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Creating Secure Mobile Applications Illuminating Mobile Threats

OWASP Software Assurance Day DC 2009

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Agenda

- Introduction
- Mobile Architectures
- Mobile Threat Model – Attacks and Defenses
- Wrap-Up & Discussion

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The Scale of Things

- The Internet Is big.
- There are approximately 1,000,000,000 people on the internet.
- And there are approximately 3,000,000,000 mobile handsets in use.
- What sort of attack surface, computational power, and force multiplication do cell phones have?

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Mobile Platforms are Fragmented

- Nokia
  - Symbian (J2ME, C/C++)
  - UIQ (J2ME, C/C++)
- SonyEricsson (J2ME, C/C++)
- iPhone (J2ME, Objective C)
- RIM (J2ME, C/C++)
- Motorola (J2ME, C/C++)
- Google Android (Java, C/C++)

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Mobile Platforms are Fragmented

- This fragmentation leads to tiny "islands" of content, applications, and use cases
- These islands will begin to disappear as carriers, handset manufacturers, and framework providers come together to monetize cell phones
- Once these islands are gone, we've got the good, and we've got the bad.

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Mobile Platforms are Standardized

- The Good:
  - 1-stop shopping for content and applications
  - Everyone's smart phone works with everyone else
  - Content and application providers will have an easier time converging functionality onto mobile devices

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Mobile Platforms are Standardized

- The Bad:
  - 1-stop shopping for content and applications
  - Everyone's smart phone works with everyone else
  - Content and application providers will have an easier time converging functionality onto mobile devices

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"Convergence is the Way To Go™"

- Convergence of functionality, and the requisite data onto mobile phones is only increasing
- Mobile phones are becoming interesting targets for attackers wishing to do more than just play with OS vulnerabilities
- Mobile phones could represent an incredible efficiency boost, or a horrible liability

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"Convergence is the Way To Go™"

- What do you put on your phone?
  - Phone numbers
  - Call history
  - Music?
  - Location-Based Services (Google Maps, Google Latitude, VZNav, BB Maps)
  - Photos
  - Email
  - … VPN keys?
  - … Passwords?

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"Convergence is the Way To Go™"

- There is no doubt in my mind that secure converged devices are the way to go….

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"Convergence is the Way To Go™"

- …but we've got a long way to go before we have truly secure mobile devices!

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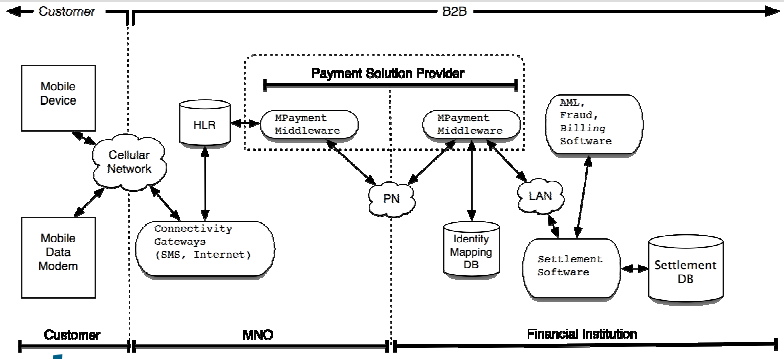
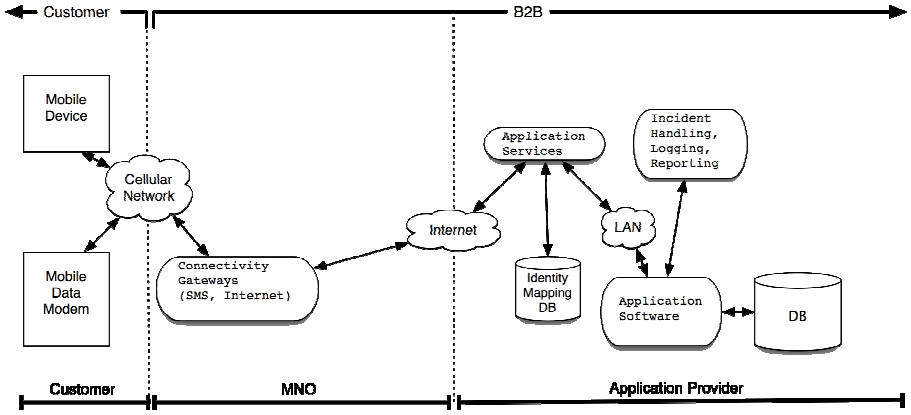
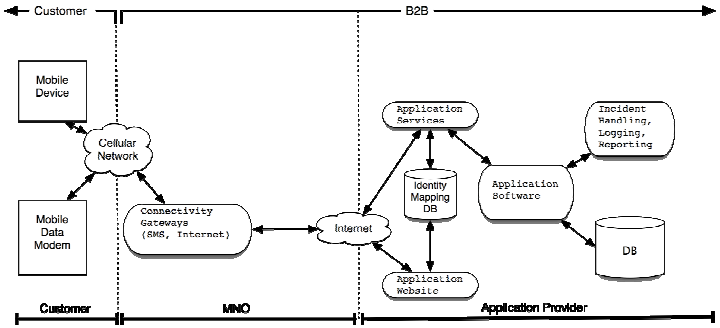
Mobile Application Architectures







Mobile Application Architectures

- Easily characterized by how much information is stored on handset.
- Generally dependent on liability, performance, scalability.
- Share more common traits than you think.
- Almost any application architecture can be transformed into another, given enough $$ and time.

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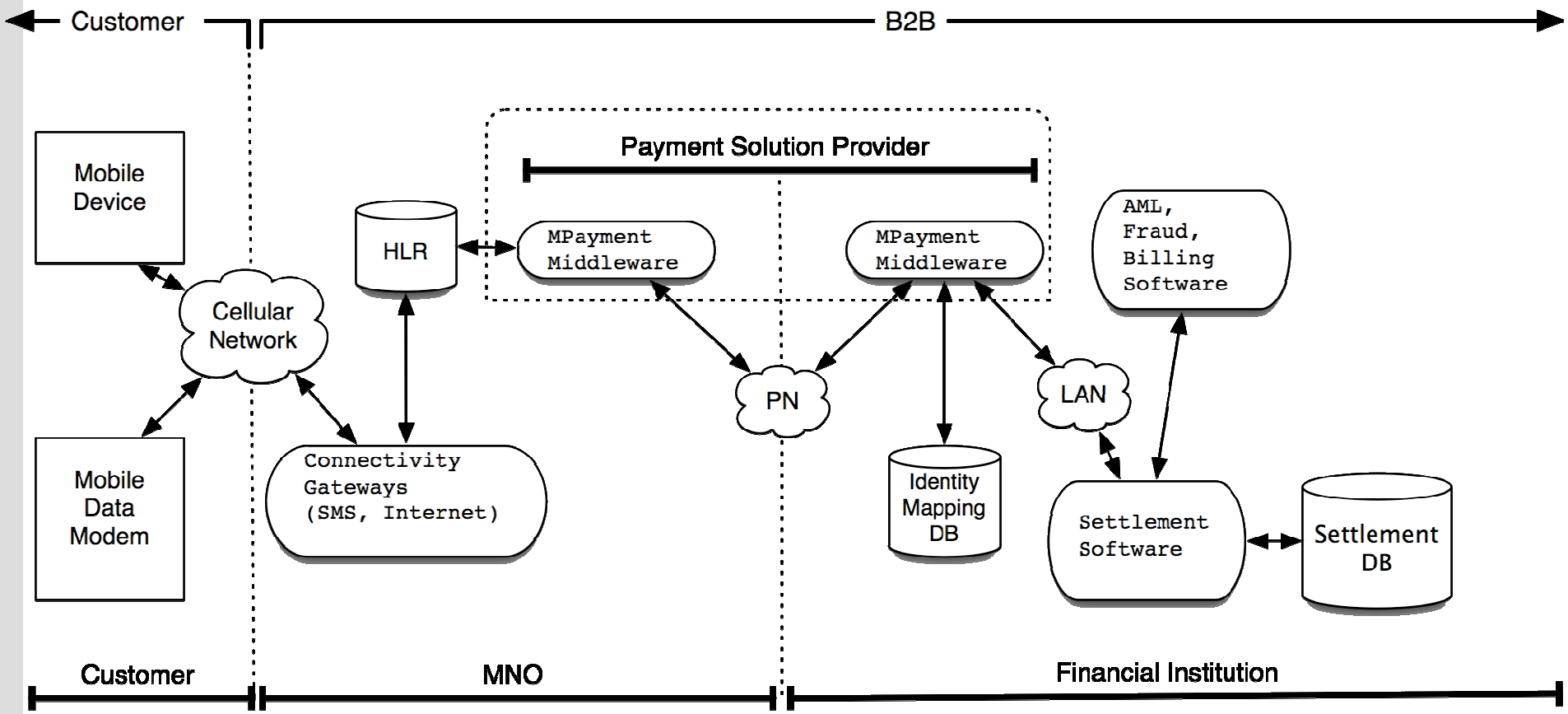
Complex Payment Architecture



Complex Payment Architecture

- Stores important information on the handset.
- Requires tight integration between MNO and FI
- Requires high trust between MNO and FI
- Burdens the handset with information protection requirements
- Device loss could become liability for consumer, MNO, or FI
- Any other issues?

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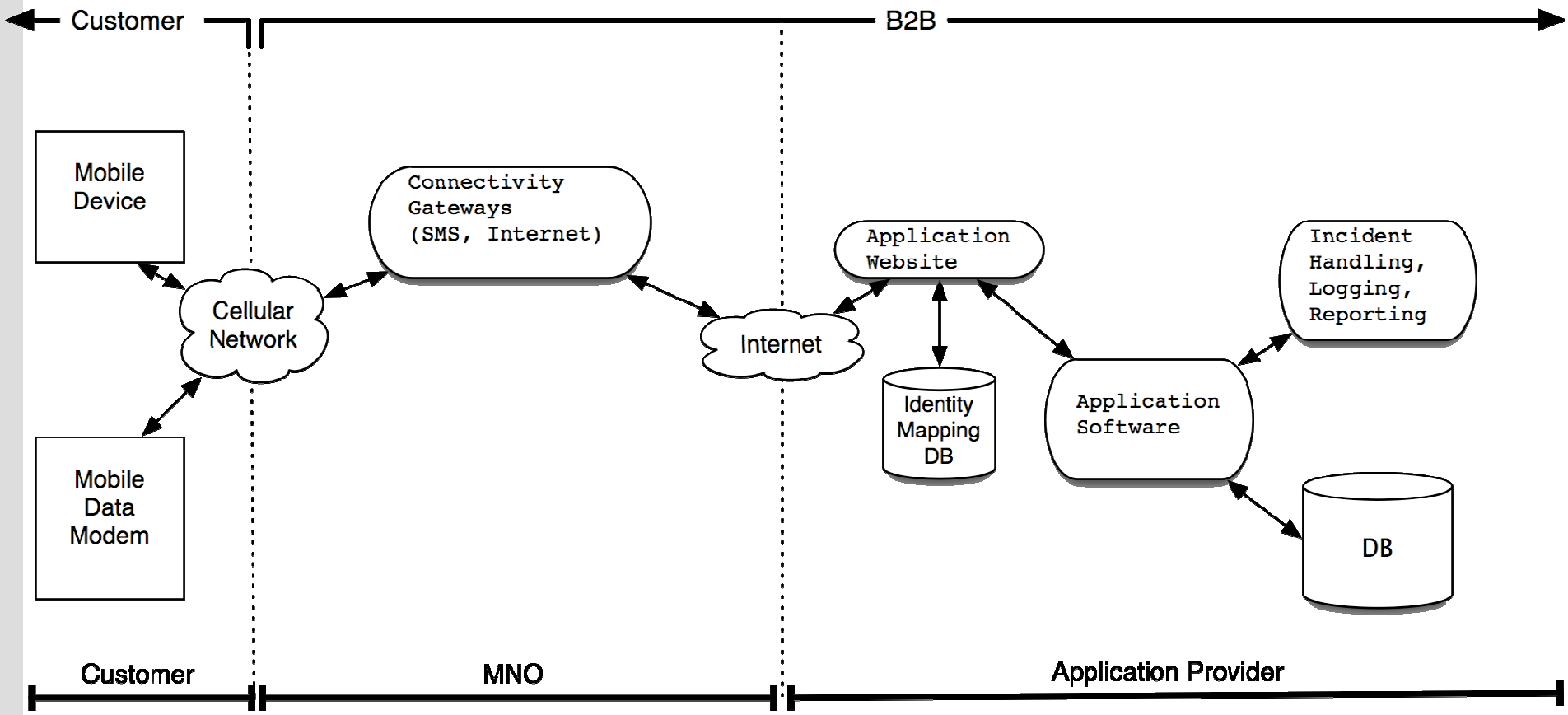
Web Front-End



Web Front-End

- Does not require storage of important information on the handset
- No integration between MNO and ASP – essentially turns MNO into a "plumber" providing pipes connecting mobile browser to ASP website
- Usually cost-effective, as ASP can leverage previous investments in web applications to on-board mobile devices
- Example: BoA Online Banking for Mobile

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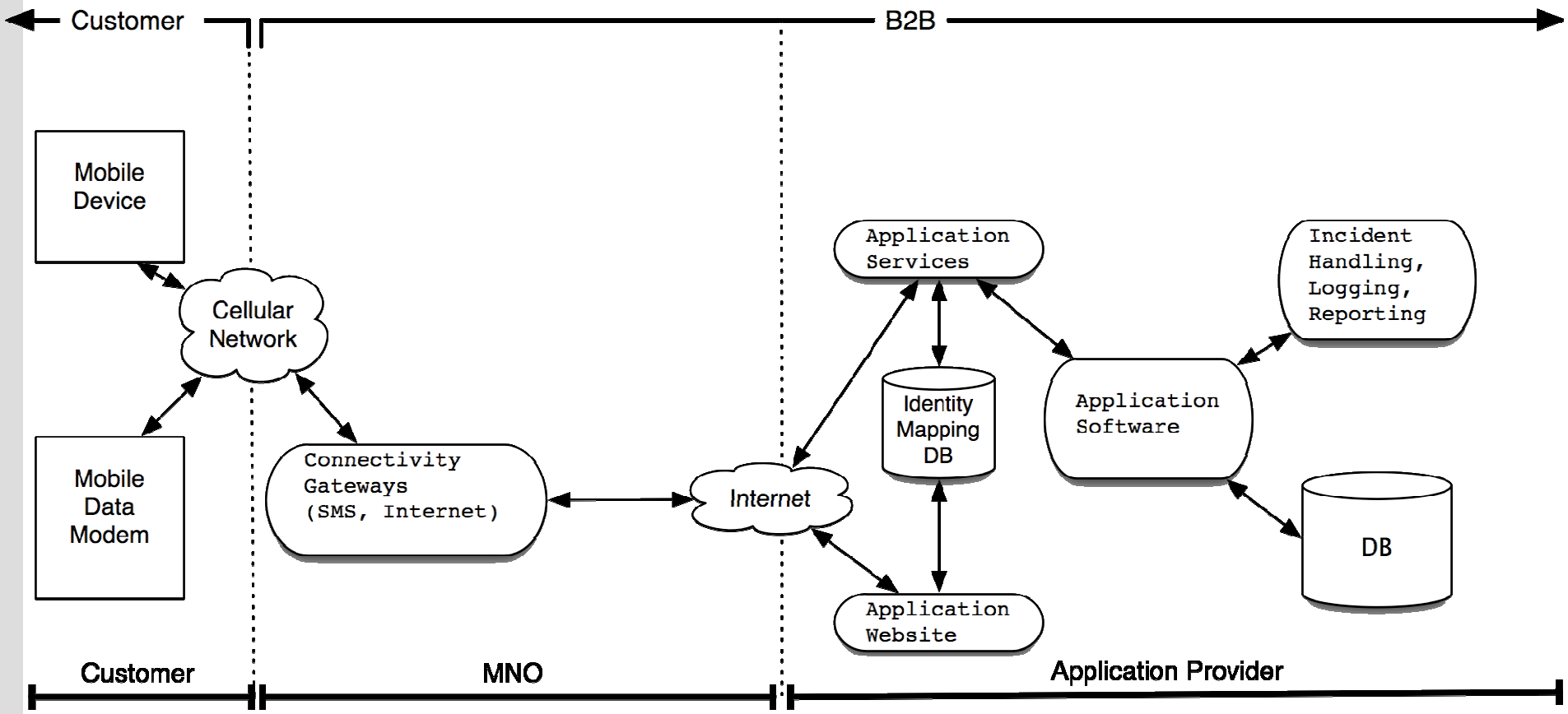
Mobile Services Client (Hybrid)



Mobile Services Client (Hybrid)

- May require storage of important information on the handset
- Little or no integration between MNO and ASP – however, MNO often controls some aspect of application loading, provisioning, and personalization
- Usually cost-effective, as ASP can leverage previous investments in web applications/services to on-board mobile devices
- Example: VzW Visual Voicemail

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Mobile Threats – Attacks, Defenses, and Data

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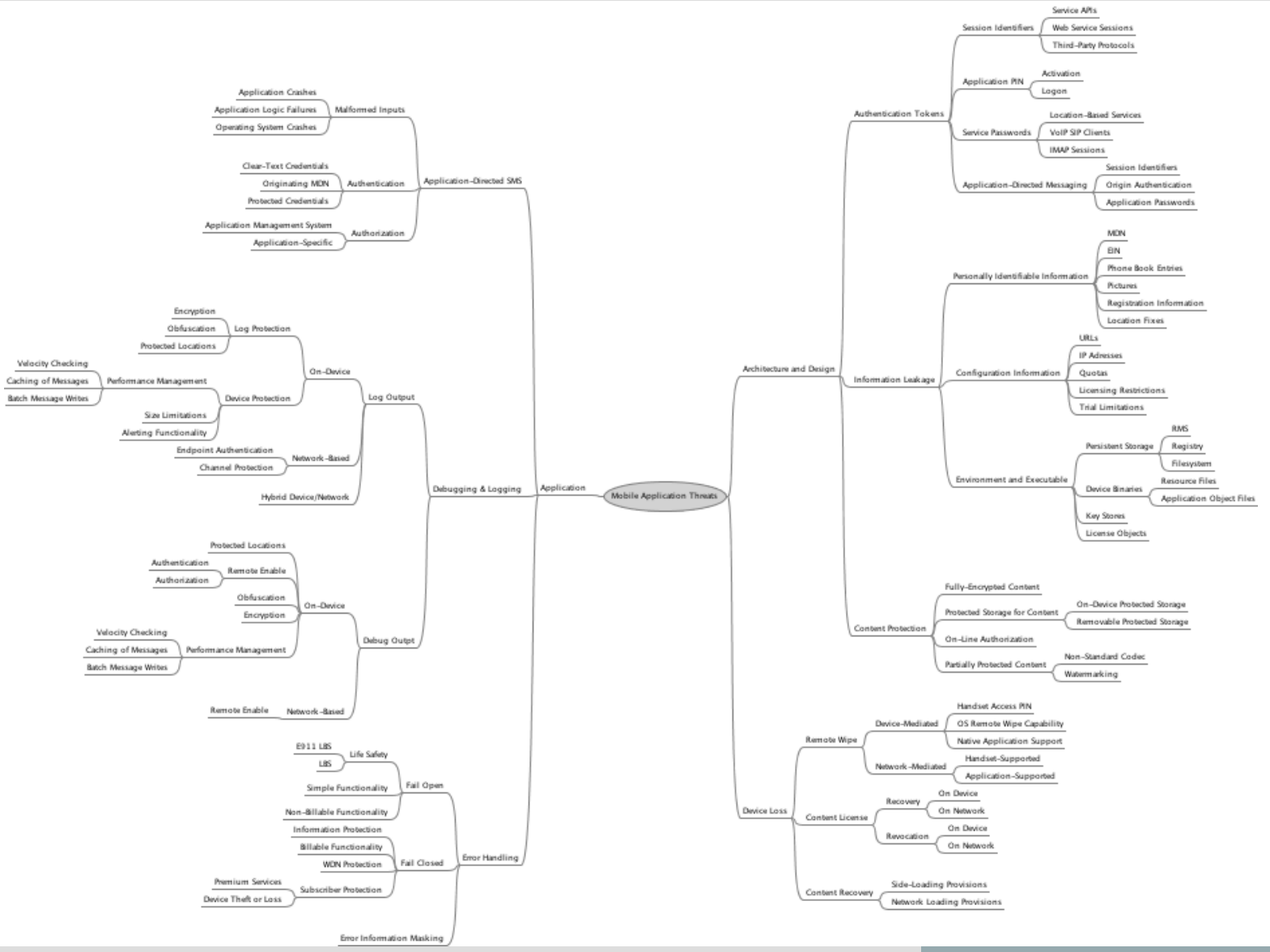
Mobile Application Threat Mind Map



5 Main Areas | Resources and Practices

5 Main Areas

- Directed SMS
  - Application event drivers
- Debugging & Logging
  - Wildly variable implementation
- Error Handling
  - Failures & Recovery
- Architecture & Design
  - “remote control” to “full mobile application”
- Device Loss or Capture
  - Remote control of content

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5 Main Areas | Resources and Practices

Directed SMS

Debugging & Logging

Error Handling

Architecture & Design

Device Loss or Capture

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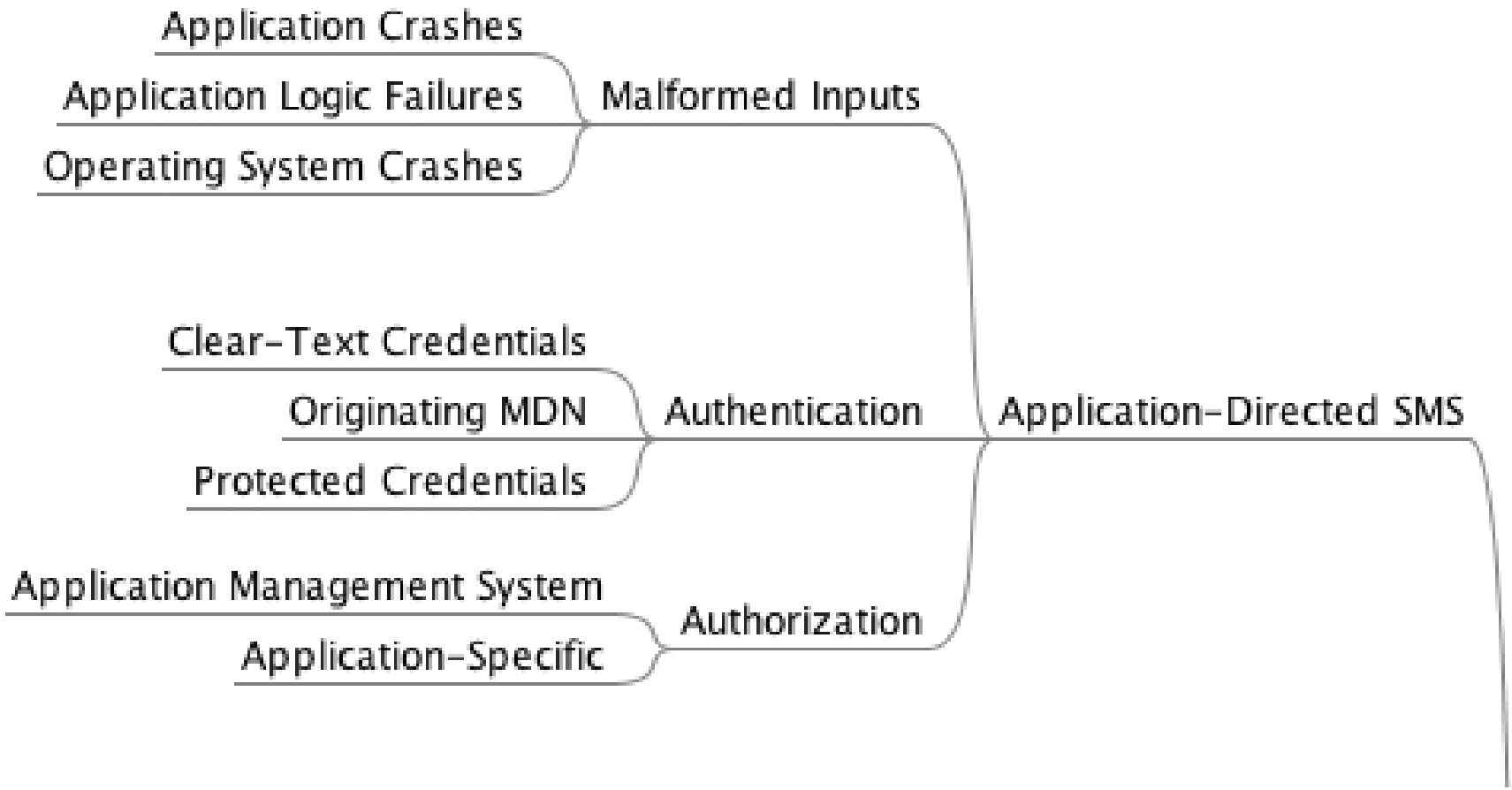
Directed SMS



Directed SMS

- Messages drive many events for handset applications
- Often, these messages contain actionable data, from content IDs to IP addresses
- This input must be carefully screened for malicious content
- Information contained in these messages must be protected as well as information stored on a handset!

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Directed SMS

- How often do we authenticate the sender or receiver of an SMS message?
- How can we authenticate such principals?

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5 Main Areas | Resources and Practices

Directed SMS

Debugging & Logging

Error Handling

Architecture & Design

Device Loss or Capture

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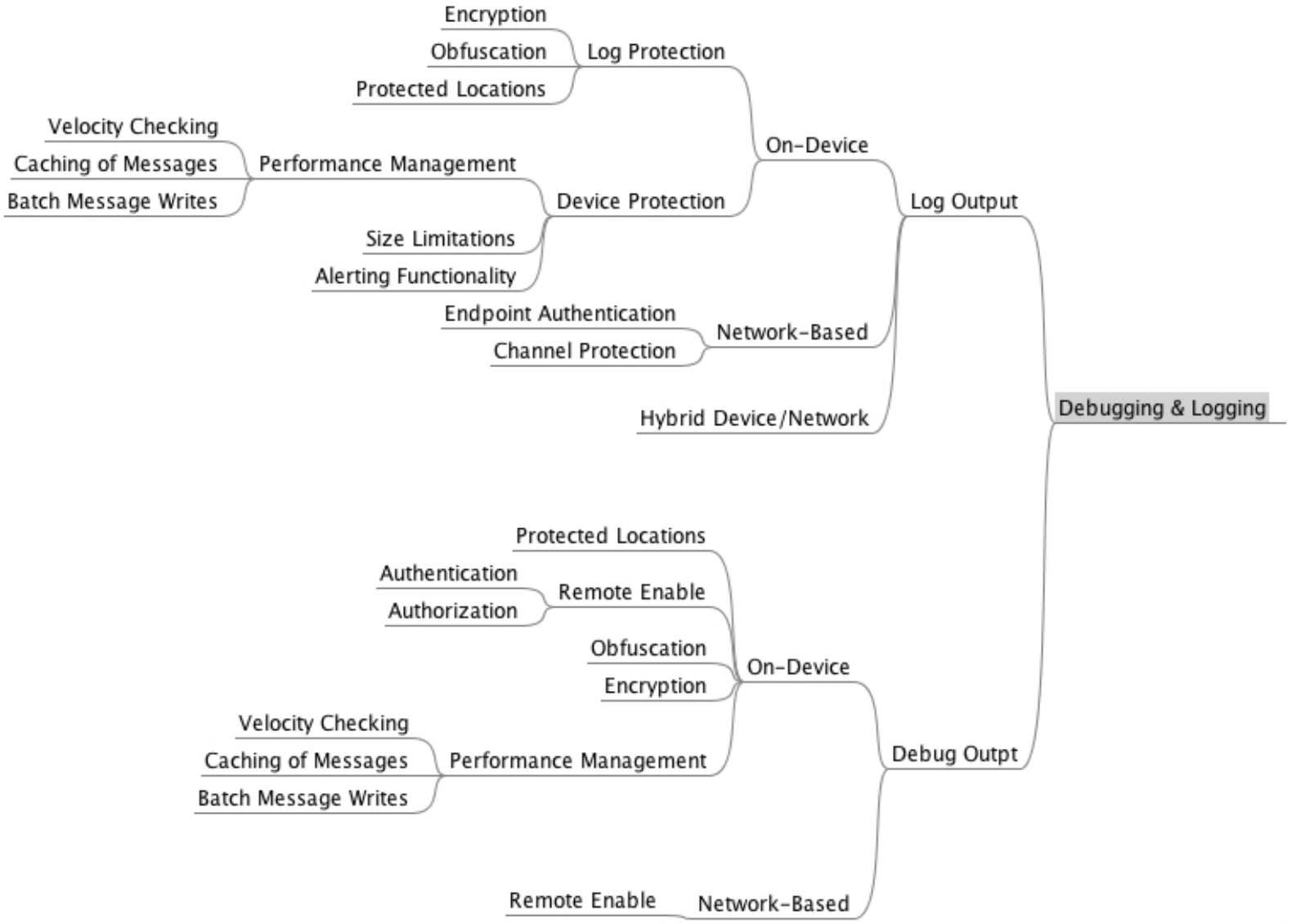
Debugging & Logging



Debugging & Logging

- Near & Dear to my heart
- Incredibly valuable to:
  - Programmers
  - Attackers
- Not so directly valuable to:
  - Users
- Let's look at the topics separately

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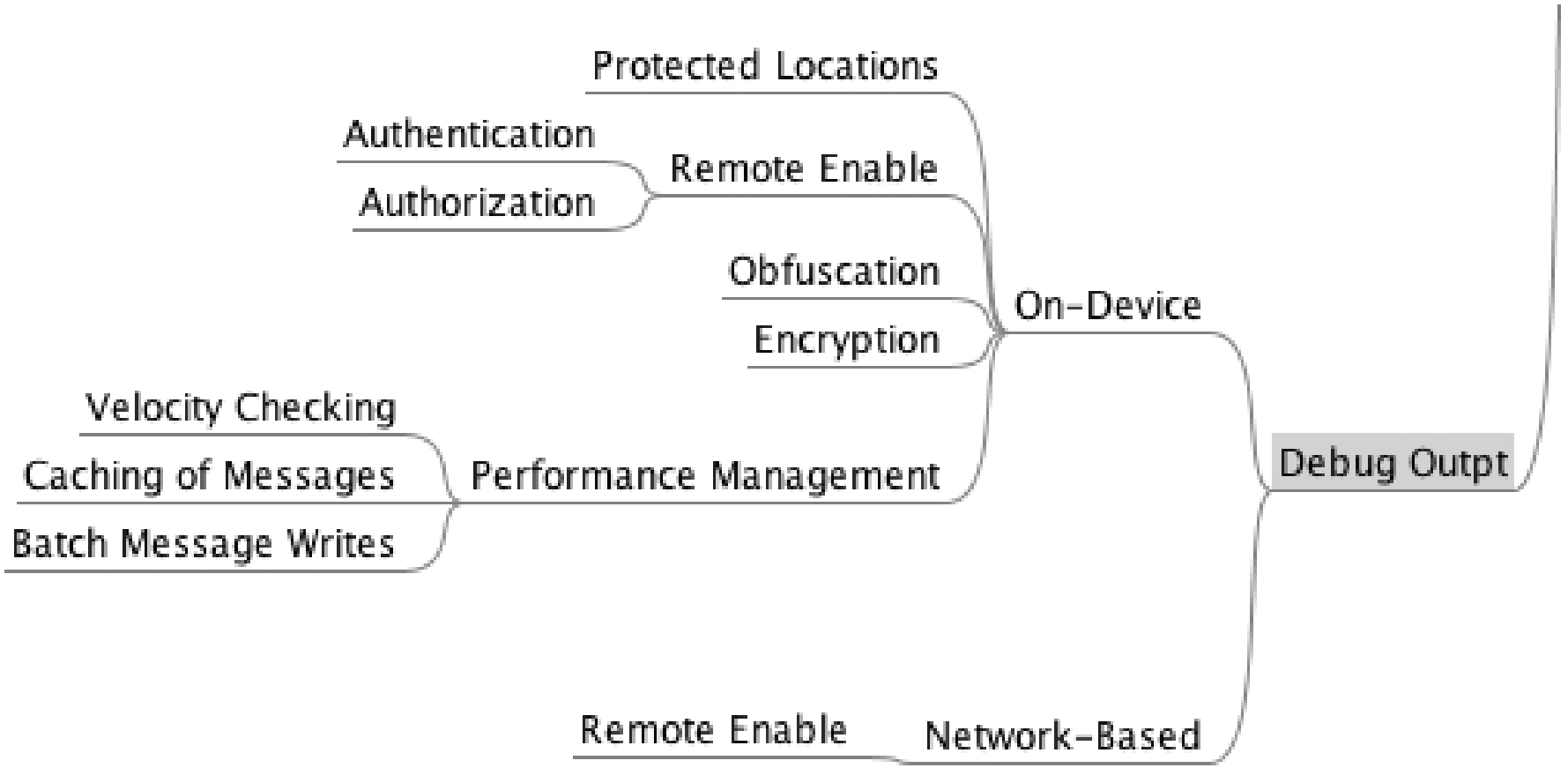
Debugging



Debugging

- Need to know what to record and what *not* to record.
- Need to take into consideration where you're storing this information
- Need to consider performance hits
- Need to consider remote-control ability for debug logs and troubleshooting

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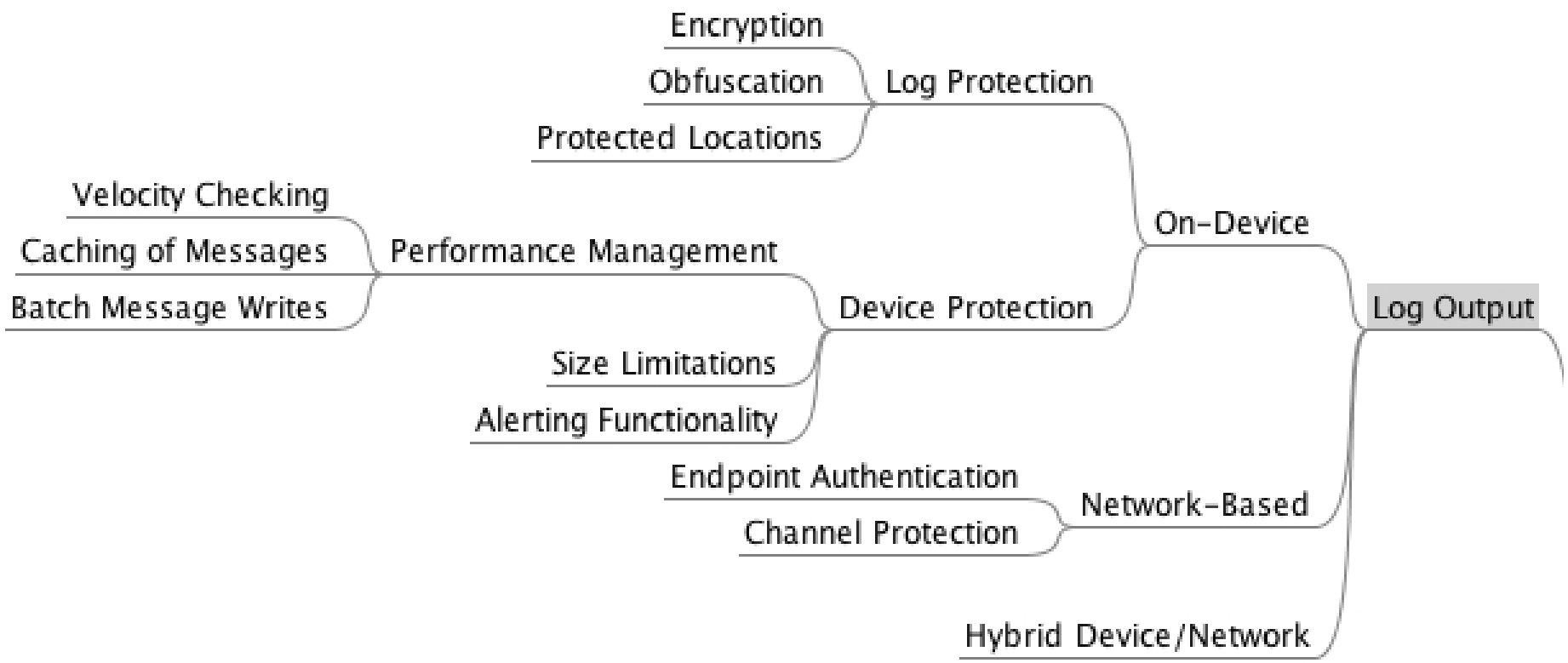
Logging



Logging

- Very different from debugging – logs could conceivably stay on during normal deployments, and might even form a part of the application's data model
- Still have some of the same issues – what to log, how to log it, where to log it, etc…

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5 Main Areas | Resources and Practices

Directed SMS

Debugging & Logging

Error Handling

Architecture & Design

Device Loss or Capture

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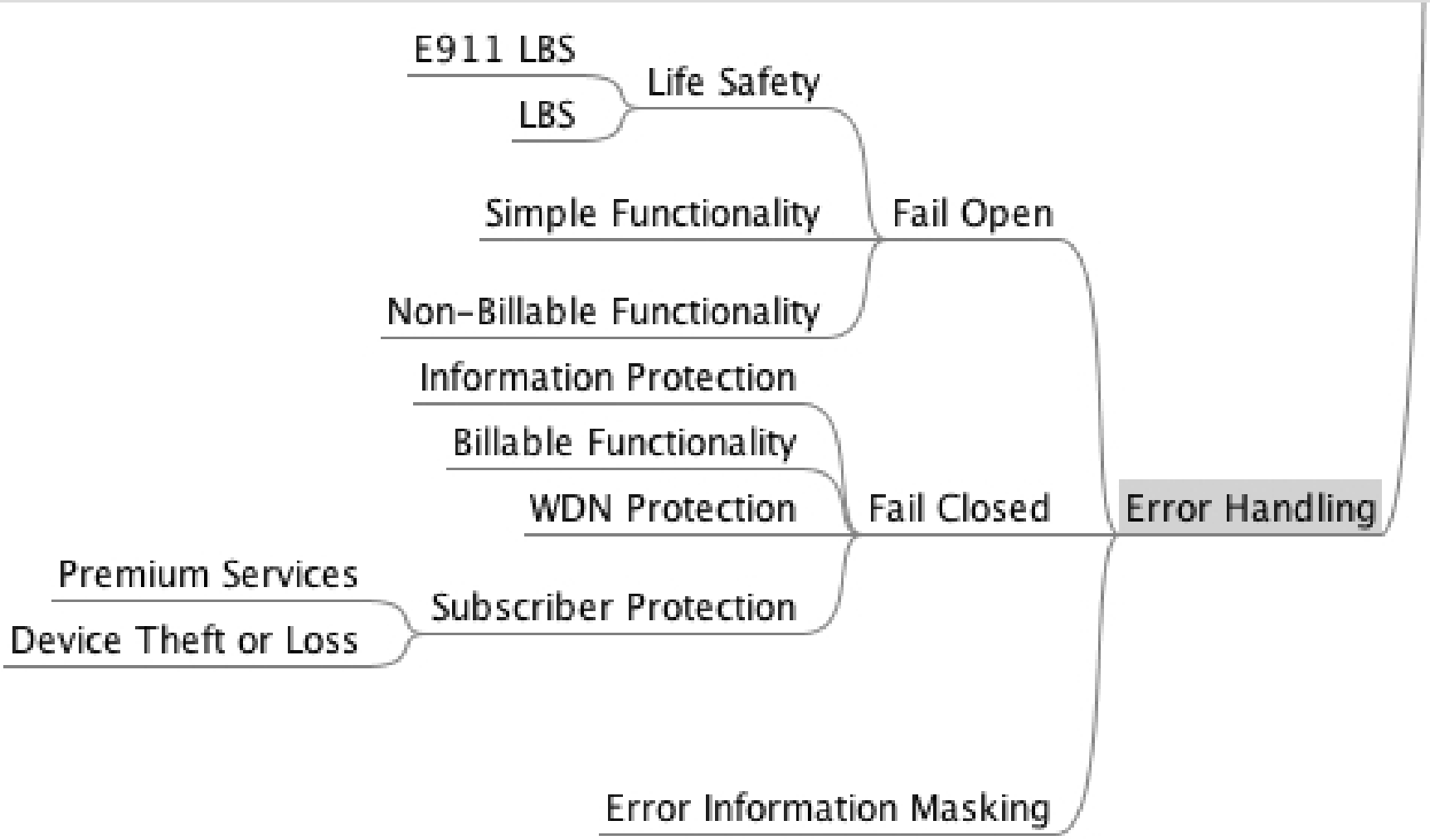
Error Handling



Error Handling

- Error handling can be a make-or-break aspect of many mobile applications.
- Error handling can release protected content (fail open)
- Error handling can cause lost revenue when, for instance, an application uninstall is interrupted but the billing information is erased
- Error handling can even affect life safety, if we look at E911 services

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Error Handling

- The biggest question to ask yourself is: Fail Open, or Fail Closed?
- The answer to this question will dictate any and all controls you must put in place downstream

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5 Main Areas | Resources and Practices

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Architecture & Design

- The architecture can drastically affect where we store and process information. This means that we have to be cognizant of a number of areas, including:
  - Authentication Tokens
  - Information Leakage
  - Content Protection

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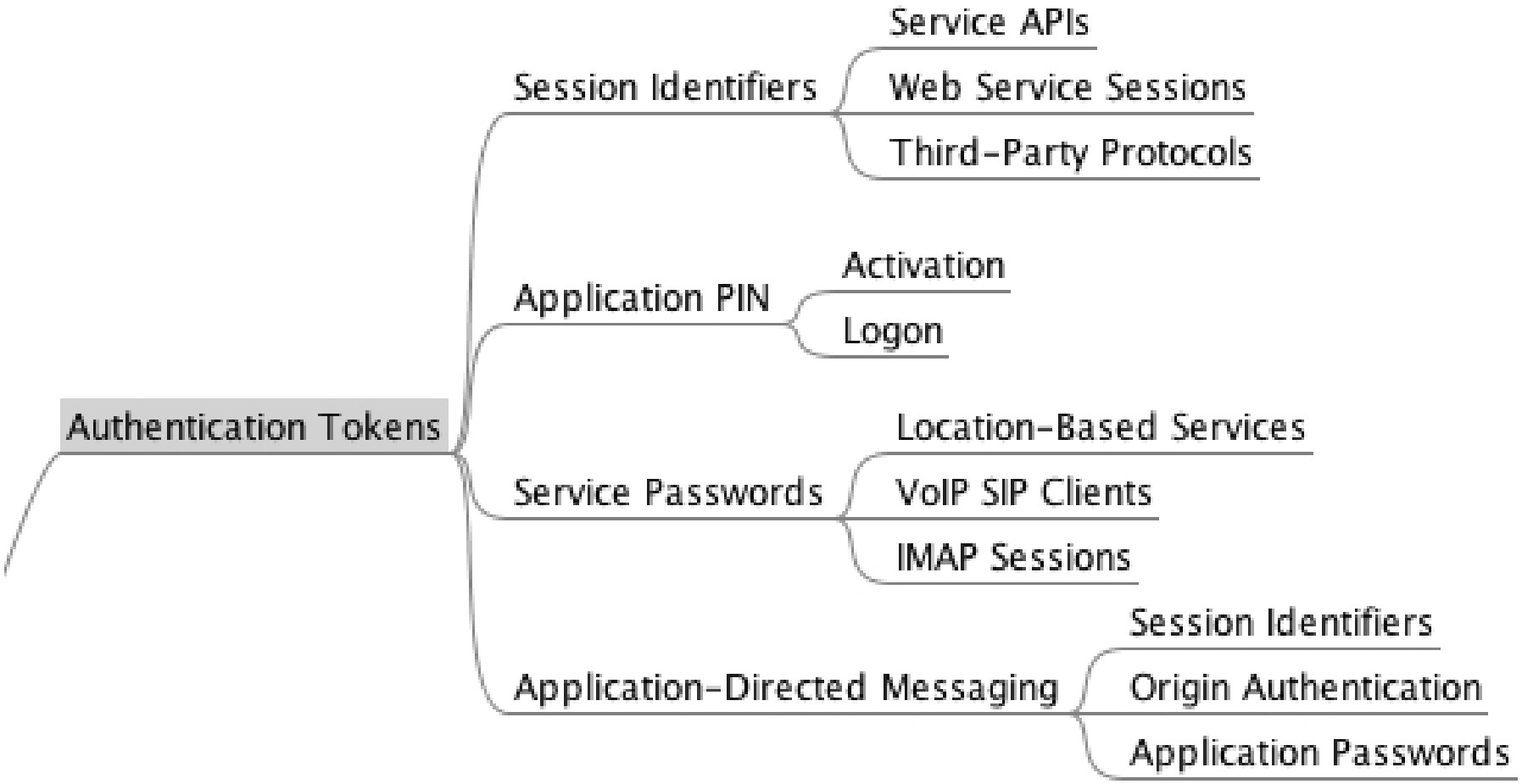
Authentication Tokens



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Authentication Tokens

- Auth tokens are the holy grail of attackers
- If they can be stolen, predicted, fixed, or obviated, then we have lost, and the attacker has won
- The key issue here is to *be aware of the tokens you use, how long you use them, and how they are disposed of!*

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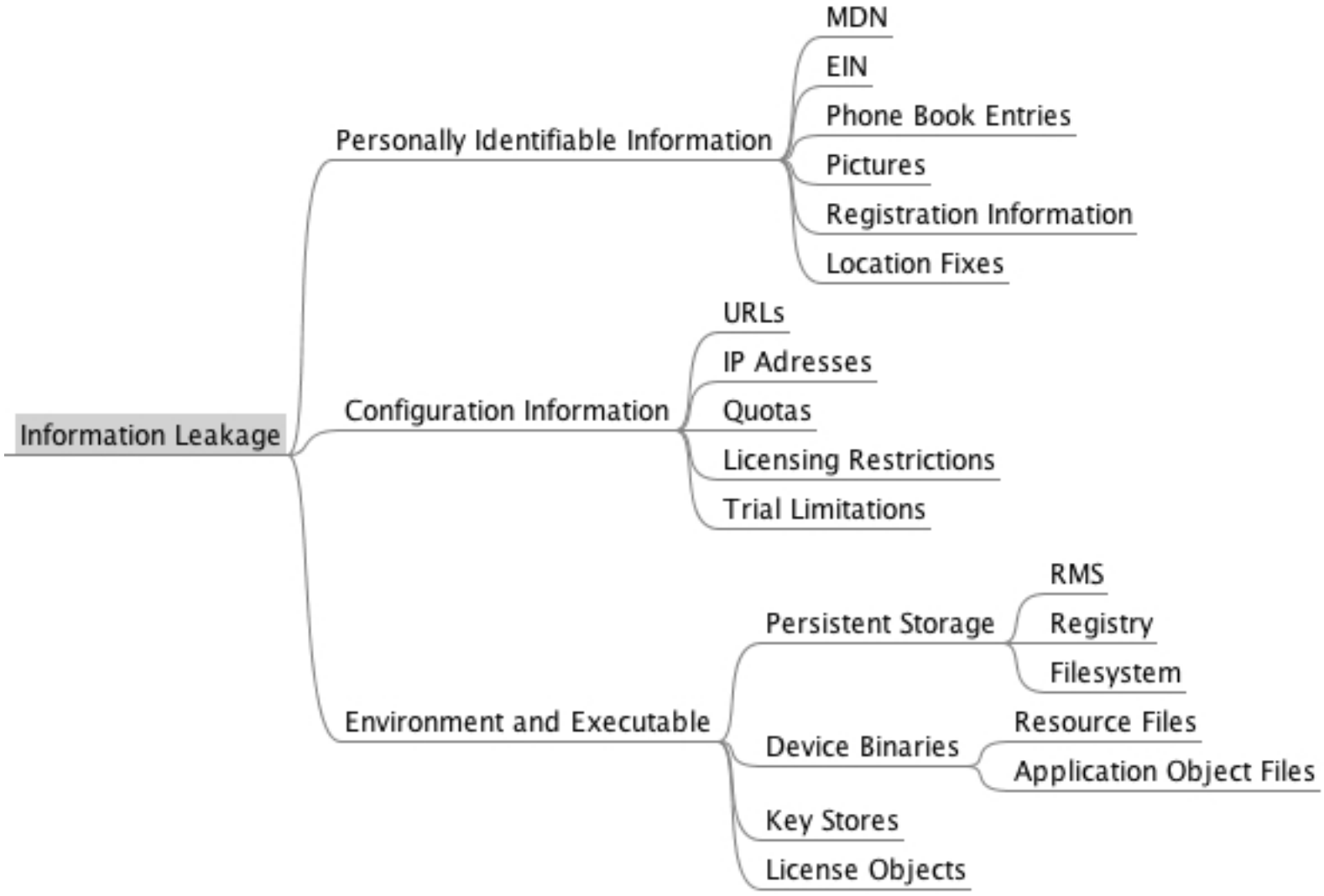
Information Leakage



Information Leakage

- We see many familiar things here – Personally Identifiable Information, like MDN, phonebook entries, LBS fixes...
- All of this is a potential customer-affecting issue!
- Information leakage must be curtailed during the architecture phase and managed with strict controls in deployment
- Handsets have a rich storage capacity in multiple formats and multiple transfer capabilities

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Information Leakage

- We often forget, as developers, just how much information we leave on handsets!
- Debug PINs
- URLs
- Error Strings
- Authentication Clues

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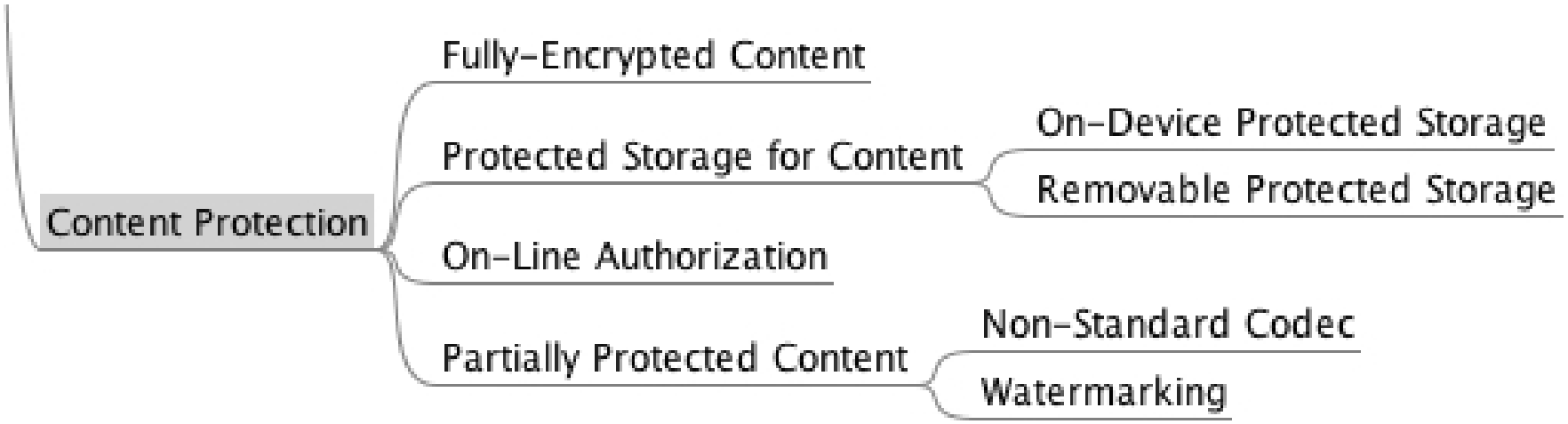
Content Protection



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Content Protection

- Content Protection is an easy to understand issue on today's networks: carriers seek to monetize content and its delivery
- Content protection can run the gamut from encrypted files with a robust key-management scheme to a simple "stream-on-demand" model that seeks to prevent content from existing on the handset for too long
- Some vendors are even pursuing watermarking of content as a deterrent

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5 Main Areas | Resources and Practices

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Architecture & Design

Device Loss or Capture

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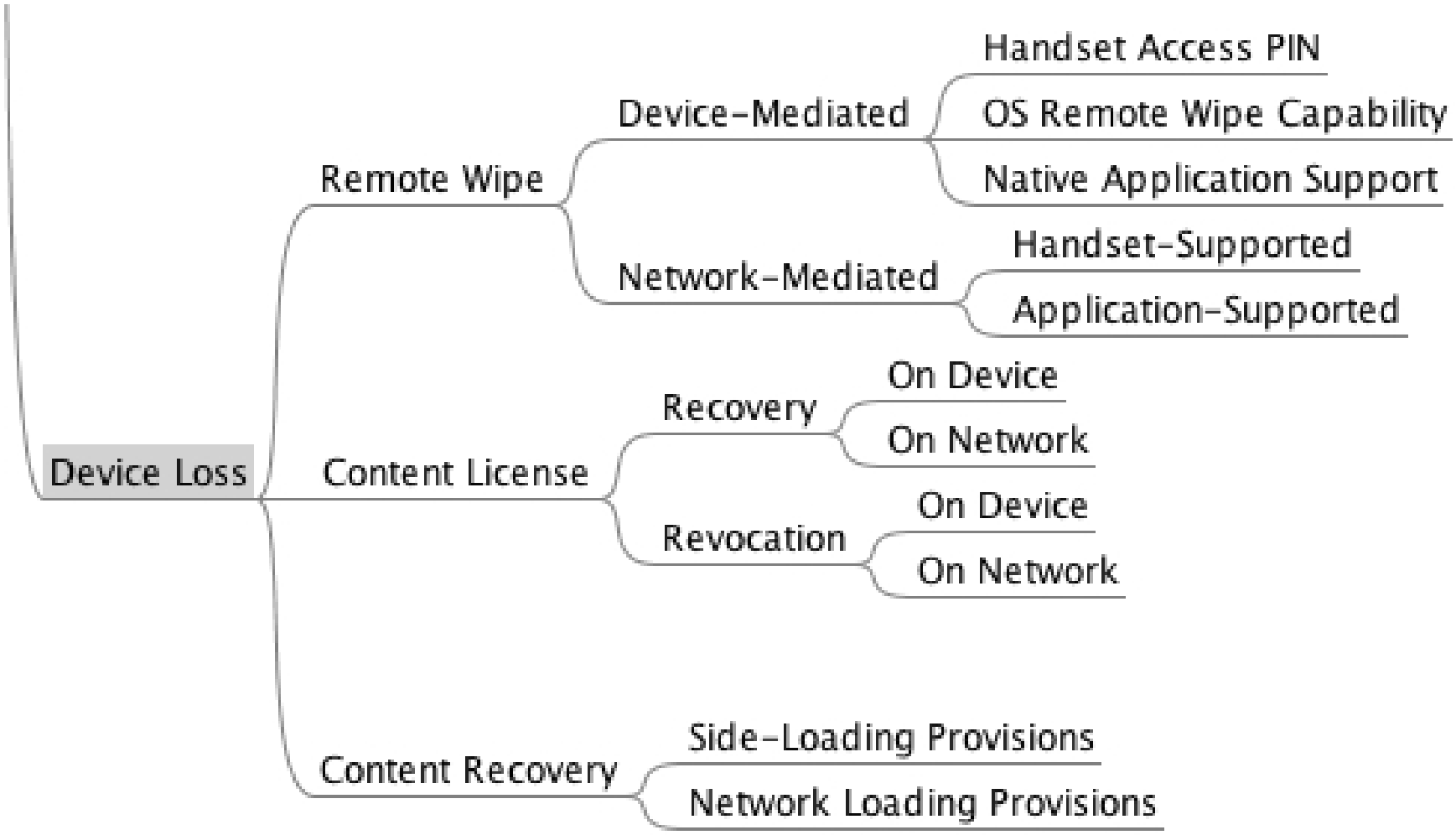
Device Loss or Capture



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Remote Wipe

- Often times it's easiest to classify this functionality as "network" or "device" mediated.
- If the carrier/MNO can remotely wipe a device, there is a good amount of protection.
- If a local application, however, is able to wipe the device by using a dead-man's switch, then this could catch criminals off-guard
- True or False: There is rarely a need in consumer goods for robust network or device remote wipe!

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Content Licensing

- When a device is lost, it is as important to recover a customer's licenses as it is to recover their content
- If those licenses cannot be recovered, then the device should support some form of revocation, to protect both the customer and the content owner from fraudulent uses of their data

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Content Recovery

- The biggest problem with content recovery is: where do I get my content from? Most mobile applications can reconstruct or restore a handset's state by re-personalizing or re-provisioning a handset
- When we have hundreds of megabytes or more, however, things get complicated
- Side-loading is by far the easiest method to off-load the network, but it may cause headaches with OS support, client issues, etc…

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Wrap-Up

Wrap-Up

- We've covered a lot of ground: mobile architectures, mobile threats.

- Take a moment to digest, and let's talk about some of the relationships between these elements and any other questions we might have.

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Discussion & Question Period