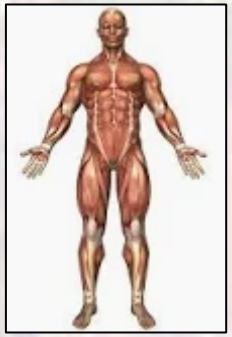
Systems

Last updated 10/3/24

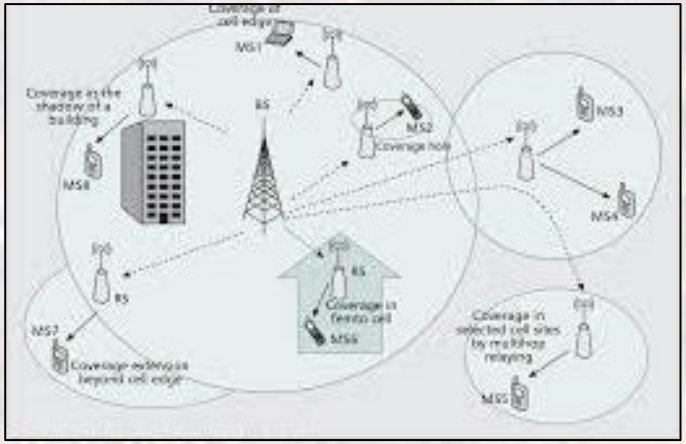
These slides introduce basic system concepts

Systems

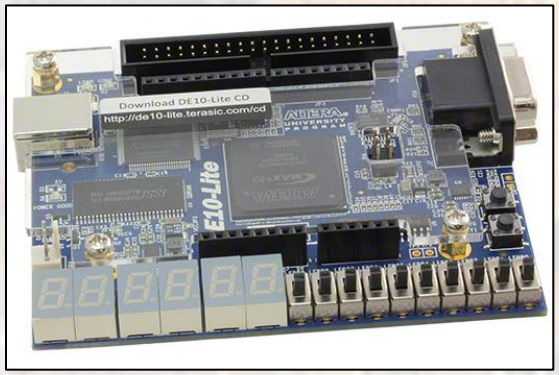
- System
  - A set of interrelated components working together to provide a desired outcome



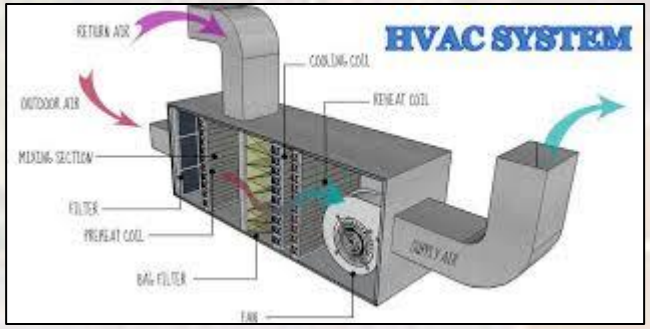
musculoskeletal



cellular



digital FPGA



Systems

- Digital System Concepts
  - Hierarchy
  - Abstraction
  - Modularity
  - Regularity
  - Testability

Systems

- Hierarchy
  - Systems of blocks within blocks within blocks
    - System → board → chip → USB interface → gates
    - Provides the required information at each level
  - Top Down
    - Enables very complex systems to be broken into smaller, easier to understand and analyze parts
  - Bottom Up
    - Builds very complex systems by combining smaller, easier to understand and design parts
  - Parallel development
    - Blocks at different levels can be developed at the same time
    - Different teams can develop blocks separately

Systems

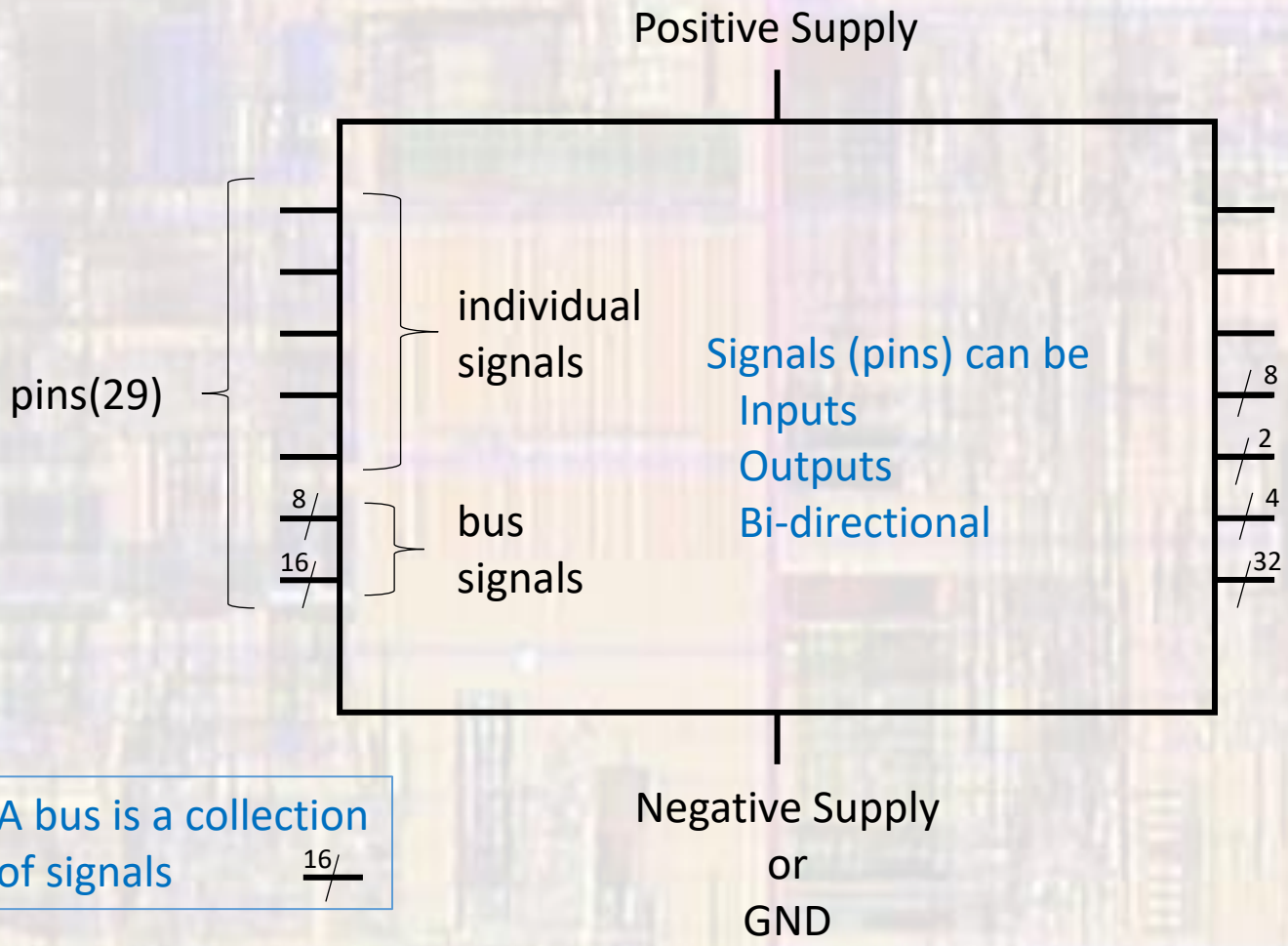
- Abstraction
  - Only include the required information to execute the desired tasks at a given level of the hierarchy
    - Instructions to setup some device – with no understanding of what's inside
  - Behavioral
    - Describes the overall system with no concern for the internal structure
  - Structural
    - Describe how components are connected at the current level with no concern about how those components are constructed
- Modularity
  - Break the system into separate components
    - Blocks must have clear functional and interface requirements
    - Allows independent development, test, and maintenance of each block
    - Blocks can be interchanged or upgraded - if they meet the interface requirements

Systems

- Regularity
  - Use uniform components in the system
    - Common chips, blocks and library components
  - Standardization
    - Adopting common standards and practices across blocks
  - Repetition
    - Using repetitive patterns to reduce complexity
    - The basis for FPGA designs
- Testability
  - Re-use
    - Use already verified blocks when possible to reduce errors
  - Observability
    - The ability to observe the internal state of a system
  - Controllability
    - The ability to control the internal state of a system to test its behavior

Systems

- Digital System Block



A bus is a collection of signals 16

Systems

- Digital System
  - Collection of interconnected blocks