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CMSC436: Programming Handheld Systems

Networking

Today's Topics

Networking

Android networking classes

Processing HTTP responses

Networking

Early handheld devices gave us mobility, but had limited connectivity

Today's devices have greater mobility and connectivity

Today, many applications use data and services via the Internet

Networking

Android includes multiple networking support classes, e.g.,

java.net – (Socket, URL, URLConnection)

Example Application

Sends a request to a networked server for earthquake data

Receives the earthquake data

Displays the requested data

Sending HTTP Requests

HttpURLConnection

OkHttpClient

Ktor HttpClient

Networking Permissions

Applications need permission to open network sockets

```
<uses-permission android:name=  
    "android.permission.INTERNET" />
```

Ktor HttpClient

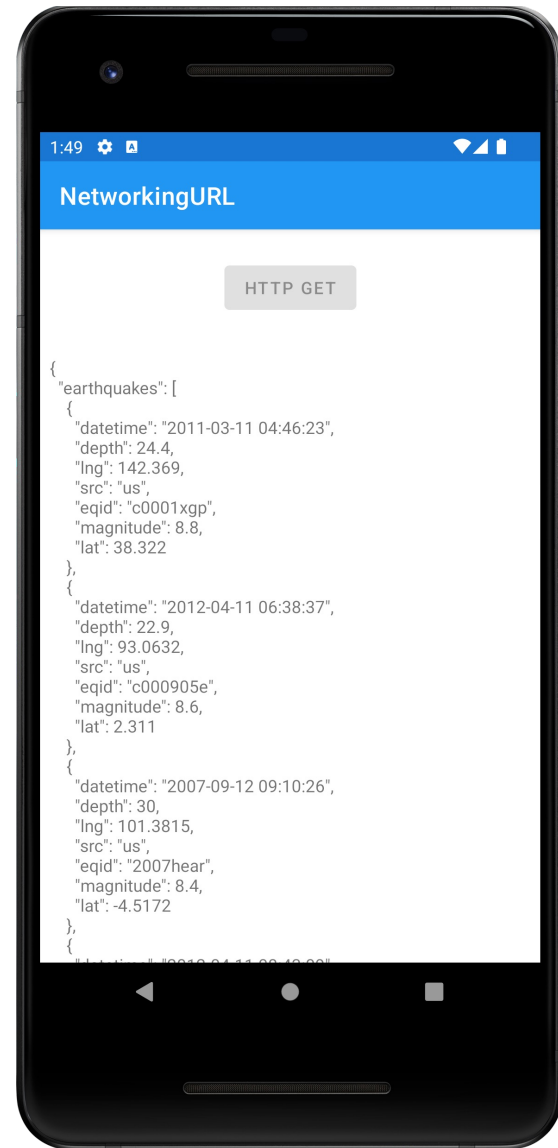
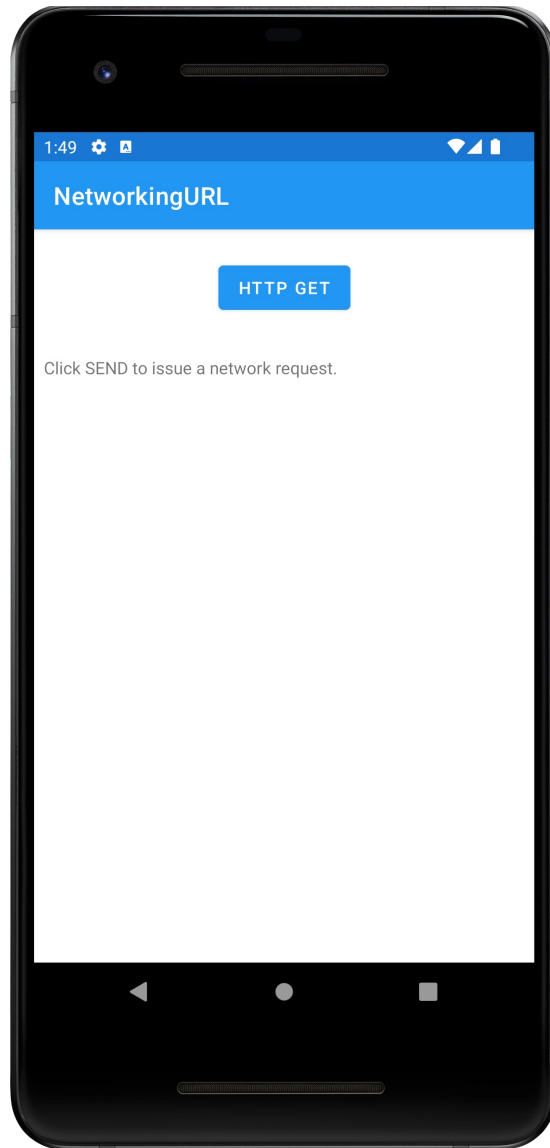
Http client for Android and Java applications

See: <https://ktor.io/docs/getting-started-ktor-client.html#create-client>

Usage Pattern for Http Get

1. Get an HttpClient instance
2. Prepare your request
3. Issue get() call (or related method)
4. Read the response
5. Process response

Networking URL



Processing Http Responses

Will focus on two popular formats:

JSON

XML

Javascript Object Notation (JSON)

A lightweight data interchange format

Data packaged in two types of structures:

- Maps of key/value pairs

- Ordered lists of values

See: <http://www.json.org/>

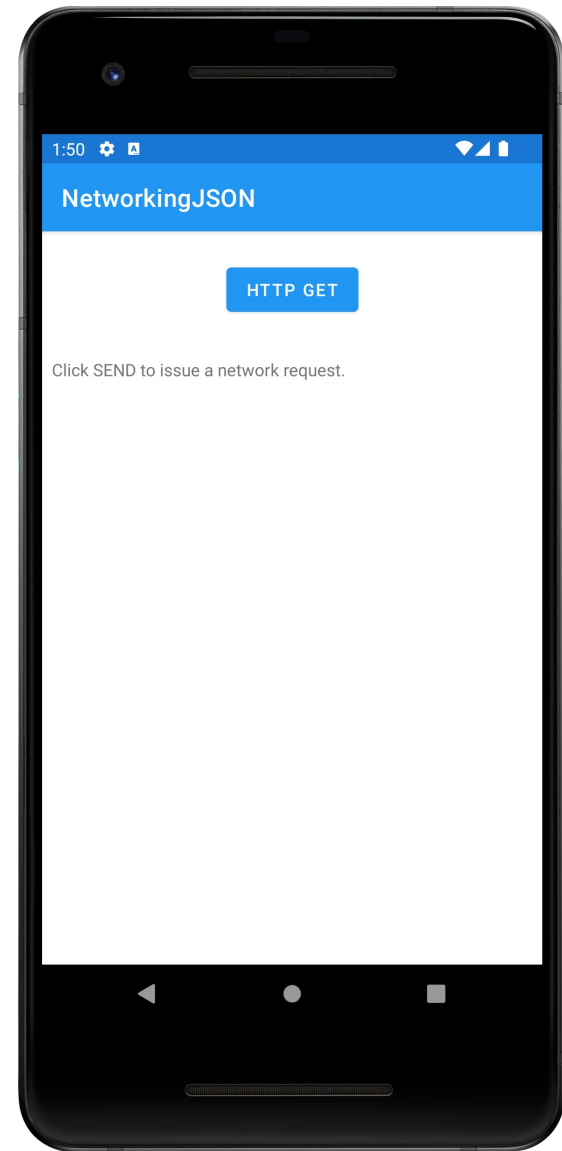
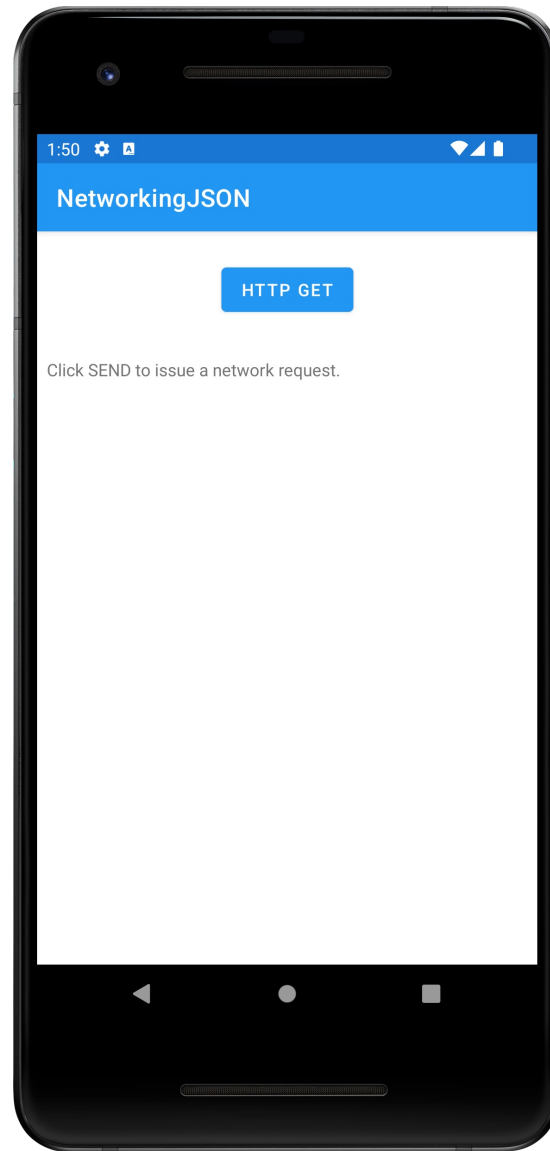
Earthquake Data Request (JSON)

<http://api.geonames.org/earthquakesJSON?north=44.1&south=-9.9&east=-22.4&west=55.2&username=demo>

JSON Response

```
{"earthquakes": [  
  {"eqid":"c0001xgp","magnitude":8.8,"lng":142.369,"src":"us","datetime":"2011-  
03-11 04:46:23","depth":24.4,"lat":38.322}  
  {"eqid":"2007hear","magnitude":8.4,"lng":101.3815,"src":"us","datetime":"2007-  
09-12 09:10:26","depth": 30,"lat":-4.5172},  
  ...  
  {"eqid":"2010xkbv","magnitude":7.5,"lng":91.9379,"src":"us","datetime":"2010-  
06-12 17:26:50","depth":35,"lat":7.7477}  
]  
}
```


Networking JSON



eXtensible Markup Language (XML)

XML documents can contain markup & content

Markup encodes a description of the document's storage layout and logical structure

Content is everything else

See <http://www.w3.org/TR/xml>

Earthquake Data (XML)

[http://api.geonames.org/earthquakes?north=44.1
&south=-9.9&east=-22.4&
west=55.2&username=demo](http://api.geonames.org/earthquakes?north=44.1&south=-9.9&east=-22.4&west=55.2&username=demo)

XML Response

```
<geonames>  
  <earthquake>  
    <src>us</src>  
    <eqid>c0001xgp</eqid>  
    <datetime>2011-03-11 04:46:23</datetime>  
    <lat>38.322</lat>  
    <lng>142.369</lng>  
    <magnitude>8.8</magnitude>  
    <depth>24.4</depth>  
  </earthquake>  
  ...  
</geonames>
```

Parsing XML

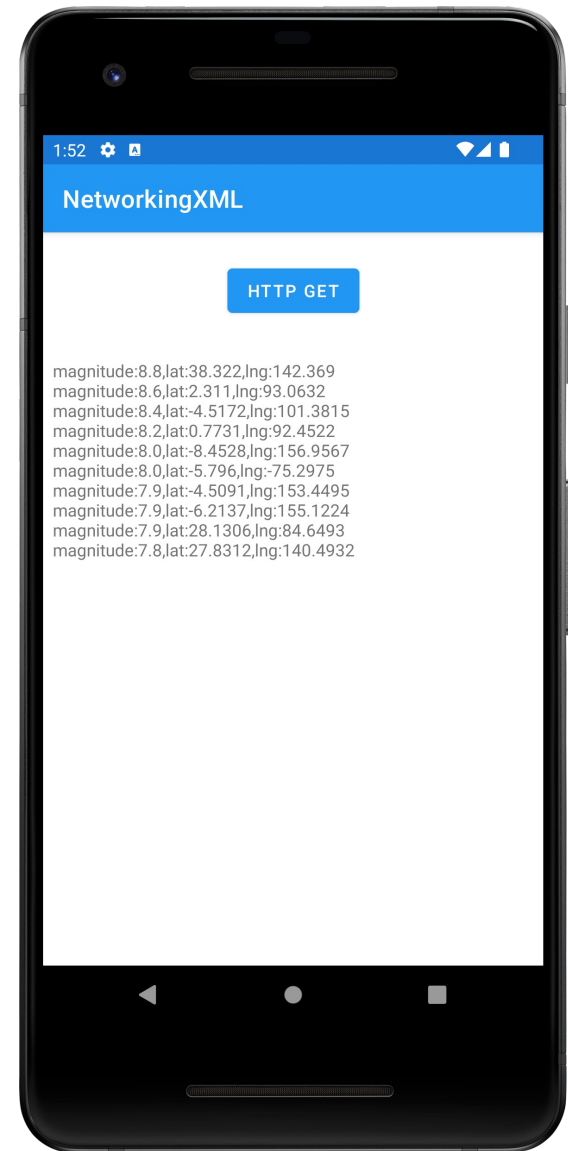
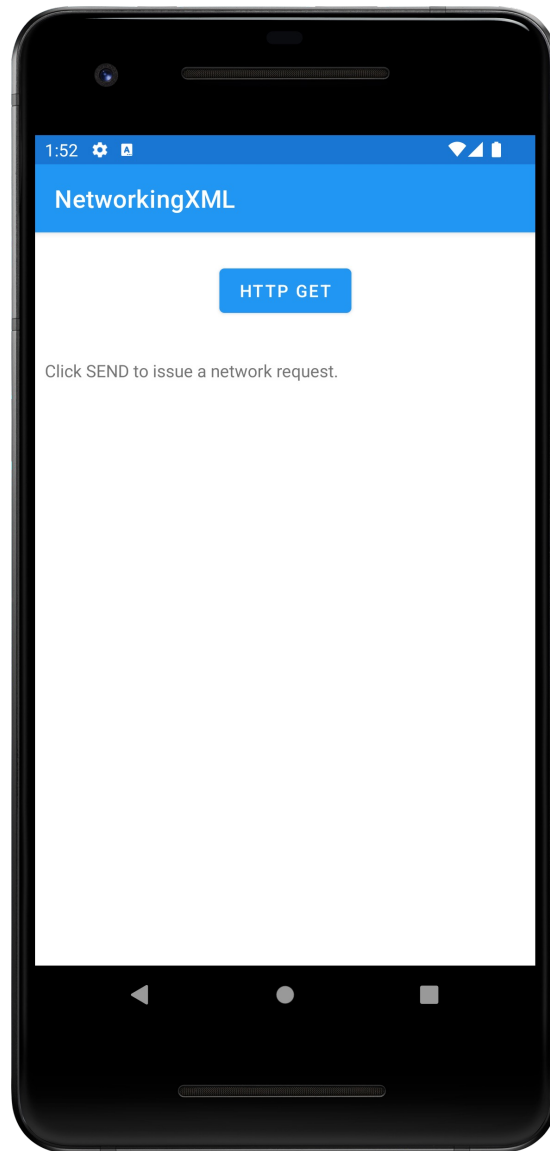
Several types of parsers available

DOM – Converts document into a tree of nodes

SAX – streaming with application callbacks

Pull – Application iterates over XML entries

Networking XML



Next Time

Graphics and Animation

Example Applications

NetworkingURL

NetworkingJSON

NetworkingXML