

HiFi: An Architecture for Large-Scale Sensor Data Processing*

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EE290Q

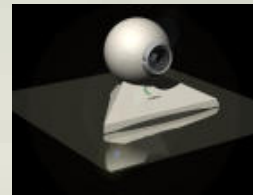
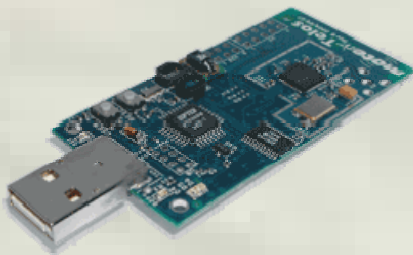
May 3rd, 2006

*Slides shamelessly stolen from Shawn Jeffrey (UCB)



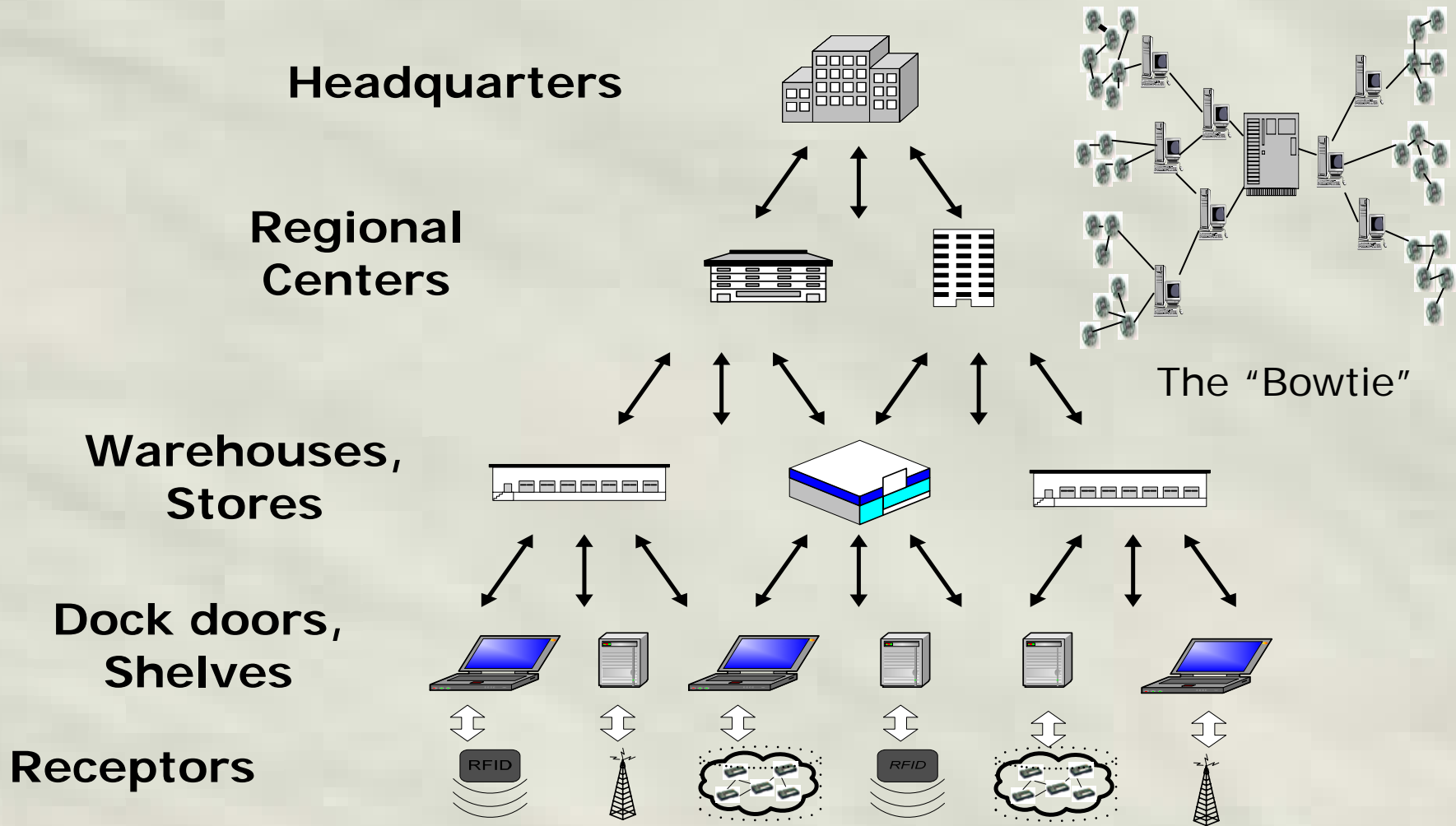
Receptor-based Systems

- Receptors everywhere!
 - Wireless sensor networks, RFID technologies, digital homes, network monitors, ...



Large-scale deployments will be **High Fan-In Systems**

High Fan-in Example (SCM)



Properties



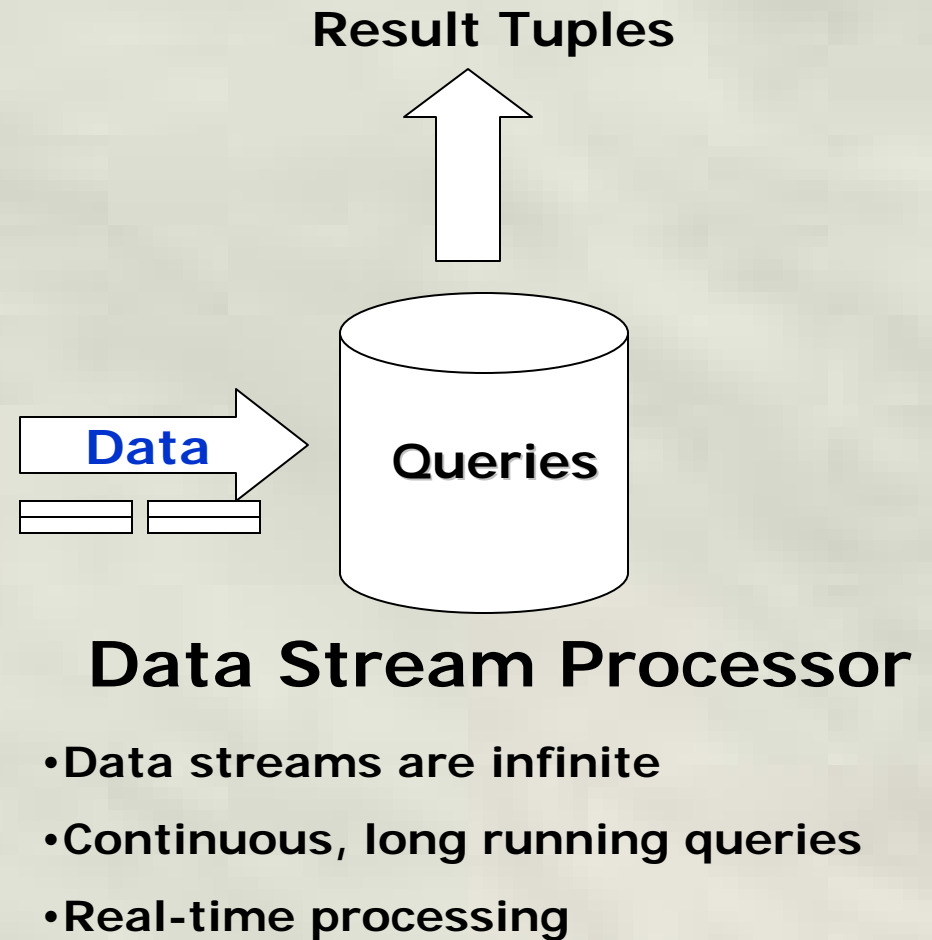
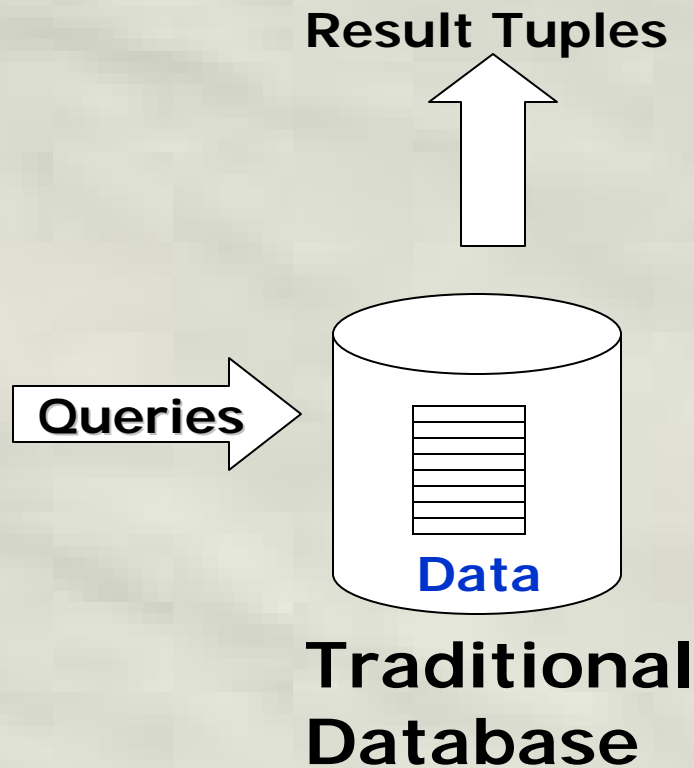
- **High Fan-In**, globally-distributed architecture
- Large data volumes generated at **edges**
- Successive **aggregation** as you move inwards
- Many **heterogeneous** devices
- Strong **temporal** focus
- Strong **spatial/geographic** focus
- Streaming data **and** stored data
- **Integration** within and across enterprises

HiFi



- A **data management** infrastructure for high fan-in environments
- *Uniform Declarative Framework*
 - Every node is a data stream processor that speaks SQL-ese
 - stream-oriented queries *at all levels*
 - Hierarchical, stream-based views as an organizing principle

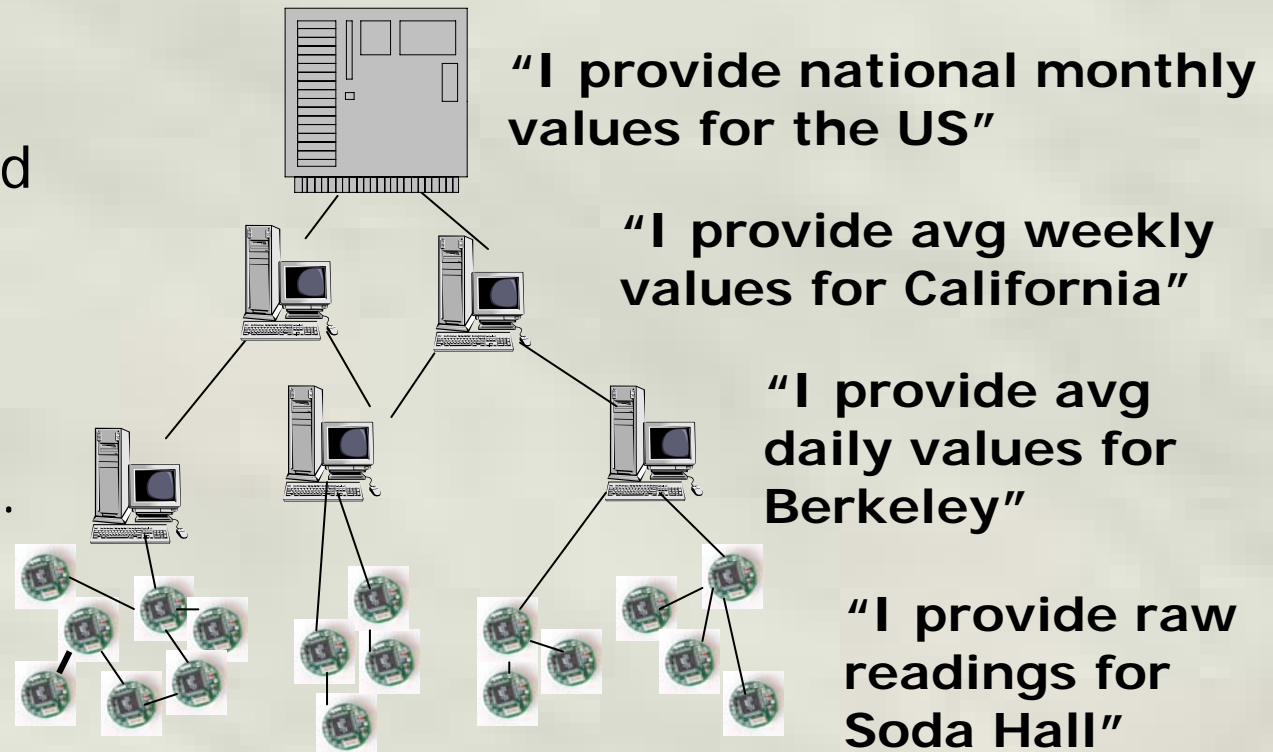
Data Stream Processing



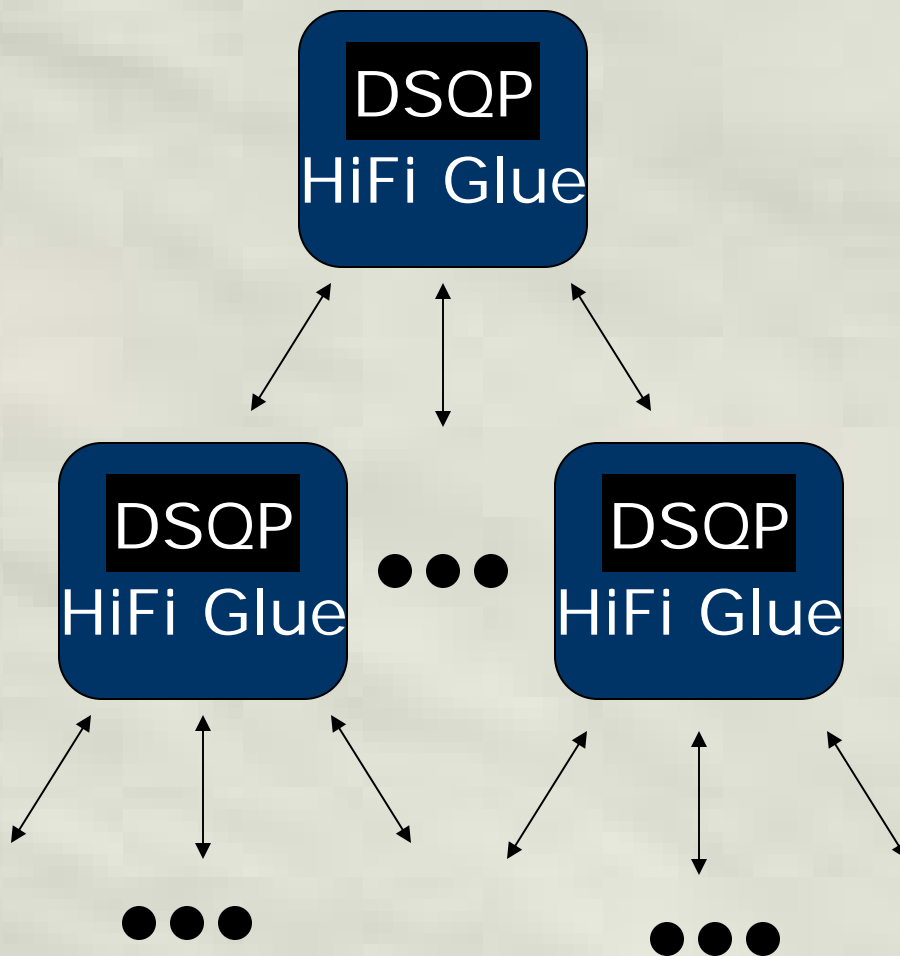
Hierarchical Query Processing



- Continuous and Streaming
 - Automatic placement and optimization
- Hierarchical
 - Temporal granularity vs. geographic scope
 - Sharing of lower-level streams

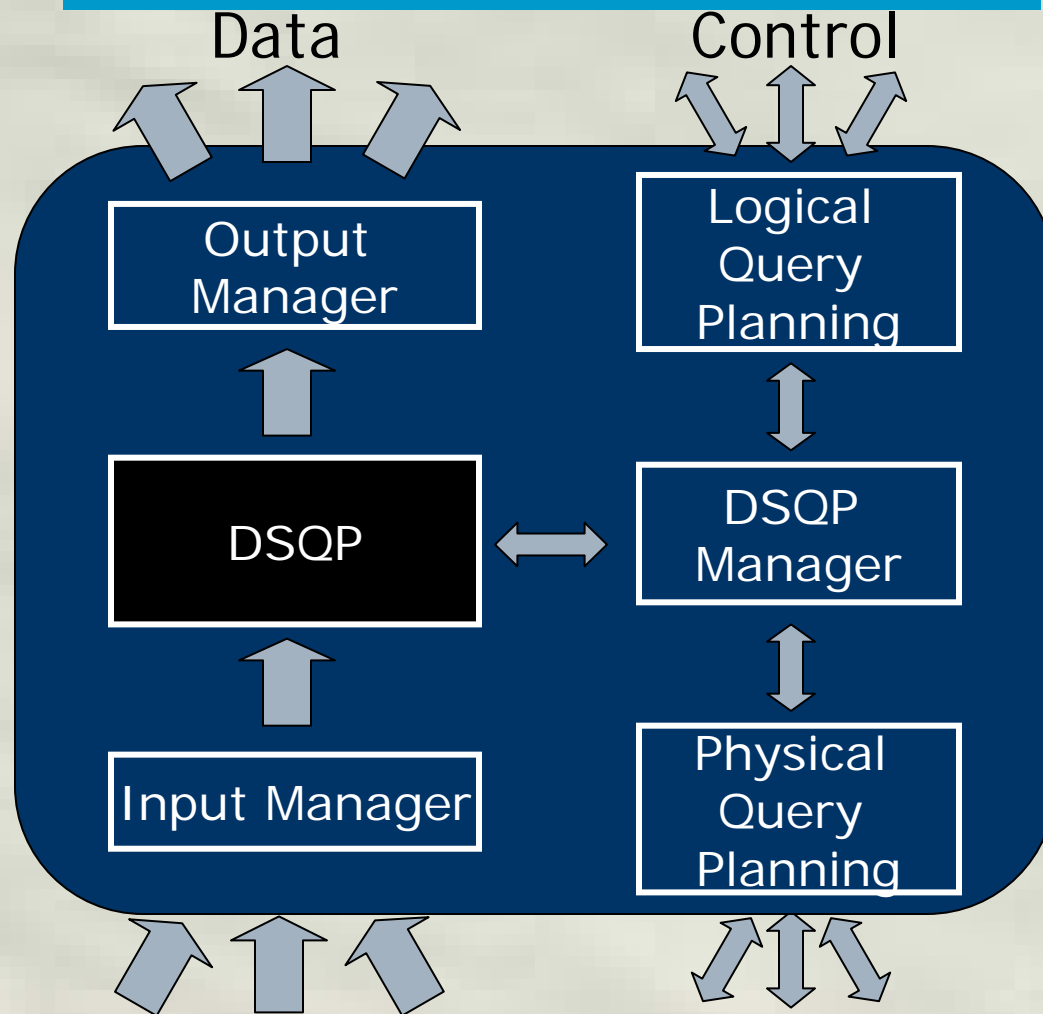


Basic HiFi Architecture



- Hierarchical federation of nodes

Basic HiFi Architecture



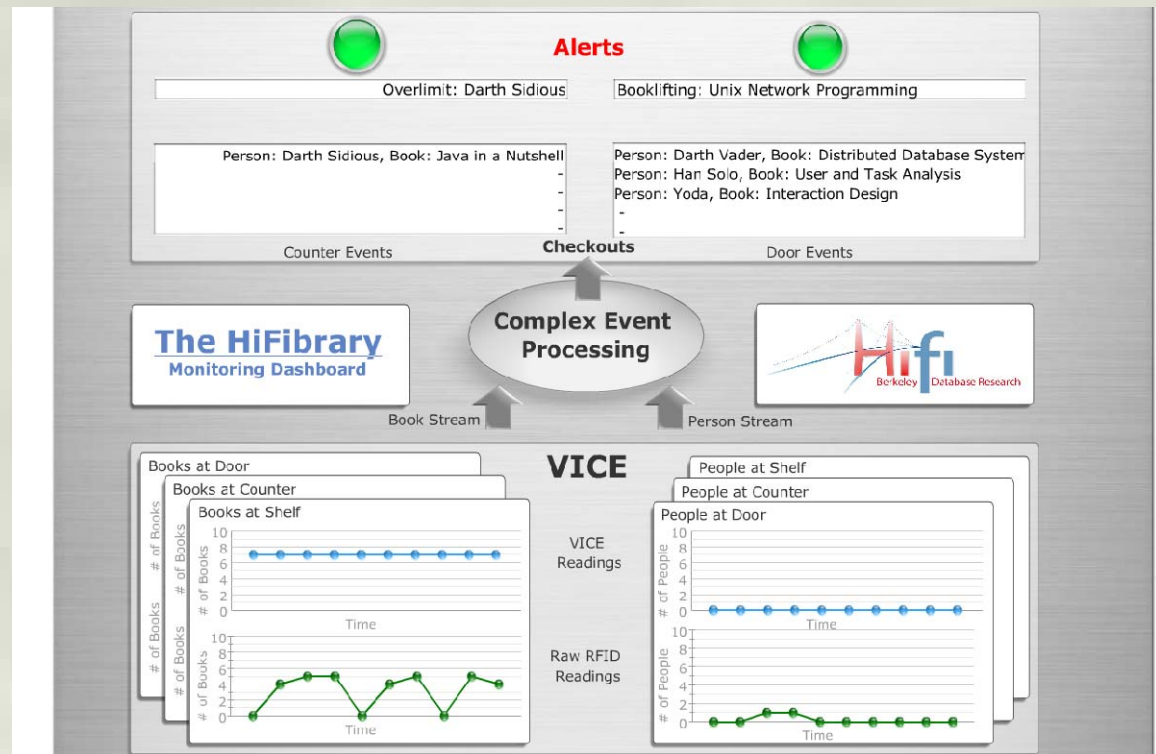
- Hierarchical federation of nodes
- Each node:
 - Data Stream Query Processor (DSQP)
 - HiFi Glue
 - DSQP Management
 - Query Planning
 - Archiving
 - Inter-node coordination and communication

Current Status: “Events on the Edge”



Advanced functionality at the edges of HiFi (SIGMOD '05)

- Heterogeneous Sensing:
 - RFID readers
 - X10 motion sensors
 - Barcode scanner
- A VICE for providing MDI
- Sophisticated app logic using complex event processing



Conclusions



- Receptors everywhere → High Fan-In Systems
 - Current middleware solutions are complex & brittle
 - Uniform declarative framework is the key
- The HiFi project is exploring this approach
- Prototype deployments validated HiFi approach
- MDI + VICEs provide a device-independent infrastructure to access receptor data
- See <http://hifi.cs.berkeley.edu> for more info.