XMPP and Android

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XMPP

e**X**tensible **M**essaging and **P**resence **P**rotocol

- Allows to exchange data in form of XML elements between entities
- Specified by
  - RFC 6120 (XMPP-Core), RFC 6121 (XMPP-IM), RFC 6122 (JID)
  - various “XMPP Extension Protocols” (XEPs)
- Specifies 3 root elements, called “stanzas”

message	send asynchronous, fire-and-forget, store-and-forward
iq	request-response (response is mandatory)
presence	multicast to subscribed entities, pub/sub paradigm

XMPP (cont.)

e**X**tensible **M**essaging and **P**resence **P**rotocol

XML?!

- Allows to extend the protocol without breaking compatibility
- You can encapsulate any data you want, for example JSON (XEP-295)
  - Be careful when doing so, parsing is always a possible attack vector
  - See “BlackPwn: BlackPhone SilentText Type Confusion Vulnerability” [2], for a case where XMPP encapsulated JSON parsing went wrong

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eXtensible Messaging and Presence Protocol

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XMPP is not strictly an IM protocol! [4]

It allows you to exchange data between entities, and can therefore be used as protocol for Instant Messaging (IM), Social Media, the Internet of Things (IoT), Multi-Agent Systems (MAS), ...

Smack

An Open Source XMPP Client Library written in Java for JVMs and Android

- Started by Jive Software in 2002
- Was first ported to Android by the end of 2007 [6]
- Jive founded the “Ignite Realtime” community 2009
- Rene Treffer created aSmack in 2009 for Buddycloud
- Native support for Android added with Smack 4.1 (beta)

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- Native support for Android added with Smack 4.1 (beta)
- Appears to be used (at least partly) by Google for the "GTalk Service"

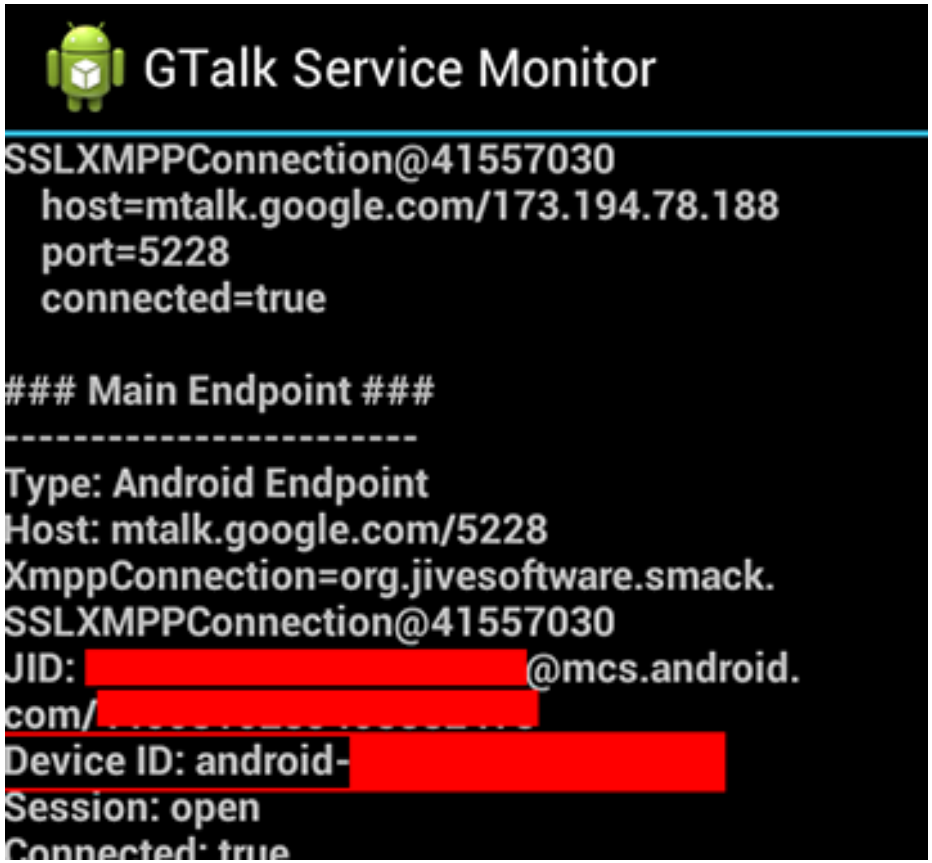

Figure : GTalk Service Monitor on Android 2.2 / 2.3

Smack

Code example

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XMPPTCPConnection connection =
  new XMPPTCPConnection("sensor42", "pass", "example.org");
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PacketFilter filter = new AndFilter(MessageTypeFilter.NORMAL,
   new PacketExtensionFilter("data", "http://foocorp.com"));
connection.addAsyncPacketListener(new PacketListener() {
  public void processPacket(Packet stanza) {  ...  }
}, filter);
```

Smack on Android

Use cases:

- A chat app (e.g. for your community)
- Push target
- Status monitoring
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Now: Smack 4.1

Tested by gradle to build against `android.jar` (`-bootclasspath`. This guarantees that Smack runs on Android (min. API level 8). Smack 4.1 uses APIs provided by the Android runtime where possible.

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realized using XMPP on Android?

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"Why not simply use GCM?"

- Not all devices come with Google Services Framework
- You may don't want to depend on Google
- Have a single push mechanism: XMPP
- XMPP Push notifications are faster [3]
- Some Push service provider don't guarantee delivery

"I've heard that XMPP is not battery friendly!"

- More on that in a few minutes

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XMPP is already been used for Push Services. But what are the pitfalls?

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Using XMPP on Android

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  - Not much memory
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Lesson learned

Some (most?) XMPP implementations, especially older ones, where **not** designed with mobile devices in mind. For example Smack 3 will drop your whole connection state after `disconnect()`.

Running on a resource constraint system

Smack design decisions

- Smack uses efficient XML Pull Parsing [5]
- No Document Object Model (DOM), no problems.
  - DOM is memory intensive
  - and hard to use efficiently
  - You can still use it if you really want/need to.
- Smack is modular, you can pick the components you need and disable the others
- Smack is designed with minimal resource consumption in mind
  - Doesn't use JABX. But you can use JABX if you want.
  - We try our best to avoid memory-leaks

Approaches for data connectivity issues

XEP-198: Stream Management (SM)

Stanza Acknowledging

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Stream Resumption

- With help of the counters, it's possible to *resume a stream*
- The TCP connection initially used by the stream can be replaced by another one
- This is useful for example
  - during short (a few minutes) connection interruptions
  - for the GSM-WiFi switch

Approaches for data connectivity issues (cont.)

XEP-199: XMPP Ping, using Smack's `PingManager`

- Check "liveness" of XMPP connection by sending XMPP Pings
- Smack automatically sends server Pings in a configurable interval
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Use Smack's `ServerPingWithAlaramManager` to reliable schedule server pings on Android.

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Use Smack's `ServerPingWithAlaramManager` to reliable schedule server pings on Android.

If the connection silently breaks, i.e. no `SIGPIPE`, then there is nothing you can do to detect that besides draining the battery by increasing the ping interval.

About XMPP's battery consumption

- Sending and receiving data involves power consumption
- If the mobile device sends a stanza it usually has a good reason
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Solution

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Typical examples:

1. (Certain) Message stanzas
2. Presence stanzas if the user is inactive (next)
3. Stanzas send by an malicious entity (slide after next)

About XMPP's battery consumption (cont.)

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- No presence information required if the user isn't looking at the roster
- Idea: Delay presence delivery until user is active
- XEP-352: Client State Indication

Further techniques to decrease power consumption

- Avoid network I/O by using XEP-115: Entity Capabilities
- Minimize data size (as recommend by XEP-286: XMPP on Mobile Devices)
- Use compression (XEP-138: Stream Compression)
  - **Warning:** Using compression opens an attack vector (cf. CRIME/BEAST attacks) [1]

About XMPP's battery consumption

Preventing malicious users from stealing your battery charge

A malicious entity (user) could drain the victims battery if it knows

- your bare JID, and the only connected resource is the mobile client
- your full JID

by sending stanzas to the victims mobile device.

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Possible solution:
XEP-16: Privacy Lists

- Enables server-side blocking of stanzas
- Create a list that
  1. Allows stanzas from JIDs that are **subscribed to your presence**
  2. Allows stanzas from your XMPP service
     - otherwise you may just locked yourself out of the service
  3. Blocks everything else

Using Smack's XMPPTCPConnection on Android

- Create an `android.app.Service` which holds the reference to and manages your `XMPPTCPConnection`
- Model the service as Finite-State Machine, with those states:
  - Disconnected
  - Connecting
  - Connected
  - Disconnecting
  - WaitingForNetwork
  - WaitingForRetry
- Register `BroadcastReceiver` for `android.net.conn.CONNECTIVITY_CHANGE`
  - Check in receiver if the data connectivity really changed
  - If so, call `XMPPTCPConnection.instantShutdown()` followed by `connect()` to re-establish (and possible resume) XMPP stream

XMPP Login Duration

XMPP Login takes to long.
Number with 80ms round-trip

Phase	Time
TCP connect incl. DNS	60ms
Client-Server Initial Stream	80ms
TLS RFC 6120 § 9.1.1	420ms
SASL RFC 6120 § 9.1.2	470ms
Compression XEP-138	160ms
Stream Management XEP-198	190ms
Roster retrieval using versioning	80ms
Privacy List already set	80ms
Total (Real)	1750ms
Total (Sum. Parts)	1540ms

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Number with 80ms round-trip

- Could use XEP-305: XMPP Quickstart
- Not supported by Smack and still not enough
- Should be possible to resume stream in under 200ms
- Work in progress

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Any help with Smack is appreciated.

- Top priority: Add support for XEP-174: Serverless messaging (XMPP via zeroconf/link-local)
  - Guardian Project's ChatSecure wants to switch to Smack 4.1
  - They need XMPP link-local support
  - ChatSecure is currently locked-in using an old version of aSmack
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Thanks for your attention.
Meet me in 30min at the Realtime Lounge (Building K, Level 2) if you have further questions.

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