Faculty of ECMS / School of Computer Science

Software Engineering & Project
Software Engineering Tools

Software Engineering Tools

Lecture 6

Outline

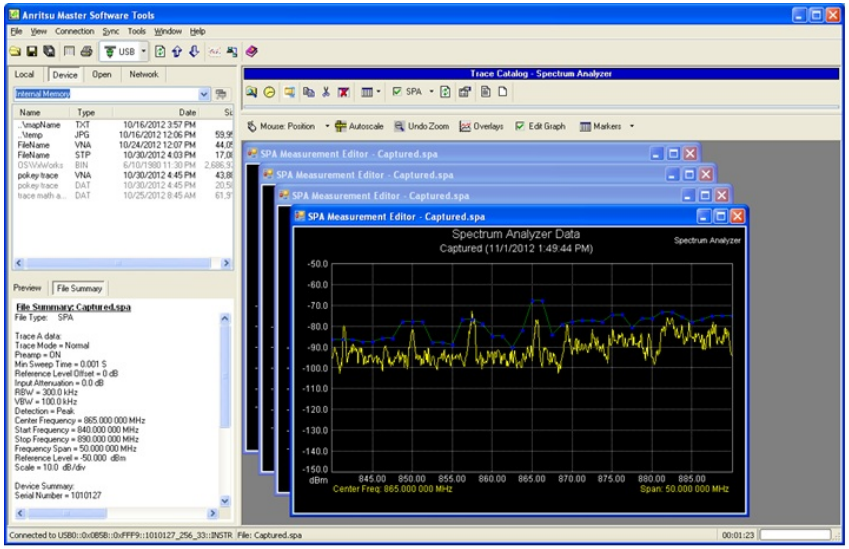
- Why tools?
- Tools evolution
- Computer-Aided Software Engineering (CASE)
- Integrated Development Environments

- Software tools
  - LaTex
  - Build tools
    - Apache Ant
    - Make

Why Tools?

Why Tools? (Cont.)

- Enhanced productivity during development and maintenance
- Support for team working – team integration
- Higher quality analysis and design
- Support for the software development process



Tools Evolution

- Late 50's: primitive tools
  - Machine code
  - Assembly language
  - Card sorters, tape cutters

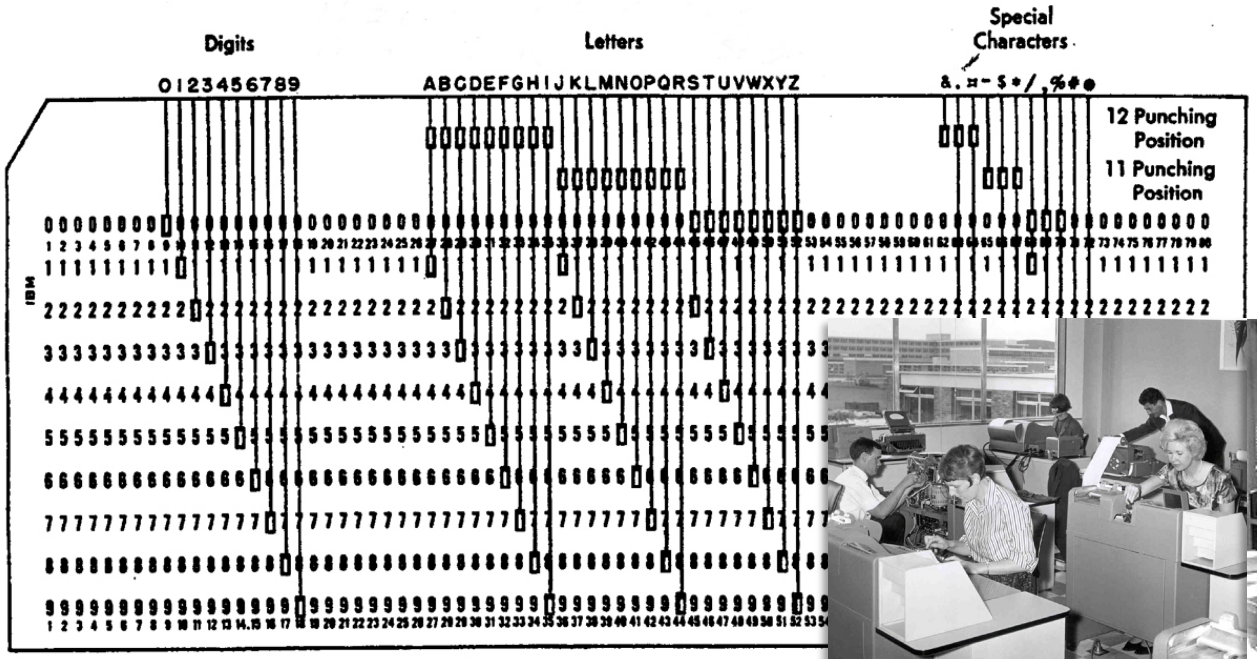


Figure 2. Punching Positions in Card

Tools Evolution (Cont.)

- Early 60's: simple tools
  - Programming languages
  - Compilers
  - Editors
- 70's-80's: simple tool integration
  - File systems
  - Unix tools (make, cc, filters etc)
- 90's-: CASE toolset, integrated environments
  - Support teamwork
  - Integrated development environment

Computer-Aided Software Engineering

- Computer-aided software engineering (CASE) is software to support software development and evolution processes
- Activity automation
  - Graphical editors for system model development;
  - Data dictionary to manage design entities;
  - Graphical UI builder for user interface construction;
  - Debuggers to support program fault finding;
  - Automated translators to generate new versions of a program.

CASE Technology

- CASE technology has led to significant improvements in the software process. However, these are not the order of magnitude improvements that were once predicted
  - Software engineering requires creative thought - this is not readily automated;
  - Software engineering is a team activity and, for large projects, much time is spent in team interactions. CASE technology does not really support these.

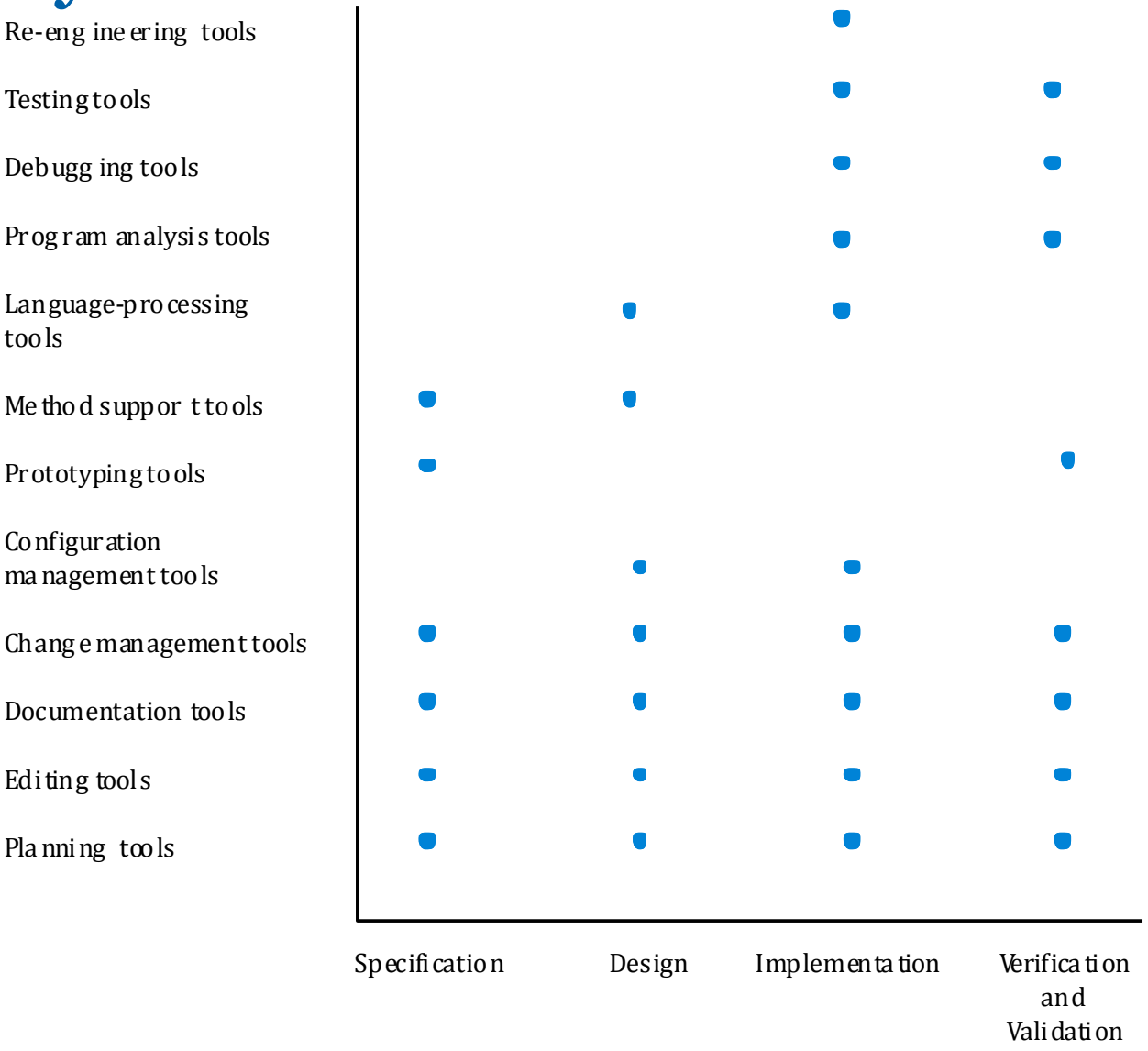
Tools Classification

- Classification helps us understand the different types of CASE tools and their support for process activities
- Functional perspective
  - Tools are classified according to their specific function
- Process perspective
  - Tools are classified according to process activities that are supported
- Integration perspective
  - Tools are classified according to their organisation into integrated units

Functional Tool Classification

Tool type	Examples
Planning tools	PERT tools, estimation tools, spreadsheets
Editing tools	Text editors, diagram editors, word processors
Change management tools	Requirements traceability tools, change control systems
Configuration management tools	Version management systems, system building tools
Prototyping tools	Very high-level languages, user interface generators
Method-support tools	Design editors, data dictionaries, code generators
Language-processing tools	Compilers, interpreters
Program analysis tools	Cross reference generators, static analysers, dynamic analysers
Testing tools	Test data generators, file comparators
Debugging tools	Interactive debugging systems
Documentation tools	Page layout programs, image editors
Re-engineering tools	Cross-reference systems, program re-structuring systems

Activity-Based Tool Classification



Integrated Development Environments

- IDEs are used to couple the Edit-Compile-Run toolchains and usually include coupling of documentation tasks, CVS control etc.
  - An *one-stop-shop* for code development
- IBM's eclipse is a very sophisticated IDE that works for several programming languages
- Most IDEs are tied to a specific language system
- JDEE is available for Java development inside emacs
  - (require 'jde) is all you need put in your .emacs file…
    - Plus some configuration! Tell it where your Java compiler is…
- JDEE is typical – you have class browsing, code completion and built-in templates to speed to coding task

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A Few Words First

- The tools discussed today are very important for your project
- This lecture is about opening the door for you to some software, not a complete teaching tutorial
  - Each might be worth an one-day workshop or even longer
- Take today's lecture as the starting point, use the software and try to command them
  - Consult resources (manuals, online tutorials etc) when you have problems---be an active learner!
  - If cannot solve the problems yourself, post them to the forum
- Team work is very important

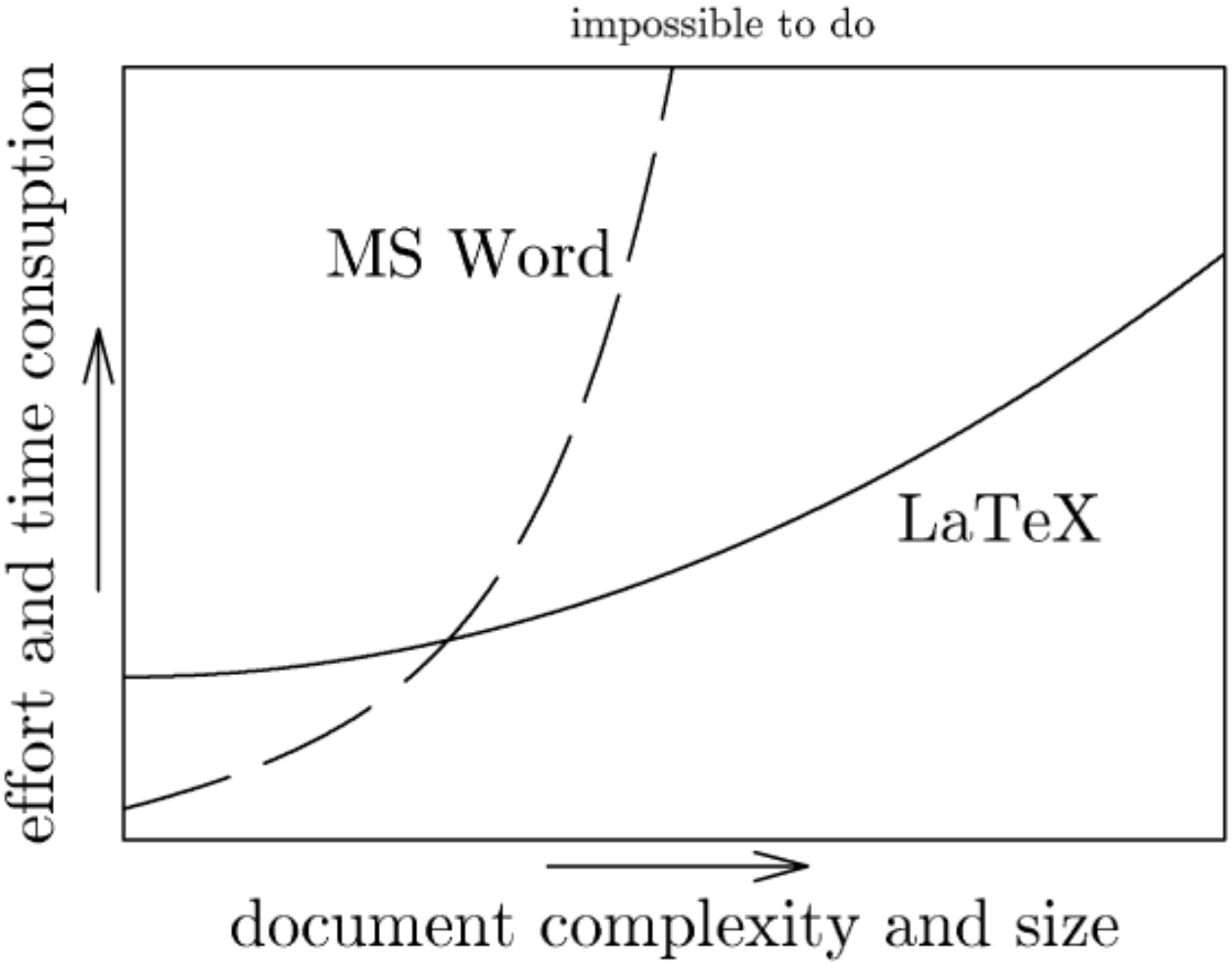
Use of LaTex (LaTex's ABC)

- LaTeX is a macro package which enables authors to typeset their work at the highest typographical quality, using a predefined, professional layout.
- LaTeX was originally written by Leslie Lamport. It uses the TeX for typesetting.
- Tex was written by the legendary computer scientist Donald E. Knuth: http://www-cs-faculty.stanford.edu/~knuth/ . It is intended primarily for typesetting text and mathematical formulae.
- The "X" stands for the Greek letter Chi. TeX is pronounced "Tech" with a "ch" as in the German word "Ach" or in Scottish "Loch". It is definitely is not pronounced "ks"
- In 1995 the LaTeX package was updated by the LaTeX3 team. This version is called LaTeX2e.
- Widely used in professional publication (e.g., publishers like Springer, IEEE, ACM)

Use of LaTex (comparing with WYSIWYG)

- Advantages of LaTeX over WYSIWYG (e.g., MS Word):
  - Professionally crafted layouts are available
  - The typesetting of mathematical formulae is supported in a convenient way
  - Users need only to learn a few simple commands, which specify the logical structure of a document. They almost never need to tinker with the actual layout of the document
  - Complex structures such as footnotes, references, table of contents, and bibliographies can be generated easily
  - For many typographical tasks not directly supported by basic LaTeX, there exist free add-on packages
  - LaTeX encourages authors to write well structured texts
  - LaTeX is highly portable and *free*

Use of LaTex (comparing with WYSIWYG)

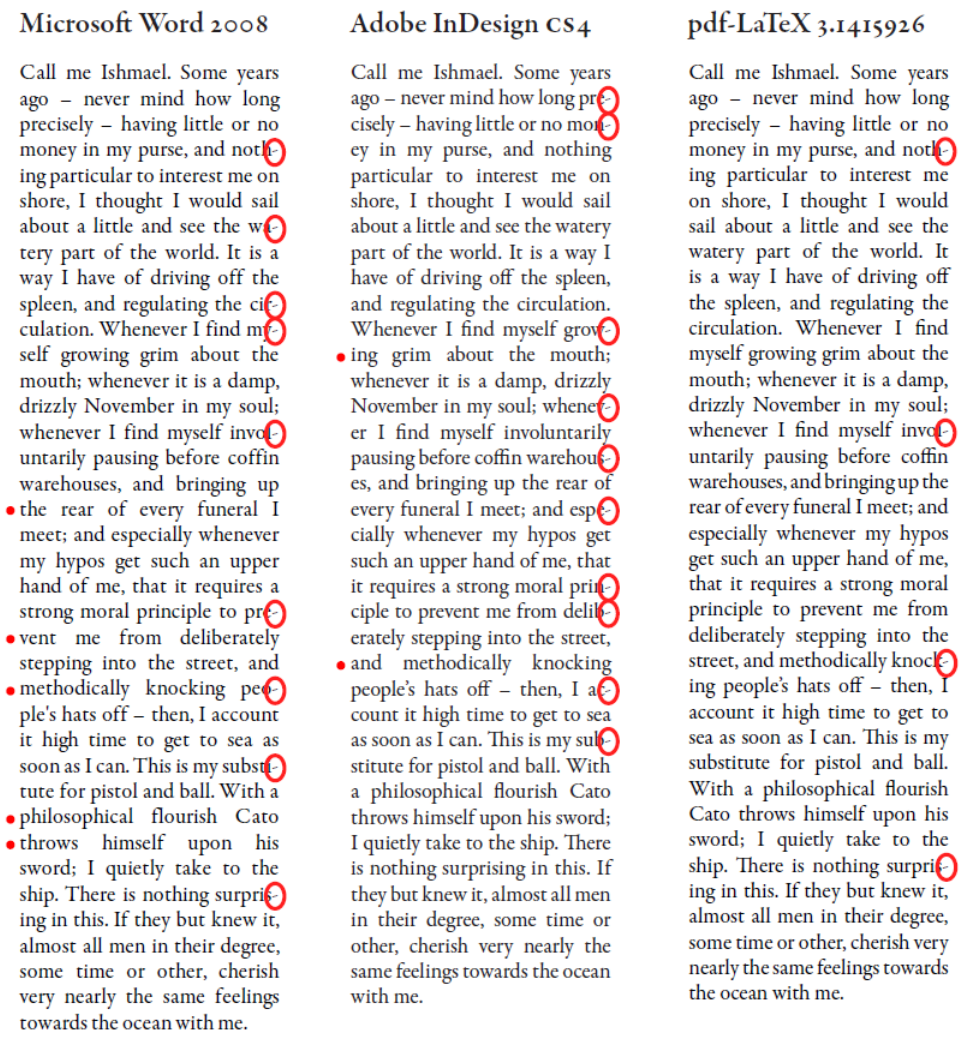


http://www.pinteric.com/miktex.html

Use of LaTex (comparing with WYSIWYG)

- LaTeX also has some “disadvantages”:
  - What you see is not what you get.
    - Is this really a disadvantage? Why are you thinking about layout instead of content?
  - More resources (memory, disk-space, computing power) are required to run a LaTeX system than a simple word processor, But
    - Word for Windows 6.0 needs even more disk space than a normal LaTeX system.
    - When it comes to processor usage, LaTeX beats any WYSIWYG system, as it only needs a lot of CPU time when a document is actually processed
  - The design of a whole new layout is difficult and takes a lot of time.

Use of LaTex (comparing with WYSIWYG)



Microsoft Word 2008

Call me Ishmael. Some years ago – never mind how long precisely – having little or no money in my purse, and nothing particular to interest me on shore, I thought I would sail about a little and see the watery part of the world. It is a way I have of driving off the spleen, and regulating the circulation. Whenever I find myself growing grim about the mouth; whenever it is a damp, drizzly November in my soul; whenever I find myself involuntarily pausing before coffin warehouses, and bringing up the rear of every funeral I meet; and especially whenever my hypos get such an upper hand of me, that it requires a strong moral principle to prevent me from deliberately stepping into the street, and methodically knocking people's hats off – then, I account it high time to get to sea as soon as I can. This is my substitute for pistol and ball. With a philosophical flourish Cato throws himself upon his sword; I quietly take to the ship. There is nothing surprising in this. If they but knew it, almost all men in their degree, some time or other, cherish very nearly the same feelings towards the ocean with me.

Adobe InDesign CS4

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pdf-LaTeX 3.1415926

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Use of LaTex (comparing with WYSIWYG)

Hyphenation and inter-word spacing statistics

	Word	InDesign	pdf-LaTeX
Number of hyphenations	9	10	4
SD of IWS (pt)	2.26	1.94	1.42
Maximum IWS (pt)	14.4	13.2	9.0
Number of lines with IWS > 9 pt	5	2	0

SD: standard deviation; IWS: inter-word spacing

Use of LaTeX

- We cannot demonstrate how to use LaTeX. Having manuals of LaTeX on hand is necessary. Print one and keep it for your reference
  - A simplified introduction to Latex
    - http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.122.6892&rep=rep1&type=pdf
  - The not so short introduction to Latex 2e
    - http://tobi.oetiker.ch/lshort/lshort.pdf (also available from course website)

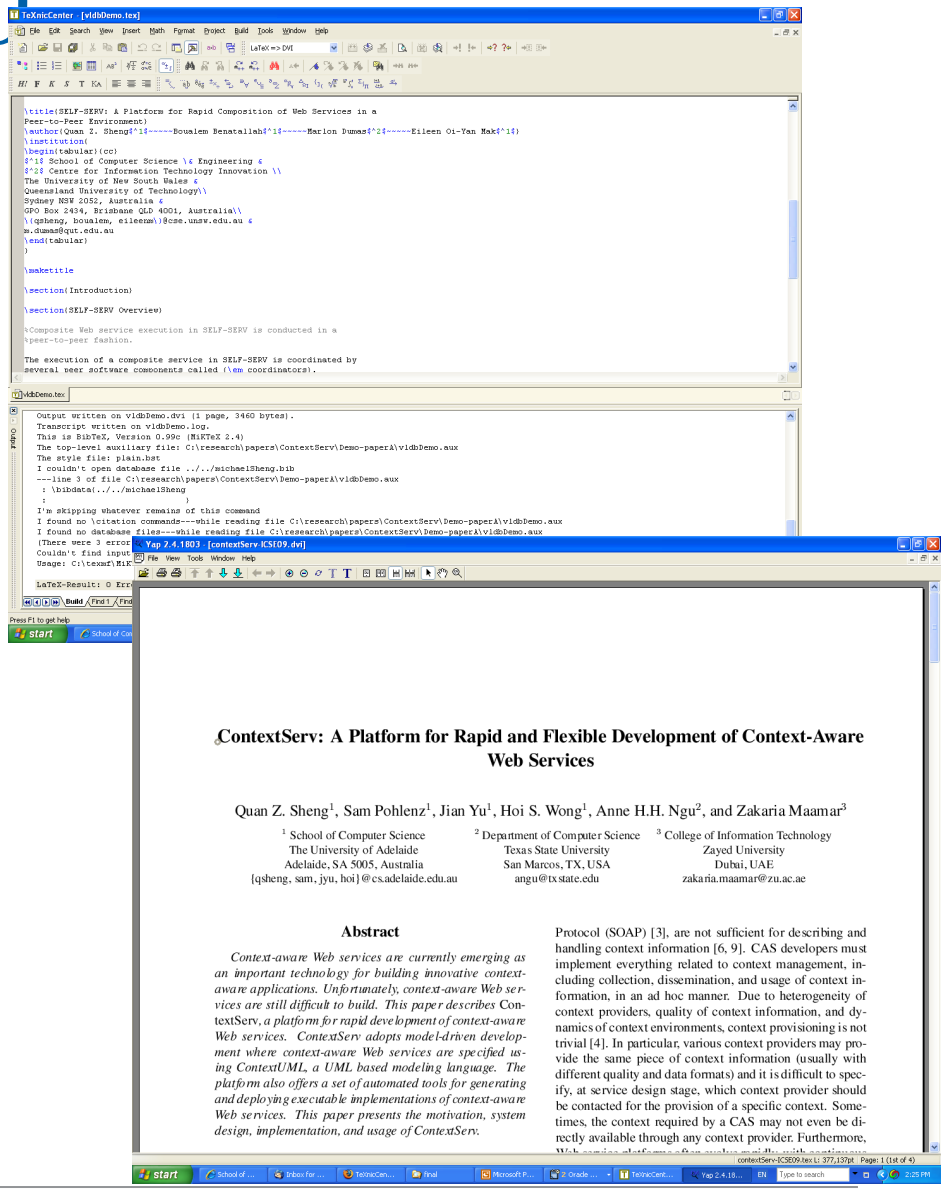
- Post a question on the forum if you have difficulties in using LaTex.

Use of LaTeX (Cont.)

- Some quick command tips
  1. latex *paper* (compile your document paper.tex)
  2. bibtex *paper* (compile references, you need to re-run 1)
  3. xdvi *paper* (display your document)
  4. dvips *paper* (produce postscript of your document, paper.ps)
  5. ps2pdf *paper.ps paper.pdf* (produce PDF of your document, paper.pdf)
  6. dvipdf *paper.dvi paper.pdf* (produce PDF from dvi directly)

Use of LaTeX (Cont.)

- Latex IDEs
  - **TexnicCenter**: easy to use integrated environment for creating Latex documents on Windows platforms.
  - http://www.texniccenter.org
  - **Kile**: an integrated LaTex environment for Linux
  - http://kile.sourceforge.net
  - **TexWorks**: cross-platform LaTex IDE
  - https://www.tug.org/texworks/



Apache Ant

- What is Ant?
  - A build tool
  - Implemented in Java
  - An open source maintained by Apache

- What can Ant do?
  - Can compile source codes
  - Can run unit tests (e.g., Junit)
  - Can package compiled code and resources (e.g., jars, wars, ears, tars, zips etc)
  - Can handle dependencies between targets
  - Can do much more (Ant comes with over 80 built-in core tasks)

Apache Ant (Cont.)

- Each project using Ant will have a build file
  - Typically called build.xml
- Each build file has one or more targets
  - Targets correspond to activities like compiling, running codes
- Each target has one or more tasks, which are executed in sequence when the target is executed
- A simple build file for Hello.java:

```
<project default="compile">
  <target name="compile">
    <javac srcdir="." />
  </target>
  <target name="jar" depends="compile">
    <jar destfile="Hello.jar" basedir="." includes="**/*.class"/>
  </target>
  <target name="run" depends="jar">
    <java classname="Hello"
        classpath="Hello.jar" fork="true"/>
  </target>
</project>
```

compile

package

execute

Apache Ant (Using Ant)

- After download, don't forget to set your environment
  - Define ANT_HOME as the place where Ant stores
  - Check your Java home
  - Add to PATH
- ant [options] [target-names]
  - If no target name is given, run the default target
- ant –help
  - List other command-line options
- ant – projecthelp
  - List targets in build.xml of the current directory
- Other more tips (important!) see:
  - http://ant.apache.org/manual/index.html
  - http://www.exubero.com/ant/antintro-s5.html

Make

- Make is a simple tool available with Unix
- Make accepts a specification of the hierarchy and a set of rules which can be used to generate the system.
- Make, and all similar systems, work by examining the timestamps on the files.
- Imagine you have files main.c and main.o
  - if you see the timestamp on main.c is later in time than main.o, then main.o is out of date and needs re–compilation.
- This relationship is transitive, so if any module on which this module depends is out of date, then so is this module.
- Make also has a set of rules for "making" one kind of a file from another
  - You can make a ".o" file from a ".c" file via the C compiler

About Your Project

- Learn the tools mentioned (LaTeX, Git, Ant)
- You will be required to demonstrate your understanding of the tools!
- Investigate an IDE for Java programming
  - The lab machines have Eclipse already installed
- Explore other tools to improve your process and productivity
- Find what works for you and your team
- A little bit of effort in the right places can pay off immensely