In Vivo Evaluation of the Secure Opportunistic Schemes Middleware using a Delay Tolerant Social Network

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Motivation

- Online social networks (OSNs) such as Twitter & Facebook have experienced rapid growth, over 1 billion users[1]
- A major limitation of OSNs is the dependence on Internet which is often sparse, difficult to maintain, or unavailable in rural areas or developing communities[2]
- In natural disaster situations, Internet and cellular communication infrastructures can be severely disrupted, prohibiting users from notifying family, friends, and associates about safety, location, food, water, and other resources
- DTNs have the ability to deliver data in intermittent networks, but a major challenge is assessing the real-world performance of DTN routing[3]
- This work discusses the capabilities of the SOS Middleware and the AlleyOop Social Research Platform. Together, the middleware and platform provide a secure delay tolerant social network on Apple iOS devices and enables *in vivo* evaluation of DTN routing schemes.

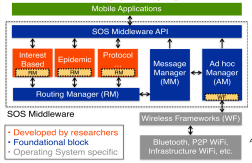
AlleyOop Social Research Platform

- A Low Latency Evaluation sYstem for ad-hOc Opportunistic Passing
- Online/offline (centralized/decentralized) social network
- Publish/subscribe system
- Disseminate messages using D2D connections (Bluetooth, P2P WiFi, infrastructure WiFi)
- Allows users to switch between multiple DTN wireless schemes

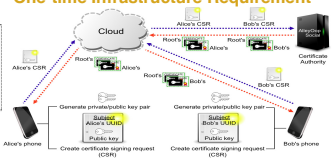
Opportunistic Communication in AlleyOop Social

- Secure Opportunistic Schemes Middleware
- Supports multiple DTN routing schemes
- Simple & intuitive, implemented protocols consist of <100 lines of code
- Each device can handle up to 16 ad hoc connections simultaneously
- Handles D2D and end-to-end security and encryption

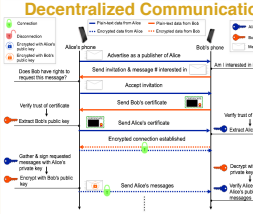
Middleware



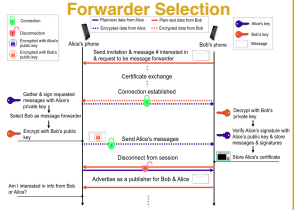
One-time Infrastructure Requirement



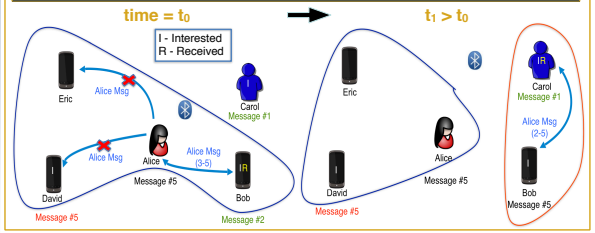
Decentralized Communication



Forwarder Selection



SOS Middleware Routing Scheme - Interest Based

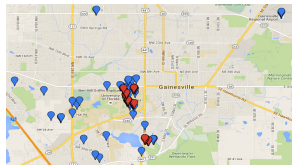


Comparison with Simulated Environments

Protocol	Nodes	Transmission Range	Area
Interest based routing	10	5m - 50m	88km²
Epidemic routing (Vahdat, 2000)	50	25m	.45km²
		50m	
PRoPHET (Lindgren, 2004)		100m	4.5km²
CAR (Musolesi, 2009)		200m	1km²
SocialCast (Costa, 2008)	100		16km²
CAR (Musolesi, 2000)		250m	2km²

Real-World Evaluation

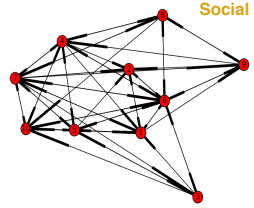
Gainesville, FL (11km x 8km)



Blue - Messages created
Red - Messages disseminated

Parameters	Activ
Number of nodes (n)	10
Duration (days)	7
Total messages created	259
Total messages disseminated (1-hop)	796
Total messages disseminated (>1-hop)	167

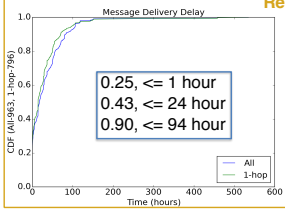
Social Relationships



Directed Graph - G(V,E)

Parameters	Values
Number of nodes (n)	10
Average shortest path length	1.3
Maximum shortest path length (d)	2
Network density	0.64
Radius	1
Center nodes	6 and 7
Transitivity	0.80

Results



Conclusion & Future Work

Conclusion

- AlleyOop Social enables practical evaluations of DTN schemes
- One-time infrastructure requirement for secure D2D communication
- Captures mobility & interaction of users
- Captures analytics pertaining to device and operating system usage

Future Work

- Incorporate additional research based routing schemes
- Investigate social relationships and density correlations of users
- Investigate optimal resource requirements for opportunistic communication

References

1.Faloutsos M, et. al. "Online Social Networks," *Network, IEEE*, 2010
2.Fall K. "A delay-tolerant network architecture for challenged internets." Applications, tech…, ACM, 2003
3.Hui P, et. al. "Phase transitions of opportunistic communication." Challenge networks, ACM, 2008

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