Rational. Tau and DOORS Analyst

User Guide

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Introduction to Tau DoDAF

Tau DoDAF is a tool for the development advanced software systems. Tau DoDAF is included as an add-in for IBM Rational Tau 4.3.

Overview

This section will explain how the IBM Rational Tau, IBM Rational DOORS and the Tau add-in supports the DoDAF standard. A behind the scene detail of how the Fast Pass model was created is given, with emphasis on how the diagrams and the views came to be rather then their content.

An assumption is made by the author at this point that the reader is familiar with, and has a basic understanding of the DoDAF standard, the Unified Modeling Language (UML) as well as the IBM Rational products, including DOORS, Tau and the integration between them.

What is UML?

The Unified Modeling Language (UML) is a visual language standardized by the Object Management Group (OMG). It is intended to be used for specifying, constructing and documenting systems. It is a graphical language that is designed to be easy to learn and read. It is an expressive language, customizable through the use of properties and stereotypes which are either pre-

defined, or user defined. UML version 2.0 is Object-oriented and due to its formalism, it has consistent interpretation which is ideal for mapping to other languages and therefore the model can stay target language independent.

What is DoDAF?

The Department of Defense (DoD) Architecture Framework Working Group has release the DoD Architecture Framework (DoDAF), Version 1.0, which defines a common approach for DoD architecture description development, presentation, and integration for both warfighting operations and business operations and processes.

An architecture description is a representation of a defined domain that currently exists or will exist in the future. The domain is described in terms of its parts, what they do, how they relate to each other and to the environment, and the rules and constraints governing them.

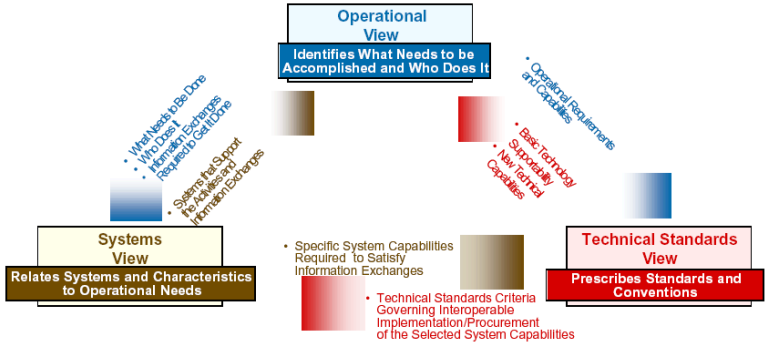

Figure 1: Linkages Among Views

The DoDAF describes the architecture in terms of products (textual, graphical, and tabular artifacts) produced as is described in Figure 1 on page 6.

1. All-Views (AV): describes aspects of an architecture that are of pertinent to all three views. The AV products set the scope and context of the architecture, such as subject area, relevant goals and vision statements, environmental conditions, concepts of operations (CONOPS) etc.
2. Operational View (OV): identifies, describes and details the tasks and activities, operational nodes and elements, information exchanges, nature of the information exchange, as well as frequency of exchanges required to accomplish DoD missions.
3. Systems View (SV): describes systems and interconnections providing for, or supporting, DoD warfighting and business functions. The SV associates system resources to support the operational activities of the OV.
4. Technical Standards View (TV): the minimal set of rules governing the arrangement, interaction, and interdependence of system parts or elements. Its purpose is to ensure that a system satisfies a specified set of operational requirements. The TV provides the technical systems implementation guidelines upon which engineering specifications are based, common building blocks are established, and product lines are developed. The TV includes a collection of the technical standards, implementation conventions, standards options, rules, and criteria organized into profile(s) that govern systems and system elements for a given architecture.

The DoDAF standard is released in three documents:

- Volume I provided the definitions of the products, guidelines, as well as background material.
- Volume II contains the descriptions of each of the products
- Deskbook provides supplementary information such as examples.

Please refer to these documents for more details on DoDAF, the views, and their products.

Introduction to the Tau DoDAF Add-in

The Tau DoDAF add-in consists of IBM Rational's advances modeling environment, Tau, DOORS and their integration. A special DoDAF profile has been created which expands this environment with DoDAF-specific modeling elements and menus, a variety of documents and templates, as well as an example, The Fast Pass.

Tau DoDAF ensures consistent, correct and complete architectures by demonstrating compliance and traceability, in a variety of methods producing DoDAF products intended to simplifying communications.

What is a Profile?

It is very common to force a domain to adhere to the restrictions of a specific tool. Tau has a concept of a profile that is used to make the tool adhere to the domain instead.

The goal of the profile is to make the tool speak the language of the domain and follow the restrictions of the specified domain. As a first step a metamodel of the language is created, mapping and expanding the current terminology to the terminology of the domain. A profile may hide the irrelevant bits of the UML model and add specific capabilities. In the DoDAF profile for example, specific stereotypes, associations, menus etc., have been created, as well as the ability to produce reports such as OV-3 and SV-6. The DoDAF profile also provides guidance while creating the different products via a variety of context sensitive menus, standards, and examples. An example of the context sensitive menus is that the profile can control what type of model artifacts that can be created in what context, preventing one from creating an SV artifacts under the OV layer

One thing to note about a profile is that it applies a filter on what part of the model is depicted based on the metamodel of the profile. In other words, the model may have a lot of information and the profile will filter entities and only depict the information that is appropriate to the profile.

The view of the model can be changed to toggle between the supported profiles, as shown in Figure 2 on page 9. One tool, one model and yet many profiles representing different domains to depict the information as needed.

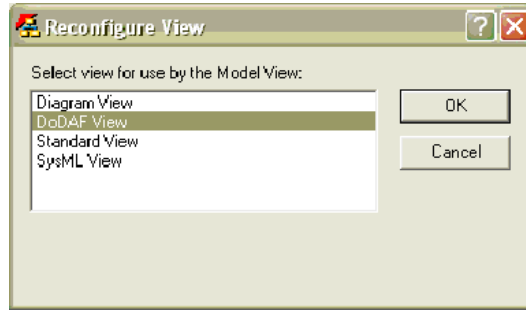

Figure 2: Reconfigure Model View

Hint

From the Menu Bar, select View / Reconfigure Model View

The Power of Managing Project Information in DOORS

Requirements, standards, project plans and work products in any real project are inter-related. Successful management of a project requires that both the content and interdependencies of this information are readily available and that changes can be managed and communicated to the project team while maintaining compliance to specified requirements and standards.

The task of managing product entities and the relationships between them is a cumbersome and time consuming task. Figure 3 on page 10 illustrates an example of one user requirement leading to two technical requirements with lead into three design elements and three test cases. Often such information is kept in spreadsheets or some kind of other static document and managed manually.

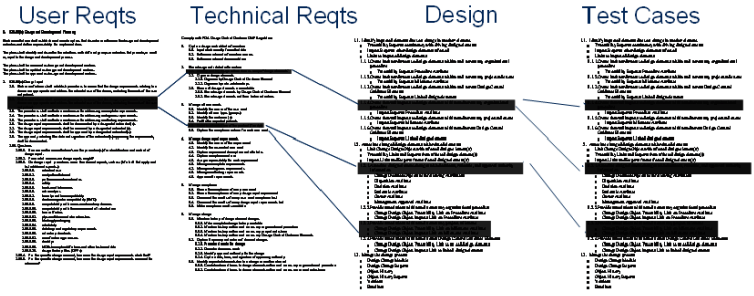

Figure 3: Traceability is the key to compliance

DOORS allows capturing of project information, analyzing it, as well as linking between related objects based on a traceability model that is process specific and defined by the user/project manager. This implies that the relationship between elements is always up-to-date and readily available.

Links are used to understand dependencies between requirements and assess the impact of change. Via wizards and specialized views, the links can be analyzed depending on a need, i.e. impact analysis, show dropped or creeping requirements etc.

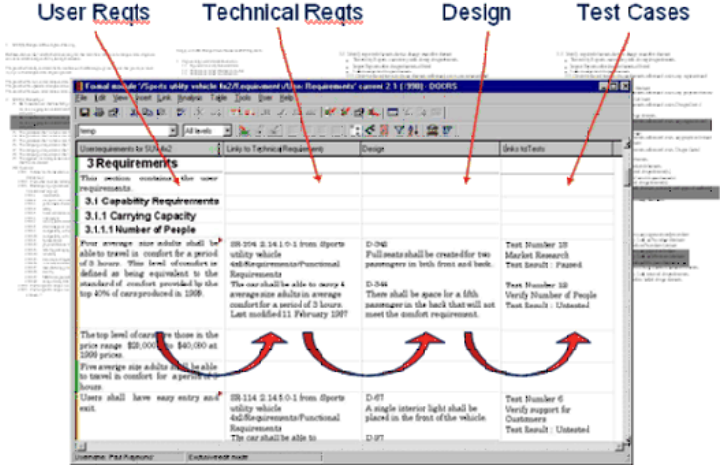

Figure 4: Traceability of Linked Entities in a Single View

DOORS/Tau Integration

The integration between DOORS and Tau is a role based approach to managing requirements and models, letting each user work with either Tau or DOORS without the need to learn the other tool, or to have both tools running at the same time.

This integration allows DOORS artifacts to be visible in Tau, thus being able to reference them and link to them at the time of model development. It also allows for the Tau artifacts and all the traceability links created between the requirements and/or the model elements to be managed in DOORS thus ensuring traceability through the overall development process.

The provided Templates used for FastPass and New projects

- Templates in DOORS: Understanding and Referencing the Standards

  It is very important to understand what DoDAF's different products represent and what information they will hold. It is often necessary to make references to a standard that is being used as a guide to development.

  – Access imported standards

    Documents such as DoDAF Volume I, II, and the Deskbook, JTA Volume I and II, DoD TRM User Guide etc. can be found in their electronic form, most often in Microsoft Word format or Acrobat (PDF). A good starting point was to import those documents and others into DOORS. With these documents in place, links can be made from the DoDAF products in DOORS and Tau, back to the standards.

    The standards can be accessed by restoring the DOORS project file `FastPass.dpa` from the `DoDAFFastPass` directory, in DOORS. They are found in a folder called Standards and Guidance with all these documents, as depicted in Figure 5 on page 12.

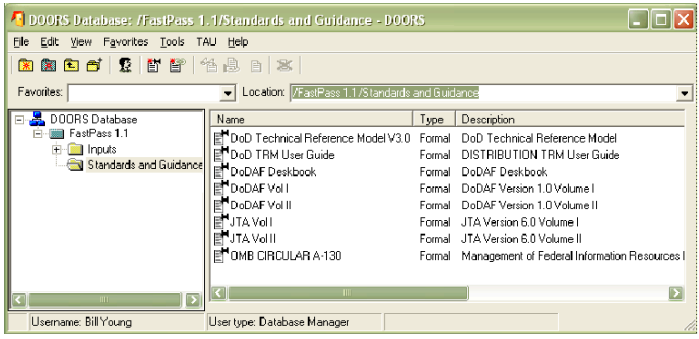

Figure 5: DOORS and DoDAF Standards and Guidance

- Templates in Tau: DoDAF Outline and `FastPass` example

  In the installation directory of Tau exists a subdirectory “examples”, and in it persist a number of examples, just like its name suggests. Two of these examples are `DoDAFFastPass` and `DoDAFProjectTemplate`

  The `DoDAFProjectTemplate` (Figure 6 on page 13), as its name states, produces a template that is used as a starting point when creating a new DoDAF project. It contains the necessary outline of the Tau project and activates the necessary DoDAF add-ins.

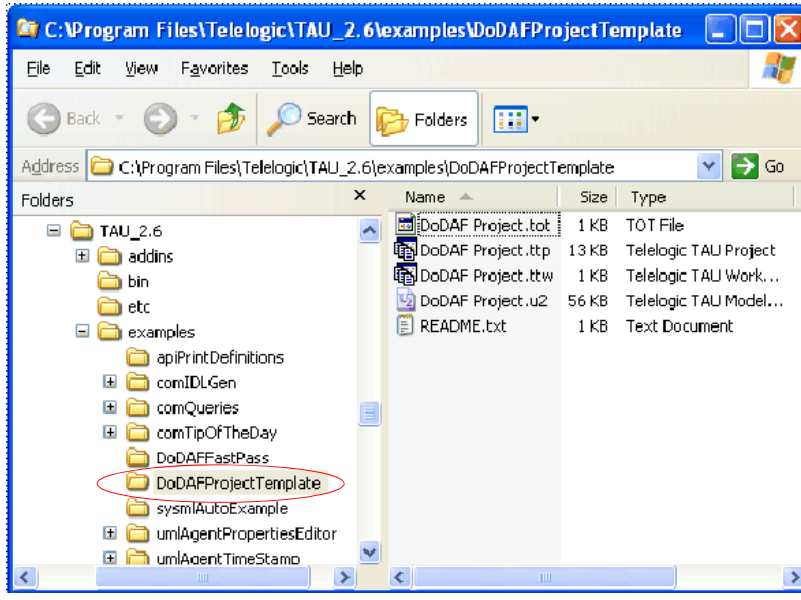

Figure 6: DoDAF Project Template

The DoDAF `FastPass` example illustrates the use of the architecture framework. It consists of a project that fills in the template and depicts all of the views with the necessary artifacts. Notice that there is both a Tau component to this example (`DoDAFFastPass.ttw`), and a DOORS component (`FastPass.dpa`) - Figure 7 on page 14

In this paper an attempt will be made to explain how the `FastPass` example was created from the templates and the details that give us the necessary DoDAF views.

Hint

To get a copy of the `DoDAFProjectTemplate`*, follow the following steps.*
From the Menu Bar, select File/New.
From the New popup window, select the Template tab.
Select the `DoDAFProjectTemplate` *and specify the directory where a copy should be stored.*
Press OK.

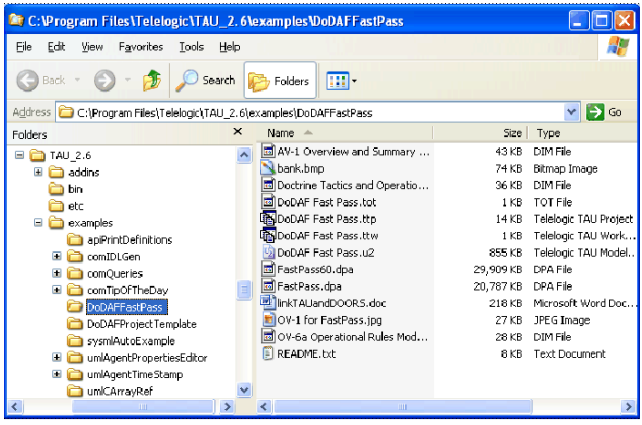

Figure 7: DoDAF Fast Pass

– Create a new project using the template:

  As mentioned earlier, the `DoDAFProjectTemplate` is used as a starting point when creating a new DoDAF project since it provides a starting outline of packages, activates the necessary add-ins and used the DoDAF profile

– Exploring the project

  Notice that there are three distinct packages for Operational, System, and Technical Views as depicted in Figure 8 on page 15. These views are connected and what is defined in one view is known in the other due to the relationships defined between the packages in the Architecture Structure Overview class diagram of the template.

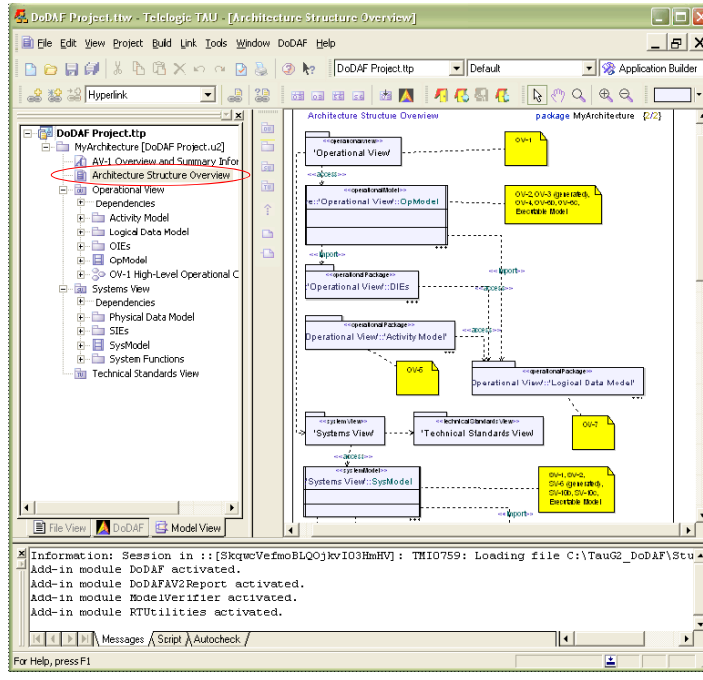

Figure 8: TAU and the DoDAF Project Template

Notice in the output window's message tab of Figure 8 on page 15, that several add-ins were activated.

The DoDAF add-in introduces the DoDAF view, metamodel, context sensitive menus and tool palettes, and the DoDAF report toolbar used for certain reports. This add-in makes the tool “speak the language of the domain”.

The DoDAF add-in also introduces the DoDAF tab and an extra button on the report toolbar used to update the DoDAF tab. This tab lists all the diagrams of the system, grouped by DoDAF diagram type rather than scope. In other words, all of the OV-6c diagrams that are used to describe different mission/objectives, would be grouped in the OV-6c section even though their scope belongs below the mission/objectives. All of the views of DoDAF are depicted as folders and all of the diagrams are referenced below them.

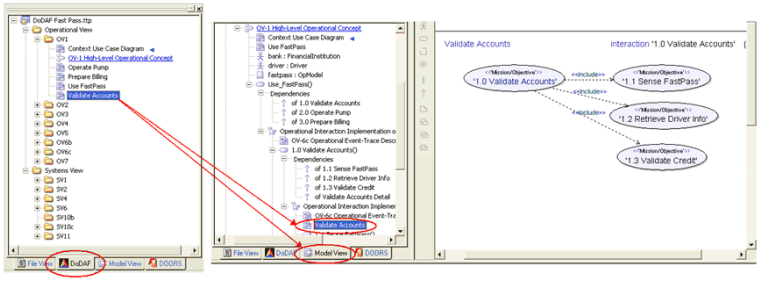

Figure 9: Use the DoDAF Tab to Navigate through the Model

Double clicking in a diagram in the DoDAF tab will cause a switch to the model view tab, highlighting the diagram, and displaying the graphical representation of it, as depicted in Figure 9 on page 16.

Hint

To activate the add-ins; for IBM Rational Tau, from the Menu Bar, select Tools/Customize. Make sure that the box next to the add-in you are interested in activating is checked and close the window.

To deactivate an add-in, select Tools/Customize from the Menu Bar. Make sure that the box next to the add-in you are interested in deactivating is not checked and close the window. You do not have to save explicitly, this will be done when you close the dialog.

What product goes with which tool?

So far, both DOORS and Tau have been utilized. Utilization of these tools and their integration is crucial as they make up the Tau DoDAF add-in. The following table was taken from the DoDAF standard and slightly modified from its original detail, to depict the individual tools of Tau DoDAF add-in and their support of the DoDAF artifacts. Items marked with the asterisk (*) represent automatically generated entities derived from previously entered data; deduced from the other views.

IBM Rational Tool	Diagram Type	Framework Product	Framework Product Name	General Description
DOORS		AV-1	Overview and Summary Information	Scope, purpose, intended users, environment depicted, analytical findings. Typically text based and this is why it resides in DOORS.
Tau*	Model Index	AV-2	Integrated Dictionary	Architecture data repository with definitions of all terms used in all products (HTML Report)
Tau	Use Case Diagram	OV-1	High-Level Operational Concept Graphic	High-level graphical/textual description of operational concept
Tau	Architecture Diagram	OV-2	Operational Node Connectivity Description	Operational nodes, connectivity, and information exchange needlines between nodes
Tau*	Signals and Parameters	OV-3*	Operational Information Exchange Matrix	Information exchanged between nodes and the relevant attributes of that exchange
Tau	Class Diagram	OV-4	Organizational Relationships Chart	Organizational, role, or other relationships among organizations

IBM Rational Tool	Diagram Type	Framework Product	Framework Product Name	General Description
Tau	Activity Diagram	OV-5	Operational Activity Model	Capabilities, operational activities, relationships among activities, inputs, and outputs; overlays can show cost, performing nodes, or other pertinent information
DOORS		OV-6a	Operational Rules Model	One of three products used to describe operational activity- identifies business rules that constrain operation
Tau	State Diagram	OV-6b	Operational State Transition Description	One of three products used to describe operational activity- identifies business process responses to events
Tau*	Sequence Diagram	OV-6c	Operational Event-Trace Description	One of three products used to describe operational activity- traces actions in a scenario or sequence of events
Tau	Class Diagram	OV-7	Logical Data Model	Documentation of the system data requirements and structural business process rules of the Operational View

IBM Rational Tool	Diagram Type	Framework Product	Framework Product Name	General Description
Tau	Architecture Diagram	SV-1	Systems Interface Description	Identification of systems nodes, systems, and system items and their interconnections, within and between nodes
Tau	Architecture Diagram	SV-2	Systems Communications Description	Systems nodes, systems, and system items, and their related communications laydowns
DOORS*		SV-3*	Systems-Systems Matrix	Relationships among systems in a given architecture; can be designed to show relationships of interest, e.g., system-type interfaces, planned vs. existing interfaces, etc.
Tau	Activity Diagram	SV-4	Systems Functionality Description	Functions performed by systems and the system data flows among system functions
DOORS*		SV-5	Operational Activity to Systems Function Traceability Matrix	Mapping of systems back to capabilities or of system functions back to operational activities

IBM Rational Tool	Diagram Type	Framework Product	Framework Product Name	General Description
Tau*	Signals and Parameters	SV-6	Systems Data Exchange Matrix	Provides details of system data elements being exchanged between systems and the attributes of that exchange
DOORS		SV-7	Systems Performance Parameters Matrix	Performance characteristics of Systems View elements for the appropriate time frame(s)
DOORS		SV-8	Systems Evolution Description	Planned incremental steps toward migrating a suite of systems to a more efficient suite, or toward evolving a current system to a future implementation
DOORS		SV-9	Systems Technology Forecast	Emerging technologies and software/hardware products that are expected to be available in a given set of time frames and that will affect future development of the architecture

IBM Rational Tool	Diagram Type	Framework Product	Framework Product Name	General Description
DOORS		SV-10a	Systems Rules Model	One of three products used to describe system functionality-identifies constraints that are imposed on systems functionality due to some aspect of systems design or implementation
Tau	State Diagram	SV-10b	Systems State Transition Description	One of three products used to describe system functionality-identifies responses of a system to events
Tau*	Sequence Diagram	SV-10c	Systems Event-Trace Description	One of three products used to describe system functionality-identifies system-specific refinements of critical sequences of events described in the Operational View

IBM Rational Tool	Diagram Type	Framework Product	Framework Product Name	General Description
Tau	Class Diagram	SV-11	Physical Schema	Physical implementation of the Logical Data Model entities, e.g., message formats, file structures, physical schema
DOORS		TV-1	Technical Standards Profile	Listing of standards that apply to Systems View elements in a given architecture
DOORS		TV-2	Technical Standards Forecast	Description of emerging standards and potential impact on current Systems View elements, within a set of time frames

Due to the highly related nature of the products and the dependencies that exit between then, it is often necessary that products are developed in an interactive manner, often starting on a new product before a previous one has been finalized. A data-centric build sequence is discussed in the standard and this is the approach we will follow when developing the `FastPass` example. The image below is an image found in the DoDAF standard and is utilized in the manuals to summarize this approach. We will also use this diagram as a guide to the development of the `FastPass`.

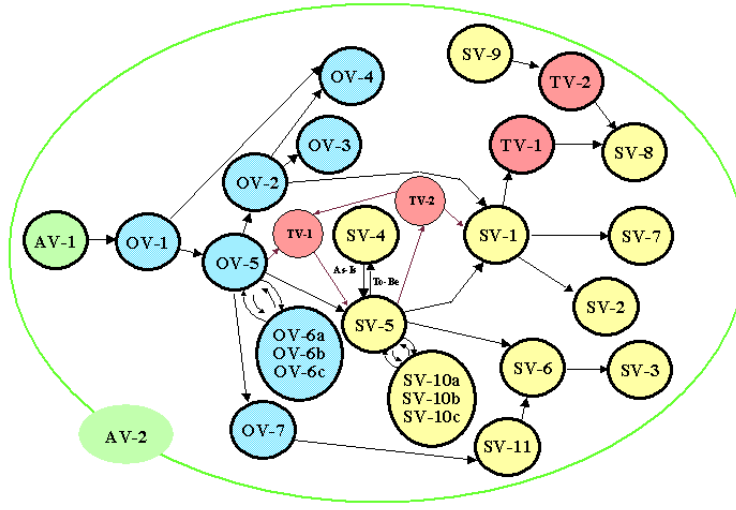

Figure 10: Data Centric Build Sequence of DoDAF Views

The Fast Pass Example

Overview of Behavior

`FastPass` uses an electronic system located in the pump to "talk" with a miniature radio-like device (a transponder in the form of a car tag or key tag). Together, these electronic devices provide "instant" access to gasoline by automatically charging fuel purchases to the credit card the driver has pre-selected. This is similar to the technology used successfully by many toll ways (e.g. Dulles Access, Easy Pass).

Overview and Summary Information (AV-1)

All view documents such us AV-1 and AV-2 are important from the very start and are updated as needed throughout the development process. At the beginning the Overview and Summary Information (AV-1) and the Operational Graphic View (OV-1) are worked on together. The Integrated Dictionary (AV-2) is developed as a side-effect of the development of all the other products.

The AV-1 defines the objective, scope and context (intended users, environment). Later the AV-1 will also contain analysis, recommendations, and conclusions, similar to a Statement of Work (SOW). It is defined in DOORS to keep track of the changes and take advantage of the powers of the tool such as linking which will allow us to track how the conclusions where derived providing justification and objective evidence moving forward.

It is also a good idea to link such a document as the AV-1 to the applicable standards. DOORS' drag and drop linking can be used to link from the AV-1 object developed by the user, to the imported standards. The analysis wizard of DOORS can be utilized to create a new view displaying the linked standards information, inside the AV-1 module. Figure 11 on page 24 is an example of the result.

Hint

The `FastPass` *project in DOORS has already imported the JTA and DoDAF reference material in DOORS modules. Those modules can be used in other projects*

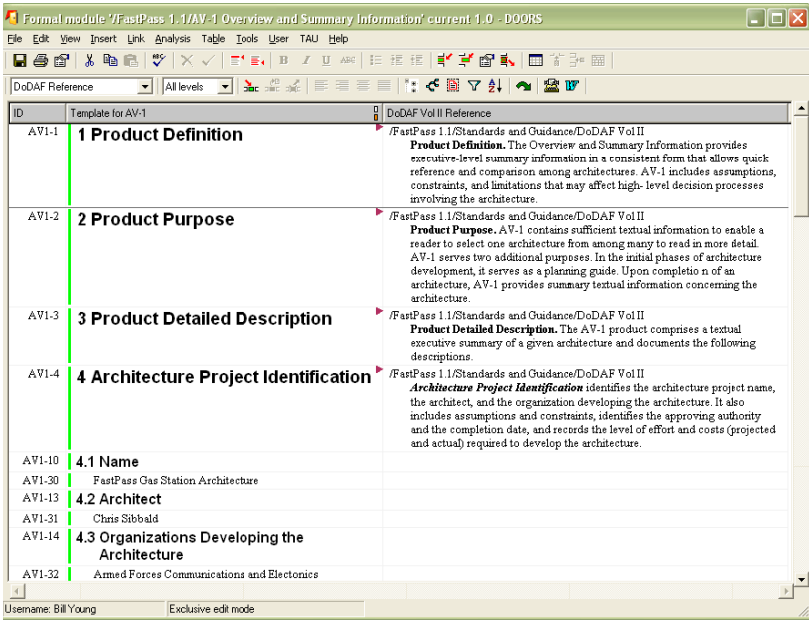

Figure 11: DoDAF Reference View

In the `FastPass` example, both the AV-1 Overview and Summary Information and Doctrine Tactics and Operation Procedures exist as formal modules in DOORS. The DOORS/Tau integration was used to bring this information into Tau and make it available for referencing and linking (Figure 12 on page 25).

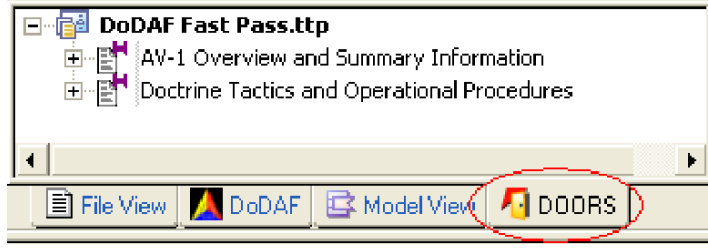

Figure 12: Referencing of DOORS Formal Modules in Tau

Operational Graphic View (OV-1)

The OV-1 is a high-level description of the operational context depicted graphically or textually. Even though this document starts out being very general, it will eventually evolve during the Architectural effort to a concise summary of the Architecture. This document is often created with a third party drawing tool, or hand drawn and scanned in. The OV-1 will be hyperlinked in Tau. The best location for it currently is in the **OV-1 High-Level Operational Concept** in the **Operational View** package.

Hint

One way to create a hyperlink is described in the following steps:
1. Assure that Hyperlink is selected in the Link Menu.
2. Right-click on the entity you want to link from, i.e. the OV-1 High-Level Operational Concept in the Operational View package.
3. Select Link/Start link.
4. Fill in the appropriate information in the Insert Hyperlink popup window
5. Press OK

Here is an example of such a document, as it is displayed in Tau (Figure 13 on page 26). Notice that **OV-1 High-Level Operational Concept** has been underlined and in blue to indicate a hyperlink. Clicking on the link opens the document.

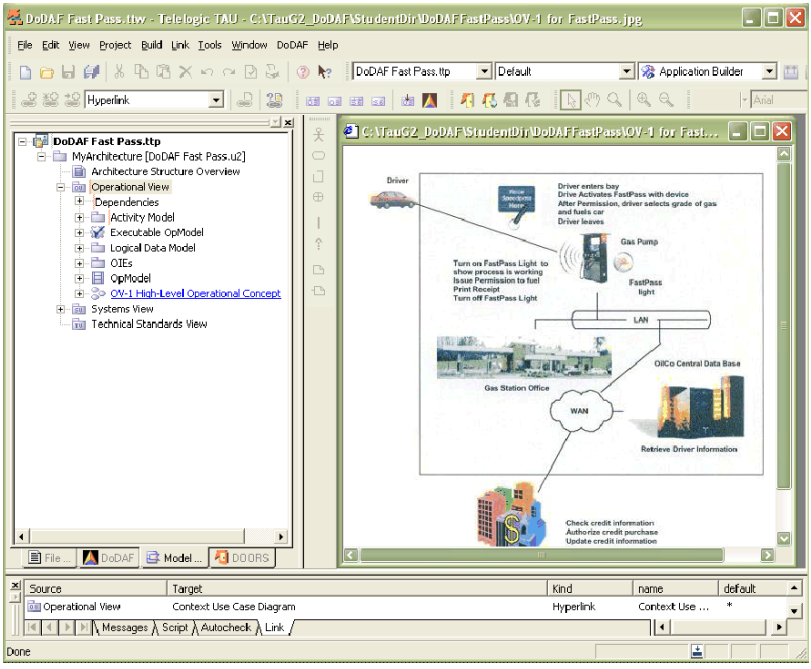

Figure 13: Hyperlink OV-1 is a High-level Description Graphic

As a next step an **OV-1 Context Diagram** is created from interpreting this high level graphic.

The currently provided OV-1 Context Diagram is modified from the template default to the detailed OV-1 High Level Operational Concept name **Context Use Case Diagram** as depicted in Figure 14 on page 27 and Figure 15 on page 28.

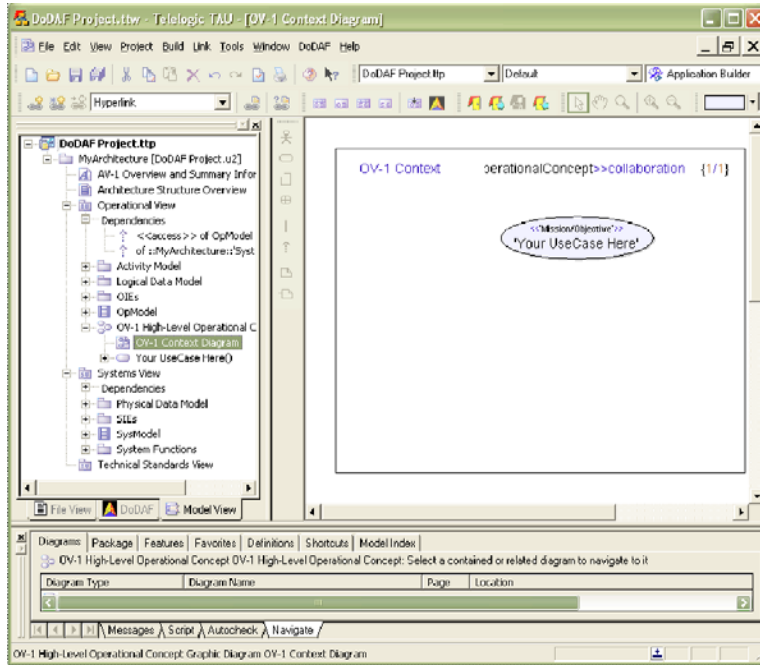

Figure 14: OV-1 Context Diagram - Template Default

Notice that <<**asset**>> driver is typed, or associated to <<**humanRole**>> **Driver**, and <<**asset**>> **bank** is typed as <<**organization**>> **FinancialInstitution**. **Driver** and **FinancialInstitution** have not been defined yet, and this is why they are underlined in Tau. It may appear that including them here is premature. Think of this however as a way to capture information that is known and will be farther defined later.

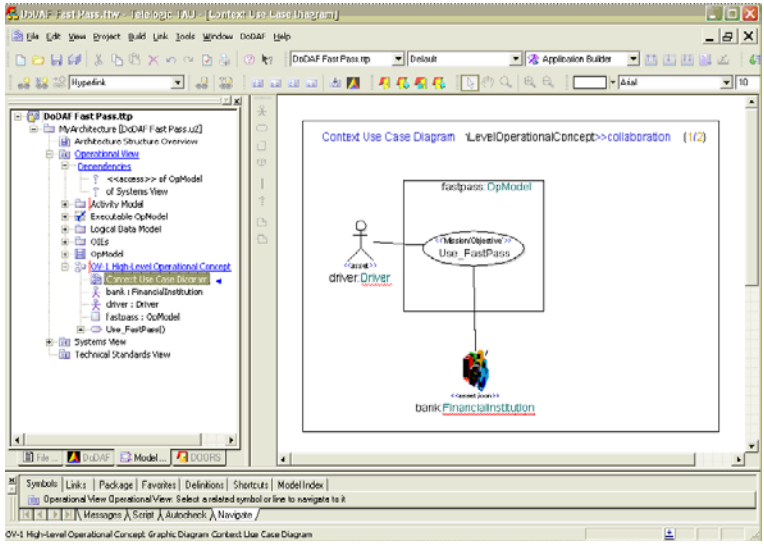

Figure 15: OV-1 Context Diagram - Domain Specific

Also notice that a hyperlink was created from the **Operational View** package (once again indicated by the blue color and underline), to the **OV-1 Context Diagram** which has been renamed to **Context Use Case Diagram** (marked by an incoming link). The reason for this is to allow for easy access; the diagram **Context Use Case Diagram**, which describes the very high level description, can now easily be opened by following the hyperlink from the package Operational view.

Hint

Notice that <<asset>> bank:FinancialInstitution is depicted as an icon and is thus stereotyped <<asset, icon>>. This can be done by enabling the icon stereotype and associating a picture with it. Here are the steps:
1. Right-click on an element (any element can be farther stereotyped, i.e. asset, subject, collaboration, etc.,) and select properties.
2. In the properties window, press the Stereotype button
3. Scroll to `TTDStereotypeDetails::icon` *and assure that the box has been checked*
4. Press OK
*5. In the properties window, fill in the Icon File. You may use the "**Stereotypes...**" button to browse to the correct location.*
6. Check mark the `KeepIconProportions` *box.*

The <<**Mission/Objective**>> `Use_FastPass` created can be farther decomposed to show details. By right-clicking on the **OV-1 High-Level Operational Concept**, the context sensitive menus can be used to aid with the diagram creation.

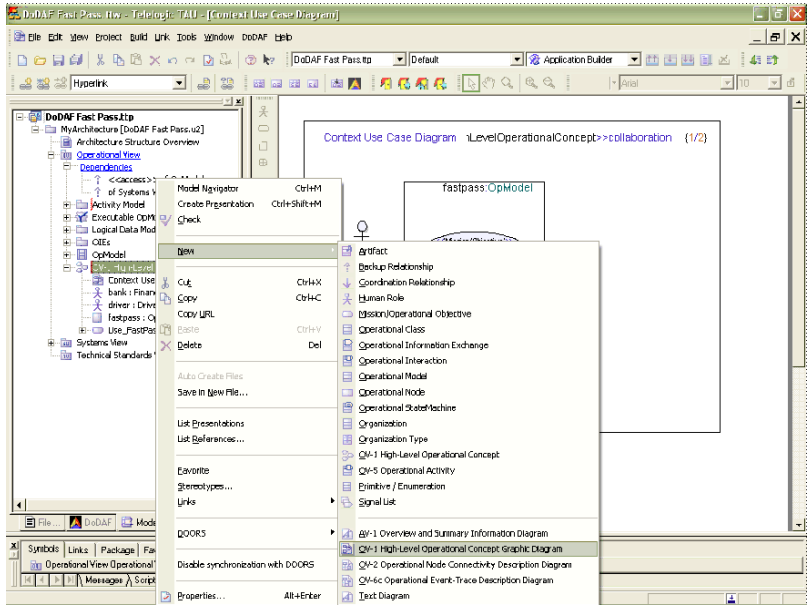

Figure 16: Creation of Diagram via Context Sensitive Menu

Once we have a new OV-1 High-Level Operational concept Graphic Diagram, we can rename it to `Use_FastPass`. The `Use_FastPass` mission/objective was dragged from the model view and dropped to the diagram so we can reuse it and build on its definition. The diagram element creation toolbar is used to create additional mission objectives and their associations. The outcome is Figure 17 on page 30.

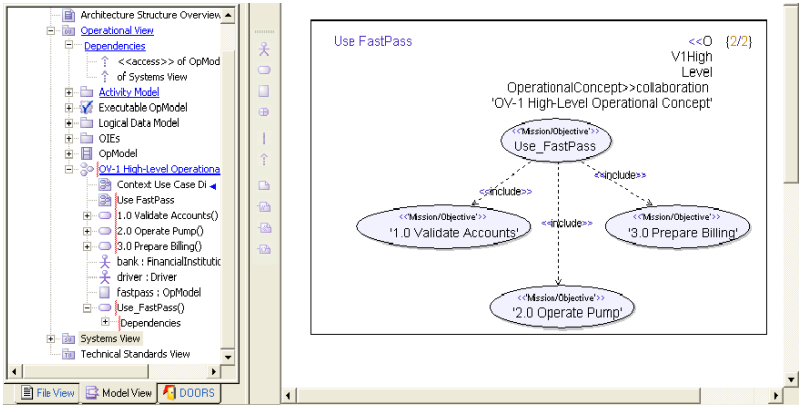

Figure 17: OV-1 High Level Operation Concept

The dependency lines that are drawn represent that mission/objectives `'1.0 Validate Accounts'`, `'2.0 Operate Pump'`, `'3.0 Prepare Billing'` are all important and mandatory for the functionality of mission/objective `Use_FastPass`.

Hint

When creating dependencies between mission/objectives, the stereotype `<<linekind>>` *may appear on the dependency. You can deactivate this by right-clicking on the line and selecting stereotype and un-checking the* `[]DoDAF::'Operational View'::OV1:lineKind`, *and pressing the OK button*

Hint

The type of dependency can be changed from <<include>> which indicates a necessary mission/objective to <<extend>> which indicates an optional mission/objective by right-clicking on the dependency line and selecting Extend

Organization Relationship Chart (OV-4)

Further analysis on the **OV-1 High Level Operation Concept** (**Context Use Case Diagram**) created earlier, the **OV-1 High-level Description Graphic**, and the **AV-1 Overview and Summary Information**, lead to the creation of an OV-4 to show the major organizations of the `OpModel`.

In package `MyArchitecture`, in the **Operational View**, you will find the operational model `OpModel`. One level down in the hierarchy exists an OV-4 Organizational Relationship chart. This is modified to depict the analysis.

Remember that UML is case sensitive. Notice how the roles of the associations and the organizations of Figure 18 on page 32, map to the original assets of Figure 15 on page 28.

With the help of the drawing toolbar, three organizations named `Station`, `FinancialInstitution` and `OilCo` where drawn on the OV-4, and one human role called Driver.

Hint

FinancialInstitution and Driver were already implied in Figure 15 on page 28. If you drag-and-drop the assets `driver:Driver` *and* `bank:FinanacialInstitution` *then Tau creates classes Bank and FinancialInstitution stereotyped* `<<actor,asset>>`*. To make them DoDAF specific right click on then and stereotype FinancialInstitution as organization, and Driver as a humanRole.*

The appropriate organizational relationships where drawn, with labels and roles as depicted in Figure 18 on page 32.

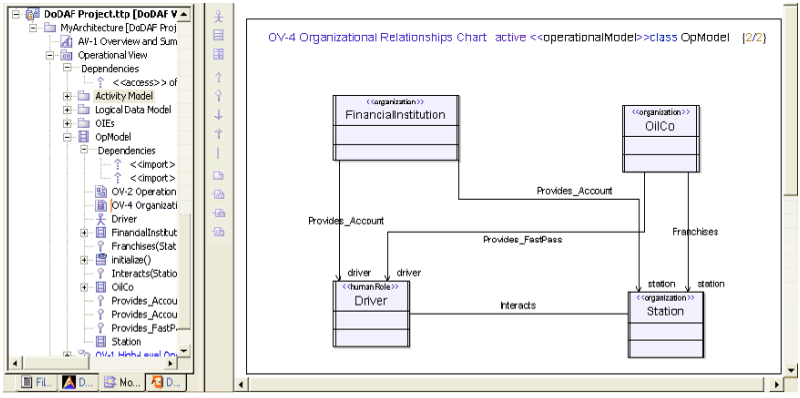

Figure 18: Organizational Relationship Chart

Hint

The Organizational relationship drawn between `Driver` *and* `Station` *is undirected, indicating an awareness of each other but no direct interaction. To achieve this, draw a normal organizational relationship between the classes, right-click on the arrow (target) and assure that option* `Navigable`*, under Target, is not selected*

Hint

If labels overlap each other, drag them to a more appropriate spot. CAUTION: Be careful not to move labels to a location where they can visually be misread as belonging to a different element. If confusion exists, there are several ways to do a sanity check, i.e. the model view, properties of the line, using the Tab to jump between the editable fields, etc.

Operational Activity Model (OV-5), Logical Data Model (OV-7), and Operational Information Exchanges (OIE)

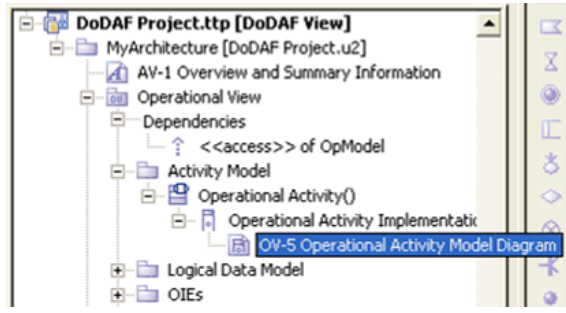

Figure 19: Original Hierarchy in Template

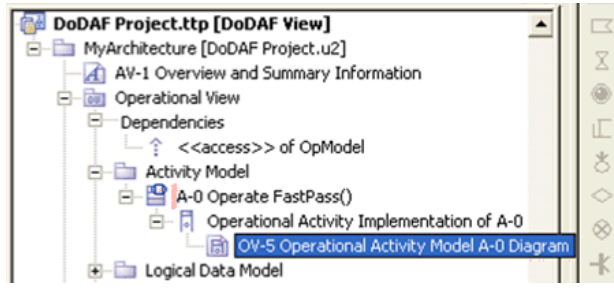

Figure 20: Renamed Hierarchy

It is not uncommon to use operational activity modeling as a logical starting point for a DoDAF model, in lieu of following the mission/objectives path of this example.

OV-5 diagrams are utilized to depict the data that is expected to enter the system, activities and who is responsible for them, and the expected output. Following Structured Analysis/Design diagramming, the OV-5 diagrams in this example depict input in the left side of the diagram and the outputs on the right.

Figure 19 on page 33 depicts the original template hierarchy and Figure 20 on page 33 depicts the edited labels of the hierarchy.

Figure 21 on page 34 depicts a detailed diagram. Notice the red underlines that depict that entities are not defined. This information is defined in the Logical Data Model section and the OIEs section as depicted in Figure 23 on page 35 and Figure 24 on page 36.

It is very important that the logical data model and operational information exchanges are defined in the appropriate diagrams to ensure the proper scope within the model. Refer to Figure 8 on page 15 for a reference to how the different packages are interrelated.

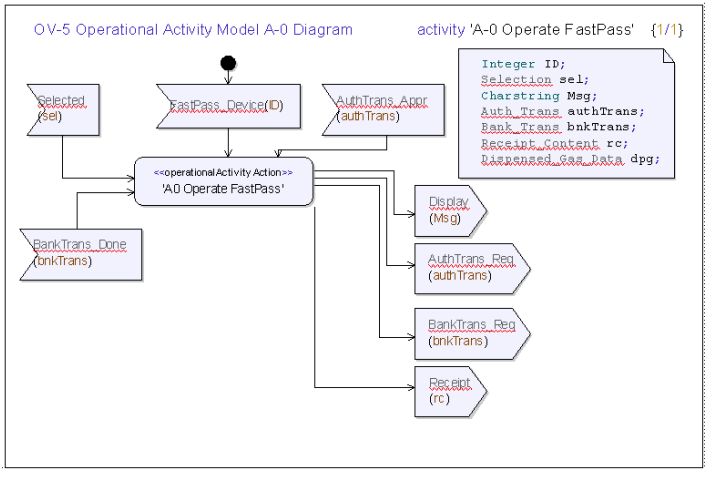

Figure 21: OV-5 Operational Activity Model

Hint

The orientation of the symbols in the activity diagram can be changed by right-clicking on a symbol (i.e. an input symbol) and selecting Flip

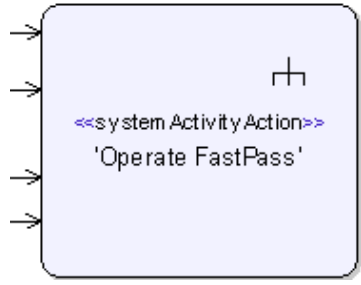

Figure 22: The "rake" symbol indicates additional sub-diagrams

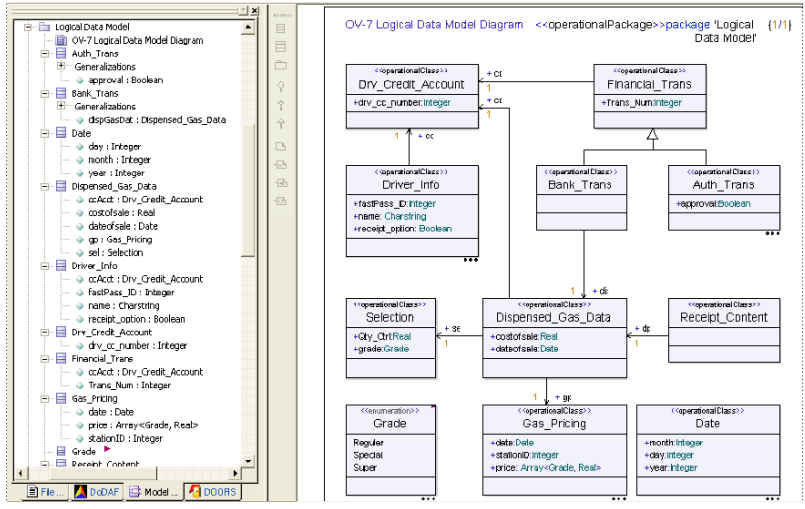

Figure 23: Logical Data Model

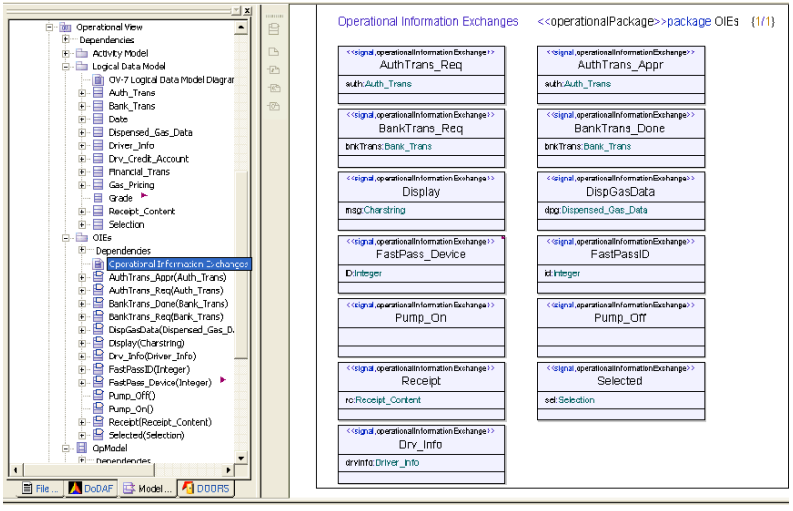

Figure 24: Operational Information Exchanges (OIE)

Additional OV-5 diagrams can be created with as much detail as needed.

In the model, operational activity action `A0 Operate FastPass` is marked visually with a “rake” symbol (Figure 22 on page 35) indicating that additional “sub-diagrams” exist

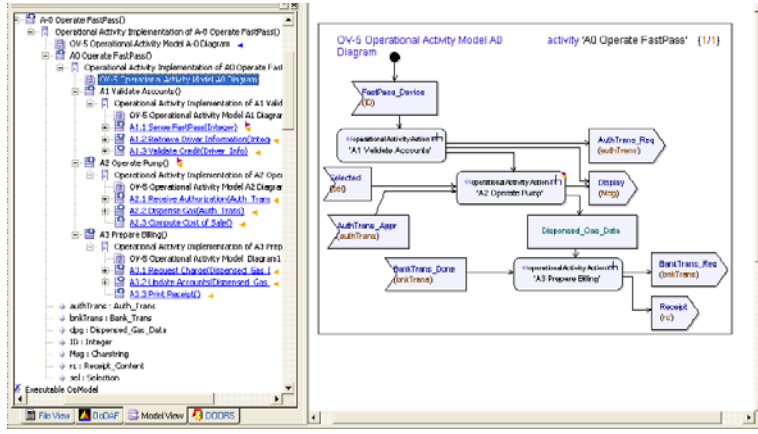

Figure 25: OV-5 Operational Activity Model for A0

Operational Rule Model (OV-6a) and Event-Trace Descriptions (OV-6c)

The creation of each view is not a “waterfall” development, finishing a view and moving to the next, never looking back, but rather an iterative process, as additional views are created, old ones are modified or detailed with additional diagrams to depict results of the analysis.

In the `FastPass` example, during the creation of the OV-5s, we saw the creation of the OV-7 and the OIEs. Also additional OV-1 diagrams have been created and further described with OV-6c Operational Event-Trace Descriptions to detail the mission objectives of the OV-1s.

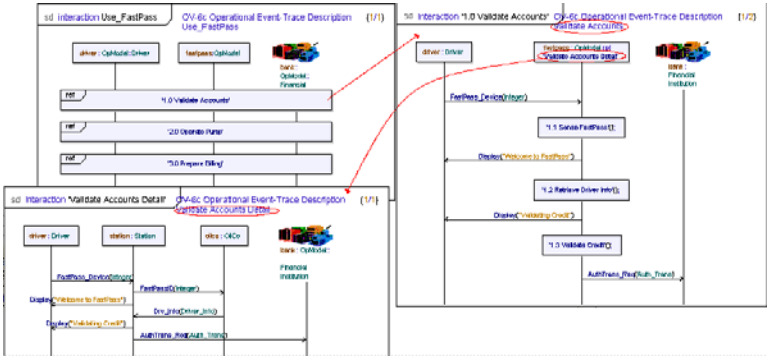

Figure 26: Examples of OV-6c Operational Event-Trace Descriptions

As depicted in Figure 27 on page 38, operational views are being filled in as discovered in DOORS. Via the DOORS/Tau integration, a surrogate module of the OV-6a is brought into Tau for linking and referencing.

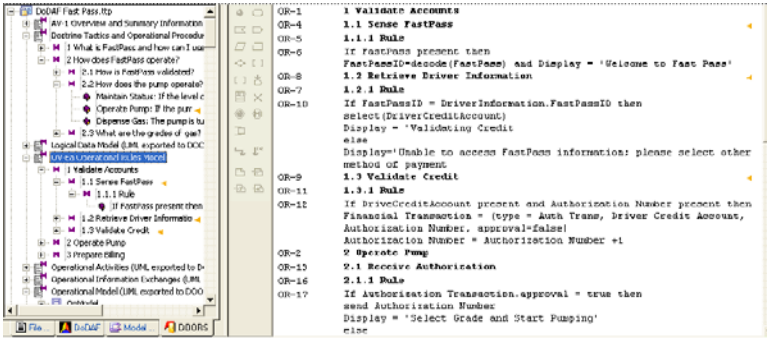

Figure 27: DOORS Surrogate Module in Tau with Operation Rules (OV-6a)

Example 1: ———————————————————————————————

A new OV-6c Operational Event-Trace Description was created at a scope level below mission/objecting `Use_FastPass` created earlier in order to depict an appropriate sequence for three new mission objectives, as per the analysis of the OV-5. The mission/objectives where also moved from their current scope to be in the same scope as the OV-6c Operational Event-Trace Description `Use_FastPass`.

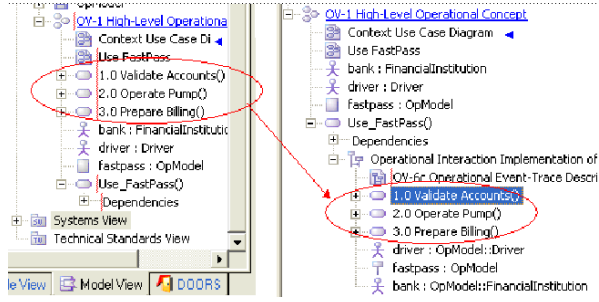

Figure 28: The mission/objectives moved to OV-6c Operational Event-Trace Description `Use_FastPass`

The model view was reorganized by dragging the elements at different encapsulation levels. This is the way the hierarchy was achieved for the OV-6c and the Mission/objectives in the OV-1 High Level Operational Concepts

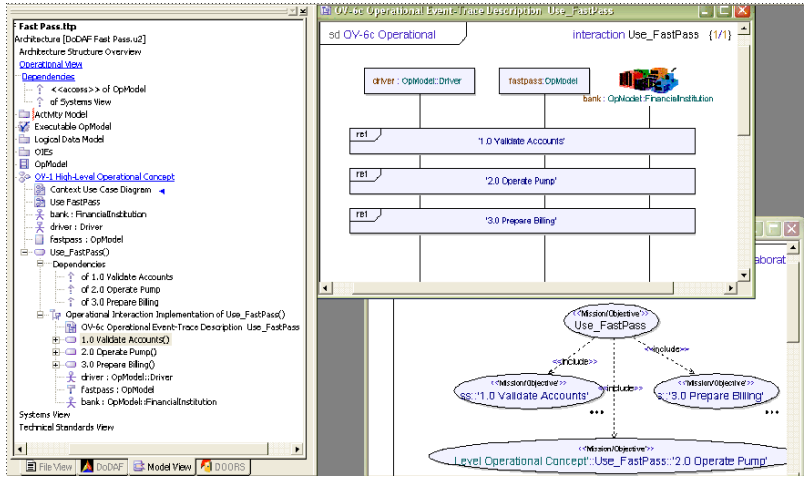

Figure 29: OV-6c Operational Event-Trace Description `Use_FastPass`.

Notice that the context use case (`Use_FastPass`) previously (Figure 17 on page 30) created has now been updated by the tool to reflect the use scope of the mission/objectives. Such details can be hidden by pressing show hide qualifiers on Remote Definitions button from the Show/Hide Remote Definition toolbar.

Hint

During model verification OV6c and SV10c are generated when Sequence Diagram tracing in enabled. These diagrams are stored in a package called `DebugTrace`*.*
`DebugTrace1` *and Interaction Implementation of* `DebugTrace1` *are editable and can both be reused as part of the OVs (i.e. OV6c) or SVs (i.e. SV10c) by appropriately stereotyping them and moving then to the correct location.*

Operational Node Connectivity Description (OV-2)

In the OV-6cs and OV-5s that where created, the OV-2 Operational Node Connectivity Descriptions can be deduced as a natural next step. In order to simplify the information on the needlines, signal lists where created to group together signals as depicted in Figure 30 on page 41. Interfaces where not used due to the fact that they make reuse of signals a bit more difficult.

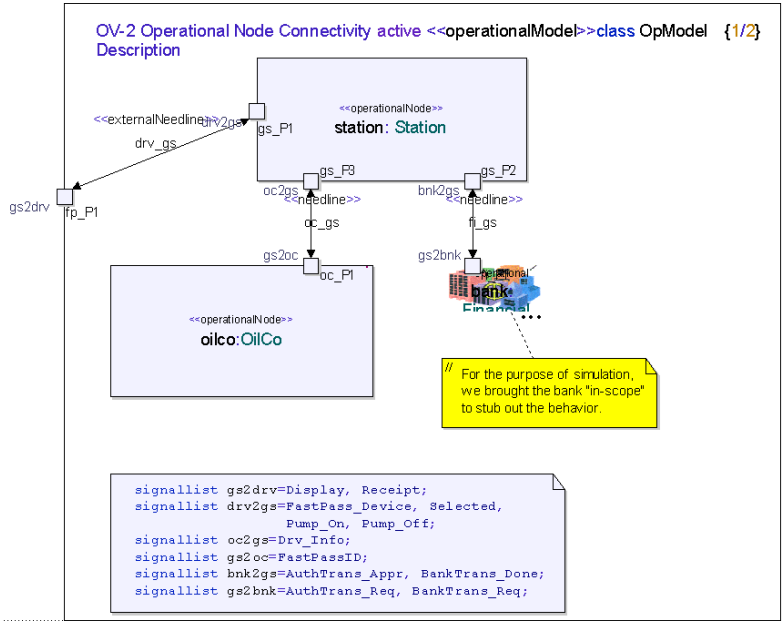

Figure 30: OV-2 Operational Node Connectivity Description for `OpModel`

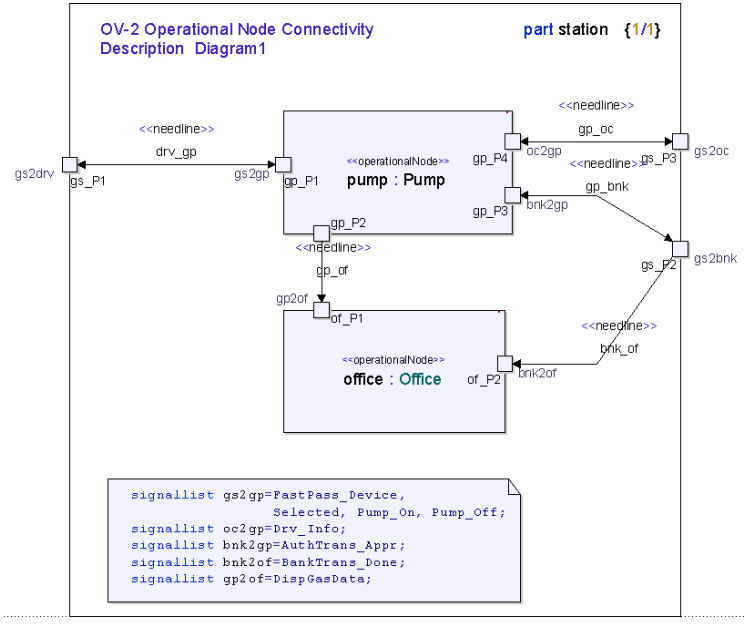

Figure 31:OV-2 Operational Node Connectivity Description for Station

Operational Information Exchange Matrix (OV-3)

In order to associate Operational Activities to Operational Nodes for the purpose of generating an OV-3 report, you should assign each Operational Activity to an Activity Partition which will in turn reference the appropriate Operational Node. To do so, if you have already implemented activity partitions in your OV-5 operational activity model, ensure that the selector of each partition references the appropriate operational node. Enter the name of the operational node in the selector field of the activity partition. The selector field is located under the name. You can also add a selector to an existing Activity Partition by dragging and dropping the appropriate operational node on to the partition. In the `FastPass` example, an association might appear as: `station::pump`.

Hyperlinks Vs. Traceability links in Tau

Within the `FastPass` example both Traceability links and Hyperlinks have been used. It is up to the users of Tau and their methodology to determine what type of link should be created and when.

A traceability link example has been depicted in Figure 32 on page 44.

A hyperlink example is shown in Figure 33 on page 44

Traceability links are necessary between DOORS requirements/objects and Tau artifacts since traceability links can be controlled both in DOORS and Tau. The same hold true for the SV-6 reports where the Systems must be linked to the System Activity Actions via traceability links.

In the `FastPass` example, hyperlinks have been used for several different reasons. As expected, hyperlinks are used in order to link external artifacts, such as the OV-1 High Level Operational Graphic to Tau. They have also been used in order to provide quick navigation between elements and graphics such as the link created from the package Operation View to Context Use Case Diagram. In some cases related model elements have been hyperlinked together, i.e. operational activities have been hyperlinked with operational states indicating which state machine (or part of a state machine i.e. a state) implements an activity.

In this latter case, traceability links may have been a better option since traceability links transfer to DOORS and can be used for farther analysis, however the decision is left up to the users.

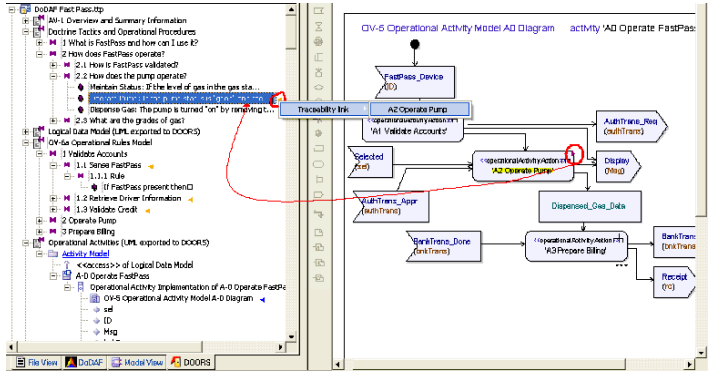

Figure 32: Traceability Links from Activities to Requirements

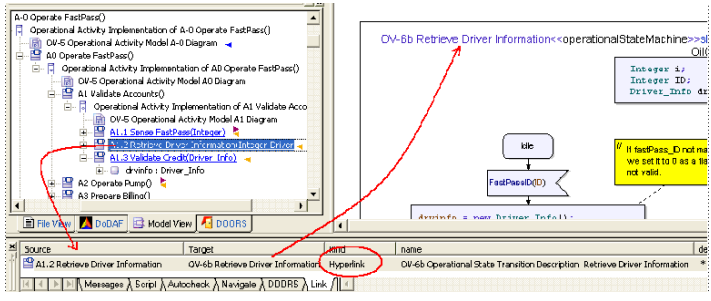

Figure 33: Hyperlink from Activity to OV-6 Operational State Transition Description

Operational State Transition Description (OV-6b)

Some operational activities identified in the OV-5s have their implementation specified as Operational State Transition Descriptions (OV-6b). The operational activity has been hyperlinked to the operational state transition descriptions as indicated in Figure 33 on page 44.

Special care was taken dividing the operational state machine implementations into several diagrams; think of it as several pages of the same diagram. This was done in order to logically link activities to these implementations.

One could also create OV-6b diagrams hierarchically below each activity, rather then an OV-6b defined hierarchically below an organization. However, even though all OV-6s are checked syntactically and semantically in Tau, only the OV-6b describing an organization are considered and executed dynamically during model verification.

Tau Model Elements and Links to DOORS

Let's backtrack and remember that Tau and DOORS are tightly integrated and take advantage of this integration by pushing the `FastPass` model and the traceability links to DOORS.

From the Operational View package the following was exported to DOORS:

Package in Tau	Equivalent Module in DOORS
`Activity Model`	Operational Activities
`Logical Data Model`	Logical Data Model
`OIEs`	Operational Information Exchanges
`OpModel`	Operational Model

Figure 34 on page 45 and Figure 35 on page 46 show the result.

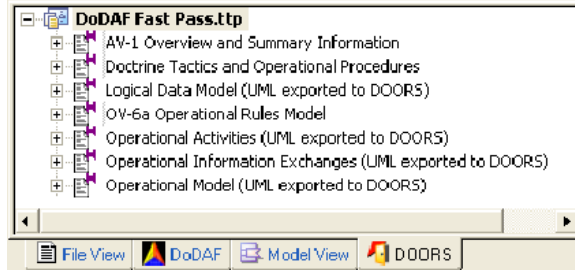

Figure 34: DOORS Tab in Tau (Shared information between DOORS and Tau)

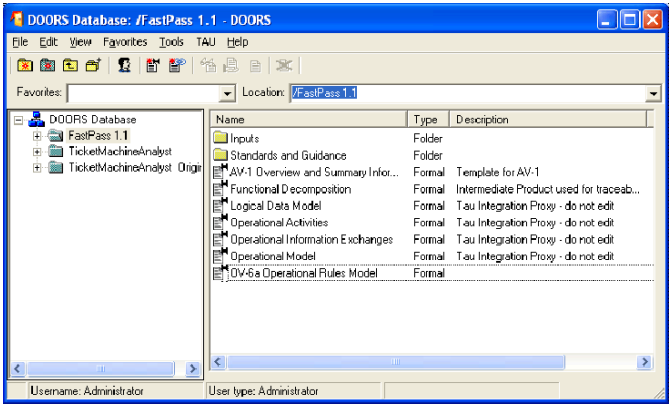

Figure 35: Model Entities Pushed from Tau to DOORS

Once in DOORS, formal module Operational Model was analyzed and the `op` node to `op` activity trace view was created by displaying the object attribute UML Kind and running the analysis wizard to display all outgoing links (Figure 36 on page 47).

Once this view is created, it is available for use at any time. The Out-Links column is a DXL script that was created by DOORS and it actively tracks and displays out-links.

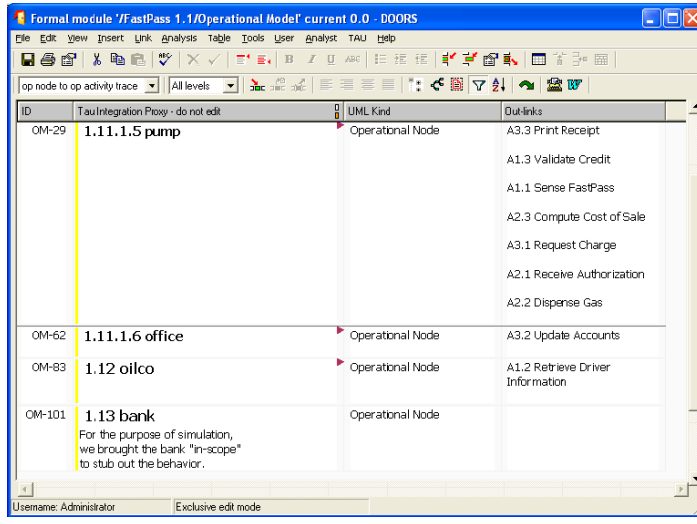

Figure 36: Operational note to Operational Activity Trace View in DOORS

Similarly an allocation traceability view was created and saved for the Operational Activities formal module (Figure 37 on page 47).

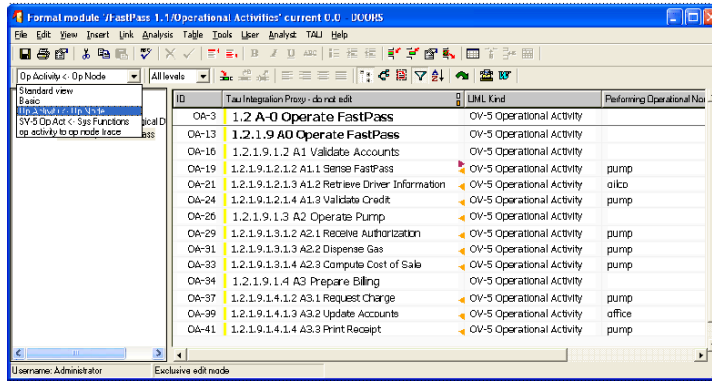

Figure 37: Operational Activity and Performing Operational Node Traceability View in DOORS (Allocation Traceability)

System Functionality Description View (SV-4)

Analogous to the OV-4 Organization relationship chart, several SV-4 System Functionality Description Context Diagrams are created in order to depict the functions performed by the systems and the system data flows.

Figure 38 on page 48 depicts a high level description of the main functionality of the system-of-systems `FastPass`,'`Operate FastPass`'. `Driver` and Financial institutions which are external to `FastPass` are shown here in order to capture the flow of data to these entities as the function is performed.

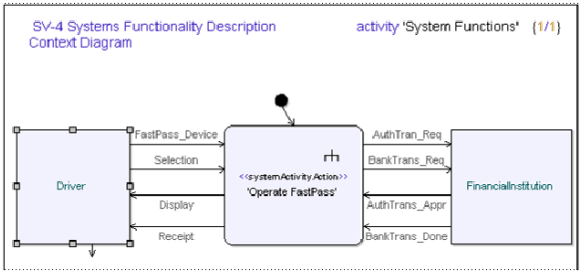

Figure 38: SV-7 Systems Functionality Description Context Diagram

Example 2:

For simplicity in the diagram, the physical data elements have been written directly on the activity lines as text (Figure 40 on page 50) rather then as object nodes. Even though this makes for a cleaner diagram, it misses one of the strengths of Tau, binding of defined elements and marking undefined elements with the red-underline. Notice the two presentations of Selection in Figure 39 on page 49 (below). Also notice the two presentations of `SelectionX` which is undefined

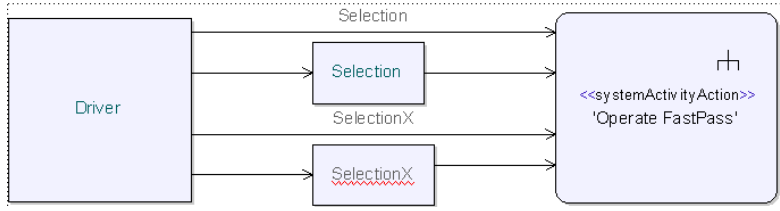

Figure 39: Binding of defined elements

The data referenced on the activity edges, is defined in the Physical Data Model package as System Classes (Figure 11 on page 24), and in the SIEs package as a System Information Element

"`Operate FastPass`" if farther analyzed and decomposed in several SV-4 diagrams and sub-diagrams, an example of which is depicted in Figure 40 on page 50.

The relevant system activity actions discovered are hyperlinked to the relevant operational activity actions, from the system to the operation. This step is crucial for model consistency and traceability. A happy side affect of the linking is the creation of the SV-5 once the information is pushed to DOORS.

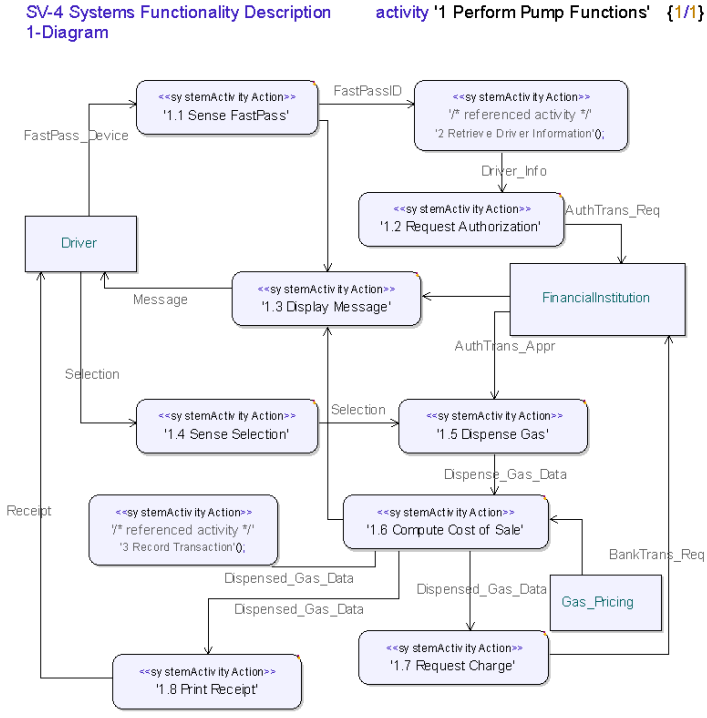

Figure 40: SV-4 System Functionality Description with Links

Operational Activity to System Function Traceability Matrix (SV-5)

The goal of the SV-5 is to map the systems and its functions discovered back to the capabilities or operational activities. The links created during the creation of the SV-4 provide that information.

The System Functions package was exported to DOORS with the same name. The links where synchronized to reflect the links created during the creation of the SV-4s.

In DOORS, the Analysis Wizard was used in formal module System Functions to create the `SV-5 Sys Function -> Op Activities` view as depicted in Figure 41 on page 51.

The Analysis Wizard was also used inside the formal module Operational Activities for the `SV-5 Op Act <- Sys Functions` view.

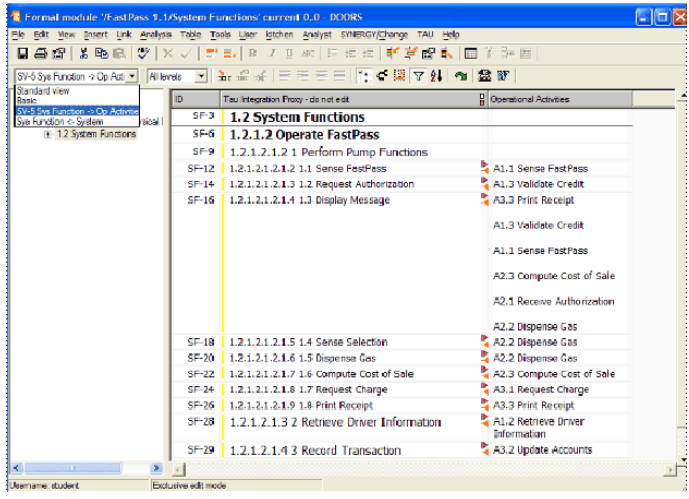

Figure 41: SV-5 System Activity Action to Operational Activity Actions Traceability Matrix

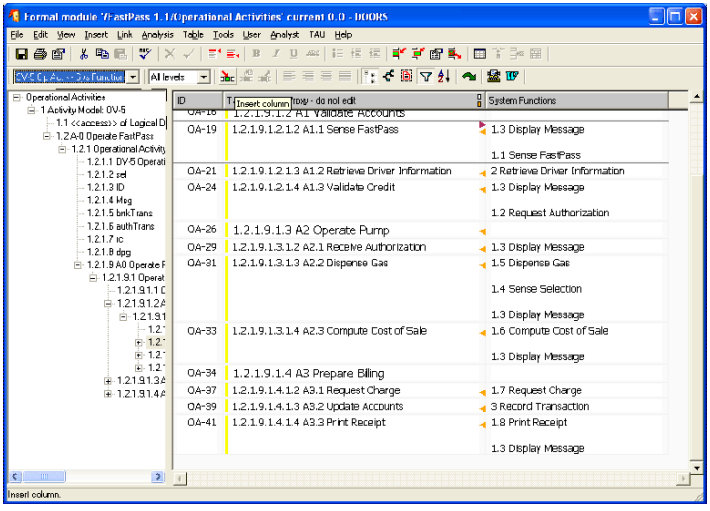

Figure 42: SV-5 Operational Activity Actions to System Activity Actions Traceability Matrix

System Rules Model (SV-10a) and Systems Event-Trace Description (SV-10C)

The SV-10a represent the systems rules and just like the OV-6a (Figure 27 on page 38),its object view counterpart, it is stored in DOORS and utilized in Tau for linking

An SV-10c can be used in the System Function package to capture interactions of system modes, similar to the OV-6.

Physical Schema (SV11)

From previous analysis, i.e. the OV-7, it was decided that `FastPass` is a system of systems basically comprised of the oil company and the station, which in turn is comprised of the office and one or more pumps. This information is captured in an SV-11 Physical Schema diagrams

Analysis during the SV-4 and SV-10abc reveal the decomposition of system class Pump into `DisplyUnit`, `Calculator`, `Printer`, `FPSensor` and, `PumpECU`. The system breakdown structure is Defined in the Physical Data Model package (Figure 43 on page 53).

In the Physical Data Model package is another SV-11 diagram with all the data/passive system classes (Figure 44 on page 54).

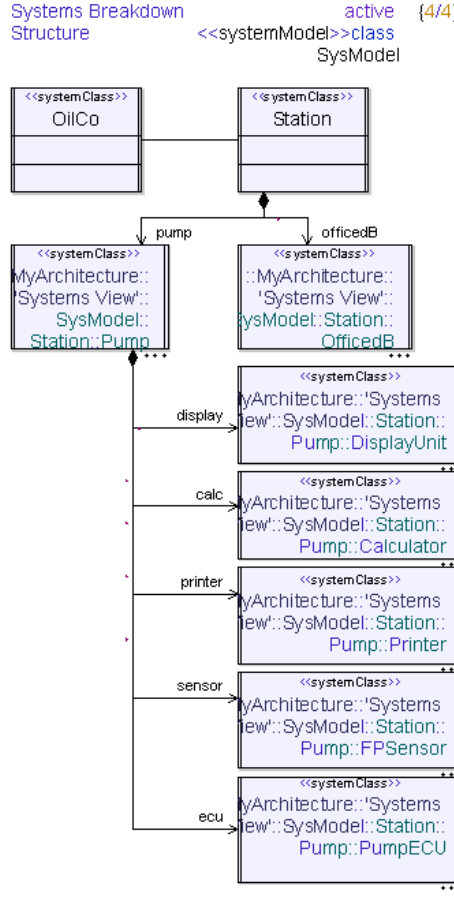

Figure 43: SV-11 Physical Schema Diagram

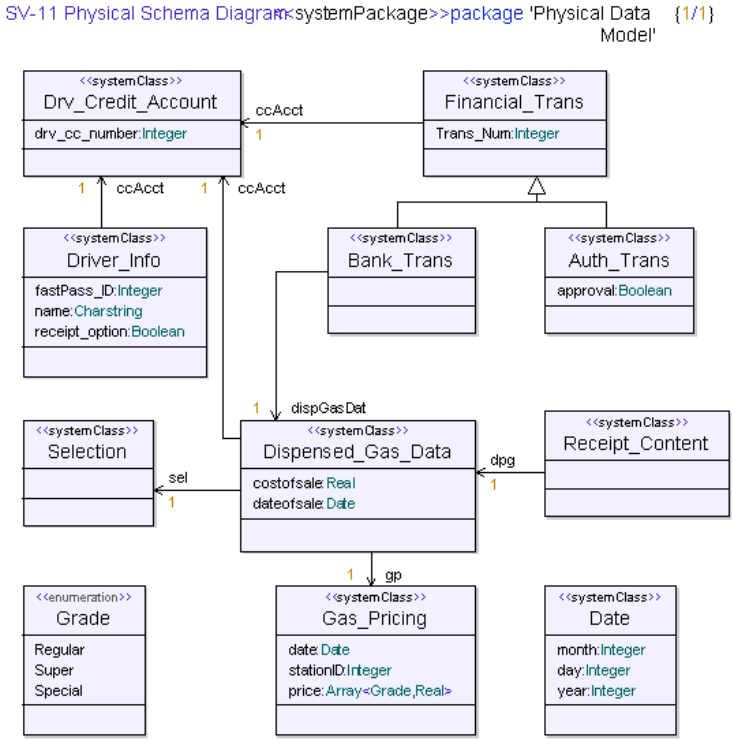

Figure 44: Physical Schema Diagram (SV-11)

Systems State Transition Description (SV-10b)

Even though an SV-10b DoDAF product is not depicted in the `FastPass` model, it can be described much like OV-6b diagram, in order to show the complex dynamic behavior of the systems

Systems Interface Description (SV-1) and Systems Communication Description (SV-2)

SV-1 and SV-2 DoDAF products can be defined in Tau as part of the system model, more specifically in the scope of the system that they are describing. Figure 45 on page 55 depicts: a system, two system nodes, how they are connected and the data that they exchange. Figure 46 on page 56 and Figure 47 on page 57 are other such examples.

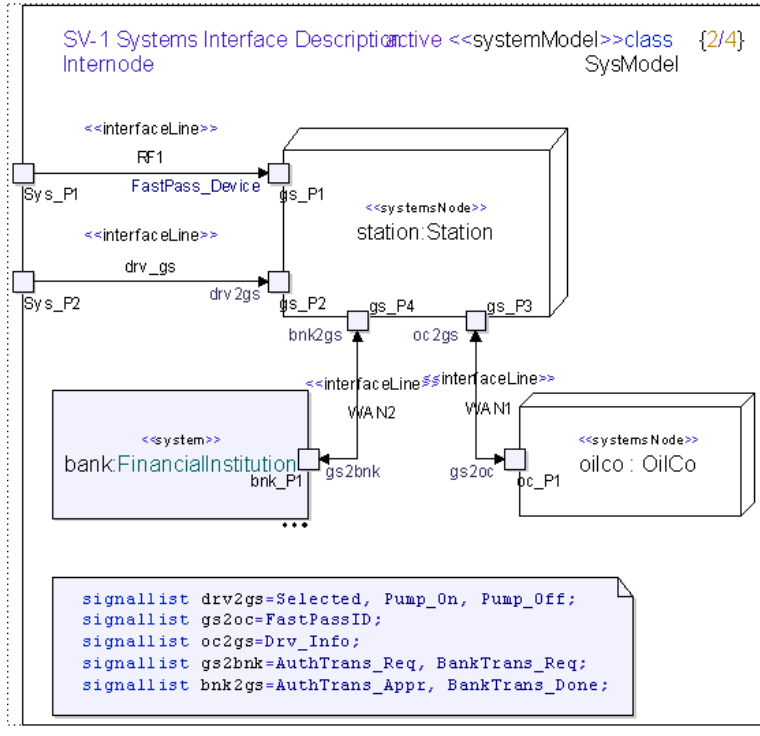

Figure 45: SV-1 Systems Interface Description for Class `SysModel`

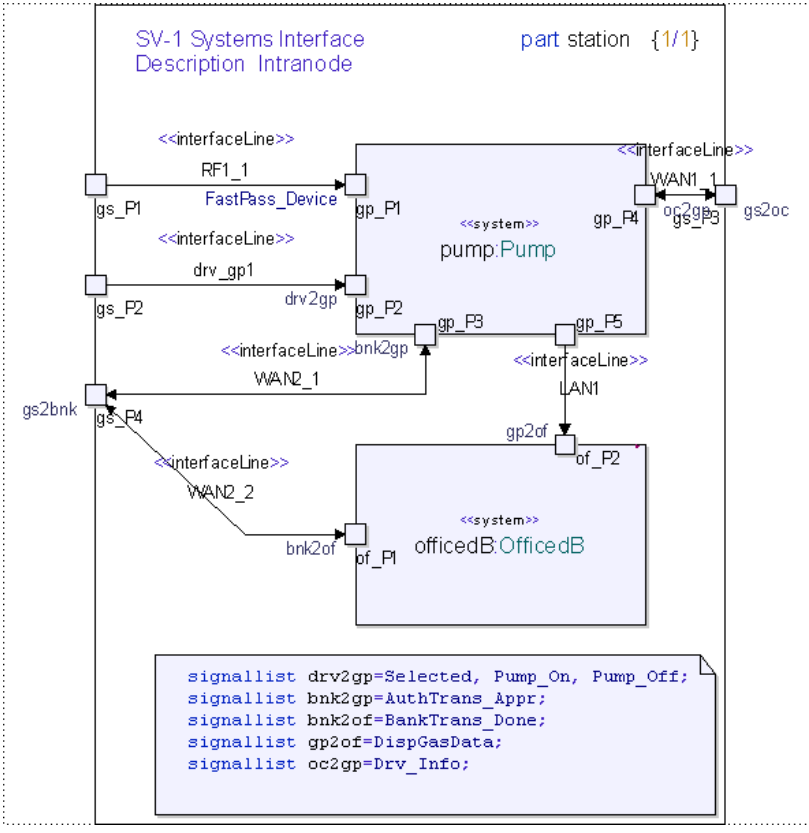

Figure 46: SV-1 Systems Interface Description `Intranode` *for station*

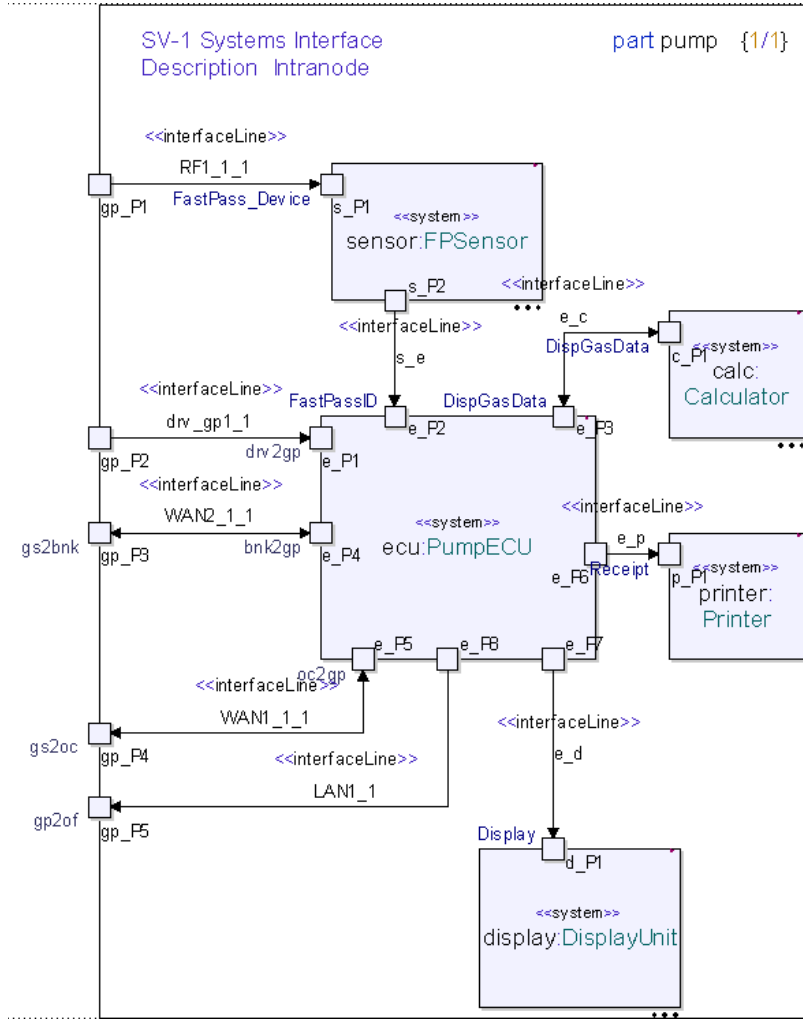

Figure 47: SV-1 Systems Interface Description `Intranode` *for Pump*

Some key points need to be made about the SV-1 and SV-2 diagrams

The first point is the use of signal lists which once again used to group system data exchanges. Signal lists could have also been defined as part of SIEs package or Physical Data Model package since they are themselves a sort of definition.

The second point is the links of the systems back to the system action activities. Just like described in the OV-3 section, the links are used for traceability and production of the SV-6.

System Data Exchange Matrix (SV-6)

The system information exchanges considered are found in the SIEs package (Figure 49 on page 59). The report used the systems and interface lines of the SV-1 and the SV-2, as well as the data they interchange. Each system information element on the interface line connecting systems or subsystems, the system is checked to see if it has a traceability link to a system action activity. If it does, the report is printed. An example of the report is found in Figure 48 on page 58.

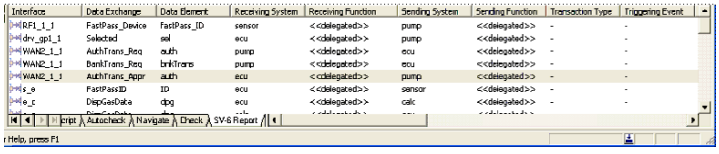

Figure 48: SV-6 Report

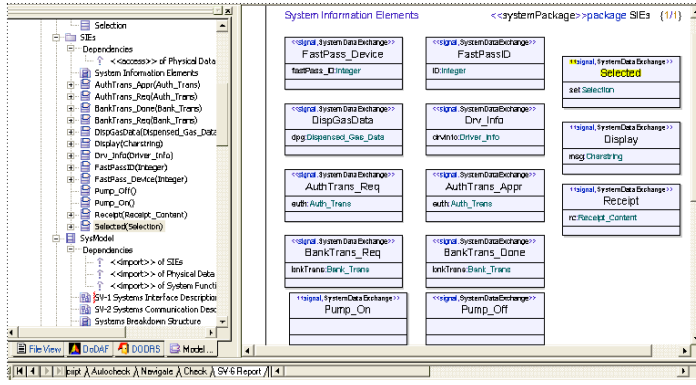

Figure 49: System Information Exchanges

System-Systems Matrix (SV-3)

An SV-3 view is supposed to show the relationship between systems in a given architecture. This is a DoDAF product that is generated by building the model and the other views. When synchronizing into DOORS, all of the system entities are transferred and filters within DOORS can be used to display relevant information. Attributes can be defined in doors, or tag values in Tau, to provide additional information such as planned vs. exiting interfaces.

System Performance Parameter Matrix (SV-7)

The System Performance Parameter Matrix is a result of synchronizing Tau with DOORS. Once the model and the links are in DOORS, a view can be created to depict the SV-7 DoDAF product (Figure 50 on page 60).

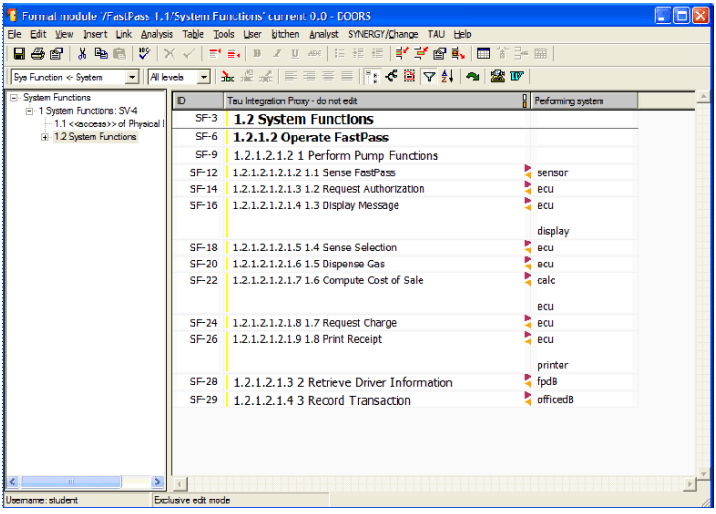

Figure 50: System Function to System Matrix

Integrated Dictionary (AV-2)

The integrated dictionary can automatically be created by running the AV-2 Report of the DoDAF menu option. The report is customizable via a GUI allowing for reports specific on one or more DoDAF Views (Figure 51 on page 61)

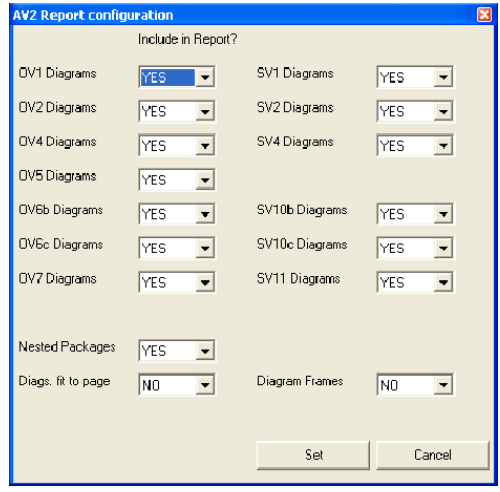

Figure 51: AV-2 Report Configuration

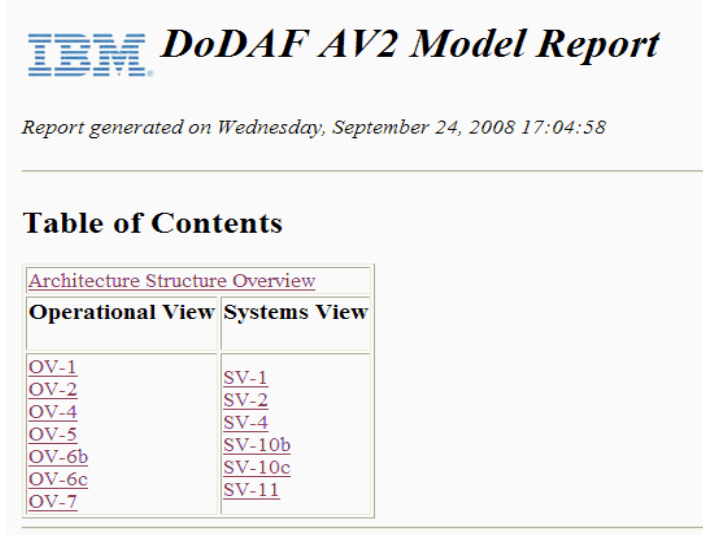

Figure 52: Example of AV-2 Report

Hint

An AV-2 report can be generated by selecting a package and selecting DoDAF/AV2 Report/Generate AV2 Report from the menu bar. To see the report select DoDAF/AV2 Report/Open Last AV2 Report from the menu bar

System Technology Forecast (SV-9), System Evolution Description (SV-8), Technical Standards Forecast (TV2) and Technical Standards Profile (TV-1)

The remaining views are not covered in the `FastPass` example. They are however all views that are stored in DOORS. An example of a TV-1 is depicted in Figure 53 on page 62

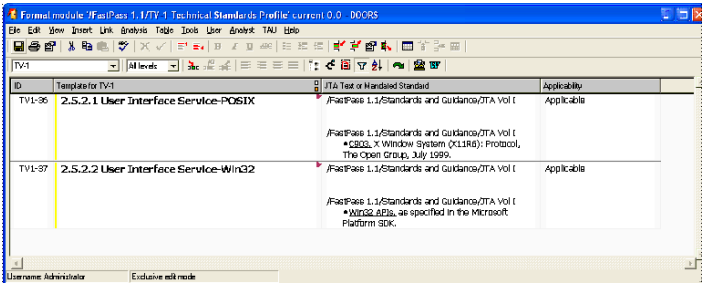

Figure 53: TV-1 Stored in DOORS

4

Additional Resources

This section list documents that are not part of the help file, but that may help you to extend your knowledge about Tau. Links to useful web resources are also provided.

Contacting Customer Support

If the self-help resources have not provided a resolution to your problem, you can contact IBM® Rational® Software Support for assistance in resolving product issues.

Before you contact Customer Support

To submit your problem to IBM Rational Software Support, you must have an active Passport Advantage® software maintenance agreement. Passport Advantage is the IBM comprehensive software licensing and software maintenance (product upgrades and technical support) offering. You can enroll online in Passport Advantage from lhttp://www.ibm.com/software/lotus/passportadvantage/howtoenroll.htm

To learn more about Passport Advantage, visit the Passport Advantage FAQs at http://www.ibm.com/software/lotus/passportadvantage/brochures_faqs_quickguides.html.

For further assistance, contact your IBM representative.

To submit your problem online (from the IBM Web site) to IBM Rational Software Support, you must additionally:

- Be a registered user on the IBM Rational Software Support Web site. For details about registering, go to http://www-01.ibm.com/software/support/.
- Be listed as an authorized caller in the service request tool.

Submitting Problems

To submit your problem to IBM Rational Software Support:

1. Determine the business impact of your problem. When you report a problem to IBM, you are asked to supply a severity level. Therefore, you need to understand and assess the business impact of the problem that you are reporting.

Use the following table to determine the severity level

Severity	Description
1	The problem has a *critical* business impact: You are unable to use the program, resulting in a critical impact on operations. This condition requires an immediate solution.
2	This problem has a *significant* business impact: The program is usable, but it is severely limited.
3	The problem has *some* business impact: The program is usable, but less significant features (not critical to operations) are unavailable.
4	The problem has *minimal* business impact: The problem causes little impact on operations or a reasonable circumvention to the problem was implemented

2. Describe your problem and gather background information, When describing a problem to IBM, be as specific as possible. Include all relevant background information so that IBM Rational Software Support specialists can help you solve the problem efficiently. To save time, know the answers to these questions:
   - What software versions were you running when the problem occurred?

   To determine the exact product name and version, use the option applicable to you:
   - Start the IBM Installation Manager and select **File** > **View Installed Packages**. Expand a package group and select a package to see the package name and version number.
   - Start your product, and click **Help** > **About** to see the offering name and version number.
   - What is your operating system and version number (including any service packs or patches)?
   - Do you have logs, traces, and messages that are related to the problem symptoms?
   - Can you recreate the problem? If so, what steps do you perform to recreate the problem?
   - Did you make any changes to the system? For example, did you make changes to the hardware, operating system, networking software, or other system components?
   - Are you currently using a workaround for the problem? If so, be prepared to describe the workaround when you report the problem.

3. Submit your problem to IBM Rational Software Support. You can submit your problem to IBM Rational Software Support in the following ways:
   - **Online**: Go to the IBM Rational Software Support Web site at https://www.ibm.com/software/rational/support/ and in the Rational support task navigator, click **Open Service Request.** Select the electronic problem reporting tool, and open a Problem Management Record (PMR), describing the problem accurately in your own words.
   - For more information about opening a service request, go to http://www.ibm.com/software/support/help.html
   - You can also open an online service request using the IBM Support Assistant. For more information, go to http://www-01.ibm.com/software/support/isa/faq.html.
   - **By phone**: For the phone number to call in your country or region, go to the IBM directory of worldwide contacts at http://www.ibm.com/planetwide/ and click the name of your country or geographic region.
   - **Through your IBM Representative**: If you cannot access IBM Rational Software Support online or by phone, contact your IBM Representative. If necessary, your IBM Representative can open a service request for you. You can find complete contact information for each country at http://www.ibm.com/planetwide/.

If the problem you submit is for a software defect or for missing or inaccurate documentation, IBM Rational Software Support creates an Authorized Program Analysis Report (APAR). The APAR describes the problem in detail. Whenever possible, IBM Rational Software Support provides a workaround that you can implement until the APAR is resolved and a fix is delivered. IBM publishes resolved APARs on the IBM Rational Software Support Web site daily, so that other users who experience the same problem can benefit from the same resolution.

Links

IBM Rational Tau links

IBM Rational Tau

The following link direct you to Tau resources:

Tau resources

Other links

DoD

Links related to the United States Department of Defense Architecture Framework
http://www.army.mil/aeioo/erp/aetg_tools.htm

http://www.enterprise-architecture.info/Images/Defence%20C4ISR/Enterprise%20Architecture%20Defense.htm

ITU-T

Formerly CCITT
http://www.itu.int/

OMG

For more information about Object Management Group (OMG) and Unified Modeling Language (UML), see:
http://www.omg.org
http://www.uml.org

PDF

PDF files are opened and read with Adobe Acrobat Reader:
www.adobe.com

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