Information Systems

2 Data Flow Diagrams (DFD)

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Previously, we looked at rich pictures - an informal way of visualising a system. Now we look at data flow diagrams - a formal way of visualising a system.

Data flow diagrams show the movement of data between processes and files. We check them out and see how to create them. Data flow diagrams are sometimes called **information flow diagrams**.

2.1 Notation
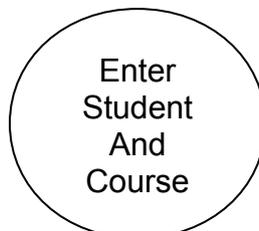
Curved Arrows represent the flow of data.
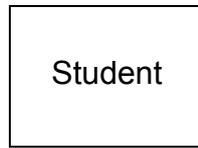
completedEnrolmentForm

Parallel lines represent a data store. A data store could be a file on disk or a paper file.

studentRecords

Circles represent processes. A process acts on data. A process could be to store data on a file, or to retrieve data from a file.
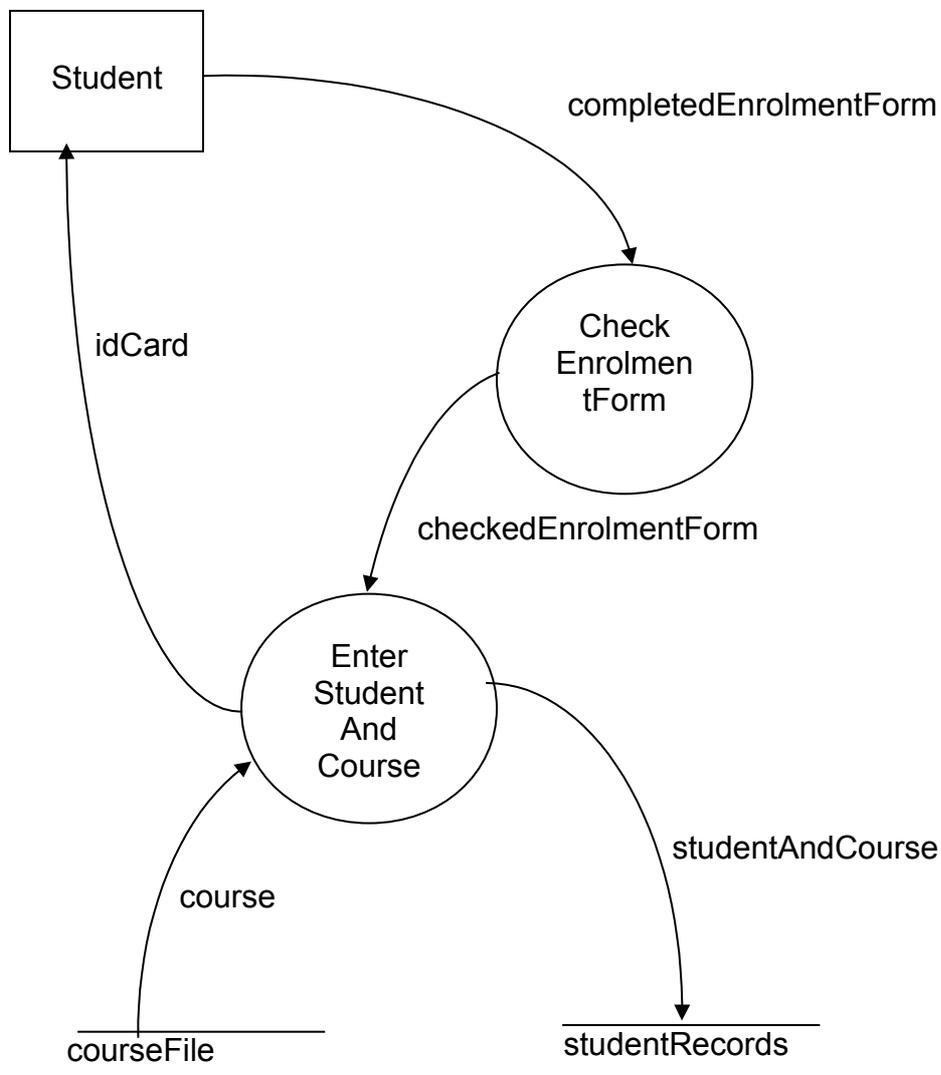
Enter
Student
And
Course

Rectangles represent sources or sinks of data outside the system. A source is where data comes from. A sink is where data goes to.

```
┌─────────────┐
│             │
│   Student   │
│             │
└─────────────┘
```

Data flows, data stores, processes, sources and sinks all have descriptive names.

2.2 Student Enrolment System

```
┌───────────┐
│           │  ──────────→  completedEnrolmentForm
│  Student  │                        ↓
│           │                   ╭─────────╮
└───────────┘                   │  Check  │
      ↑                         │Enrolmen │
      │                         │  tForm  │
   idCard                       ╰─────────╯
      │                              │
      │                    checkedEnrolmentForm
      │                              ↓
      │                         ╭─────────╮
      │                         │  Enter  │
      │                         │ Student │
      │                         │   And   │
      │                         │ Course  │
      │                         ╰─────────╯
      │              ↗                    ↘  studentAndCourse
   course                                     ↓
  ─────────────                        ──────────────
   courseFile                          studentRecords
  ─────────────                        ──────────────
```

A student completes an enrolment form, has it checked and signed by a lecturer, and hands it to the enrolment clerk for processing. The enrolment clerk checks the

course file for the requested course and issues a Student Id Card. The student and course details get placed on the student records file.

## 2.3 Construct a Data Flow Diagram

To construct a data flow diagram:

- maintain a consistent level of detail with between five and nine symbols per page. Data flow arrows do not cross each other.

- label your data flow arrows first - these are the most important items - and your processes circles last

- process circles may have several arrows flowing into and out of them

- an arrow from a data store always go to a process. An arrow to a data store always comes from a process

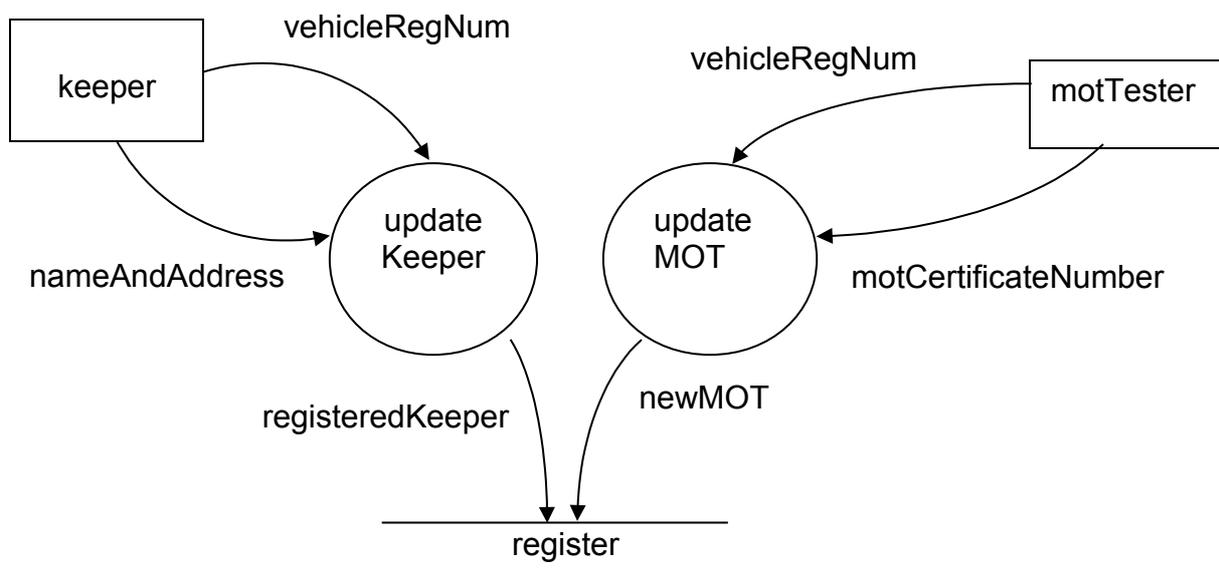- include a descriptive narrative that explains the data flow diagram

We use the original Tom De Marco notation because it is simple and straightforward.

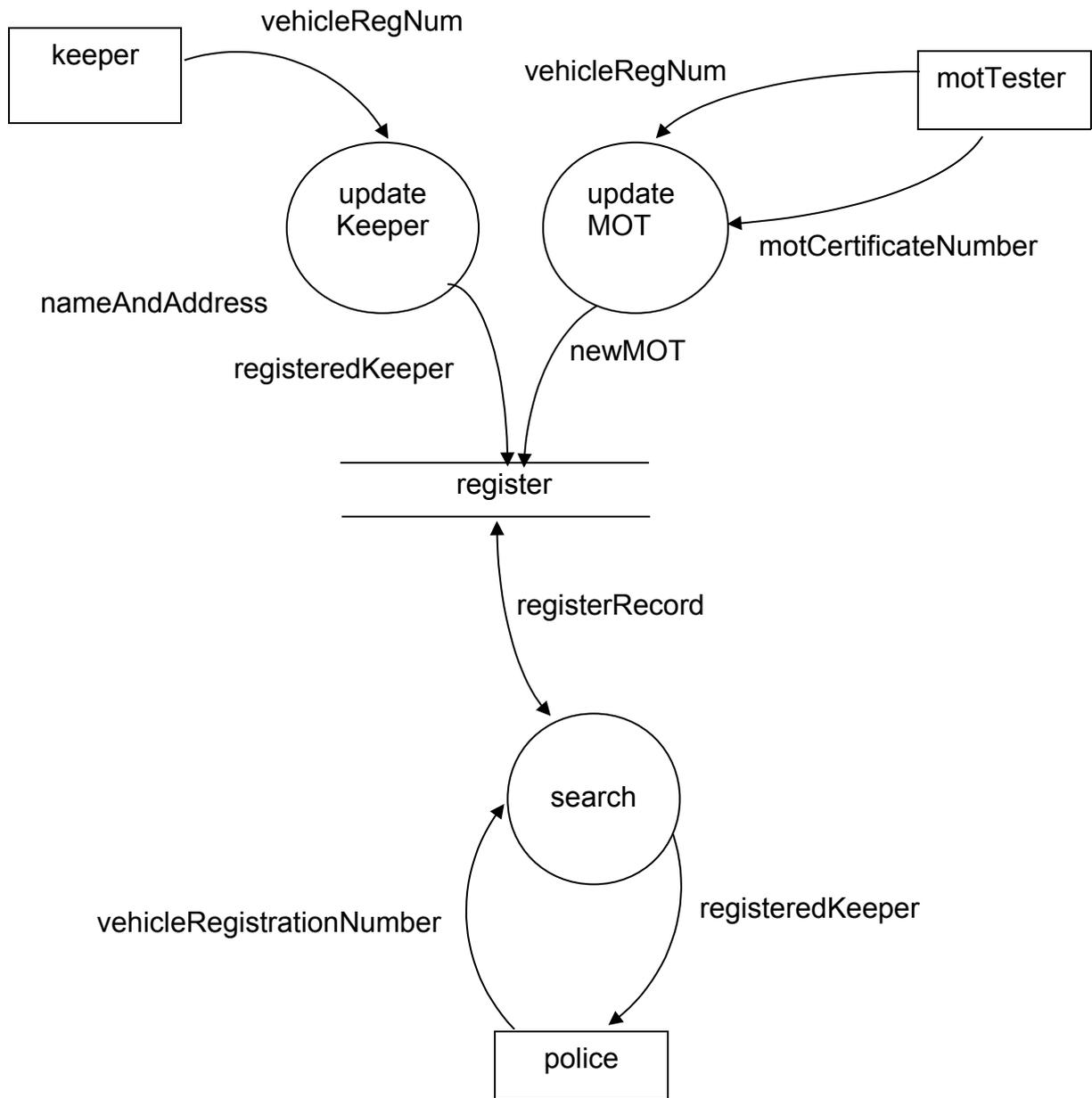## 2.4 Motor Vehicle Registration - Yet Another Data Flow Diagram

A motor vehicle has a registered keeper (who is not necessarily the owner). When you acquire a motor vehicle you are obliged to inform DVLA (Driver and Vehicle Licencing Agency) who update their register.

```
  ┌──────────┐        vehicleRegistrationNumber
  │  keeper  │
  └──────────┘
         nameAndAddress        ╭─────────╮
                               │  update │
                               │  Keeper │
                               ╰─────────╯
                          registeredKeeper

              ─────────────────────
                    register
              ─────────────────────
```
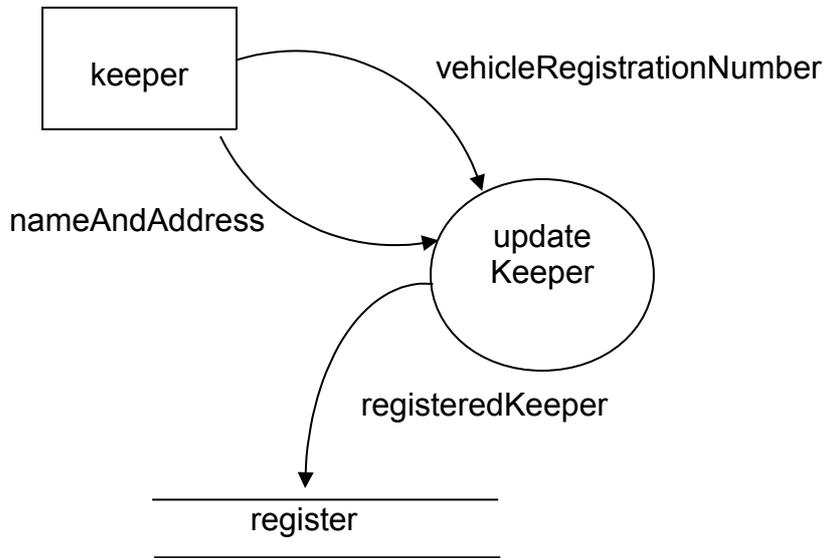
When a vehicle is MOT'd (Ministry of Transport safety test) its record is updated by the MOT station tester.

```
  ┌──────────┐   vehicleRegNum          vehicleRegNum    ┌───────────┐
  │  keeper  │                                           │ motTester │
  └──────────┘                                           └───────────┘
      nameAndAddress  ╭────────╮   ╭────────╮
                      │ update │   │ update │
                      │ Keeper │   │  MOT   │   motCertificateNumber
                      ╰────────╯   ╰────────╯
         registeredKeeper       newMOT

                  ─────────────────────
                        register
                  ─────────────────────
```

If the vehicle was seen at the scene of a crime, the police might like to know who its registered keeper is.

keeper

vehicleRegNum

update
Keeper

vehicleRegNum

motTester

update
MOT

motCertificateNumber

nameAndAddress

registeredKeeper

newMOT

register

registerRecord

search

vehicleRegistrationNumber

registeredKeeper

police

2.5 Exercises

Construct and explain data flow diagrams for each of the following scenarios.

a. A borrower chooses a copy of a book from a library shelf and takes it to the check-out desk. The librarian scans both the borrower's library card and the copy's accession number. (An accession number uniquely identifies a copy - there may be several copies of the same book title.) If the borrower has a fine outstanding, or has reached their limit on the number of loans permissible at any one time, the loan is refused. If there are no fines outstanding and if the borrower has not reached his or her loan limit, the accession number and the date due for return are recorded on the borrower's computer record and the date due for return is also stamped in the book copy.

b. When a copy of a book is returned to a library, the librarian scans its accession number. The computer system locates the borrower's record and records the return of the copy. The computer system checks and reports if a fine is due. The librarian checks whether a copy of the book has been reserved by another borrower: if it has, the copy is placed on the reserved shelf; if it has not the copy is placed in its proper place on the lending shelves.

c. When a book title becomes out of date, all its copies are removed from circulation and disposed off, and the catalogue is updated. When copies of a new book title are received by the library, each copy is given a unique accession number, the catalogue is updated and the copies placed on the appropriate place on the shelves. If a borrower wants to know what books are available on a particular subject, they supply the subject and the computer system searches the catalogue and displays the results.

Bibliography

PRESSMAN R.S *Software Engineering - A Practioner's* Approach McGraw-Hill 1992

http://www.yourdon.com/strucanalysis/wiki/index.php?title=Chapter_9 accessed 12 Dec 2007

Next we look at the characteristics of a system.