# WS8
# Telemetry architecture
## Designing with metadata

Joris Putteneers


y,stupid,honest

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Architect, software dev, agent of the Anthroposcene

- Projects
- Portfolio
- Lab
- Blockchain assets

657 /366
current project: /
project collaborators: /
project year: 2021

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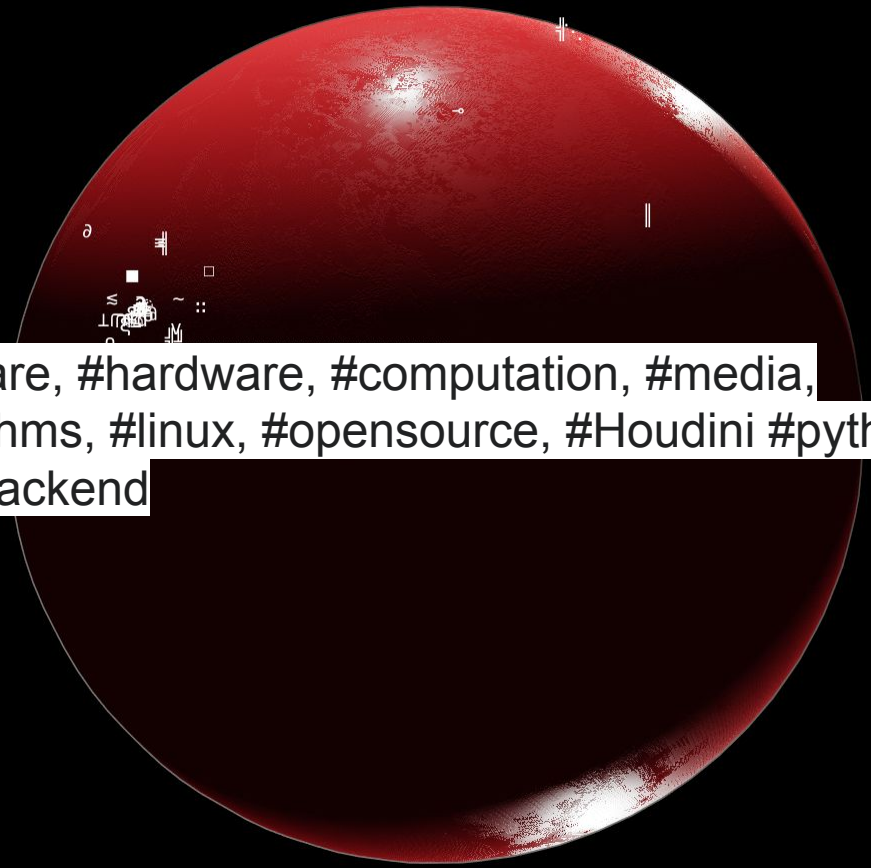

#Software, #hardware, #computation, #media, #algorithms, #linux, #opensource, #Houdini #python # c++, #backend

# Telemetry

**Telemetry** is the in situ collection of measurements or other data at remote points and their automatic transmission to receiving equipment (telecommunication) for monitoring.[1] The word is derived from the Greek roots *tele*, 'remote', and *metron*, 'measure'. Systems that need external instructions and data to operate require the counterpart of telemetry: telecommand.[2]

A saltwater crocodile with a GPS-based satellite transmitter attached to its head for tracking


25years of phones

Companies like Google and Facebook are notorious for collecting large volumes and scopes of user data, including:

- Network connectivity
- GPS coordinates
- Vehicle type, speed, direction, etc.
- Temperature, humidity, air quality, light levels
- Audio and video calls
- Spending patterns
- Click patterns
- Ambient audio recording
- Eye tracking patterns
- Heart rate, blood pressure, body temperature, emotional state, sleep patterns (some smartwatches only)

# Telemetry data extracted from google takeout: “records.json”


```
    "strength": -90,
      "frequencyMhz": 5180
    }, {
      "mac": "53857698144312",
      "strength": -94,
      "frequencyMhz": 2457
    }]
  },
  "osLevel": 30,
  "serverTimestamp": "2024-08-07T18:44:53.716Z",
  "deviceTimestamp": "2024-08-07T18:44:52.068Z",
  "batteryCharging": false,
  "formFactor": "PHONE",
  "timestamp": "2024-08-07T18:22:07.608Z"
}, {
  "latitudeE7": 137229101,
  "longitudeE7": 1005466295,
  "accuracy": 12,
  "altitude": -19,
  "verticalAccuracy": 1,
  "source": "WIFI",
  "deviceTag": 2091204548,
  "platformType": "ANDROID",
  "locationMetadata": [{
    "wifiScan": {
      "accessPoints": [{
        "mac": "125918858613109",
        "strength": -69,
        "frequencyMhz": 2437
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        "mac": "262480224589637",
        "strength": -73,
        "frequencyMhz": 2412
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        "mac": "123719824871797",
        "strength": -74,
        "frequencyMhz": 5765
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        "mac": "125918847078773",
        "strength": -74,
        "frequencyMhz": 5765
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        "mac": "262480229832517",
        "strength": -75,
        "frequencyMhz": 2412
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        "strength": -76,
        "frequencyMhz": 5180
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        "strength": -76,
        "frequencyMhz": 5180
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        "mac": "94653850136201",
        "strength": -76,
        "frequencyMhz": 2462
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        "strength": -77,
        "frequencyMhz": 5180
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        "strength": -77,
        "frequencyMhz": 2462
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        "strength": -77,
        "frequencyMhz": 2462
      }, {
        "mac": "94653851184777",
        "strength": -78,
        "frequencyMhz": 2462
      }, {
        "mac": "171711292873603",
        "strength": -82,
        "frequencyMhz": 5805
      }, {
        "mac": "74851900833899",
        "strength": -84,
        "frequencyMhz": 2427
      }, {
        "mac": "31542103267415",
          "strength": -90,
          "frequencyMhz": 2472
        }]
      },
      "osLevel": 30,
      "serverTimestamp": "2024-08-07T18:44:53.716Z",
      "deviceTimestamp": "2024-08-07T18:44:52.068Z",
      "batteryCharging": false,
      "formFactor": "PHONE",
      "inferredLocation": [{
        "timestamp": "2024-08-07T18:22:28.601Z",
        "latitudeE7": 137229165,
        "longitudeE7": 1005466641,
        "accuracy": 19
      }],
      "timestamp": "2024-08-07T18:22:28.600Z"
    }, {
      "latitudeE7": 137229322,
      "longitudeE7": 1005466169,
      "accuracy": 12,
      "altitude": -17,
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      "locationMetadata": [{
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            "mac": "125918855467381",
            "strength": -69,
            "frequencyMhz": 2437
          }, {
            "mac": "125918853370229",
            "strength": -69,
            "frequencyMhz": 2437
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            "strength": -70,
            "frequencyMhz": 2437
          }, {
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      }, {
        "latitudeE7": 510573917,
        "longitudeE7": 36999362,
        "accuracy": 14,
        "activity": [{
          "activity": [{
            "type": "STILL",
            "confidence": 100
          }],
          "timestamp": "2020-01-06T21:35:01.231Z"
        }],
        "source": "WIFI",
        "deviceTag": 1767572464,
        "timestamp": "2020-01-06T21:35:03.128Z"
      }, {
        "latitudeE7": 510574146,
        "longitudeE7": 36999290,
        "accuracy": 15,
        "source": "WIFI",
        "deviceTag": 1767572464,
        "timestamp": "2020-01-06T21:40:08.779Z"
      }, {
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        "longitudeE7": 36999290,
        "accuracy": 15,
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        "deviceTag": 1767572464,
        "timestamp": "2020-01-06T21:50:00.407Z"
      }, {
        "latitudeE7": 510573920,
        "longitudeE7": 36999356,
        "accuracy": 15,
        "source": "WIFI",
        "deviceTag": 1767572464,
        "timestamp": "2020-01-06T21:55:53.234Z"
      }, {
        "latitudeE7": 510573920,
        "longitudeE7": 36999356,
        "accuracy": 15,
        "source": "WIFI",
        "deviceTag": 1767572464,
        "timestamp": "2020-01-06T22:03:04.907Z"
```
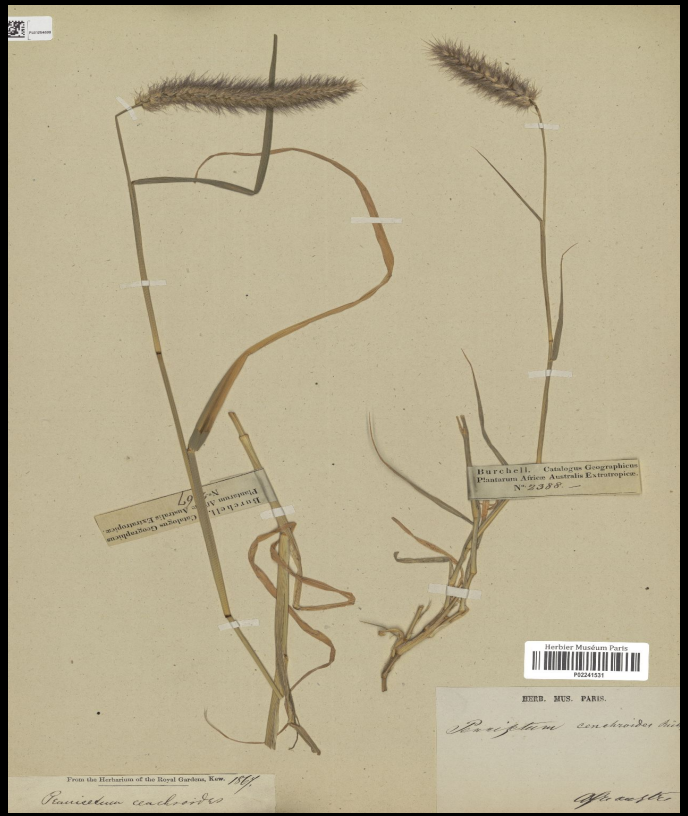

# Metadata

**Metadata** (or **metainformation**) is "data that provides information about other data",[1] but not the content of the data itself, such as the text of a message or the image itself.[2]




This physical herbarium record of *Cenchrus ciliaris* consists of the specimens as well as metadata about them, while the barcode points to a digital record with metadata about the physical record.

Globally, in 2023, about 400 million terabytes of data is being uploaded everyday. This includes 5.3 billion images. That is the same amount of images for a single day, as for the whole year of 2011.

Lets assume 1 image is 1mb and that metadata counts for 1% of the image's data, that would still mean  53,000 GB = 53 TB of metadata (terabytes) / day.

# Metadata extracted from image

```
identify -verbose IMG_20231231_100704.jpg
Image:  Filename: IMG_20231231_100704.jpg
  Format: JPEG (Joint Photographic Experts Group JFIF format)
  Mime type: image/jpeg
  Class: DirectClass
  Geometry: 3072x4080+0+0
  Resolution: 72x72
  Print size: 42.6667x56.6667
  Units: PixelsPerInch
  Colorspace: sRGB
  Type: TrueColor
  Base type: Undefined
  Endianness: Undefined
  Depth: 8-bit
  Channel depth:
    red: 8-bit
    green: 8-bit
    blue: 8-bit
  Channel statistics:
    Pixels: 12533760
    Red:
      min: 0  (0)
      max: 255 (1)
      mean: 105.166 (0.412417)
      standard deviation: 57.556 (0.22571)
      kurtosis: 0.534034
      skewness: 0.994667
      entropy: 0.935891
    Green:
      min: 0  (0)
      max: 255 (1)
      mean: 106.125 (0.416178)
      standard deviation: 56.607 (0.221988)
      kurtosis: 0.483865
      skewness: 0.932525
      entropy: 0.939697
  Transparent color: black
  Interlace: None
  Intensity: Undefined
  Iterations: 0
  Compression: JPEG
  Quality: 98
  Orientation: TopLeft
  Profiles:
    Profile-exif: 3319 bytes
  Properties:
    date:create: 2024-09-22T03:31:40+00:00
    date:modify: 2024-02-20T10:55:28+00:00
    exif:ApertureValue: 169/100
    exif:BrightnessValue: 0/100
    exif:ColorSpace: 1
    exif:ComponentsConfiguration: 1, 2, 3, 0
    exif:DateTime: 2023:12:31 10:07:05
    exif:DateTimeDigitized: 2023:12:31 10:07:05
    exif:DateTimeOriginal: 2023:12:31 10:07:05
    exif:ExifOffset: 211
    exif:ExifVersion: 48, 50, 50, 48
    exif:ExposureBiasValue: 0/6
    exif:ExposureMode: 0
    exif:ExposureProgram: 0
    exif:ExposureTime: 1/50
    exif:Flash: 16
    exif:FlashPixVersion: 48, 49, 48, 48
    exif:FNumber: 180/100
    exif:FocalLength: 4250/1000
    exif:FocalLengthIn35mmFilm: 0
    exif:GPSAltitude: 29986/1000
    exif:GPSAltitudeRef: 1
    exif:GPSDateStamp: 2023:12:31
    exif:GPSInfo: 3096
    exif:GPSLatitude: 13/1, 44/1, 399/100
    exif:GPSLatitudeRef: N
    exif:GPSLongitude: 100/1, 31/1, 5724/100
    exif:GPSLongitudeRef: E
    exif:WhiteBalance: 0
    exif:YCbCrPositioning: 1
    jpeg:colorspace: 2
    jpeg:sampling-factor: 2x2,1x1,1x1
    signature:
7b02df95a2011b72c989525aea12d569302fd06f0c0585a8ef663cac57d7637f
    unknown: 140, 69, 71, 106, 40, 161, 34, 1, 171, 11, 88, 188, 184, 150, 243, 179,
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139, 148, 116, 243, 2, 35, 107, 194, 85, 160, 1, 32, 15, 160, 11, 251, 209, 93, 151,
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22, 214, 241, 243, 84, 115, 189, 240, 182, 144, 68, 24, 79, 33, 14, 185, 59, 100, 61,
210, 45, 75, 181, 9, 72, 54, 65, 43, 139, 89, 218, 223, 208, 64, 77, 154, 214, 31, 38,
39, 220, 44, 251, 12, 44, 149, 132, 94, 78, 186, 101, 145, 9, 193, 89, 46, 221, 205,
162, 72, 150, 206, 116, 56, 138, 79, 182, 242, 29, 48, 28, 112, 245, 50, 138, 170, 104,
231, 255, 100, 163, 29, 14, 109, 141, 178, 127, 59, 49, 21, 10, 140, 4, 16, 226, 145,
98, 72, 91, 168, 165, 43, 153, 105, 47, 189, 255, 119, 19, 118, 179, 24, 142, 15, 37,
53, 136, 130, 250, 29, 246, 112, 211, 139, 90, 255, 123, 37, 98, 84, 91, 151, 138, 182,
216, 178, 231, 116, 54, 117, 159, 14, 75, 250, 245, 145, 13,40, 149, 74, 179, 186, 163,
154, 183, 65, 52, 123, 120, 242, 145, 188, 166, 161, 253, 73, 182, 26, 140, 3, 187,
234, 23, 4, 39, 119, 186, 216, 13, 234, 197, 128, 162, 79, 67, 115, 244, 54, 83, 181,
```

The built reality is only one layer that makes up the environments we inhabit, it is influenced by other material and immaterial layers, and it contributes to larger economic, material, environmental, informational and infrastructural systems.

Architects should be aware of the impact and potential of this complex reality of today and proactively engage with it, rather than passively waiting for design briefs and projects.

Why don’t we build with metadata in mind?

Tools:
Houdini, blender,Python, ..

Techniques:
Folksonomy, scraping, mapping,tagging, modeling, programming, hacking...

For more information regarding class schedules, content, expectations, visit the Github link


THANK YOU!