

# Profiling and Optimizing D-Bus APIs

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# Profiling

“Silhouetted Wheel” by zzathras777

# Why?

- Why does it take so long to sign in/join #ubuntu with Empathy?
- Does some signal keep waking up lots of processes?
- See how an API works out in practice
- Getting your head around a new framework

# How?

- Slow D-Bus calls won't show up in generic profilers
  - (you are making async calls, right?)
- Need to study several processes' interaction
- Timing of messages on the bus is handy
- Let's use a D-Bus-specific tool.

```

13382ms ...st_2fTelepathy_2e5cf34db7/RosterChannel/Group/William_20Shatner
...sktop.Telepathy.Channel.Interface.Group.MembersChangedDetailed

13382ms .../Connection/gabble/jabber/wjt_40localhost_2fTelepathy_2e5cf34db7
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13382ms .../Connection/gabble/jabber/wjt_40localhost_2fTelepathy_2e5cf34db7
...freedesktop.Telepathy.Connection.Interface.Requests.NewChannels

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13382ms .../wjt_40localhost_2fTelepathy_2e5cf34db7/RosterChannel/List/stored
org.freedesktop.DBus.Properties.GetAll

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13383ms ...wjt_40localhost_2fTelepathy_2e5cf34db7/RosterChannel/List/publish
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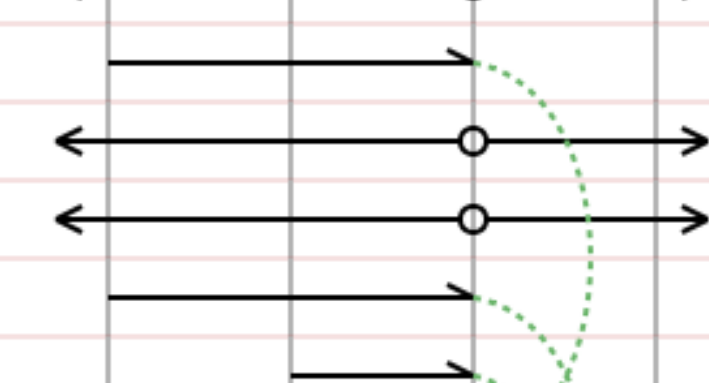
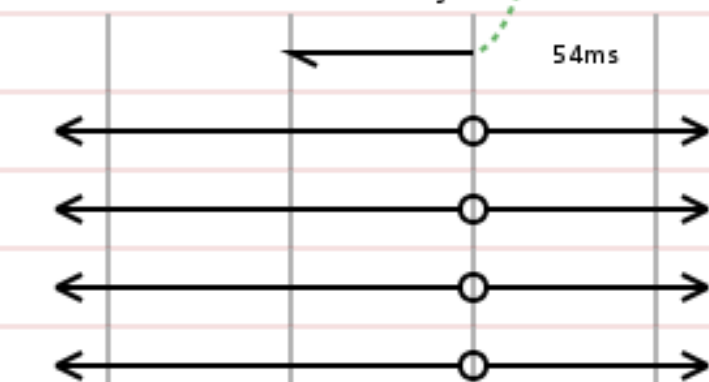
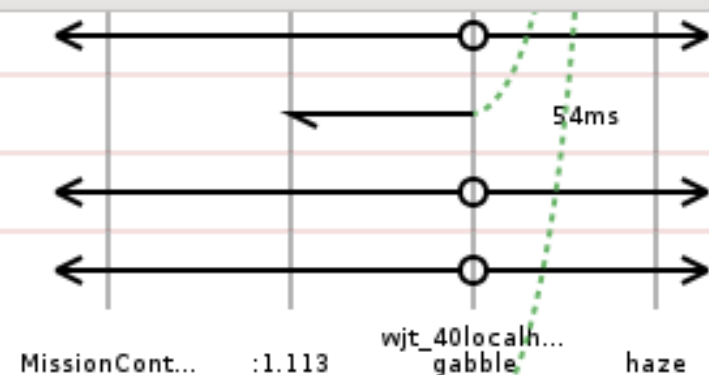
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13384ms ...t_40localhost_2fTelepathy_2e5cf34db7/RosterChannel/List/subscribe
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```



# Statistics

- *bustle-count* summarizes number of calls to methods and emissions of signals
- *bustle-time* shows total and average time spent in each method
- *bustle-dot* plus GraphViz shows component dependencies

# Wishlist

- Equivalents of *bustle-count* and *bustle-time* in the UI
- Searching and filtering
- Spacing events in proportion to time
- Showing the contents of messages

# /getinvolved

- Get it:
  - <http://willthompson.co.uk/bustle/>
  - <git://git.collabora.co.uk/git/user/wjt/bustle.git>
  - <http://git.collabora.co.uk/?p=user/wjt/bustle.git>
- “Bug tracker”:
  - [will.thompson@collabora.co.uk](mailto:will.thompson@collabora.co.uk)





Optimizing



# Reduce roundtrips



“M40 at Night” by timo\_w2s

# Standard access pattern

- Fetch initial state
- Subscribe to change notifications
- Do whatever you wanted to do

# Standard access pattern

- **Fetch initial state**
- Subscribe to change notifications
- Do whatever you wanted to do

6ms ...onnection/gabble/jabber/wjt2\_40localhost\_2fTelepathy\_2e257194e3  
...freedesktop.Telepathy.Connection.Interface.Requests.**NewChannels**

6ms ...onnection/gabble/jabber/wjt2\_40localhost\_2fTelepathy\_2e257194e3  
org.freedesktop.Telepathy.Connection.**NewChannel**

11ms ...bble/jabber/wjt2\_40localhost\_2fTelepathy\_2e7314cfce/MucChannel1  
org.freedesktop.Telepathy.Channel.**GetInterfaces**

12ms ...bble/jabber/wjt2\_40localhost\_2fTelepathy\_2e7314cfce/MucChannel1  
org.freedesktop.Telepathy.Channel.**GetInterfaces**

12ms ...onnection/gabble/jabber/wjt2\_40localhost\_2fTelepathy\_2e7314cfce  
org.freedesktop.Telepathy.Connection.**InspectHandles**

13ms ...Connection/gabble/jabber/wjt2\_40localhost\_2fTelepathy\_2e7314cfce  
org.freedesktop.Telepathy.Connection.**InspectHandles**

13ms ...bble/jabber/wjt2\_40localhost\_2fTelepathy\_2e7314cfce/MucChannel1  
org.freedesktop.Telepathy.Channel.Interface.Group.**GetAllMembers**

14ms ...bble/jabber/wjt2\_40localhost\_2fTelepathy\_2e7314cfce/MucChannel1  
org.freedesktop.Telepathy.Channel.Interface.Group.**GetAllMembers**

14ms ...bble/jabber/wjt2\_40localhost\_2fTelepathy\_2e7314cfce/MucChannel1  
...lepathy.Channel.Interface.Group.**GetLocalPendingMembersWithInfo**

15ms ...bble/jabber/wjt2\_40localhost\_2fTelepathy\_2e7314cfce/MucChannel1  
...elepathy.Channel.Interface.Group.**GetLocalPendingMembersWithInfo**

15ms ...bble/jabber/wjt2\_40localhost\_2fTelepathy\_2e7314cfce/MucChannel1  
org.freedesktop.Telepathy.Channel.Interface.Group.**GetSelfHandle**

15ms ...bble/jabber/wjt2\_40localhost\_2fTelepathy\_2e7314cfce/MucChannel1  
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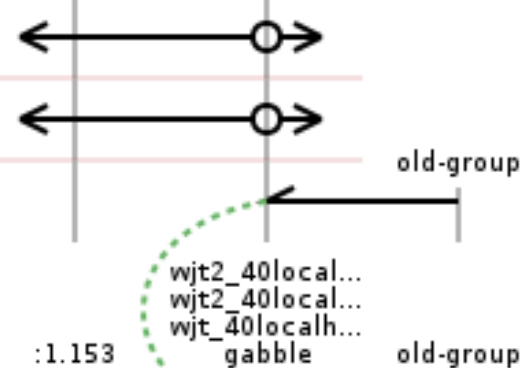
16ms ...onnection/gabble/jabber/wjt2\_40localhost\_2fTelepathy\_2e7314cfce  
org.freedesktop.Telepathy.Connection.**InspectHandles**

17ms ...Connection/gabble/jabber/wjt2\_40localhost\_2fTelepathy\_2e7314cfce  
org.freedesktop.Telepathy.Connection.**InspectHandles**

17ms ...bble/jabber/wjt2\_40localhost\_2fTelepathy\_2e7314cfce/MucChannel1  
org.freedesktop.Telepathy.Channel.Interface.Group.**GetGroupFlags**

18ms ...bble/jabber/wjt2\_40localhost\_2fTelepathy\_2e7314cfce/MucChannel1  
org.freedesktop.Telepathy.Channel.Interface.Group.**GetGroupFlags**

18ms ...bble/jabber/wjt2\_40localhost\_2fTelepathy\_2e7314cfce/MucChannel1  
org.freedesktop.Telepathy.Channel.Interface.Group.**GetHandleOwners**



0ms

0ms

0ms

0ms

0ms

0ms

0ms

# Use D-Bus properties, not accessors

- `Get(iface, "Foo")` rather than `GetFoo()`
- `GetAll(iface)` rather than `Get(), Get(), Get()`



# Telepathy's Group interface

- Used for chatrooms, calls and contact list groups
- Three conceptual lists of participants:
  - **Members**
  - **LocalPendingMembers**
  - **RemovePendingMembers**
- Used to have lots of separate accessors
- Now just `GetAll("...Channel.Interface.Group")`

# ConnMan's properties

- Reinvents DBus.Properties once per interface
- GetProperties() → a{sv}
- SetProperty( s: name, v: value ) → ()
- PropertyChanged( s: name, v: value )

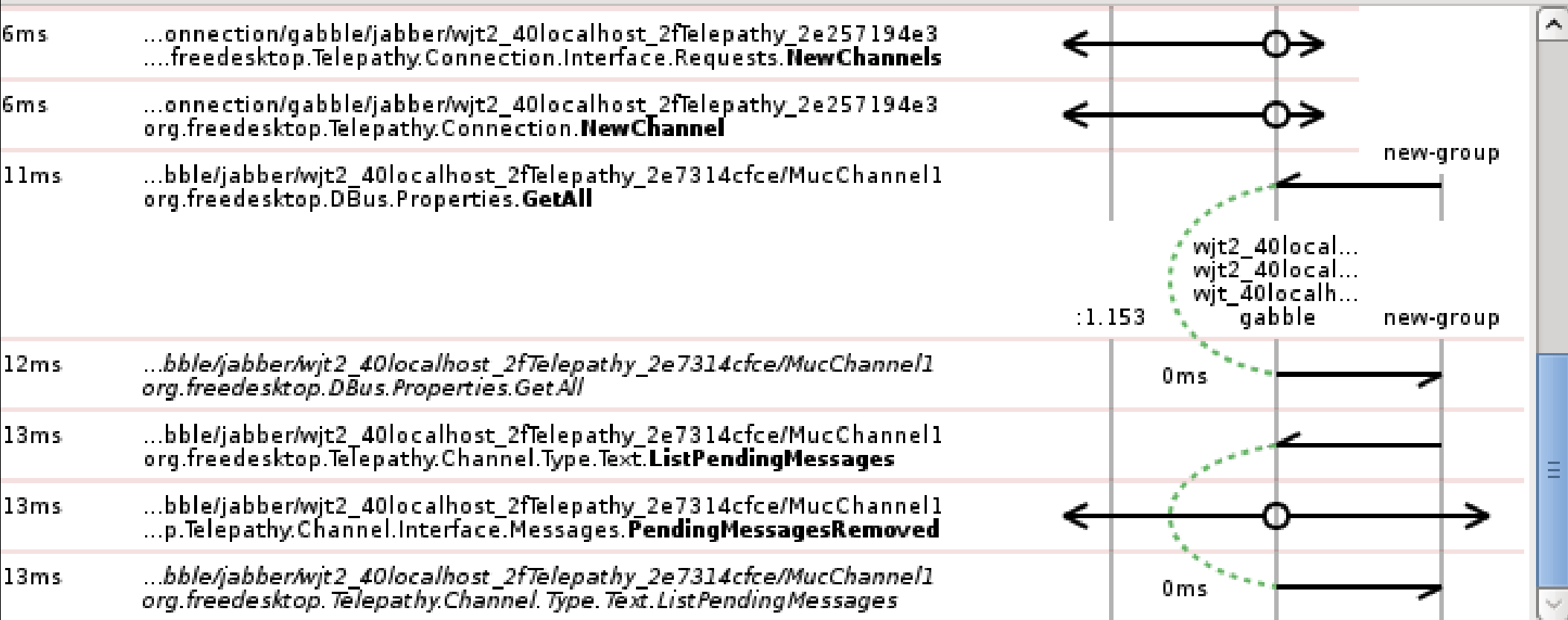


# Supply information up front

- FooAdded / NewFoo signals can contain a snapshot of properties
- Lets UI react immediately without needing to get properties first

# NewChannel → NewChannels

- NewChannel contains:
  - the contact/chatroom's integer handle (not name!);
  - whether it's a call, text conversation, ...
- NewChannels adds:
  - the contact/chatroom's name;
  - whether you requested the channel;
  - who invited you;
- ... and more, as appropriate:
  - the incoming file's name, type, size, etc.;
  - whether the call is (initially) audio/video/both;
  - the application being shared over the tube;
  - ...



foreach



"16th July 2008" by gregoryjameswalsh

```
descriptions = [ programme.Describe(talk)
                  for talk in gcds_talks ]
```

```
descriptions = programme.Describe(gcds_talks)
```

# Fetching metadata from Tracker

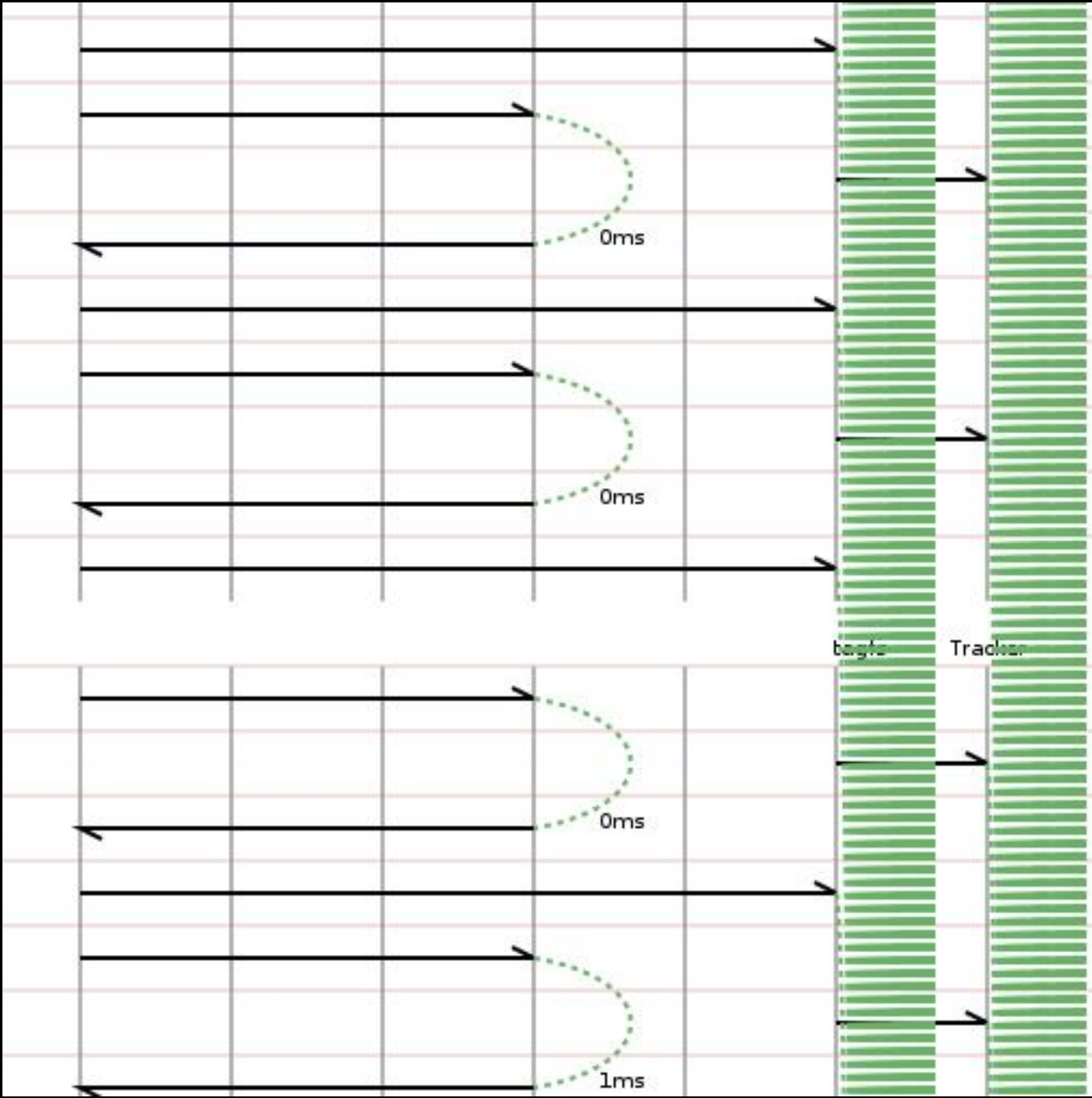
- `Get( s: service_type, s: uri, as: keys ) → as: metadata`





"Adam's Record Collection" by melancon





# Fetching metadata from Tracker

- ~~Get( s: service\_type, s: uri, as: keys ) → as: metadata~~
- GetMultiple( s: service\_type, as: uris, as: keys ) → aas: metadatas
- In extreme cases (thousands of items — your photo collection/mp3 library/mail archive?): 2.5× faster.

# Telepathy contacts' metadata

- `InspectHandles( ..., au: handles ) → as: identifiers`

# Telepathy contacts' metadata

- `GetAliases( au: contacts ) → a{us}: aliases`
- `GetPresences( au ) → a{u(uss)}: presences`
- `GetKnownAvatarTokens( au ) → a{us}: tokens`

# Telepathy contacts' metadata

- GetLocations
- GetContactCapabilities
- GetContactInfo
- ...

# Contacts interface

GetContactAttributes(

au: Handles,

as: Interfaces )

→ a{ua{sv}}: Attributes

# Contacts interface

```
void  
tp_connection_get_contacts_by_handle (  
    TpConnection *self,  
    const TpHandle handles[],  
    const TpContactFeature features[],  
    TpConnectionContactsByHandleCb callback);
```

```
typedef void  
(*TpConnectionContactsByHandleCb) (  
    TpConnection *connection,  
    TpContact *contacts[]);
```

# Integer IDs?!

“You don’t need to invent a new kind of integer ID! That is what the object path is, it’s an id for an object.”

— Havoc Pennington, Best D-Bus Practices





"Crowd" by saturnism



Don't just wrap your C/Java/... API

# Awesome

- /
- `org.naquadah.awesome.awful.Remote`<sup>1</sup>
  - <sup>1</sup> formerly `org.awesome.awful.Remote` ...
- `Eval( s: lua ) → ???`
- Return type depends on what the Lua code returns!



# Reducing wakeups

# NameOwnerChanged

- Can wake you up on every name change, even if you don't care about the name
- Match `arg0=name.you.care.about`
- Maybe patch the daemon to warn you about unqualified matches?

# Don't force information on clients

- Split information into conceptually self-contained interfaces
- Lets clients only monitor properties they care about

# Client API

- Efficient D-Bus APIs can be inconvenient to use
- Good bindings help a lot

# Tp::Proxy (and TpProxy)

- Create object; call `call_when_ready()`
- Subsequent changes through normal Qt / GObject signals



# Features

- Specify what you care about at construct time.
- Upgrade: “I now care about avatars”

# Property change notification

- No standard mechanism  
⇒ no auto-generated bindings ☹️

# ConnMan

PropertyChanged( s: name, v: value )

# Telepathy chatrooms

```
MembersChanged (
    au: added,
    au: removed,
    au: local_pending,
    au: remote_pending )
```

# Potential compromise

- PropertiesChanged( s: interface, a{sv}: values )
- IDL annotation for properties that use it.

# Logging in with Empathy ...

- Connecting
  - Network bound.
- Getting all the avatars
  - Free if they're cached;
  - Network-bound if not.
- Getting the entire contact list
  - Hmm ...

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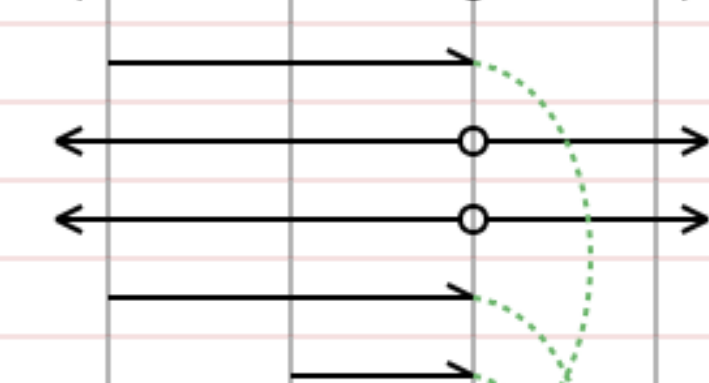
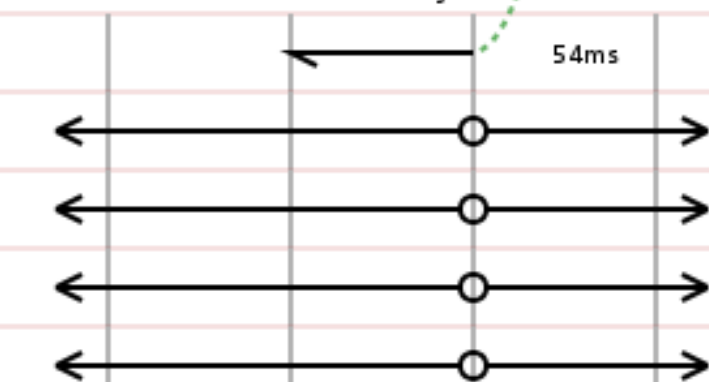
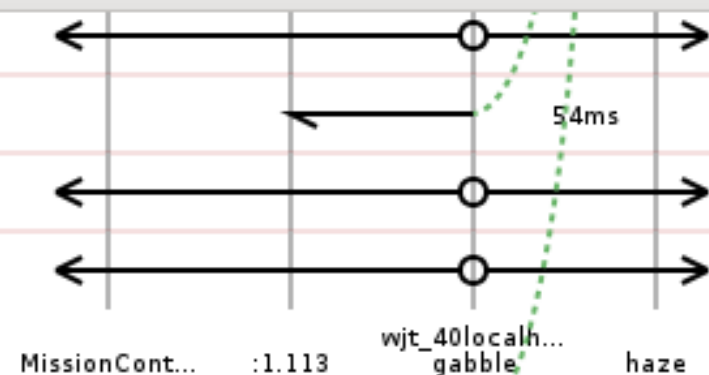
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```





# Contact list

- Separate objects for:
  - **subscribe**: contacts we're subscribed to
  - **publish**: contacts subscribed to us
  - **deny**: contacts we've blocked
  - each named group
- Each one needs to become ready.
- Then, match up the members to existing Contact objects.
- Make any Contacts you don't have (asynchronously).
- Sorry ...

# Slight improvement

- Separate objects for:
  - **subscribe**: contacts we're subscribed to
  - **publish**: contacts subscribed to us
  - **deny**: contacts we've blocked
  - each named group
  - **stored**: superset of all the above

# But we should fix it properly

- Roster object
- Property mapping contact handles to their state, with change notification
- Helper method to delegate to GetContactAttributes:
  - all contacts (for the contact list)
  - just those in state  $x$
- (or similar)

# Thanks!

- <http://willthompson.co.uk/bustle/>
- <http://telepathy.freedesktop.org/>
- #telepathy on Freenode
- <http://www.collabora.co.uk/>



# Yes, Bustle is written in Haskell!

(What of it?)