Architecture,Communication & UDG

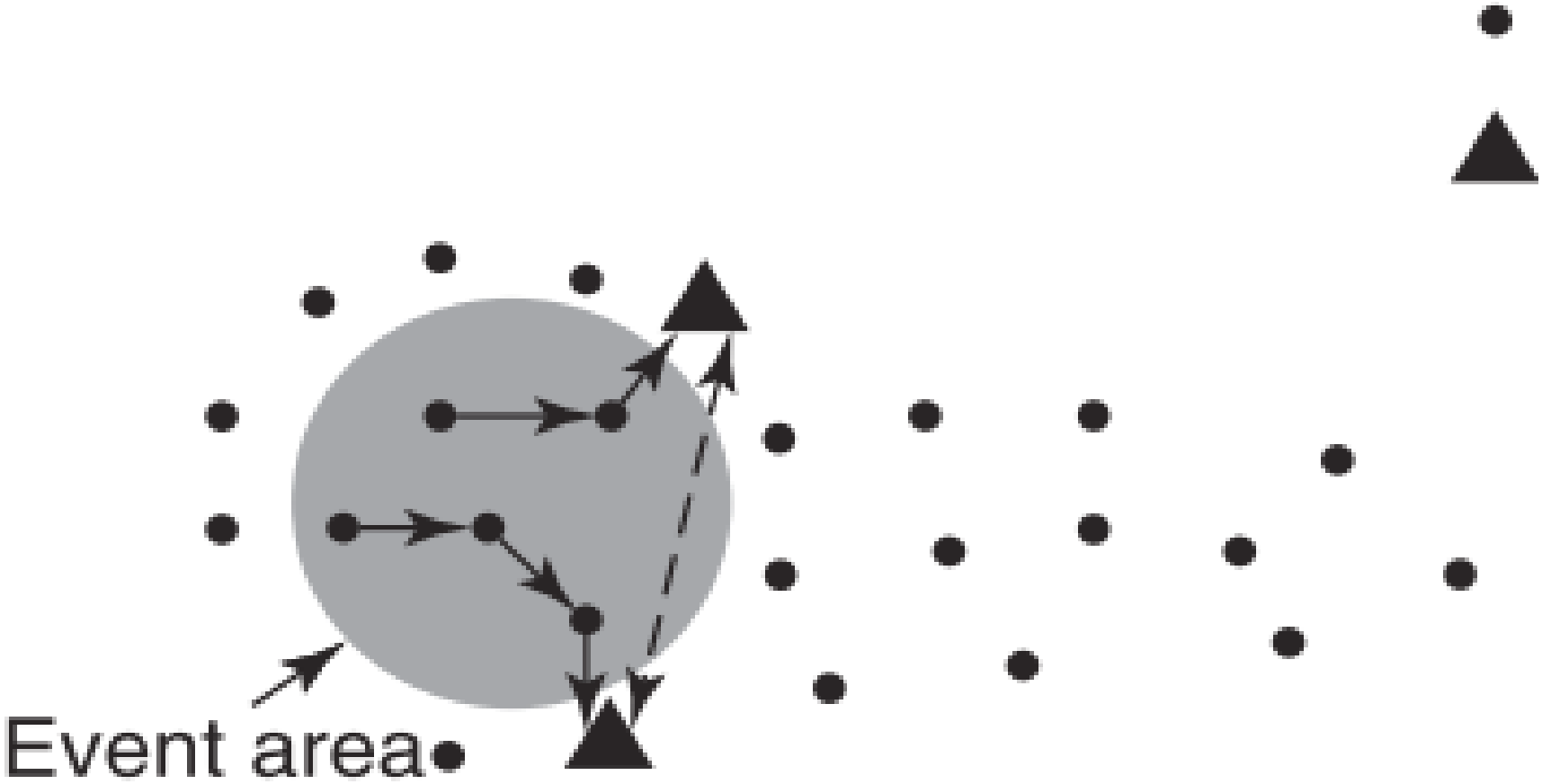
Types of Architectures

- Automated
- Semiautomated
- Cooperative

Automated Architecture

- sensor nodes sense the environment and report the data to actuator nodes which then initiate appropriate actions based on the received data.

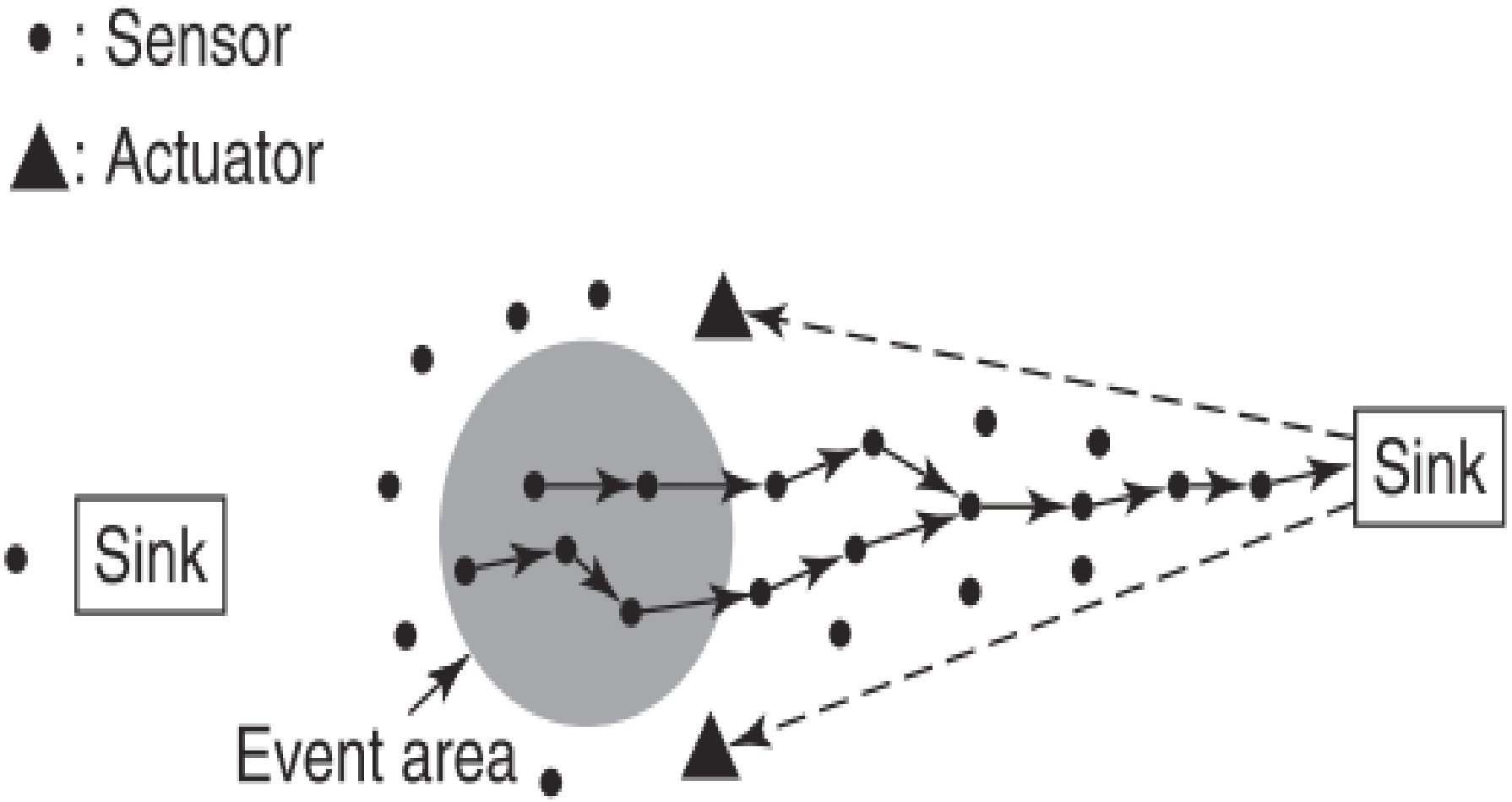
Automated Architecture



Semi automated Architecture

- where sensor nodes route sensing data back to the sink which may then issue action commands to actuator nodes.

Semi automated Architecture



Which Architecture is better ?

- Automated
- Semiautomated

Advantage of Automated Architecture

- sensing data is reported to actuators which are closer than the sink to sensors, communication latency is minimized.
- Second, in semiautomated Architecture, transmitting the sensing data to the sink usually causes fast energy depletion of nodes which are around the sink.

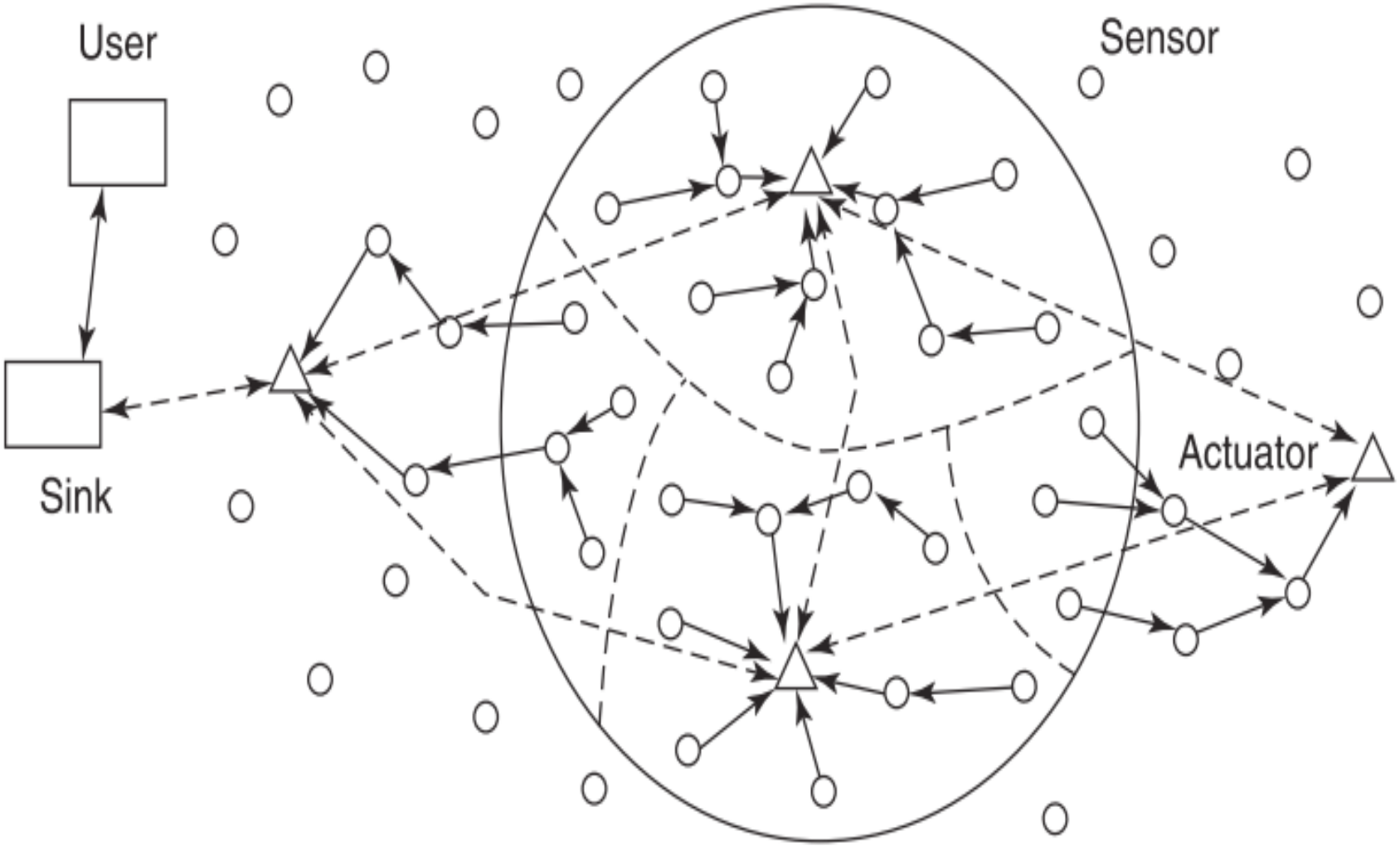
Advantage of Automated Architecture

- In automated architecture, sensing data is reported to actuators and different actuators may be triggered based on different events. Hence, the communication load can be more evenly distributed among all nodes and it results in a longer lifetime of networks.
- Automated architecture is able to provide low communication latency and longer network lifetime, which are desirable in most applications of WSANs.

Cooperative Architecture

- Sensor nodes transmit sensing data to actuator nodes via a single-hop or multiple hops.
- The actuators analyze the data and may consult the sink(s) before taking any action.
- That is, actuators may use their peer-to-peer network to make decisions and take action, possibly informing the sink about the action taken, or could inform the sink and wait for further instructions from the sink.

Cooperative Architecture



WSAN Architecture

- Wireless sensor actuator network frameworks consist of an architecture network (automated or semiautomated), a coordination level (sensor-sensor, sensor-actor, actor-actor),
- Node - mobility (fixed or mobile), and a network density (dense or sparse).

Referencences

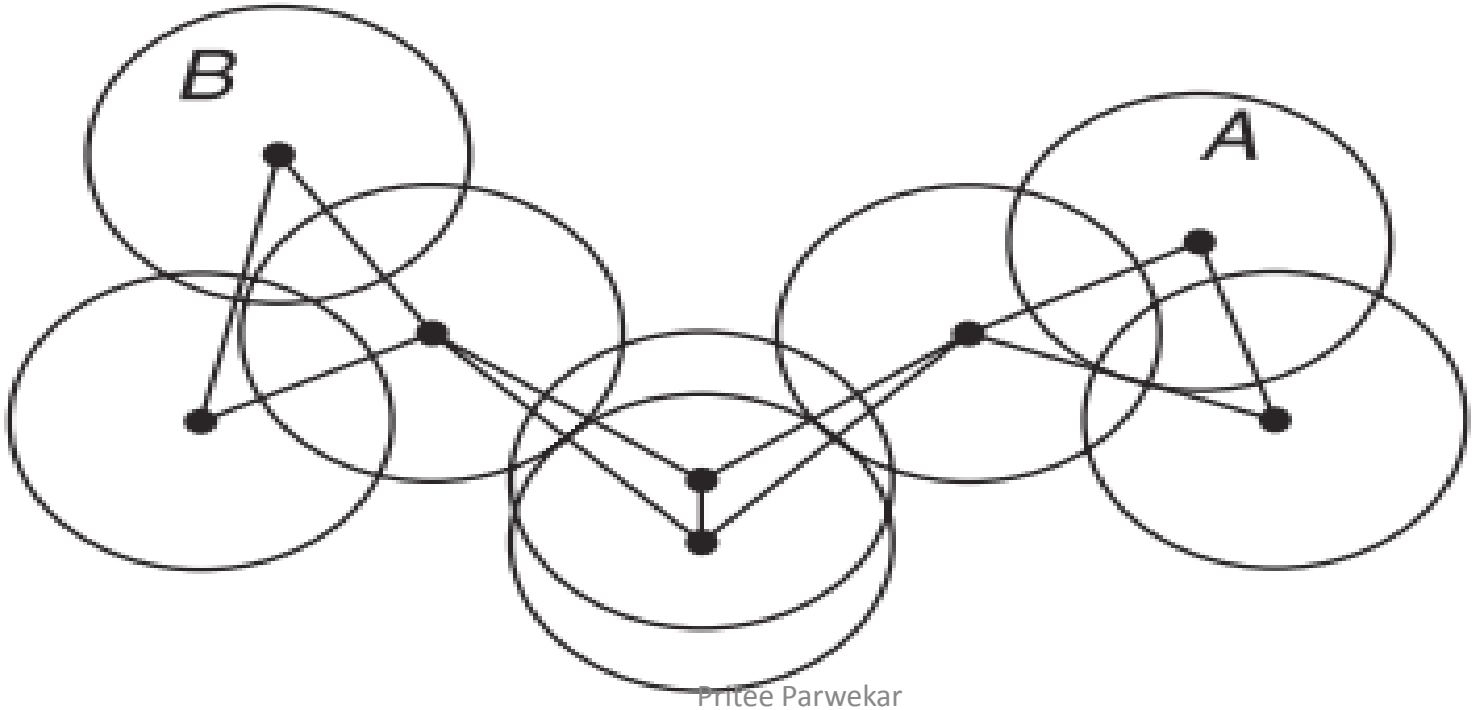
- **Ref- Ruiz-Ibarra and Villasenor (2008) proposed a taxonomy for cooperation mechanisms in wireless sensor and actor networks.**
- **The cooperative architecture is proposed in stojmenovic et al. (2007)**
- **Akyildiz and Kasimoglu (2004)-Automated and Semiautomated architecture**

UDG-Unit Disk Graph

- For a homogenous network in UDG two nodes communicate if and only if the distance between them is at most R, where R is the transmission radius which is equal for all nodes.
- A UDG is therefore determined by the positions of nodes and a fixed common transmission range R.

UDG-Unit Disk Graph

- If we use R/2 as the radius of the disk of each node, two nodes are connected if and only if their corresponding disks intersect.



UDG-Unit Disk Graph

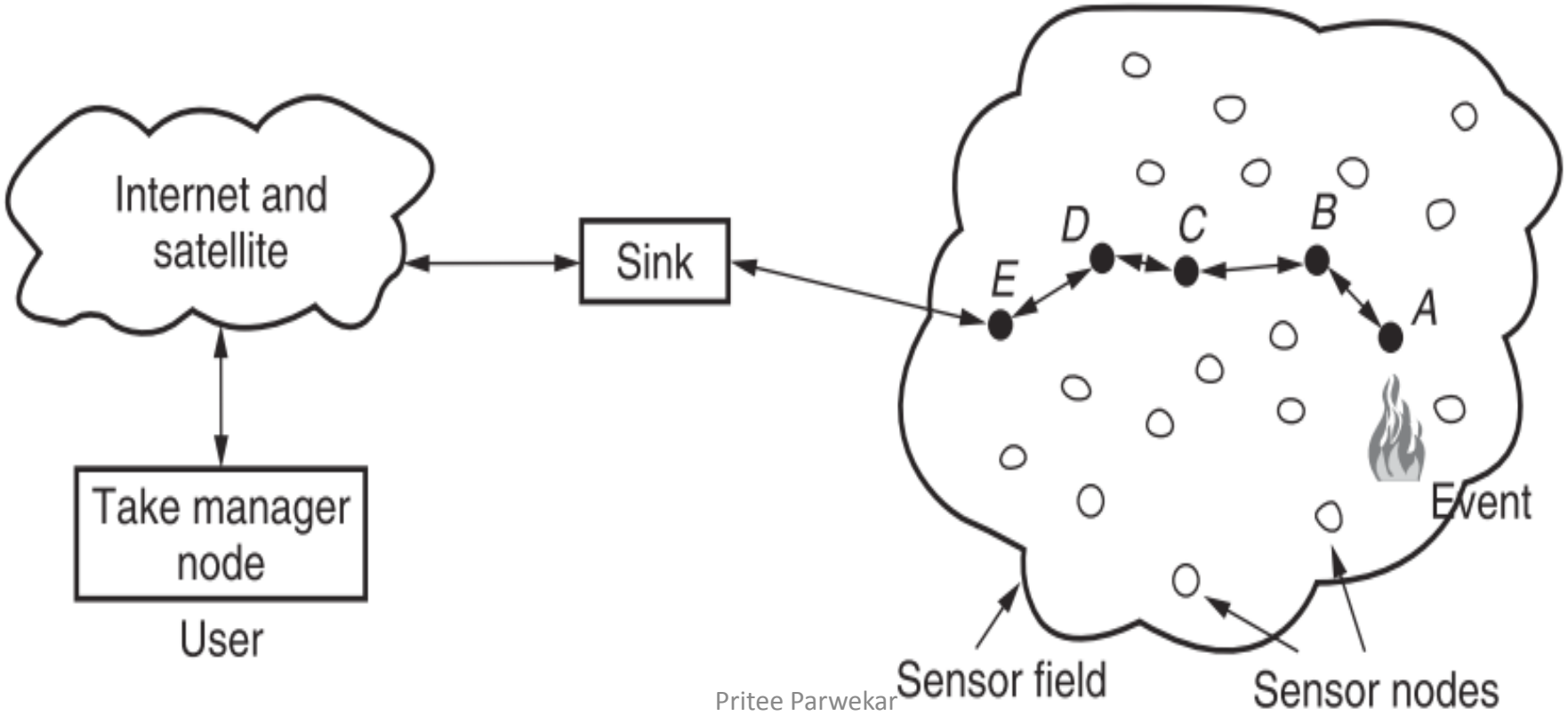
- Hop count can be used as a metric for routing in UDG if each node applies the same and fixed transmission power. It is defined as the number of hops from one node to another. Hop count between two adjacent nodes is 1. In previous diagram, the hop count between node A and node B is 4.

Data Communication Modes

- Event-driven
- Periodic
- On-demand

Event-driven Mode

- In the event-driven mode, sensors report the sensing data to the sink once a specified event (e.g., fire) has been detected



Periodic Mode

- In the periodic reporting (or time-driven) mode, sensor nodes gather information from the environment at predetermined times and periodically send the data to the sink.

On-demand Mode

- In the on-demand (or query-driven) mode, users decide when to gather data.
- They send instructions to the WSN indicating that they wish to receive data and then wait for the required type of data to be sent in the requested format.

Communication Modes

- Periodic reporting is different from event-driven reporting. Data gathered in periodic reporting does not require urgent delivery to the sink.
- The data in the event-driven reporting usually comes from sensors in the vicinity of a target or event.
- Whereas the data in periodical reporting is normally gathered from sensor nodes throughout the sensor field.

Data gathering & Data aggregation

- Sensors report to the sink by applying data gathering and data aggregation operations.
- Data gathering refers to forwarding the measured data to the sink without further changes on the way toward sink.
- sending a message from a sender node (sensor) to a destination node (sink)

Data gathering & Data aggregation

- Data collected by sensor nodes might be redundant, correlated, and/or inconsistent with data from other sensors.
- Data aggregation is used to combine data coming from different sensor nodes. This eliminates redundancy and minimizes the number of transmissions.