```
/*<html>
<span id="gsh">
<meta charset="UTF-8">
<meta name="viewport" content="width=device-width, initial-scale=1.0">
<link rel="icon" id="gsh-faviconurl" href=""><!-- place holder -->
<span id="gsh-version" style="display:none;">gsh--0.3.0--2020-09-03--SatoxITS</span>
<title>GShell-0.3.0 by SatoxITS</title>
<header id="gsh-banner" height="100px" onclick="shiftBG();" style="">
<div align="right"><note>GShell version 0.3.0 // 2020-09-03 // SatoxITS</note></div>
</header>
<h2>GShell // a General purpose Shell built on the top of Golang</h2>
<p>
<note>
It is a shell for myself, by myself, of myself. --SatoxITS(^-^)
</note>
</p>
<span id="gsh-WinId" onclick="win_jump('0.1');">0</span>
<span id="gsh-menu">
| <span id="gsh-menu-exit" onclick="html_close();"></span>
| <span id="gsh-menu-fork" onclick="html_fork();">Fork</span>
| <span id="gsh-menu-stop" onclick="html_stop(this,true);">Stop</span>
| <span id="gsh-menu-fold" onclick="html_fold(this);">Unfold</span>
| <span id="gsh-menu-cksum" onclick="html_cksum(this);">Cksum</span>
<!-- | <span id="gsh-menu-pure" onclick="html_pure(this);">Pure</span> -->
|</span>
*/
/*
<details id="gsh-statement" class="gsh-document"><summary>Statement</summary>
<h3>Fun to create a shell</h3>
<p>For a programmer, it must be far easy and fun to create his own simple shell
rightly fitting to his favor and necessities, than learning existing shells with
complex full features that he never use.
I, as one of programmers, am writing this tiny shell for my own real needs,
totally from scratch, with fun.
</p><p>
For a programmer, it is fun to learn new computer languages.  For long years before
writing this software, I had been specialized to C and early HTML2 :-).
Now writing this software,  I'm learning Go language, HTML5, JavaScript and CSS
on demand as a novice of these, with fun.
</p><p>
This single file "gsh.go", that is executable by Go, contains all of the code written
in Go. Also it can be displayed as "gsh.go.html" by browsers. It is a standalone
HTML file that works as the viewer of the code of itself, and as the "home page" of
this software.
</p><p>
Because this HTML file is a Go program, you may run it as a real shell program
on your computer.
But you must be aware that this program is written under situation like above.
Needless to say, there is no warranty for this program in any means.
</p>
<address>Aug 2020, SatoxITS (sato@its-more.jp)</address>
</details>
*/
/*
<details id="gsh-features" class="gsh-document"><summary>Features</summary><p>
</p>
<h3>Vi compatible command line editor</h3>
<p>
The command line of GShell can be edited with commands compatible with
<a href="https://www.washington.edu/computing/unix/vi.html"><b>vi</b></a>.
As in vi, you can enter <i><b>command mode</b></i> by <b>ESC</b> key,
then move around in the history by <b><code>j k / ? n N</code></b>,
or within the current line by <b><code>l h f w b 0 $ %</code></b> or so.
</p>
</details>
*/
/*
<details id="gsh-gindex">
<summary>Index</summary><div class="gsh-src">
Documents
    <span class="gsh-link" onclick="jumpto_JavaScriptView();">Command summary</span>
Go lang part<span class="gsh-src" onclick="document.getElementById('gsh-gocode').open=true;">
    Package structures
        <a href="#import">import</a>
        <a href="#struct">struct</a>
    Main functions
        <a href="#comexpansion">str-expansion</a>   // macro processor
        <a href="#finder">finder</a>        // builtin find + du
        <a href="#grep">grep</a>        // builtin grep + wc + cksum + ...
        <a href="#plugin">plugin</a>        // plugin commands
        <a href="#ex-commands">system</a>       // external commands
        <a href="#builtin">builtin</a>      // builtin commands
        <a href="#network">network</a>      // socket handler
        <a href="#remote-sh">remote-sh</a>  // remote shell
        <a href="#redirect">redirect</a>    // StdIn/Out redireciton
        <a href="#history">history</a>      // command history
        <a href="#rusage">rusage</a>        // resouce usage
        <a href="#encode">encode</a>        // encode / decode
        <a href="#IME">IME</a>      // command line IME
        <a href="#getline">getline</a>      // line editor
        <a href="#scanf">scanf</a>      // string decomposer
        <a href="#interpreter">interpreter</a>  // command interpreter
        <a href="#main">main</a>
</span>
JavaScript part
    <a href="#script-src-view" class="gsh-link" onclick="jumpto_JavaScriptView();">Source</a>
    <a href="#gsh-data-frame" class="gsh-link" onclick="jumpto_DataView();">Builtin data</a>
CSS part
    <a href="#style-src-view" class="gsh-link" onclick="jumpto_StyleView();">Source</a>
References
    <a href="#" class="gsh-link" onclick="jumpto_WholeView();">Internal</a>
    <a href="#gsh-reference" class="gsh-link" onclick="jumpto_ReferenceView();">External</a>
Whole parts
    <a href="#whole-src-view" class="gsh-link" onclick="jumpto_WholeView();">Source</a>
    <a href="#whole-src-view" class="gsh-link" onclick="jumpto_WholeView();">Download</a>
    <a href="#whole-src-view" class="gsh-link" onclick="jumpto_WholeView();">Dump</a>

</div>
</details>
*/
//<details id="gsh-gocode">
//<summary>Go Source</summary><div class="gsh-src" onclick="document.getElementById('gsh-gocode').open=false;">
// gsh - Go lang based Shell
// (c) 2020 ITS more Co., Ltd.
// 2020-0807 created by SatoxITS (sato@its-more.jp)

package main // gsh main
// <a name="import">Imported packages</a> // <a href="https://golang.org/pkg/">Packages</a>
import (
    "fmt"       // <a href="https://golang.org/pkg/fmt/">fmt</a>
    "strings"   // <a href="https://golang.org/pkg/strings/">strings</a>
    "strconv"   // <a href="https://golang.org/pkg/strconv/">strconv</a>
    "sort"      // <a href="https://golang.org/pkg/sort/">sort</a>
    "time"      // <a href="https://golang.org/pkg/time/">time</a>
```

```
    "bufio"     // <a href="https://golang.org/pkg/bufio/">bufio</a>
    "io/ioutil" // <a href="https://golang.org/pkg/io/ioutil/">ioutil</a>
    "os"        // <a href="https://golang.org/pkg/os/">os</a>
    "syscall"   // <a href="https://golang.org/pkg/syscall/">syscall</a>
    "plugin"    // <a href="https://golang.org/pkg/plugin/">plugin</a>
    "net"       // <a href="https://golang.org/pkg/net/">net</a>
    "net/http"  // <a href="https://golang.org/pkg/net/http/">http</a>
    //"html"    // <a href="https://golang.org/pkg/html/">html</a>
    "path/filepath" // <a href="https://golang.org/pkg/path/filepath/">filepath</a>
    "go/types"  // <a href="https://golang.org/pkg/go/types/">types</a>
    "go/token"  // <a href="https://golang.org/pkg/go/token/">token</a>
    "encoding/base64"   // <a href="https://golang.org/pkg/encoding/base64/">base64</a>
    "unicode/utf8"  // <a href="https://golang.org/pkg/unicode/utf8/">utf8</a>
    //"gshdata" // gshell's logo and source code
    "hash/crc32"    // <a href="https://golang.org/pkg/unicode/hash/crc32/">crc32</a>
)
const (
    NAME = "gsh"
    VERSION = "0.3.0"
    DATE = "2020-09-03"
    AUTHOR = "SatoxITS(^-^)/"
)
var (
    GSH_HOME = ".gsh"   // under home directory
    GSH_PORT = 9999
    MaxStreamSize = int64(128*1024*1024*1024) // 128GiB is too large?
    PROMPT = "> "
    LINESIZE = (8*1024)
    PATHSEP = ":"   // should be ";" in Windows
    DIRSEP = "/"    // canbe \ in Windows
)

// -xX logging control
// --A-- all
// --I-- info.
// --D-- debug
// --T-- time and resource usage
// --W-- warning
// --E-- error
// --F-- fatal error
// --Xn- network

// <a name="struct">Structures</a>
type GCommandHistory struct {
    StartAt     time.Time // command line execution started at
    EndAt       time.Time // command line execution ended at
    ResCode     int       // exit code of (external command)
    CmdError    error     // error string
    OutData     *os.File  // output of the command
    FoundFile   []string  // output - result of ufind
    Rusagev     [2]syscall.Rusage // Resource consumption, CPU time or so
    CmdId       int       // maybe with identified with arguments or impact
                      // redireciton commands should not be the CmdId
    WorkDir     string    // working directory at start
    WorkDirX    int       // index in ChdirHistory
    CmdLine     string    // command line
}
type GChdirHistory struct {
    Dir     string
    MovedAt     time.Time
    CmdIndex    int
}
type CmdMode struct {
    BackGround  bool
}
type Event struct {
    when        time.Time
    event       int
    evarg       int64
    CmdIndex    int
}
var CmdIndex int
var Events []Event
type PluginInfo struct {
    Spec        *plugin.Plugin
    Addr        plugin.Symbol
    Name        string // maybe relative
    Path        string // this is in Plugin but hidden
}
type GServer struct {
    host        string
    port        string
}

// <a href="https://tools.ietf.org/html/rfc3230">Digest</a>
const ( // SumType
    SUM_ITEMS   = 0x000001 // items count
    SUM_SIZE    = 0x000002 // data length (simplly added)
    SUM_SIZEHASH    = 0x000004 // data length (hashed sequence)
    SUM_DATEHASH    = 0x000008 // date of data (hashed sequence)
    // also envelope attributes like time stamp can be a part of digest
    // hashed value of sizes or mod-date of files will be useful to detect changes

    SUM_WORDS   = 0x000010 // word count is a kind of digest
    SUM_LINES   = 0x000020 // line count is a kind of digest
    SUM_SUM64   = 0x000040 // simple add of bytes, useful for human too

    SUM_SUM32_BITS  = 0x000100 // the number of true bits
    SUM_SUM32_2BYTE = 0x000200 // 16bits words
    SUM_SUM32_4BYTE = 0x000400 // 32bits words
    SUM_SUM32_8BYTE = 0x000800 // 64bits words

    SUM_SUM16_BSD   = 0x001000 // UNIXsum -sum -bsd
    SUM_SUM16_SYSV  = 0x002000 // UNIXsum -sum -sysv
    SUM_UNIXFILE    = 0x004000
    SUM_CRCIEEE = 0x008000
)
type CheckSum struct {
    Files       int64   // the number of files (or data)
    Size        int64   // content size
    Words       int64   // word count
    Lines       int64   // line count
    SumType     int
    Sum64       uint64
    Crc32Table  crc32.Table
    Crc32Val    uint32
    Sum16       int
    Ctime       time.Time
    Atime       time.Time
    Mtime       time.Time
    Start       time.Time
    Done        time.Time
    RusgAtStart [2]syscall.Rusage
    RusgAtEnd   [2]syscall.Rusage
}
```

```
type ValueStack [][]string
type GshContext struct {
    StartDir    string  // the current directory at the start
    GetLine     string  // gsh-getline command as a input line editor
    ChdirHistory    []GChdirHistory // the 1st entry is wd at the start
    gshPA       syscall.ProcAttr
    CommandHistory  []GCommandHistory
    CmdCurrent  GCommandHistory
    BackGround  bool
    BackGroundJobs  []int
    LastRusage  syscall.Rusage
    GshHomeDir  string
    TerminalId  int
    CmdTrace    bool // should be [map]
    CmdTime     bool // should be [map]
    PluginFuncs []PluginInfo
    iValues     []string
    iDelimiter  string // field sepearater of print out
    iFormat     string // default print format (of integer)
    iValStack   ValueStack
    LastServer  GServer
    RSERV       string // [gsh://]host[:port]
    RWD     string // remote (target, there) working directory
    lastCheckSum    CheckSum
}

func nsleep(ns time.Duration){
    time.Sleep(ns)
}
func usleep(ns time.Duration){
    nsleep(ns*1000)
}
func msleep(ns time.Duration){
    nsleep(ns*1000000)
}
func sleep(ns time.Duration){
    nsleep(ns*1000000000)
}

func strBegins(str, pat string)(bool){
    if len(pat) <= len(str){
        yes := str[0:len(pat)] == pat
        //fmt.Printf("--D-- strBegins(%v,%v)=%v\n",str,pat,yes)
        return yes
    }
    //fmt.Printf("--D-- strBegins(%v,%v)=%v\n",str,pat,false)
    return false
}
func isin(what string, list []string) bool {
    for _, v := range list  {
        if v == what {
            return true
        }
    }
    return false
}
func isinX(what string,list[]string)(int){
    for i,v := range list {
        if v == what {
            return i
        }
    }
    return -1
}

func env(opts []string) {
    env := os.Environ()
    if isin("-s", opts){
        sort.Slice(env, func(i,j int) bool {
            return env[i] < env[j]
        })
    }
    for _, v := range env {
        fmt.Printf("%v\n",v)
    }
}

// - rewriting should be context dependent
// - should postpone until the real point of evaluation
// - should rewrite only known notation of symobl
func scanInt(str string)(val int,leng int){
    leng = -1
    for i,ch := range str {
        if '0' <= ch && ch <= '9' {
            leng = i+1
        }else{
            break
        }
    }
    if 0 < leng {
        ival,_ := strconv.Atoi(str[0:leng])
        return ival,leng
    }else{
        return 0,0
    }
}
func substHistory(gshCtx *GshContext,str string,i int,rstr string)(leng int,rst string){
    if len(str[i+1:]) == 0 {
        return 0,rstr
    }
    hi := 0
    histlen := len(gshCtx.CommandHistory)
    if str[i+1] == '!' {
        hi = histlen - 1
        leng = 1
    }else{
        hi,leng = scanInt(str[i+1:])
        if leng == 0 {
            return 0,rstr
        }
        if hi < 0 {
            hi = histlen + hi
        }
    }
    if 0 <= hi && hi < histlen {
        var ext byte
        if 1 < len(str[i+leng:]) {
            ext = str[i+leng:][1]
        }
        //fmt.Printf("--D-- %v(%c)\n",str[i+leng:],str[i+leng])
        if ext == 'f' {
            leng += 1
            xlist := []string{}
            list := gshCtx.CommandHistory[hi].FoundFile
            for _,v := range list {
```

```
                //list[i] = escapeWhiteSP(v)
                xlist = append(xlist,escapeWhiteSP(v))
            }
            //rstr += strings.Join(list," ")
            rstr += strings.Join(xlist," ")
        }else
        if ext == '@' || ext == 'd' {
            // !N@ .. workdir at the start of the command
            leng += 1
            rstr += gshCtx.CommandHistory[hi].WorkDir
        }else{
            rstr += gshCtx.CommandHistory[hi].CmdLine
        }
    }else{
        leng = 0
    }
    return leng,rstr
}
func escapeWhiteSP(str string)(string){
    if len(str) == 0 {
        return "\\z" // empty, to be ignored
    }
    rstr := ""
    for _,ch := range str {
        switch ch {
            case '\\': rstr += "\\\\"
            case ' ': rstr += "\\s"
            case '\t': rstr += "\\t"
            case '\r': rstr += "\\r"
            case '\n': rstr += "\\n"
            default: rstr += string(ch)
        }
    }
    return rstr
}
func unescapeWhiteSP(str string)(string){ // strip original escapes
    rstr := ""
    for i := 0; i < len(str); i++ {
        ch := str[i]
        if ch == '\\' {
            if i+1 < len(str) {
                switch str[i+1] {
                    case 'z':
                        continue;
                }
            }
        }
        rstr += string(ch)
    }
    return rstr
}
func unescapeWhiteSPV(strv []string)([]string){ // strip original escapes
    ustrv := []string{}
    for _,v := range strv {
        ustrv = append(ustrv,unescapeWhiteSP(v))
    }
    return ustrv
}

// <a name="comexpansion">str-expansion</a>
// - this should be a macro processor
func strsubst(gshCtx *GshContext,str string,histonly bool) string {
    rbuff := []byte{}
    if false {
        //@@U Unicode should be cared as a character
        return str
    }
    //rstr := ""
    inEsc := 0 // escape characer mode
    for i := 0; i < len(str); i++ {
        //fmt.Printf("--D--Subst %v:%v\n",i,str[i:])
        ch := str[i]
        if inEsc == 0 {
            if ch == '!' {
                //leng,xrstr := substHistory(gshCtx,str,i,rstr)
                leng,rs := substHistory(gshCtx,str,i,"")
                if 0 < leng {
    //_,rs := substHistory(gshCtx,str,i,"")
    rbuff = append(rbuff,[]byte(rs)...)
                    i += leng
                    //rstr = xrstr
                    continue
                }
            }
            switch ch {
                case '\\': inEsc = '\\'; continue
                //case '%':  inEsc = '%';  continue
                case '$':
            }
        }
        switch inEsc {
        case '\\':
            switch ch {
                case '\\': ch = '\\'
                case 's': ch = ' '
                case 't': ch = '\t'
                case 'r': ch = '\r'
                case 'n': ch = '\n'
                case 'z': inEsc = 0; continue // empty, to be ignored
            }
            inEsc = 0
        case '%':
            switch {
                case ch == '%': ch = '%'
                case ch == 'T':
                    //rstr = rstr + time.Now().Format(time.Stamp)
    rs := time.Now().Format(time.Stamp)
    rbuff = append(rbuff,[]byte(rs)...)
                    inEsc = 0
                    continue;
                default:
                    // postpone the interpretation
                    //rstr = rstr + "%" + string(ch)
    rbuff = append(rbuff,ch)
                    inEsc = 0
                    continue;
            }
            inEsc = 0
        }
        //rstr = rstr + string(ch)
        rbuff = append(rbuff,ch)
    }
    //fmt.Printf("--D--subst(%s)(%s)\n",str,string(rbuff))
    return string(rbuff)
    //return rstr
```

```
}
func showFileInfo(path string, opts []string) {
    if isin("-l",opts) || isin("-ls",opts) {
        fi, err := os.Stat(path)
        if err != nil {
            fmt.Printf("---------- ((%v))",err)
        }else{
            mod := fi.ModTime()
            date := mod.Format(time.Stamp)
            fmt.Printf("%v %8v %s ",fi.Mode(),fi.Size(),date)
        }
    }
    fmt.Printf("%s",path)
    if isin("-sp",opts) {
        fmt.Printf(" ")
    }else
    if ! isin("-n",opts) {
        fmt.Printf("\n")
    }
}
func userHomeDir()(string,bool){
    /*
    homedir,_ = os.UserHomeDir() // not implemented in older Golang
    */
    homedir,found := os.LookupEnv("HOME")
    //fmt.Printf("--I-- HOME=%v(%v)\n",homedir,found)
    if !found {
        return "/tmp",found
    }
    return homedir,found
}

func toFullpath(path string) (fullpath string) {
    if path[0] == '/' {
        return path
    }
    pathv := strings.Split(path,DIRSEP)
    switch {
    case pathv[0] == ".":
        pathv[0], _ = os.Getwd()
    case pathv[0] == "..": // all ones should be interpreted
        cwd, _ := os.Getwd()
        ppathv := strings.Split(cwd,DIRSEP)
        pathv[0] = strings.Join(ppathv,DIRSEP)
    case pathv[0] == "~":
        pathv[0],_ = userHomeDir()
    default:
        cwd, _ := os.Getwd()
        pathv[0] = cwd + DIRSEP + pathv[0]
    }
    return strings.Join(pathv,DIRSEP)
}

func IsRegFile(path string)(bool){
    fi, err := os.Stat(path)
    if err == nil {
        fm := fi.Mode()
        return fm.IsRegular();
    }
    return false
}

// <a name="encode">Encode / Decode</a>
// <a href="https://golang.org/pkg/encoding/base64/#example_NewEncoder">Encoder</a>
func (gshCtx *GshContext)Enc(argv[]string){
    file := os.Stdin
    buff := make([]byte,LINESIZE)
    li := 0
    encoder := base64.NewEncoder(base64.StdEncoding,os.Stdout)
    for li = 0; ; li++ {
        count, err := file.Read(buff)
        if count <= 0 {
            break
        }
        if err != nil {
            break
        }
        encoder.Write(buff[0:count])
    }
    encoder.Close()
}
func (gshCtx *GshContext)Dec(argv[]string){
    decoder := base64.NewDecoder(base64.StdEncoding,os.Stdin)
    li := 0
    buff := make([]byte,LINESIZE)
    for li = 0; ; li++ {
        count, err := decoder.Read(buff)
        if count <= 0 {
            break
        }
        if err != nil {
            break
        }
        os.Stdout.Write(buff[0:count])
    }
}
// lnsp [N] [-crlf][-C \\]
func (gshCtx *GshContext)SplitLine(argv[]string){
    reader := bufio.NewReaderSize(os.Stdin,64*1024)
    ni := 0
    toi := 0
    for ni = 0; ; ni++ {
        line, err := reader.ReadString('\n')
        if len(line) <= 0 {
            if err != nil {
            fmt.Fprintf(os.Stderr,"--I-- lnsp %d to %d (%v)\n",ni,toi,err)
            break
            }
        }
        off := 0
        ilen := len(line)
        remlen := len(line)
        for oi := 0; 0 < remlen; oi++ {
            olen := remlen
            addnl := false
            if 72 < olen {
                olen = 72
                addnl = true
            }
            fmt.Fprintf(os.Stderr,"--D-- write %d [%d.%d] %d %d/%d/%d\n",
                toi,ni,oi,off,olen,remlen,ilen)
            toi += 1
            os.Stdout.Write([]byte(line[0:olen]))
            if addnl {
                //os.Stdout.Write([]byte("\r\n"))
```

```
                os.Stdout.Write([]byte("\\"))
                os.Stdout.Write([]byte("\n"))
            }
            line = line[olen:]
            off += olen
            remlen -= olen
        }
    }
    fmt.Fprintf(os.Stderr,"--I-- lnsp %d to %d\n",ni,toi)
}

// CRC32 <a href="http://golang.jp/pkg/hash-crc32">crc32</a>
// 1 0000 0100 1100 0001 0001 1101 1011 0111
var CRC32UNIX uint32 = uint32(0x04C11DB7) // Unix cksum
var CRC32IEEE uint32 = uint32(0xEDB88320)
func byteCRC32add(crc uint32,str[]byte,len uint64)(uint32){
    var oi uint64
    for oi = 0; oi < len; oi++ {
        var oct = str[oi]
        for bi := 0; bi < 8; bi++ {
            //fprintf(stderr,"--CRC32 %d %X (%d.%d)\n",crc,oct,oi,bi)
            ovf1 := (crc & 0x80000000) != 0
            ovf2 := (oct & 0x80) != 0
            ovf := (ovf1 && !ovf2) || (!ovf1 && ovf2)
            oct <<= 1
            crc <<= 1
            if ovf { crc ^= CRC32UNIX }
        }
    }
    //fprintf(stderr,"--CRC32 return %d %d\n",crc,len)
    return crc;
}
func byteCRC32end(crc uint32, len uint64)(uint32){
    var slen = make([]byte,4)
    var li = 0
        for li = 0; li < 4; {
                slen[li] = byte(len)
        li += 1
                len >>= 8
                if( len == 0 ){
                        break
        }
        }
        crc = byteCRC32add(crc,slen,uint64(li))
        crc ^= 0xFFFFFFFF
        return crc
}
func strCRC32(str string,len uint64)(crc uint32){
    crc = byteCRC32add(0,[]byte(str),len)
    crc = byteCRC32end(crc,len)
    //fprintf(stderr,"--CRC32 %d %d\n",crc,len)
    return crc
}
func CRC32Finish(crc uint32, table *crc32.Table, len uint64)(uint32){
    var slen = make([]byte,4)
    var li = 0
        for li = 0; li < 4; {
                slen[li] = byte(len & 0xFF)
        li += 1
                len >>= 8
                if( len == 0 ){
                        break
        }
        }
    crc = crc32.Update(crc,table,slen)
        crc ^= 0xFFFFFFFF
        return crc
}

func (gsh*GshContext)xCksum(path string,argv[]string, sum*CheckSum)(int64){
    if isin("-type/f",argv) && !IsRegFile(path){
        return 0
    }
    if isin("-type/d",argv) && IsRegFile(path){
        return 0
    }
    file, err := os.OpenFile(path,os.O_RDONLY,0)
    if err != nil {
        fmt.Printf("--E-- cksum %v (%v)\n",path,err)
        return -1
    }
    defer file.Close()
    if gsh.CmdTrace { fmt.Printf("--I-- cksum %v %v\n",path,argv) }

    bi := 0
    var buff = make([]byte,32*1024)
    var total int64 = 0
    var initTime = time.Time{}
    if sum.Start == initTime {
        sum.Start = time.Now()
    }
    for bi = 0; ; bi++ {
        count,err := file.Read(buff)
        if count <= 0 || err != nil {
            break
        }
        if (sum.SumType & SUM_SUM64) != 0 {
            s := sum.Sum64
            for _,c := range buff[0:count] {
                s += uint64(c)
            }
            sum.Sum64 = s
        }
        if (sum.SumType & SUM_UNIXFILE) != 0 {
            sum.Crc32Val = byteCRC32add(sum.Crc32Val,buff,uint64(count))
        }
        if (sum.SumType & SUM_CRCIEEE) != 0 {
            sum.Crc32Val = crc32.Update(sum.Crc32Val,&sum.Crc32Table,buff[0:count])
        }
        // <a href="https://en.wikipedia.org/wiki/BSD_checksum">BSD checksum</a>
        if (sum.SumType & SUM_SUM16_BSD) != 0 {
            s := sum.Sum16
            for _,c := range buff[0:count] {
                s = (s >> 1) + ((s & 1) << 15)
                s += int(c)
                s &= 0xFFFF
                //fmt.Printf("BSDsum: %d[%d] %d\n",sum.Size+int64(i),i,s)
            }
            sum.Sum16 = s
        }
        if (sum.SumType & SUM_SUM16_SYSV) != 0 {
            for bj := 0; bj < count; bj++ {
                sum.Sum16 += int(buff[bj])
            }
        }
```

```
        total += int64(count)
    }
    sum.Done = time.Now()
    sum.Files += 1
    sum.Size += total
    if !isin("-s",argv) {
        fmt.Printf("%v ",total)
    }
    return 0
}

// <a name="grep">grep</a>
// "lines", "lin" or "lnp" for "(text) line processor" or "scanner"
// a*,!ab,c, ... sequentioal combination of patterns
// what "LINE" is should be definable
// generic line-by-line processing
// grep [-v]
// cat -n -v
// uniq [-c]
// tail -f
// sed s/x/y/ or awk
// grep with line count like wc
// rewrite contents if specified
func (gsh*GshContext)xGrep(path string,rexpv[]string)(int){
    file, err := os.OpenFile(path,os.O_RDONLY,0)
    if err != nil {
        fmt.Printf("--E-- grep %v (%v)\n",path,err)
        return -1
    }
    defer file.Close()
    if gsh.CmdTrace { fmt.Printf("--I-- grep %v %v\n",path,rexpv) }
    //reader := bufio.NewReaderSize(file,LINESIZE)
    reader := bufio.NewReaderSize(file,80)
    li := 0
    found := 0
    for li = 0; ; li++ {
        line, err := reader.ReadString('\n')
        if len(line) <= 0 {
            break
        }
        if 150 < len(line) {
            // maybe binary
            break;
        }
        if err != nil {
            break
        }
        if 0 <= strings.Index(string(line),rexpv[0]) {
            found += 1
            fmt.Printf("%s:%d: %s",path,li,line)
        }
    }
        //fmt.Printf("total %d lines %s\n",li,path)
    //if( 0 < found ){ fmt.Printf("((found %d lines %s))\n",found,path); }
    return found
}

// <a name="finder">Finder</a>
// finding files with it name and contents
// file names are ORed
// show the content with %x fmt list
// ls -R
// tar command by adding output
type fileSum struct {
    Err int64   // access error or so
    Size    int64   // content size
    DupSize int64   // content size from hard links
    Blocks  int64   // number of blocks (of 512 bytes)
    DupBlocks int64 // Blocks pointed from hard links
    HLinks  int64   // hard links
    Words   int64
    Lines   int64
    Files   int64
    Dirs    int64   // the num. of directories
    SymLink int64
    Flats   int64   // the num. of flat files
    MaxDepth    int64
    MaxNamlen   int64   // max. name length
    nextRepo    time.Time
}
func showFusage(dir string,fusage *fileSum){
    bsume := float64(((fusage.Blocks-fusage.DupBlocks)/2)*1024)/1000000.0
    //bsumdup := float64((fusage.Blocks/2)*1024)/1000000.0

    fmt.Printf("%v: %v files (%vd %vs %vh) %.6f MB (%.2f MBK)\n",
        dir,
        fusage.Files,
        fusage.Dirs,
        fusage.SymLink,
        fusage.HLinks,
        float64(fusage.Size)/1000000.0,bsume);
}
const (
    S_IFMT    = 0170000
    S_IFCHR   = 0020000
    S_IFDIR   = 0040000
    S_IFREG   = 0100000
    S_IFLNK   = 0120000
    S_IFSOCK  = 0140000
)
func cumFinfo(fsum *fileSum, path string, staterr error, fstat syscall.Stat_t, argv[]string,verb bool)(*fileSum){
    now := time.Now()
    if time.Second <= now.Sub(fsum.nextRepo) {
        if !fsum.nextRepo.IsZero(){
            tstmp := now.Format(time.Stamp)
            showFusage(tstmp,fsum)
        }
        fsum.nextRepo = now.Add(time.Second)
    }
    if staterr != nil {
        fsum.Err += 1
        return fsum
    }
    fsum.Files += 1
    if 1 < fstat.Nlink {
        // must count only once...
        // at least ignore ones in the same directory
        //if finfo.Mode().IsRegular() {
        if (fstat.Mode & S_IFMT) == S_IFREG {
            fsum.HLinks += 1
            fsum.DupBlocks += int64(fstat.Blocks)
            //fmt.Printf("---Dup HardLink %v %s\n",fstat.Nlink,path)
        }
    }
    //fsum.Size += finfo.Size()
```

```
875     fsum.Size += fstat.Size
876     fsum.Blocks += int64(fstat.Blocks)
877     //if verb { fmt.Printf("(%8dBlk) %s",fstat.Blocks/2,path) }
878     if isin("-ls",argv){
879         //if verb { fmt.Printf("%4d %8d ",fstat.Blksize,fstat.Blocks) }
880 //      fmt.Printf("%d\t",fstat.Blocks/2)
881     }
882     //if finfo.IsDir()
883     if (fstat.Mode & S_IFMT) == S_IFDIR {
884         fsum.Dirs += 1
885     }
886     //if (finfo.Mode() & os.ModeSymlink) != 0
887     if (fstat.Mode & S_IFMT) == S_IFLNK {
888         //if verb { fmt.Printf("symlink(%v,%s)\n",fstat.Mode,finfo.Name()) }
889         //{ fmt.Printf("symlink(%o,%s)\n",fstat.Mode,finfo.Name()) }
890         fsum.SymLink += 1
891     }
892     return fsum
893 }
894 func (gsh*GshContext)xxFindEntv(depth int,total *fileSum,dir string, dstat syscall.Stat_t, ei int, entv []string,npatv[]string,argv[]string)(*fileSum){
895     nols := isin("-grep",argv)
896     // sort entv
897     /*
898     if isin("-t",argv){
899         sort.Slice(filev, func(i,j int) bool {
900             return 0 < filev[i].ModTime().Sub(filev[j].ModTime())
901         })
902     }
903     */
904         /*
905         if isin("-u",argv){
906             sort.Slice(filev, func(i,j int) bool {
907                 return 0 < filev[i].AccTime().Sub(filev[j].AccTime())
908             })
909         }
910         if isin("-U",argv){
911             sort.Slice(filev, func(i,j int) bool {
912                 return 0 < filev[i].CreatTime().Sub(filev[j].CreatTime())
913             })
914         }
915         */
916     /*
917     if isin("-S",argv){
918         sort.Slice(filev, func(i,j int) bool {
919             return filev[j].Size() < filev[i].Size()
920         })
921     }
922     */
923     for _,filename := range entv {
924         for _,npat := range npatv {
925             match := true
926             if npat == "*" {
927                 match = true
928             }else{
929                 match, _ = filepath.Match(npat,filename)
930             }
931             path := dir + DIRSEP + filename
932             if !match {
933                 continue
934             }
935             var fstat syscall.Stat_t
936             staterr := syscall.Lstat(path,&fstat)
937             if staterr != nil {
938                 if !isin("-w",argv){fmt.Printf("ufind: %v\n",staterr) }
939                 continue;
940             }
941             if isin("-du",argv) && (fstat.Mode & S_IFMT) == S_IFDIR {
942                 // should not show size of directory in "-du" mode ...
943             }else
944             if !nols && !isin("-s",argv) && (!isin("-du",argv) || isin("-a",argv)) {
945                 if isin("-du",argv) {
946                     fmt.Printf("%d\t",fstat.Blocks/2)
947                 }
948                 showFileInfo(path,argv)
949             }
950             if true { // && isin("-du",argv)
951                 total = cumFinfo(total,path,staterr,fstat,argv,false)
952             }
953             /*
954             if isin("-wc",argv) {
955             }
956             */
957             if gsh.lastCheckSum.SumType != 0 {
958                 gsh.xCksum(path,argv,&gsh.lastCheckSum);
959             }
960             x := isinX("-grep",argv); // -grep will be convenient like -ls
961             if 0 <= x && x+1 <= len(argv) { // -grep will be convenient like -ls
962                 if IsRegFile(path){
963                     found := gsh.xGrep(path,argv[x+1:])
964                     if 0 < found {
965                         foundv := gsh.CmdCurrent.FoundFile
966                         if len(foundv) < 10 {
967                             gsh.CmdCurrent.FoundFile =
968                             append(gsh.CmdCurrent.FoundFile,path)
969                         }
970                     }
971                 }
972             }
973             if !isin("-r0",argv) { // -d 0 in du, -depth n in find
974                 //total.Depth += 1
975                 if (fstat.Mode & S_IFMT) == S_IFLNK {
976                     continue
977                 }
978                 if dstat.Rdev != fstat.Rdev {
979                     fmt.Printf("--I-- don't follow differnet device %v(%v) %v(%v)\n",
980                         dir,dstat.Rdev,path,fstat.Rdev)
981                 }
982                 if (fstat.Mode & S_IFMT) == S_IFDIR {
983                     total = gsh.xxFind(depth+1,total,path,npatv,argv)
984                 }
985             }
986         }
987     }
988     return total
989 }
990 func (gsh*GshContext)xxFind(depth int,total *fileSum,dir string,npatv[]string,argv[]string)(*fileSum){
991     nols := isin("-grep",argv)
992     dirfile,oerr := os.OpenFile(dir,os.O_RDONLY,0)
993     if oerr == nil {
994         //fmt.Printf("--I-- %v(%v)[%d]\n",dir,dirfile,dirfile.Fd())
995         defer dirfile.Close()
996     }else{
997     }
998
999     prev := *total
```

```
    var dstat syscall.Stat_t
    staterr := syscall.Lstat(dir,&dstat) // should be flstat

    if staterr != nil {
        if !isin("-w",argv){ fmt.Printf("ufind: %v\n",staterr) }
        return total
    }
        //filev,err := ioutil.ReadDir(dir)
        //_,err := ioutil.ReadDir(dir) // ReadDir() heavy and bad for huge directory
        /*
        if err != nil {
            if !isin("-w",argv){ fmt.Printf("ufind: %v\n",err) }
            return total
        }
        */
    if depth == 0 {
        total = cumFinfo(total,dir,staterr,dstat,argv,true)
        if !nols && !isin("-s",argv) && (!isin("-du",argv) || isin("-a",argv)) {
            showFileInfo(dir,argv)
        }
    }
    // it it is not a directory, just scan it and finish

    for ei := 0; ; ei++ {
        entv,rderr := dirfile.Readdirnames(8*1024)
        if len(entv) == 0 || rderr != nil {
            //if rderr != nil { fmt.Printf("[%d] len=%d (%v)\n",ei,len(entv),rderr) }
            break
        }
        if 0 < ei {
            fmt.Printf("--I-- xxFind[%d] %d large-dir: %s\n",ei,len(entv),dir)
        }
        total = gsh.xxFindEntv(depth,total,dir,dstat,ei,entv,npatv,argv)
    }
    if isin("-du",argv) {
        // if in "du" mode
        fmt.Printf("%d\t%s\n",(total.Blocks-prev.Blocks)/2,dir)
    }
    return total
}

// {ufind|fu|ls} [Files] [// Names] [-- Expressions]
//  Files is "." by default
//  Names is "*" by default
//  Expressions is "-print" by default for "ufind", or -du for "fu" command
func (gsh*GshContext)xFind(argv[]string){
    if 0 < len(argv) && strBegins(argv[0],"?"){
        showFound(gsh,argv)
        return
    }
    if isin("-cksum",argv) || isin("-sum",argv) {
        gsh.lastCheckSum = CheckSum{}
        if isin("-sum",argv) && isin("-add",argv) {
            gsh.lastCheckSum.SumType |= SUM_SUM64
        }else
        if isin("-sum",argv) && isin("-size",argv) {
            gsh.lastCheckSum.SumType |= SUM_SIZE
        }else
        if isin("-sum",argv) && isin("-bsd",argv) {
            gsh.lastCheckSum.SumType |= SUM_SUM16_BSD
        }else
        if isin("-sum",argv) && isin("-sysv",argv) {
            gsh.lastCheckSum.SumType |= SUM_SUM16_SYSV
        }else
        if isin("-sum",argv) {
            gsh.lastCheckSum.SumType |= SUM_SUM64
        }
        if isin("-unix",argv) {
            gsh.lastCheckSum.SumType |= SUM_UNIXFILE
            gsh.lastCheckSum.Crc32Table = *crc32.MakeTable(CRC32UNIX)
        }
        if isin("-ieee",argv){
            gsh.lastCheckSum.SumType |= SUM_CRCIEEE
            gsh.lastCheckSum.Crc32Table = *crc32.MakeTable(CRC32IEEE)
        }
        gsh.lastCheckSum.RusgAtStart = Getrusagev()
    }
    var total = fileSum{}
    npats := []string{}
    for _,v := range argv {
        if 0 < len(v) && v[0] != '-' {
            npats = append(npats,v)
        }
        if v == "//" { break }
        if v == "--" { break }
        if v == "-grep" { break }
        if v == "-ls" { break }
    }
    if len(npats) == 0 {
        npats = []string{"*"}
    }
    cwd := "."
    // if to be fullpath ::: cwd, _ := os.Getwd()
    if len(npats) == 0 { npats = []string{"*"} }
    fusage := gsh.xxFind(0,&total,cwd,npats,argv)
    if gsh.lastCheckSum.SumType != 0 {
        var sumi uint64 = 0
        sum := &gsh.lastCheckSum
        if (sum.SumType & SUM_SIZE) != 0 {
            sumi = uint64(sum.Size)
        }
        if (sum.SumType & SUM_SUM64) != 0 {
            sumi = sum.Sum64
        }
        if (sum.SumType & SUM_SUM16_SYSV) != 0 {
            s := uint32(sum.Sum16)
            r := (s & 0xFFFF) + ((s & 0xFFFFFFFF) >> 16)
            s = (r & 0xFFFF) + (r >> 16)
            sum.Crc32Val = uint32(s)
            sumi = uint64(s)
        }
        if (sum.SumType & SUM_SUM16_BSD) != 0 {
            sum.Crc32Val = uint32(sum.Sum16)
            sumi = uint64(sum.Sum16)
        }
        if (sum.SumType & SUM_UNIXFILE) != 0 {
            sum.Crc32Val = byteCRC32end(sum.Crc32Val,uint64(sum.Size))
            sumi = uint64(byteCRC32end(sum.Crc32Val,uint64(sum.Size)))
        }
        if 1 < sum.Files {
            fmt.Printf("%v %v // %v / %v files, %v/file\r\n",
                sumi,sum.Size,
                abssize(sum.Size),sum.Files,
                abssize(sum.Size/sum.Files))
        }else{
```

```
            fmt.Printf("%v %v %v\n",
                sumi,sum.Size,npats[0])
        }
    }
    if !isin("-grep",argv) {
        showFusage("total",fusage)
    }
    if !isin("-s",argv){
        hits := len(gsh.CmdCurrent.FoundFile)
        if 0 < hits {
            fmt.Printf("--I-- %d files hits // can be refered with !%df\n",
                hits,len(gsh.CommandHistory))
        }
    }
    if gsh.lastCheckSum.SumType != 0 {
        if isin("-ru",argv) {
            sum := &gsh.lastCheckSum
            sum.Done = time.Now()
            gsh.lastCheckSum.RusgAtEnd = Getrusagev()
            elps := sum.Done.Sub(sum.Start)
            fmt.Printf("--cksum-size: %v (%v) / %v files, %v/file\r\n",
                sum.Size,abssize(sum.Size),sum.Files,abssize(sum.Size/sum.Files))
            nanos := int64(elps)
            fmt.Printf("--cksum-time: %v/total, %v/file, %.1f files/s, %v\r\n",
                abbtime(nanos),
                abbtime(nanos/sum.Files),
                (float64(sum.Files)*1000000000.0)/float64(nanos),
                abbspeed(sum.Size,nanos))
            diff := RusageSubv(sum.RusgAtEnd,sum.RusgAtStart)
            fmt.Printf("--cksum-rusg: %v\n",sRusagef("",argv,diff))
        }
    }
    return
}

func showFiles(files[]string){
    sp := ""
    for i,file := range files {
        if 0 < i { sp = " " } else { sp = "" }
        fmt.Printf(sp+"%s",escapeWhiteSP(file))
    }
}
func showFound(gshCtx *GshContext, argv[]string){
    for i,v := range gshCtx.CommandHistory {
        if 0 < len(v.FoundFile) {
            fmt.Printf("!%d (%d) ",i,len(v.FoundFile))
            if isin("-ls",argv){
                fmt.Printf("\n")
                for _,file := range v.FoundFile {
                    fmt.Printf("") //sub number?
                    showFileInfo(file,argv)
                }
            }else{
                showFiles(v.FoundFile)
                fmt.Printf("\n")
            }
        }
    }
}

func showMatchFile(filev []os.FileInfo, npat,dir string, argv[]string)(string,bool){
    fname := ""
    found := false
    for _,v := range filev {
        match, _ := filepath.Match(npat,(v.Name()))
        if match {
            fname = v.Name()
            found = true
            //fmt.Printf("[%d] %s\n",i,v.Name())
            showIfExecutable(fname,dir,argv)
        }
    }
    return fname,found
}
func showIfExecutable(name,dir string,argv[]string)(ffullpath string,ffound bool){
    var fullpath string
    if strBegins(name,DIRSEP){
        fullpath = name
    }else{
        fullpath = dir + DIRSEP + name
    }
    fi, err := os.Stat(fullpath)
    if err != nil {
        fullpath = dir + DIRSEP + name + ".go"
        fi, err = os.Stat(fullpath)
    }
    if err == nil {
        fm := fi.Mode()
        if fm.IsRegular() {
          // R_OK=4, W_OK=2, X_OK=1, F_OK=0
          if syscall.Access(fullpath,5) == nil {
            ffullpath = fullpath
            ffound = true
            if ! isin("-s", argv) {
                showFileInfo(fullpath,argv)
            }
          }
        }
    }
    return ffullpath, ffound
}
func which(list string, argv []string) (fullpathv []string, itis bool){
    if len(argv) <= 1 {
        fmt.Printf("Usage: which comand [-s] [-a] [-ls]\n")
        return []string{""}, false
    }
    path := argv[1]
    if strBegins(path,"/") {
        // should check if excecutable?
        _,exOK := showIfExecutable(path,"/",argv)
        fmt.Printf("--D-- %v exOK=%v\n",path,exOK)
        return []string{path},exOK
    }
    pathenv, efound := os.LookupEnv(list)
    if ! efound {
        fmt.Printf("--E-- which: no \"%s\" environment\n",list)
        return []string{""}, false
    }
    showall := isin("-a",argv) || 0 <= strings.Index(path,"*")
    dirv := strings.Split(pathenv,PATHSEP)
    ffound := false
    ffullpath := path
    for _, dir := range dirv {
        if 0 <= strings.Index(path,"*") { // by wild-card
            list,_ := ioutil.ReadDir(dir)
```

```
            ffullpath, ffound = showMatchFile(list,path,dir,argv)
        }else{
            ffullpath, ffound = showIfExecutable(path,dir,argv)
        }
        //if ffound && !isin("-a", argv) {
        if ffound && !showall {
            break;
        }
    }
    return []string{ffullpath}, ffound
}

func stripLeadingWSParg(argv[]string)([]string){
    for ; 0 < len(argv); {
        if len(argv[0]) == 0 {
            argv = argv[1:]
        }else{
            break
        }
    }
    return argv
}
func xEval(argv []string, nlend bool){
    argv = stripLeadingWSParg(argv)
    if len(argv) == 0 {
        fmt.Printf("eval [%%format] [Go-expression]\n")
        return
    }
    pfmt := "%v"
    if argv[0][0] == '%' {
        pfmt = argv[0]
        argv = argv[1:]
    }
    if len(argv) == 0 {
        return
    }
    gocode := strings.Join(argv," ");
    //fmt.Printf("eval [%v] [%v]\n",pfmt,gocode)
    fset := token.NewFileSet()
    rval, _ := types.Eval(fset,nil,token.NoPos,gocode)
    fmt.Printf(pfmt,rval.Value)
    if nlend { fmt.Printf("\n") }
}

func getval(name string) (found bool, val int) {
    /* should expand the name here */
    if name == "gsh.pid" {
        return true, os.Getpid()
    }else
    if name == "gsh.ppid" {
        return true, os.Getppid()
    }
    return false, 0
}

func echo(argv []string, nlend bool){
    for ai := 1; ai < len(argv); ai++ {
        if 1 < ai {
            fmt.Printf(" ");
        }
        arg := argv[ai]
        found, val := getval(arg)
        if found {
            fmt.Printf("%d",val)
        }else{
            fmt.Printf("%s",arg)
        }
    }
    if nlend {
        fmt.Printf("\n");
    }
}

func resfile() string {
    return "gsh.tmp"
}
//var resF *File
func resmap() {
    //_ , err := os.OpenFile(resfile(), os.O_RDWR|os.O_CREATE, os.ModeAppend)
    // https://developpaper.com/solution-to-golang-bad-file-descriptor-problem/
    _ , err := os.OpenFile(resfile(), os.O_RDWR|os.O_CREATE, 0600)
    if err != nil {
        fmt.Printf("refF could not open: %s\n",err)
    }else{
        fmt.Printf("refF opened\n")
    }
}

// @@2020-0821
func gshScanArg(str string,strip int)(argv []string){
    var si = 0
    var sb = 0
    var inBracket = 0
    var arg1 = make([]byte,LINESIZE)
    var ax = 0
    debug := false

    for ; si < len(str); si++ {
        if str[si] != ' ' {
            break
        }
    }
    sb = si
    for ; si < len(str); si++ {
        if sb <= si {
            if debug {
                fmt.Printf("--Da- +%d %2d-%2d %s ... %s\n",
                    inBracket,sb,si,arg1[0:ax],str[si:])
            }
        }
        ch := str[si]
        if ch  == '{' {
            inBracket += 1
            if 0 < strip && inBracket <= strip {
                //fmt.Printf("stripLEV %d <= %d?\n",inBracket,strip)
                continue
            }
        }
        if 0 < inBracket {
            if ch == '}' {
                inBracket -= 1
                if 0 < strip && inBracket < strip {
                    //fmt.Printf("stripLEV %d <  %d?\n",inBracket,strip)
                    continue
                }
```

```
            }
            argl[ax] = ch
            ax += 1
            continue
        }
        if str[si] == ' ' {
            argv = append(argv,string(argl[0:ax]))
            if debug {
                fmt.Printf("--Da- [%v][%v-%v] %s ... %s\n",
                    -1+len(argv),sb,si,str[sb:si],string(str[si:]))
            }
            sb = si+1
            ax = 0
            continue
        }
        argl[ax] = ch
        ax += 1
    }
    if sb < si {
        argv = append(argv,string(argl[0:ax]))
        if debug {
            fmt.Printf("--Da- [%v][%v-%v] %s ... %s\n",
                -1+len(argv),sb,si,string(argl[0:ax]),string(str[si:]))
        }
    }
    if debug {
        fmt.Printf("--Da- %d [%s] => [%d]%v\n",strip,str,len(argv),argv)
    }
    return argv
}

// should get stderr (into tmpfile ?) and return
func (gsh*GshContext)Popen(name,mode string)(pin*os.File,pout*os.File,err bool){
    var pv = []int{-1,-1}
    syscall.Pipe(pv)

    xarg := gshScanArg(name,1)
    name = strings.Join(xarg," ")

    pin = os.NewFile(uintptr(pv[0]),"StdoutOf-{"+name+"}")
    pout = os.NewFile(uintptr(pv[1]),"StdinOf-{"+name+"}")
    fdix := 0
    dir := "?"
    if mode == "r" {
        dir = "<"
        fdix = 1 // read from the stdout of the process
    }else{
        dir = ">"
        fdix = 0 // write to the stdin of the process
    }
    gshPA := gsh.gshPA
    savfd := gshPA.Files[fdix]

    var fd uintptr = 0
    if mode == "r" {
        fd = pout.Fd()
        gshPA.Files[fdix] = pout.Fd()
    }else{
        fd = pin.Fd()
        gshPA.Files[fdix] = pin.Fd()
    }
        // should do this by Goroutine?
        if false {
            fmt.Printf("--Ip- Opened fd[%v] %s %v\n",fd,dir,name)
            fmt.Printf("--RED1 [%d,%d,%d]->[%d,%d,%d]\n",
                os.Stdin.Fd(),os.Stdout.Fd(),os.Stderr.Fd(),
                pin.Fd(),pout.Fd(),pout.Fd())
        }
            savi := os.Stdin
            savo := os.Stdout
            save := os.Stderr
            os.Stdin  = pin
            os.Stdout = pout
            os.Stderr = pout
        gsh.BackGround = true
        gsh.gshelllh(name)
        gsh.BackGround = false
            os.Stdin  = savi
            os.Stdout = savo
            os.Stderr = save

    gshPA.Files[fdix] = savfd
    return pin,pout,false
}

// <a name="ex-commands">External commands</a>
func (gsh*GshContext)excommand(exec bool, argv []string) (notf bool,exit bool) {
    if gsh.CmdTrace { fmt.Printf("--I-- excommand[%v](%v)\n",exec,argv) }

    gshPA := gsh.gshPA
    fullpathv, itis := which("PATH",[]string{"which",argv[0],"-s"})
    if itis == false {
        return true,false
    }
    fullpath := fullpathv[0]
    argv = unescapeWhiteSPV(argv)
    if 0 < strings.Index(fullpath,".go") {
        nargv := argv // []string{}
        gofullpathv, itis := which("PATH",[]string{"which","go","-s"})
        if itis == false {
            fmt.Printf("--F-- Go not found\n")
            return false,true
        }
        gofullpath := gofullpathv[0]
        nargv = []string{ gofullpath, "run", fullpath }
        fmt.Printf("--I-- %s {%s %s %s}\n",gofullpath,
            nargv[0],nargv[1],nargv[2])
        if exec {
            syscall.Exec(gofullpath,nargv,os.Environ())
        }else{
            pid, _ := syscall.ForkExec(gofullpath,nargv,&gshPA)
            if gsh.BackGround {
                fmt.Fprintf(stderr,"--Ip- in Background pid[%d]%d(%v)\n",pid,len(argv),nargv)
                gsh.BackGroundJobs = append(gsh.BackGroundJobs,pid)
            }else{
                rusage := syscall.Rusage {}
                syscall.Wait4(pid,nil,0,&rusage)
                gsh.LastRusage = rusage
                gsh.CmdCurrent.Rusagev[1] = rusage
            }
        }
    }else{
        if exec {
            syscall.Exec(fullpath,argv,os.Environ())
        }else{
```

```
            pid, _ := syscall.ForkExec(fullpath,argv,&gshPA)
            //fmt.Printf("[%d]\n",pid); // '&' to be background
            if gsh.BackGround {
                fmt.Fprintf(stderr,"--Ip- in Background pid[%d]%d(%v)\n",pid,len(argv),argv)
                gsh.BackGroundJobs = append(gsh.BackGroundJobs,pid)
            }else{
                rusage := syscall.Rusage {}
                syscall.Wait4(pid,nil,0,&rusage);
                gsh.LastRusage = rusage
                gsh.CmdCurrent.Rusagev[1] = rusage
            }
        }
    }
    return false,false
}

// <a name="builtin">Builtin Commands</a>
func (gshCtx *GshContext) sleep(argv []string) {
    if len(argv) < 2 {
        fmt.Printf("Sleep 100ms, 100us, 100ns, ...\n")
        return
    }
    duration := argv[1];
    d, err := time.ParseDuration(duration)
    if err != nil {
        d, err = time.ParseDuration(duration+"s")
        if err != nil {
            fmt.Printf("duration ? %s (%s)\n",duration,err)
            return
        }
    }
    //fmt.Printf("Sleep %v\n",duration)
    time.Sleep(d)
    if 0 < len(argv[2:]) {
        gshCtx.gshellv(argv[2:])
    }
}
func (gshCtx *GshContext)repeat(argv []string) {
    if len(argv) < 2 {
        return
    }
    start0 := time.Now()
    for ri,_ := strconv.Atoi(argv[1]); 0 < ri; ri-- {
        if 0 < len(argv[2:]) {
            //start := time.Now()
            gshCtx.gshellv(argv[2:])
            end := time.Now()
            elps := end.Sub(start0);
            if( 1000000000 < elps ){
                fmt.Printf("(repeat#%d %v)\n",ri,elps);
            }
        }
    }
}

func (gshCtx *GshContext)gen(argv []string) {
    gshPA := gshCtx.gshPA
    if len(argv) < 2 {
        fmt.Printf("Usage: %s N\n",argv[0])
        return
    }
    // should br repeated by "repeat" command
    count, _ := strconv.Atoi(argv[1])
    fd := gshPA.Files[1] // Stdout
    file := os.NewFile(fd,"internalStdOut")
    fmt.Printf("--I-- Gen. Count=%d to [%d]\n",count,file.Fd())
    //buf := []byte{}
    outdata := "0123 5678 0123 5678 0123 5678 0123 5678\r"
    for gi := 0; gi < count; gi++ {
        file.WriteString(outdata)
    }
    //file.WriteString("\n")
    fmt.Printf("\n(%d B)\n",count*len(outdata));
    //file.Close()
}

// <a name="rexec">Remote Execution</a> // 2020-0820
func Elapsed(from time.Time)(string){
    elps := time.Now().Sub(from)
    if 1000000000 < elps {
        return fmt.Sprintf("[%5d.%02ds]",elps/1000000000,(elps%1000000000)/10000000)
    }else
    if 1000000 < elps {
        return fmt.Sprintf("[%3d.%03dms]",elps/1000000,(elps%1000000)/1000)
    }else{
        return fmt.Sprintf("[%3d.%03dus]",elps/1000,(elps%1000))
    }
}
func abbtime(nanos int64)(string){
    if 1000000000 < nanos {
        return fmt.Sprintf("%d.%02ds",nanos/1000000000,(nanos%1000000000)/10000000)
    }else
    if 1000000 < nanos {
        return fmt.Sprintf("%d.%03dms",nanos/1000000,(nanos%1000000)/1000)
    }else{
        return fmt.Sprintf("%d.%03dus",nanos/1000,(nanos%1000))
    }
}
func abssize(size int64)(string){
    fsize := float64(size)
    if 1024*1024*1024 < size {
        return fmt.Sprintf("%.2fGiB",fsize/(1024*1024*1024))
    }else
    if 1024*1024 < size {
        return fmt.Sprintf("%.3fMiB",fsize/(1024*1024))
    }else{
        return fmt.Sprintf("%.3fKiB",fsize/1024)
    }
}
func absize(size int64)(string){
    fsize := float64(size)
    if 1024*1024*1024 < size {
        return fmt.Sprintf("%8.2fGiB",fsize/(1024*1024*1024))
    }else
    if 1024*1024 < size {
        return fmt.Sprintf("%8.3fMiB",fsize/(1024*1024))
    }else{
        return fmt.Sprintf("%8.3fKiB",fsize/1024)
    }
}
func abbspeed(totalB int64,ns int64)(string){
    MBs := (float64(totalB)/1000000) / (float64(ns)/1000000000)
    if 1000 <= MBs {
        return fmt.Sprintf("%6.3fGB/s",MBs/1000)
    }
```

```
1625     if 1 <= MBs {
1626         return fmt.Sprintf("%6.3fMB/s",MBs)
1627     }else{
1628         return fmt.Sprintf("%6.3fKB/s",MBs*1000)
1629     }
1630 }
1631 func abspeed(totalB int64,ns time.Duration)(string){
1632     MBs := (float64(totalB)/1000000) / (float64(ns)/1000000000)
1633     if 1000 <= MBs {
1634         return fmt.Sprintf("%6.3fGBps",MBs/1000)
1635     }
1636     if 1 <= MBs {
1637         return fmt.Sprintf("%6.3fMBps",MBs)
1638     }else{
1639         return fmt.Sprintf("%6.3fKBps",MBs*1000)
1640     }
1641 }
1642 func fileRelay(what string,in*os.File,out*os.File,size int64,bsiz int)(wcount int64){
1643     Start := time.Now()
1644     buff := make([]byte,bsiz)
1645     var total int64 = 0
1646     var rem int64 = size
1647     nio := 0
1648     Prev := time.Now()
1649     var PrevSize int64 = 0
1650
1651     fmt.Printf(Elapsed(Start)+"--In- X: %s (%v/%v/%v) START\n",
1652         what,absize(total),size,nio)
1653
1654     for i:= 0; ; i++ {
1655         var len = bsiz
1656         if int(rem) < len {
1657             len = int(rem)
1658         }
1659         Now := time.Now()
1660         Elps := Now.Sub(Prev);
1661         if 1000000000 < Now.Sub(Prev) {
1662             fmt.Printf(Elapsed(Start)+"--In- X: %s (%v/%v/%v) %s\n",
1663                 what,absize(total),size,nio,
1664                 abspeed((total-PrevSize),Elps))
1665             Prev = Now;
1666             PrevSize = total
1667         }
1668         rlen := len
1669         if in != nil {
1670             // should watch the disconnection of out
1671             rcc,err := in.Read(buff[0:rlen])
1672             if err != nil {
1673                 fmt.Printf(Elapsed(Start)+"--En- X: %s read(%v,%v)<%v\n",
1674                     what,rcc,err,in.Name())
1675                 break
1676             }
1677             rlen = rcc
1678             if string(buff[0:10]) == "((SoftEOF " {
1679                 var ecc int64 = 0
1680                 fmt.Sscanf(string(buff),"((SoftEOF %v",&ecc)
1681                 fmt.Printf(Elapsed(Start)+"--En- X: %s Recv ((SoftEOF %v))/%v\n",
1682                     what,ecc,total)
1683                 if ecc == total {
1684                     break
1685                 }
1686             }
1687         }
1688
1689         wlen := rlen
1690         if out != nil {
1691             wcc,err := out.Write(buff[0:rlen])
1692             if err != nil {
1693                 fmt.Printf(Elapsed(Start)+"-En-- X: %s write(%v,%v)>%v\n",
1694                     what,wcc,err,out.Name())
1695                 break
1696             }
1697             wlen = wcc
1698         }
1699         if wlen < rlen {
1700             fmt.Printf(Elapsed(Start)+"--En- X: %s incomplete write (%v/%v)\n",
1701                 what,wlen,rlen)
1702             break;
1703         }
1704
1705         nio += 1
1706         total += int64(rlen)
1707         rem -= int64(rlen)
1708         if rem <= 0 {
1709             break
1710         }
1711     }
1712     Done := time.Now()
1713     Elps := float64(Done.Sub(Start))/1000000000 //Seconds
1714     TotalMB := float64(total)/1000000 //MB
1715     MBps := TotalMB / Elps
1716     fmt.Printf(Elapsed(Start)+"--In- X: %s (%v/%v/%v) %v %.3fMB/s\n",
1717         what,total,size,nio,absize(total),MBps)
1718     return total
1719 }
1720 func tcpPush(clnt *os.File){
1721     // shrink socket buffer and recover
1722     usleep(100);
1723 }
1724 func (gsh*GshContext)RexecServer(argv[]string){
1725     debug := true
1726     Start0 := time.Now()
1727     Start := Start0
1728 //  if local == ":" { local = "0.0.0.0:9999" }
1729     local := "0.0.0.0:9999"
1730
1731     if 0 < len(argv) {
1732         if argv[0] == "-s" {
1733             debug = false
1734             argv = argv[1:]
1735         }
1736     }
1737     if 0 < len(argv) {
1738         argv = argv[1:]
1739     }
1740     port, err := net.ResolveTCPAddr("tcp",local);
1741     if err != nil {
1742         fmt.Printf("--En- S: Address error: %s (%s)\n",local,err)
1743         return
1744     }
1745     fmt.Printf(Elapsed(Start)+"--In- S: Listening at %s...\n",local);
1746     sconn, err := net.ListenTCP("tcp", port)
1747     if err != nil {
1748         fmt.Printf(Elapsed(Start)+"--En- S: Listen error: %s (%s)\n",local,err)
1749         return
```

```
1750    }
1751
1752    reqbuf := make([]byte,LINESIZE)
1753    res := ""
1754    for {
1755        fmt.Printf(Elapsed(Start0)+"--In- S: Listening at %s...\n",local);
1756        aconn, err := sconn.AcceptTCP()
1757        Start = time.Now()
1758        if err != nil {
1759            fmt.Printf(Elapsed(Start)+"--En- S: Accept error: %s (%s)\n",local,err)
1760            return
1761        }
1762        clnt, _ := aconn.File()
1763        fd := clnt.Fd()
1764        ar := aconn.RemoteAddr()
1765        if debug { fmt.Printf(Elapsed(Start0)+"--In- S: Accepted TCP at %s [%d] <- %v\n",
1766            local,fd,ar) }
1767        res = fmt.Sprintf("220 GShell/%s Server\r\n",VERSION)
1768        fmt.Fprintf(clnt,"%s",res)
1769        if debug { fmt.Printf(Elapsed(Start)+"--In- S: %s",res) }
1770        count, err := clnt.Read(reqbuf)
1771        if err != nil {
1772            fmt.Printf(Elapsed(Start)+"--En- C: (%v %v) %v",
1773                count,err,string(reqbuf))
1774        }
1775        req := string(reqbuf[:count])
1776        if debug { fmt.Printf(Elapsed(Start)+"--In- C: %v",string(req)) }
1777        reqv := strings.Split(string(req),"\r")
1778        cmdv := gshScanArg(reqv[0],0)
1779        //cmdv := strings.Split(reqv[0]," ")
1780        switch cmdv[0] {
1781            case "HELO":
1782                res = fmt.Sprintf("250 %v",req)
1783            case "GET":
1784                // download {remotefile|-zN} [localfile]
1785                var dsize int64 = 32*1024*1024
1786                var bsize int = 64*1024
1787                var fname string = ""
1788                var in *os.File = nil
1789                var pseudoEOF = false
1790                if 1 < len(cmdv) {
1791                    fname = cmdv[1]
1792                    if strBegins(fname,"-z") {
1793                        fmt.Sscanf(fname[2:],"%d",&dsize)
1794                    }else
1795                    if strBegins(fname,"{") {
1796                        xin,xout,err := gsh.Popen(fname,"r")
1797                        if err {
1798                        }else{
1799                            xout.Close()
1800                            defer xin.Close()
1801                            in = xin
1802                            dsize = MaxStreamSize
1803                            pseudoEOF = true
1804                        }
1805                    }else{
1806                        xin,err := os.Open(fname)
1807                        if err != nil {
1808                            fmt.Printf("--En- GET (%v)\n",err)
1809                        }else{
1810                            defer xin.Close()
1811                            in = xin
1812                            fi,_ := xin.Stat()
1813                            dsize = fi.Size()
1814                        }
1815                    }
1816                }
1817                //fmt.Printf(Elapsed(Start)+"--In- GET %v:%v\n",dsize,bsize)
1818                res = fmt.Sprintf("200 %v\r\n",dsize)
1819                fmt.Fprintf(clnt,"%v",res)
1820                tcpPush(clnt); // should be separated as line in receiver
1821                fmt.Printf(Elapsed(Start)+"--In- S: %v",res)
1822                wcount := fileRelay("SendGET",in,clnt,dsize,bsize)
1823                if pseudoEOF {
1824                    in.Close() // pipe from the command
1825                    // show end of stream data (its size) by OOB?
1826                    SoftEOF := fmt.Sprintf("((SoftEOF %v))",wcount)
1827                    fmt.Printf(Elapsed(Start)+"--In- S: Send %v\n",SoftEOF)
1828
1829                    tcpPush(clnt); // to let SoftEOF data apper at the top of recevied data
1830                    fmt.Fprintf(clnt,"%v\r\n",SoftEOF)
1831                    tcpPush(clnt); // to let SoftEOF alone in a packet (separate with 200 OK)
1832                        // with client generated random?
1833                    //fmt.Printf("--In- L: close %v (%v)\n",in.Fd(),in.Name())
1834                }
1835                res = fmt.Sprintf("200 GET done\r\n")
1836            case "PUT":
1837                // upload {srcfile|-zN} [dstfile]
1838                var dsize int64 = 32*1024*1024
1839                var bsize int = 64*1024
1840                var fname string = ""
1841                var out *os.File = nil
1842                if 1 < len(cmdv) { // localfile
1843                    fmt.Sscanf(cmdv[1],"%d",&dsize)
1844                }
1845                if 2 < len(cmdv) {
1846                    fname = cmdv[2]
1847                    if fname == "-" {
1848                        // nul dev
1849                    }else
1850                    if strBegins(fname,"{") {
1851                        xin,xout,err := gsh.Popen(fname,"w")
1852                        if err {
1853                        }else{
1854                            xin.Close()
1855                            defer xout.Close()
1856                            out = xout
1857                        }
1858                    }else{
1859                    // should write to temporary file
1860                    // should suppress ^C on tty
1861                xout,err := os.OpenFile(fname,os.O_CREATE|os.O_RDWR|os.O_TRUNC,0600)
1862                //fmt.Printf("--In- S: open(%v) out(%v) err(%v)\n",fname,xout,err)
1863                        if err != nil {
1864                            fmt.Printf("--En- PUT (%v)\n",err)
1865                        }else{
1866                            out = xout
1867                        }
1868                    }
1869                fmt.Printf(Elapsed(Start)+"--In- L: open(%v,w) %v (%v)\n",
1870                    fname,local,err)
1871                }
1872                fmt.Printf(Elapsed(Start)+"--In- PUT %v (/%v)\n",dsize,bsize)
1873                fmt.Printf(Elapsed(Start)+"--In- S: 200 %v OK\r\n",dsize)
1874                fmt.Fprintf(clnt,"200 %v OK\r\n",dsize)
```

```
                fileRelay("RecvPUT",clnt,out,dsize,bsize)
                res = fmt.Sprintf("200 PUT done\r\n")
            default:
                res = fmt.Sprintf("400 What? %v",req)
        }
        swcc,serr := clnt.Write([]byte(res))
        if serr != nil {
            fmt.Printf(Elapsed(Start)+"--In- S: (wc=%v er=%v) %v",swcc,serr,res)
        }else{
            fmt.Printf(Elapsed(Start)+"--In- S: %v",res)
        }
        aconn.Close();
        clnt.Close();
    }
    sconn.Close();
}
func (gsh*GshContext)RexecClient(argv[]string)(int,string){
    debug := true
    Start := time.Now()
    if len(argv) == 1 {
        return -1,"EmptyARG"
    }
    argv = argv[1:]
    if argv[0] == "-serv" {
        gsh.RexecServer(argv[1:])
        return 0,"Server"
    }
    remote := "0.0.0.0:9999"
    if argv[0][0] == '@' {
        remote = argv[0][1:]
        argv = argv[1:]
    }
    if argv[0] == "-s" {
        debug = false
        argv = argv[1:]
    }
    dport, err := net.ResolveTCPAddr("tcp",remote);
    if err != nil {
        fmt.Printf(Elapsed(Start)+"Address error: %s (%s)\n",remote,err)
        return -1,"AddressError"
    }
    fmt.Printf(Elapsed(Start)+"--In- C: Connecting to %s\n",remote)
    serv, err := net.DialTCP("tcp",nil,dport)
    if err != nil {
        fmt.Printf(Elapsed(Start)+"Connection error: %s (%s)\n",remote,err)
        return -1,"CannotConnect"
    }
    if debug {
        al := serv.LocalAddr()
        fmt.Printf(Elapsed(Start)+"--In- C: Connected to %v <- %v\n",remote,al)
    }

    req := ""
    res := make([]byte,LINESIZE)
    count,err := serv.Read(res)
    if err != nil {
        fmt.Printf("--En- S: (%3d,%v) %v",count,err,string(res))
    }
    if debug { fmt.Printf(Elapsed(Start)+"--In- S: %v",string(res)) }

    if argv[0] == "GET" {
        savPA := gsh.gshPA
        var bsize int = 64*1024
        req = fmt.Sprintf("%v\r\n",strings.Join(argv," "))
        fmt.Printf(Elapsed(Start)+"--In- C: %v",req)
        fmt.Fprintf(serv,req)
        count,err = serv.Read(res)
        if err != nil {
        }else{
            var dsize int64 = 0
            var out *os.File = nil
            var out_tobeclosed *os.File = nil
            var fname string = ""
            var rcode int = 0
            var pid int = -1
            fmt.Sscanf(string(res),"%d %d",&rcode,&dsize)
            fmt.Printf(Elapsed(Start)+"--In- S: %v",string(res[0:count]))
            if 3 <= len(argv) {
                fname = argv[2]
                if strBegins(fname,"{") {
                    xin,xout,err := gsh.Popen(fname,"w")
                    if err {
                    }else{
                        xin.Close()
                        defer xout.Close()
                        out = xout
                        out_tobeclosed = xout
                        pid = 0 // should be its pid
                    }
                }else{
                    // should write to temporary file
                    // should suppress ^C on tty
                    xout,err := os.OpenFile(fname,os.O_CREATE|os.O_RDWR|os.O_TRUNC,0600)
                    if err != nil {
                        fmt.Print("--En- %v\n",err)
                    }
                    out = xout
                    //fmt.Printf("--In-- %d > %s\n",out.Fd(),fname)
                }
            }
            in,_ := serv.File()
            fileRelay("RecvGET",in,out,dsize,bsize)
            if 0 <= pid {
                gsh.gshPA = savPA // recovery of Fd(), and more?
                fmt.Printf(Elapsed(Start)+"--In- L: close Pipe > %v\n",fname)
                out_tobeclosed.Close()
                //syscall.Wait4(pid,nil,0,nil) //@@
            }
        }
    }else
    if argv[0] == "PUT" {
        remote, _ := serv.File()
        var local *os.File = nil
        var dsize int64 = 32*1024*1024
        var bsize int = 64*1024
        var ofile string = "-"
        //fmt.Printf("--I-- Rex %v\n",argv)
        if 1 < len(argv) {
            fname := argv[1]
            if strBegins(fname,"-z") {
                fmt.Sscanf(fname[2:],"%d",&dsize)
            }else
            if strBegins(fname,"{") {
                xin,xout,err := gsh.Popen(fname,"r")
                if err {
```

```
                }else{
                    xout.Close()
                    defer xin.Close()
                    //in = xin
                    local = xin
                    fmt.Printf("--In- [%d] < Upload output of %v\n",
                        local.Fd(),fname)
                    ofile = "-from."+fname
                    dsize = MaxStreamSize
                }
            }else{
                xlocal,err := os.Open(fname)
                if err != nil {
                    fmt.Printf("--En- (%s)\n",err)
                    local = nil
                }else{
                    local = xlocal
                    fi,_ := local.Stat()
                    dsize = fi.Size()
                    defer local.Close()
                    //fmt.Printf("--I-- Rex in(%v / %v)\n",ofile,dsize)
                }
                ofile = fname
                fmt.Printf(Elapsed(Start)+"--In- L: open(%v,r)=%v %v (%v)\n",
                    fname,dsize,local,err)
            }
        }
        if 2 < len(argv) && argv[2] != "" {
            ofile = argv[2]
            //fmt.Printf("(%d)%v B.ofile=%v\n",len(argv),argv,ofile)
        }
        //fmt.Printf(Elapsed(Start)+"--I-- Rex out(%v)\n",ofile)
        fmt.Printf(Elapsed(Start)+"--In- PUT %v (/%v)\n",dsize,bsize)
        req = fmt.Sprintf("PUT %v %v \r\n",dsize,ofile)
        if debug { fmt.Printf(Elapsed(Start)+"--In- C: %v",req) }
        fmt.Fprintf(serv,"%v",req)
        count,err = serv.Read(res)
        if debug { fmt.Printf(Elapsed(Start)+"--In- S: %v",string(res[0:count])) }
        fileRelay("SendPUT",local,remote,dsize,bsize)
    }else{
        req = fmt.Sprintf("%v\r\n",strings.Join(argv," "))
        if debug { fmt.Printf(Elapsed(Start)+"--In- C: %v",req) }
        fmt.Fprintf(serv,"%v",req)
        //fmt.Printf("--In- sending RexRequest(%v)\n",len(req))
    }
    //fmt.Printf(Elapsed(Start)+"--In- waiting RexResponse...\n")
    count,err = serv.Read(res)
    ress := ""
    if count == 0 {
        ress = "(nil)\r\n"
    }else{
        ress = string(res[:count])
    }
    if err != nil {
        fmt.Printf(Elapsed(Start)+"--En- S: (%d,%v) %v",count,err,ress)
    }else{
        fmt.Printf(Elapsed(Start)+"--In- S: %v",ress)
    }
    serv.Close()
    //conn.Close()

    var stat string
    var rcode int
    fmt.Sscanf(ress,"%d %s",&rcode,&stat)
    //fmt.Printf("--D-- Client: %v (%v)",rcode,stat)
    return rcode,ress
}

// <a name="remote-sh">Remote Shell</a>
// gcp file [...] { [host]:[port:][dir] | dir } // -p | -no-p
func (gsh*GshContext)FileCopy(argv[]string){
    var host = ""
    var port = ""
    var upload = false
    var download = false
    var xargv = []string{"rex-gcp"}
    var srcv = []string{}
    var dstv = []string{}
    argv = argv[1:]

    for _,v := range argv {
        /*
        if v[0] == '-' { // might be a pseudo file (generated date)
            continue
        }
        */
        obj := strings.Split(v,":")
        //fmt.Printf("%d %v %v\n",len(obj),v,obj)
        if 1 < len(obj) {
            host = obj[0]
            file := ""
            if 0 < len(host) {
                gsh.LastServer.host = host
            }else{
                host = gsh.LastServer.host
                port = gsh.LastServer.port
            }
            if 2 < len(obj) {
                port = obj[1]
                if 0 < len(port) {
                    gsh.LastServer.port = port
                }else{
                    port = gsh.LastServer.port
                }
                file = obj[2]
            }else{
                file = obj[1]
            }
            if len(srcv) == 0 {
                download = true
                srcv = append(srcv,file)
                continue
            }
            upload = true
            dstv = append(dstv,file)
            continue
        }
        /*
        idx := strings.Index(v,":")
        if 0 <= idx {
            remote = v[0:idx]
            if len(srcv) == 0 {
                download = true
                srcv = append(srcv,v[idx+1:])
                continue
```

```
            }
            upload = true
            dstv = append(dstv,v[idx+1:])
            continue
        }
        */
        if download {
            dstv = append(dstv,v)
        }else{
            srcv = append(srcv,v)
        }
    }
    hostport := "@" + host + ":" + port
    if upload {
        if host != "" { xargv = append(xargv,hostport) }
        xargv = append(xargv,"PUT")
        xargv = append(xargv,srcv[0:]...)
        xargv = append(xargv,dstv[0:]...)
    //fmt.Printf("--I-- FileCopy PUT gsh://%s/%v < %v // %v\n",hostport,dstv,srcv,xargv)
    fmt.Printf("--I-- FileCopy PUT gsh://%s/%v < %v\n",hostport,dstv,srcv)
        gsh.RexecClient(xargv)
    }else
    if download {
        if host != "" { xargv = append(xargv,hostport) }
        xargv = append(xargv,"GET")
        xargv = append(xargv,srcv[0:]...)
        xargv = append(xargv,dstv[0:]...)
    //fmt.Printf("--I-- FileCopy GET gsh://%v/%v > %v // %v\n",hostport,srcv,dstv,xargv)
    fmt.Printf("--I-- FileCopy GET gsh://%v/%v > %v\n",hostport,srcv,dstv)
        gsh.RexecClient(xargv)
    }else{
    }
}

// target
func (gsh*GshContext)Trelpath(rloc string)(string){
    cwd, _ := os.Getwd()
    os.Chdir(gsh.RWD)
    os.Chdir(rloc)
    twd, _ := os.Getwd()
    os.Chdir(cwd)

    tpath := twd + "/" + rloc
    return tpath
}
// join to rmote GShell - [user@]host[:port] or cd host:[port]:path
func (gsh*GshContext)Rjoin(argv[]string){
    if len(argv) <= 1 {
        fmt.Printf("--I-- current server = %v\n",gsh.RSERV)
        return
    }
    serv := argv[1]
    servv := strings.Split(serv,":")
    if 1 <= len(servv) {
        if servv[0] == "lo" {
            servv[0] = "localhost"
        }
    }
    switch len(servv) {
        case 1:
            //if strings.Index(serv,":") < 0 {
            serv = servv[0] + ":" + fmt.Sprintf("%d",GSH_PORT)
            //}
        case 2: // host:port
            serv = strings.Join(servv,":")
    }
    xargv := []string{"rex-join","@"+serv,"HELO"}
    rcode,stat := gsh.RexecClient(xargv)
    if (rcode / 100) == 2 {
        fmt.Printf("--I-- OK Joined (%v) %v\n",rcode,stat)
        gsh.RSERV = serv
    }else{
        fmt.Printf("--I-- NG, could not joined (%v) %v\n",rcode,stat)
    }
}
func (gsh*GshContext)Rexec(argv[]string){
    if len(argv) <= 1 {
        fmt.Printf("--I-- rexec command [ | {file || {command} ]\n",gsh.RSERV)
        return
    }

    /*
    nargv := gshScanArg(strings.Join(argv," "),0)
    fmt.Printf("--D-- nargc=%d [%v]\n",len(nargv),nargv)
    if nargv[1][0] != '{' {
        nargv[1] = "{" + nargv[1] + "}"
        fmt.Printf("--D-- nargc=%d [%v]\n",len(nargv),nargv)
    }
    argv = nargv
    */
    nargv := []string{}
    nargv = append(nargv,"{"+strings.Join(argv[1:]," ")+"}")
    fmt.Printf("--D-- nargc=%d %v\n",len(nargv),nargv)
    argv = nargv

    xargv := []string{"rex-exec","@"+gsh.RSERV,"GET"}
    xargv = append(xargv,argv...)
    xargv = append(xargv,"/dev/tty")
    rcode,stat := gsh.RexecClient(xargv)
    if (rcode / 100) == 2 {
        fmt.Printf("--I-- OK Rexec (%v) %v\n",rcode,stat)
    }else{
        fmt.Printf("--I-- NG Rexec (%v) %v\n",rcode,stat)
    }
}
func (gsh*GshContext)Rchdir(argv[]string){
    if len(argv) <= 1 {
        return
    }
    cwd, _ := os.Getwd()
    os.Chdir(gsh.RWD)
    os.Chdir(argv[1])
    twd, _ := os.Getwd()
    gsh.RWD = twd
    fmt.Printf("--I-- JWD=%v\n",twd)
    os.Chdir(cwd)
}
func (gsh*GshContext)Rpwd(argv[]string){
    fmt.Printf("%v\n",gsh.RWD)
}
func (gsh*GshContext)Rls(argv[]string){
    cwd, _ := os.Getwd()
    os.Chdir(gsh.RWD)
    argv[0] = "-ls"
    gsh.xFind(argv)
```

```
    os.Chdir(cwd)
}
func (gsh*GshContext)Rput(argv[]string){
    var local string = ""
    var remote string = ""
    if 1 < len(argv) {
        local = argv[1]
        remote = local // base name
    }
    if 2 < len(argv) {
        remote = argv[2]
    }
    fmt.Printf("--I-- jput from=%v to=%v\n",local,gsh.Trelpath(remote))
}
func (gsh*GshContext)Rget(argv[]string){
    var remote string = ""
    var local string = ""
    if 1 < len(argv) {
        remote = argv[1]
        local = remote // base name
    }
    if 2 < len(argv) {
        local = argv[2]
    }
    fmt.Printf("--I-- jget from=%v to=%v\n",gsh.Trelpath(remote),local)
}

// <a name="network">network</a>
// -s, -si, -so // bi-directional, source, sync (maybe socket)
func (gshCtx*GshContext)sconnect(inTCP bool, argv []string) {
    gshPA := gshCtx.gshPA
    if len(argv) < 2 {
        fmt.Printf("Usage: -s [host]:[port[.udp]]\n")
        return
    }
    remote := argv[1]
    if remote == ":" { remote = "0.0.0.0:9999" }

    if inTCP { // TCP
        dport, err := net.ResolveTCPAddr("tcp",remote);
        if err != nil {
            fmt.Printf("Address error: %s (%s)\n",remote,err)
            return
        }
        conn, err := net.DialTCP("tcp",nil,dport)
        if err != nil {
            fmt.Printf("Connection error: %s (%s)\n",remote,err)
            return
        }
        file, _ := conn.File();
        fd := file.Fd()
        fmt.Printf("Socket: connected to %s, socket[%d]\n",remote,fd)

        savfd := gshPA.Files[1]
        gshPA.Files[1] = fd;
        gshCtx.gshellv(argv[2:])
        gshPA.Files[1] = savfd
        file.Close()
        conn.Close()
    }else{
        //dport, err := net.ResolveUDPAddr("udp4",remote);
        dport, err := net.ResolveUDPAddr("udp",remote);
        if err != nil {
            fmt.Printf("Address error: %s (%s)\n",remote,err)
            return
        }
        //conn, err := net.DialUDP("udp4",nil,dport)
        conn, err := net.DialUDP("udp",nil,dport)
        if err != nil {
            fmt.Printf("Connection error: %s (%s)\n",remote,err)
            return
        }
        file, _ := conn.File();
        fd := file.Fd()

        ar := conn.RemoteAddr()
        //al := conn.LocalAddr()
        fmt.Printf("Socket: connected to %s [%s], socket[%d]\n",
            remote,ar.String(),fd)

        savfd := gshPA.Files[1]
        gshPA.Files[1] = fd;
        gshCtx.gshellv(argv[2:])
        gshPA.Files[1] = savfd
        file.Close()
        conn.Close()
    }
}
func (gshCtx*GshContext)saccept(inTCP bool, argv []string) {
    gshPA := gshCtx.gshPA
    if len(argv) < 2 {
        fmt.Printf("Usage: -ac [host]:[port[.udp]]\n")
        return
    }
    local := argv[1]
    if local == ":" { local = "0.0.0.0:9999" }
    if inTCP { // TCP
        port, err := net.ResolveTCPAddr("tcp",local);
        if err != nil {
            fmt.Printf("Address error: %s (%s)\n",local,err)
            return
        }
        //fmt.Printf("Listen at %s...\n",local);
        sconn, err := net.ListenTCP("tcp", port)
        if err != nil {
            fmt.Printf("Listen error: %s (%s)\n",local,err)
            return
        }
        //fmt.Printf("Accepting at %s...\n",local);
        aconn, err := sconn.AcceptTCP()
        if err != nil {
            fmt.Printf("Accept error: %s (%s)\n",local,err)
            return
        }
        file, _ := aconn.File()
        fd := file.Fd()
        fmt.Printf("Accepted TCP at %s [%d]\n",local,fd)

        savfd := gshPA.Files[0]
        gshPA.Files[0] = fd;
        gshCtx.gshellv(argv[2:])
        gshPA.Files[0] = savfd

        sconn.Close();
        aconn.Close();
```

```
        file.Close();
    }else{
        //port, err := net.ResolveUDPAddr("udp4",local);
        port, err := net.ResolveUDPAddr("udp",local);
        if err != nil {
            fmt.Printf("Address error: %s (%s)\n",local,err)
            return
        }
        fmt.Printf("Listen UDP at %s...\n",local);
        //uconn, err := net.ListenUDP("udp4", port)
        uconn, err := net.ListenUDP("udp", port)
        if err != nil {
            fmt.Printf("Listen error: %s (%s)\n",local,err)
            return
        }
        file, _ := uconn.File()
        fd := file.Fd()
        ar := uconn.RemoteAddr()
        remote := ""
        if ar != nil { remote = ar.String() }
        if remote == "" { remote = "?" }

        // not yet received
        //fmt.Printf("Accepted at %s [%d] <- %s\n",local,fd,"")

        savfd := gshPA.Files[0]
        gshPA.Files[0] = fd;
        savenv := gshPA.Env
        gshPA.Env = append(savenv, "REMOTE_HOST="+remote)
        gshCtx.gshellv(argv[2:])
        gshPA.Env = savenv
        gshPA.Files[0] = savfd

        uconn.Close();
        file.Close();
    }
}

// empty line command
func (gshCtx*GshContext)xPwd(argv[]string){
    // execute context command, pwd + date
    // context notation, representation scheme, to be resumed at re-login
    cwd, _ := os.Getwd()
    switch {
    case isin("-a",argv):
        gshCtx.ShowChdirHistory(argv)
    case isin("-ls",argv):
        showFileInfo(cwd,argv)
    default:
        fmt.Printf("%s\n",cwd)
    case isin("-v",argv): // obsolete emtpy command
        t := time.Now()
        date := t.Format(time.UnixDate)
        exe, _ := os.Executable()
        host, _ := os.Hostname()
        fmt.Printf("{PWD=\"%s\"",cwd)
        fmt.Printf(" HOST=\"%s\"",host)
        fmt.Printf(" DATE=\"%s\"",date)
        fmt.Printf(" TIME=\"%s\"",t.String())
        fmt.Printf(" PID=\"%d\"",os.Getpid())
        fmt.Printf(" EXE=\"%s\"",exe)
        fmt.Printf("}\n")
    }
}

// <a name="history">History</a>
// these should be browsed and edited by HTTP browser
// show the time of command with -t and direcotry with -ls
// openfile-history, sort by -a -m -c
// sort by elapsed time by -t -s
// search by "more" like interface
// edit history
// sort history, and wc or uniq
// CPU and other resource consumptions
// limit showing range (by time or so)
// export / import history
func (gshCtx *GshContext)xHistory(argv []string){
    atWorkDirX := -1
    if 1 < len(argv) && strBegins(argv[1],"@") {
        atWorkDirX,_ = strconv.Atoi(argv[1][1:])
    }
    //fmt.Printf("--D-- showHistory(%v)\n",argv)
    for i, v := range gshCtx.CommandHistory {
        // exclude commands not to be listed by default
        // internal commands may be suppressed by default
        if v.CmdLine == "" && !isin("-a",argv) {
            continue;
        }
        if 0 <= atWorkDirX {
            if v.WorkDirX != atWorkDirX {
                continue
            }
        }
        if !isin("-n",argv){ // like "fc"
            fmt.Printf("!%-2d ",i)
        }
        if isin("-v",argv){
            fmt.Println(v) // should be with it date
        }else{
            if isin("-l",argv) || isin("-l0",argv) {
                elps := v.EndAt.Sub(v.StartAt);
                start := v.StartAt.Format(time.Stamp)
                fmt.Printf("@%d ",v.WorkDirX)
                fmt.Printf("[%v] %11v/t ",start,elps)
            }
            if isin("-l",argv) && !isin("-l0",argv){
                fmt.Printf("%v",Rusagef("%t %u\t// %s",argv,v.Rusagev))
            }
            if isin("-at",argv) { // isin("-ls",argv){
                dhi := v.WorkDirX // workdir history index
                fmt.Printf("@%d %s\t",dhi,v.WorkDir)
                // show the FileInfo of the output command??
            }
            fmt.Printf("%s",v.CmdLine)
            fmt.Printf("\n")
        }
    }
}
// !n - history index
func searchHistory(gshCtx GshContext, gline string) (string, bool, bool){
    if gline[0] == '!' {
        hix, err := strconv.Atoi(gline[1:])
        if err != nil {
            fmt.Printf("--E-- (%s : range)\n",hix)
            return "", false, true
```

```
        }
        if hix < 0 || len(gshCtx.CommandHistory) <= hix {
            fmt.Printf("--E-- (%d : out of range)\n",hix)
            return "", false, true
        }
        return gshCtx.CommandHistory[hix].CmdLine, false, false
    }
    // search
    //for i, v := range gshCtx.CommandHistory {
    //}
    return gline, false, false
}
func (gsh*GshContext)cmdStringInHistory(hix int)(cmd string, ok bool){
    if 0 <= hix && hix < len(gsh.CommandHistory) {
        return gsh.CommandHistory[hix].CmdLine,true
    }
    return "",false
}

// temporary adding to PATH environment
// cd name -lib for LD_LIBRARY_PATH
// chdir with directory history (date + full-path)
// -s for sort option (by visit date or so)
func (gsh*GshContext)ShowChdirHistory1(i int,v GChdirHistory, argv []string){
    fmt.Printf("!%-2d ",v.CmdIndex) // the first command at this WorkDir
    fmt.Printf("@%d ",i)
    fmt.Printf("[%v] ",v.MovedAt.Format(time.Stamp))
    showFileInfo(v.Dir,argv)
}
func (gsh*GshContext)ShowChdirHistory(argv []string){
    for i, v := range gsh.ChdirHistory {
        gsh.ShowChdirHistory1(i,v,argv)
    }
}
func skipOpts(argv[]string)(int){
    for i,v := range argv {
        if strBegins(v,"-") {
        }else{
            return i
        }
    }
    return -1
}
func (gshCtx*GshContext)xChdir(argv []string){
    cdhist := gshCtx.ChdirHistory
    if isin("?",argv ) || isin("-t",argv) || isin("-a",argv) {
        gshCtx.ShowChdirHistory(argv)
        return
    }
    pwd, _ := os.Getwd()
    dir := ""
    if len(argv) <= 1 {
        dir = toFullpath("~")
    }else{
        i := skipOpts(argv[1:])
        if i < 0 {
            dir = toFullpath("~")
        }else{
            dir = argv[1+i]
        }
    }
    if strBegins(dir,"@") {
        if dir == "@0" { // obsolete
            dir = gshCtx.StartDir
        }else
        if dir == "@!" {
            index := len(cdhist) - 1
            if 0 < index { index -= 1 }
            dir = cdhist[index].Dir
        }else{
            index, err := strconv.Atoi(dir[1:])
            if err != nil {
                fmt.Printf("--E-- xChdir(%v)\n",err)
                dir = "?"
            }else
            if len(gshCtx.ChdirHistory) <= index {
                fmt.Printf("--E-- xChdir(history range error)\n")
                dir = "?"
            }else{
                dir = cdhist[index].Dir
            }
        }
    }
    if dir != "?" {
        err := os.Chdir(dir)
        if err != nil {
            fmt.Printf("--E-- xChdir(%s)(%v)\n",argv[1],err)
        }else{
            cwd, _ := os.Getwd()
            if cwd != pwd {
                hist1 := GChdirHistory { }
                hist1.Dir = cwd
                hist1.MovedAt = time.Now()
                hist1.CmdIndex = len(gshCtx.CommandHistory)+1
                gshCtx.ChdirHistory = append(cdhist,hist1)
                if !isin("-s",argv){
                    //cwd, _ := os.Getwd()
                    //fmt.Printf("%s\n",cwd)
                    ix := len(gshCtx.ChdirHistory)-1
                    gshCtx.ShowChdirHistory1(ix,hist1,argv)
                }
            }
        }
    }
    if isin("-ls",argv){
        cwd, _ := os.Getwd()
        showFileInfo(cwd,argv);
    }
}
func TimeValSub(tv1 *syscall.Timeval, tv2 *syscall.Timeval){
    *tv1 = syscall.NsecToTimeval(tv1.Nano() - tv2.Nano())
}
func RusageSubv(ru1, ru2 [2]syscall.Rusage)([2]syscall.Rusage){
    TimeValSub(&ru1[0].Utime,&ru2[0].Utime)
    TimeValSub(&ru1[0].Stime,&ru2[0].Stime)
    TimeValSub(&ru1[1].Utime,&ru2[1].Utime)
    TimeValSub(&ru1[1].Stime,&ru2[1].Stime)
    return ru1
}
func TimeValAdd(tv1 syscall.Timeval, tv2 syscall.Timeval)(syscall.Timeval){
    tvs := syscall.NsecToTimeval(tv1.Nano() + tv2.Nano())
    return tvs
}
/*
func RusageAddv(ru1, ru2 [2]syscall.Rusage)([2]syscall.Rusage){
```

```
    TimeValAdd(ru1[0].Utime,ru2[0].Utime)
    TimeValAdd(ru1[0].Stime,ru2[0].Stime)
    TimeValAdd(ru1[1].Utime,ru2[1].Utime)
    TimeValAdd(ru1[1].Stime,ru2[1].Stime)
    return ru1
}
*/

// <a name="rusage">Resource Usage</a>
func sRusagef(fmtspec string, argv []string, ru [2]syscall.Rusage)(string){
    // ru[0] self , ru[1] children
    ut := TimeValAdd(ru[0].Utime,ru[1].Utime)
    st := TimeValAdd(ru[0].Stime,ru[1].Stime)
    uu := (ut.Sec*1000000 + int64(ut.Usec)) * 1000
    su := (st.Sec*1000000 + int64(st.Usec)) * 1000
    tu := uu + su
    ret := fmt.Sprintf("%v/sum",abbtime(tu))
    ret += fmt.Sprintf(", %v/usr",abbtime(uu))
    ret += fmt.Sprintf(", %v/sys",abbtime(su))
    return ret
}
func Rusagef(fmtspec string, argv []string, ru [2]syscall.Rusage)(string){
    ut := TimeValAdd(ru[0].Utime,ru[1].Utime)
    st := TimeValAdd(ru[0].Stime,ru[1].Stime)
    fmt.Printf("%d.%06ds/u ",ut.Sec,ut.Usec) //ru[1].Utime.Sec,ru[1].Utime.Usec)
    fmt.Printf("%d.%06ds/s ",st.Sec,st.Usec) //ru[1].Stime.Sec,ru[1].Stime.Usec)
    return ""
}
func Getrusagev()([2]syscall.Rusage){
    var ruv = [2]syscall.Rusage{}
    syscall.Getrusage(syscall.RUSAGE_SELF,&ruv[0])
    syscall.Getrusage(syscall.RUSAGE_CHILDREN,&ruv[1])
    return ruv
}
func showRusage(what string,argv []string, ru *syscall.Rusage){
    fmt.Printf("%s: ",what);
    fmt.Printf("Usr=%d.%06ds",ru.Utime.Sec,ru.Utime.Usec)
    fmt.Printf(" Sys=%d.%06ds",ru.Stime.Sec,ru.Stime.Usec)
    fmt.Printf(" Rss=%vB",ru.Maxrss)
    if isin("-l",argv) {
        fmt.Printf(" MinFlt=%v",ru.Minflt)
        fmt.Printf(" MajFlt=%v",ru.Majflt)
        fmt.Printf(" IxRSS=%vB",ru.Ixrss)
        fmt.Printf(" IdRSS=%vB",ru.Idrss)
        fmt.Printf(" Nswap=%vB",ru.Nswap)
    fmt.Printf(" Read=%v",ru.Inblock)
    fmt.Printf(" Write=%v",ru.Oublock)
    }
    fmt.Printf(" Snd=%v",ru.Msgsnd)
    fmt.Printf(" Rcv=%v",ru.Msgrcv)
    //if isin("-l",argv) {
        fmt.Printf(" Sig=%v",ru.Nsignals)
    //}
    fmt.Printf("\n");
}
func (gshCtx *GshContext)xTime(argv[]string)(bool){
    if 2 <= len(argv){
        gshCtx.LastRusage = syscall.Rusage{}
        rusagev1 := Getrusagev()
        fin := gshCtx.gshellv(argv[1:])
        rusagev2 := Getrusagev()
        showRusage(argv[1],argv,&gshCtx.LastRusage)
        rusagev := RusageSubv(rusagev2,rusagev1)
        showRusage("self",argv,&rusagev[0])
        showRusage("chld",argv,&rusagev[1])
        return fin
    }else{
        rusage:= syscall.Rusage {}
        syscall.Getrusage(syscall.RUSAGE_SELF,&rusage)
        showRusage("self",argv, &rusage)
        syscall.Getrusage(syscall.RUSAGE_CHILDREN,&rusage)
        showRusage("chld",argv, &rusage)
        return false
    }
}
func (gshCtx *GshContext)xJobs(argv[]string){
    fmt.Printf("%d Jobs\n",len(gshCtx.BackGroundJobs))
    for ji, pid := range gshCtx.BackGroundJobs {
        //wstat := syscall.WaitStatus {0}
        rusage := syscall.Rusage {}
        //wpid, err := syscall.Wait4(pid,&wstat,syscall.WNOHANG,&rusage);
        wpid, err := syscall.Wait4(pid,nil,syscall.WNOHANG,&rusage);
        if err != nil {
            fmt.Printf("--E-- %%%d [%d] (%v)\n",ji,pid,err)
        }else{
            fmt.Printf("%%%d[%d](%d)\n",ji,pid,wpid)
            showRusage("chld",argv,&rusage)
        }
    }
}
func (gsh*GshContext)inBackground(argv[]string)(bool){
    if gsh.CmdTrace { fmt.Printf("--I-- inBackground(%v)\n",argv) }
    gsh.BackGround = true // set background option
    xfin := false
    xfin = gsh.gshellv(argv)
    gsh.BackGround = false
    return xfin
}
// -o file without command means just opening it and refer by #N
// should be listed by "files" comnmand
func (gshCtx*GshContext)xOpen(argv[]string){
    var pv = []int{-1,-1}
    err := syscall.Pipe(pv)
    fmt.Printf("--I-- pipe()=[#%d,#%d](%v)\n",pv[0],pv[1],err)
}
func (gshCtx*GshContext)fromPipe(argv[]string){
}
func (gshCtx*GshContext)xClose(argv[]string){
}

// <a name="redirect">redirect</a>
func (gshCtx*GshContext)redirect(argv[]string)(bool){
    if len(argv) < 2 {
        return false
    }

    cmd := argv[0]
    fname := argv[1]
    var file *os.File = nil

    fdix := 0
    mode := os.O_RDONLY

    switch {
    case cmd == "-i" || cmd == "<":
```

```
        fdix = 0
        mode = os.O_RDONLY
    case cmd == "-o" || cmd == ">":
        fdix = 1
        mode = os.O_RDWR | os.O_CREATE
    case cmd == "-a" || cmd == ">>":
        fdix = 1
        mode = os.O_RDWR | os.O_CREATE | os.O_APPEND
    }
    if fname[0] == '#' {
        fd, err := strconv.Atoi(fname[1:])
        if err != nil {
            fmt.Printf("--E-- (%v)\n",err)
            return false
        }
        file = os.NewFile(uintptr(fd),"MaybePipe")
    }else{
        xfile, err := os.OpenFile(argv[1], mode, 0600)
        if err != nil {
            fmt.Printf("--E-- (%s)\n",err)
            return false
        }
        file = xfile
    }
    gshPA := gshCtx.gshPA
    savfd := gshPA.Files[fdix]
    gshPA.Files[fdix] = file.Fd()
    fmt.Printf("--I-- Opened [%d] %s\n",file.Fd(),argv[1])
    gshCtx.gshellv(argv[2:])
    gshPA.Files[fdix] = savfd

    return false
}

//fmt.Fprintf(res, "GShell Status: %q", html.EscapeString(req.URL.Path))
func httpHandler(res http.ResponseWriter, req *http.Request){
    path := req.URL.Path
    fmt.Printf("--I-- Got HTTP Request(%s)\n",path)
    {
        gshCtxBuf, _ :=  setupGshContext()
        gshCtx := &gshCtxBuf
        fmt.Printf("--I-- %s\n",path[1:])
        gshCtx.tgshelll(path[1:])
    }
    fmt.Fprintf(res, "Hello(^-^)/\n%s\n",path)
}
func (gshCtx *GshContext) httpServer(argv []string){
    http.HandleFunc("/", httpHandler)
    accport := "localhost:9999"
    fmt.Printf("--I-- HTTP Server Start at [%s]\n",accport)
    http.ListenAndServe(accport,nil)
}
func (gshCtx *GshContext)xGo(argv[]string){
    go gshCtx.gshellv(argv[1:]);
}
func (gshCtx *GshContext) xPs(argv[]string)(){
}

// <a name="plugin">Plugin</a>
// plugin [-ls [names]] to list plugins
// Reference: <a href="https://golang.org/src/plugin/">plugin</a> source code
func (gshCtx *GshContext) whichPlugin(name string,argv[]string)(pi *PluginInfo){
    pi = nil
    for _,p := range gshCtx.PluginFuncs {
        if p.Name == name && pi == nil {
            pi = &p
        }
        if !isin("-s",argv){
            //fmt.Printf("%v %v ",i,p)
            if isin("-ls",argv){
                showFileInfo(p.Path,argv)
            }else{
                fmt.Printf("%s\n",p.Name)
            }
        }
    }
    return pi
}
func (gshCtx *GshContext) xPlugin(argv[]string) (error) {
    if len(argv) == 0 || argv[0] == "-ls" {
        gshCtx.whichPlugin("",argv)
        return  nil
    }
    name := argv[0]
    Pin := gshCtx.whichPlugin(name,[]string{"-s"})
    if Pin != nil {
        os.Args = argv // should be recovered?
        Pin.Addr.(func())()
        return nil
    }
    sofile := toFullpath(argv[0] + ".so") // or find it by which($PATH)

    p, err := plugin.Open(sofile)
    if err != nil {
        fmt.Printf("--E-- plugin.Open(%s)(%v)\n",sofile,err)
        return err
    }
    fname := "Main"
    f, err := p.Lookup(fname)
    if( err != nil ){
        fmt.Printf("--E-- plugin.Lookup(%s)(%v)\n",fname,err)
        return err
    }
    pin := PluginInfo {p,f,name,sofile}
    gshCtx.PluginFuncs = append(gshCtx.PluginFuncs,pin)
    fmt.Printf("--I-- added (%d)\n",len(gshCtx.PluginFuncs))

    //fmt.Printf("--I-- first call(%s:%s)%v\n",sofile,fname,argv)
    os.Args = argv
    f.(func())()
    return err
}
func (gshCtx*GshContext)Args(argv[]string){
    for i,v := range os.Args {
        fmt.Printf("[%v] %v\n",i,v)
    }
}
func (gshCtx *GshContext) showVersion(argv[]string){
    if isin("-l",argv) {
        fmt.Printf("%v/%v (%v)",NAME,VERSION,DATE);
    }else{
        fmt.Printf("%v",VERSION);
    }
    if isin("-a",argv) {
        fmt.Printf(" %s",AUTHOR)
```

```
    }
    if !isin("-n",argv) {
        fmt.Printf("\n")
    }
}

// <a name="scanf">Scanf</a> // string decomposer
// scanf [format] [input]
func scanv(sstr string)(strv[]string){
    strv = strings.Split(sstr," ")
    return strv
}
func scanUntil(src,end string)(rstr string,leng int){
    idx := strings.Index(src,end)
    if 0 <= idx {
        rstr = src[0:idx]
        return rstr,idx+len(end)
    }
    return src,0
}

// -bn -- display base-name part only // can be in some %fmt, for sed rewriting
func (gsh*GshContext)printVal(fmts string, vstr string, optv[]string){
    //vint,err := strconv.Atoi(vstr)
    var ival int64 = 0
    n := 0
    err := error(nil)
    if strBegins(vstr,"_") {
        vx,_ := strconv.Atoi(vstr[1:])
        if vx < len(gsh.iValues) {
            vstr = gsh.iValues[vx]
        }else{
        }
    }
    // should use Eval()
    if strBegins(vstr,"0x") {
        n,err = fmt.Sscanf(vstr[2:],"%x",&ival)
    }else{
        n,err = fmt.Sscanf(vstr,"%d",&ival)
//fmt.Printf("--D-- n=%d err=(%v) {%s}=%v\n",n,err,vstr, ival)
    }
    if n == 1 && err == nil {
        //fmt.Printf("--D-- formatn(%v) ival(%v)\n",fmts,ival)
        fmt.Printf("%"+fmts,ival)
    }else{
        if isin("-bn",optv){
            fmt.Printf("%"+fmts,filepath.Base(vstr))
        }else{
            fmt.Printf("%"+fmts,vstr)
        }
    }
}
func (gsh*GshContext)printfv(fmts,div string,argv[]string,optv[]string,list[]string){
    //fmt.Printf("{%d}",len(list))
    //curfmt := "v"
    outlen := 0
    curfmt := gsh.iFormat

    if 0 < len(fmts) {
        for xi := 0; xi < len(fmts); xi++ {
            fch := fmts[xi]
            if fch == '%' {
                if xi+1 < len(fmts) {
                    curfmt = string(fmts[xi+1])
 gsh.iFormat = curfmt
                    xi += 1
    if xi+1 < len(fmts) && fmts[xi+1] == '(' {
        vals,leng := scanUntil(fmts[xi+2:],")")
        //fmt.Printf("--D-- show fmt(%v) val(%v) next(%v)\n",curfmt,vals,leng)
        gsh.printVal(curfmt,vals,optv)
        xi += 2+leng-1
        outlen += 1
    }
                    continue
                }
            }
            if fch == '_' {
                hi,leng := scanInt(fmts[xi+1:])
                if 0 < leng {
                    if hi < len(gsh.iValues) {
                        gsh.printVal(curfmt,gsh.iValues[hi],optv)
                        outlen += 1 // should be the real length
                    }else{
                        fmt.Printf("((out-range))")
                    }
                    xi += leng
                    continue;
                }
            }
            fmt.Printf("%c",fch)
            outlen += 1
        }
    }else{
        //fmt.Printf("--D-- print {%s}\n")
        for i,v := range list {
            if 0 < i {
                fmt.Printf(div)
            }
            gsh.printVal(curfmt,v,optv)
            outlen += 1
        }
    }
    if 0 < outlen {
        fmt.Printf("\n")
    }
}
func (gsh*GshContext)Scanv(argv[]string){
    //fmt.Printf("--D-- Scanv(%v)\n",argv)
    if len(argv) == 1 {
        return
    }
    argv = argv[1:]
    fmts := ""
    if strBegins(argv[0],"-F") {
        fmts = argv[0]
        gsh.iDelimiter = fmts
        argv = argv[1:]
    }
    input := strings.Join(argv," ")
    if fmts == "" { // simple decomposition
        v := scanv(input)
        gsh.iValues = v
        //fmt.Printf("%v\n",strings.Join(v,","))
    }else{
        v := make([]string,8)
```

```
        n,err := fmt.Sscanf(input,fmts,&v[0],&v[1],&v[2],&v[3])
        fmt.Printf("--D-- Scanf ->(%v) n=%d err=(%v)\n",v,n,err)
        gsh.iValues = v
    }
}
func (gsh*GshContext)Printv(argv[]string){
    if false { //@@U
        fmt.Printf("%v\n",strings.Join(argv[1:]," "))
        return
    }
    //fmt.Printf("--D-- Printv(%v)\n",argv)
    //fmt.Printf("%v\n",strings.Join(gsh.iValues,","))
    div := gsh.iDelimiter
    fmts := ""
    argv = argv[1:]
    if 0 < len(argv) {
        if strBegins(argv[0],"-F") {
            div = argv[0][2:]
            argv = argv[1:]
        }
    }

    optv := []string{}
    for _,v := range argv {
        if strBegins(v,"-"){
            optv = append(optv,v)
            argv = argv[1:]
        }else{
            break;
        }
    }
    if 0 < len(argv) {
        fmts = strings.Join(argv," ")
    }
    gsh.printfv(fmts,div,argv,optv,gsh.iValues)
}
func (gsh*GshContext)Basename(argv[]string){
    for i,v := range gsh.iValues {
        gsh.iValues[i] = filepath.Base(v)
    }
}
func (gsh*GshContext)Sortv(argv[]string){
    sv := gsh.iValues
    sort.Slice(sv , func(i,j int) bool {
        return sv[i] < sv[j]
    })
}
func (gsh*GshContext)Shiftv(argv[]string){
    vi := len(gsh.iValues)
    if 0 < vi {
        if isin("-r",argv) {
            top := gsh.iValues[0]
            gsh.iValues = append(gsh.iValues[1:],top)
        }else{
            gsh.iValues = gsh.iValues[1:]
        }
    }
}

func (gsh*GshContext)Enq(argv[]string){
}
func (gsh*GshContext)Deq(argv[]string){
}
func (gsh*GshContext)Push(argv[]string){
    gsh.iValStack = append(gsh.iValStack,argv[1:])
    fmt.Printf("depth=%d\n",len(gsh.iValStack))
}
func (gsh*GshContext)Dump(argv[]string){
    for i,v := range gsh.iValStack {
        fmt.Printf("%d %v\n",i,v)
    }
}
func (gsh*GshContext)Pop(argv[]string){
    depth := len(gsh.iValStack)
    if 0 < depth {
        v := gsh.iValStack[depth-1]
        if isin("-cat",argv){
            gsh.iValues = append(gsh.iValues,v...)
        }else{
            gsh.iValues = v
        }
        gsh.iValStack = gsh.iValStack[0:depth-1]
        fmt.Printf("depth=%d %s\n",len(gsh.iValStack),gsh.iValues)
    }else{
        fmt.Printf("depth=%d\n",depth)
    }
}

// <a name="interpreter">Command Interpreter</a>
func (gshCtx*GshContext)gshellv(argv []string) (fin bool) {
    fin = false

    if gshCtx.CmdTrace { fmt.Fprintf(os.Stderr,"--I-- gshellv((%d))\n",len(argv)) }
    if len(argv) <= 0 {
        return false
    }
    xargv := []string{}
    for ai := 0; ai < len(argv); ai++ {
        xargv = append(xargv,strsubst(gshCtx,argv[ai],false))
    }
    argv = xargv
    if false {
        for ai := 0; ai < len(argv); ai++ {
            fmt.Printf("[%d] %s [%d]%T\n",
                ai,argv[ai],len(argv[ai]),argv[ai])
        }
    }
    cmd := argv[0]
    if gshCtx.CmdTrace { fmt.Fprintf(os.Stderr,"--I-- gshellv(%d)%v\n",len(argv),argv) }
    switch { // https://tour.golang.org/flowcontrol/11
    case cmd == "":
        gshCtx.xPwd([]string{}); // emtpy command
    case cmd == "-x":
        gshCtx.CmdTrace = ! gshCtx.CmdTrace
    case cmd == "-xt":
        gshCtx.CmdTime = ! gshCtx.CmdTime
    case cmd == "-ot":
        gshCtx.sconnect(true, argv)
    case cmd == "-ou":
        gshCtx.sconnect(false, argv)
    case cmd == "-it":
        gshCtx.saccept(true , argv)
    case cmd == "-iu":
        gshCtx.saccept(false, argv)
    case cmd == "-i" || cmd == "<" || cmd == "-o" || cmd == ">" || cmd == "-a" || cmd == ">>" || cmd == "-s" || cmd == "><":
```

```
3125        gshCtx.redirect(argv)
3126    case cmd == "|":
3127        gshCtx.fromPipe(argv)
3128    case cmd == "args":
3129        gshCtx.Args(argv)
3130    case cmd == "bg" || cmd == "-bg":
3131        rfin := gshCtx.inBackground(argv[1:])
3132        return rfin
3133    case cmd == "-bn":
3134        gshCtx.Basename(argv)
3135    case cmd == "call":
3136        _,_ = gshCtx.excommand(false,argv[1:])
3137    case cmd == "cd" || cmd == "chdir":
3138        gshCtx.xChdir(argv);
3139    case cmd == "-cksum":
3140        gshCtx.xFind(argv)
3141    case cmd == "-sum":
3142        gshCtx.xFind(argv)
3143    case cmd == "-sumtest":
3144        str := ""
3145        if 1 < len(argv) { str = argv[1] }
3146        crc := strCRC32(str,uint64(len(str)))
3147        fprintf(stderr,"%v %v\n",crc,len(str))
3148    case cmd == "close":
3149        gshCtx.xClose(argv)
3150    case cmd == "gcp":
3151        gshCtx.FileCopy(argv)
3152    case cmd == "dec" || cmd == "decode":
3153        gshCtx.Dec(argv)
3154    case cmd == "#define":
3155    case cmd == "dic" || cmd == "d":
3156        xDic(argv)
3157    case cmd == "dump":
3158        gshCtx.Dump(argv)
3159    case cmd == "echo" || cmd == "e":
3160        echo(argv,true)
3161    case cmd == "enc" || cmd == "encode":
3162        gshCtx.Enc(argv)
3163    case cmd == "env":
3164        env(argv)
3165    case cmd == "eval":
3166        xEval(argv[1:],true)
3167    case cmd == "ev" || cmd == "events":
3168        dumpEvents(argv)
3169    case cmd == "exec":
3170        _,_ = gshCtx.excommand(true,argv[1:])
3171        // should not return here
3172    case cmd == "exit" || cmd == "quit":
3173        // write Result code EXIT to 3>
3174        return true
3175    case cmd == "fdls":
3176        // dump the attributes of fds (of other process)
3177    case cmd == "-find" || cmd == "fin" || cmd == "ufind" || cmd == "uf":
3178        gshCtx.xFind(argv[1:])
3179    case cmd == "fu":
3180        gshCtx.xFind(argv[1:])
3181    case cmd == "fork":
3182        // mainly for a server
3183    case cmd == "-gen":
3184        gshCtx.gen(argv)
3185    case cmd == "-go":
3186        gshCtx.xGo(argv)
3187    case cmd == "-grep":
3188        gshCtx.xFind(argv)
3189    case cmd == "gdeq":
3190        gshCtx.Deq(argv)
3191    case cmd == "genq":
3192        gshCtx.Enq(argv)
3193    case cmd == "gpop":
3194        gshCtx.Pop(argv)
3195    case cmd == "gpush":
3196        gshCtx.Push(argv)
3197    case cmd == "history" || cmd == "hi": // hi should be alias
3198        gshCtx.xHistory(argv)
3199    case cmd == "jobs":
3200        gshCtx.xJobs(argv)
3201    case cmd == "lnsp" || cmd == "nlsp":
3202        gshCtx.SplitLine(argv)
3203    case cmd == "-ls":
3204        gshCtx.xFind(argv)
3205    case cmd == "nop":
3206        // do nothing
3207    case cmd == "pipe":
3208        gshCtx.xOpen(argv)
3209    case cmd == "plug" || cmd == "plugin" || cmd == "pin":
3210        gshCtx.xPlugin(argv[1:])
3211    case cmd == "print" || cmd == "-pr":
3212        // output internal slice // also sprintf should be
3213        gshCtx.Printv(argv)
3214    case cmd == "ps":
3215        gshCtx.xPs(argv)
3216    case cmd == "pstitle":
3217        // to be gsh.title
3218    case cmd == "rexecd" || cmd == "rexd":
3219        gshCtx.RexecServer(argv)
3220    case cmd == "rexec" || cmd == "rex":
3221        gshCtx.RexecClient(argv)
3222    case cmd == "repeat" || cmd == "rep": // repeat cond command
3223        gshCtx.repeat(argv)
3224    case cmd == "replay":
3225        gshCtx.xReplay(argv)
3226    case cmd == "scan":
3227        // scan input (or so in fscanf) to internal slice (like Files or map)
3228        gshCtx.Scanv(argv)
3229    case cmd == "set":
3230        // set name ...
3231    case cmd == "serv":
3232        gshCtx.httpServer(argv)
3233    case cmd == "shift":
3234        gshCtx.Shiftv(argv)
3235    case cmd == "sleep":
3236        gshCtx.sleep(argv)
3237    case cmd == "-sort":
3238        gshCtx.Sortv(argv)
3239
3240    case cmd == "j" || cmd == "join":
3241        gshCtx.Rjoin(argv)
3242    case cmd == "a" || cmd == "alpa":
3243        gshCtx.Rexec(argv)
3244    case cmd == "jcd" || cmd == "jchdir":
3245        gshCtx.Rchdir(argv)
3246    case cmd == "jget":
3247        gshCtx.Rget(argv)
3248    case cmd == "jls":
3249        gshCtx.Rls(argv)
```

```
3250     case cmd == "jput":
3251         gshCtx.Rput(argv)
3252     case cmd == "jpwd":
3253         gshCtx.Rpwd(argv)
3254 
3255     case cmd == "time":
3256         fin = gshCtx.xTime(argv)
3257     case cmd == "ungets":
3258         if 1 < len(argv) {
3259             ungets(argv[1]+"\n")
3260         }else{
3261         }
3262     case cmd == "pwd":
3263         gshCtx.xPwd(argv);
3264     case cmd == "ver" || cmd == "-ver" || cmd == "version":
3265         gshCtx.showVersion(argv)
3266     case cmd == "where":
3267         // data file or so?
3268     case cmd == "which":
3269         which("PATH",argv);
3270     default:
3271         if gshCtx.whichPlugin(cmd,[]string{"-s"}) != nil {
3272             gshCtx.xPlugin(argv)
3273         }else{
3274             notfound,_ := gshCtx.excommand(false,argv)
3275             if notfound {
3276                 fmt.Printf("--E-- command not found (%v)\n",cmd)
3277             }
3278         }
3279     }
3280     return fin
3281 }
3282 
3283 func (gsh*GshContext)gshelll(gline string) (rfin bool) {
3284     argv := strings.Split(string(gline)," ")
3285     fin := gsh.gshellv(argv)
3286     return fin
3287 }
3288 func (gsh*GshContext)tgshelll(gline string)(xfin bool){
3289     start := time.Now()
3290     fin := gsh.gshelll(gline)
3291     end := time.Now()
3292     elps := end.Sub(start);
3293     if gsh.CmdTime {
3294         fmt.Printf("--T-- " + time.Now().Format(time.Stamp) + "(%d.%09ds)\n",
3295             elps/1000000000,elps%1000000000)
3296     }
3297     return fin
3298 }
3299 func Ttyid() (int) {
3300     fi, err := os.Stdin.Stat()
3301     if err != nil {
3302         return 0;
3303     }
3304     //fmt.Printf("Stdin: %v Dev=%d\n",
3305     //  fi.Mode(),fi.Mode()&os.ModeDevice)
3306     if (fi.Mode() & os.ModeDevice) != 0 {
3307         stat := syscall.Stat_t{};
3308         err := syscall.Fstat(0,&stat)
3309         if err != nil {
3310             //fmt.Printf("--I-- Stdin: (%v)\n",err)
3311         }else{
3312             //fmt.Printf("--I-- Stdin: rdev=%d %d\n",
3313             //  stat.Rdev&0xFF,stat.Rdev);
3314             //fmt.Printf("--I-- Stdin: tty%d\n",stat.Rdev&0xFF);
3315             return int(stat.Rdev & 0xFF)
3316         }
3317     }
3318     return 0
3319 }
3320 func (gshCtx *GshContext) ttyfile() string {
3321     //fmt.Printf("--I-- GSH_HOME=%s\n",gshCtx.GshHomeDir)
3322     ttyfile := gshCtx.GshHomeDir + "/" + "gsh-tty" +
3323          fmt.Sprintf("%02d",gshCtx.TerminalId)
3324          //strconv.Itoa(gshCtx.TerminalId)
3325     //fmt.Printf("--I-- ttyfile=%s\n",ttyfile)
3326     return ttyfile
3327 }
3328 func (gshCtx *GshContext) ttyline()(*os.File){
3329     file, err := os.OpenFile(gshCtx.ttyfile(),os.O_RDWR|os.O_CREATE|os.O_TRUNC,0600)
3330     if err != nil {
3331         fmt.Printf("--F-- cannot open %s (%s)\n",gshCtx.ttyfile(),err)
3332         return file;
3333     }
3334     return file
3335 }
3336 func (gshCtx *GshContext)getline(hix int, skipping bool, prevline string) (string) {
3337     if( skipping ){
3338         reader := bufio.NewReaderSize(os.Stdin,LINESIZE)
3339         line, _, _ := reader.ReadLine()
3340         return string(line)
3341     }else
3342     if true {
3343         return xgetline(hix,prevline,gshCtx)
3344     }
3345     /*
3346     else
3347     if( with_exgetline && gshCtx.GetLine != "" ){
3348         //var xhix int64 = int64(hix); // cast
3349         newenv := os.Environ()
3350         newenv = append(newenv, "GSH_LINENO="+strconv.FormatInt(int64(hix),10) )
3351 
3352         tty := gshCtx.ttyline()
3353         tty.WriteString(prevline)
3354         Pa := os.ProcAttr {
3355             "", // start dir
3356             newenv, //os.Environ(),
3357             []*os.File{os.Stdin,os.Stdout,os.Stderr,tty},
3358             nil,
3359         }
3360 //fmt.Printf("--I-- getline=%s // %s\n",gsh_getlinev[0],gshCtx.GetLine)
3361 proc, err := os.StartProcess(gsh_getlinev[0],[]string{"getline","getline"},&Pa)
3362         if err != nil {
3363             fmt.Printf("--F-- getline process error (%v)\n",err)
3364             // for ; ; { }
3365             return "exit (getline program failed)"
3366         }
3367         //stat, err := proc.Wait()
3368         proc.Wait()
3369         buff := make([]byte,LINESIZE)
3370         count, err := tty.Read(buff)
3371         //_, err = tty.Read(buff)
3372         //fmt.Printf("--D-- getline (%d)\n",count)
3373         if err != nil {
3374             if ! (count == 0) { // && err.String() == "EOF" ) {
```

```
                fmt.Printf("--E-- getline error (%s)\n",err)
            }
        }else{
            //fmt.Printf("--I-- getline OK \"%s\"\n",buff)
        }
        tty.Close()
        gline := string(buff[0:count])
        return gline
    }else
    */
    {
        // if isatty {
            fmt.Printf("!%d",hix)
            fmt.Print(PROMPT)
        // }
        reader := bufio.NewReaderSize(os.Stdin,LINESIZE)
        line, _, _ := reader.ReadLine()
        return string(line)
    }
}

//== begin ================================================== getline
/*
 * getline.c
 * 2020-0819 extracted from dog.c
 * getline.go
 * 2020-0822 ported to Go
 */
/*
package main // getline main
import (
    "fmt"       // <a href="https://golang.org/pkg/fmt/">fmt</a>
    "strings"   // <a href="https://golang.org/pkg/strings/">strings</a>
    "os"        // <a href="https://golang.org/pkg/os/">os</a>
    "syscall"   // <a href="https://golang.org/pkg/syscall/">syscall</a>
    //"bytes"       // <a href="https://golang.org/pkg/os/">os</a>
    //"os/exec" // <a href="https://golang.org/pkg/os/">os</a>
)
*/

// C language compatibility functions
var errno = 0
var stdin  *os.File = os.Stdin
var stdout *os.File = os.Stdout
var stderr *os.File = os.Stderr
var EOF = -1
var NULL = 0
type FILE os.File
type StrBuff []byte
var NULL_FP *os.File = nil
var NULLSP = 0
//var LINESIZE = 1024

func system(cmdstr string)(int){
    PA := syscall.ProcAttr {
        "", // the starting directory
        os.Environ(),
        []uintptr{os.Stdin.Fd(),os.Stdout.Fd(),os.Stderr.Fd()},
        nil,
    }
    argv := strings.Split(cmdstr," ")
    pid,err := syscall.ForkExec(argv[0],argv,&PA)
    if( err != nil ){
        fmt.Printf("--E-- syscall(%v) err(%v)\n",cmdstr,err)
    }
    syscall.Wait4(pid,nil,0,nil)

    /*
    argv := strings.Split(cmdstr," ")
    fmt.Fprintf(os.Stderr,"--I-- system(%v)\n",argv)
    //cmd := exec.Command(argv[0:]...)
    cmd := exec.Command(argv[0],argv[1],argv[2])
    cmd.Stdin = strings.NewReader("output of system")
    var out bytes.Buffer
    cmd.Stdout = &out
    var serr bytes.Buffer
    cmd.Stderr = &serr
    err := cmd.Run()
    if err != nil {
        fmt.Fprintf(os.Stderr,"--E-- system(%v)err(%v)\n",argv,err)
        fmt.Printf("ERR:%s\n",serr.String())
    }else{
        fmt.Printf("%s",out.String())
    }
    */
    return 0
}
func atoi(str string)(ret int){
    ret,err := fmt.Sscanf(str,"%d",ret)
    if err == nil {
        return ret
    }else{
        // should set errno
        return 0
    }
}
func getenv(name string)(string){
    val,got := os.LookupEnv(name)
    if got {
        return val
    }else{
        return "?"
    }
}
func strcpy(dst StrBuff, src string){
    var i int
    srcb := []byte(src)
    for i = 0; i < len(src) && srcb[i] != 0; i++ {
        dst[i] = srcb[i]
    }
    dst[i] = 0
}
func xstrcpy(dst StrBuff, src StrBuff){
    dst = src
}
func strcat(dst StrBuff, src StrBuff){
    dst = append(dst,src...)
}
func strdup(str StrBuff)(string){
    return string(str[0:strlen(str)])
}
func sstrlen(str string)(int){
    return len(str)
}
func strlen(str StrBuff)(int){
```

```
    var i int
    for i = 0; i < len(str) && str[i] != 0; i++ {
    }
    return i
}
func sizeof(data StrBuff)(int){
    return len(data)
}
func isatty(fd int)(ret int){
    return 1
}

func fopen(file string,mode string)(fp*os.File){
    if mode == "r" {
        fp,err := os.Open(file)
        if( err != nil ){
            fmt.Printf("--E-- fopen(%s,%s)=(%v)\n",file,mode,err)
            return NULL_FP;
        }
        return fp;
    }else{
        fp,err := os.OpenFile(file,os.O_RDWR|os.O_CREATE|os.O_TRUNC,0600)
        if( err != nil ){
            return NULL_FP;
        }
        return fp;
    }
}
func fclose(fp*os.File){
    fp.Close()
}
func fflush(fp *os.File)(int){
    return 0
}
func fgetc(fp*os.File)(int){
    var buf [1]byte
    _,err := fp.Read(buf[0:1])
    if( err != nil ){
        return EOF;
    }else{
        return int(buf[0])
    }
}
func sfgets(str*string, size int, fp*os.File)(int){
    buf := make(StrBuff,size)
    var ch int
    var i int
    for i = 0; i < len(buf)-1; i++ {
        ch = fgetc(fp)
        //fprintf(stderr,"--fgets %d/%d %X\n",i,len(buf),ch)
        if( ch == EOF ){
            break;
        }
        buf[i] = byte(ch);
        if( ch == '\n' ){
            break;
        }
    }
    buf[i] = 0
    //fprintf(stderr,"--fgets %d/%d (%s)\n",i,len(buf),buf[0:i])
    return i
}
func fgets(buf StrBuff, size int, fp*os.File)(int){
    var ch int
    var i int
    for i = 0; i < len(buf)-1; i++ {
        ch = fgetc(fp)
        //fprintf(stderr,"--fgets %d/%d %X\n",i,len(buf),ch)
        if( ch == EOF ){
            break;
        }
        buf[i] = byte(ch);
        if( ch == '\n' ){
            break;
        }
    }
    buf[i] = 0
    //fprintf(stderr,"--fgets %d/%d (%s)\n",i,len(buf),buf[0:i])
    return i
}
func fputc(ch int , fp*os.File)(int){
    var buf [1]byte
    buf[0] = byte(ch)
    fp.Write(buf[0:1])
    return 0
}
func fputs(buf StrBuff, fp*os.File)(int){
    fp.Write(buf)
    return 0
}
func xfputss(str string, fp*os.File)(int){
    return fputs([]byte(str),fp)
}
func sscanf(str StrBuff,fmts string, params ...interface{})(int){
    fmt.Sscanf(string(str[0:strlen(str)]),fmts,params...)
    return 0
}
func fprintf(fp*os.File,fmts string, params ...interface{})(int){
    fmt.Fprintf(fp,fmts,params...)
    return 0
}

// <a name="IME">Command Line IME</a>
//---------------------------------------------------------------------- MyIME
var MyIMEVER = "MyIME/0.0.2";
type RomKana struct {
    dic string  // dictionaly ID
    pat string  // input pattern
    out string  // output pattern
    hit int64   // count of hit and used
}
var dicents = 0
var romkana [1024]RomKana
var Romkan []RomKana

func isinDic(str string)(int){
    for i,v := range Romkan {
        if v.pat == str {
            return i
        }
    }
    return -1
}
const (
    DIC_COM_LOAD = "im"
```

```
    DIC_COM_DUMP = "s"
    DIC_COM_LIST = "ls"
    DIC_COM_ENA  = "en"
    DIC_COM_DIS  = "di"
)
func helpDic(argv []string){
    out := stderr
    cmd := ""
    if 0 < len(argv) { cmd = argv[0] }
    fprintf(out,"--- %v Usage\n",cmd)
    fprintf(out,"... Commands\n")
    fprintf(out,"...   %v %-3v [dicName] [dicURL ] -- Import dictionary\n",cmd,DIC_COM_LOAD)
    fprintf(out,"...   %v %-3v [pattern] -- Search in dictionary\n",cmd,DIC_COM_DUMP)
    fprintf(out,"...   %v %-3v [dicName] -- List dictionaries\n",cmd,DIC_COM_LIST)
    fprintf(out,"...   %v %-3v [dicName] -- Disable dictionaries\n",cmd,DIC_COM_DIS)
    fprintf(out,"...   %v %-3v [dicName] -- Enable dictionaries\n",cmd,DIC_COM_ENA)
    fprintf(out,"... Keys ... %v\n","ESC can be used for '\\'")
    fprintf(out,"...   \\c -- Reverse the case of the last character\n",)
    fprintf(out,"...   \\i -- Replace input with translated text\n",)
    fprintf(out,"...   \\j -- On/Off translation mode\n",)
    fprintf(out,"...   \\l -- Force Lower Case\n",)
    fprintf(out,"...   \\u -- Force Upper Case (software CapsLock)\n",)
    fprintf(out,"...   \\v -- Show translation actions\n",)
    fprintf(out,"...   \\x -- Replace the last input character with it Hexa-Decimal\n",)
}
func xDic(argv[]string){
    if len(argv) <= 1 {
        helpDic(argv)
        return
    }
    argv = argv[1:]
    var debug = false
    var info = false
    var silent = false
    var dump = false
    var builtin = false
    cmd := argv[0]
    argv = argv[1:]
    opt := ""
    arg := ""

    if 0 < len(argv) {
        arg1 := argv[0]
        if arg1[0] == '-' {
            switch arg1 {
                default: fmt.Printf("--Ed-- Unknown option(%v)\n",arg1)
                    return
                case "-b": builtin = true
                case "-d": debug = true
                case "-s": silent = true
                case "-v": info = true
            }
            opt = arg1
            argv = argv[1:]
        }
    }

    dicName := ""
    dicURL := ""
    if 0 < len(argv) {
        arg = argv[0]
        dicName = arg
        argv = argv[1:]
    }
    if 0 < len(argv) {
        dicURL = argv[0]
        argv = argv[1:]
    }
    if false {
        fprintf(stderr,"--Dd-- com(%v) opt(%v) arg(%v)\n",cmd,opt,arg)
    }
    if cmd == DIC_COM_LOAD {
        //dicType := ""
        dicBody := ""
        if !builtin && dicName != "" && dicURL == "" {
            f,err := os.Open(dicName)
            if err == nil {
                dicURL = dicName
            }else{
                f,err = os.Open(dicName+".html")
                if err == nil {
                    dicURL = dicName+".html"
                }else{
                    f,err = os.Open("gshdic-"+dicName+".html")
                    if err == nil {
                        dicURL = "gshdic-"+dicName+".html"
                    }
                }
            }
            if err == nil {
                var buf = make([]byte,128*1024)
                count,err := f.Read(buf)
                f.Close()
                if info {
                    fprintf(stderr,"--Id-- ReadDic(%v,%v)\n",count,err)
                }
                dicBody = string(buf[0:count])
            }
        }
        if dicBody == "" {
            switch arg {
                default:
                    dicName = "WorldDic"
                    dicURL = WorldDic
                    if info {
                    fprintf(stderr,"--Id-- default dictionary \"%v\"\n",
                        dicName);
                    }
                case "wnn":
                    dicName = "WnnDic"
                    dicURL = WnnDic
                case "sumomo":
                    dicName = "SumomoDic"
                    dicURL = SumomoDic
                case "sijimi":
                    dicName = "SijimiDic"
                    dicURL = SijimiDic
                case "jkl":
                    dicName = "JKLJaDic"
                    dicURL = JA_JKLDic
            }
            if debug {
                fprintf(stderr,"--Id-- %v URL=%v\n\n",dicName,dicURL);
            }
            dicv := strings.Split(dicURL,",")
```

```
            if debug {
                fprintf(stderr,"--Id-- %v encoded data...\n",dicName)
                fprintf(stderr,"Type: %v\n",dicv[0])
                fprintf(stderr,"Body: %v\n",dicv[1])
                fprintf(stderr,"\n")
            }
            body,_ := base64.StdEncoding.DecodeString(dicv[1])
            dicBody = string(body)
        }
        if info {
            fmt.Printf("--Id-- %v %v\n",dicName,dicURL)
            fmt.Printf("%s\n",dicBody)
        }
        if debug {
            fprintf(stderr,"--Id-- dicName %v text...\n",dicName)
            fprintf(stderr,"%v\n",string(dicBody))
        }
        entv := strings.Split(dicBody,"\n");
        if info {
            fprintf(stderr,"--Id-- %v scan...\n",dicName);
        }
        var added int = 0
        var dup int = 0
        for i,v := range entv {
            var pat string
            var out string
            fmt.Sscanf(v,"%s %s",&pat,&out)
            if len(pat) <= 0 {
            }else{
                if 0 <= isinDic(pat) {
                    dup += 1
                    continue
                }
                romkana[dicents] = RomKana{dicName,pat,out,0}
                dicents += 1
                added += 1
                Romkan = append(Romkan,RomKana{dicName,pat,out,0})
                if debug {
                    fmt.Printf("[%3v]:[%2v]%-8v [%2v]%v\n",
                        i,len(pat),pat,len(out),out)
                }
            }
        }
        if !silent {
            url := dicURL
            if strBegins(url,"data:") {
                url = "builtin"
            }
            fprintf(stderr,"--Id-- %v scan... %v added, %v dup. / %v total (%v)\n",
                dicName,added,dup,len(Romkan),url);
        }
        // should sort by pattern length for conclete match, for performance
        if debug {
            arg = "" // search pattern
            dump = true
        }
    }
    if cmd == DIC_COM_DUMP || dump {
        fprintf(stderr,"--Id-- %v dump... %v entries:\n",dicName,len(Romkan));
        var match = 0
        for i := 0; i < len(Romkan); i++ {
            dic := Romkan[i].dic
            pat := Romkan[i].pat
            out := Romkan[i].out
            if arg == "" || 0 <= strings.Index(pat,arg)||0 <= strings.Index(out,arg) {
                fmt.Printf("\\\\%v\t%v [%2v]%-8v [%2v]%v\n",
                    i,dic,len(pat),pat,len(out),out)
                match += 1
            }
        }
        fprintf(stderr,"--Id-- %v matched %v / %v entries:\n",arg,match,len(Romkan));
    }
}
func loadDefaultDic(dic int){
    if( 0 < len(Romkan) ){
        return
    }
    //fprintf(stderr,"\r\n")
    xDic([]string{"dic",DIC_COM_LOAD});

    var info = false
    if info {
        fprintf(stderr,"--Id-- Conguraturations!! WorldDic is now activated.\r\n")
        fprintf(stderr,"--Id-- enter \"dic\" command for help.\r\n")
    }
}
func readDic()(int){
    /*
    var rk *os.File;
    var dic = "MyIME-dic.txt";
    //rk = fopen("romkana.txt","r");
    //rk = fopen("JK-JA-morse-dic.txt","r");
    rk = fopen(dic,"r");
    if( rk == NULL_FP ){
        if( true ){
            fprintf(stderr,"--%s-- Could not load %s\n",MyIMEVER,dic);
        }
        return -1;
    }
    if( true ){
        var di int;
        var line = make(StrBuff,1024);
        var pat string
        var out string
        for di = 0; di < 1024; di++ {
            if( fgets(line,sizeof(line),rk) == NULLSP ){
                break;
            }
            fmt.Sscanf(string(line[0:strlen(line)]),"%s %s",&pat,&out);
            //sscanf(line,"%s %[^\r\n]",&pat,&out);
            romkana[di].pat = pat;
            romkana[di].out = out;
            //fprintf(stderr,"--Dd- %-10s %s\n",pat,out)
        }
        dicents += di
        if( false ){
            fprintf(stderr,"--%s-- loaded romkana.txt [%d]\n",MyIMEVER,di);
            for di = 0; di < dicents; di++ {
                fprintf(stderr,
                    "%s %s\n",romkana[di].pat,romkana[di].out);
            }
        }
    }
    fclose(rk);

```

```
3875     //romkana[dicents].pat = "//ddump"
3876     //romkana[dicents].pat = "//ddump" // dump the dic. and clean the command input
3877     */
3878     return 0;
3879 }
3880 func matchlen(stri string, pati string)(int){
3881     if strBegins(stri,pati) {
3882         return len(pati)
3883     }else{
3884         return 0
3885     }
3886 }
3887 func convs(src string)(string){
3888     var si int;
3889     var sx = len(src);
3890     var di int;
3891     var mi int;
3892     var dstb []byte
3893
3894     for si = 0; si < sx; { // search max. match from the position
3895         if strBegins(src[si:],"%x/") {
3896             // %x/integer/ // s/a/b/
3897             ix := strings.Index(src[si+3:],"/")
3898             if 0 < ix {
3899                 var iv int = 0
3900                 //fmt.Sscanf(src[si+3:si+3+ix],"%d",&iv)
3901                 fmt.Sscanf(src[si+3:si+3+ix],"%v",&iv)
3902                 sval := fmt.Sprintf("%x",iv)
3903                 bval := []byte(sval)
3904                 dstb = append(dstb,bval...)
3905                 si = si+3+ix+1
3906                 continue
3907             }
3908         }
3909         if strBegins(src[si:],"%d/") {
3910             // %d/integer/ // s/a/b/
3911             ix := strings.Index(src[si+3:],"/")
3912             if 0 < ix {
3913                 var iv int = 0
3914                 fmt.Sscanf(src[si+3:si+3+ix],"%v",&iv)
3915                 sval := fmt.Sprintf("%d",iv)
3916                 bval := []byte(sval)
3917                 dstb = append(dstb,bval...)
3918                 si = si+3+ix+1
3919                 continue
3920             }
3921         }
3922         if strBegins(src[si:],"%t") {
3923             now := time.Now()
3924             if true {
3925                 date := now.Format(time.Stamp)
3926                 dstb = append(dstb,[]byte(date)...)
3927                 si = si+3
3928             }
3929             continue
3930         }
3931         var maxlen int = 0;
3932         var len int;
3933         mi = -1;
3934         for di = 0; di < dicents; di++ {
3935             len = matchlen(src[si:],romkana[di].pat);
3936             if( maxlen < len ){
3937                 maxlen = len;
3938                 mi = di;
3939             }
3940         }
3941         if( 0 < maxlen ){
3942             out := romkana[mi].out;
3943             dstb = append(dstb,[]byte(out)...);
3944             si += maxlen;
3945         }else{
3946             dstb = append(dstb,src[si])
3947             si += 1;
3948         }
3949     }
3950     return string(dstb)
3951 }
3952 func trans(src string)(int){
3953     dst := convs(src);
3954     xfputss(dst,stderr);
3955     return 0;
3956 }
3957
3958 //------------------------------------------------------------- LINEEDIT
3959 // "?" at the top of the line means searching history
3960
3961 // should be compatilbe with Telnet
3962 const (
3963     EV_MODE     = 255
3964     EV_IDLE     = 254
3965     EV_TIMEOUT  = 253
3966
3967     GO_UP       = 252   // k
3968     GO_DOWN     = 251   // j
3969     GO_RIGHT    = 250   // l
3970     GO_LEFT     = 249   // h
3971     DEL_RIGHT   = 248   // x
3972     GO_TOPL     = 'A'-0x40  // 0
3973     GO_ENDL     = 'E'-0x40  // $
3974
3975     GO_TOPW     = 239   // b
3976     GO_ENDW     = 238   // e
3977     GO_NEXTW    = 237   // w
3978
3979     GO_FORWCH   = 229   // f
3980     GO_PAIRCH   = 228   // %
3981
3982     GO_DEL      = 219   // d
3983
3984     HI_SRCH_FW  = 209   // /
3985     HI_SRCH_BK  = 208   // ?
3986     HI_SRCH_RFW = 207   // n
3987     HI_SRCH_RBK = 206   // N
3988 )
3989
3990 // should return number of octets ready to be read immediately
3991 //fprintf(stderr,"\n--Select(%v %v)\n",err,r.Bits[0])
3992
3993
3994 var EventRecvFd = -1 // file descriptor
3995 var EventSendFd = -1
3996 const EventFdOffset = 1000000
3997 const NormalFdOffset = 100
3998
3999 func putEvent(event int, evarg int){
```

```
    if true {
        if EventRecvFd < 0 {
            var pv = []int{-1,-1}
            syscall.Pipe(pv)
            EventRecvFd = pv[0]
            EventSendFd = pv[1]
            //fmt.Printf("--De-- EventPipe created[%v,%v]\n",EventRecvFd,EventSendFd)
        }
    }else{
        if EventRecvFd < 0 {
            // the document differs from this spec
            // https://golang.org/src/syscall/syscall_unix.go?s=8096:8158#L340
            sv,err := syscall.Socketpair(syscall.AF_UNIX,syscall.SOCK_STREAM,0)
            EventRecvFd = sv[0]
            EventSendFd = sv[1]
            if err != nil {
                fmt.Printf("--De-- EventSock created[%v,%v](%v)\n",
                    EventRecvFd,EventSendFd,err)
            }
        }
    }
    var buf = []byte{ byte(event)}
    n,err := syscall.Write(EventSendFd,buf)
    if err != nil {
        fmt.Printf("--De-- putEvent[%v](%3v)(%v %v)\n",EventSendFd,event,n,err)
    }
}
func ungets(str string){
    for _,ch := range str {
        putEvent(int(ch),0)
    }
}
func (gsh*GshContext)xReplay(argv[]string){
    hix := 0
    tempo := 1.0
    xtempo := 1.0
    repeat := 1

    for _,a := range argv { // tempo
        if strBegins(a,"x") {
            fmt.Sscanf(a[1:],"%f",&xtempo)
            tempo = 1 / xtempo
            //fprintf(stderr,"--Dr-- tempo=[%v]%v\n",a[2:],tempo);
        }else
        if strBegins(a,"r") { // repeat
            fmt.Sscanf(a[1:],"%v",&repeat)
        }else
        if strBegins(a,"!") {
            fmt.Sscanf(a[1:],"%d",&hix)
        }else{
            fmt.Sscanf(a,"%d",&hix)
        }
    }
    if hix == 0 || len(argv) <= 1 {
        hix = len(gsh.CommandHistory)-1
    }
    fmt.Printf("--Ir-- Replay(!%v x%v r%v)\n",hix,xtempo,repeat)
        //dumpEvents(hix)
    //gsh.xScanReplay(hix,false,repeat,tempo,argv)
    go gsh.xScanReplay(hix,true,repeat,tempo,argv)
}

// <a href="https://golang.org/pkg/syscall/#FdSet">syscall.Select</a>
// 2020-0827 GShell-0.2.3
func FpollIn1(fp *os.File,usec int)(uintptr){
    nfd := 1

    rdv := syscall.FdSet {}
    fd1 := fp.Fd()
    bank1 := fd1/32
    mask1 := int32(1 << fd1)
    rdv.Bits[bank1] = mask1

    fd2 := -1
    bank2 := -1
    var mask2 int32 = 0

    if 0 <= EventRecvFd {
        fd2 = EventRecvFd
        nfd = fd2 + 1
        bank2 = fd2/32
        mask2 = int32(1 << fd2)
        rdv.Bits[bank2] |= mask2
        //fmt.Printf("--De-- EventPoll mask added [%d][%v][%v]\n",fd2,bank2,mask2)
    }

    tout := syscall.NsecToTimeval(int64(usec*1000))
    //n,err := syscall.Select(nfd,&rdv,nil,nil,&tout) // spec. mismatch
    err := syscall.Select(nfd,&rdv,nil,nil,&tout)
    if err != nil {
        //fmt.Printf("--De-- select() err(%v)\n",err)
    }
    if err == nil {
        if 0 <= fd2 && (rdv.Bits[bank2] & mask2) != 0 {
            if false {
                fmt.Printf("--De-- got Event\n")
            }
            return uintptr(EventFdOffset + fd2)
        }else
        if (rdv.Bits[bank1] & mask1) != 0 {
            return uintptr(NormalFdOffset + fd1)
        }else{
            return 1
        }
    }else{
        return 0
    }
}
func fgetcTimeout1(fp *os.File,usec int)(int){
  READ1:
    readyFd := FpollIn1(fp,usec)
    if readyFd < 100 {
        return EV_TIMEOUT
    }

    var buf [1]byte

    if EventFdOffset <= readyFd {
        fd := int(readyFd-EventFdOffset)
        _,err := syscall.Read(fd,buf[0:1])
        if( err != nil ){
            return EOF;
        }else{
            if buf[0] == EV_MODE {
                recvEvent(fd)
```

```
4125                goto READ1
4126            }
4127            return int(buf[0])
4128        }
4129    }
4130
4131    _,err := fp.Read(buf[0:1])
4132    if( err != nil ){
4133        return EOF;
4134    }else{
4135        return int(buf[0])
4136    }
4137 }
4138
4139 func visibleChar(ch int)(string){
4140    switch {
4141        case '!' <= ch && ch <= '~':
4142            return string(ch)
4143    }
4144    switch ch {
4145        case ' ': return "\\s"
4146        case '\n': return "\\n"
4147        case '\r': return "\\r"
4148        case '\t': return "\\t"
4149    }
4150    switch ch {
4151        case 0x00: return "NUL"
4152        case 0x07: return "BEL"
4153        case 0x08: return "BS"
4154        case 0x0E: return "SO"
4155        case 0x0F: return "SI"
4156        case 0x1B: return "ESC"
4157        case 0x7F: return "DEL"
4158    }
4159    switch ch {
4160        case EV_IDLE: return fmt.Sprintf("IDLE")
4161        case EV_MODE: return fmt.Sprintf("MODE")
4162    }
4163    return fmt.Sprintf("%X",ch)
4164 }
4165 func recvEvent(fd int){
4166    var buf = make([]byte,1)
4167    _,_ = syscall.Read(fd,buf[0:1])
4168    if( buf[0] != 0 ){
4169        romkanmode = true
4170    }else{
4171        romkanmode = false
4172    }
4173 }
4174 func (gsh*GshContext)xScanReplay(hix int,replay bool,repeat int,tempo float64,argv[]string){
4175    var Start time.Time
4176    var events = []Event{}
4177    for _,e := range Events {
4178        if hix == 0 || e.CmdIndex == hix {
4179            events = append(events,e)
4180        }
4181    }
4182    elen := len(events)
4183    if 0 < elen {
4184        if events[elen-1].event == EV_IDLE {
4185            events = events[0:elen-1]
4186        }
4187    }
4188    for r := 0; r < repeat; r++ {
4189        for i,e := range events {
4190            nano := e.when.Nanosecond()
4191            micro := nano / 1000
4192            if Start.Second() == 0 {
4193                Start = time.Now()
4194            }
4195            diff := time.Now().Sub(Start)
4196            if replay {
4197                if e.event != EV_IDLE {
4198                    putEvent(e.event,0)
4199                    if e.event == EV_MODE { // event with arg
4200                        putEvent(int(e.evarg),0)
4201                    }
4202                }
4203            }else{
4204            fmt.Printf("%7.3fms #%-3v !%-3v [%v.%06d] %3v %02X %-4v %10.3fms\n",
4205                    float64(diff)/1000000.0,
4206                    i,
4207                    e.CmdIndex,
4208                    e.when.Format(time.Stamp),micro,
4209                    e.event,e.event,visibleChar(e.event),
4210                    float64(e.evarg)/1000000.0)
4211            }
4212            if e.event == EV_IDLE {
4213                d := time.Duration(float64(time.Duration(e.evarg)) * tempo)
4214                //nsleep(time.Duration(e.evarg))
4215                nsleep(d)
4216            }
4217        }
4218    }
4219 }
4220 func dumpEvents(arg[]string){
4221    hix := 0
4222    if 1 < len(arg) {
4223        fmt.Sscanf(arg[1],"%d",&hix)
4224    }
4225    for i,e := range Events {
4226        nano := e.when.Nanosecond()
4227        micro := nano / 1000
4228        //if e.event != EV_TIMEOUT {
4229        if hix == 0 || e.CmdIndex == hix {
4230            fmt.Printf("#%-3v !%-3v [%v.%06d] %3v %02X %-4v %10.3fms\n",i,
4231                e.CmdIndex,
4232                e.when.Format(time.Stamp),micro,
4233                e.event,e.event,visibleChar(e.event),float64(e.evarg)/1000000.0)
4234        }
4235        //}
4236    }
4237 }
4238 func fgetcTimeout(fp *os.File,usec int)(int){
4239    ch := fgetcTimeout1(fp,usec)
4240    if ch != EV_TIMEOUT {
4241        now := time.Now()
4242        if 0 < len(Events) {
4243            last := Events[len(Events)-1]
4244            dura := int64(now.Sub(last.when))
4245            Events = append(Events,Event{last.when,EV_IDLE,dura,last.CmdIndex})
4246        }
4247        Events = append(Events,Event{time.Now(),ch,0,CmdIndex})
4248    }
4249    return ch
```

```
}

var TtyMaxCol = 72 // to be obtained by ioctl?
var EscTimeout = (100*1000)
var (
    MODE_VicMode    bool    // vi compatible command mode
    MODE_ShowMode   bool
    romkanmode  bool    // shown translation mode, the mode to be retained
    MODE_Recursive  bool    // recursive translation
    MODE_CapsLock   bool    // software CapsLock
    MODE_LowerLock  bool    // force lower-case character lock
    MODE_ViInsert   int // visible insert mode, should be like "I" icon in X Window
    MODE_ViTrace    bool    // output newline before translation
)
type IInput struct {
    lno     int
    lastlno     int
    pch     []int   // input queue
    prompt      string
    line        string
    right       string
    inJmode     bool
    pinJmode    bool
    waitingMeta string  // waiting meta character
    LastCmd     string
}
func (iin*IInput)Getc(timeoutUs int)(int){
    ch1 := EOF
    ch2 := EOF
    ch3 := EOF
    if( 0 < len(iin.pch) ){ // deQ
        ch1 = iin.pch[0]
        iin.pch = iin.pch[1:]
    }else{
        ch1 = fgetcTimeout(stdin,timeoutUs);
    }
    if( ch1 == 033 ){ /// escape sequence
        ch2 = fgetcTimeout(stdin,EscTimeout);
        if( ch2 == EV_TIMEOUT ){
        }else{
            ch3 = fgetcTimeout(stdin,EscTimeout);
            if( ch3 == EV_TIMEOUT ){
                iin.pch = append(iin.pch,ch2) // enQ
            }else{
                switch( ch2 ){
                    default:
                        iin.pch = append(iin.pch,ch2) // enQ
                        iin.pch = append(iin.pch,ch3) // enQ
                    case '[':
                        switch( ch3 ){
                            case 'A': ch1 = GO_UP; // ^
                            case 'B': ch1 = GO_DOWN; // v
                            case 'C': ch1 = GO_RIGHT; // >
                            case 'D': ch1 = GO_LEFT; // <
                            case '3':
                ch4 := fgetcTimeout(stdin,EscTimeout);
                                if( ch4 == '~' ){
                //fprintf(stderr,"x[%02X %02X %02X %02X]\n",ch1,ch2,ch3,ch4);
                                    ch1 = DEL_RIGHT
                                }
                        }
                    case '\\':
                //ch4 := fgetcTimeout(stdin,EscTimeout);
                //fprintf(stderr,"y[%02X %02X %02X %02X]\n",ch1,ch2,ch3,ch4);
                        switch( ch3 ){
                            case '~': ch1 = DEL_RIGHT
                        }
                }
            }
        }
    }
    return ch1
}
func (inn*IInput)clearline(){
    var i int
    fprintf(stderr,"\r");
    // should be ANSI ESC sequence
    for i = 0; i < TtyMaxCol; i++ { // to the max. position in this input action
        fputc(' ',os.Stderr);
    }
    fprintf(stderr,"\r");
}
func (iin*IInput)Redraw(){
    redraw(iin,iin.lno,iin.line,iin.right)
}
func redraw(iin *IInput,lno int,line string,right string){
    inMeta := false
    showMode := ""
    showMeta := "" // visible Meta mode on the cursor position
    showLino := fmt.Sprintf("!%d! ",lno)
    InsertMark := "" // in visible insert mode

    if MODE_VicMode {
    }else
    if 0 < len(iin.right) {
        InsertMark = " "
    }

    if( 0 < len(iin.waitingMeta) ){
        inMeta = true
        if iin.waitingMeta[0] != 033 {
            showMeta = iin.waitingMeta
        }
    }
    if( romkanmode ){
        //romkanmark = " *";
    }else{
        //romkanmark = "";
    }
    if MODE_ShowMode {
        romkan := "--"
        inmeta := "-"
        inveri := ""
        if MODE_CapsLock {
            inmeta = "A"
        }
        if MODE_LowerLock {
            inmeta = "a"
        }
        if MODE_ViTrace {
            inveri = "v"
        }
        if MODE_VicMode {
            inveri = ":"
        }
```

```
        if romkanmode {
            romkan = "\343\201\202"
            if MODE_CapsLock {
                inmeta = "R"
            }else{
                inmeta = "r"
            }
        }
        if inMeta {
            inmeta = "\\"
        }
        showMode = "["+romkan+inmeta+inveri+"]";
    }
    Pre := "\r" + showMode + showLino
    Output := ""
    Left := ""
    Right := ""
    if romkanmode {
        Left = convs(line)
        Right = InsertMark+convs(right)
    }else{
        Left = line
        Right = InsertMark+right
    }
    Output = Pre+Left
    if MODE_ViTrace {
        Output += iin.LastCmd
    }
    Output += showMeta+Right
    for len(Output) < TtyMaxCol { // to the max. position that may be dirty
        Output += " "
        // should be ANSI ESC sequence
        // not necessary just after newline
    }
    Output += Pre+Left+showMeta // to set the cursor to the current input position
    fprintf(stderr,"%s",Output)

    if MODE_ViTrace {
        if 0 < len(iin.LastCmd) {
            iin.LastCmd = ""
            fprintf(stderr,"\r\n")
        }
    }
}
// <a href="https://golang.org/pkg/unicode/utf8/">utf8</a>
func delHeadChar(str string)(rline string,head string){
    _,clen := utf8.DecodeRune([]byte(str))
    head = string(str[0:clen])
    return str[clen:],head
}
func delTailChar(str string)(rline string, last string){
    var i = 0
    var clen = 0
    for {
        _,siz := utf8.DecodeRune([]byte(str)[i:])
        if siz <= 0 { break }
        clen = siz
        i += siz
    }
    last = str[len(str)-clen:]
    return str[0:len(str)-clen],last
}

// 3> for output and history
// 4> for keylog?
// <a name="getline">Command Line Editor</a>
func xgetline(lno int, prevline string, gsh*GshContext)(string){
    var iin IInput
    iin.lastlno = lno
    iin.lno = lno

    CmdIndex = len(gsh.CommandHistory)
    if( isatty(0) == 0 ){
        if( sfgets(&iin.line,LINESIZE,stdin) == NULL ){
            iin.line = "exit\n";
        }else{
        }
        return iin.line
    }
    if( true ){
        //var pts string;
        //pts = ptsname(0);
        //pts = ttyname(0);
        //fprintf(stderr,"--pts[0] = %s\n",pts?pts:"?");
    }
    if( false ){
        fprintf(stderr,"! ");
        fflush(stderr);
        sfgets(&iin.line,LINESIZE,stdin);
        return iin.line
    }
    system("/bin/stty -echo -icanon");
    xline := iin.xgetline1(prevline,gsh)
    system("/bin/stty echo sane");
    return xline
}
func (iin*IInput)Translate(cmdch int){
    romkanmode = !romkanmode;
    if MODE_ViTrace {
        fprintf(stderr,"%v\r\n",string(cmdch));
    }else
    if( cmdch == 'J' ){
        fprintf(stderr,"J\r\n");
        iin.inJmode = true
    }
    iin.Redraw();
    loadDefaultDic(cmdch);
    iin.Redraw();
}
func (iin*IInput)Replace(cmdch int){
    iin.LastCmd = fmt.Sprintf("\\%v",string(cmdch))
    iin.Redraw();
    loadDefaultDic(cmdch);
    dst := convs(iin.line+iin.right);
    iin.line = dst
    iin.right = ""
    if( cmdch == 'I' ){
        fprintf(stderr,"I\r\n");
        iin.inJmode = true
    }
    iin.Redraw();
}
// aa 12 a1a1
func isAlpha(ch rune)(bool){
    if 'a' <= ch && ch <= 'z' || 'A' <= ch && ch <= 'Z' {
```

```
        return true
    }
    return false
}
func isAlnum(ch rune)(bool){
    if 'a' <= ch && ch <= 'z' || 'A' <= ch && ch <= 'Z' {
        return true
    }
    if '0' <= ch && ch <= '9' {
        return true
    }
    return false
}

// 0.2.8 2020-0901 created
// <a href="https://golang.org/pkg/unicode/utf8/#DecodeRuneInString">DecodeRuneInString</a>
func (iin*IInput)GotoTOPW(){
    str := iin.line
    i := len(str)
    if i <= 0 {
        return
    }
    //i0 := i
    i -= 1
    lastSize := 0
    var lastRune rune
    var found = -1
    for 0 < i { // skip preamble spaces
        lastRune,lastSize = utf8.DecodeRuneInString(str[i:])
        if !isAlnum(lastRune) { // character, type, or string to be searched
            i -= lastSize
            continue
        }
        break
    }
    for 0 < i {
        lastRune,lastSize = utf8.DecodeRuneInString(str[i:])
        if lastSize <= 0 { continue } // not the character top
        if !isAlnum(lastRune) { // character, type, or string to be searched
            found = i
            break
        }
        i -= lastSize
    }
    if found < 0 && i == 0 {
        found = 0
    }
    if 0 <= found {
        if isAlnum(lastRune) { // or non-kana character
        }else{ // when positioning to the top o the word
            i += lastSize
        }
        iin.right = str[i:] + iin.right
        if 0 < i {
            iin.line = str[0:i]
        }else{
            iin.line = ""
        }
    }
    //fmt.Printf("\n(%d,%d,%d)[%s][%s]\n",i0,i,found,iin.line,iin.right)
    //fmt.Printf("") // set debug messae at the end of line
}
// 0.2.8 2020-0901 created
func (iin*IInput)GotoENDW(){
    str := iin.right
    if len(str) <= 0 {
        return
    }
    lastSize := 0
    var lastRune rune
    var lastW = 0
    i := 0
    inWord := false

    lastRune,lastSize = utf8.DecodeRuneInString(str[0:])
    if isAlnum(lastRune) {
        r,z := utf8.DecodeRuneInString(str[lastSize:])
        if 0 < z && isAlnum(r) {
            inWord = true
        }
    }
    for i < len(str) {
        lastRune,lastSize = utf8.DecodeRuneInString(str[i:])
        if lastSize <= 0 { break } // broken data?
        if !isAlnum(lastRune) { // character, type, or string to be searched
            break
        }
        lastW = i // the last alnum if in alnum word
        i += lastSize
    }
    if inWord {
        goto DISP
    }
    for i < len(str) {
        lastRune,lastSize = utf8.DecodeRuneInString(str[i:])
        if lastSize <= 0 { break } // broken data?
        if isAlnum(lastRune) { // character, type, or string to be searched
            break
        }
        i += lastSize
    }
    for i < len(str) {
        lastRune,lastSize = utf8.DecodeRuneInString(str[i:])
        if lastSize <= 0 { break } // broken data?
        if !isAlnum(lastRune) { // character, type, or string to be searched
            break
        }
        lastW = i
        i += lastSize
    }
DISP:
    if 0 < lastW {
        iin.line = iin.line + str[0:lastW]
        iin.right = str[lastW:]
    }
    //fmt.Printf("\n(%d)[%s][%s]\n",i,iin.line,iin.right)
    //fmt.Printf("") // set debug messae at the end of line
}
// 0.2.8 2020-0901 created
func (iin*IInput)GotoNEXTW(){
    str := iin.right
    if len(str) <= 0 {
        return
    }
    lastSize := 0
```

```
4625     var lastRune rune
4626     var found = -1
4627     i := 1
4628     for i < len(str) {
4629         lastRune,lastSize = utf8.DecodeRuneInString(str[i:])
4630         if lastSize <= 0 { break } // broken data?
4631         if !isAlnum(lastRune) { // character, type, or string to be searched
4632             found = i
4633             break
4634         }
4635         i += lastSize
4636     }
4637     if 0 < found {
4638         if isAlnum(lastRune) { // or non-kana character
4639         }else{ // when positioning to the top o the word
4640             found += lastSize
4641         }
4642         iin.line = iin.line + str[0:found]
4643         if 0 < found {
4644             iin.right = str[found:]
4645         }else{
4646             iin.right = ""
4647         }
4648     }
4649     //fmt.Printf("\n(%d)[%s][%s]\n",i,iin.line,iin.right)
4650     //fmt.Printf("") // set debug messae at the end of line
4651 }
4652 // 0.2.8 2020-0902 created
4653 func (iin*IInput)GotoPAIRCH(){
4654     str := iin.right
4655     if len(str) <= 0 {
4656         return
4657     }
4658     lastRune,lastSize := utf8.DecodeRuneInString(str[0:])
4659     if lastSize <= 0 {
4660         return
4661     }
4662     forw := false
4663     back := false
4664     pair := ""
4665     switch string(lastRune){
4666         case "{": pair = "}"; forw = true
4667         case "}": pair = "{"; back = true
4668         case "(": pair = ")"; forw = true
4669         case ")": pair = "("; back = true
4670         case "[": pair = "]"; forw = true
4671         case "]": pair = "["; back = true
4672         case "<": pair = ">"; forw = true
4673         case ">": pair = "<"; back = true
4674         case "\"": pair = "\""; // context depednet, can be f" or back-double quote
4675         case "'": pair = "'"; // context depednet, can be f' or back-quote
4676         // case Japanese Kakkos
4677     }
4678     if forw {
4679         iin.SearchForward(pair)
4680     }
4681     if back {
4682         iin.SearchBackward(pair)
4683     }
4684 }
4685 // 0.2.8 2020-0902 created
4686 func (iin*IInput)SearchForward(pat string)(bool){
4687     right := iin.right
4688     found := -1
4689     i := 0
4690     if strBegins(right,pat) {
4691         _,z := utf8.DecodeRuneInString(right[i:])
4692         if 0 < z {
4693             i += z
4694         }
4695     }
4696     for i < len(right) {
4697         if strBegins(right[i:],pat) {
4698             found = i
4699             break
4700         }
4701         _,z := utf8.DecodeRuneInString(right[i:])
4702         if z <= 0 { break }
4703         i += z
4704     }
4705     if 0 <= found {
4706         iin.line = iin.line + right[0:found]
4707         iin.right = iin.right[found:]
4708         return true
4709     }else{
4710         return false
4711     }
4712 }
4713 // 0.2.8 2020-0902 created
4714 func (iin*IInput)SearchBackward(pat string)(bool){
4715     line := iin.line
4716     found := -1
4717     i := len(line)-1
4718     for i = i; 0 <= i; i-- {
4719         _,z := utf8.DecodeRuneInString(line[i:])
4720         if z <= 0 {
4721             continue
4722         }
4723         //fprintf(stderr,"-- %v %v\n",pat,line[i:])
4724         if strBegins(line[i:],pat) {
4725             found = i
4726             break
4727         }
4728     }
4729     //fprintf(stderr,"--%d\n",found)
4730     if 0 <= found {
4731         iin.right = line[found:] + iin.right
4732         iin.line = line[0:found]
4733         return true
4734     }else{
4735         return false
4736     }
4737 }
4738 // 0.2.8 2020-0902 created
4739 // search from top, end, or current position
4740 func (gsh*GshContext)SearchHistory(pat string, forw bool)(bool,string){
4741     if forw {
4742         for _,v := range gsh.CommandHistory {
4743             if 0 <= strings.Index(v.CmdLine,pat) {
4744                 //fprintf(stderr,"\n--De-- found !%v [%v]%v\n",i,pat,v.CmdLine)
4745                 return true,v.CmdLine
4746             }
4747         }
4748     }else{
4749         hlen := len(gsh.CommandHistory)
```

```
        for i := hlen-1; 0 < i ; i-- {
            v := gsh.CommandHistory[i]
            if 0 <= strings.Index(v.CmdLine,pat) {
                //fprintf(stderr,"\n--De-- found !%v [%v]%v\n",i,pat,v.CmdLine)
                return true,v.CmdLine
            }
        }
    }
    //fprintf(stderr,"\n--De-- not-found(%v)\n",pat)
    return false,"(Not Found in History)"
}
// 0.2.8 2020-0902 created
func (iin*IInput)GotoFORWSTR(pat string,gsh*GshContext){
    found := false
    if 0 < len(iin.right) {
        found = iin.SearchForward(pat)
    }
    if !found {
        found,line := gsh.SearchHistory(pat,true)
        if found {
            iin.line = line
            iin.right = ""
        }
    }
}
func (iin*IInput)GotoBACKSTR(pat string, gsh*GshContext){
    found := false
    if 0 < len(iin.line) {
        found = iin.SearchBackward(pat)
    }
    if !found {
        found,line := gsh.SearchHistory(pat,false)
        if found {
            iin.line = line
            iin.right = ""
        }
    }
}
func (iin*IInput)getstring1(prompt string)(string){ // should be editable
    iin.clearline();
    fprintf(stderr,"\r%v",prompt)
    str := ""
    for {
        ch := iin.Getc(10*1000*1000)
        if ch == '\n' || ch == '\r' {
            break
        }
        sch := string(ch)
        str += sch
        fprintf(stderr,"%s",sch)
    }
    return str
}

// search pattern must be an array and selectable with ^N/^P
var SearchPat = ""
var SearchForw = true

func (iin*IInput)xgetline1(prevline string, gsh*GshContext)(string){
    var ch int;

    MODE_ShowMode = false
    MODE_VicMode = false
    iin.Redraw();
    first := true

    for cix := 0; ; cix++ {
        iin.pinJmode = iin.inJmode
        iin.inJmode = false

        ch = iin.Getc(1000*1000)

        if ch != EV_TIMEOUT && first {
            first = false
            mode := 0
            if romkanmode {
                mode = 1
            }
            now := time.Now()
            Events = append(Events,Event{now,EV_MODE,int64(mode),CmdIndex})
        }
        if ch == 033 {
            MODE_ShowMode = true
            MODE_VicMode = !MODE_VicMode
            iin.Redraw();
            continue
        }
        if MODE_VicMode {
            switch ch {
                case '0': ch = GO_TOPL
                case '$': ch = GO_ENDL
                case 'b': ch = GO_TOPW
                case 'e': ch = GO_ENDW
                case 'w': ch = GO_NEXTW
                case '%': ch = GO_PAIRCH

                case 'j': ch = GO_DOWN
                case 'k': ch = GO_UP
                case 'h': ch = GO_LEFT
                case 'l': ch = GO_RIGHT
                case 'x': ch = DEL_RIGHT
                case 'a': MODE_VicMode = !MODE_VicMode
                    ch = GO_RIGHT
                case 'i': MODE_VicMode = !MODE_VicMode
                    iin.Redraw();
                    continue
                case '~':
                    right,head := delHeadChar(iin.right)
                    if len([]byte(head)) == 1 {
                        ch = int(head[0])
                        if( 'a' <= ch && ch <= 'z' ){
                            ch = ch + 'A'-'a'
                        }else
                        if( 'A' <= ch && ch <= 'Z' ){
                            ch = ch + 'a'-'A'
                        }
                        iin.right = string(ch) + right
                    }
                    iin.Redraw();
                    continue
                case 'f': // GO_FORWCH
                    iin.Redraw();
                    ch = iin.Getc(3*1000*1000)
                    if ch == EV_TIMEOUT {
                        iin.Redraw();
```

```
                        continue
                    }
                    SearchPat = string(ch)
                    SearchForw = true
                    iin.GotoFORWSTR(SearchPat,gsh)
                    iin.Redraw();
                    continue
                case '/':
                    SearchPat = iin.getstring1("/") // should be editable
                    SearchForw = true
                    iin.GotoFORWSTR(SearchPat,gsh)
                    iin.Redraw();
                    continue
                case '?':
                    SearchPat = iin.getstring1("?") // should be editable
                    SearchForw = false
                    iin.GotoBACKSTR(SearchPat,gsh)
                    iin.Redraw();
                    continue
                case 'n':
                    if SearchForw {
                        iin.GotoFORWSTR(SearchPat,gsh)
                    }else{
                        iin.GotoBACKSTR(SearchPat,gsh)
                    }
                    iin.Redraw();
                    continue
                case 'N':
                    if !SearchForw {
                        iin.GotoFORWSTR(SearchPat,gsh)
                    }else{
                        iin.GotoBACKSTR(SearchPat,gsh)
                    }
                    iin.Redraw();
                    continue
            }
        }
        switch ch {
            case GO_TOPW:
                iin.GotoTOPW()
                iin.Redraw();
                continue
            case GO_ENDW:
                iin.GotoENDW()
                iin.Redraw();
                continue
            case GO_NEXTW:
                // to next space then
                iin.GotoNEXTW()
                iin.Redraw();
                continue
            case GO_PAIRCH:
                iin.GotoPAIRCH()
                iin.Redraw();
                continue
        }

        //fprintf(stderr,"A[%02X]\n",ch);
        if( ch == '\\' || ch == 033 ){
            MODE_ShowMode = true
            metach := ch
            iin.waitingMeta = string(ch)
            iin.Redraw();
                // set cursor //fprintf(stderr,"???\b\b\b")
            ch = fgetcTimeout(stdin,2000*1000)
                // reset cursor
            iin.waitingMeta = ""

            cmdch := ch
            if( ch == EV_TIMEOUT ){
                if metach == 033 {
                    continue
                }
                ch = metach
            }else
            /*
            if( ch == 'm' || ch == 'M' ){
                mch := fgetcTimeout(stdin,1000*1000)
                if mch == 'r' {
                    romkanmode = true
                }else{
                    romkanmode = false
                }
                continue
            }else
            */
            if( ch == 'k' || ch == 'K' ){
                MODE_Recursive = !MODE_Recursive
                iin.Translate(cmdch);
                continue
            }else
            if( ch == 'j' || ch == 'J' ){
                iin.Translate(cmdch);
                continue
            }else
            if( ch == 'i' || ch == 'I' ){
                iin.Replace(cmdch);
                continue
            }else
            if( ch == 'l' || ch == 'L' ){
                MODE_LowerLock = !MODE_LowerLock
                MODE_CapsLock = false
                if MODE_ViTrace {
                    fprintf(stderr,"%v\r\n",string(cmdch));
                }
                iin.Redraw();
                continue
            }else
            if( ch == 'u' || ch == 'U' ){
                MODE_CapsLock = !MODE_CapsLock
                MODE_LowerLock = false
                if MODE_ViTrace {
                    fprintf(stderr,"%v\r\n",string(cmdch));
                }
                iin.Redraw();
                continue
            }else
            if( ch == 'v' || ch == 'V' ){
                MODE_ViTrace = !MODE_ViTrace
                if MODE_ViTrace {
                    fprintf(stderr,"%v\r\n",string(cmdch));
                }
                iin.Redraw();
                continue
            }else
```

```
            if( ch == 'c' || ch == 'C' ){
                if 0 < len(iin.line) {
                    xline,tail := delTailChar(iin.line)
                    if len([]byte(tail)) == 1 {
                        ch = int(tail[0])
                        if( 'a' <= ch && ch <= 'z' ){
                            ch = ch + 'A'-'a'
                        }else
                        if( 'A' <= ch && ch <= 'Z' ){
                            ch = ch + 'a'-'A'
                        }
                        iin.line = xline + string(ch)
                    }
                }
                if MODE_ViTrace {
                    fprintf(stderr,"%v\r\n",string(cmdch));
                }
                iin.Redraw();
                continue
            }else{
                iin.pch = append(iin.pch,ch) // push
                ch = '\\'
            }
        }
        switch( ch ){
            case 'P'-0x40: ch = GO_UP
            case 'N'-0x40: ch = GO_DOWN
            case 'B'-0x40: ch = GO_LEFT
            case 'F'-0x40: ch = GO_RIGHT
        }
        //fprintf(stderr,"B[%02X]\n",ch);
        switch( ch ){
            case 0:
                continue;

            case '\t':
                iin.Replace('j');
                continue
            case 'X'-0x40:
                iin.Replace('j');
                continue

            case EV_TIMEOUT:
                iin.Redraw();
                if iin.pinJmode {
                    fprintf(stderr,"\\J\r\n")
                    iin.inJmode = true
                }
                continue
            case GO_UP:
                if iin.lno == 1 {
                    continue
                }
                cmd,ok := gsh.cmdStringInHistory(iin.lno-1)
                if ok {
                    iin.line = cmd
                    iin.right = ""
                    iin.lno = iin.lno - 1
                }
                iin.Redraw();
                continue
            case GO_DOWN:
                cmd,ok := gsh.cmdStringInHistory(iin.lno+1)
                if ok {
                    iin.line = cmd
                    iin.right = ""
                    iin.lno = iin.lno + 1
                }else{
                    iin.line = ""
                    iin.right = ""
                    if iin.lno == iin.lastlno-1 {
                        iin.lno = iin.lno + 1
                    }
                }
                iin.Redraw();
                continue
            case GO_LEFT:
                if 0 < len(iin.line) {
                    xline,tail := delTailChar(iin.line)
                    iin.line = xline
                    iin.right = tail + iin.right
                }
                iin.Redraw();
                continue;
            case GO_RIGHT:
                if( 0 < len(iin.right) && iin.right[0] != 0 ){
                    xright,head := delHeadChar(iin.right)
                    iin.right = xright
                    iin.line += head
                }
                iin.Redraw();
                continue;
            case EOF:
                goto EXIT;
            case 'R'-0x40: // replace
                dst := convs(iin.line+iin.right);
                iin.line = dst
                iin.right = ""
                iin.Redraw();
                continue;
            case 'T'-0x40: // just show the result
                readDic();
                romkanmode = !romkanmode;
                iin.Redraw();
                continue;
            case 'L'-0x40:
                iin.Redraw();
                continue
            case 'K'-0x40:
                iin.right = ""
                iin.Redraw();
                continue
            case 'E'-0x40:
                iin.line += iin.right
                iin.right = ""
                iin.Redraw();
                continue
            case 'A'-0x40:
                iin.right = iin.line + iin.right
                iin.line = ""
                iin.Redraw();
                continue
            case 'U'-0x40:
                iin.line = ""
                iin.right = ""
```

```
                iin.clearline();
                iin.Redraw();
                continue;
            case DEL_RIGHT:
                if( 0 < len(iin.right) ){
                    iin.right,_ = delHeadChar(iin.right)
                    iin.Redraw();
                }
                continue;
            case 0x7F: // BS? not DEL
                if( 0 < len(iin.line) ){
                    iin.line,_ = delTailChar(iin.line)
                    iin.Redraw();
                }
                /*
                else
                if( 0 < len(iin.right) ){
                    iin.right,_ = delHeadChar(iin.right)
                    iin.Redraw();
                }
                */
                continue;
            case 'H'-0x40:
                if( 0 < len(iin.line) ){
                    iin.line,_ = delTailChar(iin.line)
                    iin.Redraw();
                }
                continue;
        }
        if( ch == '\n' || ch == '\r' ){
            iin.line += iin.right;
            iin.right = ""
            iin.Redraw();
            fputc(ch,stderr);
            break;
        }
        if MODE_CapsLock {
            if 'a' <= ch && ch <= 'z' {
                ch = ch+'A'-'a'
            }
        }
        if MODE_LowerLock {
            if 'A' <= ch && ch <= 'Z' {
                ch = ch+'a'-'A'
            }
        }
        iin.line += string(ch);
        iin.Redraw();
    }
EXIT:
    return iin.line + iin.right;
}

func getline_main(){
    line := xgetline(0,"",nil)
    fprintf(stderr,"%s\n",line);
/*
    dp = strpbrk(line,"\r\n");
    if( dp != NULL ){
        *dp = 0;
    }

    if( 0 ){
        fprintf(stderr,"\n(%d)\n",int(strlen(line)));
    }
    if( lseek(3,0,0) == 0 ){
        if( romkanmode ){
            var buf [8*1024]byte;
            convs(line,buff);
            strcpy(line,buff);
        }
        write(3,line,strlen(line));
        ftruncate(3,lseek(3,0,SEEK_CUR));
        //fprintf(stderr,"outsize=%d\n",(int)lseek(3,0,SEEK_END));
        lseek(3,0,SEEK_SET);
        close(3);
    }else{
        fprintf(stderr,"\r\ngotline: ");
        trans(line);
        //printf("%s\n",line);
        printf("\n");
    }
*/
}
//== end ========================================================== getline

//
// $USERHOME/.gsh/
//      gsh-rc.txt, or gsh-configure.txt
//              gsh-history.txt
//              gsh-aliases.txt // should be conditional?
//
func (gshCtx *GshContext)gshSetupHomedir()(bool) {
    homedir,found := userHomeDir()
    if !found {
        fmt.Printf("--E-- You have no UserHomeDir\n")
        return true
    }
    gshhome := homedir + "/" + GSH_HOME
    _, err2 := os.Stat(gshhome)
    if err2 != nil {
        err3 := os.Mkdir(gshhome,0700)
        if err3 != nil {
            fmt.Printf("--E-- Could not Create %s (%s)\n",
                gshhome,err3)
            return true
        }
        fmt.Printf("--I-- Created %s\n",gshhome)
    }
    gshCtx.GshHomeDir = gshhome
    return false
}
func setupGshContext()(GshContext,bool){
    gshPA := syscall.ProcAttr {
        "", // the staring directory
        os.Environ(), // environ[]
        []uintptr{os.Stdin.Fd(),os.Stdout.Fd(),os.Stderr.Fd()},
        nil, // OS specific
    }
    cwd, _ := os.Getwd()
    gshCtx := GshContext {
        cwd, // StartDir
        "", // GetLine
        []GChdirHistory { {cwd,time.Now(),0} }, // ChdirHistory
        gshPA,
```

```
        []GCommandHistory{}, //something for invokation?
        GCommandHistory{}, // CmdCurrent
        false,
        []int{},
        syscall.Rusage{},
        "", // GshHomeDir
        Ttyid(),
        false,
        false,
        []PluginInfo{},
        []string{},
        " ",
        "v",
        ValueStack{},
        GServer{"",""}, // LastServer
        "", // RSERV
        cwd, // RWD
        CheckSum{},
    }
    err := gshCtx.gshSetupHomedir()
    return gshCtx, err
}
func (gsh*GshContext)gshelllh(gline string)(bool){
    ghist := gsh.CmdCurrent
    ghist.WorkDir,_ = os.Getwd()
    ghist.WorkDirX = len(gsh.ChdirHistory)-1
    //fmt.Printf("--D--ChdirHistory(@%d)\n",len(gsh.ChdirHistory))
    ghist.StartAt = time.Now()
    rusagev1 := Getrusagev()
    gsh.CmdCurrent.FoundFile = []string{}
    fin := gsh.tgshelll(gline)
    rusagev2 := Getrusagev()
    ghist.Rusagev = RusageSubv(rusagev2,rusagev1)
    ghist.EndAt = time.Now()
    ghist.CmdLine = gline
    ghist.FoundFile = gsh.CmdCurrent.FoundFile

    /* record it but not show in list by default
    if len(gline) == 0 {
        continue
    }
    if gline == "hi" || gline == "history" { // don't record it
        continue
    }
    */
    gsh.CommandHistory = append(gsh.CommandHistory, ghist)
    return fin
}
// <a name="main">Main loop</a>
func script(gshCtxGiven *GshContext) (_ GshContext) {
    gshCtxBuf,err0 := setupGshContext()
    if err0 {
        return gshCtxBuf;
    }
    gshCtx := &gshCtxBuf

    //fmt.Printf("--I-- GSH_HOME=%s\n",gshCtx.GshHomeDir)
    //resmap()

    /*
    if false {
        gsh_getlinev, with_exgetline :=
             which("PATH",[]string{"which","gsh-getline","-s"})
        if with_exgetline {
            gsh_getlinev[0] = toFullpath(gsh_getlinev[0])
            gshCtx.GetLine = toFullpath(gsh_getlinev[0])
        }else{
        fmt.Printf("--W-- No gsh-getline found. Using internal getline.\n");
        }
    }
    */

    ghist0 := gshCtx.CmdCurrent // something special, or gshrc script, or permanent history
    gshCtx.CommandHistory = append(gshCtx.CommandHistory,ghist0)

    prevline := ""
    skipping := false
    for hix := len(gshCtx.CommandHistory); ; {
        gline := gshCtx.getline(hix,skipping,prevline)
        if skipping {
            if strings.Index(gline,"fi") == 0 {
                fmt.Printf("fi\n");
                skipping = false;
            }else{
                //fmt.Printf("%s\n",gline);
            }
            continue
        }
        if strings.Index(gline,"if") == 0 {
            //fmt.Printf("--D-- if start: %s\n",gline);
            skipping = true;
            continue
        }
        if false {
            os.Stdout.Write([]byte("gotline:"))
            os.Stdout.Write([]byte(gline))
            os.Stdout.Write([]byte("\n"))
        }
        gline = strsubst(gshCtx,gline,true)
        if false {
            fmt.Printf("fmt.Printf %%v - %v\n",gline)
            fmt.Printf("fmt.Printf %%s - %s\n",gline)
            fmt.Printf("fmt.Printf %%x - %s\n",gline)
            fmt.Printf("fmt.Printf %%U - %s\n",gline)
            fmt.Printf("Stouut.Write -")
            os.Stdout.Write([]byte(gline))
            fmt.Printf("\n")
        }
        /*
        // should be cared in substitution ?
        if 0 < len(gline) && gline[0] == '!' {
            xgline, set, err := searchHistory(gshCtx,gline)
            if err {
                continue
            }
            if set {
                // set the line in command line editor
            }
            gline = xgline
        }
        */
        fin := gshCtx.gshelllh(gline)
        if fin {
            break;
        }
```

```
        prevline = gline;
        hix++;
    }
    return *gshCtx
}
func main() {
    gshCtxBuf := GshContext{}
    gsh := &gshCtxBuf
    argv := os.Args
    if 1 < len(argv) {
        if isin("version",argv){
            gsh.showVersion(argv)
            return
        }
        comx := isinX("-c",argv)
        if 0 < comx {
            gshCtxBuf,err := setupGshContext()
            gsh := &gshCtxBuf
            if !err {
                gsh.gshellv(argv[comx+1:])
            }
            return
        }
    }
    if 1 < len(argv) && isin("-s",argv) {
    }else{
        gsh.showVersion(append(argv,[]string{"-l","-a"}...))
    }
    script(nil)
    //gshCtx := script(nil)
    //gshell1(gshCtx,"time")
}
//</div></details>
//<details id="gsh-todo"><summary>Considerations</summary><div class="gsh-src">
// - inter gsh communication, possibly running in remote hosts -- to be remote shell
// - merged histories of multiple parallel gsh sessions
// - alias as a function or macro
// - instant alias end environ export to the permanent > ~/.gsh/gsh-alias and gsh-environ
// - retrieval PATH of files by its type
// - gsh as an IME with completion using history and file names as dictionaies
// - gsh a scheduler in precise time of within a millisecond
// - all commands have its subucomand after "---" symbol
// - filename expansion by "-find" command
// - history of ext code and output of each commoand
// - "script" output for each command by pty-tee or telnet-tee
// - $BUILTIN command in PATH to show the priority
// - "?" symbol in the command (not as in arguments) shows help request
// - searching command with wild card like: which ssh-*
// - longformat prompt after long idle time (should dismiss by BS)
// - customizing by building plugin and dynamically linking it
// - generating syntactic element like "if" by macro expansion (like CPP) >> alias
// - "!" symbol should be used for negation, don't wast it just for job control
// - don't put too long output to tty, record it into GSH_HOME/session-id/comand-id.log
// - making canonical form of command at the start adding quatation or white spaces
// - name(a,b,c) ... use "(" and ")" to show both delimiter and realm
// - name? or name! might be useful
// - htar format - packing directory contents into a single html file using data scheme
// - filepath substitution shold be done by each command, expecially in case of builtins
// - @N substition for the history of working directory, and @spec for more generic ones
// - @dir prefix to do the command at there, that means like (chdir @dir; command)
// - GSH_PATH for plugins
// - standard command output: list of data with name, size, resouce usage, modified time
// - generic sort key option -nm name, -sz size, -ru rusage, -ts start-time, -tm mod-time
//   -wc word-count, grep match line count, ...
// - standard command execution result: a list of string, -tm, -ts, -ru, -sz, ...
// - -tailf-filename like tail -f filename, repeat close and open before read
// - max. size and max. duration and timeout of (generated) data transfer
// - auto. numbering, aliasing, IME completion of file name (especially rm of quieer name)
// - IME "?" at the top of the command line means searching history
// - IME %d/0x10000/ %x/ffff/
// - IME ESC to go the edit mode like in vi, and use :command as :s/x/y/g to edit history
// - gsh in WebAssembly
// - gsh as a HTTP server of online-manual
//---END--- (^-^)/ITS more</div></details>

//<span class="gsh-golang-data">

var WorldDic = //<span id="gsh-world-dic">
"data:text/dic;base64,"+
"Ly8gTXlJTUUvMC4wLjEg6L6e5pu4ICgyMDIwLTA4MTlhKQpzZWthaSDkuJbnlYwKa28g44GT"+
"Cm5uIOOCkwpuaSDjgasKY2hpIOOBoQp0aSDjgaEKaGEg44GvCnNlIOOBmwprYSDjgYsKaSDj"+
"gYQK";
//</span>

var WnnDic = //<span id="gsh-wnn-dic">
"data:text/dic;base64,"+
"PGlldGEgY2hhcnNldD0iVVRGLTgiPgo8dGV4dGFyZWEgY29scz04MCByb3dzPTQwPgovL2Rp"+
"Y3ZlcglHU2hlbGxcc0lNRVxzZGljdGlvbmFyeVxzZm9yXHNXbm5ccy8vXHMyMDIwLTA4MzAK"+
"R1NoZWxsCUdTaGVsbArjgo/jgZ/jgZcJ56eBCndhdGFzaGkJ56eBCndhdGFzaQnnp4EK44Gq"+
"44G+44GICeWQjeWJjQpuYWlhZQnlkI3liY0K44Gq44GL44GuCeS4remHjgpuYWthbm8J5Lit"+
"6YeOCndhCeOCjwp0YQnjgZ8Kc2kJ44GXCnNoaQnjgZcKbm8J44GuCm5hCeOBqgptYQnjgb4K"+
"ZQnjgYgKaGEJ44GvCm5hCeOBqgprYQnjgYsKbm8J44GuCmRlCeOBpwpzdQnjgZkKZVxzCWVj"+
"aG8KZGljCWRpYwplY2hvCWVjaG8KcmVwbGF5CXJlcGxheQpyZXBlYXQJcmVwZWF0CmR0CWRh"+
"dGVccysnJVklbSVkLSVIOiVNOiVTJwp0aW9uCXRpb24KJXQJJXQJLy8gdG8gYmUgYW4gYWN0"+
"aW9uCjwvdGV4dGFyZWE+Cg=="
//</span>

var SumomoDic = //<span id="gsh-sumomo-dic">
"data:text/dic;base64,"+
"PGlldGEgY2hhcnNldD0iVVRGLTgiPgo8dGV4dGFyZWEgY29scz04MCByb3dzPTQwPgovL3Zl"+
"cglHU2hlbGxcc0lNRVxzZGljdGlvbmFyeVxzZm9yXHNTdW1vbW9ccy8vXHMyMDIwLTA4MzAK"+
"c3UJ44GZCm1vCeOCggpubwnjga4KdQnjgYYKY2hpCeOBoQp0aQnjgaEKdWNoaQnlhoUKdXRp"+
"CeWGhQpzdW1vbW8J44GZ44KC44KCCnNlbW9tb21vCeOBmeOCguOCguOCggptb21vCeahgwpt"+
"b21vbW8J5qGD44KCCiwsCeOAgQouLgnjgIIKPC90ZXh0YXJlYT4K"
//</span>

var SijimiDic = //<span id="gsh-sijimi-dic">
"data:text/dic;base64,"+
"PGlldGEgY2hhcnNldD0iVVRGLTgiPgo8dGV4dGFyZWEgY29scz04MCByb3dzPTQwPgovL3Zl"+
"cglHU2hlbGxcc0lNRVxzZGljdGlvbmFyeVxzZm9yXHNTaGlqaW1pXHMvL1xzMjAyMC0wODMw"+
"CnNpCeOBlwpzaGkJ44GXCmppCeOBmAptaQnjgb8KbmEJ44GqCmplCeOBmOOChQp4eXUJ44KF"+
"CnUJ44GGCm5pCeOBqwprbwnjgZMKYnUJ44G2Cm5uCeOCkwpubwnjga4KY2hpCeOBoQp0aQnj"+
"gaEKa2EJ44GLCnJhCeOCiQosLAnjgIEKLi4J44CCChnhuYW5hCeS4gwp4anV1CeWNgQp4bmkJ"+
"5LqMCmtveAnlgIsKa29xCeWAiwprb3gJ5YCLCm5hbmFqdXVuaXgJNzIKbmFuYWp1dW5peHgJ"+
"77yX77ySCm5hbmFqdXVuaVgJ77yX77ySCuS4g+WNgeS6jHgJNzIKa29idW5uCeWAi+WIhgp0"+
"aWthcmFxCeOBoeOBi+OCiQp0aWthcmEJ5YqbCmNoaWthcmEJ5YqbCjwvdGV4dGFyZWE+Cg="
//</span>

var JA_JKLDic = //<span id="gsh-ja-jkl-dic">
"data:text/dic;base64,"+
"Ly92ZXJsCU15SU1FamRpY2ptb3JzZWpKQWpKS0woMjAyMGowODE5KSheLV4pL1NhdG94SVRT"+
"CmtqamprbGtqa2tsa2psIOS4lueVjApqamtqamwJ44GCCmtqbAnjgYQKa2tqbAnjgYYKamtq"+
"amwJ44GICmtqa2trbAnjgYoKa2pra2wJ44GLCmpramtrbAnjgY0Ka2tramwJ44GPCmpramps"+
"CeOBkQpqampqbAnjgZMKamtqa2psCeOBlQpqamtqa2wJ44GXCmpqamtqbAnjgZkKa2pqamts"+
"CeOBmwpqamprbAnjgZ0KamtsCeOBnwpra2prbAnjgaEKa2pqa2wJ44GkCmtqa2pqbAnjgaYK"+
```

```
"a2tqa2tsCeOBqApramtsCeOBqgpqa2prbAnjgasKa2tra2wJ44GsCmpqa2psCeOBrQpra2pq"+
"bAnjga4Kamtra2wJ44GvCmpqa2tqbAnjgbIKampra2wJ44G1CmtsCeOBuApqa2tsCeOBuwpq"+
"a2tqbAnjgb4Ka2tqa2psCeOBvwpqbAnjgoAKamtra2psCeOCgQpqa2tqa2wJ44KCCmtqamwJ"+
"44KECmpra2pqbAnjgoYKampsCeOCiApra2tsCeOCiQpqamtsCeOCigpqa2pqa2wJ44KLCmpq"+
"amwJ44KMCmtqa2psCeOCjQpqa2psCeOCjwpramtramwJ44KQCmtqamtrbAnjgpEKa2pqamwJ"+
"44KSCmtqa2prbAnjgpMKa2pqa2psCeODvApra2wJ44KbCmtramprbAnjgpwKa2pramtqbAnj"+
"gIEK";
```


```
//</span>

//</span>
/*
<details id="references"><summary>References</summary><div class="gsh-src">
<p>
<a href="https://golang.org">The Go Programming Language</a>
<iframe src="https://golang.org" width="100%" height="300"></iframe>

<a href="https://developer.mozilla.org/ja/docs/Web">MDN web docs</a>
 <a href="https://developer.mozilla.org/ja/docs/Web/HTML/Element">HTML</a>
 CSS:
   <a href="https://developer.mozilla.org/en-US/docs/Web/CSS/CSS_Selectors">Selectors</a>
   <a href="https://developer.mozilla.org/en-US/docs/Web/CSS/background-repeat">repeat</a>
 HTTP
 JavaScript:
 ...
</p>
</div></details>
*/
/*
<details id="html-src" onclick="frame_open();"><summary>Raw Source</summary><div>

<!-- h2>The full of this HTML including the Go code is here.</h2 -->
<details id="gsh-whole-view"><summary>Whole file</summary>
 <a name="whole-src-view"></a>
 <span id="src-frame"></span><!-- a window to show source code -->
</details>

<details id="gsh-style-frame" onclick="fill_CSSView()"><summary>CSS part</summary>
 <a name="style-src-view"></a>
 <span id="gsh-style-view"></span>
</details>

<details id="gsh-script-frame" onclick="fill_JavaScriptView()"><summary>JavaScript part</summary>
 <a name="script-src-view"></a>
 <span id="gsh-script-view"></span>
</details>

<details id="gsh-data-frame" onclick="fill_DataView()"><summary>Builtin data part</summary>
 <a name="gsh-data-frame"></a>
 <span id="gsh-data-view"></span>
</details>

</div></details>
*/
/*
<div id="gsh-footer" style=""></div><!-- ----------- END-OF-VISIBLE-PART ----------- -->


<style id="gsh-style-def">
 //body {display:none;}
 .gsh-link{color:green;}
 #gsh {border-width:1;margin:0;padding:0;}
 #gsh {font-family:monospace,Courier New;color:#ddf;font-size:8px;}
 #gsh header{height:100px;}
 #xgsh header{height:100px;background-image:url(GShell-Logo00.png);}
 #gsh-menu{font-size:14pt;color:#f88;}
 #gsh-footer{height:100px;background-size:80px;background-repeat:no-repeat;}
 #gsh note{color:#000;font-size:10pt;}
 #gsh h2{color:#24a;font-family:Georgia;font-size:18pt;}
 #gsh h3{color:#24a;font-family:Georgia;font-size:16pt;}
 #gsh details{color:#888;background-color:#fff;font-family:monospace;}
 #gsh summary{font-size:16pt;color:#fff;background-color:#8af;height:30px;}
 #gsh pre{font-size:11pt;color:#223;background-color:#faffff;}
 #gsh a{color:#24a;}
 #gsh a[name]{color:#24a;font-size:16pt;}
 #gsh .gsh-src{white-space:pre;font-family:monospace,Courier New;font-size:11pt;}
 #gsh .gsh-src{background-color:#faffff;color:#223;}
 #gsh-src-src{spellcheck:false}
 #src-frame-textarea{white-space:pre;font-family:monospace,Courier New;font-size:11pt;}
 #src-frame-textarea{background-color:#faffff;color:#223;}
 .gsh-code {white-space:pre;font-family:monospace !import;}
 .gsh-code {color:#088;font-size:11pt; background-color:#eef;}
 .gsh-golang-data {display:none;}
 #gsh-WinId {color:#000;font-size:14pt;}

 .gsh-document {font-size:11pt;background-color:#fff;font-family:Georgia;}
 .gsh-document {color:#000;background-color:#fff !import;}
 .gsh-document > h2{color:#000;background-color:#fff !import;}
 .gsh-document details{color:#000;background-color:#fff;font-family:Georgia;}
 .gsh-document p{max-width:550pt;color:#000;background-color:#fff;font-family:Georgia;}
 .gsh-document address{width:500pt;color:#000;background-color:#fff;font-family:Georgia;}

 @media print {
  #gsh pre{font-size:11pt !import;}
 }
</style>

<!--
// Logo image should be drawn by JavaScript from a meta-font.
// CSS seems not follow line-splitted URL
-->
<script id="gsh-data">
//GshLogo="QR-ITS-more.jp.png"
GshLogo="\
```


```
iVBORw0KGgoAAAANSUhEUgAAAQEAAAB/CAYAAADvs3f4AAAAAXNSR0IArs4c6QAAAHhlWElm\
TU0AKgAAAAgABAEaAAUAAAABAAAAPgEbAAUAAAABAAAARgEoAAMAAAABAAIAAIdpAAQAAAAB\
AAAATgAAAAAAAABIAAAAAQAAAEgAAAABAAOgAQADAAAAAQABAACgAgAEAAAAAQAAAQGgAwAE\
AAAAAQAAAH8AAAAAYx1BhgAAAAlwSFlzAAALEwAACxMBAJqcGAAAF3RJREFUeAHtnQuUFNWZ\
x++t7ukZ3iCggO/jY6Osb8WgMzAvn7uG4+bISTR7YnQXdQPCkGj2aNwlD2MSlRkeUaPnoCdu\
4iuJx7jriYZ50DOGmF2VqIBEiSggCoiMMA+mu+vu//ZMD9U1dau6a2aUbv91GKrq3vvdx6/q/\
fnXvdx8tBA8SIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAES\
IAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAES\
IAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAES\
IAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIIFDl4A8dLP2\
2eXs9H9+ftSkSdHxsic2qqdE7YusS+1qaalKfnY5YsokMHwEPtdK4MQFz5UeExlbLYSaYUl5\
npDiLKXEZClFiRM53JSUaq9ScqcU6i+2kK3StuONy5reEGKJ7Qw7mOvKec2ToqOiZwoljhFS\
jbOVHCstMRb3USXEJ8hFu7DsdmFb2+xU4vWWFVXbBpMeZUlAE/hcKoGab66eKGOlNykh56PC\
HxH2VVBKoRKqh3qUeKi1YdaOi0N9DLmXpFK/60p2P/Piyovf\
N8mfM+/nJWNGnjw9KqOToLVGSFt2p2Ril1gn3ij0Vk7YsoWVMzEuVPfPlRKYdfOak2LRSB0q\
zrWocCOG6qEhvgRaCj/dktj3g7dXXH4gKN6aS0zpYzerqS6RAoZDQqfk79SKTRXHu/e+9FN\
L66as88pU/PN1pNlTLZJKSc73dPXSr20ur7iiwPcC8QhbbNnCyhUIlryyOTQvYF5JfvqBL7jx\
+cNHjBj5gJRyDlJHy39o84D40H2Qtx8THaPeFuIOU+w1C1CKnyhK5FGEv0WGgAExB83eXMoLY\
rikbd9gHEP52VgQl4h89FUA6kJyYFbbQbnzLJg4zFiesnDHCwvUoeiVQOb/5C9FY9lUeOH\
+zGhUh9nSqOqrm0uWgurkI9RpjBD4Y6uQcQdD5TUOW63zD3MHesy14V49isbdKyxbGHlCpFR\
UJ6toACF7F9VF58NBfDHT0MBaE74E74Ent+eWrrWr+Lz/QTw60cOoBNCeMUZ\
ttCu/coG28fLpvKElTPFV8juRasEahbHRx5jCuC/5ZhvxvW+Gz9L/dUZH3r/Lz1BZoUcdEf\
```

bgGgov0g1zgGGw4jF392xnHhdc+Mwf3JTjfntZ2yC1YJBJXNUt5KIKyck1sxXRdld6BmcevN\
aJovy/VBacMevqEP46/ZlnJjt9jx17VL53Zl5Mtvap1QGlNHw5pQDqXyNTQlZ2b8nGcMG2ZV\
qOoFjSdYvV0AZzDfayidv6FJ35CS4jXZk9hir7e27zm6p3T8hLJpkYicJpV1HtK/DJFU4Jw1\
lImhxM5IR9fzzgRKx4w/C+HQSPE+krbIyrN3qEPTNahsHaLDs2xh5Q5NCoPPVdEpgcqbm/8e\
7/zdOaHptag/mlKJ77U0VG0xybTdX/Ex/PTfa/i7r7Ku+cSoiCxUwrohUxF16wEV9H+ccVgl\
pd/CfU42AK2IUPlvTK1L/sJjyE5PVHqr728NzvfUzvvDODGy9GoopuuhmNLNfcTx48YHL2qH\
f/8hpXVu/43rQg9xtq6YtcvlXDC3fmWDQn9nbf2le7wKE1bOK65icBu0Eqhd3IaW82dwKPUw\
hrauc6ZcWdkcjUZK8EUXMae71zUqwCu2nbi6eVn1Ji9/P7eW+ioMAogF+NI3iJLSf8dn9ipA\
WNW4rPy9jJxuPeDL/HXzNzgTsveslD2vsWHWI9mu5rvVvZX9foS4v/LfmqdEIpHDGlfM2uCW\
gJIy2wOENPaZ3fEcivd+ZYNCNJYtrNyhyGAo8jRoJTAUmRiqOCJnRW5FpTN++frTwdh4SiUv\
bVlWvbffLcRF04qazRD7176/rBjKylD5pBiZ5Wi4wQu7tikPBeCOpuW+Kj0sqP8GHNoAZuwL\
iOzuywDhQ9zBr2xoDRqVQFi5QxxH6OwVjRKAAW46pvT+RxAJVLjW7vY9/+CeUBMkl68/rPQn\
mCufKzaldFN/yI8gA5iwC3dkIKhsyvZuCYSVG/KHcwhFWDRKAMMcD8EKX+rHFl2A9bt2d172\
2qNzOvzCDYmfEtNy7QogXDXWIKAIQ7cOQZchyADWnerqN5xVXttcJsdGp2OtwqmWJU7A+Eh7\
yhYbUgm1IX7f7K1DwaRyUfN42FIuxNDdVEtamL6sYC9R26VtbZaW2px8Nfmehz3EM+mgsolk\
d3/ZnBGElXPGUWzXg1YCq5eW5/zBGy54aWOgwWKfnWbqptcevWT4FUBvov32gew8DLzDTMaj\
aupq7t/bMXX+yw/egJGKoTksy2d+gFBb9VoDvX5BlZTOR+Wfjyb0pP6U0XGOYNqR/quta3vB\
Fgeua6qv2d7vn8dFdV3rldBw34GSPg9i0DG9h5XWknh9kAaMmyJ6dklPzZmtD3cnu77vtw5C\
h/YrG1p7Wxp/VvuRDuc+wsq54ymm+8zzKOgyRSPRa4IKoGz1i8b6ytagcEPmb9v/m09cUATz\
Jow6tVnPcMxHzj+sNNpHsCJyja6csrRsMyrGkiwF4I5UiouliL1RW7fmNLeX3z2+/GfW1LU2\
Y572b6EAzkfYoPctJi15Q1nJyLdrFrUZp1/3pmkuG/yN9gAoGyMTf7neVIvx/6CHUghlluh/\
f9Uvo+gG7O3q7rzFL8xQ+zW+/8F6PW6fV7xSXhiNlayvWdz2X1ULm/4uL1mPwNoA5uGcdoL9\
ZFa6cgoxzhTG6Q4lNR5Doj9xuvlcy+rFbcujVsnLkKv0CefphUbICLRMvl+9KP4vngHg6Fc2\
NCqMSiCsnCkfxeD+mTflBwuxdmFbOZqT/l94225Y3TCrzpQWhthG2zHraJO/yb0kkdhpanZq\
GXwFf66/8Cb5AHcbzdpnhUjeG6YFow1gZeMmtqNCDekzTiXVuc3LK4yVTJepuq5tqSWFkXdA\
ufu9MfWiG3sqnNtcX76+3xEXQWWzVeqSpvrZmC2afYSVy46l+O4KvyVgicCugG2rp0yPTveJ\
o2Ulm2JWZEO+f6K0dFtNXfw2U9x7O/bqZct5z0Poi0+vdpyDJcdxrD34U9XCeHrloSktt3ug\
AcwtkOO9FZFn+gWtWdS6ODcFoDrAxneOCfRXWUSoK93pBZXN7vAe+gwr506/2O4LXgngLbrC\
76HgRdvetHz2WlMYVVqqm5zTTP5+7volRR/zJlOYlx+8ohOzEb+CV/0TU5ic3NGfjkSs30MZ\
tFUtil+Yi4yfAcwkjzqpZyb6HlgJebwpgLYxoO9/j8k//WW3xS32gQPHrV5aMTp1IDFN2Op6\
fz5ywF4HfmXD+/Buy4NVu73yEFbOK65icot+ZjP+8qf4JkYiTnGKTb/qST0zMKACq18jjPGL\
A4PCxYNpMKOtjREv84HpyOsws/BsqyT2RGZ6rzl0gA9sBhEp46hsP2ratmOJeGrugBWDB2Pw\
NYD1B4OSTMBmcmdS2E/GG2ZvrF7Uejsqyw/7A7guEH6Kyyl9q3fpQQvgXtx4dz+Ueg+Lmy5v\
bjjYtO+b5LSqpq5Nz6nwbFFhUdaYgemZy4ap1z5dlbByA3NQTC4F3RKYfOTkaUF9Xry0LwU8\
sDMC/H29oV0GTNV1C+iZhTu27rgAebkb4+8H3P553qOOyu/WHj21ZWbd7z2XLuv4fA1gmQSV\
2GML+6KmhorvaQWgne11yZ/glLX+IBNcn2FQ7F9Y5XQfN/qUa+Hr3UrAGg1MTLrG3bfPyEtp\
m6d5oyCZcJmzX9nQ2jAqgbBymXSL9VzQSgBfxUBjHpbXbzM+vKueRBRiotE/Bw8ogf/LIZhY\
/9Tcnsb68lt7DtgnQRE8lEvT2z9eWT5SjF7lFSZoVlyfTLvqUTOb62etccbRO1lHeS68SYeT\
2OzUdegWmRTW7S7ng7dKrVi9rLztoMPBK73nA4YrdZfM+5DZsymDymaHnClokvPOVHG5FrQS\
wCY6RwU9Dkx5MU9wQXMaX+ePguLw8/dvfg6U1LPvsPBpXspOniQwagElsm9gqNxctOEQlvj5\
7tBBBjAdHkMPdY0/q/irW1bf44t5cNKQKwAq7DsuJzHl6Clz8bk+1u2u78FXYWfklQ4/qY2x\
tYvjX8boyWN6zwc9/Ojwz7pUtv1Lp0NQ2UxLo8PKOdMu1uvooTDjLyxcrNWHEhjQWsyKrkPs\
2JHl4LpJicQXoyp6nMs5fYsKeile0G95+WXcEj3m5mcmjNe5b+lyHZYELxGjRmDnY/HtMK0S\
aPE7Md34PueUYz8DWDovSjzXVF/xsFe+Lpz/wjQQ9eiH94ZWqVS62+CUhV3lMtNjSHfXorHf\
wKgZg9FwIrTCRJwjWh5+/ocSLzQ1zG52BvItG+wOpqXRYeWcaRfrdbSgC5bD/PySxBHakPWO\
qZx9y4L10uABB4xk5we8qDsHO6++b0nwjzFXYaUViy6Ece0O1I7SAZkxOUgxtmZB9RcaVyxx\
2CbMBjAdTcruWWyKriwy4myTH9zt3R93/8Xlj0ESWetyy7qFIj1odwkAmhFEA2KD6DlwNe6h\
H52HuWwIaLQHQOUYZwr6yznTLs7rgu4OYBJq4JBWJCayRhTyeYx4X8/xCw+rus9L5yc50A+W\
8v0w0N2ZxAw7VADPZcEDpXpdsLXoDKefrwEM+yj47aEAa7yxzMjXm+61FzUL46ch7cOd6Q/m\
Wncf9BTvXbs6Z3hNxPIvm1kJhJUbTFkKRbaglQCWiwbuiiPtyKlhHwZaq8YKoeMcji9Iy9Ly\
Pwk79U/55Bk75fSXMchwhj79Y35xY7qu8YspvTbqSG+55hdjjn6YS6ErfyqVOL2xoeLrbmWj\
YwkqG5S2p1IOK5djzgs+2LB1B4Z6/gG+uosa6yuWOYljzcCuoG4llqxVQOYep1wu1xUL4pPR\
zD3GL6wlVE4jA35xePk1NlSuBb/34RcwB6JXGgz6rflBBjBbJH7tlWbGDRVdb4bieXgpPbhN\
NQT3iqMHz7ETHvuRxnv45r8FpfQWRnDiqVfV2qBlxEFl6+rqDLV82CTnVYBidBs2JfBpwMJP\
aW3rXYbqm9qXMLnmChjCnvUN5fKMRc2LbzJBk8mU55cn4x/2rLdJQzNjtKkyuuO1pdqccfMz\
gKGp/aHfXooVi+JTofimZuJyn8F7QHmhAMxdAaUeTX6c7F07sUUkgyq5Oz33vV/Z0C7b+scH\
LtnpltH3YeW84ipGt4JWAnu7Pn5xwqjxB4IMabBc3Q8rfLzPCJfTc0SF0b8NaDzSFWqYfhBU\
nm1djITHGhN3eSRt+42Mk5KWcTsxFMe35RJTvorP3rmn49VMOgfP8oiD19lX6IdvbXmkqjvb\
NfydX9m8WimZlMLKZeSL/VzQSkDPzcdYcyte7lq/B4XKfKQaNeK3mL47r29fQL/gaT+/vrEO\
gDTTX0U9UWbKUVMfh9MYuLZjVPzxxu0fPO0/pTedhOd/1XXxGZawfuXp6eGIlz+eme2X9lbo\
0xuUl19F0bLaKGgQhafa5NVPhxjK7X0gLuOMRm+JAFefsnnaKzLRhZXLyBf5ediUwKc1/wD7\
fD+JL72vEtDPEIqgWkZj6zFP/d5duzt+ZHihxfkLnhs7umT0l1AjKkyVScenpJ1WAlAACzAE\
dqV2Sx/S+nLN0dPelXVtD/SkUr+JL5/9VsbL75z+bYNS8Q2EuQN/Oa3x1/FJZS/VZ30EGcBg\
ePdtCYCR0RCKr3q6vL0pOf7XfXvDAaVzcGjQECZX56CyYcmxZ/7CyuWar2IIN2xK4NOC075/\
4yMTRk3XuwyfGJgmxt/xdbpt8uSRi7Fl1luoFJtQm3Ul7cKXfyqMVsfDvwpVq9RPAeh07FRv\
hUL4693pwu1YyN+FX0C+Cy0VrIWXzylh/w3n7fiibreUtTsVURMitjpKWRYmPKkZmHDzFciM\
dMflf6+eWl0/65lMmCDD2YFEl2dFycgj38aRAbQSPGX1sCGUcCaKrDOUyszauvgcZx6zAvTf\
LLGqFlXPjFjyIthCkphR+cN+r76LoLJ1d3d45i+snDv9Yr4veCWg9+SrXtx6G/arezLXB4WX\
tgzv7Wk4n+Z8f/FFzzUKIa3ky5ULmo9CE8N3HgLinI5IsRNy32hsXxoRnTBmBvWmiP9zT7o3\
j0q8vnN35zecGfY1gCm1w2/fviCjoJXytieolL0xvRGhMyNZ1/IJtL6Ww3j5y8j+7i1dyU57\
xLjDJmM+xOFQgtrucgEUTDVIpFcnovWAf2KAEvArG5T3tjBGQT+5rCIU+U1BzxPIPJumpRVP\
4YEuz9wP9xlfvw/0ppuyxDp9uNPyih9l/XNXovNSd5dGG8C8wms31CzfrkCQUTCZSHj+wm8q\
JV7XE3xM6WqjLSr6LVB668ToEXtHjJ/4Cdw24+uzFvsJrsT11RkFoOOALtznFZdf2SDl2QrQ\
8YSV88pDsboVhRLQD6exvrEOj9y4g9DQPkC5Zmjjyz021LdV7yb3zfL8qmsDmOFARTVWFC3i\
N1NQGwX1jEavqOMrZ78D2ZVefmHcdPfCU86nbFBB5rKFlfPMRHE6Fo0S0AtoVm/d8VV8km7D\
C58YrseFuLvspLpbx79z64erdZNyuNLKileJdalUak7j0orr315x+YA9CbQBDF/ck7JkHDdB\
E5sg69OKMH9pdRJd6v3vgEvYbdQcucSlVM9nO/QaPP3KZlve8zWCmJjk3OkX+30RKQE8KiwN\
blxafhe29JqBL8of8GKam6n5P9mdGP5bmUikpmc22tR7BHSKjjP0kmCktCf/KAMlsOJXtejK\
v7q+/OzmZbN/Z5IoHT3+NPgZn2eyx7uiZOJDM9xoyTcZBTOya+vndqW3URPijYxbmDOe1/au\
zq4BrYqgslmphGdLIKxcmLwXskzBGwa94OstveB+sf714IiK3oiO5mXod+r9/I2VxB0P9Ec3\
xp7XQYu8JGTqmcatO+NeY/99v3xbh+21bh03cnotljdfCZnzkeapSDN/vjDg4XP4Cnb8+W9p\
9zzduKz2Q3fevO5lytqtomo30pzk9Ec5sHOY+FXfVl5Or6xr5HkDFMGAadKQ3yAO9DydFdjj\
ppf5kjNq6qrnYi3DfyKI5h14oOKj1aZehBJ9NtWTfBAGvv1uIawS2xVTahfsB5OdfrpseEaP\
mRiFlXOm8Xm4xnP/fBy6aVg2fty5SkWno2mMPfSF3sgCf3o4UGGSj/wI548wVLfbVvab7Z0b\
Xx/MrwGlf9ZrXPQMbMx5CiAfjiHIyXjhsR7BKkMfG8mLT+D3CdJF2qod1vNN3V3d60xW7hyf\
koSVf0pEpkZFeqJWQtld70c6dnp1H7zi0z933hOLHWYJu1REhZ7ptxeVe69XWH+3Jdasm6tO\
iEWsY1G5j8Eaj2NR0adga7IeVOR2LBSCcVC8Z0u5Ue1JbspxVqHEcusjRKkYLW0VSSUinTmW\
LaycfxHpSwIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIk\
QAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIk\
QAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIk\
QAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIk\
QAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIk\
QAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAIkQAJ5Evh/ikTb\
m38w0ncAAAAASUVORK5CYII=";

GshIcon="\
iVBORw0KGgoAAAANSUhEUgAAAKwAAAB/CAYAAABymylZAAAAAXNSR0IArs4c6QAAAHhlWElm\
TU0AKgAAAAgABAEaAAUAAAABAAAAPgEbAAUAAAABAAAARgEoAAMAAAABAAIAAIdpAAQAAAAB\
AAAATgAAAAAAAABIAAAAAQAAAEgAAAABAAOgAQADAAAAAQABAACgAgAEAAAAAQAAAKygAwAE\
AAAAAQAAAH8AAAAACt6tZwAAAAlwSFlzAAALEwAACxMBAJqcGAAADQRJREFUeAHtnQ9wFNUd\
x9/b21z+iYCKCiIK1amW1j/jH6BCkstFEFth1IGpRWdstQoqkEunttrW2nFqO1YTIlatinZ0\
amdAqY6jIyOXi7kgg1arVv74b3BAQPkbdVe7csmcbjb784kd/ve7723+3nf/784kd/ve7723+3nf\
ffv+nxA8SIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAE\
SIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESMCGgLRx84/Tylk/EYasHcANHxRK\
XiEuf65tAHEwaD8ImP2wLTxTadyBmzrT+42pzRSrd3peQvpXsMtrhgNYCn8fewHXFUap+zyjH\
ZUASIAESIAESOKII+LPR9dzsk5ELvxdKdBC8zPZlhpQpkbIXCn+7nvesCn7CjQfIzRJ8kkgQ8\
hsf7VweE6PyDZ+oM6JmAxwzznN6REVCqS4SQXwihLI8XtFcuWqWHx7AMRgIkQAJHIAH/\
Nbqem3098iHoOS8sa5O44oUmz+EZcEAE/FWHXfnjs0FLd/YP80ZNJkRALvAW1qEGg4C/BGsE\
rgK0AMb/d3uCJ1WJsIyVnsIy0KAQ8Fe/YVNmsWmTq6EmvvA1Tq/YhBpt4Ebx/ZoBzbZdsTQ/\
65pV5ccdZ46QncHyziL1ZeDt1K7m5l2nZQCT/s3e05692nZQ\
2D8HBZtDXp+28KXicYGjq9FBVa+Eh5QVCinOVEqOkOz6gpKVFL1Ka7gpKVWbUnWbbUnGrPtwl\
e0Lc2e8+3+ra1pxH4QeJO+sQfMBPBEr7kBBrhqnU8kBn8iDk9jn8k3zUgVxrTFbVrxVvnAoJvmf\
fawMFi9QQt4/uEJ41XyZnXHpCPCUvQEb0GTLXg78RetKRjHQcrw49LmeEnSpZ6Ba3FVa51EqX\
rHrDxjvvnShYmyysWPTq4WVMiHyOrmR8aemlHZiRVkdhpAVH0FJXPwUcNi9eQavOM5hQHAEXE\
FGR5ZaZff85lOgmVOrtlSeXG/oTLB9s+r5h9BbrFlp8FG/LGz9sMUl/YGmAT5S0+KEyAbnZ2\
RD0IWqq88L/HqOSdtLTdsTNWcxxGm4wj2cs1GFbE9wo2PKdIP6wtzBVoZlHz7s5jyWEaFpXnT\
lfhprLH6fTfbbP7VC6PfkuUXFvwHsOZYS4pTzcSLI80sDfC8jWnL8oRoD/wW3PgKgNZ5ttdrJU\
xBWEcD4JKLl42HQkc7oeZo3gvEWBiqoawuAC\
CBgKdJpzDUfdWMGrf0n8BezIJxDYscH\
a+vntqfDT10QH1kcVCej9jsVJebVqEtOSfv1/ERXV9fE\
74raV8+EyC/v6Wf7XamnO5KqNr60YlemJ+GqTOA6dKXNTz8weeCCamh8Mobur8I5Bbl\
RbHvm2bRm7hi95JVlhSPpWyEn9sXhL6JNe71K1+UwQWK2HcmG5M6VJZWUaCfv5\
lfhprLH6fTfbbP7VC6PfkuUXFvwHsOZYSjzcSLI80sDfC8jWnL8oRoD/wW3PgKgNZ5ttdrJU

```
GPqe4dUaP7R/74/WPD77y76+A3c574a/FyENPbyb9YB/cVZPn3oYfrtv3PCjGPJ0FAKqAet3\
7T4wc6jEqpkHy0eaEKuDXFG7FWKKHh72Wx453a+vBKsbWtla7r0hpRYM9SyotQ1dvQtfd2/1\
Tr/7DA8W5jK8WHVTLKfuMts4CszRV4IlA+Y8t/zD1L0now1VcTe7wfDHK3+TazxSTjKLi2K6\
C8zV1gcGfhKsRNeUXnGQ9UBVoK390MFfZTUYZA8prA05RYnejKA0/huOtNw+cc5y9264nCLN\
TyPHOlR+3pL9VWMIdCpG6plLTstasnpJRcQ+BiH0q9kKGnrXmH4dRYnEzujfavZkBtINQKzX\
eQd16tyHZZX6MCWt2lh9JeY9+O/wj2AjrQ+hFTPfKYutZOqipvsrX7Oz6ZobW1yiJ0ePsfN3\
csNYwSFsi3RXtKHi7ky7cCT+GEaorst0dzvHgMI/O9rVwtaHpu1zsy0kf99UCZDBlzllHOqT\
2yDWtdlsVHHx9fDrt1h1fOgMKMF/29W2qY7k7zDUuzlbutncUdLMKykR60OL45Oy2RSiuy8E\
213vcxGbegYZDF3bH6gAT7f3yc0VArNdIoMx/886D1mVSBlTZPt5SDnaCMhXwpHmaf0Mmbfm\
vhDsqJNGjXHr80QJu84lF/WeBp4PPAlZG1gtD1Zu7VBWBRp9q/ubAB6EYVKYL/ulF8EXgsVc\
V9eGEnbQ/DSrWOYsRxRiQB34EOx/ssYPD73WK9owbTpEezP++jfTSoqyoAzc6xR/ofj5QrDY\
BnasW4Zhsv+2rDYr5qZQAvdp5We1t/GQSumZYW6HgmgfPJRo/y4aaU+7Gffyl+LS0KKWcC+3\
AjzxxVwCLD+BYJ07RA6IHTuc8jclEpNNZZ5qZ4PS8xK09H9p55d2S3TmJNgu8zUPTN+OL/PC\
dc2P4UFahmsfn47H6RPl2VnwjzrZ5LufLwSLBs0YF72KosQJJyIzN2fL0OaGkG4U6b8+BxYQ\
TkKVwenYqeupTgZ2ftH6qhg26/jB8aPKnoBo59jZZLh9L+O84E59USUQhki65Vwg6P3njyDW\
85ziR500l+qAbRR6TsO+rzbMQxwv2xr0csSSmQI/fCFY7LPdZ2lJZr5KK+C5dELh6ixYITwL\
Vl/nm4/cmBCW+nXmNWee48EZnelWaOf+EKyUroI1DOGpL3PawpZRGFplnIhtCOXYQ5CLqPQW\
RGj4fb1+LEuY3VncC8bZF4KVlszeZfVNVs6qjsQv++Y0t29BUzqWrjqWZDI1oBJWxzEl8vIx\
KEFL9fdsBxp/2Xs6sgXKM3dfCLatfd8adBN1uOUNhlAfwg6Bw93sevqj1HMULPw/b14a6npg\
pkSWlwr06fYMn+v3MlU6MwfbD3KwyWsTXwj2zUcuO4jSJ+6WUyjBTlLlpSv1okE327S/NJwX\
MqJ+21W6VtW1Ti4TY/bUnDxmS7iu9baqa2OYX5DbUX1z9BRpGEvdrDHJ51k3m3z394VgdSYp\
qZbnklkQbbVhBteHI61/0vu/ZgszaeFLR+tNOBCxY90Xa7q7BBtQ6tbuV/oYiPhu8xhzA4R7\
olMaOu3Q4pYZWHWwCtlaI7Ndi3bXo2P7v2p70cmmEPycew8L4Q6770Ev+htZPnED+mNPy/W2\
9LRATHr5EJ/vQ5gfIlw7StTREMd4gAu5rQ3T6aRSqdmx7Z+/GB47ui290UWv9JX4AnJ7llIS\
16Y+xi8sfm6YcrRQxul4K1ysH6Be9llOYHs79i/4cxbvgnH2jWB1jlXXxecYQuZU0g5WDluq\
Y6xMFg2XRcb6wYrTJp5NO7ZuP3v9irmdNn4F5eSbKoHOtab6aStQOt7/beUgSubPmhrC27B1\
0YQhSlOJvclkYo4fxKoZ+kqw+oajDVEsgVEr9PehP+SrXWnkMNLm6VpQnUiKxIzm+0PveQqf\
h4F8J1j9WwOrt+64Stf50OWEzd2G5tCd/FZS/VXH3nagrQUl+4B2j8m8SsS/FmI9D3McBjwo\
kRn3kXzuqzpsZkZUlcbOCRjmPWhQlaBxM1gsduI3l5d3J1R9ywOVm9Np1kTiE/CQYIdtWZV2\
8/KpqxnKkvc1bdveIDDt0Usc+RxmsDIpnxmIw78tYM6HZGdCt2fgZnJ+8xzuSRBvQ4zrhEw9\
H926s8VJSOHFzRdII7AAPQwzkI7Lsp1urBj0QPxYbyb/8dmn2//ll/qqnago2AwqF/38+WEl\
I4afr5Q5EXMARkAoI2CCP2xvJNV+lMZ78LkH3V27LWVt2n9w4/+6JqdkxJPLqd7b1TADkwlp\
nIhS+QSI+HiEw5RPuVengV20d6Nf7K0t1oF1dj/ikUsatCEBEiABEiABEiABEiABEiABEiAB\
EiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiAB\
EiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiAB\
EiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiAB\
EiABEiABEiABEiABEiABEiABEhD/B9wOq7SGUV++AAAAAElFTkSuQmCC";

ITSmoreQR="\
iVBORw0KGgoAAAANSUhEUgAAAG8AAABvAQMAAADYCwwjAAAABlBMVEX///9BaeFHqDaJAAAB\
HklEQVQ4jdXTsa2EMAwGYCMX7sICkVgjXVaCBe7CArASXdaIlAWgS4HwM5zEVS+mvSgS+ZBQ\
8gcb4BdHyzwv8szMSaUBHNm+KAd4QC8LDpDn8ogT4UpPGci2jI8IGFx3eLwPWaHknVyWecev\
UEbDXaB0X2aNjueYDOzNklQassPCkjc4nW3E1SfwqYk6jU/vAkPhg0AlSFhve8Jt0dkwDMwr\
yMGSSuPyWHAr19k0tkV2sb3sdW2rUCqW88g4Rp1A9s1JPv9cTplNRD4XFkin8XaQCIwT6Lzq\
ZO8dHw/4+U2GzqlS8gbqVmkfr1N6YXK8OqlD0OmlGTMvzPERA8AL9vvbOifpSoL33fsVytrL\
S9wiqDzznhUI38v5n783/gBuUs2eLg1c8gAAAABJRU5ErkJggg==";

</script>

<script id="gsh-script">
//document.getElementById('gsh-faviconurl').href = GshIcon
//document.getElementById('gsh-faviconurl').href = GshLogo
document.getElementById('gsh-faviconurl').href = ITSmoreQR

// id of GShell HTML elemets
var E_BANNER = "gsh-banner" // banner element in HTML
var E_FOOTER = "gsh-footer" // footer element in HTML
var E_GINDEX = "gsh-gindex" // index of Golang code of GShell
var E_GOCODE = "gsh-gocode" // Golang code of GSHell
var E_TODO   = "gsh-todo"   // TODO of GSHell
var E_DICT   = "gsh-dict"   // Dictionaly of GSHell

function bannerElem(){ return document.getElementById(E_BANNER); }
function bannerStyleFunc(){ return bannerElem().style; }
var bannerStyle = bannerStyleFunc()
bannerStyle.backgroundImage = "url("+GshLogo+")";

function footerElem(){ return document.getElementById(E_FOOTER); }
function footerStyle(){ return footerElem().sytle; }
footerElem().style.backgroundImage="url("+ITSmoreQR+")";
//footerStyle().backgroundImage = "url("+ITSmoreQR+")";

function html_fold(e){
    if( e.innerHTML == "Fold" ){
        e.innerHTML = "Unfold"
        document.getElementById('gsh-menu-exit').innerHTML=""
        document.getElementById('gsh-statement').open=false
        document.getElementById('html-src').open=false
        document.getElementById(E_GINDEX).open=false
        document.getElementById(E_GOCODE).open=false
        document.getElementById(E_TODO).open=false
        document.getElementById('references').open=false
    }else{
        e.innerHTML = "Fold"
        document.getElementById('gsh-statement').open=true
        document.getElementById(E_GINDEX).open=true
        document.getElementById(E_GOCODE).open=true
        document.getElementById(E_TODO).open=true
        document.getElementById('references').open=true
    }
}
function html_pure(e){
    if( e.innerHTML == "Pure" ){
        document.getElementById('gsh').style.display=true
        //document.style.display = false
        e.innerHTML = "Unpure"
    }else{
        document.getElementById('gsh').style.display=false
        //document.style.display = true
        e.innerHTML = "Pure"
    }
}

var bannerIsStopping = false
//NOTE: .com/JSREF/prop_style_backgroundposition.asp
function shiftBG(){
    bannerIsStopping = !bannerIsStopping
    bannerStyle.backgroundPosition = "0 0";
}
// status should be inherited on Window Fork(), so use the status in DOM
function html_stop(e,toggle){
    if( toggle ){
        if( e.innerHTML == "Stop" ){
            bannerIsStopping = true
            e.innerHTML = "Start"
        }else{
            bannerIsStopping = false
            e.innerHTML = "Stop"
        }
    }else{
        // update JavaScript variable from DOM status
        if( e.innerHTML == "Stop" ){ // shown if it's running
            bannerIsStopping = false
        }else{
            bannerIsStopping = true
```

```
        }
    }
}
html_stop(document.getElementById('gsh-menu-stop'),false) // onInit.
//html_stop(bannerElem(),false) // onInit.

//https://www.w3schools.com/jsref/met_win_setinterval.asp
function shiftBanner(){
    var now = new Date().getTime();
    //"console.log("now="+(now%10))
    if( !bannerIsStopping ){
        bannerStyle.backgroundPosition = ((now/10)%100000)+" 0";
    }
}
setInterval(shiftBanner,10); // onInit.

//  <a href="https://developer.mozilla.org/ja/docs/Web/API/Window/open">window.open()</a>
// from embedded html to standalone page
var MyChildren = 0
function html_fork(){
    MyChildren += 1
    WinId = document.getElementById('gsh-WinId').innerHTML + "." + MyChildren;
    newwin = window.open("",WinId,"");
    src = document.getElementById("gsh");
    newwin.document.write("/*<"+"html>\n");
    newwin.document.write("<"+"span id=\"gsh\">");
    newwin.document.write(src.innerHTML);
    newwin.document.write("<"+"/span><"+"/html>\n"); // gsh span
    newwin.document.getElementById('gsh-menu-exit').innerHTML = "Close";
    newwin.document.getElementById('gsh-WinId').innerHTML = WinId;
    newwin.document.close();
    newwin.focus();
}
function html_close(){
    window.close()
}
function win_jump(win){
    //win = window.top;
    win = window.openner; // https://developer.mozilla.org/ja/docs/Web/API/window.opener
    if( win == null ){
        console.log("jump to window.opener("+win+")(Error)\n")
    }else{
        console.log("jump to window.opener("+win+")\n")
        win.focus();
    }
}

// 0.2.9 2020-0902 created chekcsum of HTML
CRC32UNIX = 0x04C11DB7 // Unix cksum
function byteCRC32add(bigcrc,octstr,octlen){
    var crc = new Int32Array(1)
    crc[0] = bigcrc

    let oi = 0
    for( ; oi < octlen; oi++ ){
        var oct = new Int8Array(1)
        oct[0] = octstr[oi]
        for( bi = 0; bi < 8; bi++ ){
            //console.log("--CRC32 "+crc[0]+" "+oct[0].toString(16)+" ["+oi+"."+bi+"]\n")
            ovf1 = crc[0] < 0 ? 1 : 0
            ovf2 = oct[0] < 0 ? 1 : 0
            ovf = ovf1 ^ ovf2
            oct[0] <<= 1
            crc[0] <<= 1
            if( ovf ){ crc[0] ^= CRC32UNIX }
        }
    }
    //console.log("--CRC32 byteAdd return crc="+crc[0]+","+oi+"/"+octlen+"\n")
    return crc[0];
}
function strCRC32add(bigcrc,stri,strlen){
    var crc = new Uint32Array(1)
    crc[0] = bigcrc
    var code = new Uint8Array(strlen);
    for( i = 0; i < strlen; i++){
        code[i] = stri.charCodeAt(i) // not charAt() !!!!
        //console.log("=== "+code[i].toString(16)+" <<== "+stri[i]+"\n")
    }
    crc[0] = byteCRC32add(crc,code,strlen)
    //console.log("--CRC32 strAdd return crc="+crc[0]+"\n")
    return crc[0]
}
function byteCRC32end(bigcrc,len){
    var crc = new Uint32Array(1)
    crc[0] = bigcrc
    var slen = new Uint8Array(4)
    let li = 0
        for( ; li < 4; ){
                slen[li] = len
        li += 1
                len >>= 8
                if( len == 0 ){
                        break
        }
        }
        crc[0] = byteCRC32add(crc[0],slen,li)
        crc[0] ^= 0xFFFFFFFF
        return crc[0]
}
function strCRC32(stri,len){
    var crc = new Uint32Array(1)
    crc[0] = 0
    crc[0] = strCRC32add(0,stri,len)
    crc[0] = byteCRC32end(crc[0],len)
    //console.log("--CRC32 "+crc[0]+" "+len+"\n")
    return crc[0]
}
function html_cksum(){
    //alert("cksum="+strCRC32("",0))
    //alert("cksum="+strCRC32("0",1))
    //return

    version = document.getElementById('gsh-version').innerHTML
    sfavico = document.getElementById('gsh-faviconurl').href;
    sbanner = document.getElementById('gsh-banner').style.backgroundImage;
    spositi = document.getElementById('gsh-banner').style.backgroundPosition;
    sfooter = document.getElementById('gsh-footer').style.backgroundImage;
    document.getElementById('gsh-faviconurl').href = "";
    document.getElementById('gsh-banner').style.backgroundImage = "";
    document.getElementById('gsh-banner').style.backgroundPosition = "";
    document.getElementById('gsh-footer').style.backgroundImage = ""

    //html = document.getElementById("gsh").outerHTML;
    html = document.getElementById("gsh").innerHTML;

```

```
        textarea = document.createElement("textarea")
        textarea.innerHTML = html
        // <a href="https://stackoverflow.com/questions/5796718/html-entity-decode">Thanks</a>
        text = textarea.value
        //textarea.destroy()
        text = ""
         + "/*<"+"html>\n"      // lost preamble text
         + "<"+"span id=\"gsh\">"   // lost preamble text
         + text
         + "<"+"/span><"+"/html>\n" // lost trail text
        ;

    tlen = text.length
    console.log("length="+tlen+"\n"+text)
    alert("cksum : " + strCRC32(text,tlen) + " " + tlen + " " + version)

    document.getElementById('gsh-faviconurl').href                = sfavico;
    document.getElementById('gsh-banner').style.backgroundImage    = sbanner;
    document.getElementById('gsh-banner').style.backgroundPosition = spositi;
    document.getElementById('gsh-footer').style.backgroundImage    = sfooter;
}

// source code viewr
function frame_close(){
    srcframe = document.getElementById("src-frame");
    srcframe.innterHTML = "";
    //srcframe.style.cols = 1;
    srcframe.style.rows = 1;
    srcframe.style.height = 0;
    srcframe.style.display = false;
    src = document.getElementById("src-frame-textarea");
    src.innerHML = ""
    //src.cols = 0
    src.rows = 0
    src.display = false
    //alert("--closed--")
}
//<!-- | <span onclick="html_view();">Source</span> -->
//<!-- | <span onclick="frame_close();">SourceClose</span> -->
//<!--| <span>Download</span> -->
function frame_open(){
    document.getElementById('gsh-faviconurl').href = "";
    oldsrc = document.getElementById("GENSRC");
    if( oldsrc != null ){
        //alert("--I--(erasing old text)")
        oldsrc.innterHTML = "";
        return
    }else{
        //alert("--I--(no old text)")
    }
    banner = document.getElementById('gsh-banner').style.backgroundImage;
    footer = document.getElementById('gsh-footer').style.backgroundImage;
    document.getElementById('gsh-banner').style.backgroundImage = "";
    document.getElementById('gsh-banner').style.backgroundPosition = "";
    document.getElementById('gsh-footer').style.backgroundImage = "";

    src = document.getElementById("gsh");
    srcframe = document.getElementById("src-frame");
    srcframe.innerHTML = ""
     + "<"+"cite id=\"GENSRC\">\n"
     + "<"+"style>\n"
     + "#GENSRC textarea{tab-size:4;}\n"
     + "#GENSRC textarea{-o-tab-size:4;}\n"
     + "#GENSRC textarea{-moz-tab-size:4;}\n"
     + "#GENSRC textarea{spellcheck:false;}\n"
     + "</"+"style>\n"
     + "<"+'textarea id="src-frame-textarea" cols=100 rows=20 class="gsh-code">'
     + "/*<"+"html>\n"           // lost preamble text
     + "<"+"span id=\"gsh\">"     // lost preamble text
     + src.innerHTML
     + "<"+"/span><"+"/html>\n"   // lost trail text
     + "</"+"textarea>\n"
     + "</"+"cite><!-- GENSRC -->\n";

    //srcframe.style.cols = 80;
    //srcframe.style.rows = 80;

    document.getElementById('gsh-banner').style.backgroundImage = banner;
    document.getElementById('gsh-footer').style.backgroundImage = footer;
}
function fill_CSSView(){
    part = document.getElementById('gsh-style-def')
    view = document.getElementById('gsh-style-view')
    view.innerHTML = ""
     + "<"+'textarea cols=100 rows=20 class="gsh-code">'
     + part.innerHTML
     + "<"+"/textarea>"
}
function fill_JavaScriptView(){
    jspart = document.getElementById('gsh-script')
    view = document.getElementById('gsh-script-view')
    view.innerHTML = ""
     + "<"+'textarea cols=100 rows=20 class="gsh-code">'
     + jspart.innerHTML
     + "<"+"/textarea>"
}
function fill_DataView(){
    part = document.getElementById('gsh-data')
    view = document.getElementById('gsh-data-view')
    view.innerHTML = ""
     + "<"+'textarea cols=100 rows=20 class="gsh-code">'
     + part.innerHTML
     + "<"+"/textarea>"
}
function jumpto_StyleView(){
    jsview = document.getElementById('html-src')
    jsview.open = true
    jsview = document.getElementById('gsh-style-frame')
    jsview.open = true
    fill_CSSView()
}
function jumpto_JavaScriptView(){
    jsview = document.getElementById('html-src')
    jsview.open = true
    jsview = document.getElementById('gsh-script-frame')
    jsview.open = true
    fill_JavaScriptView()
}
function jumpto_DataView(){
    jsview = document.getElementById('html-src')
    jsview.open = true
    jsview = document.getElementById('gsh-data-frame')
    jsview.open = true
    fill_DataView()
}
```

```
function jumpto_WholeView(){
    jsview = document.getElementById('html-src')
    jsview.open = true
    jsview = document.getElementById('gsh-whole-view')
    jsview.open = true
    frame_open()
}
function html_view(){
    html_stop();

    banner = document.getElementById('gsh-banner').style.backgroundImage;
    footer = document.getElementById('gsh-footer').style.backgroundImage;
    document.getElementById('gsh-banner').style.backgroundImage = "";
    document.getElementById('gsh-banner').style.backgroundPosition = "";
    document.getElementById('gsh-footer').style.backgroundImage = "";

    //srcwin = window.open("","CodeView2","");
    srcwin = window.open("","","");
    srcwin.document.write("<span id=\"gsh\">\n");

    src = document.getElementById("gsh");
    srcwin.document.write("<"+"style>\n");
    srcwin.document.write("textarea{tab-size:4;}\n");
    srcwin.document.write("textarea{-o-tab-size:4;}\n");
    srcwin.document.write("textarea{-moz-tab-size:4;}\n");
    srcwin.document.write("</style>\n");
    srcwin.document.write("<h2>\n");
    srcwin.document.write("<"+"span onclick=\"window.close();\">Close</span> | \n");
    //srcwin.document.write("<"+"span onclick=\"html_stop();\">Run</span>\n");
    srcwin.document.write("</h2>\n");
    srcwin.document.write("<textarea id=\"gsh-src-src\" cols=100 rows=60>");
    srcwin.document.write("/*<"+"html>\n");
    srcwin.document.write("<"+"span id=\"gsh\">");
    srcwin.document.write(src.innerHTML);
    srcwin.document.write("<"+"/span><"+"/html>\n");
    srcwin.document.write("</"+"textarea>\n");

    document.getElementById('gsh-banner').style.backgroundImage = banner;
    document.getElementById('gsh-footer').style.backgroundImage = footer

    sty = document.getElementById("gsh-style-def");
    srcwin.document.write("<"+"style>\n");
    srcwin.document.write(sty.innerHTML);
    srcwin.document.write("<"+"/style>\n");

    run = document.getElementById("gsh-script");
    srcwin.document.write("<"+"script>\n");
    srcwin.document.write(run.innerHTML);
    srcwin.document.write("<"+"/script>\n");

    srcwin.document.write("<"+"/span><"+"/html>\n"); // gsh span
    srcwin.document.close();
    srcwin.focus();
}
</script>

<!-- ###################### WebCrypto ######################### -->
<details id="WebCrypto" open><summary>WebCrypto</summary>
 Reference: <a href="https://mdn.github.io/dom-examples/web-crypto/encrypt-decrypt/index.html">
                    https://mdn.github.io/dom-examples/web-crypto/encrypt-decrypt/index.html</a>
 <style id="web-crypto-demo-style.css">
 #WebCrypto *{ color:#080; font-size:9pt; }
 #rsa-oaep-message{ width:100% !important; height:24pt; color:#000 !important;
                    border-width:2 !important; background-color:#eee !important; }
 #WebCrypto input{ width:50pt; background-color:#4a4; color:#fff; border-width:0; }
 </style>

 <span id="web-crypto-demo.html">
   <section class="encrypt-decrypt rsa-oaep">
     <h3 class="encrypt-decrypt-heading">Web Crypto - RSA-OAEP</h3>
     <section class="encrypt-decrypt-controls">
       <p>
         <b>Plain text:</b><br>
         <input type="textarea" id="rsa-oaep-message" name="message"
         value="Hello, GShell!" style="color:#000;background-color:#fff;font-size:12pt;">
       </p>
       <p>
         <input class="encrypt-button" type="button" value="Encrypt"><br>
         <span class="ciphertext"><b>Cipher text:</b><br>
    <span class="ciphertext-value"></span></span>
       </p>
       <p>
         <input class="decrypt-button" type="button" value="Decrypt"><br>
         <span class="decrypted"><b>Decrypted text:</b><br>
         <span class="decrypted-value"></span></span>
       </p>
       <p>
         <input type="button" value="ShowKey" onclick="ShowKey()"><br>
    <span id="PublicKey">PublicKey...</span>
       </p>
   </section>
  </section>
 </span>

 <script id="web-crypto-rsa-oaep.js">
 var RSAKeyPair = null;
 function ShowKey(){
  document.getElementById("PublicKey").innerHTML = RSAKeyPair.publicKey;
 }
    (() => {
      //Store the calculated ciphertext here, so we can decrypt the message later.
      let ciphertext;

      //Fetch the contents of the "message" textbox, and encode it
      //in a form we can use for the encrypt operation.
      function getMessageEncoding() {
        const messageBox = document.querySelector("#rsa-oaep-message");
        let message = messageBox.value;
        let enc = new TextEncoder();
        return enc.encode(message);
      }

      //Get the encoded message, encrypt it and display a representation
      //of the ciphertext in the "Ciphertext" element.
      async function encryptMessage(key) {
        let encoded = getMessageEncoding();
        ciphertext = await window.crypto.subtle.encrypt(
          {
        name: "RSA-OAEP"
          },
          key,
          encoded
        );

        //let xbuffer = new Uint8Array(ciphertext, 0, 5);
```

```
        let xbuffer = new Uint8Array(ciphertext, 0, ciphertext.byteLength);
 let b = new Uint8Array(ciphertext,0,ciphertext.byteLength);
 //document.write("{"+b.length+"}")
 //let b64 = btoa(b);
 let b64 = btoa(new Uint8Array(ciphertext,0,ciphertext.byteLength));
      const ciphertextValue = document.querySelector(".rsa-oaep .ciphertext-value");
        ciphertextValue.classList.add('fade-in');
        ciphertextValue.addEventListener('animationend', () => {
          ciphertextValue.classList.remove('fade-in');
        });
        ciphertextValue.textContent =
ciphertext.byteLength
+ " bytes "
+ xbuffer
//+ " ... "
//+ b + "(" + b.length + ")"
//+ b64 + "(" + b64.length + ")"
;
      }

      //Fetch the ciphertext and decrypt it.
      //Write the decrypted message into the "Decrypted" box.
      async function decryptMessage(key) {
        let decrypted = await window.crypto.subtle.decrypt(
          {
        name: "RSA-OAEP"
          },
          key,
          ciphertext
        );

        let dec = new TextDecoder();
        const decryptedValue = document.querySelector(".rsa-oaep .decrypted-value");
        decryptedValue.classList.add('fade-in');
        decryptedValue.addEventListener('animationend', () => {
          decryptedValue.classList.remove('fade-in');
        });
        decryptedValue.textContent = dec.decode(decrypted);
      }

      //Generate an encryption key pair, then set up event listeners
      //on the "Encrypt" and "Decrypt" buttons.
      window.crypto.subtle.generateKey(
        {
        name: "RSA-OAEP",
        // Consider using a 4096-bit key for systems that require long-term security
        modulusLength: 2048,
        publicExponent: new Uint8Array([1, 0, 1]),
        hash: "SHA-256",
        },
        true,
        ["encrypt", "decrypt"]
      ).then((keyPair) => {
 RSAKeyPair = keyPair
        const encryptButton = document.querySelector(".rsa-oaep .encrypt-button");
 //document.getElementById('PublicKey').innerHTML = crypto.subtle.exportKey(pkcs8,keyPair.publicKey)
        encryptButton.addEventListener("click", () => {
          encryptMessage(keyPair.publicKey);
        });

        const decryptButton = document.querySelector(".rsa-oaep .decrypt-button");
        decryptButton.addEventListener("click", () => {
          decryptMessage(keyPair.privateKey);
        });
      });

    })();
  </script>
</details>

*///<br></span></html>
```