# Avaya Proactive Outreach Manager Port Matrix

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# 1. Proactive Outreach Manager Components

Data flows and their sockets are owned and directed by an application. Here a server running on RHEL 6.8 has many applications, such as Tomcat, Postgres, Apache Kafka, POM components, EP components. For all applications, sockets are created on the network interfaces on the server. For the purposes of firewall configuration, these sockets are sourced from the server, so the firewall (iptables service) should be running on the same server. Application components in the Proactive Outreach Manager Application Server are listed as follows.

| Component | Interface | Description |
|---|---|---|
| ActiveMQ | Eth0 | This is a messaging component used for Inter process communication between POM components.<br>For example – Values modified at runtime on POM Dashboard are sent to corresponding POM processes using ActiveMQ. |
| Agent Manager | Eth0 | The core POM component that manages agent operations. This component interfaces with the agent desktop, rule engine, nailer and driver applications, WFO, CMS and Campaign Manager. |
| WFO | Eth0 | Agent Manager provides interface to communicate with Avaya WFO (ACR) for recording events. |
| JMX | Eth0 | Used for process monitoring of POM components. |
| Campaign Manager | Eth0 | The core POM component that manages the execution of campaigns. It interfaces with Agent Manager, EPM web services and rule engine for contact processing and dialing. |
| Campaign Director | Eth0 | The core POM component that manages the life-cycle of campaigns, data imports and exports. It interfaces with the POM vpms_plugin installed on primary experience portal management system (EPMS) and campaign manager for contact processing. |
| Rule Engine | Eth0 | The core POM component that evaluates system rules and campaign rules for each campaign. It interfaces with Campaign Manager and Agent Manager at runtime for rule evaluation of the contacts. |
| Application Sever | Eth0 | The POM nailer and driver CCXML are hosted on the application server that manages the customer dialing and agent dialog. These application interfaces with agent manager for sending the call and agent events and receiving agent operation events. |
| VPMS_Plugin | Eth0 | The core POM component that provides management interfaces for configuring POM servers, campaign, strategies etc. This component is deployed on Primary Experience Portal Management System. |
| Agent Desktop | Eth0 | The desktop application that interfaces with the agent manager component for providing agent related features like Preview, Redial, callbacks, agent scripts etc. |
| Kafka Server,<br>Zookeeper | Eth0 | This is used for event framework in POM.POM generates and sends various events such as Job events, Agent events and also sends real-time statistics such as Job statistics, Agent statistics to Apache Kafka server. |

| Component | Interface | Description |
|---|---|---|
| EventSDK | Eth0 | Event SDK is used for receiving events from Apache Kafka server and the events are generated by POM to Kafka server and it will also provide interface to clients for their customization. |
| Advanced List and Campaign Management service | Eth0 | New Springboot based microservice used for Splitting Master contact list file using filter templates into smaller set of files and subsequently into contact lists. |
| Agent SDK Service | Eth0 | New Springboot based microservice which wraps up AgentManager APIs for WebSocket interface consumed by Workspace for Elite Agent Desktop for POM |
| Dashboard Service | Eth0 | New Springboot based microservice for showing supervisor dashboard |
| Multitenancy Service | Eth0 | New Service for Tenant and User management |
| POMCache | Eth0 | New Cache cluster based on Apache Ignite |

# 2. Port Usage Tables

## 2.1 Port Usage Table Heading Definitions

**Source System:** System name or type that initiates connection requests.

**Source Port:** This is the default layer-4 port number of the connection source. Valid values include: 0 – 65535. A "(C)" next to the port number means that the port number is configurable.

**Destination System:** System name or type that receives connection requests.

**Destination Port:** This is the default layer-4 port number to which the connection request is sent. Valid values include: 0 – 65535. A "(C)" next to the port number means that the port number is configurable.

**Network/Application Protocol:** This is the name associated with the layer-4 protocol and layers-5-7 application.

**Optionally Enabled / Disabled:** This field indicates whether customers can enable or disable a layer-4 port changing its default port setting. Valid values include: Yes or No

"No" means the default port state cannot be changed (e.g. enable or disabled).

"Yes" means the default port state can be changed and that the port can either be enabled or disabled.

**Default Port State:** The "product" source or destination port is either open, closed, filtered or N/A.

Open: ports will respond to queries

Closed: ports may or may not respond to queries and are listed when they can be optionally enabled.

Filtered: ports can be open or closed, filtered UDP ports will not respond to queries, filtered TCP will respond to queries but will not allow connectivity.

N/A: primarily ephemeral ports used to connect to external sources such as DNS, NTP, etc.

**Description:** Connection details. Add a reference to refer to the Notes section after each table for specifics on any of the row data, if necessary.

## 2.2 Port Tables

Below are the tables which document the port usage for this product.

**Table 1.** Ports for Proactive Outreach Manager 3.1.2 (eth0)

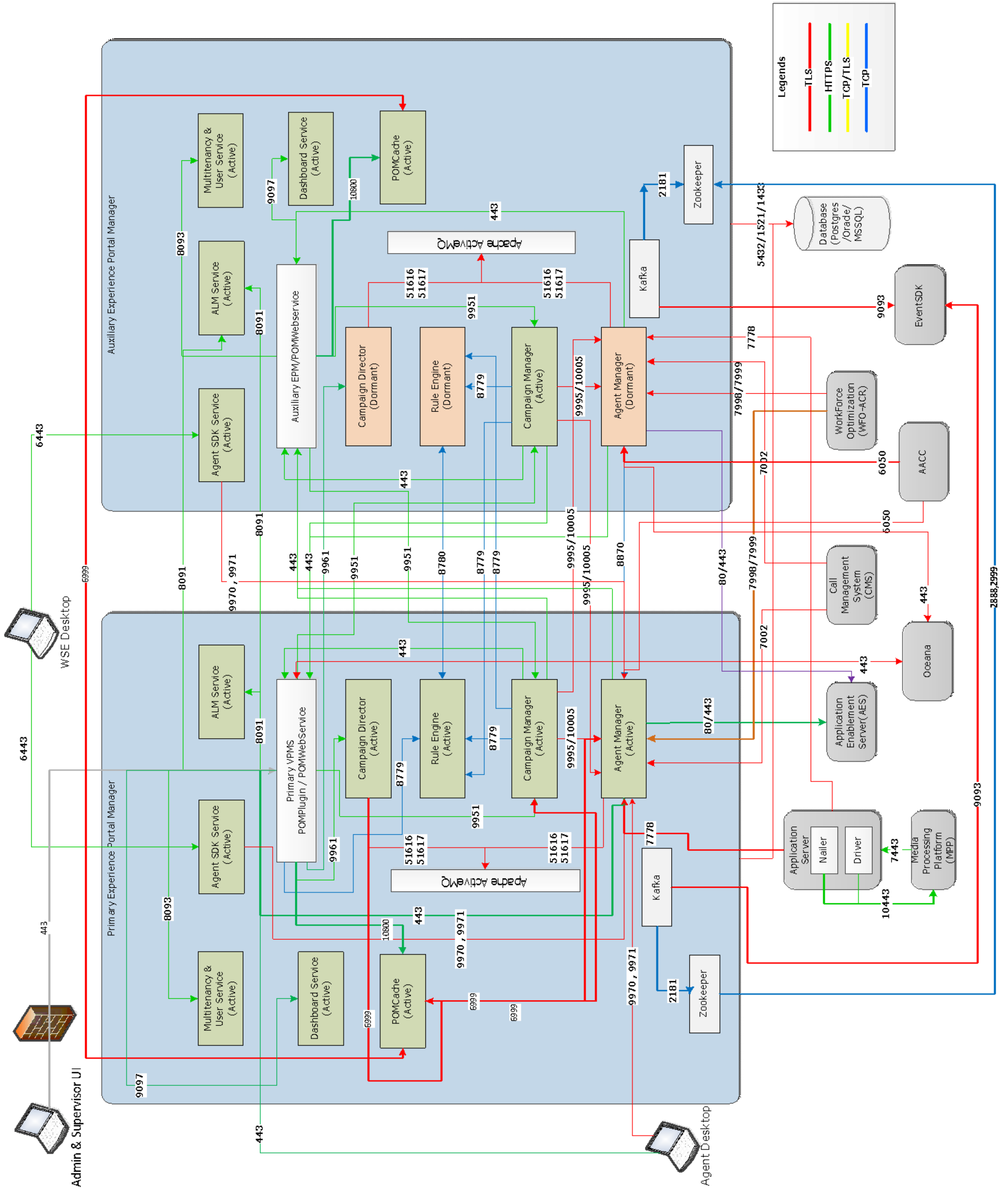
| Source | | Destination | | Network / Application Protocol | Optionally Enabled / Disabled? | Default Port State | Description |
|---|---|---|---|---|---|---|---|
| **System** | **Port (Configurable Range)** | **System** | **Port (Configurable Range)** | | | | |
| Campaign Manager | 1024-65535 | Agent Manager | 9995 – maximum number of zones (C) | TLS | No | Open | Pacer for each zone uses to communicate changes in pacing to the Campaign Manager. |
| Campaign Manager | 1024-65535 | Rule Engine | 8779 | TLS | No | Open | Campaign Manager request Rule Engine for rule evaluation for the contact to be attempted. |
| Campaign Manager | 1024-65535 | EPM | 443 | HTTPS | No | Open | This port is used for invoking Outcall Web services. |
| Campaign Manager | 1024-65535 | Agent Manager | 10005 – maximum number of zones (C) | TLS | No | Open | Pacer for each zone request agent records from campaign manager when attribute based or personal agenda based campaign is running. For each zone next port is opened So, we have 10006, 10007 for each new zone. |
| Agent Manager | 1024-65535 | ActiveMQ | l | TCP/TLS | No | Open | Agent manager uses ActiveMQ for inter process communication between self and EPM. |
| Agent Manager | 1024-65535 | AES | 80/443 | HTTP/HTTPS | No | Open | Agent Manager communicates with AES to fetch agent information from Communication Manager on agent login. |
| Agent Manager | 1024-65535 | Agent Manager | 8870 | TCP | No | Open | In multi POM environment for high availability of Agent Manager, the processes monitor the health of other servers on this port. |
| Agent Manager | 1024-65535 | EPM | 443 | HTTPS | No | Open | This port is used for invoking Outcall Web services. |
| Campaign Director | 1024-65535 | ActiveMQ | 51616 (C)/51617 | TCP/TLS | No | Open | Campaign Director uses ActiveMQ for inter process communication between self and EPM. |
| Rule Engine | 1024-65535 | Rule Engine | 8780 | TCP | No | Open | In multi POM environment for high availability of Rule Engine, the processes monitor the health of other servers on this port. |
| VPMS_Plugin | 1024-65535 | Campaign Manager | 9951 | HTTPS | No | Open | POM web services and user interface sends contact events to Campaign Manager on this port. |
| VPMS_Plugin | 1024-65535 | Rule Engine | 8779 | TLS | No | Open | POM user interface sends rule configuration to Rule Engine on this port. |
| VPMS_Plugin | 1024-65535 | Campaign Director | 9961 | HTTPS | No | Open | POM user interfaces sends JOB start event to Campaign Director on this port. |

| Source | | Destination | | Network / Application Protocol | Optionally Enabled / Disabled? | Default Port State | Description |
|---|---|---|---|---|---|---|---|
| System | Port (Configurable Range) | System | Port (Configurable Range) | | | | |
| Application Server | 1024-65535 | Agent Manager | 7778-maximum number of zones (C) | TLS | No | Open | Router uses to communicate agent information with application servers |
| Agent Desktop | 1024-65535 | Agent Manager | 9970, 9971-maximum number of zones (C) | TLS | No | Open | Agent desktops using POM Desktop API library connect to Agent Manager on these ports. |
| WFO | 1024-65535 | Agent Manager | 7999 (C) | TCP | No | Open | Avaya WFO connects to POM for recording events on this TCP port. |
| WFO | 1024-65535 | Agent Manager | 7998 (C) | TLS | No | Open | Avaya WFO connects to POM for recording events on this TLS port. |
| CMS Rt_socket | 1024-65535 | Agent Manager | 7002 (C) | TLS | No | Open | Agent Manager receives Skill data feed from Rt_socket package. |
| JMX Console | 1024-65535 | Agent Manager | 10010 | TCP | No | Open | These are JMX ports used for monitoring Campaign Manager, Campaign Director and the Agent Manager process. |
| JMX Console | 1024-65535 | Campaign Manager | 10011 | TCP | No | Open | These are JMX ports used for monitoring Campaign Manager, Campaign Director and the Agent Manager process. |
| JMX Console | 1024-65535 | Campaign Director | 10012 | TCP | No | Open | These are JMX ports used for monitoring Campaign Manager, Campaign Director and the Agent Manager process. |
| Agent Manager, Campaign Director, Campaign Manager, Rule Engine | 1024-65535 | Postgres | 5432 (C) | TCP/TLS | No | Open | Database Port |
| Agent Manager, Campaign Director, Campaign Manager, Rule Engine | 1024-65535 | Oracle | 1521 (C) | TCP/TLS | No | Open | Database Port |
| Agent Manager, Campaign Director, Campaign Manager, Rule Engine | 1024-65535 | MSSQL | 1433 (C) | TCP/TLS | No | Open | Database Port |
| Application Server | 1024-65535 | MPP | 10443 | HTTPS | No | Open | This port is used for sending events to MPP server. |
| EventSDK | 1024-65535 | Kafka | 9093 (C) | TLS | No | Open | Kafka server listens on this port and it is used for getting request/response from Kafka clients (EventSDK). |

| Source | | Destination | | Network / Application Protocol | Optionally Enabled / Disabled? | Default Port State | Description |
|---|---|---|---|---|---|---|---|
| System | Port (Configurable Range) | System | Port (Configurable Range) | | | | |
| Kafka | 1024-65535 | Zookeeper | 2181 | TCP | No | Open | Kafka server and Zookeeper talks internally on this port. |
| Agent Manager, Campaign Director, Campaign Manager | 1024-65535 | Kafka | 9093 (C) | TLS | No | Open | Producers send data event to kafka server on this port. |
| Advanced List Management Service | 1024-65535 | Advanced List Management Service | 8091 | TLS | No | Open | This port is used for communicating to ALM service via TLS |
| Agent SDK Service | 1024-65535 | Agent SDK Service | 6443 | TLS | No | Open | This port is used form Workspace for Elite POM desktop to Websocket based service |
| External Selection | 1024-65535 | Agent Manager | 11000 | TLS | No | Open | This port is used for connecting External selection system to Agent Manager |
| ZooKeeper | 1024-65535 | Zookeeper | 2888, 2999 | TCP | Yes | Open | ZooKeeper nodes use a pair of ports -<br>2888 and 3888 for follower nodes to connect to the leader node and for leader election, respectively. |
| EPM | 1024-65535 | Dashboard Service | 9097 | HTTPS | Yes | Open | Forwarding HTTPS requests from main EPM Tomcat to Dashboard Service |
| EPM | 1024-65535 | Multitenancy Sevice | 8093 | HTTPS | Yes | Open | Forwarding HTTPS requests from main EPM Tomcat to Multitenancy Service |
| Multitenancy Service(Ignite Cache) | 1024-65535 | Multitenancy Sevice | 10850 | TLS | Yes | Open | This port is used by Ignite Cache in Multitenancy service |
| Agent Manager | 1024-65535 | POMCache | 6999 | TLS | Yes | Open | This port is used for communication between AM and POMCache |
| Campaign Manager | 1024-65535 | POMCache | 6999 | TLS | Yes | Open | This port is used for communication between Campaign Manager and POMCache |
| Campaign Director | 1024-65535 | POMCache | 6999 | TLS | Yes | Open | This port is used for communication between Campaign Director and POMCache |
| EPM | 1024-65535 | POMCache | 10800 | TLS | Yes | Open | This port is used for communication between VPMS and POMCache service |
| POMCache | 1024-65535 | POMCache | 6999, 47100-47102, 10800-10802, 11211, 7445 | TLS | Yes | Open | Cache Service uses this port to synchronize between each other |
| POMCache | 1024-65535 | POMCache | 6999 | TLS | Yes | Open | Cache Service uses this port to synchronize between each other |
| POMCache | 1024-65535 | POMCache | 47100-47102 | TCP | Yes | Open | Cache Service uses this port for Internal TCP communication |

| Source | | Destination | | Network / Application Protocol | Optionally Enabled / Disabled? | Default Port State | Description |
|---|---|---|---|---|---|---|---|
| System | Port (Configurable Range) | System | Port (Configurable Range) | | | | |
| POMCache | 1024-65535 | POMCache | 10800-10802 | TCP | Yes | Open | Cache Service uses this port for Thin client discovery ports |
| POMCache | 1024-65535 | POMCache | 11211 | HTTP/S | Yes | Open | HTTP internal |
| POMCache | 1024-65535 | POMCache | 7445 | HTTP/S | Yes | Open | Cache Spring boot server port |
| AACC | 1024-65535 | Agent Manager | 6050 | TLS | Yes | Open | AACC broadcast |
| EPM | 1024-65535 | AACC/ Oceana | 443 | TLS | Yes | Open | UI makes a call to AACC/Oceana for skills |

## 3. Port Usage Diagram



Legends
TLS
HTTPS
TCP/TLS
TCP
Auxiliary Experience Portal Manager
Primary Experience Portal Manager
Multitenancy & User Service (Active)
Dashboard Service (Active)
POMCache (Active)
ALM Service (Active)
Agent SDK Service (Active)
Auxiliary EPM/POMWebservice
Primary VPMS POMPlugin / POMWebService
Campaign Director (Dormant)
Campaign Director (Active)
Rule Engine (Dormant)
Rule Engine (Active)
Campaign Manager (Active)
Agent Manager (Dormant)
Agent Manager (Active)
Apache ActiveMQ
Kafka
Zookeeper
Database (Postgres /Oracle/ MSSQL)
EventSDK
WorkForce Optimization (WFO-ACR)
AACC
Call Management System (CMS)
Oceana
Application Enablement Server(AES)
Application Server
Nailer
Driver
Media Processing Platform (MPP)
WSE Desktop
Admin & Supervisor UI
Agent Desktop
8093
9097
10800
443
8091
51616 51617
9951
8779
9995/10005
2181
5432/1521/1433
9093
7778
7998/7999
7002
6050
80/443
8870
8780
9961
9970 , 9971
6443
6999
2888,2999
7443
10443

# Appendix A: Overview of TCP/IP Ports

## What are ports and how are they used?

TCP and UDP use ports (defined at http://www.iana.org/assignments/port-numbers) to route traffic arriving at a particular IP device to the correct upper layer application. These ports are logical descriptors (numbers) that help devices multiplex and de-multiplex information streams. For example, your PC may have multiple applications simultaneously receiving information: email using destination TCP port 25, a browser using destination TCP port 443 and a ssh session using destination TCP port 22. These logical ports allow the PC to de-multiplex a single incoming serial data packet stream into three mini-streams inside the PC. Each of the mini-streams is directed to the correct high-level application identified by the port numbers. Every IP device has incoming (Ingress) and outgoing (Egress) data streams.

Ports are used in TCP and UDP to name the ends of logical connections which carry data flows. TCP and UDP streams have an IP address and port number for both source and destination IP devices. The pairing of an IP address and a port number is called a socket. Therefore, each data stream is uniquely identified with two sockets. Source and destination sockets must be known by the source before a data stream can be sent to the destination. Some destination ports are “open” to receive data streams and are called “listening” ports. Listening ports actively wait for a source (client) to make contact with the known protocol associated with the port number. HTTPS, as an example, is assigned port number 443. When a destination IP device is contacted by a source device using port 443, the destination uses the HTTPS protocol for that data stream conversation.

## Port Types

Port numbers are divided into three ranges: Well Known Ports, Registered Ports, and Dynamic Ports (sometimes called Private Ports). The Well Known and Registered ports are assigned by IANA (Internet Assigned Numbers Authority) and are found here: http://www.iana.org/assignments/port-numbers.

### Well Known Ports

Well Known Ports are those numbered from 0 through 1023.
For the purpose of providing services to unknown clients, a service listen port is defined. This port is used by the server process as its listen port. Common services often use listen ports in the well-known port range. A well-known port is normally active meaning that it is “listening” for any traffic destined for a specific application. For example, well known port 23 on a server is actively waiting for a data source to contact the server IP address using this port number to establish a Telnet session. Well known port 25 is waiting for an email session, etc. These ports are tied to a well understood application and range from 0 to 1023.

In UNIX and Linux operating systems, only root may open or close a well-known port. Well Known Ports are also commonly referred to as “privileged ports”.

### Registered Ports

Registered Ports are those numbered from 1024 through 49151.
Unlike well-known ports, these ports are not restricted to the root user. Less common services register ports in this range. Avaya uses ports in this range for call control. Some, but not all, ports used by Avaya in this range include: 1719/1720 for H.323, 5060/5061 for SIP, 2944 for H.248 and others. The registered port range is 1024 – 49151. Even though a port is registered with an application name, industry often uses these ports for different applications. Conflicts can occur in an enterprise when a port with one meaning is used by two servers with different meanings.

### Dynamic Ports

Dynamic Ports are those numbered from 49152 through 65535.
Dynamic ports, sometimes called “private ports”, are available to use for any general purpose. This means there are no meanings associated with these ports (similar to RFC 1918 IP Address Usage). These are the safest ports to use because no application types are linked to these ports. The dynamic port range is 49152 – 65535.

## Sockets

A socket is the pairing of an IP address with a port number. An example would be 192.168.5.17:3009, where 3009 is the socket number associated with the IP address. A data flow, or conversation, requires two sockets – one at the source device and one at the destination device. The data flow then has two sockets with a total of four logical elements. Each data flow must be unique. If one of the four elements is unique, the data flow is unique. The following three data flows are uniquely identified by socket number and/or IP address.

Data Flow 1: 172.16.16.14:1234 - 10.1.2.3:2345
two different port numbers and IP addresses and is a valid and typical socket pair

Data Flow 2: 172.16.16.14.123**5** - 10.1.2.3:2345
same IP addresses and port numbers on the second IP address as data flow 1, but since the port number on the first socket differs, the data flow is unique

Data Flow 3: 172.16.16.14:1234 - 10.1.2.4:2345

If one IP address octet changes, or one port number changes, the data flow is unique.

Socket Example Diagram

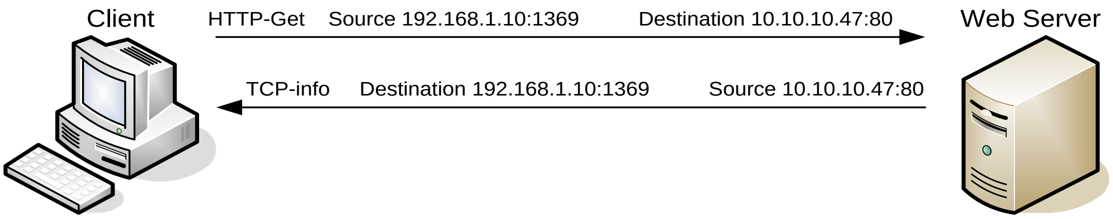


**Figure 1.** Socket example showing ingress and egress data flows from a PC to a web server

The client egress stream includes the client’s source IP and socket (1369) and the destination IP and socket (80). The ingress stream from the server has the source and destination information reversed.

## Understanding Firewall Types and Policy Creation

### Firewall Types

There are three basic firewall types:

- Packet Filtering
- Application Level Gateways (Proxy Servers)
- Hybrid (Stateful Inspection)

Packet Filtering is the most basic form of the firewalls. Each packet that arrives or leaves the network has its header fields examined against criterion to either drop the packet or let it through. Routers configured with Access Control Lists (ACL) use packet filtering. An example of packet filtering is preventing any source device on the Engineering subnet to telnet into any device in the Accounting subnet.

Application level gateways (ALG) act as a proxy, preventing a direct connection between the foreign device and the internal destination device. ALGs filter each individual packet rather than blindly copying bytes. ALGs can also send alerts via email, alarms or other methods and keep log files to track significant events.

Hybrid firewalls are dynamic systems, tracking each connection traversing all interfaces of the firewall and making sure they are valid. In addition to looking at headers, the content of the packet, up through the application layer, is examined. A stateful inspection firewall also monitors the state of the connection and compiles the information in a state table. Stateful inspection firewalls close off ports until the connection to the specific port is requested. This is an enhancement to security against port scanning[1].

## Firewall Policies

The goals of firewall policies are to monitor, authorize and log data flows and events. They also restrict access using IP addresses, port numbers and application types and sub-types.

This paper is focused with identifying the port numbers used by Avaya products so effective firewall policies can be created without disrupting business communications or opening unnecessary access into the network.

Knowing that the source column in the following matrices is the socket initiator is key in building some types of firewall policies. Some firewalls can be configured to automatically create a return path through the firewall if the initiating source is allowed through. This option removes the need to enter two firewall rules, one for each stream direction, but can also raise security concerns.

Another feature of some firewalls is to create an umbrella policy that allows access for many independent data flows using a common higher layer attribute. Finally, many firewall policies can be avoided by placing endpoints and the servers that serve those endpoints in the same firewall zone.

[1] The act of systematically scanning a computer's ports. Since a port is a place where information goes into and out of a computer, port scanning identifies open doors to a computer. Port scanning has legitimate uses in managing networks, but port scanning also can be malicious in nature if someone is looking for a weakened access point to break into your computer.