UNIT-2

1. M2M Architecture

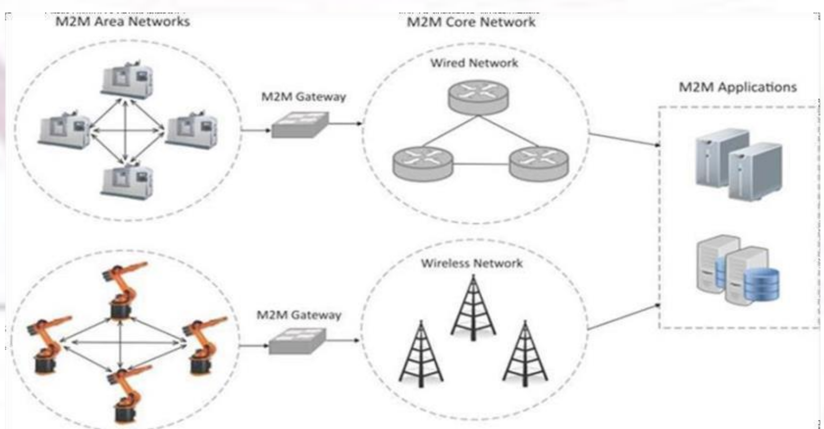
Machine-to-Machine (M2M) refers to networking of machines (or devices) for the purpose of remote monitoring, control, and data exchange.

- The term which is often synonymous with IoT is Machine-to-Machine (M2M).
- IoT and M2M are often used interchangeably.

Fig. shows the end-to-end architecture of M2M systems, which comprises M2M area networks, communication networks, and the application domain.

- An M2M area network comprises machines (or M2M nodes) which have embedded network modules for sensing, actuation, and communication. Various communication protocols can be used for M2M LAN such as ZigBee, Bluetooth, M-Bus, Wireless M-Bus, etc. These protocols provide connectivity between M2M nodes within an M2M area network.
- The communication network provides connectivity to remote M2M area networks. The communication network can use either wired or wireless networks (IP-based). While the M2M area networks use either proprietary or non-IP-based communication protocols, the communication network uses IP-based networks. Since non-IP-based protocols are used within the M2M area network, the M2M nodes within one network cannot communicate directly with nodes in an external network.

  - To enable the communication between remote M2M are network, M2M gateways are used.



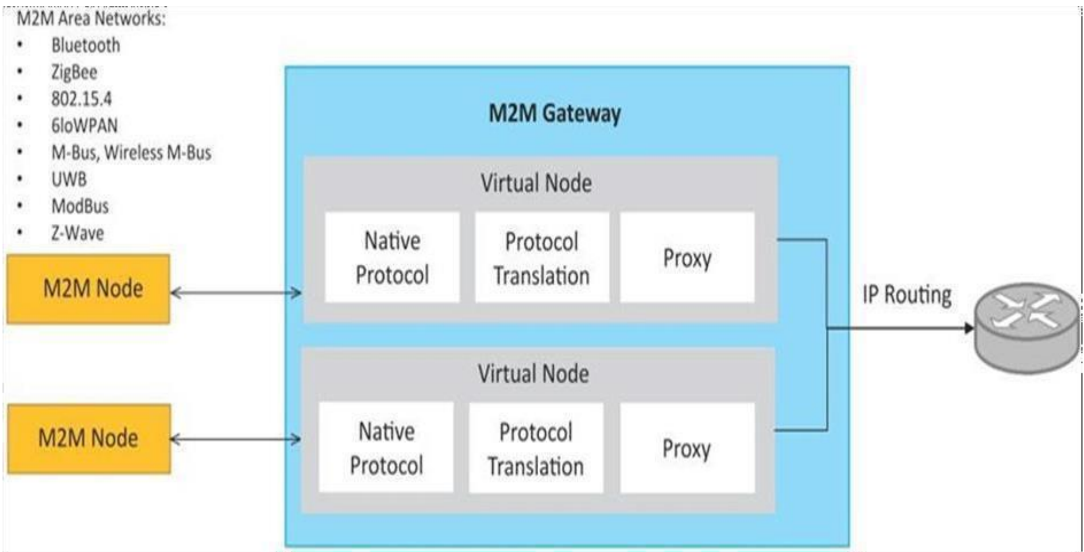


Fig. Block diagram of an M2M gateway.

The communication between M2M nodes and the M2M gateway is based on the communication protocols which arenaive to the M2M are network.M2Mgatewayperformsprotocoltranslations to enable Ip-connectivity for M2M are networks. M2M gateway acts as a proxy performing translations from/to native protocols to/from Internet Protocol(IP). With an M2M gateway, each mode in an M2M area network appears as a virtualized node for external M2M area networks.

2. SDN architecture

Key elements of SDN:

1) **Centralized Network Controller:** With decoupled control and data planes and centralized network controller, the network administrators can rapidly configure the network.

2) Programmable Open APIs

3) Standard Communication Interface(Open Flow)

SDN architecture uses a standard communication interface between the control and infrastructure layers (Southbound interface). Open Flow, which is defined by the Open Networking Foundation (ONF) is the broadly accepted SDN protocol for the Southbound interface.

3. NFV architecture

Network Function Virtualization(NFV)

- Network Function Virtualization (NFV) is a technology that leverages virtualization to consolidate the heterogeneous network devices onto industry standard high volume servers, switches and storage.
- NFV is complementary to SDN as NFV can provide the infrastructure on which SDN can run.

Key elements of NFV:NFV Architecture

Virtualized Network Function (VNF):

VNF is a software implementation of a network function which is capable of running over the NFV Infrastructure (NFVI).

1) NFV Infrastructure (NFVI):

NFV Iincludes compute, network and storage resources that are virtualized.

2) NFV Management and Orchestration:

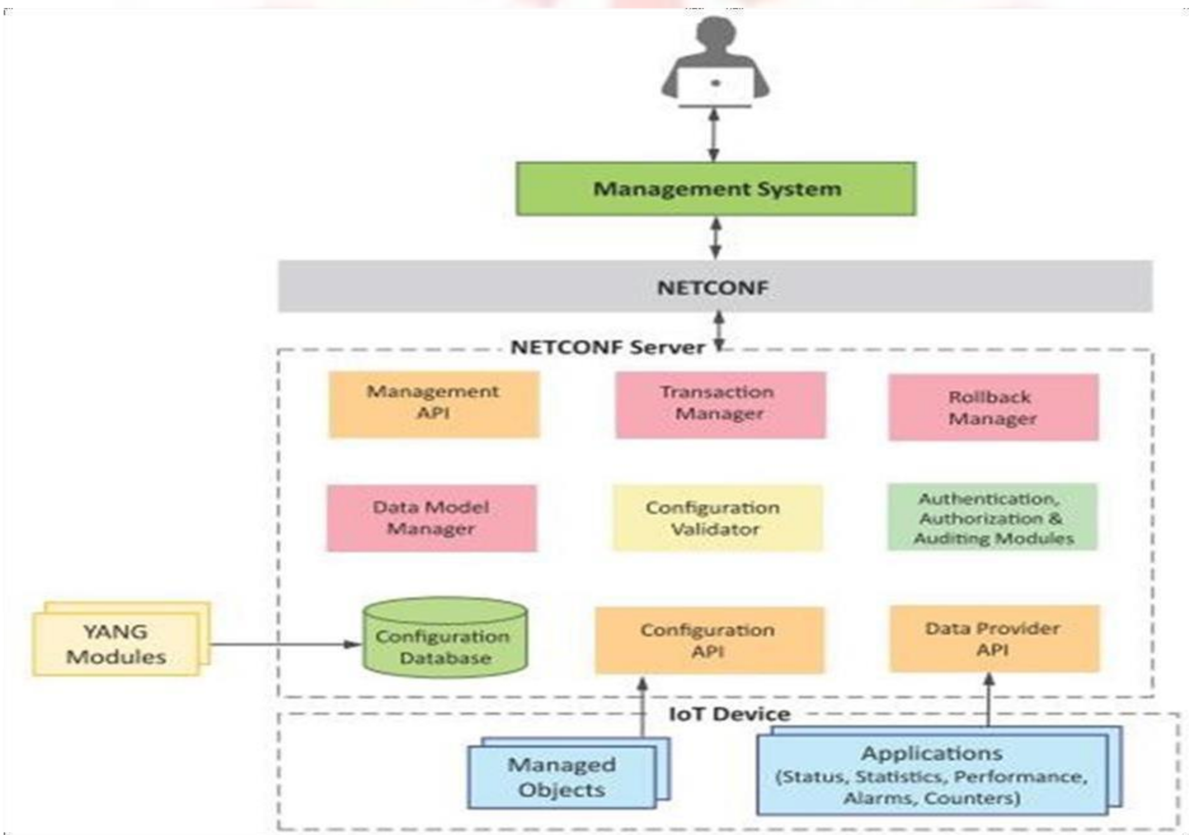
NFV Management and Orchestration focuses on all virtualization-specific management tasks and covers the orchestration and life-cycle management of physical and/or software resources that support the infrastructure virtualization, and the life-cycle management of VNFs.

4. IOT system Management with NET CONFIG–YANG

YANG isadatamodelinglanguageusedtomodelconfigurationandstatedata manupulatedbythe NETCONFprotocol.

ThegenericapproachofIoTdevice management weithNETCONF-YANG.Rolesof various components are:

1) Management System
2) Management API
3) Transaction Manager
4) Roll back Manager
5) Data Model Manager
6) Configuration Validator
7) Configuration Database
8) Configuration API
9) Data Provider API



1) **Management System:** The operator uses a management system to send NETCONF messages to configure the IoT device and receives state information and notifications from the device as NETCONF messages.
2) **Management API:** allows management application to start NETCONF sessions.
3) **Transaction Manager:** executes all the NETCONF transactions and ensures that ACID properties hold true for the transctions.
4) **Roll back Manager :** is responsible for generating all the transactions necessary toroll back a current configuration to its original state.
5) **Data Model Manager:** Keep strack of all the YANG data models and the corresponding managed objects. Also keeps track of the applications which provide data for each part of a data model.
6) **Configuration Validator:** check s if the resulting configuration after applying a transaction would be a valid configuration.
7) **Configuration Database:** contains both configuration and operational data.
8) **Configuration API :** Using the configuration API the application on the IoT device can be read configuration data from the configuration data store and write operational data to the operational data store.
9) **Data Provider API:** Applications on the IoT device can register for callbacks for various events using the Data Provider API. Through the Data Provider API, the applications can report statistics and operational data.

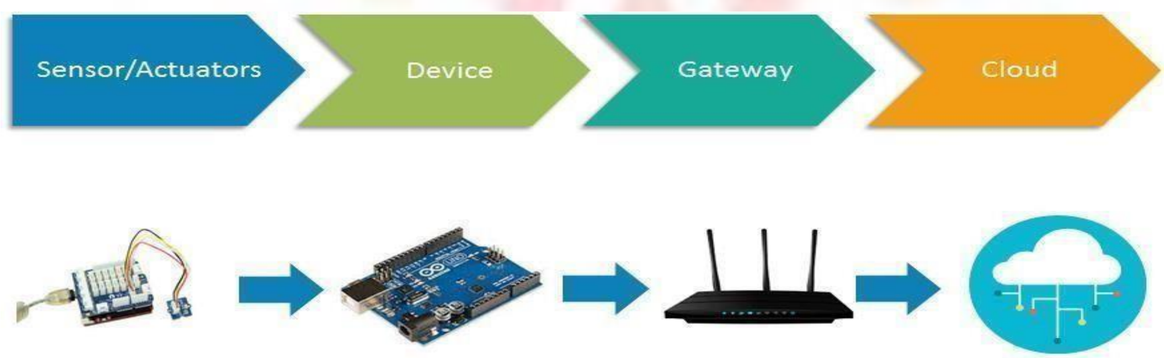
UNIT– 3

1. IOT architecture

State of the art

IoT architecture varies from solution to solution, based on the type of solution which we intend to build. IoT as a technology majorly consists of four main components, over which an architecture is framed.

1) Sensors
2) Devices
3) Gateway
4) Cloud



Stages of IoT Architecture

Stage 1: Sensors/actuators

Sensors collect data from the environmentor objectundermeasurementandturn itintousefuldata. Think ofthe specialized structures in your cellphone that detectthe directionalpullofgravity and the phone's relative position to the “thing” we call the earth and convert it into data that your phone can use to orient the device.

Actuators can also intervene to change the physical conditions that generate the data. An actuator might,forexample,shutoffapowersupply,adjustanairflowvalve,ormovearoboticgripper in an assembly process.

The sensing/actuating stage covers everything from legacy industrial devices to robotic camera systems,waterleveldetectors,airqualitysensors,accelerometers,andheartratemonitors.And thescopeoftheIoT isexpandingrapidly, thanks inparttolow-powerwirelesssensor network technologiesandPoweroverEthernet,whichenabledevicesonawiredLANtooperatewithout the need for an A/C power source.