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Reality Check

"Augmenting form factor designs with validation and debug capability"
John Kelbert - Intel Corporation

"New Possibility with Coax Via Risers"
Matthew Priolo, Adrian Rodriquez, Christopher Kinney, Adewale Oladeinde – Intel

"Processes for Validating and Maintaining Electrical DUT Interfaces"
Martin Gao, Carolina Lock - Texas Instruments
Augmenting Form Factor Designs with Validation and Debug Capability

John Kelbert
Intel Corporation

BiTS Workshop
March 5 - 8, 2017
Product Complexity Rising

More IP Blocks, Higher complexity

Source: Semico Research Corp.
Reality – Many Products are Late

“..79% of new products miss the launch date\textsuperscript{1}, companies have an enormous opportunity to increase sales and profitability by improving new product time to market (TTM)\textsuperscript{2}”

\textsuperscript{1}CGT/Sopheon Survey
\textsuperscript{2}https://www.sopheon.com/new-product-time-to-market/
Complexity Management with Multi-step Platform Approach

Start with this

Initial debug platform

- Easy to access
- Easy to debug
- Modular, reconfigure
Complexity Management with Multi-step Platform Approach

Progress to this

End point: product

- Difficult to access
- Challenging to debug
- Fixed configuration
Complexity Management with Multi-step Platform Approach

Starting point: debug platform
- Easy to access
- Easy to debug
- Modular, reconfigure

End point: product
- Difficult to access
- Challenging to debug
- Fixed configuration
Complexity Management with Multi-step Platform Approach

• All the while avoiding shortcuts that could lead to disaster
Upside of Multi-step Platform

• Advantages of specialized test platforms
  – Flexibility, expose key interfaces, added instrumentation, capability, …

Initial starting point
Downside of Multi-step Platform

Disadvantages

- PCB layers added for debug and test
- Longer routing of critical interfaces
- Connectors added to modularize
- Added test points
- Mounting holes for sockets

Initial starting point

Complexity added here…
Downside of Multi-step Platform

Key Differences
- Power and Performance
- Drivers, FW/BIOS
- Component placement
- PCB stackup
- Signal Integrity
- Power Integrity

Compromises efforts and investment to get here.

Initial starting point

Complexity added here...

End point
POWER AND PERFORMANCE
PRODUCT TUNING

Multi-step approach example:
Designing in complexity
Example: Power and Performance Board Layout

PCB placement bottom view

PCB placement top view

53 current sense resistors added to tune power-performance product point
Example: Power and Performance Power Layout Compromise

- Recommended product power shapes
- Product component placement
- Compromised power shapes for instrumentation
- Component placement pushed out from SoC
Example: Power and Performance
Physical Connections

Blue wires connections added for
data acquisition equipment

Image: Best Inc.
Consequences

Non-product deviations

- Placement
- Layout
- Debug Features

Deviations irrelevant to final product
AUGMENTATION WITH INTERPOSERS

A different approach
Move Test Feature Complexity to Interposers

Non-product parts, layout, connections moved from baseboard to interposer
Interposer Possibilities

Socketing Solutions

Power Profiling

Memory Configurations

Debug Interfaces
Interposer Extremes

0.4mm pitch devices class
depth interposer solution

1.0mm pitch server class
power profiling solution
Socket Attach Opportunity

Interposers became ideal candidates for attaching sockets without the need for additional mounting holes or keep out volume.
Augmentation enables a Return to Product Focus

Reduce non-product components
Maintain product component placement

Utilize product power plane shapes

Eliminate need for added PCB layers
Interposer Implementation Challenges and Limitations

- Signal and power integrity impact
- Attachment of interposer to system
- Mechanical conflicts and keep out volumes
- Capability is limited to what can be exposed at component's system interface
Conclusion

Product complexity rising

No change in product cadence

Validation and debug capability drive deviation from product focus

Interposers move complexity from target system while providing needed capability

Augmentation with interposers enables a stronger focus on the end product
Acknowledgements

Interposer and riser development:
Floy Campbell – Intel Corporation
Ashok Kabadi – Intel Corporation (retired)
Matthew G Priolo – Intel Corporation
Adrian R Rodriguez – Intel Corporation