PlanX

Enabling Innovative Measurements of Operational Wireless Networks

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Why is it important to measure operational wireless networks?

Diagnose faults

Identify interference and classify interferers

Adapt protocol behavior

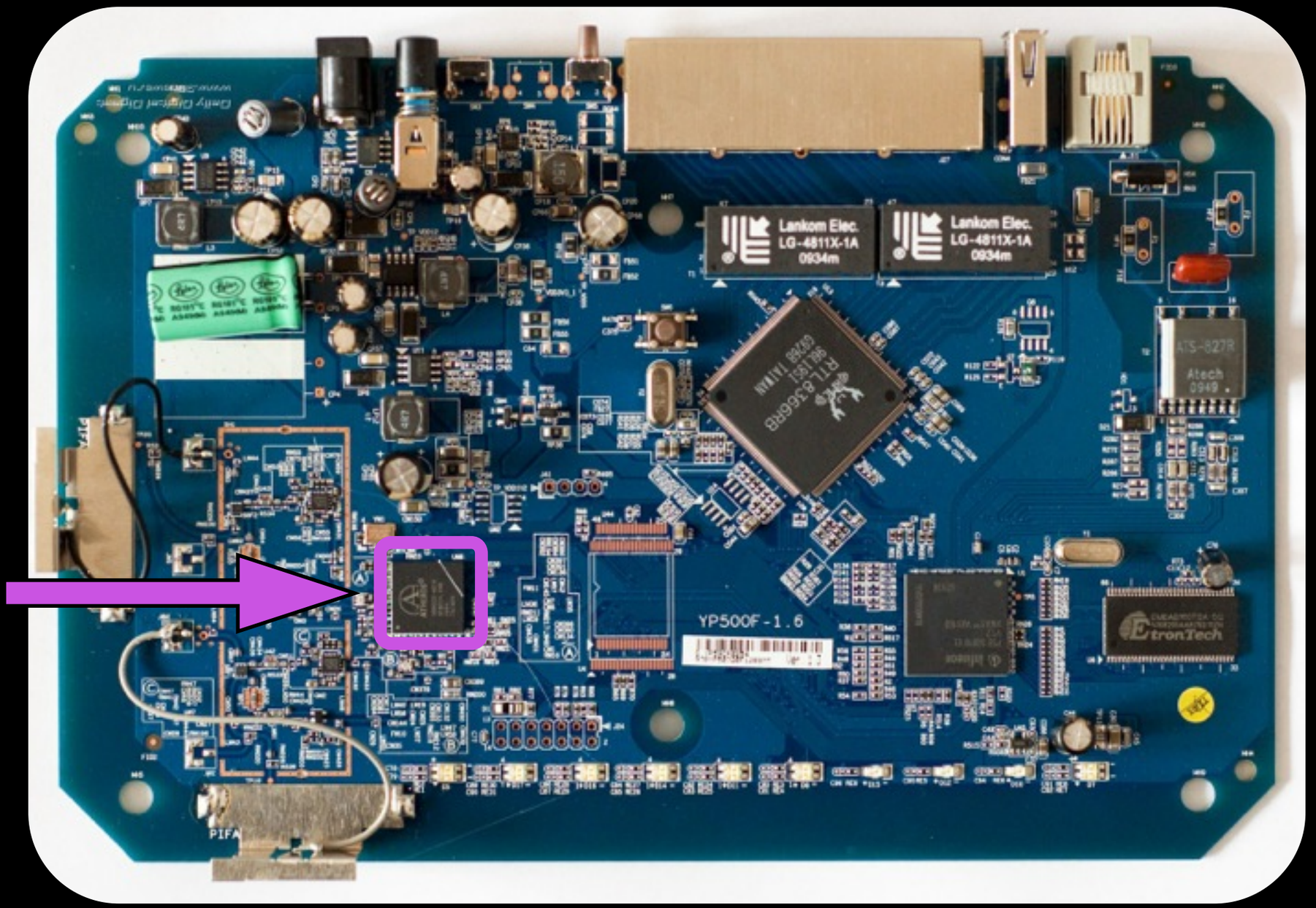
Classify other users and adapt to their behavior

Adapt spectrum usage

Find the best available spectrum

ASICs have been the heart of our operational wireless networks

Atheros WiFi



Netgear Wireless-N 300 Access Point

Source: www.3dnews.ru

Measuring with ASICs

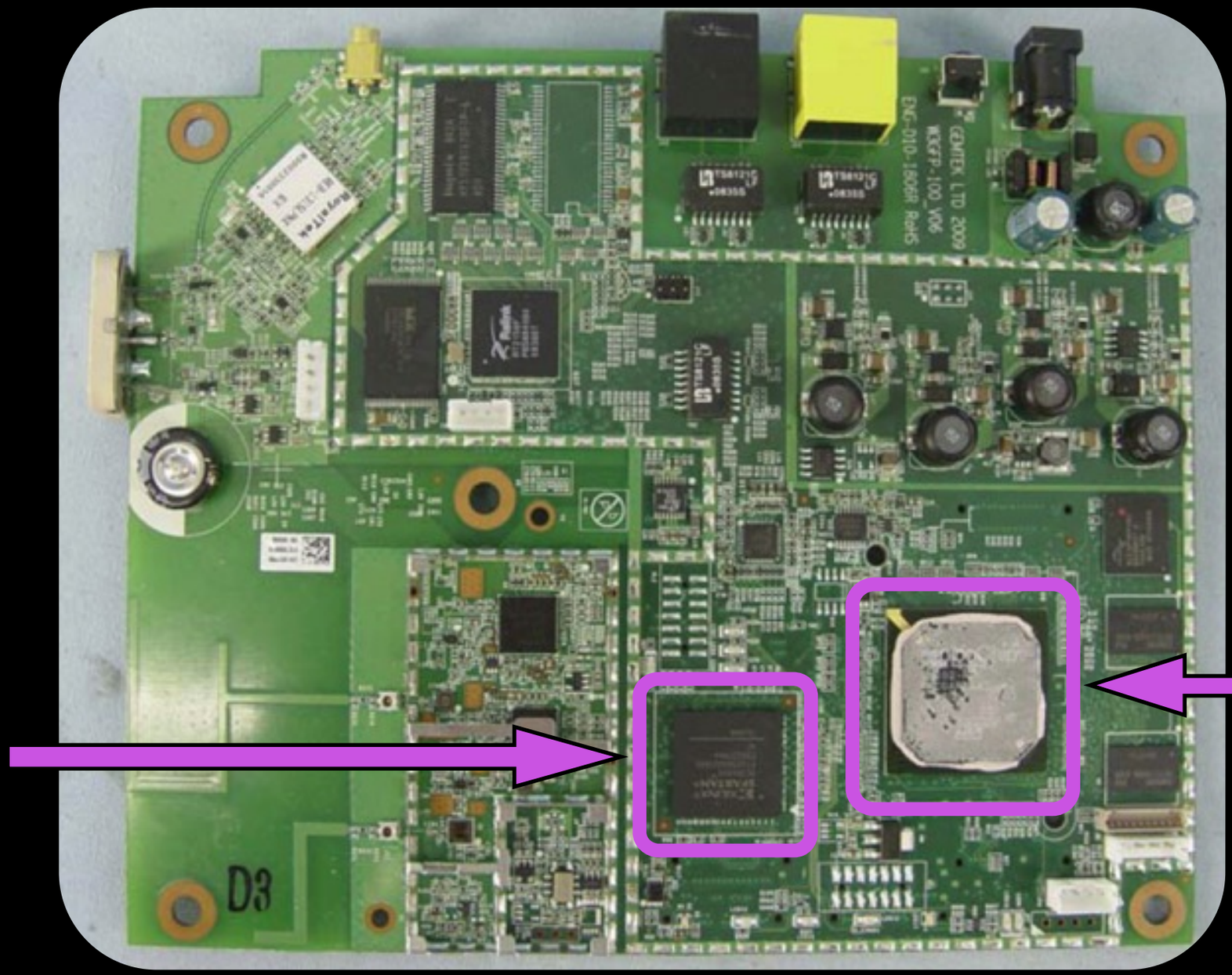
Useful and well understood

- Packet traces (with broken bits)
- Signal power estimates in each subcarrier

Useful but not well understood *(Unless you NDA)*

- Failure counters
- Signal strength: RSSI and SNR

Soon, **programmable DSPs** and FPGAs will be the heart of operational networks



AT&T 3G “MicroCell” Femtocell

Source: FCC Filing

Measurement with DSPs

So much potential. No more inflexibility.
We can deploy our SDR measurements!

Diagnosing Faults

Measure SNR at all points along the receive chain

Protocols will change often and break often

Adapt protocol behavior

Adapt protocol to coexist with other networks

"A Local Wireless Information Plane" Hong et al.

Adapt spectrum usage

Classify all transmissions in all 100 MHz of 2.4 GHz spectrum

"Practical Signal Detection and Classification…" Oshea et al.

Or not. Protocol implementations will be closed, or at least difficult to modify and not break.

We need open and modifiable implementations of wireless protocols for DSPs

PlanX

An open source software framework for implementing high data rate, latency sensitive, PHY and MAC on TI's Multicore DSPs

Program DSP blocks in C, then tie them together with PlanX

With Plan*X*, one grad student implemented the 802.11a 54 Mbps RX and TX PHY in two years*

* While simultaneously developing PlanX and learning about signal processing

Measurements in extra DSP cycles

"Practical Signal Detection and Classification in GNU Radio" by Oshea et al.

8-core 1 GHz DSP can classify emissions in 100 MHz of spectrum in only 18% of cycles

Operation	*Cycles*
Blackman-Harris	3,484
512-pt FFT	2,000 (approx.)
PSD of 512 samples	1,024
Binwise-average of 512 samples	1,024
Total	**7,532**
Available	5,120 cycles x 8 cores = **41,680**