Grundzüge der Wirtschaftsinformatik
Introduction to Business Information Systems

Unit 3
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Logistics

- **Lecture**
  - Tuesdays, 13:15 - 14:45, Auditorium Maximum (Building 33)

- **Tutorial and Exercises (Begin: October 17)**
  - Wednesdays, 11:30 – 13:00, Building 33 Room 2401 (in German)
  - Thursdays, 09:45 - 11:15, Building 43 Room 4/126 (in German)
  - Thursdays, 15:00 - 16:30, Building 33 Room 2216 (in German)

Waiting for feedback on available classrooms...

Assignment from Last Week

- WI2: pp. 93-211, 387-515
- IBIS, pp. 55-78
- Review the slides

WI1 = Hansen/Neumann: Wirtschaftsinformatik 1; WI2 = Hansen/Neumann: Wirtschaftsinformatik 2; IBIS = Wigand et al: Introduction to Business Information Systems.

Structure of the Lecture

Unit 1: Introduction
Unit 2: Central Processing Units
Unit 3: Storage and Data Structures
Unit 4: Input and Output Devices
Unit 5: Software
Unit 6: Networks, Data Interchange, and the Internet
Unit 7: Design, Development, Deployment, and Operations of Information Systems
Unit 8: Office Applications
Unit 9: Enterprise Applications
Unit 10: Supply Chain Applications and E-Business
Unit 11: Management Support Systems
Unit 12: Exam Review

Storage and Data Structures

If we want to store information in a computer system, we need to
- Develop a **representation structure** and
- Have a **media** to write to and read from

1. Coding
2. Storing
3. Reading
4. Decoding
### Storage and Data Structures

**1. Coding**

<table>
<thead>
<tr>
<th>Number</th>
<th>Represents</th>
</tr>
</thead>
<tbody>
<tr>
<td>00110111</td>
<td>I</td>
</tr>
<tr>
<td>00110101</td>
<td>N</td>
</tr>
<tr>
<td>00111110</td>
<td>V</td>
</tr>
<tr>
<td>00111101</td>
<td>O</td>
</tr>
<tr>
<td>00110111</td>
<td>I</td>
</tr>
<tr>
<td>00110011</td>
<td>C</td>
</tr>
<tr>
<td>00010100</td>
<td>E</td>
</tr>
</tbody>
</table>

**2. Storing**

- USB Stick
- Hardisk
- DVD-R

**3. Reading**

All information must be converted into a sequence of numbers between 0 and 255.

**4. Decoding**

### Data vs. Information

**Data**

- 8-28-2003 Miller, John 37.40
- 8-28-2003 Smith, Bill 23.20
- 8-27-2003 Burger, Mary 11.11
- 8-26-2003 Miller, John 40.00

**Information**

- Turnover 111.71
- Total sales by customer:
  - Miller, John 77.40
  - Smith, Bill 23.20
  - Burger, Mary 11.11
- Customers on August 28:
  - Miller, John
  - Smith, Bill

### Storage

- Exploiting physical phenomena for storing and retrieving data
- Examples:
  - Iron and iron oxide (ferrous oxide) can keep magnetism
  - A laser can be used to modify the surface of a media so that it reflects (or no longer reflects) light

### Atomic Data

- **Characters and Symbols**
  - A-Z, 0-9
- **Numbers**
  - Integer
    - 1, 2, 3
  - Floating-point
    - 3.1415
    - 6.7

### Encoding Characters and Strings

- Define the set of relevant characters (an alphabet)
- Examples
  - Just A-Z and 0-9
  - A-Z, a-z, ÆØÜ, åöü, ß
  - Mathematical symbols
- Create a mapping between characters and binary values


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**INVOICE #1234**
Neubiberg, Oct 16
1 Laptop € 1999.00
Common Codesets

- **ASCII**: “American Standard Code for Information Interchange (ASCII)”
- Extended ASCII (8 Bit): ISO 8859
  - 256 characters \( \rightarrow \) 0-255
- Unicode: 1,114,112 (= \(2^{20} + 2^{16}\)) possible code points
  - Currently about 100,000 of those used
  - Including Chinese, Korean, and Japanese characters
- UTF-8 and UTF-16
  - Varying number of bytes per character, depending on its frequency of usage

Encoding Real Values

- Fixed-point representation
  - E.g., one byte or half a byte per digit
- Floating-point representation
  - **Mantissa** or significant: string of digits
    - Base 2 or base 10
  - **Exponent**: The power of the base by which the significant is multiplied
- Example
  - \(2.753E3 \rightarrow 2.753 \times 10^3\)

On the Importance of Codeset Standardization

> “I have also approved recommendations of the Secretary of Commerce regarding standards for recording the Standard Code for Information Interchange on magnetic tapes and paper tapes when they are used in computer operations. All computers and related equipment configurations brought into the Federal Government inventory on or after July 1, 1969, must have the capability to use the Standard Code for Information Interchange and the formats prescribed by the magnetic tape and paper tape standards when these media are used.”


Encoding Integer Values

- **Non-negative Integers**
  - Simple binary numbers
  - Combine multiple bytes to store larger numbers
  - Example: 16 Bit Number for values 0 – 65535
  - Represented value: lower byte + 256* higher byte
- **Positive and Negative Values**
  - Simple: Use highest bit for storing the sign (+/-)
  - Two-complement

Precision Problems

- What is 1/3 * 3?
  - 1?
  - 0.99999?
- Significant rounding errors can occur in computer systems, because such precision problems sum up

Complex Data

- **Strings**
  - „Peter Miller“, „Universität der Bundeswehr“
- **Structured Data**
  - Qty / Description / Price
Complex Data: Fixed Length vs. Explicit Delimiters

- **Fixed Length**: All fields have the same length
  - 255 characters for each street address
- **Explicit Delimiters**: A special character that is not included in the regular alphabet indicates the end of one data field
  - Example: Comma-separated Values (CSV) "Peter Miller, Hauptstrasse 8, Neubiberg"

Dataset and Files

- **Dataset**: Set of data elements (atomic or complex) that belong together
  - Address: Name, Street, ZIP, City
  - Invoice: Customer, Items, Total
- **File**: Collection of datasets of the same type
  - All addresses
  - All invoices

Machine-readable Content vs. Unstructured Data

```
ORDER
QTTY=3
ITEMNO=1234

“Please send me 3 pieces of item no. 1234.”
```

Further Examples

<table>
<thead>
<tr>
<th>Good</th>
<th>Bad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structured text message</td>
<td>Fax Image</td>
</tr>
<tr>
<td>Vector drawing of a floor plan</td>
<td>Photo</td>
</tr>
</tbody>
</table>

Locating a Dataset in a File

- **Fixed length**: Dataset Number * length of Dataset
  - Example:
    - Each address be 250 characters long
    - 1st address starts at first byte (0), 2nd at byte 250, 3rd at byte 500, ...
- **Variable length**
  - Explicit dataset delimiter (different from field delimiter)
  - Table with pointers to beginning of datasets

Storage

- Exploiting physical phenomena for storing and retrieving data
- Examples:
  - Iron and iron oxide (ferrous oxide) can keep magnetism
  - A laser can be used to change the surface of a media so that it reflects (or no longer reflects) light
Access Methods

- **Sequential**: records must be retrieved in order
  - Devices used are called sequential access storage devices (SASD)
- **Direct**: records can be retrieved in any order
  - Devices used are called direct access storage devices (DASDs)

Hard Disks

- **Platters**
- **Read/Write Head**
- **Actuator Arm**

![Dust Particle](http://www.flickr.com/photos/gek_at2000/485151116/)

Dust and Abrasion

- A few micrometers (ca. 1/1,000,000 yard)

Speed

- \[ r = \frac{3.5\,\text{"}}{2} \]
- \[ \text{diameter} = 3.5\,\text{"} \]
- \[ \text{circumference} = 2\pi r \]
- \[ = 3.5\,\text{"} \times 3.1415 = \text{ca. 11"} \]
- \[ = 7200\,\text{rpm} \]
- \[ = 11\,\text{"} \times 7.200\,\text{inch/minute} = (79,200\,\text{"/min}) \]
- \[ = 11\,\text{"} \times 7.200 \times 60\,\text{inch/hour} = 4,752,000\,\text{inch/hour} \]
- \[ = 4,752,000 / 63,360 = 75\,\text{mph} \]
Headcrash

Floppy Disk

Hard Disks

CD-ROM

Flash Memory

CD-ROM
Only ONE Track!

CLV vs. CAV

CLV: Constant Linear Velocity: inches per second remains constant
CAV: Constant Angular Velocity: rotations per second remains constant

CD-R

Magneto-Optical Drives

http://www.usbyte.com/common/MOsystems.htm

Memory Hierarchy

Virtual Memory, Archival & Persistence

Caching

CPU
Register
L1 Cache
L2 Cache
Main Memory
Random-Access Media
(Harddisk)
Media for Backup and Archival

Assignment for Next Week

- WI2: pp. 213-300
- Review the slides

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Thank you!

The slides and additional materials will be available at
http://www.heppnetz.de/teaching/psu/
shortly.

Don't forget: Tutorials will start this week!