IEEE 1722 Control Format
Generic Image Sensor Transport

2020-07-14, Rev 2

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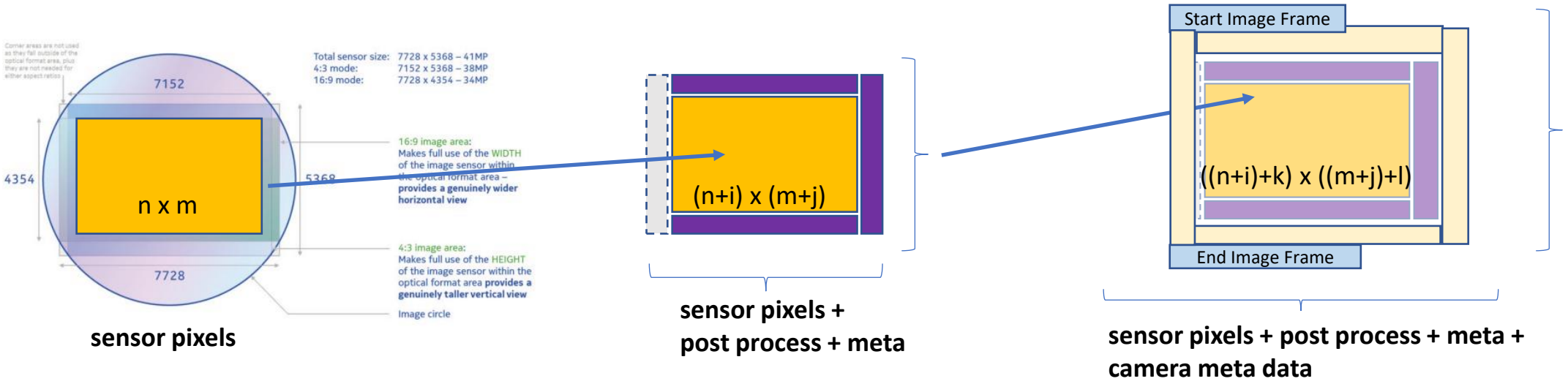
Motivation

- One of the major justifications of automotive Multi-gig Ethernet PHY (IEEE 802.3ch) is network connection of high bandwidth autonomous drive (AD)/advanced driver assistance system (ADAS) sensors, such as uncompressed AD and parking cameras.
- Image sensors outputs n x m matrix of n pixels per line x m lines.
- Image sensors meta-data outputs, often, are embedded in the extra row or columns.
- There is a need to transport image sensor outputs, row by row, over high-speed serial interface; P2P, or ideally real P2MP network, transport protocol that supports time sensitive networking, i.e. IEEE 1722 AVTP.
- Avoid pre-standard and proprietary implementation islands that form once system productions start; Avoid artificial turf defense when these form. There is no intrinsic value to having multiple different but functionally equivalent approaches.
- Avoid compatibility issues, implement transparent transport, i.e. bits in, bits out, layered.
- Stated goal of 1722b – serve the industry and perform necessary revision quickly – fits well with a goal of this proposal.

Cameras used in ADAS and Autonomous Drive

- 1 MP, 1.3MP, 2MP, and 8 MP, often leveraged from consumer electronics R&D, e.g. cell phones.
  - The same image sensors but instead of RGBG (Red, Green, Blue, Green) filter lens, it may use alternate color filters, RCCC (Red, Clear, Clear, Clear), or other combinations that are optimized for machine vision and object detection.
  - Camera sensor wrapped around camera system SoC may outputs to a number of standard interfaces.
  - Many of the ADAS/AD camera system leverages the mobile camera (integrated Sensor + system SoC) R&D.
- Transport Considerations
  - Camera sensors output what it sees in various configurable formats
  - Camera system SoC output what it processes in various configurable formats
  - Transport should just transport bits, bytes. In camera terms, [frame start] [lines]…[lines][frame end].

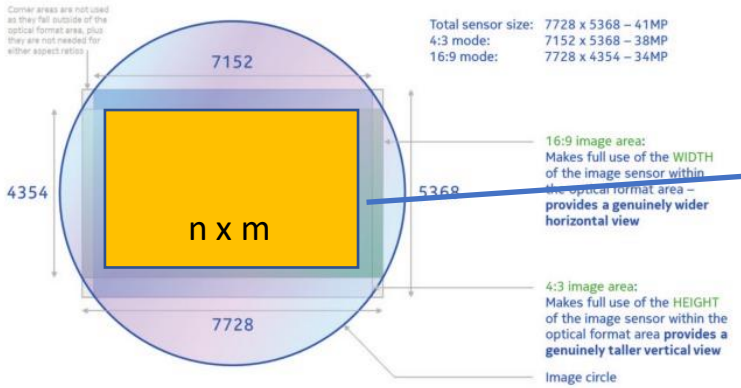


sensor pixels

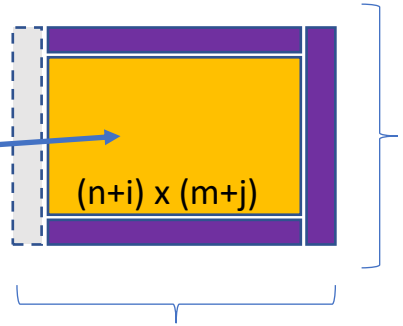
sensor pixels + post process + meta

sensor pixels + post process + meta + camera meta data

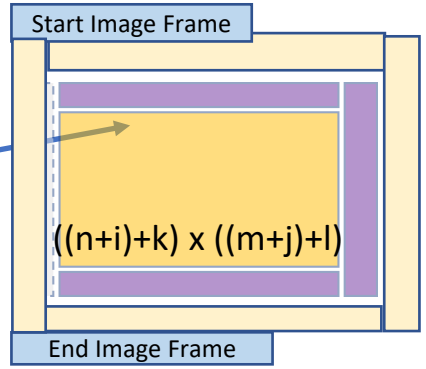
1722b to transport image data - image sizes



sensor pixels



sensor pixels +
post process + meta



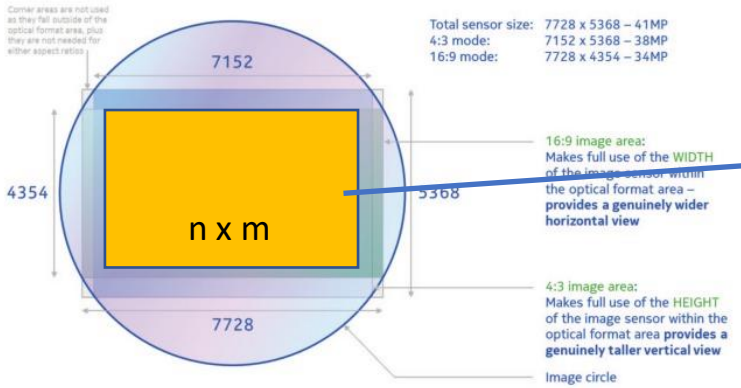
sensor pixels + post process + meta +
camera meta data

- Image sensor + lens + filter
- Just accept n x m pixels of some resolution
- No need to know, don't care about content (from transport perspective)

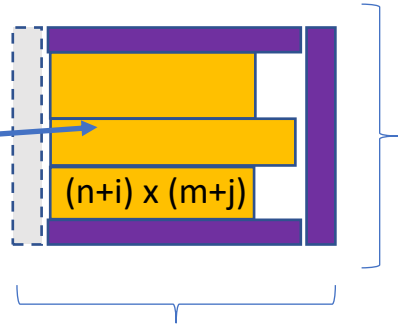
- Pixels has meaning (color space, depth, HDR processed, etc. whatever).
- Added pixel space may be added for meta data that increases n x m to be a bit bigger.
- No need to know, don't care about content (from transport perspective)

- Transparent transport of the previous content.
  - Start Image Frame
  - Line by line
  - End Image Frame.
  - May have added metadata but not distinguishable.

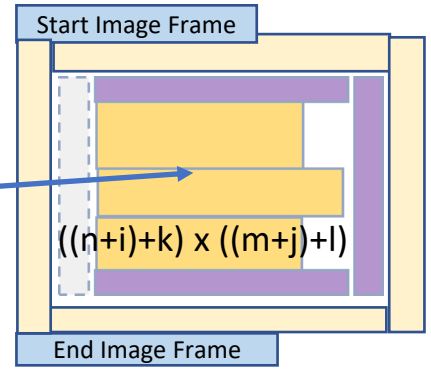
1722b to transport image data - discuss



sensor pixels



sensor pixels + post process + meta



sensor pixels + post process + meta + camera meta data

- Image sensor + lens + filter
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- Each image is on its own.
- Frame, Line, .. Line, Frame
- Don't assume fixed image size/depth.
- Each image type is separate stream (e.g allow for interspersed raw and HDR images, or dual image sensors onto single transport.)

- Each frame is on its own.
- FS, 'embedded', … , line, …, embedded', FE
- Don't assume fixed image size/depth.
- Transparent transport of packet header – issues?