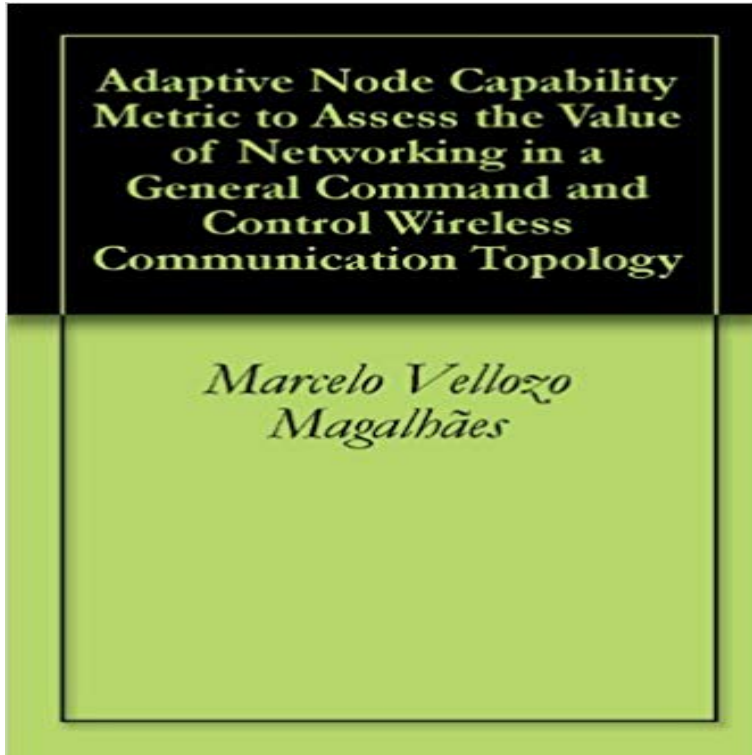


# Adaptive Node Capability Metric to Assess the Value of Networking in a General Command and Control Wireless Communication Topology



In order to quantify any nodes capacity to support optimal information flow within a distributed command and control network, a novel node capability value calculation is developed from first principles. The expression for the node capability value is developed using three fundamental building blocks: data throughput, bandwidth efficiency, and the link margin. The data throughput depends on the average packet arrival rate, the probability of not dropping a packet and the probability of correct receiving a packet at the queue. The bandwidth efficiency depends on the node data rate and the transmission bandwidth, while the link margin is a function of the received and required energy per bit to noise power density. The generalized connectivity integrates the computed node capability value by considering all the distributed network connections scaled by their route length and estimating the characteristic tempo, which is the maximum information exchange rate. The generalized connectivity results reflect the amount and quality of detectable information that the nodes can process and transmit about the network. The results also show how the power and bandwidth efficiency of any specific node compares the power and bandwidth efficiency of all the other nodes. A four-node dynamic scenario is simulated and used to numerically evaluate the expression for the node capability value. Command and control tradeoff issues facing battlespace managers and decision makers are examined by including the networks characteristic tempo into a single observe, orient, decide and act (OODA loop). Also, included in the OODA loop, are action tempos and the command and control speed. Consideration of the influence of three classic Sheridan levels of automation on decision making are used to model the operational impacts via three action tempo tiers: high, medium, and

low-action. Input command and control information rates produced the strongest observed influences on aggregate network simulation outputs.

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