



OCP Engineering Workshop - Telco

OCP U.S. SUMMIT 2016

Low Latency Mobile Edge Computing

Trevor Hiatt

Product Management, IDT

IDT Company Overview

Founded	1980
Workforce	Approximately 1,800 employees
Headquarters	San Jose, California



#1 Serial Switching – 100% 4G Infrastructure with RapidIO

#1 Memory Interface – Industry Leader DDR4

#1 Silicon Timing Devices – Broadest Portfolio

800+ Issued and Pending Patents Worldwide

Mixed-signal application-specific solutions

Agenda

- Network Trends
- RapidIO 20-50 Gbps Technology
- Edge Computing Architectures
- OCP Edge Computing Servers and Scale Out
- Open HPAC Lab for Telco Project



The Network is the Data Center

5G Base Station + Edge Computing Appliance




- RapidIO
- IEEE 1588
- Timing
- RF Products



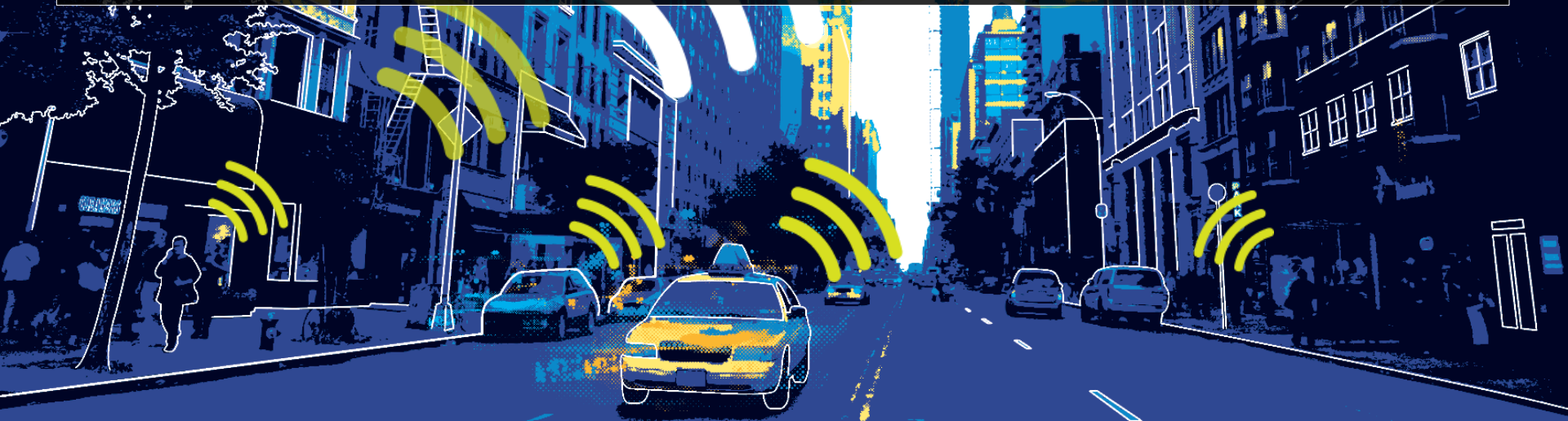
- Memory Interface
- Retimers
- Sensors

Ecommerce
Fleet Management
Semi Autonomous Vehicles
Traffic management

- 
- Low Latency
 - Energy Efficient
 - Analytics Workloads
 - At Network Edge

The Network is the Data Center

**Ubiquitous Computing:
IDT connects, synchronizes, times and makes sense
of the human-and-machine connected world**



Network and Data Center Convergence



Wired and Wireless
Access nodes



Servers/
Analytics

Boosting User Experience by Innovating at the Mobile Network Edge

An Introduction to the new ETSI Industry Specification Group (ISG)
for **Mobile Edge Computing (MEC)**

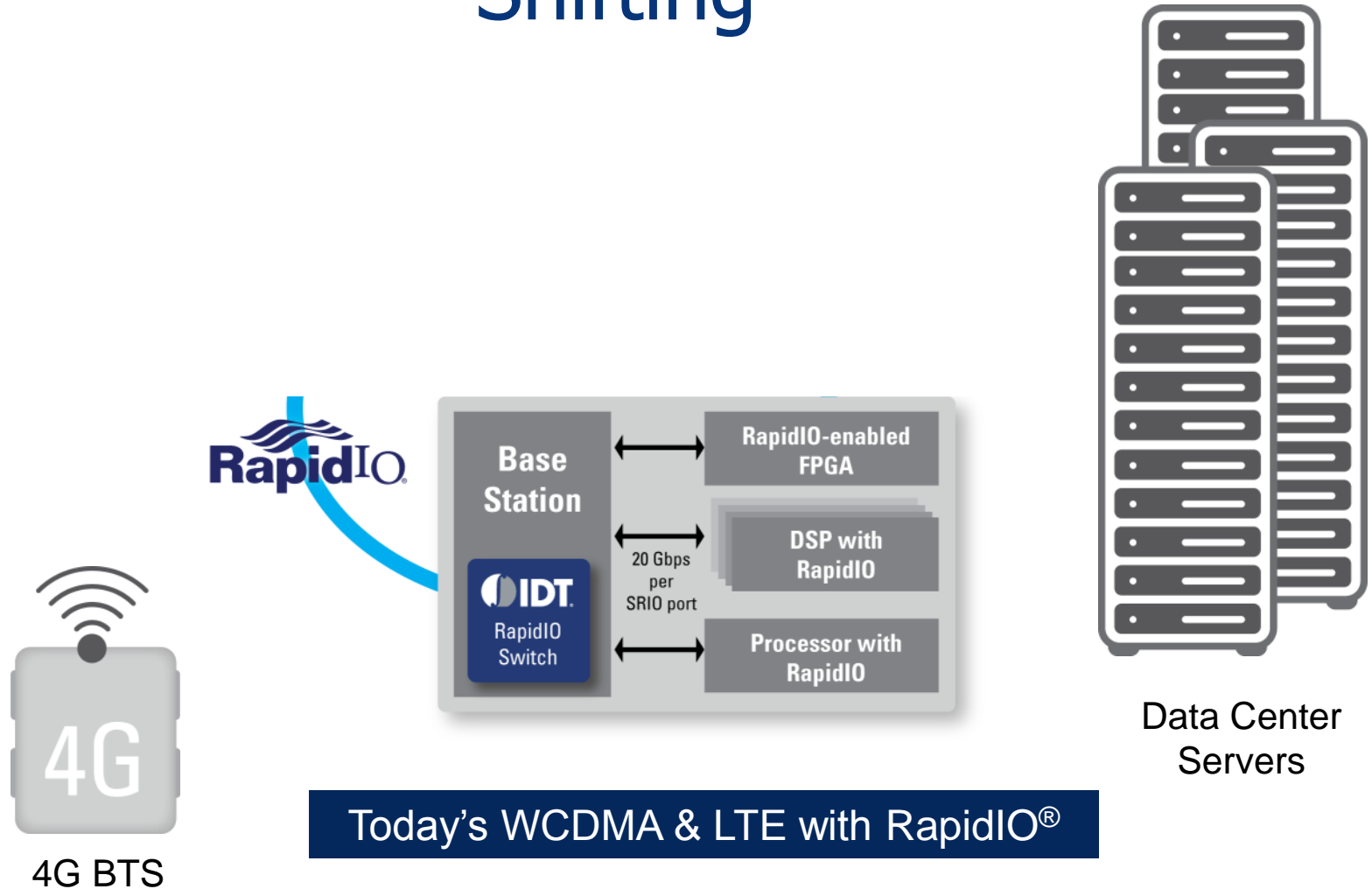


Presented by Dr. Rolf Schuster, Vodafone

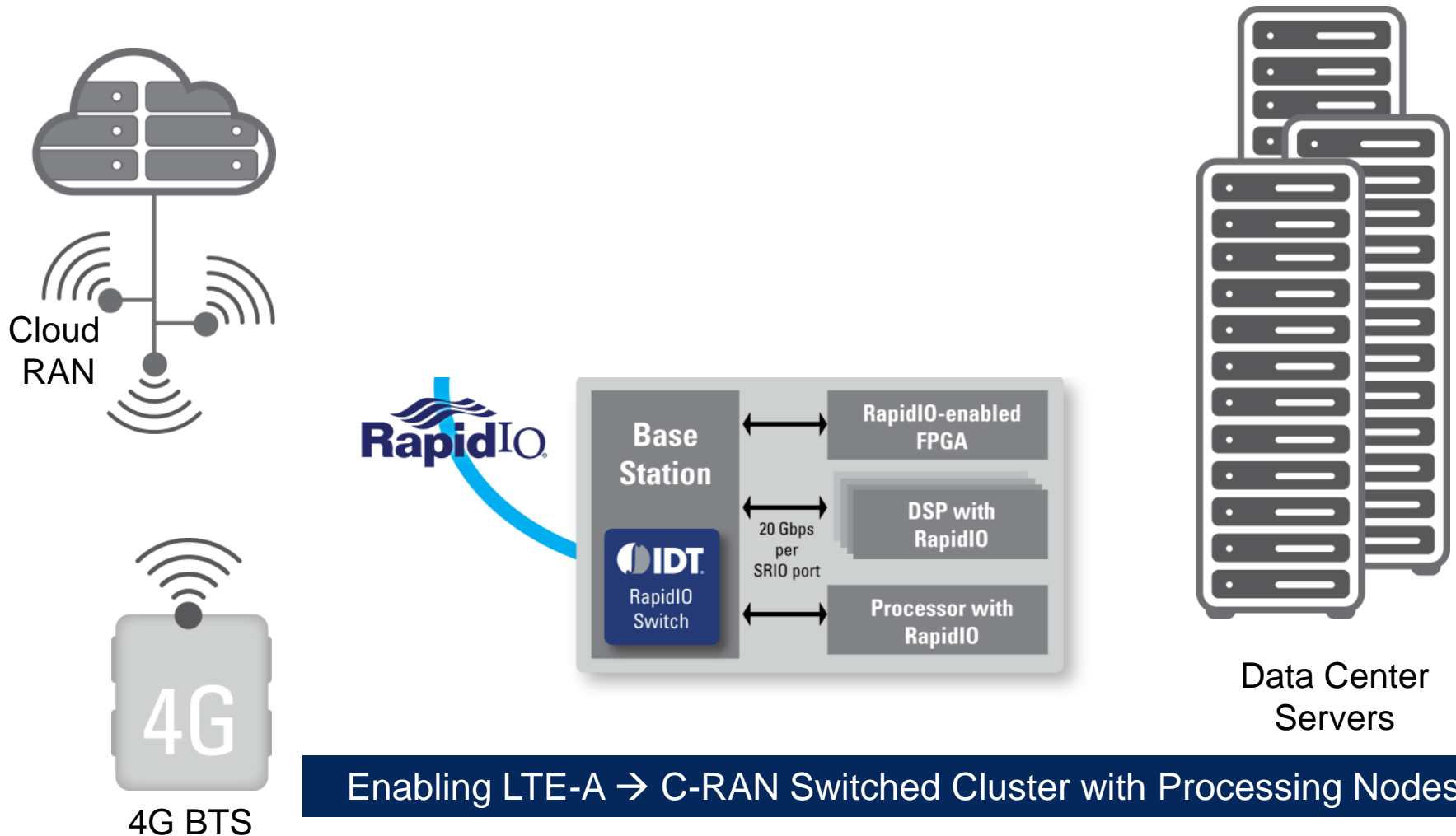
- Apps moving from data center to co-locate with access node (base station or wired access node)
- Supporting real time communication to mobile devices (phones, cars, IOT)
- Tight time synchronization between apps running on distributed servers and in data center
- Need low latency interconnect

Edge Computing an
essential element
of 5G Rollouts

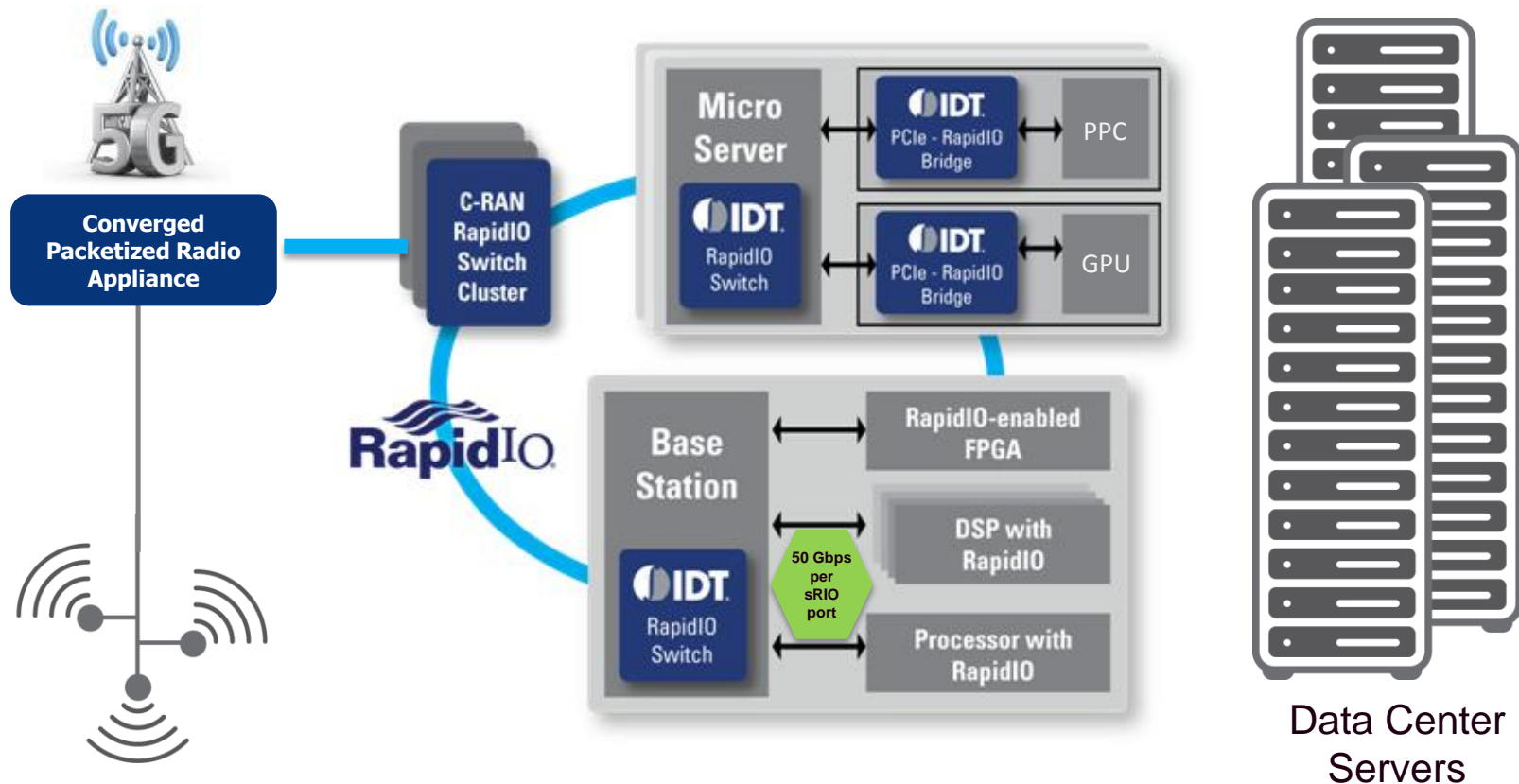
Network Deployment Architecture is Shifting



Cloud Radio Access Network (C-RAN)



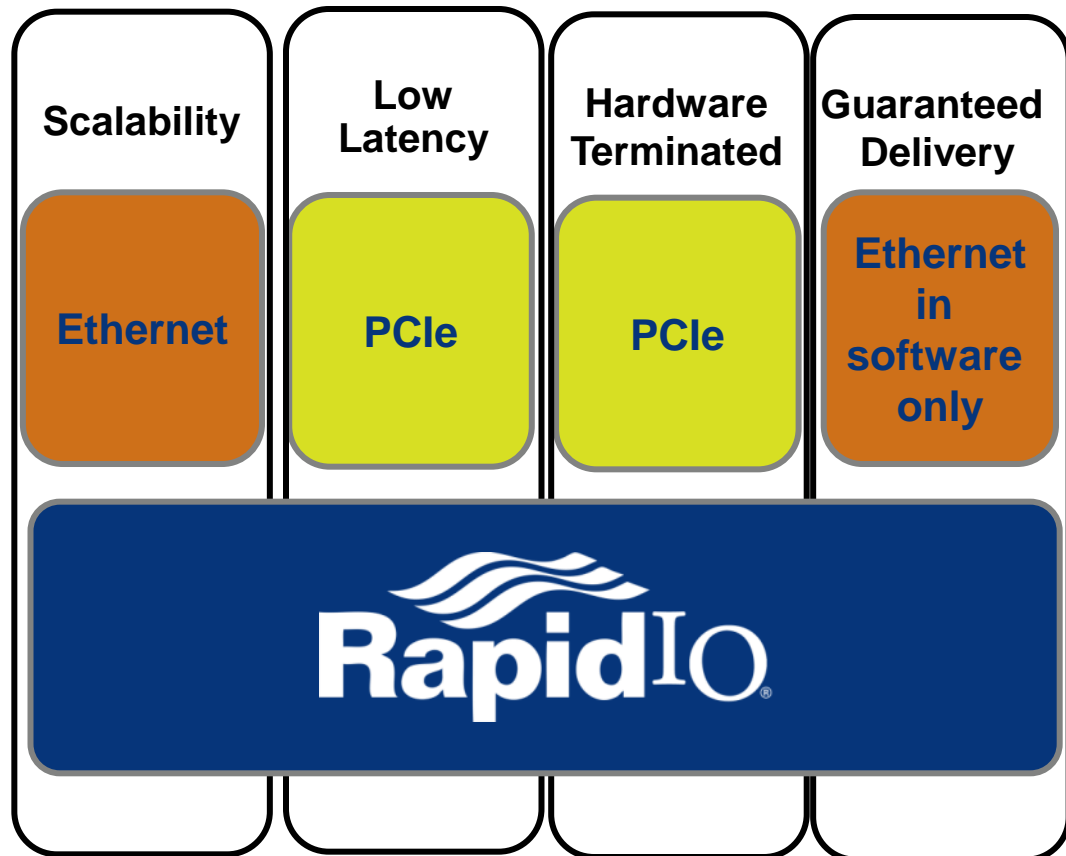
Mobile Edge Computing for 5G networks



Towards 5G/MEC → Co-located CPU and Accelerators

Clustering Fabric Needs

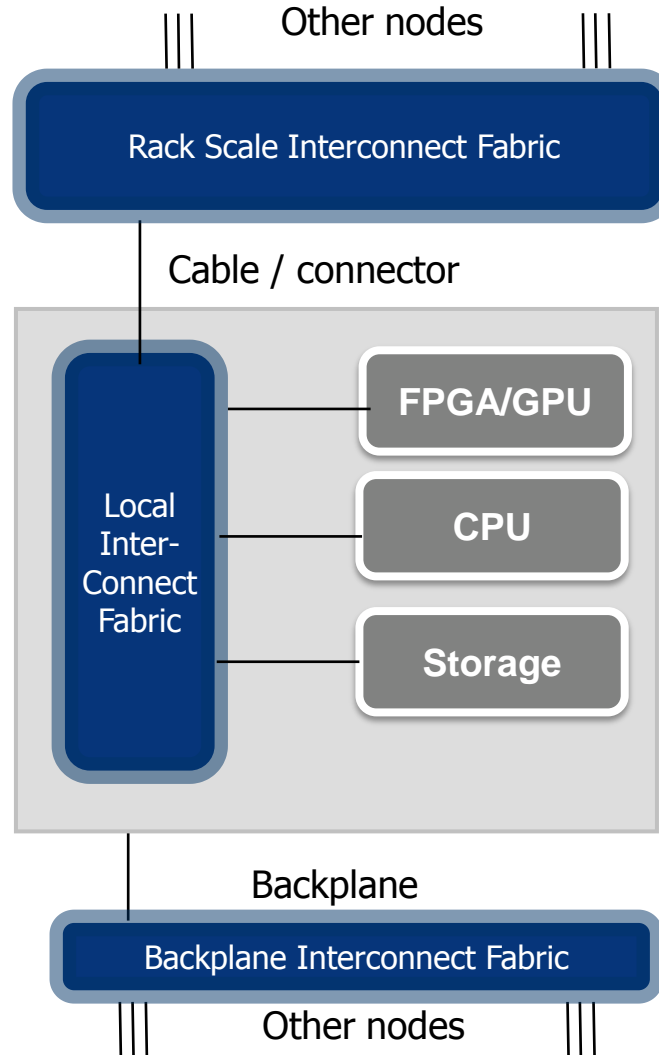
- Lowest Deterministic System Latency
- Scalability
- Peer to Peer / Any Topology
- Embedded Endpoints
- Energy Efficiency
- Cost per performance
- HW Reliability and Determinism



RapidIO Interconnect combines the best attributes of PCIe® and Ethernet in a multi-processor fabric

RapidIO in Edge Computing Appliances

- Heterogeneous compute workloads
- No protocol termination CPU cycles
- Energy efficiency
- 20 to 50 Gbps embedded interconnect
- Mission critical reliability
- Scalable Fat node connect multiple boards in Edge Appliance
- Connect multiple boards at Rack Scale in Central Office or C-RAN
- Push Data Center app use cases into the network



**Flexible Solutions
Appliance → Rack Scale**

RapidIO

Multi-Processor
Embedded Interconnect

Switched | Scalable | Low Latency | Reliable

10 Gbps

20 Gbps

40 Gbps

100+ Gbps

WIRELESS INFRASTRUCTURE | SERVER | HPEC | IMAGING | AEROSPACE | INDUSTRIAL

ANY TOPOLOGY
ANY PROCESSOR
OPEN STANDARD

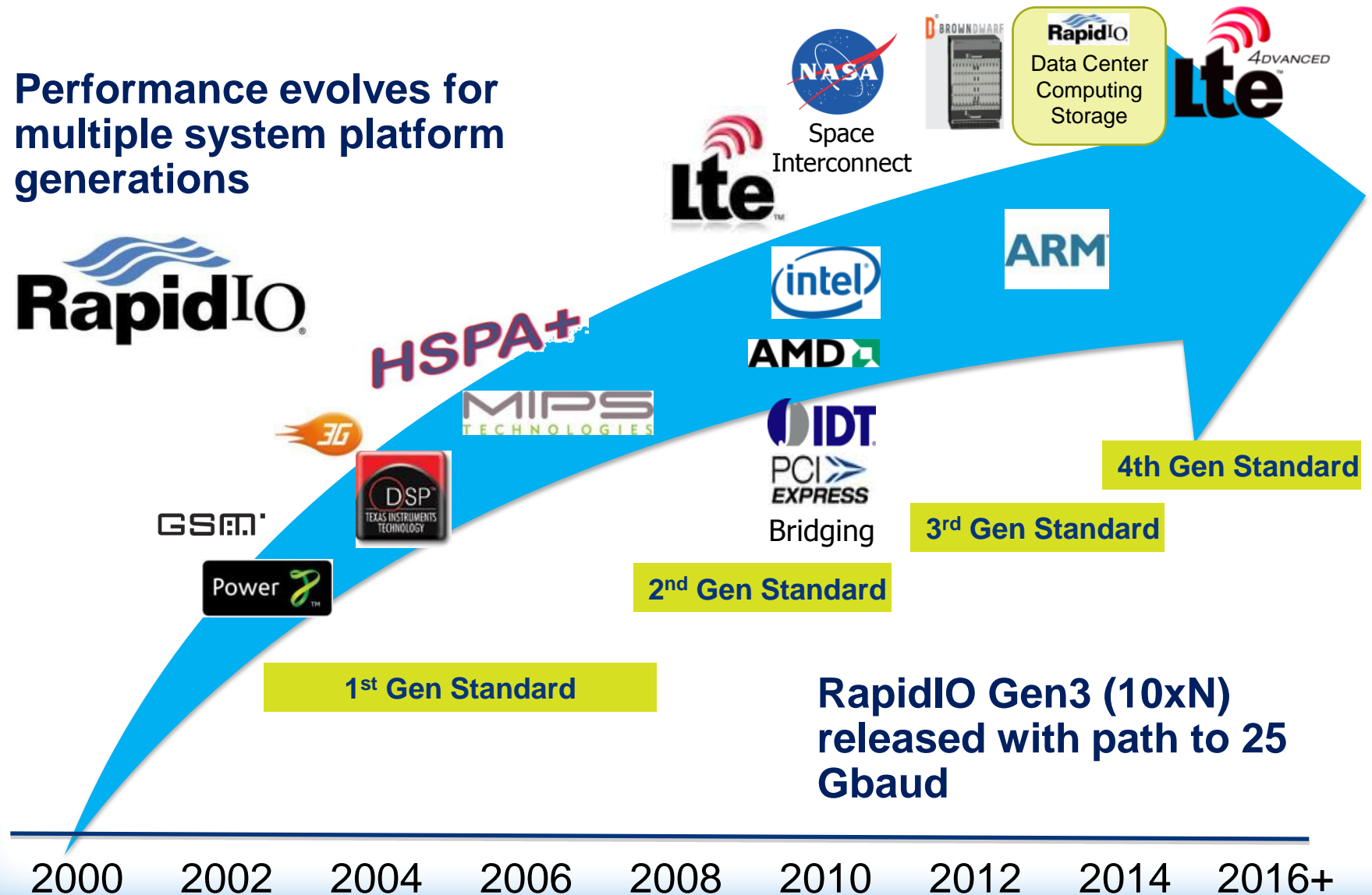
- **10/20/40/50 Gbps per port – 6.25/10/12.5 Gbps lane**
- 100+ Gbps interconnect in definition
- Embedded RapidIO NIC on processors, DSPs, FPGA and ASICs.
- Hardware termination at PHY layer: 3 layer protocol
- Lowest Latency Interconnect ~ 100 ns
- Inherently scales to large system with 1000's of nodes

- **Over 15 million RapidIO switches shipped**
- Over 110 million 10-20 Gbps ports shipped
- **100% 4G interconnect market share**
- 60% 3G, 100% China 3G market share

RapidIO Ecosystem and Market Progression

Performance evolves for multiple system platform generations

RapidIO



IDT Launches Next-Generation RapidIO Switches for 5G Mobile Network Development and Mobile Edge Computing

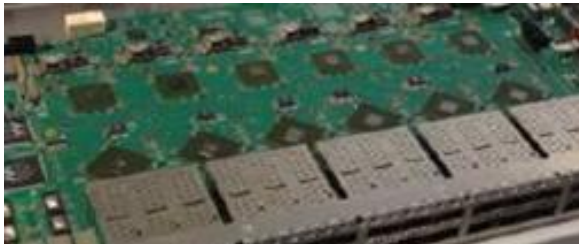
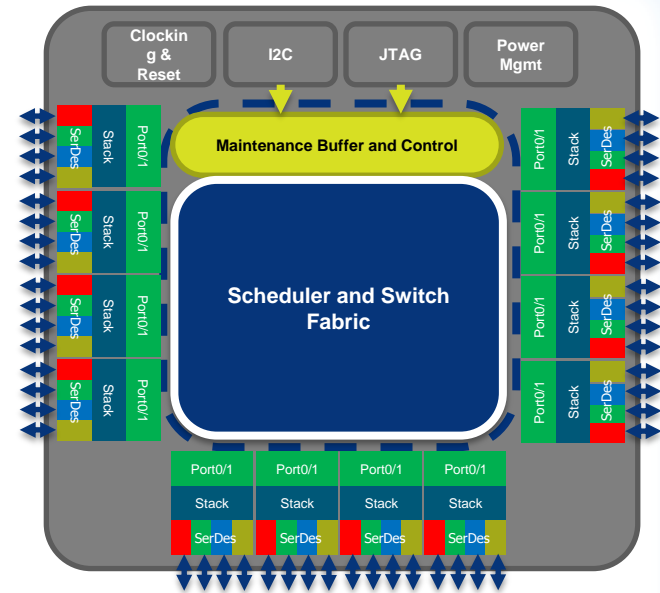
With Over Twice the Performance Used in 4G Systems, the Low-Latency Devices Exceed the RapidIO 10xN Standard and are Ideal for 5G, HPC, and Mobile Edge Computing

Share +1



IDT Launches Next-Generation RapidIO Switches for 5G Mobile Network Development and Mobile Edge Computing

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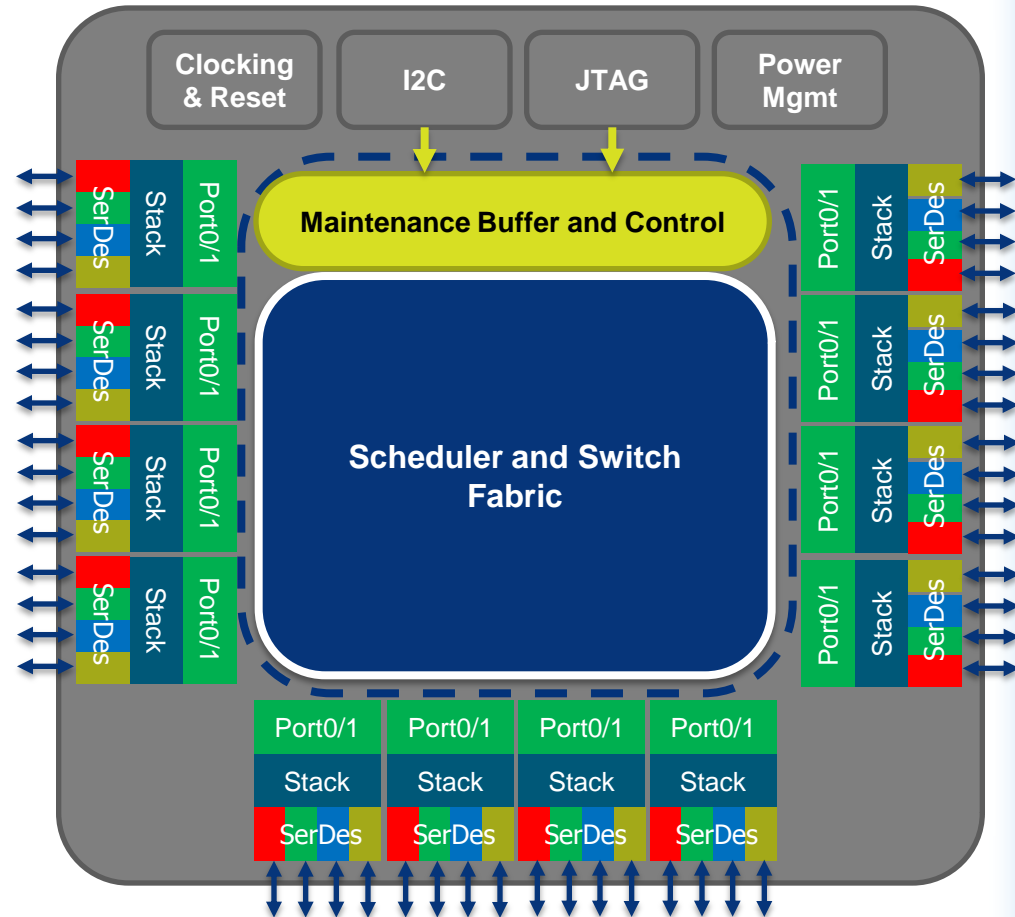
IDT and Prodrive Technologies Partner to Develop 100ns Latency, Energy-Efficient RapidIO Switch Appliance Portfolio

Optimized Top-of-Rack Switches Deliver Scalable Bandwidth—From 750 Gbps to 4.8 Tbps—for 5G, C-RAN, Mobile Edge and High-Performance Computing, Analytics and Financial Trading

Share +1

5G Telco Optimized 100ns 50 Gbps Switch Silicon

- RXS2448
 - 600 Gbps Full-Duplex Serial RapidIO® Switch
 - 50 Gbps per port
 - 33 x 33 mm package
 - 48 lanes at 12.5 Gbps
 - Up to 24 Serial RapidIO Ports
 - RapidIO Specification (Rev 3.2) Compliant
- RXS1632
 - 400 Gbps Full-Duplex Serial RapidIO Switch
 - 50 Gbps per port
 - 29 x 29 mm package
 - 32 lanes at 12.5 Gbps
 - Up to 16 Serial RapidIO Ports
 - RapidIO Specification (Rev 3.2) Compliant



50 Gbps per port | 300mW per 10 Gbps data | 100ns latency

5G Mobile Infrastructure

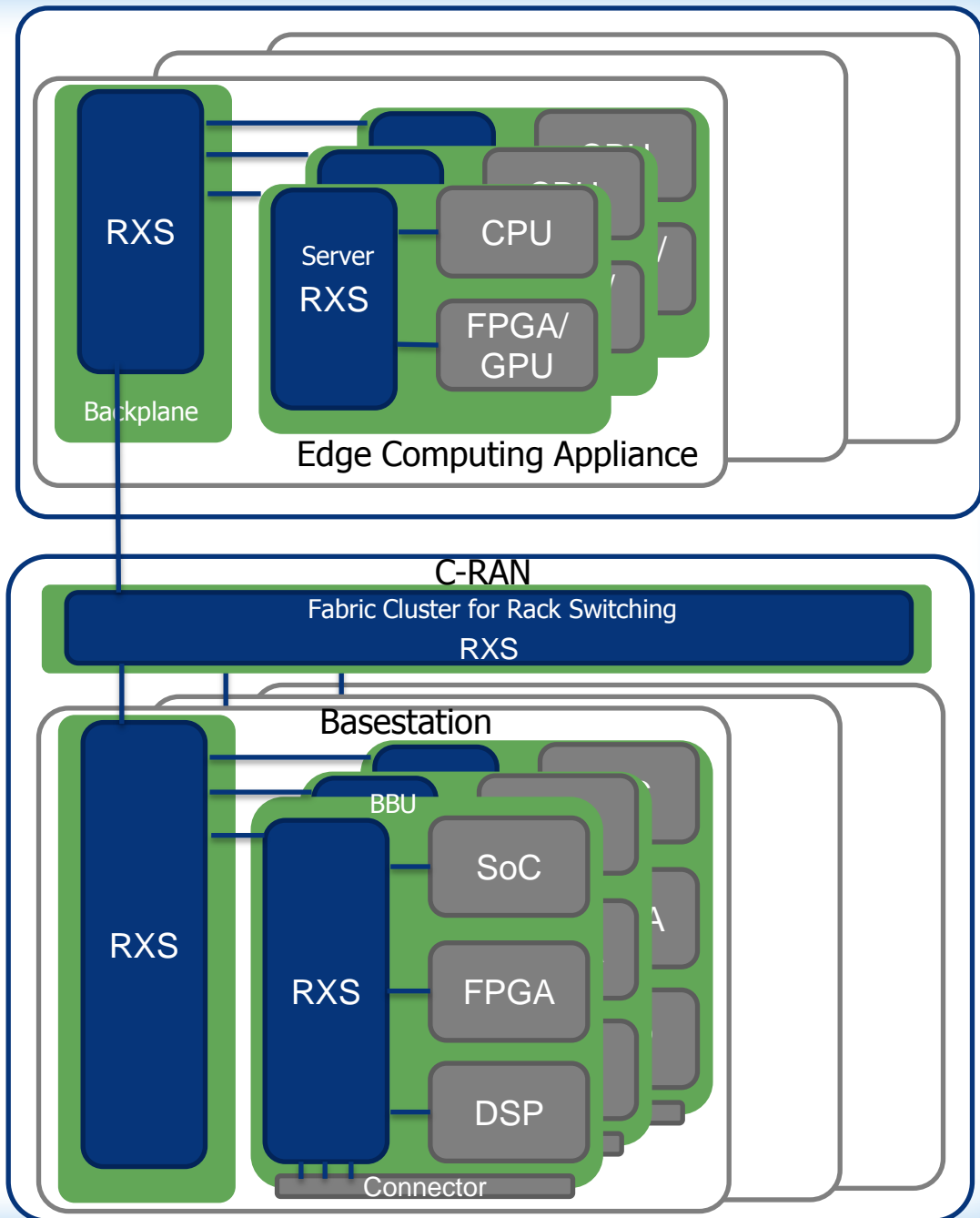
KEY APPLICATIONS

- LTE-A & 5G baseband unit
- Mobile Edge Computing
- Backplane switching
- C-RAN

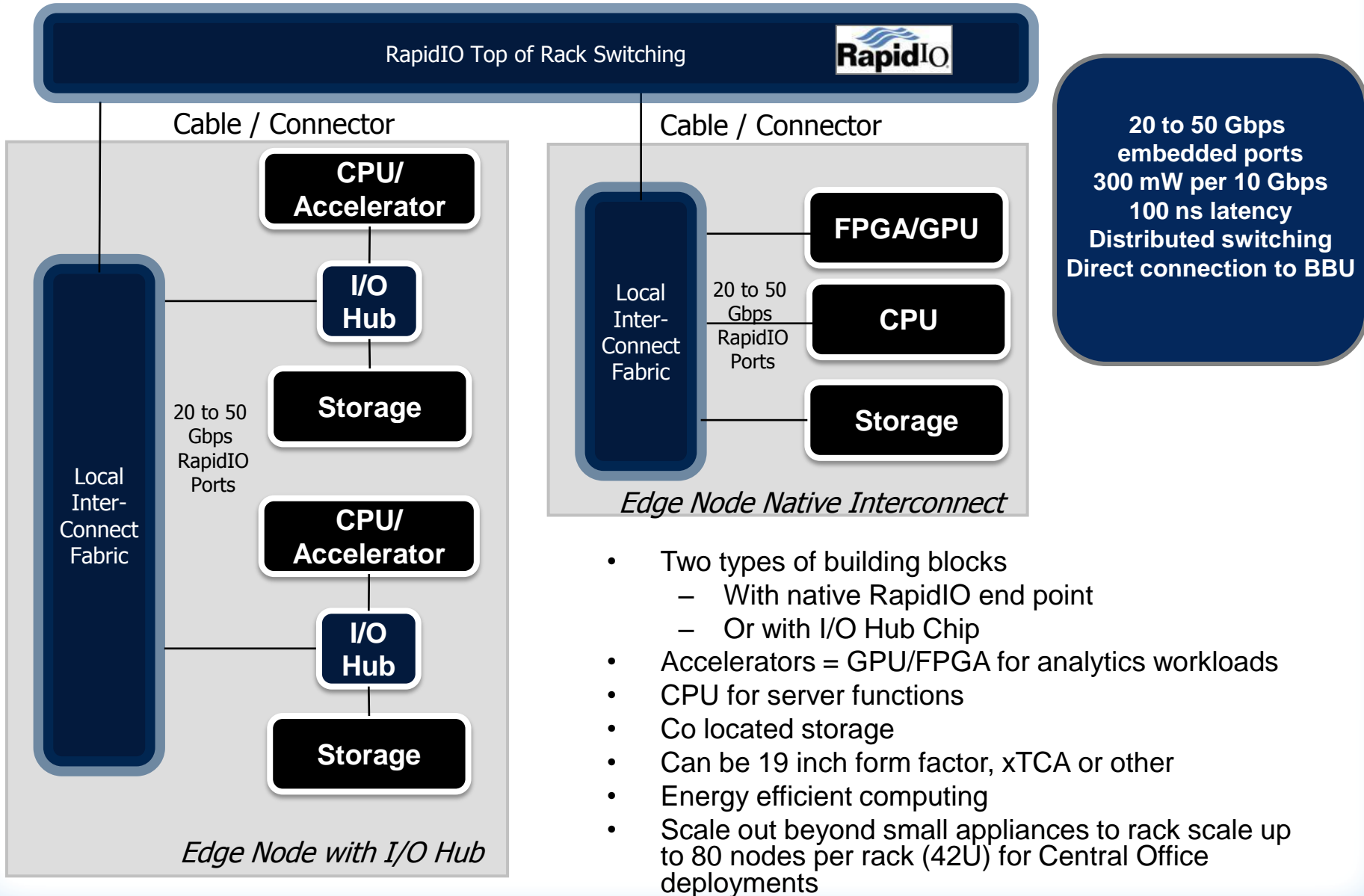
APPLICATION ISSUES SOLVED

- 50 Gbps per port with 95% link utilization
- 100 ns latency
- Power efficient 300 mW per 10 Gbps

**Distributed
low latency switching
Optimized for needs
of OCP Telco Initiatives**

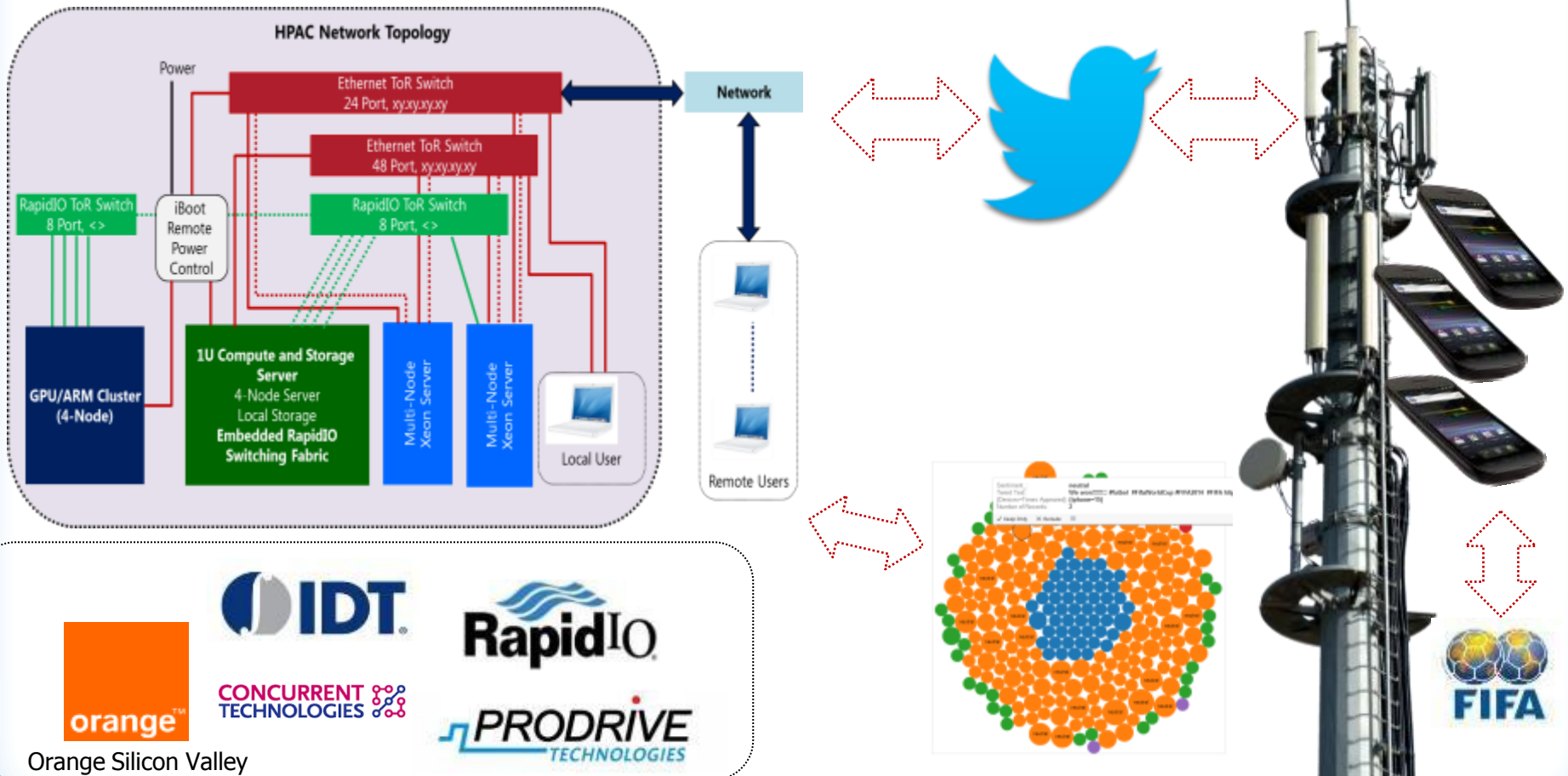


Scalable Low Latency Edge Computing Fat Node



Edge Social Data Analytics

- Analyze User Impressions on World Cup Final 2014 (Germany/Argentina)
 - HPAC Lab project to analyze World Cup 2014 twitter data using Hadoop and visualize using Tableau public on HPAC Platform



5G Lab Germany: Edge Analytics for Autonomous Vehicles

[The Mission](#)[Demos](#)[References](#)[Events](#)[Press Releases](#)[About](#)

Autonomous Vehicle

Video Analytics/Object
Recognition

Deep Learning/Object Analytics



- Network Edge and In Vehicle Analytics
 - Edge Node Multi processor network
 - GPU/x86/ARM/Open Power based Analytics
 - Low latency RapidIO Fabric
 - In vehicle sensor fusion in real time with low latency
 - Leverage OCP Innovations (Edge Appliance and ToR)

Open High Performance Analytics and Computing Lab



- Low latency scalable RapidIO interconnect to accelerate end market usage
- Key focus areas:
 - Hyperscale Cloud Data Center-Based Analytics
 - High-Performance Computing
 - Autonomous Connected Vehicles
 - Wireless 4G advanced, 5G and Mobile Edge Computing
 - Video Analytics
- Project by project contribution model
- Projects completed or in progress
 - Twitter Analytics on FIFA World Cup Finals
 - Supercomputing at the Edge with GPU
 - CERN LHC target acquisition and data center analytics
 - RapidIO ToR switching
 - 5 G Lab Germany: Mobile Edge Computing for 5G wireless networks with connected vehicles

Accelerate Adoption of OCP Solutions
Interest in establishing OCP Telco lab
Contact: Openhpac@idt.com

Analytics Platform for the Edge

Launched at Mobile Edge
Computing Congress
2015 London UK



RapidIO|GPU|x86|FPGA|Power|ARM
Low Latency | Energy Efficient | High Bandwidth

Example User Applications



User
Space

Fabric
Management

Messaging
Events

DMA

High
Performance
Sockets

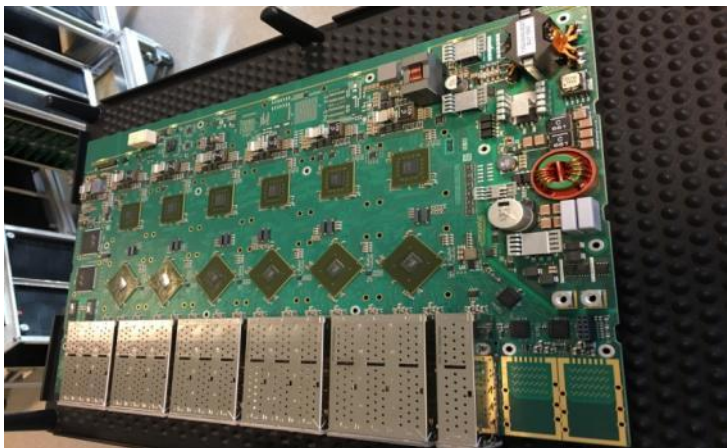
Kernel
Space

Device Drivers

Hardware
(NIC/Switch/SoC)

Contribute to OCP
Telco for Edge Computing
Planned 1H 2016

Proposed: OCP Telco Low Latency Switch for Edge Computing Scale Out



RapidIO
taking your solutions more competitive

PRODRIVE

IDT

0.75 Tbps
1 U 19 Inch 100 ns Switch
With 20 Gbps ports

- 38 x 20 Gbps ports
- Sub 200W switching power
- Support 42U Rack level scale out
- Available Now

Roadmap to 4.8 Tbps
2U 100 ns Switch
With 50 Gbps ports

- 96 x 50 Gbps ports
- Sub 400W switching power
- Supports redundant ports to 42U rack and intra rack scale out
- 2H 2016

5G|Mobile Edge Computing |HPC| Video Analytics | Low Latency Financial Trading



OPEN

Compute Project

