

手写Web服务器

1.课程目标

- 综合运用JavaSE高级特性：IO流、多线程编程、网络编程、反射、面向对象，XML解析！
- 通过手写Web服务器，了解Web请求的流程和Web服务器大致的工作原理
- 积累代码量，养成良好编码习惯

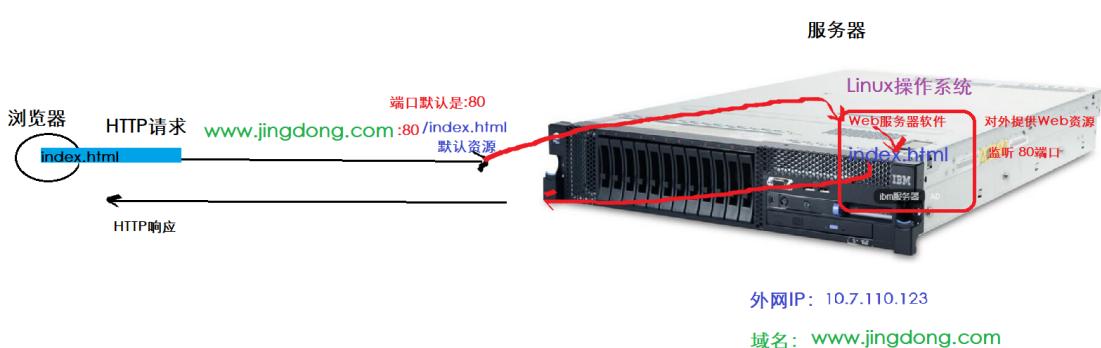
2.什么是Web服务器

硬件：实实在在的一台机器！



软件：安装在硬件服务器上的一个Web服务器软件，负责监听服务器的某一端口，接收用户发送过来的请求，并解析请求资源地址，然后对外提供服务！

课程中所说的Web服务器，指的是Web服务器这个软件！



3.Java中常见的Web服务器

Web服务器是运行及发布Web应用的容器，只有将开发的Web项目放置到该容器中，才能使网络中的所有用户通过浏览器进行访问。开发Java Web应用所采用的服务器主要是与JSP/Servlet兼容的Web服务器，比较常用的有Tomcat、Resin、JBoss、WebSphere 和 WebLogic 等，下面将分别进行介绍。

3.1.Tomcat 服务器

目前最为流行的Tomcat服务器是Apache-Jarkarta开源项目中的一个子项目，是一个小型、轻量级的支持JSP和Servlet 技术的Web服务器，也是初学者学习开发JSP应用的首选。

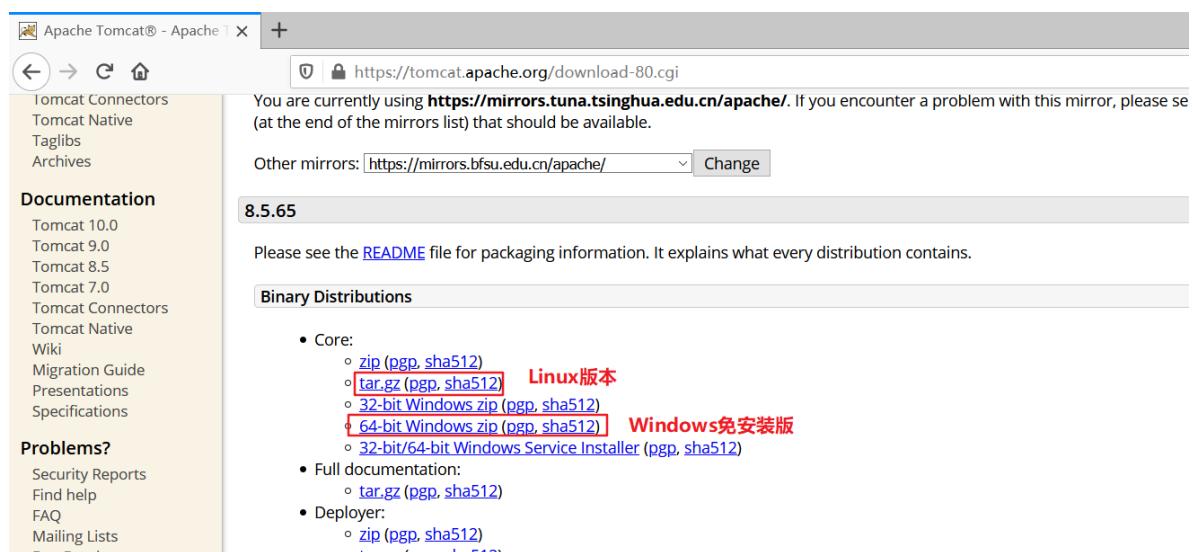
apache软件基金会：<https://www.apache.org>

3.1.1 tomcat官网：<http://tomcat.apache.org/>



The screenshot shows the official Apache Tomcat website. At the top, there's a navigation bar with icons for back, forward, search, and refresh, followed by the URL 'https://tomcat.apache.org/' and a note '不安全'. Below the header is the Apache logo (a yellow cat). The main title 'Apache Tomcat®' is prominently displayed. To the left, there's a sidebar with links for 'APACHECON September 21-23 2021 www.apachecon.com Save the date!', 'Apache Tomcat', and a search bar. The main content area contains a brief introduction to the software, mentioning it's an open source implementation of Java Servlet, JavaServer Pages, Java Expression Language, and Java WebSocket specifications, developed under the Java Community Process. It also notes that the software is developed in an open and participatory environment.

3.1.2.tomcat下载：



The screenshot shows the download page for Apache Tomcat version 8.5.65. On the left, there's a sidebar with links for 'Tomcat Connectors', 'Tomcat Native', 'Taglibs', 'Archives', 'Documentation' (with sub-links for Tomcat 10.0, 9.0, 8.5, 7.0, Connectors, Native, Wiki, Migration Guide, Presentations, Specifications), 'Problems?' (with sub-links for Security Reports, Find help, FAQ, Mailing Lists, Bug Databases), and 'Other mirrors' (set to 'https://mirrors.bfsu.edu.cn/apache/'). The main content area shows the download links for the specified version. Under 'Binary Distributions', there are sections for 'Core' (with links for 'zip (pgp, sha512)', 'tar.gz (pgp, sha512)', '32-bit Windows zip (pgp, sha512)', '64-bit Windows zip (pgp, sha512)', and '32-bit/64-bit Windows Service Installer (pgp, sha512)'), 'Full documentation' (with a link for 'tar.gz (pgp, sha512)'), and 'Deployer' (with a link for 'zip (pgp, sha512)'). A note at the top of the page says 'You are currently using https://mirrors.tuna.tsinghua.edu.cn/apache/'. There's also a 'Change' button for the mirror list.

tomcat服务器是使用Java编写的，所以需要本地有JDK的支持。 java -version

```
C:\WINDOWS\system32\cmd.exe
Microsoft Windows [版本 10.0.19041.867]
(c) 2020 Microsoft Corporation. 保留所有权利。

C:\Users\bruceliu>java -version
java version "1.8.0_40"
Java(TM) SE Runtime Environment (build 1.8.0_40-b25)
Java HotSpot(TM) 64-Bit Server VM (build 25.40-b25, mixed mode)

C:\Users\bruceliu>
```

3.1.3 启动Tomcat服务器



双击startup.bat启动web服务器,打开一个命令行CMD界面:

```
Tomcat
12-Apr-2021 09:59:32.160 淵℃俺 [main] org.apache.catalina.core.StandardService.startInternal 姝 e 源錫 姮鍏姩姸[Catalina]
12-Apr-2021 09:59:32.160 淵℃俺 [main] org.apache.catalina.core.StandardEngine.startInternal 姝 e 源錫 姮 Server 家晨搆併鍙Apache Tomcat/8.5.65
12-Apr-2021 09:59:32.182 淵℃俺 [localhost-startStop-1] org.apache.catalina.startup.HostConfig.deployDirectory 鍗圭eb 奉旂敱紕煇嬪鑿箇 | 讲錄扮併簾?[C:\Users\bruceliu\Desktop\tomcat\apache-tomcat-8.5.65\windows-x64\apache-tomcat-8.5.65\webapps\docs]

12-Apr-2021 09:59:32.900 廽～慊 [localhost-startStop-1] org.apache.catalina.util.SessionIdGeneratorBase.createSecureRandom 淑跨數[SHA1PRNG]鍒涘缓浼氳彥ID鑾畠
鍊连渢由eSecureRandom偣鍓鑰鑼辨垂浜暭罕403]效狀 錄?

12-Apr-2021 09:59:32.939 淵℃俺 [localhost-startStop-1] org.apache.catalina.startup.HostConfig.deployDirectory Web奉旂敱紕煇嬪鑿箇[C:\Users\bruceliu\Desktop\tomcat\apache-tomcat-8.5.65\windows-x64\apache-tomcat-8.5.65\webapps\docs]鑺勭儵緝插凡鍊-758]效狀 網哩畲鑷?

12-Apr-2021 09:59:32.946 淵℃俺 [localhost-startStop-1] org.apache.catalina.startup.HostConfig.deployDirectory 鍗圭eb 奉旂敱紕煇嬪鑿箇 | 讲錄扮併簾?[C:\Users\bruceliu\Desktop\tomcat\apache-tomcat-8.5.65\windows-x64\apache-tomcat-8.5.65\webapps\examples]

12-Apr-2021 09:59:33.973 淵℃俺 [localhost-startStop-1] org.apache.catalina.startup.HostConfig.deployDirectory Web奉旂敱紕煇嬪鑿箇[C:\Users\bruceliu\Desktop\tomcat\apache-tomcat-8.5.65\windows-x64\apache-tomcat-8.5.65\webapps\examples]鑺勭儵緝插凡鍊-1_026]效狀 網哩畲鑷?

12-Apr-2021 09:59:33.379 淵℃俺 [localhost-startStop-1] org.apache.catalina.startup.HostConfig.deployDirectory 鍗圭eb 奉旂敱紕煇嬪鑿箇[C:\Users\bruceliu\Desktop\tomcat\apache-tomcat-8.5.65\windows-x64\apache-tomcat-8.5.65\webapps\host-manager]

12-Apr-2021 09:59:34.010 淵℃俺 [localhost-startStop-1] org.apache.catalina.startup.HostConfig.deployDirectory Web奉旂敱紕煇嬪鑿箇[C:\Users\bruceliu\Desktop\tomcat\apache-tomcat-8.5.65\windows-x64\apache-tomcat-8.5.65\webapps\host-manager]鑺勭儵緝插凡鍊-2]效狀 網哩畲鑷?

12-Apr-2021 09:59:34.011 淵℃俺 [localhost-startStop-1] org.apache.catalina.startup.HostConfig.deployDirectory 鍗圭eb 奉旂敱紕煇嬪鑿箇[C:\Users\bruceliu\Desktop\tomcat\apache-tomcat-8.5.65\windows-x64\apache-tomcat-8.5.65\webapps\manager]

12-Apr-2021 09:59:34.053 淵℃俺 [localhost-startStop-1] org.apache.catalina.startup.HostConfig.deployDirectory Web奉旂敱紕煇嬪鑿箇[C:\Users\bruceliu\Desktop\tomcat\apache-tomcat-8.5.65\windows-x64\apache-tomcat-8.5.65\webapps\manager]鑺勭儵緝插凡鍊-4]效狀 網哩畲鑷?

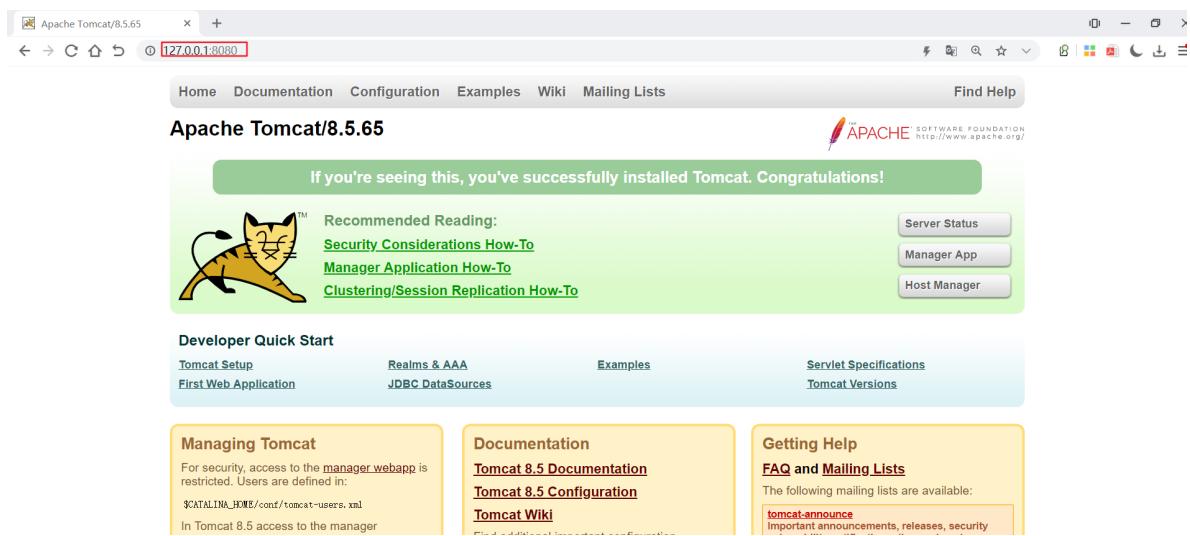
12-Apr-2021 09:59:34.060 淵℃俺 [localhost-startStop-1] org.apache.catalina.startup.HostConfig.deployDirectory 鍗圭eb 奉旂敱紕煇嬪鑿箇[C:\Users\bruceliu\Desktop\tomcat\apache-tomcat-8.5.65\windows-x64\apache-tomcat-8.5.65\webapps\ROOT]

12-Apr-2021 09:59:34.087 淵℃俺 [localhost-startStop-1] org.apache.catalina.startup.HostConfig.deployDirectory Web奉旂敱紕煇嬪鑿箇[C:\Users\bruceliu\Desktop\tomcat\apache-tomcat-8.5.65\windows-x64\apache-tomcat-8.5.65\webapps\ROOT]鑺勭儵緝插凡鍊-27]效狀 網哩畲鑷?

12-Apr-2021 09:59:34.108 淵℃俺 [main] org.apache.coyote.AbstractProtocol.start 寂C澧犻箣鑰嬪 綽啗疋鑿鑷[http://nio-8080]
12-Apr-2021 09:59:34.127 淵℃俺 [main] org.apache.catalina.startup.Catalina.start Server startup in 2019 ms 服务器在2秒钟以内启动....
```

测试Web服务器(web服务器不要关闭):

tomcat服务器默认监听的是8080端口,后期可以人工设置



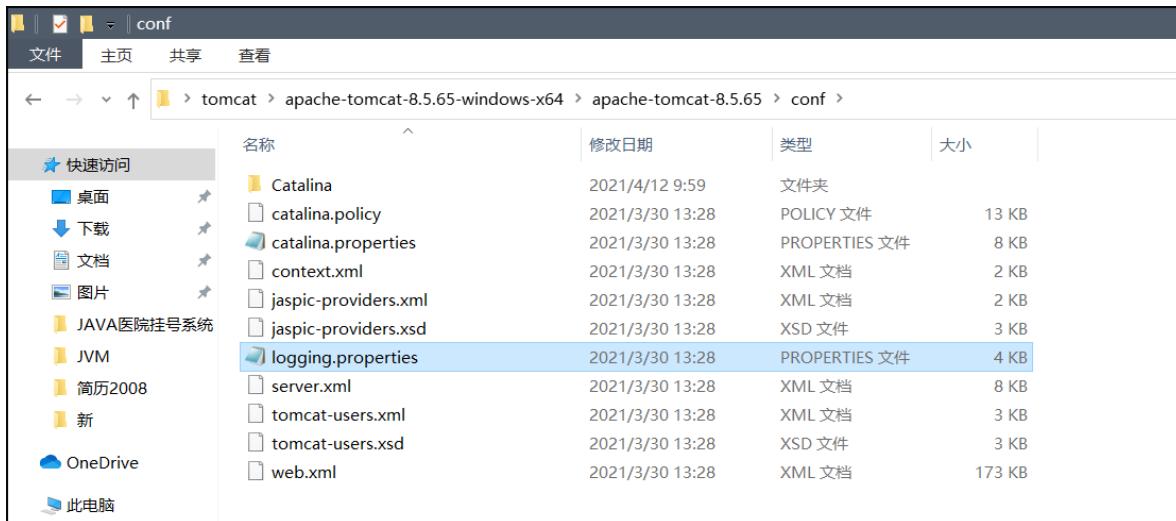
- 1 | <http://127.0.0.1:8080/>
- 2 | <http://localhost:8080/>

3.1.4 启动Tomcat服务器问题

- 1 | 启动完毕之后页面一闪而过，就自动关闭啦：
- 2 |
 - 1.有可能是JDK环境变量有问题
 - 2.有可能JDK的版本和下载的Tomcat的版本不匹配

3.1.5 启动Tomcat服务器控制台乱码





```

logging.properties

# Handler specific properties.
# Describes specific configuration info for Handlers.
#####
1catalina.org.apache.juli.AsyncFileHandler.level = FINE
1catalina.org.apache.juli.AsyncFileHandler.directory = ${catalina.base}/logs
1catalina.org.apache.juli.AsyncFileHandler.prefix = catalina.
1catalina.org.apache.juli.AsyncFileHandler.encoding = GBK
2localhost.org.apache.juli.AsyncFileHandler.level = FINE
2localhost.org.apache.juli.AsyncFileHandler.directory = ${catalina.base}/logs
2localhost.org.apache.juli.AsyncFileHandler.prefix = localhost.
2localhost.org.apache.juli.AsyncFileHandler.encoding = GBK
3manager.org.apache.juli.AsyncFileHandler.level = FINE
3manager.org.apache.juli.AsyncFileHandler.directory = ${catalina.base}/logs
3manager.org.apache.juli.AsyncFileHandler.prefix = manager.
3manager.org.apache.juli.AsyncFileHandler.encoding = GBK
4host-manager.org.apache.juli.AsyncFileHandler.level = FINE
4host-manager.org.apache.juli.AsyncFileHandler.directory = ${catalina.base}/logs
4host-manager.org.apache.juli.AsyncFileHandler.prefix = host-manager.
4host-manager.org.apache.juli.AsyncFileHandler.encoding = GBK
java.util.logging.ConsoleHandler.level = FINE
java.util.logging.ConsoleHandler.formatter = org.apache.juli.OneLineFormatter
java.util.logging.ConsoleHandler.encoding = GBK

```

```

选择Tomcat
[2-Apr-2021 10:22:22.634 信息 [main] org.apache.coyote.AbstractProtocol.init 初始化协议处理器 ["http-nio-8080"]
[2-Apr-2021 10:22:22.713 信息 [main] org.apache.tomcat.util.net.NioSelectorPool.getSharedSelector Using a shared selector for servlet write/read
[2-Apr-2021 10:22:22.726 信息 [main] org.apache.catalina.startup.Catalina.load Initialization processed in 677 ms
[2-Apr-2021 10:22:22.759 信息 [main] org.apache.catalina.core.StandardService.startInternal 正在启动服务[Catalina]
[2-Apr-2021 10:22:22.759 信息 [main] org.apache.catalina.core.StandardEngine.startInternal 正在启动 Servlet 引擎: [Apache Tomcat/8.5.65]
[2-Apr-2021 10:22:22.776 信息 [localhost-startStop-1] org.apache.catalina.startup.HostConfig.deployDirectory 把 web 应用程序部署到目录 [C:\Users\bruceliu\Desktop\tomcat\apache-tomcat-8.5.65-windows-x64\apache-tomcat-8.5.65\webapps\docs]
[2-Apr-2021 10:22:23.522 警告 [localhost-startStop-1] org.apache.catalina.util.SessionIdGeneratorBase.createSecureRandom 使用 [SHA1PRNG] 创建会话ID生成的 SecureRandom 实例花费了 [454] 毫秒。
[2-Apr-2021 10:22:23.547 信息 [localhost-startStop-1] org.apache.catalina.startup.HostConfig.deployDirectory Web 应用程序目录 [C:\Users\bruceliu\Desktop\tomcat\apache-tomcat-8.5.65-windows-x64\apache-tomcat-8.5.65\webapps\docs] 的部署已在 [771] 毫秒内完成
[2-Apr-2021 10:22:23.548 信息 [localhost-startStop-1] org.apache.catalina.startup.HostConfig.deployDirectory 把 web 应用程序部署到目录 [C:\Users\bruceliu\Desktop\tomcat\apache-tomcat-8.5.65-windows-x64\apache-tomcat-8.5.65\webapps\examples]
[2-Apr-2021 10:22:24.017 信息 [localhost-startStop-1] org.apache.catalina.startup.HostConfig.deployDirectory Web 应用程序目录 [C:\Users\bruceliu\Desktop\tomcat\apache-tomcat-8.5.65-windows-x64\apache-tomcat-8.5.65\webapps\examples] 的部署已在 [469] 毫秒内完成
[2-Apr-2021 10:22:24.017 信息 [localhost-startStop-1] org.apache.catalina.startup.HostConfig.deployDirectory 把 web 应用程序部署到目录 [C:\Users\bruceliu\Desktop\tomcat\apache-tomcat-8.5.65-windows-x64\apache-tomcat-8.5.65\webapps\host-manager]
[2-Apr-2021 10:22:24.063 信息 [localhost-startStop-1] org.apache.catalina.startup.HostConfig.deployDirectory Web 应用程序目录 [C:\Users\bruceliu\Desktop\tomcat\apache-tomcat-8.5.65-windows-x64\apache-tomcat-8.5.65\webapps\host-manager] 的部署已在 [461] 毫秒内完成
[2-Apr-2021 10:22:24.064 信息 [localhost-startStop-1] org.apache.catalina.startup.HostConfig.deployDirectory 把 web 应用程序部署到目录 [C:\Users\bruceliu\Desktop\tomcat\apache-tomcat-8.5.65-windows-x64\apache-tomcat-8.5.65\webapps\manager]
[2-Apr-2021 10:22:24.121 信息 [localhost-startStop-1] org.apache.catalina.startup.HostConfig.deployDirectory Web 应用程序目录 [C:\Users\bruceliu\Desktop\tomcat\apache-tomcat-8.5.65-windows-x64\apache-tomcat-8.5.65\webapps\manager] 的部署已在 [57] 毫秒内完成
[2-Apr-2021 10:22:24.121 信息 [localhost-startStop-1] org.apache.catalina.startup.HostConfig.deployDirectory 把 web 应用程序部署到目录 [C:\Users\bruceliu\Desktop\tomcat\apache-tomcat-8.5.65-windows-x64\apache-tomcat-8.5.65\webapps\ROOT]
[2-Apr-2021 10:22:24.154 信息 [localhost-startStop-1] org.apache.catalina.startup.HostConfig.deployDirectory Web 应用程序目录 [C:\Users\bruceliu\Desktop\tomcat\apache-tomcat-8.5.65-windows-x64\apache-tomcat-8.5.65\webapps\ROOT] 的部署已在 [33] 毫秒内完成
[2-Apr-2021 10:22:24.158 信息 [main] org.apache.coyote.AbstractProtocol.start 开始处理协议句柄 ["http-nio-8080"]
[2-Apr-2021 10:22:24.170 信息 [main] org.apache.catalina.startup.Catalina.start Server startup in 1443 ms

```

3.1.6 修改tomcat默认的端口

1 | tomcat默认的端口是8080,可以自定义端口

File Explorer showing the contents of the 'conf' directory of Apache Tomcat 8.5.65. The 'server.xml' file is selected.

名称	修改日期	类型	大小
Catalina	2021/4/12 9:59	文件夹	
catalina.policy	2021/3/30 13:28	POLICY 文件	13 KB
catalina.properties	2021/3/30 13:28	PROPERTIES 文件	8 KB
context.xml	2021/3/30 13:28	XML 文档	2 KB
jaspic-providers.xml	2021/3/30 13:28	XML 文档	2 KB
jaspic-providers.xsd	2021/3/30 13:28	XSD 文件	3 KB
logging.properties	2021/4/12 10:22	PROPERTIES 文件	4 KB
server.xml	2021/3/30 13:28	XML 文档	8 KB
tomcat-users.xml	2021/3/30 13:28	XML 文档	3 KB
tomcat-users.xsd	2021/3/30 13:28	XSD 文件	3 KB
web.xml	2021/3/30 13:28	XML 文档	173 KB

Visual Studio Code editor showing the 'server.xml' configuration file. A red arrow points to the line where the port is set to 80.

```

<!-- A "Connector" represents an endpoint by which requests are received
     and responses are returned. Documentation at :
      Java HTTP Connector: /docs/config/http.html
      Java AJP Connector: /docs/config/ajp.html
      APR (HTTP/AJP) Connector: /docs/apr.html
      Define a non-SSL/TLS HTTP/1.1 Connector on port 8080
-->
<Connector port="80" protocol="HTTP/1.1"
           connectionTimeout="20000"
           redirectPort="8443" />
<!-- A "Connector" using the shared thread pool-->
<!--
<Connector executor="tomcatThreadPool"
           port="8080" protocol="HTTP/1.1"
           connectionTimeout="20000"
           redirectPort="8443" />

```

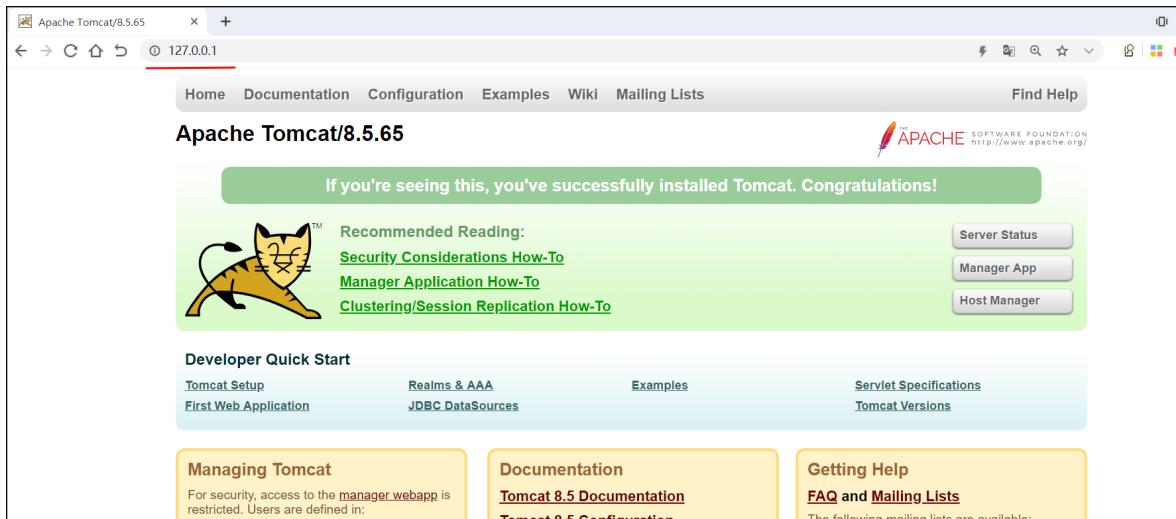
Tomcat log output showing the startup process. A red arrow points to the line where the port is set to 80.

```

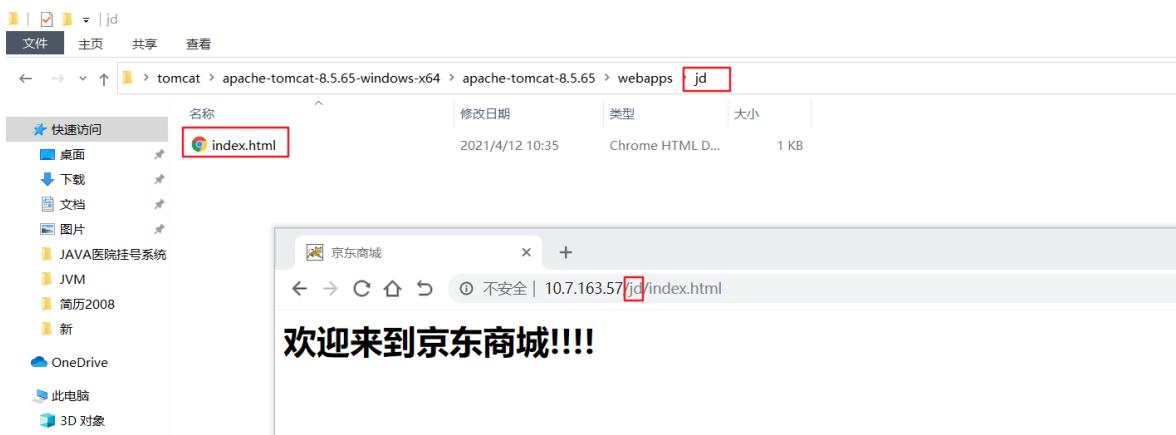
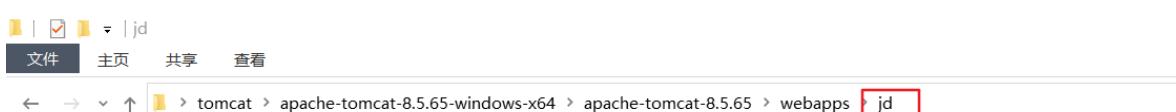
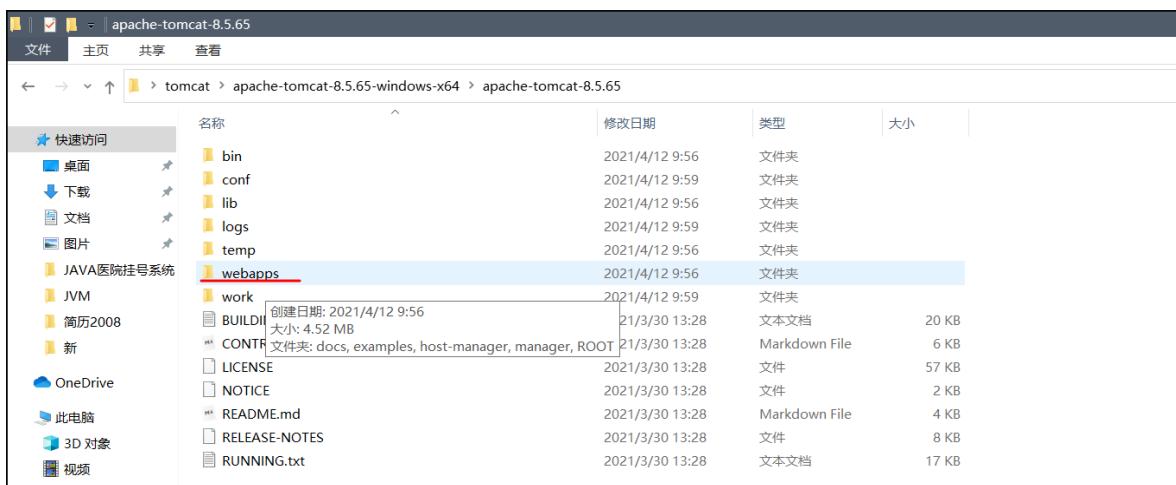
12-Apr-2021 10:26:06.750 信息 [main] org.apache.catalina.core.AprLifecycleListener.initializeSSL OpenSSL成功初始化 [OpenSSL 1.1.1k 25 Mar 2021]
12-Apr-2021 10:26:06.876 信息 [main] org.apache.coyote.AbstractProtocol.init 初始话协议处理器 ["http-nio-80"]
12-Apr-2021 10:26:06.943 信息 [main] org.apache.tomcat.util.net.NioSelectorPool.getSharedSelector Using a shared selector for servlet write/read
12-Apr-2021 10:26:06.953 信息 [main] org.apache.catalina.startup.Catalina.load Initialization processed in 679 ms
12-Apr-2021 10:26:06.989 信息 [main] org.apache.catalina.core.StandardService.startInternal 正在启动服务[Catalina]
12-Apr-2021 10:26:06.990 信息 [main] org.apache.catalina.core.StandardEngine.startInternal 正在启动 Servlet 引擎: [Apache Tomcat/8.5.65]
12-Apr-2021 10:26:07.001 信息 [localhost-startStop-1] org.apache.catalina.startup.HostConfig.deployDirectory 把Web 应用程序部署到目录 [C:\Users\bruceliu\Desktop\tomcat\apache-tomcat-8.5.65\webapps\docs]
12-Apr-2021 10:26:07.708 警告 [localhost-startStop-1] org.apache.catalina.util.SessionIdGeneratorBase.createSecureRandom 使用[SHA1PRNG]创建会话ID生成的SecureRandom实例花费了[441]毫秒内完成
12-Apr-2021 10:26:07.732 信息 [localhost-startStop-1] org.apache.catalina.startup.HostConfig.deployDirectory Web应用程序目录[C:\Users\bruceliu\Desktop\tomcat\apache-tomcat-8.5.65\webapps\examples]的部署已在[730]毫秒内完成
12-Apr-2021 10:26:07.733 信息 [localhost-startStop-1] org.apache.catalina.startup.HostConfig.deployDirectory Web应用程序部署到目录 [C:\Users\bruceliu\Desktop\tomcat\apache-tomcat-8.5.65\webapps\examples]的部署已在[480]毫秒内完成
12-Apr-2021 10:26:08.222 信息 [localhost-startStop-1] org.apache.catalina.startup.HostConfig.deployDirectory Web应用程序目录[C:\Users\bruceliu\Desktop\tomcat\apache-tomcat-8.5.65\webapps\examples]的部署已在[46]毫秒内完成
12-Apr-2021 10:26:08.222 信息 [localhost-startStop-1] org.apache.catalina.startup.HostConfig.deployDirectory Web应用程序部署到目录 [C:\Users\bruceliu\Desktop\tomcat\apache-tomcat-8.5.65\webapps\examples\host-manager]的部署已在[46]毫秒内完成
12-Apr-2021 10:26:08.279 信息 [localhost-startStop-1] org.apache.catalina.startup.HostConfig.deployDirectory Web应用程序目录[C:\Users\bruceliu\Desktop\tomcat\apache-tomcat-8.5.65\webapps\host-manager]的部署已在[57]毫秒内完成
12-Apr-2021 10:26:08.279 信息 [localhost-startStop-1] org.apache.catalina.startup.HostConfig.deployDirectory Web应用程序部署到目录 [C:\Users\bruceliu\Desktop\tomcat\apache-tomcat-8.5.65\webapps\host-manager]
12-Apr-2021 10:26:08.325 信息 [localhost-startStop-1] org.apache.catalina.startup.HostConfig.deployDirectory Web应用程序目录[C:\Users\bruceliu\Desktop\tomcat\apache-tomcat-8.5.65\webapps\host-manager]的部署已在[46]毫秒内完成
12-Apr-2021 10:26:08.325 信息 [localhost-startStop-1] org.apache.catalina.startup.HostConfig.deployDirectory Web应用程序部署到目录 [C:\Users\bruceliu\Desktop\tomcat\apache-tomcat-8.5.65\webapps\host-manager]
12-Apr-2021 10:26:08.356 信息 [localhost-startStop-1] org.apache.catalina.startup.HostConfig.deployDirectory Web应用程序目录[C:\Users\bruceliu\Desktop\tomcat\apache-tomcat-8.5.65\webapps\ROOT]的部署已在[31]毫秒内完成
12-Apr-2021 10:26:08.358 信息 [main] org.apache.coyote.AbstractProtocol.start 开始协议处理句柄["http-nio-80"]
12-Apr-2021 10:26:08.369 信息 [main] org.apache.catalina.startup.Catalina.start Server startup in 1416 ms

```

测试端口：



3.1.7 tomcat部署项目



3.2.其他的Web服务器

Resin 服务器

Resin是Caucho公司的产品，是一个非常流行的支持Servlet和JSP的服务器，速度非常快。Resin本身包含了一个支持HTML的Web服务器，这使它不仅可以显示动态内容，而且显示静态内容的能力也毫不逊色，因此许多网站都是使用Resin服务器构建。

JBoss服务器

JBoss是一个遵从JavaEE规范的、开放源代码的、纯Java的EJB服务器，对于J2EE有很好的支持。JBoss采用JML API实现软件模块的集成与管理，其核心服务又是提供EJB服务器，不包含Servlet和JSP的Web容器，不过它可以和Tomcat完美结合。

WebSphere 服务器

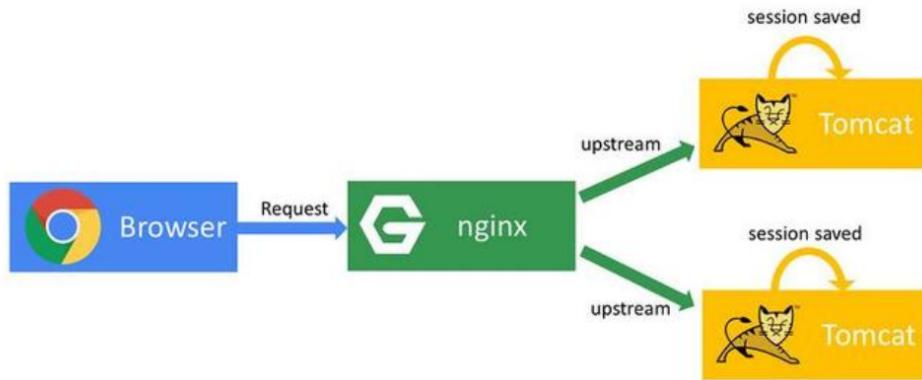
WebSphere是IBM公司的产品，可进一步细分为 WebSphere Performance Pack、Cache Manager 和WebSphere Application Server等系列，其中WebSphere Application Server 是基于Java 的应用环境，可以运行于 Sun Solaris、Windows NT 等多种操作系统平台，用于建立、部署和管理Internet和Intranet Web应用程序。

WebLogic 服务器

WebLogic 是BEA公司的产品，可进一步细分为 WebLogic Server、WebLogic Enterprise 和 WebLogic Portal 等系列，其中 WebLogic Server 的功能特别强大。WebLogic 支持企业级的、多层次的和完全分布式的Web应用，并且服务器的配置简单、界面友好。对于那些正在寻求能够提供Java平台所拥有的一切应用服务器的用户来说，WebLogic是一个十分理想的选择。

为什么选tomcat?

轻量级，开源服务器。免费！中小型企业，甚至大型的互联网公司，都在使用tomcat！性能稳定，支持定制开发，支持集群！

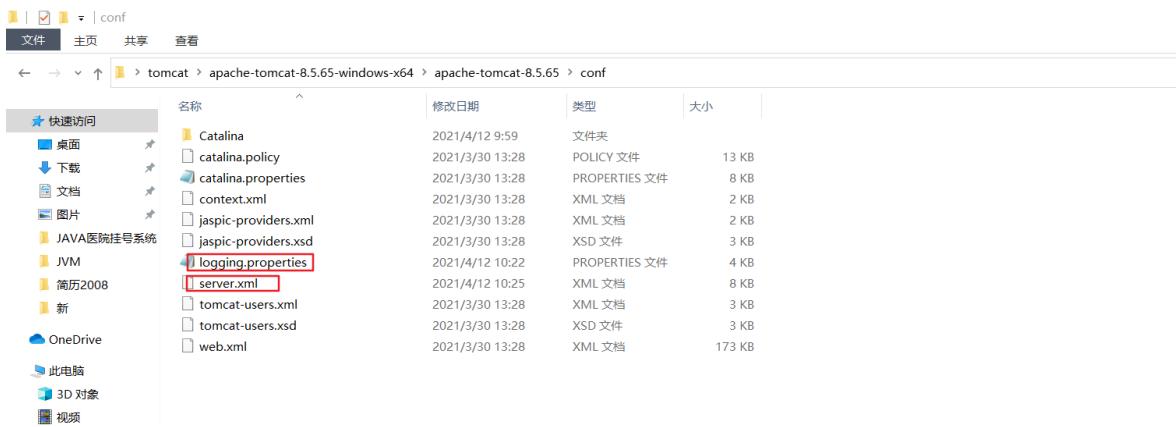


4.xml文件概念

- 1 XML文件：是有一定数据格式的一种文件，一般作用：
- 2 1.作为配置文件使用
- 3 2.网络传输的一种数据文件格式，因为XML文件是跨平台的！
- 4
- 5 一般都是作为配置文件使用：不能把有些信息，写在Java源码中，编译之后没法修改！但是XML文件作为一个程序的配置文件，随时可以修改，不要硬编码！！

```

1 <?xml version="1.0" encoding="UTF-8"?>
2 <students>
3   <student>
4     <name id="001">张三</name>
5     <age>18</age>
6     <hobby>计算机</hobby>
7   </student>
8   <student>
9     <name id="002">李四</name>
10    <age>19</age>
11    <hobby>计算机</hobby>
12  </student>
13  <student>
14    <name id="003">王五</name>
15    <age>20</age>
16    <hobby>体育</hobby>
17  </student>
18 </students>
```



5.xml文件解析

如果需要读取XML配置文件的信息，需要掌握一个技术：XML解析技术！在Java中XML解析有很多技术可以实现，SAX解析，DOM解析，DOM4J解析！目前市场上比较流行的XML解析技术是：DOM4J解析！

DOM4J是一个开源的，进行XML解析的框架，在Java以后学习的框架中内部大部分的都是使用DOM4J解析XML的！甚至SUN公司有些技术栈也是使用DOM4J！

<https://dom4j.github.io>

The screenshot shows the official GitHub page for the dom4j project. The header reads 'Flexible XML framework for Java.' Below it, three version cards are displayed:

- dom4j-1.6.1**
 - XML Document Object Model based on Java Collections Framework
 - Java 1.4+

Released on May 20, 2005
Download 1.6.1 ▾
- dom4j-2.0.3**
 - XML Document Object Model based on Java Collections Framework
 - Java 5+
 - Generics support

Released on April 11, 2020
Download 2.0.3 ▾
- dom4j-2.1.3**
 - XML Document Object Model based on Java Collections Framework
 - Java 8+
 - Generics support

Released on April 12, 2020
Download 2.1.3 ▾