

Navigating the Turbulent Waters of Off-Shore Software Development – The First Twelve Years

COMPSAC 2004
– Session 16 –
Panel on Computer
Supported Cooperative Work
in Software Engineering

Stephen Chen
Senior Director, Systems
Engineering and Systems
Integration Division
Global Software Group
stephen.chen@motorola.com

MOTOROLA and the Stylized M Logo are registered in the US Patent & Trademark Office. All other product or service names are the property of their respective owners. © Motorola, Inc. 2003.



Questions?

- **Does internal outsourcing create issues different from that of external outsourcing?**
- **Are there issues of cooperation between US-based employees and their offshore counterparts?**
- **What are the “real” costs of outsourcing when project management, out-of-hours meetings, offshore travel, and telecommunications are considered? And can CSCW tools help?**
- **What CSCW lessons have been learned?**

Formation of Motorola India Electronics, Ltd. (MIEL)

- Formed in 1991 to be a SEI CMM Level 5 organization
- Major drivers were:
 - attractive cost structure
 - availability of software talent
 - benign governmental policies
- Achieved goal of being the world's first software organization assessed at Level 5 in November, 1993
- As of August, 2001, with 1018 organizations reporting to SEI, 49 were assessed at Level 5



Original Bangalore, India facility
Opened in October 1992



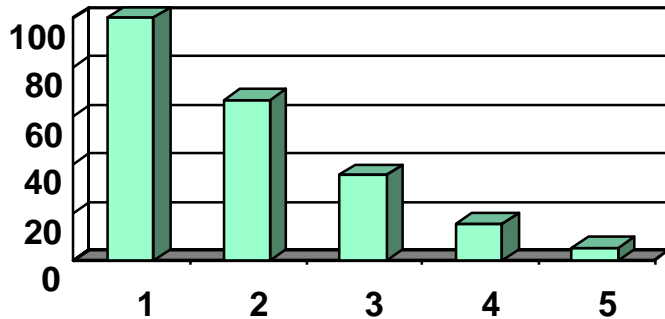
New Bangalore, India facility
Opened in March 2004

Why is SEI Important?

Proven Industry Benefits

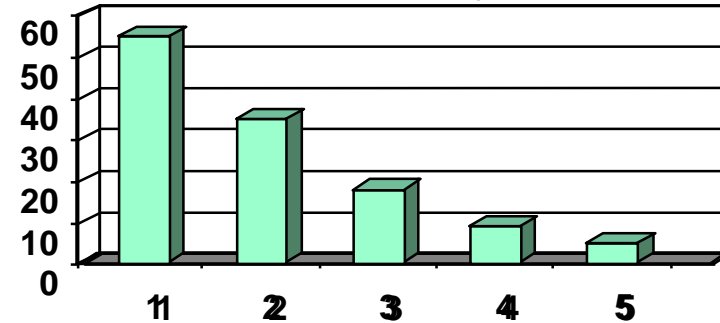
Quality:

Relative Defects After Release



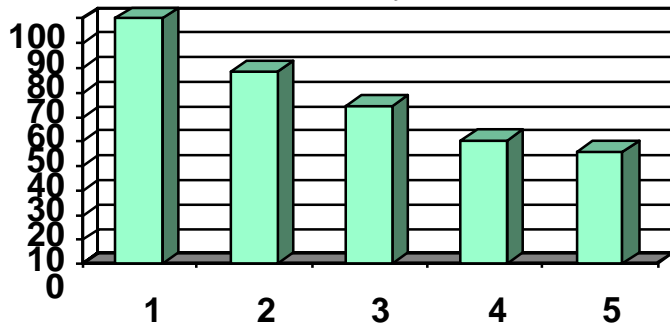
Decreased Cost of Poor Quality:

Relative % of Development Effort



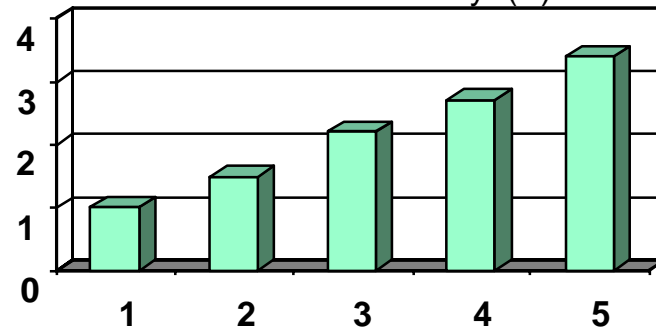
Reduced Cycle Time:

Relative Cycle Time



Increased Productivity:

Relative Productivity (X)



SEI CMM® Process Maturity Levels

SEI CMM® Process Maturity Levels

Early Experiences

- **Difficult to convince existing software engineering teams to identify work for MIEL**
- **US on-site engineers were often required**
- **Eventually, trust was established**
- **Early assignments were mainly in the areas of testing and low-level coding**
- **Quality of English communication skills (written and oral) is a critical factor in acceptance by US engineers**
- **Data communications and common software configuration, development, and testing tools were issues**

RISK

- **Time Zones & Physical Distances**
 - Customs & cultures
 - Language
- **Tool Vendor Support**
 - Multi-country licenses
 - Multi-country customer support

MITIGATION

- **Create virtual environment**
 - high speed telecommunications for voice, data, video
 - “double-shift” development and testing
 - Weekly conference calls
 - Initial visit to remote site by local managers
 - Initial use of on-site engineers
- **Renegotiate global contracts with vendors**

RISK

- **Government Issues**
 - Immigration (US side)
 - Customs
 - Import/export restrictions
- **Tools**
 - Configuration management
 - MR management
- **Process**
 - Differing SEI levels
 - Reuse
 - Architecture
 - Testing & Integration

MITIGATION

- **Planning**
 - Visas (H and J)
 - Use of local expeditors
 - Complex issues
- **Agree to a single site for configuration control, builds, problem tracking**
- **Use of tools for requirements definition, systems modeling, code generation, generation of test suites**

RISK

- **Organizational issues**
 - Budget
 - Loss of local control

- **Local developers' skepticism**

MITIGATION

- **Forcing the issues**
 - Use of software estimation tools
 - Full-time liaison people on both sides
 - Face-to-face meetings

- **On-site assignments, travel, more communications, successful results**

Questions?

- **Does internal outsourcing create issues different from that of external outsourcing?**
 - IP is no longer an issue, however, care must be taken due to US import/export restrictions
 - US job loss concerns remain
- **Are there issues of cooperation between US-based employees and their offshore counterparts?**
 - Yes, especially if the corporate hierarchy is used as a “stick”
 - No, if the outsourcing frees up US resources to work on next generation products

Questions (cont'd)?

- **What are the “real” costs of outsourcing when project management, out-of-hours meetings, offshore travel, and telecommunications are considered? And can CSCW tools help?**
 - GSG has done extensive studies to quantify these costs and determined that the “increased costs” are due more to cost of software quality processes (eg walkthroughs, design reviews, more thorough documentation,...) than those associated with remote development
 - Efforts are underway to reduce these costs
 - CSCW tools are a small cost factor relative to the whole
- **What CSCW lessons have been learned?**
 - Netmeeting plus conference bridge is key tool for global meetings
 - In-house document collaboration tool lags commercial tools but is “good enough”
 - High correlation of cooperation when teams can meet face to face especially at project commencement

Results

- **MIEL has grown from 10 engineers to over 1500**
- **GSG now has over 4000 software engineers in locations in 12 countries with 80% in organizations assessed at SEI CMM Level 4/5**
- **GSG is involved in every major software project in Motorola delivering over 300 projects annually with virtually no defects and 95% on-time delivery**
 - Embedded systems
 - Real-time
 - Wireless telephony
 - Internet
 - Tools

Measurements

GSG Improvements from SEI*

Attribute	1993	1995	2001	Industry Average
Delivered Quality Level	++	++	+++	4.3 σ
Cost of Poor Quality	-	--	---	40%
Relative Productivity	+	++	+++	1X
Cycle Time Improvement	>2X	>4X	>5X	N/A

* As of year-end 2001, 70% of GSG's population was at SEI Level 5 and 11% was at Level 4, vs. 10% industry total SEI Level 4 & 5's.

Backup

What is SEI Software?

- **Software Engineering Institute (SEI)**
 - Founded in 1984 by US Department of Defense (DoD) and located at Carnegie-Mellon University in Pittsburgh
 - DoD alarmed at poor quality of third-party software systems
 - Charter was to
 - Establish standards of excellence for software engineering
 - Accelerate the transition of advanced technology and methods into practice
- **Initial project was to**
 - Provide a way to characterize the capabilities of software development organizations
 - Provide guidance on how to establish and improve software development processes
- **The result was the *Capability Maturity Model (CMM)***

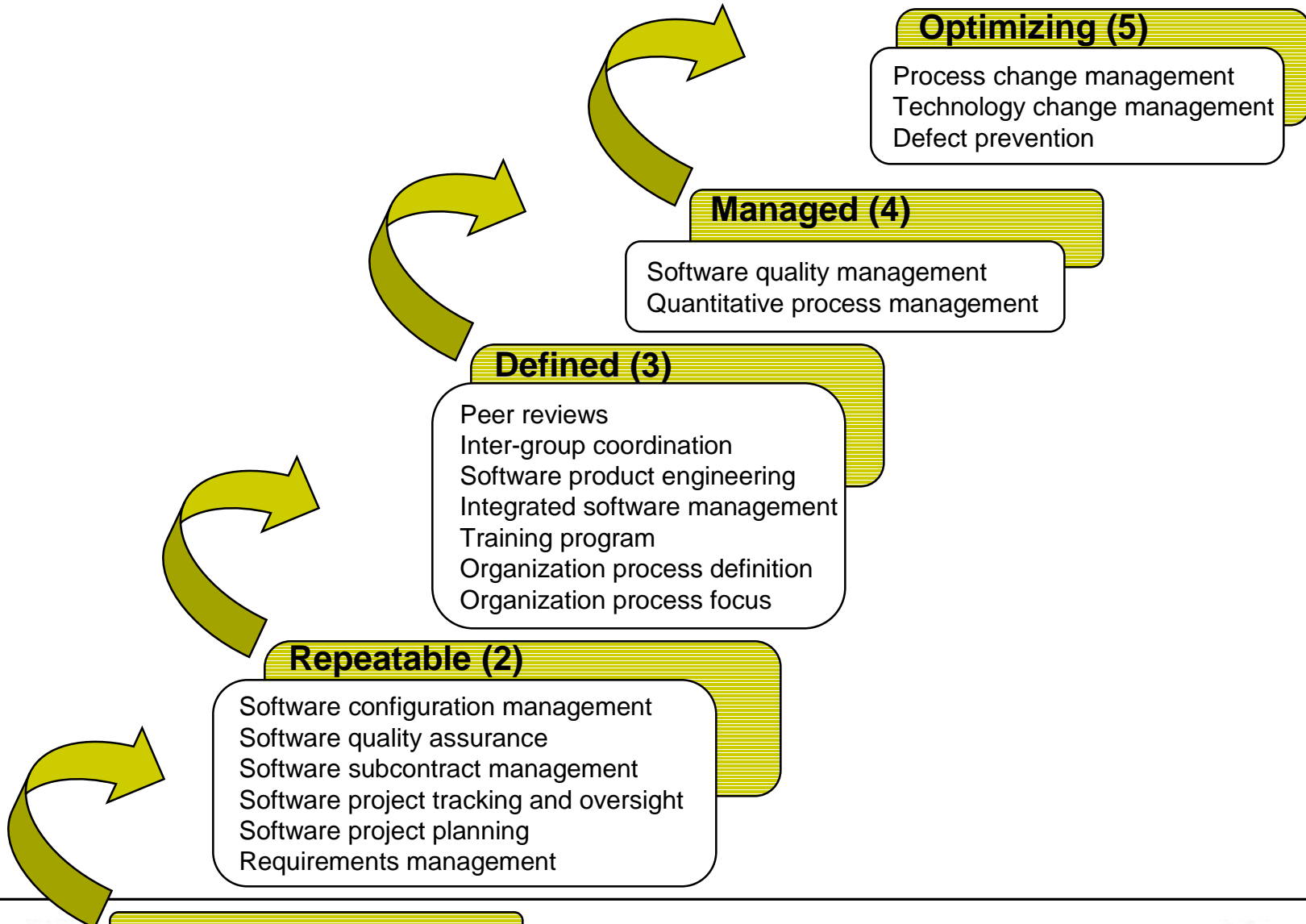
Software Engineering Institute - Capability Maturity Model

Maturity Levels

The CMM

- **Recommends practices in multiple *key process areas (KPA)***
 - KPAs enhance software development and maintenance capability
 - KPAs assume that process improvement is evolutionary rather than revolutionary
- **Consists of five nested maturity levels:**
 - ***Initial*** - No standard way of doing anything, few management controls of any kind
 - ***Repeatable*** - Management tracks cost, schedule, and functionality; a stable process has emerged, but is not yet formally defined
 - ***Defined*** - A software process is formally defined and used
 - ***Managed*** - The software process and its products are measured and controlled
 - ***Optimizing*** - The process is continuously improved

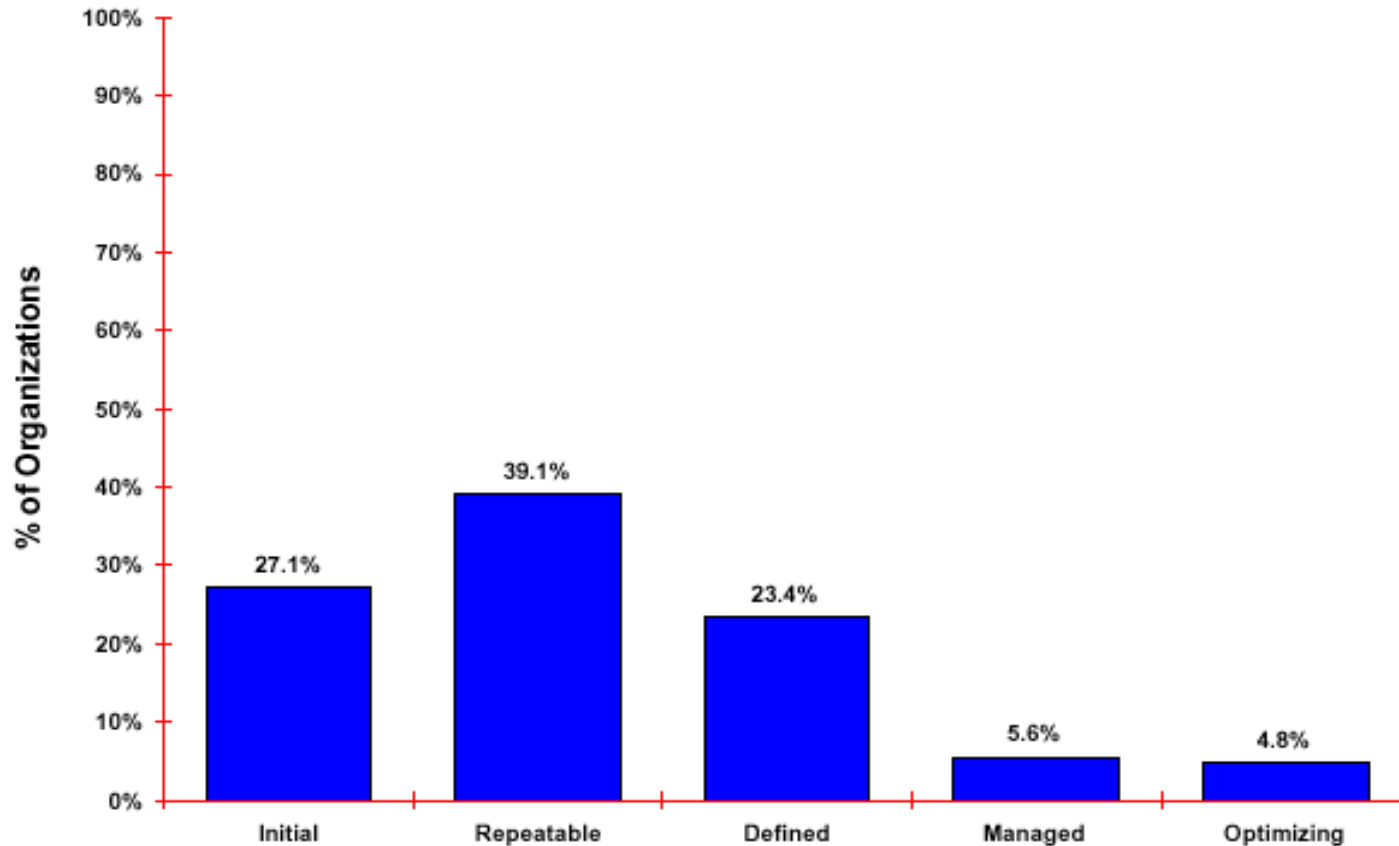
Key Process Areas by Maturity Level





Organization Maturity Profile

August 2001



Based on most recent assessment, since 1997, of 1018 organizations.