Dynamic signaling of parameter for target network behavior and operation

Date: 2006-07-18

Authors:

Name	Company	Address	Phone	email
Marc Emmelmann	Technical University Berlin	Einsteinufer 25 10587 Berlin, Germany	+49-30-314-24580	emmelmann@ieee.org
Berthold Rathke	Technical University Berlin	Einsteinufer 25 10587 Berlin, Germany	+49-30-314-34832	rathke@tkn.tu-berlin.de

Abstract

TGv works on a coherent network management interface specifying several capabilities to achieve this goal.

In a heterogeneous operator or vendor environment, several vendors or operators may optimize their network for different requirements. It could be expected, that different optimization goals hinder each other and may not lead to optimal network behavior which may cause poor performance or even a collapse of the network.

Having knowledge of these different optimization goals can be used to improve network performance or even avoid the network to collapse.

This presentation is intended to start a discussion in TGv to elaborate if this further information should be distributed using 802.11 protocol mechanisms.

Motivation

- **Status Quo:**
  - Goal: complete a coherent upper layer interface for network management (.11v PAR)
  - objectives specify required capabilities, e.g.:
    - spectrum etiquette / dynamic power control (Req 2041)
    - dynamic channel selection (Req 2000)

    but the reason for employing these mechanisms will not be standardized

- **Result:**
  - Each vendor may use these management interfaces / capabilities and employ its own algorithms to for network and resource management
  - Different algorithms having the same aim may different in their performance and the "quality" of the result
  - These algorithms characterizes the maturity of each vendor's product and should not be covered in the standard, but ...

- **Problem: Algorithms with different aims may hinder each other and may cause poor performance or even the collapse of the network**

Example 1 -- Ordering Names

- **Sort the following names: Tim, Adam, John, Bob, Peter**

- **Several algorithms exist to sort these name, one are more efficient, others are not, e.g.:**

  – Vendor A applies algorithm A

  – Vendor B applies algorithm B

- **Problem: What happens if the two vendors do not agree on the sorting order (alphabetically increasing or decreasing)**

- **Imagine if only the top three in the list get a promotion and the others are fired ...** only John won't care :-)

Example 2 -- Optimization of Cell Size

- **Goal: Optimize Cell Size**

- **Employed Mechanism: Spectrum Etiquette / Dynamic Power Ctrl.**

- **Criteria:**
  - Vendor A tries to reduce interference
  - Vendor B tries to maximize network coverage

- **What could happen?**

Min. Interference VS. Max. Coverage

APs have adjusted cell size to minimize interference

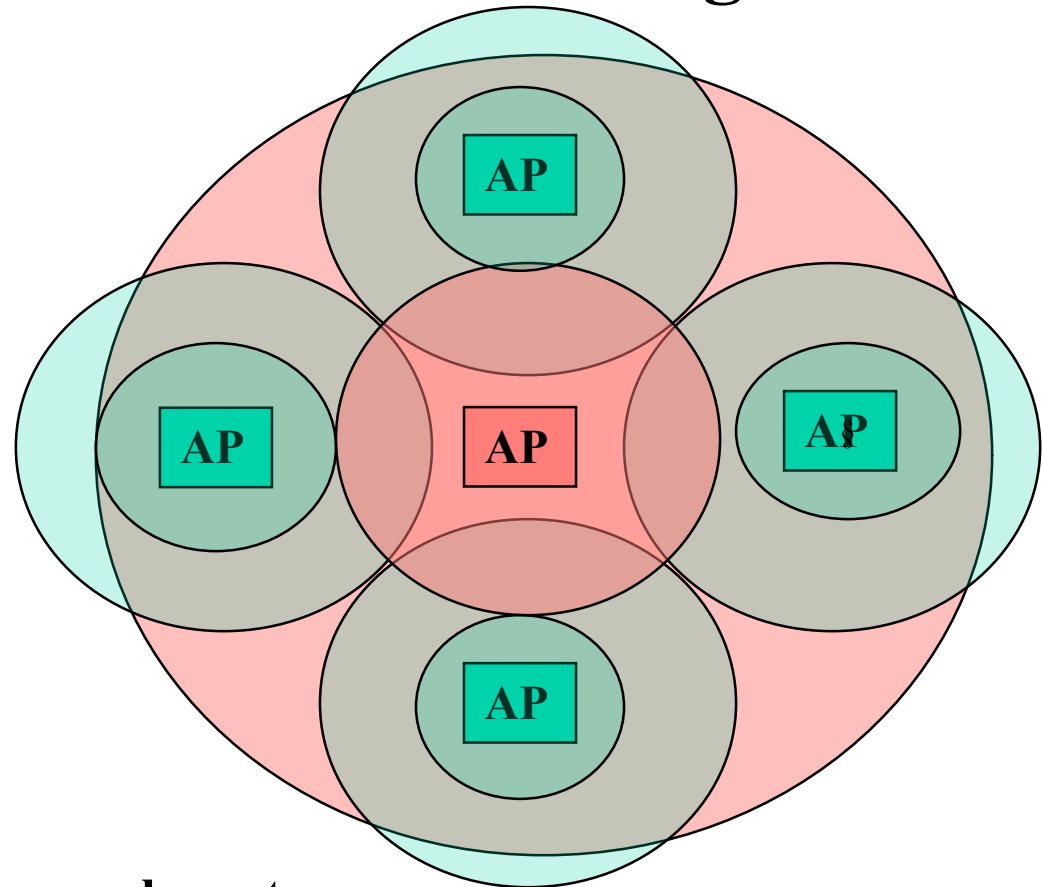**AP joins and maximizes coverage area employing medium Tx power**

APs detect interference and reduce cell size

APs further increases Tx power to ensure contineous coverage

APs detect interference and further reduce cell size

Is this the desired behavior? Maybe, maybe not.

But this will happen regardless of the employed algorithm at each AP.

Solution: Signaling of Optimization Criteria

- **If the optimization criteria (max. coverage or min. interference) was signaled, each AP had some idea on the possible behavior of others.**

- **What could happen?**
  - Vendor specific algorithm does not use this information
    --> nothing gained but also nothing lost (this is what we have)
  - Some vendors use this algorithm:
    - The "green" now knows that they can never reach optimal (zero) interference and may act accordingly.
    - The "red" now knows that others optimize for reduced interference and may change its algorithm or even the optimization criteria.
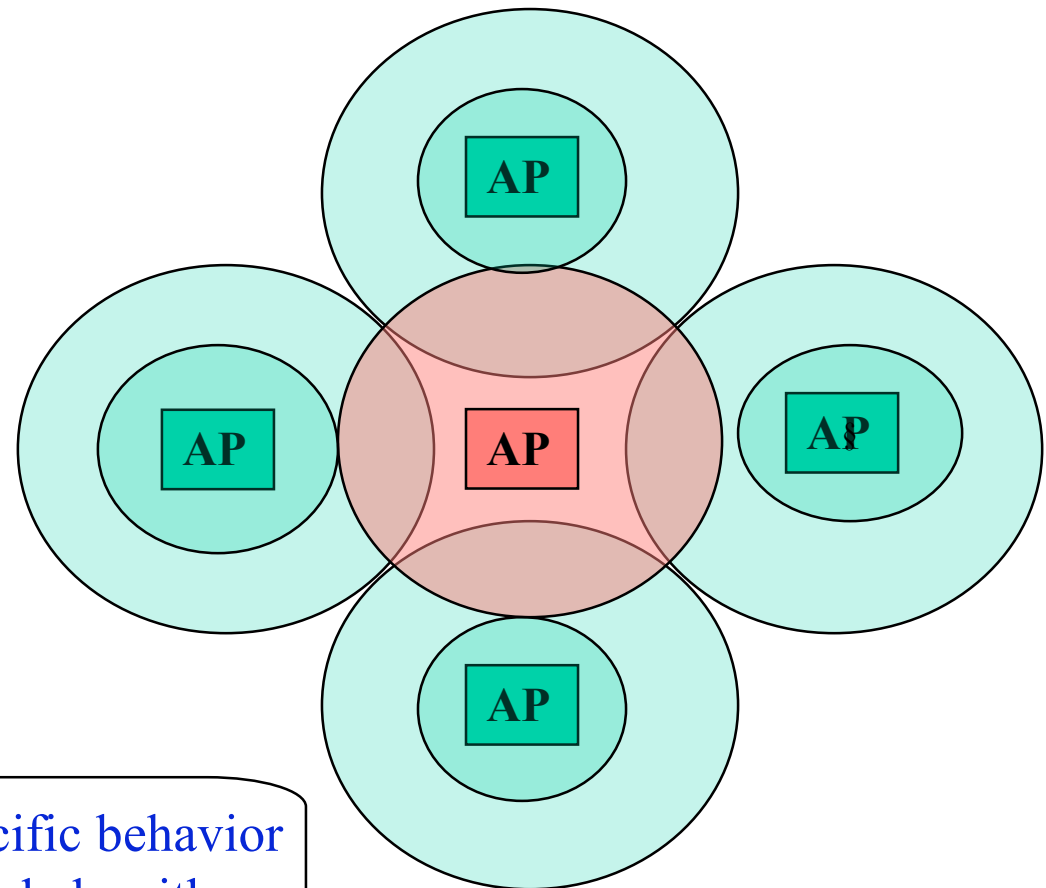
Partial use of knowledge:
Adapt min. interference criteria

APs have adjusted cell size to minimize interference

AP joins and maximizes coverage area employing medium Tx power

APs detect interference but know that the source is an AP optimizing for network coverage

APs might accept a region of interference and a do not decrease cell size

Vendor-specific behavior of employed algorithm

Partial use of knowledge:
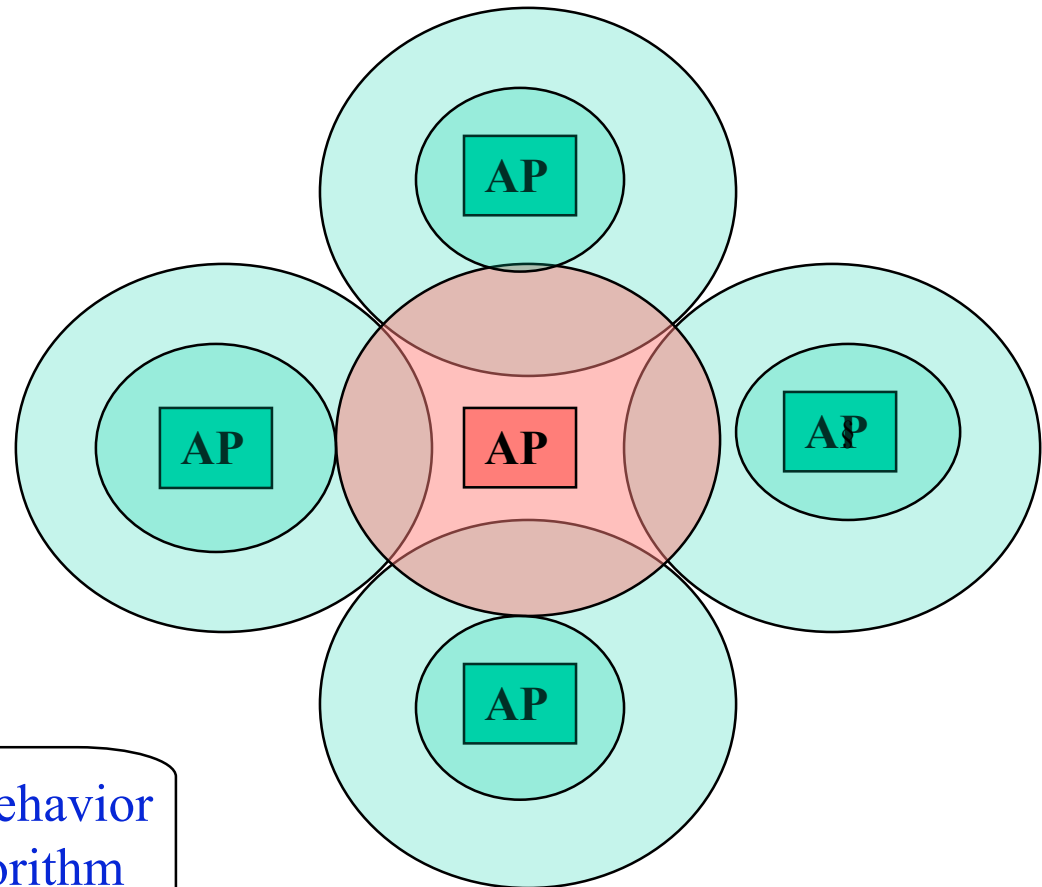# Adapt max. network coverage criteria

APs have adjusted cell size to
minimize interference

AP joins and **maximizes coverage**
area employing medium Tx power

APs detect interference and reduce
cell size

APs do not further increases Tx
power but accept limited coverage

Vendor-specific behavior
of employed algorithm

Agreement on Optimization Criteria

- **All APs have knowledge on the other's behavior and may try to negotiate a common optimization criteria**

    – They do not agree on a common criteria
    --> noting gained but also nothing lost

    – They agree either on interference reduction or coverage optimization

Conclusion

- **Providing only mechanisms for network management may result in unintended network behavior as different vendors might use them for different purposes employing different criteria**

- **Distributing information on these criteria may help to deal with this problem and should be made available using 11v mechanisms**

- **Further improvement: Mechanisms to reach an agreement on a common criteria**

- **Possible TGv objectives that could address this issue:**
  - Client Management Protocol (Req 1500)
  - Access Point Coordination (Req 2050)
  - Advertisement (Req 1300)
  - other ?

Discussion

- **Feasibility to**

  - *announce* how capabilities 11v devices are used, i.e., the "aim" / optimization criteria

  - provide schemes to *negotiate / agree* on common "aim"

- **Possible TGv objectives that could address this issue:**

  - Client Management Protocol (Req 1500)

  - Access Point Coordination (Req 2050)

  - Advertisement (Req 1300)

  - other ?

References

- **P802.11v-D0.03**
- **11-06/827r3**