Review

- What are two tools we can use to help build software?
  - How are they similar? How are they different?
- We haven't needed build tools before this. Why do we need build tools?

Comparing Make and Ant

```
simulator: $(OBJECTS)
        $(CC) $(CFLAGS) –o simulator $(OBJECTS)
simulator.o: simulator.c
        $(CC) $(CFLAGS) –c simulator.c

customer.o: customer.c
        $(CC) $(CFLAGS) –c customer.c
…
clean:
        rm $(OBJECTS) simulator
```

```
<target name="compile"
        description="Compile the source code">
    <mkdir dir="build/classes"/>
    <javac srcdir="src"
           destdir="build/classes"
           debug="on">
        <include name="**/*.java"/>
        <classpath refid="build.class.path"/>
    </javac>
</target>
```

Revisiting make example

```
# More detailed example
# Breaks into more targets so you don't have to compile as much
# if only one file changes.

all: hello

hello: main.o factorial.o hello.o
        g++ main.o factorial.o hello.o -o hello

main.o: main.cpp
        g++ -c main.cpp

factorial.o: factorial.cpp
        g++ -c factorial.cpp

hello.o: hello.cpp
        g++ -c hello.cpp

clean:
        rm *o hello
```

```
$ make -f Makefile-2 clean
rm *o hello
rm: cannot remove 'hello': No such
file or directory
Makefile-2:20: recipe for target
'clean' failed
make: *** [clean] Error 1
```

Build and Management Tools

- Ant
- Maven

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- Develops >350 open-source projects

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  - **Httpd (Web Server)**
  - Tomcat
  - Struts, Wicket
  - Hadoop
  - Spam Assassin
  - Common library

Using `ant`

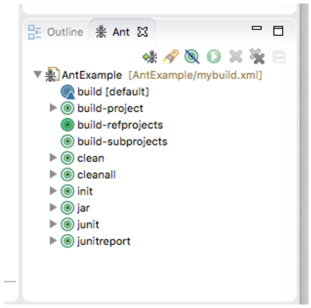
- Can be used on the command-line and in IDEs
- We'll try it out in Eclipse!
  - Import the project from the Jar file

Using `ant` in Eclipse

- Import an existing project
  - *`/csdept/courses/cs397/handouts/antexample.tar.gz`*
- Double-click on `mybuild.xml`
  - Look at the contents
  - What does it do?
  - Open with "XML Editor", look at Design view
  - (Default name is usually `build.xml`)

Using `ant` in Eclipse

- Window → Show View → Ant
- Click the “Add Buildfiles” button
  - Add `mybuild.xml`
- Ant view:



```
▼ AntExample [AntExample/mybuild.xml]
    build [default]
  ▶ build-project
    build-refprojects
    build-subprojects
  ▶ clean
  ▶ cleanall
  ▶ init
  ▶ jar
  ▶ junit
  ▶ junitreport
```

Creating Build Files

- Export from Eclipse
- Use a template
  - Check out our mybuild.xml
  - How much would we need to change our build file to make it work for other projects?

Apache Maven™

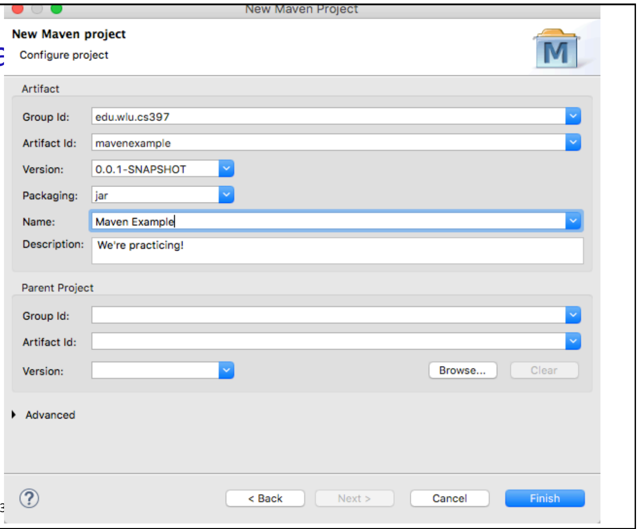
- Maven: Yiddish word meaning *accumulator of knowledge*
- For building and managing any Java-based project
  - Uses a Project object model (POM)
- Goal: download and build a project quickly

http://maven.apache.org/

Maven

- Can be used as standalone tool or within Eclipse (what we'll do)

Ma



New Maven project

Configure project

Artifact

Group Id:	edu.wlu.cs397
Artifact Id:	mavenexample
Version:	0.0.1-SNAPSHOT
Packaging:	jar
Name:	Maven Example
Description:	We're practicing!

Parent Project

Group Id:	
Artifact Id:	
Version:	