

USING STRUCTURED OVERLAYS  
TO CREATE  
DECENTRALIZED AND DISTRIBUTED APPLICATIONS

By

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A PROPOSAL PRESENTED TO THE GRADUATE SCHOOL  
OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT  
OF THE REQUIREMENTS FOR THE DEGREE OF  
DOCTOR OF PHILOSOPHY

UNIVERSITY OF FLORIDA

2009

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I dedicate this to ...

## ACKNOWLEDGMENTS

Thanks will be given in due time.

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Abstract of Proposal Presented to the Graduate School  
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February 2009

Chair: Renato Figueiredo

Major: Electrical and Computer Engineering

Structured peer to peer overlays enable users to deploy and maintain decentralized, distributed applications with limited need for centralization. Structured overlays are constructed in such a way to guarantee fast seek time when searching for the node nearest to a specific overlay address. A simple data store known as a distributed hash table (DHT) can be built on top of this to provide the storage of key, value pairs. Each key consists of an overlay address, which can be produced by using a cryptographic hashing function to generate an overlay address, uniformly distributed values into the overlay. Applications can use the DHT in place of a centralized directory. In this proposal, I present applications and enhancements to structured overlays that can be made decentralized using this approach. The key contributions in the field of structured overlays, I have and propose to research are enabling public key infrastructure and decentralized revocation; enabling application specific parallel, private overlays; handling situations where direct connection between peers is hindered by NATs and firewalls; and reliable streaming.

The focal applications for this work are virtual private networks (VPNs), social networks, and grid computing. For each of these, I explain how to apply structured overlays in order to limit the use of central and third-party resources making each



application user focused. Through these examples, I argue that the techniques used in this proposal can be used to enhance structured overlays applicability and ease of use.

## REFERENCES

## BIOGRAPHICAL SKETCH

David Isaac Wolinsky was born on October 31, 1982. He has been married to Donna Korin Wolinsky since June 2007 and was blessed with a son, Isaac Emmanuel, on November 30, 2009. He began his studies at the University of Florida in August 2001, obtained a bachelors of science degree in the spring of 2005 and a masters of science degree in the spring of 2007, and am currently pursuing a doctorate of philosophy. My advisor is Professor Renato Figueiredo, whom I have had the pleasure of working with since the spring of 2006 at the Advanced Computing and Informatoin Systems Lab.

My primary research focuses are network virtualization using structured P2P overlays. This research work has been realized in IPOP, a free (GPL) network virtualization software. I have worked on enabling DHTs, decentralized NAT traversal through relays, software models for improved network virtualization, and autonomic virtual networking stacks. This work is a major contribution to my other research focus, Grid Appliance, which enables the creation of decentralized, distributed grids through virtualized, physical, and cloud resources.

During my free time, I enjoy time with my boy (son), running, playing basketball with the LBBA (Larsen-Benton Basketball Association) colleagues, and occassionally playing video games. At one point prior to engaging in the arts of seeking a Ph.D., I was ranked in the top 20 on the US East Warcraft III Free For All Ladder. Most of my time is split between the Archer project and attempting to finish my Ph.D. prior to turning 30, thankfully I have a few years prior to turning 30. During my deeper moments, I contemplate my struggle with the amazing gift that Christ as my savior gave to me in spite of my brokenness.