

Title : Heterogeneous Integration Roadmap's (HIR) Integrated Photonics Technical Working Group update

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The Heterogeneous Integration Roadmap (HIR) includes twenty-two technical working groups that span a wide range of topics within the heterogeneous integration effort. Its annual meeting, which was held in the form of a symposium in Santa Clara, California, has recently concluded on February the 20<sup>th</sup>. Integrated Photonics is one of the notable technical working groups within HIR, represented in the roadmap within the Photonics technical working group (TWG). This article covers the scope of this working group and its planned activities for this year.

Packaged photonics devices cover a vast field of components spanning from components such as laser diodes, light emitting diodes and topological sensors, to circuits including photonic integrated circuits for camera modules, LIDARS and pluggable transceivers just to name a few. There are many unique thermal, electrical and mechanical characteristics which will require specialized materials, purpose-specific packaging, testing and supply chain integration to address upcoming market needs. For instance, for datacenter application, it is envisaged that a migration to 400G pluggable optical transceiver modules is planned for this year with 800G speeds using a QSFP form factor planned shortly after.

The Photonics technical group is comprised of a group of volunteers from industry and academia as well as national labs. Their expertise span the full range of optics as discussed above, spanning devices, systems, test, design, materials and emerging trends. Some of the topics which constituted the highlights of the technical working group presentations in the annual symposium included solutions pertinent to high performance computing, optical interconnects for electronic chips as well as data centre applications. For example power consumption and thermal management challenges were highlighted as key challenges to be addressed in the near future.

The TWG takes a view with three timescales; 5, 10 and 15 year horizons. For these horizons, important questions are addressed. Examples include: what are the optimum test vectors associated with the optical components and circuits, before and after heterogeneous integration given the disparity in the nature of components and their total count in photonic versus electronic integrated circuits. In addition, given the difference in operating temperature and the temperature-swing sensitivity associated with some photonic devices, when compared to their electronic counterparts, the questions associated with the thermal management of photonic circuits is a topic of immense interest that is being addressed within the TWG. Important questions about the bandwidth density, viable switchover between electronic to optical interconnects on the board and multi-chip module levels are also topics of massive activity within the TWG, given the challenges associated with progressing beyond 112 Gbps line speeds in the electronic domain.

A domain of applications, where photonics is poised to play a unique enabling role is in data path switching around data centres. While all-optical transparent switches are a remarkable target sought by the industry, it is speculated not likely to be ready for deployment, in a viable form-factor and power consumption on a medium time scale. It is apparent that a likely route of progress will involve photonics technologies gradually being incorporated into the switching fabric, while maintaining electronic signal

processing. The time scales over which this phased introduction of photonics into the switch matrix is also a topic of active studies within the TWG.

The integrated photonics technology working group typically meet once every month to discuss on various segments of the chapters. Its work is at a level of pre-competitive collaboration between all industry participants/leaders in an effort to guide the technology progression in this field. HIR integrated photonics working group is seeking out industry leader as volunteer participants towards preparation of the HIR 2020 edition. If you are interested and would like to contribute, please reach out to Amr, who serves as Co-Chair of the working group for more details.

[Integrated Photonics HIR Chapter](#)