Design of the Transit Access Point Hardware Platform
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**Project Abstract**
A transit access point, or TAP, is a wireless network base station with multiple air interfaces, each composed of multiple antennas. TAPs provide high-speed data links to mobile users and to other TAPs. These TAP-to-TAP links allow access points to be connected to a larger network without a wired connection. We describe here the design of the hardware for the TAP platform.

**Motivation**
- Most residential internet access is slow & expensive
- Average “broadband” is slower than 1Mbps
- US broadband penetration only around 50%
- Current options are too slow
  - Cable & DSL can’t achieve widespread 100+ Mbps
  - Fiber to the home could cost $100+ billion
- Broadband wireless may be the answer
  - WiFi “hot-spots”
    - Access point, router & expensive T1 connection
    - High speed but very limited coverage
- 3G and fixed wireless (WiMAX, LMDS)
  - Good coverage but slow
  - Significant spectrum licensing costs
  - Untested scalability

**Hardware Requirements**
- Substantial processing resources
  - New algorithms will be complex
  - Must be programmable & very flexible
- Multiple wireless interfaces
  - Each uses multiple radios & antennas
  - Same interface must transmit & receive
- Wired network interfaces
  - Some TAPs need internet connections
- Extensible hardware design
  - Needs will vary between TAPs

**Design Decisions**
- FPGAs for baseband processing
  - Good for complex DSP-intensive algorithms
  - Highly flexible
  - Full control of parallelism vs. resource use
  - Many design tool flow options
  - A few drawbacks to FPGAs
    - Substantial power consumption
    - Chips are expensive (without donations)
- Wideband 2.4GHz radios
  - Same frequency band as 802.11b/g
  - We use a commercial transceiver chip
- Partitioning of hardware
  - Single board per TAP is expensive & risky
  - Design is divided into three boards
- Xilinx Virtex-II Pro FPGAs
  - Substantial logic resources
  - Embedded PowerPC cores
  - Multi-gigabit transceivers (RocketIO)

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