The cloud as a vehicle for democratization of hybrid computing

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<table>
<thead>
<tr>
<th>Year</th>
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**SAP in the cloud**
Examples of Popular Advanced Analytics Services Offered on The Cloud

- Marketing Automation (Adobe Marketing Cloud, Nielsen Exelate)
- Predictive Analytics (Google Prediction API, Apigee)
- Hadoop As a Service (Datameer, Xplenty, Altiscale)
- Machine Learning APIs provided as a service on the cloud (BigML, IBM AlchemyAPI, Metamind, Cortica)
- Social Media Analytics (Tracx, Salesforce Radian6)
The market is shifting from on-premise appliance / software license model to subscription based service model.

Growing demand and popularity of PaaS / SaaS vs IaaS

It is very hard to determine optimal pricing for SaaS - you charge for the service while customer is not interested in what it takes to deliver the service.

Profit == Subscription Fee – Infrastructure Total Cost of Ownership (TCO)

As a result the pressure for TCO reduction is constantly growing.
Advanced Analytics Infrastructure – Challenges

Infrastrucure Design must be optimized for **flexible scaling** of memory, processing, and storage density per rack unit

Better infrastructure **utilization and density** is essential for the **TCO reduction**

Processing density scaling is not as flexible as storage and network
Emerging Solutions

Infrastructure unification and consolidation – Software Defined Everything

Software defined **storage** and **network** stacks running on commodity server equipment rather than on dedicated and expensive HW appliances

**Multi-tenancy** as an alternative to virtualization should result in better infrastructure utilization

Possible solution for **processing density** scaling is **heterogeneous computing** - where traditional CPUs are combined with dedicated compute units or **HW accelerators**
Popular HW Accelerators and Tools

General Purpose GPU (GPGPU)
- Intel Xeon Phi
- NVIDIA Kepler
- AMD FirePro

Field Programmable Gate Arrays (FPGA)
- Xilinx
- Altera

Average price of a GPU is $1K - $4K USD
Up to 16GB RAM memory on a single card
Thousands of dedicated processing cores on a single card
Heterogeneous Computing Adoption

Consortium around IBM POWER microprocessor and NVIDIA GPU among others

Standards body for heterogeneous computing, founded by AMD, ARM, Qualcomm, TI and Samsung among others

Intel Xeon-Phi accelerators share resources with its CPUs

Amazon Web Services provides Heterogeneous environments

Microsoft uses FPGA in the Bing search service

Microsoft
Our Validation

SAP HANA Predictive Analytics Library (PAL) – successfully demonstrated x150 acceleration using NVIDIA Kepler versus standard CPU core

SAP Sybase Event Stream Processor – successfully demonstrated ESP event processing throughput optimization using FPGA based solution – 9M messages per second handled on a single PCI card
Use Case – HANA Predictive Analytics Library

SAP HANA Predictive Analytics Library (PAL) is embedded in the HANA in-memory database.

The use case demonstrates using the regular interface and seamlessly offloading the operation to an attached accelerator.

This is a PoC and not yet an SAP product.
Thank you