Assisting ConOps with Storyboards

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Concept of Operations Storyboard Tool

- Background – assist building ConOps
- Storyboard Tool functions
  - Authoring – descriptions, sketches
  - Evaluating – slide show
  - Reporting – ConOps Document - Web page
  - Workflow assistance
- Lessons Learned
- Future

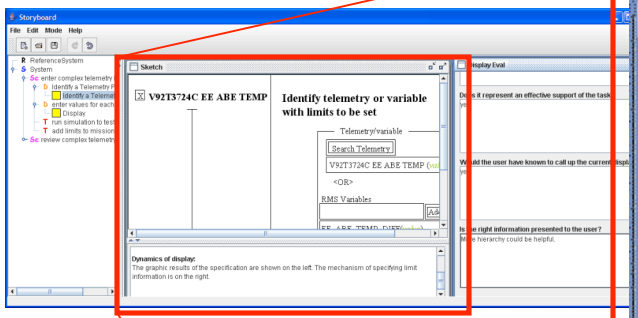
Why do a ConOps? (use cases for Storyboard Tool)

- Test the waters
  - You have an idea for a new system and want to try it out on a few colleagues to see if it merits refinement.
- Prepare for detailed requirements work
  - You will be developing requirements for a new system. The details are sketchy. You need consensus with the requirements team and management so that requirements can be developed more smoothly.
- Prepare for design – smaller project
  - A customer has expressed a desire for a new system and has responded positively to your ideas. You need a solid meeting of the minds before working out a top-level system design.
- Research a requested requirements change
  - Designer suggests a requirements change to avoid an unnecessarily expensive design feature. You need to know if the proposed change violates stakeholder expectations.

Storyboard Tool Functions

- Make ConOps easier to
  - Create (Authoring Support)
    - User's viewpoint – user task orientation, not sw function orientation
    - Strong support for scenarios – sketches, descriptions
    - Product-oriented work-flow assistance
  - Refine (Evaluation Support)
    - Presents slide shows of sequential steps in scenarios/storyboards
    - Gathers useful comments
  - Use in subsequent development products (Reporting)
    - ConOps document – printed, web page
    - User interaction development – task analysis
    - Training development (Online Help, Tutorial, User Manual)
    - Requirements development
    - UML diagramming

Display Sketch with Description



- Tool integrates sketches with descriptions to clarify intent.
- Tool helps refine sketches
  - Beginning as a concept: “napkin drawing”
  - Evolving to refined design: screen snapshots

Sketch

V92T3724C EE ABE TEMP

Identify telemetry or variable with limits to be set

Telemetry/variable

Search Telemetry

V92T3724C EE ABE TEMP (*value*)

<OR>

RMS Variables

Add variable

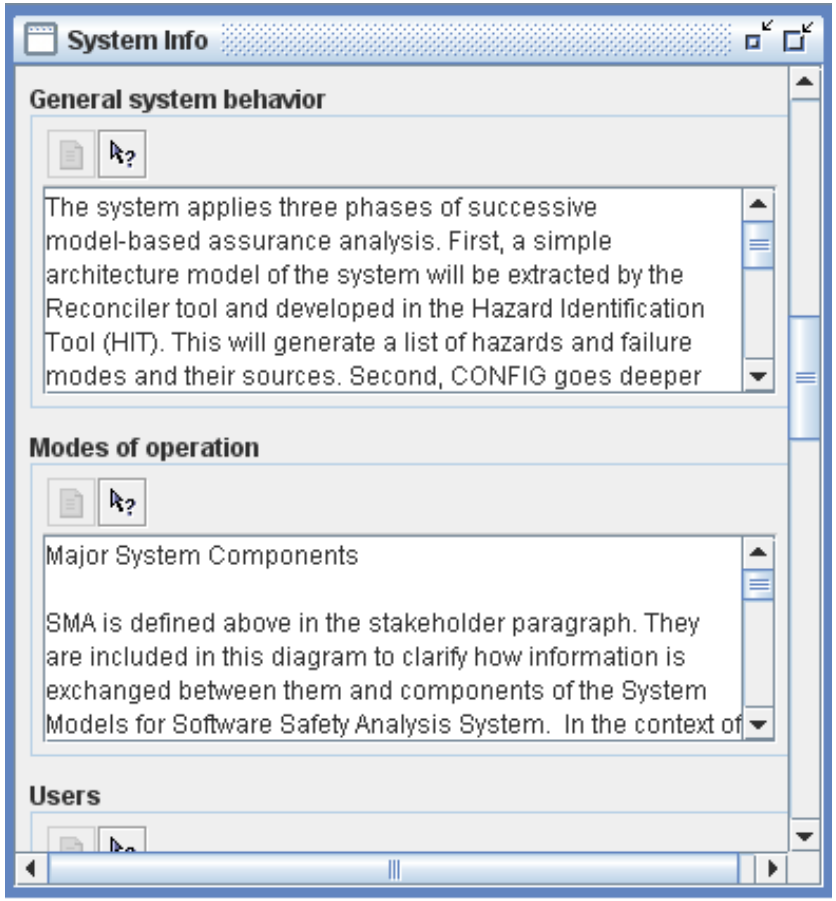
EE_ABE_TEMP_DIFF(*value*)
AFT MRL STATE (*Unknown*)

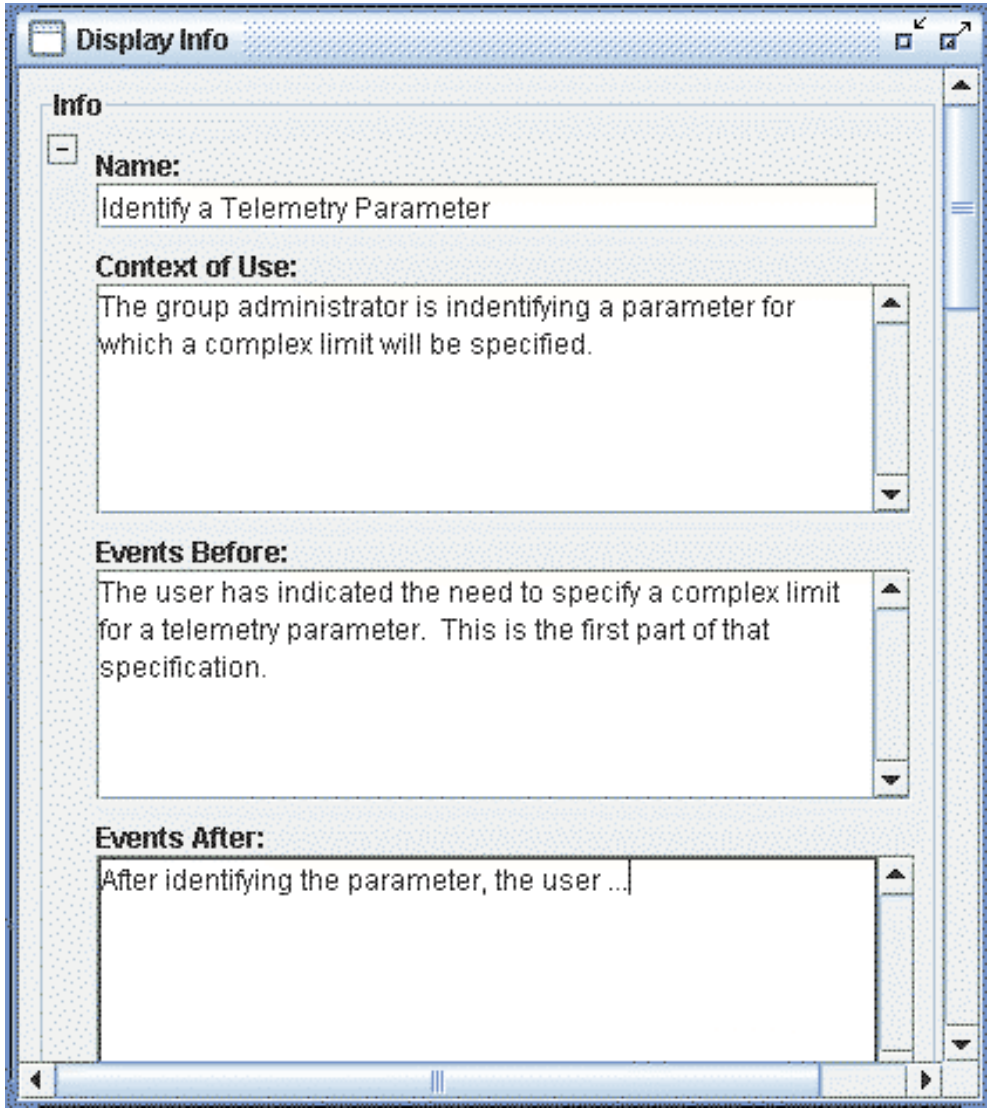
Display components that should not change:
Side-by-side is important.

Display components that could change without impact:
Left vs right is unimportant.

Dynamics of display:
The graphic results of the specification are shown on the left. The mechanism of specifying limit information is on the right.

Authoring: Information Categories



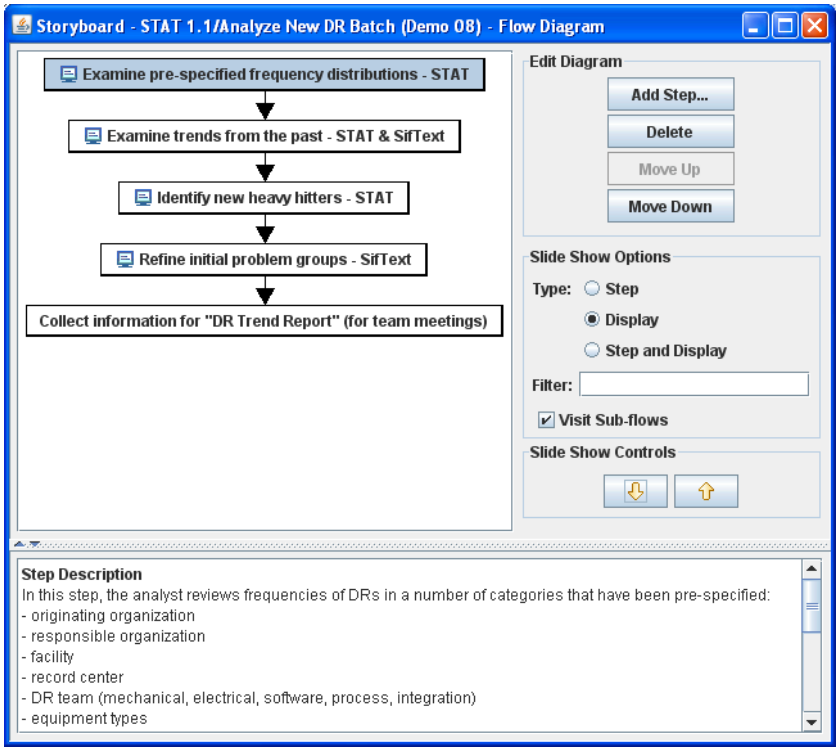


Descriptive information is organized by information categories.

- Reminders to authors
- Data-oriented, report generation
- Flexible report formats, content

Refine – Evaluation w/ Others

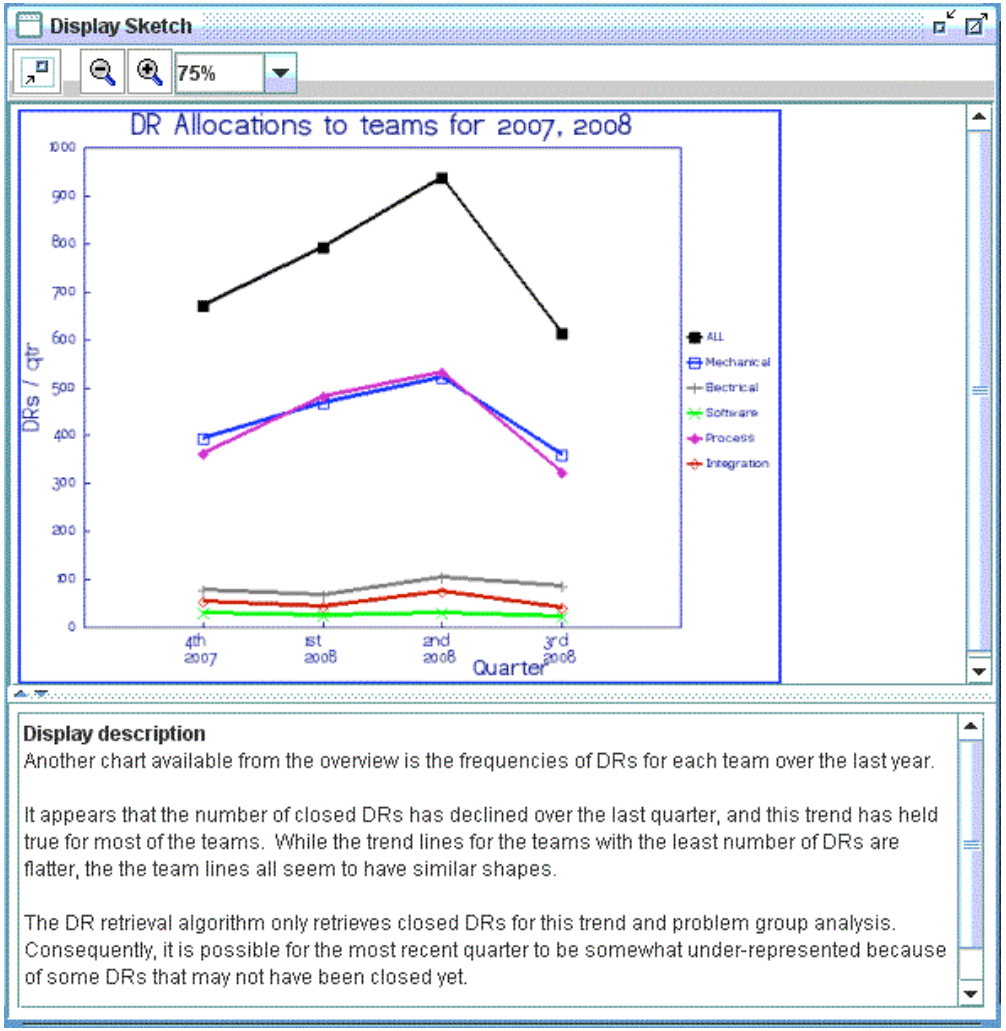
Slide Show Controls



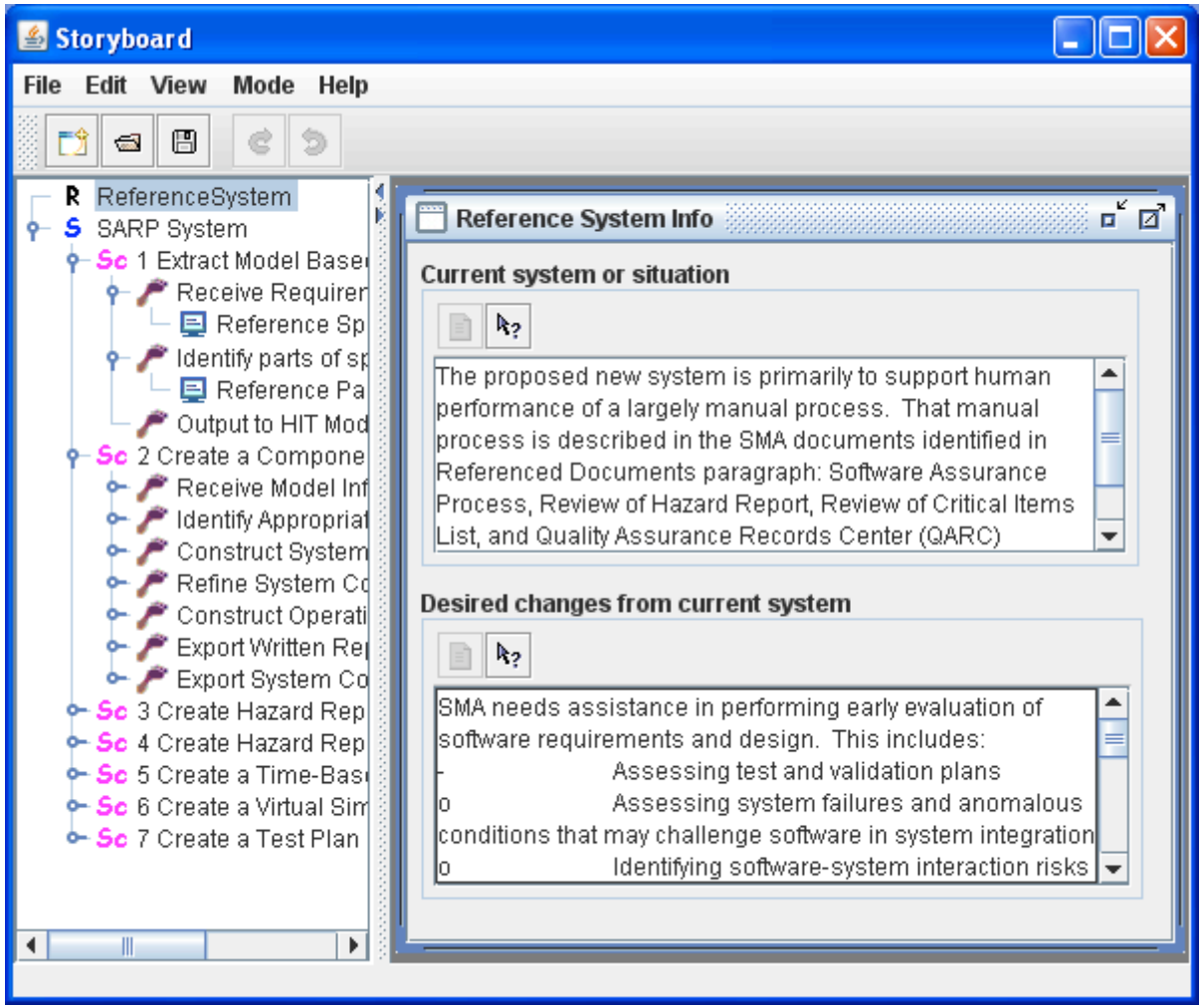
Slide shows can convey
- The end users workflow
- Spanning multiple displays
- Display dynamics

Also has information categories for stakeholder comments

Slide Show



Reporting: ConOps Document



Source

Descriptions represented as data allows standard and customized report generation.

Reporting: ConOps Document

Destination

SARP System Concept of Operations Document

Current System or Situation

Reference System

The proposed new system is primarily to support human performance of a largely manual process. That manual process is described in the SMA documents identified in Referenced Documents paragraph: Software Assurance Process, Review of Hazard Report, Review of Critical Items List, and Quality Assurance Records Center (QARC) Processing and Maintenance of Discrepancy Reports/Material Review Records (JSC Form 2176).

Desired Changes from Current System

SMA needs assistance in performing early evaluation of software requirements and design. This includes:

- Assessing test and validation plans
  - Assessing system failures and anomalous conditions that may challenge software in system integration
  - Identifying software-system interaction risks
- Identifying requirements gaps
- Performing virtual system integration tests prior to hardware integration.

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SARP System Description

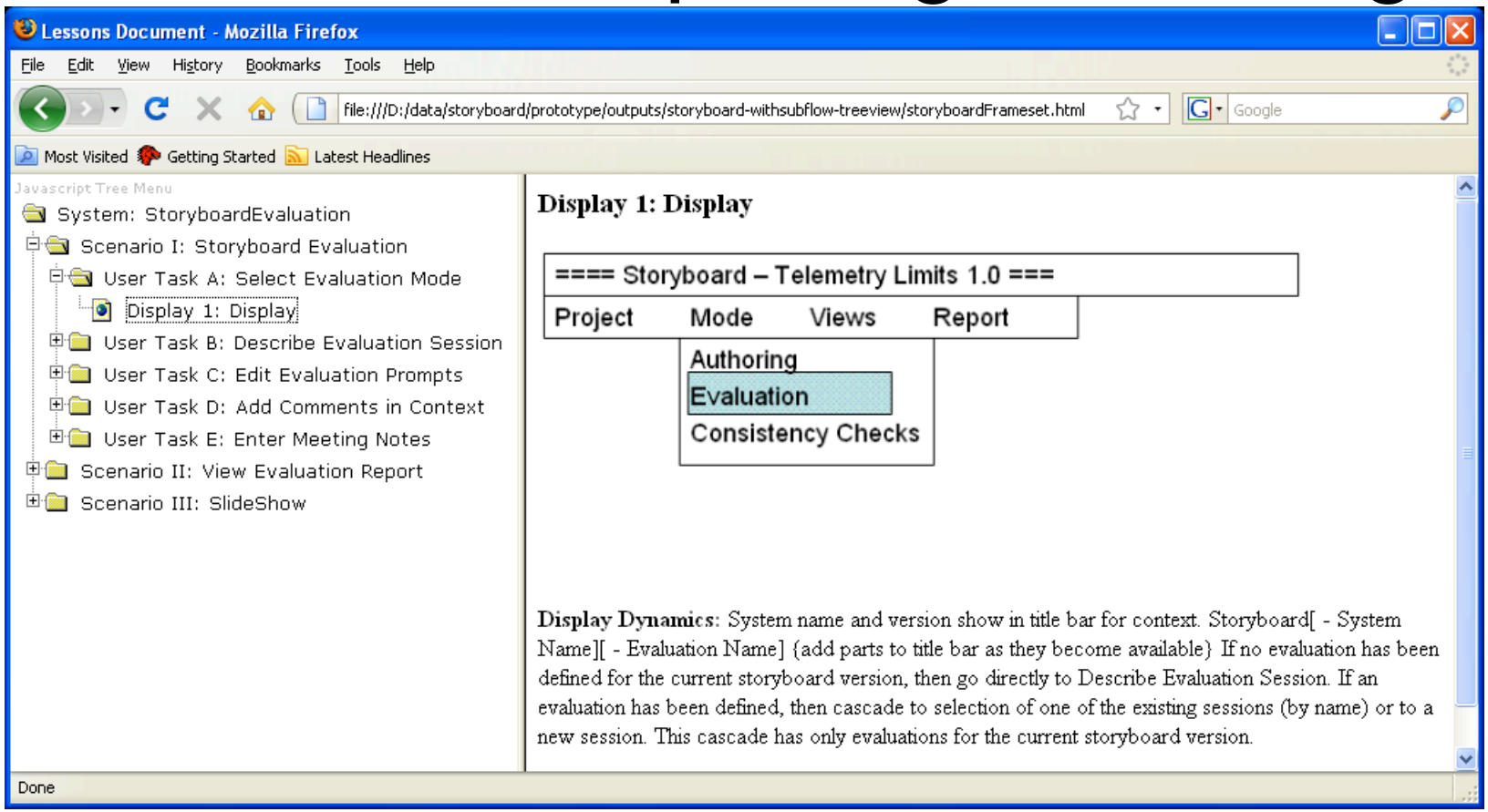
…

Scenarios

…

A standard format ConOps document generated from storyboard tool data.

Evaluation, Reporting: Web Page

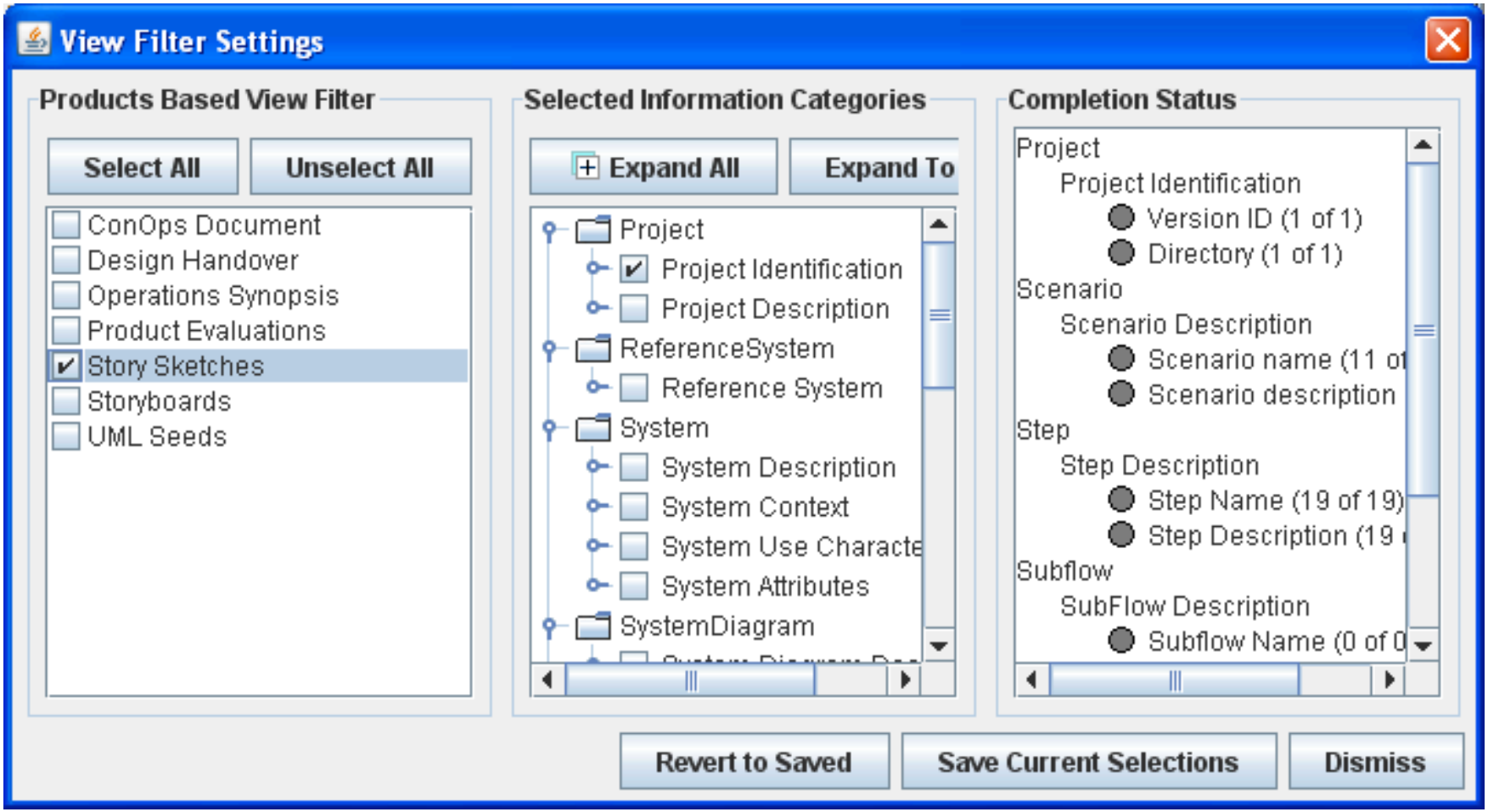


- Exporting to a web page allows a paperless, broad distribution of tool products for refining and reporting the ConOps.
- Reviewers and consumers of the ConOps do not need to have copies of the Storyboard Tool.

Handoff for Development

- Data-oriented descriptive information can support subsequent design activities
- UML diagram information can be extracted from tool information categories
- Requirements-oriented information can be extracted into a single report to assist the development of requirements
- Use cases and user tasks are explicitly identified and provide foundation for
  - Human factors analysis
  - Development of training materials and job aids

Work Flow Assistance



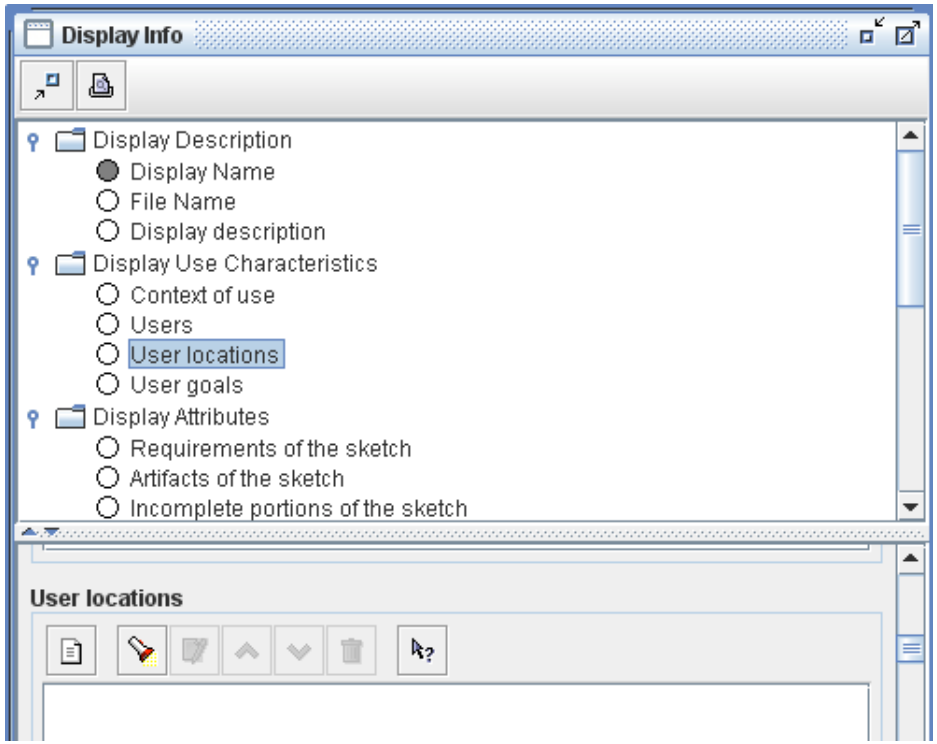
1. Select a desired product from the storyboard tool.

2. See tool information categories associated with the product.

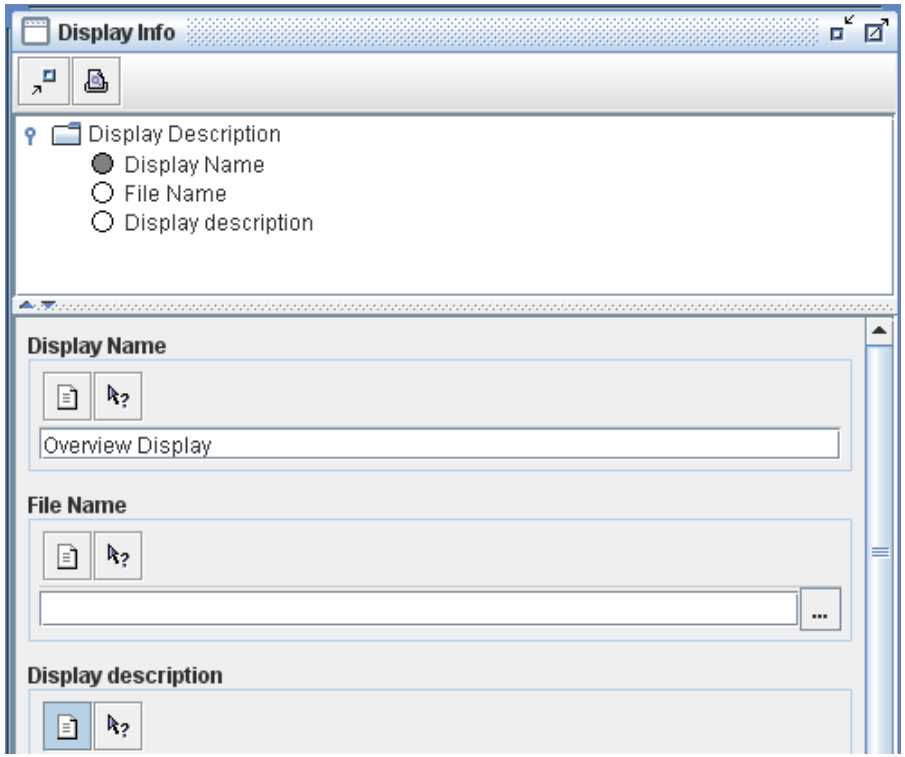
3. See completion status of the information in those categories.

Work Flow Assistance

All Information Categories



ViewFilter Selected Categories



- Viewing options while authoring:
  - All information categories
  - Only ViewFilter selected categories
  - Enables a tighter focus on intended Storyboard products
  - Clarifies what information is needed to produce desired product

Lessons Learned

- Integration of sketches with descriptions aids communication among stakeholders
- Organizing descriptive data enables flexible use by software – special purpose reports, views of data
- Product (task, use case) oriented assistance
  - Enables flexible, simplified use of complex application
  - Integrates user task view with software functions view
  - Provides wizard-like assistance, revealing software capabilities
- ConOps is a good time to start involving HFEs
  - HFEs are end-user task specialists
  - Helps focus system concept on user task support
- Iteration is especially important for innovative human task support – agile development of system concept

Future

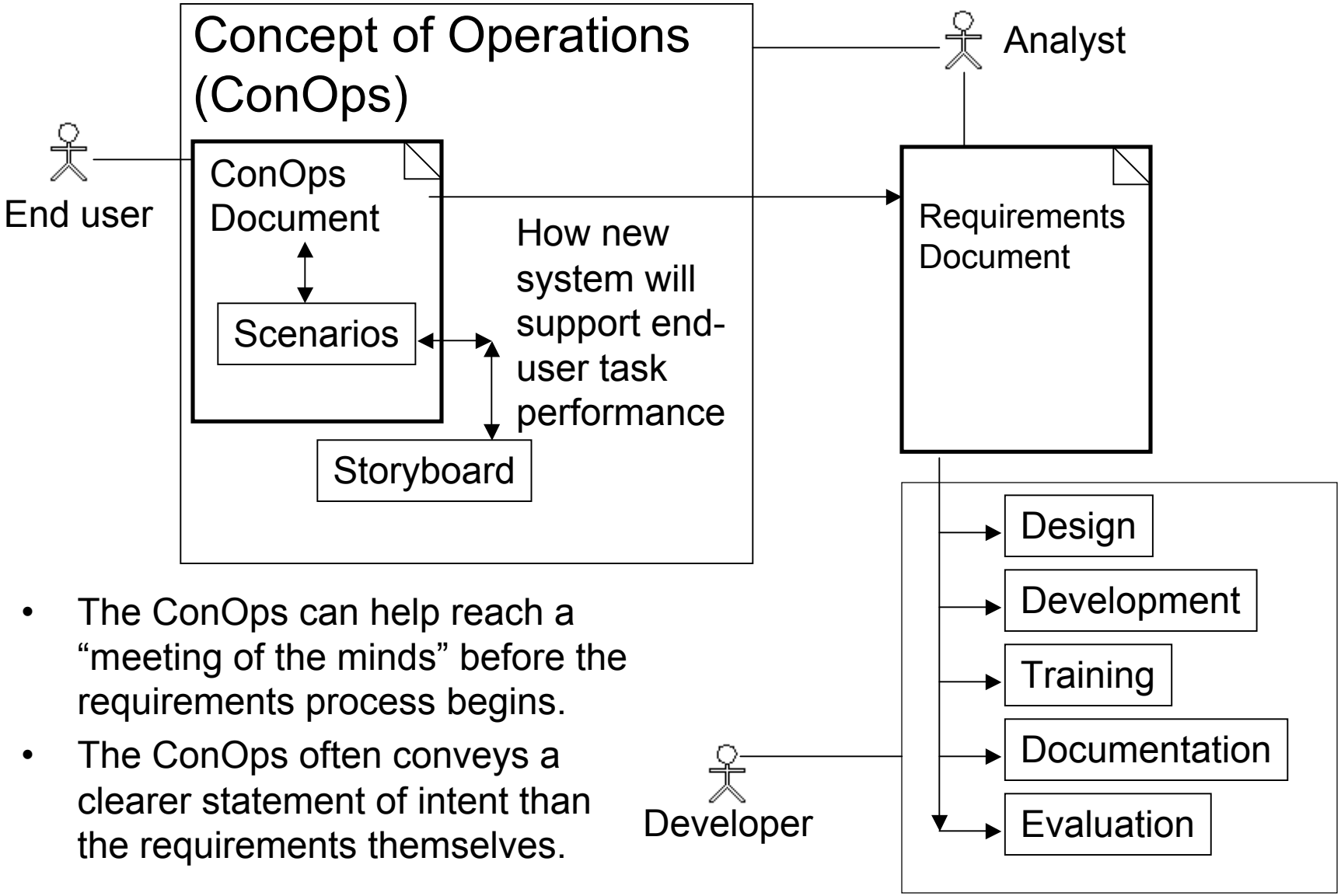
- Small Business Innovative Research (SBIR)
  - Finished Phase I & II
  - Produced a proof-of-principle prototype
  - Refined prototype by supporting NASA/JSC projects
- Ready to develop commercial product
  - SBIR Phase III – beta test & further refinement
  - Other beta test & refinement arrangements
- Product development options
  - Collaborate with larger business offering systems engineering software tools – Cradle, DOORs, Rational
  - Standalone ConOps product
- Suggestions, comments, advice

Backups

What is a Concept of Operations?

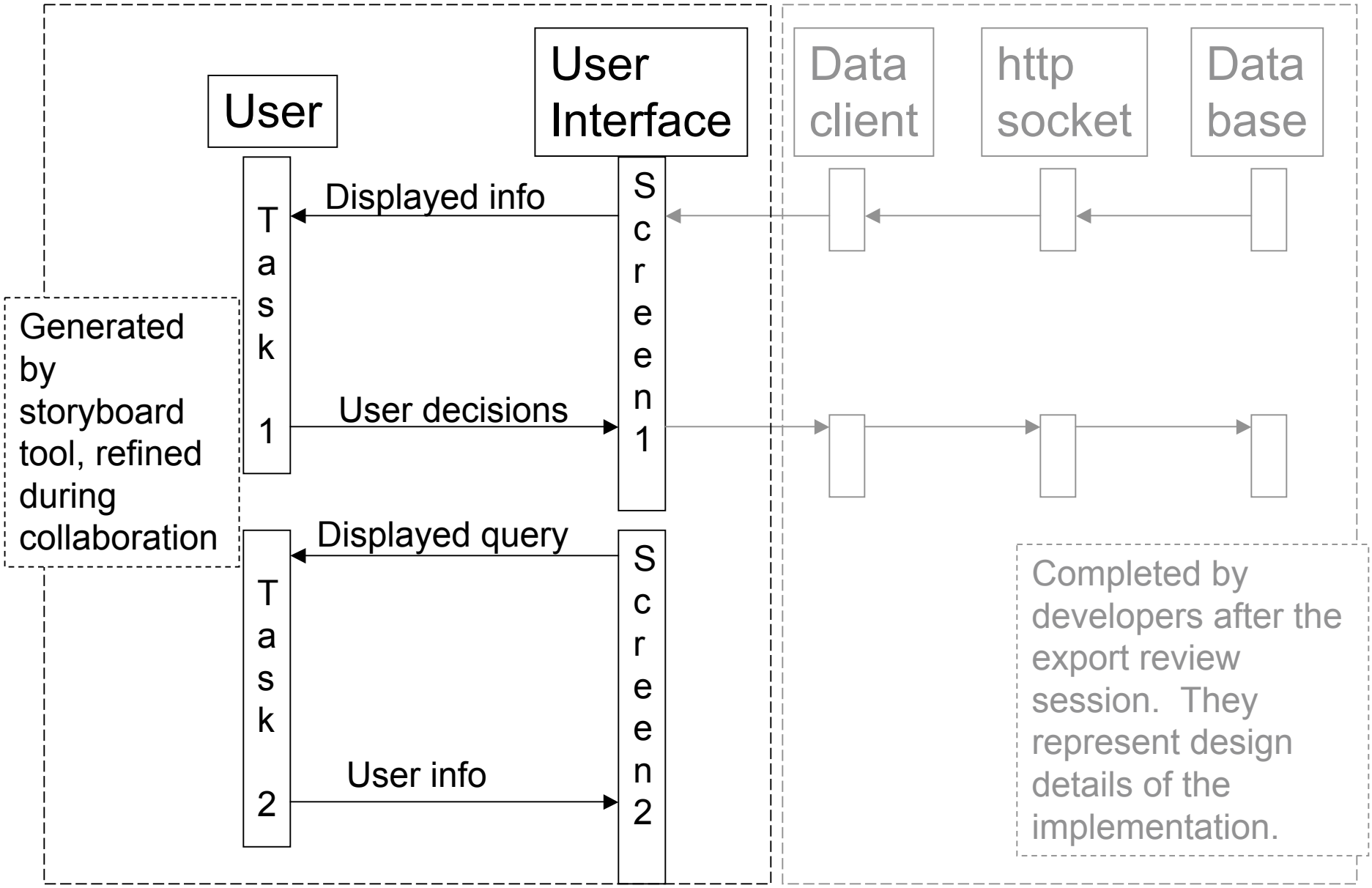
- Concept of operations – ConOps, supported by Storyboard Tool
- Tells how new software will be used, includes
  - The work that is currently performed
  - Changes to that work based on new software
- ConOps can be done for any engineering project
  - How will the new system be used – End-user viewpoint
  - For example, a ConOps for a building would include
    - Who will use it
    - How it will be used
    - How it will affect neighborhood
- ConOps has an increasingly recognized role in systems engineering
  - Mandated by NASA standards (JPR7120.3, Par. 4.1.1.6, 4.1.3)
  - NASA Systems Engineering Handbook (SP-2007-6105, Rev 1, Par 4.1.2.1)
  - ConOps document standard formats
    - IEEE 1362-1998 – IEEE guide for ConOps document
    - ANSI/AIAA G-043-1992 – guide from American National Standards Institute
    - DI-IPSC-81430 – DoD data item description for ConOps document

ConOps Role in Development

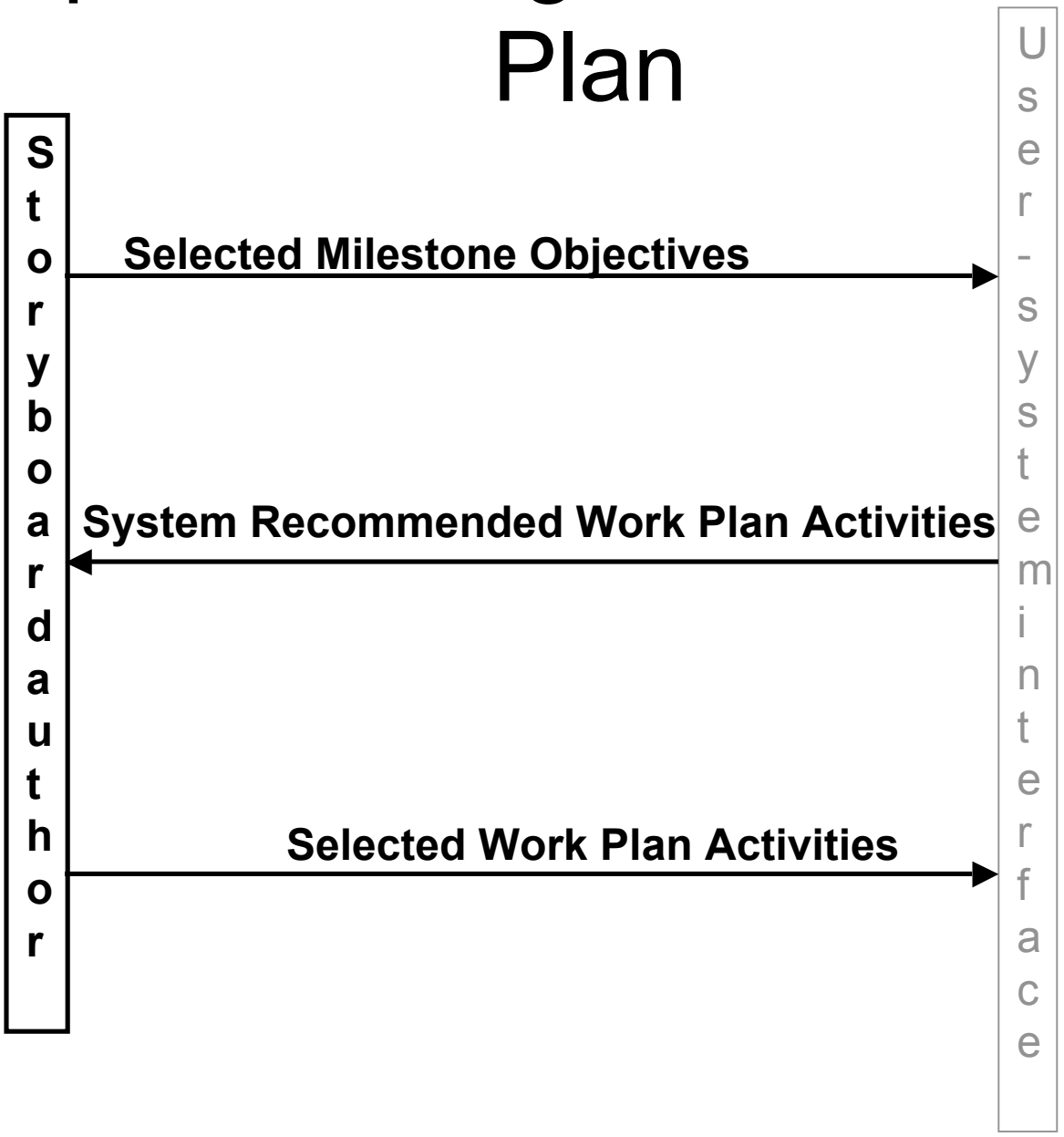


- The ConOps can help reach a “meeting of the minds” before the requirements process begins.
- The ConOps often conveys a clearer statement of intent than the requirements themselves.

Sequence Diagram From Scenario Info



Sequence Diagram: Build Work Plan



UML sequence diagram information represented in an example storyboard tool ConOps. (This particular ConOps is for an extension of the tool itself.)

Tool Serves Full Life Cycle

- Software Engineering Life Cycle Products/Phases
  - System Concept (Using Storyboard Tool)
    - Create ConOps – how the new system will be used
    - Communicate with potential users
    - Communicate with developers
  - Requirements and design (Based on output of Storyboard Tool)
  - Implementation → Deployment → Maintenance (later phases)
- SW Engineering products are often out-of-date
  - Changes during implementation are often not shown in earlier products
  - Document-oriented products are difficult to maintain and distribute
- Data-oriented products are more maintainable
  - Changes can be more thoroughly evaluated, recorded, and distributed
  - Data-oriented approach is an increasing trend for requirements, design, and implementation – Cradle, DOORS, Rational Rose
  - Storyboard Tool helps extend data approach to ConOps information