IEEE802.3bt 4-Pair Power over Ethernet Task Force

Interoperability – Use Case Analysis

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Yair Darshan
Microsemi
ydarshan@microsemi.com

Microsemi

Supporters

- Farid Hamidy / Pulse
- Victor Renteria/BEL
- Christian BEIA / ST
- Rimboim, Pavlick / MSCC
- Brian Buckmeier /BEL
- Rick Frosch / Phihong
- Sesha Panguluri/Broadcom
- Abramson David / TI
- Valerie Maguire / SIEMON
- John N. Wilson / Silabs
- Yakov Belopolsky / BEL
- Picard Jean / TI

Objectives

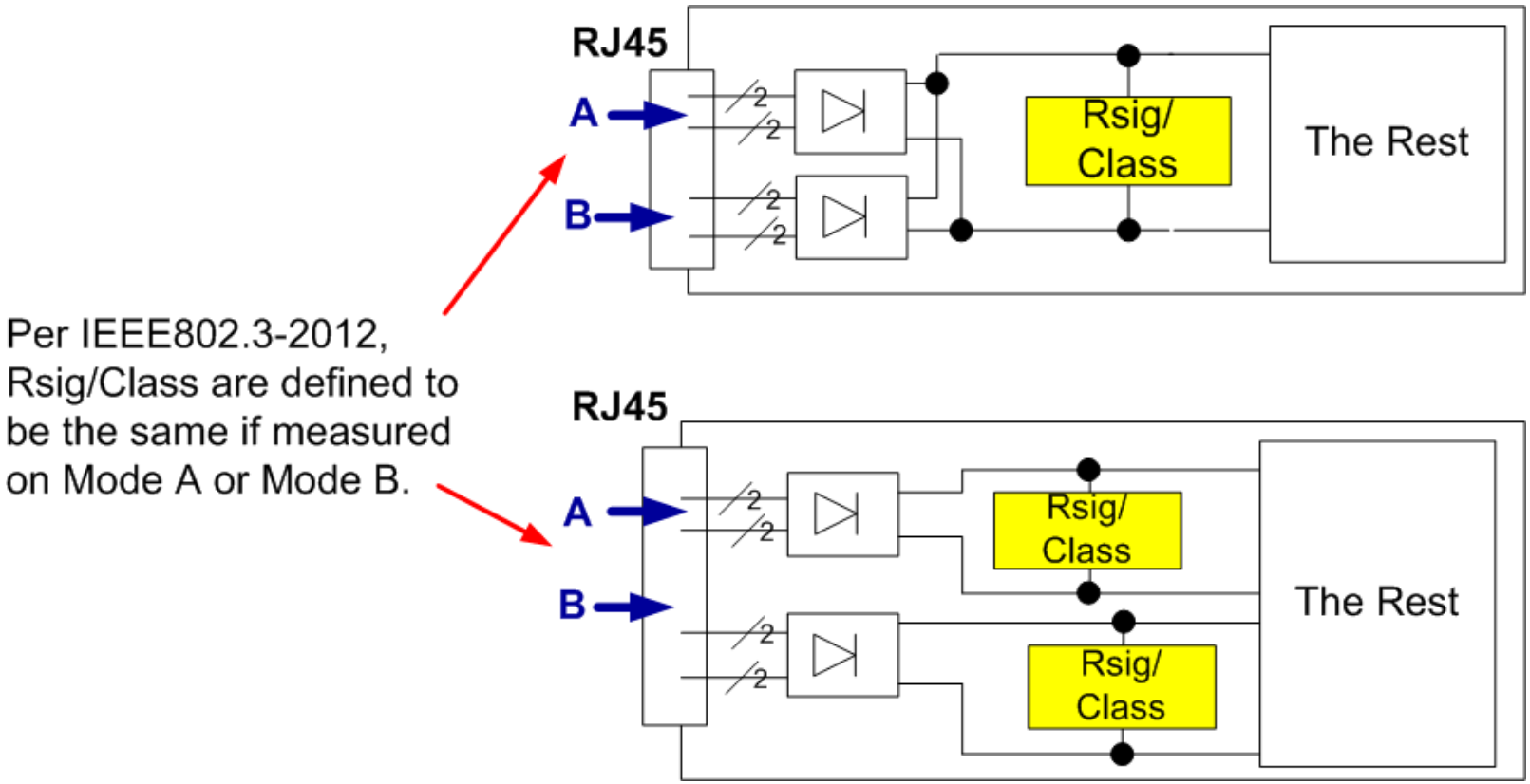
- Analyze and discuss interoperability of compliant PDs per IEEE802.3-2012 standard and new high power 4P PDs with 4P PSE concepts.

- Suggest concept that allow supporting
  - Existing compliant current PD implementations
  - New 4P PDs that meets our objectives (See Annex A)

Terms

- Mode A: Power/Data Channel A =Pairs 1,2,3,6 in the PD.
- Mode B: Power/Data Channel B=Pairs 4,5,7,8 in the PD.
- Alternative A: Power/Data Channel A = Pairs 1,2,3,6 in the PSE as defined by IEEE802.3-2012
- Alternative B: Power/Data Channel B = Pairs 4,5,7,8 in the PSE as defined by IEEE802.3-2012
- PSE: Power Sourcing Equipment, as defined in IEEE Standard 802.3
- PD: Powered Device, as defined in IEEE Standard 802.3
- Detection: Per IEEE802.3 clause 33.1 and 33.3.5:
  - A protocol allowing the detection of a device that requests power from a PSE.
  - In any operational state, the PSE required not apply operating power to the PI until the PSE has successfully detected a PD requesting power.
  - Moreover the PSE is required to turn on power only on the same pairs as those used for detection.
  - Type “3” (Temporary type name):PDs with up to 49W and PSE to support it.
  - Type “4” (Temporary type name):PDs with >49W and less than 100W and PSE to support it.
- Reduced features operating mode: PDs that was designed to work with lower power than their power type. E.g. Type 2 PD that can work also at type 1 power or Type 3 PD that can work with Type 2 power there is a fault in some of the PD loads or there is not sufficient power etc.
- 1 P_CHANNEL: The two Alternative A and Alternative B are tied together at the PSE to form single 4P power channel by using single power switch between PSE load to PSE power supply.
- 2 P_CHANNEL: Per the current IEEE802.3-2012 standard, Alternative A and Alternative B are connected to PSE power supply through power switch per ALT A and ALT B.

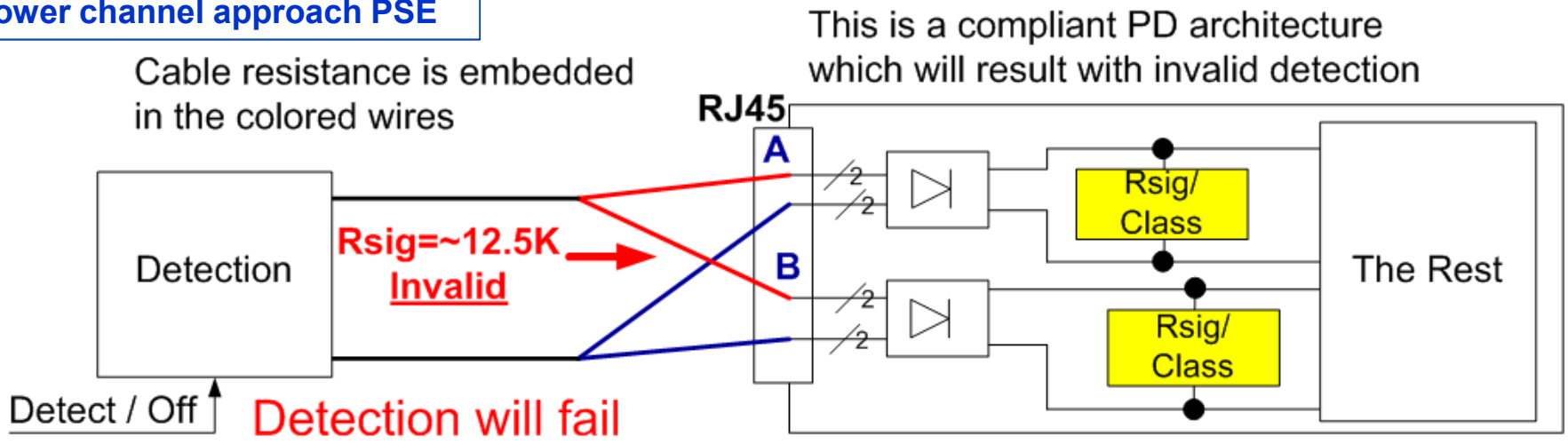
Interoperability – Use case #1 -1
4P PSE is connected to a Type 1/2 PD with Rsig on each 2 pair



Therefore both Implementations are compliant to the standard.
Base on this fact both implementations are used in the market today
(Type 1, 2 PDs) and need to be supported.

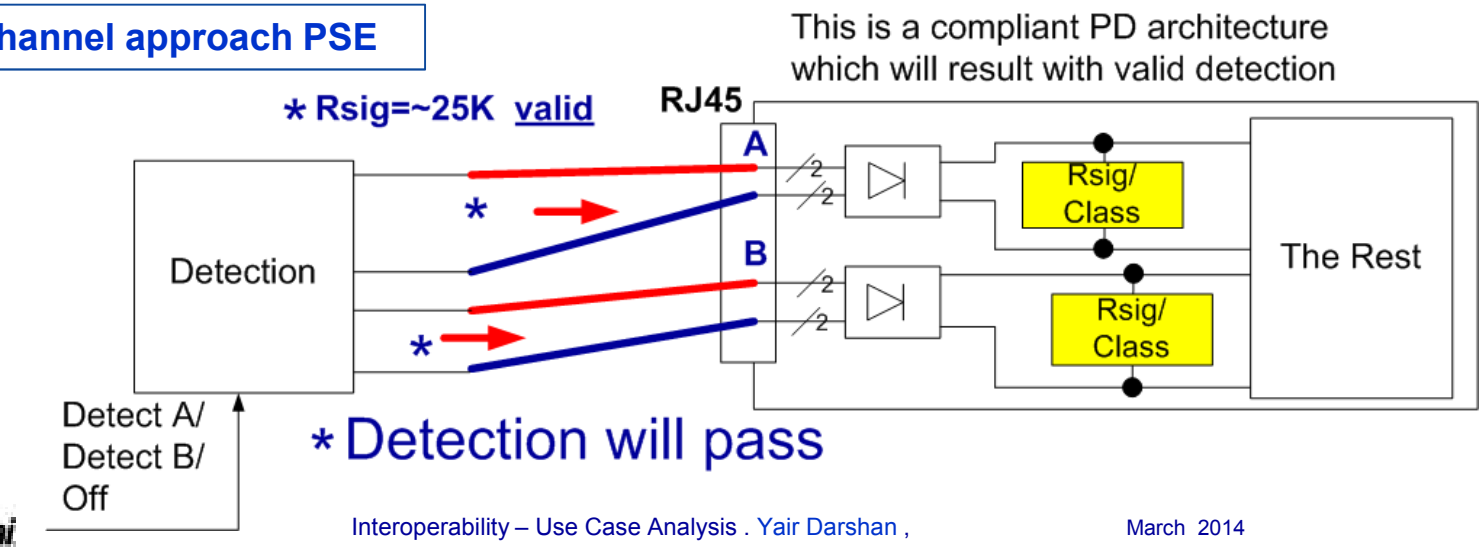
Interoperability – Use case #1 -2
4P PSE is connected to a Type 1/2 PD with Rsig on each 2 pair

1-power channel approach PSE



Note: Additional problem; PSE will see twice the class current, resulting with wrong class and/or class over current condition.

2-power channel approach PSE

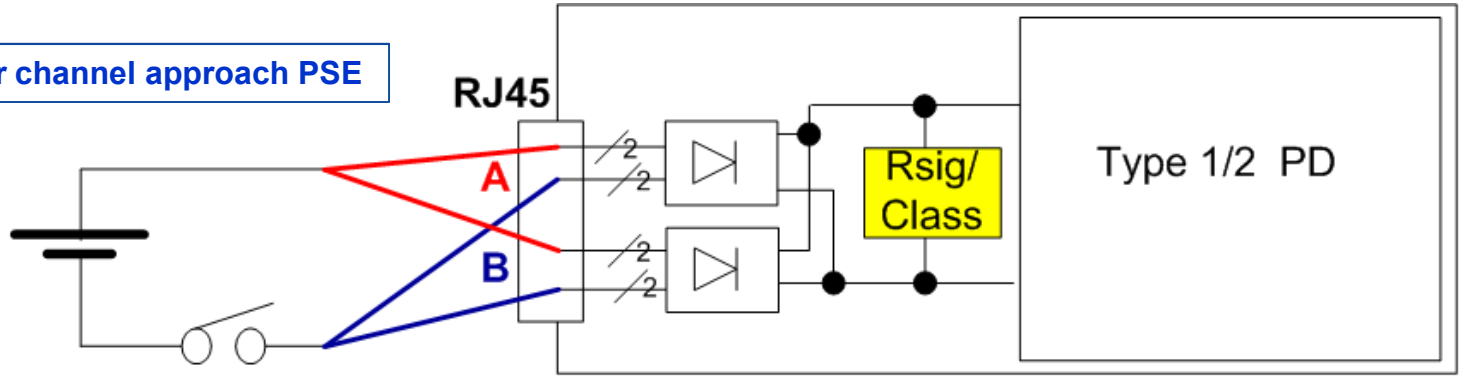


Interoperability – Use case #1 -3

- As per IEEE802.3at, Both Mode A and B should show the same detection Signature and Classification signature
- This is a clear case that is allowed by the standard for Type 1 and 2 systems.
- If 4P PSE is implemented by 1 Power Channel, some of the standard compliant PDs in field will be seen as invalid signature.
- **Q1:** How many such PDs in the market ?
- **A1:** Irrelevant question. It is meeting the current standard. Its Type 1/2. From 5C we need to be backwards compatible. The rest is implementation.
- **Q2:** Yes agreed, but how many of it are used in the market
- **A2:** Large quantities (Vendor A: >3 million ports, Vendor B>900,000 ports and there are more).

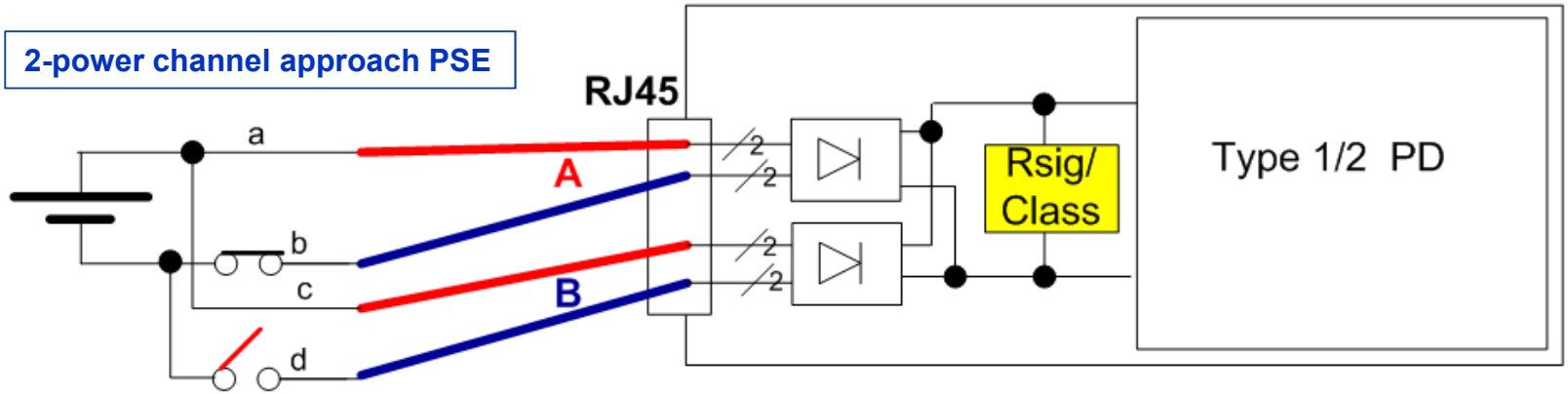
Interoperability - Use Case # 2a -1
Faults along ALT A or ALT B power channels

1-power channel approach PSE



In single power channel were 1 Switch is used:
Fault on one of the ALT A or B channels, will remove power completely.

2-power channel approach PSE



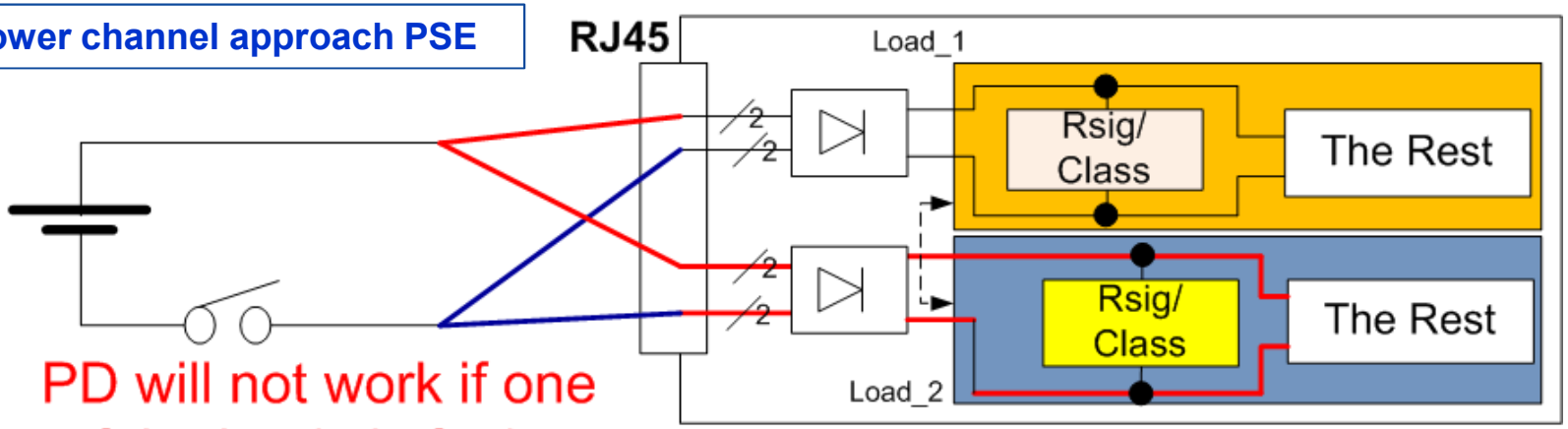
In 2-power channels were separate switch is used:
Fault on one of the ALT A or B channels will not affect PD – PD will still powered over the other pair.

Interoperability – Use case #2b -2
4P PSEs connected to PDs that can work over 2pair and with <25.5Watts

See more details in Annex B.

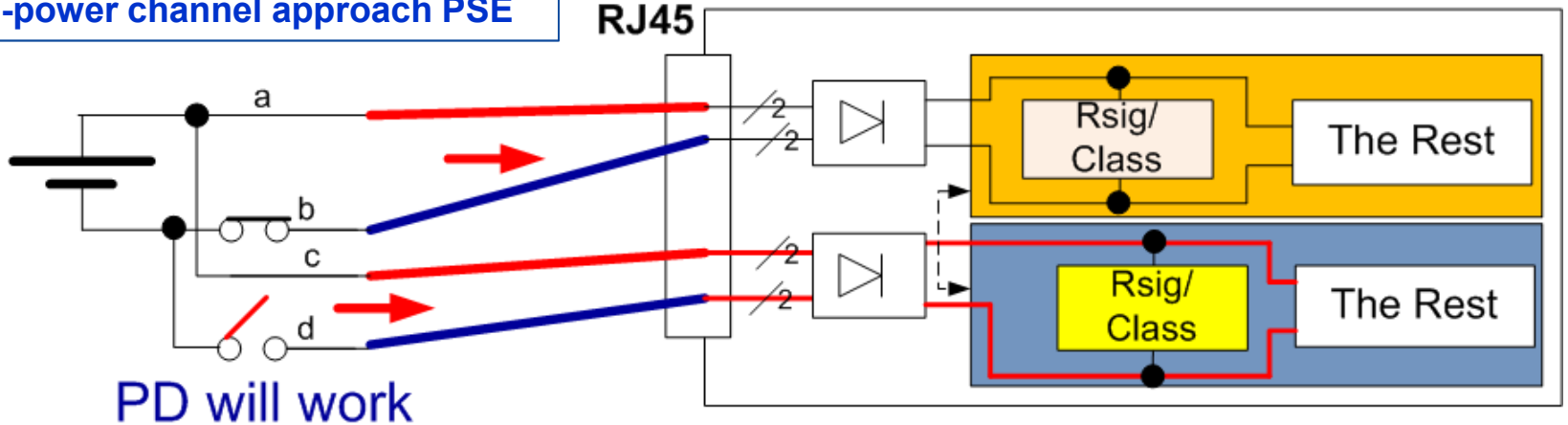
One of the PD loads is functional. The 2nd load is faulty e.g. overload.

1-power channel approach PSE



PD will not work if one of the loads is faulty.

2-power channel approach PSE



PD will work

Interoperability – Use case #2b -3
PDs that can operate in Type 2 or less Power Levels

- Under fault (one of the power channel or other):

	PD Type 1 or 2	PD Type 3 with ability to work with 25.5W over 2P.
1 Power Channel (1 switch)	NOT WORK	NOT WORK
2 Power Channel (2 switch)	WORK	works

- The approach were:
  - A) power channels are connected in parallel **(1-power channel)**
  - B) Combined control is used (➔ Only all power channels ON or all OFF is possible)
  - The above PDs under fault will not work.
  - Interoperability and backwards computability issues. Project Objectives are not met.
- The approach were:
- each power channel can be ON or OFF separately (2-power channel)
  - A) PD Type 1 and 2 works always.
  - B) PDs with capability to work with 25.5W over 2P will work.

Interoperability – Use case #2c -4
SEs that can support ALT A or ALT B or Both.

- **From IEEE802.3-2012 Claus 33.2.3**

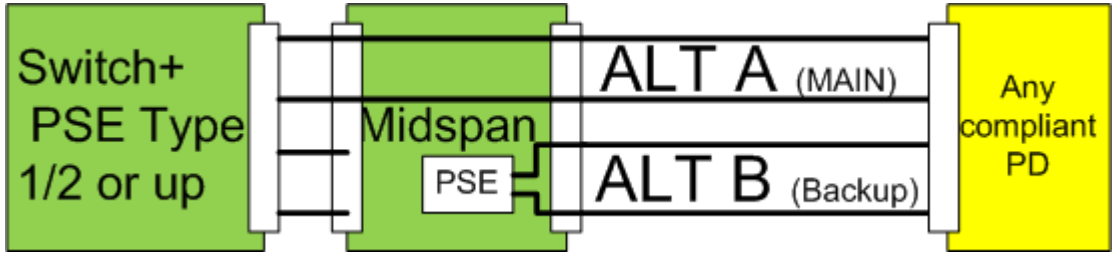
- A PSE shall implement Alternative A, Alternative B, or both.
- While a PSE may be capable of both Alternative A and Alternative B, PSEs shall not operate both Alternative A and Alternative B on the same link segment simultaneously.
- The above specifications allows capability of both Alternative A and B as long as they are not operated simultaneously.

- **Applications:** PDs that needs power backup. (Security etc. applications)

- **Typical PSE implementations to support such PDs**
  - Endspan with Midspan to generate power capability on ALT A and B.
    - Benefit the back-off function to allow successful detection of two separate and independent entities
  - 4P PSEs that support ALT A and ALT B power channel while only one of the power channels is active and under fault the 2nd is on and the 1st is OFF.

Interoperability – Use case 2c -5
PSEs that can support ALT A or ALT B or Both.

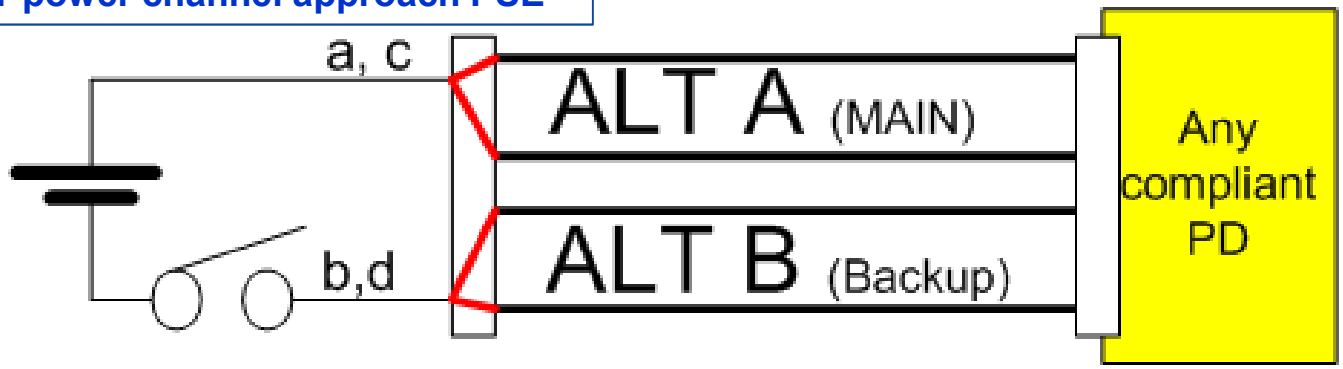
PDs:
-Security cameras
-Banks
-Industrial Applications



- Typical low cost Applications in the market today.
- Type 1/2 or higher power levels
- ALT A (and/or ALT B) can be disconnected under PSE power fault
- Compliant to IEEE802.3-2012

Interoperability – Use case 2c -6
PSEs that can support ALT A or ALT B or Both.

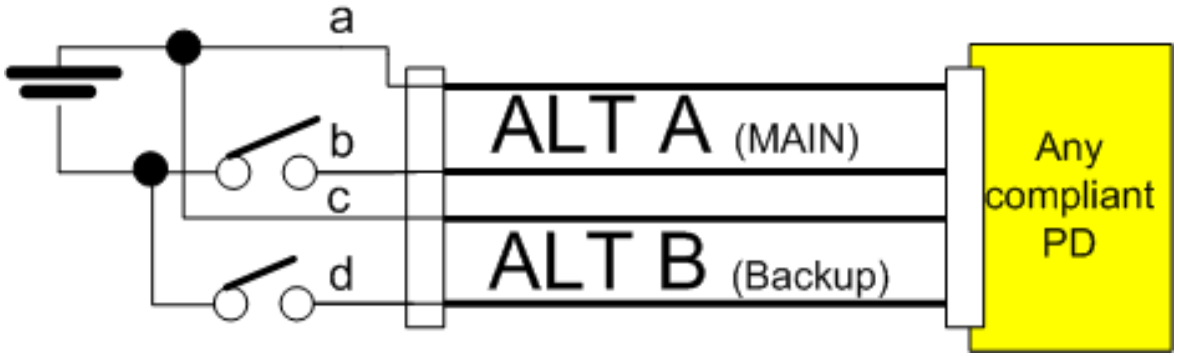
1-power channel approach PSE



Will not work

- if all power channels are connected in parallel through a single switch
- Under Fault, on main power channel
- PD will not work with 802.3bt PSE(with all power level types 1/2/3/4)

2-power channel approach PSE



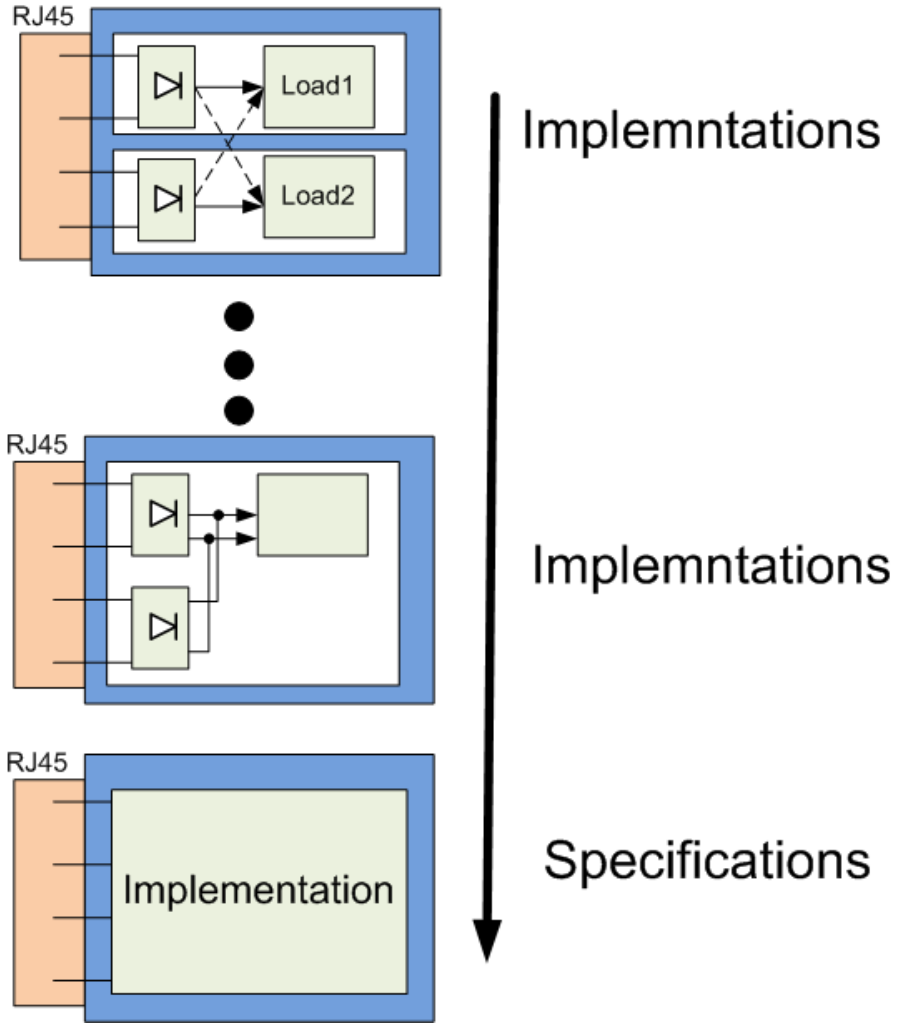
- Will Work
- PD will work with 802.3bt PSE (with all power level types 1/2/3/4)

Interoperability – Summary -1

#	PD Type	Use Case Description	Power Channel approach	
			1 P CHANNEL	2 POWER CHANNEL
1	1/2 (.af/,at)	Single Rsig	Works	Works
1	1/2 (.af/,at)	Single Class	Works	Works
1	1/2 (.af/,at)	Separate Rsig	**Not working**	Works
1	1/2 (.af/,at)	Separate Class	**Not working**	Works
2a	1/2 (.af/,at)	With one 2pair faulty	**Not working**	Works
2b	3 /4 (.bt)	PD Capable of working at Type 2 power over 2P	**Not working under fault**	Works
2c	Type 1/2. Future Type 3 / 4	PSE with backup power capability	**Not working under fault**	Works

Interoperability – Summary -2

Market needs: flexible PD implantation for now and the future



- PoE success is function of PD market size
- PD market size is function of the extent of PD design flexibility that will be allowed by the spec. and PSE to support it.
- **A PSE port that can detect and turn on/off each 2P will do the work.**

Discussion / Q&A

Thank You

Annex A

- From IEEE802.3bt objectives

  - 4PPoE PDs which operate at power levels consistent with IEEE 802.3-2012 PDs will interoperate with IEEE 802.3-2012 PSEs.

  - 4PPoE PSEs will be backwards compatible with IEEE 802.3-2012 PDs.

Annex B- Interoperability – Use case 2b
4P PSEs connected to PDs that can work over 2pair and with <25.5Watts

- Existing Type 1 and Type 2 PDs implementations with two internal loads (sometime the loads are identical).

- 4P PDs with higher power that can work at Type 2 power level over 2 pairs.

-The loads in this example are identical. If PD is driven by Mode A, Load 1 will work. If PD is driven by Mod B, load 2 will work. They are not working simultaneously. This is a compliant PD.

-This PD may be connected to Type 2 system that can work over each ALT A or B mode not simultaneously as allowed by the standard or connected to 802.3bt 4P PSE.

-There are security cameras that are working as above.