

In this white paper we give the overview of NOR-STA argument notation:

1. basic concepts – what is an argument?
2. what are the argument elements?
3. how the argument structure is build?
4. how NOR-STA indicates incomplete argument structure?

1 Basic concepts

The principal concept for assurance cases is the **argument**. As the argument we usually understand a reason or reasons why we support or oppose an idea. When we want to defend an idea or a **claim** we need a way of reasoning (**argumentation strategy**) and some **premises**.

The **premises** can be:

1. **facts** or observations that we are sure of because we have the evidence stating that they are true,
2. **sub-claims** for which we can provide another argument to support them.
3. **assumptions** taken as they are without any further support as they are out of our control or depend on the context.

You can also need some justification for the way of reasoning and we call it the **rationale**.

The concept of an argument and its elements is presented in Figure 1. We have the claim (conclusion) on the left for which we use justified argumentation strategy (inference rule) based on premises on the right.

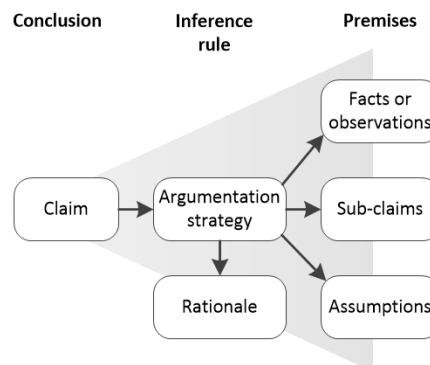


Figure 1. Argument structure

We can combine a set of related arguments to form an assurance case:

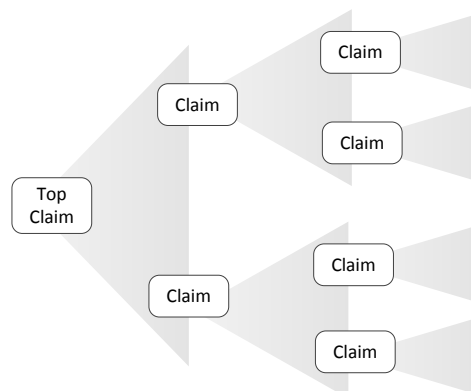










Figure 2. Assurance case is decomposed of arguments

2 NOR-STA argument elements

NOR-STA assurance case contains all types of elements required by ISO/IEC 15026-2:2011 “Systems and software assurance – Part 2: Assurance case”. The argument structure is also compliant with OMG Argument Metamodel (ARM).

All the NOR-STA assurance case elements are listed in the table below:



Icon	Name	Definition
	Claim	A conclusion (true-false statement) that requires argumentation and evidence to demonstrate its validity
	Argumentation Strategy	Explanation of how the conclusion (claim) is to be supported by its premises (the elements linked directly to this argumentation strategy)
	Counter-Argumentation Strategy	Explanation of how the conclusion (claim) is to be refuted based on the provided premises (the elements linked directly to this counter-argumentation strategy)
	Rationale	Justification of the validity of the inference linking the premises and the conclusion of an argumentation (counter-argumentation) strategy
	Assumption	A premise representing an assumed property or condition taken as it is, usually representing the context-dependent constraints
	Fact	A premise representing an assertion (true-false statement) directly supported by the evidence
	Reference	A reference to a single external resource - a document, webpage, video or any other type of identifiable element. Typically, references are used to integrate the external evidence and/or contextual data
	Information	An additional information item which is not part of the argumentation itself but provides explanations and/or integrates external contextual data

A set of attributes is defined for each argument element like: description, creator and history of changes, assessment results and comments.

3 NOR-STA argument structure

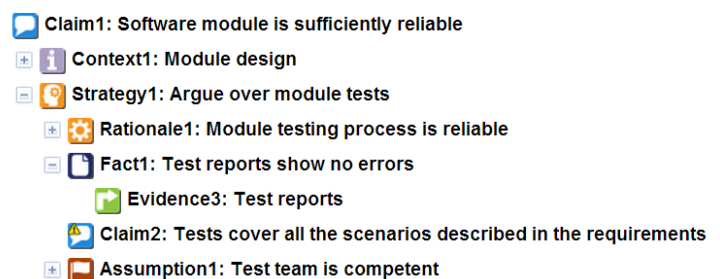
NOR-STA argument is a hierarchy presented as a tree view.

The elements on a lower level of the hierarchy support the elements on the higher levels.

An element can be expanded () to reveal the supporting elements, if any, and collapsed () to hide them.

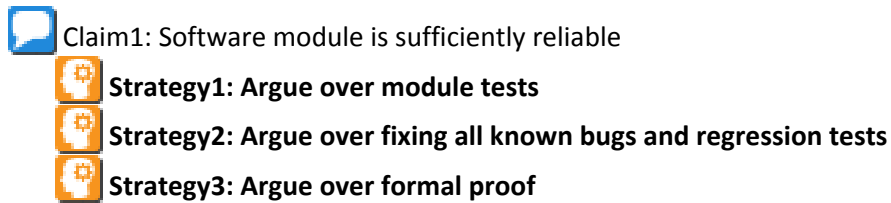
NOR-STA argument tree has just one type of relation between the elements: ancestor-descendant (or parent-child). Each element (except the root element) has one parent.

NOR-STA argument structure should follow the rules describes in the following subsections.



3.1 Each claim is supported by one or more strategies

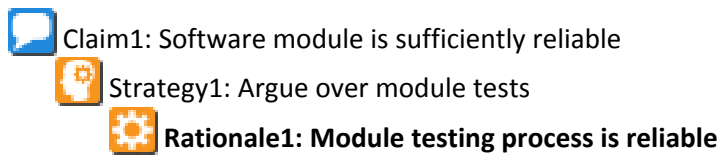
NOR-STA notation requires each claim to be supported by at least one argumentation strategy. More than one strategy for a claim can be defined to represent diverse argumentations.



Claims are always supported by an argumentation strategy - it is not allowed for claims to be supported directly by evidence or other claims.

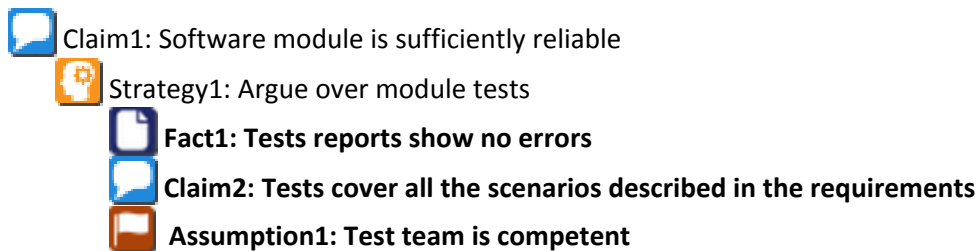
3.2 A rationale is provided for each argumentation and counter-argumentation strategy

Each strategy is associated with a rationale to justify the reasoning.



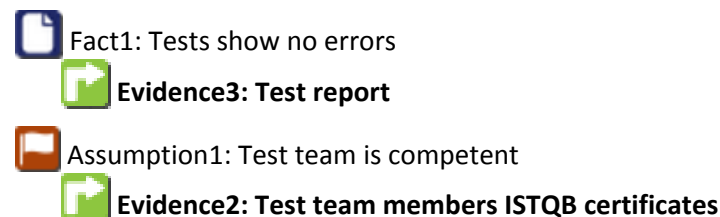
3.3 Argumentation strategy is supported by an arbitrary number of premises (facts, claims and/or assumptions)

A strategy should be supported by one or more premises. A premise is a fact, an assumption or a claim.



3.4 Facts and assumptions are supported directly by references to the evidence

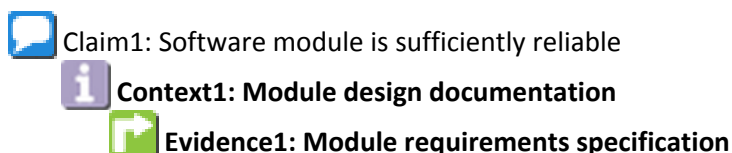
Facts and assumptions can be supported by the (external) evidence. No claims or explicit argumentation strategies are needed to support them.



Providing evidence for facts is mandatory in NOR-STA, while evidence for assumptions is optional.

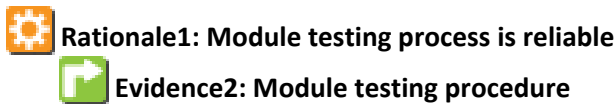
3.5 Information element can be attached to any element

Additional information like context data can be attached to any element using an information element. Such information element can be supported by references to the evidence.



3.6 Rationale can be supported by its own premises




Rationale element can be supported either by an external evidence or by an explicit argument (a confidence argument) if a detailed argumentation is needed to build confidence in the rationale.

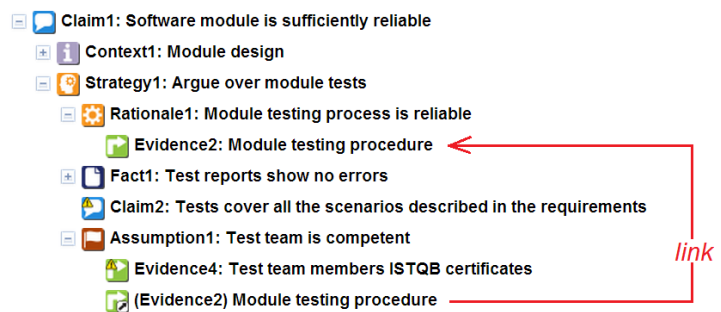


4 Links

It is a good practice not to duplicate elements in the assurance case unless it is necessary. When one element is to be used more than once we can use links. Links work like references in a book: the information is defined once and then referred to from other parts of the text. This enables a systematic reuse and helps to build a modular assurance cases.

We can use links for all assurance case elements except rationale as this element is specific for a given Argumentation Strategy and cannot be reused.

All links are marked with a small black arrow in their icons:   .

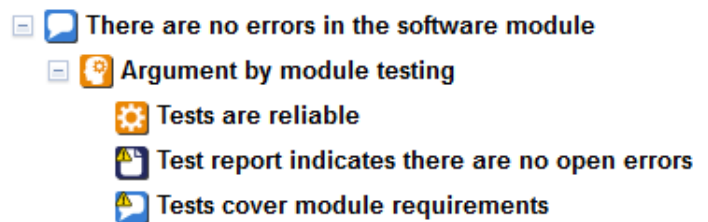


5 Indicators of argument incompleteness

The argument is not complete when:

- any fact is not supported by a reference to the evidence,
- any reference does not contain an address for the evidence document,
- any claim is not supported by an argumentation strategy,
- any argumentation strategy is not supported by a premise (claim, fact or assumption) [NOR-STA version 6.3].

Incomplete elements are marked with a warning sign ().



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