DTE Power Problem Set and Solution Methodology

Presented to the IEEE 802.3
Power Via MDI Study Group

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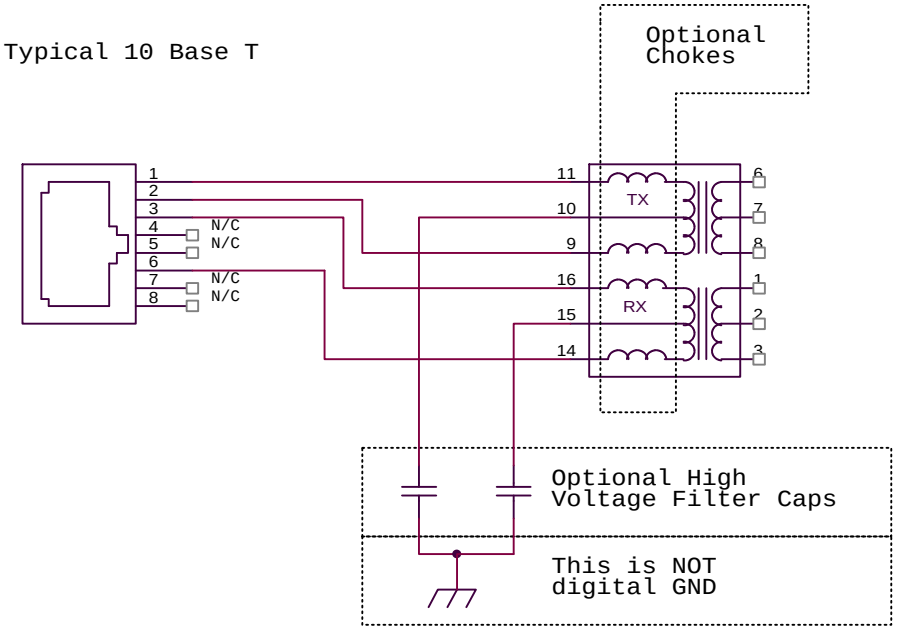
Problem Set
Termination

- Existing Termination Schemes
  - Known Terminations
    - Low Ù between pairs
    - Low Ù between center taps
    - 1/10 Watt resistors
    - Pairs directly shorted
  - No Limitation in the Standard for Termination
    - Only requirement is 1500V isolation requirement

Problem Set

Termination Type A



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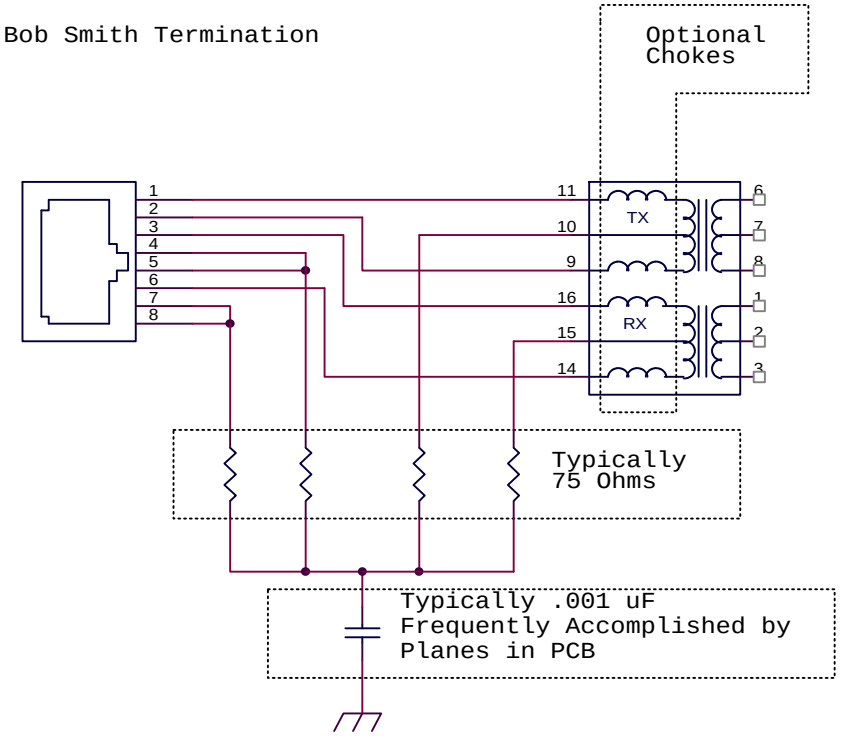
Problem Set

Termination Type B



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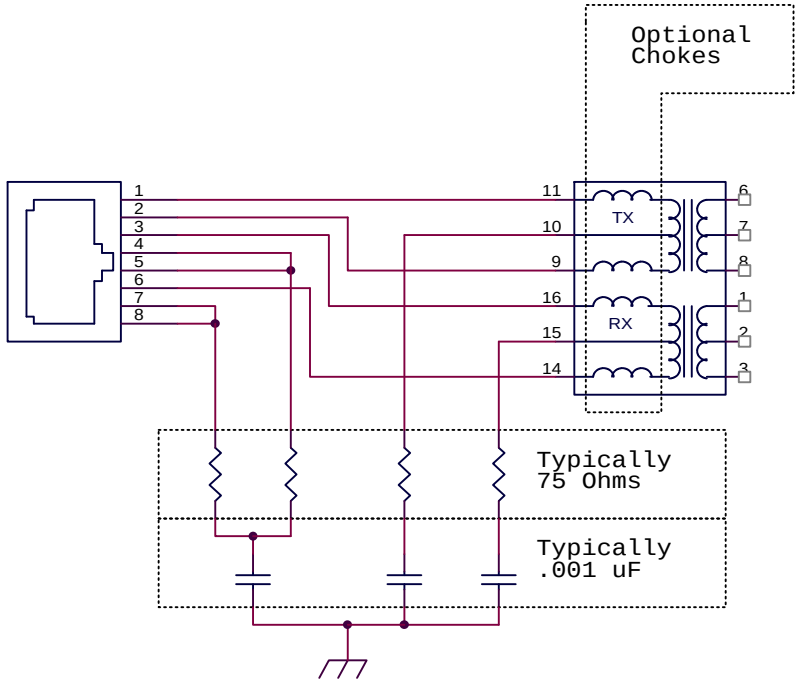
Problem Set

Termination Type C



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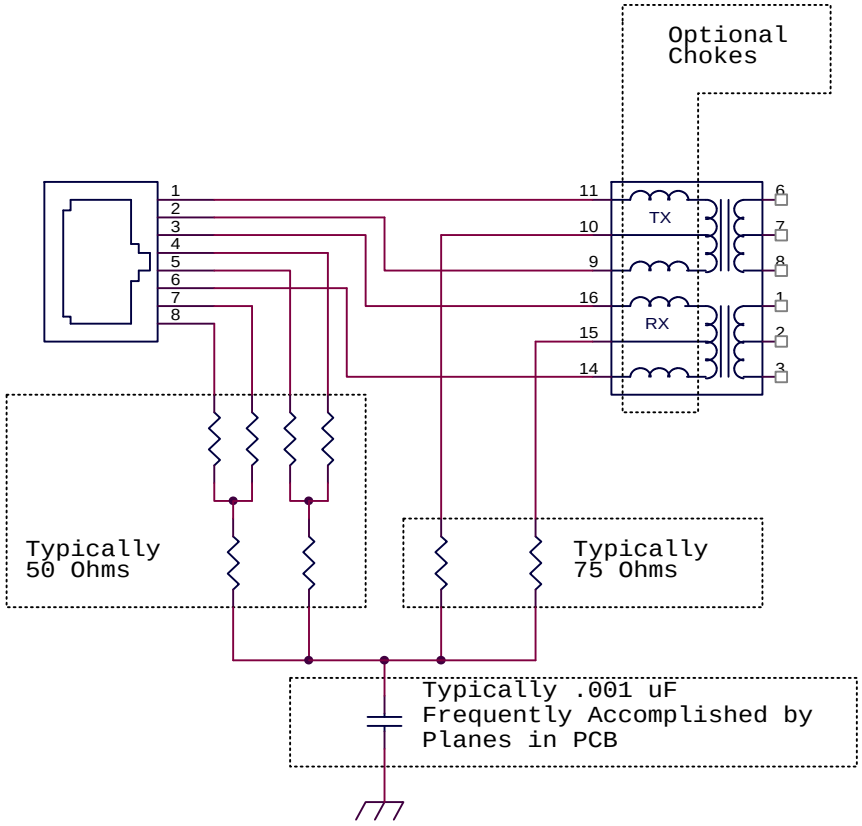
Problem Set

Termination Type D



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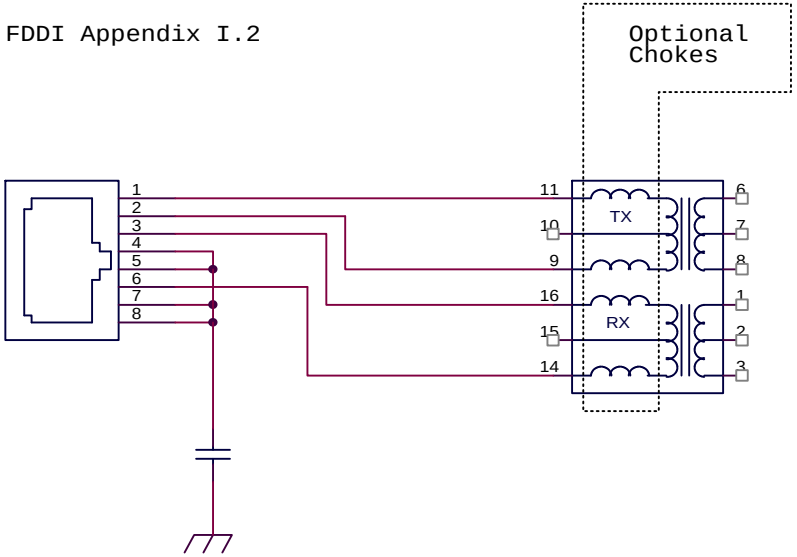
Problem Set

Termination Type E



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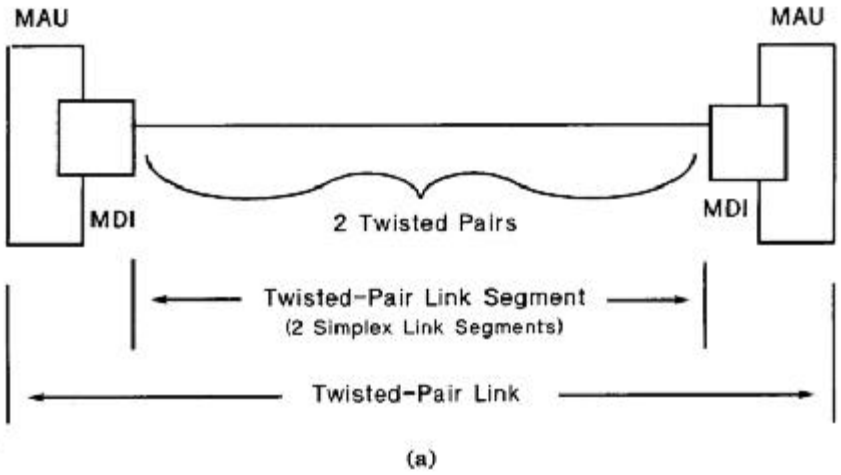
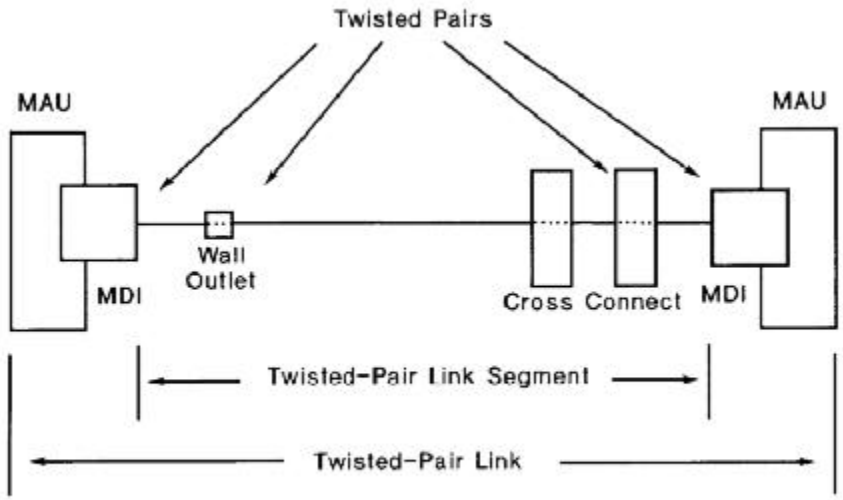
Problem Set
Cable

- Cable - 10BASE-T
  - Two pair installations
  - 22 to 26 AWG “telephone wire”



Problem Set
Cable

- Cable Plant - 10BASE-T
  - 25 pair bundles
  - Cross connects
  - Patch Cords
  - Cabling
  - Jacks



(b)

Figure 14-2—Twisted-pair link

Problem Set
Cable

- Cable Connections
  - Crossover from Powering Hub to Powering Hub
  - No standard crossover
  - Other RJ-45 patch cords
  - Other RJ-45 based interfaces
  - Intentional misuses
  - Cuts and partial cuts
  - Shorts

Problem Set
Regulatory

- Regulatory
  - Safety
    - Voltage
    - Power
    - Isolation
    - Fault / Overdraw
  - Emissions
    - Termination
    - Chokes / Filters
    - Effects on existing equipment

Problem Set

802.3 Issues

- 100BASE-T Baseline Wander
  - Mandated transformer size
- 1500V Isolation
  - Power supply front end
  - Mutually exclusive with Grounding
- Grounding
  - Precludes numerous applications
  - Mutually exclusive with Isolation

Problem Set

Miscellaneous

- Power to Powered Devices
- Management Reporting
- Semiconductor Geometries
- Aggregate Power Insertion Requirements

Problem Set

Application Requirements

- EtherPhones
  3 - 6 Watts
- Wireless Access Points
  4 - 11 Watts
- EtherCams
  8 - 12 Watts
- Remote PowerHub
  100 - 250 Watts

A Proposal
The Premise

- Stimulus and Unique Response
  - Stimulus is different from response
  - Network side contains only a stimulator, can not generate response
  - Terminal side responds only when stimulated correctly
  - Responses must be different from responses possible from passive termination

- Results in a very reliable detection method

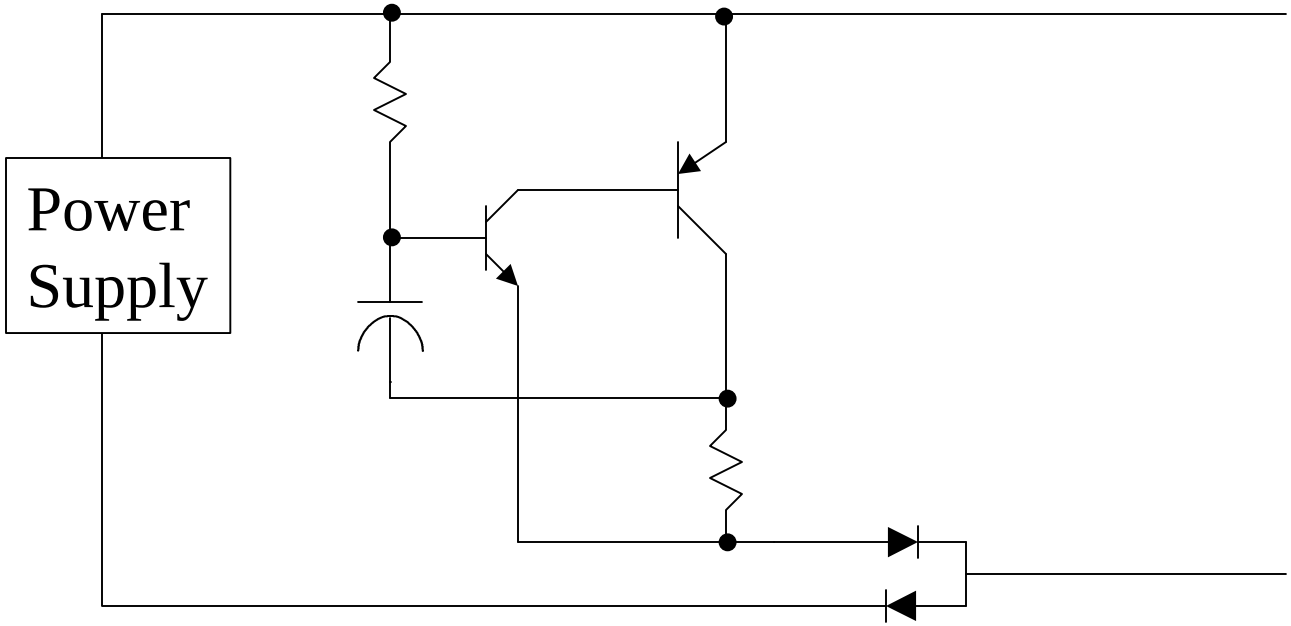
A Proposal
A Few Examples

- Zener Diode Bridge
  - Stimulate with two voltage
  - Zener allows current flow at only one voltage
- Dual Tone and Filter Bridge
  - Stimulate two tones
  - Filter bridge only allows a single tone to loop
- Oscillator Bridge
  - Stimulate with current limited low voltage
  - Oscillator creates a distinctive voltage / current profile

A Proposal
An Implementation

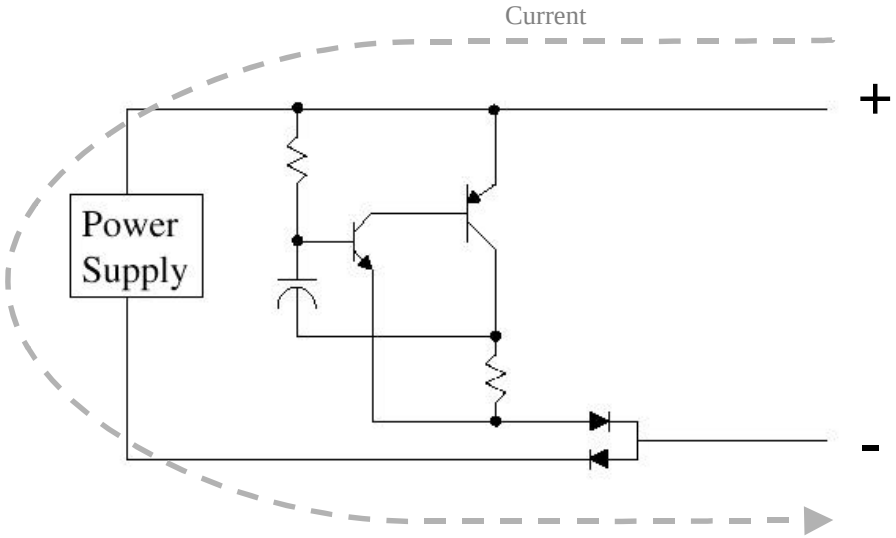
- 2.2VDC is applied across two pairs
- Current is measured
  - Current > 45 milliamps ⇒ Short, remove power
  - Constant current < 45 milliamps ⇒ Passive termination, remove power
  - Oscillating current ⇒ Power Device
- During Powered State current draw must be constantly monitored
  - Too high ⇒ Short or failure, remove power
  - Too low ⇒ disconnected or failure, remove power

A Proposal
The DTE End



A Proposal

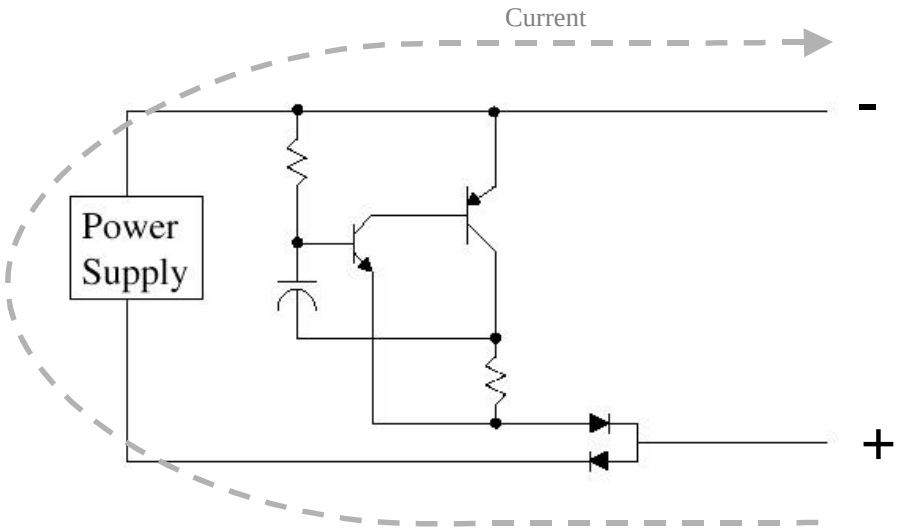
The DTE End - Detection Phase



- Operates from 1.2 to 5V
- Alternates from near zero current to a programmable current draw
- Operational power supply is removed from current path
- Current draw profile is distinctive

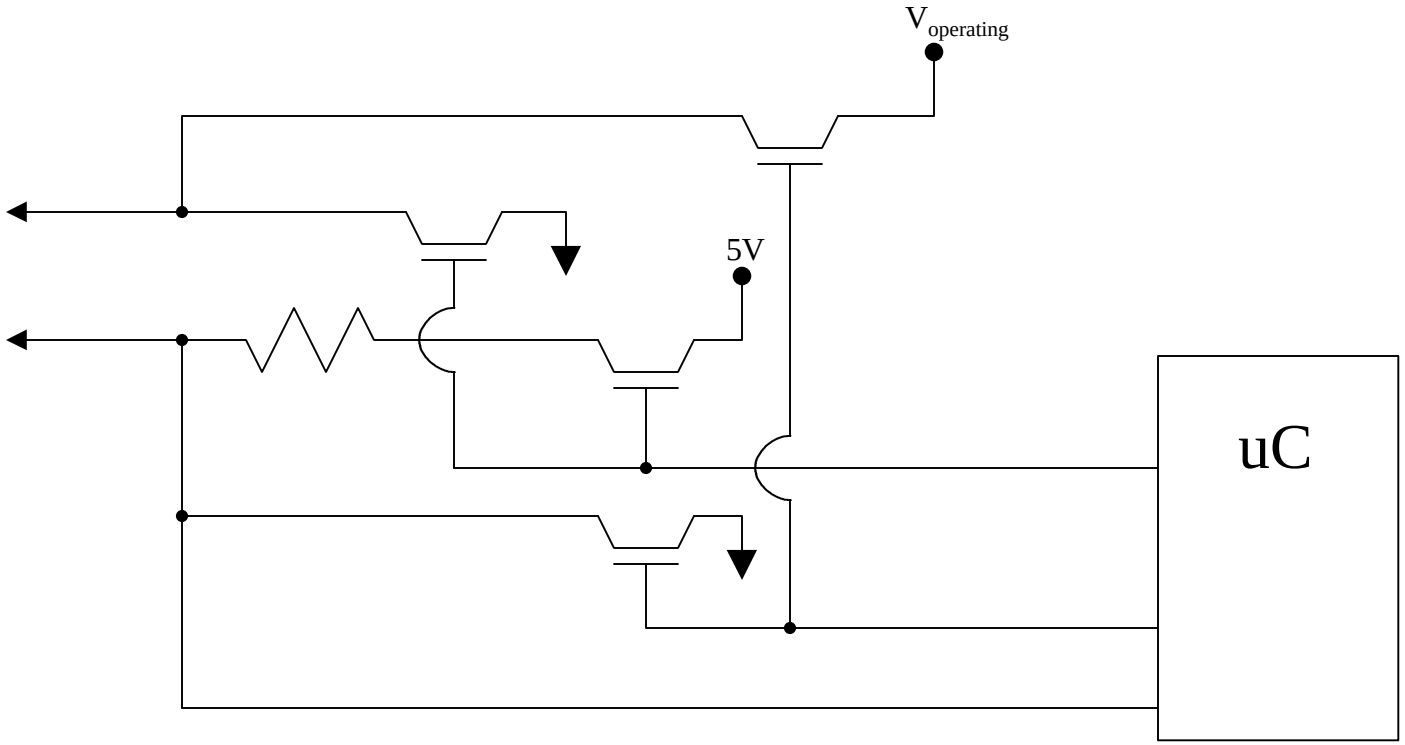
A Proposal

The DTE End - Powered Phase



- Oscillator is protected from “high” voltage power
- Current is only drawn by the operational supply
- Current **must** still be monitored to detect faults and failures.

A Proposal
The Network End



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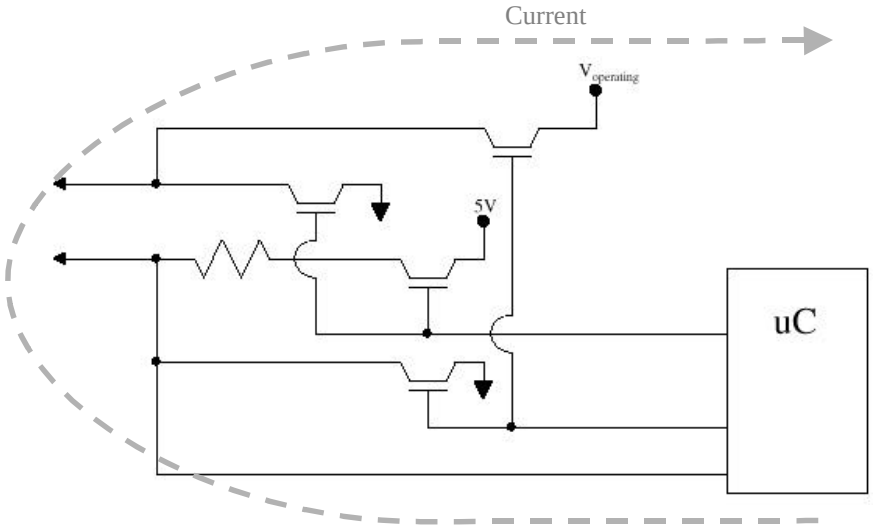
A Proposal

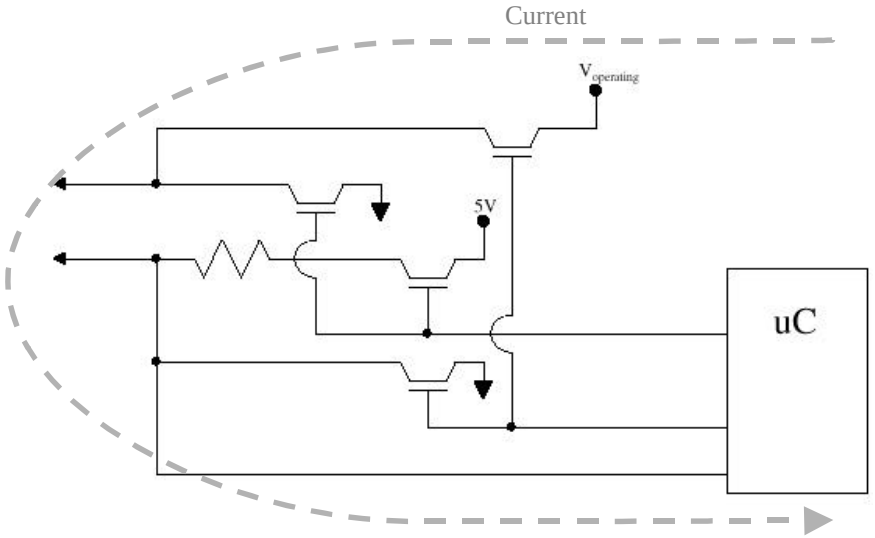
The Network End - Detection Phase



- 5V is enabled through resistor
- uC looks for:
  - Signature voltage oscillation
  - Voltage too low
  - Voltage too high
  - Constant voltage

A Proposal

The Network End - Powered Phase



- $V_{operating}$ is enabled
- uC looks for:
  - Over current
  - Under current

(Current sensing is not shown)

Conclusion

- Numerous aspects of the Problem Set remain to be defined
- These are new class of devices envisioned for power over Ethernet, we have the opportunity to create a unique and distinctive signature to ensure legacy devices and other impairments are distinguishable from our new devices.