Presto 2.0

Using Presto Rules

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So, I Installed Presto. Now What?

Don't be intimidated. Writing Presto rules is simple, once you get the hang of it. Let's start by looking at the default rules that are in place when you run the Presto Server for the first time. Open the Presto Server Console and navigate to the Rules pane (click in
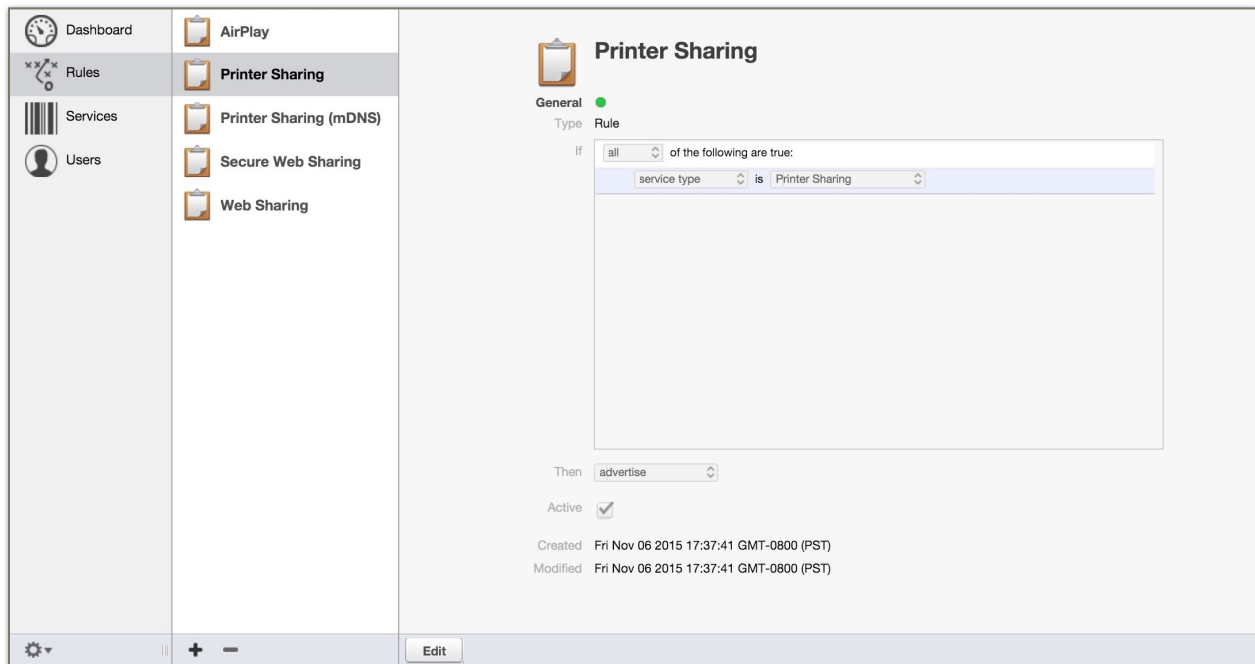
the world Rules in the leftmost column). You should see this (Figure 1):

Figure 1. Presto Server Console with default rules.

Default Rules

Select the Printer Sharing rule (click on it in the second column). Click the Edit button in the lower left corner. It should like like Figure 2 (minus the red annotations).
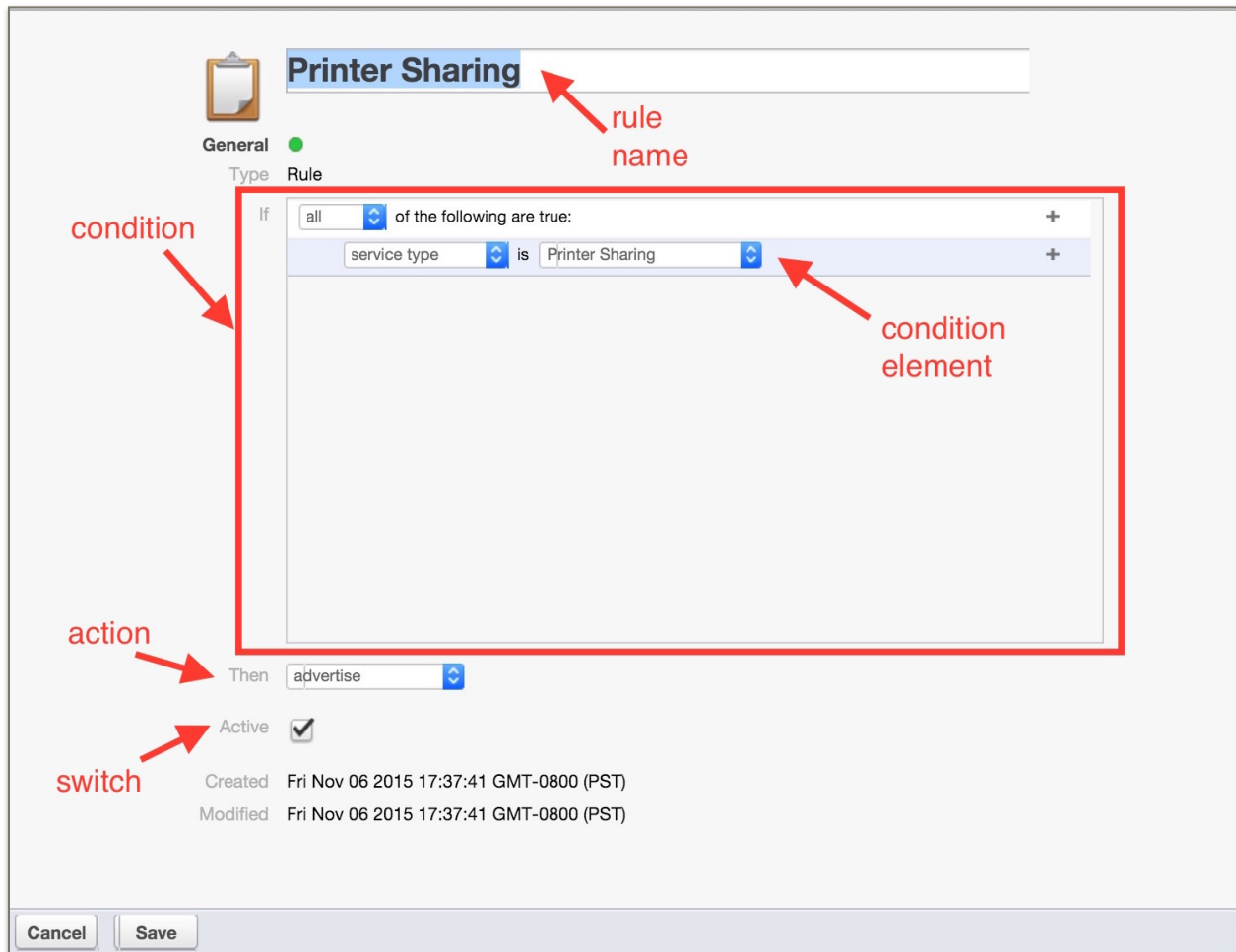
Figure 2. Parts of a Rule.

Rule Name

The rule name is simply that. When the rule is open for editing, you can change it. Rule names must be unique, but the rule editor will force uniqueness by adding a number if you try to make two rules with the same name.

Condition

Everything enclosed in the red box in Figure 2 is the rule condition. Note the word "If" next to the upper left corner of the box. A condition is made up of condition elements.

Action

Click on the rule action (next to the word "Then"). You should see a pop-up menu with two choices: advertise and do not advertise. We'll talk more about this in a moment.

Switch

If the switch check-box (next to the word "Active") is checked, the rule is active—it will have an effect how Presto responds to queries for services. If it isn't checked, the rule is inactive, having no effect.

What does this rule do?

In order to answer that, we need to understand what Presto is doing in a larger sense. One of Presto's primary jobs is to respond to queries for services. For example, if you want to print a document from your mobile device, when you open the print dialog you will be given the opportunity to select a printer from among a list of available printers. When you mobile device needs to find available services (like printers, or AirPlay devices) it performs a *browse* operation. If Presto is installed on your network and your device, this browse operation takes the form of a query message, sent by your device to the Presto server. The query message specifies what type of service it's browsing for (e.g., printers), and may include additional context, such as the user ID of the person performing the browse, or the location of the device sending the query message. When the Presto server receives the query, it applies the logic expressed in the active rules to determine which of the available services on the network will be included in the response to the query. (When a service is included in a query response, that is called *advertising* the service).

Rules match services to queries on a pairwise basis—one query and one service are considered together when evaluating the rule condition. Each condition element in a rule is a statement about the query or the service (or sometimes both) that is either true or false. If all of the condition elements in a rule are true, when evaluated with a particular query / service pair, that query / service pair is said to *satisfy* the rule. The effect of the rule on the response to the query depends on the rule's action. For the moment, let's focus on rules with the *advertise* action. If a rule that advertises is satisfied by a particular query / service pair—that is, the condition of the rule, taken as a whole, evaluates to true for that query / service pair—then the service will be included in the response to the query (it will be *advertised*). In the specific scenario at hand, that means the printer (the service) will be one of the choices presented in the print dialog box when you browse for printers on your mobile device.

Back to the original question—what does this rule (Printer Sharing) do? Printer Sharing, and the other default rules (except for Printer Sharing mDNS; ignore that one for now) are the simplest rules that can be written for Presto. They all have only one condition element— the service type. The service type condition element applies to both the query and the service. Every query will include the type of service that is being browsed for. Likewise, every service has a type. Whenever the Presto server receives a query of type Printer Sharing, the rule engine will pair that query with every printer currently available on the network, and evaluate this rule against the pair. Because this rule doesn't make any other statements about the printer under consideration, all of the printers will satisfy the rule, when paired with any query of type Printer Sharing. The Printer Sharing rule will result in all available printers being advertised in response to any browse for print services. All of the other default rules (except Printer Sharing mDNS) are similarly promiscuous—all services of the type specified in the rule will be advertised in response to any query for that type. For smaller organizations with only a few printers, all in the same location, this may be the desired behavior.

Maxims

Before we consider more complex scenarios, there are some important maxims that must be observed. The first condition element in any rule is a compound condition element—it groups together a set of condition elements beneath it. Compound condition elements come in two flavors—*any* or *all*. We'll discuss how these are used in more detail later. For now, just accept the first Maxim:

> Maxim 1: The first condition element in any rule must be a compound condition element of type *all*.

You can try to change it to *any* if you want, but when you save the rule the editor will respond with an error message and refuse the change.

> Maxim 2: The second condition element in any rule must specify the service type that the rule applies to.

The editor will also enforce this maxim, displaying an error message and refusing the change when an attempt to save is made.

The rest of this document will focus primarily on different scenarios that illustrate how rules can be used to achieve desired effects. In each case, emphasis will be placed

stating the desired behavior as clearly and precisely as possible. Let's just make that a Maxim:

> Maxim 3: Before you start composing rules, take the time to define what you want them to do, clearly and precisely.

Scenario 1: Different Printers for Different Groups of Users

Operating systems typically require users to be assigned to groups, and allow administrators to grant or deny permission to resources based on group membership. In this scenario, the word group is used in that sense—group identities managed by the authentication and authorization mechanisms of the underlying operating system.

In this scenario, we make the following assumptions and statements of intent:

- Our organization has an art department. Employees in the art department belong to the group "art_dept".

- The art department owns printers used for graphics production. These printers use expensive media and consumables. Only employees of the art department should be able to print on those printers.

- All other printers should be available for use by anyone.

Let's re-state that in terms of sets. First, we have a set of people called employees. We have a subset of employees, called art department employees. We have a set of printers, divided into two disjoint subsets—public printers, and restricted printers (where restricted printers are those belonging to the art department).

We need a way to identify sets of users and sets of services (e.g., printers), and a mechanism for writing rules that control advertisements based on membership in those sets. Fortunately, Presto provides just such a mechanism.

In order to make a point, first we're going to write a set of rules that, while functional, are overly complicated. After that, we'll see how rules can be simplified in some cases.

Tags

Tags are your best friend in the Presto world. Tags are simple character strings that can be associated with users, queries, and services. Some tags are automatically generated and assigned by Presto. Administrators can define their own tags and assign them to users and services. Rules can include condition elements that depend on certain tag values being associated with queries or services.

Group Tags

Presto automatically generates tags based on the groups that a user has membership in. Figure 3 shows a Presto user profile with automatically generated group tags. Each tag name is created by appending the group name to the string "group:". This user (Chromium Mozambique) belongs to the group art_dept, having the tag "group:art_dept".
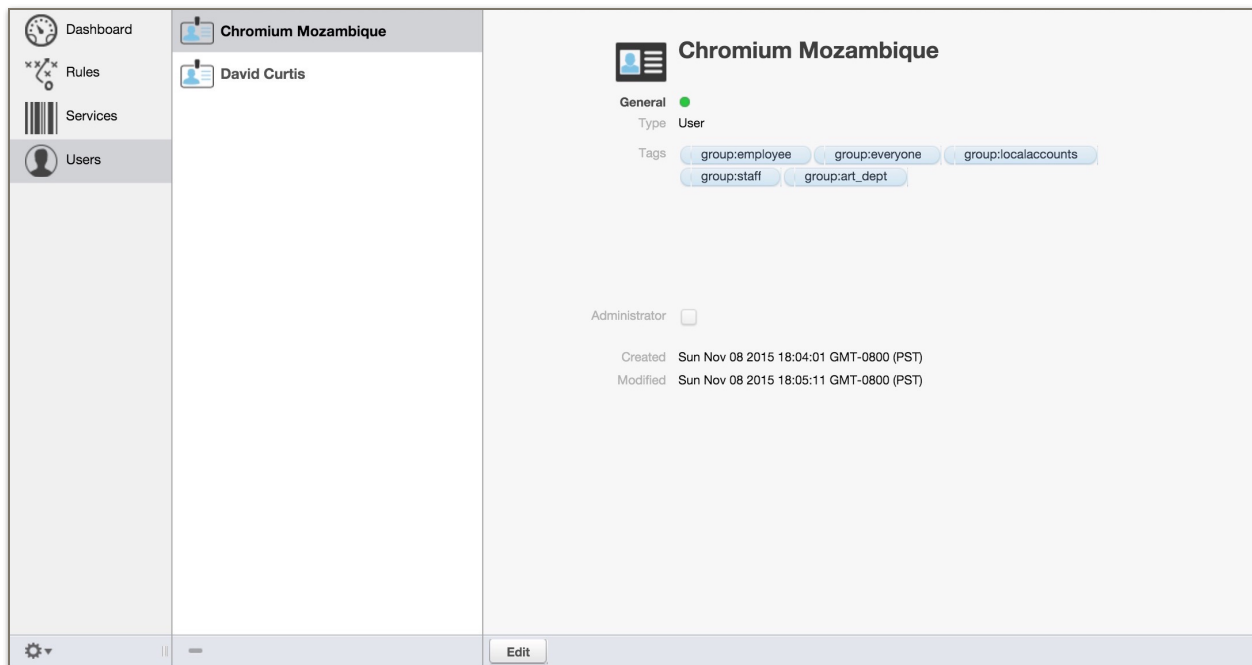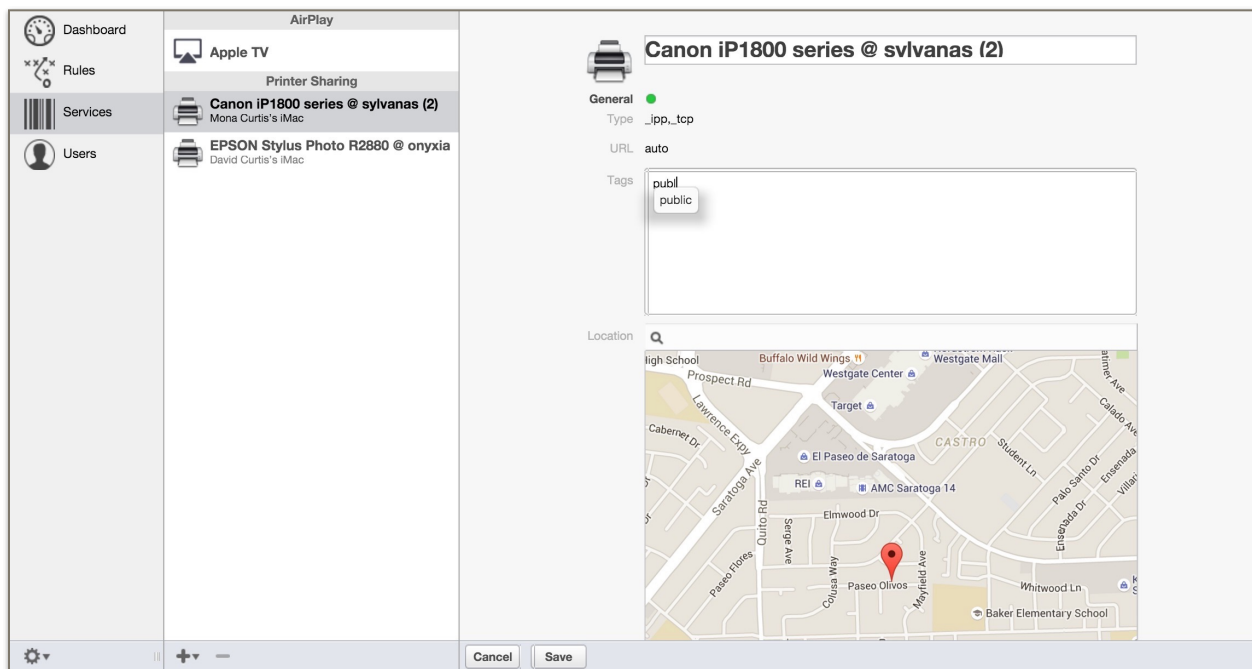
Figure 3. Automatically generated group tags.

If a user is logged in to the Presto app on their mobile device, and they are using a device that supports user identity in queries, then Presto will include all of the user's tags in the query context.

Now we can assign tags to printers to distinguish between public and restricted printers. Tags are assigned through the Services pane, as shown in Figure 4.

Figure 4. Assigning tags to services

Presto will offer auto-complete options when entering a tag name, if the entry matches existing tags. Let's assume that the other printer (the Epson) belongs to the art department, so we assign it the "restricted" tag (see Figure 5).
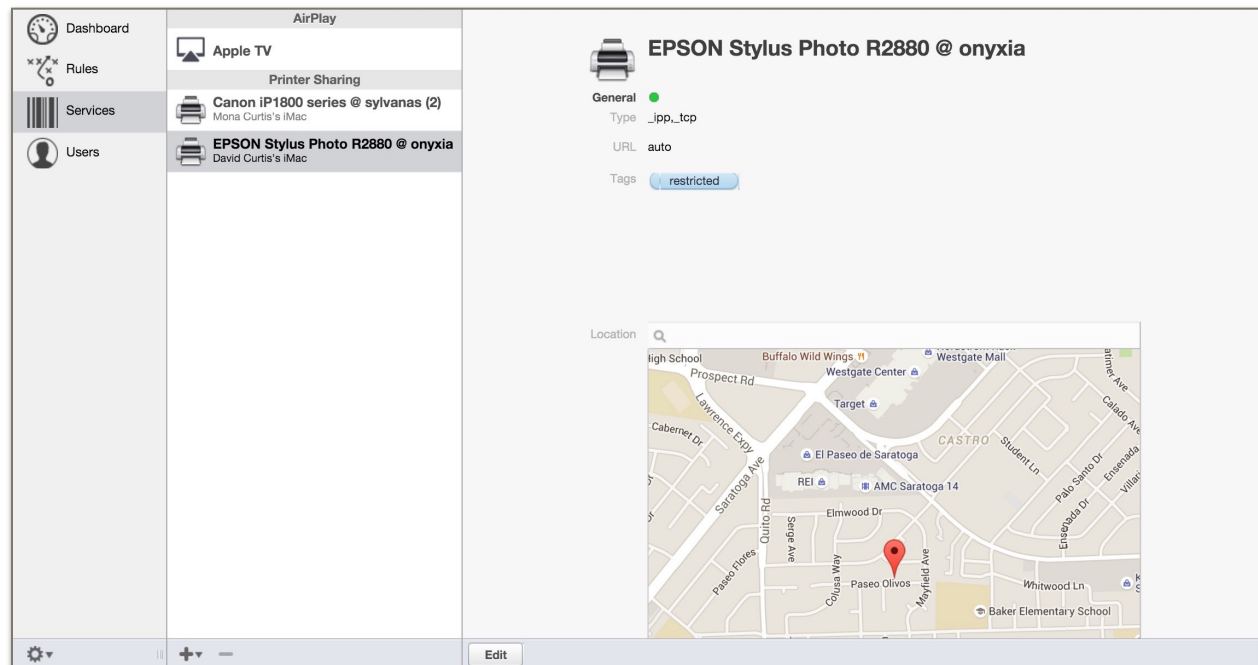

Figure 5. Another service tag

Now we can create rules that provide the desired behavior. The rule Public Printers (in Figure 6) will advertise printers with the "public" tag to all queries for printers. Note that we don't specify any user tags because this rule should work for any query, regardless of the user that originated it. The rule Restricted Printers (in Figure 7) will advertise printers tagged with "restricted" only to queries from users with the tag "group:art_dept". So, for example, if Chromium (in the art department) tries to print a document, all printers will appear in the list of printer choices. Another user who is not in the art department (or who is not logged in to the Presto app on the device) will only see the printers tagged "public".

Figure 6. Public Printers rule

Figure 7. Restricted Printers rule

Simplify and Generalize

As simple as these rules are, they are unnecessarily complicated. As you may have already observed, given that employees in the art department can print on any printer, it isn't necessary to tag the restricted printers. If we simply remove the service tag condition element from Restricted Printers, the rules will still work as desired. The edited, simplified Restricted Printers rule is shown in Figure 8.
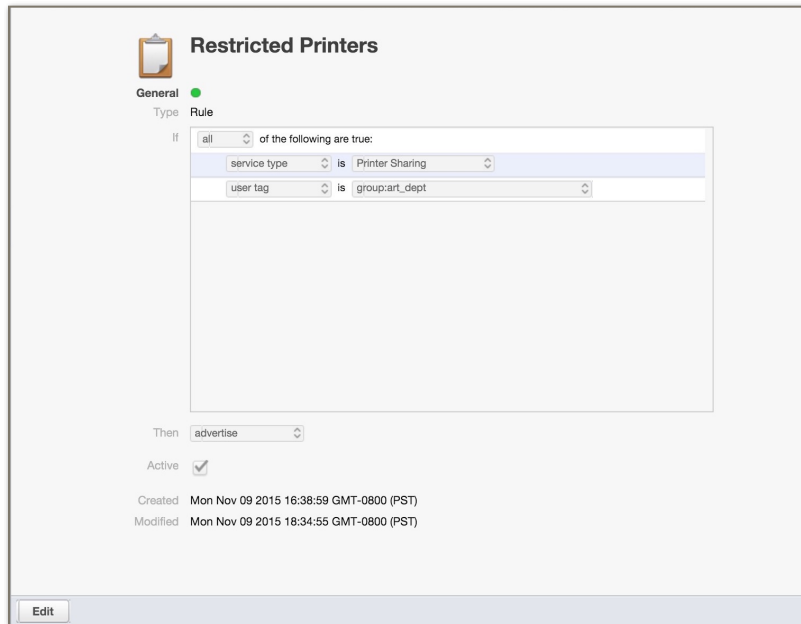

Figure 8. Simplified rule.

Putting the "restricted" tag on the art department's printers is also unnecessary. By simply omitting the "public" tag, we prevent advertising the restricted printers from being advertised by the Public Printers rule.

This leads us to more Maxims:

Maxim 4: Prefer simpler rules (with fewer condition elements) to complex rules.

Maxim 5: The best way to broaden a rule (that is, increase the number of queries it advertises to) is to remove condition elements, not add them.

Maxim 6: Make rules as general as possible (this is really just another way of stating Maxims 4 and 5 together).

More about query context

User tags are only available to rules if the user making the query is logged in to the Presto app on the mobile device in use, and the device support the ability to send context as part of the query message. At present, iOS devices cannot sent user identity or location information in the query. How can advertisement be controlled if user identity and tags aren't available?

Subnets

Every query includes a tag that identifies the subnet from which the query originated. The name of the tag is "subnet:" followed by the IP address of the subnet. This is always present in the query context, regardless of the type of device, or whether the user is logged in. Rules can be written to advertise to queries based on these subnet tags. The approach requires that users' devices be configured to connect to different wireless SSIDs, which, in turn, are on different subnets. Let's re-cast our previous example so that it works with this approach.

Scenario 2: Supporting AirPrint

Assume that our organization has two wireless networks with different SSIDs, and which are on separate subnets—192.168.0.0/24 and 192.168.1.0/24. Also, assume that the mobile devices of the art department employees are configured to connect to the SSID on 192.168.0.0/24, and other employees' devices are configured to connect to 192.168.1.0/24. If you're using this approach, it's easiest to think of a subnet tag as the rough equivalent of a user group tag, since you're segregating user groups with subnets.

It may be a bit confusing, but the subnet tags appear to rules as if they are user tags, even though the subnet tag isn't part of the user profile. A more appropriate name for the condition element type might be "query tag", since the tags are actually associated with the query, not necessarily users. Nevertheless, use the user tag condition element to specify the subnet tags in a rule. The new version of the rule for art department printers ("Subnet Restricted Printers") in Figure 9 specifies the appropriate subnet instead of the user group tag. Note that the Public Printers rule doesn't need to change, since it doesn't specify a group tag.
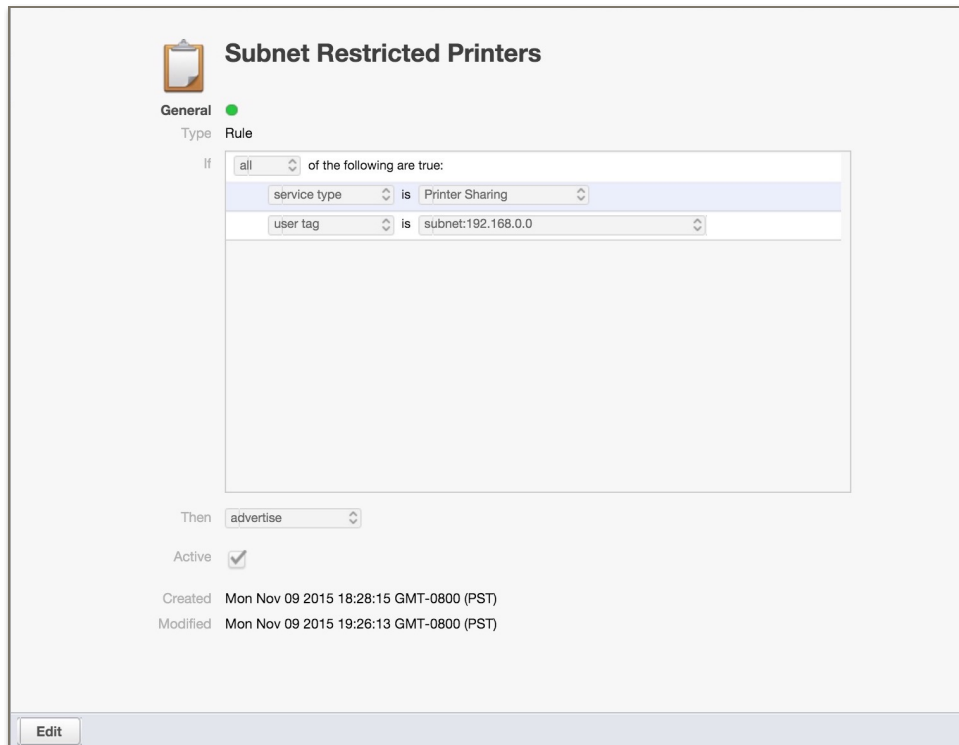
Figure 9. Using subnet tags in the place of user group tags.

Combining Different Strategies

In an organization where users have a variety of devices (e.g., iOS, Android, or Chrome OS devices), non-iOS devices support the inclusion of user ID and location. The original Public Printers rule will permit non-iOS device users in the art department to have access to their restricted printers, regardless of the subnet they are on. Using Restricted Printers and Subnet Restricted Printers in the same configuration is a perfectly reasonable thing to do, and allows an administrator a little more flexibility in how devices and networks are configured.

It's worth noting that, if an Android user in the art department were connected to subnet 192.168.0.0, both rules would allow restricted printers to be advertised to that user. This is perfectly acceptable. It won't cause the printer to show up twice in the printer selection dialog.

Scenario 3:Using Compound Condition Elements

Let's expand the original scenario—administrators decided that they want to be able to print to the fancy printers in the art department because… well, they are administrators,

so who is going to stop them? Anyway, we can extend the Restricted Printers rule to accommodate this. Edit the Restricted Printers rule as follows:

1. Remove the condition element that specifies the user tag "group:art_dept" by clicking on the minus sign at the right end of that condition element.

2. Add a compound condition element to the rule by clicking the plus sign on the last condition element in the rule while holding down the option key.

3. Select the "any" option in the pop-up menu of the compound condition element.

4. Note that, when the compound condition element is added, another condition element (by default, of type service name) is added beneath the compound element. Change this to a user tag condition element, and select the tag value "group:admin" from the pop-up menu of tag values.

5. Click the plus sign on the right end of the user tag element you just added, to create another element. Change this element to a user tag element, and select the tag value "group:art_dept".

6. Save the rule. It should look something like Figure 10.

Figure 10. Compound condition element

The two user tag elements are indented beneath the compound element, indicating that they are subordinate to the compound element, or members of the group defined by the compound element. Because the compound element is of type "any", it will evaluate to true if at least one of the sub-elements are true. While we're add it we can add the subnet tag for the subnet reserved for art_department employees with iOS devices and eliminate the rule "Subnet Restricted Printers" (see Figure 11).

Figure 11. Adding sub-elements to the compound element

Any query that satisfies at least one of these three elements will have all available printers (public or restricted) advertised in it's response.

Loose Ends

There are a few topics that haven't been covered by these scenarios that, nevertheless, merit some discussion.

What's this mDNS stuff all about?

Presto depends on DNS services to perform its job. Most medium or large enterprises have internal DNS servers that can be configured to forward appropriate requests to the Presto server. Small organizations, in contrast typically use external DNS servers (usually provided by their ISPs or publicly-available servers like OpenDNS), and typically consist of a single subnet. The configuration of DNS services for Presto installations is covered in detail in the Presto Administrator Guide.

In small environments consisting of a single subnet with external DNS servers, Presto relies on multicast DNS queries to support iOS devices. The Printer Sharing (mDNS) rule exists to support such small environments. By default, this rule is not active. If your network environment fits this description, you should set the Printer Sharing (mDNS) rule to active. Otherwise (if you have internal DNS servers configured to support Presto), leave this rule inactive. You should not edit the condition of this rule.

Rules that Prohibit Advertisement

 If the action of a rule is set to *do not advertise*, and one or more query/service pairs satisfy the rule's condition, that rule will prohibit the services being advertised to the queries they are pair with. A rule that prohibits advertisement takes priority over rules that might propose advertising those services to that query. In general, prohibitive rules are a bit like sledgehammers—they are powerful, but must be used with care. In general, if you can achieve the desired behavior using only rules that advertise, that is preferable.

Summary

Presto's rules facility provides unprecedented control and flexibility over service discovery and access in Enterprise Environments. As we continue to improve our product and work with our customers to understand and solve their problems, expect to see new capabilities added—more context to reason about, new condition elements, richer logical expressions—informed by our customers' experiences and needs. We also plan to continue adding to and refining this document, so that over time it evolves into a true guide to "best practices" for Presto rules.