In [6]:
```
import numpy as np
import json
import matplotlib.pyplot as plt
from tqdm import tqdm
from collections import defaultdict
```

In [44]:
```
with open("compression_results_12000.json") as file:
    json_res = json.loads(file.read())
```

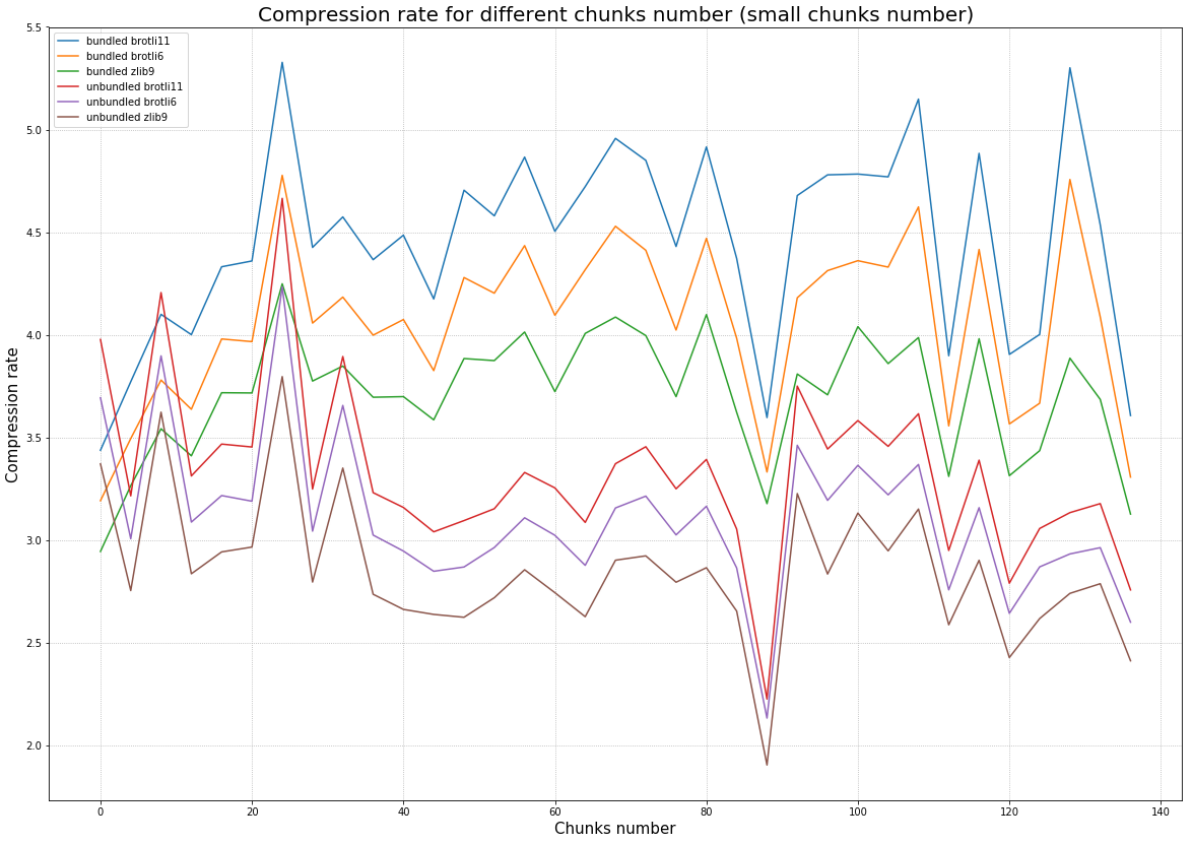
In [46]:
```
def to_vector(json_data, take_unbundled, algorithms):
    result = []
    approaches = ["bundled"]
    if take_unbundled:
        approaches.append("unbundled")
    attributes = ["_compression_rate", "_speed"]
    for attr in attributes:
        for approach in approaches:
            for alg in algorithms:
                result.append(json_data[approach][alg + attr])
    return np.array(result)

# for applying smoothing of the data as data is noisy
def to_range_number(number, range_size):
    return number // range_size
```

By chunks

In [56]:
```
def get_rates_by_chunks(data, range_size, take_unbundled=True,
                        algorithms=["brotli11", "brotli9", "brotli6
", "zlib9"]):

    chunks_to_ind = defaultdict(list)
    for i in range(len(data)):
        if "'chunks_count': 0" not in str(data[i]) and "{'chunks_ex
ecution_result': 0}" not in str(data[i]):
            chunks_to_ind[to_range_number(data[i]["chunks_count"],
range_size)].append(i)

    mean_size = 2 * len(algorithms)
    if take_unbundled:
        mean_size *= 2
    chunks_to_mean = dict()
    for chunk in chunks_to_ind:
        rates = []
        for i in chunks_to_ind[chunk]:
            rates.append(to_vector(data[i], take_unbundled, algorit
hms))
        mean = np.zeros(mean_size)
        rates = np.array(rates)
        for i in range(mean_size):
            #filter outliers
            if len(rates[:,i]) <= 2:
                mean[i] = np.mean(rates[:,i])
            else:
                mean[i] = np.mean(np.sort(rates[:,i])[1:-1])
        chunks_to_mean[chunk] = mean

    all_chunks = []
    for chunk in chunks_to_mean:
        all_chunks.append(chunk)
    all_chunks = np.sort(all_chunks)
    return chunks_to_mean, all_chunks
```

Small chunks number

In [74]:
```
names = ["bundled brotli11", "bundled brotli6", "bundled zlib9",
         "unbundled brotli11", "unbundled brotli6", "unbundled zlib
9"]

range_smoothing_size = 4
chunks_to_mean, all_chunks = get_rates_by_chunks(json_res, range_sm
oothing_size, take_unbundled=True,
                                                 algorithms=["brotl
i11", "brotli6", "zlib9"])

plt.figure(figsize=(20, 14))
for i, feat in enumerate(np.arange(6)):
    line = []
    for chunk in all_chunks:
        line.append(chunks_to_mean[chunk][feat])
    plt.plot(np.array(all_chunks[:35]) * range_smoothing_size, line
[:35], label=names[i])

plt.legend()
plt.grid(ls=":")
plt.xlabel("Chunks number", fontsize=15)
plt.ylabel("Compression rate", fontsize=15)
plt.title("Compression rate for different chunks number (small chun
ks number)", fontsize=20)
plt.show()
```



All chunks

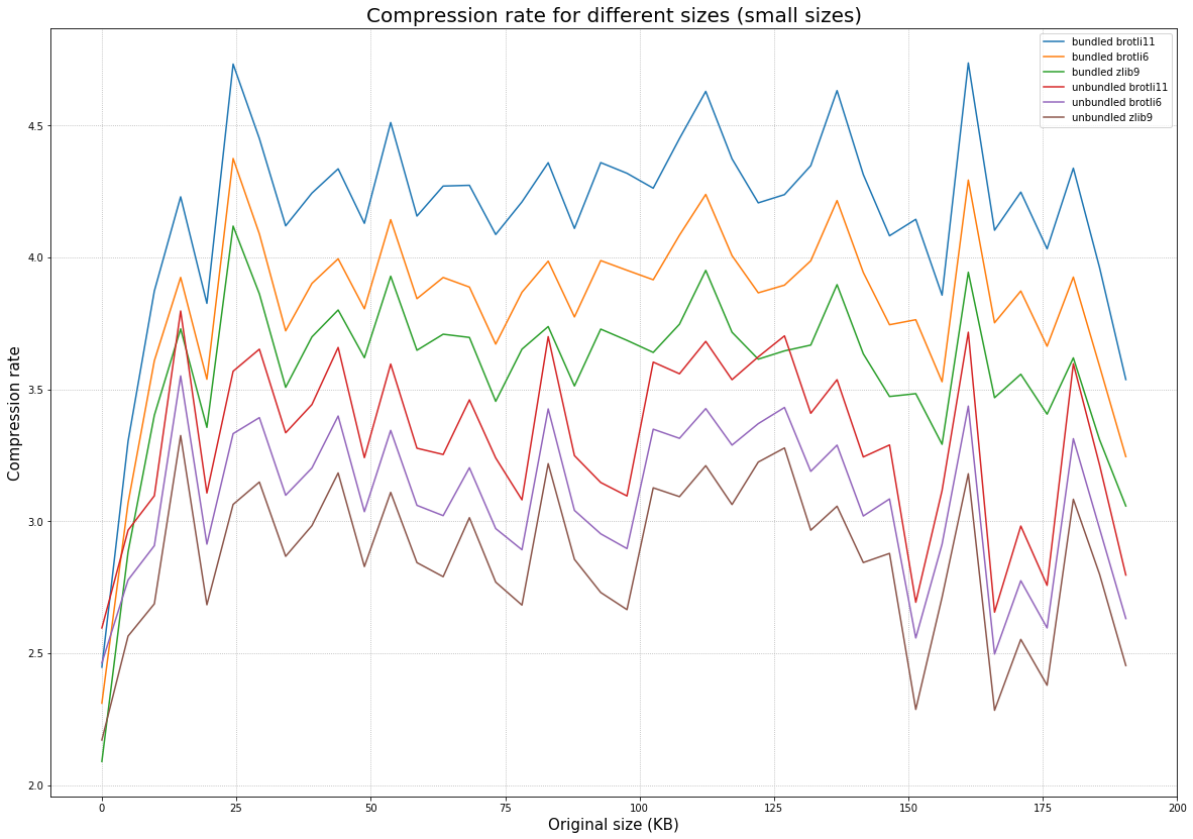
In [70]:
```
range_smoothing_size = 30
chunks_to_mean, all_chunks = get_rates_by_chunks(json_res, range_sm
oothing_size, take_unbundled=True,
                                                 algorithms=["brotl
i11", "brotli6", "zlib9"])

plt.figure(figsize=(20, 14))
for i, feat in enumerate(np.arange(6)):
    line = []
    for chunk in all_chunks:
        line.append(chunks_to_mean[chunk][feat])
    plt.plot(np.array(all_chunks) * range_smoothing_size, line, lab
el=names[i])

plt.legend()
plt.grid(ls=":")
plt.xlabel("Chunks number", fontsize=15)
plt.ylabel("Compression rate", fontsize=15)
plt.title("Compression rate for different chunks number (all chunks
)", fontsize=20)
plt.show()
```

SIZES

In [65]:
```
def get_rates_by_sizes(data, range_size, take_unbundled=True,
                       algorithms=["brotli11", "brotli9", "brotli6
", "zlib9"]):

    size_to_ind = defaultdict(list)
    for i in range(len(data)):
        if "'chunks_count': 0" not in str(data[i]) and "{'chunks_ex
ecution_result': 0}" not in str(data[i]):
            if data[i]["unbundled"]["brotli11_compression_rate"] >
10 or data[i]["bundled"]["brotli11_compression_rate"] > 10:
                continue
            size_to_ind[to_range_number(data[i]["original_size"], r
ange_size)].append(i)

    mean_size = 2 * len(algorithms)
    if take_unbundled:
        mean_size *= 2
    size_to_mean = dict()
    for size in size_to_ind:
        rates = []
        for i in size_to_ind[size]:
            rates.append(to_vector(data[i], take_unbundled, algorit
hms))
        mean = np.zeros(mean_size)
        rates = np.array(rates)
        for i in range(mean_size):
            #filter outliers
            if len(rates[:,i]) <= 2:
                mean[i] = np.mean(rates[:,i])
            elif len(rates[:,i]) <= 4:
                mean[i] = np.mean(np.sort(rates[:,i])[1:-1])
            else:
                mean[i] = np.mean(np.sort(rates[:,i])[2:-2])
        size_to_mean[size] = mean

    all_sizes = []
    for size in size_to_mean:
        all_sizes.append(size)
    all_sizes = np.sort(all_sizes)

    return size_to_mean, all_sizes
```

Small sizes

In [71]:
```
range_smoothing_size = 5000
size_to_mean, all_sizes = get_rates_by_sizes(json_res, range_smooth
ing_size, take_unbundled=True,
                                             algorithms=["brotli11"
, "brotli6", "zlib9"])

plt.figure(figsize=(20, 14))
for i, feat in enumerate(np.arange(6)):
    line = []
    for size in all_sizes:
        line.append(size_to_mean[size][feat])
    plt.plot(np.array(all_sizes[:40]) * range_smoothing_size / 1024
, line[:40], label=names[i])

plt.legend()
plt.grid(ls=":")
plt.xlabel("Original size (KB)", fontsize=15)
plt.ylabel("Compression rate", fontsize=15)
plt.title("Compression rate for different sizes (small sizes)", fon
tsize=20)
plt.show()
```



In [73]:
```
range_smoothing_size = 30000
size_to_mean, all_sizes = get_rates_by_sizes(json_res, range_smooth
ing_size, take_unbundled=True,
                                             algorithms=["brotli11"
, "brotli6", "zlib9"])

plt.figure(figsize=(20, 14))
for i, feat in enumerate(np.arange(6)):
    line = []
    for size in all_sizes:
        line.append(size_to_mean[size][feat])
    plt.plot(np.array(all_sizes)[:-1] * range_smoothing_size / 1024
/ 1024, line[:-1], label=names[i])

plt.legend()
plt.grid(ls=":")
plt.xlabel("Original size (MB)", fontsize=15)
plt.ylabel("Compression rate", fontsize=15)
plt.title("Compression rate for different sizes (all sizes)", fonts
ize=20)
plt.show()
```