

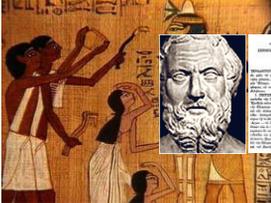
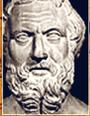
Realizing the Dream

Building and Deploying a Re-Usable Requirements Library

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What do these people have in common?


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The Power of Documentation

2500 Years after Herodotus documented the Procedure for Mummification, 2 Scientists used that documentation to faithfully recreate a Mummy.

- Ronn Wade (left), the Director of Anatomical Services at the University of Maryland Medical School in Baltimore.
- Bob Brier (right), an Egyptologist at the C. W. Post Campus of Long Island University.



<http://imhqp.net/2011/10/28/egypt-in-the-news/mumab-a-modern-day-ancient-egyptian-mummy-and-what-he-has-taught-us-so-far/>

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Some Facts

- Ancient Egyptian Culture was dominant for approximately 2500 years -- *think about it...*
- The Priest Class represented a successful, viable organization during most of this time - They *documented and retained* their most valuable organizational skill during the entire period.
- The Modern team *successfully* recreated a mummification process *from source documentation* published 2454 years ago.
- Could your company successfully recreate one of your processes from your source documentation published 2454 days ago? (about 6 years, 8 months).*

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A Question...

Hmm... Could I re-design a Printer from 2010 from our own company's documentation?



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What is "Re-Use"?

- This term means different things to different people
 - Clarify the definition today
- Transfer of product requirements and designs across projects and product variants within an organization
 - Leverage mature system designs over-and-over again in product lines, similar systems or variants
 - Accommodate variations in design or application
- Transfer of common design information from one project to another or between product variants, for instance:
 - Use or application
 - Requirements
 - Behavior
 - Test descriptions

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Two Types of Re-Use

- Re-use of "Common" requirements and design
 - Many organizations include "common" elements
 - Common requirements ← Today's focus
 - Common architectures
 - Common processes
- Element Re-Use
 - Product Variants ← Today's focus
 - Re-usable 'components'
 - Product Lines

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Where does re-usable content typically reside?

- Engineer knows where data resides
- Engineer knows how to read data
- Engineer can find "golden nuggets"
- Engineer's brain:
 - Incorporates experience informing future decisions
 - Acts as a body of knowledge
 - Acts as a search engine
 - Acts as a repository of implications and rationale

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Our History of Re-Use Libraries

- Foundational thinking in 1990s
- Developed Re-Usability approach - Mid 2000s
 - Commonality Assessment Process (CAP)
 - Started with Re-Usable Requirements (presented here)
 - Published/Presented first paper 2005
- Developed and deployed multiple libraries:
 - US Army
 - NASA
 - Commercial
 - Measured ROI
- Expanded re-usability approach to MBSE
 - Published/Presented Model-Based Re-Usable Elements (MBREs)
 - Incorporated Re-Use libraries into MBSE Tool

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Characteristics of a Re-Use Library

- A Re-use library transforms individual *tribal* knowledge into *organizational* knowledge
 - Corporate or Organizational Asset
- A Re-use library contains requirements, analysis, design, and verification information common to the organization's products
 - Product Lines / Variants
 - Requirements / Verification Methods
- Searchable, Filtered sets
- Built-in Training / Use instructions
- Information is enabled by model-based systems engineering
 - Performing engineering from re-usable elements an/or
 - Platform for retaining re-use library
 - Design repository or product data management system.

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Back to the Printer question...

- Printer Company:
 - Black and White Printers
 - Color Printers
 - Print 2-sided pages
 - Print Photos
 - Scale Pages
 - Faster Print Times
 - Hundred other Printer Features

Why?
Documentation tends to be a point solution.
Geared toward a single Project

- BUT, the engineers still spend all day designing printers.

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Steps to Building Re-Usable Requirements

- Perform Commonality Assessment
- Assess Engineering Artifacts
 - System Requirements
 - System Design
 - Subsystem Requirements/Design
 - Verification Test Cases
 - Validation Test Scripts
- Choose Re-Use Library Repository
- Engineer Common Artifacts
- Build Re-Use Library Repository

Re-Use Libraries are a general solution.
A separate project

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Bang for the Buck

- Commonality among Product Lines.
- Universally Applicable Requirements.
- Selectively Applicable Requirements.
- Library User Interface and Instructions.
- ROI.

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Secret 1: Finding Commonality

Universally Applicable Requirements

- Re-Use Library's First Secret: Finding Commonality among Product Lines
 - 20%-70% of a product line's requirements are common.
 - Non-Functional
 - Selective Function, Interface and Performance
- Universally Applicable Requirements
 - Standard Behavior
 - Standard Architecture
 - Standard Interfaces
 - Regulatory Requirements
 - Best Practices

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Secret 2: Ease of Use Re-Usable Requirements Library

- The harsh reality of any tool is that if it is not sufficiently easy to use, it will become shelfware.
- Re-Use Library's second secret for a successful deployment - Assure the requirements:
 - Are easy to access
 - Are pertinent to the developer
 - Can generate requirements products (such as specifications) that the developers can use
 - Have impossible-to-miss, easily-accessible on-line training

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Secret 3: The Library Deserves Attention Building the Re-Usable Database

- Third and Final Secret:
 - Building such an *Organizational Asset cannot be done as a "sidebar" to a production development effort.*
 - A Library *must* be built as a project in its own right.
 - The *Organizational Knowledge* needed to build a re-useable requirements database *is different from* building a point-solution RM Db during a Product development lifecycle.

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Re-Use Library: Deployment Insights

- Generate baseline specifications from the library
- Support common templates to socialize use
- Traceability back to the source material used to generate the Common Requirements
- Include fields for storing requirements *Analysis*

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Return on Investment Calculations Requirements Library

- Extracted from other Author's presentation
- Common Requirements Measurement

\$3.28 project savings for every \$1.00 invested

Paper captures summary ROI Analysis

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Benefits of Re-Use Libraries

Management Benefits

- Investment in Employees is not lost as they Retire
 - Saving and Re-Using Core Knowledge and Experience
 - Isolated experts no longer represent a bottleneck
- Replaces **Tribal Knowledge** with **Organizational Knowledge**
- Catapults Future Development Ahead of Schedule

Technical Benefits

- Assures **Completeness** and **Consistency** of Design
- Quicker, higher quality development of variants.
- Project Requirements, Design and Tests can be re-used on other Projects
- Traces and Documents Engineered Product Artifacts
- Specifications reflect collective knowledge

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Paper available upon request

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