

In this paper, the authors propose a new approach to defining competences according to which a competence is a defined set of three elements: executors of the actions, on board processes and objects needed to execute a task or a decision within one process. Each of the elements has to be defined separately. Correlation between the competences' elements should be defined as well. Generic competences are of the extreme importance for the successful on board processes. Therefore, a correlation between the generic competences' elements should be defined as well. These definitions' application has been shown on the examples of professional and generic competences. As has already been mentioned, objects have become a part of the new, redefined and improved definition of competences. Objects can be divided into the ones referring to generic competences and the ones referring to professional competences. They are devices, machines, tools, persons, groups of people and concepts. They change significantly under the influence of technological development and automation, which, consequently influences the whole process as well as task executors.

Competences (C) represent a defined set of three elements:

- 1) Subject ( $e_1$ )
- 2) On board process ( $e_2$ ), and
- 3) Object ( $e_3$ ).

This set of elements can be represented like this:

$$C = \{e_1, e_2, e_3\}$$

Subject is an element that does  $m$  of operations with  $n$  of objects. For the purpose of this paper, a subject can be one crew member (e.g. deck officer) or a group of people with the same goal. Depending on the number of its members, a group of people can be divided into:

- 1) Smaller teams, e.g. bridge team,
- 2) Middle-size teams, e.g. deck crew, and
- 3) Large teams, e.g. ship crew.

An on board process is a set of operations, decisions and tasks within operations whose time of execution  $t$  has been implicitly or explicitly set.

$$e_2(t) = \{O_1, O_2, \dots, O_n, D_1, D_2, \dots, D_n\} t$$

$$\sum t_i < t_g$$

Where:

$t_i$  – time of execution

$t_g$  – limited time of execution

As far as generic competences are concerned, the object is usually a person, a team, a concept or a device, whereas as far as professional competences are concerned, it usually represents a device, machine or a tool.

#### Difference between professional and generic competences

As far as professional competences are concerned:

$e_3$  = an advice, number of devices, machine, number of machines, tool or number of tools.

As far as generic competences are concerned:

$e_3$  = a person, team, concept or device.

Pilot Boarding process - part of the already existing competence *Manoeuvring and Handling a Ship in all Conditions* prescribed by the STCW Convention.

Subjects, executing a task in this case:

- 1) bridge team and
- 2) deck crew.

Objects they use are:

- 1) manoeuvring system,
- 2) navigation system,
- 3) communication system and
- 4) equipment needed for pilot boarding.

Bridge team and deck crew prepare themselves for pilot boarding according to the prescribed procedure on pilot boarding. Upon receiving a pilot boarding position from the authorities in charge, the bridge team has to determine ship's position, course and speed with reference to boarding time. The position is checked according to defined voyage plan and time intervals. Before reaching the agreed position, a contact with pilot boat has to be made. Pilot boarding position should be confirmed as well as boarding time and the ship's boarding side. Furthermore, the ship's speed has to be in accordance with pilot ship's demands. Manoeuvre is carried out in cooperation with a pilot boat and administration responsible for pilot's activities. Pilot boarding should be visually followed and helped. It is important to emphasize that, at the same time, the ship is being manoeuvred in restricted waters, very frequently under the influence of strong wind and currents. Therefore, it needs continuous speed and steering corrections. After the safe pilot boarding has been confirmed, the master himself manoeuvres the ship until the pilot takes charge of his advisory position.

At the same time, deck crew prepares pilot boarding station. It has to mark and illuminate boarding location, set up pilot ladder, and ensure the shortest, illuminated passage from the pilot boarding station to the bridge. The equipment used to set up pilot ladder differs on the basis of the way it has to be lowered, i.e. manually or automatically.

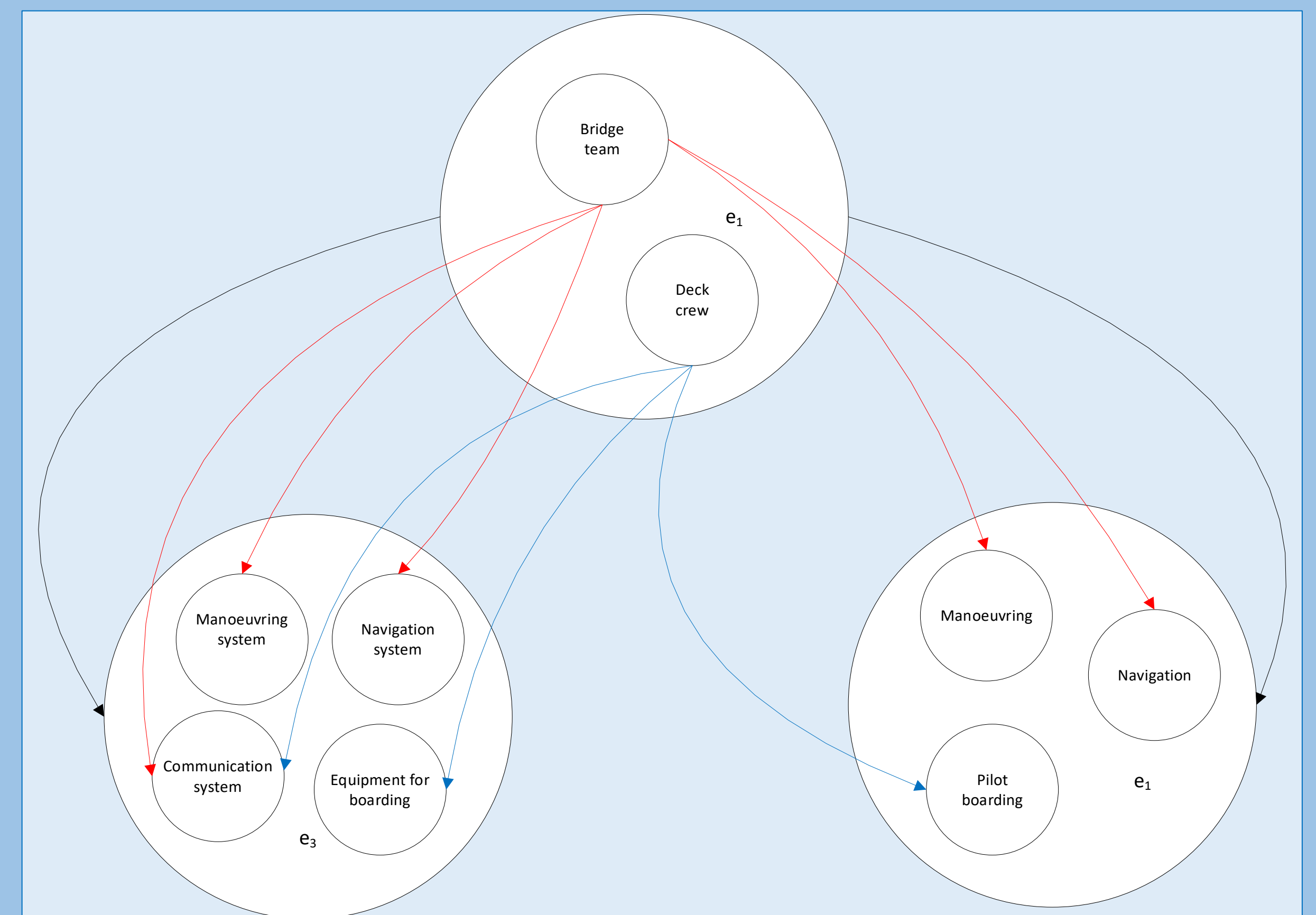


Figure 3. Pilot Boarding

In this example, the term knowledge refers to:

- 1) Type of objects (e.g., communication resources are the UHF resources, used for the internal communication on a ship, and VHF resources, used for the communication with pilot ship and authorities in charge).
- 2) Elements the objects consist of (e.g., manoeuvring system can be divided into propulsion system and steering equipment),
- 3) Elements' work principle (e.g., propeller thrust) and
- 4) Elements limitations (e.g., radar reflected images and photos' limitations – a false reflection could appear or, due to heavy traffic, the ship's reflection does not have to be seen).

The term understanding refers to the relationship between:

- 1) Bridge team and manoeuvring system, navigation system, communication system and lifesaving equipment,
- 2) Deck crew, communication system, and pilot boarding equipment, and
- 3) Bridge team and deck crew.

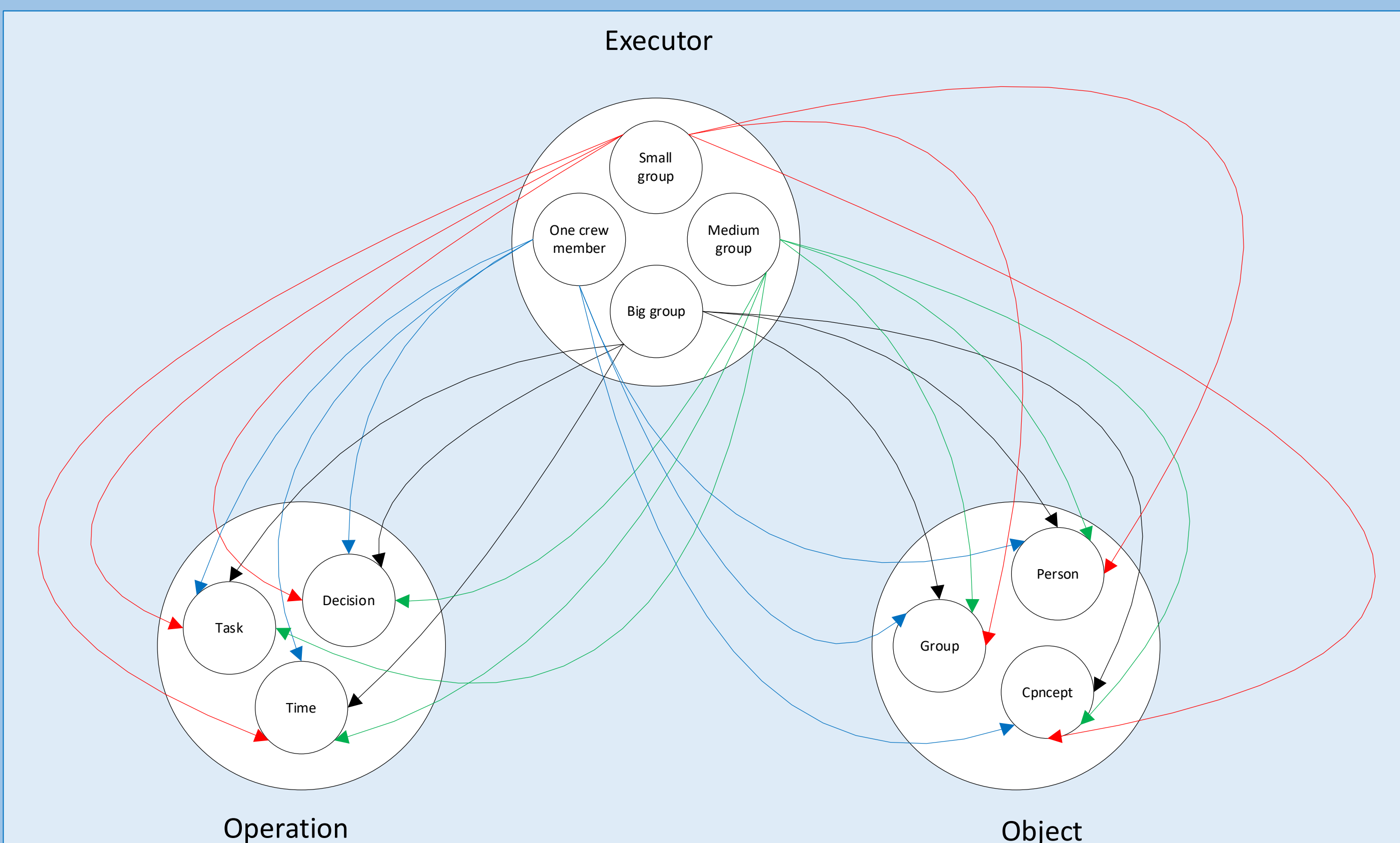


Figure 1. Generic competences

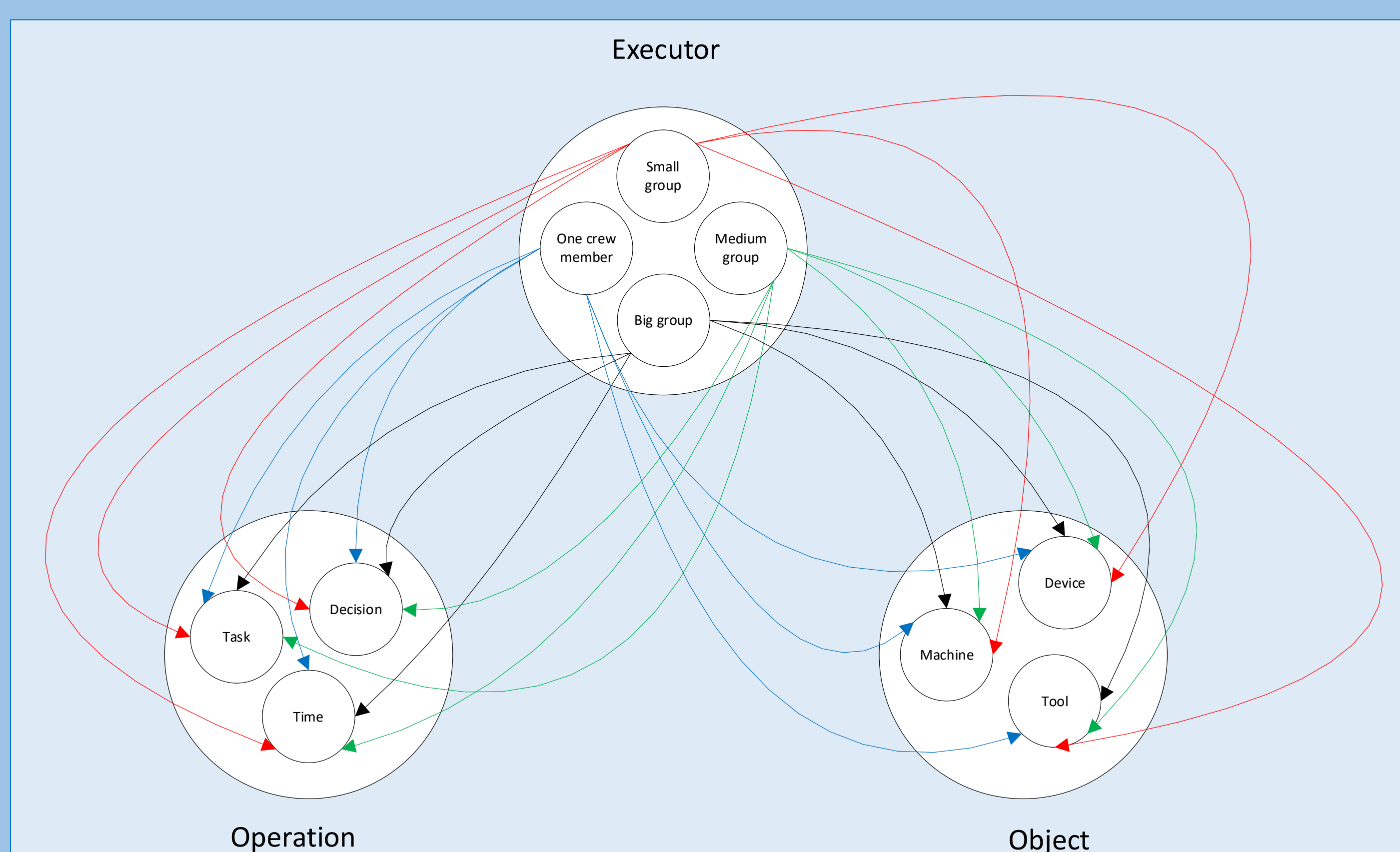


Figure 2. Professional competences

#### Conclusion

STCW Convention's classification of competences was based on functions on board. On board processes and the accompanying equipment were not analysed at all. Competences do not have to be determined and classified on the basis of on board functions. They can be determined on the basis of the crew's environment analysis i.e. on the basis of the analysis of on board processes. Such an analysis encompasses tasks that have to be done, decisions that have to be made, their executors as well as the equipment needed to do a task or to make a decision.

In order to improve STCW Convention's description of competences, a method of determining competences on the basis of processes on board has been proposed. Activities and tasks that a master and first deck officer do, but did not perform at lower levels of responsibility should be defined more precisely. Only afterwards, competences needed at higher levels of responsibility that were not needed at lower levels of responsibility, could be determined. Furthermore, a more clear and precise listing of knowledge, understanding and proficiency referring to the particular competence should be determined.

So far, the method of prescribing competences has referred to an individual only, i.e. to a crew member. Therefore, this paper proposes a redefined approach to defining competences, which interrelates competences and processes on board as well as devices used. Moreover, a concept of an individual widens to a concept of a subject. In doing so, a subject could be an individual or a team carrying out the same process by using one or more devices. Therefore, not only competences of a crew member should be analysed in the future, but of the whole team participating in the particular process on board.