```
/*<html>
<span id="gsh">
<meta charset="UTF-8">
<meta name="viewport" content="width=device-width, initial-scale=1.0">
<link rel="icon" id="GshFaviconURL" href=""><!-- place holder -->
<span id="GshVersion" style="display:none;">gsh--0.3.5--2020-09-08--SatoxITS</span>
<title>GShell-0.3.5 by SatoxITS</title>
<header id="GshBanner" height="100px" onclick="shiftBG();" style="">
<div align="right"><note><a href="http://gshell.org">GShell</a> version 0.3.5 // 2020-09-08 // 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="GshMenu">
| <span id="gsh-menu-exit" onclick="html_close();"></span>
| <span id="gsh-menu-fork" onclick="html_fork();">Fork</span>
| <span id="GshMenuStop" onclick="html_stop(this,true);">Stop</span>
| <span id="GshMenuFold" onclick="html_fold(this);">Unfold</span>
| <span id="gsh-menu-cksum" onclick="html_digest();">Digest</span>
<!-- | <span id="gsh-menu-pure" onclick="html_pure(this);">Pure</span> -->
|</span>
*/
/*
<details id="GshStatement" 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="GshFeatures" 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>
)

// // 2020-0906 added,
// // <a href="https://golang.org/cmd/cgo/">CGo</a>
// #include <poll.h> // </poll.h> to be closed as HTML tag :-p
// typedef struct { struct pollfd fdv[8]; } pollFdv;
// int pollx(pollFdv *fdv, int nfds, int timeout){
//  return poll(fdv->fdv,nfds,timeout);
// }
import "C"

// // 2020-0906 added,
func CFpollIn1(fp*os.File, timeoutUs int)(ready uintptr){
    var fdv = C.pollFdv{}
    var nfds = 1
    var timeout = timeoutUs/1000

    fdv.fdv[0].fd = C.int(fp.Fd())
    fdv.fdv[0].events = C.POLLIN
    if( 0 < EventRecvFd ){
        fdv.fdv[1].fd = C.int(EventRecvFd)
        fdv.fdv[1].events = C.POLLIN
        nfds += 1
    }
    r := C.pollx(&fdv,C.int(nfds),C.int(timeout))
    if( r <= 0 ){
        return 0
    }
    if (int(fdv.fdv[1].revents) & int(C.POLLIN)) != 0 {
        //fprintf(stderr,"--De-- got Event\n");
        return uintptr(EventFdOffset + fdv.fdv[1].fd)
    }
    if (int(fdv.fdv[0].revents) & int(C.POLLIN)) != 0 {
        return uintptr(NormalFdOffset + fdv.fdv[0].fd)
    }
    return 0
}

const (
    NAME = "gsh"
    VERSION = "0.3.5"
    DATE = "2020-09-08"
    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){
    strRep := isin("-str",argv) // "..."+
    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)
        if strRep { os.Stdout.Write([]byte("\"")) }
        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 {
                if strRep {
                    os.Stdout.Write([]byte("\"+\n\""))
                }else{
                    //os.Stdout.Write([]byte("\r\n"))
                    os.Stdout.Write([]byte("\\"))
                    os.Stdout.Write([]byte("\n"))
                }
            }
            line = line[olen:]
            off += olen
            remlen -= olen
        }
        if strRep { os.Stdout.Write([]byte("\"\n")) }
    }
    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
}
```

```
875 func showFusage(dir string,fusage *fileSum){
876     bsume := float64(((fusage.Blocks-fusage.DupBlocks)/2)*1024)/1000000.0
877     //bsumdup := float64((fusage.Blocks/2)*1024)/1000000.0
878 
879     fmt.Printf("%v: %v files (%vd %vs %vh) %.6f MB (%.2f MBK)\n",
880         dir,
881         fusage.Files,
882         fusage.Dirs,
883         fusage.SymLink,
884         fusage.HLinks,
885         float64(fusage.Size)/1000000.0,bsume);
886 }
887 const (
888     S_IFMT    = 0170000
889     S_IFCHR   = 0020000
890     S_IFDIR   = 0040000
891     S_IFREG   = 0100000
892     S_IFLNK   = 0120000
893     S_IFSOCK  = 0140000
894 )
895 func cumFinfo(fsum *fileSum, path string, staterr error, fstat syscall.Stat_t, argv[]string,verb bool)(*fileSum){
896     now := time.Now()
897     if time.Second <= now.Sub(fsum.nextRepo) {
898         if !fsum.nextRepo.IsZero(){
899             tstmp := now.Format(time.Stamp)
900             showFusage(tstmp,fsum)
901         }
902         fsum.nextRepo = now.Add(time.Second)
903     }
904     if staterr != nil {
905         fsum.Err += 1
906         return fsum
907     }
908     fsum.Files += 1
909     if 1 < fstat.Nlink {
910         // must count only once...
911         // at least ignore ones in the same directory
912         //if finfo.Mode().IsRegular() {
913         if (fstat.Mode & S_IFMT) == S_IFREG {
914             fsum.HLinks += 1
915             fsum.DupBlocks += int64(fstat.Blocks)
916             //fmt.Printf("---Dup HardLink %v %s\n",fstat.Nlink,path)
917         }
918     }
919     //fsum.Size += finfo.Size()
920     fsum.Size += fstat.Size
921     fsum.Blocks += int64(fstat.Blocks)
922     //if verb { fmt.Printf("(%8dBlk) %s",fstat.Blocks/2,path) }
923     if isin("-ls",argv){
924         //if verb { fmt.Printf("%4d %8d ",fstat.Blksize,fstat.Blocks) }
925 //      fmt.Printf("%d\t",fstat.Blocks/2)
926     }
927     //if finfo.IsDir()
928     if (fstat.Mode & S_IFMT) == S_IFDIR {
929         fsum.Dirs += 1
930     }
931     //if (finfo.Mode() & os.ModeSymlink) != 0
932     if (fstat.Mode & S_IFMT) == S_IFLNK {
933         //if verb { fmt.Printf("symlink(%v,%s)\n",fstat.Mode,finfo.Name()) }
934         //{ fmt.Printf("symlink(%o,%s)\n",fstat.Mode,finfo.Name()) }
935         fsum.SymLink += 1
936     }
937     return fsum
938 }
939 func (gsh*GshContext)xxFindEntv(depth int,total *fileSum,dir string, dstat syscall.Stat_t, ei int, entv []string,npatv[]string,argv[]string)(*fileSum){
940     nols := isin("-grep",argv)
941     // sort entv
942     /*
943     if isin("-t",argv){
944         sort.Slice(filev, func(i,j int) bool {
945             return 0 < filev[i].ModTime().Sub(filev[j].ModTime())
946         })
947     }
948     */
949         /*
950         if isin("-u",argv){
951             sort.Slice(filev, func(i,j int) bool {
952                 return 0 < filev[i].AccTime().Sub(filev[j].AccTime())
953             })
954         }
955         if isin("-U",argv){
956             sort.Slice(filev, func(i,j int) bool {
957                 return 0 < filev[i].CreatTime().Sub(filev[j].CreatTime())
958             })
959         }
960         */
961     /*
962     if isin("-S",argv){
963         sort.Slice(filev, func(i,j int) bool {
964             return filev[j].Size() < filev[i].Size()
965         })
966     }
967     */
968     for _,filename := range entv {
969         for _,npat := range npatv {
970             match := true
971             if npat == "*" {
972                 match = true
973             }else{
974                 match, _ = filepath.Match(npat,filename)
975             }
976             path := dir + DIRSEP + filename
977             if !match {
978                 continue
979             }
980             var fstat syscall.Stat_t
981             staterr := syscall.Lstat(path,&fstat)
982             if staterr != nil {
983                 if !isin("-w",argv){fmt.Printf("ufind: %v\n",staterr) }
984                 continue;
985             }
986             if isin("-du",argv) && (fstat.Mode & S_IFMT) == S_IFDIR {
987                 // should not show size of directory in "-du" mode ...
988             }else
989             if !nols && !isin("-s",argv) && (!isin("-du",argv) || isin("-a",argv)) {
990                 if isin("-du",argv) {
991                     fmt.Printf("%d\t",fstat.Blocks/2)
992                 }
993                 showFileInfo(path,argv)
994             }
995             if true { // && isin("-du",argv)
996                 total = cumFinfo(total,path,staterr,fstat,argv,false)
997             }
998             /*
999             if isin("-wc",argv) {
```

```
            }
            */
            if gsh.lastCheckSum.SumType != 0 {
                gsh.xCksum(path,argv,&gsh.lastCheckSum);
            }
            x := isinX("-grep",argv); // -grep will be convenient like -ls
            if 0 <= x && x+1 <= len(argv) { // -grep will be convenient like -ls
                if IsRegFile(path){
                    found := gsh.xGrep(path,argv[x+1:])
                    if 0 < found {
                        foundv := gsh.CmdCurrent.FoundFile
                        if len(foundv) < 10 {
                            gsh.CmdCurrent.FoundFile =
                            append(gsh.CmdCurrent.FoundFile,path)
                        }
                    }
                }
            }
            if !isin("-r0",argv) { // -d 0 in du, -depth n in find
                //total.Depth += 1
                if (fstat.Mode & S_IFMT) == S_IFLNK {
                    continue
                }
                if dstat.Rdev != fstat.Rdev {
                    fmt.Printf("--I-- don't follow differnet device %v(%v) %v(%v)\n",
                        dir,dstat.Rdev,path,fstat.Rdev)
                }
                if (fstat.Mode & S_IFMT) == S_IFDIR {
                    total = gsh.xxFind(depth+1,total,path,npatv,argv)
                }
            }
        }
    }
    return total
}
func (gsh*GshContext)xxFind(depth int,total *fileSum,dir string,npatv[]string,argv[]string)(*fileSum){
    nols := isin("-grep",argv)
    dirfile,oerr := os.OpenFile(dir,os.O_RDONLY,0)
    if oerr == nil {
        //fmt.Printf("--I-- %v(%v)[%d]\n",dir,dirfile,dirfile.Fd())
        defer dirfile.Close()
    }else{
    }

    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
                }
            }
            arg1[ax] = ch
            ax += 1
            continue
        }
        if str[si] == ' ' {
            argv = append(argv,string(arg1[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
        }
        arg1[ax] = ch
        ax += 1
    }
    if sb < si {
        argv = append(argv,string(arg1[0:ax]))
        if debug {
            fmt.Printf("--Da- [%v][%v-%v] %s ... %s\n",
                -1+len(argv),sb,si,string(arg1[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
```

```
1500
1501     gshPA.Files[fdix] = savfd
1502     return pin,pout,false
1503 }
1504
1505 // <a name="ex-commands">External commands</a>
1506 func (gsh*GshContext)excommand(exec bool, argv []string) (notf bool,exit bool) {
1507     if gsh.CmdTrace { fmt.Printf("--I-- excommand[%v](%v)\n",exec,argv) }
1508
1509     gshPA := gsh.gshPA
1510     fullpathv, itis := which("PATH",[]string{"which",argv[0],"-s"})
1511     if itis == false {
1512         return true,false
1513     }
1514     fullpath := fullpathv[0]
1515     argv = unescapeWhiteSPV(argv)
1516     if 0 < strings.Index(fullpath,".go") {
1517         nargv := argv // []string{}
1518         gofullpathv, itis := which("PATH",[]string{"which","go","-s"})
1519         if itis == false {
1520             fmt.Printf("--F-- Go not found\n")
1521             return false,true
1522         }
1523         gofullpath := gofullpathv[0]
1524         nargv = []string{ gofullpath, "run", fullpath }
1525         fmt.Printf("--I-- %s {%s %s %s}\n",gofullpath,
1526             nargv[0],nargv[1],nargv[2])
1527         if exec {
1528             syscall.Exec(gofullpath,nargv,os.Environ())
1529         }else{
1530             pid, _ := syscall.ForkExec(gofullpath,nargv,&gshPA)
1531             if gsh.BackGround {
1532                 fmt.Fprintf(stderr,"--Ip- in Background pid[%d]%d(%v)\n",pid,len(argv),nargv)
1533                 gsh.BackGroundJobs = append(gsh.BackGroundJobs,pid)
1534             }else{
1535                 rusage := syscall.Rusage {}
1536                 syscall.Wait4(pid,nil,0,&rusage)
1537                 gsh.LastRusage = rusage
1538                 gsh.CmdCurrent.Rusagev[1] = rusage
1539             }
1540         }
1541     }else{
1542         if exec {
1543             syscall.Exec(fullpath,argv,os.Environ())
1544         }else{
1545             pid, _ := syscall.ForkExec(fullpath,argv,&gshPA)
1546             //fmt.Printf("[%d]\n",pid); // '&' to be background
1547             if gsh.BackGround {
1548                 fmt.Fprintf(stderr,"--Ip- in Background pid[%d]%d(%v)\n",pid,len(argv),argv)
1549                 gsh.BackGroundJobs = append(gsh.BackGroundJobs,pid)
1550             }else{
1551                 rusage := syscall.Rusage {}
1552                 syscall.Wait4(pid,nil,0,&rusage);
1553                 gsh.LastRusage = rusage
1554                 gsh.CmdCurrent.Rusagev[1] = rusage
1555             }
1556         }
1557     }
1558     return false,false
1559 }
1560
1561 // <a name="builtin">Builtin Commands</a>
1562 func (gshCtx *GshContext) sleep(argv []string) {
1563     if len(argv) < 2 {
1564         fmt.Printf("Sleep 100ms, 100us, 100ns, ...\n")
1565         return
1566     }
1567     duration := argv[1];
1568     d, err := time.ParseDuration(duration)
1569     if err != nil {
1570         d, err = time.ParseDuration(duration+"s")
1571         if err != nil {
1572             fmt.Printf("duration ? %s (%s)\n",duration,err)
1573             return
1574         }
1575     }
1576     //fmt.Printf("Sleep %v\n",duration)
1577     time.Sleep(d)
1578     if 0 < len(argv[2:]) {
1579         gshCtx.gshellv(argv[2:])
1580     }
1581 }
1582 func (gshCtx *GshContext)repeat(argv []string) {
1583     if len(argv) < 2 {
1584         return
1585     }
1586     start0 := time.Now()
1587     for ri,_ := strconv.Atoi(argv[1]); 0 < ri; ri-- {
1588         if 0 < len(argv[2:]) {
1589             //start := time.Now()
1590             gshCtx.gshellv(argv[2:])
1591             end := time.Now()
1592             elps := end.Sub(start0);
1593             if( 1000000000 < elps ){
1594                 fmt.Printf("(repeat#%d %v)\n",ri,elps);
1595             }
1596         }
1597     }
1598 }
1599
1600 func (gshCtx *GshContext)gen(argv []string) {
1601     gshPA := gshCtx.gshPA
1602     if len(argv) < 2 {
1603         fmt.Printf("Usage: %s N\n",argv[0])
1604         return
1605     }
1606     // should br repeated by "repeat" command
1607     count, _ := strconv.Atoi(argv[1])
1608     fd := gshPA.Files[1] // Stdout
1609     file := os.NewFile(fd,"internalStdOut")
1610     fmt.Printf("--I-- Gen. Count=%d to [%d]\n",count,file.Fd())
1611     //buf := []byte{}
1612     outdata := "0123 5678 0123 5678 0123 5678 0123 5678\r"
1613     for gi := 0; gi < count; gi++ {
1614         file.WriteString(outdata)
1615     }
1616     //file.WriteString("\n")
1617     fmt.Printf("\n(%d B)\n",count*len(outdata));
1618     //file.Close()
1619 }
1620
1621 // <a name="rexec">Remote Execution</a> // 2020-0820
1622 func Elapsed(from time.Time)(string){
1623     elps := time.Now().Sub(from)
1624     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)
    }
    if 1 <= MBs {
        return fmt.Sprintf("%6.3fMB/s",MBs)
    }else{
        return fmt.Sprintf("%6.3fKB/s",MBs*1000)
    }
}
func abspeed(totalB int64,ns time.Duration)(string){
    MBs := (float64(totalB)/1000000) / (float64(ns)/1000000000)
    if 1000 <= MBs {
        return fmt.Sprintf("%6.3fGBps",MBs/1000)
    }
    if 1 <= MBs {
        return fmt.Sprintf("%6.3fMBps",MBs)
    }else{
        return fmt.Sprintf("%6.3fKBps",MBs*1000)
    }
}
func fileRelay(what string,in*os.File,out*os.File,size int64,bsiz int)(wcount int64){
    Start := time.Now()
    buff := make([]byte,bsiz)
    var total int64 = 0
    var rem int64 = size
    nio := 0
    Prev := time.Now()
    var PrevSize int64 = 0

    fmt.Printf(Elapsed(Start)+"--In- X: %s (%v/%v/%v) START\n",
        what,absize(total),size,nio)

    for i:= 0; ; i++ {
        var len = bsiz
        if int(rem) < len {
            len = int(rem)
        }
        Now := time.Now()
        Elps := Now.Sub(Prev);
        if 1000000000 < Now.Sub(Prev) {
            fmt.Printf(Elapsed(Start)+"--In- X: %s (%v/%v/%v) %s\n",
                what,absize(total),size,nio,
                abspeed((total-PrevSize),Elps))
            Prev = Now;
            PrevSize = total
        }
        rlen := len
        if in != nil {
            // should watch the disconnection of out
            rcc,err := in.Read(buff[0:rlen])
            if err != nil {
                fmt.Printf(Elapsed(Start)+"--En- X: %s read(%v,%v)<%v\n",
                    what,rcc,err,in.Name())
                break
            }
            rlen = rcc
            if string(buff[0:10]) == "((SoftEOF " {
                var ecc int64 = 0
                fmt.Sscanf(string(buff),"((SoftEOF %v",&ecc)
                fmt.Printf(Elapsed(Start)+"--En- X: %s Recv ((SoftEOF %v))/%v\n",
                    what,ecc,total)
                if ecc == total {
                    break
                }
            }
        }

        wlen := rlen
        if out != nil {
            wcc,err := out.Write(buff[0:rlen])
            if err != nil {
                fmt.Printf(Elapsed(Start)+"-En-- X: %s write(%v,%v)>%v\n",
                    what,wcc,err,out.Name())
                break
            }
            wlen = wcc
        }
        if wlen < rlen {
            fmt.Printf(Elapsed(Start)+"--En- X: %s incomplete write (%v/%v)\n",
                what,wlen,rlen)
            break;
        }

```

```
        nio += 1
        total += int64(rlen)
        rem -= int64(rlen)
        if rem <= 0 {
            break
        }
    }
    Done := time.Now()
    Elps := float64(Done.Sub(Start))/1000000000 //Seconds
    TotalMB := float64(total)/1000000 //MB
    MBps := TotalMB / Elps
    fmt.Printf(Elapsed(Start)+"--In- X: %s (%v/%v/%v) %v %.3fMB/s\n",
        what,total,size,nio,absize(total),MBps)
    return total
}
func tcpPush(clnt *os.File){
    // shrink socket buffer and recover
    usleep(100);
}
func (gsh*GshContext)RexecServer(argv[]string){
    debug := true
    Start0 := time.Now()
    Start := Start0
//  if local == ":" { local = "0.0.0.0:9999" }
    local := "0.0.0.0:9999"

    if 0 < len(argv) {
        if argv[0] == "-s" {
            debug = false
            argv = argv[1:]
        }
    }
    if 0 < len(argv) {
        argv = argv[1:]
    }
    port, err := net.ResolveTCPAddr("tcp",local);
    if err != nil {
        fmt.Printf("--En- S: Address error: %s (%s)\n",local,err)
        return
    }
    fmt.Printf(Elapsed(Start)+"--In- S: Listening at %s...\n",local);
    sconn, err := net.ListenTCP("tcp", port)
    if err != nil {
        fmt.Printf(Elapsed(Start)+"--En- S: Listen error: %s (%s)\n",local,err)
        return
    }

    reqbuf := make([]byte,LINESIZE)
    res := ""
    for {
        fmt.Printf(Elapsed(Start0)+"--In- S: Listening at %s...\n",local);
        aconn, err := sconn.AcceptTCP()
        Start = time.Now()
        if err != nil {
            fmt.Printf(Elapsed(Start)+"--En- S: Accept error: %s (%s)\n",local,err)
            return
        }
        clnt, _ := aconn.File()
        fd := clnt.Fd()
        ar := aconn.RemoteAddr()
        if debug { fmt.Printf(Elapsed(Start0)+"--In- S: Accepted TCP at %s [%d] <- %v\n",
            local,fd,ar) }
        res = fmt.Sprintf("220 GShell/%s Server\r\n",VERSION)
        fmt.Fprintf(clnt,"%s",res)
        if debug { fmt.Printf(Elapsed(Start)+"--In- S: %s",res) }
        count, err := clnt.Read(reqbuf)
        if err != nil {
            fmt.Printf(Elapsed(Start)+"--En- C: (%v %v) %v",
                count,err,string(reqbuf))
        }
        req := string(reqbuf[:count])
        if debug { fmt.Printf(Elapsed(Start)+"--In- C: %v",string(req)) }
        reqv := strings.Split(string(req),"\r")
        cmdv := gshScanArg(reqv[0],0)
        //cmdv := strings.Split(reqv[0]," ")
        switch cmdv[0] {
            case "HELO":
                res = fmt.Sprintf("250 %v",req)
            case "GET":
                // download {remotefile|-zN} [localfile]
                var dsize int64 = 32*1024*1024
                var bsize int = 64*1024
                var fname string = ""
                var in *os.File = nil
                var pseudoEOF = false
                if 1 < len(cmdv) {
                    fname = cmdv[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
                            dsize = MaxStreamSize
                            pseudoEOF = true
                        }
                    }else{
                        xin,err := os.Open(fname)
                        if err != nil {
                            fmt.Printf("--En- GET (%v)\n",err)
                        }else{
                            defer xin.Close()
                            in = xin
                            fi,_ := xin.Stat()
                            dsize = fi.Size()
                        }
                    }
                }
                //fmt.Printf(Elapsed(Start)+"--In- GET %v:%v\n",dsize,bsize)
                res = fmt.Sprintf("200 %v\r\n",dsize)
                fmt.Fprintf(clnt,"%v",res)
                tcpPush(clnt); // should be separated as line in receiver
                fmt.Printf(Elapsed(Start)+"--In- S: %v",res)
                wcount := fileRelay("SendGET",in,clnt,dsize,bsize)
                if pseudoEOF {
                    in.Close() // pipe from the command
                    // show end of stream data (its size) by OOB?
                    SoftEOF := fmt.Sprintf("((SoftEOF %v))",wcount)
                    fmt.Printf(Elapsed(Start)+"--In- S: Send %v\n",SoftEOF)

                    tcpPush(clnt); // to let SoftEOF data apper at the top of recevied data
```

```
                    fmt.Fprintf(clnt,"%v\r\n",SoftEOF)
                    tcpPush(clnt); // to let SoftEOF alone in a packet (separate with 200 OK)
                        // with client generated random?
                    //fmt.Printf("--In- L: close %v (%v)\n",in.Fd(),in.Name())
                }
                res = fmt.Sprintf("200 GET done\r\n")
            case "PUT":
                // upload {srcfile|-zN} [dstfile]
                var dsize int64 = 32*1024*1024
                var bsize int = 64*1024
                var fname string = ""
                var out *os.File = nil
                if 1 < len(cmdv) { // localfile
                    fmt.Sscanf(cmdv[1],"%d",&dsize)
                }
                if 2 < len(cmdv) {
                    fname = cmdv[2]
                    if fname == "-" {
                        // nul dev
                    }else
                    if strBegins(fname,"{") {
                        xin,xout,err := gsh.Popen(fname,"w")
                        if err {
                        }else{
                            xin.Close()
                            defer xout.Close()
                            out = xout
                        }
                    }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)
            //fmt.Printf("--In- S: open(%v) out(%v) err(%v)\n",fname,xout,err)
                        if err != nil {
                            fmt.Printf("--En- PUT (%v)\n",err)
                        }else{
                            out = xout
                        }
                    }
                fmt.Printf(Elapsed(Start)+"--In- L: open(%v,w) %v (%v)\n",
                    fname,local,err)
                }
                fmt.Printf(Elapsed(Start)+"--In- PUT %v (/%v)\n",dsize,bsize)
                fmt.Printf(Elapsed(Start)+"--In- S: 200 %v OK\r\n",dsize)
                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
    }
```

```
2250
2251    /*
2252    nargv := gshScanArg(strings.Join(argv," "),0)
2253    fmt.Printf("--D-- nargc=%d [%v]\n",len(nargv),nargv)
2254    if nargv[1][0] != '{' {
2255        nargv[1] = "{" + nargv[1] + "}"
2256        fmt.Printf("--D-- nargc=%d [%v]\n",len(nargv),nargv)
2257    }
2258    argv = nargv
2259    */
2260    nargv := []string{}
2261    nargv = append(nargv,"{"+strings.Join(argv[1:]," ")+"}")
2262    fmt.Printf("--D-- nargc=%d %v\n",len(nargv),nargv)
2263    argv = nargv
2264
2265    xargv := []string{"rex-exec","@"+gsh.RSERV,"GET"}
2266    xargv = append(xargv,argv...)
2267    xargv = append(xargv,"/dev/tty")
2268    rcode,stat := gsh.RexecClient(xargv)
2269    if (rcode / 100) == 2 {
2270        fmt.Printf("--I-- OK Rexec (%v) %v\n",rcode,stat)
2271    }else{
2272        fmt.Printf("--I-- NG Rexec (%v) %v\n",rcode,stat)
2273    }
2274 }
2275 func (gsh*GshContext)Rchdir(argv[]string){
2276    if len(argv) <= 1 {
2277        return
2278    }
2279    cwd, _ := os.Getwd()
2280    os.Chdir(gsh.RWD)
2281    os.Chdir(argv[1])
2282    twd, _ := os.Getwd()
2283    gsh.RWD = twd
2284    fmt.Printf("--I-- JWD=%v\n",twd)
2285    os.Chdir(cwd)
2286 }
2287 func (gsh*GshContext)Rpwd(argv[]string){
2288    fmt.Printf("%v\n",gsh.RWD)
2289 }
2290 func (gsh*GshContext)Rls(argv[]string){
2291    cwd, _ := os.Getwd()
2292    os.Chdir(gsh.RWD)
2293    argv[0] = "-ls"
2294    gsh.xFind(argv)
2295    os.Chdir(cwd)
2296 }
2297 func (gsh*GshContext)Rput(argv[]string){
2298    var local string = ""
2299    var remote string = ""
2300    if 1 < len(argv) {
2301        local = argv[1]
2302        remote = local // base name
2303    }
2304    if 2 < len(argv) {
2305        remote = argv[2]
2306    }
2307    fmt.Printf("--I-- jput from=%v to=%v\n",local,gsh.Trelpath(remote))
2308 }
2309 func (gsh*GshContext)Rget(argv[]string){
2310    var remote string = ""
2311    var local string = ""
2312    if 1 < len(argv) {
2313        remote = argv[1]
2314        local = remote // base name
2315    }
2316    if 2 < len(argv) {
2317        local = argv[2]
2318    }
2319    fmt.Printf("--I-- jget from=%v to=%v\n",gsh.Trelpath(remote),local)
2320 }
2321
2322 // <a name="network">network</a>
2323 // -s, -si, -so // bi-directional, source, sync (maybe socket)
2324 func (gshCtx*GshContext)sconnect(inTCP bool, argv []string) {
2325    gshPA := gshCtx.gshPA
2326    if len(argv) < 2 {
2327        fmt.Printf("Usage: -s [host]:[port[.udp]]\n")
2328        return
2329    }
2330    remote := argv[1]
2331    if remote == ":" { remote = "0.0.0.0:9999" }
2332
2333    if inTCP { // TCP
2334        dport, err := net.ResolveTCPAddr("tcp",remote);
2335        if err != nil {
2336            fmt.Printf("Address error: %s (%s)\n",remote,err)
2337            return
2338        }
2339        conn, err := net.DialTCP("tcp",nil,dport)
2340        if err != nil {
2341            fmt.Printf("Connection error: %s (%s)\n",remote,err)
2342            return
2343        }
2344        file, _ := conn.File();
2345        fd := file.Fd()
2346        fmt.Printf("Socket: connected to %s, socket[%d]\n",remote,fd)
2347
2348        savfd := gshPA.Files[1]
2349        gshPA.Files[1] = fd;
2350        gshCtx.gshellv(argv[2:])
2351        gshPA.Files[1] = savfd
2352        file.Close()
2353        conn.Close()
2354    }else{
2355        //dport, err := net.ResolveUDPAddr("udp4",remote);
2356        dport, err := net.ResolveUDPAddr("udp",remote);
2357        if err != nil {
2358            fmt.Printf("Address error: %s (%s)\n",remote,err)
2359            return
2360        }
2361        //conn, err := net.DialUDP("udp4",nil,dport)
2362        conn, err := net.DialUDP("udp",nil,dport)
2363        if err != nil {
2364            fmt.Printf("Connection error: %s (%s)\n",remote,err)
2365            return
2366        }
2367        file, _ := conn.File();
2368        fd := file.Fd()
2369
2370        ar := conn.RemoteAddr()
2371        //al := conn.LocalAddr()
2372        fmt.Printf("Socket: connected to %s [%s], socket[%d]\n",
2373            remote,ar.String(),fd)
2374
```

```
        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 == "><":
        gshCtx.redirect(argv)
    case cmd == "|":
        gshCtx.fromPipe(argv)
    case cmd == "args":
        gshCtx.Args(argv)
    case cmd == "bg" || cmd == "-bg":
        rfin := gshCtx.inBackground(argv[1:])
        return rfin
    case cmd == "-bn":
        gshCtx.Basename(argv)
    case cmd == "call":
        _,_ = gshCtx.excommand(false,argv[1:])
    case cmd == "cd" || cmd == "chdir":
        gshCtx.xChdir(argv);
    case cmd == "-cksum":
        gshCtx.xFind(argv)
    case cmd == "-sum":
        gshCtx.xFind(argv)
    case cmd == "-sumtest":
        str := ""
        if 1 < len(argv) { str = argv[1] }
        crc := strCRC32(str,uint64(len(str)))
        fprintf(stderr,"%v %v\n",crc,len(str))
    case cmd == "close":
        gshCtx.xClose(argv)
    case cmd == "gcp":
        gshCtx.FileCopy(argv)
    case cmd == "dec" || cmd == "decode":
        gshCtx.Dec(argv)
    case cmd == "#define":
    case cmd == "dic" || cmd == "d":
        xDic(argv)
    case cmd == "dump":
        gshCtx.Dump(argv)
    case cmd == "echo" || cmd == "e":
        echo(argv,true)
    case cmd == "enc" || cmd == "encode":
        gshCtx.Enc(argv)
    case cmd == "env":
        env(argv)
    case cmd == "eval":
        xEval(argv[1:],true)
    case cmd == "ev" || cmd == "events":
        dumpEvents(argv)
    case cmd == "exec":
        _,_ = gshCtx.excommand(true,argv[1:])
        // should not return here
    case cmd == "exit" || cmd == "quit":
        // write Result code EXIT to 3>
        return true
    case cmd == "fdls":
        // dump the attributes of fds (of other process)
    case cmd == "-find" || cmd == "fin" || cmd == "ufind" || cmd == "uf":
        gshCtx.xFind(argv[1:])
    case cmd == "fu":
        gshCtx.xFind(argv[1:])
    case cmd == "fork":
        // mainly for a server
    case cmd == "-gen":
        gshCtx.gen(argv)
    case cmd == "-go":
        gshCtx.xGo(argv)
    case cmd == "-grep":
        gshCtx.xFind(argv)
    case cmd == "gdeq":
        gshCtx.Deq(argv)
    case cmd == "genq":
        gshCtx.Enq(argv)
    case cmd == "gpop":
        gshCtx.Pop(argv)
    case cmd == "gpush":
        gshCtx.Push(argv)
    case cmd == "history" || cmd == "hi": // hi should be alias
        gshCtx.xHistory(argv)
    case cmd == "jobs":
        gshCtx.xJobs(argv)
    case cmd == "lnsp" || cmd == "nlsp":
        gshCtx.SplitLine(argv)
    case cmd == "-ls":
        gshCtx.xFind(argv)
```

```
    case cmd == "nop":
        // do nothing
    case cmd == "pipe":
        gshCtx.xOpen(argv)
    case cmd == "plug" || cmd == "plugin" || cmd == "pin":
        gshCtx.xPlugin(argv[1:])
    case cmd == "print" || cmd == "-pr":
        // output internal slice // also sprintf should be
        gshCtx.Printv(argv)
    case cmd == "ps":
        gshCtx.xPs(argv)
    case cmd == "pstitle":
        // to be gsh.title
    case cmd == "rexecd" || cmd == "rexd":
        gshCtx.RexecServer(argv)
    case cmd == "rexec" || cmd == "rex":
        gshCtx.RexecClient(argv)
    case cmd == "repeat" || cmd == "rep": // repeat cond command
        gshCtx.repeat(argv)
    case cmd == "replay":
        gshCtx.xReplay(argv)
    case cmd == "scan":
        // scan input (or so in fscanf) to internal slice (like Files or map)
        gshCtx.Scanv(argv)
    case cmd == "set":
        // set name ...
    case cmd == "serv":
        gshCtx.httpServer(argv)
    case cmd == "shift":
        gshCtx.Shiftv(argv)
    case cmd == "sleep":
        gshCtx.sleep(argv)
    case cmd == "-sort":
        gshCtx.Sortv(argv)

    case cmd == "j" || cmd == "join":
        gshCtx.Rjoin(argv)
    case cmd == "a" || cmd == "alpa":
        gshCtx.Rexec(argv)
    case cmd == "jcd" || cmd == "jchdir":
        gshCtx.Rchdir(argv)
    case cmd == "jget":
        gshCtx.Rget(argv)
    case cmd == "jls":
        gshCtx.Rls(argv)
    case cmd == "jput":
        gshCtx.Rput(argv)
    case cmd == "jpwd":
        gshCtx.Rpwd(argv)

    case cmd == "time":
        fin = gshCtx.xTime(argv)
    case cmd == "ungets":
        if 1 < len(argv) {
            ungets(argv[1]+"\n")
        }else{
        }
    case cmd == "pwd":
        gshCtx.xPwd(argv);
    case cmd == "ver" || cmd == "-ver" || cmd == "version":
        gshCtx.showVersion(argv)
    case cmd == "where":
        // data file or so?
    case cmd == "which":
        which("PATH",argv);
    default:
        if gshCtx.whichPlugin(cmd,[]string{"-s"}) != nil {
            gshCtx.xPlugin(argv)
        }else{
            notfound,_ := gshCtx.excommand(false,argv)
            if notfound {
                fmt.Printf("--E-- command not found (%v)\n",cmd)
            }
        }
    }
    return fin
}

func (gsh*GshContext)gshelll(gline string) (rfin bool) {
    argv := strings.Split(string(gline)," ")
    fin := gsh.gshellv(argv)
    return fin
}
func (gsh*GshContext)tgshelll(gline string)(xfin bool){
    start := time.Now()
    fin := gsh.gshelll(gline)
    end := time.Now()
    elps := end.Sub(start);
    if gsh.CmdTime {
        fmt.Printf("--T-- " + time.Now().Format(time.Stamp) + "(%d.%09ds)\n",
            elps/1000000000,elps%1000000000)
    }
    return fin
}
func Ttyid() (int) {
    fi, err := os.Stdin.Stat()
    if err != nil {
        return 0;
    }
    //fmt.Printf("Stdin: %v Dev=%d\n",
    //  fi.Mode(),fi.Mode()&os.ModeDevice)
    if (fi.Mode() & os.ModeDevice) != 0 {
        stat := syscall.Stat_t{};
        err := syscall.Fstat(0,&stat)
        if err != nil {
            //fmt.Printf("--I-- Stdin: (%v)\n",err)
        }else{
            //fmt.Printf("--I-- Stdin: rdev=%d %d\n",
            //  stat.Rdev&0xFF,stat.Rdev);
            //fmt.Printf("--I-- Stdin: tty%d\n",stat.Rdev&0xFF);
            return int(stat.Rdev & 0xFF)
        }
    }
    return 0
}
func (gshCtx *GshContext) ttyfile() string {
    //fmt.Printf("--I-- GSH_HOME=%s\n",gshCtx.GshHomeDir)
    ttyfile := gshCtx.GshHomeDir + "/" + "gsh-tty" +
         fmt.Sprintf("%02d",gshCtx.TerminalId)
         //strconv.Itoa(gshCtx.TerminalId)
    //fmt.Printf("--I-- ttyfile=%s\n",ttyfile)
    return ttyfile
}
func (gshCtx *GshContext) ttyline()(*os.File){
    file, err := os.OpenFile(gshCtx.ttyfile(),os.O_RDWR|os.O_CREATE|os.O_TRUNC,0600)
```

```
    if err != nil {
        fmt.Printf("--F-- cannot open %s (%s)\n",gshCtx.ttyfile(),err)
        return file;
    }
    return file
}
func (gshCtx *GshContext)getline(hix int, skipping bool, prevline string) (string) {
    if( skipping ){
        reader := bufio.NewReaderSize(os.Stdin,LINESIZE)
        line, _, _ := reader.ReadLine()
        return string(line)
    }else
    if true {
        return xgetline(hix,prevline,gshCtx)
    }
    /*
    else
    if( with_exgetline && gshCtx.GetLine != "" ){
        //var xhix int64 = int64(hix); // cast
        newenv := os.Environ()
        newenv = append(newenv, "GSH_LINENO="+strconv.FormatInt(int64(hix),10) )

        tty := gshCtx.ttyline()
        tty.WriteString(prevline)
        Pa := os.ProcAttr {
            "", // start dir
            newenv, //os.Environ(),
            []*os.File{os.Stdin,os.Stdout,os.Stderr,tty},
            nil,
        }
//fmt.Printf("--I-- getline=%s // %s\n",gsh_getlinev[0],gshCtx.GetLine)
proc, err := os.StartProcess(gsh_getlinev[0],[]string{"getline","getline"},&Pa)
        if err != nil {
            fmt.Printf("--F-- getline process error (%v)\n",err)
            // for ; ; { }
            return "exit (getline program failed)"
        }
        //stat, err := proc.Wait()
        proc.Wait()
        buff := make([]byte,LINESIZE)
        count, err := tty.Read(buff)
        //_, err = tty.Read(buff)
        //fmt.Printf("--D-- getline (%d)\n",count)
        if err != nil {
            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
}
```

```
3625 func fputc(ch int , fp*os.File)(int){
3626     var buf [1]byte
3627     buf[0] = byte(ch)
3628     fp.Write(buf[0:1])
3629     return 0
3630 }
3631 func fputs(buf StrBuff, fp*os.File)(int){
3632     fp.Write(buf)
3633     return 0
3634 }
3635 func xfputss(str string, fp*os.File)(int){
3636     return fputs([]byte(str),fp)
3637 }
3638 func sscanf(str StrBuff,fmts string, params ...interface{})(int){
3639     fmt.Sscanf(string(str[0:strlen(str)]),fmts,params...)
3640     return 0
3641 }
3642 func fprintf(fp*os.File,fmts string, params ...interface{})(int){
3643     fmt.Fprintf(fp,fmts,params...)
3644     return 0
3645 }
3646
3647 // <a name="IME">Command Line IME</a>
3648 //---------------------------------------------------------------------- MyIME
3649 var MyIMEVER = "MyIME/0.0.2";
3650 type RomKana struct {
3651     dic string  // dictionaly ID
3652     pat string  // input pattern
3653     out string  // output pattern
3654     hit int64   // count of hit and used
3655 }
3656 var dicents = 0
3657 var romkana [1024]RomKana
3658 var Romkan []RomKana
3659
3660 func isinDic(str string)(int){
3661     for i,v := range Romkan {
3662         if v.pat == str {
3663             return i
3664         }
3665     }
3666     return -1
3667 }
3668 const (
3669     DIC_COM_LOAD = "im"
3670     DIC_COM_DUMP = "s"
3671     DIC_COM_LIST = "ls"
3672     DIC_COM_ENA  = "en"
3673     DIC_COM_DIS  = "di"
3674 )
3675 func helpDic(argv []string){
3676     out := stderr
3677     cmd := ""
3678     if 0 < len(argv) { cmd = argv[0] }
3679     fprintf(out,"--- %v Usage\n",cmd)
3680     fprintf(out,"... Commands\n")
3681     fprintf(out,"...   %v %-3v [dicName] [dicURL ] -- Import dictionary\n",cmd,DIC_COM_LOAD)
3682     fprintf(out,"...   %v %-3v [pattern] -- Search in dictionary\n",cmd,DIC_COM_DUMP)
3683     fprintf(out,"...   %v %-3v [dicName] -- List dictionaries\n",cmd,DIC_COM_LIST)
3684     fprintf(out,"...   %v %-3v [dicName] -- Disable dictionaries\n",cmd,DIC_COM_DIS)
3685     fprintf(out,"...   %v %-3v [dicName] -- Enable dictionaries\n",cmd,DIC_COM_ENA)
3686     fprintf(out,"... Keys ... %v\n","ESC can be used for '\\'")
3687     fprintf(out,"...   \\c -- Reverse the case of the last character\n",)
3688     fprintf(out,"...   \\i -- Replace input with translated text\n",)
3689     fprintf(out,"...   \\j -- On/Off translation mode\n",)
3690     fprintf(out,"...   \\l -- Force Lower Case\n",)
3691     fprintf(out,"...   \\u -- Force Upper Case (software CapsLock)\n",)
3692     fprintf(out,"...   \\v -- Show translation actions\n",)
3693     fprintf(out,"...   \\x -- Replace the last input character with it Hexa-Decimal\n",)
3694 }
3695 func xDic(argv[]string){
3696     if len(argv) <= 1 {
3697         helpDic(argv)
3698         return
3699     }
3700     argv = argv[1:]
3701     var debug = false
3702     var info = false
3703     var silent = false
3704     var dump = false
3705     var builtin = false
3706     cmd := argv[0]
3707     argv = argv[1:]
3708     opt := ""
3709     arg := ""
3710
3711     if 0 < len(argv) {
3712         arg1 := argv[0]
3713         if arg1[0] == '-' {
3714             switch arg1 {
3715                 default: fmt.Printf("--Ed-- Unknown option(%v)\n",arg1)
3716                     return
3717                 case "-b": builtin = true
3718                 case "-d": debug = true
3719                 case "-s": silent = true
3720                 case "-v": info = true
3721             }
3722             opt = arg1
3723             argv = argv[1:]
3724         }
3725     }
3726
3727     dicName := ""
3728     dicURL := ""
3729     if 0 < len(argv) {
3730         arg = argv[0]
3731         dicName = arg
3732         argv = argv[1:]
3733     }
3734     if 0 < len(argv) {
3735         dicURL = argv[0]
3736         argv = argv[1:]
3737     }
3738     if false {
3739         fprintf(stderr,"--Dd-- com(%v) opt(%v) arg(%v)\n",cmd,opt,arg)
3740     }
3741     if cmd == DIC_COM_LOAD {
3742         //dicType := ""
3743         dicBody := ""
3744         if !builtin && dicName != "" && dicURL == "" {
3745             f,err := os.Open(dicName)
3746             if err == nil {
3747                 dicURL = dicName
3748             }else{
3749                 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);

    //romkana[dicents].pat = "//ddump"
    //romkana[dicents].pat = "//ddump" // dump the dic. and clean the command input
    */
    return 0;
}
func matchlen(stri string, pati string)(int){
    if strBegins(stri,pati) {
        return len(pati)
    }else{
        return 0
    }
}
func convs(src string)(string){
    var si int;
    var sx = len(src);
    var di int;
    var mi int;
    var dstb []byte

    for si = 0; si < sx; { // search max. match from the position
        if strBegins(src[si:],"%x/") {
            // %x/integer/ // s/a/b/
            ix := strings.Index(src[si+3:],"/")
            if 0 < ix {
                var iv int = 0
                //fmt.Sscanf(src[si+3:si+3+ix],"%d",&iv)
                fmt.Sscanf(src[si+3:si+3+ix],"%v",&iv)
                sval := fmt.Sprintf("%x",iv)
                bval := []byte(sval)
                dstb = append(dstb,bval...)
                si = si+3+ix+1
                continue
            }
        }
        if strBegins(src[si:],"%d/") {
            // %d/integer/ // s/a/b/
            ix := strings.Index(src[si+3:],"/")
            if 0 < ix {
                var iv int = 0
                fmt.Sscanf(src[si+3:si+3+ix],"%v",&iv)
                sval := fmt.Sprintf("%d",iv)
                bval := []byte(sval)
                dstb = append(dstb,bval...)
                si = si+3+ix+1
                continue
            }
        }
        if strBegins(src[si:],"%t") {
            now := time.Now()
            if true {
                date := now.Format(time.Stamp)
                dstb = append(dstb,[]byte(date)...)
                si = si+3
            }
            continue
        }
        var maxlen int = 0;
        var len int;
        mi = -1;
        for di = 0; di < dicents; di++ {
            len = matchlen(src[si:],romkana[di].pat);
            if( maxlen < len ){
                maxlen = len;
                mi = di;
            }
        }
        if( 0 < maxlen ){
            out := romkana[mi].out;
            dstb = append(dstb,[]byte(out)...);
            si += maxlen;
        }else{
            dstb = append(dstb,src[si])
            si += 1;
        }
    }
    return string(dstb)
}
func trans(src string)(int){
    dst := convs(src);
    xfputss(dst,stderr);
```

```
4000     return 0;
4001 }
4002
4003 //---------------------------------------------------------- LINEEDIT
4004 // "?" at the top of the line means searching history
4005
4006 // should be compatilbe with Telnet
4007 const (
4008     EV_MODE     = 255
4009     EV_IDLE     = 254
4010     EV_TIMEOUT  = 253
4011
4012     GO_UP       = 252   // k
4013     GO_DOWN     = 251   // j
4014     GO_RIGHT    = 250   // l
4015     GO_LEFT     = 249   // h
4016     DEL_RIGHT   = 248   // x
4017     GO_TOPL     = 'A'-0x40  // 0
4018     GO_ENDL     = 'E'-0x40  // $
4019
4020     GO_TOPW     = 239   // b
4021     GO_ENDW     = 238   // e
4022     GO_NEXTW    = 237   // w
4023
4024     GO_FORWCH   = 229   // f
4025     GO_PAIRCH   = 228   // %
4026
4027     GO_DEL      = 219   // d
4028
4029     HI_SRCH_FW  = 209   // /
4030     HI_SRCH_BK  = 208   // ?
4031     HI_SRCH_RFW = 207   // n
4032     HI_SRCH_RBK = 206   // N
4033 )
4034
4035 // should return number of octets ready to be read immediately
4036 //fprintf(stderr,"\n--Select(%v %v)\n",err,r.Bits[0])
4037
4038
4039 var EventRecvFd = -1 // file descriptor
4040 var EventSendFd = -1
4041 const EventFdOffset = 1000000
4042 const NormalFdOffset = 100
4043
4044 func putEvent(event int, evarg int){
4045     if true {
4046         if EventRecvFd < 0 {
4047             var pv = []int{-1,-1}
4048             syscall.Pipe(pv)
4049             EventRecvFd = pv[0]
4050             EventSendFd = pv[1]
4051             //fmt.Printf("--De-- EventPipe created[%v,%v]\n",EventRecvFd,EventSendFd)
4052         }
4053     }else{
4054         if EventRecvFd < 0 {
4055             // the document differs from this spec
4056             // https://golang.org/src/syscall/syscall_unix.go?s=8096:8158#L340
4057             sv,err := syscall.Socketpair(syscall.AF_UNIX,syscall.SOCK_STREAM,0)
4058             EventRecvFd = sv[0]
4059             EventSendFd = sv[1]
4060             if err != nil {
4061                 fmt.Printf("--De-- EventSock created[%v,%v](%v)\n",
4062                     EventRecvFd,EventSendFd,err)
4063             }
4064         }
4065     }
4066     var buf = []byte{ byte(event)}
4067     n,err := syscall.Write(EventSendFd,buf)
4068     if err != nil {
4069         fmt.Printf("--De-- putEvent[%v](%3v)(%v %v)\n",EventSendFd,event,n,err)
4070     }
4071 }
4072 func ungets(str string){
4073     for _,ch := range str {
4074         putEvent(int(ch),0)
4075     }
4076 }
4077 func (gsh*GshContext)xReplay(argv[]string){
4078     hix := 0
4079     tempo := 1.0
4080     xtempo := 1.0
4081     repeat := 1
4082
4083     for _,a := range argv { // tempo
4084         if strBegins(a,"x") {
4085             fmt.Sscanf(a[1:],"%f",&xtempo)
4086             tempo = 1 / xtempo
4087             //fprintf(stderr,"--Dr-- tempo=[%v]%v\n",a[2:],tempo);
4088         }else
4089         if strBegins(a,"r") { // repeat
4090             fmt.Sscanf(a[1:],"%v",&repeat)
4091         }else
4092         if strBegins(a,"!") {
4093             fmt.Sscanf(a[1:],"%d",&hix)
4094         }else{
4095             fmt.Sscanf(a,"%d",&hix)
4096         }
4097     }
4098     if hix == 0 || len(argv) <= 1 {
4099         hix = len(gsh.CommandHistory)-1
4100     }
4101     fmt.Printf("--Ir-- Replay(!%v x%v r%v)\n",hix,xtempo,repeat)
4102         //dumpEvents(hix)
4103     //gsh.xScanReplay(hix,false,repeat,tempo,argv)
4104     go gsh.xScanReplay(hix,true,repeat,tempo,argv)
4105 }
4106
4107 // <a href="https://golang.org/pkg/syscall/#FdSet">syscall.Select</a>
4108 // 2020-0827 GShell-0.2.3
4109 /*
4110 func FpollIn1(fp *os.File,usec int)(uintptr){
4111     nfd := 1
4112
4113     rdv := syscall.FdSet {}
4114     fd1 := fp.Fd()
4115     bank1 := fd1/32
4116     mask1 := int32(1 << fd1)
4117     rdv.Bits[bank1] = mask1
4118
4119     fd2 := -1
4120     bank2 := -1
4121     var mask2 int32 = 0
4122
4123     if 0 <= EventRecvFd {
4124         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)
    readyFd := CFpollIn1(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)
                goto READ1
            }
            return int(buf[0])
        }
    }

    _,err := fp.Read(buf[0:1])
    if( err != nil ){
        return EOF;
    }else{
        return int(buf[0])
    }
}

func visibleChar(ch int)(string){
    switch {
        case '!' <= ch && ch <= '~':
            return string(ch)
    }
    switch ch {
        case ' ': return "\\s"
        case '\n': return "\\n"
        case '\r': return "\\r"
        case '\t': return "\\t"
    }
    switch ch {
        case 0x00: return "NUL"
        case 0x07: return "BEL"
        case 0x08: return "BS"
        case 0x0E: return "SO"
        case 0x0F: return "SI"
        case 0x1B: return "ESC"
        case 0x7F: return "DEL"
    }
    switch ch {
        case EV_IDLE: return fmt.Sprintf("IDLE")
        case EV_MODE: return fmt.Sprintf("MODE")
    }
    return fmt.Sprintf("%X",ch)
}
func recvEvent(fd int){
    var buf = make([]byte,1)
    _,_ = syscall.Read(fd,buf[0:1])
    if( buf[0] != 0 ){
        romkanmode = true
    }else{
        romkanmode = false
    }
}
func (gsh*GshContext)xScanReplay(hix int,replay bool,repeat int,tempo float64,argv[]string){
    var Start time.Time
    var events = []Event{}
    for _,e := range Events {
        if hix == 0 || e.CmdIndex == hix {
            events = append(events,e)
        }
    }
    elen := len(events)
    if 0 < elen {
        if events[elen-1].event == EV_IDLE {
            events = events[0:elen-1]
        }
    }
    for r := 0; r < repeat; r++ {
        for i,e := range events {
            nano := e.when.Nanosecond()
            micro := nano / 1000
            if Start.Second() == 0 {
                Start = time.Now()
            }
            diff := time.Now().Sub(Start)
            if replay {
                if e.event != EV_IDLE {
                    putEvent(e.event,0)
                    if e.event == EV_MODE { // event with arg
                        putEvent(int(e.evarg),0)
                    }
```

```
4250                }
4251            }else{
4252            fmt.Printf("%7.3fms #%-3v !%-3v [%v.%06d] %3v %02X %-4v %10.3fms\n",
4253                    float64(diff)/1000000.0,
4254                    i,
4255                    e.CmdIndex,
4256                    e.when.Format(time.Stamp),micro,
4257                    e.event,e.event,visibleChar(e.event),
4258                    float64(e.evarg)/1000000.0)
4259            }
4260            if e.event == EV_IDLE {
4261                d := time.Duration(float64(time.Duration(e.evarg)) * tempo)
4262                //nsleep(time.Duration(e.evarg))
4263                nsleep(d)
4264            }
4265        }
4266    }
4267 }
4268 func dumpEvents(arg[]string){
4269    hix := 0
4270    if 1 < len(arg) {
4271        fmt.Sscanf(arg[1],"%d",&hix)
4272    }
4273    for i,e := range Events {
4274        nano := e.when.Nanosecond()
4275        micro := nano / 1000
4276        //if e.event != EV_TIMEOUT {
4277        if hix == 0 || e.CmdIndex == hix {
4278            fmt.Printf("#%-3v !%-3v [%v.%06d] %3v %02X %-4v %10.3fms\n",i,
4279                e.CmdIndex,
4280                e.when.Format(time.Stamp),micro,
4281                e.event,e.event,visibleChar(e.event),float64(e.evarg)/1000000.0)
4282        }
4283        //}
4284    }
4285 }
4286 func fgetcTimeout(fp *os.File,usec int)(int){
4287    ch := fgetcTimeout1(fp,usec)
4288    if ch != EV_TIMEOUT {
4289        now := time.Now()
4290        if 0 < len(Events) {
4291            last := Events[len(Events)-1]
4292            dura := int64(now.Sub(last.when))
4293            Events = append(Events,Event{last.when,EV_IDLE,dura,last.CmdIndex})
4294        }
4295        Events = append(Events,Event{time.Now(),ch,0,CmdIndex})
4296    }
4297    return ch
4298 }
4299
4300 var TtyMaxCol = 72 // to be obtained by ioctl?
4301 var EscTimeout = (100*1000)
4302 var (
4303    MODE_VicMode    bool    // vi compatible command mode
4304    MODE_ShowMode   bool
4305    romkanmode  bool    // shown translation mode, the mode to be retained
4306    MODE_Recursive  bool    // recursive translation
4307    MODE_CapsLock   bool    // software CapsLock
4308    MODE_LowerLock  bool    // force lower-case character lock
4309    MODE_ViInsert   int // visible insert mode, should be like "I" icon in X Window
4310    MODE_ViTrace    bool    // output newline before translation
4311 )
4312 type IInput struct {
4313    lno     int
4314    lastlno     int
4315    pch     []int   // input queue
4316    prompt      string
4317    line        string
4318    right       string
4319    inJmode     bool
4320    pinJmode    bool
4321    waitingMeta string  // waiting meta character
4322    LastCmd     string
4323 }
4324 func (iin*IInput)Getc(timeoutUs int)(int){
4325    ch1 := EOF
4326    ch2 := EOF
4327    ch3 := EOF
4328    if( 0 < len(iin.pch) ){ // deQ
4329        ch1 = iin.pch[0]
4330        iin.pch = iin.pch[1:]
4331    }else{
4332        ch1 = fgetcTimeout(stdin,timeoutUs);
4333    }
4334    if( ch1 == 033 ){ /// escape sequence
4335        ch2 = fgetcTimeout(stdin,EscTimeout);
4336        if( ch2 == EV_TIMEOUT ){
4337        }else{
4338            ch3 = fgetcTimeout(stdin,EscTimeout);
4339            if( ch3 == EV_TIMEOUT ){
4340                iin.pch = append(iin.pch,ch2) // enQ
4341            }else{
4342                switch( ch2 ){
4343                    default:
4344                        iin.pch = append(iin.pch,ch2) // enQ
4345                        iin.pch = append(iin.pch,ch3) // enQ
4346                    case '[':
4347                        switch( ch3 ){
4348                            case 'A': ch1 = GO_UP; // ^
4349                            case 'B': ch1 = GO_DOWN; // v
4350                            case 'C': ch1 = GO_RIGHT; // >
4351                            case 'D': ch1 = GO_LEFT; // <
4352                            case '3':
4353                ch4 := fgetcTimeout(stdin,EscTimeout);
4354                                if( ch4 == '~' ){
4355                //fprintf(stderr,"x[%02X %02X %02X %02X]\n",ch1,ch2,ch3,ch4);
4356                                    ch1 = DEL_RIGHT
4357                                }
4358                        }
4359                    case '\\':
4360                //ch4 := fgetcTimeout(stdin,EscTimeout);
4361                //fprintf(stderr,"y[%02X %02X %02X %02X]\n",ch1,ch2,ch3,ch4);
4362                        switch( ch3 ){
4363                            case '~': ch1 = DEL_RIGHT
4364                        }
4365                }
4366            }
4367        }
4368    }
4369    return ch1
4370 }
4371 func (inn*IInput)clearline(){
4372    var i int
4373    fprintf(stderr,"\r");
4374    // 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
    var lastRune rune
    var found = -1
    i := 1
    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
            found = i
            break
        }
        i += lastSize
    }
    if 0 < found {
        if isAlnum(lastRune) { // or non-kana character
        }else{ // when positioning to the top o the word
            found += lastSize
        }
        iin.line = iin.line + str[0:found]
        if 0 < found {
            iin.right = str[found:]
        }else{
            iin.right = ""
        }
    }
    //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 2020-0902 created
func (iin*IInput)GotoPAIRCH(){
    str := iin.right
    if len(str) <= 0 {
        return
    }
    lastRune,lastSize := utf8.DecodeRuneInString(str[0:])
    if lastSize <= 0 {
        return
    }
    forw := false
    back := false
    pair := ""
    switch string(lastRune){
        case "{": pair = "}"; forw = true
        case "}": pair = "{"; back = true
        case "(": pair = ")"; forw = true
        case ")": pair = "("; back = true
        case "[": pair = "]"; forw = true
        case "]": pair = "["; back = true
        case "<": pair = ">"; forw = true
        case ">": pair = "<"; back = true
        case "\"": pair = "\""; // context depednet, can be f" or back-double quote
        case "'": pair = "'"; // context depednet, can be f' or back-quote
        // case Japanese Kakkos
    }
    if forw {
        iin.SearchForward(pair)
    }
    if back {
        iin.SearchBackward(pair)
    }
}
// 0.2.8 2020-0902 created
func (iin*IInput)SearchForward(pat string)(bool){
    right := iin.right
    found := -1
    i := 0
    if strBegins(right,pat) {
        _,z := utf8.DecodeRuneInString(right[i:])
        if 0 < z {
            i += z
        }
    }
    for i < len(right) {
        if strBegins(right[i:],pat) {
            found = i
            break
        }
        _,z := utf8.DecodeRuneInString(right[i:])
```

```
        if z <= 0 { break }
        i += z
    }
    if 0 <= found {
        iin.line = iin.line + right[0:found]
        iin.right = iin.right[found:]
        return true
    }else{
        return false
    }
}
// 0.2.8 2020-0902 created
func (iin*IInput)SearchBackward(pat string)(bool){
    line := iin.line
    found := -1
    i := len(line)-1
    for i = i; 0 <= i; i-- {
        _,z := utf8.DecodeRuneInString(line[i:])
        if z <= 0 {
            continue
        }
        //fprintf(stderr,"-- %v %v\n",pat,line[i:])
        if strBegins(line[i:],pat) {
            found = i
            break
        }
    }
    //fprintf(stderr,"--%d\n",found)
    if 0 <= found {
        iin.right = line[found:] + iin.right
        iin.line = line[0:found]
        return true
    }else{
        return false
    }
}
// 0.2.8 2020-0902 created
// search from top, end, or current position
func (gsh*GshContext)SearchHistory(pat string, forw bool)(bool,string){
    if forw {
        for _,v := range gsh.CommandHistory {
            if 0 <= strings.Index(v.CmdLine,pat) {
                //fprintf(stderr,"\n--De-- found !%v [%v]%v\n",i,pat,v.CmdLine)
                return true,v.CmdLine
            }
        }
    }else{
        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' ){
```

```
5000                mch := fgetcTimeout(stdin,1000*1000)
5001                if mch == 'r' {
5002                    romkanmode = true
5003                }else{
5004                    romkanmode = false
5005                }
5006                continue
5007            }else
5008            */
5009            if( ch == 'k' || ch == 'K' ){
5010                MODE_Recursive = !MODE_Recursive
5011                iin.Translate(cmdch);
5012                continue
5013            }else
5014            if( ch == 'j' || ch == 'J' ){
5015                iin.Translate(cmdch);
5016                continue
5017            }else
5018            if( ch == 'i' || ch == 'I' ){
5019                iin.Replace(cmdch);
5020                continue
5021            }else
5022            if( ch == 'l' || ch == 'L' ){
5023                MODE_LowerLock = !MODE_LowerLock
5024                MODE_CapsLock = false
5025                if MODE_ViTrace {
5026                    fprintf(stderr,"%v\r\n",string(cmdch));
5027                }
5028                iin.Redraw();
5029                continue
5030            }else
5031            if( ch == 'u' || ch == 'U' ){
5032                MODE_CapsLock = !MODE_CapsLock
5033                MODE_LowerLock = false
5034                if MODE_ViTrace {
5035                    fprintf(stderr,"%v\r\n",string(cmdch));
5036                }
5037                iin.Redraw();
5038                continue
5039            }else
5040            if( ch == 'v' || ch == 'V' ){
5041                MODE_ViTrace = !MODE_ViTrace
5042                if MODE_ViTrace {
5043                    fprintf(stderr,"%v\r\n",string(cmdch));
5044                }
5045                iin.Redraw();
5046                continue
5047            }else
5048            if( ch == 'c' || ch == 'C' ){
5049                if 0 < len(iin.line) {
5050                    xline,tail := delTailChar(iin.line)
5051                    if len([]byte(tail)) == 1 {
5052                        ch = int(tail[0])
5053                        if( 'a' <= ch && ch <= 'z' ){
5054                            ch = ch + 'A'-'a'
5055                        }else
5056                        if( 'A' <= ch && ch <= 'Z' ){
5057                            ch = ch + 'a'-'A'
5058                        }
5059                        iin.line = xline + string(ch)
5060                    }
5061                }
5062                if MODE_ViTrace {
5063                    fprintf(stderr,"%v\r\n",string(cmdch));
5064                }
5065                iin.Redraw();
5066                continue
5067            }else{
5068                iin.pch = append(iin.pch,ch) // push
5069                ch = '\\'
5070            }
5071        }
5072        switch( ch ){
5073            case 'P'-0x40: ch = GO_UP
5074            case 'N'-0x40: ch = GO_DOWN
5075            case 'B'-0x40: ch = GO_LEFT
5076            case 'F'-0x40: ch = GO_RIGHT
5077        }
5078        //fprintf(stderr,"B[%02X]\n",ch);
5079        switch( ch ){
5080            case 0:
5081                continue;
5082
5083            case '\t':
5084                iin.Replace('j');
5085                continue
5086            case 'X'-0x40:
5087                iin.Replace('j');
5088                continue
5089
5090            case EV_TIMEOUT:
5091                iin.Redraw();
5092                if iin.pinJmode {
5093                    fprintf(stderr,"\\J\r\n")
5094                    iin.inJmode = true
5095                }
5096                continue
5097            case GO_UP:
5098                if iin.lno == 1 {
5099                    continue
5100                }
5101                cmd,ok := gsh.cmdStringInHistory(iin.lno-1)
5102                if ok {
5103                    iin.line = cmd
5104                    iin.right = ""
5105                    iin.lno = iin.lno - 1
5106                }
5107                iin.Redraw();
5108                continue
5109            case GO_DOWN:
5110                cmd,ok := gsh.cmdStringInHistory(iin.lno+1)
5111                if ok {
5112                    iin.line = cmd
5113                    iin.right = ""
5114                    iin.lno = iin.lno + 1
5115                }else{
5116                    iin.line = ""
5117                    iin.right = ""
5118                    if iin.lno == iin.lastlno-1 {
5119                        iin.lno = iin.lno + 1
5120                    }
5121                }
5122                iin.Redraw();
5123                continue
5124            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)
    //gshelll(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">
```

```
5500
5501 var WorldDic = //<span id="gsh-world-dic">
5502 "data:text/dic;base64,"+
5503 "Ly8gTXlJTUUvMC4wLjEg6L6e5pu4ICgyMDIwLTA4MTlhKQpzZWthaSDkuJbnlYwKa28g44GT"+
5504 "Cm5uIOOCkwpuaSDjgasKY2hpIOOBoQp0aSDjgaEKaGEg44GvCnNlIOOBmwprYSDjgYsKaSDj"+
5505 "gYQK";
5506 //</span>
5507
5508 var WnnDic = //<span id="gsh-wnn-dic">
5509 "data:text/dic;base64,"+
5510 "PGlldGEgY2hhcnNldD0iVVRGLTgiPgo8dGV4dGFyZWEgY29scz04MCByb3dzPTQwPgovL2Rp"+
5511 "Y3ZlcglHU2hlbGxcc0lNRVxzZGljdGlvbmFyeVxzZm9yXHNXbm5ccy8vXHMyMDIwLTA4MzAK"+
5512 "R1NoZWxsCUdTaGVsbArjgo/jgZ/jgZcJ56eBCndhdGFzaGkJ56eBCndhdGFzaQnnp4EK44Gq"+
5513 "44G+44GICeWQjeWJjQpuYW1hZQnlkI3liY0K44Gq44GL44GuCeS4remHjgpuYWthbm8J5Lit"+
5514 "6YeOCndhCeOCjwp0YQnjgZ8Kc2kJ44GXCnNoaQnjgZcKbm8J44GuCm5hCeOBqgptYQnjgb4K"+
5515 "ZQnjgYgKaGEJ44GvCm5hCeOBqgprYQnjgYsKbm8J44GuCmRlCeOBpwpzdQnjgZkKZVxzCWVj"+
5516 "aG8KZGljCWRpYwplY2hvCWVjaG8KcmVwbGF5CXJlcGxheQpyZXBlYXQJcmVwZWF0CmR0CWRh"+
5517 "dGVccysnJVklbSVkLSVIOiVNOiVTJwp0aW9uCXRpb24KJXQJJXQJLy8gdG8gYmUgYW4gYWN0"+
5518 "aW9uCjwvdGV4dGFyZWE+Cg=="
5519 //</span>
5520
5521 var SumomoDic = //<span id="gsh-sumomo-dic">
5522 "data:text/dic;base64,"+
5523 "PGlldGEgY2hhcnNldD0iVVRGLTgiPgo8dGV4dGFyZWEgY29scz04MCByb3dzPTQwPgovL3Zl"+
5524 "cglHU2hlbGxcc0lNRVxzZGljdGlvbmFyeVxzZm9yXHNTdW1vbW9ccy8vXHMyMDIwLTA4MzAK"+
5525 "c3UJ44GZCm1vCeOCggpubwnjga4KdQnjgYYKY2hpCeOBoQp0aQnjgaEKdWNoaQnlhoUKdXRp"+
5526 "CeWGhQpzdW1vbW8J44GZ44KC44KCCnNlbW9tb21vCeOBmeOCguOCguOCggptb21vCeahgwpt"+
5527 "b21vbW8J5qGD44KCCiwsCeOAgQouLgnjgIIKPC90ZXh0YXJlYT4K"
5528 //</span>
5529
5530 var SijimiDic = //<span id="gsh-sijimi-dic">
5531 "data:text/dic;base64,"+
5532 "PGlldGEgY2hhcnNldD0iVVRGLTgiPgo8dGV4dGFyZWEgY29scz04MCByb3dzPTQwPgovL3Zl"+
5533 "cglHU2hlbGxcc0lNRVxzZGljdGlvbmFyeVxzZm9yXHNTaGlqaW1pXHMvL1xzMjAyMC0wODMw"+
5534 "CnNpCeOBlwpzaGkJ44GXCmppCeOBmAptaQnjgb8KbmEJ44GqCmplCeOBmOOChQp4eXUJ44KF"+
5535 "CnUJ44GGCm5pCeOBqwprbwnjgZMKYnUJ44G2Cm5uCeOCkwpubwnjga4KY2hpCeOBoQp0aQnj"+
5536 "gaEKa2EJ44GLCnJhCeOCiQosLAnjgIEKLi4J44CCCnhuYW5hCeS4gwp4anVlCeWNgQp4bmkJ"+
5537 "5LqMCmtveAnlgIsKa29xCeWAiwprb3gJ5YCLCm5hbmFqdXVuaXgJNzIKbmFuYWp1dW5peHgJ"+
5538 "77yX77ySCm5hbmFqdXVuaVgJ77yX77ySCuS4g+WNgeS6jHgJNzIKa29idW5uCeWAi+WIhgp0"+
5539 "aWthcmFxCeOBoeOBi+OCiQp0aWthcmEJ5YqbCmNoaWthcmEJ5YqbCjwvdGV4dGFyZWE+Cg="
5540 //</span>
5541
5542 var JA_JKLDic = //<span id="gsh-ja-jkl-dic">
5543 "data:text/dic;base64,"+
5544 "Ly92ZXJsCU15SU1FamRpY2ptb3JzZWpKQWpKS0woMjAyMGowODE5KSheLV4pL1NhdG94SVRT"+
5545 "CmtqamprbGtqa2tsa2psIOS4lueVjApqamtqamwJ44GCCmtqbAnjgYQKa2tqbAnjgYYKamtq"+
5546 "amwJ44GICmtqa2trbAnjgYoKa2pra2wJ44GLCmpramtrbAnjgY0Ka2tramwJ44GPCmpramps"+
5547 "CeOBkQpqampqbAnjgZMKamtqa2psCeOBlQpqamtqa2wJ44GXCmpqamtqbAnjgZkKa2pqamts"+
5548 "CeOBmwpqamprbAnjgZ0KamtsCeOBnwpra2prbAnjgaEKa2pqa2wJ44GkCmtqa2pqbAnjgaYK"+
5549 "a2tqa2tsCeOBqApramtsCeOBqgpqa2prbAnjgasKa2tra2wJ44GsCmpqa2psCeOBrQpra2pq"+
5550 "bAnjga4Kamtra2wJ44GvCmpqa2tqbAnjgbIKampra2wJ44G1CmtsCeOBuApqa2tsCeOBuwpq"+
5551 "a2tqbAnjgb4Ka2tqa2psCeOBvwpqbAnjgoAKamtra2psCeOCgQpqa2tqa2wJ44KCCmtqamwJ"+
5552 "44KECmpra2pqbAnjgoYKampsCeOCiApra2tsCeOCiQpqamtsCeOCigpqa2pqa2wJ44KLCmpq"+
5553 "amwJ44KMCmtqa2psCeOCjQpqa2psCeOCjwpramtramwJ44KQCmtqamtrbAnjgpEKa2pqamwJ"+
5554 "44KSCmtqa2prbAnjgpMKa2pqa2psCeODvApra2wJ44KbCmtramprbAnjgpwKa2pramtqbAnj"+
5555 "gIEK";
5556 //</span>
5557
5558 //</span>
5559 /*
5560 <details id="references"><summary>References</summary><div class="gsh-src">
5561 <p>
5562 <a href="https://golang.org">The Go Programming Language</a>
5563 <iframe src="https://golang.org" width="100%" height="300"></iframe>
5564
5565 <a href="https://developer.mozilla.org/ja/docs/Web">MDN web docs</a>
5566  <a href="https://developer.mozilla.org/ja/docs/Web/HTML/Element">HTML</a>
5567  CSS:
5568    <a href="https://developer.mozilla.org/en-US/docs/Web/CSS/CSS_Selectors">Selectors</a>
5569    <a href="https://developer.mozilla.org/en-US/docs/Web/CSS/background-repeat">repeat</a>
5570  HTTP
5571  JavaScript:
5572  ...
5573 </p>
5574 </div></details>
5575 */
5576 /*
5577 <details id="html-src" onclick="frame_open();"><summary>Raw Source</summary><div>
5578
5579 <!-- h2>The full of this HTML including the Go code is here.</h2 -->
5580 <details id="gsh-whole-view"><summary>Whole file</summary>
5581  <a name="whole-src-view"></a>
5582  <span id="src-frame"></span><!-- a window to show source code -->
5583 </details>
5584
5585 <details id="gsh-style-frame" onclick="fill_CSSView()"><summary>CSS part</summary>
5586  <a name="style-src-view"></a>
5587  <span id="gsh-style-view"></span>
5588 </details>
5589
5590 <details id="gsh-script-frame" onclick="fill_JavaScriptView()"><summary>JavaScript part</summary>
5591  <a name="script-src-view"></a>
5592  <span id="gsh-script-view"></span>
5593 </details>
5594
5595 <details id="gsh-data-frame" onclick="fill_DataView()"><summary>Builtin data part</summary>
5596  <a name="gsh-data-frame"></a>
5597  <span id="gsh-data-view"></span>
5598 </details>
5599
5600 </div></details>
5601 */
5602 /*
5603 <div id="gsh-footer" style=""></div><!-- ----------- END-OF-VISIBLE-PART ----------- -->
5604
5605 <!--
5606 // 2020-0906 added,
5607 https://developer.mozilla.org/en-US/docs/Web/CSS/z-index
5608 https://developer.mozilla.org/en-US/docs/Web/CSS/position
5609 -->
5610 <span id="GshGrid">(^_^)/<small>{Hit j k l h}</small></span>
5611
5612 <span id="GStat" style="">
5613  [ GShell Status Line ]<br>
5614 </span>
5615 <div id="GPos" style="" align="right"></div>
5616 <div id="GLog" style=""></div>
5617 <span id="GMenu" onclick="GShellMenu(this)" style=""></span>
5618 <span id="GTop"></span>
5619
5620 <style id="GshStyleDef">
5621  #GTop{
5622    z-index:9;
5623    opacity:1.0;
5624    position:fixed; top:0px; left:0px;
```

```
  width:320px; height:20px;
  color:#fff; background-color:rgba(0,0,0,0.5);
  color:#fff; font-size:12px;
}
#GPos{
  z-index:10;
  position:fixed; top:0px; left:0px;
  opacity:1.0;
  width:320px; height:30px;
  color:#fff; background-color:rgba(0,0,0,0.4);
  color:#fff; font-size:12px;
}
#GMenu{
  z-index:20;
  position:fixed; top:250px; left:0px;
  opacity:1.0;
  width:100px; height:170px;
  color:#fff; background-image:url(GShellInsideIcon);
  color:#fff; font-size:16px; font-family:Georgia;
  background-repeat:no-repeat;
}
#GStat{
  z-index:9;
  xopacity:0.0;
  position:fixed; top:20px; left:0px;
  width:320px; height:90px;
  color:#fff; background-color:rgba(0,0,0,0.4);
  font-size:20px; font-family:Georgia;
}
#GLog{
  z-index:10;
  position:fixed; top:50px; left:0px;
  opacity:1.0;
  width:320px; height:60px;
  color:#fff; background-color:rgba(0,0,0,0.3);
  font-size:12px;
}
#GshGrid {
  z-index:11;
  xopacity:0.0;
  position:fixed; top:0px; left:0px;
  width:320px; height:30px;
  color:#9f9; font-size:16px;
}
xbody {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);}
#GshMenu{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:#fafffe;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">
//GSellLogo="QR-ITS-more.jp.png"
GSellLogo="\
iVBORw0KGgoAAAANSUhEUgAAAQEAAAB/CAYAAADvs3f4AAAAAXNSR0IArs4c6QAAAHhlWElm\
TU0AKgAAAAgABAEaAAUAAAABAAAAPgEbAAUAAAABAAAARgEoAAMAAAABAAIAAIdpAAQAAAAB\
AAAATgAAAAAAAABIAAAAAQAAAEgAAAABAAOgAQADAAAAAQABAACgAgAEAAAAAQAAAQGgAwAE\
AAAAAQAAAH8AAAAAYx1BhgAAAAlwSFlzAAALEwAACxMBAJqcGAAAF3RJREFUeAHtnQuUFNWZ\
x++t7ukZ3iCggO/jY6OSb8WgMzAvn7uG4+bISTR7YnQXdQPCkGj2aNwlD2MSlRkeUaPnoCdu\
4iuJx7jriYZ50DOGmF2VqIBEiSggCoiMMA+mu+vu//ZMD9U1dau6a2aUbv91GKrq3vvdx6/q\
fnXvdx8tBA8SIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAES\
IAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAES\
IAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAES\
IAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAES\
IAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIIFDl4A8dLP2\
2eXs9H9+ftSkSdHxsic2qqdE7YusS+lqaalKfnY5YsokMHwEPtdK4MQFz5UeExlbLYSaYUl5\
npDiLKXEZClFiRM53JSUaq9ScqcU6i+2kK3StuONy5reEGKJ7Qw7mOvKec2ToqOiZwoljhFS\
jbOVHCstMRb3USXEJ8hFu7DsdmFb2+xU4vWWFVXbBpMeZUlAE/hcKoGab66eKGOlNykh56PC\
HxH2VVBKoRKqh3qUeKilYdaOfONJ56OkdI6w5BwomnOQlyPzi0N9DLmXpFK/60p2P/Piyovf\
N8mfM+/nJWNGnjw9KqOToLVGSFt2p2Ril1gn3ij0Vk7YsoWVMzEuVPfPlRKYdfOak2LRSB0q\
zrWocCOG6qEhvgRaCj/dktj3g7dXXH4gKN6aRS0zpYzerqS6RAoZDQqfk79SKTRXHu/e+9FN\
L66as88pU/PN1pNlTLQJKSc73dPXSr20ur7iiwPcC8QhbNnCyhUIlryyOTQvYF5JfvqBL7jx\
+cNHjBj5gJRyDlJHy39o84D40H2Qtx8THaPeFuIOU+w1C+KnyhK5FGEv0WGgAExB83eXMoLY\
rikbd9gHEP52VgQl4h89FUA6kJyYFbbQbnzLJg4zFiesnDHCwvUoeiVQOb/5C9FY9DlUueOH\
+zGhUh9nSqOqrm0uWgurkI9RpjBD4Y6uQcQdD5TUOW63zD3MHesy14V49isbdKyxbGHlCpFR\
UJ6toACF7F9VF58NBfDHT0MBaE74Ent+eWrrWr+Lz/QTw60AdB7QUjps/OA7cOoBNBCeMUZ\
ttCu/coG28fLpvKElTPFV8juRasEahbHvxaRlguoeBPyfUDo4+OfeBdyb8L4tz9XeSXFAMOc\
bgGgov0g1zgGGw4jF392xnHhdc+Mwf3JTjfntZ2yC1YJBJXNUt5KIKyck1sxXRdld6BmcevN\
aJovy/VBacMevqEP46/ZlnJjt9jx17VL53Zl5MtvaplQGlNHw5pQDqXyNTQlZ2b8nGcMG2ZV\
qOoFjSdYvV0AZzDfayidv6FJ35CS4jXZk9hir7e27zm6p3T8hLJpkYicJpV1HtK/DJFU4Jw1\
lImhxM5IR9fzzgRKx4w/C+HQSPE+krbIyrN3qEPTNahsHaLDs2xh5Q5NCoPPVdEpgcqbm/8e\
7/zdOaHptag/mlKJ77U0VG0xybTdX/Ex/PTfa/i7r7Ku+cSoiCxUwrohUxF16wEV9H+ccVgl\
pd/CfU42AK2IUPlvTKlL/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\
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ZUASIAESIAESOKII+LPR9dzsk5ELvxdKBTzlhpQpkbIeFle+8Jan8AzkmYA/67BKXiek+pmQ\
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CGJpzDUfdWMGrf0n8BezIJxDYscHa+vntqfDT10QH1kcVCej9jsVJebVqEtOSfv1/ERXV9fE\
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7T4wc6jEqpkHy0eaEKuDXFG7FWKKHh72Wx453a+vBKsbWtla7r0hpRYM9SyotQ1dvQtfd2/1\
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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\
dc2P4UFahmsfn47H6RP12VnwjzrZ5LufLwSLBs0YF72KosQJJyIzN2fLO0aGkG4U6b8+BxYQ\
TkKVwenYqeupTgZ2ftH6qhg26/jB8aPKnoBo59jZZLh9L+O84E59USUQhki65Vwg6P3njyDW\
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Vl/nm4/cmBCW+nXmNWee48EZnelWaOf+EKyUroI1DOGpL3PawpZRGFp1nIhtCOXYQ5CLqPQW\
RGj4fb1+LEuY3VncC8bZF4KVlszeZfVNVs6qjsQv++Y0t29BUzqWrjqWZDI1oBJWxzEl8vIx\
KEFL9fdsBxp/2Xs6sgXKM3dfCLatfd8adBN1uOUNhlAfwg6Bw93sevqj1HMULPw/b14a6npg\
pkSWlwr06fYMn+v3MlU6MwfbD3KwyWsTXwj2zUcuO4jSJ+6WUyjBTlLlpSv1okE327S/NJwX\
MqJ+21W6VtWlTi4TY/bUnDxmS7iu9baqa2OYX5DbUXlz9BRpGEvdrDHJ5lk3m3z394VgdSYp\
qZbnklkQbbVhBteHI61/0vu/ZgszaeFLR+tNOBCxY90Xa7q7BBtQ6tbuV/oYiPhu8xhzA4R7\
olMaOu3Q4pYZWHWwCtlaI7Ndi3bXo2P7v2p70cmmEPycew8L4Q6770Ev+htZPnED+mNPy/W2\
9LRATHr5EJ/vQ5gfIlw7StTREMd4gAu5rQ3T6aRSqdmx7Z+/GB47ui290UWv9JX4AnJ7llIS\
16Y+xi8sfm6YcrRQxul4K1ysH6Be9llOYHs79i/4cxbvgnH2jWB1jlXXxecYQuZU0g5WDluq\
Y6xMFg2XRcb6wYrTJp5NO7ZuP3v9irmdNn4F5eSbKoHOtab6aStQOt7/beUgSubPmhrC27B1\
0YQhS1OJvclkYo4fxKoZ+kqw+oajDVEsgVEr9PehP+SrXWnkMNLm6VpQnUiKxIzm+0PveQqf\
h4F8J1j9WwOrt+64Stf50OWEzd2G5tCd/FZS/VXH3nagrQUl+4B2j8m8SsS/FmI9D3McBjwo\
kRn3kXzuqzpsZkZUlcbOCRjmPWhQlaBxM1gsduI3l5d3JlR9ywOVm9Np1kTiE/CQYIdtWZV2\
8/KpqxnKkvc1bdveIDDt0Usc+RxmsDIpnxmIw78tYM6HZGdCt2fgZnJ+8xzuSRBvQ4zrhEw9\
H926s8VJSOHFzRdII7AAPQwzkI7Lsp1urBj0QPxYbyb/8dmn2//ll/qqnago2AwqF/38+WEl\
I4afr5Q5EXMARkAoI2CCP2xvJNV+lMZ78LkH3V27LWVt2n9w4/+6JqdkxJPLqd7b1TADkw1p\
nIhS+QSI+HiEw5RPuVengV20d6Nf7K0t1oF1dj/ikUsatCEBEiABEiABEiABEiABEiABEiAB\
EiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiAB\
EiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiAB\
EiABEiABEiABEiABEiABEhD/B9wOq7SGUV++AAAAAElFTkSuQmCC";

ITSmoreQR="\
iVBORw0KGgoAAAANSUhEUgAAAG8AAABvAQMAAADYCwwjAAAABlBMVEX///9BaeFHqDaJAAAB\
HklEQVQ4jdXTsa2EMAwGYCMX7sICkVgjXVaCBe7CArASXdaIlAWgS4HwM5zEVS+mvSgS+ZBQ\
8gcb4BdHyzwv8szMSaUBHNm+KAd4QC8LDpDn8ogT4UpPGci2jI8IGFx3eLwPWaHknVyWecev\
UEbDXaB0X2aNjueYDOzNklQassPCkjc4nW3E1SfwgYk6jU/vAkPhg0AlSFhve8Jt0dkwDMwr\
yMGSSuPyWHAr19k0tkV2sb3sdW2rUCqW88g4Rp1A9slJPv9cTp1NRD4XFkin8XaQCIwT6Lzq\
ZO8dHw/4+U2GzqlS8gbqVmkfr1N6YXK8OqlD0OmlGTMvzPERA8AL9vvbOifpSoL33fsVytrL\
S9wiqDzznhUI38v5n783/gBuUs2eLg1c8gAAAABJRU5ErkJggg==";

</script>

<script id="gsh-script">
//document.getElementById('GshFaviconURL').href = GShellFavicon
document.getElementById('GshFaviconURL').href = GShellInsideIcon
//document.getElementById('GshFaviconURL').href = ITSmoreQR
//document.getElementById('GshFaviconURL').href = GSellLogo

// id of GShell HTML elemets
var E_BANNER = "GshBanner" // 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("+GSellLogo+")";
//bannerStyle.backgroundImage = "url("+GShellInsideIcon+")";
//bannerStyle.backgroundImage = "url("+GShellFavicon+")";
GMenu.style.backgroundImage = "url("+GShellInsideIcon+")";

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('GshStatement').open=false
        GshFeatures.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('GshStatement').open=true
        GshFeatures.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('GshMenuStop'),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 getDigest(){
    //alert("cksum="+strCRC32("",0))
    //alert("cksum="+strCRC32("0",1))
    //return

    version = document.getElementById('GshVersion').innerHTML
    sfavico = document.getElementById('GshFaviconURL').href;
    sbanner = document.getElementById('GshBanner').style.backgroundImage;
    spositi = document.getElementById('GshBanner').style.backgroundPosition;
    sfooter = document.getElementById('gsh-footer').style.backgroundImage;
    document.getElementById('GshFaviconURL').href = "";
    document.getElementById('GshBanner').style.backgroundImage = "";
    document.getElementById('GshBanner').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)
    digest = strCRC32(text,tlen) + " " + tlen

    document.getElementById('GshFaviconURL').href                = sfavico;
    document.getElementById('GshBanner').style.backgroundImage    = sbanner;
    document.getElementById('GshBanner').style.backgroundPosition = spositi;
    document.getElementById('gsh-footer').style.backgroundImage    = sfooter;
    return digest
}
function html_digest(){
    version = document.getElementById('GshVersion').innerHTML
    digest = getDigest()
    alert("cksum: " + digest + " " + version)
}

// 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('GshFaviconURL').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('GshBanner').style.backgroundImage;
    footer = document.getElementById('gsh-footer').style.backgroundImage;

    document.getElementById('GshFaviconURL').href = "";
    document.getElementById('GStat').style = "";
    document.getElementById('GPos').style = "";
    document.getElementById('GPos').innerHTML = "";
    document.getElementById('GLog').style = "";
    document.getElementById('GLog').innerHTML = "";
    document.getElementById('GMenu').style = "";
    //document.getElementById('GMenu').style.backgroundImage = "";
    //document.getElementById('GMenu').style.backgroundPosition = "";

    document.getElementById('GshBanner').style.backgroundImage = "";
    document.getElementById('GshBanner').style.backgroundPosition = "";
    document.getElementById('gsh-footer').style.backgroundImage = "";
    document.getElementById('rsa-oaep-message').style = "";

    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('GshBanner').style.backgroundImage = banner;
    document.getElementById('gsh-footer').style.backgroundImage = footer;
}
function fill_CSSView(){
    part = document.getElementById('GshStyleDef')
    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('GshBanner').style.backgroundImage;
    footer = document.getElementById('gsh-footer').style.backgroundImage;
    document.getElementById('GshBanner').style.backgroundImage = "";
    document.getElementById('GshBanner').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('GshBanner').style.backgroundImage = banner;
    document.getElementById('gsh-footer').style.backgroundImage = footer

    sty = document.getElementById("GshStyleDef");
    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();
}
GSH = document.getElementById("gsh")

//GSH.onclick = "alert('Ouch!')"
//GSH.css = "{background-color:#eef;}"
//GSH.style = "background-color:#eef;"
//GSH.style.display = false;
//alert('Ouch0!')
//GSH.style.display = true;

// 2020-0904 created, tentative
document.addEventListener('keydown',jgshCommand);
//CurElement = GshStatement
CurElement = GshMenu
MemElement = GshMenu

function nextSib(e){
    n = e.nextSibling;
    for( i = 0; i < 100; i++ ){
        if( n == null ){
            break;
        }
        if( n.nodeName == "DETAILS" ){
            return n;
        }
        n = n.nextSibling;
    }
    return null;
}
function prevSib(e){
    n = e.previousSibling;
    for( i = 0; i < 100; i++ ){
        if( n == null ){
            break;
        }
        if( n.nodeName == "DETAILS" ){
            return n;
        }
        n = n.previousSibling;
    }
    return null;
}
function setColor(e,eName,eColor){
    if( e.hasChildNodes() ){
        s = e.childNodes;
        if( s != null ){
            for( ci = 0; ci < s.length; ci++ ){
                if( s[ci].nodeName == eName ){
                    s[ci].style.color = eColor;
                    //s[ci].style.backgroundColor = eColor;
                    break;
                }
            }
        }
    }
}

// https://docs.microsoft.com/en-us/previous-versions//hh781509(v=vs.85)
function showCurElementPosition(ev){
    if( document.getElementById("GPos") == null ){
        return;
    }
    if( GPos == null ){
        return;
    }
    e = CurElement
    y = e.getBoundingClientRect().top.toFixed(0)
    x = e.getBoundingClientRect().left.toFixed(0)

    h = ev + " "
    h += 'y='+y+", "+ 'x='+x+" -- "
    h += "w=" + window.innerWidth + ", h=" + window.innerHeight + " -- "
    //GPos.test = h
    //GPos.innerHTML = h
    GPos.innerHTML = h
}

function GShellMenu(e){
    d = new Date()
    GLog.innerHTML = "Hello, World! ("
        + d.getFullYear() + "/" + d.getMonth() + "/" + d.getDate() + " "
        + d.getHours() + ":" + d.getMinutes() + ":" + d.getSeconds()
        + "." + d.getMilliseconds()
        + " " + d.getTimezoneOffset()/60
        + " "
        + d.getTime()  + "." + d.getMilliseconds() + ")"

}
// placements of planes
function GShellResizeX(ev){
    if( document.getElementById("GMenu") != null ){
        GMenu.style.left = window.innerWidth - 100
        GMenu.style.top = window.innerHeight - 90
    }
    GStat.style.width = window.innerWidth
    if( document.getElementById("GPos") != null ){
        GPos.style.width = window.innerWidth
        GPos.style.top = window.innerHeight - 30; //GPos.style.height
    }
    if( document.getElementById("GLog") != null ){
        GLog.style.width = window.innerWidth
        GLog.innerHTML = ""
    }
    if( document.getElementById("GLog") != null ){
```

```
        //GLog.innerHTML = "Resize: w=" + window.innerWidth +
        //", h=" + window.innerHeight
    }
    showCurElementPosition(ev)
}
function GShellResize(){
    GShellResizeX("[RESIZE]")
}
window.onresize = GShellResize

function ScrollToElement(oe,ne){
    ne.scrollIntoView()
    ny = ne.getBoundingClientRect().top.toFixed(0)
    nx = ne.getBoundingClientRect().left.toFixed(0)
    GLog.innerHTML = "["+ny+","+nx+"]"
    //window.scrollTo(0,0)

    GTop.style.backgroundColor = "rgba(0,0,0,0.0)"
    GshGrid.style.left = '250px';
    GshGrid.style.zIndex = 0
    return
    oy = oe.getBoundingClientRect().top.toFixed(0)
    ox = oe.getBoundingClientRect().left.toFixed(0)
    y = e.getBoundingClientRect().top.toFixed(0)
    x = e.getBoundingClientRect().left.toFixed(0)
    window.scrollTo(x,y)
    ny = e.getBoundingClientRect().top.toFixed(0)
    nx = e.getBoundingClientRect().left.toFixed(0)
    GLog.innerHTML = "["+oy+","+ox+"]->["+y+","+x+"]->["+ny+","+nx+"]"
}
function jgshCommand(event){
    key = event
    keycode = key.code
    //GStat.style.width = window.innerWidth
    GStat.style.backgroundColor = "rgba(0,0,0,0.4)"

    console.log("JSGsh-Key:"+keycode+"(^-^)/")
    if( keycode == "Digit1" ){ // fold side-bar
        primary.style.width = "94%"
        secondary.style.width = "0%"
        secondary.style.opacity = 0
        GStat.innerHTML = "[Single Column View]"
    }else
    if( keycode == "Digit2" ){ // unfold side-bar
        primary.style.width = "58%"
        secondary.style.width = "36%"
        secondary.style.opacity = 1
        GStat.innerHTML = "[Double Column View]"
    }else
    if( keycode == "KeyU" ){ // fold/unfold all
        html_fold(GshMenuFold);
        location.href = "#"+CurElement.id;
    }else
    if( keycode == "KeyO" || keycode == "ArrowRight" ){ // fold the element
        CurElement.open = !CurElement.open;
    }else
    if( keycode == "ArrowRight" ){ // unfold the element
        CurElement.open = true
    }else
    if( keycode == "ArrowLeft" ){ // unfold the element
        CurElement.open = false
    }else
    if( keycode == "KeyI" ){ // inspect the element
        e = CurElement
        GLog.innerHTML = "Current Element: " + e + "<br>"
            + "name="+e.nodeName + ", "
            + "id="+e.id + ", "
            + "children="+e.childNodes.length + ", "
            + "parent="+e.parentNode.id + "<br>"
            + "text="+e.textContent
        GStat.style.backgroundColor = "rgba(0,0,0,0.8)"
        return
    }else
    if( keycode == "KeyM" ){ // memory the position
        MemElement = CurElement
    }else
    if( keycode == "KeyN" || keycode == "ArrowDown" ){ // next element
        e = nextSib(CurElement)
        if( e != null ){
            setColor(CurElement,"SUMMARY","#fff")
            setColor(e,"SUMMARY","#8f8") // should be complement ?
            oe = CurElement
            CurElement = e
            //location.href = "#"+e.id;
            ScrollToElement(oe,e)
        }
    }else
    if( keycode == "KeyP" || keycode == "ArrowUp" ){ // previous element
        oe = CurElement
        e = prevSib(CurElement)
        if( e != null ){
            setColor(CurElement,"SUMMARY","#fff")
            setColor(e,"SUMMARY","#8f8") // should be complement ?
            CurElement = e
            //location.href = "#"+e.id;
            ScrollToElement(oe,e)
        }else{
            e = document.getElementById("GshBanner")
            if( e != null ){
                setColor(CurElement,"SUMMARY","#fff")
                CurElement = e
                ScrollToElement(oe,e)
            }else{
                e = document.getElementById("primary")
                if( e != null ){
                    setColor(CurElement,"SUMMARY","#fff")
                    CurElement = e
                    ScrollToElement(oe,e)
                }
            }
        }
    }else
    if( keycode == "KeyR" ){
        location.reload()
    }else
    if( keycode == "KeyJ" ){
        GshGrid.style.top = '120px';
        GshGrid.innerHTML = '(>_<){Down}';
    }else
    if( keycode == "KeyK" ){
        GshGrid.style.top = '0px';
        GshGrid.innerHTML = '(^-^){Up}';
    }else
    if( keycode == "KeyH" ){
        GshGrid.style.left = '0px';
```

```
        GshGrid.innerHTML = "('_'){Left}";
    }else
    if( keycode == "KeyL" ){
        GLog.innerHTML +=
            'screen='+screen.width+'px'+'<br>'+
            'window='+window.innerWidth+'px'+'<br>'
        GshGrid.style.left = (document.documentElement.clientWidth-160).toString(10)+'px';
        GshGrid.innerHTML = '(@_@){Right}';
    }else
    if( keycode == "KeyS" ){
        html_stop(GshMenuStop,true)
    }else
    if( keycode == "KeyF" ){
        html_fork()
    }else
    if( keycode == "KeyC" ){
        window.close()
    }else
    if( keycode == "KeyD" ){
        html_digest()
    }

    showCurElementPosition("["+key.code+"] --");
    if( document.getElementById("GPos") != null ){
        //GPos.innerHTML += "["+key.code+"] --"
    }
    //GShellResizeX("["+key.code+"] --");
}
GShellResizeX("[INIT]");
//showCurElementPosition("[INIT]");
GLog.innerHTML +=
      "-- GShell: " + GshVersion.innerHTML
    + "<br>" + "-- Digest: " + getDigest()
    + "<br>" + "-- Display: " + 'screen='+screen.width+'px'+', '+
    'window='+window.innerWidth+'px'
</script>


<!-- ###################### WebCrypto ######################### -->
<details id="WebCrypto"><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:#f8f8f8 !important; font-size:13pt !impotant;
 }
 #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="">
      </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>
```