Technology Advantage

ThroughPuter's *dynamic parallel execution* technology delivers the following critical capabilities and associated benefits and value for its users conveniently as a highly integrated Platform as a Service:

Feature	Benefit	Customer Value
Demand driven optimization of manycore processing capacity allocation: Dynamic allocation of cores based on processing loads by application programs, while ensuring that each application, whenever so demanded, gets its contractually entitled share of the processing capacity.	▪ Maximized processing capacity for users of the computing service per unit cost. ▪ Bursting: Dynamic access to capacity when actually needed. ▪ Assured access to at least the contract based minimum capacity allocation level whenever the application so demands.	Maximized **cost-efficiency** of networked utility ('cloud') computing.
Overhead-free, secure hardware operating system: ThroughPuter's manycore architecture performs in programmable hardware conventional OS software functions of monitoring application and task processing capacity demands, optimally allocating processing capacity, scheduling and placing application tasks for execution at cores of the system, handling inter-task communications, load balancing etc.	▪ Manycore fabric with embedded OS taking care of parallel execution routines. ▪ Fast, secure hardware automation of OS routines; practically all processing time of the cores usable for processing client programs rather than OS functions. ▪ Avoidance of overhead and vulnerabilities of system-wide software OS; client applications may have their own independent OSs as/if desired.	Maximized program processing on-time throughput **performance** (e.g. instructions or operations per second).
On-chip network optimized for the hardware operating system: Ability to dynamically and efficiently run any application task instance at any core of their host manycore processors.	▪ Restriction-free, demand driven processing capacity allocation among the application tasks dynamically sharing a given manycore processor. ▪ Tasks of any application can efficiently communicate with each others without having to know whether/where other tasks are executing at any given time.	Superior **scalability**, in terms of numbers of effectively utilized cores, as well as applications and tasks able to dynamically run on a given system.
Hardware based security: Each client application program instance completely resides on its dedicated memory segments, with any unauthorized interactions among applications simply not enabled in the hardware, leading to avoidance of the needs to deal with more complex security issues at driver, operating system, middleware and application software layers.	▪ Prevention already at hardware level of undesired interactions between the client applications sharing a given manycore system and between such applications and the system itself. ▪ Ability to develop, test and run multiple client applications securely on a multi-user shared manycore system as if each individual application was the only program running on the system.	Straightforward, built-in security without complexity and costs of conventional software based security patchwork: ▪ **Cloud security without cloudiness**; ▪ **Productivity**.
Billing system purpose-built for dynamic cloud computing: Hardware logic automated, accurate and overhead-free billing counters with ability to bill, at however fine time granularity, for the contractually entitled as well as demanded-and-allocated levels of access to the system capacity.	▪ Incentivization for client applications to demand no more of the manycore system capacity than what they are able to effectively utilize for processing their tasks, thus leaving maximized amount of system core capacity available to meet demand peaks of applications that at any given time are able to most effectively utilize them.	Optimized computing on-time throughput per unit cost of the service for the customers; **maximized cloud computing cost-efficiency**.

Key Innovations

ThroughPuter's core innovations provide optimized architectural foundation for secure and dynamic cloud computing for the parallel processing age. These innovations set ThroughPuter PaaS apart by enabling a parallel program development and execution platform, with the unique ability support contracts with private, dedicated supercomputing infrastructure class performance and security at a cost base of only a small fraction of the costs of implementing equal development productivity and application throughput capacity with alternative technologies.

Specific innovative techniques include:
- Realtime application processing load adaptive allocation of space and time shared processing capacity (cores), while ensuring guaranteed access to a contractually entitled level of capacity to each given client application whenever any given application so demands.
- Fast and secure, hardware automation of operating system functions for manycore processors, including periodically allocating cores among the client application based on their respective levels of demands and contractual entitlements for core capacity and accordingly scheduling and placing the selected application tasks for execution on the system cores.
- Hardware OS controlled dynamic, secure and high performance on-chip networking, enabling to execute any selected application task instance at any core of their host processors in a restriction-free manner as well as to support minimum overhead, high-performance inter-task communications for each application program, irrespective of where and whether any given tasks are executing on the manycore processor at any given time.
- Hardware resource access control based strict isolation and built-in security among the client applications, while supporting revenue-maximizing dynamic resource allocation among the applications.
- Hardware logic automated billing, with incentives for the client applications to not demand more core capacity than they are able to effectively utilize for execution of their tasks at any given time, in order to maximize the volume of system cores available for realtime application processing load driven core capacity allocation, thereby maximizing the client application processing on-time throughput per unit cost across all applications sharing a given manycore processing system.

ThroughPuter's technology innovations thus enable each application program to dynamically get a maximized number of cores that it can utilize in parallel so long as such demand-driven core allocation allows all applications on the system to get at least up to their contractually entitled number of cores whenever their processing load actually so demands. ThroughPuter's innovations thereby enable maximizing the processing on-time throughput per unit cost across all the client applications configured to run on the shared manycore computing system.

Service Offering and Customer Value Proposition

ThroughPuter offers the development and execution environment, both as an integrated hosted service, for developing and running web and enterprise application software with maximized cost-efficiency and performance on dynamic parallel cloud processing hardware.

Primary intended customers for the ThroughPuter Platform-as-a-Service are the Software-as-a-Service providers and enterprises with in-house software development, who stand to benefit from ThroughPuter's service through following ways:
- Avoidance of the complexities of developing and fine-tuning programs for sufficiently efficient parallel execution in the cloud to achieve necessary performance improvement as the processor clock rates are no longer providing the speed up.
- Access to cost-effective compute capacity service optimized for dynamic parallel processing, reducing the SaaS customer's IT infrastructure spending as % of revenue -- both the level of upfront capital and ongoing operating expenses needed to support a given revenue level for the SaaS provider.
- Cloud computing security as a built-in feature of the PaaS service, from the hardware level up.

Altogether, the above advantages of ThroughPuter PaaS enable the customer to minimize the complexity and operating costs of acquiring and maintaining computing capacity as well as these costs of the back-end of the software development process, while improving performance and security of the customer's SaaS offering or enterprise applications. By moving to ThroughPuter's PaaS, the customers can therefore, with no upfront spending, increase their competitiveness, capital efficiency and profitability.