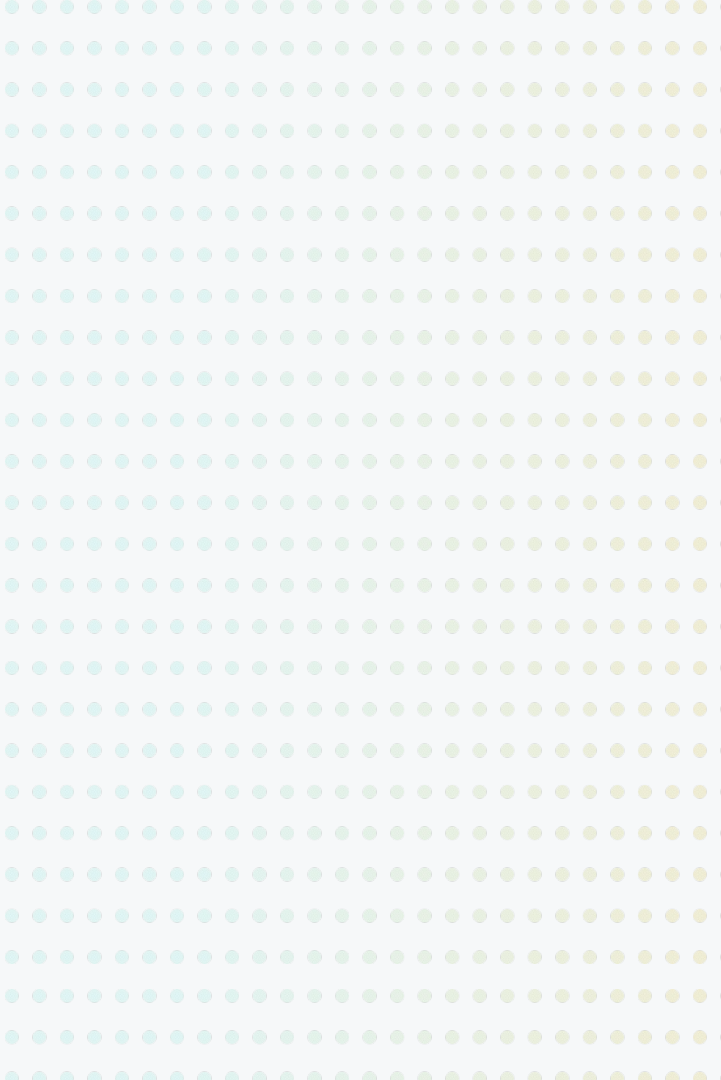




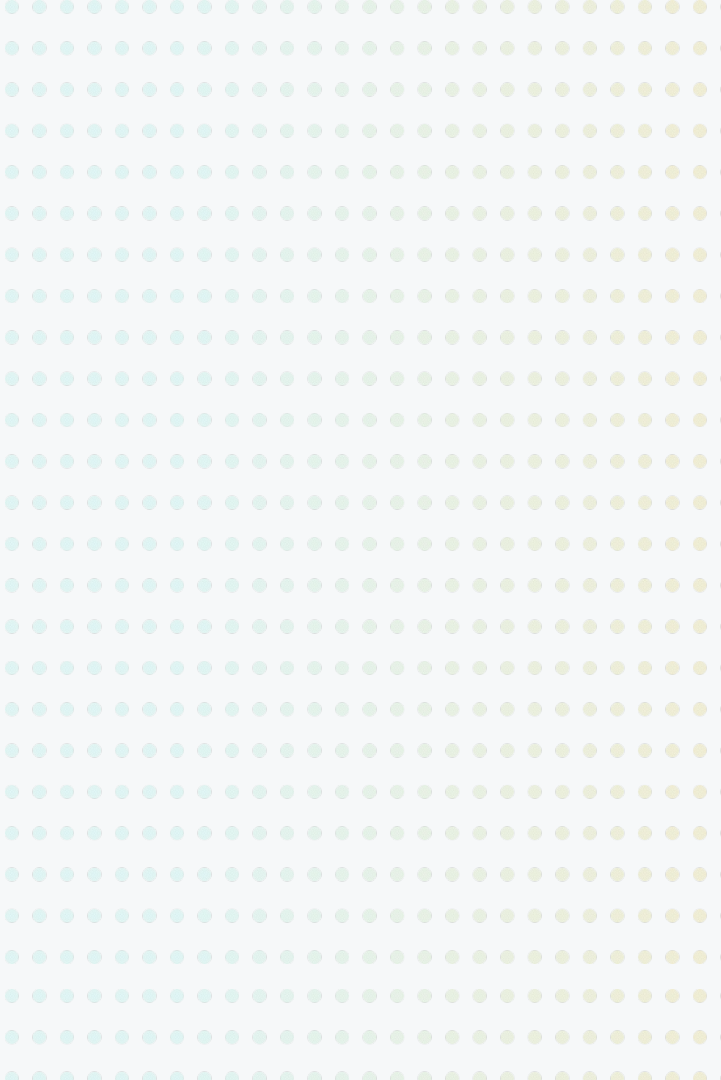
Emergency Shutdown for Integration Partners

Integrations Team, Maker Foundation



Agenda

1. Introduction to Emergency Shutdown (ES)
2. Implementation Properties of ES
3. Dai and Collateral Redemption
4. Auction Settlement
5. Users Affected
6. Cage Keeper
7. Design Patterns with ES in mind
8. Call-to-Action for Integration Partners



Introduction to ES

Emergency Shutdown is intended to be triggered in the case of a system upgrade or serious emergencies, which include, but are not limited to:

- Long-term market irrationality
- A protocol hack
- A security breach

Initiating ES is decentralized and controlled by MKR voters, who can trigger ES through two ways:

1. Executive Proposal within MakerDAO Governance
2. [Emergency Shutdown Module \(ESM\)](#)
 - Used to combat against malicious executive proposals
 - The ESM requires 50,000 MKR (as of July 2020) to be deposited in order to trigger cage
 - The MKR is burned immediately once triggered

When triggered, ES stops and shuts down the Maker Protocol while ensuring that both Dai holders and Vault owners receive the net value of assets.

Introduction to ES - three phases

1. **System Caged** - An executive proposal or the ESM calls `End.cage()` function, which freezes the USD price for each collateral type as well as many parts of the system.
2. **Processing Period** - Next, Vault owners interact with End to settle their Vault and withdraw excess collateral. Auctions are left to conclude or are yanked before Dai redemption.
3. **Dai Redemption** - After the processing period duration `End.wait` has elapsed, Vault settlement and all Dai generating processes (auctions) are assumed to have concluded. At this point, Dai holders can begin to claim a proportional amount of each collateral type at a fixed rate.

Introduction to ES - three phases

System Caged



Processing Period

- **Start Waiting Period** ↻
Time to identify and process under-collateralized Vaults
- **Cancel Debt & Surplus auctions**
- **"Freeze" / Register prices for all collateral types**
- **Process Vaults such that excess collateral can be freed**



Vault Owner

Vault Owner can withdraw excess collateral from Vault immediately after Emergency Shutdown



Dai Redemption



Duration of Waiting Period

Collateral Auctions are completed or cancelled



Dai Holder

Dai Holder can receive collateral for their Dai once the Waiting Period has elapsed

Introduction to ES - nine discrete steps

1. System Caged

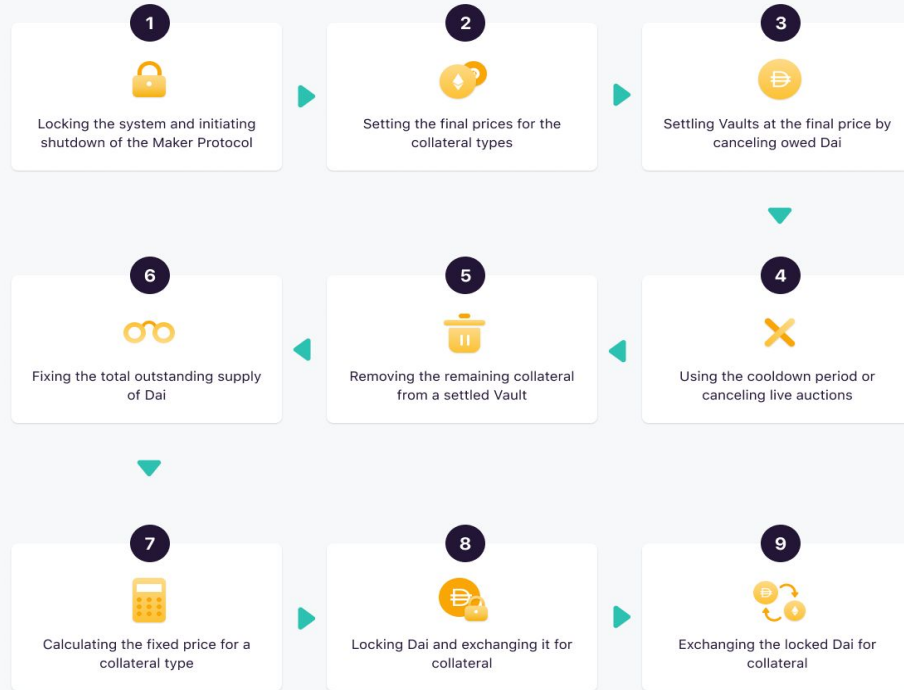
a. Step 1

2. Processing Period

a. Step 2-6

3. Dai Redemption

a. Step 7-9

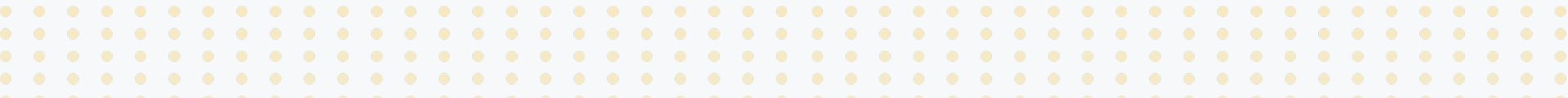


Implementation Properties of ES

1. **Dai no-race condition:** Every Dai holder will be able to redeem the same relative quantity of collateral proportional to their Dai holdings, regardless of when they interact with the contract.
2. **Vault Parity:** Vault Owners are prioritized, allowing them to withdraw their excess collateral before Dai holders are able to access collateral.
3. **Immediate Vault redemption:** After ES is initiated, Vault owners are allowed to free their collateral immediately, provided that they execute all contract calls atomically.
4. **No off-chain calculations:** The system does not require the cage authority to supply any off-chain calculated values (i.e., it can rely entirely on the last OSM feed prices).
5. **Vow Buffer Assistance:** After ES is initiated, any surplus or bad debt in the buffer acts as a reward or penalty distributed pro-rata to all Dai holders. e.g. if 10% of Dai supply is in the form of net surplus in the Vow, then Dai holders receive 10% more collateral.

Why does ES prioritize Vault Owners over Dai Holders?

1. Overcollateralized Vaults do not subsidize the Protocol for undercollateralized Vaults during the *active* system, so it's consistent for ES to have the same behavior.
2. Giving priority to Vault owners to recover their excess collateral incentivizes them to maintain overcollateralization.



Dai and Collateral Redemption

Vault Owner User Story

- Vault owners can **retrieve excess collateral** from their Vaults **immediately after** the initialization of ES.
- Retrieval can be **completed via Vault frontends**, such as Oasis Borrow, that have ES support implemented, or via command-line tools.

Dai Holder User Story

- Dai holders can, after the waiting period (for processing), use their Dai to redeem a **pro rata share** of all types of collateral in the system.
- The amount of collateral that can be claimed during this period is determined by the Maker Oracles at the time ES is triggered and the existence of bad debt / surplus in the Vow.
- Dai holders will **always receive the same amount of collateral** from the system whether their claims are among the first or last to be processed.

Auction Settlement

- Before the Dai redemption phase starts, **End** must know the Total Dai Supply.
- We need to ensure that collateral (flip) auctions will not reduce Dai supply after the Total Dai supply is fixed within the ES contract (**End**). If the actual Total Dai supply is below what the **End** contract believes, then some collateral would be forever frozen in the **End** contract.
- Therefore, Maker Governance has set a time delay between ES begins and Dai Redemption to ensure all auctions either finish or canceled
 - (As of Aug, 2020, it's 73 hours on mainnet)
- The delay must expire before any exchange of Dai for collateral can take place.
- Anyone can cancel Flip auctions at any time, whereas pending Flap and Flop auctions are canceled when ES is triggered.
 - Canceled auctions return the bids to the last bidder.

Users Affected

Dai Holders

Vault Owners

MKR Holders

Centralized Exchanges

Custodial / Non Custodial Wallet

Decentralized Exchanges

Dapp Browsers

Vault Integrators

Decentralized Applications

Market Makers

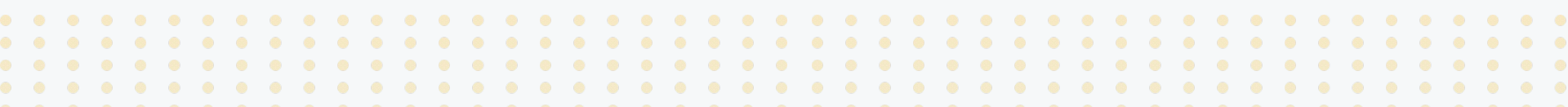


Cage Keeper

The cage-keeper is a bot used to help facilitate Emergency Shutdown of the Maker Protocol.

To prevent a race-condition for Dai holders during Dai Redemption (Step 3), it's imperative that any Vaults having a **collateralization ratio of less than 100%** at System Caged (Step 1) **must be processed** during Processing Period (Step 2). The owner of an underwater Vault would not receive excess collateral, so they lack an incentive to `skim()` their position in the `End` contract.

Thus, it is the **responsibility of a MakerDAO Stakeholder** (MKR holders, large Dai holders, etc) to ensure the system facilitates a Dai redemption phase without a “run on the collateral pool”. The cage-keeper is a tool to help stakeholders carry out this responsibility.



Cage Keeper Actions

1. **System Caged** - contracts now have bounded functionality
2. **Processing Period** - Auctions stopped/finished. Vault owners settle their positions and remove any excess collateral
 - Keeper: Fixes the final oracle price for each collateral type (via `cage(ilk)`)
 - Keeper: Stops all Flap and Flop auctions (via `yank()`)
 - Keeper: Stops all Flip auctions (via `skip()`)
 - Keeper: Processes all underwater Vaults (via `skim()`)
 - Over Collateralized Vault Owners: Process their Vault and remove excess Dai
3. **Dai Redemption** - Dai holders are free to claim proportional amount of collateral
 - Keeper: After cooldown period, Dai Redemption phase is started (via `thaw()`)
 - Dai Holders: Redeem collateral with Dai (through Redemption keeper or contracts)



Design Patterns with ES in Mind



Design Patterns with ES in mind

We believe each system that integrates with the Maker Protocol is unique and must design and implement a tailored Emergency Shutdown plan in order to mitigate confusion and protect your users after ES is triggered.

For your convenience, we've created an [ES Design Pattern Guide](#), which includes the following patterns:

Freeze actions

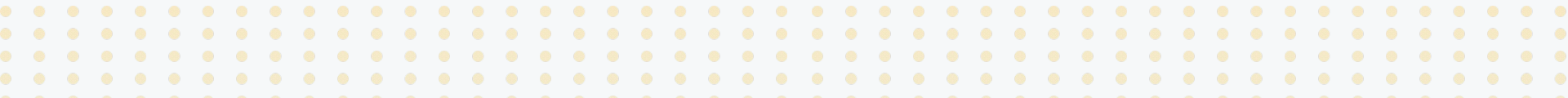
Freezing the part of your system that interacts with Dai or Vaults when ES is triggered will help avoid complications.

Oracle price feeds

After ES, Dai's value will be pegged to a basket of collateral, so your system shouldn't hardcode the value of Dai to \$1.

Undo

Your systems must be able to cancel long running actions like auctions which could have been started pre-ES with a different set of assumptions.



Design Patterns with ES in mind

Withdrawal of Dai

Digital asset custodians that hold Dai may need to prepare for large amounts of simultaneous Dai withdrawals.

Collateral in the Maker Protocol

Partners should think critically about how collateral is manifested on-chain, its ownership properties and distribution among Dai holders if ES is called.

Settlement

Derivative contracts which use Dai as collateral and rely on its stability will have to settle the contract right after ES is called.

Recursive Redemption

Collateral redemption would require several rounds if any collateral is ultimately backed by Dai. After each round the user would be left with a decreasing amount of Dai, which is used to redeem more collateral until the full value of Dai is redeemed.



Call-to-Action for Integration Partners

It's imperative that integration partners design systems that can support Dai and Vaults during all conditions of the Protocol, including emergencies.

We recommend that you do the following as soon as possible:

1. **Learn.** Go through this presentation and [our documentation](#)
2. **Apply.** Upgrade your systems, following [our recc. ES Design Patterns](#) and discussions with the Integrations team if needed.
3. **Prepare.** Make ready a [communication plan](#) to educate your users

If you carry a large stake (Dai, Vaults, MKR holder, etc) in the Maker Protocol, consider running a cage-keeper to help facilitate the system's wind down.



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