Decision-Acquisition System Based on a Common Decision-Exchange Protocol

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Topic 2: Networks and Networking (including standards)

Presentation Topic Outline: Common Decision-Exchange Protocol (CDEP)

- What is and what is not the CDEP?
- Why is CDEP important?
- Decision support vs. decision acquisition
- Characteristics of decisions & the decision-making process
- Design of a decision-acquisition system
- Examples: How to use a CDEP-based decision-acquisition system
  - **Information gathering**
  - **Decision options**
  - **Advantages and disadvantages of alternatives**
  - **Capture confidence levels at various stages**
- Future directions for applications

Common Decision-Exchange Protocol (CDEP): What it is and what it is not.

- CDEP is a proposed open-standard format to represent decisions & decision-making process on networks for:
  - Information exchange
  - Situational awareness
  - Training
- CDEP is an XML- and REST-based protocol for representing generic human decisions in a simple, interoperable format.
- CDEP is not yet an accepted open standard.
- CDEP is not primarily a decision-support system.
- A decision-acquisition system is needed to instantiate CDEP and realize its benefits.

Why is the CDEP Important to the War Fighter?

- **CDEP will enable war fighters to:**
  - Track and manage the decision-making process better.
  - Maintain a network-accessible archive of the decisions and the decision-making process.
  - Understand and anticipate commanders' decision styles.
  - Automate data acquisition for time-management metrics in command centers.
  - Improve information sharing across networks.
  - Support better and faster decision making.

Why is the CDEP Important?

- **A CDEP-based decision-acquisition system will:**
  - Provide concise, generic, structured assessments and decisions that enable “drill down.”
  - Support pedigree and confidence.
  - Enable approvals and vetting.
  - Help track the options considered.
  - Link to previous decisions.
  - Capture features of decisions and the decision-making process.
  - Enable expert systems to
    - extract features
    - construct a decision-style profile for various decision makers.

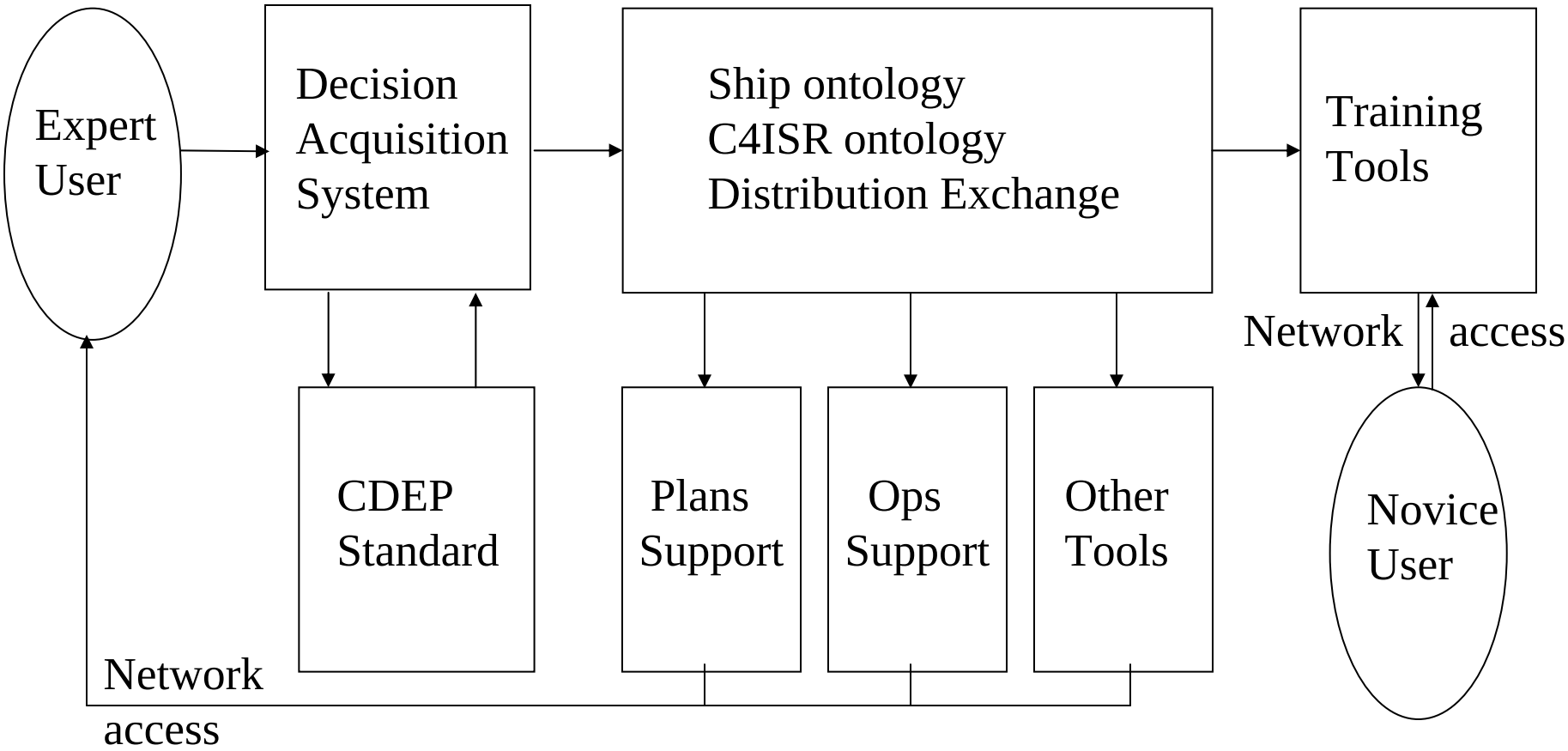
Characteristics of Decisions & Process
What to Information Capture?

- What was the decision?
- Who made the decision and when?
- Who participated? Who was consulted & brought into the decision-making process?
- What options were considered?
- What were the criteria, pros, and cons?
- Why was the selected option chosen?
- How was the decision made, e.g. individual decision, majority vote, consensus, expert opinion?
- What was the context for this decision?
- What was the confidence level at various stages?

Stages The Decision-Making Process

- What states in the decision-making process need to be captured? For example:
  - Not yet started
  - Gathering information
  - Evaluating, analyzing and fusing information
  - Listing of alternatives
  - Paring down the list
  - Selecting an alternative
  - Preparing decision product
  - Communicating the decision
  - Gathering feedback regarding the decision
  - Finished.

CDEP-Based
Decision–Acquisition System Description



CDEP supports training, planning, operations, and other functions.

CDEP-Based Decision Acquisition System
XML Example 1: Information Gathering


```xml
<?xml version = "1.0" encoding = "UTF-8"?>
<decisions>
  <decision>
    <guid>http://www.spawar.navy.mil/Code90/decisions/114.xml</guid>
    <question> What is a good base platform for the search and
                rescue mission? </question>
   <description> RADM Jones needs a ship for search and rescue
                 in the Indian Ocean.</description>
    <decision confidence>Low</decision confidence>
    <state>Gathering Info</state>
    <eventInfo>
      <who>http://www.spawar.navy.mil/code90/people/RADM_Jones.xml</who>
      <when>2008-04-15T13:00-08:00</when>
    </eventInfo>
  </decision>
</decisions>
```

CDEP-Based Decision-Acquisition System
XML Message Example 2: Options


```
<decisions>
  <decision>
    <guid>http://www.spawar.navy.mil/code90/decisions/114.xml</guid>
    <question> What is a good of base platform for the search and rescue mission?</question>
    <description> RADM Jones needs a ship for search and rescue
                  in the Indian Ocean.</description>
    <options>
      <option>
        <idea>USS Valley Forge</idea>
        <description> Aegis ship is fully SAR-mission capable.</description>
        <selected>false</selected>
      </option>
      <option>
        <idea>USS Sentry</idea>
        <description> Mine sweeper is partially SAR-mission capable.</description>
        <selected>false</selected>
      </option>
    </options>
    <decision confidence>Medium</decision confidence>
    <state>Analyzing Info</state>…
```

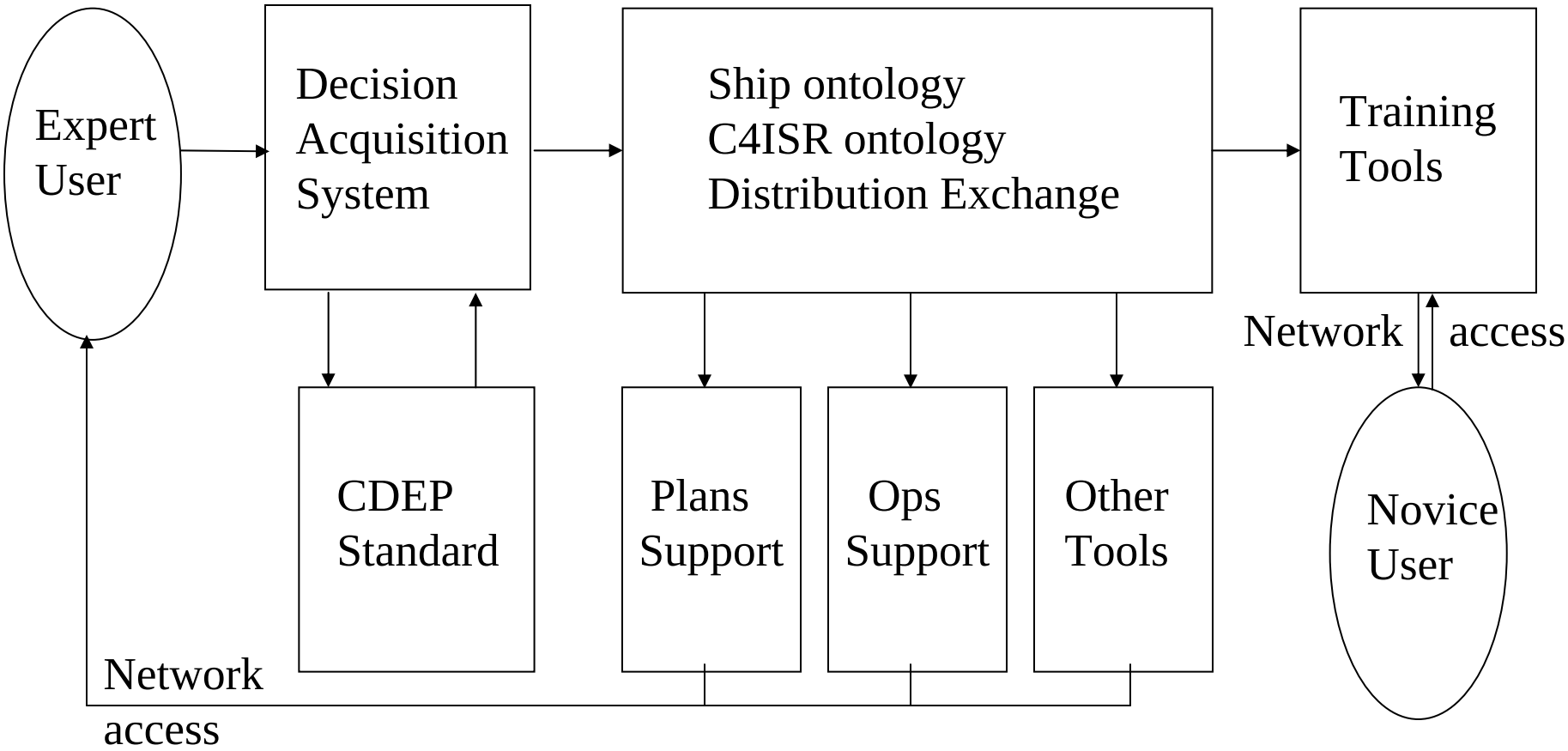
CDEP Example 3: Alternative 1
XML-Coded Advantages & Disadvantages

```
<option>
        <idea>USS Valley Forge</idea>
        <description>USS Valley Forge could perform search and rescue.</description>
        <selected>false</selected>
       <pros>
         <pro>
           <title>Capable</title>
            <description>USS Valley Forge is a very mission-capable ship</description>
         </pro>
         <pro>
           <title>Available</title>
           <description> USS Valley Forge is available for mission.</description>
         </pro>
        </pros>
         <cons>
          <con>
            <title>Distance</title>
            <description>USS Valley Forge is 50 NM away from search area.</description>
          </con>
        </cons>
      </option>
```

CDEP Example 3: Alternative 2
XML-Coded Decision Selection & Reasoning


```
<option>
        <idea>USS Sentry</idea>
        <description>USS Sentry is 15 NM from the search area.</description>
        <selected>true</selected>
       <pros>
         <pro>
           <title>Capable</title>
            <description>USS Sentry is a mission-capable ship</description>
         </pro>
         <pro>
           <title>Available</title>
           <description>USS Sentry is available for mission.</description>
         </pro>
         <pro>
           <title>Distance</title>
           <description>USS Sentry is 15 NM from the search area.</description>
         </pro>
        </pros>
    </option>
  </options>
  <decision confidence>High</decision confidence>
```

Uses of a CDEP-Based Decision–Acquisition System



CDEP supports training, planning, operations, and other functions.

Challenges and Obstacles to Efficient and Automated Decision Acquisition

- A CDEP-based decision-acquisition system needs to be unobtrusive. The main risk: No one will use it if it distracts the decision maker, particularly if requires too much manual input.
- Automation at the level of intelligent software is needed to avoid irritating the decision maker. This requires an advanced expert system, such as a KASER for knowledge acquisition.
- The system will need to detect topics and fill in the XML format automatically.
- The human-computer interface must learn what the decision maker is doing and detect the stage(s) of the decision-making process automatically.
- The system must function on a network as a network service so that multiple users, both expert and novice, can access it.

Directions for Future Research & Development

1. Develop a CDEP-based decision-acquisition tool to capture the following aspects of the decision process:

- The users' general decision styles
- The information users need to perform their tasks including the pedigree metadata to reduce uncertainty in situational awareness
- The alternatives under consideration
- The level of certainty at each stage of the process
- The reasoning the decision maker used to arrive at decisions.

2. Install the system on a secure network to archive decisions and recall them for training and future decision support.

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