



The Value-Added Intelligent Fixed RFID Reader

Introduction

A truly intelligent RFID reader that is able to work alone without a networked PC interacting with it, that is able to read tag and write tag according to certain business process specific logic that is also remotely configurable and reconfigurable, that is able to work based on a tag group with item specific additional information, that is able to do automatically and sequentially a bunch of commands in the fastest possible manner with minimum latency, that is able to work in an ultra fast and robust manner with no worry of network latency, that is able to work with minimum possible failure parts and maximum possible MTBF, that is able to start working properly on every reboot without externally re-initialization, is the dream of all RFID system integrators and end users.

Background

Traditionally, a fixed RFID reader relies on a program on the PC side to configure it, to control it, and to retrieve tag data from it. The program on the PC side will analyze the retrieved data, and then further control the reader to do other operations, such as a write operation, or to open a turnstile for a vehicle to pass through. This kind of PC-reader interaction has, over years of operation, been known to have 3 weaknesses:

- 1) The interaction between the reader and the PC is usually done within an Ethernet network, and the time latency in the network is not always predictable. This is particularly true when one PC is handling many readers. Since most business processes have time requirements, the system integrator has to do a lot of on-site tuning, testing and worst case analysis to ensure the system would not face sporadic network saturation and hence traffic jam problem. This is particularly problematic for applications where latency is not allowed or tolerated. High speed conveyor distribution transport, for example, is usually very time critical and this interaction delay becomes a show stopper.
- 2) The elements in this system consist of the reader, the Ethernet cables, the routers, and the PC, plus the 3 different power supplies to the hardware. As is well known, the more elements you have in your system, the more chances you have a system failure. Apparently, if any one of the above elements fails, then the system stops working. Although a wish by most system integrators to have a



completely new system, of those elements, usually only the reader is the new item – the other 3 elements are all existing old installations. Their chances of failure will inevitably grow as time goes on.

- 3) To overcome the problem of latency, many system integrators have to resort to installing one PC right beside each reader. Some system integrators have to set up dedicated Ethernet network, in fact may be more than one network to cover a large number of readers. All these extras cost money – and the overall system cost is massive.
- 4) Since the reader relies on external PC to control it, if the reader reboots, or in fact if any component in the system power down and up, the PC has to reconfigure or re-initialize the reader from whatever state it was stuck in before. This usually causes delays or lapses in operation, far beyond the actual power rail down time.
- 5) Because of the overall complexity of the reader-network-PC architecture, every RFID project is a serious investment and the end-user needs to maintain a rather long term maintenance relationship with the SI. All of these add to the reluctance of many end users in starting new sweeping projects in their companies, although there are so many well published results of success in the industry!!

In recent years, some companies started promoting the concept of intelligent reader and started offering such. This is a wonderful first step. However, these companies fell short of providing a real intelligent reader because they only provide an open platform inside the reader for customers to put programs in. The system integrator thus have to spend effort to write embedded system software which, on one side, has to talk to the internal reader, and on the other side, has to talk to a remote PC. Now this is HEAVY investment, and usually requires at least 15 months to mature, to say the least. The system integrator is VERY hesitant in this heavy investment because:

1. The SI never knows whether this reader will win in upcoming tenders.
2. The SI never knows whether that RFID reader company will continue to sell that reader or even exist in the next 15 months – before the embedded software is completed and tested bug free and mature.
3. Because of points 1. and 2., the risk of the investment is



calculated to be too high for companies to accept.

Because of that, the so called “intelligent reader” concept did not fly very well, and end users, with appetite wetted, are now waiting earnestly for an intelligent reader that can really work alone and handle complex events and do multiple combo functions in a configurable manner – without the need to write code inside the reader!

The Solution

The CS461 intelligent reader from Convergence Systems Limited is such a reader. The CS461 intelligent reader contains an upper layer and a foundation layer.

On the foundation layer, CS461 contains the best-in-class Impinj Speedway reader technology that is licensed from Impinj. This ensures the CS461 reader has the best air interface capability, including high speed dense reader environment read and write tag performance, a world famous attribute of the Speedway technology. Without a good performing foundation layer, adding intelligent capabilities to the reader is meaningless.

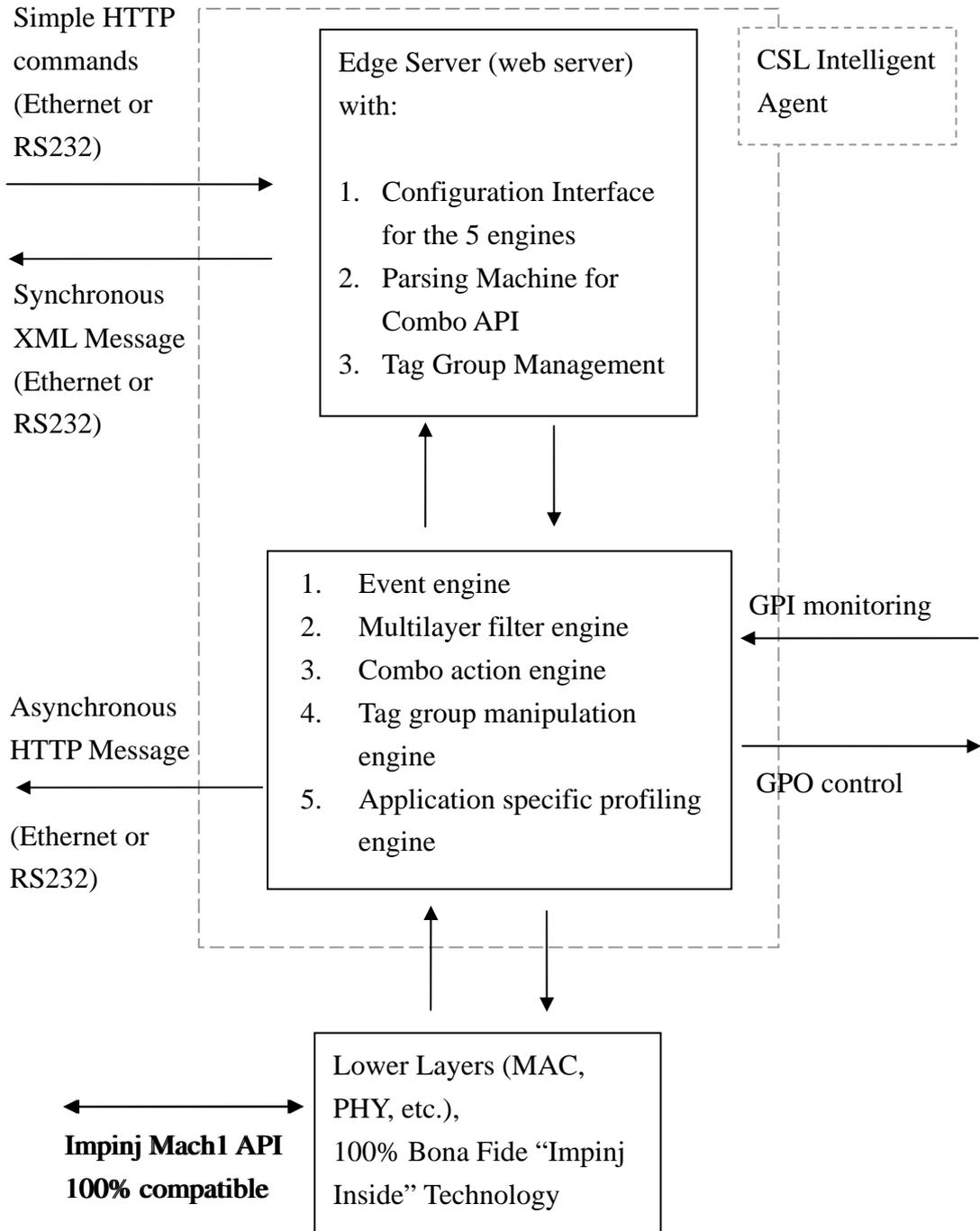
On the upper layer, the CSL CS461 reader contains an additional value-added embedded intelligent agent inside the reader that allows the reader to run autonomously. This intelligent agent consists of the following 5 engines:

1. Event engine
2. Multilayer filter engine
3. Combo action engine
4. Tag group manipulation engine
5. Application specific profiling engine

This intelligent configurable software is the culmination of 2 years of intensive development work with side by side deployment into many famous sites, including world famous aerospace companies, shipyards, global logistics operations, major factories, major government infrastructures and offices, to name a few. These successful deployments are gradually released out to the public and verify and validate the efficiency and flexibility of this reader. Moreover, this value-added embedded engine comes standard with every CS461 reader with no additional cost. With its extremely competitive price tag, the CS461 reader represents the reader with the highest price-performance ratio in the industry.



The CS461 reader software architecture is as follows (note that user can connect either by Ethernet or RS232):





interface is necessary in case one has 200 readers in a site and going to each reader's web interface to change a parameter is rather tedious. So an HTTP API interface allows one to write a central program and send out all these configuration commands to all readers sequentially in a short time. This is particularly useful for the MIS manager.

Here are some examples of the “trigger” and “resultant action” that you can select in CS461.

Example “triggers”:

1. Read Any Tags, 1 Trigger Per Tag
2. Input Sensor State
3. No Tag Read in Specified Time Span
4. No Tag Read in Inventory Enabling Cycle
5. Trigger in Tag Group
6. Capture Vehicle Tag
7. Trigger if RSSI Larger Than or Equal To
8. etc.

Example “resultant actions”

1. Batch Alert to Server
2. Instant Alert to Server
3. Output Port
4. Write Tag (Trigger in Tag Group)
5. Write Tag (Read Filtering)
6. Write Tag (Write Once from Tag Group)
7. etc.

2. Multilayer Filtering Engine

The CS461 Intelligent Reader comes with a high level filtering engine in addition to a low level one. The high level filtering engine can mix and match tags coming in from the 4 different antenna ports, doing filtering on some but not all, and so on. Again, this filtering can be configured either via the web interface or the HTTP API interface. Filtering can be done in many ways, including duplicate filtering and bit mask filtering. For example, the duplicate filtering allows one to adjust the duplicate filtering time, which may be very short or very long. The way the duplicate filtering is done is also selectable.



3. Combo API Engine

The CS461 Intelligent Reader allows special combo APIs that will actually execute multiple instructions autonomously by the reader. This requirement turns out to be a popular one from many business processes. The sequence of API calls is not simply time synchronized and time matched, but also requires some internal logic and optimization. These combo APIs have been developed over the years based on real business processes and they turn out to be generically useful for many applications.

4. Tag Group Manipulation Engine

Tag group management is very useful for many applications where inventory or security check operations are needed with respect to an “Allowed Group”, or “E-Manifest List”, or “Black-listed Group”, or any other groupings. The user can either make decisions based on whether the Tag ID they read are inside or outside the group, or may use the information within each tag group to further operate on the tags that enter into the reader’s illumination field.

5. Application Specific Profile Engine

Special application specific profiles have been developed over the years for specific business processes. For example, the **Vehicle Profile** allows the CS461 reader to capture high speed vehicles moving on the road or highway, either for tolling (identification) or for traffic management (e.g. Journey Time Information System) purposes. Another example is the **WIP Profile** (WIP stands for Work In Progress, as in production line of a factory). This profile allows one to read and write tags that are attached to production items at a very fast speed on the production line.

Summary

The CSL CS461 reader is a truly intelligent reader that enables system integrators fast deployment. In fact, there are business cases where the system integrator can simply use the web based configuration interface to set the reader up with an event engine, and have it deployed within 2 hours of shipment. This is unheard of in the RFID industry. Because CS461 has already been deployed in a great variety of applications, the CS461 intelligent agent has been verified to be flexible and powerful enough to handle them in a most efficient manner.

The CS461 reader development kit comes with extensive training materials and



videos that can get the programmer up and running in no time. Even for software engineers with no prior RFID background, the materials contain explanation of the physics behind RFID operations to make them understand enough to use the reader in productive deployed manner in very short time. The overall learning curve is extremely steep and will make most bosses happy.

CS461 reader has already obtained regulatory certification for most countries of the world, including:

1. FCC for USA
2. CE for Armenia, Austria, Belgium, Bosnia, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Macedonia, Malta, Moldova, Netherlands, Norway, Poland, Portugal, Romania, Russia, Serbia/Montenegro, Slovak, Slovenia, Spain, Sweden, Switzerland, Tunisia, Turkey, United Kingdom.
3. SRRC for China
4. NCC for Taiwan
5. Telec for Japan
6. MIC for Korea
7. ACMA for Australia

For other countries, many of them recognize one or more of the above certifications as their accepted certification.

CS461 is also EPC Certified with **EPC Number: 950110126000000902**

Find out more from: www.convergence.com.hk

The following is a photograph of the CS461 reader.

