



HPE SILICON PHOTONICS ECOSYSTEM

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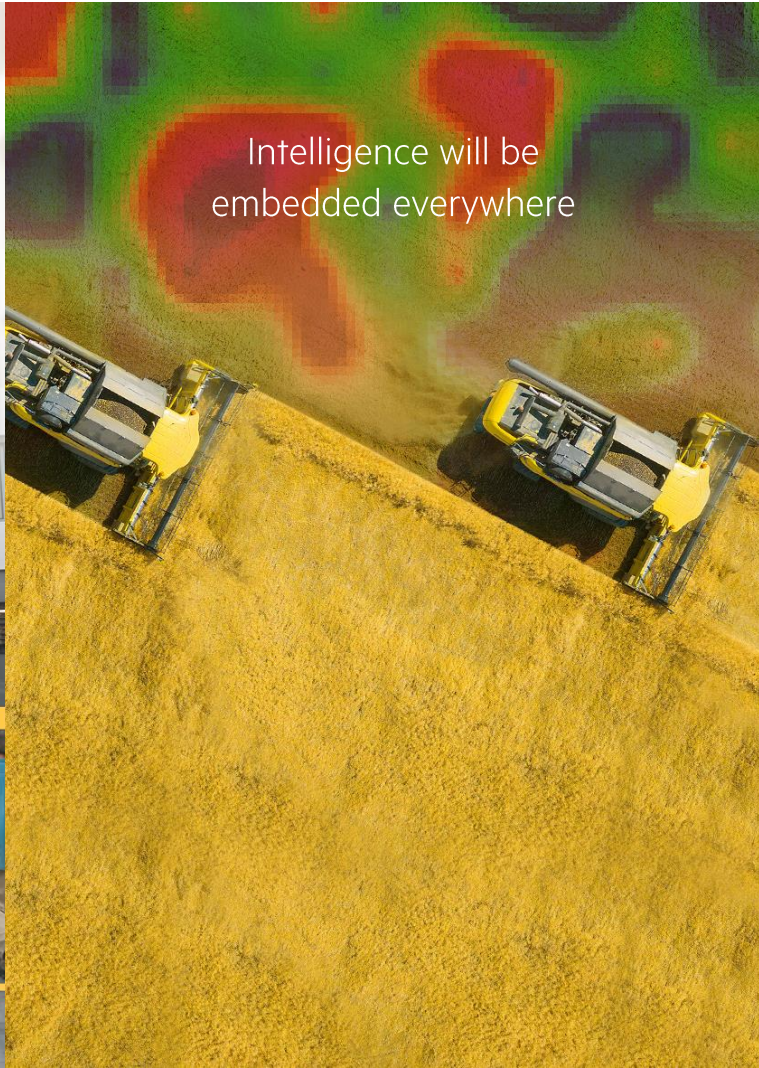
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CREATING A WORLD WHERE EVERYTHING COMPUTES

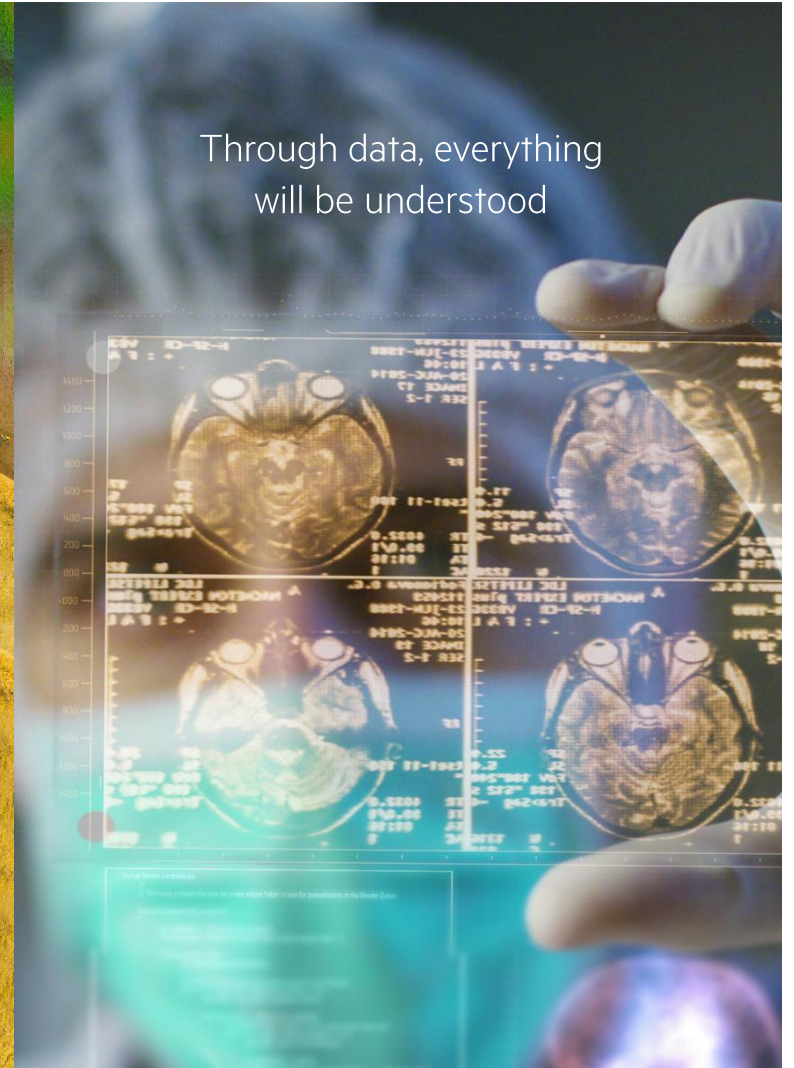
Everyone and everything
will be connected and secure



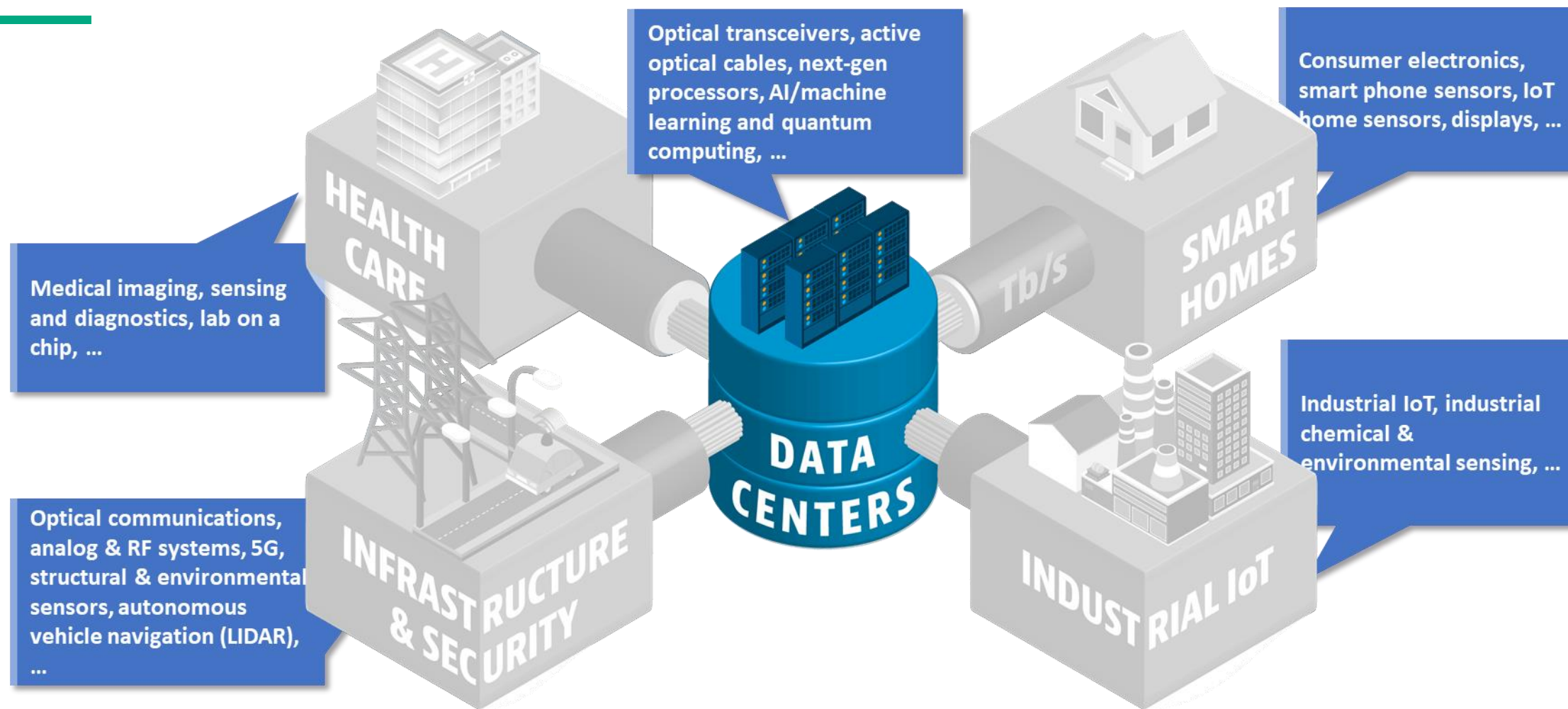
Intelligence will be
embedded everywhere



Through data, everything
will be understood



PHOTONICS EVERYWHERE!



PHOTONICS IN DATA CENTERS AND HPC

East-West traffic is exploding, driving a need for much higher bandwidth...

Hyperscale

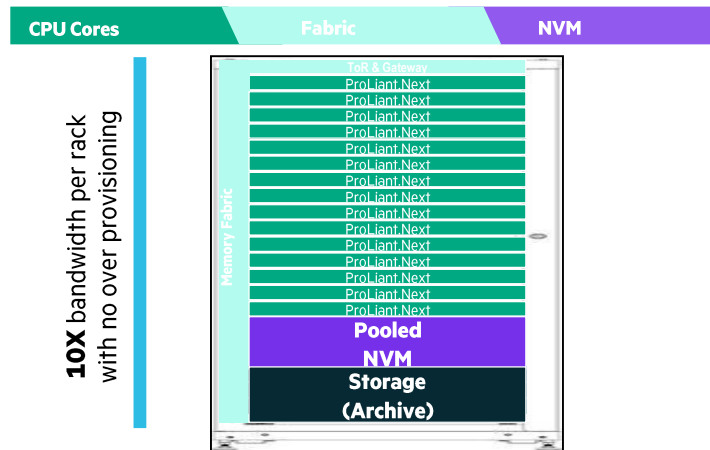
Facebook Network Traffic¹



Increasingly complex, AI driven workloads drive significant machine-to-machine traffic to deliver richer customer experiences and user value

... and enterprises are seeking rack-scale architectural composability

Enterprise

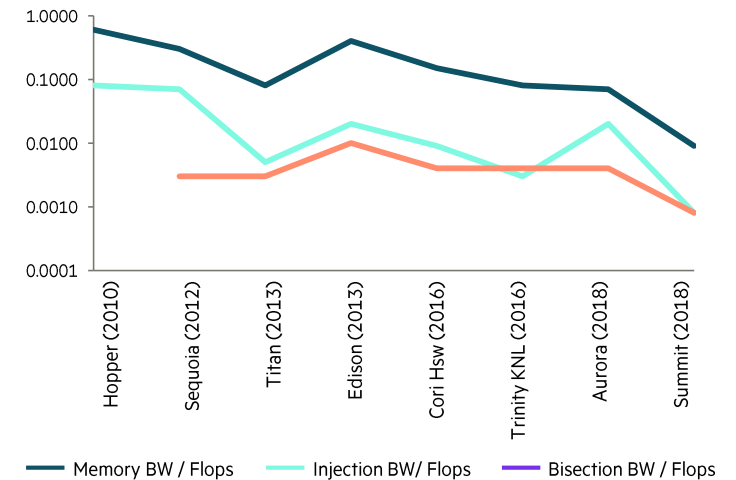


Requires significant bandwidth across the rack to dynamically compose resources

... and in HPC systems, bandwidth is not keeping up with compute

HPC

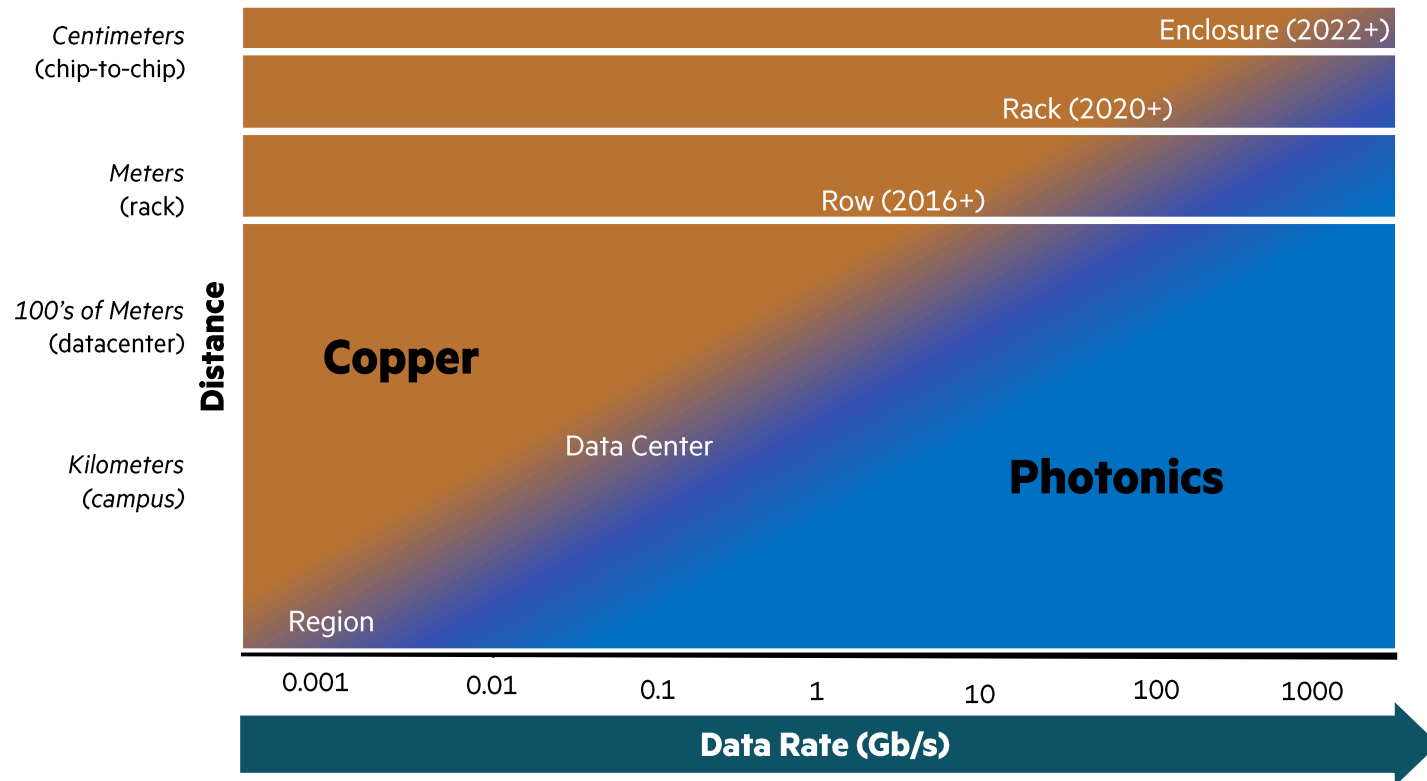
Bandwidth / Flops (Exascale Systems)²



The industry is seeking higher bandwidth, much lower cost & lower power

COPPER TO PHOTONICS TRANSITION

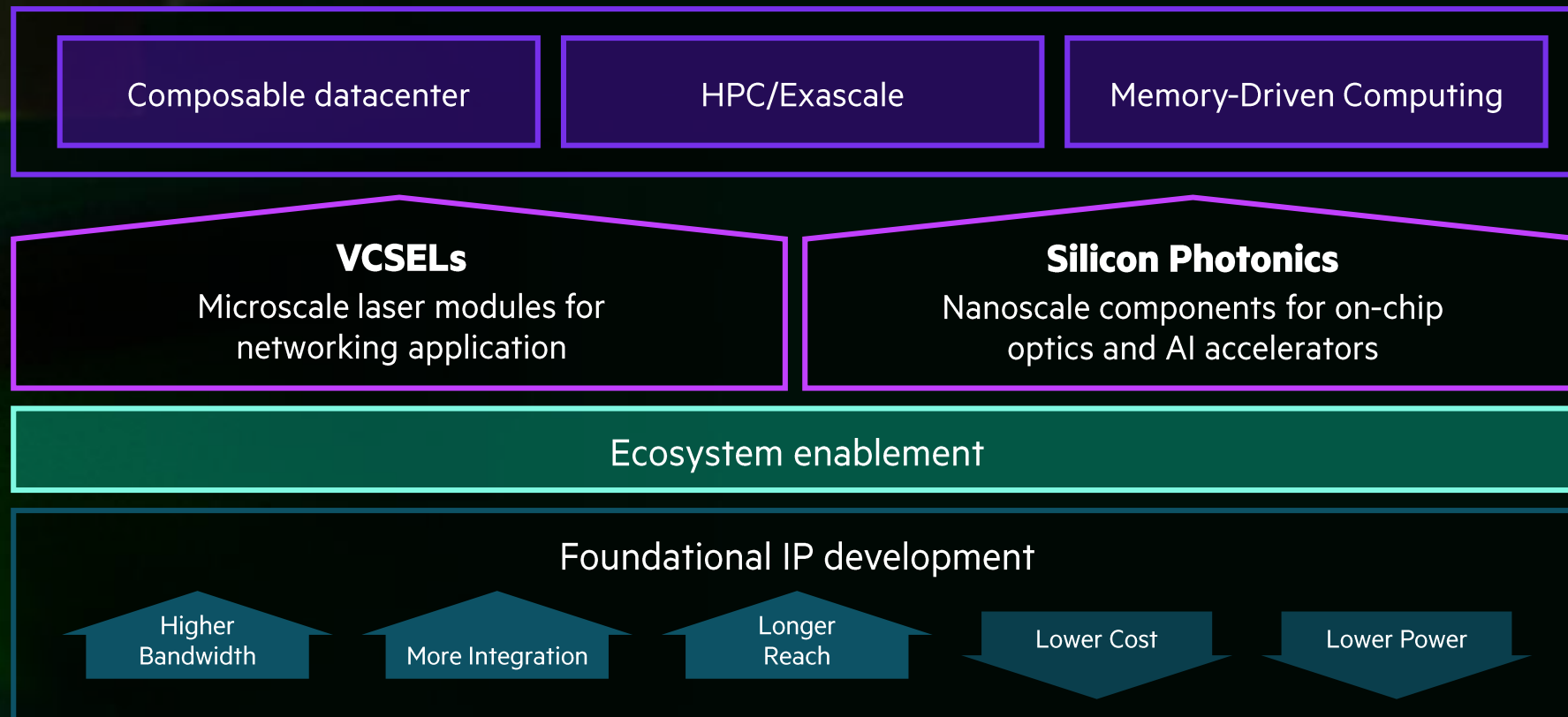
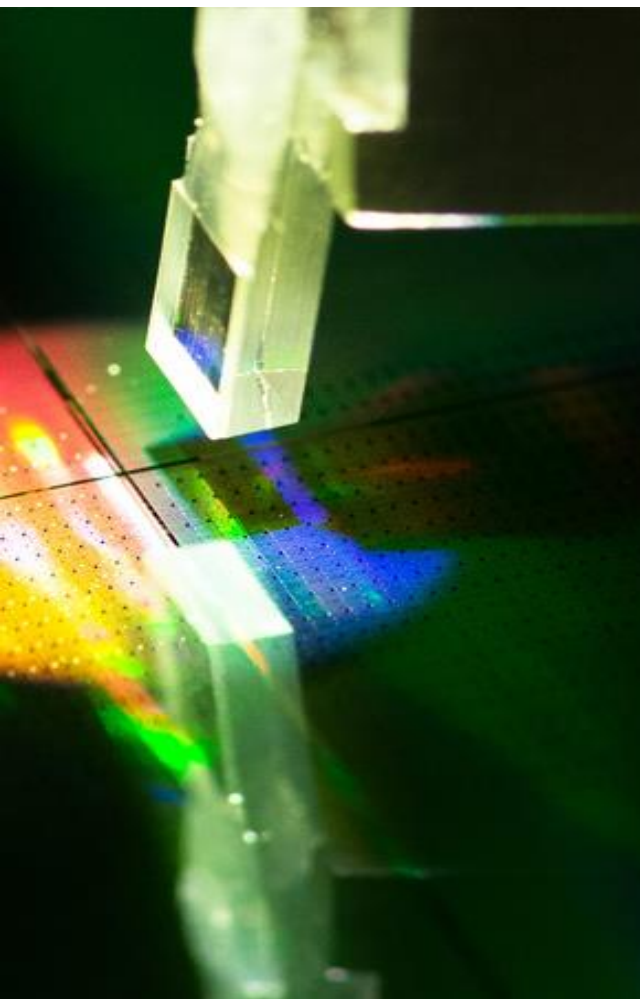
The Imperative for Optics in the Rack



- **Hyperscale and HPC will be first adopters** of new low-cost photonic solution beginning in 2020
- **Enterprise market will begin adopting in 2021**, with some segments lagging

PHOTONICS

Harnessing the power of light



HPE PRODUCTS ENABLED BY PHOTONICS HARDWARE

Data Center Scale

- Remove switch tiers
- Existing data centers
- Hyperscale and Co-lo



Advantages

- Lower cost
- Higher performance

HPC Solutions

- Rack/Row scale connectivity
- Very high internode bandwidth
- Accelerators, memory, etc.



Advantages

- Higher performance
- Better performance/cost

Smart IO & Composable Fabric

- Rack-scale composability
- Integrated Plexxi technology
- Higher performance/bandwidth
- Big data configs with NVMe



Advantages

- Richer configurations
- Better performance/cost

Memory-Driven Computing & Gen-Z

- Supports modules
- Copper to optical



Advantages

- Richer configurations
- Better performance/cost

Telco & Aruba

- Optical product line
- Enterprise-focused
- Robust feature set



Advantages

- Latest technology
- Better performance/cost

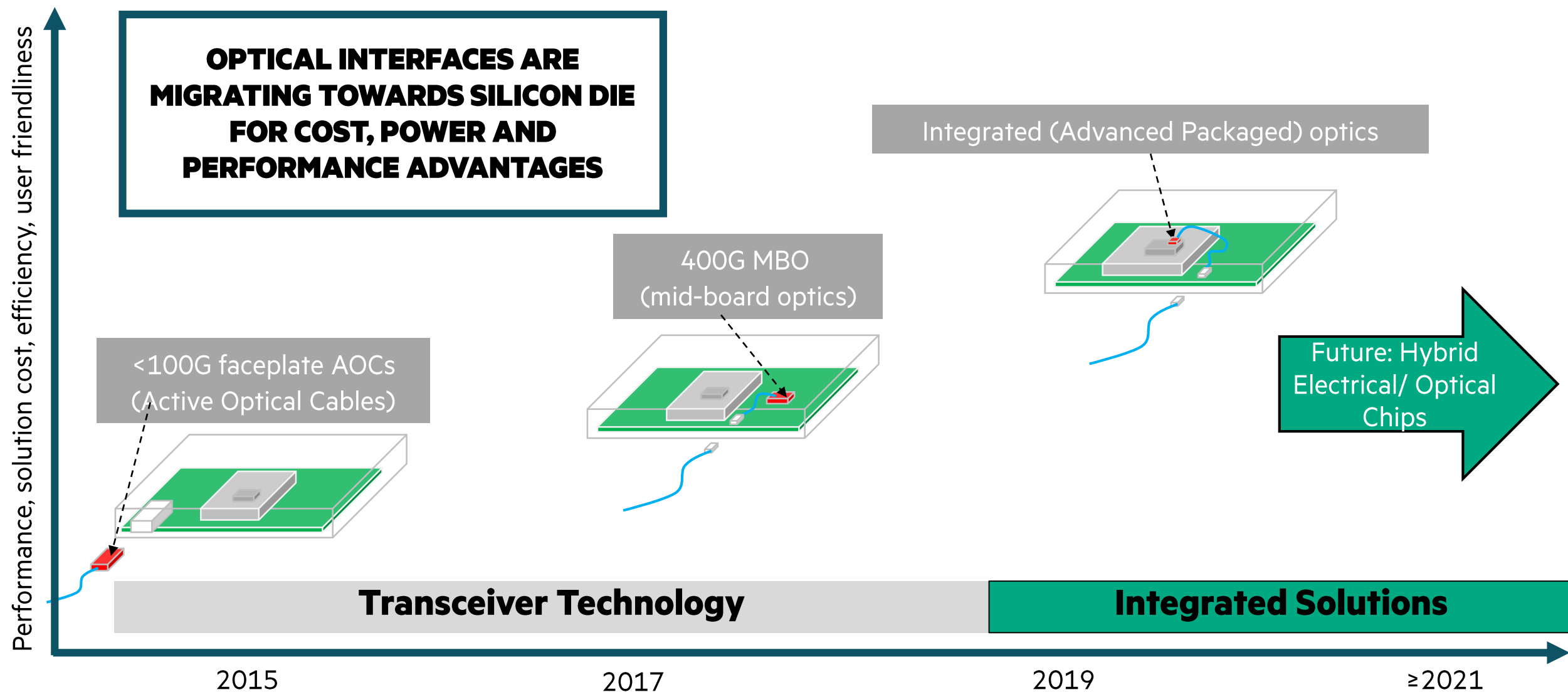


Data Center Scale



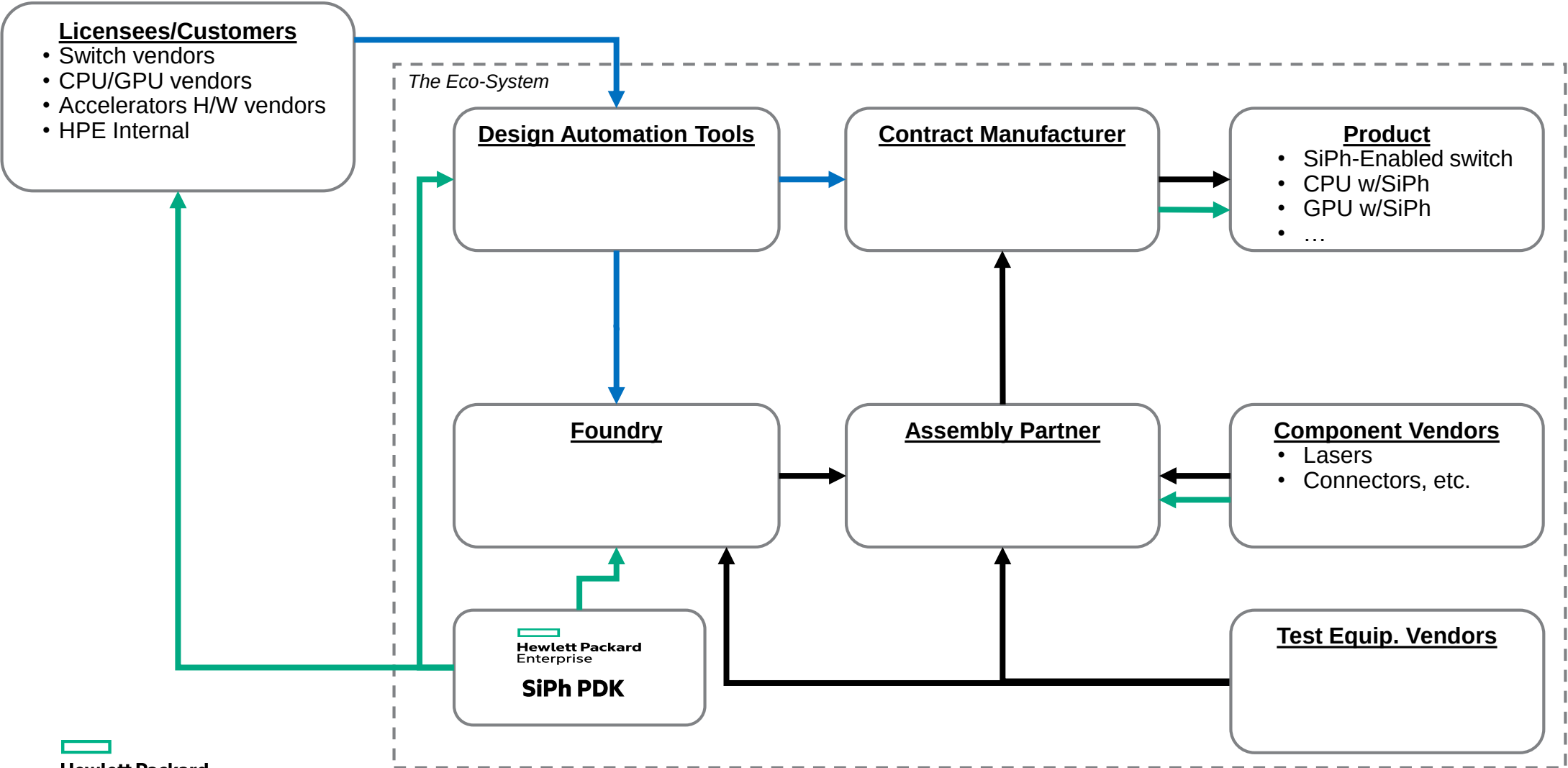
Rack Scale

TRANSITION TO CO-PACKAGED PHOTONICS

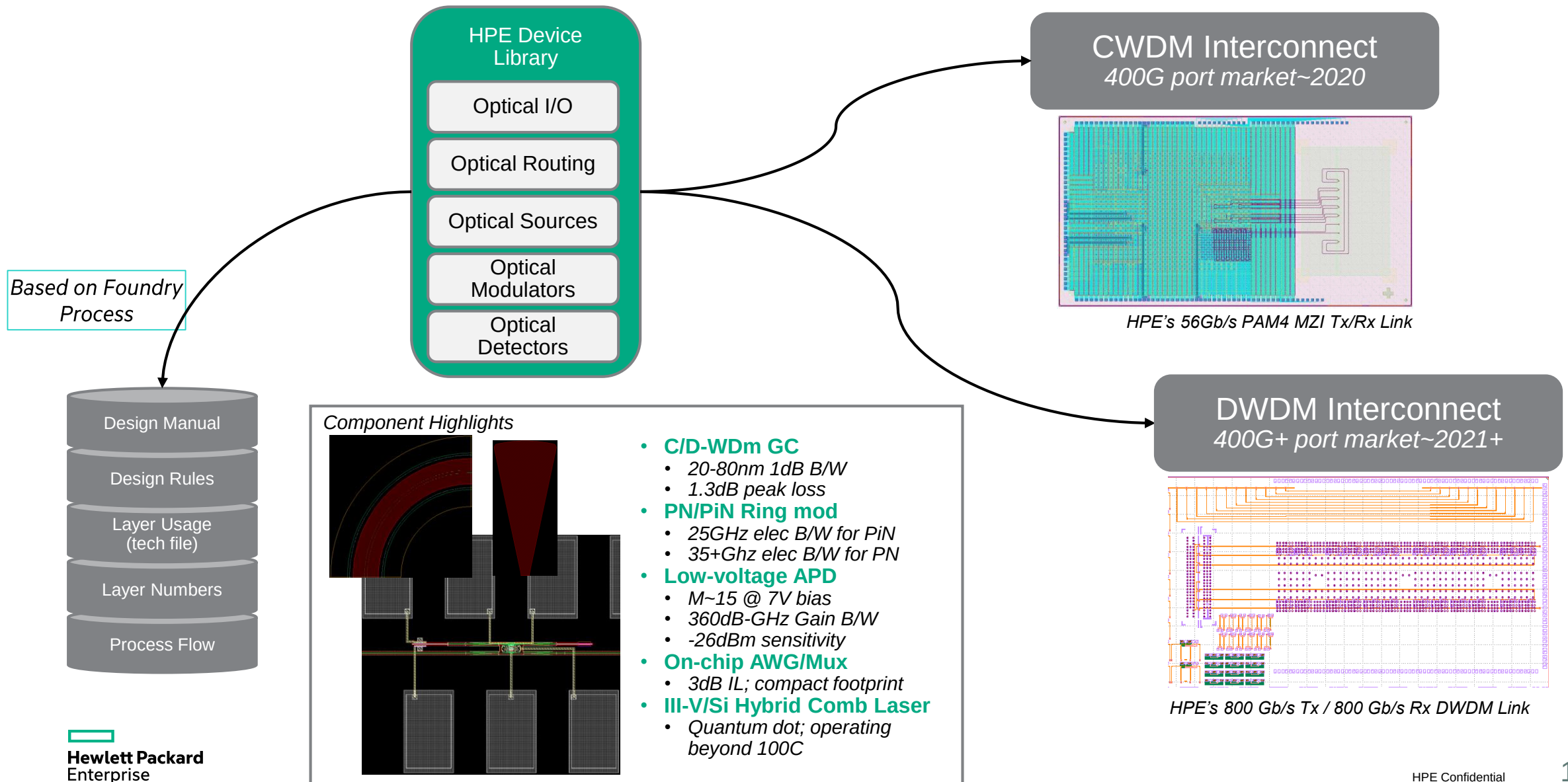


HORIZONTAL SILICON PHOTONICS ECO-SYSTEM

OPEN ACCESS TO ECO-SYSTEM



PDK MARKET ALIGNMENT



PACKAGING SOLUTION & CHIP HIGHLIGHTS

- **Highly Parallelizable Interconnect**

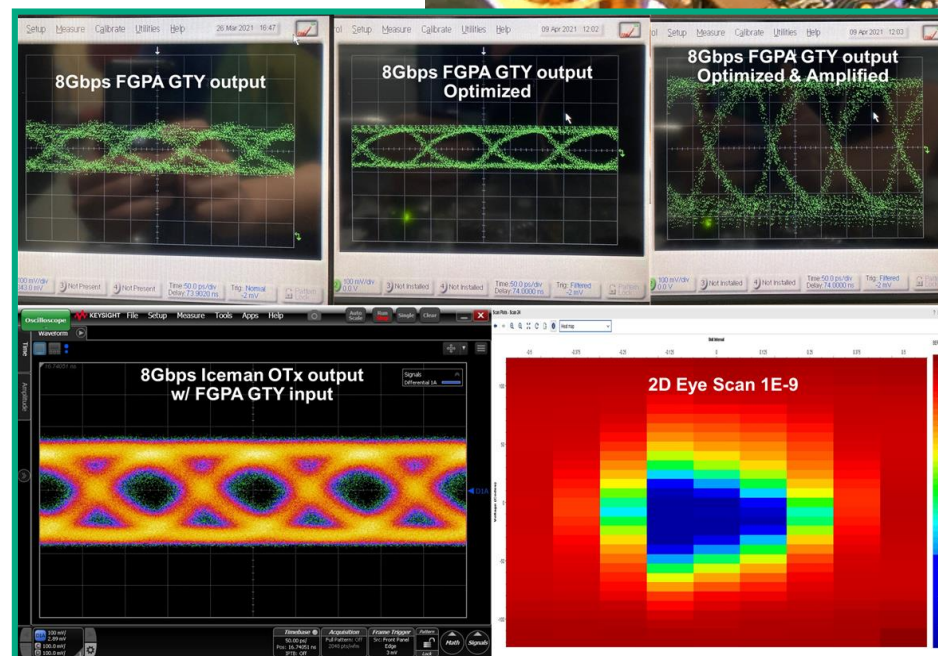
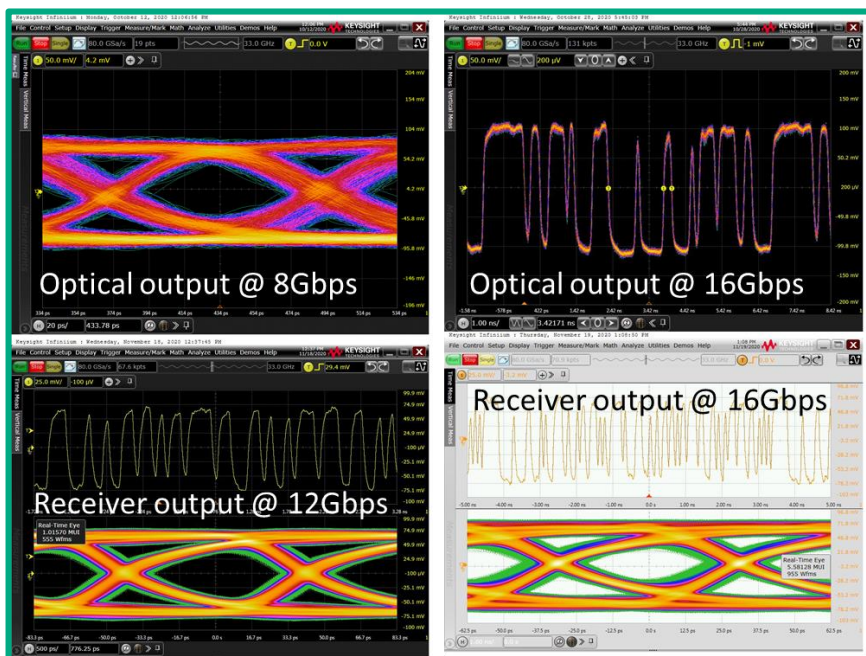
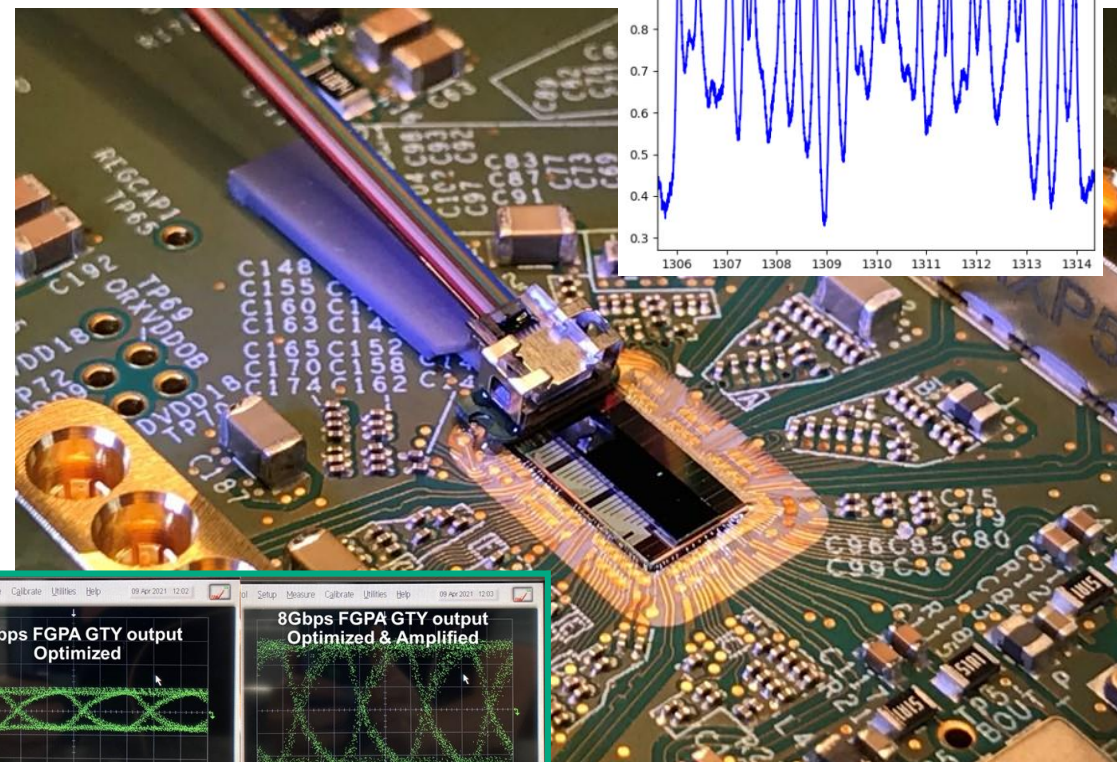
- Software-defined bandwidth per fiber enabled by on-chip wavelength routing

- **Dense 3D Packaging**

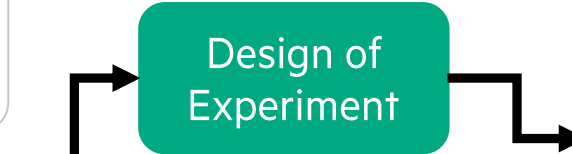
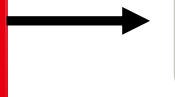
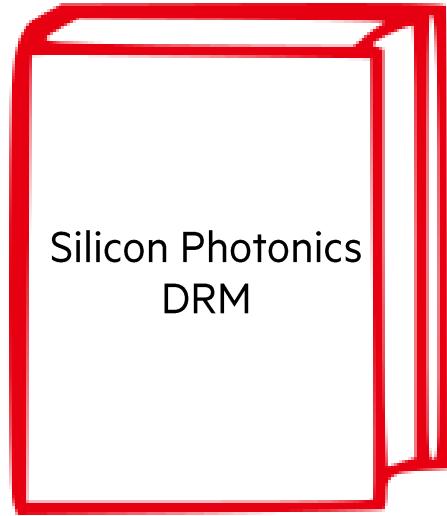
- Eases ASIC floorplan restrictions by allowing I/O where the data is generated, not at chip edge
- TSVs will remove need for wire bonds

- **Connectorized Fiber to Chip solution**

- Avoid fiber pigtail, reducing cost
- Non-permanent solution enables replacement of O/E tile
- Various optical engine, modulator options also enable compatibility w/external vendor hardware

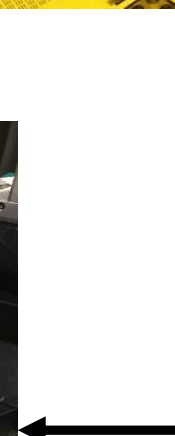
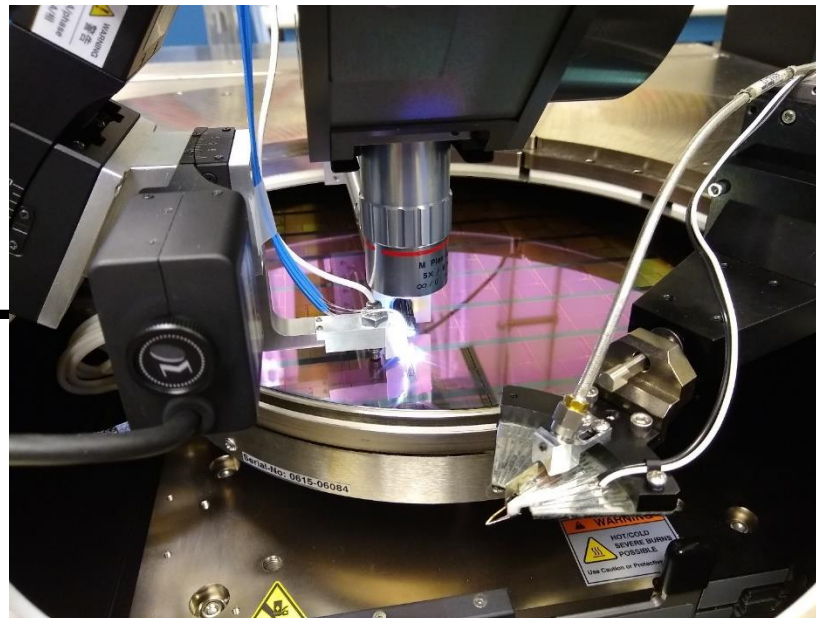


SILICON PHOTONICS PDK DEVELOPMENT

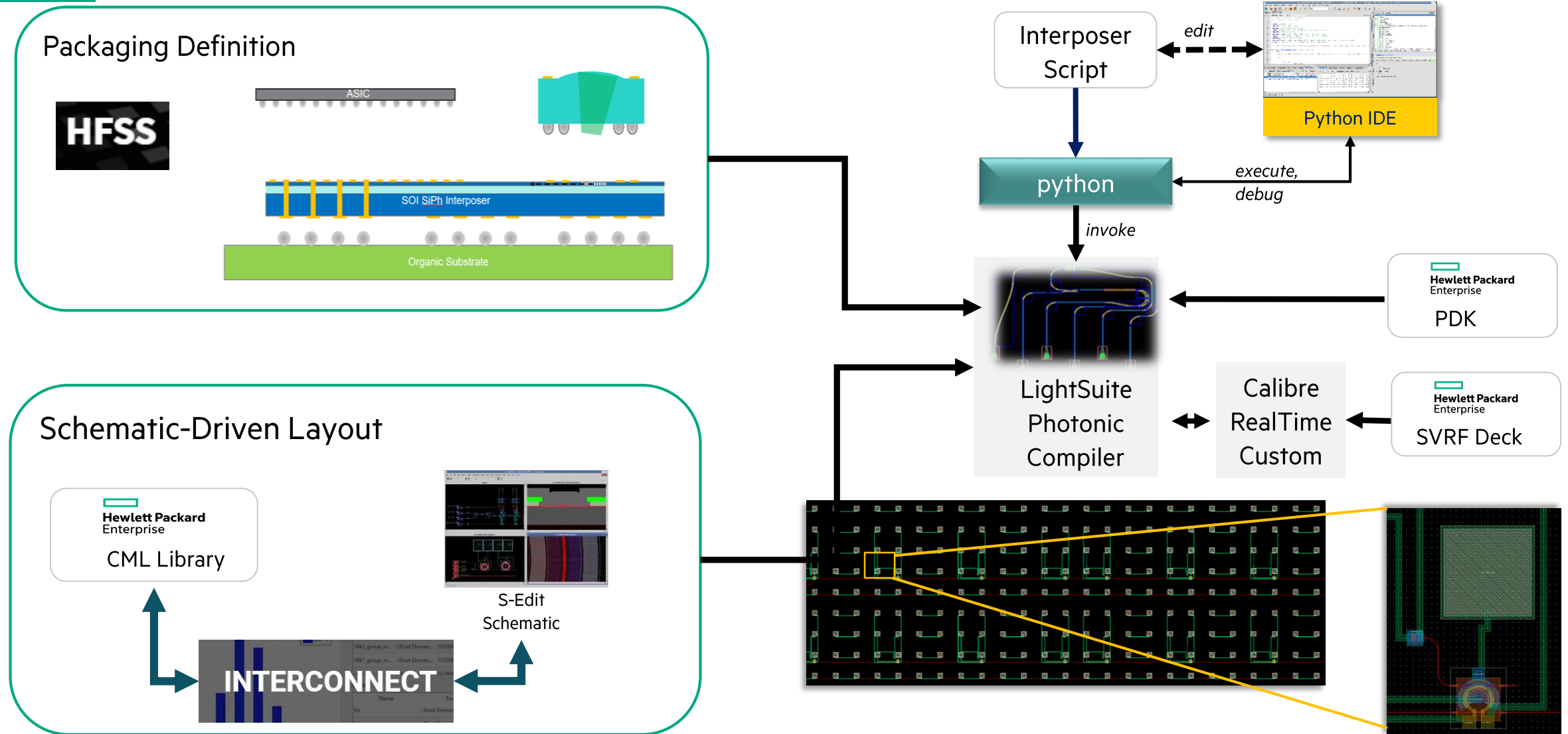


Silicon Photonics Foundry

Automated Wafer Level Test



AUTOMATED DESIGN FLOW AND THE NEED FOR CO-SIMULATION



IN CONCLUSION

- Photonics is critical to meet future system demands
- Horizontal business model enables access to silicon photonics eco-system in a similar fashion to traditional electronics
- HPE Silicon Photonics PDK poised to enable energy-efficient and cost-effective co-packaged solutions
- Eco-system of partners enables a robust, competitive market to reduce operating expense for all



Let's Collaborate!

Hewlett Packard Labs' R&D interests in EU:
Photonics, AI & quantum computing

Looking for consortium partners and EU funding opportunities!

HORIZON-CL4-2021-DIGITAL-EMERGING-01-06

HORIZON-CL4-2021-DIGITAL-EMERGING-01-07

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THANK YOU

