CCNx 1.0 Simple Service Discovery

Glenn Scott[1]

Abstract
Service Discovery is a way to detect computation, storage, communication, sensors or actuator functions offered by devices on a network in a dynamic way. Typically what is detected is metadata about the offered service such that clients may interact with the service directly. This note describes a protocol and conventions for providing a simple discovery protocol using CCN to obtain this metadata.

Keywords
Information Centric Networks — Named Data Networks — Content Centric Networking

[1] *Computing Science Laboratory, Palo Alto Research Center*

Contents

1. Introduction

The major components in this Service Discovery scheme are:

1. Service Provider Computation, storage, communication, sensor, actuator or other resource offered on the network.

2. Service Client A consumer of a service offered on the network.

3. Service Discovery Broker A well known, named function that admits and demits Services and answers queries for admitted Services.

4. Service Agent A component that represents a Service Provider on the CCN network and performs the interactions with the Service Discovery Broker and, potentially, the Service Client.

A natural approach is to have all Service Providers listen for CCN Interests in a particular name that is unique to each Provider. This name is coordinated with a Service Discovery Broker. When a Service Client needs to find a service, it interacts with a Service Discovery Broker to obtain the Service metadata. The Service Client uses the metadata to communicate directly with the Service. The features of CCN permit but aren?t limited to, the caching of the metadata within the network and the distribution of the functionality of the Service Broker.

2. Service Discovery Name Space

A CCN name is chosen as the root of the Service Discovery Name Space. This name is established a priori by convention and is well known across the participants in the Service Discovery protocol. This name is the authoritative root for a hierarchy of names structuring one or more kinds of services in any way that can be described by convention.

For example a Service Discovery Name Space may be organized by service type, like Printer, Projector, and so forth. It may organize by location, or any other distinction that is suitable for the environment that it serves.

Consider `/parc/Services` as the name of a Service Discovery Name Space for the following examples. CCN Names that are children of a Service Discovery Name Space are Services within that name space; including the possibility of being yet another Service Discovery Name Space.

So, extending the root prefix introduced above, both `/parc/Services/Printer` and `/parc/Services/Fortune` are also discoverable name spaces.

3. Service Discovery Broker

The Service Discovery Broker is an entity that manages the Service Discovery Name Space and responds to requests from Service Clients discovering Services, and to requests from Service Providers making their Services available for discovery.

3.1 Content Discovery in Service Discovery

The Service Discovery Broker listens for CCN Interests directed to the top of the tree of names that comprise its Service Discovery Name Space. When an Interest is received directed

to that specific name, the Broker responds with a Content Object containing structured data consisting of the names of the next level child name spaces, and information necessary for new services to register themselves with the Service Discovery Broker.

For example, consider the name Printer and Fortune representing two discoverable services. Within the Service Discovery Name Space, the full names are:
`/parc/Services/Printer`
`/parc/Services/Fortune`

A CCN Interest sent to the name `/parc/Services` results in a CCN Content Object for `/parc/Services` that contains in the payload a list of the names of the child namespaces.
`/parc/Services/Printers`
`/parc/Services/Fortunes`

The Service Discovery Broker also listens for Admit, Demit, and Discovery Interests on corresponding child namespaces.

4. Service Registration

A Service must be registered with the Service Discovery Broker before it can be discovered. Service registration consists of the steps: admission, initiation and ultimately demitting.

4.1 Admission

desired Service Discovery Name Space to join. For example, admitting the printer named parakeet consists of transmitting an Interest to /parc/Services/Printers/nonce. The Interest includes:

1. The public key, or a reference thereto, of the Service Agent.
2. An optional proposed CCN name for the Service.
3. The description of the Service useful to Service Clients.
4. Other meta-data necessary to be admitted.

This CCN Interest is transmitted via CCN and ultimately received by the Service Discovery Broker. If the Interest is successful in passing the requirements for the Service to be admitted, the Service Discovery Broker

1. Updates its database of Services with the given service information,
2. Replies to the Service Agent with a Content Object that contains
   (a) An admission-token encrypted with the Service Agent?s public key,
   (b) The approved name of the Service (which may be the same as requested in the admission Interest).

Otherwise, if not successful, the Service Broker replies to the Service Agent with a Content Object indicating failure and potentially other information that could lead to future success.

4.2 Initiation

Once a Service Agent receives a successful Admission Content Object, the Service Agent proceeds to initiate the service and interact with Service Clients.

It extracts the name of the Service from the Admission Content Object, and announces to the CCN network that Interests for that name are to be forwarded to the Service Agent.

4.3 Demitting

When a Service is no longer participating, the Service Agent

1. Removes the previously established announcement to the CCN network that Interests for that name are to be forwarded to the Service Agent.
2. Transmits an Interest to the Service Discovery Name Space indicating that the service is to be removed. The Interest contains
3. The previously obtained admission-token encrypted by the Service Agent?s private-key, and then the Service Discovery Broker?s public-key.

5. Service Discovery Client

A Service Client finds a Service by transmitting an Interest to the Service Discovery Name Space. The responding Content object contains the names and additional metadata, for the printers that have been admitted to the Service Discovery name space.

For example, a CCN Interest is transmitted to `/parc/Services/Printers` and the resulting CCN Content Object contains:
`/parc/printer/parakeet,Xerox 7345`
`/parc/printer/speedy,Xerox 4180`

The client determines which of these printers are suitable and uses the name of the printer to negotiate the print service.

1. A system comprised of multiple hardware or software servers maintaining a variable named by a ICN routable name, where the name, a portion of the name, or a derivative of the name, and the routing govern which servers participate in the protocol.
2. Where hardware or software servers maintaining a variable may be dynamically relocated by redirecting the routing information.