CLAIMS

.1 – Method for determining the configuration of a set of nodes Ni and/or links grouped together within a cluster (10i) possessing a cluster head, CHk, with the cluster there being associated a constraint value to be satisfied and radio resources, the method is characterized in that it comprises at least the following steps:

a) given a set of operating channels, triggering an information request (202) by interrogating one or more nodes Ni or links and asking the said nodes or the said links to evaluate for each communication channel an index $I_i[c]$ of communication quality for a node or a link between two nodes of the cluster (203), and then selecting a configuration (204) when the cluster head has received the indices of communication quality of the interrogated nodes or links,

b) the cluster head verifies whether the indices of quality received comply with a given constraint for the cluster, and retains the indices which satisfy the largest number of nodes Ni or links and triggers a configuration selection procedure (204),

c) if the configuration retained satisfies the set of nodes Ni or links interrogated, then the cluster head will update (206) the list c of communication channels and will communicate (207) this configuration for the nodes or links of the cluster,

d) if not, then the cluster head will either update (211) the list of communication channels, or remain in the initial configuration of the set of nodes or links,

e) the information request (202) is triggered on receipt of an alarm (201) at the level of the cluster head expressing a number of nodes or links of the cluster that are not satisfied (220) by the chosen configuration,

f) a node or link counts up the number of times that the measured index of quality does not make it possible to satisfy the required constraint and

transmits an alarm value to the cluster head if the value of the constraint is not satisfied a given number n_a times.

2 – Method according to Claim 1, characterized in that when the cluster head does not find any suitable configuration, d), then, it verifies whether there exists another configuration from among several configuration subsets that are predefined, by testing the subsets according to a given order of priority.

3 – Method according to Claim 1, characterized in that the information request (202) is triggered by an off-alarm triggering procedure (231) by drawing a random value A uniformly distributed between two values [0, 1] and if the value A is less than a given probability value, then the information request procedure is triggered.

4 - Method according to Claim 1, characterized in that the information request (202) is triggered using a deterministic mode in which a probability variation law, associated with the information request triggering, is defined for the cluster k.

5 – Method according to Claim 4, characterized in that a variation law is used where $\pi_k(t)=1$ at determined instants and $\pi_k(t)=0$ otherwise with $\pi_k(t)$ the probability of triggering an information request procedure for the cluster k.

6 – Method according to one of the preceding claims, characterized in that the cluster head asks the nodes or links to transmit to it the gain/noise plus interference power ratios Q_m^s for all the possible channels m of the pre-established list:

$$Q_m^k = (Q_m^k(1), Q_m^k(2), \ldots, Q_m^k(F)),$$

where each element of the vector is defined as:

$$Q_m^k(s) = \frac{G^s(m,m)}{\sigma^2 + MAI_{m,s}}$$

$G^s(m,m)$ represents the gain in power of the channel of the link m belonging to the cluster k, for the channel s, and $MAI_{m,s}$ the multiple access interference, defined as

$$MAI_{m,s} = \sum_{h \in K \setminus k} 1\{C_h = s\} \left(\sum_{l \in N_h} P_h G^s(l,m) \right).$$

where $G^s(l,m)$ represents the gain in power of the channel between the sender of the link l and the receiver of the link and $1\{.\}$ corresponds to a standard indicator function,

on the basis of the vectors received Q_m^k, the cluster head organizes the vectors received Q_m^k in a matrix G, $G(\ell, f)$ indicates the element in the ℓ-th row (link) and the f-th column (channel) of the matrix, the element is equal to the f-th element of the vector Q_ℓ^k:

$$G = \begin{bmatrix} Q_1^k(1) & Q_1^k(2) & \dots & Q_1^k(F) \\ Q_2^k(1) & \dots & & \\ \dots & & \dots & \\ Q_{L_k}^k(1) & & & Q_{L_k}^k(F) \end{bmatrix}$$

afterwards, it evaluates the maximum number of links which is suitable for satisfying the quality of service,

$$L_{MAX} = \max_f \sum_\ell 1\{P_{MAX} G(\ell, f) \geq \Gamma_\ell\}.$$

the matrix G' is thereafter constructed by zeroing all the columns of G where

$$\sum_\ell 1\{P_{MAX} G(\ell, f) \geq \Gamma_\ell\} < L_{MAX},$$

the cluster head thereafter chooses a particular value f* as a function of the needs of the network as well as the configuration c_ℓ for each link ℓ on the basis of the matrix $G(\ell, f^*)$.

7 – Method according to Claim 6, characterized in that the cluster head uses a min-max criterion, it selects the minimum value of the link ℓ^* and the channel f* by using the expression:

$$\begin{cases} \ell^* = \arg\min_{\ell} \left\{ \dfrac{G'(\ell, f)}{\Gamma_\ell} \text{ such as } \dfrac{P_{MAX}\, G'(\ell, f)}{\Gamma_\ell} \geq 1 \right\} \\ f^* = \arg\max_{f} \dfrac{G'(\ell^*, f)}{\Gamma_{\ell^*}} \end{cases},$$

and then the cluster head allots each link a power for the communication:

$$P_\ell = \left\lceil \frac{\Gamma_\ell}{G'(\ell, f^*)} \right\rceil,$$

where the quantization operator $\lceil . \rceil$ gives the smallest quantized value of power greater than $\Gamma_\ell / (G'(\ell, f^*))$.

8 – Method according to Claim 6 or 7, characterized in that the links ℓ such that $P_{MAX} G'(\ell, f^*) < \Gamma_\ell$, are set to zero by allotting them a zero power $P_\ell = 0$.

9– Method according to one of Claims 1 to 8, characterized in that the constraint to be satisfied is a quality of service.

10 – Method according to one of Claims 1 to 9, for the configuration of nodes or links in an ad-hoc mobile network.