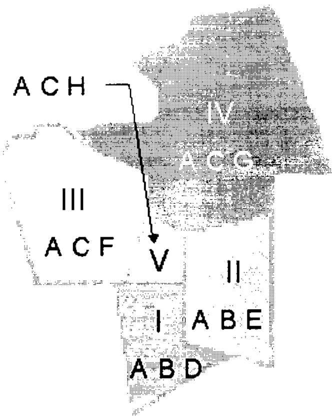

Services	Bandwidths
A	3
B	3
C	5
D	7
E	4
F	2
G	1
H	2
Ensemble size: 9	

Figure 1: Ensemble planning problem.

different ensembles on the same frequency block). For our example, we assume that only adjacent areas (such as I and V, or II and IV, but not I and IV) interfere.

Now our task is (1) to arrange the services into a collection of ensembles for each area (we call this an *ensemble assignment*), and (2) to assign channels to the resulting ensembles without introducing interferences (called a *block assignment*). We want to do this in such a manner that:

- the total bandwidth of each ensemble does not exceed the maximum ensemble size;
- for each service to be supplied in a given area, that area has an ensemble containing that service.

And, of course, we want the number of required frequency blocks to be as small as possible. (This is the hard part.)

Two different solutions for our sample planning problem are shown in Figure 2. The first solution (on the left-hand side) is fairly straightforward: we simply pack the services required for each area into a minimum number of ensembles. We call such an assignment, which supplies each area *exactly* with the requested services, a *strict* ensemble assignment. It is easy to see that this solution requires five frequency blocks in order to avoid interference, and in fact one can show that in this example *each* strict ensemble assignment needs at least five frequencies.

It is possible to do better than this, but only if we allow a certain degree of "over-supply" as shown in the second solution. Here, we packed the *entire* service collection into three different ensembles, which can then be transmitted using three frequency blocks. It can be shown that this solution is indeed optimal, i.e., two frequencies are not sufficient to realize the given requirements.

Thus we see that in DAB networks it is possible to *save frequencies through over-supply.* This sounds paradoxical at first, but of course it is an immediate consequence of the SFN