```go
// Unbounded buffer, where underlying values are byte arrays

package bufb

import (
        "errors"
)

// Linked list element
type BufEle struct {
        val []byte
        next *BufEle
}

type Buf struct {
        head *BufEle         // Oldest element
        tail *BufEle         // Most recently inserted element
}

func NewBuf() *Buf {
        return new(Buf)
}

func (bp *Buf) Insert(val []byte) {
        ele := &BufEle{val : val}
        if bp.head == nil {
                // Inserting into empty list
                bp.head = ele
                bp.tail = ele
        } else {
                bp.tail.next = ele
                bp.tail = ele
        }
}

func (bp *Buf) Front() []byte {
        if bp.head == nil { return nil }
        return bp.head.val
}

func (bp *Buf) Remove() ([]byte, error) {
        e := bp.head
        if e == nil {
                err := errors.New("Empty Buffer")
                return nil, err
        }
        bp.head = e.next
        // List becoming empty
        if e == bp.tail { bp.tail = nil }
        return e.val, nil
}

func (bp *Buf) Empty() bool {
        return bp.head == nil
}

func (bp *Buf) Flush() {
        bp.head = nil
        bp.tail = nil
}
```

```go
// Testing code for buffer

package bufb

import (
	"encoding/json"
	"math/rand"
	"testing"
)

// Convert integer to byte array
func i2b(i int) []byte {
	b, _ := json.Marshal(i)
	return b
}

// Convert byte array back to integer
func b2i(b []byte) int {
	var i int
	json.Unmarshal(b, &i)
	return i
}

// How many repetitions
var ntest int = 10

// How many elements per test
var nele int = 50

func TestBuf(t *testing.T) {
	// Run same test ntest times
	for i := 0; i < ntest; i++ {
		bp := NewBuf()
		runtest(t, bp)
		if !bp.Empty() {
			t.Logf("Expected empty buffer")
			t.Fail()
		}
	}
}

func runtest(t *testing.T, bp *Buf) {
	inserted := 0
	removed := 0
	emptycount := 0
	for removed < nele {
		if bp.Empty() {
			emptycount++
		}
		// Choose action: insert or remove
		insert := !(inserted == nele)
		if inserted > removed && rand.Int31n(2) == 0 {
			insert = false
		}
		if insert {
			bp.Insert(i2b(inserted))
			inserted++
		} else {
			b, err := bp.Remove()
			if err != nil {
				t.Logf("Attempt to remove from empty buffer\n")
				t.Fail()
			}
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                        v := b2i(b)
                        if v != removed {
                                t.Logf("Removed %d.  Expected %d\n", v, removed)
                                t.Fail()
                        }
                        removed++
                }
        }
}
```

```go
// Unbounded buffer, where underlying values are arbitrary values

package bufi

import (
	"errors"
)

// Linked list element
type BufEle struct {
	val interface{}
	next *BufEle
}

type Buf struct {
	head *BufEle		// Oldest element
	tail *BufEle		// Most recently inserted element
}

func NewBuf() *Buf {
	return new(Buf)
}

func (bp *Buf) Insert(val interface{}) {
	ele := &BufEle{val : val}
	if bp.head == nil {
		// Inserting into empty list
		bp.head = ele
	} else {
		bp.tail.next = ele
	}
	bp.tail = ele
}

func (bp *Buf) Front() interface{} {
	if bp.head == nil { return nil }
	return bp.head.val
}

func (bp *Buf) Remove() (interface{}, error) {
	e := bp.head
	if e == nil {
		err := errors.New("Empty Buffer")
		return nil, err
	}
	bp.head = e.next
	// List becoming empty
	if e == bp.tail { bp.tail = nil }
	return e.val, nil
}

func (bp *Buf) Empty() bool {
	return bp.head == nil
}

func (bp *Buf) Flush() {
	bp.head = nil
	bp.tail = nil
}
```

```go
// Testing code for buffer

package bufi

import (
	"encoding/json"
	"fmt"
	"math/rand"
	"testing"
)

// How many repetitions
var ntest int = 10

// How many elements per test
var nele int = 50

// Convert integer to byte array
func i2b(i int) []byte {
	b, _ := json.Marshal(i)
	return b
}

// Convert byte array back to integer
func b2i(b []byte) int {
	var i int
	json.Unmarshal(b, &i)
	return i
}

func btest(t *testing.T, bp *Buf) {
	inserted := 0
	removed := 0
	emptycount := 0
	fmt.Printf("Byte array data: ")
	for removed < nele {
		if bp.Empty() {
			emptycount++
		}
		// Choose action: insert or remove
		insert := !(inserted == nele)
		if inserted > removed && rand.Int31n(2) == 0 {
			insert = false
		}
		if insert {
			bp.Insert(i2b(inserted))
			inserted++
		} else {
			x, err := bp.Remove() // Type = interface{}
			if err != nil {
				t.Logf("Attempt to remove from empty buffer\n")
				t.Fail()
			}
			b := x.([]byte)  // Type = []byte
			v := b2i(b)
			if v != removed {
				t.Logf("Removed %d.  Expected %d\n", v, removed)
				t.Fail()
			}
			removed++
		}
	}
	fmt.Printf("Empty buffer %d/%d times\n", emptycount, nele)
```

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}

func itest(t *testing.T, bp *Buf) {
        inserted := 0
        removed := 0
        emptycount := 0
        fmt.Printf("Integer data: ")
        for removed < nele {
                if bp.Empty() {
                        emptycount++
                }
                // Choose action: insert or remove
                insert := !(inserted == nele)
                if inserted > removed && rand.Int31n(2) == 0 {
                        insert = false
                }
                if insert {
                        bp.Insert(inserted)
                        inserted++
                } else {
                        x, err := bp.Remove() // Type = interface{}
                        if err != nil {
                                t.Logf("Attempt to remove from empty buffer\n")
                                t.Fail()
                        }
                        v := x.(int)     // Type = int
                        if v != removed {
                                t.Logf("Removed %d.  Expected %d\n", v, removed)
                                t.Fail()
                        }
                        removed++
                }
        }
        fmt.Printf("Empty buffer %d/%d times\n", emptycount, nele)
}

func mtest(t *testing.T, bp *Buf) {
        inserted := 0
        removed := 0
        emptycount := 0
        fmt.Printf("Mixed data: ")
        for removed < nele {
                if bp.Empty() {
                        emptycount++
                }
                // Choose action: insert or remove
                insert := !(inserted == nele)
                if inserted > removed && rand.Int31n(2) == 0 {
                        insert = false
                }
                if insert {
                        if rand.Int31n(2) == 0 {
                                // Insert as integer
                                bp.Insert(inserted)
                        } else {
                                // Insert as byte array
                                bp.Insert(i2b(inserted))
                        }
                        inserted++
                } else {
                        x, err := bp.Remove() // Type = interface{}
                        if err != nil {
                                t.Logf("Attempt to remove from empty buffer\n")
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                                t.Fail()
                        }
                        var iv int
                        switch v := x.(type) {
                        case int:
                                iv = v
                        case []byte:
                                iv = b2i(v)
                        default:
                                t.Logf("Invalid data\n")
                                t.Fail()
                        }
                        if iv != removed {
                                t.Logf("Removed %d.  Expected %d\n", iv, removed)
                                t.Fail()
                        }
                        removed++
                }
        }
        fmt.Printf("Empty buffer %d/%d times\n", emptycount, nele)
}

type TestFun func(*testing.T, *Buf)

func testBuf(t *testing.T, f TestFun) {
        // Run same test ntest times
        for i := 0; i < ntest; i++ {
                bp := NewBuf()
                f(t, bp)
                if !bp.Empty() {
                        t.Logf("Expected empty buffer")
                        t.Fail()
                }
        }
}

func TestB(t *testing.T) {
        testBuf(t, btest)
}

func TestI(t *testing.T) {
        testBuf(t, itest)
}

func TestM(t *testing.T) {
        testBuf(t, mtest)
}
```

```go
// Implementation of a UDP proxy

package main

import (
	"flag"
	"fmt"
	"log"
	"net"
	"os"
	"strings"
	"sync"
)

// Information maintained for each client/server connection
type Connection struct {
	ClientAddr *net.UDPAddr // Address of the client
	ServerConn *net.UDPConn // UDP connection to server
}

// Generate a new connection by opening a UDP connection to the server
func NewConnection(srvAddr, cliAddr *net.UDPAddr) *Connection {
	conn := new(Connection)
	conn.ClientAddr = cliAddr
	srvudp, err := net.DialUDP("udp", nil, srvAddr)
	if checkreport(1, err) {
		return nil
	}
	conn.ServerConn = srvudp
	return conn
}

// Global state
// Connection used by clients as the proxy server
var ProxyConn *net.UDPConn

// Address of server
var ServerAddr *net.UDPAddr

// Mapping from client addresses (as host:port) to connection
var ClientDict map[string]*Connection = make(map[string]*Connection)

// Mutex used to serialize access to the dictionary
var dmutex *sync.Mutex = new(sync.Mutex)

func setup(hostport string, port int) bool {
	// Set up Proxy
	saddr, err := net.ResolveUDPAddr("udp", fmt.Sprintf(":%d", port))
	if checkreport(1, err) {
		return false
	}
	pudp, err := net.ListenUDP("udp", saddr)
	if checkreport(1, err) {
		return false
	}
	ProxyConn = pudp
	Vlogf(2, "Proxy serving on port %d\n", port)

	// Get server address
	srvaddr, err := net.ResolveUDPAddr("udp", hostport)
	if checkreport(1, err) {
		return false
	}
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        ServerAddr = srvaddr
        Vlogf(2, "Connected to server at %s\n", hostport)
        return true
}

func dlock() {
        dmutex.Lock()
}

func dunlock() {
        dmutex.Unlock()
}

// Go routine which manages connection from server to single client
func RunConnection(conn *Connection) {
        var buffer [1500]byte
        for {
                // Read from server
                n, err := conn.ServerConn.Read(buffer[0:])
                if checkreport(1, err) {
                        continue
                }
                // Relay it to client
                _, err = ProxyConn.WriteToUDP(buffer[0:n], conn.ClientAddr)
                if checkreport(1, err) {
                        continue
                }
                Vlogf(3, "Relayed '%s' from server to %s.\n",
                        string(buffer[0:n]), conn.ClientAddr.String())
        }
}

// Routine to handle inputs to Proxy port
func RunProxy() {
        var buffer [1500]byte
        for {
                n, cliaddr, err := ProxyConn.ReadFromUDP(buffer[0:])
                if checkreport(1, err) {
                        continue
                }
                Vlogf(3, "Read '%s' from client %s\n",
                        string(buffer[0:n]), cliaddr.String())
                saddr := cliaddr.String()
                dlock()
                conn, found := ClientDict[saddr]
                if !found {
                        conn = NewConnection(ServerAddr, cliaddr)
                        if conn == nil {
                                dunlock()
                                continue
                        }
                        ClientDict[saddr] = conn
                        dunlock()
                        Vlogf(2, "Created new connection for client %s\n", saddr)
                        // Fire up routine to manage new connection
                        go RunConnection(conn)
                } else {
                        Vlogf(5, "Found connection for client %s\n", saddr)
                        dunlock()
                }
                // Relay to server
                _, err = conn.ServerConn.Write(buffer[0:n])
                if checkreport(1, err) {
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                        continue
                }
        }
}

var verbosity int = 6

// Log result if verbosity level high enough
func Vlogf(level int, format string, v ...interface{}) {
        if level <= verbosity {
                log.Printf(format, v...)
        }
}

// Handle errors
func checkreport(level int, err error) bool {
        if err == nil {
                return false
        }
        Vlogf(level, "Error: %s", err.Error())
        return true
}

func main() {
        var ihelp *bool = flag.Bool("h", false, "Show help information")
        var ipport *int = flag.Int("p", 6667, "Proxy port")
        var isport *int = flag.Int("P", 6666, "Server port")
        var ishost *string = flag.String("H", "localhost", "Server address")
        var iverb *int = flag.Int("v", 1, "Verbosity (0-6)")
        //      var idrop *float64 = flag.Float64("d", 0.0, "Packet drop rate")
        flag.Parse()
        verbosity = *iverb
        if *ihelp {
                flag.Usage()
                os.Exit(0)
        }
        if flag.NArg() > 0 {
                ok := true
                fields := strings.Split(flag.Arg(0), ":")
                ok = ok && len(fields) == 2
                if ok {
                        *ishost = fields[0]
                        n, err := fmt.Sscanf(fields[1], "%d", isport)
                        ok = ok && n == 1 && err == nil
                }
                if !ok {
                        flag.Usage()
                        os.Exit(0)
                }
        }
        hostport := fmt.Sprintf("%s:%d", *ishost, *isport)
        Vlogf(3, "Proxy port = %d, Server address = %s\n",
                *ipport, hostport)
        if setup(hostport, *ipport) {
                RunProxy()
        }
        os.Exit(0)
}
```