Node Security

Ganeticon, Sep 2014

Helga Velroyen, helgav@google.com

Agenda

- SSL node security
- SSH node security

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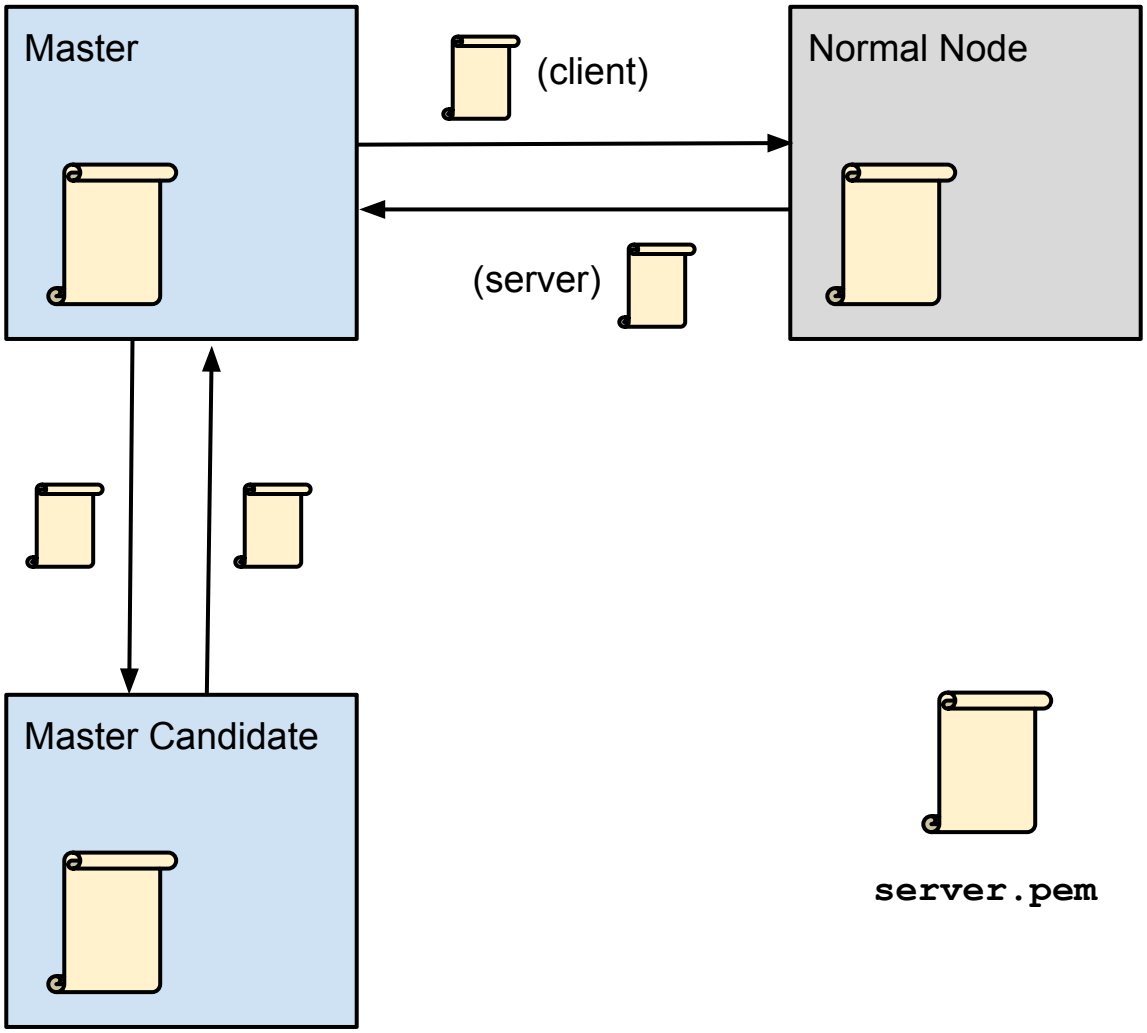
SSL

Node Security

RPC via SSL (pre 2.11)



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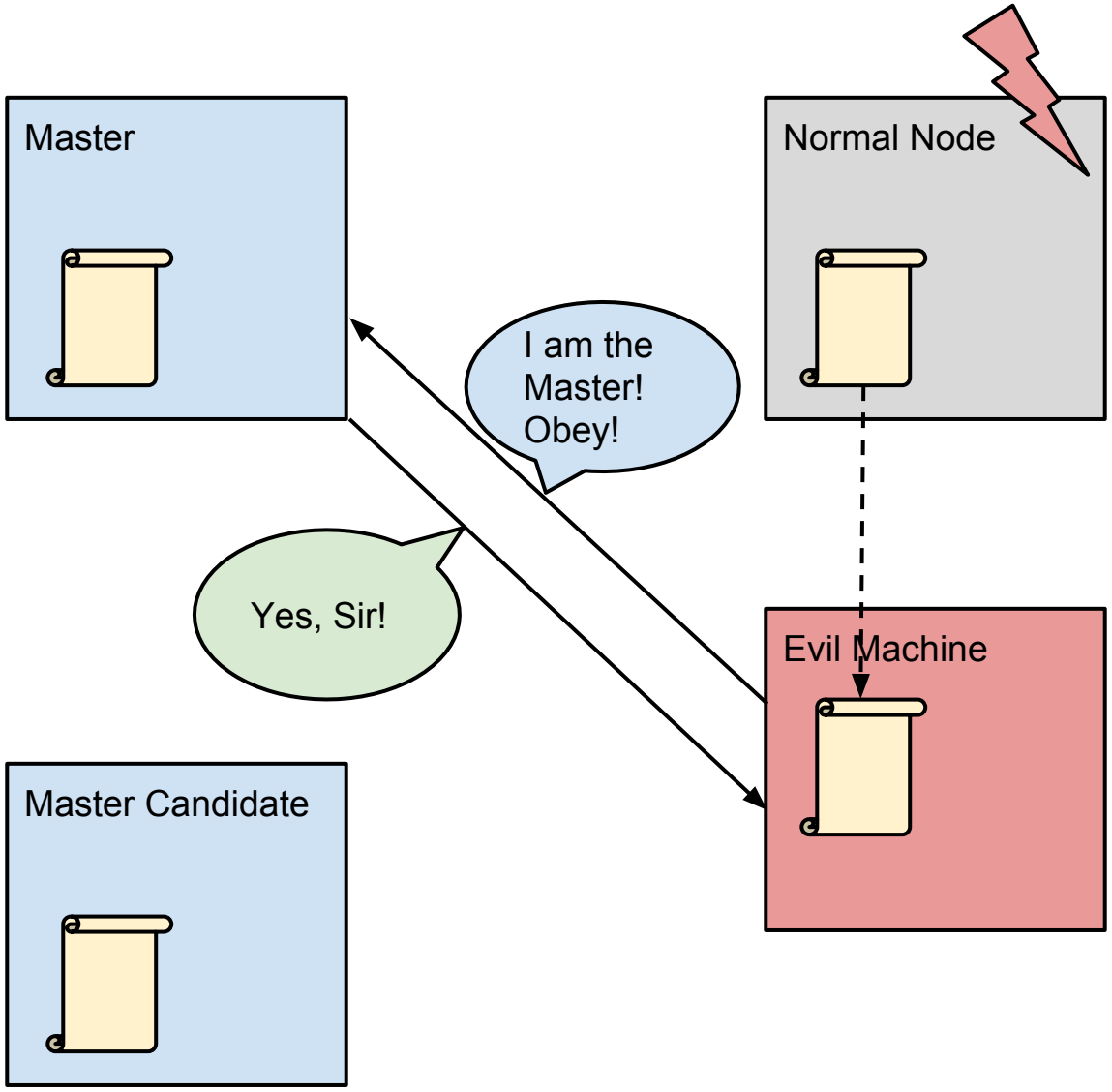
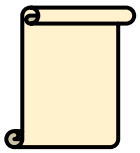


Compromising a Node can lead to random Nodes impersonating the Master



`server.pem`

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Design Goals

- A compromised normal node should not harm other nodes
- Nice to have: it should be possible to identify and remove a compromised master or master candidate
- Details: doc/design-node-security.rst

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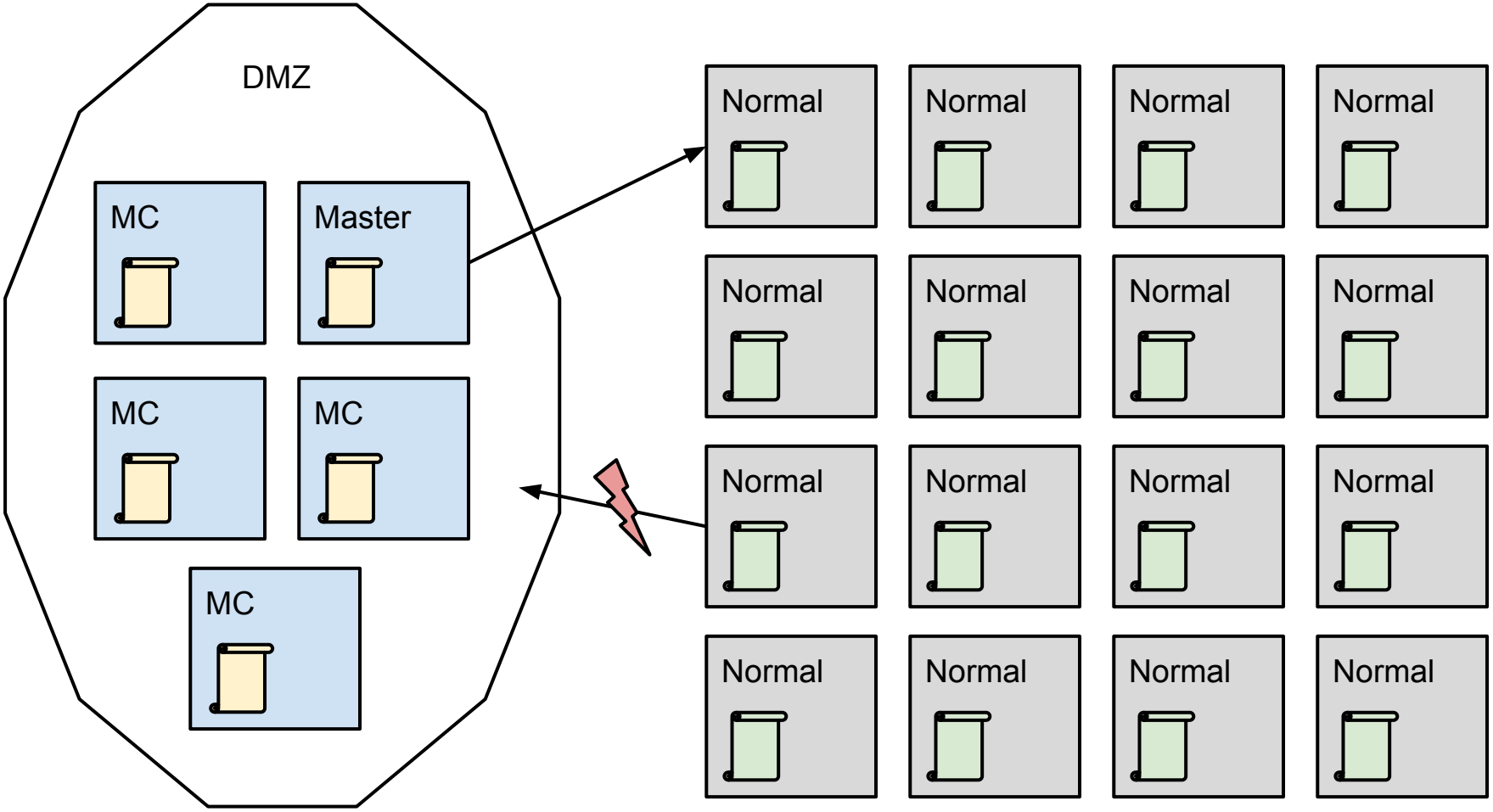
Possible Setup: Shield your Master Candidates



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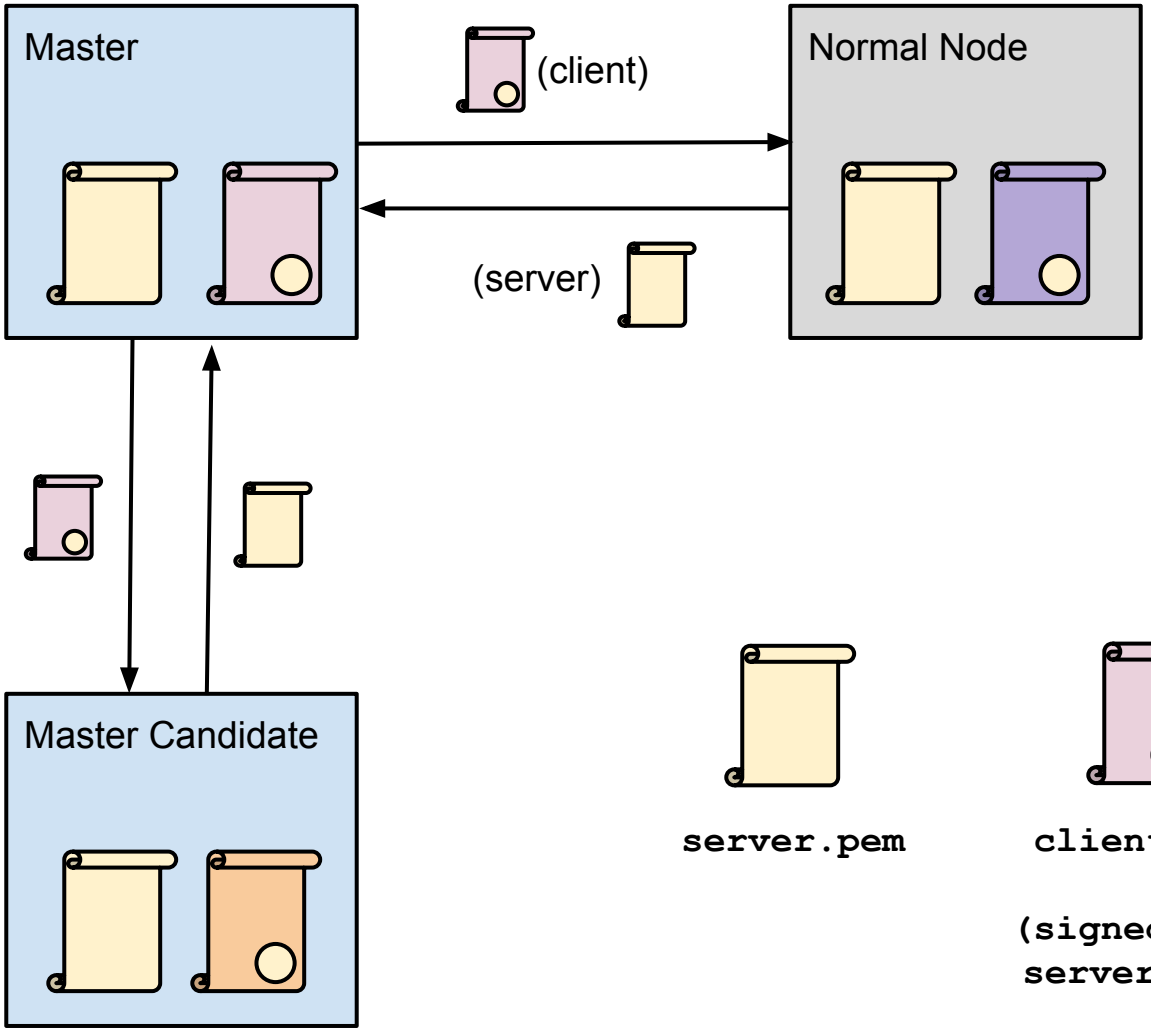
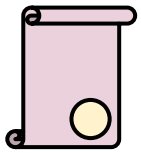
RPC via SSL Individual Client Certificates



`server.pem`



`client.pem`

`(signed with server.pem)`

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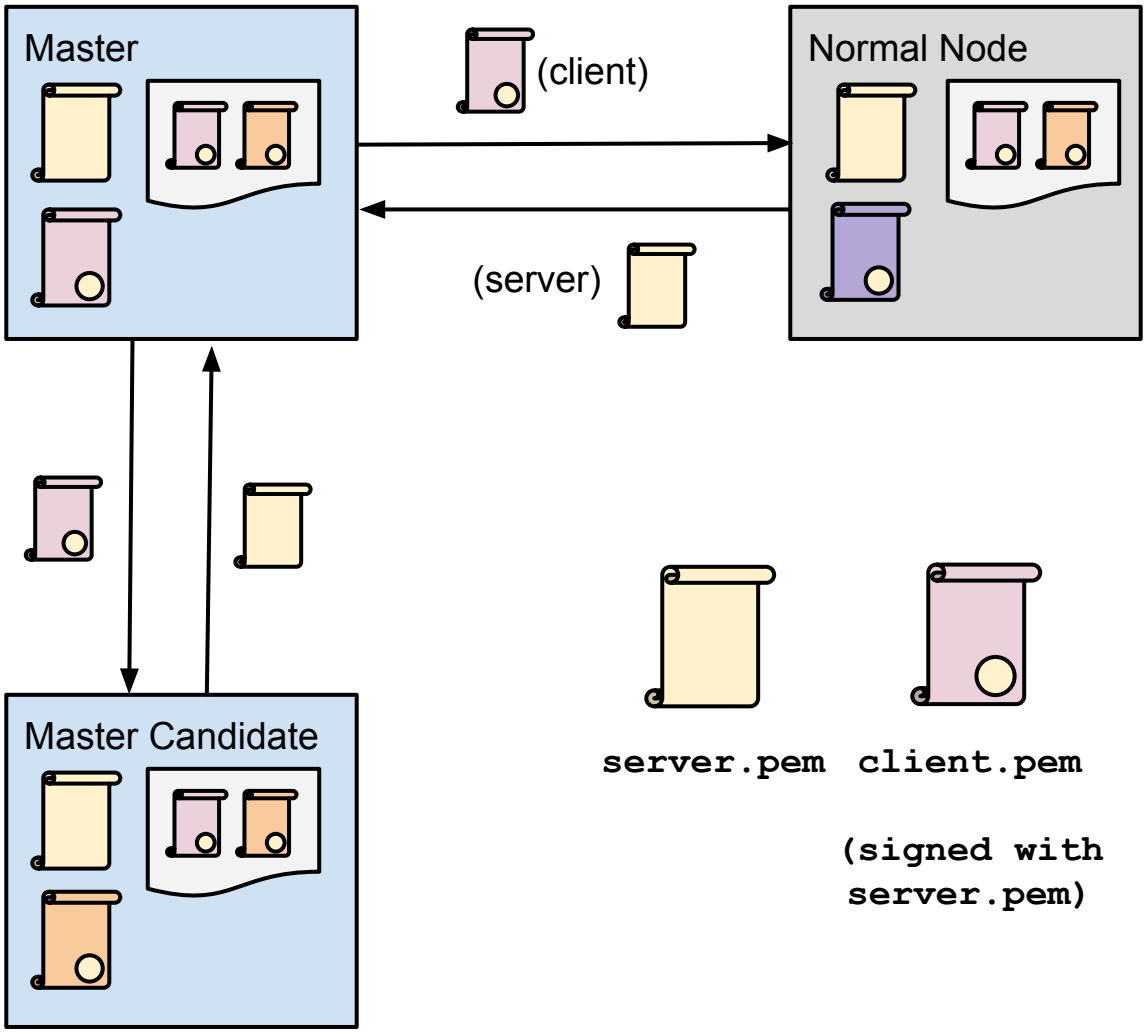
RPC via SSL Master Candidate Certificate Lists



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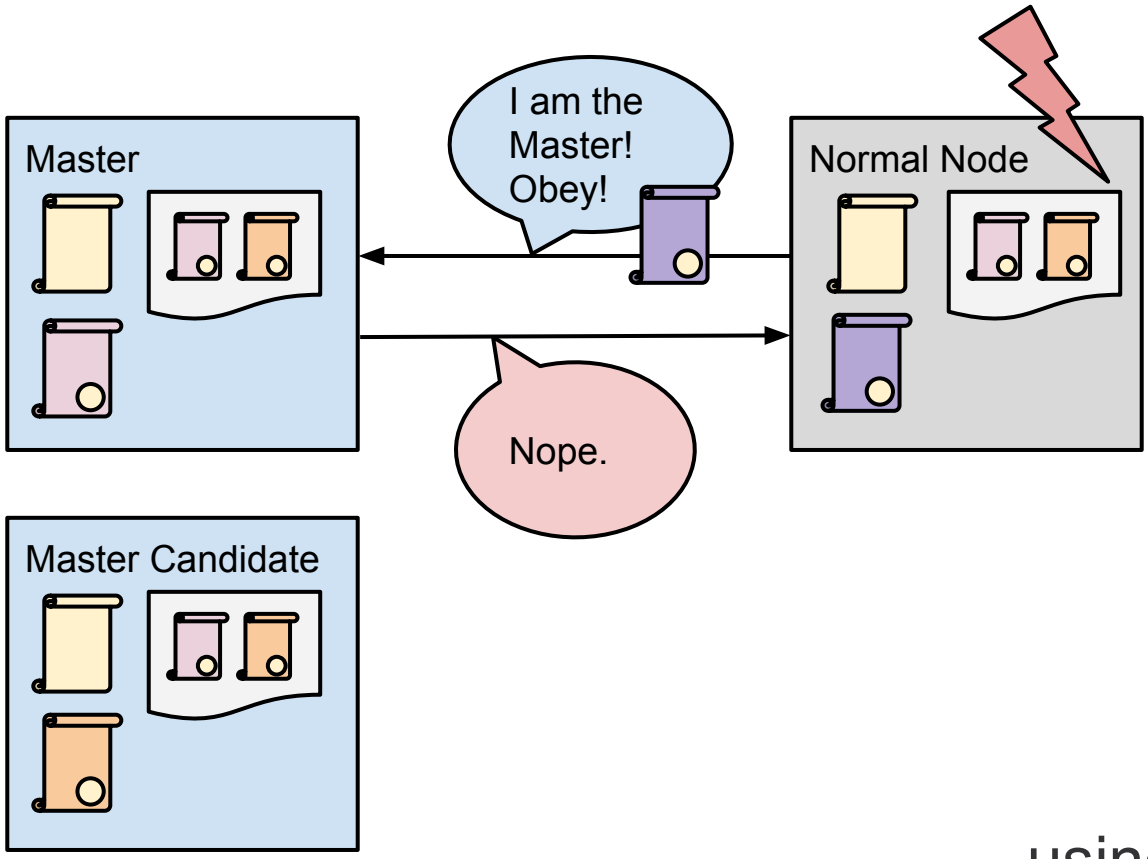

Attack Scenario:
using a client certificate
of a normal node is futile.

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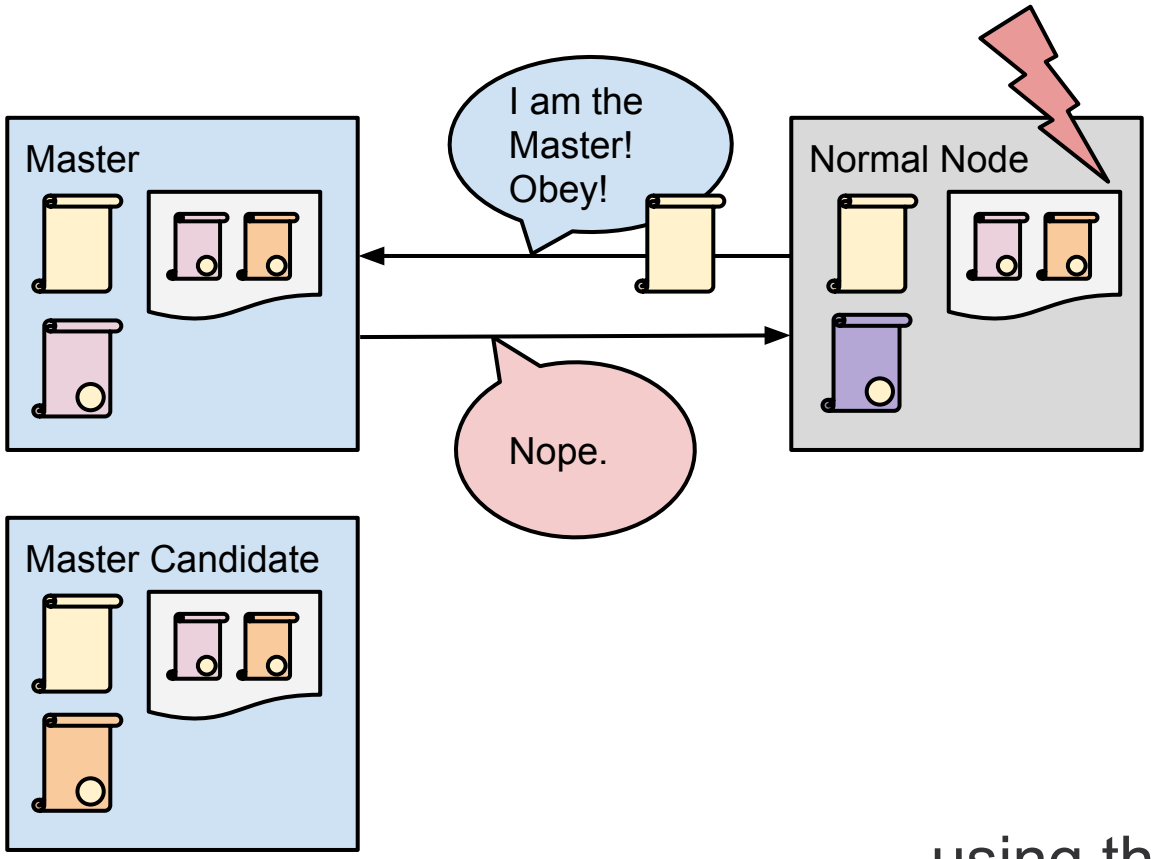

Attack Scenario:
using the **server** certificate is futile.

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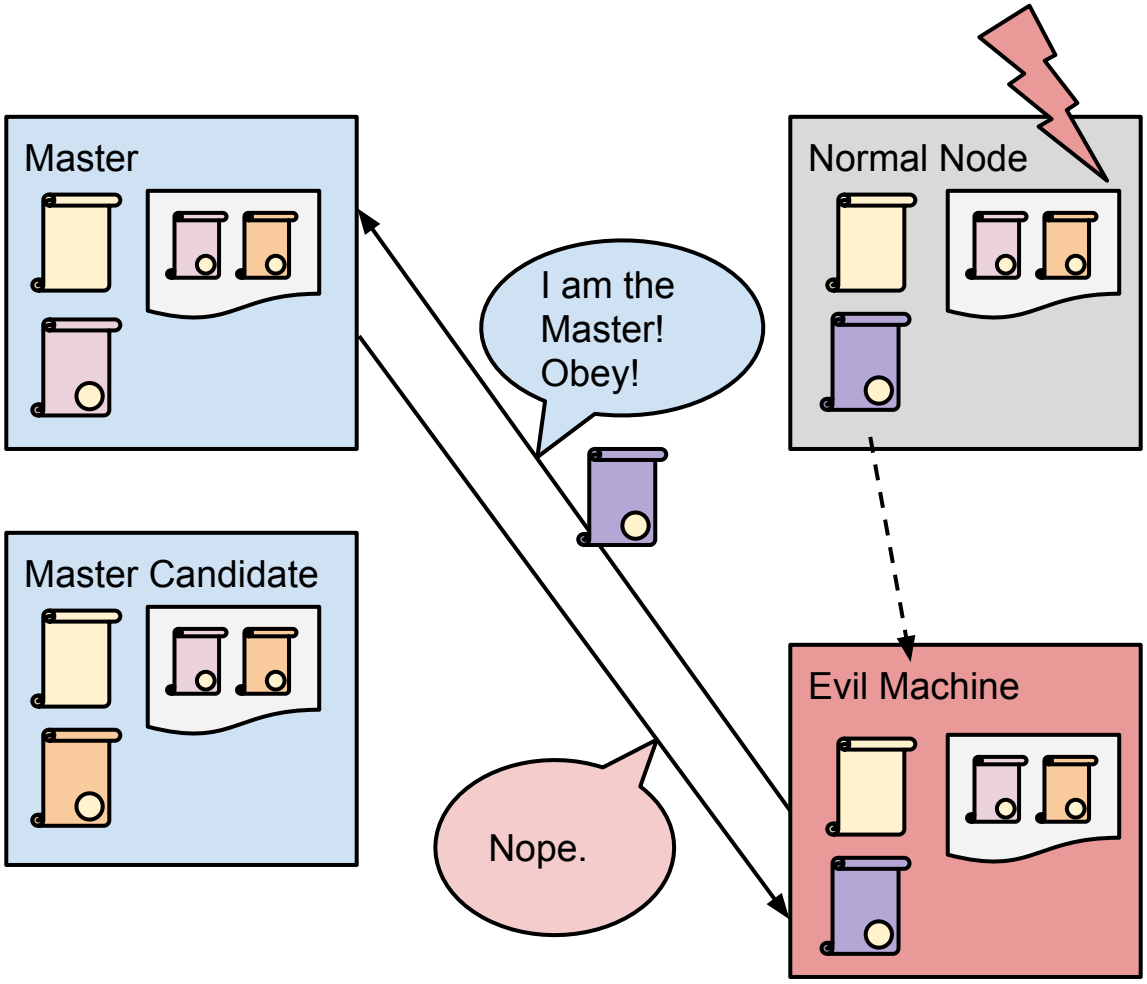

Attack Scenario: Same applies to external machines using copied certificates

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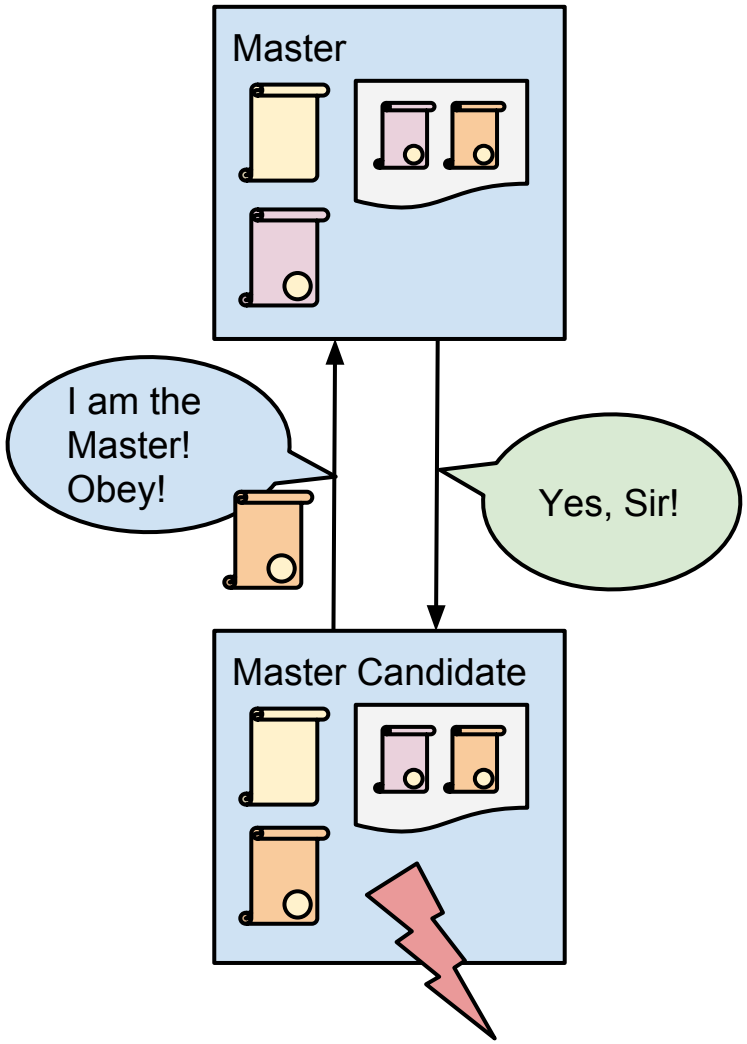

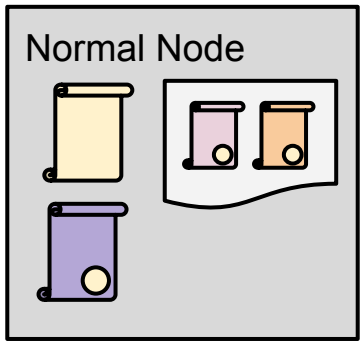

Attack Scenario:
Compromised
Master Candidates
can still own the cluster :(

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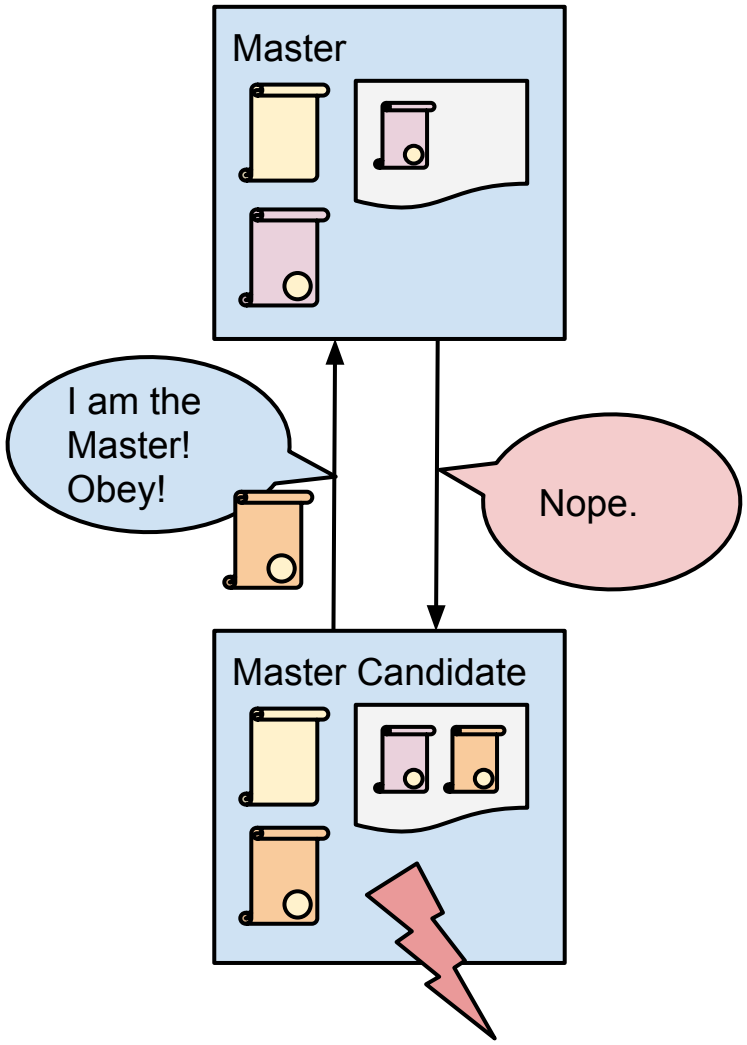

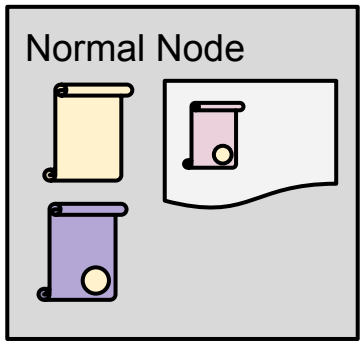

But at least a certificate of an identified compromised master candidate can be removed

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Implementation Challenges

- Bootstrapping: how to change from “Before” to “After” on upgrading Clusters
- Cluster renew-crypto
- Writing Configuration + Timing Issues
- Fun with undocumented differences between SSL libraries

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Comparison: Before and After

- Poor man's usage of SSL
- One certificate for client and server role
- The same certificate for all nodes
- Certificate self-signed
- One compromised node can compromise the cluster

- Slightly richer man's usage of SSL
- One shared certificate used for server role
- Individual certificates used for client role
- Only master candidate certificates allowed as client
- A compromised normal node cannot harm other nodes
- A compromised master candidate can still harm, but certificate can be removed individually

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Can we do better?

Yes! No? Maybe?

Discuss this with us on Thursday in the Security Design session!

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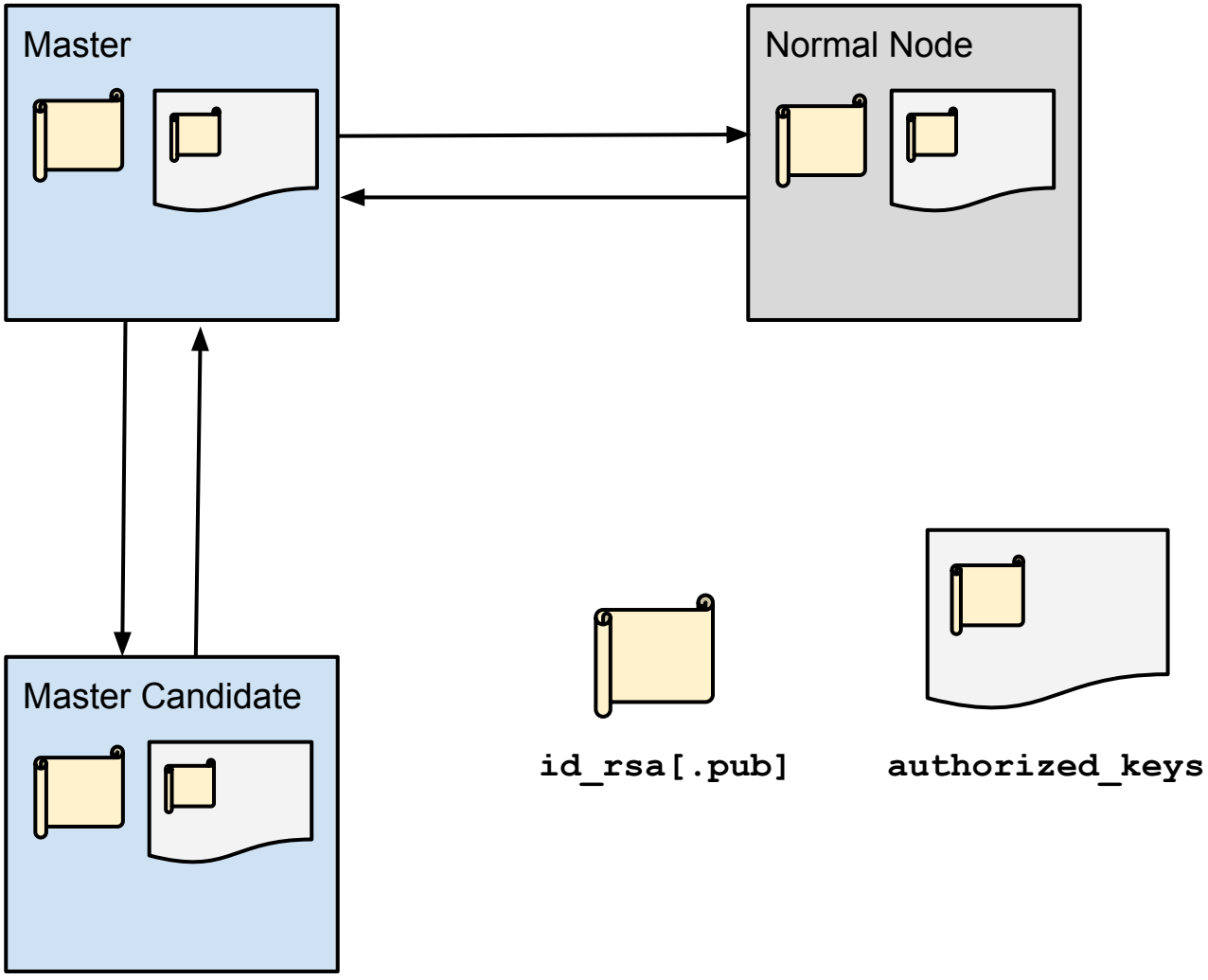
SSH

Node Security

SSH key setup (pre 2.13)



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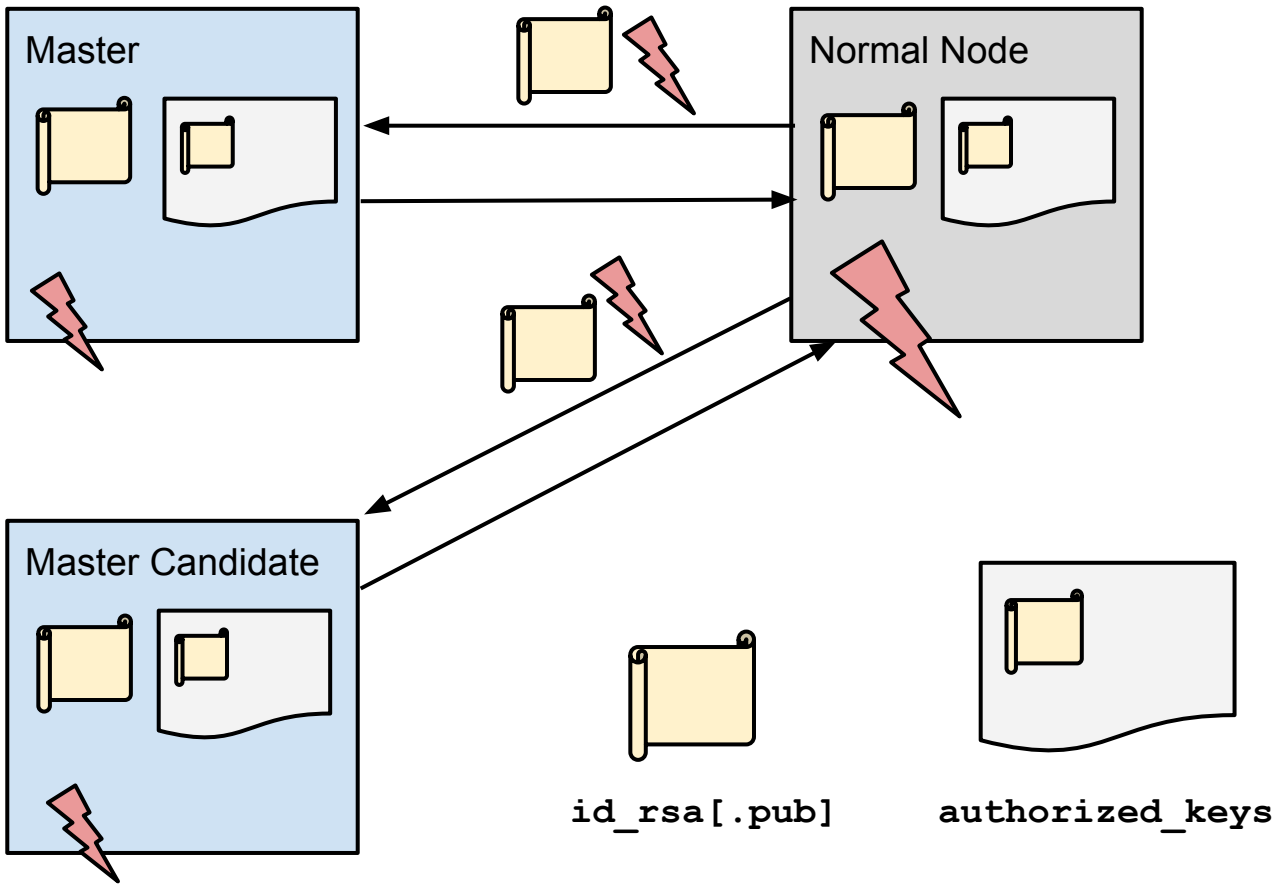
Attack Scenario: One Node owns it all



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Design Goals

- Same as for SSL actually
- Compromised normal nodes should do no harm to others
- Nice to have: Compromised master candidates can be removed separately
- Details: doc/design-node-security.rst

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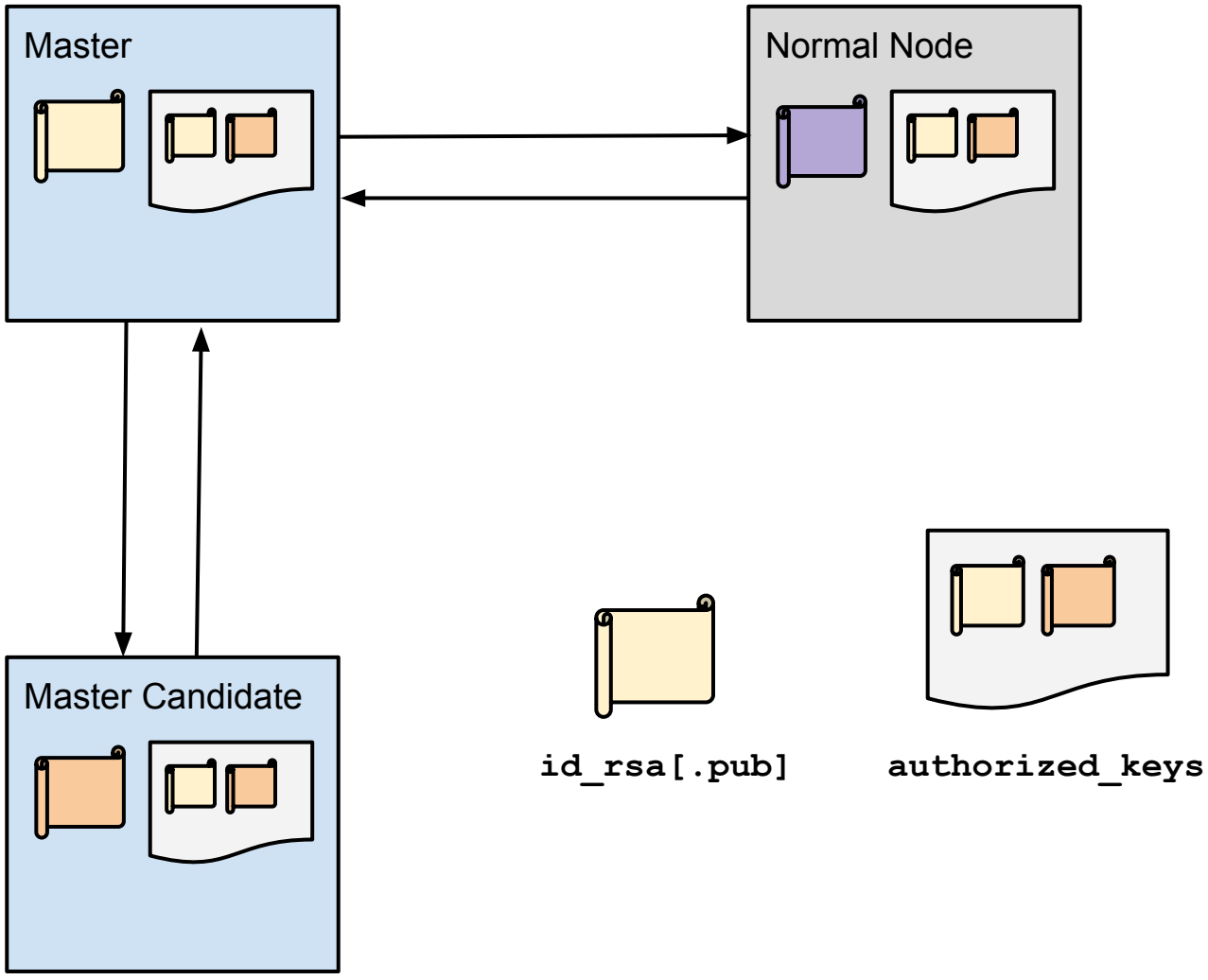
SSH key setup in 2.13 (hopefully)



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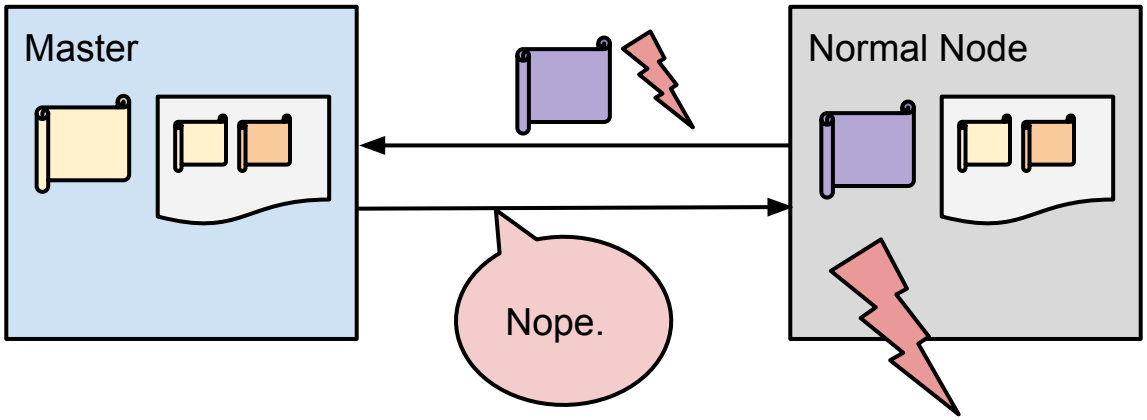
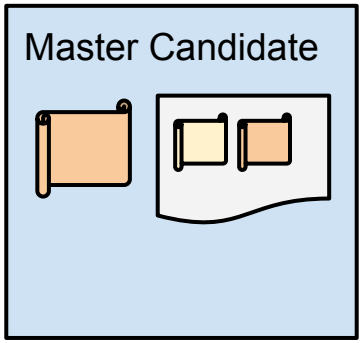
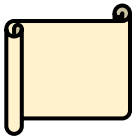
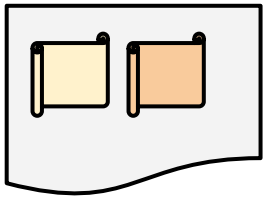


Attack Scenario: Compromised normal node does no harm





`id_rsa[.pub]`



`authorized_keys`

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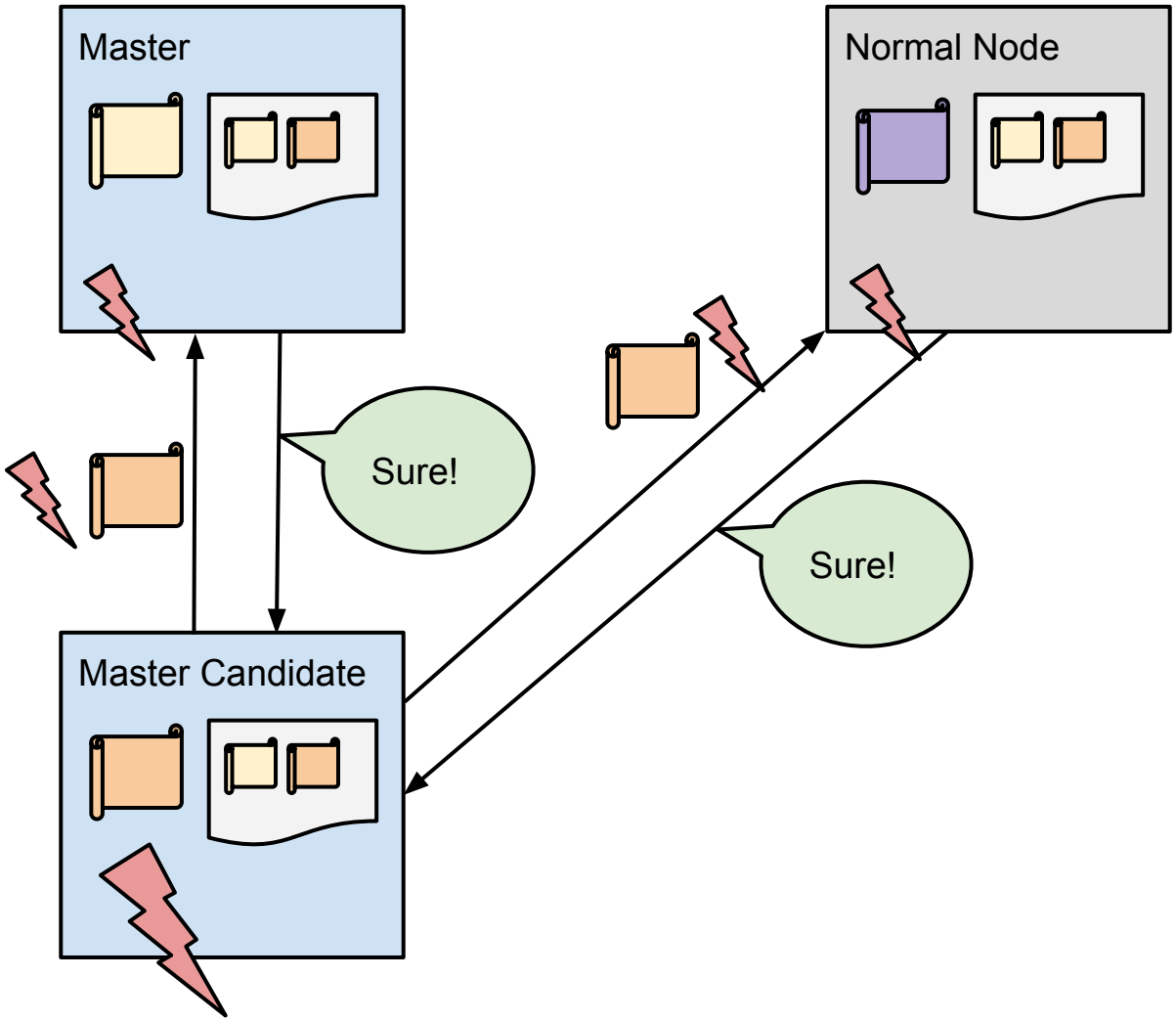

Attack Scenario: Master Candidates still do harm :(

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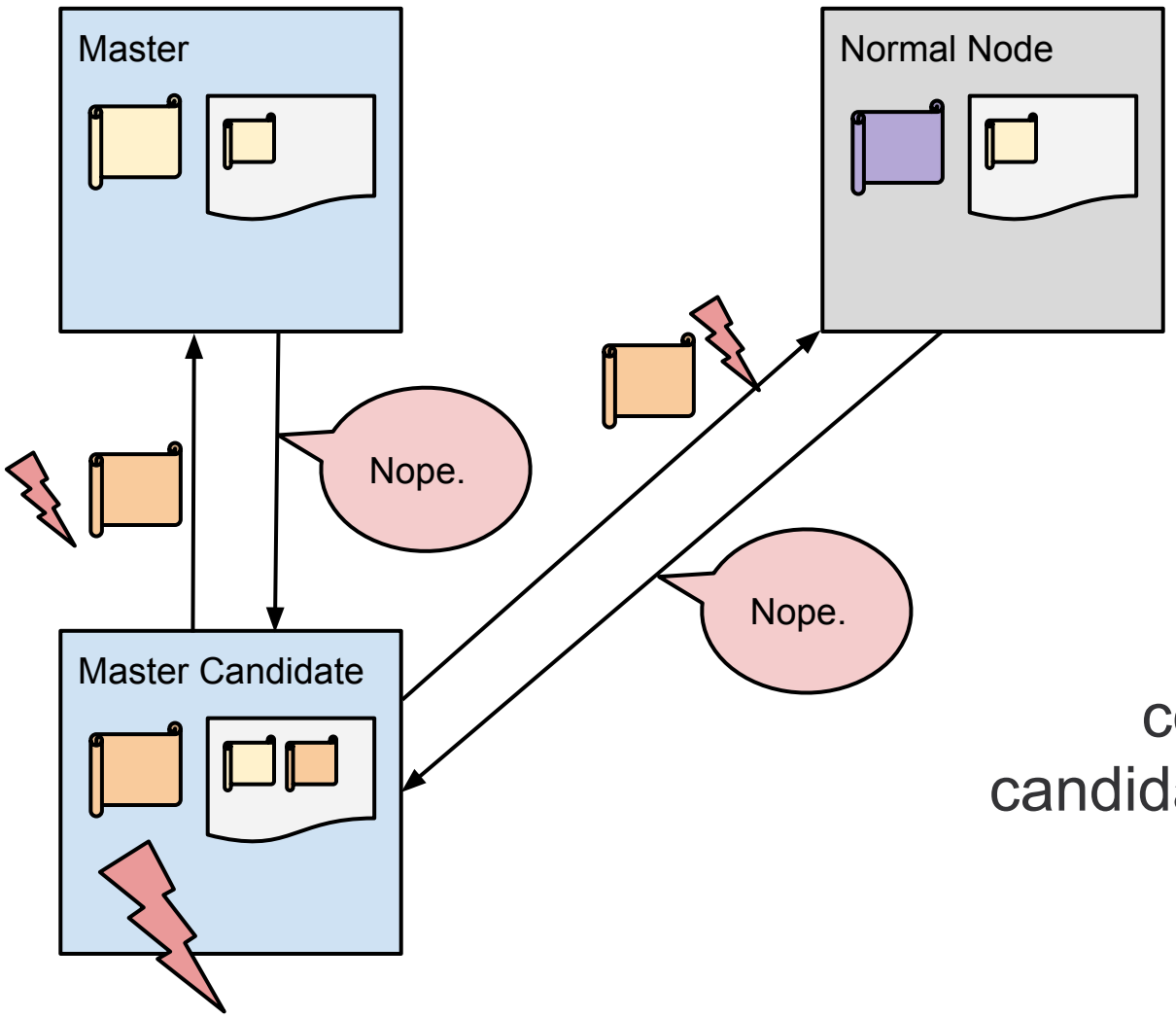

… but the key of a compromised master candidate can be removed independently.

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Comparison: Before and After

- Poor man's version of SSH usage
- One key pair for all nodes
- One compromised node can own the cluster

- Proper usage of SSH
- One key per node
- Only master candidate nodes' keys are put into the authorized_keys file
- A compromised normal node cannot spread the breakage
- An identified compromised master candidate's key can be removed from the cluster

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Implementation Challenges

- Don’t clutter up the ‘authorized_keys’ file
- Don’t lock yourself out
- Don’t add keys of random machines
- No private SSH key shall ever leave the node
- Don’t rely (too much) on SSL security
- gnt-cluster renew-crypto --new-ssh-keys
- Bootstrapping: from “Before” to “After”

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Can we do better?

Yes! No? Maybe?

Discuss this with us on Thursday in the Security Design session!

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Security Design Session

Ganeticon, Sep 2014

Helga Velroyen, helgav@google.com

Agenda

- SSL node security
- SSH node security
- Other security foo

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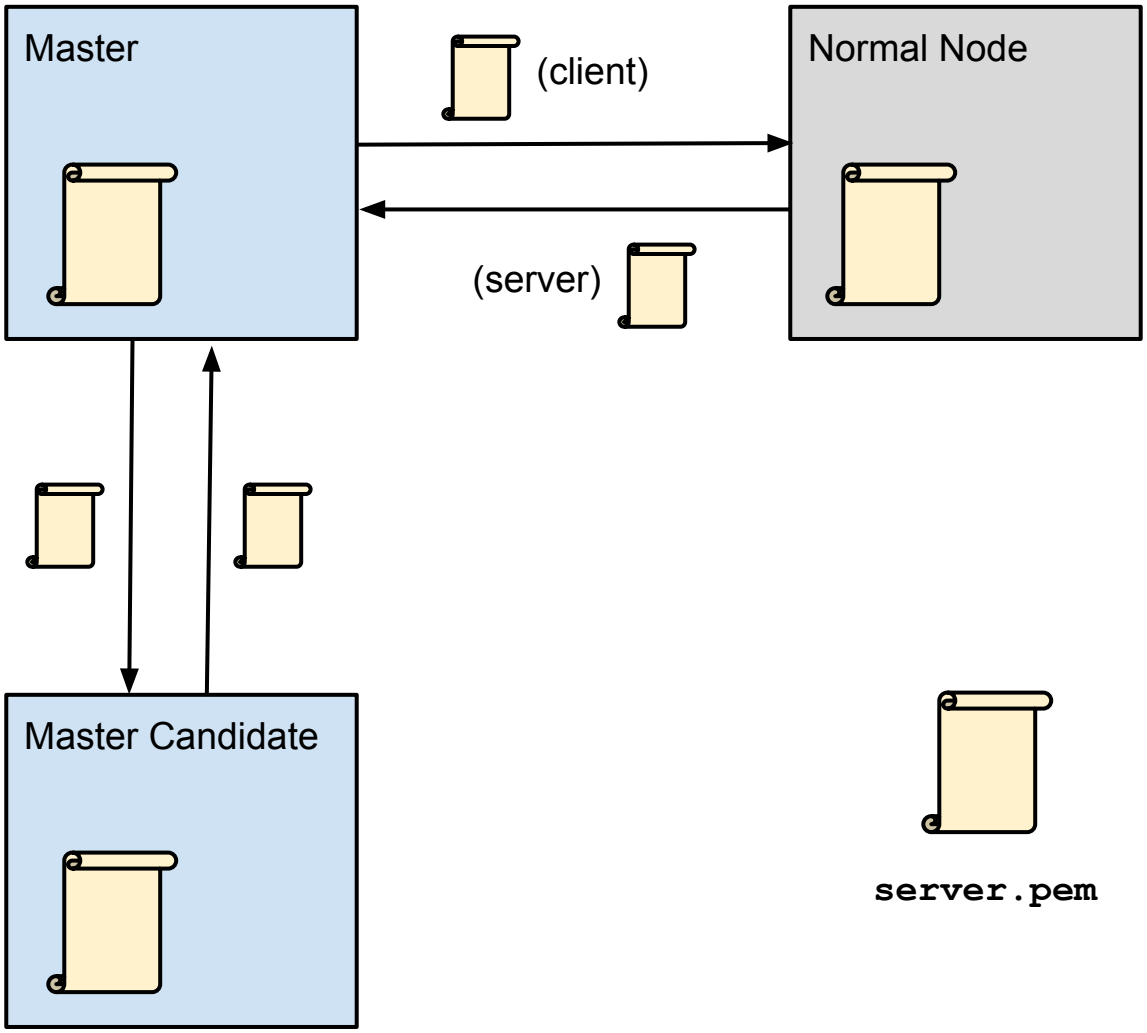
SSL

Node Security (Design Session)

RPC via SSL (pre 2.11)



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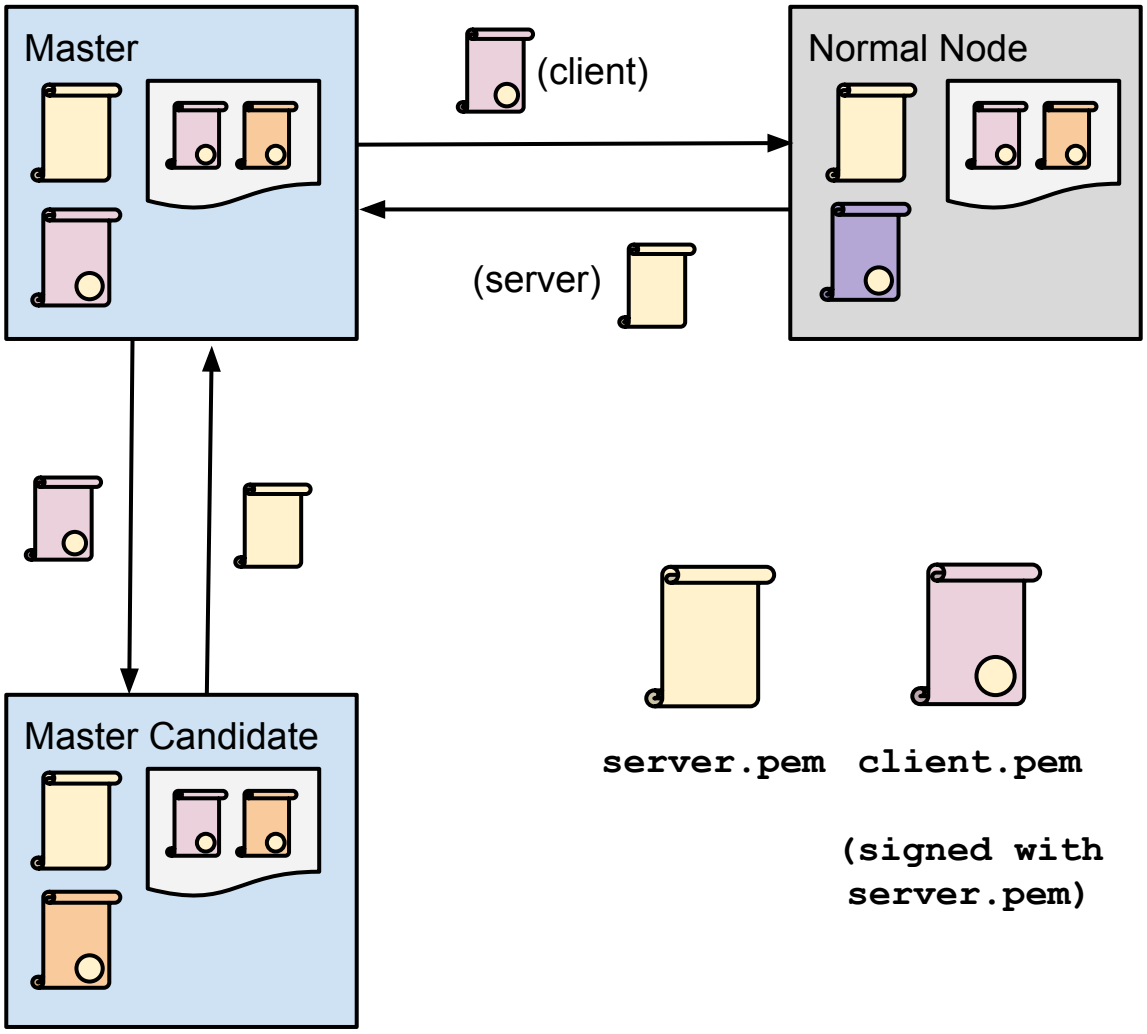
RPC via SSL Master Candidate Certificate Lists



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Pro Points of the Current Implementation

Pro:

- It’s better than before!
- It was implementable with reasonable effort.
- It meets the design goals.
- SSL key handling / creation / distribution is done by Ganeti completely without additional configuration effort necessary

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Pros and Cons of the Current Implementation

Con:

- Still not implemented as SSL is supposed to be used
- Still a shared certificate for all nodes (server.pem)
- Server.pem “abused” to sign client certificates
- Server certificate is self-signed
- No proper signing process (e.g. using signing requests)
- No real authority to sign client certificates (each node does it by themselves)
- No proper revocation process
- No integration in existing SSL infrastructure
- No hostname verification

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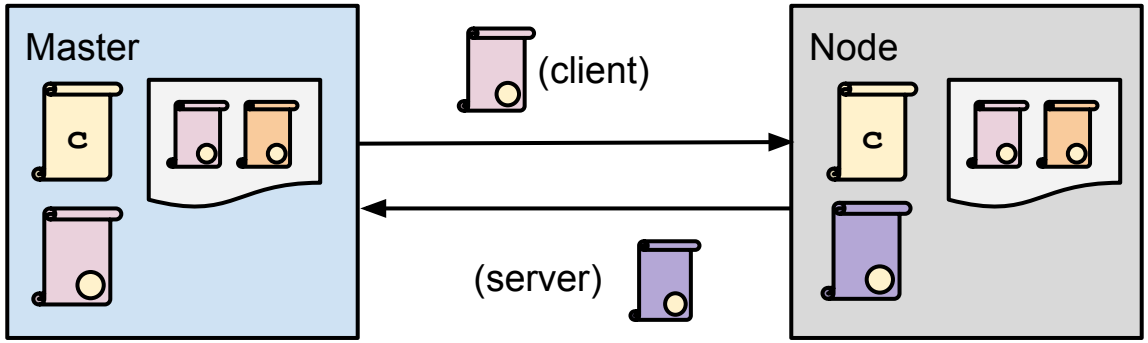
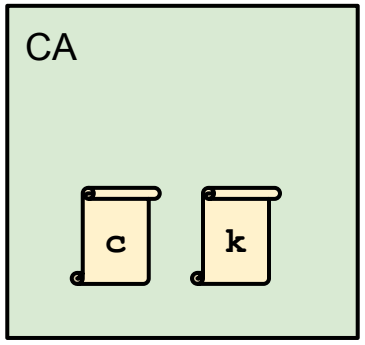
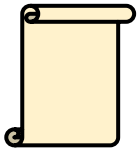
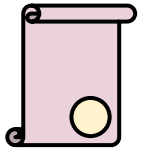
Use CA-signed certificates



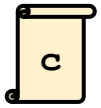




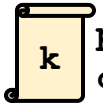
ca.pem



node.pem (signed by ca)



certificate



private key of certificate

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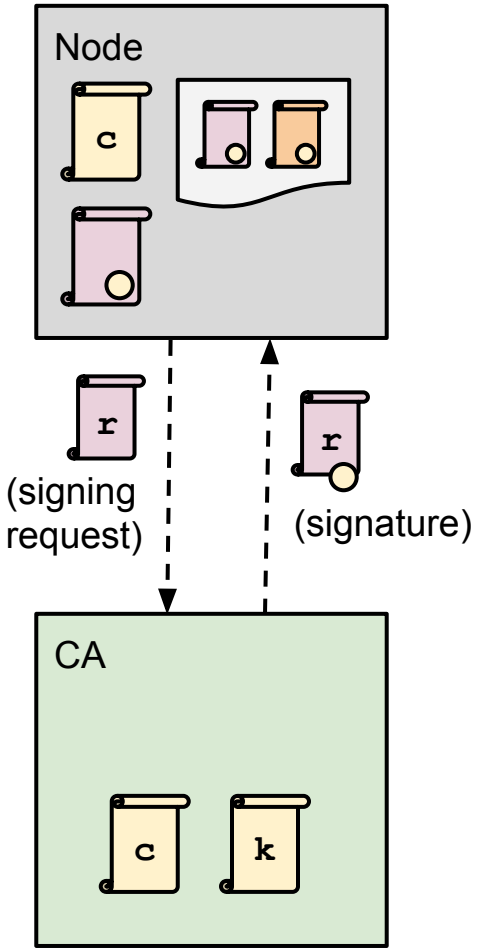
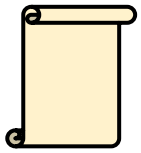
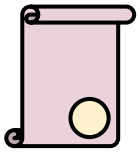
Proper Signing Process by CA

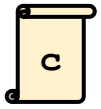




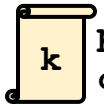
ca.pem



node.pem (signed by ca)



certificate



private key of certificate

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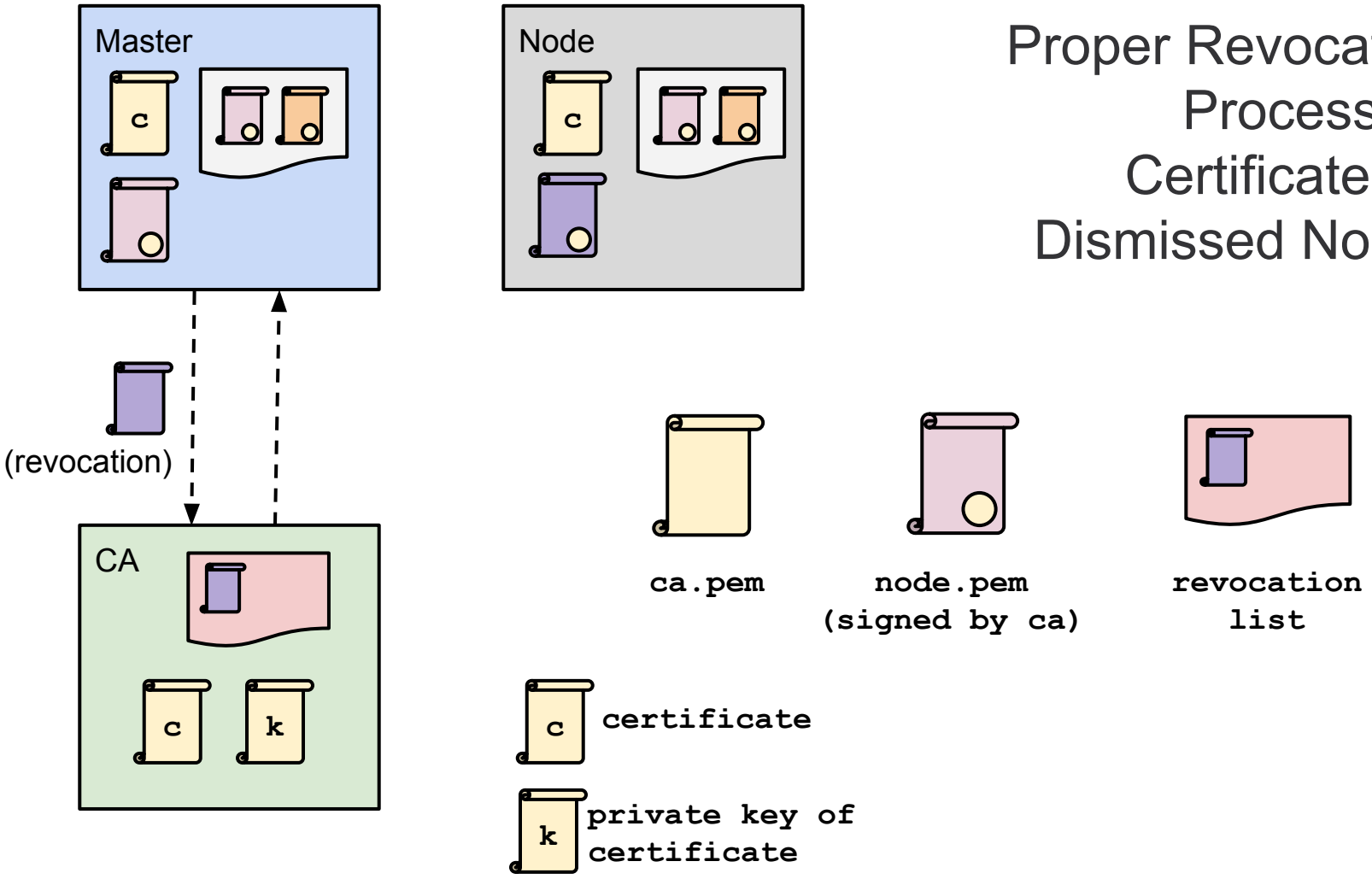
Proper Revocation Process for Certificates of Dismissed Nodes



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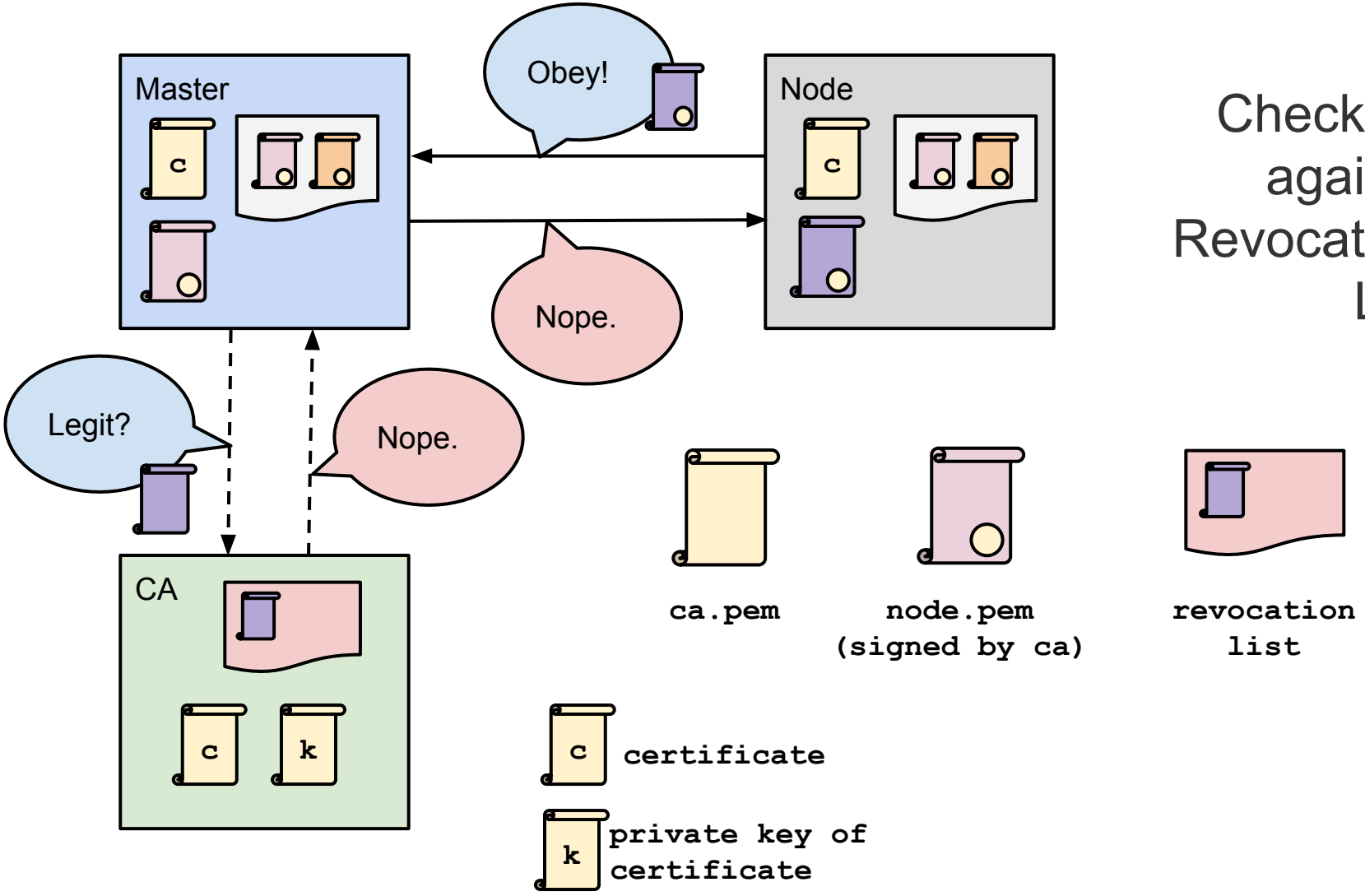
Checking against Revocation List



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Pros of using a CA

- proper certificate signing process
- proper revocation (and checking against) process
- nodes only have public part of CA cert
- more like SSL was designed to be used
- CA certs itself can be signed properly (hierarchy)
- option to integrate existing / external CA infrastructure
- we could use proper hostname verification
- CA would be useful for imports / exports as well

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Internal vs. External CA

Internal, aka “Ganeti CA”:

- What nodes should be the CA?
  - {Master, MCs} = CA?
  - Dedicated set of Ganeti nodes?
- Lots of crap to be implemented!
- Should be easy to setup for Ganeti admins
- Should also work for small clusters

External CA:

- Larger organizations already run their CA infrastructure
- Other distributed systems have similar approach (puppet, bareos)
- Less logic to be implemented in Ganeti

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Your 2 cents?!

- What do you think of the current design? (server.pem + client.pem)
- What do you think of the proposal to use CAs?
- Is the missing CA a pain point for you so far?
- Would you prefer a Ganeti CA or an external CA?
- Any other SSL-related suggestions?

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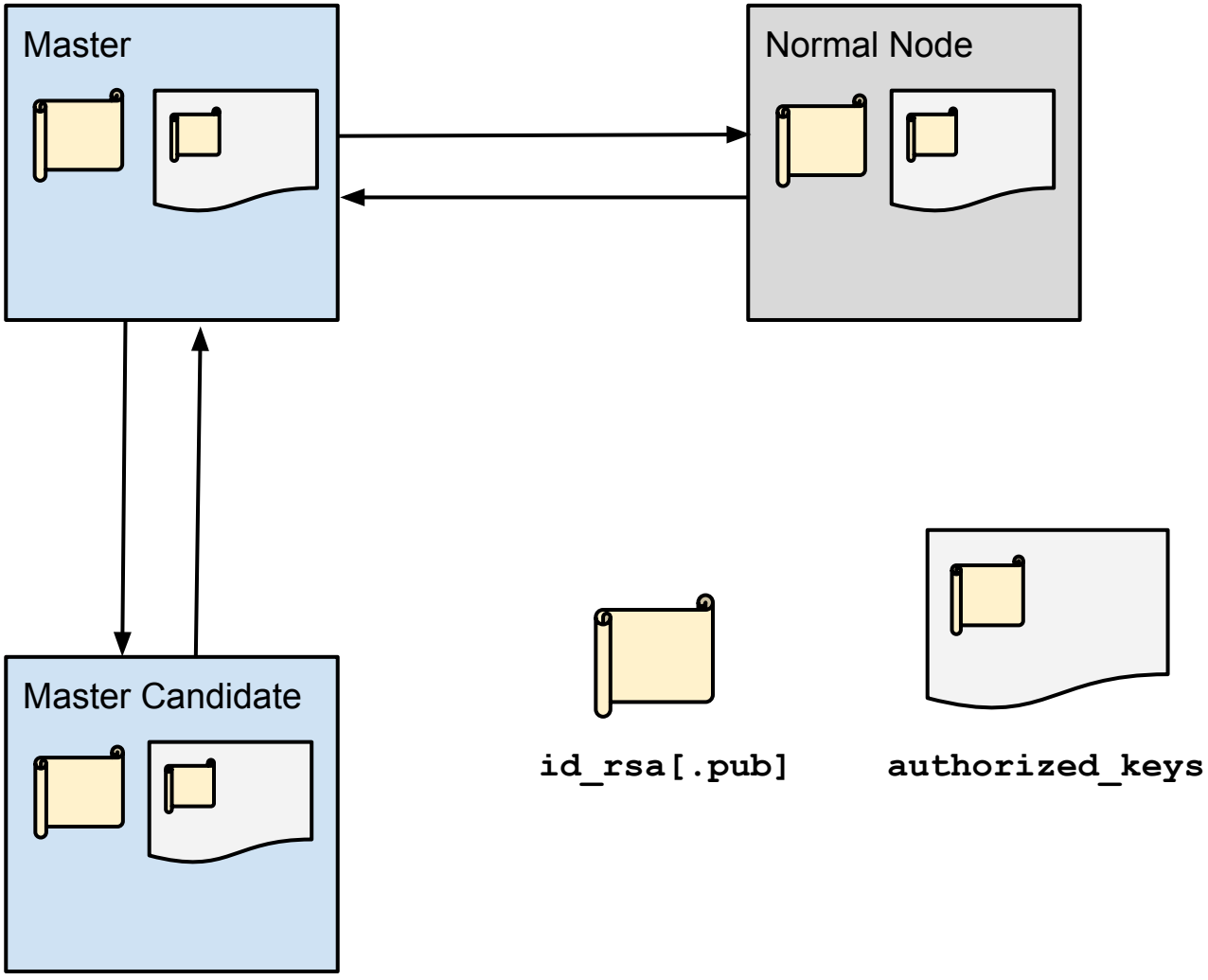
SSH

Node Security (Design Session)

SSH key setup (pre 2.13)



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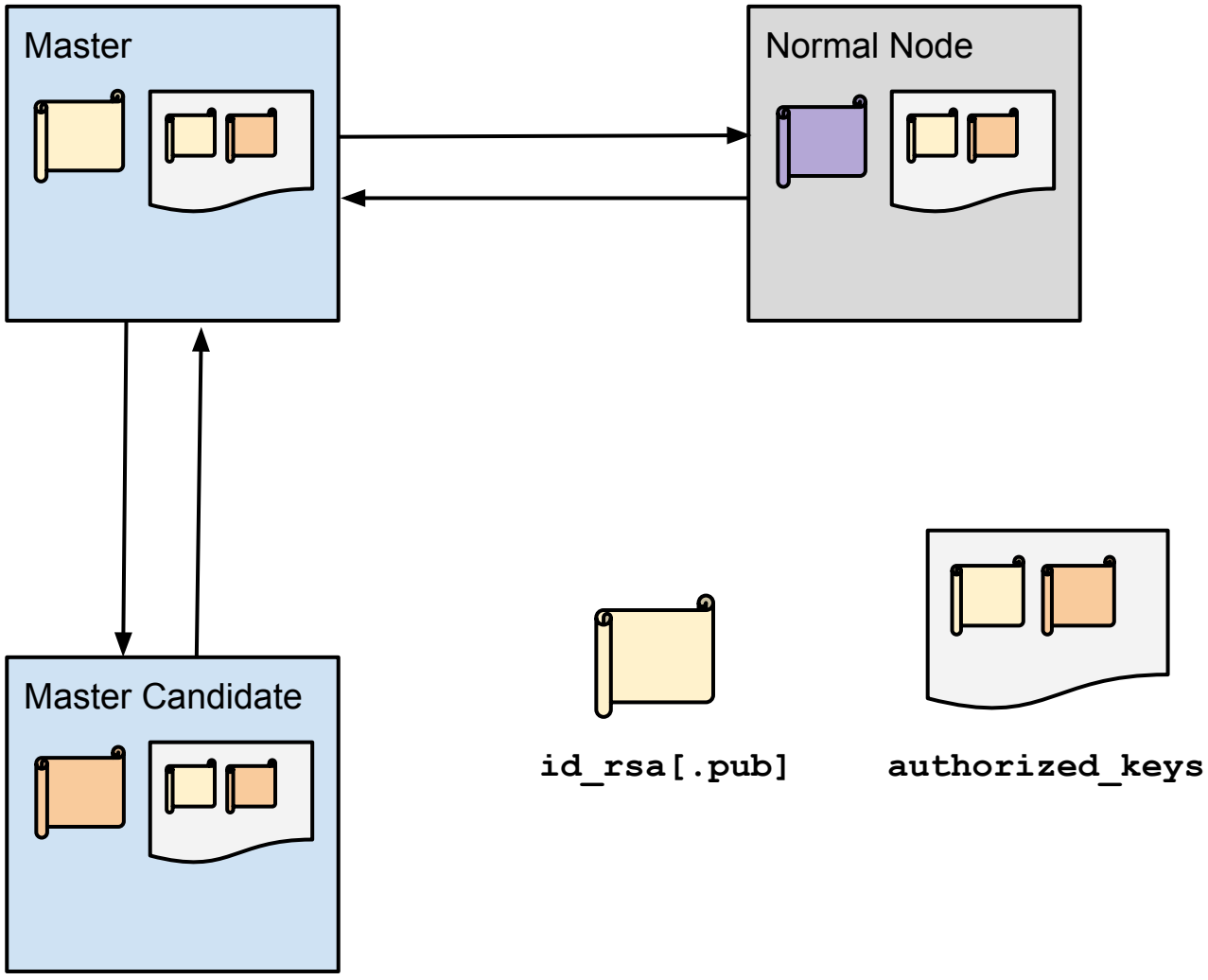
SSH key setup in 2.13 (hopefully)



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Pros and Cons of the New Implementation

Pro:

- Increased security
- Compromised Normal Nodes can do no harm
- Compromised Master Candidates can be removed
- Implemented how SSH is supposed to be used

Con:

- Increased Complexity of Ganeti's SSH key handling
- No integration of external system so handle SSH key distribution
  - although doable by preventing Ganeti from handling the keys

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Your 2 cents?!

- Was the previous design a concern for you?
- Are you happy with the new design?
- Any further suggestions / improvements?

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Other Security Foo

Node Security (Design Session)

What else?!

- Anything else security related which we should talk about?

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