strengths and weaknesses of existing process
  - evaluate level of deployment of defined processes within the company
  - use as a basis for improving the defined process

- **Companies well within the process improvement cycle:**
  - periodic metric to evaluate the effectiveness of process improvement efforts
  - tool for linking process improvement to company strategic goals
5 Steps to Improved Product Development

Each level is designed to lay the foundation for the next and achieve incremental change and learning

Level 1
“Do-It”: Ad Hoc, no control

Level 2
Getting order locally; capturing and sharing project cost, schedule, & performance data; experimenting and learning from programs

Level 3
Documenting and sharing the best from the program learning across the organization

Level 4
Capturing quantifiable process performance data

Level 5
Using that data to improve
Don’t Wait Until Level 5 For Improvement!

Level 5
Quantitative quality goals for processes based on statistical data at level 4

Level 4
Statistical data on performance of processes, quantitative quality goals for all products

Level 3
Organization wide process performance goals and metrics

Level 2
Project performance data => cost & schedule

Level 1
Gut feel, no real data

Improvement happens at all levels - data that forms the basis of improvement becomes more accurate & sophisticated
Two Primary CMMs Being Used by Industry

- **Software Capability Maturity Model (SW-CMM)**
  - Developed by the Software Engineering Institute
  - Includes the elements necessary for effective software development to be practiced within the organization
  - Generates a single number rating (i.e. “Level 2” or “Level 3”)

- **Systems Engineering Capability Maturity Model (SE-CMM)**
  - Developed by an industrial collaboration
  - Includes the elements necessary for effective systems engineering to be practiced within the organization
  - Generates a rating profile (18 number score)
At First the SE-CMM and SW-CMM Seem Very Different...

Result of an SW-CMM Assessment

“Level 2”

Result of an SE-CMM Assessment
...But The Models Are More Similar Than They Appear

**SW-CMM**

The common management practices - the “what you have to do to get from one CMM level to the next” are commingled with the software unique content

Any Level is defined by Key Process Areas

Tasks in all Key Process Areas are organized into categories- software unique (Activities) and common management categories (Commitment, Abilities, Measurement, Verification)

**SE-CMM**

The common management practices - the “what you have to do to get from one CMM level to the next” are separated from the systems engineering unique content

Although tasks have been rearranged, and the software unique tasks have been replaced by systems engineering - there is no other difference between the 2 models.
...Now What Does That Mean to Me?

- Whether you plan on using the Software or Systems Engineering CMM the “past success stories” are applicable

- This is because the common management practices - (i.e. what defines each CMM Level and what makes a CMM a CMM) - are the same in both models
Formed to help companies improve their product development processes using Capability Maturity Models as a primary tool.

SECAT LLC principles are authors of CMMs, including the Systems Engineering CMM and Integrated Product Development CMM.

Offering CMM training, assessments, process improvement guidance and supporting products such as “Pocket Guides”.

SECAT LLC operates internationally, providing services for customers that include Motorola, NCR, Eastman Kodak, Defense Logistics Agency, Hughes, TRW, Northrop Grumman, Thomson CSF, and Computing Devices Canada.
More Information or Obtaining CMM Products

- For more on CMMs, assessments, etc. contact SECAT LLC at
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- To see a list of companies that have published their Software CMM score:
  - http://www.sei.cmu.edu/sema/pub_ml.html