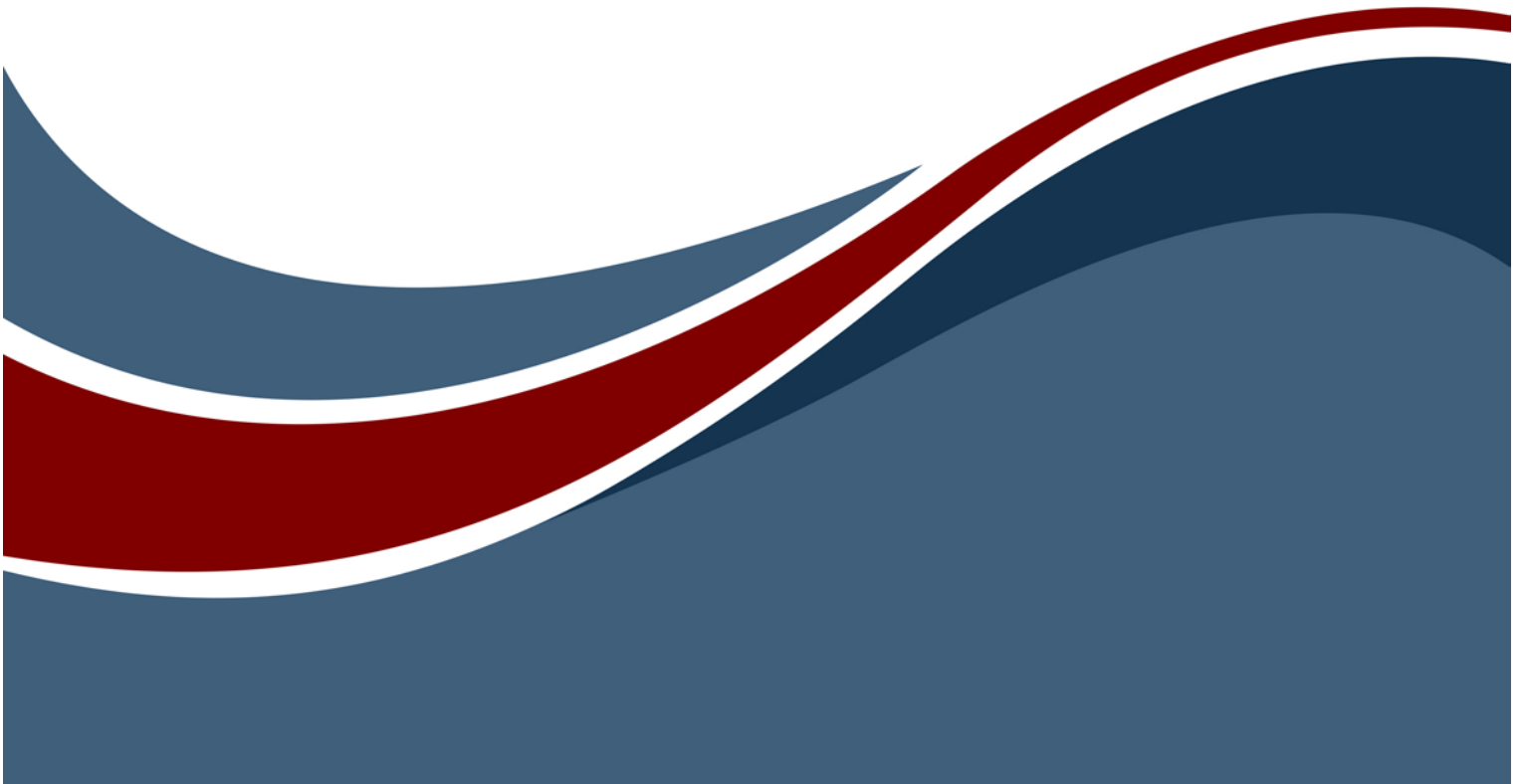




SBE Vision Adapter Guide



SBE Vision Adapter Guide

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TABLE OF CONTENTS

GENESYS Adapter to the SBE Vision Digital Thread Platform	1
Definitions	2
Capability and Usage Overview	4
Export (Publishing)	5
Import (Subscribing)	7
One-Way Data Transfer and Round-Tripping	7
One-Way Data Transfer	8
Subsequent Update to the ASoT	9
Round-Tripping	9
Using the GENESYS–SBE Vision Digital Thread Adapter	11
Installation of the SBE Vision Schema Extension	11
How to Import the SBE Vision Digital Thread Schema into an Existing Project	11
Access the GENESYS–SBE Vision Digital Thread Adapter	13
Procedures for Performing Imports, Exports, One-Way Transfers, and Round-Tripping	13
SBE Vision Setup	13
Export	15
Import	16
One-Way Data Transfer into GENESYS	17
Round-Tripping (GENESYS as the SSoT)	17
The GENESYS–SBE Vision Digital Thread Platform Adapter UI	17
Input screen 1 – Viewpoint, Credentials, SBE Connection Settings	17
Input Screen 2 – Specifying Import or Export	19
Input Screen 3 – Specification of the Data Location on the SBE Digital Thread	20
Input Screen 4 – Review of Selected Scope and Location	21
Results Screen 1 – Operation Summary and Issues	22
List of Non-Isomorphic Transformation Rules	23
GENESYS Entity’s Parameters to SBE Digital Thread Parameter Class Entities	23
Egress / Publish	23
Ingest	23
SBE Vision DOORS Classic & DOORS NextGen Integrations	24
General Notes on Data-Processing Rules	24
Attribute Type Mappings	24
Relationship Attributes	25
Embedded Images and Tables	25
Inherited Parameters and Attributes	25
Parameter Substitutions	25
Parameter Bindings	25



CUSTOMER RESOURCE OPTIONS

Supporting users throughout their entire journey of learning model-based systems engineering (MBSE) is central to Vitech's mission. For users looking for additional resources outside of this document, please refer to the links below. Alternatively, all links may be found at www.vitechcorp.com/online-resources/.



[Webinars](#)

Immense, on-demand library of webinar recordings, including systems engineering industry and tool-specific content.



[Screencasts](#)

Short videos to guide users through installation and usage of GENESYS.



[A Primer for Model-Based Systems Engineering](#)

Our free eBook and our most popular resource for new and experienced practitioners alike.



[Help Files](#)

Searchable online access to GENESYS help files.



[Technical Papers](#)

Library of technical and white papers for download, authored by Vitech systems engineers.



[Technical Support](#)

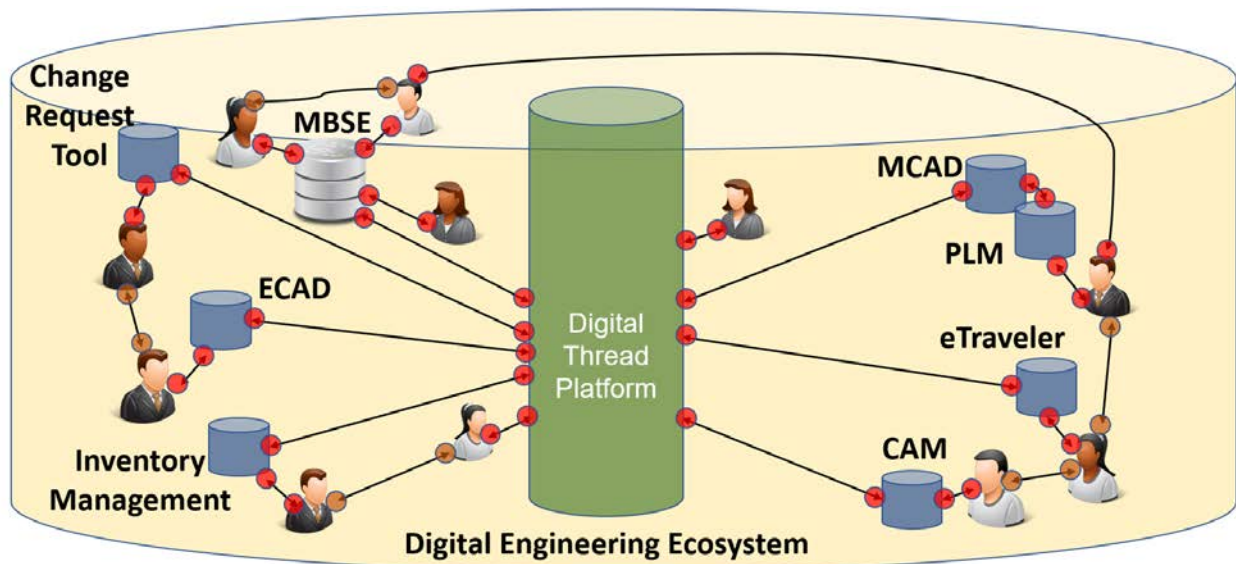
Frequently Asked Questions (FAQ), support-ticket web form, and information regarding email, phone, and chat support options.

GENESYS ADAPTER TO THE SBE VISION DIGITAL THREAD PLATFORM

Many companies recognize the need to move from siloed, stand-alone engineering and product lifecycle-related software tools to a connected, integrated network of applications, each capable of maintaining its own authoritative sources of data while sharing subsets of data with other tools and users with a need to know. Historically, this has been achieved with either one-time exports, manual manipulation of the data, import into another tool, or by custom-built point-to-point adapters developed between specific tools. While these approaches can function up to a certain scale and level of complexity, they have drawbacks, such as the possibility of introducing human error, slow transfer time, costly development and maintenance, and an ever-increasing number of point-to-point connectors.

In the connected Digital Engineering Ecosystem (DEE), model-based systems engineering (MBSE) is not the center of the universe, but instead, a critical cog in the integrated software tool chain supporting the full product development life cycle. The center of gravity within the DEE will shift depending on the phase of the product development lifecycle. Whereas MBSE is the “connective tissue” for requirements, behavior, physical design, and verification and validation, a Digital Thread tool, such as the SBE Vision Digital Thread platform, is the “connective tapestry” for a connected DEE consisting of a rich mix of engineering, program management, manufacturing, and enterprise management software tools. Rather than relying on point-to-point connections, a Digital Thread tool provides a many-to-many central hub that handles the inter-tool data exchanges. A data-driven approach is required that determines the key information that must be shared between tools. It’s important to remember that data-driven does not mean “gather all your data and proliferate it everywhere;” rather, it should be question-based: what information is needed where and at what time to answer a specific question.

The diagram below shows an illustration of a connected DEE, comprised of tools, connections, and the people executing the work. In this view, the Digital Thread platform acts as the central inter-tool data translator and broker, providing a many-to-many connection approach.



The built-in SBE Vision Digital Thread platform adapter enables a GENESYS project to connect to an instance of the SBE Vision Digital Thread platform¹ and exchange digital engineering (DE) data with a broad ecosystem of other DE tools. SBE Vision uses a hub-and-spoke, ontology-first approach to data ingestion, mapping, translation, and transfer. This approach allows the ontological concepts in an Entity-

¹ SBE Vision’s Digital Thread Platform requires separate licensing. For more information, contact SBE Vision at: <https://www.sbe-vision.com/contact>

SBE Vision Adapter Guide

Relationship-Attribute (ERA)-based tool to be mapped to SBE's master ontology and published to a defined channel. The paired tool on the other side of the channel also maps to the SBE master ontology, and the data is then translated. A list of the software tools that SBE currently has integrations with is available at <https://www.sbe-vision.com/adapters-sdk>.

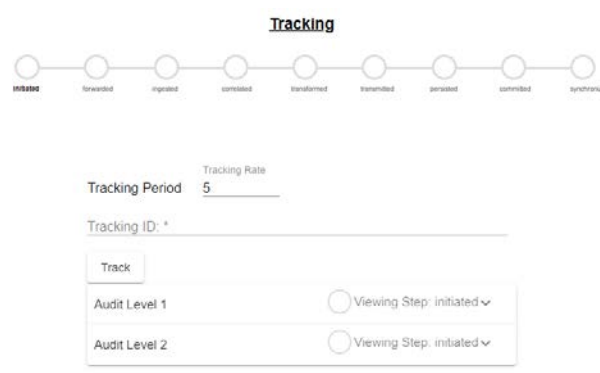
Definitions

Authoritative Source of Truth (ASoT) – An entity, such as a person, governing body, or system that applies expert judgment and rules to proclaim a digital artifact is valid and that it originates from a legitimate source. The ASoT for a [digital artifact](#) serves as the primary means of ensuring the credibility and coherence of the digital artifact that its creators share with a variety of stakeholders. ASoT gives stakeholders from diverse organizations and distributed locations the authorization to access, analyze, and use valid digital artifacts from an authoritative source. The owners of digital environments or the community for digital engineering ecosystems provide stakeholders with an ASoT that assures confidence in the quality of the digital artifact across disciplines, domains, and life cycle phases.²

Branch - A kind of entity set that holds a collection of entities that can be revised because they are considered a Work-in-Process (WIP).

Channel - A bi-directional data pipeline for the transmission of artifacts between an entity set and the smallest unit of versionable containment in a Data Source.

Commit ID - A tracking identifier for any entity sets published to the Digital Thread. See the Tracking user interface in SBE Vision for more context:



Digital Engineering Ecosystem – A digital engineering ecosystem (DEE) includes an enterprises' interconnected digital environments, stakeholder-networks, and semantic data that allow the exchange of digital artifacts from an authoritative source of truth to serve the stakeholder communities' interests.³

Digital Thread – A data-driven architecture that links together information generated from across the product lifecycle and is envisioned to be the primary or authoritative data and communication platform for a company's products at any instance of time⁴. It consists of a network of connections, both inside each domain model (intra-model), between models in different repositories (inter-model), and the transfer of data and information across the network.

Digital Thread Package – A specialized kind of **Package** in GENESYS used to define the set of GENESYS entities that are paired to a specified SBE Vision Digital Thread subscription. The "subscriptionID" of the

² From: https://www.omgwiki.org/MBSE/doku.php?id=mbse:authoritative_source_of_truth#:~:text=An%20authoritative%20source%20is%20known.Primary%20sources%20articulate%20the%20law.%20%E2%80%A6

³ https://www.omgwiki.org/MBSE/doku.php?id=mbse:digital_engineering_ecosystem

⁴ From: <https://intercax.com/2020/08/21/syndeia-and-building-the-digital-thread/>

SBE Vision Adapter Guide

SBE Vision DT subscription is held in an attribute in the Digital Thread Package. A GENESYS project may have as many Digital Thread Packages as desired, allowing the modeler to ingest and/or egest multiple data sets from other DEE tools.

Entity Set - A managed collection of Digital Thread Entities within a Partition. Each entity set can have zero or more dependent entity sets, which together define a Configuration Context.

Item Locator - A global unique identifier (GUID) that GENESYS uses to correlate entities in GENESYS with their counterparts on the SBE Vision DT platform. Within the SBE Vision DT platform, an "Item Locator" is a key value-pair object associated with each entity. On the SBE DT Platform, GENESYS creates a new key called "genesysId" within the Item Locator that stores the GENESYS-created unique ID string. The mapping between GENESYS and the SBE Vision DT Platform is:

GENESYS		SBE Digital Thread
attribute: sbeDTItemLocator	↔	Item Locator Key: genesysID

Non-isomorphic Transformation – In mathematics, non-isomorphic means “not having the same form” and is used in many branches of mathematics to identify mathematical objects which are structurally distinct⁵. Here, it means a data object in an Entity-Relationship-Attribute (ERA) ontological model of a specific classification in one software tool that is mapped and transformed to a different ERA classification in another tool. For example, an *attribute* of an entity in Tool A is mapped and transformed to a first-class *entity* in Tool B.

Ontology - Includes a representation, formal naming, and definition of the categories, properties, and relations between the concepts, data, and entities that substantiate one, many, or all [domains of discourse](#). More simply, an ontology is a way of showing the properties of a subject area and how they are related by defining a set of concepts and categories that represent the subject.⁶

Partition - An SBE container that owns a cohesive collection of entity sets. A partition can contain any number of channels.

Single Source of Truth - A single source of truth is a single point of access and modification for a data element. It requires both a normalized data model and integration such that producers and consumers of a data element all access the same copy. It is an architectural practice and data strategy that helps to ensure that data are reliable, accurate, and secured.⁷ This term is not used in this user's guide but is included in the definitions section to differentiate it from the term “Subscribed Source of Truth” (SSoT), which is used.

Subscribed Source of Truth (SSoT) – An external system that holds transformed objects within a Subscription that originally came from an ASoT.

Subscription - An operation to include a named subset of the Entities that have been cloned and transformed beneath another Branch or Tag for inclusion into the External System in its own native format.

⁵ <https://mathworld.wolfram.com/Nonisomorphic.html#:~:text=The%20term%20%22nonisomorphic%22%20means%20%22,are%20said%20to%20be%20isomorphic>

⁶ [https://en.wikipedia.org/wiki/Ontology_\(information_science\)](https://en.wikipedia.org/wiki/Ontology_(information_science))

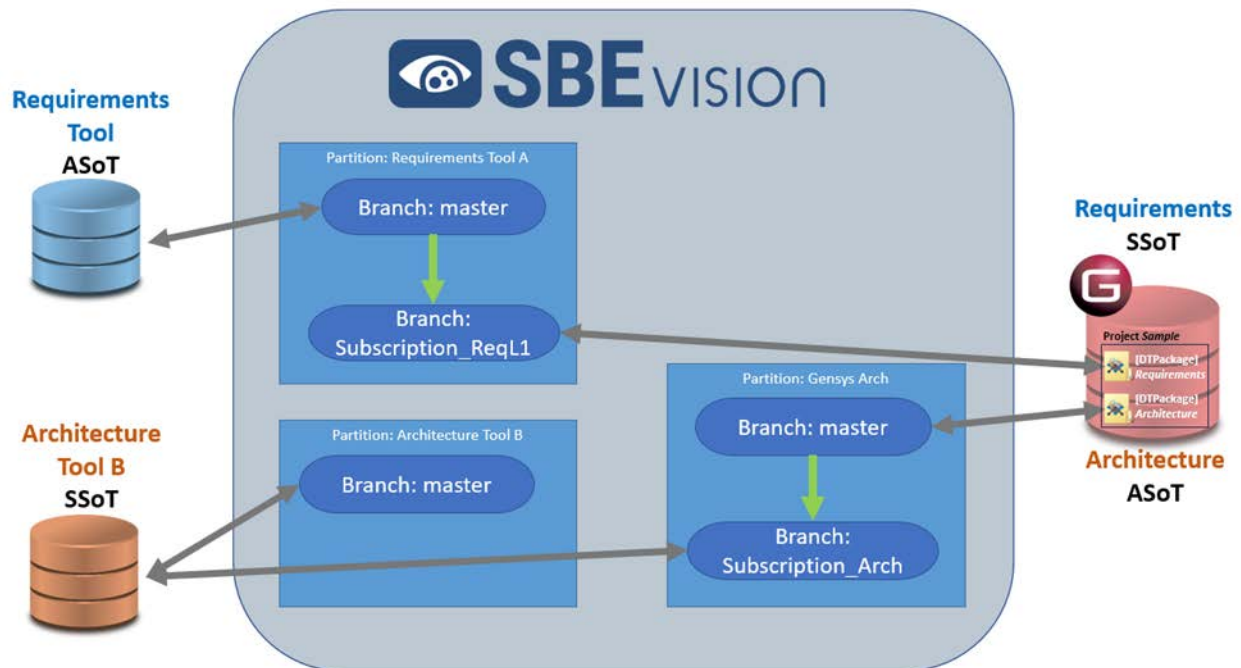
⁷ https://www.omgwiki.org/MBSE/doku.php?id=mbse:authoritative_source_of_truth#:~:text=An%20authoritative%20source%20is%20known,Primary%20sources%20articulate%20the%20law.%20%E2%80%A6

CAPABILITY AND USAGE OVERVIEW

The transfer of an entity set from one software tool to another using the SBE Vision DT platform requires a coordinated interplay between the two tools and the DT platform. The diagram below will be used to illustrate the export (publishing), import (subscribing), one-way data transfer, and round-tripping processes.

In this example, we have a Requirements Tool that acts as the ASoT for all requirements on the program. This is the tool where the requirements engineers perform their work. The systems engineers working in a GENESYS project on the systems architecture need an authoritative set of the requirements in their model to ensure that the functional and physical architectures that they are deriving are compliant with the program's requirements and to establish proper traceability. For this use case, the Requirements Tool acts as the ASoT for requirements, and GENESYS acts as the SSoT for requirements.

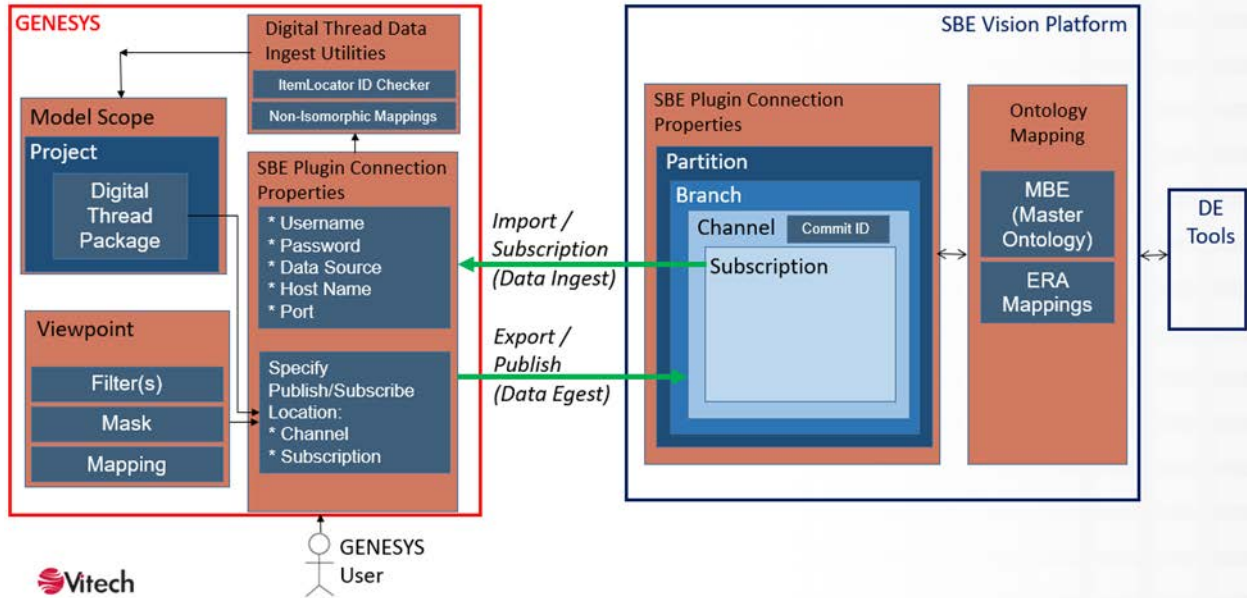
Additionally, GENESYS acts as the overall ASoT for the systems architecture. A partner organization working on the program uses another MBSE tool to develop the architecture for one of the subsystems. They are using Architecture Tool B and need a subset of the overall systems architecture model captured in the GENESYS architecture ASoT project to provide them context from which to derive their subsystem's functional and physical architectures and to establish traceability to the higher-level architectural model. For this use case, GENESYS acts as the ASoT for architecture, and Architecture Tool B acts as the SSoT for architecture.



In general, GENESYS always processes data exchanges to and from the DT via a Digital Thread Package (**DTPackage**), which defines the exchanged entity set within GENESYS, and through a Viewpoint (see the [Viewpoint help topic](#) for more information), which allows the data to be transformed into the local language and expectations of the end user. Additionally, any applicable non-isomorphic transformation rules are also processed. GENESYS utilizes a unique ID (stored in an attribute within GENESYS called "sbeDTItemLocator" and stored within the SBE Vision DT as the value associated with the key called "genesysID" that is housed within *ItemLocator* attached to each entity), to determine if data in the GENESYS project has previously been on the SBE Vision DT or not. This check is performed to ensure that entities are not incorrectly duplicated or replicated upon multiple import and export operations.

An overall nested physical architecture of the key interacting **Components** of GENESYS and the SBE Vision DT Platform client is shown in the diagram below.

SBE Vision Adapter Guide



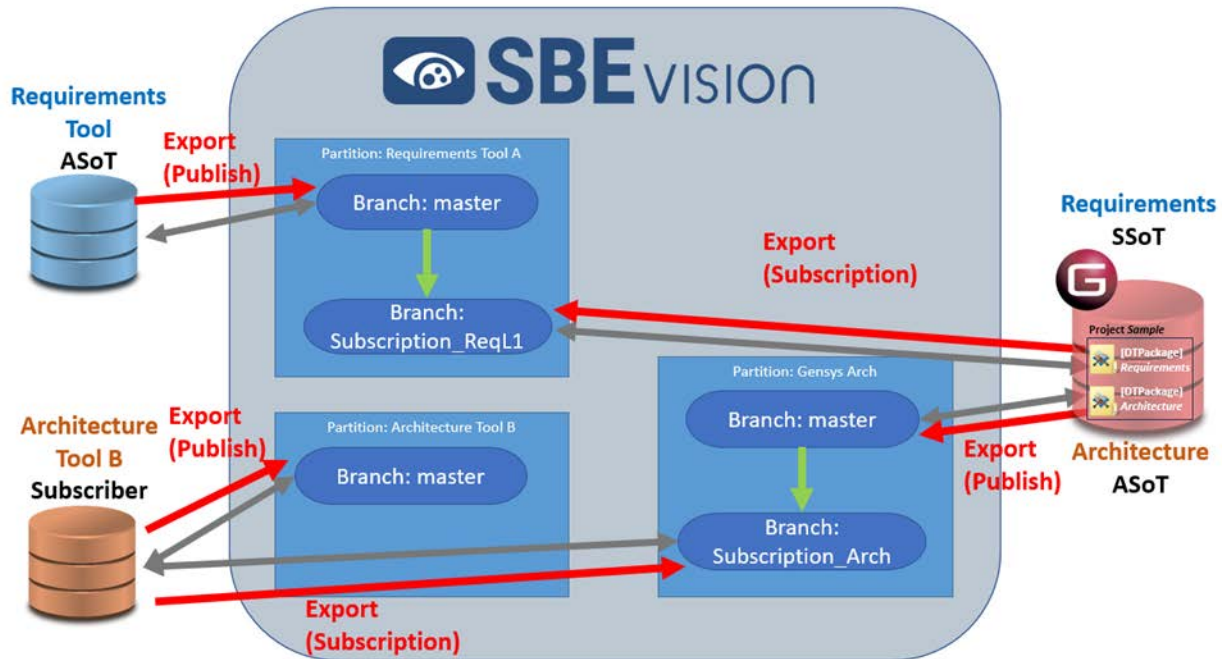
The GENESYS schema extension for the SBE Vision DT adapter must be installed prior to using the SBE Vision DT adapter. For more information, see the section entitled “Installation of the SBE Vision Schema Extension.”

For the steps involving actions that must be taken within the SBE Vision DT platform client, refer to SBE Vision’s help documentation.

The following sections describe the general process for exporting (publishing), importing (subscribing), one-way data transfers, and round-tripping. After those sections, the mechanics of how to execute each process in GENESYS are described.

Export (Publishing)

In our example, all three tools can export entity sets. Exports can be divided into two categories: ASoT exports, which typically go to the master branch in SBE Vision, and subscription exports, which typically go to a subscription branch in another tool’s partition.

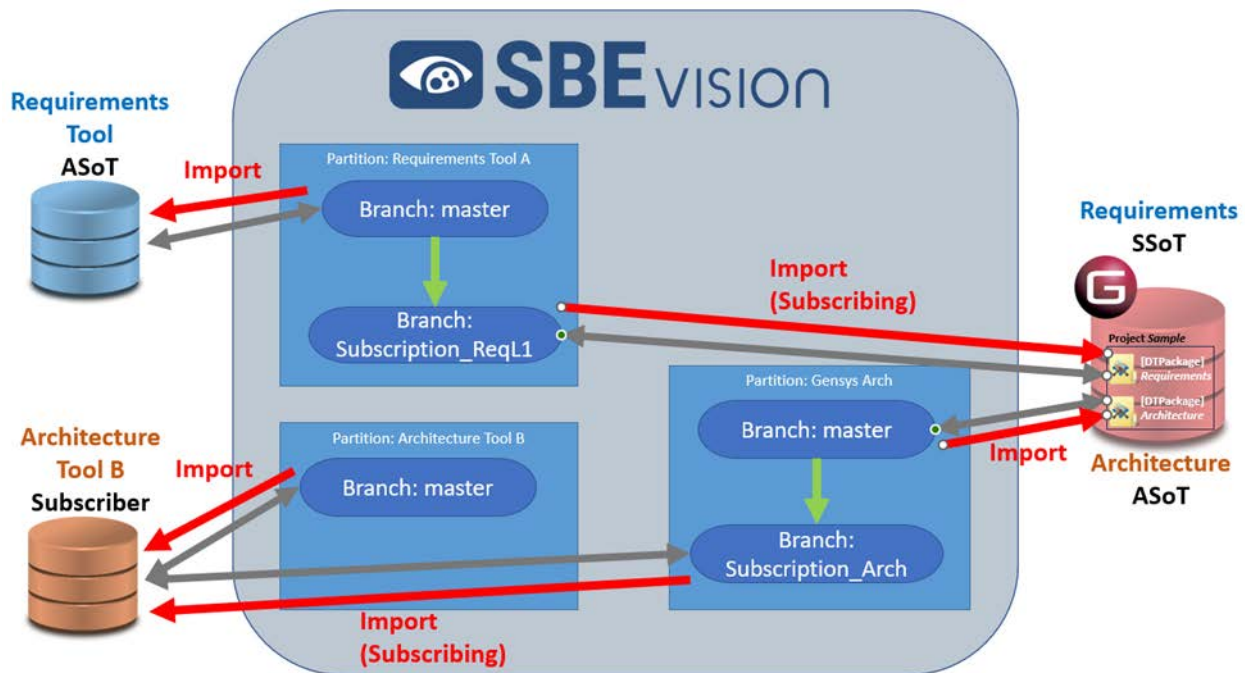


One or more partitions are created on the SBE Vision DT platform for each associated tool. If different subsets of an overall project's data need to be transferred to different end point tools via the SBE Vision platform, each unique data set should have its own partition. As a best practice, ASoT information should be published to a master branch. In this example, the Requirements Tool publishes its requirements to the "Branch: master" within the Requirements Tool A partition. The requirements entity set within the channel are now available to any other connected tool connected to the SBE Vision DT after ontologies are mapped between the two tools, which in this example, will be GENESYS. Similarly, the GENESYS project publishes its ASoT data related to functional and physical architecture to the "Branch: master" within the GENESYS Arch partition. The architecture entity set within the channel is now available to any other connected tool once ontologies are mapped. While it will not be used in our example, "Architecture Tool B" can also publish its authoritative entity set to "Branch: master" within the Architecture Tool B partition.

If changes to the entity set are made in the subscribing tool and the user wishes those changes to be published back for consideration of updating the ASoT, those changes are exported and published to a subscription branch in the appropriate repository. In the example shown, if the GENESYS user makes updates to the requirements entity set, they can be published back to the "Requirements Tool A" partition on a branch, which in the example is called "Branch: Subscription_ReqL1." Similarly, if the user in "Architecture Tool B" makes changes to the physical architecture, the entity set may be published back to the Genesys Arch Partition into the "Branch: Subscription_Arch." How to merge the proposed changes back into the master branch and then into the ASoT tool are described in the section on Round-Tripping.

Import (Subscribing)

Imports are most often conducted from subscription branches, which are generated for the purpose of making an entity set available to a subscribing tool wishing to import an SSoT. However, imports can also be made from the master branch back into the ASoT tool; this is most often done when conducting an “authoritative refresh,” which is executed immediately after a publication. This “authoritative refresh” allows the ASoT tool to ingest and store the Item Locator GUID that the SBE Vision platform assigned to all first-time published entities. This operation ensures continuity between the entities in the ASoT and their counterparts on the SBE Vision platform in the master branch. Examples of each category of import are shown in the diagram below.



In this example, there is a “Branch: Subscription_ReqL1” in the Requirements Tool A partition. This subscription branch has been populated with all the “level 1” requirements from the Requirements Tool. These requirements can then be imported into GENESYS with the import procedure. Similarly, there is a “Branch: Subscription_Arch” in the GENESYS Arch partition that is populated with the functional and physical architecture previously published out from GENESYS. The architecture entity set can then be imported into Architecture Tool B with the import procedure.

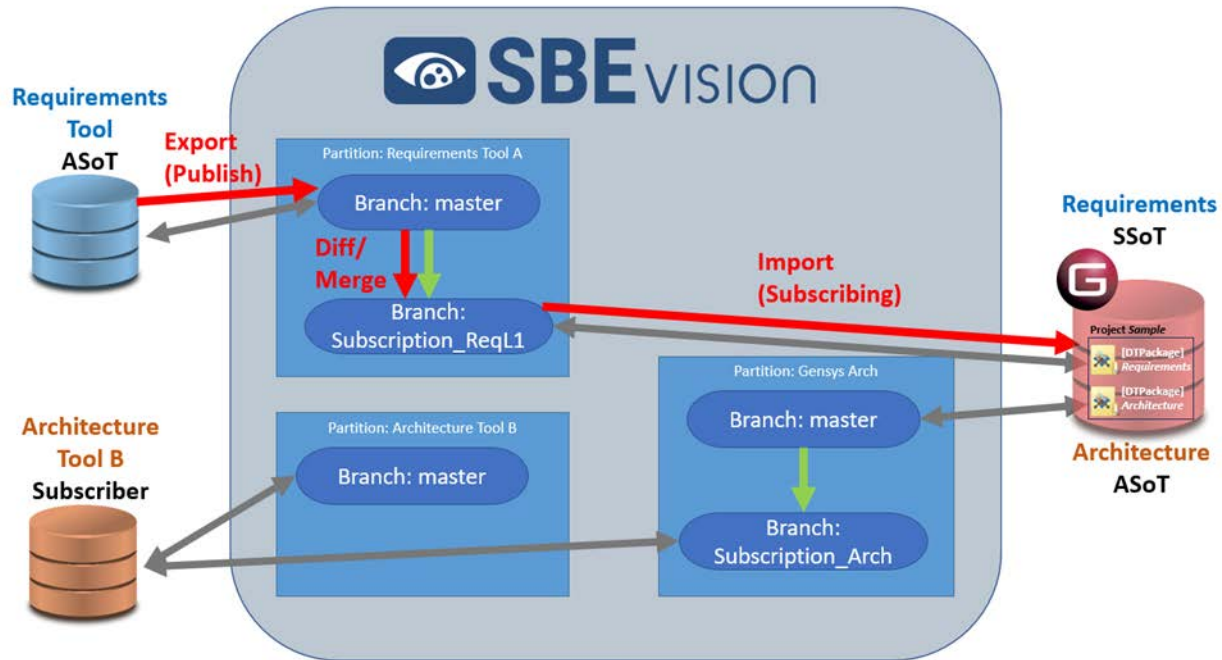
One-Way Data Transfer and Round-Tripping

Combinations of exports, imports, branches, and diffs/merges across the SBE Vision DT platform can be joined to transfer data between associated software tools. The two most common scenarios are discussed in the subsequent sections.

Within the SBE Vision DT platform client, an additional step must be performed for all tool-to-SBE Vision DT-to-tool data transformations. The ontological concepts in each tool must be related to one another through the platform’s ontology mapping interface. See SBE Vision help resources for more information.

One-Way Data Transfer

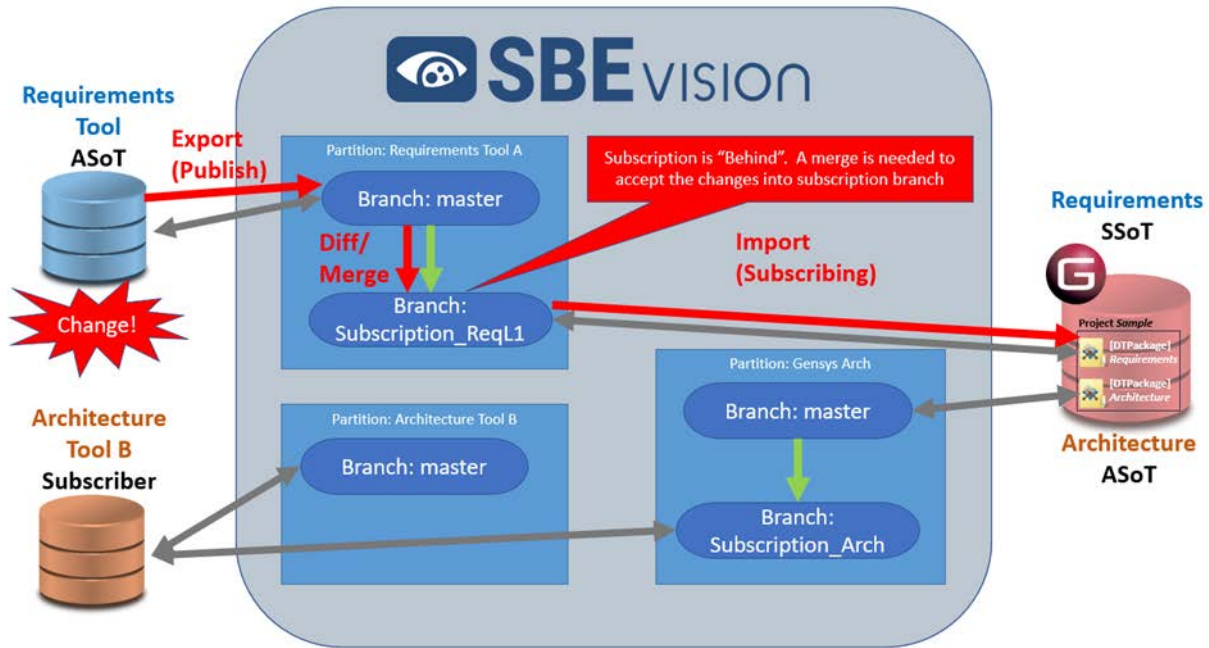
In our example, the Requirements Tool is the ASoT for all requirements on the program. The systems engineers working in a GENESYS project on the systems architecture must have an authoritative set of the requirements in their model to ensure that the functional and physical architectures that they are deriving are compliant with the program's requirements and to establish proper traceability. The requirements can be placed into GENESYS using a combination of an export, merge, and import across the DT. The following diagram summarizes the operations to be performed.



The requirements are first exported from the Requirements Tool to the “Branch: master” in the Requirements Tool A partition on the SBE Vision DT platform. Then, a diff/merge operation is performed between the “Branch: Subscription_ReqL1” and the “Branch: master” in the Requirements Tool A partition. This then updates the “Subscription_ReqL1” branch to be consistent with the entity set in the “Branch: master.” Finally, an import can be performed from the GENESYS–SBE Vision DT adapter interface to ingest the requirements entity set contained within “Subscription_ReqL1” branch into a specified Digital Thread Package, named “requirements” in our example, within the GENESYS project.

Subsequent Update to the ASoT

After the requirements from the Requirements Tool have been ingested into GENESYS, it is likely that the requirements will go through another round of updates or refinements at some point in the product lifecycle. If the requirements are updated after the initial data transfer, a refresh operation needs to be performed. This is shown in the following figure.



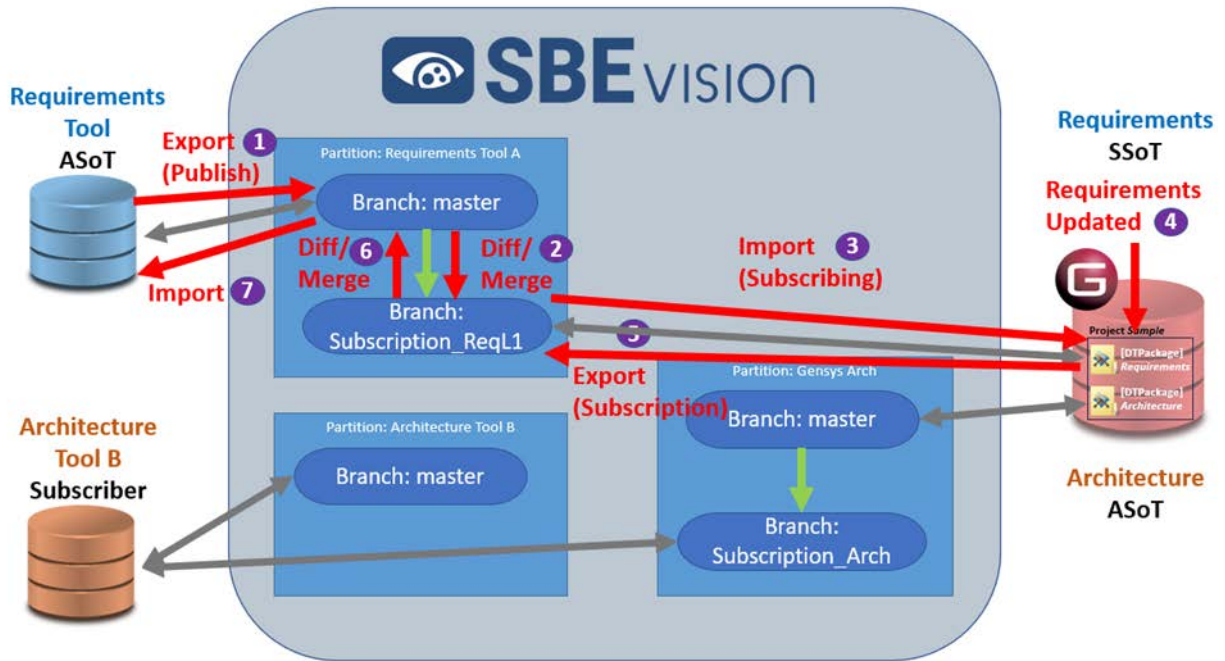
The steps to ingest an update of the requirements into GENESYS are the same as those specified in the section above with the only difference being that the Subscription branch is initially populated with an out-of-date requirements data **Package**. However, following the same steps as specified in the “One-Way Data Transfer” section will result in an update of the requirement entities in the DT **Package** called “Requirements” in GENESYS. On import, GENESYS will check to see whether each entity previously existed in GENESYS by comparing the set of GENESYS *sbeDTItemLocator* unique IDs against the SBE DT Item Locator *genesysID* set. If the entity previously existed in GENESYS, GENESYS will update the entity’s associated data; if the entity is new, GENESYS will create a new entity.

Round-Tripping

Round-tripping is an exchange of data between paired tools in a full cycle, with the primary direction being data flowing from the ASoT to the subscriber but also between the subscriber and the ASoT. It may be the case that the individual or team working in the subscriber tool finds something that needs to be corrected in the ASoT’s data and may make a request to push an update from the subscriber back to the ASoT. When this occurs, the individual data elements make a full “round-trip” from the ASoT tool to the subscribing tool back to the ASoT tool.

In our example, requirements that have been ingested to GENESYS from the Requirements Tool have been found to potentially require an update in the ASoT due to an inconsistency found by the systems engineer.

SBE Vision Adapter Guide



The steps are the same as described above in the “One-Way Data Transfer” section up through the ingestion of the entity set into GENESYS. GENESYS systems engineers update some of the requirements (step 4) and then publish the requirements data set back out to the “Branch: Subscription_ReqL1” within the Requirements Tool A partition. The entity set between the master and subscription branch are now different. A diff/merge operation must be performed between the “Subscription_ReqL1” and the “Branch: master” within the Requirements Tool A partition. If the requirement updates are accepted by the designated authority during the merge process, the “Branch: master” is then brought into alignment with the “Branch: Subscription_ReqL1.” Finally, an import can be performed to ingest the updated requirements entity set contained within “Branch: master” into a specified location within the Requirements Tool.

USING THE GENESYS–SBE VISION DIGITAL THREAD ADAPTER

For the GENESYS 2023 R2 release, the GENESYS–SBE Vision Digital Thread adapter has been robustly tested with DOORS classic and DOORS Next Generation. Testing with Dassault Systems Cameo Systems Modeler, and other MBSE tools, has been conducted for a limited set of classes and relationships. SBE Vision’s other supported tools will work with GENESYS to a degree, although the fidelity of the data transformations and exchanges has not yet been benchmarked.

Installation of the SBE Vision Schema Extension

You must import the provided SBE Vision schema extension into your project in GENESYS before transferring data to or from the SBE Vision Digital Thread. This extension records the SBE Vision DT metadata for each GENESYS entity as attributes.

The schema extension contains the following attributes:

Attribute alias	Attribute name	Class applicability	Description
SBE Vision Digital Thread URL	sbeDTURI	All classes	Link to the entity in the SBE Vision DT platform web client mirroring the entity in GENESYS.
SBE Digital Thread ASOT URL	sbeDTASOTURL	All classes	Link to the object in an SBE Vision–linked software tool, marked as the ASOT for the data item.
SBE Digital Thread unique identifier	sbeDTItemLocator	All classes	A GUID that connects GENESYS elements with SBE Vision DT counterparts. Assigned by GENESYS and stored in a "genesysID" key within the Item Locator object associated with each entity on the SBE Vision DT platform.
SBE Digital Thread Subscription ID	sbeDTSubscriptionID	Package class	Records the SBE Vision Subscription ID for data republishing in round-tripping situations.

GENESYS users can find the SBE Vision Digital Thread Schema extension in the GENESYS installation folders on their computer at the following location:

Program Files\Vitech\GENESYS 2023 R2\Extensions\SBE Vision Digital Thread Schema Extension.gnsx

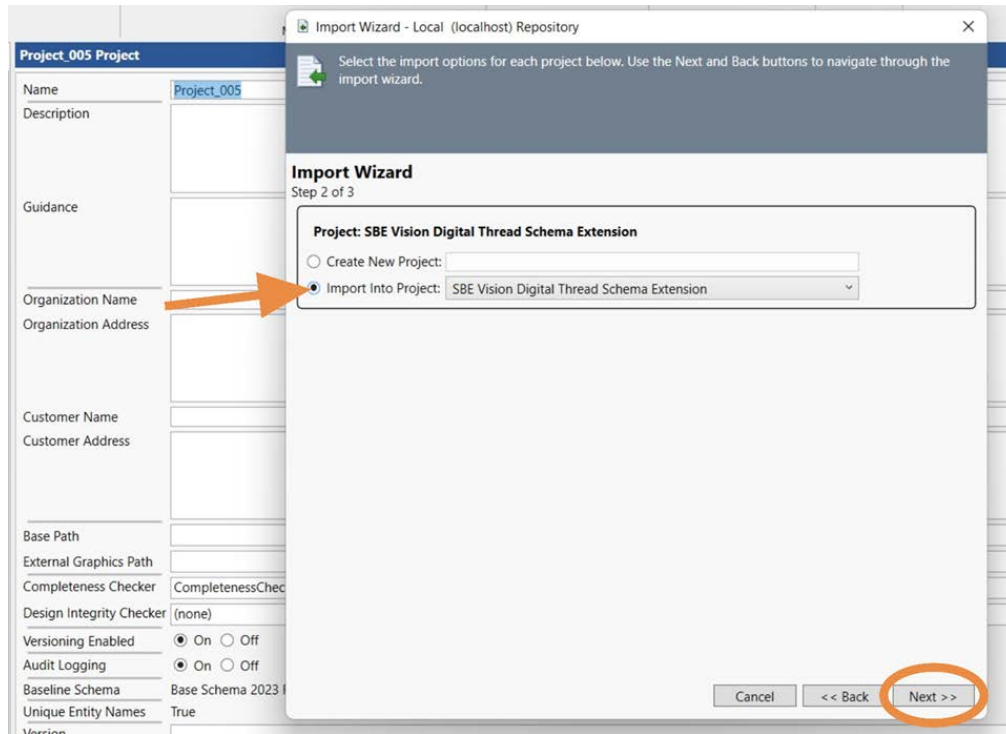
How to Import the SBE Vision Digital Thread Schema into an Existing Project

1. In GENESYS, click the **File** tab >  **Import**.
2. In the "Import GENESYS File" window, open the file "SBE Vision Digital Thread Schema Extension.gnsx" from your computer > click **Next >>**.

Note: This extension can be found at Program Files\Vitech\GENESYS 2023 R2\Extensions.

3. In the Import Wizard, select "Import Into Project" > click **Next >>**.

SBE Vision Adapter Guide



Note: If displayed, disregard the yellow warning message, which is not applicable to this type of import.

4. In the Import Wizard window, click the **Import** button.
5. When import is finished, click the **Close** button.

Migrate Schemas in GENESYS 2023 R2 with DT Package Changes

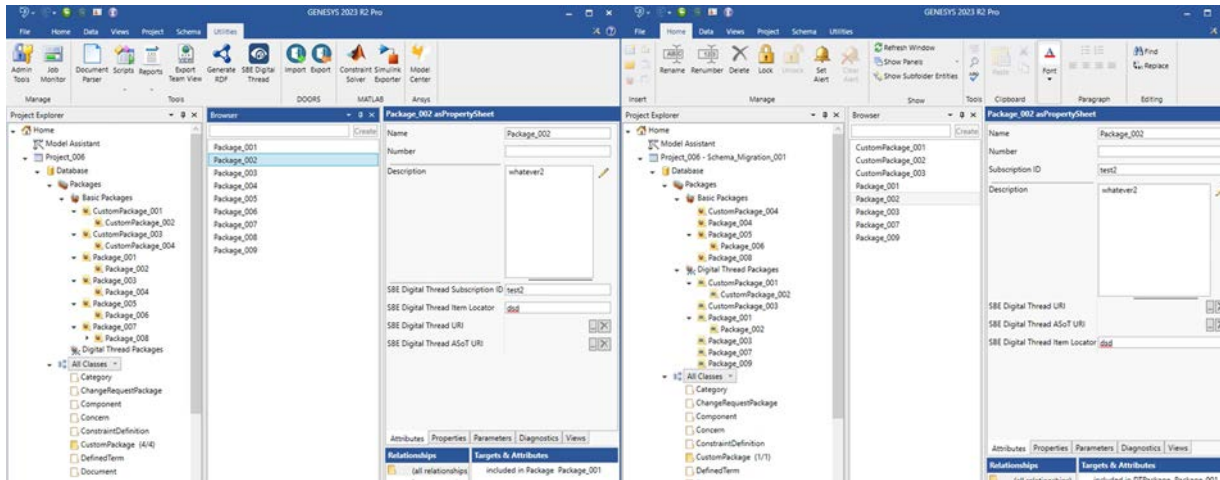
The SBE Vision schema migrator transitions schemas from older versions of GENESYS to the GENESYS 2023 R2 version. The schema migrator scans for the "SBE Digital Thread Subscription ID" attribute, previously part of the SBE Schema Import, within Package classes of the previous version of GENESYS. When this attribute is found to be populated, the schema migrator triggers the conversion of that **Package** into a **DTPackage**. This migration also includes any nested **Packages** that have a populated "SBE Digital Thread Subscription ID" attribute.

If a Child **Package** does not have a populated "SBE Digital Thread Subscription ID" attribute, it remains a Basic **Package** and is not converted to a Child of the **DTPackage**.

Any discrepancies, such as a Child **Package** lacking the necessary ID attribute, are logged as a conflict to ensure that the user is aware of elements that did not transition to **DTPackage**.

The images below show before schema migration (left) and after schema migration (right):

SBE Vision Adapter Guide



ACCESS THE GENESYS–SBE VISION DIGITAL THREAD ADAPTER

1. In GENESYS, click the **Utilities** tab on the ribbon.
2. Click the SBE Digital Thread icon  to access the SBE Vision DT adapter.



PROCEDURES FOR PERFORMING IMPORTS, EXPORTS, ONE-WAY TRANSFERS, AND ROUND-TRIPPING

The upcoming sections provide a detailed guide on executing common tasks using the SBE Vision DT. For each step's placement in the process, see the referenced UI screens. A comprehensive description of these UI screens is available in the section “The GENESYS–SBE Vision DT platform adapter UI.”

SBE Vision Setup

To publish (Export) or synchronize (Import) requirements to/from the Digital Thread, a Data Source type, Data Source, Partition, Branch, and Channel must be configured by the administrator for successful connection prior to the Import/Export action. For the initial setup of the SBE Vision Digital Thread adapter in GENESYS, these specific requirements must be met.

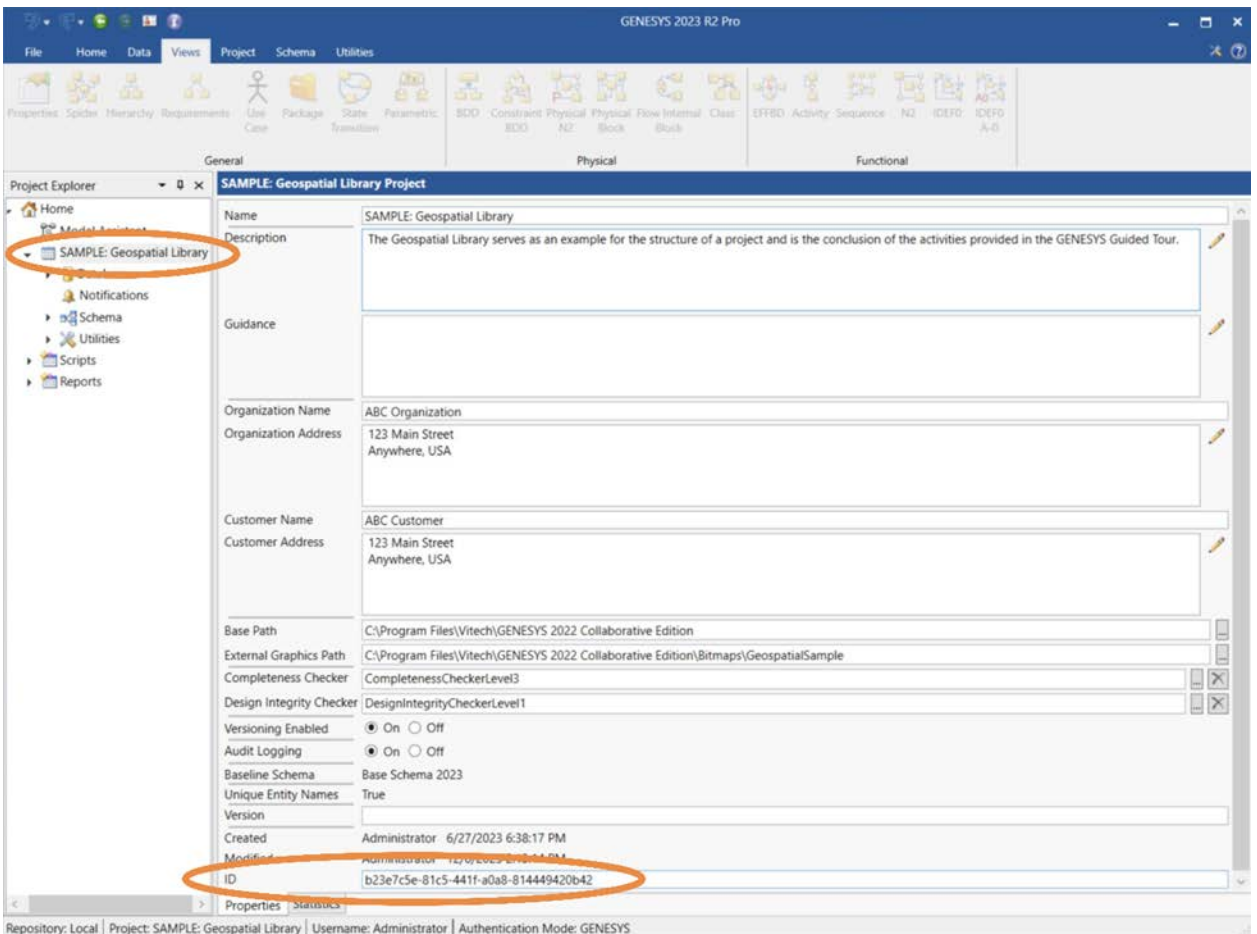
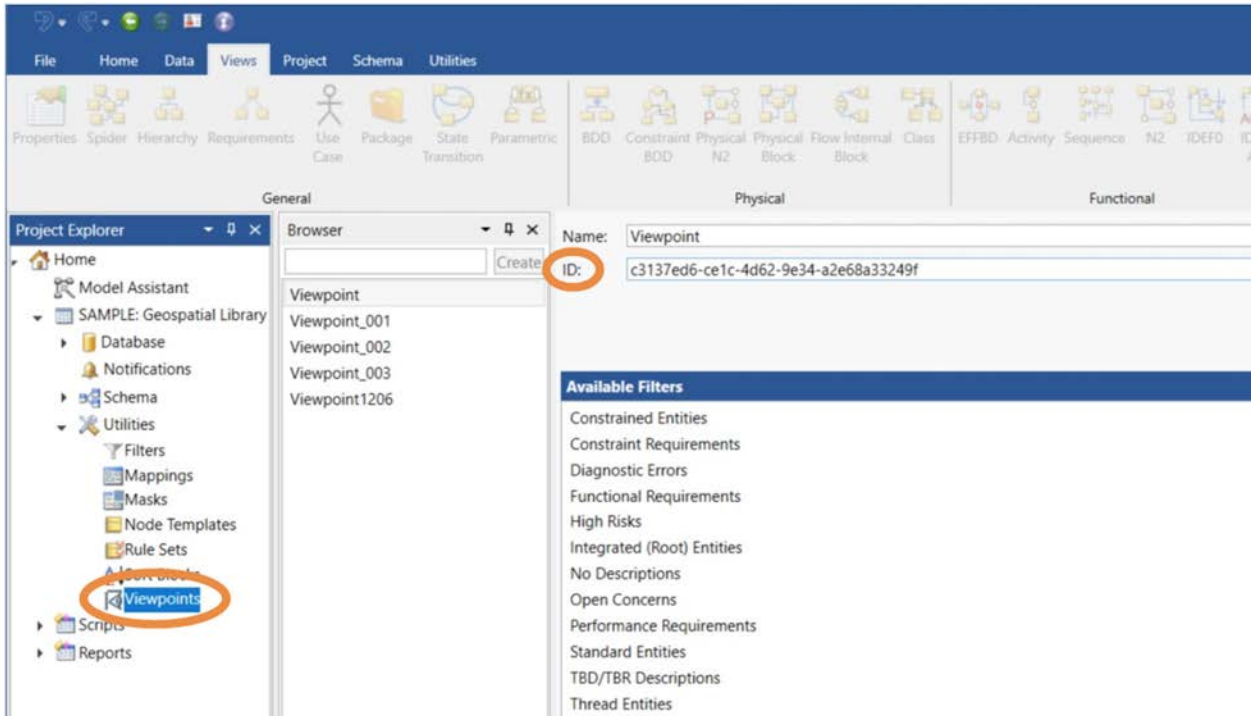
In SBE Vision:

1. Create a Data Source of the “GENESYS” Data Source Type.
2. Create a Partition in the Data Source for your data.
3. Create a branch in the partition, if not using the master branch (the master branch is created when creating a partition).
4. Create a channel associated with the branch and set the Channel properties of “viewpoint” and “project” based on information in GENESYS.

Note: The Viewpoint ID can be found in the Viewpoint's property sheet, and the GENESYS Project ID can be found in Properties in Project Explorer. See images below.

5. Subscribe your channel to the master branches in the partitions for other tools from which you wish to import data. This will create subscription branches in those partitions for the data you will import.




SBE Vision Adapter Guide



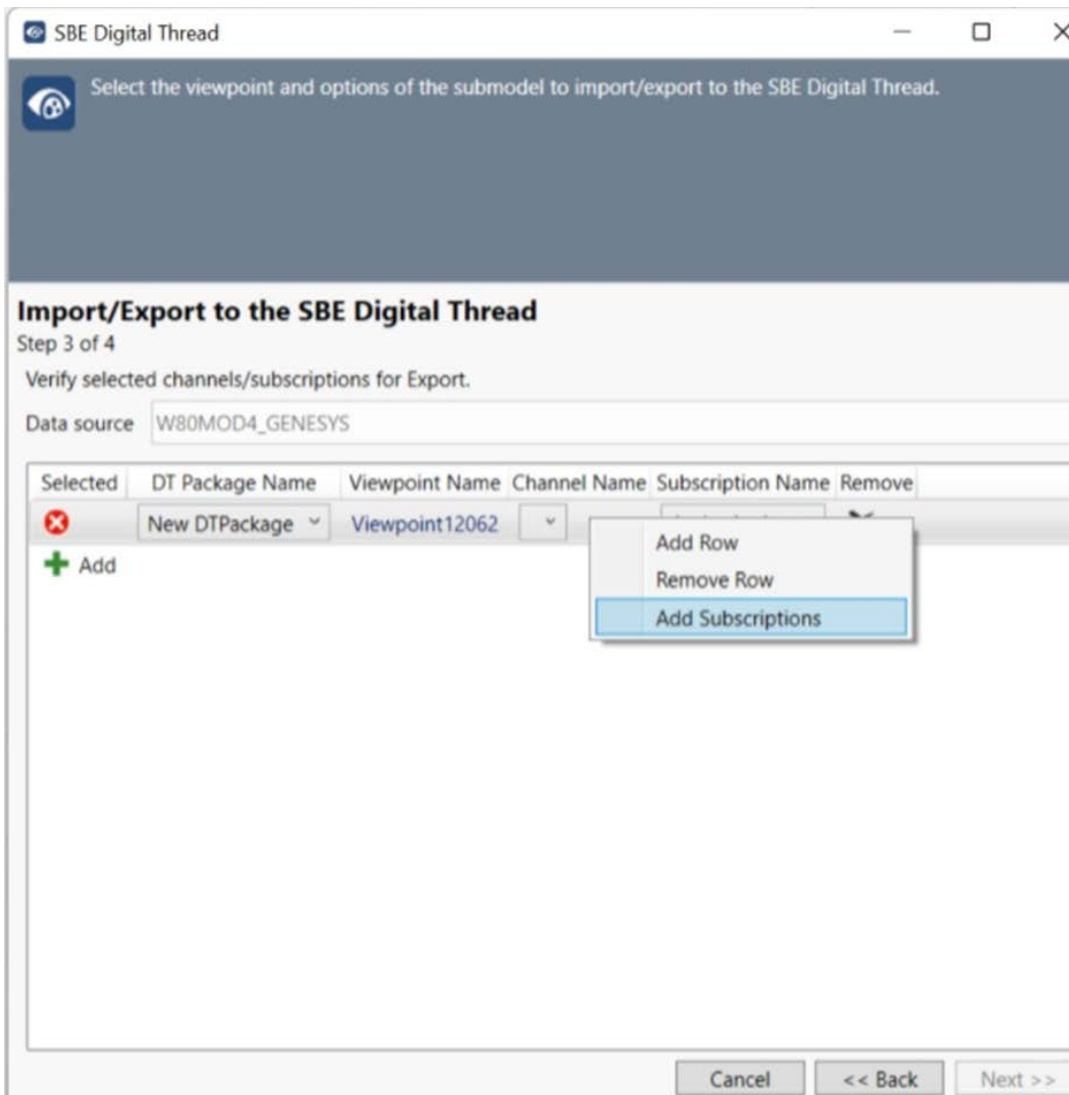
SBE Vision Adapter Guide

Export

These are the steps to export from GENESYS to the SBE DT platform.

1. In GENESYS, click the **Utilities** tab in the upper left of the screen.
2. In the ribbon, click the SBE Digital Thread icon  to access the SBE Vision DT adapter.
3. In the SBE Digital Thread window, enter the username and password required to establish a connection to the SBE Digital Thread platform.
4. Click the down arrow  to open "SBE Connection settings."
5. Select a Data Source > enter a Host > enter a Port (if required).
6. Click **Connect** > click **Next** > >.
7. Select the "Export" option to indicate that an export operation is to be performed > click **Next** > >.
(Input Screen 2)
8. Click  **Add** to add a DT Package, Viewpoint, Channel, and Subscription.
9. In the "Viewpoint Selection" window, select a Viewpoint from the drop-down menu > click **OK**.

Note: In the "SBE Digital Thread" window, right-click on the selected row to add rows, remove rows, or add one or more Subscriptions to the export.



SBE Digital Thread


Select the viewpoint and options of the submodel to import/export to the SBE Digital Thread.


Import/Export to the SBE Digital Thread

Step 3 of 4

Verify selected channels/subscriptions for Export.

Data source: W80MOD4_GENESYS

Selected	DT Package Name	Viewpoint Name	Channel Name	Subscription Name	Remove
	New DTPackage	Viewpoint12062			

 Add

Context Menu:

- Add Row
- Remove Row
- Add Subscriptions

Buttons: Cancel, << Back, Next >>




SBE Vision Adapter Guide

Note: Publishing of ASoT information, as a best practice, should be published to a master branch. (Input Screen 3)

10. Click **Run** to publish the DT Package to the specified SBE DT Channel. GENESYS will perform the following actions as part of the publishing process:
 - a. Process the data **Package** through the selected viewpoint's masks, mappings, and filters.
 - b. Process the data through any non-isomorphic transformation rules assigned to the GENESYS project.
 - c. For each entity or relationship that has been previously published to the DT from GENESYS, GENESYS finds the associated SBE Vision DT object by using its *genesysId* in the ItemLocator and updates all attributes of the object, or end point connections of the relationship, with the values stored in GENESYS.
 - d. For new entities that have never been published to the DT from GENESYS, GENESYS creates new objects in the SBE Vision DT Channel of the appropriate class or relationship and ShapeID based on the established mappings, assigns the GENESYS GUID to the GENESYS attribute "sbeDTItemLocator" in the object's ItemLocation, and writes all attributes from the GENESYS object to the SBE Vision DT object.
11. GENESYS reports a summary of the data transfer operation's results, including a list of all conflicts generated, if any, during the export. (Results Screen 1)

Import

The steps to subscribe and ingest a data **Package** from the SBE Vision DT platform into GENESYS are:

1. In GENESYS, click the **Utilities** tab in the ribbon at the top left of the screen.
2. Click the SBE Digital Thread icon  to access the SBE Vision DT adapter.
3. In the SBE Vision DT window, enter the username and password required to establish a connection to the SBE Vision DT platform.
4. Click the down arrow  to open "SBE Connection settings."
5. Select a Data Source > enter a Host > enter a Port (if required).
6. Select the "Import" option to indicate that an import operation is to be performed, then click **Next > >**. (Input Screen 2)
7. Click  **Add** to add a Channel, Subscription, DT Package, and Viewpoint.
8. In the "Viewpoint Selection" window, select the Viewpoint from the drop-down menu to use for the import.
9. At the bottom right on the SBE Digital Thread window, click **Run** to import the SBE DT subscription entity set to the specified GENESYS DT Package.

Note: For an import, in addition to specifying the Channel, you must also select a Subscription, which is part of a Channel. A Subscription consists of data from the Channel that has been cloned and transformed into the format that the ingesting tool is expecting. (Input Screen 3)

GENESYS performs the following actions as part of the import process:

- a. GENESYS queries the subscription and caches a list of all entities, attributes, and relationships in the set.
- b. For each entity in the SBE Vision DT subscription, GENESYS verifies if it has an existing "genesysId" in its ItemLocator. If the entity does not have an existing "genesysId," GENESYS assigns it a new unique ID.
- c. GENESYS performs a sync operation of the dataset back to the SBE Vision DT Channel, which ensures that all entities in the set have their ItemLocator "genesysId" established on the SBE Vision platform.
- d. Processes the data through any non-isomorphic transformation rules assigned to the GENESYS project.
- e. Processes the data **Package** through the selected Viewpoint's masks and mappings.

Note: For an import, the viewpoint's associated filters are not processed in reverse order, as they lose context in the reverse direction.

- f. For entities and relationships with a pre-existing "ItemLocator" genesysID prior to the sync operation (entities and relationships that already exist in the GENESYS project), GENESYS overwrites the existing object's attributes and parameters with the new DT values.
 - g. For entities and relationships that are new to the GENESYS project, GENESYS creates new GENESYS objects for each and populates their attributes, parameters, and relationships with the information included in the SBE DT subscription.
10. GENESYS reports a summary of the data transfer operation's results, including a list of conflicts generated, if any, during the import. (Results Screen 1)

One-Way Data Transfer into GENESYS

1. Export a data **Package** from an external tool to a master Branch (see Export section).
2. On the SBE Vision DE platform, locate the subscription branch to be updated and perform a diff/merge operation to bring the subscription branch into alignment with the master branch (see SBE Vision's help for more information on the diff/merge operation).
3. Import the SBE Vision subscription branch entity set into the designated DT Package in GENESYS (see Import section).

Round-Tripping (GENESYS as the SSoT)

The following steps apply for round-tripping when GENESYS is the SSoT for the specified entity set. When GENESYS is the ASoT, change the position of the external tool and GENESYS in the steps.

1. Export a data **Package** from an external tool to the master branch in the external tool's partition on the SBE Vision DE platform (see Export section).
2. On the SBE DE platform, locate the subscription branch and perform a diff/merge operation to bring the subscription branch into alignment with the master branch (see SBE Vision's help for more information on the diff/merge operation).
3. Import the SBE Vision subscription entity set into the designated DT Package in GENESYS (see Import section).
4. A systems engineer finds information in GENESYS that must be updated in the DT Package's scope. The applicable entities, relationships, and attributes are updated in GENESYS with rationale documented.
5. The updated data from the GENESYS DT Package is published, using a subscription, to publish it to the subscription branch in the external tool's partition (see Export section).
6. On the SBE DE platform, locate the subscription branch and perform a diff/merge operation to determine which updates in the subscription branch should be aligned with the master branch.

Note: The diff/merge process allows discrete differences to be accepted or rejected (see SBE Vision's help for more information on the diff/merge operation).

7. Perform an import/sync from the master branch back into the external tool. The external tool now has the accepted and approved updated data, which originated in GENESYS (see Import section).

THE GENESYS–SBE VISION DIGITAL THREAD PLATFORM ADAPTER UI

Input screen 1 – Viewpoint, Credentials, SBE Connection Settings

The user's credentials to log into the SBE Vision DT platform instance are entered here. The username and password are not persisted and must be entered for any interaction with the Digital Thread.

The last section of this screen is dedicated to specifying the SBE Connection settings to the instance of the SBE Vision platform to which GENESYS is being connected.

SBE Vision Adapter Guide

1. In the “Host” field, enter the host name assigned to your company. These data are persisted and must be updated only when importing or exporting data to a different SBE portal than the last Digital Thread interaction with GENESYS.
2. In the “Port” field, enter the port identifier.

Note: Populating the “Port” field is required only if you are working on a local machine.

The screenshot shows a software window titled "SBE Digital Thread". Inside, there's a header bar with a blue icon and the text "Select the scope, viewpoint, and options, of the submodel to import/export to the SBE Digital Thread." Below this is a section titled "Import/Export to the SBE Digital Thread" with the subtitle "Step 1 of 4". The form contains the following elements:

- "User Name:" followed by a text input field.
- "Password:" followed by a text input field.
- A section titled "SBE Connection settings" with an expand/collapse icon.
- "Data Source:" followed by a dropdown menu.
- "Host:" followed by a text input field.
- "Port:" followed by a text input field.
- A large "Connect" button at the bottom center.
- At the bottom right, three buttons: "Cancel", "<< Back", and "Next >>".

Input Screen 1

Input Screen 2 – Specifying Import or Export

The second screen allows the user to specify whether an Import or Export operation will be performed.

SBE Vision uses different terms than GENESYS for these operations. The equivalent terms are shown in the table below.

GENESYS Term	SBE Vision Term	Description
Import	Synchronize	This operation performs a refresh and then a publish in the same action.
Export	Publish	This operation publishes all the data to the selected SBE Vision channel.

SBE Digital Thread -

Select the viewpoint and options of the submodel to import/export to the SBE Digital Thread.

Import/Export to the SBE Digital Thread

Step 2 of 4

Choose either Import or Export.

Import will allow user to select the partition, branch, channel, and subscription for importing data related to the digital thread subscription.

Export allows a user to select the partition and channel that will be used to store selected GENESYS classes into the digital thread.

☒ Import ⓘ

☐ Export ⓘ

Cancel << Back Next >>

Input Screen 2

Input Screen 3 – Specification of the Data Location on the SBE Digital Thread

On Input Screen 3, for an export operation, specify the location on the SBE Digital Thread platform where the GENESYS data **Package** will be stored.

For an import operation, specify the DT Package of the data on the SBE Digital Thread platform that will be ingested into GENESYS.

1. From the drop-down menus, select the DT Package name and Viewpoint name in GENESYS , as well as the Channel name and Subscription name in the SBE Vision DT client to connect to.
2. "Subscription Name" must be specified for import operations only.
3. Add additional rows to conduct a bulk operation, if desired.

SBE Digital Thread

Select the viewpoint and options of the submodel to import/export to the SBE Digital Thread.

Import/Export to the SBE Digital Thread

Step 3 of 4

Verify selected channels/subscriptions for Export.

Data source: GENESYS

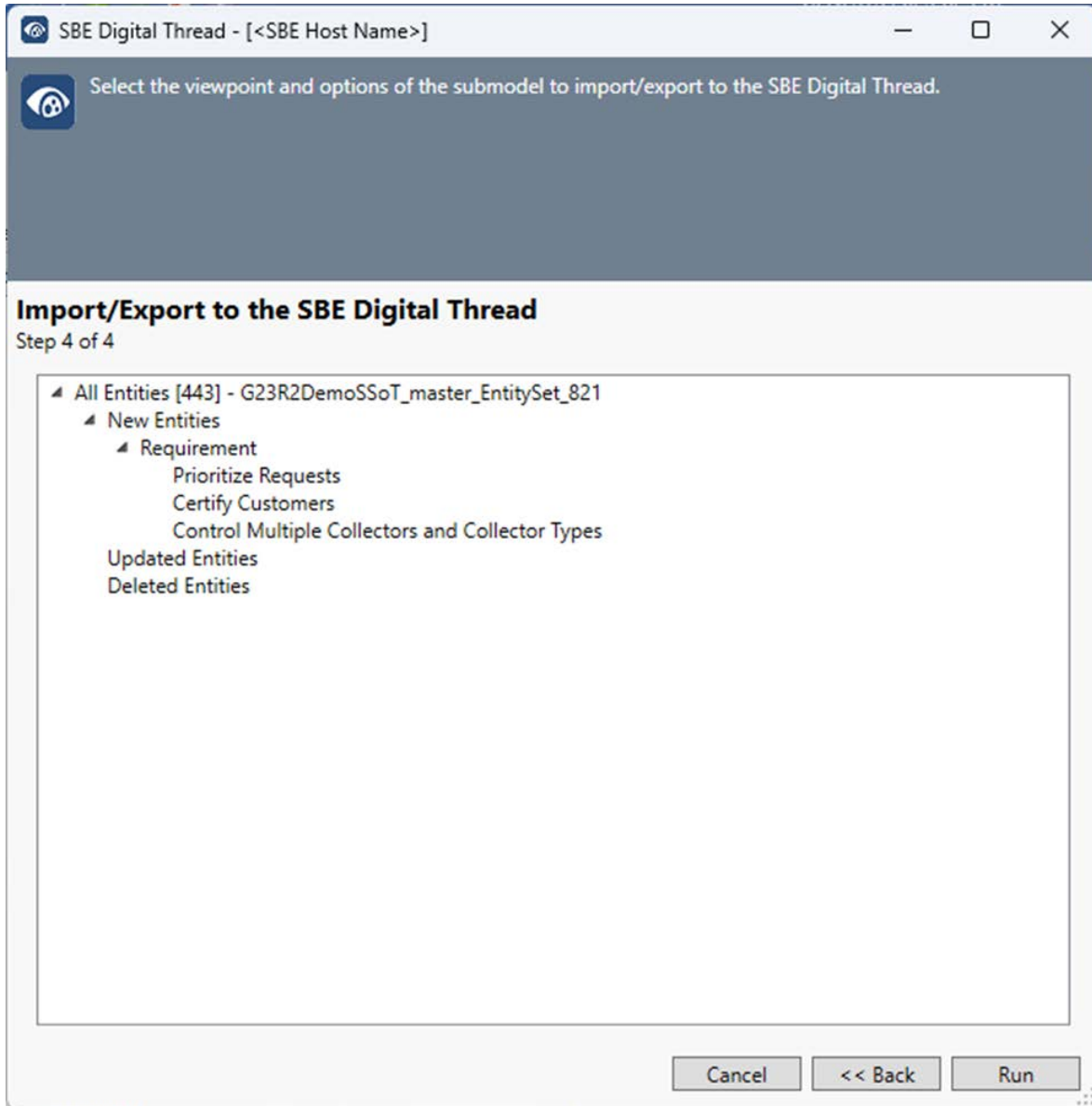
Selected	DT Package Name	Viewpoint Name	Channel Name	Subscription Name	Remove
<input checked="" type="checkbox"/>		Viewpoint_001		Authoritative	
Add					

Cancel << Back Next >>

Input Screen 3

Input Screen 4 – Review of Selected Scope and Location

The last input screen allows the user to review the scope and location of the data transfer before executing the operation. For an export operation, the selected DT Package(s) and their content are displayed. For an import operation, the location where the imported DT Package will be placed within the GENESYS project file and the entities to be imported are displayed.

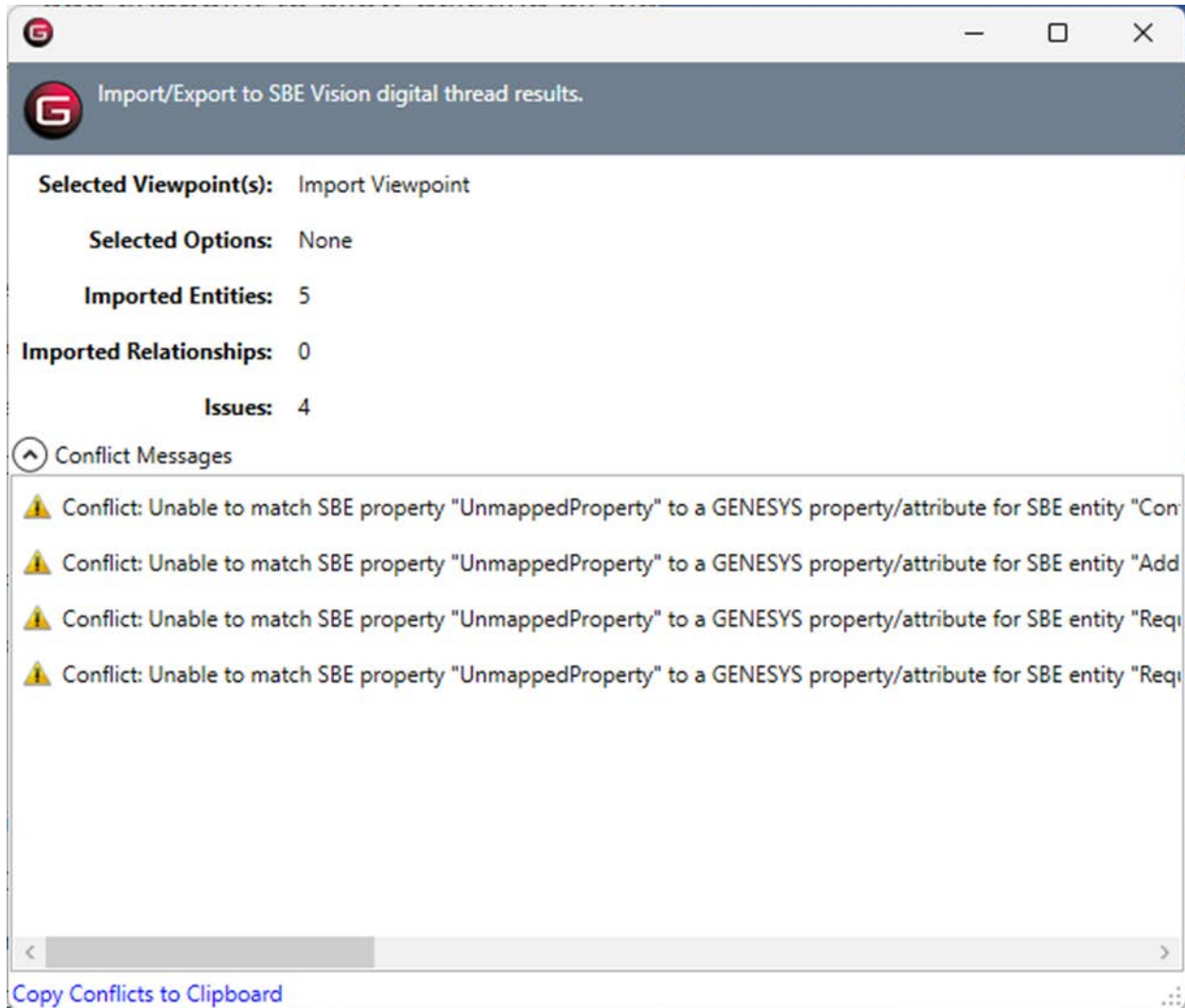


Input Screen 4

Results Screen 1 – Operation Summary and Issues

The final operation summary and issues screen is presented after the import or export operation has been completed.

Results Screen 1 summarizes the options selected for the performed operation, provides summary statistics on the number of entities and relationships, and summarizes any issues. Issues that are encountered have additional details displayed in the “Conflict Messages” pane. These messages can be copied to the clipboard by clicking the text displayed at the bottom left of the window, **Copy Conflicts to Clipboard**.



Results Screen 1

LIST OF NON-ISOMORPHIC TRANSFORMATION RULES

GENESYS 2023 R2 features these non-isomorphic transformation rules:

GENESYS Entity's Parameters to SBE Digital Thread Parameter Class Entities

Parameters of any entity in GENESYS are transformed to first-class parameter entities on the SBE Vision platform. This transformation is performed to facilitate interaction with other MBSE tools that treat values and units as first-class entities.

Egress / Publish

Parameters are published to the SBE Vision Digital Thread as Parameter entities. These entities are related to the host entity with a *contained in* relationship. Each Parameter entity on the SBE Vision Digital Thread has its Shape Name set to match its Parameter Name in GENESYS.

Within the MBE Master ontology on the SBE Vision DT, there are 3 sub-classes of the Parameter entity with the following GENESYS parameter fields mapped to it:

SBE Vision::Parameter Sub-class	GENESYS::Parameter Field
Constraint Parameter	Minimum Maximum Objective units
Design Parameter	Design nits
Requirement Parameter	Observed units

Units are mapped to each of the subclasses. Parameter entities may be synchronized to different DE tools and may not be shipped as a complete set. As such, each parameter entity must hold its units.

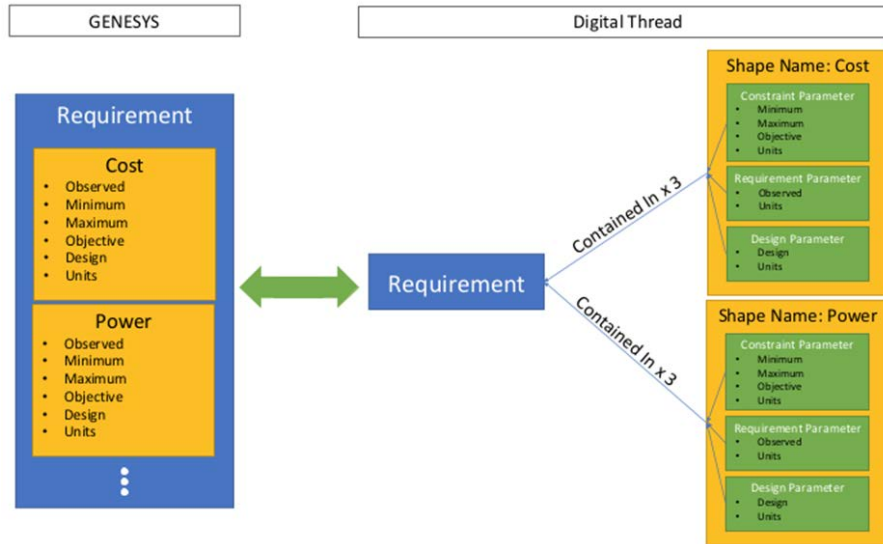
SBE Vision users can modify both the sub-class names and the mappings of GENESYS parameter fields to these sub-classes.

Ingest

In the SBE Digital Thread subscription collection, GENESYS searches for entities of type "Parameter." These entities must have a "parameterrelation" relationship with another entity and a shape name of either "genesysrequirementparameter," "genesysdesignparameter," or "genesysconstraintparameter." Any entities fitting this description will have their specific parameter fields, such as minimum, maximum, objective, design, observed, and unit, matched and imported back to their corresponding fields in the related GENESYS element upon import.

An illustration of this non-isomorphic transformation is shown in the following figure.

SBE Vision Adapter Guide



SBE Vision DOORS Classic & DOORS NextGen Integrations

DOORS Requirement elements that have Stakeholder attributes of attribute type “multi-select” are transformed to GENESYS **Organization** class entities of the same name. In GENESYS, a *has stakeholder/is stakeholder of* relationship is created between the **Organization** entity and the related **Requirement** entity. This rule is included by request of the launch customer for the GENESYS-SBE Vision adapter.

GENERAL NOTES ON DATA-PROCESSING RULES

This section describes general notes on data processing rules applied to imports and exports.

Attribute Type Mappings

GENESYS has unique attribute types, some of which do not have a direct corollary on the SBE Vision DT platform. To account for this, GENESYS has the following mappings:

GENESYS Attribute Type	SBE Vision DT Platform Type
Boolean	Boolean
Collection	Array
Date	String
Date Time	String
Entity Reference	String
Enumeration	String
Float	Float
Hierarchical Number	String
Integer	Integer
Number Spec - Constant	Float
Number Spec - Random	--not supported-- / --not exported --
Reference Spec	String
Script Spec	--not supported-- / --not exported --
String	String
Text	String

Relationship Attributes

GENESYS supports the concept of relationship attributes. However, the SBE Vision DT currently does not. As such, relationship attributes are not currently exported to the SBE Vision DT platform.

Embedded Images and Tables

The SBE Vision DT platform currently does not support the transport of embedded images or tables in entity attributes. As such, all embedded images and tables are neither exported from GENESYS nor available from other tools to be imported into GENESYS.

Inherited Parameters and Attributes

GENESYS supports the capability of entities to inherit parameters and attributes from parent entities through the *specialization* relationship. However, data imported from the SBE Vision may have parent-child entities that are not consistent with this inheritance. If this inconsistency occurs, GENESYS imports the data as defined in the SBE Vision DT subscription and overrides the attribute and parameter values as needed.

Parameter Substitutions

Parameter Substitutions are a useful way in GENESYS to avoid having to hard code numerical values and units in a textual attribute field. Rather, they allow the user to create a coded reference to the values, which are replaced any time the entity attribute is exported from GENESYS, ensuring that the textual description is always consistent with the parameters whenever they change. However, this coded reference creates a challenge when exporting and importing data from the Digital Thread where other tools do not have a corresponding concept.

The way that GENESYS handles this is as follows:

- On export, parameter substitutions are published with the coded references replaced with their associated parameter's values.
- On import, any attributes of type "text" are imported as-is. GENESYS does not attempt to try to resolve the text strings with any associated parameters. The user must review and update these fields manually, if needed.

Parameter Bindings

Parameter bindings provide a mechanism to ensure that parameters remain consistent between associated entities. However, this concept creates a challenge when exporting and importing from the Digital Thread where other tools do not have a corresponding concept.

The way that GENESYS handles this is as follows:

- On export, bound parameters are published as "unbound" copies of the parameters in each bounded entity (the Child entity). This is a dumb export where the concept of binding is removed, and each parameter is exported independently.
- On import, if there are conflicts that violate existing parameter bindings in GENESYS, the binding in GENESYS is removed and the values from the DT are published to the appropriate fields.



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