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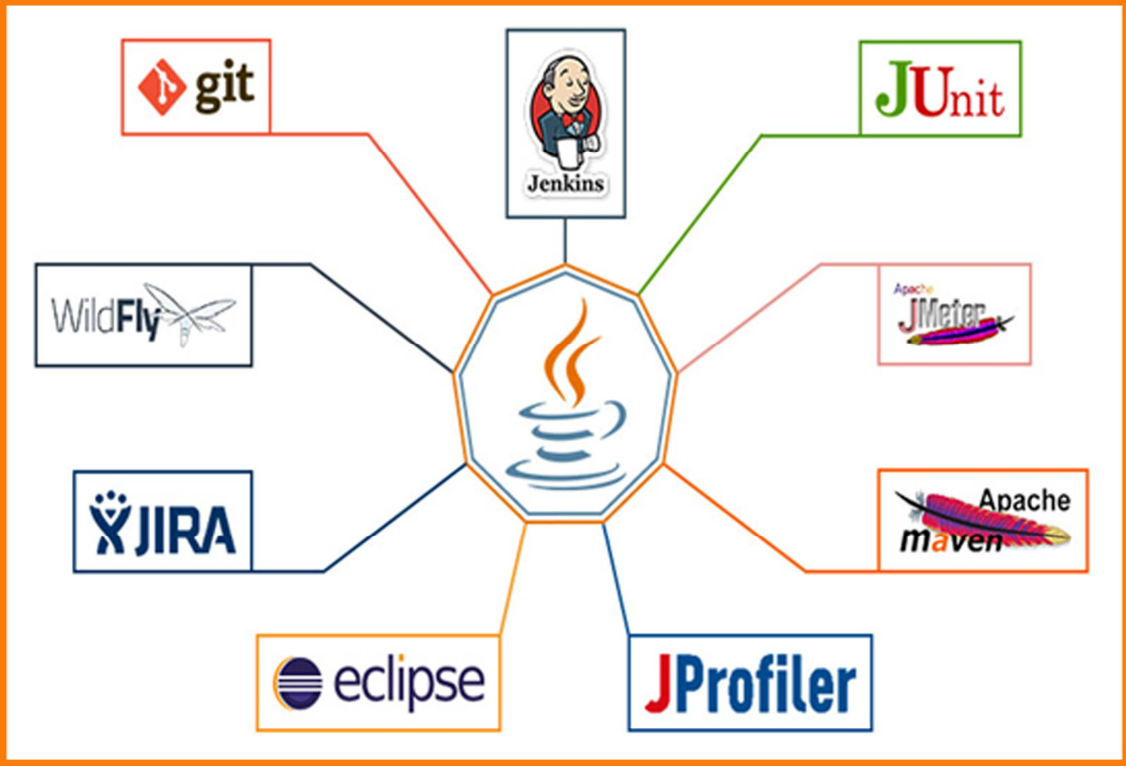
Java Real Time Tools

Log4J



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Real-Time Log4J

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Log4J

Introduction to Logging:

What is Logging?

Logging is a technique or process to record the development activities to a console or a log file.

Several Logging frameworks simplify and standardize the process of logging for the Java platform.

Why we need logging in an application?

- ✓ To understand the flow of the application logic
- ✓ To find out root cause of an issue
- ✓ To track transactions (In Banking Domain) permanently by storing log into a Data base.

Advantages of Logging:

- ✓ Easy to debug application
- ✓ Easy to find out root cause of the problem
- ✓ Easy to find out flow of the logic

Drawbacks of Logging:

- ✓ Logging severely affects the performance of the application
- ✓ It consumes some memory at server side to store data.

In Realtime, most of the developers uses different logging techniques during development to understand his/her code execution process and also to find out root cause of the problem.

As a less experience developer or not working people, you may like to use

System.out.println(logMessage)

Statement to log your statements to a console(Command prompt).

But it is NOT recommended to use System.out.println(logMessage)

in real time. It has lot of advantages.

What is the simple logging technique available for a Java Program?

Using System.out.println(logMessage)

What is the major drawback of System.out.println(); logging technique?

When we want to deliver code from development to next phase or into production, we have to remove or comment all SOP statements one by one manually.

- ✓ It is very time consuming process
- ✓ It kills our development time
- ✓ It increases development time and cost

That's why most of the people uses one of the available logging frameworks in their application.

Popular Logging Frameworks for Java Applications:

S.No.	Logging Frameworks for JAVA
1	Java Logging API
2	Log4J
3	Apache Commons Logging
4	SLF4J

SLF4J stands for Simple Logging Facade for Java

Java Logging API

Sun MircoSystmes (Oracle Corporation) has introduced one logging framework as part of JSE(Java Standard Edition) API under java.util.logging package.

Sample API Classes

java.util.logging.FileHandler

java.util.logging.Level

java.util.logging.LogManager

java.util.logging.Logger

java.util.logging.XMLFormatter

Sample Java Logging Program:

```
import java.util.logging.Level;
import java.util.logging.Logger;
public class SampleProgram
{
        public static void main(String[] args)
        {
                Logger log = Logger.getLogger("Some Logging");
                log.info("Its an INFO Message");
                log.log(Level.SEVERE, "Its an INFO Message");
                log.info("Its an INFO Message");
        }
}
```

Output:

```
Jun 2, 2011 3:00:30 PM SampleProgram main
INFO: Its an INFO Message
Jun 2, 2011 3:00:30 PM SampleProgram main
SEVERE: Its an SEVERE Message
Jun 2, 2011 3:00:30 PM SampleProgram main
INFO: Its an INFO Message
```

JSE Logging API contains some drawbacks

- ✓ Does NOT contain meaningful logging levels
- ✓ Performance issues
- ✓ Less flexible to use

NOTE:-

Unlike other frameworks - Log4J, Java Logging API does NOT flexible API to use different configuration files like properties file, xml file etc.

The levels in descending order are:

- SEVERE (highest value)
- WARNING
- INFO
- CONFIG
- FINE
- FINER
- FINEST (lowest value)

Log4J solves most of these problems and provides many advantages.

LOG4J Framework

What is Log4J?

Log4J stands for Logging Framework for Java

It is an open source logging framework from Apache Software Foundation for Java Applications

Log4J is the most popular logging framework for Java Applications (for both Standalone Java Applications and Web applications).

Log4j is JDK 1.1.x compatible.

Log4J Framework Advantages:

- ✓ Contains meaningful logging levels
- ✓ Resolves some Performance issues
- ✓ Easy and flexible to use
- ✓ Supports both properties file configurations and XML configurations

Drawbacks of Log4J Framework:

- ✓ Reduces some application performance
- ✓ Tightly coupled
- ✓ Bit tough to migrate Log4J framework to other framework

Log4J Framework Features:

- log4j is optimized for speed.
- log4j is based on a named logger hierarchy.
- log4j is fail-stop but not reliable.
- log4j is thread-safe.
- log4j is not restricted to a predefined set of facilities.
- Logging behavior can be set at runtime using a configuration file. Configuration files can be property files or in XML format.
- log4j is designed to handle Java Exceptions from the start.
- log4j can direct its output to a file, the console, an java.io.OutputStream, java.io.Writer, a remote server using TCP, a remote Unix Syslog daemon, to a remote listener using JMS, to the NT EventLog or even send e-mail.
- log4j uses 5 levels, namely DEBUG, INFO, WARN, ERROR and FATAL.
- The format of the log output can be easily changed by extending the Layout class.
- The target of the log output as well as the writing strategy can be altered by implementations of the Appender interface.

- log4j supports multiple output appenders per logger.
- log4j supports internationalization.

NOTE:-

To overcome this tightly couple problem, Spring Framework has introduced AOP (Aspect Oriented Programming). In AOP, we can do logging dynamically and declaratively at runtime.

That means Logging component won't touch our application program.

Log4J supports the following logging levels

ALL

DEBUG

INFO

WARN

ERROR

FATAL

OFF

→For normal log levels in Log4J Framework, the ascending log levels are

DEBUG

INFO

WARN

ERROR

FATAL

Log4J Logging levels

Level	Description
FATAL	Severe errors that cause premature termination. Expect these to be immediately visible on a status console.
ERROR	Other runtime errors or unexpected conditions. Expect these to be immediately visible on a status console.
WARNING	Use of deprecated APIs, poor use of API, near errors, other runtime situations that are undesirable or unexpected, but not necessarily "wrong". Expect these to be immediately visible on a status console.
INFO	Interesting runtime events (startup/shutdown). Expect these to be immediately visible on a console, so be conservative and keep to a minimum.
DEBUG	detailed information on the flow through the system. Expect these to be written to logs only.
OFF	Switch off Logging completely Or Turns Off all logging
ALL	Supports all Logging levels. Turns ON all logging

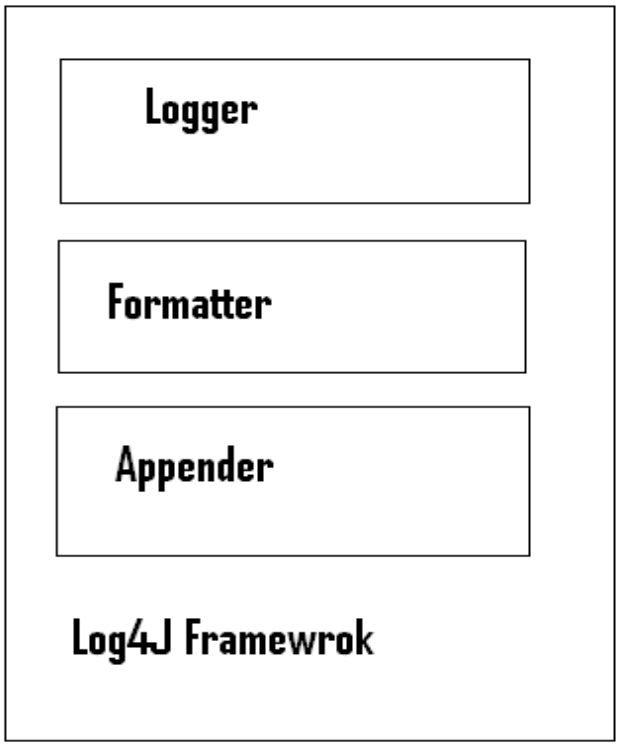
NOTE:-

Initially, Apache Software foundation has developed Commons Logging API.

Log4J Framework internally uses Apache Commons Logging which is available in commons-logging-x.x.jar file.

Official web site for Apache Log4J Framework

http://logging.apache.org/log4j/1.2/download.html



Log4J Frameworks Architecture:

Log4J Framework is broken into three major parts

- ✓ Logger
- ✓ Formatter
- ✓ Handler (Appender)

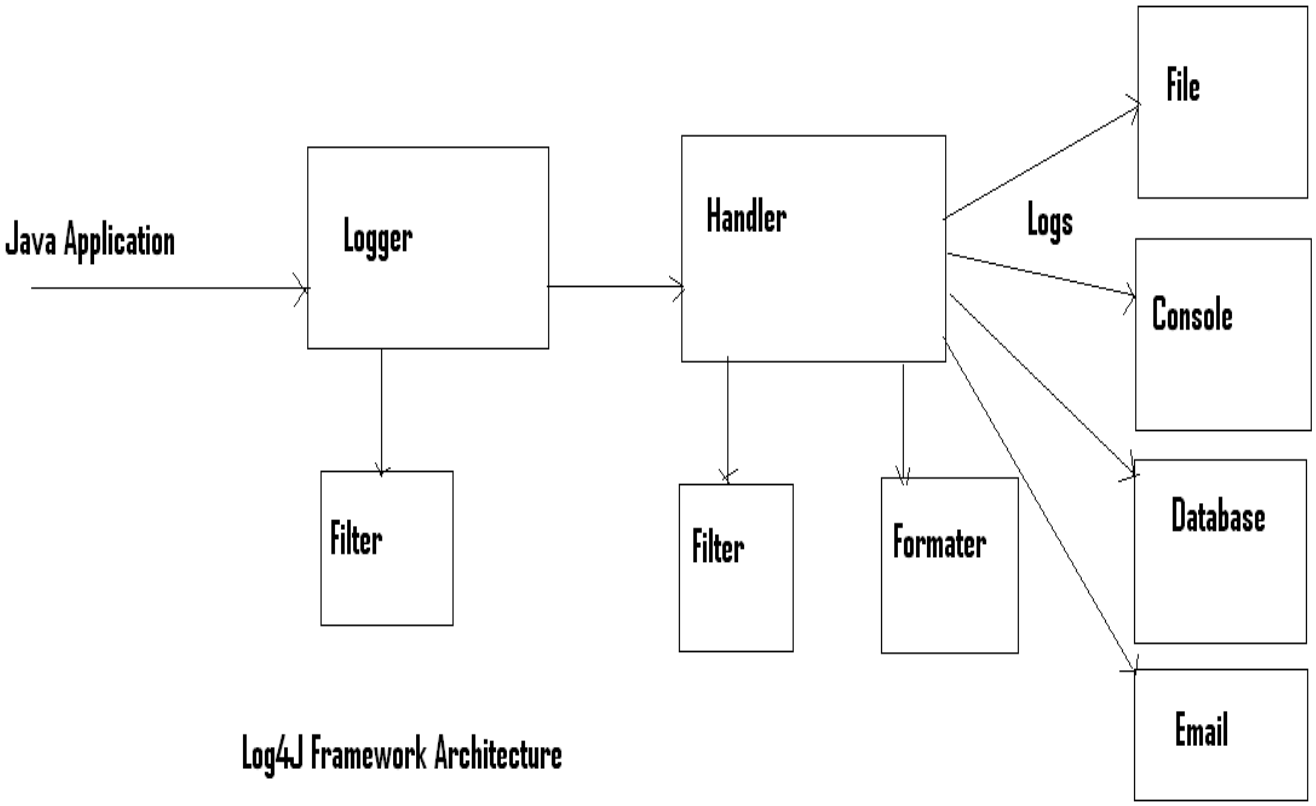
The Logger is responsible for capturing the message to be logged along with certain metadata and passing it to the logging framework.

After receiving the message, the framework calls the Formatter with the message.

The Formatter accepts the message object and formats it for output.

The framework then hands the formatted message to the appropriate Appender for disposition.

This might include a console display, writing to disk, appending to a database, or email.



Log4J Framework Architecture

Advantages of Log4j:

– Simpler log level hierarchy and log methods

– More handlers

– Mighty formatters

– Optimized logging costs

– Simpler log level hierarchy:

Steps to integrate Log4J Framework with Java Applications

a) Download log4j-x.x.jar file and add it to your application classpath

b) As per your project requirements, configure logging details in log4j.properties or log4j.xml file

c) User Logger to log messages in your application Java Programs

Configuration File Examples

a) log4j.properties

b) log4j.xml

Simple log4j.properties example

```
log4j.rootLogger= info, way2it

log4j.appender.way2it=org.apache.log4j.ConsoleAppender

log4j.appender.way2it.layout=org.apache.log4j.PatternLayout

log4j.appender. way2it.layout.conversionPattern=%d{yyyy-MM-dd
HH:mm:ss,SSS} %-5p - %m%n
```

It configures the following things

- ✓ ConsoleAppender to display logs to a console
- ✓ PatternLayout
- ✓ Conversion
- ✓ Pattern

It is using the following conversion pattern

%d{yyyy-MM-dd HH:mm:ss,SSS} %-5p - %m%n

Complex and flexible log4j.properties file configuration

```
log4j.rootLogger=INFO,C,F
#log4j.rootLogger=DEBUG,F

log4j.appender.C=org.apache.log4j.ConsoleAppender
log4j.appender.C.layout=org.apache.log4j.PatternLayout

log4j.appender.F=org.apache.log4j.FileAppender
log4j.appender.F.layout=org.apache.log4j.HTMLLayout
log4j.appender.F.file=banking.html
log4j.appender.F.layout.conversionPattern=%d{yyyy-MM-dd
HH:mm:ss,SSS} %-5p - %m%n
```

Here it defines the following things

A) To destinations – File and Console

B) Two Appenders

ConsoleAppender

FileAppender

C) Conversion pattern

```
log4j.rootLogger=INFO,C,F

#log4j.rootLogger=DEBUG,F

log4j.appender.C=org.apache.log4j.ConsoleAppender

log4j.appender.C.layout=org.apache.log4j.PatternLayout

log4j.appender.F=org.apache.log4j.RollingFileAppender

log4j.appender.F.layout=org.apache.log4j.HTMLLayout

log4j.appender.F.file=banking.html

log4j.appender.F.layout.conversionPattern=%d{yyyy-MM-dd
HH:mm:ss,SSS} %-5p - %m%n

#Default is true

log4j.appender.F.append=true
```

Here it is using RollingFileAppender Appender to log data into a log file.

What is the major difference between FileAppender and RollingFileAppender?

FileAppender:

Whenever we log data to a file, it overwrites the existing log data with new log data.

That means first it cleans the existing log data and add new data

RollingFileAppender:

Whenever we log data to a file, it DOES NOT overwrite the existing log data with new log data.

That means, it simply appends the new logging data to the existing log data.

```
log4j.rootLogger=INFO,C,F
#log4j.rootLogger=DEBUG,F

log4j.appender.C=org.apache.log4j.ConsoleAppender
log4j.appender.C.layout=org.apache.log4j.PatternLayout

log4j.appender.F=org.apache.log4j.RollingFileAppender
log4j.appender.F.layout=org.apache.log4j.HTMLLayout
log4j.appender.F.file=banking.html
log4j.appender.F.layout.conversionPattern=%d{yyyy-MM-dd HH:mm:ss,SSS} %-5p - %m%n
log4j.appender.F.MaxFileSize=10KB
# Keep one backup file
log4j.appender.R.MaxBackupIndex=1
#Default is true
log4j.appender.F.append=true
```

In this example, we are using new properties like file size and file backup

log4j.appender.F.MaxFileSize=5MB

It defines the maximum limit of file size. Here our file size is 5MB. Once it reaches, it moves the Entire log data into backup file and creates new empty log file.

log4j.appender.R.MaxBackupIndex=1

It specifies how many backup files we want to use to store log data.

log4j.xml example

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE log4j:configuration PUBLIC "-//LOGGER"
"http://logging.apache.org/log4j/1.2/apidocs/org/apache/log4j/xml/doc-files/log4j.dtd">
<log4j:configuration>
  <!--
     an appender is an output destination, such as the console or a file;
     names of appenders are arbitrarily chosen
  -->
  <appender name="stdout" class="org.apache.log4j.ConsoleAppender">
    <layout class="org.apache.log4j.PatternLayout">
      <param name="ConversionPattern"
        value="%d{ABSOLUTE} %5p %c{1}:%L - %m%n" />
    </layout>
  </appender>
  <!--
     loggers of category 'org.springframework' will only log messages of level "info" or higher;
     if you retrieve Loggers by using the class name (e.g. Logger.getLogger(AClass.class))
     and if AClass is part of the org.springframework package, it will belong to this category
  -->
  <logger name="org.springframework">
    <level value="info"/>
```

```
    </logger>
    <!--
       everything of spring was set to "info" but for class
       PropertyEditorRegistrySupport we want "debug" logging
    -->
    <logger name="org.springframework.beans.PropertyEditorRegistrySupport">
      <level value="debug"/>
    </logger>
    <logger name="org.acegisecurity">
      <level value="info"/>
    </logger>
     <!-- the root category -->
    <root>
      <!--
         all log messages of level "debug" or higher will be logged, unless defined otherwise
         all log messages will be logged to the appender "stdout", unless defined otherwise
      -->
      <level value="debug" />
      <appender-ref ref="stdout" />
    </root>
  </log4j:configuration>
```

TTCC

TTCC stands for Time Thread Category Component

TTCC is a message format used by log4j. It uses the following pattern:

```
%r [%t] %-5p %c %x - %m%n
```

Mnemonic	Description
%r	Used to output the number of milliseconds elapsed from the construction of the layout until the creation of the logging event.
%t	Used to output the name of the thread that generated the logging event.
%p	Used to output the priority of the logging event.
%c	Used to output the category of the logging event.
%x	Used to output the NDC (Nested Diagnostic Context) associated with the thread that generated the logging event.
%m	Used to output the application supplied message associated with the logging event.
%n	Used to output the platform-specific newline character or characters.
%d	To display current date and time

Note:-

Log4j has been ported by independent authors to C, C++, Python, Ruby, Eiffel and the much maligned C#.

Log4J Examples:

Example1)

```
package com.way2it;

import org.apache.log4j.Logger;
```

```
public class HelloWorld
{
	static Logger logger = Logger.getLogger("com.way2it.HelloWorld");
	static public void main(String[] args)
	{
		logger.debug("Hello world Log.");
	}
}
```

OR

```
package com.way2it;
import org.apache.log4j.Logger;
public class HelloWorld
{
	static Logger logger = Logger.getLogger(HelloWorld.class);
	static public void main(String[] args)
	{
		logger.debug("Hello world Log.");
	}
}
```

Can we use lower case logging levels in log4j.propertiles file?

Yes we can use

```
#Log4j properties
log4j.rootLogger=debug,bank
```

OR

```
#Log4j properties
log4j.rootLogger=DEBUG,bank
```

Do we need to use same the following properties file for Log4J or we can use different file names?

a) log4j.properties

b) log4j.xml

Because Log4J API contains org.apache.log4j .LogManager and defines these two files as show below.

```
package org.apache.log4j;

public class LogManager

{

        public static final String DEFAULT_CONFIGURATION_FILE = "log4j.properties";

        public static final String DEFAULT_XML_CONFIGURATION_FILE = "log4j.xml";

}
```

If we don't use one of these files, then we cant get output. We can observe some warning messages.

```
import org.apache.log4j.Logger;

public class Sample

{

        static Logger log = Logger.getLogger(Sample.class);

        public static void main(String[] args)

        {

                log.info("Hello 1");

                log.info("Hello 2");

                log.info("Hello 3");
```

```
        }
}
```

Output:

log4j:WARN No appenders could be found for logger (Sample).

log4j:WARN Please initialize the log4j system properly.

If we don't want to use log4j.properties or log4j.xml file, then we can use BasicConfigurator to

get the log messages with default format.

Default implementation of BasicConfigurator

```
package org.apache.log4j;

public class BasicConfigurator

{s

  public static void configure()

  {

    Logger root = Logger.getRootLogger();

    root.addAppender(new ConsoleAppender(new PatternLayout("%r [%t] %p %c %x - %m%n")));

  }

  public static void configure(Appender appender)

  {

    Logger root = Logger.getRootLogger();

    root.addAppender(appender);

  }

  public static void resetConfiguration()

  {

    LogManager.resetConfiguration();

  }

}
```

By Default, BasicConfigurator is connected to ConsoleAppender and with basic pattern

%r [%t] %p %c %x - %m%n

The output contains

- ✓ Relative time-the number of milliseconds that elapsed since the start of the program until the invocation of the logging request2,
- ✓ The name of the invoking thread between brackets
- ✓ The level of the request
- ✓ The logger name
- ✓ Finally the message.

Example:

```
import org.apache.log4j.BasicConfigurator;

import org.apache.log4j.Logger;

public class Sample

{

	static Logger log = Logger.getLogger(Sample.class);

	public static void main(String[] args)

	{

		BasicConfigurator.configure();

		log.info("Hello 1");

		log.info("Hello 2");

		log.info("Hello 3");

	}

}
```

Output:

```
0 [main] INFO Sample  - Hello 1

0 [main] INFO Sample  - Hello 2

0 [main] INFO Sample  - Hello  3
```

%r [%t] %p %c %x - %m%n

NOTE:-

BasicConfigurator.configure() being the simplest but also the least flexible.

For each Log4J logging levels, Logger class contains respective methods.

Logger class contains the following methods

debug() – DEBUG level

info() – INFO level

warn() – WARN level

error() – ERROR level

fatal() – FATAL level

Ordering of Log4J Log levels:

ALL < DEBUG < INFO < WARN < ERROR < FATAL < OFF.

If we want stop logs in Production or LIVE systems, how do it in Log4J Framework?

Changing logging level form existing value to OFF in log4j.properties file

log4j.rootLogger=**OFF,**C,F

log4j.appender.C=org.apache.log4j.ConsoleAppender

log4j.appender.C.layout=org.apache.log4j.PatternLayout

log4j.appender.C.layout.conversionPattern=%d{yyyy-MM-dd HH:mm:ss,SSS} %-5p - %m%n

log4j.rootLogger=**OFF,**C,F ➔ this OFF value stop logs

RootLogger:

What is RootLogger? What is the importance of it?

RootLogger is root object for all remaining application logs.

It contains default log level. If you don't assign any log level to your application logger, then they inherit RootLogger log level or it's immediate root logger automatically.

Examples:

Logger name	Assigned level	Effective level

root	DEBUG	DEBUG
x	none	DEBUG
x.y	none	DEBUG
x.y.z	none	DEBUG

Logger name	Assigned level	Effective level
root	DEBUG	DEBUG
x	ERROR	ERROR
x.y	INFO	INFO
x.y.z	INFO	INFO

Logger name	Assigned level	Effective level
root	DEBUG	DEBUG
x	ERROR	ERROR
x.y	none	ERROR
x.y.z	INFO	INFO

Logger name	Assigned level	Effective level
root	DEBUG	DEBUG
x	ERROR	ERROR
x.y	INFO	INFO
x.y.z	none	INFO

BasicConfigurator.configure()

It is equal to the following log4j.properties file

```
# Set root logger level to DEBUG and add an appender called A1.
log4j.rootLogger=DEBUG, A1
# A1 is set to be a ConsoleAppender.
log4j.appender.A1=org.apache.log4j.ConsoleAppender
```

```
# A1 uses PatternLayout.
log4j.appender.A1.layout=org.apache.log4j.PatternLayout
log4j.appender.A1.layout.ConversionPattern=%-4r [%t] %-5p %c %x -%m%n
```

PropertyConfigurator

If we want to configure properties programmatically, we can do it using PropertyConfigurator class available in org.apache.log4j file.

Example:

```
import java.io.FileInputStream;
import java.io.FileNotFoundException;
import java.io.IOException;
import java.util.Properties;
import org.apache.log4j.BasicConfigurator;
import org.apache.log4j.Logger;
import org.apache.log4j.PropertyConfigurator;
public class Sample
{
        static Logger log = Logger.getLogger(Sample.class);
        public static void main(String[] args)
                throws FileNotFoundException, IOException
        {
                String file = "mylog.properties";
                Properties logProperties = new Properties();
                logProperties.load(new FileInputStream(file));
               PropertyConfigurator.configure(logProperties);
                //BasicConfigurator.configure();
                PropertyConfigurator.configure(logProperties);
                log.debug("debug 1");
                log.info("info 2");
```

```
            log.error("eror  3");
        }
}
```


How to define different logging levels for different Project Modules?

Let us assume that we have the following two modules in our Banking application

a) CreditCard Module

b) DebitCard Module

log4j.properties

```
# CreditCardFileAppender - used to log messages in the creditcard.log file.
log4j.appender.CreditCardFileAppender=org.apache.log4j.FileAppender
log4j.appender.CreditCardFileAppender.File=creditcard.log
log4j.appender.CreditCardFileAppender.layout=org.apache.log4j.PatternLayout
log4j.appender.CreditCardFileAppender.layout.ConversionPattern= %-4r [%t] %-5p
%c %x -    s%m%n
# DebitCardFileAppender - used to log messages in the debitcard.log file.
log4j.appender.DebitCardFileAppender=org.apache.log4j.FileAppender
log4j.appender.DebitCardFileAppender.File=debitcard.log
```

```
log4j.appender.DebitCardFileAppender.layout=org.apache.log4j.PatternLayout

log4j.appender.DebitCardFileAppender.layout.ConversionPattern= %-4r [%t] %-5p
%c %x -    %m%n

log4j.logger.com.way2it.creditcard=WARN,CreditCardFileAppender

log4j.logger.com.way2it.debitcard=DEBUG,DebitCardFileAppender
```

Project Modules

Java Programs

```
package com.way2it.creditcard;

import org.apache.log4j.Logger;

import org.apache.log4j.PropertyConfigurator;

import com.way2it.debitcard.DebitCardModule;

public class CreditCardModule

{

static Logger logger = Logger.getLogger(CreditCardModule.class);

public static void main(String[] args)

{

        PropertyConfigurator.configure("log4j.properties");

        logger.debug("Sample debug message");

        logger.info("Sample info message");

        logger.warn("Sample warn message");

        logger.error("Sample error message");

        logger.fatal("Sample fatal message");

        SampleReport obj = new SampleReport();

        obj.generateReport();

}

}

package com.way2it.debitcard;

import org.apache.log4j.Logger;
```

```
public class DebitCardModule
{
        static Logger logger = Logger.getLogger(DebitCardModule.class);
        public void generateReport()
        {
        logger.debug("Sample debug message");
        logger.info("Sample info message");
        logger.warn("Sample warn message");
        logger.error("Sample error message");
        logger.fatal("Sample fatal message");
        }
}
```

Output:

After executing the program, the contents of **creditcard.log** file.

[main] WARN com.way2it.creditcard.CreditCardModule - Sample warn message

[main] ERROR com.way2it.creditcard.CreditCardModule - Sample error message

[main] FATAL com.way2it.creditcard.CreditCardModule - Sample fatal message

The contents of **debitcard.log** file.

[main] DEBUG com.way2it.debitcard.DebitCardModule - Sample debug message

[main] INFO com.way2it.debitcard.DebitCardModule Sample info message

[main] WARN com.way2it.debitcard.DebitCardModule - Sample warn message

[main] ERROR com.way2it.debitcard.DebitCardModule - Sample error message

[main] FATAL com.way2it.debitcard.DebitCardModule - Sample fatal message

How to configure log4j.xml file programmatically?

log4j.xml

```
<?xml version="1.0" encoding="UTF-8" ?>
<!DOCTYPE log4j:configuration SYSTEM "log4j.dtd">
<log4j:configuration xmlns:log4j='http://jakarta.apache.org/log4j/'>
	<appender name="way2it" class="org.apache.log4j.ConsoleAppender">
	<layout class="org.apache.log4j.PatternLayout">
	<param name="ConversionPattern" value="%-4r [%t] %-5p %c %x - %m%n" />
	</layout>
	</appender>
	<root>
	<level value="debug" />
	<appender-ref ref=" way2it " />
	</root>
</log4j:configuration>
```

HelloWorld.java

```
package com.way2it.helloworld;
import org.apache.log4j.Logger;
import org.apache.log4j.xml.DOMConfigurator;
public class HelloWorld
{
static Logger logger = Logger.getLogger(HelloWorld.class);
public static void main(String[] args)
{
	DOMConfigurator.configure("log4j.xml");
	logger.debug("Sample debug message");
```

```
        logger.info("Sample info message");
        logger.warn("Sample warn message");
        logger.error("Sample error message");
        logger.fatal("Sample fatal message");
}
}
```

Output:

```
[main] DEBUG com.way2it.helloworld.HelloWorld - Sample debug message
[main] INFO com.way2it.helloworld.HelloWorld - Sample info message
[main] WARN com.way2it.helloworld.HelloWorld - Sample warn message
[main] ERROR com.way2it.helloworld.HelloWorld - Sample error message
[main] FATAL com.way2it.helloworld.HelloWorld - Sample fatal message
```


Top Eleven tips on logging in Java

1) Use isDebugEnabled() for putting debug log in Java , it will save lot of string concatenation activity if your code run in production environment with production logging level instead of DEBUG logging level.

2) Carefully choose which kind of message should go to which level for logging in Java, It become extremely important if you are writing server application in core

java and only way to see what happing is java logs. If you log too much information your performance will be affected and same time if you don't log important information like incoming messages and outgoing messages in java logs then it would become extremely difficult to identify what happened in case of any issue or error because nothing would be in java logs.

3) Use either log4j or java.util.logging for logging in Java, I would recommend log4j because I have used it a lot and found it very flexible. It allows changing logging level in java without restarting your application which is very important in production or controlled environment. To do this you can have log4j watchdog which continuously look for log4j.xml in a particular directory and if founds loads it and reset logging in java.

4) By using log4j.xml you can have different logger configuration for different java classes as well. You can have some classes in INFO mode, some in WARN mode or ERROR mode. It's quite flexible to do this to customize java logging.

5) Another important point to remember is format of java logging, this you specify in logger. Properties file in case of java.util.logging API for logging to use which java logging Formatter. Don't forget to include Thread Name and fully qualified java class Name while printing logs because it would be impossible to find sequence of events if your code is executed by multiple threads without having thread name on it. In my opinion this is the most important tips you consider for logging in Java.

6) By carefully choosing format of java logging at logger level and format of writing log you can have generate reports from your java log files. Be consistent while logging messages, be informative while logging message, print data with message whereever required.

7)while writing message for logging in Java try to use some kind of prefix to indicate which part of your code is printing log e.g. client side , Database site or session side, later you can use this prefix to do a "grep" or "find" in Unix and have related logs at once place. Believe me I have used this technique and it helped a lot while debugging or investigating any issues and your log file is quite large. For example you can put all Database level log with a prefix "DB_LOG:" and put all session level log with prefix "SESSION_LOG:"

8) If a given logger is not assigned a level, then it inherits one from its closest ancestor. That's why we always assign log level to root logger in configuration file log4j.rootLogger=DEBUG.

9) Both no logging and excessive logging is bad so carefully planned what to log and on which level you log that messages so that you can run fast in production environment and at same time able to identify any issue in QA and TEST environment.

10) I found that for improving logging its important you look through your log and monitor your log by yourself and tune it wherever necessary. It's also important to log in simple English and it should make sense and human readable since support

team may wan to put alert on some logging message and they may want to monitory your application in production.

11) if you are using SLFJ for logging in java use parametrized version of various log methods they are faster as compared to normal method.

logger.debug("No of Orders " + noOfOrder + " for client : " + client); // slower

logger.debug("No of Executions {} for clients:{}", noOfOrder , client); // faster

Nested Diagnostic Contexts

Uses Stack per user

Most real-world systems have to deal with multiple clients simultaneously. In a typical multithreaded implementation of such a system, different threads will handle different clients. Logging is especially well suited to trace and debug complex distributed applications. A common approach to differentiate the logging output of one client from another is to instantiate a new separate logger for each client. This promotes the proliferation of loggers and increases the management overhead of logging.

To uniquely stamp each request, the user pushes contextual information into the NDC, the abbreviation of Nested Diagnostic Context. The NDC class is shown below.

```
public class NDC {
  // Used when printing the diagnostic
  public static String get();
  // Remove the top of the context from the NDC.
  public static String pop();
  // Add diagnostic context for the current thread.
  public static void push(String message);
  // Remove the diagnostic context for this thread.
  public static void remove();
```

```
}
```

The NDC is managed per thread as a **stack** of contextual information.

Log4J Thread-Safe:

Is Lo4J Framework Thread-safe? Why Log4J has lot of performance issues?

Yes Log4j is thread-safe.

It's not just thread-safe, it uses synchronized methods everywhere. That means that for heavy logging log4j will induce performance bottleneck and possible deadlocks for EJBs.

How and when do loggers inherit level?

Following 3 rules could be applied:

- Root logger always has an assigned level.
- A logger which does not have an explicit log level specified inherits the parent's log level.
- If the parent logger is not initialized then the parent's parent is checked and so on, until the root logger.

So , in effect, every logger which does not have an explicit level, will inherit from its parent. The parent may in turn inherit for its own parent, if no explicit logging was specified for the parent, and so on, until the root logger, which is guaranteed to have a log level.

Where can i download log4j?

We can download Log4J Framework at the following log4j website.

http://logging.apache.org/log4j/index.html

What is the root logger? How to get it?

It is the root of all logging classes in the log4j architecture. It always exists and applications can retrieve it using LogManager.getRootLogger() API.

LogManager.getRootLogger()

How do we know which log requests sent to the logger will be logged?

A log request is said to be enabled (and logged), if the log level of the request is higher than or equal to the log level of the logger.

IF LOG.LEVEL >= LOGGER.LEVEL, then the LOG is assumed enabled.

For normal log levels in log4j the ascending log levels are DEBUG, INFO, WARN, ERROR and FATAL

Also to filter just the messages with a particular level, without the allowing the higher or lower levels to be logged is done using LevelMatchFilter

How many loggers of the same name can exist?

Only 1 logger with a specified name can exist at a time.

Multiple requests to getLogger API for a same logger name, returns exact same reference for each of the requests.

SLF4J

What is SLF4J? Why and when do we need to use SLF4J?

SLF4J Stands for Simple Logging Facade for Java

The Simple Logging Facade for Java or (SLF4J) serves as a simple facade or abstraction for various logging frameworks, e.g. java.util.logging, log4j and logback, allowing the end user to plug in the desired logging framework at deployment time.

Similarities and Differences with Log4j

Five of Log4j's six logging levels are used. FATAL has been dropped on the basis that inside the logging framework is not the place to decide when an application should terminate and therefore there is no difference between ERROR and FATAL from the logger's point of view.

Logger instances are created via the LoggerFactory, which is very similar in Log4j. For example,

```
private static final Logger LOG = LoggerFactory.getLogger(Wombat.class);
```

In Logger, the logging methods are overloaded with forms that accept one, two or more values.[1] Occurrences of the simple pattern {} in the log message is replaced in turn with the values. This is simple to use yet provides a performance benefit when the values have expensive toString() methods. When logging is disabled at the DEBUG level, the logging framework does not need to evaluate the string representation of the values. In the following example, the values count or userAccountList only need to be evaluated when DEBUG is enabled; otherwise the overhead of the debug call is trivial.

```
LOG.debug("There are now " + count + " user accounts: " + userAccountList); // slow

LOG.debug("There are now {} user accounts: {}", count, userAccountList);     // faster
```

Similar methods exist in Logger for isDebugEnabled() etc. to allow more complex logging calls to be wrapped so that they are disabled when the corresponding level is disabled, avoiding unnecessary processing.

Unlike Log4j, SLF4J offers logging methods that accept markers. These are special objects that enrich the log messages and are an idea that SLF4J has borrowed from logback.

FAQs

Log4J Interview Questions

Why we need logging in Java?

What are different logging levels in Java?

How to choose correct logging level in java?

How incorrect java logging affect performance?

What are different logging frameworks available for Java?

What is Log4J?

Why most of the people are using Log4J in their applications.

Advantages of Log4J Framework?

Drawbacks of Log4J Framework?

What is PropertyConfigurator?

How to use different log4j properties file name?

Is log4j.properties file mandatory?

How to use multiple log files?

What is ConsoleAppender? What is the use of it?

What is conversion pattern?

What is the meaning of the following conversion pattern?

%-4r [%t] %-5p %c %x - %m%n

How and where to specify log file size?

What is the default logging level for Log4J?

Who is the founder of Log4J Framework?

What is the root element of log4j.xml file?

What is FileAppender? What is the use of it?

What is RollingFileAppender? What is the use of it?

What are the major differences between FileAppender and RollingFileAppender?

How and where to define log file appending option?

How to define package level loggings?

What is the xml element to define conversion pattern in log4j.xml file?

How to input log4j.properties file to our java class in programmatic approach?

Drawbacks of Log4J programmatic approachs?

Advantages of Log4J Declarative approachs?

Why most of the people uses log4j.properties file for logging in ther applicaton?

What is DOMConfigurator?

When do we need to use DOMConfigurator?

How to input log4j.xml file to our java class in programmatic approach?

Which one is more preferable between log4j.properties and log4j.xml file?

Can we use lower case logging levels in log4j.propertiles file?

Is Log4J Thread-safe? Why?

How to solve Performance issues of Log4J?

How and when do loggers inherit level?