MQ Publish/Subscribe

An Introduction to Topic Objects, Nodes and Strings (among other things)

Matthew Whitehead

mwhitehead@uk.ibm.com

Agenda

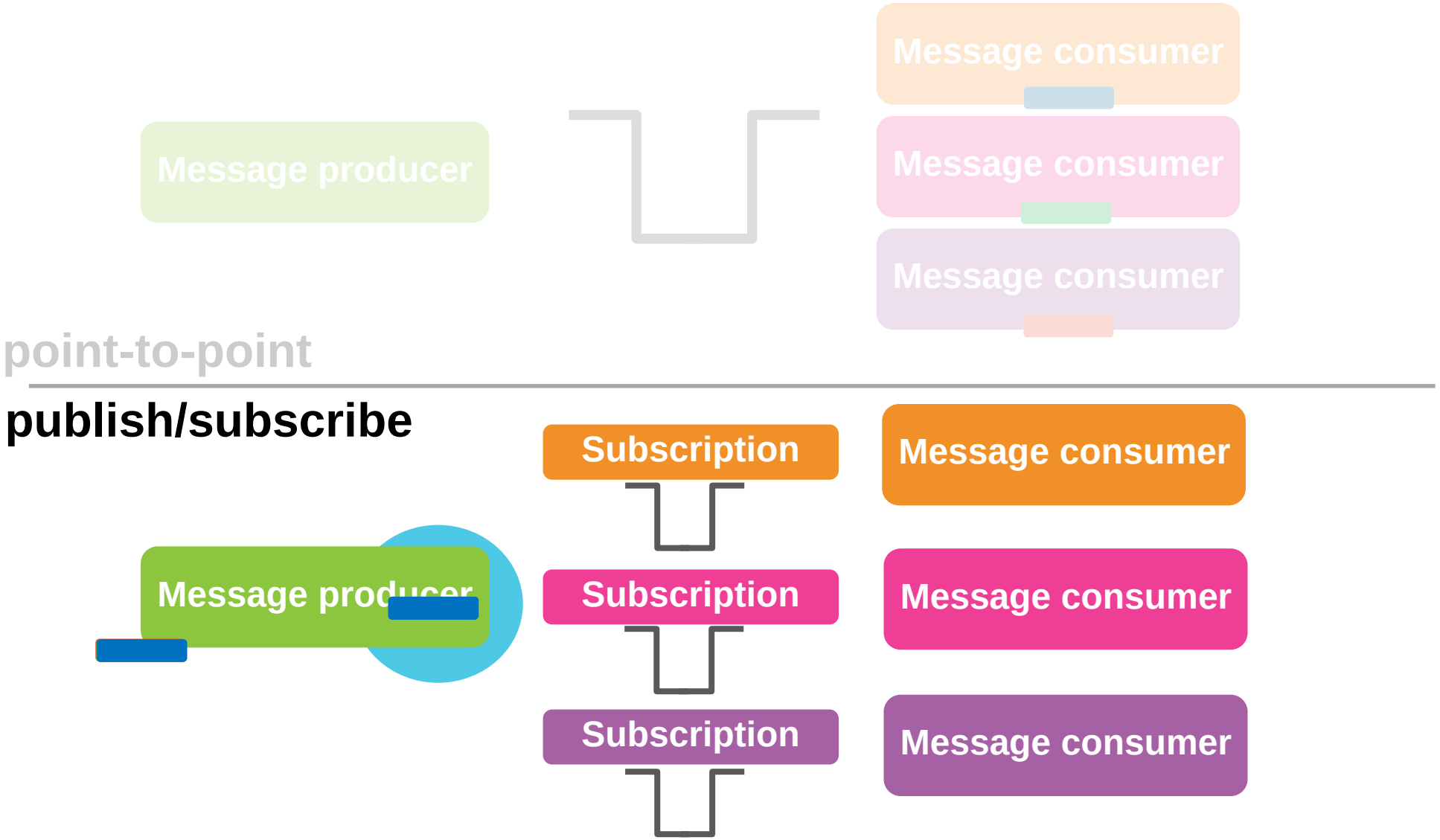
- Publish/Subscribe in IBM MQ
- Administration of publish/subscribe
- Management of publish/subscribe
- Subscriptions and publications
- Quick look at topologies

What is publish/subscribe?

How does it compare to point-to-point?

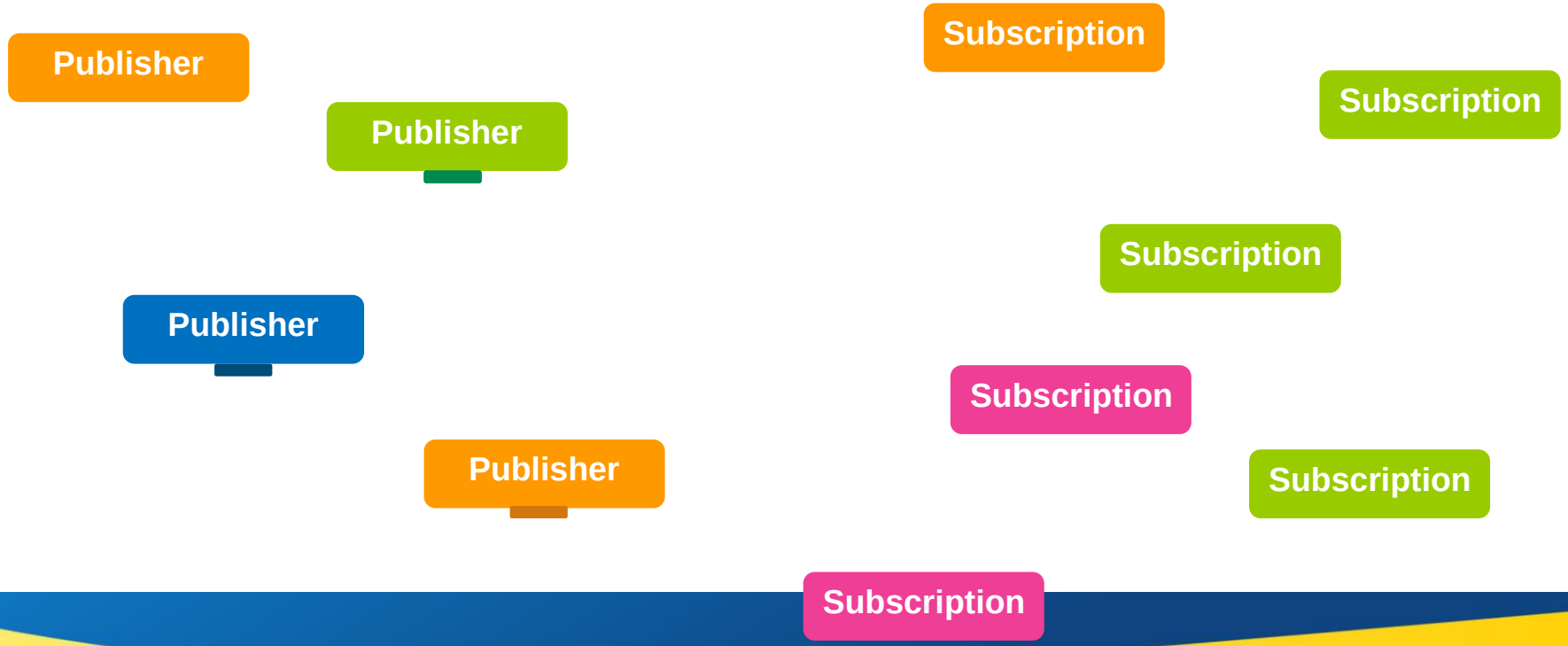
point-to-point

How does it compare to point-to-point?



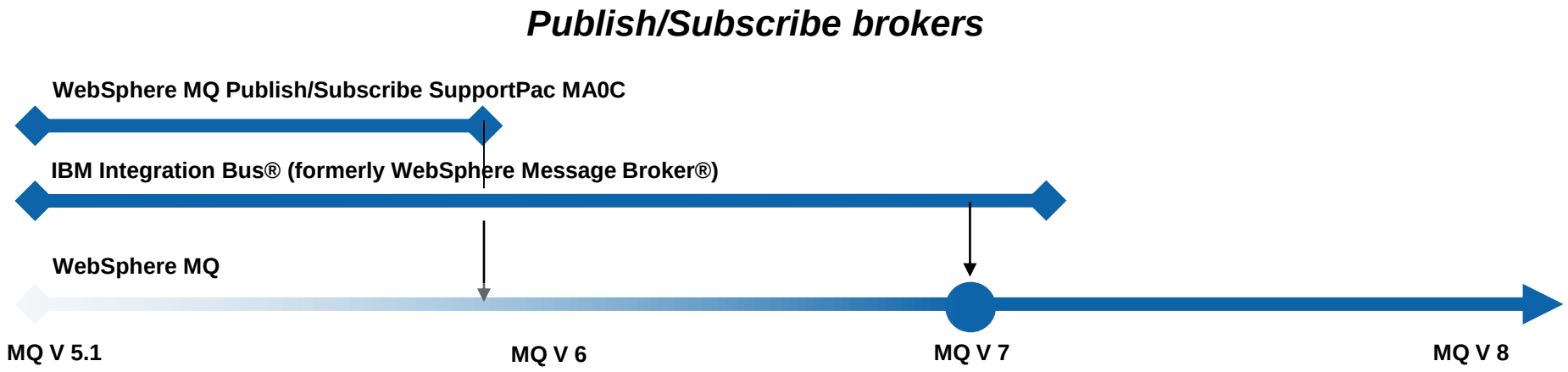
But which subscriptions receive the messages?

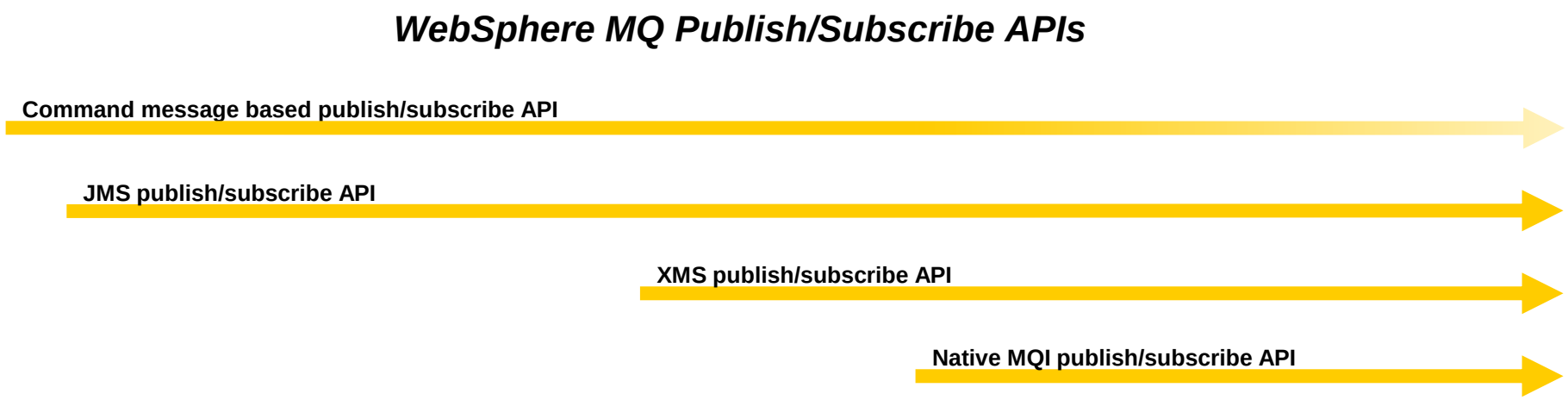
- Publishing and subscribing is based on '**topics**'
  - **Green** messages go to **green** subscribers
  - **Orange** messages go to **orange** subscribers
  - But nobody wants a ***blue*** message!



Publish/Subscribe in IBM MQ

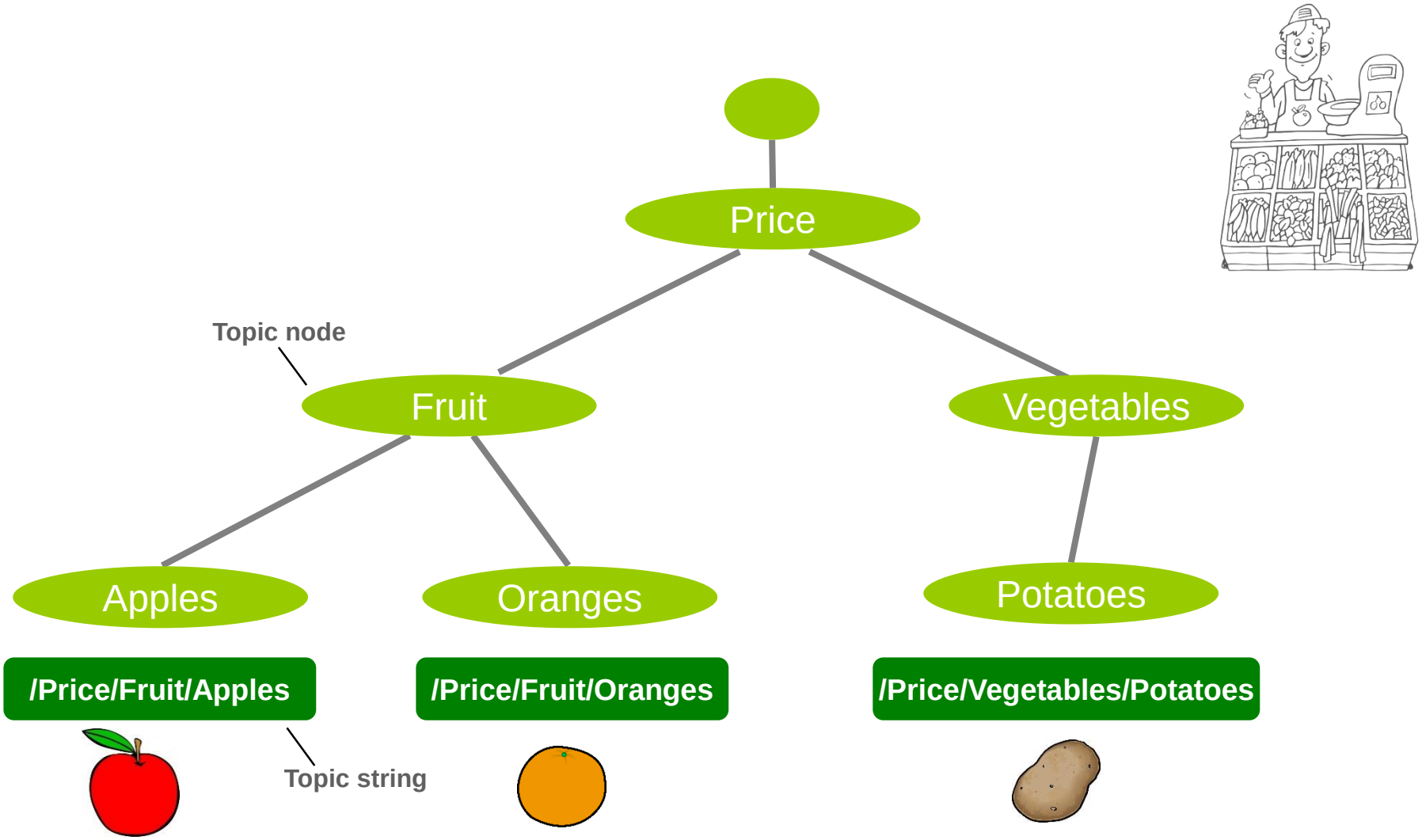
WebSphere MQ's publish/subscribe over the years



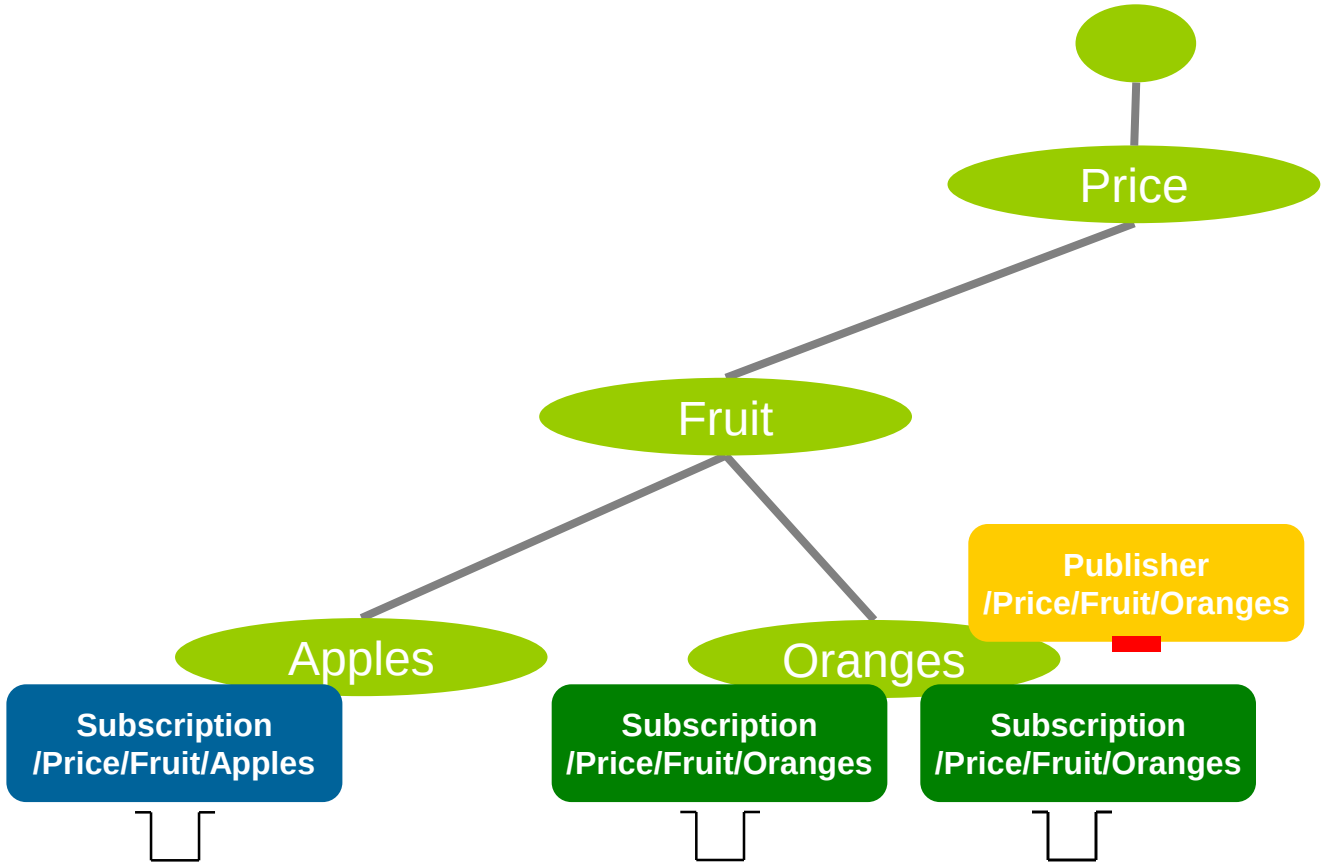


Topics

It's all about the *topic tree*

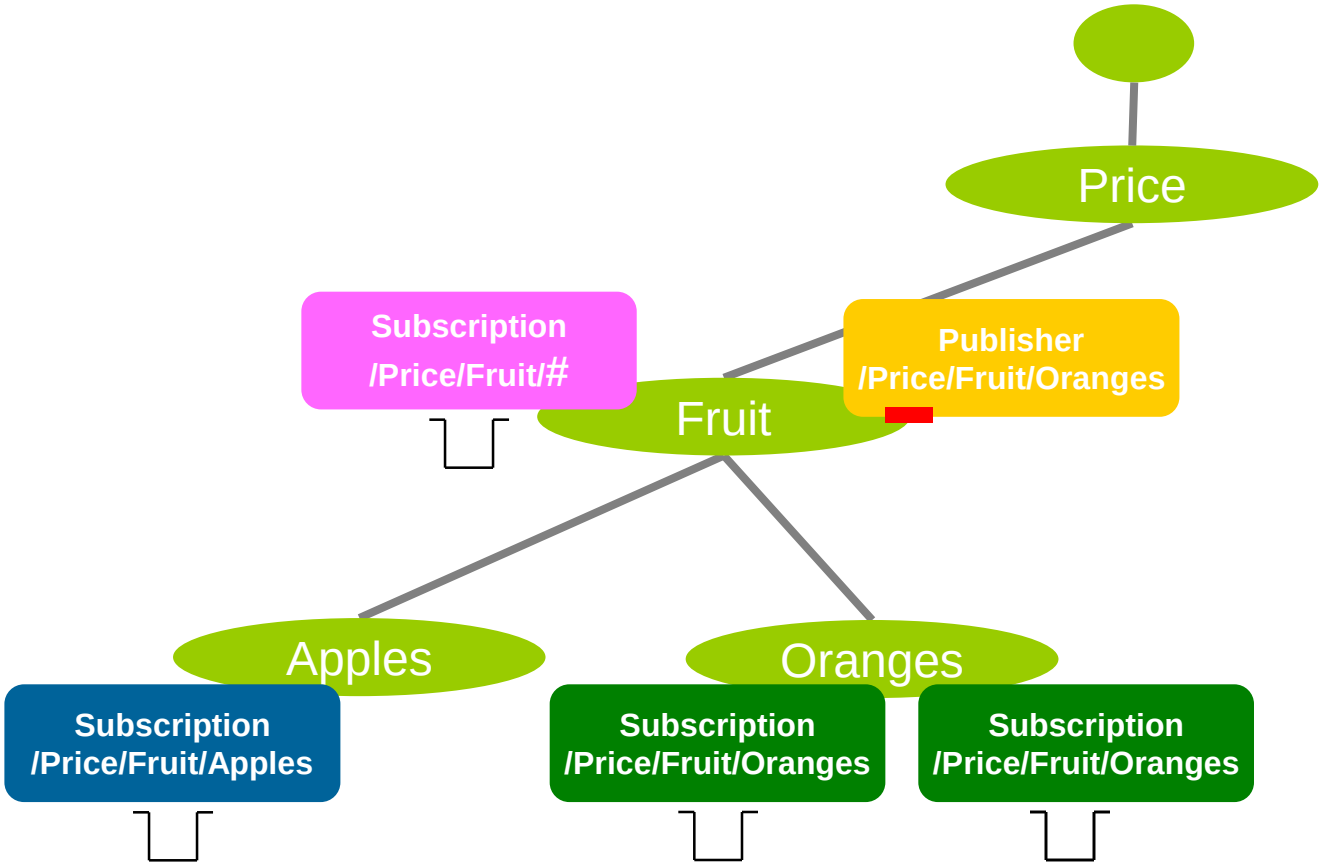


Matching publications to subscriptions



- Subscriptions are attached to matching nodes in the topic tree
- Publications identify the relevant topic node
- A copy of the publication is delivered to the queue identified by *each* matching subscription

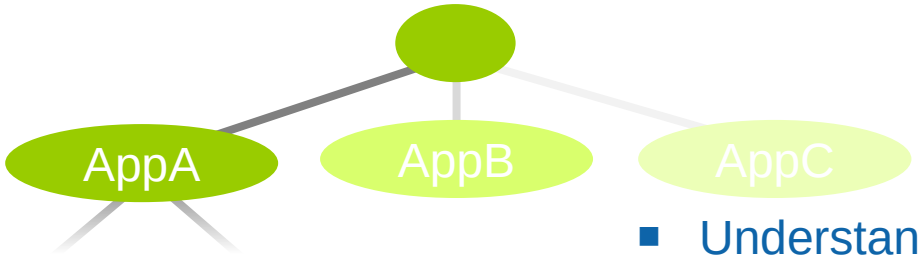
Matching publications to subscriptions

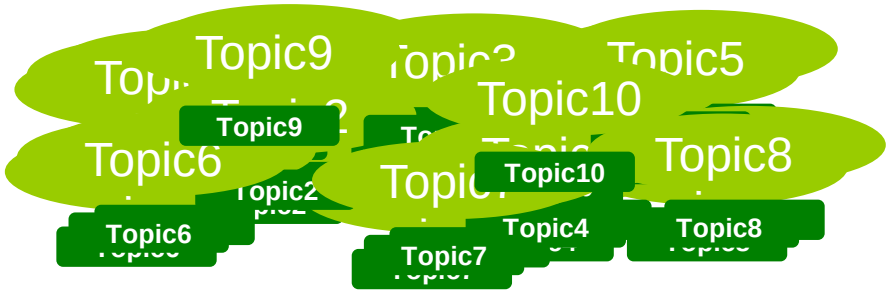


- ***Wildcarding*** subscriptions at the topic node level can receive messages from multiple topic strings

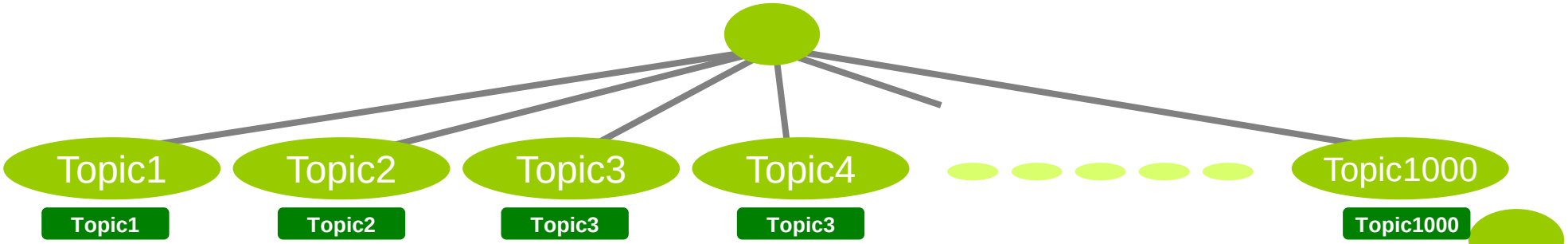
Designing your topic tree structure

- Make it extendable.

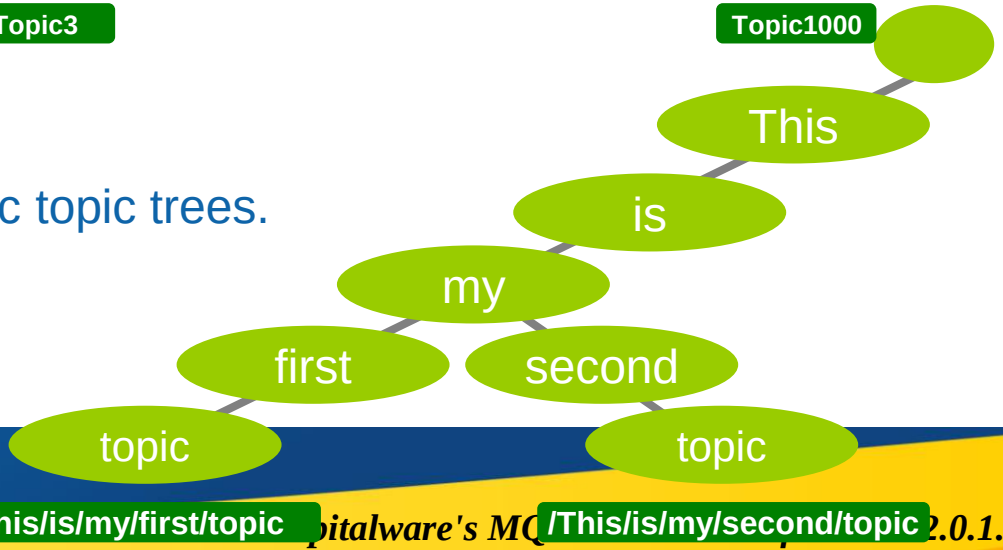




- Understand a rapidly changing set of topic strings.

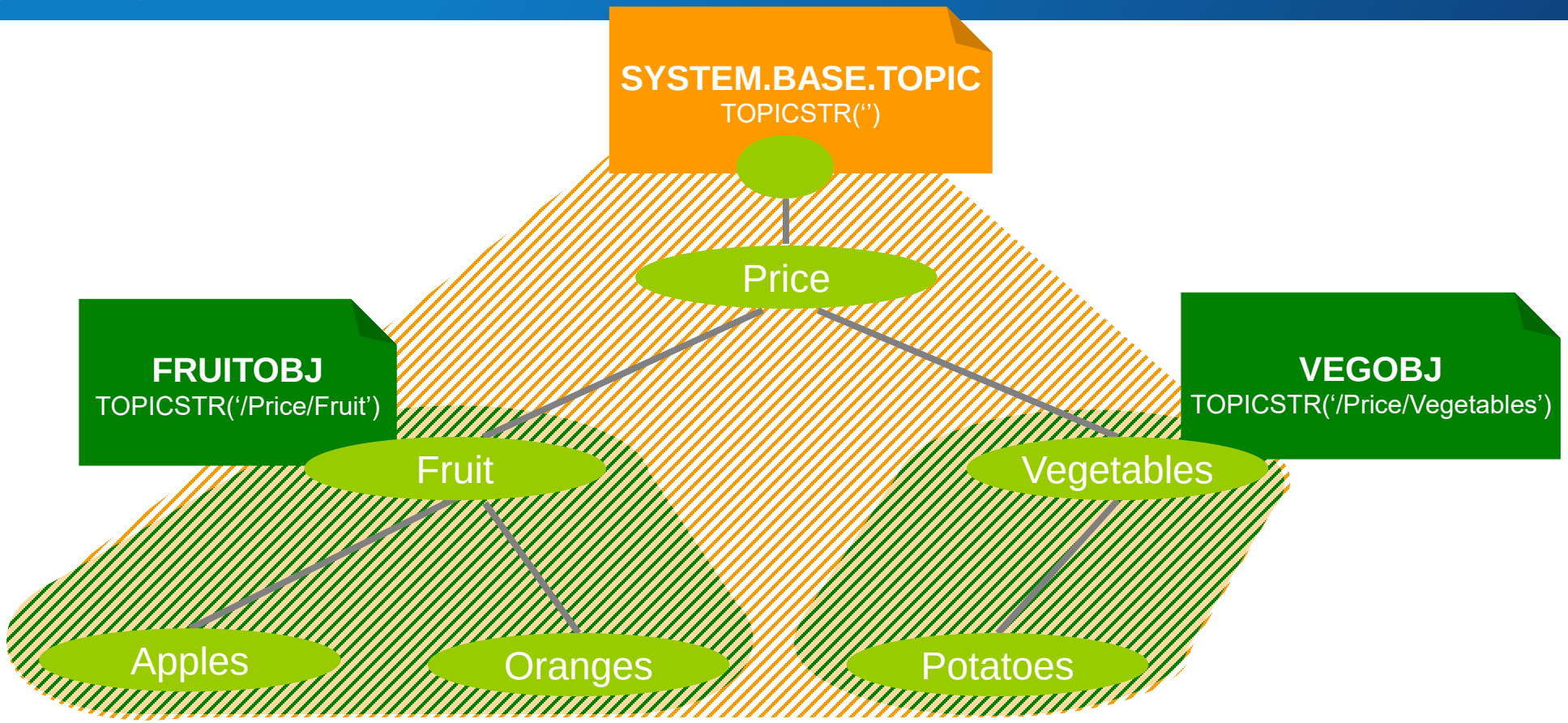


- Avoid excessively **wide** or **deep** dynamic topic trees.
  - Use structure where appropriate.
  - Limit it to *subscribable* content.



Configuration

Topic *Objects*



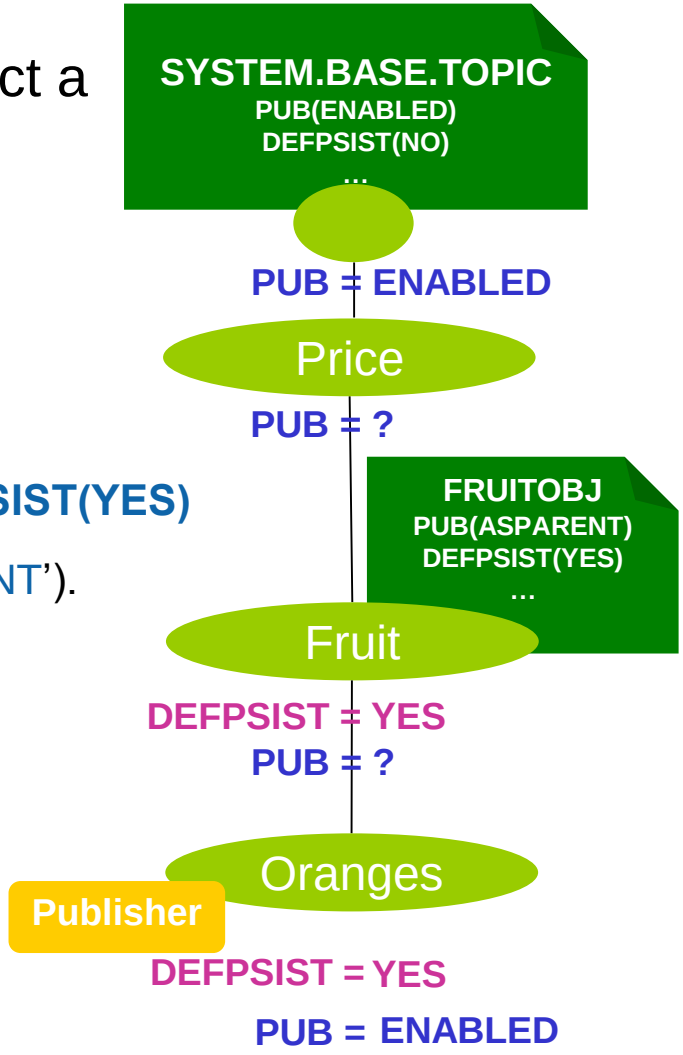
- Topic objects are a point of administration associated with a node in the topic tree.
- You start with a base object defined for the ‘ ’ node … the rest are ***optional***.
- They provide hook points in the topic tree to configure specific pub/sub behaviour for a branch.
- A dynamically created topic node **inherits** its attributes from administered topic objects associated with topic nodes above it in the topic tree.

Topic object attributes

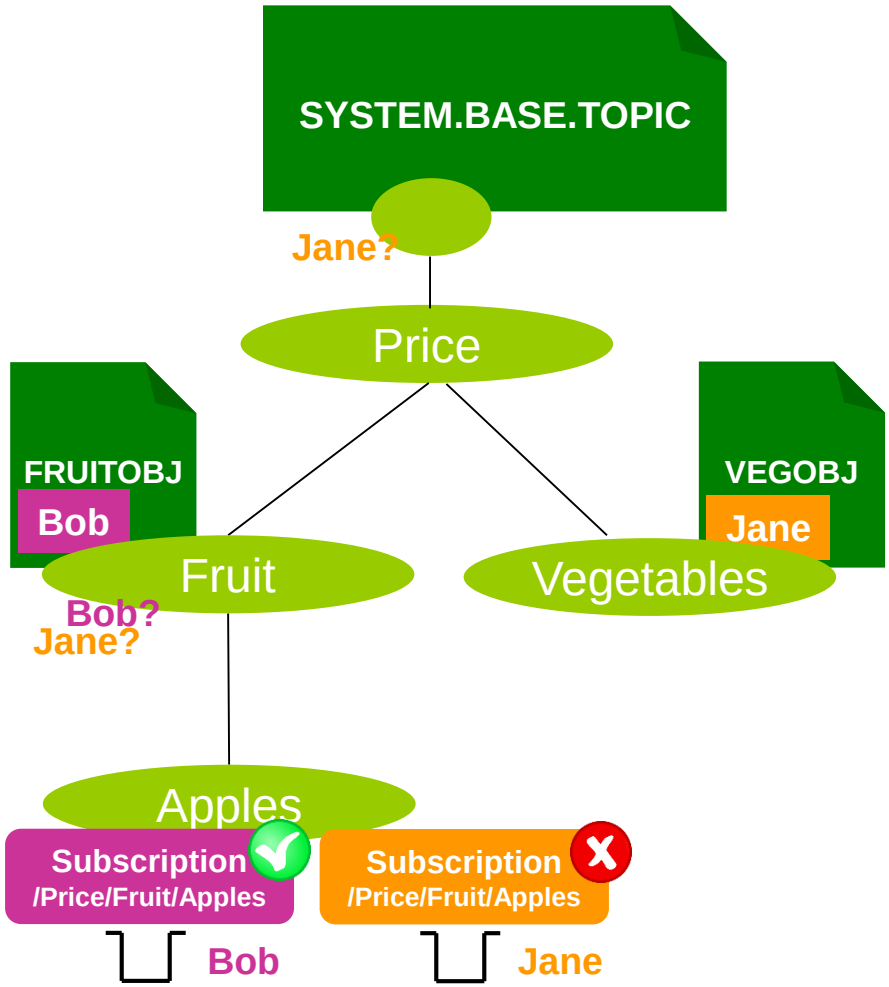
- Many attributes can be set on topic objects to effect a publisher or subscriber's behaviour.
- Dynamic nodes inherit their behaviour from nodes above.

- Create a topic object for topic string **'/Price/Fruit'**
  - **DEFINE TOPIC(FRUITOBJ) TOPICSTR('/Price/Fruit') DEFPSIST(YES)**
  - Attributes default to *inherit settings from above* (e.g. 'ASPARENT').
    - *(So by default, a new object does nothing)*

- Publish a message to topic string **'/Price/Fruit/Oranges'**
  - **What message persistence to use?**
  - **Are publications enabled?**



Topic Security



- Access control is set as for queues, but for a defined ***topic object***, *not a topic string!*
- Authority checks performed on the topic tree
  - Walk up the tree, just like attributes.
  - Keep checking until an authorisation is found or we run out of topic tree.

Managing topics

Managing topics

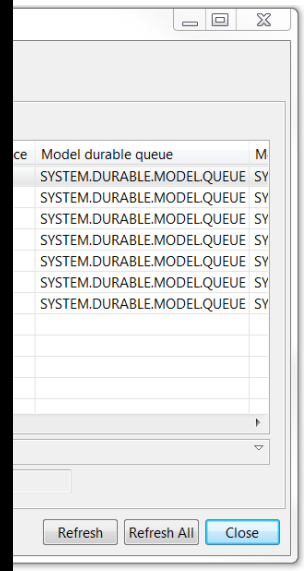
- Displaying topic object definitions
  - This shows how administered **topic objects** are configured

```
5724-H72 (C) Copyright IBM Corp. 1994, 2014.

DISPLAY TOPIC(FRUITOBJ)
     2 : DISPLAY TOPIC(FRUITOBJ)
AMQ8633: Display topic details.
   TOPIC(FRUITOBJ)                          TYPE(LOCAL)
   TOPICSTR(/Price/Fruit)                   DESCR(Price of fruit)
   CLUSTER( )                               CLROUTE(DIRECT)
   DURSUB(ASPARENT)                         PUB(ASPARENT)
   SUB(ASPARENT)                            DEFPSIST(YES)
   DEFPRTY(ASPARENT)                        DEFPRESP(ASPARENT)
   ALTDATE(2015-02-03)                      ALTTIME(08.44.48)
   PMSGDLV(ASPARENT)                        NPMSGDLV(ASPARENT)
   PUBSCOPE(ASPARENT)                       SUBSCOPE(ASPARENT)
   PROXYSUB(FIRSTUSE)                       WILDCARD(PASSTHRU)
   MDURMDL( )                               MNDURMDL( )
   MCAST(ASPARENT)                          COMMINFO( )
   USEDLQ(ASPARENT)                         CUSTOM( )
```

Managing topics

- Displaying the topic tree
  - This shows how the **topic nodes** in the topic tree behave

```
DISPLAY TPSTATUS('/Price/Fruit/Apples')
    23 : DISPLAY TPSTATUS('/Price/Fruit/Apples')
AMQ8754: Display topic status details.
   TOPICSTR(/Price/Fruit/Apples)              ADMIN( )
   CLUSTER( )
   COMMINFO(SYSTEM.DEFAULT.COMMINFO.MULTICAST)
   MDURMDL(SYSTEM.DURABLE.MODEL.QUEUE)
   MNDURMDL(SYSTEM.NDURABLE.MODEL.QUEUE)
   CLROUTE(NONE)                              DEFPSIST(YES)
   DEFPRTY(0)                                 DEFPRESP(SYNC)
   DURSUB(YES)                                PUB(ENABLED)
   SUB(ENABLED)                               PMSGDLV(ALLDUR)
   NPMSGDLV(ALLAVAIL)                         RETAINED(NO)
   MCAST(DISABLED)                            PUBCOUNT(0)
   SUBCOUNT(1)                                PUBSCOPE(ALL)
   SUBSCOPE(ALL)                              USEDLQ(YES)
```



Applications

Applications and *topics*

- *When creating subscriptions or opening topics to publish on, do I use a topic string or a topic object?*
  - A **topic string**. No, a **topic object**. No, **both**. Actually, er, ***any of them!***
- *So which should I use?*
  - Using the topic string is probably the easiest, it's closest to what the application is expecting
    - *Sub(- , '**/Price/Fruit/Apples**')* → **/Price/Fruit/Apples**
  - Using a topic object maps the operation to the topic string of that topic object
    - *Sub(**FRUITOBJ**, '')* → **/Price/Fruit**
  - If you use both, you get both!
    - The topic string is appended to the topic string of the object
    - *Sub(**FRUITOBJ**, '**Apples**')* → **/Price/Fruit/Apples**
- *If in doubt, check the topic tree for which nodes are actually being used*

Subscriptions

Subscription types

- There are many different *types* of subscriptions:
  - **Administered** or **application** created
  - **Durable** or **non-durable**
  - **Managed** or **unmanaged** subscription queues
- *These different aspects of a subscription can be combined, don't assume it's one or the other…*

Subscription types

Subscription creation and deletion

- Application **created subscriptions**
  - Applications use an API to dynamically create and delete subscriptions
- Administratively **created subscriptions**
  - An administrator defines subscriptions that can be accessed by applications
  - Applications can either use the publish/subscribe APIs to access these subscriptions or access their associated queue using point-to-point APIs.

Subscription types

Subscription lifetime

- Durable **subscriptions**
  - The lifetime of the subscription is independent of any application
- Non-durable **subscriptions**
  - The lifetime of the subscription is bounded by the creating application
    - Subscriptions are automatically deleted when the application closes

	Durable	Non-durable
Admin	✓	✗
Application	✓	✓

Subscription queue management

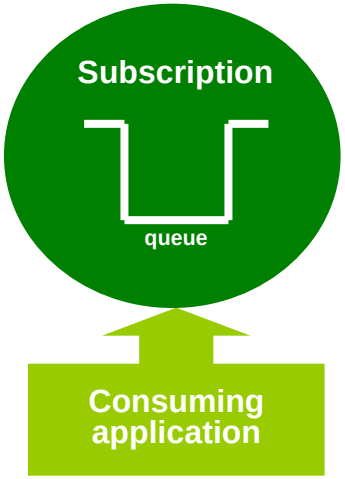
- **A subscription maps a topic to a queue. The queue relationship is either explicit or implicit…**
- Managed **subscription queue**
  - The subscription automatically creates and deletes a queue for the use of queuing any matching publications.
- Unmanaged **subscription queue**
  - When the subscription is created the name and location of an existing queue must be provided by you.

	Managed		Unmanaged	
	Durable	Non-durable	Durable	Non-durable
Admin	✓	✗	✓	✗
Application	✓	✓	✓ *(Not JMS)*	✓ *(Not JMS)*

Accessing a subscription's messages

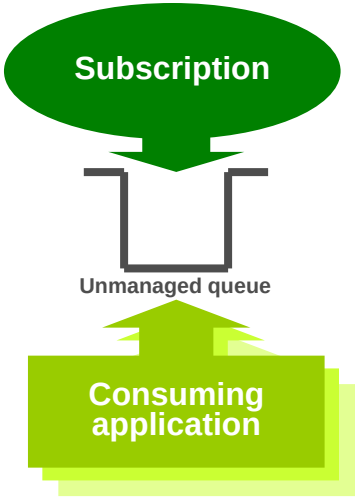
Via the *subscription*

- **An application opens the subscription**
  - *A true pub/sub application*
- **Works with managed and unmanaged subscription queues**
- **Limited to one attached consuming application at a time**
  - Unless you're using JMS cloned/shared subscriptions
- **Generally better pub/sub status feedback**



Via the *queue*

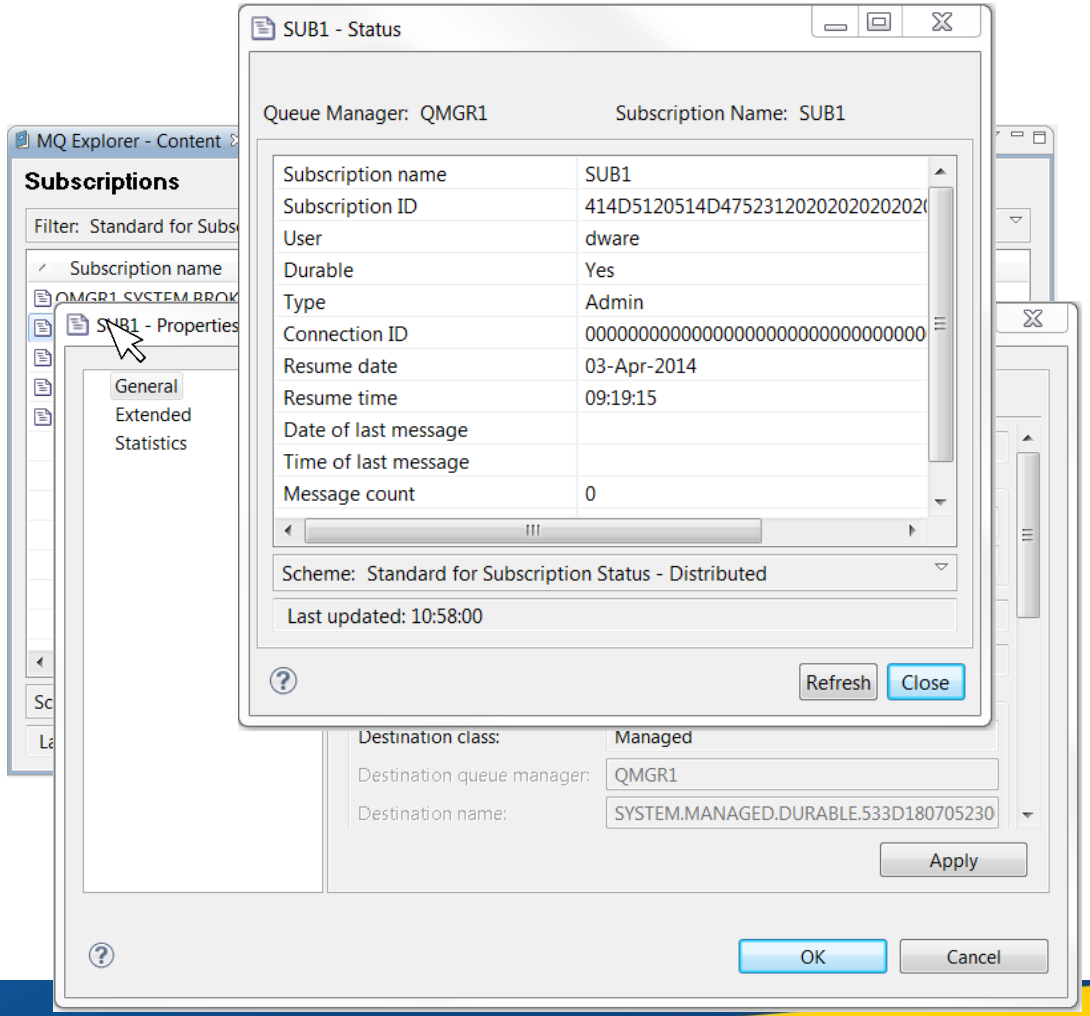
- **An application opens the queue associated with the subscription**
  - *This is really a point-to-point application*
- **Only works with unmanaged subscription queues**
- **Allows more freedom in what can be done**
  - For example, multiple concurrent consuming applications possible from any API



Managing subscriptions

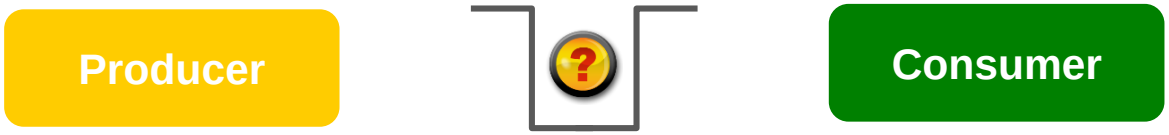
- Displaying subscriptions
  - This shows the subscriptions on a queue manager

```
5724-H72 (C) Copyright IBM Corp. 1994, 2014.
Starting MQSC for queue manager QMGR1. DISPLAY
DISPLAY SUB(SUB1)
     2 : DISPLAY SUB(SUB1)
AMQ8096: WebSphere MQ subscription inquired.
   SUBID(414D5120514D4752312020202020202007183D5320002306)
   SUB(SUB1)                          TOPICSTR(/Price/Fruit/Apples)
   TOPICOBJ( )
   DEST(SYSTEM.MANAGED.DURABLE.533D180705230020)
   DESTQMGR(QMGR1)                    PUBAPPID( )
   SELECTOR( )                        SELTYPE(NONE)
   USERDATA( )
   PUBACCT(16010515000000DEA960DF651724E4B97C192FE803000000000B)
   DESTCORL(414D5120514D4752312020202020202007183D5320002306)
   DESTCLAS(MANAGED)                  DURABLE(YES)
   EXPIRY(UNLIMITED)                  PSPROP(MSGPROP)
   PUBPRTY(ASPUB)                     REQONLY(NO)
   SUBSCOPE(ALL)                      SUBLEVEL(1)
   SUBTYPE(ADMIN)                     VARUSER(ANY)
   WSCHEMA(TOPIC)                     SUBUSER(xxxx)
   CRDATE(2014-04-03)                 CRTIME(09:19:15)
   ALTDATE(2014-04-03)                ALTTIME(09:19:15)

DISPLAY SBSTATUS(SUB1)
     3 : DISPLAY SBSTATUS(SUB1)
AMQ8099: WebSphere MQ subscription status inquired.
   SUB(SUB1)
   SUBID(414D5120514D4752312020202020202007183D5320002306)
   SUBUSER(xxxx)                      RESMDATE(2014-04-03)
   RESMTIME(09:19:15)                 LMSGDATE( )
   LMSGTIME( )
   ACTCONN(000000000000000000000000000000000000000000000000)
   DURABLE(YES)                       MCASTREL( , )
   NUMMSGS(0)                         SUBTYPE(ADMIN)
   TOPICSTR(/Price/Fruit/Apples)

DISPLAY QLOCAL(SYSTEM.MANAGED.DURABLE.533D180705230020)
```



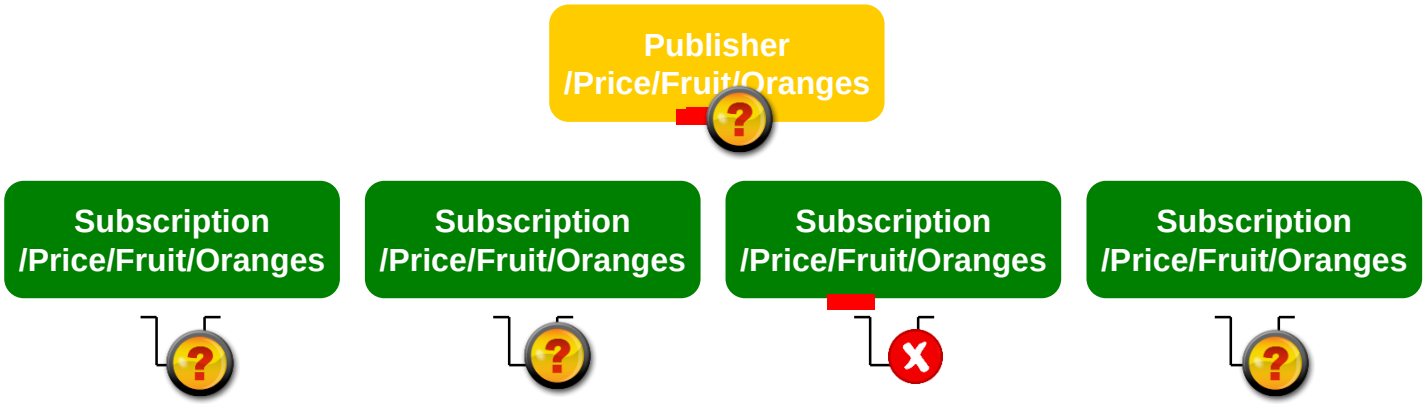
Publishing

Publication, success or failure?



- Point-to-point is nice and simple:
  - Did the message get onto the queue?
  - Was it persistent and transacted?

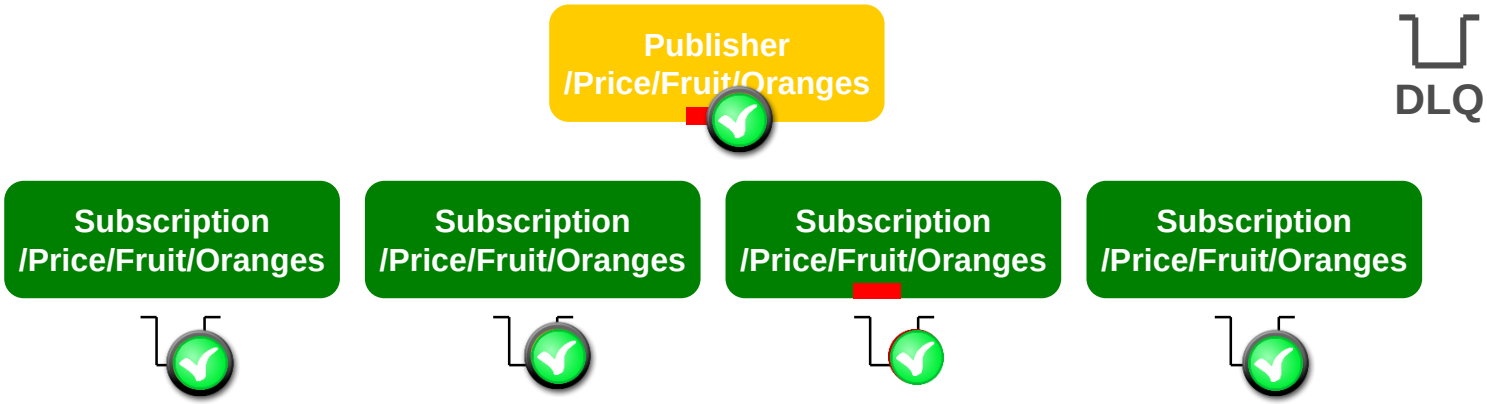
Publication, success or failure?



- Point-to-point is nice and simple:
  - Did the message get onto the queue?
  - Was it persistent and transacted?

- Publish/subscribe is not so clear cut…
  - **Persistence and transactions still ensures integrity of *successful* publications.**
  - But if one or more subscriptions can't receive the publication, ***should the publish fail?***

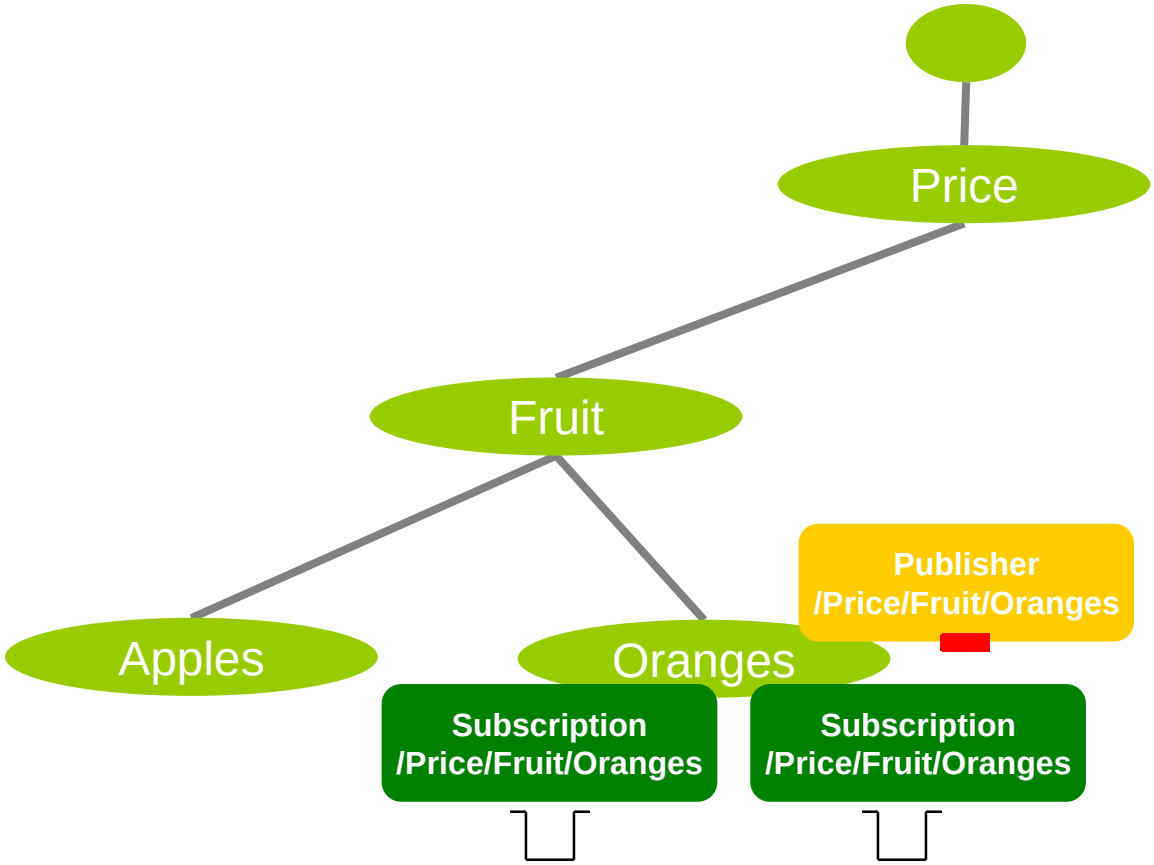
Publication, success or failure?



- *Should those subscriptions impact the others, should the publisher know?*
- *What if the subscriptions are **durable** and the publication is **persistent**?*
- Controlled at the topic level
  - Persistent Message Delivery (**PMSGDLV**) and Non-persistent Message Delivery (**NPMSGDLV**): **ALL, ALLDUR, ALLAVAIL**
- Don't forget that being able to DLQ a publication is still counted as a *success!*
  - **USEDLQ** on the topic to fine tune this behaviour. V7.1
- *And finally, **remember** – when there are no subscriptions, no-one gets it. That's still a successful publish!*

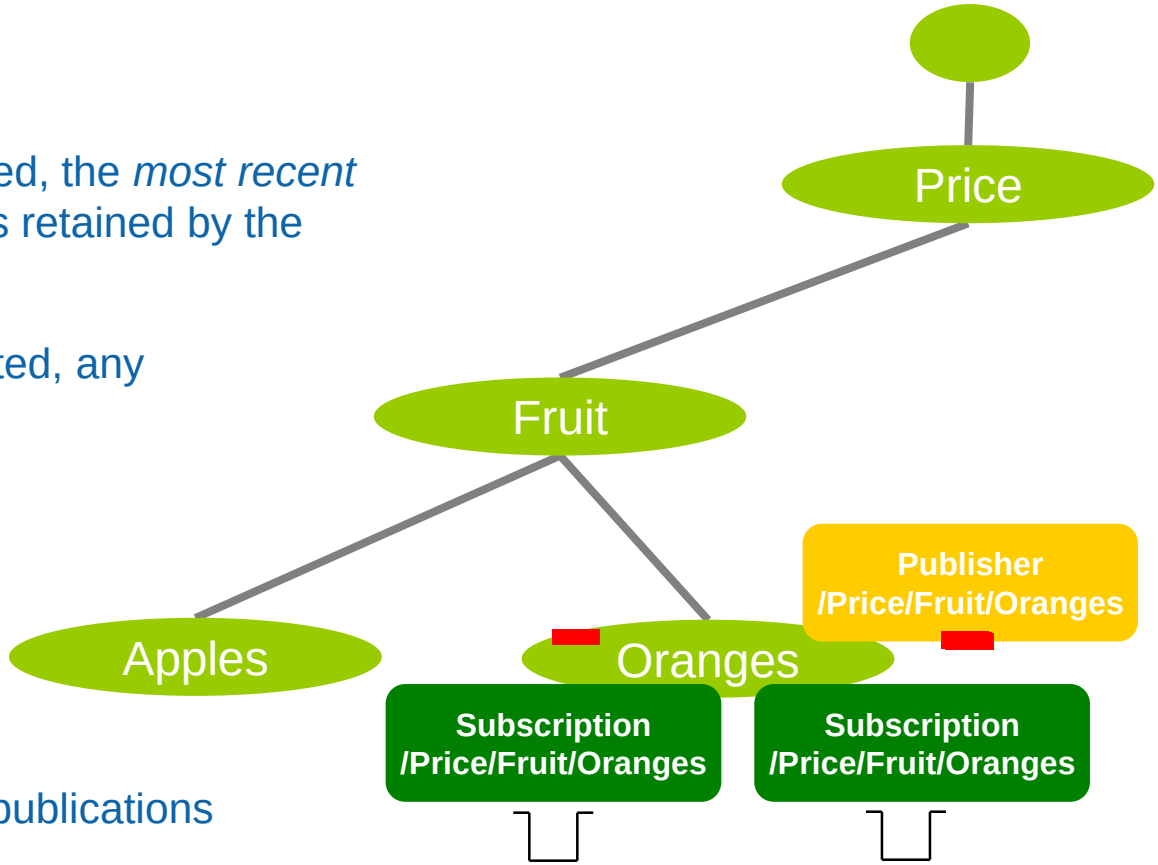
Retained publications

- When a message is published to a topic string, it is delivered to each matching subscription registered at that time.
- Subscriptions created after that point will not receive the message only newly published ones.
- Unless publications are ***retained***



Retained publications

- When a message is published to a topic string, it is delivered to each matching subscription registered at that time.
- Subscriptions created after that point will not receive the message only newly published ones.
- Unless publications are ***retained***
- Every time a message is published, the *most recent* publication for each topic string is retained by the queue manager.
- When a new subscription is created, any matching retained message is delivered to it.

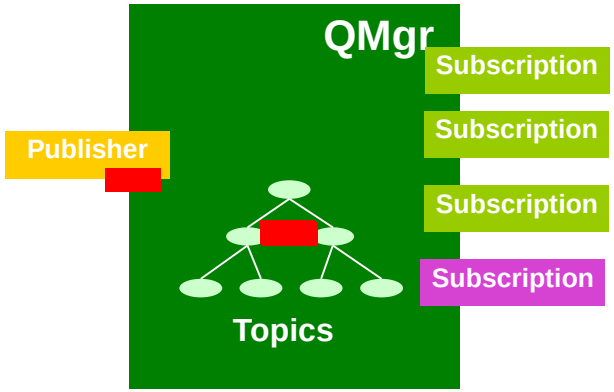


- Take care, using retained can be ***subtle***
- Don't confuse it with **persistent** publications

Quick look at topologies

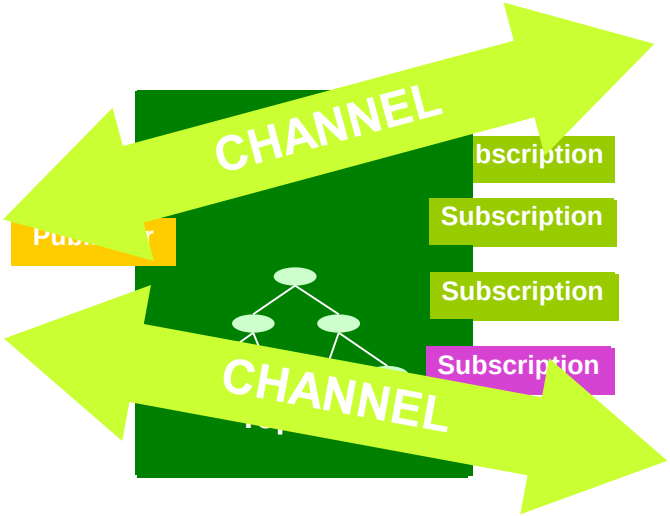
Distributed publish/subscribe

- Everything revolves around the topic tree, dynamically built up in a queue manager



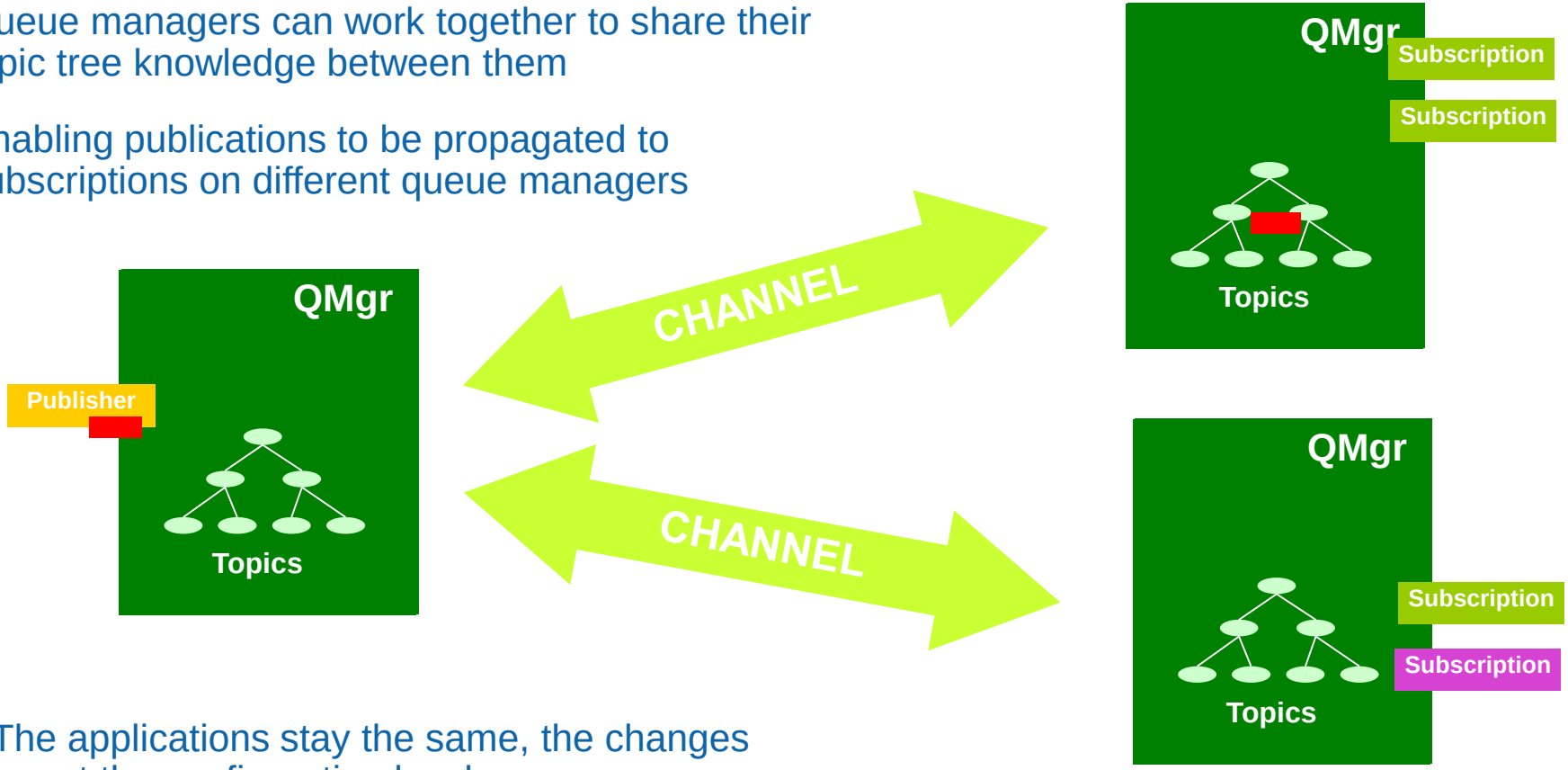
Distributed publish/subscribe

- Everything revolves around the topic tree, dynamically built up in a queue manager
- Queue managers can work together to share their topic tree knowledge between them



Distributed publish/subscribe

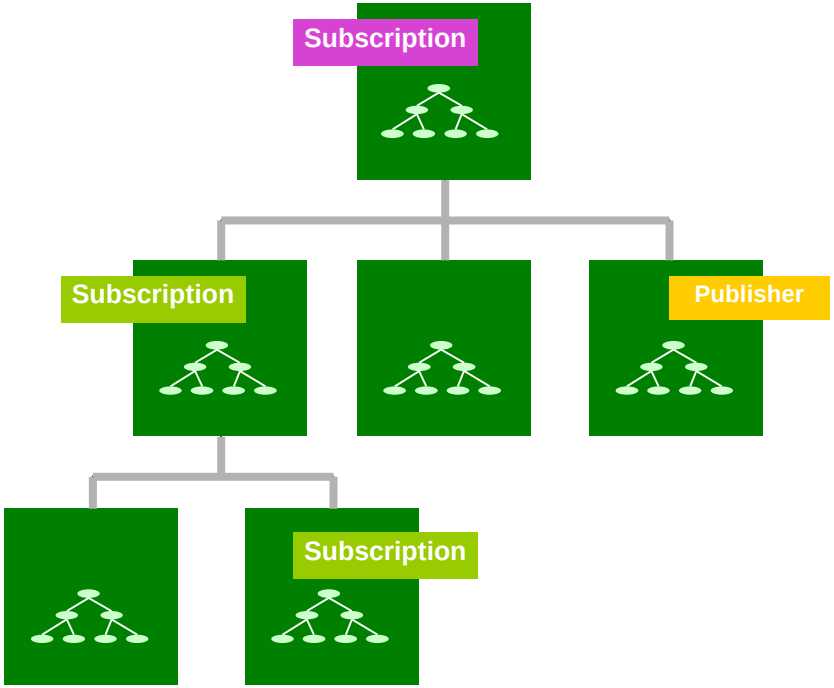
- Everything revolves around the topic tree, dynamically built up in a queue manager
- Queue managers can work together to share their topic tree knowledge between them
- Enabling publications to be propagated to subscriptions on different queue managers

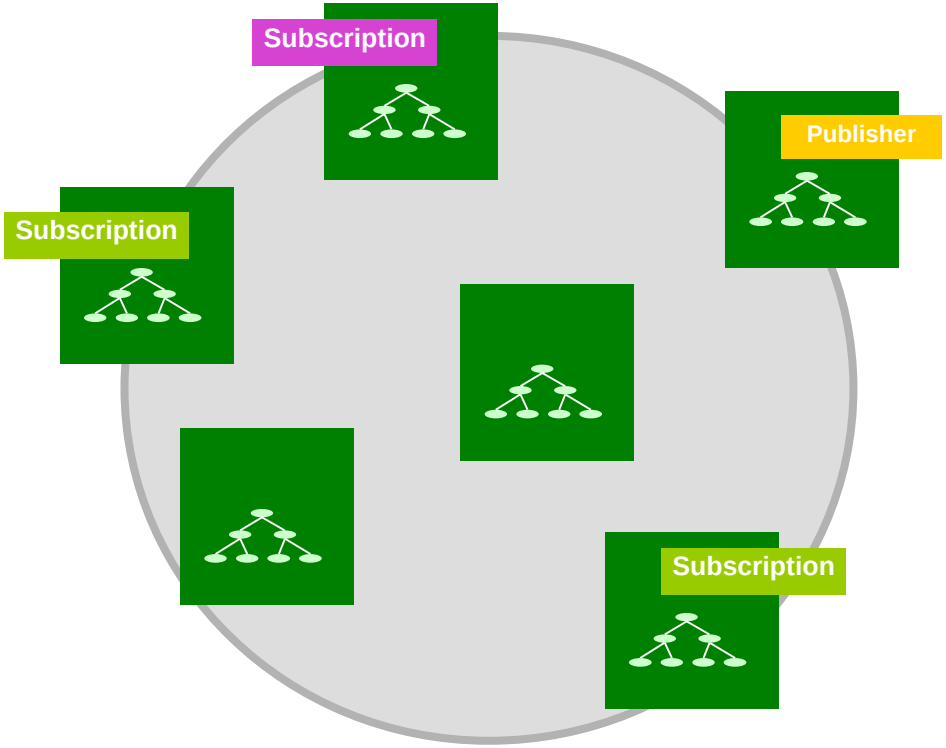


- The applications stay the same, the changes are at the configuration level.

Distributed publish/subscribe topologies

- Publish/subscribe topologies can either be created as a defined ***hierarchy*** or more dynamically as a ***cluster***





Summary

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- Administration of publish/subscribe
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- Subscriptions and publications
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Questions & Answers

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