Building a Modern Multi-User Desktop

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What is a multi-user desktop?

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- A system that can support a rich experience for multiple simultaneous user sessions
- A user session that is multi-user aware

Why is this useful?

Why is this useful?

- Over 80% of US households have a shared computer (according to a Microsoft report)
- Even in households/businesses with multiple computers some are more desired than others.
- Computers are idle most of the time.
- Computers are expensive. (cost, heat, space, noise)
- Guests don't want to see your porn collection.
- Why log out?

http://windowsxp.devx.com/presentations/devforawinxpmultiuserpc_110k/default.htm

What forms can this take?

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- Fast User Switching – share from single location

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- Multi-Seat – share from different locations

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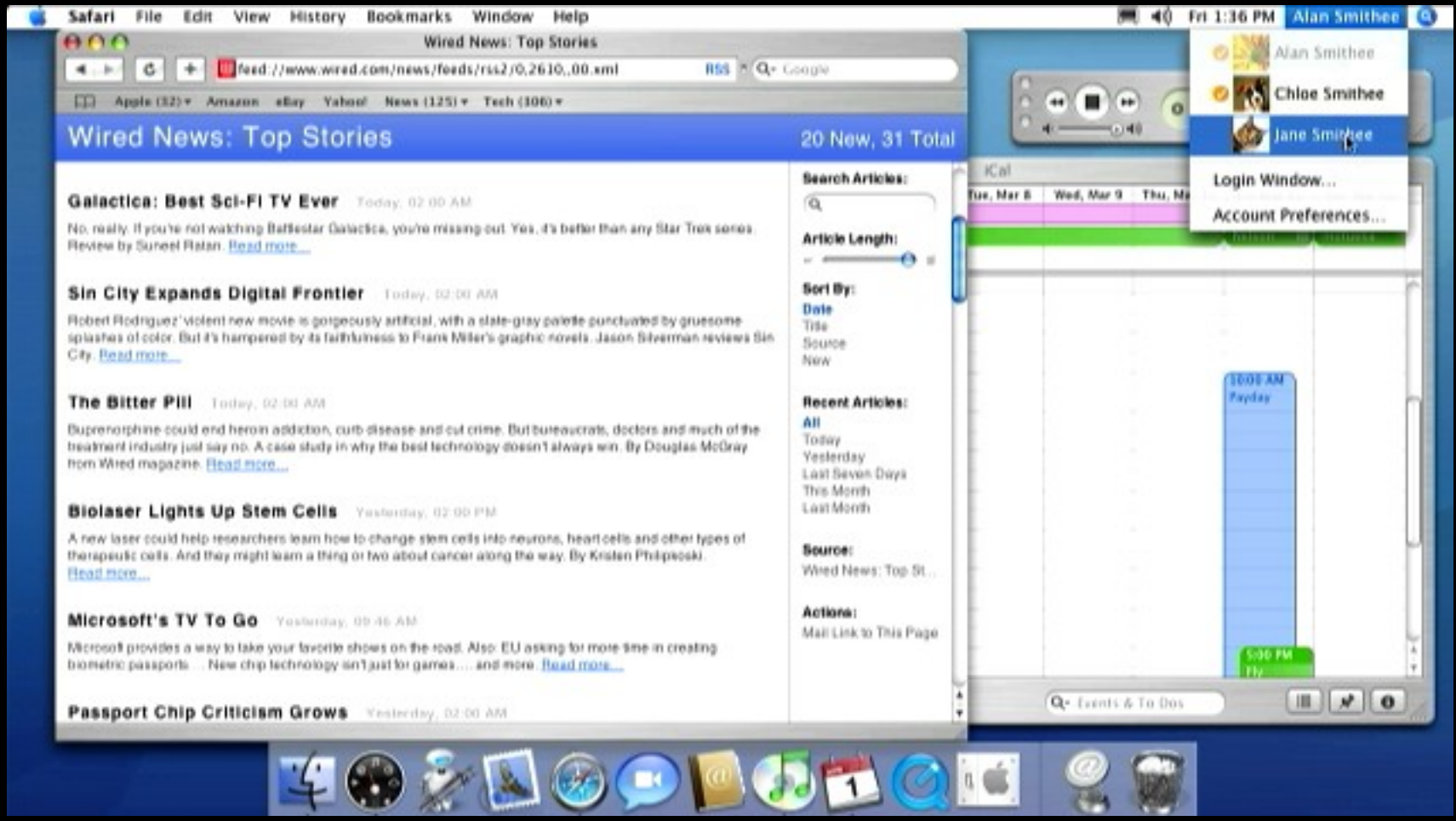
- Fast User Switching – share from single location
- Multi-Seat – share from different locations
- Hot desking / Session migration - combination

What is Fast User Switching?

OS X Fast User Switching



OS X Fast User Switching

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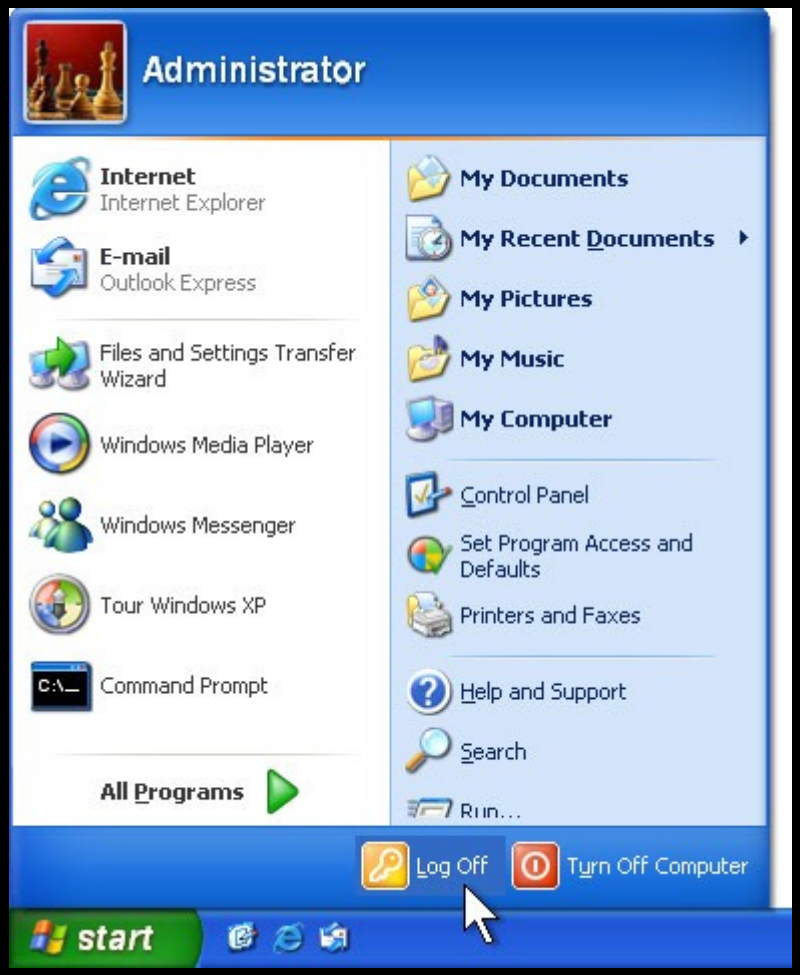
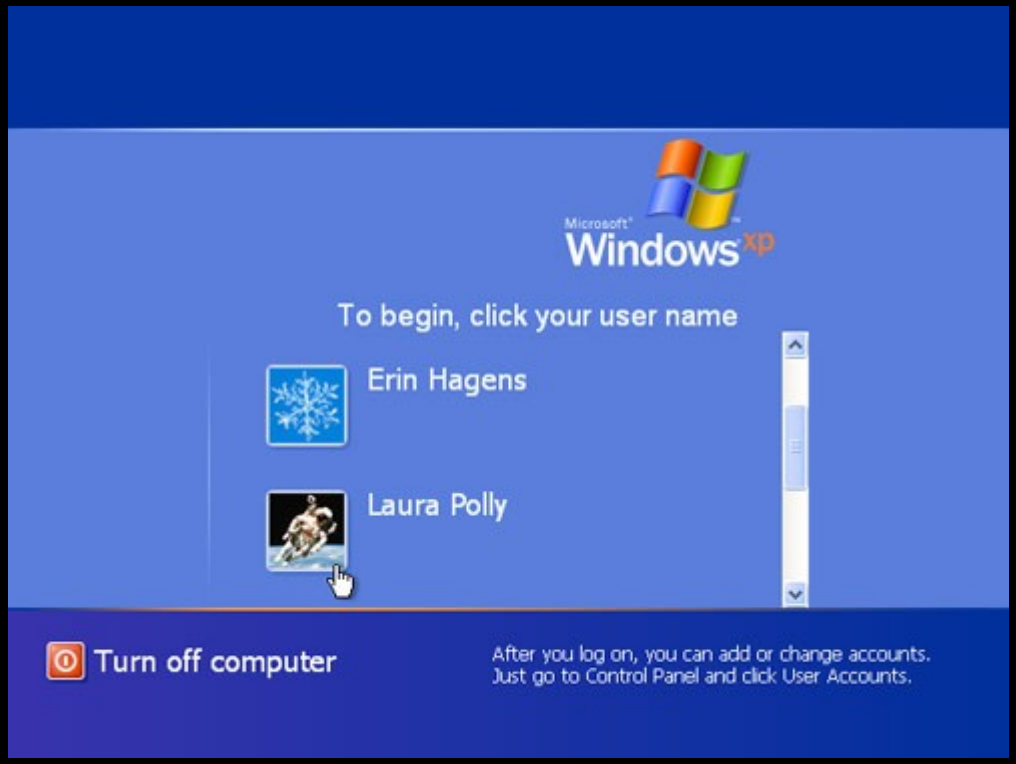
Windows XP Fast User Switching



Windows XP Fast User Switching

Windows XP Fast User Switching



Can't I do that already?

GNOME 2.16 Fast User Switching

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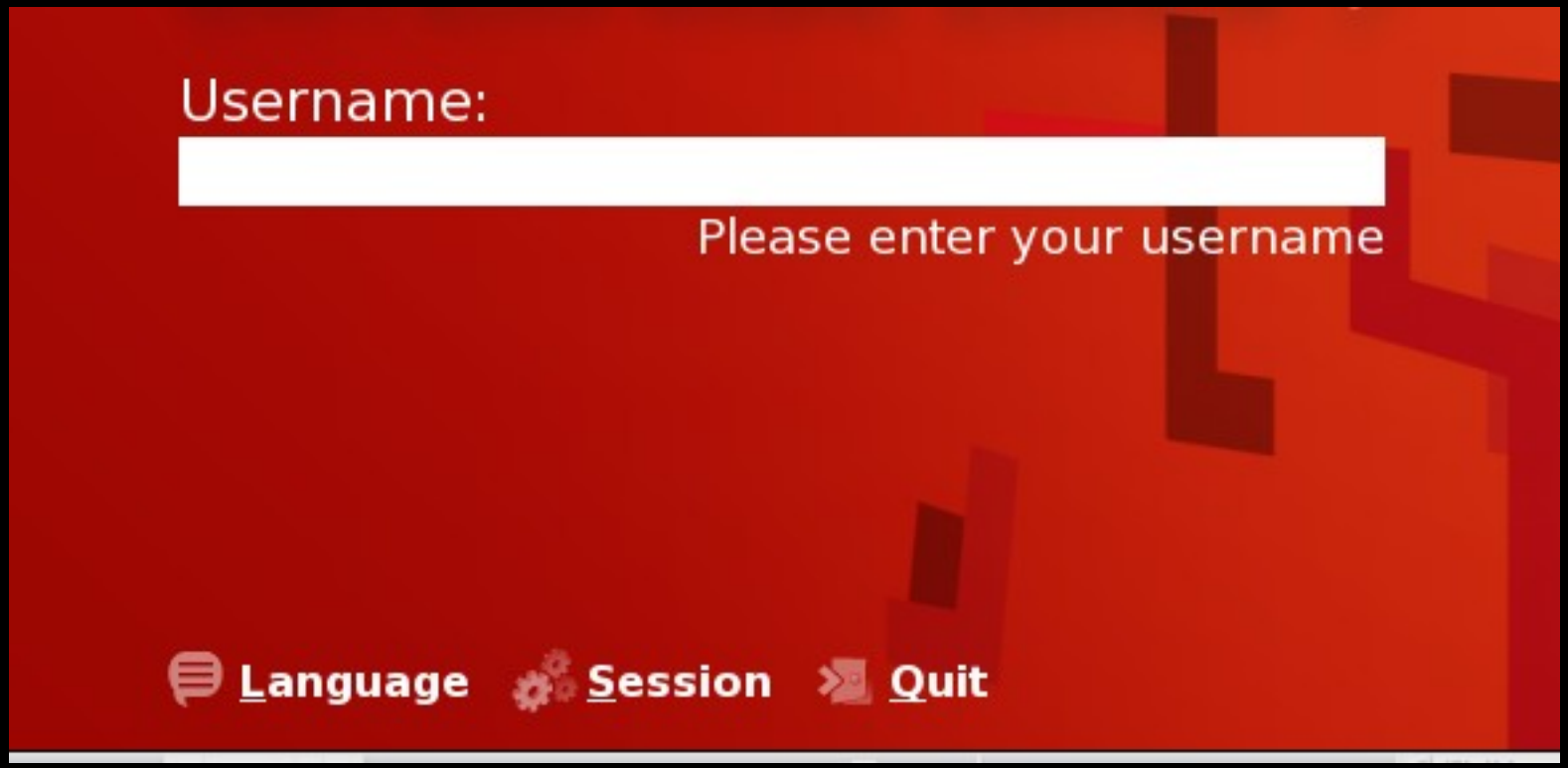
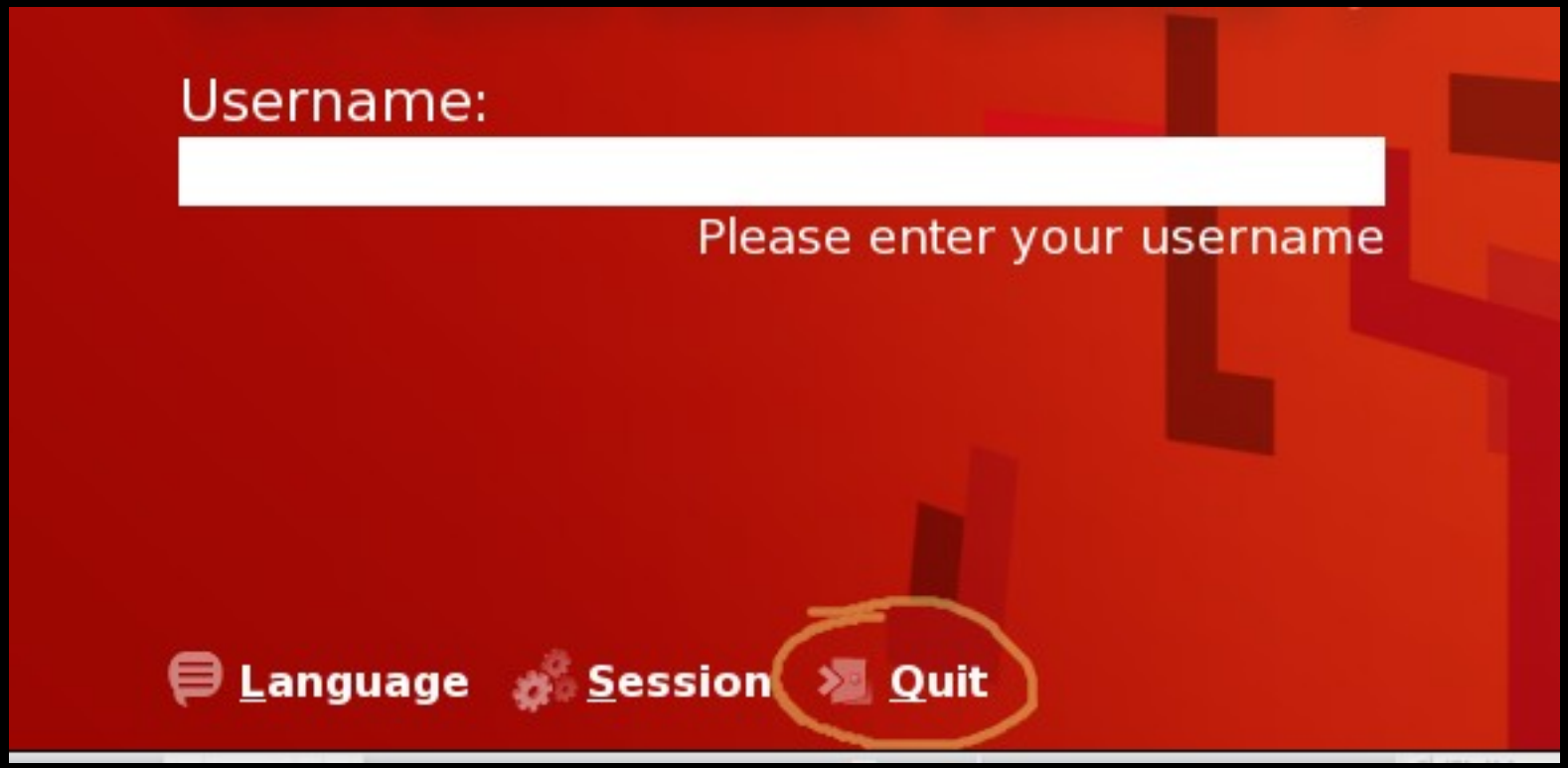


GNOME 2.16 Fast User Switching



GNOME 2.16 Fast User Switching

What did we get wrong?

What did we get wrong?

- Selected a user in Switcher applet but Login Screen didn't use it.
- Screen goes all flashy-flashy between Switcher applet and Login Screen.
- Login Screen has a Quit button.
- Login Screen dies after a while.
- Login Screen either doesn't have a “face-browser” or has a not-so-good one.
- After authenticating we switch directly to... a locked screen.

What did we get wrong?

- After logging out we can end up on another locked screen or even an empty VT.
- Applications are still consuming resources in inactive session. (Videos, screensavers etc)
- Applications in inactive session may not relinquish devices. (Music players, webcams)
- Sessions may race to acquire new devices.

What did we get wrong?

- No power-management while at Login Screen.
- Potentially no wireless networking at Login Screen. (software updates, backups, remote login)
- No user status information at Login Screen.
- User switcher applet isn't seat aware.
- We continue to poll optical drives when no one is logged in.

What did we get wrong?

- And so on...

What did we get wrong?

- Survey: root passwords

What do we need?

Text Login Manager

- Open a new Session.
- Set properties for the Session.
- Maintain some state for life-cycle tracking.
- Close the Session at logout.

Graphical Login Manager

- Get a list of attached Seats.
- Know if the current seat supports session switching.
- List all sessions on the current Seat.
- Know which session is active for the current Seat.
- Notification of session active state changes.
- Notification when sessions are added or removed.
- Access to the metadata for any open Session.

System daemon

- Know if any user sessions are open.
- Know if the system is currently being used.

Hardware Abstraction Layer

- Determine what hardware is associated with a Seat.
- Determine if a Session is active or inactive on a particular Seat.
- Know when the session active state changes.
- Determine what Session a process belongs to.

Fast User Switching Agent

- Determine which session it is running in.
- Determine which Seat it is running on.
- Know if the current seat supports session switching.
- Get a list of all sessions on the current Seat.
- Find which session is active for the current Seat.
- Know when the session active state changes.
- Access to the metadata for any open Session.
- Know when sessions are added or removed.

What is a Session?

What is a Session?

- The collection of processes that are direct descendants of a single, authenticated, interactive login process for a real user?

Desperately Seeking a Session

- POSIX process session
- OS security context
- PAM session
- Entry in the accounting database
- D-Bus session
- Desktop session management
- All connections to a Xserver
- XDMCP Session

POSIX process session

- The problem here is that there are various ways to create new sessions (process groups) for a single user login. For example, when a program (gnome-power-manager) is daemonized it detaches from the controlling terminal and is no longer part of the same session.
- Not the behavior that we want

OS security context

- Didn't seem like it was possible to uniquely identify groups of processes.

PAM sessions

- Excellent support for defining the "who" of the session but little support for the "where" and "what".
- Shouldn't trust passed in PAM_TTY value.
- PAM_TTY value isn't always a tty but sometimes a $DISPLAY.
- Sometimes PAM_TTY is just bogus (eg. sshd uses "ssh")
- Can't reliably get a pid for session leader since PAM module isn't always run by that process but by a helper/proxy or parent.
- Prior art – pam_console/foreground

Entry in the accounting database (utmp)

- Information is not authoritative.
- Poor standardization of structure.
- Few rules for content / usage.
- Designed for TTY (no X11 support)
- Must monitor file, re-read, and compare with last known state in order to get change notifications (and still aren't atomic)
- Field length limitations.

D-Bus session

- Historically and currently, non-graphical "sessions" have not started a D-Bus session – but could.
- Not all processes are necessarily connected to a session bus - not a problem.
- The grouping characteristic isn't so much the connection to the bus as the knowledge of the bus address.

Desktop session management

- This is too high level and oriented toward stateful graphical applications. We need something that works as well for daemon processes and non-graphical sessions.

All connections to a Xserver

- Obviously precludes non-graphical sessions.
- Maintaining the X connection may not be desirable.
- Sessions probably shouldn't be defined server-side.

XDMCP Session

- Too specific obviously.
- But a case that must be handled.

So... what is a session?

- A session is a collection of all processes that share knowledge of a secret. In the typical case, these processes all originate from a single common ancestor.

Session Implementation Details

- For now, this secret should be stored in the process environment by the session leader under the name XDG_SESSION_COOKIE.
- When we are able to take advantage of a mechanism in the underlying system to store session registration information - we will.

Side Effects

- A possible advantage - it is quite easy for a process to opt-out of a Session by simply unsetting the XDG_SESSION_COOKIE variable. Well... probably have to fork/exec too in practice.
- A possible disadvantage - not being able to strictly limit visibility of the secret to a particular process ancestry. So, it is not possible to enforce session boundaries other than on a per-user basis. For example, we don't yet have a way to prevent a process from moving between sessions owned by the same user.

What is a Seat?

- A seat is a collection of sessions and a set of hardware (usually at least an output and input device).

What is multi-seat?

But...

- Aren't new, small and mobile form devices eliminating the need for multi-user support? Or... what part of One Laptop Per Child don't you understand?

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- If personalization of a potentially shared resource is helpful then it is worth considering multi-user support / profiles. (handwriting/voice recognition etc)

But...

- Aren't new, small and mobile form devices eliminating the need for multi-user support? Or... what part of One Laptop Per Child don't you understand?
- If personalization of a potentially shared resource is helpful then it is worth considering multi-user support / profiles. (handwriting/voice recognition etc)
- Ubiquity of mobile devices may push PC into more server-like and appliance roles – more integrated with a location. (Media/Entertainment center, Home server, Smart home)

What do we need to make it work better?

What do we need to make it work better?

- ConsoleKit
- HAL
- PolicyKit
- DisplayManager
- Kernel mode drivers
- Session Agents
- Well-behaved applications

ConsoleKit

- http://gitweb.freedesktop.org/?p=ConsoleKit.git
- http://people.freedesktop.org/~mccann/doc/ConsoleKit/ConsoleKit.html
- http://lists.freedesktop.org/archives/hal/2007-January/006996.html
- First prototype: 26 Sept 2006
- Initial check-in to git: 25 Oct 2006
- Announced: 11 Jan 2007

ConsoleKit

- ConsoleKit is a framework for defining and tracking user login sessions and seats.
- It can be used as a replacement for utmp.
- Who is logged in, from where, for how long, are they active, inactive, idle etc.

Session Object

- Properties
  - ID
  - Seat ID
  - Session type
  - Unix user
  - X11 display
  - X11 display device
  - Remote hostname
  - Active state
  - Local state
  - Creation Time
  - Idle hint state
  - Idle hint since time
- Signals
  - Active changed
  - Idle hint changed
  - Lock
  - Unlock

Seat Object

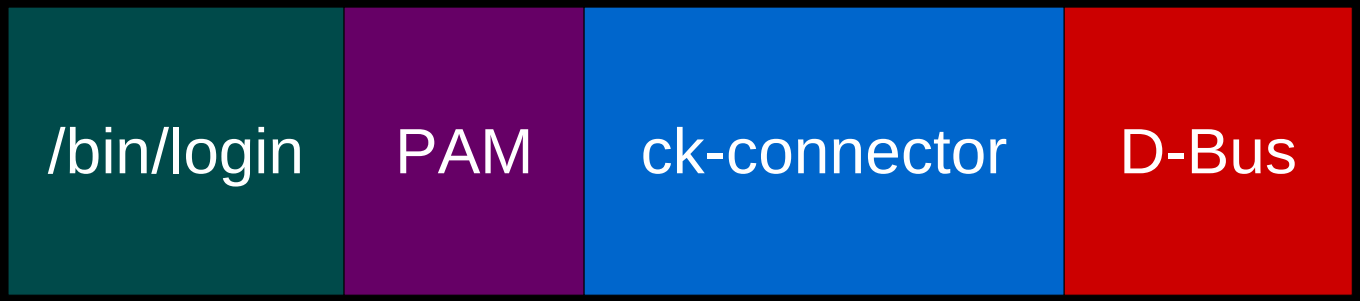
- Methods
  - GetId
  - GetSessions
  - GetActiveSessions
  - CanActivateSessions
  - ActivateSession
- Signals
  - ActiveSessionChanged
  - SessionAdded
  - SessionRemoved

Manager Object

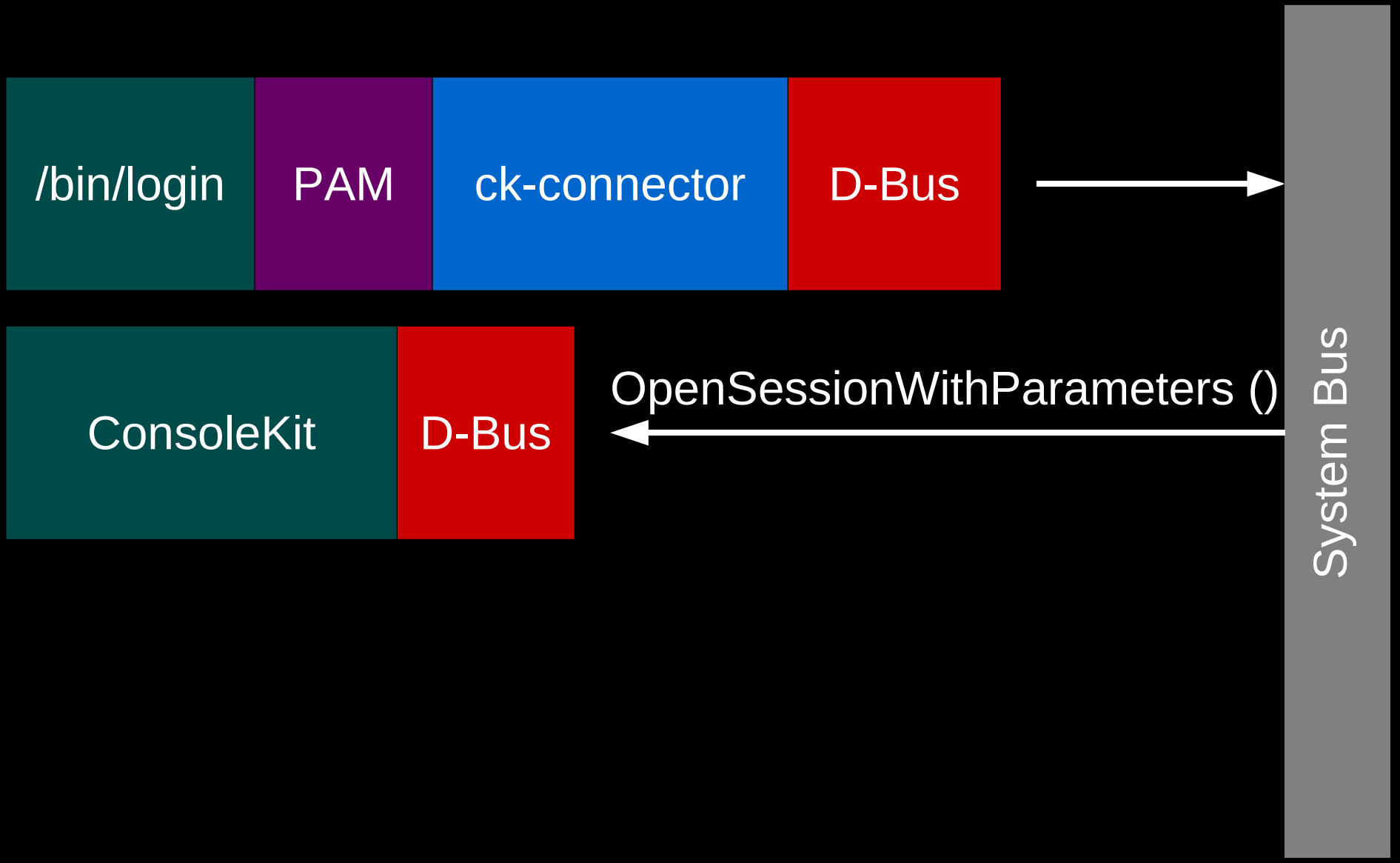
- Methods
  - OpenSession
  - OpenSessionWithParameters
  - CloseSession
  - GetSeats
  - GetSessionForCookie
  - GetSessionForUnixProcess
  - GetCurrentSession
  - GetSessionsForUnixUser
  - GetSystemIdleHint
  - GetSystemIdleHintSince
- Signals
  - SeatAdded
  - SeatRemoved
  - SystemIdleHintChanged

How does it work?

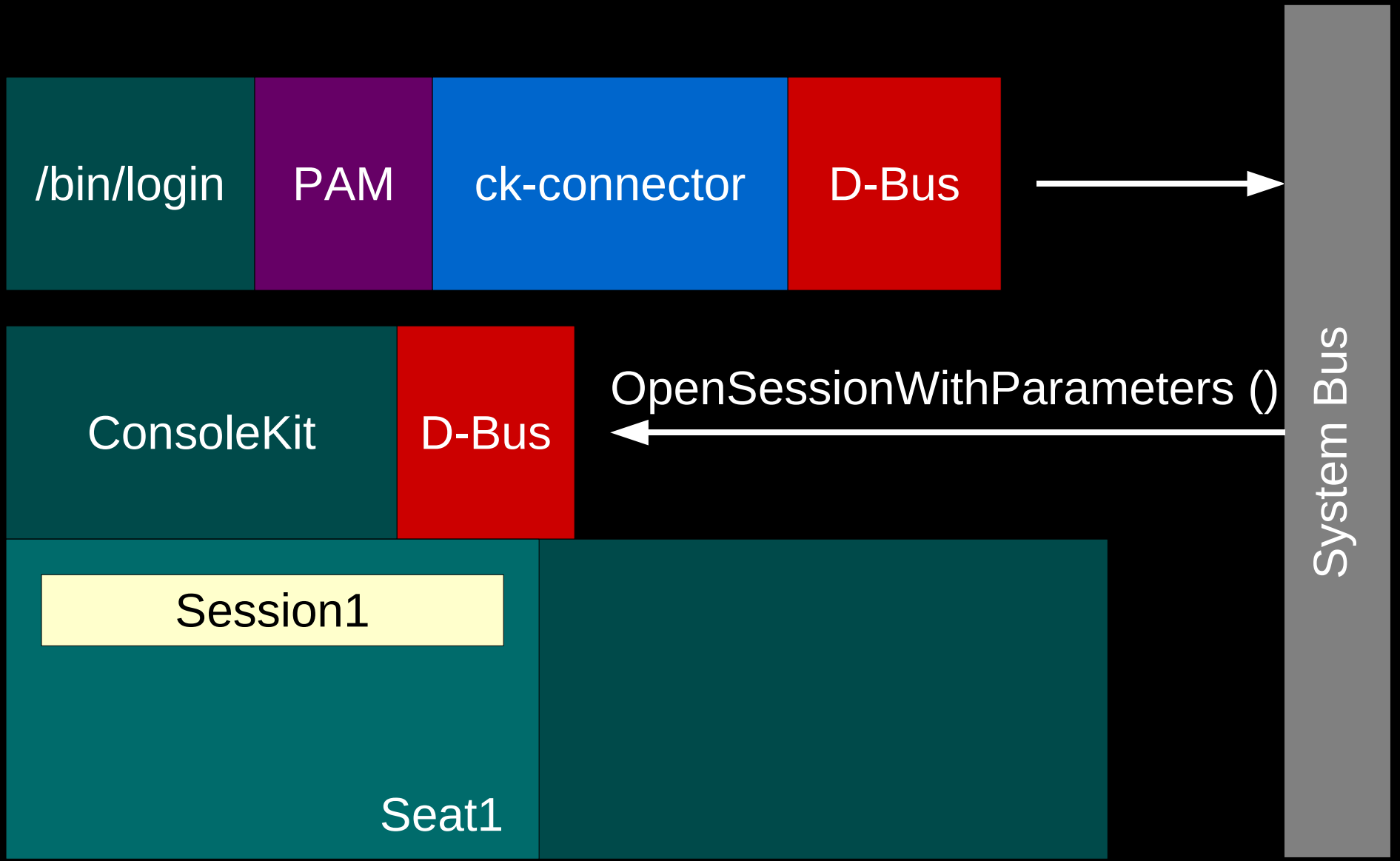
Text Login



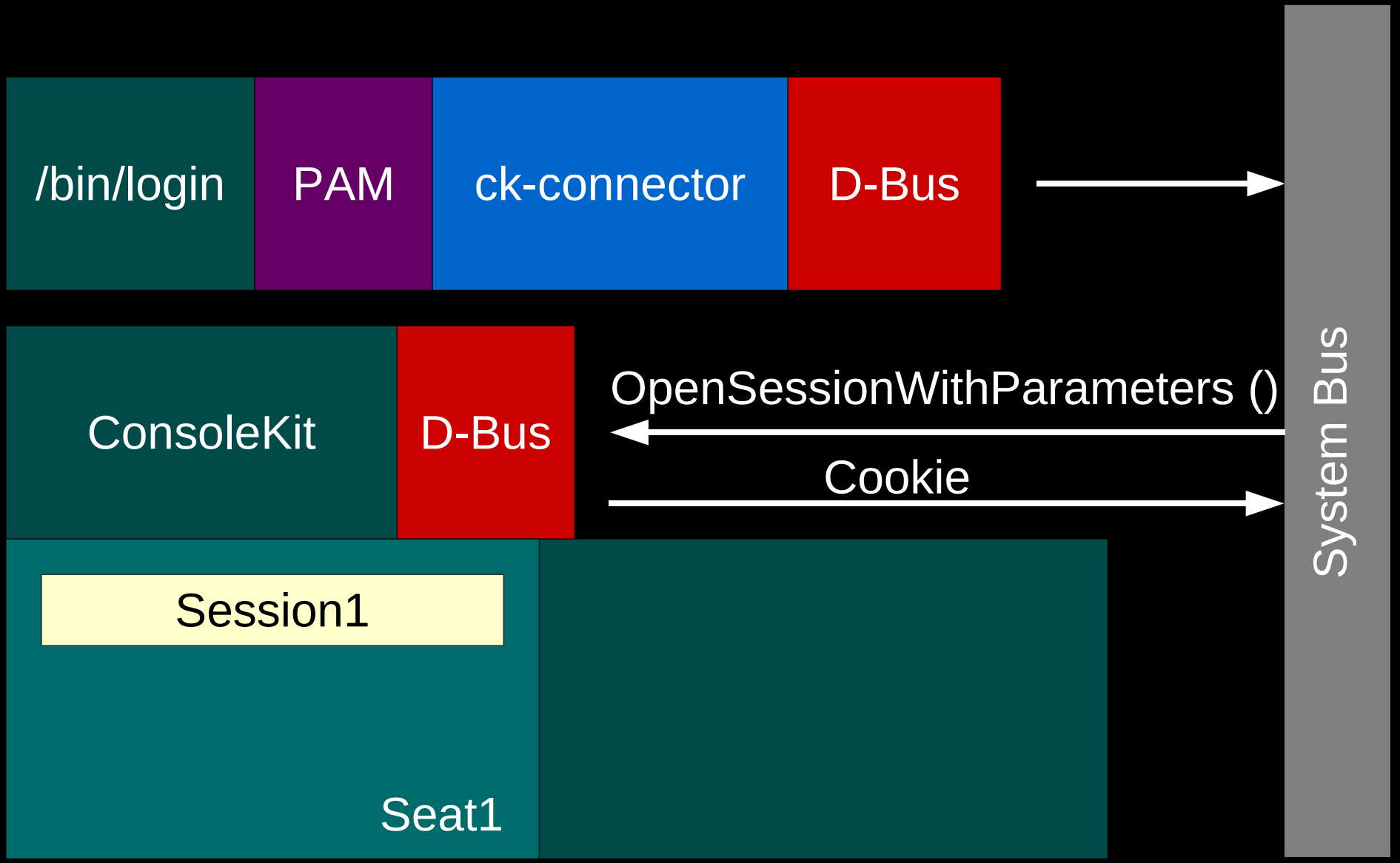
Text Login


/bin/login
PAM
ck-connector
D-Bus
System Bus
ConsoleKit
D-Bus
OpenSessionWithParameters ()

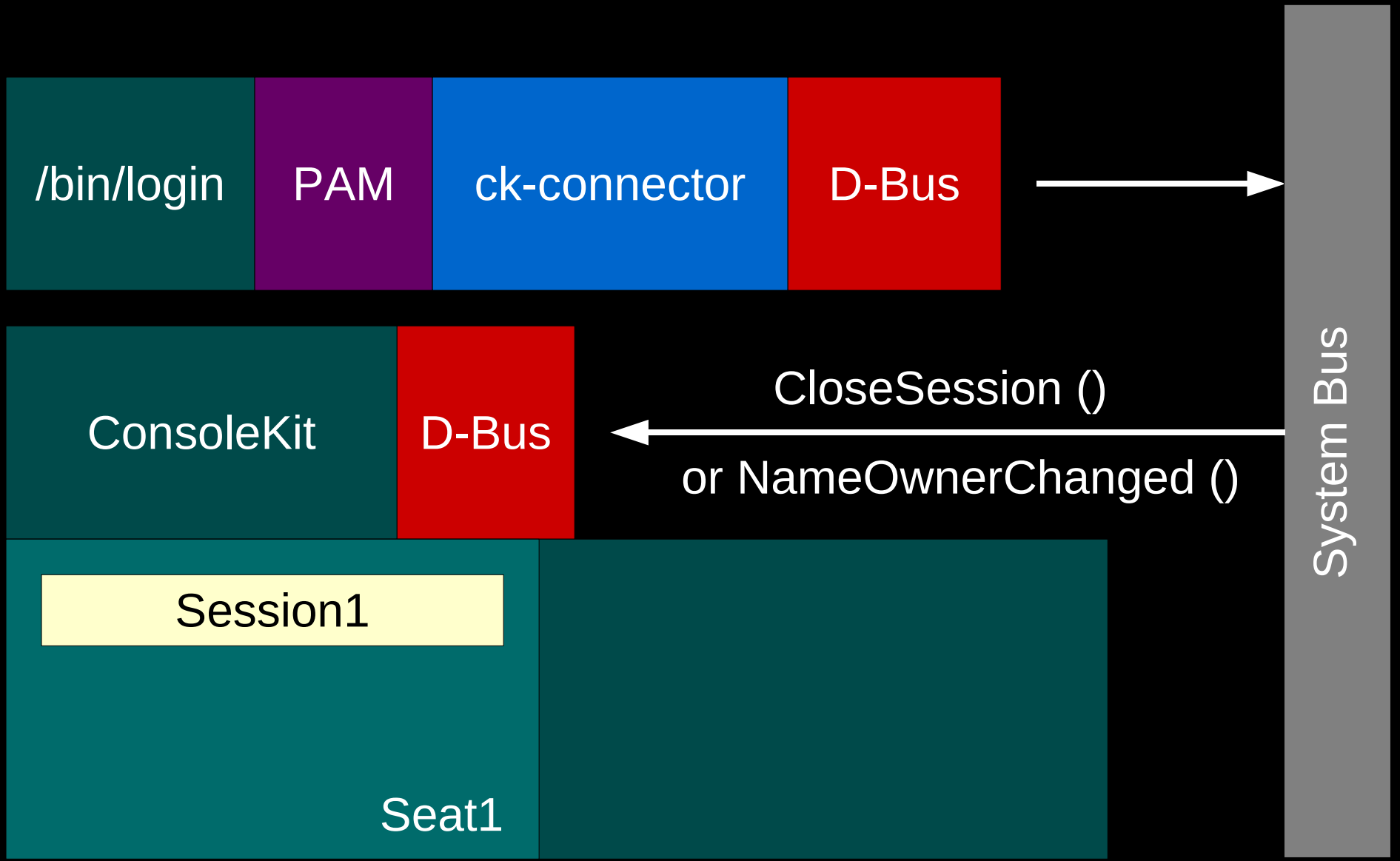
Text Login


/bin/login
PAM
ck-connector
D-Bus
System Bus
ConsoleKit
D-Bus
OpenSessionWithParameters ()
Session1
Seat1

Text Login


/bin/login
PAM
ck-connector
D-Bus
System Bus
ConsoleKit
D-Bus
OpenSessionWithParameters ()
Cookie
Session1
Seat1

Text Login


/bin/login
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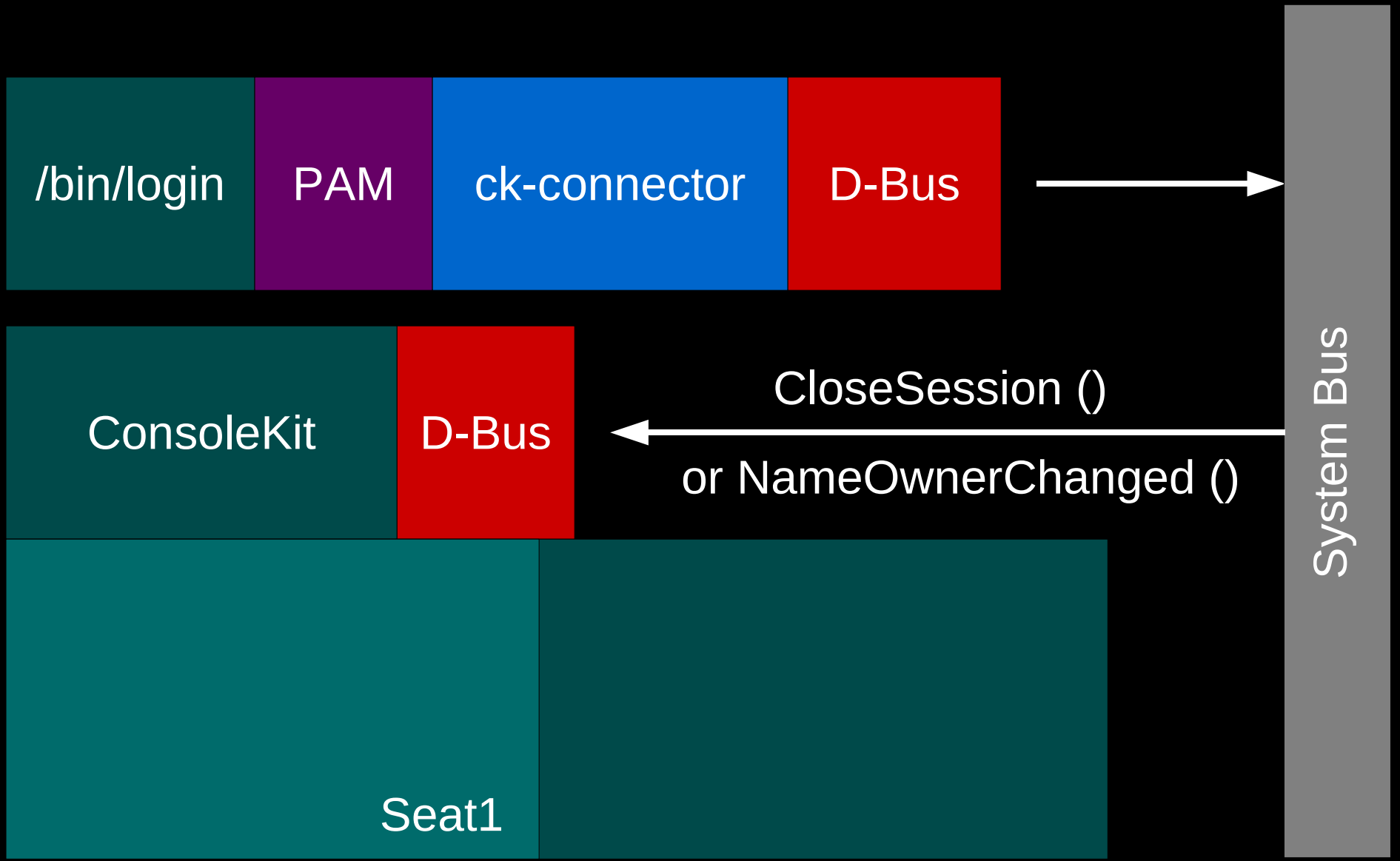
Seat1

Text Login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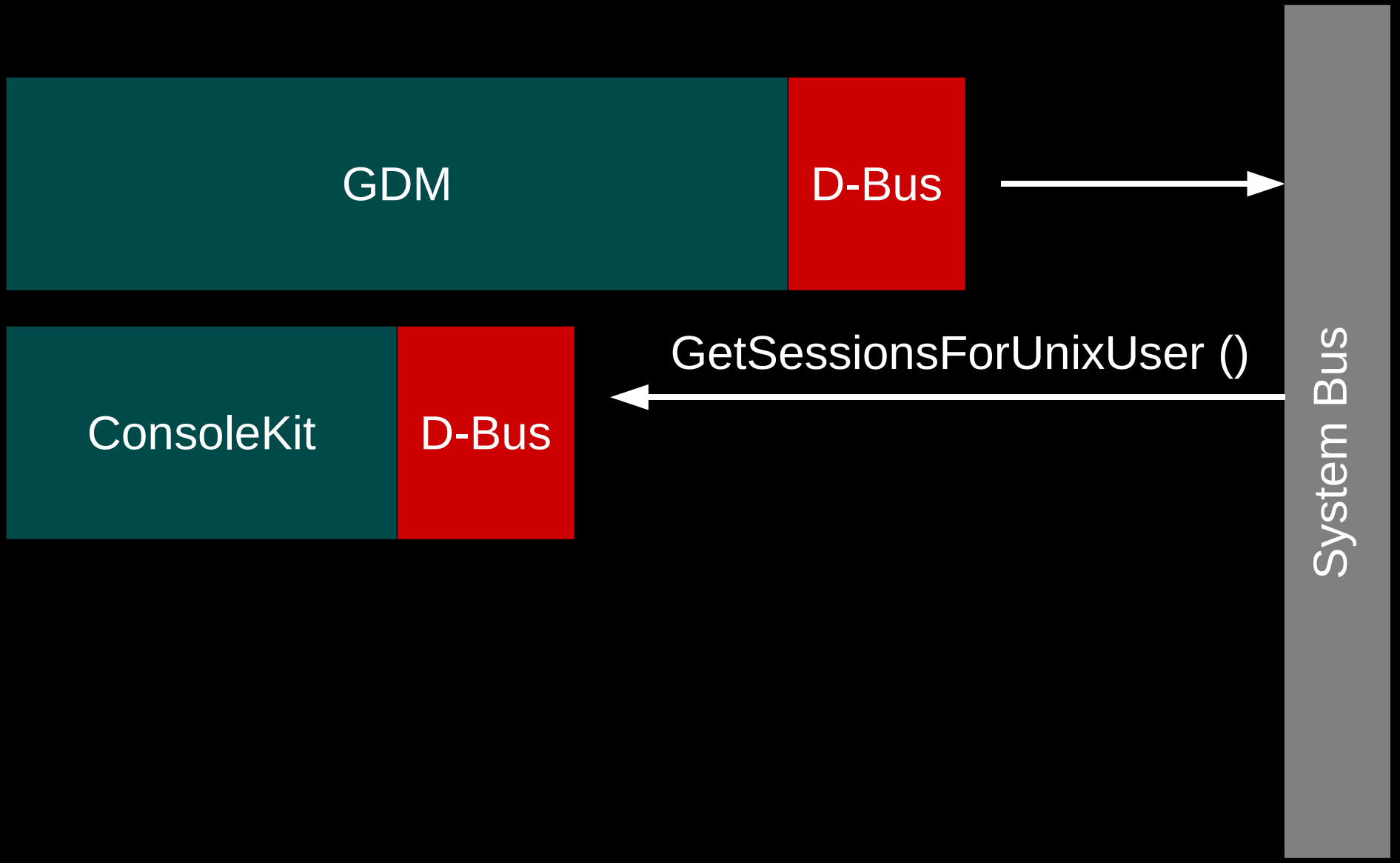

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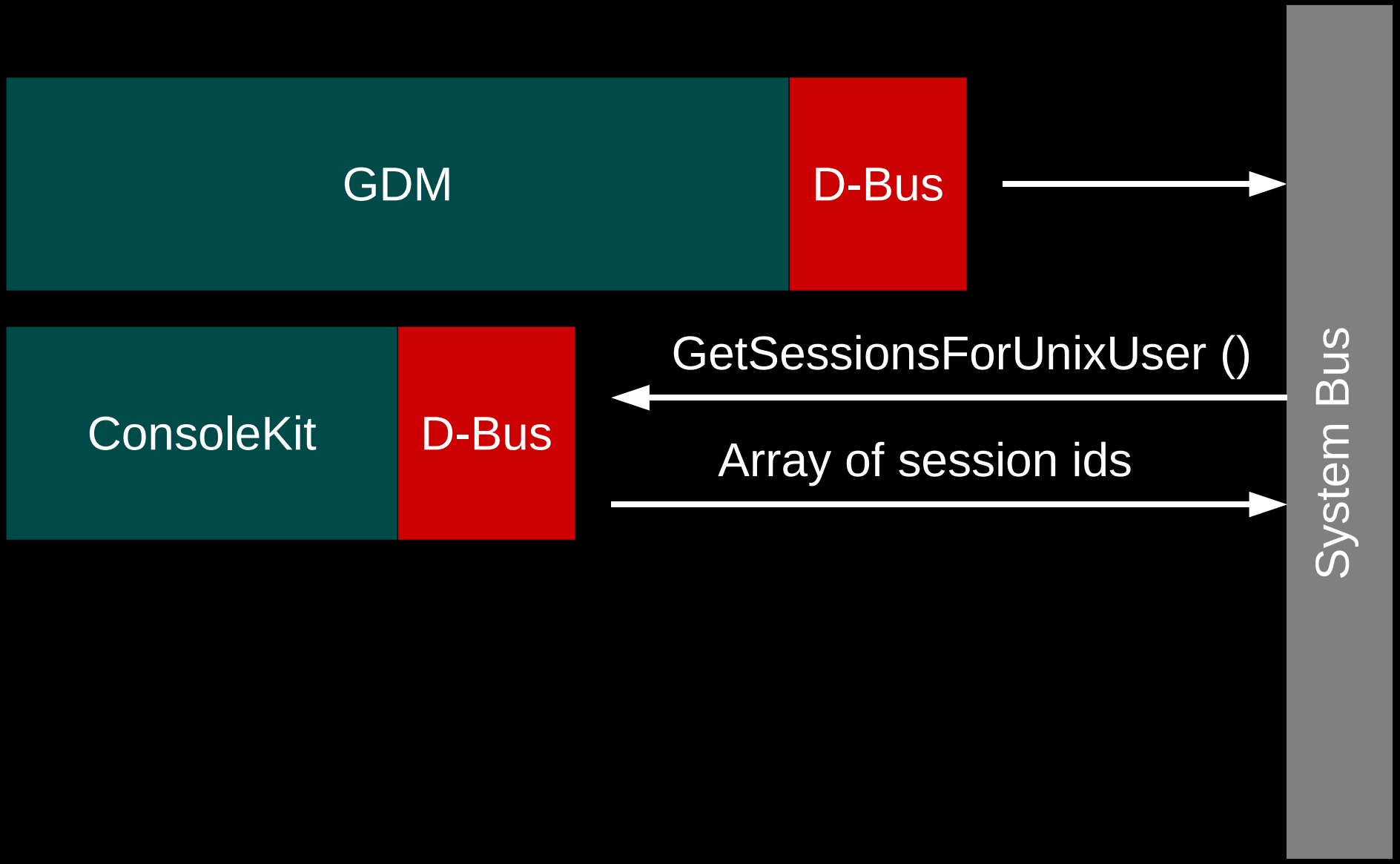

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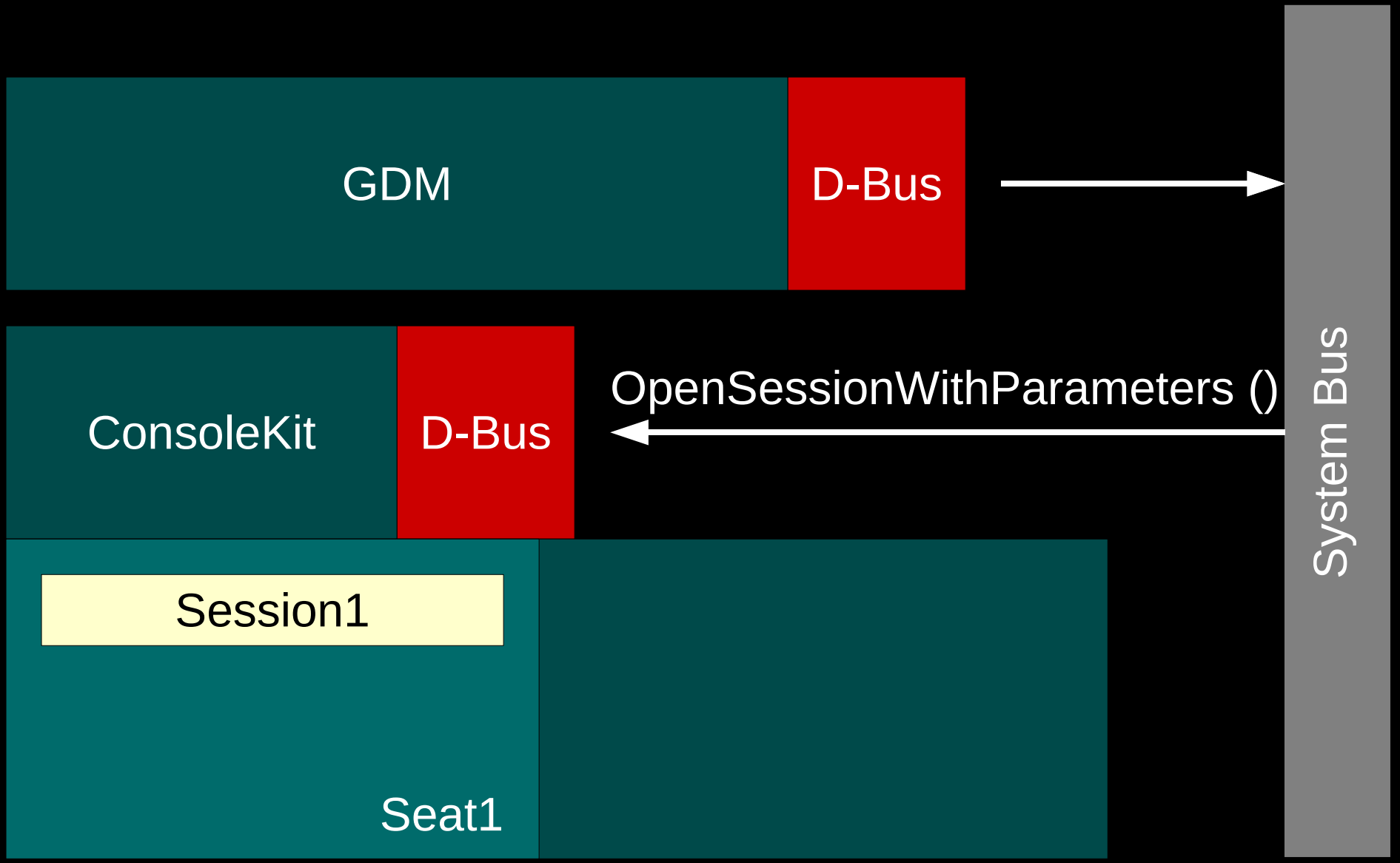

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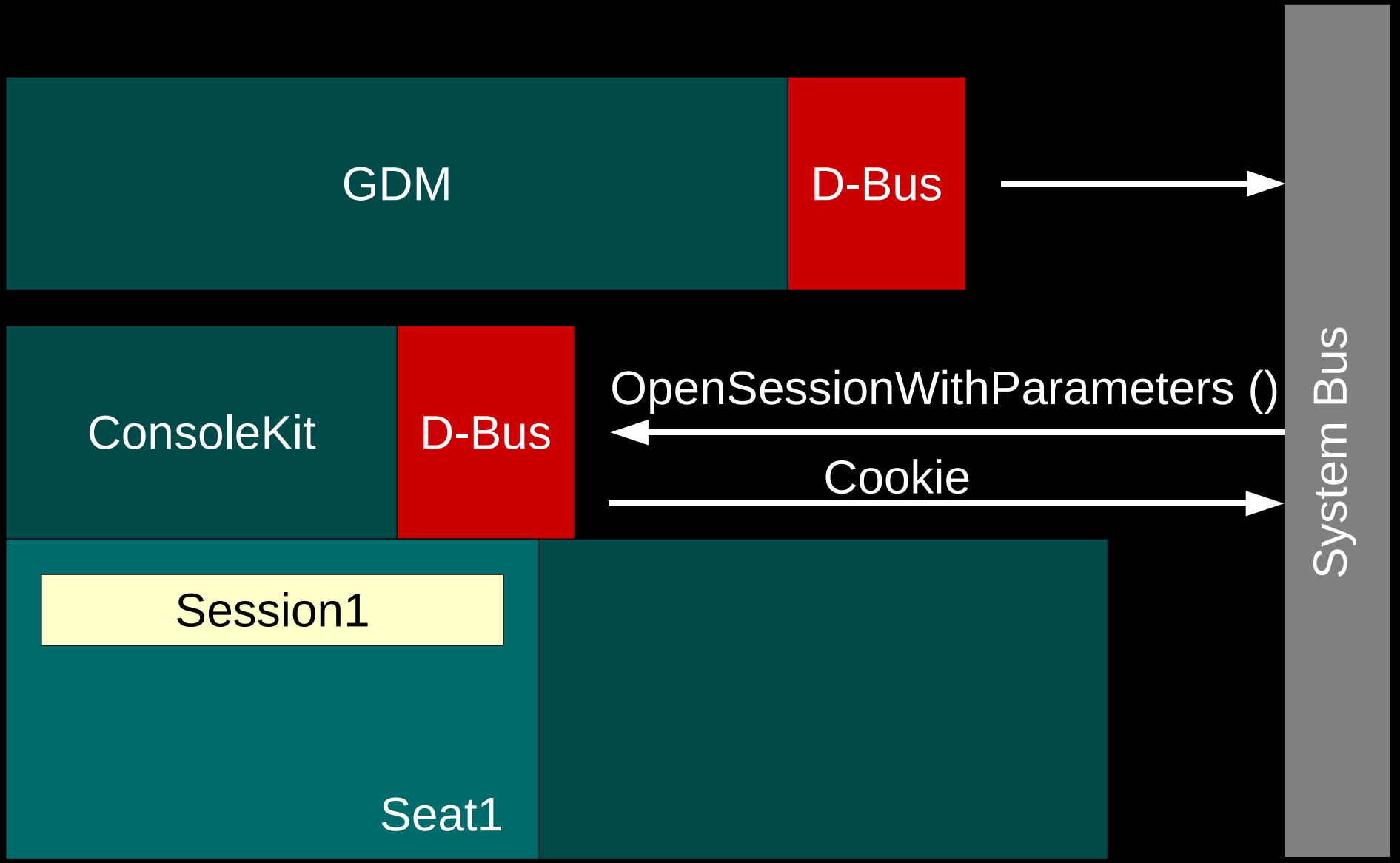

User Switching

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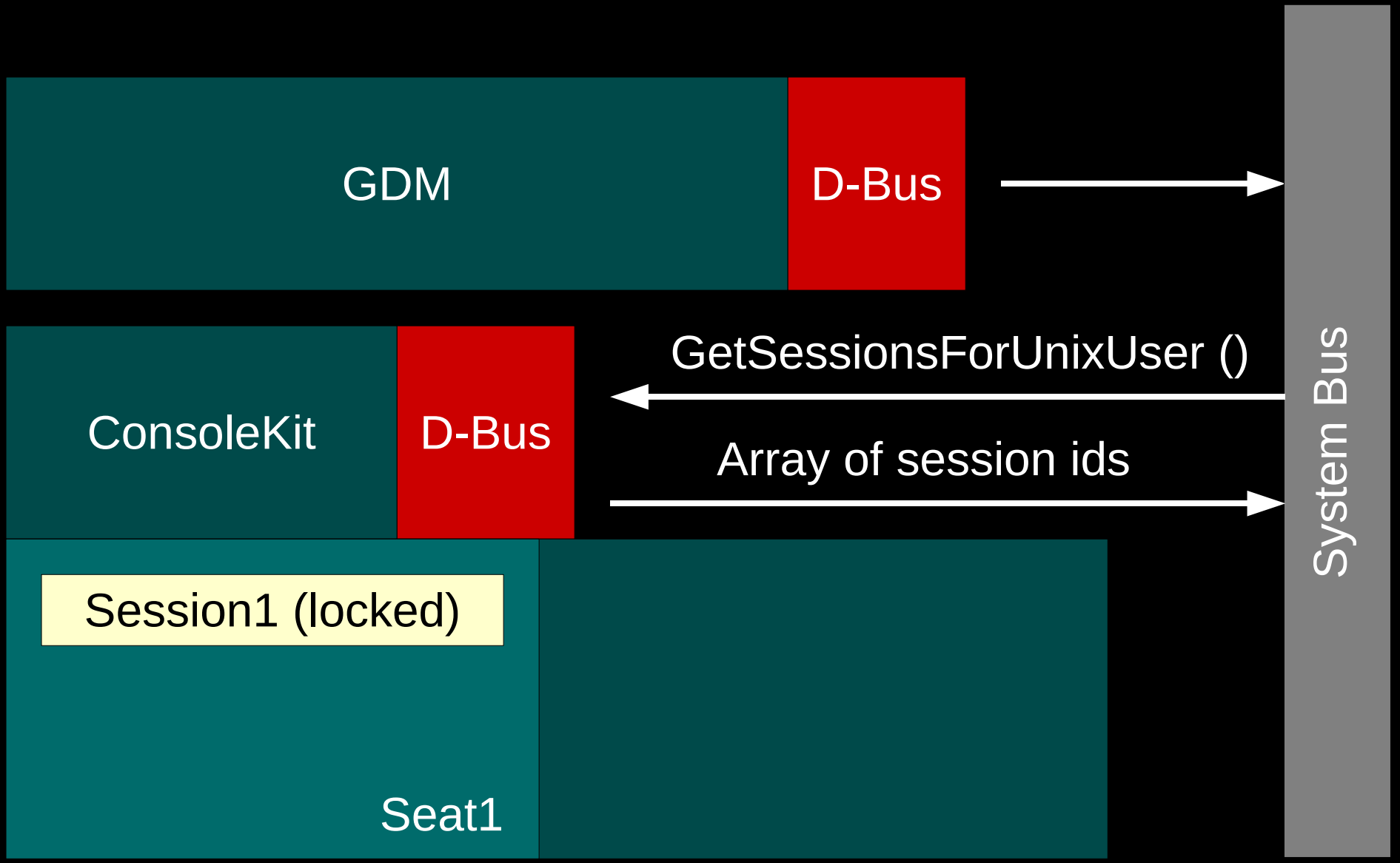

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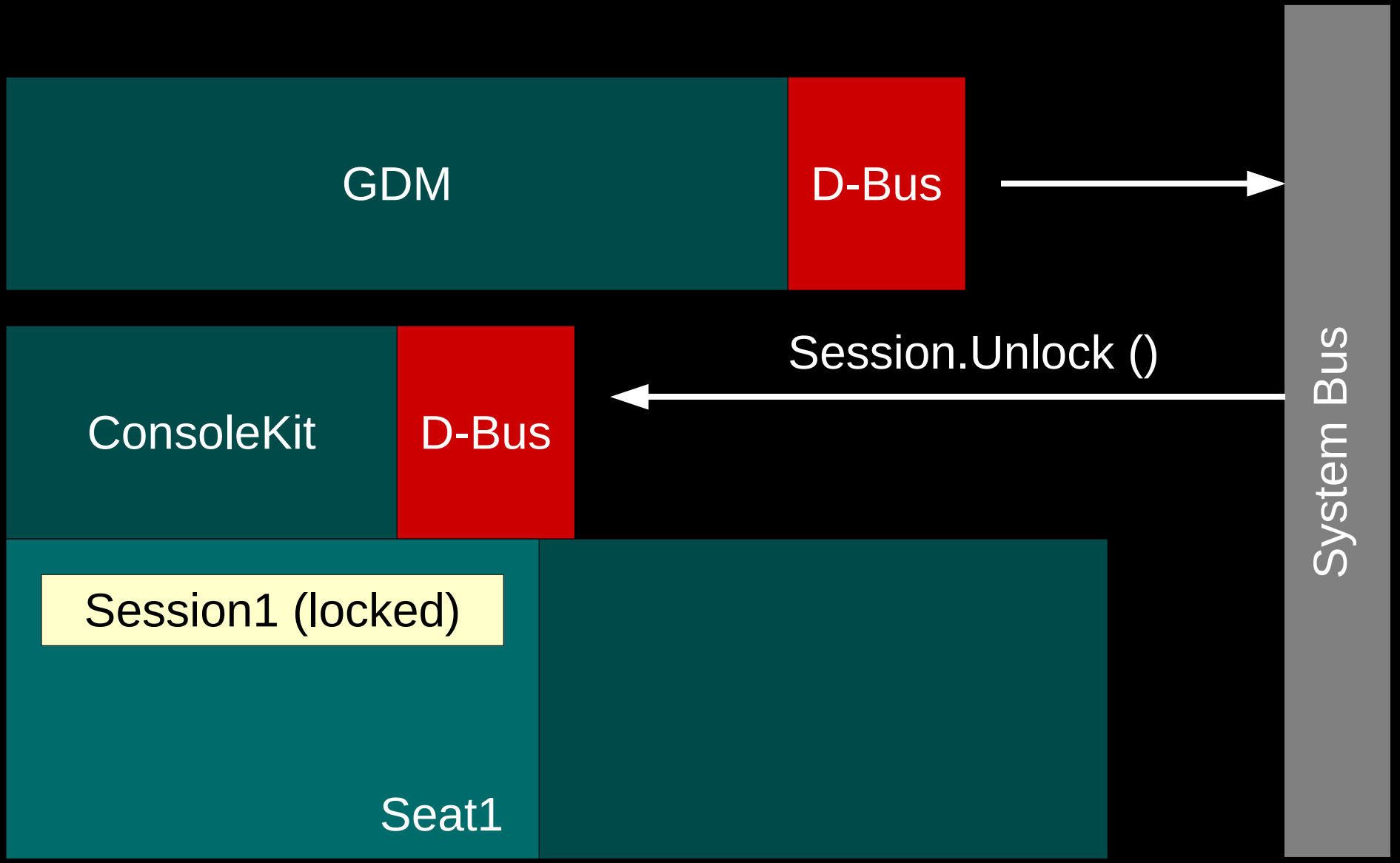

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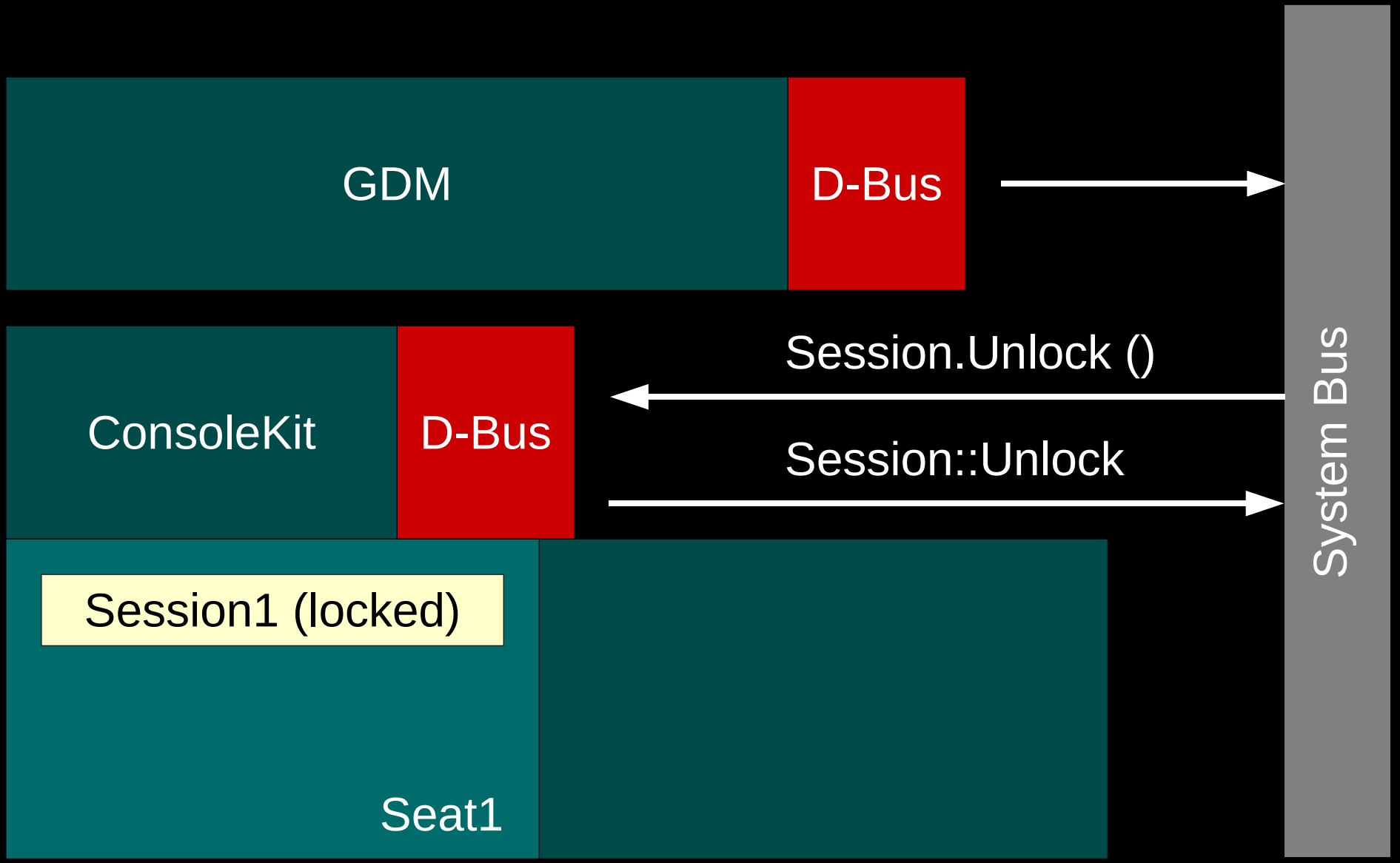

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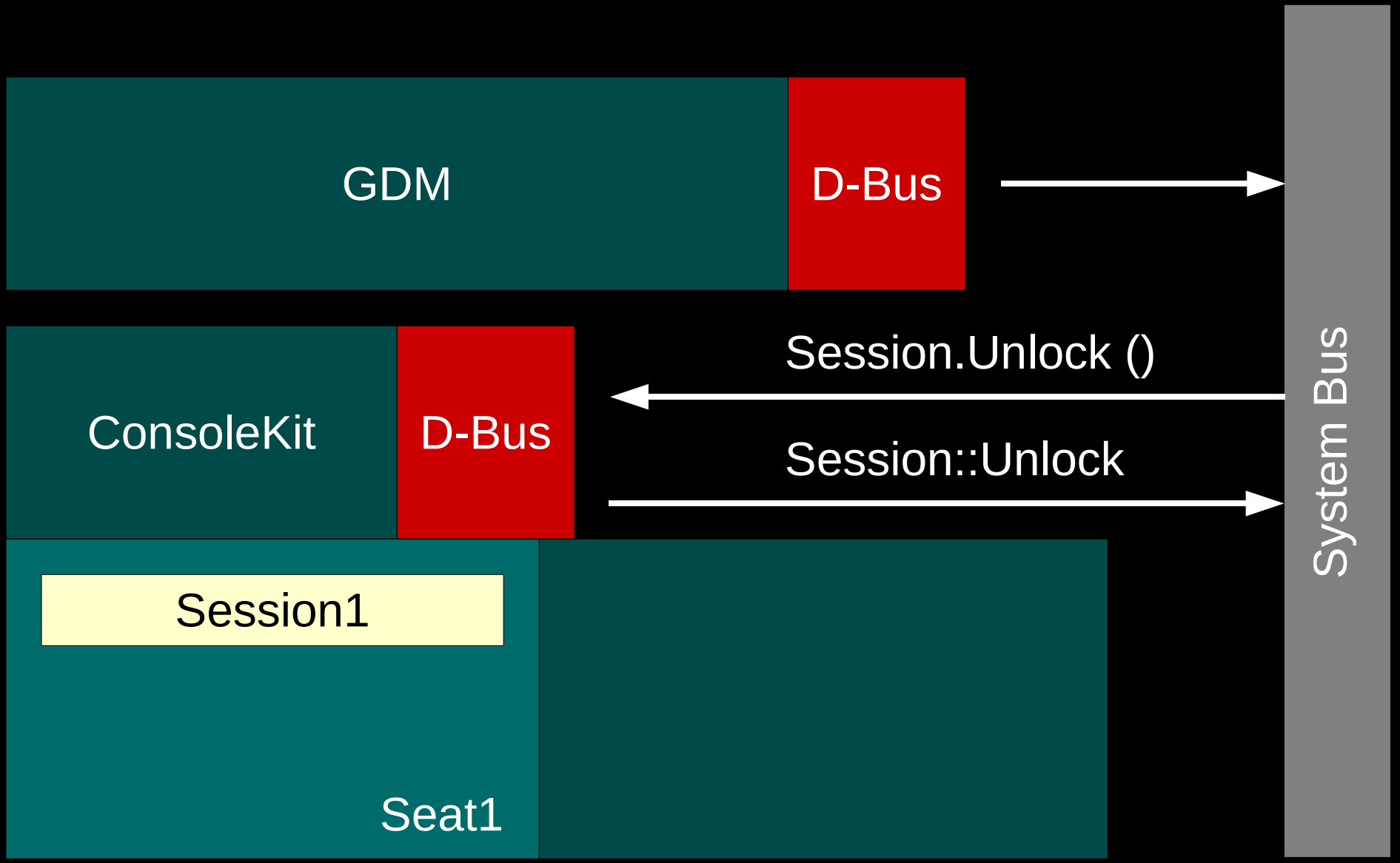

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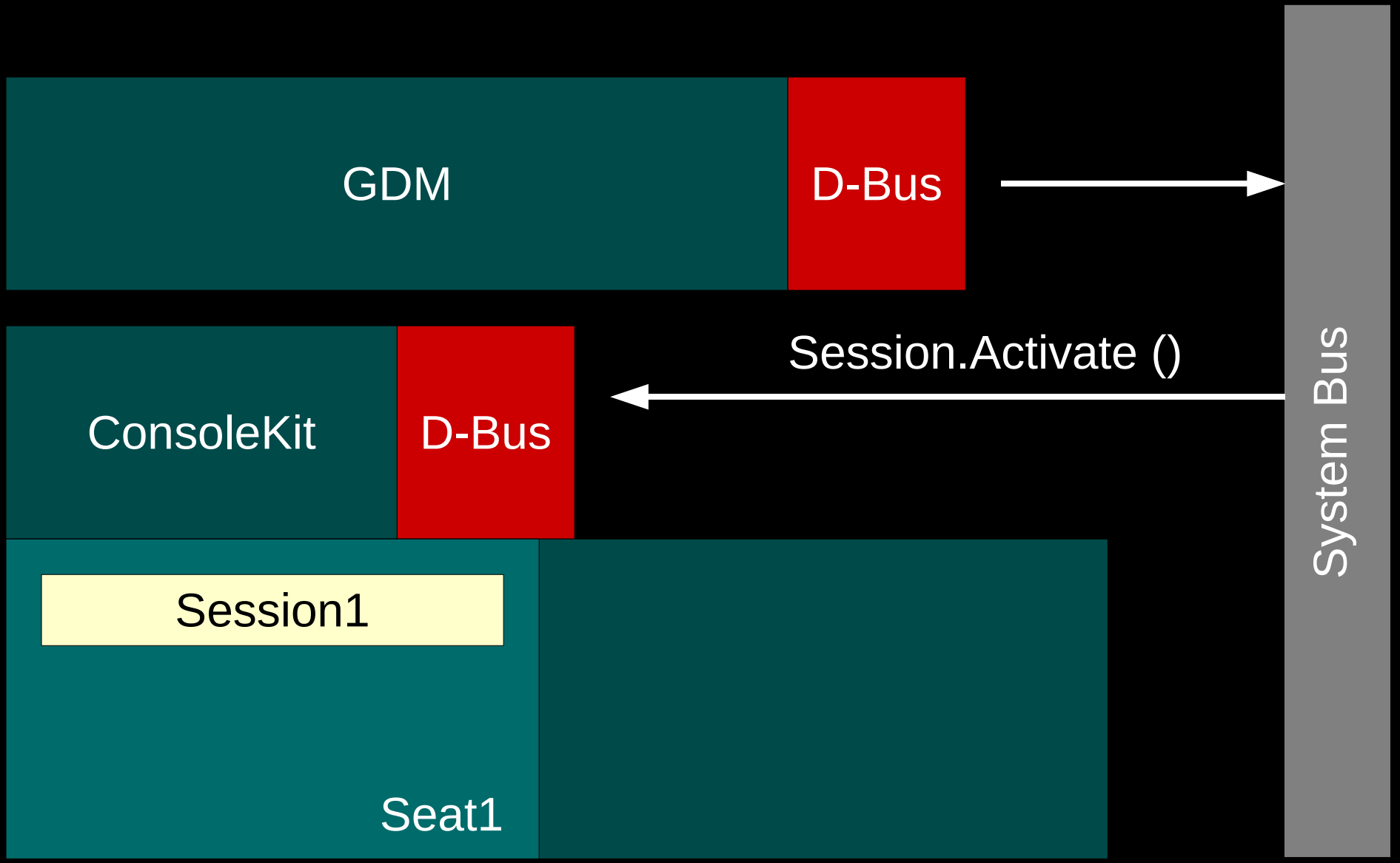

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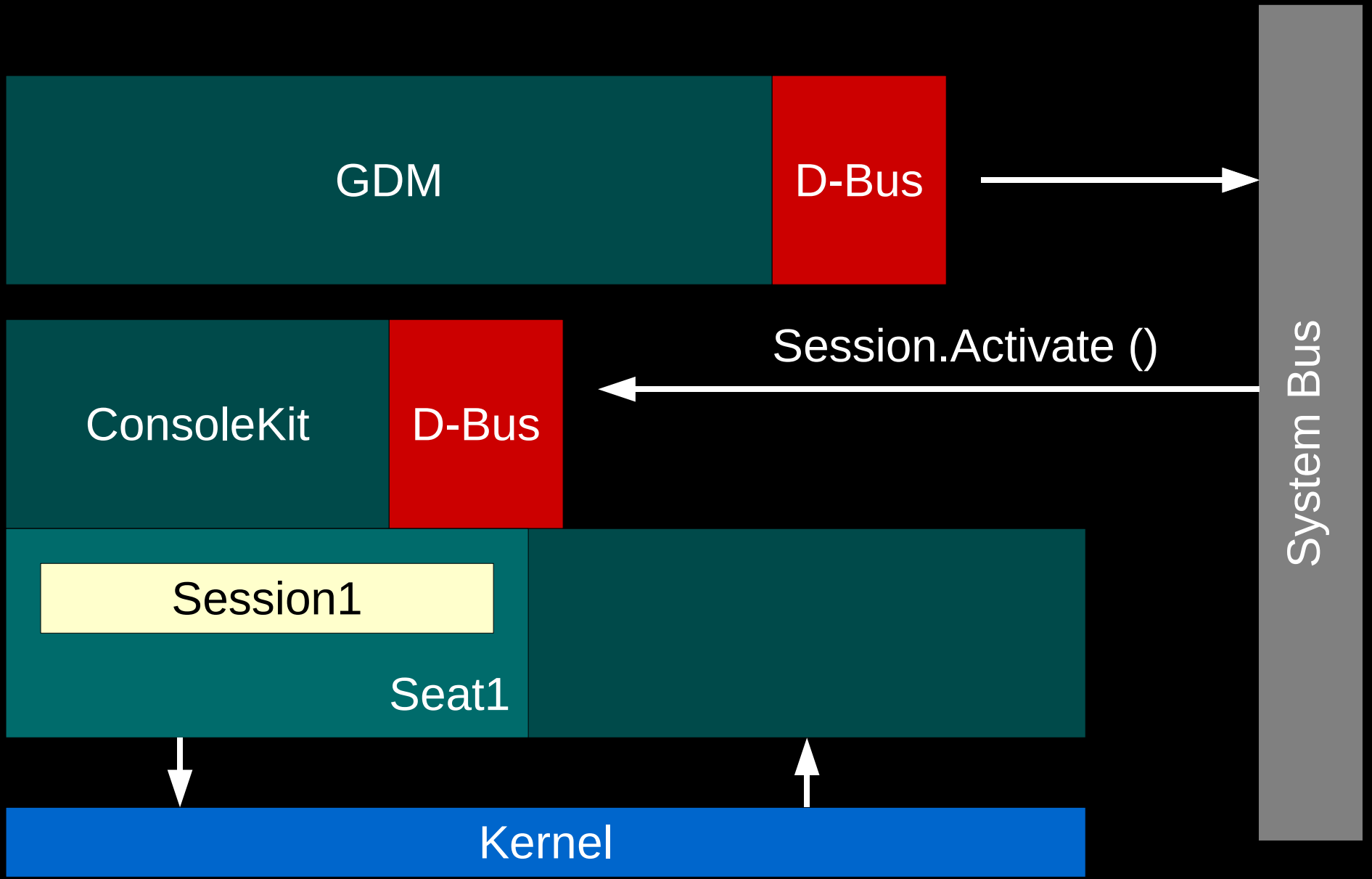

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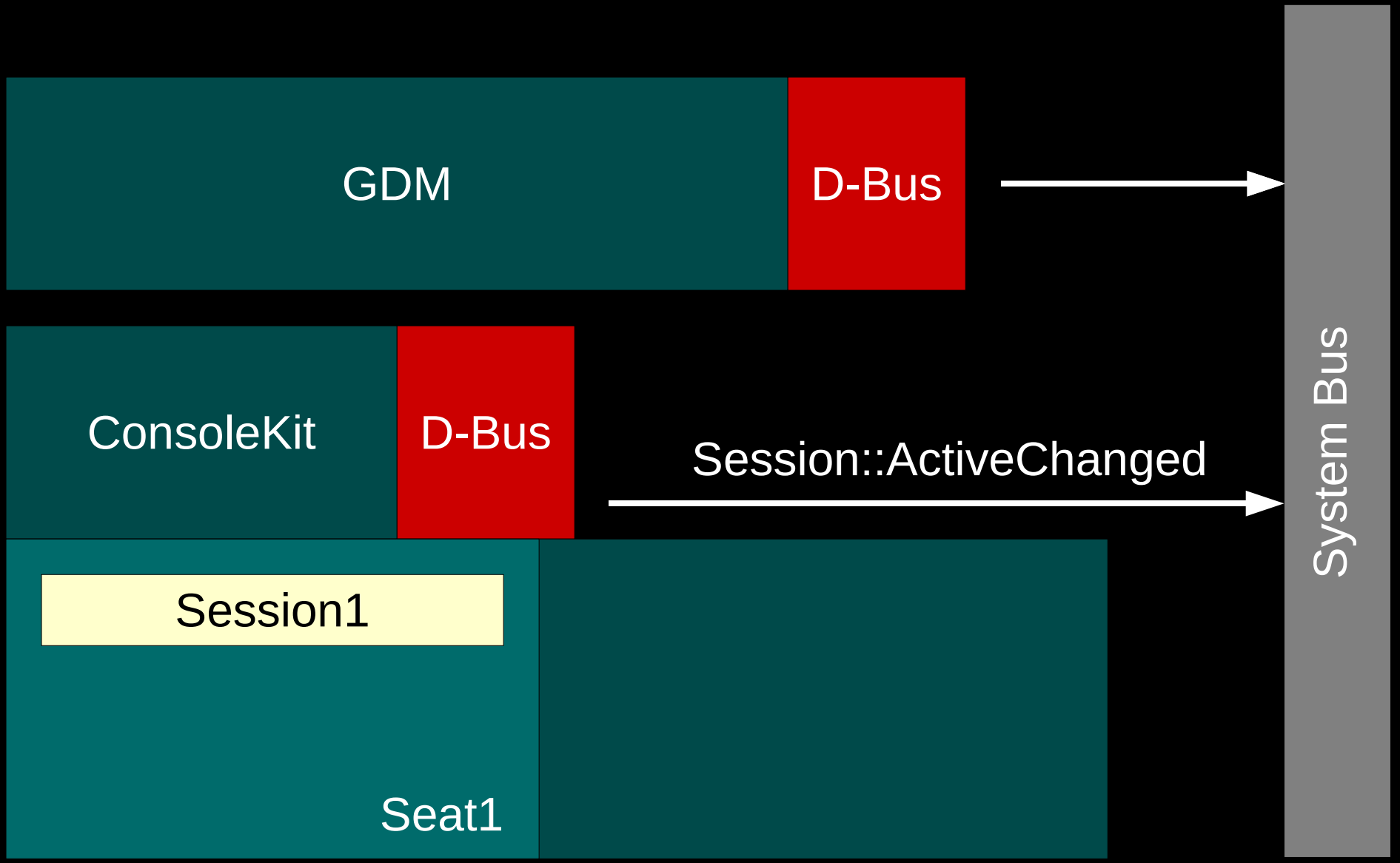

HAL

HAL

- Now that we have well-defined sessions, and session change notifications, HAL can refuse service to inactive sessions and stop polling when the system is idle.
- However, whether a session is active is only one possible criterion for policy decisions...

PolicyKit

- Decide whether something can be done by a given user to a given resource.
- Decide whether a given resource is accessible from a given session.
- Decide what resources belong to which seats.

DisplayManager

- Needs to detect changes in seat configuration.
- Start a greeter per seat.
- Make a greeter more session-like.
- Integrate ConsoleKit more deeply.

GDM2

- Just not up to the task in its current form.
- Serious problems at just about every level.
- Had reached the threshold of maintainability.

A Fresh Start

- In May 2007 I decided to branch gdm and essentially start from scratch.
- http://svn.gnome.org/viewcvs/gdm2/branches/mccann-gobject/

What is interesting about it?

- New configuration system but still uses the old .desktop file backend. Designed to simplify migration to a hypothetical system-wide GConf.
- Replaced the internal and external socket protocols with D-Bus interfaces.
- Dramatically simplified the interface between daemon and greeter.
- Made greeter a real session with gnome-power-manager running.
- Includes a factory greeter display that spawns sessions on new VTs.

Homework: Write an awesome greeter

```
GDM_GREETER_DBUS_ADDRESS

<interface name="org.gnome.DisplayManager.GreeterServer">
  <method name="AnswerQuery">
    <arg name="text" direction="in" type="s"/>
  </method>
  <method name="SelectSession">
    <arg name="text" direction="in" type="s"/>
  </method>
  <method name="SelectLanguage">
    <arg name="text" direction="in" type="s"/>
  </method>
  <method name="SelectUser">
    <arg name="text" direction="in" type="s"/>
  </method>
  <method name="Cancel">
  </method>
  <signal name="Info">
    <arg name="text" type="s"/>
  </signal>
  <signal name="Problem">
    <arg name="text" type="s"/>
  </signal>
  <signal name="InfoQuery">
    <arg name="text" type="s"/>
  </signal>
  <signal name="SecretInfoQuery">
    <arg name="text" type="s"/>
  </signal>
  <signal name="Reset">
  </signal>
</interface>
```

How can I make an application multi-user aware?

How can I make an application multi-user aware?

- Detect multiple instances
- Don't expect exclusive access to devices
- Yield resources
- Know when to take a nap
- Be a good neighbor
- Do your grunt work when system is idle

What's next?

- Finish new DisplayManager
- Integrate with PolicyKit
- Port applications to new interfaces
- Work on multi-seat configuration
- Experiment with hot desking / session migration
- Session hibernation?

How can I help?

- Build / Test / Develop / Discuss
- ConsoleKit / PolicyKit / HAL: http://lists.freedesktop.org/mailman/listinfo/hal
- DisplayManager: http://mail.gnome.org/mailman/listinfo/gdm-list