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REDEFINING CLOUD SERVICES, DELIVERING GREATER AGILITY AND COST EFFICIENCY

Pi DATACENTERS* delivers best-in-class software-defined infrastructure and Harbour1®, a future-ready cloud solution, using the latest generation of Intel® processors

" Harbour1® , Pi's own enterprise cloud platform, is tailor-made to handle heterogeneous critical workloads for enterprises across industries. Powered by Intel's latest & next generation processors, Harbour1® packs some significantly high performance, coupled with the flexibility to scale at will and at a lower TCO. Our choice to collaborate with Intel is attributed to the fact that both the organizations are committed to play a decisive role in making the paradigm shift for enterprise agility while driving business outcomes. "

Kalyan Muppaneni
CEO & Co-founder, Pi DATACENTERS

Executive Summary

In a span of just a few years, cloud has redefined the computing landscape for both large enterprises and midsize businesses — and yet the transformation is only beginning. Increasing end-user technical and experience demands, rapid and simultaneous technology transitions, and a constantly shifting business environment are all fueling further cloud proliferation. And to stay ahead of the curve, businesses are constantly looking to accelerate their adoption of innovative cloud solutions to enhance business agility, productivity and customer experiences while enabling greater efficiencies and reducing costs.

Pi DATACENTERS (Pi) offers an end-to-end enterprise-class cloud platform powered by Intel® architecture that provides businesses with a highly customizable, scalable cost-effective and self-service solution, designed to meet all their cloud data center needs.

Today's Cloud Demands Agility and Scalability

Businesses face increasing demands to deliver efficient, agile services in new ways, and in turn, driving the need for rapid innovation and even better customer experiences. To meet these expectations, businesses have been embracing cloud computing in an unprecedented manner.

Cloud computing provides businesses the advantage of huge gains in efficiency and flexibility at a time when demands on data center are growing exponentially. But even with the benefits that it brings for businesses, the majority of today's cloud deployments are bogged down by technology barriers that keep businesses from building scalable and agile data centers. Businesses also face challenges that are inherent to large legacy IT environments that include:

- Heterogeneous IT platforms and specialized hardware sometimes take months to provision platform resources
- Provisioning of new resources requires a great deal of manual work
- The need for expensive storage solutions driven by rapidly growing capacity requirements
- IT complexity makes it difficult to meet the demands of customers

To address these challenges, businesses must invest in a cloud solution that can enable them to keep up with evolving demands and complexities of data center computing. To help businesses meet these needs, Pi offers businesses an enterprise-class cloud platform, Harbour1®, which is fully software-defined right from the network to the storage, and supports heterogeneous enterprises and industries, both in the context of public and private clouds.

Unlocking the Full Potential of the Cloud

Pi's Harbour1® has been designed to be platform agnostic and deliver maximum flexibility, scalability, cost-efficiency and high customizability through a Software-Defined Strategic Data Center (SDDC) model, which is delivered out of Pi Amaravati.

Harbour1® is built on a Software-Defined Network (SDN) and Software-Defined Storage (SDS) architecture and driven by the OpenStack* software platform for cloud. It is one of the few cloud solutions in the world with this combination that has been executed on a completely commercial scale.

Harbour1® OpenStack solution platform, optimized on Intel® architecture, provides IT agility for customers, and is designed to be highly customizable and easily adaptable to dynamic demands of the customer's environment, which gives customers the flexibility and simplicity to use it on a self-service basis.

Harbour1® services offering spans Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a service (SaaS), Container as a Service (CaaS) and Disaster Recovery as a Service (DRaaS), and drives the platform's self-service model. The self-service model enables customers to provision, access, monitor and manage the cloud infrastructure. This model enables customers as tenants to manage applications, data runtime, middleware, databases, web applications, and different operating system choices, while Pi manages the underlying virtualization, servers, hard drives, storage, and network layers through Pi's Cloud Managed Services offering. The Cloud Managed Services provides customers with a portfolio of product offerings that include maintenance tasks, proactive monitoring, trend analysis, and strategic advisory.

The self-service portal allows customers to provision from pre-defined templates on virtual servers, independent storage, network architectures, and virtual private clouds.
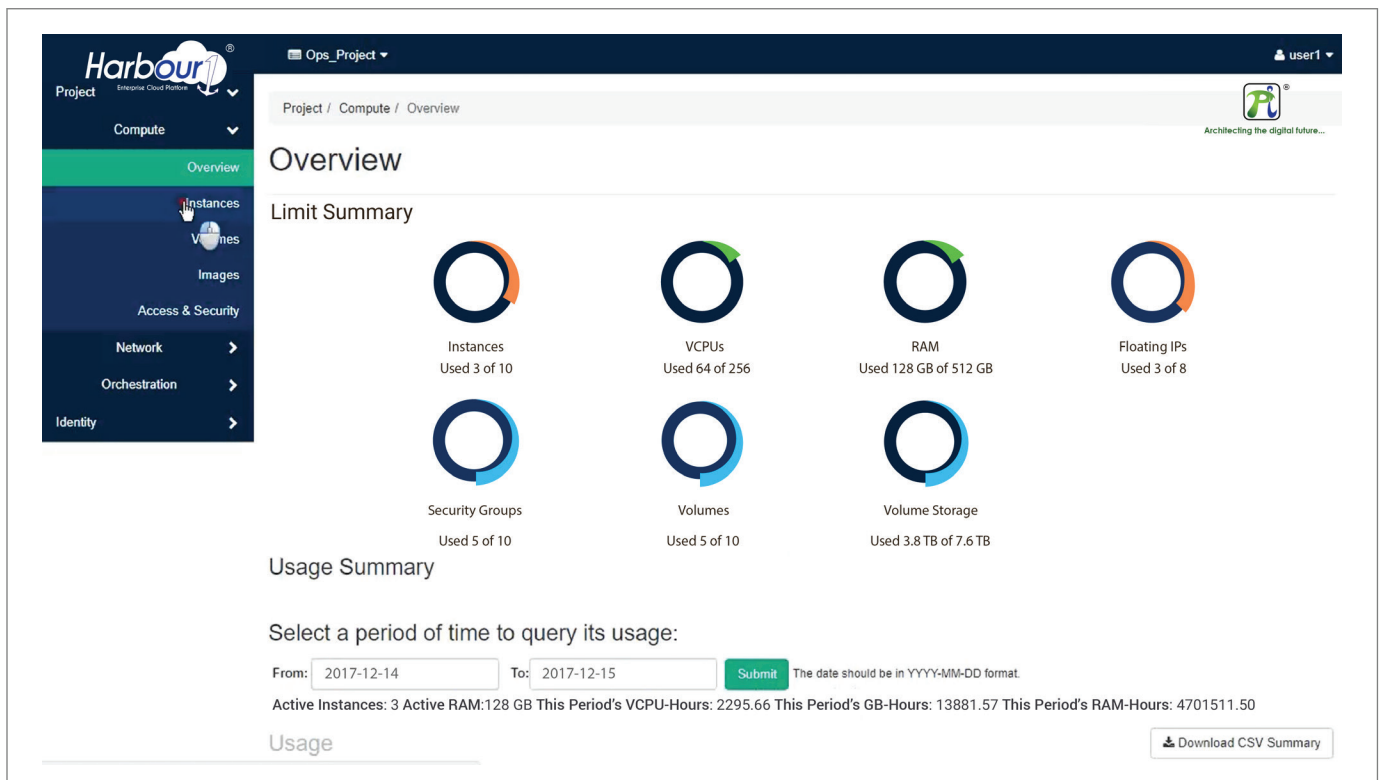
Disaster Recovery Made More Effective and Accessible

A key element of the Harbour1® cloud platform is Disaster Recovery as a Service (DRaaS) offered to customers completely free of cost as part of the solution. Pi's DRaaS, which is driven by Intel® architecture, offers high-end replication features, advanced enterprise technologies, and fully managed services to assess, plan and execute disaster recovery plans and meet compliance for customer specific requirements automatically with minimal manual efforts.

Pi's DRaaS leverages Intel's virtualization technologies that are built into the latest Intel® Xeon® processors, and are key to ensuring reliability and uptime of business-critical services. Intel® Xeon® Scalable processors with Intel® Virtualization Technology (Intel® VT) help in extending the benefits of software virtualization far beyond consolidation, and play a key role in enhancing business continuity and increasing user uptime through virtual machine failover, load balancing, and disaster recovery capabilities.

Maximizing the OpenStack and Intel Advantage

The framework of Harbour1® is built on the OpenStack platform and enterprise cloud technologies that are optimized to take full advantage of the features of Intel® architecture. OpenStack software provides a scalable, open cloud computing platform for private, public and hybrid clouds. It is increasingly recognized as a viable cloud environment and as an enabler of a hybrid cloud strategy, due to its openness.

The OpenStack platform provides end users the advantage of an enterprise-class IaaS cloud environment to increase business agility, accelerate application deployment, and reduce operating costs. Other key benefits of solutions built on the OpenStack platform include:

- Rapid, easy and customized deployment of services and applications

- Maximum customizability driven by an application-centric set-up environment

- Capability to scale infrastructure without the need to increase IT staff

- Access to computing resources on demand and with minimum effort

- Higher levels of automation to optimize service levels, utilization and cost

- Accelerating development and deployment of new applications

Intel is a key driver behind OpenStack's increasing enterprise readiness. Thanks to the active contributions of Intel engineers and the support of a broad ecosystem, the OpenStack platform delivers excellent performance on Intel® architecture.

Harbour1® enterprise-class cloud platform is optimized to take full advantage of the features of Intel® architecture and Intel's many contributions to the open-source projects that continue to enhance OpenStack—a key component of this solution. The OpenStack software is centrally deployed on Intel-based servers in Pi's SDDC that is built up with software layers that extend beyond cloud compute, storage and network, and provides extreme flexibility through an ideal combination of hybrid, private and public clouds.

The solution components of Harbour1® include:

- Servers powered by the latest Intel® Xeon® Scalable processor family

- SUSE* OpenStack Cloud 7 based private, public and hybrid clouds

- Open Source IaaS, PaaS, CaaS and DRaaS software

- SUSE Enterprise Cloud Storage

- Hypervisor Environment with ESXi*, KVM* and Hyper-V*

- Intel® Ethernet Network adapters

- Intel® Solid-State Drives (Intel® SSDs)

Pi's SDDC uses the OpenStack virtualization framework to deliver best-in-class computing, storage, and networking experience with a capacity of up to 5,000 racks with Intel® architecture cores.
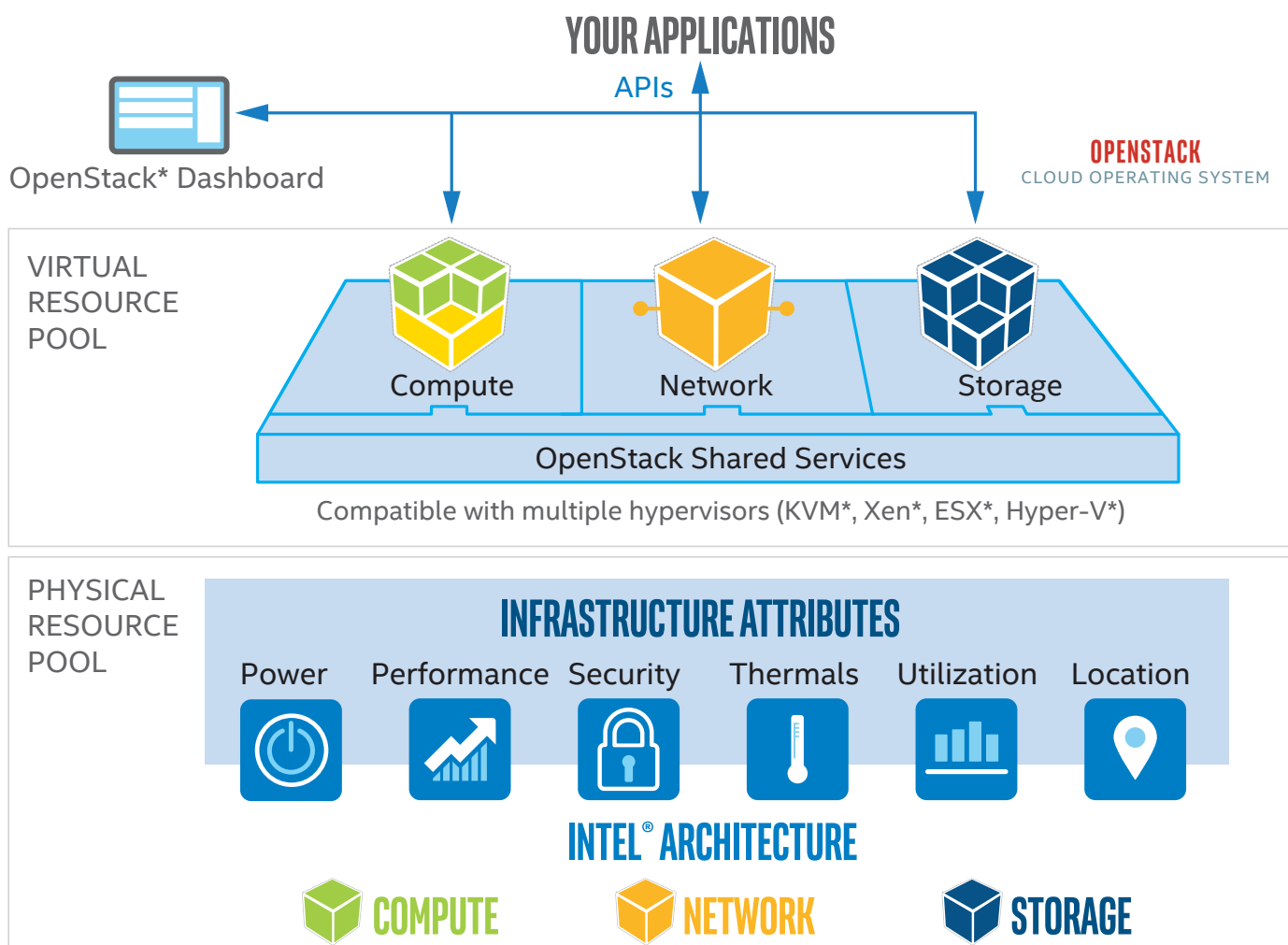

Prakash Mallya
Managing Director,
Intel India

" As businesses expand, operational complexities increase and the goal of companies is to provide the best services to end users, with the highest business value for themselves. Given the multiple elements in play, we work closely with cloud service providers such as Pi DATACENTERS, to assemble relevant cloud platforms. This whitepaper covers aspects ranging from technology and architectural concepts, to important business considerations for cloud adoption, and will act as a relevant reference point for companies looking for a solid hardware and software based cloud platform. "

Harbour1® Architecture

YOUR APPLICATIONS

APIs

OpenStack* Dashboard

OPENSTACK
CLOUD OPERATING SYSTEM

VIRTUAL RESOURCE POOL

Compute   Network   Storage

OpenStack Shared Services

Compatible with multiple hypervisors (KVM*, Xen*, ESX*, Hyper-V*)

PHYSICAL RESOURCE POOL

INFRASTRUCTURE ATTRIBUTES

Power   Performance   Security   Thermals   Utilization   Location

INTEL® ARCHITECTURE

COMPUTE   NETWORK   STORAGE

OpenStack* software and Intel® architecture offer comprehensive support for private cloud implementations, enabling agile and efficient orchestration of existing compute, network, and storage resources.

The challenge in a cloud environment is to match workloads and virtual machines (VMs) to best-fit server platforms that have the combination of resources needed to maximize performance and utilization. This requires a higher level of visibility and control than is currently available in many cloud platforms, whether public or private. Intel's processors, chipsets, solid-state storage drives, network adapters and other key components help dramatically improve performance, and are key to driving the best-in-class software defined architecture of Harbour1®.

Security and compliance are among the most critical areas that Harbour1® focus on, and OpenStack software and Intel® architecture allow administrators to establish trusted resource pools and create policies that constrain selected workloads from running on other, untrusted infrastructure. These capabilities are based on a number of Intel's security technologies like Intel® Trusted Execution Technology (Intel®

TXT), Intel® Advanced Encryption Standard New Instructions (Intel® AES-NI), and Intel® Secure Key.

Intel® Xeon® Scalable Processors Deliver Pervasive, Breakthrough Performance

For customers to maximize their cloud investment, the underlying architecture matters. And today's cloud requires a powerful platform that can handle the widest range of enterprise workloads, which can efficiently scale to meet dynamic demands and supports increased security and reliability capabilities for the modern data center. Harbour1® is powered by the Intel® Xeon® Scalable processor family that enables fast performance and scalability to support the diverse set of workloads, both on and off premises, running on the cloud.

- **Expanded I/O:** 48 lanes of PCIe* 3.0 bandwidth and throughput for demanding I/O-intensive workloads.

- **Intel® Ultra Path Interconnect (Intel® UPI):** Up to three Intel® UPI channels increase scalability of the platform to as many as eight sockets, as well as improves inter-CPU bandwidth for I/O-intensive workloads versus previous generation[1] (with Intel® Quick Path Interconnect). Intel® UPI offers the perfect balance between improved throughput and energy efficiency.

- **Intel® Advanced Vector Extensions 512 (Intel® AVX-512):** With double the flops per clock cycle compared to previous generation Intel® AVX2,[2] Intel AVX-512 boosts performance and throughput for the most demanding computational tasks in applications, such as modeling and simulation, data analytics and machine learning, data compression, visualization, and digital content creation.

- **Security without Compromise:** Near-zero encryption overhead[3] enables higher performance on all secure data transactions.

Delivering Great Value and Benefits for Customers

Driven by the power of Intel® architecture, OpenStack and industry standard systems, Harbour1® provides customers with a security oriented configuration model, business continuity through disaster management, virtualization orchestration, process automation and auto scaling. It delivers great benefits that include:

- Cost savings in moving from CapEx to OpEx

- Just-in-time self-service infrastructure provisioning

- Infinite scalability on demand

- Security and multi-tenancy

- Increased business agility

- Reduced time to market

- Integrated backup and DR capabilities

- Cost-effective deployment

- OpenStack APIs and no lock-in

- Runs on TIER-IV data centers

Helping Realize Maximum Business Impact

Businesses are always looking to reduce the challenges in building the cloud they needs to quickly roll out new services and applications. Harbour1®, powered by Intel® architecture, is the ideal platform for a cloud solution that provides maximum business value—increasing data center efficiency and security while simultaneously lowering TCO. With this solution, IT can be certain its data center is powered by Intel's high performance and exceptionally scalable platform, a platform that is truly future-ready, and can handle the complex and unexpected requirements of today's data centers.

The new Intel® Xeon® Scalable processor family represents the ideal cloud foundation, merging and extending the best enterprise-class attributes from the Intel® Xeon® processor E5 and E7 families. From its new Intel® Mesh Architecture and widely expanded resources to its hardware-accelerating and newly integrated technologies, the Intel® Xeon® Scalable platform enables a new level of consistent, pervasive, and breakthrough performance. Additionally, the Intel® Xeon® Scalable processor family delivers a strong performance boost in virtualization capabilities—also critical to cloud agility and efficiency. Servers based on Intel's latest processor allow enterprises to run more virtual machines (VMs) per server than ever before.

Foundational enhancements of Intel® Xeon® Scalable processors include:

- **Higher Per-Core Performance:** Up to 28 cores, delivering high performance and scalability for compute-intensive workloads across compute, storage, and network usages.

- **Greater Memory Bandwidth/Capacity:** 50 percent increased memory bandwidth and capacity. Six memory channels versus four memory channels of previous generation for memory-intensive workloads.

Spotlight on Pi DATACENTERS

Pi DATACENTERS is Asia's largest UPTIME Institute Certified TIER IV, green field, Software-Defined Strategic Datacenter (SDDC) and an enterprise-class cloud service provider with disruptive approach to technology, infrastructure and security of global standards. Envisioned and built by technocrats, the organization, which has a multi-locale data center presence, has a strong leadership acumen with more than 350 years of global technology experience.

The product portfolio of Pi DATACENTERS is designed to cater to all major industry verticals across domestic and global markets, through its set of tailored solutions around Infrastructure as a Service, Platform as a Service, Disaster Recovery as a Service, Enterprise Applications on cloud, and hosts of other cloud enabled products & services.

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Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as SYSmark* and MobileMark*, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. For more complete information about performance and benchmark results, visit http://www.intel.com/benchmarks.

Intel technologies' features and benefits depend on system configuration and may require enabled hardware, software or service activation. Performance varies depending on system configuration. No computer system can be absolutely secure. Check with your system manufacturer or retailer or learn more at intel.com.

[1]More inter-CPU bandwidth. 10.4 GT/s on Intel® Xeon® Scalable processors vs. 9.6 GT/s on Intel® Xeon® processor E5-2600 v4 product family.

[2]As measured by Intel comparing Intel® Xeon® processor Scalable family with Intel® Advanced Vector Extensions 512 (Intel® AVX-512) to an Intel® Xeon® E5 v4 processor with Intel® Advanced Vector Extensions 2 (Intel® AVX2).

[3]BigBench, Near Zero encryption overhead: BigBench query Runtime/second. Testing done by Intel. BASELINE: Platform 8168, NODES 1 Mgmt + 6 Workers, Make Intel Corporation, Model S2600WFD, Form Factor 2U, Processor Intel® Xeon® Platinum 8168, Base Clock 2.70 GHz, Cores per socket 24, Hyper-Threading Enabled, NUMA mode Enabled, RAM 384 GB DDR4, RAM Type 12x 32 GB DDR4, OS Drive Intel® SSD DC S3710 Series (800 GB, 2.5 in SATA 6Gb/s, 20nm, MLC), Data Drives 8x – Seagate Enterprise 2.5 HDD ST2000NX0403 2 TB, Intel® SSD DC P3520 Series (2.0TB), Temp Drive DC 3520 2 TB, NIC Intel X722 10 GBE – Dual Port, Hadoop Cloudera 5.11, Benchmark TPCx-BB 1.2, Operating System CentOS Linux release 7.3.1611 (Core); HDFS encryption turned OFF. vs. NEW: Platform 8168, NODES 1 Mgmt + 6 Workers, Make Intel Corporation, Model S2600WFD, Form Factor 2U, Processor Intel® Xeon® Platinum 8168, Base Clock 2.70 GHz, Cores per socket 24, Hyper-Threading Enabled, NUMA mode Enabled, RAM 384 GB DDR4, RAM Type 12x 32 GB DDR4, OS Drive Intel® SSD DC S3710 Series (800 GB, 2.5 in SATA 6 Gb/s, 20nm, MLC), Data Drives 8x – Seagate Enterprise 2.5 HDD ST2000NX0403 2 TB, Intel® SSD DC P3520 Series (2.0 TB), Temp Drive DC 3520 2 TB, NIC Intel X722 10 GBE – Dual Port, Hadoop Cloudera 5.11, Benchmark TPCx-BB 1.2, Operating System CentOS Linux release 7.3.1611 (Core); HDFS encryption turned ON.