Network Apps for iPhone OS

Part 1

Quinn "The Eskimo!"
Developer Technical Support

Why Are We Here?


3G
9:41 AM
Messages
Monday
7
Calendar
Photos
Camera
YouTube
Stocks
280
Maps
73°
Weather
Notes
Utilities
iTunes
App Store
Settings
Phone
Mail
Safari
iPod

i… wait for it… Phone


3G
9:41 AM
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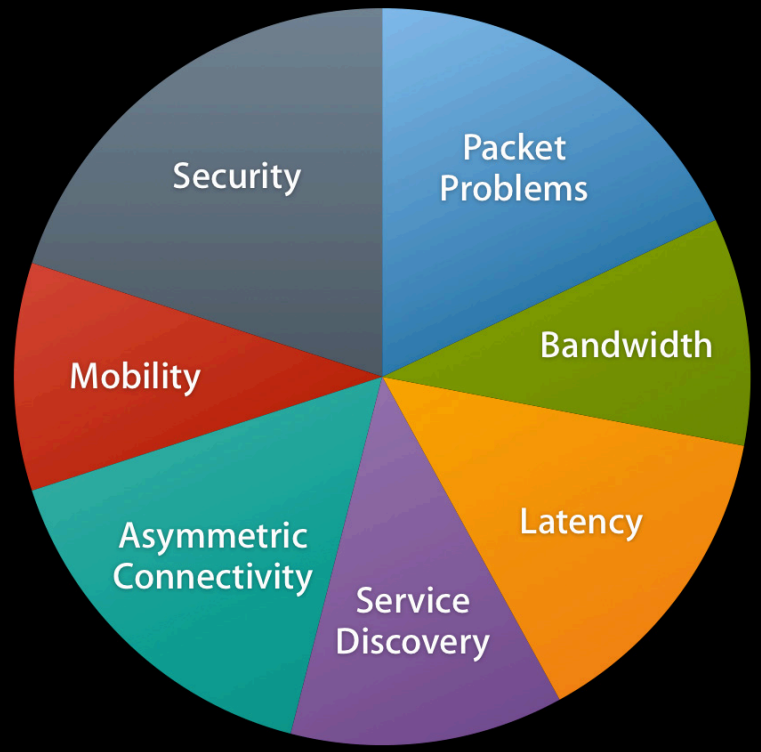
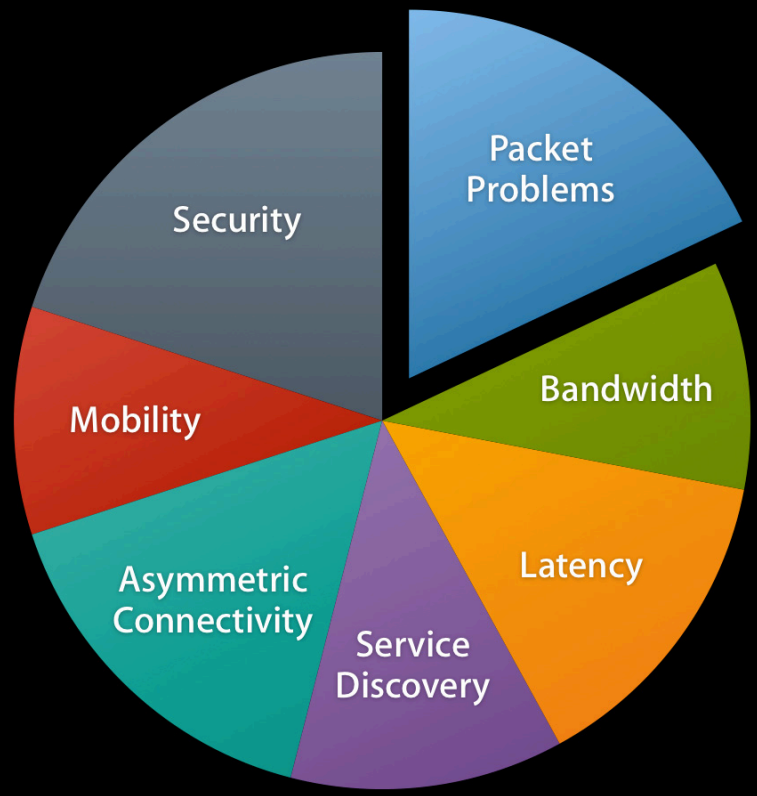
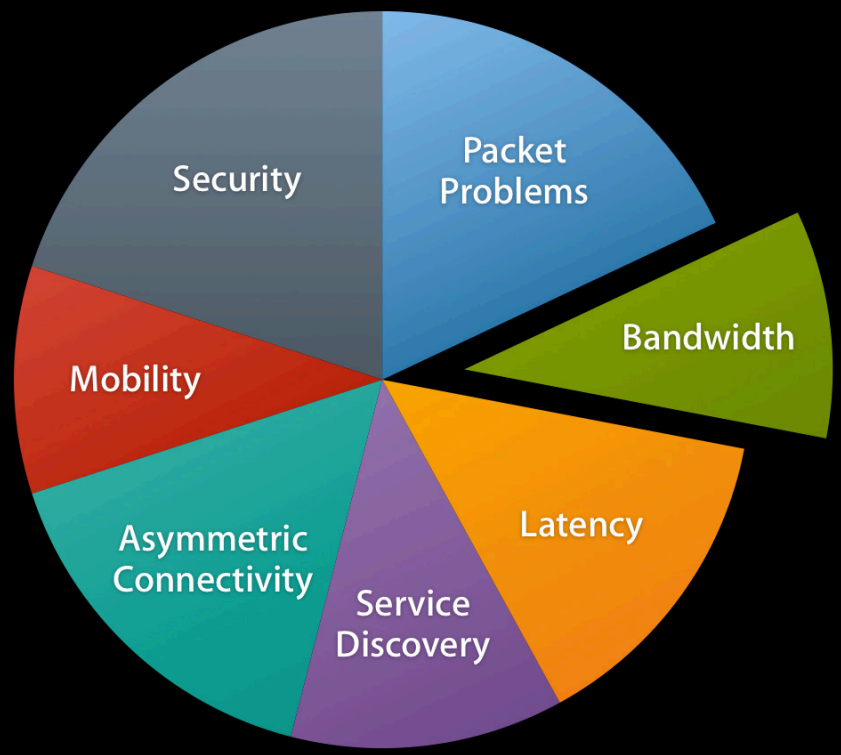
Networking Is Hard™


Security
Packet Problems
Bandwidth
Mobility
Latency
Asymmetric Connectivity
Service Discovery


Packet Problems
Bandwidth
Latency
Service Discovery
Asymmetric Connectivity
Mobility
Security

Packet Problems

- Corrupt packets
- Dropped packets
- Reordered packets
- TCP
  - Stream
  - Reliable transfer
  - Or torn connection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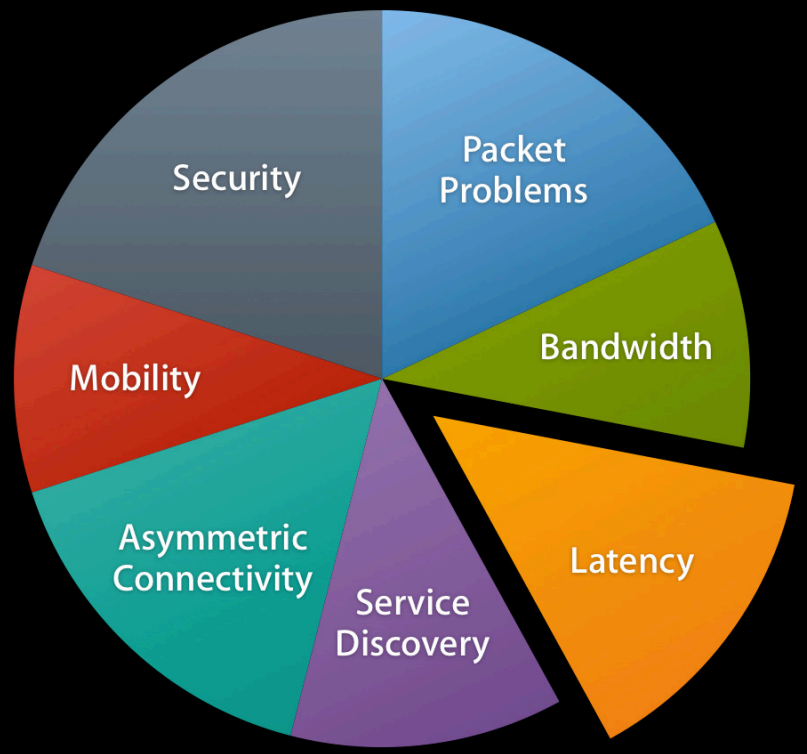
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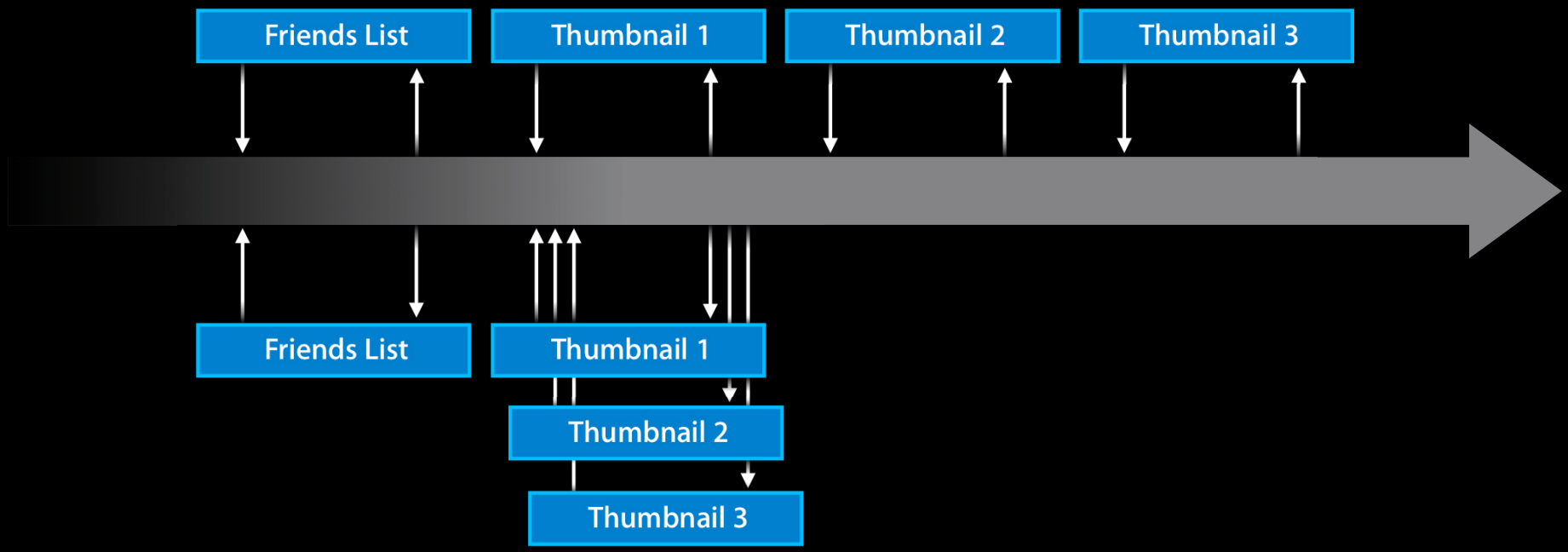
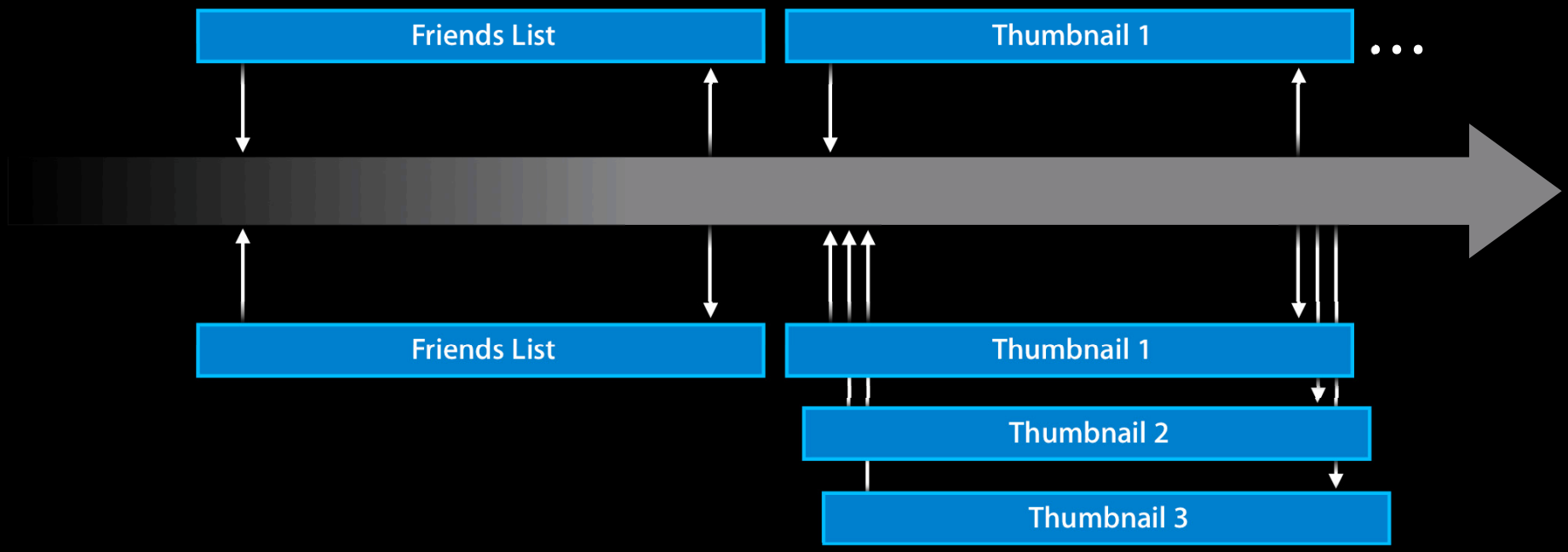
Latency

- Request friends list
- Request thumbnail for each friend

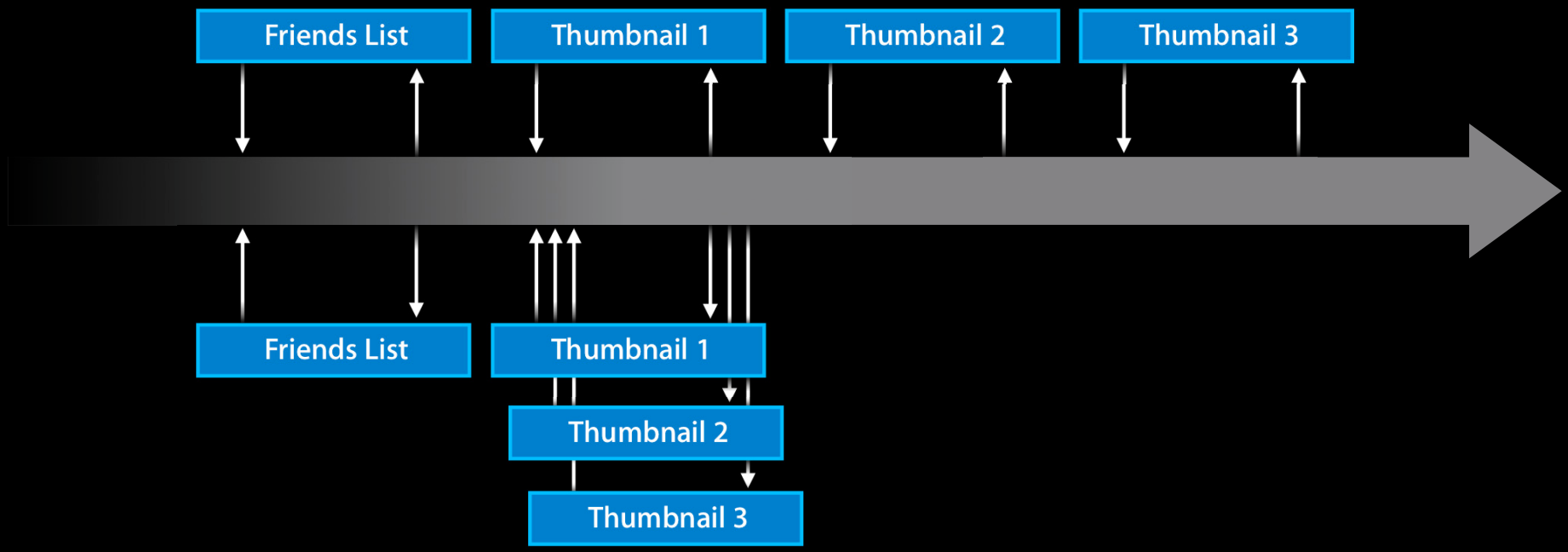
Latency


Friends List
Thumbnail 1
Thumbnail 2
Thumbnail 3
Friends List
Thumbnail 1
Thumbnail 2
Thumbnail 3

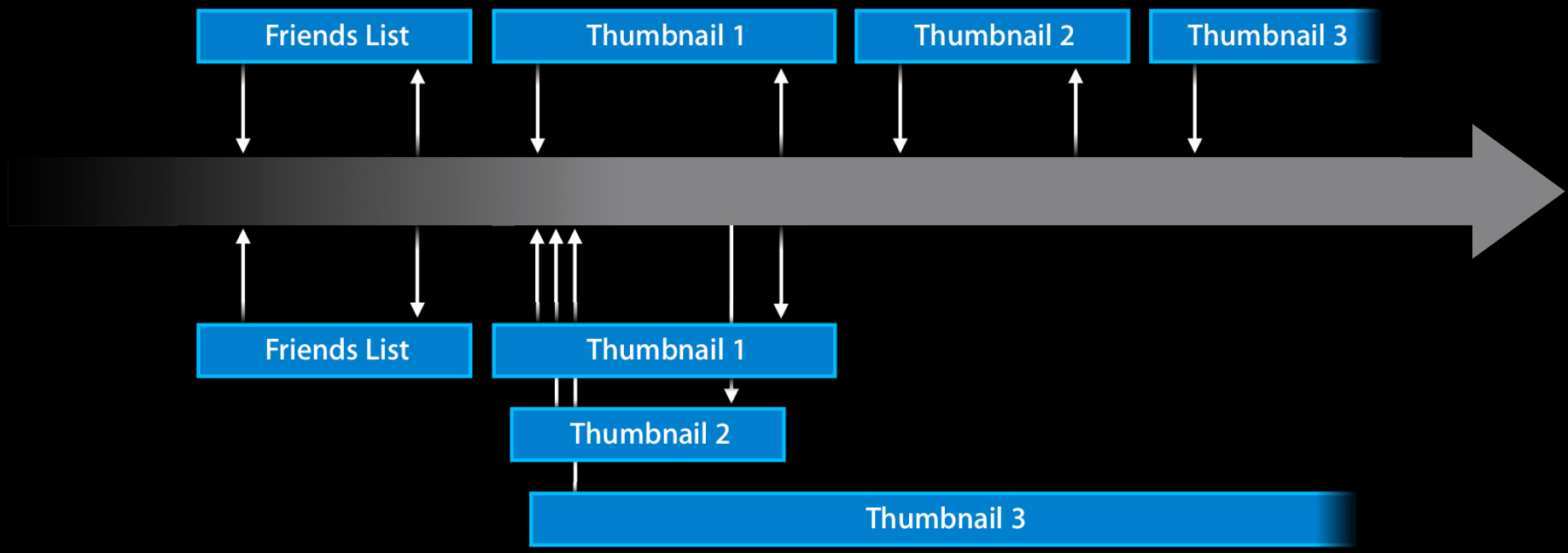
Latency, Cellular



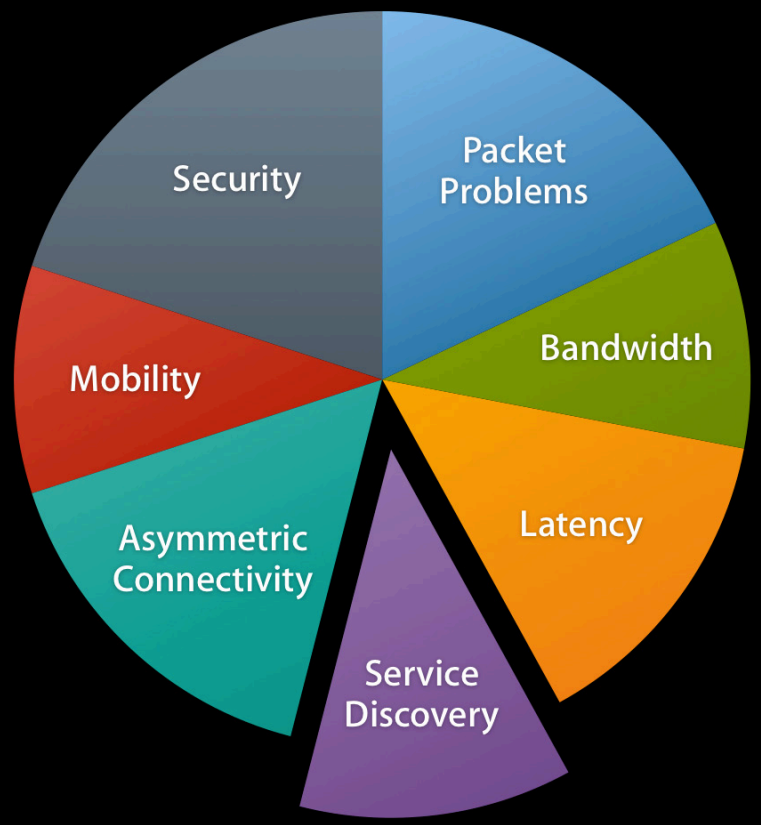
Latency, Ideal



Latency, Real World



Plan for Latency!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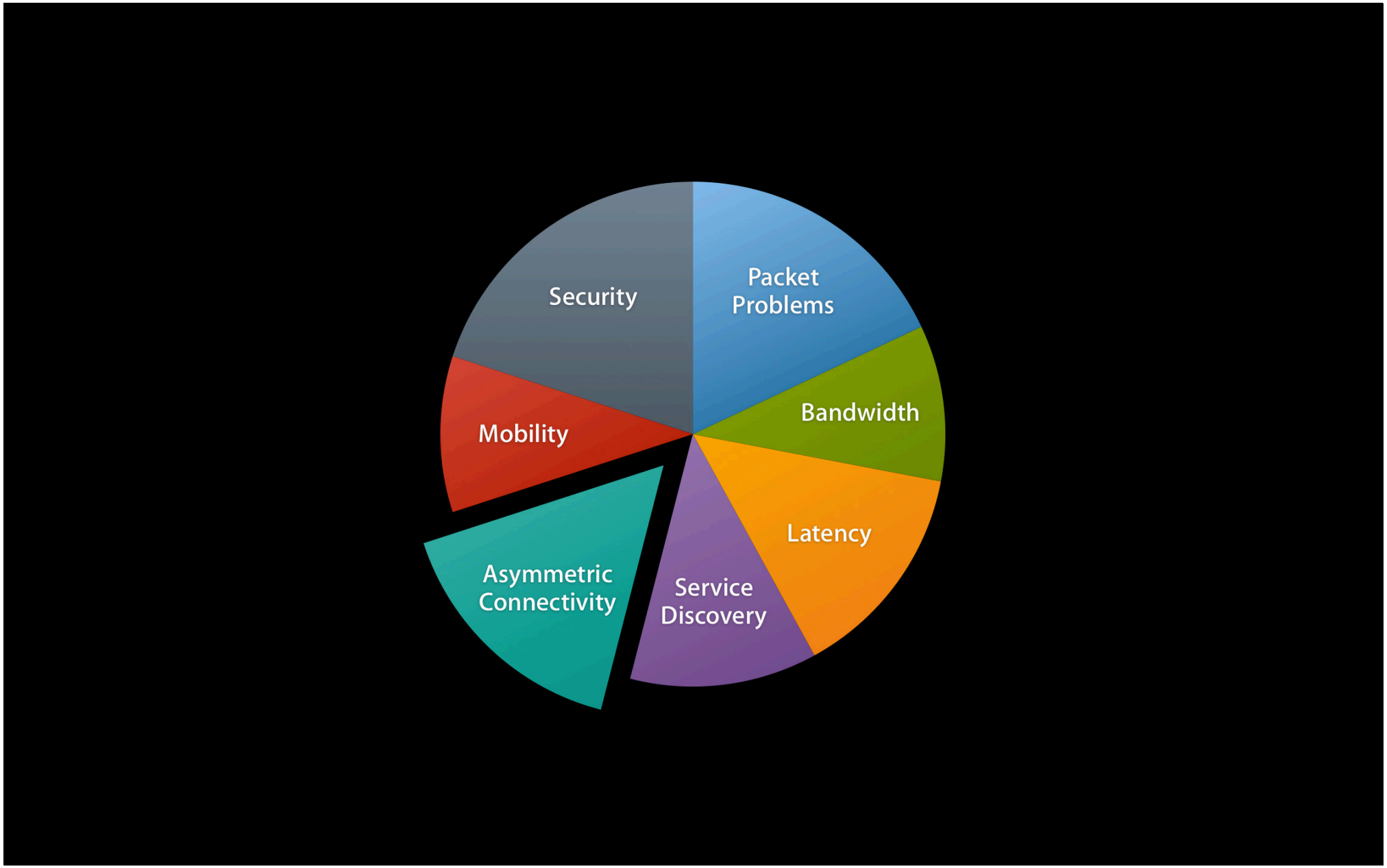
Service Discovery = Bonjour

See Session:
Simplifying Networking Using Bonjour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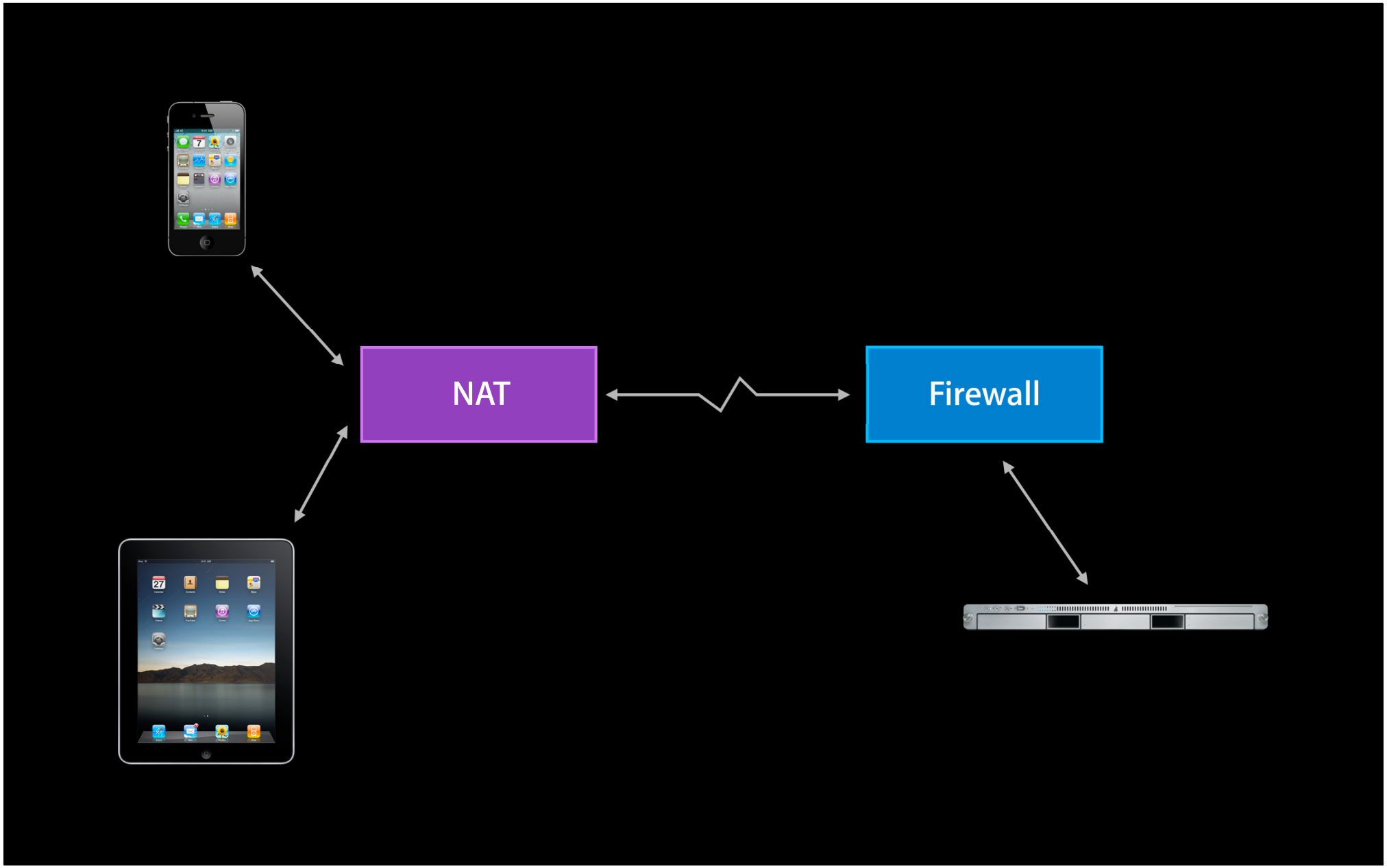
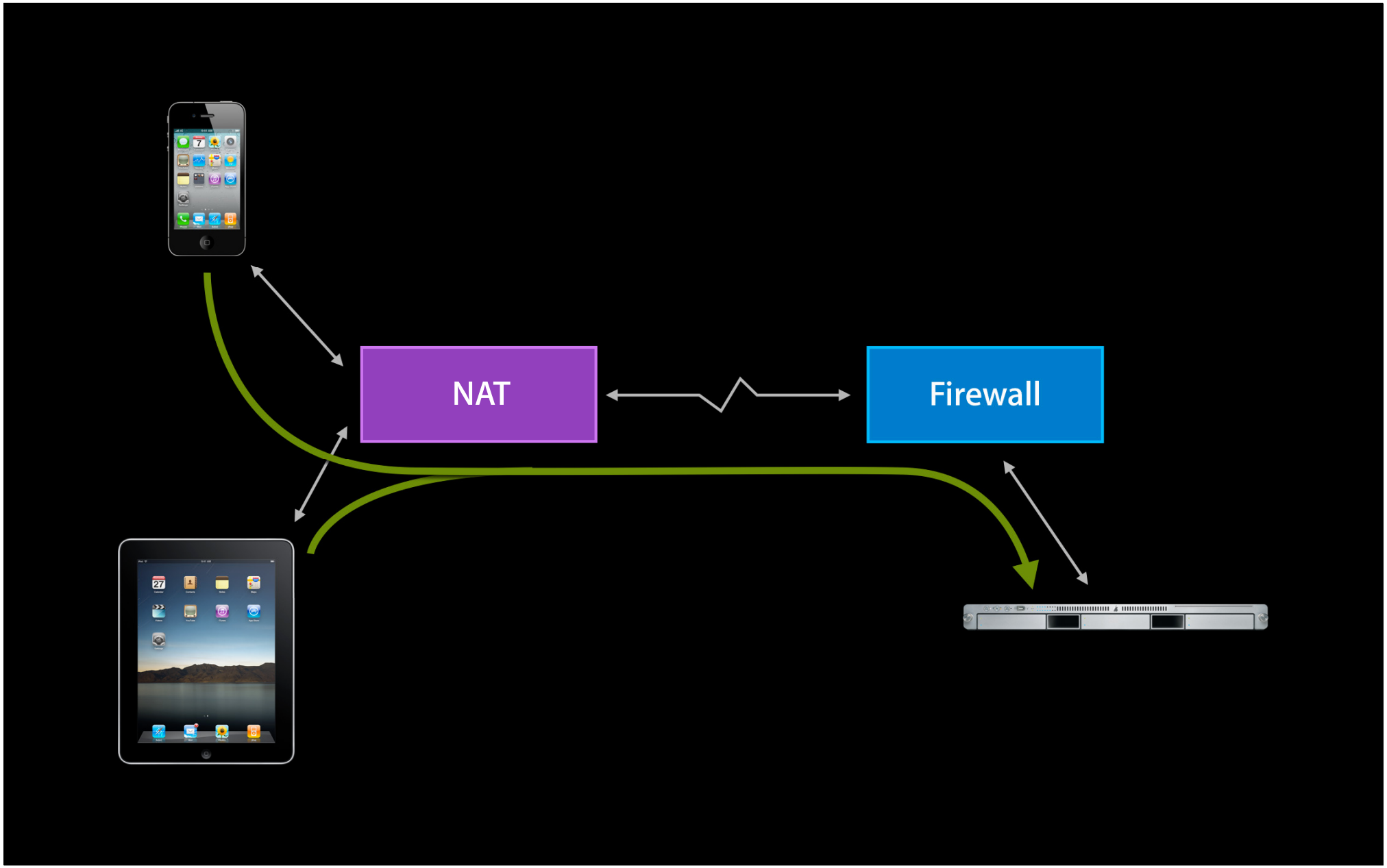

NAT
Firewall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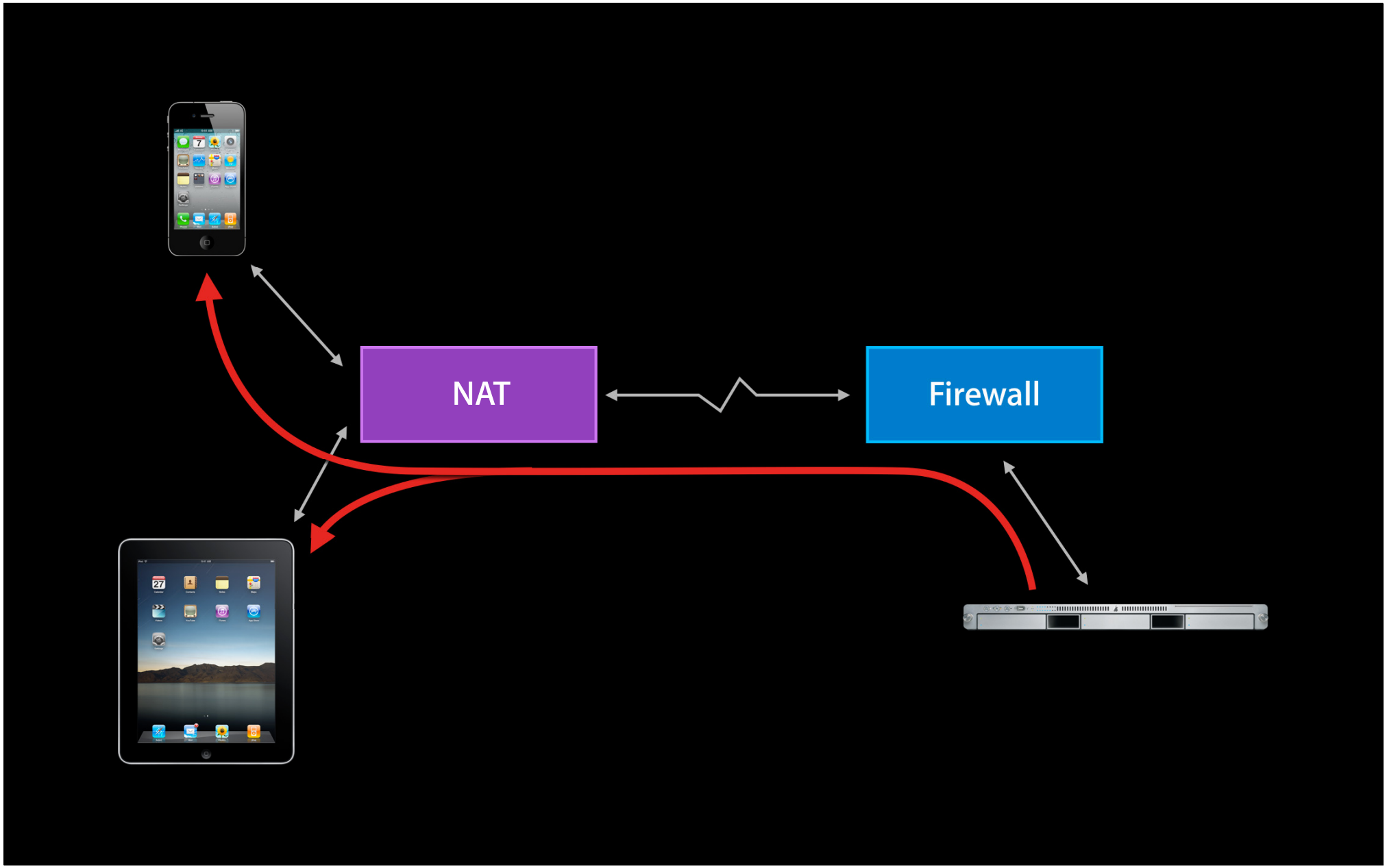
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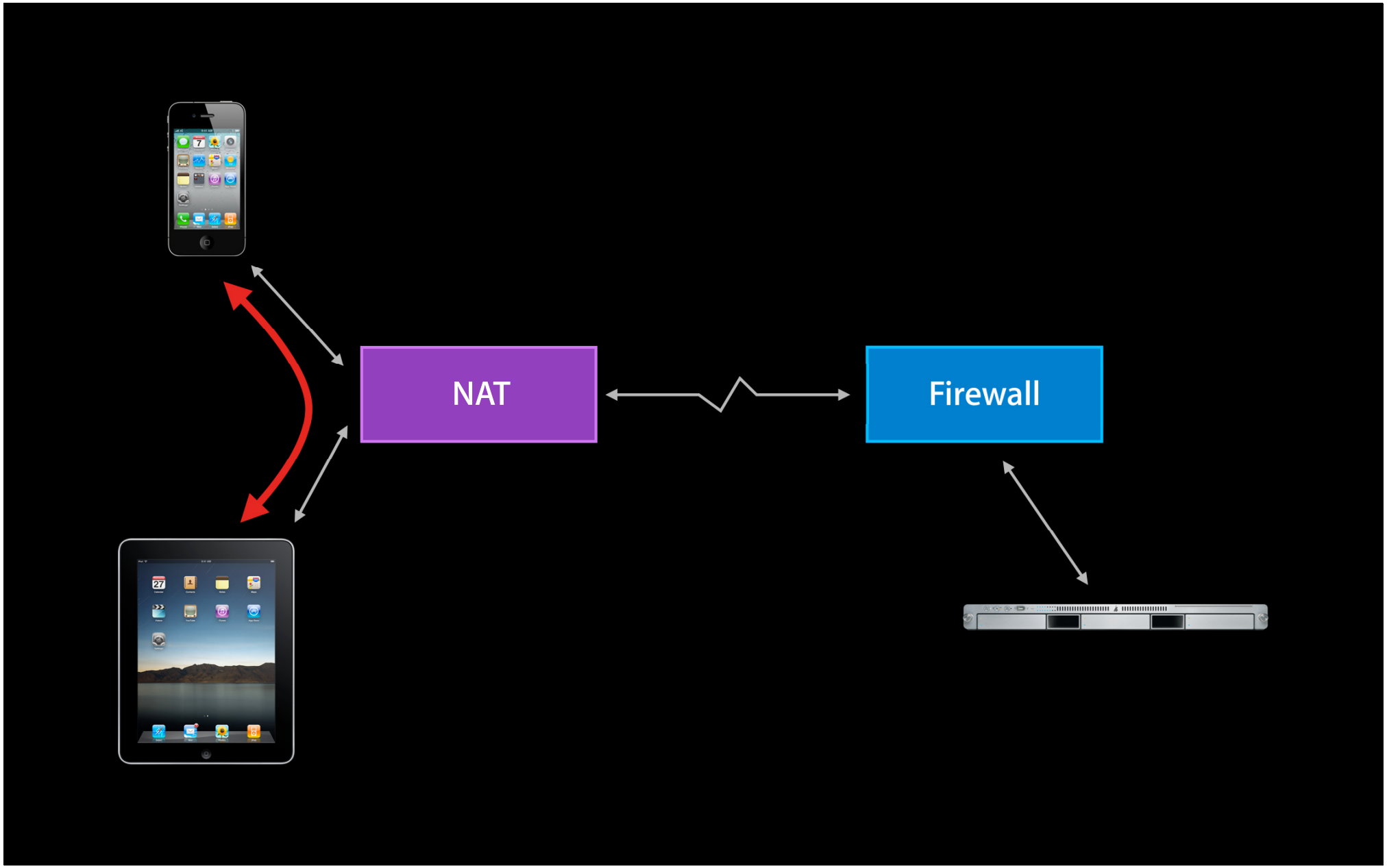
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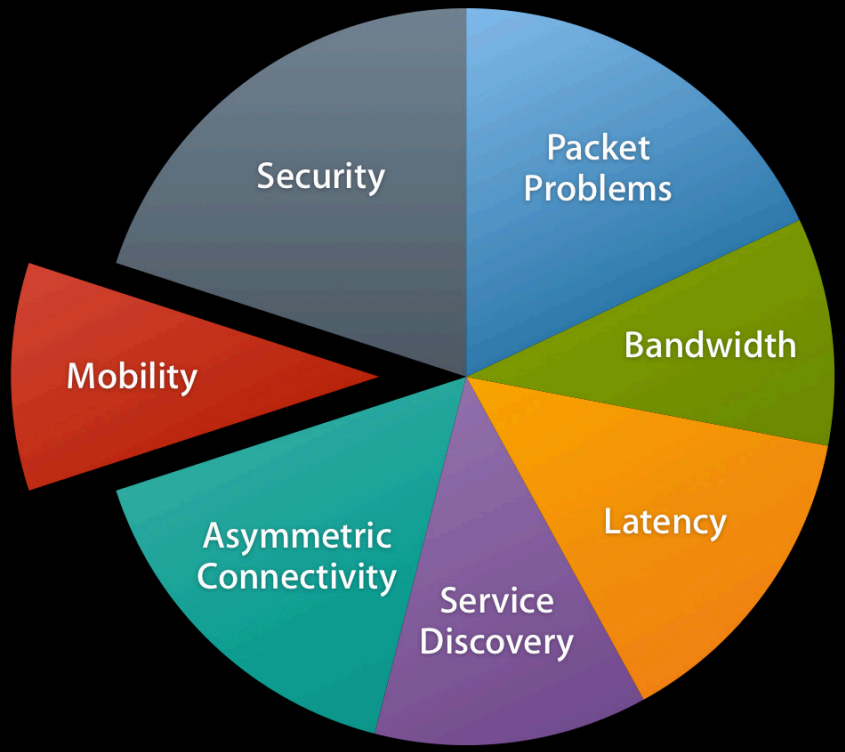
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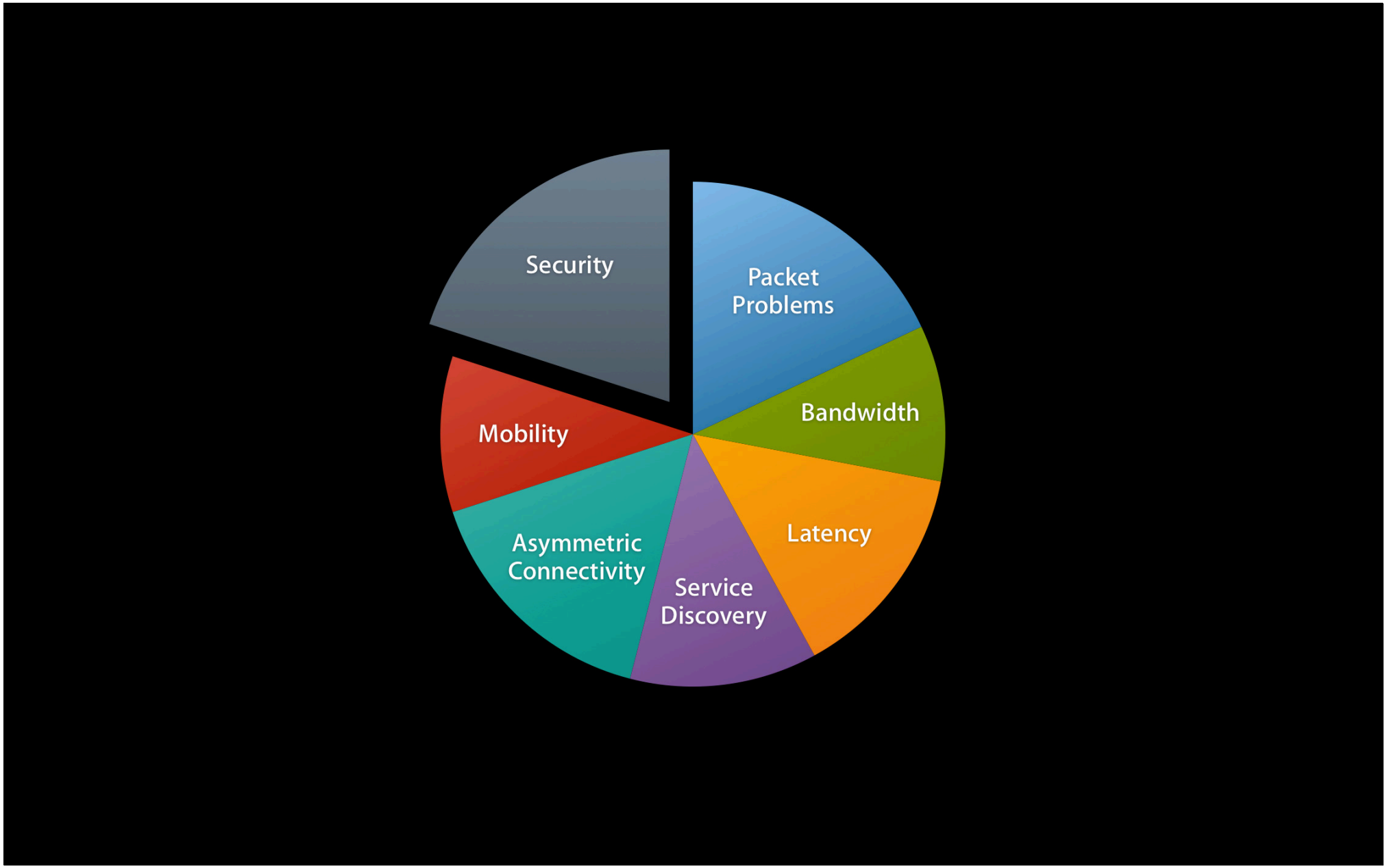
“What’s the IP Address of the Device?”

Static

Dynamic

Mobility Techniques

- Automatic retry
- Resume transfers
- Persistent state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Mobility

"I don't care about security because…"

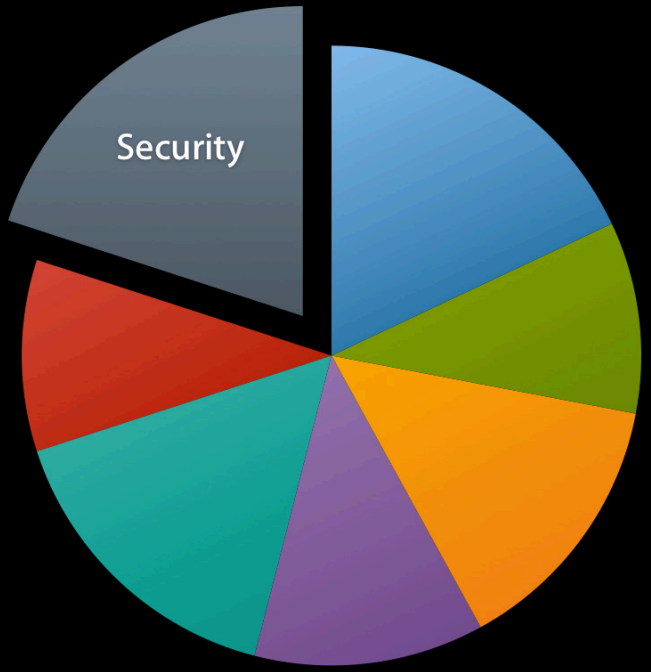
J Random Developer

Security Examples

Obvious	Non-Obvious
Instant messaging	To-do list
Shopping	TV remote control
Banking	

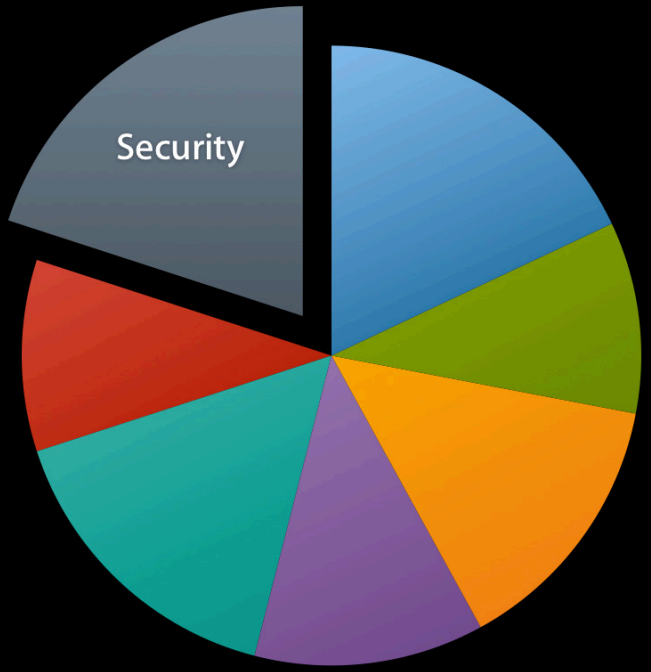
Secure by Default

Security



- Authentication
- Authorization
- Privacy
- Malicious attack

Security



- Authentication
- Authorization
- Privacy
- Malicious attack

Authentication and Authorization

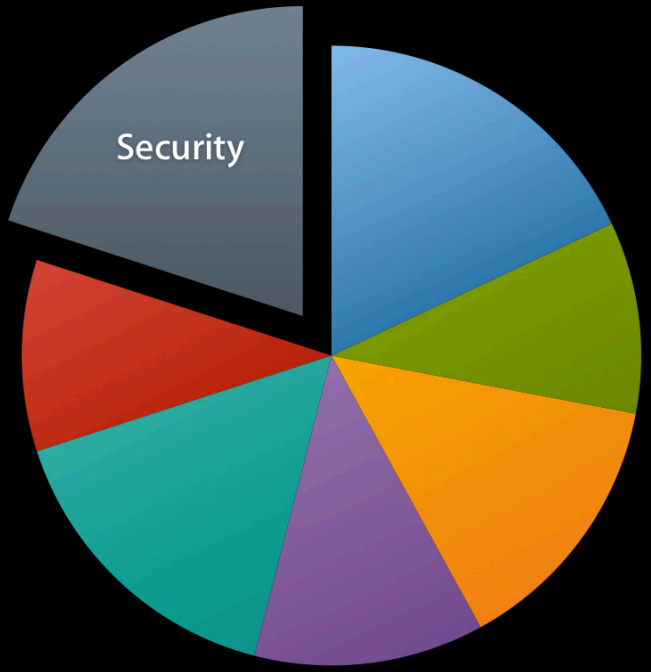
Authentication	Establishing identity
Authorization	Deciding identity's access rights

Auth[entic|oriz]ation

In order of necessity

- Client authenticates server
- Server authorizes client
  - Server authenticates client
- Client authorizes server

Security



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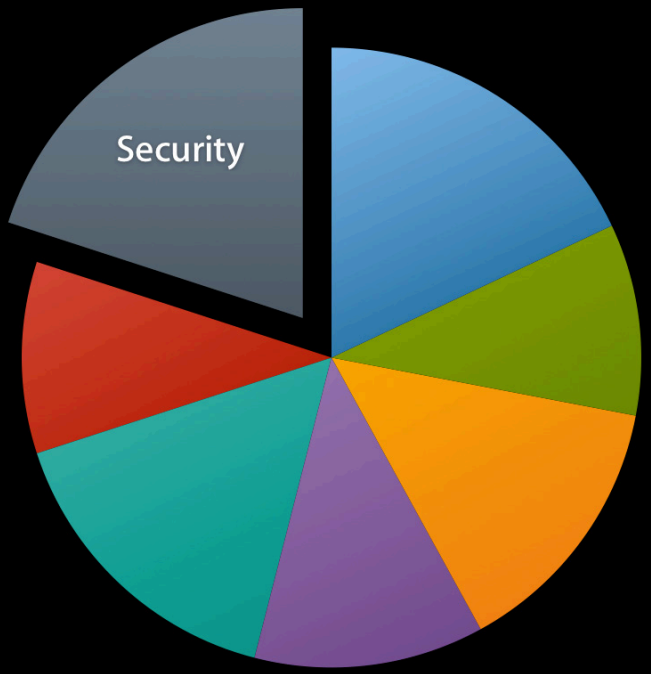
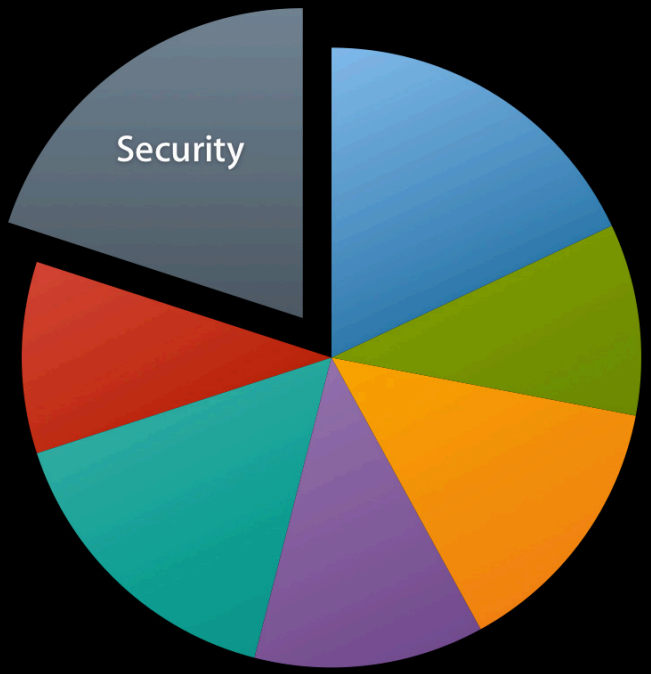


- Authentication
- Authorization
- On-the-wire privacy
- Malicious attack

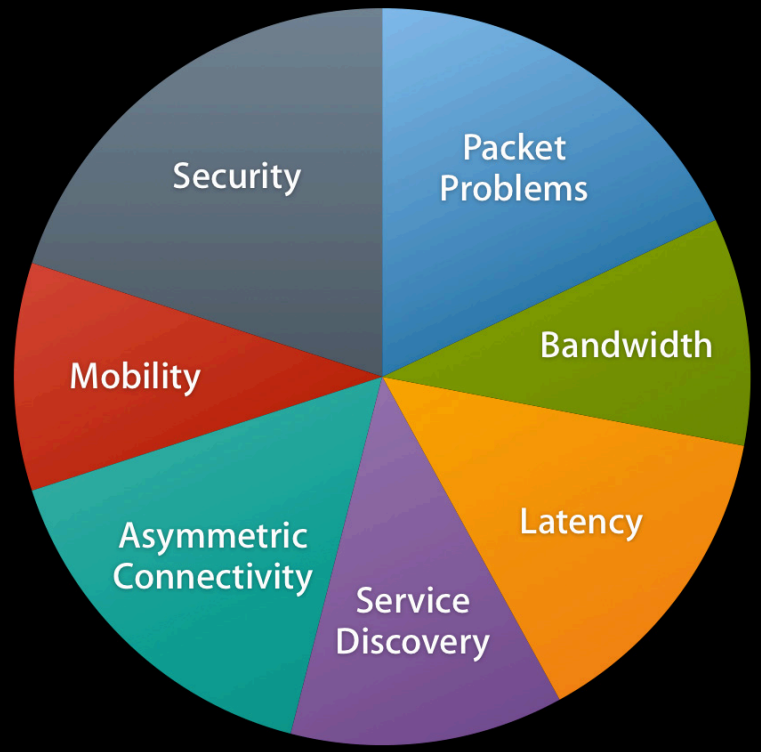
Security



- Authentication
- Authorization
- On-the-wire privacy
- Malicious attack

Malicious Attack

See Session:
Creating Secure Applications and iPhone OS
See Lab:
Mac OS X Security Lab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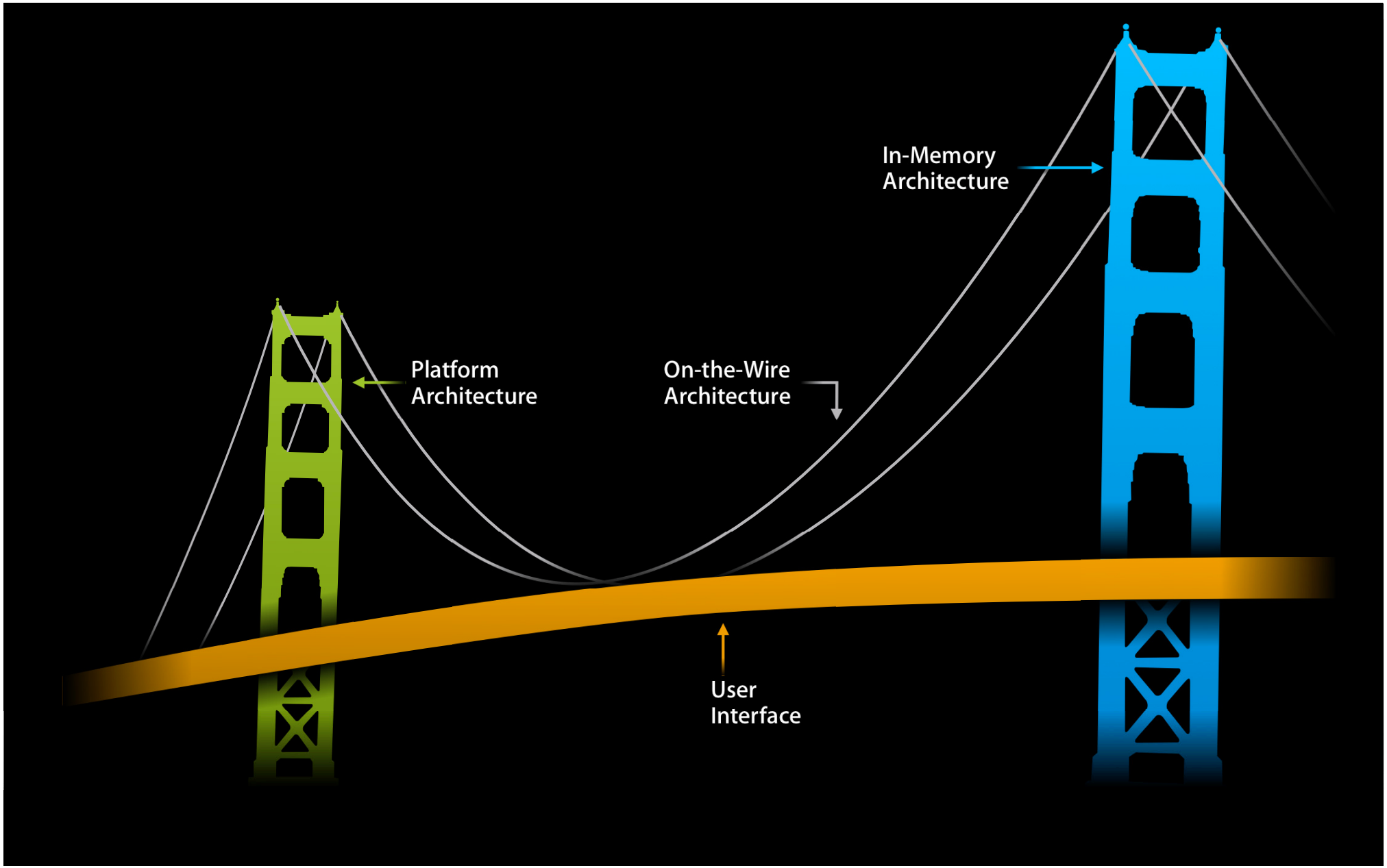
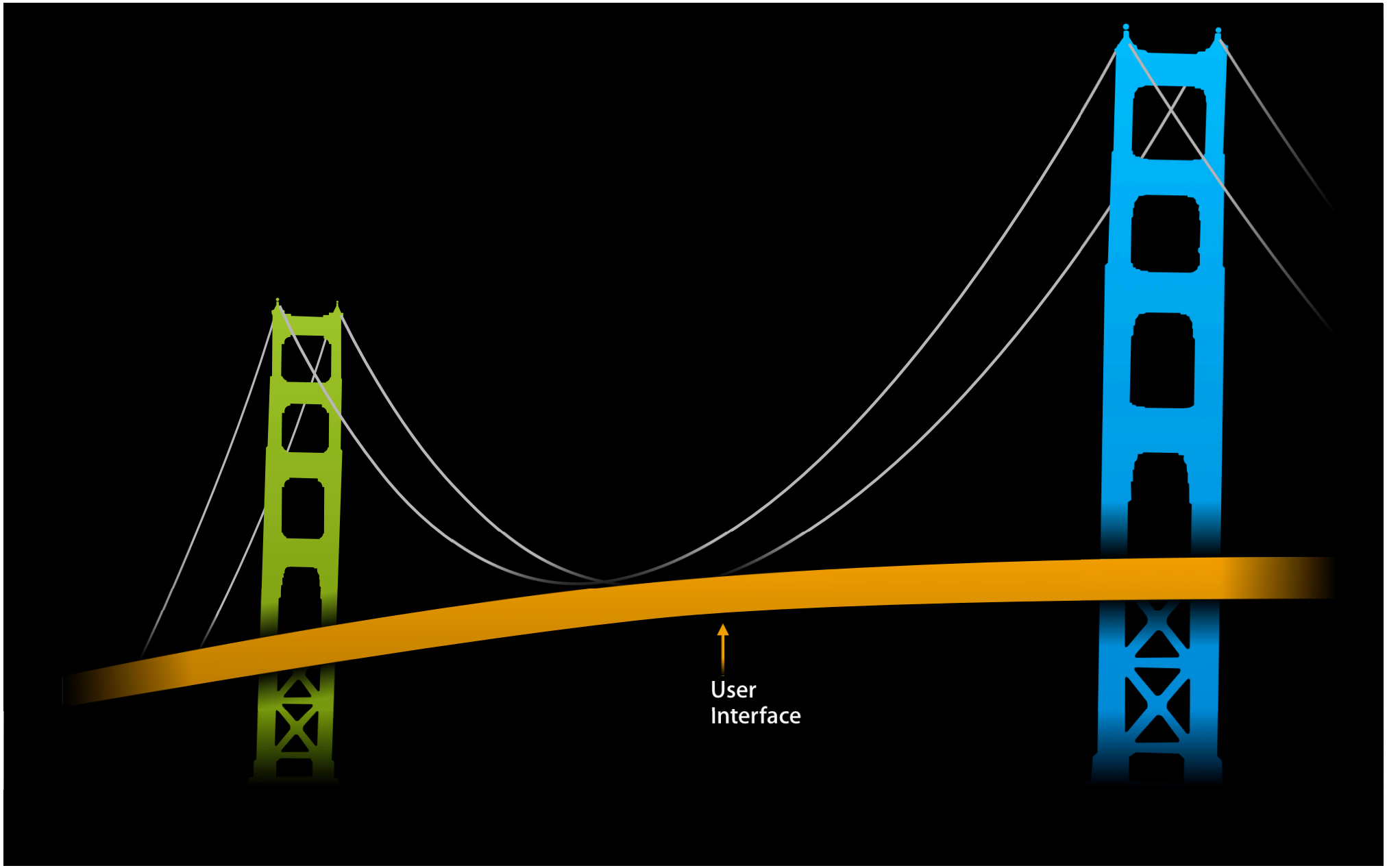
Service Discovery

What You'll Learn

- Part 1 Problems and Architecture
  - Networking is hard
  - Architecting for success
  - Security via TLS
- Part 2 Practical Matters
  - Asynchrony
  - Debugging
  - Common mistakes

Architecting For Success

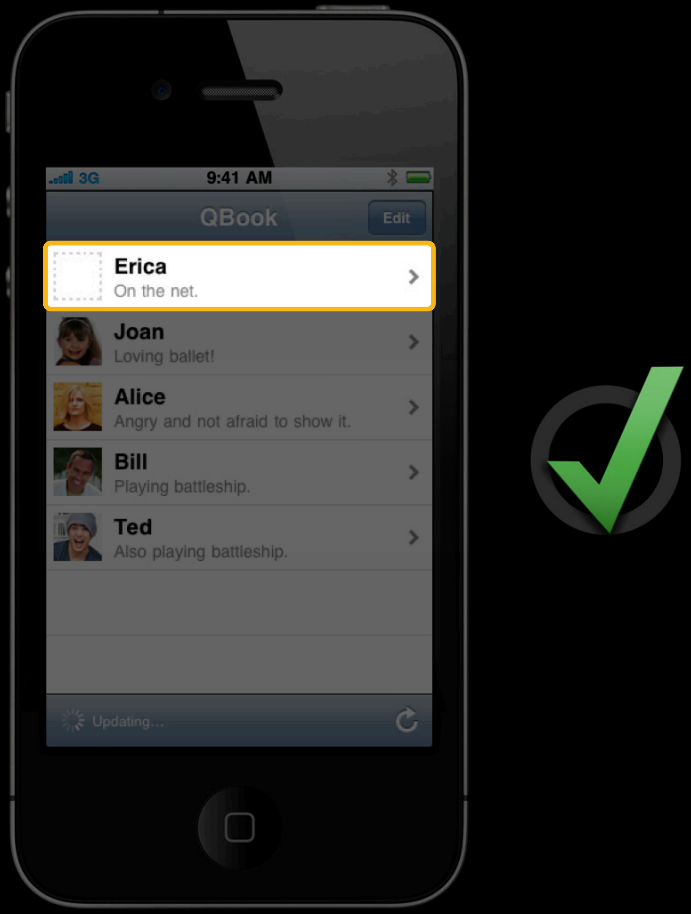

In-Memory
Architecture
Platform
Architecture
On-the-Wire
Architecture
User
Interface


User
Interface

“Don’t make promises
the network can’t deliver.”

Placeholders


3G
9:41 AM
QBook
Edit
Erica
On the net.
Joan
Loving ballet!
Alice
Angry and not afraid to show it.
Bill
Playing battleship.
Ted
Also playing battleship.
Updating...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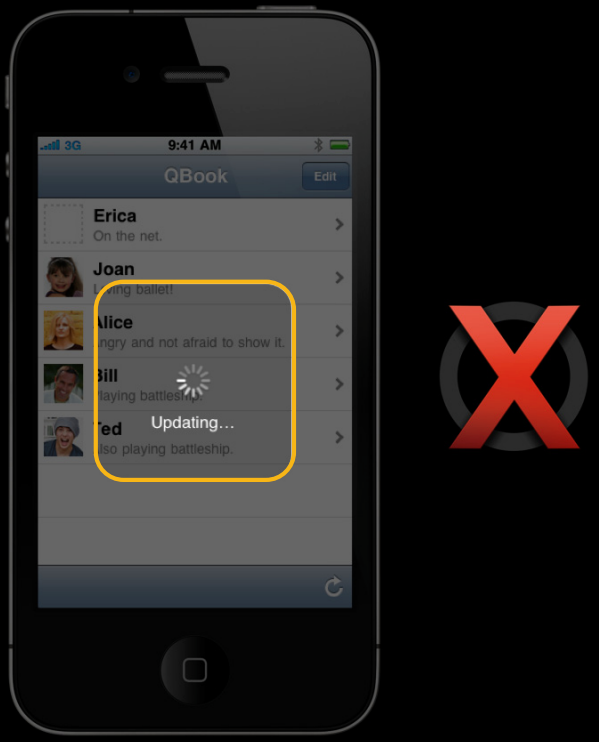
Solicited vs. Unsolicited

Modality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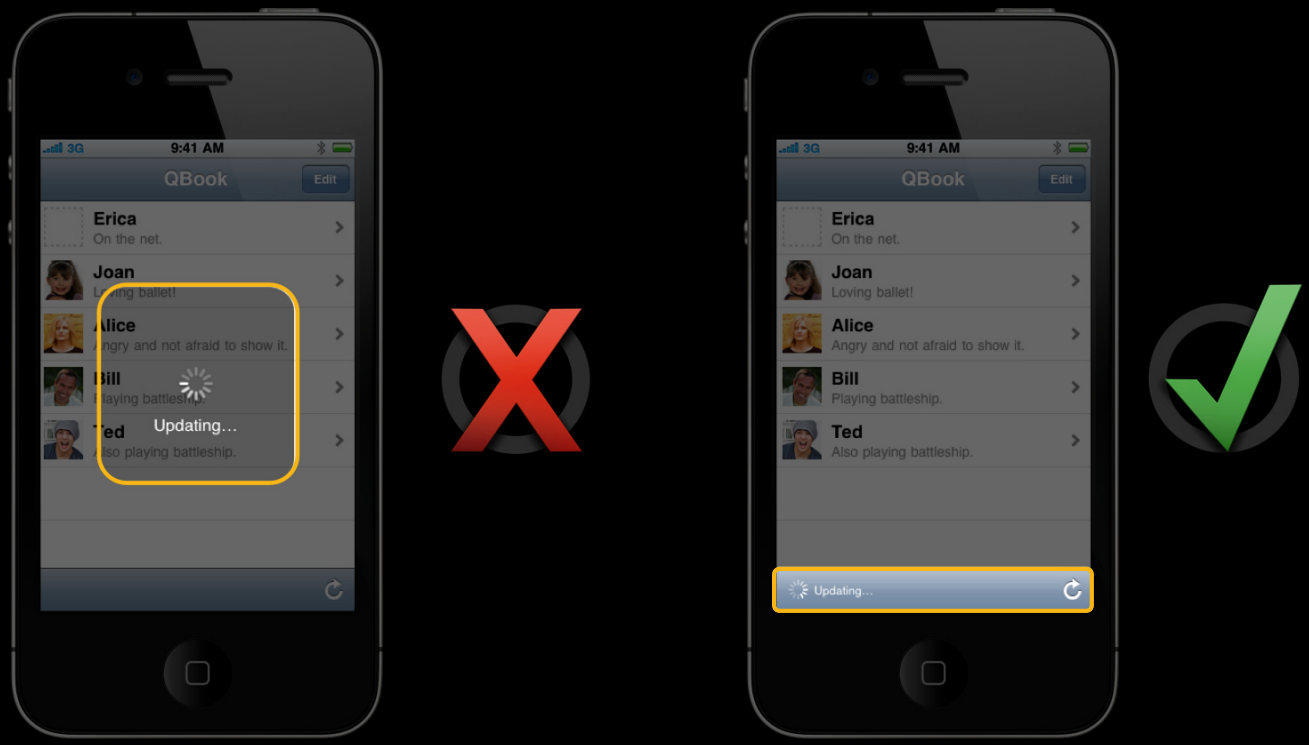
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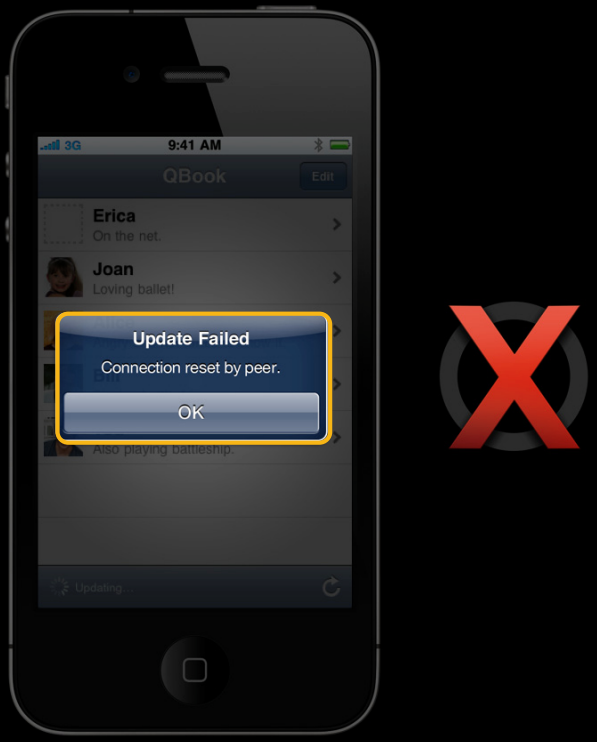
Errors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9:41 AM
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Edit
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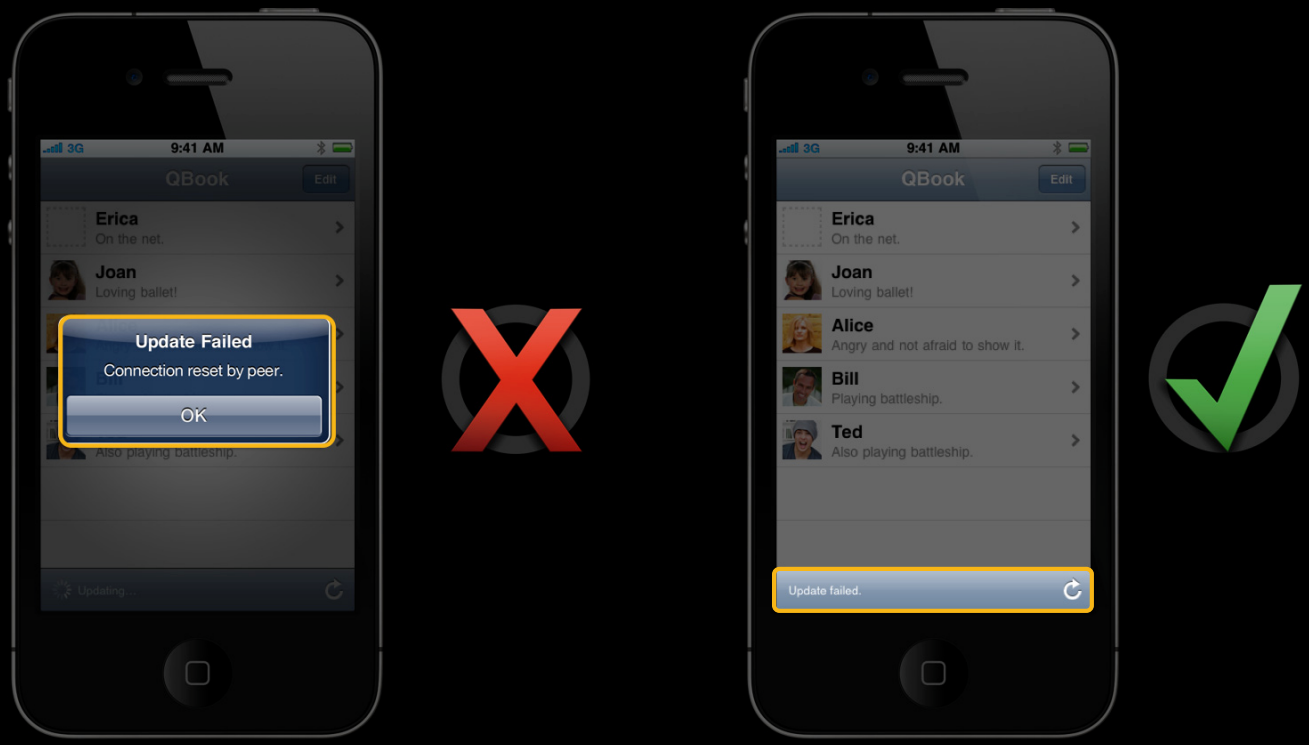
Loving ballet!
Update Failed
Connection reset by peer.
OK
Also playing battleship.
Updating...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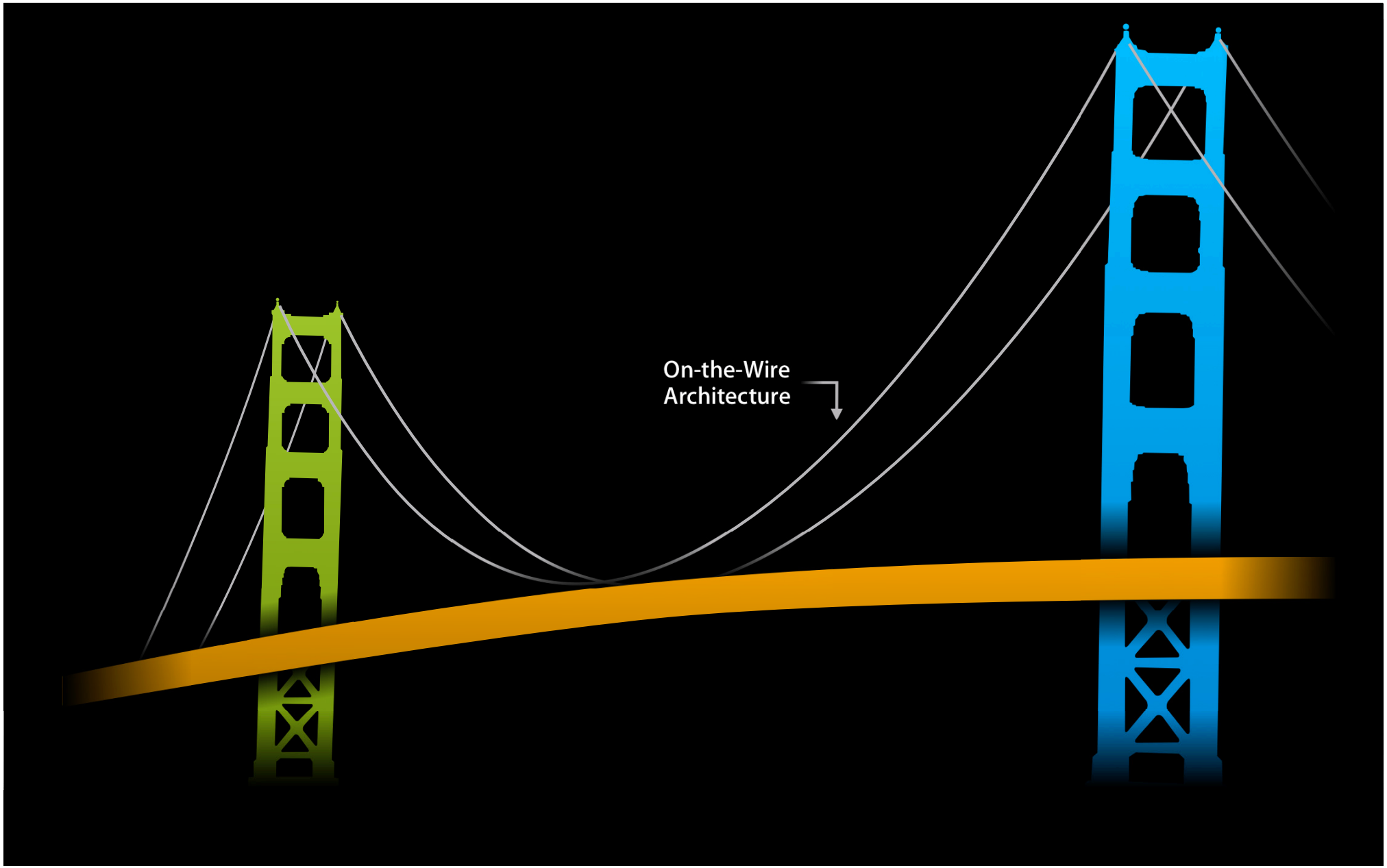
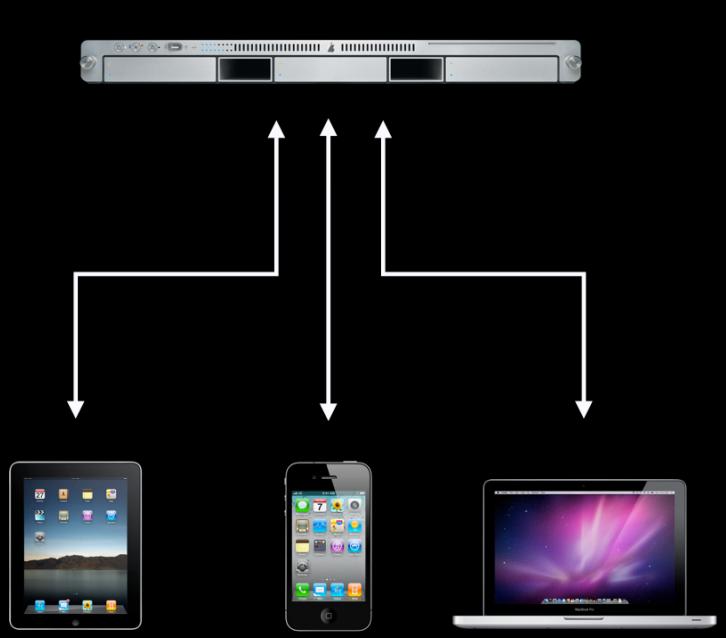
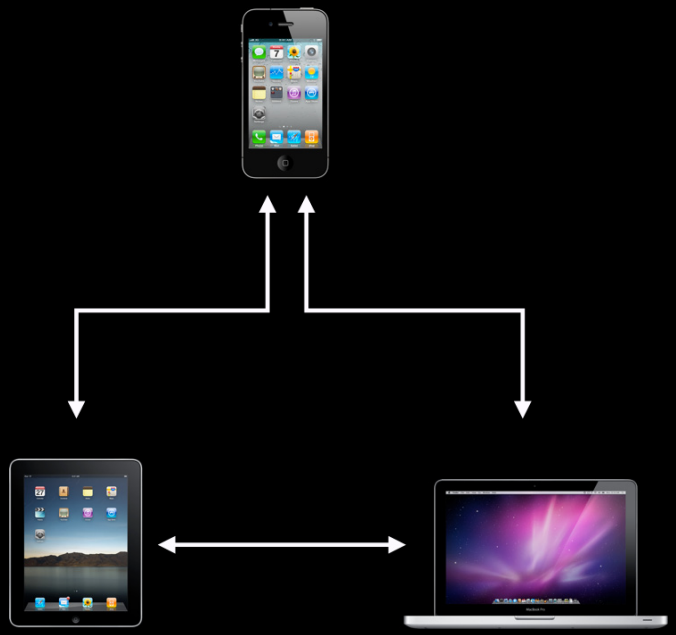

On-the-Wire
Architecture

On-the-Wire Architectures



Centralized Server



Peer-to-Peer

Quinn's Patented On-the-Wire Architecture Algorithm

```
if ( ! [design isYourChoice] ) {
  [self dealWithIt];
} else if ( [design isCompatibleWith:kCentralizedServer] ) {
  [self commitDesign:design architecture:kCentralizedServer];
} else if ( [design isCompatibleWith:kPeerToPeer] ) {
  [self commitDesign:design architecture:kPeerToPeer];
} else {
  [self immolate];
}
```

Advantages of Centralized Server Design

Service discovery	No problem, hardwire a DNS name
Asymmetric connectivity	No problem
Privacy	No problem, TLS (a.k.a. SSL)
Auth[entic|oriz]ation	Less of a problem, TLS, server-side user list
Mobility	Less of a problem
Malicious attack	Still a problem

Protocol Choice

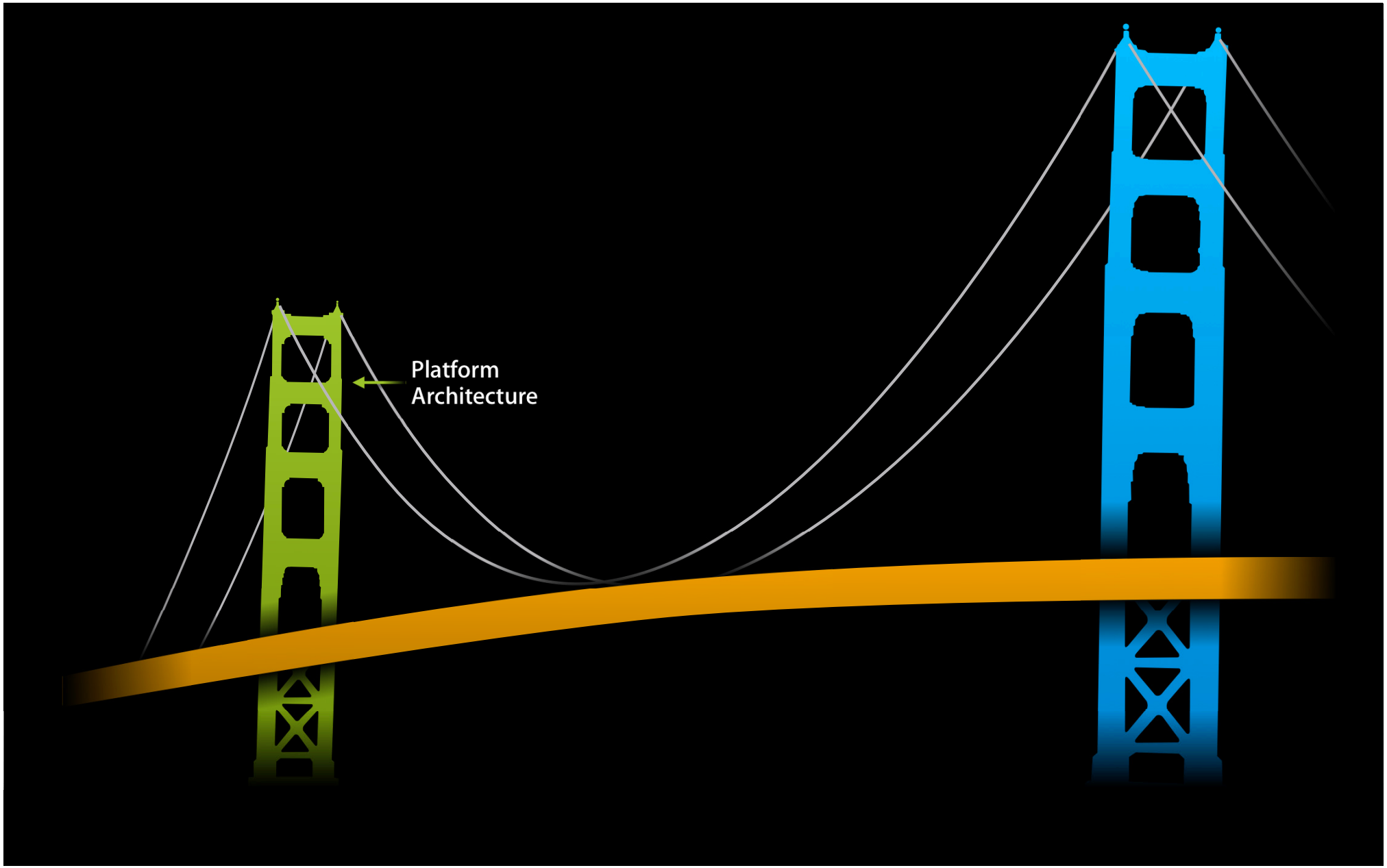
Use Existing	Roll Your Own	Extend Existing
Often only choice	Flexibility	Hybrid
Less design	Extra work	HTTP
Existing code	Network risk	

Protocol Choice

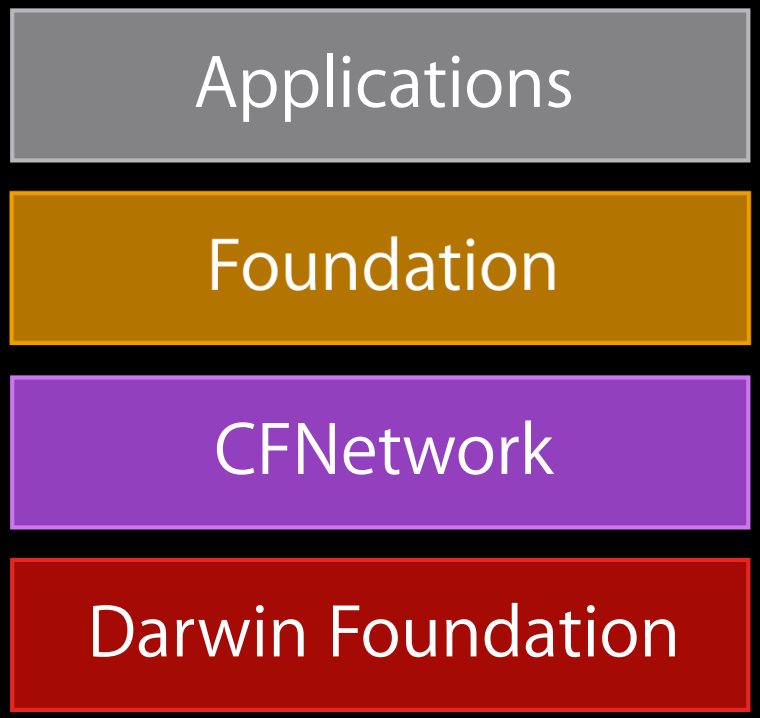
Use Existing	Roll Your Own	Extend Existing
Often only choice	Flexibility	Hybrid
Less design	Extra work	HTTP
Existing code	Network risk	

Top Five Tips for Rolling Your Own Protocol

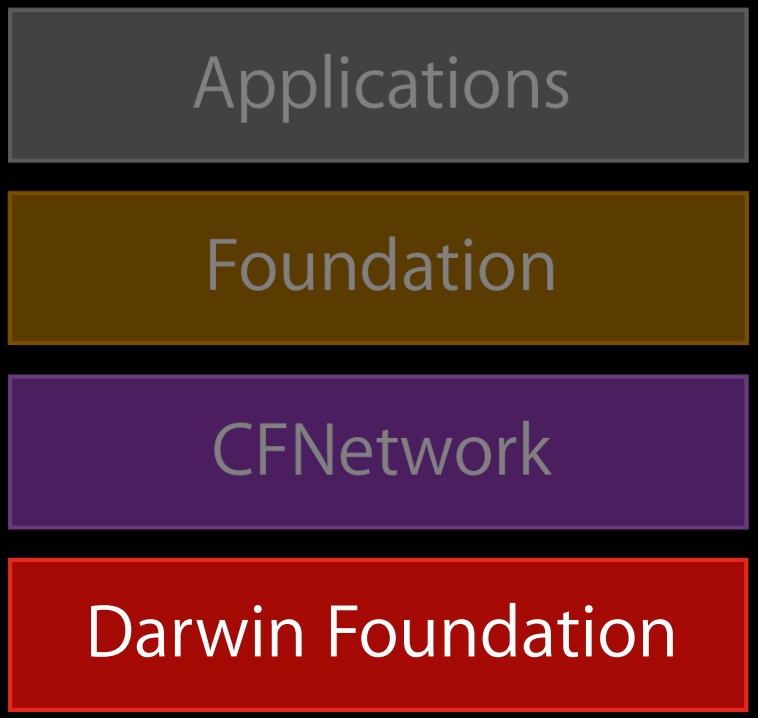
5. CPU architecture neutral
4. Latency, latency, latency
3. Transport Layer Security (TLS, aka SSL)
2. TCP not UDP
1. Don't!


Platform
Architecture

iPhone OS Networking

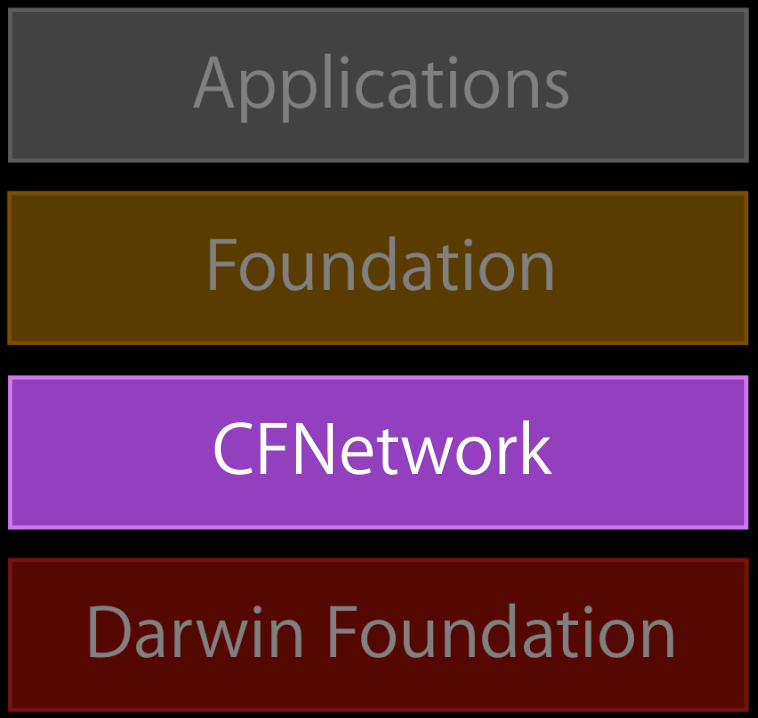


Darwin



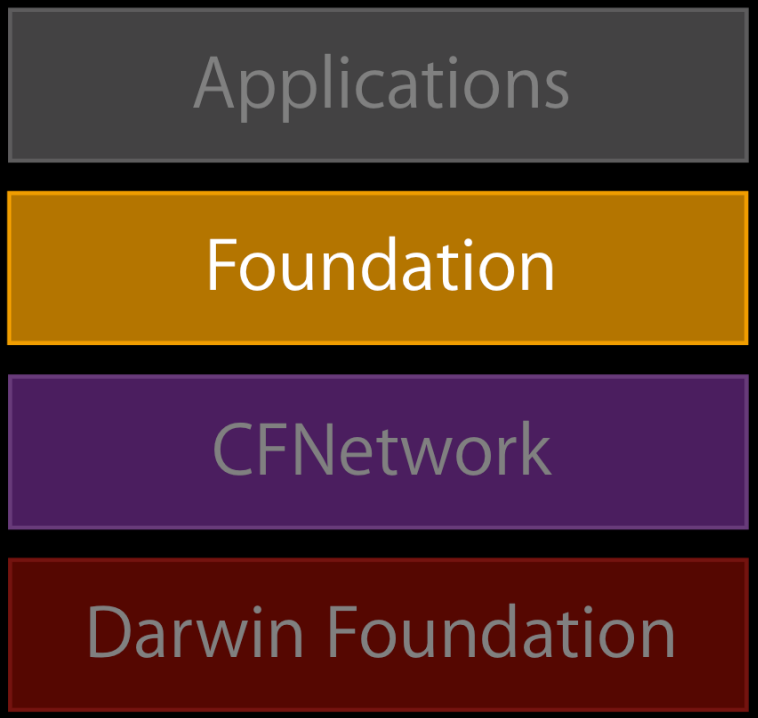
- C API
  - BSD sockets
  - Bonjour (dns_sd)
- Best performance
- Cross platform
- Issues
  - WWAN interface
  - Run loop integration

CFNetwork



- C API
- WWAN activation
- Good run loop integration
- Protocols
  - Bonjour
  - TCP
  - TLS
  - FTP
  - HTTP/HTTPS

Foundation



- Objective-C
- Ideal for Cocoa applications
- Protocols
  - Bonjour
  - TCP
  - TLS
  - FTP (get only)
  - HTTP/HTTPS

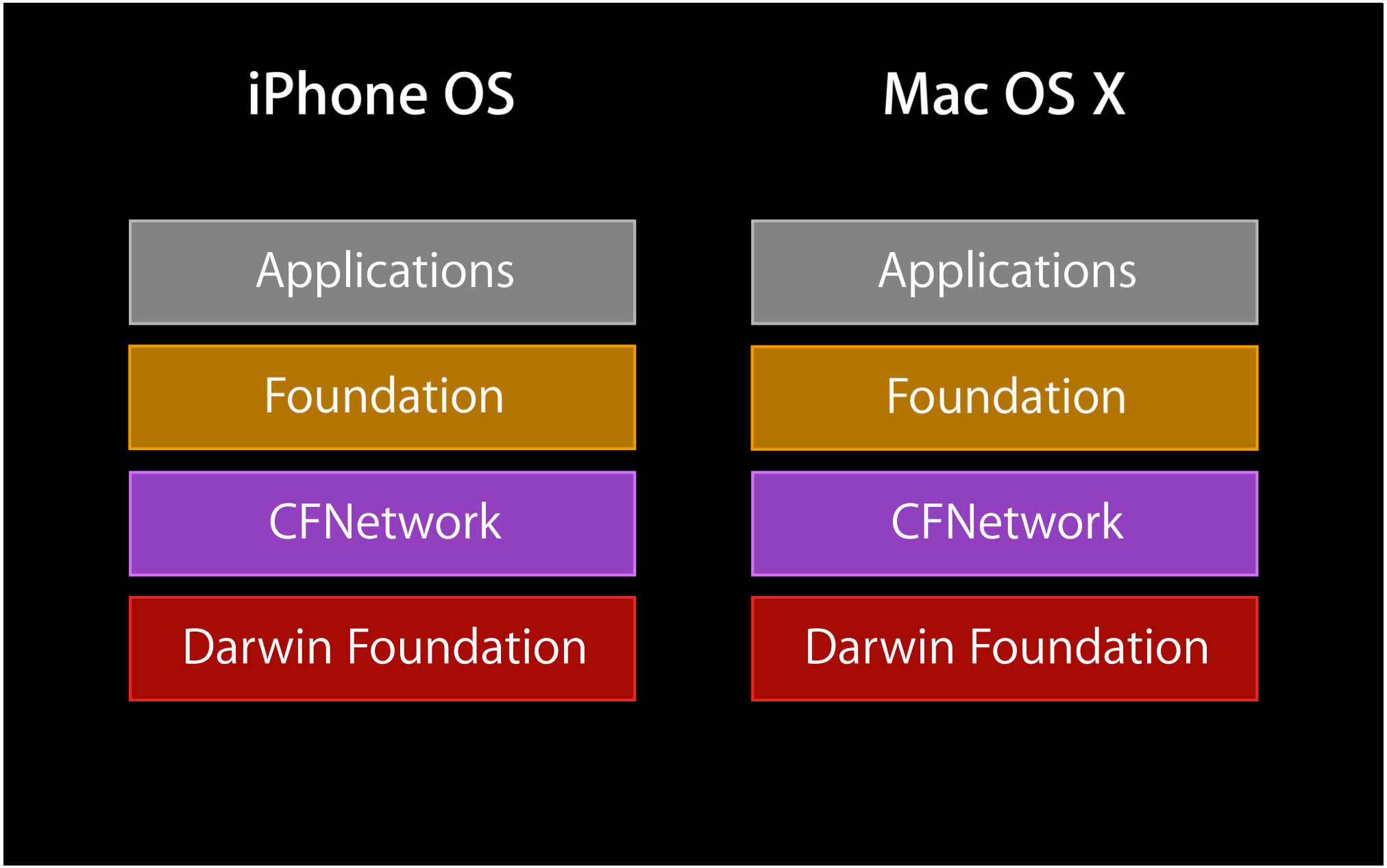
Recommended

Applications

Foundation

CFNetwork

Darwin Foundation


iPhone OS
Applications
Foundation
CFNetwork
Darwin Foundation
Mac OS X
Applications
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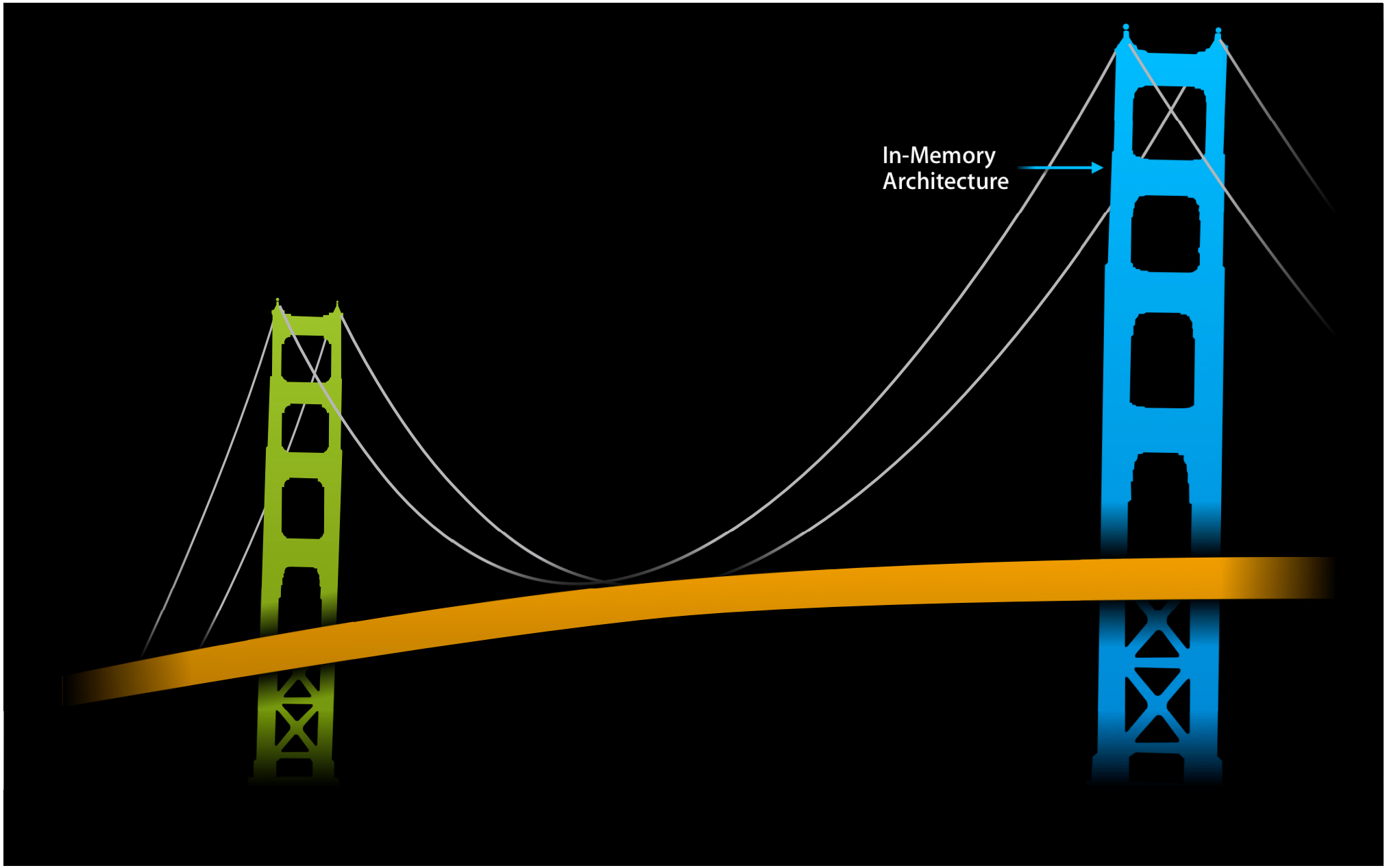
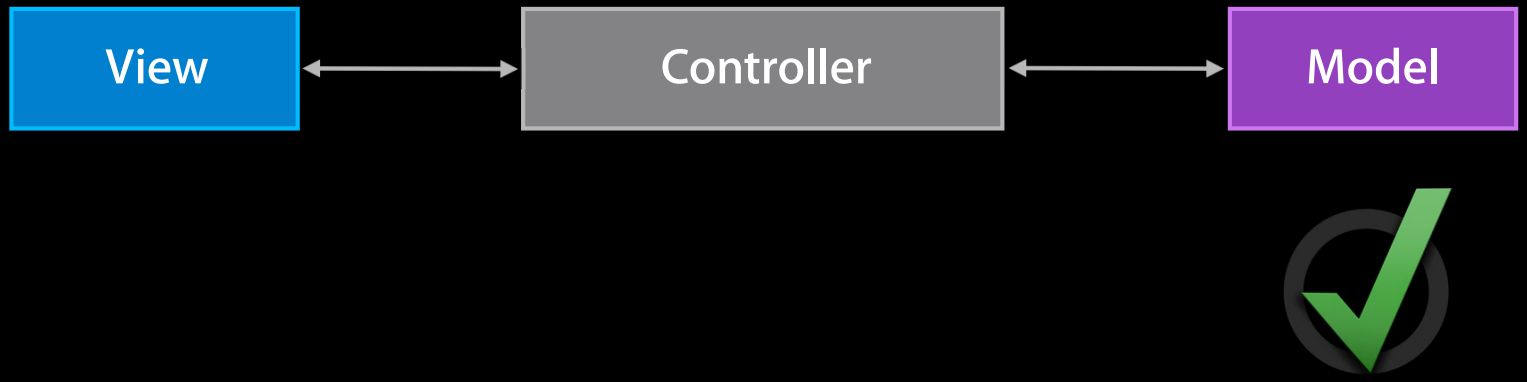
CFNetwork
Darwin Foundation


In-Memory
Architecture

Model-View-Controller

Model-View-Controller



Where?

- View
- Controller
- Model

Where?

- View
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Where?

- View
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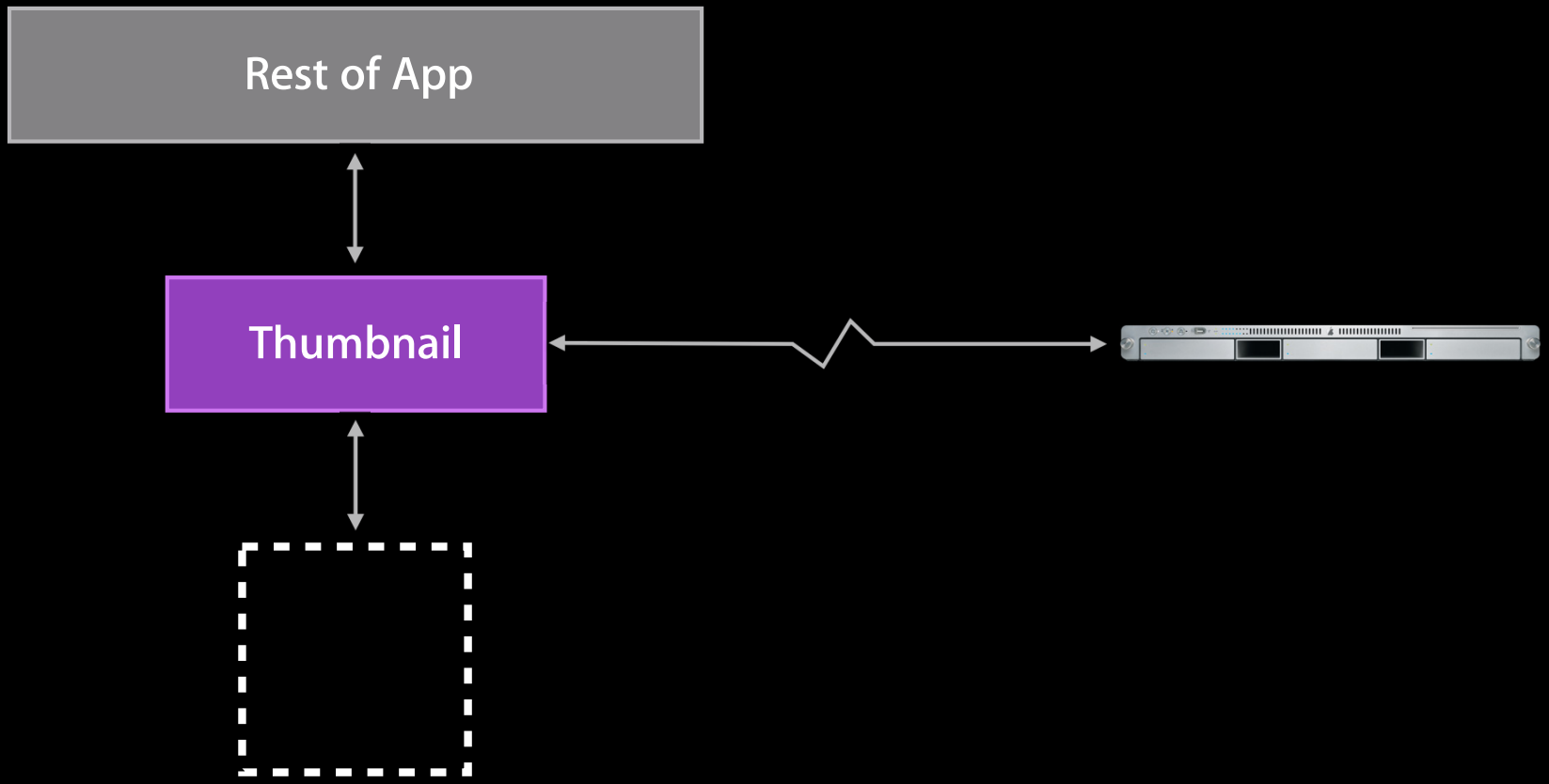
Model Example



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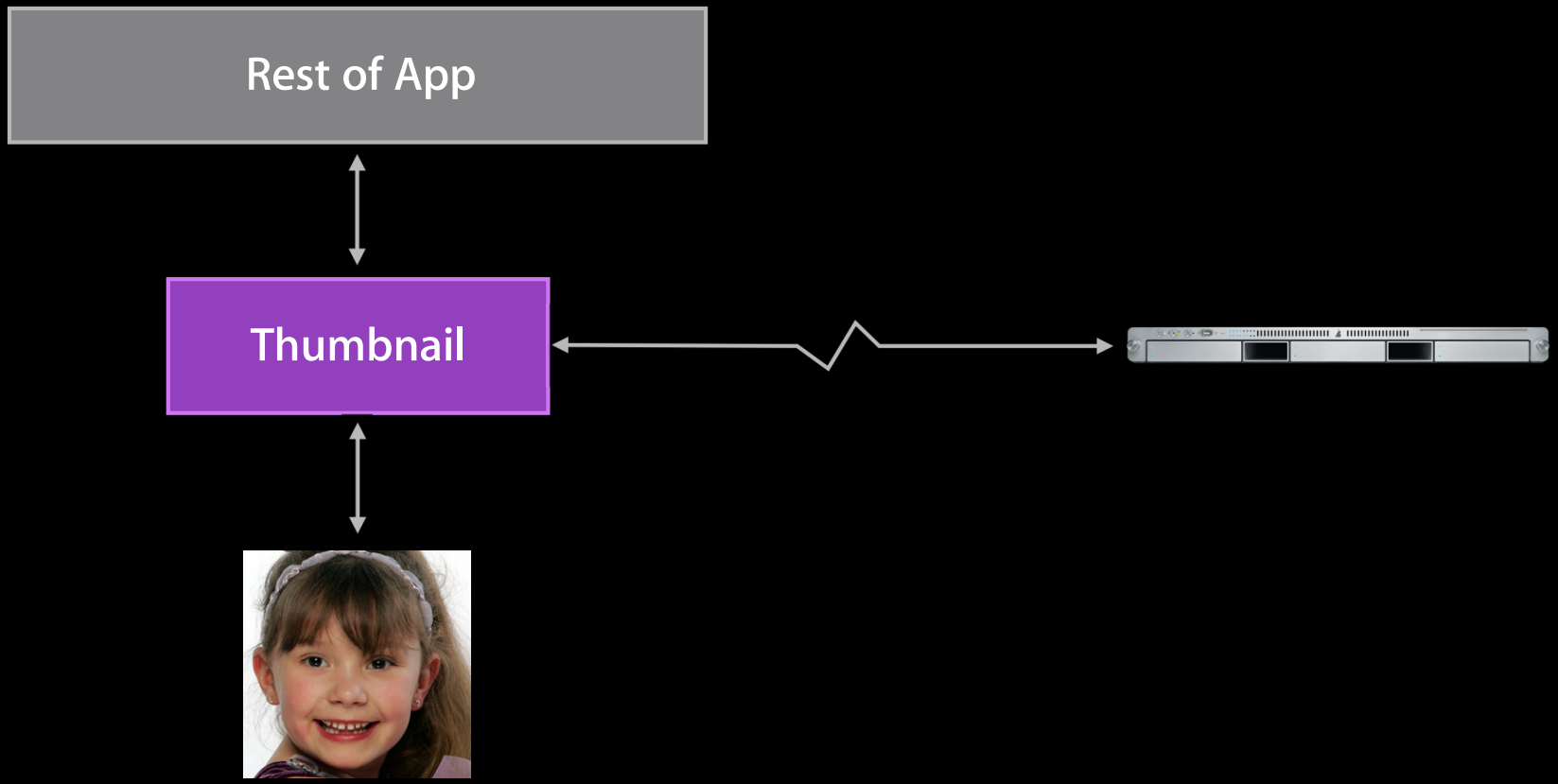

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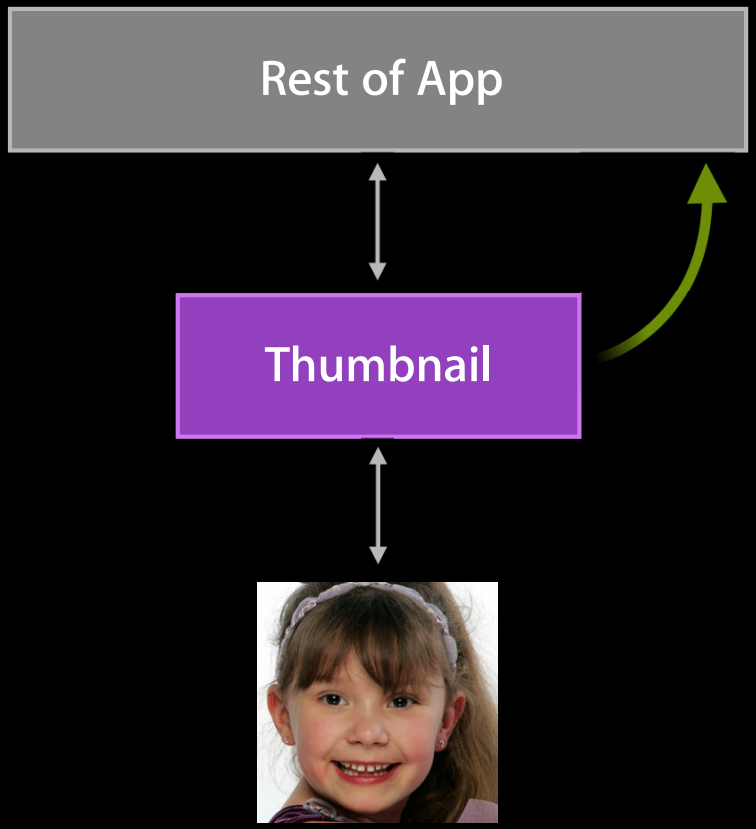

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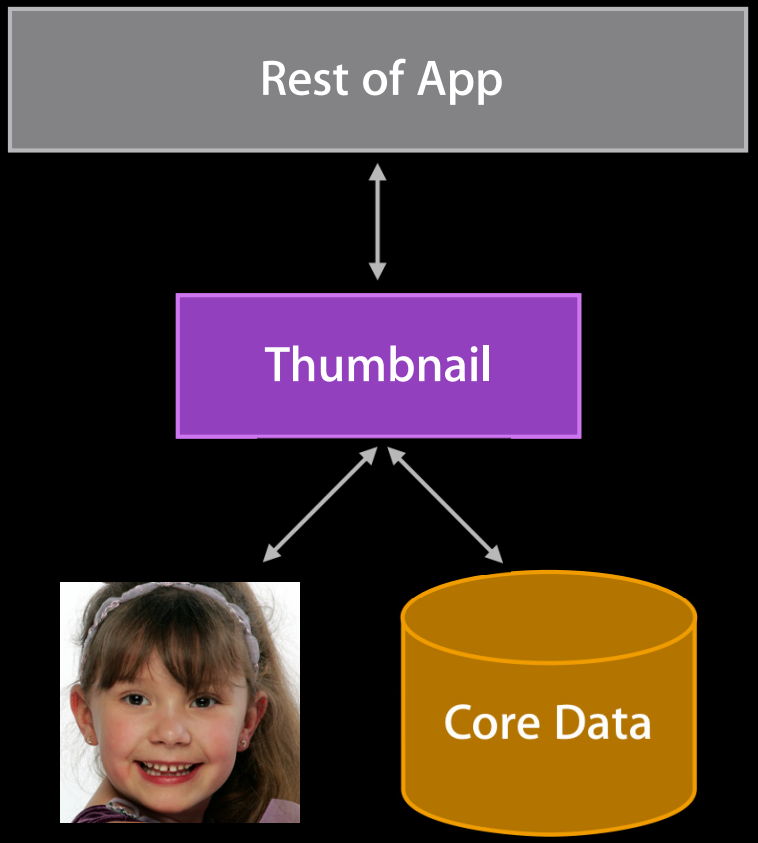
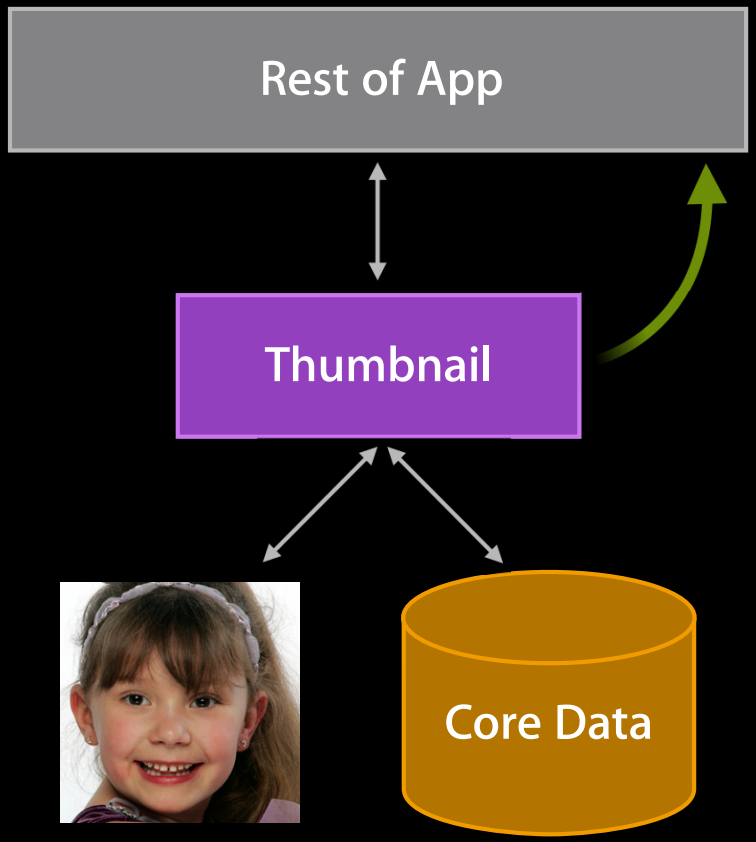
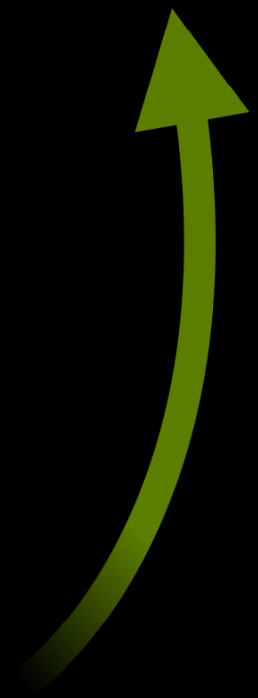


Advantages

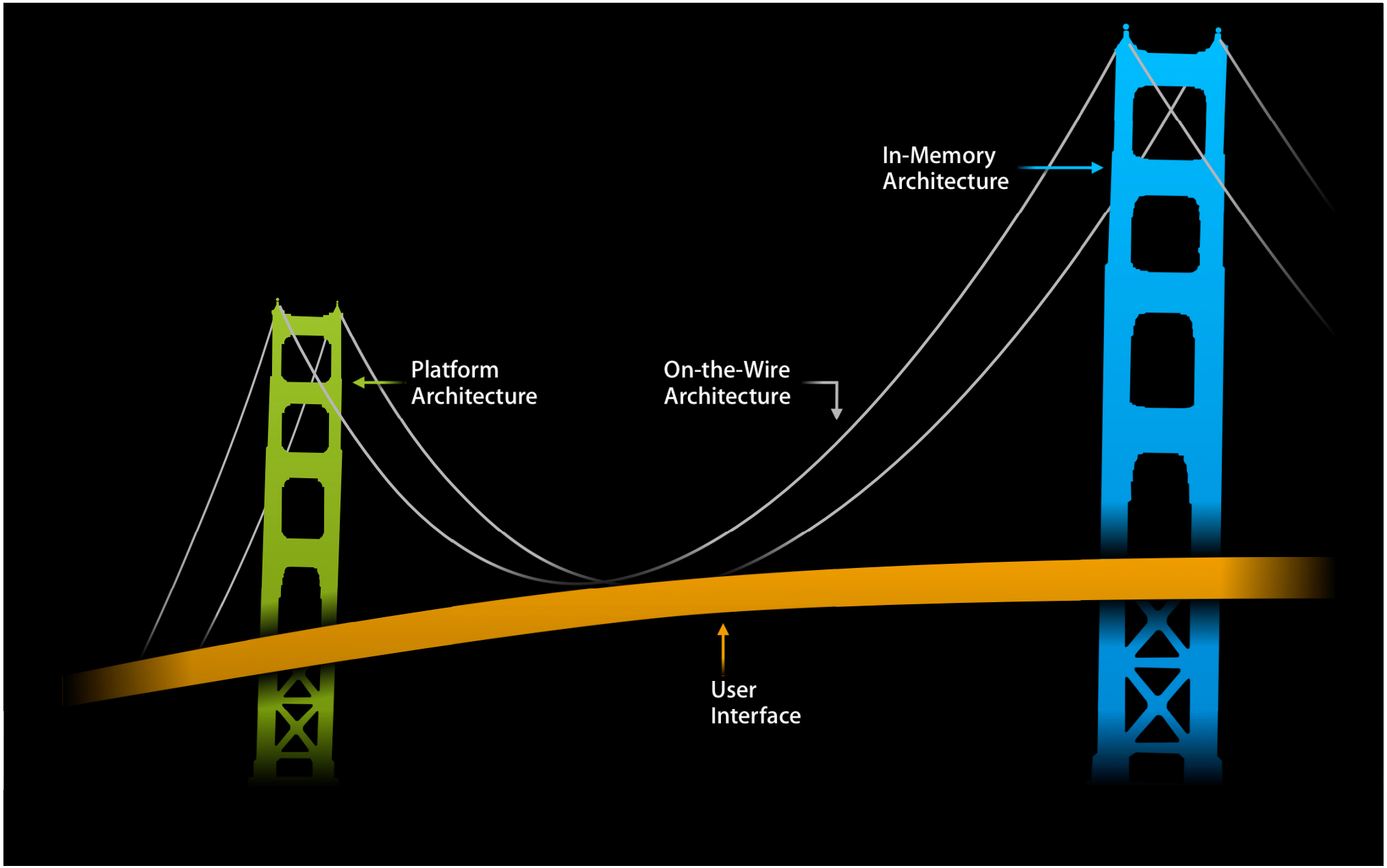


- Isolates networking
- Persistence
- External changes
- Testing

Model Notification Bake Off



Mechanism	1:N	Granularity
Delegation	No	Fine
NSNotification	Yes	Coarse
Key-Value-Observing	Yes	Fine

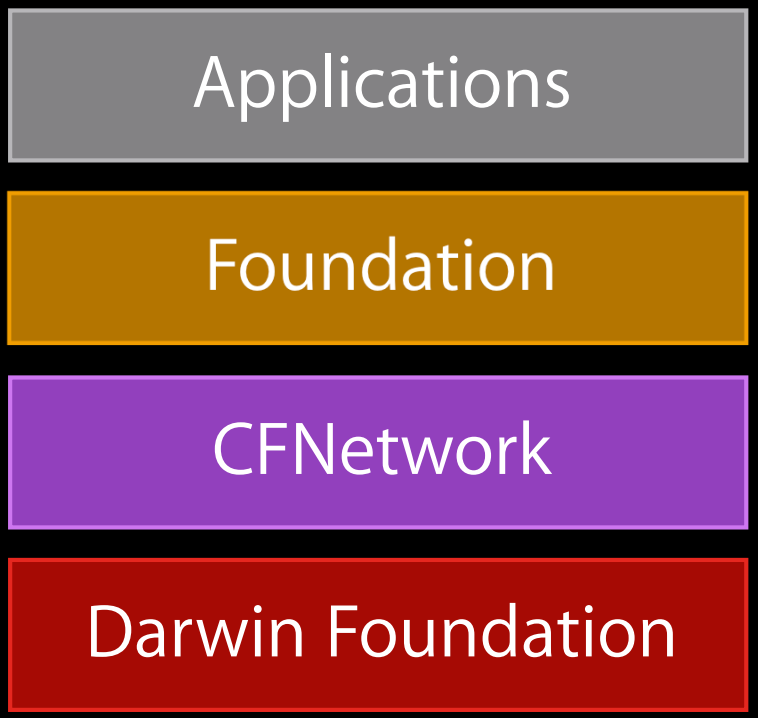

In-Memory
Architecture
Platform
Architecture
On-the-Wire
Architecture
User
Interface

Security via TLS

Transport Layer Security

- Evolution of Secure Sockets Layer (SSL)
- On-the-wire security
- Centralized server
  - Server identity from certificate authority (CA)
  - Client-authenticates-server authentication
  - On-the-wire privacy
- Peer-to-peer
  - Tricky

TLS in iPhone OS



- NSURLConnection
  - https://…
- NSStream
- CFSocketStream
- No Darwin-level support
  - No Secure Transport
  - No OpenSSL

Summary

- Networking is hard
- Good architecture makes it easier
  - User interface
  - Centralized server
  - Foundation networking
  - Networking is a model operation
- TLS is your friend

But Wait, There's More!

A Lot More!

Part 2 Practical Matters

- Asynchrony
- Debugging
- Common mistakes

More Information

Quinn "The Eskimo!"
Developer Technical Support
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Dogsbody Evangelist
danbold@apple.com

Documentation
Networking
http://developer.apple.com/networking/

Apple Developer Forums
http://devforums.apple.com

More Information

Sample Code

SimpleNetworkStreams, SimpleURLConnections, AdvancedURLConnections, SimpleFTPSample, Reachability, WiTap, BonjourWeb

iPhone Dev Center > iPhone Reference Library > Sample Code

Sample Code

CocoaHTTPServer, CocoaEcho, UDPEcho, SimplePing

Mac Dev Center > Mac OS X Reference Library > Sample Code

Related Sessions

Network Apps for iPhone OS, Part 2	Marina Wednesday 3:15PM
Core OS Networking	Pacific Heights Tuesday 9:00AM
Simplifying Networking Using Bonjour	Nob Hill Wednesday 10:15AM
Creating Secure Applications	Russian Hill Tuesday 4:30PM

Labs

Networking Lab	Core OS Lab B Thursday 9:00AM
Networking Lab	Core OS Lab B Friday 9:00AM
iPhone OS and Mac OS X Security Lab	Core OS Lab A Thursday 2:00PM


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