

Enhancing the Procedure Flow in WirelessMAN-CX Operating Stage

----Methods to Fairly Use Channels in WirelessMAN-CX Operating Stage

Document Number: IEEE S802.16h-07/037r1

Date Submitted: March 05, 2007

Source:

Liwen Chu
liwen.chu@st.com
STMicroelectronics
San Jose, CA, USA

George Vlantis
george.vlantis@st.com
STMicroelectronics
San Jose, CA, USA

Venue: IEEE 802.16 Session #47 Orlando, USA

Base Document: IEEE 80216h-06_D2.pdf

Purpose: Enhance the WirelessMAN-CX operating stage.

Notice:

This document has been prepared to assist IEEE 802.16. It is offered as a basis for discussion and is not binding on the contributing individual(s) or organization(s). The material in this document is subject to change in form and content after further study. The contributor(s) reserve(s) the right to add, amend or withdraw material contained herein.

Release:

The contributor grants a free, irrevocable license to the IEEE to incorporate material contained in this contribution, and any modifications thereof, in the creation of an IEEE Standards publication; to copyright in the IEEE's name any IEEE Standards publication even though it may include portions of this contribution; and at the IEEE's sole discretion to permit others to reproduce in whole or in part the resulting IEEE Standards publication. The contributor also acknowledges and accepts that this contribution may be made public by IEEE 802.16.

IEEE 802.16 Patent Policy:

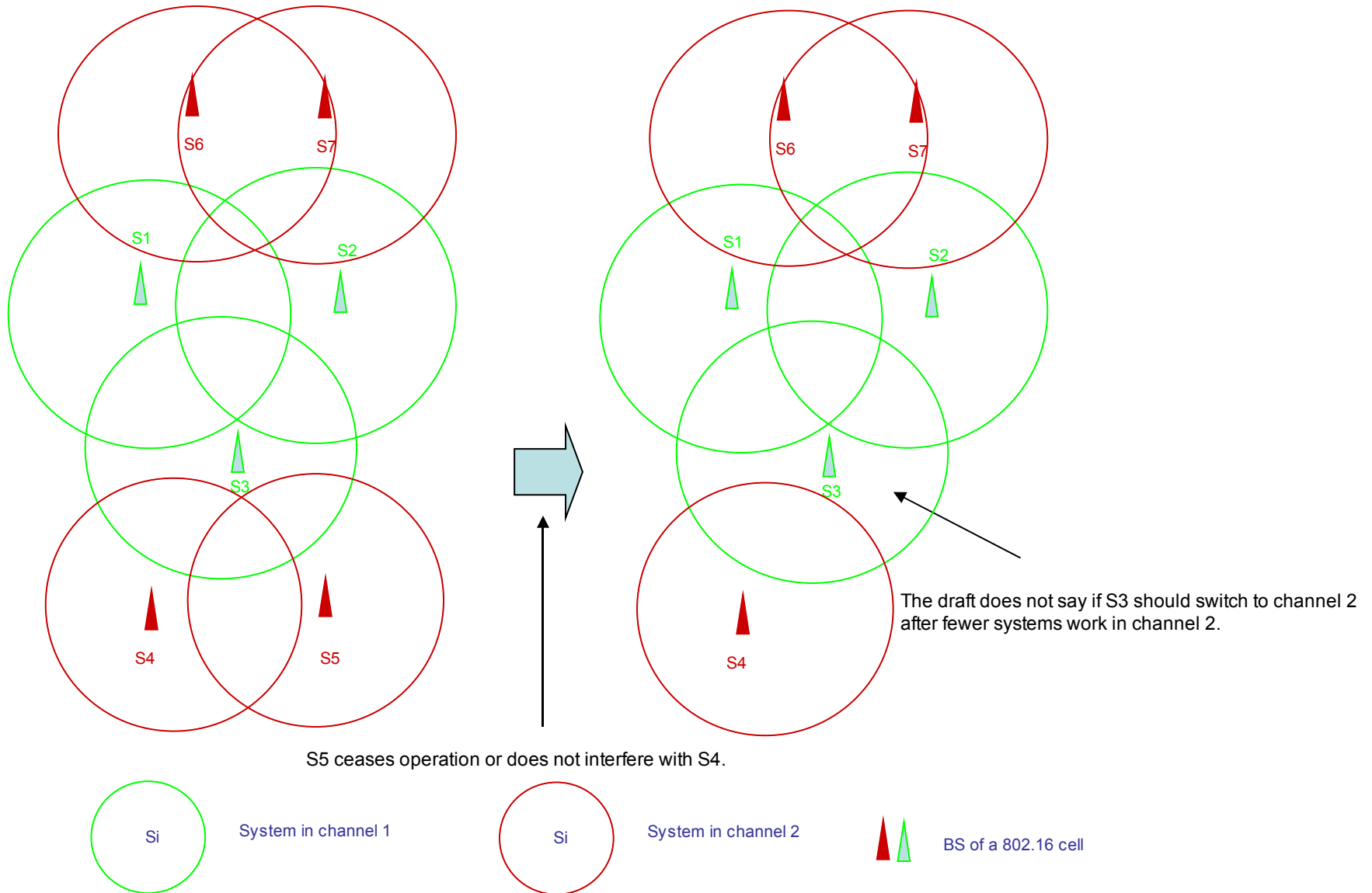
The contributor is familiar with the IEEE 802.16 Patent Policy and Procedures <<http://ieee802.org/16/ipr/patents/policy.html>>, including the statement "IEEE standards may include the known use of patent(s), including patent applications, provided the IEEE receives assurance from the patent holder or applicant with respect to patents essential for compliance with both mandatory and optional portions of the standard." Early disclosure to the Working Group of patent information that might be relevant to the standard is essential to reduce the possibility for delays in the development process and increase the likelihood that the draft publication will be approved for publication. Please notify the Chair <<mailto:chair@wirelessman.org>> as early as possible, in written or electronic form, if patented technology (or technology under patent application) might be incorporated into a draft standard being developed within the IEEE 802.16 Working Group. The Chair will disclose this notification via the IEEE 802.16 web site <<http://ieee802.org/16/ipr/patents/notices>>.

Abstract

802.16h draft [1] defines the procedure of WirelessMAN-CX systems in operating stage. But the procedure in [1] does not describe what should the systems in a congested channel do when they find channels with fewer systems working in them. The procedure in [1] also does not provide the methods to avoid the channel switching collisions and to guarantee the fair channel usage when the systems switch to a new working channel.

Here, we provide the procedure for the systems in a congested channel to switch to a channel with fewer systems working in it. We also propose the priority-based backoff mechanism to solve the switching collision problem and make channel usage more fair when 802.16 systems switch to a new working channel. The key idea is that the systems trying to switch to a new working channel generate backoff periods before the channel switching and the higher priority (smaller backoff period) are given to the systems in more congested channels. So the systems in more congested channels have more chance to switch to a new working channel.

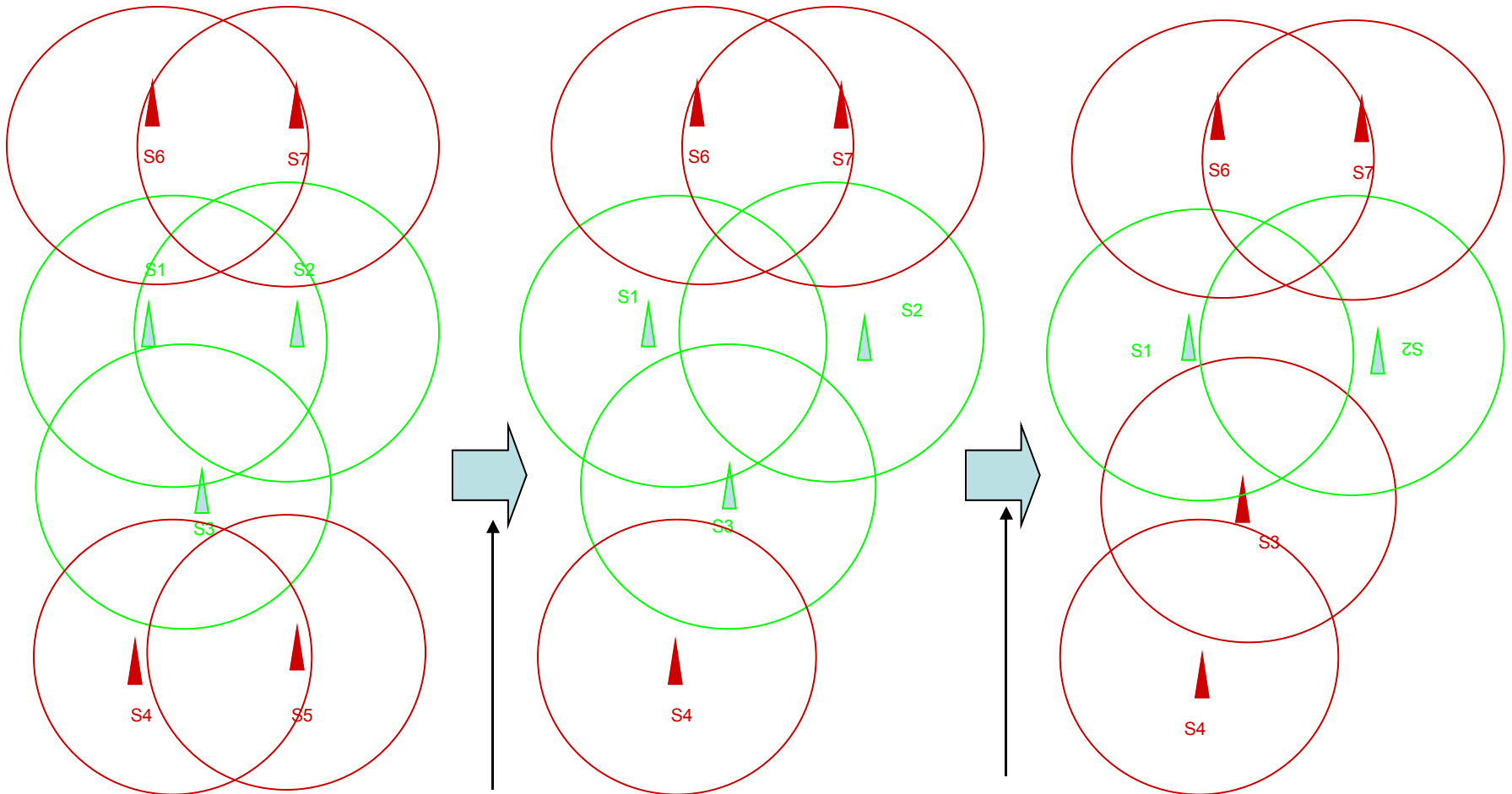
Unfairly Channel Usage Example 1



Solution to Unfairly Channel Usage Example 1

- If , after a system in operating stage finds a channel with fewer systems and switches to it, the new working channel does not become more congested than the original working channel, the system should switch its working channel to the channel with fewer systems.
- The switching system may request its coexistence neighbors to delete it from their coexistence neighbor list by using CXP message. The switching system shall also negotiate with the systems working in the new working channel about the new frame structure, OCSI. The switching system may also update its neighbors with its new working channel, OCSI after it joins the new community.

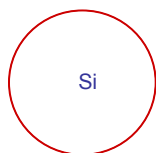
Solution to Unfairly Channel Usage Example 1



S5 ceases operation or does not interfere with S4. S3 switches to a channel 2 since fewer systems work in channel 2.



System in channel 1

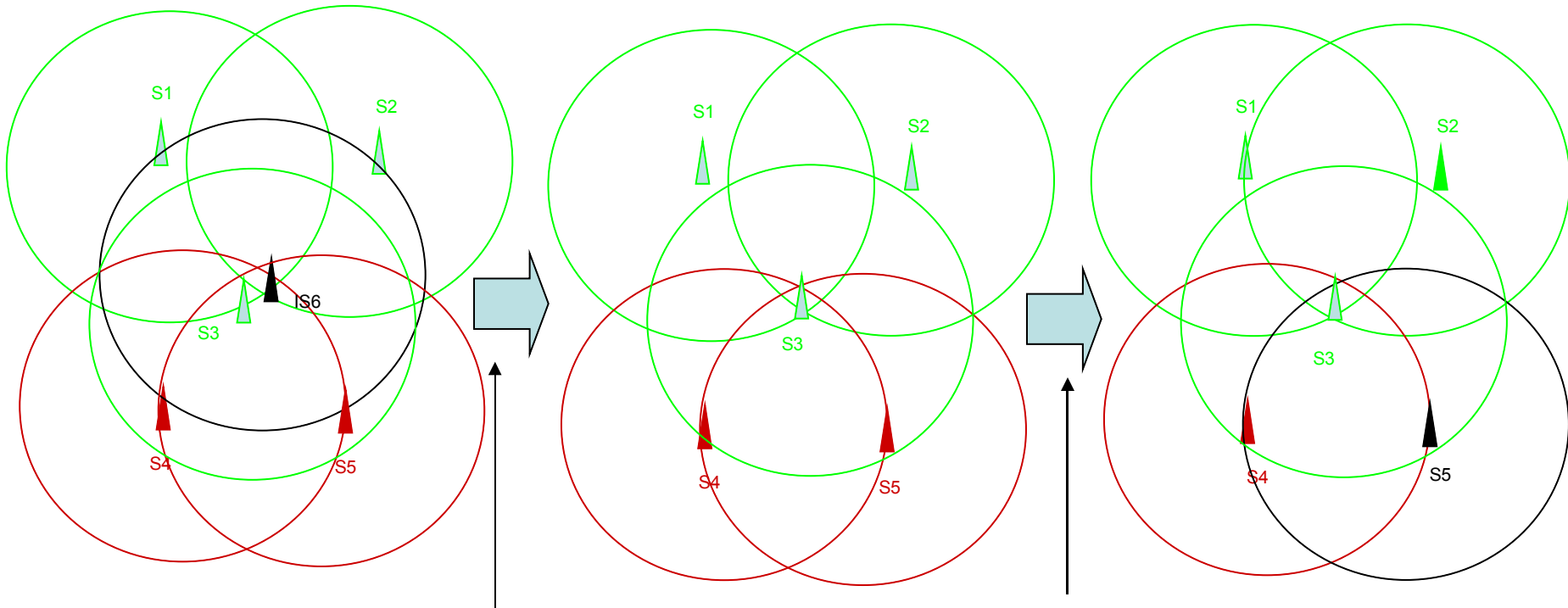


System in channel 2



BS of a 802.16 cell

Unfairly Channel Usage Example 2

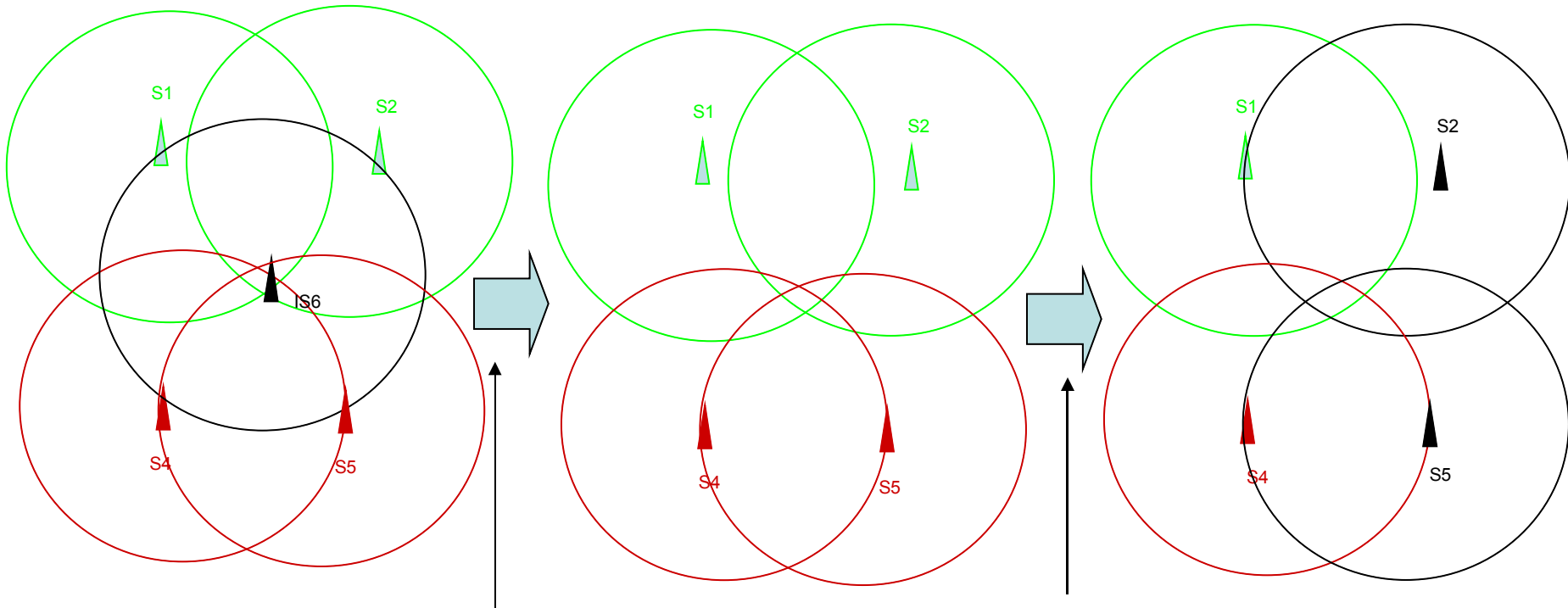


Incumbent user 6 ceases operation or does not interfere with 16 systems.

All the systems have the same priorities to switch to channel 2 and S5 wins. Channel 1 is still a congested channel and another channel switching may be required.

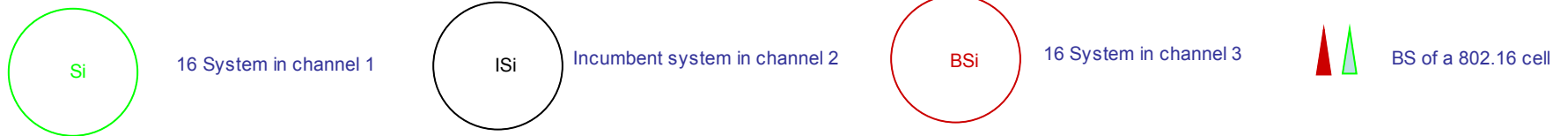


Unnecessary Multiple Channel Switching Example



Incumbent user 3 ceases operation or does not interfere with 16 systems.

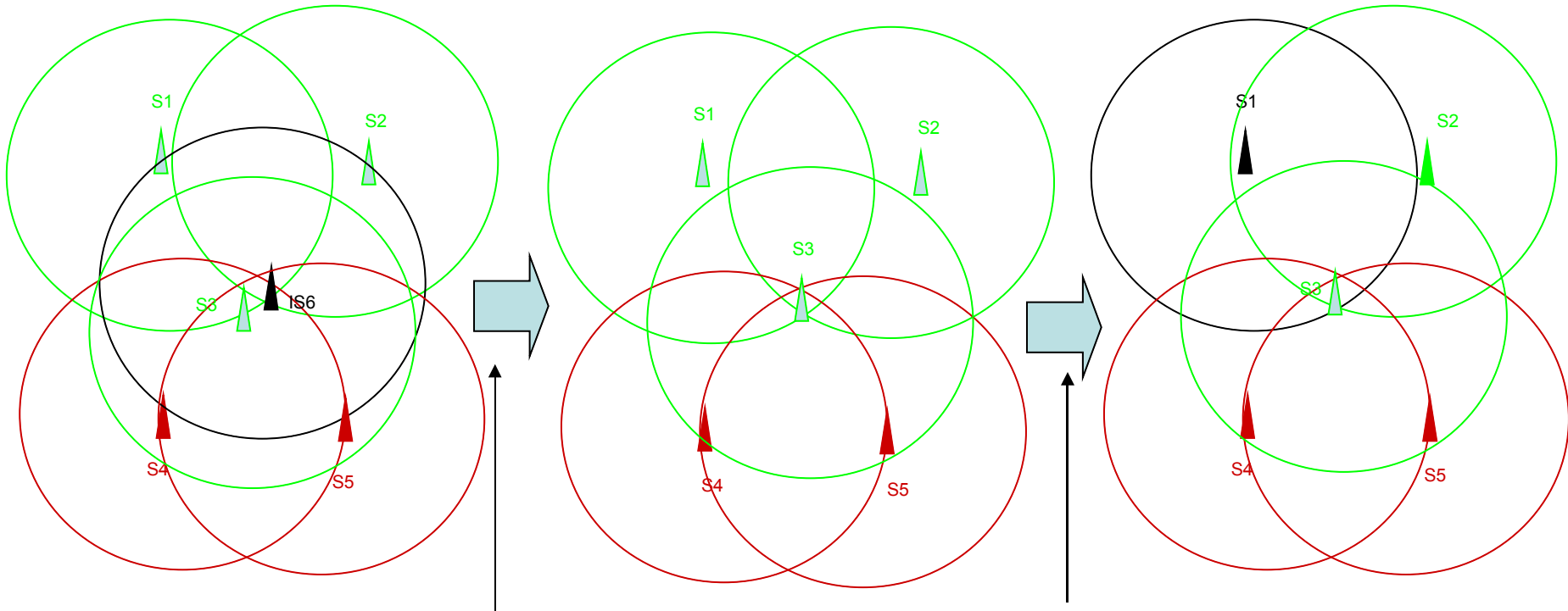
S2 and S5 try to switch to idle channel 2 at the same time.



Solution to Unfairly Channel Usage Example 2 and Unnecessary Multiple Channel Switching

- The higher priorities (smaller backoff periods) are given to the systems in more congested channels. The Systems with 3 (maximal value) overlapping neighbors working in the same channel has the smaller backoff window. The Systems with 2 overlapping neighbors working in the same channel has the larger backoff window. The systems trying to switch to a new channel select a random numbers from the backoff windows.
- A BS will generate a backoff period before it tries to switch its working channel to an idle channel or a channel with fewer systems working in it.
- During the backoff procedure, the BS and its associated Ss shall allocate more resource to measure the channel that it tries to switch to. In case another BS switch to that channel, the BS shall stop the backoff procedure. If the channel is still a sparsely used channel, the BS may start another backoff procedure or keep stay in the original working channel.

Solution to Unfairly Channel Usage Example 2

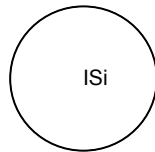


Incumbent user 6 ceases operation or does not interfere with 16 systems.

Congested systems have high priority to switch to channel 2. S1 win the switching procedure.



16 System in channel 1



Incumbent system in channel 2

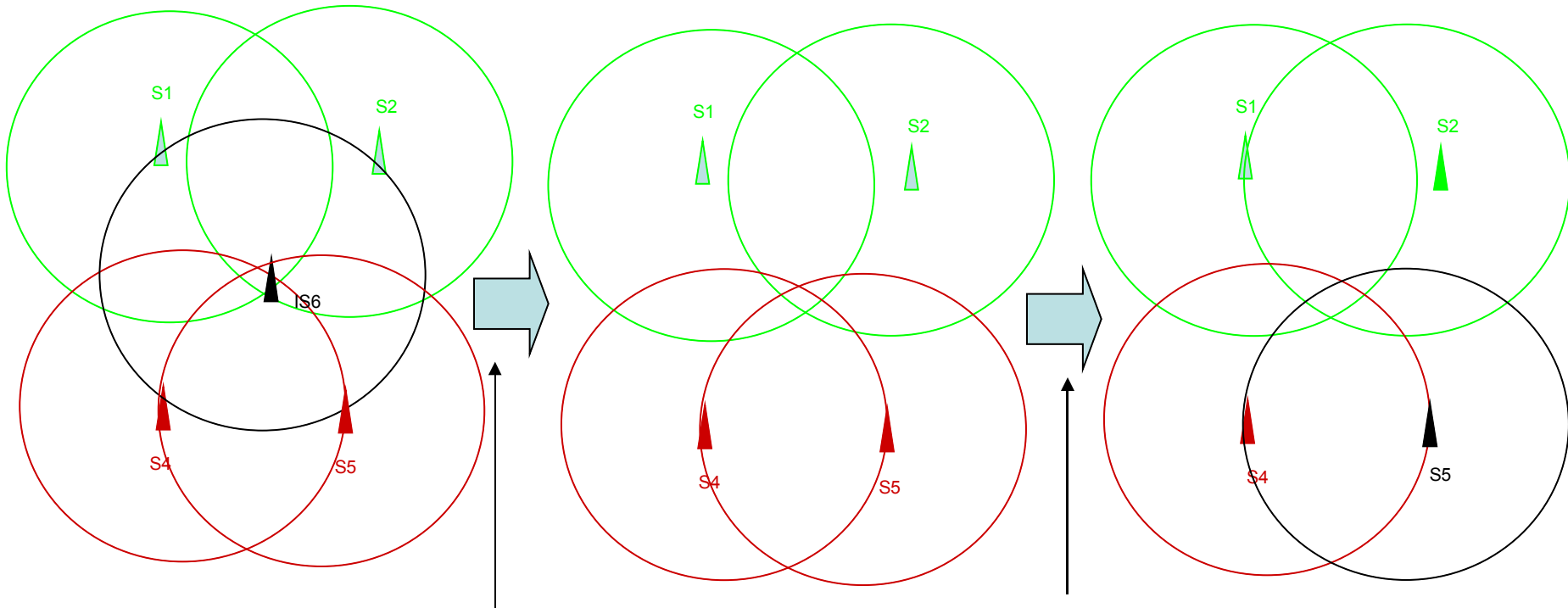


16 System in channel 3



BS of a 802.16 cell

Solution to Unnecessary Multiple Channel Switching Example

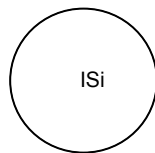


Incumbent user 3 ceases operation or does not interfere with 16 systems.

Before switching the working channel, 16 systems go through backoff procedures. S5 first finish the backoff procedure and switch to channel2



16 System in channel 1



Incumbent system in channel 2



16 System in channel 3



BS of a 802.16 cell

Reference

- [1] Draft in progress, Part 16: Air Interface for Fixed and Mobile Broadband Wireless Access Systems----Amendment for Improved Coexistence Mechanisms for License-Exempt Operation, 80216h-06_D2.pdf