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FSM™ Femtocell Station Modem

A Highly Integrated, Performance Driven Chipset for the Small Cell Market

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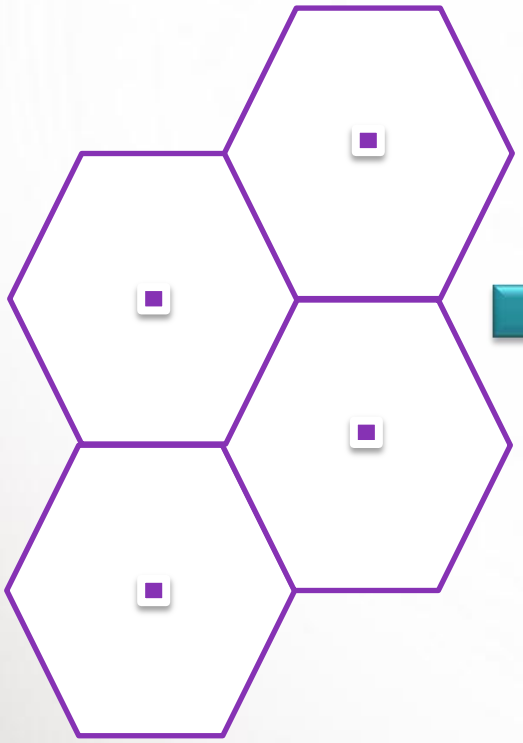
Outline

- Small Cells: Motivation and Implications
- Cellular Access Point Evolution
- The FSM9xxx Chipset
- Design Challenges
- Selected Advanced Features
- FSM9xxx Based Access Point
- Power Consumption
- Summary and Closing Remarks

Traditional Cellular Coverage Model

+ Small Cells

New Cellular Topology



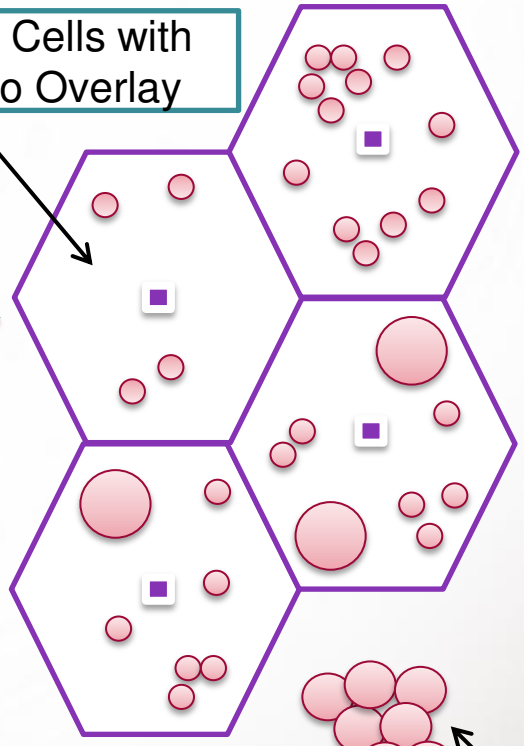
Data Demand ↑

Capacity ↑

Limited Spectrum

Improved User Experience

Small Cells with Macro Overlay



Interference Management

Low Cost

Low Power

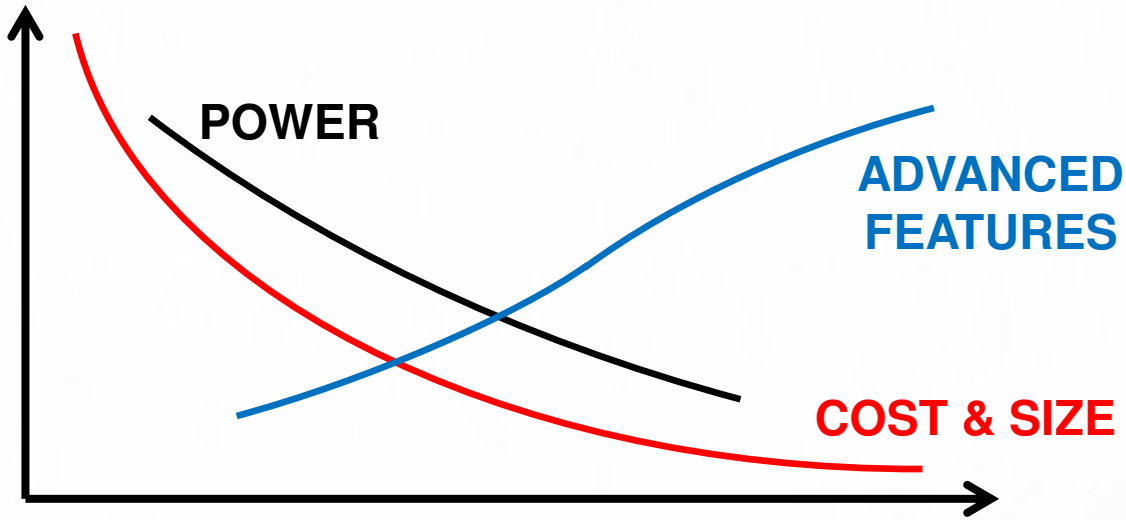
Advanced Features

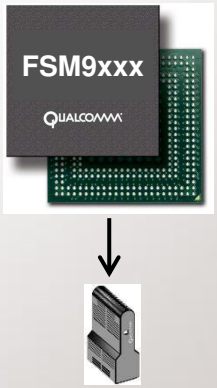
Ultra Compact Small Cell Access Point

Neighborhood Femtocells

New Requirements for Cellular Access Points

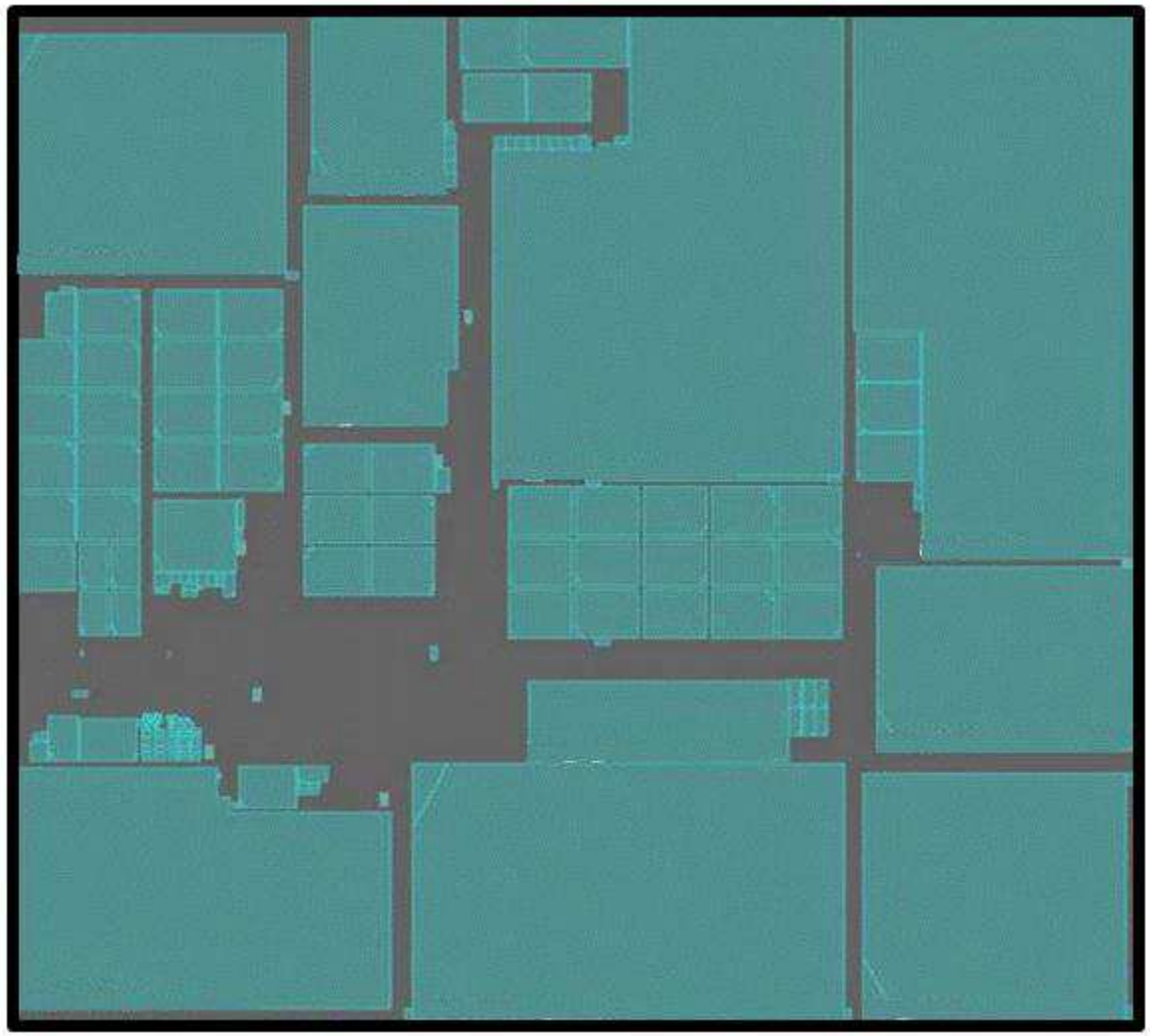
Cellular Access Point Evolution





The FSM9xxx SoC

Chip Layout



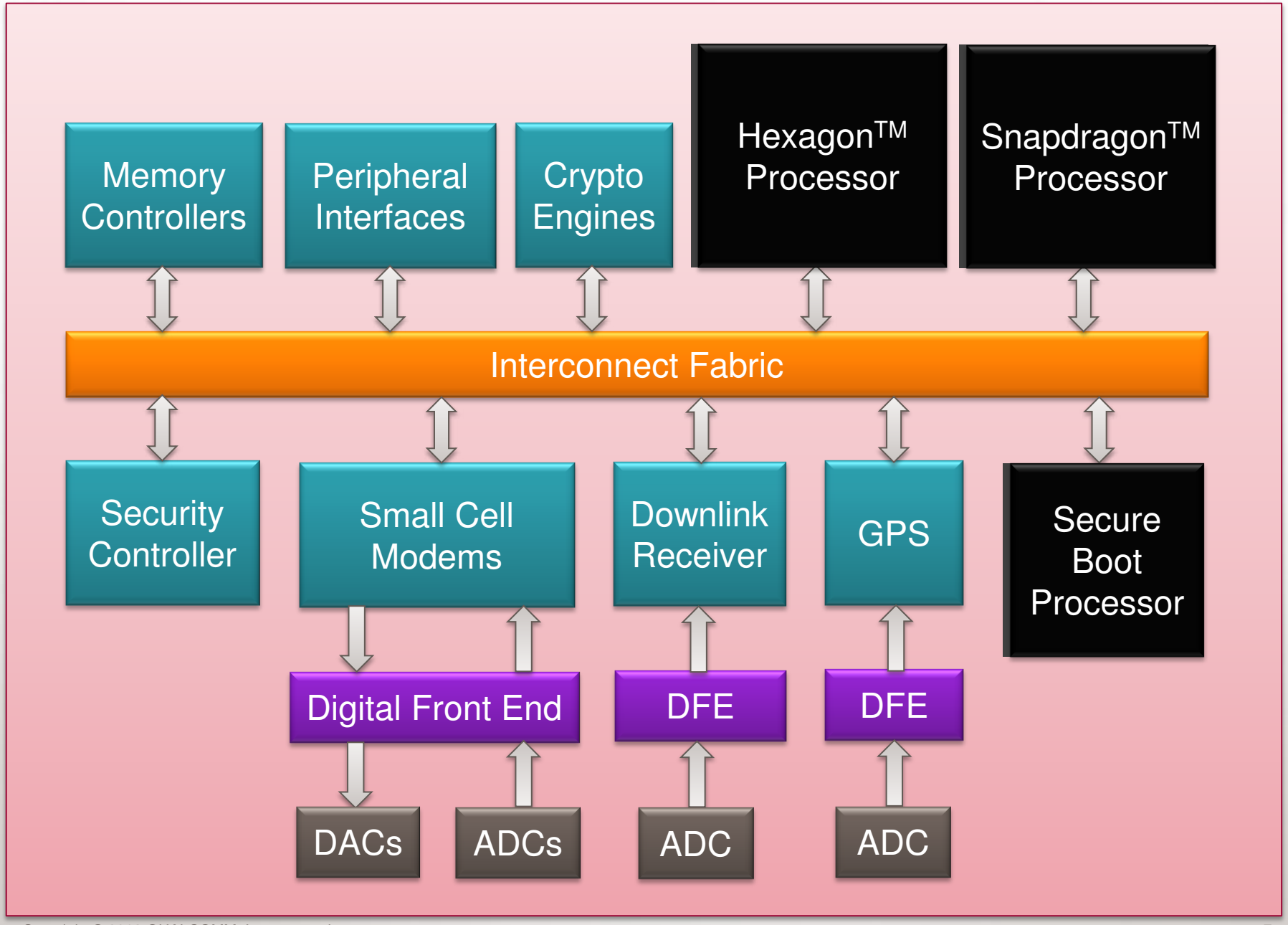
Key Stats

- 45 nm
- ~ 1.8 W for realistic full load
- Sampling commercially since April 2011

Key Features

- Small Cell Modem
- Integrated GPS
- Snapdragon™ Application Processor
- Security provisions
- Interference management

The FSM9xxx Architecture



Processors

Snapdragon™ Processor

- Qualcomm's 1st generation CPU, codenamed "Scorpion"
- 1 GHz
- ARMv7 ISA
- ~ 1.6x DMIPS/MHz w.r.t. ARM11
- Optimized for low power
- Open processor
- Handles L3, OA&M, etc.

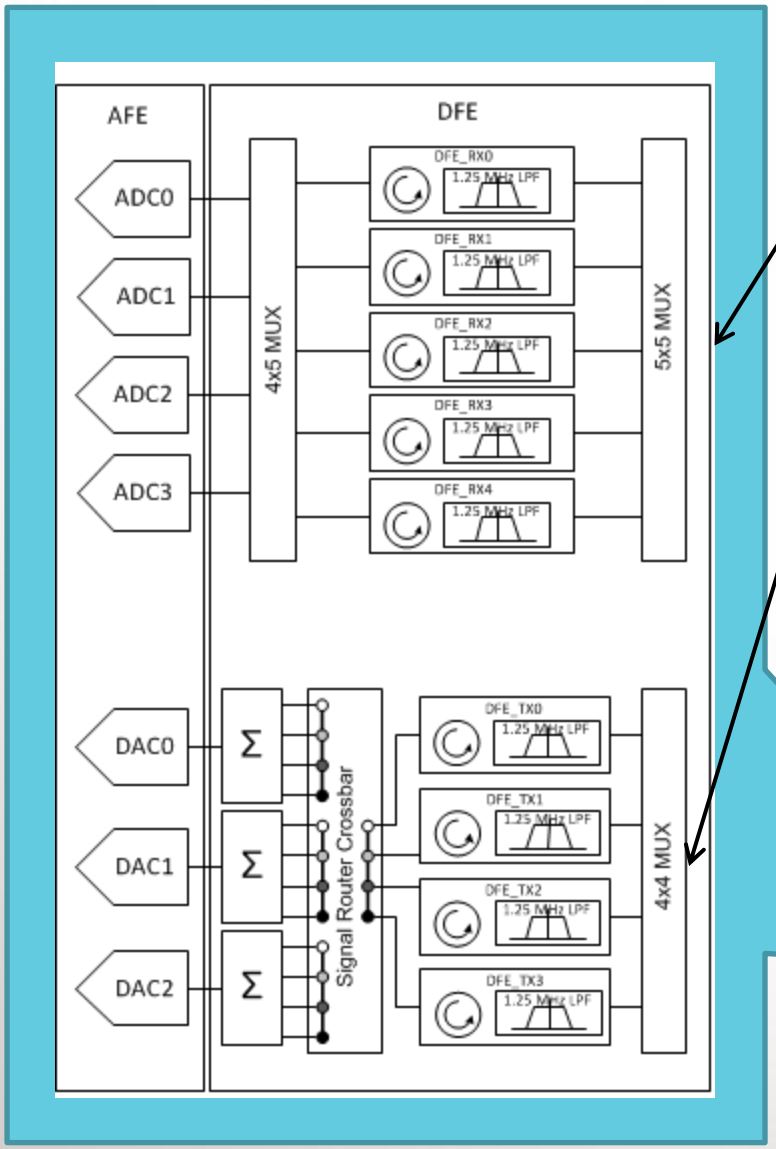
Hexagon™ Processor

- Qualcomm's custom DSP
- 600 MHz
- Multi-threaded
- Closed processor
- Handles L1 hardware control and L2

Design Challenges

- Need to combine base station and mobile functionality
  - Downlink processing for neighbor discovery and self-configuration
- Aggressive power consumption target
  - < 5W for full solution
- Stringent security requirements for residential deployment
  - Requires on-chip trusted execution environment
- Uncompromised modem performance
  - Up to 16 Multi-RAB UMTS users
  - 28 Mb/s downlink throughput
  - 5.7 Mb/s uplink throughput
  - Rx and Tx diversity
- Support for advanced interference management features
  - Additional processing chains for beaconing and uplink measurements

Advanced Signal Processing

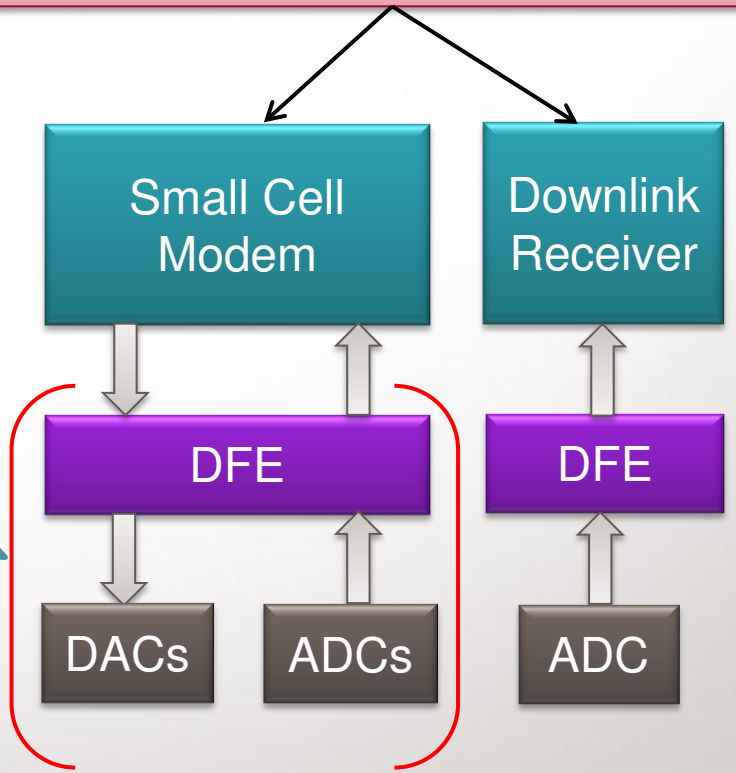


Additional processing chains:

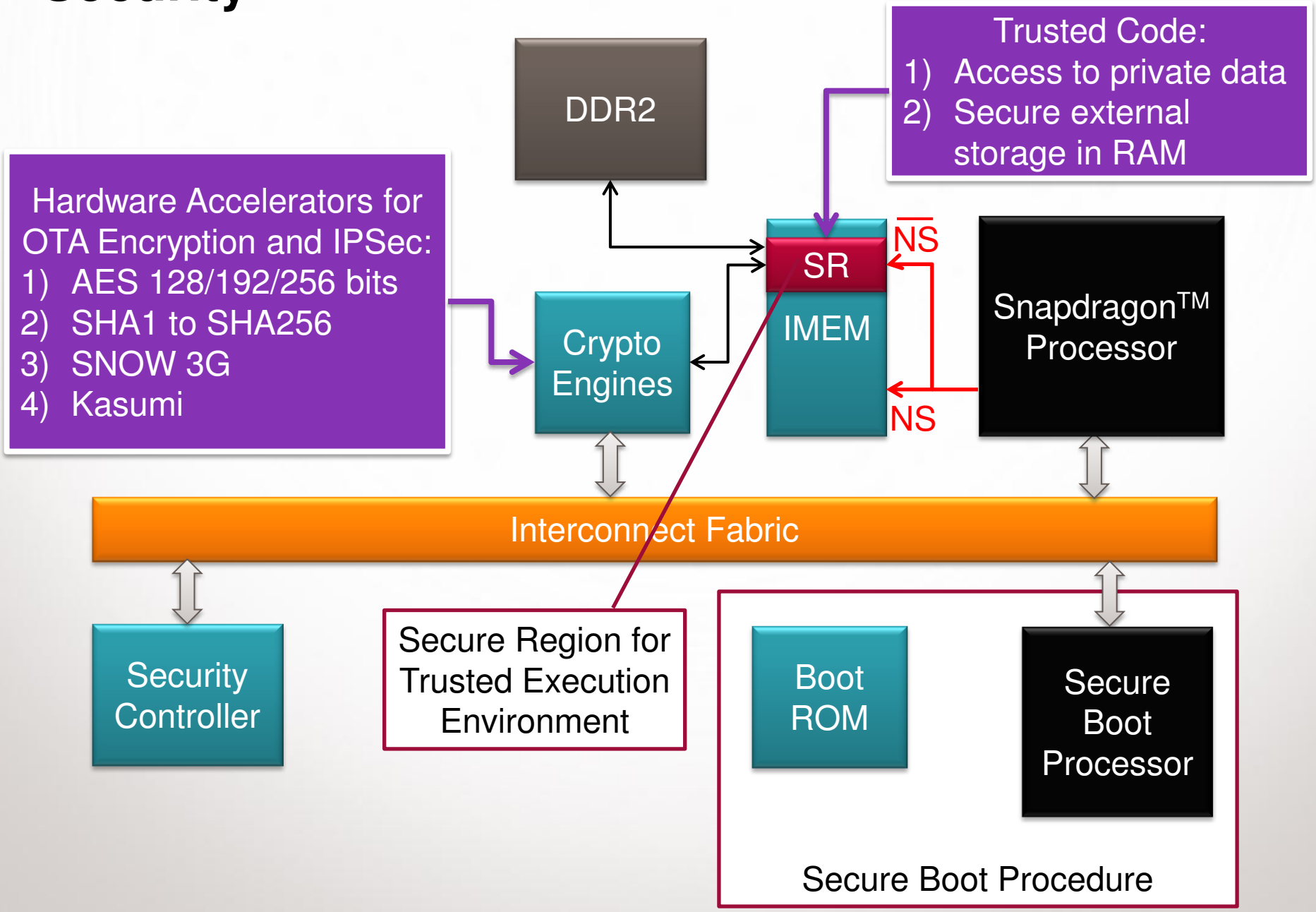
1) Downlink beaconing to facilitate system reselection
2) Uplink mobile and interference sensing

Simultaneous small cell service and downlink sniffing:

1) Dynamic interference management
2) Continuous VCTCXO disciplining



Security



The FSM9xxx Chipset

FSM9xxx Baseband Processor

- FSM92xx SKUs for UMTS
- FSM98xx SKUs for CDMA2000

FTR8700 Transceiver

- 2x2 wideband (25 MHz) chains
- Global UMTS and CDMA2000 bands

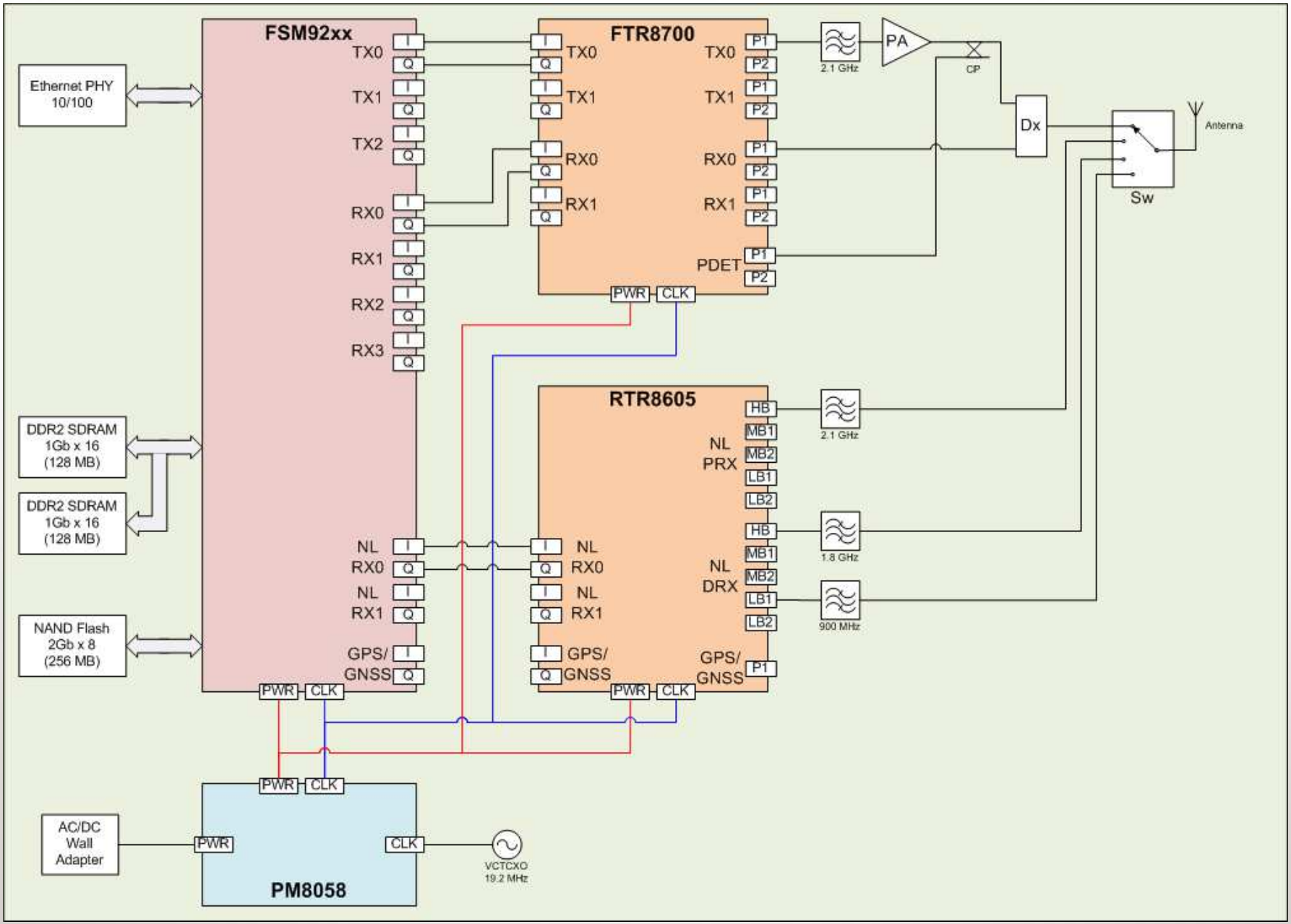
RTR8605 Receiver

- Downlink receiver
- GPS receiver

Power Management IC

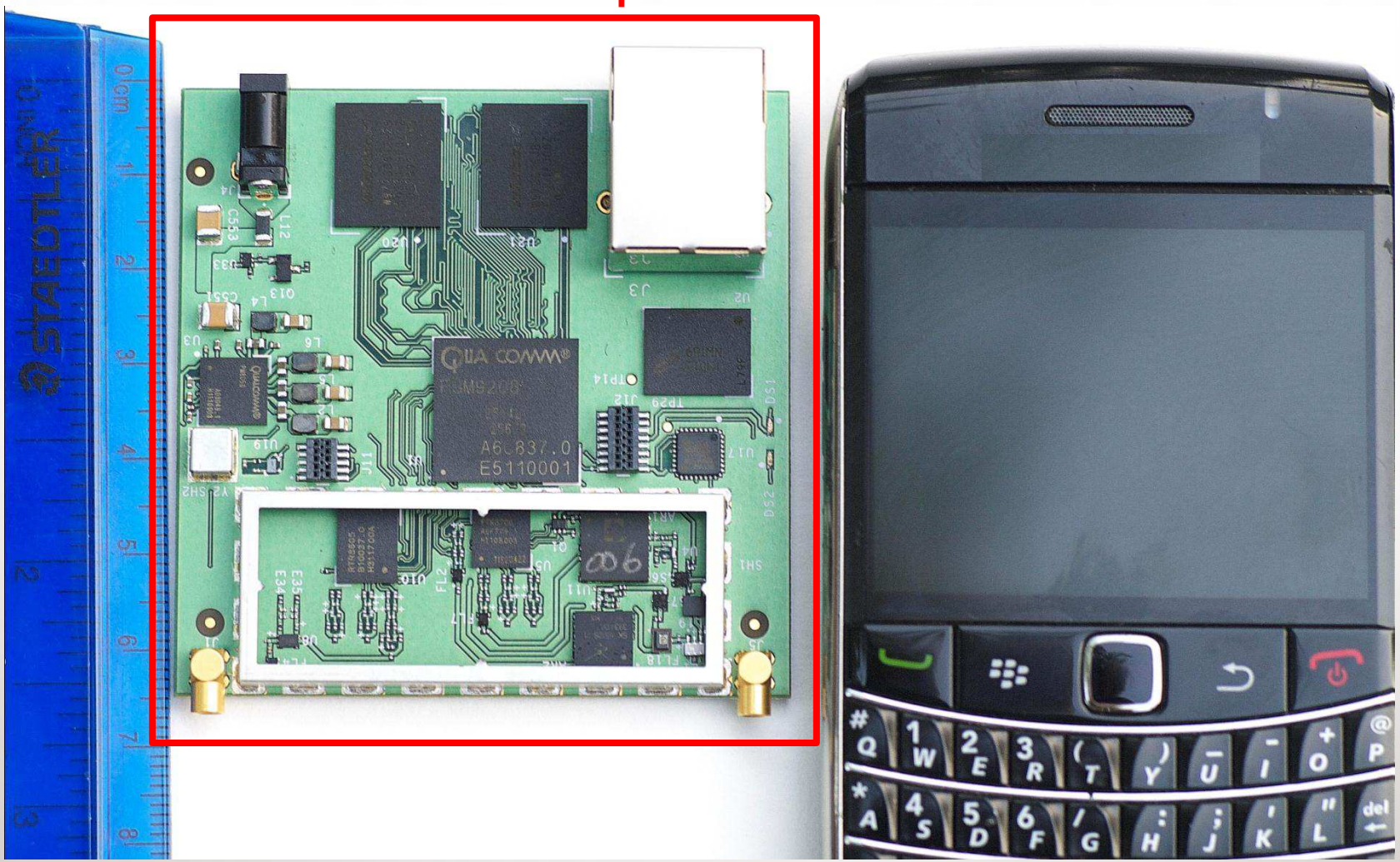
- Voltage regulators
- System clocks

FSM9xxx Based AP: Functional View

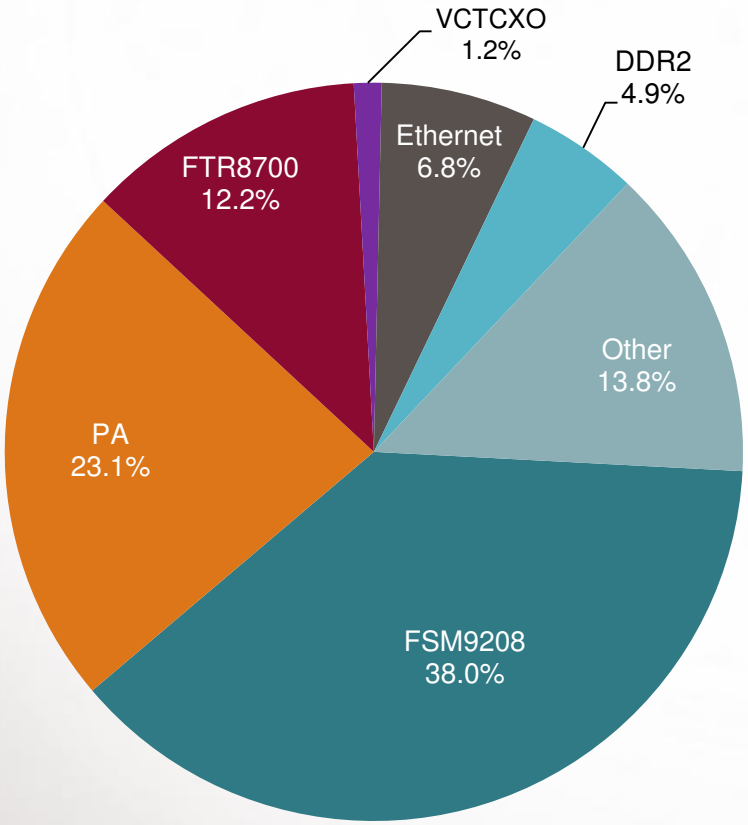


FSM9xxx Based AP: Implementation

2.5 in. x 2.5 in., 6-layer Board
Small Cell Access Point Implementation



Power Consumption



Total AP Power: 4.8 W

Test Configuration:

- 8 user residential femtocell (FSM9208)
- HSDPA + EUL operation
- 1.9 GHz band
- 13 dBm maximum Tx power
- Single Tx/Rx
- GPS and downlink receiver active
- Measurements at room temperature

Summary and Closing Remarks

- Data demand, capacity limits and economics are driving operators towards small cells
- Small cells deployment models create new opportunities and introduce new design challenges
- The FSM SoC provides a set of advanced features for improved system performance
- This SoC enables a very compact, low power small cell AP design
- The FSM9xxx chipset is Qualcomm's 1st generation small cell solution, focused on 3G
- This chipset is part of a portfolio of solutions that will include LTE, integrated Wi-Fi, and small cells evolution

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Thank You!