AutomaTech™

The OSI Model

Networking Basics

Marty Rubenstein
Presales Application Engineer
mrubenstein@automatech.com

AutomaTech Solution Brief

What is a network?

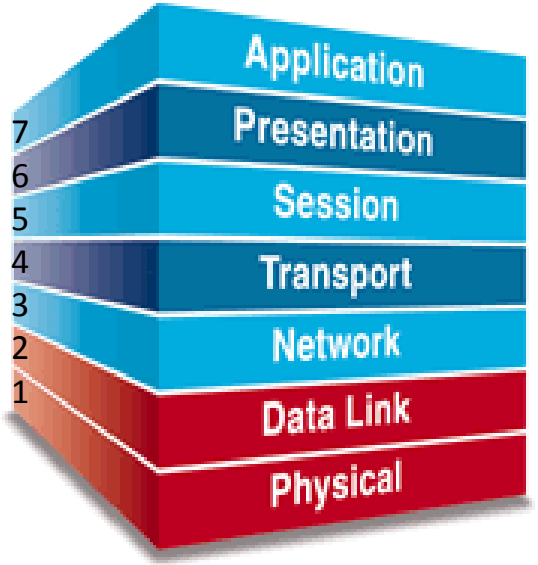
- We all use networks in our everyday lives
  - Facebook
  - Linkedin
  - Internet
- Getting data from one point to another efficiently and effectively
- Networks include two or more intelligent devices connected to a communication system
- Networks tend to grow with time as more and more capabilities are required and more endpoints are added.

AutomaTech Solution Brief

Basic Networking

- As networks begin to be more integrated security becomes an issue.
  - Some communications we want to allow
  - Others we do not.
- When networks get larger they become harder and more complex to manage.
- More protocols required, and greater networking knowledge required to maintain.
- Having a good foundation on the basics will help you understand the more complicated topics in the future.

The OSI Model



FTP, SNMP ,SMTP, HTTP

TCP/UDP

IP

Ethernet

Rj-45/ Fiber/ Wireless

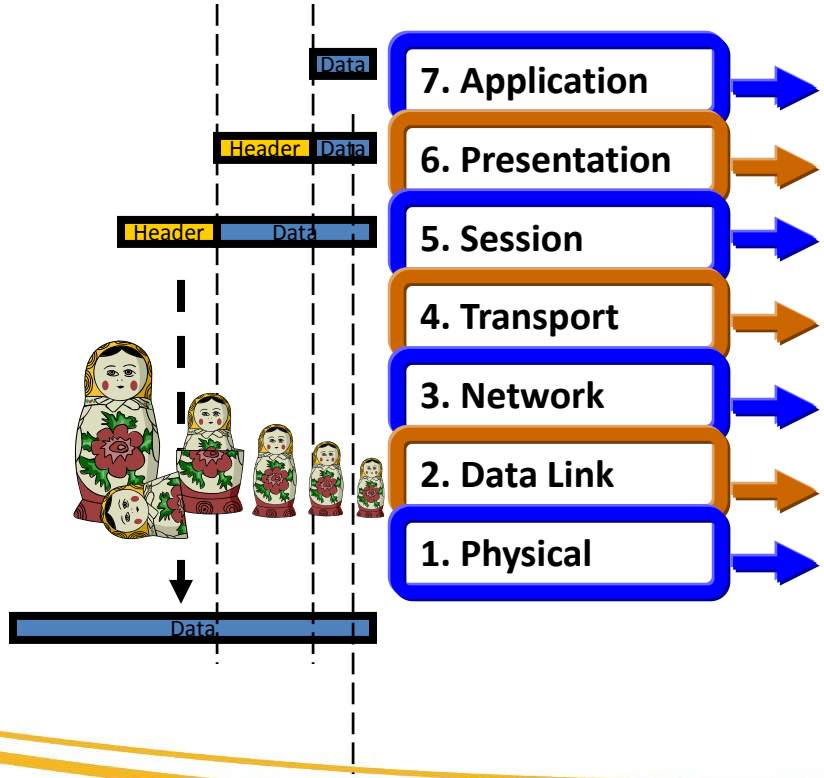
The primary purpose is to allow different vendors networks to interoperate.

Benefits of the OSI Model

- It divides the network communication processes into smaller and simpler components, aiding component design and troubleshooting.
- It allows for multivendor development through standardization of network components.
- It encourages industry standardization by defining what functions occur at each layer of the model.
- It allows various network hardware and software to communicate.
- It prevents changes in one layer from effecting the other layers simplifying development.

Data Encapsulation

AutomaTech®
We Make Plant Information Flow

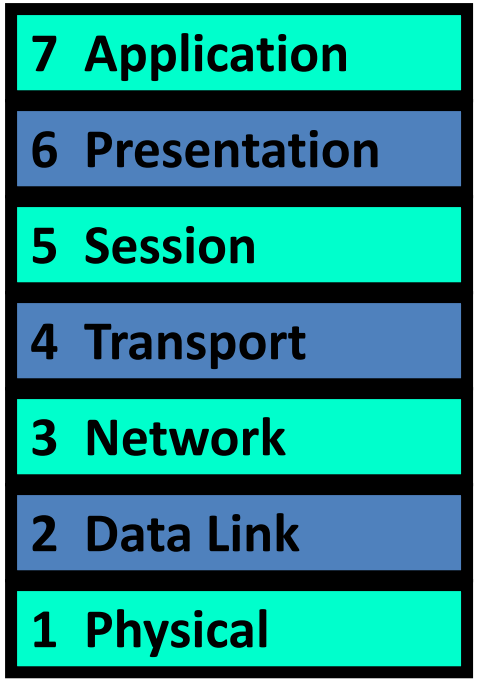


Layer Functions

7. Application	Provide Network Process to applications
6. Presentation	Format conversion, encryption/decryption
5. Session	Interhost communication, logon/off
4. Transport	Reliability, Error check, flow control
3. Network	Logical Addressing, Routing
2. Data Link	Physical Addressing, link error check
1. Physical	Electrical signaling, cabling

Host and Media Layers

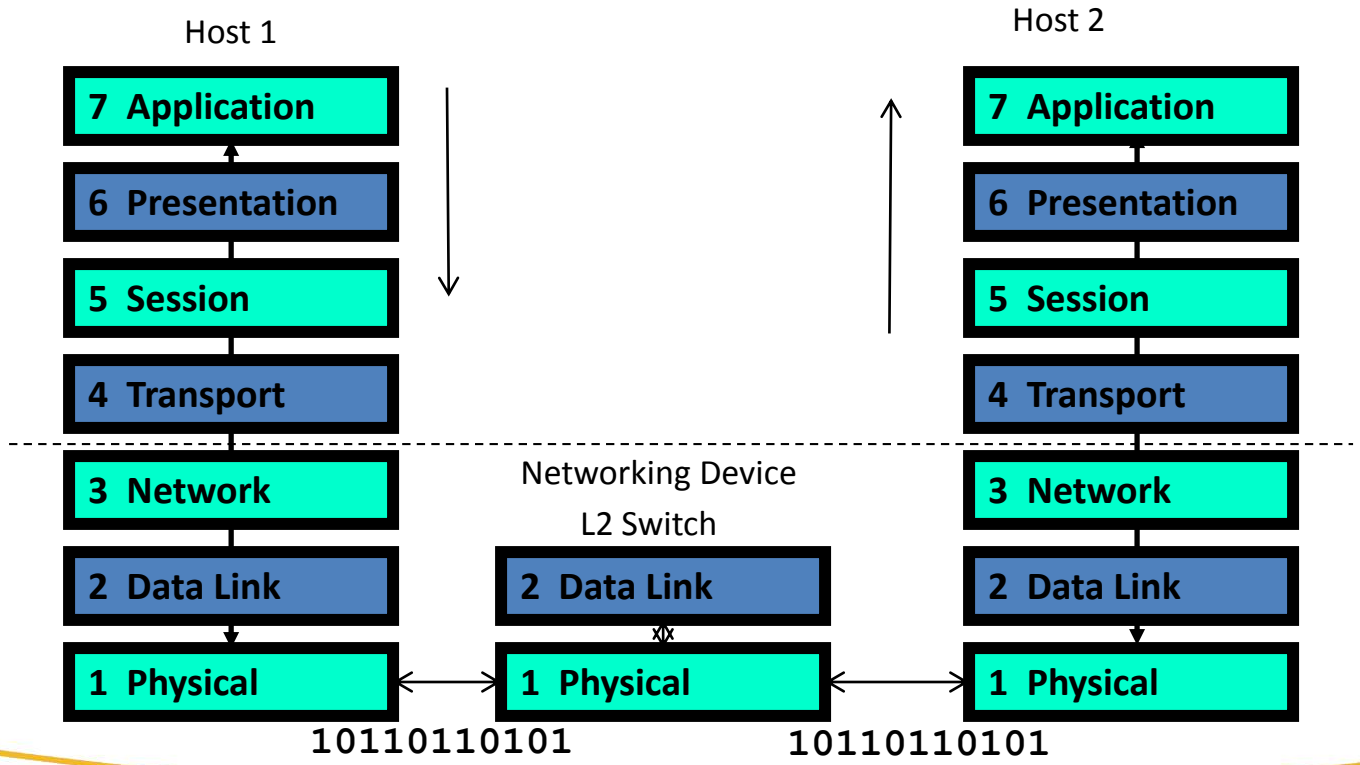
AutomaTech®
We Make Plant Information Flow



- Host Layers
  - These layers exist in the source and destination host devices
- Media Layers
  - These layers manage the information in the LAN or WAN between the source and destination devices

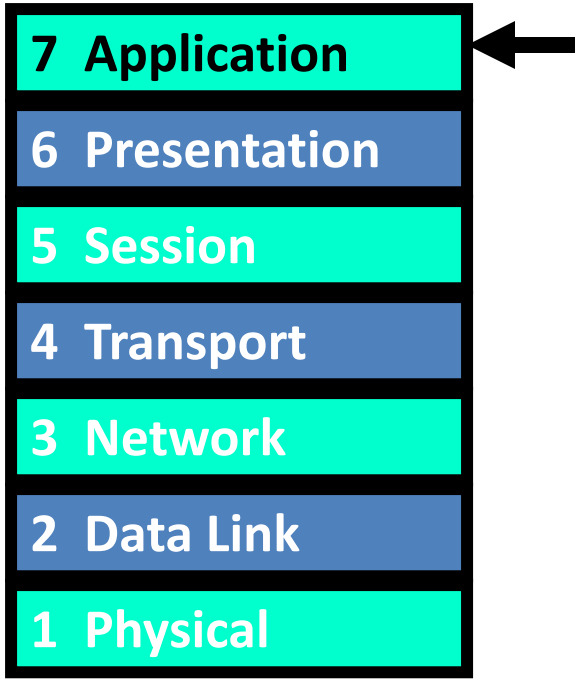
Host to Host Flow

AutomaTech®
We Make Plant Information Flow



Layer 7 - The Application Layer

AutomaTech®
We Make Plant Information Flow



Responsibilities:

- This layer deals with networking applications.
- Application Services like ftp, tftp, etc
- Establishes availability of communication partner
- Where users actually communicate with the device

Used for applications specially written to run over the network

Examples: Email, Web browsers
Telnet

Protocol Data Unit: User Data

OSI 7 Layers:
Application Layer in Automation

AutomaTech®
We Make Plant Information Flow

FF HSE

PROFInet

MODBUS/TCP

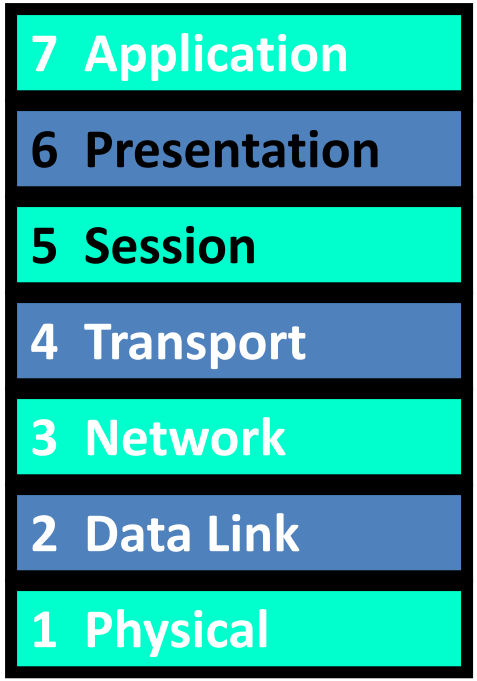
BACNet/IP

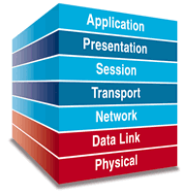
EtherNet/IP

EIBNet/IP

Presentation & Session Layers

AutomaTech®
We Make Plant Information Flow

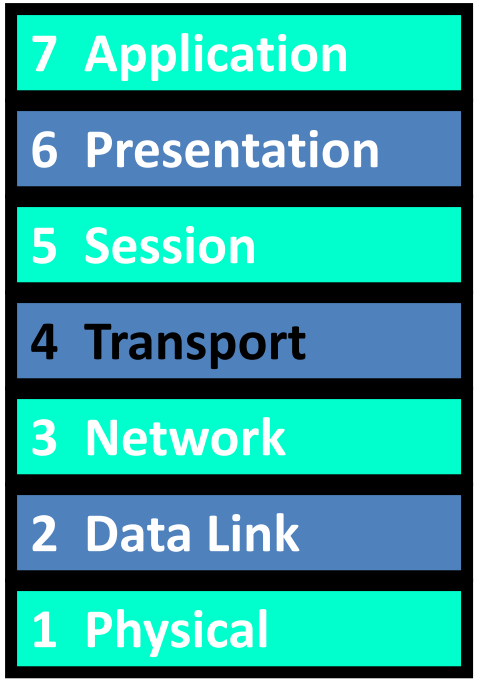




- Presentation
  - Responsible for protocol conversion, character conversions, data encryption / decryption, and data compression
- Session
  - Establishes, maintains and ends sessions across the network
  - Manages who can transmit data when and for how long

Layer 4 -The Transport Layer

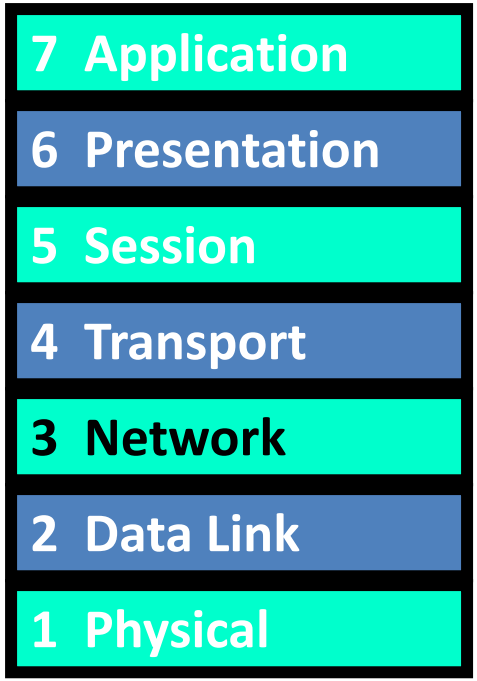
AutomaTech®
We Make Plant Information Flow



- **Responsibilities:**
  - Provides virtual end-to-end links between peer processes.
  - Fragmentation & Reassembly
  - End-to-end flow control
- **Provides:**
  - TCP/UDP headers
  - Error detection
  - Reliable communication
- **PDU**
  - Protocol data unit is called a ‘Segment’

Layer 3 - The Network Layer

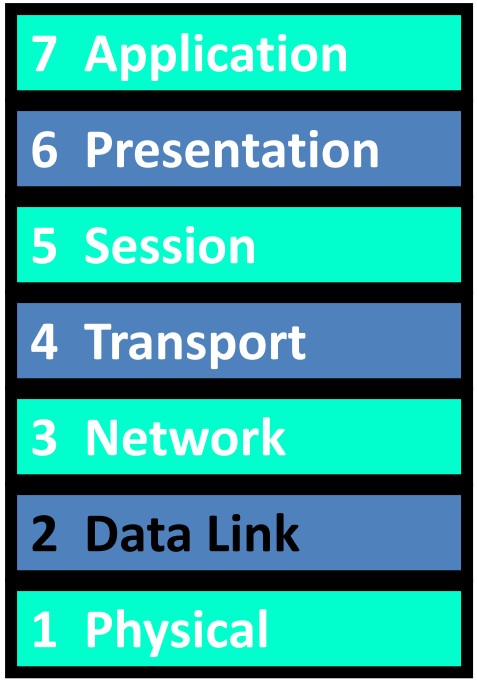
AutomaTech®
We Make Plant Information Flow



- **Responsibilities:**
  - "Best Path Determination" based on logical addresses (Routing)
  - Subnet flow control. (IP)
  - Translation between different network types.
- **Provides:**
  - IP packet headers
  - Virtual circuits
- **Example: Router**
- **PDU**
  - Protocol data unit is the 'Packet'

Layer 2 - The Data Link Layer

AutomaTech®
We Make Plant Information Flow

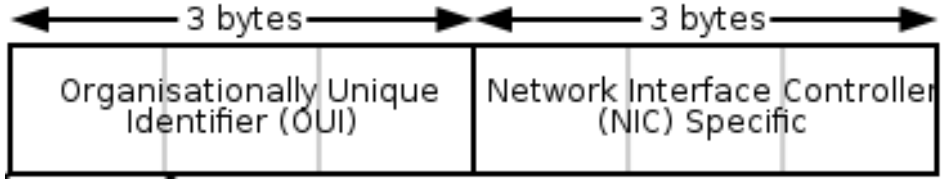


- **Responsibilities:**
  - This layer provides reliable transit of data across a physical link.
  - Makes decisions based on physical addresses (usually MAC addresses).
- **Provides:**
  - Physical Addressing
  - Data link control
- **Example: Switch**
- **PDU**
  - Protocol data unit is a ‘Frame’

The Data Link Layer - The MAC sub-layer

AutomaTech®
We Make Plant Information Flow

- Provides addressing and channel control mechanisms that make it possible for network nodes to communicate over a shared medium
- Unique hardware Identifier MAC Address



00:90:E8

Layer 1 - The Physical Layer

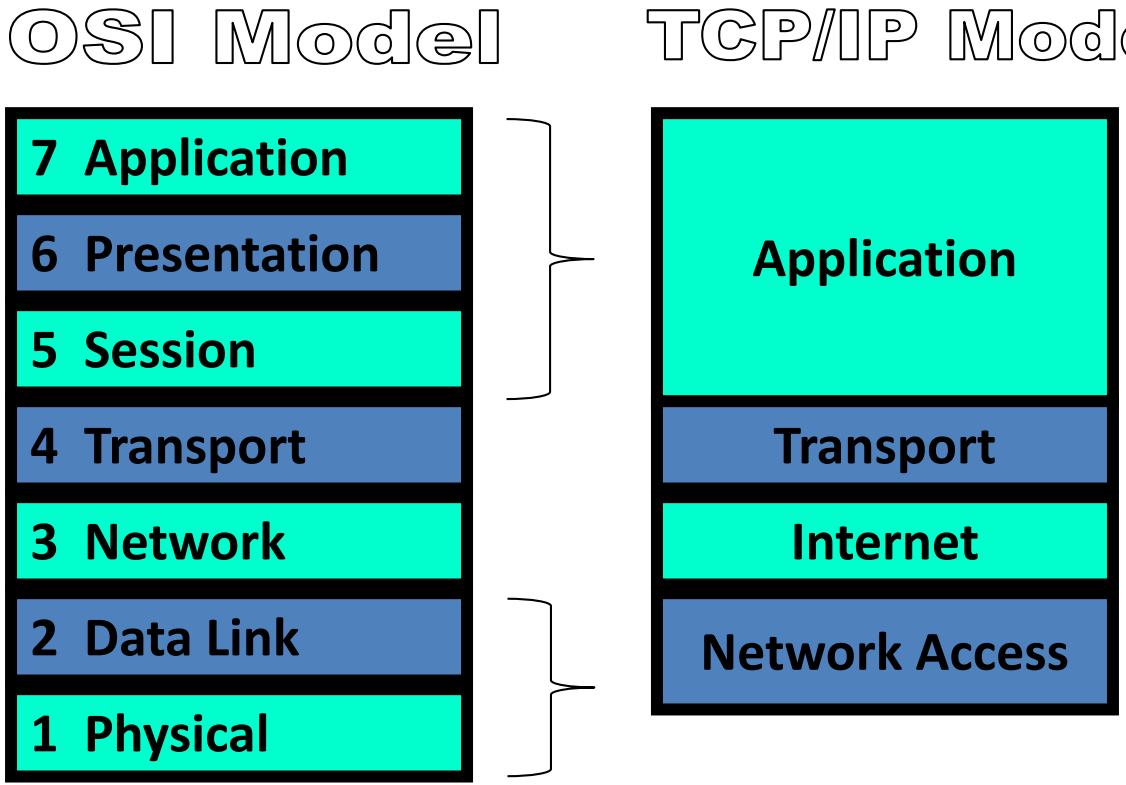
AutomaTech®
We Make Plant Information Flow

7 Application
6 Presentation
5 Session
4 Transport
3 Network
2 Data Link
1 Physical

- **Responsibility:**
  - Transmission of raw bits over a communication channel.
- **Provides:**
  - Mechanical and Electrical interfaces
  - Maintains link between systems
  - Timing
- **Examples: Cat-5, Fiber**
- **PDU – 'Bits'**

OSI Model vs TCP/IP Model

AutomaTech®
We Make Plant Information Flow



AutomaTech™

Thank you! Please contact AutomaTech or visit www2.automatech.com/solution-briefs for additional information on future Solution Briefs and technology