

# Introduction to IEEE/RAS Standard for Robot Map Data Representation (MDR) for Navigation

## What is the MDR standard?

The MDR standard aims to standardise a common representation and encoding for the two-dimensional map data used for navigation by mobile robots. The encoding will be used when exchanging map data with other components and systems. The standard focuses on interchange of map data between components and systems, particularly those that may be supplied by different vendors. As well as the encoding, the standard aims to specify some examples of APIs and protocols for the interchange process so that navigation-related components from multiple vendors may inter-operate.

## What does the MDR standard not do?

It does not aim to standardise the format of map data used internally in systems, such as for performing navigation calculations, obstacle avoidance, or for storage in a database. It also does not place any constraints on vendors supplying robot components relevant to navigation who choose to conform to the standard may use any encoding they choose for internal representation, provided the map data is available in the standard encoding when accessed through the standard APIs.

The standard additionally places no constraints on where map data comes from or how it is constructed. A vendor's component is free to construct map data online or load it from a database of maps constructed *a priori* as it sees fit.

## What does the standard target?

The MDR standard is aimed at mobile robots capable of movement in two dimensions operating in both indoor and outdoor environments. No restrictions are placed on the complexity of the environment. Applications include, but are not limited to, autonomous road navigation, factory logistics systems, defence and rescue robots, and household service robots.

## What sorts of maps will be supported?

Most importantly, the standard only considers static maps. Maps with dynamic information will not be explicitly supported. Metric maps, topological maps, and combined metric/topological maps will all be supported equally by the standard. Additionally, no limit is placed on geographical scale or sensor modalities.

## Why does the standard matter?

Autonomous robots, operating without guide tracks in uncontrolled environments are becoming increasingly common and economically viable. One of the most basic requirements for robot navigation is some form of map.

Complying with a standard for map data representation makes a vendor's components more compatible with others and therefore makes their products more desirable and more likely to win contracts. Standards compliance is particularly important in environments with devices from diverse vendors inter-operating, such as factories and military environments, where data interchange is a

common occurrence. Being able to both use and provide the common data being shared amongst such devices is essential.

## **Progress of the MDR standardization**

Since its official approval of the proposed Project Authorization Request (PAR) at November of 2011, the MDR WG has been active to develop a draft specification of the MDR. The following are a few important events and activities conducted by MDR WG members.

- Nov. 2011: PAR approved. The project “P1873 standard for Robot Map Data Representation for Navigation” has been activated by the IEEE-SA and our technical sponsor, IEEE Robotics & Automation Society
- May 2012 (ICRA2012): in the WG meeting, we examined existing standardization efforts that may fall within the technical scope of the MDR, including OGC CityGML, IndoorML, and others. Also, the MDR WG has defined the contents that shall be included in the standard document.
- Aug. 2012 (CASE2012): We organized an IEEE CASE workshop on MDR, which was held in Seoul. In the workshop, we could listen to practical use cases from the industry including Samsung Techwin, Hyundai MnSoft, Toshiba, and other research institutes and universities. For details of the workshop program, please refer to <http://www.case2012.org>.
- Oct. 2012 (IROS2012): in the WG meeting, participants introduced a very first idea to shape individual sections of the MDR draft. In-depth discussion and presentation were made, topics including 2D metric maps, mobile coordinate system conventions, robot map data models worth consideration, and so on.
- May 2013 (ICRA2013): in the WG meeting, we defined the initial set of terms related to robot navigation and mapping. Also defined was a hierarchy of maps. We also had a map building use-case presentation from Samsung Electronics and discussed a data format for metric and topological map.
- Nov. 2013 (IROS2013): in the WG meeting, we reviewed the very initial draft of the MDR. We agreed on using XML technology for map data exchange, and members from Japan and Austria agreed to take on the task of developing an MDR XML schema.
- Jan. 2014 & Apr. 2014: the MDR WG has conducted online discussion to determine attributes and methods of the class diagrams related to the MDR specification. MDR XML schema has been developed and added to the main document.

## **Current Status of the MDR Standardization**

The standard abstract data model and concrete data format are almost defined. Some examples of APIs and protocols for translating map representations between the MDR standard and other formats are being developed. A graphical illustration of a current status of the MDR standardization is shown in Figure 1. The MDR standard draft is supposed to be submitted for a sponsor ballot

before the end of 2014. In practice, the official submission will be made around the next IROS meeting (IROS2014).

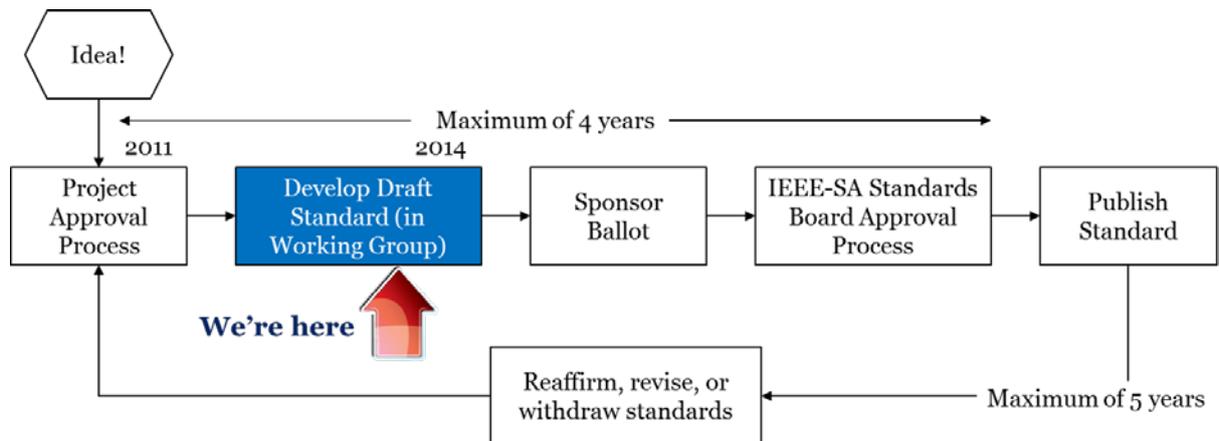


Figure 1. Current status of the MDR standardization.

In the upcoming meeting scheduled to be held on June 1<sup>st</sup> at HongKong, the MDR draft will be completed and reference implementations according to the proposed technical specifications of the MDR will be reviewed. There is a chance to contribute to the development of the MDR standard; please refer to the agenda below for more information.

## IEEE P1873 WG Meetings

**Location: Room G311, on L3 - Hong Kong Convention and Exhibition Centre, Hong Kong**  
**Date: 13:30-17:00, June 1st (Sun), 2014**

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### **MEETING AGENDA:**

1. Welcome and Introductions (15min)
2. Agree on agenda and add any other business (5min)
3. Review and approval of minutes from the previous meeting (5min)
4. WG Update and Reports (5min)
5. Discussion items
  - Review of the Map Data Representation (MDR) standard draft
    - Review of MDR class diagrams
    - Review of MDR XML schema and others
  - Introduction and review of reference implementation of the MDR standard, including:
    - ROS-based metric maps,
    - GVG-based topological maps,
    - application to a robot shuttle example, and others
  - Review of technical reports as resources to explain the MDR standard
    - MDR use-case
    - Comparison with other standards (for example, OGC IndoorML)
6. Next meeting agenda (10 min)
7. Adjourn

Breaks will be taken according to the ICRA conference schedule or upon request of attendees