

Software Defined Radio

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Aim

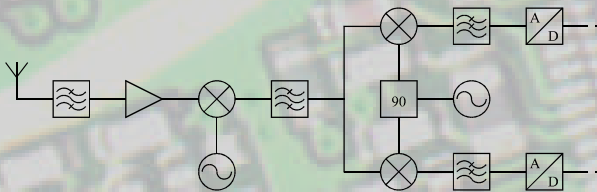
- a flexible (programmable/configurable) mobile radio
- focus is on the analog + digital front-end

Motivation

- Convenient: true global roaming
- Cheap: only one device for all standards (economy of scale)
- Short TTM: no new hardware necessary to support new standard
- High performance and long battery life: high performance when necessary, low energy consumption when possible

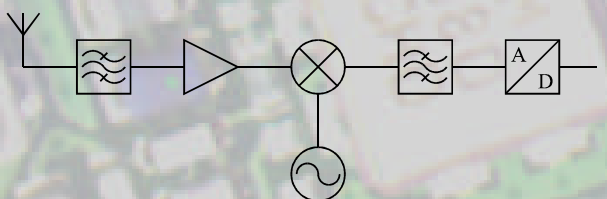
Some architectures

- Super heterodyne



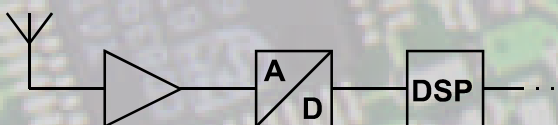
- + proven concept
- + low power consumption
- inflexible

- Digital IF



- + more flexible
- separate front-ends necessary for each standard

- Utopical software radio



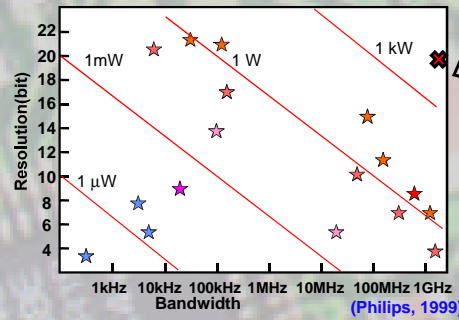
- + flexible
- unfeasible due to technology constraints

Technology constraints

- A/D conversion

Trade-off between resolution, sampling frequency and power (see figure below for some A/D-convertors)

Progress is very slow

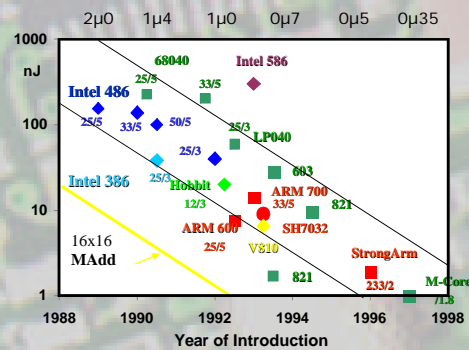


e.g. GSM
(rough estimate):
20 bits @ 2 GHz
⇒ 1 kW ! 😞

So: the ideal software radio will remain a utopy for a long time.

- Digital processing

Energy consumption per instruction is decreasing very fast: 😊



e.g. GSM
(rough estimate):
several thousands
of MIPS
⇒ several watts

- The ideal software radio will remain a utopy for a long time, so another solution is required.
- As the energy efficiency of digital hardware progresses fast, more and more functionality will be implemented digitally.
- An architectural solution depends on analog and digital technology, so an approach from both analog and digital perspective is essential.

Challenge

- To find an architecture that is both flexible and feasible.
 - what architecture to choose
 - how to partition analog/digital parts
 - how to partition flexibility (ASIC/FPGA/DSP)

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energy efficiency

system freedom