

# TK1 Exercise 5

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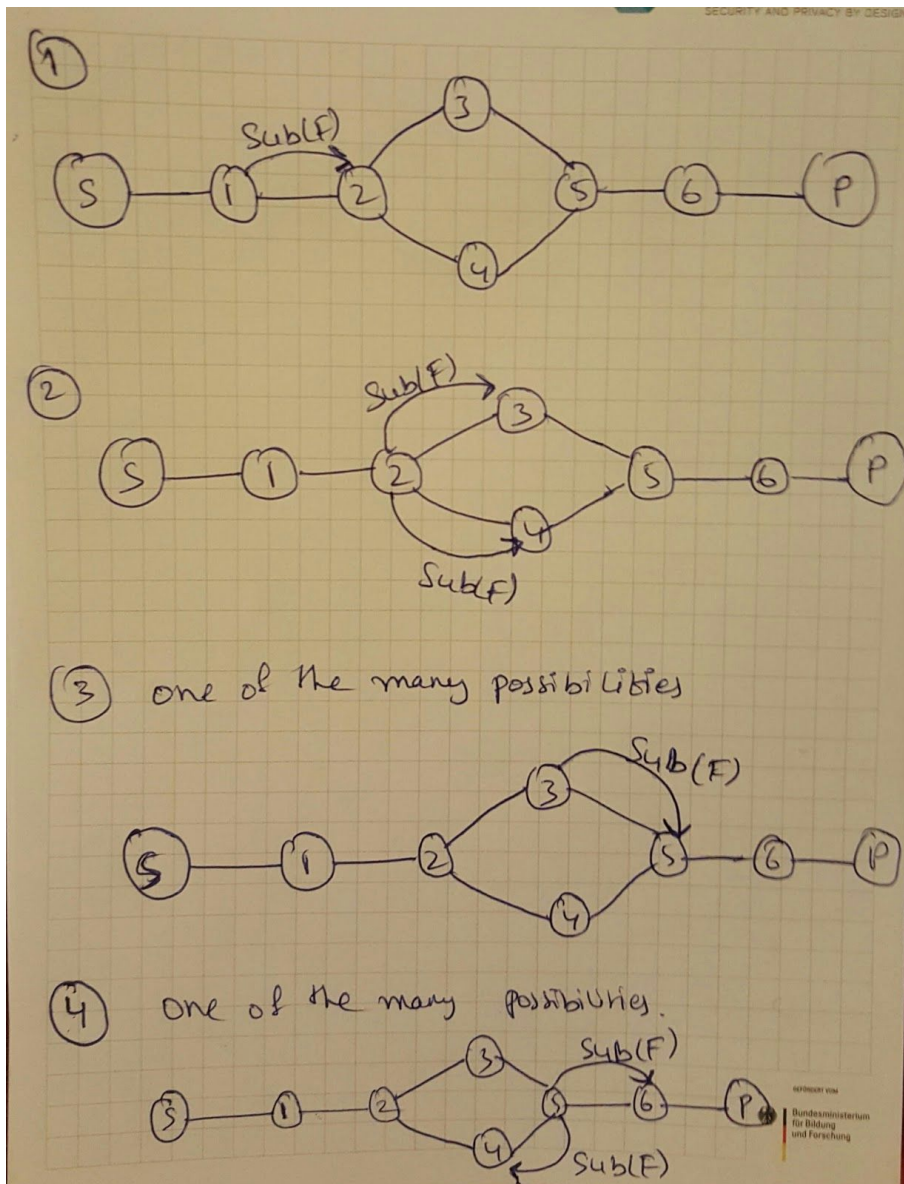
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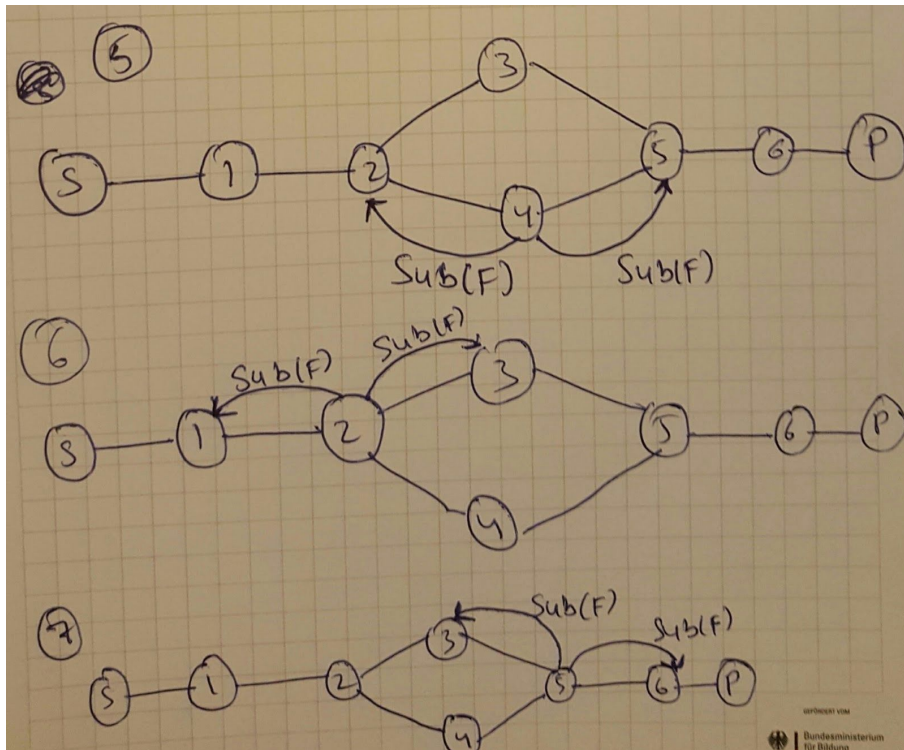
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## Task 1 : Routing with Subscriptions

### 1. Subscription flow graph and routing tables





Corresponding routing tables for each step respectively:

Step 1:

Router 1		Router 2		Router 3		Router 4		Router 5		Router 6	
D	Filt.	D	Filt.	D	Filt.	D	Filt.	D	Filt.	D	Filt.

Step 2:

Router 1		Router 2		Router 3		Router 4		Router 5		Router 6	
D	Filt.	D	Filt.	D	Filt.	D	Filt.	D	Filt.	D	Filt.
		1	F								

Step 3:

Router 1		Router 2		Router 3		Router 4		Router 5		Router 6	
D	Filt.	D	Filt.	D	Filt.	D	Filt.	D	Filt.	D	Filt.
		1	F	2	F	2	F				

Step 4:

Router 1		Router 2		Router 3		Router 4		Router 5		Router 6	
D	Filt.	D	Filt.	D	Filt.	D	Filt.	D	Filt.	D	Filt.
		1	F	2	F	2	F	3	F		

Step 5:

Router 1		Router 2		Router 3		Router 4		Router 5		Router 6	
D	Filt.	D	Filt.	D	Filt.	D	Filt.	D	Filt.	D	Filt.
		1	F	2	F	2	F	3	F	5	F
						5	F				

Step 6:

Router 1		Router 2		Router 3		Router 4		Router 5		Router 6	
D	Filt.	D	Filt.	D	Filt.	D	Filt.	D	Filt.	D	Filt.
		1	F	2	F	2	F	3	F	5	F
		4	F			5	F	4	F		

Step 7:

Router 1		Router 2		Router 3		Router 4		Router 5		Router 6	
D	Filt.	D	Filt.	D	Filt.	D	Filt.	D	Filt.	D	Filt.
2	F	1	F	2	F	2	F	3	F	5	F
		4	F			5	F	4	F		

After Step 7:

Router 1		Router 2		Router 3		Router 4		Router 5		Router 6	
D	Filt.	D	Filt.	D	Filt.	D	Filt.	D	Filt.	D	Filt.
2	F	1	F	2	F	2	F	3	F	5	F
		4	F	5	F	5	F	4	F		

Steady state:

Router 1		Router 2		Router 3		Router 4		Router 5		Router 6	
D	Filt.	D	Filt.	D	Filt.	D	Filt.	D	Filt.	D	Filt.
2	F	1	F	2	F	2	F	3	F	5	F
		4	F	5	F	5	F	4	F		
		3	F								

Assumption: Not all routers are equally fast at forwarding packets

## 2. Problem:

The subscriptions are broadcasted to all neighbours except from where it arrived. The network has a cyclic topology. So, the subscriptions will be forwarded indefinitely in the loop and also forming two way subscription links between all neighbours on the left side of the cycle, including the cycle.

## Solution:

Use of unique subscription ids corresponding to each subscription. The id should be preserved as the subscription request is forwarded between the routers. This allows for immediate detection of cycles and duplicate requests - either from same or different source, which can be ignored. TTL could also work but that would still result in duplicate subscriptions.

3. Yes! The notification messages could also be caught up in the loop topology and resulting in duplicates. Use notification ids that are unique to each notification generated in the network and the id is retained as the notification packet traverses through routers.

## Task 2:

### 1. Subscription in different type of addressing

1. Channel based addressing

Interested parties can subscribe to a channel using a unique channel id and there is no interplay between different channels.

2. Type based addressing  
Interested parties can subscribe to a type of events and the channels form type a hierarchy. Subscription is implied for the types in a given hierarchy
3. Subject based addressing  
Subscriptions express interest in subjects by some form of expressions, example regex expression, to be evaluated against the subject. Subject determines the 'address'
4. Content based addressing  
Subscribers exclusively describe their interests with filter expressions on the content.

## **2. Filtering in different type of addressing**

1. Channel based subscription  
Filtering based on a single attribute - channel id with simple equality operator
2. Type based subscription  
Filtering based on event data types matching and subtype tests
3. Subject based subscription  
Filtering based on message subject attribute. Filter applied by evaluating an expression on the subject attribute
4. Content based subscription  
Filtering based on message content attribute. Filter applied by evaluating an expression on the message content attribute

## **Task 3**

- a. Hierarchical  
All nodes are directed from one root that defines the tree structure. And there is a clear parent child relation between the nodes
- b. Acyclic Peer-to-Peer  
A parent child relation between the nodes, if any, is ambiguous. No direction defined for the edges between nodes and no sub graph forms a cycle.
- c. Generic Peer-to-Peer  
There are cycles in the graph