**ROUTING SPACE SIZE ESTIMATION FOR RECONFIGURABLE OPTICAL NETWORKS**

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**ABSTRACT**

We propose a heuristic method. The aim is to find a reasonable estimation of \( K_{\text{MAX}} \). This parameter represents the number of lightpath per node pairs to be used in the routing algorithm.

**MOTIVATIONS**

In the routing and wavelength allocation (RWA) process, usually, a \( k \) shortest path algorithm is used. The choice of the maximum value of \( k \) \((K_{\text{MAX}})\) is crucial for the RWA algorithm performance. A too small value enhances the frequency of blocking events. A too large value slows down the RWA process.

**METHODOLOGY**

**INPUT:**
- Network topology
- The connectivity matrix \( CM \)
- The percentile of allocated LP: \( \alpha \)

**ALGORITHM:**
1. Compute the routing space using the \( k \) shortest path algorithm: \( LP^k_{\text{SD}} \)
2. Sort the \( LP^k_{\text{SD}} \) based on a priority principle
3. Allocate the \( CM \) following the order
4. Evaluate the CDF: \( F_k(k) \) of allocated \( LP^k_{\text{SD}} \)
5. Compute: \( K_{\text{MAX}} = F_k^{-1}(\alpha) \)

**PRIORITY TO:**
- Higher Number of hops: \( m_i = \sum_{i \in \text{E}} 1 \)
- LP with link with higher occurrence
- Higher total occurrence: \( m_{\text{total}} = \sum_{i \in \text{E}} O(l) \)

**TEST:**

The SNAP\(^{[1][2]} \) is run with several \( K_{\text{MAX}} \) and the blocking ratio \( B_R \) is computed.

\[
B_R = \frac{\text{number of blocking events}}{\text{number of requests}}
\]

With the growth of \( K_{\text{MAX}} \), the \( B_R \) saturates. Thus, if \( K_{\text{MAX}} \) is in the saturation region, the results don't enhance the frequency of the blocking events and results are good.

**RESULTS**

- We used the 17-nodes and 26-link German backbone network
- \( CM = N (1 - I_{17}) \), \( N=2, 3, 4, 5 \)
- \( \alpha = 95\%, 99\% \) and \( 100\% \)

**K-MAX ESTIMATION**

The CDFs and \( K_{\text{MAX}} \) are computed.

\( K_{\text{MAX}} \) results to be:

- \( 1 \) (95%), \( 2 \) (99%), \( 3 \) (100%) for \( N=2 \)
- \( 4 \) (95%), \( 8 \) (99%), \( 25-40 \) (100%) for \( N=3 \)
- \( 6 \) (95%), \( 18-25 \) (99%), \( 37-45 \) (100%) for \( N=4,5 \)

**TEST OF RESULTS**

The SNAP is used to validate the results. It is run with the \( CM \) matrices and several values of \( K_{\text{MAX}} \).

It can be observed that for:
- \( N=2,3 \): 99% and 100% are more confident
- \( N=4,5 \): all the percentiles provide reliable results

**CONCLUSION**

- A finer analysis based on randomly generated networks to refine \( \alpha \) and find the better priority principle
- Using the algorithm to study the variation of \( K_{\text{MAX}} \) in function of the network parameters

**BIBLIOGRAPHY**