

## EXPERIMENT 5: SIMULATION OF WIRELESS PERSONAL, LOCAL AND WIDE AREA NETWORKS

TEAM 9

### AIM

To simulate wireless personal, local and wide area networks using Cisco Packet Tracer.

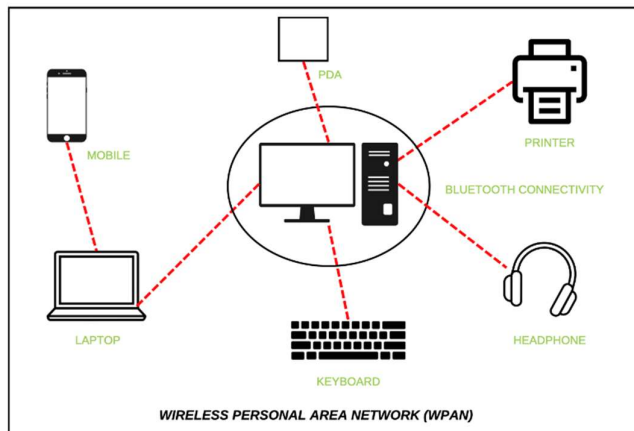
### SOFTWARES REQUIRED

1. Oracle VM VirtualBox 6.1.38, Oracle Corporation
2. Ubuntu 22.04 (64-bit) Operating System
3. Cisco Packet Tracer 8.2.0 64-bit, Cisco Systems Inc.

### THEORY

#### **Personal Area Network (PAN): -**

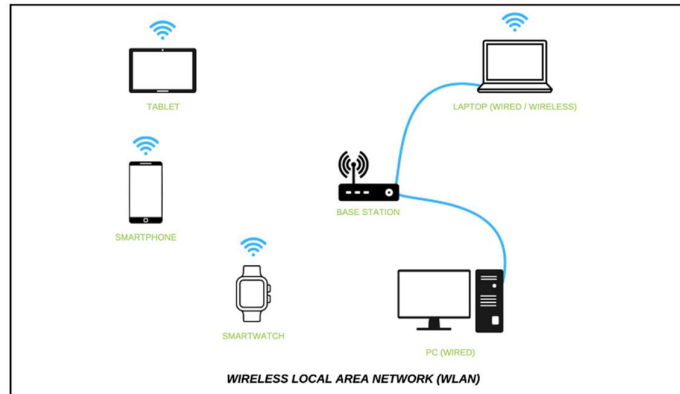
1. Range – Electronic devices in a user's local vicinity are connected by a personal area network (PAN). A personal area network (PAN) links technological items that are normally within a single user's range, which is roughly 10 meters (33 feet) apart.
2. Components – Laptops, smartphones, tablets, wearable technology, printers, and entertainment equipment are the most common PAN components. A desktop computer, a wireless mouse, and wireless headphones, for instance, can all be linked together, but only the computer can establish a direct connection to the Internet.
3. Working – Although devices within a PAN can communicate with one another and exchange data, PANs typically lack a router and cannot connect directly to the Internet. But a PAN device can also be linked to a LAN, and the LAN can subsequently be linked to the Internet.
4. Data Transfer – This kind of network is made to allow wired or wireless communication and resource, data, and application sharing across devices in a small office or home office (SOHO) setting.
5. Use Cases – The link between a Bluetooth earpiece and a smartphone is one of the most typical real-world instances of a PAN. PANs can link various electronic devices including keyboards, printers, tablets, and laptops.



6. Examples – There are wired and wireless PAN network connections available. Wireless connection technologies include Bluetooth, Wi-Fi, IrDA, and Zigbee, while wired connection methods include USB and FireWire.

### Local Area Network (LAN): -

1. Range – A group of devices connected in a single physical location, such as a building, office, or home, is known as a local area network (LAN).
2. Property – The fact that a LAN connects devices that are located in a single, constrained region is its sole distinguishing feature, regardless of size. A wide area network (WAN) or metropolitan area network (MAN), in contrast, spans a wider geographic area. A few WANs and MANs link numerous LANs collectively.

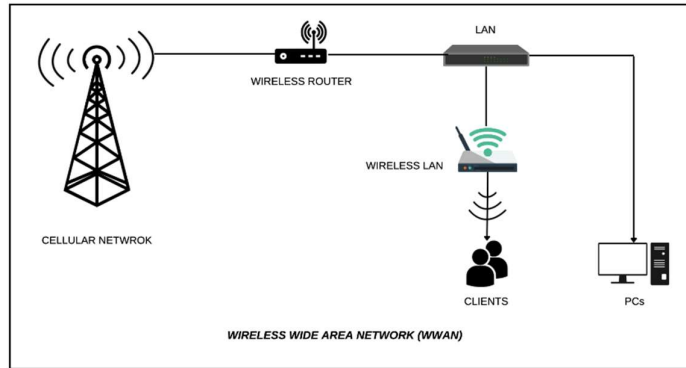


3. Components – A local area network (LAN) is made up of cables, access points, switches, routers, and additional parts that allow devices to connect to internal servers, web servers, and other LANs via wide area networks.
4. Working – The computers in each department might be conceptually connected to the same switch in an office with many departments, such as accounting, IT support, and administration, but they might be segmented to operate separately.
5. Virtualization – The growth of virtualization has also sped up the creation of virtual LANs, which let network managers divide and logically organize network nodes without having to make significant changes to their infrastructure.
6. Data Transfer – The benefits of a LAN are the same as those of any networked group of devices. The devices can share files, print to shared printers, access and even control one another, use a single Internet connection, and more.
7. Use Cases – LANs are being used by households, restaurants, coffee shops, shops, and schools in addition to companies and educational institutions.
8. Growth – Even while the advantages of connecting devices to a network have long been acknowledged, it wasn't until the widespread adoption of Wi-Fi technology that LANs started to become typical in almost all types of environments.

### Wide Area Network (WAN): -

1. Range – A vast network of information that is not connected to a single location is referred to as a wide area network (also known as WAN). Through a WAN provider, WANs may help devices from all over the world communicate, exchange information, and do much more.

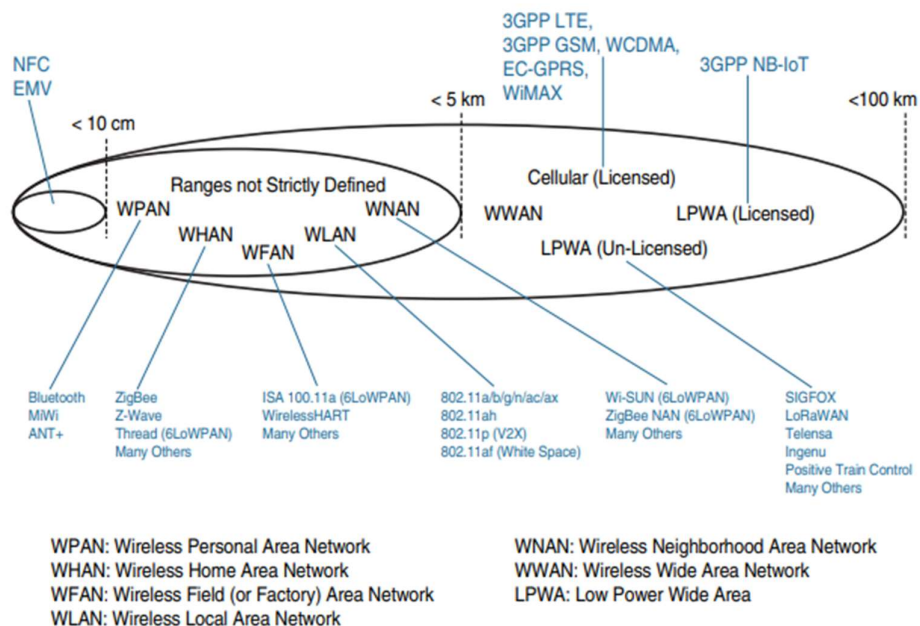
2. Internet – The internet is regarded as the world's largest WAN, making WANs crucial for global commerce as well as for daily use.



3. Working – These networks are frequently built by service providers who then rent out their WAN to organizations including businesses, universities, governments, and the general public.
4. Data Transfer – No matter where they are, as long as they have access to the established WAN, these clients can utilize the network to relay and store data or connect with other users.
5. Use Cases – Different linkages, such as virtual private networks (VPNs) or lines, wireless networks, cellular networks, or internet access, can be used to enable access.

There are also more types of telecommunications networks, such as:

- Home Area Networks (HAN)
- Neighbourhood Area Networks (NAN)
- Field (or Factory) Area Networks (FAN)
- Metropolitan Area Networks (MAN)
- Internet (or Cloud) Area Networks (IAN)



**Figure 2-9** Access Technologies and Distances

### **ALGORITHM**

#### **Personal Area Network (PAN): -**

- I. Choose the required components along with the IoT devices. Rename them conveniently and make connections using suitable connection types.
- II. For the door and light configurations, set the network adapter as PT-IOT-NM-CFE.
- III. For the router configuration,
  - Assign the IPv4 address and subnet mask in the suitable interface.
  - Turn the port status ON.
  - In the command line interface (CLI), enable the DHCP server to assign the IP address to the IoT devices.
- IV. Assign IP configuration to the server by the static method. Turn ON IoT Registration Server Services. Create a registration server account using the desktop web browser.
- V. Register each IoT device using remote server configuration.
- VI. Add conditions for the devices in the IoT server as follows,

Enabled	Name	Condition	Actions
Yes	RFID-Valid	IoT4 Card ID = 1001	Set IoT4 Status to Valid
Yes	RFID-Invalid	IoT4 Card ID != 1001	Set IoT4 Status to Invalid
Yes	Door-Open	IoT4 Status is Valid	Set IoT2 Lock to Unlock
Yes	Door-Lock	IoT4 Status is Invalid	Set IoT2 Lock to Lock

- VII. Discover Bluetooth (Portable Music Player & Speaker) devices and pair the same. Connect them to the home gateway by filling out the SSID and authentication details.

#### **Local Area Network (LAN): -**

- I. Choose the required components along with the IoT devices. Rename them conveniently and make connections using suitable connection types.
- II. Connect the PC and laptop to the router by removing the default physical connection and replacing it with the wireless interface.
- III. Navigate to the PC desktop web browser and provide the authentication details. One can make changes such as IP address, DHCP server settings, router password, etc. over here. In the basic wireless settings,
  - Rename your network name to an appropriate one.
  - Set the security mode to WPA2 Personal.
  - Set the encryption type to AES.
  - Set a strong passphrase.

- IV. For each end device, configure the SSID and WPA2-PSK authentication under the wireless interface. An alternative in the case of PC and laptop is to connect to the wireless network through desktop PC wireless.
- V. If SSID broadcasting is disabled, manually set up a new network profile and choose the required options under the advanced settings. Repeat the same functionalities as in step III.

**Wide Area Network (WAN):** - Setup Pre-requisite – Integrate LAN and PAN steps to form WAN. Further steps include the following,

- I. Create topologies for two separate wireless local area networks (WLANs).
  - o Configure the wireless interface on each device with the IP address in the WLANs.
  - o Set Wired Equivalent Privacy (WEP) key on each device in the WLANs.
- II. Connect the two WLANs with a wired backbone network and configure the IP address on each device in the wired network.
- III. Check communication between,
  - o Wired Devices
  - o Wireless Devices
  - o Wired and Wireless Devices
- IV. Outputs generated include,
  - o Successful ping responses between different devices.
  - o Sample screenshots of WEP key setting and IP address configuration.

**Network Address Translation (NAT) Mini Demonstration in Wireless WAN: -**

- I. NAT allows a single device, such as a router, to act as an agent between the Internet (public network) and a local (private) network. This means only a single, unique IP address is required to represent an entire group of computers.
- II. In static NAT, a private IP address is mapped to a public IP address, where the public address is always the same IP address (i.e., it has a static address). This allows an internal host such as a web server, to have an unregistered (private) IP address and still be reachable over the internet.
- III. Configure the IP address on the interface in both routers, PCs and the server.
- IV. Ping to the server from PC1 and then, configure static NAT.

STEP – I	STEP – II	STEP – III
configure terminal	int serial 0/0/0	ip nat inside source static 192.172.1.1 1.0.0.1
int fastEthernet 0/0	ip nat outside	ip route 0.0.0.0 0.0.0.0 serial 0/0/0
ip nat inside	ex	ip nat inside source static 192.172.1.2 1.0.0.1
ex		ip route 0.0.0.0 0.0.0.0 serial 0/0/0

- V. Ping command on both PCs and check connectivity.

## SCREENSHOTS OF INPUTS & OUTPUTS

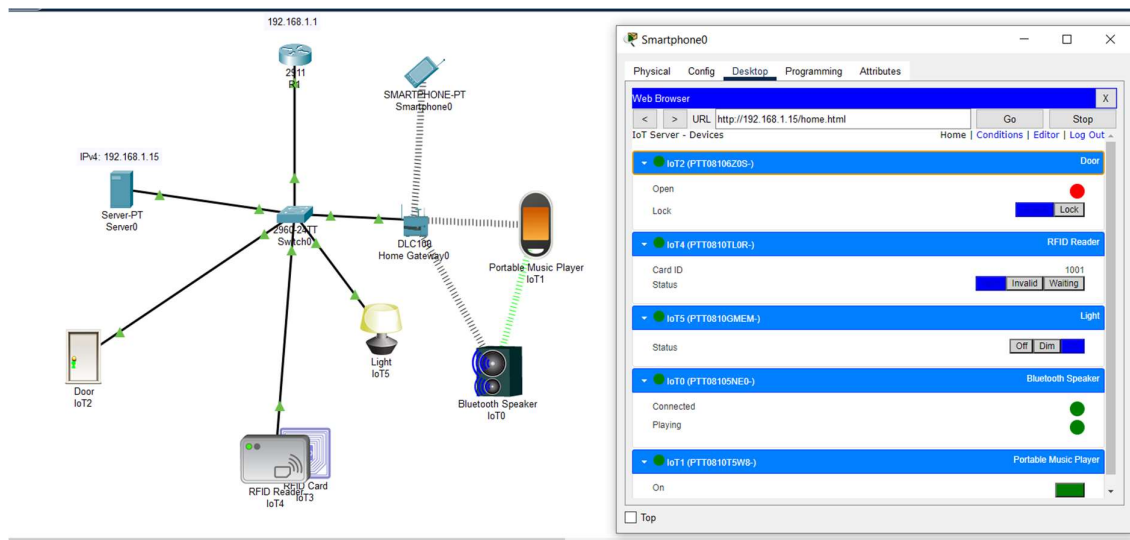


Figure 1 – Wireless Personal Area Network (WPAN)

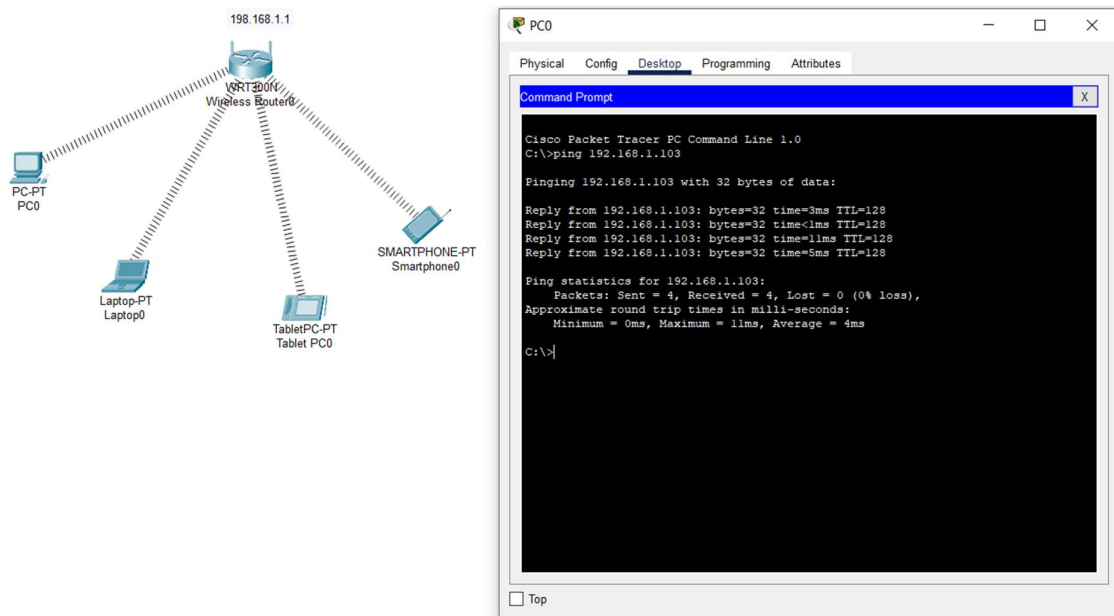


Figure 2 – Wireless Local Area Network (WLAN)

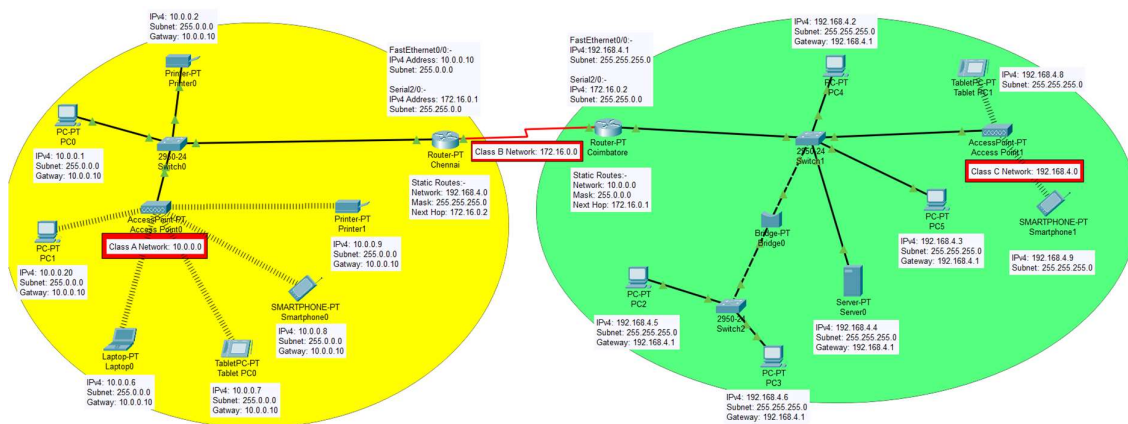


Figure 3 – Wireless Wide Area Network (WWAN)

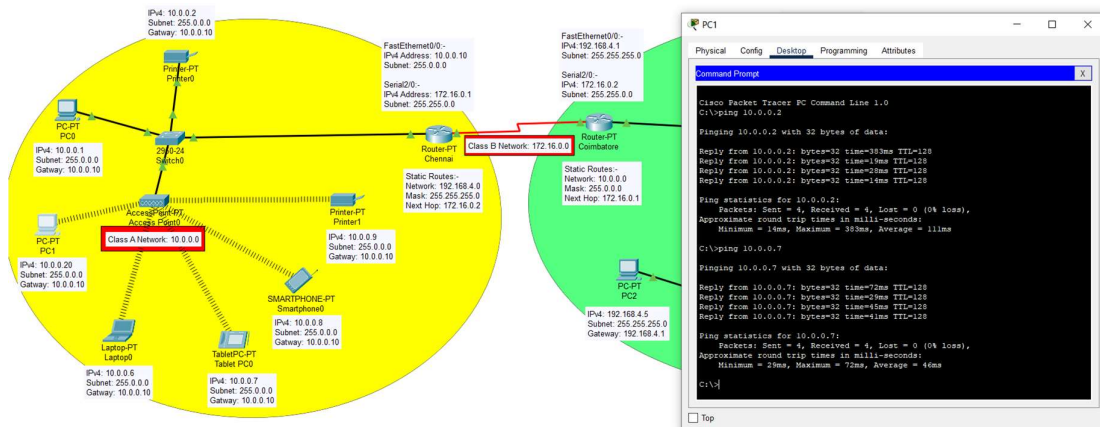


Figure 4 – Wireless Wide Area Network (WWAN)

### Class A Network Command Prompt (Ping)

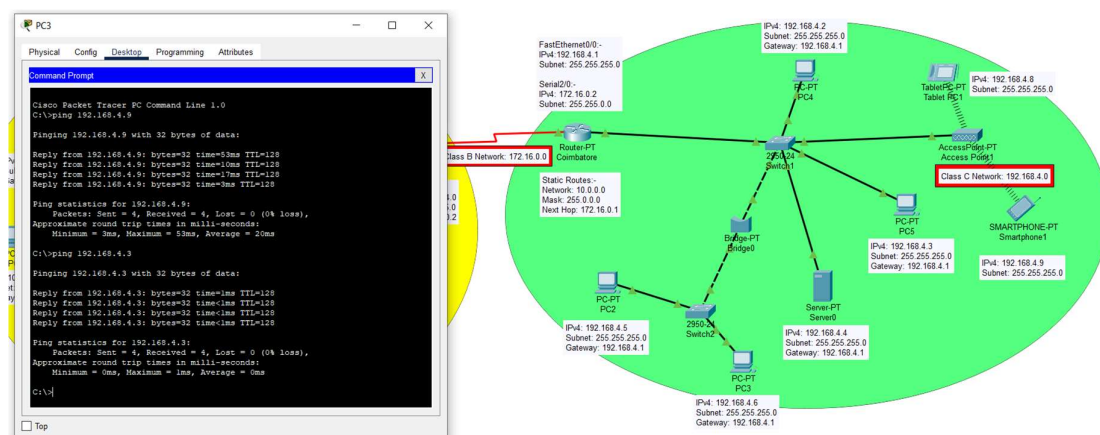


Figure 5 – Wireless Wide Area Network (WWAN)

### Class B Network Command Prompt (Ping)



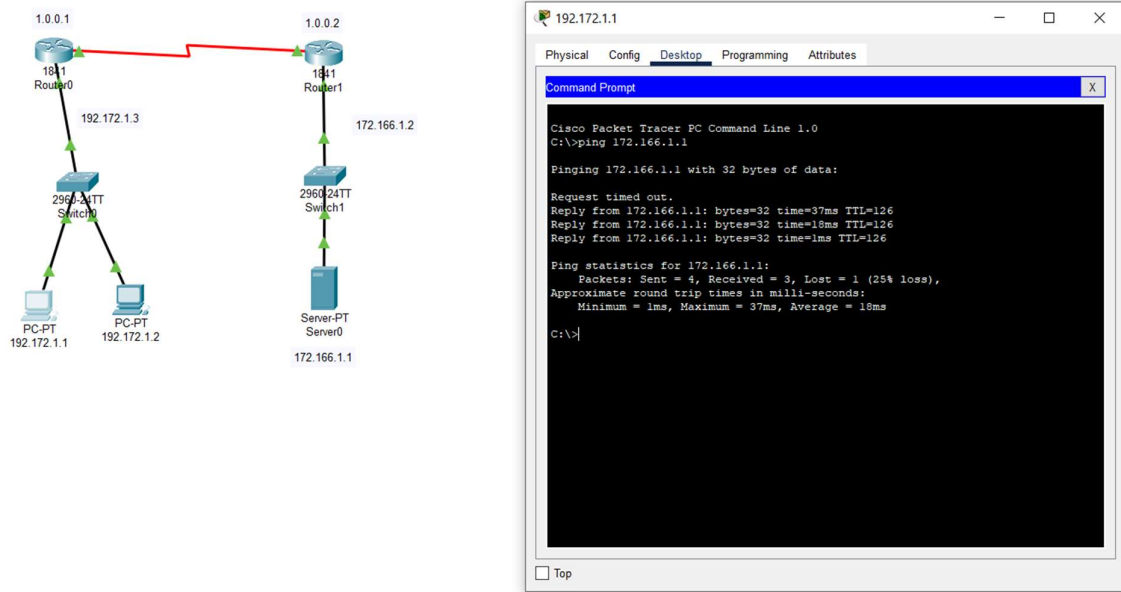


Figure 6 – Network Address Translation (NAT) Mini Demonstration in Wireless WAN

## RESULT

Thus, simulated wireless personal, local and wide area networks using Cisco Packet Tracer. All the simulation results were verified successfully.

## REFERENCES

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### **CONTRIBUTION – TEAM 9**

Name	Roll Number	Work Done		
		Cisco Packet Tracer	Documentation	Role
<b>B Ambareesh</b>	CB.EN.U4CCE20006	Network Address Translation (NAT)	Others	Review
<b>Narendran S</b>	CB.EN.U4CCE20036	Wireless Local Area Network (WLAN) & Wireless Personal Area Network (WPAN)	Theory (Text-Only)	Testing
<b>Narun T</b>	CB.EN.U4CCE20037			
<b>Pabbathi Greeshma</b>	CB.EN.U4CCE20040	Wireless Wide Area Network (WWAN)	Algorithm	Debugging
<b>Santosh</b>	CB.EN.U4CCE20053			