CS 349
Layout

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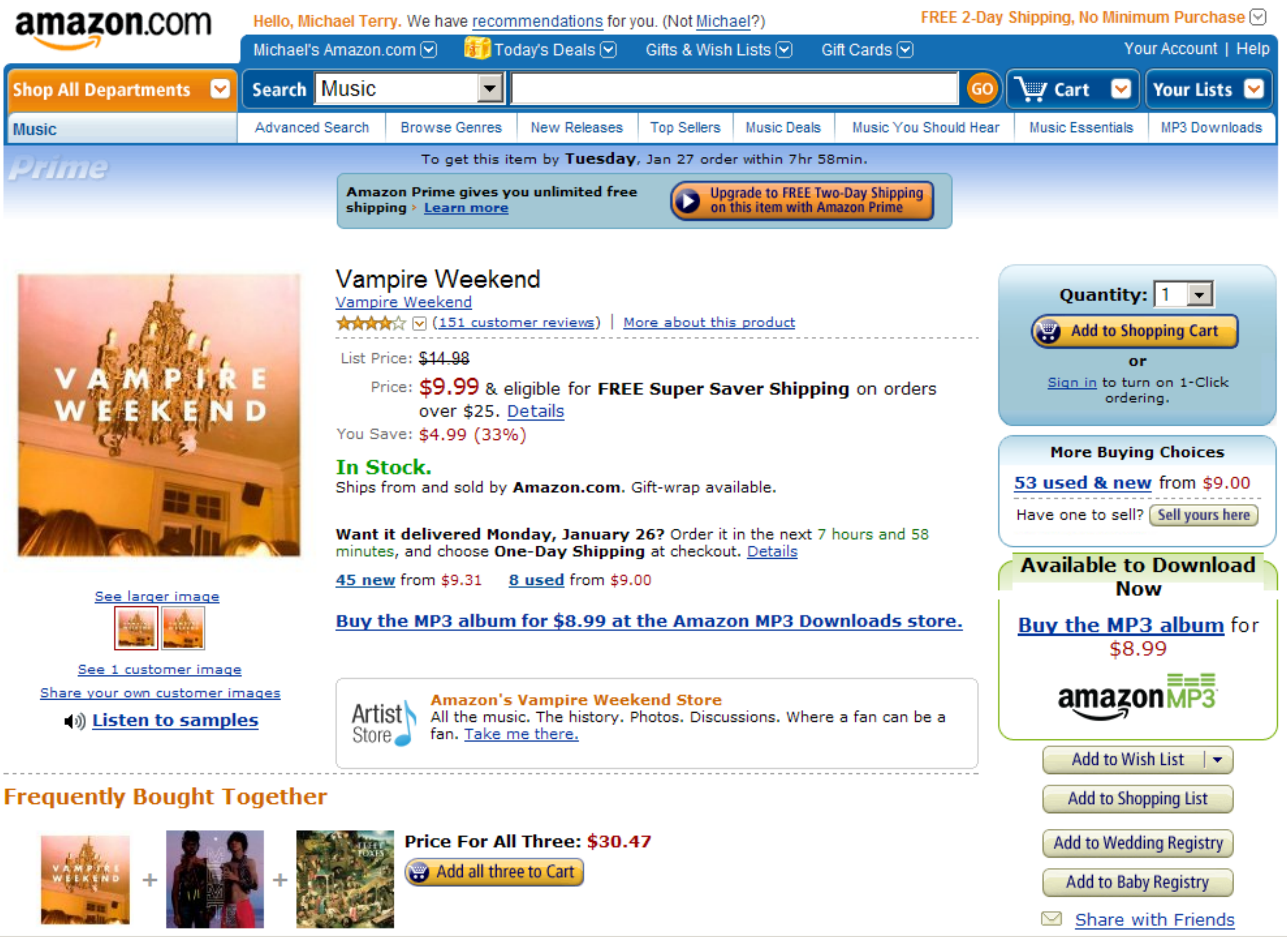
Spring 2009

Slides mostly by Michael Terry

University of Waterloo

Interface Layout

- Layout of components can be thought of as two processes:
  - Determining an optimal visual layout (ie, applying principles of good graphic design)
  - Applying algorithms that maintain that desired visual layout through resizes of window
- Demo: Amazon page
- This lecture focuses on the latter



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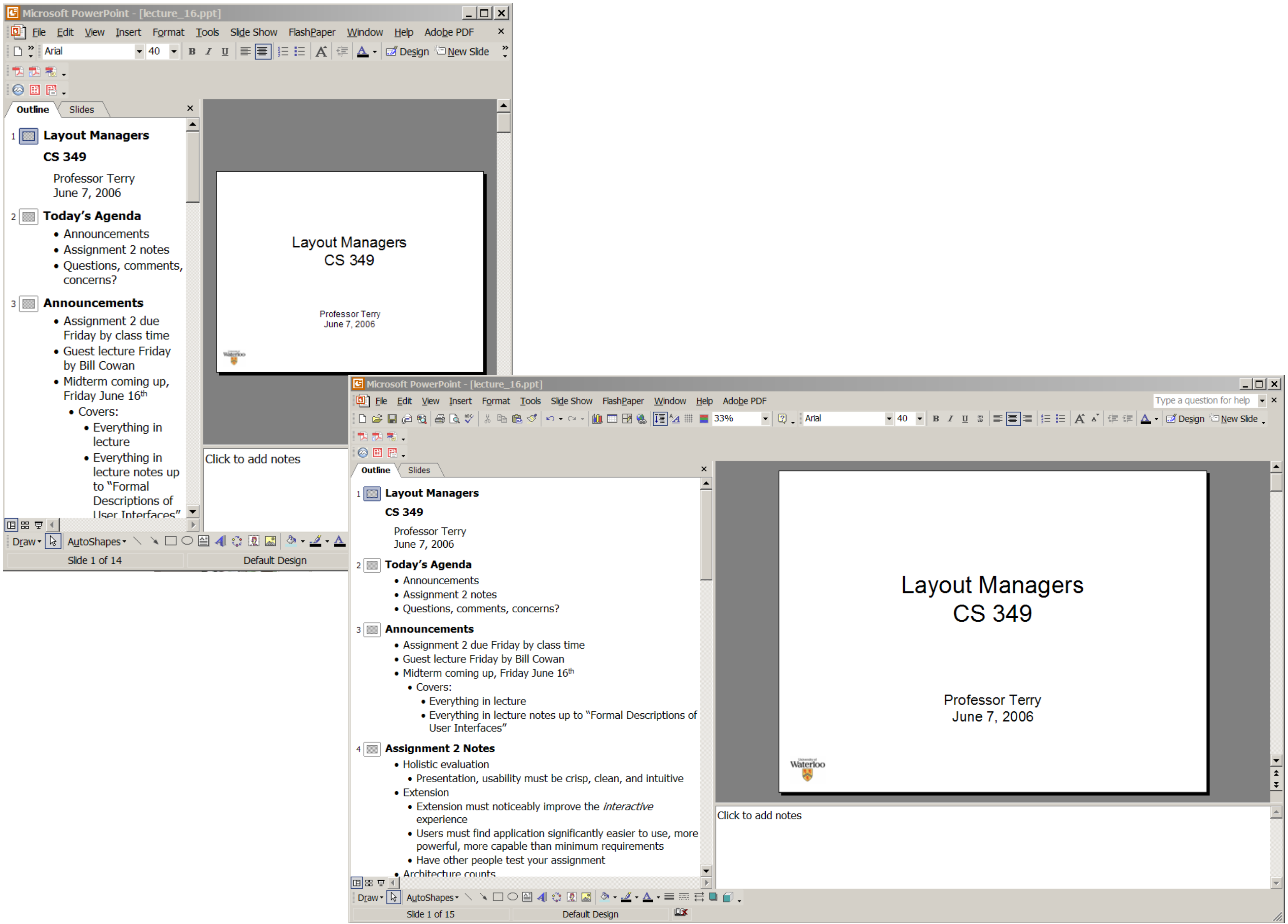

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1 **Layout Managers**

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Professor Terry
June 7, 2006

2 **Today's Agenda**

- Announcements
- Assignment 2 notes
- Questions, comments, concerns?

3 **Announcements**

- Assignment 2 due Friday by class time
- Guest lecture Friday by Bill Cowan
- Midterm coming up, Friday June 16th
  - Covers:
    - Everything in lecture
    - Everything in lecture notes up to "Formal Descriptions of User Interfaces"

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4 **Assignment 2 Notes**

- Holistic evaluation
  - Presentation, usability must be crisp, clean, and intuitive
- Extension
  - Extension must noticeably improve the *interactive* experience
  - Users must find application significantly easier to use, more powerful, more capable than minimum requirements
  - Have other people test your assignment
- Architecture counts

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Dynamic Layout

- Windows are dynamic, can be resized
- Through any resize, we wish to:
  - Maintain *consistency* in interface's presentation
  - Preserve *affordances* communicated through interface's layout
  - Preserve overall visual layout found to be ideal in user testing
- Need to dynamically modify allocation of space, locations of objects in interface

Dynamic Layout

- Dynamic layout a process of:
  - Specifying components
  - Specifying desired *constraints* for the components and their relationships with respect to one another
  - Attempting to satisfy those constraints
- Dynamic layout has applications in:
  - User interface design
  - Document layout (eg, TeX)
  - Information visualization

Layout in Java

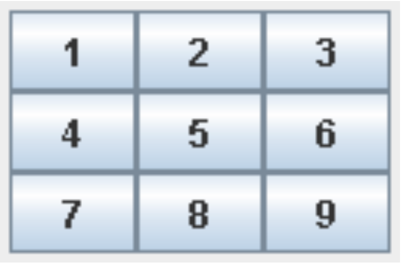
- *Containers* maintain collection of components
- Container (eg, JPanel) can utilize a *LayoutManager*

  ```
  myPanel.setLayout(new GridLayout(1,1))
  ```

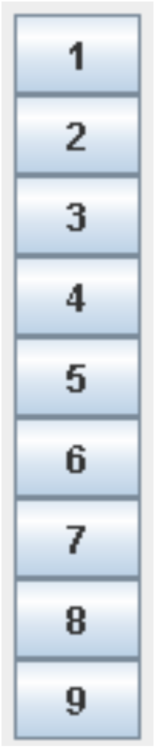
- LayoutManager a *strategy pattern* that factors out process of positioning, sizing components within that container
- Can vary LayoutManager independently of container, components

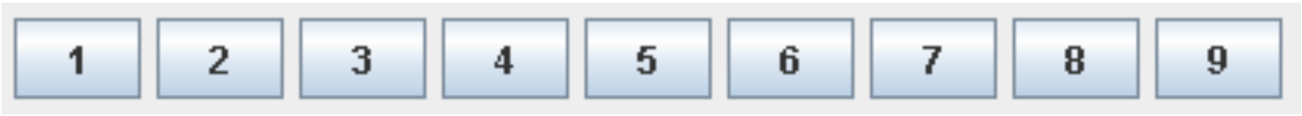
Layout Example

Grid Layout



Box Layout (y axis)





Flow Layout

Java Layout Demo

- LayoutDemo.java
- Available on CS349 Resources page.

General Layout Strategies

- Fixed layout
- Intrinsic size
- Struts and springs
- Variable intrinsic size
- Constraints

Fixed Layout

- Components are of a fixed size, position
- In Java, achieved by setting LayoutManager to *null*
- Where/when is this practical?
- How can it break down even when windows aren't resized?

Intrinsic Size

- Query each item for its preferred size
- Grow the component to perfectly contain each item
- A bottom-up approach where top-level component’s size completely dependent on its contained components
- Example LayoutManagers in Java that use this strategy
  - BoxLayout, FlowLayout
- Examples of use in interface design?
- Special needs?

Intrinsic Size Uses and Needs

- A list of items that grows to accommodate every item
  - Menus
  - Address book list
- Text documents
  - Text panel continually grows to contain text
- If can grow arbitrarily large, could overflow bounds of screen
  - Scrollbars, cascading menus help address these problems

Struts and Springs

- Layout specified by marking aspects of components that are fixed vs. those that can “stretch”
- Strut defines a fixed length (width/height)
  - Specifies invariant relationships in a layout
- Spring defines a space that “pushes” on nearby edges
  - Specifies variable relationships
- Example LayoutManagers in Java
  - SpringLayout

Struts and Springs Uses

- One of the most common strategies, especially in user interface builders
- Provides easily accessible metaphors for people performing layout
- Cocoa demo…

Variable Intrinsic Size

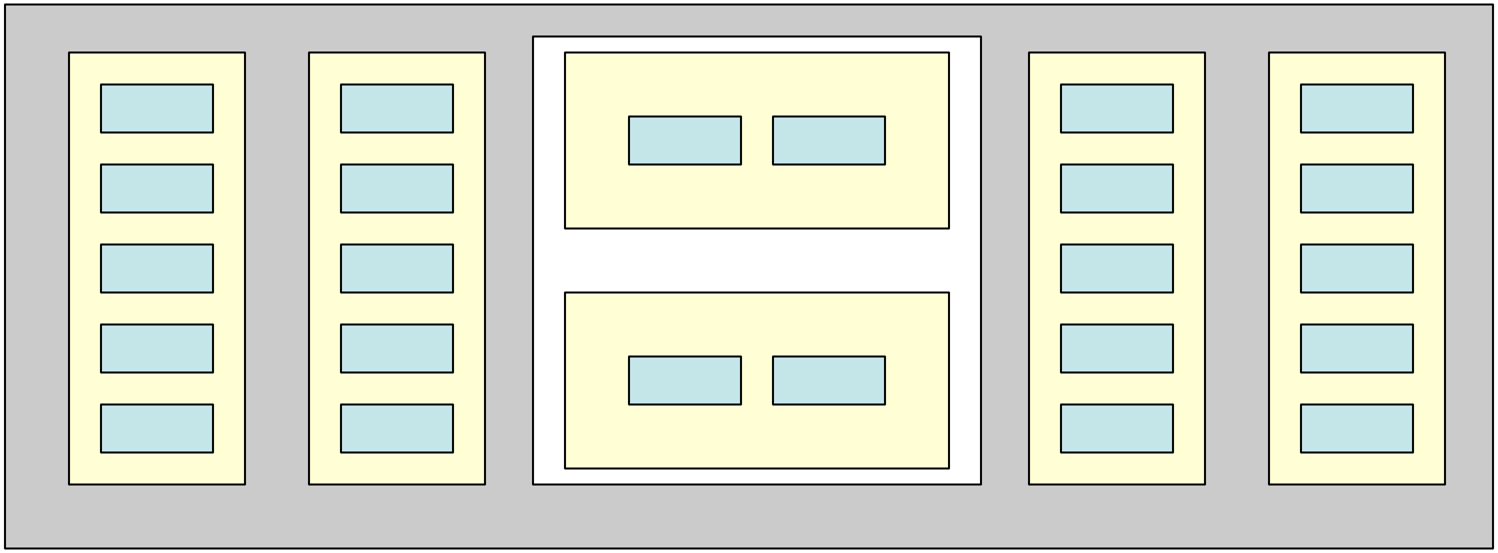
- Layout determined in bottom-up and top-down phases
- Bottom-up phase:
  - Container asks each child for its preferred, minimum, maximum sizes
  - Values used to partition the container's space
- Top-down phase:
  - Children are sized and told to lay themselves out in space specified
- Example LayoutManagers in Java
  - GridBagLayout

Tips and Strategies

- javax.swing.Box has number of useful items that can be used in *any* layout manager
  - “Glue”
    - `Box.createHorizontal/VerticalGlue()`
    - Similar to notion of “springs”: Expands to fill space
  - Struts
    - `Box.createHorizontal/VerticalStrut()`
  - Rigid areas
    - `Box.createRigidArea()`

Tips and Strategies

- Cluster components into panels based on layout needs
- Provide layout manager for each panel



Tips and Strategies

- Define your own layout manager if necessary

```
public interface LayoutManager
{       void addLayoutComponent(String name, Component comp);
        void removeLayoutComponent(Component comp);
        Dimension preferredLayoutSize(Container parent);
        Dimension minimumLayoutSize(Container parent);
        void layoutContainer(Container parent);
}
// LayoutManager2 has methods for specifying constraints
```

Constraints

- Specify the mathematical relationships between components of the interface.
  - All of the layout managers have constraints to some degree.
  - This is meant to be more general.
- Prefuse takes it to a new level
  - Demo
    - AggregateDemo
    - GraphView
    - Fisheye Menu
    - TreeView
  - See prefuse.org for downloads, videos, etc.
    - Importing into Eclipse is particularly straight-forward if you follow the instructions!