Developing Real-Time Embedded Object-Oriented Applications with CORBA

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Three Applications

- Ultrasound scanner

- Theodolite

- Scale

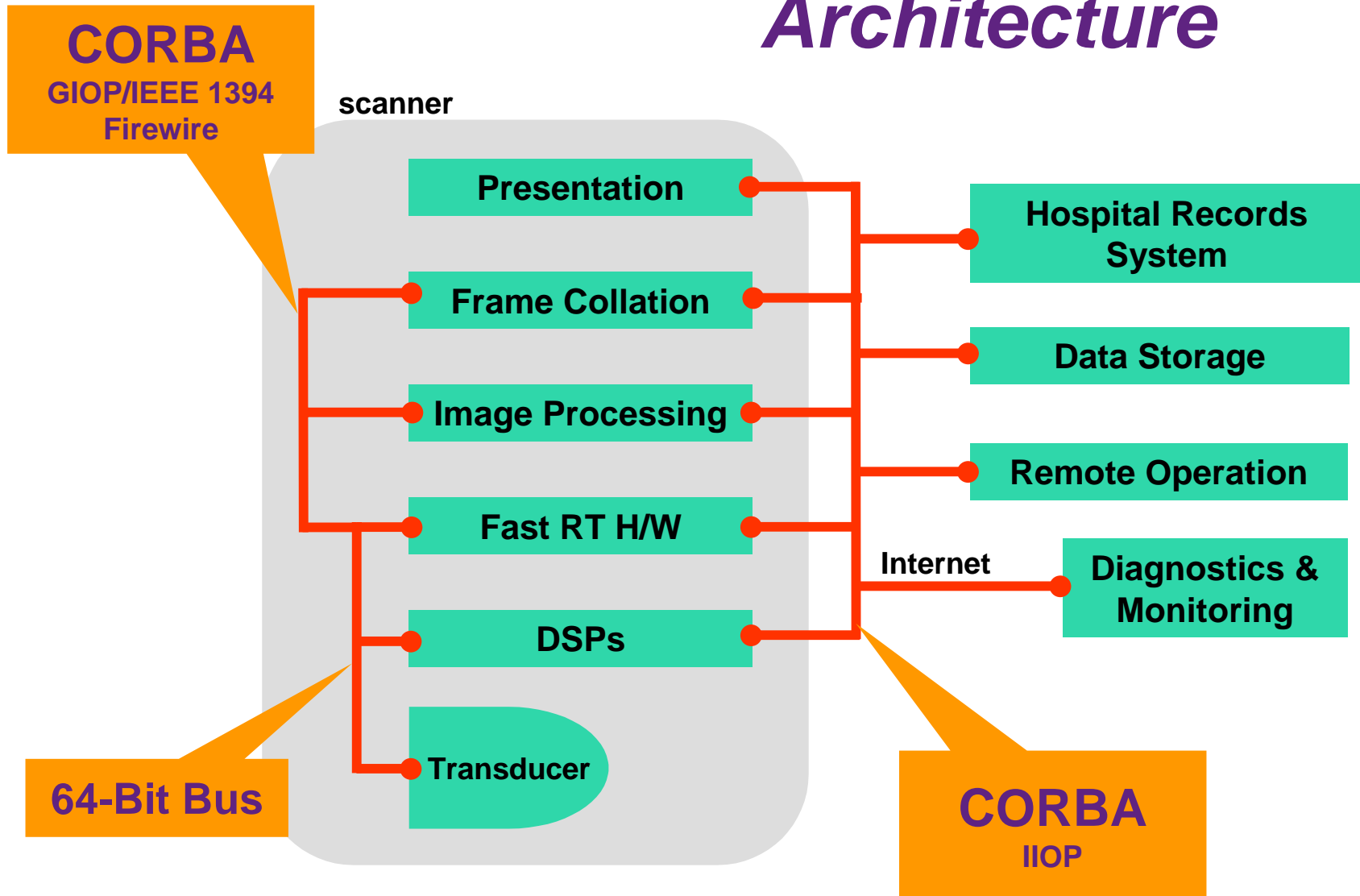# *Ultrasound Scanner Product Requirements*

- User views ultrasound images in real-time
  - Presentation software must keep up with DSP
  - Sensor emits data every 2 milliseconds

- Play back images later
  - Access to remote data storage

- Diagnostics & monitoring from across Internet

- Support mobility
  - Paramedics, In-hospital facilities
  - Small and rugged

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Ultrasound Scanner Development Requirements

- Reduce development and maintenance costs
  - reduce use of proprietary H/W, S/W
  - this version and down the line

- Maximize "image quality" over successive product generations
  - all measurements (heart rate, blood pressure, fetal parameters) are derived from images

- Shorten development schedule
  - build software before hardware
    - OO design, 3rd party tools, portable software layer

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Ultrasound Scanner Architecture

CORBA
GIOP/IEEE 1394 Firewire

scanner

- Presentation
- Frame Collation
- Image Processing
- Fast RT H/W
- DSPs
- Transducer

- Hospital Records System
- Data Storage
- Remote Operation
- Diagnostics & Monitoring
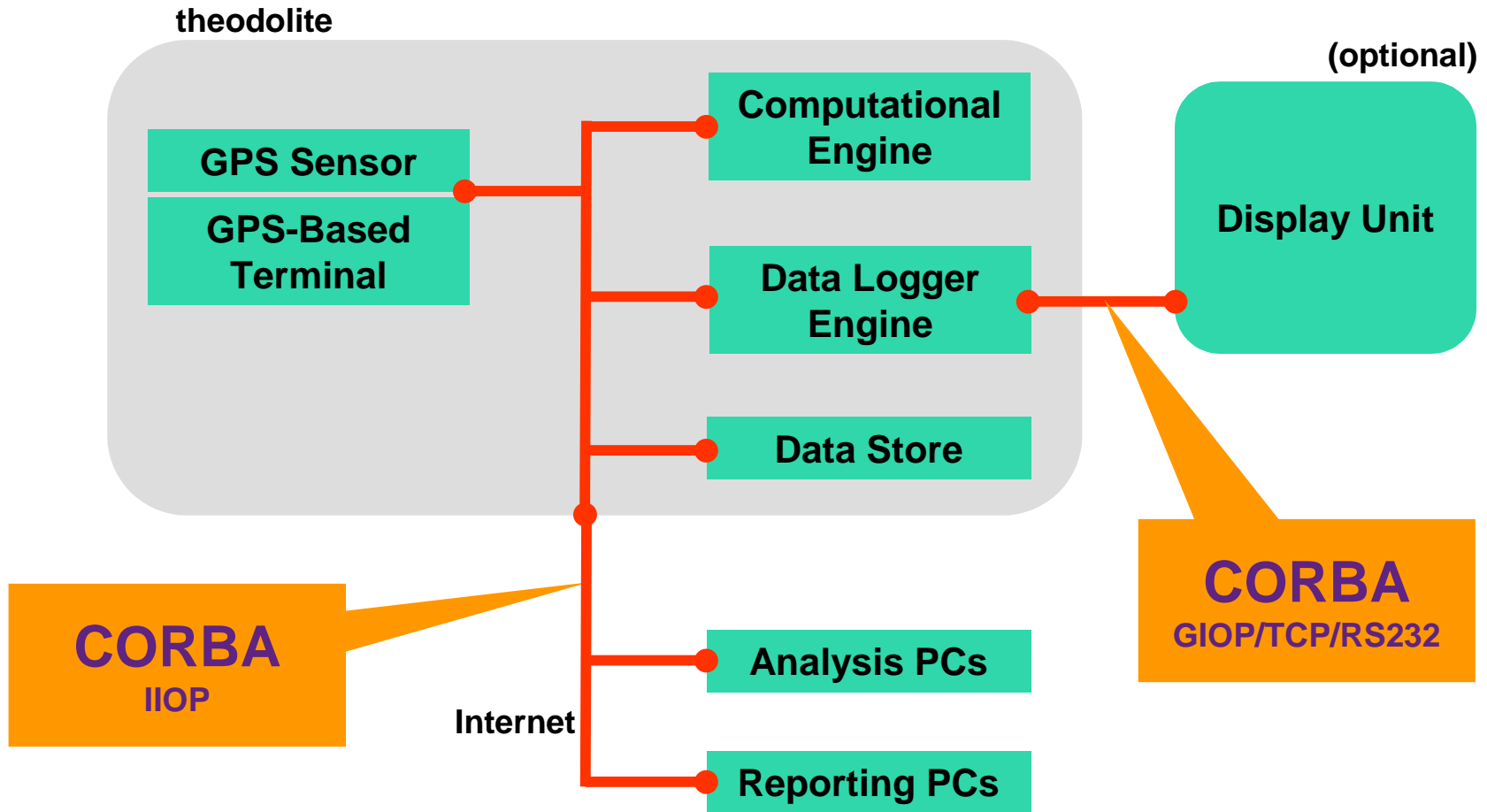
Internet

64-Bit Bus

CORBA
IIOP

Theodolite Product Requirements

- User measures/records land topography from GPS data
  - Position and height updates generated every 100 ms
  - GPS receiver generates Real-Time Kinematic (RTK) data with 1 cm accuracy
  - Must transform real-time time-series data into coordinate data; algorithm based on time-series windows
- Plug-and-play architecture
  - Interface between components from different vendors
  - Interface to standard PCs
- Must interface with radio modem for real-time, on the fly rover
- System initialization less than 30 seconds
- Device has limited memory (4 Mb to 85 Mb flash or PCMCIA)

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Theodolite Development Requirements

- Reduce use of proprietary H/W, S/W

- Shorten development schedule
    - build software before hardware
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Theodolite Architecture

theodolite

(optional)

GPS Sensor

GPS-Based Terminal

Computational Engine

Data Logger Engine

Data Store

Display Unit

Analysis PCs

Internet

**Reporting PCs**

CORBA
IIOP

CORBA
GIOP/TCP/RS232

Scale
Product Requirements

- Measure weight of merchandise and calculate price
- Scales are VxWorks, displays are PCs
- Sell by component—card, display, bus
  - Freedom to change card or displays
  - Platform-independent applications
  - Non-proprietary communication protocols

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Scale
Development Requirements

- COTS HW/SW

Scale Architecture
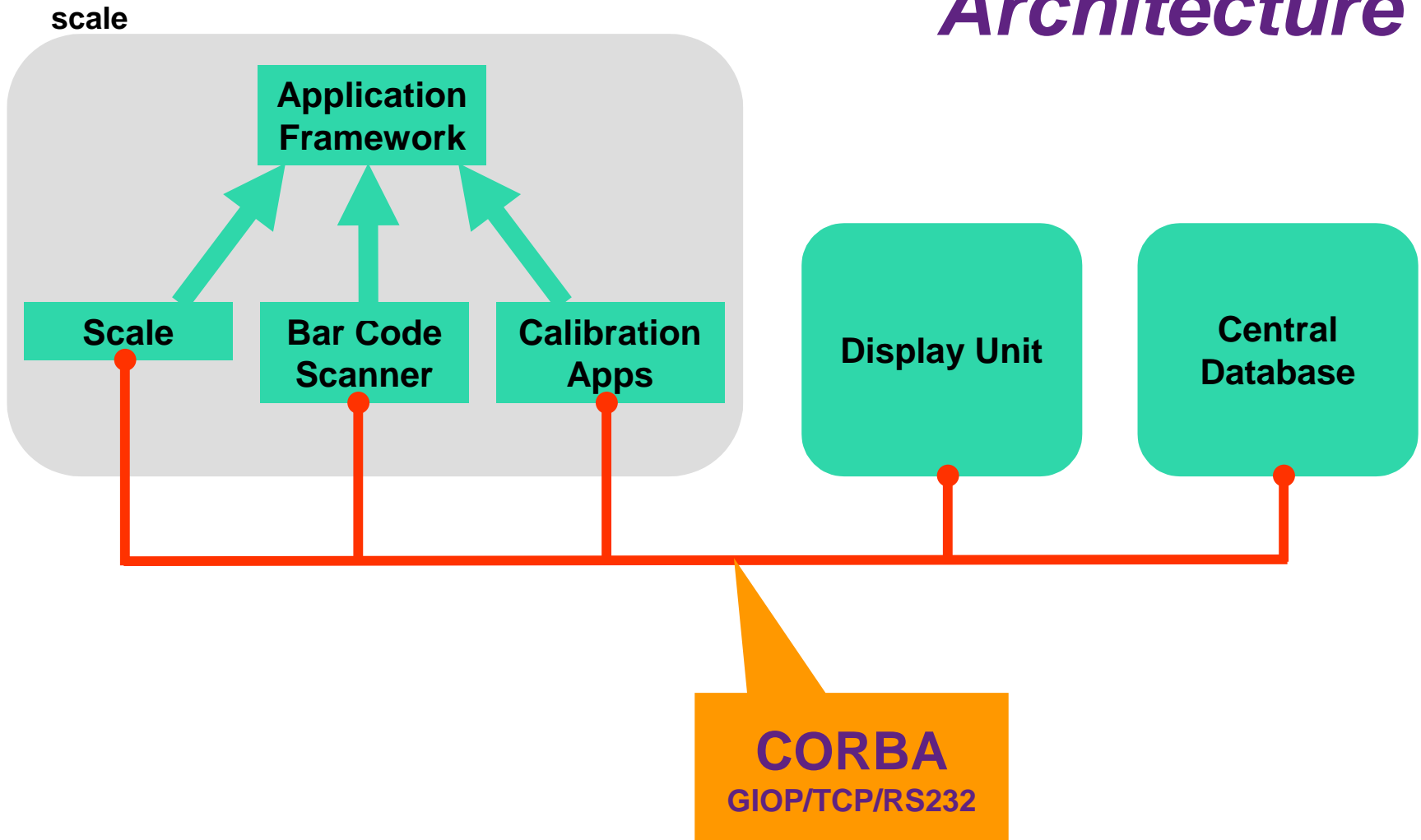
Summary

- 2-bus architecture separates fast real-time bus from outside-the-box bus
  - RT at layers just above HW
  - Interoperable outside the box

- Real-time embedded CORBA enables a COTS approach
  - Small footprint
  - High performance
  - Real-Time QoS
  - Shorter development schedule *and* reduced risk

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Thank You

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