



Quark: A Dynamic SDLC Methodology

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National Superconducting Cyclotron Laboratory, East Lansing, Michigan, USA. "If you can't describe what you are doing as a process, you don't know what you're doing. -Deming" **Overview**

Background

- Software Crisis
- SDLC Models
- NSCL EE Department Requirements
- The Quark Software Process Model
- Implementation
- Results
- Conclusion





"You can always tell a physicist, but you can't tell him much."

NSCL Requirements

- Transparent
- Predictive
- Un-bureaucratic
- Low Overhead
- Minimal Customer Interaction
- Must Not Stifle Creativity





"Real programmers can write assembly code in any language. -Larry Wall"

Software Crisis

- Software Crisis
 - Software Projects Behind Schedule
 - Over Budget
 - Low Quality
 - Difficult to Maintain
 - Inefficient
- Software Process Models, SDLC Methodologies
 - Waterfall, V-Model, Spiral, RUP, Agile (Scrum, XP, FDD, DSDM etc)
- Frameworks
 - CMMI, ISO 9000-3, PMBOK
- Quality Management Systems
 - TQM, Six Sigma, Lean Software Development





"We adore chaos because we love to produce order. -M. C. Escher"

Software Engineering

- Four Decades and Still No Light
- Software Development: Art, Science, or Black Magic?
- Engineering Discipline Futile for Software Development?
- Humainst Management
- Multi-disciplinary: Psychology, Sociology, Organizational Theory
- Creativity vs Efficiency
- Chaos and Creativity
- Predictive vs Adaptive





"Three virtues of a programmer: laziness, impatience, and hubris. -Larry Wall."

SDLC Model Selection

	Waterfall	RUP	Agile	V-Model
Requirements Volatility	Low	High	High	Low
Requirements Clarity	High	Medium	Low	High
Development	Custom	Custom	Custom/Product	Custom/Product
Customer Availability	Low	High	High	Low
Criticality	Low	High	Medium	Medium
Complexity	Low	High	High	Medium
Size	Low	High	Medium	Medium
Customer Involvement	Low	High	High	Low



"All science is either physics or stamp collecting. -Ernest Rutherford."

Quark Model: Elements

- Iterations
 - Parameterized: Quark Parameters (QMPs)
- Projects
 - Qualified: Project Characteristics (PCTs)
- Project Management
 - Integrated





"Remember that there is no code faster than no code."

Quark Model: QMPs

- Duration
- Change Control Specification
- Planning Detail
- Documentation Detail
- Communication
- Quality Control





"Brooks Law: Adding manpower to a late software project makes it later!"

Quark Model: Static PCTs

- Safety and Security Requirements
- Quality Requirements
- Timeline Constraints
- Customer Availability
- Bespoke or off-the-shelf
- Contract Type
- Team Location





"Brooks Law: Adding manpower to a late software project makes it later!"

Quark Model: Dynamic PCTs

- Requirements Clarity
- Customer Requirements Clarity
- Size
- Technology Expertise
- Complexity
- Estimate Confidence Level





"The perfect project plan is possible if one first documents a list of all the unknowns." Quark Model







"If at first you don't succeed, call it version 1.0"

Development Process







"You cannot teach beginners top-down programming, because they don't know which end is up. -Hoare."

Development Process

- Refine Requirements and Architecture
- Plan for iteration or release (PFI)
- Refine design and test plans
- Code, Refactor, Unit Test (CRUT)
- Release
- Deploy and Test
- Review
- Perform User Acceptance Test (UAT)





"I have always found that plans are useless, but planning is indispensable -Eisenhower."

PM Processes







"Wirth's law: Software gets slower faster than hardware gets faster."

Performance Measurement

- Earned Value Management (EVM)
- Planned Value (PV): Work Scheduled
- Earned Value (EV): Work Completed
- Actual Cost (AC): Cost Incurred
- Cost Performance Index (CPI) = EV/AC
- Schedule Performance Index (SPI) = EV/PV
- Performance Measured Periodically (Weekly)





"If the code and the comments disagree, then both are probably wrong."

Documentation

- Refined Iteratively
- QMPs Dictate the Detail Level
- SRS and AD Kept in Sync with CRUT of Last Iteration
- Essential Documents
 - Requirement Specifications, Architecture Document
 - Installation Manual, Release Notes, User Manual
 - Project Plan, Project Closure Report





"In theory, there is no difference between theory and practice. But, in practice, there is."

Implemenation: SPI

• Software Process Infrastructure (SPI)

Policies

Procedures

Guidelines, Checklists, Templates, Standards





"Nine people can't make a baby in a month. - Brooks"

Implementation

- Quark SPI
 - Hosted on the Web
 - Policies Based on CMMI-Dev 1.2
 - Procedures Based on QM, PMBOK-4
 - Templates

LEMA

Project Plan, SRS, AD, PSR, EVM, PQM, PCR





"Better train people and risk they leave - than do nothing and risk they stay."

Preliminary Results

- All Projects In EE Department Must Follow QM
- PM Processes Being Utilized By Other Groups
- First Software Projects:
 - Channel Access Protocol on Rabbit CoreModule
 - LINAC Emittance Measurement Application (LEMA)
- Currently 5 Software And About 15 Hardware Projects Using QM





"Simplicity is prerequisite for reliability. -Edsger W.Dijkstra."

Results: LEMA

- Under Budget
- Slight Schedule Slippage Due to Customer Surveys
- Customer Satisfaction Survey: 8.4/9





"For every complex problem there is an answer that is clear, simple, and wrong."

Silver Bullet?

- Have We Killed The Beast?
- Too Early to Say?
- Far From It....
- Subjective Measurement Of QMPs And PCTs
- EVM May Not Be Suitable For All Types Of Projects
- Heavier-weight Model (Due To PM)





"The software isn't finished until the last user is dead."

Conclusions

- In Less Than a Year We Have Moved From Almost No Processes to Mature Processes
- Quark's Processes Are Fairly Generic
- Still Being Evaluated
- Resource Utilization
- Current Work
 - Objective Measurement Of PCTs And QMPs
 - EVM For QM
 - Tailoring Integration
 - Requirements Traceability
 - Project/Release Performance





"Software and cathedrals are much the same - first we build them, then we pray."



