HOW WE STAND NOW

• OK For Small Projects, Not So Good For Large Projects
• Not Good For Addressing Iterative Nature Of Requirements Resolution & Implementation (Mostly Based On Waterfall)
• Does Not Address Complexity Issues Of Requirements Stabilization (Based On Functional Decomposition)
• Does Not Explicitly Address Reuse Opportunities
• Does Not Help With People Shortages

NEED TO DEFINE AND AUTOMATE IMPROVED SOFTWARE ENGINEERING PROCESSES
Reuse Library Parts Are Used To Generate Good Approximations To Desired Solutions, i.e., Prototypes

Rapid Prototype Composition Implies Use Of Pre-existent Parts, I.E., Reusable Parts

- Prototype Quality Depends On Fit Of The Available Parts
- The Parts Will Often Require Some Adaptation
- As The Set of Parts Available Becomes Richer The Prototypes Will Better Approximate Acceptable Pieces of Final Systems
Big Gains In Productivity Will Come From Reusing Fewer Larger Parts Or Assemblies Of Smaller Parts, Not From Many Unassembled Small Parts.

Productivity Gain vs Cost Is Acceptable If Assemblies Of Parts Are Reused Frequently.
SYNTHESIS MOTIVATED BY AND ORIENTED TOWARD

- Reuse: Exploit Similarities Across Systems
- Iteration: Feedback and Enhancement
- Composition and Adaptation: Using Standard Schemes, Parts, and Designs
- Specialists: Incorporate Expertise, and Facilitating and Coordinating
- Systems View: Engineering Process
- Applying Synthesis to "Synthesizer"
THREE MAJOR SYNTHESIS SUBPROCESSES

Domain Analysis

Application System Modeling Toolset

Domain Independent Toolsets

Reuse Libraries

Project Library & Work Areas

Scavenging or Re-Engineering

System Development & Evolution

Reusable Work Products
Single System Work Products
Developed Toolset

SOFTWARE PRODUCTIVITY CONSORTIUM
TARGET APPLICATIONS FOR
DOMAIN ANALYSIS -
AIRPLANE EXAMPLE

Systems

Avionics
- Instrumentation
- Navigation
- Communications

Sensors
- Radar
- IR EO
- Laser

Electronic Warfare System
- ESM/ELINT
- ECM
- TWS

Command & Control System
- Fire Control System

Subsystems

Assemblies

- Processor
- Flight Instrument
- Engine Instrument
- NAV Radio Receiver
- Inertial Navigation
- Processor
- Flight Data Sensor
- Intercom
- Transmitter
- Receiver
- Antenna

- Transmitter
- Receiver
- Antenna
- Signal Processor
- Control Processor
- Display
- Detector
- Signal Processor
- Display
- Designator
- Detector
- Signal Processor
- Display

- Receiver
- Antenna
- Signal Processor
- Control Processor
- Antenna
- Transmitter
- Signal Processor
- Control Processor
- Antenna
- Receiver
- Signal Processor
- Control Processor
- Display

SOFTWARE
PRODUCTIVITY
CONSORTIUM
ESSENCE OF DOMAIN ANALYSIS

- Each application area must be analyzed and characterized by standard *designs* or *architectures* that capture the way that many systems in that area could reasonably be built.

- The application engineer must be able to state his needs in application terms and have those needs mapped appropriately to an instance of the standard design.

- The design instance can be realized by specification of a set of parts from a reuse library and a set of rules for combining those parts.
SYNTHESIS SUBPROCESS – SCAVENGING

- Many systems with software have portions amenable to adaptation for reuse.
- Scavenging these systems for reusable parts involves:
  - Extraction
  - Generalization
  - Standardization
  - Certification
  - Cataloging and storing in reuse libraries.
A MISSILE GUIDANCE SYNTHESIS PROTOTYPE TOOL

An example of the application of reuse, prototyping, and synthesis using a reuse library in a specific domain

- Based on U.S. Air Force "Common Ada Missile Packages" (CAMP) parts
- Initially demonstrates a longitudinal autopilot control system
- Aids understanding of the economics of reuse
PARTS OF SYNTHESIS/SYNTHESIZER

User Interface Services

Domain Analysis

Reuse Libraries

Application System Modeling Toolset

Domain Independent Design Dynamics Assessment
Composition Traceability
Coding Verification
Management & Coordination OA and Documentation

System Development & Evolution

Scavenging

Project Library & Work Areas

SOFTWARE PRODUCTIVITY CONSORTIUM
A METHODOLOGY FOR PARTS SPECIFICATION AND MODEL ASSEMBLY IS EVOLVING

- Based On NRL Software Cost Reduction Methodology
  - Information Hiding Module Families
  - Abstract Interfaces

- Accommodates Ada Packaging And Tasking Concepts
  - Tasking Guidelines Evolved (ADARTS)

- Initial Guidebooks Written And In Use
UIS ARCHITECTURE

Tool

User Interface Code

Computation Code

Widget Instantiation Calls

Tool Computation Callbacks

User Interface services

Ada Bindings

HP Widgets

SPC Widgets

X Toolkit

X Library

X Protocol Network Messages

X Display Server

(or Integrated Server for X and Native Window System)

X Window System
THE LAYERED REPOSITORY CONCEPT

ONE FOR EACH MEMBER COMPANY NETWORK LOCATION

ONE FOR EACH PROJECT

ONE OR MORE FOR EACH DATABASE LOCATION

CREATED BASED ON PROJECT NEEDS

INCLUDED BASED ON PROJECT NEEDS (COLLECTIONS CAN CONTAIN DATA OBJECTS AND/OR OTHER COLLECTIONS)

ACTUAL DATA OBJECTS.

INCLUDES BOTH RDBMS STORAGE AND COTS CM STORAGE

DISTRIBUTED DATA LEVEL

INDIVIDUAL DATABASE LOCATION LEVEL

OBJECT LEVEL

REPOSITORY

PROJECT LIBRARY

PARTITION

COLLECTION

OBJECT
TYPICAL PROJECT LIBRARY ACCESS

APPLICATIONS CODE
- DESIGN TOOL
- ASSESSMENT TOOL
- TRACEABILITY
- HARNESS TOOLS
- MC DEVELOPED TOOLS

TYPICAL COMMANDS
DATA OBJECT RELATED
- CREATE DATA OBJECT
- DELETE DATA OBJECT
- CHECK OUT DATA OBJECT BODY
- CHECK IN DATA OBJECT BODY
- GET ATTRIBUTE
- SET ATTRIBUTE
- GET CONTENTS LIST

RELATIONSHIP RELATED
- CREATE RELATIONSHIP
- DELETE RELATIONSHIP
- GET ATTRIBUTE
- SET ATTRIBUTE

UNIQUE ID RELATED
- PATHNAME TO UID
- RELATIONSHIP TO UID

QUERY RELATED
- FETCH BY ATTRIBUTE VALUE
- GET RELATIONSHIP TYPES
- GET RELATIONSHIPS

DMS CODE

COTS PRODUCTS

TOOL K

DAS/DMS

RDBMS

ATTRIBUTES
RELATIONSHIPS

DYNAMIC SQL INTERFACE

TAILORED CODE INTERFACE

COTS CM

OBJECT BODIES
**Requirements objects in /xyz/abc/def/jkl**

Subset: date > 880325, owner = Johnson

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**Traceability Navigator**

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**Trace Relationships**

Tracing from requirements objects in NAV window 1

- specify relationship type(s)
  - tested by
  - implemented by
  - derived from
  - described in
  - similar

specify scope of tracing

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IV23_CCMS
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**Software Development**

**Traceability Navigator**

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**Software Development**
IMPACT ANALYSIS TOOLSET OVERVIEW

Modification Request → Person → Initial Impact Set → Impact Analysis Tool → Estimated Impact Set

OBJECT CHANGE LIST:
List of impacted objects to examine

Verify that person inspected/changed all objects in the change list

Yes → Perform Change?

No → Forget it!

Impacts on Project Schedule

Manager/Config. Control Bd.
CANDIDATE USER INTERFACE FOR RLT

X-WINdow System

Tool Display Windows

Types of Life Cycle Objects
- Documentation
- Source Code
- Requirements
- Design
- Executable code
- Miscellaneous

LCO Information Display
- General Attributes
  - Part ID: 1087
  - Name: OFF Structure
  - Description: The F15 OFF structure
- Relationships

Selection Criteria
- Classification
- LCO Types
- Attributes
- Relationships

SOFTWARE PRODUCTIVITY