

Android Concurrency: Overview of Android Handler



Douglas C. Schmidt

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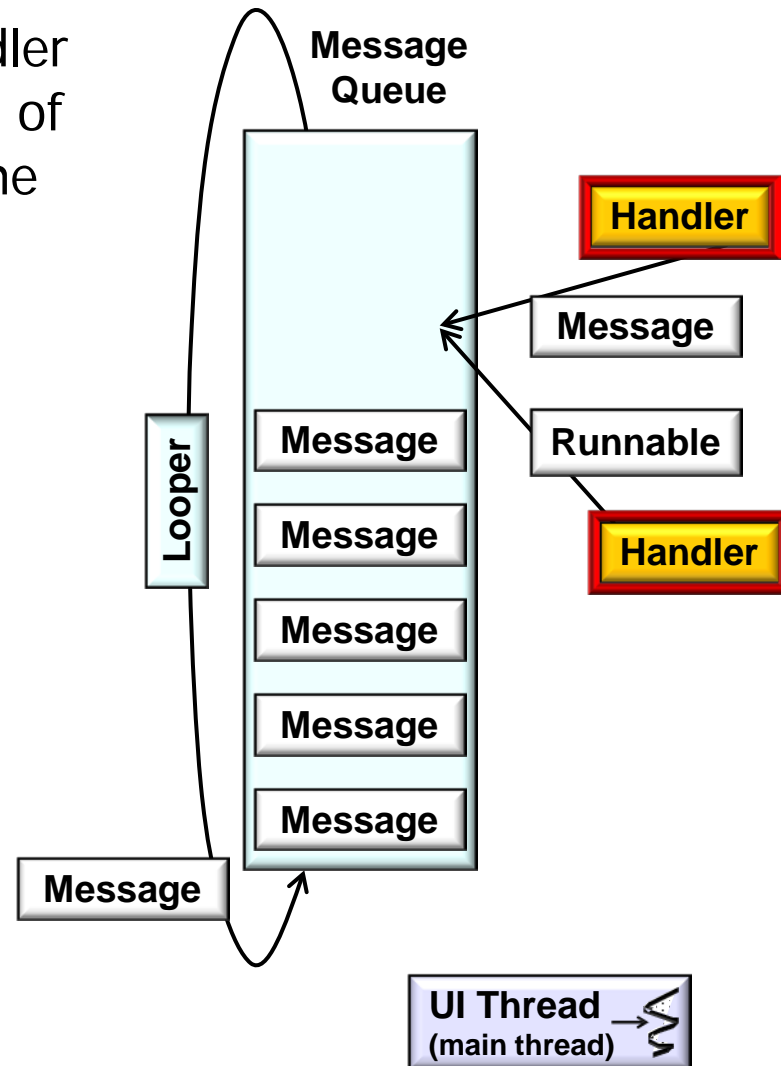
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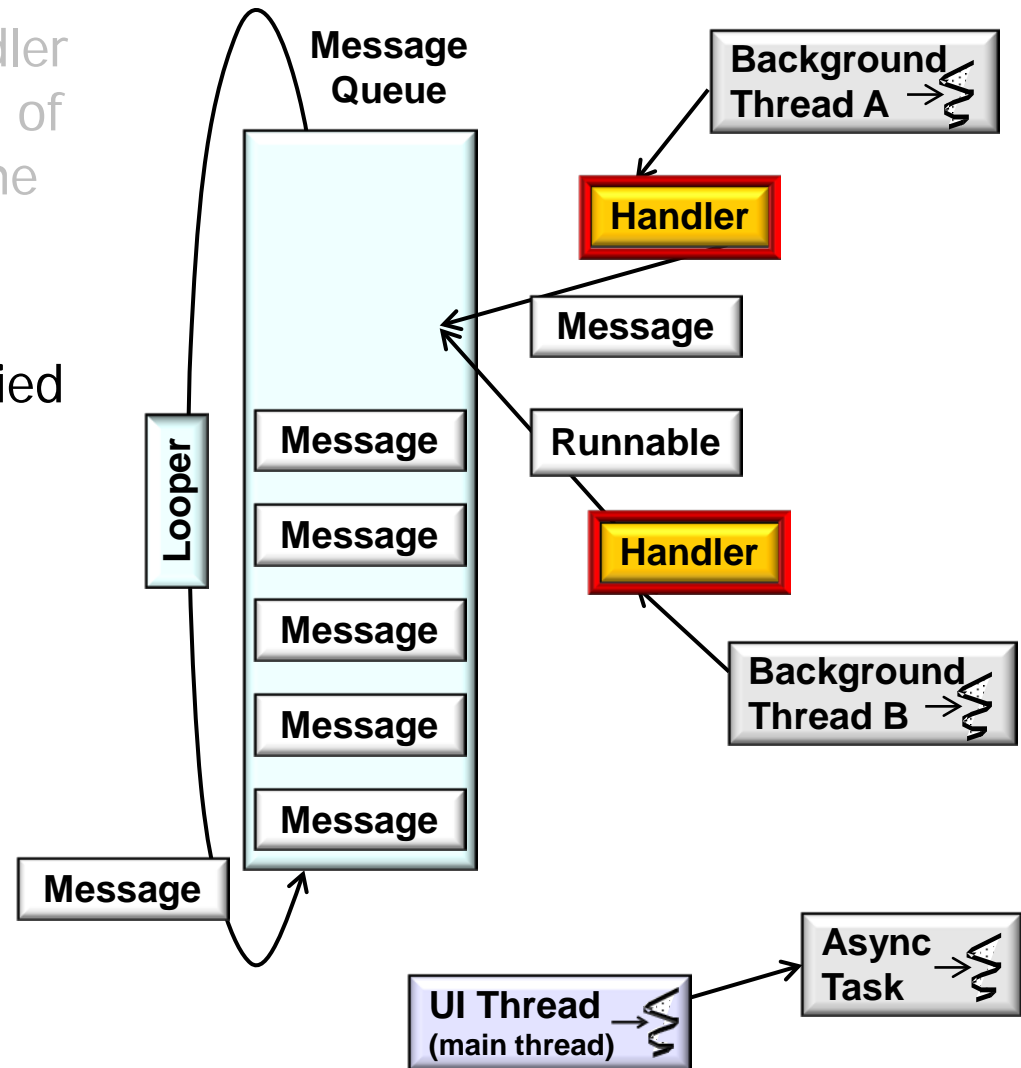
Learning Objectives in this Part of the Module

- Understand how an Android Handler enables the sending & processing of Message & Runnable objects in the MessageQueue associated with a Thread's Looper



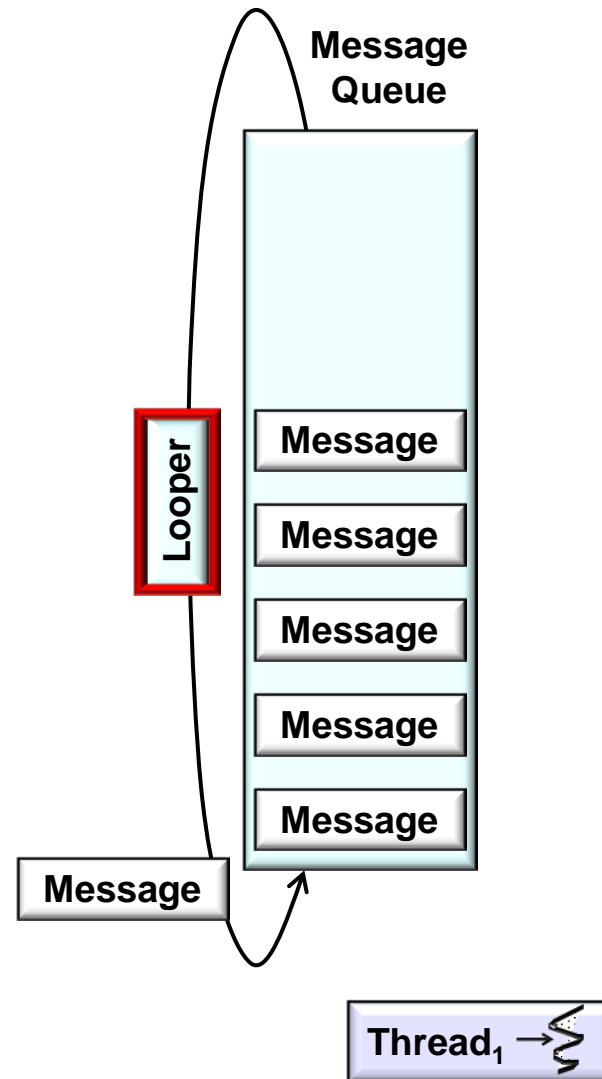
Learning Objectives in this Part of the Module

- Understand how an Android Handler enables the sending & processing of Message & Runnable objects in the MessageQueue associated with a Thread's Looper
- Recognize how Handlers are applied in Android applications & concurrency frameworks



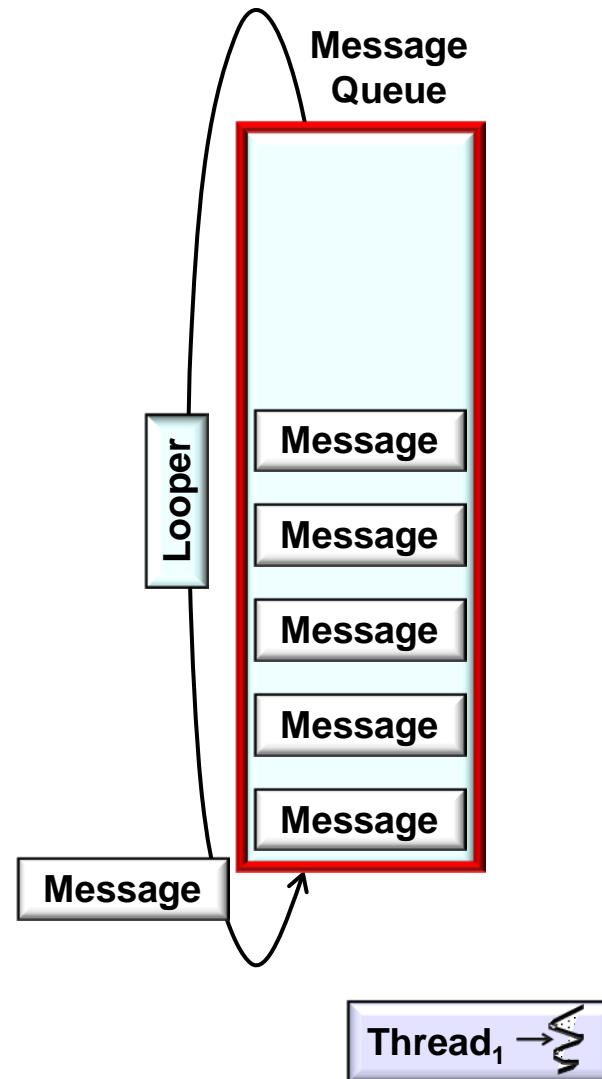
The Handler Class

- A Looper has a MessageQueue



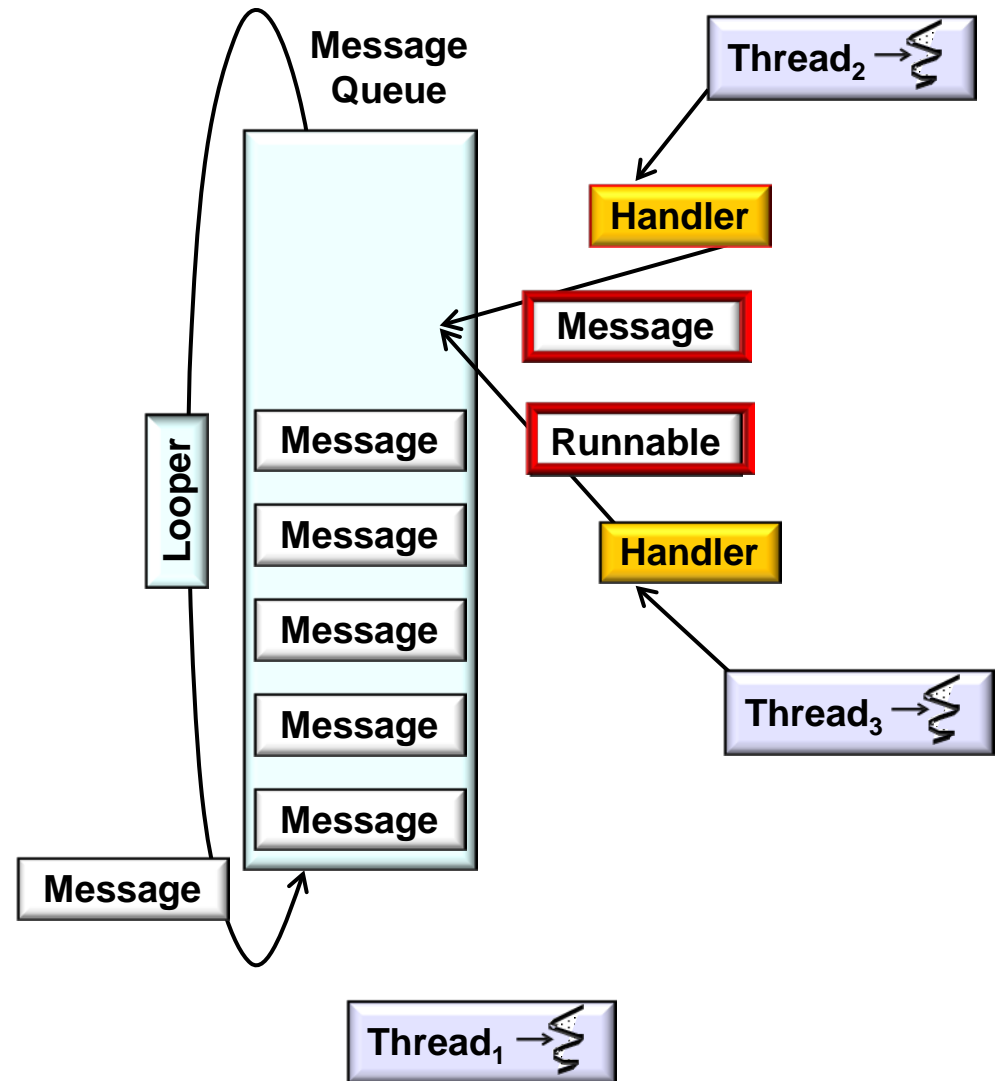
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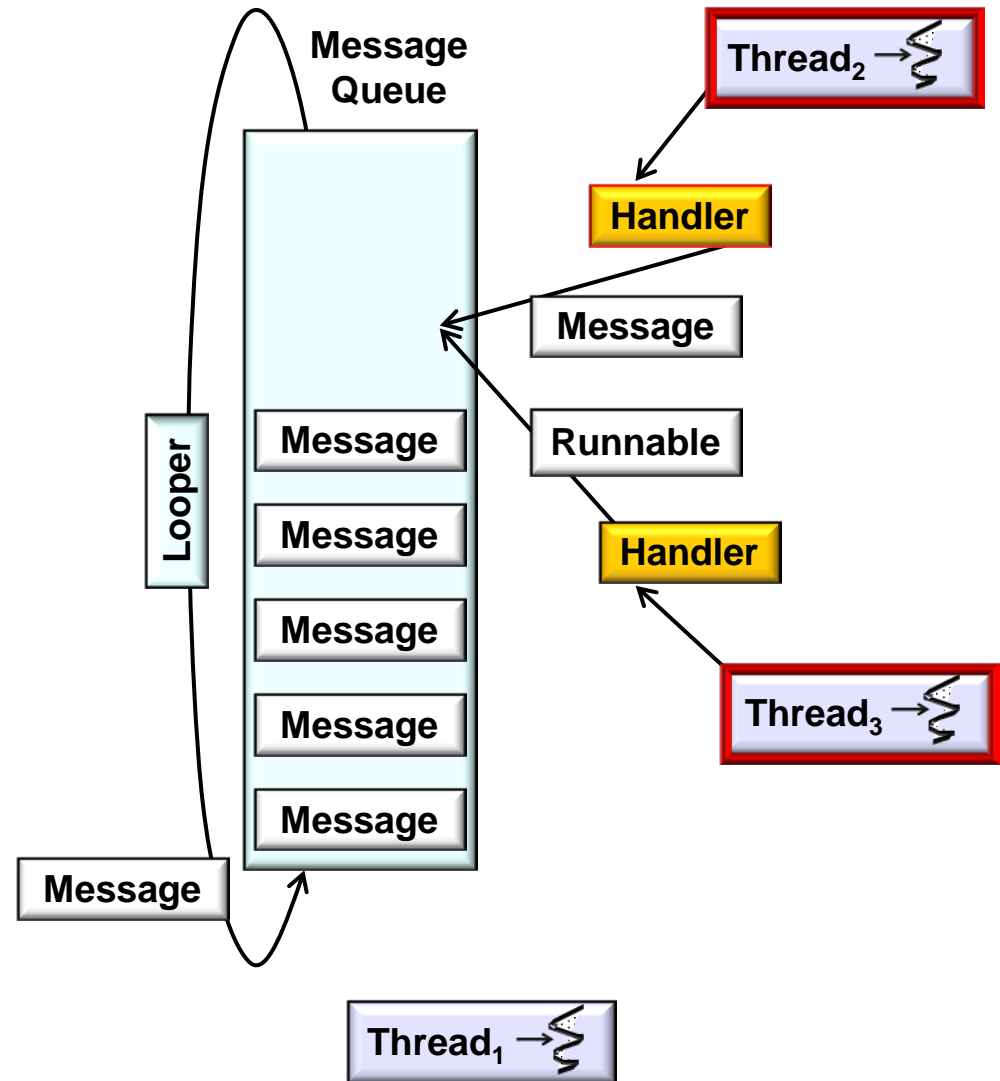
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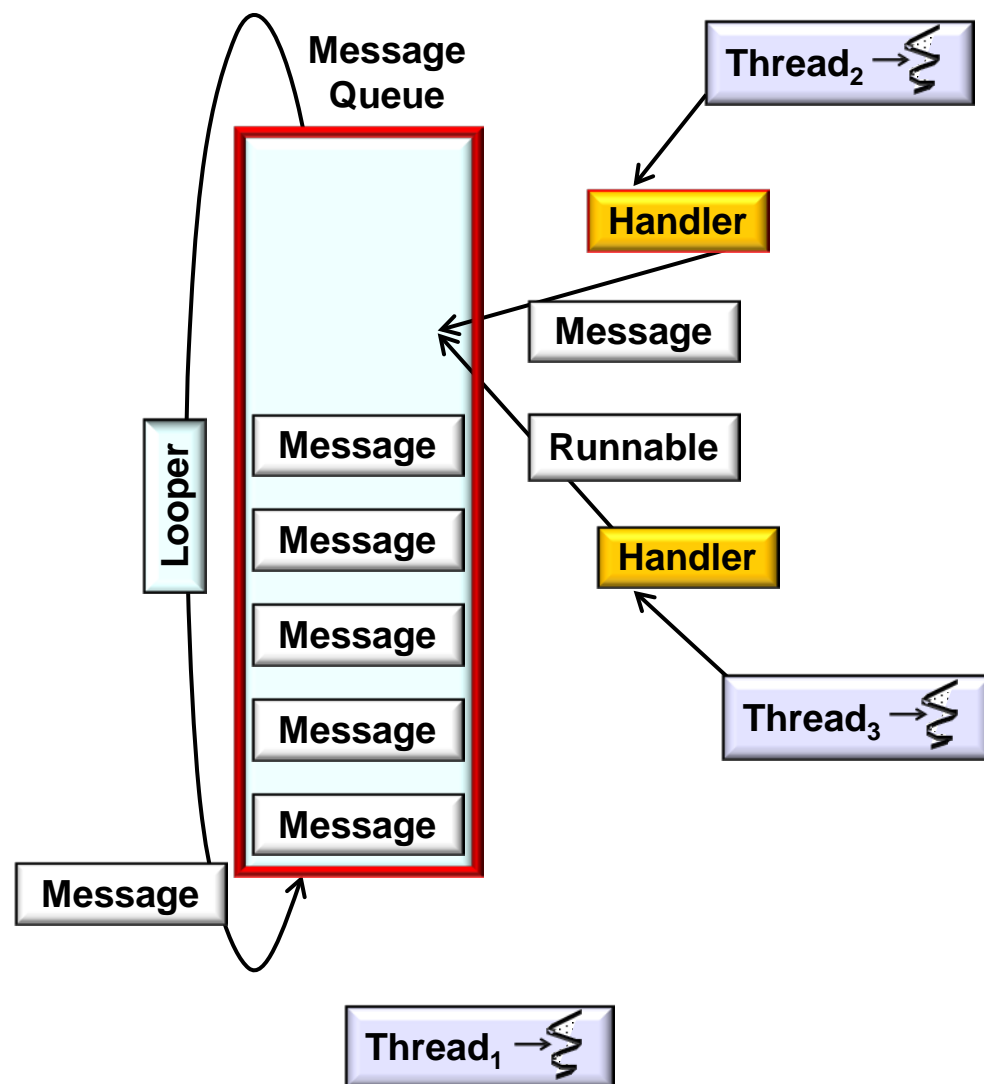
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See previous part on "Android Looper"

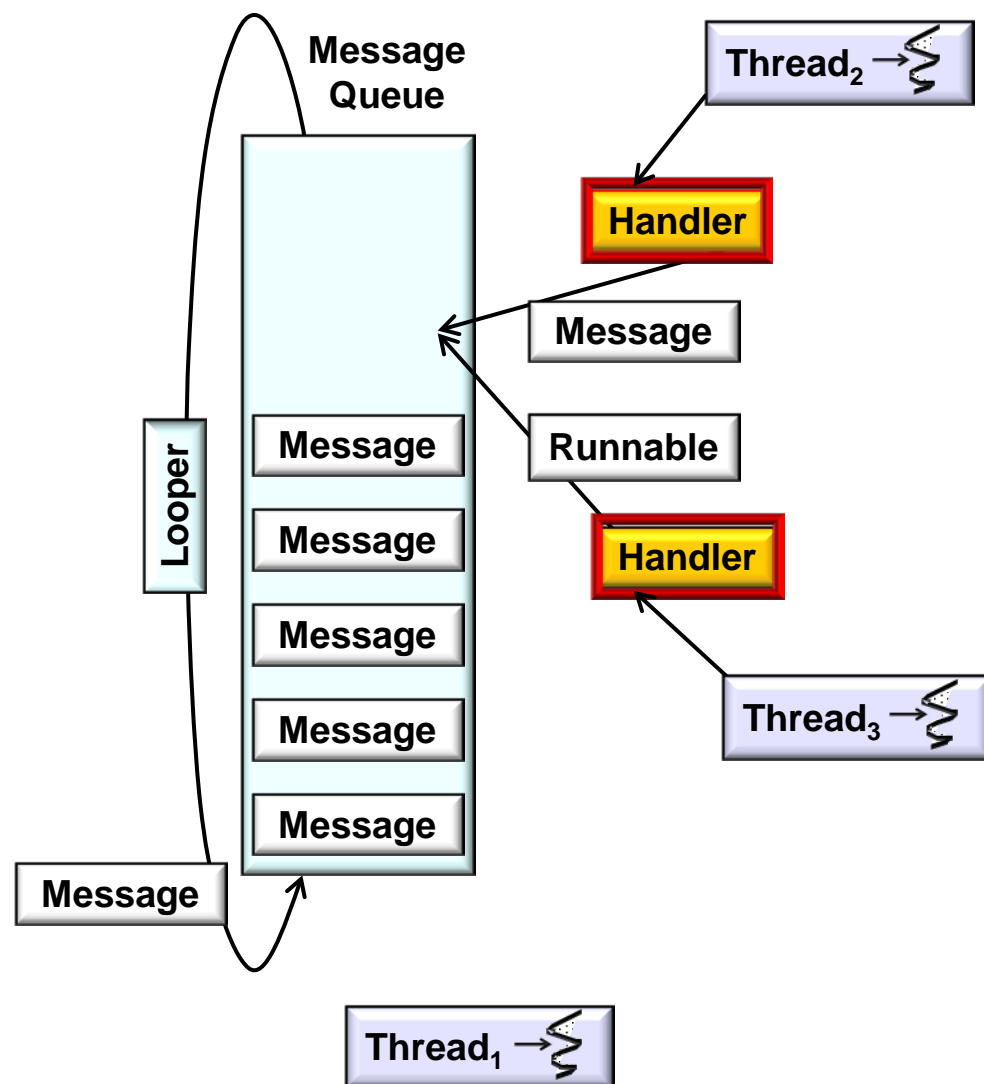
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- A Looper has a MessageQueue
- The actual management of the MessageQueue is done by instances of Handlers



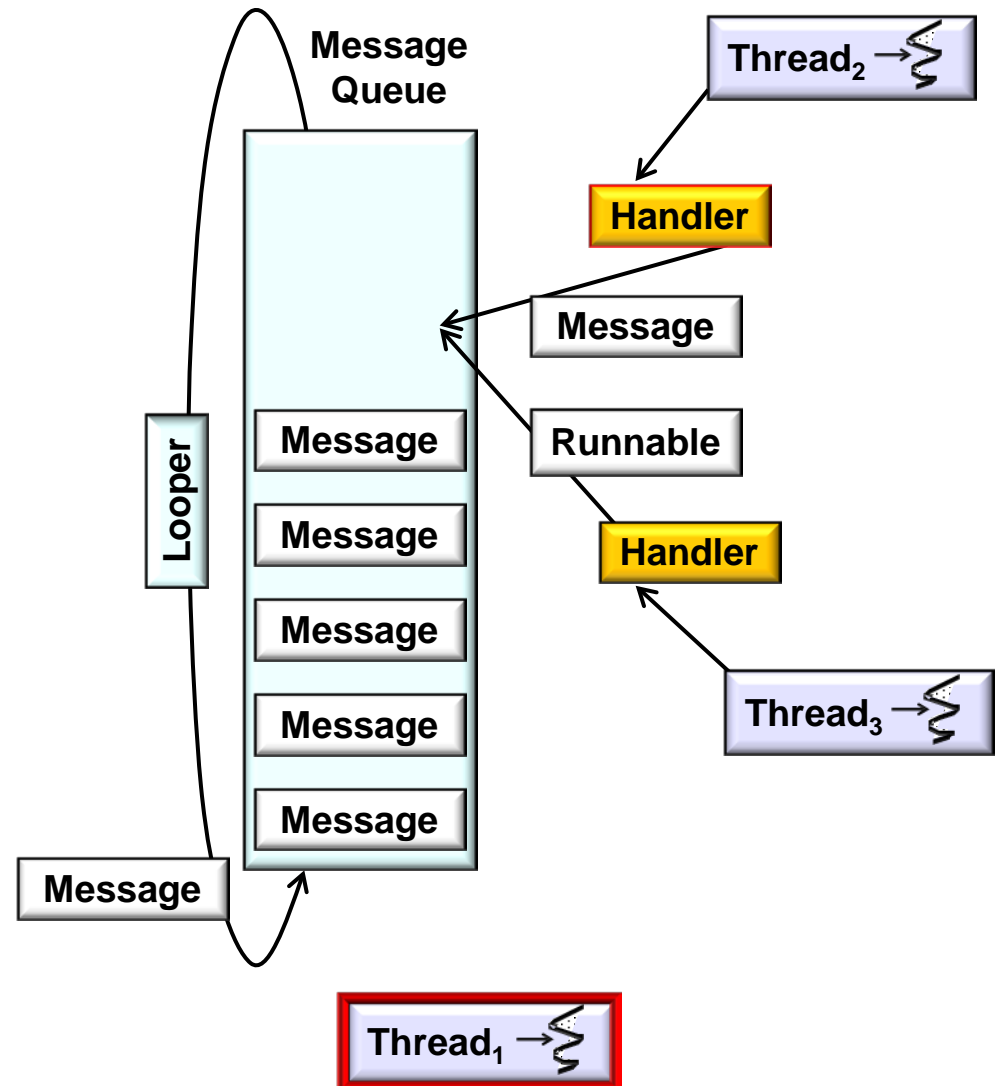
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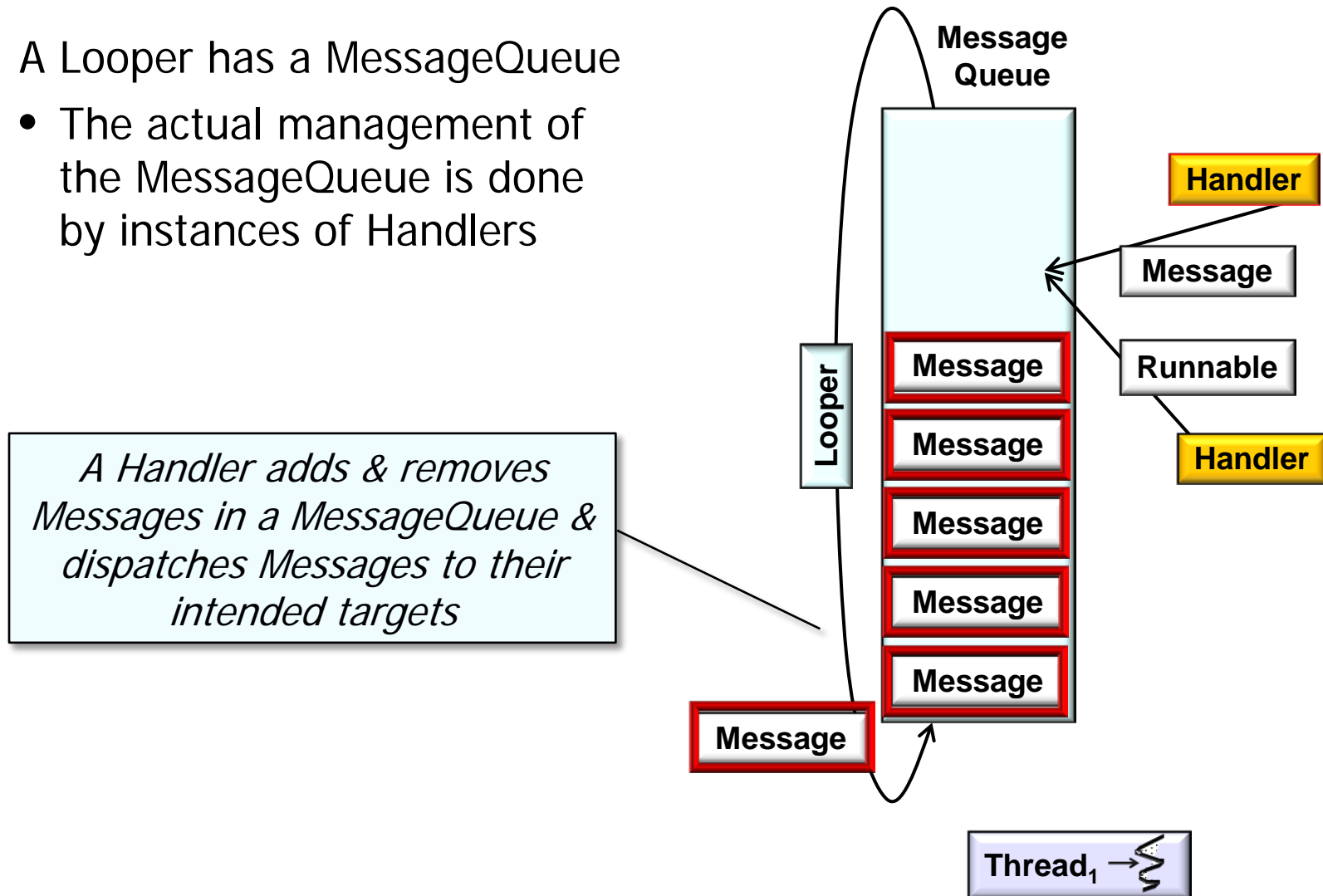
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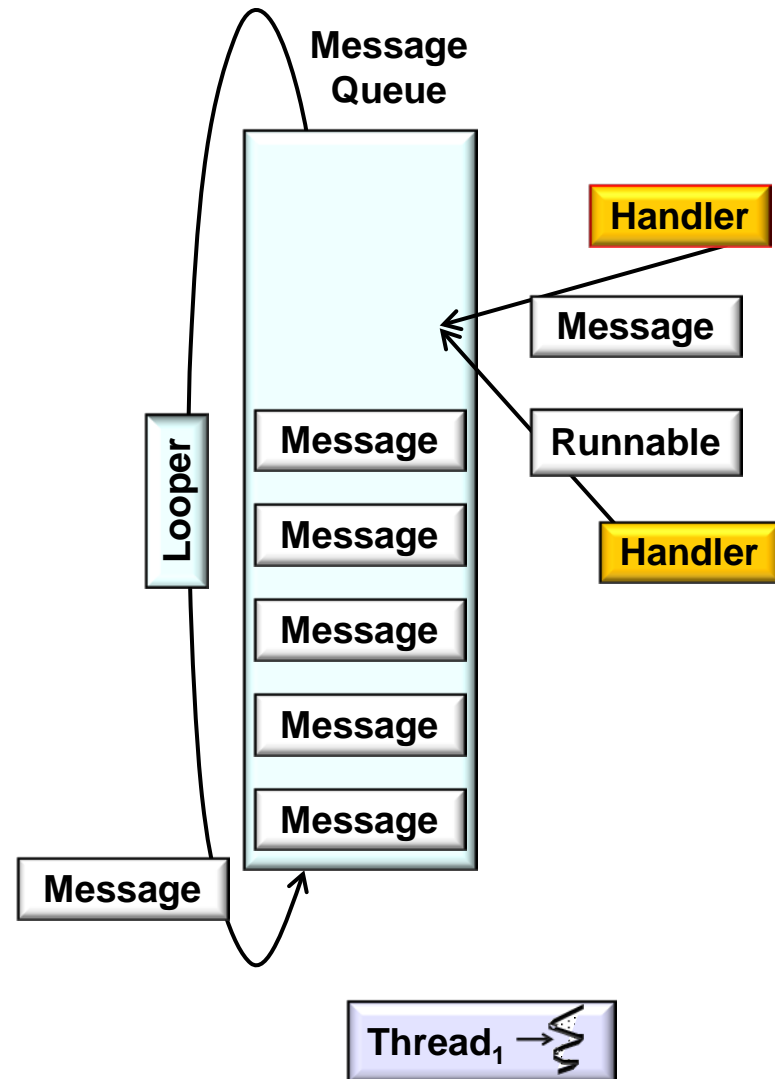
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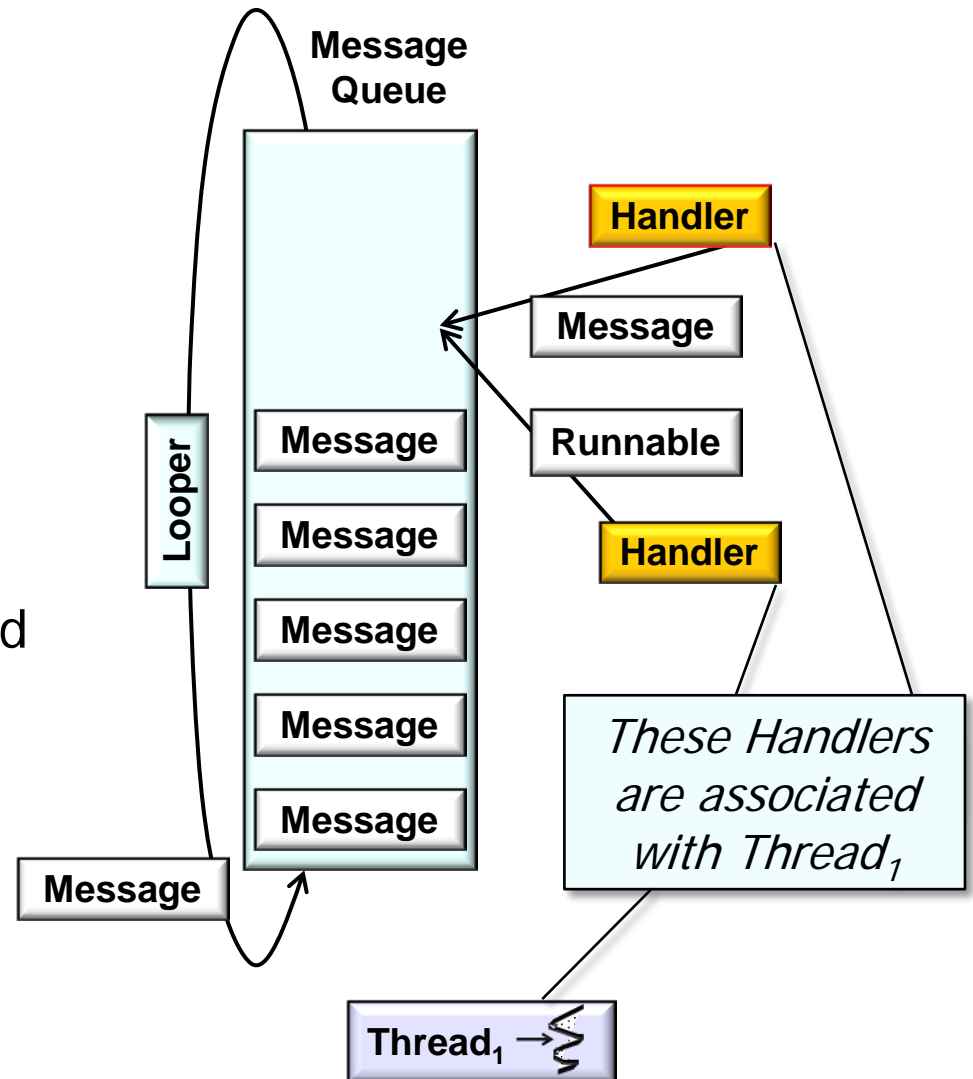
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- A Handler is associated with a particular Looper



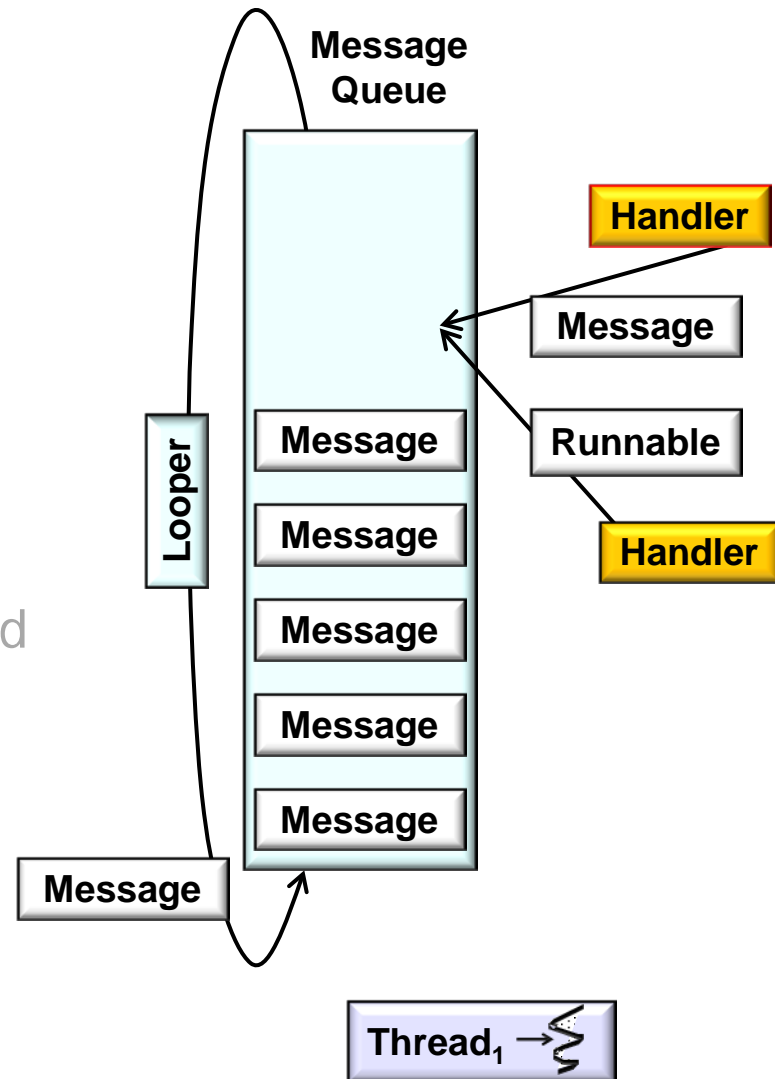
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 - The actual management of the MessageQueue is done by instances of Handlers
- A Handler is associated with a particular Looper
 - Defaults to the Looper in which the current Thread in which the Handler was created



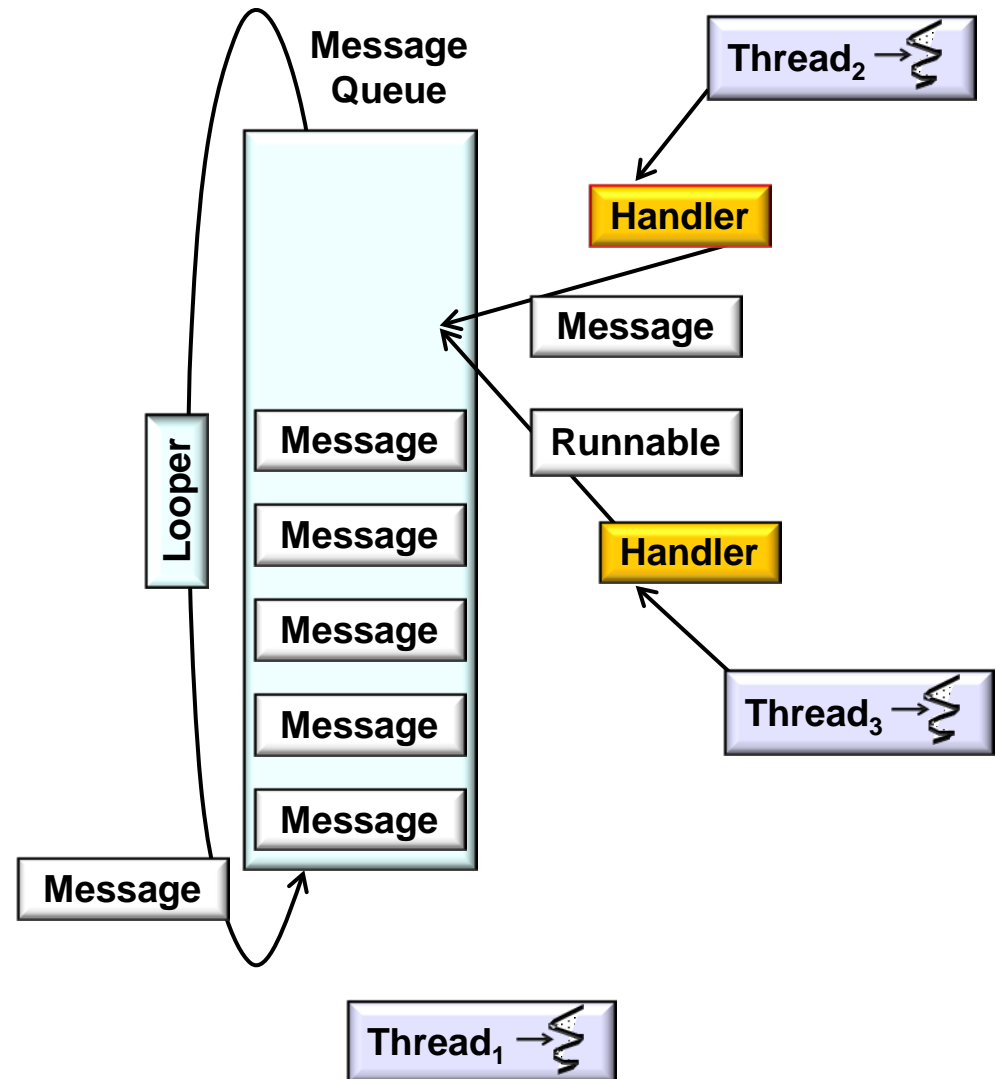
The Handler Class

- A Looper has a MessageQueue
 - The actual management of the MessageQueue is done by instances of Handlers
- A Handler is associated with a particular Looper
 - Defaults to the Looper in which the current Thread in which the Handler was created
- A different Looper can be passed as a parameter to the constructor



The Handler Class

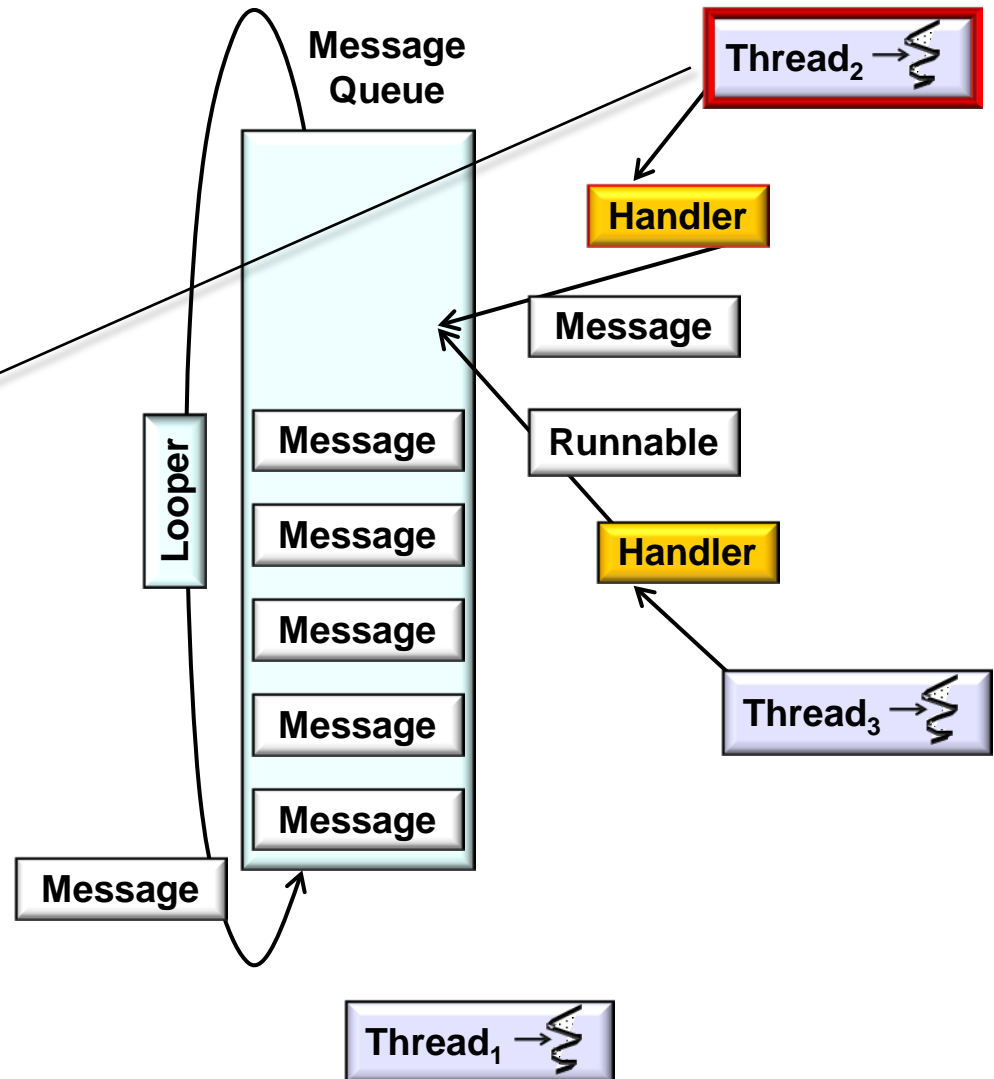
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The Handler Class

- A Looper has a MessageQueue
- A Handler provides several capabilities to applications
- Sends Messages & posts Runnables to a Thread's Looper

`Handler.sendMessage(msg)`

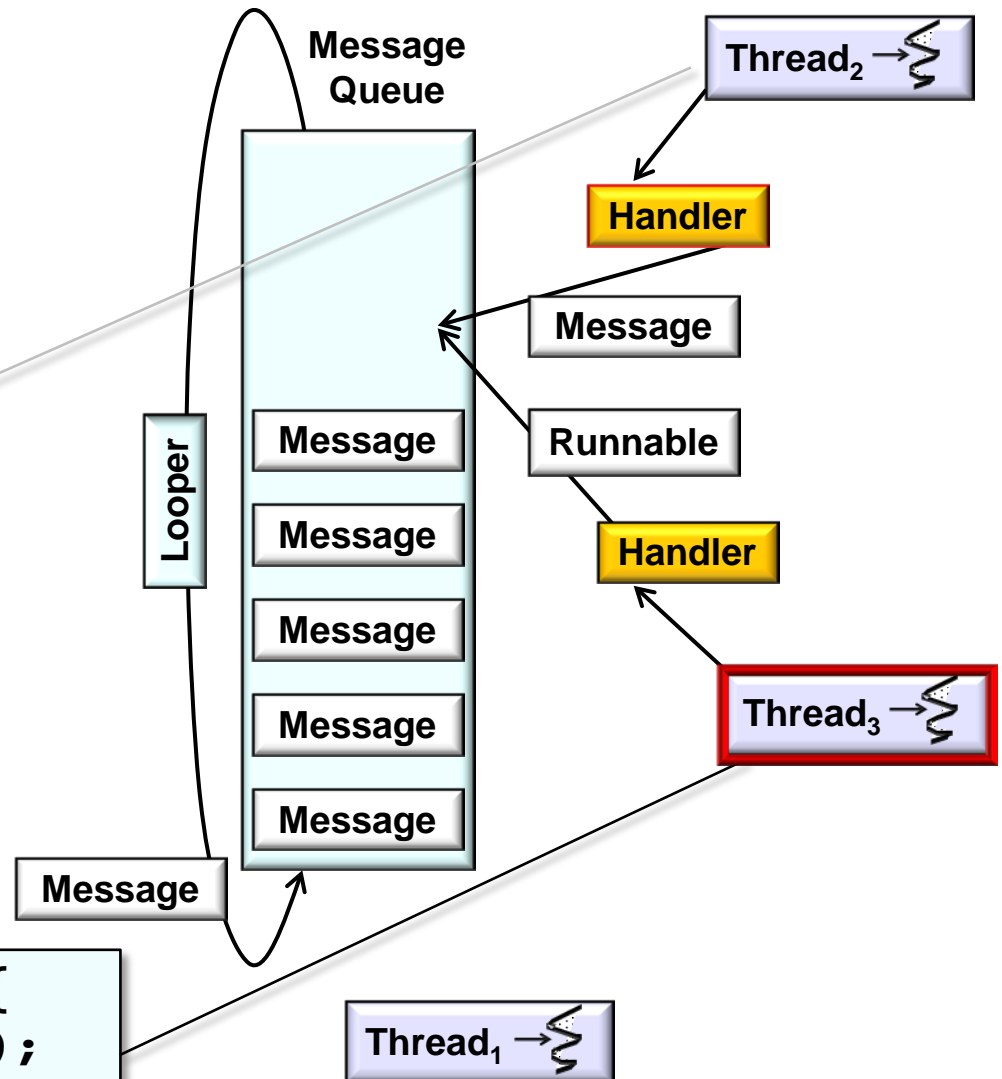


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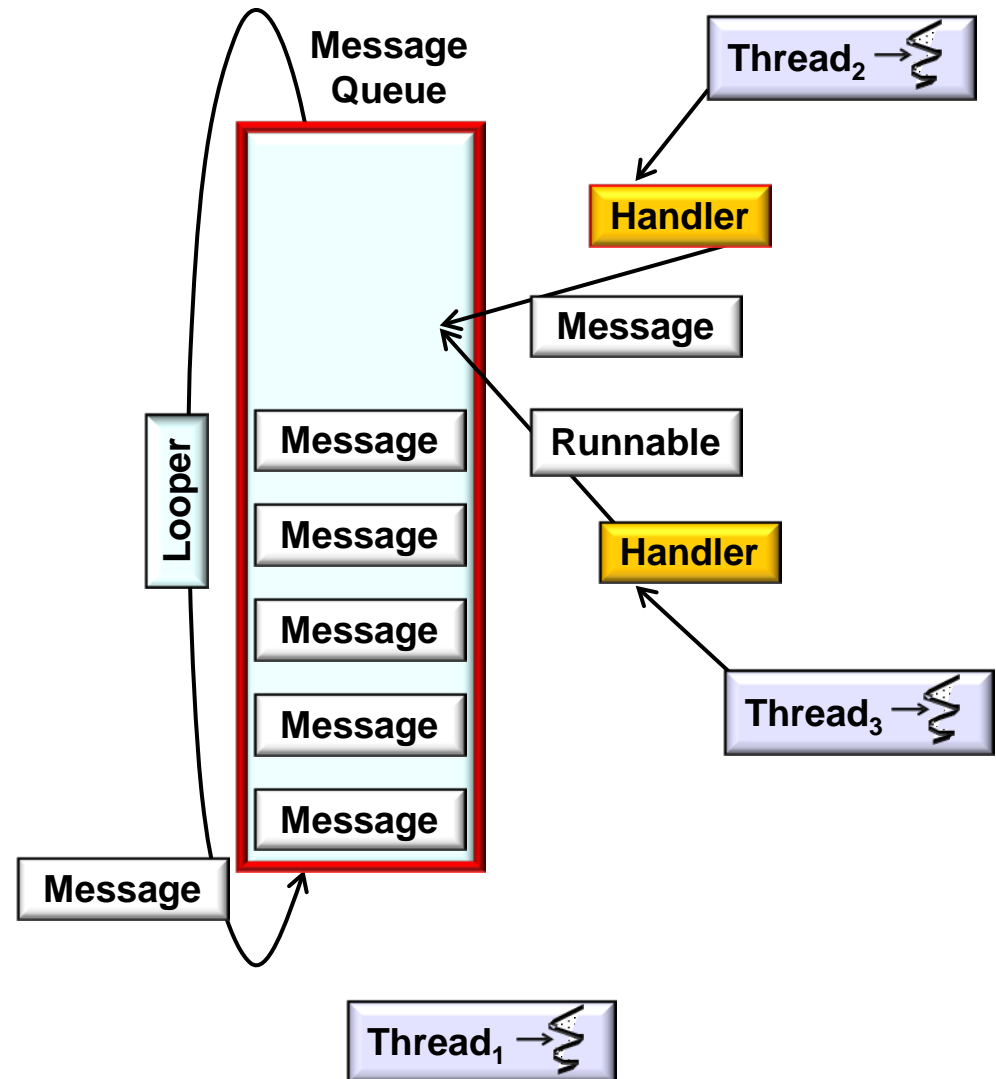
```
Handler.sendMessage(msg)
```

```
Handler.post(new Runnable(){  
    public void run(){ ... }  
});
```



The Handler Class

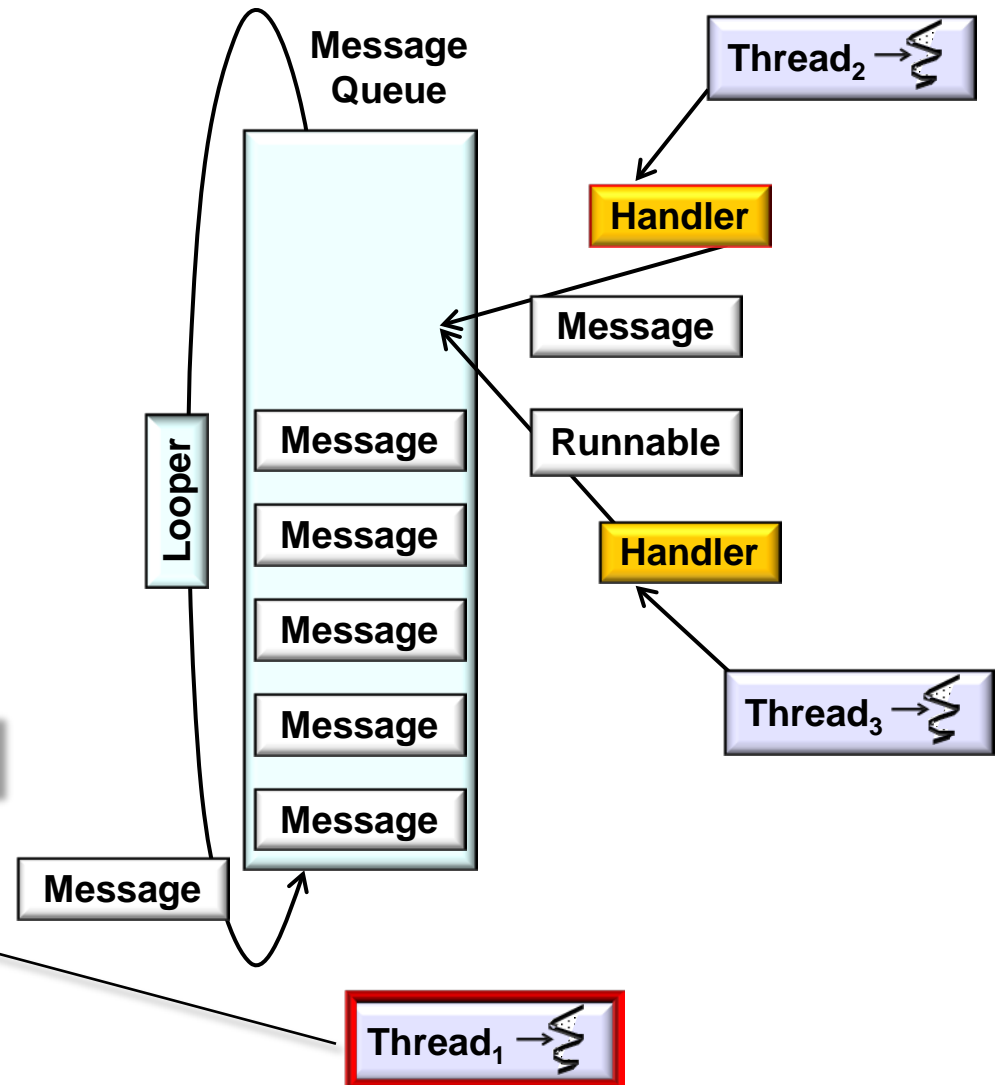
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 - Sends Messages & posts Runnables to a Thread's Looper
 - The Looper's MessageQueue enqueues & schedules them for future execution



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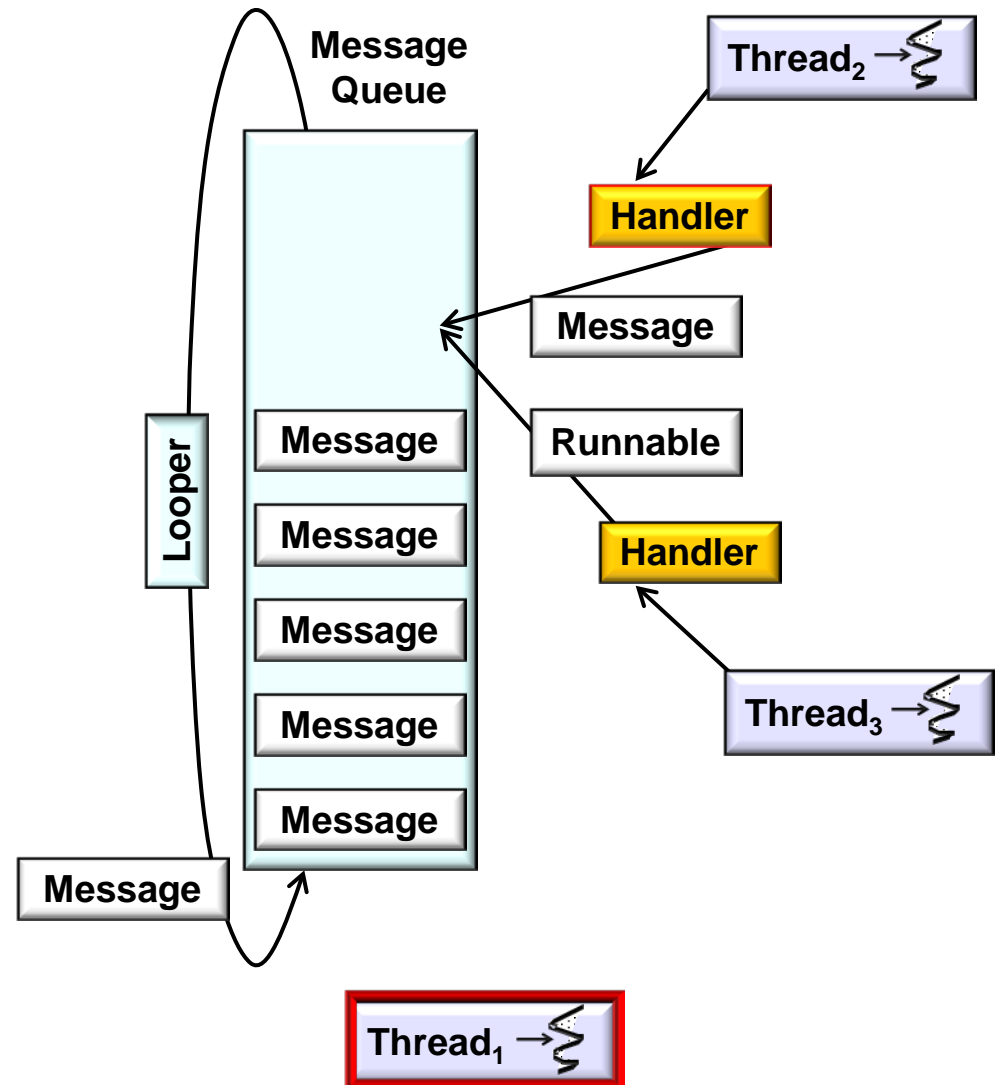
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`Handler.dispatchMessage()`



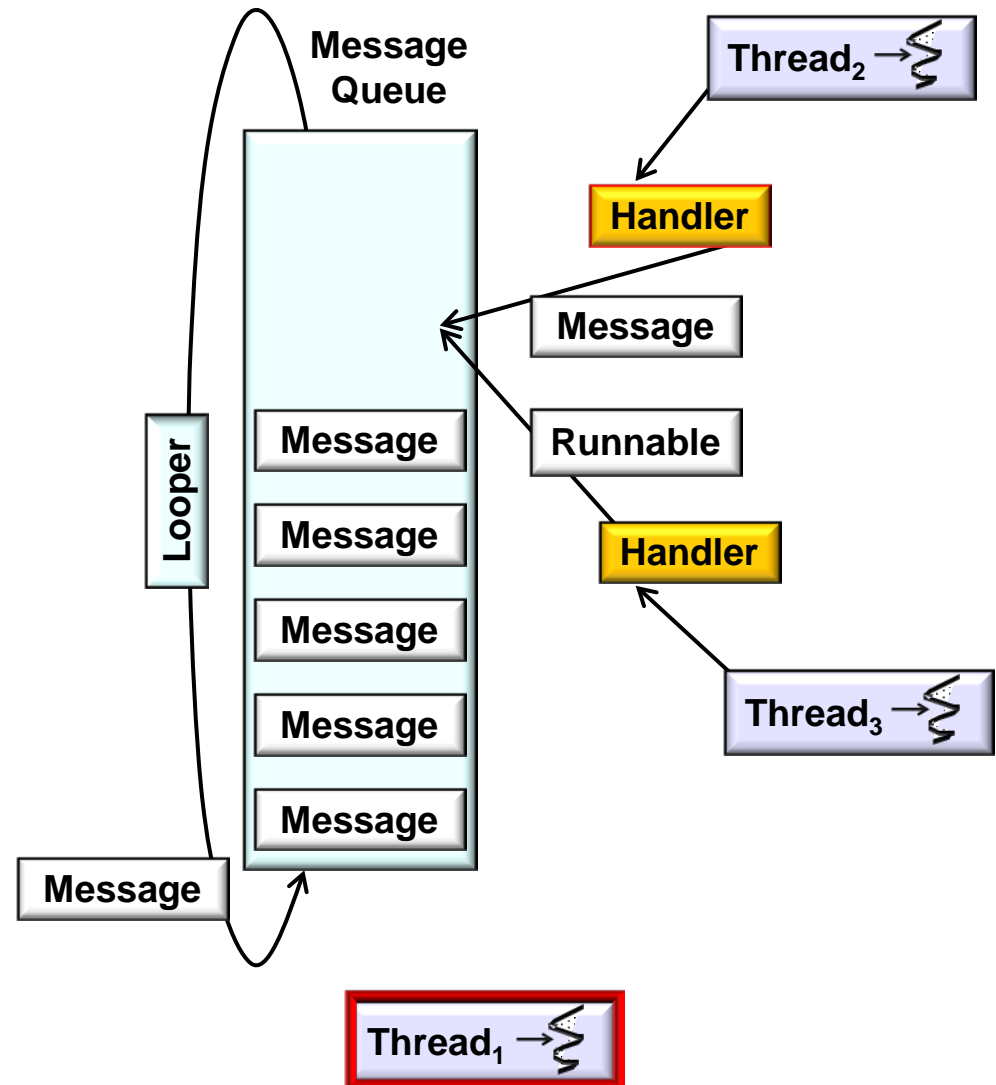
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- A Looper has a MessageQueue
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 - Sends Messages & posts Runnables to a Thread's Looper
- Collaborates with Looper to serialize the processing of Messages in a Thread



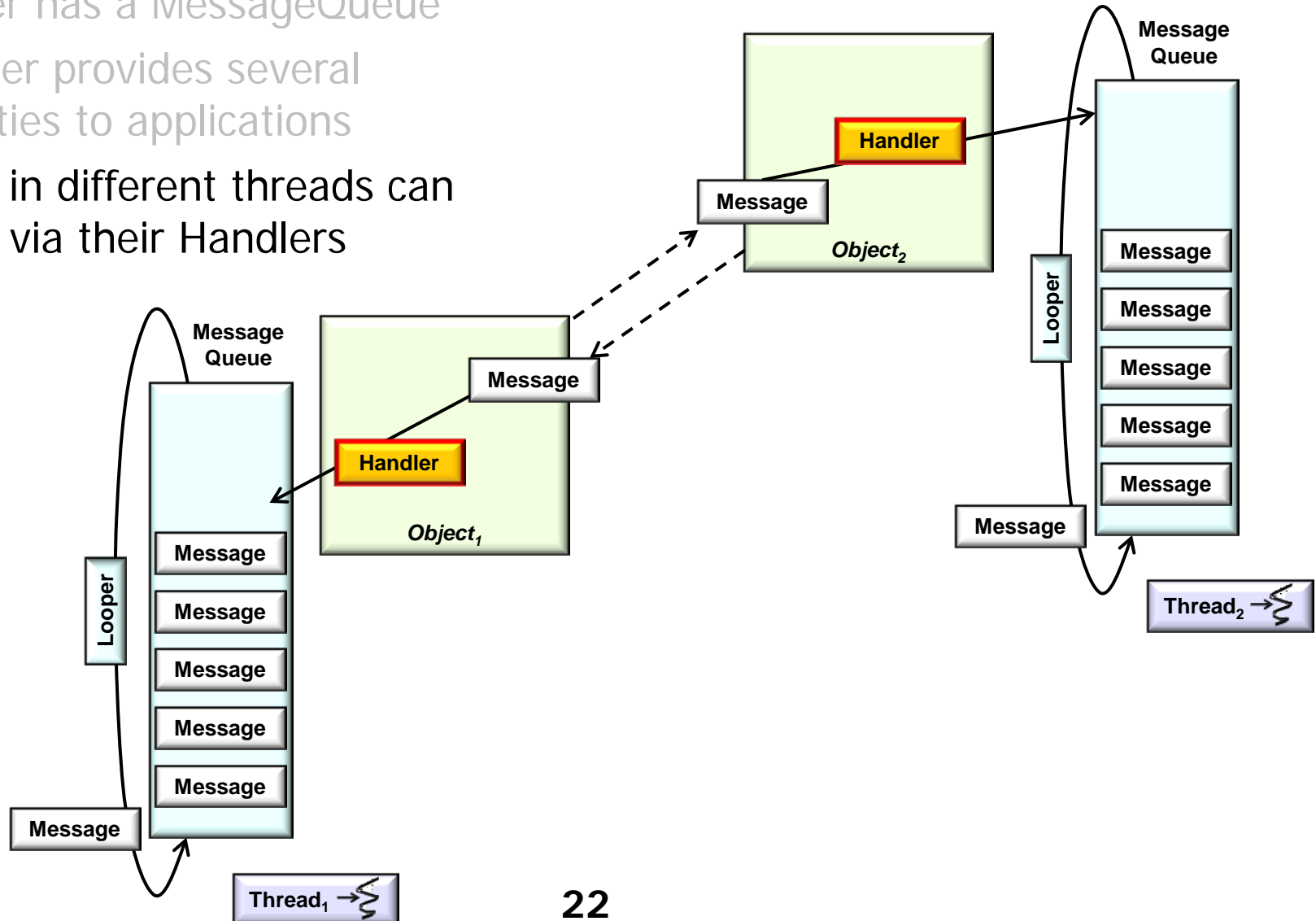
The Handler Class

- A Looper has a MessageQueue
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 - Sends Messages & posts Runnables to a Thread's Looper
- Collaborates with Looper to serialize the processing of Messages in a Thread
 - Can simplify concurrency control if design rules are followed



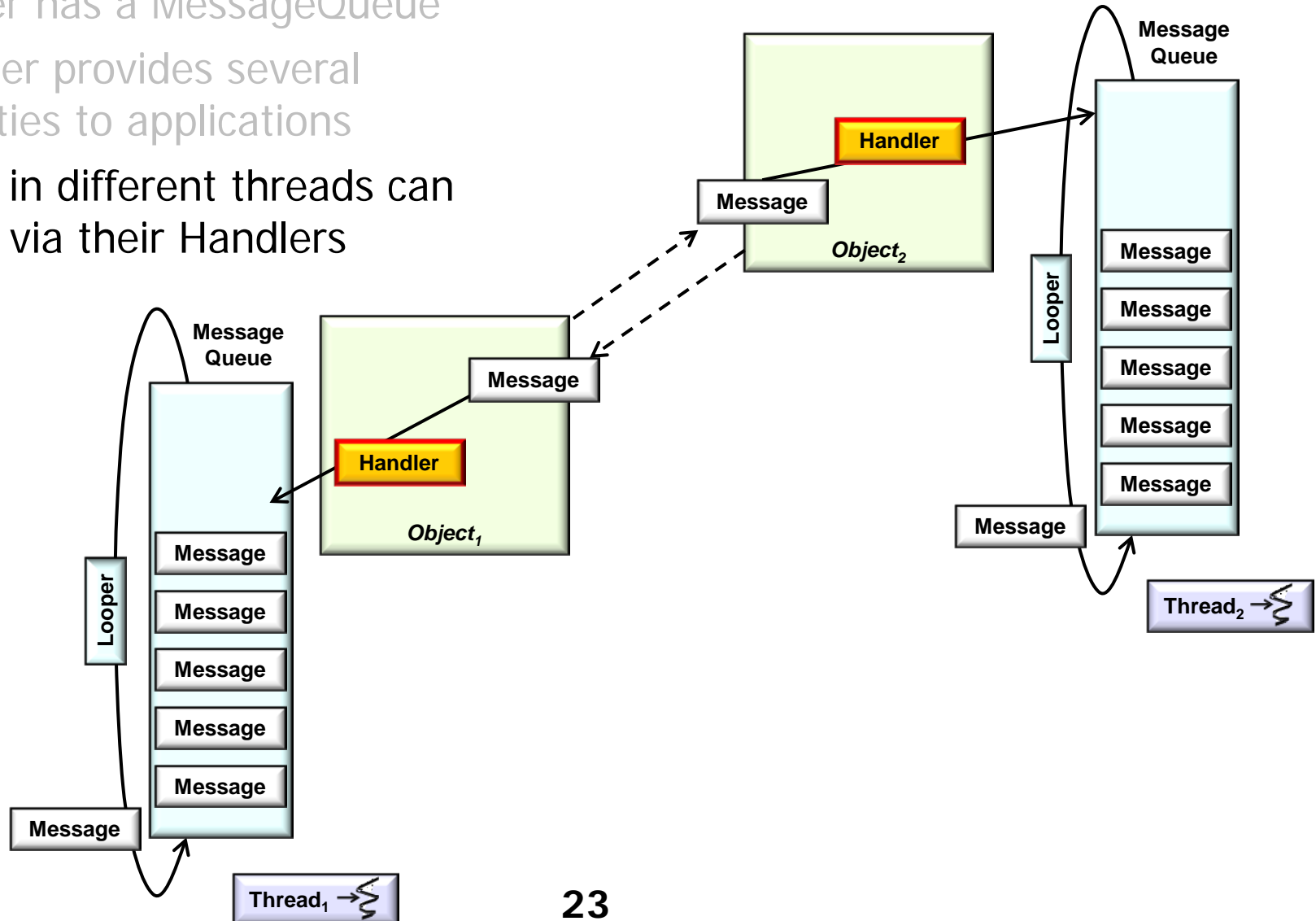
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- A Looper has a MessageQueue
- A Handler provides several capabilities to applications
- Objects in different threads can interact via their Handlers



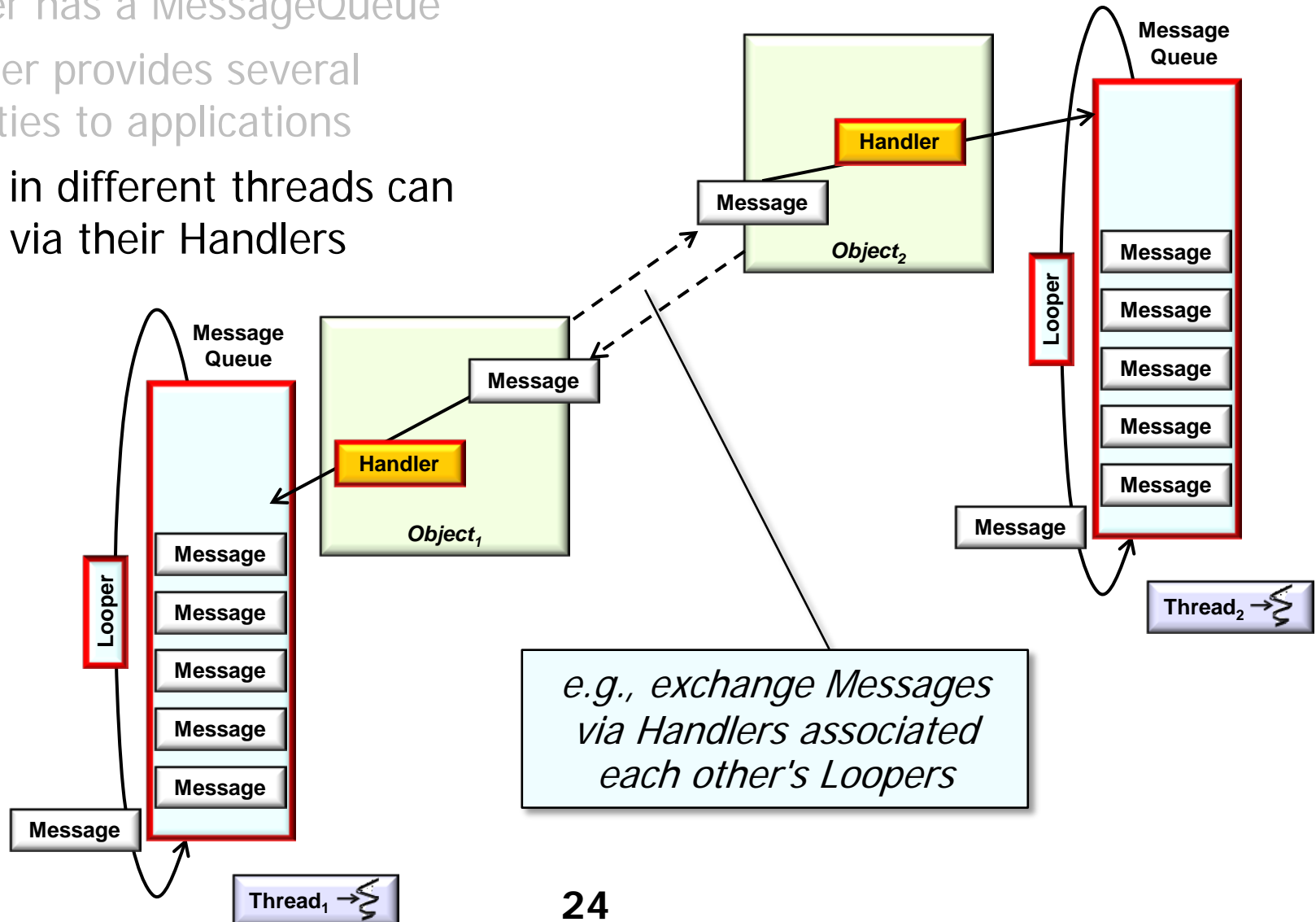
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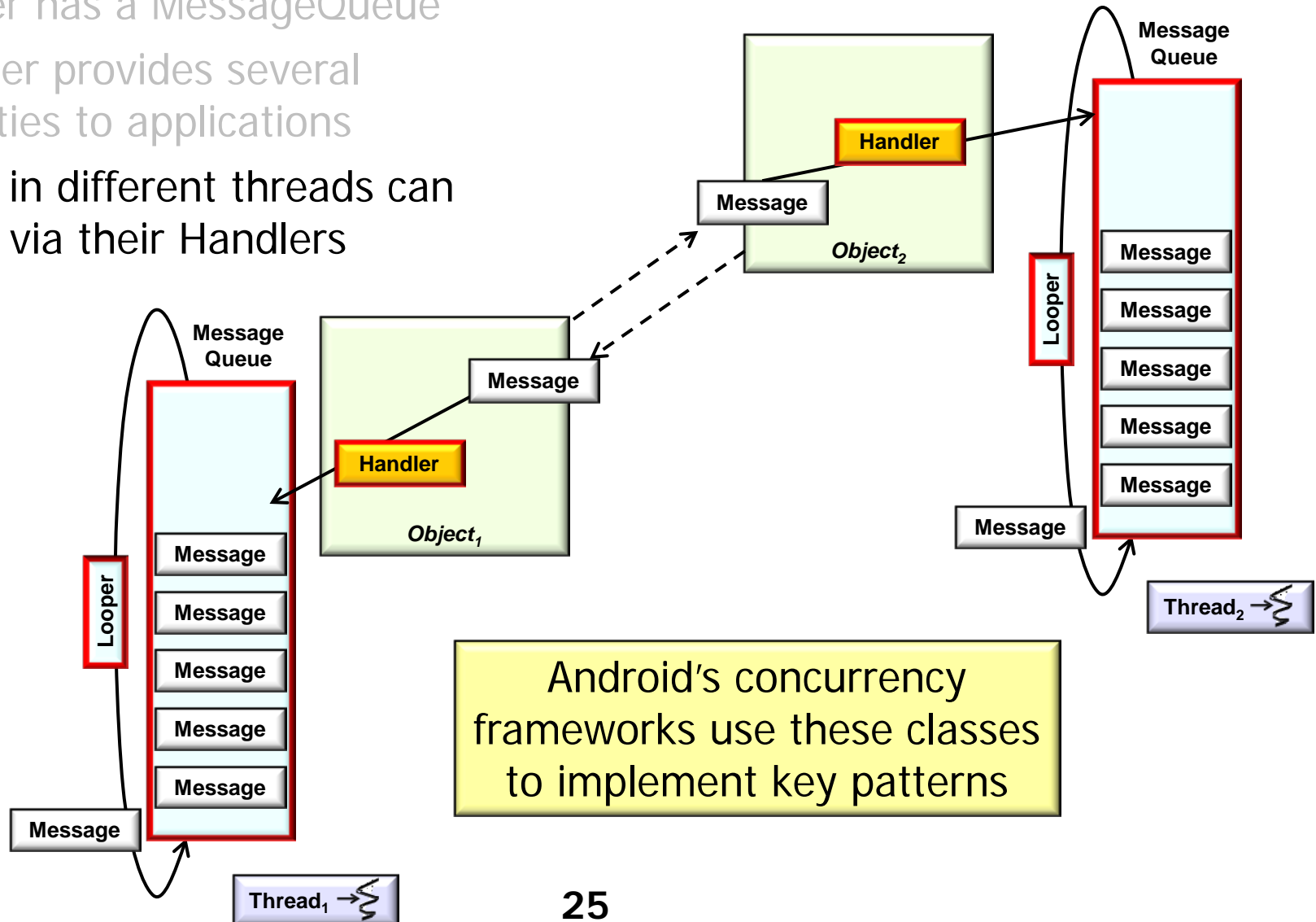
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Categories of Methods in the Handler Class

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- The Handler class has over two dozen methods

Handler

extends [Object](#)

[java.lang.Object](#)
↳ [android.os.Handler](#)

► Known Direct Subclasses
[AsyncQueryHandler](#), [AsyncQueryHandler.WorkerHandler](#), [HttpAuthHandler](#), [SslErrorHandler](#)

Class Overview

A Handler allows you to send and process [Message](#) and [Runnable](#) objects associated with a thread's [MessageQueue](#). Each Handler instance is associated with a single thread and that thread's message queue. When you create a new Handler, it is bound to the thread / message queue of the thread that is creating it – from that point on, it will deliver messages and runnables to that message queue and execute them as they come out of the message queue.

There are two main uses for a Handler: (1) to schedule messages and runnables to be executed as some point in the future; and (2) to enqueue an action to be performed on a different thread than your own.

Methods | [Expand All]
Added in API level 1

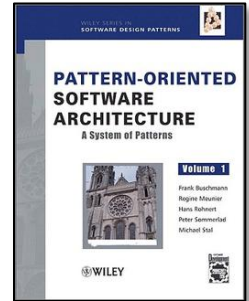
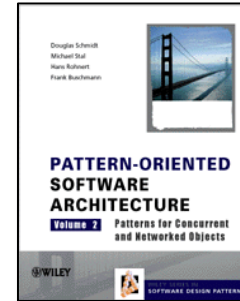
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- These methods can be grouped into four main categories



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 - Posting/removing Runnables

`boolean post(Runnable r)`

- Add Runnable to MessageQueue & run when MessageQueue is ready

`void removeCallbacks(Runnable r)`

- Remove any pending posts of Runnable r that are in the MessageQueue

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 - Insert/delete a Runnable into/from MessageQueue associated with the Handler
 - The Handler & its Thread-specific Looper dequeue each Runnable & dispatch it's run() hook method

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 - Sending/removing Messages

`boolean sendMessage(Message msg)`

- Puts msg at end of queue immediately

`void removeMessages(int what)`

- Remove any pending posts of Messages with code 'what' that are in the MessageQueue

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 - Sending/removing Messages
 - Insert/delete a Message into/from MessageQueue associated with the Handler
 - A Message contains a bundle of data processed by the Handler's handleMessage() hook method

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 - Sending/removing Messages
 - Obtaining Messages

Message obtainMessage()

- Returns a new Message from the global message pool

**Message obtainMessage
(int what)**

- Same as obtainMessage(), except that it also sets the what member of the returned Message

**Message obtainMessage
(int what, int arg1,
int arg2, Object obj)**

- Same as obtainMessage(), except that it also sets the what, obj, arg1, and arg2 values on the returned Message

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 - Factories that create Messages passed to `sendMessage()`

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 - Dispatching/handling Messages

void dispatchMessage(Message msg)

- Invoke the appropriate callback (e.g., `run()` or `handleMessage()`) based on the type of the Message

void handleMessage(Message msg)

- Subclasses must implement this method to receive messages

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 - handleMessage() runs in the context of the Handler Thread

void dispatchMessage(Message msg)

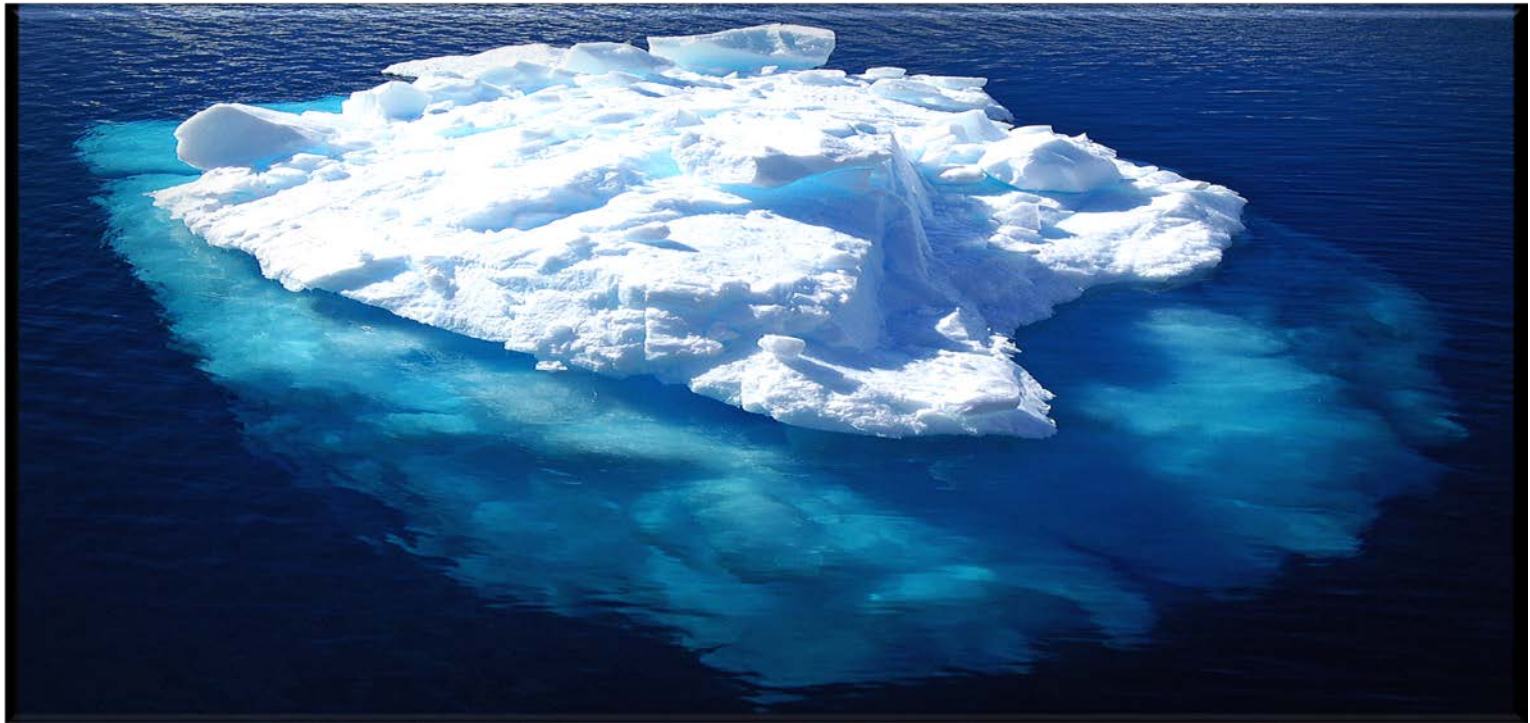
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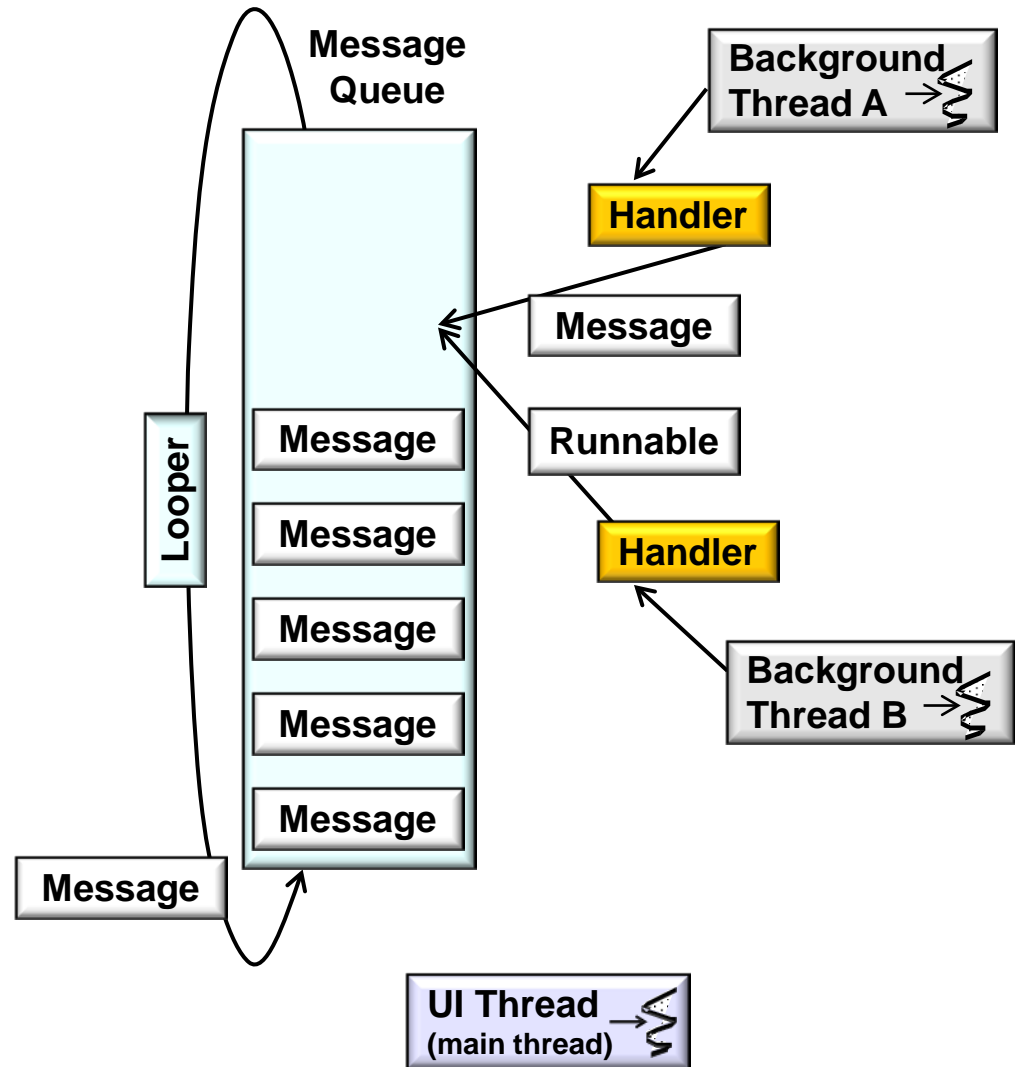
The next two parts of the module cover these Handler methods in more detail

Summary



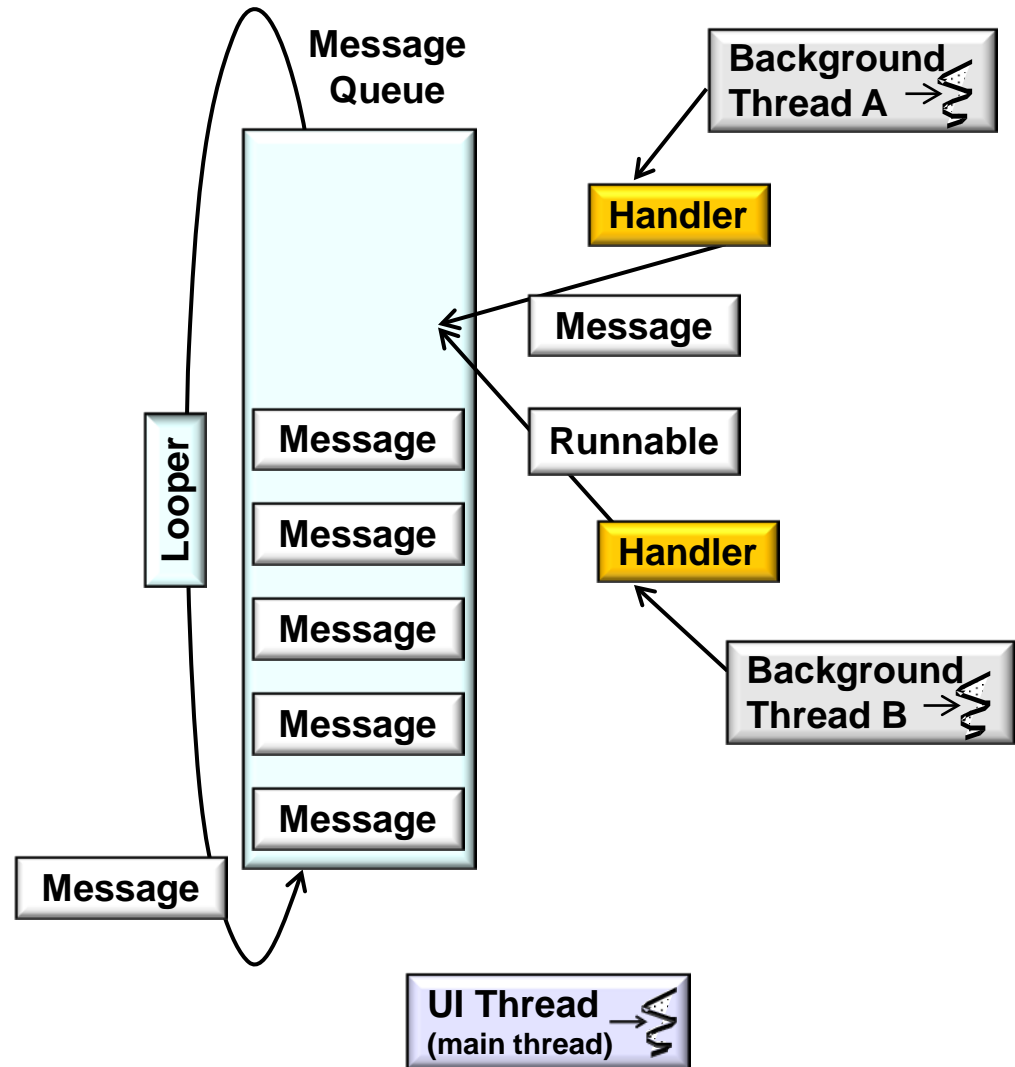
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- UI & background threads often need to communicate



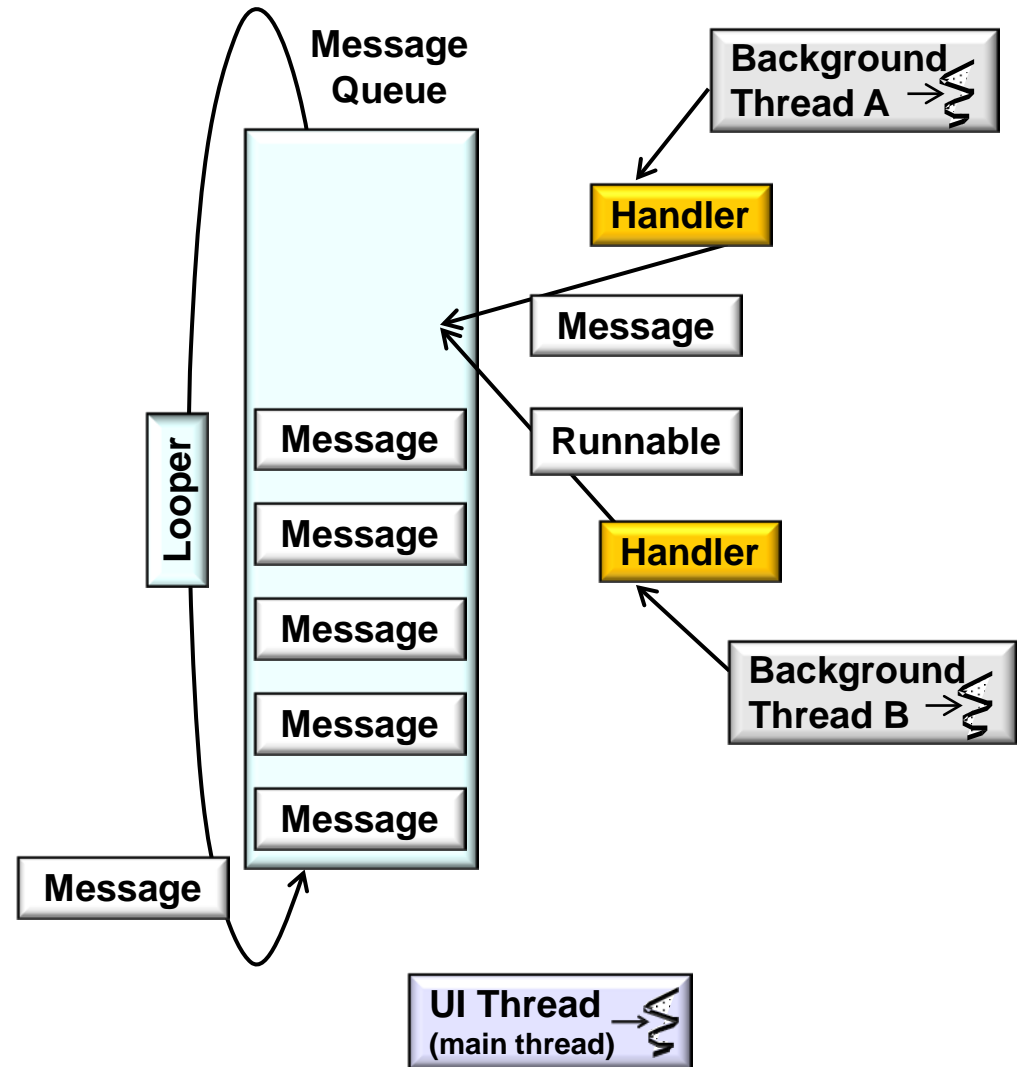
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- UI & background threads often need to communicate, e.g.
- To perform their operations concurrently



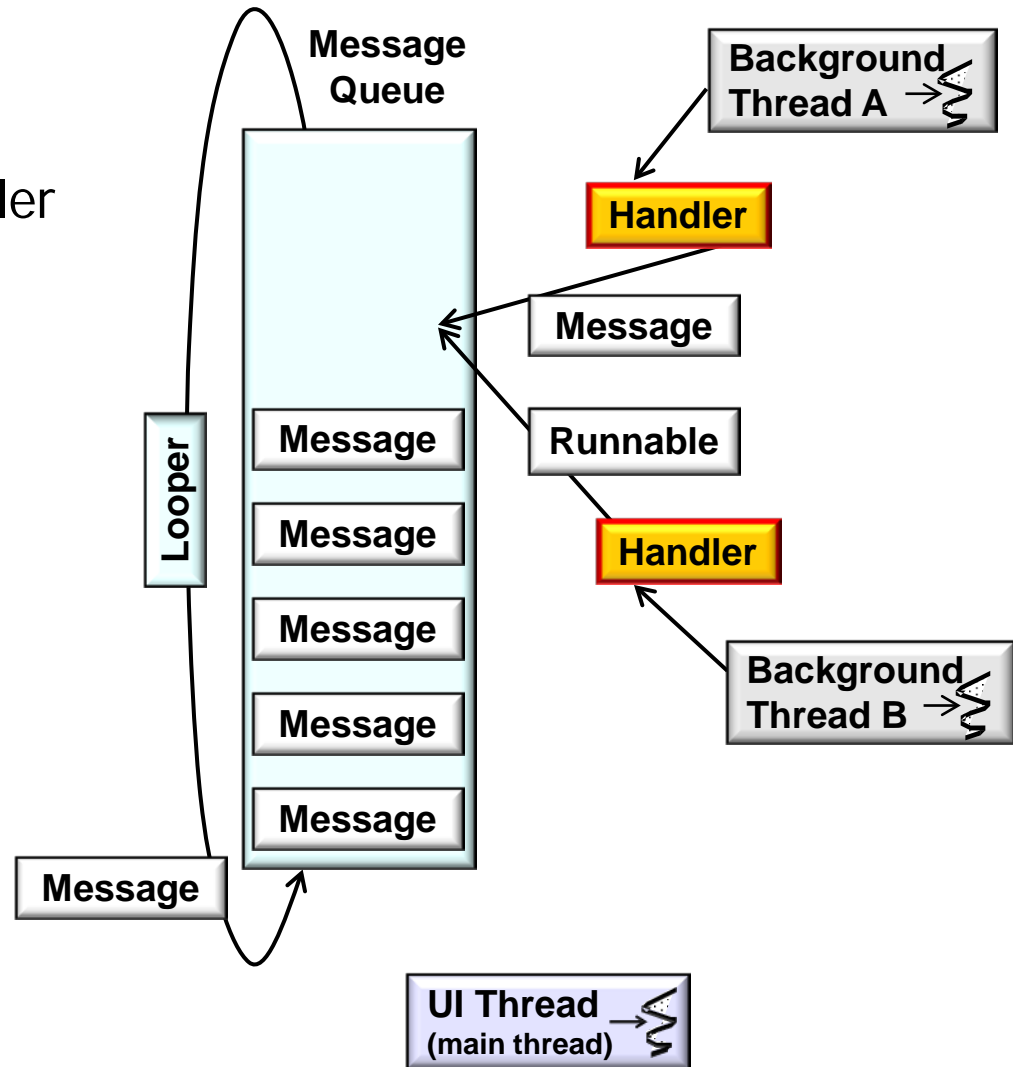
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- UI & background threads often need to communicate, e.g.
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 - To coordinate their behavior



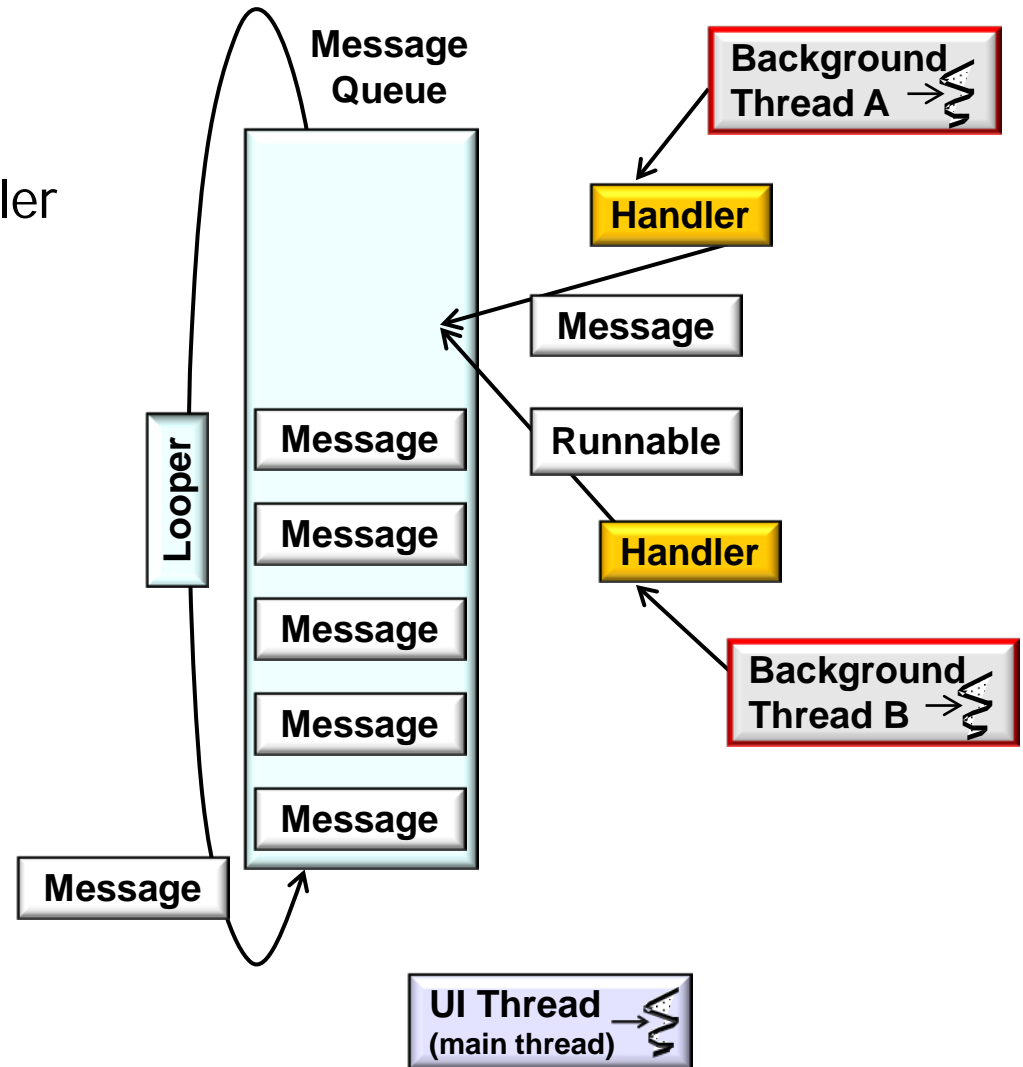
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- UI & background threads often need to communicate
- HaMeR framework provides Handler class to support this use case



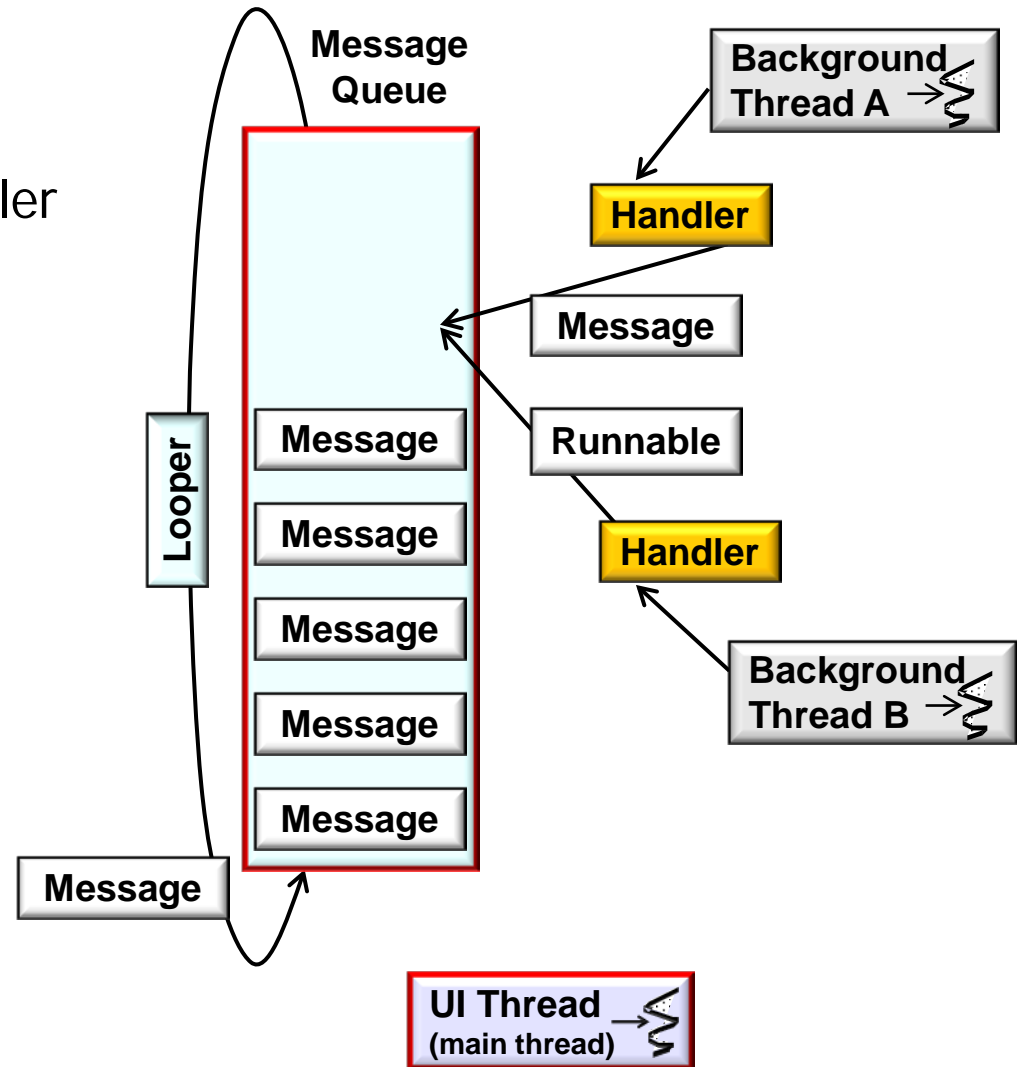
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 - A Handler allows background Threads to send Messages or post Runnables to the UI Thread's MessageQueue



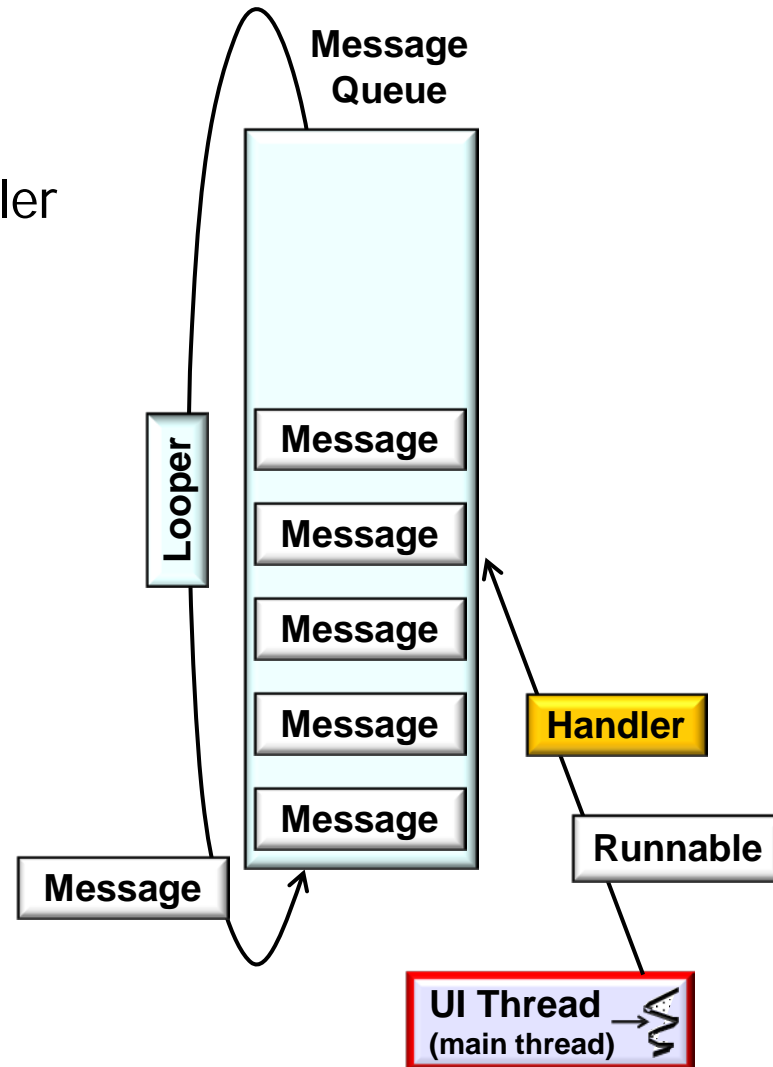
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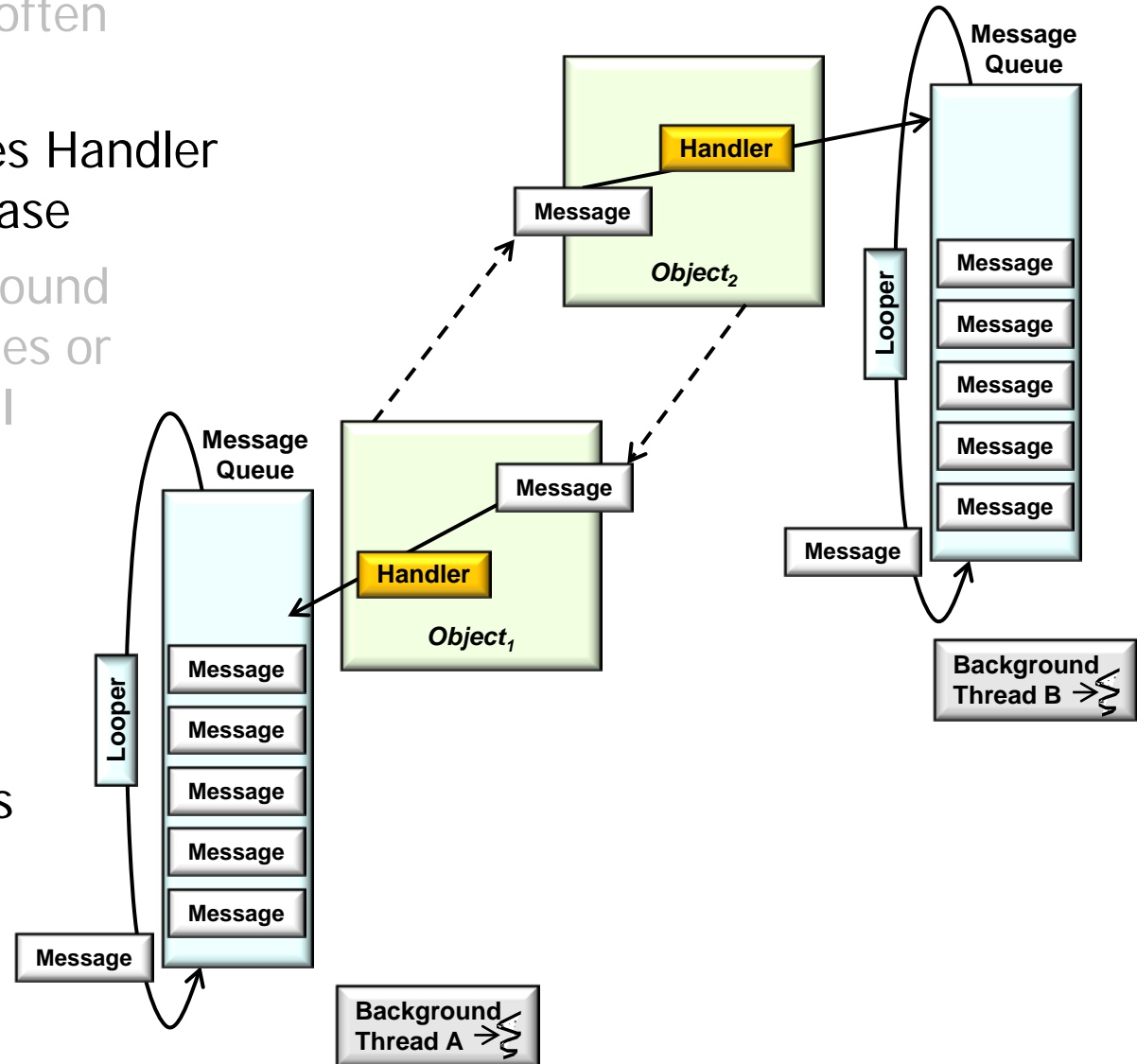
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- UI & background threads often need to communicate
- HaMeR framework provides Handler class to support this use case
 - A Handler allows background Threads to send Messages or post Runnables to the UI Thread's MessageQueue
- It can also allow a Thread to send/post to itself



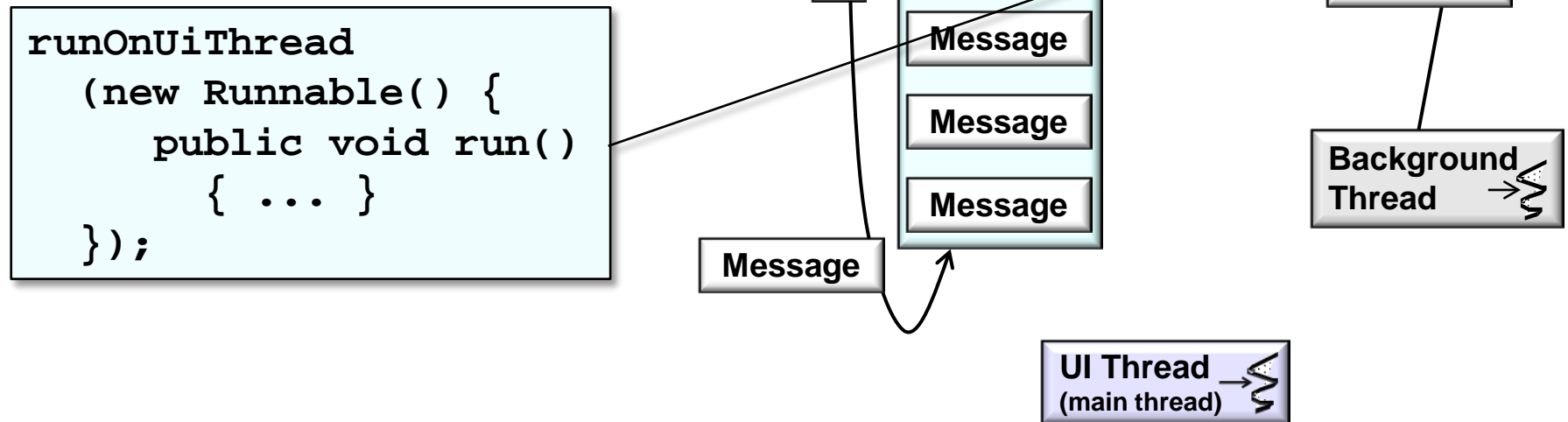
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 - A Handler allows background Threads to send Messages or post Runnables to the UI Thread's MessageQueue
 - It can also allow a Thread to send/post to itself
- Background Threads can interact via Handlers



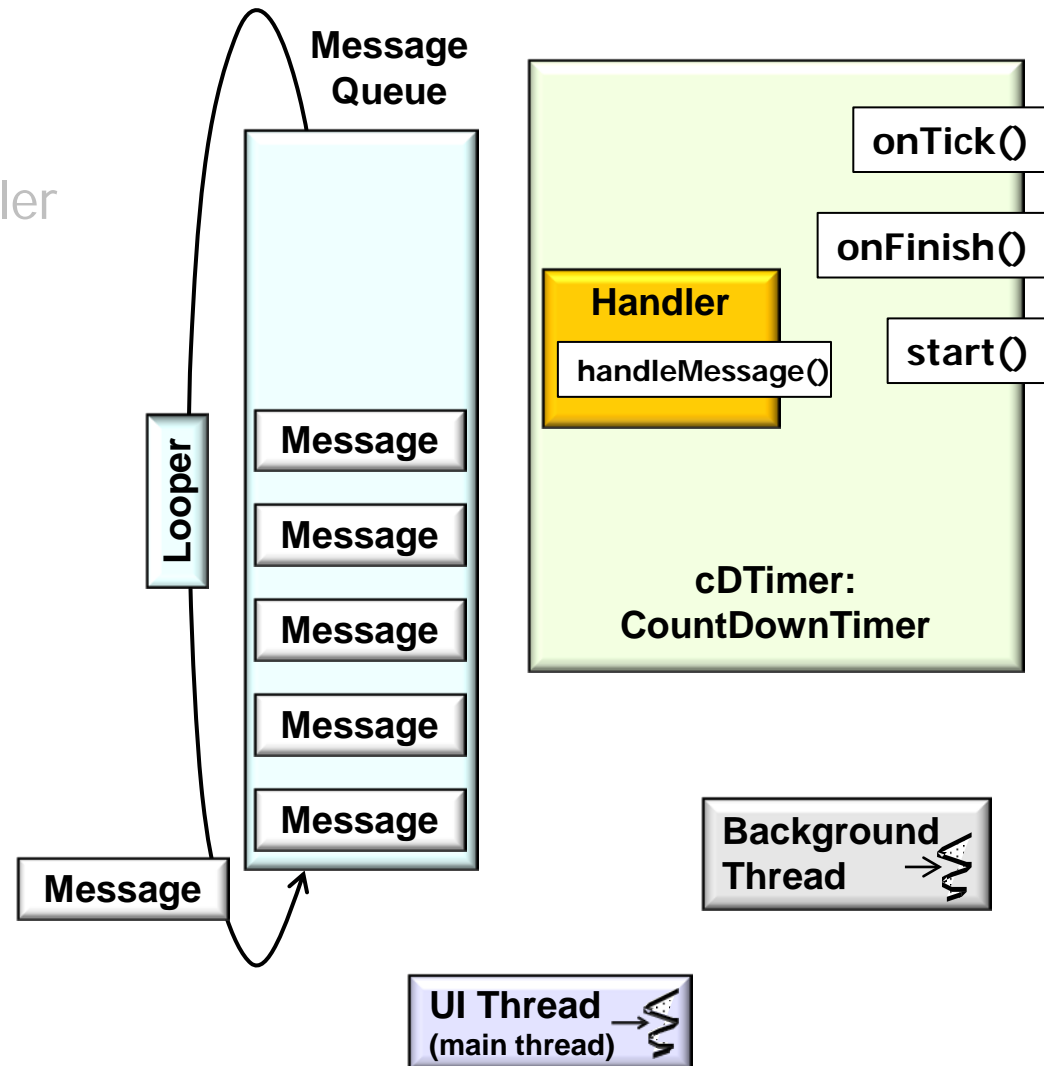
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- UI & background threads often need to communicate
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- `post()` methods used when senders know what operations to perform



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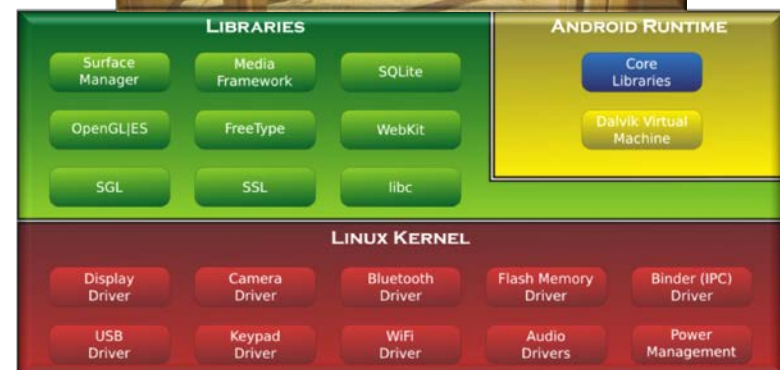
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- `sendMessage()` methods used when receivers know what operations to perform



See upcoming part on "Sending & Handling Messages with Android Handler"

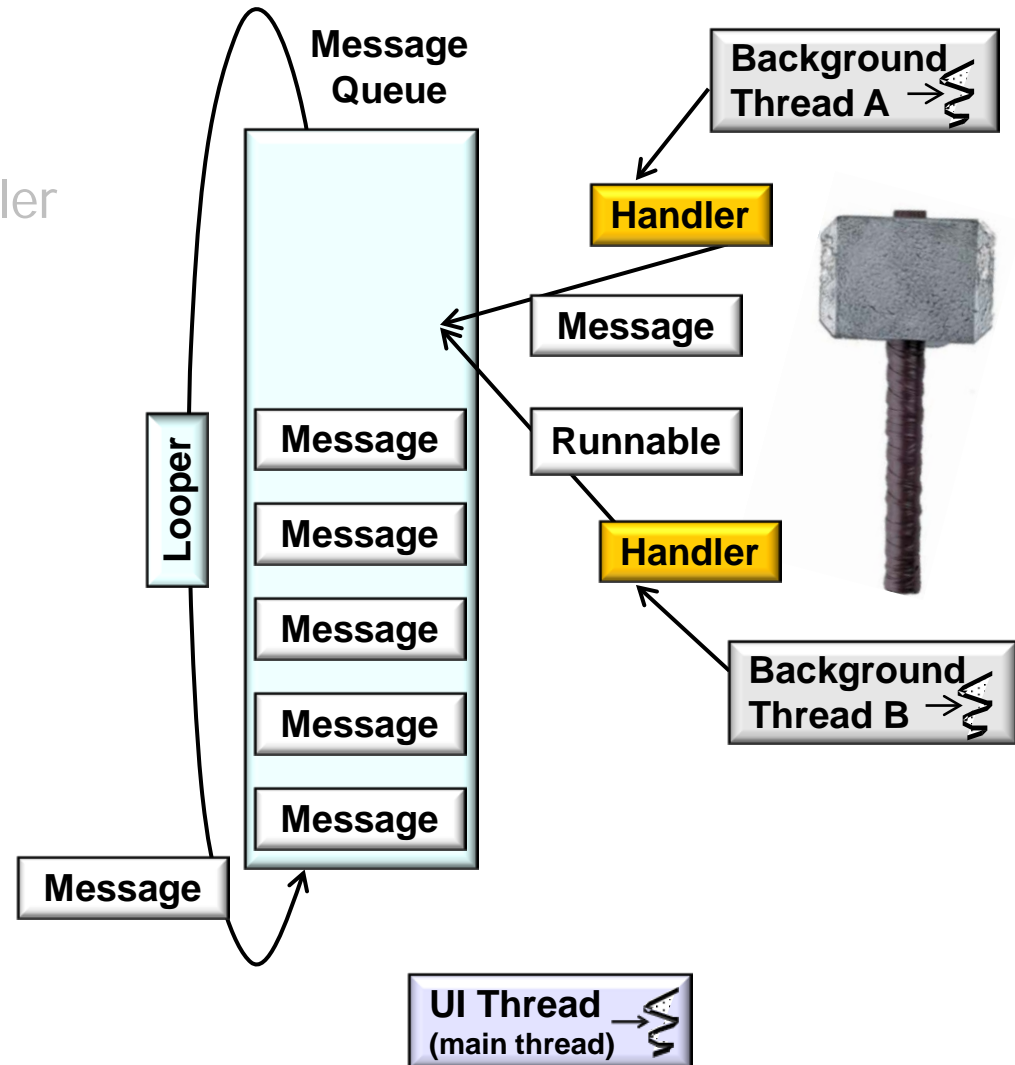
Summary

- UI & background threads often need to communicate
- HaMeR framework provides Handler class to support this use case
- `post()` methods used when senders know what operations to perform
- `sendMessage()` methods used when receivers know what operations to perform
- Handlers used in many Android applications & frameworks



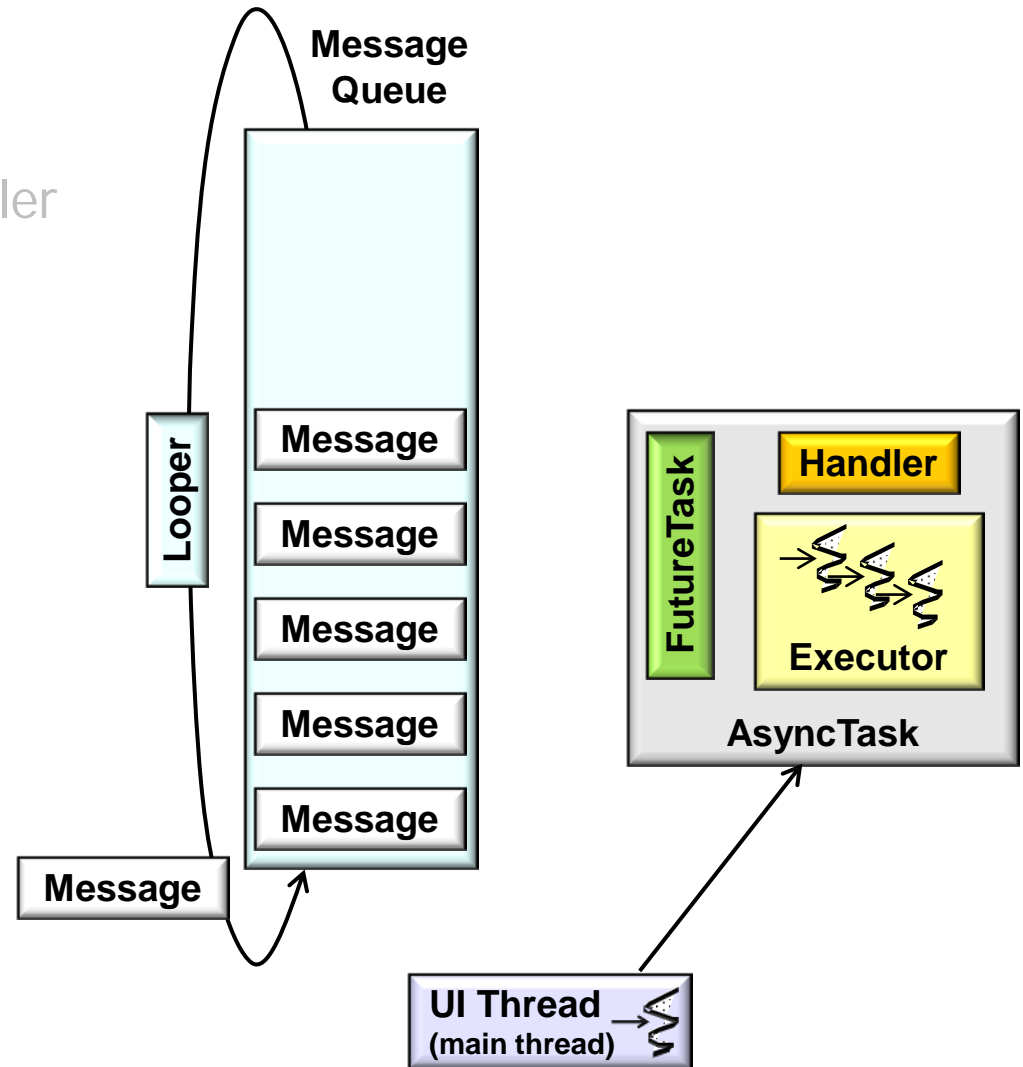
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- `post()` methods used when senders know what operations to perform
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- Handlers used in many Android applications & frameworks, e.g.
 - HaMeR framework



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- `post()` methods used when senders know what operations to perform
- `sendMessage()` methods used when receivers know what operations to perform
- Handlers used in many Android applications & frameworks, e.g.
 - HaMeR framework
 - AsyncTask framework



See upcoming part on "the AsyncTask Framework"

Summary

- UI & background threads often need to communicate
- HaMeR framework provides Handler class to support this use case
- `post()` methods used when senders know what operations to perform
- `sendMethod()` methods used when receivers know what operations to perform
- Handlers used in many Android applications & frameworks
- Other sources explain how to use Handlers in Android concurrency frameworks & applications

