# Assess and Summarize: Improve Outage Understanding with Large Language Models

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# What are outages in cloud systems?

Cloud systems are becoming popular today

# Impact of Outages

Outage  ->  Unsatisfying customers  ->  Economic loss
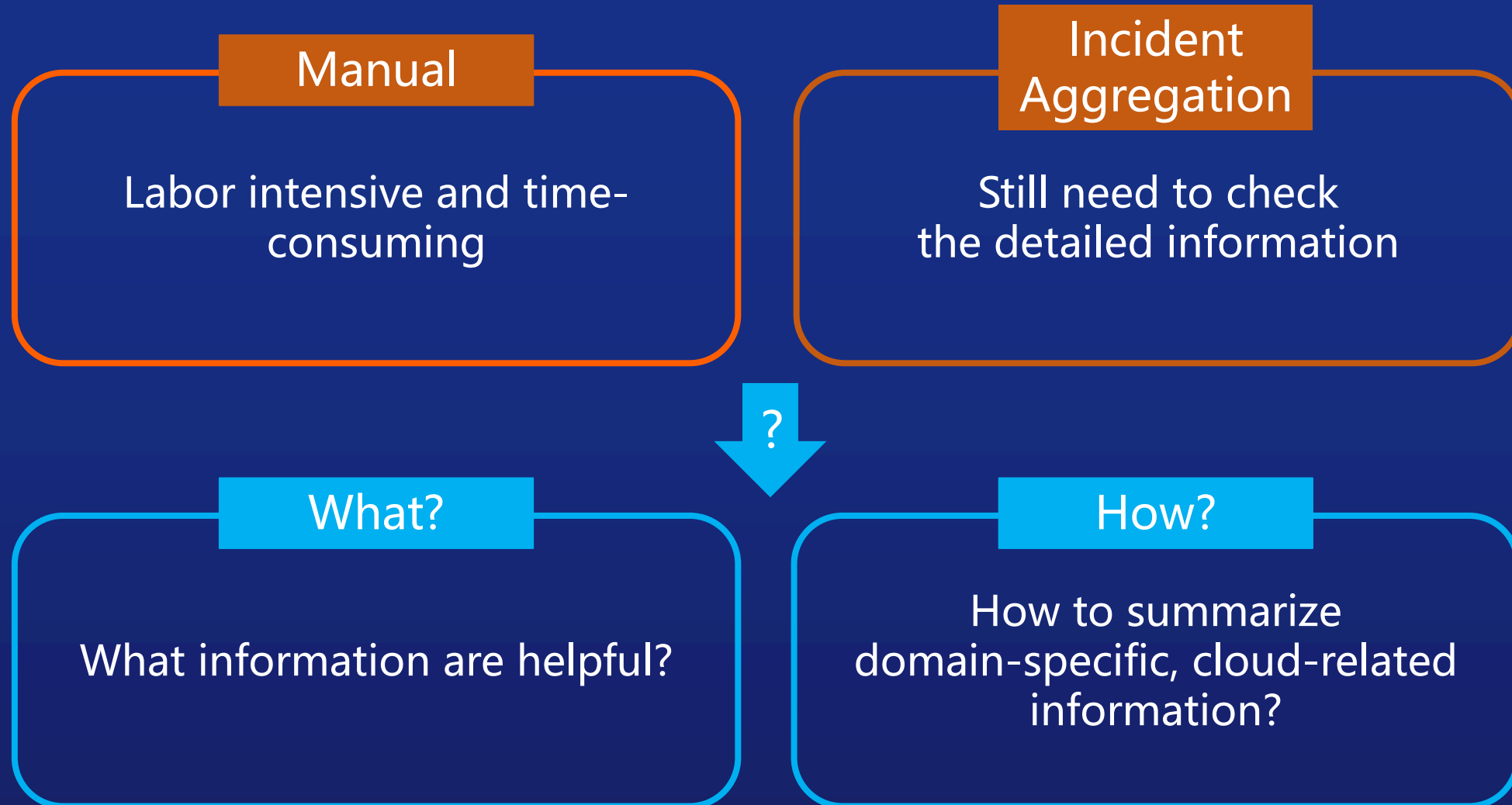
# Impact Scope of Outages



Application

Container

VM

Database

Affected
by outage!
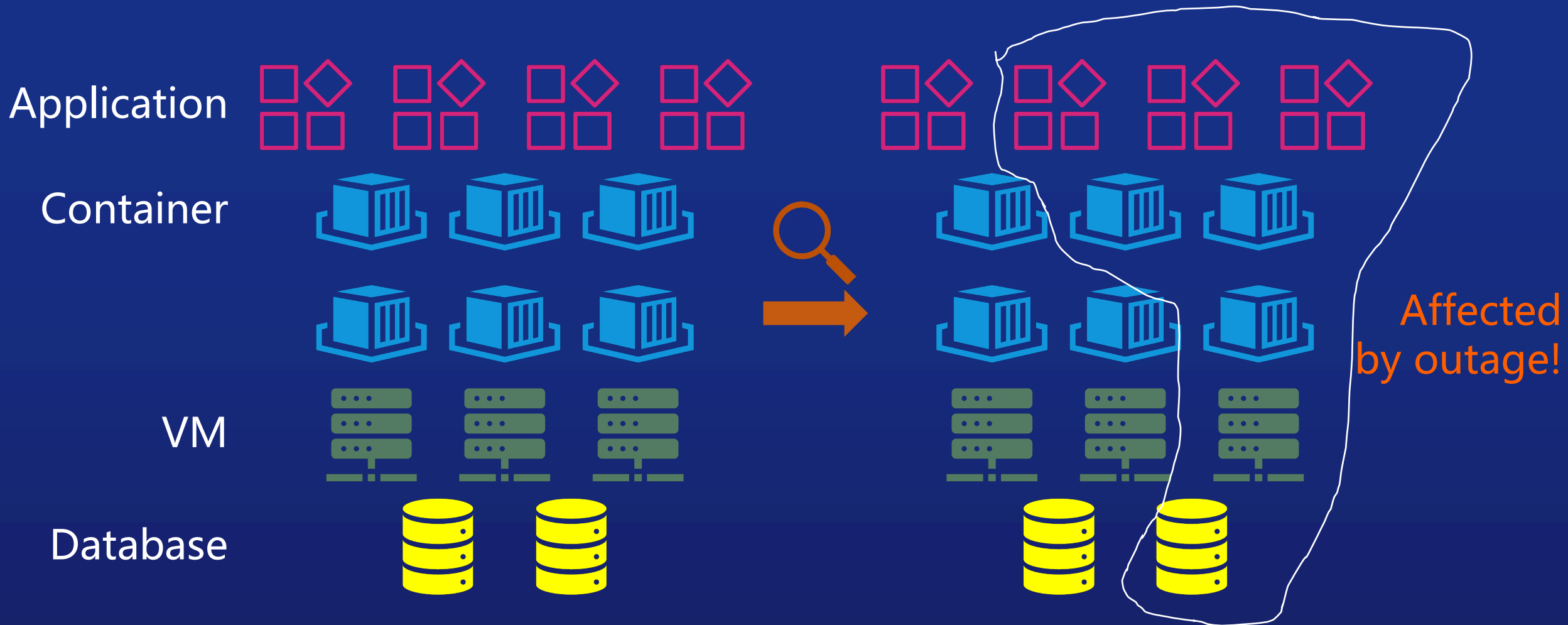
# Timeline of an Outage



Multiple incidents should be summarized when declaring the outage

# How to understand an outage?

## Manual
Labor intensive and time-consuming

## Incident Aggregation
Still need to check the detailed information

**?**

## What?
What information are helpful?

## How?
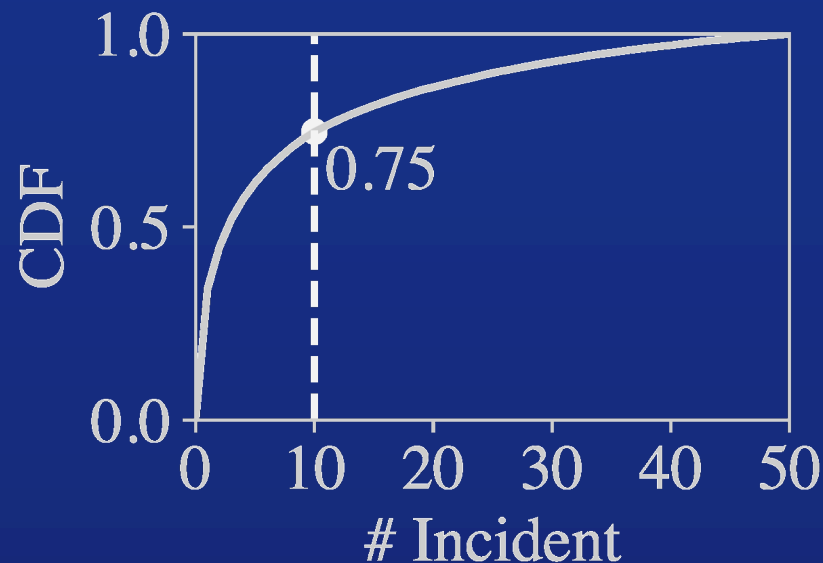How to summarize domain-specific, cloud-related information?

第二章节

# What is the outage summarization?

# RQ1: What is the impact of outages?

- Microsoft IcM
- 18 cloud systems of Microsoft
- over three years
-  "MITIGATED" or "RESOLVED"

- **86.4%** of outages impact large subscriptions
- #persistent outages = **1.81** × #intermittent outages
- **25%** of outages have more than **10** relevant incidents

**Incident 1 Title:** Alert: email-api-batchevents-errors-production-allregions-exceeded
**Description:** The Email Service was experiencing connectivity issues to their replica database in the West US Region. Due to this issue, System-Cloud customers globally were not receiving any type of System-Cloud notifications.
**Severity:** 2
**Start time:** 2020-x-x 14:28
**Service:** SQL

**Incident 2 Title:** No Success Signal in the last 60 minutes.
**Description:** Calls to the API-Sub failed with a 5xx HTTP error. Approximately $\alpha_1$ customers could not upgrade their subscriptions on URL-Cloud-Portal.
**Severity:** 2
**Start time:** 2020-x-x 15:30
**Service:** Commercial

**Incident 3 Title:** System-Cloud Email Orchestrator Health in Cluster$_1$
**Description:** Email notifications sent to customers could be delayed.
**Severity:** 3
**Start time:** 2020-x-x 14:33
**Service:** Business Intelligence

**Incident 4 Title:** Api request failed with multiple -1 responses.
Target: URL-Cloud-Email
**Description:** Calls to the API-Marketplace service failed which prevented the service from sending emails to the customers and affected $\alpha_2$ customers.
**Severity:** 3
**Start time:** 2020-x-x 17:06
**Service:** Marketplace

**Incident 5 Title:** Email Service calls are failing for Monitor-Email-Exceptions evaluated on MonitorRule$_1$ unhealthy
**Description:** Customers could not view Customer renewal and subscription alerts were delayed. In addition, users were unable to get authentication codes to verify login and new account sign-ups.
**Severity:** 3
**Start time:** 2020-x-x 14:44
**Service:** Notification

**Outage Title:** Outage for Email Service - Triage
**Impact start time:** 2020-x-x 14:20
**Outage declared time:** 2020-x-x 14:28
**OCEs engage time:** 2020-x-x 14:29
**Outage Summary:** The Email Service experienced connectivity issues to their replica database in the West US Region. This affected customer email delivery for approximately $\alpha_3$ internal company services. Due to this issue, System-Cloud customers were not receiving notifications including purchase, renewal, and monitor alert notifications. The Portal team reported that approximately $\alpha_1$ customers were unable to upgrade their subscriptions on URL-Cloud-Portal.
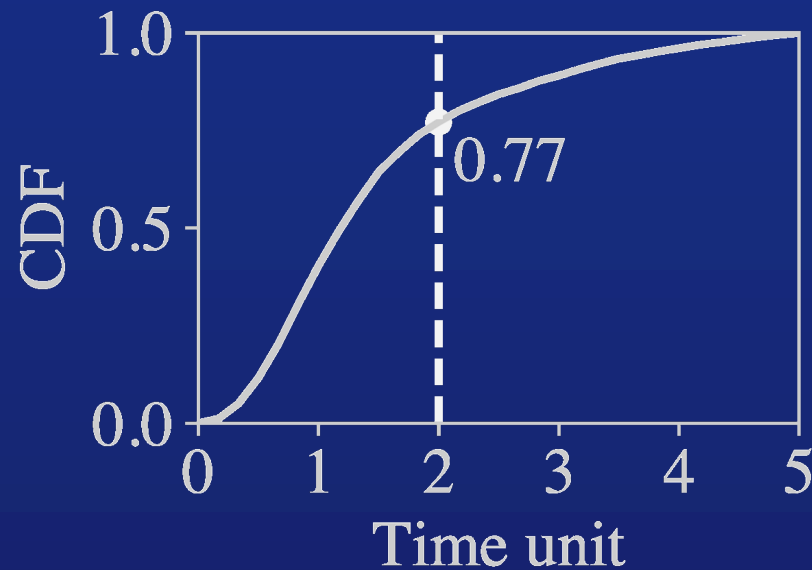
When, where, who, what, why

Relevant Incidents → Outage Summary

- High-severity incidents
- Textual descriptions

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- Time when the impact begins: **T1**
- Time when the summary is completed: **T2**
- Time to Summary (**TTS**) : **T2 - T1**



(Due to company policy, we are unable to disclose the specific duration of one time unit to the public.)

**AIOps Challenge**

Relevant and valuable information

**Usefulness**

The outage summary reads fluently

**Readability**

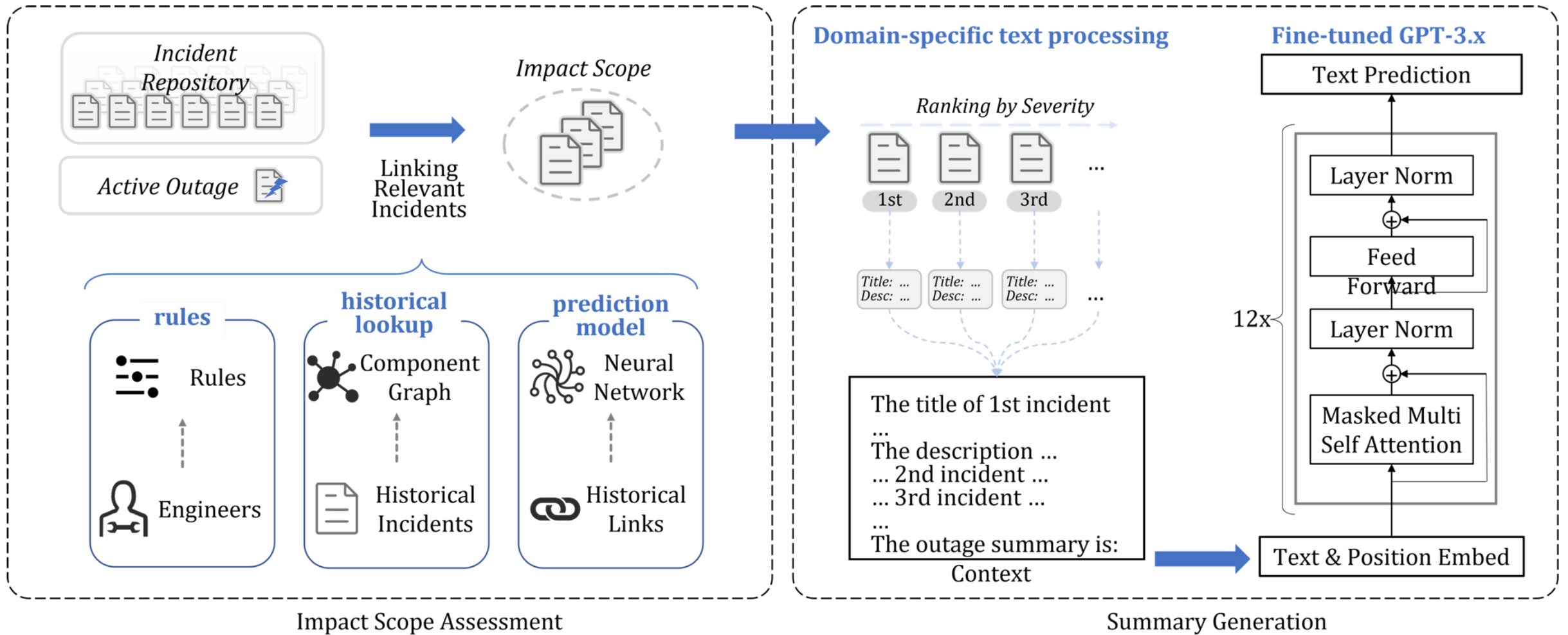Summarize outage in a short time

**Reducing TTS**

Oasis

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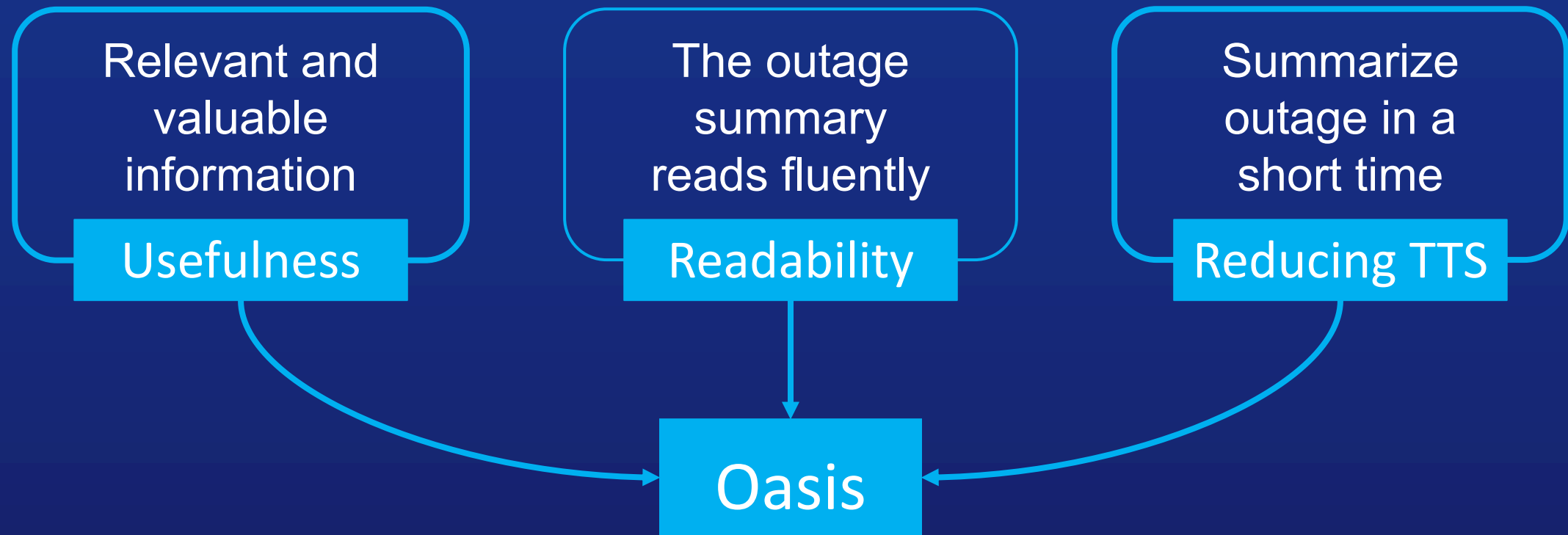
第三章节

# How to summarize outages?
# - Oasis Approach

Outage Assessment and Summarization for Cloud Systems

# Oasis Overview



Impact Scope Assessment

Summary Generation

第四章节

# Evaluation

# Evaluation

## Proposing outages' summaries

| Model | BLEU-4 | | ROUGE-L | | METEOR | |
|---|---|---|---|---|---|---|
| | Top1 | Top5 | Top1 | Top5 | Top1 | Top5 |
| IR | 0.04 | 0.05 | 0.14 | 0.18 | 0.12 | 0.15 |
| Rule-based | 0.28 | NA | 0.51 | NA | 0.63 | NA |
| GPT2 | 0.46 | 0.51 | 0.56 | 0.59 | 0.54 | 0.57 |
| Curie | 0.65 | 0.70 | 0.73 | 0.78 | 0.72 | 0.78 |
| Davinci | **0.66** | **0.71** | **0.74** | **0.78** | **0.73** | **0.78** |

## Proposing outages' titles

| Model | BLEU-4 | | ROUGE-L | | METEOR | |
|---|---|---|---|---|---|---|
| | Top1 | Top5 | Top1 | Top5 | Top1 | Top5 |
| IR | 0.17 | 0.21 | 0.40 | 0.43 | 0.34 | 0.37 |
| Rule-based | 0.01 | NA | 0.21 | NA | 0.32 | NA |
| GPT2 | 0.62 | 0.67 | 0.67 | 0.70 | 0.64 | 0.69 |
| Curie | 0.83 | 0.88 | 0.88 | 0.90 | 0.84 | 0.89 |
| Davinci | **0.66** | **0.89** | **0.88** | **0.91** | **0.87** | **0.91** |

# Evaluation: Efficiency

Average time cost of models

| Time | Rule | IR | GPT-2 | Curie | DaVinci |
|---|---|---|---|---|---|
| Fine-tuning ($10^{-1}\times$time unit) | NA | NA | 3.0 | 3.4 | 8.7 |
| Generation ($10^{-5}\times$ time unit) | 2.8 | 13.9 | 11.1 | 13.3 | 39.6 |

Oasis is 251x faster than the median of manual summarization.

# Human Evaluation

- 54 outage owners
- Ranking summaries
- #1 for the most preferred

## Criteria

- Useful
- Readable
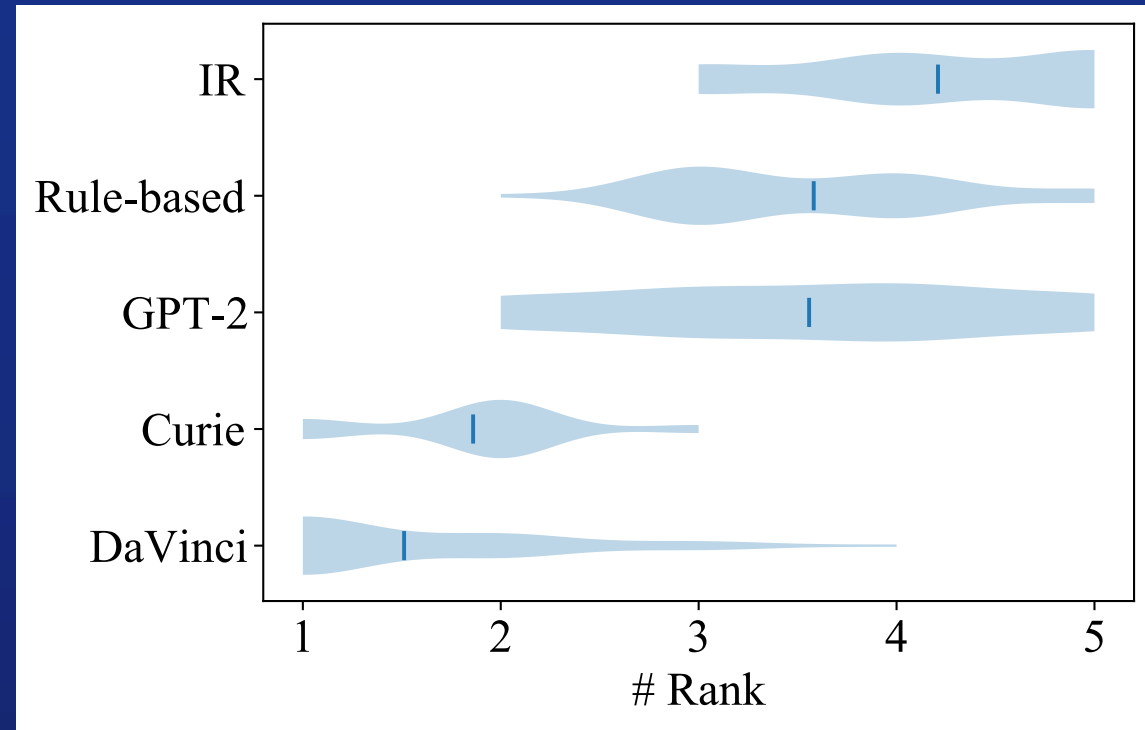


**Feedback:** *"I absolutely believe in the ability of AI to assist with incident management and outage summaries."*

# Conclusion

- **Motivation:** the first work to identify the problem of outage understanding for large-scale cloud services

- **Design goals:** usefulness, readability, reducing TTS

- **Solution:** Oasis framework for automatic outage assessment and summarization
  - Impact Scope Assessment, Summary Generation

- **Deployment:** acknowledgment from OCEs; shorten TTS by 251x