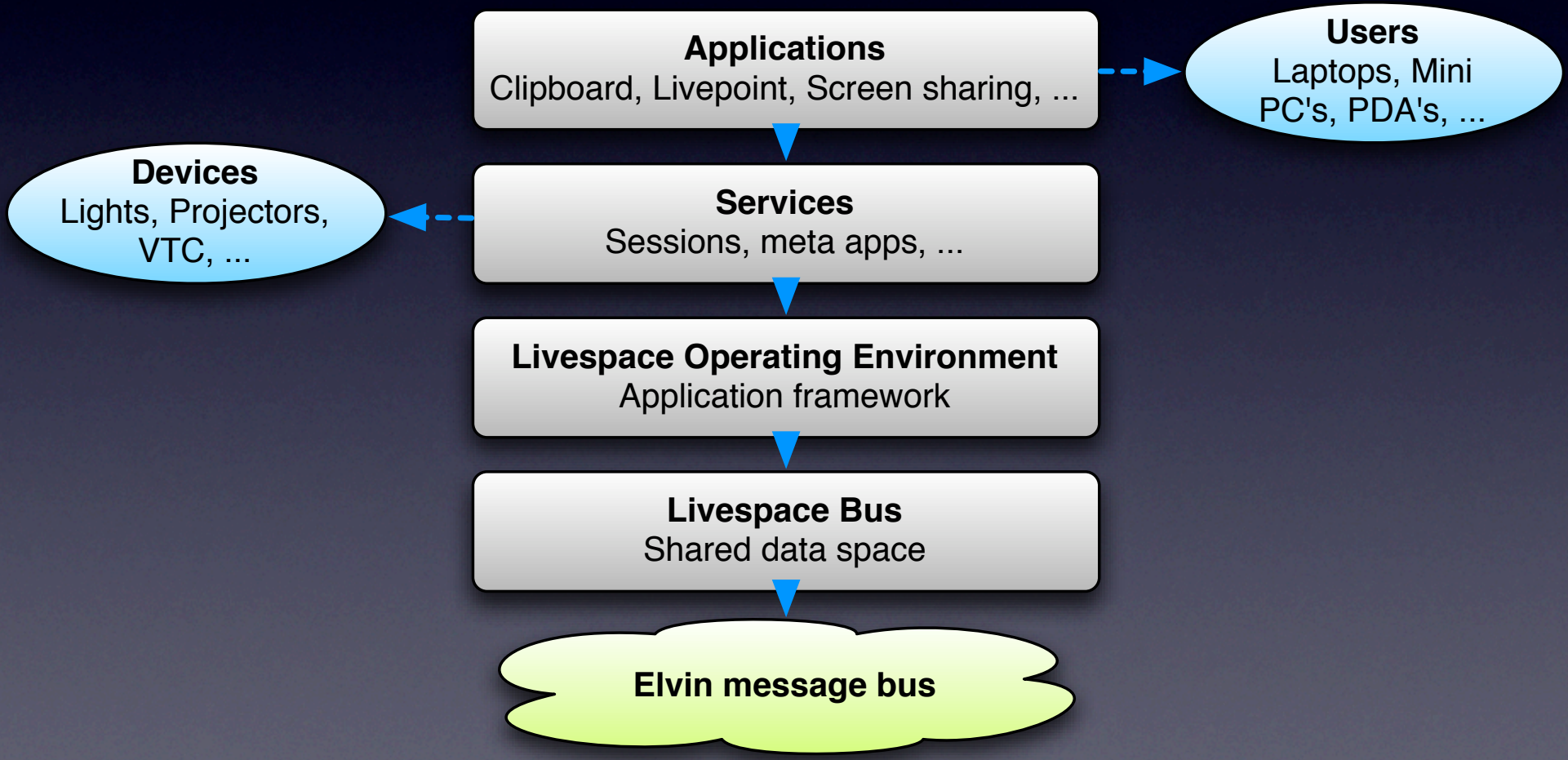
The Livespace Bus

Part I

The Livespace Bus

The Livespace bus is the core communication system underlying a Livespace

Where The Bus Fits



History

- Where the concepts underlying the Livespace architecture came from

History

- Livespaces started life as AUSPLANS
- Originally built with iROS, ODSI, Breeze and other bits and pieces
- This had lots of problems for any number of reasons
- But the root cause of most of them were due to the fact that...

Distributed Systems

Are

Hard

Eight Fallacies Of Distributed Computing

1. The network is reliable
2. Latency is zero
3. Bandwidth is infinite
4. The network is secure
5. Topology doesn't change
6. There is one administrator
7. Transport cost is zero
8. The network is homogeneous

– Peter Deutsch, Bill Joy, Tom Lyon, James Gosling

Everyone Thinks RPC's Are A Solution

- Remote Procedure Calls (RPC's) seem like a a natural solution
- Every developer understands the model
- Just run a call over the network

RPC's Fall Afoul Of The Eight Fallacies

- Especially affected by
  - Unreliable network
  - Non-zero latency
  - Security
  - Topology changes

Other Ways RPC's Fail

- Synchronous – clients tied to the network
- Large & brittle API – evolution is hard
- One way – hard for a "client" to connect to "server"
- A leaky abstraction – real procedure calls do not randomly fail when someone kicks a cable out of a socket

Why Tuple Spaces Don't (Quite) Work

- Tuple spaces are a good step up
- And they *almost* solve our problems
- Tuples are network events, often used to
  - Find/announce a resource's existence
  - Telling you about a change to a resource
  - Requesting a change (to a resource)

Resources: Find, Update, Monitor

- The resource *find*, *update* and *monitor* pattern is universal in tuple spaces
- But they miss one thing:

  They don't actually define what a resource is

- Clearly the next step is...

Make Everything A Resource

Everything in a Livespace should a

findable,

modifiable,

observable

information resource

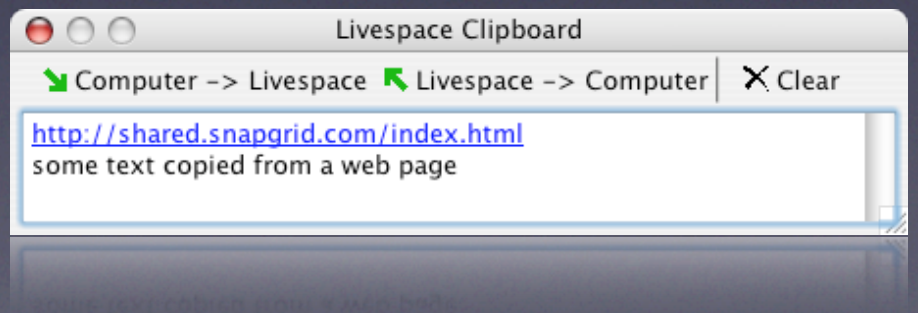
... simple!

It Actually Is Almost That Simple

- All operations in a Livespace are modelled as state changes to distributed resources
- We call these resources *entities*

Simplest Example – The Clipboard

- To set clipboard text
  - Find the `clipboard` entity
  - Set its `text` property



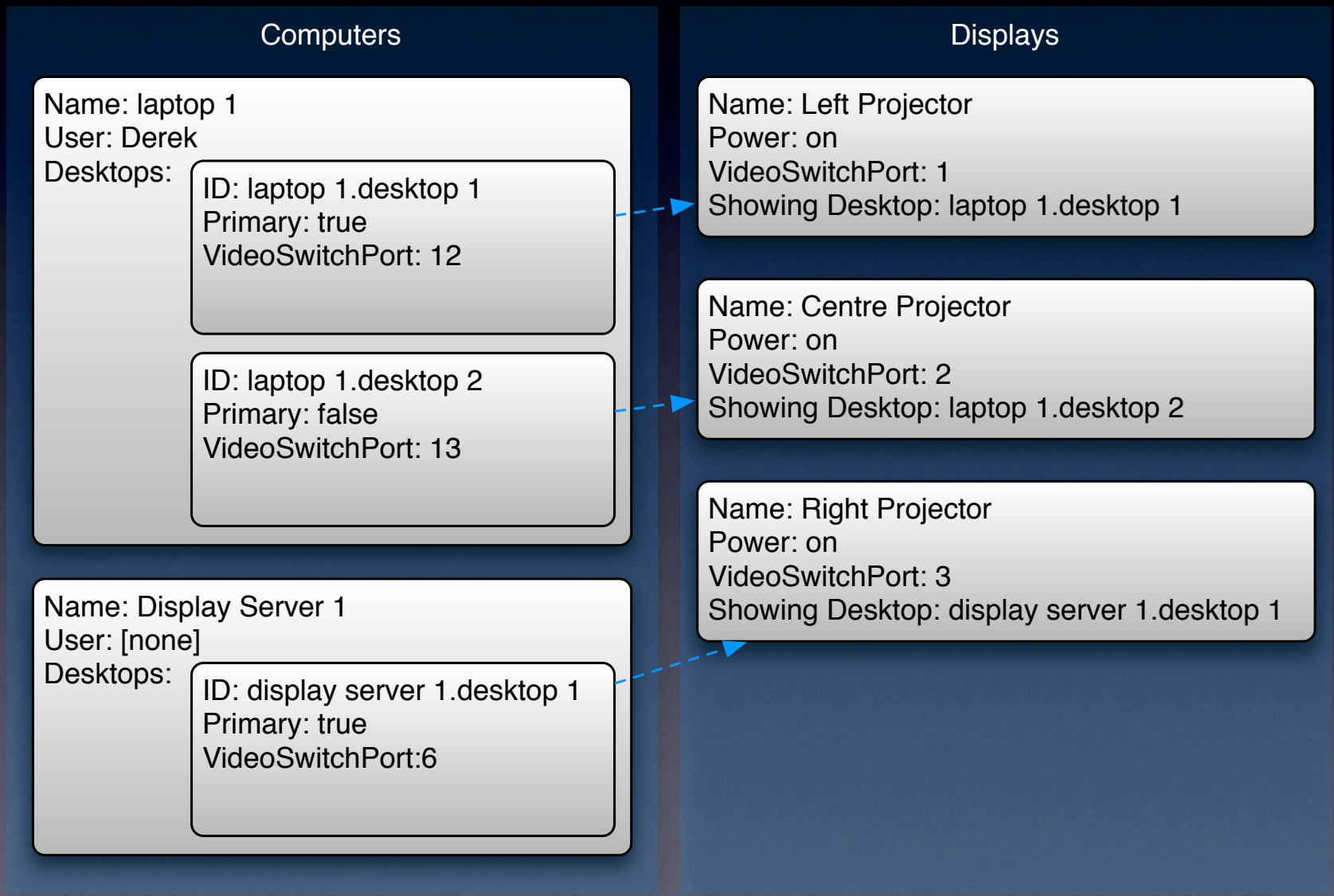
Another Example – The Command Line Service

- Allows commands to be executed on a host
- An example of an active service
- Set the `computer` entity's `commandLine.command` property to execute a command on that computer
- Result is echoed in other properties

Complex Example – Forwarding A Screen

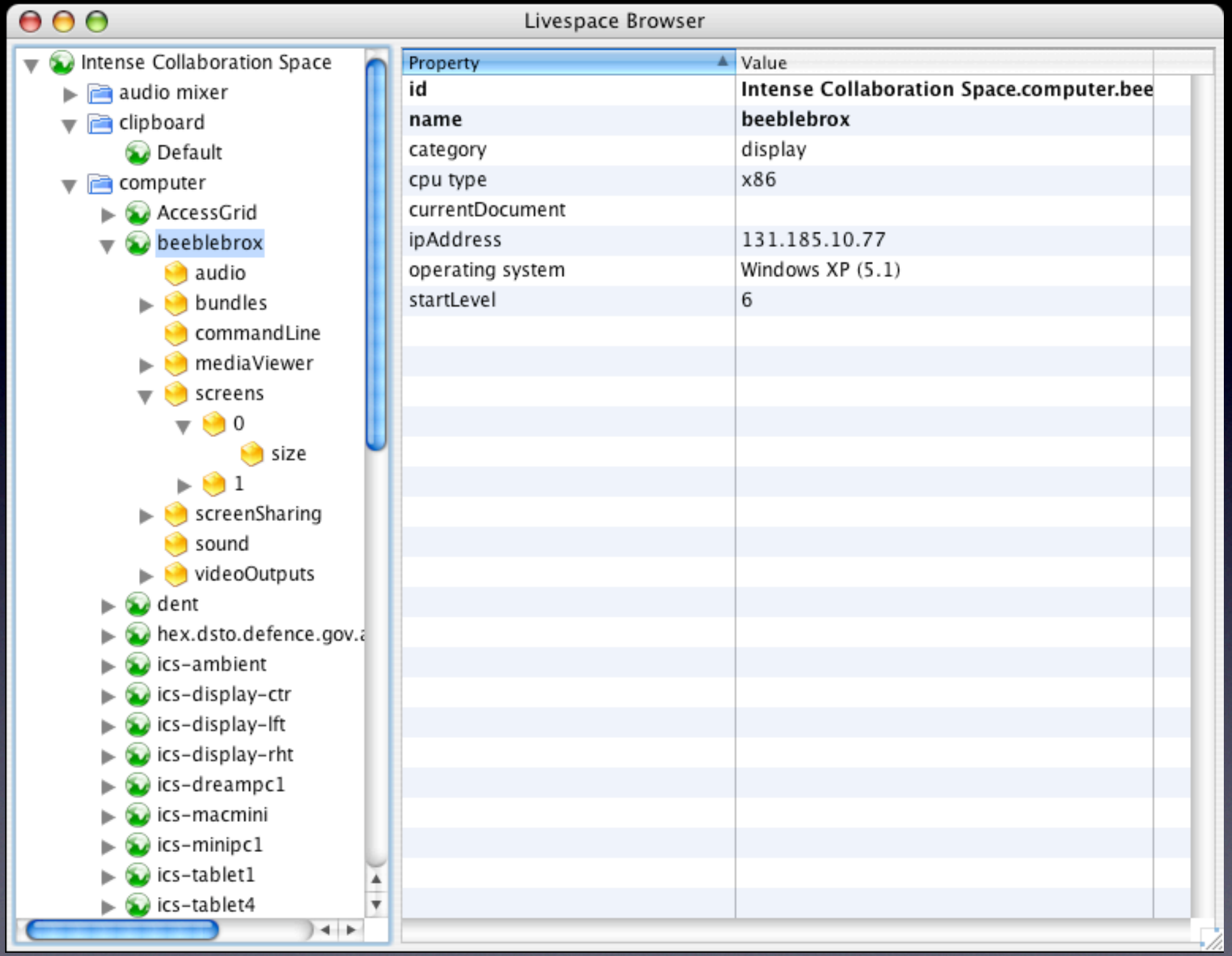
- Find the computer's `screen` entity
- Find the `display` entity
- Set the display's `videoSource` property

Example – Forwarding A Screen



The Browser

- The *everything-is-an-entity* approach makes it easier to see what's going on
- The Livespace Browser is a general exploration & debugging tool for entities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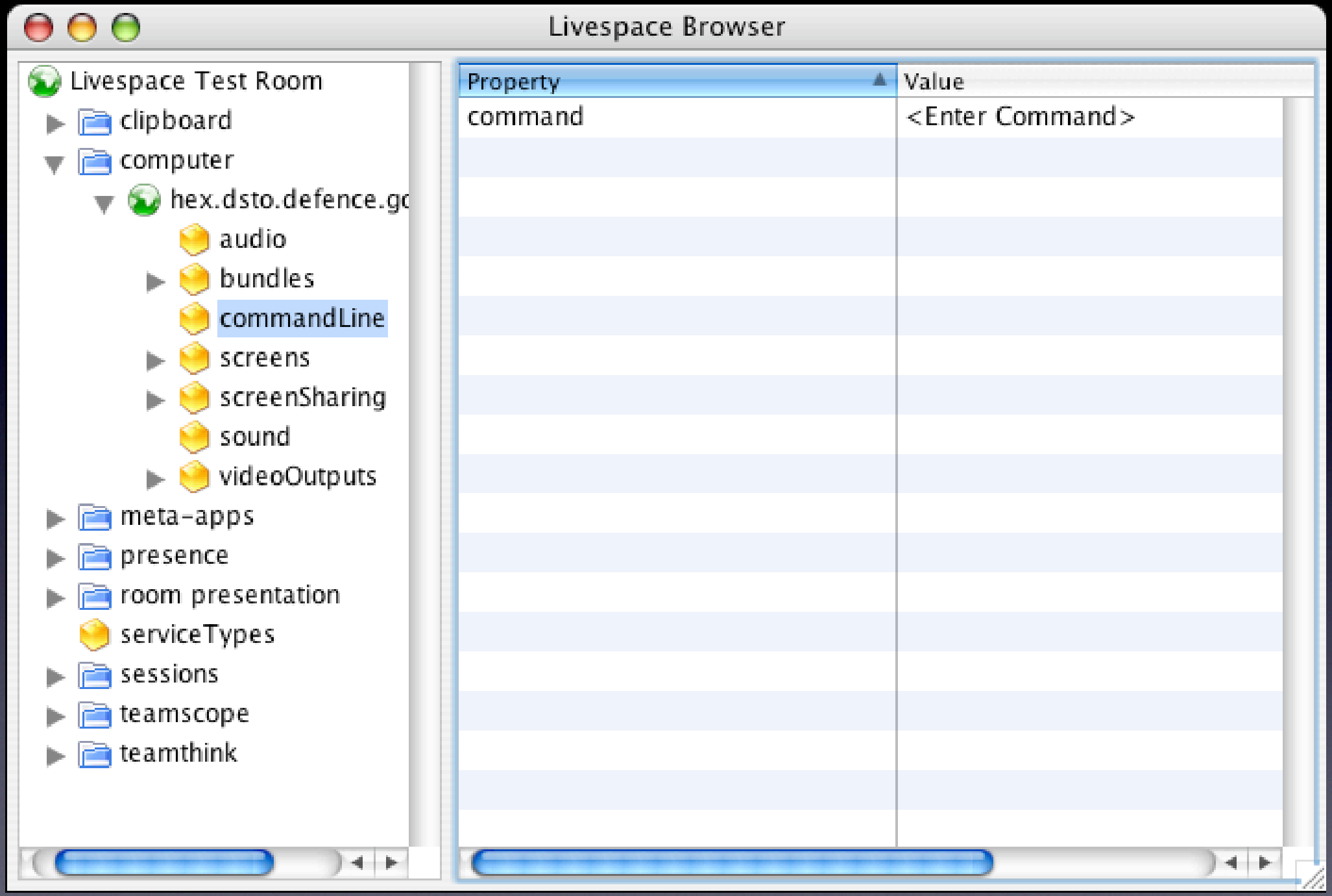
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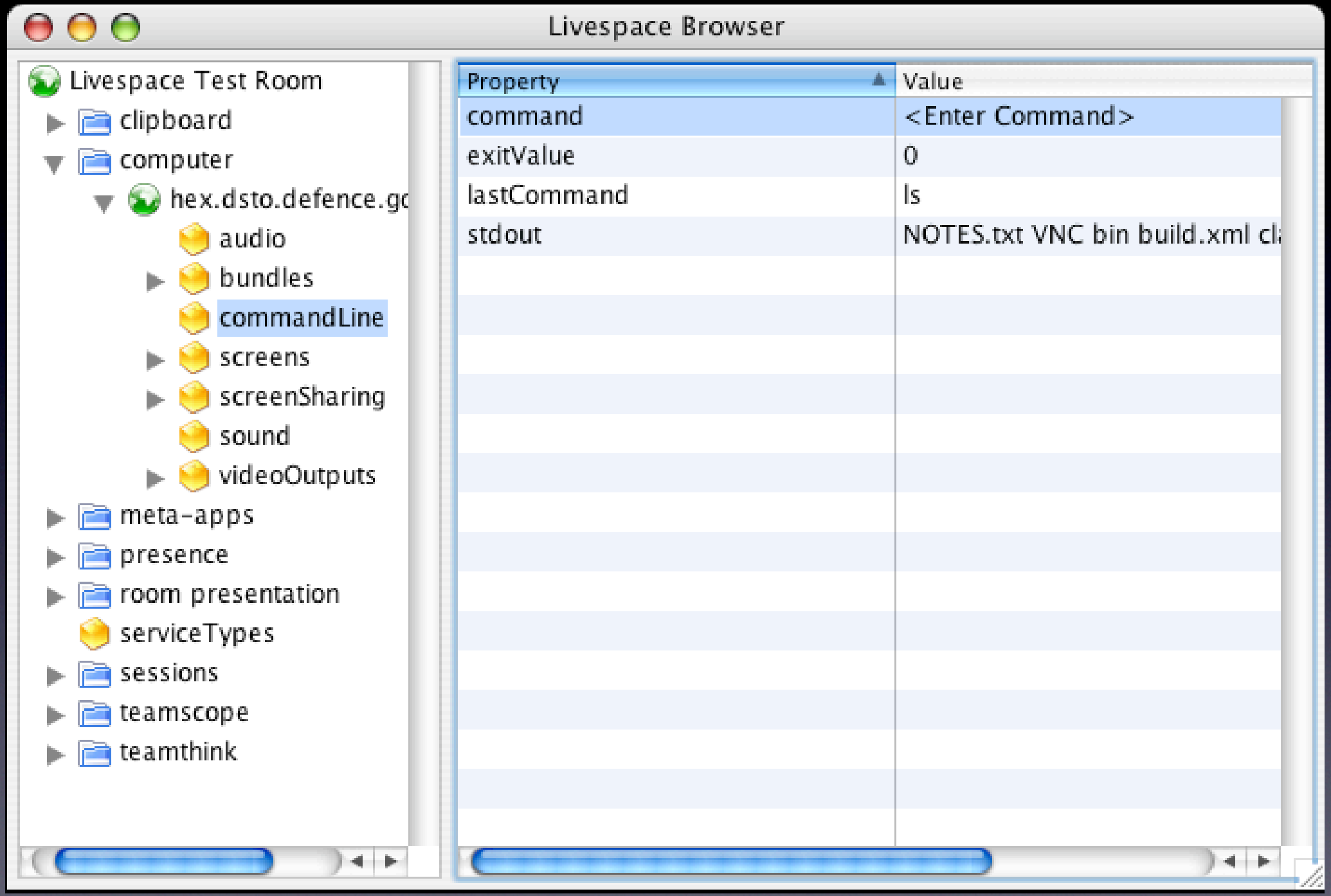
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Contrast To RPC

- An RPC screen forwarding approach would need API's for:
  - Setting a screen forward
  - Deleting a screen forward
  - Querying what screens are forwarded
  - Querying what screens can be forwarded
  - Adding/removing a screen forwarding listener
  - ...

End Of Part 1