

STUDY ON GRAPH THEORY AND APPLICATION IN NETWORK SECURITY

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Abstract: Graph theory has become a very critical component in many application in the computing field including networking and security. It is also amongst the most complex topics to understand and applied. We review some of the key application of graph theory in network security. Some algorithm aspects, then present network coding and its relation to routing. In order to improve the safety of network the graph theory and neural network are combined to have safety analysis for the network security. In this graph theory the simple algorithm is designed and finally the case study was carried out to verify the effective of this method.

Keywords: Network Security, Network Coding, Four-color theorem.

I.INTRODUCTION

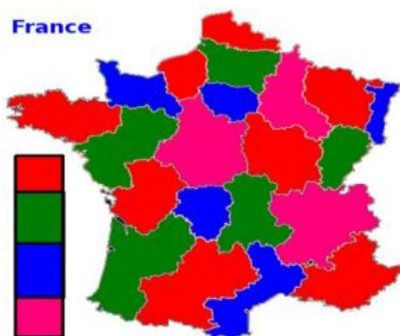
Rapid growth in global mobile communication networks demands new solution for existing problems. Such problems include reduced bandwidth in mobile device and the constant change in their associated network topologies. This creates a need for network algorithms with

- Least possible communication traffic.
- High speed execution.

In this paper we explore applications of graph theory in cellular networks with an emphasis on the ‘four-color’ theorem and network coding and their relevant application in wireless mobile networks.

II.GRAPH THEORY MODELS IN SECURITY

Graph Theory: A graph is a simple geometric structure made up of vertices and lines. The line may be directed arcs or undirected edges, each linking a pair of vertices. Graph theory as applied to mapping has proved to be useful in planning wireless communication networks.



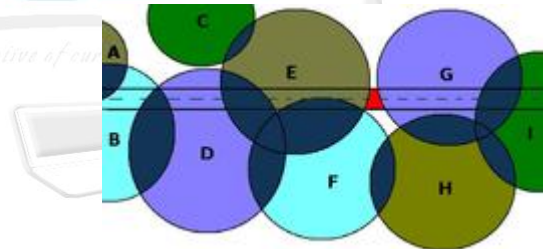
The four-color graph theorem: The famous four-color theorem states that for any map, such as that of the contiguous provinces of France below, one needs only up to four colors to color them such that no two adjacent provinces of a common boundary has the same color. Mathematicians have been able to prove that this applies for all maps irrespective of the boarder or surface shape.

Applying of the Four-color Theorem in wireless a cell tower placement plan: -

Consider the cell tower placement map shown above, each cell tower broadcast channel is likened to a color, and channel-colors are limited to four.

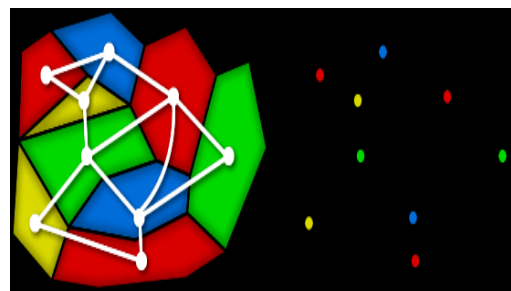
Two challenges:

- Elimination of two non- coverage spots.
- Allocation of a different channel in the sports where the channel overlap occurs. In analogy, colors must be different, so that cell phone signals are handed of to a different channel.



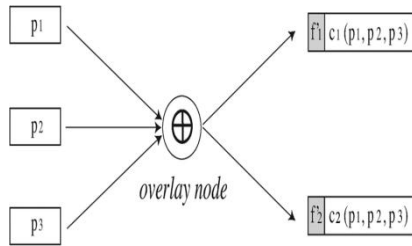
Node coloring theorem:

As can be seen in the map below, borders wander making it a different problem to analyse a map. Instead of using a sophisticated map with many wandering boundaries, it become a simpler problem if we use node coloring. If two nodes are connected by a line, then they can't be same color. Wireless service providers employee node coloring to make an extremely complex network map much more manageable.



Network coding:

Network coding is another technique where graph theory finds applications in mobile communication network. In traditional network, nodes can only replicate or forward incoming packets.



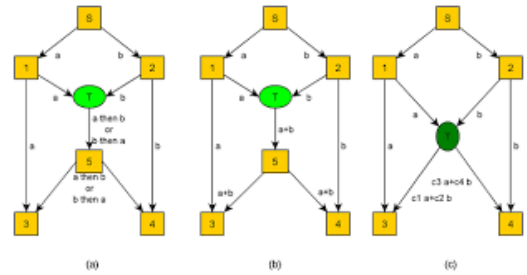
Wireless multi-hop networks: -

- Wireless mesh networks.
- Wireless sensor networks.
- Mobile ad-hoc network.
- Cellular relay network.

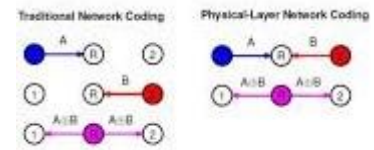
Peer-to-peer file distribution: -

- Peer-to-peer streaming.
- Distributed storage.

- That all links have a unique capacity of a single packet per time slot.
- That the links be directed such that traffic can only flow in one direction.



Applications in physical layer network: -



The challenge is inferring w_1, w_2 from the observed signal

$$Y = h_1x_1 + h_2x_2 + z$$

$$h_1 = h_2 = 1$$

This one requires phase synchronization and power control.

III.CONCLUSION

It was shown that in the graph theory, as far as the four-color theorem and network coding are concerned, can help provide significant throughput benefits for

- Wireless multi hop network.
- Content distribution scenario.

Other benefits are

- Time, resource and energy saving simplified operation.

IV.REFERENCE

[1]. <https://arxiv.org/pdf/1511.04785>
 [2]. <https://arxiv.org > cs>
 [3]. ijet.com/wp-content/uploads/2013/07/21.pdf.

Application of network coding in a content distribution scenario: -

- The network is a multi-cast system where all destinations wish to receive similar information from the source.