Abstract:
- API of primitive operations to bridge MATLAB environment to ROCI systems.
- These operations are the basic building blocks in higher-level applications over ROCI systems.

ROCI:
- Remote Object Control Interface.
- An architecture developed in the GRASP Laboratory at the University of Pennsylvania.
- Enables the manipulation of a network of distributed sensory nodes, each running the ROCI kernel.
- Network can be established over Ethernet or wireless LAN.
- Defines a framework for developing reusable, self-describing modules in Microsoft .NET.

Motivations:
- A framework did not exist to interact with ROCI through the MATLAB environment.
- MATLAB language is simple in that developers can quickly code and deploy applications.
- MATLAB is a familiar tool already commonly used within research projects.
- MATLAB has several built-in features and add-on toolboxes for data processing.
- Enhance productivity of interactions with ROCI systems and the data that they produce.

Approach:
- Object-Oriented:
  - Object Composition Tree
    - NODE
      - List of Peers:
      - TASK
        - List of Available Tasks:
        - TASK_DESCRIPTOR
        - List of Running Tasks:
        - TASK
          - List of Modules:
            - MODULE
              - List of Pins:
              - PIN
                - PIN_DATA
                - CONTROL_PARAMETERS
  - Implemented as MATLAB class data types.
  - Each object encapsulates information from one or more XML documents published by the ROCI kernel.
  - Most objects only store information to locate the documents, e.g. a base URL.
  - Objects are constructed on as-needed basis.
    - Avoids transferring XML data that are not of interest to the user.
    - Minimizes delay time experienced in transferring XML data over low-bandwidth networks.

Querying/Modifying ROCI
- Steps:
  - Get NODE object whose state is of interest.
  - Traverse down component tree until relevant object is found.
  - Invoke appropriate member function.
- E.g. query-ROCI functions:
  - NODE.getRunningTasks, MODULE.getPins, PIN.readData
- E.g. modify-ROCI functions:
  - NODE.injectTask, TASK.suspend, TASK.kill, PIN.sendData
- Manipulating an entire ROCI network is achieved by iterating over a list of NODE objects, e.g. NODE.getPeers. Iteration is simplified by MATLAB's language support of operators for array data types.

Communication Mechanism:
- ROCI kernel supports handling HTTP requests on port 2010.
- Supports GET and POST requests.
- Serves XML documents that describe the state of the ROCI node, e.g. running tasks, list of pins, data acquired by sensors.
- Each document can be located through a URL that follows a pattern specific to the type of data content. For example:
  - Pattern to locate a pin in a module of a task:
    http://[node-address]:2010/[task]/[module]/[pin]
- Example XML document from ROCI: