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# 4G Wireless Networks

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***Abstract*** **- The Third-Generation (3G) wireless technologies offer wireless web, SMS, MMS, EDGE, WCDMA, GPRS etc. 4G is a packet switched technology, uses bandwidth much more efficiently, allowing each user's packets to compete for available bandwidth. It solves the non-standardization problems associated with 3G. Data transfer rate will be 20 to 100 Mbps, which is 10 to 50 times than 3G and 10-20 times faster than ADSL. Operating frequency range will be 3 to 10 GHz and the IPv6 protocol will be used. In this paper, fundamentals of 4G and their various proposed architectures are explained. In India it can be used to network rural and urban areas, reduce cost of communication, flourish educational activities, facilitate research and development, faster internet connectivity, more cellular options, real time information systems, crisis management, Tele-medicines and many more. The present 3G networks need not to be discarded, and can be used in conjunction with 4G technology. There are various architectures proposed that can be used to deploy 4G.**

## I. INTRODUCTION

The fourth-generation wireless (4G) technology implements designs that will take the wireless telecommunication industry beyond 2010. The infrastructure of the 4G will function on top of the current existing CDMA, GSM and TDMA. It extends the 3G capabilities These technical opportunities strengthen the user mobility and encourage the deployment of the mobile technologies for the development of various (mobile) applications providing information, orientation (routing) and other helpful services.

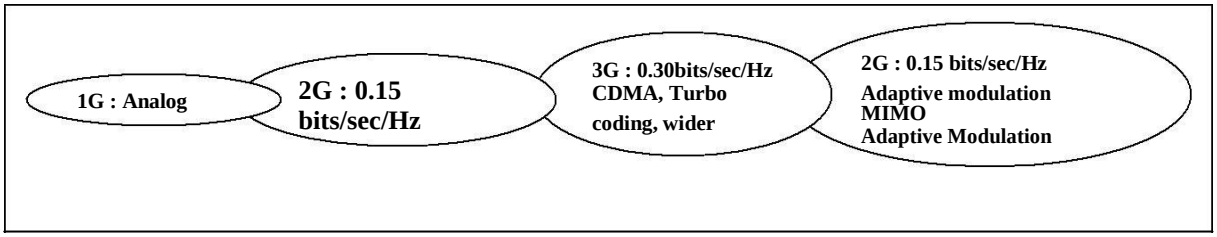


**Fig1. INCREMENTAL PROGRESS OF WIRELESS TECHNOLOGY**

It will deliver superior quality video and data, in addition to voice. It also solves the non-standardization problems associated with 3G networks for voice, video and data transmission. The data transfer rate is 20 to 100 Mbps, which will be 10 to 50 times those offered by 3G links and 10-20 times faster than standard ADSL (Asymmetric Digital Subscriber Line) services. The operating frequency ranges between 3 to 10 GHz and the IPV6 protocol used will be used. High-definition television programming through wireless broadband connections, Internet-based multi-channel video and higher mobile Internet will become a reality. The Defense Advanced Research Projects Agency (DARPA) in the US originally conceived of 4G.

## II. NEED OF 4G

- 3G performances insufficient to meet high performance future needs.
- Multiple incompatible standards. Global mobility and service portability required.
- Need for hybrid networks for both WLAN and cellular network design.
- Technology to utilize newly found modulation methods.

- Need for All IP network with converged voice and data capability.
- Wider bandwidth.

## III. CHARACTERSTICS

### *A. End-to-End Internet Protocol (IP)*

It will provide access through a collection of radio interfaces, seamless roaming/handover and the best-connected service, combining multiple radio access interfaces (such as WLAN, Bluetooth and GPRS) into a single network that subscribers may use. It allows any mobile device to seamlessly roam over different wireless technologies automatically, using the best connection available for the intended use. Users will have access to different services, increased coverage, the convenience of a single device, one bill with reduced total access cost, and more reliable wireless access even with the failure or loss of one or more networks.

### *B.* Peer-to-Peer networks

In this system, every device is both a transceiver and a router/repeater for other devices in the network, elimination of a single node does not disable the network. 4G can be defined as "wireless ad hoc peer-to-peer networking."

## IV. SIGNIFICANCE OF 4G

In 4G networks, users joining the network add mobile routers to the network infrastructure. Network capacity and coverage is dynamically shifted to accommodate changing user patterns. Wherever the concentration of people is more in one area, additional routes are created, thus enabling additional access to network capacity. Users will automatically hop away from congested routes to less congested routes. This permits the network to dynamically and automatically balance capacity and increase network utilization. As number of users increases, the service improves for all users.

## V. FEATURES OF 4G

### *A. High speed*

100 Mbps in stationary mode with an average of 20 Mbps when traveling.

### *B. High network capacity*

Should be at least 10 times that of 3G systems.

### *C. Fast/seamless handover across multiple networks*

4G wireless networks should support global roaming across multiple wireless and mobile networks,

### *D. Next-generation multimedia support*

fast speed and large volume data transmission at a lower cost than today.

### *E. MIMO techniques*

The benefit of array or multiple antennas for spatial diversity has long been realized. Yet only recently were they combined with advanced coding techniques to from extremely efficient MIMO (Multiple Input Multiple Output) systems.

### *F. Wireless access technologies*

OFDMA (Orthogonal Frequency – Division Multiple Access ) and MC-CDMA (Multiple Carrier CDMA) are the main contender for the future system. Another more radical access scheme for the downlink, yet better in terms of throughput, is a single queue packet based system

## VI. FUTURE APPLICATION

### *A. Tele-medicine*

a paramedic assisting a victim of a traffic accident in a remote location could access medical records (e.g., x-rays) and establish a videoconference so that a remotely-based surgeon could provide "on-scene" assistance.

### *B. Crisis-management applications*

In case of any natural disasters where the entire communications infrastructure has collapsed, restoring communications quickly is essential. With 4G networks it can be set up in a matter of hours. In comparison, it may take days or even weeks to re-establish communications capabilities when a wire line network fail

## VII.POSSIBLE ARCHITECTURE ON 4G

One of the most challenging problems facing deployment of 4G technology is how to access several different mobile and wireless networks. Three possible architectures: using a multi-mode device, an overlay network, or a common access protocol.

### *A. Multimode devices (Fig2)*

A single physical terminal with multiple interfaces to access services on different wireless networks. The multimode device architecture may improve call completion and expand effective coverage area. It should also provide reliable wireless coverage in case of network, link, or switch failure. The device itself incorporates most of the additional complexity without requiring wireless network modification or employing inter-working devices. Each network can

deploy a database that keeps track of user location, device capabilities, network conditions, and user preferences. The handling of quality-of-service (QoS) issues remains an open research question.

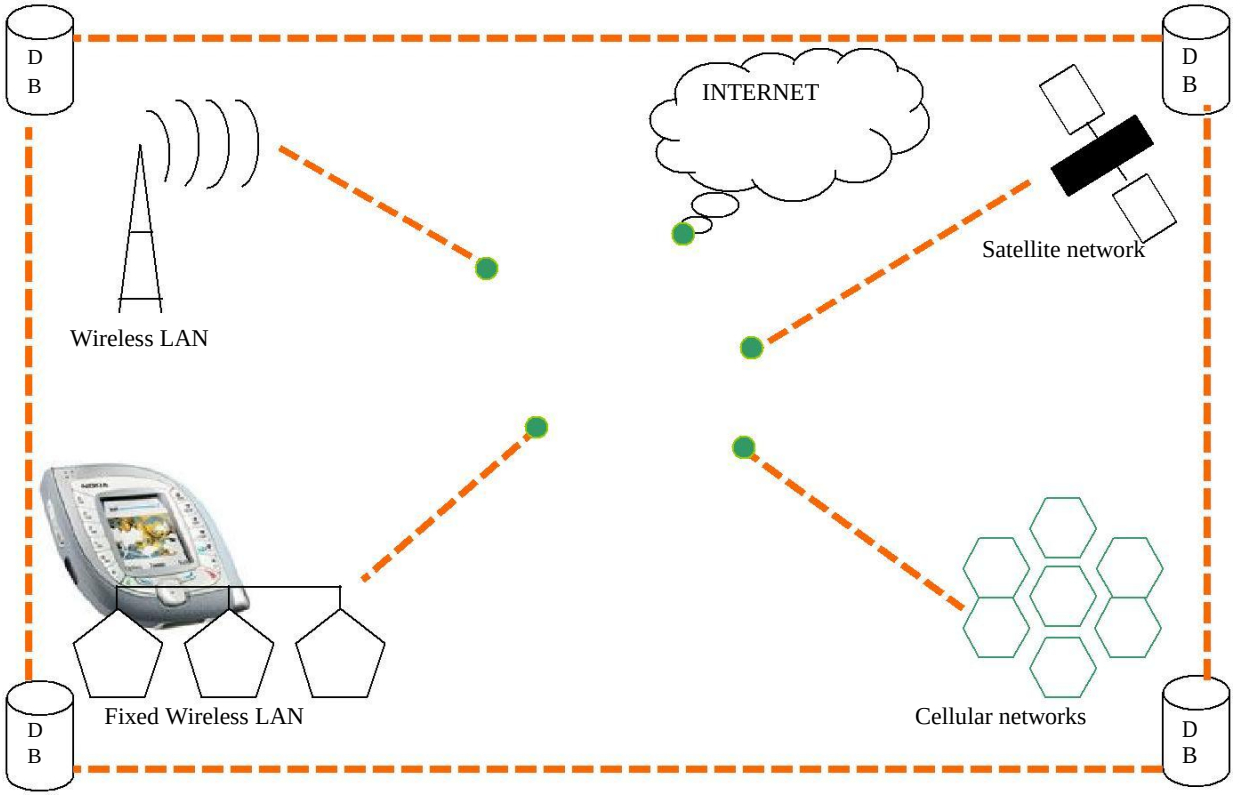


**Fig 2. A multimode device lets the user, device, or network initiate handoff between networks without the need for network modification or interworking devices.**

***B. Overlay mode (Fig 3) :***

In this architecture, a user accesses an overlay network consisting of several universal access points. These UAPs in turn select a wireless network based on availability, QoS specifications, and user-defined choices. A UAP performs protocol and frequency translation, content adaptation, and QoS negotiation-renegotiation on behalf of users. The overlay network, rather than the user or device, performs handoffs as the user moves from one UAP to another. A UAP stores user, network, and device information, capabilities, and preferences. Because UAPs can keep track of the various resources a caller uses, this architecture supports single billing and subscription. Satellite network Fixed wireless network.

***C. Common access protocol (Fig4)***

This protocol becomes viable if wireless networks can support one or two standard access protocols. One possible solution, which will require interworking between different networks, uses wireless asynchronous transfer mode. To implement wireless ATM, every wireless network must allow transmission of ATM cells with additional headers or wireless ATM cells requiring changes in the wireless networks. One or more types of satellite-based networks might use one protocol while one or more terrestrial wireless networks use another protocol. Wireless LAN Cellular network.

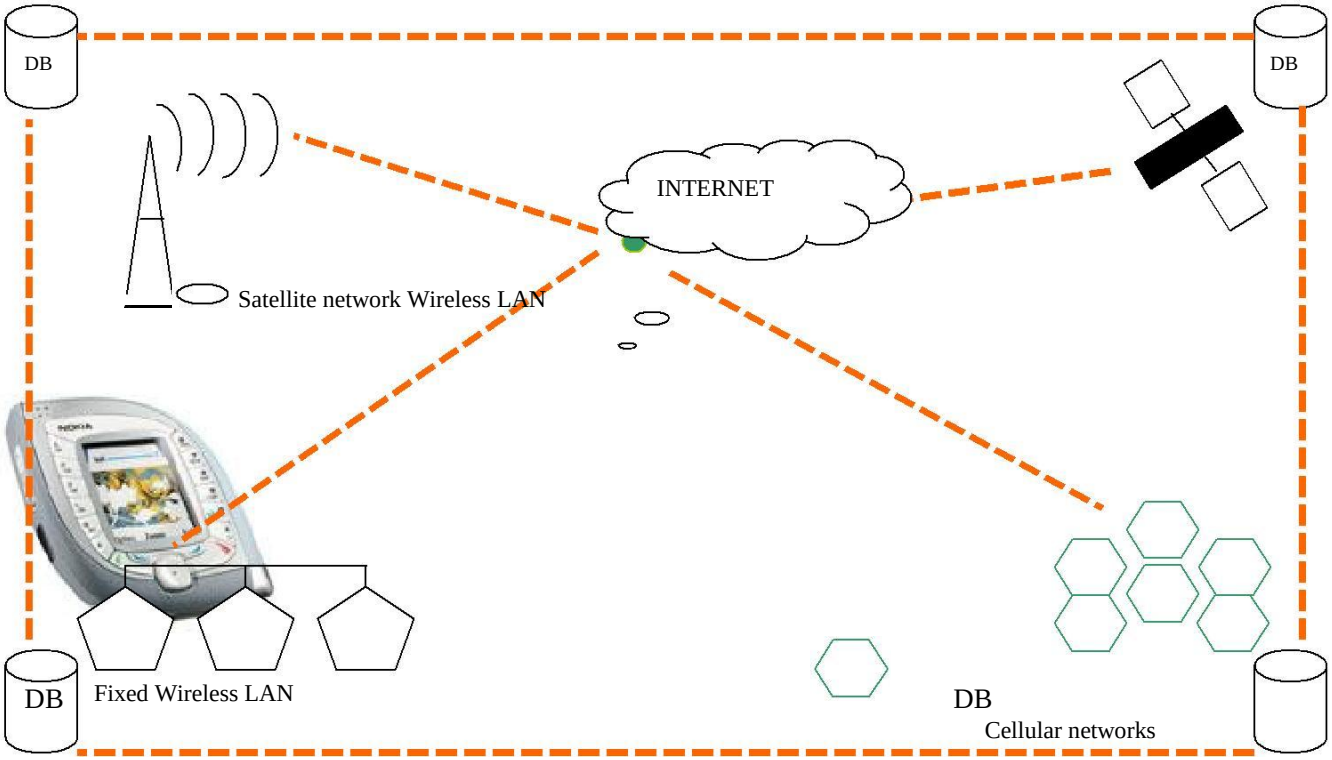


**Fig 3. A device capable of automatically switching between networks is possible if wireless networks can support a common protocol to access a satellite-based network and another protocol for terrestrial networks.**

## VIII.CONCLUSION

4G is the next upcoming wireless technology. It holds a lot of promises in solving today's problems and tomorrows needs. 4G will also make worldwide roaming using a single handheld device. 4G networks may eventually deliver on all the promises. At times, it seems that technological advances are being made on a daily basis. These advances will make high-speed data/voice-over-Internet-protocol (VoIP) networks a reality. In the meantime, it is important for industry to develop a strong 3G offering that is palatable for the general public. Equally as important, industry must ensure that expectations are realistic and that services meet and exceed those expectations. If all goes according to what the industry envisions, it may be sooner, rather than later that we will see wireless communications evolve. This evolution will give the general public as well as the public safety community amazing functionality from the convenience of a single handheld device.

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