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IQRA UNIVERSITY PESHAWAR
EXAME FINAL TERAM
SUBJECT :NETWORKS MANAGEMENT
SEMESTER :SPRING 2020

IQRA NATIONAL UNIVERSITY, PESHAWAR, PAKISTAN

NETWORKS MANAGEMENT

Program: MSCS/PhDCS **FINAL-TERM EXAM** **Semester: Spring 2020**

Maximum Marks: 50 **Time Allowed: 6 Hours**

Note : ***Write down the complete statements of Q1 otherwise just answers will lead to zero marks.***

The paper should be submitted in pdf form and plagiarism will be checked; ***2 students with the same plagiarism report and answers will lead to zero marks to both.***

Cc: ***to Vice Chancellor***

Controller of Examination

Head of Department

Q1. Select the correct answer of the given ones. (10)

1) Interactive transmission of data independent of a time sharing system may be best suited to
   (a) simplex lines (b) half-duplex lines (c) full-duplex lines (d) biflex- lines

2) The loss in the signal power as of an Electromagnetic signal is called
(a) attenuation (b) propagation (c) scattering (d) interruption

3) Early detection of packet losses improves _____________ acknowledgment performance.
   (a) odd (b) even (c) positive (d) negative

4) Additional signal introduced in the desired signal in producing hypes is called
   (a) fading (b) noise
   (c) scattering (d) dispersion

5) Token is a **FRAME**that rotates around the ring.

6) Ring may have up to **250BIT** (802.5) or **260**(IBM) nodes.

7) FDDI can support a maximum of **500** stations.

8) Error-correcting codes are **intelligent** enough to handle all errors.

9) ACK is a small **chunks** confirming reception of an earlier frame.

10) Electronics are **organised** as compared to optics.

Q2: Distinguish between error correction and error detection. Explain any two error detection techniques with mathematical examples other than given in slides, search from internet. (10)

ANSWER: **ERROR DETECTION:**

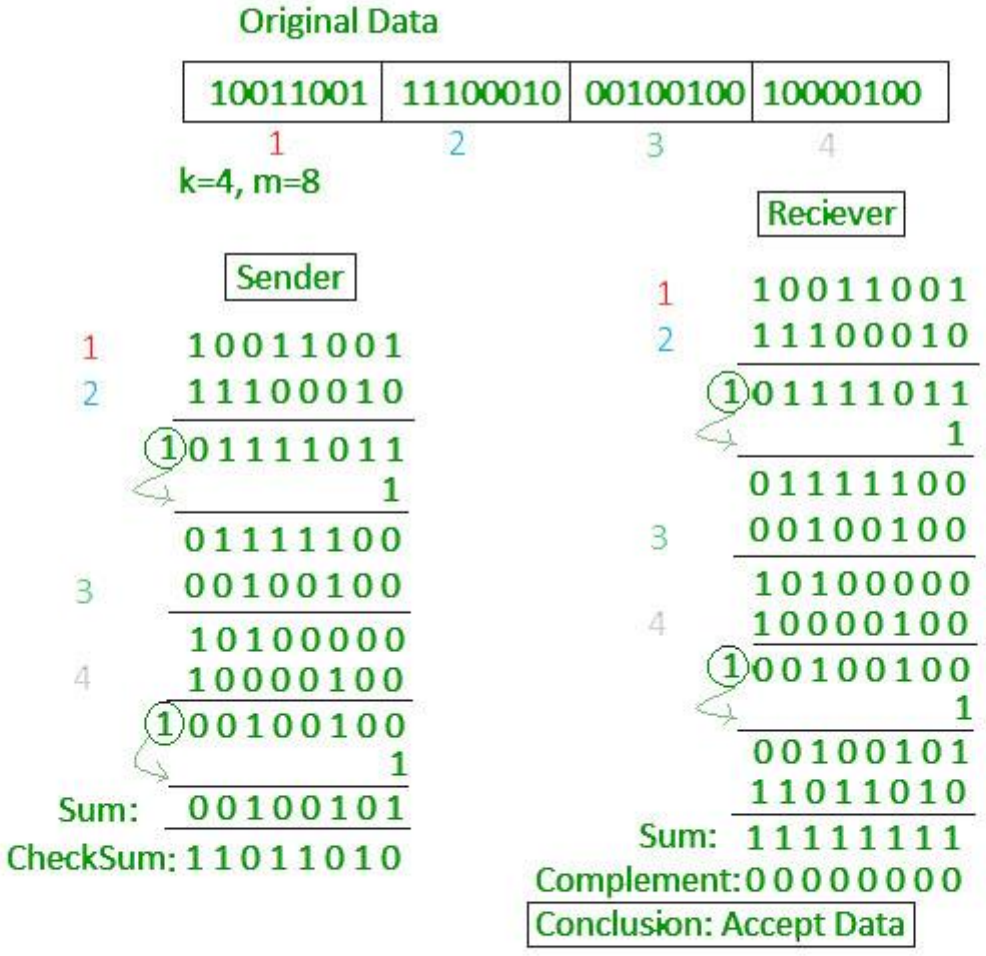
A condition when the receiver's information does not match with the sender's information. During transmission, digital signals suffer from noise that can introduce errors in the binary bits travelling from sender to receiver. That means a 0 bit may change to 1 or a 1 bit may change to 0.

Basic approach used for error detection is the use of redundancy bits, where additional bits are added to facilitate detection of errors.

ERROR CORRECTION: is the process of detecting errors in transmitted messages and reconstructing the original error-free data. Error correction ensures that corrected and error-free messages are obtained at the receiver side.

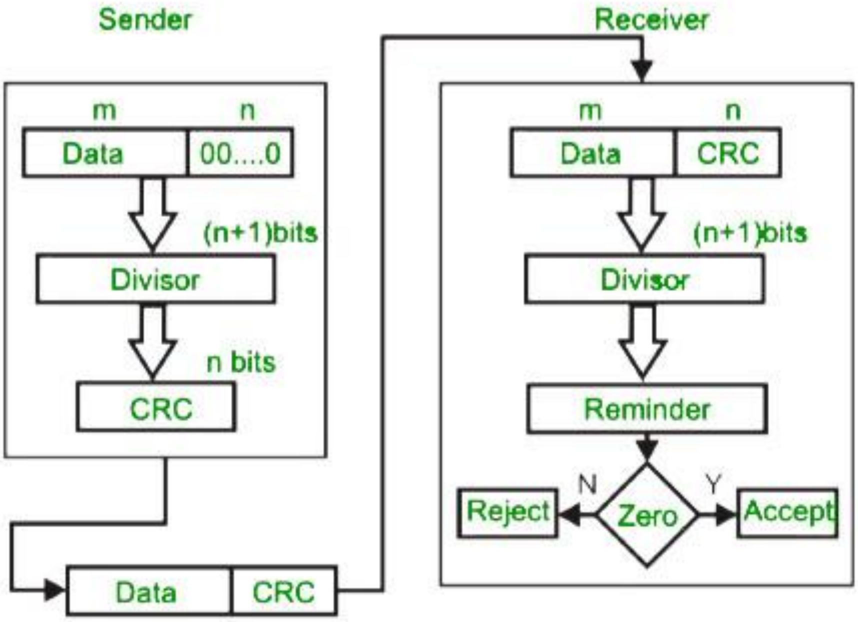
Some popular techniques for error detection are:

- 1. **Checksum**: In checksum error detection scheme, the data is divided into k segments each of m bits.
- In the sender's end the segments are added using 1's complement arithmetic to get the sum. The sum is complemented to get the checksum.
- The checksum segment is sent along with the data segments.
- At the receiver's end, all received segments are added using 1's complement arithmetic to get the sum. The sum is complemented.
- If the result is zero, the received data is accepted; otherwise discarded

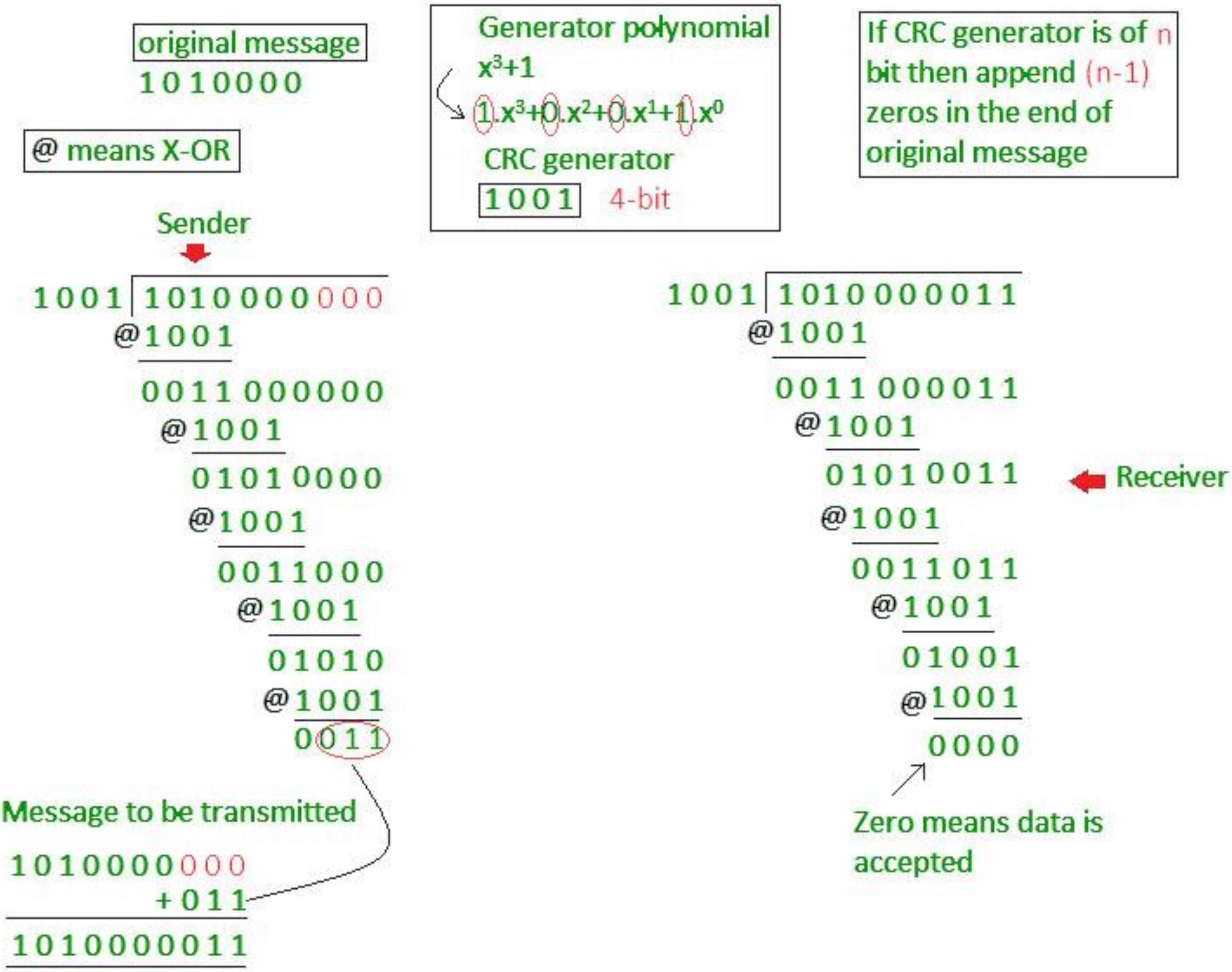


4. **Cyclic redundancy check:**

- Unlike checksum scheme, which is based on addition, CRC is based on binary division.
- In CRC, a sequence of redundant bits, called cyclic redundancy check bits, are appended to the end of data unit so that the resulting data unit becomes exactly divisible by a second, predetermined binary number.
- At the destination, the incoming data unit is divided by the same number. If at this step there is no remainder, the data unit is assumed to be correct and is therefore accepted.
- A remainder indicates that the data unit has been damaged in transit and therefore must be rejected.


Sender
Receiver
m
n
Data
00....0
(n+1)bits
Divisor
n bits
CRC
m
n
Data
CRC
(n+1)bits
Divisor
Reminder
N
Y
Reject
Zero
Accept
Data
CRC

Example :



Q3: What is encoding? Write down different types of encoding. Explain characteristics of AM, FM and PM with mathematical equations. (10)

ANSWER: Encoding is the process of converting data into a format required for a number of information processing needs, including:

- Program compiling and execution
- Data transmission, storage and compression/decompression
- Application data processing, such as file conversion

Encoding can have two meanings:

- In computer technology, encoding is the process of applying a specific code, such as letters, symbols and numbers, to data for conversion into an equivalent cipher.
- In electronics, encoding refers to analog to digital conversion.

Encoding involves the use of a code to change original data into a form that can be used by an external process.

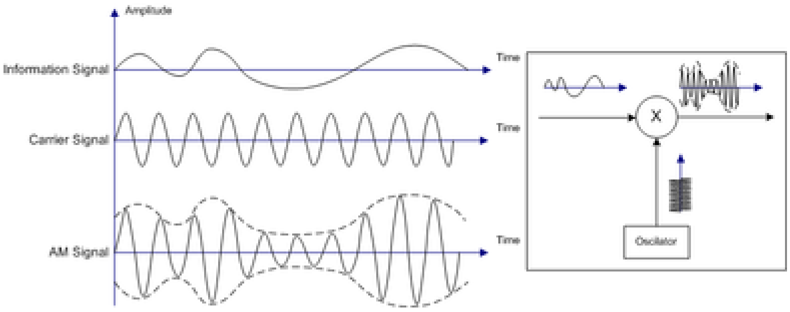
The type: of code used for converting characters is known as American Standard Code for Information Interchange (ASCII), the most commonly used encoding scheme for files that contain text. ASCII contains printable and nonprintable characters that represent uppercase and lowercase letters, symbols, punctuation marks and numbers. A unique number is assigned to some characters.

The standard ASCII scheme has only zero to 127 character positions; 128 through 255 are undefined. The problem of undefined characters is solved by Unicode encoding, which assigns a number to every character used worldwide. Other types of codes include BinHex, Uuencode (UNIX to UNIX encoding) and Multipurpose Internet Mail Extensions (MIME).

Encoding is also used to reduce the size of audio and video files. Each audio and video file format has a corresponding coder-decoder (codec) program that is used to code it into the appropriate format and then decodes for playback.

Encoding should not be confused with encryption, which hides content. Both techniques are used extensively in the networking, software programming, wireless communication and storage fields.

Amplitude modulationIn :order that a radio signal can carry audio or other information for broadcasting or for two way radio communication, it must be modulated or changed in some way. Although there are a number of ways in which a radio signal may be modulated, modulated, one of the easiest easiest is to change its amplitude in line with variations of the sound.



Amplitude modulationIn

• **Broadcast transmissions**: AM is still widely used for broadcasting on the long, medium and short wave bands.

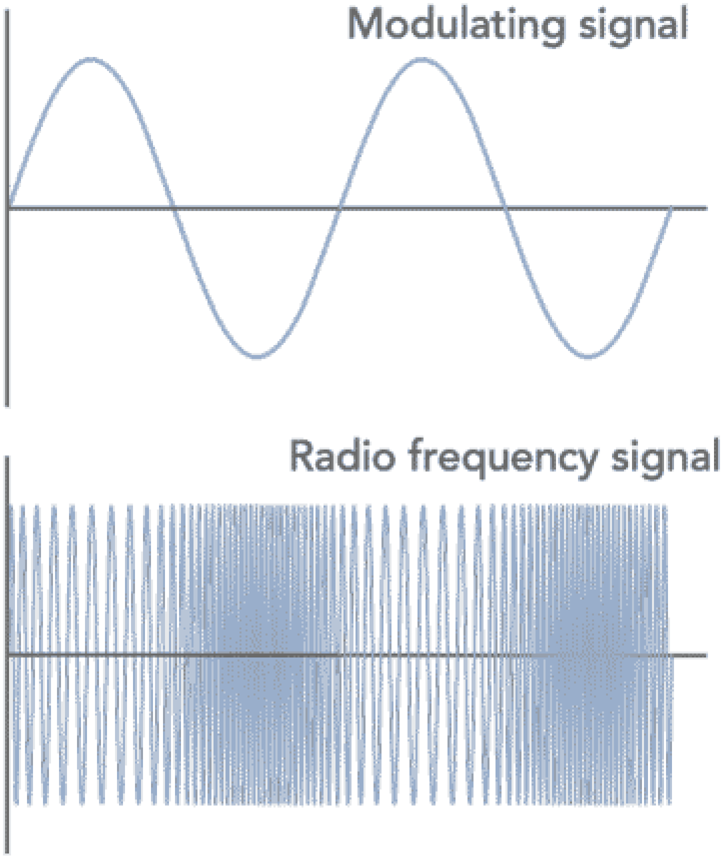
• **Air band radio:** VHF transmissions for many airborne applications still use AM.

• **Single sideband:** Amplitude modulation in the form of single sideband is still used for HF radio links.

• **Quadrature amplitude modulation:** AM is widely used for the transmission of data in everything from short range wireless links such as Wi-Fi to cellular telecommunications.

• **Phase modulation,** PM is sometimes used for analogue transmission, but it has become the basis for modulation schemes used for carrying data. Phase shoft keying, PSK is widely used for data communication.Phase modulation is also the basis of a form of modulation known as quadrature amplitude modulation, modulation, where both phase and amplitude amplitude are varied to provide additional capabilities.

• **Frequency modulation:** As with any form of modulation, it is necessary to be able to successfully demodulate it and recover the original signal. The FM demodulator may be called a variety of names including FM demodulator, FM detector or an FM discriminator. • There are a number of different types of FM demodulator, but all of them enable the • There are a number of different types of FM demodulator, but all of them enable the frequency variations of the incoming signal to be converted into amplitude variations on the output. These are typically fed into an audio amplifier, or possibly a digital interface if data is being passed over the system.

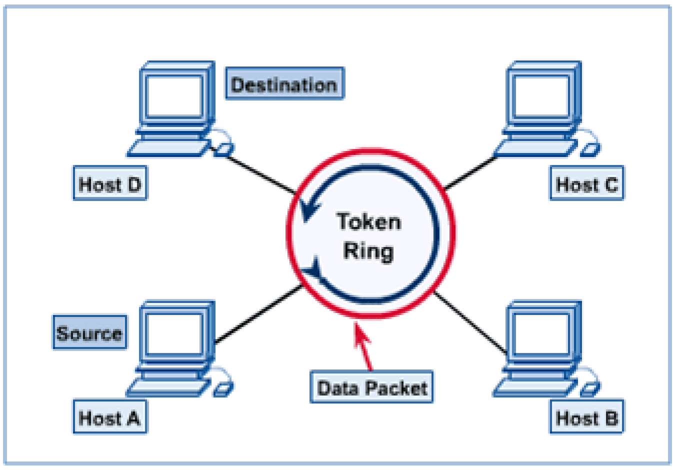


Frequency modulation.

Q4: Compare Ethernet and Token Ring concept of data networking with diagrams. Which one is better in your opinion and why? (10)

ANSWER: 1. **Token Ring :**

In the token ring a token ring passes over a physical ring. Token ring is defined by IEEE 802.5 standard. In token ring, there is a station and a special frame called token. A station in token ring can transmit data frame if it contains a token. After the successful transmission of data frame token are pointed(issued). Token ring is a Star shaped topology and handles priority in which some nodes may give priority to the token.



Token Ring.

2. Ethernet :

IEEE 802.3 defines the Ethernet. It uses CSMA/CD mechanism. It means that if many stations exist at the same time to talk, all stations will be closed. To resume them, wait for a random time. Unlike token ring it doesn't employ any priorities. And it is less costly than token ring network.

Let's see the difference between the token ring and Ethernet:-

Token Ring Vs Ethernet

Token Ring	Ethernet
Token Ring network uses token passing mechanism.	Ethernet network use CSMA/CD mechanism.
Physical star topology is used.	Any topology can be used as physical topology.
Defined by IEEE 802.5 standard.	Defined by IEEE 802.3 standard.
Devices in token ring may transmit only at specific time.	Devices can transmit as soon as the medium is free.
Support heavy network traffic and maintains the network performance.	The performance of the Ethernet network degrades as network traffic increases.
Token Ring network is deterministic.	Ethernet network is not deterministic as token ring.
Token ring network provides bandwidth efficiency up to 90%.	Ethernet network provides bandwidth efficiency up to 40%.
The network setup and maintenance of token ring is expensive than Ethernet.	The cost of network equipment is lower for Ethernet.

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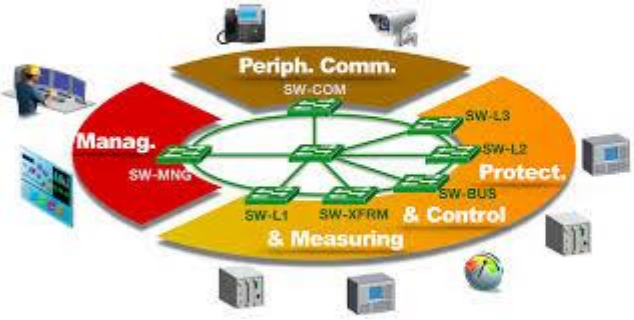
Q5. Explain the concept and review of Reliable Transmission with diagram (from a research paper of 2019 or 2020) and its functionality. The name and reference of paper should be given. (10)

ANSWER: Abstract:

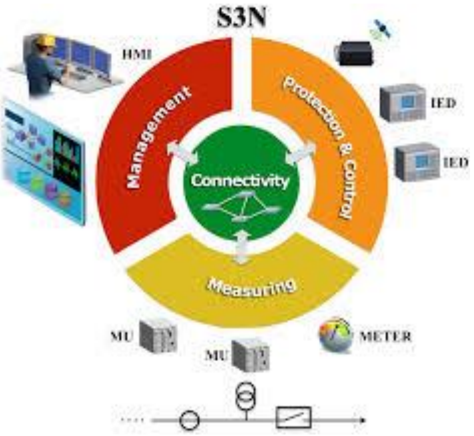
In recent years, communication networks on modern power substations have grown both in size and complexity, demanding the highest levels of reliability. However, there is no unique criterion to define the structure of the topology in such networks, since in every substation the end user implements their own topology or the topology suggested by a vendor, according to IEC 61850 standard guidelines. This paper proposes a methodology, using integer linear programming, to solve the problem of generating a reliable network topology in a software-defined power substations context. The trustworthiness of the reached solution is evaluated using terminal reliability techniques, graph metrics, and end-to-end time delay performance. The obtained results confirm that the proposed network topology is highly reliable to be implemented in power substations, according to the network redundancy considerations proposed by the IEC 62439 standard, and the operation time requirements suggested by the on IEC 61850 standard. In addition, we present software defined networking-based solutions for loop-based topologies in the proposed network topology, which would be technically unfeasible using traditional network protocols. These solutions include algorithms to solve problems related to the broadcast traffic containment and the diffusion and reliability of the multicast traffic.



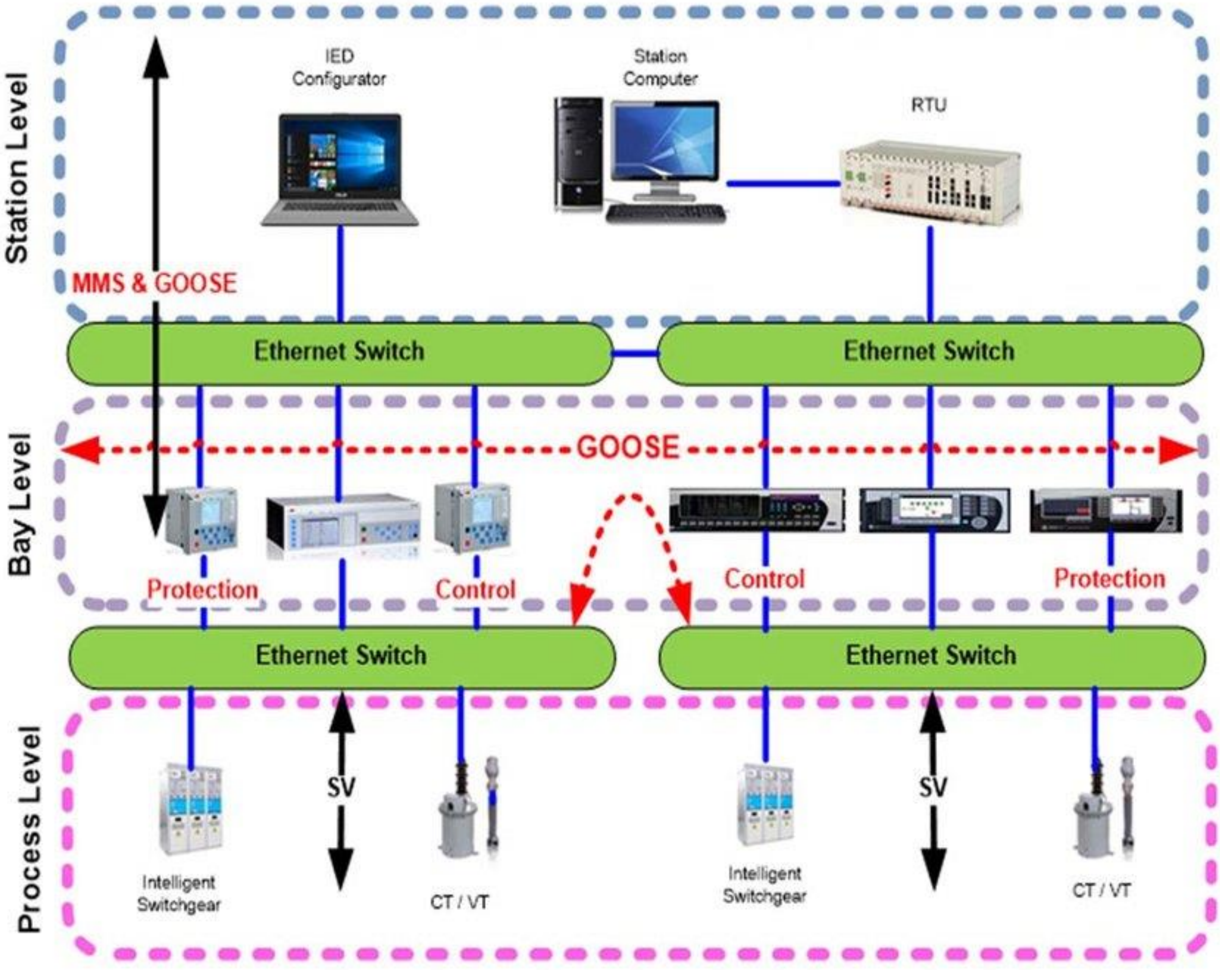
Defining a reliable network topology in software-defined power substations.

Introduction:

A power substation communications network is a mission-critical network and needs to be designed with redundancy principles to guarantee fault-tolerance. In this scenario, the network topology is one of the main components to provide reliability. Currently, different network topologies can be implemented for substation networks based on the IEC 61850 standard, for example: star, ring, multiple ring, or combinations of these [1]. However, there is no single network topology that provides better performance for all substation automation applications. Each topology has its strengths and weaknesses depending on the use, but it must always ensure fault-tolerance and low latency. This means, if one connection element fails, communication should still be possible through a backup connection ensuring an appropriate delay. Although there are other important factors associated with the choice of the topology (relative cost, administration issue.



S3N Architecture, a reconceptualization of the power substations communications network architecture.



IEC 61850 network architecture.

Conclusions:

The selection of the requirements to define the right network topology changes according to the purpose for which a network is built, and they are the key to a good design. However, a right balance between the requirements is not easy to get. Reliability, efficiency, costs, real-time performance and management are features that can not be satisfied simultaneously.

In this paper, we propose an ILP model to solve the problem of reliability for a network topology in a Software-defined power substations context, taking into account requirements such as SDN environment (S3N architecture), edge-disjoint paths (redundancy) and IEC 61850-90-4 recommendations (backward compatibility). Our studio corroborated that the proposed solution, the spider web topology, is a reliable network topology that allows to improve the performance of the operation network, by using three different analytical approximations: terminal reliability, graph metrics and ETE time-delay performance; and its comparison against several practical Ethernet architectures. In addition, our solution emulates the behavior of traditional recovery protocols such as PRP or HSR, without the need to use additional devices (Redbox or HSR interface) or duplicated networks.

This article also shows how SDN applications can solve complex issues in loop-based topologies such as SV and GOOSE multicast traffic management and broadcast traffic control; which would be technically unfeasible using common network protocols. In particular, we develop applications to define the traffic behavior in the proposed network topology. The achieved results, when the algorithms were applied over our testbed, were consequent with the expected operation scheme of the communication network. In addition, excepting the GOOSE algorithm which takes advantage of the particularities of the spider web topology, the others algorithms proved to work satisfactorily in a dual redundant tree topology.

References

Citation Map

1. IEC, IEC/TR TC57 61850-90-4, "Communication Networks and Systems for Power Utility Automation, Part 90-4: Network Engineering Guidelines", 2013.
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2. E. A. Leal and J. F. Botero, "S3N-smart solution for substation networks an architecture for the management of communication networks in power substations" in Management and Security in the Age of Hyperconnectivity, Cham, Switzerland:Springer, vol. 9701, pp. 52-56, 2016.
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3. E. A. Leal and J. F. Botero, "Software defined power substations: An architecture for network communications and its control plane", Proc. 8th IEEE Latin-Amer. Conf. Commun. (LATINCOM), pp. 1-6, Nov. 2016.
Show Context View Article Full Text: PDF (2093KB) Google Scholar

4. IEC, 61850, "Communication Networks and Systems for Power Utility Automation", 2010.
Show Context Google Scholar

5. Hirschmann White Paper Data Communication in Substation Automation System (SAS). WP 1004HE—Part 3, 2012, [online] Available: http://www.beldensolutions.com/de/Service/Downloadcenter/index.phtml.
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