Group Key Encryption

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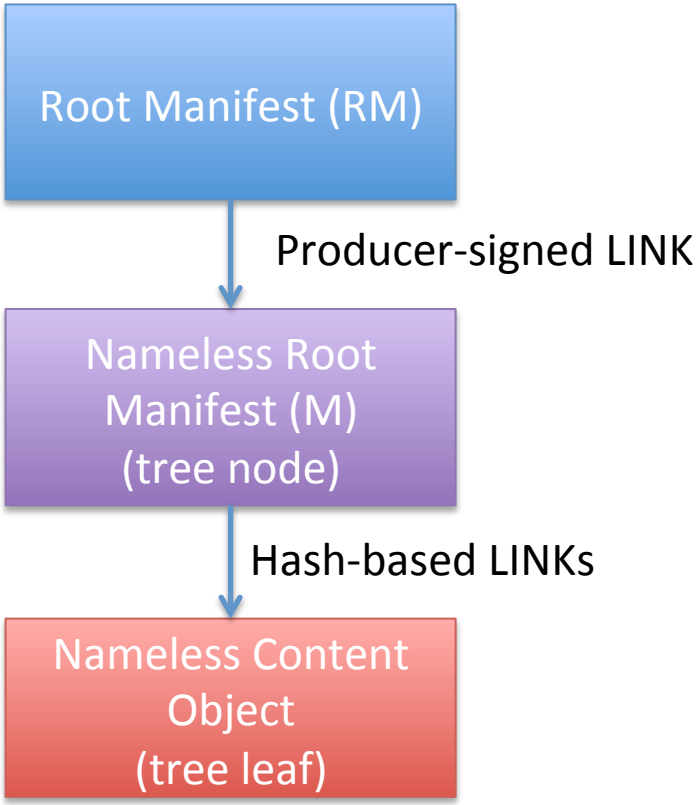
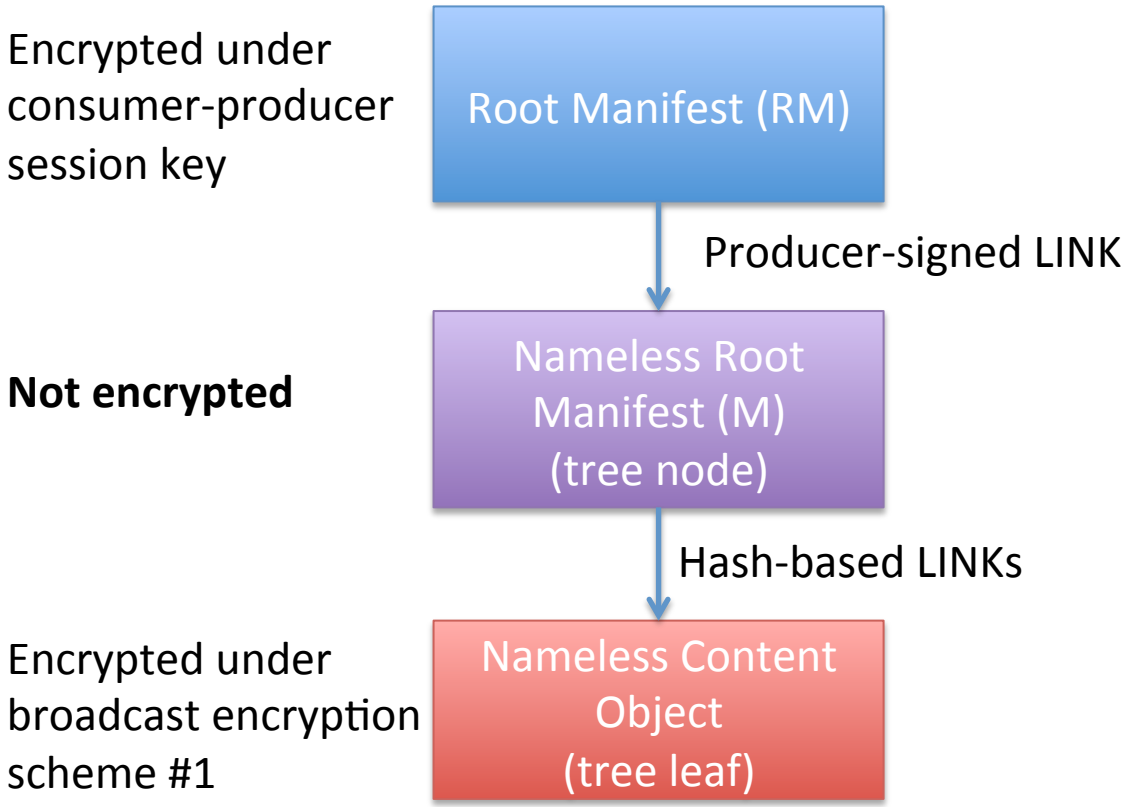
Goal

- Specify how to encrypt replica-stored data under a common group key
  - *Not how to manage that group key*
- Defer access control management of group keys to named data to a higher layer in the stack

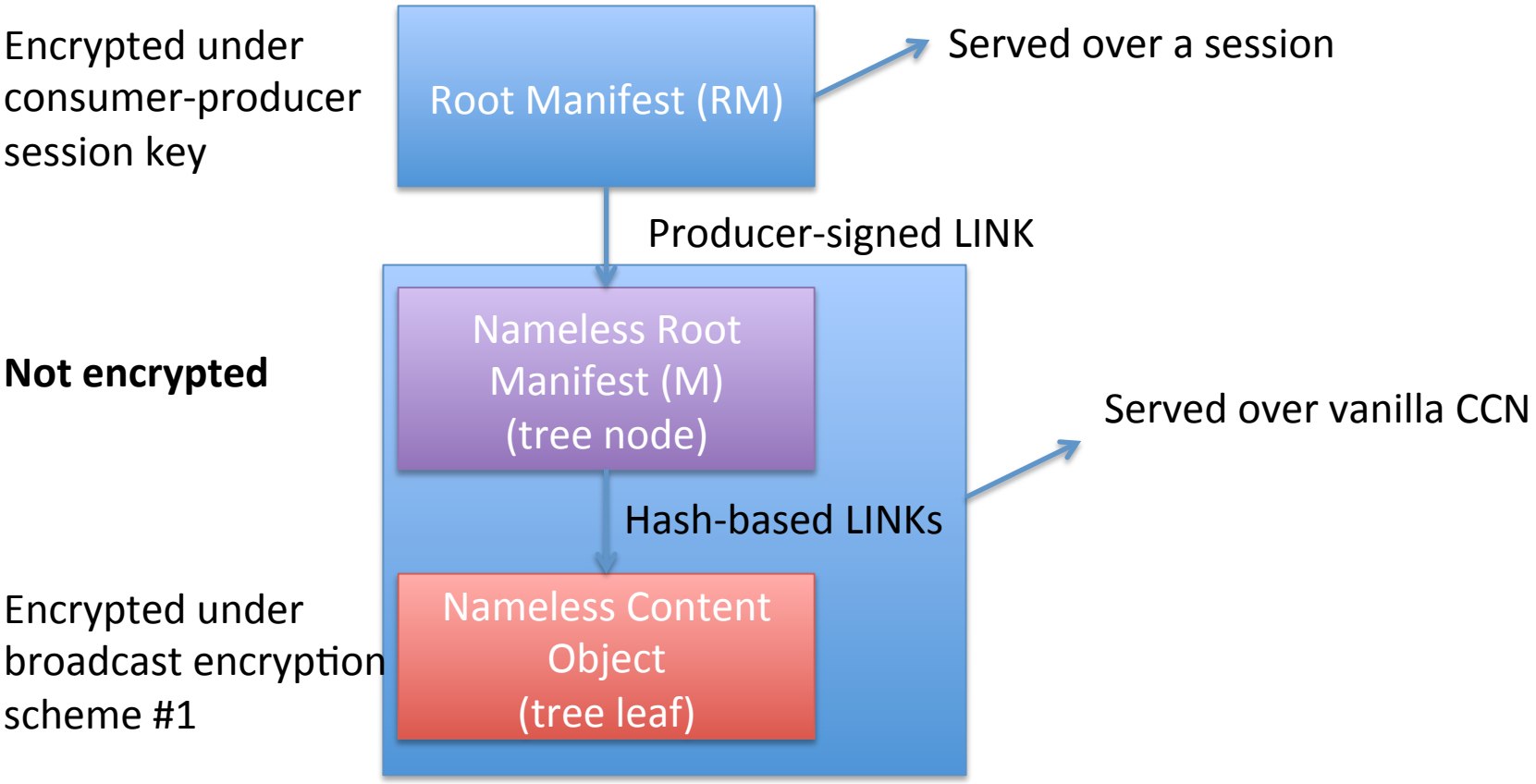
Data Layers


Root Manifest (RM)
Producer-signed LINK
Nameless Root Manifest (M) (tree node)
Hash-based LINKs
Nameless Content Object (tree leaf)

Encryption Layers



Encryption Layers



Message Types

Root Manifest (RM)

Application-layer manifest that contains:

- Producer-signed LINK to M
- List of replica pointers (locators or LINKs)
- Encrypted content symmetric key

Nameless Root Manifest (M) (tree node)

Nameless FLIC Manifest

Nameless Content Object (tree leaf)

Nameless Content Object

Nameless Content Object Construction

- Input:
  - Symmetric data encryption key DEK
  - Content object C
- Output:
  - C with payload encrypted under DEK

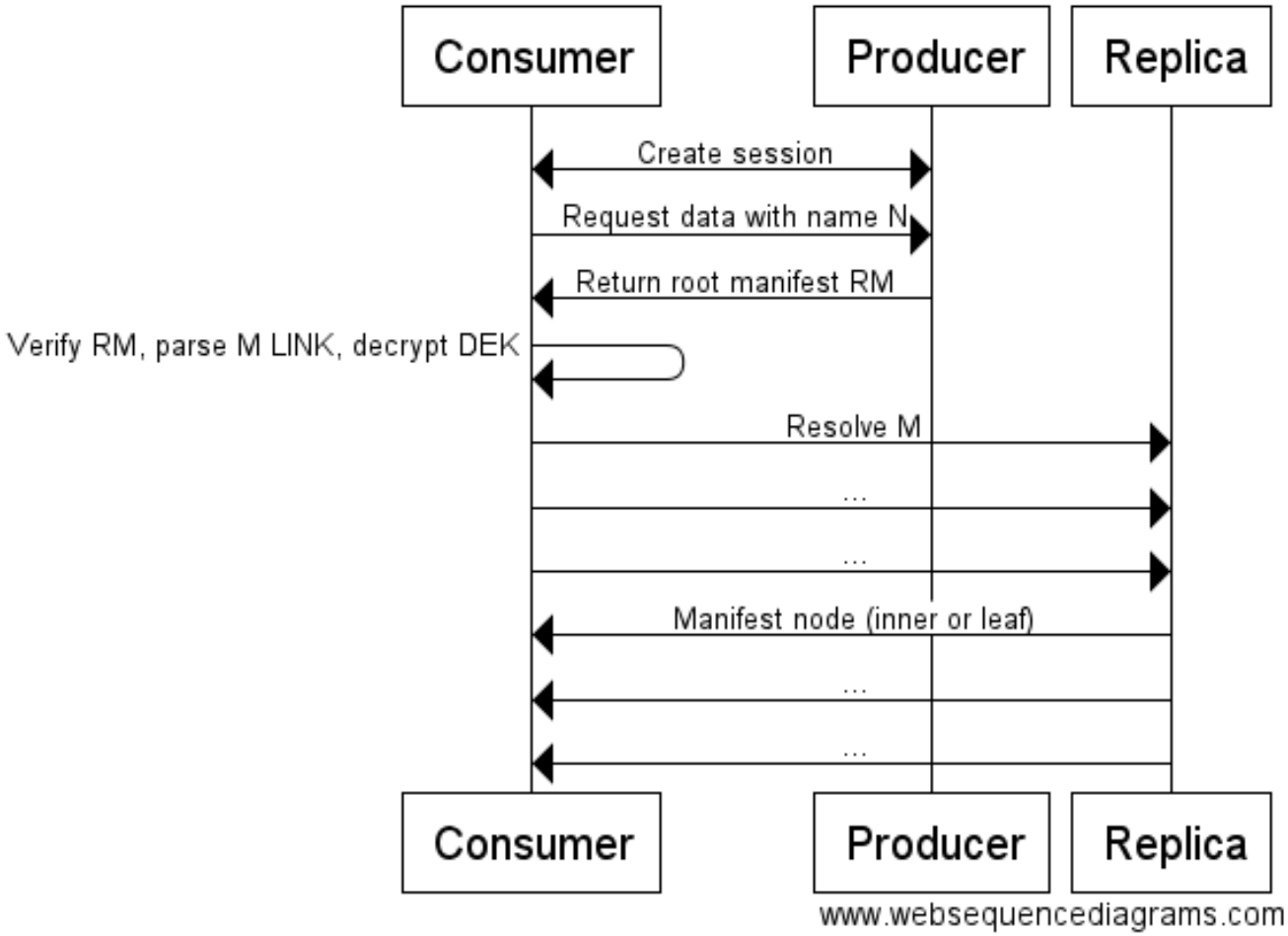
Nameless Manifest Construction

- Input:
  - Encrypted Content Object leaves C1,…,Cn
  - Symmetric data encryption key DEK
  - Group key GK (KEK)
  - Producer private key SK
  - Data name N
- Output:
  - DEK encapsulated with GK
  - Nameless manifest tree with root M built on the leaves
  - Signed link that binds N to H(M)

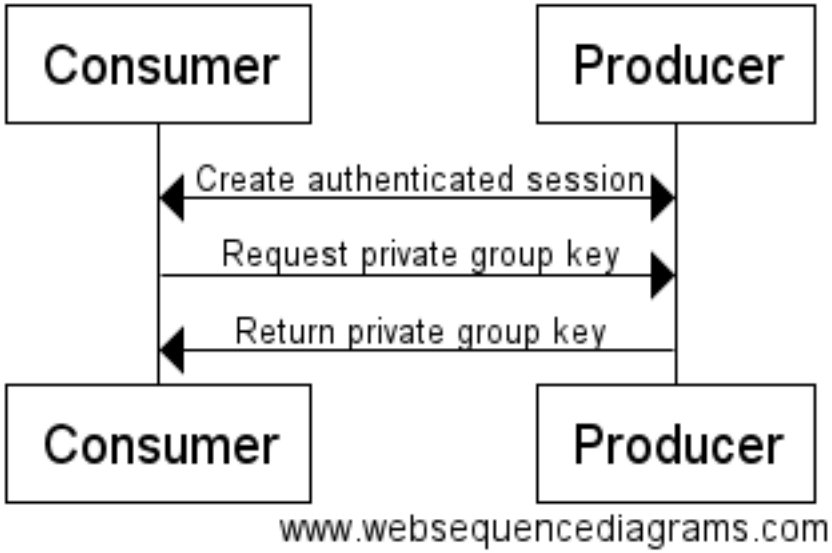
Root Manifest Construction

- Input:
  - Encrypted DEK under GK
  - Producer-generated link for M
  - Data name N
  - ID of group key GK -- GK_{id}
- Output:
  - **Content object** with name N a body containing the signed link, encrypted DEK, and GK_{id}

(Full) Protocol



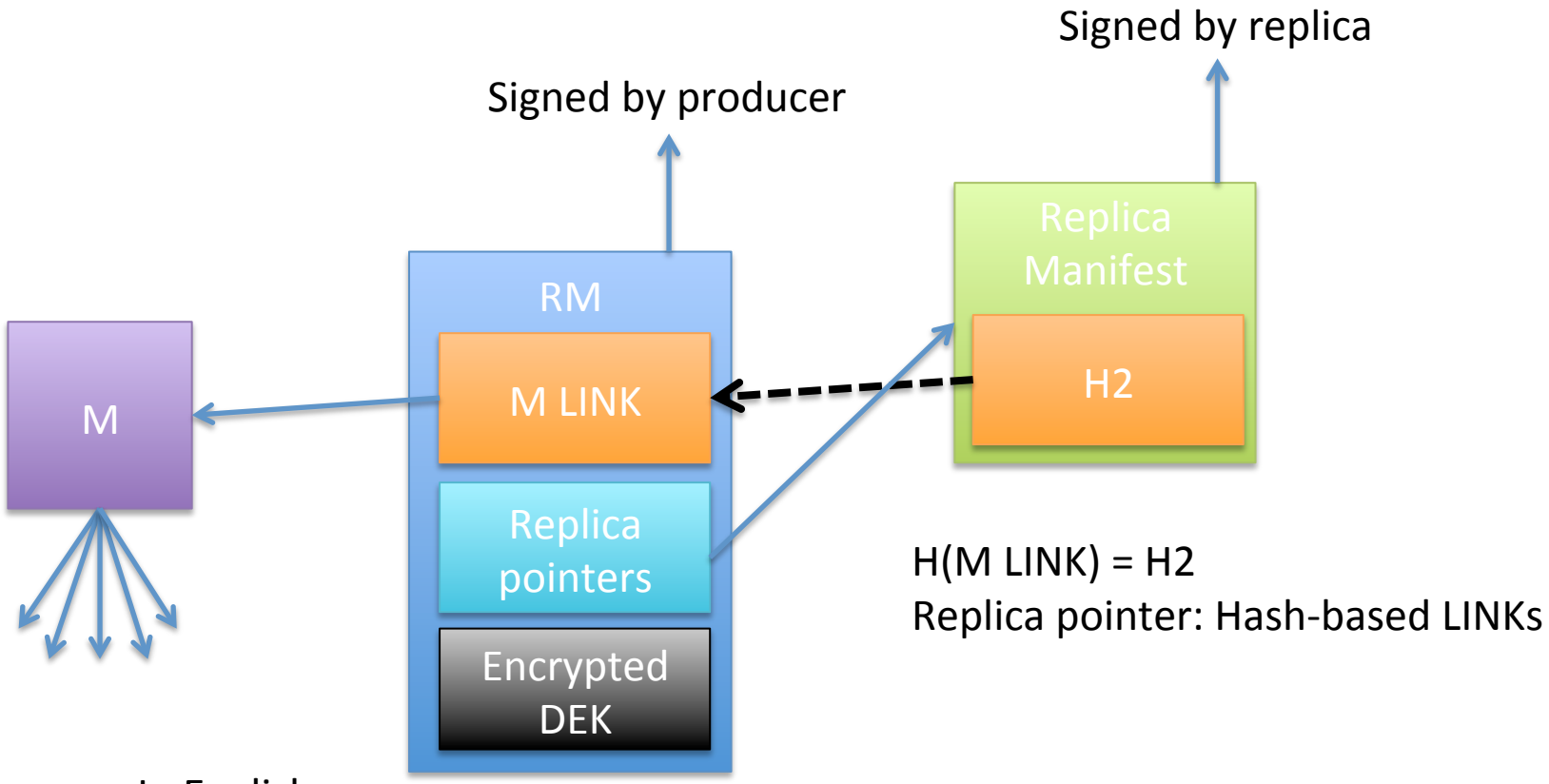
Obtaining Private Decryption Key



Lame Delegation

- Lame delegation is when RM points a namespace where M is not stored
- This occurs when the replica does not confirm the pointers in RM

Preventing Lame Delegation



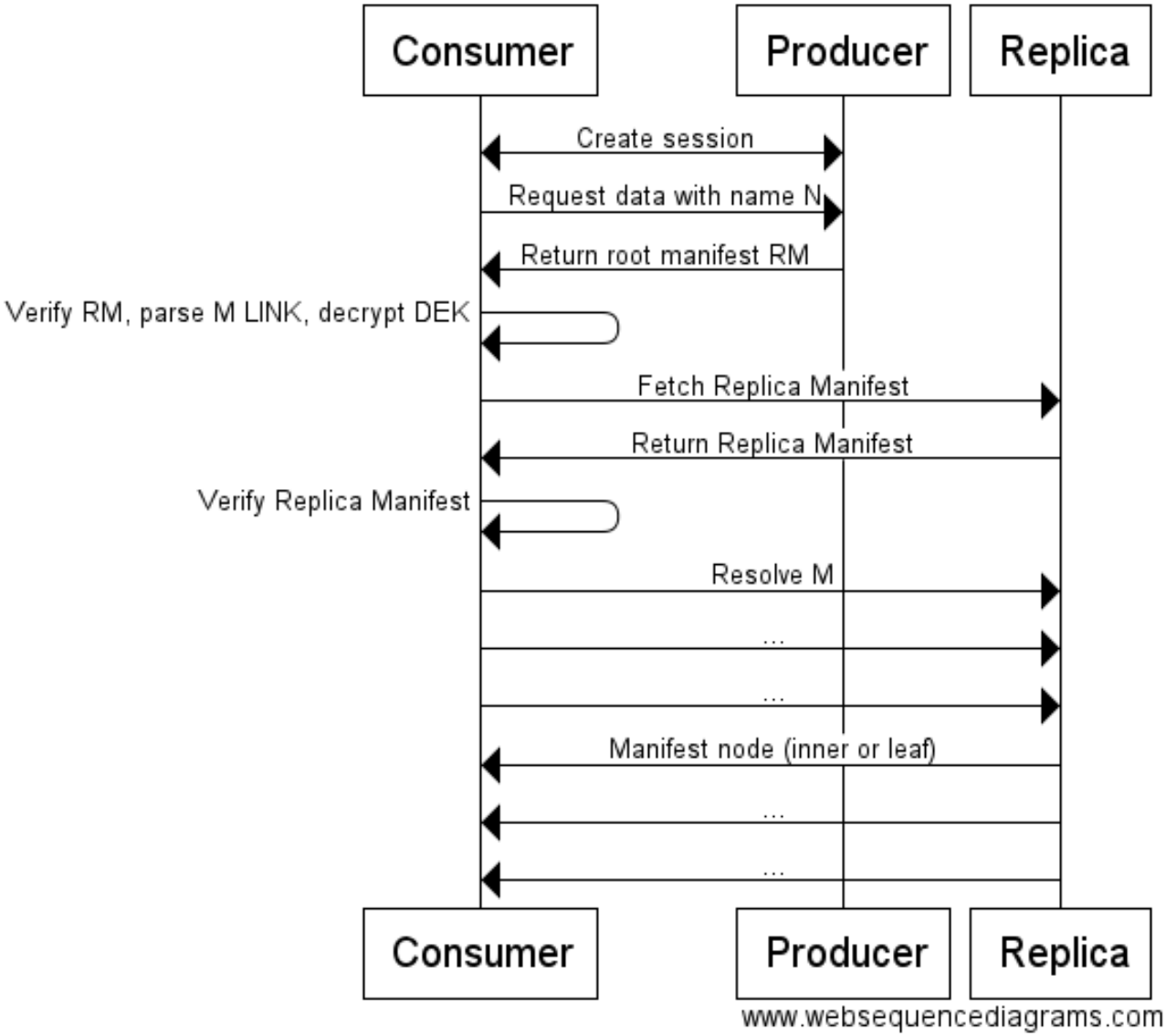
In English:

- RM says M can be obtained at the replica
- The Replica Manifest says that M can be obtained under its namespace

Replica Manifest Construction

- Input:
  - M LINK
  - Replica names
  - Replica private key SK
- Output:
  - Replica manifest (signed by SK) with the hash of M LINK and list of replica names

Lame Delegation Variant



Simple Extensions

- Move data creation to the replica
- Producer and replica(s) exchange KEK
- Protocol:
  - Consumers ask replica(s) for N and get RM
  - Consumers ask replica(s) for encrypted data