Tutorial
Distributed Systems (IN2259)

EXERCISES ON PUBLISH/SUBSCRIBE

EXERCISE 1 Distributed Routing

Figure 1.1 illustrates a pub/sub network composed of one publisher, three subscribers, and five brokers. Each node has an ID, and each link is labeled. Depending on the routing model used, different brokers will send and receive different messages and store different types of data.

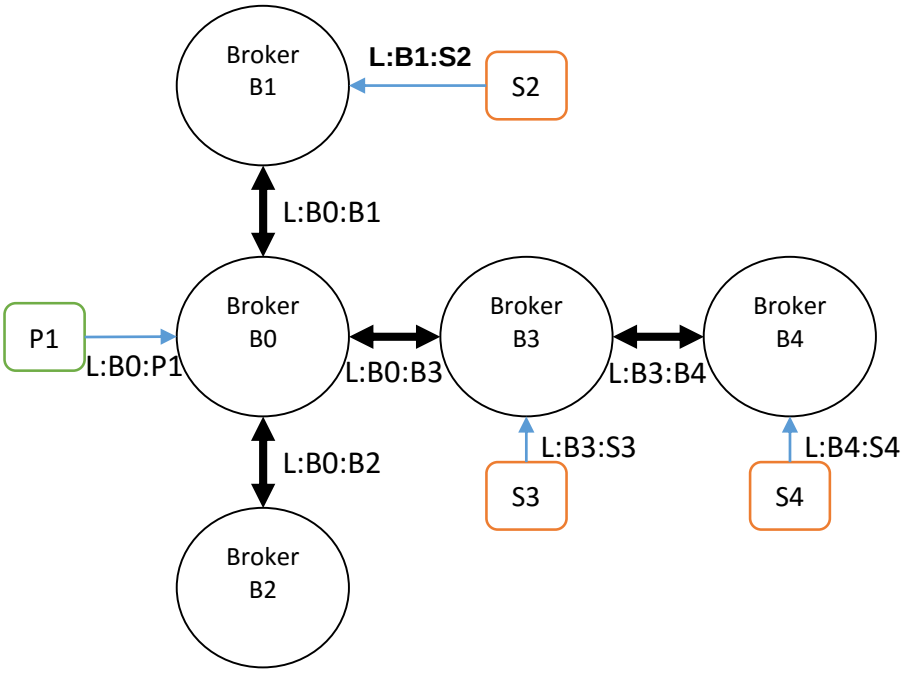

Figure 1.1: Example network

(a) In an advertisement-based routing model, show what type of data is stored by each broker. Describe what happens when $P1$ advertises, then $S2$ sends a matching subscription. Suppose subscription covering is not enabled, show what happens after $S3$ sends the same subscription as $S2$.

(b) In a subscription-based routing model, show what type of data is stored by each broker. Describe what happens when $S3$ sends a matching subscription. Suppose subscription covering is enabled, show what happens after $S4$ sends the same subscription as $S3$.

(c) In a rendezvous-based routing model using Bloom filters with link IDs (see labels), show what type of data is stored by each broker, where $B2$ is the rendezvous broker. Suppose subscribers $S2-4$ have already subscribed. Show what happens when $P1$ sends a publication P which matches $S2$ and $S3$. Assume there are no false positives with the Bloom Filter.

EXERCISE 2 Publish/subscribe - content-based matching

Figure 2.2 shows the overlay broker network for an advertisement-based publish/subscribe system. The brokers serve as the contact point for any client of the system; they receive subscriptions and publications and forward them to their destination. In order to route the messages, the brokers maintain two routing tables: Subscription Routing Table (SRT) and Publication Routing Table (PRT)(see Figure 2.3). Now, consider a stock trading application providing information about all kinds of stocks. A stock consists of a tuple of following properties: stock symbol, stock price and stock trend (e.g., $[s,=,MSFT]$, $[p,<,128]$, $[t,=,+8]$).

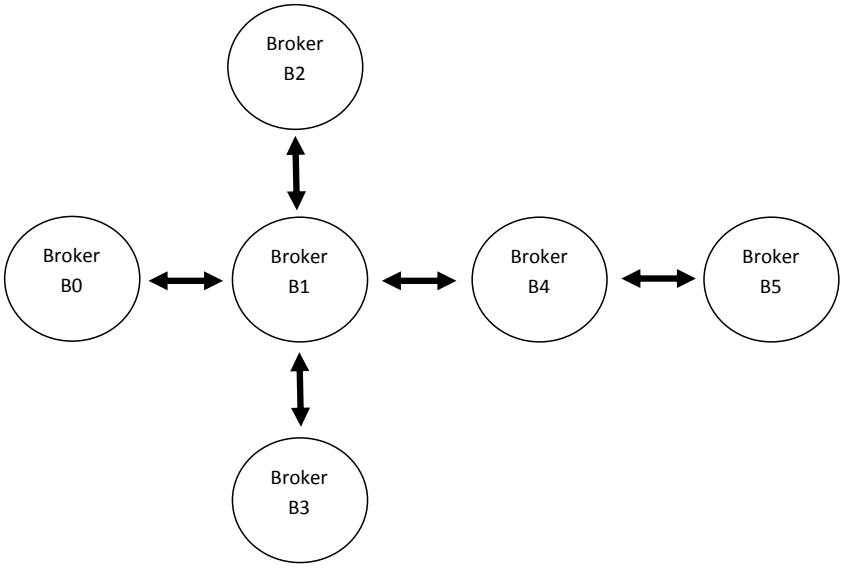

Figure 2.2: Broker overlay

(a) The publishers flood the network with their advertisements to inform potential subscribers. Update the routing tables.

1. Publisher p_1 connects to broker b_0 and advertises $[s,=,AAPL][p,=,*][t,=,*]$
2. p_2 connects to b_2 and advertises $[s,=,GOOG][p,=,*][t,=,*]$
3. p_3 connects to b_4 and advertises $[s,=,AMZ][p,=,*][t,=,*]]$

(b) The subscribers issue their subscriptions to the brokers. Route the subscriptions and update the routing tables accordingly. Assume subscription covering is disabled.

1. Subscriber s_1 connects to broker b_3 and subscribes to $[s,=,AAPL][p,>,100]$
2. s_2 connects to b_5 and subscribes to $[s,=,AAPL],[t,>,+20]$
3. s_3 connects to b_4 and subscribes to $[s,=,GOOG],[p,<,50]$
4. s_4 connects to b_3 and subscribes to $[s,=,GOOG],[p,>,40],[t,>,+10]$
5. s_5 connects to b_3 and subscribes to $[s,=,AMZ],[p,>,35]$

(c) Describe changes, if any, to the above if subscription covering is enabled.

(d) The publishers publish the following events. Specify the routing path and the set of receivers (e.g. $\{p_1,b_0,b_1,\{b_3,s_1\}||\{b_4,b_5,s_2\}\} \rightarrow s_1,s_2$).

1. Publisher p_1 publishes $[s,MSFT],[p,120],[t,-20]$
2. Publisher p_2 publishes $[s,GOOG],[p,50],[t,+10]$
3. Publisher p_1 publishes $[s,AAPL],[p,110],[t,+10]$

4. Publisher p_3 publishes $[s, AMZ], [p, 60], [t, -5]$
5. Publisher p_2 publishes $[s, GOOG], [p, 45], [t, +20]$
6. Publisher p_1 publishes $[s, AAPL], [p, 140], [t, +30]$

Broker B0			
SRT		PRT	

Broker B1			
SRT		PRT	

Broker B2			
SRT		PRT	

Broker B3			
SRT		PRT	

Broker B4			
SRT		PRT	

Broker B5			
SRT		PRT	

Figure 2.3: Routing tables