

RFID

“The Next Phase in the Information Age”

QUESTNet2006 - 13 July Coolum

Gerry Wind
Technical Manager RFID
Telstra Extended Enterprise Solutions.

Page 1

History of RFID

- 1939 IFF transponders (forerunner to RFID) were used by the British and Allies during World War II to identify aircraft as Friend or Foe.
- 1945 Leon Theremin - invented a covert passive listening device for the Soviet Government, not an identification tag, it is attributed as the first known predecessor to RFID technology
- 1970's – 1980's Toll passes,
- 1990's Integrated Circuit,
- 2000's Auto-ID Center and the EPC,



RFID

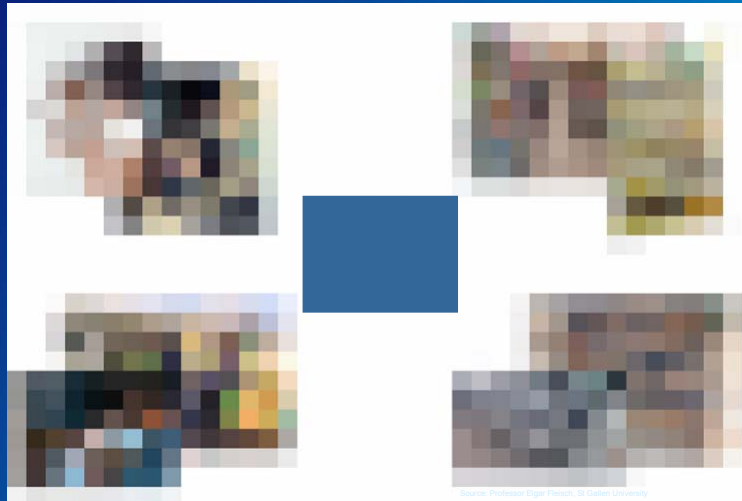
Enables

Computers to “SEE”

The perfect interface
between
systems and data entry

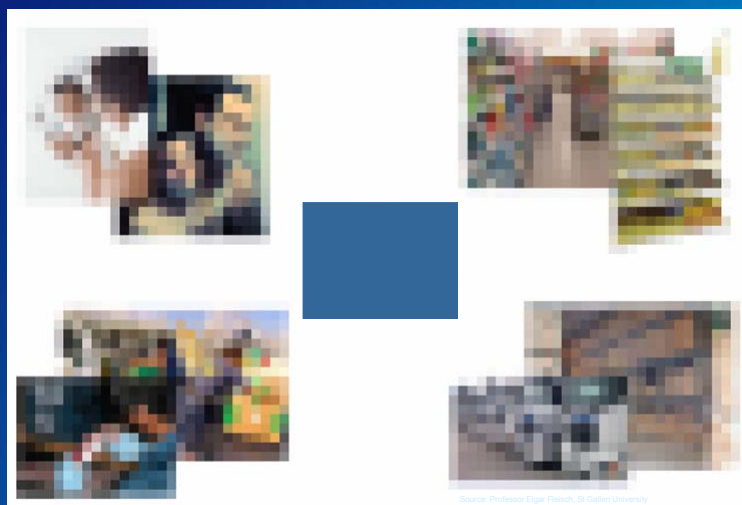
Error Free - No Human Intervention

Today's computers have no eyes and ears - blurred mapping of the physical world



Source: Professor Elgar Fleisch, St Gallen University

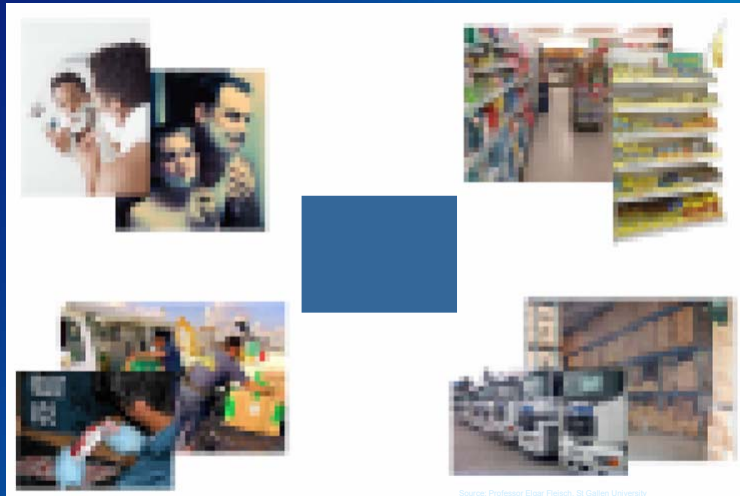
Better measuring tools change the way we can manage



Source: Professor Elgar Fleisch, St Gallen University

Source: Professor Elgar Fleisch, St Gallen University

New technology improves the focus further



Source: Professor Elgar Fleisch, St Gallen University

Source: Professor Elgar Fleisch, St Gallen University

... machine sensing advances the way we do business.



Source: Professor Elgar Fleisch, St Gallen University

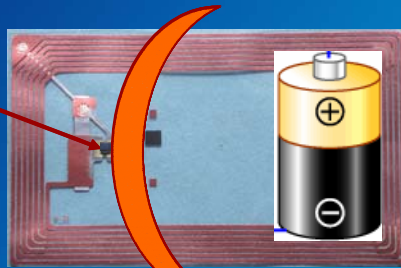
By creating a transparent Supply Chain.

Source: Professor Elgar Fleisch, St Gallen University

So How does it Work?

RFID is **enabling** technology, it's not magic
“can do anything”

1. It is a Microchip (silicon)
2. Attached to an antennae
3. which will respond when it receives power from a transmitter.



RFID Tag

98765432

It's uniqueness is that the Microchip and the transmitter/receiver do not have to see each other to communicate automatically

Types of Tags

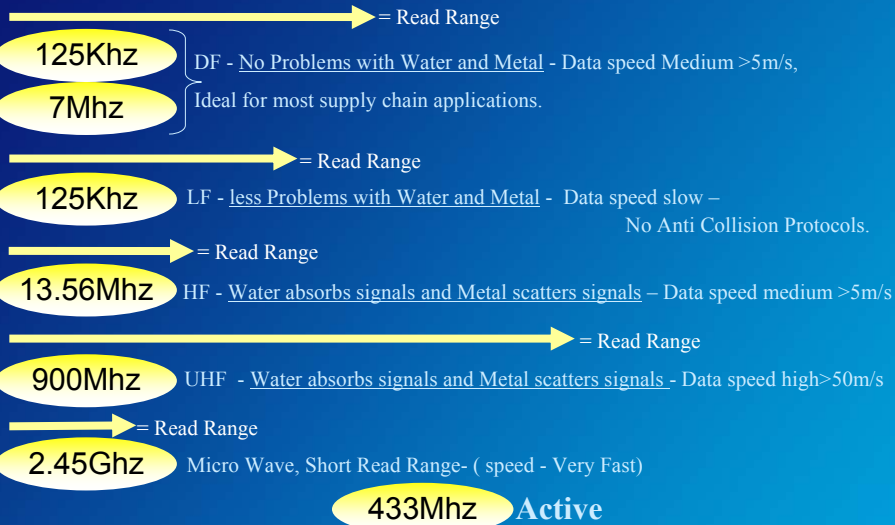
- Active (most costly)
 - With Battery (has own power)
 - Eg. E-Toll Tags & Car Clickers
- Semi Active (Cheap for its functionality)
 - Power Paper
 - Printed Battery (intermittent sleep/wake periods)
 - Cost is Relatively Low
 - Eg. Temperature sensor in shipping containers.
- Passive (Cheapest of microchip tags)
 - No Battery (Obtains power from reader)
 - Low Cost, Mass Applications
 - Ideal for Supply Chain Solutions



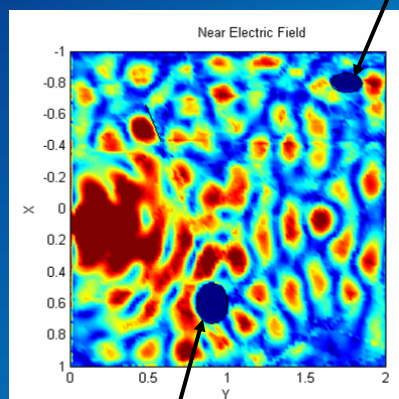
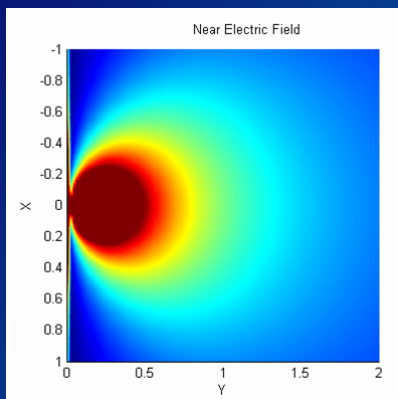
Nail TAG

What Frequency's to use and why?

Tag choice



UHF reader antennas – Fields



- Smooth reader fields in free space
- Reflections from walls cause unpredictable reader fields
- FSS and absorbers can be used to improve field uniformity

RFID Standards



Ultra High Frequency / 850Mhz to 956Mhz

- ISO 18000- Part6 : Radio Frequency Identification for Item Management
- **EPC - Electronic Product code – before ISO committee now.**
 - UHF
 - HF

High Frequency / 13.56MHz

- ISO 14443 : Proximity coupling smartcards (type A or B Mifare)
- ISO 15693 : Vicinity coupling smart cards
- ISO 18000- Part3 : Radio Frequency Identification for Item Management

Low Frequency / 125kHz, 134.2kHz

- ISO 11784/785 : Radio Frequency Identification of Animals
- ISO 14223 : Radio Frequency Identification of Animals, Advanced Transponders
- ISO 18000- Part2 : Radio Frequency identification for Item Management

DF - Dual Frequency - before ISO committee now

“Horses for Courses”

Facts



- “CPG shrinkage is \$60billion yearly of \$3 trillion turnover” (*ECR Europe*).
- “75% of the cost of a retail product is getting it there” (*MIT*)
- “Up to 20% of foods are discarded due to spoilage through the supply chain.” (*Food and Drug Administration*)
- Stock-outs at retailers cost six percent of sales. On third of these are items in the retailer’s store. (*Proctor and Gamble*)
- Medication non-compliance costs the US alone approximately \$100 billion and 125,000 deaths yearly” (*US National Pharmaceutical Council*)
- Counterfeits: perfume 15%; Aircraft and Automotive parts 10%; Pharmaceuticals 10% (in third-world 30%); thousands of deaths every year. (*Industry estimates*)

Facts



- Examples of savings at Marks & Spencers UK Retailer.

- 25 trays per dolly
- 36 dollies per vehicle

Barcode Scanning = $36 \times 29 = 1044\text{secs} = (17.4 \text{ mins})$

Portal “scan” = $36 \times 5 = 180\text{secs} = (3 \text{ mins})$

Reduction in data recording time = 83%

(LITI Japan 75% for tagged apparel) source M & S , Intellident

Facts



- 7 out of every 50 keystrokes are wrong
- A distribution centre reduced the receiving process by average of 27 minutes per order and achieved ROI in six months through the use of RFID technology.
- By using RFID tags on cases and containers (AMR research)
 - average labour savings are 1% to 5%
 - Cut working capital between 2% and 8%
 - CPG's can cut shrinkage by an estimated 10%
- Only 40% of work in the average warehouse is genuinely productive (Manhattan Assoc.)

RFID with US DoD



- With current deployment on pallets & containers DoD expect to conservatively break even within 3 yrs. 7yrs if all pallets and containers were tagged, not counting side benefits.
- Side benefits include:-
 - 3% improvement in accuracy reducing in miss-routings
 - 39% of time normally taken to process containers.
- In a “short” period the system identified 335 shipments worth \$12.6mill in automating receipt and confirmation. These items would have been reordered and the money lost.
- Results from Iraq,
 - Inventory reduced from \$127m to \$70m
 - Wait time reduced from 28 days to 16 days
 - Fulfilment deliver rate increased from 77% to 89%
 - Reduced retail backlog from 92,000 orders to 11,000
- DoD only wants to use UHF
- DoD wants suppliers to build cost of RFID into their contracts

Wal*Mart



Oct. 14, 2005 University of Arkansas found in a 29 week study, that Wal-Mart reduced out-of-stocks by 16 percent through use of RFID. 4,000 SKU's at 12 pilot stores compared with 12 stores without RFID

May. 3, 2006 University of Arkansas updated its findings to 30% reduction of out-of-stock items, on items that sold between 0.1 and 15 units per day.

May 17, 2006 Kerry Pauling CIO Wal*Mart, says that items which sold between 6 and 15 per day, Out Of Stock has reduced by 63%

Improvements were measured by

- cases arrived at the store
- how many are put on shelves,
- Compare that with point-of-sale data

Automatically created pick lists resulted in

- A 10% reduction of manual orders
- RFID tagged cases are replenished three times more often
- Reduced in-store inventory by reducing orders placed for more cases when cases were already somewhere in the back room.

April 18, 2006- Wal*Mart orders 15,000 readers from Impinj and Alien

Albertsons orders 5,000 readers from Symbol

Wal*Mart have “enabled”

- 5 Distribution Centres
- 475 Stores 36 Sam's Club outlets
- 300 top Suppliers are now involved
- They receive 3 million tagged cases each week.
- Key findings –
 - They have not needed to overhaul their ERP and only implemented a small change to their ERP Software.
 - For products sold 6 to 10 times a day “out-of-stock” reduced by 48%
 - RFID enabled stores are 63% more effective in replenishment.
 - P&G Fusion Blades (all cases tagged) increased a massive 19% in sales. Mainly because shelves were not empty.
 - Case study – Hanna's Candle Coy delivered 90 pallets, which W*M stored incorrectly. System alerted W*M staff that these candles had been sent but not delivered. Hence tracked down the pallets, which were sold. Had they not been found W*M would have assumed the product was not popular and their forecasting system would have reduced future orders from Hanna's Candle Coy. (Win – Win)

Wal*Mart progress in 2006

Wal*Mart see a major RFID pay-back as reduction of “out of stock” this has proven to be between 16% and 63% depending on the number of items sold per day.

- **Will focus on;-**
 - Ensuring the right product in in store at the right time, E.g. product launches to coincide with product media campaigns
 - Speed of product to shelf. RFID system will tell them if shelf for product is empty or low, thereby alerting staff to move product directly to shelf upon receipt, and not stored. 50% of daily sales occur between 4pm and 8pm, they want to ensure shelves are full.
 - New focus – W*M will use sensor-based tags to monitor quality of products for temperature or short lifetime products.

Wal*Mart key dates & performance



- By 31 Dec 06 – will have 1000 of their stores RFID enabled
- 1 Jan 07 next 300 suppliers will commence delivery of Pallets & Cases with RFID tags.
- Improvement of 65% faster read-rate of Gen2 over Gen1
- Better performance around Metal and Fluids.
- Tag prices have dropped 50% to 70% and readers by 40% in the last 12 months.
- Wal*Mart will only use UHF technology – even when they move to Item-level tagging.

Pricing trends of RFID tags & inlays



- September 13 - **Alien Technology** announces Gen1 squiggles at 12.9 cents for million-unit orders
- September 19 - **Avery Dennison** announces Gen2 inlays at 7.9 cents for million-unit orders
- September 22 - **RSI ID Technologies** announces fully converted Gen2 labels at 14.9 cents for million-unit orders
- September 28 - **AWID** announces \$1,000 Gen2 reader, complete with four antennas
- September 29 - **UPM Rafsec** announces sub 10-cent Gen2 inlays for million-unit orders
- October 7 - **SATO** has announced 14.9-cent, fully converted labels that use the Avery Dennison Gen2 inlays in quantities of 2000.
- March 29 - Avery Dennison RFID, will offer Gen 2 inlays at 8.9 cents. Assumed to be for quantities in excess of 1 million.
- May 2 - **SmartCode** offers 5-cent tag pricing for purchase quantities of 100 million or more

Technology advances



- Vue Technology have developed their 3rd generation smart shelf. They are the most advanced, in a very under-supplied market.
- Vue's first generation shelf was first trialled by Tesco on DVD's – sales increased by 4% - because they know when the shelf was empty.
- In other case studies sales improved by as much as 15%
- Costs have reduced from 1m to 100k to latest's at 20k.
- Only one cable per shelf to a single reader per unit. Capable of being connected to multiple shelves or numbers of stores. This will enable the systems to optimise stock between stores.
- The latest "smart-shelf is possible because Gen2 reads faster by 5 or 6 times.
- In pilots at Best Buy – inventory accuracy increased from 85% to 99%
- Why is it not used extensively – Tesco or Best Buy don't want to tag items themselves, manufacturing don't want the expense of doing it for just one or two customers, it should be all.

Technology advances



- Impinj demonstrated their new Near Field (NF) UHF tag at a recent conference. In this picture each little coloured ball contains a NF UHF tag being read through 3 to 4 centimetres of fluid. The reader is the black panel underneath.
- This same tag was dropped into a bottle of Gatorade and read through the fluid. No trick



Technology advances



- This container has over 200 items in it. Including foil blister packs, dry medicines, and syringes. All were read within one second, despite the many orientations.
- NF UHF tags were attached to the centre of DVD and were read through a stack of 14
- Also demonstrated was readability from 50Cm with the same tag in clothing labels.
- NF UHF tags will be 20% to 30% Cheaper – less material. Same chip as Gen2 smaller antenna.



Applications



Reading crates full of fish with a forklift



Applications



Installing a UHF reader in the rear of a Semi-Trailer

Reading pallets as Semi-trailer is unloaded



Applications



Testing Dual-Frequency on steel crates



Placement of tag on crate so it can be read by fork-lift reader



Reading multiple crates



Applications



Tracking carcasses in an abattoir by the hooks



Applications



Road-barrier sections can be tagged and tracked from a car passing by.

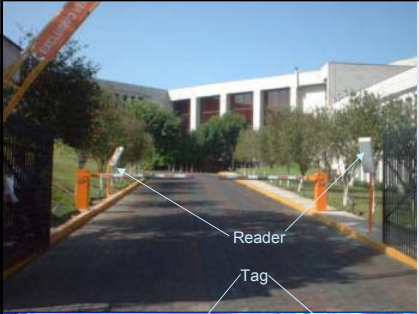


Typical tote to be tagged throughout the production process

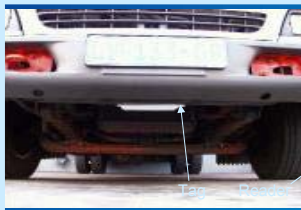


Passive RFID for Vehicle Tracking








High Speed vehicle tracking (270kph)







Typical Asset Tracking Solution Options





\$1500



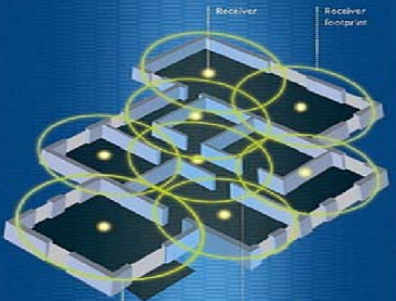
\$100



\$400



\$2



Reception footprints can be fixed in size from 0m to 20m diameter

Receivers are 'daisy chained' with one logging location to track asset movement between areas



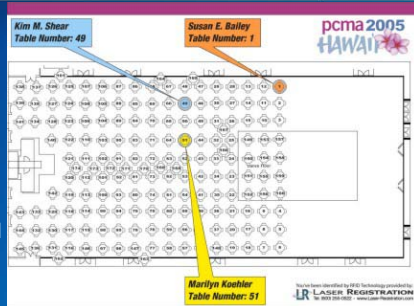
Passive RFID for Free Flow People Tracking

Conference Delegate Tracking



Greeting
on arrival

Banquet
seating
graphical
display



Internet &
Email Access



Continued
Education
Unit Credits



Reason for Floor Tagging



We didn't know where our finished goods were.

- We had at least one person per shift looking for the right goods to despatch.
 - Many forklifts placing goods in warehouse, the previous pallet location of a job was not known to the other drivers.
 - At shift change and whole new pattern would be started.
- 2000 pallet warehouse regularly had in excess of 2500 pallets
- Factory would have to stop production to clear the finished goods store.
- Loads needed to be staged on Loading dock (double handling, increased damage)
- 12 to 20 Trucks would wait for 5 to 9 hours, to be loaded
- Remake of "lost" pallet of cartons,
 - Below economic order quantity in remake
 - Loss of production
 - Waste of original product when "found"

What are the benefits



▪ Considerable savings

- Factory has not stopped due to inability to move finished goods out.
- Trucks wait for 20 to 40 minutes
- Warehouse seldom has more than 800 to 1000 pallets in it
- Reduction of Stocktake costs from 26 people for 9 hours every month to 6 people for 5 hours each quarter =< 97%
- Reduction of Despatch staff by 45% - remaining staff have considerable spare time.
- Loads do not need staging – direct from warehouse into truck.
- All forklifts can load one truck together.
- Delivery docket is printed for the driver by the time he arrives at the despatch office.





Thank
You