IEEE 1900.7 White Space Radio Use Cases

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Summary of Use Cases

- Four categories of use cases are identified
  - Wireless backbone networks
    - Wireless access backbone network
    - Wireless mesh backbone network
    - High speed vehicular backbone network
    - Rural broadband network
  - Land fixed/mobile networks
    - Smart home network
    - Digital signage network
    - Transportation logistics network
    - Wireless access network
  - Maritime networks
    - Maritime wireless access network
    - Inter-ship mesh network
    - Maritime grid network
  - Home/office networks
    - Home/office Network

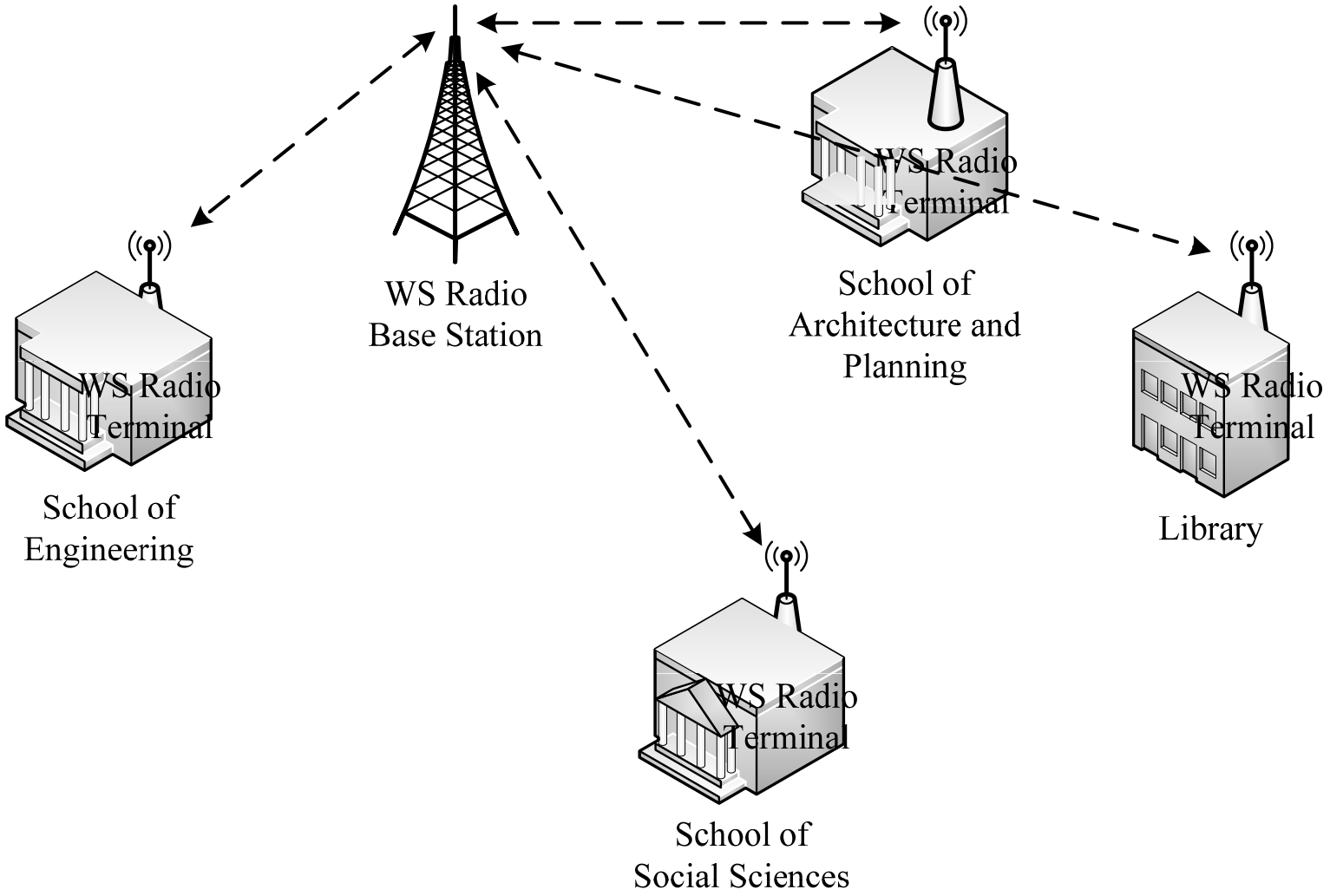
I. Wireless Backbone Networks

- This category includes three use cases
  - Wireless Access Backbone Network
    - High data rate wireless access network serving as a backbone network for fixed stations that provide wireless/wired access service to their users
  - Wireless Mesh Backbone Network
    - High data rate mesh backbone network connecting fixed stations that provide wireless/wired access service to their users
  - High Speed Vehicle Backbone Network
    - High data rate backbone network for high speed vehicles
  - Rural broadband network
    - Broadband access to homes

Wireless Access Backbone Network

- White space radio is used to provide high data rate wireless access network serving as a backbone network for fixed stations that provide wireless/wired access service to their users
- Potential applications
  - Campus connectivity
  - Enterprise connectivity
  - Dynamic backhaul
  - Quick-to-deploy temporary networks

Wireless Access Backbone Network



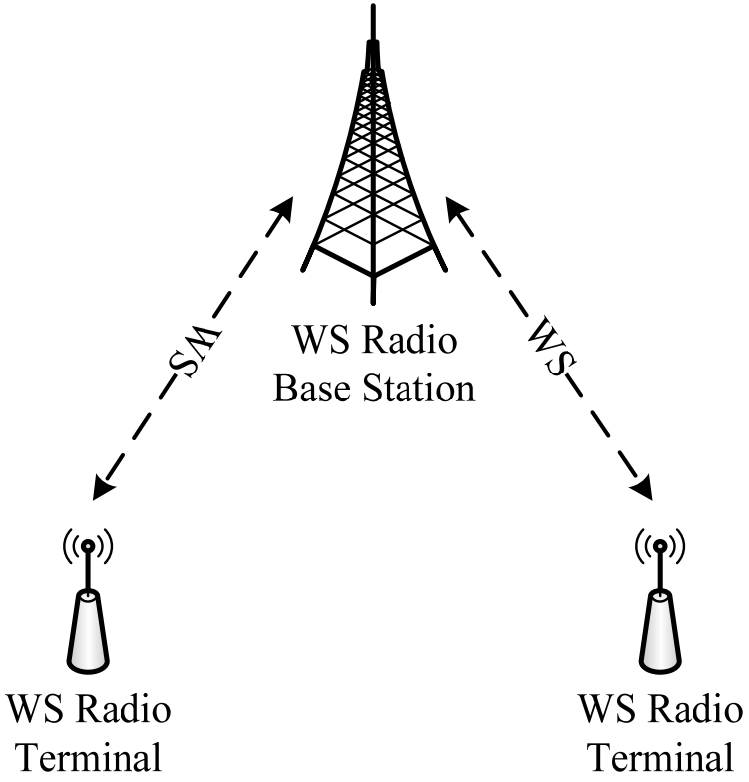
Wireless Access Backbone Network

Propagation environment	Outdoor LOS, NLOS
	Outdoor to indoor LOS, NLOS
Expected data rate per terminal (1)	30 Mbps
Maximum transmission range	10 km
Maximum mobility speed	fixed
Tolerable delay	High
Security level	High
Number of terminals per base station (2)	5-10

(1) Expected data rate per terminal is the maximum rate that a terminal is able to achieve theoretically .
(2) Number of terminals per base station is the number of connected devices (active and in sleep mode) .

Wireless Access Backbone Network

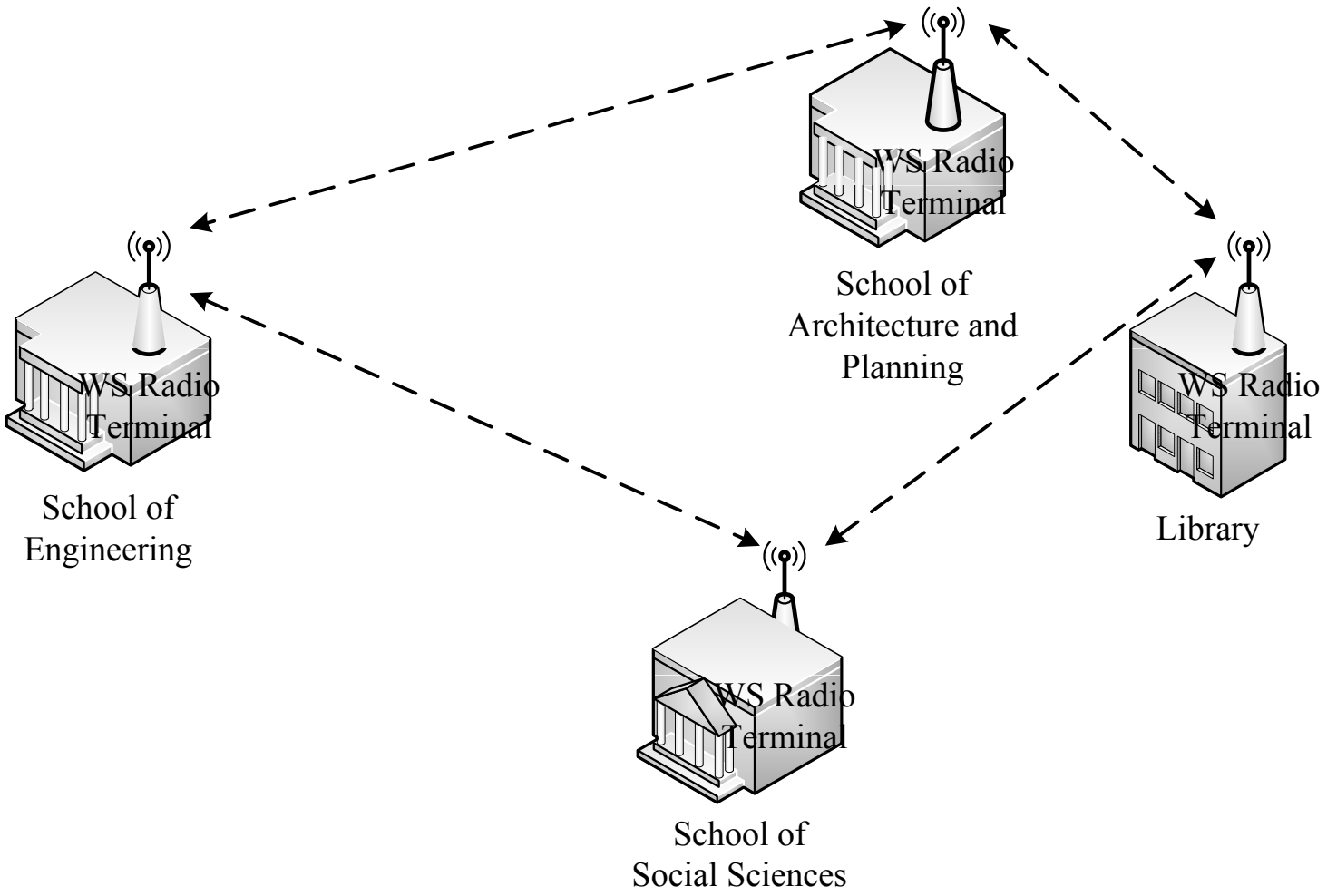
- WS Radio Base Station is fixed
- WS Radio Terminals are fixed



Wireless Mesh Backbone Network

- White space radio is used to provide high data rate mesh backbone network connecting fixed stations that provide wireless/wired access service to their users
- Potential applications
  - Campus connectivity
  - Enterprise connectivity
  - Quick-to-deploy temporary networks

Wireless Mesh Backbone Network

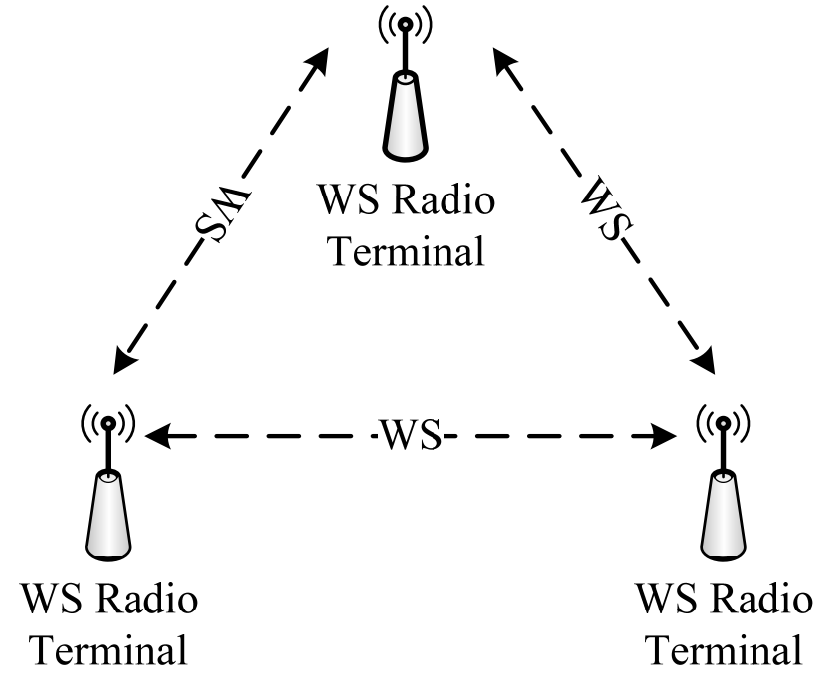


Wireless Mesh Backbone Network

Propagation environment	Outdoor LOS, NLOS
	Outdoor to indoor NLOS
Expected data rate per terminal	20 Mb/s
Maximum transmission range	5 km
Maximum mobility speed	fixed
Tolerable delay	High
Security level	High
Number of terminals	5 – 10

Wireless Mesh Backbone Network

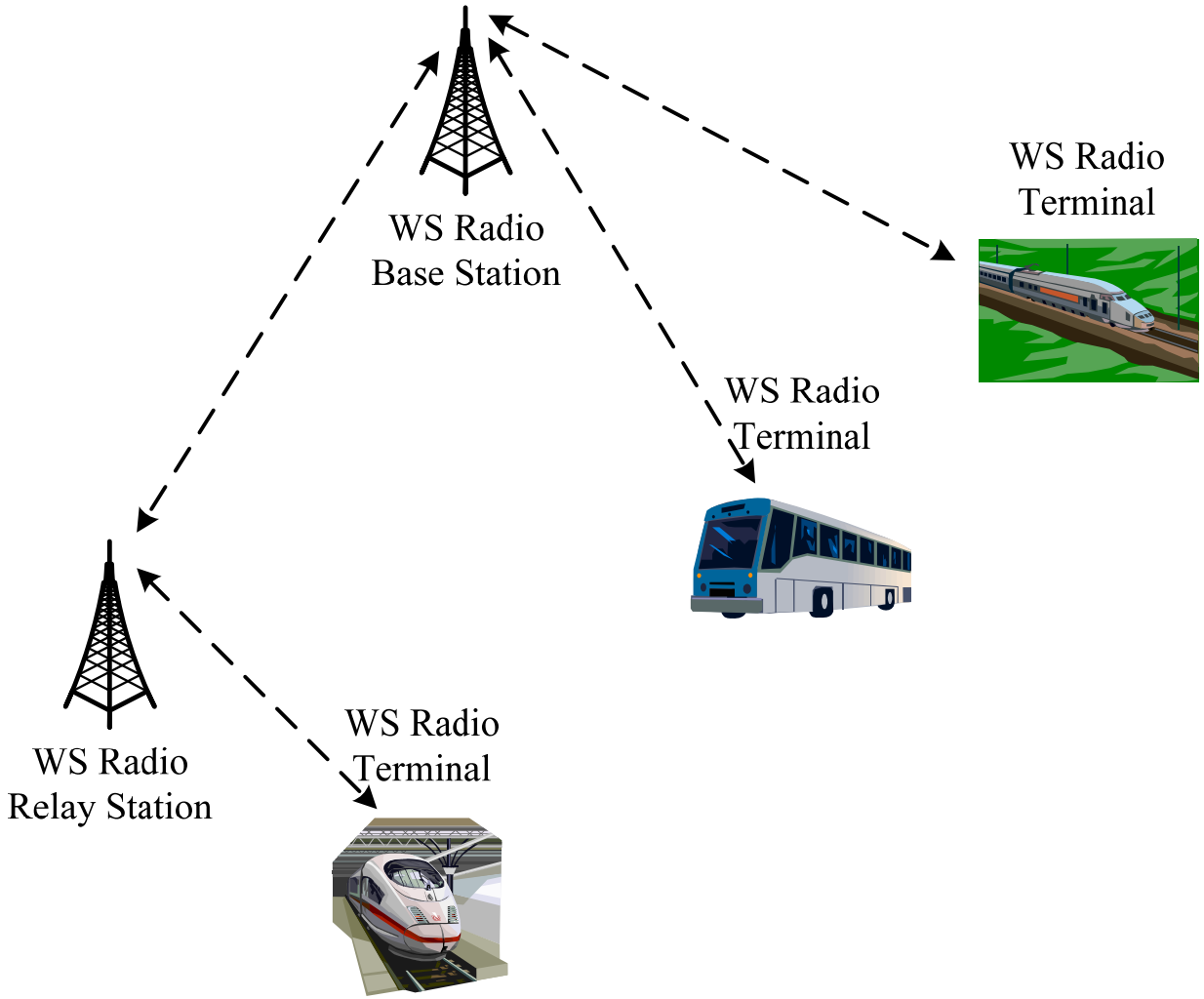
- WS Radio Terminals are fixed



High Speed Vehicle Backbone Network

- White space radio is used to provide high data rate backbone network for high speed vehicles
- Potential applications
  - Backbone network for high-speed trains
  - Backbone network for long distance buses

High Speed Vehicle Backbone Network

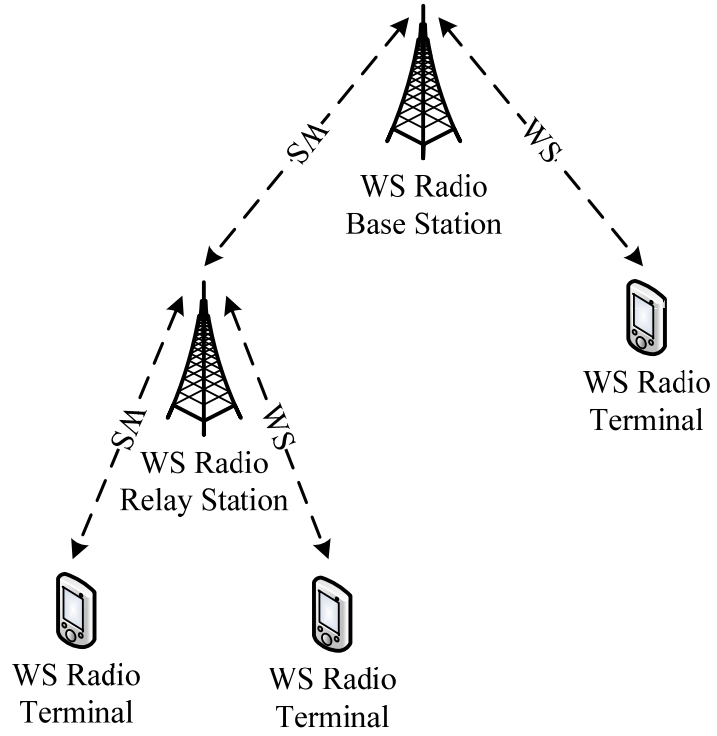


High Speed Vehicle Backbone Network

Propagation environment	Outdoor LOS, NLOS
Expected data rate per terminal	10 Mbps
Maximum transmission range	10 km
Maximum mobility speed	300 km/h
Tolerable delay	Medium
Security level	Medium
Number of terminals per base station	1-10

High Speed Vehicle Backbone Network

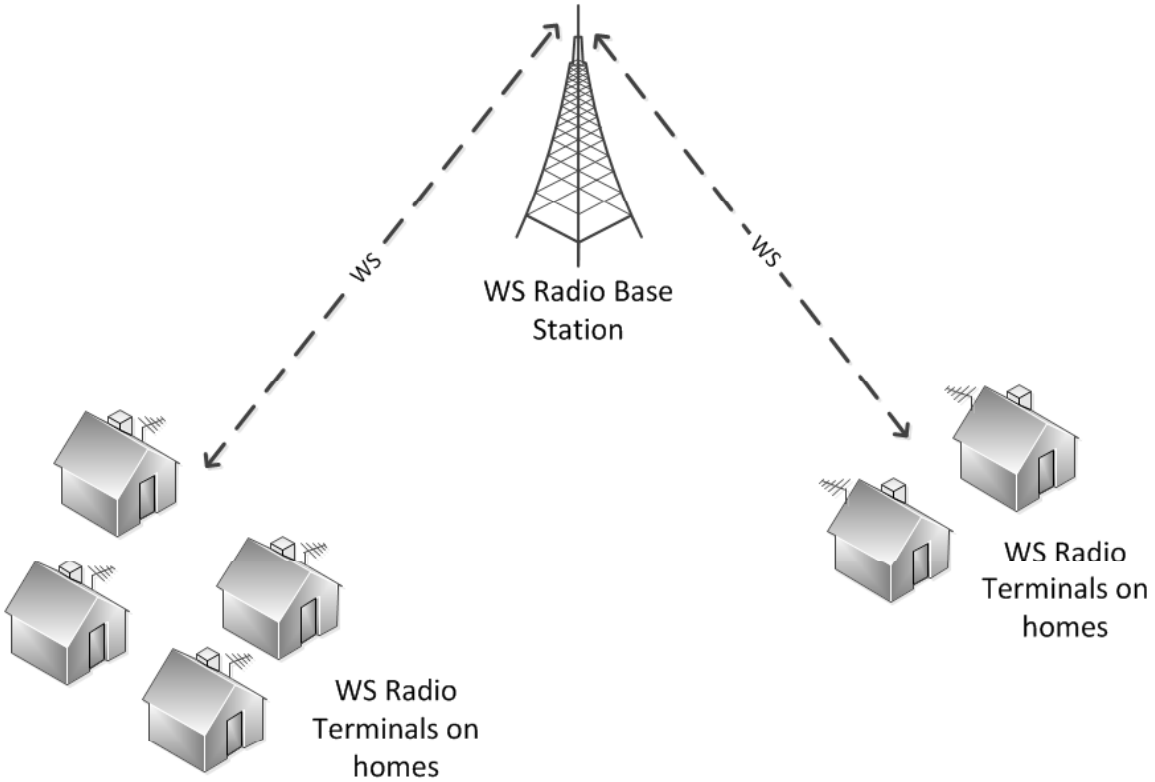
- WS Radio Base Station is fixed
- WS Radio Relay Stations are fixed
- WS Radio Terminals are mobile



Rural Broadband network

- White space radio is used to provide broadband access to homes.
- Base stations are fixed
- Home terminals are fixed
- Distribution around homes is not part of this use case (possibly home/office network solution later in this document)

Rural Broadband network



Rural Broadband network

Propagation environment	Outdoor LOS, NLOS
	Outdoor to indoor LOS, NLOS (possibly)
Expected data rate per terminal	30 Mbps
Maximum transmission range	10 km
Maximum mobility speed	fixed
Tolerable delay	High
Security level	High
Number of terminals per base station	30

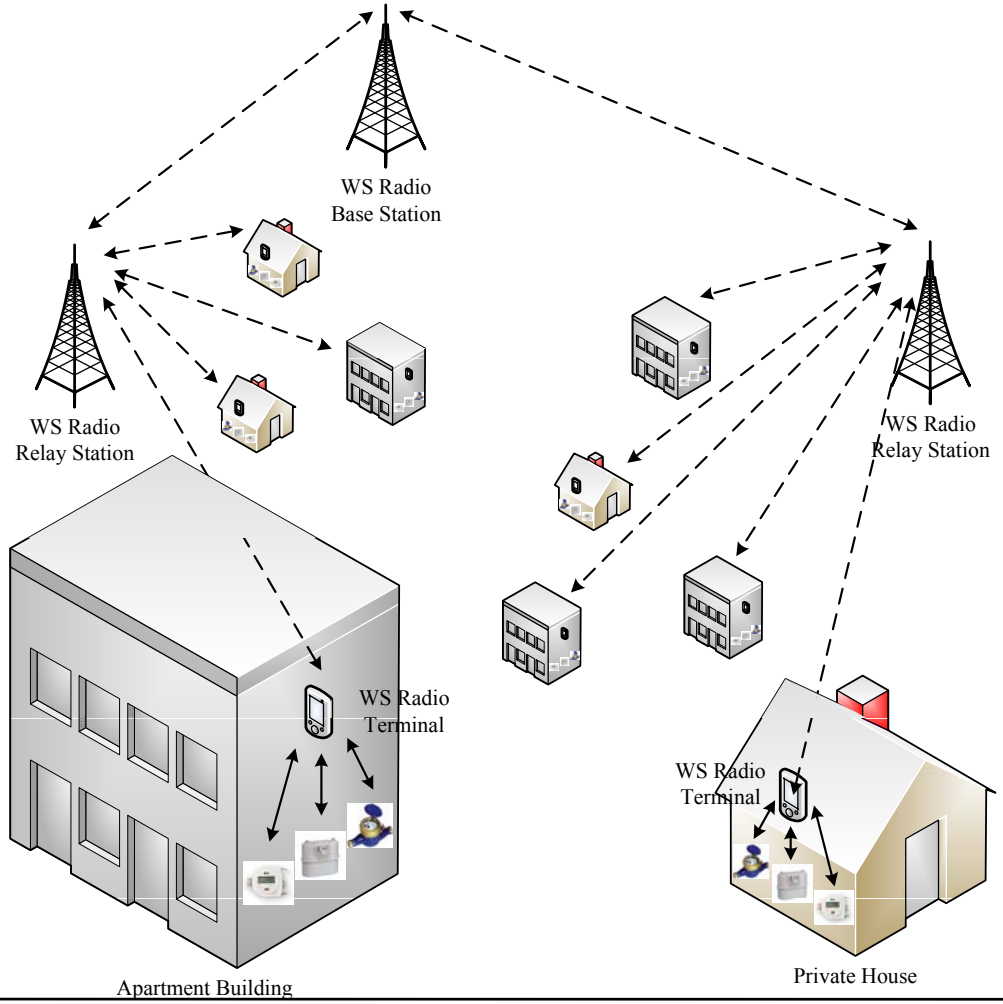
II. Land Fixed/Mobile Networks

- This category includes three use cases
  - Smart Home Networks
    - Low data rate network for collecting data from low power consumption stations gathering measurements from utility devices (e.g., gas, water, and electricity meters)
  - Digital Signage Network
    - Distribution network for digital signs
  - Transportation Logistics Network
    - Low data rate network for tracking and controlling mobile stations (e.g., post delivery vehicles)
  - Mobile Wireless Access Network
    - Providing wireless access to mobile stations

Smart Home Network

- White space radio is used to provide low data rate network for collecting data from low power consumption stations gathering measurements from devices, e.g., gas, water, electricity meters, and to control such devices from a server
- Potential applications
  - Smart metering
  - Monitoring and control

Smart Home Networks

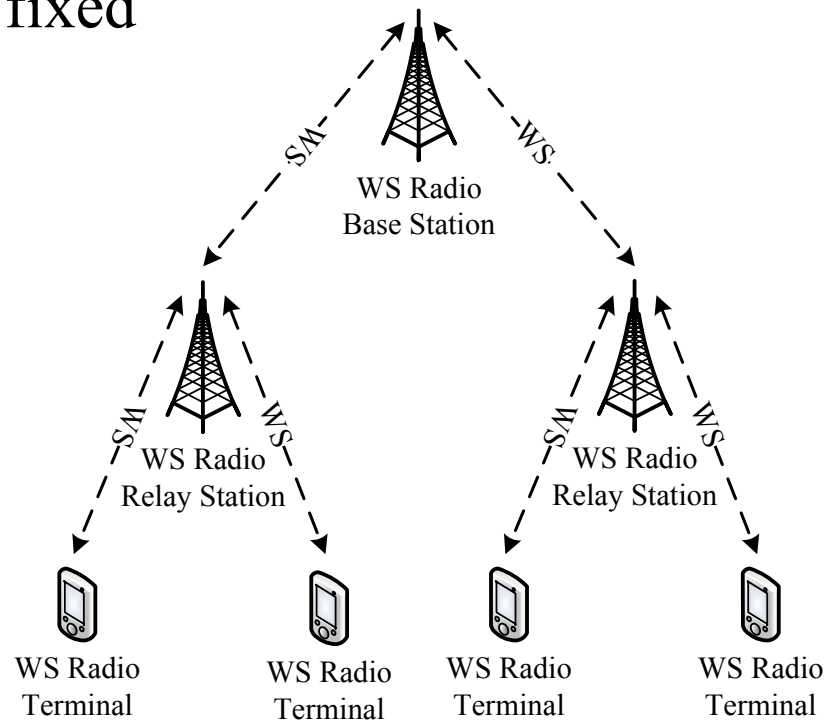


Smart Home Network

Propagation environment	Outdoor LOS, NLOS
	Outdoor to indoor NLOS
Expected data rate per terminal	10 kbps
Maximum transmission range	10 km
Maximum mobility speed	fixed
Tolerable delay	High
Security level	High
Number of terminals per base station	100-1000

Smart Home Network

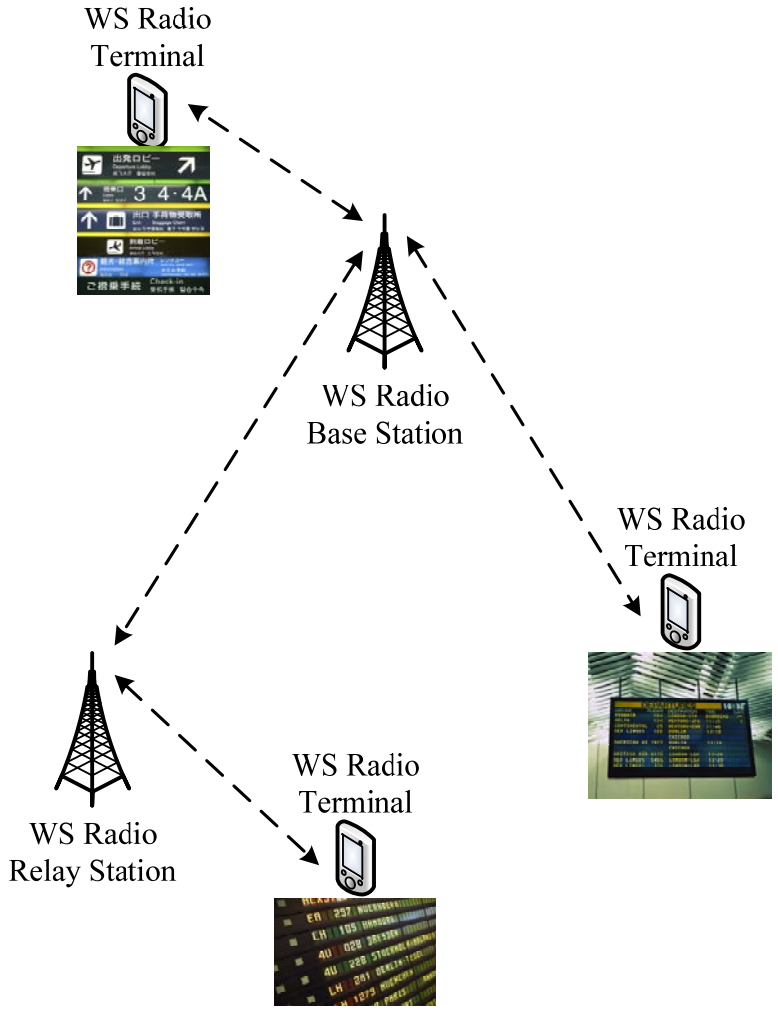
- WS Radio Base Station is fixed
- WS Radio Relay Stations are fixed
- WS Radio Terminals are fixed



Digital Signage Network

- White space radio is used to provide data distribution network for digital signs
- Potential applications
  - Digital signage

Digital Signage Network

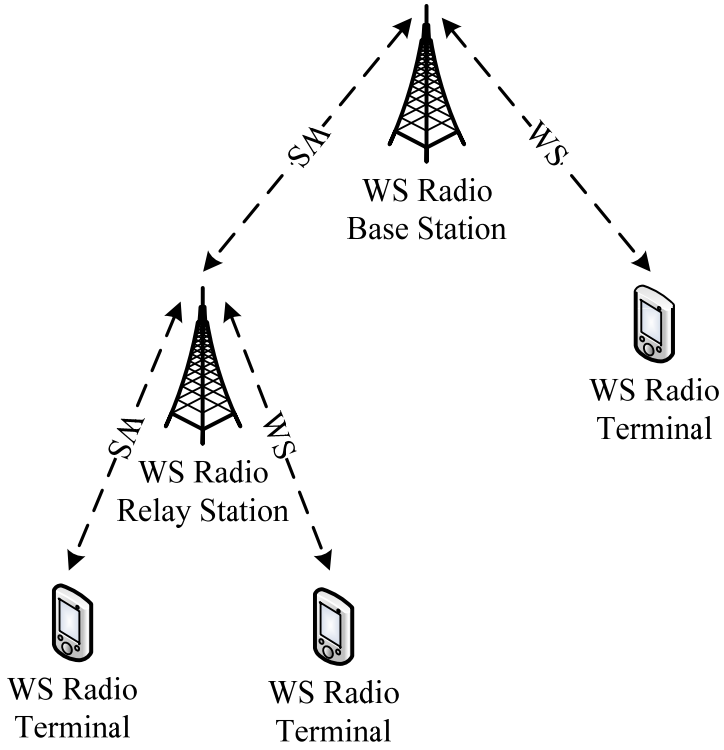


Digital Signage Network

Propagation environment	Outdoor LOS, NLOS
Expected data rate per terminal	1 Mbps
Maximum transmission range	10 km
Maximum mobility speed	fixed
Tolerable delay	High
Security level	High
Number of terminals per base station	10-100

Digital Signage Network

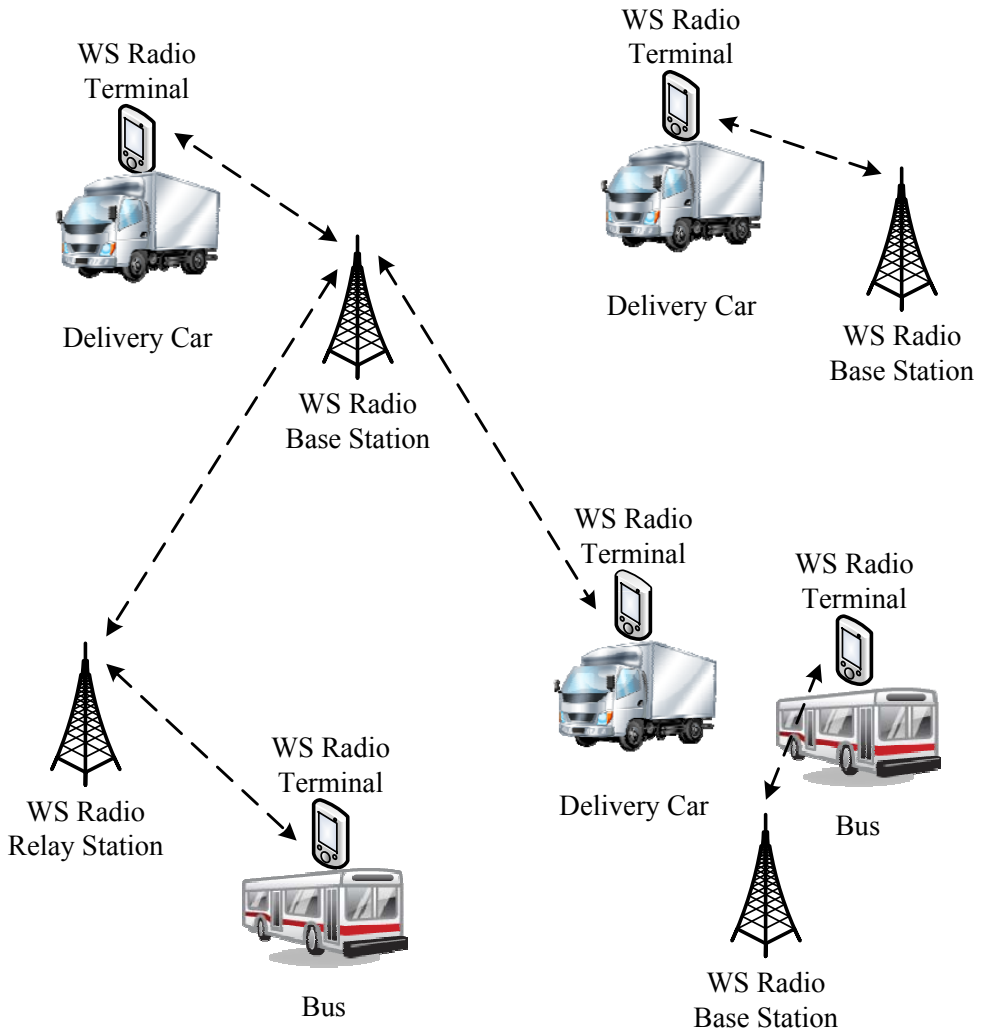
- WS Radio Base Station is fixed
- WS Radio Relay Stations are fixed
- WS Radio Terminals are fixed



Transportation Logistics Network

- White space radio is used to provide low data rate network for tracking and controlling mobile stations, e.g., post delivery vehicles
- Potential applications
  - Public transportation logistics
  - Control and management of postal and delivery services

Transportation Logistics Network

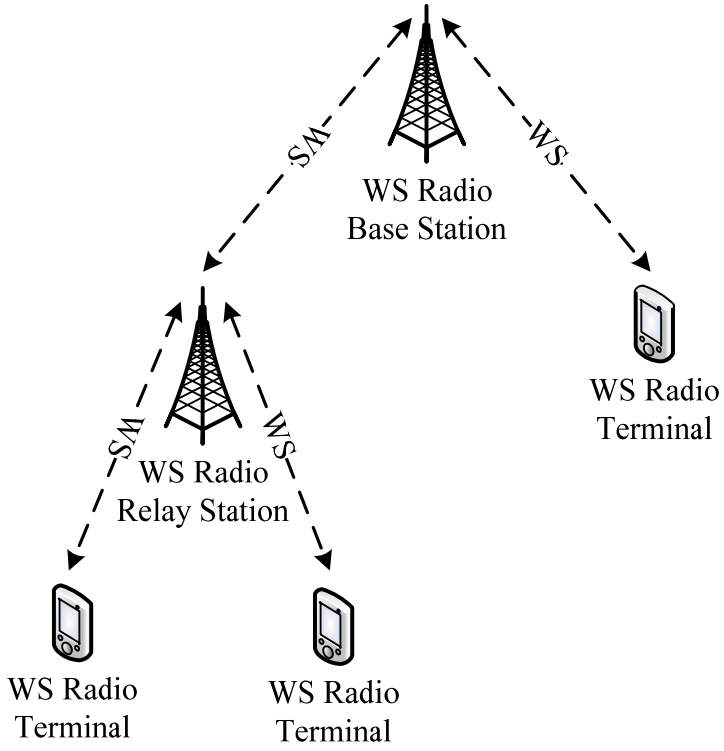


Transportation Logistics Network

Propagation environment	Outdoor LOS, NLOS
Expected data rate per terminal	10 kbps
Maximum transmission range	10 km
Maximum mobility speed	120 km/h
Tolerable delay	High
Security level	High
Number of terminals per base station	100-1000

Transportation Logistics Network

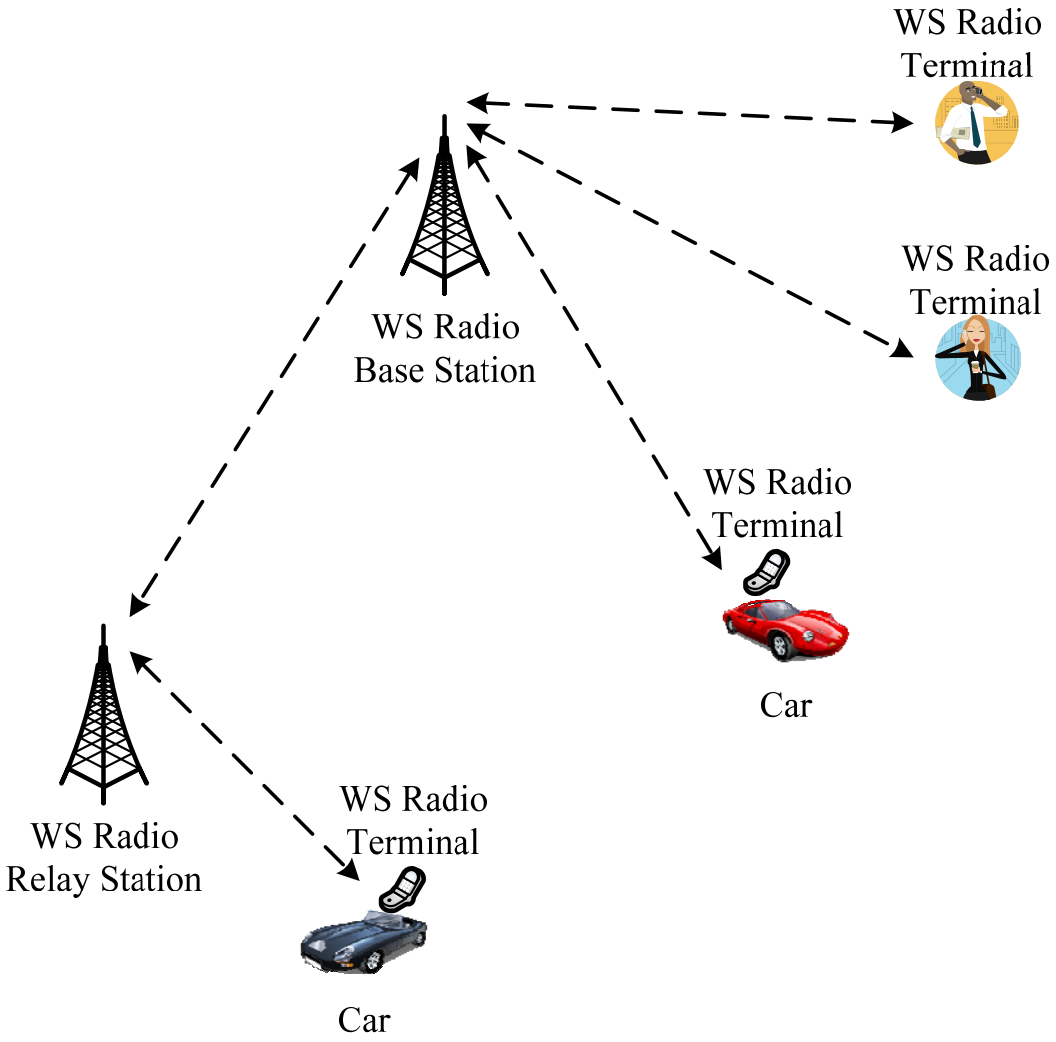
- WS Radio Base Station is fixed
- WS Radio Relay Stations are fixed
- WS Radio Terminals are mobile



Mobile Wireless Access Network

- White space radio is used to provide wireless access to mobile stations
- Potential applications
  - Mobile wireless access
  - Cellular network extension to white space

Mobile Wireless Access Network

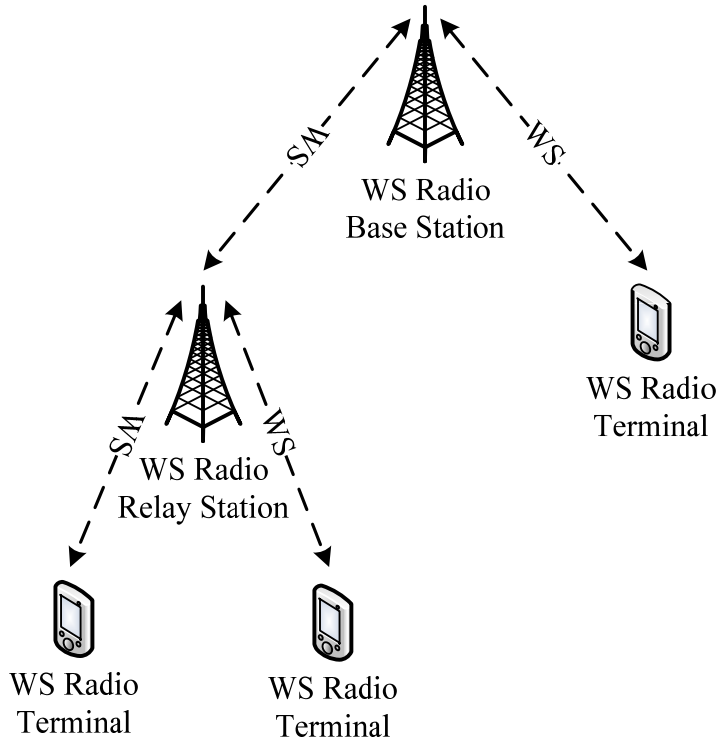


Mobile Wireless Access Network

Propagation environment	Outdoor LOS, NLOS
	Outdoor to indoor NLOS
Expected data rate per terminal	5 Mbps
Maximum transmission range	5 km
Maximum mobility speed	120 km/h
Tolerable delay	Low
Security level	Medium
Number of terminals per base station	10-100

Mobile Wireless Access Network

- WS Radio Base Station is fixed
- WS Radio Relay Stations are fixed
- WS Radio Terminals are mobile and pedestrian



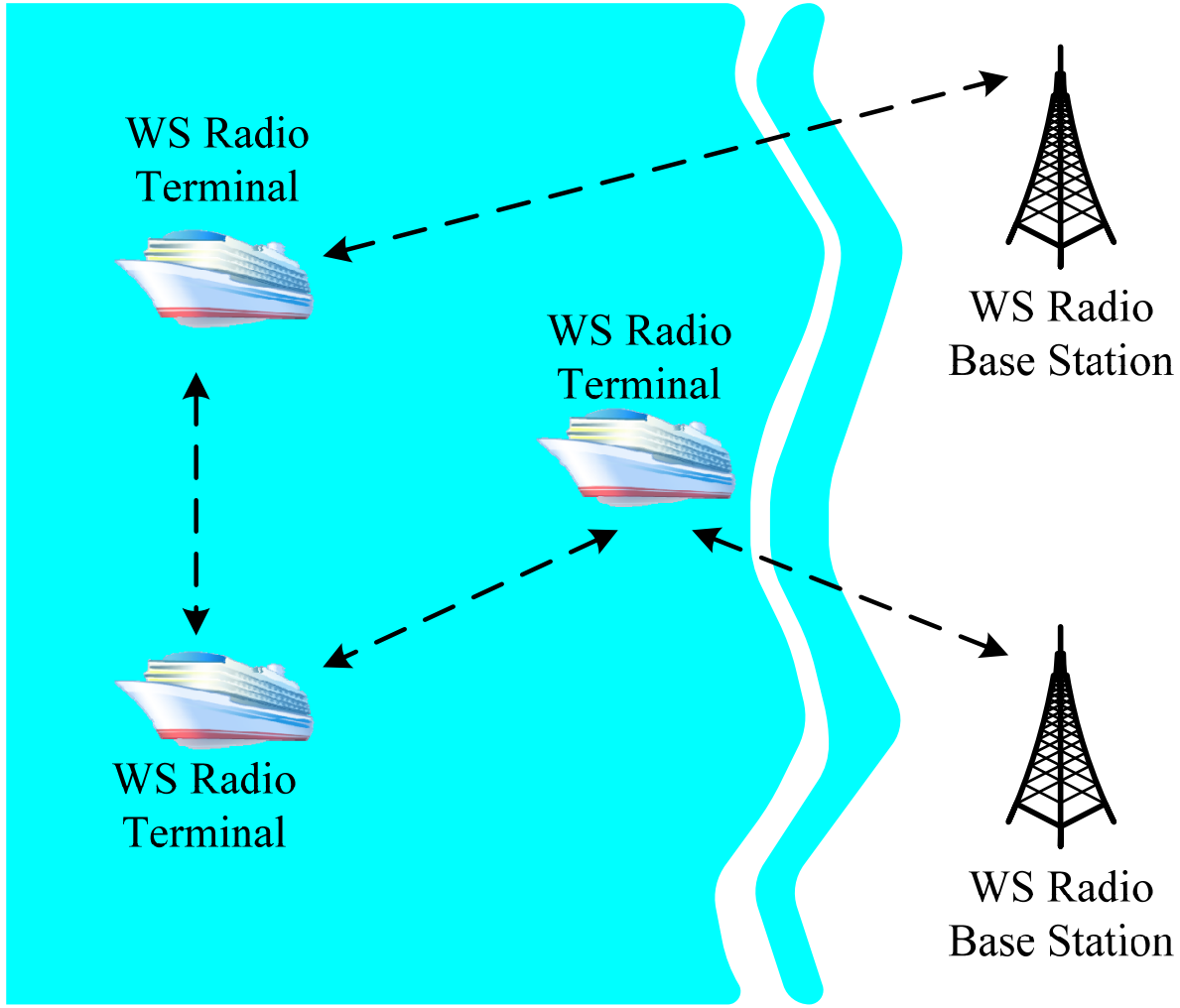
III. Maritime Networks

- This category includes three use cases
  - Maritime Wireless Access Network
    - Providing wireless access to ships and connecting ships with each other
  - Inter-ship Mesh Network
    - Mesh network connecting stations located on ships
  - Maritime Grid Network
    - Low data rate network collecting data from marine environment monitoring stations, oil/gas platforms, etc

Maritime Wireless Access Network

- White space radio is used to provide maritime wireless access network
- Potential applications
  - Wireless access for ship crew and passengers
  - Fleet and seaport management
  - Inter-ship communications

Maritime Wireless Access Network

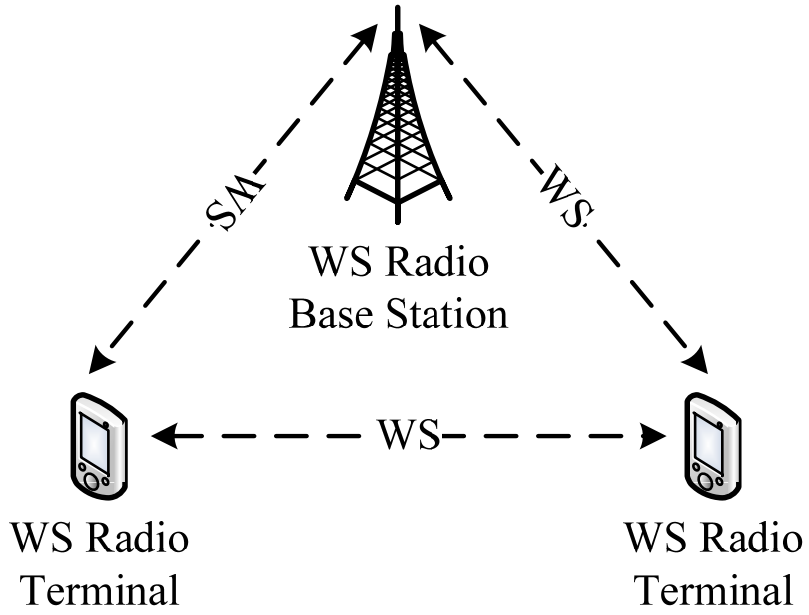


Maritime Wireless Access Network

Propagation environment	Outdoor LOS, NLOS
Expected data rate per terminal	10 Mbps
Maximum transmission range	20 km
Maximum mobility speed	60 km/h
Tolerable delay	Low
Security level	Medium
Number of terminals per base station	several-10

Maritime Wireless Access Network

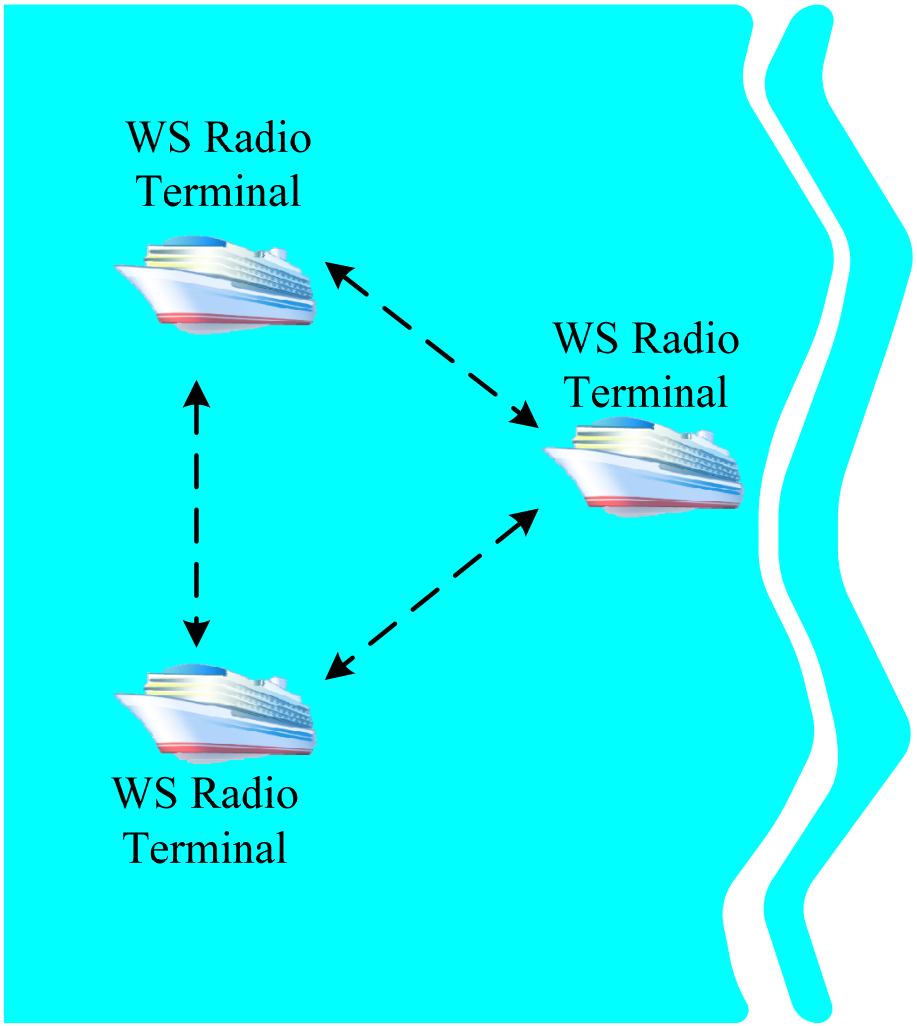
- WS Radio Base Station is fixed
- WS Radio Terminals are mobile



Inter-ship Mesh Network

- White space radio is used to provide mesh network connecting stations located on ships
- Potential applications
  - Fleet management
  - Inter-ship communications
  - Disaster rescue
  - Anti-piracy

Inter-ship Mesh Network

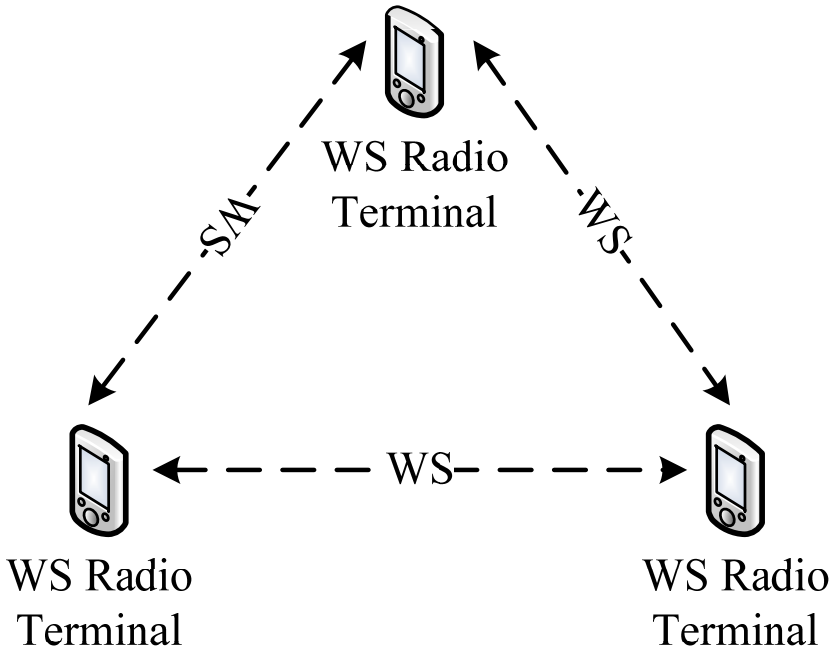


Inter-ship Mesh Network

Propagation environment	Outdoor LOS, NLOS
Expected data rate per terminal	5 Mbps
Maximum transmission range	20 km
Maximum mobility speed	60 km/h
Tolerable delay	Low
Security level	Medium
Number of terminals	several-10

Inter-ship Mesh Network

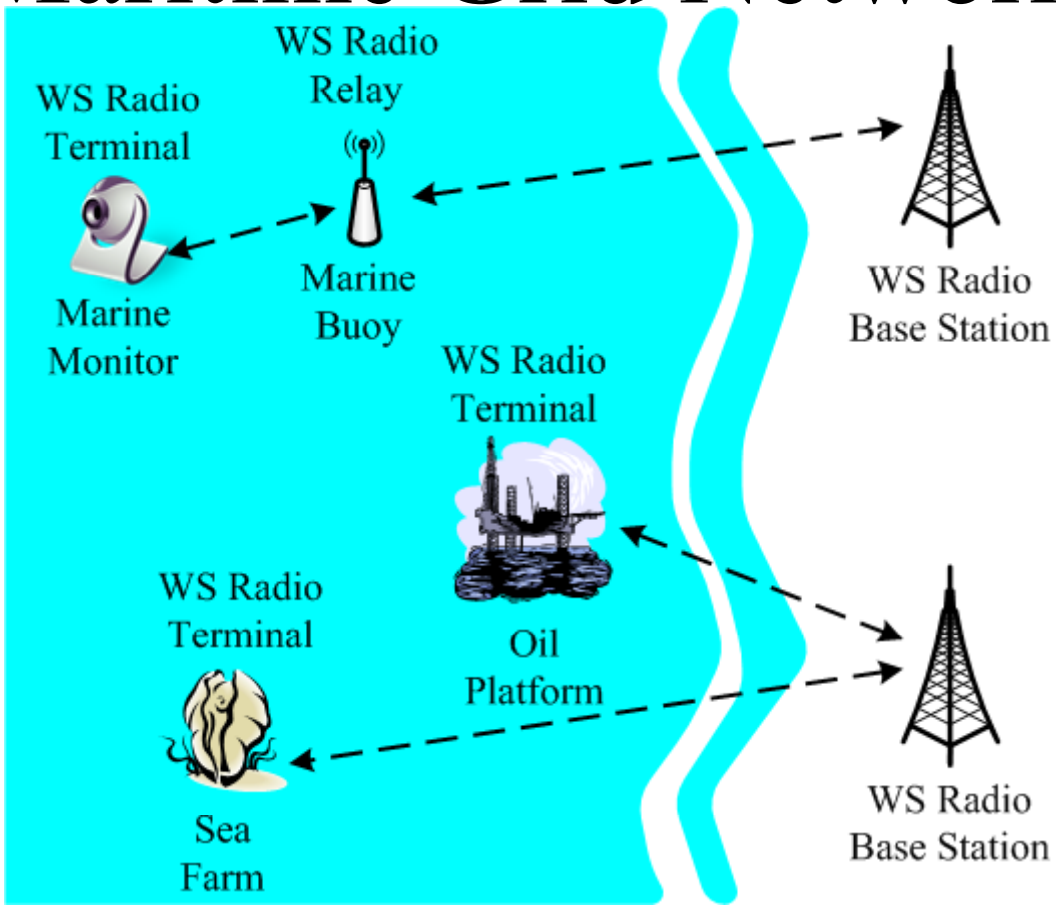
- WS Radio Terminals are mobile



Maritime Grid Network

- White space radio is used to provide low data rate network collecting data from marine environment monitoring stations, oil/gas platforms, etc
- Potential applications
  - Seaport management
  - Control and management of oil platforms, sea farms
  - Marine environment monitoring and data collection

Maritime Grid Network

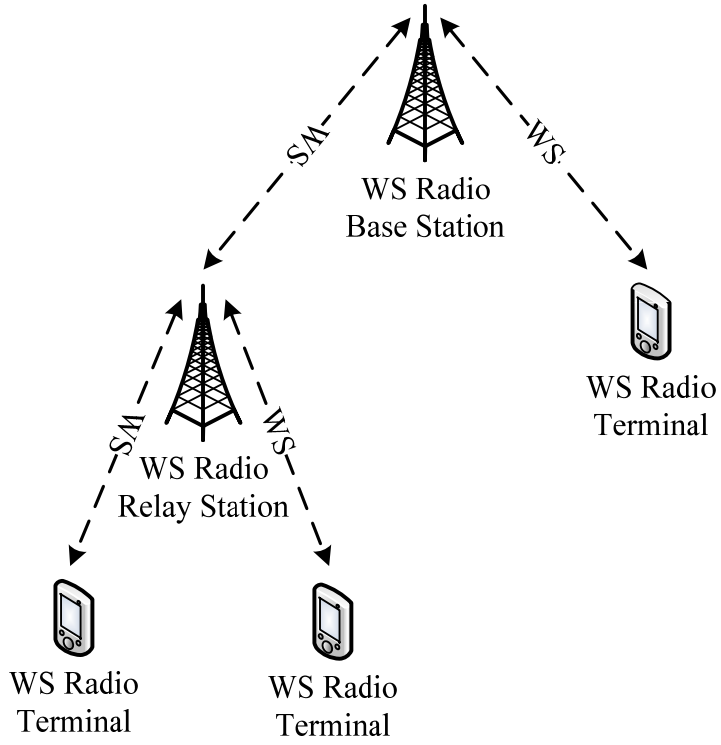


Maritime Grid Network

Propagation environment	Outdoor LOS, NLOS
Expected data rate per terminal	10 Mbps
Maximum transmission range	20 km
Maximum mobility speed	Fixed/Mobile
Tolerable delay	High
Security level	High
Number of terminals per base station	100-1000

Maritime Grid Network

- WS Radio Base Station is fixed
- WS Radio Relay Stations are fixed
- WS Radio Terminals are fixed, mobile



Indoor Networks

- This category includes one use case
  - Indoor Network
    - Providing wireless access inside office or home

Home/Office Network

- White space radio is used to provide wireless access inside home or office
- Potential applications
  - Wireless access inside office
  - Wireless access inside home
  - Inside-to-outside coverage

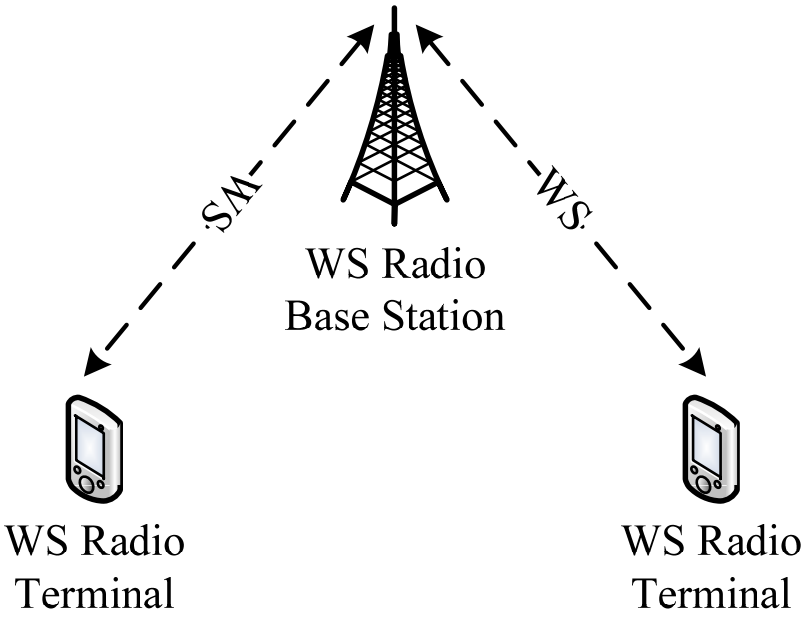
Home/Office Network

Indoor Network

Propagation environment	Indoor LOS, NLOS
	Outdoor to indoor LOS, NLOS
Expected data rate per terminal	20 Mbps
Maximum transmission range	300 m
Maximum mobility speed	4 km/h
Tolerable delay	Medium
Security level	Medium
Number of terminals per base station	1-10

Indoor Network

- WS Radio Base Station is fixed
- WS Radio Terminals are pedestrian



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