introspect technology

Introspect ESP Software Breakthrough: Combined Form Factors

Presenter:
David Tétreault-La Roche
Software Developer at Introspect

September 8, 2022

Agenda

1. Combine any Introspect product
2. History & Motivation
3. Technical insight
4. Going forward

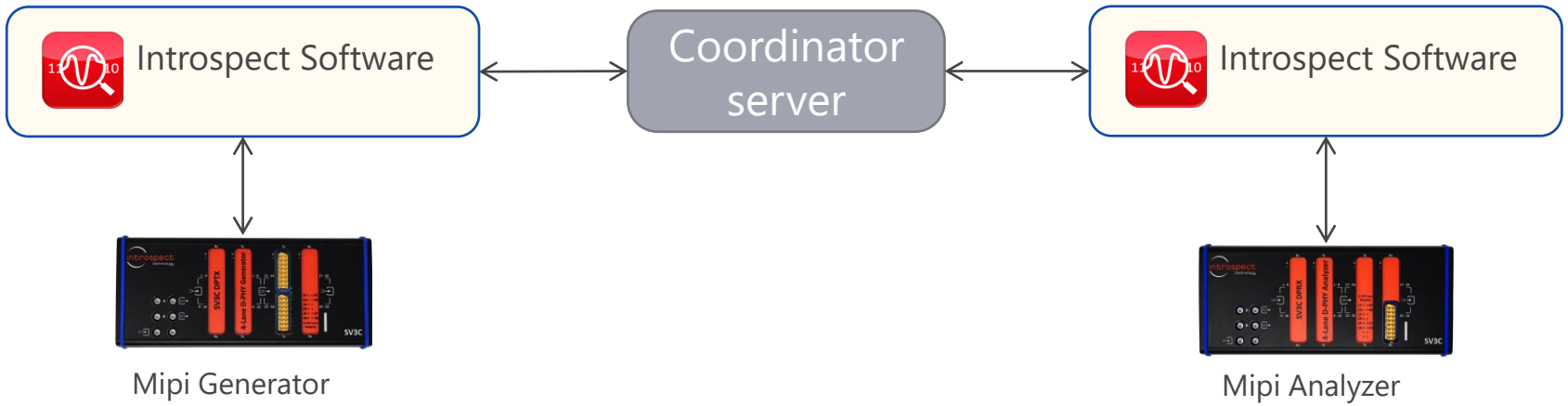
introspect technology

Combining Introspect products

Combining hardware: the old way

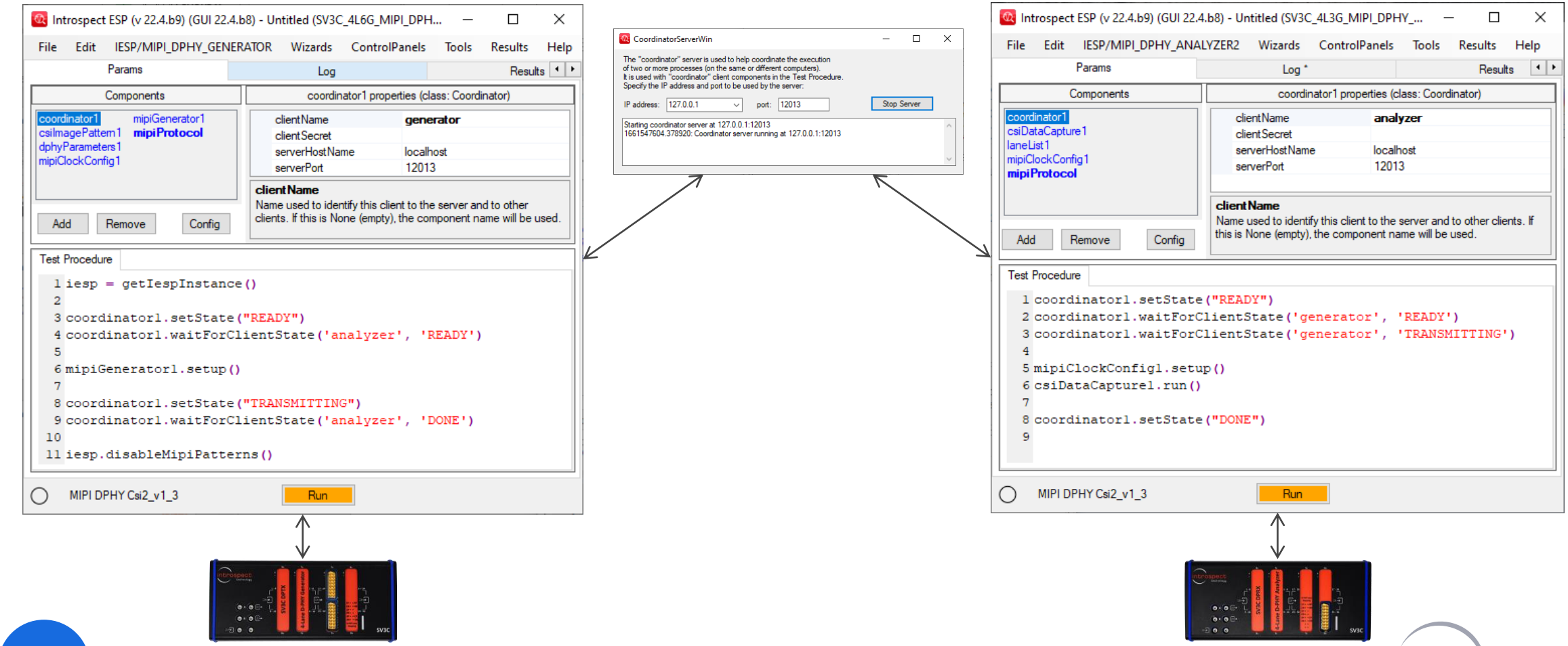
MULTIPLE HARDWARE, MULTIPLE SOFTWARE

- Requires two tests folder to be saved
  - Tightly coupled code must be written in two places
- Need to use a coordinator server for full automation
- Flexible: combine any introspect product together



introspect technology

Combining hardware: the old way



Mipi Generator

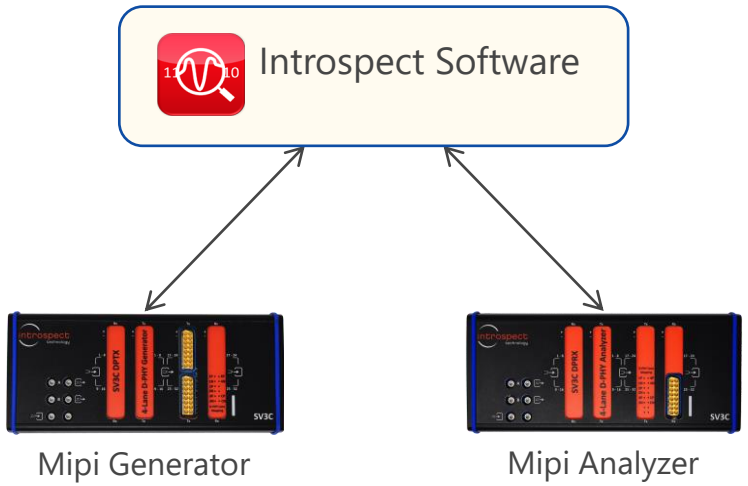
Mipi Analyzer

introspect technology

Combining hardware: the new way

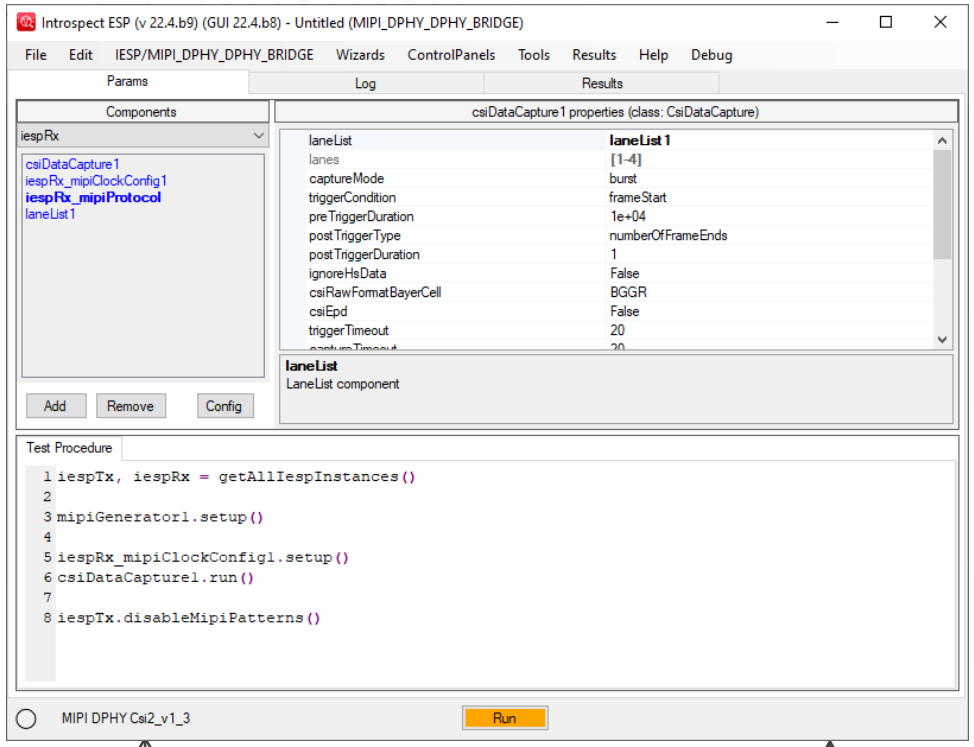
MULTIPLE HARDWARE, ONE SOFTWARE

- One test folder for the whole setup – all the code is in one place
- No coordinator!
- Same flexibility: combine any Introspect product together



introspect technology

Combining hardware: the new way



Mipi Generator

Mipi Analyzer

introspect technology

Two tests & coordinator

```
iesp = getIespInstance()

coordinator1.setState("READY")
coordinator1.waitForClientState('analyzer', 'READY')

mipiGenerator1.setup()

coordinator1.setState("TRANSMITTING")
coordinator1.waitForClientState('analyzer', 'DONE')

iesp.disableMipiPatterns()
```

```
coordinator1.setState("READY")
coordinator1.waitForClientState('generator', 'READY')
coordinator1.waitForClientState('generator', 'TRANSMITTING')

mipiClockConfig1.setup()
csiDataCapture1.run()

coordinator1.setState("DONE")
```

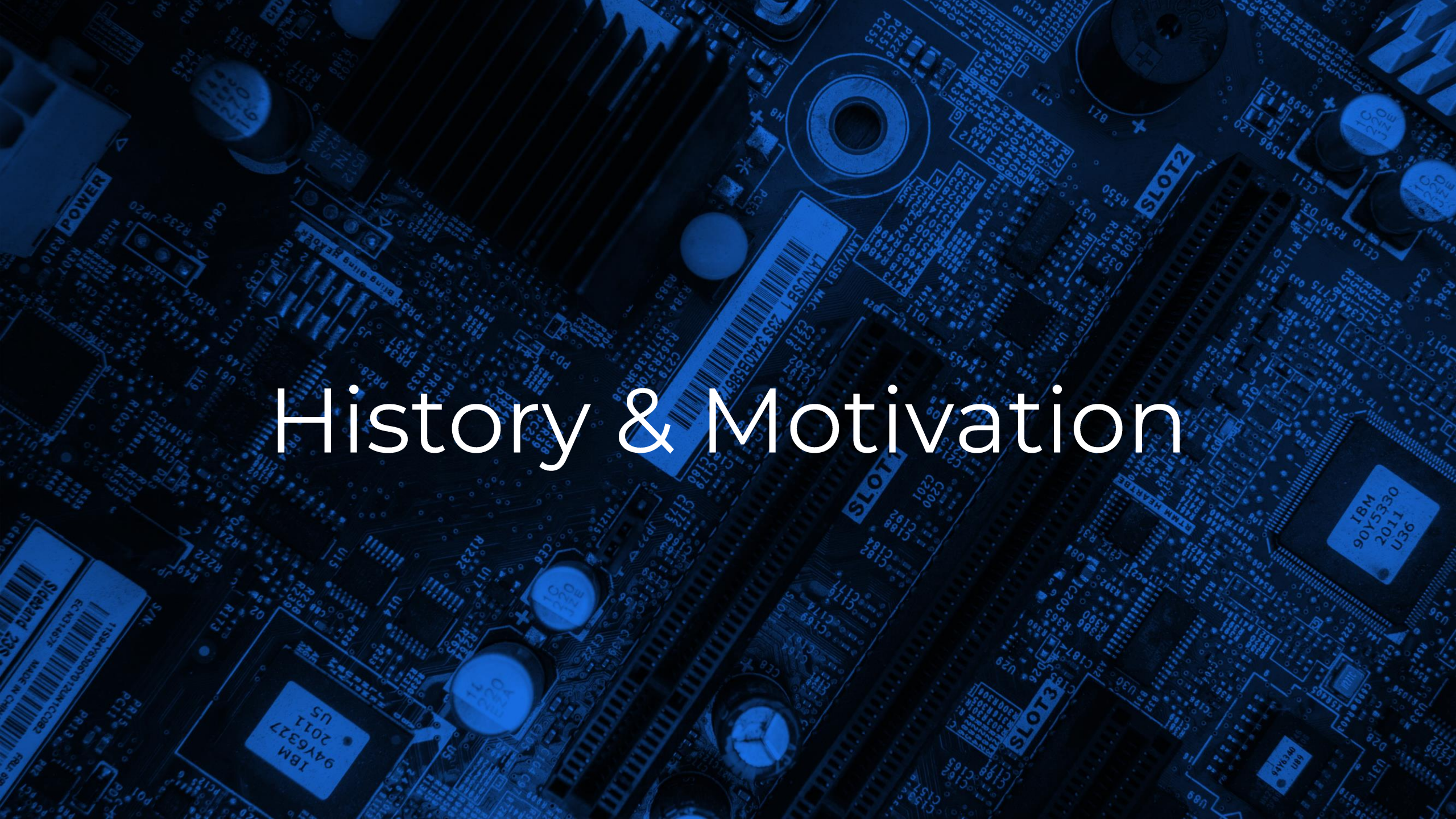
Combined form factor

```
iespTx, iespRx = getAllIespInstances()

mipiGenerator1.setup()

iespRx_mipiClockConfig1.setup()
csiDataCapture1.run()

iespTx.disableMipiPatterns()
```



History & Motivation

Why now?

COORDINATOR: SIMPLE BUT UNSCALABLE

- Pro: Simple implementation: does not requires any changes to architecture
- Con: Becomes very tedious to handle 3+ pieces of hardware (one test per hardware!).
    - Each test is effectively multithreaded (multiprocessed)
- Con: Writing multithreaded code is difficult, even for software engineers.
    - Many of Introspect's customers aren't software engineers themselves!

COMBINED FORMFACTOR: MAJOR CHANGES REQUIRED

- Con: Years of "single hardware" assumptions must be undone
- Con: Much of the internal software architecture must be rethought
- Pro: much easier for the user

10 years ago...

INTROSPECT'S PRODUCTS WERE ITERATIVE

SV1, SV2, and SV3 were interchangeable:

- All are SerDes products
- Similar feature set
- The later generation of products had better performance than the previous one

No real drive to combine products: they all fit in a similar niche.

Need 32 channels? Don't use four SV1C, just use an SV3C instead!

SINGLE HARDWARE, SINGLE SOFTWARE

- Simplifies software engineering quite a bit
- Easier to protype

Today

SERDES PLATFORMS

- SV1
- SV2
- SV2_PAM4
- SV3
- SV5
- SV7 (upcoming!)

PROTOCOL PRODUCTS

- MIPI
- Display port
- SLVS
- DDR
- I3C
- *and more…*

introspect technology

Many products, many opportunities

Combine MIPI TX & RX

Simplify your test bench

Mipi Generator

Mipi Analyzer

64-channel SV5

Used in DDR test suite

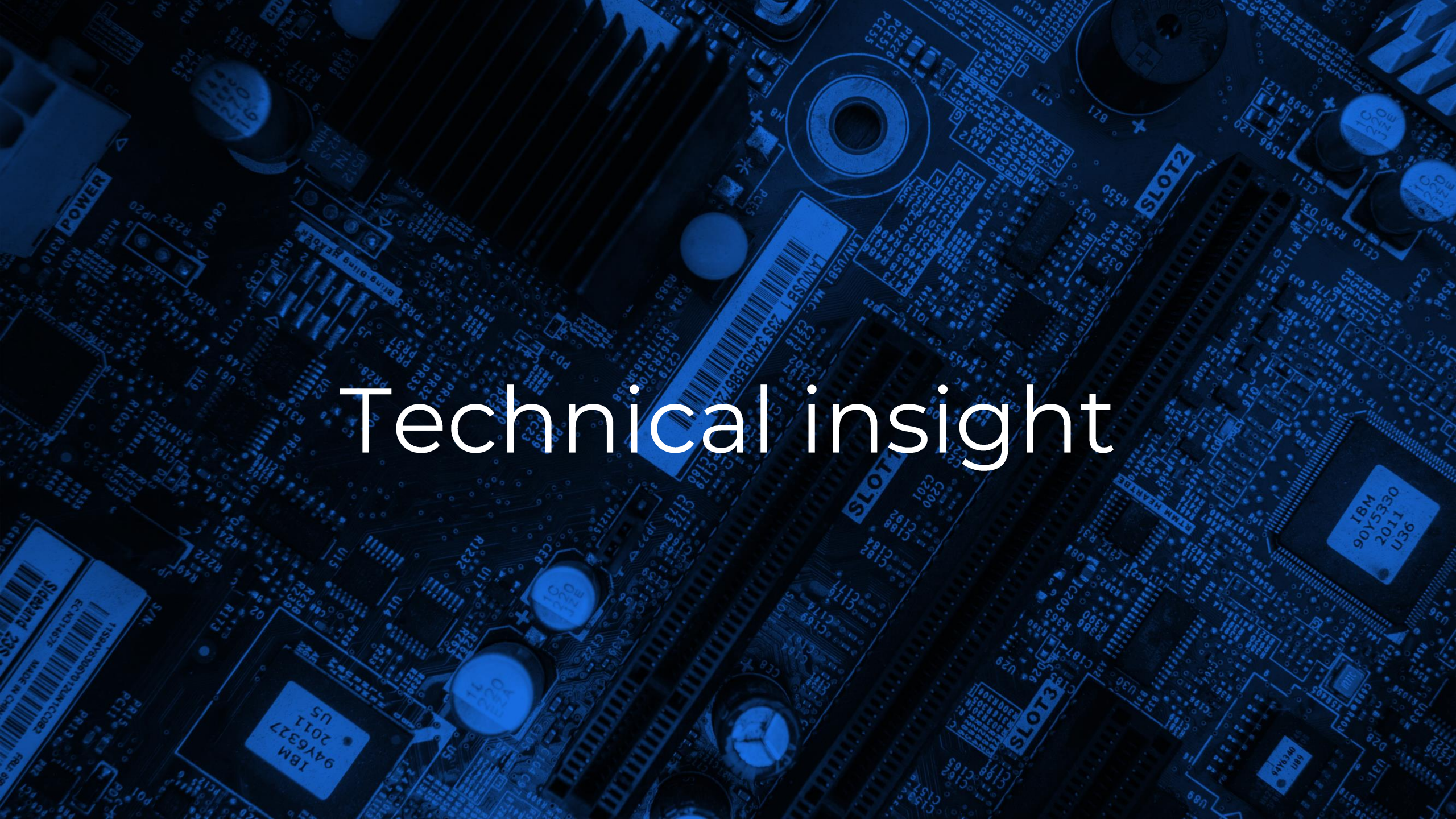
SV5C SerDes

I3C + anything!

SV4E I3C

?

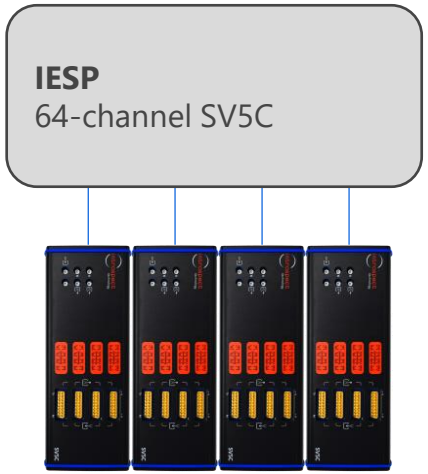
introspect technology


Technical insight

Combined form factors: two types

EXTENDED IESP

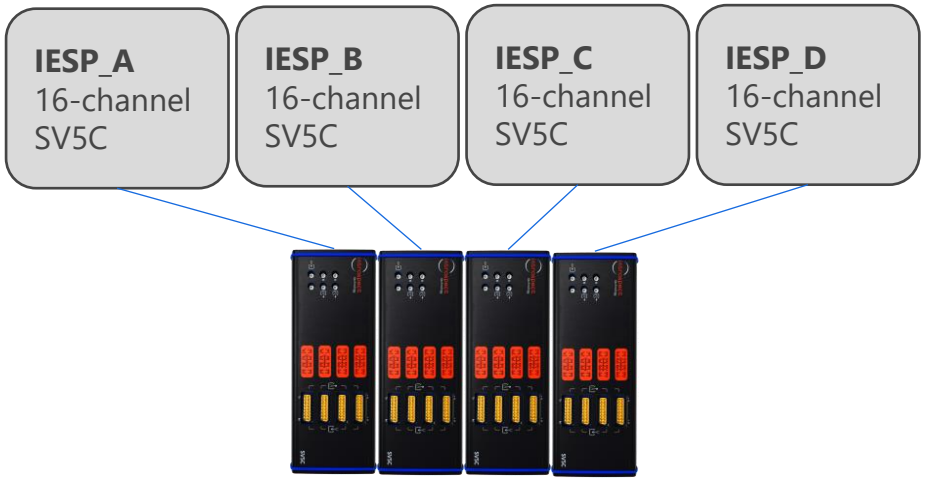
- Multiple boxes used as if one



4x 16-channel SV5C

MULTIPLE IESP

- Similar to having multiple tests open, but a single unified Python test procedure
- Replaces coordinator server



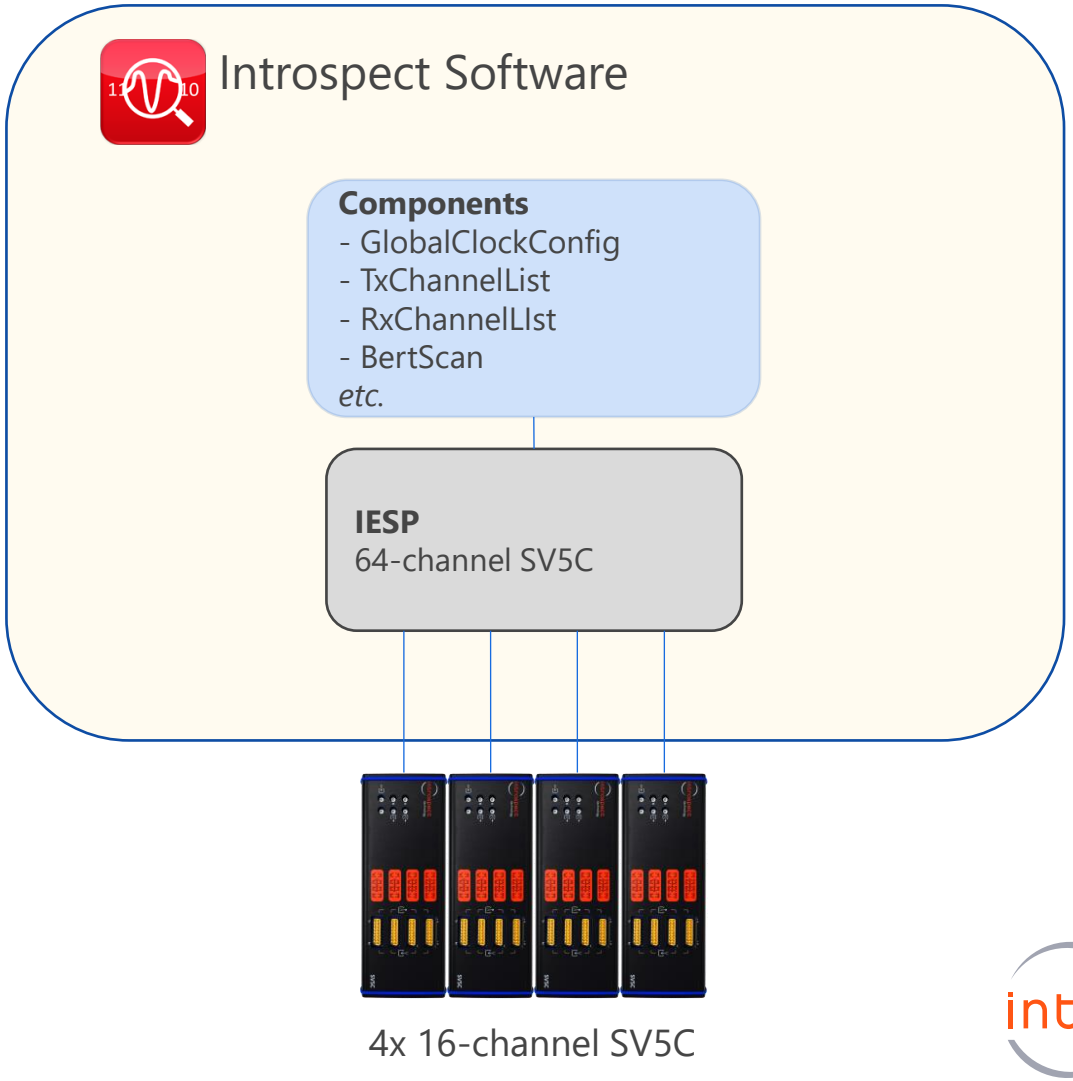
4x 16-channel SV5C

introspect technology

New architecture: extended IESP

ADD BOXES FOR MORE CHANNELS

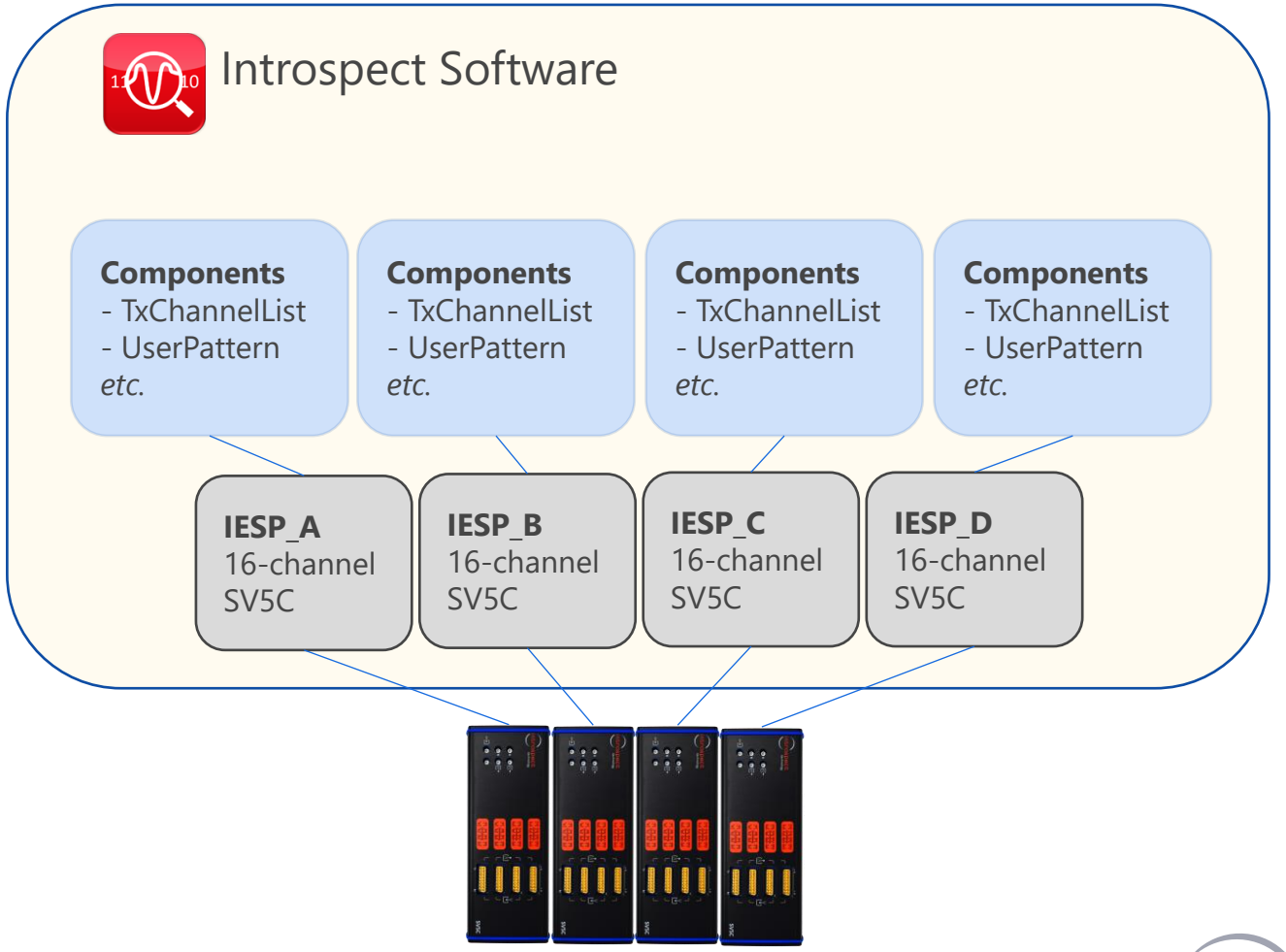
- Same as regular usage, except more channels!
- Only possible for SERDES form factors
  - Protocol form factors (Mipi, Display port, I3C, etc.) *cannot* be extended.
- Note: alignment between channels not guaranteed
- No limit to number of hardware pieces used.



New architecture: multiple IESP

COMPONENTS FOR EACH HARDWARE

- One *set of components* per hardware
  - Components of one set can only be used together
  - Can't use a UserPattern for IespA with the TxChannelList for IespB
- The test procedure code can refer to both sets of components seamlessly
- No limit to number or type hardware pieces used.



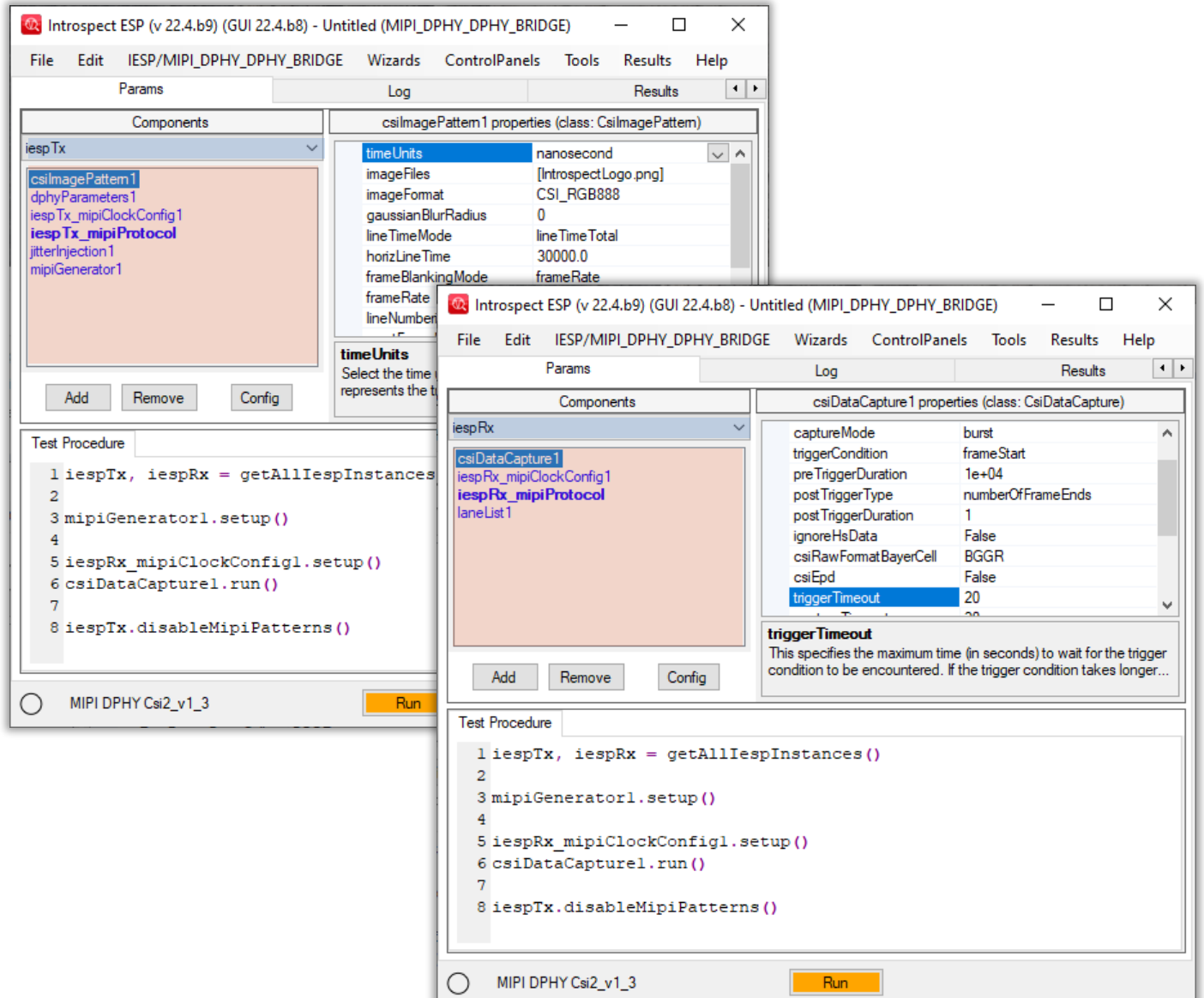
4x 16-channel SV5C

introspect technology

New architecture: multiple IESP

COMPONENTS FOR EACH HARDWARE

- One *set of components* per hardware
  - Components of one set can only be used together
  - Can't use a UserPattern for IespA with the TxChannelList for IespB
- The test procedure code can refer to both sets of components seamlessly
- No limit to number of hardware pieces used.



How-to?

MAKE YOUR OWN COMBINED FORM FACTOR

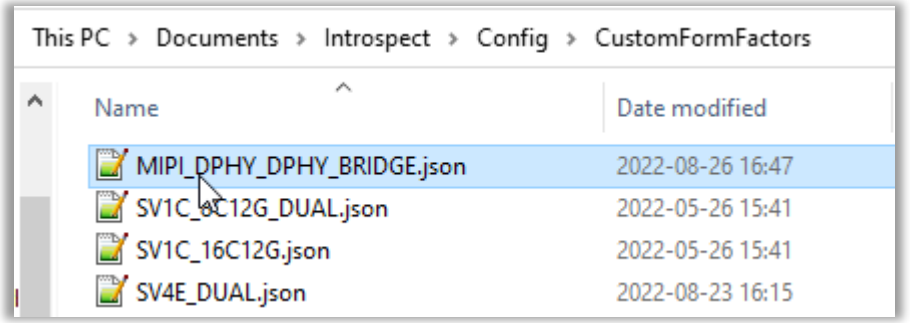
- Can only be done by creating a .json describing the necessary products
- Users need to know exactly what they want (can't explore options)
- **Very cumbersome workflow**: this will be heavily improved in the future

1 - Create combined form factor file

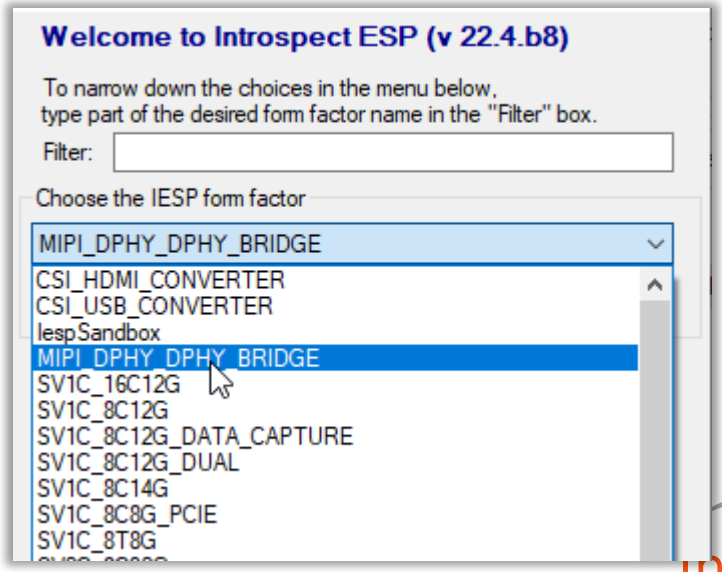
MIPI_DPHY_DPHY_BRIDGE.json

```
{
    "name": "MIPI_DPHY_DPHY_BRIDGE",
    "iespClassMap": {
        "iespTx": "SV3C_4L6G_MIPI_DPHY_GENERATOR",
        "iespRx": "SV3C_4L3G_MIPI_DPHY_ANALYZER2"
    }
}
```

2 - Place it in this folder



3 - Select it in the GUI



introspect technology


Going forward

Whats next?

WHEN WILL IT BE AVAILABLE?

- Its already in place! The most recent version(s) of the IntrospectESP software already support combined form factors.

FUTURE IMPROVEMENTS

- Updates to how the combined form factors are created since current approach is less than ideal
- Add a mechanism to save the combined form factor as part of a standard test folder.


introspect
technology
To Learn More Visit:
INTROSPECT.CA