**A New Algorithm for the Convex Hull Problem**

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*Friday, June 7 2013*

This concept of operations details a “Divide and Defend” Firewall. Recently there has been a surge of malware attacks, those attacks typically being orchestrated through botnets. Modern enterprise and personal firewalls are not designed by default to handle massive number of attacks at once like botnets can incur. D&D is designed with that very thought in mind.

# introduction,

As of right now, the best time we have for the best algorithm to solve the convex hull problem is O(nh) for the Gift Wrapping Algorithm and O(nlogn) for the rest of the viable algorithms. I would like to present an algorithm ARC that solves the Convex Hull Problem in O(n-1) = O(n) computation time.

# ARC

The algorithm begins with deciding four points of the set of points to be the extrema, then using them to define quadrants. The topmost and bottommost point is used to separate the left and right halves, and the leftmost and rightmost points are used to divide the plane into top and bottom. The algorithm begins by connecting the top middle point (the first point) to the next point to the right and finally the third point to the right in an arc. The tangent is taken of the first point. If the arc is concave down we move on to the next point, so we have the second point, the third point, and the fourth point. If the tangent is wrong (not concave down), the middle point of the arc is removed and now we take the first point, the third point and fourth point. We continue this. If the first test failed, we now are testing one, three, and four. If the tangent test fails (wrong concavity), we remove point three. If the tangent passes, we continue on. We continue on with this. We shift points and move from one set of three points to the next, moving one point at a time, testing the arc of the three points with the tangent function. If the tangent fails we remove the middle point and continue on.

We started in the uppermost right quadrant.

Nothing really changes from quadrant to quadrant except the acceptable concavity for tan.

Below the right most point and to the right of the bottommost point the tan concavity has to be concave up to be an accepted point.

Below the left most point and to the left of the bottommost point the tan concavity has to be concave up to be an accepted point.

To the left of the topmost point and above the leftmost point (upper left quadrant) the tangent must be concave down as well as the one we started with (upper right quadrant), to the right of the topmost point and above the rightmost point.

# DIAGRAMS



Points to surround with Convex Hull



Failed concavity test on first arc





Removed middle node



Continuing around to the bottom (concave up)

Still at bottom (concave down)





Reached top half again, concave down



Node causes concave up in top, remove.







Convex Hull Found