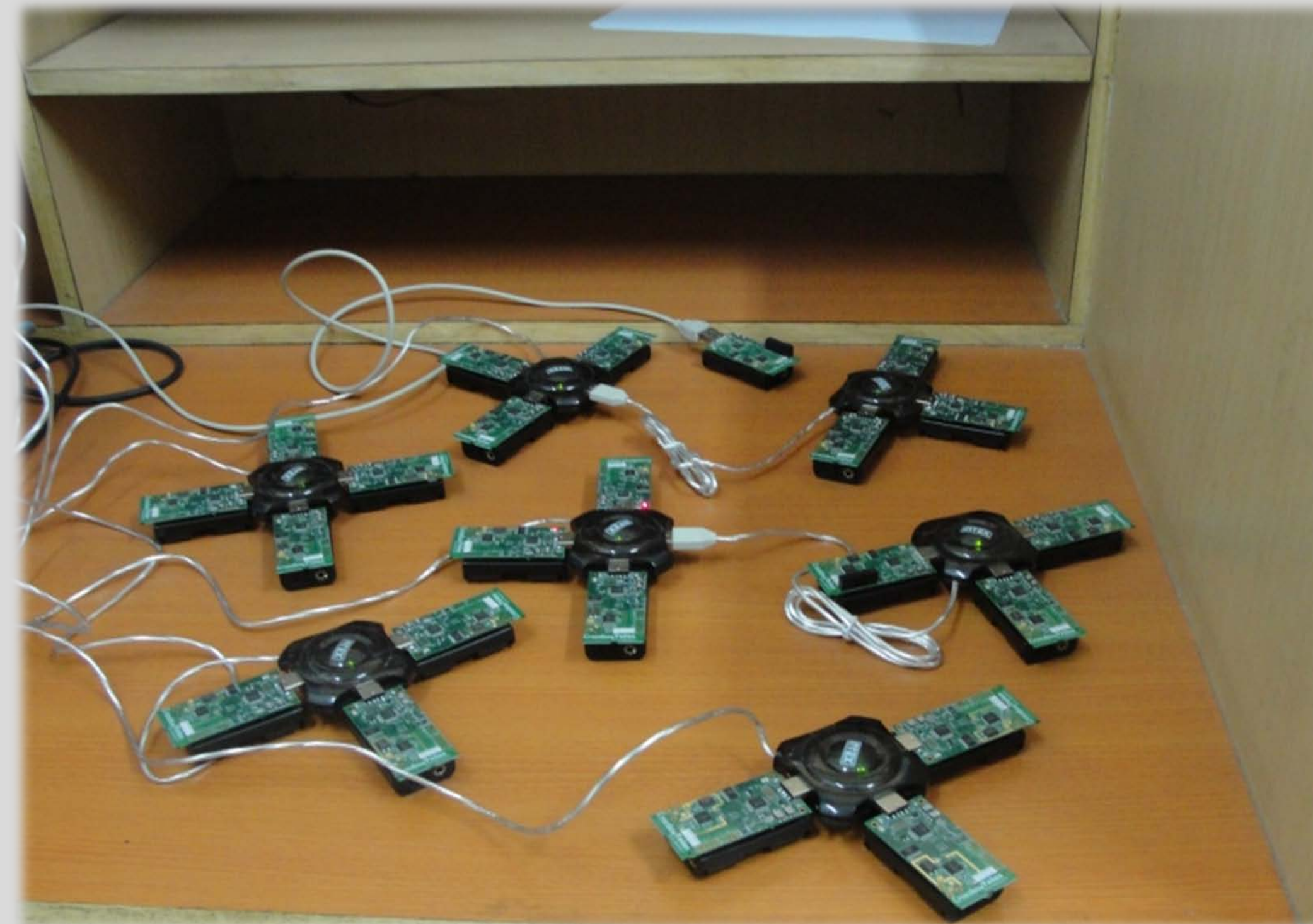# Distributed Computing Lab

Current Research Areas

A. Computer Networks and System Security

- Routing Protocols for MANET and WSNs
- Authentication and Key Management Protocols for MANET and WSNs
- Reliable Multicast Transmission for Wireless Networks

B. Distributed Computing Systems

- Fault-Tolerant, Energy-Efficient and Scalable Clock Synchronization Protocols for WSNs
- Distributed storage system

C. Operating Systems

- Memory and Energy Efficient OS for WSNs with Preemptive Scheduling

Energy Efficient Clock Synchronization for Wireless Sensor Networks
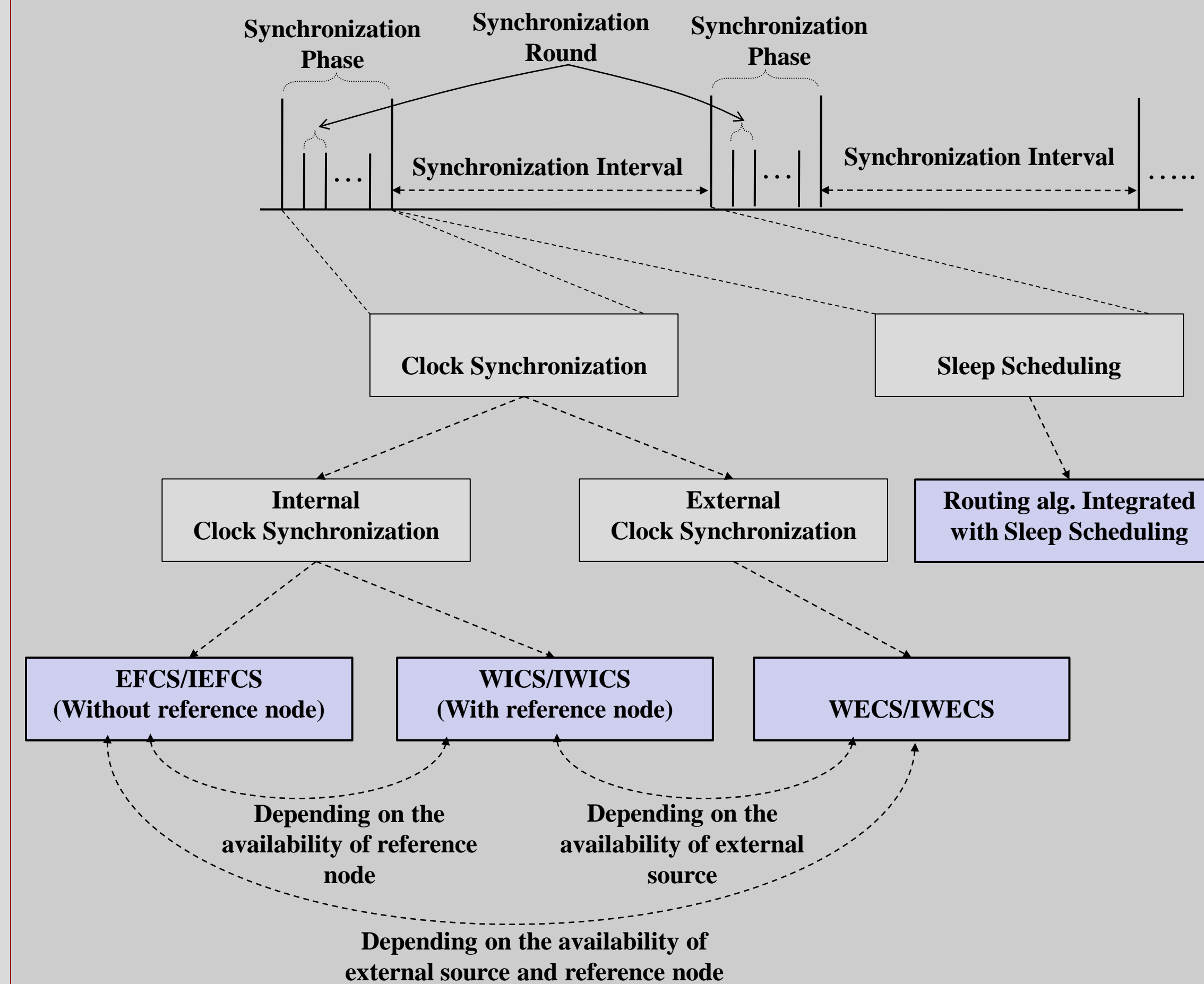
Features

- Protocol provides both internal and external clock synchronization
- Sleep scheduling is integrated with the clock synchronization protocol
- Internal clock synchronization is achieved using with reference node or without reference node
- Proposed clock synchronization protocols are dynamically interchangeable depending upon availability of reference node and external sources

Amulya Ratna Swain, R. C. Hansdah, "A Weighted Average Based External Clock Synchronization Protocol for Wireless Sensor Networks", In Proceeding of the 31st International Conference on Distributed Computing Systems Workshops (ICDCSW 2011), Minneapolis, Minnesota, USA, June 20-24, 2011, pp. 218-229.

Membership Models and the Design of Authentication Protocols for MANET

- Authentication Protocol for MANETs - required to ensure that nodes which are legitimate members of the network are equipped with the necessary security credentials (keys)
- Applicability & Performance of Authentication Protocol – highly depends on the underlying networking environment
- Membership Model (MM) for a MANET - networking environment related to the membership of a MANET
- MEMBERSHIP MODEL (MM) = Membership Granting Server (MGS) Model + Membership Set Pattern (MSP) Model

MGS Model No.	Physical Location of MGS	Reachability of MGS	Number of MGS	Architecture of MGS	Homogeneity of Multiple MGSs
1	Internal	Online	Single	Centralized	-
2	Internal	Online	Single	Distributed	-
3	Internal	Online	Multiple	Centralized	Homogeneous
4	Internal	Online	Multiple	Centralized	Heterogeneous
5	Internal	Online	Multiple	Distributed	Homogeneous
6	Internal	Online	Multiple	Distributed	Heterogeneous
7	External	Online	Single	Centralized	-
8	External	Semi-online	Single	Centralized	-
9	External	Offline	Single	Centralized	-
10	External	Online	Multiple	Centralized	Heterogeneous
11	External	Semi-online	Multiple	Centralized	Heterogeneous
12	External	Offline	Multiple	Centralized	Heterogeneous

Various Models of Membership Granting Server (MGS) for a MANET

MSP Model No.	Closed / Open	Limited / Unlimited (in case of Open MSP)	Homogeneous / Heterogeneous	Migratable / Non-migratable (in case of Heterogeneous MSP)
1	Closed	-	Homogeneous	-
2	Closed	-	Heterogeneous	Migratable
3	Closed	-	Heterogeneous	Non-migratable
4	Open	Limited	Homogeneous	-
5	Open	Limited	Heterogeneous	Migratable
6	Open	Limited	Heterogeneous	Non-migratable
7	Open	Unlimited	Homogeneous	-
8	Open	Unlimited	Heterogeneous	Migratable
9	Open	Unlimited	Heterogeneous	Non-migratable

Various models of Membership Set Pattern (MSP) for a MANET

S. Maity and R. C. Hansdah. "Membership Models and the Design of Authentication Protocols for MANETs". Accepted for presentation at the 8th International Workshop on Heterogeneous Wireless Networks (to be held in conjunction with 26th IEEE AINA 2012), Fukuoka, Japan, March 2012.

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