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XML Compression System on Smartcard Case Study of Medical Record Data

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Abstract

*In the medical service at the practice site as well as in the standard hospital, the physician keeps a record of the patient's information in a file known as the medical record. The drawback to this file is the availability of unreliable data. Where a patient's medical record should be searched one by one in a particular file. In this research, we will create a medical record application system with XML compression feature with tag method (firstchild, sibling) * data combined with Bzip2 method on ACOS smartcard storage media. The results obtained are, the ratio of file size written on smartcard media is smaller than the files that are not compressed. The average ratio ranges from 14.04% with sampling data from 500 - 31000 bytes. Average reading time is 5.71 seconds, and the writing process is about 11.69 seconds.*

Keywords*: XML compression, smartcard, medical record data.*

1. Introduction

To date, the size of smartcard storage is only between 8 kb s / d 255kb. Very far when compared with other media capacity such as hard disk or flash disk. To overcome these limitations, one of the best solutions is to use the compression method. By compressing unnecessary bits, it can save 30% to 80% of the data size written on the smartcard, which depends also on what compression method we use. In this application, we will develop sibling tag compression method for XML tag, followed by Bzip2 compression method for file compression, before being saved to smart card media.Method" chapter can be added to explain briefly the proposed method or algorithm.

Smartcard is a card that has a chip that can be used to process something or store data. The chip can be programmed so we can create applications that run on the card. According to ISO / IEC 7810 standard, smartcard is defined with the size 85.60 x 53.98 mm. For the version of SIM card is standardized with the size 25 x 15 mm. Both have thick 0.76 mm [4].

XML (Bray, Tim; Paoli, Jean; Sperberg-McQueen, C. M.; Maler, Eve; Yergeau, François; 2008) is an abbreviation of eXtensible Markup Language, a versatile markup language recommended by the W3C to describe a variety of data. XML uses markup tags just like HTML but its use is not limited to web views only [1].

Example of a simple XML document as follows:

```
xml>
<datapribadi>
  <id>1</id>
  <noktp>3520100206870001</noktp>
  <nama>Muhammad Syarifuddin</nama>
  <alamat>RT 03/01 Pilang Payung 1, Desa Geneng Kab Ngawi</alamat>
  <tanggal_lahir>06/02/87</tanggal_lahir>
  <kelamin>Laki-laki</kelamin>
  <kawin>Belum Kawin</kawin>
  <no_telp>0816512355</no_telp>
  <gol_darah>O</gol_darah>
</datapribadi>
<medicalrecord>
```

```
  <tanggal>4/17/2010</tanggal>
  <dokter>Dr. Roedi Sudjatmiko</dokter>
  <diagnosa>Sakit tenggorokan, sakit ketika menelan, badan
  meriang</diagnosa>
  <penyakit>radang tenggorokan</penyakit>
  <obat>Amoxicilin 250mg 3x1</obat>
  <tanggal>6/12/2010</tanggal>
  <dokter>Dr. Sunaryo</dokter>
  <diagnosa>Pilek, demam, pusing, panas, badan pegal-pegal</diagnosa>
  <penyakit>Flu</penyakit>
  <obat>Pseudoefedrin 250mg 3x1, Paracetamol 250mg 3x1</obat>
  <tanggal>9/21/2010</tanggal>
  <dokter>Dr. Joko Rusjayani</dokter>
  <diagnosa>Gatal sekujur tubuh, kulit terasa panas, demam</diagnosa>
  <penyakit>Alergi</penyakit>
  <obat>Benozon N krim 5gr 3x1, Paracetamol 250mg 3x1</obat>
<tanggal>12/05/2010</tanggal>
  <dokter>Dr Roedi Sudjatmiko</dokter>
  <diagnosa>Pusing</diagnosa>
  <penyakit>Sakit kepala</penyakit>
  <obat>Paracetamol 250mg 3x1</obat>
  <tanggal>12/30/2010</tanggal>
  <dokter>Dr. Sunaryo</dokter>
  <diagnosa>Mual muntah, sakit kepala, lemas, diare</diagnosa>
  <penyakit>Tiphus</penyakit>
  <obat>Penilalamin 500mg 3x1</obat>
</medicalrecord>
      </xml>
```

The XML document contains 3 components, namely tags, attributes, and data. The tag element, always beginning with <name_tag> and ending with a </ nama_tag> sign. Elements can be based on previous elements, or create a peranakan with a branching tree model. The tag element can contain attributes typically written after the tag name, eg <attribute_name attribute = "content attribute">. Additionally, tag elements also have data flanked by opening tags and closing tags, such as example: <name_tag> data </ name_tag>. In the tag compression scheme (firstchild, sibling), XML files are split into two parts, namely tags and data[2].

BZip2 is a compression method invented by Julian Seward in 1996 with an open source license (Seward, Julian 2005). BZip2 compresses data using blocks of 100-900 kB and uses the Burrows-Wheeler algorithm to change characters that appear repeatedly with certain letters, then the characters are forwarded bytenya address using Huffman algorithm. BZip2 has a .bz2 extension for its file output, and it is now implemented to a wide range of compression software. Output conversion from tag (firstchild, sibling) * data can be displayed in hexa format 2 blocks (1 character BZip2 = 2 hex characters) [3].

The advantages of this last output are as follows:

1. Bytes are used less than required using the original format
2. In addition to compressing the number of bytes of a data, bzip compression can also disguise the original data format, so that data can be protected its security.

In this research the selected problem to be studied is as follows how to use smartcard as data storage media and save data compression result into smartcard. Standard card used is ACOS (Advance Card Operating System) from Advance Card System Ltd and Smartcard used is type contact. which will be implemented and used for medical record data.

The purpose of this research is to make compression software for files with XML format and to make memory resource efficiency is limited to smart card.

Benefits derived from this research is the capacity of the smart card can be used efficiently and with this compression system, then the capacity of smart cards used can use the lower.

2. Research Method

2.1. Program Algorithm

The compression algorithm from XML to finite automata and vice versa can be described as follows :

Compression & decompression process diagram :

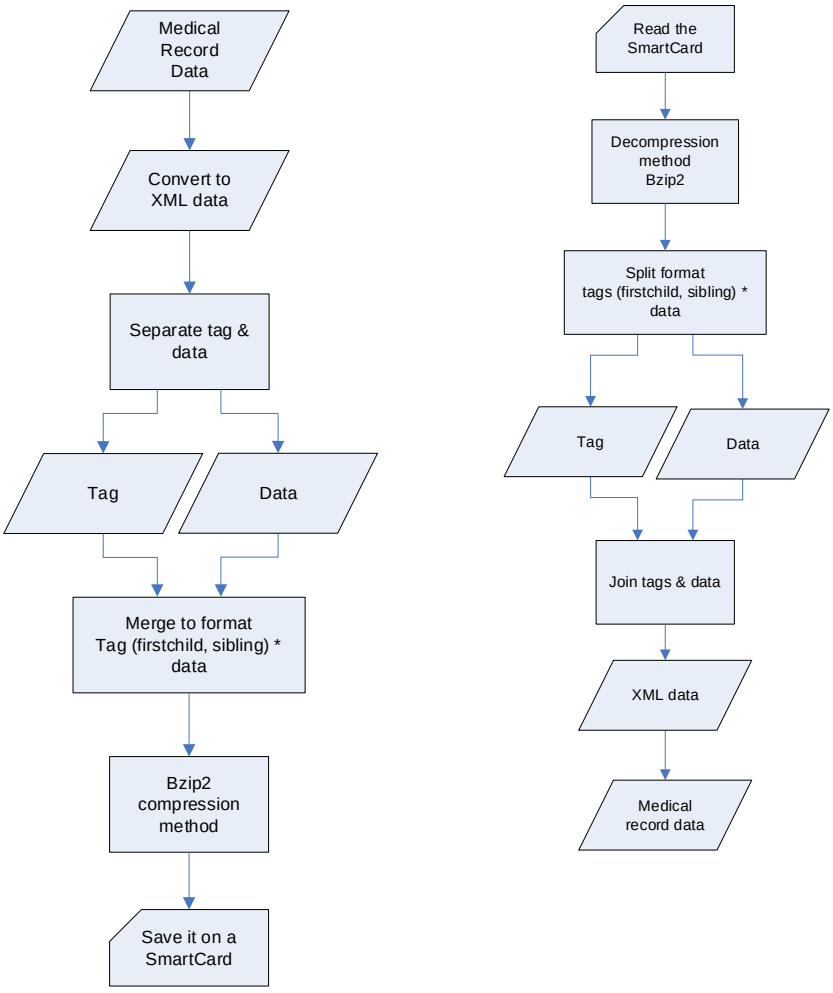

Figure 1. Algorithm

2.2. System Requirement

This XML compression system is built using the software and hardware described as table 1.

Table 1. Hardware

No	Nama	Spec
1	Laptop	Windows, 1.6GHz, 768Mb, 1 USB port
2	Smartcard reader	ACR38U (port USB)
3	Smartcard	ACOS 16 Kilobytes

Table 2. Software

No	Nama	Function
1	Borland Delphi	Development Software
2	ACOS SDK	Development Kit
3	ACR38U Driver	Driver Connectifity
4	Windows	Operating Systems

2.3. Smartcard Connection and Windows Operating

SystemThere are two types of drivers as a connection between smartcard and windows, among others :

1. ACR38 PC / SC driver, stands for Personal Computer / Smart Card, is a standard driver for integrating smart card media with computer environment. be it microsoft windows, linux, or macintosh.
2. ACR38U Proprietary driver, is a special driver issued by ACS smart card manufacturer (Advance Card System). The difference between these drivers with PC / SC is that there are some features developed by the ACS manufacturers themselves.

In this study, used ACOS 16 Kb card, therefore the selected driver is ACR38U Proprietary, to adjust to SDK ACOS (Advance Card Operating System).

2.4. Smartcard Physical Connection with Computer ACR38U

Smartcard reader has a USB interface, so it can easily connect with the latest computer devices. The connection between smartcard and computer can be explained with the figure 2.

Figure 2. Smartcard connection to computer

2.5. System Design

System design is one of the most decisive process in making this research, because from program design, flowchart order can be processed one by one. The design of this research program can be explained as figure 3 to 6.

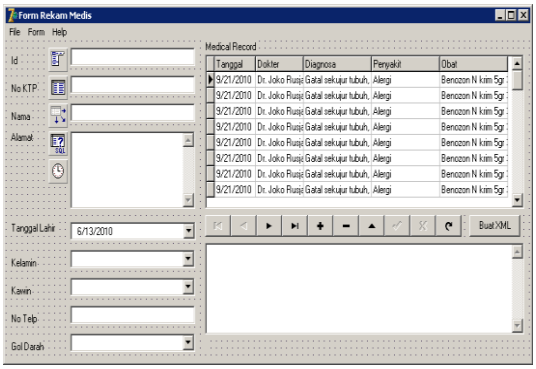

Figure 3. The main form of medical record data

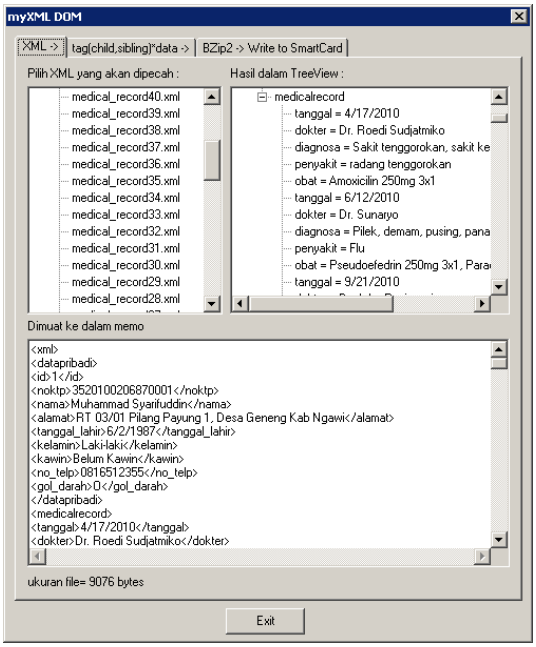

Figure 4. compression form

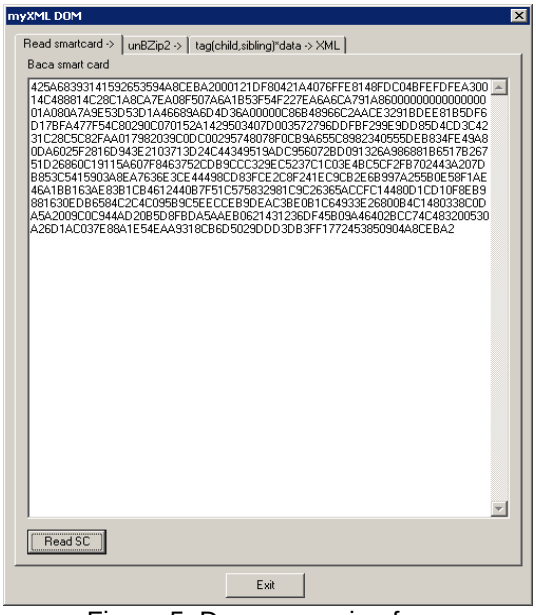

Figure 5. Decompression form

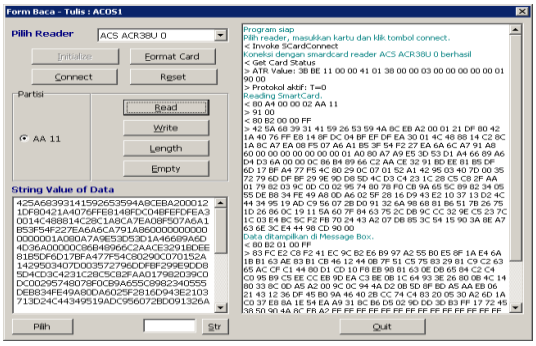

Figure 6. Decompression form

3. Results and Analysis

To measure the ability to read & write, used 100 medical record data that has been changed to XML format. The test conducted can be explained by the figure 7 and 8.

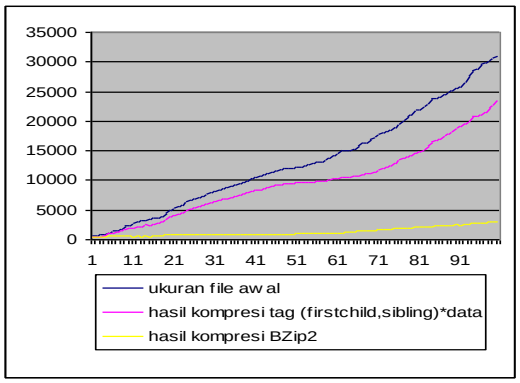

Figure 7. comparison graph between the size of bytes and the amount of data

From the results of the trials that have been done, the data used between 500 bytes - 31000 bytes. compression tag results (firstchild, sibling) * data generates output ranging from 440 bytes - 23647 bytes. The last compression using BZip2 produces output between 380 bytes - 3067 bytes. The ratio of the lowest compression result is 7.35%, the highest is 64.2%, the average ranges between 14.04% of the source file.

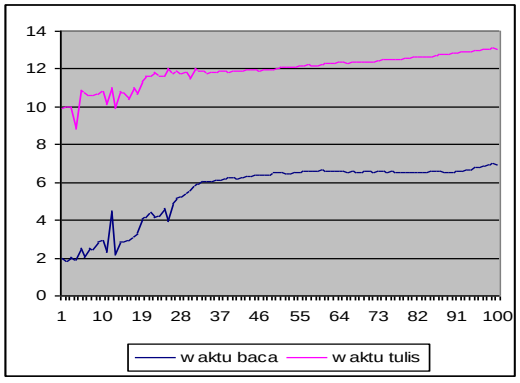

Figure 8. Time graph and amount of data

From the graph of read & write time, it can be concluded that the average reading process takes about 5.71 seconds, and the write time is about 11.69 seconds.

4. Conclusion

From research on XML compression system on smartcard this can be drawn the following conclusions: From the test conducted, the average reading and decompression process

about 2.62 seconds. Compression process & write on smartcard takes about 10.36 seconds. While the average ratio of compression on the number 33.22% of the initial file size. Suggestion after doing research, there is a need to develop algorithms that allow for smaller compression than the currently created BZip2 method.

References

[1] Bray, Tim; Paoli, Jean; Sperberg-McQueen, C. M.; Maler, Eve; Yergeau, François; (2008). XML: W3C recommendation. http://www.w3.org/TR/REC-xml.
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