Setting the Standard for Automation™

Beyond Modbus: Designing SCADA With Other Open Protocols

Jacob Brodsky, PE
Jacobs

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Agenda

- The Limitations of Real Time Reporting
- Real Time Vs. Event Reporting
- Performance Differences
- Object Orientation
- Authentication
- The Advantages of Standards-Based SCADA

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Backdrop Issues

- Water Utility Experience over past 30 years:
  - Number of points doubles every five years
  - RTUs get “fatter”
    - More Features
    - More points
- Changing Telecom Infrastructure
- Need More Security

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Modbus is a Thin Standard

Protocol	ModbusRTU	DNP3 (Serial)
Transport Layer	CRC every 253 bytes or less	CRC every 16 bytes or less
Commands	User-defined and Well-Known	No User Defined Commands
Data	16 Bit words and single bit states	Huge library of standard objects
Multi-Master	Yes	Complicated, but Possible
Time-Stamping	Make up your own	Part of Object Definitions
Endianness	Whatever Floats Your Boat	Little Endian Only

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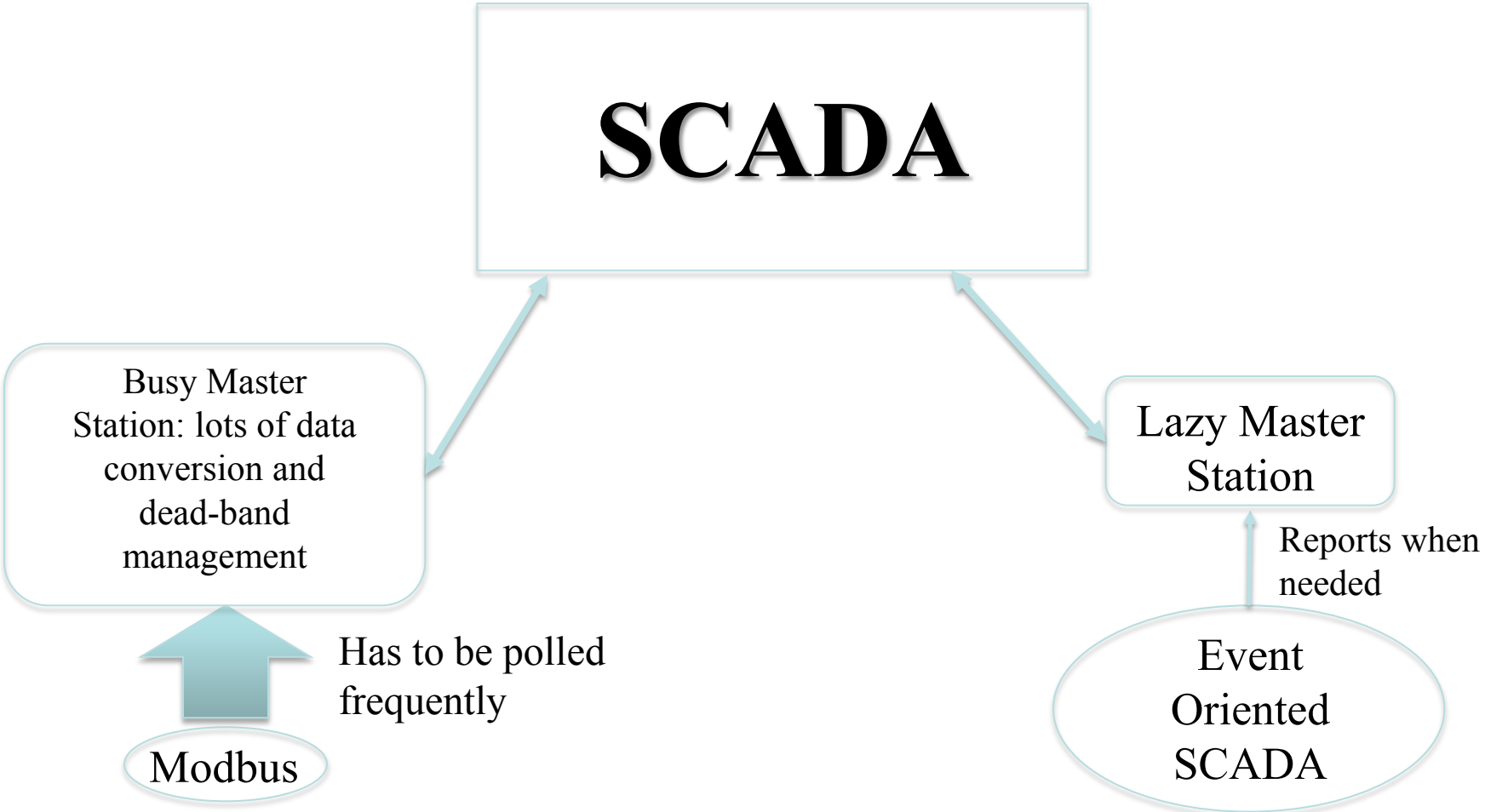
Compatibility



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Real Time Reporting

- Simple: Ask what it is
  - It tells you what the readings are right now
  - No concept of time
- Must poll at least twice the rate of the shortest event time capture (Nyquist Theorem)
- Does not scale up well

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Event Based

- Ask it what's new
  - Reports whatever is "notable"
  - Time is a component of the event
- More complicated at RTU end
- Can poll at whatever rate is adequate
- Scales up better
- Can still capture very fast events and report

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Which is Better?

- Real Time:
  - Small Point Count
  - Simple Data Types
  - Simple functions
- Event Oriented:
  - Larger Point Count
  - Does NOT need to be polled at Nyquist Limit
  - Can show detail between reports
  - Complex Data Types
  - Expects local controls and automation
  - Irregular communications not a problem

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What Triggers an Event?

- Change in Value
  - Deadband Types:
    - Absolute
    - Relative
    - Integrated
    - Swinging Door
    - Your idea goes here
- Timed Snapshot
  - Counters use these
    - Example: Tipping Bucket Rain Gauge
  - Volumetric calculations might use it
- Manual Request

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OPC-DA Mapping

- OPC DA is a common driver API for most SCADA systems
- It was designed around real time protocols
- Event Oriented protocols may have an older time stamp than the arrival time
- OPC DA has no place to put that original time stamp
  - Everyone makes up their own method for handling the field time stamp

- Avoid using OPC-DA drivers with Event Oriented Protocols

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Object Orientation

- Events include
  - Reported value
  - Data Quality/Flags
  - Time/Date
- Fundamental Data Types
  - State
  - Raw Analog Value (usually 16 bit register)
  - 32 bit counters
  - Floating Point Calculations
    - Local Volumetric Derived Flow
    - Scaled values
  - Strings

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Authentication

- Data Provenance is becoming a larger concern
- Authentication proves the data and/or Command came from an authentic source
- Event Oriented Protocols can authenticate without the additional latency affecting the time stamp

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Open Standard Protocol Advantages

- Portability
  - Data formats are well defined
  - Smoother System upgrades
  - Not tied to any one vendor
- Staff Training
  - Third party technical help can resolve problems
  - Training is readily available
  - Protocol can be discussed openly
- Open Source Software exists

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For More Information:

JACOBS NSS – Sr. ICS Cybersecurity Engineer
Name: Jacob Brodsky, P.E.
Phone: (443) 285 -3514
Email: Jacob.Brodsky@jacobs.com

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