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Calendar operator practices – Guidelines to protect against calendar abuse

THE CALENDARING AND SCHEDULING CONSORTIUM
TC CALSPAM

CALCONNECT REPORT

DRAFT STANDARD

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CONTENTS

Foreword

Introduction

Definition

Impact

1. Scope

2. Normative references

3. Terms, definitions, symbols and abbreviated terms

3.1. Terms and definitions

3.2. Symbols and abbreviated terms

4. Best common practices for mitigating calendar abuse

4.1. Detecting and mitigating spam at the source system

4.2. Detecting and mitigating spam on receiving system

4.3. Other ways calendar spam can occur

5. Conclusion

6. Acknowledgements

Appendix A (informative) Technical information

A.1. Structure of a best practice iMIP message containing an event

Bibliography

FOREWORD

The Calendaring and Scheduling Consortium ("CalConnect") is global non-profit organization with the aim of facilitating interoperability of technologies across user-centric systems and applications.

CalConnect works closely with liaison partners including international organizations such as ISO, OASIS and M3AAWG.

The procedures used to develop this document and those intended for its further maintenance are described in the CalConnect Directives and in this case also aligned with the procedures used at M3AAWG.

In particular the different approval criteria needed for the different types of CalConnect documents should be noted. This document was drafted in accordance with the editorial rules of the CalConnect Directives.

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This document was prepared by Technical Committee *CALSPAM*.

INTRODUCTION

Definition

"Calendar spam", unsolicited or otherwise unwanted calendar events and meeting invitations, is a recently exploited channel for abuse aimed at users of calendaring & scheduling systems. It is a new form of application-specific spam which takes advantage of the application layer across multiple technologies that spans scheduling, calendaring and messaging systems. As is the case with email spam, calendar spam is not only used to deliver unwanted information, but can also be used for malicious purposes such as phishing attempts and delivering dangerous payloads.

As calendar events and meeting invitations are often (but not exclusively) transported and delivered via email, combatting calendar spam requires awareness, intervention and integration with email systems and services.

Impact

Calendar spam is unique in a number of ways:

- a. Calendar spam, unlike email, can be placed chronologically anywhere in calendars, in the past or the future, not just the present, making it difficult for the end-user to detect at the time of delivery.
- b. Spam meeting invitations, may automatically see these unwanted invitations added to their calendar without their consent, with notifications sent to all their devices. These invitations are not only difficult to find, but in some cases there is no way for the user to remove these events short of deleting the entire calendar.
- c. Calendar events and meeting invitations do not yet carry the rich provenance which today accompanies email (detailed header information), making it difficult to ascertain where and when events originated and were delivered.
- d. Calendar events often contain notifications/alarms which are propagated across a user's desktop and mobile calendaring clients. It is common for users to have multiple calendaring clients which exacerbates the abuse.
- e. Calendar events can include recurrence meaning that one event can show up in the user's calendar multiple times with multiple notifications/alarms being triggered over time.

1. SCOPE

This document specifies guidelines for calendar and mail system operators to:

- detect the occurrence of calendar abuse;
- consider processes and procedures to mitigate calendar abuse; and
- suggest acceptable (non-abusive) practices with calendar usage.

2. NORMATIVE REFERENCES

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IETF RFC 6047, iCalendar Message-Based Interoperability Protocol (iMIP)

IETF RFC 5546, iCalendar Transport-Independent Interoperability Protocol (iTIP)

3. TERMS, DEFINITIONS, SYMBOLS AND ABBREVIATED TERMS

For the purposes of this document, the following terms and definitions apply.

3.1. Terms and definitions

3.1.1

calendar spam

calendar events and meeting invitations containing *spam* (Clause 3.1.3) delivered through *calendar systems* (Clause 3.1.5)

3.1.2

calendar abuse

malicious usage of a *calendar system* (Clause 3.1.5), possibly leading to an *attack* (ISO/IEC 27000:2018, Clause 3.2) on the receiving user

3.1.3

spam

unsolicited or unwanted information

3.1.4

attack

attempt to destroy, expose, alter, disable, steal or gain unauthorized access to or make unauthorized use of an asset

[SOURCE: ISO/IEC 27000:2018]

3.1.5

calendar system

information system that provides calendar and scheduling functionality for user accounts

3.1.6

mail system

information system that provides electronic mail functionality

3.1.7

user system

information system that provides authentication and authorization functionality

3.2. Symbols and abbreviated terms

iMIP iCalendar Message-Based Interoperability Protocol (see [RFC 6047](#))

iTIP iCalendar Transport-Independent Interoperability Protocol (see [RFC 5546](#))

SMTP Simple Mail Transfer Protocol (see [RFC 2821](#))

4. BEST COMMON PRACTICES FOR MITIGATING CALENDAR ABUSE

4.1. Detecting and mitigating spam at the source system

User accounts could be compromised by malicious actors or free hosting providers could be abused with bots signing up for free accounts.

These accounts are then used to create calendar spam events. The calendar system uses templating to send an email invitation with the calendar event attached and the event content will also be inserted into body of the email. The "source" hosting provider should take steps to detect and mitigate this internal abuse on the calendar system and the email system.

4.1.1. At the calendar systems

There are different best common practices that can be applied here:

- a. abuse detection on front-end usage using input as network/IPs, user agents, click rate / path
- b. checking the event content (e.g. subject, description, recurrence, number of attendees, links) for typical spam patterns before creating the event and sending the email invitations

There are many potential actions that could be invoked if potential spam is detected (e.g. not sending, display frontend error or feedback, alert user account, apply rate limiting, demand solving captcha before sending, block the account altogether and more.)

4.1.2. Using SMTP

Different best common practices can be applied here, including:

- a. abuse detection for SMTP access using input, such as: network patterns, DNSBL checks against the client IP, etc.
- b. checks on email spam content patterns, (such as malicious content, blacklisted/known phishing URLs) using standard email anti-spam scanning applications

There are many potential actions that could be invoked if potential spam is detected (e.g. bounce the message, discard the message, data sharing with the receiving email / calendar providers, and more.)

4.2. Detecting and mitigating spam on receiving system

Spam events are typically received by recipients in two ways:

- a. via email from an external system, or

b. directly from another account (bot or compromised) within the *calendar system*

Events from internal accounts may propagate natively within the *calendar system* or they may propagate over email, depending on implementation. The "receiving" hosting provider can take steps to detect and mitigate the "external" abuse on the *calendar system* and the *mail system*.

4.2.1. Mail system

There are different best common practices that can be applied here:

- a. abuse detection for receiving email including input as network, mail header/ structure, ...
- b. check email for spam content patterns using standard email anti-spam scanning applications, DNSBLs, URIBLs, etc.
- c. check sender From address reputation using internal and external sources e.g. subscribe to InfoSec feeds of known malicious addresses, organiser on whitelist, ...

There are many potential actions that could be invoked if potential spam is detected (e.g. bounce the message, discard the message, put the message in quarantine or spam folder.) Interaction (e.g. adding the event to the end-user's calendar) with the *calendar system* should not be initiated in these instances.

As some of these actions do not deliver the email to the user and no interaction with the *calendar system* occurs, the recipient has no way to handle false positives. Therefore these actions can only be taken if the *mail system* is very certain about this being abuse or spam.

For some of the milder actions (e.g. putting in spam folder) the user should be offered options. For example, allow these emails to be marked as false positives and offer the client option to manually insert the events into the user's calendar.

4.2.2. Interaction between *mail system* and *calendar system*

Interaction between the *mail system* and the *calendar system* should follow these best common practices:

- a. the interaction should only be triggered for emails not already identified as spam during applying the above mentioned best common practices for mail systems
- b. the events should be parsed by the *calendar system* due to the domain knowledge regarding calendar structure not present or mature in most types of *mail system*
- c. the event content should be checked for spam patterns (subject, description, recurrence, links, ...) to determine the likeliness being *spam*
- d. depending on the likeliness being *spam*, spam handling options should be offered in the users settings for insert (e.g. only automatic insert for organizers on a whitelist / personal address book, state of this event in availability of calendar (e.g. free, conditional or blocked))

There are many potential actions that could be invoked if potential spam detected (e.g. not automatically inserting, deactivated notifications, ...)

4.2.3. *calendar system*

Besides inserting or not inserting the received events into the user calendar during the interaction between *mail system* and *calendar system*, the *calendarsystem* should offer these best common practices:

- a. offer the end-user a delete option for unwanted events (e.g. mark as spam in the client) in order to give the user the option for deleting the unwanted events without notifying the organizer.
- b. consider sending ARF reports for calendar abuse reporting
- c. store information about how an event was inserted into the users calendar (e.g. Message-ID) in order to be able to inform the user about this contextual information and to provide additional information to the sending system about the abuse

There are many potential actions that could be invoked if spam is detected by the user e.g. sending Feedback loop if MailID and original email is still available in the *mail system*.

4.3. Other ways calendar *spam* can occur

4.3.1. subscribing to shared calendars containing malicious events

Another way how malicious events can end up in users calendar are shared calendars being manipulated on origin side. Popular calendars e.g. official vacation/bank holidays in countries or states or schedules of popular sports clubs could be target for phishing / taken over by spammers.

Single malicious events within these subscribed calendars can not be deleted if shared read-only. More robust controls may be needed for calendar subscribers, but unsubscribing the specific calendar can solve the problem on an all or nothing approach (also the wanted events are then unsubscribed and deleted from users calendar).

4.3.2. *iTIP*

Calendar systems using *iTIP* for direct communication between each other e.g. within the same *calendar system* also need to consider and implement anti-abuse options as mentioned above.

5. CONCLUSION

Spam is along-standing and well-known email problem. As email is a commonly used transport for calendar ("meeting") invitations and events, spammers are now using these calendar events and invitations as a spam vector. Consequently, knowledge of both domains is required to develop defenses against these attacks.

This document provides email and calendar system operators with an introduction to calendar spam, and best practices for identifying and mitigating calendar spam. Implementing these guidelines will largely be system-specific.

As the "war" against malware, including spam, is dynamic and ever-changing, email and calendar system experts will need to share their expertise and experiences with each other on an ongoing basis. CalConnect's collaboration with M3AAWG represents the first formal collaboration in this area.

6. ACKNOWLEDGEMENTS

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APPENDIX A (INFORMATIVE) TECHNICAL INFORMATION

A.1. Structure of a best practice iMIP message containing an event

An email message should only contain a single iCalendar attachment (an iMIP file).

NOTE Current practice allows attaching multiple iCalendar attachments to a single email.

The recommended MIME/multipart structure of the email is provided as follows:

- a single `multipart/mixed` part, which contains:
 - a single `multipart/alternative` part, which contains:
 - a `text/plain` part; and
 - a `text/html` part;
 - a `text/calendar` part with `method=REQUEST`; and
 - an `application/ics` part, with a `content-disposition:attachment`, in BASE64 encoding

This structure is based on interoperability testing with various existing implementations. Some clients will only see the part with the standard `text/calendar` content-type and the method header. Other clients are only able to attached parts with `application/ics` (which is non-standard).

It is also recommended that the filename of the `application/ics` part ends with the `.ics` file extension.

Some vendors add links within the HTML part which can be used from non-calendaring-aware email clients to accept or decline a request without having to process the calendar parts at all. The server just updates the ORGANIZER's copy of the event based on the link clicked.

When using standard conform *calendar systems* the structure of the email will be like above and the `text/plain` and `text/html` part of the message in the body will also include information of the event e.g. subject, description, This does not prevent spammers from not including this potential malicious content besides the attached files, so all parts need to be parsed to detect malicious content in events.

BIBLIOGRAPHY

- [1] ISO/IEC 27000:2018, *Information technology -- Security techniques -- Information security management systems -- Overview and vocabulary*
- [2] IETF RFC 2821, Simple Mail Transfer Protocol