Random Linear Network Coding (RLNC)-Based Symbol Representation

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General-purpose, **low overhead** representation of “coded” symbols.
Motivation

1. Representation of coded symbols is a small but essential part of any protocol using network coding.
2. Reuse of representation for faster protocol development.
3. Interoperability between implementations of the underlying code.
4. Accommodation of varying frame size and changing link conditions.
Design goals and features

Goals

1. Low header overhead
2. Support recoding
3. Generate symbols from incomplete block
4. Support both block and sliding window type code

Resulting supported features

1. Variable number of symbols represented - efficiently
2. 3 symbol types
   a. Uncoded
   b. Coded
   c. Recoded
3. Small and large encoding window
   a. Additional variants could be defined.
4. Parameters that can be defined per stream, packet, representation... defined by outer protocol
General symbol representation

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<th>TYPE</th>
<th>SYMBOLS</th>
<th>ENCODER RANK</th>
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<tbody>
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<td>SEED or CODING COEFFICIENTS</td>
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<tr>
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<td>SYMBOL(S) DATA</td>
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Figure 4: A general symbol representation design.
Symbol representation types

Figure 5: A **uncoded** symbol representation.

Figure 6: A **coded** symbol representation.

Figure 7: A **recoded** symbol representation.
Relation to outer protocol and limitations

Supported by the representation

1. Any number of representations can be included in a single payload
2. Up to 15 symbols per representation
3. Block size / window size up to
   a. 1023 for small representation
   b. 262,143 for large representation

Must be defined by outer protocol / application

1. Field
2. Symbol size
3. Representation type
   a. Currently small or large
4. Block id or window offset.

Can be defined (if needed)

5. Block size
6. Density (for sparse symbols)
7. Pseudo random generator
Thanks for the attention

Questions, Comments, Suggestions?
Uncoded example

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Figure 8: A symbol representation with 3 uncoded symbols.
Figure 9: A symbol representation with 2 coded symbols.
Recoded example

Figure 10: A symbol representation with 2 recoded symbols having coding coefficients attached.