DTE Power over MDI: Building Consensus

Ralph Andersson
TDK Semiconductor

Daniel Dove
Hewlett Packard

Robert Muir
Level One Communications

May 24, 2000

Objectives:

- I am not going to re-present all of the proposals for the application of power over the MDI
- I will focus on the proposals that have occurred within this group concerning which pairs to apply power over: the signal pairs or the IDLE pairs.
- Benefits of each
- Drawbacks of each
- Consensus on the path where there is the greatest commonality
- Is this possible?

Power over MDI:

- Objectives to be considered from 11/99:
  - (1) Economically provide power over a twisted- pair link segment to a single Ethernet device.
    - To be included:
      - 10BASE-T,
      - 100BASE-TX.
    - To be considered:
      - 1000BASE-T.
  - (2) Select one power distribution technique for world wide use
  - (3) Not cause damage and inter-operate with compliant RJ- 45 MDI Ethernet devices including:
    a. Switch- to- switch connections (both supplying power)
    b. Cross- over cables
    c. Common mode termination implementations
    d. Shorted conductors, pairs or loop- back plug Support current standard, 4- pair, horizontal cabling infrastructure for installed Cat 3 and Cat 5 cabling

Power over MDI:

- Objectives to be considered from 11/99 (cont.):
  - (4) Define a capability detection function that works with a powered and an un-powered device
  - (6) Add appropriate management objects for power capability and status
  - (7) Support current standard, 4- pair, horizontal cabling infrastructure for installed Cat 3 and Cat 5 cabling
  - (8) Preserve the signal transmission and isolation characteristics of existing equipment and cabling
  - (9) Maintain normal functionality of Link Integrity Test function in legacy and new devices

Power over MDI:

- Motions to be considered:
  (1) Without specifying the two and only two pairs to be utilized for DTE power, DTE power shall utilize two pair powering where each wire in the pair is at the same nominal potential and the power supply potential is between the two pairs selected.

  Moved: Michael McCormack Second: Henry Hinrichs

  Yes: 23 Opposed: 4 Abstains: 3, Total attendance: 33, January 21, 2000

  (2) Regardless of the detection scheme adopted and the power feed scheme adopted, the power detection and the power feed shall operate on the same set of pairs.

  Moved: Michael McCormack Second: Dave Richkas

  Yes: 31 Opposed: 0 Abstaining: 1, Total Attendance 33, January 21, 2000

Power over MDI:

- Motions to be considered:

  (3) In order to progress we accept that there are now two isolation requirements of 802.3, environment A and B per 802.3 section 27.5.3 et al, and that for the purposes of this committee we will treat as a priority for consideration environment B without precluding environment A.

  Moved: N. Stapleton Second: L. Miller

  Yes: 23 Opposed: 3 Abstaining: 9, March 7-8, 2000

  (4) Move to add a requirement that: The solution for DTE powering shall support mid-span insertion of the power source.

  Moved : A. Anderson Second: D. Dove

  Yes: 33 Opposed: 0 Abstaining: 1, March 7-8, 2000

Power over MDI:

- There are two camps:
  - Power over the signal pair.
  - Power over the idle pair.
- A third camp violates Motion (1) and will not be discussed.
  - Power over both (TR41.4)

Power over MDI- Signal Camp:

- How can mid-span insertion be supported with power applied over the signal pair?
  - Transformer inserted into signal path at mid-span
    - Return loss may be an issue; there is not much margin on a class D link to facilitate the insertion of new elements. Objectives (8) & (9)
    - Insertion loss of the inserted element may be an issue. Objectives (8) & (9)
    - Each transformer adds an additional pole into the forward transfer characteristics of the link. How many legacy transceivers will stop working? Objectives (8) & (9)
  - Use a different power pair for mid-span solutions

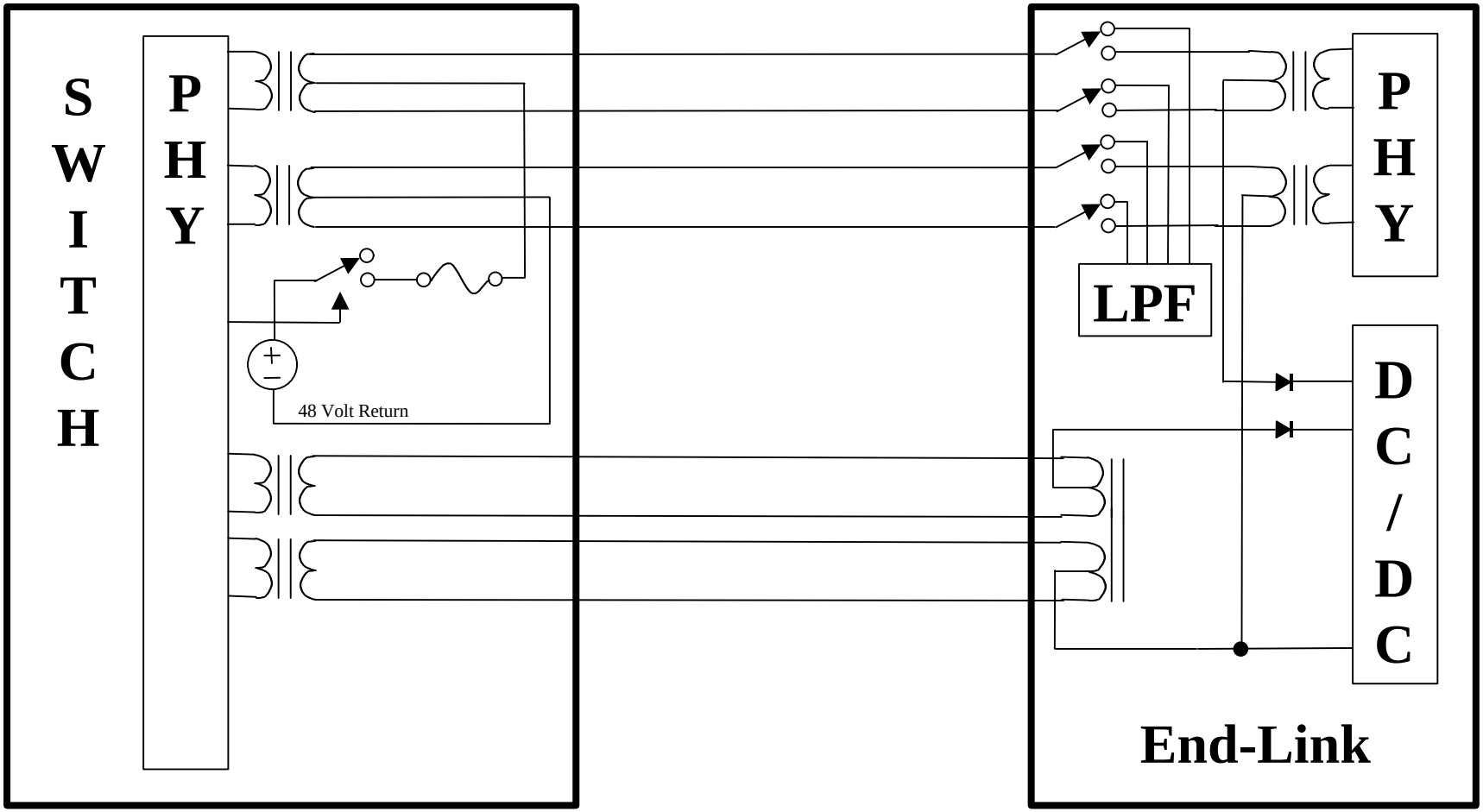
Power over MDI- Signal Camp: Cisco's Proposal

- There has been quite a bit of confusion on the reflector over what Cisco's proposal entails.
- Sources for this portion of the presentation are:
  - Power over the DTE 1/00 Frazier et al, Cisco
  - Considerations for Mid-Span Power Insertion 3/00 Yousefi et al, Broadcom
  - DTE Power Detection Algorithm 3/00 Yousefi et al, Broadcom
  - Logical guess-work

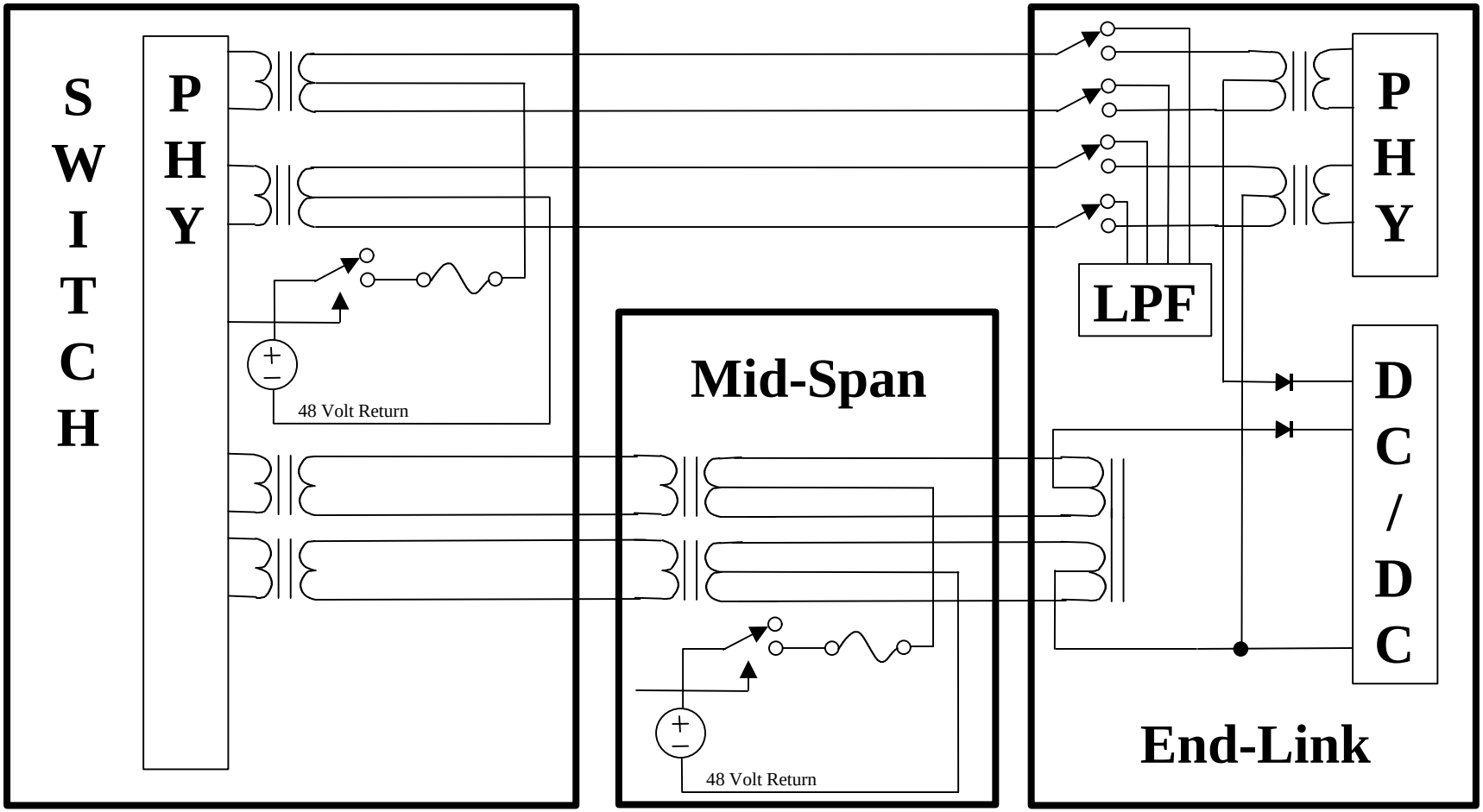
Power over MDI- Signal Camp: Cisco's Proposal

- Cisco's switch based solution uses the 1236 pairs to supply common-mode power from the switch to a remote application requiring power.
- Cisco's mid-span solution uses the 4578 pairs to supply common-mode power for a mid-span power insertion.
- 10BASE-T and 100BASE-TX applications are allowed to operate over a mid-span power insertion, 1000BASE-T is not.
- 10BASE-T, 100BASE-TX, and 1000BASE-T applications are allowed to operate over a switch supplied power insertion.

Power over MDI- Signal Camp: Cisco's Switch-Based Proposal



Power over MDI- Signal Camp: Cisco's Mid-Span Proposal



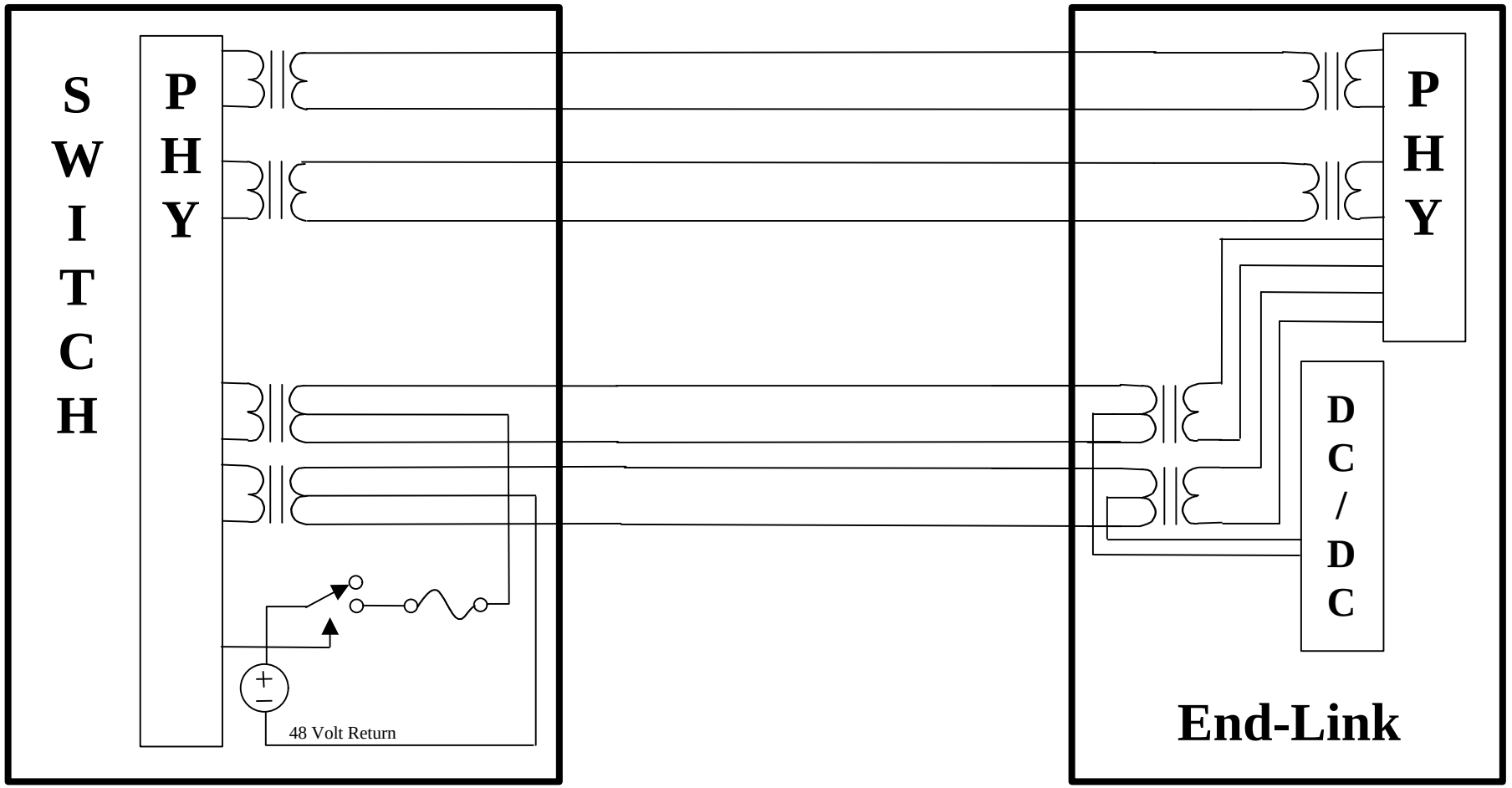
Power over MDI- Signal Camp: Cisco's Proposal

- Advantages:
  - Return loss & insertion loss are not are not affected by the addition of the mid-span transformer element for 10BASE-T and 100BASE-TX applications.
  - Follows Motion (2) and (4). Detection scheme and the power feed scheme operate on the same set of pairs. Mid-span is supported.
  - Will support 2 pair installed wiring for switched based power insertion.
  - Supports 1000BASE-T
- Disadvantages:
  - Operates outside the intent of Motion (1). Power can be applied to more than two pairs. The letter of the law set forth by Motion (1), however, allows the multiple sources if only one is selected. This assumes a method for conveying discovery information between switch and mid-span. Assumes a foolproof power prioritization definition.
  - Possible coupling between power supply noise events and transceiver performance for 10BASE-T and 100BASE-TX PHYs.
  - 1000BASE-T not supported for mid-span insertions.
  - Complex

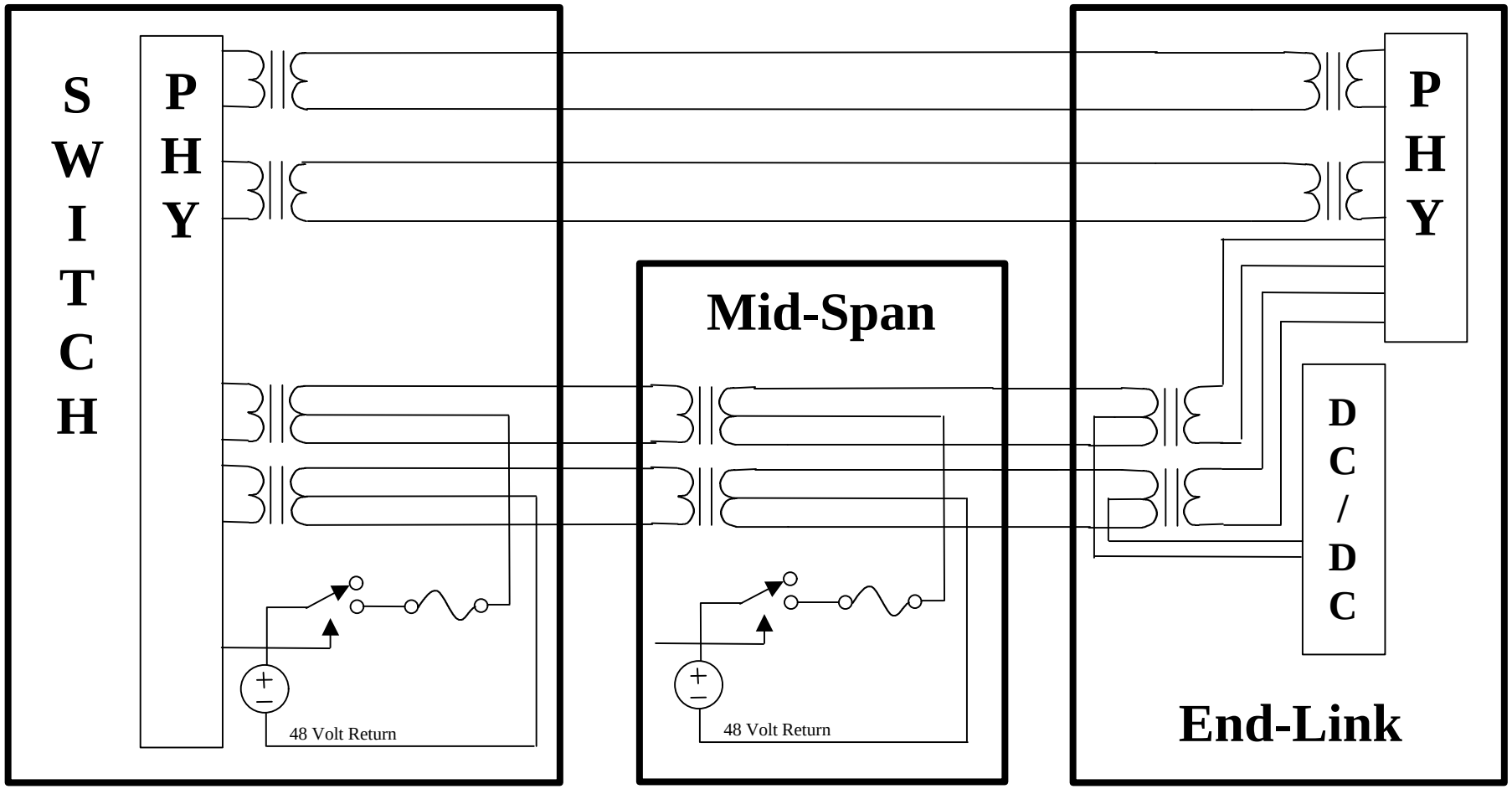
Power over MDI- IDLE Pair Camp:

- This proposal uses the 4578 pairs to supply common-mode power from the switch to a remote application requiring power.
- This proposal uses the 4578 pairs to supply common-mode power for a mid-span power insertion.
- 10BASE-T and 100BASE-TX applications are allowed to operate over a mid-span power insertion, 1000BASE-T is not.
- 10BASE-T, 100BASE-TX, and 1000BASE-T applications are allowed to operate over a switch supplied power insertion.

Power over MDI- IDLE Pair Camp: Switch Based Insertion



Power over MDI- IDLE Pair Camp: Mid-Span Insertion



IDLE Pair Proposal:

- Advantages:
  - Supports Motions (1), (2), and (4). Power is applied to two pair, discovery can be set up to operate on these pairs, and mid-span insertion of power can be supported.
  - Can support PHY based or power supply based discovery.
  - Return loss & insertion loss are not are not affected by the addition of the mid-span transformer element for 10BASE-T, 100BASE-TX, and 1000BASE-T applications.
  - No coupling between power supply noise events and transceiver performance for 10BASE-T and 100BASE-TX PHYs.
  - Can support 1000BASE-T to the same extent that Cisco's proposal can e.g. no 1000BASE-T supported for mid-span insertions.
- Disadvantages:
  - Won't support 2 pair installed wiring. Objective (7) says this is O.K.
  - 1000BASE-T not supported for mid-span insertions. Diligence is required if we want to design this to support 1000BASE-T for switched based power insertions.

Consensus Objectives:

- Select solution that supports Motions (1), (2), and (4)
- Support of Motion (3) is understood and is common to all proposed solutions
- Select solution that supports all Objectives
- W.r.t. Objective (1) give strong consideration to support of 1000BASE-T
- K.I.S.S.

Consensus Observations:

- Signal 1236 pairs solution supports Motions (2), and (4). Motion (1) is debatable.
- IDLE 4578 pairs solution supports Motions (1), (2), and (4)
- Both Signal 1236 pairs and IDLE 4578 pairs solutions support all Objectives. Certain risk to 10BASE-T and 100BASE-TX solutions with Signal 1236 pairs solution.
- Support of 1000BASE-T for switch based insertions only is common to both Signal 1236 pairs and IDLE 4578 pairs proposals

Consensus Conclusions:

- Select IDLE 4578 pairs solution
- Support 1000BASE-T support for switch based insertions only
- Select discovery method that best supports Objective (6). Add appropriate management objects for power capability and status.