IT 607:Wireless Communication and Applications

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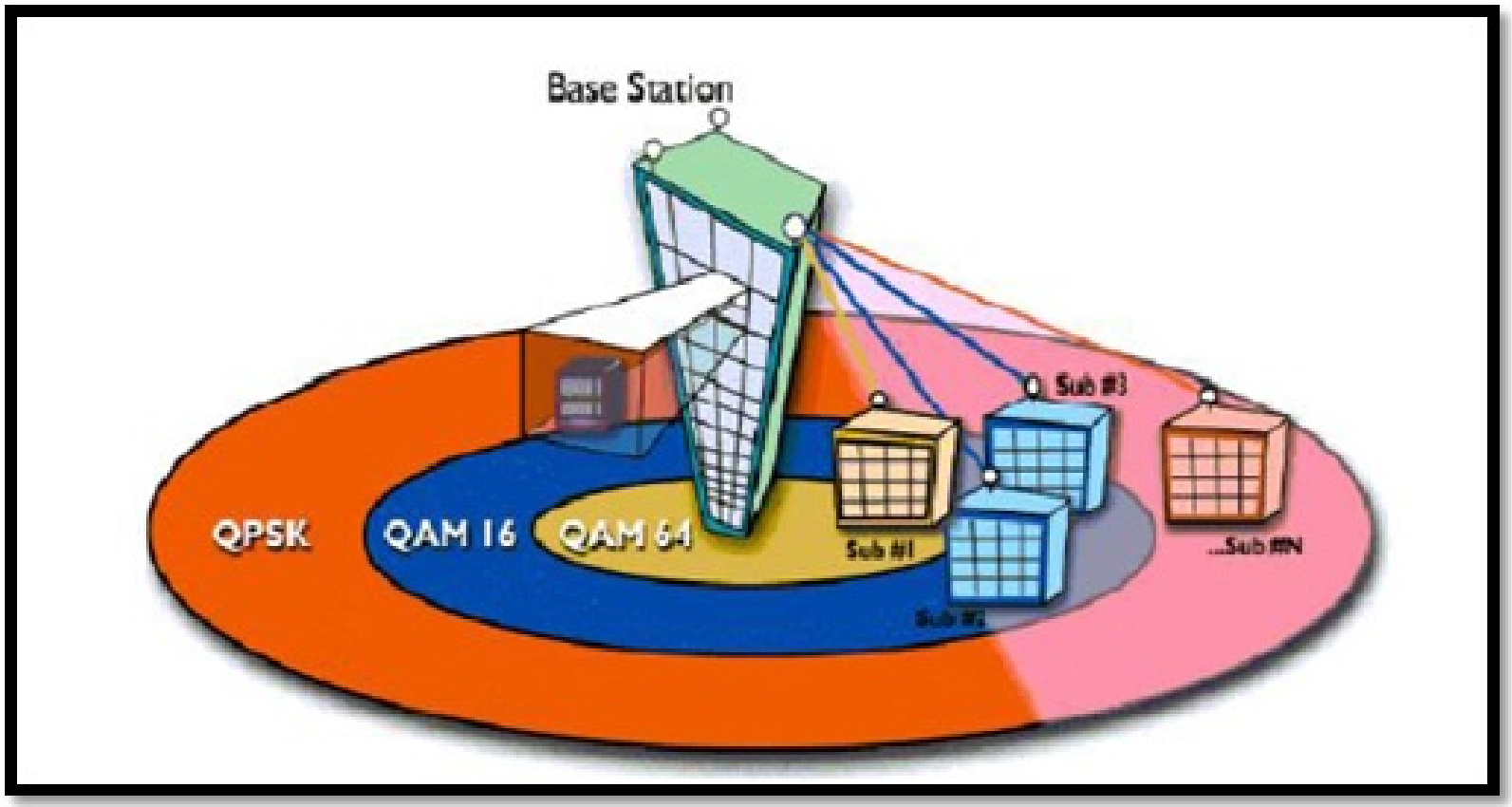
ADAPTIVE MODULATION AND CODING

- Introduction
- Adaptive modulation and coding technique in wireless network
- Digital modulation methods
- Orthogonal Frequency Division Multiplexing (OFDMS)
- Software defined radio
- Conclusion

Introduction

- Adaptive modulation and coding (AMC) is a method which adapts its transmitting parameters according to the channel state and is used in various modern wireless communications to maximize spectrum efficiency by minimizing the error rate.
- Adaptive modulation is a method to improve the spectral efficiency of a radio link for a given maximum required quality (error probability
- Modulation is the process of varying a periodic waveform, i.e. a tone, in order to use that signal to convey a message
- Coding allows bit errors introduced by transmission of a

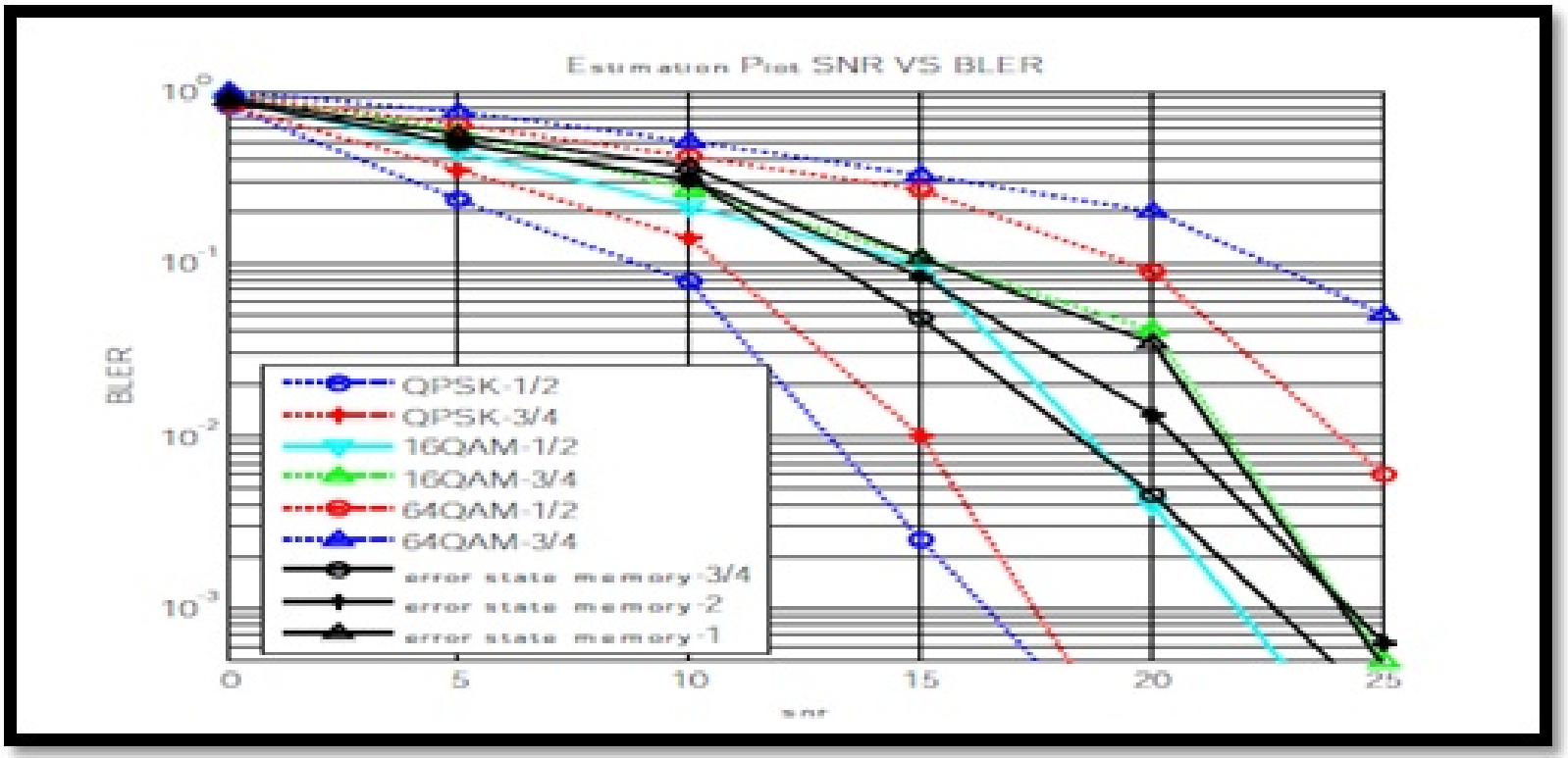
ARCHTECTURE:Adaptive modulation and coding



Types of Modulation and Coding Techniques

- Variable-rate: Data rate R() is varied as per channel gain Fix symbol rate RS=1/TS and use multiple modulation schemes or increase constellation size.
- Variable-error probability: Instantaneous BER is adapted subject to an average BER constraint
- Variable coding techniques: Stronger error correction code when is small Weaker error correction code when is large
- Variable-power technique :Transmit power is changed to compensate for SNR variations due to fading.
- Hybrid Techniques :Joint optimization of different techniques

Coding rates



STRENGTH ACM

- Adaptive Coding and Modulation, has the Potential to improve the availability satellite links and also deliver significant bandwidth savings)
- Adaptive Coding and Modulation is a technology which can Automatically change the modulation and forward error Correction
- The Use of ACM makes it unnecessary for service operators and system designers to trade off desired link availability and throughput

STRENGTH ACM ...

- ACM can increase the throughput of a robust Link by allowing it to dynamically adjust to a less robust Modulation/coding (MODCOD) resulting in higher Throughput under clear sky conditions
- ACM technology is able to alter the modulation and FEC by implementing a feed-back circuit containing link performance information

MODULATION

- Modulation is the process by which a carrier wave is able to carry the message or digital signal (series of ones and zeroes)
- TYPES MODULATION
- Analogue
- Digital
- Analogue: In analog modulation, the modulation is applied continuously in response to the analog information signal. It low-frequency message signal may be carried by an AM or FM radio wave.

Digital modulation methods

- In digital modulation, an analog carrier signal is modulated by a digital bit stream
- The most common digital modulations

  -Phase-shift keying (PSK

  -Frequency-shift keying (FSK)

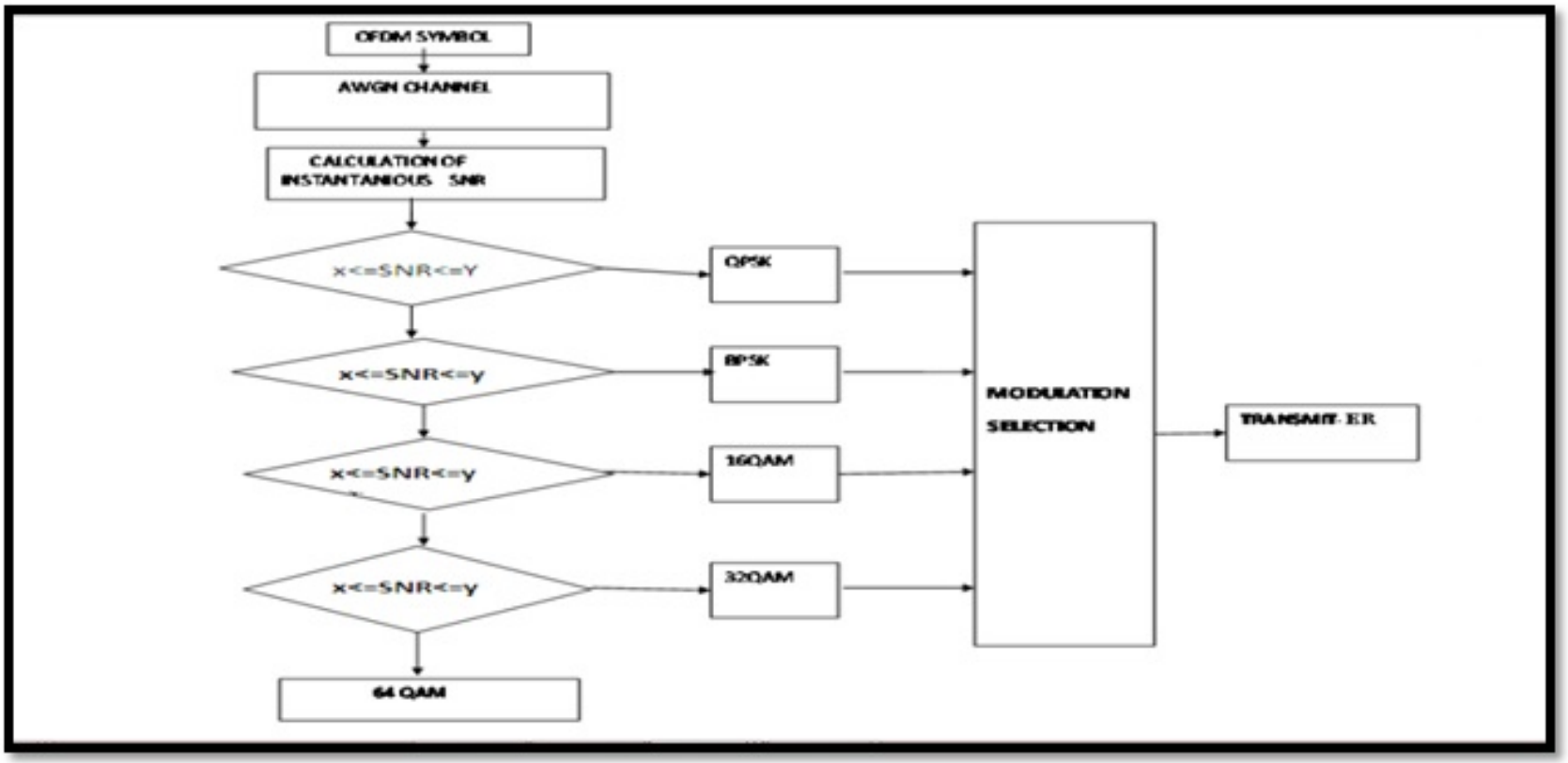
  -Amplitude-shift keying (ASK)

  -Quadrature amplitude modulation (QAM

Two Common Digital Modulation

- Orthogonal Frequency Division Multiplexing (OFDM): a special form of Multi-Carrier Modulation (MCM) with densely spaced sub carriers and overlapping spectra.
- Spread-spectrum modulation:Is methods by which energy generated in a particular bandwidth is deliberately spread in the frequency domain, resulting in a signal with a wider bandwidth

Orthogonal Frequency Division Multiplexing (OFDM)



Advantages of ODFM

- The primary advantage of OFDM over single-carrier schemes is its ability to cope with severe channel conditions.
- OFDM transmits symbols that have relatively long time duration, but a narrow bandwidth
- OFDM systems are designed so that each subcarrier is narrow enough to experience frequency-flat fading
- OFDM is used by power line devices to extend Ethernet connections to other rooms in a home through its power wiring
- OFDM systems are designed so that each subcarrier is narrow

Drawbacks OFDM

- The OFDM signal has a noise like amplitude with a very large dynamic range; therefore it requires RF power amplifiers with a high peak to average power ratio.
- It is more sensitive to carrier frequency offset and drift than single carrier systems are due to leakage of the DFT

Software defined radio

- Software defined radio have become more of reality than a buzz word in recent times. Give more flexibility on Radio Front-End
- Using the same Hardware Platform for different systems(Different standards)
- Different frequency bands and frequency bandwidths Providing more easily intergration
- SDR are flexible, reconfigurable and multi-standard system which are capable of providing efficient communication.

Advantages

- Reduce the development costs.
- Reduce the equipment costs .
- Reduction of size and weight of equipment
- Improved autonomy of equipment

Disadvantages.

- Narrowband filtering early in the receiver chain means most of the interferers are rejected -only closest ones are important -useful signal is dominant in the signal that comes into the Analogue/Digital
- Analogue or Digital Conversion is applied close to the antenna -We need to avoid over-specification and over-testing .

Conclusion and Challenges

The use of adaptive modulation allows wireless technologies to optimize throughput, yielding higher throughputs while also covering long distances. Adaptive modulation selection plays an important role in wireless communication since the wireless channel conditions vary progressively. Therefore, it has been taken as one of the key physical techniques.

Conclusion and Challenges

- Power consumption has always been one of the most crucial challenges for handheld devices in Adaptive Modulation and Coding (AMC)
- Performance prediction accuracy and complexity is a very challenging part of the overall AMC design procedure.
- selection of the available modes of operation to be used by the AMC algorithm. As the number of modes increase, the optimization algorithm itself can become very complex.
- New techniques in advanced waveform modulation, coding, multiple access, and full–duplex radios,along with algorithms