SwatDB HeapPage Lab: Using type-recasting to mapping Heap Page structure on top of raw Page space (char/byte array)

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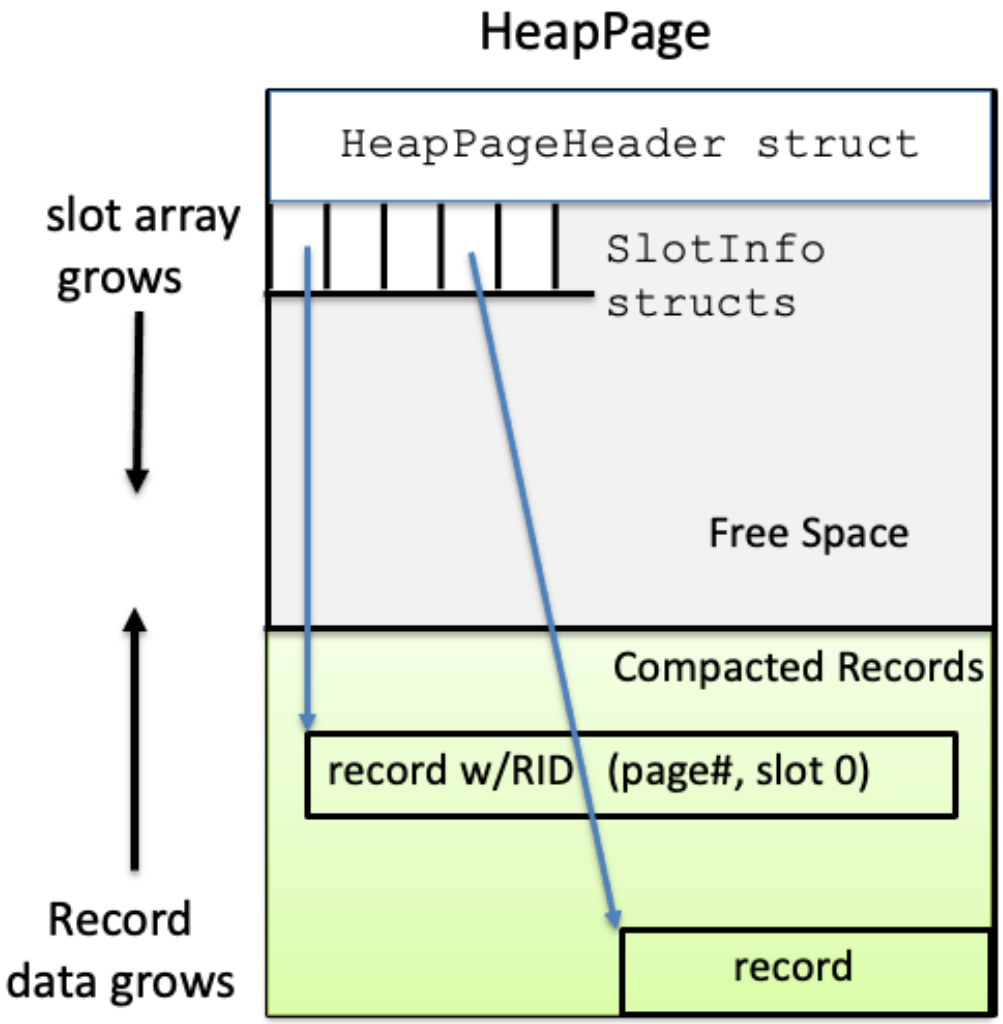
SwatDB HeapPage Structure



for Variable-length records

PAGE_SIZE chunk of space:

- A PAGE_SIZE array of bytes/chars
- Page is unit of storage in the system.
- Every type of Page is exactly the same size. Heap Page, Index Page, Leaf Page, ...

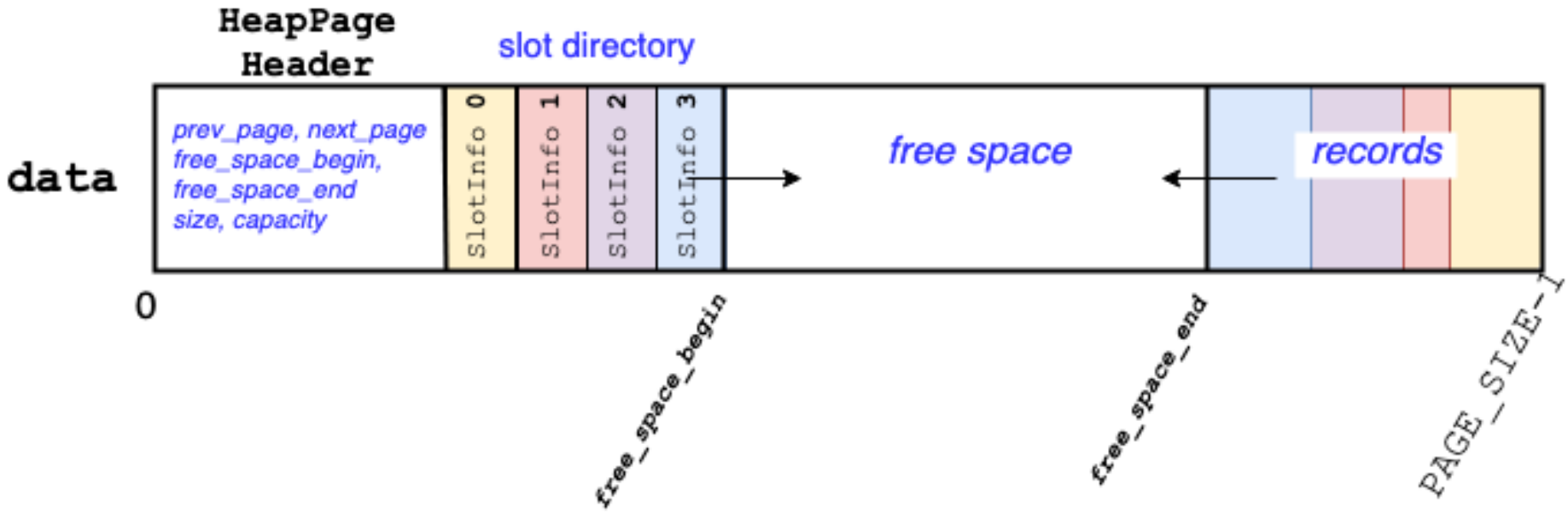
HeapPage is derived from Page class

- Page class defines raw page-size space
- HeapPage maps structure onto raw data

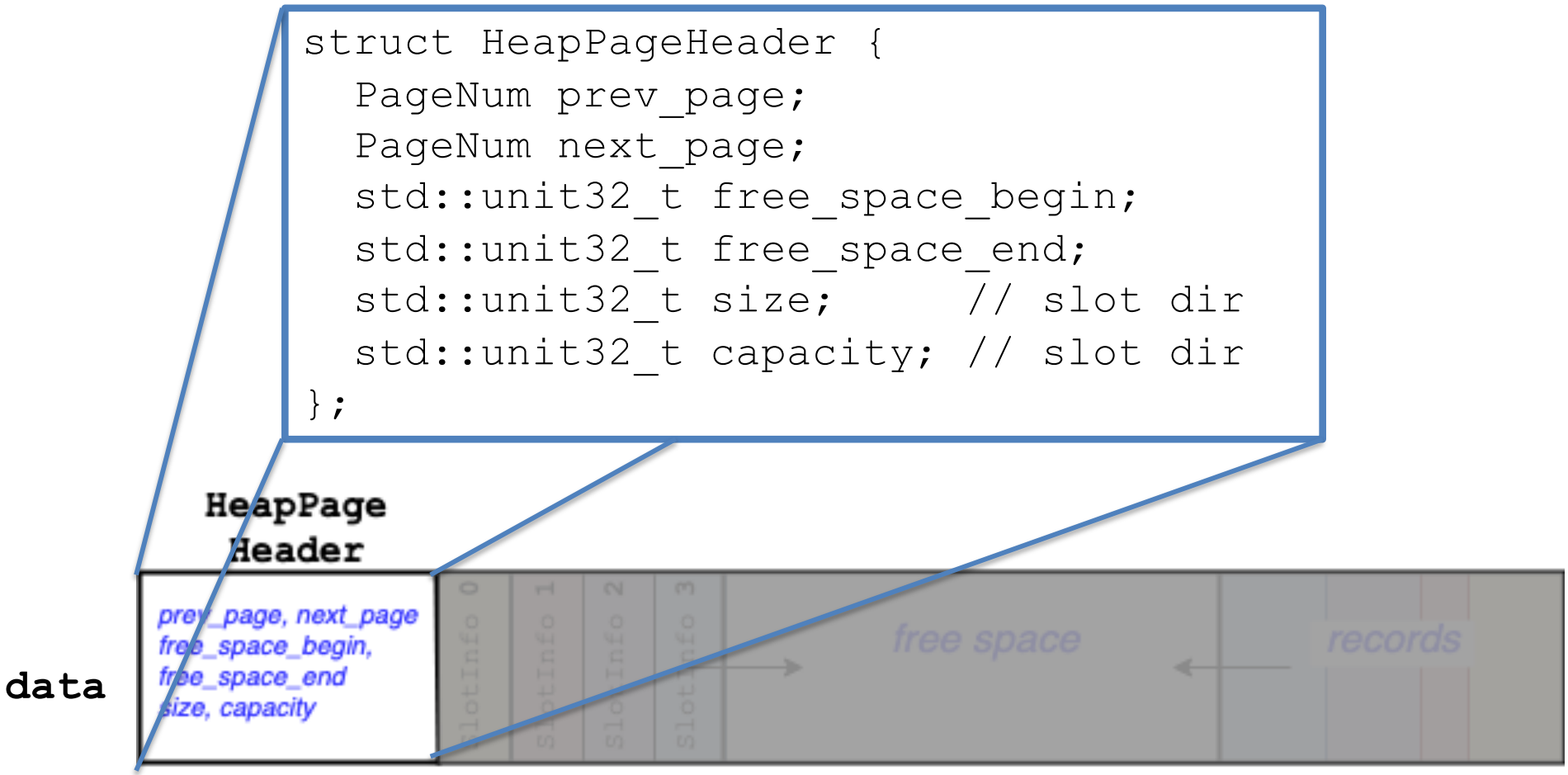
```
class HeapPage : public Page { … }

class Page {
    …
    private:
        char data[PAGE_SIZE];  // raw page-size data
};
```

HeapPage maps heap page-specific structure onto the raw page-size space defined by Page class

a structured type-specific view on top of array of bytes (char)



Map Heap Page header information on top of the first bytes of the page data



Map HeapPageHeader information on top of the first bytes of the page data

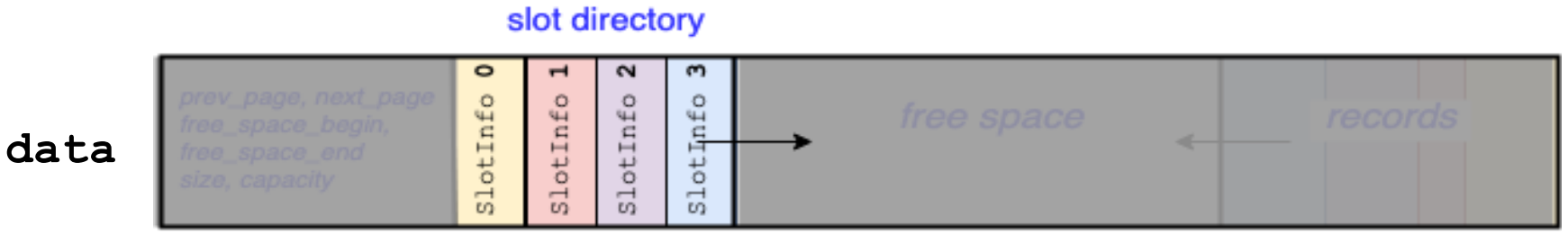
Map: re-cast memory address as type you want to map onto it
(instead of an address of char, re-cast as address of HeapPageHeader)

```
HeapPageHeader* HeapPage::_getPageHeader(){
  // re-cast data as a pointer to a HeapPageHeader
  return (HeapPageHeader*)data; // &data[0]
}
```

Call: `HeapPageHeader *hdr = _getPageHeader();`

Use: `hdr->size = 10;` //sets offset of size field into data array to 10

Map slot directory entries after header on data



Map: re-cast memory address as type you want to map onto it

```
SlotInfo *HeapPage::_getSlotDirectory(){
  // re-cast address in data after HeapPageHeader as
  // pointer to SlotInfo struct (base address slot dir)
  return (SlotInfo *)(data +sizeof(HeapPageHeader));
}
```

data + sizeof(HeapPageHeader):

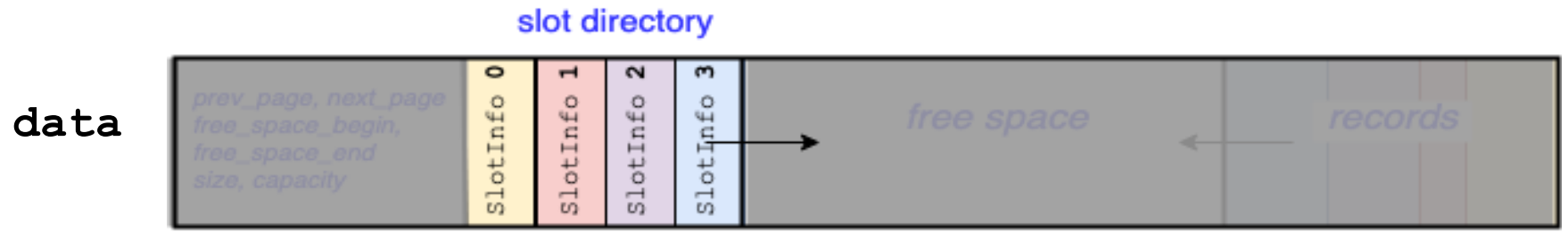
Pointer Arithmetic: adds to address value based on type computes the address at sizeof(HeapPageHeader) number of bytes/chars from the base address of data

ex. `data + 3` is &(data[3])

```
ex. x = sizeof(HeapPageHeader);
    data + x
```

is &(data[x])

Map slot directory entries after header on data

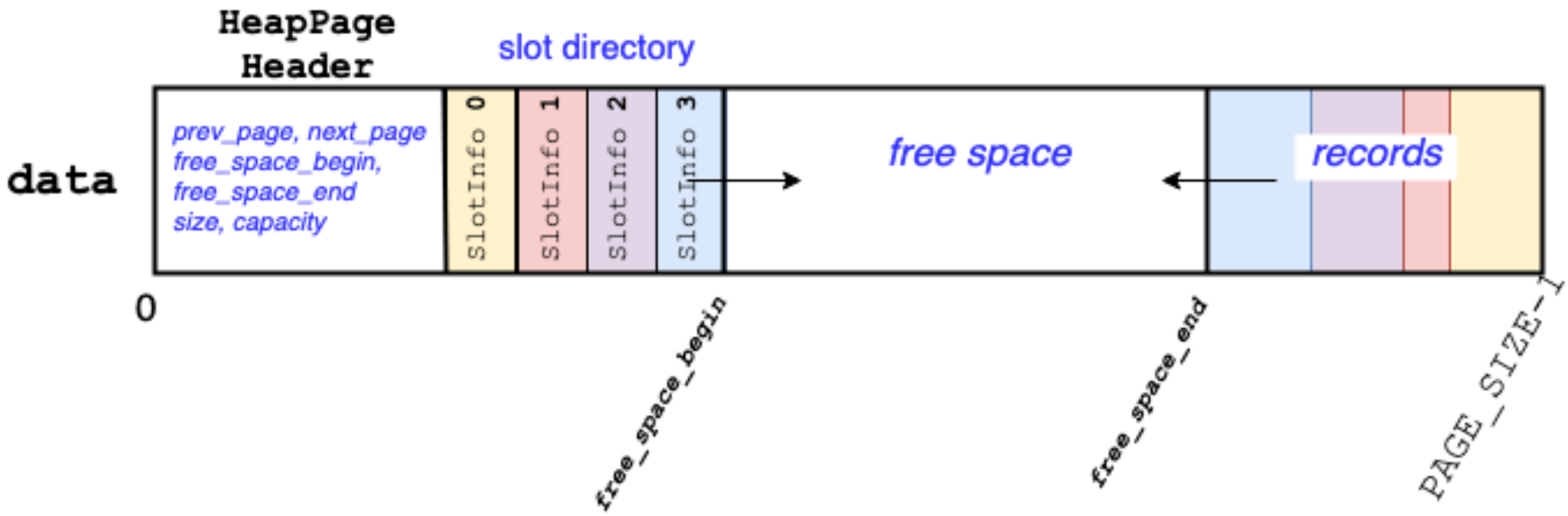


Map: re-cast memory address as type you want to map onto it

```
SlotInfo *HeapPage::_getSlotDirectory(){
  // re-cast address in data after HeapPageHeader as
  // pointer to SlotInfo struct (base address slot dir)
  return (SlotInfo *)(data +sizeof(HeapPageHeader));
}
```

Call: `SlotInfo *slot_dir = _getSlotDirecotory();`

Use: `slot_dir[3].offset = 400;` // set offset field of entry 3 in slot array




```
HeapPageHeader *hdr = _getPageHeader();
hdr->size = 10;                  // modify size of slot directory
hdr->free_space_end -= 24;       // modify free space end on page

SlotInfo *slot_dir = _getSlotDirecotory();
slot_dir[3].offset=400;  // set the offset field of slot directory entry 3
```

slot_dir is base address of an array of SlotInfo structs (slot directory)

slot_dir[3].offset is offset field in the 3rd bucket of the slot_dir (at some address from the start of data array)