# Who Am I?

- Intelligent Systems Division, National Institute of Standards and Technology (NIST), Gaithersburg MD, USA
  - Group Leader of the Cognition and Collaboration System Group
  - Acting Group Leader of the Sensing and Perception Systems Group
  - Project Leader of the Agility Performance of Robotic Systems Project
- IEEE Standards Association
  - Chair, Ontologies for Robotics and Automation Working Group (P1872 Standard)
  - Co-Chair, Industrial Robot Ontology Study Group
  - Member, IEEE RAS-SCSA Advisory Board
- Previous Positions
  - Director of Ontologies, VerticalNet Inc.
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# How Do Ontologies Play a Role In Autonomous System Verification?

Represent, Reason, Explain

- Ontologies represent key concepts, their properties, their relationships, and their rules and constraints.

- Ontologies often focus more heavily on the meaning of concepts as opposed to terms that are used to represent them

- Vocabulary + Structure = Taxonomy

- Taxonomy + (Relationships and Constraints) = Ontology

- Ontologies:
  - Bring meaning to data
  - Make different relationships explicit
  - Allows computers to use semantic relationships
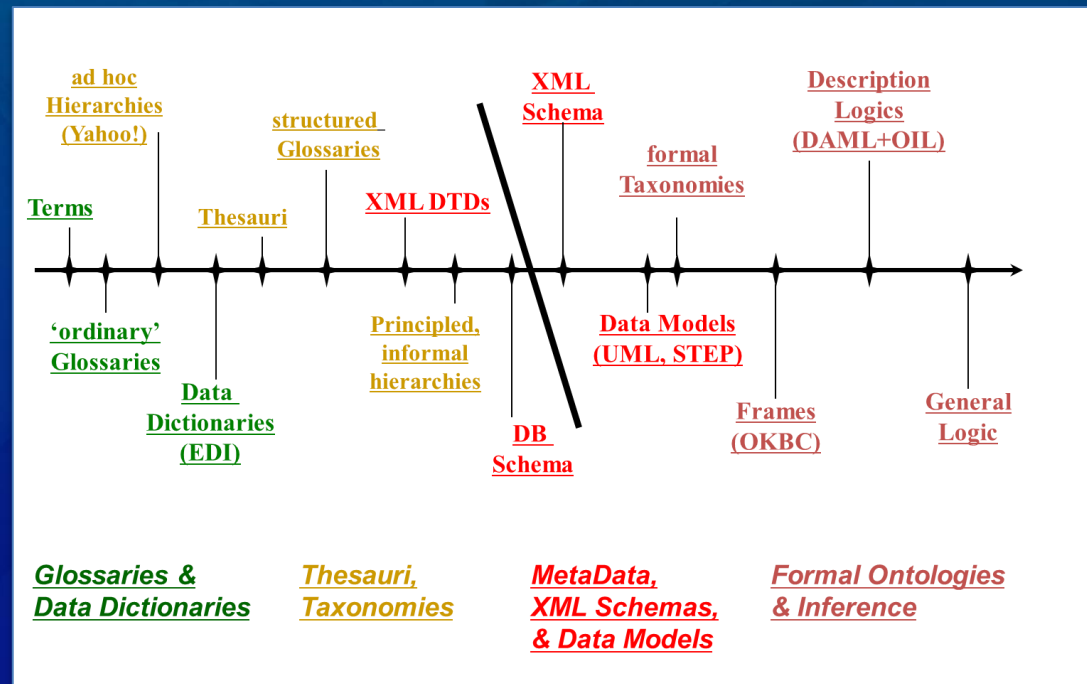
Core Ontologies for Robotics and Automation Standard

- Developed by the IEEE RAS Ontologies for Robotics and Automation Working Group

- IEEE 1872-2015

- http://standards.ieee.org/findstds/standard/1872-2015.html

- Working group made of 171 experts from 23 nations

- "… allows for the representation of, reasoning about, and communication of knowledge in the robotics and automation domain."

- This includes concepts such as automation, pose, robotic systems, and interaction; and allows one to extend these concepts for their specific robotics application.
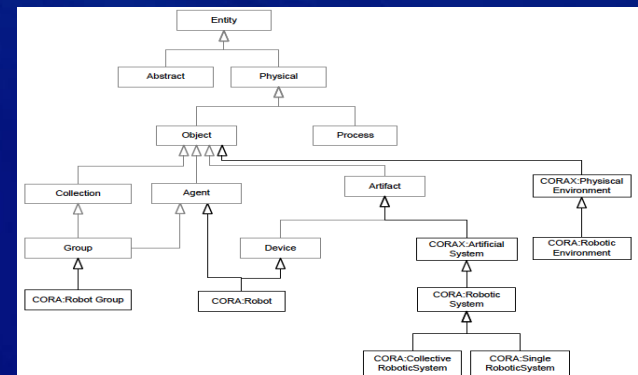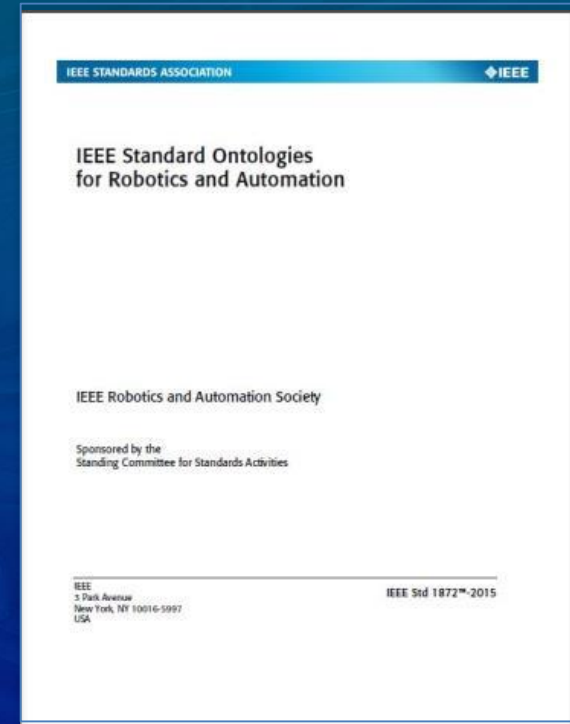
Agile Robotics for Industrial Automation Competition (ARIAC)

- Goal: To verify the agility of industrial robot systems, with the goal of enabling industrial robots on the shop floors to be more productive, more autonomous, and to require less time from shop floor workers.

- Simulation-based competition to be held "in the cloud" in the January 2017 timeframe

- Generating lots of interest (two media interviews, 78 people/companies on our mailing list)
    - KUKA, Google, Siemens, ABB, Ford, DELMIA, Battelle, Raytheon

- "Kickoff meeting" to be held in conjunction with the IEEE Conference on Automation Science and Engineering (CASE)
    - August 21-24, 2016 in San Antonio Texas
    - Presentations by Siemens, ABB, DELMIA, SWRI, OSRF, and GTRI (so far)

- Benchmark control system may use our ORA ontology

- Potential co-sponsors:
    - Siemens, ABB, DELMIA