Introduction to Internet of Things

Week 10

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Smart Cities and Smart Homes

✓ **A Smart City is-**

- An urban system
- Uses Information & Communication Technology (ICT)
- Makes infrastructure more interactive, accessible and efficient.

✓ **Need for Smart Cities arose due to-**

- Rapidly growing urban population
- Fast depleting natural resources
- Changes in environment and climate

Humans	Smart Cities
Skeleton	Buildings, Industries, People
Skin	Transportation, Logistics
Organs	Hospital, Police, Banks, Schools
Brain	Ubiquitously embedded intelligence
Nerves	Digital telecommunication networks
Sensory Organs	Sensors, Tags
Cognition	Software

Application of Smart Cities and Smart Homes

Smart Economy
- Competitiveness

Smart Governance
- Citizen participation

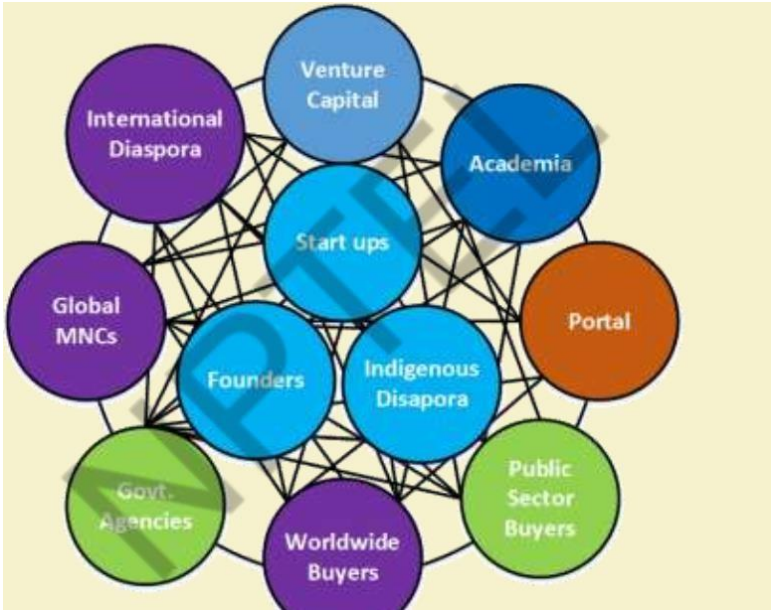
Smart People
- Social and Human Capital

Smart Mobility
- Transport and ICT

Smart Environment
- Natural resources

Smart Living
- Quality of life

Smart Economy, Governance, and People

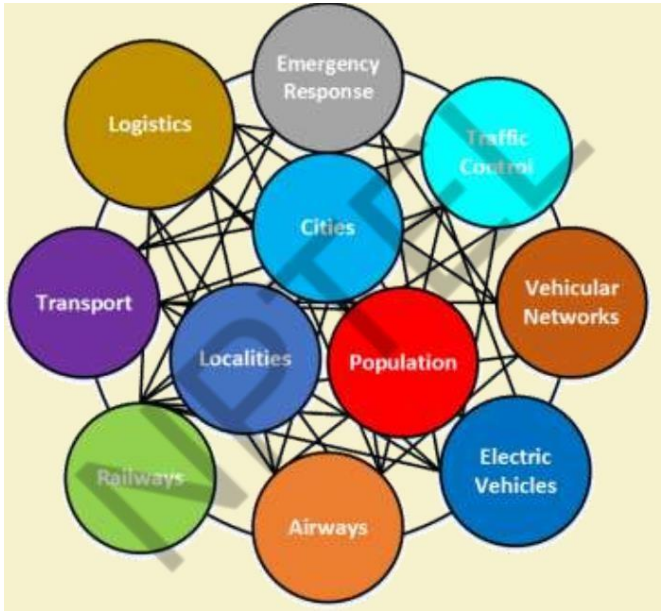


Smart Economy

Smart Governance

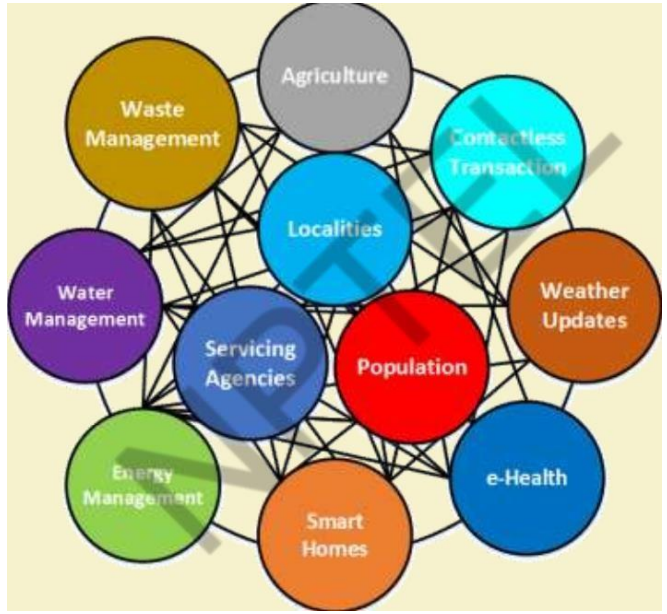
Smart People

Smart Mobility, Environment, and People



Smart Mobility

Smart Environment



Smart Living

Current Focus Areas

✓ **Smart Homes**

- Health monitoring.
- Conservation of resources (e.g. electricity, water, fuel).
- Security and safety.

✓ **Smart Parking Lots**

- Auto routing of vehicles to empty slots.
- Auto charging for services provided.
- Detection of vacant slots in the parking lot.

✓ **Smart Vehicles**

- Assistance to drivers during bad weather or low-visibility.
- Detection of bad driving patterns or driving under the influence of substances.
- Auto alert generation during crashes.

✓ **Smart Health**

- Low cost, portable, at-home medical diagnosis kits.
- Remote check-ups and diagnosis.
- On-body sensors for effortless and accurate health monitoring.
- Auto alert generation in case of emergency medical episodes (e.g. Heart attacks, seizures).

Current Focus Areas

✓ **Pollution and Calamity Monitoring**

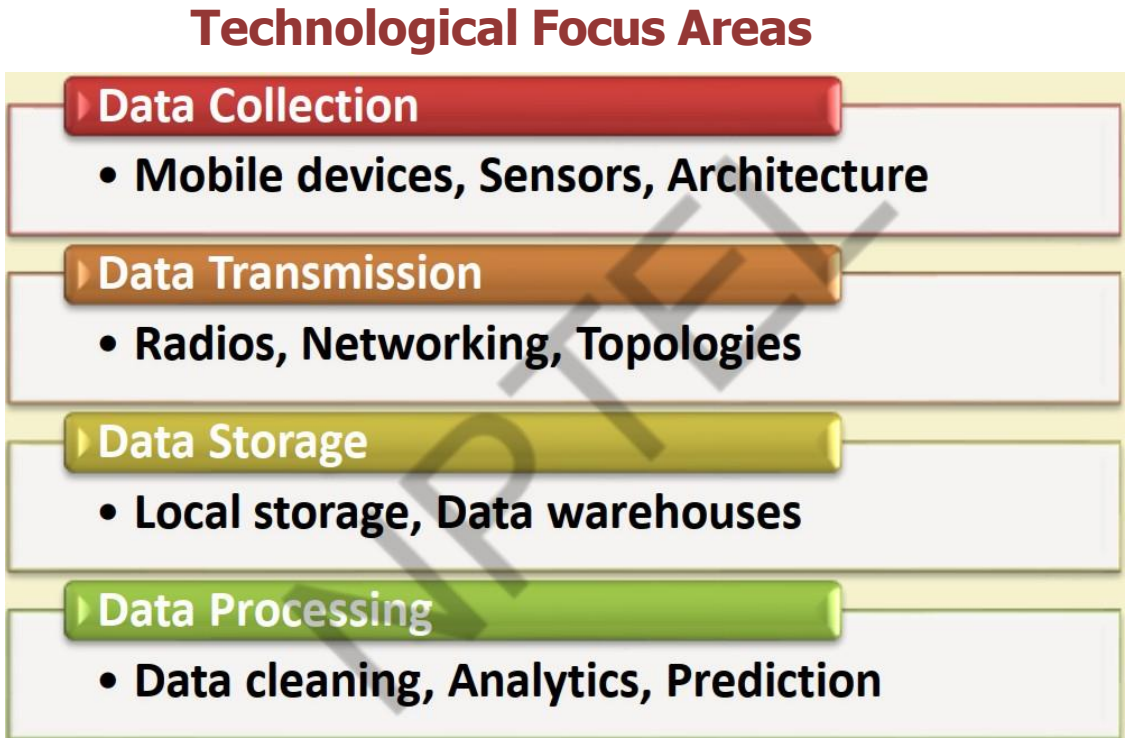
- Monitoring for weather or man-made based calamities.
- Alert generation in case of above-threshold pollutants in the air or water.
- Resource reallocation and rerouting of services in the event of calamities.

✓ **Smart Energy**

- Smart metering systems.
- Smart energy allocation and distribution system.
- Incorporation of traditional and renewable sources of energy in the same grid.

✓ **Smart Agriculture**

- Automatic detection of plant water stress.
- Monitoring of crop health status.
- Auto detection of crop infection.
- Auto application of fertilizers and pesticides.
- Scheduling harvesting and arranging proper transfer of harvests to warehouses or markets.



IoT Challenges in Smart Cities

✓ **Security and Privacy**

- Exposure to attacks (e.g. cross-site scripting, side channel, etc.).
- Exposure to vulnerabilities.
- Multi-tenancy induces the risk of data leakage.

✓ **Heterogeneity**

- Integration of varying hardware platforms and specifications.
- Integration of different radio specifications.
- Integration of various software platforms.
- Accommodating varying user requirements.

✓ **Reliability**

- Unreliable communication due to vehicle mobility.
- Device failures still significant

✓ **Large scale**

- Delay due to large scale deployments.
- Delay due to mobility of deployed nodes.
- Distribution of devices can affect monitoring tasks.

✓ **Legal and Social aspects**

- Services based on user provided information may be subject to local or international laws.
- Individual and informed consent required for using humans as data sources.

✓ **Big data**

- Transfer, storage and maintenance of huge volumes of data is expensive.
- Data cleaning and purification is time consuming.
- Analytics on gigantic data volumes is processing intensive.

✓ **Sensor Networks**

- Choice of appropriate sensors for individual sensing tasks is crucial.
- Energy planning is crucial.
- Device placement and network architecture is important for reliable end-to-end IoT implementation.
- Communication medium and means play an important role in seamless function of IoT in smart cities.

Data Fusion

- ✓ Enormous volume of data is produced periodically in a smart city environment.
- ✓ Challenges include making the available/ incoming large data volume precise and accurate.
- ✓ Quality of data precision and accuracy affects the quality of decision making in IoT-enabled smart cities.
- ✓ Data fusion enables optimum utilization of massive data gathered from multiple sources, and across multiple platforms.

Multi-sensor Data Fusion

- ✓ Combines information from multiple sensor sources.
- ✓ Enhances the ability of decision making systems to include a multitude of variables prior to arriving at a decision.
- ✓ Inferences drawn from multiple sensor type data is qualitatively superior to single sensor type data.
- ✓Information fusion generated from multiple heterogeneous sensors provides for better understanding of the operational surroundings.

Challenges

Imperfection	Inaccurate or uncertain WSN sensor data
Ambiguity	Outliers, missing data
Conflicts	Same sensor type reports different data for the same location.
Alignment	Arises when sensor data frames are converted to a singular frame prior to transmission
Trivial features	Processing of trivial data features may bring down the accuracy of the whole system

Data Fusion Opportunities in IoT

- ✓ Collective data is rich in information and generates better intelligence compared to data from single sources.
- ✓ Optimal amalgamation of data.
- ✓ Enhancing the collective information content obtained from multiple low-power, low-precision sensors.
- ✓ Enables hiding of critical data sources and semantics (useful in military applications, medical cases, etc.).

Stages of Data Fusion

Decision level	Feature level	Pixel level	Signal level
• Ensemble of decisions	• Fusion of information prior to decision making	• Fusion of information at the imaging device level itself	• Fusion of information at the sensor node/ within the local network itself.

Mathematical Methods of Data Fusion

Probability based

- Bayesian analysis, Statistics, Recursive methods

AI based

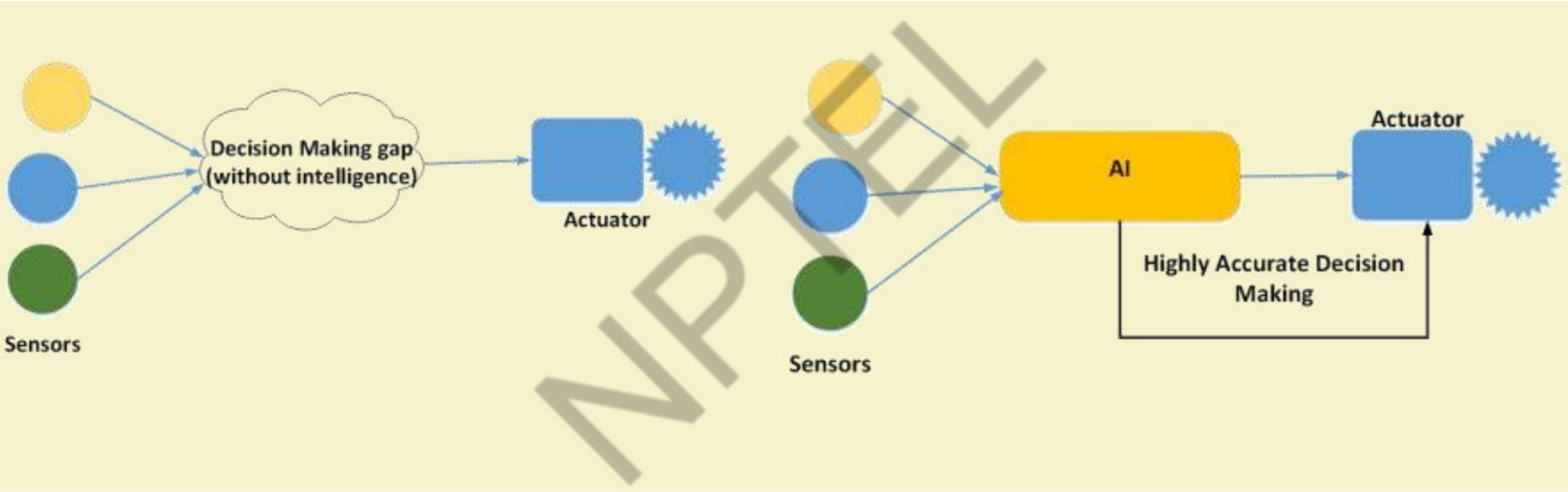
- ANN, Machine Learning, CNN

Theory of Evidence based

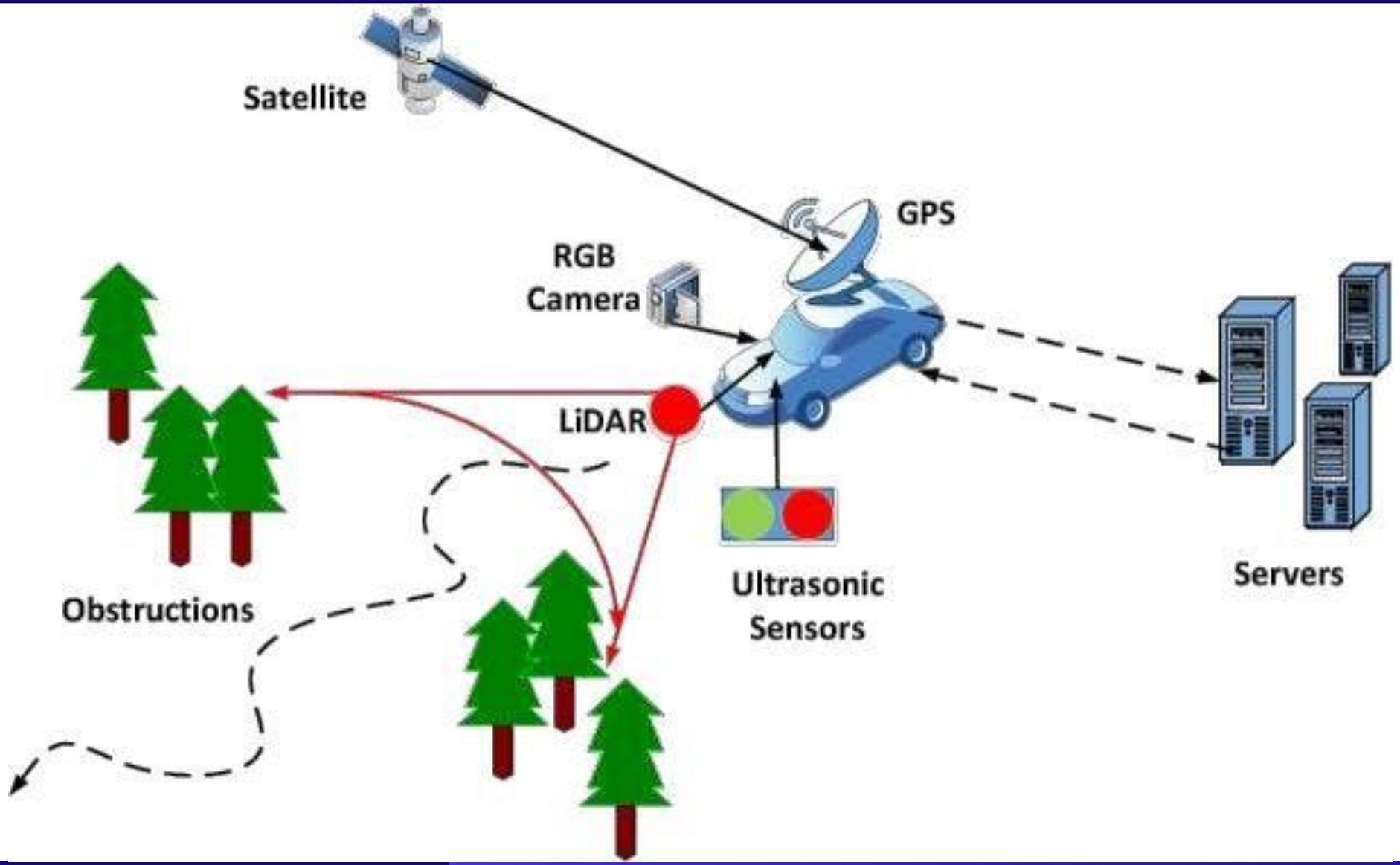
- Belief functions, Transferable belief models

https://link.springer.com/chapter/10.1007/978-3-030-90639-9_88#:~:text=Generally%2C%20data%20fusion%20process%20includes,gathered%20by%20a%20fusion%20formalism.

AI in IoT decision Making



Data Fusion for Autonomous Vehicles



Smart Parking

- ✓ Shortens parking search time of drivers.
- ✓ Reduces traffic congestion.
- ✓ Reduces pollution by keeping unnecessarily lingering vehicles off the roads.
- ✓ Reduces fuel consumption and costs.
- ✓ Increases urban mobility.
- ✓ Shorter parking search time results in more parked time, and hence, more revenue.

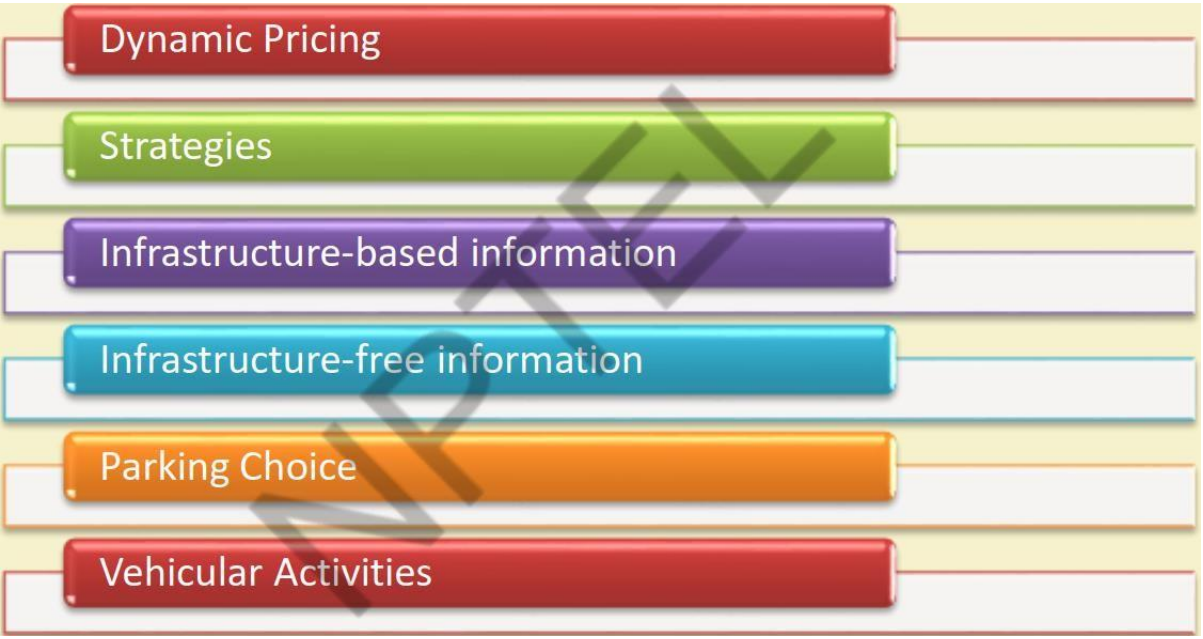
Functional Layers in Smart parking

Information Collection

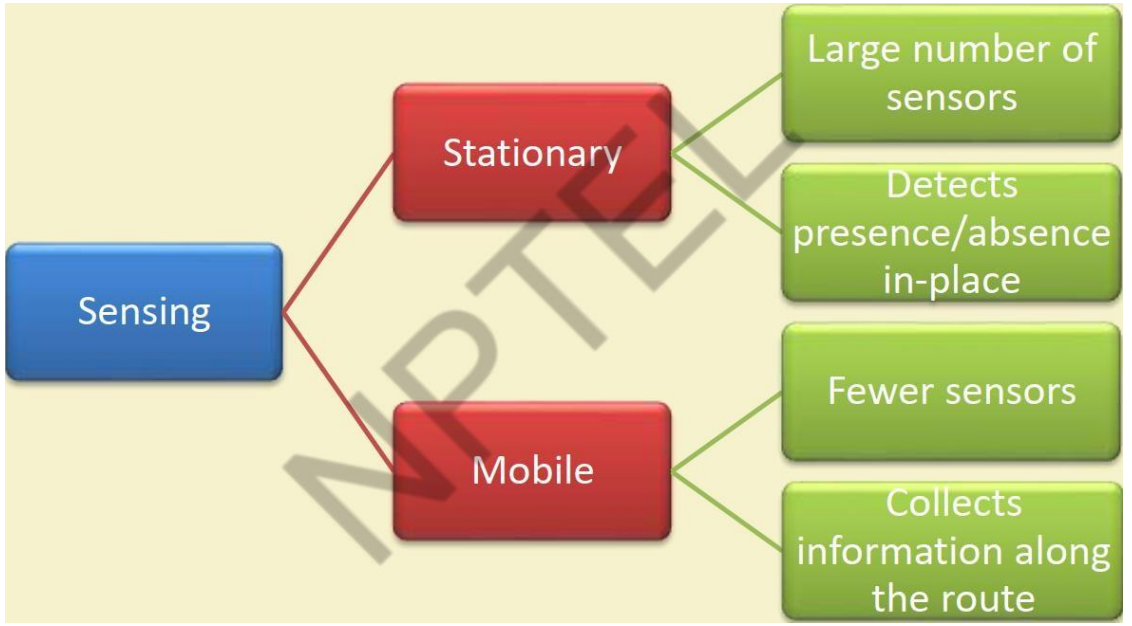
System Deployment

Smart Parking

Service Dissemination



Information Sensing



Energy Management in Smart Cities

✓ **Energy efficient solutions**

- Lightweight protocols
- Scheduling optimization
- Predictive models for energy consumption
- Cloud-based approach
- Low-power transceivers
- Cognitive management framework

✓ **Energy harvesting solutions**

- Ambient energy harvesting
- RF sources
- Wind
- Sun
- Heat
- Vibration

✓ **Energy harvesting solutions**

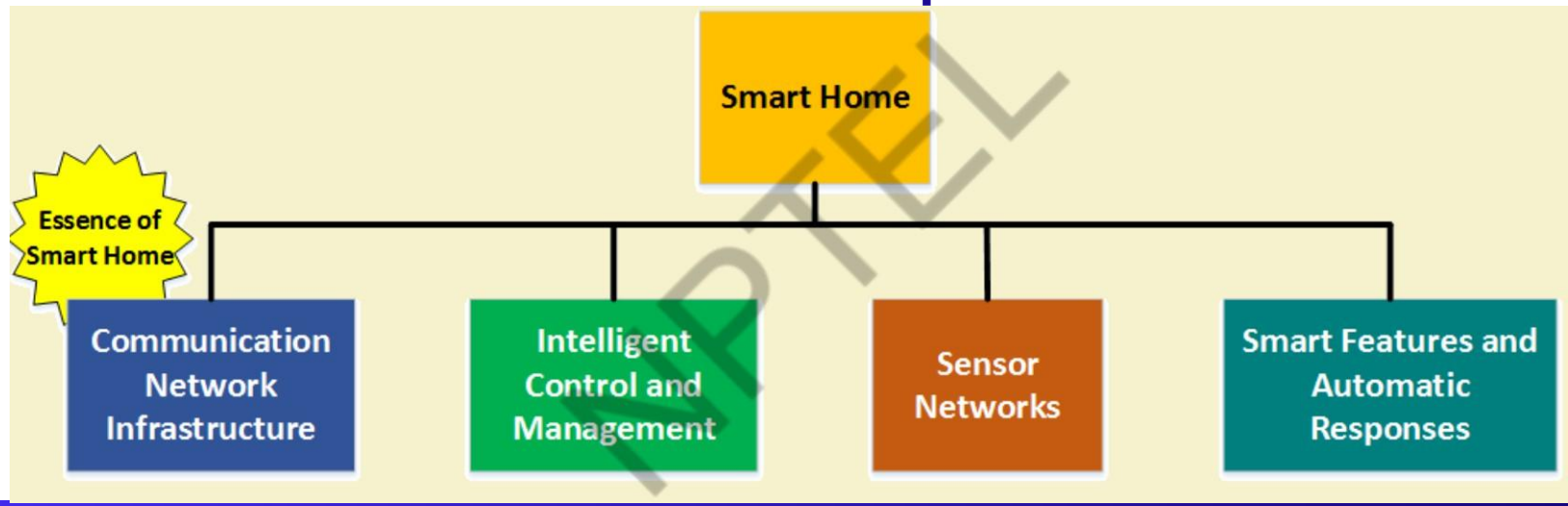
- Dedicated energy harvesting
- Energy sources intentionally deployed near IoT sources.
- Amount of energy harvested depends upon:

1. Sensitivity of the harvesting circuit
2. Distance between the device and source
3. Environment

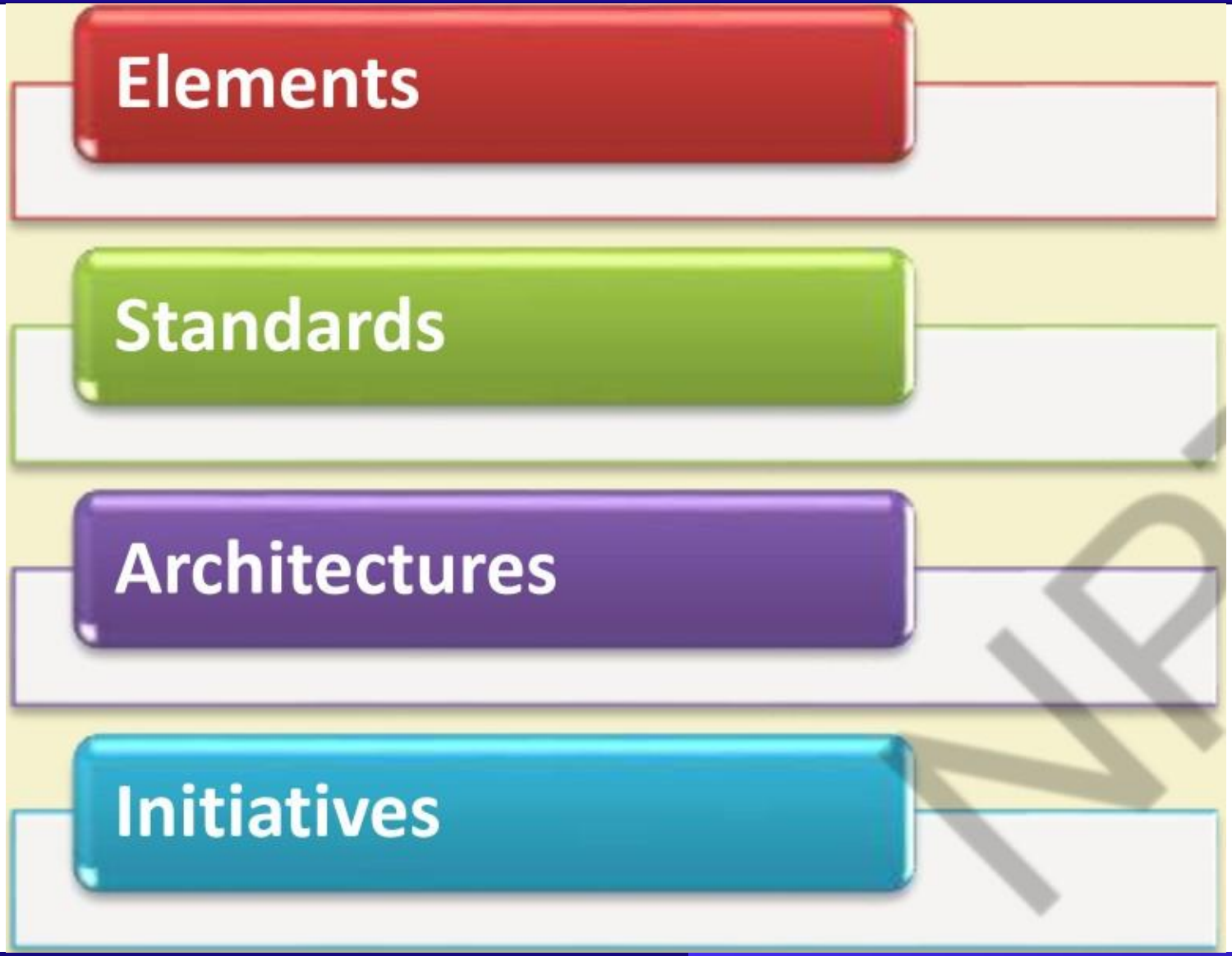
Smart Homes

- ✓ Smart home infrastructure consists of:
  - Intelligent networking device infrastructure
  - Seamless integration of various devices using wired/wireless technologies
- ✓ Allows ease of use for household systems.
- ✓ Creates a highly personalized and safe home space
- ✓ Corporations seriously indulging in smart home systems include GE, Cisco, Google, Microsoft, and others.
- ✓ Provides productive and cost-efficient environment.
- ✓ Maximizes the effectiveness of the occupants.
- ✓ Provides efficient management with minimum life-time costs of hardware and facilities.
- ✓ Optimizes-
  - Structures
  - Systems
  - Services and management
  - Interrelationships between the above three

Smart Home Aspects



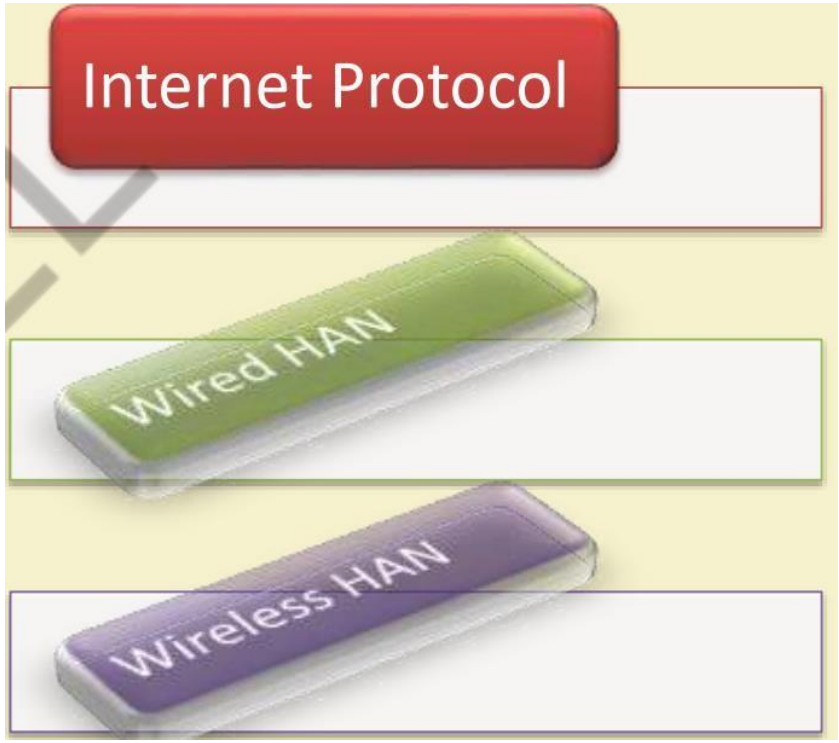
Home Area Networks



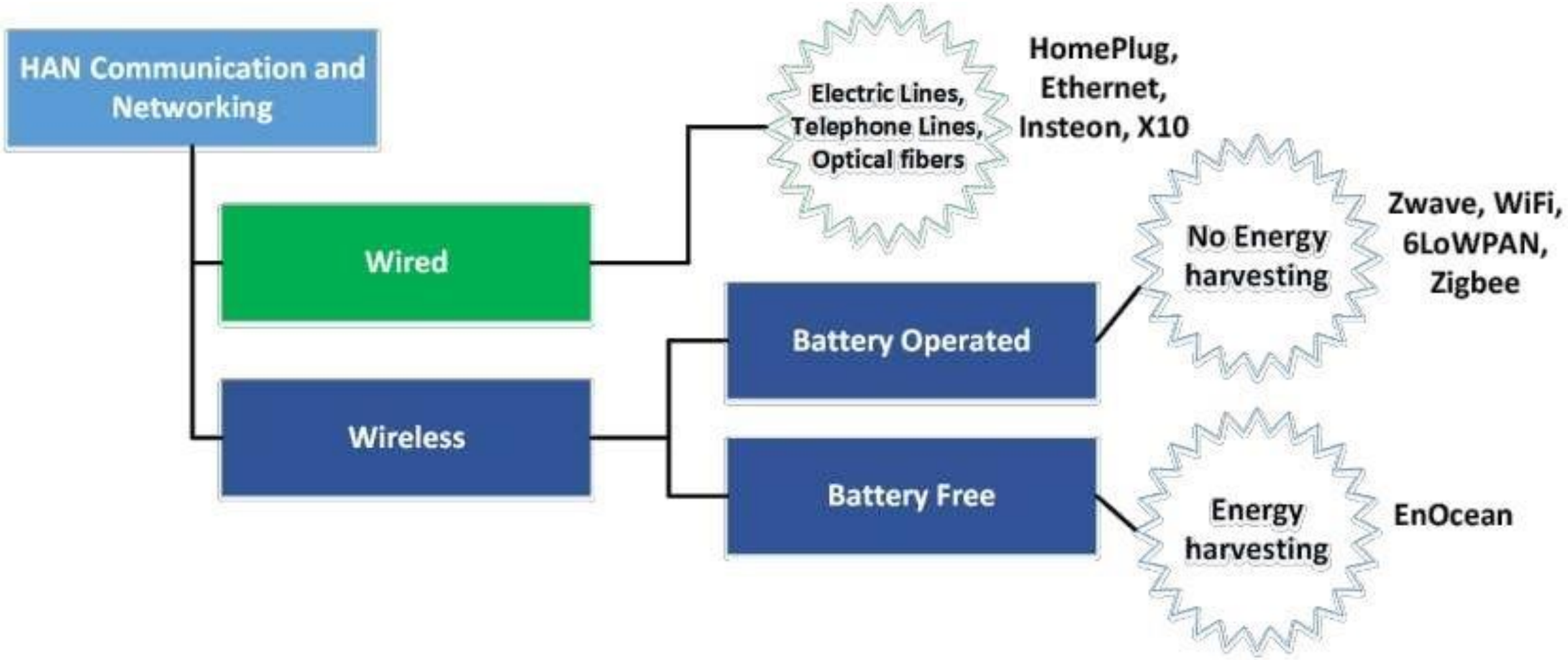
- ✓ Network contained within a home.
- ✓Enables remote access and control of devices and systems.
- ✓Provides amalgamation of various systems within a home, such as – security systems, home automation systems, personal media, communication, etc.

Home Area Networks Elements

- ✓ **Internet Protocol (IP)**
  - Multi-protocol gateway bridges non-IP network to IP network.
  - Bridging between new technologies is limited.
  - For new technologies or networks, a new mapping is required for bridging to perform satisfactorily.
- ✓ **Wired HAN**
  - Easy integration with preexisting house infrastructure.
  - Low cost.
  - Can use power lines, coaxial cables, telephone lines, optical fibers, and other such technologies for communication.
- ✓ **Wireless HAN**
  - Can use popular home Wi-Fi, ZigBee, and even new standards, such as 6LoWPAN.
  - Wireless makes implementation easy.



Home Area Networks Medium Classification



Home Area Networks Standards

Universal Plug and Play (UPnP).

✓ Application layer technology, mainly web-based.

✓TCP/IP protocol stack provides support for the lower layers, and enables seamless integration of various technologies.

✓Provides transparent networking with support for zero-configuration networking and automatic discovery of devices.

Digital Living Network Alliance (DLNA)

✓ Trade organization created by Sony, Intel, and Microsoft.

✓Connects cable-based networks with wireless networks for increased sharing of media, control and access.

✓ Domestically shares network media resources.

Konnex (KNX)

✓ an open important standard for home and building networks.

✓ Utilizes the full range of home communication infrastructure – Power lines, coaxial cables, twisted pair, RF, etc.

✓ Must be setup and configured via a software before its proper usage.

Home Area Networks Standards

Local Operation Networks (LonWorks).

- ✓ Every device includes a Neuron Chip, a transceiver and the application electronics.
- ✓ Neuron chip is a (System on Chip) SOC with multiple microprocessors, RAM, ROM and IO interface ports.
- ✓ Splits device groups into intelligent elements, which can communicate through a physical communication medium.

Zigbee

- ✓ Zigbee consists of four layers – Physical, Medium Access Control, Network, and Application.
- ✓ Physical and MAC layers are defined by IEEE802.15.4, whereas Network and Application are defined by Zigbee.
- ✓ Aims at low-cost, low-energy devices.
- ✓ ZigBee Alliance is composed of Mitsubishi, Honeywell, Invensys, Motorola and Philips

X-10

✓X-10 enables remote control of compliant transmitters and receivers over power lines and electrical wirings present in the house.

- ✓ Adopted by GE and Philips.
- ✓ Standard defines procedures for transmission of bits over AC carrier signals.
- ✓ Low-speed and low data rate.
- ✓ Mainly used for control of lighting, appliance networks and security sensors

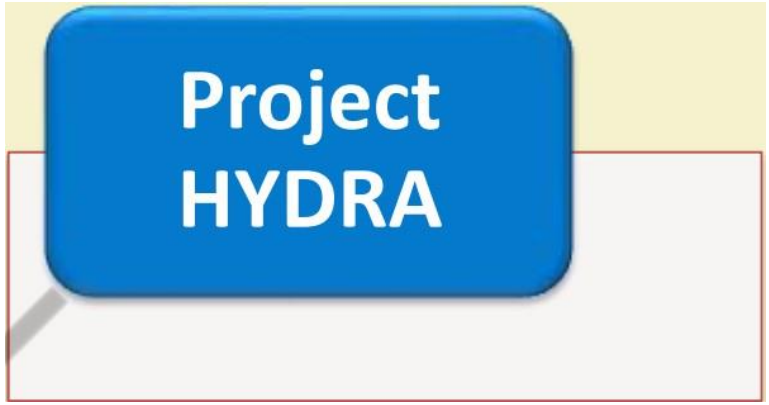
Home Area Networks Architecture

- ✓ Uses XML for description and webservices for control.
- ✓ Follows a Service oriented Architecture (SOA).
- ✓ Not tied to any software, language or architecture.
- ✓ A central gateway connects different technologies.
- ✓ A tech Manager for each technology provides web services for control and access.

- ✓ Connects various devices sharing their resources with auto-configuration and auto-installation.
- ✓Based on JAVA environment and pursued by Sun Microsystems (Now, Oracle).
- ✓Constructs an organized distribution system without a central node (federation).
- ✓ Jini apps use bytecode to run JVM, and are portable.
- ✓ Follows Object Oriented Paradigm.

Home Area Networks Initiatives

- ✓ Middleware for embedded intelligent systems.
- ✓ Connects a Service Oriented Architecture Network.
- ✓Connected devices may have limited resources, low processing power, memory or energy consumption.
- ✓ Each device has an embedded HYDRA client which acts as a proxy between the device and the middleware.



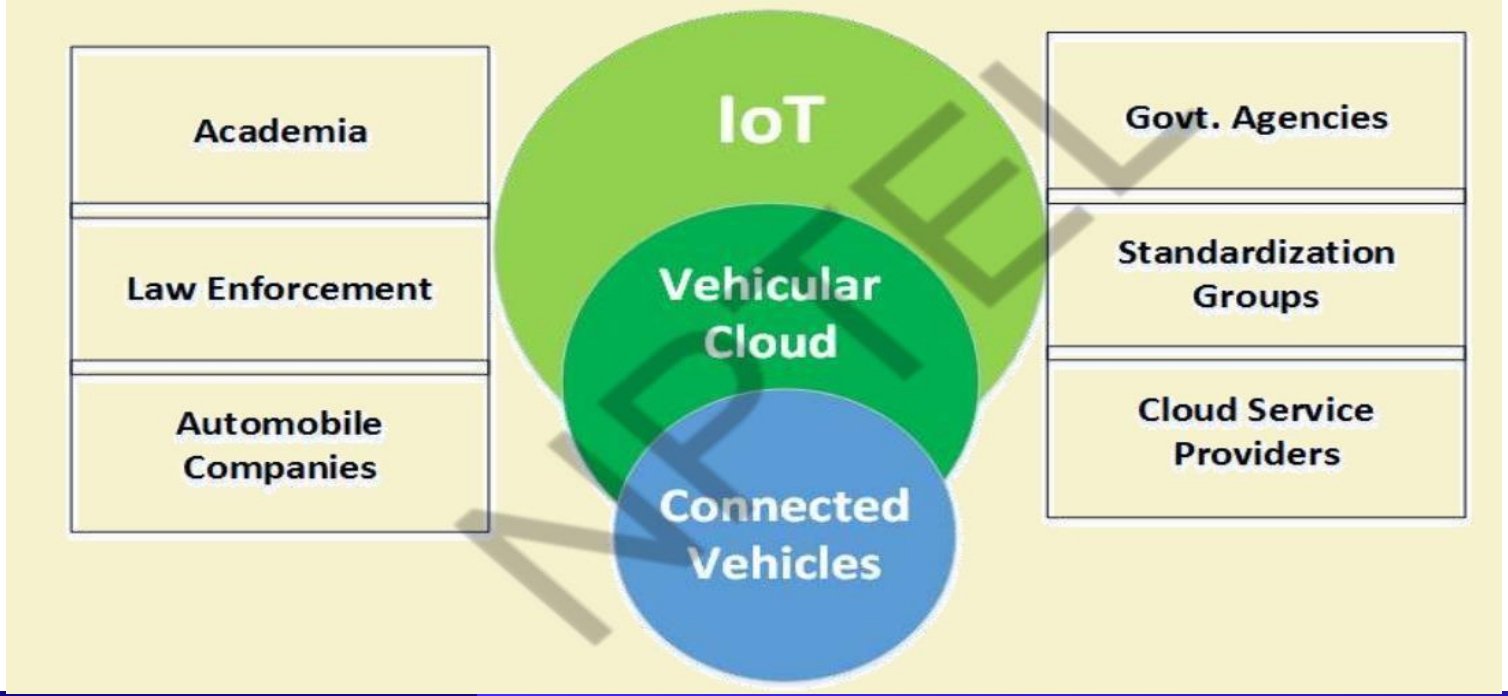
- ✓ Aimed at:-
  - Ambient intelligent systems
  - For networked home systems
- ✓Features user-friendly interfaces, interoperability, and automatic discovery of devices and services.

Connected Vehicles

- ✓ Vehicles equipped with
  - Sensors
  - Networking and communicating devices
- ✓ Capable of :
  - Communicating with other devices within the vehicle
  - Communicating with other similar vehicles
  - Communicating with fixed infrastructure

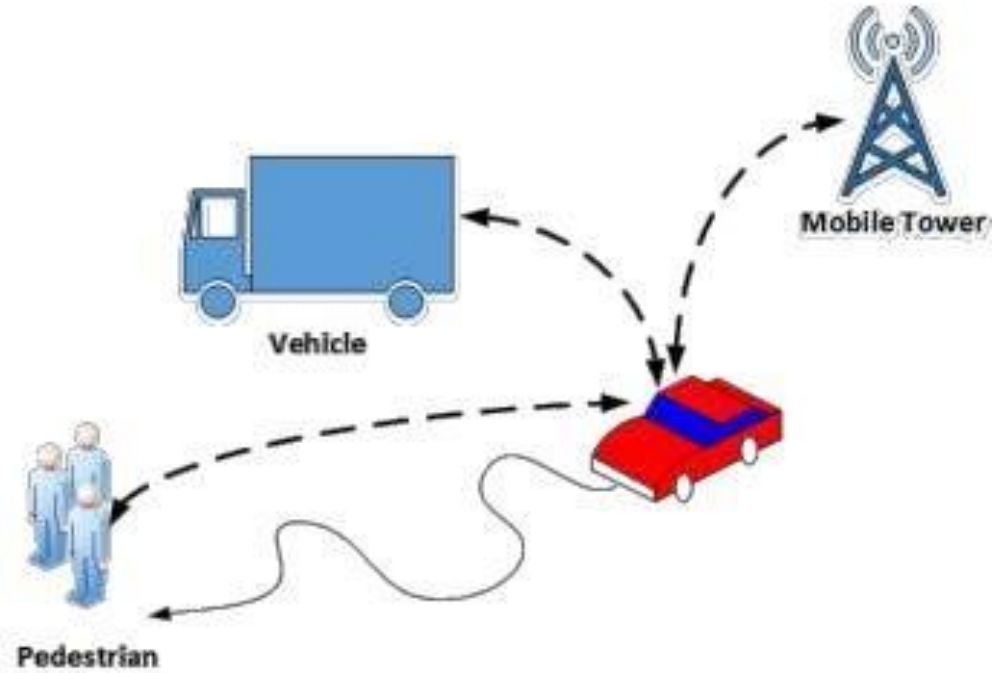
Challenges

- ✓ Security
- ✓ Privacy
- ✓ Scalability
- ✓ Reliability
- ✓ Quality of service
- ✓ Lack of global standards



Vehicle to Everything Paradigm

✓ Main component of future Intelligent Transportation System (ITS).
✓Enables vehicles to wirelessly share a diverse range of information.
✓Information sharing may be with other vehicles, pedestrians, or fixed infrastructures (mobile towers, parking meters, etc.)
✓Allows for traffic management, ensuring on-road and off-road safety, mobility for traveling.



✓ Follows a distributed architecture, where contents are widely distributed over the network.
✓ Not restricted to single source information provider.
✓ Designed mainly for highly mobile environments.
✓ Can share information to nodes in vicinity, as well as remotely located.
✓ Has greatly enhanced travel efficiency, as well as safety.
✓ The network is mainly used as a tool for sharing and disseminating information.

Failures of TCP/IP in V2X

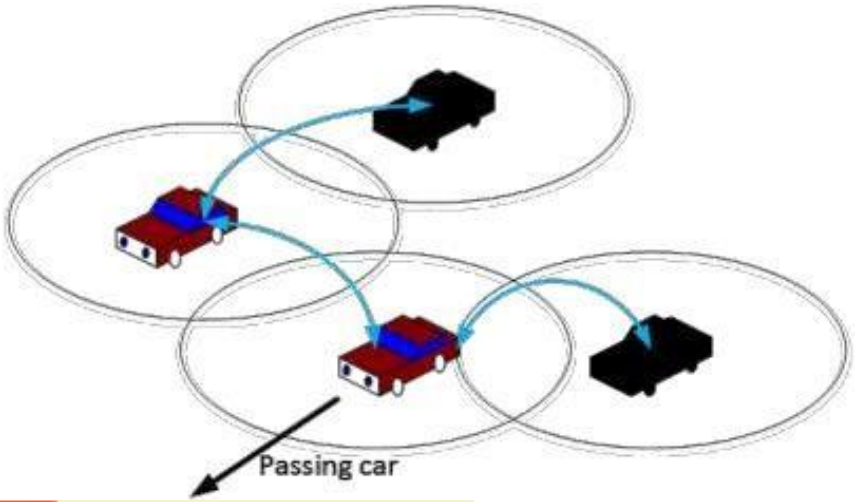
- ✓ Designed mainly for handling information exchange between a single pair of entities.
- ✓ Information exchange dependent on the location of data.
- ✓ Can only identify the addresses of endpoints, which alone is not useful for content distribution.
- ✓ Increase in number of wireless devices, restricts the mobility of the nodes.

Content Centric Networking (CCN)

- ✓ CCN is derived from Information Centric Networking (ICN) architecture.
- ✓ Focuses more on the data than its actual location.
- ✓ Hierarchically named data.
- ✓ Hierarchical data is transmitted directly instead of being part of a conversation.
- ✓ Enables scalable and efficient data dissemination.
- ✓ In-network caching allows for low data traffic.
- ✓ Works well in highly mobile environments.

Vehicular Ad-hoc Networks (VANETs)

- ✓ Routing protocols derived from MANETs.
- ✓ High throughput achievable in mobile environments.
- ✓ Guaranteed low-latency in mobile environments.



VANET Features

High Dynamic Topology
- Vehicles in highly mobile environments causes constant changes in network partitioning and topology.

High transmission and computation capability
- Vehicle-stored energy sources and computational power do not restrict capabilities.

Unstable connectivity
- Link durations are short due to highly dynamic nature of VANETs.

Large scale
- Can be easily scaled up to include all vehicles on roads.

Predictable mobility pattern
- Vehicular restriction within roads, makes mobility pattern predictable.

Vehicular Ad-hoc Networks Applications

Safety

- Emergency braking, lane change warning, collision avoidance, hazard notification

Efficiency

- Congestion management, electronic toll collection, parking availability

Commercial

- Internet access, multimedia stream

Comfort

- Weather information, autonomous driving, journey time estimation

CCN for VANETS

✓ Routing

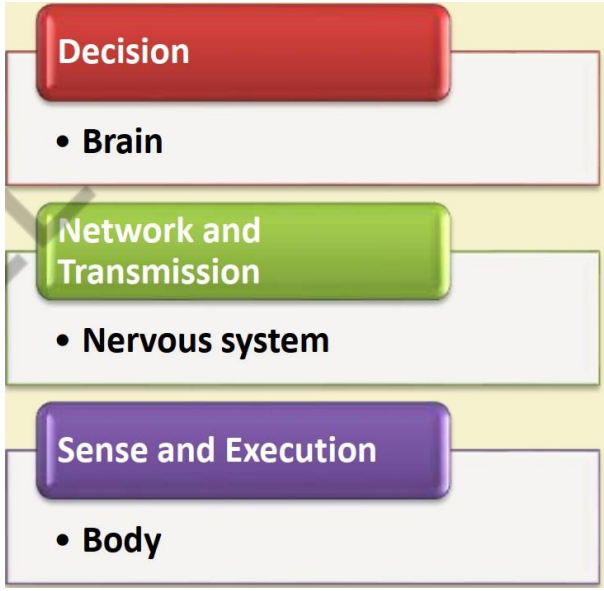
- Forwarding and routing based on name of content (not location).
- Individual content's name prefixes are advertised by routers across the network.
- This helps to build a Forwarding Information Base (FIB) for each router.
- The name of content remains same and unique globally.
- No issues of IP address management or address exhaustion.
- Communication does not depend on speed or direction of nodes.

✓ Scalability

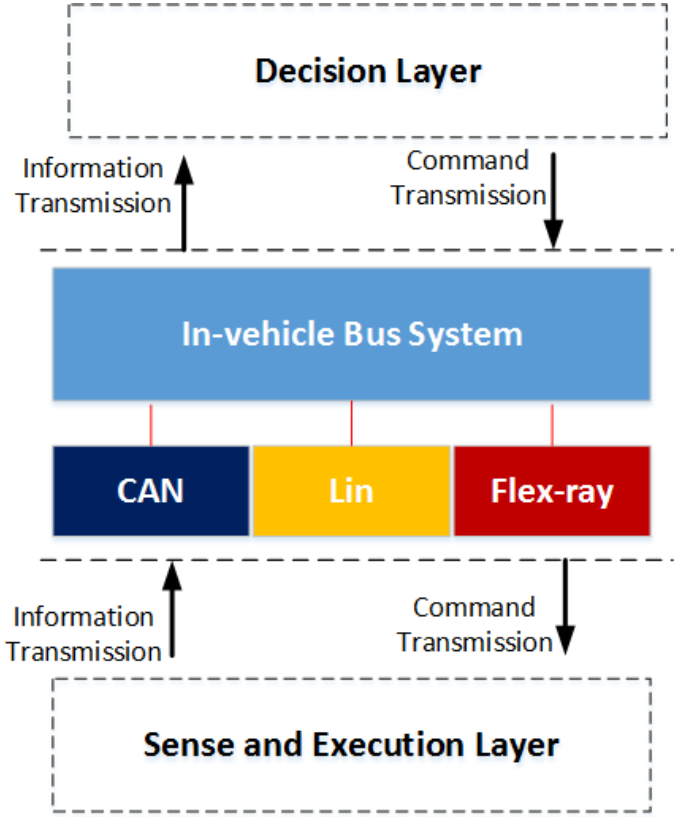
- An in-network caching mechanism at each router.
- Uniquely identifiable (named) data chunks are stored in Content Store (CS), which acts as a cache.
- Subsequent requests for a stored data chunk can be made to a CS.
- The naming system in the CS enables a data to be used multiple times, unlike normal IP-based routers.
- Reduced network load during increased network size, as a result of the caching mechanism.

Body and Brain Architecture

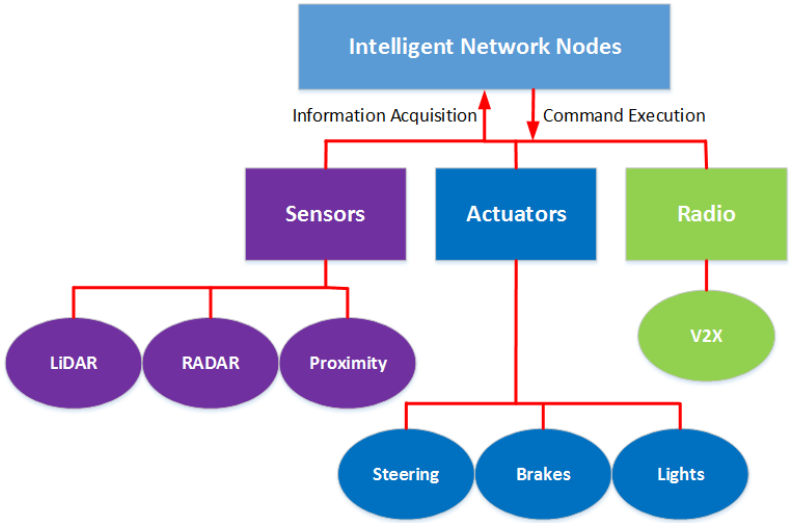
- ✓ An in-vehicle networking architecture.
- ✓ Three layered architecture.
- ✓ The body consists of intelligent networking nodes (INN) which constantly collect information from the vehicle.
- ✓ The brain manages central coordination



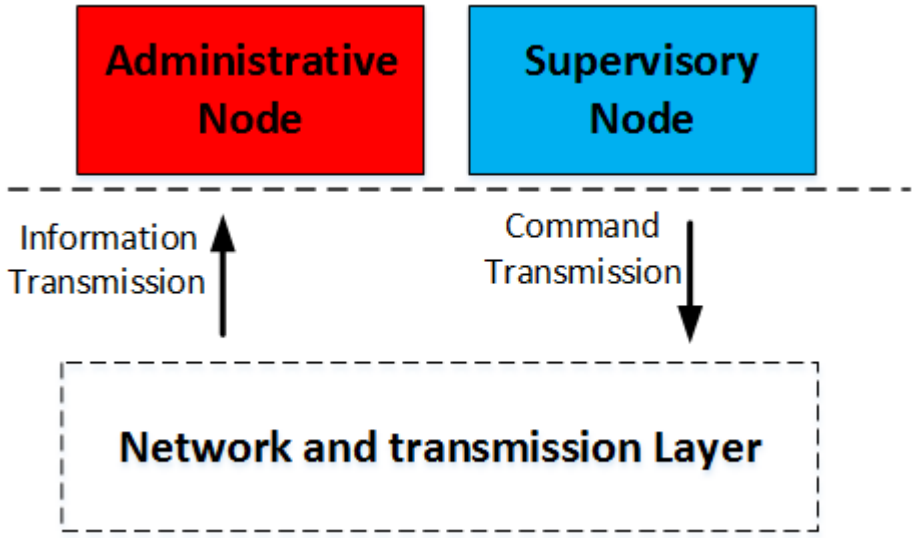
Network and Transmission Layer



Sense and Execution Layer



Decision Layer



Intelligent Connected Vehicles (ICVs)

Phases of ICV Development

Phase-1

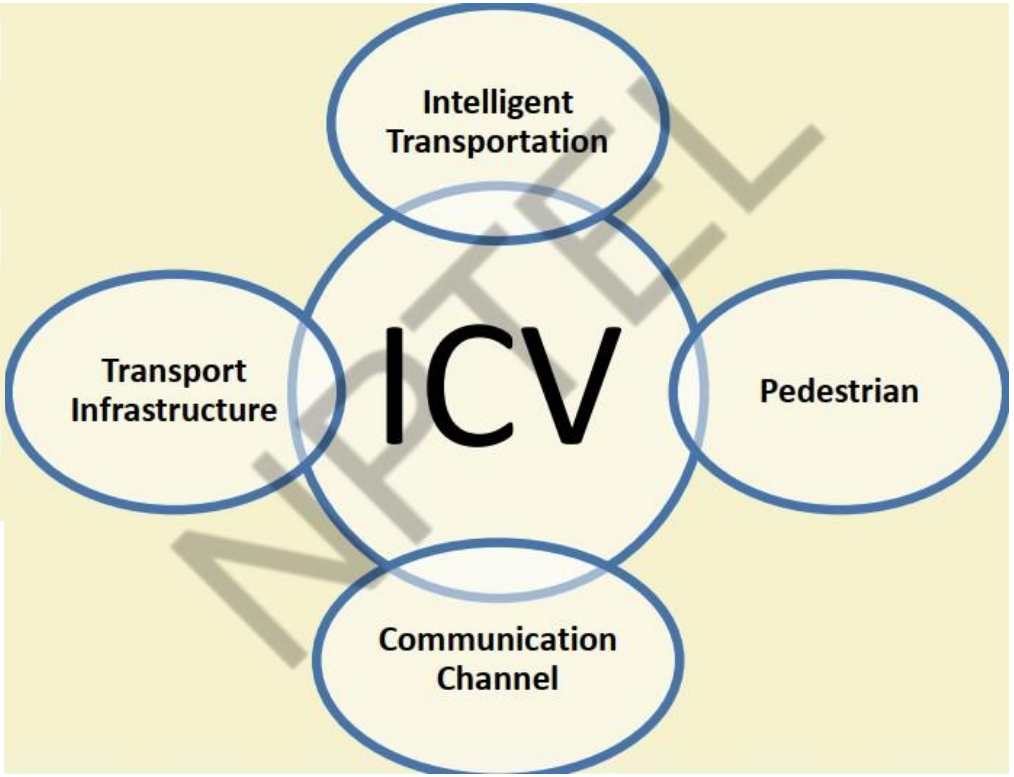
- Infotainment service with remote information processing
- Based on 2G/3G

Phase-2

- Intelligent transportation service
- Based on 4G LTE or DSRC

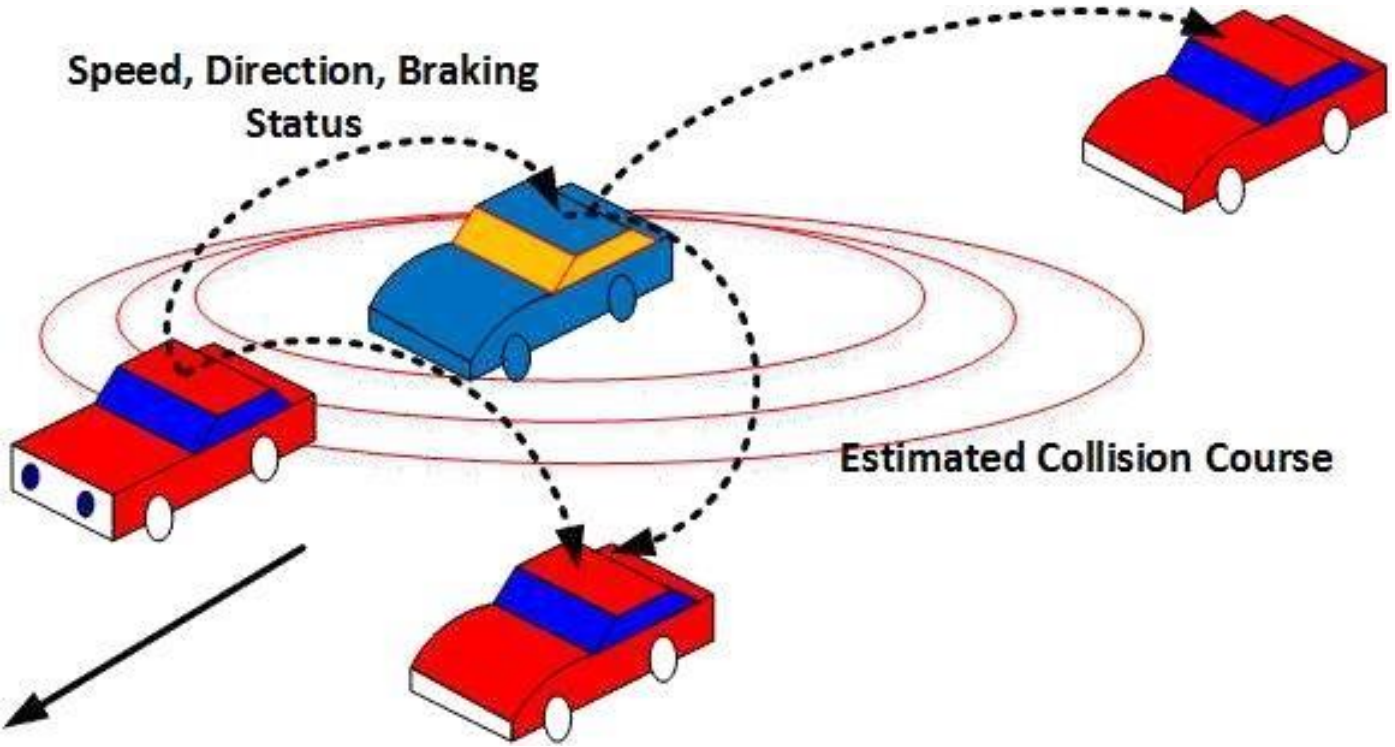
Phase-3

- Vehicles connected to the cloud

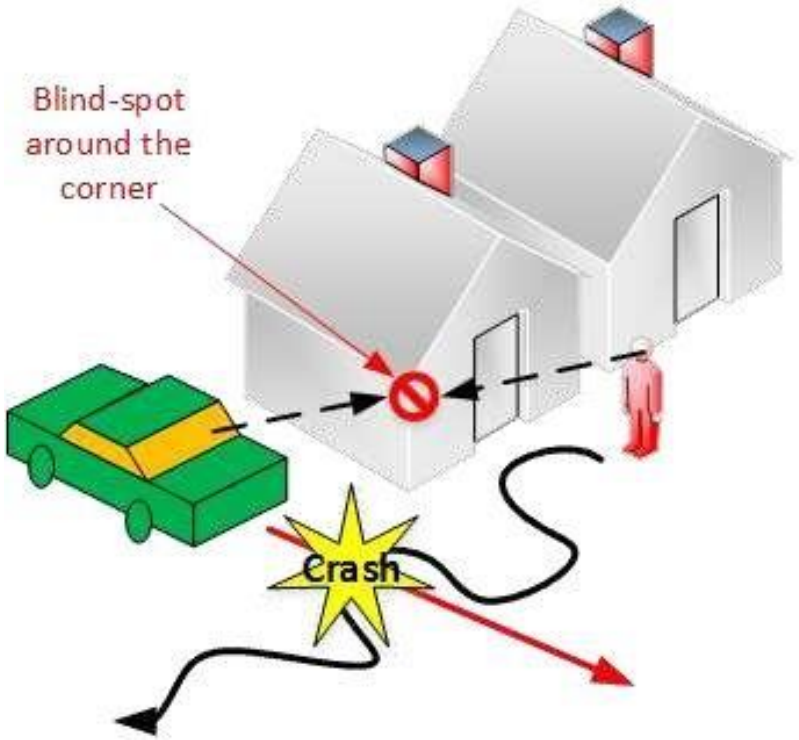


Intelligent Connected Vehicles (ICVs)

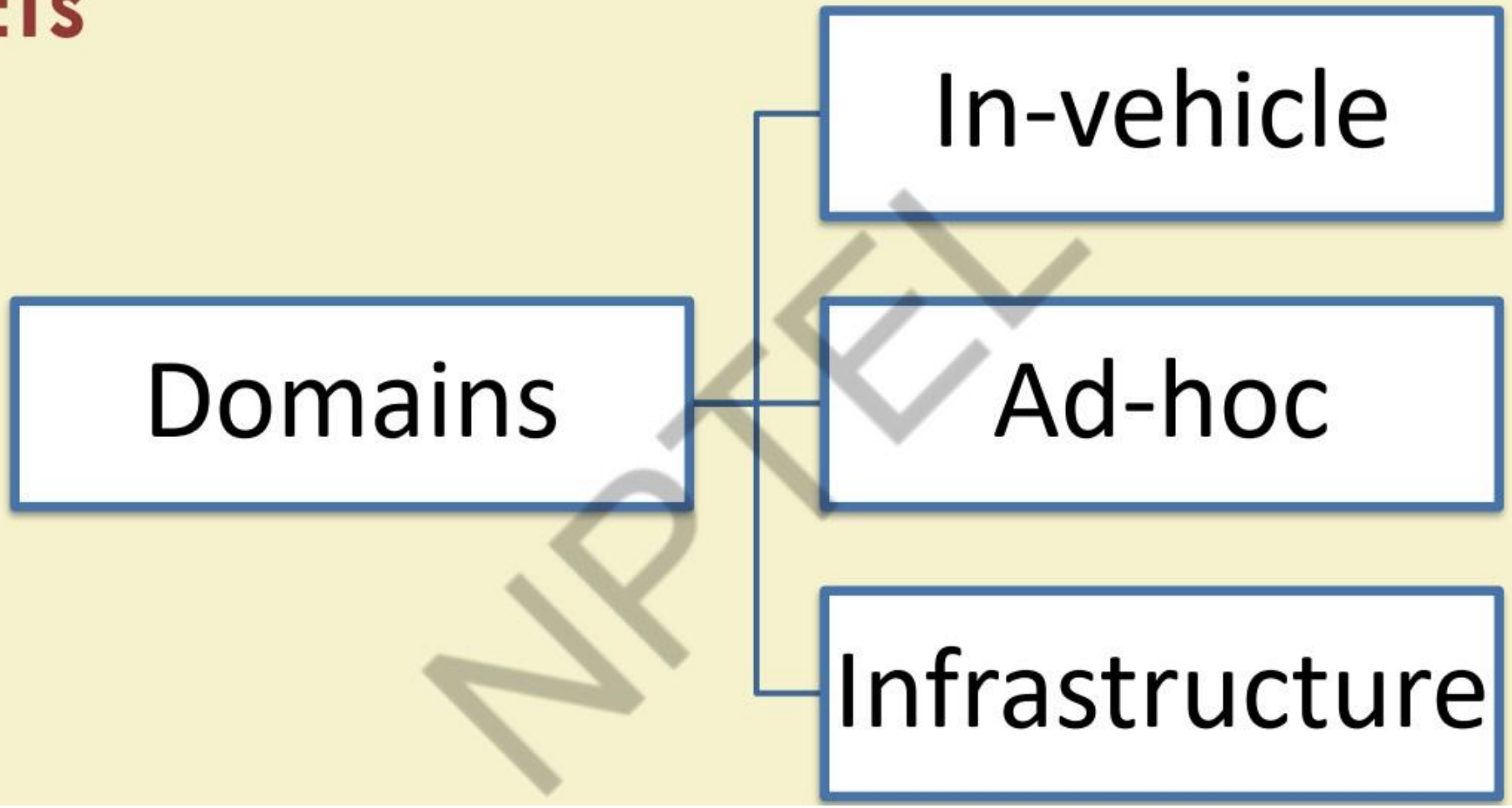
Forward Collision Warning (V2V)



Vulnerable Road User Safety (V2P)



VANETs



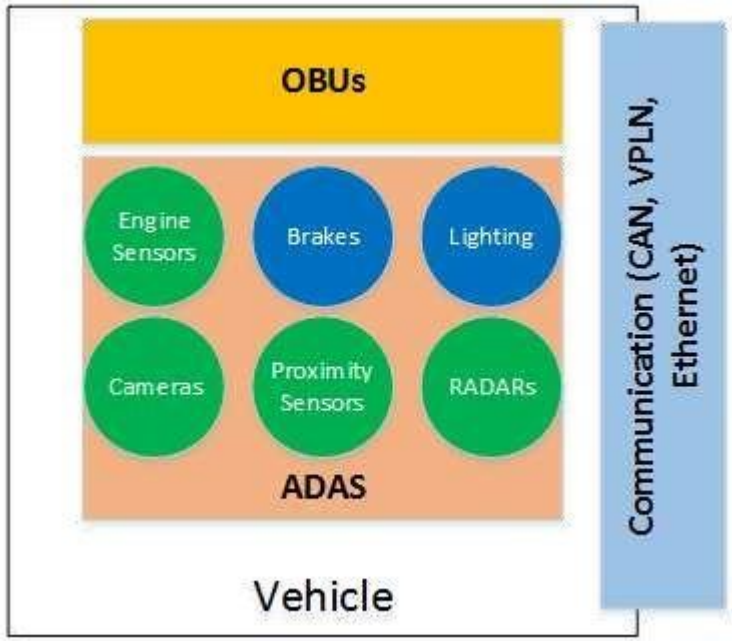
In-Vehicle Domain

✓ Composed of one or more on-board units (OBUs).

✓Additional presence of Advanced Driver Assistance Systems (ADAS) sensors such as-

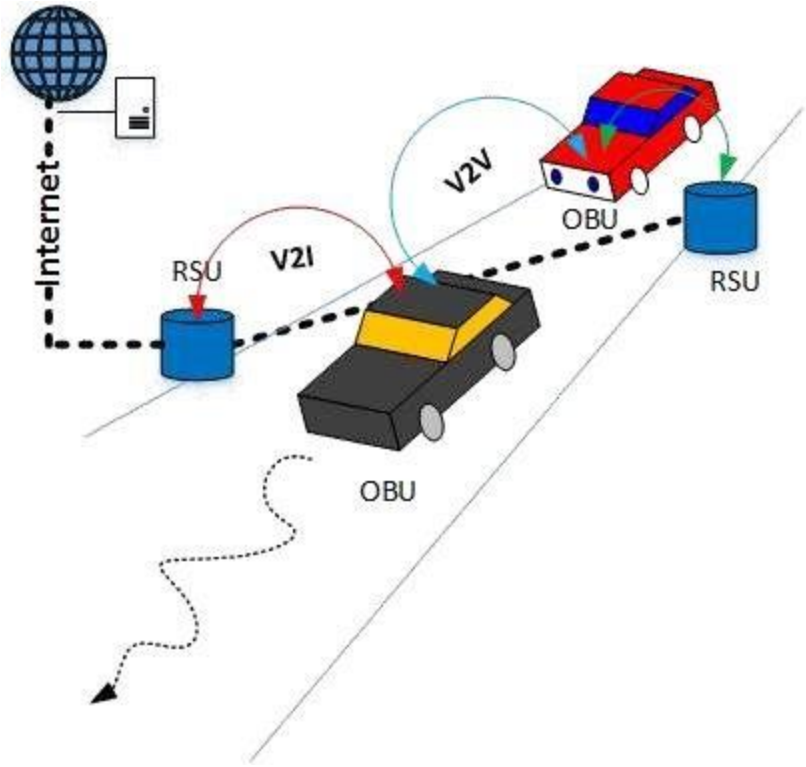
- cameras
- proximity sensors
- Engine sensors
- Radars
- Actuators

✓ Communication is mainly through Controller Area Network (CAN), Vehicular Powerline Networks (VPLN), and Ethernet.



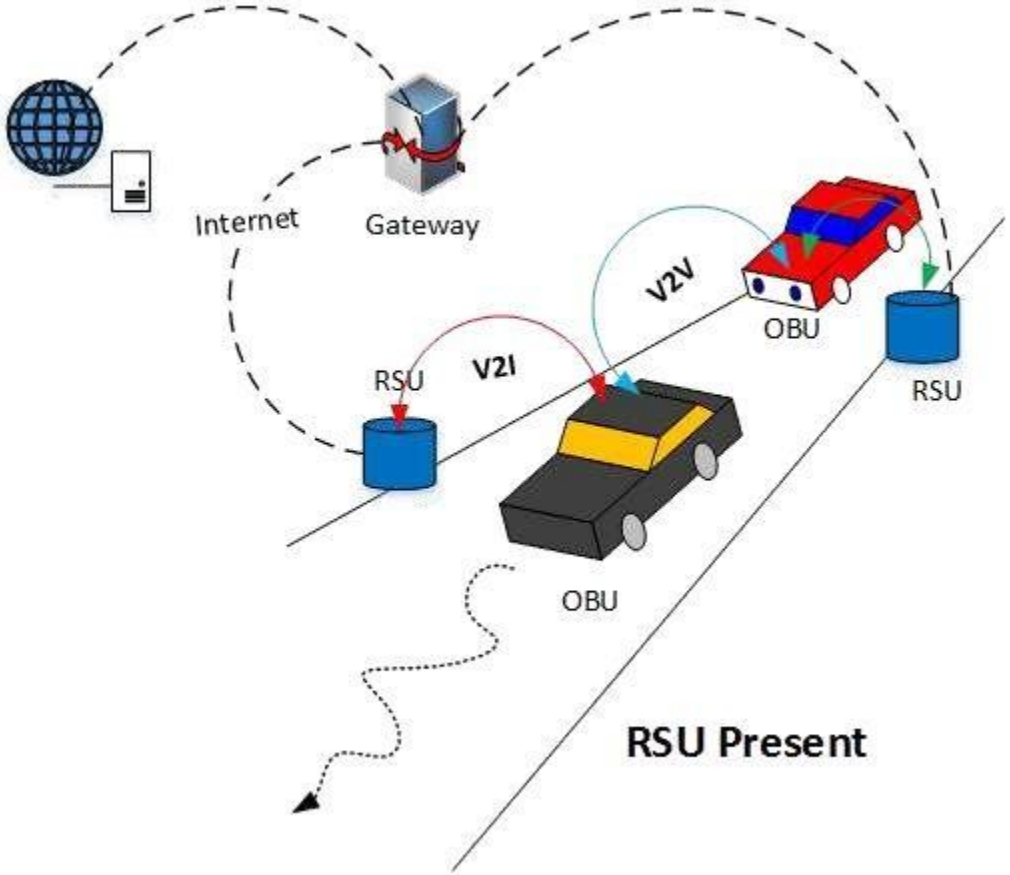
Ad-hoc Domain

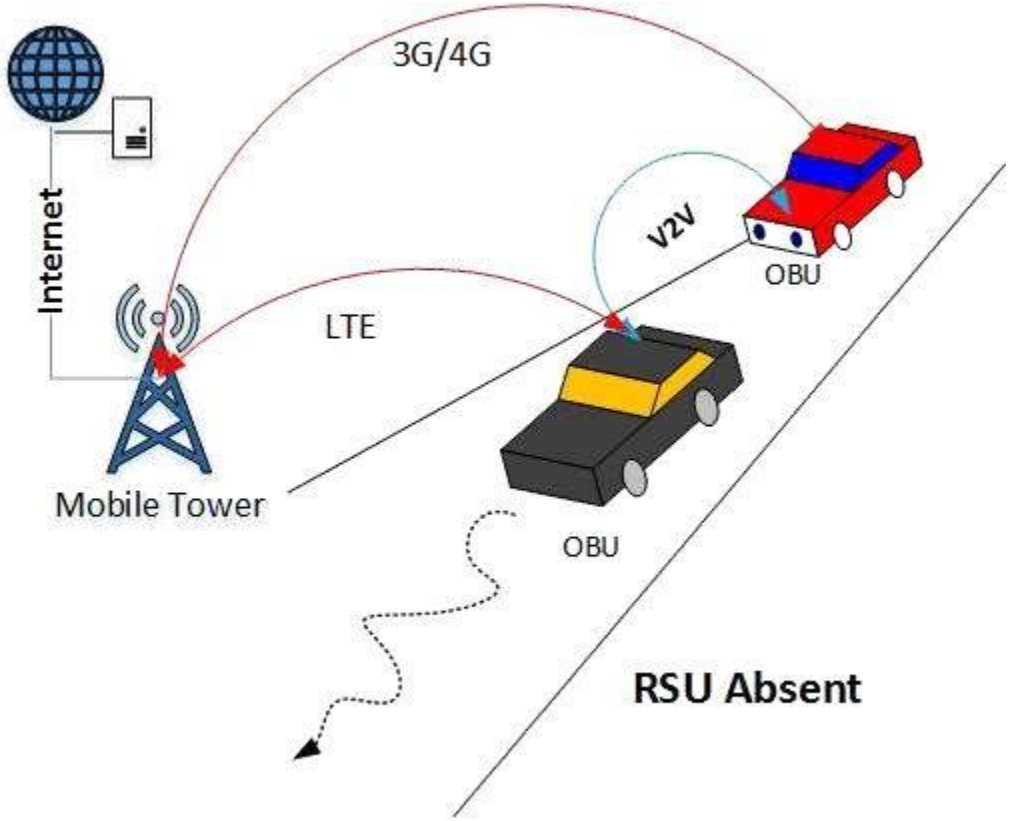
- ✓ Composed of vehicles and road-side units.
- ✓ The vehicles (OBUs) are mobile.
- ✓ The road-side units (RSUs) are static.
- ✓ Communication mode may be either V2V or V2I.
- ✓ Communication through DSRC stack (IEEE 802.11p)



Infrastructure Domain

- ✓ RSUs connected to Internet by means of Gateways.
- ✓ In the presence of RSUs, the vehicles may communicate to the Internet via V2I interfaces.
- ✓In the absence of RSUs, the vehicles may communicate with each other or the Internet through cellular networks such as 3G/4G. LTE. etc.





V2X Communication

V2X Communication: Advantages

- ✓ Increased traffic safety.
- ✓ Increased driver safety.
- ✓ Optimized time of travel.
- ✓ Efficiency of fuel consumption.
- ✓ Secure travel.
- ✓ Easier drive in low-visibility or unfavorable weather conditions.

V2X Communication: Disadvantages

- ✓ Violation of privacy.
- ✓ Loss of data control.
- ✓ Collection of personal data.
- ✓ Second use of data.
- ✓ Data use by unauthorized entities.
- ✓ Tracking of movements.
- ✓ Localization of position

V2X Communication

Concept	Definition	Focus
IoV (Internet of Vehicles)	The integration of vehicles into the Internet of Things (IoT) ecosystem	Integration with the IoT
VANET (Vehicular Ad Hoc Network)	A specific type of wireless ad hoc network that enables communication between vehicles and between vehicles and roadside infrastructure	Communication between vehicles and infrastructure
Connected Vehicles	Vehicles that are equipped with communication technologies to connect with other vehicles and the environment	Communication and sharing of information
Intelligent Vehicles	Vehicles that are equipped with advanced sensors and software to operate autonomously or semi-autonomously	Autonomous operation and decision-making

Question No: 1

Fill in the blank. Facilities that need to be provided in smart parking lot includes _____.

a. Identification of empty slots in parking slot
b. Automatic routing of vehicles in vacant slot
c. Automatic charging for services rendered
d. All of these

Question No: 1

Fill in the blank. Facilities that need to be provided in smart parking lot includes _____.

a. Identification of empty slots in parking slot
b. Automatic routing of vehicles in vacant slot
c. Automatic charging for services rendered
d. All of these

Current focus of area related to smart parking lot includes identification of empty slots in parking slot, automatic routing of vehicles in vacant slot, automatic charging for services rendered.

Question No: 2

In the near future, auto alert generation in case of sudden heart attack leading to emergency medical condition is supposed to be handled by smart health.

a. True
b. False

Question No: 2

In the near future, auto alert generation in case of sudden heart attack leading to emergency medical condition is supposed to be handled by smart health.

a. True
b. False

Current focus area in smart home includes auto alert generation in case of emergency medical condition.

Question No: 3

During an event of disaster, the resource reallocation and service rerouting can be handled by which of the following method?

a. Energy monitoring
b. Traffic monitoring
c. Calamity monitoring
d. Health monitoring

Question No: 3

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a. Energy monitoring
b. Traffic monitoring
c. Calamity monitoring
d. Health monitoring

The resource reallocation and service rerouting in the event of calamity is performed through pollution and calamity monitoring.

Question No: 4

Which of the following challenges can be experienced due to the periodic generation of the large volume of data in smart city?

a. Making data volume precise and accurate
b. Provisioning quality of service
c. Proper resource management
d. None of these

Question No: 4

Which of the following challenges can be experienced due to the periodic generation of the large volume of data in smart city?

a. Making data volume precise and accurate
b. Provisioning quality of service
c. Proper resource management
d. None of these

Enormous volume of data is produced periodically in a smart city environment. Challenges includes making the available or incoming data volume precise and accurate.

Question No: 5

Fill in the blank.
_____ enables optimal usages of the huge data generated from different sources and across different platforms.

a. Data storage
b. Data cleaning
c. Data fusion
d. None of these

Question No: 5

Fill in the blank.
_____ enables optimal usages of the huge data generated from different sources and across different platforms.

a. Data storage
b. Data cleaning
c. Data fusion
d. None of these

Data fusion enables optimum utilization of the massive data generated from different sources and across different platforms.

Question No: 6

Which of the following is included in mathematical model that is used for performing data fusion?

a. Convolutional neural network neural network
b. Statistical model
c. Belief function
d. All of these

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a. Convolutional neural network neural network
b. Statistical model
c. Belief function
d. All of these

Mathematical model of data function includes convolutional neural network neural network, statistical model, belief function, machine learning, artificial neural network, etc.

Question No: 7

Which of the following statements are true about the different components present in a smart home?

Statement I: Sensor networks and communication network infrastructure
Statement II: Intelligent control and management
Statement III: Manual instead of automatic access of devices

a. Statements I and II
b. Statements I and III
c. Statements II and III
d. Statements I, II and III

Question No: 7

Which of the following statements are true about the different components present in a smart home?

Statement I: Sensor networks and communication network infrastructure
Statement II: Intelligent control and management
Statement III: Manual instead of automatic access of devices

a. Statements I and II
b. Statements I and III
c. Statements II and III
d. Statements I, II and III

The different components of smart home include communication network infrastructure, Intelligent control and management, Sensor networks, smart features and automatic response.

Question No: 8

Which of the following are included in the HAN standards?

Statement I: UPnP and LonWorks
Statement II: Zigbee and X-10
Statement III: DLNA and Zigbee

a. Statement I and II
b. Statement II and III
c. Statement I and III
d. Statement I, II and III

Question No: 8

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Statement III: DLNA and Zigbee

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b. Statement II and III
c. Statement I and III
d. Statement I, II and III

HAN standards include UPnP, LonWorks, DLNA, Zigbee and X- 10.

Question No: 9

Fill in the blank.

_____ provisions amalgamation of different features at home including home automation system, personal media, security system, etc.

a. Local area network
b. Personal area network
c. Metropolitan area network
d. Home area network

Question No: 9

Fill in the blank.

_____ provisions amalgamation of different features at home including home automation system, personal media, security system, etc.

a. Local area network
b. Personal area network
c. Metropolitan area network
d. Home area network

Home area network provides amalgamation of various features at home such as- home automation system, personal media, security system, etc.

Question No: 10

Fill in the blank.

In Vehicle-to-human / human-to-vehicle interaction, the human communicating with the vehicle _____.

a. Is present in another vehicle
b. Is present in the same vehicle
c. Is present outside the vehicle on the roadside
d. All of these

Question No: 10

Fill in the blank.

In Vehicle-to-human / human-to-vehicle interaction, the human communicating with the vehicle _____.

a. Is present in another vehicle
b. Is present in the same vehicle
c. Is present outside the vehicle on the roadside
d. All of these

In V2H/H2V, the human is present outside the vehicle on the roadside.

Question No: 11

Information centric networks are derived from content centric network architecture.

a. True
b. False

Question No: 11

Information centric networks are derived from content centric network architecture.

a. True
b. False

Content centric network architecture is derived from information centric networks.

Question No: 12

Which of the following statement(s) is/are true about the Vehicular Ad-hoc network (VANET)?

a. Routing protocol of MANET is derived from VANET
b. High latency is achieved in mobile environment
c. Does not have wireless access in vehicular environment
d. None of these

Question No: 12

Which of the following statement(s) is/are true about the Vehicular Ad-hoc network (VANET)?

a. Routing protocol of MANET is derived from VANET
b. High latency is achieved in mobile environment
c. Does not have wireless access in vehicular environment
d. None of these

In Vehicular Ad-hoc network, routing protocol of VANET is derived from MANET, high throughput is achieved in mobile environment, and it is based on wireless access in vehicular environment.

Question No: 13

Which of the following is considered in Intelligent connected vehicles?

a. Intelligent transportation
b. Communication channels
c. Pedestrian
d. All of these

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b. Communication channels
c. Pedestrian
d. All of these

Intelligent connected vehicles consider intelligent transportation, pedestrian, communication channels, and transportation infrastructure

Question No: 14

Dedicated short range communication standards developed by Society of Automotive Engineers are SAE J2735 and J2945.

a. True
b. False

Question No: 14

Dedicated short range communication standards developed by Society of Automotive Engineers are SAE J2735 and J2945.

a. True
b. False

Society of Automotive Engineers came up with SAE J2735 and J2945 as DSRC standards

Question No: 15

What are the disadvantages of V2X communication?

a. Increased traffic safety
b. Efficient use of fuel
c. Tracking of movement
d. None of these

Question No: 15

What are the disadvantages of V2X communication?

a. Increased traffic safety
b. Efficient use of fuel
c. Tracking of movement
d. None of these

Disadvantages of V2X communication includes tracking of movement, violation of privacy, loss of data control, etc.

Question No: 16

Fill in the blank.
In LoNWorks, each neuron chip has _____ memory types.

a. ROM and RAM
b. RAM and EEPROM
c. ROM and EEPROM
d. ROM, RAM and EEPROM

Question No: 16

Fill in the blank.
In LoNWorks, each neuron chip has _____ memory types.

a. ROM and RAM
b. RAM and EEPROM
c. ROM and EEPROM
d. ROM, RAM and EEPROM

Question No: 17

V2X follows centralized architecture.

a. True
b. False

Question No: 17

V2X follows centralized architecture.

a. True
b. False

Question No: 18

Which of the following is not true about Content Centric Networking?

a. Focuses more on actual location than data.
b. Hierarchical data is transmitted directly instead of being part of a conversation.
c. Enables scalable and efficient data dissemination.
d. Derived from Information Centric Networking architecture.

Question No: 18

Which of the following is not true about Content Centric Networking?

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b. Hierarchical data is transmitted directly instead of being part of a conversation.
c. Enables scalable and efficient data dissemination.
d. Derived from Information Centric Networking architecture.

Question No: 19

In VANET, link durations are long and easily scaled-up to include all the vehicles on the road?

a. True
b. False.

Question No: 19

In VANET, link durations are long and easily scaled-up to include all the vehicles on the road?

a. True
b. False.

Question No: 20

Which of the following is not true about Ad-hoc domain.

a. Composed of vehicles (OBUs) and road-side units (RSUs).
b. Vehicles and road-side units are mobile.
c. Communication takes place through DSRC stack.
d. Communication mode may be either V2V or V2I.

Question No: 20

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b. Vehicles and road-side units are mobile.
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d. Communication mode may be either V2V or V2I.

Question No: 21

In infrastructure domain, RSUs are connected to internet by means of _____.

a. V2I interface
b. Cellular network
c. V2V interface
d. Gateway

Question No: 21

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a. V2I interface
b. Cellular network
c. V2V interface
d. Gateway

Question No: 22

Which of the following is the draft standard for Wireless Access in Vehicular Environments (WAVE)?

a. IEEE PI609.0
b. IEEE PI609.1
c. IEEE PI609.2
d. IEEE PI609.3

Question No: 22

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a. IEEE PI609.0
b. IEEE PI609.1
c. IEEE PI609.2
d. IEEE PI609.3

Question No: 23

Inferences drawn from multiple sensor type data is qualitatively superior to single sensor type data.

a. True
b. False

Question No: 23

Inferences drawn from multiple sensor type data is qualitatively superior to single sensor type data.

a. True
b. False

Question No: 24

Which of the following statements are not correct regarding Data Fusion?

a. Rich in information.
b. Generate better intelligence.
c. Optimal amalgamation of data.
d. Expose critical data sources and semantics.

Question No: 24

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a. Rich in information.
b. Generate better intelligence.
c. Optimal amalgamation of data.
d. Expose critical data sources and semantics.

Question No: 25

What happens at signal level of data fusion?

a. Fusion of information at the imaging device level itself.
b. Fusion of information at the sensor node with the local network itself.
c. Fusion of information prior to decision making.
d. Ensemble of decision.

Question No: 25

What happens at signal level of data fusion?

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b. Fusion of information at the sensor node with the local network itself.
c. Fusion of information prior to decision making.
d. Ensemble of decision.

Question No: 26

Which of the following is not a functional layer of smart parking?

a. Information collection
b. Information fusion
c. System deployment
d. Service dissemination

Question No: 26

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a. Information collection
b. Information fusion
c. System deployment
d. Service dissemination

Question No: 27

Fill in the blank.
Solutions related to Smart Cities should have _____.

a. Cognitive management framework.
b. Low power transceiver.
c. Predictive model for energy consumption.
d. All of the above.

Question No: 27

Fill in the blank.
Solutions related to Smart Cities should have _____.

a. Cognitive management framework.
b. Low power transceiver.
c. Predictive model for energy consumption.
d. All of the above.

Question No: 28

In UPnP, device search and advertisements are _____ through HTTP over UDP over port 1900.

a. Multicast
b. Unicast
c. Broadcast
d. Stored

Question No: 28

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a. Multicast
b. Unicast
c. Broadcast
d. Stored

Question No: 29

UPnP is _____ layer technology.

a. Data link layer.
b. Application layer.
c. Network layer.
d. Transport Layer.

Question No: 29

UPnP is _____ layer technology.

a. Data link layer.
b. Application layer.
c. Network layer.
d. Transport Layer.

Question No: 30

In Lonworks, every device includes a Neuron Chip.

a. True.
b. False.

Question No: 30

In Lonworks, every device includes a Neuron Chip.

a. True.
b. False.

Question No: 31

A smart city _____.

Is an urban system
Uses ICT
Makes infrastructure more reliable
All of these

Question No: 31

A smart city _____.

Is an urban system
Uses ICT
Makes infrastructure more reliable
All of these

Question No: 32

Collective data is more intelligent than the single sources.

True
False

Question No: 32

Collective data is more intelligent than the single sources.

True

False

Question No: 33

Which of the following is one of the challenges of Data fusion?

Imperfection
Conflicts
Ambiguity
All of the above

Question No: 33

Which of the following is one of the challenges of Data fusion?

Imperfection
Conflicts
Ambiguity
All of the above

Question No: 34

Which of the following challenges are the challenges of IoT in smart cities?

Security and Reliability
Small scale
Homogeneity
None of these

Question No: 34

Which of the following challenges are the challenges of IoT in smart cities?

Security and Reliability
Small scale
Homogeneity
None of these

Question No: 35

Fill in the blank.
_____ combines information from multiple sensors.

Data storage
Data cleaning
Data fusion
None of these

Question No: 35

Fill in the blank.

_____ combines information from multiple sensors.

Data storage

Data cleaning

Data fusion

None of these

Question No: 36

Which of the following are the functional layers in smart parking?

Information collection
System Deployment
Service Dissemination
All of these

Question No: 36

Which of the following are the functional layers in smart parking?

Information collection
System Deployment
Service Dissemination
All of these

Question No: 37

Which of the following statements are true about the different components present in a smart home?
Statement I: Sensor networks and communication network infrastructure
Statement II: Intelligent control and management
Statement III: Manual instead of automatic access of devices

Statements I and II
Statements I and III
Statements II and III
Statements I, II and III

Question No: 37

Which of the following statements are true about the different components present in a smart home?
Statement I: Sensor networks and communication network infrastructure
Statement II: Intelligent control and management
Statement III: Manual instead of automatic access of devices

Statements I and II
Statements I and III
Statements II and III
Statements I, II and III

Question No: 38

Which of the following are included in the Service Dissemination in smart parking?
Statement I: Dynamic Pricing
Statement II: Infrastructure-free and infrastructure-based information
Statement III: Parking Choice

Statement I and II
Statement II and III
Statement I and III
Statement I, II and III

Question No: 38

Which of the following are included in the Service Dissemination in smart parking?
Statement I: Dynamic Pricing
Statement II: Infrastructure-free and infrastructure-based information
Statement III: Parking Choice

Statement I and II
Statement II and III
Statement I and III
Statement I, II and III

Question No: 39

Fill in the blank.
_____ is a network contained within a home.

Local area network
Home area network
Personal area network
Metropolitan area network

Question No: 39

Fill in the blank.
_____ is a network contained within a home.

Local area network
Home area network
Personal area network
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Question No: 39

Fill in the blank. In Vehicle-to-human / human-to-vehicle interaction, the human communicating with the vehicle _____.

a. Is present in another vehicle
b. Is present in the same vehicle
c. Is present outside the vehicle on the roadside

Question No: 39

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a. Is present in another vehicle
b. Is present in the same vehicle
c. Is present outside the vehicle on the roadside

Question No: 40

Wired HAN provides easy integration with pre-existing house infrastructure.

True
False

Question No: 40

Wired HAN provides easy integration with pre-existing house infrastructure.

True

False

Question No: 41

Which of the following statement(s) is/are true about the Konnex?

Utilises only short ranges in home
Can be used before configuration
Does not have standards for building networks
None of these

Question No: 41

Which of the following statement(s) is/are true about the Konnex?

Utilises only short ranges in home
Can be used before configuration
Does not have standards for building networks
None of these

Question No: 42

Which of the following is the reason for failures of TCP/IP in V2X?

TCP/IP handles information exchange between multiple pair of entities
The increase in the number of wireless devices restricts the mobility
TCP/IP can identify the addresses of the endpoints
Information exchange does not depend on the location of the data

Question No: 42

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TCP/IP handles information exchange between multiple pair of entities
The increase in the number of wireless devices restricts the mobility
TCP/IP can identify the addresses of the endpoints
Information exchange does not depend on the location of the data

Question No: 43

CCN is derived from ICN architecture.

True
False

Question No: 43

CCN is derived from ICN architecture.

True

False

Question No: 44

What are the disadvantages of V2X communication?

Increased traffic safety
Tracking of movement
Efficient use of fuel
None of these

Question No: 44

What are the disadvantages of V2X communication?

Increased traffic safety
Tracking of movement
Efficient use of fuel
None of these

Thank You