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Cloud Foundry - Services

Objectives of CF - Services

- Purpose:
  - To learn pivotal cloud foundry services.
- Product:
  - Managed Services
  - Pivotal CF Services
  - PWS and App Direct Services
  - Creating and Binding Services
- Process:
  - To learn and deploy a service.

Table of Contents

MANAGED (MARKETPLACE) SERVICES

What is a Service?

- Service is an external application dependency or component such as
  - Database
  - Message Queue
  - Monitoring App
  - Security
  - Hadoop instance
  - Generic Service Endpoint (Web Services)
  - Other dependent applications

Features and Functionality

- Provide functionality to our applications
- External to our applications
  - Add-on provisioned alongside an application.
- May be shared among many applications
  - Example – Relational DB, Messaging system
- Are bound to (associated with) an application
  - Using a “Service Broker”
- Provide connection information to application via environment variables
  - **VCAP_SERVICES**

Why use a service?

- Applications are the deployment unit
  - Must be self-contained
- Anything else they need is provided by the PaaS
  - By a service
- Services in a PaaS are
  - One of the main possible charging units / elements
    - Instead of hardware resources like an IaaS
  - Make commercial PaaS possible
  - Enable charge-back in your organization

Two Types of Services

- Managed Services (a.k.a. “Marketplace” Services)
  - Available ‘out-of-the-box’
  - Selected from marketplace ‘catalog’
  - Instances provisioned by PaaS, for use by application

CF Managed

User Managed

- User Defined Services
  - Services running external to Cloud Foundry
  - Connection information stored and used to connect
  - PaaS does not provision resources, only supplies connection information.

Custom services

Also CF Managed

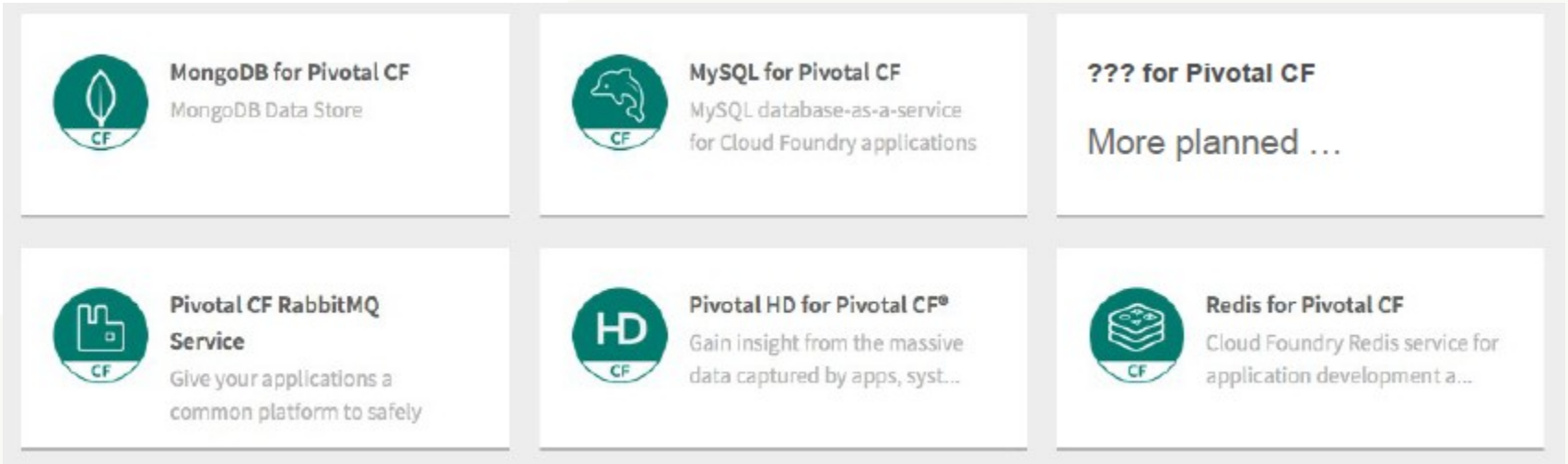
- Custom Built Services
  - Custom service created and installed into Cloud Foundry
    - Looks like any other managed service once added
    - Appears in the Marketplace
  - Alternative to user-defined services
    - Full integration with CF
- Requirements
  - Custom development of *service broker*
  - And *operator* installation into Cloud Foundry

Accessing External Services

- Typically these exist already
  - Your ERP and CRM systems (Oracle, SAP …)
  - Mainframe developed/running in-house
  - Cloud-based services such as sales, CRM or payroll
- Two options
  - User-defined service
    - Our ops people continue to manage and provision
  - Custom Service
    - CF uses service-broker to provision and bind

Accessing Managed Services

- Easily available via Marketplace
  - Allow us to sign-up, select plans, etc
  - Once bound to application, can be used easily
- Many pre-packaged services for Pivotal CF
  - See https://network.pivotal.io/products



Managed Services

- Services preconfigured and made available to Cloud Foundry
  - Typically by operations personnel
- On-premise/private cloud
  - Our company controls what is available
  - Services typically run in our data-centre
- Public cloud
  - Cloud provided controlled
  - Services may run anywhere – locality considerations

PIVOTAL CF SERVICES

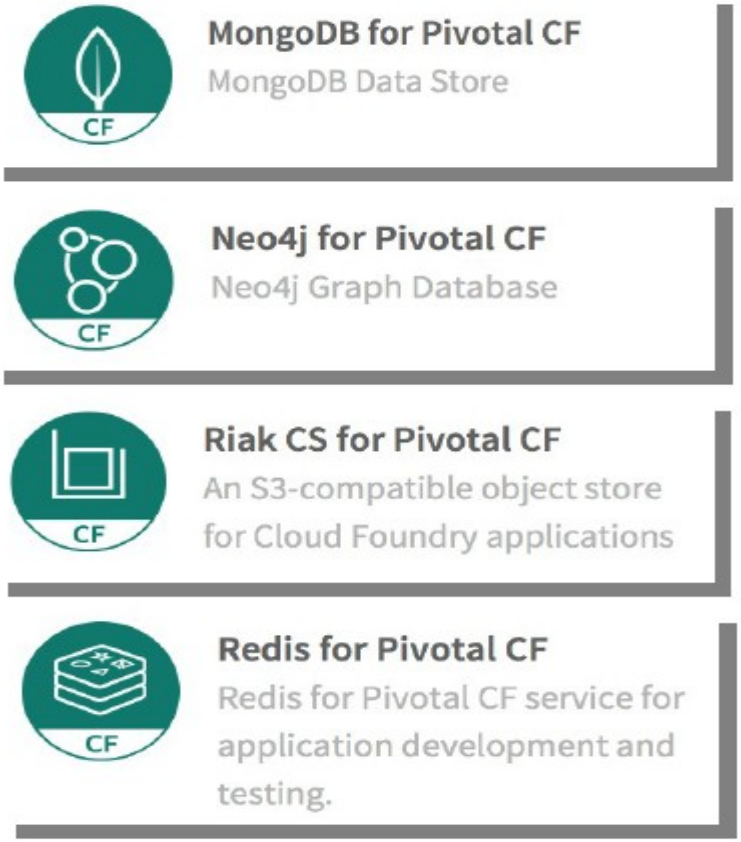
What Services are Available

- Whatever our company chooses
  - Services added after Pivotal CF installation by Ops
  - Available as .pivotal files from Pivotal Network
    - See https://network.pivotal.io
- The section discusses several services
  - They may not be available to your private cloud

SQL Databases - MYSQL

- Free, Open Source Relational Database
  - GPL licensing
  - High-Available, clustered, synchronously replicated using MariaDB Galera Cluster
    - Each mode has a copy of each DB
    - Writes to any DB are replicated to all copies
    - Client connections routed to primary, on failure proxy routes to a healthy node
  - Suitable for production use

NoSQL Data Services

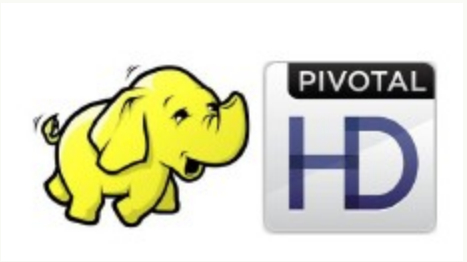


- MongoDB – Popular Document store
- Neo4j – Graph Database
- Riak CS – "Cloud Store" for accessing Amazon S3-like file storage
- Redis – Popular Key / Value store from Pivotal

- Available Soon: Elasticssearch, Memcached , Gemfire, DataStax (Cassandra)
- Not *intended* for production use

Pivotal HD for Cloud Foundry

- Directly from Pivotal CF, provision Hadoop resources to power data-centric Cloud Foundry Apps
  - HDFS, Map-Reduce, Hive, Hbase, YARN, Zookeeper ..
    - Or connect to existing Hadoop cluster
  - HAWQ: Pivotal's fast, distributed SQL engine
    - Perform deep, complex analytics in SQL (or R, Madlib, etc)
    - Run Hadoop jobs directly from Pivotal CF application
- Runtime service broker integration
  - Instant credential generation & binding to shared PHD cluster



RabbitMQ

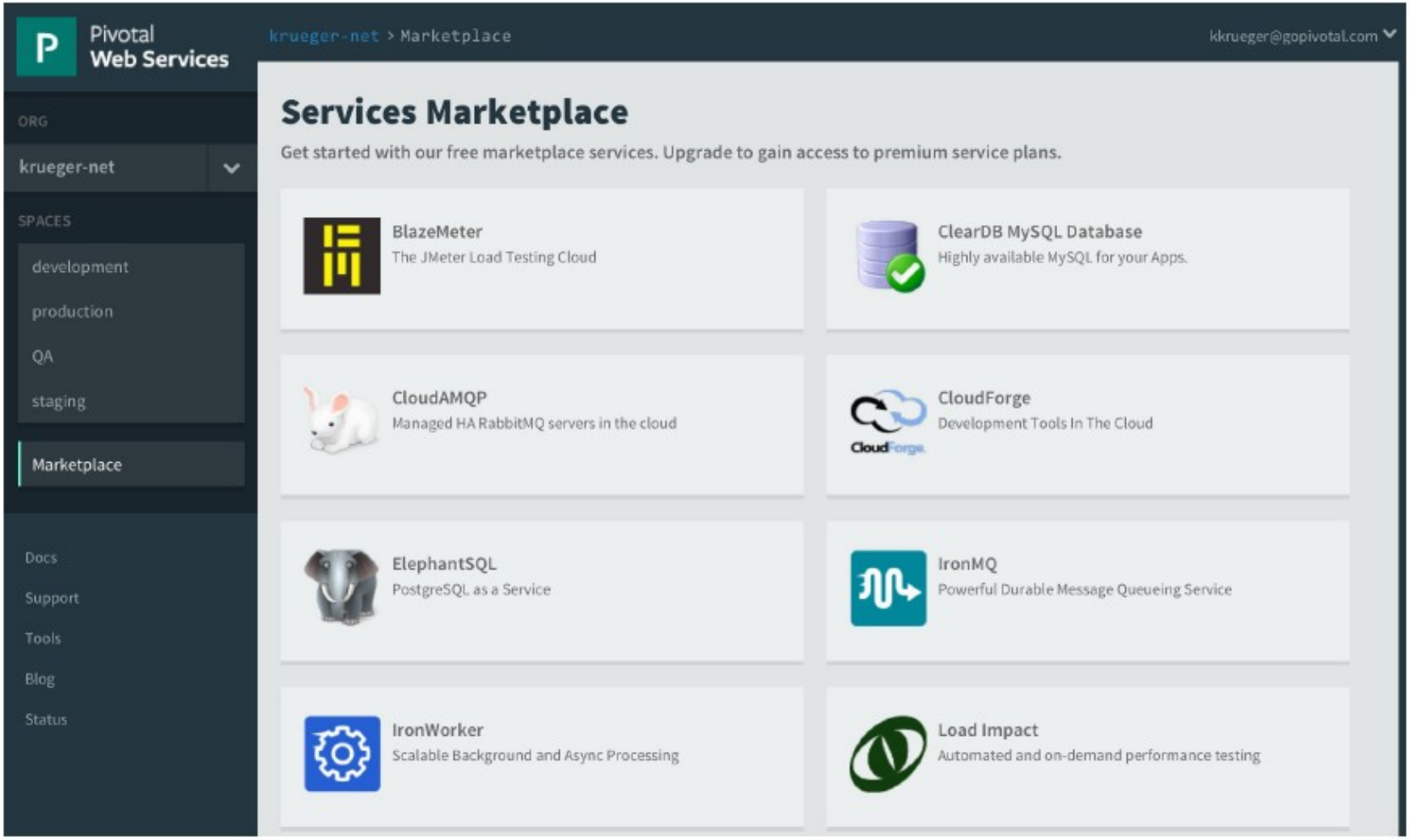
- Single HA cluster deployment of RabbitMQ
  - Runtime service broker integration
    - Instant credential generation, binding to shared RMQ cluster
    - Unique virtual host per binding
  - Is intended for production use

PWS AND APPS DIRECT

Pivotal Web Services (PWS)

- Public Cloud Foundry instance
  - Hosted on AWS
  - Provides extensive marketplace of services via App Direct
    - Some free
    - Some pay-per use
  - Examples
    - Postgres DB, MYSQL, MongoDB, Redis
    - Rabbit MQ
    - Blazemeter monitoring
    - Many, many more …

Marketplace Home Page in App Manager Console



App-Direct

AppDirect

- Commercial provider of services
  - Provide third-party service market
    - Teamed up with well-known providers, like Redis Labs
    - Various plans and fees
  - The provider of services offered by PWS
  - Our company may choose to use App-Direct as well
- Services run by providers
  - For example a Redis instance would run at Redis Labs
  - External to our data-centre
  - Locality issues: performance, connectivity, security, legal

PWS Cloud – Foundry Services

- Marketplace services in PWS offered via App-Direct

http://www.appdirect.com

Running Cloud Foundry On Premise

- All services typically run in our data-centre
  - Many may already exits
    - Databases, message-brokers, mail servers …
  - CF ops decide what services to install and/or make available to applications
- Our company may choose to use third-party services
  - For services it does not wish to manage
  - Cloud-based services such as sales, CRM, payroll
  - And/or a Commercial provider like AppDirect

Using a Public Service

- Services provided for us by our cloud provider
  - For example PWS
  - We have little control over what services are offered
  - Services may not be hosted by cloud provider
- Considerations around service location
  - Network reliability
  - Legal jurisdiction of host servers
  - Security

CREATING AND BINDING SERVICES

Provisioning Services → Service Vs. Service Instance

- Services provision services instances
  - For example
    - ClearDB service provisions MySQL databases.
    - Offers different plans (fees, SLAs)
  - We may get a dedicated server, or share a multi-tenant server

Provisioning – Operator View

- Available services depend on CF setup
  - Must be installed and configured by CF Ops
    - Either via Pivotal CF Operator's Console (*Ops Manager*)
    - Using **cf** CLI
    - Or using the BOSH provisioning tool
- Once Ops have deployed a service to your CF instance
  - It appears in the ***marketplace***
  - Can be made available to our application = **provisioning**

OPERATOR

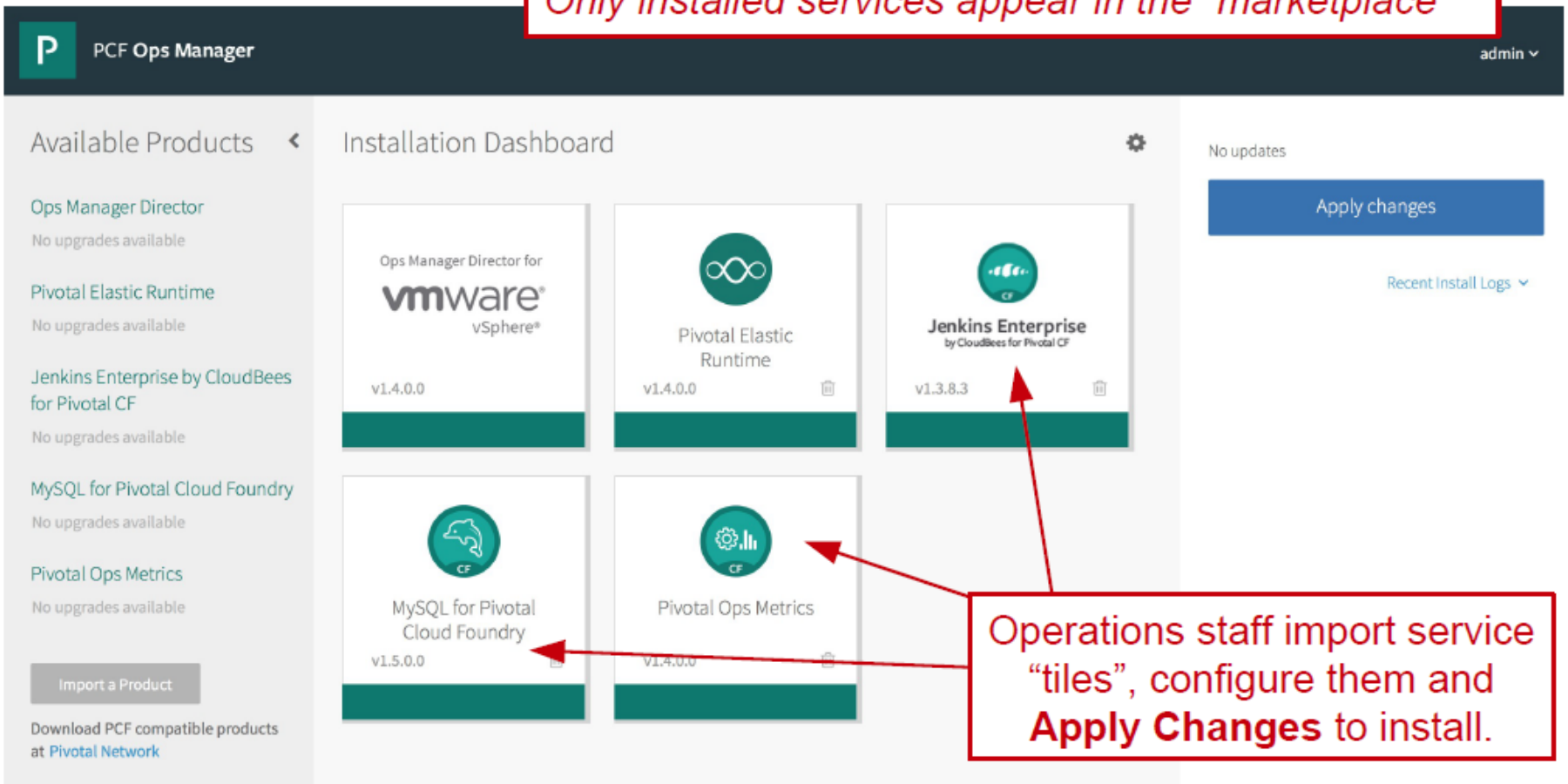
cf create-service-broker

cf enable-service-access

Service “Tiles” in PCF Ops Manager

OPERATOR

Only installed services appear in the “marketplace”



Provisioning – Developer View

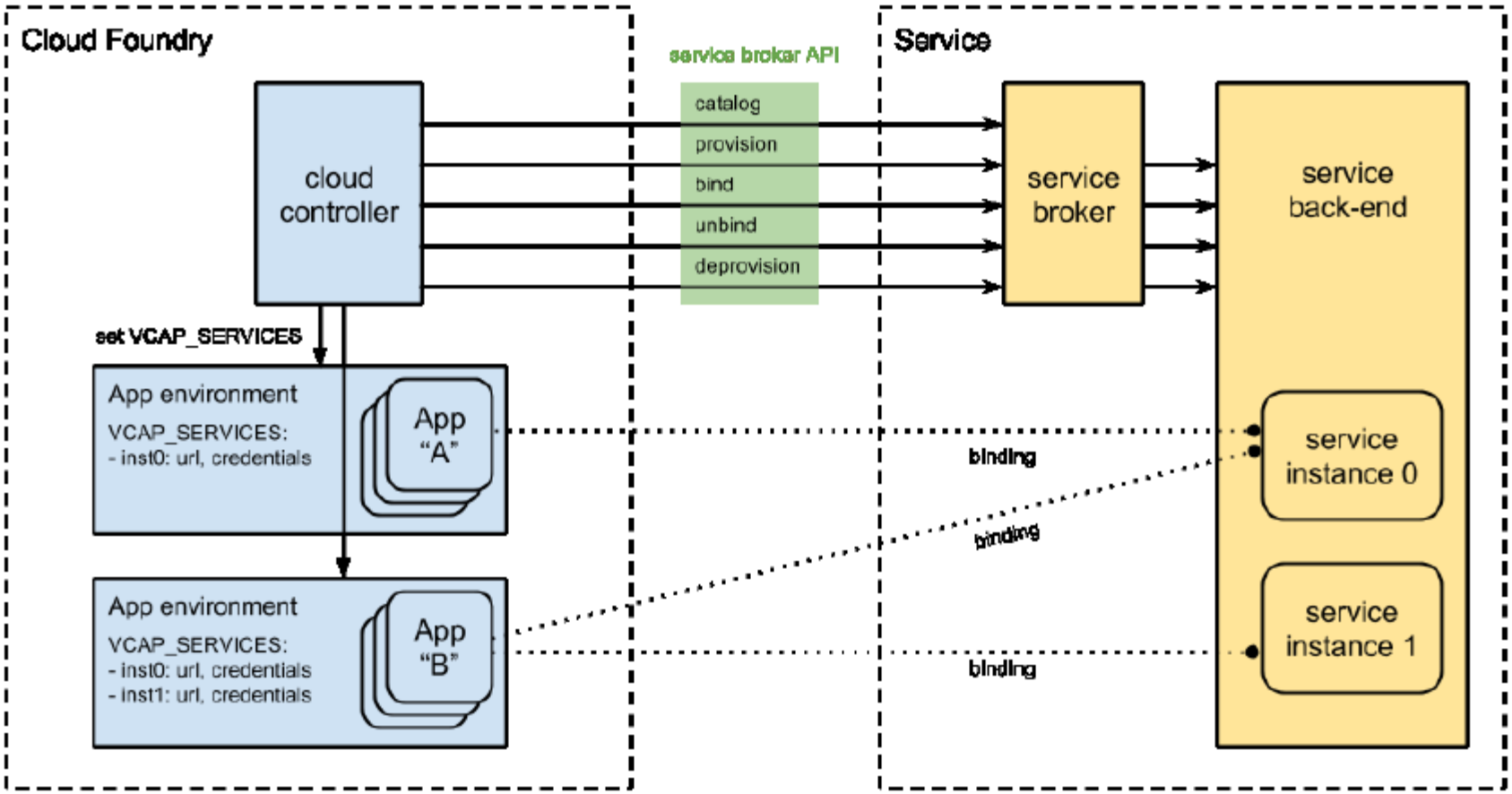
- Only concerned with what a developer has to do
  - Create (provision) a service
  - Bind it to your application

DEVELOPER

cf create <myService>

cf bind <myApp> <myService>

Services Overview – Service Brokers



Creating a Service Instance

- Actually we are Provisioning an instance of a service
  - It must already exist in CF marketplace
- Use App Manager or **cf create-service**
  - Allows selection of service and plan
- Service instance becomes available to current space
  - And any applications running in it
  - For multiple spaces, run **create-service** in each space

Using the CLI

Finding Available Services (*Command Line Interface*)

- Check marketplace for available services
  - Essentially a service catalog

```
example$ cf marketplace
Getting services from marketplace in org pivotaledu / space development as user@domain...
OK

service       plans                                                  description

blazemeter    free-tier, basic1kmr, pro5kmr, pp10kmr, hv40kmr        The JMeter Load Testing Cloud
cleardb       spark, boost, amp, shock                               Highly available MySQL for your Apps
cloudamqp     lemur, tiger, bunny, rabbit, panda                     Managed HA RabbitMQ servers in the cloud
cloudforge    free, standard, pro                                    Development Tools In The Cloud
elephantsql   turtle, panda, hippo, elephant                         PostgreSQL as a Service
ironmq        pro_platinum, pro_gold, large, medium, small, pro_silver   Powerful Durable Message Queueing Service
ironworker    large, pro_gold, pro_platinum, pro_silver, small, medium   Scalable Background and Async Processing
...
```

Finding Existing Service Instances
(*Command Line Interface*)

- List existing services instance
  - In current space

- In this example: one service instance called mysql

```
example$ cf services
Getting services in org pivotaledu / space development as user@domain...
OK

name        service     plan    bound-apps
mydb        cleardb     spark   booking-app-123
```

- Remember, to change spaces
  - **cf target –s [space-name]**

Provisioning a new Service Instance (*Command Line Interface*)

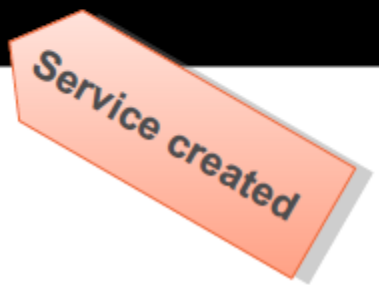
- Provision a new service instance
  - Added to current space
  - Give it a name
  - Choose the correct plan or contract
- Usage
  - **cf create-service [service-name] [plan-name] [instance-name]**

```
example$ cf create-service elephantsql turtle mypg
Creating service mypg in org pivotaledu / space development as user@domain...
OK
```

Finding Existing Service Instances
(*Command Line Interfaces*)

- List service instances again for current space
  - New service instance now appears

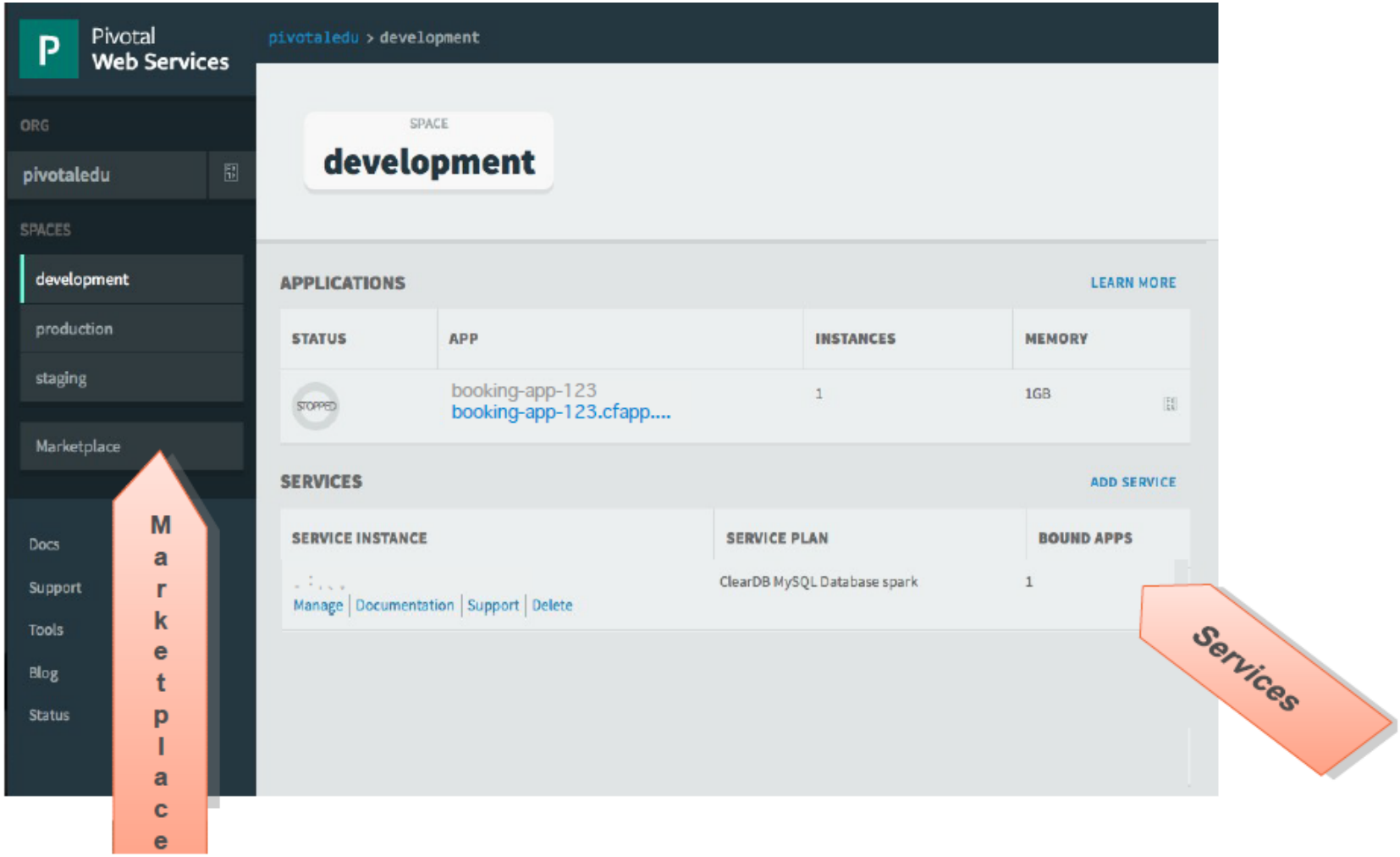
```
example$ cf services
Getting services in org pivotaledu / space development as user@domain...
OK

name        service     plan    bound-apps
mydb        cleardb     spark   booking-app-123
mypg        elephantsql turtle
```



Using the Pivotal CF App Manager Console

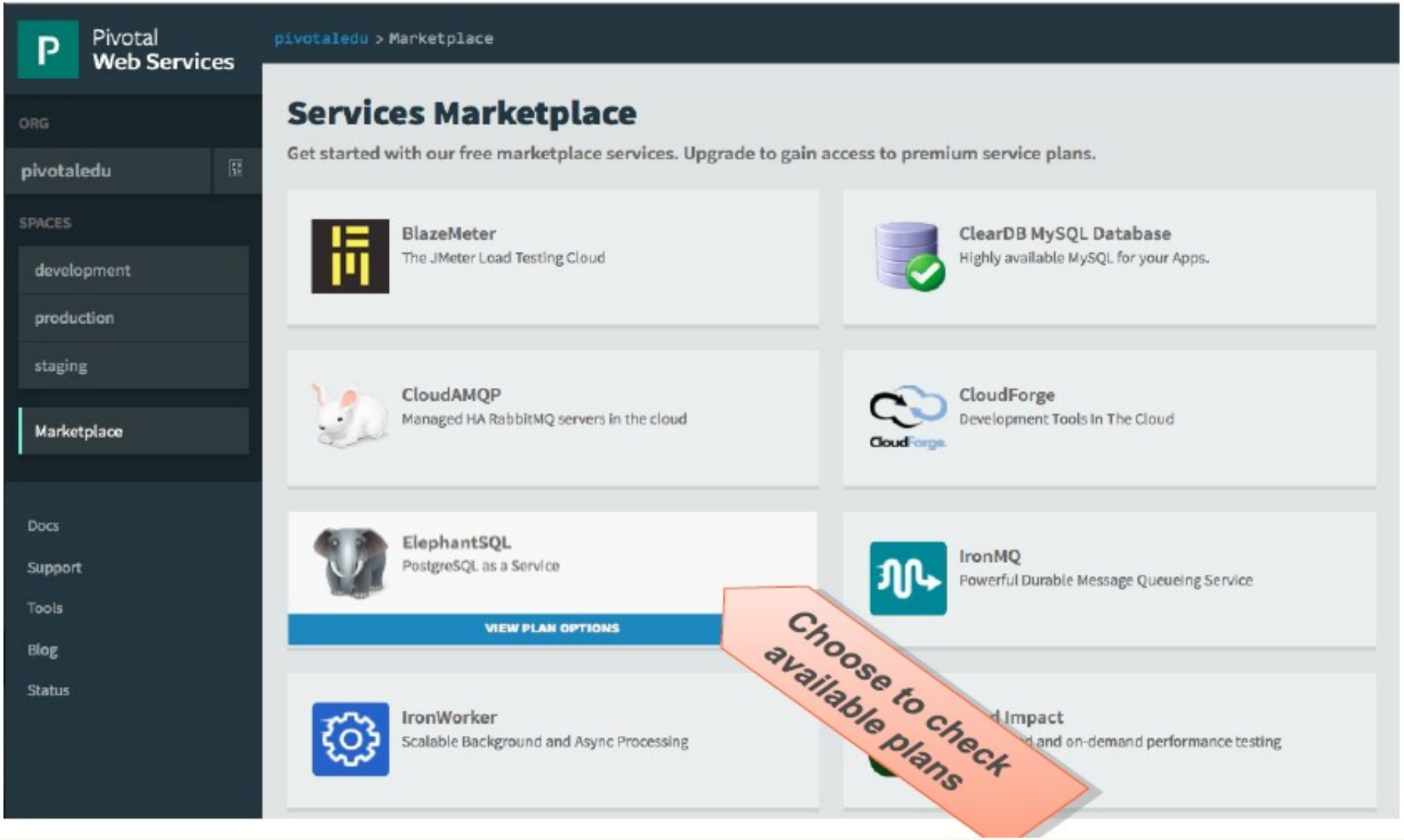
Provisioning Service Instances

GUI

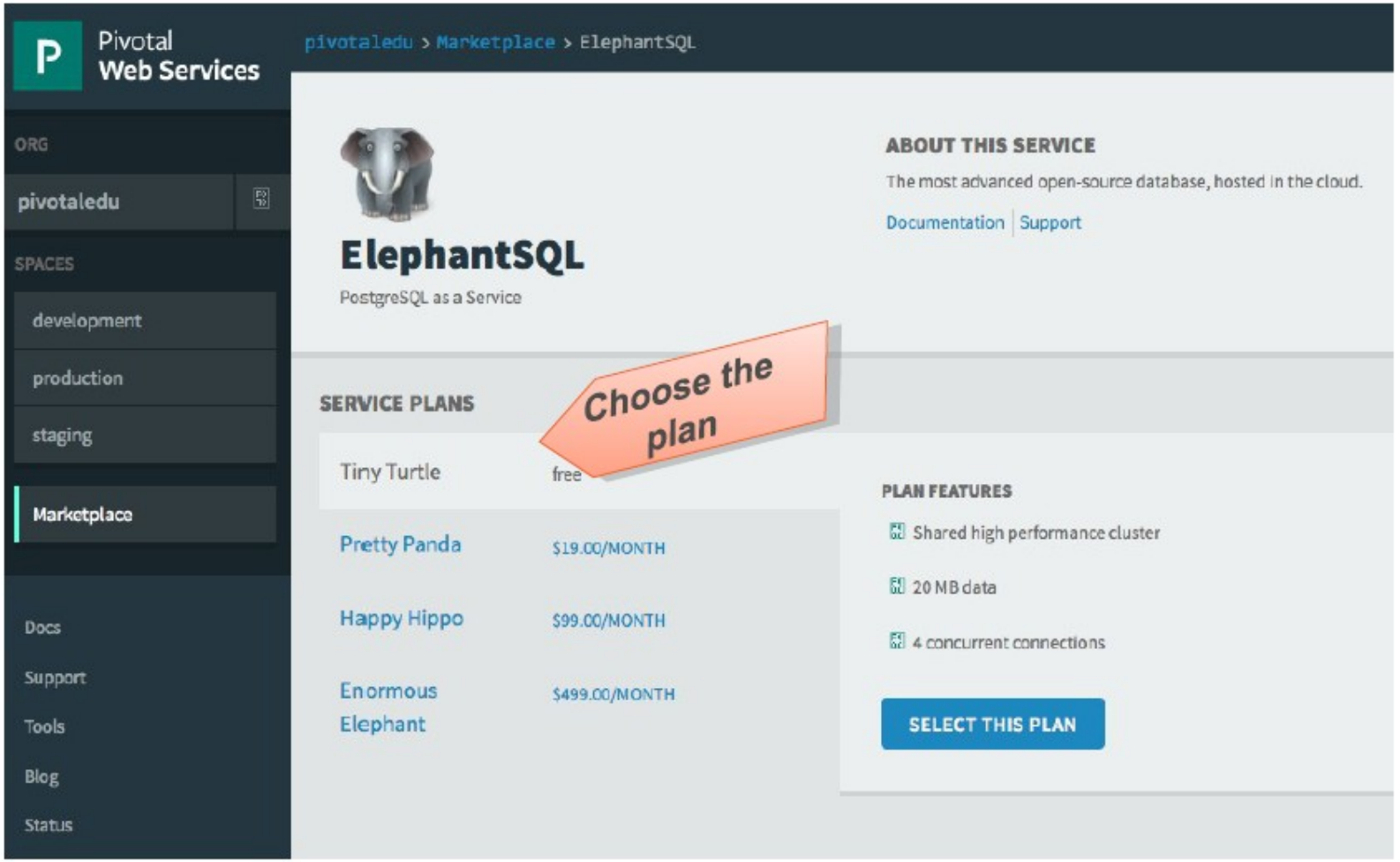


All work described was performed by Capgemini or a Capgemini affiliate

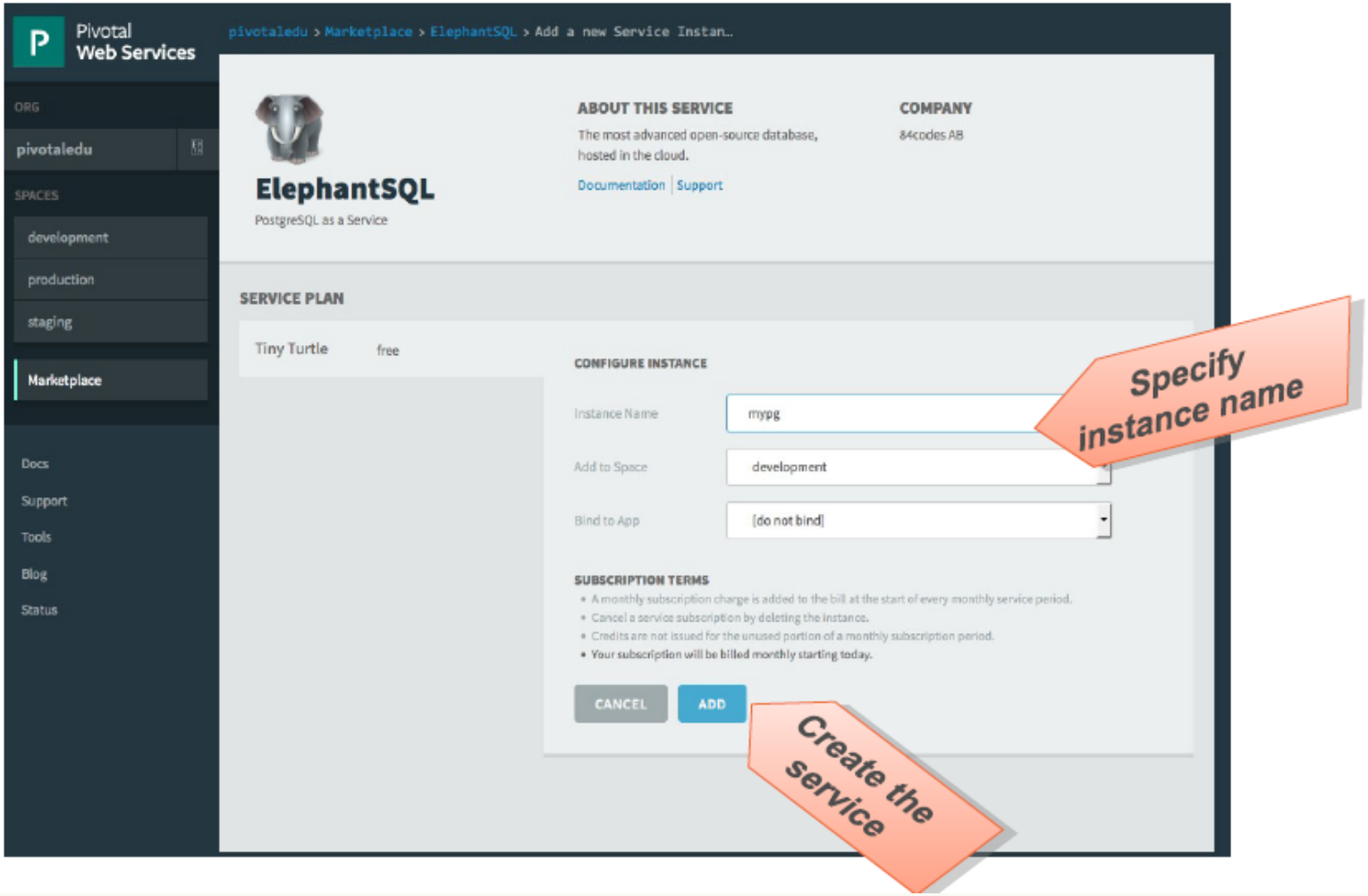
Finding Available Services – (*Service Selection*)



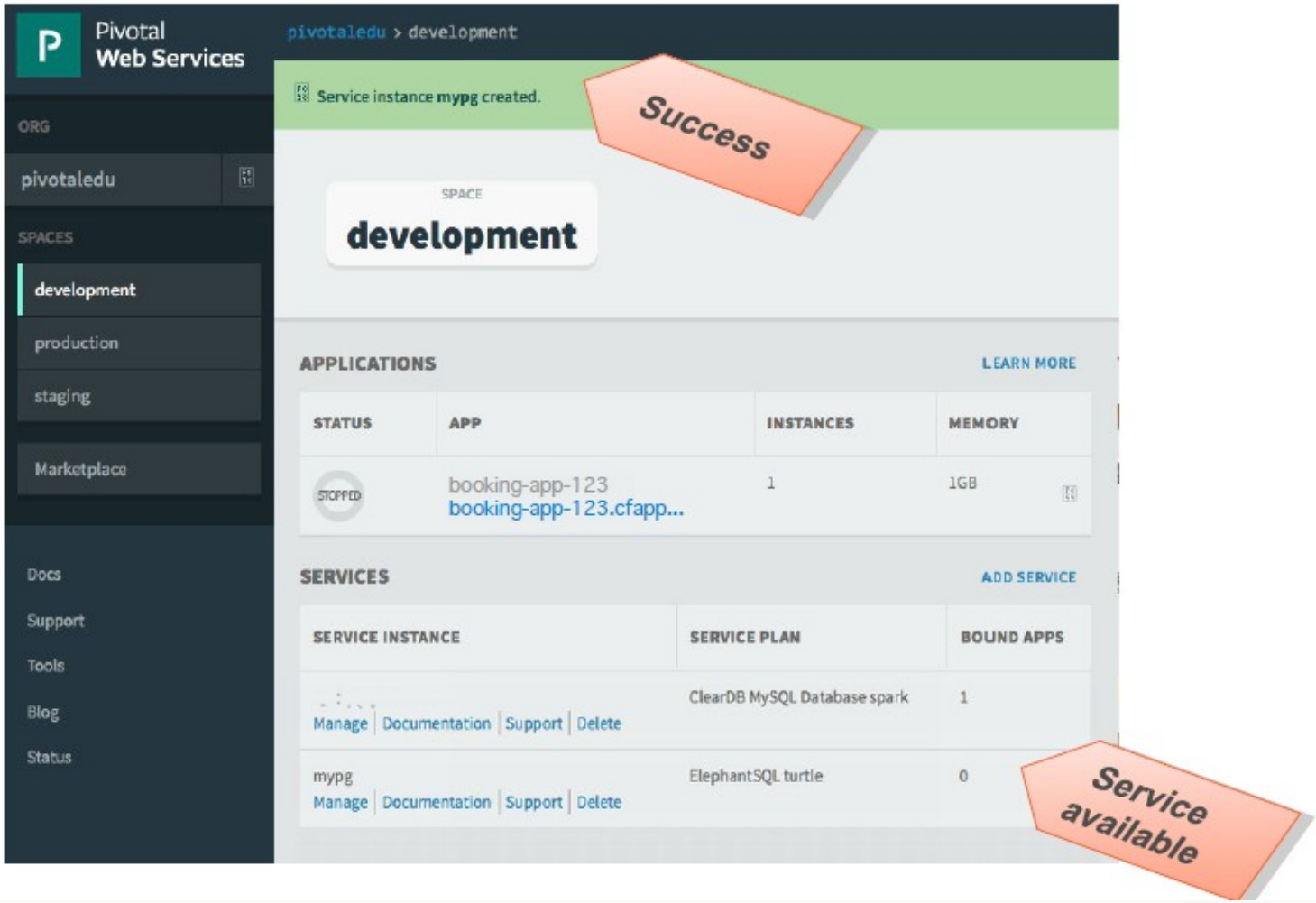
Provisioning a new Service Instance – (*Pick a Plan*)



Provisioning a new Service Instance – (*Provision (create) service*)



Provisioning a new Service Instance – (*Complete*)



Binding to a Service

Accessing Service Instances from an App? (*Traditional way*)

- Traditionally, for an application to access a service instance, connection properties are required
- For example: a database instance
  - Need to know service address / port, credentials
    - Such as a JDBC connection
- May be hard-coded, provided through the environment or a configuration file
- Typically service-specific code is required

Accessing Service Instances from an App?
(*Traditional way*)

- Configuration files

```
development:
  adapter: mysql2
  encoding: utf8
  database: pivotaldb
  username: pivotal
  password: pivotal
  host: myDbHost
  port: 3306
```

Ruby

```
datasource {
    driverClassName = "com.mysql.jdbc.Driver"
    username = "pivotal"
    password = "pivotal"
    url = "jdbc:mysql://myDbHost:3306/pivotaldb"
}
```

Groovy

```
datasource.driverClassName="com.mysql.jdbc.Driver"
datasource.username="pivotal"
datasource.password="pivotal"
datasource.url="jdbc:mysql://myDbHost:3306/pivotaldb"
```

Java

Accessing Service Instances from an App?
(*The CloudFoundry way*)

- In CloudFoundry, you bind the service instance to apps
  - Connection credentials are negotiated / defined for you
  - Application code only needs service name and type/kind
    - Example: a Postgres instance with name "**mypg**"
  - Service details injected into application by CF
    - VCAP_SERVICES
  - Any changes (host/port/credentials) are managed external to the application.

Example VCAP_SERVICES Property

```
VCAP_SERVICES=
{
  cleardb-n/a: [
    {
      name: "cleardb-1",
      label: "cleardb-n/a",
      plan: "spark",
      credentials: {
        name: "ad_c6f4446532610ab",
        hostname: "us-cdbr-east-03.cleardb.com",
        port: "3306",
        username: "b5d435f40dd2b2",
        password: "ebfc00ac",
        uri: "mysql://b5d435f40dd2b2:ebfc00ac@us-cdbr-east-
                          03.cleardb.com:3306/ad_c6f4446532610ab",
        jdbcUrl: "jdbc:mysql://b5d435f40dd2b2:ebfc00ac@us-
                  cdbr-east-03.cleardb.com:3306/ad_c6f4446532610ab"
      }
  ...
```

ClearDB is the MySQL instance offered through App Direct

Using a Service – Cloud Foundry
(*Binding using the CLI*)

- Binding associates an application to a service instance.
  - Use **cf bind-service**
  - Syntax
    - **cf bind-service [app_name] [service_name]**

```
example$ cf bind-service booking-app-456 mypg
Binding service mypg to booking-app-456 in org pivotaledu / space development
as user@domain...
OK
TIP Use 'cf restage' to ensure your env variable changes take effect ← Note
```

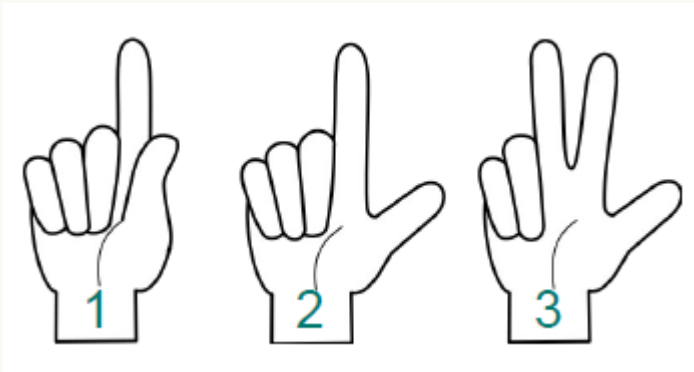

Using a Service – Cloud Foundry
(*Binding using a Manifest*)

- Add a services section to our application in the manifest
  - Example manifest.yml

```
---
applications:
- name: booking-app-456
  memory: 256M
  instances: 2
  host: booking-app-456
  domain: cfapps.io
  path: target/booking-app.war
  # services, one per line
  services:
  - mypg
  - mydb
```

Using a Service – (*The CloudFoundry way*)

- Cloud Foundry provides application with VCAP_SERVICES environment variable
  - Which contains connection details / credentials in JSON.
- How can an application obtain the credentials?
- Three options:
  - Manual
    - Explicit low-level code
  - Custom library
    - Explicit code, higher level interface
  - Auto Configuration
    - CF does it for you



Using a Service – (*Application View*)
1. Manually

- Manual configuration
  - Access VCAP_SERVICES environment variable
  - In our code, parse the JSON (see next slide)
- Very low-level but works in most languages
  - Fall-back option when options 2 and 3 aren't possible

Recall: VCAP_SERVICES Property

```
VCAP_SERVICES=
{
  cleardb-n/a: [
    {
      name: "cleardb-1",
      label: "cleardb-n/a",
      plan: "spark",
      credentials: {
        name: "ad_c6f4446532610ab",
        hostname: "us-cdbr-east-03.cleardb.com",
        port: "3306",
        username: "b5d435f40dd2b2",
        password: "ebfc00ac",
        uri: "mysql://b5d435f40dd2b2:ebfc00ac@us-cdbr-east-
                          03.cleardb.com:3306/ad_c6f4446532610ab",
        jdbcUrl: "jdbc:mysql://b5d435f40dd2b2:ebfc00ac@us-
                  cdbr-east-03.cleardb.com:3306/ad_c6f4446532610ab"
      }
  ...
```

Just a very long string in JSON format

Parse to extract these credentials

Using a Service – (*Application View*)
2. Custom Library

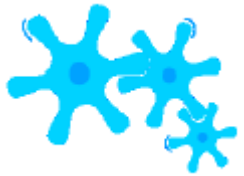
- Avoid manual parsing using a cloud-aware library
  - Cloud foundry aware helper code
    - Language/framework dependent
    - Parses VCAP_SERVICES for us
  - JVM: use Spring Cloud project
  - Node.js: use *cfruntime* object

Derived from VCAP_SERVICES

```
for (ServiceInfo service : cloud.getServiceInfos() ) {
    if (service instanceof MysqlServiceInfo)
        connectionURI = ((MysqlServiceInfo)service).getJdbcUri();
    } ...
```

Java Example

Using a Service – (*Application View*)
3. Auto Configuration



- Cloud Foundry creates the service connection for us
  - Not always supported, depends on:

1. The buildpack
   - Some builpacks support auto-configuration, others do not.
2. The framework
   - Spring, grails, Lift, Rails currently supported.
3. The uniqueness of the service type
   - For example, can auto-configure ONE database connection

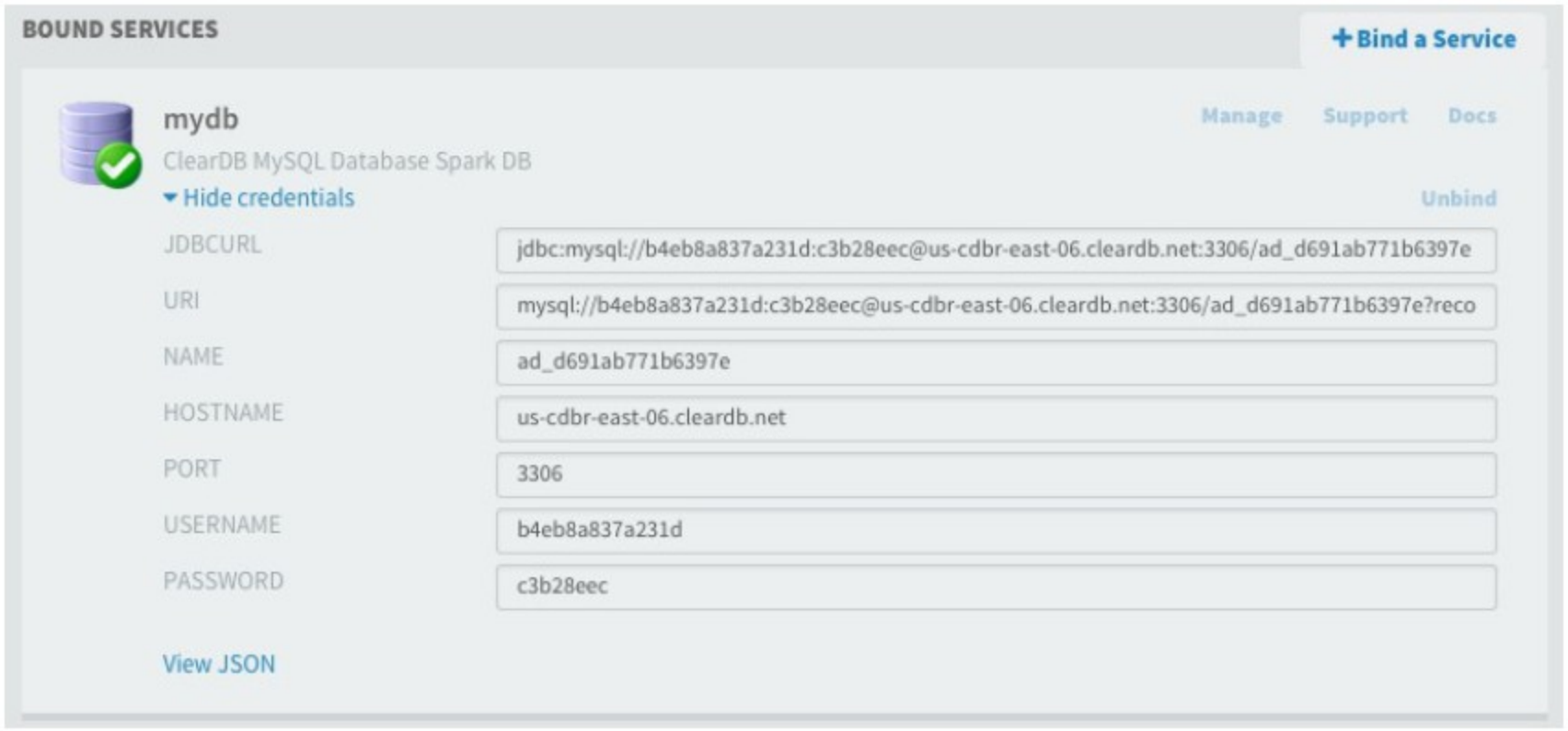
CF doesn't know which is which if there are two or more

Accessing Connection Information

- Recall
  - Connection information once bound is in **VCAP_SERVICES**
  - Every application's environment is logged at startup
- Once application is staged, view connection information using
  - cf env [app-name]
  - Look for **VCAP_SERVICES** in the output

Accessing Connection Information -2

- Connection information also available via App manager:



User Provided Services

User Provided Service Instances

- User-provided service instances are service instances
  - Already provisioned outside of **C**loud **F**oundry
  - Behave like other service instances once created
  - Are little more than predefined configurations
    - A “mock” service for providing credentials
- When bound they provide service instance configuration (including credentials) to applications
  - Avoids hard coding service instance endpoints

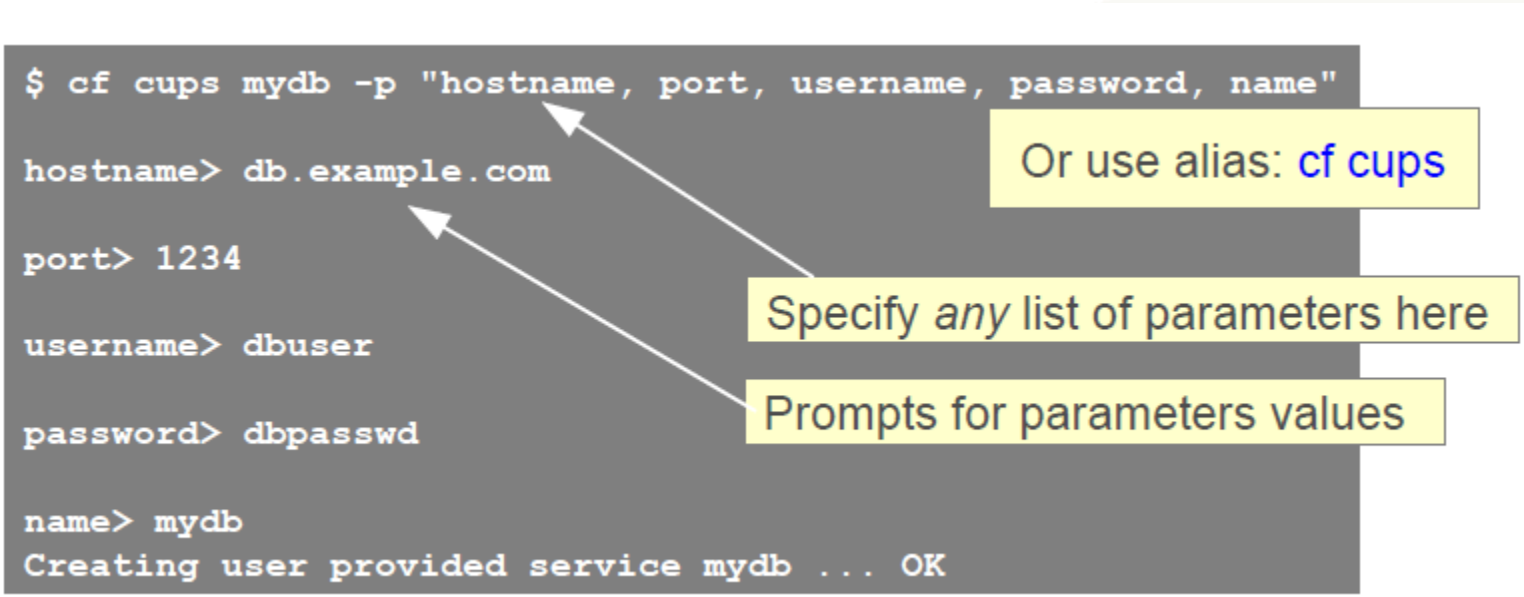
http://docs.cloudfoundry.org/devguide/services/user-provided.html

Use Cases
User Provided Service Instances

- These are typically legacy or existing instances of a service (databases, queues, email, etc)
  - Applications connect to the same instance
    - With CF services, applications get different instances
  - Typically used with CF on-premise
    - Easy integration of your CF PaaS with our existing systems
- Credentials passing used to inject the same credential set into each applicaiton

Defining User Provided Services - 1

- Use **cf create-user-provided-service** command
  - Provide name and parameters/credentials
  - All applications bound to same instance in same way



Defining User Provided Services - 2

- Or define within application's manifest.yml

```
---
applications:
- name: spring-music
  memory: 512M
  instances: 1
  host: spring-music
  domain: cfapps.io
  path: build/libs/spring-music.war
  services:
    mydb:
      label: user-provided
      credentials:
        uri: postgres://dbuser:dbpass@db.example.com:1234/dbname
        username: pivotal
        password: pivotal
```

User Provided Services - Accessing

- Bound service properties available in **VCAP_SERVICES environment variable**
- In our code
  - Access variable
  - Parse JSON
  - Use to connect

```
{
  user-provided: [
    {
      name: "mydb",
      label: "user-provided",
      tags: [ ],
      credentials: {
        hostname: "db.example.com",
        port: "1234",
        username: "dbuser",
        password: "dbpasswd",
        name: "mydb"
      }
    }
  ]
}
```

Example: Application with Multiple Services

```
VCAP_SERVICES: {
  "rediscloud": [
   {
    "credentials": {
      "hostname": "redisvr...com",
      "password": "wU974wucDT45Jc",
      "port": "19016"
    },
    "label": "rediscloud",
    "name": "session-replication",
    "plan": "25mb",
    "tags": [
     "Data Stores",
     "Cloud Databases",
     "Developer Tools",
     "Data Store",
     "key-value",
     "redis"
    ]
   }
  ],
```

```
"user-provided": [
   {
    "credentials": {
     "uri": "http://review.cfapps.io"
    },
    "label": "user-provided",
    "name": "reviews",
    "syslog_drain_url": "",
    "tags": []
   },
   {
    "credentials": {
     "uri": "http://products.cfapps.io"
    },
    "label": "user-provided",
    "name": "products",
    "syslog_drain_url": "",
    "tags": []
   }
  ]
 }
```


Recap

Services

CF Service

accessing Service

VCAP_SERVICE

access

User Defined Service

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