Programming Languages

Tevfik Koşar

Lecture - I
January 17th, 2006

Contact Information

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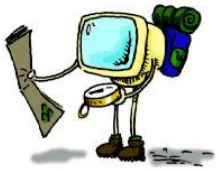
- Office hours: Tue & Thu, 1:30pm – 2:30pm
- Course web page: http://www.cct.lsu.edu/~kosar/csc4101

- Provide me with your active email address to be added to the class mailing list.

Roadmap

- Meet the Professor
  - Background
  - Teaching philosophy
- Motivation for the Course
  - What expect to learn?
- Introduction to the Course Material
- Administrative details
- Take Photos



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Tevfik Kosar

- Joined LSU in August 2005
- Education:
  - PhD: University of Wisconsin-Madison (CS)
  - MS: Rensselaer Polytechnic Institute, NY (CS)
  - BS: Bosporus University, Turkey (CompE)
- Teaching
  - This semester:
    - CSC 4101 – Programming Languages
  - Next year:
    - CSC 4103: Operating Systems
    - CSC 7700: Data Intensive Distributed Computing

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Research

- Grid Computing
  - Analogy to the Power Grid
  - A special case for Distributed Computing
  - Spans wide area networks and multiple administrative domains
- The Center for Computation & Technology
  - Spend half of my time there
  - Office: Johnston 333
  - Multi-disciplinary research
  - http://www.cct.lsu.edu

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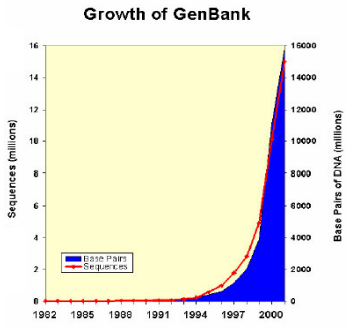
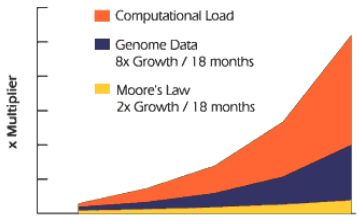
The Imminent Data "deluge"

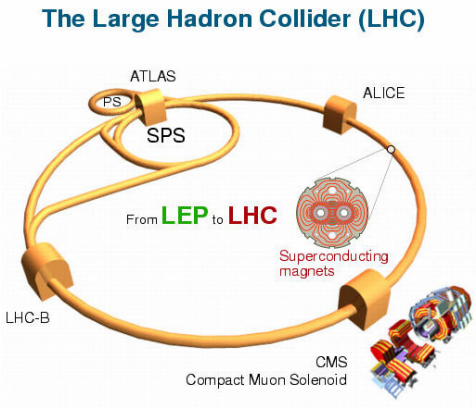
- Exponential growth of scientific data
  - 2000 : ~0.5 Petabyte
  - 2005 : ~10 Petabytes
  - 2010 : ~100 Petabytes
  - 2015 : ~1000 Petabytes
- *"I am terrified by terabytes"*
  -- Anonymous
- *"I am petrified by petabytes"*
  -- Jim Gray
- Moore's Law outpaced by growth of scientific data!





A High Energy Physics Project: LHC

- The detectors at the LHC will probe fundamental forces in our Universe , such as search for the yet-undetected Higgs Boson.
- Starting in 2006 the LHC accelerator will produce proton-proton collisions with a rate of 10^9 events/s.
- Four detectors:
  - ATLAS, CMS, ALICE, LHC-B
- LHC Challenges:
  - **11 Petabytes of data per year**
  - **100,000 CPUs**
  - **5000 physicists, in 300 institutes in 50 countries**



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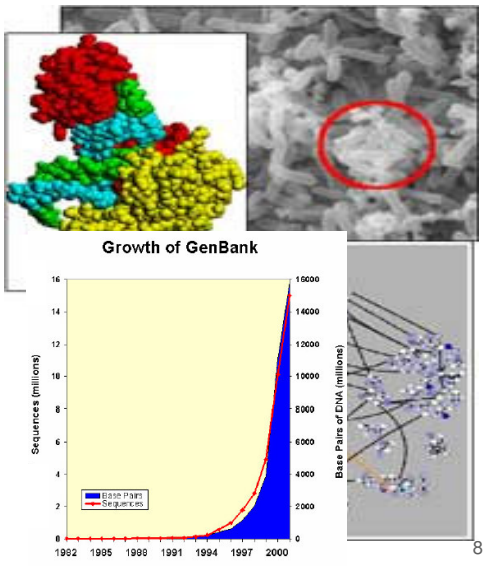
A Bioinformatics Project: BLAST

- Goal: decode genetic information and map the genomes of humans, and other species.
- Uses comparative genomics: compares unknown genetic sequences (~billions) to known genomes in search of similarities.
- Current dataset:
  - Several Petabytes
- Future:
  - Exponential Growth: SCARY!



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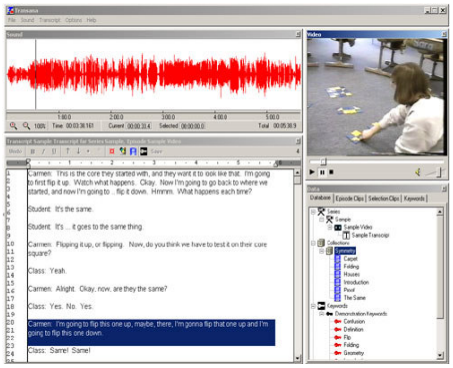
An Educational Technology Project: WCER Educational Video Processing



- Build histories of student learning for use in education research and instruction relying on video data.
- Analyze and share large amount of video.
- 1 hour DV video is ~13 GB
  - A typical educational research video uses 3 cameras => 39 GB for 1 hour
- Current data set:
  - > 500 Terabytes
- Future:
  - Several Petabytes

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Astronomy

- Mapping of Universe, detection of new galaxies and stars…

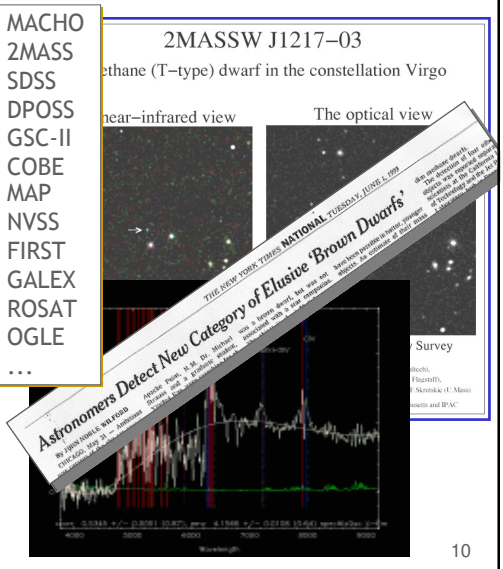
Current Datasets

Project	Data Volume
DPOSS	3 TB
2MASS	12 TB
SDSS	40 TB

Future Productions

Project	Data Volume
WFCAM	20 TB/year
VISTA	100 TB/year
LSST	1000 TB/year

MACHO
2MASS
SDSS
DPOSS
GSC-II
COBE
MAP
NVSS
FIRST
GALEX
ROSAT
OGLE
…



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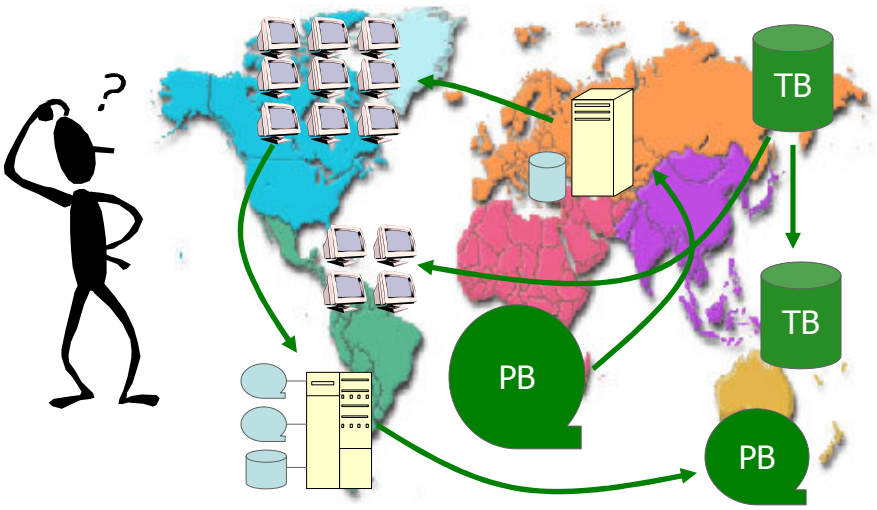
How to access and process distributed data?



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Interested?

- Send an email to kosar@lsu.edu
- Register for a independent study (CSC 4999)
- Take 3 credits for doing research in one of these interesting topics during one semester

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Teaching Philosophy

- Goal:
  - For instructor: teaching the material
  - For student: learning and applying the material in real life
- Grades are of second degree importance
- Do not memorize, understand the material
  - Exams may be openbook!
- You are only responsible from material
  - Covered in the class
  - Part of projects or homework assignments

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Programming Languages

- How many different programming languages are there?
  - More than 200!
- Can you name some of them?
- Which ones have you used before?
  - Java
  - C++
  - C
  - Lisp/Scheme
  - Prolog
  - ….

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Language of the Computer

- Machine Language
  - Consists of 0's and 1's
  - Which refers to high and low voltage states
  - 0010 0111 1010 1101 1111 1111 1101 0000 ….
  - 27bdffd0 afbf0014 0c1002a8 …
- Assembly Language
  - **push bx**
    mov bx
    div bx
    add dx
  - **Direct mapping to machine language**
- Higher Level Languages
  - C, C++, Java, Pascal, Scheme, Prolog ..
  - First one: Fortran

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Why are there so many programming languages?

- Special Purposes
  - Each language is designed to solve a certain problem:
    - Perl for string parsing and manipulation
    - C/C++ for systems programming
    - Java for platform independent programs
    - Prolog for logic programming and AI
    - Fortran for numerical computations
- Personal Preferences
- Evolution
  - Learn better ways of doing things over time..
  - eg. from "go to" to "while" loops, "case" statements

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What makes a language successful?

- easy to learn (BASIC, Pascal, LOGO, Scheme)
- easy to express things, easy use once fluent, "powerful" (C, Common Lisp, APL, Algol-68, Perl)
- easy to implement (BASIC, Forth)
- possible to compile to very good (fast/small) code (Fortran)
- backing of a powerful sponsor (COBOL, PL/1, Ada, Visual Basic)
- wide dissemination at minimal cost (Pascal, Turing, Java)

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Programming Paradigms

- Group languages as
  - declarative
    - functional (Scheme, ML, pure Lisp, FP)
    - logic, constraint-based (Prolog, VisiCalc, RPG)
  - imperative
    - von Neumann (Fortran, Pascal, Basic, C)
    - object-oriented (Smalltalk, Eiffel, C++)
    - scripting languages (Perl, Python, JavaScript, PHP)

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Why study programming languages?

- Help you choose a language
- Make it easier to learn new languages
  - Syntactic similarities
    - C++ vs Java
  - Conceptual siilarities
    - C vs Pascal
- Help you make better use of whatever language you use
  - Choose among alternative ways
    - Using arrays vs pointers
    - Loops vs Recursion
  - Simulate useful features in languages that lack them
    - Faking pointers
    - Faking modularity

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Textbooks

- Required text:
  - Programming Language Pragmatics (2nd edition)
  - *by Michael Scott, Morgan Kauffman Publishers, 2005*
- Recommended text:
  - Concepts of Programming Languages (6th edition)
  - *Robert W. Sebesta, Addison-Wesley, 2003*
- There will be additional links for supplementary course material on the course web page

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Grading

- The end-of-semester grades will be composed of:
  - Popup Quizzes : 5%
  - Active Contribution : 5%
  - Homework : 15%
  - Projects : 30%
  - Midterm : 20%
  - Final : 25%

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Reading Assignment

- Read chapter 1 from Programming Language Pragmatics (PLP).

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Any Questions?