



AGILE READER REFERENCE PLATFORM

PROGRAM UPDATE

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AGENDA

- The RFID Reader Manifesto
- Agile Reader Project Goals
- Team introduction
- Current status update
- Design Overview
- Conclusion



THE READER MANIFESTO

(AS ARTICULATED IN NOVEMBER)

The RFID Reader of the Future will:

1. Operate on more than one band
2. Speak Internet protocols natively
3. Be part of a distributed, client-server system
4. Incorporate agent-like behavior to manage a tag population at a fine grained level
5. Not require human intervention to fix problems

The RFID Reader of the Future must have flexible software to match its flexible hardware.



PROJECT GOALS

Provide a practical reference design for an RFID reader which:

1. Operates on multiple bands- at least 13.56MHz, 868/915MHz bands
2. Provides a flexible back-end network interface (TCP/IP)
3. Complements the Savant's scalable architecture
4. Is manufacturable at reasonable cost (~\$100 OEM, 100K units)

Resulting in a reproducible, published open reference platform
(and thus realizing the Manifesto)



VALUE OF REFERENCE PLATFORM

Auto ID Center

- Research platform that is easily modified and completely open
- Easy implementation of emerging EPC specifications for testing and evaluation

RFID Hardware Vendors

- Direct engineering applicability
- Open standard interface development

RFID Integrators and Service Firms

End Users

- RF level interoperability standards
- Software/Network level interoperability specifications
- Benefits of a common platform



READER PROJECT TEAM

- ThingMagic R&D Team
 - Matt Reynolds (RF and system architect)
 - Joey Richards (DSP lead)
 - Bernd Schoner (DSP, project management)
 - Sumukh Pathare (DSP)
 - Harry Tsai (Bamboo / Java software)
 - Ravi Pappu (Prototype hardware build management)
- Auto ID Center
 - Sanjay Sarma, Peter Cole, Dan Engels, Kevin Ashton, and Auto ID Center team
- Auto ID Center Sponsor Community
 - OATSystems, Alien, Philips, Markem



PROJECT SCHEDULING

- Design work started August 2001
- Project duration 9 months
ending Q2 2002
- Major milestones achieved
 - Evaluation hardware deployment at Field Test sites in Arkansas and Tennessee
 - Integrated with the Savant system
- Reference design (primary deliverable)
being published Q2/Q3 2002- starting today

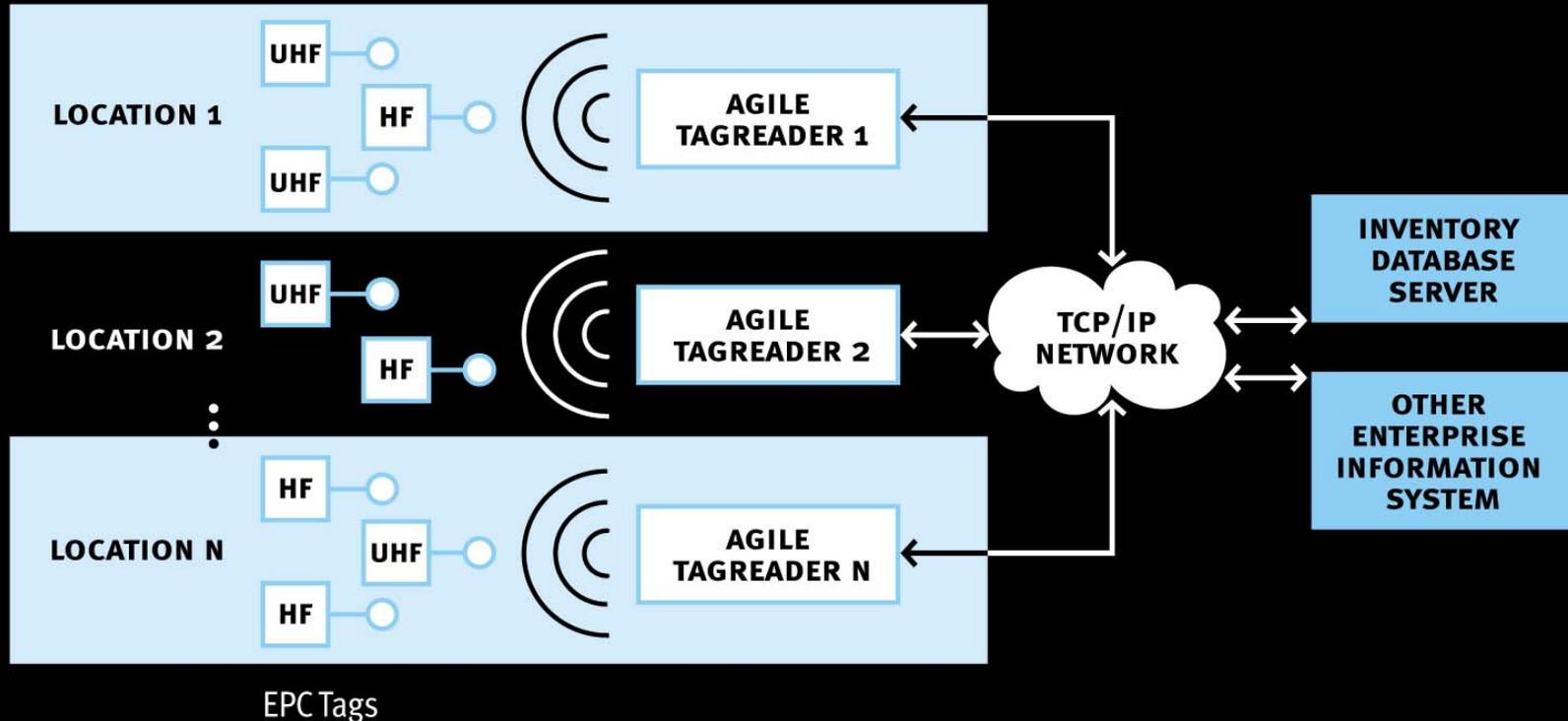


CURRENT STATUS

- Single band (900MHz CCAG) version currently deployed in the Field Test
- Dual band version (900MHz/13.56MHz) demo today
undergoing lab testing
to be deployed in the Field Test September '02
(jointly with Markem Corp.)
- CCAG915 support
Finalized and running
- CCAG13.56 support
being finalized as the protocol emerges (current draft is implemented and being tested)



THE NETWORKED READER VISION



THE READER IS A **GATEWAY** BETWEEN **TAGS** AND THE **NETWORK**

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READER SYSTEM OVERVIEW

Design philosophy: flexibility and low cost

- Maximum of component and system reuse
- High level of inter-band integration in both HW and SW
- Make good use of DSP techniques
- Provide a standard, well documented TCP/IP interface to the outside world



GENERAL DATA HANDLING APPROACH

Two processors:

- Digital signal processor (DSP)
Performs real time signal processing tasks
- Network processor (Bamboo™ Linux platform)
Handles data, schedules reads, interacts with TCP/IP network
Acts as a Savant database agent

Shared memory interface between DSP and network

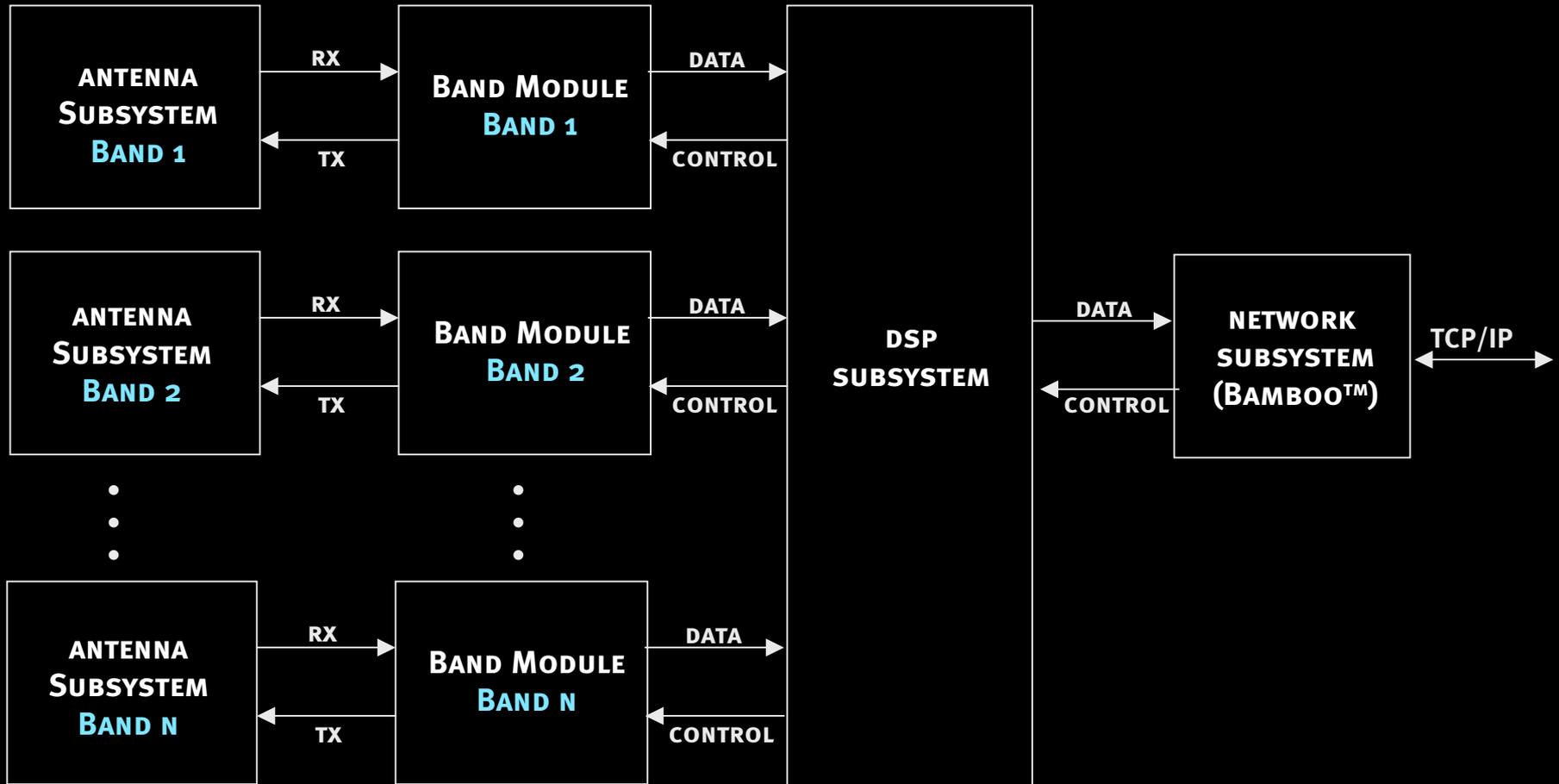


HARDWARE DESIGN GOALS

- Complete hardware-software modularity
 - Separate band modules (HW) from protocol modules (SW)
 - (Any protocol module can talk to any band module)
- Simplify the hardware as much as possible
 - Build the simplest HW consistent with good performance
 - Use only standard COTS components for lowest possible cost
- Make good use of DSP
 - Software can be easily field-upgradeable, while hardware cannot.

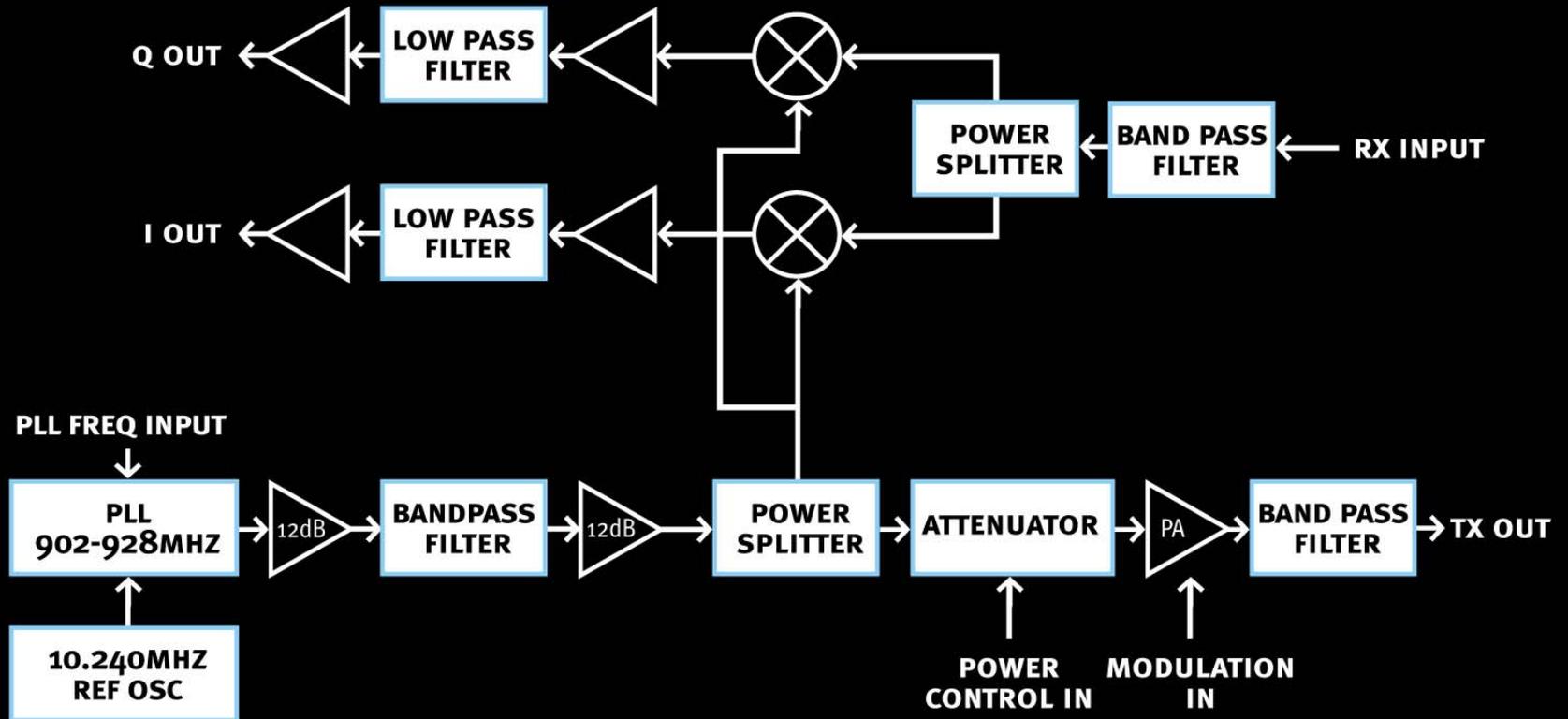


OVERALL HARDWARE ARCHITECTURE



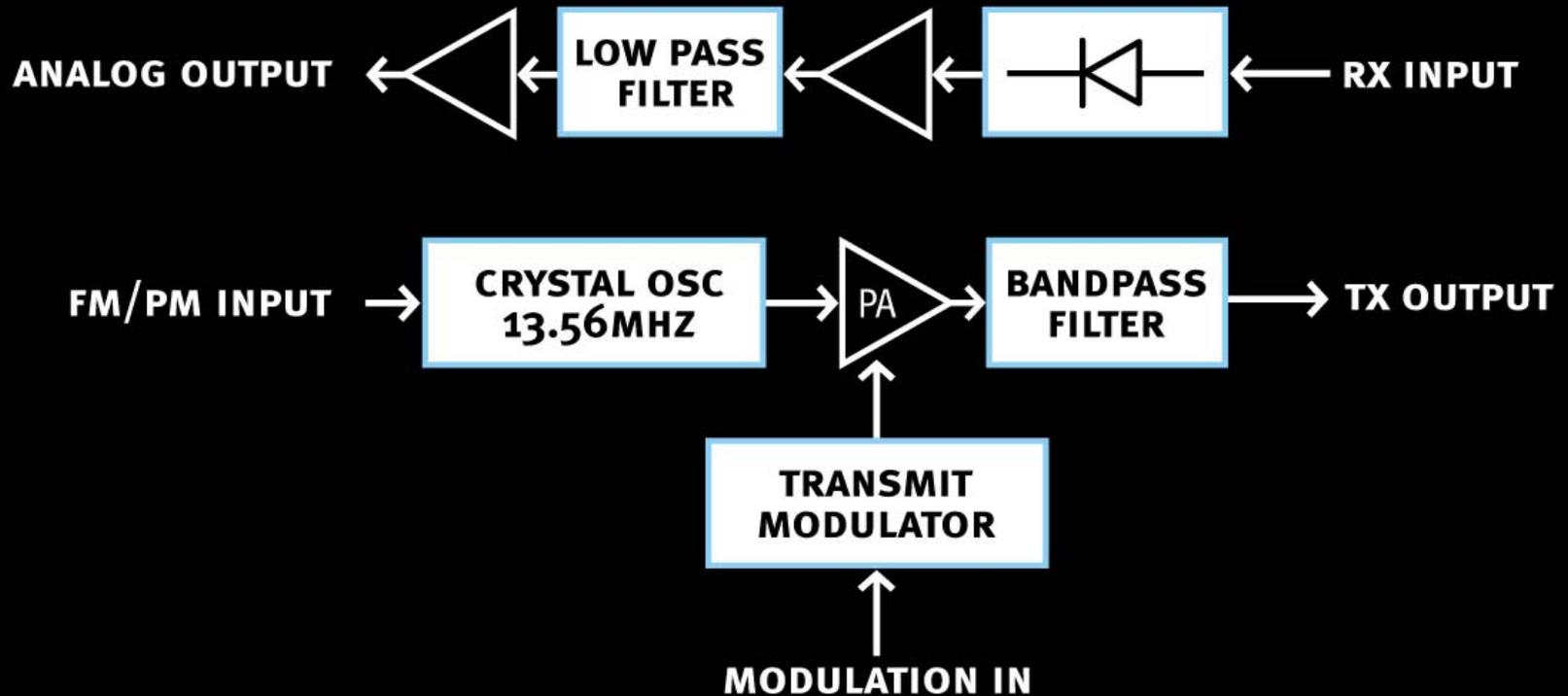


915MHz BAND MODULE SCHEMATIC





13.56 BAND MODULE SCHEMATIC



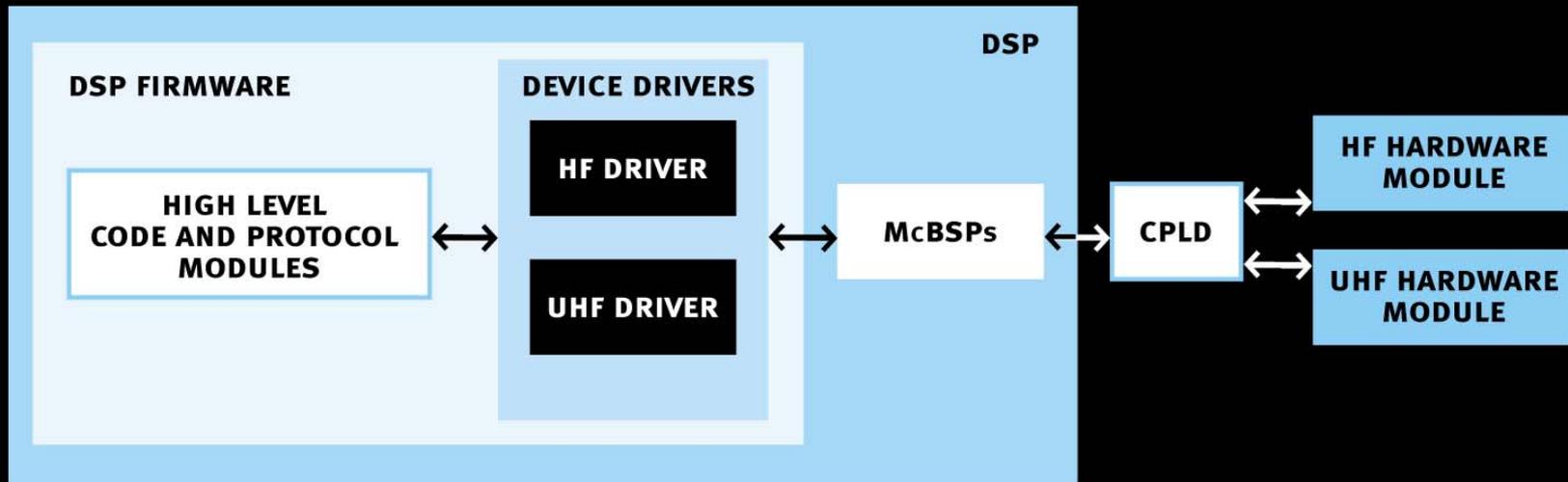


SOFTWARE DESIGN GOALS

- Complete hardware-software modularity
 - Device drivers abstract the hardware from the software
 - (Any protocol module can talk to any band module)
- Modularize the software as much as possible
 - Combine common software elements into modules
 - Provide real-time OS services to all software modules
 - Communicate easily with non-real-time network processor
- Communicate fluently with the networked world
 - Speak TCP/IP and SQL natively- with a built-in database server
 - Interface directly with enterprise systems

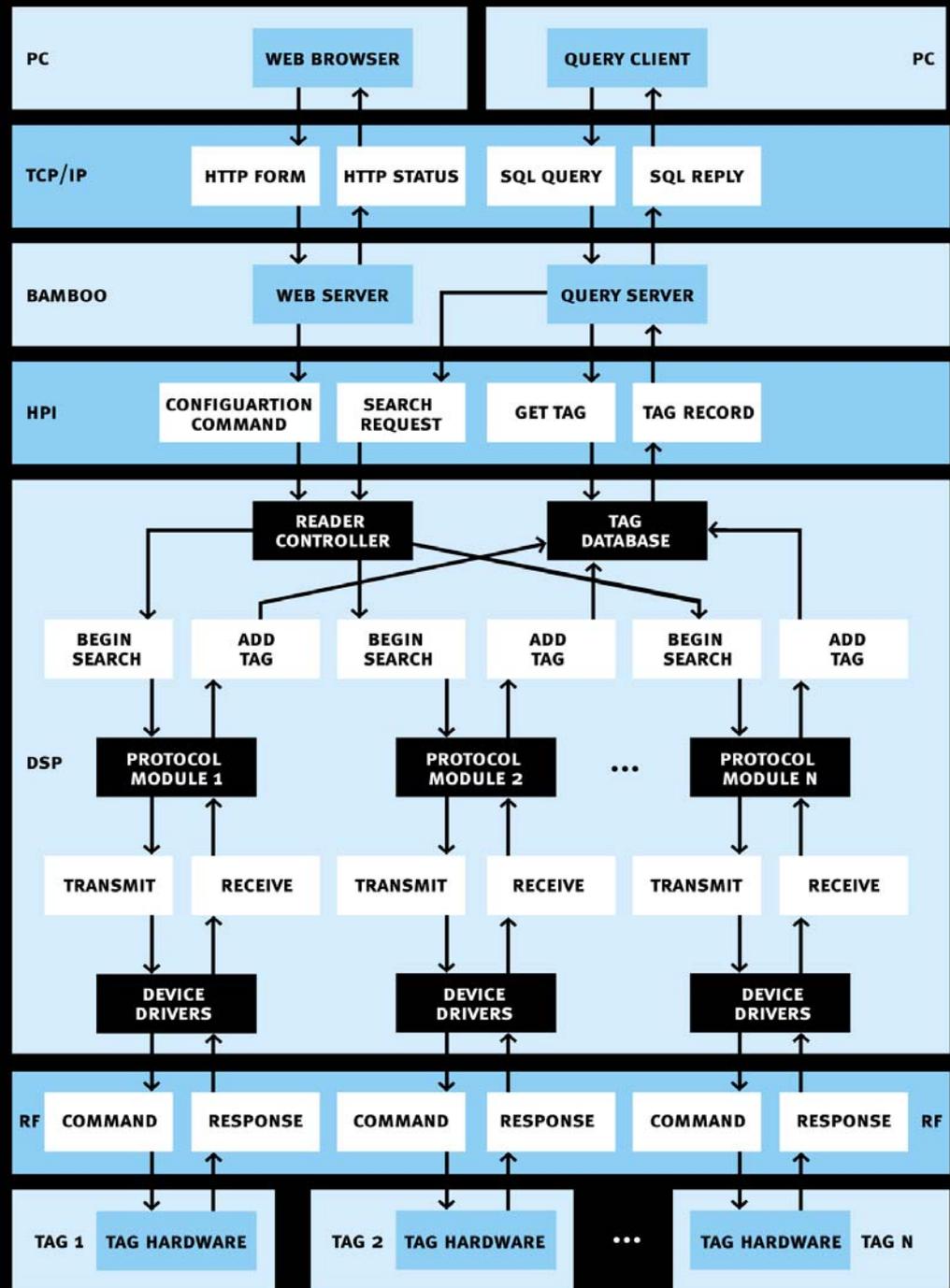


REAL-TIME MODULARITY AND ABSTRACTION LAYERS





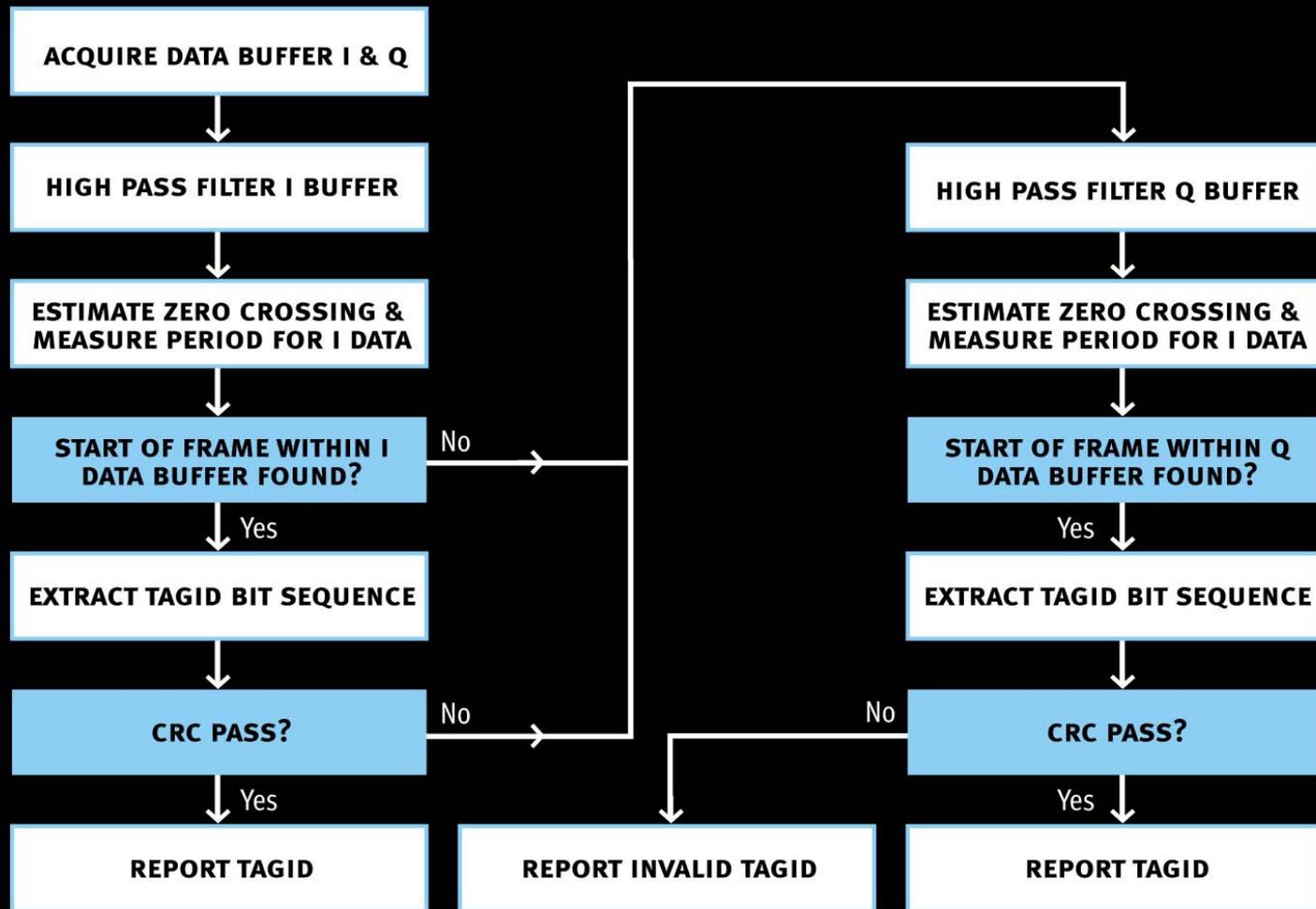
OVERALL SOFTWARE ARCHITECTURE



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CCAG915 SIGNAL PROCESSING MODULE





NETWORK SOFTWARE ARCHITECTURE

Goal: Standards-based, stable,
maintainable networked computing

Solution: Run Linux in the reader.

Protocols supported:

IP, UDP, TCP, FTP, NFS, Telnet, HTTP, SQL, SNMP

Interfaces:

Java based Web client (for humans)

SQL interface (for computers)



CONCLUSION

Our RFID Reader **IS** the Future!

It:

1. Operates in 13.56MHz, 868/915MHz bands
2. Intelligently maximizes band usage
3. Supports multiple and changing protocols via network-downloadable firmware
4. Speaks TCP/IP natively
5. Provides a flexible back-end network interface (TCP/IP)
6. Is part of a distributed, client-server system (Savant)
7. Is fully remotely maintainable

And it is **freely available** from the Auto-ID Center.

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