Making Sense of “The API* Economy”

Joseph Gulla, Ph.D.
IT Thought Leader, Consultant and Business Leader

* Application Programming Interface
Snapshot of My Activities

- **IT Analysis, Research, Services and Writing**
  - OpenLegacy
  - PathPoint Software, Inc.
  - MSP TechMedia

- **Book Publishing**
  - Alazar Press

- **Artisan Food & Buy Local in NC**
  - Rose's Meat Market & Sweet Shop

- **Incubator Farm & Support NC Farmers**
  - Heartstrong Farm
INTRODUCTION TO THE API ECONOMY

Topics
• Gartner Vision
• Delivering value, growth and change
• Classifications
• Examples
• Small data programs and microservices
According to Gartner*, the API economy is an **enabler** for turning a business or organization into a **platform**. How is this possible?

The API economy is a **set of business models and channels** based on secure access of functionality and exchange of data.

In new ways, APIs make it simpler to **integrate and connect people, places, systems, data, things and algorithms**.

Can also be used to--

<table>
<thead>
<tr>
<th>Create new user experiences</th>
<th>Enable transactions and algorithms</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Share data and information</strong></td>
<td>Leverage third-party algorithms</td>
</tr>
<tr>
<td><strong>Authenticate people and things</strong></td>
<td>Create new product/services and business models</td>
</tr>
</tbody>
</table>

*Welcome to the API Economy, 2016*
How companies and organizations deliver value leveraging emerging technology like APIs

Generating Revenue
- Technology Companies
  - Google – 5 Billion Transactions a Day

Improving Efficiency
- Government Agencies
  - FAA - Live Airport Status

Lowering Costs
- Financial Services
  - Unbundle Services to Compete

Competitive Response
- Insurance Companies
  - Mobile Apps for Transactions
- Manufacturing Companies
  - On Boarding Retailers
- Distributors
  - Integrating with Partners

Sources:
API Economy by Collins & Sisk.
Intro to APIs in Government, API Use for the Insurance Industry by Glickenhouse.
Welcome To The API Economy, Forbes Magazine.
## Classification of APIs by Type

### O-APIs (Dawn of Operating Systems)

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Example APIs</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-type</td>
<td>Access Methods</td>
<td>Queued Sequential Access Method</td>
</tr>
<tr>
<td>P-type</td>
<td>Performance</td>
<td>Application Response Measurement</td>
</tr>
</tbody>
</table>

### N-APIs (Dawn of WWW)

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Example APIs</th>
</tr>
</thead>
<tbody>
<tr>
<td>D-type</td>
<td>Data access</td>
<td>Local Government, Climate, Ecosystems, Agriculture, Ocean, ...</td>
</tr>
<tr>
<td>$-type</td>
<td>Accept online and mobile payments</td>
<td>PayPal Payments &amp; Square online and in-person payments</td>
</tr>
<tr>
<td>M-type (Dawn of Cloud Computing)</td>
<td>Application program in the form of a microservice</td>
<td>Created from a variety of API Management tools; a new kind of application running on top of the legacy applications; non-disruptive</td>
</tr>
</tbody>
</table>
## Search the Largest API Directory on the Web

Programmable Web

Search Over 17,189 APIs

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### Filter APIs

- **Agriculture**
- Include Deprecated APIs

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<table>
<thead>
<tr>
<th>API Name</th>
<th>Description</th>
<th>Category</th>
<th>Submitted</th>
</tr>
</thead>
<tbody>
<tr>
<td>OIPA: Openaid IATI</td>
<td>OIPA extracts all published IATI XML files from the IATI Registry and stores them in a PostgreSQL database, that you can access using a RESTful API.</td>
<td>Data-as-a-Service</td>
<td>09.03.2012</td>
</tr>
<tr>
<td>tropicalfruitandveg</td>
<td>The tropicalfruitandveg.com API provides a simple way to integrate information on tropicalfruitandveg.com. This REST API is available in XML, JSON and HTML and returns description, health, soil,...</td>
<td>Food</td>
<td>03.13.2017</td>
</tr>
<tr>
<td>Parrot Flower Power User</td>
<td>This API provides access to user data using the Flower Power Cloud and returns, Get profile and Obtain version info. The Parrot Pot is a smart flowerpot that helps your plants with a self-watering...</td>
<td>Internet of Things</td>
<td>11.15.2016</td>
</tr>
</tbody>
</table>

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D-type: https://www.programmableweb.com/category/agriculture/apis?category=19986&deadpool=1
The home of the U.S. Government’s open data
Here you will find data, tools, and resources to conduct research, develop web and mobile applications, design data visualizations, and more.

D-type

GET STARTED
SEARCH OVER 165,976 DATASETS

Manufacturing & Trade Inventories & Sales

BROWSE TOPICS

- Agriculture
- Climate
- Consumer
- Ecosystems
- Education
- Energy
- Finance
- Health
- Local Government
- Manufacturing
- Maritime
- Ocean
- Public Safety
- Science & Research

HIGHLIGHTS

By the numbers: port statistics for some of the largest U.S. ports

As intermodal connectors for domestic and international freight, our nation’s ports serve a critical role in numerous supply chains and the national economy. In recognition of this importance, the Fixing America’s Surface Transportation (FAST) Act (PL. 114-94; Dec. 4, 2015; 129 Stat. 1312) established a Port Performance Freight Statistics Program within the U.S. Department of Transportation: Bureau of Transportation Statistics. The first annual Port Performance Freight Statistics Program report provides descriptive statistics for a group of ports for year 2016, including the top 25 ports in terms of total tonnage, twenty-foot equivalent units (TEUs), and dry bulk tonnage. The report is available to download at https://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/PFFS_Annual_Report.pdf.

The 2016 Port Performance report used multiple sources, including public datasets featured on Data.Gov. One foundational dataset used in the report is the total commercial tonnage carried on waterways published by the U.S. Army Corps of Engineers – Waterborne Commerce Statistics Center.

Link to dataset: https://catalog.data.gov/dataset/total-tonnage-foreign-and-domestic-of-commodities-carried-on-commercial-waterways
M-type is a N-API that Evolved
Since the Dawn of Cloud Computing

API application programs are starting to be called microservices. Five things to know--

1. Created in an Integrated Development Environment (IDE)
2. Provide a connection between the legacy world (systems of record) and the new world of engagement (mobile)
3. Surrounded by support software and tools like management console, security, analytics & logging that are used for governance
4. You build then deploy, manage, HA, back up, etc.
5. API products have a lot of elements like a gateway, server, designer console, and are deployed in the cloud or on-premises
M-type Lives Here

Source: http://www.apiacademy.co/resources/api-management-103-choosing-a-solution/
APIs and Microservices

Two views—

1. **An Architectural Style** -- Through adoption of the microservices architectural style, companies use many very small modules, communicating using lightweight protocols, that combine to provide a service. They are part of an application like order processing, supporting a business area like add a new customer, for a specific scenario like verify customer address. The microservices can be used in multiple scenarios.

2. **A Kind of Program** -- Many API Management software suppliers are providing an IDE and other key components like a management console and analytics, in support of the creation of small data applications they call microservices. These data applications can be used stand-alone or combined into applications by making important data and processes available in new ways without disrupting the system of record.
SURVEY OF API MANAGEMENT PRODUCTS

Topics
• IDC Taxonomy
• Forrester and Gartner
Where does API software fit into the IDC taxonomy?

Integration and Orchestration Middleware
1. Business-to-Business Middleware
   - B2B Gateway Middleware
   - B2B Networks and B2B Managed Services

2. Integration Middleware
   - API Management Software
   - Enterprise Service Bus Middleware
   - Connectivity Middleware

3. Event-Driven Middleware
   - Business Activity Monitoring
   - Complex Event Processing Middleware
   - Message-Oriented Middleware

4. Managed File Transfer Software

*IDC's Worldwide Software Taxonomy, 2016
Henry D. Morris, July 2016, IDC #US41572216
Here is the Latest Forrester Wave on API Software

What API companies/products are reviewed by Forrester?

Forrester has a different list compared to IDC with 8 different companies/products.

IDC and Forrester combine to 15 total companies/products.

The Forrester Wave™: API Management Solutions, Q4 2016
The 14 Providers That Matter Most And How They Stack Up
by Hardy Hednar
November 14, 2016
Here is the Gartner Magic Quadrant

What API companies/products are reviewed by Gartner?

Gartner has a somewhat different list with 6 different companies/products as compared with IDC and Forrester.

IDC, Forrester and Gartner combine to 21 total companies/products.

Magic Quadrant for Full Life Cycle API Management

Published: 27 October 2016   ID: G00277632
Analyst(s): Paolo Malinverno, Mark O'Neill

Source: Gartner (October 2016)
# API Management Leaders, Visionaries & Strong Performers

<table>
<thead>
<tr>
<th>Company/Product</th>
<th>IDC¹</th>
<th>Forrester²</th>
<th>Gartner³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Akana</td>
<td>R</td>
<td>Leader</td>
<td>V</td>
</tr>
<tr>
<td>Apigee</td>
<td>R</td>
<td>Leader</td>
<td>Leader</td>
</tr>
<tr>
<td>Axway</td>
<td>R</td>
<td>S</td>
<td>Leader</td>
</tr>
<tr>
<td>CA Technologies</td>
<td>R</td>
<td>Leader</td>
<td>Leader</td>
</tr>
<tr>
<td>IBM</td>
<td>R</td>
<td>Leader</td>
<td>Leader</td>
</tr>
<tr>
<td>Mulesoft</td>
<td>R</td>
<td>S</td>
<td>Leader</td>
</tr>
<tr>
<td>Red Hat (3scale)</td>
<td>S</td>
<td>Leader</td>
<td></td>
</tr>
<tr>
<td>TIBCO Mashery</td>
<td>R</td>
<td>S</td>
<td>Leader</td>
</tr>
</tbody>
</table>

**IDC¹**: Representative vendor  
**Forrester²**: Leaders, Strong Performer, Contenders & Challengers  
**Gartner³**: Leaders, Visionaries, Niche players & Challengers
HOW THE API MANAGEMENT SYSTEMS ARE ORGANIZED AND REPRESENTED

Topics

• The Full Stack View
• The Fiorano API Management View
• Four Component Views
The Tools of API Management — The Full Stack

BLOG post showing the features of many API products.

1. Design Time—Data Modeling, Interface Modeling and Registry & Repository

2. Run Time--API Management Solution, Identity Stack, Monitoring, DevOps Tools, Logging, and Application Infrastructure

Robert Broeckelmann, Principal Consultant at Levvel, LLC
see: https://www.linkedin.com/pulse/tools-api-management-full-stack-robert-broeckelmann?trk=v-feed Published on February 6, 2017
A View of the **Role** of APIs

Unlock your Business Capabilities

Leverage Existing Enterprise Assets

Four Components Views -- API Management Products

**TIBCO**

API Gateway
- Runtime routing and security enforcement

API Manager
- Portal for API providers and consumers

API Analytics
- Interactive visualization of usage and behavior

API Consumers
- Application Developers

API Providers
- API Product Managers

**Software AG**

API Consumers

Client App Developers

**Axway**

API Clients

API Provider

**Microsoft**

Azure API Management

API Gateway

Developer portal

Gateway

Direct or VPN

Backend services

APIs

API publishers

API consumers

API mediation

API life cycle mgmt

API security

API visibility

API mediation and analytics

API lifecycle and policy

API mediation and governance

API monitoring and analytics

API mediation and security

API mediation and management

Cloud

DMZ

Enterprise

Back-end Systems

Enterprise Service Bus

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API mediation and management

TIBCO

Software AG

Microsoft

Axway
ROLE OF OPEN SOURCE AND OPEN STANDARDS

Topics
• Open Source Tools
• Standards
• Styles
Open Source Tools, Standards and Styles Used with API Management Software

Language

Java - a general-purpose computer programming language that is concurrent, class-based, object-oriented

Others – PHP, Python, Ruby, .NET / C#, Perl, ColdFusion, Node / JavaScript, & ActionScript

Architectural Style

Web Service - Standardized way of integrating web-based applications using XML, SOAP and other open standards

REST Service - Representational State Transfer (REST) is an architectural style for networked services that are lightweight, maintainable and scalable that uses HTTP requests to GET, PUT, POST and DELETE data. SOAP is compared to REST but SOAP is a protocol not a style.

Support

Apache Log4j - A reliable, fast and flexible logging framework written in Java

Trail File - An XML representation of in/out screens

OAuth - Open protocol to allow secure authorization for REST APIs, web, mobile and desktop applications

EhCache - Widely used open source Java distributed cache engine

Angular - Open source development platform for web applications

Freemarker - Open source, Java-based template engine

Templates - A structured format, created by Freemarker, into which data is entered when generating entities

Development Environment

Eclipse - Open source IDE

Example of template use →
IMPORTANCE OF RESTFUL WEB SERVICES AND OTHER INTERNET TECHNOLOGIES

Topic

- REST and JSON
- SOAP
**RESTful API is an Architectural Style**

Application

**Application Interface**

API

HTTP

Client

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**Application Data Model**

**Resource Model**

Source: http://www.hongkiat.com/blog/rest-restful-api-dev/

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**JSON**

- Javascript Object Notation (JSON)
- JSON is lightweight computer data interchange format.
- JSON is based on a subset of Javascript programming language.
- Using of XML format.

Source: https://www.slideshare.net/materaj/web-architecture-mechanism-and-threats
SOAP is Compared to REST

1. SOAP is a protocol. REST is an architectural style.

2. REST APIs access a resource for data (a URI); SOAP APIs perform an operation.

3. REST permits many different data formats including plain text, HTML, XML, and JSON, which is a great fit for data and yields more browser compatibility; SOAP only uses XML.

4. Security is handled differently.

5. SOAP requires more bandwidth; REST requires fewer resources (depending on the API).

6. SOAP has Atomicity, Consistency, Isolation, Durability (ACID) is a set of properties of database transactions.

7. Here is a thoughtful comparison.

Source: https://www.upwork.com/hiring/development/soap-vs-rest-comparing-two-apis/
SPECIAL FOCUS ON API WITH ENTERPRISE COMPUTING

Topic
• z/OS Connect Gateway
• CICS Example
=> In 2015, IBM announced z/OS Connect Enterprise Edition, a strategic API gateway into z/OS.

=> This gateway is a configurable, high throughput interface into CICS, IMS, DB2 and WebSphere Application Server.

=> This product made APIs that could utilize data from CICS and IMS applications while requiring no changes to the application’s underlying COBOL or PL/1 code.

Source: https://www.slideshare.net/LuigiTommaseo/excellent-2-pager-on-zos-connect-ent-edition
Want to see how they do it? This is for CICS.

You will need to spend a few minutes and look at this step-by-step example using the hyperlinked text. Put PowerPoint in full-screen mode and the link will work.

"There are 4 stages to creating an API using z/OS Connect:

1. Generate bindings for your application – Using a supplied piece of JCL generate the bindings (data definitions like a commarea copybook) that will allow z/OS Connect to call your CICS application. This generates a Service Archive File (SAR file).
2. Import SAR file into the tooling – This allows the tooling to display the fields that are part of your application interface.
3. Map the API – Define the Uniform Resource Identifiers (URIs) that make up your API, you can then map fields from the URIs to the fields within the application interface.
4. Deploy – Once your API is ready you need to deploy it. The z/OS Connect EE tooling has the ability to deploy your API directly to CICS. This is done through a service in the runtime that is listening on the same HTTP port that your API will be executed from.

CICS is easier to API than IMS. The next chart is a security example using CICS.
Security Design Involves userid/password, identity in tokens, and RACF

1. The user logs into the Bluemix application using a “distributed” identity and a password. The user credentials are sent with the API request in an HTTP authorization header over a secure connection to DataPower.

2. DataPower performs a number of security functions:
   - Acts as Secure Gateway Client for Bluemix connectivity
   - Protects the system against malicious attack
   - Authenticates the user and forwards the distributed user ID in an LTPA (“Lightweight Third Party Authentication”) token to API Connect

3. LDAP is used as the user registry for distributed users and groups.

4. API Connect checks the Bluemix application client ID and forwards the request to z/OS Connect EE.

5. z/OS Connect EE performs a number of security functions:
   - Validates the user credentials (LTPA token)
   - Calls RACF to map the distributed ID to a RACF user ID
   - Calls RACF to check that the user is authorized to invoke the API
   - Audits the request to record who invoked the API
   - Propagates the mapped RACF user ID to CICS

6. RACF is used for the mainframe user registry, mapping distributed IDs to RACF user IDs and for authorizing API calls.

7. CICS performs further authorization checks to make sure that the mapped RACF user ID is authorized to access CICS resources.

Source: https://developer.ibm.com/mainframe/docs/securing-apis/securing-api-example-scenario/
Questions?

- **Contact Info**
  - joseph.g.gulla@gmail.com

- **Writing**
  - Magazine articles
  - BLOG
  - Destination z
ADDITIONAL MATERIALS

Topic
• APIs are driving growth and change
• Classification by consumer
• DATA.GOV Applications
• IDC list of API Management Products
APIs are driving growth and change

“APIs are a key growth driver for hundreds of companies across a wide range of industry sectors. It’s not just for Silicon Valley visionaries anymore.”

- Eric Savitz, Forbes Magazine

“APIs have been elevated from a development technique to a business model driver and boardroom consideration.”

- API economy (Tech Trends 2015), Deloitte

“Data.gov doesn’t just catalog raw data, it also includes APIs from across government. You can browse the current catalog for APIs, but expect this listing to grow as agencies include more of their APIs.”

- DATA.GOV
## Classification of APIs by Consumer

<table>
<thead>
<tr>
<th></th>
<th>Public - External</th>
<th>Private – Internal</th>
<th>Protected - B2B</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Consumer</strong></td>
<td>Open to any developer</td>
<td>Used within the enterprise</td>
<td>Enterprise to enterprise</td>
</tr>
<tr>
<td><strong>Focus</strong></td>
<td>End user</td>
<td>Employees</td>
<td>Business to business</td>
</tr>
<tr>
<td><strong>Driver</strong></td>
<td>Data availability</td>
<td>Cost savings and productivity</td>
<td>Efficiency, productivity and cost reduction</td>
</tr>
<tr>
<td><strong>Example</strong></td>
<td>Facebook =&gt; post to newsfeed</td>
<td>Common I/O RESTful APIs to shared data</td>
<td>Shared inventory APIs for supplier reorder</td>
</tr>
</tbody>
</table>

Open government data powers software applications that help people make informed decisions – from choosing financial aid options for college to finding the safest consumer products and vehicles. Below are just a few examples of government, community, and business tools that: use open government data from the United States; are accessible, vetted, and available; and are, for the majority, free and do not require registration to use.
API Management Software
API management software and cloud services support the secure and scalable publishing and management of application programming interfaces. This software helps API publishers design, monitor, manage, and update APIs and scale access to the services that connect to the APIs. Representative vendors and products include the following:

- Apigee Enterprise API Management
- Axway API Management
- CALayer7
- IBM API Management
- Intel Mashery
- MuleSoft API Manager
- SOA Software (now known as Akana) API Management
- TIBCO API Exchange

API Management is a label for both API generators, API managers and those who do both.