

A Geometry of Networks

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Abstract. This presentation will describe a coordinate geometry of networks and its applications to mobility, security, overlays and traffic management. Given a network graph, one can construct an abstract group and associate elements of the group with graph nodes to provide “coordinates”. Much like Cartesian coordinates, a route may be simply computed from the coordinates of the source and destination. Given a metric of link “length” (e.g., delay, utilization), one may easily select shortest-distance routes. Furthermore, this route selection may vary for each source-destination stream, or even for each packet. For example, unlike current networks, one may pursue dispersion-routing where a stream of packets is routed over multiple paths to load-balance traffic. The coordinates geometry admits dynamic topology changes and may thus be used to support various forms of mobility, including mobile ad-hoc networks, or dynamic deployment of virtual-machines through cloud infrastructures. A given network may admit multiple independent geometry overlays. Each such overlay can serve as a VPN to protect access to respective nodes. Finally, geometry overlays may be flexibly layered over each other, permitting simple scalability, applications-specific-networks and flexible private networks.