BAS NETWORK ARCHITECTURE

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TYPICAL BAS NETWORKS

- IP

- Proprietary

- RS485
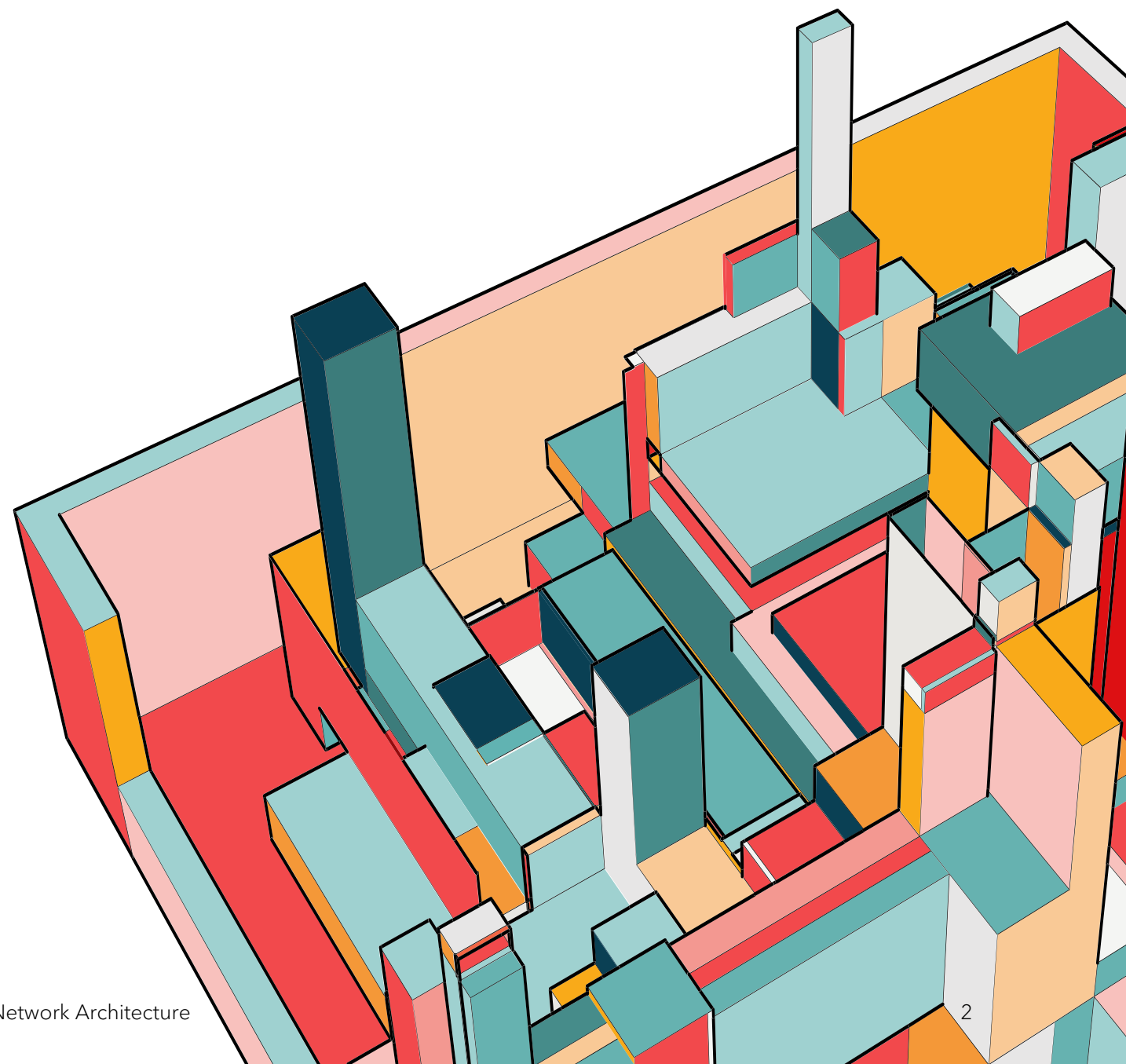
IP NETWORKS

The future of BAS Networks (?)

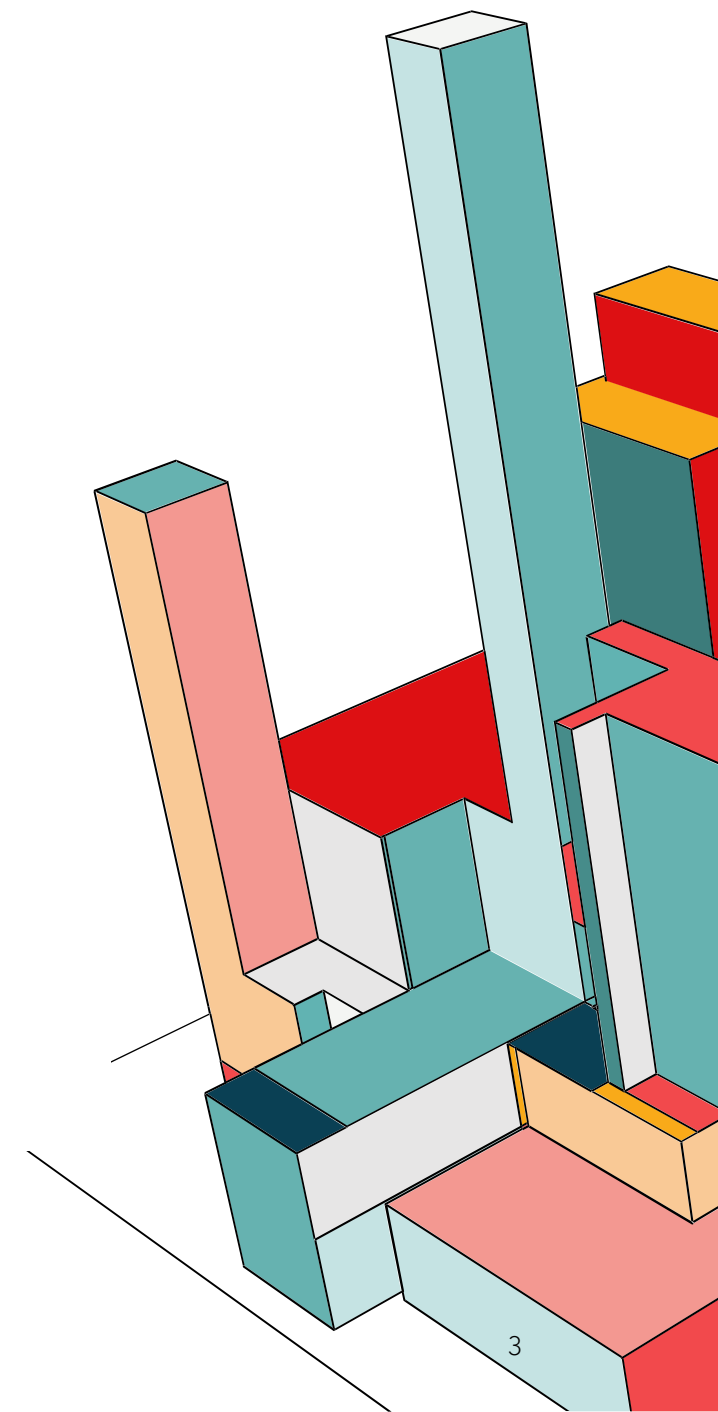Companies are pushing their IP offerings as the best solutions

Benefits

- Fast
- Latest technology

Risks at the Physical Layer

- Integrated switches can cause network outages with power failure

Upfront Costs

- Expensive installation
- Expensive controllers
- Expensive additional hardware

IP NETWORK ISSUES

Johnson Controls
IP Controllers

Johnson Controls
Engine/Supervisory Controller

Cisco
IE 2000 Switch

Hardware Considerations

- How is the network physically installed?

  - Ring topology

  - Home-run topology

- Who manages the switches?

  - Static IP or automatic DHCP

  - DNS servers

- Are unmanaged switches permitted?
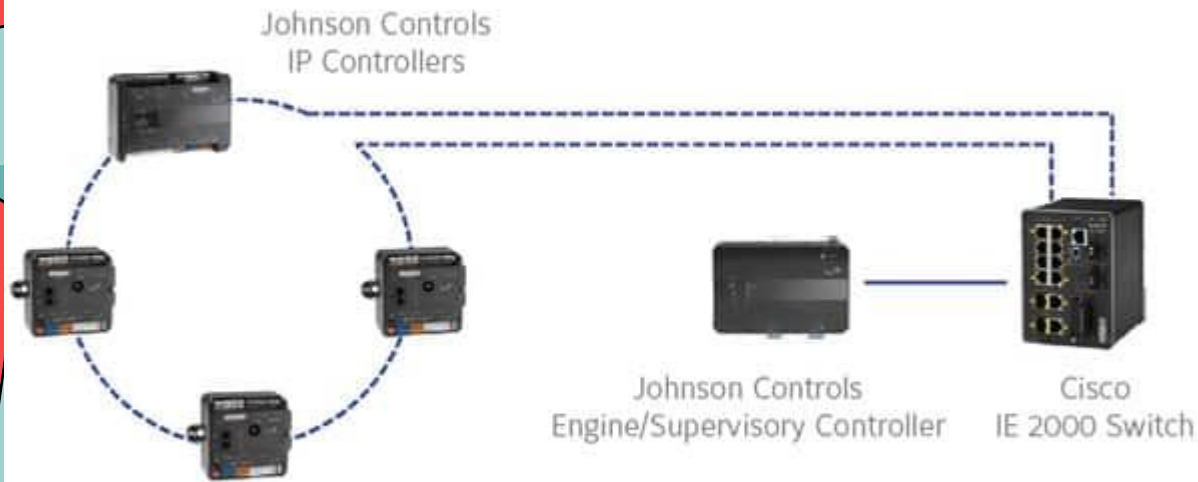
IP NETWORK ISSUES

Security Considerations Part 1

- Traditional BACnet/IP and Modbus/TCP lack security
- BACnet/SC as an option
    - Secure connection between devices
    - Generally will require a BACnet/SC Hub to facilitate the communication
    - BACnet/SC is not widely used yet
- Tridium's Niagara FOXS
    - Secure connections between supervisor controllers
    - Only available to Niagara systems (Distech, Honeywell, Facility Explorer, etc)

IP NETWORK ISSUES

Security Considerations Part 2

- Connections to the front-end GUI

    - Secure connections require valid SSL certificates

    - SSL certificate components

        - SSL certificate

        - Certificate Authority

    - Unsecure BAS connections are at risk for hacking
- Making SSL connections comes with a significant monetary cost

    - More upfront costs

    - More long-term costs to maintain SSL certificates

IP NETWORK ISSUES

Security Considerations Part 3

- Port security
- Password security
- IP networks can put a hacker on the rest of the network without the necessary precautions

BAS Network Architecture
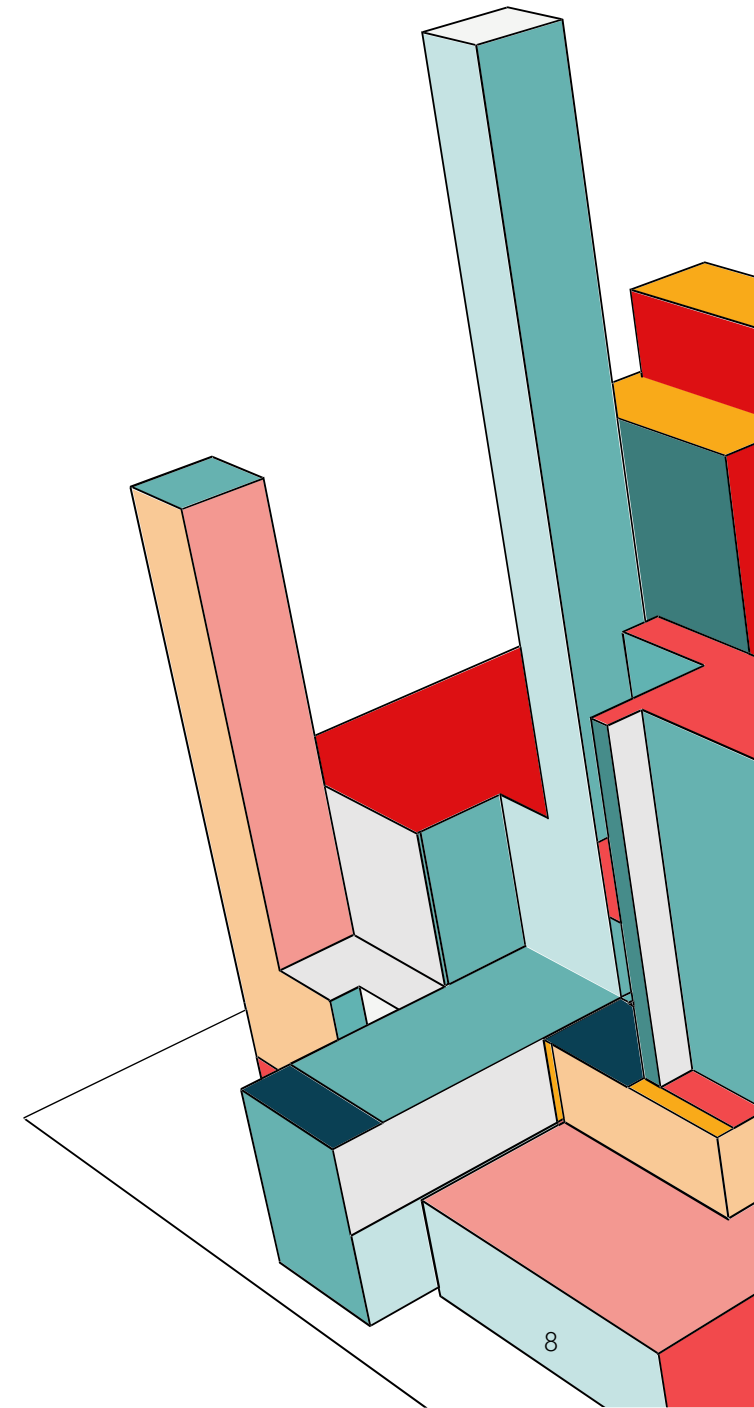
PROPRIETARY NETWORKS

Lonworks

A formerly popular network designed by the Echelon Corporation

Considerations

- Free Topology
- Non-polarity sensitive
- Typically only found in older installations
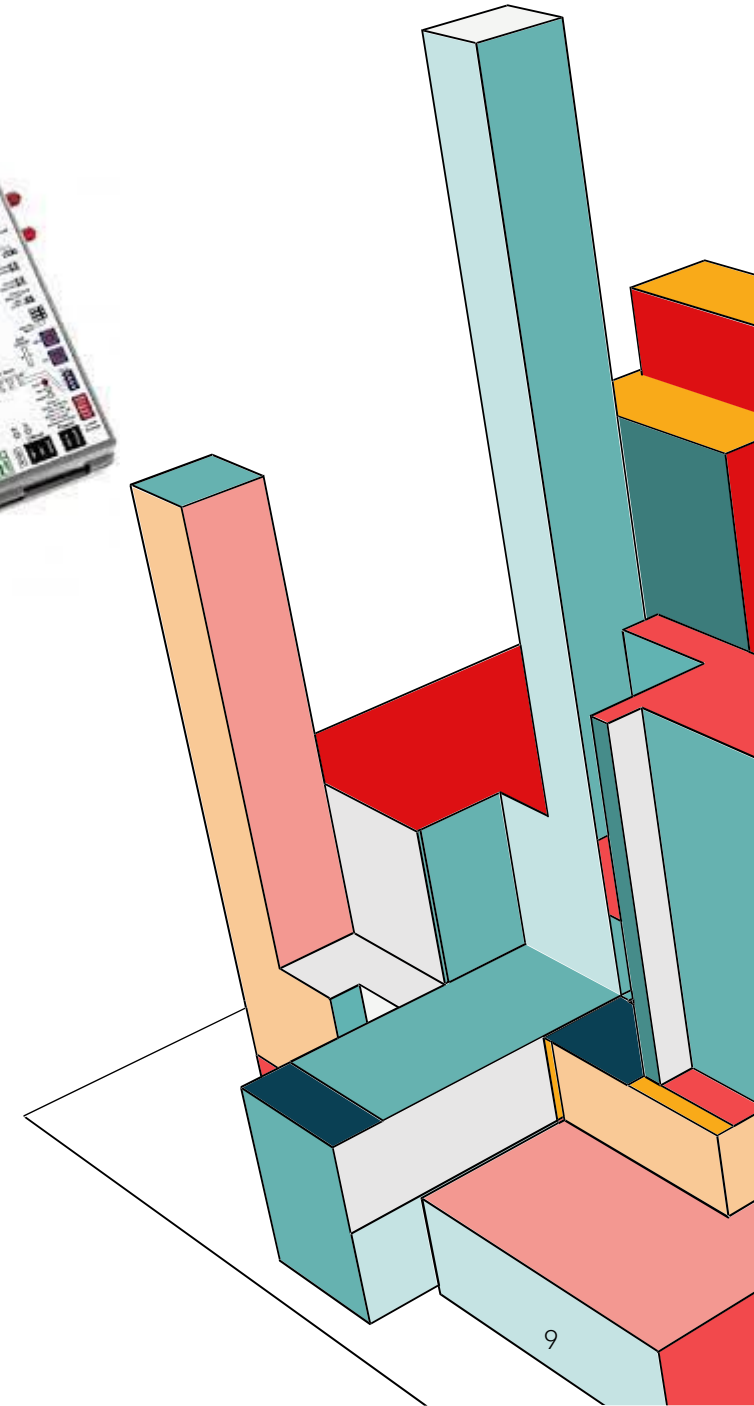
RS485 NETWORKS

Common and Reliable
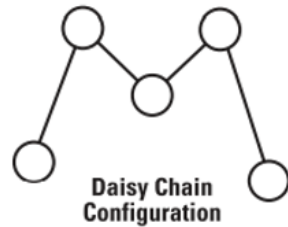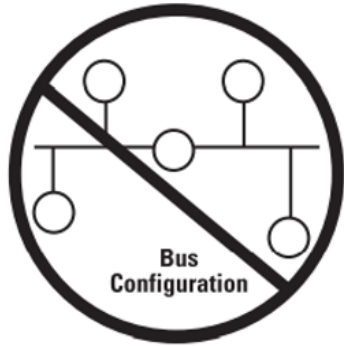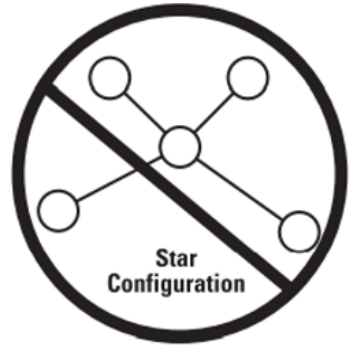
- Modbus
- BACnet
- N2
- Arcnet

Benefits

- Modbus and BACnet are common protocols
- Low-cost install
- Lower-cost controllers

Risks

- Network troubleshooting can be difficult

BACNET/MSTP BASICS

Technical Items to Keep in Mind

- Master Slave Token Passing
    - MAC addresses from 0-127 on one network
    - Unique Device Instance numbers
- 3-wire network
    - The wire used matters
    - Daisy-chained topology
    - Max length is 4,000 feet
    - Baud rates typically 38.4kbps or 76.8kbps
- Network capacity of 32 devices
    - Not all devices count as full load devices
    - BACnet repeaters can increase the number of devices

Star Configuration

Bus Configuration

Daisy Chain Configuration

TROUBLESHOOTING 101

These issues commonly occur after network modifications

- Verify you have the correct polarity of wires

    - Some installers use black as (+) and some use black as (-)
- Check the "third" wire on 2-wire BACnet networks

    - Is the 24VAC power grounded at the transformer?

    - Is the 24VAC landed correctly on the suspect controller?
- Verify you have sufficient power and voltage
- Check that you have daisy-chain wiring
- Make sure you don't have a conflicting MAC address
- Verify that you have the correct baud rate

TROUBLESHOOTING 201

Be prepared to have plenty of time set aside

- Split the network in half

  - Find a spot on the network where you can physically break the network apart
- With BACnet, send out a Who-Is to refresh the network

  - With Tridium-based systems, this is called "Discover"

  - For Lon or Modbus, ping the devices

  - Otherwise, wait at least five minutes
- If devices come back online, the trouble is away from the supervisor controller
- If the network continues to be down, the trouble is closer to the supervisor
- Repeat until you narrow down the issue

TROUBLESHOOTING 701

Graduate-level troubleshooting

- Wireshark
- Oscilloscope
- Software updates
- Firmware updates

BAS Network Architecture

WHAT TO EXPECT FROM INSTALLERS

As-Built Network Layout

A mechanical plan with a line drawn from device to device is best

As-Built Power Layout

Have transformers labelled so you know what TX powers what devices

BAS Network Architecture

THANK YOU

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