BACnet MS/TP

- Physical and Electrical considerations
- Packet structure
- Receive Frame State Machine
- Slave and Master Node State Machine
- Design issues (timing, buffering, MAC address)
BACnet MS/TP EIA-485

This may not be the ideal circuit for EIA-485. There has been much debate in the BACnet MS/TP working group about it.
# MS/TP Packet Structure

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x55</td>
<td>Preamble</td>
</tr>
<tr>
<td>0xFF</td>
<td>2 octets</td>
</tr>
<tr>
<td>Frame Type</td>
<td>1 octet</td>
</tr>
<tr>
<td>Destination Address</td>
<td>1 octet</td>
</tr>
<tr>
<td>Source Address</td>
<td>1 octet</td>
</tr>
<tr>
<td>Length</td>
<td>2 octets, most significant octet first</td>
</tr>
<tr>
<td>Header CRC</td>
<td>1 octet</td>
</tr>
<tr>
<td>Data</td>
<td>(present if Length is non-zero) Length octets</td>
</tr>
<tr>
<td>Data CRC</td>
<td>(present if Length is non-zero) 2 octets</td>
</tr>
<tr>
<td>0xFF</td>
<td>pad (optional) at most, 1 octet</td>
</tr>
</tbody>
</table>
Receive Frame State Machine
Master Node State Machine
Slave Node State Machine

INITIALIZE

ReceivedUnwantedFrame

ReceivedInvalidFrame

ReceivedDataNoReply

ReceivedDataNeedingReply

ANSWER DATA REQUEST

Cannot Reply

Reply
MS/TP Timing

- **T-frame_abort**: < 60 bit times
- **T-turnaround**: > 40 bit times
- **T-postdrive**: < 15 bit times
- **T-usage_timeo**: < 20ms

```
55 FF 00 72 0A 00 00 A9
```

```
55 FF 00 03 72 00 00 05
```

```
55 FF 00 A0 00 00 00 04
```
MS/TP Timing

Poll For Master

Token

T_{usage_timeo} < 20\text{ms}

BACnet Data Expecting Reply

T_{reply_timeout} < 255\text{ms}
BACnet Data Expecting Reply

- May use Reply Postponed
- Practical use only in RTOS or queued data
- Single buffer, single thread, just reply
- Buffer, queue - match packet signature
MS/TP MAC Address

- Master Node MAC 0-127 (0x00 - 0x7F)
- Slave Node MAC 0-254 (0x00-0xFE)
- Broadcast 255 (0xFF)
- DIP switch, dials, LCD
- Non-volatile, same after power cycle or reset
- Proposed Auto Addressing (DHCP, ZeroConfig)