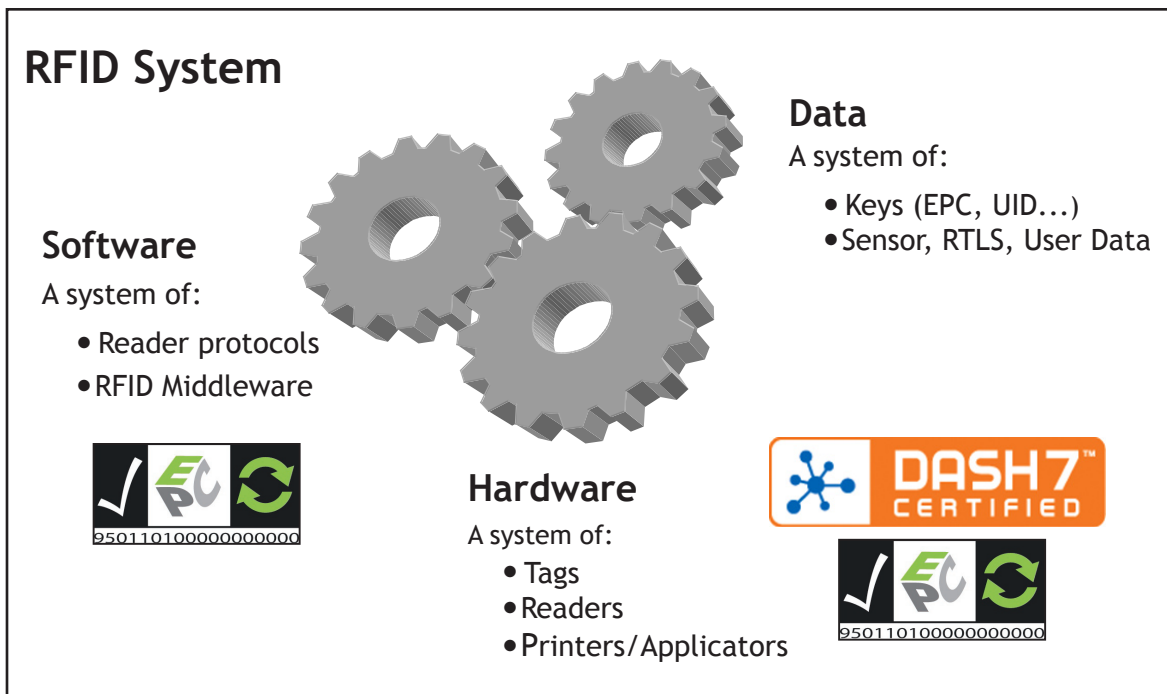


## What is RFID Interoperability?

The common definition of Interoperability is that of “the functional testing of a product against another product according to a set of test specifications”. Unfortunately, this definition does not meet RFID requirements. The primary reason for it is that RFID implementations consist of a system of hardware, data and software. RFID tags communicate with readers and exchange data using air interface protocols. Software facilitates communications between readers, RFID middleware, and enterprise applications such as ERPs and WMS.

Any component of the RFID system may cause interoperability issues that could affect implementation. An interoperable RFID system typically consists of three components:

1. RFID Hardware consisting of a system of tags, readers, printers/applicators.
2. Software consisting of reader management software and RFID Middleware. RFID Middleware consists of applications that collect and filter event data, add business context to it, and interface with enterprise applications such as ERP or WMS.
3. Data which is stored on tags or collected from tags with additional business context data. The data will always include an identification of a tagged item using keys such as EPC, UID or others. Additional data processed may include RTLS, sensor, and user data.



As the above figure shows, the certification is available for RFID hardware and software. That’s important but not sufficient. Incorrectly encoded EPC or UID mean that a tagged product will not be visible to enterprise applications. It can be filtered out at a read time or will have to go thru a manual identification process. DASH7 already recognized the importance of it during the recent PlugFest by making sure that data (EPC, sensor and GPS) is encoded correctly.

EPCglobal plans to introduce data certification based on its Tag Data Standard specification which will help the GS1 Visibility initiative to succeed.

***To ensure system-wide interoperability, it is imperative that buyers purchase certified components of the system.***

## Economic Impact of Interoperability:

NIST has conducted several studies on the cost of interoperability.

Their estimates for some industries are listed below: The amounts are staggering.



Industry	Cost of Interoperability
US Construction Industry	\$15.8 billion or at least 2% of total investment
US Automotive Supply Chain	\$1+ billion
Electric Power Industry	\$1 billion (source: GridWise Architecture Council)

*The lack of interoperability can also impact the lives of patients, soldiers, and firefighters (the NYC Firefighters did not receive WTC evacuation notice because of non-interoperable radio equipment. NYPD did receive the notice).*

***Even though RFID was not subject to a study it is industry's obligation to implement programs that will minimize interoperability issues and costs.***

## RFID Interoperability Issues

**The testing conducted with both passive and active RFID devices, has discovered many issues with the devices and the standards. The most important fact is that both DASH7 and EPCglobal offer a process to correct them.**

### EPCglobal Findings

There are several known interoperability issues experienced with UHG Gen 2 products.

The common ones involve passing Dense Reader Mode tests or reading tag timing issues. for conformance and Select-Query-EPC Test Script (Interoperability).

According to the statistics provided to EPCglobal by MET Labs, over 44% of hardware products fail on the very first test. Most of these products are then fixed, retested and certified. However, some do not come back, including tag-ICs vendors. It takes months and millions of dollars to fix a microchip. In such a case the tag-IC vendor works with a group of partners (reader manufacturers) to develop workarounds. As not all reader vendors are aware of it, the unexpected interoperability issues are experienced at the worst time, that is during implementation. Usually end-users have to foot the bill.

In other scenarios, MET Labs found that new versions or releases of RFID device often break conformance or interoperability.

Therefore, it is a good practice to check the EPCglobal web site to find if a specific model of a device is certified.

With software certification, 98% of vendors fail on the first try. However, as it is easier to fix software, all vendors re-test and get certification.

***Therefore, if a hardware device or software application is not listed on EPCglobal website ([www.epcglobalinc.org/certification](http://www.epcglobalinc.org/certification)), it is prudent to assume that they will not interoperate.***

-continued

## DASH7 Findings

During the DASH7 PlugFest held in April 2010, several issues were found with over 20 devices tested for conformance and interoperability.

Some of the issues discovered were related to ISO 18047-7 Conformance Test Methods not being clear nor correct.

Some readers assumed a bigger role handling exception processing by catching invalid request to tags that resulted in extending the battery life of a tag which is a good idea, if all readers would do it. Otherwise, this inconsistent behavior may cause the RFID capture application that is directing a reader to read or to write to tags to fail.

The rigorous testing of tags revealed that some of them experience memory fragmentation when subjected to a heavy load of write commands. The reader applications need to be aware of these limitations.

The PlugFest also tested whether tags and readers can exchange EPC keys, sensor and GPS data. These tests were run successfully for all readers and tags with memory.

The vendors that participated in the PlugFest agreed to a resolution of all issues encountered and resolved them. The DASH7 Testing and Certification WG approved the resolutions. Issues related to specifications will be submitted to ISO as change requests.

The list of participating devices can be found on <http://dash7.org/> in "Certified Products" tab.

***It is safe to assume that devices that did not participate in the PlugFest will encounter conformance or interoperability issues.***

## DASH7 Interoperability

DASH7 Alliance was created to promote an adoption of active tag technology based on ISO 18000-7 standards in commercial environments. DASH7 technology is the de-facto standard in the militaries of many nations.



Many RFID deployments (especially in the transportation and logistics) use active and passive tags. As an example, an ocean container may use active tags (433MHz). Pallets and cases inside may use EPCglobal Gen2 passive tags (860-920 MHz range). The active tag could store ID's of all pallets inside, in addition to other data. This common scenario reflects that devices will have to implement several standards (from different standards organizations). In the above scenario, an active tag will implement several standards:

- ISO 18000-7, ISO 18047-7 and DASH7 extensions
- EPCglobal Tag Data Standards 1.5
- Sensor data based on IEEE 1451.7 (ISO 21451.7)
- GPS data based on NMEA 0183

***DASH7 is committed to work with standards organizations such as EPCglobal or ISO to ensure interoperability of the system.***

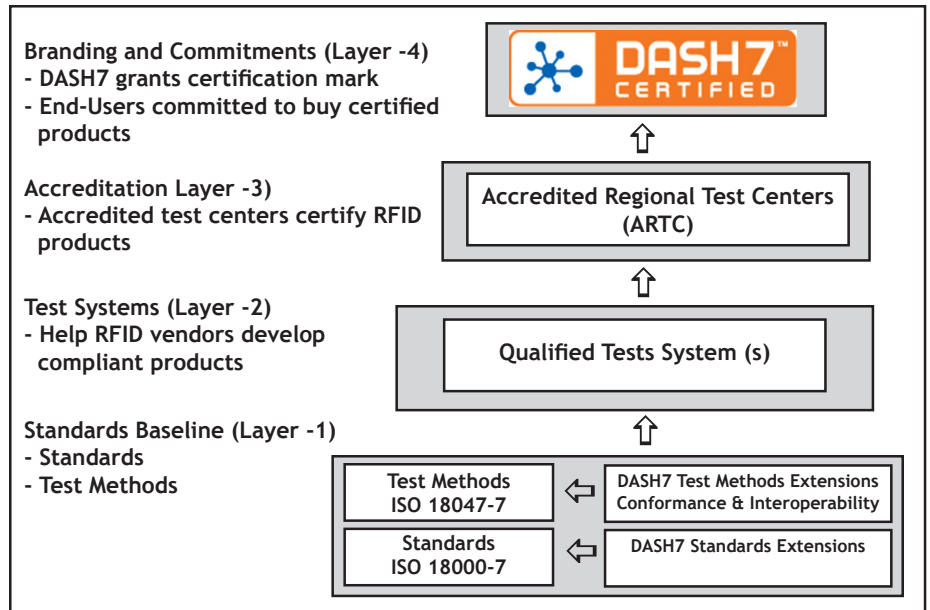
# Certification Program Architecture

A common approach to manage complex systems is to develop an architecture that will identify major components, their interfaces, and layers. OSI system architecture consisting of 7 layers is a good example of it.

DASH7 Interoperability approach has followed this proven approach and the Certification Architecture has been developed to manage it.

The architecture together with certification policy and process will make the DASH7 the best certification program in the industry. The architecture consists of 4 layers.

**Each layer is necessary and plays a major role as defined below.**



## Standards Baseline (Layer-1)

The components of this layer are developed by the DASH7 Testing and Certification workgroup in collaboration with the Technical workgroup.

The outputs of this layer are the DASH7 test protocols consisting of separate Conformance and Interoperability Specifications.

The DASH Conformance Specification is based on ISO 18047-7 Conformance test methods and may be extended by additional requirements. The extensions will be submitted to ISO for inclusions into the conformance test methods.

DASH7 developed Interoperability test methods based on the submission from the US DoD.

These test methods will also be submitted to ISO. At present, DASH7 specifications are available only for hardware testing. Software specifications for handling reader management or RFID middleware will be included. They may be adopted from other standards organizations such as EPCglobal or ISO.

## Accreditation (Layer-3)

The Accredited Regional Test Centers (ARTCs) are accredited to ISO 17025 quality standard. The ARTC program is managed by MET Labs. The test centers must be members of DASH7 Alliance, follow the certification program policy and use Qualified Test System. The test centers will promote DASH7 technology by offering complementary services such as pre-testing, training, consulting and other services.

## Qualified Test Systems (Layer-2)

A qualified test system implements both conformance and interoperability test methods. The qualification or validation is achieved based on defined qualification criteria.

This approach has many benefits. The most important one is that a qualified test system will produce consistent and repeatable results. It also obviates a need to have PlugFest or to use "golden" tags or readers.

DASH7 certification is not limited to any one vendor. Multiple test systems from different manufacturers are planned to be qualified. Qualified test systems will be available to test centers and RFID vendors.

## Branding and Commitments (Layer-4)

This is a very important part of DASH7 program where tested products will be awarded a certification mark. Specific rules on how to use it, where to place it are available. The "DASH7 Certified™" mark will convey trust in the device and the certification program.

Members of the alliance are committed to purchase certified products as a way to ensure interoperability which will drive demand for certification of devices.

## Benefits of the Program

The DASH7 Certification program offers many benefits. The most important ones are:

### Clear message to end-users

The “DASH7 Certified™” mark means that a product has been built in compliance with ISO specifications and DASH7 specifications, and is interoperable.

### Quality of the program

The quality will be achieved by focusing on the quality of its components:

- a. Program policies and procedures, including issue resolution process
- b. Test specifications
- c. Qualified test systems
- d. Accredited Regional Test Centers (ARTCs) audited yearly

### Global outreach

A vendor from China can purchase a qualified test system from National Instruments and use it for pre-testing or to verify that an early prototype is compliant to DASH7. When ready for certification, a vendor can select any test center for certification including the one that is closest to minimize travel costs.

The ARTCs will also offer pre-testing for vendors that do not have their own test equipment. A test center will also be involved in promoting DASH7 technology in the local markets by conducting training, seminars, conferences and other activities.

The Certification Program incorporates the best practices of other certification programs and lessons learned. The Certification Program has been developed and is overseen by the DASH7 Testing and Certification workgroup.

***Interoperability is the ultimate goal of the DASH7 Alliance.***



### Author:

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**He has started and managed EPCglobal Certification program. Currently he manages DASH7 Certification Program for the DASH7 Alliance**



MET Laboratories has provided technical and administrative support to the major movers within the RFID community bring technical standards into the real world.

MET Laboratories has been there from the beginning, providing testing platforms for products in the earliest phases of standards development, for providing certification and administrative services once standards evolved into consensually adopted standardized practices. Learn more about MET at [www.METLabs.com](http://www.METLabs.com)