Platform-Based Development: Android Programming – Communication

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Wireless Connectivity

- Smartphone wireless interfaces
  - GSM, 3G, LTE, 5G
  - WiFi
  - Bluetooth
  - NFC
- Understanding tradeoffs

Selecting Connectivity Mode

- NFC
  - Very low power (tags don't even need to be powered)
  - Very short range (~10cm)
  - Low throughput (~400 kbps)
  - Security tags, location-based services
- Bluetooth
  - Low power (~10mW)
  - Short range (~10m)
  - Low throughput (~1 Mbps)
  - Connection with peripherals, wearables (smartwatch)

Selecting Connectivity Mode

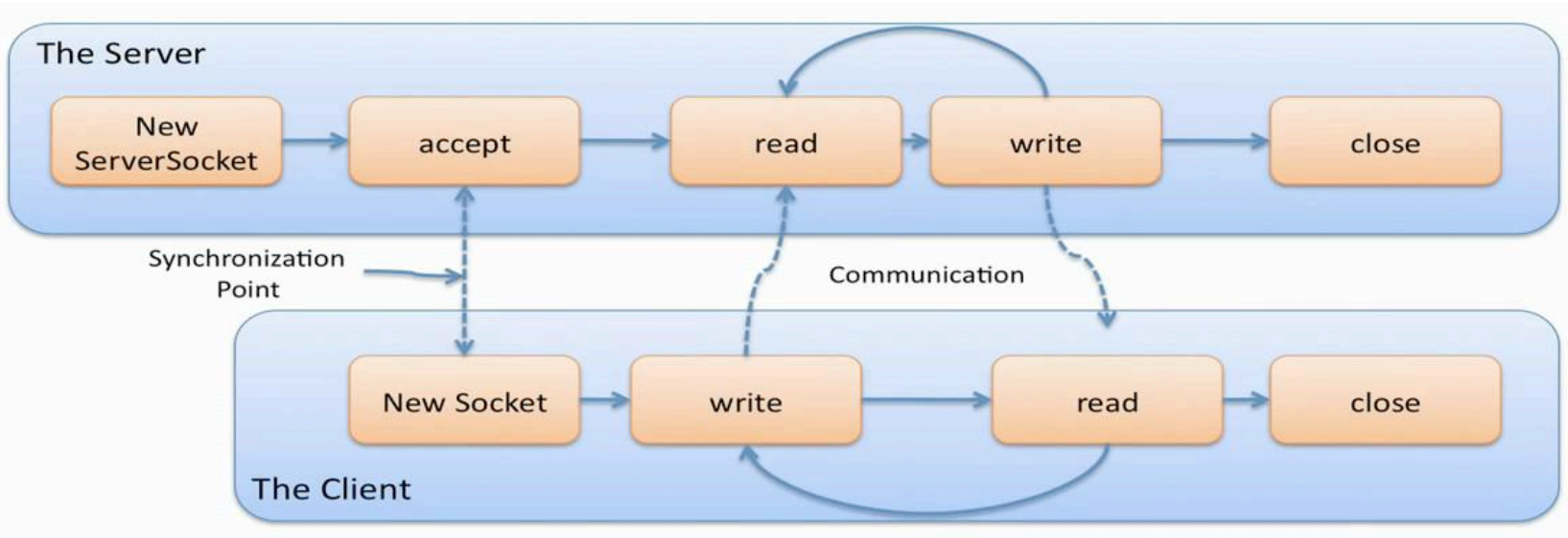
- WiFi
  - Medium power consumption (~100mW)
  - Low range (~100m)
  - High throughput (~100 Mbps)
  - Large downloads, system updates; WiFi is usually unmetered network
- Cellular network (GSM, 3G, LTE, 5G)
  - High power (~200mW)
  - Long range (~1000m)
  - Varying throughput (up to ~1 Gbps with 5G)
  - Ubiquitous connectivity

Android Networking Support

- NfcManager
- BluetoothManager
  - Use it to get BluetoothAdapter
- WifiManager
  - WiFi-specific operations: scans, (dis)associate, etc.
- TelephonyManager
  - Cellular-specific operations: scans, get subscriber and network information
- ConnectivityManager
  - Monitors network connections, manages failovers, notifies when connectivity changes

Networking Abstractions

- You can run any protocol over Android networking stack
- Sockets
  - Standard Java sockets: Socket (TCP) and DatagramSocket (UDP)



Networking Abstractions

- Http(s)URLConnection
  - Connecting to a URL using HTTP(S) protocol
  - Communicate with a REST API
  - Supports secure communication via Transport Layer Security (TLS)
- OkHttp (third-party library)
  - Advanced HTTP Client
  - Pools connections, compresses data, caches content, recovers from network problems, etc.

Networking Abstractions

- Retrofit
  - REST Client for Android
  - Define a model
  - Define possible HTTP operations
  - Define adapter and converter
- Volley
  - Somewhere in between Retrofit and OkHttp
- Glide
  - Media fetching and decoding

Simple Networking Best Practices

- Security
  - Use encrypted communication – HttpsURLConnection
- Run network operations on a separate thread
  - AsyncTask doInBackground for networking requests
  - AsyncTask onPostExecute to process the result
- Data conversion and handling
  - InputStream converted to a target data type (e.g. string, image, whatever you are downloading)
  - Callback interface to report the results to the UI

Http Client Example

https://bitbucket.org/veljkop/httpclientexample

Issues with HttpsUrlConnection + AsyncTask

- Multiple requests are serviced in the First In – First Out fashion
  - But some requests are more important than others!
- Applications often repeatedly issue identical requests
  - Cache!
- Request data can be large
  - Compress!
- AsyncTask can lead to memory leaks

OkHttp Example

https://bitbucket.org/veljkop/okhttpexample