!CHAOS and LabVIEW™ integration
The rationale behind the technology effort

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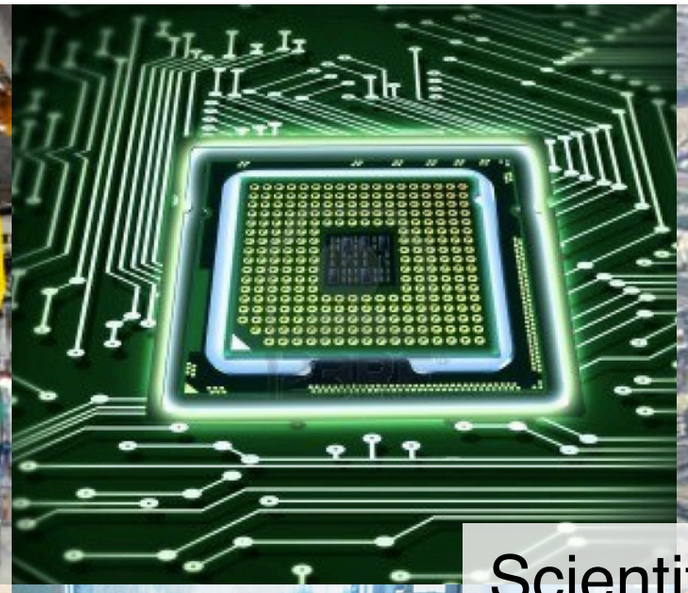
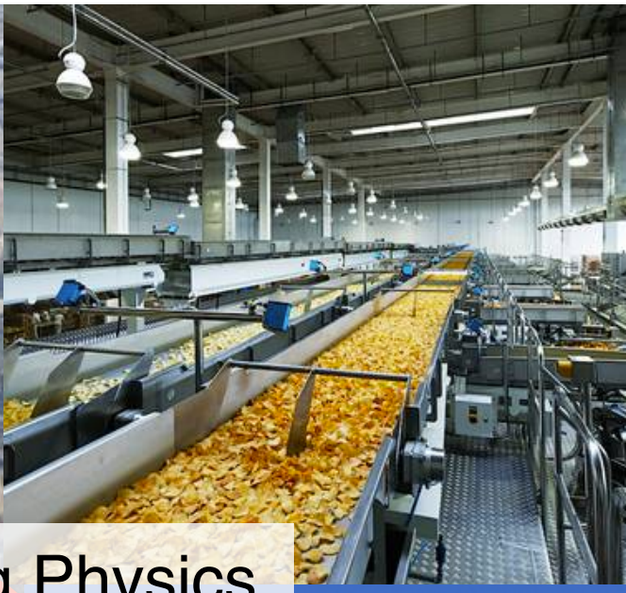
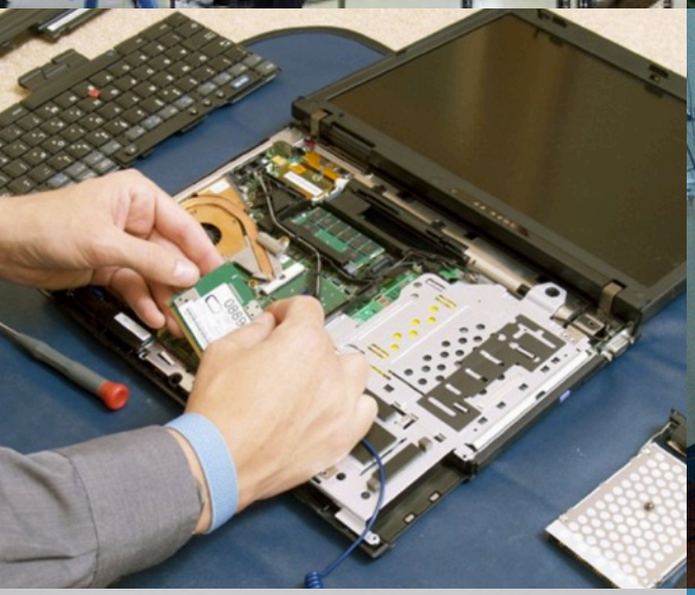
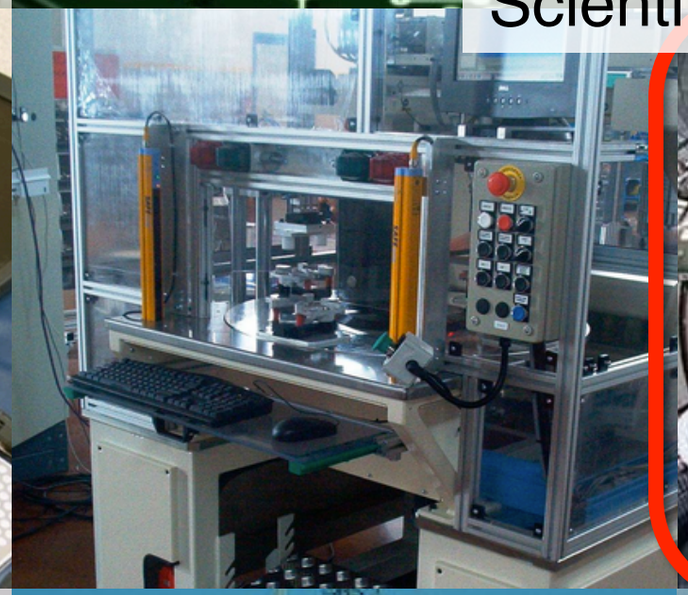
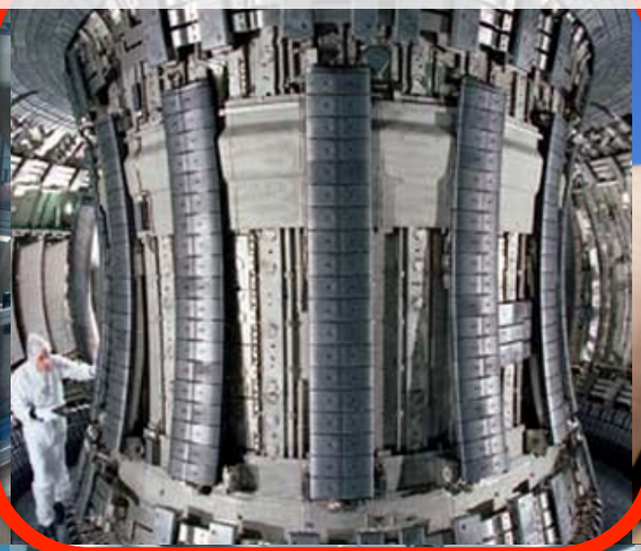
Diversity of Applications – Multitude of Benefits




Scientific Research and Big Physics

MEASUREMENTS, CONTROL AND DIAGNOSTICS

NI Commitment to Big Physics

NI Benefit

- Basic research is a cradle of technology – Reuse it for mass market
- Cutting edge technology & challenges – Engineering capability is expanded
- First in market with latest technology / solution

Research Institute Benefit

- Reduce cost due to NIs experience with broad based industry and commercial technology
- Product certification and in-depth testing – same products used in other critical applications e.g medical applications
- RASM – Reliability, Availability, Serviceability and Maintainability
- Long term support (10+ years)

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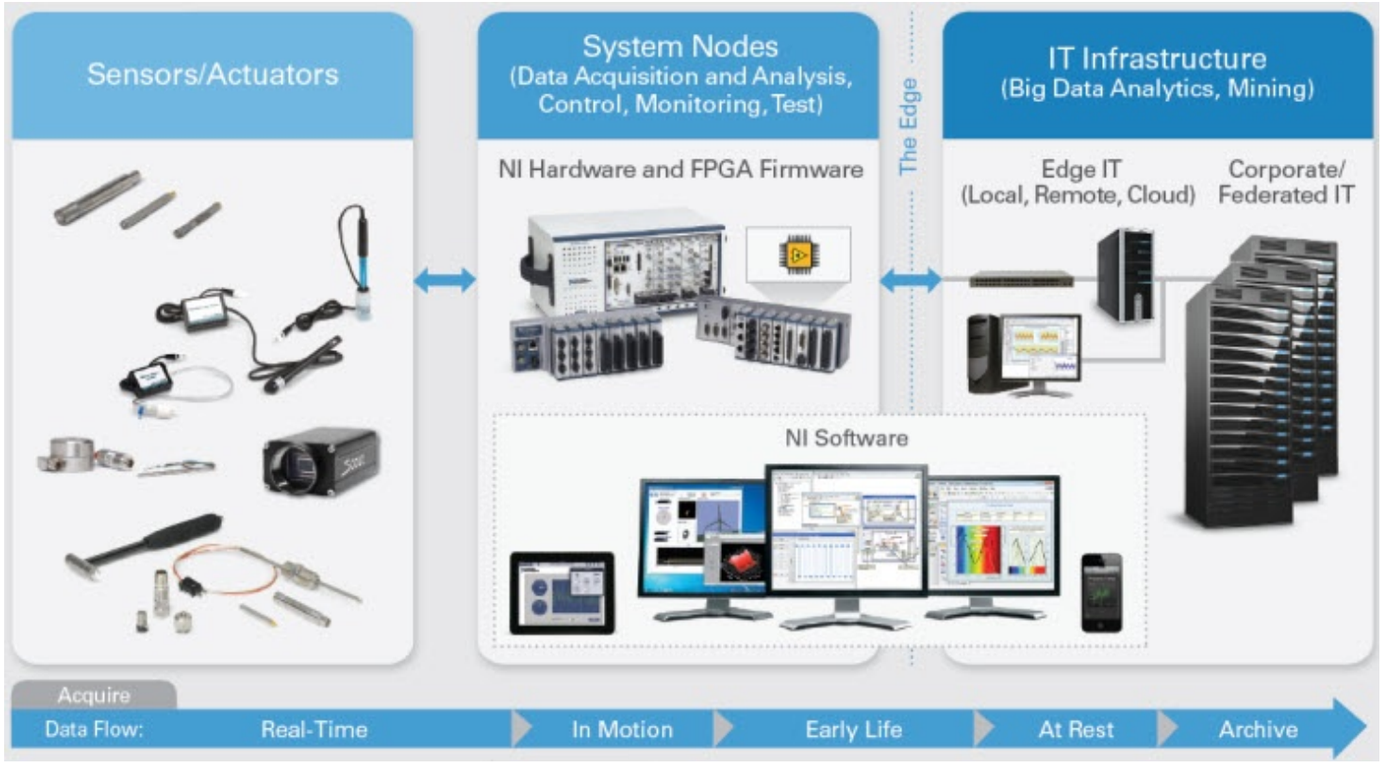
There is an **edge** between the system nodes (front-end devices) and the IT infrastructure due to different use of destination and to different topology of development of the two areas:

- the **front end** is a **state machine** optimized to **read and set sensors and actuators**, where fastens and time accuracy are governing the data acquisition system and software architectures and where you can also decide, ultimately, to loss data - dead time - but not their accuracy;
- the **IT infrastructure** is on the other hand optimized to offer **reliability**, **scalability**, **redundancy, stability and safety** of the data as main priority.

The conflicting requirements of the two worlds can **degrade the performance** once they are connected.



!CHAOS is intended to provide a set of services and plugins optimized from sensors to data storage and analysis where **data are treated in an uniform and optimized way from the source (system nodes) to the IT infrastructure** through a **serialization** (BSON) of data and their structure, syntax and semantic.

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Use LabVIEW™ as one of the tools for the !CHAOS GUI to:

- easily build graphical interface
- reuse existing legacy LabVIEW code
- automatically generate LabVIEW GUI from a configuration file (LabVIEW scripting)
- automatically generate data type structure.

Use LabVIEW™ in !CHAOS architecture at front end level to:

- dispose of LabVIEW library drivers
- reuse existing legacy LabVIEW code
- use labVIEW as a tool for system-nodes (front-end controllers) development of !CHAOS on NI hardware and more…

Interprocess communication and/or application builder

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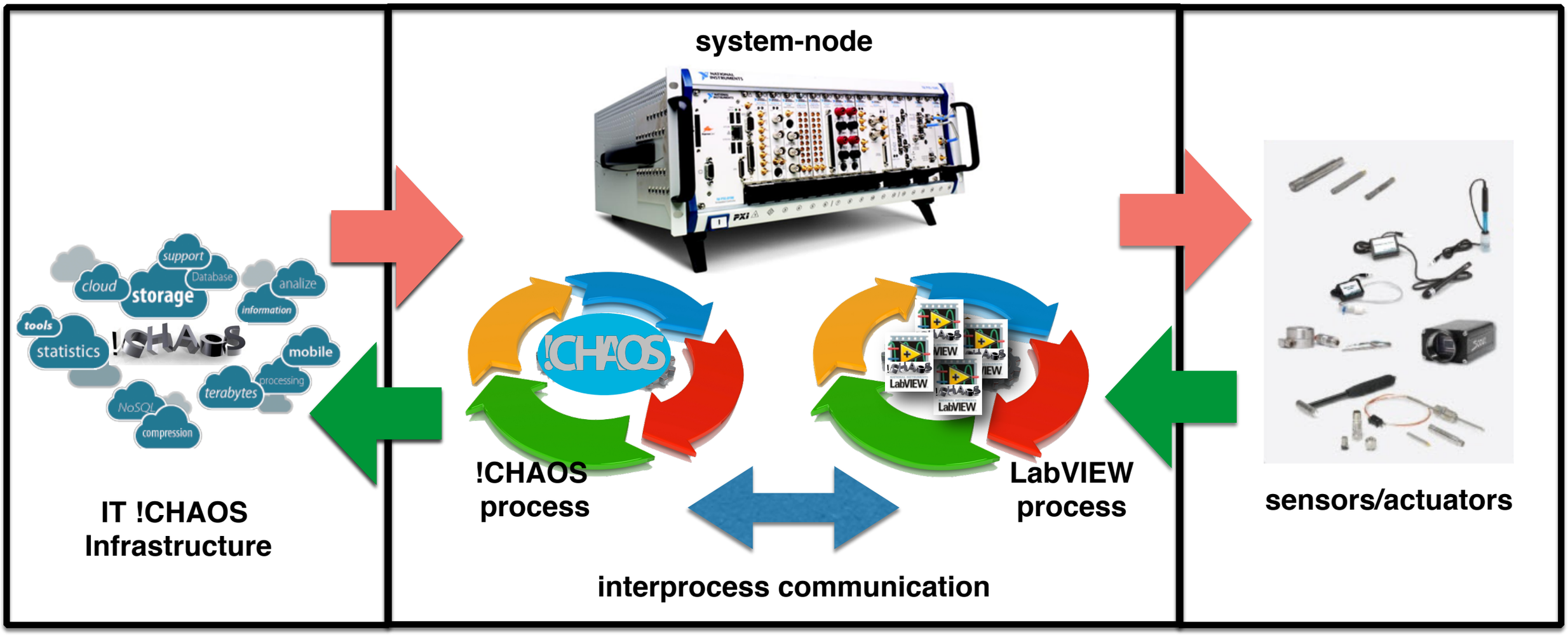
!CHAOS(LabVIEW) – **Interprocess Communications**



An R&D activity where **pipe interprocess communication** has been used to connect a !CHAOS front-end server with LabVIEW process has been started **highlighting the limitations** mainly due to

- synchronization of processes with independent task
- data format alignment
- complexity of LabVIEW code to handle handshaking with !CHAOS infrastructure

Those reasons pushed us to the development of Cluster2BISON and BISON2Cluster LabVIEW library

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LabVIEW(!CHAOS) - **Application Builder**

NI **LabVIEW Application Builder/C code generator** able to **create and deploy stand-alone applications developed in LabVIEW** software f**or the !CHAOS architecture**, to be applied for distributed control system, large deployment and possibly real time application.

Large Deployment

Distributed Control System

LabVIEW
Real-Time
Sviluppo grafico,
prestazioni real-time
Presentazione Multimediale: "Introduction to LabVIEW Real-Time" »

Applicable areas of interest
(examples, not limited to..)

- Big Analog Data
  - See also BAG Horizon 2020 ITN project (CERN, ESRF, INFN, Univ of Manchester, Boston Solutions)
  - INFN PD and BO are beneficiaries organization
- Alternative (H)DCS for HEP projects/experiments
  - Advantage: diagnostic AND control are merged together
  - Would it make sense to lobby with others to increase win chance / gain momentum?
- Industrial applications
  - Facility Management
  - Wide area network /highly distributed and abstract control system
    - Environmental monitoring

- Challenges/discussion topics
  - TSN integration?
    - Potential opening towards MPS and (fast)ICS
  - Events handling?
  - GPU connectivity?
  - Beta testers?