```go
/*
Copyright 2018 The pdfcpu Authors.

Licensed under the Apache License, Version 2.0 (the "License");
you may not use this file except in compliance with the License.
You may obtain a copy of the License at

    http://www.apache.org/licenses/LICENSE-2.0

Unless required by applicable law or agreed to in writing, software
distributed under the License is distributed on an "AS IS" BASIS,
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
See the License for the specific language governing permissions and
limitations under the License.
*/

package pdfcpu

import (
    "bufio"
    "bytes"
    "io"
    "os"
    "sort"
    "strconv"
    "strings"

    "github.com/pdfcpu/pdfcpu/pkg/filter"
    "github.com/pdfcpu/pdfcpu/pkg/log"
    "github.com/pkg/errors"
)

const (
    defaultBufSize = 1024
    //unknownDelimiter = byte(0)
)

// ReadFile reads in a PDF file and builds an internal structure holding its cross reference table aka the Context.
func ReadFile(inFile string, conf *Configuration) (*Context, error) {

    log.Info.Printf("reading %s..\n", inFile)

    f, err := os.Open(inFile)
    if err != nil {
        return nil, errors.Wrapf(err, "can't open %q", inFile)
    }

    defer func() {
        f.Close()
    }()

    return Read(f, conf)
}

// Read takes a readSeeker and generates a Context,
// an in-memory representation containing a cross reference table.
func Read(rs io.ReadSeeker, conf *Configuration) (*Context, error) {

```



```go
    log.Read.Println("Read: begin")

    ctx, err := NewContext(rs, conf)
    if err != nil {
        return nil, err
    }

    if ctx.Reader15 {
        log.Info.Println("PDF Version 1.5 conforming reader")
    } else {
        log.Info.Println("PDF Version 1.4 conforming reader - no object streams or xrefstreams allowed")
    }

    // Populate xRefTable.
    if err = readXRefTable(ctx); err != nil {
        return nil, errors.Wrap(err, "Read: xRefTable failed")
    }

    // Make all objects explicitly available (load into memory) in corresponding xRefTable entries.
    // Also decode any involved object streams.
    if err = dereferenceXRefTable(ctx, conf); err != nil {
        return nil, err
    }

    // Some PDFWriters write an incorrent Size into trailer.
    if *ctx.XRefTable.Size < len(ctx.XRefTable.Table) {
        *ctx.XRefTable.Size = len(ctx.XRefTable.Table)
    }

    log.Read.Println("Read: end")

    return ctx, nil
}

// ScanLines is a split function for a Scanner that returns each line of
// text, stripped of any trailing end-of-line marker. The returned line may
// be empty. The end-of-line marker is one carriage return followed
// by one newline or one carriage return or one newline.
// The last non-empty line of input will be returned even if it has no newline.
func scanLines(data []byte, atEOF bool) (advance int, token []byte, err error) {

    if atEOF && len(data) == 0 {
        return 0, nil, nil
    }

    indCR := bytes.IndexByte(data, '\r')
    indLF := bytes.IndexByte(data, '\n')

    switch {

    case indCR >= 0 && indLF >= 0:
        if indCR < indLF {
            if indLF == indCR+1 {
                // 0x0D0A
                return indLF + 1, data[0:indCR], nil
            }
            // 0x0D ... 0x0A
```



```go
            return indCR + 1, data[0:indCR], nil
        }
        // 0x0A ... 0x0D
        return indLF + 1, data[0:indLF], nil

    case indCR >= 0:
        // We have a full carriage return terminated line.
        return indCR + 1, data[0:indCR], nil

    case indLF >= 0:
        // We have a full newline-terminated line.
        return indLF + 1, data[0:indLF], nil

    }

    // If we're at EOF, we have a final, non-terminated line. Return it.
    if atEOF {
        return len(data), data, nil
    }

    // Request more data.
    return 0, nil, nil
}

func newPositionedReader(rs io.ReadSeeker, offset *int64) (*bufio.Reader, error) {

    if _, err := rs.Seek(*offset, io.SeekStart); err != nil {
        return nil, err
    }

    log.Read.Printf("newPositionedReader: positioned to offset: %d\n", *offset)

    return bufio.NewReader(rs), nil
}

// Get the file offset of the last XRefSection.
// Go to end of file and search backwards for the first occurrence of startxref {offset} %%EOF
func offsetLastXRefSection(ctx *Context) (*int64, error) {

    rs := ctx.Read.rs

    var (
        prevBuf, workBuf []byte
        bufSize          int64 = 512
        offset           int64
    )

    for i := 1; offset == 0; i++ {

        off, err := rs.Seek(-int64(i)*bufSize, io.SeekEnd)
        if err != nil {
            return nil, errors.New("pdfcpu: can't find last xref section")
        }

        log.Read.Printf("scanning for offsetLastXRefSection starting at %d\n", off)

        curBuf := make([]byte, bufSize)

```



```go
        _, err = rs.Read(curBuf)
        if err != nil {
            return nil, err
        }

        workBuf = curBuf
        if prevBuf != nil {
            workBuf = append(curBuf, prevBuf...)
        }

        j := strings.LastIndex(string(workBuf), "startxref")
        if j == -1 {
            prevBuf = curBuf
            continue
        }

        p := workBuf[j+len("startxref"):]
        posEOF := strings.Index(string(p), "%%EOF")
        if posEOF == -1 {
            return nil, errors.New("pdfcpu: no matching %%EOF for startxref")
        }

        p = p[:posEOF]
        offset, err = strconv.ParseInt(strings.TrimSpace(string(p)), 10, 64)
        if err != nil {
            return nil, errors.New("pdfcpu: corrupted last xref section")
        }

    }

    log.Read.Printf("Offset last xrefsection: %d\n", offset)

    return &offset, nil
}

// Read next subsection entry and generate corresponding xref table entry.
func parseXRefTableEntry(s *bufio.Scanner, xRefTable *XRefTable, objectNumber int) error {

    log.Read.Println("parseXRefTableEntry: begin")

    line, err := scanLine(s)
    if err != nil {
        return err
    }

    if xRefTable.Exists(objectNumber) {
        log.Read.Printf("parseXRefTableEntry: end - Skip entry %d - already assigned\n", objectNumber)
        return nil
    }

    fields := strings.Fields(line)
    if len(fields) != 3 ||
        len(fields[0]) != 10 || len(fields[1]) != 5 || len(fields[2]) != 1 {
        return errors.New("pdfcpu: parseXRefTableEntry: corrupt xref subsection header")
    }

```



```go
    offset, err := strconv.ParseInt(fields[0], 10, 64)
    if err != nil {
        return err
    }

    generation, err := strconv.Atoi(fields[1])
    if err != nil {
        return err
    }

    entryType := fields[2]
    if entryType != "f" && entryType != "n" {
        return errors.New("pdfcpu: parseXRefTableEntry: corrupt xref subsection entry")
    }

    var xRefTableEntry XRefTableEntry

    if entryType == "n" {

        // in use object

        log.Read.Printf("parseXRefTableEntry: Object #%d is in use at offset=%d, generation=%d\n", objectNumber, offset, generation)

        if offset == 0 {
            log.Info.Printf("parseXRefTableEntry: Skip entry for in use object #%d with offset 0\n", objectNumber)
            return nil
        }

        xRefTableEntry =
            XRefTableEntry{
                Free:       false,
                Offset:     &offset,
                Generation: &generation}

    } else {

        // free object

        log.Read.Printf("parseXRefTableEntry: Object #%d is unused, next free is object#%d, generation=%d\n", objectNumber, offset, generation)

        xRefTableEntry =
            XRefTableEntry{
                Free:       true,
                Offset:     &offset,
                Generation: &generation}

    }

    log.Read.Printf("parseXRefTableEntry: Insert new xreftable entry for Object %d\n", objectNumber)

    xRefTable.Table[objectNumber] = &xRefTableEntry

    log.Read.Println("parseXRefTableEntry: end")

    return nil
```



```go
}

// Process xRef table subsection and create corrresponding xRef table entries.
func parseXRefTableSubSection(s *bufio.Scanner, xRefTable *XRefTable, fields []string) error {

    log.Read.Println("parseXRefTableSubSection: begin")

    startObjNumber, err := strconv.Atoi(fields[0])
    if err != nil {
        return err
    }

    objCount, err := strconv.Atoi(fields[1])
    if err != nil {
        return err
    }

    log.Read.Printf("detected xref subsection, startObj=%d length=%d\n", startObjNumber, objCount)

    // Process all entries of this subsection into xRefTable entries.
    for i := 0; i < objCount; i++ {
        if err = parseXRefTableEntry(s, xRefTable, startObjNumber+i); err != nil {
            return err
        }
    }

    log.Read.Println("parseXRefTableSubSection: end")

    return nil
}

// Parse compressed object.
func compressedObject(s string) (Object, error) {

    log.Read.Println("compressedObject: begin")

    o, err := parseObject(&s)
    if err != nil {
        return nil, err
    }

    d, ok := o.(Dict)
    if !ok {
        // return trivial Object: Integer, Array, etc.
        log.Read.Println("compressedObject: end, any other than dict")
        return o, nil
    }

    streamLength, streamLengthRef := d.Length()
    if streamLength == nil && streamLengthRef == nil {
        // return Dict
        log.Read.Println("compressedObject: end, dict")
        return d, nil
    }

    return nil, errors.New("pdfcpu: compressedObject: stream objects are not to be stored in an object stream")
```



```go
}

// Parse all objects of an object stream and save them into objectStreamDict.ObjArray.
func parseObjectStream(osd *ObjectStreamDict) error {

    log.Read.Printf("parseObjectStream begin: decoding %d objects.\n", osd.ObjCount)

    decodedContent := osd.Content
    prolog := decodedContent[:osd.FirstObjOffset]

    objs := strings.Fields(string(prolog))
    if len(objs)%2 > 0 {
        return errors.New("pdfcpu: parseObjectStream: corrupt object stream dict")
    }

    // e.g., 10 0 11 25 = 2 Objects: #10 @ offset 0, #11 @ offset 25

    var objArray Array

    var offsetOld int

    for i := 0; i < len(objs); i += 2 {

        offset, err := strconv.Atoi(objs[i+1])
        if err != nil {
            return err
        }

        offset += osd.FirstObjOffset

        if i > 0 {
            dstr := string(decodedContent[offsetOld:offset])
            log.Read.Printf("parseObjectStream: objString = %s\n", dstr)
            o, err := compressedObject(dstr)
            if err != nil {
                return err
            }

            log.Read.Printf("parseObjectStream: [%d] = obj %s:\n%s\n", i/2-1, objs[i-2], o)
            objArray = append(objArray, o)
        }

        if i == len(objs)-2 {
            dstr := string(decodedContent[offset:])
            log.Read.Printf("parseObjectStream: objString = %s\n", dstr)
            o, err := compressedObject(dstr)
            if err != nil {
                return err
            }

            log.Read.Printf("parseObjectStream: [%d] = obj %s:\n%s\n", i/2, objs[i], o)
            objArray = append(objArray, o)
        }

        offsetOld = offset
    }

```



```go
    osd.ObjArray = objArray

    log.Read.Println("parseObjectStream end")

    return nil
}

// For each object embedded in this xRefStream create the corresponding xRef table entry.
func extractXRefTableEntriesFromXRefStream(buf []byte, xsd *XRefStreamDict, ctx *Context) error {

    log.Read.Printf("extractXRefTableEntriesFromXRefStream begin")

    // Note:
    // A value of zero for an element in the W array indicates that the corresponding field shall not be present in the stream,
    // and the default value shall be used, if there is one.
    // If the first element is zero, the type field shall not be present, and shall default to type 1.

    i1 := xsd.W[0]
    i2 := xsd.W[1]
    i3 := xsd.W[2]

    xrefEntryLen := i1 + i2 + i3
    log.Read.Printf("extractXRefTableEntriesFromXRefStream: begin xrefEntryLen = %d\n", xrefEntryLen)

    if len(buf)%xrefEntryLen > 0 {
        return errors.New("pdfcpu: extractXRefTableEntriesFromXRefStream: corrupt xrefstream")
    }

    objCount := len(xsd.Objects)
    log.Read.Printf("extractXRefTableEntriesFromXRefStream: objCount:%d %v\n", objCount, xsd.Objects)

    log.Read.Printf("extractXRefTableEntriesFromXRefStream: len(buf):%d objCount*xrefEntryLen:%d\n", len(buf), objCount*xrefEntryLen)
    if len(buf) < objCount*xrefEntryLen {
        // Sometimes there is an additional xref entry not accounted for by "Index".
        // We ignore such a entries and do not treat this as an error.
        return errors.New("pdfcpu: extractXRefTableEntriesFromXRefStream: corrupt xrefstream")
    }

    j := 0

    // bufToInt64 interprets the content of buf as an int64.
    bufToInt64 := func(buf []byte) (i int64) {

        for _, b := range buf {
            i <<= 8
            i |= int64(b)
        }

        return
    }

```



```go
    for i := 0; i < len(buf) && j < len(xsd.Objects); i += xrefEntryLen {

        objectNumber := xsd.Objects[j]

        i2Start := i + i1
        c2 := bufToInt64(buf[i2Start : i2Start+i2])
        c3 := bufToInt64(buf[i2Start+i2 : i2Start+i2+i3])

        var xRefTableEntry XRefTableEntry

        switch buf[i] {

        case 0x00:
            // free object
            log.Read.Printf("extractXRefTableEntriesFromXRefStream: Object #%d is unused, next free is object#%d, generation=%d\n", objectNumber, c2, c3)
            g := int(c3)

            xRefTableEntry =
                XRefTableEntry{
                    Free:       true,
                    Compressed: false,
                    Offset:     &c2,
                    Generation: &g}

        case 0x01:
            // in use object
            log.Read.Printf("extractXRefTableEntriesFromXRefStream: Object #%d is in use at offset=%d, generation=%d\n", objectNumber, c2, c3)
            g := int(c3)

            xRefTableEntry =
                XRefTableEntry{
                    Free:       false,
                    Compressed: false,
                    Offset:     &c2,
                    Generation: &g}

        case 0x02:
            // compressed object
            // generation always 0.
            log.Read.Printf("extractXRefTableEntriesFromXRefStream: Object #%d is compressed at obj %5d[%d]\n", objectNumber, c2, c3)
            objNumberRef := int(c2)
            objIndex := int(c3)

            xRefTableEntry =
                XRefTableEntry{
                    Free:            false,
                    Compressed:      true,
                    ObjectStream:    &objNumberRef,
                    ObjectStreamInd: &objIndex}

            ctx.Read.ObjectStreams[objNumberRef] = true

        }

        if ctx.XRefTable.Exists(objectNumber) {
            log.Read.Printf("extractXRefTableEntriesFromXRefStream: Skip entry %d - already assigned\n", objectNumber)
```



```go
        } else {
            ctx.Table[objectNumber] = &xRefTableEntry
        }

        j++
    }

    log.Read.Println("extractXRefTableEntriesFromXRefStream: end")

    return nil
}

func xRefStreamDict(ctx *Context, o Object, objNr int, streamOffset int64) (*XRefStreamDict, error) {

    // must be Dict
    d, ok := o.(Dict)
    if !ok {
        return nil, errors.New("pdfcpu: xRefStreamDict: no dict")
    }

    // Parse attributes for stream object.
    streamLength, streamLengthObjNr := d.Length()
    if streamLength == nil && streamLengthObjNr == nil {
        return nil, errors.New("pdfcpu: xRefStreamDict: no \"Length\" entry")
    }

    filterPipeline, err := pdfFilterPipeline(ctx, d)
    if err != nil {
        return nil, err
    }

    // We have a stream object.
    log.Read.Printf("xRefStreamDict: streamobject #%d\n", objNr)
    sd := NewStreamDict(d, streamOffset, streamLength, streamLengthObjNr, filterPipeline)

    if _, err = loadEncodedStreamContent(ctx, &sd); err != nil {
        return nil, err
    }

    // Decode xrefstream content
    if err = saveDecodedStreamContent(nil, &sd, 0, 0, true); err != nil {
        return nil, errors.Wrapf(err, "xRefStreamDict: cannot decode stream for obj#:%d\n", objNr)
    }

    return parseXRefStreamDict(&sd)
}

// Parse xRef stream and setup xrefTable entries for all embedded objects and the xref stream dict.
func parseXRefStream(rd io.Reader, offset *int64, ctx *Context) (prevOffset *int64, err error) {

    log.Read.Printf("parseXRefStream: begin at offset %d\n", *offset)

    buf, endInd, streamInd, streamOffset, err := buffer(rd)
    if err != nil {
```



```go
        return nil, err
    }

    log.Read.Printf("parseXRefStream: endInd=%[1]d(%[1]x) streamInd=%[2]d(%[2]x)\n", endInd, streamInd)

    line := string(buf)

    // We expect a stream and therefore "stream" before "endobj" if "endobj" within buffer.
    // There is no guarantee that "endobj" is contained in this buffer for large streams!
    if streamInd < 0 || (endInd > 0 && endInd < streamInd) {
        return nil, errors.New("pdfcpu: parseXRefStream: corrupt pdf file")
    }

    // Init object parse buf.
    l := line[:streamInd]

    objectNumber, generationNumber, err := parseObjectAttributes(&l)
    if err != nil {
        return nil, err
    }

    // parse this object
    log.Read.Printf("parseXRefStream: xrefstm obj#:%d gen:%d\n", *objectNumber, *generationNumber)
    log.Read.Printf("parseXRefStream: dereferencing object %d\n", *objectNumber)
    o, err := parseObject(&l)
    if err != nil {
        return nil, errors.Wrapf(err, "parseXRefStream: no object")
    }

    log.Read.Printf("parseXRefStream: we have an object: %s\n", o)

    streamOffset += *offset
    sd, err := xRefStreamDict(ctx, o, *objectNumber, streamOffset)
    if err != nil {
        return nil, err
    }
    // We have an xref stream object

    err = parseTrailerInfo(sd.Dict, ctx.XRefTable)
    if err != nil {
        return nil, err
    }

    // Parse xRefStream and create xRefTable entries for embedded objects.
    err = extractXRefTableEntriesFromXRefStream(sd.Content, sd, ctx)
    if err != nil {
        return nil, err
    }

    // Create xRefTableEntry for XRefStreamDict.
    entry :=
        XRefTableEntry{
            Free:       false,
            Offset:     offset,
            Generation: generationNumber,
            Object:     *sd}
```



```go

    log.Read.Printf("parseXRefStream: Insert new xRefTable entry for Object %d\n", *objectNumber)

    ctx.Table[*objectNumber] = &entry
    ctx.Read.XRefStreams[*objectNumber] = true
    prevOffset = sd.PreviousOffset

    log.Read.Println("parseXRefStream: end")

    return prevOffset, nil
}

// Parse an xRefStream for a hybrid PDF file.
func parseHybridXRefStream(offset *int64, ctx *Context) error {

    log.Read.Println("parseHybridXRefStream: begin")

    rd, err := newPositionedReader(ctx.Read.rs, offset)
    if err != nil {
        return err
    }

    _, err = parseXRefStream(rd, offset, ctx)
    if err != nil {
        return err
    }

    log.Read.Println("parseHybridXRefStream: end")

    return nil
}

// Parse trailer dict and return any offset of a previous xref section.
func parseTrailerInfo(d Dict, xRefTable *XRefTable) error {

    log.Read.Println("parseTrailerInfo begin")

    if _, found := d.Find("Encrypt"); found {
        encryptObjRef := d.IndirectRefEntry("Encrypt")
        if encryptObjRef != nil {
            xRefTable.Encrypt = encryptObjRef
            log.Read.Printf("parseTrailerInfo: Encrypt object: %s\n", *xRefTable.Encrypt)
        }
    }

    if xRefTable.Size == nil {
        size := d.Size()
        if size == nil {
            return errors.New("pdfcpu: parseTrailerInfo: missing entry \"Size\"")
        }
        // Not reliable!
        // Patched after all read in.
        xRefTable.Size = size
    }

    if xRefTable.Root == nil {
        rootObjRef := d.IndirectRefEntry("Root")
```



```go
        if rootObjRef == nil {
            return errors.New("pdfcpu: parseTrailerInfo: missing entry \"Root\"")
        }
        xRefTable.Root = rootObjRef
        log.Read.Printf("parseTrailerInfo: Root object: %s\n", *xRefTable.Root)
    }

    if xRefTable.Info == nil {
        infoObjRef := d.IndirectRefEntry("Info")
        if infoObjRef != nil {
            xRefTable.Info = infoObjRef
            log.Read.Printf("parseTrailerInfo: Info object: %s\n", *xRefTable.Info)
        }
    }

    if xRefTable.ID == nil {
        idArray := d.ArrayEntry("ID")
        if idArray != nil {
            xRefTable.ID = idArray
            log.Read.Printf("parseTrailerInfo: ID object: %s\n", xRefTable.ID)
        } else if xRefTable.Encrypt != nil {
            return errors.New("pdfcpu: parseTrailerInfo: missing entry \"ID\"")
        }
    }

    log.Read.Println("parseTrailerInfo end")

    return nil
}

func parseTrailerDict(trailerDict Dict, ctx *Context) (*int64, error) {

    log.Read.Println("parseTrailerDict begin")

    xRefTable := ctx.XRefTable

    err := parseTrailerInfo(trailerDict, xRefTable)
    if err != nil {
        return nil, err
    }

    if arr := trailerDict.ArrayEntry("AdditionalStreams"); arr != nil {
        log.Read.Printf("parseTrailerInfo: found AdditionalStreams: %s\n", arr)
        a := Array{}
        for _, value := range arr {
            if indRef, ok := value.(IndirectRef); ok {
                a = append(a, indRef)
            }
        }
        xRefTable.AdditionalStreams = &a
    }

    offset := trailerDict.Prev()
    if offset != nil {
        log.Read.Printf("parseTrailerDict: previous xref table section offset:%d\n", *offset)
    }

    offsetXRefStream := trailerDict.Int64Entry("XRefStm")
```



```go
    if offsetXRefStream == nil {
        // No cross reference stream.
        if !ctx.Reader15 && xRefTable.Version() >= V14 && !ctx.Read.Hybrid {
            return nil, errors.Errorf("parseTrailerDict: PDF1.4 conformant reader: found incompatible version: %s", xRefTable.VersionString())
        }
        log.Read.Println("parseTrailerDict end")
        // continue to parse previous xref section, if there is any.
        return offset, nil
    }

    // This file is using cross reference streams.

    if !ctx.Read.Hybrid {
        ctx.Read.Hybrid = true
        ctx.Read.UsingXRefStreams = true
    }

    // 1.5 conformant readers process hidden objects contained
    // in XRefStm before continuing to process any previous XRefSection.
    // Previous XRefSection is expected to have free entries for hidden entries.
    // May appear in XRefSections only.
    if ctx.Reader15 {
        if err := parseHybridXRefStream(offsetXRefStream, ctx); err != nil {
            return nil, err
        }
    }

    log.Read.Println("parseTrailerDict end")

    return offset, nil
}

func scanLineRaw(s *bufio.Scanner) (string, error) {
    if ok := s.Scan(); !ok {
        if s.Err() != nil {
            return "", s.Err()
        }
        return "", errors.New("pdfcpu: scanLineRaw: returning nothing")
    }
    return s.Text(), nil
}

func scanLine(s *bufio.Scanner) (s1 string, err error) {
    for i := 0; i <= 1; i++ {
        s1, err = scanLineRaw(s)
        if err != nil {
            return "", err
        }
        if len(s1) > 0 {
            break
        }
    }

    // Remove comment.
    i := strings.Index(s1, "%")
    if i >= 0 {
        s1 = s1[:i]
    }
```



```go

    return s1, nil
}

func isDict(s string) (bool, error) {
    o, err := parseObject(&s)
    if err != nil {
        return false, err
    }
    _, ok := o.(Dict)
    return ok, nil
}

func scanTrailer(s *bufio.Scanner, line string) (string, error) {

    var buf bytes.Buffer
    var err error
    var i, j, k int

    log.Read.Printf("line: <%s>\n", line)

    // Scan for dict start tag "<<".
    for {
        i = strings.Index(line, "<<")
        if i >= 0 {
            break
        }
        line, err = scanLine(s)
        log.Read.Printf("line: <%s>\n", line)
        if err != nil {
            return "", err
        }
    }

    line = line[i:]
    buf.WriteString(line)
    buf.WriteString(" ")
    log.Read.Printf("scanTrailer dictBuf after start tag: <%s>\n", line)

    // Scan for dict end tag ">>" but account for inner dicts.
    line = line[2:]

    for {

        if len(line) == 0 {
            line, err = scanLine(s)
            if err != nil {
                return "", err
            }
            buf.WriteString(line)
            buf.WriteString(" ")
            log.Read.Printf("scanTrailer dictBuf next line: <%s>\n", line)
        }

        i = strings.Index(line, "<<")
        if i < 0 {
            // No <<
            j = strings.Index(line, ">>")
            if j >= 0 {
```



```go
                // Yes >>
                if k == 0 {
                    // Check for dict
                    ok, err := isDict(buf.String())
                    if err == nil && ok {
                        return buf.String(), nil
                    }
                } else {
                    k--
                }
                line = line[j+2:]
                continue
            }
            // No >>
            line, err = scanLine(s)
            if err != nil {
                return "", err
            }
            buf.WriteString(line)
            buf.WriteString(" ")
            log.Read.Printf("scanTrailer dictBuf next line: <%s>\n", line)
        } else {
            // Yes <<
            j = strings.Index(line, ">>")
            if j < 0 {
                // No >>
                k++
                line = line[i+2:]
            } else {
                // Yes >>
                if i < j {
                    // handle <<
                    k++
                    line = line[i+2:]
                } else {
                    // handle >>
                    if k == 0 {
                        // Check for dict
                        ok, err := isDict(buf.String())
                        if err == nil && ok {
                            return buf.String(), nil
                        }
                    } else {
                        k--
                    }
                    line = line[j+2:]
                }
            }
        }
    }
}

func processTrailer(ctx *Context, s *bufio.Scanner, line string) (*int64, error) {

    var trailerString string

    if line != "trailer" {
        trailerString = line[7:]
        log.Read.Printf("processTrailer: trailer leftover: <%s>\n", trailerString)
```



```go
    } else {
        log.Read.Printf("line (len %d) <%s>\n", len(line), line)
    }

    trailerString, err := scanTrailer(s, trailerString)
    if err != nil {
        return nil, err
    }

    log.Read.Printf("processTrailer: trailerString: (len:%d) <%s>\n", len(trailerString), trailerString)

    o, err := parseObject(&trailerString)
    if err != nil {
        return nil, err
    }

    trailerDict, ok := o.(Dict)
    if !ok {
        return nil, errors.New("pdfcpu: processTrailer: corrupt trailer dict")
    }

    log.Read.Printf("processTrailer: trailerDict:\n%s\n", trailerDict)

    return parseTrailerDict(trailerDict, ctx)
}

// Parse xRef section into corresponding number of xRef table entries.
func parseXRefSection(s *bufio.Scanner, ctx *Context) (*int64, error) {

    log.Read.Println("parseXRefSection begin")

    line, err := scanLine(s)
    if err != nil {
        return nil, err
    }

    log.Read.Printf("parseXRefSection: <%s>\n", line)

    fields := strings.Fields(line)

    // Process all sub sections of this xRef section.
    for !strings.HasPrefix(line, "trailer") && len(fields) == 2 {

        if err = parseXRefTableSubSection(s, ctx.XRefTable, fields); err != nil {
            return nil, err
        }

        // trailer or another xref table subsection ?
        if line, err = scanLine(s); err != nil {
            return nil, err
        }

        // if empty line try next line for trailer
        if len(line) == 0 {
            if line, err = scanLine(s); err != nil {
                return nil, err
            }
        }
```



```go

        fields = strings.Fields(line)
    }

    log.Read.Println("parseXRefSection: All subsections read!")

    if !strings.HasPrefix(line, "trailer") {
        return nil, errors.Errorf("xrefsection: missing trailer dict, line = <%s>", line)
    }

    log.Read.Println("parseXRefSection: parsing trailer dict..")

    return processTrailer(ctx, s, line)
}

// Get version from first line of file.
// Beginning with PDF 1.4, the Version entry in the document's catalog dictionary
// (located via the Root entry in the file's trailer, as described in 7.5.5, "File Trailer"),
// if present, shall be used instead of the version specified in the Header.
// Save PDF Version from header to xRefTable.
// The header version comes as the first line of the file.
// eolCount is the number of characters used for eol (1 or 2).
func headerVersion(rs io.ReadSeeker) (v *Version, eolCount int, err error) {

    log.Read.Println("headerVersion begin")

    var errCorruptHeader = errors.New("pdfcpu: headerVersion: corrupt pdf stream - no header version available")

    // Get first line of file which holds the version of this PDFFile.
    // We call this the header version.
    if _, err = rs.Seek(0, io.SeekStart); err != nil {
        return nil, 0, err
    }

    buf := make([]byte, 20)
    if _, err = rs.Read(buf); err != nil {
        return nil, 0, err
    }

    s := string(buf)
    prefix := "%PDF-"

    if len(s) < 8 || !strings.HasPrefix(s, prefix) {
        return nil, 0, errCorruptHeader
    }

    pdfVersion, err := PDFVersion(s[len(prefix) : len(prefix)+3])
    if err != nil {
        return nil, 0, errors.Wrapf(err, "headerVersion: unknown PDF Header Version")
    }

    s = s[8:]
    s = strings.TrimLeft(s, "\t\f ")

    // Detect the used eol which should be 1 (0x00, 0x0D) or 2 chars (0x0D0A)long.
    // %PDF-1.x{whiteSpace}{eol}
```



```go
    if s[0] == 0x0A {
        eolCount = 1
    } else if s[0] == 0x0D {
        eolCount = 1
        if s[9] == 0x0A {
            eolCount = 2
        }
    } else {
        return nil, 0, errCorruptHeader
    }

    log.Read.Printf("headerVersion: end, found header version: %s\n", pdfVersion)

    return &pdfVersion, eolCount, nil
}

// bypassXrefSection is a hack for digesting corrupt xref sections.
// It populates the xRefTable by reading in all indirect objects line by line
// and works on the assumption of a single xref section - meaning no incremental updates have been made.
func bypassXrefSection(ctx *Context) error {
    var z int64
    g := FreeHeadGeneration
    ctx.Table[0] = &XRefTableEntry{
        Free:       true,
        Offset:     &z,
        Generation: &g}

    rs := ctx.Read.rs
    eolCount := ctx.Read.EolCount
    var off, offset int64

    rd, err := newPositionedReader(rs, &offset)
    if err != nil {
        return err
    }

    s := bufio.NewScanner(rd)
    s.Split(scanLines)

    bb := []byte{}
    var (
        withinObj     bool
        withinXref    bool
        withinTrailer bool
    )

    for {
        line, err := scanLineRaw(s)
        if err != nil {
            break
        }
        if withinXref {
            offset += int64(len(line) + eolCount)
            if withinTrailer {
                bb = append(bb, ' ')
                bb = append(bb, line...)
                i := strings.Index(line, "startxref")
                if i >= 0 {
```



```go
                    // Parse trailer.
                    _, err = processTrailer(ctx, s, string(bb))
                    return err
                }
                continue
            }
            // Ignore all until "trailer".
            i := strings.Index(line, "trailer")
            if i >= 0 {
                bb = append(bb, line...)
                withinTrailer = true
            }
            continue
        }
        i := strings.Index(line, "xref")
        if i >= 0 {
            offset += int64(len(line) + eolCount)
            withinXref = true
            continue
        }
        if !withinObj {
            i := strings.Index(line, "obj")
            if i >= 0 {
                withinObj = true
                off = offset
                bb = append(bb, line[:i+3]...)
            }
            offset += int64(len(line) + eolCount)
            continue
        }

        // within obj
        offset += int64(len(line) + eolCount)
        bb = append(bb, ' ')
        bb = append(bb, line...)
        i = strings.Index(line, "endobj")
        if i >= 0 {
            l := string(bb)
            objNr, generation, err := parseObjectAttributes(&l)
            if err != nil {
                return err
            }
            of := off
            ctx.Table[*objNr] = &XRefTableEntry{
                Free:       false,
                Offset:     &of,
                Generation: generation}
            bb = nil
            withinObj = false
        }
    }
    return nil
}

// Build XRefTable by reading XRef streams or XRef sections.
func buildXRefTableStartingAt(ctx *Context, offset *int64) error {

    log.Read.Println("buildXRefTableStartingAt: begin")

```



```go
    rs := ctx.Read.rs

    hv, eolCount, err := headerVersion(rs)
    if err != nil {
        return err
    }

    ctx.HeaderVersion = hv
    ctx.Read.EolCount = eolCount

    for offset != nil {

        rd, err := newPositionedReader(rs, offset)
        if err != nil {
            return err
        }

        s := bufio.NewScanner(rd)
        s.Split(scanLines)

        line, err := scanLine(s)
        if err != nil {
            return err
        }

        log.Read.Printf("line: <%s>\n", line)

        if strings.TrimSpace(line) == "xref" {
            log.Read.Println("buildXRefTableStartingAt: found xref section")
            if offset, err = parseXRefSection(s, ctx); err != nil {
                return err
            }
        } else {

            log.Read.Println("buildXRefTableStartingAt: found xref stream")
            ctx.Read.UsingXRefStreams = true
            rd, err = newPositionedReader(rs, offset)
            if err != nil {
                return err
            }
            if offset, err = parseXRefStream(rd, offset, ctx); err != nil {
                log.Read.Printf("bypassXRefSection after %v\n", err)
                // Try fix for corrupt single xref section.
                return bypassXrefSection(ctx)
            }
        }
    }

    log.Read.Println("buildXRefTableStartingAt: end")

    return nil
}

// Populate the cross reference table for this PDF file.
// Goto offset of first xref table entry.
// Can be "xref" or indirect object reference eg. "34 0 obj"
// Keep digesting xref sections as long as there is a defined previous xref section
// and build up the xref table along the way.
func readXRefTable(ctx *Context) (err error) {
```



```go

    log.Read.Println("readXRefTable: begin")

    offset, err := offsetLastXRefSection(ctx)
    if err != nil {
        return
    }

    err = buildXRefTableStartingAt(ctx, offset)
    if err == io.EOF {
        return errors.Wrap(err, "readXRefTable: unexpected eof")
    }
    if err != nil {
        return
    }

    // Log list of free objects (not the "free list").
    //log.Read.Printf("freelist: %v\n", ctx.FreeObjects)

    // Ensure valid freelist of objects.
    err = ctx.EnsureValidFreeList()
    if err != nil {
        return
    }

    log.Read.Println("readXRefTable: end")

    return
}

func growBufBy(buf []byte, size int, rd io.Reader) ([]byte, error) {

    b := make([]byte, size)

    _, err := rd.Read(b)
    if err != nil {
        return nil, err
    }
    //log.Read.Printf("growBufBy: Read %d bytes\n", n)

    return append(buf, b...), nil
}

func nextStreamOffset(line string, streamInd int) (off int) {

    off = streamInd + len("stream")

    // Skip optional blanks.
    // TODO Should be skip optional whitespace instead?
    for ; line[off] == 0x20; off++ {
    }

    // Skip 0A eol.
    if line[off] == '\n' {
        off++
        return
    }

    // Skip 0D eol.
```



```go
    if line[off] == '\r' {
        off++
        // Skip 0D0A eol.
        if line[off] == '\n' {
            off++
        }
    }

    return
}

func lastStreamMarker(streamInd *int, endInd int, line string) {

    if *streamInd > len(line)-len("stream") {
        // No space for another stream marker.
        *streamInd = -1
        return
    }

    // We start searching after this stream marker.
    bufpos := *streamInd + len("stream")

    // Search for next stream marker.
    i := strings.Index(line[bufpos:], "stream")
    if i < 0 {
        // No stream marker within line buffer.
        *streamInd = -1
        return
    }

    // We found the next stream marker.
    *streamInd += len("stream") + i

    if endInd > 0 && *streamInd > endInd {
        // We found a stream marker of another object
        *streamInd = -1
    }

}

// Provide a PDF file buffer of sufficient size for parsing an object w/o stream.
func buffer(rd io.Reader) (buf []byte, endInd int, streamInd int, streamOffset int64, err error) {

    // process: # gen obj ... obj dict ... {stream ... data ... endstream} ... endobj
    //                                    streamInd                            endInd
    //                                  -1 if absent                        -1 if absent

    //log.Read.Println("buffer: begin")

    endInd, streamInd = -1, -1

    for endInd < 0 && streamInd < 0 {

        buf, err = growBufBy(buf, defaultBufSize, rd)
        if err != nil {
            return nil, 0, 0, 0, err
        }
```



```go

        line := string(buf)
        endInd = strings.Index(line, "endobj")
        streamInd = strings.Index(line, "stream")

        if endInd > 0 && (streamInd < 0 || streamInd > endInd) {
            // No stream marker in buf detected.
            break
        }

        // For very rare cases where "stream" also occurs within obj dict
        // we need to find the last "stream" marker before a possible end marker.
        for streamInd > 0 && !keywordStreamRightAfterEndOfDict(line, streamInd) {
            lastStreamMarker(&streamInd, endInd, line)
        }

        log.Read.Printf("buffer: endInd=%d streamInd=%d\n", endInd, streamInd)

        if streamInd > 0 {

            // streamOffset ... the offset where the actual stream data begins.
            //                  is right after the eol after "stream".

            slack := 10 // for optional whitespace + eol (max 2 chars)
            need := streamInd + len("stream") + slack

            if len(line) < need {

                // to prevent buffer overflow.
                buf, err = growBufBy(buf, need-len(line), rd)
                if err != nil {
                    return nil, 0, 0, 0, err
                }

                line = string(buf)
            }

            streamOffset = int64(nextStreamOffset(line, streamInd))
        }
    }

    //log.Read.Printf("buffer: end, returned bufsize=%d streamOffset=%d\n", len(buf), streamOffset)

    return buf, endInd, streamInd, streamOffset, nil
}

// return true if 'stream' follows end of dict: >>{whitespace}stream
func keywordStreamRightAfterEndOfDict(buf string, streamInd int) bool {

    //log.Read.Println("keywordStreamRightAfterEndOfDict: begin")

    // Get a slice of the chunk right in front of 'stream'.
    b := buf[:streamInd]

    // Look for last end of dict marker.
    eod := strings.LastIndex(b, ">>")
    if eod < 0 {
        // No end of dict in buf.
```

```go
        return false
    }

    // We found the last >>. Return true if after end of dict only whitespace.
    ok := strings.TrimSpace(b[eod:]) == ">>"

    //log.Read.Printf("keywordStreamRightAfterEndOfDict: end, %v\n", ok)

    return ok
}

func buildFilterPipeline(ctx *Context, filterArray, decodeParmsArr Array, decodeParms Object) ([]PDFFilter, error) {

    var filterPipeline []PDFFilter

    for i, f := range filterArray {

        filterName, ok := f.(Name)
        if !ok {
            return nil, errors.New("pdfcpu: buildFilterPipeline: filterArray elements corrupt")
        }
        if decodeParms == nil || decodeParmsArr[i] == nil {
            filterPipeline = append(filterPipeline, PDFFilter{Name: filterName.Value(), DecodeParms: nil})
            continue
        }

        dict, ok := decodeParmsArr[i].(Dict)
        if !ok {
            indRef, ok := decodeParmsArr[i].(IndirectRef)
            if !ok {
                return nil, errors.Errorf("buildFilterPipeline: corrupt Dict: %s\n", dict)
            }
            d, err := dereferencedDict(ctx, indRef.ObjectNumber.Value())
            if err != nil {
                return nil, err
            }
            dict = d
        }

        filterPipeline = append(filterPipeline, PDFFilter{Name: filterName.String(), DecodeParms: dict})
    }

    return filterPipeline, nil
}

// Return the filter pipeline associated with this stream dict.
func pdfFilterPipeline(ctx *Context, dict Dict) ([]PDFFilter, error) {

    log.Read.Println("pdfFilterPipeline: begin")

    var err error

    o, found := dict.Find("Filter")
    if !found {
        // stream is not compressed.
```



```go
        return nil, nil
    }

    // compressed stream.

    var filterPipeline []PDFFilter

    if indRef, ok := o.(IndirectRef); ok {
        o, err = dereferencedObject(ctx, indRef.ObjectNumber.Value())
        if err != nil {
            return nil, err
        }
    }

    //fmt.Printf("dereferenced filter obj: %s\n", obj)

    if name, ok := o.(Name); ok {

        // single filter.

        filterName := name.String()

        o, found := dict.Find("DecodeParms")
        if !found {
            // w/o decode parameters.
            log.Read.Println("pdfFilterPipeline: end w/o decode parms")
            return append(filterPipeline, PDFFilter{Name: filterName, DecodeParms: nil}), nil
        }

        d, ok := o.(Dict)
        if !ok {
            ir, ok := o.(IndirectRef)
            if !ok {
                return nil, errors.Errorf("pdfFilterPipeline: corrupt Dict: %s\n", o)
            }
            d, err = dereferencedDict(ctx, ir.ObjectNumber.Value())
            if err != nil {
                return nil, err
            }
        }

        // with decode parameters.
        log.Read.Println("pdfFilterPipeline: end with decode parms")
        return append(filterPipeline, PDFFilter{Name: filterName, DecodeParms: d}), nil
    }

    // filter pipeline.

    // Array of filternames
    filterArray, ok := o.(Array)
    if !ok {
        return nil, errors.Errorf("pdfFilterPipeline: Expected filterArray corrupt, %v %T", o, o)
    }

    // Optional array of decode parameter dicts.
    var decodeParmsArr Array
```



```go
    decodeParms, found := dict.Find("DecodeParms")
    if found {
        decodeParmsArr, ok = decodeParms.(Array)
        if !ok {
            return nil, errors.New("pdfcpu: pdfFilterPipeline: expected decodeParms array corrupt")
        }
    }

    //fmt.Printf("decodeParmsArr: %s\n", decodeParmsArr)

    filterPipeline, err = buildFilterPipeline(ctx, filterArray, decodeParmsArr, decodeParms)

    log.Read.Println("pdfFilterPipeline: end")

    return filterPipeline, err
}

func streamDictForObject(ctx *Context, d Dict, objNr, streamInd int, streamOffset, offset int64) (sd StreamDict, err error) {

    streamLength, streamLengthRef := d.Length()

    if streamInd <= 0 {
        return sd, errors.New("pdfcpu: streamDictForObject: stream object without streamOffset")
    }

    filterPipeline, err := pdfFilterPipeline(ctx, d)
    if err != nil {
        return sd, err
    }

    streamOffset += offset

    // We have a stream object.
    sd = NewStreamDict(d, streamOffset, streamLength, streamLengthRef, filterPipeline)

    log.Read.Printf("streamDictForObject: end, Streamobject #%d\n", objNr)

    return sd, nil
}

func dict(ctx *Context, d1 Dict, objNr, genNr, endInd, streamInd int) (d2 Dict, err error) {

    if ctx.EncKey != nil {
        _, err := decryptDeepObject(d1, objNr, genNr, ctx.EncKey, ctx.AES4Strings, ctx.E.R)
        if err != nil {
            return nil, err
        }
    }

    if endInd >= 0 && (streamInd < 0 || streamInd > endInd) {
        log.Read.Printf("dict: end, #%d\n", objNr)
        d2 = d1
    }

```



```go
    return d2, nil
}

func object(ctx *Context, offset int64, objNr, genNr int) (o Object, endInd, streamInd int, streamOffset int64, err error) {

    var rd io.Reader
    rd, err = newPositionedReader(ctx.Read.rs, &offset)
    if err != nil {
        return nil, 0, 0, 0, err
    }

    //log.Read.Printf("object: seeked to offset:%d\n", offset)

    // process: # gen obj ... obj dict ... {stream ... data ... endstream} endobj
    //                                    streamInd                        endInd
    //                                  -1 if absent                    -1 if absent
    var buf []byte
    buf, endInd, streamInd, streamOffset, err = buffer(rd)
    if err != nil {
        return nil, 0, 0, 0, err
    }

    //log.Read.Printf("streamInd:%d(#%x) streamOffset:%d(#%x) endInd:%d(#%x)\n", streamInd, streamInd, streamOffset, streamOffset, endInd, endInd)
    //log.Read.Printf("buflen=%d\n%s", len(buf), hex.Dump(buf))

    line := string(buf)

    var l string

    if endInd < 0 { // && streamInd >= 0, streamdict
        // buf: # gen obj ... obj dict ... stream ... data
        // implies we detected no endobj and a stream starting at streamInd.
        // big stream, we parse object until "stream"
        log.Read.Println("object: big stream, we parse object until stream")
        l = line[:streamInd]
    } else if streamInd < 0 { // dict
        // buf: # gen obj ... obj dict ... endobj
        // implies we detected endobj and no stream.
        // small object w/o stream, parse until "endobj"
        log.Read.Println("object: small object w/o stream, parse until endobj")
        l = line[:endInd]
    } else if streamInd < endInd { // streamdict
        // buf: # gen obj ... obj dict ... stream ... data ... endstream endobj
        // implies we detected endobj and stream.
        // small stream within buffer, parse until "stream"
        log.Read.Println("object: small stream within buffer, parse until stream")
        l = line[:streamInd]
    } else { // dict
        // buf: # gen obj ... obj dict ... endobj # gen obj ... obj dict ... stream
        // small obj w/o stream, parse until "endobj"
        // stream in buf belongs to subsequent object.
        log.Read.Println("object: small obj w/o stream, parse until endobj")
        l = line[:endInd]
    }

    // Parse object number and object generation.
    var objectNr, generationNr *int
```



```go
    objectNr, generationNr, err = parseObjectAttributes(&l)
    if err != nil {
        return nil, 0, 0, 0, err
    }

    if objNr != *objectNr || genNr != *generationNr {
        return nil, 0, 0, 0, errors.Errorf("object: non matching objNr(%d) or generationNumber(%d) tags found.", *objectNr, *generationNr)
    }

    o, err = parseObject(&l)

    return o, endInd, streamInd, streamOffset, err
}

// ParseObject parses an object from file at given offset.
func ParseObject(ctx *Context, offset int64, objNr, genNr int) (Object, error) {

    log.Read.Printf("ParseObject: begin, obj#%d, offset:%d\n", objNr, offset)

    obj, endInd, streamInd, streamOffset, err := object(ctx, offset, objNr, genNr)
    if err != nil {
        return nil, err
    }

    switch o := obj.(type) {

    case Dict:
        d, err := dict(ctx, o, objNr, genNr, endInd, streamInd)
        if err != nil || d != nil {
            // Dict
            return d, err
        }
        // StreamDict.
        return streamDictForObject(ctx, o, objNr, streamInd, streamOffset, offset)

    case Array:
        if ctx.EncKey != nil {
            if _, err = decryptDeepObject(o, objNr, genNr, ctx.EncKey, ctx.AES4Strings, ctx.E.R); err != nil {
                return nil, err
            }
        }
        return o, nil

    case StringLiteral:
        if ctx.EncKey != nil {
            s1, err := decryptString(o.Value(), objNr, genNr, ctx.EncKey, ctx.AES4Strings, ctx.E.R)
            if err != nil {
                return nil, err
            }
            return StringLiteral(*s1), nil
        }
        return o, nil

    case HexLiteral:
        if ctx.EncKey != nil {
            bb, err := decryptHexLiteral(o, objNr, genNr, ctx.EncKey, ctx.AES4Strings, ctx.E.R)
```



```go
            if err != nil {
                return nil, err
            }
            return StringLiteral(string(bb)), nil
        }
        return o, nil

    default:
        return o, nil
    }
}

func dereferencedObject(ctx *Context, objectNumber int) (Object, error) {

    entry, ok := ctx.Find(objectNumber)
    if !ok {
        return nil, errors.New("pdfcpu: dereferencedObject: unregistered object")
    }

    if entry.Compressed {
        err := decompressXRefTableEntry(ctx.XRefTable, objectNumber, entry)
        if err != nil {
            return nil, err
        }
    }

    if entry.Object == nil {

        log.Read.Printf("dereferencedObject: dereferencing object %d\n", objectNumber)

        o, err := ParseObject(ctx, *entry.Offset, objectNumber, *entry.Generation)
        if err != nil {
            return nil, errors.Wrapf(err, "dereferencedObject: problem dereferencing object %d", objectNumber)
        }

        if o == nil {
            return nil, errors.New("pdfcpu: dereferencedObject: object is nil")
        }

        entry.Object = o
    }

    return entry.Object, nil
}

func dereferencedInteger(ctx *Context, objectNumber int) (*Integer, error) {

    o, err := dereferencedObject(ctx, objectNumber)
    if err != nil {
        return nil, err
    }

    i, ok := o.(Integer)
    if !ok {
        return nil, errors.New("pdfcpu: dereferencedInteger: corrupt integer")
    }

```



```go
    return &i, nil
}

func dereferencedDict(ctx *Context, objectNumber int) (Dict, error) {

    o, err := dereferencedObject(ctx, objectNumber)
    if err != nil {
        return nil, err
    }

    d, ok := o.(Dict)
    if !ok {
        return nil, errors.New("pdfcpu: dereferencedDict: corrupt dict")
    }

    return d, nil
}

// dereference a Integer object representing an int64 value.
func int64Object(ctx *Context, objectNumber int) (*int64, error) {

    log.Read.Printf("int64Object begin: %d\n", objectNumber)

    i, err := dereferencedInteger(ctx, objectNumber)
    if err != nil {
        return nil, err
    }

    i64 := int64(i.Value())

    log.Read.Printf("int64Object end: %d\n", objectNumber)

    return &i64, nil

}

// Reads and returns a file buffer with length = stream length using provided reader positioned at offset.
func readContentStream(rd io.Reader, streamLength int) ([]byte, error) {

    log.Read.Printf("readContentStream: begin streamLength:%d\n", streamLength)

    buf := make([]byte, streamLength)

    for totalCount := 0; totalCount < streamLength; {
        count, err := rd.Read(buf[totalCount:])
        if err != nil {
            return nil, err
        }
        log.Read.Printf("readContentStream: count=%d, buflen=%d(%X)\n", count, len(buf), len(buf))
        totalCount += count
    }

    log.Read.Printf("readContentStream: end\n")

    return buf, nil
}

```



```go
// LoadEncodedStreamContent loads the encoded stream content from file into StreamDict.
func loadEncodedStreamContent(ctx *Context, sd *StreamDict) ([]byte, error) {

    log.Read.Printf("LoadEncodedStreamContent: begin\n%v\n", sd)

    var err error

    // Return saved decoded content.
    if sd.Raw != nil {
        log.Read.Println("LoadEncodedStreamContent: end, already in memory.")
        return sd.Raw, nil
    }

    // Read stream content encoded at offset with stream length.

    // Dereference stream length if stream length is an indirect object.
    if sd.StreamLength == nil {
        if sd.StreamLengthObjNr == nil {
            return nil, errors.New("pdfcpu: loadEncodedStreamContent: missing streamLength")
        }
        // Get stream length from indirect object
        sd.StreamLength, err = int64Object(ctx, *sd.StreamLengthObjNr)
        if err != nil {
            return nil, err
        }
        log.Read.Printf("LoadEncodedStreamContent: new indirect streamLength:%d\n", *sd.StreamLength)
    }

    newOffset := sd.StreamOffset
    rd, err := newPositionedReader(ctx.Read.rs, &newOffset)
    if err != nil {
        return nil, err
    }

    log.Read.Printf("LoadEncodedStreamContent: seeked to offset:%d\n", newOffset)

    // Buffer stream contents.
    // Read content from disk.
    rawContent, err := readContentStream(rd, int(*sd.StreamLength))
    if err != nil {
        return nil, err
    }

    //log.Read.Printf("rawContent buflen=%d(#%x)\n%s", len(rawContent), len(rawContent), hex.Dump(rawContent))

    // Save encoded content.
    sd.Raw = rawContent

    log.Read.Printf("LoadEncodedStreamContent: end: len(streamDictRaw)=%d\n", len(sd.Raw))

    // Return encoded content.
    return rawContent, nil
}

// Decodes the raw encoded stream content and saves it to streamDict.Content.
```



```go
func saveDecodedStreamContent(ctx *Context, sd *StreamDict, objNr, genNr int, decode bool) (err error) {

    log.Read.Printf("saveDecodedStreamContent: begin decode=%t\n", decode)

    // If the "Identity" crypt filter is used we do not need to decrypt.
    if ctx != nil && ctx.EncKey != nil {
        if len(sd.FilterPipeline) == 1 && sd.FilterPipeline[0].Name == "Crypt" {
            sd.Content = sd.Raw
            return nil
        }
    }

    // Special case: If the length of the encoded data is 0, we do not need to decode anything.
    if len(sd.Raw) == 0 {
        sd.Content = sd.Raw
        return nil
    }

    // ctx gets created after XRefStream parsing.
    // XRefStreams are not encrypted.
    if ctx != nil && ctx.EncKey != nil {
        sd.Raw, err = decryptStream(sd.Raw, objNr, genNr, ctx.EncKey, ctx.AES4Streams, ctx.E.R)
        if err != nil {
            return err
        }
        l := int64(len(sd.Raw))
        sd.StreamLength = &l
    }

    if !decode {
        return nil
    }

    // Actual decoding of content stream.
    err = decodeStream(sd)
    if err == filter.ErrUnsupportedFilter {
        err = nil
    }
    if err != nil {
        return err
    }

    log.Read.Println("saveDecodedStreamContent: end")

    return nil
}

// Resolve compressed xRefTableEntry
func decompressXRefTableEntry(xRefTable *XRefTable, objectNumber int, entry *XRefTableEntry) error {

    log.Read.Printf("decompressXRefTableEntry: compressed object %d at %d[%d]\n", objectNumber, *entry.ObjectStream, *entry.ObjectStreamInd)

    // Resolve xRefTable entry of referenced object stream.
    objectStreamXRefTableEntry, ok := xRefTable.Find(*entry.ObjectStream)
    if !ok {
```



```go
        return errors.Errorf("decompressXRefTableEntry: problem dereferencing object stream %d, no xref table entry", *entry.ObjectStream)
    }

    // Object of this entry has to be a ObjectStreamDict.
    sd, ok := objectStreamXRefTableEntry.Object.(ObjectStreamDict)
    if !ok {
        return errors.Errorf("decompressXRefTableEntry: problem dereferencing object stream %d, no object stream", *entry.ObjectStream)
    }

    // Get indexed object from ObjectStreamDict.
    o, err := sd.IndexedObject(*entry.ObjectStreamInd)
    if err != nil {
        return errors.Wrapf(err, "decompressXRefTableEntry: problem dereferencing object stream %d", *entry.ObjectStream)
    }

    // Save object to XRefRableEntry.
    g := 0
    entry.Object = o
    entry.Generation = &g
    entry.Compressed = false

    log.Read.Printf("decompressXRefTableEntry: end, Obj %d[%d]:\n<%s>\n", *entry.ObjectStream, *entry.ObjectStreamInd, o)

    return nil
}

// Log interesting stream content.
func logStream(o Object) {

    switch o := o.(type) {

    case StreamDict:

        if o.Content == nil {
            log.Read.Println("logStream: no stream content")
        }

        if o.IsPageContent {
            //log.Read.Printf("content <%s>\n", StreamDict.Content)
        }

    case ObjectStreamDict:

        if o.Content == nil {
            log.Read.Println("logStream: no object stream content")
        } else {
            log.Read.Printf("logStream: objectStream content = %s\n", o.Content)
        }

        if o.ObjArray == nil {
            log.Read.Println("logStream: no object stream obj arr")
        } else {
            log.Read.Printf("logStream: objectStream objArr = %s\n", o.ObjArray)
        }

    default:
```



```go
        log.Read.Println("logStream: no ObjectStreamDict")

    }

}

// Decode all object streams so contained objects are ready to be used.
func decodeObjectStreams(ctx *Context) error {

    // Note:
    // Entry "Extends" intentionally left out.
    // No object stream collection validation necessary.

    log.Read.Println("decodeObjectStreams: begin")

    // Get sorted slice of object numbers.
    var keys []int
    for k := range ctx.Read.ObjectStreams {
        keys = append(keys, k)
    }
    sort.Ints(keys)

    for _, objectNumber := range keys {

        // Get XRefTableEntry.
        entry := ctx.XRefTable.Table[objectNumber]
        if entry == nil {
            return errors.Errorf("decodeObjectStream: missing entry for obj#%d\n", objectNumber)
        }

        log.Read.Printf("decodeObjectStreams: parsing object stream for obj#%d\n", objectNumber)

        // Parse object stream from file.
        o, err := ParseObject(ctx, *entry.Offset, objectNumber, *entry.Generation)
        if err != nil || o == nil {
            return errors.New("pdfcpu: decodeObjectStreams: corrupt object stream")
        }

        // Ensure StreamDict
        sd, ok := o.(StreamDict)
        if !ok {
            return errors.New("pdfcpu: decodeObjectStreams: corrupt object stream")
        }

        // Load encoded stream content to xRefTable.
        if _, err = loadEncodedStreamContent(ctx, &sd); err != nil {
            return errors.Wrapf(err, "decodeObjectStreams: problem dereferencing object stream %d", objectNumber)
        }

        // Save decoded stream content to xRefTable.
        if err = saveDecodedStreamContent(ctx, &sd, objectNumber, *entry.Generation, true); err != nil {
            log.Read.Printf("obj %d: %s", objectNumber, err)
            return err
        }

```



```go
        // Ensure decoded objectArray for object stream dicts.
        if !sd.IsObjStm() {
            return errors.New("pdfcpu: decodeObjectStreams: corrupt object stream")
        }

        // We have an object stream.
        log.Read.Printf("decodeObjectStreams: object stream #%d\n", objectNumber)

        ctx.Read.UsingObjectStreams = true

        // Create new object stream dict.
        osd, err := objectStreamDict(&sd)
        if err != nil {
            return errors.Wrapf(err, "decodeObjectStreams: problem dereferencing object stream %d", objectNumber)
        }

        log.Read.Printf("decodeObjectStreams: decoding object stream %d:\n", objectNumber)

        // Parse all objects of this object stream and save them to ObjectStreamDict.ObjArray.
        if err = parseObjectStream(osd); err != nil {
            return errors.Wrapf(err, "decodeObjectStreams: problem decoding object stream %d\n", objectNumber)
        }

        if osd.ObjArray == nil {
            return errors.Wrap(err, "decodeObjectStreams: objArray should be set!")
        }

        log.Read.Printf("decodeObjectStreams: decoded object stream %d:\n", objectNumber)

        // Save object stream dict to xRefTableEntry.
        entry.Object = *osd
    }

    log.Read.Println("decodeObjectStreams: end")

    return nil
}

func handleLinearizationParmDict(ctx *Context, obj Object, objNr int) error {

    if ctx.Read.Linearized {
        // Linearization dict already processed.
        return nil
    }

    // handle linearization parm dict.
    if d, ok := obj.(Dict); ok && d.IsLinearizationParmDict() {

        ctx.Read.Linearized = true
        ctx.LinearizationObjs[objNr] = true
        log.Read.Printf("handleLinearizationParmDict: identified linearizationObj #%d\n", objNr)

        a := d.ArrayEntry("H")

```



```go
        if a == nil {
            return errors.Errorf("handleLinearizationParmDict: corrupt linearization dict at obj:%d - missing array entry H", objNr)
        }

        if len(a) != 2 && len(a) != 4 {
            return errors.Errorf("handleLinearizationParmDict: corrupt linearization dict at obj:%d - corrupt array entry H, needs length 2 or 4", objNr)
        }

        offset, ok := a[0].(Integer)
        if !ok {
            return errors.Errorf("handleLinearizationParmDict: corrupt linearization dict at obj:%d - corrupt array entry H, needs Integer values", objNr)
        }

        offset64 := int64(offset.Value())
        ctx.OffsetPrimaryHintTable = &offset64

        if len(a) == 4 {

            offset, ok := a[2].(Integer)
            if !ok {
                return errors.Errorf("handleLinearizationParmDict: corrupt linearization dict at obj:%d - corrupt array entry H, needs Integer values", objNr)
            }

            offset64 := int64(offset.Value())
            ctx.OffsetOverflowHintTable = &offset64
        }
    }

    return nil
}

func loadStreamDict(ctx *Context, sd *StreamDict, objNr, genNr int) error {

    var err error

    // Load encoded stream content for stream dicts into xRefTable entry.
    if _, err = loadEncodedStreamContent(ctx, sd); err != nil {
        return errors.Wrapf(err, "dereferenceObject: problem dereferencing stream %d", objNr)
    }

    ctx.Read.BinaryTotalSize += *sd.StreamLength

    // Decode stream content.
    err = saveDecodedStreamContent(ctx, sd, objNr, genNr, ctx.DecodeAllStreams)

    return err
}

func updateBinaryTotalSize(ctx *Context, o Object) {

    switch o := o.(type) {

    case StreamDict:
        ctx.Read.BinaryTotalSize += *o.StreamLength

```



```go
    case ObjectStreamDict:
        ctx.Read.BinaryTotalSize += *o.StreamLength

    case XRefStreamDict:
        ctx.Read.BinaryTotalSize += *o.StreamLength

    }

}

func dereferenceObject(ctx *Context, objNr int) error {

    xRefTable := ctx.XRefTable
    xRefTableSize := len(xRefTable.Table)

    log.Read.Printf("dereferenceObject: begin, dereferencing object %d\n", objNr)

    entry := xRefTable.Table[objNr]

    if entry.Free {
        log.Read.Printf("free object %d\n", objNr)
        return nil
    }

    if entry.Compressed {
        err := decompressXRefTableEntry(xRefTable, objNr, entry)
        if err != nil {
            return err
        }
        //log.Read.Printf("dereferenceObject: decompressed entry, Compressed=%v\n%s\n", entry.Compressed, entry.Object)
        return nil
    }

    // entry is in use.
    log.Read.Printf("in use object %d\n", objNr)

    if entry.Offset == nil || *entry.Offset == 0 {
        log.Read.Printf("dereferenceObject: already decompressed or used object w/o offset -> ignored")
        return nil
    }

    o := entry.Object

    // Already dereferenced stream dict.
    if o != nil {
        logStream(entry.Object)
        updateBinaryTotalSize(ctx, o)
        log.Read.Printf("handleCachedStreamDict: using cached object %d of %d\n<%s>\n", objNr, xRefTableSize, entry.Object)
        return nil
    }

    // Dereference (load from disk into memory).

    log.Read.Printf("dereferenceObject: dereferencing object %d\n", objNr)

    // Parse object from file: anything goes dict, array, integer, float, streamdicts...
```



```go
    o, err := ParseObject(ctx, *entry.Offset, objNr, *entry.Generation)
    if err != nil {
        return errors.Wrapf(err, "dereferenceObject: problem dereferencing object %d", objNr)
    }

    entry.Object = o

    // Linearization dicts are validated and recorded for stats only.
    err = handleLinearizationParmDict(ctx, o, objNr)
    if err != nil {
        return err
    }

    // Handle stream dicts.

    if _, ok := o.(ObjectStreamDict); ok {
        return errors.Errorf("dereferenceObject: object stream should already be dereferenced at obj:%d", objNr)
    }

    if _, ok := o.(XRefStreamDict); ok {
        return errors.Errorf("dereferenceObject: xref stream should already be dereferenced at obj:%d", objNr)
    }

    if sd, ok := o.(StreamDict); ok {

        err = loadStreamDict(ctx, &sd, objNr, *entry.Generation)
        if err != nil {
            return err
        }

        entry.Object = sd
    }

    log.Read.Printf("dereferenceObject: end obj %d of %d\n<%s>\n", objNr, xRefTableSize, entry.Object)

    logStream(entry.Object)

    return nil
}

func processDictRefCounts(xRefTable *XRefTable, d Dict) {
    for _, e := range d {
        switch o1 := e.(type) {
        case IndirectRef:
            entry, ok := xRefTable.FindTableEntryForIndRef(&o1)
            if ok {
                entry.RefCount++
            }
        case Dict:
            processRefCounts(xRefTable, o1)
        case Array:
            processRefCounts(xRefTable, o1)
        }
    }
}
```



```go

func processArrayRefCounts(xRefTable *XRefTable, a Array) {
    for _, e := range a {
        switch o1 := e.(type) {
        case IndirectRef:
            entry, ok := xRefTable.FindTableEntryForIndRef(&o1)
            if ok {
                entry.RefCount++
            }
        case Dict:
            processRefCounts(xRefTable, o1)
        case Array:
            processRefCounts(xRefTable, o1)
        }
    }
}

func processRefCounts(xRefTable *XRefTable, o Object) {

    switch o := o.(type) {
    case Dict:
        processDictRefCounts(xRefTable, o)

    case StreamDict:
        processDictRefCounts(xRefTable, o.Dict)

    case Array:
        processArrayRefCounts(xRefTable, o)
    }
}

// Dereferences all objects including compressed objects from object streams.
func dereferenceObjects(ctx *Context) error {

    log.Read.Println("dereferenceObjects: begin")

    xRefTable := ctx.XRefTable

    // Get sorted slice of object numbers.
    // TODO Skip sorting for performance gain.
    var keys []int
    for k := range xRefTable.Table {
        keys = append(keys, k)
    }
    sort.Ints(keys)

    for _, objNr := range keys {
        err := dereferenceObject(ctx, objNr)
        if err != nil {
            return err
        }
    }

    for _, objNr := range keys {
        entry := xRefTable.Table[objNr]
        if entry.Free || entry.Compressed {
            continue
        }
        processRefCounts(xRefTable, entry.Object)
```



```go
    }

    log.Read.Println("dereferenceObjects: end")

    return nil
}

// Locate a possible Version entry (since V1.4) in the catalog
// and record this as rootVersion (as opposed to headerVersion).
func identifyRootVersion(xRefTable *XRefTable) error {

    log.Read.Println("identifyRootVersion: begin")

    // Try to get Version from Root.
    rootVersionStr, err := xRefTable.ParseRootVersion()
    if err != nil {
        return err
    }

    if rootVersionStr == nil {
        return nil
    }

    // Validate version and save corresponding constant to xRefTable.
    rootVersion, err := PDFVersion(*rootVersionStr)
    if err != nil {
        return errors.Wrapf(err, "identifyRootVersion: unknown PDF Root version: %s\n", *rootVersionStr)
    }

    xRefTable.RootVersion = &rootVersion

    // since V1.4 the header version may be overridden by a Version entry in the catalog.
    if *xRefTable.HeaderVersion < V14 {
        log.Info.Printf("identifyRootVersion: PDF version is %s - will ignore root version: %s\n",
            xRefTable.HeaderVersion, *rootVersionStr)
    }

    log.Read.Println("identifyRootVersion: end")

    return nil
}

// Parse all Objects including stream content from file and save to the corresponding xRefTableEntries.
// This includes processing of object streams and linearization dicts.
func dereferenceXRefTable(ctx *Context, conf *Configuration) error {

    log.Read.Println("dereferenceXRefTable: begin")

    xRefTable := ctx.XRefTable

    // Note for encrypted files:
    // Mandatory provide userpw to open & display file.
    // Access may be restricted (Decode access privileges).
    // Optionally provide ownerpw in order to gain unrestricted access.
    err := checkForEncryption(ctx)
    if err != nil {
```



```go
        return err
    }
    //fmt.Println("pw authenticated")

    // Prepare decompressed objects.
    err = decodeObjectStreams(ctx)
    if err != nil {
        return err
    }

    // For each xRefTableEntry assign a Object either by parsing from file or pointing to a decompressed object.
    err = dereferenceObjects(ctx)
    if err != nil {
        return err
    }

    // Identify an optional Version entry in the root object/catalog.
    err = identifyRootVersion(xRefTable)
    if err != nil {
        return err
    }

    log.Read.Println("dereferenceXRefTable: end")

    return nil
}

func handleUnencryptedFile(ctx *Context) error {

    if ctx.Cmd == DECRYPT || ctx.Cmd == SETPERMISSIONS {
        return errors.New("pdfcpu: this file is not encrypted")
    }

    if ctx.Cmd != ENCRYPT {
        return nil
    }

    // Encrypt subcommand found.

    if ctx.OwnerPW == "" {
        return errors.New("pdfcpu: please provide owner password and optional user password")
    }

    return nil
}

func idBytes(ctx *Context) (id []byte, err error) {

    if ctx.ID == nil {
        return nil, errors.New("pdfcpu: missing ID entry")
    }

    hl, ok := ctx.ID[0].(HexLiteral)
    if ok {
        id, err = hl.Bytes()
        if err != nil {
            return nil, err
```



```go
        }
    } else {
        sl, ok := ctx.ID[0].(StringLiteral)
        if !ok {
            return nil, errors.New("pdfcpu: ID must contain hex literals or string literals")
        }
        id, err = Unescape(sl.Value())
        if err != nil {
            return nil, err
        }
    }

    return id, nil
}

func needsOwnerAndUserPassword(cmd CommandMode) bool {

    return cmd == CHANGEOPW || cmd == CHANGEUPW || cmd == SETPERMISSIONS
}

func handlePermissions(ctx *Context) error {

    // AES256 Validate permissions
    ok, err := validatePermissions(ctx)
    if err != nil {
        return err
    }

    if !ok {
        return errors.New("pdfcpu: corrupted permissions after upw ok")
    }

    // Double check minimum permissions for pdfcpu processing.
    if !hasNeededPermissions(ctx.Cmd, ctx.E) {
        return errors.New("pdfcpu: insufficient access permissions")
    }

    return nil
}

func setupEncryptionKey(ctx *Context, d Dict) (err error) {

    ctx.E, err = supportedEncryption(ctx, d)
    if err != nil {
        return err
    }

    ctx.E.ID, err = idBytes(ctx)
    if err != nil {
        return err
    }

    var ok bool

    //fmt.Printf("opw: <%s> upw: <%s> \n", ctx.OwnerPW, ctx.UserPW)

    // Validate the owner password aka. permissions/master password.
    ok, err = validateOwnerPassword(ctx)
```



```go
    if err != nil {
        return err
    }

    // If the owner password does not match we generally move on if the user password is correct
    // unless we need to insist on a correct owner password due to the specific command in progress.
    if !ok && needsOwnerAndUserPassword(ctx.Cmd) {
        return errors.New("pdfcpu: please provide the owner password with -opw")
    }

    // Generally the owner password, which is also regarded as the master password or set permissions password
    // is sufficient for moving on. A password change is an exception since it requires both current passwords.
    if ok && !needsOwnerAndUserPassword(ctx.Cmd) {
        // AES256 Validate permissions
        ok, err = validatePermissions(ctx)
        if err != nil {
            return err
        }
        if !ok {
            return errors.New("pdfcpu: corrupted permissions after opw ok")
        }
        return nil
    }

    // Validate the user password aka. document open password.
    ok, err = validateUserPassword(ctx)
    if err != nil {
        return err
    }
    if !ok {
        return errors.New("pdfcpu: please provide the correct password")
    }

    //fmt.Printf("upw ok: %t\n", ok)

    return handlePermissions(ctx)
}

func checkForEncryption(ctx *Context) error {

    ir := ctx.Encrypt

    if ir == nil {
        // This file is not encrypted.
        return handleUnencryptedFile(ctx)
    }

    // This file is encrypted.
    log.Read.Printf("Encryption: %v\n", ir)

    if ctx.Cmd == ENCRYPT {
        // We want to encrypt this file.
        return errors.New("pdfcpu: this file is already encrypted")
    }

    // Dereference encryptDict.
```



```go
    d, err := dereferencedDict(ctx, ir.ObjectNumber.Value())
    if err != nil {
        return err
    }
    log.Read.Printf("%s\n", d)

    // We need to decrypt this file in order to read it.
    return setupEncryptionKey(ctx, d)
}

```