

# Developing OpenADR Products

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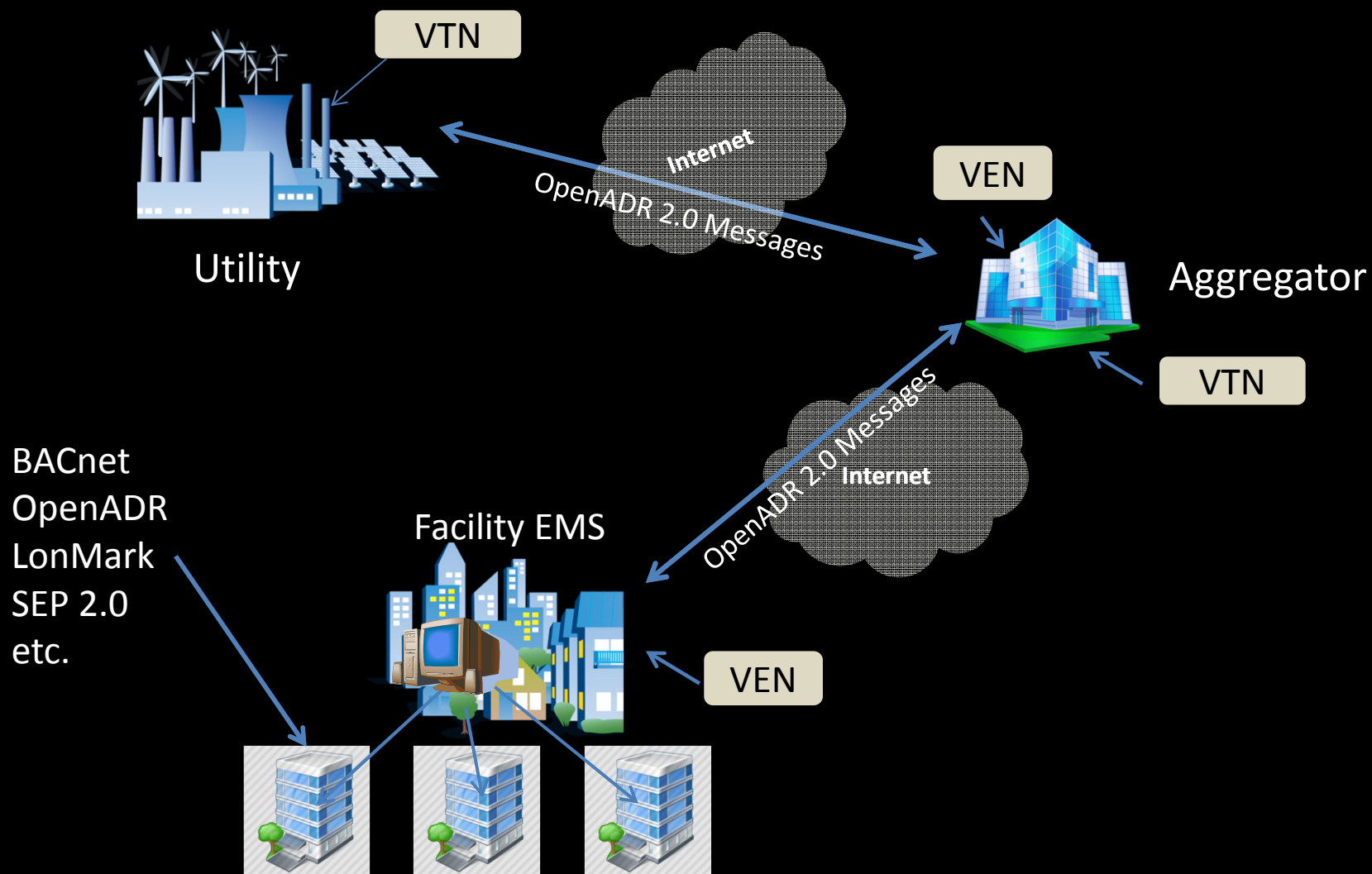
# Topics

- OpenADR Fundamentals
- Developing OpenADR Products
  - Requirements Docs
  - Required Feature Support
  - Certification
  - Development and Testing Resources

# OpenADR Fundamentals

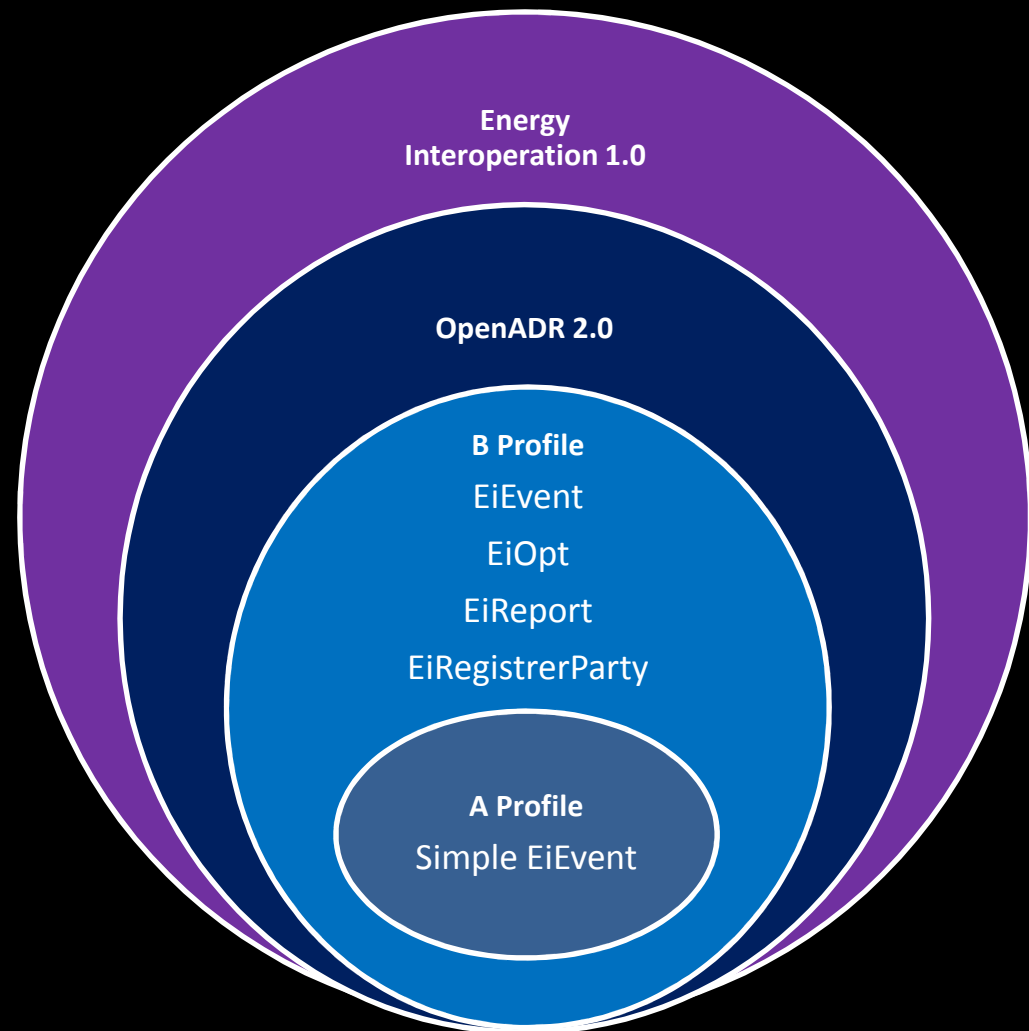
- Demand Response message exchange protocol
- Messages contain the when, who, and how much of a DR Event
- Two actors...
  - VTNs (utilities/aggregators) send events
  - VENs receive events, act upon them, and provide telemetry data

# OpenADR Fundamentals



# OpenADR Fundamentals

- “A” profile is targeted at limited resource devices and simple DR applications
- “B” profile is targeted at robust devices and sophisticated DR applications



# Services Usage Scenario



**VTN**  
(ISO or Utility)



**VEN**  
(C&I, SMB)



# OpenADR Requirements

- OpenADR requirements are defined in the OpenADR Schema and Profile Specification
- The Schema describes the payload structure
- The Profile Specification defines sequence of payload exchanges and the business rules
- "A" and "B" profiles have separate specifications and schemas

# Profile Specification

- Conformance rules in the Profile Specification define behavior rules such as...

47	An event with an overall duration of 0 indicates an event with no defined end time and will remain active until explicitly cancelled.
65	When an event containing a randomization value in the startafter element is cancelled, either explicitly or implicitly, the VEN MUST randomize its termination of the event. The randomization window should be between 0 and a duration equal to the value specified in startafter.



# Features

- Services
  - Event, Report, Opt, Registration
- Transports
  - HTTP, XMPP
- Security
  - RSA, ECC, X.509 Certs, XML Signatures
- Exchange Model
  - Push and Pull

# A and B Profiles

- Interoperability
  - VTNs must support all features and functions
  - VENs have some limited optionality
- Backwards Compatibility
  - VTNs must concurrently communicate with both "A" and "B" profile VENs
  - VTNs must upgrade to latest profile version to maintain certification

# Optional Feature Support



		B VTN	B VEN	B VEN Report	A VEN
Services	EiEvent - Simple	M	M	NA	M
	EiEvent – Full	M	M	NA	NA
	EiOpt	M	M	NA	NA
	EiRegistraton	M	M	M	NA
	EiReport	M	M	M	NA
Security	RSA and ECC Ciphers	M	One(1)	One(1)	One(1)
	XML Signatures	O	O	O	NA
Transport	SimpleHTTP Only	NA	NA	NA	M
	XMPP and SimpleHTTP	M	One(1)	One(1)	NA
Exchange Model	Pull - SimpleHTTP	M	M	M	M
	Push - SimpleHTTP	M	O	O	O
Profile	B support for A profile	M	NA	NA	NA

(1) Must support at least one , but can support both.

O=Optional M=Mandatory

# PICS and Test Specification



- PICS
  - Listing of all testable requirements
  - Manufacturer declares conformance prior to certification
- Test Specification
  - A set of tests that validates all of the testable requirements defined in the PICS
  - Positive tests including limited boundary testing
  - Negative tests focused on graceful error handling
  - Security and Transport Tests

# Typical VEN Test Case

**E0\_0040 –Send 24\_Prices Event, VEN Push oadrDistributeEvent**

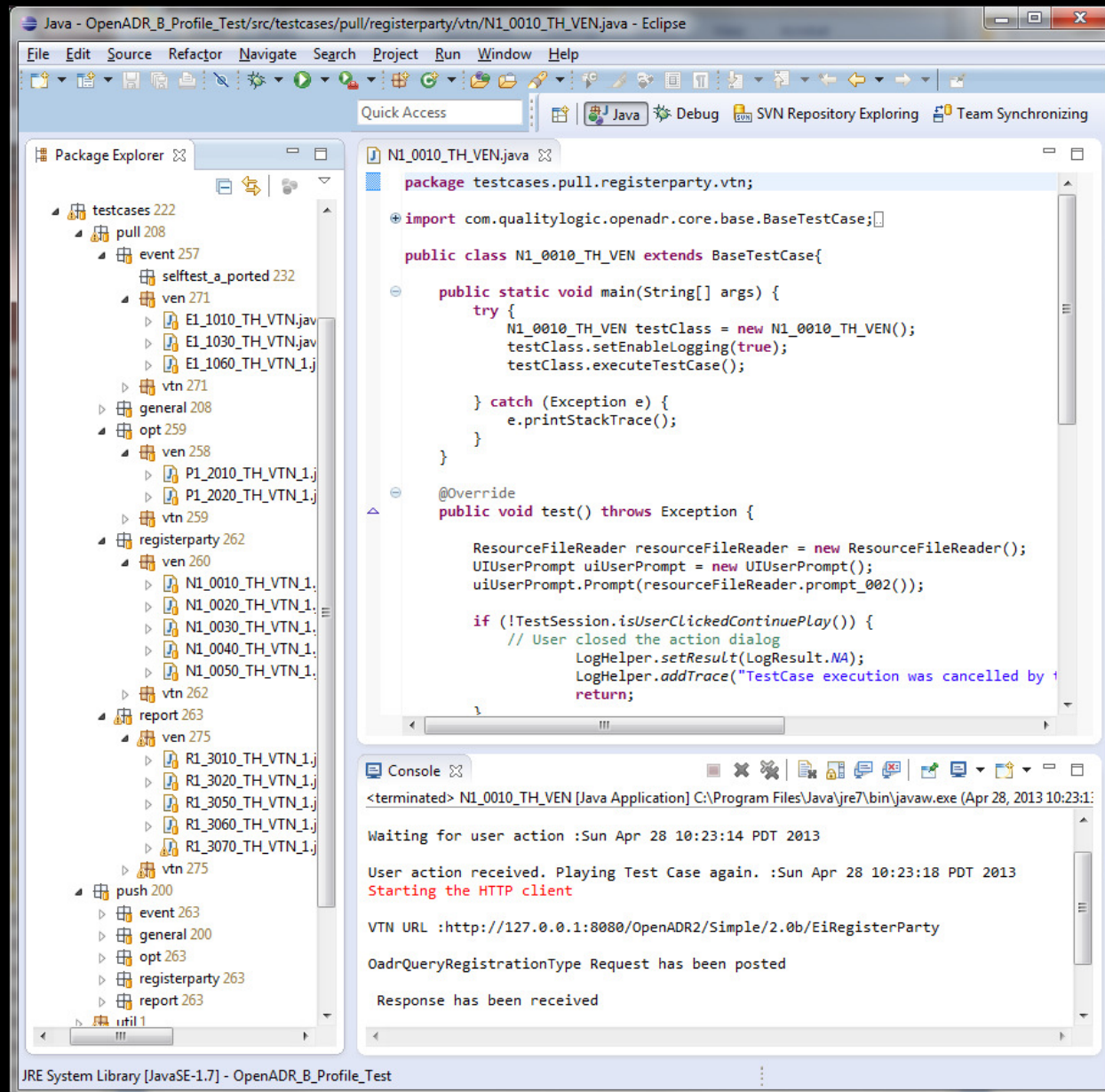
**E1\_0040 –Send 24\_Prices Event, VEN Pull oadrDistributeEvent**

Prerequisites	- DUT_VEN has no pending or active events
Scenario	{DUT_VEN: <u>oadrRequestEvent</u> } TH_VTN: <u>oadrDistributeEvent</u> – 24 Prices Event, “always” {DUT_VEN: Transport Acknowledgement} DUT_VEN: <u>oadrCreatedEvent</u> TH_VTN: <u>oadrResponse</u> , success  <b>Note: set the <u>responseRequired</u> element in the <u>oadrDistributeEvent</u> to “always” for this test case. Set <u>signalType</u> to “prices”</b>
Expected Results	1)Common Pass/Fail verdicts 2)Received <u>oadrCreatedEvent</u> with <u>optType</u> equal to <u>optIn</u>
Notes	-A basic 24 hour pricing event transaction

# Test Harness

- Implementation of the test cases defined in the Test Specification
- Used for certification and available Pre-certification test tool
- Each test case validates...
  - Payloads validate against the OpenADR Schema
  - Correct message interaction pattern
  - OpenADR Conformance rules are followed
  - The intent of the test case is achieved

# Test Harness



The screenshot displays the Eclipse IDE interface for a Java project named "OpenADR\_B\_Profile\_Test". The Package Explorer on the left shows a hierarchical structure of test cases, including "pull", "event", "selftest\_a\_ported", "ven", "vtn", "general", "opt", "registerparty", "report", and "util". The main editor window shows the source code for "N1\_0010\_TH\_VEN.java", which is a Java class extending "BaseTestCase". The code includes a static main method for running the test and an overridden test method that interacts with a test session and logs results. The Console window at the bottom shows the execution output, including the start of the HTTP client, the VTN URL, the request being posted, and the response being received.

```
package testcases.pull.registerparty.vtn;

import com.qualitylogic.openadr.core.base.BaseTestCase;

public class N1_0010_TH_VEN extends BaseTestCase{

    public static void main(String[] args) {
        try {
            N1_0010_TH_VEN testClass = new N1_0010_TH_VEN();
            testClass.setEnableLogging(true);
            testClass.executeTestCase();
        } catch (Exception e) {
            e.printStackTrace();
        }
    }

    @Override
    public void test() throws Exception {

        ResourceFileReader resourceFileReader = new ResourceFileReader();
        UIUserPrompt uiUserPrompt = new UIUserPrompt();
        uiUserPrompt.Prompt(resourceFileReader.prompt_002());

        if (!TestSession.isUserClickedContinuePlay()) {
            // User closed the action dialog
            LogHelper.setResult(LogResult.NA);
            LogHelper.addTrace("TestCase execution was cancelled by user");
            return;
        }
    }
}
```

Console Output:

```
<terminated> N1_0010_TH_VEN [Java Application] C:\Program Files\Java\jre7\bin\javaw.exe (Apr 28, 2013 10:23:14 PDT)

Waiting for user action :Sun Apr 28 10:23:14 PDT 2013

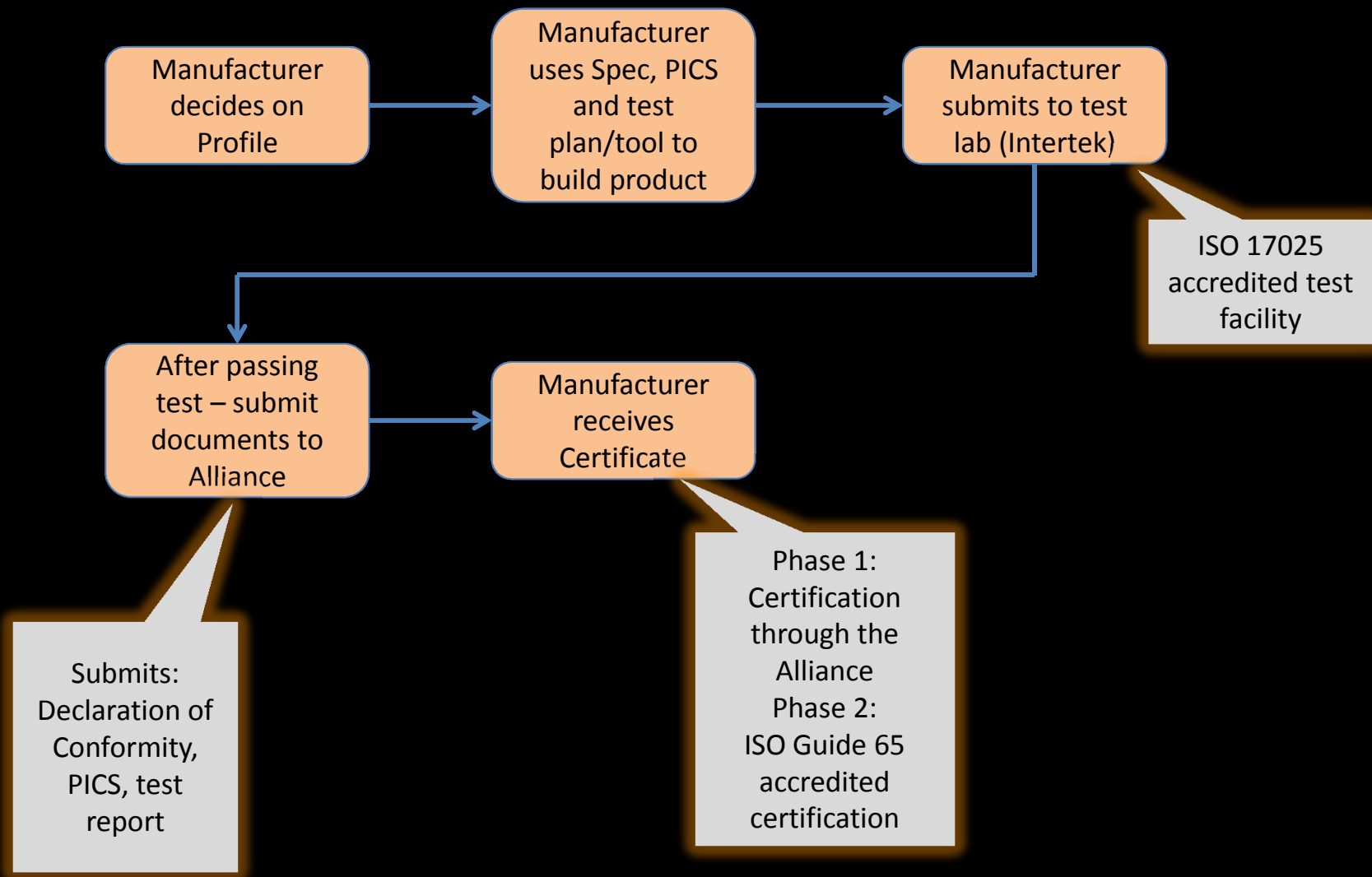
User action received. Playing Test Case again. :Sun Apr 28 10:23:18 PDT 2013
Starting the HTTP client

VTN URL :http://127.0.0.1:8080/OpenADR2/Simple/2.0b/EiRegisterParty

OadrQueryRegistrationType Request has been posted

Response has been received
```

# Certification Process





# Other Resources

- [www.openadr.org](http://www.openadr.org)
  - Schema and profiles specifications (public)
  - Certification documentation package
  - Join working groups, email reflectors
  - Implementation guides (reporting, certs)
  - DR Program Guide
  - Pre-Certification Test Harness

# Other Resources

- [www.sourceforge.com](http://www.sourceforge.com)
  - EPRI VTN
  - EPRI VEN
  - EPRI VEN C++ Library
- [www.github.com](http://www.github.com)
  - EnerNOC "A" Profile VEN and VTN (only useful for XMPP implementation details)

# Other Resources

- [www.qualitylogic.com](http://www.qualitylogic.com)
  - OpenADR Developer Workshop
  - OpenADR Developer Support
  - OpenADR VTN in the Cloud
  - Pre-Certification Test Harness
- [www.universal-devices.com](http://www.universal-devices.com)
  - Off the shelf certified VEN

# Questions?