Blaise 5 Server Configuration for Web Surveys

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A configuration of Blaise 5 software used to support web surveys and connected mobile surveys is referred to as a Blaise Server Park. Blaise uses a service oriented architecture and the various major functional components of the Blaise software are programmed, installed, and operated as services to permit the software to be installed on one or several servers. This flexibility permits organizations to adopt various server configurations of Blaise 5 to meet different scaling, continuity, and security requirements.

This document is written primarily with reference to the installation of Blaise 5 using Microsoft platforms for web surveys.

A Blaise 5 Server Park consists of one or several Windows servers on which the following Blaise 5 server roles are configured:

Blaise Server Role	Description
Survey Manager	The Survey Manager role provides administrative functions to manage the Blaise 5 server park including defining server roles, maintaining users, creating and publishing surveys, etc.
Web server	The Web server role hosts files for Blaise internet surveys. This is the server role to which end-users directly connect. The Web server role processes user input and sends UI responses.
Resource server	The Resource server role applies layout and formats Blaise 5 user interface output for different devices/modes.
Data Entry server	The Data Entry server role interprets and validates input and applies the rules defined in the survey.
Data server	The Data server role reads data from and writes survey data to a Blaise 5 database.
Session Server	The Session server role manages and stores data associated with all active interview sessions. In most cases, the Session server role should be assigned to the same Windows server that the Data server role has been assigned.
Audit Trail Server	The Audit Trail server role maintains a log of audit records, each of which contains evidence directly pertaining to and resulting from the execution of a Data Entry Session.
Database Management System (DBMS)	Although not part of the Blaise 5 Server Park, a DBMS is also required to host the Blaise database. Blaise 5 currently supports SQL Lite (installs with Blaise 5 by default), Microsoft SQL Server, MySQL, Sybase, and Oracle.

It is important to note that the Blaise 5 server roles are functional designations of the Blaise software and do not correspond to the underlying Windows servers. A Blaise 5 Server Park can consist of one or several Windows servers depending on the level of resource required and the configuration and security standards of the organization. The following are additional options and restrictions for the configuration of Blaise Server Parks:

- All Blaise 5 server roles can be installed on a single server and a DBMS can also be installed on the same server. As a result, a fully functioning Blaise 5 server installation can be supported on a single server.

- For improved security, it is common practice to isolate DBMS servers from front-end web servers through the use of firewalls or other network devices. As a result, a minimum recommended configuration of Blaise 5 for production use would consist of at least two servers – one server for the Blaise 5 software and a DBMS server.

- Alternatively, Blaise 5 server roles can be installed on separate servers. Web, Resource and Data Entry server roles can also be installed on multiple servers for enhanced scalability and continuity.

- The Data server role, Session server role, Audit trail server role, and Survey Manager role can each be installed on only one server in a Server Park.

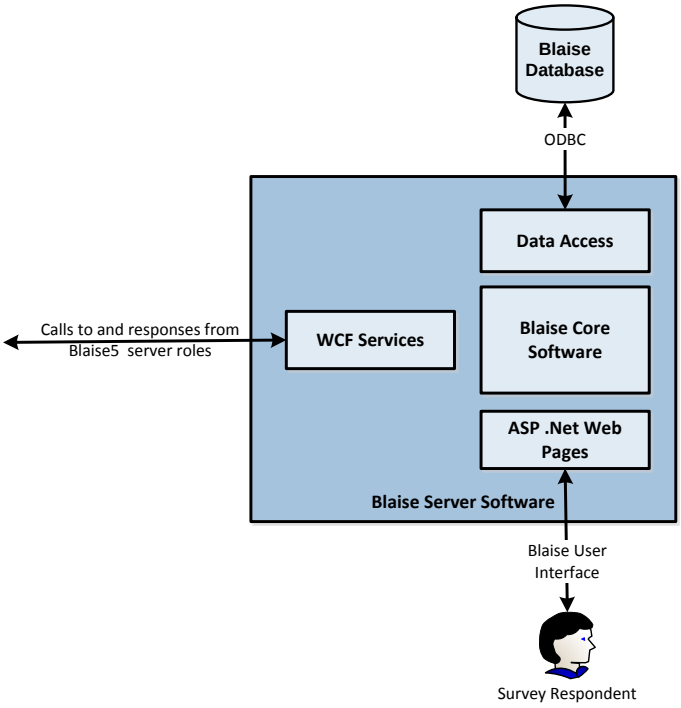
- One server in a Blaise 5 Server Park is established as the Survey Manager for the Server Park. Functions in the Survey Manager are used to configure other servers on which Blaise 5 software has been installed, i.e. which servers will support which server roles and the protocols and ports to be used.

- Scaling/clustering of the DBMS server is a function of the DBMS software and not directly supported by the Blaise 5 software. Scaling/clustering of the DBMS server must be configured and supported by a Database Administrator familiar with the capabilities of the platform being used.

- Blaise 5 server roles can be installed on either physical or virtual servers depending on the capabilities of the underlying operating system being used. Similarly, Blaise 5 server roles can be installed on Windows servers hosted using cloud IaaS services such as Amazon AWS or Microsoft Azure. The use of cloud services may present unique security, connectivity, cost, and operations support issues that must be considered.

Blaise Server Software Architecture

The following diagram shows the major functional components of the Blaise 5 server software and the mechanisms used by the software to communicate with/connect to external parties/resources:



- The Blaise 5 installation and software footprint is the same for every server that will be used to support a server role in a Blaise server park. In order to prepare a server to function as part of a Blaise 5 Server Park, a full installation of the Blaise 5 server software is performed. Blaise 5 server roles are defined on the server during the installation process.

- A Windows service is created when the Blaise 5 software is installed. It is through interfaces exposed by this Windows service that Blaise 5 server role functionality is invoked through WCF service calls.

- Blaise 5 is a .Net 4.0 application and the web functionality is supported via an ASP .Net web framework running under IIS 6.0 or higher.

- The DBMS software and related OS components are not shown in this diagram but are necessary and central to the operation of the software, i.e., for a Windows installation, a Blaise Windows service is created during software installation and supports the various service interfaces, Internet Information Services (IIS) accepts connections from the end user and invokes the appropriate Blaise 5 ASP .Net pages, and SQL Server provides DBMS services to the Blaise database.

Connectivity requirements in a Blaise Server Park

The following table indicates the connectivity requirements between the various server roles in a Blaise 5 Server Park and with key external resources. The information in this table is particularly useful when planning for the installation of Blaise 5 server roles on multiple servers. Where a single Blaise 5 application server is used (i.e., all server roles running on a single server) most of these interactions are made internally on the server.

Calling Role / Service Role	Web	Resource	Data Entry	Data	Server Manager	Session	Audit Trail	DBMS	Web User
Web	--	--	--	--	HTTP/ 8031	--	--	--	HTTP/ HTTPS 80/443
Resource	HTTP/TCP 8033	--	--	--	HTTP/TCP 8031	--	--	--	--
Data Entry	HTTP/TCP 8033	--	--	--	HTTP/TCP 8031	--	--	--	--
Data	--	--	HTTP/TCP 8032	--	HTTP/TCP 8031	--	--	--	--
Server Manager	--	--	--	--	--	--	--	--	--
Session	--	--	HTTP/TCP 8032	--	HTTP/TCP 8031	--	--	--	--
Audit Trail	HTTP/TCP 8033	--	--	--	HTTP/TCP 8031	--	--	--	--
DBMS	--	--	--	ODBC	--	ODBC	ODBC	--	--
Web User	--	--	--	--	--	--	--	--	--

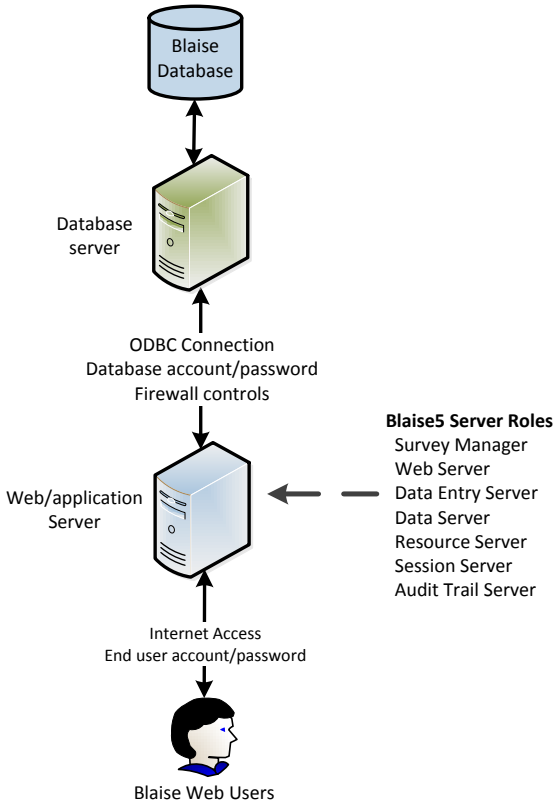
Additional notes on connectivity requirements between Blaise 5 server roles:

- The server roles/resource listed in the column is the resource initiating the call; the server role/resource listed in the row is the resource servicing the call.
- A cell value of '- - 'indicates that the calling resource (column) will never request a connection to the serving resource (row). For example, resources never call themselves (all cells on the diagonal have the value '-- -'), the Web server role does request service from the Data Entry server role, the Resource server role does request service from any server role, etc.
- Each cell in the table lists the protocol (or protocol alternative) and the default port over which the connection is made. When configuring the server roles on servers you can designate the protocol and port to use and override the default value.
- Only two server roles support connections directly with end users –the Web server role for web survey respondents over HTTP/HTTPS and the Survey Manager through a Windows application installed on the server.

Blaise 5 Server Configurations

The Blaise 5 architecture is quite flexible and permits organizations to adopt several different server configurations based on resource availability, scaling considerations, security requirements, or other factors.

2-server configuration - the following diagram shows a 2-server configuration for Blaise 5. One server is a web/application server on which the Blaise 5 software is installed and which support all of the Blaise 5 server roles. The 2nd server is a database server running SQL Server or another supported DBMS:



Notes about this configuration:

- This represents the minimum recommended security configuration for production use as it permits the database to be segregated from the front-end web server.

- A single instance of SQL Server can be used to support multiple Blaise 5 surveys and a separate SQL Server database can be defined for each Blaise 5 survey. This permits organizations running Blaise 5 to host several different surveys on the same underlying DBMS server and control access to survey data through the creation of separate SQL accounts and access control rules.

- During installation, the Blaise 5 software is configured to run under a Windows account. By default the local administrator account is used. Alternatively, a new Windows account can be created and assigned only the privileges required to run the Blaise 5 software. This is consistent with the security principle of least privilege and is a more secure practice.

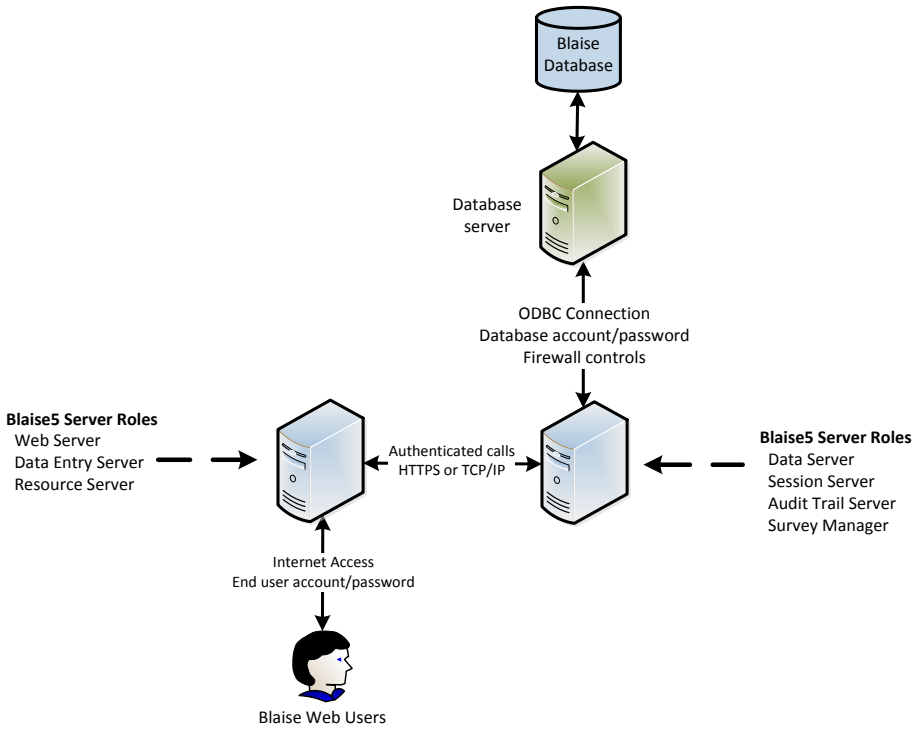
- The database connection between the Blaise 5 Data server and SQL Server is secured through the use of an account/password which is stored in a Blaise .bdix file.

- Access to the Blaise 5 instrument by Blaise users can be configured to use an HTTPS connection so that all user input is encrypted.

- The Survey Manager provides functions to create end-user accounts with passwords. These accounts can be assigned to end-users to control access to surveys.

- Stress testing performed by Westat indicates that a 2-server configuration can support between 200 – 300 concurrent users with acceptable response times. These results depend on the complexity and coding of the web survey, specification of the servers, etc.

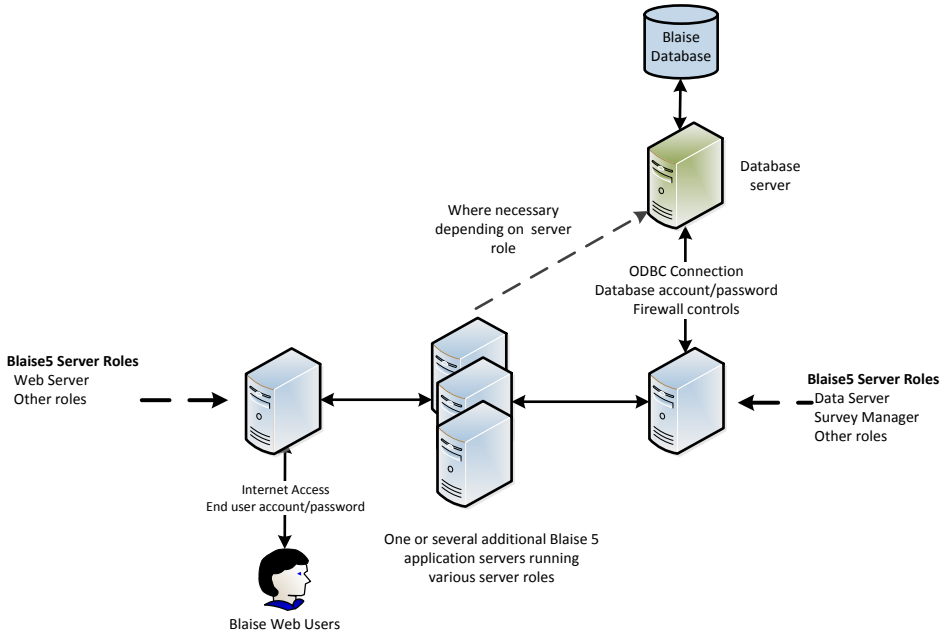
3-server configuration - the following diagram shows a 3-server configuration for Blaise 5 (one database server and two Blaise 5 web/application servers) with a recommended allocation of Blaise 5 server roles between servers:



Notes about this configuration:

- This configuration provides additional server resources for greater scale.
- This configuration also segregates the Blaise 5 server roles that access the Blaise 5 database from direct end-user access.
- Interaction between the Blaise 5 server roles on the two Blaise 5 servers is over HTTPS or TCP/IP protocol and can be secured through account/password or certificates.
- Westat has not yet performed stress testing using a 3-server configuration. We plan to complete this over the next several months.

Configurations for greater scalability – the following diagram shows a configuration where additional Blaise 5 servers have been added to the Server Park to scale out beyond a 3-server configuration:



Notes about this configuration:

- The Survey Manager role and Data Server role, Session Server role and the Audit Trail Server role can each be assigned to only one server in a server park.
- The Data Entry server role and Session server role are the two server roles that tend to become resource intensive as the number of concurrent users is increased. In instances where it becomes necessary to add additional servers to a Blaise 5 server park (i.e.,

more than 3) it will typically be most beneficial to assign the Session server role to a dedicated server and the Data Entry server role to multiple servers.

- Where the Web server role is assigned to more than one server, this configuration is analogous to employing the use of a network load balancer to distribute user connections to a web site across multiple web servers. The Blaise 5 software provides the functions of balancing load and distributing sessions across the multiple server.

Westat is continuing to work with Blaise 5 software under different configurations to better understand the various configuration options and more completely explore the performance of Blaise 5 for web surveys under increased load.