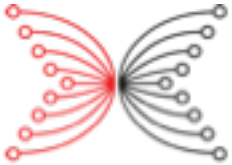
# MARS: Monetized Ad-Hoc Routing Systems

Bernardo David, Rafael Dowsley, Mario Larangeira



INPUT | OUTPUT

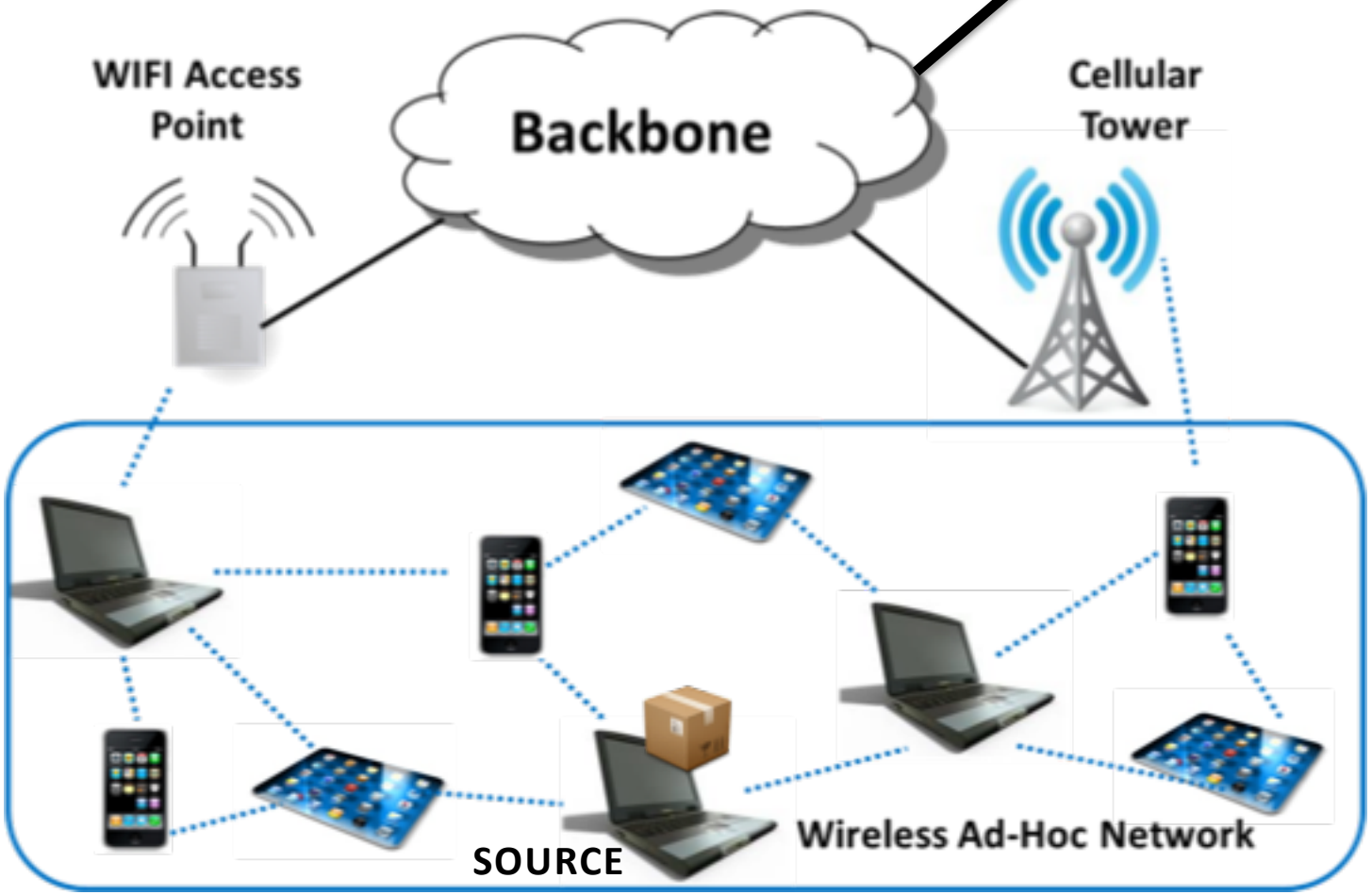
AARHUS UNIVERSITY

# Agenda

- Introduction
- Our Contributions
- Related Works
- Building Blocks
- MARS Protocol
- Future Works

# Introduction

- Mobile Ad-Hoc Networks

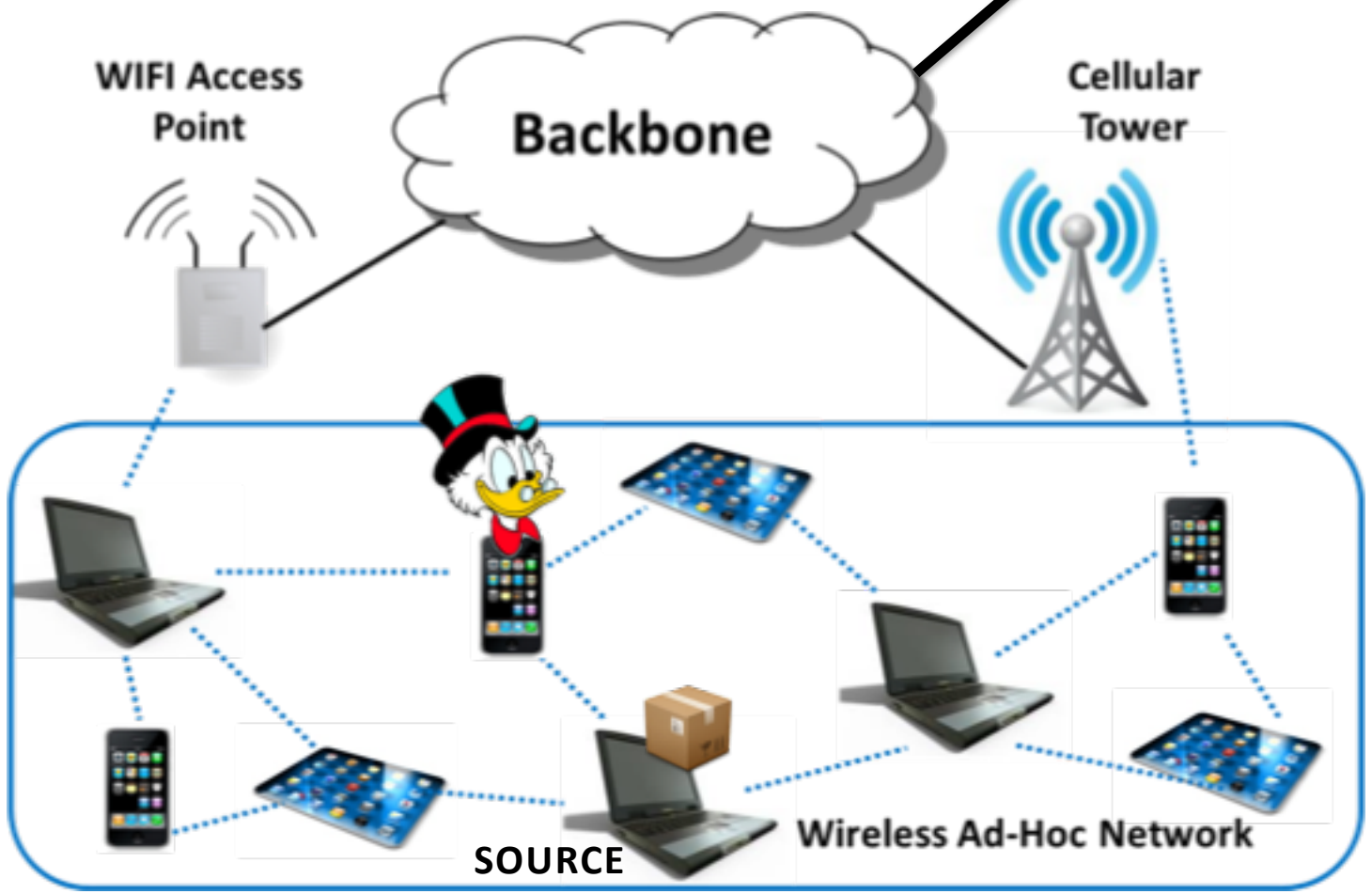


# Introduction

- Malicious Node

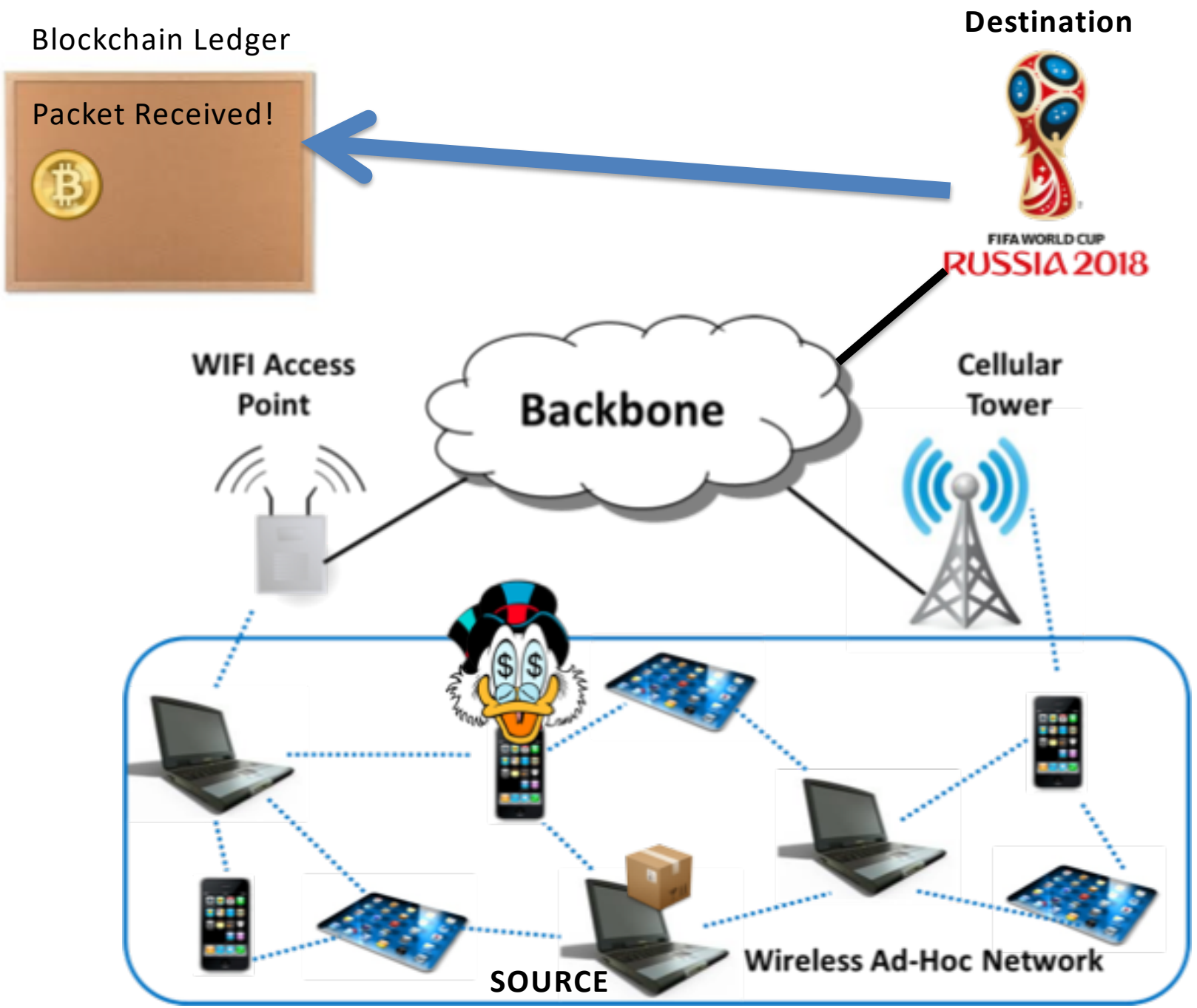
# Introduction

- Selfish Node



# Our Contributions

- Monetized Reputation System
  - Well behaved nodes earn reputation points that can be traded
- Cryptographic mechanism to track reputation
  - “Proof of Routing” based on Composite Signatures
  - No malicious node can “fake” reputation
- Decentralized reputation tracking and trading
  - Blockchain based system

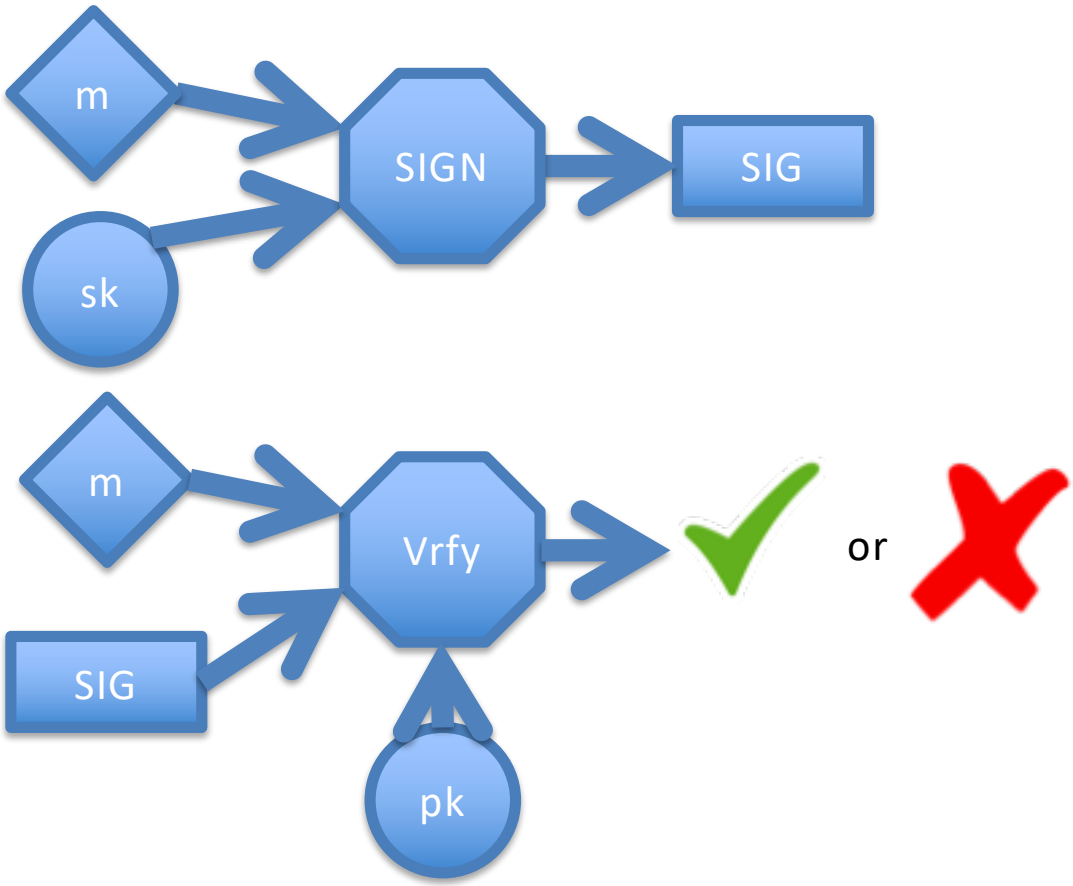

Blockchain Ledger
Packet Received!
Destination
FIFA WORLD CUP
RUSSIA 2018
WIFI Access Point
Backbone
Cellular Tower
SOURCE
Wireless Ad-Hoc Network

# Related Works

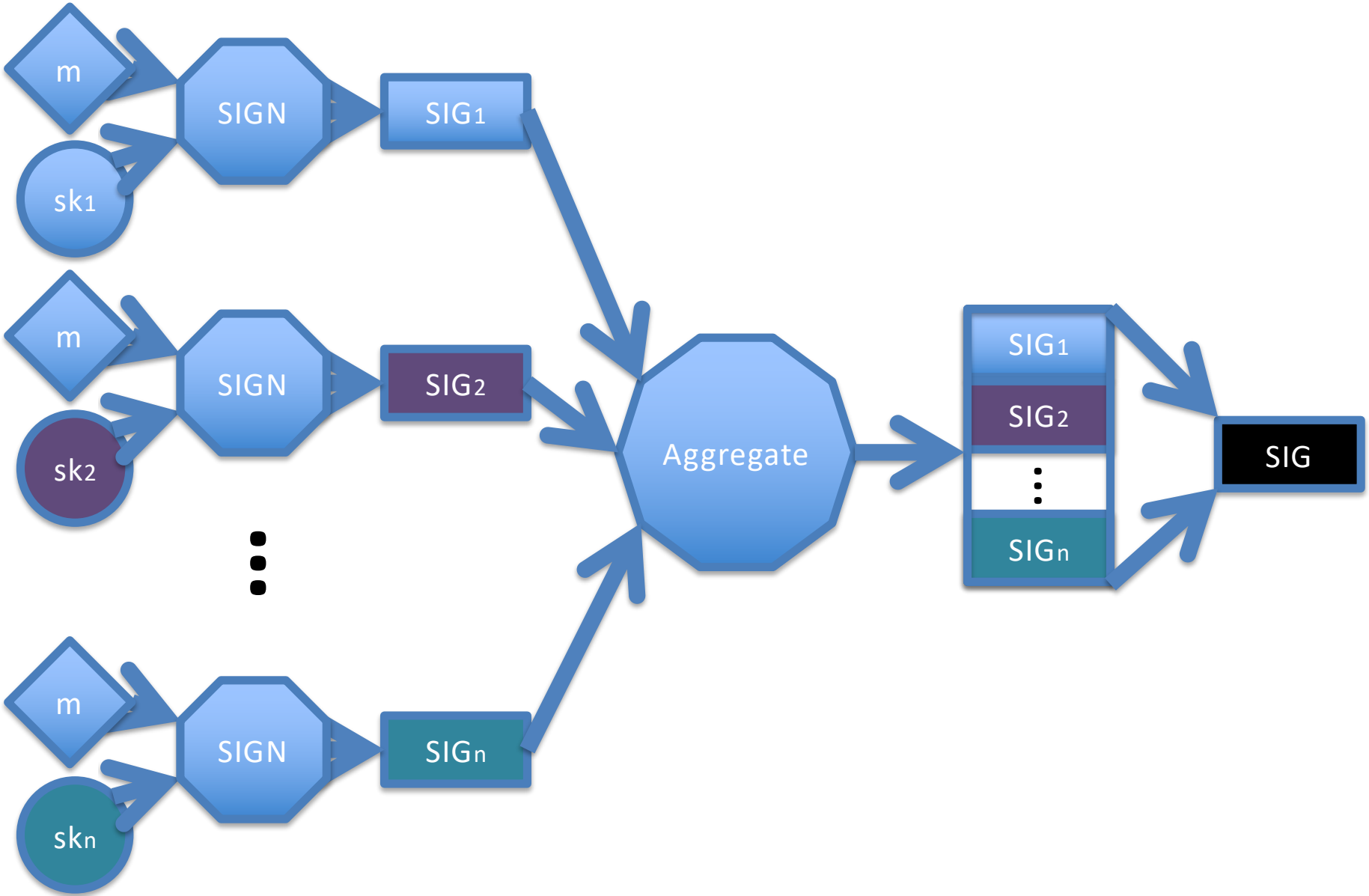
- Reputation Systems for MANETs [BDV05],[BB02], [BB03], [MM02] (Core) and [MGLB00]
- (Centralized) Financial Compensation: [AE03] (Ad-Hoc Vcg) and [ZCY03] (Sprite)
- Decentralized Financial Compensation for fixed infrastructures [BP15]

# Building Blocks: Composite Signatures

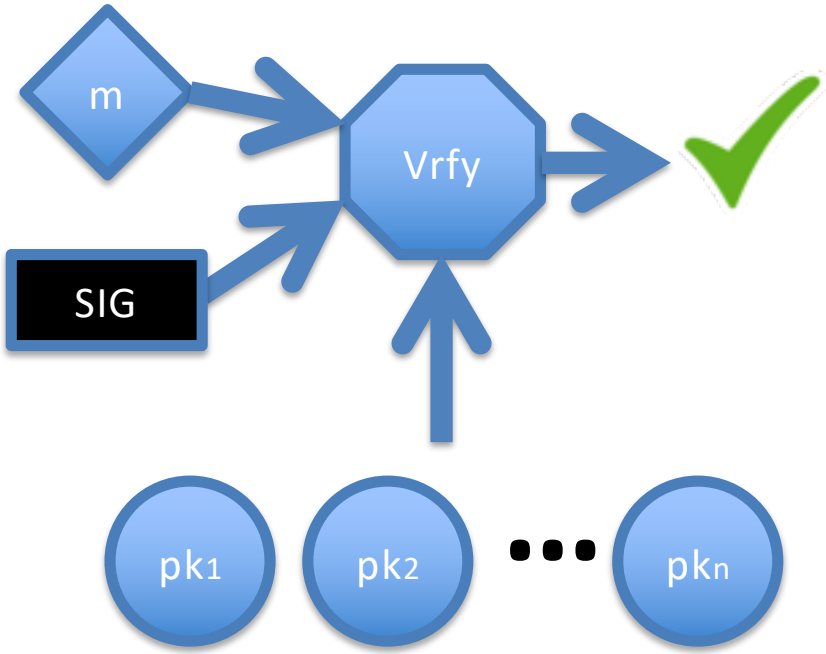
- Aggregate signatures that can't be "un-aggregated" [SMD14]



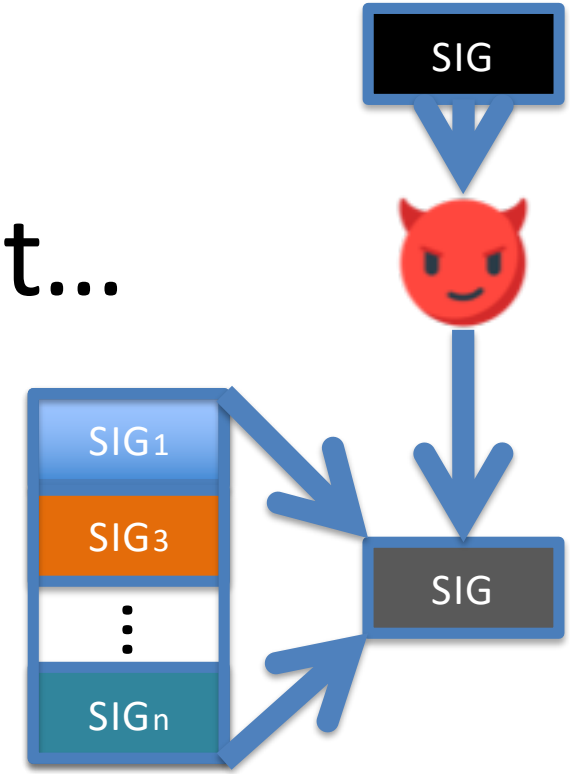
# Building Blocks: Composite Signatures



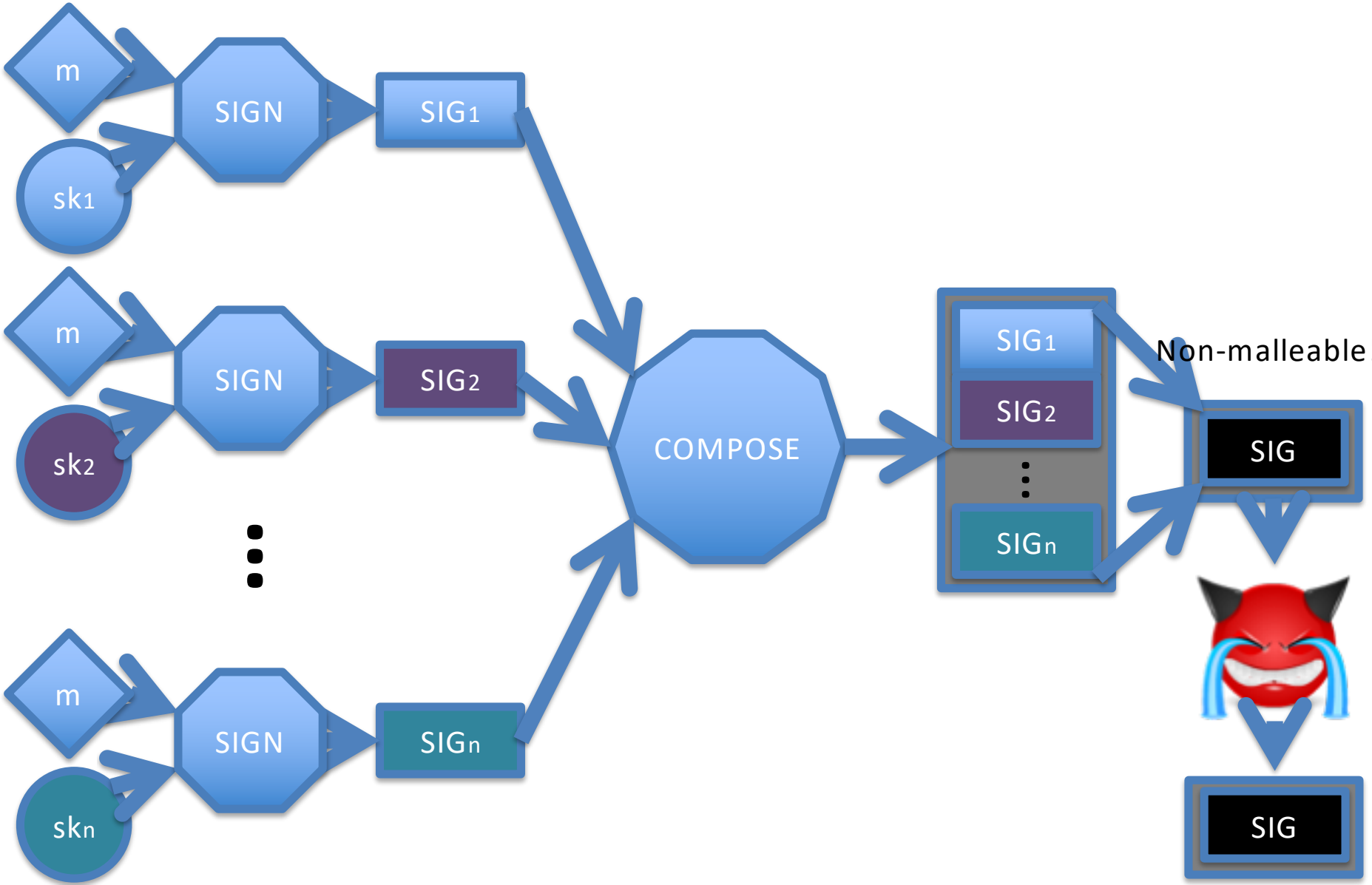
# Building Blocks: Composite Signatures




But…

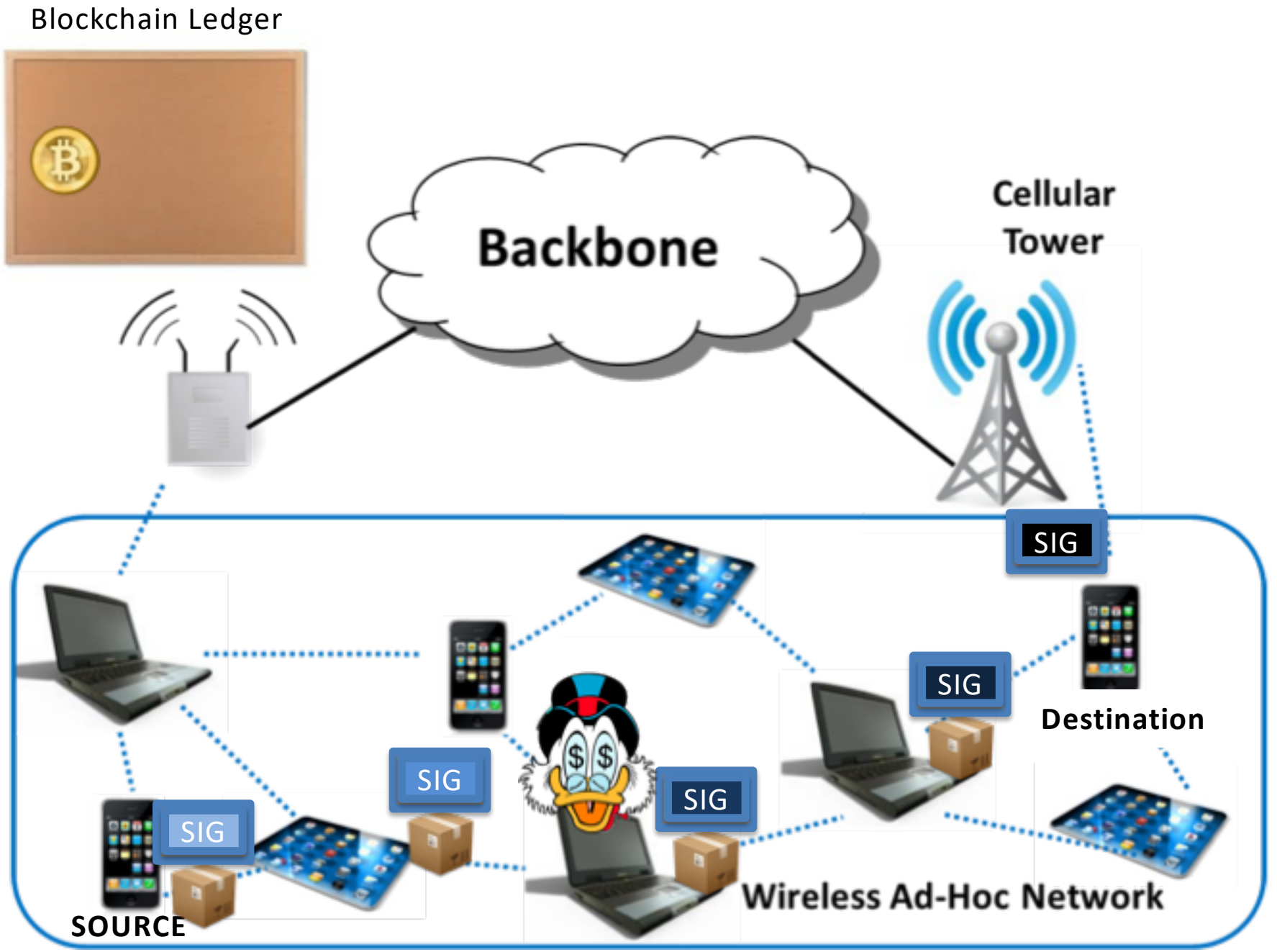


# Building Blocks: Composite Signatures



# MARS Protocol

- Lightweight Blockchain: Proof-of-Stake based protocol (e.g. Ouroboros)
- Proof of routing via Composite Signatures:
  - Each node in a route signs the packet
  - Final proof is compact
  - Adversaries are assumed not to collude
- Registered reputation tokens can be traded on chain or exchanged for better services or other tokens.


Blockchain Ledger
Backbone
Cellular Tower
SIG
SIG
SIG
SIG
SIG
Destination
SOURCE
Wireless Ad-Hoc Network

# Future Works

- Theoretical:
  - Formal modeling of reputation systems
  - Better security: composability and adaptive adv.
  - Game theoretical analysis of incentive structure
- Practical:
  - Prototype implementation
  - Benchmarking over different kinds of Ad-Hoc routing protocols
  - Optimized implementation


Read the paper:
https://iohk.io/research/papers/#AEPEJRQX

Contact:
bernardo@bmdavid.com