APIs

What They Are and How to Use Them

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Who We Are

- **Jordan Emmendorfer**, Software Developer
  - 2+ years at the Credit Union
  - Maintains API for Authentication of 3rd party chat system
- **Austin Drouare**, Senior Software Developer
  - 9 years at the Credit Union
  - Experience consuming APIs of 3rd party vendors
  - Maintaining and consuming internal APIs for Computerline and Mobile banking applications.
- **Thanks to Ryan Ballard, Jenny Schiebner, Aaron Parks for contributing content to this presentation**

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Agenda

- API definition
- Common API formats
- API consumption demo
- Considerations around using APIs
- Overview of API documentation

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What is an API?

An **Application Programming Interface (API)** is a set of protocols used by programmers to create applications for a specific operating system or to interface between the different modules of an application. (*dictionary.com*)

- Operating system
- Web-based system
- Database system
- Computer hardware
- Software library

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What is an API? (cont.)

Simplified: An API is how our code can leverage code written by other developers.

- *Software library*
  The library's API is how your IDE (e.g. Eclipse, NetBeans, IntelliJ) is able to provide autocomplete suggestions.
- *Web-based system*
  Availability: open (public), partner (licensed), or internal (private)
  We will focus on open APIs today.

  Not built in like a library – so how do we communicate?

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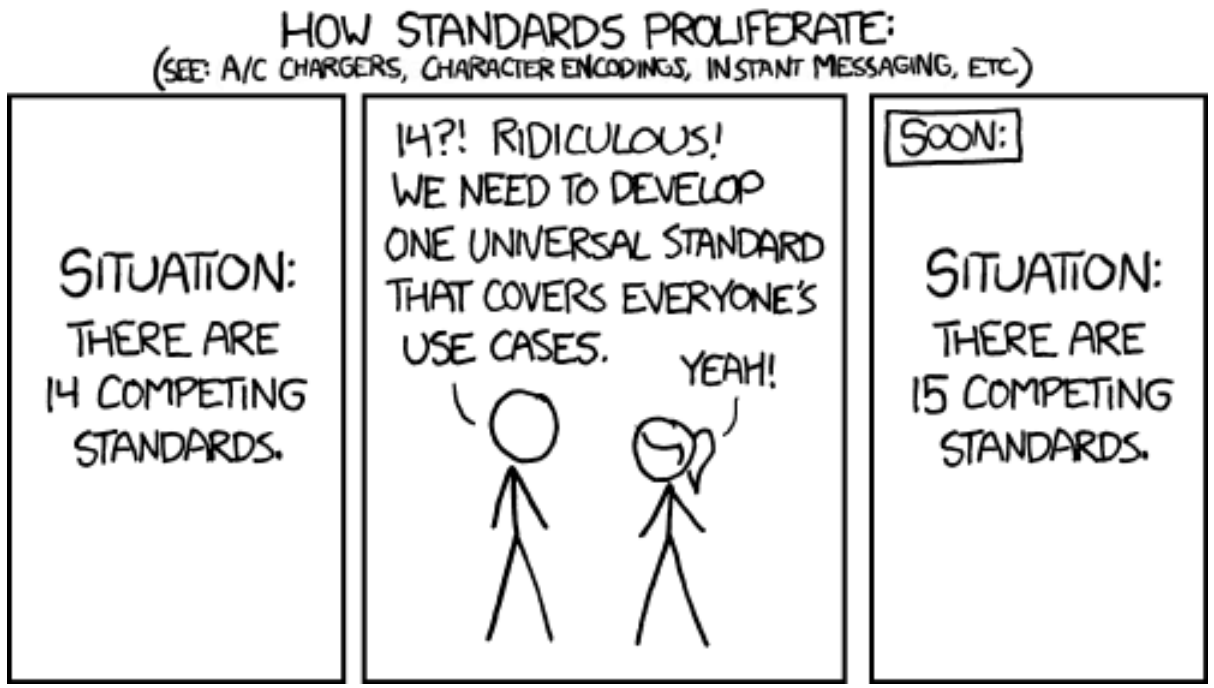
It depends!



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API Standards and Protocols

Define how we communicate with APIs

- Remote Procedure Call (RPC) and Remote Method Invocation (RMI)
- Simple Object Access Protocol (SOAP)
- Representational State Transfer (REST) (kind of)
  - REST is an architectural style, not a protocol, but REST implementations typically use a common set of protocols

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RPC and RMI

- RPC was first, and RMI is the object-oriented analog
- Usually includes tooling to generate stubs and data structures as well as libraries to serialize requests and de-serialize responses.
- First popular implementation was Sun's RPC, best known for its use in Network File System (NFS).
  - Java RMI, DCOM, CORBA, and WCF have also enjoyed popularity in their niches.

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Simple Object Access Protocol (SOAP)

- Descended from XML-RPC
- Formalized by the World Wide Web Consortium (W3C)
- Currently (somewhat) popular, though it is rapidly being replaced by REST and REST-like services.
- Requests and responses are serialized as XML and typically sent by HTTP, though other communication protocols may also be used.
- Contract typically defined in machine-readable format (WSDL and XSD) to support tooling.

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SOAP Request Example

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"
                  xmlns:web="http://services.aonaware.com/webservices/">
   <soapenv:Header/>
   <soapenv:Body>
      <web:Define>
         <web:word>test</web:word>
      </web:Define>
   </soapenv:Body>
</soapenv:Envelope>
```

- When dealing with SOAP, language aside, SoapUI is your friend

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Representational State Transfer (REST)

- More general than RPC
  - Can be used to implement RPC or RMI
  - More often presents as a CRUD interface
  - Good APIs are typically a blend
- Works with HTTP rather than against it – makes semantic use of HTTP operations (GET, POST, PUT, DELETE, etc.) and response codes, caching, and so on.
- JSON is the most common serialization. XML was popular too.
- Hypermedia: good APIs include links to other resources in their responses rather than assuming the client knows where to find them.

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HTTP Overview (for REST purposes)

Headers

- Content-Type
- Accepts
- Authentication
- Explicit Caching

Status Codes

- 1xx – Informational
- 2xx – All good!
- 3xx – Redirect
- 4xx – You messed up
- 5xx – I messed up

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SOAP vs REST

SOAP

- XML
- Typically HTTP
- More explicitly defined
- More common in internal/private web services

REST

- Typically JSON
- Exclusively HTTP
- More implicitly understandable
- More common in external/public web services

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Live Demo

- https://github.com/oucreditunion/grizzhacks2019
- Consuming a REST API
- If you're still not sure where to start, check out this tutorial: https://www.restapitutorial.com/

Should I use an external API?

Pros

- Leverage work that's already done
- Maintenance is outsourced
- Focus on the core functionality of your project

Cons

- Additional overhead/latency
- Usage limits
- Risk of API going away or changing without notice
- Potential mismatch in SLAs

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Should I use an internal API?

Pros

- Allow sharing of resources across systems/languages
- Can prevent isolated failures from bringing the entire system down
  - Only works if API consumers are fault tolerant
  - e.g. Netflix
- Can use to limit other systems' access to network elements (e.g. data sources)

Cons

- Additional overhead
- Additional maintenance
- More points of failure
- System coupling
- Less obvious discrepancy issues
  - Compile vs. runtime

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Decision factors for using an API

External API

- Can the same functionality be reasonably recreated and maintained?
- Is there a code library that performs a similar function?
- Is the API functionality vital to the success of the project?

Internal API

- Would multiple systems benefit from access to the resource?
  - Still could use a library if they're the same language
- Do the consuming systems have value without the resource?

At larger organizations, these questions are typically not answered (exclusively) by software developers.

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Either way, exercise caution

- Fault tolerance/graceful failure
- Caching/backup plan

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Examples from OU Credit Union

- Google Maps API
- Correio
- NeverBounce
  - We also have in-house solutions for integrating e-mail bounce detection with proprietary vendor software
- Visa
- Some vendors have SOAP APIs
- We expose some APIs internally to share implementations of defined processes and communicate between languages

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Examples of Cool (Free-ish!) APIs

- REST
  - Weather: darksky.net (aka forecast.io)
    - first 1,000 requests/day are free
  - Contact: twilio.com
    - Free trial with credit, some limitations on call length, etc.
  - Others can be found in this article: https://blog.rapidapi.com/most-popular-apis/
- SOAP
  - Dictionary: http://services.aonaware.com/DictService/DictService.asmx
  - E-mail Verification: http://ws.cdyne.com/emailverify/Emailvernotestemail.asmx

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What makes good documentation?

- Clear communication layer requirements (request/response objects).
- Detailed descriptions (types and purpose) of properties.
- Easy to find and search, separated from other documentation.
- Language-agnostic
- Examples:
  - https://darksky.net/dev/docs (simple)
  - https://developers.google.com/maps/documentation/ (complex well organized)

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If you have any questions, please check the FAQ and, if you can't find what you're looking for there, send us an email.

API Request Types

Forecast Request

```
https://api.darksky.net/forecast/[key]/[latitude],[longitude]
```

A Forecast Request returns the current weather conditions, a minute-by-minute forecast for the next hour (where available), an hour-by-hour forecast for the next 48 hours, and a day-by-day forecast for the next week.

Example Request

```
GET https://api.darksky.net/forecast/0123456789abcdef9876543210fedcba/42.3601,-71.0589

{
    "latitude": 42.3601,
    "longitude": -71.0589,
    "timezone": "America/New_York",
    "currently": {
        "time": 1509993277,
        "summary": "Drizzle",
        "icon": "rain",
        "nearestStormDistance": 0,
        "precipIntensity": 0.0089,
        "precipIntensityError": 0.0046,
        "precipProbability": 0.9,
        "precipType": "rain",
        "temperature": 66.1,
        "apparentTemperature": 66.31,
        "dewPoint": 60.77,
        "humidity": 0.83,
```

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Request Parameters

Required parameters slot directly into the request URL. Optional parameters should be specified as HTTP query parameters.

key required
Your Dark Sky secret key. (Your secret key **must** be kept secret; in particular, **do not** embed it in JavaScript source code that you transmit to clients.)

latitude required
The latitude of a location (in decimal degrees). Positive is north, negative is south.

longitude required
The longitude of a location (in decimal degrees). Positive is east, negative is west.

exclude=[blocks] optional
Exclude some number of data blocks from the API response. This is useful for reducing latency and saving cache space. The value `blocks` should be a comma-delimeted list (without spaces) of any of the following:

- `currently`
- `minutely`
- `hourly`
- `daily`
- `alerts`
- `flags`

extend=hourly optional
When present, return hour-by-hour data for the next 168 hours, instead of the next 48. When using this option, we **strongly** recommend enabling HTTP compression.

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Response Format

API responses consist of a UTF-8-encoded, JSON-formatted object with the following properties:

latitude required
The requested latitude.

longitude required
The requested longitude.

timezone (e.g. `America/New_York`) required
The IANA timezone name for the requested location. This is used for text summaries and for determining when `hourly` and `daily` data block objects begin.

offset deprecated
The current timezone offset in hours. (Use of this property will almost certainly result in Daylight Saving Time bugs. Please use `timezone`, instead.)

currently optional
A data point containing the current weather conditions at the requested location.

minutely optional
A data block containing the weather conditions minute-by-minute for the next hour.

hourly optional
A data block containing the weather conditions hour-by-hour for the next two days.

daily optional
A data block containing the weather conditions day-by-day for the next week.

alerts optional
An alerts array, which, if present, contains any severe weather alerts pertinent to the requested location.

flags optional
A flags object containing miscellaneous metadata about the request.

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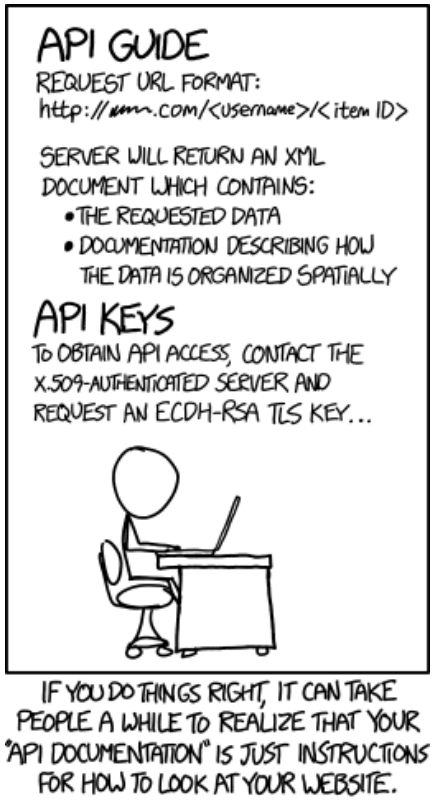
This documentation is bad. What now?

- Commiserate.
  - When documentation for a public API is poor, odds are high that someone else has struggled with it and has advice to share. Check Stack Overflow and search for blog posts if you're having a hard time using an API.
- Eliminate variables.
  - Work in test environments and do trial and error testing.



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What We Covered

- API Definition
- Different types of API
- Different communication standards and protocols for Web APIs
- How to consume a REST API
- Considerations around using an API
- How to deal with poorly documented APIs

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Questions?

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References

- Article by Glenn Johnson - https://it.toolbox.com/blogs/glennjohnson/application-programming-interface-api-definition-and-classification-by-types-040214
- Comics from xkcd.com
- The developer hive mind
- And, of course… Wikipedia

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Thank you!

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