Developing RFID ICs and solutions in a complex environment.

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Agenda

- Basics and definitions
- R&D challenges & evolution
- Applications
- Conclusion

RFID

- Basics and definitions

RFID - some definitions

- Radio Frequency Identification ICs:
  - store and remotely retrieve data
  - can be read (written) over up to several meters
  - without direct visual contact
  - applied to, or incorporated into objects, animals or people

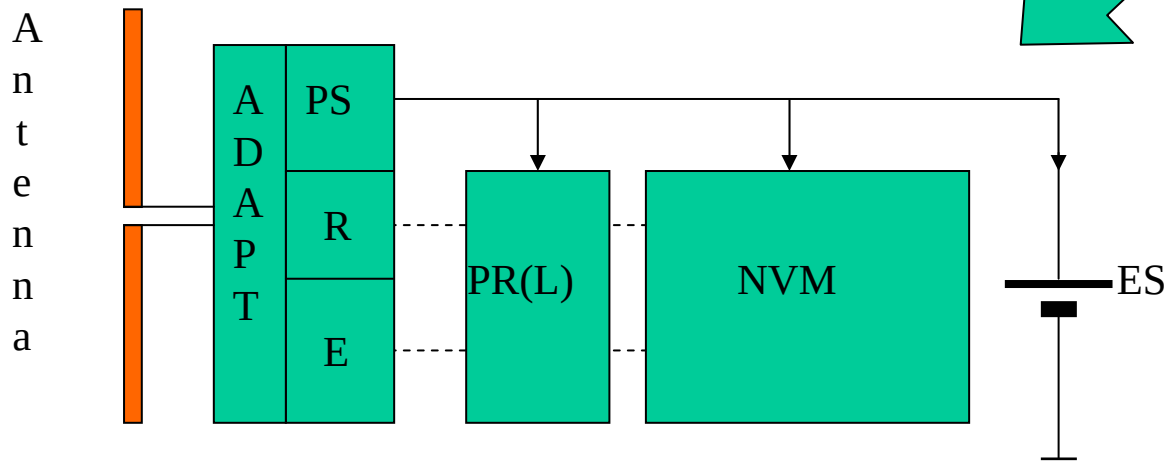
Typical RFID System

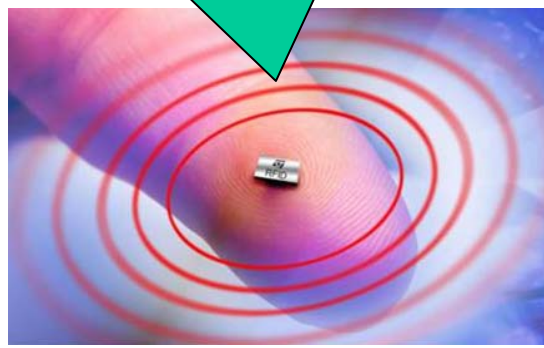
Server

Reader

RFID Tag

Chip

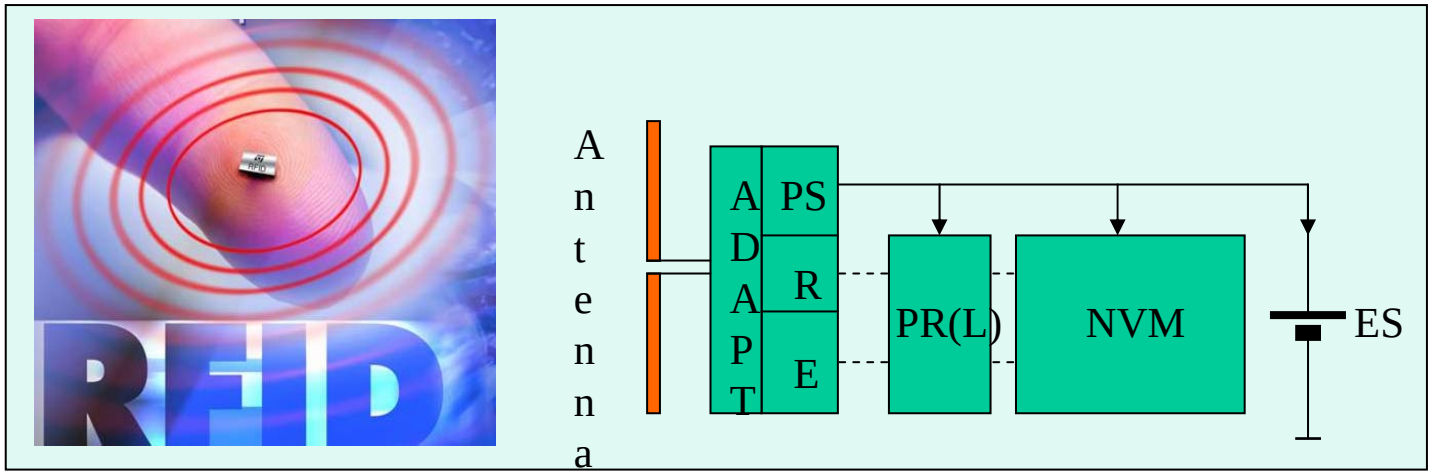




RFID Tag

- Passive
  - getting power from reader via RF
    - small, robust
- Semi-passive
  - battery in package (not for emission)
    - increased physical and chemical constraints
- ***Not just an ID, - some RFID devices can record, store and tell stories...***

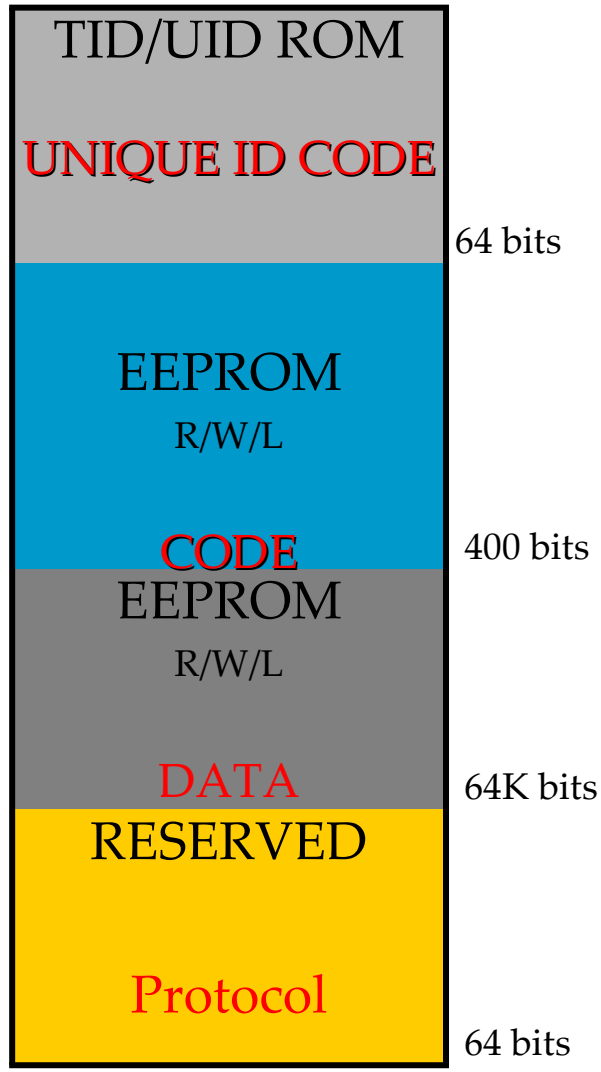
Three key functions for RFID ICs



- RFID tags in their most basic form are **EEPROM** with **RF** interface and **Logic**
- ST using :
  - High quality and robust **automotive grade** EEPROM technology
  - 40 year data retention at 55°C
  - Up to 1 Million cycles

What data to needs to be stored ?

- Part of the tag RFID storage remains unchanged
  - The IC Mfg. generates a unique code, equivalent to the bar-code. E.g.: EPC,…
- Part of the RFID Tag data will be modified during the lifetime of the IC.
  - Standardization for memory mapping with codification, level of security and accepted by all the users in the chain is required. E.g.: IATA, AIAG,…



RFID Frequencies / Antennas

	Frequency	Antenna	Technology
LF	125 kHz	inductor	3D wound coil
HF	13.56 MHz	inductor	2D printed coil
UHF	900 MHz-band	dipole	2D printed dipole

- Physical Tag Environment
- Directivity
- Size

being influenced by frequency and antenna design

RFID-Devices - Form factor

13,56 MHz

RFID

- R&D challenges & evolution

Three “laws” dictating evolution …

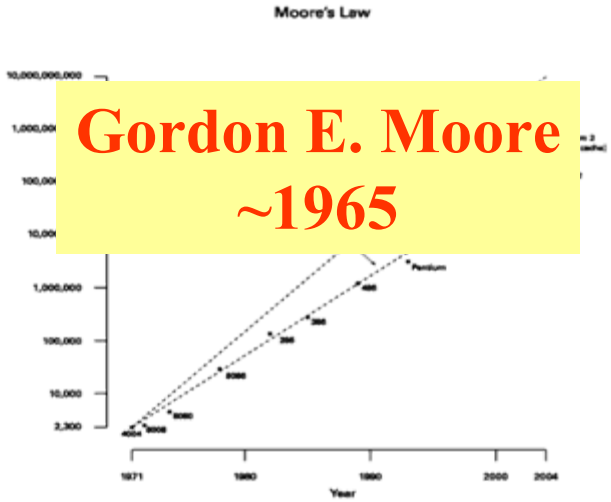
Heinrich R. Hertz
~1887

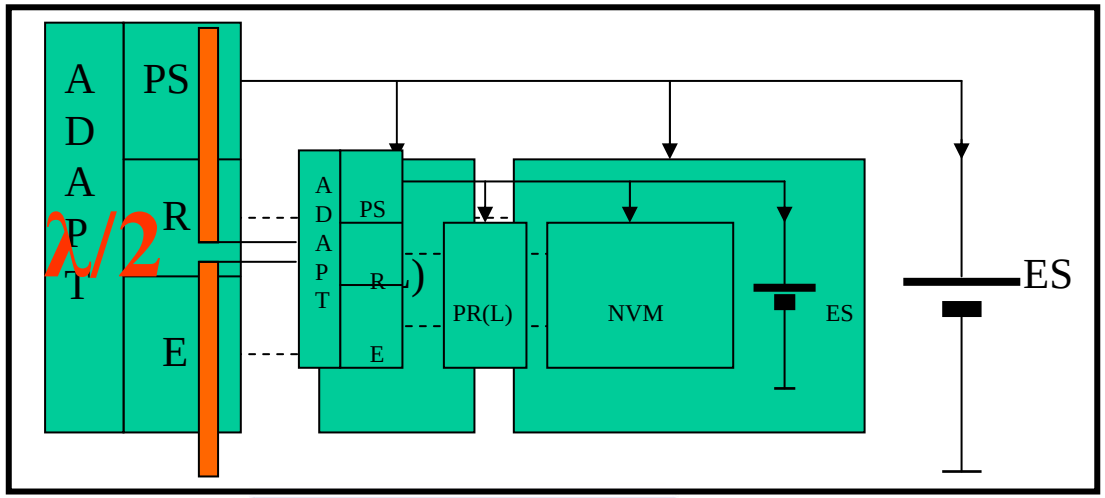
Standards

GS1

ISO

Gordon E. Moore
~1965





Other points influencing evolution …

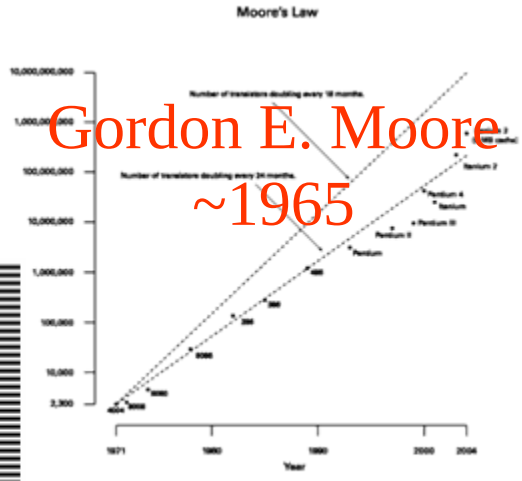
RFID Tag – a device:
"recording, storing and telling stories..."

- memory access control
- data protection / encryption
- anti-tampering
- privacy
- sensing...

...are or may be required !

RFID - there is another “law” …

Heinrich R. Hertz
~1887

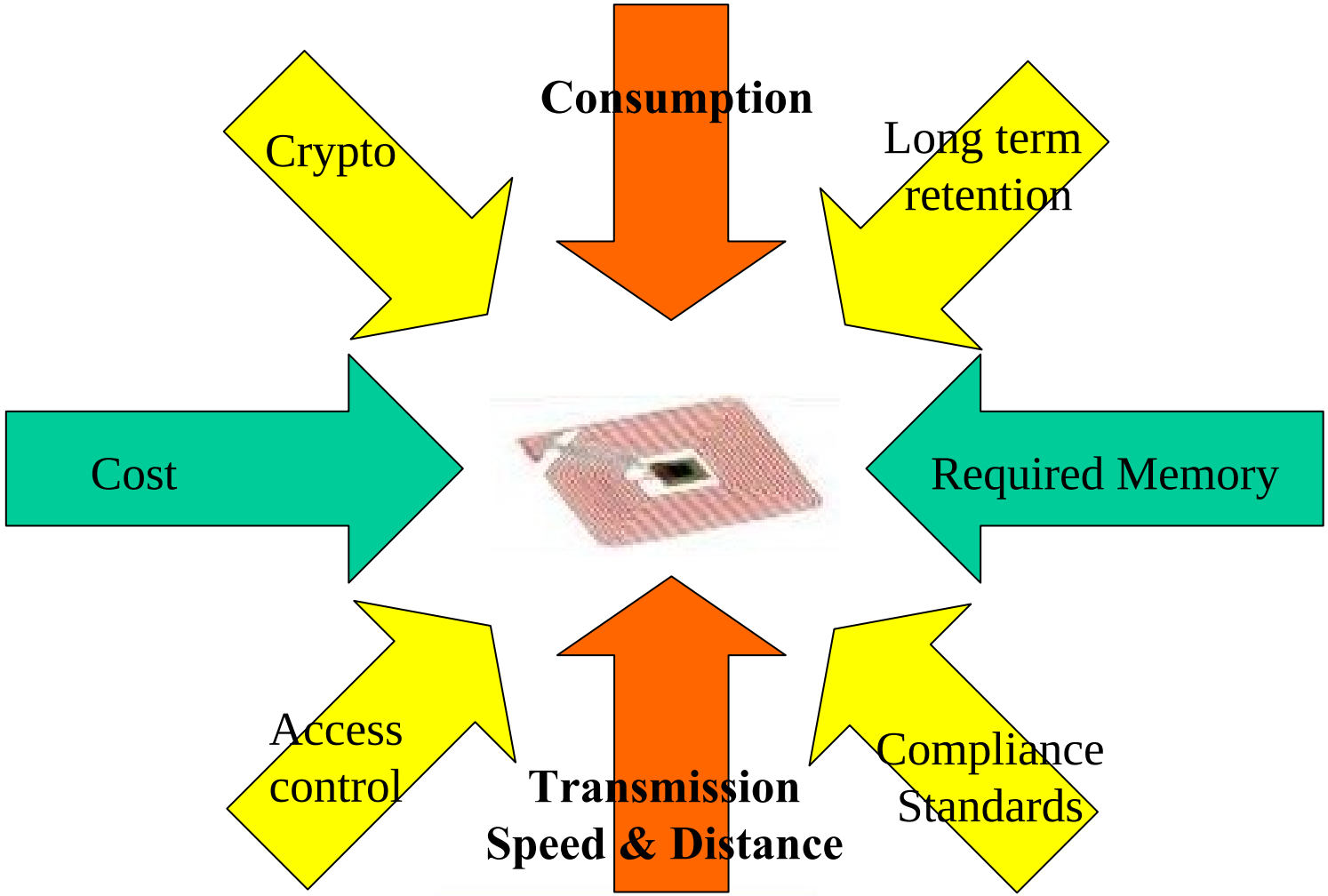


Gordon E. Moore
~1965

“Joule’s Law”

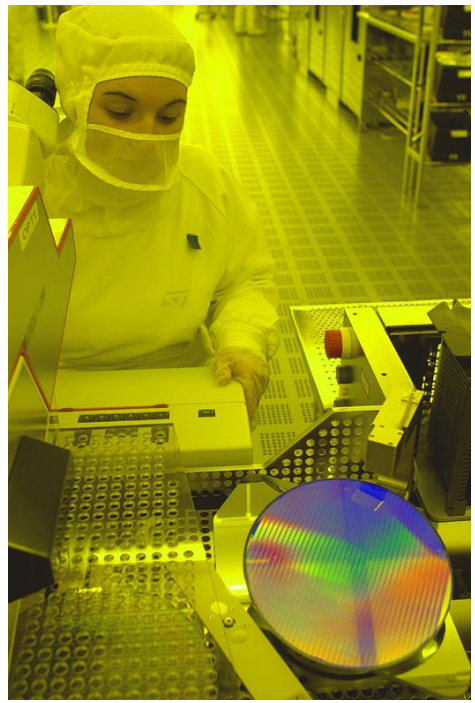
$P = \frac{1}{2} CV^2 \times f$

RFID Chip design:
dealing with contradictions



Summing up: RFID R&D topics
(just to mention a few...)

- Passive Tag
  - Rewritable large Memory
  - Enhanced security :
    - password lock, authentication, cryptography
  - Cost reduction
  - Printable antenna
  - Polymer Silicon



- Semi-passive Tag
  - Low power and low consumption microprocessor
  - Integrated sensor
  - Built-in power source:
    - flexible battery, energy scavenging
  - System in package
  - Data processing capabilities

RFID

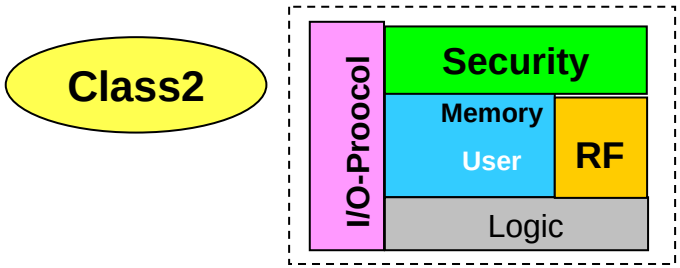
- Applications

RFID Applications trend

Large rewritable memory with security feature

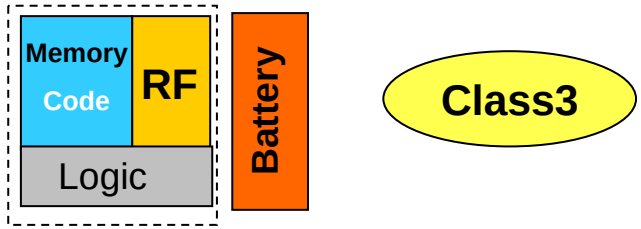
-Memory Extension :

-Improved security schemes



Battery assisted

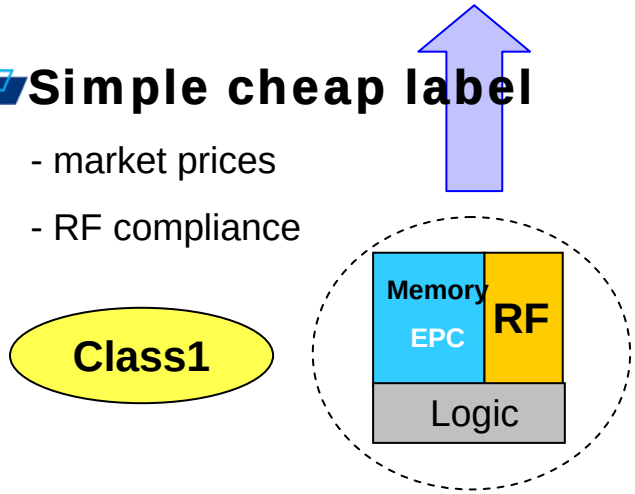
- Enhanced performances in harsh environment

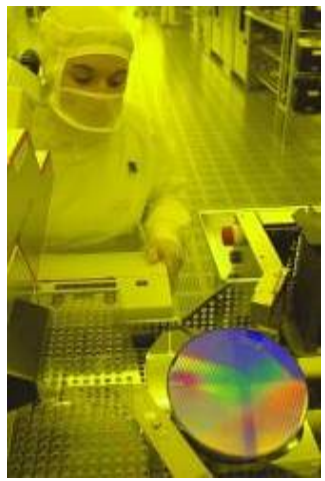


Simple cheap label

- market prices

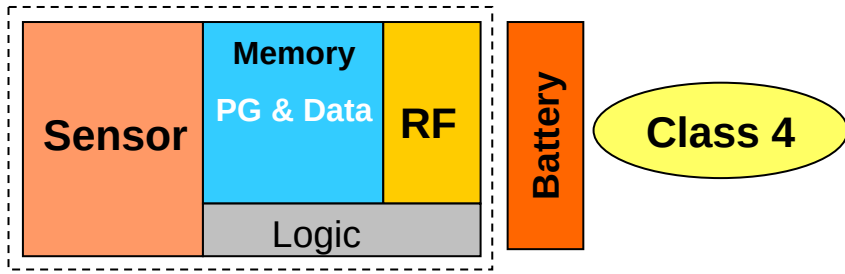
- RF compliance





Platform with sensor, power capability and data processing intelligence

- monitor physical event and send command



Closing remarks

- Hertz is keeping antenna designers under pressure
  - remember $\lambda/2$
- Joule is challenging performance increase
  - "more MIPS means more Watt"
- Moore is driving IC cost reduction, but:
  - overall optimization (IC, antenna, protocols ...) is key
  - one needs top class architects and designers
- Widely adopted standards are driving the market pervasion; interoperability is key

Thank you