```
//<html><details open><summary>GShell-0.2.5-HtmlArchive</summary>
/*<span id="gsh">
<link rel="icon" id="gsh-iconurl" href=""><!-- place holder -->
<meta charset="UTF-8">
<meta name="viewport" content="width=device-width, initial-scale=1.0">
<title>GShell-0.2.4 by SatoxITS</title>
<header id="gsh-banner" height="100px" onclick="shiftBG();" style="">
<div align="right"><note>GShell version 0.2.5 // 2020-08-29 // SatoxITS</note></div>
</header>
<h2>GShell // a General purpose Shell built on the top of Golang</h2>
<p>
<note>
It is a shell for myself, by myself, of myself. --SatoxITS(^-^)
</note>
</p>
<span id="gsh-WinId" onclick="win_jump('0.1');">0</span>
<span id="gsh-menu">
| <span id="gsh-menu-exit" onclick="html_close();"></span>
| <span id="gsh-menu-fork" onclick="html_fork();">Fork</span>
| <span id="gsh-menu-stop" onclick="html_stop(this,true);">Stop</span>
| <span id="gsh-menu-fold" onclick="html_fold(this);">Unfold</span>
<!-- | <span id="gsh-menu-pure" onclick="html_pure(this);">Pure</span> -->
|</span>
*/
/*
<details id="gsh-statement" open><summary>Statement</summary><p id="gsh-statement">
<h2>Fun to create a shell</h2>
<p>For a programmer, it must be far easy and fun to create his own simple shell
rightly fitting to his favor and necessities, than learning existing shells with
complex full features that he never use.
I, as one of programmers, am writing this tiny shell for my own real needs,
totally from scratch, with fun.
</p><p>
For a programmer, it is fun to learn new computer languages.  For long years before
writing this software, I had been specialized to C and early HTML2 :-).
Now writing this software,  I'm learning Go language, HTML5, JavaScript and CSS
on demand as a novice of these, with fun.
</p><p>
This single file "gsh.go", that is executable by Go, contains all of the code written
in Go. Also it can be displayed as "gsh.go.html" by browsers. It is a standalone
HTML file that works as the viewer of the code of itself, and as the "home page" of
this software.
</p><p>
Because this HTML file is a Go program, you may run it as a real shell program
on your computer.
But you must be aware that this program is written under situation like above.
Needless to say, there is no warranty for this program in any means.
</p>
<address>Aug 2020, SatoxITS (sato@its-more.jp)</address>
</details>
*/
/*
<details id="gsh-gindex" open>
<summary>Index</summary><div class="gsh-src">
Documents
    <span class="gsh-link" onclick="jumpto_JavaScriptView();">Command summary</span>
Go lang part<span class="gsh-src" onclick="document.getElementById('gsh-gocode').open=true;">
    Package structures
        <a href="#import">import</a>
        <a href="#struct">struct</a>
    Main functions
        <a href="#comexpansion">str-expansion</a>   // macro processor
        <a href="#finder">finder</a>        // builtin find + du
        <a href="#grep">grep</a>        // builtin grep + wc + cksum + ...
        <a href="#plugin">plugin</a>        // plugin commands
        <a href="#ex-commands">system</a>       // external commands
        <a href="#builtin">builtin</a>      // builtin commands
        <a href="#network">network</a>      // socket handler
        <a href="#remote-sh">remote-sh</a>  // remote shell
        <a href="#redirect">redirect</a>    // StdIn/Out redireciton
        <a href="#history">history</a>      // command history
        <a href="#rusage">rusage</a>        // resouce usage
        <a href="#encode">encode</a>        // encode / decode
        <a href="#IME">IME</a>      // command line IME
        <a href="#getline">getline</a>      // line editor
        <a href="#scanf">scanf</a>      // string decomposer
        <a href="#interpreter">interpreter</a>  // command interpreter
        <a href="#main">main</a>
</span>
JavaScript part
    <a href="#script-src-view" class="gsh-link" onclick="jumpto_JavaScriptView();">Source</a>
    <a href="#gsh-data-frame" class="gsh-link" onclick="jumpto_DataView();">Builtin data</a>
CSS part
    <a href="#style-src-view" class="gsh-link" onclick="jumpto_StyleView();">Source</a>
References
    <a href="#" class="gsh-link" onclick="jumpto_WholeView();">Internal</a>
    <a href="#gsh-reference" class="gsh-link" onclick="jumpto_ReferenceView();">External</a>
Whole parts
    <a href="#whole-src-view" class="gsh-link" onclick="jumpto_WholeView();">Source</a>
    <a href="#whole-src-view" class="gsh-link" onclick="jumpto_WholeView();">Download</a>
    <a href="#whole-src-view" class="gsh-link" onclick="jumpto_WholeView();">Dump</a>

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

package main // gsh main
// <a name="import">Imported packages</a> // <a href="https://golang.org/pkg/">Packages</a>
import (
    "fmt"       // <a href="https://golang.org/pkg/fmt/">fmt</a>
    "strings"   // <a href="https://golang.org/pkg/strings/">strings</a>
    "strconv"   // <a href="https://golang.org/pkg/strconv/">strconv</a>
    "sort"      // <a href="https://golang.org/pkg/sort/">sort</a>
    "time"      // <a href="https://golang.org/pkg/time/">time</a>
    "bufio"     // <a href="https://golang.org/pkg/bufio/">bufio</a>
    "io/ioutil" // <a href="https://golang.org/pkg/io/ioutil/">ioutil</a>
    "os"        // <a href="https://golang.org/pkg/os/">os</a>
    "syscall"   // <a href="https://golang.org/pkg/syscall/">syscall</a>
    "plugin"    // <a href="https://golang.org/pkg/plugin/">plugin</a>
    "net"       // <a href="https://golang.org/pkg/net/">net</a>
    "net/http"  // <a href="https://golang.org/pkg/net/http/">http</a>
    //"html"    // <a href="https://golang.org/pkg/html/">html</a>
    "path/filepath" // <a href="https://golang.org/pkg/path/filepath/">filepath</a>
    "go/types"   // <a href="https://golang.org/pkg/go/types/">types</a>
    "go/token"   // <a href="https://golang.org/pkg/go/token/">token</a>
    "encoding/base64"   // <a href="https://golang.org/pkg/encoding/base64/">base64</a>
    "unicode/utf8"  // <a href="https://golang.org/pkg/unicode/utf8/">utf8</a>
    //"gshdata" // gshell's logo and source code
    "hash/crc32"    // <a href="https://golang.org/pkg/unicode/hash/crc32/">crc32</a>
```

```
)
const (
    NAME = "gsh"
    VERSION = "0.2.5"
    DATE = "2020-08-29"
    AUTHOR = "SatoxITS(^-^)/"
)
var (
    GSH_HOME = ".gsh"   // under home directory
    GSH_PORT = 9999
    MaxStreamSize = int64(128*1024*1024*1024) // 128GiB is too large?
    PROMPT = "> "
    LINESIZE = (8*1024)
    PATHSEP = ":"   // should be ";" in Windows
    DIRSEP = "/"    // canbe \ in Windows
)

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

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

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

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

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

    SUM_SUM16_BSD   = 0x001000 // UNIXsum -sum -bsd
    SUM_SUM16_SYSV  = 0x002000 // UNIXsum -sum -sysv
    SUM_UNIXFILE    = 0x004000
    SUM_CRCIEEE = 0x008000
)
type CheckSum struct {
    Files       int64   // the number of files (or data)
    Size        int64   // content size
    Words       int64   // word count
    Lines       int64   // line count
    SumType     int
    Sum64       uint64
    Crc32Table  crc32.Table
    Crc32Val    uint32
    Sum16       int
    Ctime       time.Time
    Atime       time.Time
    Mtime       time.Time
    Start       time.Time
    Done        time.Time
    RusgAtStart [2]syscall.Rusage
    RusgAtEnd   [2]syscall.Rusage
}
type ValueStack [][]string
type GshContext struct {
    StartDir    string  // the current directory at the start
    GetLine     string  // gsh-getline command as a input line editor
    ChdirHistory    []GChdirHistory // the 1st entry is wd at the start
    gshPA       syscall.ProcAttr
    CommandHistory  []GCommandHistory
    CmdCurrent  GCommandHistory
    BackGround  bool
    BackGroundJobs  []int
    LastRusage  syscall.Rusage
    GshHomeDir  string
    TerminalId  int
    CmdTrace    bool // should be [map]
    CmdTime     bool // should be [map]
```

```
	PluginFuncs []PluginInfo
	iValues     []string
	iDelimiter  string // field sepearater of print out
	iFormat     string // default print format (of integer)
	iValStack   ValueStack
	LastServer  GServer
	RSERV       string // [gsh://]host[:port]
	RWD     string // remote (target, there) working directory
	lastCheckSum    CheckSum
}

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

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

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

// - rewriting should be context dependent
// - should postpone until the real point of evaluation
// - should rewrite only known notation of symobl
func scanInt(str string)(val int,leng int){
	leng = -1
	for i,ch := range str {
		if '0' <= ch && ch <= '9' {
			leng = i+1
		}else{
			break
		}
	}
	if 0 < leng {
		ival,_ := strconv.Atoi(str[0:leng])
		return ival,leng
	}else{
		return 0,0
	}
}
func substHistory(gshCtx *GshContext,str string,i int,rstr string)(leng int,rst string){
	if len(str[i+1:]) == 0 {
		return 0,rstr
	}
	hi := 0
	histlen := len(gshCtx.CommandHistory)
	if str[i+1] == '!' {
		hi = histlen - 1
		leng = 1
	}else{
		hi,leng = scanInt(str[i+1:])
		if leng == 0 {
			return 0,rstr
		}
		if hi < 0 {
			hi = histlen + hi
		}
	}
	if 0 <= hi && hi < histlen {
		var ext byte
		if 1 < len(str[i+leng:]) {
			ext = str[i+leng:][1]
		}
		//fmt.Printf("--D-- %v(%c)\n",str[i+leng:],str[i+leng])
		if ext == 'f' {
			leng += 1
			xlist := []string{}
			list := gshCtx.CommandHistory[hi].FoundFile
			for _,v := range list {
				//list[i] = escapeWhiteSP(v)
				xlist = append(xlist,escapeWhiteSP(v))
			}
			//rstr += strings.Join(list," ")
			rstr += strings.Join(xlist," ")
		}else
		if ext == '@' || ext == 'd' {
			// !N@ .. workdir at the start of the command
			leng += 1
			rstr += gshCtx.CommandHistory[hi].WorkDir
		}else{
			rstr += gshCtx.CommandHistory[hi].CmdLine
		}
	}else{
		leng = 0
	}
	return leng,rstr
}
func escapeWhiteSP(str string)(string){
	if len(str) == 0 {
		return "\\z" // empty, to be ignored
	}
	rstr := ""
	for _,ch := range str {
		switch ch {
			case '\\': rstr += "\\\\"
			case ' ': rstr += "\\s"
			case '\t': rstr += "\\t"
			case '\r': rstr += "\\r"
			case '\n': rstr += "\\n"
			default: rstr += string(ch)
		}
	}
	return rstr
}
func unescapeWhiteSP(str string)(string){ // strip original escapes
	rstr := ""
	for i := 0; i < len(str); i++ {
		ch := str[i]
		if ch == '\\' {
			if i+1 < len(str) {
				switch str[i+1] {
					case 'z':
						continue;
				}
			}
		}
		rstr += string(ch)
	}
	return rstr
}
func unescapeWhiteSPV(strv []string)([]string){ // strip original escapes
	ustrv := []string{}
	for _,v := range strv {
		ustrv = append(ustrv,unescapeWhiteSP(v))
	}
	return ustrv
}

// <a name="comexpansion">str-expansion</a>
// - this should be a macro processor
func strsubst(gshCtx *GshContext,str string,histonly bool) string {
	rbuff := []byte{}
	if false {
		//@@U Unicode should be cared as a character
		return str
	}
	//rstr := ""
	inEsc := 0 // escape characer mode
	for i := 0; i < len(str); i++ {
		//fmt.Printf("--D--Subst %v:%v\n",i,str[i:])
		ch := str[i]
		if inEsc == 0 {
			if ch == '!' {
				//leng,xrstr := substHistory(gshCtx,str,i,rstr)
				leng,rs := substHistory(gshCtx,str,i,"")
				if 0 < leng {
	//_,rs := substHistory(gshCtx,str,i,"")
	rbuff = append(rbuff,[]byte(rs)...)
					i += leng
					//rstr = xrstr
					continue
				}
			}
			switch ch {
				case '\\': inEsc = '\\'; continue
				//case '%':  inEsc = '%';  continue
				case '$':
			}
		}
		switch inEsc {
		case '\\':
			switch ch {
				case '\\': ch = '\\'
				case 's': ch = ' '
				case 't': ch = '\t'
				case 'r': ch = '\r'
				case 'n': ch = '\n'
				case 'z': inEsc = 0; continue // empty, to be ignored
			}
			inEsc = 0
		case '%':
			switch {
				case ch == '%': ch = '%'
				case ch == 'T':
					//rstr = rstr + time.Now().Format(time.Stamp)
	rs := time.Now().Format(time.Stamp)
	rbuff = append(rbuff,[]byte(rs)...)
					inEsc = 0
					continue;
				default:
					// postpone the interpretation
					//rstr = rstr + "%" + string(ch)
	rbuff = append(rbuff,ch)
					inEsc = 0
					continue;
			}
			inEsc = 0
		}
		//rstr = rstr + string(ch)
		rbuff = append(rbuff,ch)
	}
	//fmt.Printf("--D--subst(%s)(%s)\n",str,string(rbuff))
	return string(rbuff)
	//return rstr
}
func showFileInfo(path string, opts []string) {
	if isin("-l",opts) || isin("-ls",opts) {
		fi, err := os.Stat(path)
		if err != nil {
			fmt.Printf("---------- ((%v))",err)
		}else{
			mod := fi.ModTime()
			date := mod.Format(time.Stamp)
			fmt.Printf("%v %8v %s ",fi.Mode(),fi.Size(),date)
		}
	}
	fmt.Printf("%s",path)
	if isin("-sp",opts) {
		fmt.Printf(" ")
```

```
    }else
    if ! isin("-n",opts) {
        fmt.Printf("\n")
    }
}
func userHomeDir()(string,bool){
    /*
    homedir,_ = os.UserHomeDir() // not implemented in older Golang
    */
    homedir,found := os.LookupEnv("HOME")
    //fmt.Printf("--I-- HOME=%v(%v)\n",homedir,found)
    if !found {
        return "/tmp",found
    }
    return homedir,found
}

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

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

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

// CRC32 <a href="http://golang.jp/pkg/hash-crc32">crc32</a>
// 1 0000 0100 1100 0001 0001 1101 1011 0111
var CRC32UNIX uint32 = uint32(0x04C11DB7) // Unix cksum
var CRC32IEEE uint32 = uint32(0xEDB88320)
```

```
func byteCRC32add(crc uint32,str[]byte,len uint64)(uint32){
    var i uint64
    for i = 0; i < len; i++ {
        var oct = str[i]
        for bi := 0; bi < 8; bi++ {
            ovf1 := (crc & 0x80000000) != 0
            ovf2 := (oct & 0x80) != 0
            ovf := (ovf1 && !ovf2) || (!ovf1 && ovf2)
            oct <<= 1
            crc <<= 1
            if ovf { crc ^= CRC32UNIX }
        }
    }
    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 byteCRC32(str[]byte,len uint64)(crc uint32){
    crc = byteCRC32add(0,str,len)
    crc = byteCRC32end(crc,len)
    return crc
}
func CRC32Finish(crc uint32, table *crc32.Table, len uint64)(uint32){
    var slen = make([]byte,4)
    var li = 0
        for li = 0; li < 4; {
                slen[li] = byte(len & 0xFF)
        li += 1
                len >>= 8
                if( len == 0 ){
                        break
        }
        }
    crc = crc32.Update(crc,table,slen)
        crc ^= 0xFFFFFFFF
        return crc
}

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

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

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

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

	fmt.Printf("%v: %v files (%vd %vs %vh) %.6f MB (%.2f MBK)\n",
		dir,
		fusage.Files,
		fusage.Dirs,
		fusage.SymLink,
		fusage.HLinks,
		float64(fusage.Size)/1000000.0,bsume);
}
const (
	S_IFMT    = 0170000
	S_IFCHR   = 0020000
	S_IFDIR   = 0040000
	S_IFREG   = 0100000
	S_IFLNK   = 0120000
	S_IFSOCK  = 0140000
)
func cumFinfo(fsum *fileSum, path string, staterr error, fstat syscall.Stat_t, argv[]string,verb bool)(*fileSum){
	now := time.Now()
	if time.Second <= now.Sub(fsum.nextRepo) {
		if !fsum.nextRepo.IsZero(){
			tstmp := now.Format(time.Stamp)
			showFusage(tstmp,fsum)
		}
		fsum.nextRepo = now.Add(time.Second)
	}
	if staterr != nil {
		fsum.Err += 1
		return fsum
	}
	fsum.Files += 1
	if 1 < fstat.Nlink {
		// must count only once...
		// at least ignore ones in the same directory
		//if finfo.Mode().IsRegular() {
		if (fstat.Mode & S_IFMT) == S_IFREG {
			fsum.HLinks += 1
			fsum.DupBlocks += int64(fstat.Blocks)
			//fmt.Printf("---Dup HardLink %v %s\n",fstat.Nlink,path)
		}
	}
	//fsum.Size += finfo.Size()
	fsum.Size += fstat.Size
	fsum.Blocks += int64(fstat.Blocks)
	//if verb { fmt.Printf("(%8dBlk) %s",fstat.Blocks/2,path) }
	if isin("-ls",argv){
		//if verb { fmt.Printf("%4d %8d ",fstat.Blksize,fstat.Blocks) }
//		fmt.Printf("%d\t",fstat.Blocks/2)
	}
	//if finfo.IsDir()
	if (fstat.Mode & S_IFMT) == S_IFDIR {
		fsum.Dirs += 1
	}
	//if (finfo.Mode() & os.ModeSymlink) != 0
	if (fstat.Mode & S_IFMT) == S_IFLNK {
		//if verb { fmt.Printf("symlink(%v,%s)\n",fstat.Mode,finfo.Name()) }
		//{ fmt.Printf("symlink(%o,%s)\n",fstat.Mode,finfo.Name()) }
		fsum.SymLink += 1
	}
	return fsum
```

```
}
func (gsh*GshContext)xxFindEntv(depth int,total *fileSum,dir string, dstat syscall.Stat_t, ei int, entv []string,npatv[]string,argv[]string)(*fileSum){
	nols := isin("-grep",argv)
	// sort entv
	/*
	if isin("-t",argv){
		sort.Slice(filev, func(i,j int) bool {
			return 0 < filev[i].ModTime().Sub(filev[j].ModTime())
		})
	}
	*/
		/*
		if isin("-u",argv){
			sort.Slice(filev, func(i,j int) bool {
				return 0 < filev[i].AccTime().Sub(filev[j].AccTime())
			})
		}
		if isin("-U",argv){
			sort.Slice(filev, func(i,j int) bool {
				return 0 < filev[i].CreatTime().Sub(filev[j].CreatTime())
			})
		}
		*/
	/*
	if isin("-S",argv){
		sort.Slice(filev, func(i,j int) bool {
			return filev[j].Size() < filev[i].Size()
		})
	}
	*/
	for _,filename := range entv {
		for _,npat := range npatv {
			match := true
			if npat == "*" {
				match = true
			}else{
				match, _ = filepath.Match(npat,filename)
			}
			path := dir + DIRSEP + filename
			if !match {
				continue
			}
			var fstat syscall.Stat_t
			staterr := syscall.Lstat(path,&fstat)
			if staterr != nil {
				if !isin("-w",argv){fmt.Printf("ufind: %v\n",staterr) }
				continue;
			}
			if isin("-du",argv) && (fstat.Mode & S_IFMT) == S_IFDIR {
				// should not show size of directory in "-du" mode ...
			}else
			if !nols && !isin("-s",argv) && (!isin("-du",argv) || isin("-a",argv)) {
				if isin("-du",argv) {
					fmt.Printf("%d\t",fstat.Blocks/2)
				}
				showFileInfo(path,argv)
			}
			if true { // && isin("-du",argv)
				total = cumFinfo(total,path,staterr,fstat,argv,false)
			}
			/*
			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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

```go

// 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 == "close":
		gshCtx.xClose(argv)
	case cmd == "gcp":
		gshCtx.FileCopy(argv)
	case cmd == "dec" || cmd == "decode":
		gshCtx.Dec(argv)
	case cmd == "#define":
	case cmd == "dic":
		xDic(argv)
	case cmd == "dump":
		gshCtx.Dump(argv)
	case cmd == "echo":
		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(0)
	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":
		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
}
func fputc(ch int , fp*os.File)(int){
    var buf [1]byte
    buf[0] = byte(ch)
    fp.Write(buf[0:1])
    return 0
}
func fputs(buf StrBuff, fp*os.File)(int){
    fp.Write(buf)
    return 0
}
func xfputss(str string, fp*os.File)(int){
    return fputs([]byte(str),fp)
}
func sscanf(str StrBuff,fmts string, params ...interface{})(int){
    fmt.Sscanf(string(str[0:strlen(str)]),fmts,params...)
    return 0
}
func fprintf(fp*os.File,fmts string, params ...interface{})(int){
    fmt.Fprintf(fp,fmts,params...)
    return 0
}

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

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

```go
	fprintf(out,"...   \\x -- Replace the last input character with it Hexa-Decimal\n",)
}
func xDic(argv[]string){
	if len(argv) <= 1 {
		helpDic(argv)
		return
	}
	argv = argv[1:]
	var debug = false
	var info = false
	var dump = false
	cmd := argv[0]
	argv = argv[1:]
	opt := ""
	arg := ""

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

	dicName := ""
	dicURL := ""
	if 0 < len(argv) {
		arg = argv[0]
		argv = argv[1:]
	}
	if false {
		fprintf(stderr,"--Dd-- com(%v) opt(%v) arg(%v)\n",cmd,opt,arg)
	}
	if cmd == DIC_COM_LOAD {
		switch arg {
			default:
				dicName = "WorldDic"
				dicURL = WorldDic
				if info {
				fprintf(stderr,"--Id-- default dictionary \"%v\"\n",dicName);
				}
			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])
		if debug {
			fprintf(stderr,"--Id-- WorldDic %v text...\n",dicName)
			fprintf(stderr,"%v\n",string(body))
		}
		entv := strings.Split(string(body),"\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 info {
			fprintf(stderr,"--Id-- %v scan... %v added, %v dup. / %v total\n",
				dicName,added,dup,len(Romkan));
		}
		// 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);
	return 0;
}

//-------------------------------------------------------------- LINEEDIT
// "?" at the top of the line means searching history

const (
	GO_UP = 201
	GO_DOWN = 202
	GO_RIGHT = 203
	GO_LEFT = 204
	DEL_RIGHT= 205
	EV_TIMEOUT = 206
	EV_IDLE = 207
)

// should return number of octets ready to be read immediately
//fprintf(stderr,"\n--Select(%v %v)\n",err,r.Bits[0])


var EventRecvFd = -1 // file descriptor
var EventSendFd = -1
const EventFdOffset = 1000000
const NormalFdOffset = 100

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

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

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

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

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

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

	var buf [1]byte

	if EventFdOffset <= readyFd {
		fd := int(readyFd-EventFdOffset)
		_,err := syscall.Read(fd,buf[0:1])
		if( err != nil ){
			return EOF;
		}else{
			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")
	}
	return fmt.Sprintf("%X",ch)
}
func (gsh*GshContext)xScanReplay(hix int,replay bool){
	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 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)
			}
		}else{
			fmt.Printf("%7.3fms #%-3v !%-3v [%v.%06d] %3v %02X %-4v %10.3fms\n",
				float64(diff)/1000000.0,
				i,
				e.CmdIndex,
				e.when.Format(time.Stamp),micro,
				e.event,e.event,visibleChar(e.event),
				float64(e.evarg)/1000000.0)
		}
		if e.event == EV_IDLE {
			nsleep(time.Duration(e.evarg))
		}
	}
}
func dumpEvents(hix int){
	for i,e := range Events {
		nano := e.when.Nanosecond()
		micro := nano / 1000
		//if e.event != EV_TIMEOUT {
		if hix == 0 || e.CmdIndex == hix {
			fmt.Printf("#%-3v !%-3v [%v.%06d] %3v %02X %-4v %10.3fms\n",i,
				e.CmdIndex,
				e.when.Format(time.Stamp),micro,
				e.event,e.event,visibleChar(e.event),float64(e.evarg)/1000000.0)
		}
		//}
	}
}
func fgetcTimeout(fp *os.File,usec int)(int){
	ch := fgetcTimeout1(fp,usec)
	if ch != EV_TIMEOUT {
		now := time.Now()
		if 0 < len(Events) {
			last := Events[len(Events)-1]
			dura := int64(now.Sub(last.when))
			Events = append(Events,Event{last.when,EV_IDLE,dura,last.CmdIndex})
		}
		Events = append(Events,Event{time.Now(),ch,0,CmdIndex})
	}
	return ch
}

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

	if 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 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")
		}
	}
}
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();
}
func (iin*IInput)xgetline1(prevline string, gsh*GshContext)(string){
	var ch int;
	iin.Redraw();
	for {
		iin.pinJmode = iin.inJmode
		iin.inJmode = false

		ch = iin.Getc(1000*1000)
		//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 == 'j' || ch == 'J' ){
                iin.Translate(cmdch);
                continue
            }else
            if( ch == 'i' || ch == 'I' ){
                iin.Replace(cmdch);
                continue
            }else
            if( ch == 'l' || ch == 'L' ){
                MODE_LowerLock = !MODE_LowerLock
                MODE_CapsLock = false
                if MODE_ViTrace {
                    fprintf(stderr,"%v\r\n",string(cmdch));
                }
                iin.Redraw();
                continue
            }else
            if( ch == 'u' || ch == 'U' ){
                MODE_CapsLock = !MODE_CapsLock
                MODE_LowerLock = false
                if MODE_ViTrace {
                    fprintf(stderr,"%v\r\n",string(cmdch));
                }
                iin.Redraw();
                continue
            }else
            if( ch == 'v' || ch == 'V' ){
                MODE_ViTrace = !MODE_ViTrace
                if MODE_ViTrace {
                    fprintf(stderr,"%v\r\n",string(cmdch));
                }
                iin.Redraw();
                continue
            }else
            if( ch == 'c' || ch == 'C' ){
                if 0 < len(iin.line) {
                    xline,tail := delTailChar(iin.line)
                    if len([]byte(tail)) == 1 {
                        ch = int(tail[0])
                        if( 'a' <= ch && ch <= 'z' ){
                            ch = ch + 'A'-'a'
                        }else
                        if( 'A' <= ch && ch <= 'Z' ){
                            ch = ch + 'a'-'A'
                        }
                        iin.line = xline + string(ch)
                    }
                }
                if MODE_ViTrace {
                    fprintf(stderr,"%v\r\n",string(cmdch));
                }
                iin.Redraw();
                continue
            }else{
                iin.pch = append(iin.pch,ch) // push
                ch = '\\'
            }
        }
        switch( ch ){
            case 'P'-0x40: ch = GO_UP
            case 'N'-0x40: ch = GO_DOWN
            case 'B'-0x40: ch = GO_LEFT
            case 'F'-0x40: ch = GO_RIGHT
        }
        //fprintf(stderr,"B[%02X]\n",ch);
        switch( ch ){
            case 0:
                continue;

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

            case EV_TIMEOUT:
                iin.Redraw();
                if iin.pinJmode {
                    fprintf(stderr,"\\J\r\n")
                    iin.inJmode = true
                }
                continue
            case GO_UP:
                if iin.lno == 1 {
                    continue
                }
                cmd,ok := gsh.cmdStringInHistory(iin.lno-1)
                if ok {
                    iin.line = cmd
                    iin.right = ""
                    iin.lno = iin.lno - 1
                }
                iin.Redraw();
                continue
            case GO_DOWN:
                cmd,ok := gsh.cmdStringInHistory(iin.lno+1)
                if ok {
                    iin.line = cmd
                    iin.right = ""
                    iin.lno = iin.lno + 1
                }else{
                    iin.line = ""
                    iin.right = ""
                    if iin.lno == iin.lastlno-1 {
                        iin.lno = iin.lno + 1
                    }
                }
                iin.Redraw();
                continue
            case GO_LEFT:
                if 0 < len(iin.line) {
                    xline,tail := delTailChar(iin.line)
                    iin.line = xline
                    iin.right = tail + iin.right
                }
                iin.Redraw();
                continue;
            case GO_RIGHT:
                if( 0 < len(iin.right) && iin.right[0] != 0 ){
                    xright,head := delHeadChar(iin.right)
                    iin.right = xright
                    iin.line += head
                }
                iin.Redraw();
                continue;
            case EOF:
                goto EXIT;
            case 'R'-0x40: // replace
                dst := convs(iin.line+iin.right);
                iin.line = dst
                iin.right = ""
                iin.Redraw();
                continue;
            case 'T'-0x40: // just show the result
                readDic();
                romkanmode = !romkanmode;
                iin.Redraw();
                continue;
            case 'L'-0x40:
                iin.Redraw();
                continue
            case 'K'-0x40:
                iin.right = ""
                iin.Redraw();
                continue
            case 'E'-0x40:
                iin.line += iin.right
                iin.right = ""
                iin.Redraw();
                continue
            case 'A'-0x40:
                iin.right = iin.line + iin.right
                iin.line = ""
                iin.Redraw();
                continue
            case 'U'-0x40:
                iin.line = ""
                iin.right = ""
                iin.clearline();
                iin.Redraw();
                continue;
            case DEL_RIGHT:
                if( 0 < len(iin.right) ){
                    iin.right,_ = delHeadChar(iin.right)
                    iin.Redraw();
                }
                continue;
            case 0x7F: // BS? not DEL
                if( 0 < len(iin.line) ){
                    iin.line,_ = delTailChar(iin.line)
                    iin.Redraw();
                }
                /*
                else
                if( 0 < len(iin.right) ){
                    iin.right,_ = delHeadChar(iin.right)
                    iin.Redraw();
                }
                */
                continue;
            case 'H'-0x40:
                if( 0 < len(iin.line) ){
                    iin.line,_ = delTailChar(iin.line)
                    iin.Redraw();
                }
                continue;
        }
        if( ch == '\n' || ch == '\r' ){
            iin.line += iin.right;
            iin.right = ""
            iin.Redraw();
            fputc(ch,stderr);
            break;
        }
        if MODE_CapsLock {
            if 'a' <= ch && ch <= 'z' {
                ch = ch+'A'-'a'
            }
        }
        if MODE_LowerLock {
            if 'A' <= ch && ch <= 'Z' {
                ch = ch+'a'-'A'
            }
        }
        iin.line += string(ch);
        iin.Redraw();
    }
EXIT:
    return iin.line + iin.right;
}

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

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

//
// $USERHOME/.gsh/
//      gsh-rc.txt, or gsh-configure.txt
```

```go
//              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">
var WorldDic = //<span id="gsh-world-dic">
"data:text/dic;base64,"+
"Ly8gTXlJTUUvMC4wLjEg6L6e5pu4ICgyMDIwLTA4MTlhKQpzZWthaSDkuJbnlYwKa28g44GT"+
"Cm5uIOOCkwpuaSDjgasKY2hpIOOBoQp0aSDjgaEKaGEg44GvCnNlIOOBmwprYSDjgYsKaSDj"+
"gYQK";
//</span>
var JA_JKLDic = //<span id="gsh-ja-jkl-dic">
"data:text/dic;base64,"+
"Ly92ZXJsCU15SU1FamRpY2ptb3JzZWpKQWpKS0woMjAyMGowODE5KSheLV4pL1NhdG94SVRT"+
"CmtqamprbGtqa2tsa2psIOS4lueVjApqamtqamwJ44GCCmtqbAnjgYQKa2tqbAnjgYYKamtq"+
"amwJ44GICmtqa2trbAnjgYoKa2pra2wJ44GLCmpramtrbAnjgY0Ka2tramwJ44GPCmpramps"+
"CeOBkQpqampqbAnjgZMKamtqa2psCeOBlQpqamtqa2wJ44GXCmpqamtqbAnjgZkKa2pqamts"+
"CeOBmwpqamprbAnjgZ0KamtsCeOBnwpra2prbAnjgaEKa2pqa2wJ44GkCmtqa2pqbAnjgaYK"+
"a2tqa2tsCeOBqApramtsCeOBqgpqa2prbAnjgasKa2tra2wJ44GsCmpqa2psCeOBrQpra2pq"+
"bAnjga4Kamtra2wJ44GvCmpqa2tqbAnjgbIKampra2wJ44G1CmtsCeOBuApqa2tsCeOBuwpq"+
"a2tqbAnjgb4Ka2tqa2psCeOBvwpqbAnjgoAKamtra2psCeOCgQpqa2tqa2wJ44KCCmtqamwJ"+
"44KECmpra2pqbAnjgoYKampsCeOCiApra2tsCeOCiQpqamtsCeOCigpqa2pqa2wJ44KLCmpq"+
"amwJ44KMCmtqa2psCeOCjQpqa2psCeOCjwpramtramwJ44KQCmtqamtrbAnjgpEKa2pqamwJ"+
"44KSCmtqa2prbAnjgpMKa2pqa2psCeODvApra2wJ44KbCmtramprbAnjgpwKa2pramtqbAnj"+
"gIEK";
```

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

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

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

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

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

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

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


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

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

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

<!--
// Logo image should be drawn by JavaScript from a meta-font.
// CSS seems not follow line-splitted URL
-->
<script id="gsh-data">
//GshLogo="QR-ITS-more.jp.png"
GshLogo="data:image/png;base64,\
```

```
iVBORw0KGgoAAAANSUhEUgAAAQEAAAB/CAYAAADvs3f4AAAAAXNSR0IArs4c6QAAAHhlWElm\
TU0AKgAAAAgABAEaAAUAAAABAAAAPgEbAAUAAAABAAAARgEoAAMAAAABAAIAAIdpAAQAAAAB\
AAAATgAAAAAAAABIAAAAAQAAAEgAAAABAAOgAQADAAAAAQABAACgAgAEAAAAAQAAAQGgAwAE\
AAAAAQAAAH8AAAAAYx1BhgAAAAlwSFlzAAALEwAACxMBAJqcGAAAF3RJREFUeAHtnQuUFNWZ\
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fnXvdx8tBA8SIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAES\
IAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAES\
IAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAES\
IAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIAESIIFDl4A8dLP2\
2eXs9H9+ftSkSdHxsic2qqdE7YusS+1qaalKfnY5YsokMHwEPtdK4MQFz5UeExlbLYSaYUl5\
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jbOVHCstMRb3USXEJ8hFu7DsdmFb2+xU4vWWFVXbBpMeZUlAE/hcKoGab66eKGOlNykh56PC\
HxH2VVBKoRKqh3qUeKi1YdaOfONJ56OkdI6w5BwomnOQlyPzi0OJ56/PiyovfK/60p2P/Piyovf\
N8mfM+/nJWNGnjw9KqOToLVGSFt2p2Ril1gn3ij0Vk7YsoWVMzEuVPfPlRKYdfOak2LRSB0q\
zrWocCOG6qEhvgRaCj/dktj3g7dXXH4gKN6aRS0zpYzerqS6RAoZDQfk79SKTRXHu/e+9FN\
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+cNHjBj5gJRyDlJHy39o84D40H2Qtx8THaPeFuIOU+w1CEExB83eXMoLY\
rikbd9gHEP52VgQl4h89FUA6kJyYFbbQbnzLJg4zFiesnDHCwvUoeiVQOb/5C9FY9DlUueOH\
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WNW4rPy9jJxuPeDL/HXzNzgTsveslD2vsWHWI9mu5rvVvZX9foS4v/LfmqdEIpHDGlfM2uCW\
gJIy2wOENPaZ3fEcivd+ZYNCNJYtrNyhyGAo8jRoJTAUmRiqOCJnRW5FpTN++frTwdh4SiUv\
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tFUtil+Yi4yfAcwkjzqpZyb6HlgJebwpgLYxoO9/j8k//WW3xS32gQPHrV5aMTp1IDFN2Op6\
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EiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiABEiAB\
EiABEiABEiABEiABEiABEiABEhD/B9wOq7SGUV++AAAAAElFTkSuQmCC";
```

```
ITSmoreQR="data:image/png;base64,\
iVBORw0KGgoAAAANSUhEUgAAAG8AAABvAQMAAADYCwwjAAAABlBMVEX///9BaeFHqDaJAAAB\
HklEQVQ4jdXTsa2EMAwGYCMX7sICkVgjXVaCBe7CArASXdaIlAWgS4HwM5zEVS+mvSgS+ZBQ\
8gcb4BdHyzwv8szMSaUBHNm+KAd4QC8LDpDn8ogT4UpPGci2jI8IGFx3eLwPWaHknVyWecev\
UEbDXaB0X2aNjueYDOzNklQassPCkjc4nW3E1SfwqYk6jU/vAkPhg0AlSFhve8Jt0dkwDMwr\
yMGSSuPyWHAr19k0tkV2sb3sdW2rUCqW88g4Rp1A9s1JPv9cTp1NRD4XFkin8XaQCIwT6Lzq\
ZO8dHw/4+U2GzqlS8gbqVmkfr1N6YXK8OqlD0OmlGTMvzPERA8AL9vvbOifpSoL33fsVytrL\
S9wiqDzznhUI38v5n783/gBuUs2eLg1c8gAAAABJRU5ErkJggg==";
```

```
</script>

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

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

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

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

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

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

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

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

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

// 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(){
    oldsrc = document.getElementById("GENSRC");
    if( oldsrc != null ){
        //alert("--I--(erasing old text)")
        oldsrc.innterHTML = "";
        return
    }else{
        //alert("--I--(no old text)")
    }
    banner = document.getElementById('gsh-banner').style.backgroundImage;
    footer = document.getElementById('gsh-footer').style.backgroundImage;
    document.getElementById('gsh-banner').style.backgroundImage = "";
    document.getElementById('gsh-banner').style.backgroundPosition = "";
    document.getElementById('gsh-footer').style.backgroundImage = "";

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

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

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

```
}
function jumpto_StyleView(){
    jsview = document.getElementById('html-src')
    jsview.open = true
    jsview = document.getElementById('gsh-style-frame')
    jsview.open = true
    fill_CSSView()
}
function jumpto_JavaScriptView(){
    jsview = document.getElementById('html-src')
    jsview.open = true
    jsview = document.getElementById('gsh-script-frame')
    jsview.open = true
    fill_JavaScriptView()
}
function jumpto_DataView(){
    jsview = document.getElementById('html-src')
    jsview.open = true
    jsview = document.getElementById('gsh-data-frame')
    jsview.open = true
    fill_DataView()
}
function jumpto_WholeView(){
    jsview = document.getElementById('html-src')
    jsview.open = true
    jsview = document.getElementById('gsh-whole-view')
    jsview.open = true
    frame_open()
}
function html_view(){
    html_stop();

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

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

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

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

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

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

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