

Modeling and Simulation in DOSNs

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Modeling and Simulation in DOSNs

DOSN Models should be evaluated in:

- Real-life environment and situations
- Simulated real-life environments

Evaluation based on different scenarios:

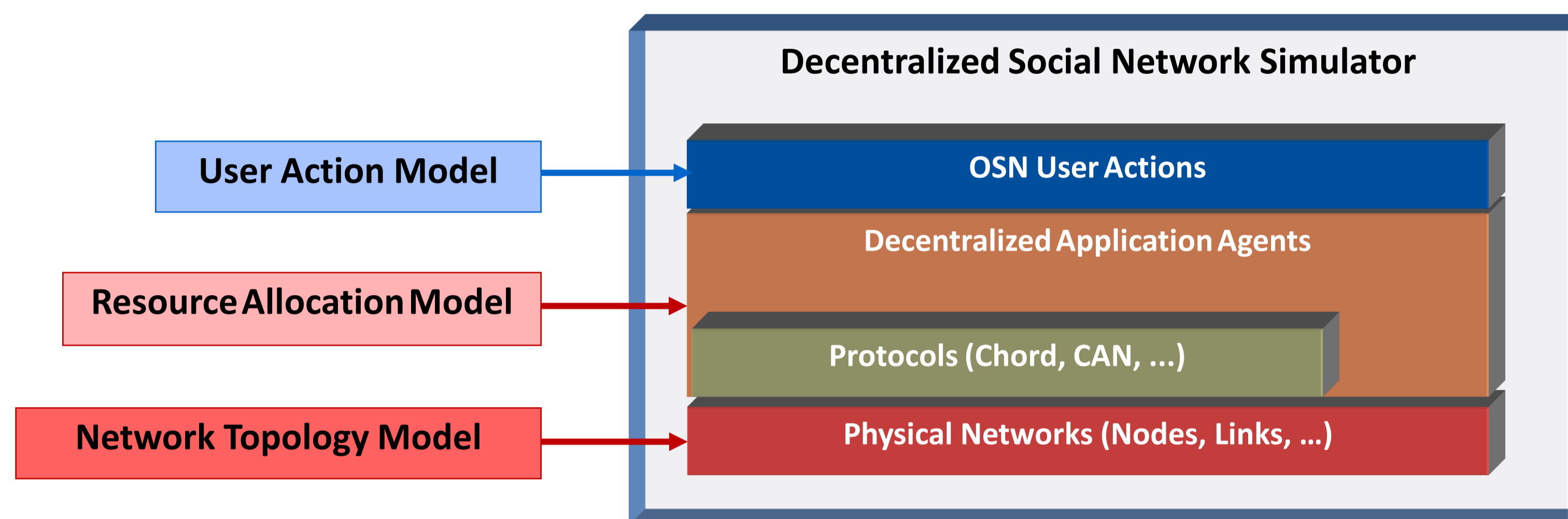
- **User Actions:** Registration, Messaging, Publishing, Searching
- **Resources:** Bandwidth limitations, Nodes hardware limitations
- **Network Topologies:** Different number of nodes, Different types of nodes
- **Combination of Different Scenarios**

Modeling and Simulation provides:

- Simulation in real-life environment and results in a short period of time
- The ability of investigating values that are difficult or impossible to use in real-life situations (e.g. large-scale scenarios, extreme values scenarios)
- The ability of testing new findings (e.g. robustness, speed, reliability, maintainability) in DOSN models

Modeling Approaches

Goal: Provide the simulator with real-life scenarios in order to achieve real-environment simulation



- **User Action Model:** Provides the user actions that will be used for the experiment
- **Resource Allocation Model:** Provides configurations for the simulation (e.g. bandwidth, speed, data exchange, type of interactions)
- **Network Topology Model:** Provides network related information (e.g. nodes and type of nodes, links and type of links)

Centralized VS Decentralized OSNs modeling

➤ Resource Allocation model

- Based on the approach that data flows between the central service and the nodes
- Based on more complex approaches, such as data flows via several and different types of hops before arrives at the destination

➤ Network Topology Model

- Network nodes are connected with each other through a central service
- The connection between nodes is based on different decentralization approaches like peer-to-peer, decentralized servers and hybrid

- Centralized approach
- Decentralized approach

Simulation Approaches and Tools

Simulators summary:

- **Language:** Programming language used for the implementation
- **Status:** Project current status
- **Usability:** How easy is the simulator to learn and use? Does it provide an API?
- **Scalability:** How does the simulator scales regarding the amount of nodes?

Simulator	Language	Status	Usability	Scalability
P2PSim	C++	Active	Poor documentation Community	3000 nodes
PeerSim	Java	Active	Poor documentation Community	1 million nodes
Narses	Java	Inactive	No documentation	600 nodes
FreePastry	Java	Active	Well documented API Community	1000 nodes – extendable
PlanetSim	Java	Active	Well documented API + Tutorials Community	300,000

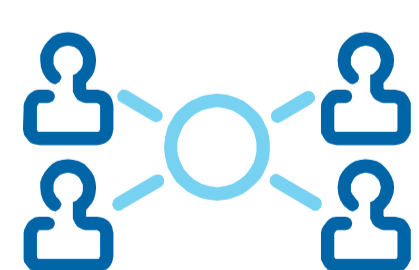
Source: Anirban Basu, Simon Fleming, James Stanier, Stephen Naicken, Ian Wakeman, and Vijay K. Gurbani. 2013. The state of peer-to-peer network simulators. ACM Comput. Surv. 45, 4, Article 46, August 2013

DOSN projects from literature:

- Which datasets do they use for the simulations?
- What do they measure in the simulations?

DOSN	Dataset	Scope	Metrics	Simulator
SuperNova	DBLP co-authorship Graph	Relation of online/offline time behavior to data availability	Data Availability Reliability	Own
eXO	Facebook Flickr	Search and Data retrieval	Data Availability Performance	FreePastry
PrPI	Own (Auto-generated users)	Queries performance (common-friends, friends' friends, friend's pictures, Top50 songs)	Response Time/Performance Data Availability	Own
Vis-a-Vis	Own (Auto-generated users)	Join, Update, Search operations according to nodes distribution	Response Time/Performance Data Availability Reliability	Own

Our Vision



How to design and develop a simulator that takes as input DOSN model(s) and provides insights and results about all possible metrics?

Research Questions

- How to design and develop a modeling tool that takes as input the requirements for a DOSN and produces the corresponding models?
- How to identify patterns between the values of different metrics and DOSNs functionalities?

