Linux, Netlink, and Go
in 7 minutes or less!

Matt Layher, August 30, 2018

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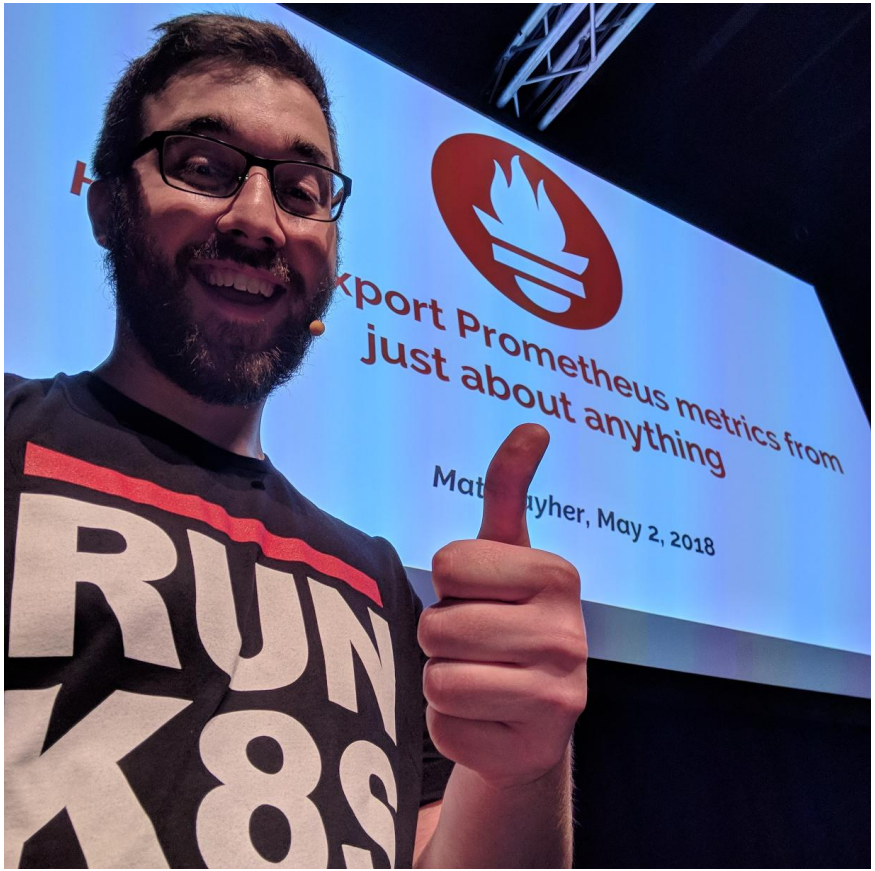
- github.com/mdlayher/talks



Introduction to Netlink

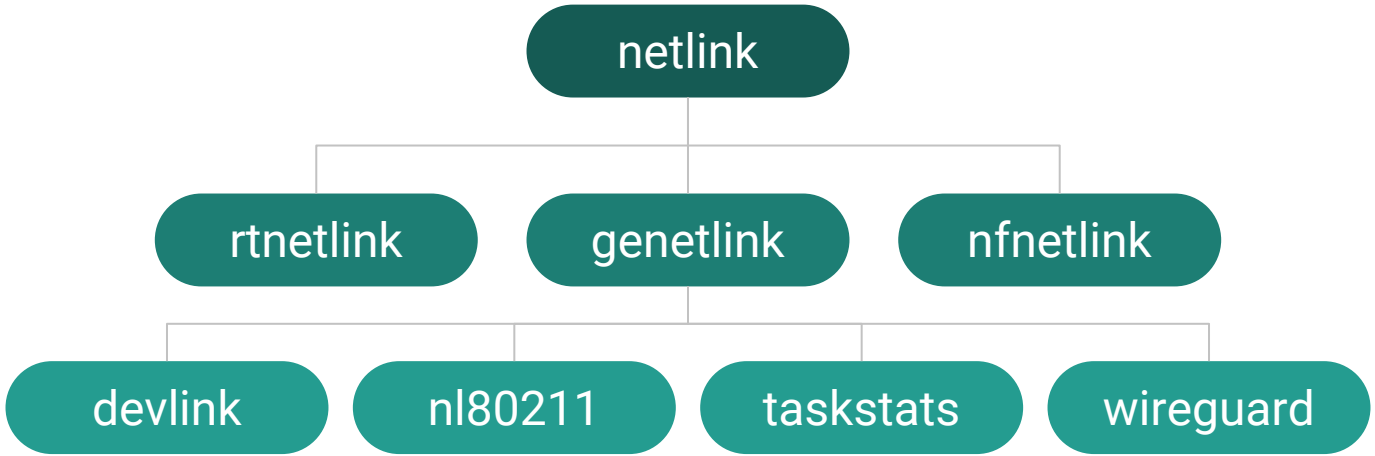
What is Netlink?

- Linux kernel inter-process communication (IPC) interface
- Flexible replacement for `ioctl(2)`
- Typically used to configure the Linux kernel or kernel modules
- Uses various “families” to interact with different parts of the kernel

Netlink families

- **rtnetlink**: configures network interfaces, addresses, routes, etc.
- **genetlink**: a generic and extensible netlink family
- **nfnetlink**: configures aspects of the kernel's netfilter subsystem
- See `netlink(7)` for the full list

Netlink family tree



Netlink programming

- BSD sockets API: `socket(2)`, `bind(2)`, `sendmsg(2)`, `recvmsg(2)`
  - Beej's Guide to Network Programming
- Fixed length headers and an arbitrary byte payload
- Messages usually contain a header or length/type/value attributes

Netlink and Go: the basics

github.com/mdlayher/netlink

- Go package that provides low-level access to Linux netlink sockets
- Used as a foundation for other netlink family packages
- Handles many of the details of netlink message/attribute passing
- No Cgo required!

```go
// Speak to generic netlink using netlink.
c, err := netlink.Dial(16, nil)
if err != nil {
    log.Fatalf("failed to dial netlink: %v", err)
}
defer c.Close()

// Ask netlink to echo back our request.
f := netlink.HeaderFlagsRequest | netlink.HeaderFlagsAcknowledge
msgs, err := c.Execute(netlink.Message{
    Header: netlink.Header{Flags: f},
})
if err != nil {
    log.Fatalf("failed to execute request: %v", err)
}

log.Printf("out: %+v", msgs)
```

Package netlink is a foundation

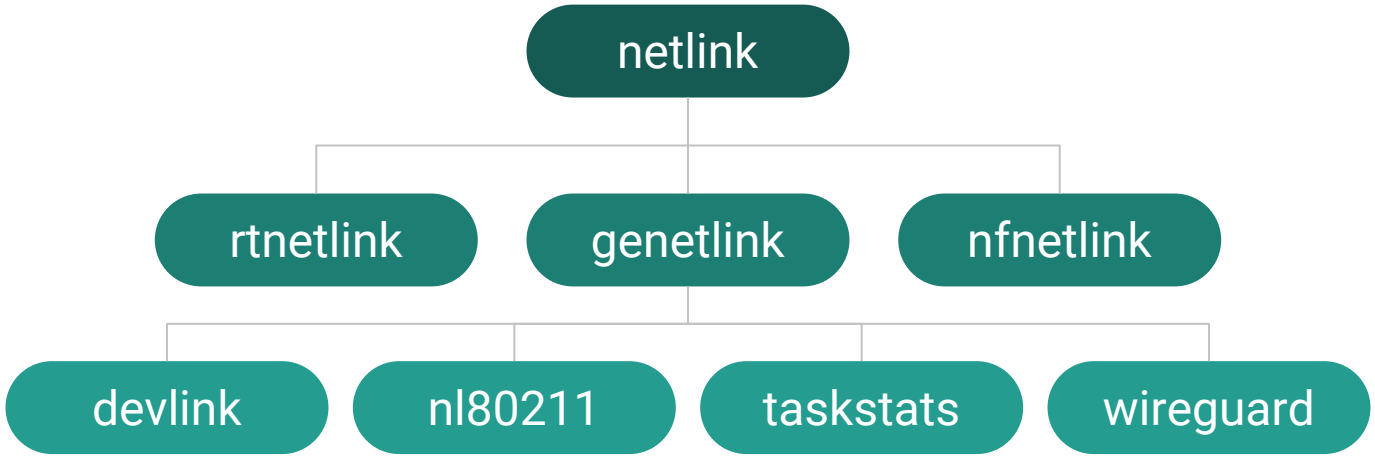
- Not recommended for direct use in your applications
- Use a higher level family package as your starting point
- godoc.org/github.com/mdlayher/netlink?importers

Netlink and Go: high level packages

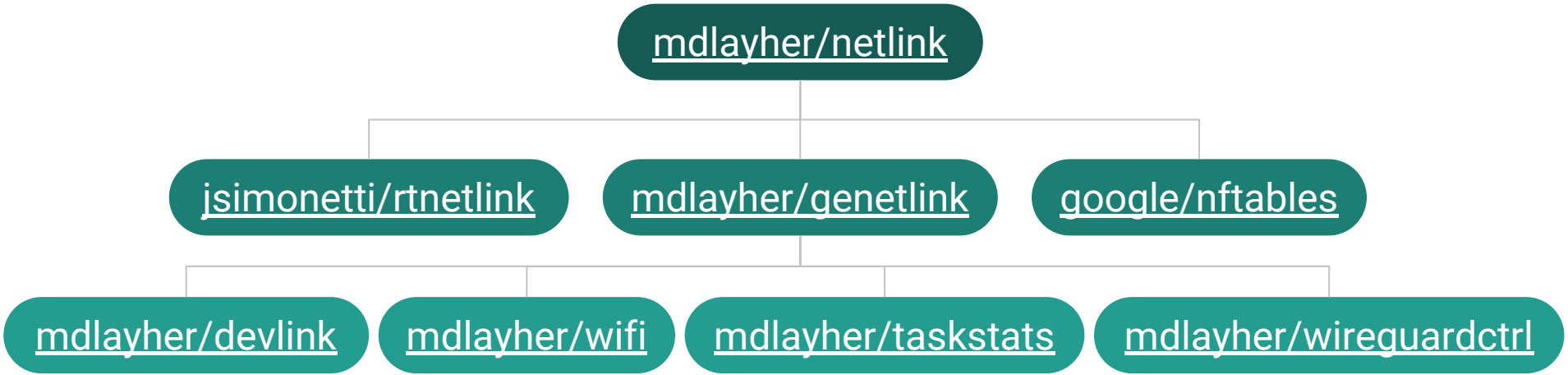
High level packages

- **rtnetlink**: github.com/jsimonetti/rtnetlink
- **genetlink**: github.com/mdlayher/genetlink
- **nfnetlink (nftables)**: github.com/google/nftables
- … and more!

Netlink family tree



Netlink and Go family tree



- 18 open-source importers on godoc.org; too many to fit on one slide!

Use cases

- devlink: manipulation of Ethernet/InfiniBand chips/ASICs
- wifi: gathering WiFi device metrics via Prometheus node_exporter
- taskstats: high-precision, per-process, CPU/memory/disk statistics
- wireguardctrl: manipulation of WireGuard VPN tunnels

Summary

Summary

- Netlink provides a powerful and flexible interface to the Linux kernel!
- Go is an excellent language for controlling the kernel; no Cgo required!
- Join us and help build more netlink family and higher-level packages!

Resources

- github.com/mdlayher/netlink
- Linux, Netlink, and Go - Part 1: netlink
- Netlink Library (libnl)

Thanks!

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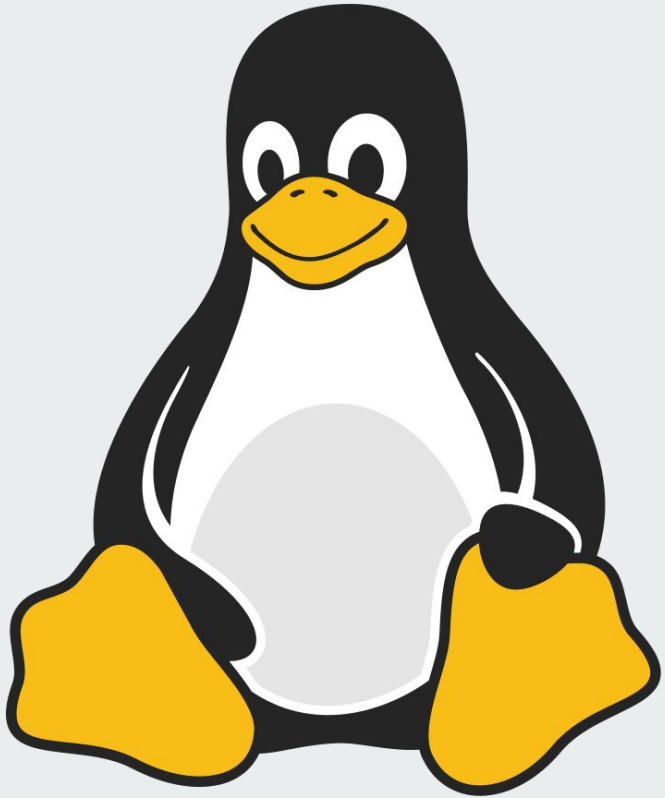

Credit: Larry Ewing: http://isc.tamu.edu/~lewing/linux/