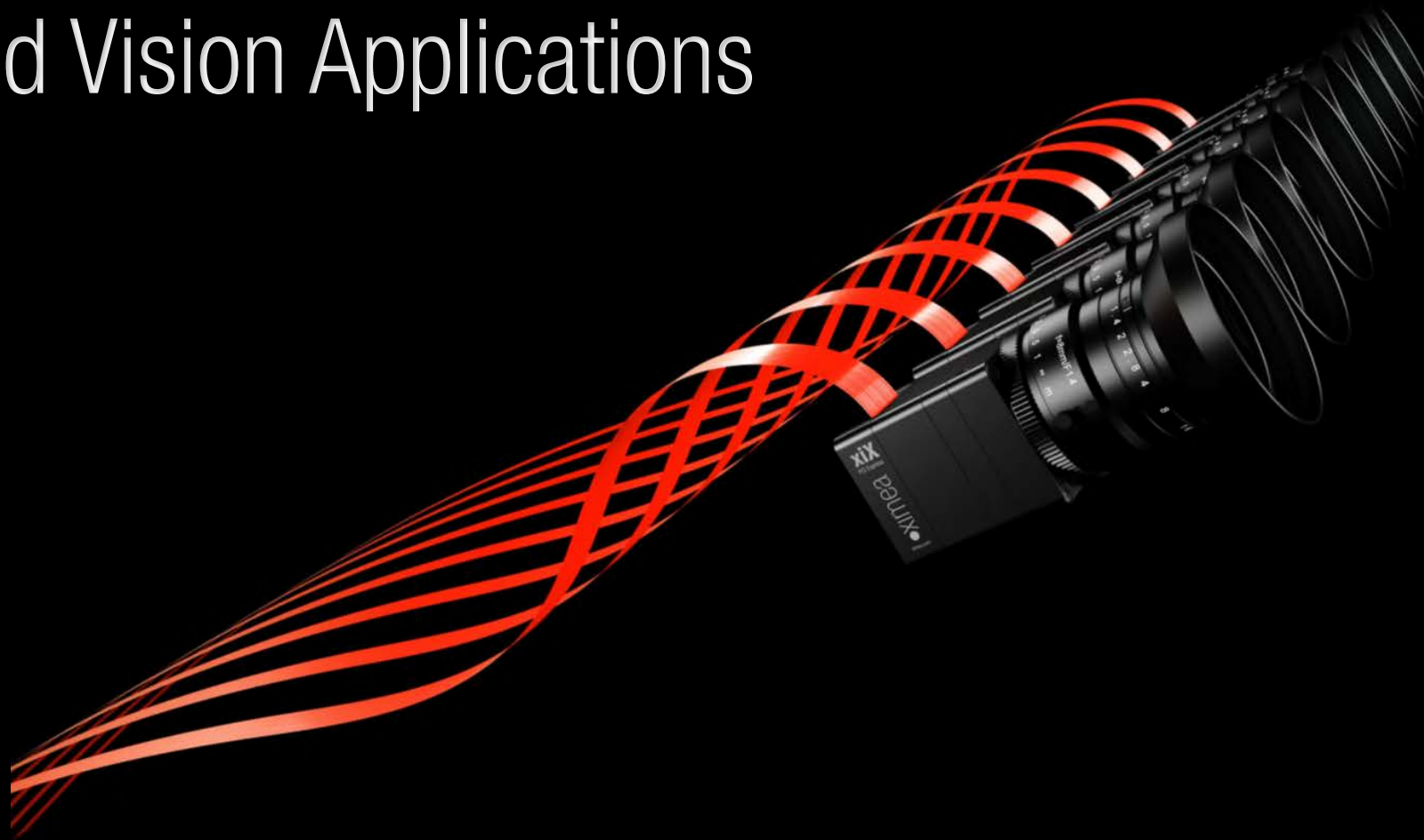


# Multi-camera Systems And Embedded Vision Applications

Max Larin  
CEO XIMEA



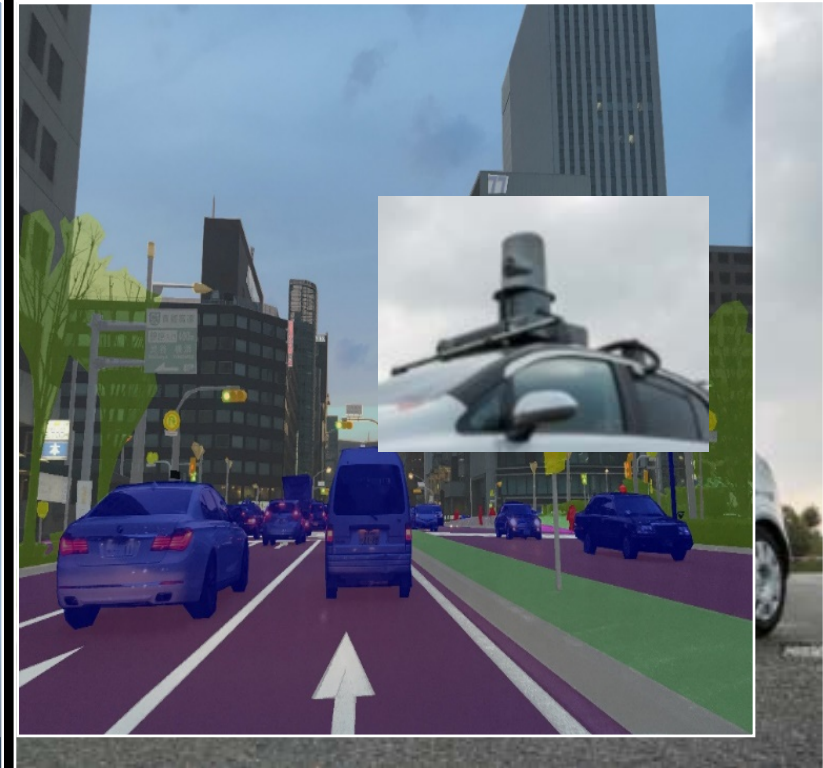
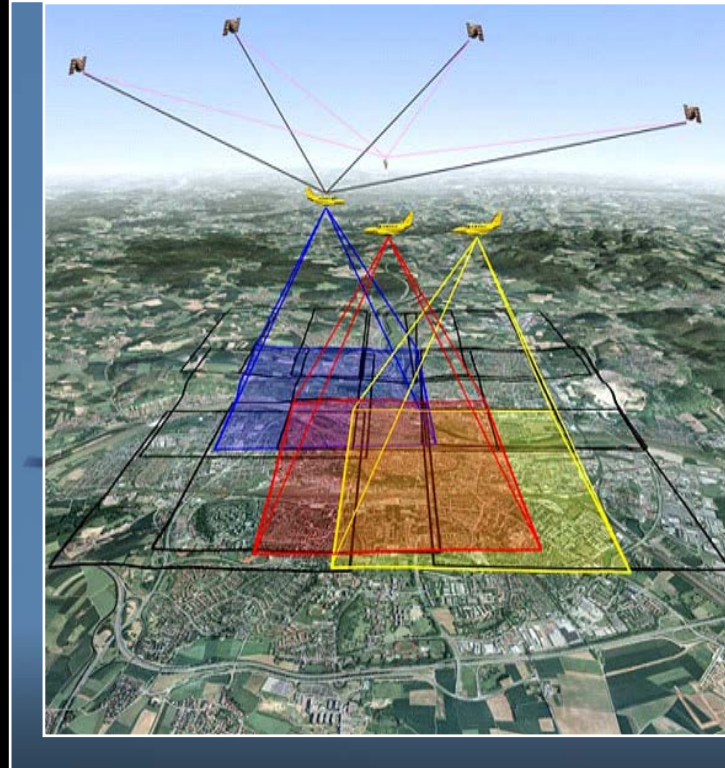
- Definition
- Applications
- Configurations
- Considerations
- Possible approach with PCIe and xSwitch

- Multi Camera Systems are systems having more than one camera  
... but
- Can include any mix of camera resolutions, fps, spectral sensitivity, triggering, etc.  
... and each camera can be addressed and configured individually

- Medical Imaging
- Mapping/Surveying
- Motion Tracking Systems
- Immersive Technologies
- Cinematography
- Machine Vision
- 3D Scanning, Photogrammetry



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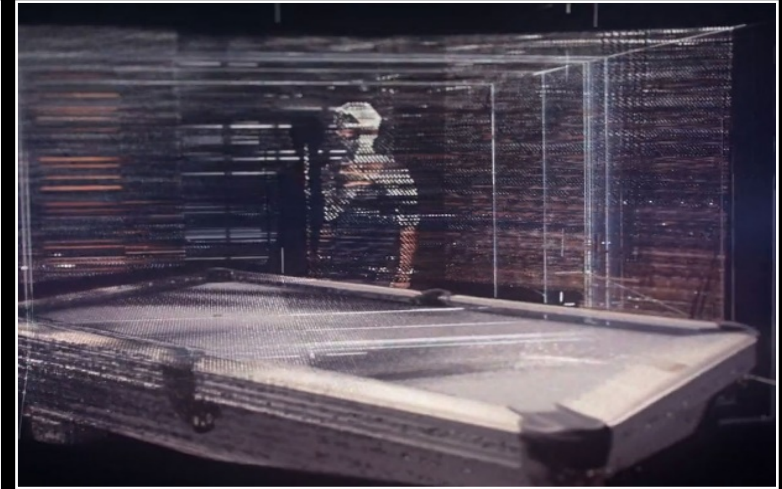
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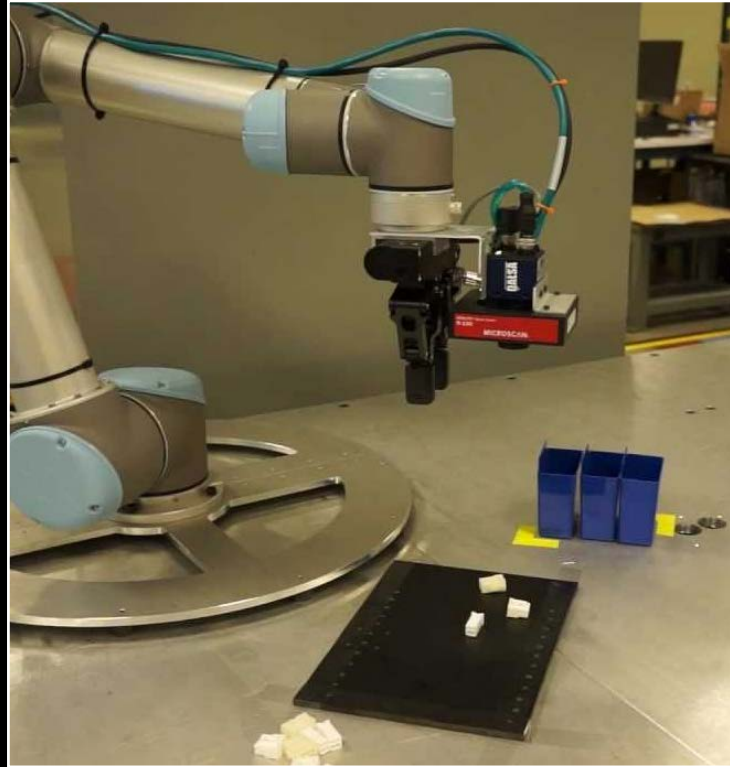


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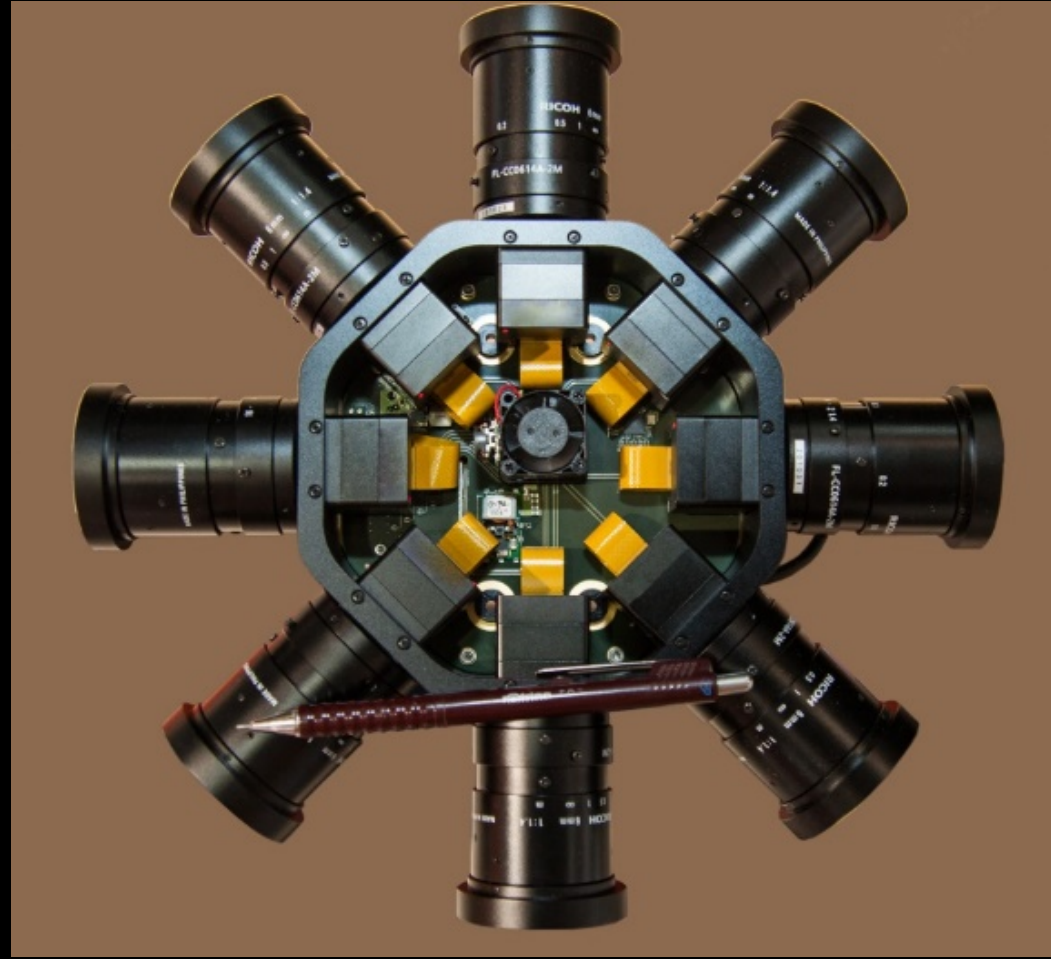


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- Inside Out
- Outside In
- Array
- Clustered

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- Outside In
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- Clustered

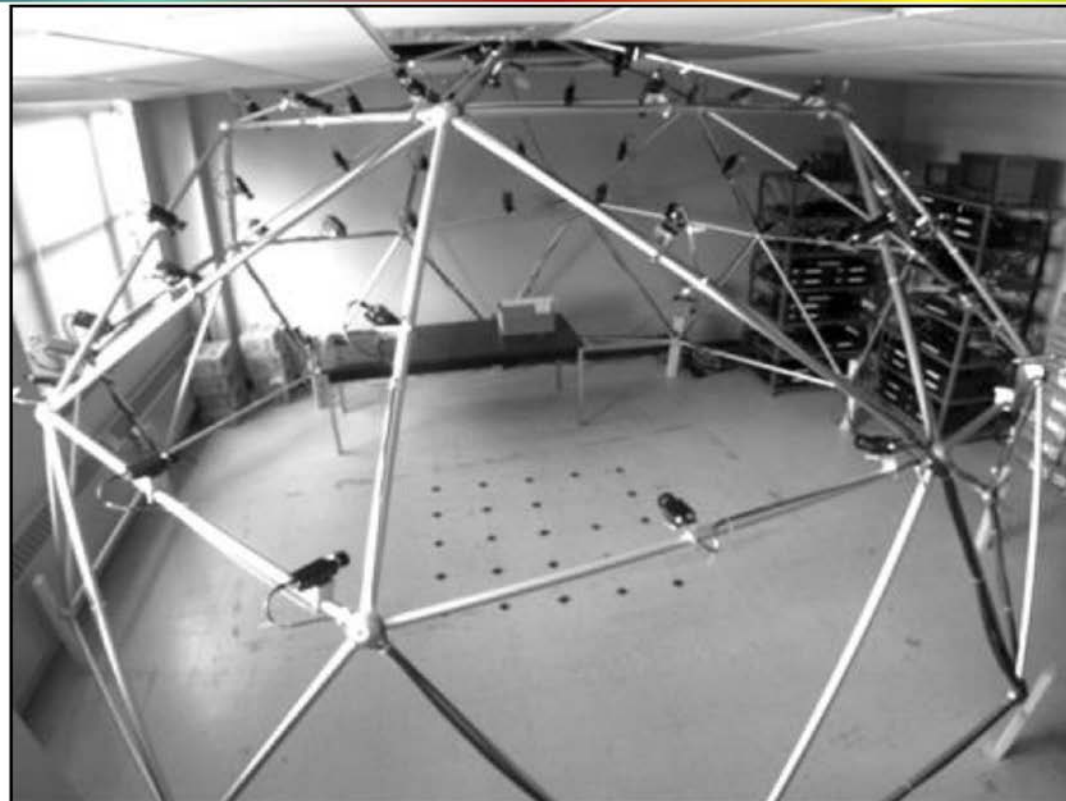




## 3D Dome (with 51 Cameras) – Analog system, circa 1995

- Inside Out
- **Outside In**
- Array
- Clustered

**51 analog cameras:  
Synchronized  
and time-stamped  
Recorded on VHS  
video tapes  
Digitized later  
one by one**



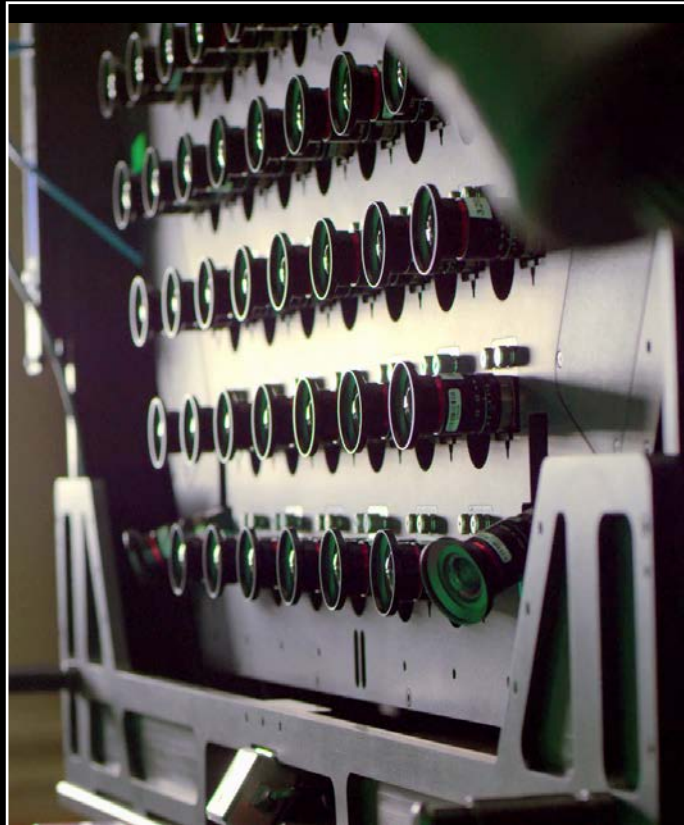
**Carnegie Mellon**

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# Multi-camera Applications and Systems Architecture Configurations

- Inside Out
- Outside In
- **Array**
- Clustered



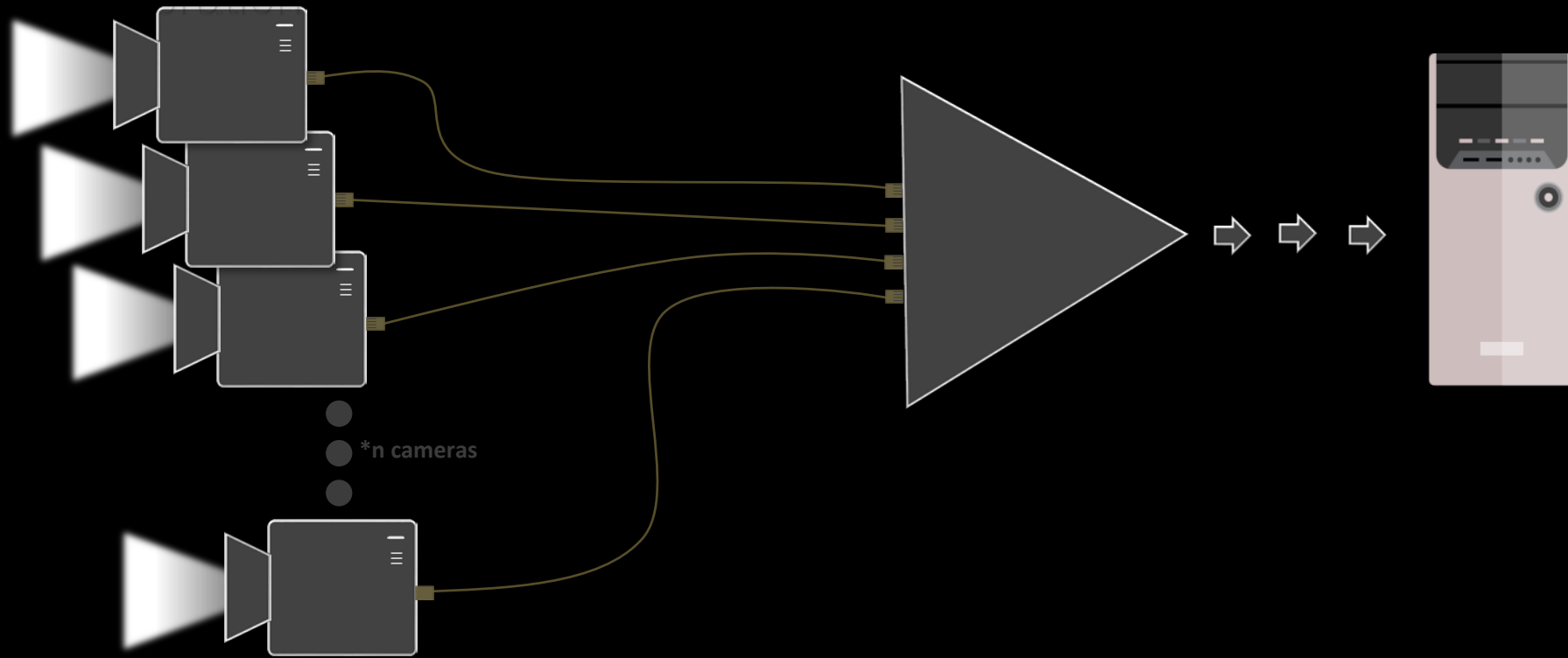
- Inside Out
- Outside In
- Array
- **Clustered**



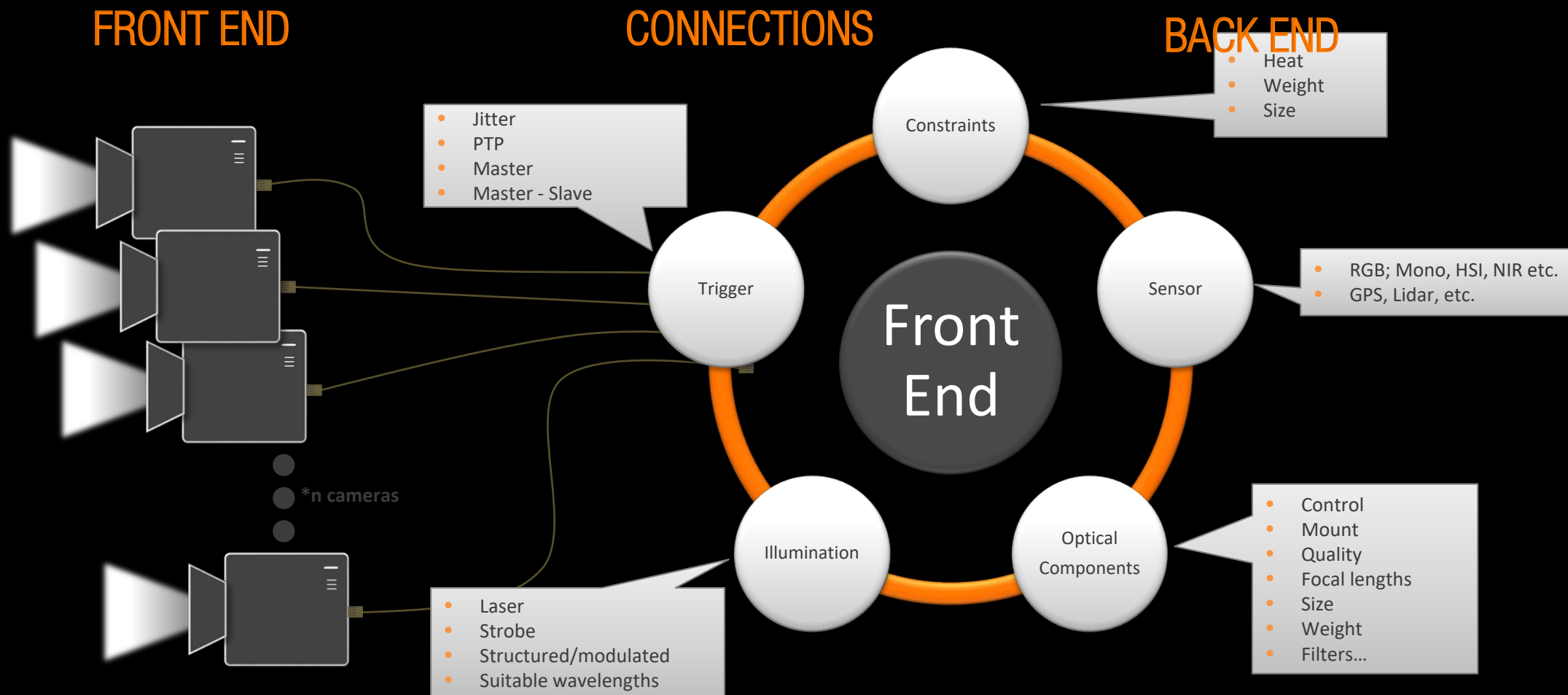
FRONT END

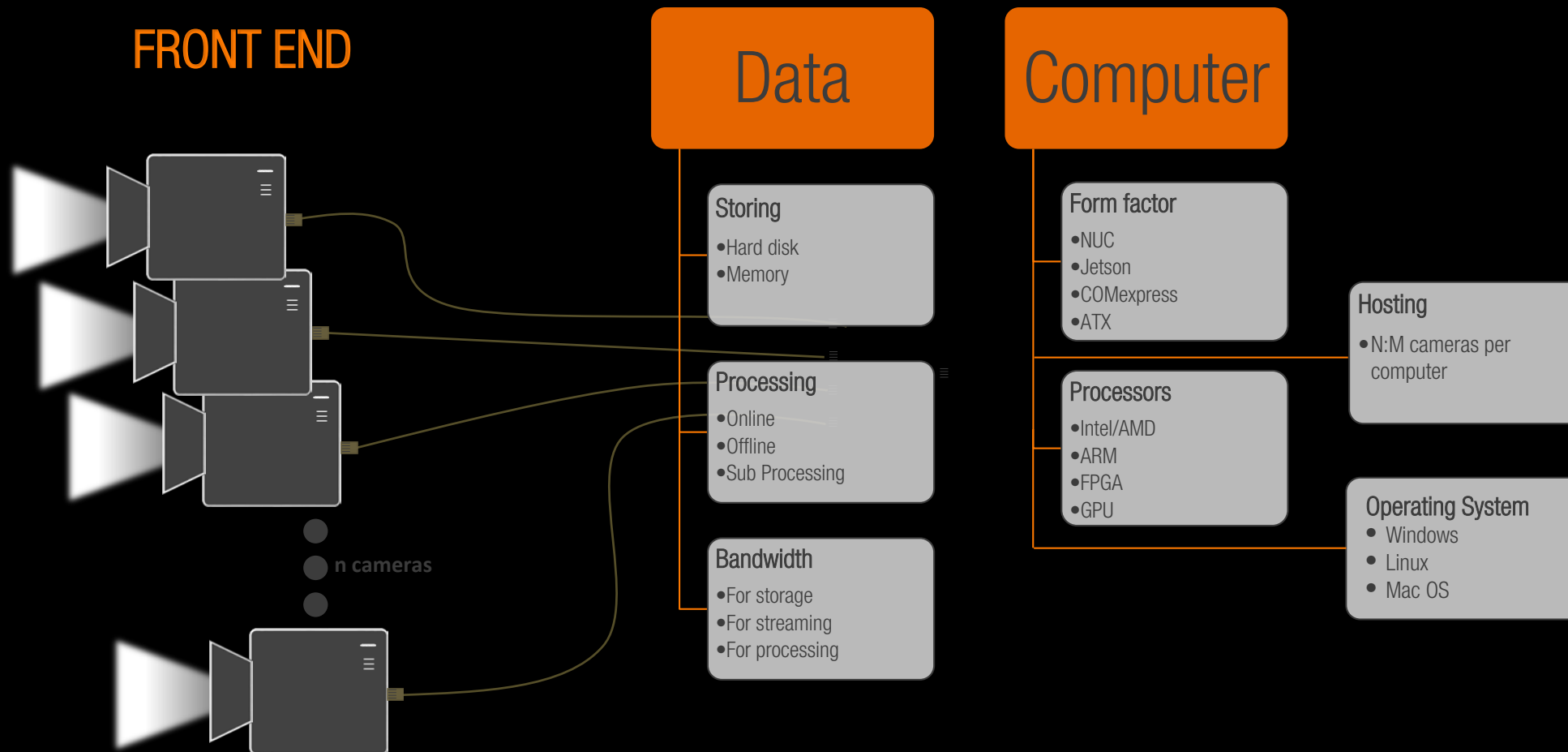
CONNECTIONS

BACK END

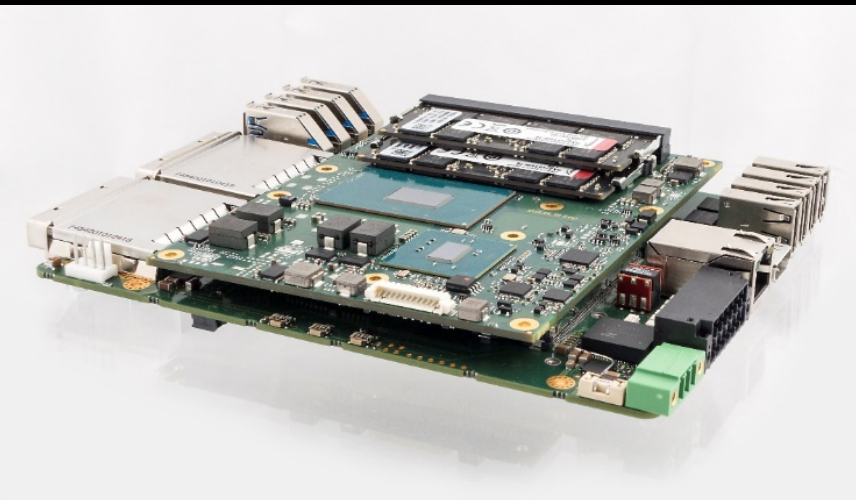








### xiCX - COM Express Embedded PC



XIMEA Custom COM Express box

- 16 PCIe G3 lanes
- 2 x PCIe X8G3
- 4 x USB 3.1 Gen1
- 4 x USB 2.0
- GigE
- HDMI
- 4 M.2 SSD PCIe4G3 slots
- up to 8TB storage



### xEC2 - NVidia Jetson TX2

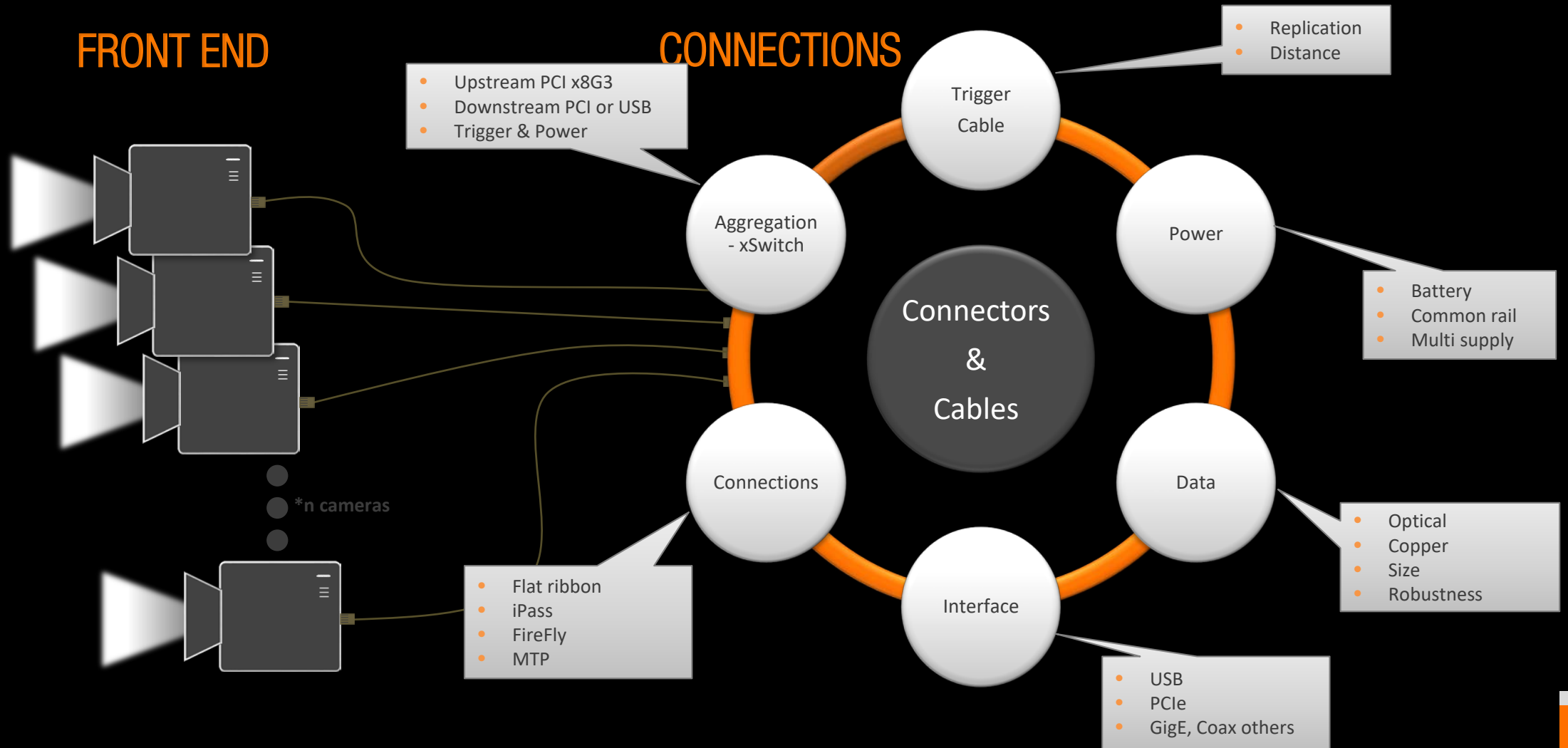


XIMEA custom carrier boards

- 4 x X2G2 downstream
- 1 x X4G2 downstream
- 2 USB 3.1 flex
- 1 USB3.0 type A
- 1 USB 2.0 micro B
- M.2 x4G3
- GigE
- HDMI
- Battery Management IC
- Hot swappable with charging
- SD memory
- mSATA



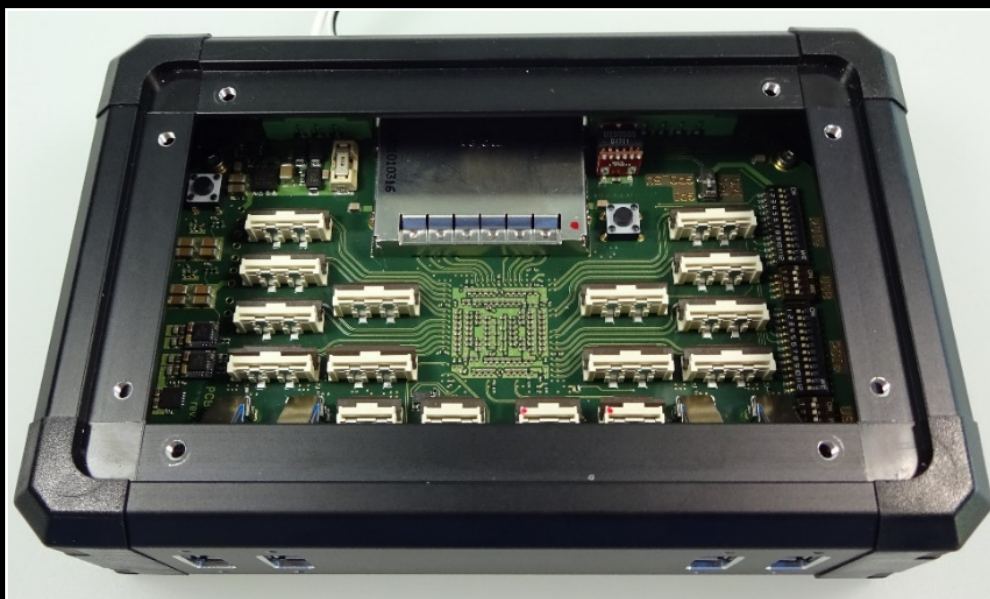




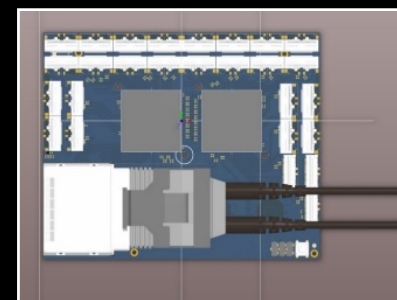
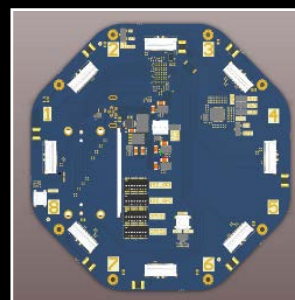
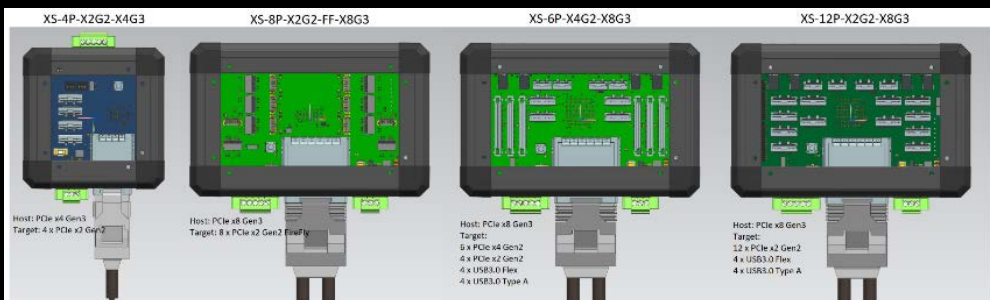
# xiFLY – a platform for rapid development of multicamera systems fom XIMEA

- Has the versatility to support all different configurations thanks to multiple interconnect options for dense and displaced architectures, superb bandwidth and excellent scalability
- E.g. a performance of:
  - 12 cameras each 12 Mpix resolution running @ 60 fps
  - totaling 8.6 GB/s sustained data rate to disk on a single PC

### PCIe + USB aggregation / multiplexing



- Up to 27 PCIe camera ports
- Up to 8 USB3 connectors
- Synchronization
- Power replication
- Bandwidth up to 64 Gbit/s



1. VisionSystems - <https://www.vision-systems.com/articles/2011/11/medical-imaging-system-comes-above-the-radar.html> / SurgicalCamera - <http://www.surgicalcamera.net/>
2. Cyclomedia - [http://www.infrasite.nl/catalogue/catalogue.php?ID\\_bedrijven=3924](http://www.infrasite.nl/catalogue/catalogue.php?ID_bedrijven=3924) / mapillary - <https://blog.mapillary.com/product/2017/05/03/mapillary-vistas-dataset.html> / geosan - [http://geosan.synnex.mn/aerial\\_photogrammetry\\_mapping.php](http://geosan.synnex.mn/aerial_photogrammetry_mapping.php) /
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5. LYTRO
6. Indiamart - <https://www.indiamart.com/proddetail/auto-optical-sorting-machine-6555430530.html> / Vision Guidhttps://www.universal-robots.com/de/produkte/ur5-roboter / robotics - [https://robotics.ua/news/industrial\\_robots/2585-the\\_new\\_robot\\_packer\\_ur5\\_from\\_universal\\_robots\\_can\\_experience\\_the\\_pack\\_expo\\_2013](https://robotics.ua/news/industrial_robots/2585-the_new_robot_packer_ur5_from_universal_robots_can_experience_the_pack_expo_2013)
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9. LYTRO
10. LYTRO
11. Cisco - <http://www.itinstock.com/cisco-3-camera-cluster-cts3k-cam-clust-hd-ip-cts-telepresence3000-video-system-34367-p.asp>





Thank you for your attention  
Questions?