Hewlett Packard Enterprise

Turnkey Lender

TurnKey Lender on HPE ProLiant for Microsoft Azure Stack

Reference Architecture

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Executive summary

TurnKey Lender is an open, secure, and integrated cloud based solution that offers enterprises an easy path to use a lending automation platform coupled with a decision management platform. The end-to-end loan lifecycle management solution gives the ability to process loan applications, automate credit scoring and make decision, digitize business processes and portfolio monitoring. With an open-architecture approach and support for hybrid service delivery, TurnKey Lender on HPE ProLiant for Microsoft Azure Stack provides the ability to run on-premises business process in the private cloud while simultaneously managing off-premises business process.

TurnKey Lender on HPE ProLiant for Microsoft Azure Stack solution allows companies to deploy the business process in the most cost-effective and productive way. The solution is ready for use on day one after the installation is completed. The Company does not need to worry about any technicalities, such as operating system version patches and upgrades, backup/restore procedures, etc. The solution is integrated to allow a worry-free operation.

TurnKey Lender clients will experience are increase in operational efficiency, more accurate loan decisions, and reduced risk profile of their portfolio. In addition, automation, predictive analytics and access to additional data sources via APIs add up to improve yields and increase profits.

Target audience: The intended audience of this document includes, but is not limited to IT managers, pre-sales engineers, services consultants, partner engineers and customers who are interested in the automation of business processes, decision-making, the developing of digital lending infrastructure in lending companies and telecom providers.

Document purpose: This document describes the capabilities of TurnKey Lender Solution on HPE ProLiant for Microsoft Azure Stack. It give the reader the opportunity to understand the solution and sizing needs. It served as a baseline and foundation. The reader is strongly advice to work with your local HPE Presales and Specialist to come out with the details bill of material configuration to address your specific customer’s needs.

Who is TurnKey Lender?

Headquartered in Singapore, with clients among big and small lenders and telecom companies in 27 countries on all continents, TurnKey Lender has become a globally recognized provider of lending, decision management and risk mitigation solutions. With TurnKey Lender ’s vast expertise in enterprise-level decision support, company created a cloud-based software platform designed especially for digital lending operations with usage of alternative scoring. A great fit for any lender looking for superior automation in conjunction with advanced credit scoring.

With TurnKey Lender, client gets deep expertise in credit risk management and lending automation, gained from years of international financial services experience. TurnKey Lender clients use the software for secured and unsecured, short-term and long-term, personal and SME loans. They leverage innovative solutions to support crowd sourced and peer-to-peer loans. They enable humanitarian efforts such as micro loans in emerging economies that help to alleviate poverty. And they engage in complex credit bureau eco-systems as well as multi-national fintech infrastructure projects in conjunction with the World Bank.

TurnKey Lender Quality Management System is certified according to ISO 9001. TurnKey Lender Security Management System is certified according to ISO 27001.

Solution Quick Overview

TurnKey Lender Enterprise

TurnKey Lender Enterprise platform combines business rules, business processes and predictive analytics to empower management and automation of real-time frequently occurring operational decisions in lending business. It combine customer interactions, business processes and automated decisions in a single transparent and coherent flow that is easy to understand and manage by subject matter experts.

TurnKey Lender Enterprise platform allows businesses of any size to implant real-time intelligence into any type of business process or customer interaction activity to increase profitability of frequently occurring operations. A decision server of high-performance ensures automatic real-time decisions and process automation, creating actionable intelligence and revealing insights from data flowing through the process in real time.

With use of TurnKey Lender Enterprise, the clients are empowered to:

1. Process Big Data.
2. Perform Predictive and Behavioral Analysis.
3. Make the most optimal desicions in terms of cost, risk and timing.

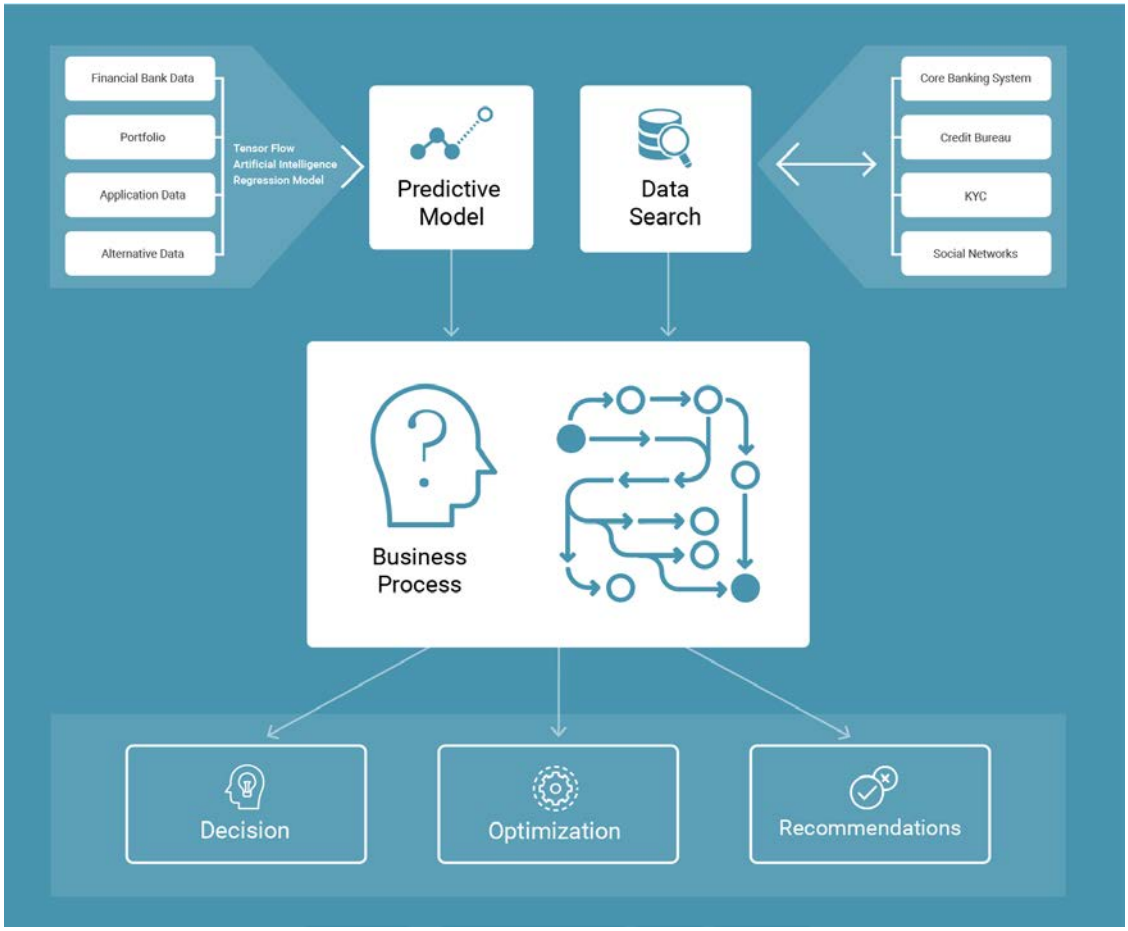


Figure 1: High level view of TurnKey Lender Enterprise

The whole architecture can be decomposed into the following layers (see figure 2 below):

- Presentation layer that comprises web and client applications;
- Application and Decision Engine services;
- Database layer.

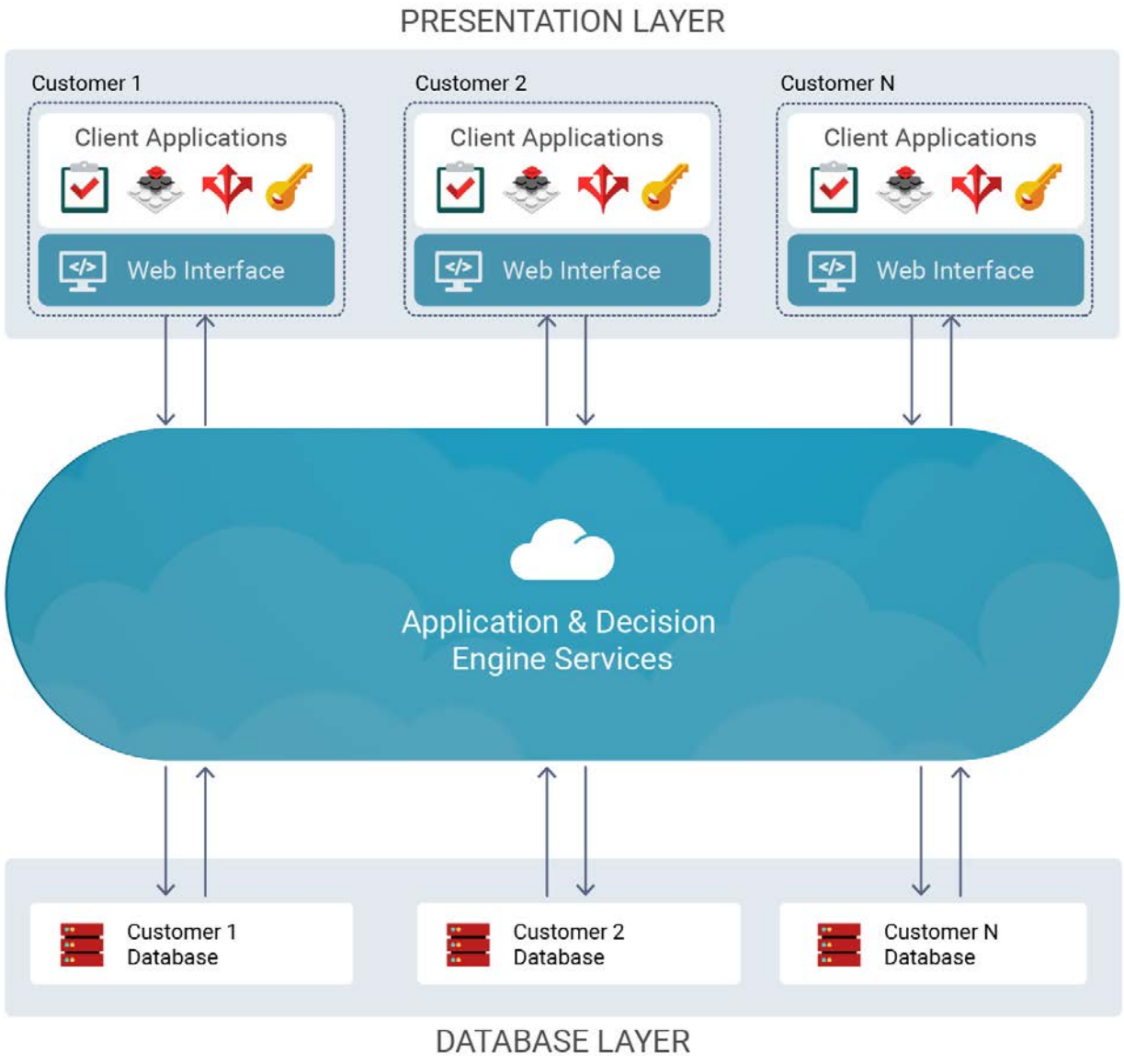
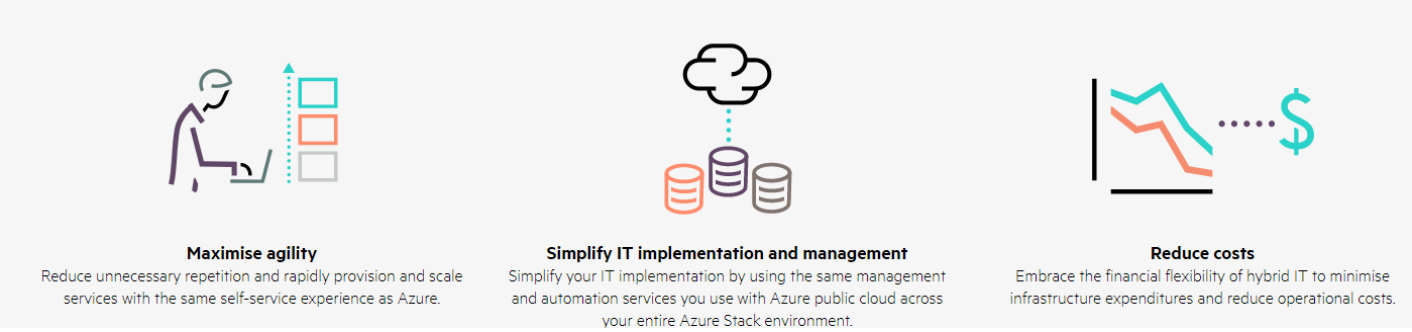


Figure 2: General Architecture of TurnKey Lender Enterprise

To optimize the deployment of the solution and to increase agility, TurnKey Lender and HPE had collaborated and deploy the entire solution on HPE ProLiant for Microsoft Azure Stack. If customer's workload ever needs to utilize some public cloud resources, this solution offer the right mix of private and public cloud to handle it.

HPE ProLiant for Microsoft Azure Stack

HPE ProLiant for Microsoft Azure Stack is a hybrid cloud solution that allows organizations to run Azure-consistent services in the data centre, providing a cohesive and simplified development, management, and security experience. HPE ProLiant for Microsoft Azure Stack enables enterprises to capture the full benefits of a hybrid cloud environment.



HPE ProLiant for Microsoft Azure Stack offer customers:

1. Greater choice with more configuration options for processor, memory, storage, third-party networking, switches, power supplies and rack options to allow seamless integration to your customer environment
2. Highest capacity with high performance at full speed allow customer to use RAM capacity up to 768GB with large bandwidth
3. Pay-per-use pricing with HPE Flexible Capacity
4. The best hybrid cloud deployment leveraging the expertise within HPE
5. Try AzureStack and accelerate the time to value

Solution Overview

A high level view of the software solution architecture is represented on the block diagram below (Figure 3).

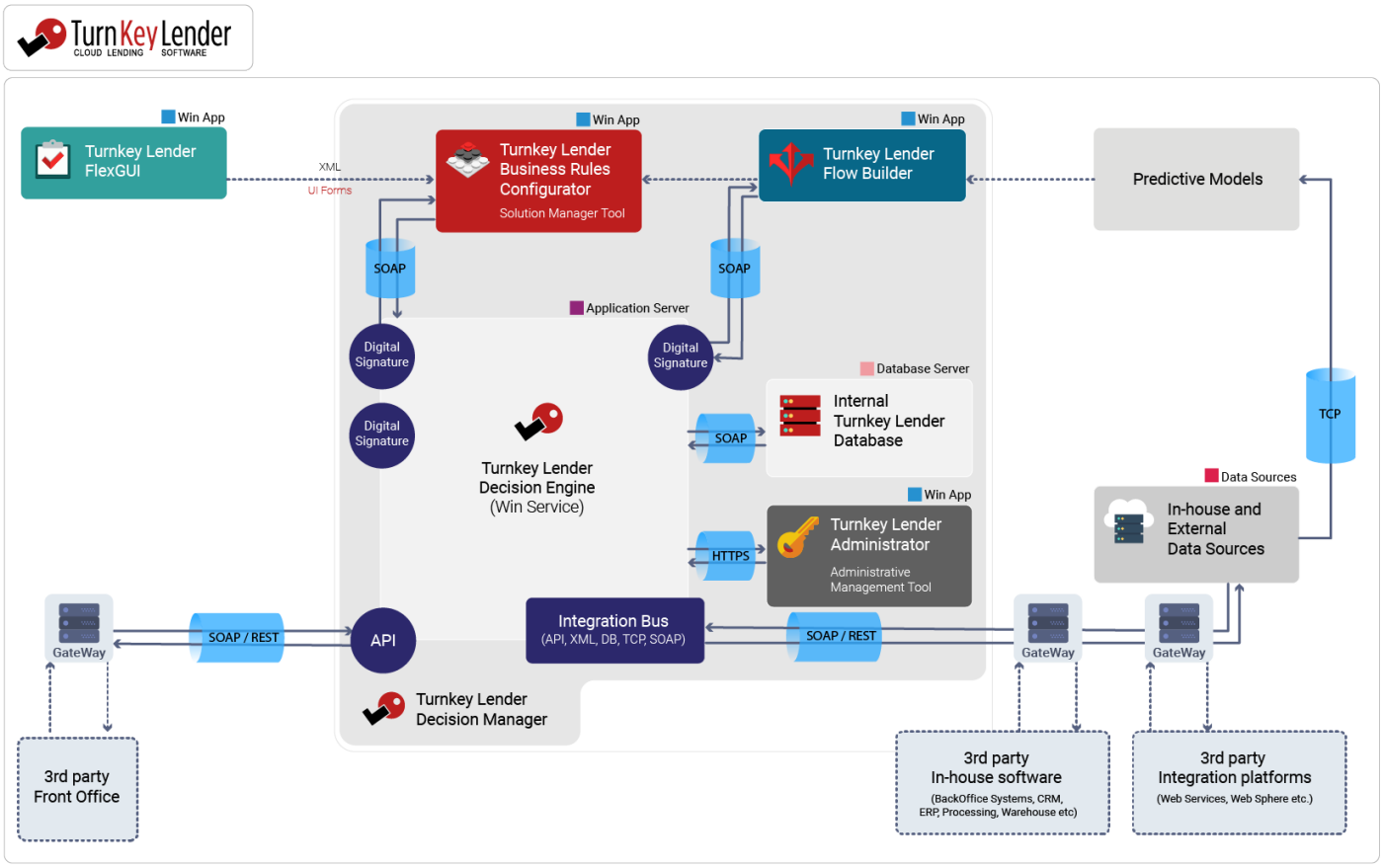


Figure 3: Functional Block Diagram

The component can be combined and/or duplicated in a way that is suitable for every particular project's needs to create a solid infrastructure, which is called the "**environment**". This infrastructure is determined and governed by the common environment configuration.

The environment configuration determines what will be the scope, organizational structure and functionality of the system to be deployed. The system deployment can be in one of the two main modes:

- Single Client Mode – only one company is supported; no need to create independent sets of data and entities;
- Multiple Client Mode – multi-tenant mode, which is intended to provide services in a SaaS mode.

TurnKey Lender Enterprise has vast possibilities of integration with external systems. The communication between the deployed system and third-party systems is provided by Data Sources. Integration Services allow for interaction between the deployed system and third-party systems.

In terms of infrastructure, the solution represented in the Figure 1 consists of the following components:

- Internal database stores system entities and data. In multi-tenant mode every client has a proprietary database, which can be accessed by this client only

- The Administrator app is used to manage user accounts and access credentials. The main function of this module is user role management and access rights administration. The Administrator interface allows creating and managing user accounts, granting access rights, blocking / unblocking user accounts and monitoring user activity (through system logs)

- Flow Builder is here to adjust business processes and decision flows in the system. This is a specialized application for building comprehensive decision-making algorithms in lending business. The application can be used to set the borrower's evaluation or decision-making rules; to calculate indicators and ratios for each particular borrower; or to find the most effective actions to address delinquencies etc.

- Business rules configurator. This application is intended to manage the instances of the system. Any change or improvement made in the system (i.e. a new scoring model, new decision-making strategy, new credit product etc.) first appears in the Business rules configurator. Only after their approval by an authorized person, they go live. The application also allows managing the process of gradual integration of system changes into the workflow by testing the changes made on a limited amount of applications and monitoring the performance (champion / challenger).

- The FlexGUI app is used to design layouts for the web-based working places

- Decision Engine is the engine developed specifically for the lending automation, decision-making and credit scoring systems. It contains a number of analytical tools and features that can be used to score, rate and re-evaluate borrowers. To suit borrower evaluation specifics best, the server allows setting individual evaluation processes for different credit products, portfolio segments or business lines, and supports several types of ratings — quantitative and qualitative. Along with rich evaluation capabilities, module provides for impressive productivity, with clustering/scalability capabilities.

- Third-party systems are integrated by means of server API, which is a part of the Integration Service;

Design Considerations

Multi-tenancy

One of the main operation modes of the application. This mode is switched on at the environment configuration level for the entire deployed infrastructure. This mode allows for using the deployed infrastructure entirely for the purposes of a large number of different, independent companies/clients.

Every System Client has a separate database at their disposal; such a database has unique sets of users, business processes, entities, and data. The information about the System Client is an essential part of the client license and is protected by means of encryption. Along with the user authentication procedure, it prevents different clients from obtaining access to one another's data and business processes. On the server, clients are isolated; every one of them has a separate Sandbox.

Clients have no access to system databases or the databases of other clients. This is regulated by SQL Server's inherent safety features. When the business process is running, the identities of the clients are hidden; every client is only represented by a separate, individually created system user account. This allows for proper specification of access rights for every client.

In addition to the general configuration, which is defined by environment config, every client has a proprietary set of adjustable configuration parameters in the database as well as a dedicated pull of functionality, the "Feature set", determined by the license.

To register users in the multi-tenant mode, a proper license server needs to be deployed.
The difference between the Single Client Mode and the multi-tenant mode, as there can be only one system client.

Configuration

The system configuration takes place within the framework of a flexible hierarchy environment configuration.
The deployed environment on the server end is managed by the environment configuration. This configuration can be accommodated on a shared file resource, which would be accessible inside the environment. This hierarchy configuration is implemented in form of an XML file with basic configurational settings for the elements of the infrastructure. These settings are specified during deployment of the system and can be changed later only when the entire system goes through a major reconfiguration.

On the system configuration phase, some settings can be made editable. Later, the changed values can be stored to the client's database. This allows for flexible management of settings, such as locale or security parameters. Client's access to different functionality blocks of the system can be managed with the Feature Set tool. The set of available features and the values of the relevant parameters are specified on the phase of license provision.

The feature set is protected from changing attempts by means of cryptography. This tool is used to manage the system behavior on both the server and the client parts. In addition to the procedures mentioned above, the system uses configurations for desktop applications. The user is provided with those to work with the system.

Integration

The system features advanced tools for third-party integrations. These tools allow for flexible data transmission and reception to/from other systems. Moreover, other systems can start certain processes inside the deployed system.

In terms of information exchange (acquisition, extraction, deletion) with the database and external systems, the system uses data sources of different types. They allow to flexibly work with:

- External databases;
- REST services;
- Web services via SOAP;
- FTP and more;

It's possible to use custom-code sources, for cases that are one-of-a-kind or complex to formalize.

To receive data and manage the processes that are initiated from outside, the Integration Services procedure is used. This procedure allows for quick configuration of integration points of any complexity inside the system – as many as necessary. The system supports various integration points which respond to the REST, SOAP, POP3, IMAP protocols. Integration procedures can use different unspecified data formats and structures, including data in the xml, json, bson or other formats.

Versioning

Almost any instance of the system is using the versioning procedure. This procedure allows for retaining the integrity and operability of the system, should any modifications be introduced to the system. With versioning, loans that were originated before based on the previous versions of business processes continue moving over their lifecycle uninterrupted, whereas new versions of business processes are being introduced and configured. This is also one of the many procedures to endure reliability of the system.

Reliability assurance procedures

Along with the versioning procedure mentioned above, the system is equipped with the following procedures to ensure reliability:

- Remote monitoring of the free disk space on the servers. This allows for system operation suspension, when the free disc space (e.g., on the database server) drops below the predetermined minimum value;
- Monitoring of how much memory the Decision Service uses. This procedure allows for smooth service reboot, if necessary;
- Monitoring of the watchdog service activity. This allows for the service reboot, when it's getting not responsive.
- Business process recovery and continuation. This procedure ensures that no data will be lost in case a running business process gets interrupted for some reason.

In addition, the system can use the features of the environment. The IIS pool for applications provides the option to configure web gardening with dedicated settings that contribute to error-free web operation. Failover cluster, as set on the database server, prevents data loss caused by malfunctions. Additionally, it's possible to use RAID to avoid data loss caused by failures in the file system. Also, redundant instances of services can be used to launch them instead of the services that, for some reason, are out of operation.

Hardware requirements and cloud configuration sizing

The hardware requirements for the physical management cluster depend on:

- The size of the cloud that is planned to be deployed;
- The high-availability option, which is configured for the cloud.

To leverage on the functionality of HPE ProLiant for Microsoft Azure Stack, the following configuration had been mapped to Azure Stack Virtual Machine (VM). For all the sizing configuration, we had mapped it to Azure Stack DS3.

Scalability

The application suggests a variety of procedures to ensure scalability:

- The application is fully compatible with Loan Balancer, allows for scalability of all web services;
- The Decision Service also supports horizontal scaling, which allows for increasing the total performance of the system as seamlessly as possible;
- Database extension can be executed by balanced distribution of the client databases across different database servers.

Cloud configuration sizing

The client needs to choose, which size of the cloud storage is necessary for their company: small (a large microfinance institution), medium (medium bank), or large (large bank). This will determine the total number of Decision Engine hosts and Web Server instances

For large non-bank lending institution with estimated number of loan application requests up to 13 per second that is 780 per minute, 46800 per hour and 374400 per working day:

Application component	CPU type	RAM
Decision Engine	DS3 (Intel® Xeon® CPU E5-2660)	14GB DDR3
Web server	DS3 (Intel® Xeon® CPU E5-2660)	14GB DDR3
Database server	DS3 (Intel® Xeon® CPU E5-2660)	14GB DDR3

For micro financing organization with estimated number of loan application requests equal to 23 per second that is 1380 per minute, 82800 per hour and 1,987200 per working day:

Application component	CPU type	RAM
Decision Engine	**2x**DS3 (Intel® Xeon® CPU E5-2660)	**2x**14GB DDR3
Web server	DS3 (Intel® Xeon® CPU E5-2660)	14GB DDR3
Database server	DS3 (Intel® Xeon® CPU E5-2660)	14GB DDR3

For large bank with estimated number of loan application requests equal to 105 per second that is 6300 per minute, 378000 per hour and 3,024,000 per working day:

Application component	CPU type	RAM
Decision Engine	**8x**DS3 (Intel® Xeon® CPU E5-2660)	**8x** 14GB DDR3
Web server	DS3 (Intel® Xeon® CPU E5-2660)	14GB DDR3
Database server	DS3 (Intel® Xeon® CPU E5-2660)	14GB DDR3

Summary: Solution Value Proposition

1. Appliance Model – Solution is cost-effective and highly efficient. Once deployed, solution is operational on day one and customer does not need to worry about day-to-day operational such as backup, etc.

2. Solution offer an easy path to use a lending automation platform coupled with a decision management platform as infrastructure enabler of lending business

3. Flexible configuration choice on a highly scalable and reliable infrastructure

4. Option for a pay-per-use model using HPE Flexible Capacity

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