Base64 encoding

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Encoding - Decoding

- Information / input
- The message
- Behaviour / output
- What I mean
- What I understand
- The Channel:
  - Speaking
  - Writing
  - Graphics
  - Video, etc
- The messenger
- The recipient
- At least some code in common

- Coding
- De-coding
What is Base64?

• $2^6 = 64$

• 64 bits can represent ASCII text

• Standard base64 index table on next page
# ASCII text – index table

<table>
<thead>
<tr>
<th>Value</th>
<th>Encoding</th>
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<th>Encoding</th>
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<td>R</td>
<td>34</td>
<td>i</td>
<td>51</td>
<td>z</td>
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</tbody>
</table>

(pad)
What base64 encoding is not...

ENCRYPTION = NOT!
ENCRYPTION = NOT!
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ENCRYPTION = NOT!

Encoding does not use a key, encryption does
Why base64?

- http – text
- Email – text
- Base64 uses 64 characters to encode strings. ‘A-Z’, ‘a-z’, ‘0-9’, ‘+’, and ‘/’ are the 63 real characters (without the ‘’, of course), and the ‘=’ sign is the padding.
- Binary-to-text encoding

- How to send non ASCII text data then???
- Binary data, images, executables, etc.
Base64 Encoding

1) Start with data to encode (can be binary)
   – Example data = “food”

2) Convert data to 8-bit binary
   f o o o d
   01100110 01101111 01101111 01100100
Base64 Encoding

3) Convert to 6-bit binary

```
f o o d
01100110 01101111 01101111 01100100 // 8 bit binary
01100110011011110110111101100100 // Bit Stream
011001 100110 111101 101111 011001 00 // 6 bit binary
```
Calculate 6bit binary value

f o o d
01100110 01101111 01101111 01100100 // 8 bit binary
01100110011011110110111101100100 // bit stream
011001 100110 111101 101111 011001 00 // 6 bit binary
25 38 61 47 25 0
Convert 6 bit to ASCII text

f o o d
01100110 01101111 01101111 01100100
01100110011011110110111101100100
11001 100110 111101 101111 011001 000000
25  38   61   47   25   0  // index
Z m  9   v   Z   A  // base64 encoded

Zm9vZA = ASCII text string for the value “food”
Additional Base64 Info

• Note we went from 4 characters to 6
• All base64 encoded strings must be built on 4 character string blocks
• Since our result is not a multiple of 4 chars
• Padding is required to bring up to 4
• Correctly encoded base64 result is Zm9vZA==
Base64 decoding

• Reverse the previous encoding steps!

• Remember to strip any pad characters “=“
Base64 – miscellaneous

Email servers - some limited to 72 chars per line

<img alt="Embedded Image" src="data:image/png;base64,iVBORw0KGgoAAhNSUhEUgAZADIA"/>