Desmistificando Microsserviços e DevOps: Projetando Arquiteturas Efetivamente Escaláveis

Prof. Vinicius Cardoso Garcia
vcg@cin.ufpe.br :: @vinicius3w :: assertlab.com

[IF1004] - Seminários em SI 3
https://github.com/vinicius3w/if1004-DevOps

AssertLab
Advanced Software and Systems Engineering Research Technologies

Desenvolvimento de Aplicações com Arquitetura Baseada em Microservices

Prof. Vinicius Cardoso Garcia
vcg@cin.ufpe.br :: @vinicius3w :: assertlab.com

[IF1007] - Tópicos Avançados em SI 4
https://github.com/vinicius3w/if1007-Microservices

AssertLab
Advanced Software and Systems Engineering Research Technologies

Licença do material

Este Trabalho foi licenciado com uma Licença

Creative Commons - Atribuição-NãoComercial-Compartilhalgual 3.0 Não Adaptada

Mais informações visite

http://creativecommons.org/licenses/by-nc-sa/3.0/deed.pt

Resources

- There is no textbook required. However, the following are some books that may be recommended:
  - Building Microservices: Designing Fine-Grained Systems
  - Spring Microservices
  - Spring Boot: Acelere o desenvolvimento de microsserviços
  - Microservices for Java Developers A Hands-on Introduction to Frameworks and Containers
  - Migrating to Cloud-Native Application Architectures
  - Continuous Integration
  - Getting started guides from spring.io

Background

AssertLab
Advanced Software and Systems Engineering Research Technologies

Before we start...

?????? Inbox x

[redacted] Aug 15 (1 day ago)

to [redacted]

Portuguese > English Translate message Turn off for: Portuguese

Pessoal,

um amigo meu está precisando de um profissional para trabalhar nas coisas abaixo. A princípio, pensei que fossem de BD, mas [redacted] não sabe o que é mais da metade disso (exatamente como eu). Vocês sabem quem seria o profissional para isso tudo? Tem alguém para indicar?

"Atuar com Framework Laravel, Front-end, MySQL (DDL, DML), Composer, OOP, ORM (pdo, doctrine, etc.), Git, Agile, Npm, grunt, bower, Framework de js (angular, react e afins), bootstrap ou qualquer mecanismo de grid. Lidar com Nodejs, Sass, Cloud, Caching, Rest, CI/CD e Docker."

Minha primeira impressão é que era um Super-Homem; agora, já acho que são três em um só....

[]'s.

...

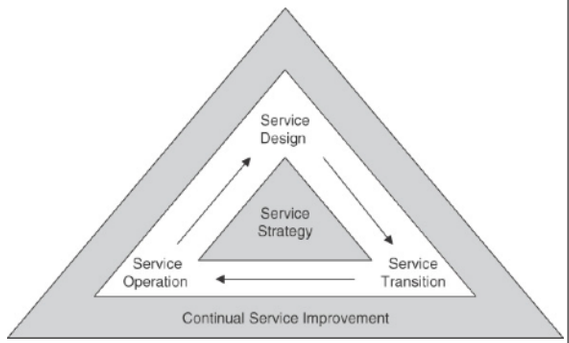
Operations

““There is a core of thinkers within the DevOps community who understand what IT management is about and are sensible about the use of ITIL within a DevOps context; and there are others with a looser grasp on reality…”

— Rob England, http://www.itskeptic.org/devops-and-itil (Excerpt From: Bass, Len. “DevOps: A Software Architect’s Perspective”)

Introduction

- To understand DevOps it is important to be aware of the context that people in Ops or Dev come from
- One characterization of Ops is given in the Information Technology Infrastructure Library (ITIL)



Service life cycle (Adapted from ITIL)

ITIL acts as a kind of coarse-grained job description for the operations staff. ITIL is based on the concept of “services,” and the job of Ops is to support the design, implementation, operation, and improvement of these services within the context of an overall strategy

Operations Services

- An operations service can be the provisioning of hardware, the provisioning of software, or supporting various IT functions.
- Services provided by operations also include the specification and monitoring of service level agreements (SLAs), capacity planning, business continuity, and information security.”

AssertLab
Advanced Software and Systems Engineering Research Technologies

Provisioning of hardware

- Hardware can be physical hardware owned by the organization, or it can be virtual hardware managed by a third party or a cloud provider.

Used by	Physical Hardware	Virtual Hardware
Individuals	Laptops, desktops, tablets, smartphones	Virtual machines for development and unit tests
Projects	Integration servers, version control servers	Virtual machines used for integration and version control
Organization	Servers for services such as printers, network infrastructure	Virtual machines used for organization-wide services

Provisioning of Software

Responsibilities for Different Types of Software

Developed by	Supported by
Project	Project
Third party	Operations or projects, depending on breadth of use
Operations	Operations
DevOps group	DevOps group

IT Functions

- Service desk operations: The service desk staff is responsible for handling all incidents and service requests and acts as first-level support for all problems.
- Technology experts: Ops typically has experts for networks, information security, storage, databases, internal servers, web servers and applications, and telephony.
- Day-to-day provisioning of IT services: These include periodic and repetitive maintenance operations, monitoring, backup, and facilities management.

Day-to-day IT services include the provisioning of new software systems or new versions of current systems, and improving this process is a main goal of DevOps.

The people involved in the Ops side of DevOps typically come from the last two categories.

As we will see in the case study in Chapter 12, information security and network experts are also involved in DevOps, at least in the design of a continuous deployment pipeline, which is ideally shared across the organization to promote standardization and avoid drifting over time.

Service Level Agreements

- An organization has a variety of SLAs with external providers of services.
  - For example, a cloud provider will guarantee a certain level of availability.
  - Ops traditionally is responsible for monitoring and ensuring that the SLAs are adhered to.
- An organization also has a variety of SLAs with its customers.
  - Ops has traditionally been responsible for ensuring that an organization meets its external SLAs.
- Similarly to external SLAs, Ops is usually responsible for meeting internal SLAs, for example, for an organization's own website or e-mail service.

Dev and DevOps are becoming more responsible for application SLAs and external SLAs in the DevOps movement.

All of these functions involve monitoring and analyzing various types of performance data from servers, networks, and applications.

Capacity Planning

- Ops is responsible for ensuring that adequate computational resources are available for the organization.

- More importantly, Ops is responsible for providing sufficient resources so that consumers of an organization's products can, for instance, browse offerings, make orders, and check on the status of orders. This involves predicting workload and the characteristics of that workload.

With cloud elasticity, the pay-as-you-go model, and the ease of provisioning new virtual hardware, capacity planning is becoming more about runtime monitoring and autoscaling rather than planning for purchasing hardware.

Business Continuity and Security

- Recovery point objective (RPO). When a disaster occurs, what is the maximum period for which data loss is tolerable?

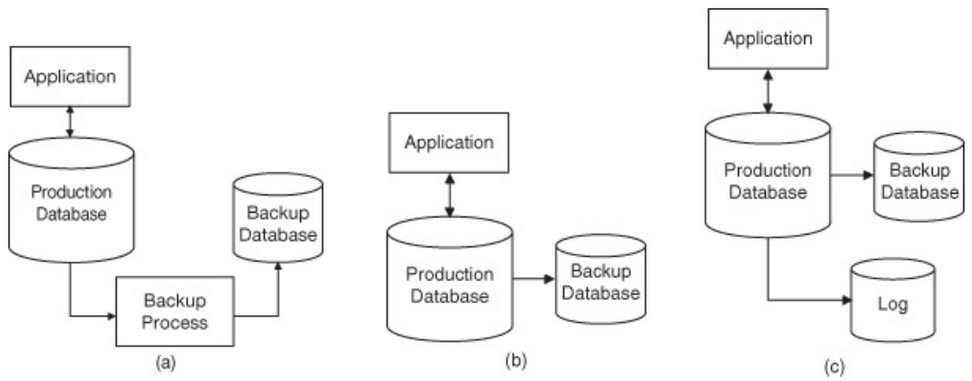
- Recovery time objective (RTO). When a disaster occurs, what is the maximum tolerable period for service to be unavailable?

The two values are independent since some loss of data may be tolerable, but being without service is not. It is also possible that being without service is tolerable but losing data is not.

AssertLab
Advanced Software and Systems Engineering Research Technologies

For instance, if a recovery solution takes 10 minutes to access the backup in a separate datacenter and another 5 minutes to instantiate new servers using the backed-up data, the RTO is 15 minutes.

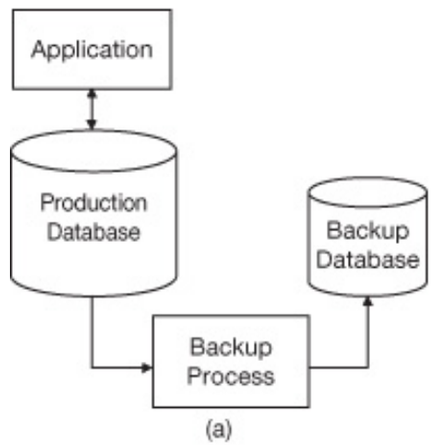
Database backup strategies



(a) An independent agent performing the backup. (b) The database management system performing the backup. (c) The database management system performing the backup and logging all transactions.

An external agent

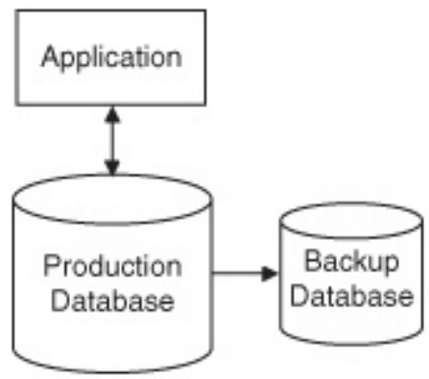
- The backup process copying the database periodically.
- No application support is required but the backup process should copy a consistent version of the database.
- That is, no updates are currently being applied. If the backup process is external to the database management system, then transactions may be in process and so the activation of the backup should be carefully performed.
- In this case, the RPO is the period between two backups. That is, if a disaster occurs just prior to the backup process being activated, all changes in the period from the last backup will be lost.



(a)

The database management system creates a copy periodically

- Guaranteeing consistency is done by the database management system
- The RPO is the period between taking copies. If the database is a relational database management system (RDBMS) offering some level of replication (i.e., a transaction only completes a commit when the replica database has executed the transaction as well), then transactions lost in the event of a disaster will be those not yet committed to the replicating database.
- The cost, however, is increased overhead per transaction.

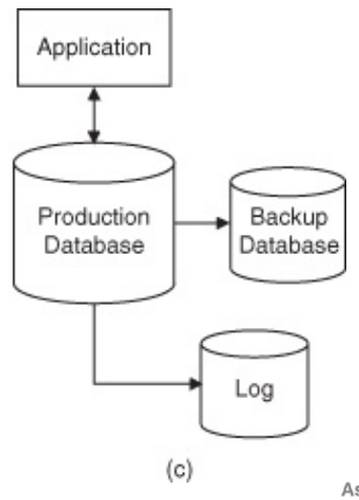


(b)

The difference between 3.2a and 3.2b is that in 3.2b, guaranteeing consistency is done by the database management system, whereas in 3.2a, consistency is guaranteed by some mechanism that governs the activation of the backup process

The database management system log every write

- The data can be re-created by beginning with the backup database and replaying the entries in the log. If both the log and the backup database are available during recovery, the RPO is 0 since all data is either in the backup database or in the log.
- The protocol for committing a transaction to the production database is that no transaction is committed until the respective log entry has been written.
- This scheme is used by high-reliability relational database management systems. It is also used by distributed file systems such as Hadoop Distributed File System (HDFS).

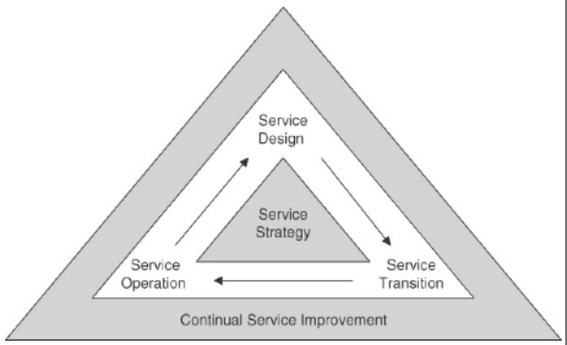


(c)

When considering RTO (i.e., how quickly you can get your application up and running after an outage or disaster), alternatives include: using multiple datacenters as discussed in the case study in Chapter 11 or using distinct availability zones or regions offered by a cloud provider, or even using several cloud providers.

Service Strategy

- Developing a strategy is a matter of deciding where you would like your organization to be in a particular area within a particular time frame, determining where you currently are, and deciding on a path from the current state to the desired state.



Service life cycle (Adapted from ITIL)

Service Design

- What automation is going to be involved as a portion of the service?
- What are the governance and management structures for the service?
- What are the SLAs for the service? How is the service to be measured, and what monitoring structure is necessary to support the measurement?
- What are the personnel requirements for the service?
- What are the compliance implications of the service?
- What are the implications for capacity?
- What are the business continuity implications of the service?
- What are the information security implications of the service? What data is sensitive and must be protected, and who has responsibility for that data?

AssertLab
Advanced Software and Systems Engineering Research Technologies

Service Transition

- Service transition subsumes all activities between service design and operation, namely, all that is required to successfully get a new or changed service into operation.

- Transition and planning support includes aspects of: resources, capacity, and change planning; scoping and goals of the transition; documentation requirements; consideration of applicable rules and regulations; financial planning; and milestones.

Service Operation

- Operation is where the customer benefits from good design, implementation, and transition — or not.

- During operation, events are defined by ITIL as “any detectable or discernible occurrence that has significance for the management of the IT infrastructure or the delivery of IT service and evaluation of the impact a deviation might cause to the services."

Events of interest during operation

- Status information from systems and infrastructure
- Environmental conditions, such as smoke detectors
- Software license usage
- Security information (e.g., from intrusion detection)
- Normal activity, such as performance metrics from servers and applications

Incident

- An incident, according to ITIL, is “any event which disrupts, or which could disrupt, a service.”
- Core activities of incident management are
  - Logging the incident
  - Categorization and prioritization
  - Initial diagnosis
  - Escalation to appropriately skilled or authorized staff, if needed
  - Investigation and diagnosis, including an analysis of the impact and scope of the incident
  - Resolution and recovery, either through the user under guidance from support staff, through the support staff directly, or through internal or external specialists
  - Incident closure, including recategorization if appropriate, user satisfaction survey, documentation, and determination if the incident is likely to recur

Incident management is one of the areas where DevOps is changing the traditional operations activities. Incidents that are related to the operation of a particular software system are routed to the development team.

Service Operations Functions

- Monitoring is of central importance during operations and can be combined with some control”
  - Open-loop control (i.e., monitoring feedback is not taken into account) can be used for regular backups at predefined times.
  - In closed-loop control, monitoring information is taken into account when deciding on an action, such as in the autoscaling example.
- Which group is responsible for handling incidents?

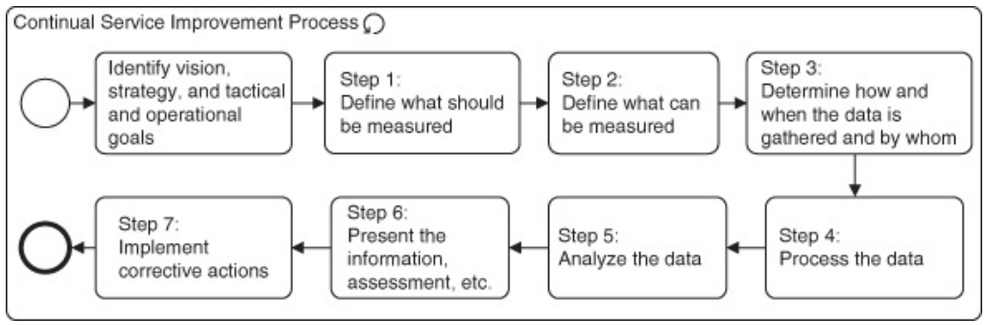
One DevOps practice is to have the development group analyze the monitoring of the single system that they developed. Monitoring of multiple systems including the infrastructure will be the responsibility of the Ops group, which is also responsible for the escalation procedure for any incidents that require handling through one or more development teams.

Continual Service Improvement

- How well is the process working? How can the process be improved? How does this process fit in the organization's overall set of processes?
  - Organizational processes should be monitored and evaluated from this perspective

- Organizationally, each of these services should have an owner, and the owner of a service is the individual responsible for overseeing its monitoring, evaluation, and improvement.

Continual service improvement process (Adapted from ITIL)



Operations and DevOps

- How interactions between traditional IT Ops and DevOps can be shaped in the future?
- Ops is responsible for provisioning of hardware and software; personnel with specialized skills; specification and monitoring of SLAs; capacity planning; business continuity; and information security.
  - all of the activities that Ops currently performs and involves both functional activities, personnel skills, and availability

Our basic message is that ignoring ITIL because it looks heavyweight and not suited for the processes of DevOps is shortsighted and will require relearning the lessons incorporated into the ITIL framework.

Activities that impact DevOps 1/2

- Hardware provisioning. Virtualized hardware may be allocated by a development team or application with more automation.
- Software provisioning. Internally developed software will be deployed by Dev. Other software is provisioned by Ops.
- IT function provision. To the extent that a Dev team is responsible for incident management and deployment tools, it must have people with the expertise to perform these tasks.
- Specification and monitoring of SLAs. For those SLAs that are specific to a particular application, Dev will be responsible for monitoring, evaluating, and responding to incidents.

Activities that impact DevOps 2/2

- Capacity planning. Dev is responsible for capacity planning for individual applications, and Ops is responsible for overall capacity planning.
- Business continuity. Dev is responsible for those aspects of business continuity that involve the application architecture, and Ops is responsible for the remainder. Ops can provide services and policies for business continuity, which in turn are used by Dev.
- Information security. Dev is responsible for those aspects of information security that involve a particular application, and Ops is responsible for the remainder.

DevOps team size

- One organization estimates that 20% of the Ops team and 20% of the Dev team are involved in DevOps processes
  - The extent to which Dev becomes the first responder in the event of an incident
  - Whether there is a separate DevOps group responsible for the tools used in the continuous deployment pipeline
  - The skill set and availability of personnel from the two groups

DevOps vs ITIL's service transition

- ITIL assumes fairly large release packages where careful planning, change management, and so on are feasible…
- …in contrast to the high-frequency small releases encountered in typical DevOps scenarios

Release Package Examples

Rob Spencer suggests in a blog post to view DevOps releases as “concurrent streams of smaller deliverables

Stream	Frequency	ITIL Roles/Processes
1 Code objects checked in, tested, and deployed	Daily	Research & Development Management (R&DM), Service Asset and Configuration Management (SACM)
2 Knowledge updates created and tested for the new functional requirements	Every other day	SACM, Service Validation and Testing (SV&T), Knowledge Management
3 Formal Operational acceptance tests	2 times/week	SV&T, Service Level Management (SLM), Business Relationship Manager (BRM), App/Tech Function Managers
4 Hardware deliveries	As required	R&DM, Tech Management
5 Early Life Support and Continual Service Improvement	Daily	Continual Service Improvement (CSI), SLM, BRM, Service Owner

AssertLab
Advanced Software and Systems Engineering Research Technologies

Summary

- ITIL provides general guidance on how activities are to be carried out rather than specific guidance
  - instead of saying “measure A with a goal of X,” ITIL says something like “for goal X, choose the measurements that will allow you to determine X.
- The specifics of the impact of DevOps on Ops will depend on the type of organization and the particular DevOps practices that are adopted.
- DevOps provides continuous delivery of the various ITIL services rather than requiring those services to be packaged into a major release.

For Further Reading

- The latest version of ITIL is from 2011. It is published in five volumes:
  - D. Cannon. ITIL Service Strategy. The Stationery Office, 2011
  - L. Hunnebeck. ITIL Service Design. The Stationery Office, 2011.
  - V. Lloyd. ITIL Continual Service Improvement. The Stationery Office, 2011.
  - S. Rance. ITIL Service Transition. The Stationery Office, 2011
  - R. A. Steinberg. ITIL Service Operation. The Stationery Office, 2011.
- T. Erl. Service-Oriented Architecture: Principles of Service Design. Prentice Hall, 2007.

For Further Reading

- Some blogs that discuss ITIL and its relation to DevOps are
  - "DevOps and ITIL: Continuous Delivery Doesn't Stop at Software"
  - "What is IT Service?"
  - FireScope is a company involved in enterprise monitoring: See the blog "What is an IT Service?"
- Recovery point objective (RPO) is defined and contrasted with recovery time objective (RTO) in a Wikipedia article at http://en.wikipedia.org/wiki/Recovery_point_objective

Homework 9

- Reading the article "An empirical study on principles and practices of continuous delivery and deployment"

- Relate the principles and practices of continuous delivery and deployment with the main issues on Dev and Ops teams activities, mentioning - if pertinent - ITIL practices discussed in this class