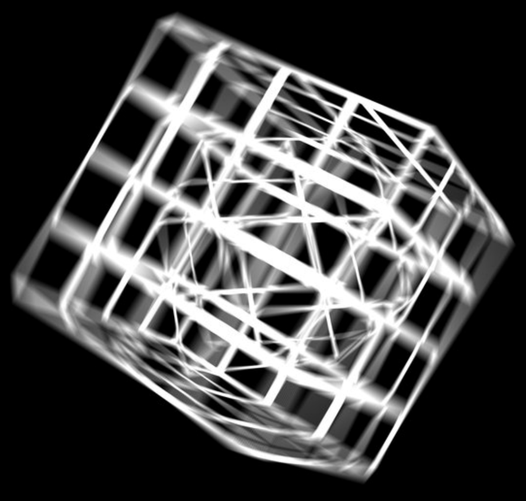
CERIAS

The Center for Education and Research in Information Assurance and Security

PURDUE UNIVERSITY



# Closing the Pandora's Box

## Defenses for Thwarting Epidemic Outbreaks in Mobile Adhoc Networks

**Rahul Potharaju, Endadul Hoque, Cristina Nita-Rotaru**
*Department of Computer Science, Purdue University*
**Saswati Sarkar, Santosh S. Venkatesh**
*Department of Electrical Engineering, University of Pennsylvania*

## { proximity-based THE RISE OF COMMUNICATION! }


**Beginning to become a key player in financial payments**


**Breathtaking applications in healthcare industry - heart monitors, pacemakers**

## { GOALS/CONTRIBUTIONS }

### Limitations of malware propagation research

**Conventional infection models assume even contact rate!**
**Most do not consider mobility or give limited consideration**

**UNDERSTAND RELATION BETWEEN INFECTION SPREAD AND MOBILITY MODEL**
- Does the infection spread faster or slower in realistic mobility models?
- What insights does it provide into designing countermeasures?

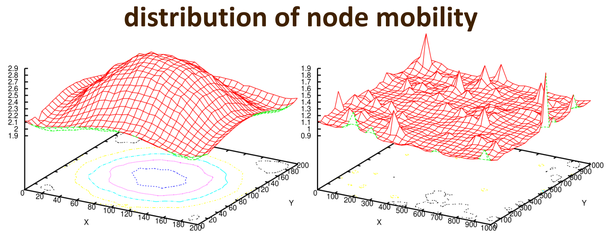
**DESIGN EFFECTIVE COUNTERMEASURES TO MALWARE SPREAD**
- What kind of healing mechanisms can be designed?
- Can we design optimal solutions that minimize time and energy?

**IMPLEMENTATION AND VERIFICATION OF COUNTERMEASURES**
- How should healers communicate with each other? How to place them?
- Do deterministic healers pose advantages over probabilistic healers?

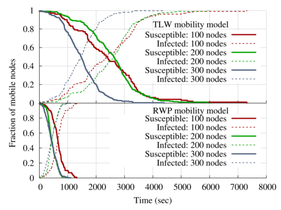
## { PROOFS AND MECHANISMS }

### INFECTION DYNAMICS

**Spatial distribution reveals non-homogeneous distribution of node mobility**




**Slower infection rate in realistic mobiliy models!**

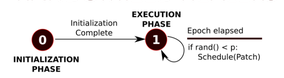


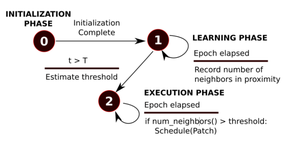

### SOLUTION BLUEPRINT

**Build Oracle Healer?**
- Formulate as T-Cover
- Reduce to minimum set cover
- Prove NP-hardedness

**Build Approximations?**
- Greedy approximation for oracle
- Effective healer placement
- Family of healers

**RANDOMIZED HEALERS**




**PROFILE-BASED HEALERS**

python

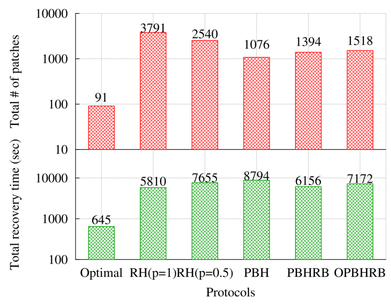
MATLAB

ns-3 NETWORK SIMULATOR

## { PERFORMANCE RESULTS }

### Evaluation Methodology

- Healer placement through Poisson Disk Sampling
- Simulate 100-300 nodes in a 1000x1000 field
- Random Waypoint vs. Truncated Levy Walk
- Varying number of static healers
- Different healer strategies
- Optimizing number of patches and recovery time




### Randomized healers
- DO NOT rely on system feedback
- DO NOT have to estimate node arrival distributions
- Utilize more patches!
- Beneficial in a time-constrained system

### Profile-based healers
- Intelligent decision making through profile building
- Utilize less patches!
- Beneficial in an energy-constrained system

CERIAS

Discovery Park e-Enterprise Center