



CONFLICT ARMAMENT RESEARCH

Systems and Analytics Division

Document Name:	Terms of Reference
Tender Name:	Data Visualisation and Analytics Solution (DVAS)
Project Title:	Provision of a secure data visualisation and analytics solution to support CAR's analysts leverage its data on the trafficking of conventional and unconventional weapons, ammunition and related materiel into conflict-affected areas.
Tender Code:	CAR_iTrace III_2018_002_DVAS
Tender Dossier:	http://www.conflictarm.com/vacancies/

Data Management Overview

Introduction

Conflict Armament Research (CAR) is a field-based research organisation whose primary activities involve the documentation and tracing of weapons, ammunition, explosives, and related materiel in conflict-affected areas. This information is used in investigations to improve the global understanding of the diversion of weapons and related materiel into armed conflicts.

This document was developed to provide tenderers submitting tenders towards its "Data Management Solution" and "Data Visualisation and Analytic Solution" Calls for Tenders in 2018 with additional information regarding elements CAR's current data management. CAR expects all tenderers who submit a tender towards either of these projects will review this document carefully and use it to develop their tender.

If tenderers have any questions, they can contact CAR's Evaluation Committee at procurement@conflictarm.com in accordance to the timeline provided in the Instruction to Tenderers document.

Table of Contents

Introduction	1
Primary entity structures	3
Data collection/entry process	4
Chain of custody mapping	6
Waypoint and route segment types	6
Waypoint links	7
Example chain of custody visualisation	8
Item Relationships	9
Direct association	9
Hierarchical association	9

Table of Figures

Figure 1: Data Entry Process - Simple	4
Figure 2: Data Entry Process - Detail	5
Figure 3: Summarised Chain of Custody	6
Figure 4: Item-Waypoint Links	7
Figure 5: Geospatial Chain of Custody Visualisation	8
Figure 6: Hierarchical Associations	9

Primary entity structures

CAR organises its data into five primary entity structures: 1) items/subitems, 2) waypoints, 3) route segments, 4) trace requests, and 5) manufacturers/groups. Item entities include weapons, ammunition, commercial vehicles, improvised explosive devices (including their components and subcomponents), unmanned aerial vehicles, documents, and potentially any other transferable item. While each item entity is unique to that item type (such that weapon attributes are unique to weapons), most item entities share an overall structure, as summarized in Table 1 below. Additionally, elements of an item, such as attachments or components of an item, may be entered into the database as a subitem record in addition to the original item's record. While each item has its own unique entity structure, there is only one entity that is used to record all subitems, regardless of which item type it is associated with.

Waypoint and route segment records come together to produce an item's "chain of custody" path.¹ Trace request records use insights from formal investigations and leads, regarding an item's chain of custody, to create additional waypoint and route segment records. Manufacturer and group records catalogue item manufacturers and groups in possession of these items. Below Table 1 summarises the information captured in each of the primary entity structures and how attributes are referenced between them:

Table 1: Summarised Entity Structures

ITEMS / SUBITEMS		WAYPOINTS		ROUTE SEGMENTS		MFR / GROUPS ²		TRACE REQUESTS	
A	Key	A	Key	A	Key	A	Key	A	Key
C	Date	D	Coordinates	B	Coordinates	E	Location	A	Trace ID
E	Classifications	C	Date range	B	Date range	F	Name	H	Recipient
H	Associations	E	Type	E	Type	E	Type	B	Item info
F	Serial/lot code	G	Diversion	F	Description	F	Description	E	Status
T	Marks	F	Description					C	Benchmarks
T	Description							F	Notes
DATA TYPE/SOURCE KEY									
A	System generated	B	Referenced	C	Date	D	Decimal degrees (DD)		
E	Categorical	F	Text	G	Binary	H	Look up		

¹ Chain of custody is defined as the chronological documentation of an item's possession and transfers from manufacture until last known custodian. Refer to Page 5 for more information on this concept.

² MFR = Manufacturer

Data collection/entry process

When CAR's field personnel are taken to a documentation site (referred to as a waypoint), they will document all relevant materiel (weapons, ammunition, etc.) and catalogue it according to the following procedure:

- Step 1: Documentation Waypoint: Contextual information and observations collected regarding the site of documentation. Will include information such as GPS coordinates and the associated group.
- Step 2: Recovery Waypoint: Contextual information collected on all recovery sites, where the materiel was seized or recovered, relevant to the materiel presented at the documentation site. Will include information such as GPS coordinates, the associated group, and the circumstances of the seizure.
- Step 3: Item records: Photographs taken of each item and later classified.
- Step 4: Subitem records: Photographs taken of each subitem/element and later classified.

In specific cases, supplemental reports will be drafted and linked to relevant, site visit, recovery group, item and subitem entries. These are identified as "attachments" in the Figure 1 below.

Once the information is collected, the field team will enter the relevant data. Each item and subitem record is linked to its respective documentation and recovery waypoints. Additionally, the manufacturing waypoint will be created by information entered in the item record. The item is then linked to the created manufacture waypoint (not shown in the diagrams below). The specifics regarding how items and waypoints are linked is provided in the next section on Pages 5 and 6.

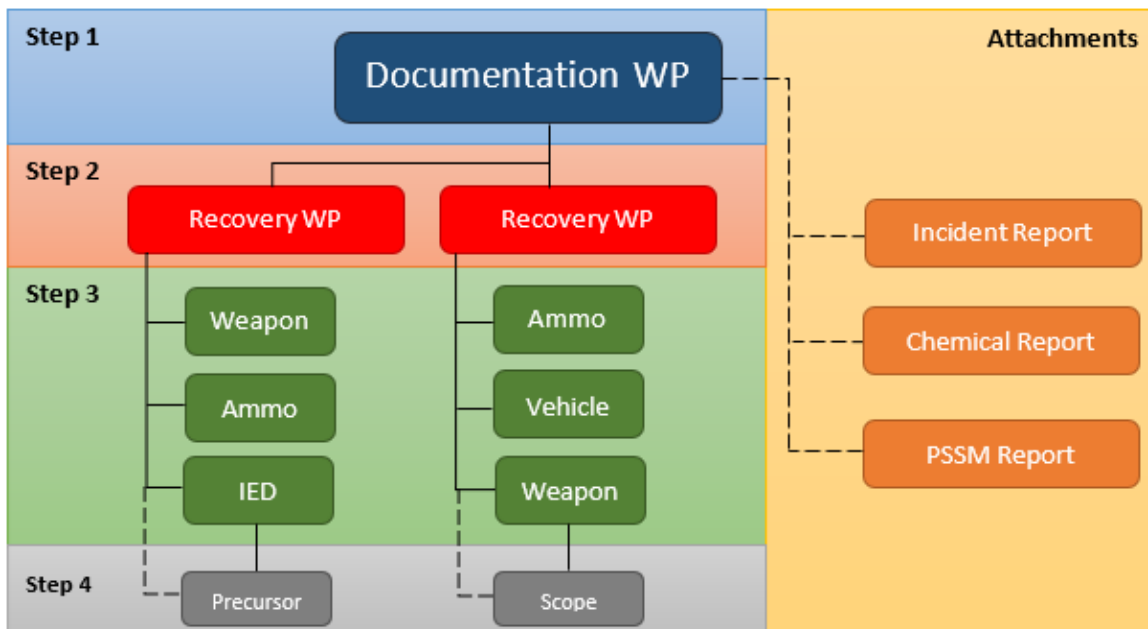


Figure 1: Data Entry Process - Simple

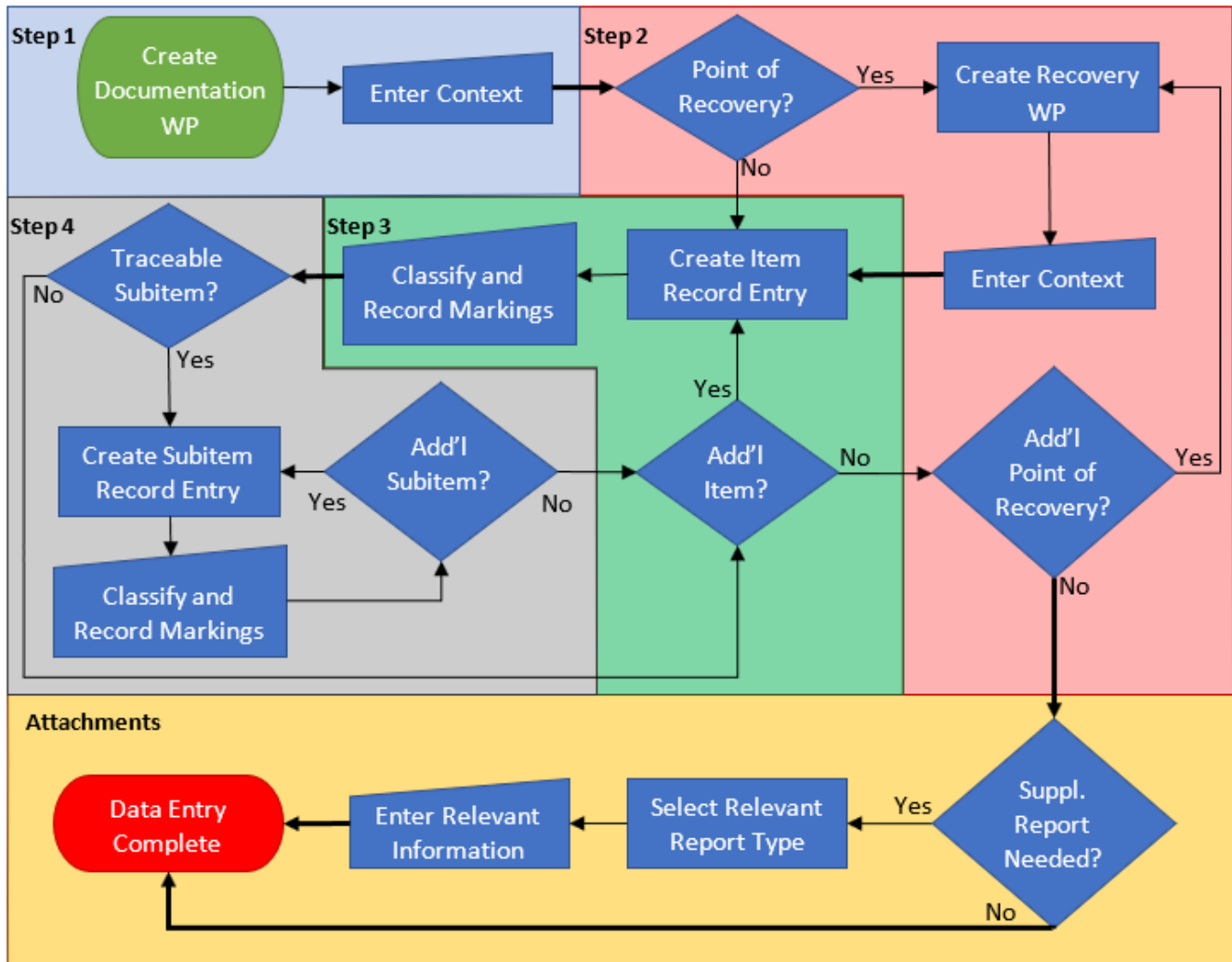


Figure 2: Data Entry Process - Detail

Most items and subitems entered into the database will follow this process and will have at least three waypoints: a documentation waypoint, a recovery waypoint, and a manufacture waypoint, known at the time of data entry. Additional waypoints will be added as investigations provide additional insight into the item's chain of custody. This additional insight is usually gained through issuing trace requests to manufacturers and groups who were in possession of the item at any point. When new custodians of the item are identified, new waypoints will be created, and the item will be linked to these added waypoints as they are entered into the database. This concept is covered in more detail in the next section.

Chain of custody mapping

The chain of custody describes the transfer of possession of an item or subitem from one custodian (owner) to another. The transfer path of an item is broken down into:

WAYPOINTS, the manufacture of an item or the possession of an item by a group at a specific location during a period of time.

- Waypoint entities capture geospatial, temporal, and descriptive attributes

ROUTE SEGMENTS, the transfer of an item from one location and/or custodian to another.

- Route segment entities capture temporal and descriptive attributes and link waypoints

Waypoint and route segment types

CAR currently has five waypoint categories and four route segment categories, as outlined in the table below:

Table 2: Waypoint and Route Segment Types

WAYPOINT TYPES		ROUTE SEGMENT TYPES	
Manufacture	Place of manufacture	Solid black	Confirmed legal transfer
Transit	Transfer point	Dotted black	Unknown legal transfer
User	Legally defined custodian	Solid red	Confirmed illegal transfer
Recovery	Point of recovery/seizure	Dotted red	Unknown illegal transfer
Documentation	Point of documentation		

In most cases, each item will have at *least three waypoints*: a manufacture waypoint, a recovery waypoint, and a documentation waypoint. Investigations will commonly uncover additional custodians and transfers for the item, which will be added over time as transit and end-user waypoints to the item's overall chain of custody. Below is a diagram, which outlines the chain of custody process—excluding spatial and temporal elements. The associated manufacturer or group (indicated in orange in the diagram) will be linked to their respective waypoint. Additionally, the trace request record is linked to the waypoint of its recipient (indicated in purple in the diagram).

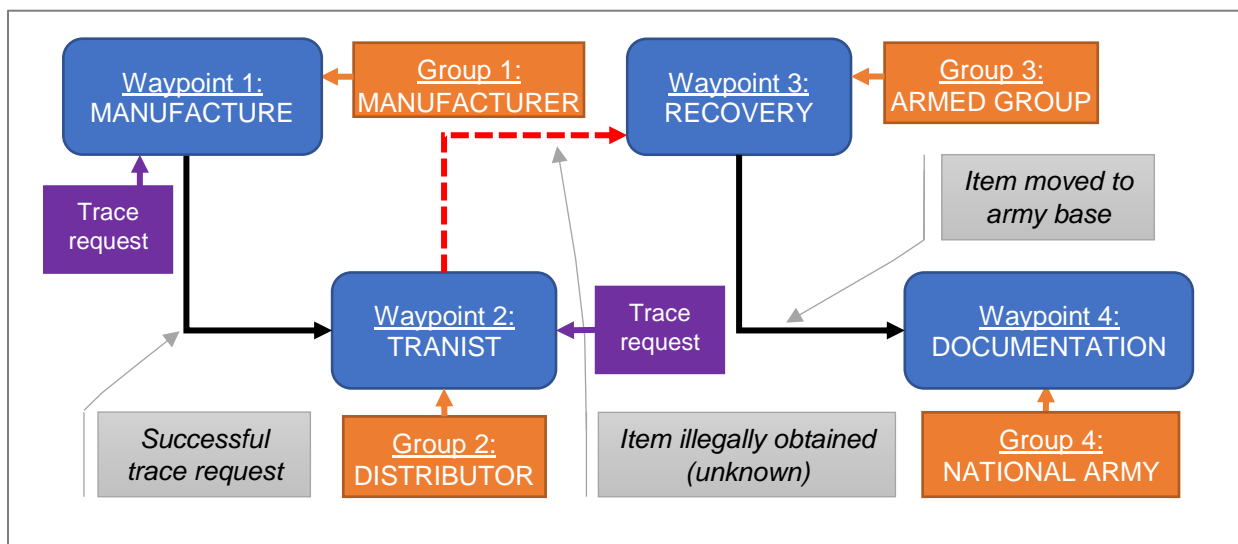


Figure 3: Summarised Chain of Custody

Waypoint links

Each documentation and recovery event will produce a waypoint. Each item documented or recovered during that event will be linked to the relevant waypoint. For example, CAR personnel are presented with materiel at a single site that was recovered during two different events. In this example, all the items will be linked to the same documentation waypoint, while items will be split between the two recovery waypoints based on where they were recovered. The figure below visualises this concept:

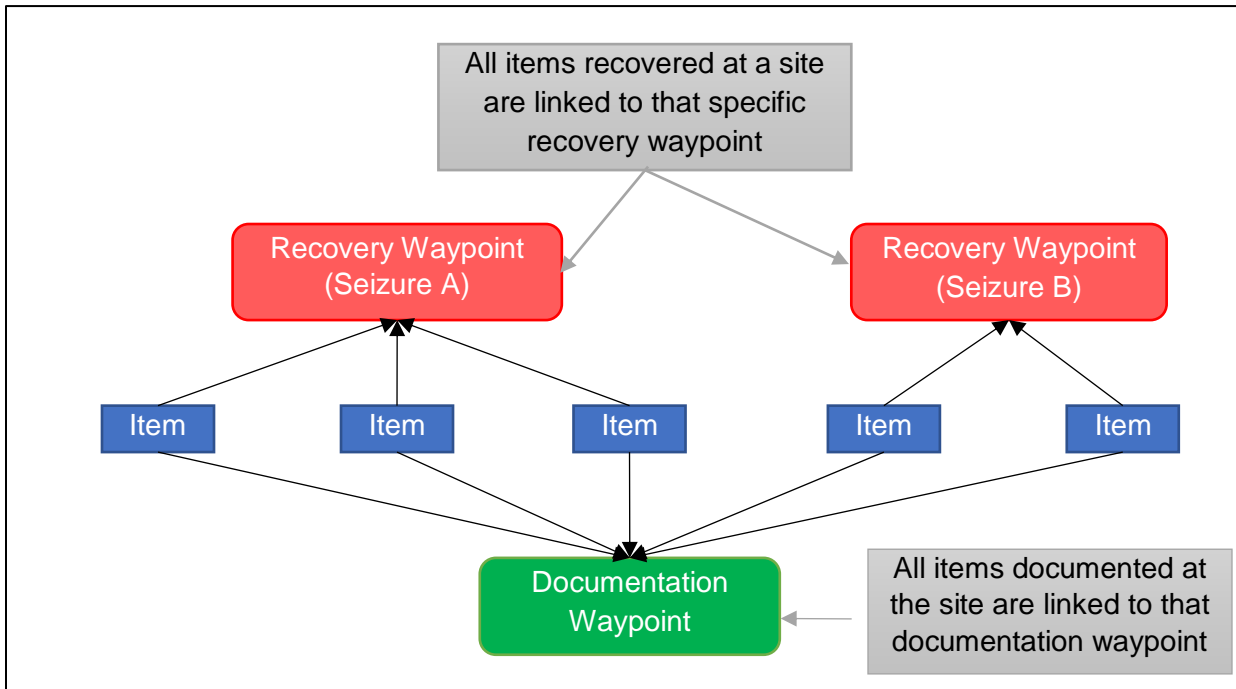


Figure 4: Item-Waypoint Links

Example chain of custody visualisation

The map below is a geospatial representation of the chain of custody for six items.

- Green pin: Manufacture waypoint
- Red pin: Transit waypoint
- Blue pin: Recovery and documentation waypoint

All six items were made by the same manufacturer. Then, all six items were sold to one distributor (transit waypoint). After this, these six items were recovered from an illegal group in three different places. It is unknown how and when these goods were transferred from the last known transit waypoint (red pin) to the eventual recovery waypoint (blue pins), so the line is red (illegal) and dashed (unknown). *In this case, the items were recovered and documented in the same physical location, so they share a pin in this visualisation.*

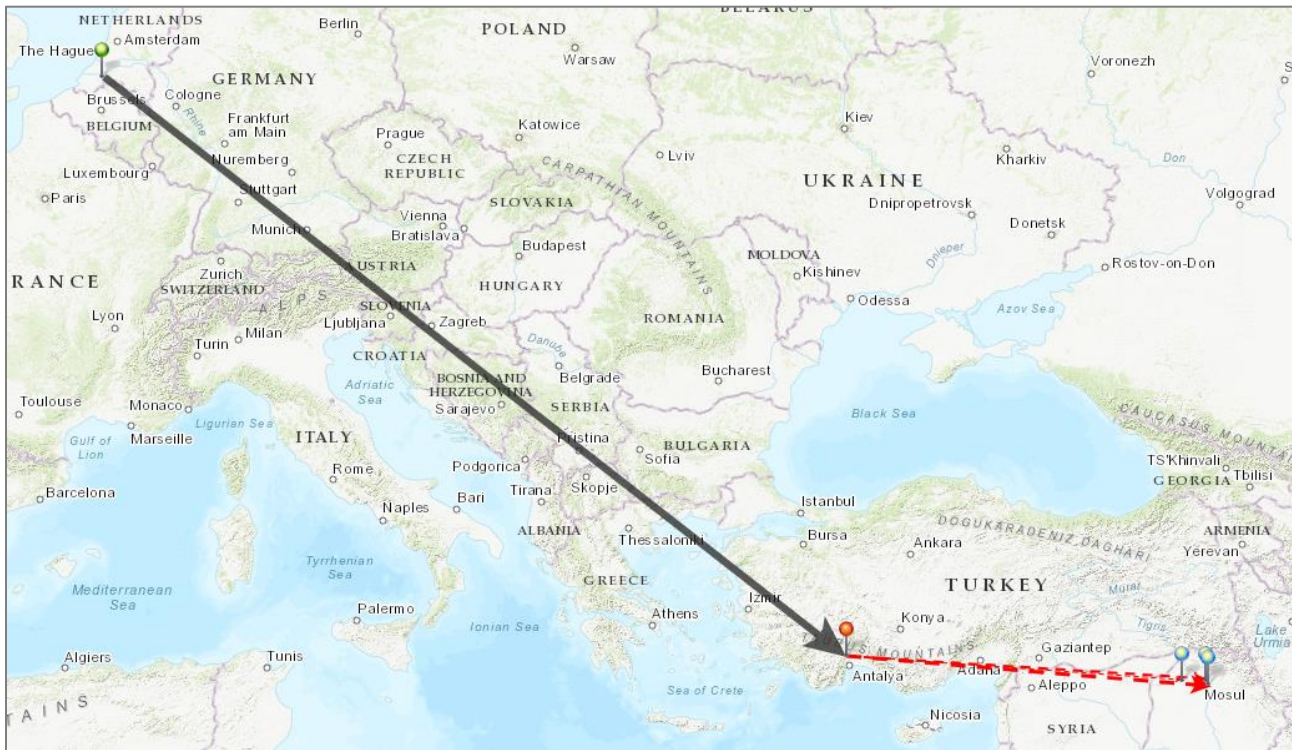


Figure 5: Geospatial Chain of Custody Visualisation

Item Relationships

Item records have three primary relationship types: custodial, direct association, and hierarchical association.

1. Custody relationships refer to the ties between the item record and its waypoints. For example, ten weapons that were documented together are linked to the same documentation waypoint (but not to each other). Custody relationships are associated by one degree of separation. This was addressed in the previous section.
2. Direct association refers to ties between items. Example: ammunition in the magazine of a weapon would be a direct associational tie between the ammunition record(s) and that weapon record.
3. Hierarchical association refers to the ties between a subitem record (an attachment or component of an item) and its parent item record. For example, the records for an explosive device's switch and power source (components) will be tied to the parent explosive device record (device). Further, the records of the integrated circuits used in the design of the custom switch circuit (subcomponents) will be tied to the parent switch record. This concept is visualised in the "Hierarchical Association" section below.

Direct association

Items that have a direct association will have a direct tie between them. While most cases of direct association occur between items documented together, this will not always be the case. The most common occurrence of direct association is ammunition loaded in a weapon at the time of documentation. In this case, the weapon and ammunition records will be linked.

Hierarchical association

Most item entities will only have one layer of hierarchical association. This will be with the item's subitem. For example, if an assault rifle is documented with a scope attached, the scope would be entered as a subitem record then linked to the weapon item record. However, this association type is most commonly used for improvised explosive devices and unmanned aerial vehicles. These two item types are likely to have multiple components (which are similar to the item entity structure) and subitems (commonly called subcomponents) records linked to the overall item record. The figure below visualises the IED hierarchical relationship structure.

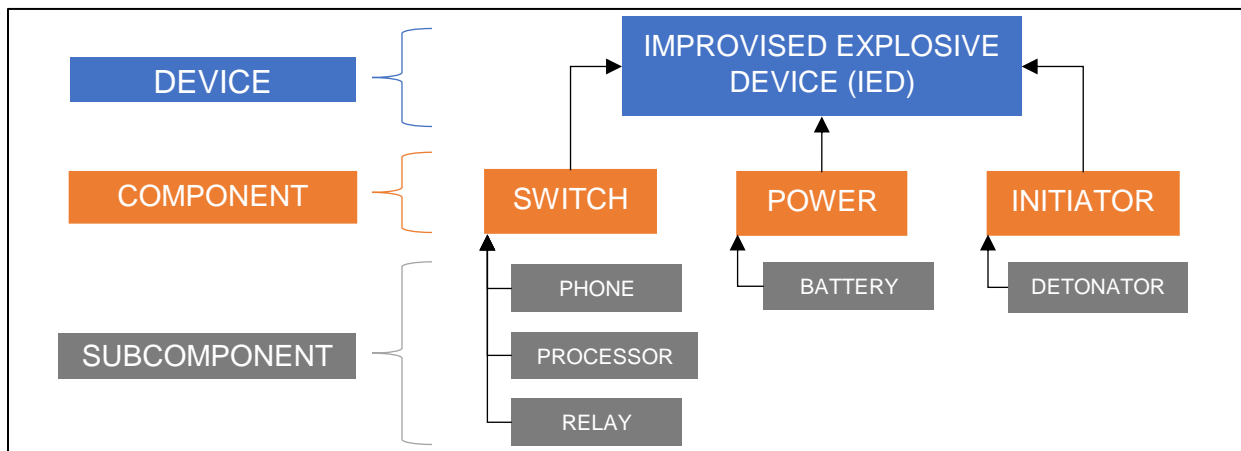


Figure 6: Hierarchical Associations