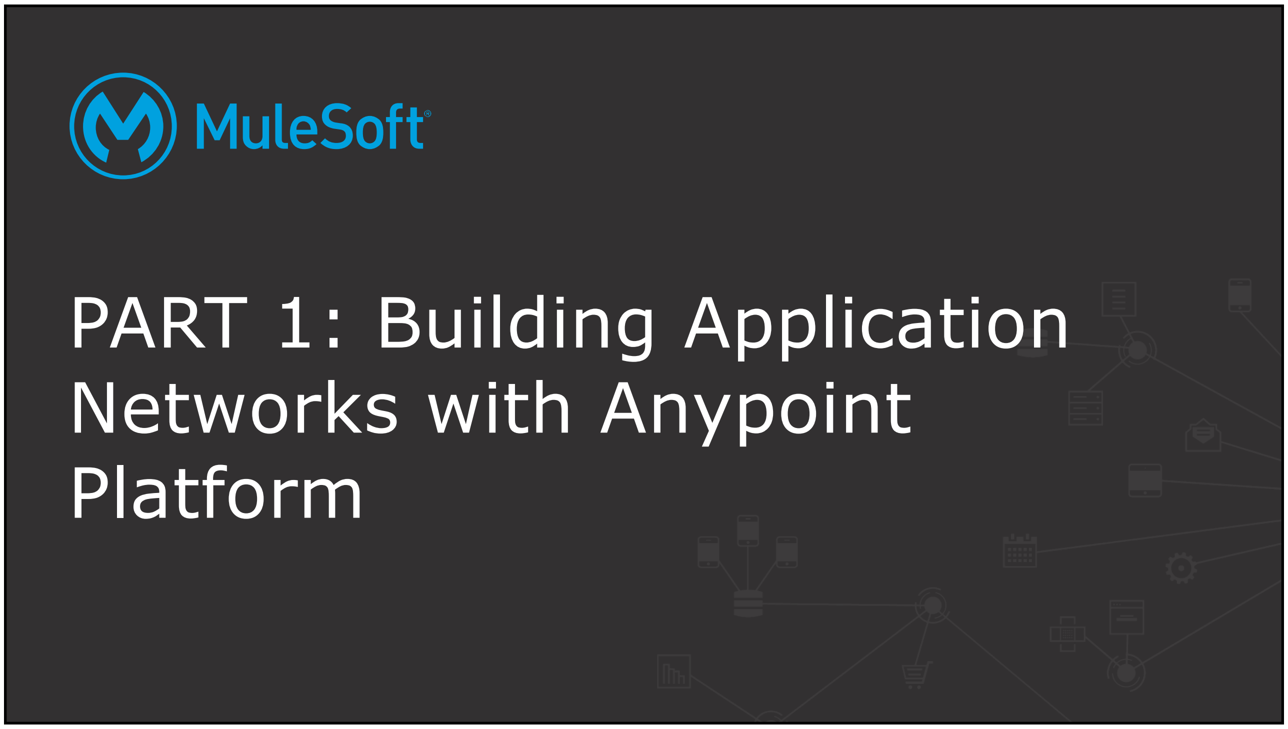
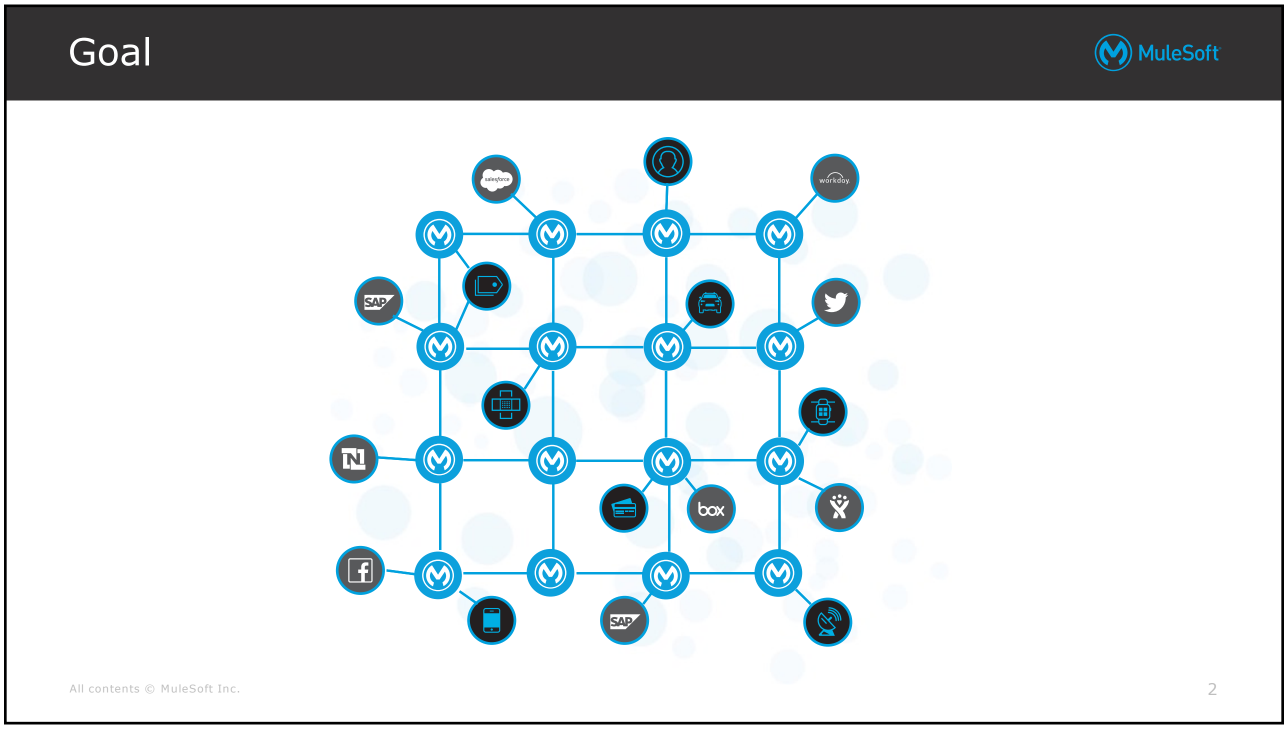
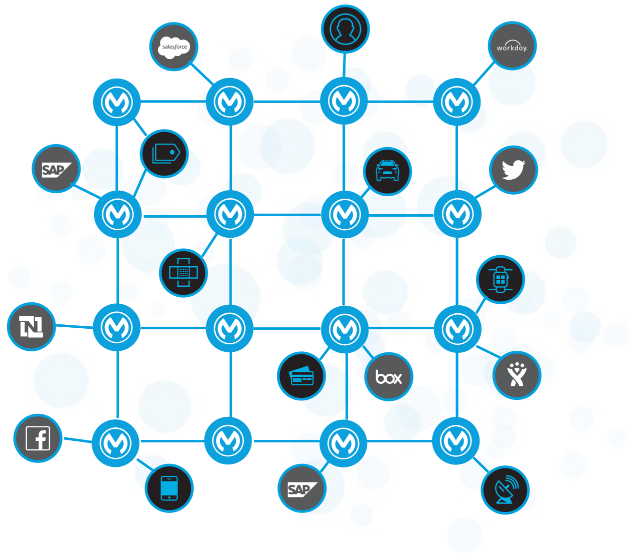


PART 1: Building Application Networks with Anypoint Platform

1

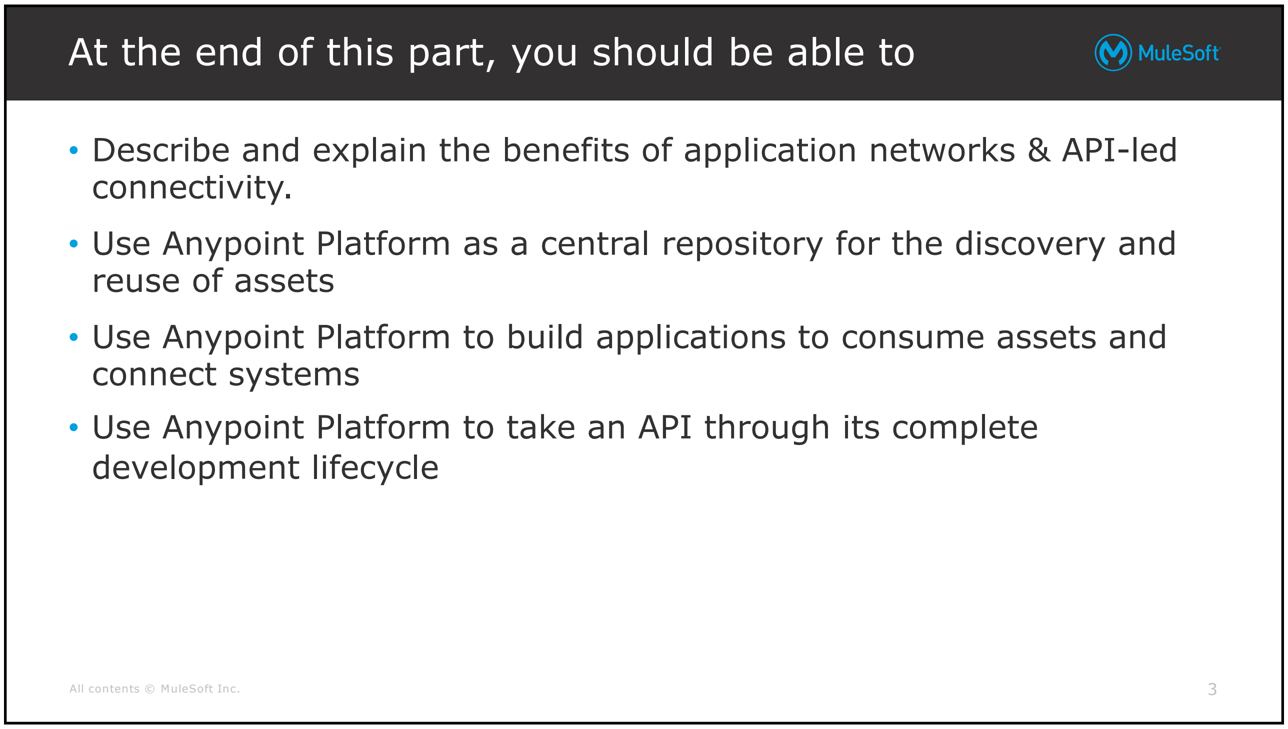


Goal



2

2



At the end of this part, you should be able to

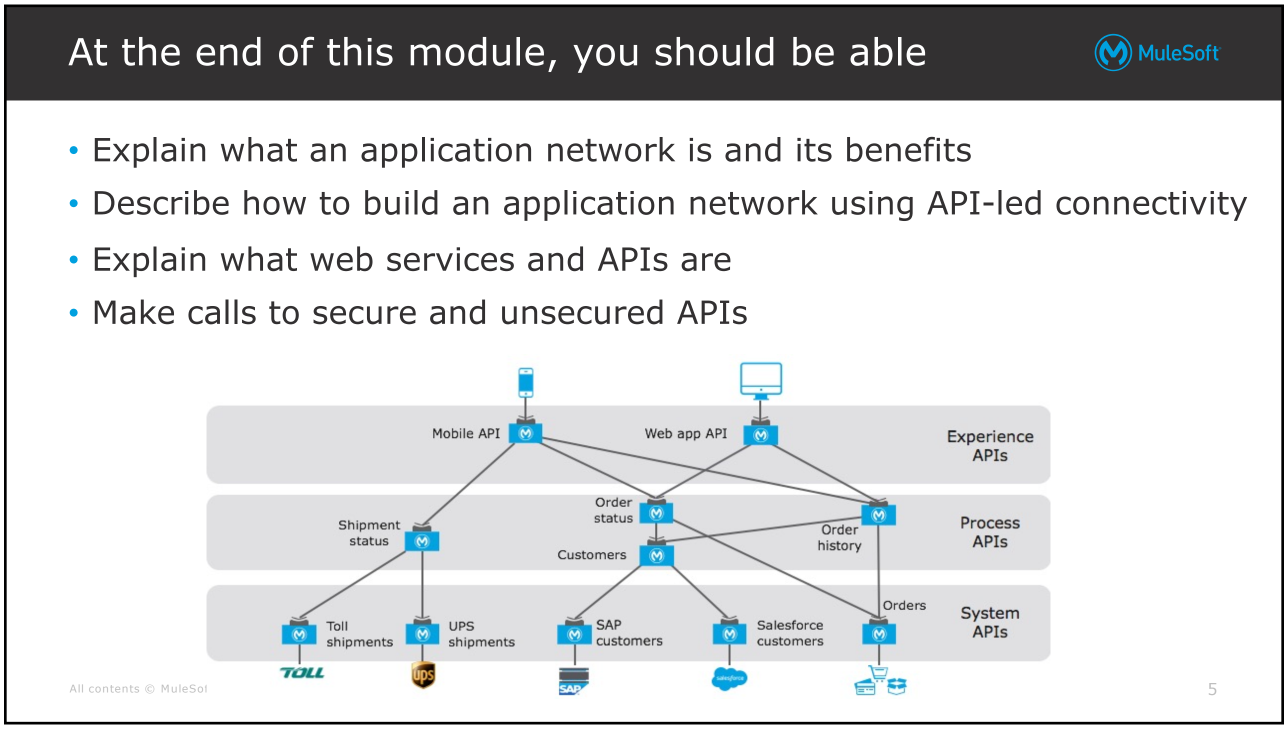
- Describe and explain the benefits of application networks & API-led connectivity.
- Use Anypoint Platform as a central repository for the discovery and reuse of assets
- Use Anypoint Platform to build applications to consume assets and connect systems
- Use Anypoint Platform to take an API through its complete development lifecycle

3

3

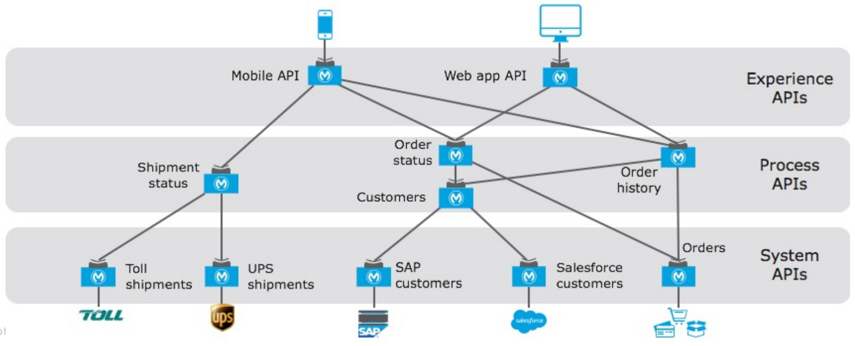
Module 1: Introducing application networks and API-led connectivity

4



At the end of this module, you should be able

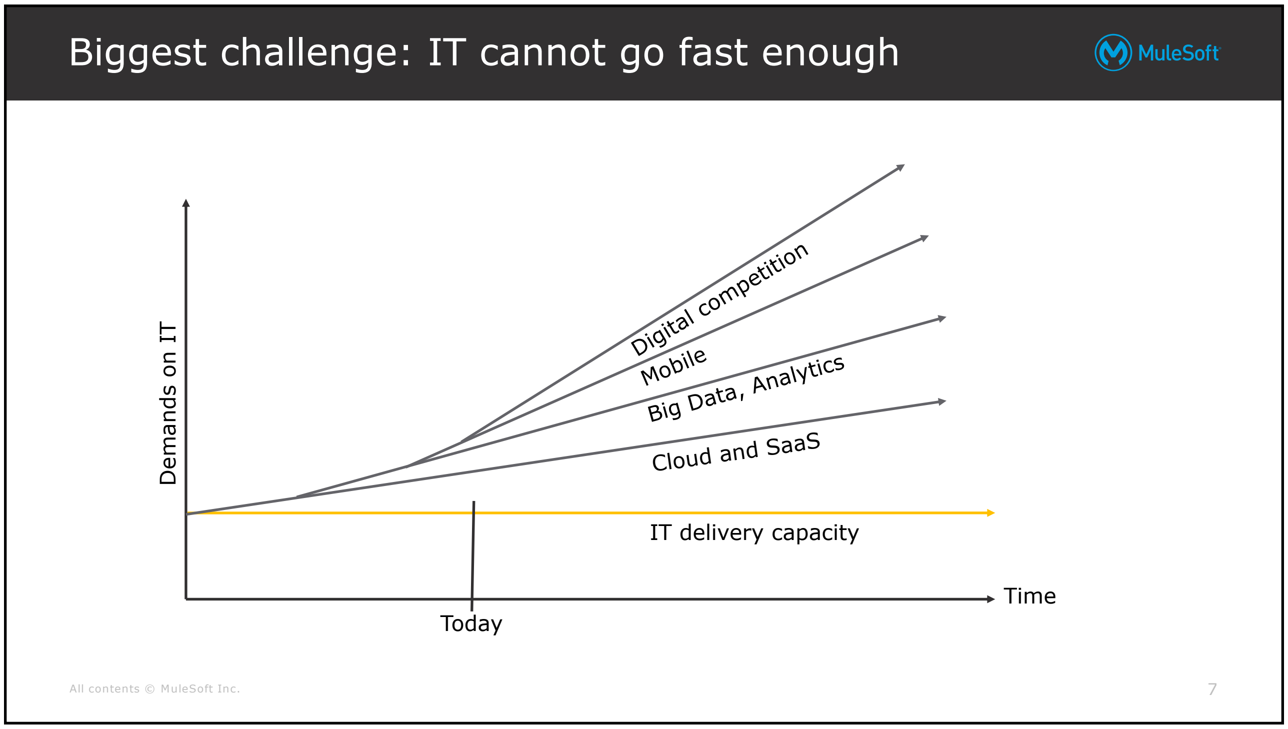
- Explain what an application network is and its benefits
- Describe how to build an application network using API-led connectivity
- Explain what web services and APIs are
- Make calls to secure and unsecured APIs



5

Identifying the problems faced by IT today

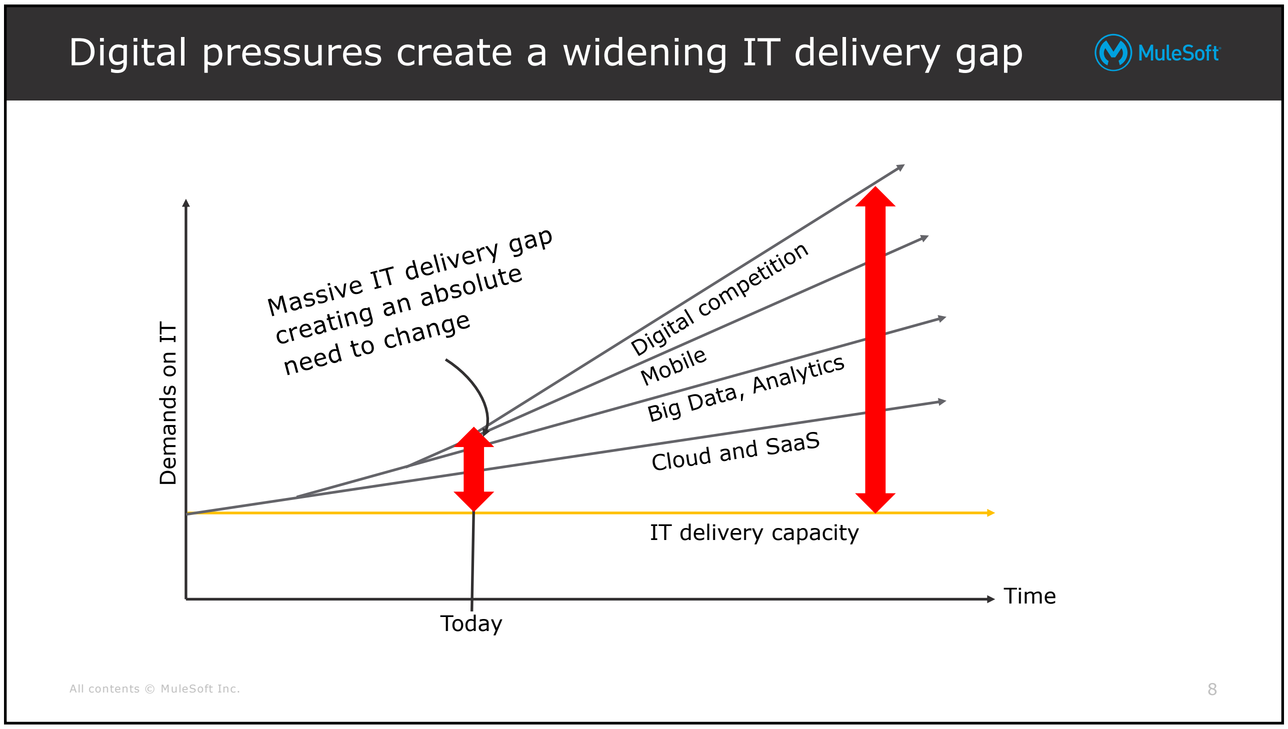
6



Biggest challenge: IT cannot go fast enough

MuleSoft
Demands on IT
Digital competition
Mobile
Big Data, Analytics
Cloud and SaaS
IT delivery capacity
Time
Today

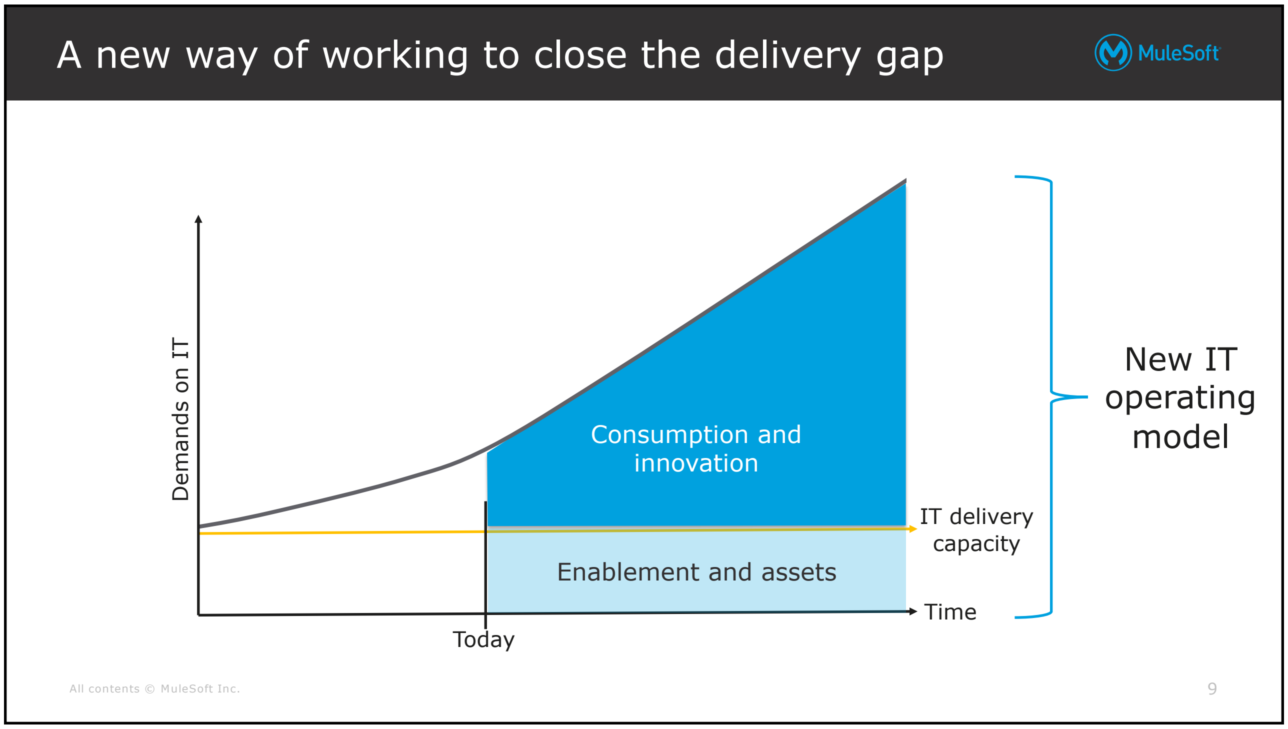
7



Digital pressures create a widening IT delivery gap

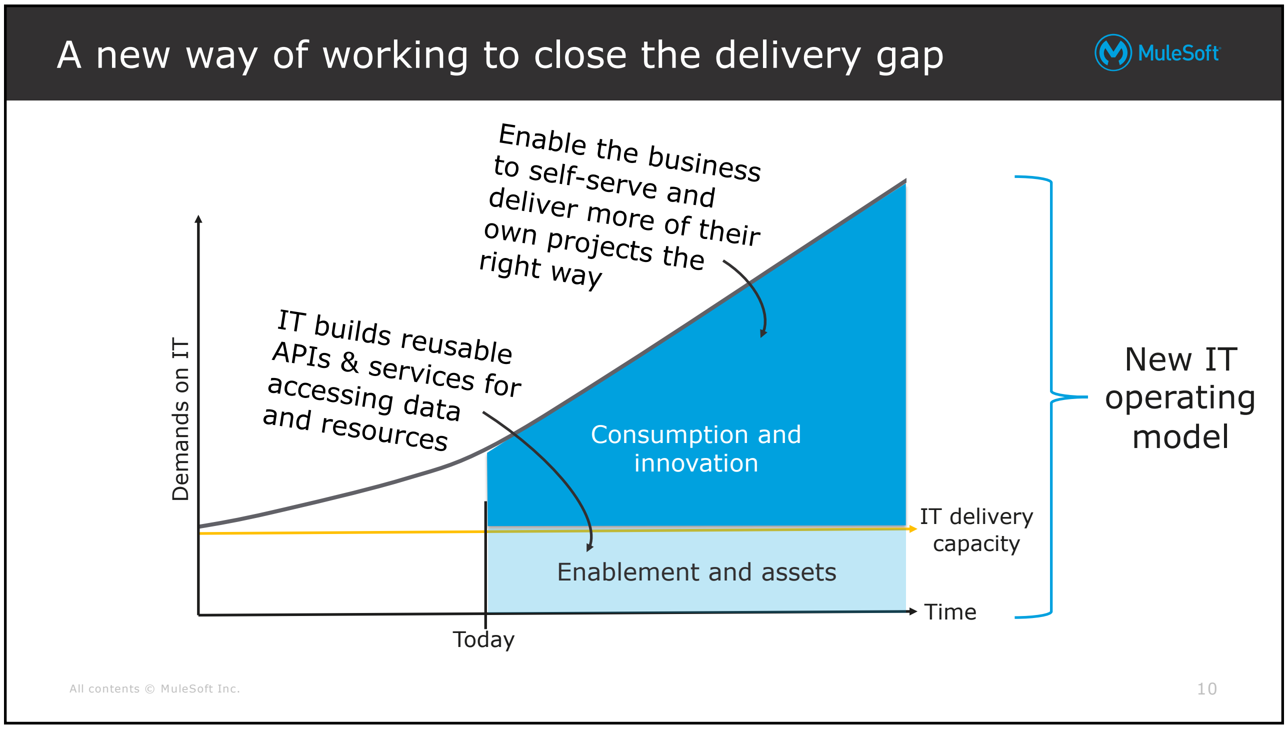
MuleSoft
Massive IT delivery gap creating an absolute need to change
Demands on IT
Digital competition
Mobile
Big Data, Analytics
Cloud and SaaS
IT delivery capacity
Time
Today

8



A new way of working to close the delivery gap

9



A new way of working to close the delivery gap

MuleSoft
Enable the business to self-serve and deliver more of their own projects the right way
IT builds reusable APIs & services for accessing data and resources
Demands on IT
Consumption and innovation
Enablement and assets
IT delivery capacity
Time
Today
New IT operating model
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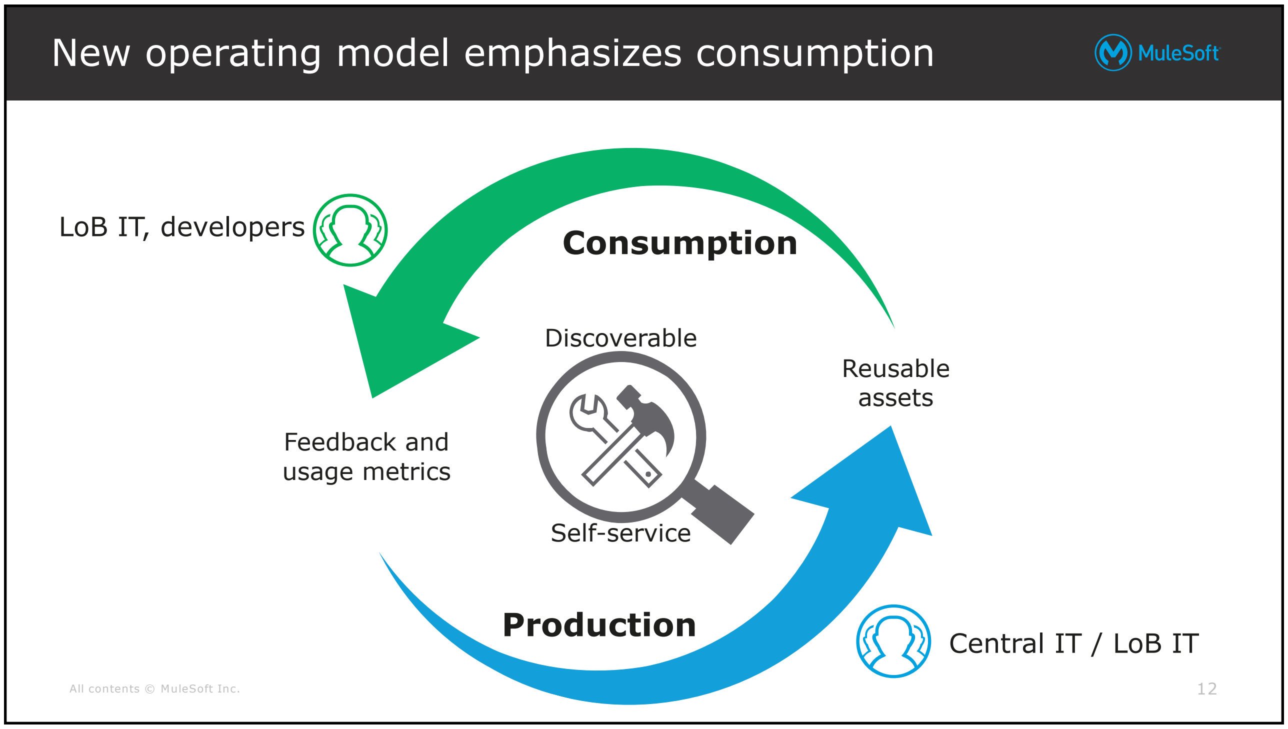
10

10

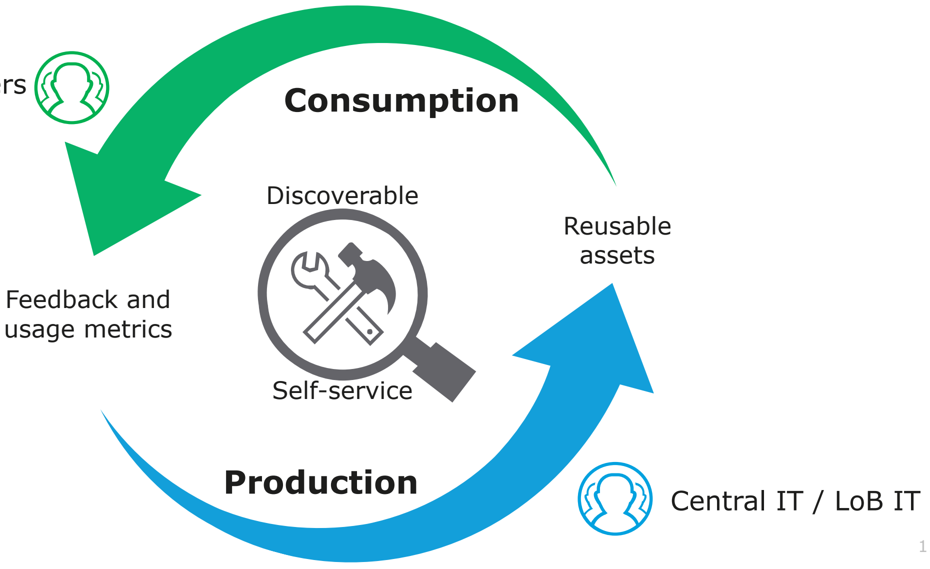
Introducing a new IT operating model

11



New operating model emphasizes consumption

MuleSoft



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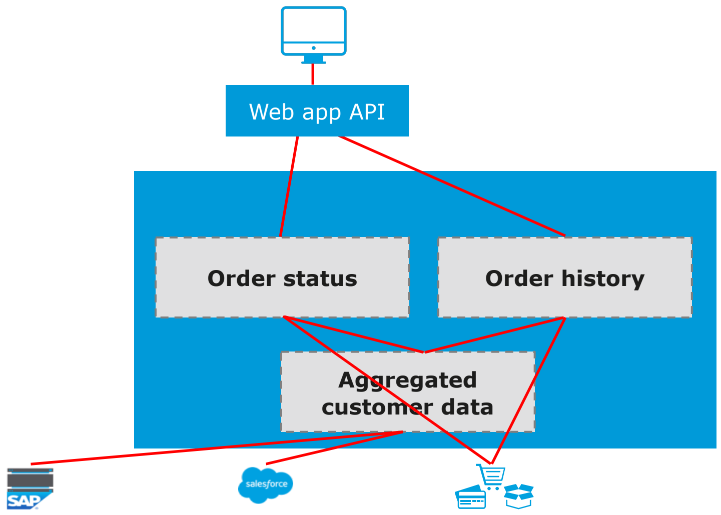
A common project-based approach

MuleSoft

Project objective: Web app provides real-time order status and order history for sales team engaging with customers

- Order data in eCommerce system
- Inventory data in SAP
- Customer data in SAP, Salesforce



A common project-based approach

MuleSoft

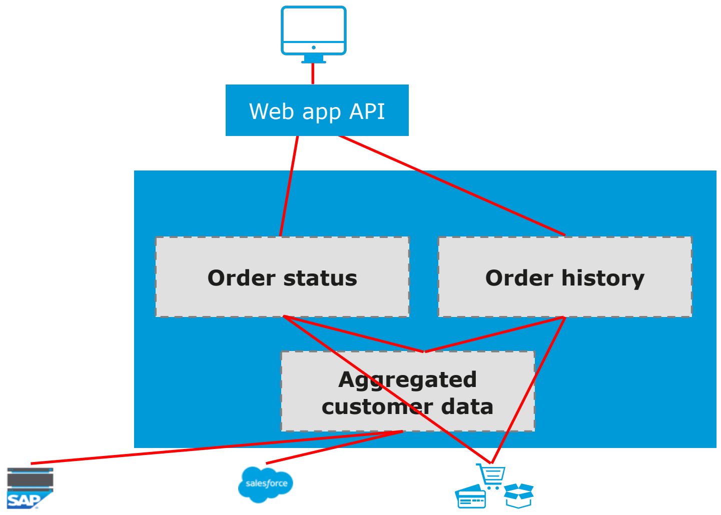
✓ On time and within budget

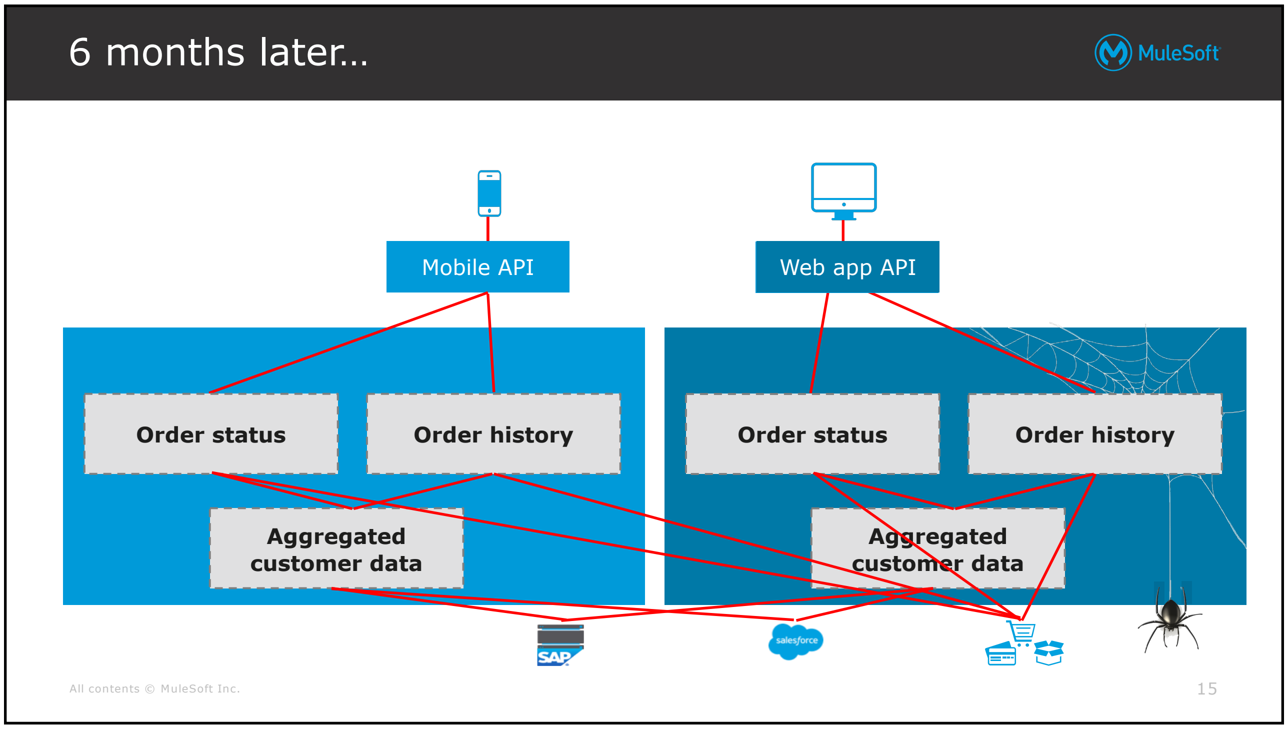
✗ Limited opportunity for reuse

✗ Tight coupling = brittleness

✗ Difficult to govern

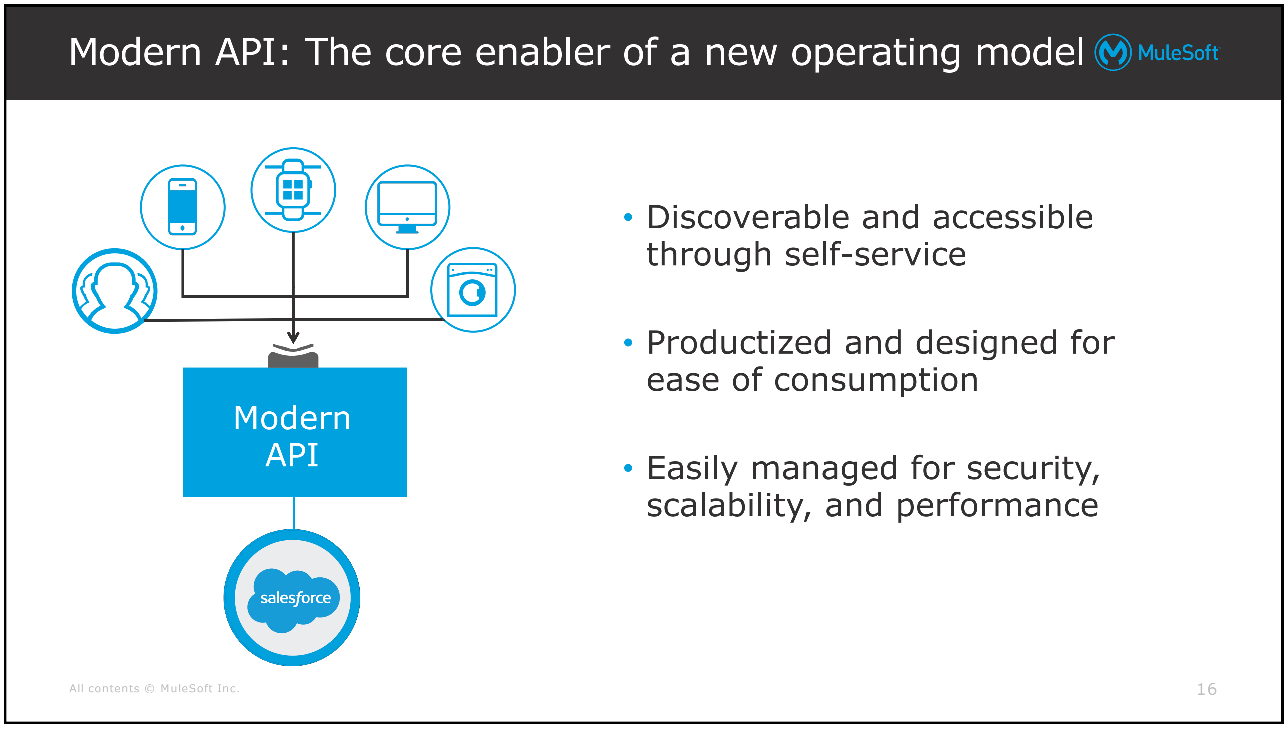
⚠ Meets business requirements





6 months later…

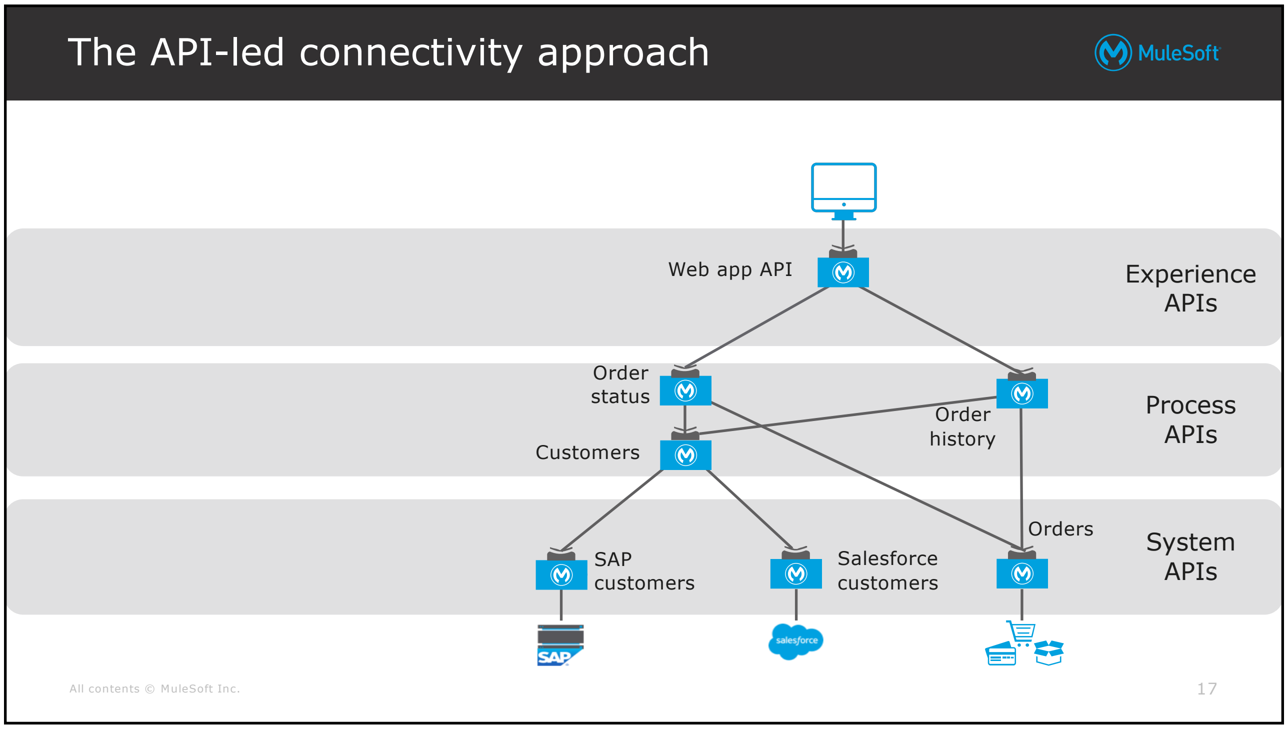
15



Modern API: The core enabler of a new operating model

- Discoverable and accessible through self-service
- Productized and designed for ease of consumption
- Easily managed for security, scalability, and performance

16



The API-led connectivity approach

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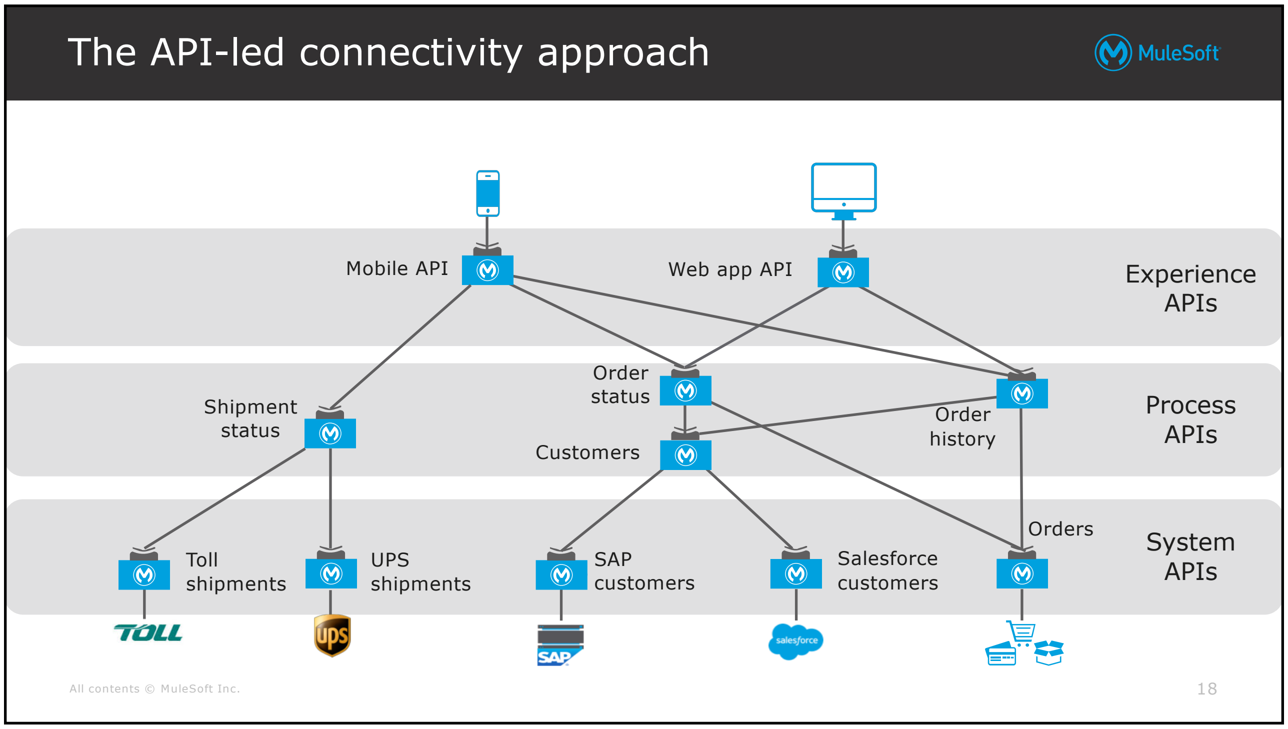
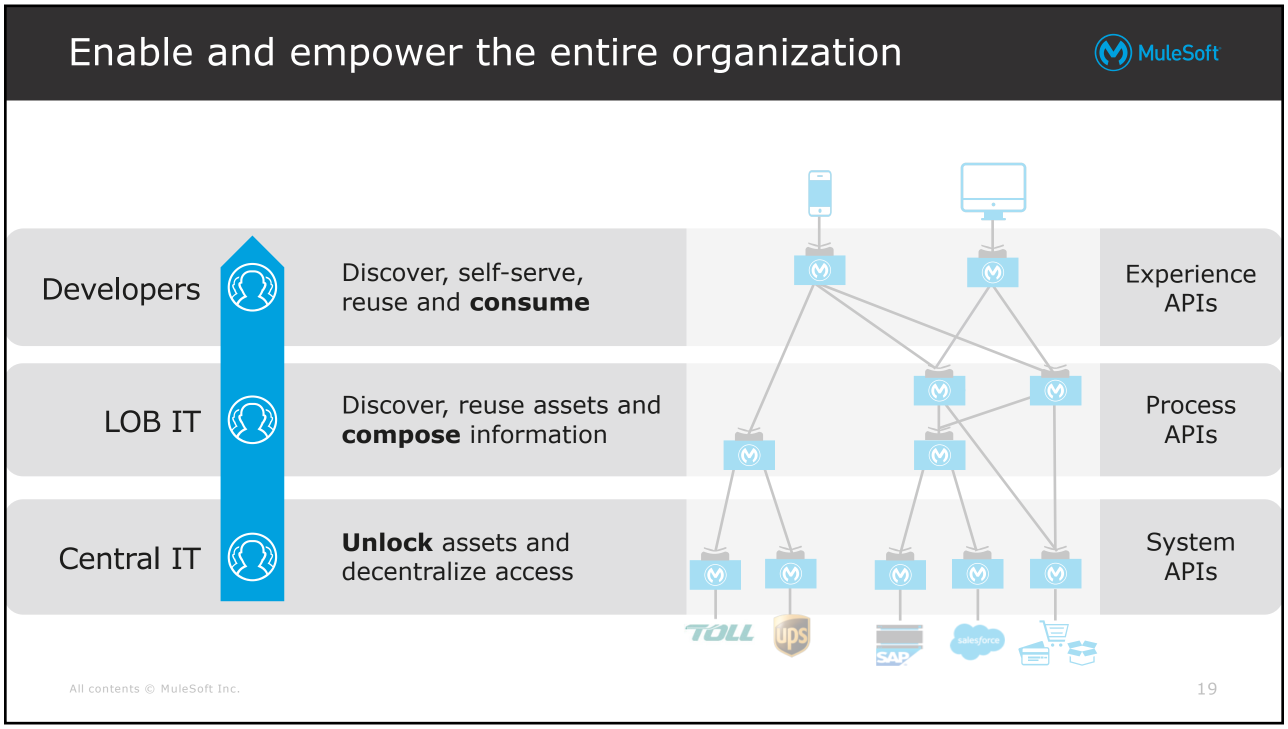


The API-led connectivity approach

18



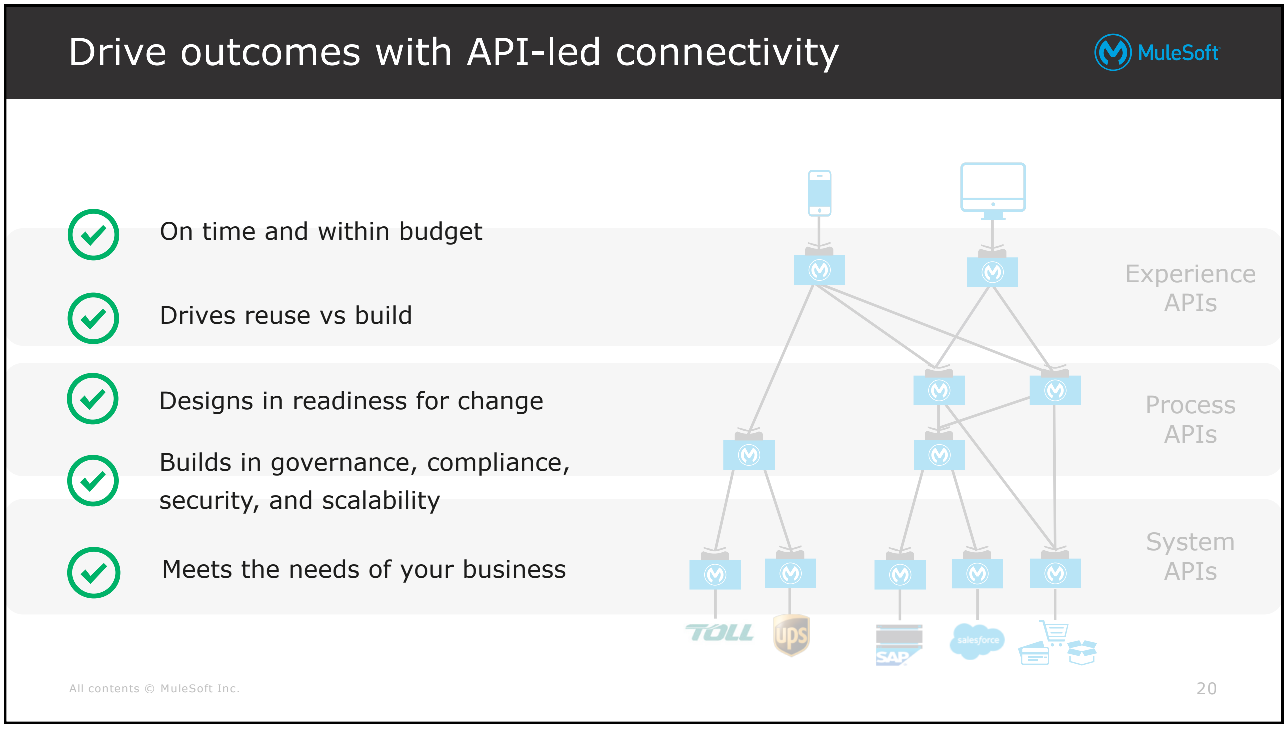
Enable and empower the entire organization

MuleSoft

Developers	Discover, self-serve, reuse and **consume**
LOB IT	Discover, reuse assets and **compose** information
Central IT	**Unlock** assets and decentralize access

19

19



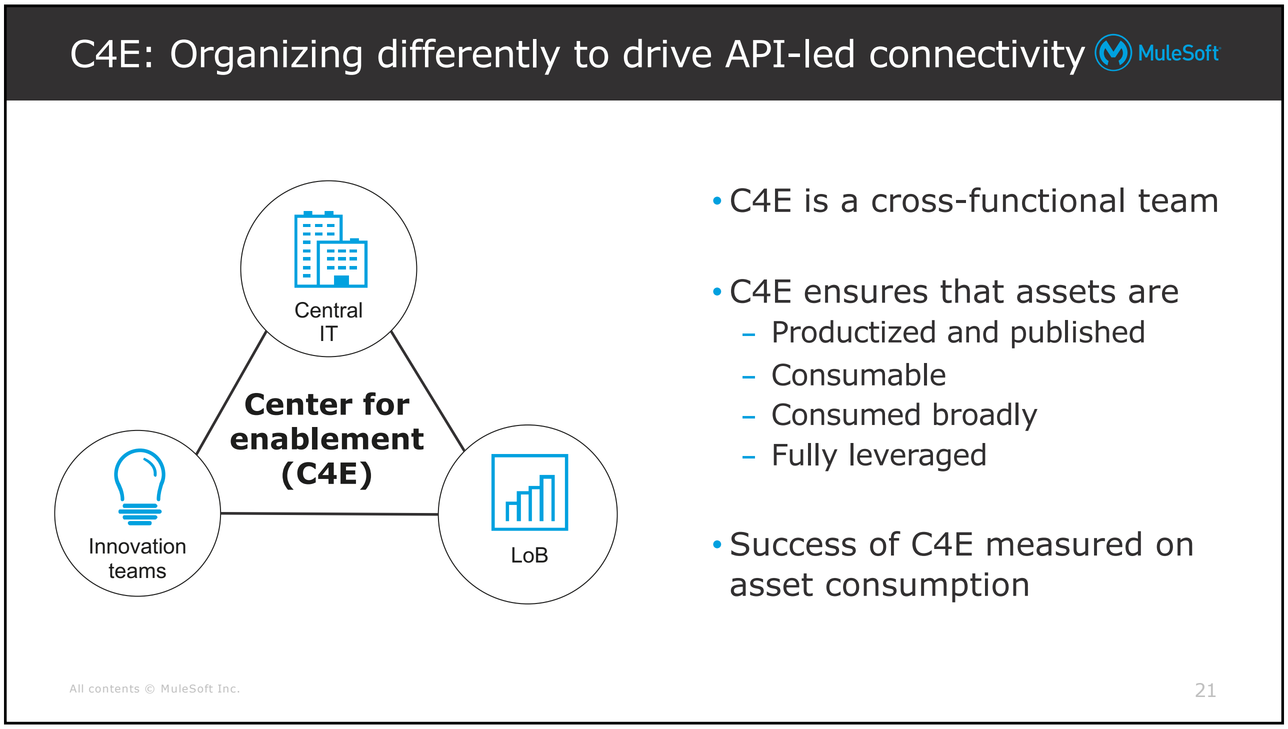
Drive outcomes with API-led connectivity

MuleSoft

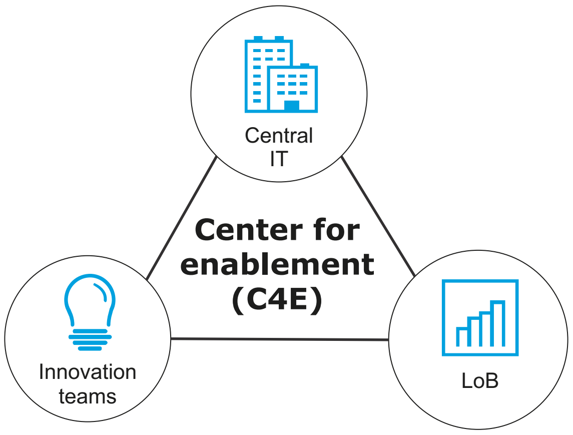
- ✓ On time and within budget
- ✓ Drives reuse vs build
- ✓ Designs in readiness for change
- ✓ Builds in governance, compliance, security, and scalability
- ✓ Meets the needs of your business

20

20

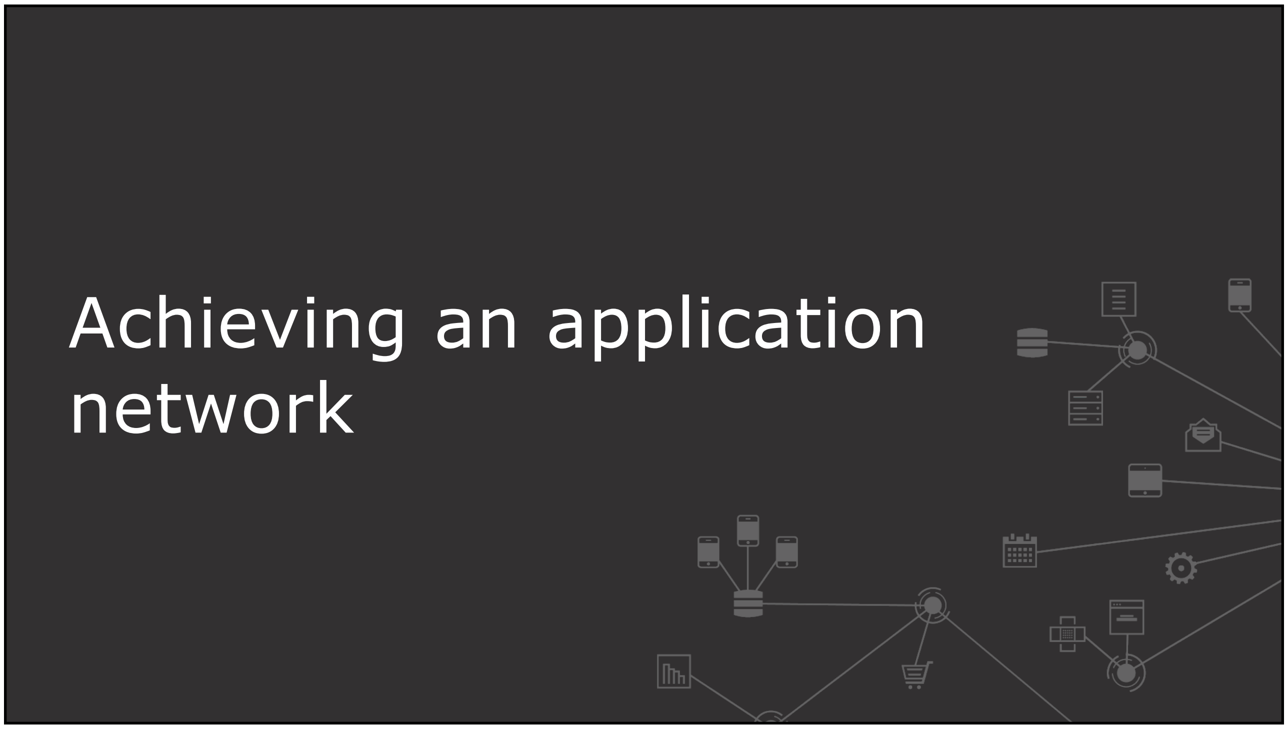


C4E: Organizing differently to drive API-led connectivity



- C4E is a cross-functional team
- C4E ensures that assets are
  - Productized and published
  - Consumable
  - Consumed broadly
  - Fully leveraged
- Success of C4E measured on asset consumption

21



Achieving an application network

22

Application landscape

MuleSoft

salesforce
workday
SAP
box
SAP

23

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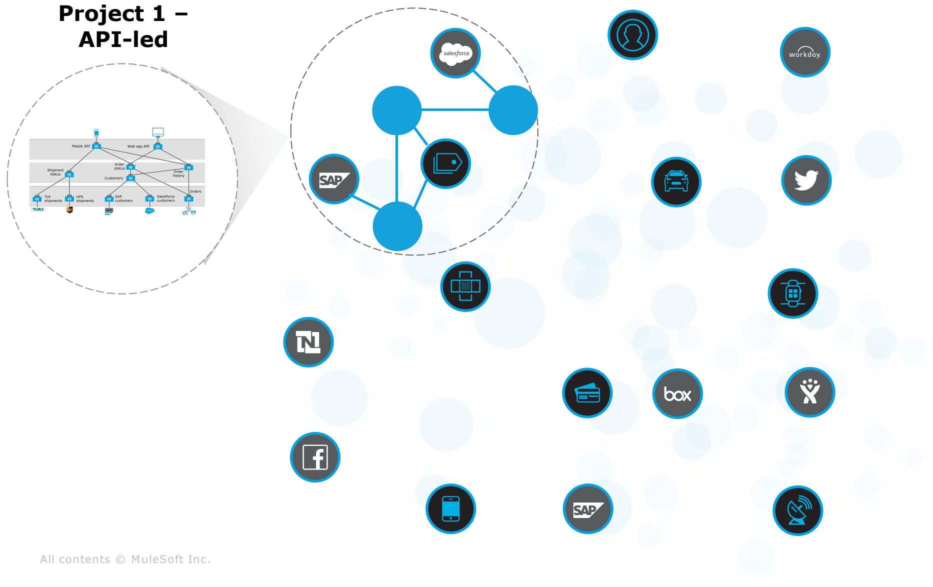
Every project adds value to the application network

MuleSoft



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Every project adds value to the application network

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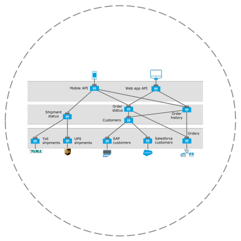
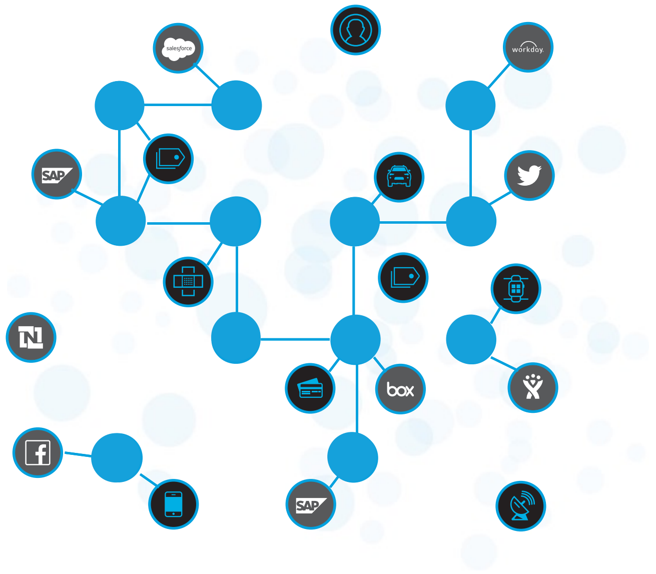
Project 1 – API-led





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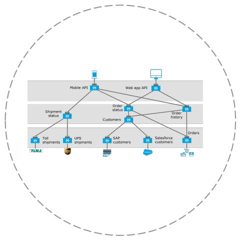
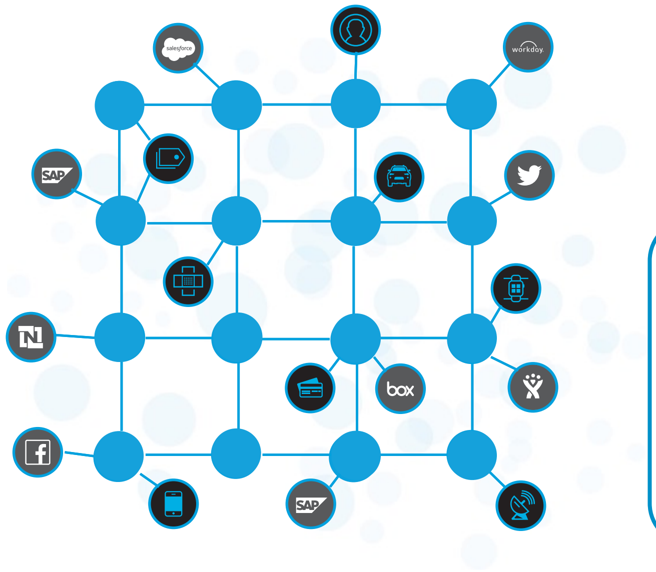
Every project adds value to the application network

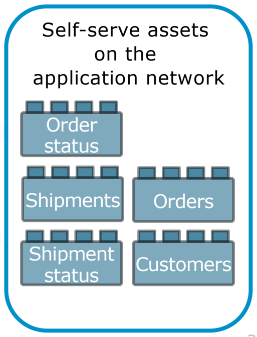
MuleSoft

Project 1 – API-led





C4E



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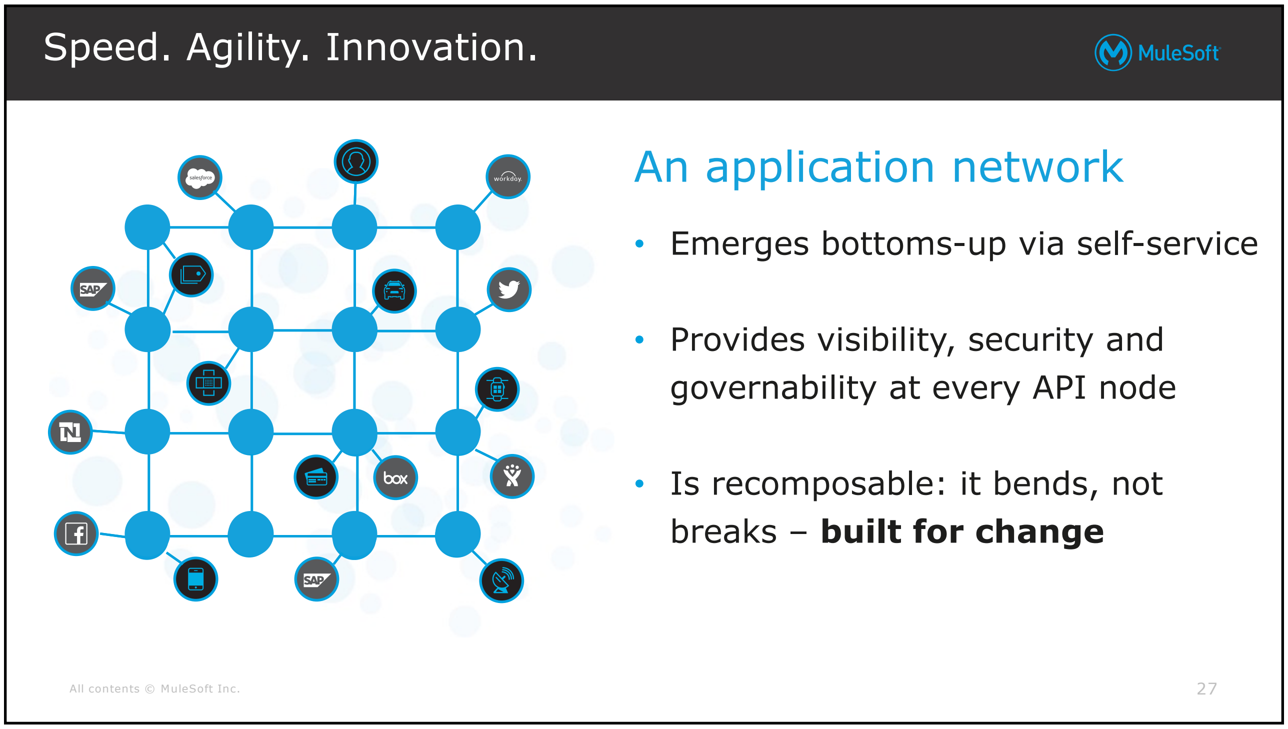
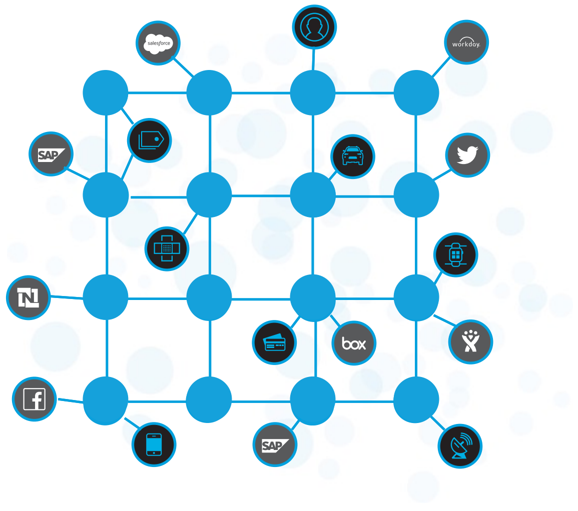


Speed. Agility. Innovation.

MuleSoft



An application network

- Emerges bottoms-up via self-service
- Provides visibility, security and governability at every API node
- Is recomposable: it bends, not breaks – **built for change**

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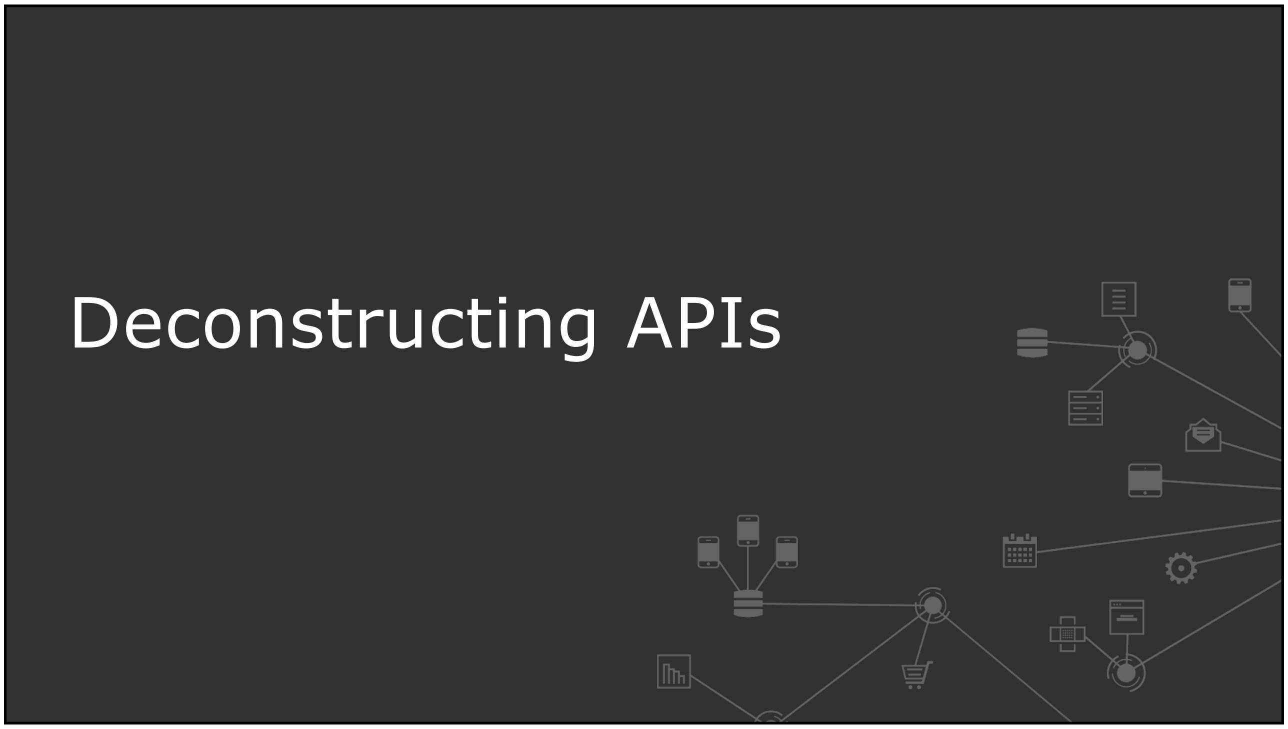
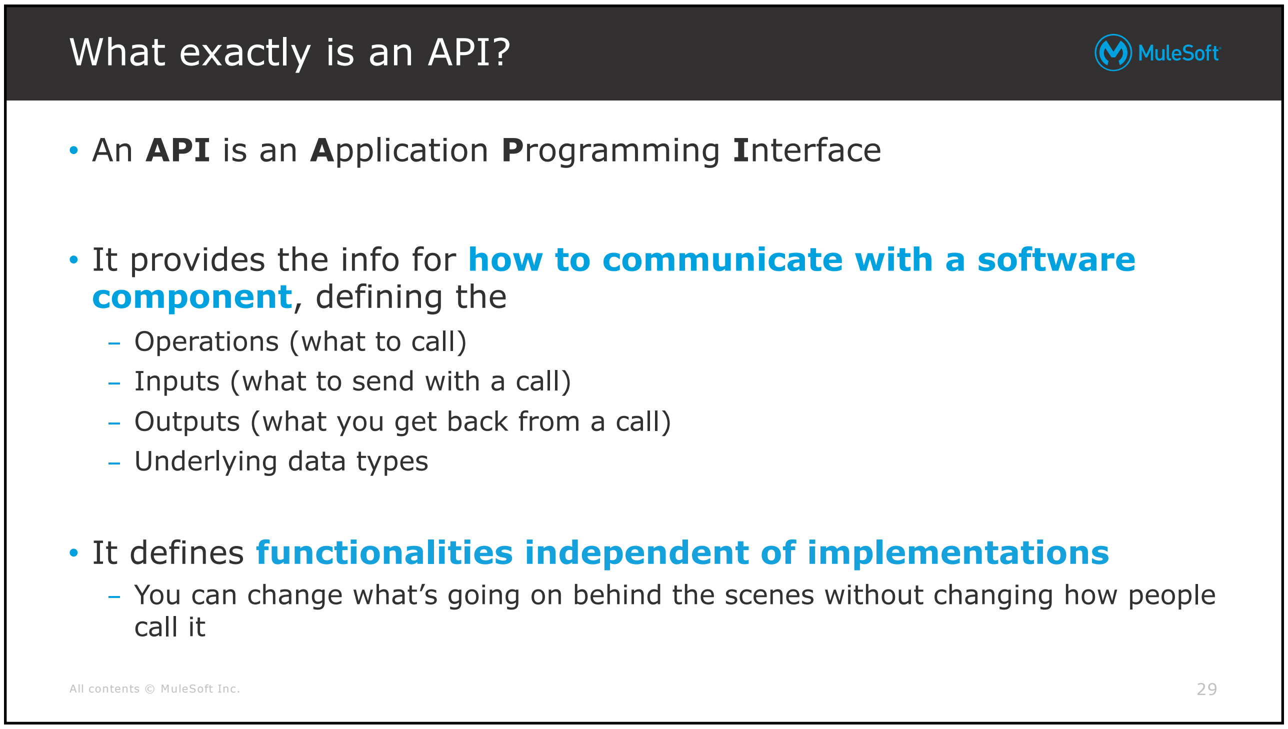


Deconstructing APIs

28



What exactly is an API?

- An **API** is an **A**pplication **P**rogramming **I**nterface

- It provides the info for **how to communicate with a software component**, defining the
  - Operations (what to call)
  - Inputs (what to send with a call)
  - Outputs (what you get back from a call)
  - Underlying data types

- It defines **functionalities independent of implementations**
  - You can change what's going on behind the scenes without changing how people call it

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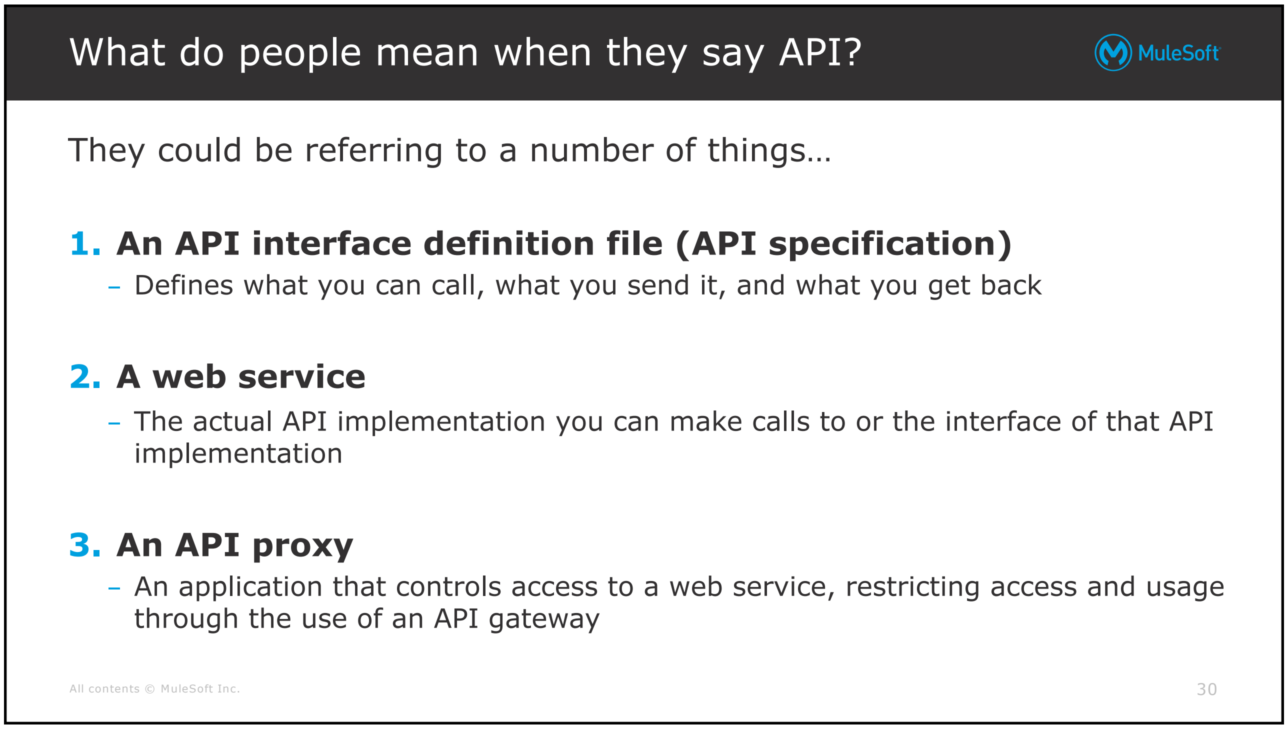

What do people mean when they say API?

They could be referring to a number of things…

1. **An API interface definition file (API specification)**
   - Defines what you can call, what you send it, and what you get back

2. **A web service**
   - The actual API implementation you can make calls to or the interface of that API implementation

3. **An API proxy**
   - An application that controls access to a web service, restricting access and usage through the use of an API gateway

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Reviewing web services

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What is a web service?

- Different software systems often need to exchange data with each other
  - Bridging protocols, platforms, programming languages, and hardware architectures
- A **web service** is a method of communication that allows two software systems to exchange data over the internet
- Systems interact with the web service in a manner prescribed by some defined rules of communication
  - How one system can request data from another system, what parameters are required, the structure of the return data, and more

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The parts of a web service

- **The web service API**
  - Describes how you interact with the web service
  - It may or may not (though it should!) be explicitly defined in a file
  - It could be any sort of text in any type of file but ideally should implement some standard API description language (or specification)
- **The web service interface implementing the API**
  - Is the code providing the structure to the application so it implements the API
  - This may be combined with the actual implementation code
- **The web service implementation itself**
  - Is the actual code and application

Two main types of web services

- SOAP web services
  - Traditional, more complex type
  - The communication rules are defined in an XML-based WSDL (Web Services Description Language) file
- **RESTful web services**
  - Recent, simpler type
  - Use the existing HTTP communication protocol

Reviewing RESTful web services

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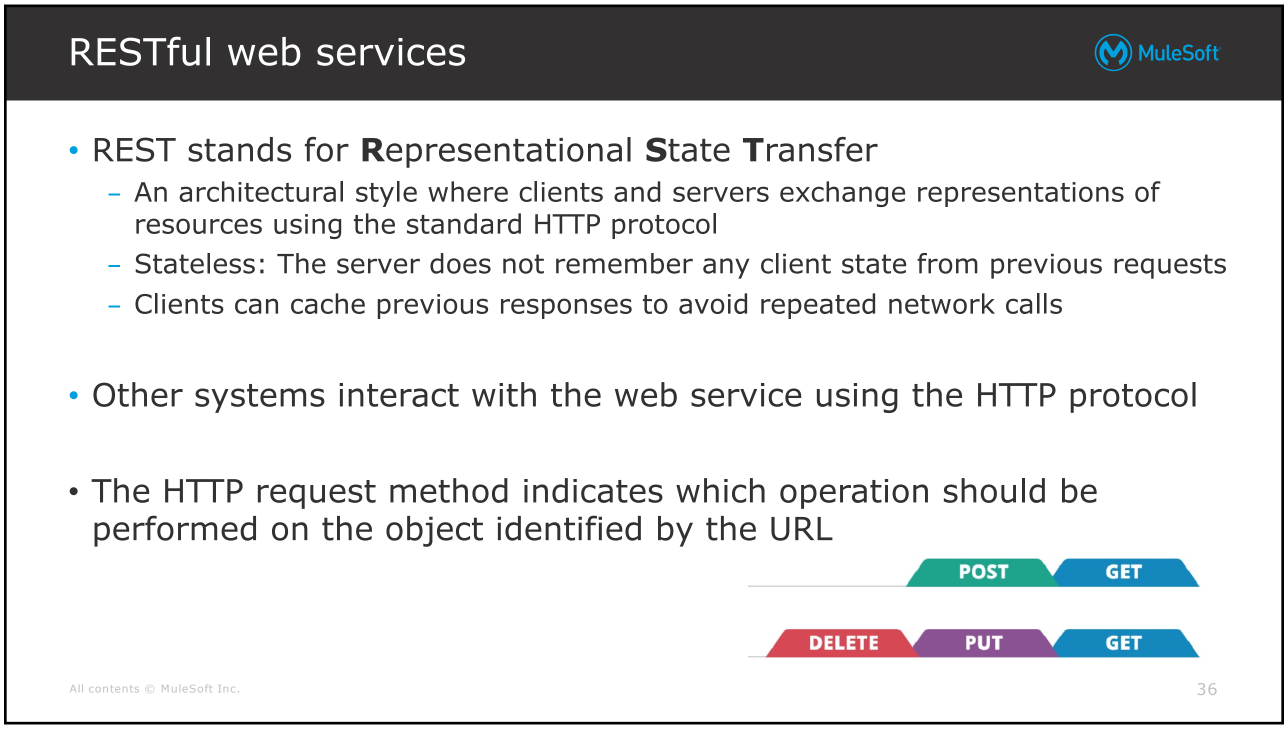
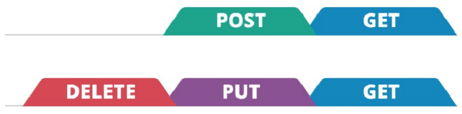


RESTful web services

MuleSoft

- REST stands for **R**epresentational **S**tate **T**ransfer
  - An architectural style where clients and servers exchange representations of resources using the standard HTTP protocol
  - Stateless: The server does not remember any client state from previous requests
  - Clients can cache previous responses to avoid repeated network calls
- Other systems interact with the web service using the HTTP protocol
- The HTTP request method indicates which operation should be performed on the object identified by the URL



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Example RESTful web service calls

- Data and resources are represented using URIs
- Resources are accessed or changed using a fixed set of operations

- (GET)/companies
- (GET)/companies?country=France
- (GET)/companies/3
- (POST)/companies with JSON/XML in HTTP body
- (DELETE)/companies/3
- (PUT)/companies/3 with JSON/XML in HTTP body

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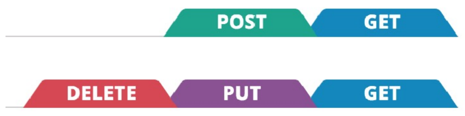
RESTful web service request methods

- **GET** retrieves the current state of a resource in some representation (usually JSON or XML)
- **POST** creates a new resource
- **DELETE** deletes a resource
- **PUT** replaces a resource completely
  - If the resource doesn't exist, a new one is created
- **PATCH** partially updates a resource
  - Just submitted data



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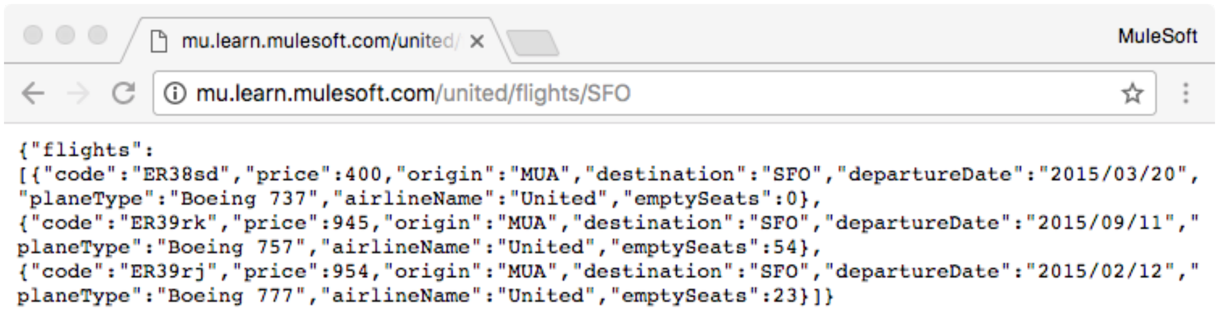
Example RESTful web service response

- JSON (JavaScript Object Notation)
  - A lightweight data-interchange format (without a lot of extra XML markup)
  - Human-readable results (usually JSON or XML)
  - Supports collections and maps


mu.learn.mulesoft.com/united/
MuleSoft
mu.learn.mulesoft.com/united/flights/SFO

```
{"flights":
[{"code":"ER38sd","price":400,"origin":"MUA","destination":"SFO","departureDate":"2015/03/20",
"planeType":"Boeing 737","airlineName":"United","emptySeats":0},
{"code":"ER39rk","price":945,"origin":"MUA","destination":"SFO","departureDate":"2015/09/11","
planeType":"Boeing 757","airlineName":"United","emptySeats":54},
{"code":"ER39rj","price":954,"origin":"MUA","destination":"SFO","departureDate":"2015/02/12","
planeType":"Boeing 777","airlineName":"United","emptySeats":23}]}
```

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Learning about APIs

- API documentation
  - Should include the list of all possible resources, how to get access to the API, and more
- API portals
  - Accelerate onboarding by providing developers a centralized place for discovering all the tools they need to successfully use the API, which could include
    - Documentation, tutorials, code snippets, and examples
    - A way to register applications to get access to the API
    - A way to provide feedback and make requests
    - A way to test the API by making calls to it
- Discover APIs in API directories and marketplaces
  - For example, **ProgrammableWeb**, which has over 19,000 APIs

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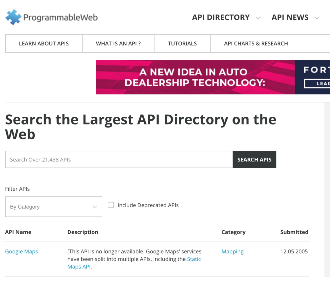
Walkthrough 1-1: Explore an API directory and an API portal

- Browse the ProgrammableWeb API directory
- Explore the API reference for an API (Vimeo)
- Explore the API portal for an API to be used in the course



Search the Largest API Directory on the Web

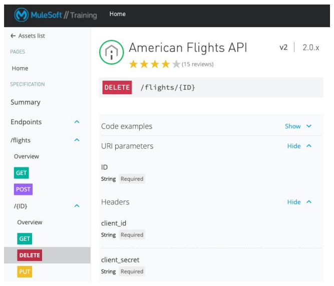
Search Over 21,438 APIs

Filter APIs

By Category

Include Deprecated APIs

API Name	Description	Category	Submitted
Google Maps	[This API is no longer available. Google Maps' services have been split into multiple APIs, including the Static Maps API,	Mapping	12.05.2005



American Flights API

DELETE /flights/{ID}

Code examples

URI parameters

ID
String Required

Headers

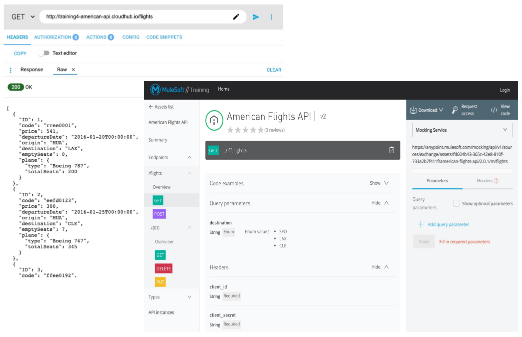
client_id
String Required

client_secret
String Required

Calling RESTful web services

Calling RESTful web services

- To call web services, you need to write code or have a tool to make the HTTP requests
  - Need to be able to specify the HTTP method, request headers, and request body
- Example tools include
  - An API portal with an API console
  - Advanced Rest Client
  - Postman
  - A cURL command-line utility


GET http://training4-american-api.cloudhub.io/flights

200 OK

```
[
  {
    "ID": 1,
    "code": "rree0001",
    "price": 541,
    "departureDate": "2016-01-20T00:00:00",
    "origin": "MUA",
    "destination": "LAX",
    "emptySeats": 0,
    "plane": {
      "type": "Boeing 787",
      "totalSeats": 200
    }
  },
  {
    "ID": 2,
    "code": "eefd0123",
    "price": 300,
    "departureDate": "2016-01-25T00:00:00",
    "origin": "MUA",
    "destination": "CLE",
    "emptySeats": 7,
    "plane": {
      "type": "Boeing 747",
      "totalSeats": 345
    }
  },
  {
    "ID": 3,
    "code": "ffee0192",
```

GET /flights

destination
String Enum
Enum values:
- SFO
- LAX
- CLE

client_id
String Required

client_secret
String Required

https://anypoint.mulesoft.com/mocking/api/v1/sources/exchange/assets/fd604b43-365c-42e8-810f-733a2b7f411f/american-flights-api/2.0.1/m/flights

Query parameters ☐ Show optional parameters

Fill in required parameters

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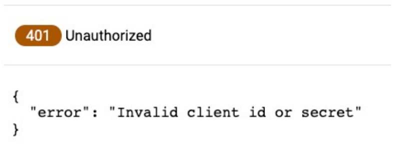
Making calls to RESTful APIs

- **Unsecured APIs**
  - The API may be public and require no authentication
- **Secured APIs**
  - The API may be secured and require authentication
  - You may need to provide credentials and/or a token
  - Often a proxy is created to govern access to an API
  - We will call and then later create an API secured by credentials
  - You can also secure an API with other authentication protocols
    - OAuth, SAML, JWT, and more


401 Unauthorized

```
{
  "error": "Invalid client id or secret"
}
```

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Getting responses from web service calls

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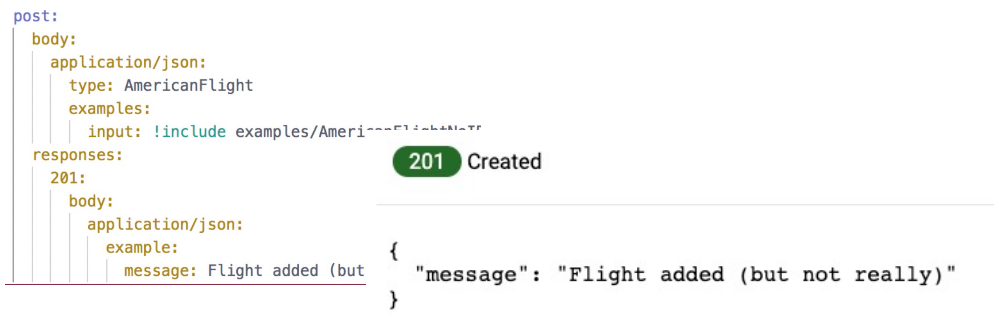
- RESTful web services return an HTTP status code with the response
- The status code provides client feedback for the outcome of the operation (succeeded, failed, updated)
  - A good API should return status codes that align with the HTTP spec



```
post:
  body:
    application/json:
      type: AmericanFlight
      examples:
        input: !include examples/Ameri
  responses:
    201:
      body:
        application/json:
          example:
            message: Flight added (but
```

201 Created

```
{
  "message": "Flight added (but not really)"
}
```

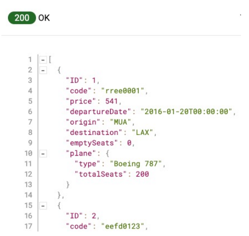
Common HTTP status codes

MuleSoft

Code	Definition	Returned by
200	OK – The request succeeded	GET, DELETE, PATCH, PUT
201	Created – A new resource or object in a collection	POST
304	Not modified – Nothing was modified by the request	PATCH, PUT
400	Bad request – The request could not be performed by the server due to bad syntax or other reason in request	All
401	Unauthorized – Authorization credentials are required or user does not have access to the resource/method they are requesting	All
404	Resource not found – The URI is not recognized by the server	All
500	Server error – Generic something went wrong on the server side	All

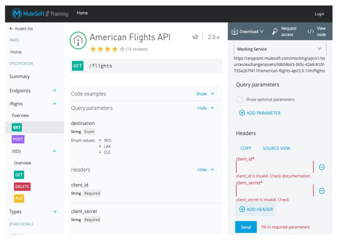
Walkthrough 1-2: Make calls to an API

- Use ARC to make calls to an unsecured API (an implementation)
- Make GET, DELETE, POST, and PUT calls
- Use ARC to make calls to a secured API (an API proxy)
- Use the API console in an API portal to make calls to a managed API using a mocking service
- Use the API console to make calls to an API proxy endpoint



200 OK

```
[
  {
    "ID": 1,
    "code": "rree0001",
    "price": 541,
    "departureDate": "2016-01-20T00:00:00",
    "origin": "MUA",
    "destination": "LAX",
    "emptySeats": 0,
    "plane": {
      "type": "Boeing 787",
      "totalSeats": 200
    }
  },
  {
    "ID": 2,
    "code": "eefd0123",
```



American Flights API v2 | 2.0.x (15 reviews)

GET /flights

Mocking Service: https://anypoint.mulesoft.com/mocking/api/v1/sources/exchange/assets/fd604b43-365c-42e8-810f-733a2b7f411f/american-flights-api/2.0.1/m/flights

Query parameters

destination — String, Enum. Enum values: SFO, LAX, CLE

Headers

client_id — String, Required

client_secret — String, Required

client_id is invalid. Check documentation.

client_secret is invalid. Check

Fill in required parameters

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Successfully creating application networks using API-led connectivity

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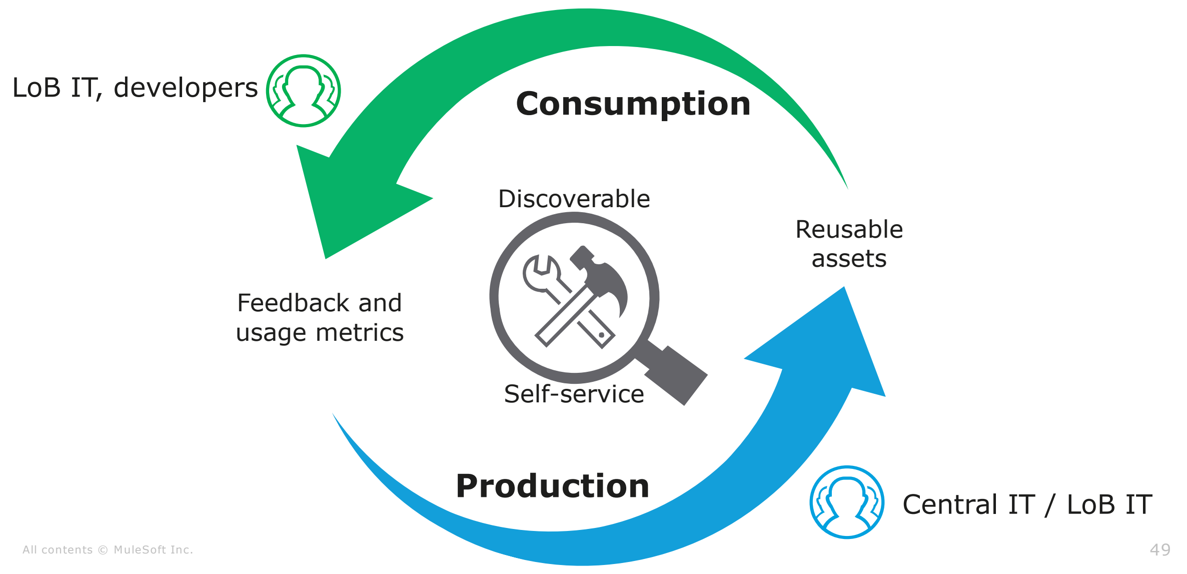
Producing discoverable and consumable assets is key

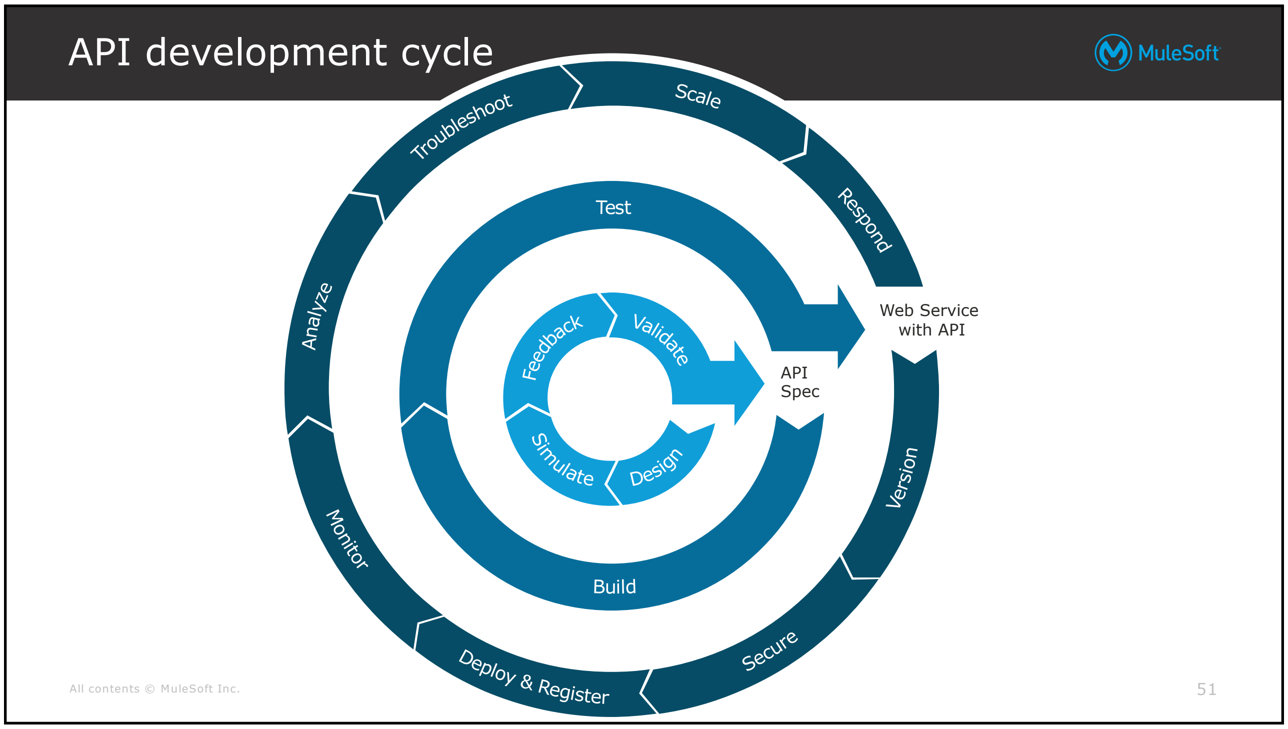
MuleSoft



Designing for API success

MuleSoft

- Create APIs that developers **can find** and **want to use** and share with others
  - Design the API for the business use cases it will fulfill, not to model the backend services or applications they expose
  - Focus on performance of client applications and user experience
- Take an **API design-first approach**!
- **Get API design right** before investing in building it
  - Define it iteratively getting feedback from developers on its usability and functionality along the way
  - Building the implementation of an API is time consuming and expensive to undo



API development cycle

MuleSoft

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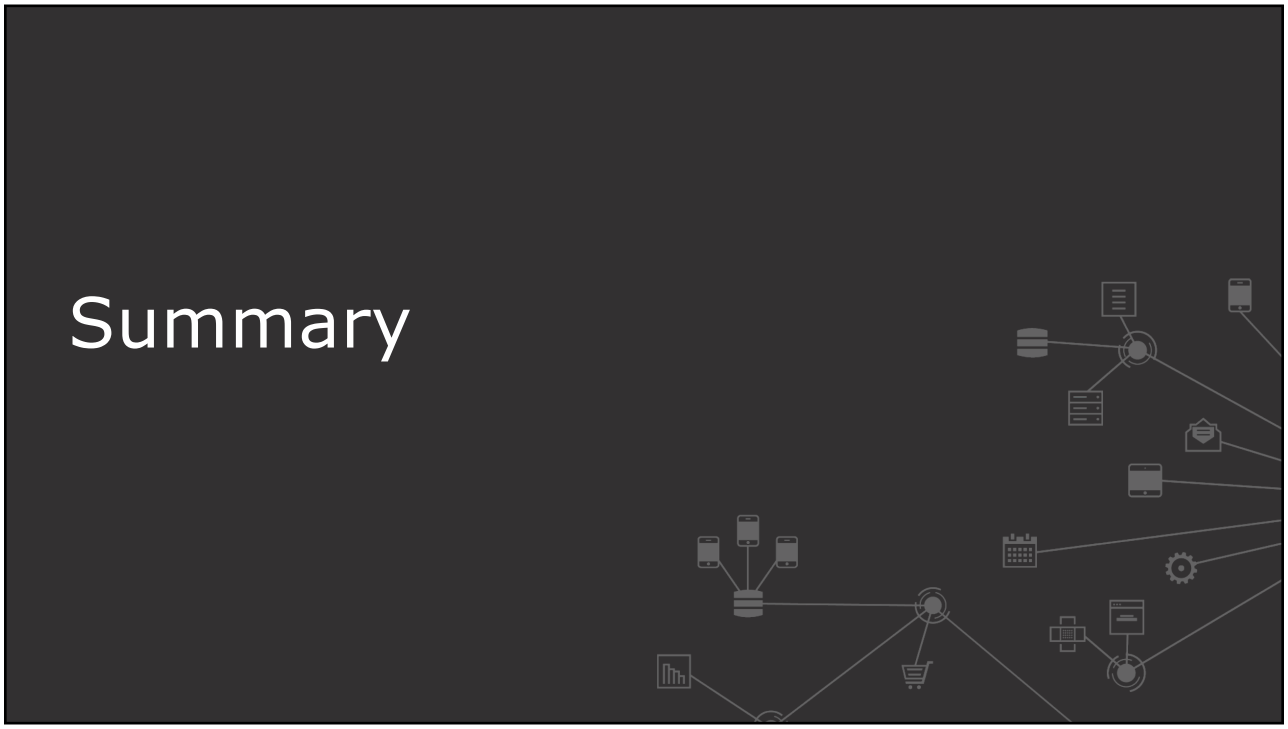

Summary

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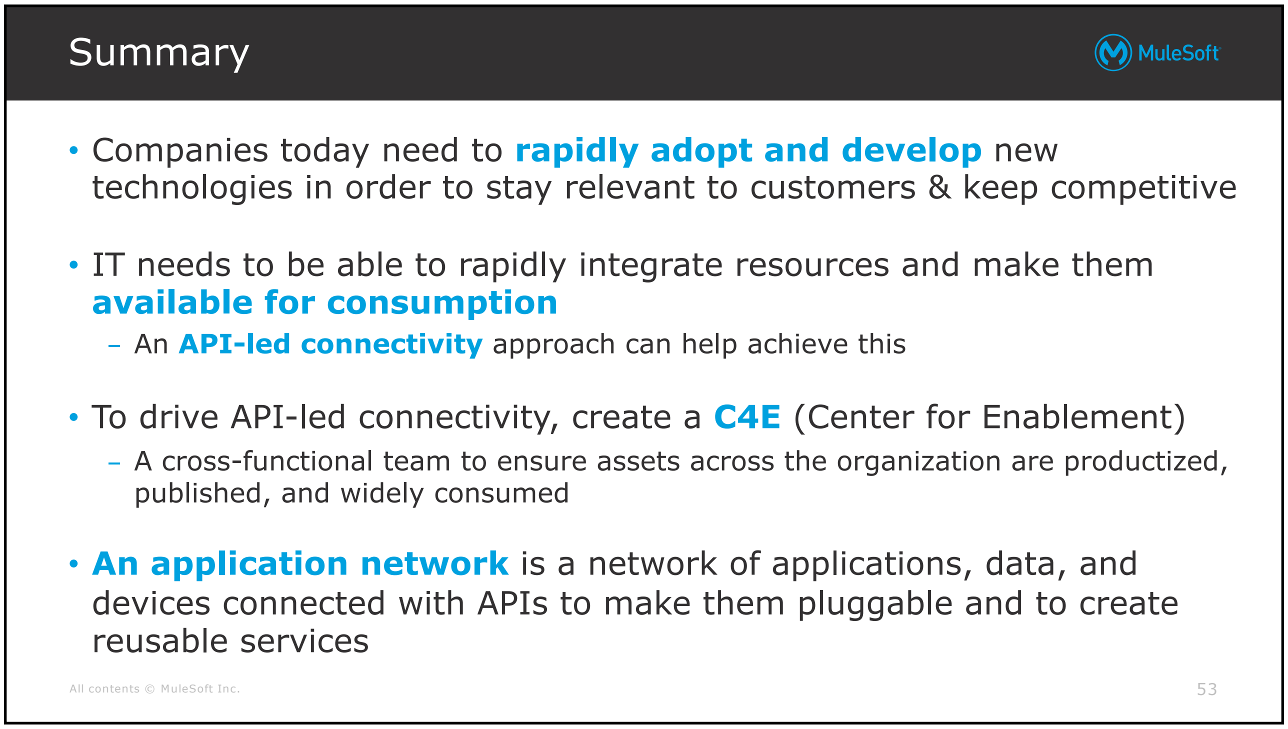

Summary

- Companies today need to **rapidly adopt and develop** new technologies in order to stay relevant to customers & keep competitive
- IT needs to be able to rapidly integrate resources and make them **available for consumption**
  - An **API-led connectivity** approach can help achieve this
- To drive API-led connectivity, create a **C4E** (Center for Enablement)
  - A cross-functional team to ensure assets across the organization are productized, published, and widely consumed
- **An application network** is a network of applications, data, and devices connected with APIs to make them pluggable and to create reusable services

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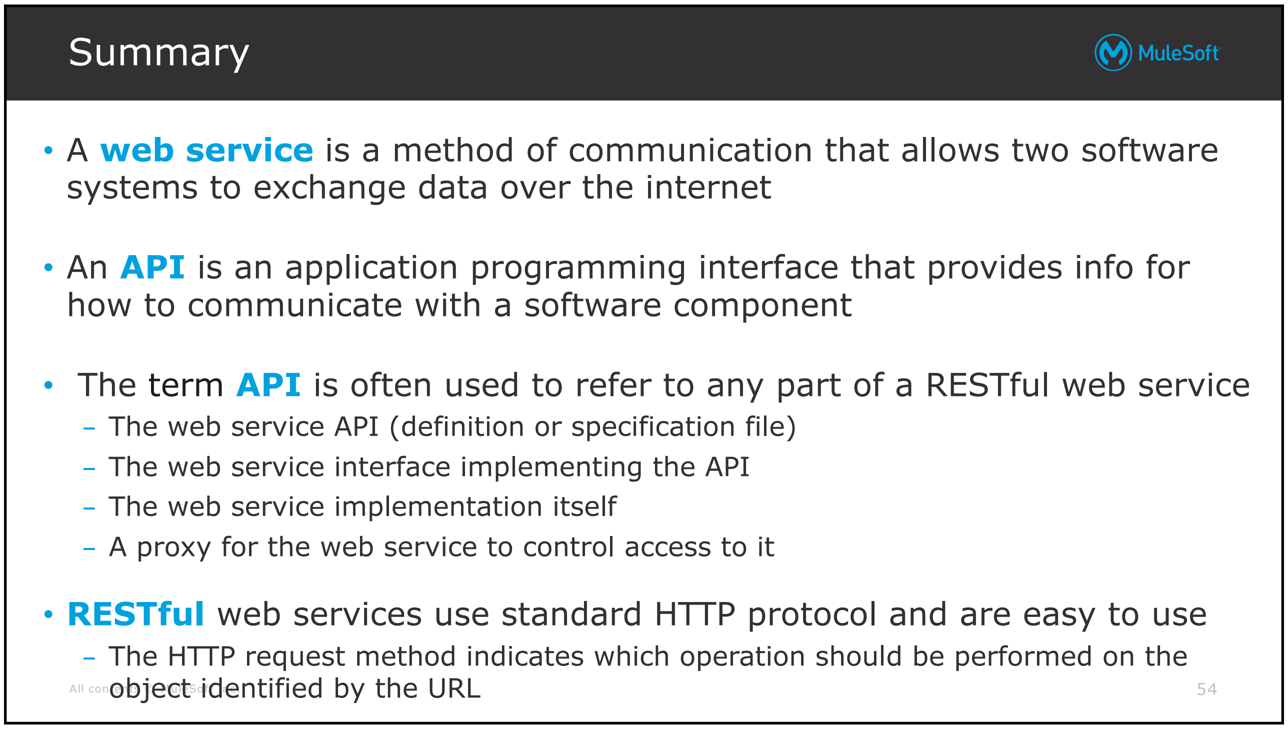

Summary

- A **web service** is a method of communication that allows two software systems to exchange data over the internet
- An **API** is an application programming interface that provides info for how to communicate with a software component
- The term **API** is often used to refer to any part of a RESTful web service
  - The web service API (definition or specification file)
  - The web service interface implementing the API
  - The web service implementation itself
  - A proxy for the web service to control access to it
- **RESTful** web services use standard HTTP protocol and are easy to use
  - The HTTP request method indicates which operation should be performed on the object identified by the URL

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