Cosign Multi-Factor Specification

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Wesley Craig & Johanna Craig
cosign@umich.edu

Introduction

We provide a general framework to support multiple authentication factors with cosign. The set of factors the user has satisfied are passed to filters. Filters enforce requirements for authentication and communicate the requirements to the central CGI for UI purposes. We also describe the impact on proxy kerberos tickets, replication, and re-authentication.

Replication

No changes are required for the the daemon's replication protocol. When a filter calls CHECK, however, and the required factors are not satisfied, the filter should fail over and query the other cosign servers. This will ensure the most up-to-date information is available to the filter.

Filter Configuration

Filters may be configured with a list of required authentication factors. For Apache:

> **CosignRequireFactor** UMICH.EDU OTP

or:

> **CosignRequireFactor** LEVEL2

would indicate that either (UMICH.EDU & OTP) or just LEVEL2 are required to satisfy the filter's multi-factor authentication criteria. If no factors are listed, then no factor checking occurs and any factor is accepted.

Filters may also be configured with a factor suffix which will be ignored. For example:

> **CosignIgnoreFactorSuffix** -junk

This causes the filter to remove the "-junk" suffix from any server-provided factors before comparison with required factors. For example, if the filter requires the factor "OTP", and ignores the suffix "-junk", and the user authenticates with the factor "OTP-junk", then the filter's authentication factor requirements would be fulfilled.

The filter will populate an environment variable, "COSIGN_FACTOR", with a comma separated list of factors in effect for that particular session. Factor suffixes configured with "CosignIgnoreFactorSuffix" will still be passed through. For example:

> **COSIGN_FACTOR**=UMICH.EDU,OTP-junk

For Apache, CosignRequireFactor is valid in the server config, virtual host, location, and directory contexts. In other filters, these or other contexts may or may not make sense. Filters on platforms that do not inherently support the finer grained contexts may need to implement a similar concept in the filter itself in order to support specific applications.

The legacy environment variable COSIGN_REALM will continue to be supported on all filters that previously made this variable available. If a user is authenticated with multiple factors, the filter makes the first factor available as COSIGN_REALM.

Query String Changes

See RFC 2396. During registration, the query string has the following syntax:

> *register-url***?**[**basic&**]*service***=***cookie*[**;**]**&***referring-url*

For example:

> https://weblogin.umich.edu/?cosign-webmail=C53H4FKtDb-bkwszVGJEdG3hbp17fQ-qfYPA3-HdyAyXLUxYHOXwwt8c

+0bKOw0rO0OaM0CuW0IjS2B7ZaCdM192yt9eOice5cTH549KC2Odb3kcxizKXdBwwioP;&https://web.mail.umich.edu/?mailbox=INBOX

The registration query string syntax changes to:

> *register-url***?**[**basic&**][**factors=***factor1*[**,***factor2*]...**&**]*service***=***cookie***&***referring-url*

where "*factor1,factor2*" are configured in the filter with CosignRequireFactors and interpreted by the cosign CGI as the list of factors to present to the user.

CGI Configuration

External authenticators are called by the CGI. Each authenticator is configured with the keyword **factor**, the *pathname* to the executable, and a list of *form-fields*. If all listed *form-fields* contain posted data, then the CGI invokes the external authenticator. The value of each *form-field* is written to the external authenticator on stdin (file descriptor 0), one per line, in the order they are listed in the configuration. If authentication is successful, the external authenticator writes the factor name on stdout (file descriptor 1) and exits with a value of 0. If an error occurs, the external authenticator writes an error message on stdout and exits with a value of 1. All other exit values are reserved for future use.

> **factor** *pathname* **[-2**] *form-field1 form-field2 ...*
> **suffix** *suffix-text*

There are currently two additional configuration options. The **-2** option to the **factor** keyword means that this factor is only checked after another (non **-2**) factor has been satisfied. It is intended for use with factors that are vulnerable to denial-of-service attacks due to repeated authentication failures. The **suffix** keyword is analogous to the CosignIgnoreFactorSuffix (see Filter Configuration, above) to support phased rollout of OTP tokens.

Several "legacy" factors are defined. The "FRIEND" factor is used when accounts are authenticated with the MySQL-email based system defined in the "CoSign Friend" specification. The "BASIC" factor is used when the cosign CGI is protected by Apache, unless the environment variable COSIGN_FACTOR is set, in which case the value of COSIGN_FACTOR is used instead. If Kerberos is used to authenticate the account, the factor is set to the Kerberos "realm" used.

The syntax of the "**cookie**" option is extend to include a list of factors that must be satisfied for re-authentication. The old syntax was:

> **cookie** *cosign-service-name* **reauth**

The new syntax is:

> **cookie** *cosign-service-name* **reauth** *factor1 ...*

The old functionality is retained by converting those options to:

> **cookie** *cosign-service-name* **reauth** UMICH.EDU

See **Multi-factor Re-authentication** below for more details of how multi-factor authentication and re-authentication interact.

Protocol Changes

The banner changes from:

> S: 220 COokie SIGNer ready

to:

> S: 220 2 Collaborative Web Single Sign-On

The second argument is the protocol version number. The current version number is 2.

The STARTTLS verb changes from:

> C: STARTTLS

```
        S: 220 Ready to start TLS
```

to:

```
        C: STARTTLS version-number
        S: 220 Ready to start TLS
        S: 221 TLS successfully started, protocol version version-number
```

Clients should utilize the highest common protocol. The client must disallow access to protected resources if the server does not support configured features. Version 2 clients must interoperate with version 0 (the previous protocol version) servers, as long as no version 2 features are configured. The additional server response corrects a protocol synchronization issue that occurs when the STARTTLS command fails for some reason.

The LOGIN verb changes from:

```
        C: LOGIN login_cookie ip principal realm [ "kerberos" ]
```

to:

```
        C: LOGIN login_cookie ip principal factor1 [ factor2 ... ] [ "kerberos" ]
```

The keyword "kerberos" is reserved, and behaves as in previous versions. New factors are established through agreement within a cosign community. Examples might include: UMICH.EDU, OTP, OTP-junk.

The CHECK verb changes from:

```
        C: CHECK servicecookie
        S: 231 ip principal realm
```

or

```
        C: CHECK logincookie
        S: 232 ip principal realm
```

to:

```
        C: CHECK servicecookie / logincookie
        S: 233 ip principal factor1 factor2 ...
```

Filters allow access only when all required factors (see **Filter Configuration**, above) are satisfied. If all required factors are not satisfied, the filter sets a new service cookie and redirects the browser to the registration URL, including all required factors (see **Query String Changes**, above).

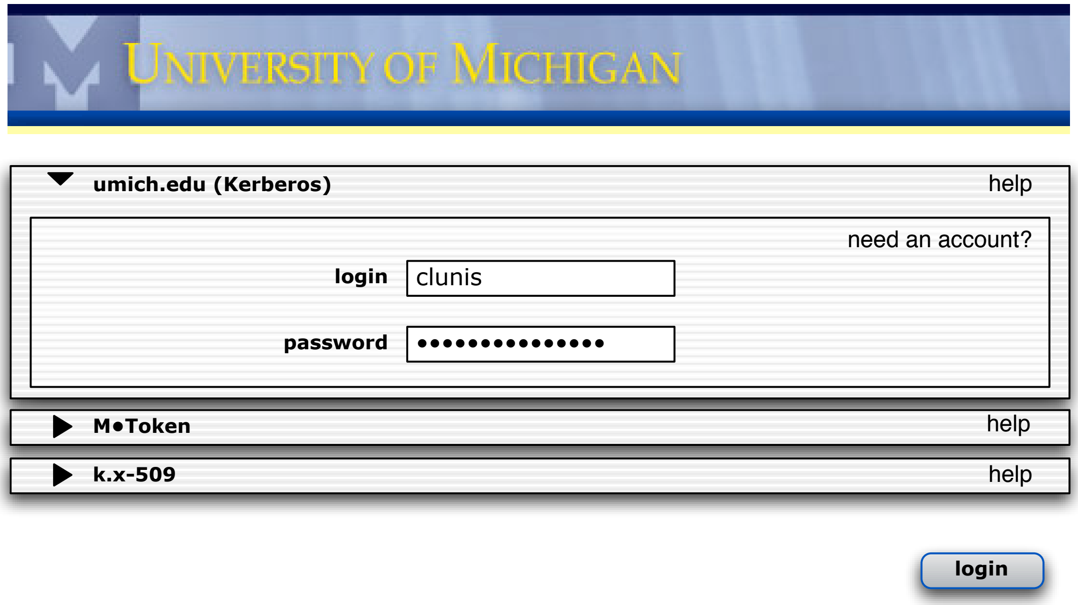
Multi-factor Re-authentication

See the re-authentication specification and **CGI Configuration** above. When a service attempts to register, the re-authentication page will display those factors specified on the query string, minus those factors that have already been satisfied, plus those factors specified in the CGI configuration for that service.

For example, if the user has already satisfied the UMICH.EDU factor, and attempts to visit a re-authenticating service which is configured with **CosignRequireFactor** to require UMICH.EDU and OTP and with **cookie-reauth** to require just UMICH.EDU, then the user interface will display both UMICH.EDU (as specified by **cookie-reauth**) and OTP (as specified by **CosignRequireFactor**). If the user has already satisfied both the UMICH.EDU and OTP factors, and attempts to visit the same re-authenticating service which is configured with **CosignRequireFactor** to require UMICH.EDU and OTP and with **cookie-reauth** to require just UMICH.EDU, then the user interface will display only UMICH.EDU (as specified by **cookie-reauth**).

User Interface

The user interface presented by cosign is controlled by the filter's configuration, through options provided on the query string. Figure 1 shows the interface when either a service was not visited first or the filter did not specify any authentication factors. The user may expose any available authentication methods.

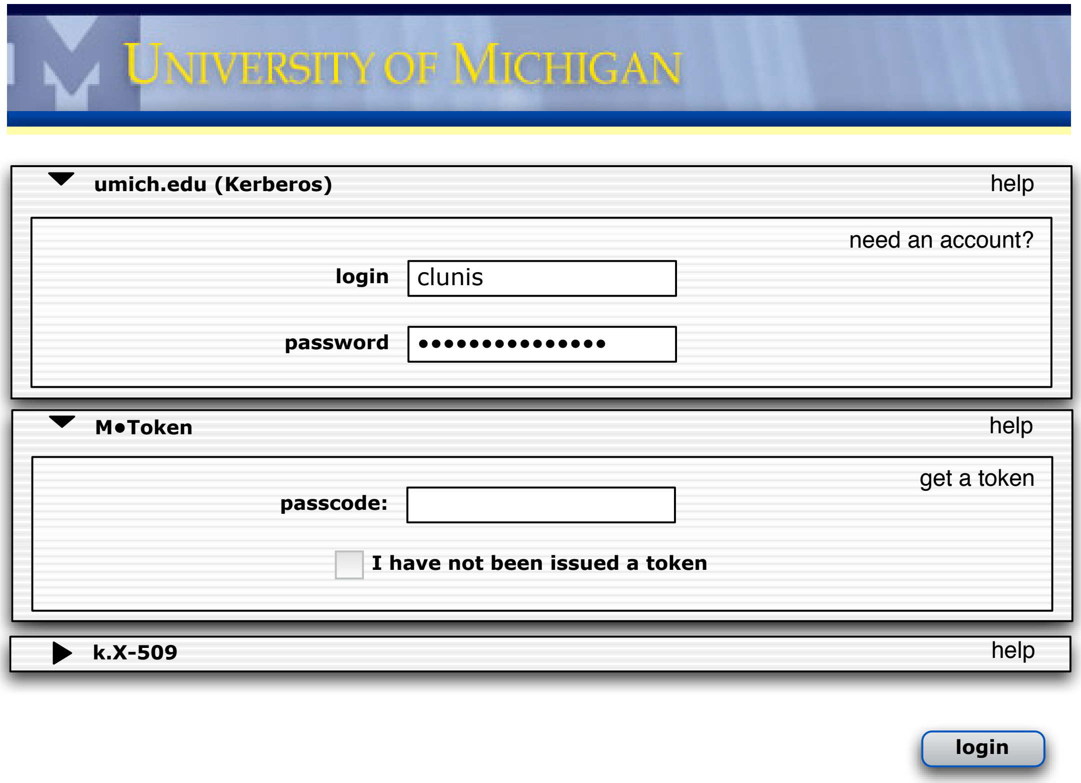


login: clunis

password: •••••••••••••••

Figure 1. Not yet logged in, visiting weblogin.umich.edu first time.

Figure 2 shows the interface when the user first interaction with an authenticated service is with a multi-factor protected service. The visible authentication factors are selected by the filter on the query string.



login: clunis

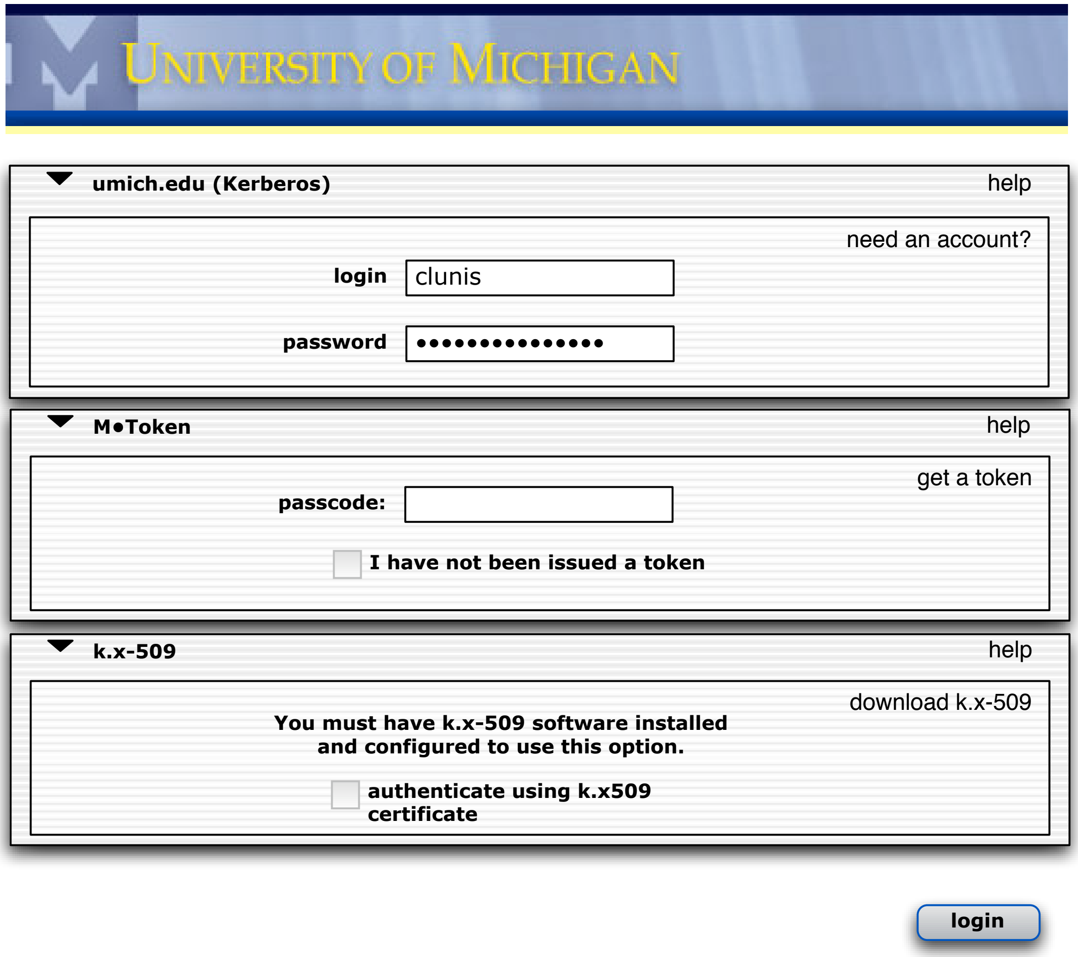
password: •••••••••••••••

passcode:

□ I have not been issued a token

Figure 2. Not yet logged in, visiting a multi-factor protected service first.

If the user has already authenticated using the UMICH.EDU factor, and then visits a multi-factor protected service, the username and password fields would not be editable, and the unsatisfied factor from the query string would be exposed.



umich.edu (Kerberos)

login clunis

password •••••••••••••••

M•Token

passcode:

□ I have not been issued a token

k.x-509

You must have k.x-509 software installed and configured to use this option.

□ authenticate using k.x509 certificate

Figure 3. All options exposed.

Figure 3 shows all authentication factors exposed. Pages for re-authentication are similar, with the username never editable.