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How to Share DoDAF 2 Data with UNICOM® System Architect®

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Contents

Executive Summary

The need to share enterprise architecture data has brought about various data interchange approaches over many years. The approaches required some amount of work to design and implement them across the various modeling tools, databases and other tools. For various reasons, the approaches were unevenly implemented across the tools and databases and they didn't accommodate the spreadsheet-based enterprise architectures used by many.

This paper describes a simpler approach based on views that DoDAF2 modeling tools and spreadsheet-based architectures already create, the OV-03 Operational Resource Flow Matrix and SV-06 System Resource Flow Matrix. The approach requires the use of spreadsheet functions but no coding. Spreadsheets other than OV-03 and SV-06 – as well as OV-03 and SV-06 spreadsheets with different contents and formats – can be imported using this technique.

The technique can be used to transfer data from other tools, databases and from hand-built spreadsheets into System Architect. While all OV-03 and SV-06 spreadsheets are not alike, their contents can be manipulated using standard Excel functions to form data that can be directly imported into System Architect to create the definitions from which diagrams, matrices and reports can be generated. The examples in this paper use a sample SV-06 which may or may not be like the SV-06 you want to import into System Architect. In any case, feel free to use the examples as templates or as a guide to building your own.

The System Architect implementation of DoDAF2 brought about significant advances in the core modeling capabilities of the tool. In System Architect DoDAF2 viewpoints (diagrams, matrices and reports) are representations of the underlying data (definitions) including relationships. The relationships contained in the data definitions are the relationships that appear on diagrams, matrices and reports. Changing a data definition, synchronizes the viewpoints on which it appears and changing a diagram or matrix will synchronize the underlying data definitions. Another DoDAF2 feature is the ability to use data subtypes. This enables the models to more closely reflect the operations and systems being modeled but requires additional information when importing relationship data. The examples in this paper focus on the consistency between definition data, related viewpoints and the technique needed to construct relationships using subtypes.

SV-06 System Resource Flow matrix

The example SV-06 System Resource Flow matrix shown in Figure 1, generated by System Architect, is the only data source used for the examples in this tutorial.

	A	B	C	D	E	F	G	H	I
1	Performer Source	Performer Type	Producing Role	Producing Function	System Data Flow	Consuming Function	Consuming Role	Performer Target	Performer Type
2	o3	Organization (DM2)	perf role 12	sf2	sdf2	sf3	perf role 14	s2	System (DM2)
3	s1	System (DM2)	perf role 13	sf2	sdf2	sf3	perf role 14	s2	System (DM2)
4	s3	System (DM2)	perf role 10	sf1	sdf1	sf2	perf role 12	o3	Organization (DM2)
5	s3	System (DM2)	perf role 10	sf1	sdf1	sf2	perf role 13	s1	System (DM2)
6	s3	System (DM2)	perf role 10	sf1	sdf4	sf3	perf role 14	s2	System (DM2)
7	s3	System (DM2)	perf role 11	sf1	sdf1	sf2	perf role 12	o3	Organization (DM2)
8	s3	System (DM2)	perf role 11	sf1	sdf1	sf2	perf role 13	s1	System (DM2)
9	s3	System (DM2)	perf role 11	sf1	sdf4	sf3	perf role 14	s2	System (DM2)

Figure 1. SV-06 System Resource Flow matrix

This example SV-06 does not contain subtype references, but it does contain the data you need to construct those references. Two subtypes of performer are used (Organization and System). Other subtypes of performer could have been used because the spreadsheets in this tutorial are prepared to handle them. The SV-06 you want to import might contain only systems without other subtypes of performer. The spreadsheets throughout this tutorial show how to import data from both a multi-subtype and single-subtype spreadsheet column.

System data flow example and import behavior

Each spreadsheet focuses on a single import definition type. When imported, the properties (attributes) of that definition type are populated from the columns in the spreadsheet. Column names that match the property names in the definitions are imported by System Architect. Column names that do not match are not imported. Note that both the System Data Flow and System Function instances are created as a result of the System Data Flow import. You can apply additional or updated data to imported definitions with subsequent imports.

In the examples in this tutorial, the data to import starts in the column following the original data (column J). The spreadsheet contains the original SV-06 data and the data to import (in this spreadsheet it is column-J through column-L). The column headings do not match the definition property names in column-A through column-I so the contents of the cells in those columns will be not be imported. Figure 2 shows a continuation of the spreadsheet in Figure 1.

This view of the spreadsheet contains the system data flows and system functions that appear in SV-04 System Functionality Description diagram.

Name	Source	Destination
sdf2-perf role 12-perf role 14	Definition:"System Function (DM2x)":"sf2"	Definition:"System Function (DM2x)":"sf3"
sdf2-perf role 13-perf role 14	Definition:"System Function (DM2x)":"sf2"	Definition:"System Function (DM2x)":"sf3"
sdf1-perf role 10-perf role 12	Definition:"System Function (DM2x)":"sf1"	Definition:"System Function (DM2x)":"sf2"
sdf1-perf role 10-perf role 13	Definition:"System Function (DM2x)":"sf1"	Definition:"System Function (DM2x)":"sf2"
sdf4-perf role 10-perf role 14	Definition:"System Function (DM2x)":"sf1"	Definition:"System Function (DM2x)":"sf3"
sdf1-perf role 11-perf role 12	Definition:"System Function (DM2x)":"sf1"	Definition:"System Function (DM2x)":"sf2"
sdf1-perf role 11-perf role 13	Definition:"System Function (DM2x)":"sf1"	Definition:"System Function (DM2x)":"sf2"
sdf4-perf role 11-perf role 14	Definition:"System Function (DM2x)":"sf1"	Definition:"System Function (DM2x)":"sf3"

Figure 2. System data flow spreadsheet

Spreadsheet Lookup table

Each spreadsheet has a Lookup tab which contains a Lookup table (technically, the tab is the name of another worksheet in the same Excel workbook). The same Lookup table is used in all spreadsheets in this tutorial. The Lookup table has two columns:

- Column-A is the Identifier
- Column-B contains the subtype reference string necessary to create subtype references

The Excel VLOOKUP function uses this table. The table must be in ascending order by search argument. Spreadsheets from other sources will likely have Identifiers other than the ones listed in Figure 3 (the lookup table used in this tutorial). You will need to change the Identifiers to match the source identifiers in the SV-06/OV-03 you are importing. If you add or change an Identifier, change the table sequence to keep it in ascending order.

The VLOOKUP function searches the "Identifier" column for a match and inserts the value from the corresponding "Subtype" column into the result. This is one of the required parts of a heterogeneous reference in System Architect.

A complete heterogeneous reference in System Architect is in the form: "Definition": "type name":"name". "Definition" and "type name" are supplied by the VLOOKUP function using the Lookup table. "Name" is typically formed from one or more columns on the spreadsheet. "Definition" specifies the class of the object being referred to and is constant because only definitions are referenced in the way.

1	Identifier	Subtype			
2	Activity (DM2)	Definition:"Activity (DM2)":			
3	ActivityPerformedByPerformer (DM2r)	Definition:"ActivityPerformedByPerformer (DM2r)":			
4	Event (DM2x)	Definition:"Event (DM2x)":			
5	Interface (Port) (DM2)	Definition:"Interface (Port) (DM2)":			
6	Organization (DM2)	Definition:"Organization (DM2)":			
7	Performer (DM2)	Definition:"Performer(DM2)":			
8	Person (DM2)	Definition:"Person (DM2)":			
9	Service (DM2)	Definition:"Service (DM2)":			
10	Service Function (DM2x)	Definition:"Service Function (DM2x)":			
11	ServiceInterface (DM2)	Definition:"ServiceInterface (DM2)":			
12	System (DM2)	Definition:"System (DM2)":			
13	System Data Flow (DM2rx)	Definition:"System Data Flow (DM2rx)":			
14	System Function (DM2x)	Definition:"System Function (DM2x)":			
15	System Resource Flow (DM2rx)	Definition:"System Resource Flow (DM2rx)":			
16					

Figure 3. Lookup table

Activity performed by Performer example and use of a Fixed Search Argument

In the System Data Flow spreadsheet, only System Functions appear as Source and Destination. This enables the use of a fixed search argument. As shown in Figure 4, the search argument is **System Function (DM2x)**. VLOOKUP searches column-A in the Lookup table, finds a match, and returns the **"Definition:"System Function (DM2x)":"** string which is concatenated with the contents of column-D. Spreadsheets that deal with performers make full use of the VLOOKUP function as there are several possible performer subtypes.

Note: The contents of column-D has a leading and trailing quote to allow for embedded spaces and special characters in a reference property.

f_x =CONCATENATE(VLOOKUP("System Function (DM2x)",Lookup!$A$2:$B$30,2),"""",D2,"""")
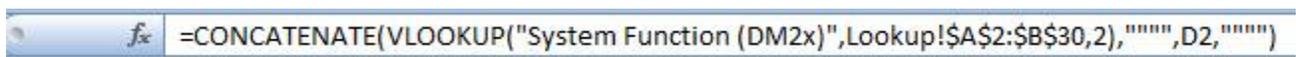
Figure 4. Fixed Search Argument Example

The ActivityPerformedByPerformer spreadsheet is pictured in Figure 5. It uses the Excel VLOOKUP and CONCATENATE functions to form the column data to import.

J	K	L
Name	Activity	Performer
perf role 12	Definition:"System Function (DM2x)":"sf2"	Definition:"Organization (DM2)":"o3"
perf role 13	Definition:"System Function (DM2x)":"sf2"	Definition:"System (DM2)":"s1"
perf role 10	Definition:"System Function (DM2x)":"sf1"	Definition:"System (DM2)":"s3"
perf role 10	Definition:"System Function (DM2x)":"sf1"	Definition:"System (DM2)":"s3"
perf role 10	Definition:"System Function (DM2x)":"sf1"	Definition:"System (DM2)":"s3"
perf role 11	Definition:"System Function (DM2x)":"sf1"	Definition:"System (DM2)":"s3"
perf role 11	Definition:"System Function (DM2x)":"sf1"	Definition:"System (DM2)":"s3"
perf role 11	Definition:"System Function (DM2x)":"sf1"	Definition:"System (DM2)":"s3"
perf role 14	Definition:"System Function (DM2x)":"sf3"	Definition:"System (DM2)":"s2"
perf role 14	Definition:"System Function (DM2x)":"sf3"	Definition:"System (DM2)":"s2"
perf role 12	Definition:"System Function (DM2x)":"sf2"	Definition:"Organization (DM2)":"o3"
perf role 13	Definition:"System Function (DM2x)":"sf2"	Definition:"System (DM2)":"s1"
perf role 14	Definition:"System Function (DM2x)":"sf3"	Definition:"System (DM2)":"s2"
perf role 12	Definition:"System Function (DM2x)":"sf2"	Definition:"Organization (DM2)":"o3"
perf role 13	Definition:"System Function (DM2x)":"sf2"	Definition:"System (DM2)":"s1"
perf role 14	Definition:"System Function (DM2x)":"sf3"	Definition:"System (DM2)":"s2"

Figure 5. ActivityPerformedByPerformer spreadsheet

Variable search argument use

The Activity column in this SV-06 is always a System Function but the Performer can be any of the performer subtypes. The VLOOKUP function uses column-B as the search argument and returns the string appropriate for the subtype reference, as shown in Figure 6.

| L2		f_x	=CONCATENATE(VLOOKUP(B2,Lookup!$A$2:$B$30,2),"""",A2,"""")		
	A	B	C	D	E	
1	Performer Source	Performer Type	Producing Role	Producing Function	System Data Flow	Consumin
2	o3	Organization (DM2)	perf role 12	sf2	sdf2	sf3
3	s1	System (DM2)	perf role 13	sf2	sdf2	sf3

Figure 6. Variable search argument

Import dialog use

Each spreadsheet must be saved as a .CSV file using **File > Save As** in Excel. To import a .CSV file use the System Architect Import function found in **Dictionary > Import Definitions**. The Import dialog page shown in Figure 7 opens.

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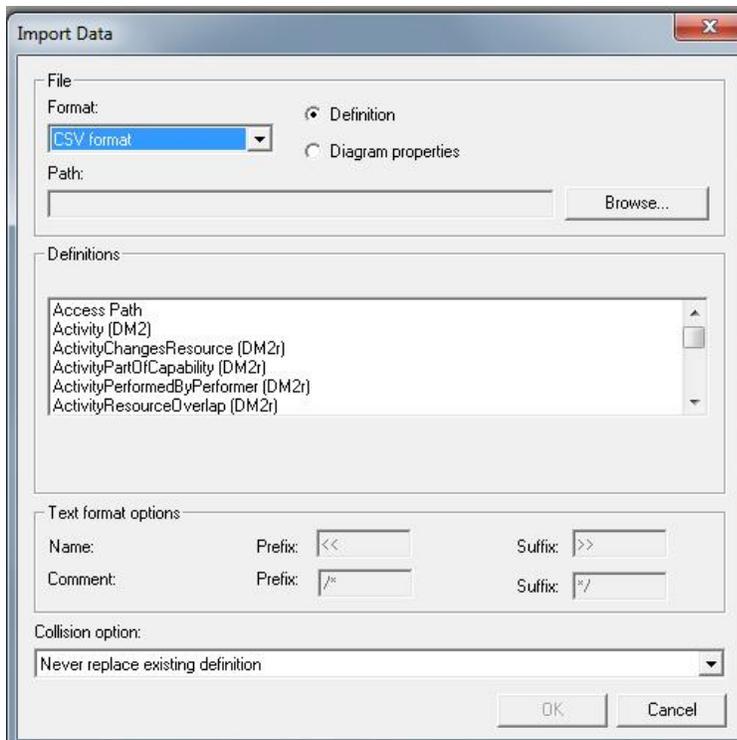
Figure 7. Import dialog

The Import dialog shown in Figure 8 is set to import the System Data Flow spreadsheet. Browse to select the .CSV file you saved and select the matching definition type. Select the collision option **Update single field when data supplied.** This collision option updates an existing definition instance's properties that have corresponding data in a spreadsheet. Keep the default settings for the other properties. A new definition instance is created if one of the same type and name does not already exist.
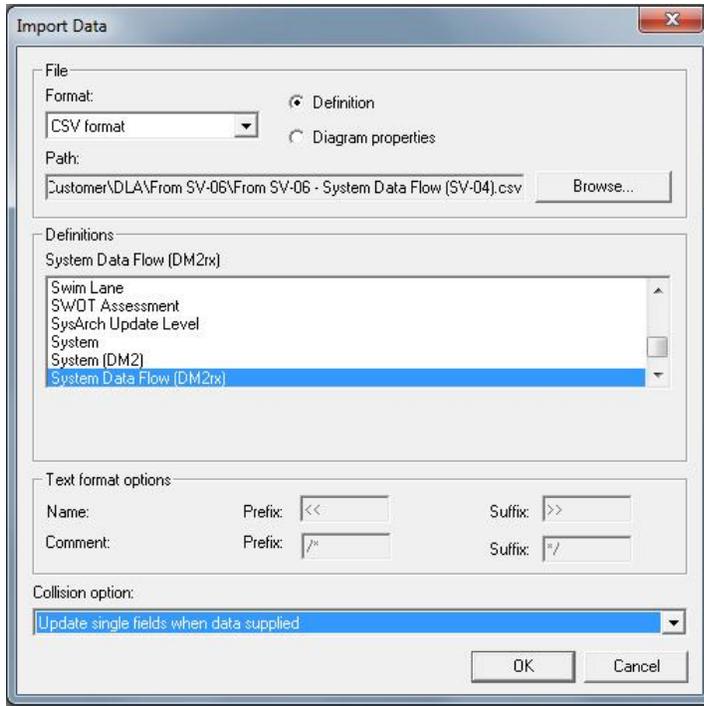
Figure 8. Importing a system data flow spreadsheet dialog

Generate an SV-04 System Functionality description diagram

Tip: Set the diagram to auto-route lines and assign connections (**Format > Diagram Auto Routing > Assign Connections**) to quickly adjust the diagram.

After you import the System Data Flow and Activity Performed by Performer .CSV files, you can generate an SV-04 System Functionality Description diagram. You can also see the relationships shown in the SV-04 System Functionality Description diagram in matrices and reports. To create the diagram in Figure 9, drag-and-drop the **System Function and Performer and Performer subtype definitions (System, Service, Service Interface, Person, Organization and Interface (Port))** from the Explorer or from the Choices dialog (on an SV-04 System Functionality Description diagram, right-click and select **Choices**). The relationships are automatically drawn based on the imported data.
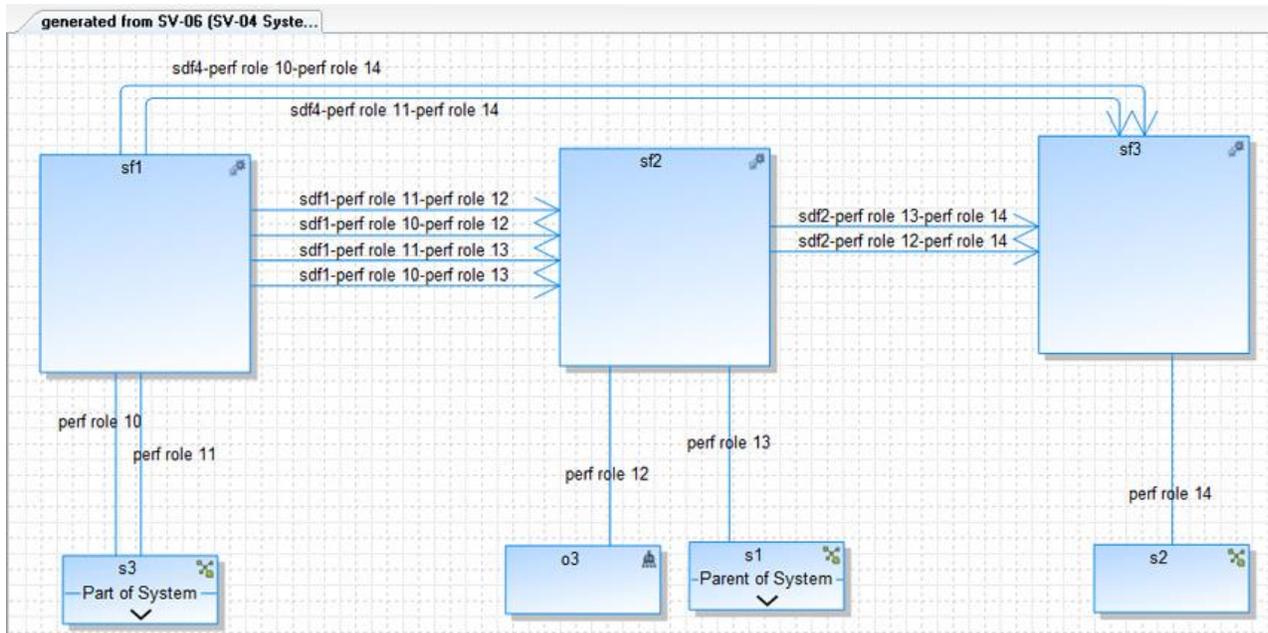
Figure 9. SV-04 System Functionality Description diagram

System Exchange example

Import system exchanges using the spreadsheet shown in Figure 10. The System Exchange references the System Resource Flows that it participates in and the System Data Flow that is its source.

Figure 10. System Exchange spreadsheet

System Resource Flow example

Use the spreadsheet shown in Figure 11 to import the System Resource Flows. Note that there is a reference property in the System Resource Flow definition that references System Exchanges. That property is populated as a result of importing the System Exchanges which are mirrored in the System Resource Flow reference property.

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J	K	L
Name	performerSource	performerTarget
o3 TO s2	Definition:"Organization (DM2)":"o3"	Definition:"System (DM2)":"s2"
s1 TO s2	Definition:"System (DM2)":"s1"	Definition:"System (DM2)":"s2"
s3 TO o3	Definition:"System (DM2)":"s3"	Definition:"Organization (DM2)":"o3"
s3 TO s1	Definition:"System (DM2)":"s3"	Definition:"System (DM2)":"s1"
s3 TO s2	Definition:"System (DM2)":"s3"	Definition:"System (DM2)":"s2"
s3 TO o3	Definition:"System (DM2)":"s3"	Definition:"Organization (DM2)":"o3"
s3 TO s1	Definition:"System (DM2)":"s3"	Definition:"System (DM2)":"s1"
s3 TO s2	Definition:"System (DM2)":"s3"	Definition:"System (DM2)":"s2"

Figure 11. System Resource Flow spreadsheet

Generate a SV-01 System Interface Description diagram

After importing the above, in addition to the SV-04 System Functionality Description diagram, you can generate the SV-01z System Exchange diagram and SV-01 System Interface Description diagram along with other viewpoints such as the SV-02 System Resource Flow diagram. Figure 12 shows the generated SV-01 System Interface Description diagram.
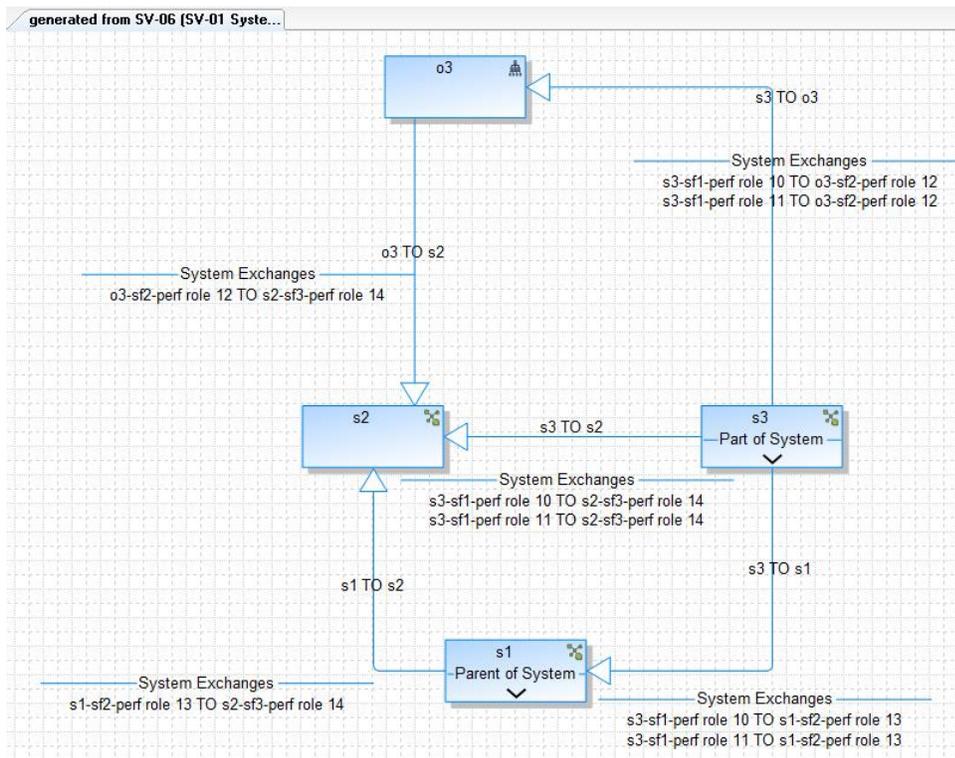
Figure 12. SV-01 System Interface Description diagram

13

Matrices resulting from imported data

Matrices, like diagrams, are driven by the contents of the underlying definitions. Figure 13 shows a System Resource Flow matrix that resulted from the imported data. The matrix contains from and to performers as X and Y axis, with System Resource Flow name at the intersection.

Note: The matrix cells contain the System Resource Flows which can be accessed from the matrix.
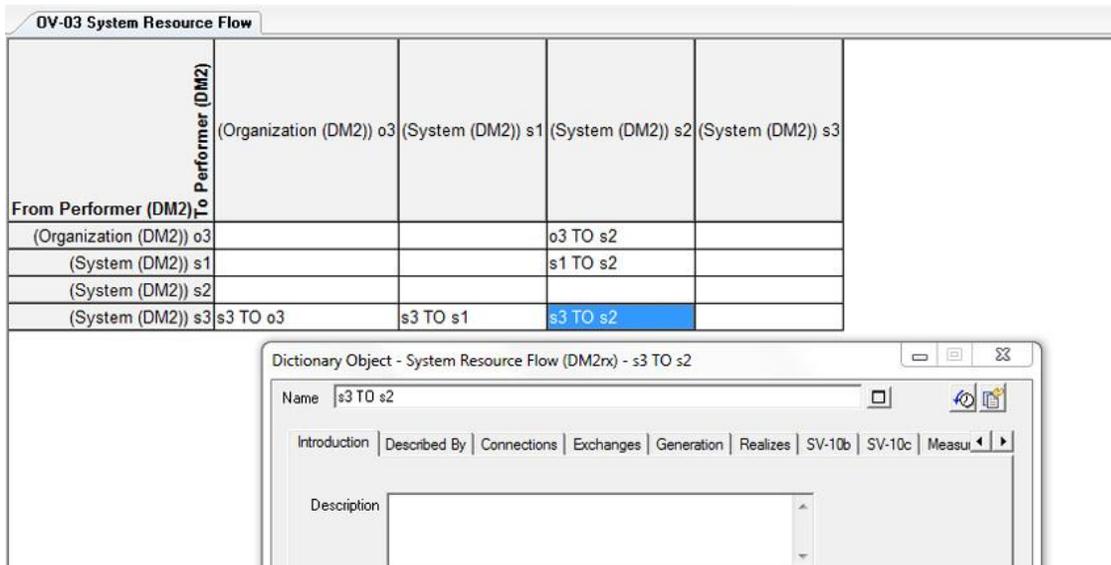
Figure 13. System Resource Flow matrix

Download

An example import is provided at the following location for download:
http://systemarchitect.info/Import_SV-06_XLSX.zip (32 KB)

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