INTERVAL EVALUATION OF THE SURVIVAL RATE OF THE COMPUTER NETWORK ON THE BASIS OF HIGHLY MOBILE UNITS WITH NORMAL DISTRIBUTION OF WORK

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The main reason for the decrease in the survivability of the computer network during its operation is the wear and aging of components. Wear leads to disability (due to deteriorating operating conditions), failure of components, etc. Aging leads to a change in bandwidth, which leads to node failures due to a large number of errors or network failure in general.

In the conditions of improvement of technological base for creation of difficult swarm flying computer networks, the question of an estimation of an interval indicator of survivability of such networks is actual. [1]. This indicator is complex and time-consuming to calculate [2].

This work is devoted to determining this indicator under the condition of normal distribution of network nodes. In the theory of reliability the normal distribution describes the operating time for failure of objects due to their wear and aging.

As a reference model, take the results of the study [3]. Assume that the failure time ς_i of each highly mobile node of the computer network is subject to normal distribution with unknown parameters T_i and σ_i $(i = 1,...,m)$, and refusals are independent. In addition, we introduce the condition that $T_i \geq 3\sigma_i$, therefore the probability of the event $\varsigma_i < 0$ can be taken as zero. Then the probability of network operation over time t_0:

$$P(t_0)=\prod_{i=1}^{m}\Xi^{\ell_i}(h_i),$$

where $h_i=\dfrac{T_i-t_0}{\sigma_i}$; $\Xi(z)=\dfrac{1}{(2\pi)^{0,5}}\int\limits_{-\infty}^{z}e^{\frac{-t^2}{2}}dt$ – Laplace function.

Next, in order to simplify the expression, we present $\ell_i=1$. Now the problem can be formulated in the following form: it is necessary to define ξ-confidence lower limit P for probability $P=P(t_0)$ according to the results of tests of network nodes according to the plan $\left[\Theta\overline{U}\Theta\right]$, $i=1,\ldots,m.$

Denote by ς_{ij} operating time before the *j*-th failure of the network node *i*-th type, $j=1,\ldots,N_i$. Then point estimates for the parameters h_i have the form:

$$\hat{h}_i=\frac{(\hat{T}_i-t_i)}{S_i},$$

where $\hat{T}_i=\dfrac{1}{N_i}\sum_{j=1}^{N_i}\varsigma_{ij}$; $S_i^2=\dfrac{1}{N_i-1}\sum_{j=1}^{N_i}\left(\varsigma_{ij}-\hat{T}_i\right)^2$.

According to the values found $\hat{h}_i$ determined sequentially:

- $\hat{h}_0=\min\limits_i\hat{h}_1$; $\hat{P}_0=\min\limits_i\Xi\left(\hat{h}_1\right)$, using normal distribution tables [];
- quantile $h\left(\hat{P}_0^N\right)=h_0$ normal level distribution $\hat{P}_0^N$ [4];
- lower confidence limit $\underline{\delta}\left(N,h_0,1-\xi\right)$ for the non-centrality parameter δ non-central distribution of Student's home values $N=\min N_i$, h_0, ξ.

Size $\underline{P}$ calculated by the formula:

$$\underline{P}=\Xi\left(\frac{\underline{\delta}}{\sqrt{N}}\right).$$

A higher level of accuracy is provided by a simpler formula that does not require the use of Student's non-central distribution tables:

$$\underline{P}\simeq\Xi\left(h_0-\Theta_\xi\left(N-1\right)^{-\frac{1}{2}}\left(1+\frac{h_0^2}{2}\right)^{\frac{1}{2}}\right),$$

where Θ_ξ – quantile of normal distribution.

Thus, according to the results of the study, a mathematical form of the indicator of the interval estimation of the survivability of the computer network on the basis of highly mobile nodes with a normal distribution of operating time. The defined indicator can be used in specialized computer networks, the nodes of which have a limited time of operation due to their wear and aging, for example: s-bot, FANET, as well as the concept of "smart dust" [5].

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