# A BIO-ECO-GEOGRAPHICAL GEOMETRICAL APPROACH TO ENHANCE DATA CENTER COOLING

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## Abstract

*Servers in cloud data centers or edge data centers (edge nodes) require energy for cooling and use fans to transfer heat to the data center cooling environment. However, the intensive use of fans increases energy consumption and is susceptible to faults. This makes it challenging for underwater servers and stratospheric servers to maximally benefit from natural cooling mechanisms. The use of underwater servers finds appeal because cloud data centers sited in the ocean can leverage on free cooling due to the low temperature in the ocean's depths. This reduces cooling costs and also improves the power usage effectiveness. In a similar manner, siting data centers in the stratosphere reduces cooling costs and enhances the power usage effectiveness. This is because they can leverage on free stratospheric cooling. This paper addresses the challenge of ensuring that underwater and stratospheric servers can maximally benefit from natural cooling mechanisms. It proposes intelligent four dimensional (4D) adaptive surface area to volume ratio technology. Performance formulation and evaluation considers three types of server geometry. These are: (i) three dimensional rectangle geometry, (ii) sphere geometry and (iii) hybrid geometry (combines sphere and three dimensional rectangles). The incorporation of 4D technology enhances the surface area to volume ratio in the case of hybrid geometry. In the case of the conventional geometry and spherical geometry, a variation in the dimension is mainly leverage to enhance the surface area to volume ratio. Results show that the use of the hybrid geometry incorporating the proposed technology significantly enhances the surface area to volume ratio.*

**Keywords: -** *Data Center; Edge computing, Servers, Cooling, Bio-Inspired Mechanisms, Surface Area to volume ratio.*

## I. Introduction