([Link to Video](http://youtube.com/watch?v=O3qFjXuxdUY))

## Keynote at re:Invent 2017

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([link to video](https://www.youtube.com/watch?v=36-CSQOBhWU))

## In order of precedence, follow these steps:

### **1) Software as a Service (SaaS)**

If SaaS is available and the business can adapt, use a SaaS platform.

Examples include Salesforce CRM, Ariba, Concur.

### **2) Platform as a Service (PaaS)**

If SaaS is not workable, use a Platform as a Service solution.

Standards are:

* Heroku
* Force.com
* AWS managed services (RDS, S3, Lambda, EKS etc)

### **3) Infrastructure as a Service (IaaS)**

If SaaS or PaaS does not work for the solution, then Infrastructure as a Service is the option.

We have two solutions as of Jan 2018:

* AWS (commercial cloud)
* OneCloud (on-prem)

### **Additional Information**

Additional elements to the strategy:

* Our current commercial cloud standard is AWS. We will focus all our efforts on making this work well in 2018.
* Eventually we will have a second commercial cloud provider. This will be determined prior to 2020 for rollout in 2021.

This same strategy also applies to more detailed [AWS Architectural Guidance](https://wiki.comp.pge.com/display/EA/AWS+Architectural+Guidance) and solutions designed within commercial cloud providers.

## Drivers

* Affordability
* Disruption
* Opportunity

## Context

* The Affordability Strategies include the [The Ingenium Project (formerly known as Technology Architecture Simplification)](https://wiki.comp.pge.com/pages/viewpage.action?pageId=48287907) strategy.
* Within that strategy is where the Cloud Strategy is delivered.

## Business Case

### **Cost Benefit Overview**

This video is an introduction to the cost benefits of the commercial cloud.

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([Link to Video](http://youtube.com/watch?v=DvdnJT7IU-Y))

### **High-Level Business Case**

In the first part of 2017 a [Cloud Business Case 2017](https://wiki.comp.pge.com/display/EA/Cloud+Business+Case+2017) was conducted. The approach was to test if the migration to cloud has value. We determined that by shifting all workload to the cloud and exiting as many Datacenters as possible we can save $75M-$125M. This is using a basic Lift-and-Shift model. If we replatform the applications using modern architecture we can save even more. This effort to replatform offsets the immediate benefits, but has has much higher benefits over time.

#### **Benefits Areas**

* Real Estate
* Power, Cooling
* Over-provisioning (systems are right-sized)
* Administration
* Licensing
* Opportunity costs
* Cost reductions offered through economies of scale

## "Why Not Cloud?" aka Cloud First 2018

* Starting in 2018 any new projects will be asked to do a [Cloud Solution Assessment](https://wiki.comp.pge.com/display/EA/CSA-000+Cloud+Solution+Assessment+Process).
* A portfolio review of Applications is scheduled for Q4 2017 and will end in Q1 2018.
* The Legacy Datacenters will start consolidation and shut down
* Policy and financial models are included in the 2020 GRC
* API & Data mandate will enforce a loose-coupling, bounded context architecture allowing for systems to decouple using APIs.

### **Order of Precendent**

1. Software as a Service
   * Examples include Salesforce, Ariba, Concur
2. Platform as a Service
   * Examples include Force.com, Heroku, AWS managed services (RDS, EKS, S3, Lambda, etc)
3. Infrastructure as a Service
   * Examples include AWS, OneCloud

### **Rules of the Road**

The Guideposts used for Affordability Strategy #10 - Technology Architecture Simplification.

# Guideposts for Technology Architecture Simplification and Cloud Strategy

These are the guiding principles PG&E will follow for the Cloud Transformation. Disagree? Have a different perspective? Want to discuss more? Please contact me or leave a comment.

### **A) AUTOMATE EVERYTHING**

* Leave the undifferentiated heavy lifting to the cloud providers.
* Where unable to automate, track processes using solutions with workflow triggers.
* Use automation for optionality (moving between cloud solutions / vendors), system recovery, and SDLC process.
* Use SDLC best practices (code repo, pipelines, test driven development, CD/CD etc) to manage automation.

### **B) SECURE CONNECTIVITY & LEAST PRIVILEGE EVERYWHERE**

* Bake security compliance into the technology
* Access to just and only what is needed
* TLS-SSL all things
* Encrypt data at rest when needed and where possible
* Follow cloud best practices to maintain separation of concerns for data access (e.g. PCI compliance, PII data, HIPPA regulations, etc)

### **C) ARCHITECT & DESIGN FOR GRACEFUL RECOVERY**

* Build to gracefully adapt to failures. Use queue mechanisms, data caching and other distributed computing principles to gracefully detect and recover from:
  + Network disconnection
  + Service failure and component malfunction
  + Data synchronization errors
* Use constant failure injection testing *in all environments* to increase reliability.

### **D) API-only APPLICATION ARCHITECTURE (aka Loosely Coupled with Bounded Context of Data)**

* All teams will henceforth expose their data and functionality through service interfaces (APIs).
* Teams must communicate with each other through these interfaces.
* There will be no other form of inter-process communication allowed: no direct linking, no direct reads of another team's data store, no shared-memory model, no back-doors whatsoever. The only communication allowed is via service interface calls over the network.
* The technology used doesn't matter. HTTP, Pubsub, custom protocols -- doesn't matter.
* All service interfaces, without exception, must be designed from the ground up to be externalizable. That is to say, the team must plan and design to be able to expose the interface to the outside world. No exceptions.

### **E) CLOUD & PLATFORM PROVIDER SOLUTIONS FIRST**

* If there is a choice between a cloud or platform provider-based service and a 3rd party licensed product, evaluate the capabilities using this criteria: functionality, automation abilities, security, maturity, and cost.
* Only if there are discernible gaps with the cloud or platform provided service, look to 3rd party solutions.
* Where concerned about cloud-platform lock-in, use automation capabilities (e.g. Infrastructure as Code solutions) to establish optionality between cloud providers.

### **F) LOG ALL THINGS**

* Ensure auditability, replay and telemetry data collection.
* Integrate with common services, such as Security Event & Incident Mgmt (SEIM) and System Monitoring.
* Use logging data as a feedback mechanism (eg A/B testing).

### **Roadmap**

* All new things will be evaluated for Cloud starting in 2018.
* Consolidate and exit the Legacy Datacenters.
* Embrace Open Source solutions.
* Enforce the API & Data Mandate.
* Retire Applications.

### **Risks and Opportunities**

|  |  |  |  |
| --- | --- | --- | --- |
| **#** | **Risk / Opportunity / Concern** | **Notes / Mitigations** |  |
| 1 | Culture and mindset shift and embracing the change - it does not map in to the heritage of Enterprises. Space and time to re-skill and a learning culture is recommended. | Created the [Cloud Certification Mentorship](https://wiki.comp.pge.com/display/EA/Cloud+Learning+Resources) program. |  |
| 2 | Shifting the operating model from capital (on premise) to expense (off premise + migration) along with associated cost to achieve | This is a long-term strategy that will pay dividends once completed. The power, flexibility and costs the cloud services offers is exponentially greater than on-prem services. |  |
| 3 | Contextualizing this Strategy within the larger company (establishing services that are a competitive advantage for the company) | There are many efforts running in parallel. These efforts are on a timeline. The cloud timeline may not match. How to cross-connect the capabilities. |  |
| 4 | Up-front Investments is significant and will yield long-term benefits as well as prepares the company for opportunities resulting from disruption |  |  |
| 5 | Increased complexity and cost before simplification and savings |  |  |
| 6 | Commitment to the long-term timeframe (7-11 years) needed to fully exit legacy datacenters and systems to achieve benefits |  |  |
| 7 | Enterprise-wide support required for this to be successful |  |  |
| 8 | Key affordability initiatives require cloud solutions (Digital Catalyst, RPA, Customer of the Future) |  |  |
| 9 | CPUC policy changes required to address financial model | 2020 GRC Policy Change. |  |
| 10 | ~~Missing overall Cyber representative has created blockage and crossed wires.~~ | Solved 10/20/2017 - Snay will represent |  |
| 11 | ~~Missing overall BT representative has created crossed wires.~~ | Rajesh Arora joined 10/30/2017 |  |
| 12 | Strategic nature of this program goes against the current S2 prioritization process | Working with Ken La Honta and Darren McKean on ways to track and capture projects associated with AR10-TAS. |  |
| 13 | Identify clear Leadership role. |  |  |
| 14 | Need for Program Manager to oversee the program inter-dependencies. | Swati is interim Program Mgr. Seeking a full-time person. |  |
| 15 | Salesforce Platform CEO is focused on Customer Care only. Opportunity: establish a COE for the Salesforce suite of solutions that spans the Enterprise (force.com, Heroku, etc) | Vishi is taking on cross-Salesforce COE responsibility. |  |
| 16 | Platform Architecture is a gap. | Laiq is working to address this gap within the EA&DI team. |  |
| 17 | Cloud Architecture role and skills are not visible. | Ashok is the Cloud Architect on the Cloud Enablement team. |  |
| 18 | API + Data Mandate is at risk of scaling to meet all the needs. Reference Architectures / Implementations are needed to jump start teams. |  |  |
| 19 | Current topic is "Shutting down Fairfield" when better phrasing is "Existing Legacy Datacenters" |  |  |
| 20 |  |  |  |

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# Guiding Principals for AWS Solution Design

**What to Choose?**

AWS has a massive offering of services across multiple domains - often with multiple services providing similar functionality. How do I decide which ones to use?

As of 2020, Amazon Web Services consists of over 175 services. While this awesome Lego set provides a massive set of building blocks across compute, storage, networking, security, analytics, monitoring, and management. While that provides great flexibility – it can also be overwhelming, providing so much optionality and novel services that builders may not know which services to chose - and why. A natural inclination is to 'go with what we know' / services that are familiar to us.

This document aims to guide high-level guiding principles for the selection and assembly of AWS components and services into Cloud-Native solutions. It is important to note that these are *guiding* *principles* - not hard and fast **rules** - as we will review below. That said, product teams should 'start at the top' and do some detailed exploration (one of the great value propositions of the commercial cloud is the ease of which services are assembled / composed / evaluated, without significant up-front investment).

# Core Principles

The principles guiding our service selection and resulting designs mirrors our overall technology strategy. Revisiting that concept - our order of preference is as follows:

* SaaS (Software-as-a-Service): PG&E has no commitment, obligation nor responsibility for the underlying technology (Example: Concur)
* PaaS (Platform-as-a-Service): Higher-order / managed 'platform' (Example: Heroku, Pivotal Cloud Foundry)
* IaaS (Infrastructure-as-a-Service): Lowest-common denominator. Virtual Machines and all the responsibilities they bring with them. (Example: OneCloud)

This same 'order of preference' also directly applies to that massive catalog of AWS services. Just as above, the goal is to offload **undifferentiated heavy lifting** - allowing PG&E employees to focus on developing solutions and delivering value to our customers. Applying this concept to the categories of AWS Services:

* Serverless (Example: Lambda)
* PaaS (Example: DynamoDB)
* Managed Services (Example: Relational Database Service)
* IaaS (Example: EC2)

While there may be situations and requirements which will drive to specific solutions - every attempt and exploration should be conducted to leverage services from the top of this list whenever possible. The reasons behind this range from management responsibility, cost, complexity and security - which we will explore and expand in the following review:

## Serverless

The term 'serverless' is a bit confusing: Clearly, there are still CPUs, storage and network elements executing code or storing data – however, the concept of a 'server': a collection of these resources, with an associated **operating system** which must be maintained and managed – is abstracted away, and we, as builders, just invoke or leverage the 'service' - which no awareness, visibility, or *responsibility* for tasks associated with traditional servers. This includes monitoring, upgrading, patching, vulnerability management and remediation. The quintessential example of Serverless, within the AWS commercial cloud, is the Lambda service - which is a 'Funtion-as-a-Service'. Just provide the code you want executed, a few runtime details - and AWS takes care of the rest. A good example of a solution built exclusively using serverless technologies is the [Cloud Mentorship App](https://mentorship.ss.pge.com/) - whose architecture diagram can be found [here](https://mentorship.ss.pge.com/assets/CMA-Architecture.pdf). Another such example is the Cloud COE [S3 Website Hosting Pipeline](https://wiki.comp.pge.com/display/CCE/S3+Web%3A+Website+Hosting+Pipeline) product ([architecture diagram](https://wiki.comp.pge.com/pages/viewpageattachments.action?pageId=49952670&preview=/49952670/49957977/aws-cfn-s3web.png)), which delivers a turnkey, pipelined web application hosting and delivery infrastructure, all without a single 'server'. A large number of AWS' services fall into this category - from S3 to Lambda to DynanoDB to the Simple Queue Service (SQS) and many more - and we should reach for such services **first**, providing functional capabilities *without* up-front investment or ongoing management and administration.

## Platform-as-a-Service

While the best fit for what folks often consider Platform-as-a-Service within AWS service offerings might be Elastic Beanstalk. This is a fairly Heroku-like service where builders just specify what components they want - but don't need to worry about the provisioning and maintenance of the underlying resources. We don't necessarily promote its use = particularly for production environments - but it can offer a low-friction introduction to the AWS ecosystem. Another example would be the Amazon SageMaker service: a one-stop shop for machine learning supporting everything from Jupyter notebooks to data labeling and classification to pre-built algorithms implementing a wide variety of AI models and techniques. Underlying infrastructure is largely abstracted away.

## Managed Services

In managed services, there **are** still servers, and we even need to be aware of them. A perfect example is Amazon's Relational Database Service, or RDS. We are required to identify and instantiate database servers in various regions, availability zones and subnets, and define their relationships (multi-master, read replica, failover, etc) – once provisioned, the 'care and feeding' of these services is provided by AWS. They manage and perform upgrades (with customer control over both major and minor releases) as well as patching, hardware monitoring and maintenance, etc. This pulls us a bit deeper into the operations of the infrastructure - but still offloads a good deal of the heavy lifting, including vulnerability management.

## Infrastructure-as-a-Service

The lowest-common-denominator, and the service most familiar to IT Practitioners. These are 'virtual machines' - or full-fledged operating systems with all the management and operational responsibilities that come along with them. In AWS, this is the Elastic Compute Cloud, or EC2. Here, traditional VMs ('instances') are provisioned in specific regions, availability zones, and Virtual Private Clouds (VPCs) to perform whatever role is necessary: Web server, application server, database server, queue or batch processing, etc. While there are several cloud-native tools that streamline their management, these instances require all the care-and-feeding of our on-prem virtual machines, including monitoring, patching, vulnerability management, designing for availability, etc. Even within this 'last option', there are still cloud-native differentiators that should be explored and understood: Auto-scaling groups, treating servers as 'cattle not pets' (killing / respawning them when problems are encountered), and the aforementioned management tools (Systems Manager, Patch Manager, Compliance, etc)

# Summary

The commercial cloud provides entirely new techniques and methodologies for developing 12-factor, cloud-native solutions which offer scalability, reliability, resilience and security not possible in existing, on-prem solutions. These services 'abstract away' and offload underlying infrastructure and activities like server administration (monitoring, patching, vulnerability management, ...). This allows our most valuable asset - our employees - to focus on higher-order business problems and delivering value to our customers. In an ideal world, our employees are valued as our most important resource, and we optimize to make the **best** use of their time performing value-adding work that delivers value to our business. This is not likely 'managing Linux servers' or 'upgrading Oracle databases'. There are additional guiding principles around the use of open-source tooling, minimizing our reliance on proprietary and licensed software - as well as more subtle application architecture guidance around loosely-coupled, distributed apps composed of microservices. This page aims to address the topic of which AWS services deliver the highest value with the lowest obligation to ongoing operational responsibilities and technical debt.

# [Introduction](https://wiki.comp.pge.com/display/EA/Introduction)

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# Cloud Strategy Introduction

The Cloud Strategy will define direction and approach for the adoption and deployment of private, hybrid, and commercial cloud services. The Cloud Strategy will support PG&E’s goals to provide safe, reliable, and affordable services.

The Cloud Strategy will establish the governance policies, practices, and procedures to deliver safe and secure services in our private, hybrid, and commercial cloud deployments. Ensuring we establish security controls, technology and processes, to protect our data and critical IT services.

The Cloud Strategy will implement policies, practices, procedures, and technology to deliver consistent and reliable private, hybrid, and commercial cloud services. Establishing the framework to define the service level agreements between our Line of Business clients and our private, hybrid, and commercial cloud IT services.

The Cloud Strategy will establish the financial and contractual controls to ensure the we are providing affordable Cost effective IT services.

While the maturity of our private OneCloud service capabilities is ever increasing. The number and maturity of the commercial cloud services is growing at an even greater rate. For PG&E to leverage these commercial cloud service offerings we need to establish the governance framework and reference architectures to consistently, securely, reliably deliver private, hybrid, and commercial cloud services.

# Cloud Business Drivers

There are three main business drivers to the Cloud Strategy:

**Time to Market** – the capability of provisioning infrastructure and services quickly.

* Provisioning a server in an IaaS model in minutes versus days
* Developing new cloud native code and application

**Agility** – the capability of adopting and delivering new services quickly

* The flexibility in leveraging cloud resources for scalability and business continuity
* Quickly utilizing “new” technologies to meet new and changing business demand, such as data analytics.

**Cost** – Lowering overall development and operating cost of information technology to the business

* Project delivery – ability to provide IT services quickly on-time and under budget.
* Operational costs associated with managing and supporting IT environments, such as private datacenters, older server, and older storage subsystem.

# Cloud Problem Statement

* Escalating costs for PG&E to build, operate and maintain IT Systems.
* Commercial Cloud solutions are, with proper architecture, more secure and run at lower cost.
* Modern architecture solutions (DevOps) allow for quality deployments in days versus months (or years).
* Companies with Digital DNA are disrupting industries. Incumbent companies that embrace Digital DNA are thriving.
* Desire of PG&E to thrive during this disruptive time.
* Unlock PG&E’s data that is trapped within systems using loose coupling and APIs.
* Reduce cost to operate Enterprise Systems.
* Reduce or eliminate datacenter costs.
* Enable Digital Utility transformation.
* Eliminate redundant systems.
* Faster delivery of features.
* Increased quality of software delivery.

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# [Cloud Charter, Goals and Outcomes](https://wiki.comp.pge.com/display/EA/Cloud+Charter%2C+Goals+and+Outcomes)

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# Cloud Charter, Goals and Outcomes

* Enable Modern application architecture that powers the Digital Utility transformation through rapid, high quality software-driven solutions with elastic scale, resilience and security.
* Lower the cost of solutions by leveraging the commercial cloud (1/3 - 1/5 the current cost, assuming proper architecture) and exit datacenter real estate.
* Strike a balanced approach to ongoing technology lifecycle investment versus leveraging commercial-cloud capabilities that mostly eliminate the need for lifecycle.
* Establish a loosely-coupled data exchange between systems using APIs to allow us to capitalize on our data as an asset.
* Enable feature deployments within days versus the current timelines of months to years, increasing the agility of PG&E’s core solutions.
* Develop secure, highly resilient solutions that can run on-prem or in the commercial cloud, depending on requirements of the solution
* Unlock business opportunities with our Telecom Network by separating Network assets from Datacenters.

# [Cloud Approach](https://wiki.comp.pge.com/display/EA/Cloud+Approach)

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# Cloud Approach

* If it is a system that operates the grid, it stays on-prem. (i.e. If the system directly controls grid assets, it stays on-prem)
* If it is an analytical system, it moves to the commercial cloud.
* If it is an Enterprise / Backoffice system, it moves to the commercial cloud.
* We exit as many datacenters as possible, moving critical systems to Control Centers. (We invest in Control Center resilience and security.)
* We lower costs and unlock speed & innovation using a combination of commercial cloud and DevOps.
* Leverage other efforts, such as Grid Modernization, to re-home, consolidate and rationalize the Operational Technology architecture (SCADA, OSI PI, ADMS etc).
* Simplify OEM / Strategic Vendors to optimize costs (12-18 months) - target Storage, Computing, Telephony, Networking equipment.
* Analyze contracts for simplification / reduction and associated execution costs (will require adjustment or investment).
* Adopt a stateless architecture (aka Cloud Native) approach to application development.  
    
  [More on the Cloud Approach](https://wiki.comp.pge.com/display/VA/Cloud+Approach)

# Cloud Approach

This a summary of the Cloud Approach (which will inform the Cloud Strategy).

## Policies and Governance

Establish clear policy and governance over the use of commercial cloud solutions (SaaS, PaaS and IaaS)

* + Govern through ARB, SRB, and IT Portfolio

## Align Capabilities

Enable reusability and affordability by aligning capabilities of in-flight and in-the-ground efforts that run on strategic platforms.

Examples of the strategic platforms include:

1. Salesforce / Heroku (SaaS and PaaS) - note that Heroku runs on AWS and Salesforce is migrating the AWS
2. Pivotal Cloud Foundry (PaaS) - Runs on-prem as well as AWS, Azure and Google commercial clouds
3. AWS Native (IaaS) - Azure and/or Google will be in the mix too, depending on need / cost

Examples of the in-flight and in-the-ground work include:

1. CBITS - Cross boar inspection tracking system (Gas Sewer Inspection) using Salesforce / Heroku (SaaS and PaaS)
2. Environmental Agency Services - tracking the ecological impact of PG&E construction using Salesforce (SaaS and PaaS)
3. Customer E-Rebate Platform using Salesforce / Heroku (SaaS and PaaS)
4. Customer Rate Analysis - AWS Native running SAS / Hadoop as a managed service
5. EPIC Cloud - a potential Sandbox environment to use for EPIC / R&D efforts
6. Gas Operations Situational Awareness - Microsoft Dynamics
7. Office 365 - SaaS on Microsoft Azure
8. DERMS - using GE Predix which is based on Pivotal Cloud Foundry (PaaS)
9. STAR and other Analytics efforts aligned to ARAD (analytics platform)
10. Mobile applications running on MRAD (mobile platform)

Examples of capabilities to align (not comprehensive):

* Identity and Access Mgmt
* Connectivity
* DevOps (Monitoring, Configuration Mgmt, Release, Deployment Pipelines, etc)
* Data Integration
* API Discovery and Management
* Database Services
* Elastic Scale & Cost Optimization
* Asynchronous and Synchronous Message Processing
* Big Data / BI / Machine Learning / Streaming Analytics

## Skills

Leverage partners to address up-leveling our skills. Start with in-flight and in-the-ground efforts.

## Business Case

Produce a business case that articulates the value of leveraging commercial cloud. This business case will include

1. Provide lower-cost options to traditional licensed software using Open Source alternatives.
2. Provide elastic scale that can reduce our IaaS costs by 40-50% (based on rough numbers).
3. Increase flexibility by reducing overhead to deploy - addressing opportunity costs.
4. Increase speed by introducing test-driven development, code pipelines and automated deployment using the Twelve Factor Cloud Native principals.
5. Increase availability through distributed computing principals (e.g. anti-fragile) and active testing of the systems’ safety margins.

## Time Line (Rough Sketch):

### **2016 - Discovery Phase 1**

* Vanguard Cloud Native work (Modern Application Architecture)
* OneCloud evolution

### **2017 - Cloud Alternative**

* Business Case + Strategy + Roadmap
* Hybrid IaaS and PaaS for EPIC Cloud
* Salesforce and Heroku Foundations
* Hybrid PaaS for ARAD and MRAD
* Office 365

### **2018 - Cloud First (Phase 1)**

* Any new infrastructure deployed in commercial cloud
* Greenfield and Brownfield applications use the commercial cloud

### **2018 - Cloud First (Phase 2)**

* Datacenter Migration starts

### **2025 - Cloud Only (Datacenter)**

* Placeholder

## Introduce Cloud Policy legislation in the 2020 GRC

* Allow cost recovery of commercial cloud solutions (i.e. allow us to treat commercial cloud costs the same as capital investments)

## Datacenter Exit by YYYY

Establish a goal of exiting our Data Centers by {2025} (date to be adjusted based on Business Case)

* Continue to invest in owning / operating our Operations Centers that run Grid technology / Industrial Control Systems (SCADA etc)

## Risks to this Approach and Strategy

* Addressing the Financial Model constraints of the Utility Industry (citation: recent [NARUC Advice on Cloud Computing](http://pubs.naruc.org/pub/4FDD6D6B-F303-DE7B-5B46-7B25C04E6317))
* Acknowledging organization structure and culture constraints (citation: ThoughtWorks article [Demystifying Conway’s Law](https://www.thoughtworks.com/insights/blog/demystifying-conways-law))
* Enabling the shift to Product-management (citation: DevOps Culture, Design-centric product management)
* Incubation and up-leveling of internal skills
* Overcoming Change resistance / disruption and migration fatigue
* Establishing corporate-scale partnerships to accelerate cloud adoption
* Shifting Utility-centric software vendors to adopt cloud-native solutions
* Making available, supporting and evolving implementations of reference architecture

## References

* Netflix as a front-runner example of most things Cloud Native
* Target as an example of leveraging a PaaS for Digital transformation
* GE as an example of embracing a cloud-native platform
* [18F](https://18f.gsa.gov/) as an example of a large, heavily regulated environment leveraging Cloud solutions (IaaS, PaaS, Open Source) and a Design-centric approach
* Gartner research on Cloud strategies (recent citation: All paths lead to PaaS)
* Numerous examples on Software Engineering Daily Podcast
* Hands-on experience starting work and running reference applications in the commercial cloud

# [Cloud Assumptions](https://wiki.comp.pge.com/display/EA/Cloud+Assumptions)

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# Cloud Assumptions

* To achieve the significant savings, this has to be an Enterprise initiative because of the cross-organization impact.
* Sufficient Investment is available to make this happen. This includes establishing the foundation, application changes and migration.
* The business will support the shift to the Commercial Cloud.
* Organizational changes required to embrace DevOps will happen.
* The cost to operate and level of complexity will increase before simplifying.
* The company will commit to the long-term (7-9 year) journey so IT can fully exit legacy systems.
* We will get approval from the PUC for increased expense and/or ability to capitalize strategic Commercial Cloud investments.
* Strategic Control Centers (operational centers) are in: Vacaville, Rocklin, Concord, Fresno, Bishop Ranch and San Ramon
* These Control Centers represent both Electric and Gas. They oversee Transmission and Distribution.
* Security capabilities that meet the Utility’s needs are available via Commercial Cloud providers at the required levels of maturity.
* DevOps is primarily focused on speed and quality. What emerges from a DevOps Culture are cost savings due to exponential productivity improvements.
* Microservices is primarily focused on agility and scale. A requirement for Microservices is a DevOps Culture.

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* Created by [Nichols, John](https://wiki.comp.pge.com/display/~JWNb), last modified on [Jan 30, 2018](https://wiki.comp.pge.com/pages/diffpagesbyversion.action?pageId=48288621&selectedPageVersions=9&selectedPageVersions=10), [viewed 44 times](https://wiki.comp.pge.com/page-tracking/page-view-detail.action?pageId=48288621&spaceKey=EA)

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## Migration Methodologies

(Adapted from [Gartner's 5-R's of Cloud](http://www.gartner.com/newsroom/id/1684114) and the [AWS Cloud Migration Methodology](https://aws.amazon.com/cloud-migration/))

### **Replace / Retire ("Archive, Shutdown")**

Replacing is to discard an existing application (or set of applications) and either use commercial software delivered as a service (SaaS) or migrating the capabilities to an already existing platform within the Enterprise. This option avoids investment in mobilizing a development team when requirements for a business function change quickly. Disadvantages can include inconsistent data semantics, data access issues, and vendor lock-in.

### **Rehost ("Lift and Shift")**

Pick up the application and move it to the commercial cloud.

Rehosting is the act of redeploy applications to a different hardware environment and change the application’s infrastructure configuration. Also known as "lift and shift," rehosting an application without making changes to its architecture can provide a fast cloud migration solution. However, the primary advantage of IaaS, that - teams can migrate systems quickly, without modifying their architecture – can be its primary disadvantage as benefits from the cloud characteristics of the infrastructure, such as scalability, will be missed.

The Cloud Providers offer different methods to do this, including automated discovery solutions, Database migration and "Virtual" to "Cloud" server migration.

### **Replatform ("Lift, tinker and shift")**

Make changes to the application to take advantage of commercial cloud solutions.

Replatforming includes different options:

* Run applications on a cloud provider’s infrastructure. The primary advantage is blending familiarity with innovation as “backward-compatible” PaaS means developers can reuse languages, frameworks, and containers they have invested in, thus leveraging code the organization considers strategic. Disadvantages include missing capabilities, transitive risk, and framework lock-in. With opinionated PaaS offerings, the capabilities developers depend on with existing platforms may require adapting to the PaaS offerings.
* Modifying or extending the existing code base to support legacy modernization requirements, then use rehost or refactor options to deploy to cloud. This option allows organizations to optimize the application to leverage the cloud characteristics of providers' infrastructure. The downside is that kicking off a (possibly major) development project will require upfront expenses to mobilize a development team. Depending on the scale of the revision, revise is the option likely to take most time to deliver its capabilities.

If you take on the Replatform option, using the Rehosting tools to make the initial transition is a good place to start. Once the systems and data are in the cloud, the solutions are easier to migrate to the managed solutions, such as [AWS RDS](https://wiki.comp.pge.com/display/EA/AWS+Series+04+-+RDS%2C+Aurora%2C+DynamoDB).

### **Rearchitect / Refactor**

* Change the application to be "Cloud Native" using the [12 factor app](https://wiki.comp.pge.com/display/VA/Cloud+Native) principles to re-write the applications.
* Add / update APIs to use [domain driven design and bounded context](https://wiki.comp.pge.com/display/EA/Additional+Reading+for+Bounded+Context).
* Rebuild the solution on PaaS, discard code for an existing application and re-architect the application.
  + Although rebuilding requires losing the familiarity of existing code and frameworks, the advantage of rebuilding an application is access to innovative features in the provider's platform. They improve developer productivity, such as tools that allow application templates and data models to be customized, metadata-driven engines, and communities that supply pre-built components. However, lock-in is the primary disadvantage so if the provider makes a pricing or technical change that the consumer cannot accept, breaches service level agreements (SLAs), or fails, the consumer is forced to switch, potentially abandoning some or all of its application assets.
* Take advantage of autoscaling and elastic resources to keep costs contained.

This method takes the longest time as it often requires rewriting the application using new or different technologies. The value of this methodology is usually the highest since the modern application architecture allows for dynamic scaling, stateless integration and self-provisioning solutions.

### **Repurchase**

* Move to a different product - this likely means your organization is willing to change the existing licensing model you have been using. For workloads that can easily be upgraded to newer versions, this strategy might allow a feature set upgrade and smoother implementation.

## Considerations for Migration

* Unsupported architecture platforms.
  + For example, IBM AIX architecture is not supported by the primary cloud providers (AWS, Google, Microsoft). IBM supports it, but a healthy amount of investigation is required before migration.
* Legacy Operating System / Legacy Software versions.
  + Often commercial cloud providers will not support running unsupported operating system versions due to security vulnerabilities.
  + The same goes for unsupported software packages.
* Tight coupling / integrations / inter-dependencies.
  + If a system is tightly coupled with another system, then both may need to migrate to cloud solutions at the same time. this tight coupling creates timeline tension and cutover anxiety.
  + In some cases it will be better to create loose coupling (separate the systems) using [domain driven design with bounded contexts](https://wiki.comp.pge.com/display/EA/Additional+Reading+for+Bounded+Context).

## Reasons for Migration

These are the three main migration methodologies. The other methods are variations on these themes.

|  |  |  |  |
| --- | --- | --- | --- |
| **Method** | **Timing** | **Benefit** | **Why** |
| **Replace / Retire** | Depends | Depends | Exit the solution. Free up resources to focus on other things. Simplify the landscape. |
| **Rehost** | Fastest | Lowest benefit of the migration options | Get to the new environment as fast as possible. Refactor / rearchitect after the migration. |
| **Rearchitect / Refactor** | Slowest | Highest benefit of the migration options | Lots of change happening with the system. Business need to make frequent releases. Fast evolution of the solution stack. |

## Cloud Migration Targets (in order of precedence)

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This is an update as of Jan 2018 describing the Cloud Strategy.

### **SaaS**

Software as a Service. Highest cost savings opportunities of 20-60% (where it fits the business need). Lead with this to create headroom for other Cloud migration activities. Examples include Ariba, Concur and Salesforce.

### **PaaS**

Platform as a Service. The most powerful solution for app-dev as much of the heavy-lifting is baked into the platform (logging, security, pipelines, etc). This has the largest payoff and the highest up-front investment. Examples of this are Pivotal Cloud Foundry and Salesforce Heroku.

### **IaaS**

Infrastructure as a Service. Relatively simple to do. 20-30% cost savings. Adds flexibility, scale and efficiencies once in the cloud. Do this if in a hurry. Examples include Amazon Web Services, Google Cloud and Microsoft Azure.

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* Created by [Nichols, John](https://wiki.comp.pge.com/display/~JWNb), last modified on [Oct 09, 2018](https://wiki.comp.pge.com/pages/diffpagesbyversion.action?pageId=48292105&selectedPageVersions=8&selectedPageVersions=9), [viewed 33 times](https://wiki.comp.pge.com/page-tracking/page-view-detail.action?pageId=48292105&spaceKey=EA)

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# Cloud Current State (Q3-2018) - Cloud Center of Excellence

The Cloud COE has formed and is aligned along several products. The Cloud COE is using AWS principles, including 2-pizza teams, loose coupling, customer obsession and working backwards (aka Future Press Release).

# Cloud COE Current State

## Cloud Products

[Link to corresponding PowerPoint on Teams](https://pge.sharepoint.com/:p:/r/sites/CloudPlatform/Shared%20Documents/General/Cloud%20COE%20Services%20and%20Structure.pptx?d=w92e8eae64ff74a98821f452445990f42&csf=1&e=19QL43)

Product Lifecycle Indicators... click to expand

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | | | |  |
| [***CI/CD Pipeline***](https://wiki.comp.pge.com/display/CCE/CICD+Pipeline) [Shah, Piyushkumar](https://wiki.comp.pge.com/display/~PTS6) | [**API Platform**](https://wiki.comp.pge.com/display/CCE/API+Platform) [Hansen, Michael](https://wiki.comp.pge.com/display/~MEHs) | [**Functions (Lambda)**](https://wiki.comp.pge.com/display/CCE/Lambda) [Hansen, Michael](https://wiki.comp.pge.com/display/~MEHs) | [**Managed Access**](https://wiki.comp.pge.com/display/CCE/Managed+Access) [Green, Jason](https://wiki.comp.pge.com/display/~J9Ge) |
| [***Datastore (RDS, S3)***](https://wiki.comp.pge.com/display/CCE/Datastores) [Leung, Simon](https://wiki.comp.pge.com/display/~SCLF) | [**Federated Cloud Identity**](https://wiki.comp.pge.com/display/CCE/Federated+Cloud+Identity) [Corgiat, Stephen](https://wiki.comp.pge.com/display/~SPCI) | [***Hosting - Windows***](https://wiki.comp.pge.com/pages/viewpage.action?pageId=49962554) [Varadhan, Ashok](https://wiki.comp.pge.com/display/~MJDo) | [***Hosting - Linux***](https://wiki.comp.pge.com/pages/viewpage.action?pageId=49962554) [Varadhan, Ashok](https://wiki.comp.pge.com/display/~A2VB) |
| [**Datastore (DynamoDB)**](https://wiki.comp.pge.com/display/CCE/Datastores) [Leung, Simon](https://wiki.comp.pge.com/display/~SCLF) | [**Container Services**](https://wiki.comp.pge.com/display/CCE/Container+Services) **(make white)** | [**Static Websites (S3web)**](https://wiki.comp.pge.com/display/CCE/S3+Web%3A+Website+Hosting+Pipeline) [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) | [**Logging Central**](https://wiki.comp.pge.com/display/CCE/Logging+Central) [Ravipati, Madhav](https://wiki.comp.pge.com/display/~m2ru) |
| [**Datastore (Redshift)**](https://wiki.comp.pge.com/display/CCE/Datastores) [Leung, Simon](https://wiki.comp.pge.com/display/~SCLF) | **Application Migration** | **Data Streaming** |  |
|  | | | |
| [**AWS Landing Zone**](https://wiki.comp.pge.com/display/CCE/AWS+Landing+Zone) [Avendano, Ryan](https://wiki.comp.pge.com/display/~MEHs) | | | |
| [***Transit VPC***](https://wiki.comp.pge.com/pages/viewpage.action?pageId=49962567) ***v1 & v2*** [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp) |  |  | [**Cloud Networking (Direct Connect)**](https://wiki.comp.pge.com/display/CCE/Cloud+Networking+and+Direct+Connect)  [Stanley, John](https://wiki.comp.pge.com/display/~JFSV) |
|  | | | |

Product Lifecycle Indicators... click to expand

## Overview of Product and Service Definition

Cloud Products have a simple characteristic that sets it apart from a service offered by the Cloud Platform:

***SELF SERVICE***

All Cloud Services that are part of the Cloud Platform have these characteristics:

* Secure by default
* Supported
* Repeatable
* Consumption and demand is tracked

#### **Product Lifecycle**

#### **Overview**

The Products, Services and Runbooks have a common lifecycle. These are the stages.

#### **Detail of the Cloud Lifecycle Stages**

|  |  |  |
| --- | --- | --- |
| **Stage** | **Description** | **Characteristics and Exit Criteria** |
| **Concept** | The earliest stage. Use hypothesis to measure / test the business value or feasibility. | Use the PR-FAQ (press release & FAQ) process to describe the product / service.  At least one Buyer of this service has been identified. |
| **Development** | Construction process. This includes the non-functional elements, such as security, availability, reliability, definitions and measures. | Refine the PR-FAQ. Confirm the characteristics with the Buyer(s). |
| **Preview** | Minimum Viable Product.  Not ready for scaling. Often manual steps required  Needs refinement of with direct customers. | The earliest releasable version.  May require hand-holding or manual steps.  Open to any group willing to help guide the direction / test and invest the time to assist. |
| ***Pilot*** | Refined version that is repeatable. Need more input before scaling.  Can be a Product (e.g. Self Service). | Open to any group willing to be self-sufficient.  Cloud COE will support in partnership with the customer/consumer. |
| **General Availability** | Ready to scale. | Scalable.  Auto-provisioned or Self Service. |
| **~~Decommission~~** | Sunset and exiting of the Service / Product. |  |

## Product List

This is a list of our products and the associated status

[New Cloud Product](https://wiki.comp.pge.com/?templateId=50429994&spaceKey=CCE&newSpaceKey=CCE)

|  |
| --- |
| **Cloud Product** |
| No content found. |

(this table is generated using the ccoe-product or cloudcoe-services labels)

See [Cloud COE Products - Standards and Guidelines](https://wiki.comp.pge.com/display/CCE/Cloud+COE+Products+-+Standards+and+Guidelines) for how to create, manage and publish these services

## Cloud COE Product Roadmaps

|  |  |
| --- | --- |
| **Name** | **Status** |
| [API Platform - Press Release & Roadmap](https://wiki.comp.pge.com/pages/viewpage.action?pageId=50858894) | **IN DEV** |
| [AWS Landing Zone Product Roadmap](https://wiki.comp.pge.com/display/CCE/AWS+Landing+Zone+Product+Roadmap) | **PILOT** |
| [CICD (Continuous Integration and Deployment) Roadmap](https://wiki.comp.pge.com/display/CCE/CICD+%28Continuous+Integration+and+Deployment%29+Roadmap) | **READY** |
| [Datastore Roadmap](https://wiki.comp.pge.com/display/CCE/Datastore+Roadmap) | **IN DEV** |
| [Federated Cloud Identity Roadmap](https://wiki.comp.pge.com/display/CCE/Federated+Cloud+Identity+Roadmap) | **IN DEV** |
| [Heroku PostgreSQL](https://wiki.comp.pge.com/display/CCE/Heroku+PostgreSQL) | **IN DEV** |
| [Hosting: Linux - Product Lifecycle Roadmap](https://wiki.comp.pge.com/display/CCE/Hosting%3A+Linux+-+Product+Lifecycle+Roadmap) | **IN DEV** |
| [Hosting: Windows on AWS - Product Lifecycle Roadmap](https://wiki.comp.pge.com/display/CCE/Hosting%3A+Windows+on+AWS+-+Product+Lifecycle+Roadmap) | **IN DEV** |
| [Logging Central Roadmap](https://wiki.comp.pge.com/display/CCE/Logging+Central+Roadmap) | **IN DEV** |
| [S3 Web Feature Backlog](https://wiki.comp.pge.com/display/CCE/S3+Web+Feature+Backlog) | **READY** |

(this table is populated using the "cloud-services-roadmap" label)

## Key Links & How-tos

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* Created by [Nichols, John](https://wiki.comp.pge.com/display/~JWNb), last modified on [Oct 09, 2018](https://wiki.comp.pge.com/pages/diffpagesbyversion.action?pageId=48292117&selectedPageVersions=8&selectedPageVersions=9), [viewed 23 times](https://wiki.comp.pge.com/page-tracking/page-view-detail.action?pageId=48292117&spaceKey=EA)

[Go to start of metadata](https://wiki.comp.pge.com/display/EA/AWS+Current+State#page-metadata-start)

## Cloud Products and Services

## Overview

This document details the Cloud COE Product and Service Standards for documentation and code repositories.

* [Lifecycle Status](https://wiki.comp.pge.com/display/EA/AWS+Current+State#AWSCurrentState-lifecycle)
* [Runbooks](https://wiki.comp.pge.com/display/EA/AWS+Current+State#AWSCurrentState-runbooks)
* [Wiki Publication](https://wiki.comp.pge.com/display/EA/AWS+Current+State#AWSCurrentState-wiki)
* [Github / Code Repos](https://wiki.comp.pge.com/display/EA/AWS+Current+State#AWSCurrentState-github)

### **Cloud Product Lifecycle Status**

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| **General Availability** | Ready to scale. | Scalable.  Auto-provisioned or Self Service. |
| **~~Decommission~~** | Sunset and exiting of the Service / Product. |  |

### **Cloud Product Runbooks**

### **Wiki Publication**

The [Cloud COE Services](https://wiki.comp.pge.com/display/CCE/AWS+Cloud+Product+Offerings) are published on the Wiki. The current format of service is a table detailing:

* + Product or Service
  + Status
  + Description

This table is constructed using the *Page Header Template*. New Product or Services can be created using the "New Service Template" found on the service page.

[Create new Cloud COE Product or Service](https://wiki.comp.pge.com/?templateId=50429994&spaceKey=CCE&newSpaceKey=CCE)

Use the "View in Hierarchy" feature of any new pages to move to the corresponding service.

Each Cloud Product or Service is comprised of a Wiki Page that has at least the following sections:

* + Service Page Header (this is used to construct the table of services)
  + Service Overview
  + Getting Started
  + Support and Assistance
  + FAQs and Troubleshooting

The Page will be tagged with "**cloud-coe-service**" and "ccoe-product" these tag is used to construct the Product Table.

#### **Status**

In the top portion of the Service, please indicate the status of this service using the Confluence "Status" macro.

See the [Cloud Lifecycle Stages](https://wiki.comp.pge.com/display/CCE/Cloud+Lifecycle+Stages) for valid status entries.

#### **Service Overview**

Include a description of the service, any examples of how to use the service (and when not to use the service), and diagrams of the service architecture.

#### **Getting Started**

[Create new Getting Started Page](https://wiki.comp.pge.com/?templateId=50430050&spaceKey=CCE&newSpaceKey=CCE)

Each Cloud Product will have a Getting Started page that includes any step-by-step instructions on how to use the service. This can link to the README.md file in the Code Repo if that is a better source.

Please indicate any requirements, expertise level etc. when putting this together.

The key is to create something that works and can be leveraged. Follow the mantra "simple things simply" when constructing.

These instructions will be displayed on the **Cloud COE** [**Getting Started with AWS Commercial Cloud - old**](https://wiki.comp.pge.com/display/CCE/Getting+Started+with+AWS+Commercial+Cloud+-+old) page.

##### **Here are instructions on the Getting Started Framework**

#### **Product or Service Roadmap**

Create a sub-page of the service called "SERVICE\_NAME Roadmap" using the [New Product or Service Roadmap](https://wiki.comp.pge.com/?templateId=50429995&spaceKey=CCE&newSpaceKey=CCE&title=SERVICE_NAME+Roadmap) template.

* + - note: if you create a roadmap from this page, you'll need to move it to the appropriate service after the fact.

#### **Support and Assistance**

Three areas are required for support and assistance:

* + - ChatOps - how to contact someone using MS-Teams. The standard is to create a corresponding service channel in the [Cloud Platform](https://teams.microsoft.com/l/team/19%3a96b9dda0f00544259edfecba3db39326%40thread.skype/conversations?groupId=93c1a6b0-9862-455b-a4dc-fd0a962e99ba&tenantId=44ae661a-ece6-41aa-bc96-7c2c85a08941) team.
    - Urgent / Escalations - what to do when requiring urgent support.
    - Contributing - how to contribute, provide feedback, make suggestions. The standard is to use Github Issues for this.

#### **FAQs and Troubleshooting**

Use this section as a place to list frequently asked questions and troubleshooting steps. You can maintain this list on the Wiki page or externalize it, based on the service team's preference.

### **Github / Code Repo**

##### **Examples of these files are maintained in GitHub under the** [**cloudcoe-standards**](https://github.com/pgetech/cloudcoe-standards) **project.**

The Github repo is used to maintain any code required for creating / maintaining the service.

These are the required files:

|  |  |
| --- | --- |
| **File name (links to the template version on Github)** | **Description** |
| [README.md](https://github.com/pgetech/cloudcoe-standards/blob/master/README.md) | The "welcome" page. |
| [CONTRIBUTING.md](https://github.com/pgetech/cloudcoe-standards/blob/master/CONTRIBUTING.md) | How to contribute. |
| [DEVELOPMENT\_GUIDE.md](https://github.com/pgetech/cloudcoe-standards/blob/master/DEVELOPMENT_GUIDE.md) | How to set up the development environment. |
| [CODE\_OF\_CONDUCT.md](https://github.com/pgetech/cloudcoe-standards/blob/master/CODE_OF_CONDUCT.md) | Expected behaviors and norms. |

#### **README.md**

Include at least the following sections:

* Overview / Introduction
* Getting Started

##### [**README Template**](https://github.com/pgetech/cloudcoe-standards/blob/master/template-README.md)

# OverviewThis overview section is an introduction to the repo. Include any related diagrams, etc.## Getting StartedStep-by-step getting started and expected behavior.## Prerequisites\* List of any pre-requisites for this.## ContributingPlease read [CONTRIBUTING.md](CONTRIBUTING.md) for details on our code of conduct, and the process for submitting pull requests to us.### Development GuidePlease refer to the [Development Guide](DEVELOPMENT\_GUIDE.md) on how to set up your environment.## Code of ConductPlease refer to the [Code of Conduct](CODE\_OF\_CONDUCT.md) for more information on expectations of behavior.

#### **CONTRIBUTING.md**

Include at least the following sections:

* Reporting Bugs/Feature Requests
* Contributing via Pull Requests (PRs)
* Finding Contributions to work on (how to help)
* Code of Conduct (to be developed)
* Security issues notifications (to be developed)
* Licensing (to be developed)

##### [**CONTRIBUTING Template**](https://github.com/pgetech/cloudcoe-standards/blob/master/template-CONTRIBUTING.md)

\_Please review these guidelines and adjust as appropriate. Remove this line when complete\_# Contributing GuidelinesThank you for your interest in contributing to our project. Whether it's a bug report, new feature, correction, or additional documentation, we greatly value feedback and contributions from our community.Please read through this document before submitting any issues or pull requests to ensure we have all the necessary information to effectively respond to your bug report or contribution.## Development GuideRefer to the [Development Guide](DEVELOPMENT\_GUIDE.md) for help with environment setup, running tests, submitting a PR, or anything that will make you more productive.## Reporting Bugs/Feature RequestsWe welcome you to use the GitHub issue tracker to report bugs or suggest features.When filing an issue, please check [existing open](../../issues), or [recently closed](../../issues?utf8=%E2%9C%93&q=is%3Aissue%20is%3Aclosed%20), issues to make sure somebody else hasn't already reported the issue. Please try to include as much information as you can. Details like these are incredibly useful:\* A reproducible test case or series of steps\* The version of our code being used\* Any modifications you've made relevant to the bug\* Anything unusual about your environment or deployment## Contributing via Pull RequestsContributions via pull requests are much appreciated. Before sending us a pull request, please ensure that:1. You are working against the latest source on the appropriate branch. See the [Development Guide](DEVELOPMENT\_GUIDE.md) for the branching strategy.2. You check existing open, and recently merged, pull requests to make sure someone else hasn't addressed the problem already.3. You open an issue to discuss any significant work - we would hate for your time to be wasted.4. The change works in all supported envirinments.5. Does the PR have updated/added unit, functional, and integration tests?6. PR is merged submitted to merge into develop.To send us a pull request, please:1. Send us a pull request, answering any default questions in the pull request interface.2. Pay attention to any automated CI failures reported in the pull request, and stay involved in the conversation.GitHub provides additional document on [forking a repository](https://help.github.com/articles/fork-a-repo/) and [creating a pull request](https://help.github.com/articles/creating-a-pull-request/).## Finding contributions to work onLooking at the existing issues is a great way to find something to contribute on. As our projects, by default, use the default GitHub issue labels ((enhancement/bug/duplicate/help wanted/invalid/question/wontfix), looking at any ['help wanted'](../../help%20wanted) issues is a great place to start. ## Code of ConductPlease refer to the [Code of Conduct](CODE\_OF\_CONDUCT.md) for more information on expectations of behavior.## Security issue notifications\_todo: develop process for security issues notification.\_## Licensing\_todo: develop appropriate licensing options.\_

#### **DEVELOPMENT\_GUIDE.md**

Include at least the following sections:

* Welcome section
* Environment Setup
* Branching Strategy
* Running Tests
* Code Conventions

##### [**DEVELOPMENT\_GUIDE Template**](https://github.com/pgetech/cloudcoe-standards/blob/master/template-DEVELOPMENT_GUIDE.md)

# DEVELOPMENT GUIDE\*\*Welcome!\*\*This document will make your life easier by helping you setup a development environment, IDEs, tests, coding practices,or anything that will help you be more productive. If you found something is missing or inaccurate, update this guideand send a Pull Request.## Environment Setup\_TODO: Modify this for your project's needs. Remove this line when complete.\_\* Step-by-step instructions on setting up the environment.## Branching Strategy (includes an Example)\_TODO: Modify this for your project's needs. Remove this line when complete.\_\* Use feature branches for all new features and bug fixes.\* Merge feature branches into the master branch using pull requests.\* Keep a high quality, up-to-date master branch.### Use feature branches for workDevelop features and fix bugs in feature branches (also known as topic branches) based off the master branch. Feature branches isolate work in progress from the completed work in the master branch. Git branches are inexpensive to create and maintain, so even small fixes and changes should have their own feature branch.Create feature branches for all changes. This makes reviewing history very simple. Look at the commits made in the branch and look at the pull request that merged the branch.### Name feature branches by conventionConsistent naming convention for feature branches will identify the work done in the branch. Include other information in the branch name, such as who created the branch.#### Feature branch Naming ConventionsUse this convention to name feature brances:```users/username/descriptionusers/username/workitembugfix/descriptionfeatures/feature-namefeatures/feature-area/feature-namehotfix/description```## Running Tests\_TODO: Modify this for your project's needs. Remove this line when complete.\_\* Information about how to run tests and the test methodology.### Unit Tests\* Step-by-step instructions on running unit tests.## Integration Test\* Step-by-step instructions on running integration tests.## Code Conventions\_TODO: Modify this for your project's needs. Remove this line when complete.\_\* Any code conventions or methodologies used in code. Linting, etc. should be noted here.

## Cloud Teams

## Overview

The Cloud Center of Excellence is made up of several teams. Each team has a set of responsibilities they deliver. Teams are formed in the "2 Pizza Team" style (no more than 12 people). Each team is responsible for their backlog, work and interactions with other teams.

[Skip to end of metadata](https://wiki.comp.pge.com/display/EA/Cloud+Future+State#page-metadata-end)

* Created by [Nichols, John](https://wiki.comp.pge.com/display/~JWNb), last modified by [Farradj, Fuad](https://wiki.comp.pge.com/display/~FXFJ) on [Jan 10, 2021](https://wiki.comp.pge.com/pages/diffpagesbyversion.action?pageId=48292107&selectedPageVersions=3&selectedPageVersions=4), [viewed 32 times](https://wiki.comp.pge.com/page-tracking/page-view-detail.action?pageId=48292107&spaceKey=EA)

[Go to start of metadata](https://wiki.comp.pge.com/display/EA/Cloud+Future+State#page-metadata-start)

# Cloud Future State Overview

PG&E has already begun to adopt commercial cloud services to address one or more of the business drivers identified above. We will be leveraging commercial cloud services to reduce our datacenter footrprint, looking to retire datacenters where we can. This will reduce our current IT infrastructure by at least 30%. As we adopt SaaS and cloud native capabilities, these cost saving will increase to 60% lower costs than we have today.

Adopting and migrating to commercial cloud will enable our modern application architectures which will empower the Digital Utility transformation through agile software driven solutions that secure, resilient, and able to scale rapidly based on demand for resources. The ability to quickly deploy and tear down system at low cost to support Proof of Value initiatives will enhance our Line of Business (LOB) clients to quickly evaluate solutions to address the changing utility demands.

Adopting an API only strategy will to develop consistent, reliable, and secure integration models that will loosely couple the data from the application. This will open up the exposure of PG&E’s enournous amount of collected and potential data for ease of integration and analytics.

At this time, we will be focusing on the following strategic commercial cloud platforms;

* Amazon Web Services (IaaS and PaaS)
* Salesforce / Heroku (PaaS & SaaS)
* Microsoft Office365 (SaaS)
* Microsoft Azure (IaaS & PaaS)

We are continuing to build out our internal private cloud, OneCloud, to enhance the internal capabilities as well as hybrid (on and off premises) cloud capabilities, to improve meet the growing demand from our LOB clients.

## AWS Future State

# Architecture and Design Contents

* [AWS Architectural Guiding Principles](https://wiki.comp.pge.com/display/CCE/AWS+Architectural+Guiding+Principles)

# Overview

The Architecture and Design Section is where the information, options, decisions and designs about the Cloud COE environment are stored (or linked). In addition to our overall Guiding Principles and How We Work - there are some key strategies and concepts that should influence our decisions and designs as we embrace the commercial cloud. Some of these are outlined in the [AWS Architectural Guiding Principles](https://wiki.comp.pge.com/display/CCE/AWS+Architectural+Guiding+Principles).

For more Architecture queries, please use the appropriate MS-Teams Channel:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CCOE Team** | **Description** | **Responsibilities** | **Products** | **MS-Teams Channel** |
| [Cloud COE Group: Cloud Business Office](https://wiki.comp.pge.com/display/CCE/Cloud+COE+Group%3A+Cloud+Business+Office) | Operating the business of the Cloud | [**Governance**](https://wiki.comp.pge.com/display/CCE/Cloud+COE+CBO+-+Governance+Function)   * Architecture Management * Product Management * Program Management * Demand Management * Financial Management   [**People**](https://wiki.comp.pge.com/display/CCE/Cloud+COE+CBO+-+People+Function)   * Advocacy * Intake and Customer Onboarding * Organizational Change Management * Communications * [Staff Development Planning and Execution](https://wiki.comp.pge.com/display/CCE/Cloud+COE+-+CBO+-+People+-+Training+and+Development) * People Management | [Pilot Migration Plans](https://wiki.comp.pge.com/display/CCE/Cloud+COE+Pilot+Migrations)  [Cloud COE Blueprint](https://wiki.comp.pge.com/display/CCE/Cloud+COE+Blueprint)  [Change Management Blueprint](https://wiki.comp.pge.com/display/CCE/Strategic+OCM+and+Adoption+Plan)  [Communications Plan](https://wiki.comp.pge.com/display/CCE/Cloud+COE+Strategic+Communications+Plan)  [Skills Assessment and Development Plan](https://wiki.comp.pge.com/display/CCE/CBO+-+People+-+Training+and+Development+-+Curriculum+Strategy) | Ingenium Project |
| [Cloud COE Group: Security, Risk and Compliance](https://wiki.comp.pge.com/display/CCE/Cloud+COE+Group%3A+Security%2C+Risk+and+Compliance) | All things Security in the AWS Landing Zone. | Networks Security (NetSec)  IAM  Policy (definition / enforcement)  Secrets  Certificates  Keys (encryption)  Vulnerability  Security Incident Response  Forensics | [Federated Cloud Identity](https://wiki.comp.pge.com/display/CCE/Federated+Cloud+Identity) | [dynGroup-Security](https://teams.microsoft.com/l/channel/19%3a84f9a64151494109bfe892a216f3ceec%40thread.skype/dynGroup-Security?groupId=93c1a6b0-9862-455b-a4dc-fd0a962e99ba&tenantId=44ae661a-ece6-41aa-bc96-7c2c85a08941)  dynTeam-NetSec  dynTeam-IAM  dynTeam-Secrets (to be created) |
| [Cloud COE Team: Landing Zone](https://wiki.comp.pge.com/display/CCE/Cloud+COE+Team%3A+Landing+Zone) | AWS MRP Landing Zone Activities |  | [API Platform](https://wiki.comp.pge.com/display/CCE/API+Platform)  [Hosting (Windows and Linux on AWS)](https://wiki.comp.pge.com/pages/viewpage.action?pageId=49962554)  [Cloud Networking and Direct Connect](https://wiki.comp.pge.com/display/CCE/Cloud+Networking+and+Direct+Connect)  [Datastores](https://wiki.comp.pge.com/display/CCE/Datastores)  [CICD Pipeline](https://wiki.comp.pge.com/display/CCE/CICD+Pipeline)  [Managed Access](https://wiki.comp.pge.com/display/CCE/Managed+Access)  [Lambda](https://wiki.comp.pge.com/display/CCE/Lambda)  [S3 Web: Website Hosting Pipeline](https://wiki.comp.pge.com/display/CCE/S3+Web%3A+Website+Hosting+Pipeline) | dynTeam-Landing-Zone |
| [Cloud COE Team: Operational Integration](https://wiki.comp.pge.com/display/CCE/Cloud+COE+Team%3A+Operational+Integration) | Integration with IT Service Management Processes at PG&E |  |  | [dynTeam-Operational Integration](https://teams.microsoft.com/l/channel/19%3a6098fc949fb34757aa08a8e445c8b9bb%40thread.skype/dynTEAM-Operational%2520Integration?groupId=93c1a6b0-9862-455b-a4dc-fd0a962e99ba&tenantId=44ae661a-ece6-41aa-bc96-7c2c85a08941) |
| [Cloud COE Team: Transit VPC](https://wiki.comp.pge.com/display/CCE/Cloud+COE+Team%3A+Transit+VPC) | The team responsible for refactoring the Transit VPC environment. |  | [Transit VPC](https://wiki.comp.pge.com/display/CCE/Transit+VPC) | dynFocus-Transit |

# Decisions and Implications

### **This page will be used to record a list of the technical, design pattern, process or other decisions related to the Commercial Cloud Architecture / Solution / Services.**

### [**How to document a decision**](https://wiki.comp.pge.com/display/CCE/Documenting+a+Decision)

[Create decision](https://wiki.comp.pge.com/?createDialogSpaceKey=CCE&createDialogBlueprintId=6869f67e-79e5-4d6b-99f7-ef8fdc55539c)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Title** | **Category** | **Due date** | **Outcome** | **Owner** | **Scope** | **Stakeholders** | **Status** | **Status Date** |
| [Use of AWS Key Management Service (KMS)](https://wiki.comp.pge.com/pages/viewpage.action?pageId=49960130) |  | 30 Jun 2018 | Team (including Cybersecurity leadership shown above) discussed and agreed that AWS Key Management Service (KMS) is 'safe to try' / available for use by the Cloud Dynamic Team and supporting projects (e.g. Contact Center 2020) | [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) |  | [Trivedi, Shalini](https://wiki.comp.pge.com/display/~S4T6) [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp) [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) [Nichols, John](https://wiki.comp.pge.com/display/~JWNb) @Medrano, Fernando @Sagona, Joe @Stamm, Nancy | **DECIDED** |  |
| [Use Cloud-Native Web Application Firewall (WAF)](https://wiki.comp.pge.com/pages/viewpage.action?pageId=53288537) | Security, Infrastructure, Performance | 17 Oct 2019 |  | [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) | Prod Customer-Facing Environments for PSPS Events | [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp) [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) [Hansen, Michael](https://wiki.comp.pge.com/display/~MEHs) [Lehane, Michael](https://wiki.comp.pge.com/display/~M3LG) [Cherukuri, Srinivas](https://wiki.comp.pge.com/display/~sqc6) | **IN PROGRESS** | 10/16/2019 - Created |
| [AWS Account strategy for 50 Main application](https://wiki.comp.pge.com/display/CCE/AWS+Account+strategy+for+50+Main+application) | Account Creation; Infrastructure | 21 Jun 2019 | Decided to start with existing CCoE nonprod environment as DEV environment for 50Main Parking Reservation Request | [Shah, Piyushkumar](https://wiki.comp.pge.com/display/~PTS6) | Application Specific environment provisioning | [Hansen, Michael](https://wiki.comp.pge.com/display/~MEHs) [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) [Varadhan, Ashok](https://wiki.comp.pge.com/display/~A2VB) | **DECIDED** | 21 Jun 2019 |
| [AWS Transfer for SFTP Service Adoption Framework Completed](https://wiki.comp.pge.com/display/CCE/AWS+Transfer+for+SFTP+Service+Adoption+Framework+Completed) | Security, Infrastructure, Application Architecture | 07 Aug 2019 | AWS Transfer for SFTP approved for use - with conditions | [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) | Design Pattern (Public vs. Private) depending on Use Case / Requirements. Focus of SAF and Service Introduction / CloudFormation on Public-facing deployment supporting Data and Analytics | [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp) [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) [Hansen, Michael](https://wiki.comp.pge.com/display/~MEHs) [Sharma, Namrata](https://wiki.comp.pge.com/display/~N1S3) | **IN REVIEW** | 07 Aug 2019 |
| [Data & Analytics Leveraging SageMaker](https://wiki.comp.pge.com/pages/viewpage.action?pageId=51887431) | Security, Service Adoption Framework (Manual Compliance) | 19 Jul 2019 |  | [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp) | Data & Analytics | [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) [Trivedi, Snay](https://wiki.comp.pge.com/display/~S3TM) | **IN PROGRESS** | 19 Jul 2019 |
| [Use AWS Parameter Store for non-secret Configuration Items](https://wiki.comp.pge.com/display/CCE/Use+AWS+Parameter+Store+for+non-secret+Configuration+Items) |  | 20 Jun 2018 | For teams looking to store non-sensitive configuration information: Use AWS Parameter Store. See below for additional detail. | [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) |  | [Hansen, Michael](https://wiki.comp.pge.com/display/~MEHs) [Shah, Piyushkumar](https://wiki.comp.pge.com/display/~PTS6) [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp) | **DECIDED** |  |
| [Use of Kinesis VPC Endpoints in Logging Central](https://wiki.comp.pge.com/display/CCE/Use+of+Kinesis+VPC+Endpoints+in+Logging+Central) |  | 19 Jul 2019 |  | [Stanley, John](https://wiki.comp.pge.com/display/~JFSV) | Non-prod (for testing) and Logging Central (for production) | [Hansen, Michael](https://wiki.comp.pge.com/display/~MEHs) [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) | **NOT STARTED** | 09 Jul 2019 |
| [Colocation Vendor Change for Direct Connect 2 - Cloud Enablement - Networking project](https://wiki.comp.pge.com/display/CCE/Colocation+Vendor+Change+for+Direct+Connect+2+-+Cloud+Enablement+-+Networking+project) |  | 14 Mar 2019 | Decision made on 5/3/2019 in Cloud COE Leads Meeting | [Luu, David](https://wiki.comp.pge.com/display/~DVL5) | AWS Direct Connect 2 | [Lehane, Michael](https://wiki.comp.pge.com/display/~M3LG), [Stanley, John](https://wiki.comp.pge.com/display/~JFSV) | Decision | 3/13/19 |
| [ARAD Quicksight VPC Access](https://wiki.comp.pge.com/display/CCE/ARAD+Quicksight+VPC+Access) | Security | 03 May 2019 | Decision made in 5/3/19 Leads meeting, all in favor of this decision. | [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp) | Limited to ARAD at this time | [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) [Trivedi, Snay](https://wiki.comp.pge.com/display/~S3TM) | **DECIDED** | 03 May 2019 |
| [Leverage S3 Gateway Endpoint (ARAD)](https://wiki.comp.pge.com/pages/viewpage.action?pageId=51872311) | Security | 30 Apr 2019 | Reviewed in leads meeting 5/3/19, decision approved by Cloud COE Leads | [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp) | ARAD usage of S3 Gateway Endpoints | [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp) | **DECIDED** |  |
| [Cloud COE will Go Live on 3/27 with single AWS Direct Connect only](https://wiki.comp.pge.com/pages/viewpage.action?pageId=51060366) | Security, Risk & Compliance, Landing Zone, Operational Integration | 15 Mar 2019 | To be confirmed - pending updates from Michael Lehane (M3LG) | [Lehane, Michael](https://wiki.comp.pge.com/display/~M3LG) | AWS Direct Connect | [Nichols, John](https://wiki.comp.pge.com/display/~JWNb) [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) [Von Schilling, Sara](https://wiki.comp.pge.com/display/~SEV3) [Hansen, Michael](https://wiki.comp.pge.com/display/~MEHs) [Varadhan, Ashok](https://wiki.comp.pge.com/display/~A2VB) [Gerdes, Peg](https://wiki.comp.pge.com/display/~PWG3) | **IN PROGRESS** | To be confirmed - pending updates from Michael Lehane (M3LG) |
| [Expand CloudAdmin privileges in Dev AWS LOB accounts](https://wiki.comp.pge.com/display/CCE/Expand+CloudAdmin+privileges+in+Dev+AWS+LOB+accounts) |  | 28 Feb 2019 |  | [Corgiat, Stephen](https://wiki.comp.pge.com/display/~SPCI) |  | [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp) [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) | **IN PROGRESS** |  |
| [Transit VPC F5 License type and throughput (BEST/5gbps)](https://wiki.comp.pge.com/pages/viewpage.action?pageId=51055170) | Security (Transit) | 19 Feb 2019 | Decided to move forward with the 5gbps BEST licensing | [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp) | To determine what the required throughput is, (1gbps, 5gbps, 10gbps) | [Johansen, Erik](https://wiki.comp.pge.com/display/~ENJ6) [Casey, Nathan](https://wiki.comp.pge.com/display/~NACk) [Trivedi, Snay](https://wiki.comp.pge.com/display/~S3TM) [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) | **DECIDED** |  |
| [PGE's Active Directory will not extend to AWS](https://wiki.comp.pge.com/display/CCE/PGE%27s+Active+Directory+will+not+extend+to+AWS) | Security - Directory Services | Before the Landing Zone goes live (3/31/2019) | Active Directory will not be deployed in AWS | [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp) | AWS Landing Zone | [Casey, Nathan](https://wiki.comp.pge.com/display/~NACk), [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp), [Trivedi, Snay](https://wiki.comp.pge.com/display/~S3TM) | **DRAFT** | 14 Jan 2019 |
| [Dropping support for Platform as a Service (Heroku) from Cloud COE Products & Services offering](https://wiki.comp.pge.com/pages/viewpage.action?pageId=50880518) |  | 09 Jan 2019 | Dropping support for Platform as a Service (Heroku) from Cloud COE Products & Services offering for now. The Cloud COE team appreciates that this is a change in direction and will continue to monitor Platform as a Service needs from teams supported by the Cloud COE. | [Lehane, Michael](https://wiki.comp.pge.com/display/~M3LG) |  | [Nichols, John](https://wiki.comp.pge.com/display/~JWNb) [Wright, David](https://wiki.comp.pge.com/display/~D3WN) [Von Schilling, Sara](https://wiki.comp.pge.com/display/~SEV3) [Shah, Piyushkumar](https://wiki.comp.pge.com/display/~PTS6) [Hansen, Michael](https://wiki.comp.pge.com/display/~MEHs) | **DECIDED** |  |
| [Leverage Amazon KMS natively with AWS root keys](https://wiki.comp.pge.com/display/CCE/Leverage+Amazon+KMS+natively+with+AWS+root+keys) |  | 10 Oct 2018 | Approved without PG&E Provided Root keys | [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp) |  | [Trivedi, Snay](https://wiki.comp.pge.com/display/~S3TM) [Harmon, Joshua](https://wiki.comp.pge.com/display/~JZHt) [John, Lester](https://wiki.comp.pge.com/display/~JZLA) [Smetak, Matthew](https://wiki.comp.pge.com/display/~MBSX) | **DECIDED** |  |
| [For data ingestion, transformation and publishing; meta data capture and governance for these steps will converge to a PG&E Enterprise standard.](https://wiki.comp.pge.com/pages/viewpage.action?pageId=50862762) |  | 28 Sep 2018 | For data ingestion, transformation and publishing; meta data capture and governance for these steps will converge to a PG&E Enterprise standard. | [Lehane, Michael](https://wiki.comp.pge.com/display/~M3LG) [Glass, Mike](https://wiki.comp.pge.com/display/~MSGA) [Nichols, John](https://wiki.comp.pge.com/display/~JWNb) [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) [Buckles, Patrick](https://wiki.comp.pge.com/display/~P1Bn) |  |  | **DECIDED** |  |
| [John Stanley confirmed as Product Owner for WAN/LAN/DNS including DirectConnect](https://wiki.comp.pge.com/pages/viewpage.action?pageId=50862752) |  | 24 Sep 2018 | John Stanley confirmed as Product Owner for WAN/LAN/DNS including DirectConnect with confirmation from Network and Cybersecurity Teams. | [Lehane, Michael](https://wiki.comp.pge.com/display/~M3LG) |  | [Wright, David](https://wiki.comp.pge.com/display/~D3WN) [Nichols, John](https://wiki.comp.pge.com/display/~JWNb) [Von Schilling, Sara](https://wiki.comp.pge.com/display/~SEV3) [Lehane, Michael](https://wiki.comp.pge.com/display/~M3LG) | **DECIDED** |  |
| [DirectConnect (Rancho Cordova to SuperNAP) will move forward with CenturyLink quote as a starting point for fiber (SuperNAP)](https://wiki.comp.pge.com/pages/viewpage.action?pageId=50859034) |  | 11 Sep 2018 | DirectConnect (Rancho Cordova to SuperNAP) will move forward with CenturyLink quote as a starting point on this work and will follow PG&E Sourcing procedures from this starting point. | [Lehane, Michael](https://wiki.comp.pge.com/display/~M3LG) |  | [Wright, David](https://wiki.comp.pge.com/display/~D3WN) [Nielsen, Paul](https://wiki.comp.pge.com/display/~PxN4) [Nichols, John](https://wiki.comp.pge.com/display/~JWNb) [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp) [Lehane, Michael](https://wiki.comp.pge.com/display/~M3LG) | **DECIDED** |  |
| [AWS DirectConnect will be delivered in 3 Phases](https://wiki.comp.pge.com/display/CCE/AWS+DirectConnect+will+be+delivered+in+3+Phases) |  | 11 Sep 2018 | AWS DirectConnect will be delivered in 3 Phases to deliver redundancy (Fairfield to Equinix) with current VPN moving to be the backup and resiliency (Rancho Cordova to SuperNAP).  Phase 1 - Build tunnel through Internet Firewalls Phase 2 - Replace Cisco cluster with Palo Alto HA Phase 3 - Setup each LOB VPC to connect back to PG&E (separate VRFS) thereby removing the IPSEC tunnel issue (capacity to 10 Gbps) | [Lehane, Michael](https://wiki.comp.pge.com/display/~M3LG) |  | [Wright, David](https://wiki.comp.pge.com/display/~D3WN) [Nielsen, Paul](https://wiki.comp.pge.com/display/~PxN4) [Nichols, John](https://wiki.comp.pge.com/display/~JWNb) [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp) [Lehane, Michael](https://wiki.comp.pge.com/display/~M3LG) | **DECIDED** |  |
| [GitHub Solution](https://wiki.comp.pge.com/display/CCE/GitHub+Solution) |  |  | Lead with Github on IaaS (EC2) while navigating the Github SaaS requirements. | [Shah, Piyushkumar](https://wiki.comp.pge.com/display/~PTS6) [Hansen, Michael](https://wiki.comp.pge.com/display/~MEHs) |  | [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp) [Lawrence, Robert](https://wiki.comp.pge.com/display/~R3Lq) | **IN PROGRESS** |  |
| [Confirming merging of two API Enablement Projects with approval of Job Estimate](https://wiki.comp.pge.com/display/CCE/Confirming+merging+of+two+API+Enablement+Projects+with+approval+of+Job+Estimate) |  | 24 Aug 2018 | Confirming merging of two API Enablement Projects with approval of Job Estimate.  On 8/24, the combined Job Estimate for this work effort was presented and approved for routing. As part of this review the proposal to merge these work efforts as reflected in the combined Job Estimate was also decided.  Decision - Close PPMc #190668, IO - API Platform & Self Service and merge work effort into PPMc# 190660 IO - RAPID API Dev & Deploy Platform | [Lehane, Michael](https://wiki.comp.pge.com/display/~M3LG) |  | [Wright, David](https://wiki.comp.pge.com/display/~D3WN) [Von Schilling, Sara](https://wiki.comp.pge.com/display/~SEV3) [Lehane, Michael](https://wiki.comp.pge.com/display/~M3LG) [Nichols, John](https://wiki.comp.pge.com/display/~JWNb) [Roy, Abhijit](https://wiki.comp.pge.com/display/~A3RF) [Adil, Rauf](https://wiki.comp.pge.com/display/~R2AT) | **DECIDED** |  |
| [Use of AWS Certificate Manager Service (ACM)](https://wiki.comp.pge.com/pages/viewpage.action?pageId=49960136) |  | 30 Jun 2018 | Safe to Try | [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) |  | [Trivedi, Shalini](https://wiki.comp.pge.com/display/~S4T6) [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp) [Nichols, John](https://wiki.comp.pge.com/display/~JWNb) [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) | **DECIDED** |  |
| [IDAAS - IAM - Using a SAAS application for out of the box Catalog based SSO integration](https://wiki.comp.pge.com/display/CCE/IDAAS+-+IAM+-+Using+a+SAAS+application+for+out+of+the+box+Catalog+based+SSO+integration) |  | 30 Jul 2018 | 1. GitHub lab account is used. Sathish, Stephen, Rauf and Shivram will have access to this GitHub lab account (in addition to John N who is the owner). 2. Will use one of Ariba/SuccesFactors from the SAP suite of apps in a pre prod environment. 3. If SAP suite of apps does not become feasible than we will use SwaggerHub (SamrtBear Ready API). | [Adil, Rauf](https://wiki.comp.pge.com/display/~R2AT) |  | [Corgiat, Stephen](https://wiki.comp.pge.com/display/~SPCI) [Kuppuswamy, Sathishkumar](https://wiki.comp.pge.com/display/~S1KO) [Sundaram, Shivram](https://wiki.comp.pge.com/display/~SKST) | **DECIDED** |  |
| [EC2 SSH Key Storage](https://wiki.comp.pge.com/display/CCE/EC2+SSH+Key+Storage) |  |  | Initial EC2 account public SSH keys will be baked into AMIs and private keys stored in PasswordSafe. | [Green, Jason](https://wiki.comp.pge.com/display/~J9Ge) |  |  | **IN PROGRESS** |  |
| [Logging Security](https://wiki.comp.pge.com/display/CCE/Logging+Security) |  |  | Logs will be decrypted, inspected and re-encrypted. | [Stanley, John](https://wiki.comp.pge.com/display/~JFSV) |  |  | **NOT STARTED** |  |
| [Network access to Production RDS](https://wiki.comp.pge.com/display/CCE/Network+access+to+Production+RDS) |  |  | Network access to production AWS RDS databases will be restricted to secure jump hosts such as PasswordSafe. | [Ravipati, Madhav](https://wiki.comp.pge.com/display/~m2ru) |  |  | **IN PROGRESS** |  |
| [RDS Access in Lower Environments](https://wiki.comp.pge.com/display/CCE/RDS+Access+in+Lower+Environments) |  |  | Network access to non-Prod AWD RDS Databases will be restricted to LOB-specific AD security groups. | [Ravipati, Madhav](https://wiki.comp.pge.com/display/~m2ru) |  |  | **IN PROGRESS** |  |
| [Binary Artifact Repo](https://wiki.comp.pge.com/display/CCE/Binary+Artifact+Repo) |  |  | Use Artifactory as the Binary Repo | [Shah, Piyushkumar](https://wiki.comp.pge.com/display/~PTS6) |  | [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp), [Kankanala, Rajeev](https://wiki.comp.pge.com/display/~R5K5), | **IN PROGRESS** |  |
| [CI/CD Tool Location in AWS](https://wiki.comp.pge.com/pages/viewpage.action?pageId=49965322) |  | 27 Jul 2018 | Jenkins will be installed in the AWS Tools Production account and available to all Workload accounts. | [Nichols, John](https://wiki.comp.pge.com/display/~JWNb) [Shah, Piyushkumar](https://wiki.comp.pge.com/display/~PTS6) |  | [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp) [Dey, Joydeep](https://wiki.comp.pge.com/display/~J2D2), [Kankanala, Rajeev](https://wiki.comp.pge.com/display/~R5K5) | **IN PROGRESS** |  |

* Prev
* **1**
* [2](https://wiki.comp.pge.com/display/EA/Cloud+Future+State#)
* [Next](https://wiki.comp.pge.com/display/EA/Cloud+Future+State#)

### **Other Requirements and Corresponding Implications**

# Decisions, Requirements and Implications

These requirements (or input) from team members have implications.

|  |  |  |  |
| --- | --- | --- | --- |
| **Area** | **Requirement / Input (Team)** | **Implication (Alternates)** | **References** |
| **SSH KEY Length** | Needs verification: ~~the SSH Keys generated by AWS are too short (less than 4096 bit).~~   * ~~4098 Key Length required~~ * AWS generates 2048 bit | ~~Unable to use AWS generated keys to access EC2 instances.~~  Created references to generate own SSH Keys. | [Generating a Public Key using ssh-keygen for access to Cloud Servers](https://wiki.comp.pge.com/display/CCE/Generating+a+Public+Key+using+ssh-keygen+for+access+to+Cloud+Servers)  [SSH Tunneling to Cloud Resources](https://wiki.comp.pge.com/display/CCE/SSH+Tunneling+to+Cloud+Resources)  [Generating user public key for SSH connection to AWS](https://wiki.comp.pge.com/display/ARAD/Generating+user+public+key+for+SSH+connection+to+AWS)  [Registering user public key on AWS for SSH connection to AWS](https://wiki.comp.pge.com/display/ARAD/Registering+user+public+key+on+AWS+for+SSH+connection+to+AWS) |
| **SSH Session Recording** | **All** SSH/RDP sessions must be recorded. | No direct SSH/RDP access to EC2. Must use BeyondTrust.  Unable to use Bastion Hosts for access (no recording) |  |
| **DNS** | ~~All traffic is managed through a firewall. The firewall rules must be dynamic in the from-to addressing (dynamic nature of the Cloud). As a result, every firewall rule in the PAN must be resolved by DNS.~~   * ~~Route53 were hitting AWS limits throttling limits due to the traffic.~~   AWS is providing new features for Route 53 Outbound and Inbound resolvers that make Route 53 a viable solution. | ~~Must use PowerDNS running on EC2 to address the level of DNS traffic.~~   * ~~3 instances of PowerDNS in Transit VPC~~ * ~~Each account requires PowerDNS instance~~ * ~~Unable to leverage the native DNS solution in any of the Cloud Providers.~~   Route 53 outbound resolver needs to be deployed in all accounts except new Transit, which (per Cyber NPS) has asynchronous routing issues that cause reliability issues for services outside of PAN and F5 deployed to that account. New Transit will use on-premise DNS Anycast and DNS Proxy on the PANs as a DNS cache for performance. All PowerDNS authoritative server domains will need to be migrated to Route 53 Public or Private hosted zones. | [DNS](https://wiki.comp.pge.com/display/CCE/DNS)  [2018-07-19 Network Disconnect (PAN, VPN, DNS)](https://wiki.comp.pge.com/pages/viewpage.action?pageId=49964294)  [Route 53 Outbound Resolver](https://wiki.comp.pge.com/display/CCE/Route+53+Outbound+Resolver) |
| **DNS** | ~~DNSSEC is a requirement.~~ | ~~Can't use Route53 as it doesn't support DNSSEC (yet).~~  ~~Loss of integrated DNS automation (Cloud Formation, etc)~~ | [DNS](https://wiki.comp.pge.com/display/CCE/DNS) |
| **Firewalls** | All traffic to / from **PGE** <-> **AWS** <-> **Internet** is inspected.  Therefore we need the F5/PAN security configuration. | There is a chance that the environment has single points of failure in the ([West III, Thomas](https://wiki.comp.pge.com/display/~T1WT) TODO: expand on this implication). More research to be done. |  |
| **Certificates** | We must use PG&E Certificates. | Integration with native AWS certificate solutions is not possible. This creates overhead and manual processes to request / use.  (There was a decision to embrace / explore AWS Certificate Manager, so this may be addressed) | [AWS ADC Diagram / Service Ports](https://wiki.comp.pge.com/pages/viewpage.action?pageId=49190526) |
| **Firewalls** | All user-based traffic requires a valid LANID on a valid workstation.  (TODO: confirm wording with [West III, Thomas](https://wiki.comp.pge.com/display/~T1WT) and [Stanley, John](https://wiki.comp.pge.com/display/~JFSV)) | The PAN must cache a list of valid devices and users based on (INSERT SOLUTION HERE).  If this cache or (SOLUTION) is unavailable, the user-based traffic fails. | [2018-07-09 PAN Network Outage](https://wiki.comp.pge.com/display/CCE/2018-07-09+PAN+Network+Outage) |

## Innovation Space

F,{8c5f9834-61e8-4af9-9f84-b3fc11d3e6c6}{100},3.125,3.125

# Overview

Have an idea you would like to explore? Need to express a reference implementation? The Digital Innovation Zone is for you. The current environment is isolated (not connected to PG&E). You can either bring your own expertise (BYOE) or work with the Vanguard Team to leverage the [Pre-Product Prototyping Methodology (P3M)](https://wiki.comp.pge.com/pages/viewpage.action?pageId=49153992).

[REQUEST INNOVATION SPACE](https://wiki.comp.pge.com/display/EA/Innovation+Space+Requests+-+Outdated+-+Do+Not+Use)

# AWS

[REQUEST INNOVATION SPACE](https://wiki.comp.pge.com/display/EA/Innovation+Space+Requests+-+Outdated+-+Do+Not+Use)

## Conceptual Architecture

F,{8c5f9834-61e8-4af9-9f84-b3fc11d3e6c6}{175},3.125,3.125

## Account Information

Master Account (Billing): [ea-cloud-admin@pge.com](mailto:ea-cloud-admin@pge.com)

Root Account: [ea-innovation-admin@pge.com](mailto:ea-innovation-admin@pge.com)

### **AWS IAM Login**

<https://pgeinnovation.signin.aws.amazon.com/console>

Login credentials to be provided at request

## Azure

ETA: 2018-Q3

## Google Cloud Platform

ETA 2019

# Constraints

### **11/17/2017 - AWS Only**

* No direct access to PG&E
* Only non-production data or masked data (must be reviewed by Cybersecurity)
* Default AWS Service Limits are in place.
* Access constraints - no direct SSH from PG&E network (use Cloud9 IDE as an alternative)
* Current support mode: self service or BYOE (bring your own expert)

[Skip to end of metadata](https://wiki.comp.pge.com/display/EA/AWS+Future+State#page-metadata-end)

* Created by [Nichols, John](https://wiki.comp.pge.com/display/~JWNb), last modified on [Oct 09, 2018](https://wiki.comp.pge.com/pages/diffpagesbyversion.action?pageId=48292125&selectedPageVersions=4&selectedPageVersions=5), [viewed 15 times](https://wiki.comp.pge.com/page-tracking/page-view-detail.action?pageId=48292125&spaceKey=EA)

[Go to start of metadata](https://wiki.comp.pge.com/display/EA/AWS+Future+State#page-metadata-start)

# Architecture and Design Contents

* [AWS Architectural Guiding Principles](https://wiki.comp.pge.com/display/CCE/AWS+Architectural+Guiding+Principles)

# Overview

The Architecture and Design Section is where the information, options, decisions and designs about the Cloud COE environment are stored (or linked). In addition to our overall Guiding Principles and How We Work - there are some key strategies and concepts that should influence our decisions and designs as we embrace the commercial cloud. Some of these are outlined in the [AWS Architectural Guiding Principles](https://wiki.comp.pge.com/display/CCE/AWS+Architectural+Guiding+Principles).

For more Architecture queries, please use the appropriate MS-Teams Channel:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CCOE Team** | **Description** | **Responsibilities** | **Products** | **MS-Teams Channel** |
| [Cloud COE Group: Cloud Business Office](https://wiki.comp.pge.com/display/CCE/Cloud+COE+Group%3A+Cloud+Business+Office) | Operating the business of the Cloud | [**Governance**](https://wiki.comp.pge.com/display/CCE/Cloud+COE+CBO+-+Governance+Function)   * Architecture Management * Product Management * Program Management * Demand Management * Financial Management   [**People**](https://wiki.comp.pge.com/display/CCE/Cloud+COE+CBO+-+People+Function)   * Advocacy * Intake and Customer Onboarding * Organizational Change Management * Communications * [Staff Development Planning and Execution](https://wiki.comp.pge.com/display/CCE/Cloud+COE+-+CBO+-+People+-+Training+and+Development) * People Management | [Pilot Migration Plans](https://wiki.comp.pge.com/display/CCE/Cloud+COE+Pilot+Migrations)  [Cloud COE Blueprint](https://wiki.comp.pge.com/display/CCE/Cloud+COE+Blueprint)  [Change Management Blueprint](https://wiki.comp.pge.com/display/CCE/Strategic+OCM+and+Adoption+Plan)  [Communications Plan](https://wiki.comp.pge.com/display/CCE/Cloud+COE+Strategic+Communications+Plan)  [Skills Assessment and Development Plan](https://wiki.comp.pge.com/display/CCE/CBO+-+People+-+Training+and+Development+-+Curriculum+Strategy) | Ingenium Project |
| [Cloud COE Group: Security, Risk and Compliance](https://wiki.comp.pge.com/display/CCE/Cloud+COE+Group%3A+Security%2C+Risk+and+Compliance) | All things Security in the AWS Landing Zone. | Networks Security (NetSec)  IAM  Policy (definition / enforcement)  Secrets  Certificates  Keys (encryption)  Vulnerability  Security Incident Response  Forensics | [Federated Cloud Identity](https://wiki.comp.pge.com/display/CCE/Federated+Cloud+Identity) | [dynGroup-Security](https://teams.microsoft.com/l/channel/19%3a84f9a64151494109bfe892a216f3ceec%40thread.skype/dynGroup-Security?groupId=93c1a6b0-9862-455b-a4dc-fd0a962e99ba&tenantId=44ae661a-ece6-41aa-bc96-7c2c85a08941)  dynTeam-NetSec  dynTeam-IAM  dynTeam-Secrets (to be created) |
| [Cloud COE Team: Landing Zone](https://wiki.comp.pge.com/display/CCE/Cloud+COE+Team%3A+Landing+Zone) | AWS MRP Landing Zone Activities |  | [API Platform](https://wiki.comp.pge.com/display/CCE/API+Platform)  [Hosting (Windows and Linux on AWS)](https://wiki.comp.pge.com/pages/viewpage.action?pageId=49962554)  [Cloud Networking and Direct Connect](https://wiki.comp.pge.com/display/CCE/Cloud+Networking+and+Direct+Connect)  [Datastores](https://wiki.comp.pge.com/display/CCE/Datastores)  [CICD Pipeline](https://wiki.comp.pge.com/display/CCE/CICD+Pipeline)  [Managed Access](https://wiki.comp.pge.com/display/CCE/Managed+Access)  [Lambda](https://wiki.comp.pge.com/display/CCE/Lambda)  [S3 Web: Website Hosting Pipeline](https://wiki.comp.pge.com/display/CCE/S3+Web%3A+Website+Hosting+Pipeline) | dynTeam-Landing-Zone |
| [Cloud COE Team: Operational Integration](https://wiki.comp.pge.com/display/CCE/Cloud+COE+Team%3A+Operational+Integration) | Integration with IT Service Management Processes at PG&E |  |  | [dynTeam-Operational Integration](https://teams.microsoft.com/l/channel/19%3a6098fc949fb34757aa08a8e445c8b9bb%40thread.skype/dynTEAM-Operational%2520Integration?groupId=93c1a6b0-9862-455b-a4dc-fd0a962e99ba&tenantId=44ae661a-ece6-41aa-bc96-7c2c85a08941) |
| [Cloud COE Team: Transit VPC](https://wiki.comp.pge.com/display/CCE/Cloud+COE+Team%3A+Transit+VPC) | The team responsible for refactoring the Transit VPC environment. |  | [Transit VPC](https://wiki.comp.pge.com/display/CCE/Transit+VPC) | dynFocus-Transit |

# Decisions and Implications

### **This page will be used to record a list of the technical, design pattern, process or other decisions related to the Commercial Cloud Architecture / Solution / Services.**

### [**How to document a decision**](https://wiki.comp.pge.com/display/CCE/Documenting+a+Decision)

[Create decision](https://wiki.comp.pge.com/?createDialogSpaceKey=CCE&createDialogBlueprintId=6869f67e-79e5-4d6b-99f7-ef8fdc55539c)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Title** | **Category** | **Due date** | **Outcome** | **Owner** | **Scope** | **Stakeholders** | **Status** | **Status Date** |
| [Use of AWS Key Management Service (KMS)](https://wiki.comp.pge.com/pages/viewpage.action?pageId=49960130) |  | 30 Jun 2018 | Team (including Cybersecurity leadership shown above) discussed and agreed that AWS Key Management Service (KMS) is 'safe to try' / available for use by the Cloud Dynamic Team and supporting projects (e.g. Contact Center 2020) | [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) |  | [Trivedi, Shalini](https://wiki.comp.pge.com/display/~S4T6) [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp) [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) [Nichols, John](https://wiki.comp.pge.com/display/~JWNb) @Medrano, Fernando @Sagona, Joe @Stamm, Nancy | **DECIDED** |  |
| [Use Cloud-Native Web Application Firewall (WAF)](https://wiki.comp.pge.com/pages/viewpage.action?pageId=53288537) | Security, Infrastructure, Performance | 17 Oct 2019 |  | [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) | Prod Customer-Facing Environments for PSPS Events | [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp) [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) [Hansen, Michael](https://wiki.comp.pge.com/display/~MEHs) [Lehane, Michael](https://wiki.comp.pge.com/display/~M3LG) [Cherukuri, Srinivas](https://wiki.comp.pge.com/display/~sqc6) | **IN PROGRESS** | 10/16/2019 - Created |
| [AWS Account strategy for 50 Main application](https://wiki.comp.pge.com/display/CCE/AWS+Account+strategy+for+50+Main+application) | Account Creation; Infrastructure | 21 Jun 2019 | Decided to start with existing CCoE nonprod environment as DEV environment for 50Main Parking Reservation Request | [Shah, Piyushkumar](https://wiki.comp.pge.com/display/~PTS6) | Application Specific environment provisioning | [Hansen, Michael](https://wiki.comp.pge.com/display/~MEHs) [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) [Varadhan, Ashok](https://wiki.comp.pge.com/display/~A2VB) | **DECIDED** | 21 Jun 2019 |
| [AWS Transfer for SFTP Service Adoption Framework Completed](https://wiki.comp.pge.com/display/CCE/AWS+Transfer+for+SFTP+Service+Adoption+Framework+Completed) | Security, Infrastructure, Application Architecture | 07 Aug 2019 | AWS Transfer for SFTP approved for use - with conditions | [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) | Design Pattern (Public vs. Private) depending on Use Case / Requirements. Focus of SAF and Service Introduction / CloudFormation on Public-facing deployment supporting Data and Analytics | [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp) [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) [Hansen, Michael](https://wiki.comp.pge.com/display/~MEHs) [Sharma, Namrata](https://wiki.comp.pge.com/display/~N1S3) | **IN REVIEW** | 07 Aug 2019 |
| [Data & Analytics Leveraging SageMaker](https://wiki.comp.pge.com/pages/viewpage.action?pageId=51887431) | Security, Service Adoption Framework (Manual Compliance) | 19 Jul 2019 |  | [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp) | Data & Analytics | [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) [Trivedi, Snay](https://wiki.comp.pge.com/display/~S3TM) | **IN PROGRESS** | 19 Jul 2019 |
| [Use AWS Parameter Store for non-secret Configuration Items](https://wiki.comp.pge.com/display/CCE/Use+AWS+Parameter+Store+for+non-secret+Configuration+Items) |  | 20 Jun 2018 | For teams looking to store non-sensitive configuration information: Use AWS Parameter Store. See below for additional detail. | [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) |  | [Hansen, Michael](https://wiki.comp.pge.com/display/~MEHs) [Shah, Piyushkumar](https://wiki.comp.pge.com/display/~PTS6) [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp) | **DECIDED** |  |
| [Use of Kinesis VPC Endpoints in Logging Central](https://wiki.comp.pge.com/display/CCE/Use+of+Kinesis+VPC+Endpoints+in+Logging+Central) |  | 19 Jul 2019 |  | [Stanley, John](https://wiki.comp.pge.com/display/~JFSV) | Non-prod (for testing) and Logging Central (for production) | [Hansen, Michael](https://wiki.comp.pge.com/display/~MEHs) [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) | **NOT STARTED** | 09 Jul 2019 |
| [Colocation Vendor Change for Direct Connect 2 - Cloud Enablement - Networking project](https://wiki.comp.pge.com/display/CCE/Colocation+Vendor+Change+for+Direct+Connect+2+-+Cloud+Enablement+-+Networking+project) |  | 14 Mar 2019 | Decision made on 5/3/2019 in Cloud COE Leads Meeting | [Luu, David](https://wiki.comp.pge.com/display/~DVL5) | AWS Direct Connect 2 | [Lehane, Michael](https://wiki.comp.pge.com/display/~M3LG), [Stanley, John](https://wiki.comp.pge.com/display/~JFSV) | Decision | 3/13/19 |
| [ARAD Quicksight VPC Access](https://wiki.comp.pge.com/display/CCE/ARAD+Quicksight+VPC+Access) | Security | 03 May 2019 | Decision made in 5/3/19 Leads meeting, all in favor of this decision. | [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp) | Limited to ARAD at this time | [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) [Trivedi, Snay](https://wiki.comp.pge.com/display/~S3TM) | **DECIDED** | 03 May 2019 |
| [Leverage S3 Gateway Endpoint (ARAD)](https://wiki.comp.pge.com/pages/viewpage.action?pageId=51872311) | Security | 30 Apr 2019 | Reviewed in leads meeting 5/3/19, decision approved by Cloud COE Leads | [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp) | ARAD usage of S3 Gateway Endpoints | [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp) | **DECIDED** |  |
| [Cloud COE will Go Live on 3/27 with single AWS Direct Connect only](https://wiki.comp.pge.com/pages/viewpage.action?pageId=51060366) | Security, Risk & Compliance, Landing Zone, Operational Integration | 15 Mar 2019 | To be confirmed - pending updates from Michael Lehane (M3LG) | [Lehane, Michael](https://wiki.comp.pge.com/display/~M3LG) | AWS Direct Connect | [Nichols, John](https://wiki.comp.pge.com/display/~JWNb) [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) [Von Schilling, Sara](https://wiki.comp.pge.com/display/~SEV3) [Hansen, Michael](https://wiki.comp.pge.com/display/~MEHs) [Varadhan, Ashok](https://wiki.comp.pge.com/display/~A2VB) [Gerdes, Peg](https://wiki.comp.pge.com/display/~PWG3) | **IN PROGRESS** | To be confirmed - pending updates from Michael Lehane (M3LG) |
| [Expand CloudAdmin privileges in Dev AWS LOB accounts](https://wiki.comp.pge.com/display/CCE/Expand+CloudAdmin+privileges+in+Dev+AWS+LOB+accounts) |  | 28 Feb 2019 |  | [Corgiat, Stephen](https://wiki.comp.pge.com/display/~SPCI) |  | [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp) [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) | **IN PROGRESS** |  |
| [Transit VPC F5 License type and throughput (BEST/5gbps)](https://wiki.comp.pge.com/pages/viewpage.action?pageId=51055170) | Security (Transit) | 19 Feb 2019 | Decided to move forward with the 5gbps BEST licensing | [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp) | To determine what the required throughput is, (1gbps, 5gbps, 10gbps) | [Johansen, Erik](https://wiki.comp.pge.com/display/~ENJ6) [Casey, Nathan](https://wiki.comp.pge.com/display/~NACk) [Trivedi, Snay](https://wiki.comp.pge.com/display/~S3TM) [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) | **DECIDED** |  |
| [PGE's Active Directory will not extend to AWS](https://wiki.comp.pge.com/display/CCE/PGE%27s+Active+Directory+will+not+extend+to+AWS) | Security - Directory Services | Before the Landing Zone goes live (3/31/2019) | Active Directory will not be deployed in AWS | [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp) | AWS Landing Zone | [Casey, Nathan](https://wiki.comp.pge.com/display/~NACk), [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp), [Trivedi, Snay](https://wiki.comp.pge.com/display/~S3TM) | **DRAFT** | 14 Jan 2019 |
| [Dropping support for Platform as a Service (Heroku) from Cloud COE Products & Services offering](https://wiki.comp.pge.com/pages/viewpage.action?pageId=50880518) |  | 09 Jan 2019 | Dropping support for Platform as a Service (Heroku) from Cloud COE Products & Services offering for now. The Cloud COE team appreciates that this is a change in direction and will continue to monitor Platform as a Service needs from teams supported by the Cloud COE. | [Lehane, Michael](https://wiki.comp.pge.com/display/~M3LG) |  | [Nichols, John](https://wiki.comp.pge.com/display/~JWNb) [Wright, David](https://wiki.comp.pge.com/display/~D3WN) [Von Schilling, Sara](https://wiki.comp.pge.com/display/~SEV3) [Shah, Piyushkumar](https://wiki.comp.pge.com/display/~PTS6) [Hansen, Michael](https://wiki.comp.pge.com/display/~MEHs) | **DECIDED** |  |
| [Leverage Amazon KMS natively with AWS root keys](https://wiki.comp.pge.com/display/CCE/Leverage+Amazon+KMS+natively+with+AWS+root+keys) |  | 10 Oct 2018 | Approved without PG&E Provided Root keys | [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp) |  | [Trivedi, Snay](https://wiki.comp.pge.com/display/~S3TM) [Harmon, Joshua](https://wiki.comp.pge.com/display/~JZHt) [John, Lester](https://wiki.comp.pge.com/display/~JZLA) [Smetak, Matthew](https://wiki.comp.pge.com/display/~MBSX) | **DECIDED** |  |
| [For data ingestion, transformation and publishing; meta data capture and governance for these steps will converge to a PG&E Enterprise standard.](https://wiki.comp.pge.com/pages/viewpage.action?pageId=50862762) |  | 28 Sep 2018 | For data ingestion, transformation and publishing; meta data capture and governance for these steps will converge to a PG&E Enterprise standard. | [Lehane, Michael](https://wiki.comp.pge.com/display/~M3LG) [Glass, Mike](https://wiki.comp.pge.com/display/~MSGA) [Nichols, John](https://wiki.comp.pge.com/display/~JWNb) [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) [Buckles, Patrick](https://wiki.comp.pge.com/display/~P1Bn) |  |  | **DECIDED** |  |
| [John Stanley confirmed as Product Owner for WAN/LAN/DNS including DirectConnect](https://wiki.comp.pge.com/pages/viewpage.action?pageId=50862752) |  | 24 Sep 2018 | John Stanley confirmed as Product Owner for WAN/LAN/DNS including DirectConnect with confirmation from Network and Cybersecurity Teams. | [Lehane, Michael](https://wiki.comp.pge.com/display/~M3LG) |  | [Wright, David](https://wiki.comp.pge.com/display/~D3WN) [Nichols, John](https://wiki.comp.pge.com/display/~JWNb) [Von Schilling, Sara](https://wiki.comp.pge.com/display/~SEV3) [Lehane, Michael](https://wiki.comp.pge.com/display/~M3LG) | **DECIDED** |  |
| [DirectConnect (Rancho Cordova to SuperNAP) will move forward with CenturyLink quote as a starting point for fiber (SuperNAP)](https://wiki.comp.pge.com/pages/viewpage.action?pageId=50859034) |  | 11 Sep 2018 | DirectConnect (Rancho Cordova to SuperNAP) will move forward with CenturyLink quote as a starting point on this work and will follow PG&E Sourcing procedures from this starting point. | [Lehane, Michael](https://wiki.comp.pge.com/display/~M3LG) |  | [Wright, David](https://wiki.comp.pge.com/display/~D3WN) [Nielsen, Paul](https://wiki.comp.pge.com/display/~PxN4) [Nichols, John](https://wiki.comp.pge.com/display/~JWNb) [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp) [Lehane, Michael](https://wiki.comp.pge.com/display/~M3LG) | **DECIDED** |  |
| [AWS DirectConnect will be delivered in 3 Phases](https://wiki.comp.pge.com/display/CCE/AWS+DirectConnect+will+be+delivered+in+3+Phases) |  | 11 Sep 2018 | AWS DirectConnect will be delivered in 3 Phases to deliver redundancy (Fairfield to Equinix) with current VPN moving to be the backup and resiliency (Rancho Cordova to SuperNAP).  Phase 1 - Build tunnel through Internet Firewalls Phase 2 - Replace Cisco cluster with Palo Alto HA Phase 3 - Setup each LOB VPC to connect back to PG&E (separate VRFS) thereby removing the IPSEC tunnel issue (capacity to 10 Gbps) | [Lehane, Michael](https://wiki.comp.pge.com/display/~M3LG) |  | [Wright, David](https://wiki.comp.pge.com/display/~D3WN) [Nielsen, Paul](https://wiki.comp.pge.com/display/~PxN4) [Nichols, John](https://wiki.comp.pge.com/display/~JWNb) [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp) [Lehane, Michael](https://wiki.comp.pge.com/display/~M3LG) | **DECIDED** |  |
| [GitHub Solution](https://wiki.comp.pge.com/display/CCE/GitHub+Solution) |  |  | Lead with Github on IaaS (EC2) while navigating the Github SaaS requirements. | [Shah, Piyushkumar](https://wiki.comp.pge.com/display/~PTS6) [Hansen, Michael](https://wiki.comp.pge.com/display/~MEHs) |  | [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp) [Lawrence, Robert](https://wiki.comp.pge.com/display/~R3Lq) | **IN PROGRESS** |  |
| [Confirming merging of two API Enablement Projects with approval of Job Estimate](https://wiki.comp.pge.com/display/CCE/Confirming+merging+of+two+API+Enablement+Projects+with+approval+of+Job+Estimate) |  | 24 Aug 2018 | Confirming merging of two API Enablement Projects with approval of Job Estimate.  On 8/24, the combined Job Estimate for this work effort was presented and approved for routing. As part of this review the proposal to merge these work efforts as reflected in the combined Job Estimate was also decided.  Decision - Close PPMc #190668, IO - API Platform & Self Service and merge work effort into PPMc# 190660 IO - RAPID API Dev & Deploy Platform | [Lehane, Michael](https://wiki.comp.pge.com/display/~M3LG) |  | [Wright, David](https://wiki.comp.pge.com/display/~D3WN) [Von Schilling, Sara](https://wiki.comp.pge.com/display/~SEV3) [Lehane, Michael](https://wiki.comp.pge.com/display/~M3LG) [Nichols, John](https://wiki.comp.pge.com/display/~JWNb) [Roy, Abhijit](https://wiki.comp.pge.com/display/~A3RF) [Adil, Rauf](https://wiki.comp.pge.com/display/~R2AT) | **DECIDED** |  |
| [Use of AWS Certificate Manager Service (ACM)](https://wiki.comp.pge.com/pages/viewpage.action?pageId=49960136) |  | 30 Jun 2018 | Safe to Try | [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) |  | [Trivedi, Shalini](https://wiki.comp.pge.com/display/~S4T6) [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp) [Nichols, John](https://wiki.comp.pge.com/display/~JWNb) [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) | **DECIDED** |  |
| [IDAAS - IAM - Using a SAAS application for out of the box Catalog based SSO integration](https://wiki.comp.pge.com/display/CCE/IDAAS+-+IAM+-+Using+a+SAAS+application+for+out+of+the+box+Catalog+based+SSO+integration) |  | 30 Jul 2018 | 1. GitHub lab account is used. Sathish, Stephen, Rauf and Shivram will have access to this GitHub lab account (in addition to John N who is the owner). 2. Will use one of Ariba/SuccesFactors from the SAP suite of apps in a pre prod environment. 3. If SAP suite of apps does not become feasible than we will use SwaggerHub (SamrtBear Ready API). | [Adil, Rauf](https://wiki.comp.pge.com/display/~R2AT) |  | [Corgiat, Stephen](https://wiki.comp.pge.com/display/~SPCI) [Kuppuswamy, Sathishkumar](https://wiki.comp.pge.com/display/~S1KO) [Sundaram, Shivram](https://wiki.comp.pge.com/display/~SKST) | **DECIDED** |  |
| [EC2 SSH Key Storage](https://wiki.comp.pge.com/display/CCE/EC2+SSH+Key+Storage) |  |  | Initial EC2 account public SSH keys will be baked into AMIs and private keys stored in PasswordSafe. | [Green, Jason](https://wiki.comp.pge.com/display/~J9Ge) |  |  | **IN PROGRESS** |  |
| [Logging Security](https://wiki.comp.pge.com/display/CCE/Logging+Security) |  |  | Logs will be decrypted, inspected and re-encrypted. | [Stanley, John](https://wiki.comp.pge.com/display/~JFSV) |  |  | **NOT STARTED** |  |
| [Network access to Production RDS](https://wiki.comp.pge.com/display/CCE/Network+access+to+Production+RDS) |  |  | Network access to production AWS RDS databases will be restricted to secure jump hosts such as PasswordSafe. | [Ravipati, Madhav](https://wiki.comp.pge.com/display/~m2ru) |  |  | **IN PROGRESS** |  |
| [RDS Access in Lower Environments](https://wiki.comp.pge.com/display/CCE/RDS+Access+in+Lower+Environments) |  |  | Network access to non-Prod AWD RDS Databases will be restricted to LOB-specific AD security groups. | [Ravipati, Madhav](https://wiki.comp.pge.com/display/~m2ru) |  |  | **IN PROGRESS** |  |
| [Binary Artifact Repo](https://wiki.comp.pge.com/display/CCE/Binary+Artifact+Repo) |  |  | Use Artifactory as the Binary Repo | [Shah, Piyushkumar](https://wiki.comp.pge.com/display/~PTS6) |  | [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp), [Kankanala, Rajeev](https://wiki.comp.pge.com/display/~R5K5), | **IN PROGRESS** |  |
| [CI/CD Tool Location in AWS](https://wiki.comp.pge.com/pages/viewpage.action?pageId=49965322) |  | 27 Jul 2018 | Jenkins will be installed in the AWS Tools Production account and available to all Workload accounts. | [Nichols, John](https://wiki.comp.pge.com/display/~JWNb) [Shah, Piyushkumar](https://wiki.comp.pge.com/display/~PTS6) |  | [Glenn, Billy](https://wiki.comp.pge.com/display/~BDG3) [Kantar, Cory](https://wiki.comp.pge.com/display/~C1Kp) [Dey, Joydeep](https://wiki.comp.pge.com/display/~J2D2), [Kankanala, Rajeev](https://wiki.comp.pge.com/display/~R5K5) | **IN PROGRESS** |  |

* Prev
* **1**
* [2](https://wiki.comp.pge.com/display/EA/AWS+Future+State#)
* [Next](https://wiki.comp.pge.com/display/EA/AWS+Future+State#)

### **Other Requirements and Corresponding Implications**

# Decisions, Requirements and Implications

These requirements (or input) from team members have implications.

|  |  |  |  |
| --- | --- | --- | --- |
| **Area** | **Requirement / Input (Team)** | **Implication (Alternates)** | **References** |
| **SSH KEY Length** | Needs verification: ~~the SSH Keys generated by AWS are too short (less than 4096 bit).~~   * ~~4098 Key Length required~~ * AWS generates 2048 bit | ~~Unable to use AWS generated keys to access EC2 instances.~~  Created references to generate own SSH Keys. | [Generating a Public Key using ssh-keygen for access to Cloud Servers](https://wiki.comp.pge.com/display/CCE/Generating+a+Public+Key+using+ssh-keygen+for+access+to+Cloud+Servers)  [SSH Tunneling to Cloud Resources](https://wiki.comp.pge.com/display/CCE/SSH+Tunneling+to+Cloud+Resources)  [Generating user public key for SSH connection to AWS](https://wiki.comp.pge.com/display/ARAD/Generating+user+public+key+for+SSH+connection+to+AWS)  [Registering user public key on AWS for SSH connection to AWS](https://wiki.comp.pge.com/display/ARAD/Registering+user+public+key+on+AWS+for+SSH+connection+to+AWS) |
| **SSH Session Recording** | **All** SSH/RDP sessions must be recorded. | No direct SSH/RDP access to EC2. Must use BeyondTrust.  Unable to use Bastion Hosts for access (no recording) |  |
| **DNS** | ~~All traffic is managed through a firewall. The firewall rules must be dynamic in the from-to addressing (dynamic nature of the Cloud). As a result, every firewall rule in the PAN must be resolved by DNS.~~   * ~~Route53 were hitting AWS limits throttling limits due to the traffic.~~   AWS is providing new features for Route 53 Outbound and Inbound resolvers that make Route 53 a viable solution. | ~~Must use PowerDNS running on EC2 to address the level of DNS traffic.~~   * ~~3 instances of PowerDNS in Transit VPC~~ * ~~Each account requires PowerDNS instance~~ * ~~Unable to leverage the native DNS solution in any of the Cloud Providers.~~   Route 53 outbound resolver needs to be deployed in all accounts except new Transit, which (per Cyber NPS) has asynchronous routing issues that cause reliability issues for services outside of PAN and F5 deployed to that account. New Transit will use on-premise DNS Anycast and DNS Proxy on the PANs as a DNS cache for performance. All PowerDNS authoritative server domains will need to be migrated to Route 53 Public or Private hosted zones. | [DNS](https://wiki.comp.pge.com/display/CCE/DNS)  [2018-07-19 Network Disconnect (PAN, VPN, DNS)](https://wiki.comp.pge.com/pages/viewpage.action?pageId=49964294)  [Route 53 Outbound Resolver](https://wiki.comp.pge.com/display/CCE/Route+53+Outbound+Resolver) |
| **DNS** | ~~DNSSEC is a requirement.~~ | ~~Can't use Route53 as it doesn't support DNSSEC (yet).~~  ~~Loss of integrated DNS automation (Cloud Formation, etc)~~ | [DNS](https://wiki.comp.pge.com/display/CCE/DNS) |
| **Firewalls** | All traffic to / from **PGE** <-> **AWS** <-> **Internet** is inspected.  Therefore we need the F5/PAN security configuration. | There is a chance that the environment has single points of failure in the ([West III, Thomas](https://wiki.comp.pge.com/display/~T1WT) TODO: expand on this implication). More research to be done. |  |
| **Certificates** | We must use PG&E Certificates. | Integration with native AWS certificate solutions is not possible. This creates overhead and manual processes to request / use.  (There was a decision to embrace / explore AWS Certificate Manager, so this may be addressed) | [AWS ADC Diagram / Service Ports](https://wiki.comp.pge.com/pages/viewpage.action?pageId=49190526) |
| **Firewalls** | All user-based traffic requires a valid LANID on a valid workstation.  (TODO: confirm wording with [West III, Thomas](https://wiki.comp.pge.com/display/~T1WT) and [Stanley, John](https://wiki.comp.pge.com/display/~JFSV)) | The PAN must cache a list of valid devices and users based on (INSERT SOLUTION HERE).  If this cache or (SOLUTION) is unavailable, the user-based traffic fails. | [2018-07-09 PAN Network Outage](https://wiki.comp.pge.com/display/CCE/2018-07-09+PAN+Network+Outage) |

## Innovation Space

F,{1f518c82-bc98-451d-9c6b-b0cf44c56b07}{226},3.125,3.125

# Overview

Have an idea you would like to explore? Need to express a reference implementation? The Digital Innovation Zone is for you. The current environment is isolated (not connected to PG&E). You can either bring your own expertise (BYOE) or work with the Vanguard Team to leverage the [Pre-Product Prototyping Methodology (P3M)](https://wiki.comp.pge.com/pages/viewpage.action?pageId=49153992).

[REQUEST INNOVATION SPACE](https://wiki.comp.pge.com/display/EA/Innovation+Space+Requests+-+Outdated+-+Do+Not+Use)

# AWS

[REQUEST INNOVATION SPACE](https://wiki.comp.pge.com/display/EA/Innovation+Space+Requests+-+Outdated+-+Do+Not+Use)

## Conceptual Architecture

F,{2f6ded6e-9372-461c-9adb-04d6fad04a83}{46},3.125,3.125

## Account Information

Master Account (Billing): [ea-cloud-admin@pge.com](mailto:ea-cloud-admin@pge.com)

Root Account: [ea-innovation-admin@pge.com](mailto:ea-innovation-admin@pge.com)

### **AWS IAM Login**

<https://pgeinnovation.signin.aws.amazon.com/console>

Login credentials to be provided at request

## Azure

ETA: 2018-Q3

## Google Cloud Platform

ETA 2019

# Constraints

### **11/17/2017 - AWS Only**

* No direct access to PG&E
* Only non-production data or masked data (must be reviewed by Cybersecurity)
* Default AWS Service Limits are in place.
* Access constraints - no direct SSH from PG&E network (use Cloud9 IDE as an alternative)
* Current support mode: self service or BYOE (bring your own expert)

# [Cloud Roadmap](https://wiki.comp.pge.com/display/EA/Cloud+Roadmap)

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* Created by [Nichols, John](https://wiki.comp.pge.com/display/~JWNb), last modified on [Sep 22, 2017](https://wiki.comp.pge.com/pages/diffpagesbyversion.action?pageId=48292111&selectedPageVersions=3&selectedPageVersions=4), [viewed 59 times](https://wiki.comp.pge.com/page-tracking/page-view-detail.action?pageId=48292111&spaceKey=EA)

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# Cloud Roadmap

## Initiative Structure

(as part of the Affordability Roadmap #10 - Technology Architecture Simplification)

F,{a0839ab0-dda3-4e0e-89fe-e2e81e6e047c}{139},3.125,3.125F,{a0839ab0-dda3-4e0e-89fe-e2e81e6e047c}{140},3.125,3.125

**Contents**

* [Detailed Roadmap](https://wiki.comp.pge.com/display/EA/Cloud+Roadmap#CloudRoadmap-DetailedRoadmap)
* [10-01-A Cloud Enablement](https://wiki.comp.pge.com/display/EA/Cloud+Roadmap#CloudRoadmap-10-01-ACloudEnablement)
* [10-01-C Exit SFIOC & FFIOC Datacenters](https://wiki.comp.pge.com/display/EA/Cloud+Roadmap#CloudRoadmap-10-01-CExitSFIOC&FFIOCDatacenters)
  + [Workshops](https://wiki.comp.pge.com/display/EA/Cloud+Roadmap#CloudRoadmap-Workshops)
  + [Legacy Datacenter Consolidation](https://wiki.comp.pge.com/display/EA/Cloud+Roadmap#CloudRoadmap-LegacyDatacenterConsolidation)
  + [Security Enclave](https://wiki.comp.pge.com/display/EA/Cloud+Roadmap#CloudRoadmap-SecurityEnclave)
  + [ODN Lite](https://wiki.comp.pge.com/display/EA/Cloud+Roadmap#CloudRoadmap-ODNLite)
  + [DR Program](https://wiki.comp.pge.com/display/EA/Cloud+Roadmap#CloudRoadmap-DRProgram)
  + [Network](https://wiki.comp.pge.com/display/EA/Cloud+Roadmap#CloudRoadmap-Network)
  + [Service and Asset Management (Monitoring, Configuration etc)](https://wiki.comp.pge.com/display/EA/Cloud+Roadmap#CloudRoadmap-ServiceandAssetManagement(Monitoring,Configurationetc))
  + [Control Center Enablement](https://wiki.comp.pge.com/display/EA/Cloud+Roadmap#CloudRoadmap-ControlCenterEnablement)
  + [Cybersecurity Capabilities](https://wiki.comp.pge.com/display/EA/Cloud+Roadmap#CloudRoadmap-CybersecurityCapabilities)
* [10-01-B Enable Lower Environments for Commercial Cloud](https://wiki.comp.pge.com/display/EA/Cloud+Roadmap#CloudRoadmap-10-01-BEnableLowerEnvironmentsforCommercialCloud)
* [Cross Connects](https://wiki.comp.pge.com/display/EA/Cloud+Roadmap#CloudRoadmap-CrossConnects)
* [Risks / Opportunities](https://wiki.comp.pge.com/display/EA/Cloud+Roadmap#CloudRoadmap-Risks/Opportunities)

## Detailed Roadmap

F,{26577735-2624-477f-996f-f0e612d6a311}{145},3.125,3.125

[Detailed Roadmap](http://my/sites/pge_jwnb/AR10TAS/Legacy%20Datacenter%20Consolidation%20Roadmap.xlsx)

## 10-01-A Cloud Enablement

Integrate and make AWS available as a standard offering.

## 10-01-C Exit SFIOC & FFIOC Datacenters

### **Workshops**

|  |  |  |
| --- | --- | --- |
| **Date** | **Subject** | **Materials** |
| 08/24/2017 | Legacy Datacenter Migration | [Day-of Deck](https://sps.utility.pge.com/sites/sdse/Shared%20Documents/Migration%20from%20Legacy%20Data%20Center%20wwt.pptx?Web=1) |
|  |  |  |

### **Legacy Datacenter Consolidation**

#### **Pureflex Retirement**

Migrate applications off Pureflex

* Link to any Initiative Documents
* e.g. costs, presentations

#### **Application and System Migration**

Enable the migration of applications and systems to cloud solutions.

##### **RAPID API Foundation**

Establish API Foundation capabilities.

*These are in still DRAFT form.*

The "Enterprise Platforms - S1-strategy+EI.pptx" is the summary that will go into S2.

* PGE EI Roadmap 2017 V4
* Rapid\_API\_Dev\_Framework-Share
* Enterprise Platforms - S1-strategy+EI.pptx

2017:

* BT Project leveraging existing platforms for integration: OSB, Weblogic, Informatica, Axway ESFT, API Gateway
* EI will be deploying one project to internal cloud using Node JS and Tomcat.
* migrating decommissioning the remaining middleware platforms in SFIOC and FFIOC.
* addressing Platform Capacity and Organic growth
* Deploy API catalog to non-EI teams.
* Rationalization of file transfer platforms (decommission PGP Server, and IP Switch) to Axway MFT.
* Informatica EDI platform being built out to replace ORACE B2B
* POC for Heroku integration and cloud gateway

Identify migration options for each.

* Link to any Initiative Documents
* e.g. costs, presentations

#### **OneCloud 2.0 / VXRAIL**

Adding VXRAIL to the OneCloud environment

Adding Cloud Management Platform solution

* Link to any Initiative Documents
* e.g. costs, presentations

#### **AIX Consolidation**

Establish an AIX pool for all AIX to land (Pureflex & SFIOC)

* Link to any Initiative Documents
* e.g. costs, presentations

### **Security Enclave**

### **ODN Lite**

### **DR Program**

### **Network**

### **Service and Asset Management (Monitoring, Configuration etc)**

### **Control Center Enablement**

### **Cybersecurity Capabilities**

There are two project initiatives I have added to Cybersecurity S2 2018

1. Cloud Security Automation (DevSecOps)
2. Core Cloud Security Enablement

The Cloud Security Automation business case is being written. Lester John is helping on this effort.

For Core Cloud Security Enablement, the focus is to ‘enable’ Top 5 core security capabilities required for onboarding cloud services. (Note: IAM is another important capability mainly provisioning, federation, SSO etc. We are already working on enabling these features)

#### **Security Capabilities Summary**

Top Five areas to focus on:

1. Configuration Management & Monitoring
2. Privilege (Account) Management
3. Certificate/Key/Secret Management
4. Logging, Monitoring, Access Reporting & Compliance
5. Data & Code Governance.

#### **Security Capabilities Details**

##### **Configuration Management & Monitoring**

* Formally document required configuration elements to be monitored and managed.
* Develop a process to quickly introduce configuration management and monitoring for new services that are introduced rapidly in a public cloud environment.
* Compare and Select a Cloud Security Platform that leverages Cloud IaaS Provider API’s to baseline the configuration of cloud providers. The solution must support Amazon Web Services and Microsoft Azure.
* The Cloud Security Platform or CASB should allow PG&E to define policies and have the flexibility to tune the product to alert on elements pg&e values.
* The Cloud Security Platform for IaaS should help us visualize the traffic flows within our cloud datacenter providers.
* The Cloud security platform should help us achieve compliance by providing and measuring the recommended settings as defined in CIS Benchmark for AWS, HIPAA, PCI, etc.
* The Cloud Security Platform should enable us to take monitored elements that are defined to be alerted on and send them to our SIEM/SIOC tools, not requiring us our existing processes to change, or support teams to look at another tool.
* Implement the Cloud Security Platform(s)

##### **Privilege (Account) Management**

* Formally document Cloud Identity Management Architecture including how and when it will be possible for UDN Active Directory to be accessed from a cloud data center provider.
* Document standards around how ssh access keys must be rotated for public cloud providers.
* Define privilege elevation products and policies for enabling traditional windows and linux instances to be securely managed in a commercial cloud datacenter provider.
* Document standards and policies for API accounts
* Document standards and policy for managing the “root” account for a cloud provider such as AWS.
* Document standards and policies for service accounts and built-in human accounts that cannot be “federated” accounts from an identity provider such as PingFederate.

##### **Certificate, Key & Secret Management**

* Document Standards and Design patterns for how to manage Certificates, Keys & Secrets for cloud providers.
* Implement a secure way for keys and secrets to be stored and retrieved.

#### **Logging, Monitoring, Access Reporting & Compliance**

* Define strategy for Logging in a Cloud provider such as Syslog, application logs, etc. e.g. should they be kept in the cloud, shipped back on prem, etc.
* Define and select products to be used for logging in a cloud provider.
* Define low, medium and high criticality metrics to be monitored and alerted on.
* Establish a way to report on and demonstrate all access to server, middleware and database tiers in public cloud.
* Establish means to measure compliance to access standards.

##### **Data & Code Governance**

* Define reference architecture and security requirements to be put in place for hosting Internal, Confidential and Restricted data in a commercial cloud data center.
* Select a product or process to monitor and enforce policy for services such as amazon S3 to prevent them from being accidentally exposed to the public and prevent a data breach.
* Define standards for migrating data between environments, e.g. dev/test, qa, prod.
* Define data masking standards for developers to be able to develop against a dev environment with masked data.
* Implement products to make sure that our code is not shared publicly via company sanctioned services like GitHub.
* Implement tool to manage Open Source License management for open source dependencies and libraries used in our code
* Implement tool to identify and manage vulnerabilities for libraries and dependencies in our code.

## 10-01-B Enable Lower Environments for Commercial Cloud

## Cross Connects

* Mainframe Retirement
* API & Data Mandate

## Risks / Opportunities

* Funding for Migration
* EPC funding
* Support for stopping work that is counter-strategy
* Migration coordination

# [Cloud Strategic Direction in 2018](https://wiki.comp.pge.com/display/EA/Cloud+Strategic+Direction+in+2018)

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## Cloud First 2018

PG&E’s Cloud Strategy will be to adopt a “Cloud First” direction in 2018. Leveraging commercial cloud services to support the development and operations of our modern applications utilizing SaaS, PaaS, and IaaS offering from commercial cloud service providers such as AWS, Microsoft Azure, and Salesforce. The key to the success of the Cloud Strategy is to allow for the innovation and agility the commercial cloud services provide, while consistently delivering reliable and secure cloud deployments.

It should be noted, that we (PG&E) are in our infancy of the Commercial Cloud Journey, as such this Cloud Strategy will be a living document as we learn and adapt to the ever changing landscape of the commercial cloud service offerings, and our business demands.

For a presentation view of the [Cloud Strategy and Technology Simplification](https://sps.utility.pge.com/Sites/tpa/Shared%20Documents/Cloud%20Strategy%20and%20Technology%20Architecture%20Simplification%20Roadmap%202017-H2.pdf) approach.

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# Cloud Policy and Governance

As stated above in a number of occasions the goal of the Cloud Strategy is to design, build, and operate cloud service deployments consistently, reliable, and securely. To achieve this goal the appropriate governance and security controls, processes, and procedures need to be established, while not stifling the innovation capabilities the cloud services provide.

## Policies and Processes

Many of our current IT Governance processes and procedures apply to commercial cloud service deployments. The challenge is in the transition from the traditional waterfall prject management methodology, to the new agile project management methodology. The Agile Project Management methodology, want to move quickly, making progress upfront with incremental progress, as the project and service (on prem or off prem is deployed).

## Cloud Financial Management

As a utility our financial model is very capital centric, commercial cloud services are today considered monthly expenses. As such we need to develop the business cases and the processes to request the appropriate expense funding to support the commercial cloud adoption. In addition, will be requesting the California Public Utilities Commission (CPUC), in the next General Rate Case (GRC) to allow us to capitalize our commercial cloud investments.

Working with Microsoft on a Cloud (Microsoft Azure) Business Case, the analysis identified an $18M saving over 2 years with a $6M investment in migrating our virtual server environments to IaaS deployments at Microsoft Azure.

Additionally, based on some quick analysis for a project looking to leverage AWS S3 Stoarge service, there was an approximate 30% cost reduction of storage costs to PG&E over a 7 year period. Which was based on forecasted capacity and cost, not the actual capacity usage and cost as would be seen leveraging commercial cloud resources. We would only pay for what we actually use on a monthly basis versus purchasing forecasted capacity upfront.

Amazon Web Services (AWS) has various IaaS cost models to fit various needs and requirements.

* On Demand – cost based on compute resources based on usage, standard model
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* Dedicated – dedicated physical server, highest cost.

Financial planning and budgeting is key to the success of the cloud strategy and cloud services adoption. As we adopt the “Cloud First” strategy there will be significant shift in our project financial planning, shifting from the current one-time capital cost to the project, to an expense based project funding, but also on-going perpetual monthly expense funding for the cloud services. We are working with Business Finance to determine the best financial model for IT and PG&E.

## Cloud Financial Workflow

> Insert Workflow Picture <

## Cloud Governance Framework

The objective of the Cloud Governance Framework is to define the business process and governance controls needed to support the deployment and implementation of cloud services consistently, reliably, and securely.

The following are the governance policies and procedures we have to help guide us through a consistent, reliable, and secure cloud service deployment.

### **Cloud Governance Framework Matrix**

|  |  |  |
| --- | --- | --- |
| **Artifact Name** | **Description** | **Function** |
| [IT Governance Policy](https://edrm.comp.pge.com/D2/servlet/Download?auth=basic&event_name=open&version=CURRENT&id=09131aad86242672&format=pdf&_docbase=pge_ecm) | Maintain accessible, reliable, and secure computer, application and telecommunications systems to achieve business objectives. | Utilized during the S1 & S2 Planning Process. |
| [Enterprise Governance Intake](https://sps.utility.pge.com/sites/ITPO/itgov/Governance%20Document%20Library/IT%20Program%20Office%20Intake%20Process.pdf) | Intake workflow for IT & LOB Technology Projects | Utilized during the S1 & S2 Planning Process. Fully implemented within the ITM. |
| [IT Governance Playbook](https://sps.utility.pge.com/sites/ITPO/itgov/Governance%20Document%20Library/Forms/Process1.aspx) | Summary of process, roles, responsibilities, and deliverables for the IT Governance Process. | Utilized during the S1 & S2 Planning Process. Fully implemented within the ITM. |
| [IT Methodology Project Health Checks](https://sps.utility.pge.com/sites/ITM/SitePages/ProjectHealthChecks.aspx) | Project Success Checks (PSCs) are scheduled review of the project health throughout the Project Delivery process | Utilized by IT Program Office/Portfolio Architecture hands-on assessment of application development projects to ensure successful, compliant, and quality project delivery. Fully implemented within the ITM. |
| [Enterprise Records and Information Management](http://pgeweb/gas/ERIM/Pages/default.aspx) | Enterprise Records and Information definitions, requirements, standards, and workflow | Utilized as guidance in understanding the Information Lifecycle Management aspects for the data/information associated with the deployment system deployed in a cloud service. |
| [Cloud Services Protection](http://wwwedm/cgi-bin/doccontent.dll?LibraryName=dmspge01%5edmsedm01&SystemType=2&LogonId=f3776c90e247e369eff1b3e33fd27cb5&DocId=005760562&Page=1) | Identifies security requirements and controls necessary for the management and use of Software as a Service, Platform as a Service, and Infrastructure as a Service, collectively known as “Cloud Services.” | Utilized as guidepost or roadmap of security requirements that are followed by system architects, solution analysts, and risk consultants. They dictate ‘what’ is required and allow the individual(s) to determine ‘how’ to meet it. |
| [IT Software Management](http://wwwedm/cgi-bin/doccontent.dll?LibraryName=dmspge01%5edmsedm01&SystemType=2&LogonId=15eee47bd1965f79b98950b15239f5d1&DocId=005736550&Page=1) | standard for the management of software and ensure that software assets are used in an operationally compliant manner at PG&E. | Utilized during the procurement and installation of software at PG&E. |
| [Software Review Board](http://pgeweb/sharedservices/supplychain/sourcing/ITSourcing/_layouts/15/WopiFrame.aspx?sourcedoc=/sharedservices/supplychain/sourcing/ITSourcing/Documents/Software%20Review%20Board%20(SRB).pptx&action=default&DefaultItemOpen=1) | Software Review Board Workflow | Utilized when request new Software subscriptions, such as SaaS cloud services. |
| [Architecture Review Board](https://sps.utility.pge.com/Sites/tpa/Shared%20Documents/ArchitectureReviewBoardCharter.docx) | Architecture Review Board Charter | Utilized as Architectural review for Architectural Guidance Documentation, IT Policy/Standard Exception, and Escalation of non-standard design patterns. |
| [Purchasing Card Program Manual](https://edrm.comp.pge.com/D2/servlet/Download?auth=basic&event_name=open&version=CURRENT&id=09131aad85737860&format=pdf&_docbase=pge_ecm) | The Purchasing Credit Card (P-Card) is used to purchase low-dollar, miscellaneous non-coded materials, and low dollar and low risk services for PG&E. | Utilized as guidance for what is allowed and not allowed to be purchased by Purchasing Credit Cards (P-Cards) and Corporate Credit Cards. |
| PG&E Cybersecurity Control Framework | Framework of security controls which dictate the security controls for the PG&E Enterprise. | Utilized within the consulting process and assigned based on asset classification. Fully implemented within the ITM. |
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### **Governing Cybersecurity Standards**

|  |  |
| --- | --- |
| **Governing Cybersecurity Standards** | |
| **Cloud Services Protection -- IT-5412S**  **Cryptographic Controls -- IT-5304S**  **Email Management -- IT-5408S**  **Exception to Standard -- IT-5301S**  **Firewall -- IT-5305S**  **Identity and Access Management -- IT-5411S**  **Information Classification and Protection -- IT-5302S**  **Information Security Awareness and Training -- IT-5307S**  **Information Security Incident Management -- IT-5316S**  **IT Asset Management -- IT-5308S**  **IT Risk Assessment and Treatment -- IT-5312S**  **Malware Protection -- IT-5401S** | **Monitoring and Measurements -- IT-5401S**  **Password Requirements -- IT-5303S**  **PII Content Usage and Integrity -- IT-5410S**  **Personnel Security -- IT-5407S**  **Secure Coding -- IT-5403S**  **Secure Disposal or Re-Use of Assets -- IT-5309S**  **Secure Software Development -- IT-5409S**  **System Security Compliance -- IT-5321S**  **Technology Continuity and Availability -- IT-5315S**  **Third-Party Services Management: IT-5402S**  **User Responsibilities -- IT-5311S**  **Wireless Network Security -- IT-5304S**  **Mobile Computing -- IT-5306S** |

### **Cloud Governance Workflow**

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### **Cloud Governance Workflow**

> Insert Cloud Governance Workflow <

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# Cloud Cybersecurity

Cloud cybersecurity is encompassed by overall cybersecurity capability for commercial cloud services. Cloud cybersecurity strategy includes the following elements, which are covered in greater detail in separate documents:

* Cloud Cybersecurity Framework
* Stakeholders for Cybersecurity Framework
* Cloud Risk Management Framework
* Cybersecurity Policy Enforcement Framework
* Utility Standard Cloud Service Protection (IT-5412S)
* Cybersecurity Audit Assurance & Compliance framework
* Project Plan to implement processes and tools (technology) to support Cybersecurity Framework

## [Cybersecurity Framework](https://sps.utility.pge.com/Sites/tpa/Shared%20Documents/Cloud%20Cybersecurity%20Framework%20v1.0%2020170727.pdf)

The cloud cybersecurity framework uses a combination of enterprise-level cybersecurity capabilities that cut across systems and system-level cybersecurity capabilities, which are tailored to plan, design, build and maintain security into specific systems. PG&E generally aligns to the NIST Cybersecurity Framework (NIST CSF) as a taxonomy for categorizing major cybersecurity capabilities.

Enterprise cloud cybersecurity capabilities can also be categorized as people, process, and technology.

> insert framework picture <

People capabilities include the organizational commitment via funding, talent staffing, and cybersecurity organizational structure. Process capabilities include governance, requirements such as policies and standards, as well as workflows and procedures. Technology capabilities bring technical capability across and within systems to automate, enforce, and technically secure IT systems.

System-level cybersecurity capabilities are planned, designed, built into, and validated in individual systems

> insert system - level cybersecurity workflow <

## Cloud Cybersecurity Identity and Access Management Framework

The objective of the Cloud Identity and Access Management Framework is to define the identity and access management security process and controls to ensure our IT staff and end-user communities have the appropriate access to the appropriate IT systems, at the appropriate time. As we continue our cloud journey, these security controls become significantly important as our systems and data can be exposed in not properly architected and secured from unwanted access. Our [Utility Standard: IT-5411S](http://wwwedm/cgi-bin/getdoctdm.asp?itemid=005748007) Identity and Access Management Standard provides requirements and guidance associated with ensuring the our identities and access controls are appropriately managed to secure our data and IT systems.

> insert picture of IAM framework <

## [Cybersecurity Risk Management Framework](https://sps.utility.pge.com/Sites/tpa/Shared%20Documents/Cloud%20Risk%20Management%20Framework%20v1.0%2020170724.pdf)

The cloud risk management framework follows a classical risk management flow where risks are assessed, analyzed, plans are made, and action is taken based on analysis and priority. With cybersecurity there are different risk contexts including strategic level, system level, and, with cloud in particular, vendor level.

> Insert picture of risk mgmt framework <

## [Cybersecurity Policy Framework](https://sps.utility.pge.com/Sites/tpa/Shared%20Documents/Cloud%20Policy%20Enforcement%20Framework_v1.0.pptx)

The objective of the Cloud Policy Enforcement Framework is to define a mechanism to validate public and or PG&E owned cloud systems (Infrastructure, Platform, Software) and enforce against existing PG&E Cybersecurity Policies, Standards and controls.

> Insert picture of policy framework <

## Cybersecurity Audit & Assurance Framework

The objective of the Cloud Cybersecurity Audit Assurance & Compliance framework is to define a mechanism for assessing cybersecurity controls for private, hybrid, and public cloud deployments (Infrastructure, Platform, Software) against existing PG&E Cybersecurity Policies, Standards and controls. Note that the Audit Assurance & Compliance Framework and the Policy Enforcement Framework have considerable overlap in leveraging common processes and tools.

> Insert picture of Audit & Assurance Framework <

## [Cybersecurity Data Security Framework](https://sps.utility.pge.com/Sites/tpa/Shared%20Documents/Cloud%20Data%20Security%20Framework%20v1.0.pptx)

The objective of the Cloud Data Security Framework is to define a mechanism to ensure data security in public and or PG&E owned cloud systems (Infrastructure, Platform, Software) and enforce against existing PG&E Cybersecurity Policies, Standards and controls.

> Insert picture of data security framework <

# [Cloud Cybersecurity Identity and Access Management Framework](https://wiki.comp.pge.com/display/EA/Cloud+Cybersecurity+Identity+and+Access+Management+Framework)

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> Insert picture of risk mgmt framework <

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## [Cybersecurity Policy Framework](https://sps.utility.pge.com/Sites/tpa/Shared%20Documents/Cloud%20Policy%20Enforcement%20Framework_v1.0.pptx)

The objective of the Cloud Policy Enforcement Framework is to define a mechanism to validate public and or PG&E owned cloud systems (Infrastructure, Platform, Software) and enforce against existing PG&E Cybersecurity Policies, Standards and controls.

> Insert picture of policy framework <

# [Cybersecurity Audit & Assurance Framework](https://wiki.comp.pge.com/pages/viewpage.action?pageId=48292191)

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* Created by [Nichols, John](https://wiki.comp.pge.com/display/~JWNb), last modified on [Aug 29, 2017](https://wiki.comp.pge.com/pages/diffpagesbyversion.action?pageId=48292191&selectedPageVersions=1&selectedPageVersions=2), [viewed 5 times](https://wiki.comp.pge.com/page-tracking/page-view-detail.action?pageId=48292191&spaceKey=EA)

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## Cybersecurity Audit & Assurance Framework

The objective of the Cloud Cybersecurity Audit Assurance & Compliance framework is to define a mechanism for assessing cybersecurity controls for private, hybrid, and public cloud deployments (Infrastructure, Platform, Software) against existing PG&E Cybersecurity Policies, Standards and controls. Note that the Audit Assurance & Compliance Framework and the Policy Enforcement Framework have considerable overlap in leveraging common processes and tools.

> Insert picture of Audit & Assurance Framework <

# [Cybersecurity Data Security Framework](https://wiki.comp.pge.com/display/EA/Cybersecurity+Data+Security++Framework)

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* Created by [Nichols, John](https://wiki.comp.pge.com/display/~JWNb), last modified on [Aug 29, 2017](https://wiki.comp.pge.com/pages/diffpagesbyversion.action?pageId=48292194&selectedPageVersions=2&selectedPageVersions=3), [viewed 6 times](https://wiki.comp.pge.com/page-tracking/page-view-detail.action?pageId=48292194&spaceKey=EA)

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## [Cybersecurity Data Security Framework](https://sps.utility.pge.com/Sites/tpa/Shared%20Documents/Cloud%20Data%20Security%20Framework%20v1.0.pptx)

The objective of the Cloud Data Security Framework is to define a mechanism to ensure data security in public and or PG&E owned cloud systems (Infrastructure, Platform, Software) and enforce against existing PG&E Cybersecurity Policies, Standards and controls.

> Insert picture of data security framework <

# [Cloud Operating Model](https://wiki.comp.pge.com/display/EA/Cloud+Operating+Model)

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* Created by [Nichols, John](https://wiki.comp.pge.com/display/~JWNb), last modified on [Feb 05, 2018](https://wiki.comp.pge.com/pages/diffpagesbyversion.action?pageId=49192646&selectedPageVersions=1&selectedPageVersions=2), [viewed 27 times](https://wiki.comp.pge.com/page-tracking/page-view-detail.action?pageId=49192646&spaceKey=EA)

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### **Proposed in 2017**

Note that the [Cloud Strategy Update](https://wiki.comp.pge.com/display/EA/Cloud+Strategy+Update) has evolved since this time and now offers more focused decision criteria and solution sets.

# [Cloud Structure Overview](https://wiki.comp.pge.com/display/EA/Cloud+Structure+Overview)

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The different Cloud Communication opportunities.

[Create New Entry](https://wiki.comp.pge.com/?templateId=48922830&spaceKey=EA&newSpaceKey=EA)

CATEGORIES: [Cloud Alignment Sessions](https://wiki.comp.pge.com/display/EA/Cloud+Alignment+Sessions) | CIO LT Deep Dives |

## Cloud Communications, Meetings, Workshops

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Title** | **Audience** | **Date** | **Materials** | **Purpose** | **Type** |
| [Cloud Alignment Session 2018-04-13](https://wiki.comp.pge.com/display/EA/Cloud+Alignment+Session+2018-04-13) | See DL | 13 Apr 2018 | Pilot Deck: <https://pge-my.sharepoint.com/:p:/p/jwnb/EVQGK6OHg55KluG-Y6xyn_EBM1pIgd9umqX-HIUFx02jmA?e=i1kRdh>  Pilot Names: <https://pge-my.sharepoint.com/:x:/p/jwnb/ETRwj-xCW-hPisrqvhovFeoBq8fKr5LlxBMD1n6eZmZTSg?e=305HgG> | Shared Understanding of the Cloud efforts, dependencies and capabilities | Workshop |
| [Cloud Alignment Workshop 2018-03-30](https://wiki.comp.pge.com/display/EA/Cloud+Alignment+Workshop+2018-03-30) | See DL | 30 Mar 2018 |  | Shared Understanding of the Cloud efforts, dependencies and capabilities |  |
| [Cloud Intake Team - Proposal](https://wiki.comp.pge.com/display/EA/Cloud+Intake+Team+-+Proposal) | IT Leadership, Project Managers, Architects | 27 Feb 2018 |  | Proposal for reviewing projects for Cloud applicability |  |
| [Cloud Alignment Workshop 2018-02-16](https://wiki.comp.pge.com/display/EA/Cloud+Alignment+Workshop+2018-02-16) | I&O  Business Technology  Digital Catalyst  Cybersecurity  Architecture | 16 Feb 2018 9a - 1p | Your 2018 plans (informed by S2) related to Cloud (emphasis on Commercial Cloud)  Identified Gaps  Recording: <https://pge.webex.com/pge/ldr.php?RCID=03c209019e9d51eb0c9db84c7b277bfb> | Review cloud initiatives. Align on priorities. Identify any gaps. Create a prioritized backlog. | Workshop |
| [Podcast: Cloud Migration Options](https://wiki.comp.pge.com/display/EA/Podcast%3A+Cloud+Migration+Options) | IT | 01 Feb 2018 | F,{744fe3ac-4427-4cd6-a5be-7dcbe6dae39d}{210},3.125,3.125 | Overview of the different cloud migration options. |  |
| [Podcast: Cloud Benefits](https://wiki.comp.pge.com/display/EA/Podcast%3A+Cloud+Benefits) | Business and Leadership | 30 Jan 2018 | F,{744fe3ac-4427-4cd6-a5be-7dcbe6dae39d}{253},3.125,3.125 | Education on the cost benefits of cloud. |  |
| [Cybersecurity Cloud Strategy Update 2018-01-29](https://wiki.comp.pge.com/display/EA/Cybersecurity+Cloud+Strategy+Update+2018-01-29) | Joe Sagona  Fernando Medrano  Snay Trivedi  Martin Strasburger  Nathan Casey | 29 Jan 2018 | [Cloud Strategy Podcast 2018-01](https://wiki.comp.pge.com/display/EA/Cloud+Strategy+Podcast+2018-01) | Update and Refresh on the latest Cloud Strategy |  |
| [Cloud Strategy Podcast 2018-01](https://wiki.comp.pge.com/display/EA/Cloud+Strategy+Podcast+2018-01) | IT | 26 Jan 2018 | F,{6db1a2b1-b278-4767-a119-f4d3be1efd3e}{111},3.125,3.125 | Update on the Cloud Strategy |  |
| [AWS re:Invent 2017 Global Partner Summit Keynote & Fast Company Interview](https://wiki.comp.pge.com/pages/viewpage.action?pageId=49153662) | Global Partner Summit at AWS re:Invent | 28 Nov 2017 | F,{6db1a2b1-b278-4767-a119-f4d3be1efd3e}{154},3.125,3.125 | Networking opportunity with other companies and partners |  |
| [Cloud Summit for PG&E (2017)](https://wiki.comp.pge.com/pages/viewpage.action?pageId=48295789) | All of PG&E, targeting key stakeholders in EO, Customer and Gas | 18 Oct 2017 | Presentation: [Cloud Summit for PG&E Presentation](http://my/sites/pge_jwnb/AR10TAS/Cloud%20Summit%20for%20PGE%202017-10-18.pptx)  Recording: [Recording](https://pge.webex.com/pge/ldr.php?RCID=64772f6489fc2244226a047723c4dc42) | Educational |  |
| [CPUC Thought Leader Session (Aug 2017)](https://wiki.comp.pge.com/pages/viewpage.action?pageId=48291727) | CPUC | 24 Aug 2017 | CPUC: [LINK](http://my/sites/pge_jwnb/Documents/Shared%20with%20Everyone/Cloud/CPUC%20Thought%20Leader%20Session%20-%20SST%202017-08-24%20TL%20Cloud%20Intro%20v02.pptx)  Opower: [LINK](http://my/sites/pge_jwnb/Documents/Shared%20with%20Everyone/Cloud/CPUC%20Thought%20Leader%20Session%20-%20Oracle_Thought%20Leaders%20Cloud_FINAL.pptx)  SAP: [LINK](http://my/sites/pge_jwnb/Documents/Shared%20with%20Everyone/Cloud/CPUC%20Thought%20Leader%20Session%20-%20SAP%20CPUC%20Intro%20v1.2.pptx)  PG&E: [LINK](http://my/sites/pge_jwnb/Documents/Shared%20with%20Everyone/Cloud/CPUC%20Thought%20Leader%20Session%20-%20PGE%20Cloud.pptx)  Moody's: [LINK](http://my/sites/pge_jwnb/Documents/Shared%20with%20Everyone/Cloud/CPUC%20Thought%20Leader%20Session%20-%20Moodies%20Toby%20Slides%20for%20CPUC.pptx) | Education on uses of Cloud; Introduction of Cloud concepts and financial treatment conversation |  |
| [Cloud Summit for Architects and Engineers (2017)](https://wiki.comp.pge.com/pages/viewpage.action?pageId=48286347) | Architects and Engineers from IT | 18 Aug 2017 | [Presentation](https://sps.utility.pge.com/Sites/tpa/KAR%20%20Documents/Cloud%20Summit%20for%20Architects%20and%20Engineers%202017-08-18.pptx)  [Recording](https://pge.webex.com/pge/ldr.php?RCID=81444451194cb15a0197a4ce0ff46849) | Cloud Strategy Update, Orientation and Training for the Cloud Solution Assessment process |  |