facebook

INFRASTRUCTURE

Internal Services Have Customers Too!

KC Braunschweig
Production Engineer
SCaLE 17x – March 2019

Internal Services Have Customers Too!

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Who Am I?

- SCaLE Volunteer

@kcbraunschweig

Who Am I?

- SCaLE Volunteer
- Ticketmaster - Web Operations
- Edmunds.com - Systems Engineering

@kcbraunschweig

Who Am I?

- SCaLE Volunteer
- Ticketmaster - Web Operations
- Edmunds.com - Systems Engineering
- Facebook - Production Engineering
  - OS & Config Management (Chef)
  - Logging Infrastructure (Scribe, Hadoop & LogDevice)
  - Coordination Infrastructure (Apache Zookeeper)

@kcbraunschweig

Agenda

- ~~Intro~~
- Facebook Service Examples
- Service Maturity Scenarios
- Conclusions

Facebook Service Examples

Facebook Examples

Scribe

- Originally a purpose built logging framework for dozens of use cases
  - “Today we have well over 100 applications using this” – Bobby Johnson 2009 [2]
- Now the transport layer for all logging, stream processing
  - Many 1000s of categories and >1TB/s [3]
- 10+ years becoming a massive multi-tenant service

[2] “Scribe Tech Talk” https://www.facebook.com/Engineering/videos/650882334523/

[3] “The History of Logging @Facebook (Abridged)” https://www.usenix.org/conference/lisa18/presentation/braunschweig

Facebook Examples

Chef

- All systems-level configuration at Facebook
    - Designed for a *small team* to manage a *massive* fleet
    - Delegate responsibility to customer teams
- “Have 4 people manage 10s of thousands of heterogeneous systems” – Phil Dibowitz 2014 [1]
- ~6 years of maturing

[1] “Really large scale systems configuration” https://www.youtube.com/watch?v=rEWHmk8vBYk

Facebook Examples

Zookeeper

- Originally backing 2 major use cases:
    - Service discovery system
    - Application configuration distribution system
    - One team with a handful of ensembles
- Now Zookeeper as a Service
    - Hundreds of ensembles [4]
    - One Zookeeper team with many customer teams

[4] “Zookeeper Meetup” https://www.facebook.com/zkmeetup/videos/559260314523351/

Service Maturity Scenarios

Facebook Examples

Plan of attack

- You don’t get to pick where to start
- What’s right? What’s wrong?
- What do we need to make things better?

Config Smell

Monitoring Zookeeper ensembles

Config Smell

Monitoring Zookeeper ensembles

- ”Where are the monitoring configs?” – Zookeeper team n00b

* Ensembles have names e.g. `zk.global.42`

Config Smell

Monitoring Zookeeper ensembles

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```
filter(zk\.global\.(0[389]|29|4[2-8]|6[589]|72|103))
```

* Ensembles have names e.g. `zk.global.42`

Config Smell

Monitoring Zookeeper ensembles

- ”Where are the monitoring configs?” – Zookeeper team n00b

```
filter(zk\.global\.(0[389]|29|4[2-8]|6[589]|72|103))

filter(zk\.global\.(0[389]|29|4[2-8]|6[589]|72))

# and 2 other places with slight variations
```

* Ensembles have names e.g. `zk.global.42`

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Monitoring Zookeeper ensembles

- ”Where are the monitoring configs?” – Zookeeper team n00b

```
filter(zk\.global\.(0[389]|29|4[2-8]|6[589]|72|103))

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# and 2 other places with slight variations
```

* Ensembles have names e.g. `zk.global.42`

Config Smell

Monitoring Zookeeper ensembles

- Growing number of ensembles
- Wormhole [5] team uses a growing subset of ensembles
- Wormhole monitoring is slightly different due to their workload

[5] “Wormhole: Reliable Pub-Sub to Support Geo-replicated Internet Services”
https://www.usenix.org/system/files/conference/nsdi15/nsdi15-paper-sharma.pdf

Config Smell

Monitoring Zookeeper ensembles

- That’s a little better

```
# Special wormhole ensembles – keep updated!
WH=filter(zk\.global\.(0[389]|29|4[2-8]|6[589]|72|103))
```

Config Smell

Monitoring Zookeeper ensembles

- That’s a lot better

```
filter(get_ensembles_by_customer(‘wormhole’))
```

Config Smell

Monitoring Zookeeper ensembles

- That’s a lot better or is it?

```
filter(get_ensembles_by_customer(‘wormhole’))
filter(get_ensembles_by_customer(‘wormhole2’))
```

Config Smell

Monitoring Zookeeper ensembles

- That's a lot better or is it?

```
filter(get_ensembles_by_customer('wormhole'))
filter(get_ensembles_by_customer('wormhole2'))
filter(get_ensembles_by_customer('stargate'))
filter(get_ensembles_by_customer('lorem'))
filter(get_ensembles_by_customer('ipsum'))
filter(get_ensembles_by_customer('adnauseum'))
...
```

Config Smell

Monitoring Zookeeper ensembles

- How about this

```
filter(get_ensembles_by_sla('hipri'))
```

Config Smell

Monitoring Zookeeper ensembles

- Or better yet

```
for sla, ensembles in get_ensembles_by_sla().items()
    # do stuff for each sla
    filter(ensembles)
```

Config Smell

Monitoring Zookeeper ensembles

What do we need?

- Separate customer metadata from service implementation
- Define scalable service offerings
- Canonical store of customer metadata

Customer Metadata

Scribe Categories

Customer Metadata

Scribe Categories

Background

- Log events are written to scribe categories
- Categories must be registered
- Registration has required fields

Customer Metadata

Scribe Categories

```
$ dmv find kctest1 -f json
[{
    "Category": "kctest1",
    "Blacklist Threshold": ”1GB",
    "Encryption": ”Yes",
    "Importance": "normal",
    "MailTo": "",
    "MaxRate": ”1MB",
    "Modified": "2018-10-08T09:00:17",
    "Modified By": "security_oncall",
    "Oncall": "scribe_oncall",
    "Owner": "kcb",
    "Retention": 1,
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Customer Metadata

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Scribe Categories

- + Know who our customers are

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```

Customer Metadata

Scribe Categories

- + Know who our customers are
- - Implementation leakage

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- ~ Metadata is *intended state* not actual state

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- ~ Clear expectations?

Customer Metadata

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}]
```

Customer Metadata

Scribe Categories

- + Know who our customers are
- - Implementation leakage
- ~ Metadata is *intended state* not actual state
- ~ Clear expectations?
- + Customer data for operations

Customer Metadata

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    "Modified": "2018-10-08T09:00:17",
    "Modified By": "security_oncall",
    "Oncall": "scribe_oncall",
    "Owner": "kcb",
    "Retention": 1,
}]
```

Customer Metadata

Scribe Categories

- + Know who our customers are
- - Implementation leakage
- ~ Metadata is *intended state* not actual state
- ~ Clear expectations?
- + Customer data for operations
- + Change history

Customer Metadata

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$ dmv find kctest1 -f json
[{
    "Category": "kctest1",
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    "Modified": "2018-10-08T09:00:17",
    "Modified By": "security_oncall",
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    "Owner": "kcb",
    "Retention": 1,
}]
```

Customer Metadata

Scribe Categories

- + Know who our customers are
- - Implementation leakage
- ~ Metadata is *intended state* not actual state
- ~ Clear expectations?
- + Customer data for operations
- + Change history
- - Implicit offerings create implicit expectations

Customer Metadata

Scribe Categories

How can we make this better?

- Manage intended -> actual state

Customer Metadata

Convergence & Failure

Intended state vs. actual state -> convergence

Customer Metadata

Convergence & Failure

Intended state vs. actual state -> convergence

```
    "Blacklist Threshold": ”1GB",
    "MaxRate": ”1MB",
```

Customer Metadata

Convergence & Failure

Intended state vs. actual state -> convergence

```
    "Blacklist Threshold": ”1GB",
    "MaxRate": ”1MB",

# system aggregate rate limits vs. capacity
impossible desires + naïve guardrails =
```

Customer Metadata

Convergence & Failure

Intended state vs. actual state -> convergence

```
    "Blacklist Threshold": ”1GB",
    "MaxRate": ”1MB",

# system aggregate rate limits vs. capacity
impossible desires + naïve guardrails = converge on system failure
```

Customer Metadata

Convergence & Failure

Intended state vs. actual state -> convergence

```
    "Blacklist Threshold": ”1GB",
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# system aggregate rate limits vs. capacity
impossible desires + naïve guardrails = converge on system failure
impossible desires + safe limits =
```

Customer Metadata

Convergence & Failure

Intended state vs. actual state -> convergence

```
     "Blacklist Threshold": ”1GB",
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# system aggregate rate limits vs. capacity
impossible desires + naïve guardrails = converge on system failure
impossible desires + safe limits = converge on customer failure
```

Customer Metadata

Convergence & Failure

Intended state vs. actual state -> convergence

```
     "Blacklist Threshold": ”1GB",
     "MaxRate": ”1MB",

# system aggregate rate limits vs. capacity
impossible desires + naïve guardrails = converge on system failure
impossible desires + safe limits = converge on customer failure
reasonable desires + safe limits + unexpected failure =
```

Customer Metadata

Convergence & Failure

Intended state vs. actual state -> convergence

```
    "Blacklist Threshold": ”1GB",
    "MaxRate": ”1MB",

# system aggregate rate limits vs. capacity
impossible desires + naïve guardrails = converge on system failure
impossible desires + safe limits = converge on customer failure
reasonable desires + safe limits + unexpected failure = ?
```

Customer Metadata

Scribe Categories

How can we make this better?

- Manage intended -> actual state
- Clarify expectations

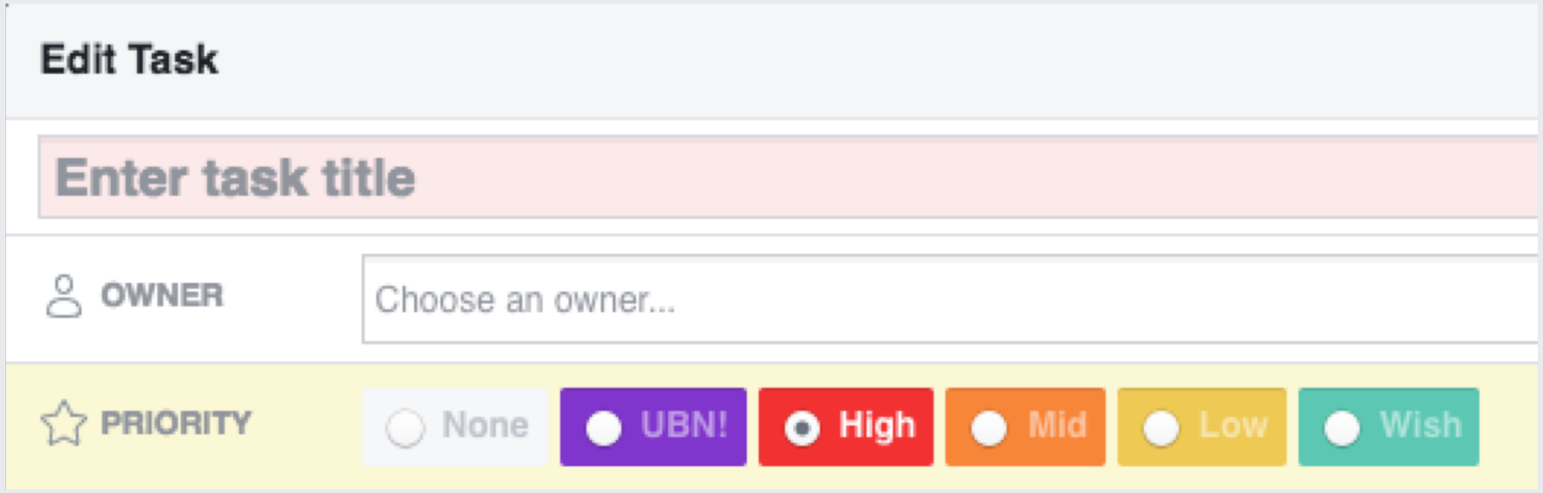
Customer Metadata

Expectations

```
$ dmv find kctest1 -f json
[{
    "Category": "kctest1",
    "Blacklist Threshold": ″1GB",
    "Encryption": ″Yes",
    "Importance": "normal",
    "MailTo": "",
    "MaxRate": ″1MB",
    "Modified": "2018-10-08T09:00:17",
    "Modified By": "security_oncall",
    "Oncall": "scribe_oncall",
    "Owner": "kcb",
    "Retention": 1,
}]
```

Customer Metadata

Expectations



Edit Task

Enter task title

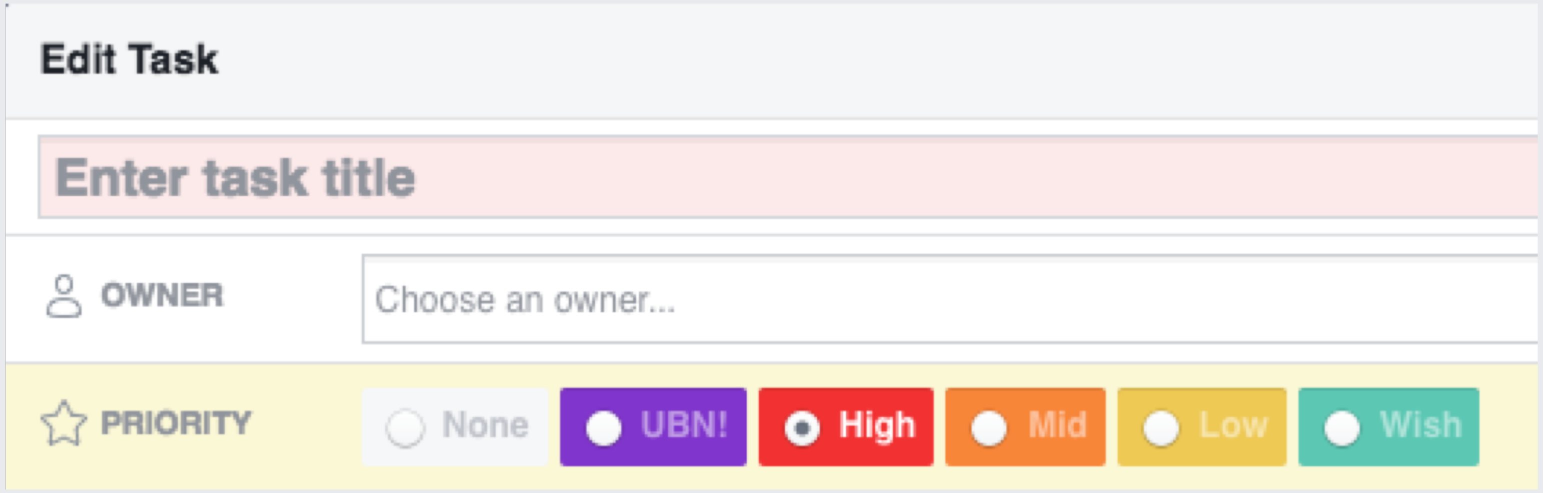
OWNER Choose an owner...

PRIORITY None UBN! [✓ High] Mid Low Wish

- Tasks – Internal task ticketing system
- Tasks have priorities
- UBN = UnBreak Now!
- UBNs page the owner automatically

Customer Metadata

Expectations



Edit Task

Enter task title

OWNER Choose an owner...

PRIORITY ○ None ○ UBN! [✓ High] ○ Mid ○ Low ○ Wish

- Organizationally meaningful priorities
- External accountability
- Enable better emergency response

Customer Metadata

Scribe Categories

How can we make this better?

- Manage intended -> actual state
- Clarify expectations
- Support implementation changes

Customer Metadata

Auditing Pattern

- “How do I turn on something new?”

Customer Metadata

Auditing Pattern

```
$ dmv find kctest1 -f json
[{
    "Category": "kctest1",
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    "MailTo": "",
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    "Oncall": "scribe_oncall",
    "Owner": "kcb",
    "Retention": 1,
}]
```

Customer Metadata

Auditing Pattern

- Goal: 100% encryption by default
- Challenges:
  - Encryption is a new backend feature
  - Encryption requires client upgrade, credential distribution
  - Fail open/closed?

Customer Metadata

Auditing Pattern

- Goal: 100% encryption by default

```
impossible desires + naïve guardrails = converge on system failure
impossible desires + safe limits = converge on customer failure
reasonable desires + safe limits + unexpected failure = ?
```

Customer Metadata

Auditing Pattern

- Goal: 100% encryption by default

```
impossible desires + naïve guardrails = converge on system failure
impossible desires + safe limits = converge on customer failure
reasonable desires + safe limits + unexpected failure = ?

change(desires + limits) + failure = ?
```

Customer Metadata

Auditing Pattern

- Goal: 100% encryption by default
- Process:
    - Mass migration (”One perfect moment”)

Customer Metadata

Auditing Pattern

- Goal: 100% encryption by default
- Process:
    - ~~Mass migration ("One perfect moment")~~
    - Prepare then migrate ("Big list")

Customer Metadata

Auditing Pattern

- Goal: 100% encryption by default
- Process:
  - ~~Mass migration ("One perfect moment")~~
  - ~~Prepare then migrate ("Big list")~~
  - Continuous auditing ("TDD for operations")

Customer Metadata

Auditing Pattern

- Goal: 100% encryption by default
- Effective auditing
    - Check metadata – is encryption enabled?
    - Check dependencies – are dependencies ready for encryption?
    - Check implementation – is category actually encrypted?

Customer Metadata

Customer Input

Customer Metadata

Customer Input

```
$ dmv find kctest1 -f json
[{
    "Category": "kctest1",
    "Blacklist Threshold": ”1GB",
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    "Importance": "normal",
    "MailTo": "",
    "MaxRate": ”1MB",
    "Modified": "2018-10-08T09:00:17",
    "Modified By": "security_oncall",
    "Oncall": "scribe_oncall",
    "Owner": "kcb",
    "Retention": 14,
}]
```

Customer Metadata

Customer Input

- Consistent public messaging
  - Group post?
  - Regular cadence

Customer Metadata

Customer Input

- In-person conversations
  - Gather allies
  - Address complexity upfront
  - Canary for automation

Customer Metadata

Customer Input

- Individual automated messaging
  - Be concise and link to additional documentation
  - Make it actionable
  - You’ll be wrong no matter what
  - Not every change is better for everyone

Customer Metadata

Customer Input

- Consistent public messaging (group posts)
- In-person conversations
- Individual automated messaging (tasks/tickets)

SLAs

You already have one

SLAs

You already have one

- If you don’t have an SLA your SLA is whatever the customer wants

SLAs

You already have one

- If you don’t have an SLA your SLA is whatever the customer wants
- The SLA is about expectations

SLAs

You already have one

- If you don’t have an SLA your SLA is whatever the customer wants
- The SLA is about expectations
- Expectations go both ways

SLAs

Zookeeper customers

- Zookeeper oncall gets UBNs for ensembles in trouble

SLAs

Zookeeper customers

- Zookeeper oncall gets UBNs for ensembles in trouble
    - Hardware failure? Bad deployment?

SLAs

Zookeeper customers

- Zookeeper oncall gets UBNs for ensembles in trouble
    - Hardware failure? Bad deployment?

```
filter(zk\.global\.(0[389]|29|4[2-8]|6[589]|72|103))
```

SLAs

Zookeeper customers

- Zookeeper oncall gets UBNs for ensembles in trouble
    - Hardware failure? Bad deployment?
    - Customer load?

```
filter(zk\.global\.(0[389]|29|4[2-8]|6[589]|72|103))
```

SLAs

Zookeeper customers

- Zookeeper oncall gets UBNs for ensembles in trouble
  - Hardware failure? Bad deployment?
  - Customer load?
- Manual alarm triaging is a symptom

SLAs

Zookeeper customers

- Zookeeper oncall gets UBNs for ensembles in trouble
    - Hardware failure? Bad deployment?
    - Customer load?
- Manual alarm triaging is a symptom
    - The system can’t defend itself from bad actors

SLAs

Zookeeper customers

- Zookeeper oncall gets UBNs for ensembles in trouble
  - Hardware failure? Bad deployment?
  - Customer load?
- Manual alarm triaging is a symptom
  - The system can’t defend itself from bad actors
  - We don’t have metadata or we’re not using it

SLAs

Zookeeper customers

- Zookeeper oncall gets UBNs for ensembles in trouble
  - Hardware failure? Bad deployment?
  - Customer load?
- Manual alarm triaging is a symptom
  - The system can’t defend itself from bad actors
  - We don’t have metadata or we’re not using it
  - Fear of conflict or visibility

SLAs

Zookeeper customers

What do we need?

- Written SLA
- Expectations go both ways
- Problems are solved by the right team
- Published metrics

Monitoring

The p100 problem

Monitoring

The p100 problem

- Monitoring is part of the service

Monitoring

The p100 problem

- Monitoring is part of the service
- Is 99% availability good?

Monitoring

The p100 problem

- Monitoring is part of the service
- Is 99% availability good?
    - 100/10000 servers failing chef runs

Monitoring

The p100 problem

- Monitoring is part of the service
- Is 99% availability good?
    - 100/10000 servers failing chef runs
    - 1/100 database masters failing chef runs

Monitoring

The p100 problem

- Monitoring is part of the service
- Is 99% availability good?
    - 100/10000 servers failing chef runs
    - 1/100 database masters failing chef runs
    - 1/100 zookeeper ensembles unavailable

Monitoring

The p100 problem

- Monitoring is part of the service
- Is 99% availability good?
    - 100/10000 servers failing chef runs
    - 1/100 database masters failing chef runs
    - 1/100 zookeeper ensembles unavailable
    - 10/1000 scribe categories failing writes

Monitoring

The p100 problem – chef monitoring

- Chef team
  - Chef backend infrastructure (is the service up)
  - Global run success (is chef working for customers)

Monitoring

The p100 problem – chef monitoring

- Chef team
    - Chef backend infrastructure (is the service up)
    - Global run success (is chef working for customers)
- Customer teams
    - Per-customer run success

Monitoring

The p100 problem – chef monitoring

- Chef team
  - Chef backend infrastructure (is the service up)
  - Global run success (is chef working for customers)
- Customer teams
  - Per-customer run success
- Sane defaults + flexibility
  - Tunable thresholds (mandatory minimums)

Monitoring

The p100 problem – chef monitoring

- Chef team
  - Chef backend infrastructure (is the service up)
  - Global run success (is chef working for customers)
- Customer teams
  - Per-customer run success
- Sane defaults + flexibility
  - Tunable thresholds (mandatory minimums)
  - Configurable notifications

Monitoring

The p100 problem – chef monitoring

- Chef team
  - Chef backend infrastructure (is the service up)
  - Global run success (is chef working for customers)
- Customer teams
  - Per-customer run success
- Sane defaults + flexibility
  - Tunable thresholds (mandatory minimums)
  - Configurable notifications
  - Automatic dependencies

Monitoring

The p100 problem – chef monitoring

What do we need?

- Monitoring *of* our service
- Monitoring *as a* service

Additional complexity

Everything was going so well

Additional complexity

Lifecycle - Decommissioning

- zookeeper – what if an ensemble becomes unused?
- scribe – what if a category becomes unused?
- What does unused mean?
- Would you be able to tell?

Additional complexity

Customers with customers

Additional complexity

Customers with customers

- Metadata service load

Additional complexity

Customers with customers

- Metadata service load
- Customers blaming their customers

Additional complexity

Customers with customers

- Metadata service load
- Customers blaming their customers
  - Incidents
  - Ownership
  - Monitoring
  - Capacity

Conclusions

Service Maturity Goals and Tips

Config Smell

- Separate customer metadata from service implementation
- Define scalable service levels

Service Maturity Goals and Tips

Customer Metadata

- Know who your customers are
- Define expectations for success *and* failure (convergence)
- Use organizationally meaningful data (task priorities)
- Plan for future changes (auditing pattern)
- Automated tasks are great (for irritating colleagues)

Service Maturity Goals and Tips

SLAs and Monitoring

- If you don’t have an SLA your SLA is whatever the customer wants
- Expectations and accountability go both ways
- Monitoring is part of the service you offer

Service Maturity Goals and Tips

Additional Complexity

- Manage the whole lifecycle
- Your customers will build services out of your service

Service Maturity Goals and Tips

Final thoughts

- There is no one right answer
- You don’t get to pick where to start
- You do get to decide what your service is and what it isn’t
- Leave things better than you found them

facebook

Thank you

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