INNOVATIONS FOR THE NEXT ERA OF CONNECTIVITY

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INNOVATION IN END-TO-END CONNECTIVITY
Forecasts are an amalgamation of analyst data and Intel analysis, based upon current expectations and available information, and are subject to change without notice. Silicon Photonics includes 100G+ links in the data center. Ethernet Switch Silicon TAM is not included in Connectivity chart (is included in Network Logic Silicon TAM).
CRITICALITY OF CONNECTIVITY TO COMPUTE

CONNECTIVITY DEFINES PERFORMANCE AT SCALE
- Improves Compute Performance, Efficiency & Scale
- Enables Storage & Accelerator Pools
- Enforces Platform Policy & Security
- Enables Warehouse → Global-scale Compute

SILICON PHOTONICS ENABLES SCALE
- Spans Increasing Distance @ Increasing Speed

SMARTNIC ACCELERATES INFRASTRUCTURE WORKLOADS
- Network, Storage, Security

INTERCONNECT: MODULES & CABLES

SWITCH: TOP OF RACK

NIC: HOST-FABRIC INTERFACE

NIC, SERVER
CRITICALITY OF CONNECTIVITY TO SCALE

EXPOENTIAL DATA GROWTH → FABRIC INNOVATIONS

Source: IDC

CONNECTIVITY GROWING SUPER-LINEARLY TO SUPPORT SCALE OUT OF COMPUTE & STORAGE

PER DATA CENTER... GROWTH '15-'18

- SERVERS 10X
- SWITCHES >15X
- OPTICAL TRANSCEIVERS >30X

INNOVATION IS REQUIRED

1 Source: Intel estimates of connectivity growth in hyper-scale cloud datacenters
#IntelDCISummit
DATA CENTER NETWORK INFLECTIONS: HOW WE WIN

**Infrastructure Acceleration Improves Performance**

*Strategy: Deliver Intelligent Platform Acceleration*
- Performance-Optimized Solutions
- Deliver Flexible Platform

**Cloud Scale: The Big Get Bigger**

*Strategy: Pioneer Next-gen Connectivity*
- Co-innovate with Cloud
- Next Gen Product Collaboration

**Critical Workloads Evolve the Network**

*Strategy: Offer End-to-End Solutions*
- Optimize Connectivity Solutions for AI, Storage
- Optical IO Integration

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INTEL’S CONNECTIVITY PORTFOLIO

INTEL® ETHERNET
30+ YEAR LEADERSHIP

INTEL® SILICON PHOTONICS
LIGHTING UP SILICON

INTEL® OMNI-PATH FABRICS
LEADING HPC FABRICS

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Intel® Ethernet Portfolio & Intel® PACs

1. Source: #1 in server Ethernet Controller and Adapter revenue MSS. Dell'Oro Research CA01A_Expanded_Controller_and_Adapter_Report_1Q18. “Intel remained the clear leader in the 10 Gbps controller and adapter market, posting all-time-highs of 80% share in port shipments.”

Foundational NICs
- Broad Portfolio
  - 1GbE – 100GbE
- 30+ Years of Leadership
- #1 MSS

New! SmartNICs
- Infrastructure Acceleration
- Fully Validated Solution Packages
- Highly Programmable

Programmable Acceleration Cards
- Versatile, Multi-Function Acceleration
- Intel-FPGA Based
- Fully Programmable

Leading Portfolio of Intelligent, Configurable Networking Products
NEW INTEL – SMARTNIC PRODUCT FAMILY

Improved TCO and System Performance for Comms and Cloud Service Providers

**Using Foundational NICs**

**Using SmartNICs**

**Cascade Glacier**

**Intel Leadership**

**Industry First**
World's First SmartNIC that Supports VM Live Migration Without Special Drivers¹

**Highly Efficient**
Minimizes CPU core Usage With Full Open vSwitch Acceleration On SmartNIC²

**Programmability with Ease of Deployment**
Unique Validated Solution Packages for Infrastructure Acceleration with Intel's Leading FPGAs

**Cascade Glacier**
Sampling Now 2x25GbE Today 100GbE In Future

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¹ Intel provides industry’s only hardware-based VirtIO support
² Based on Intel lab data for full OVS offload including fast path and slow path

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INTEL® SILICON PHOTONICS: OPTICS AT SILICON SCALE

SILICON INTEGRATION
Integrated Optics, Enabled by Intel's Hybrid Laser Technology

SILICON MANUFACTURING
Advanced CMOS Mfg Process at Intel Fabs On 300mm Wafers

SILICON SCALE
Automated On-wafer Optical, Electrical, and High-speed Test

DIFFERENTIATED SOLUTION THROUGH HYBRID LASER APPROACH

Intel® Silicon Photonics: optics at silicon scale
Integrated Optics, Enabled by Intel’s Hybrid Laser Technology
Advanced CMOS Mfg Process at Intel Fabs On 300mm Wafers
Automated On-wafer Optical, Electrical, and High-speed Test

InP
Si

Differentiated solution through hybrid laser approach
INTEL® SILICON PHOTONICS – LIGHTING UP INTEL SILICON

INTERCONNECT: MODULES & CABLES

ENABLING SCALE
Spans Increasing Distance at Increasing Speed
Integrated Optics + Intel Hybrid Laser = High Volume

SWITCH: TOP OF RACK

GAINING MOMENTUM
Ramped Hyper-scale Cloud
Demonstrated 400G
Winning Awards
New 5G Product

NIC: HOST-FABRIC INTERFACE

IN VOLUME PRODUCTION WITH MILLION+ UNIT RUN RATE

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DATA-CENTRIC INNOVATION SUMMIT
INTEL® SILICON PHOTONICS – NEW GROWTH BUSINESS
SILICON-BASED PHOTONIC PLATFORM MANUFACTURED BY INTEL

IN PRODUCTION AT CLOUD SCALE
100G Optical Module Portfolio

LIGHTING UP INTEL SILICON
Highly-integrated Photonics
Co-packaged with Logic Silicon
Reduces Power, Costs & Complexity
Increases Density

OFFERS SIGNIFICANT GROWTH FOR DCG
~$7B Datacenter TAM in 2022

Source: 1. Based on measurements of Intel Silicon Photonics vs traditional optics “gold box” products
2. 2018 Intel estimates based in part on Dell’Oro, Crehan and Lightcounting 2018 reports

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INTEL® OMNI-PATH ARCHITECTURE MARKET SUCCESS

END-TO-END HPC FABRIC SOLUTION
Silicon, Systems, Software

DEPLOYED IN ALL REGIONS & ALL SEGMENTS
Supercomputers
Artificial Intelligence
HPC Cloud
Traditional HPC
Enterprise R&D

TOP500 MOMENTUM
Record # of Systems / FLOPS
Up ~36% In Total FLOPs Since Nov ’17
50% 100Gb Nodes
18% of Top100 Systems
27% of Top100 Green Systems

Source: Top500.org June ’18

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SUMMARY: CONNECTIVITY IS CRITICAL TO COMPUTE

CONNECTIVITY UNLEASHES THE POWER OF COMPUTE AT SCALE

CONNECTIVITY IS AN $11B+ DATACENTER OPPORTUNITY

SMARTNICS AND SILICON PHOTONICS REVOLUTIONIZE NETWORK EFFICIENCY

INTEL’S E2E CONNECTIVITY PORTFOLIO LEADS THE INDUSTRY

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