WPAN Study Group
Is 802.11 the Answer?

Topics for Discussion

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Introduction / Overview

- Statement of perceived WPAN requirements
- Summary of requirements clearly / easily satisfied by the 802.11 standard
- Summary of 802.11 capabilities simply not required by the WPAN technology
- Discussion of the overlap
  - Is the basic 802.11 MAC/PHY appropriate for WPAN?
  - Are there parts that should be exploited? Avoided?
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Technical Guidelines

From April 8-9, 1998 Cambridge, MA meeting:

- Mobility: 0-10 mph (no handoff required)
- Range: 0-10 meters
- Data rate at MAC SAP: 19.2 - 100 kbps
- WPAN Coexistence: 20 within 400 square feet
- Coexistence with other wireless systems (e.g., 802.11)
- Networking support for minimum 16 devices
- Bridge or Gateway connectivity to other networks
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Additional Guidelines

Other requirements we know we must satisfy:

- Very low power solutions feasible
- Very small solutions feasible
- Low c--- solutions feasible *(can I use the "c" word?)*
- Solutions with minimal interfaces feasible
  - simple hardware and software interface assumptions
  - necessary to interface to the simplest peripherals and sensors
- Not infrastructure-based networks
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802.11 and Technical Guidelines

Can 802.11 satisfy the 4/8-9/98 guidelines?

* Mobility: 0-10 mph (no handoff required) **YES**
* Range: 0-10 meters **YES**
* Data rate at MAC SAP: 19.2 - 100 kbps **YES**
* WPAN Coexistence: 20 within 400 square feet **?????**
  PHY dependent, FHSS more likely, with minimal transmit power
* Coexistence with other wireless systems **YES**
* Networking support for minimum 16 devices **YES**
* Bridge or Gateway connectivity to other networks **YES**
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802.11 and Additional Guidelines

Can 802.11 satisfy our additional guidelines?

* Very low power solutions feasible **DEPENDS**
* Very small solutions feasible **DEPENDS**
* Low c--- solutions feasible **DEPENDS**
* Solutions with minimal interfaces feasible **NOT YET**
* Not infrastructure-based networks **YES**
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It's the DEPENDS items that are the issue. Today solutions don't satisfy what many want, ultimately the could. But of course, simpler solutions would be even better by then.

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"Extra" 802.11 Requirements

802.11 meets requirements WPANs do not have:

- Roaming
- WEP (Wired Equivalent Privacy) hooks
  might be nice
- MAC-level fragmentation?
  might be nice, but as a requirement could be unwise

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802.11 and WPAN

If we were to use 802.11 for a WPAN, we'd need:

- Hidden node mechanisms, since CSMA based MAC makes this critical for basic operation.
- Synchronization mechanisms (TSF Timers, beacons)
- Power management (TIM, DTIM, sleep, etc.)
- Independent BSS support for distributed power management, since WPAN has no infrastructure
- Association / Scanning mechanisms for IBSS (network) formation and management

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Observations

- Power control is absolutely critical to WPAN
- 802.11 does power control via beacons, coordinated sleep, and TIM/DTIM messages layered on top of base CSMA/CA protocol.
- **This is TDMA on top of CSMA**.
- In fact, time-bounded services (CFS) and many of the performance optimizations in the standard are based on the use of TDMA-like structures layered on top of the CSMA foundation.
- *Argument:* This TDMA-on-CSMA is one of the reasons 802.11 is considered complex by many.

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Opinion to Start Discussion

- 802.11 could certainly be used to satisfy the base technical requirements for WPAN identified at 4/8-9/98 Cambridge meeting.
- Technology will drive down power, size, c--- of 802.11 products. BUT …
- Much simpler approaches can be applied to the specific WPAN requirements to directly attack the problem.
- Technology will drive down the power, size, c--- of those solutions as well, to even lower points.
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Final Comment

Remember:

The fact that I can build a calculator with a Pentium and Windows 95 doesn't mean that I should.

Even if the power consumption of Pentiums is coming down every year.

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