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RFID middleware design – addressing application needs and RFID constraints

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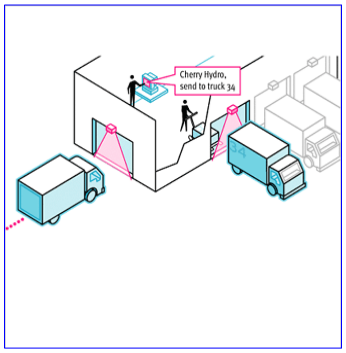
Classical RFID Application landscape

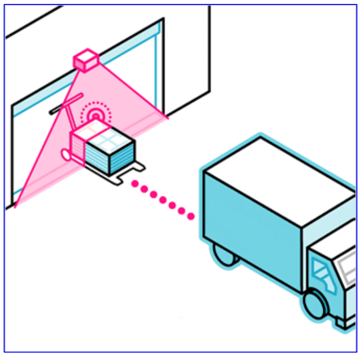
- Single tag in range
- Coarse reader deployment
- 1-to-1 relationship between reader and application
  - RFID data are captured by single reader
  - consumed by a single application

This is changing in novel application domains: Supply chain

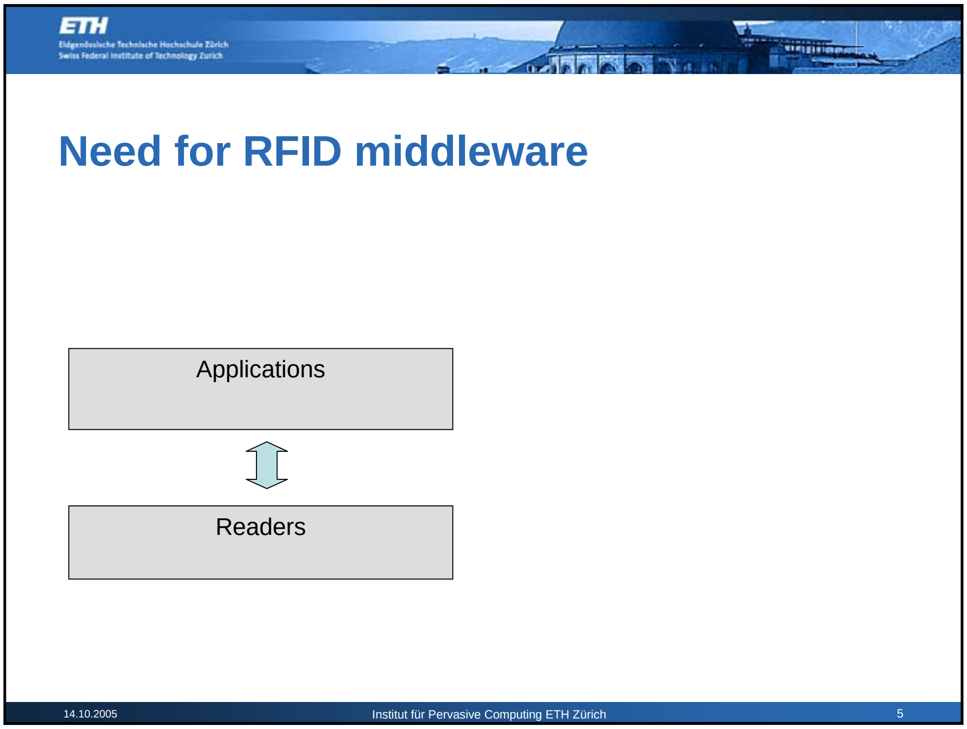


- Warehouse management
  - Update inventory
- Supply chain execution
  - Generate dispatch advice
- Pick & Pack Helper
  - Check pick list
- Regulatory compliance
  - Update pedigree

Future application landscape



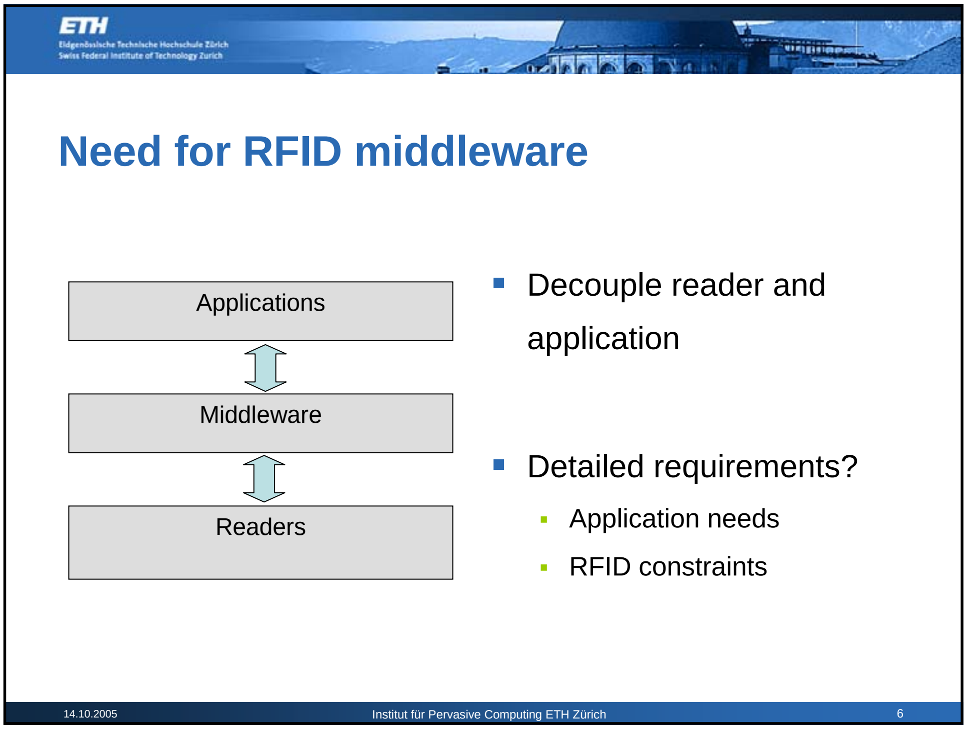
- 1000s of tags in range
- Dense reader deployments
- n-to-n relationship between readers and applications
  - RFID data are captured by multiple readers
  - consumed by various applications



Need for RFID middleware

Applications

Readers



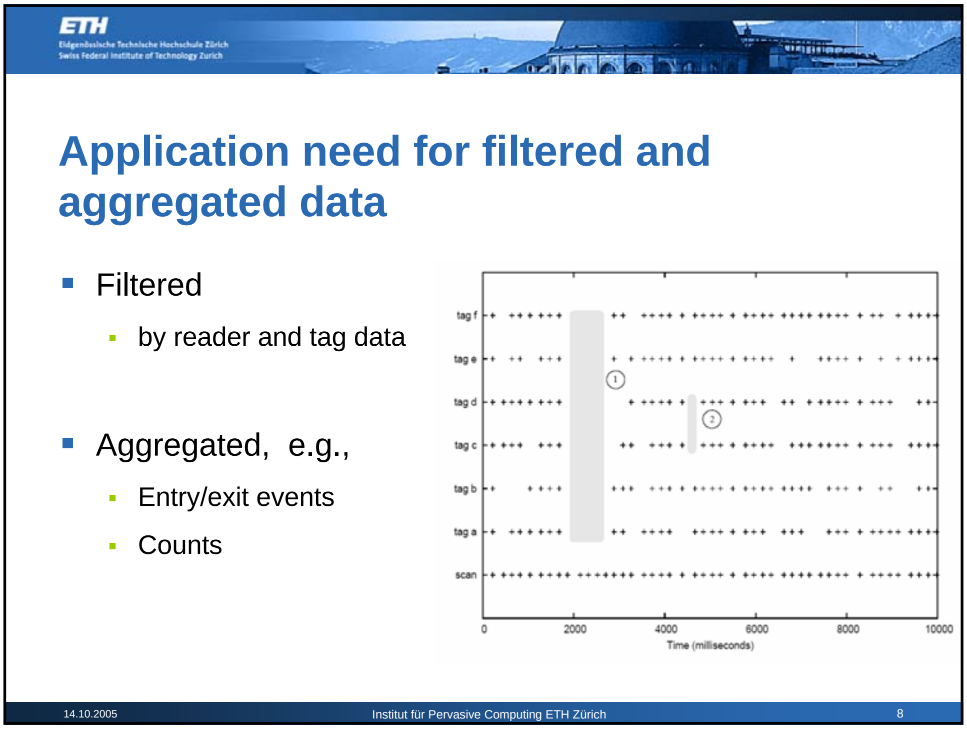
Need for RFID middleware

Applications

Middleware

Readers

- Decouple reader and application
- Detailed requirements?
  - Application needs
  - RFID constraints

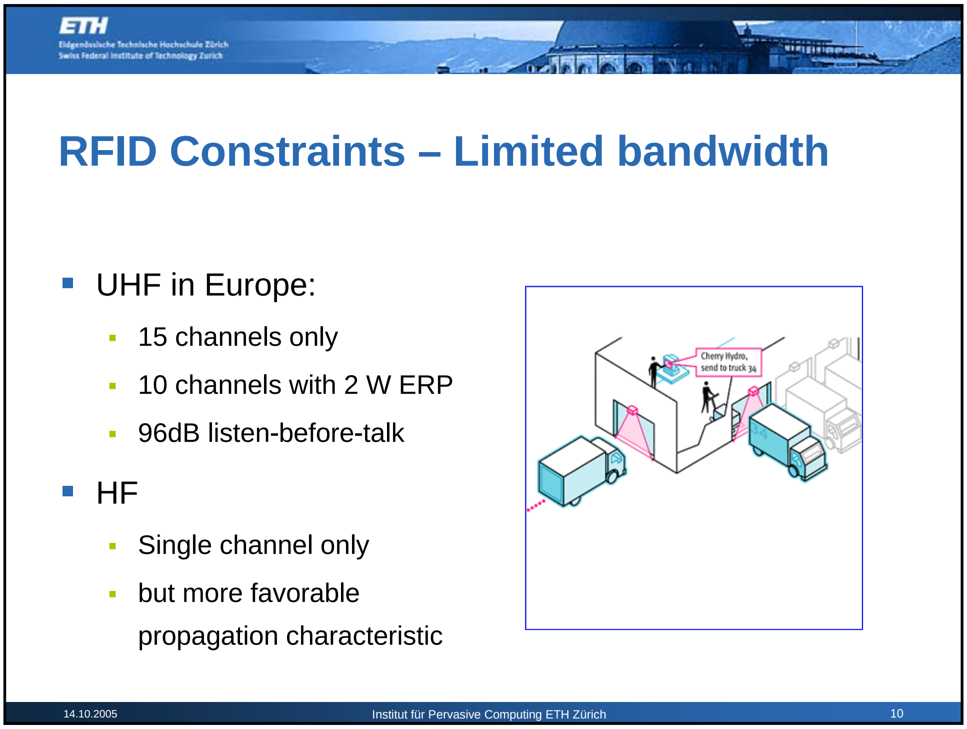


Application need for filtered and aggregated data

- Filtered
  - by reader and tag data
- Aggregated, e.g.,
  - Entry/exit events
  - Counts

Other application needs

- Support different notification latencies
  - Very short, where real-time updates are required
  - slow, where IT systems only daily receive batch updates
- Read-write to tags


Cherry Hydro, send to truck 34

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RFID Constraints – Limited bandwidth

- UHF in Europe:
  - 15 channels only
  - 10 channels with 2 W ERP
  - 96dB listen-before-talk
- HF
  - Single channel only
  - but more favorable propagation characteristic

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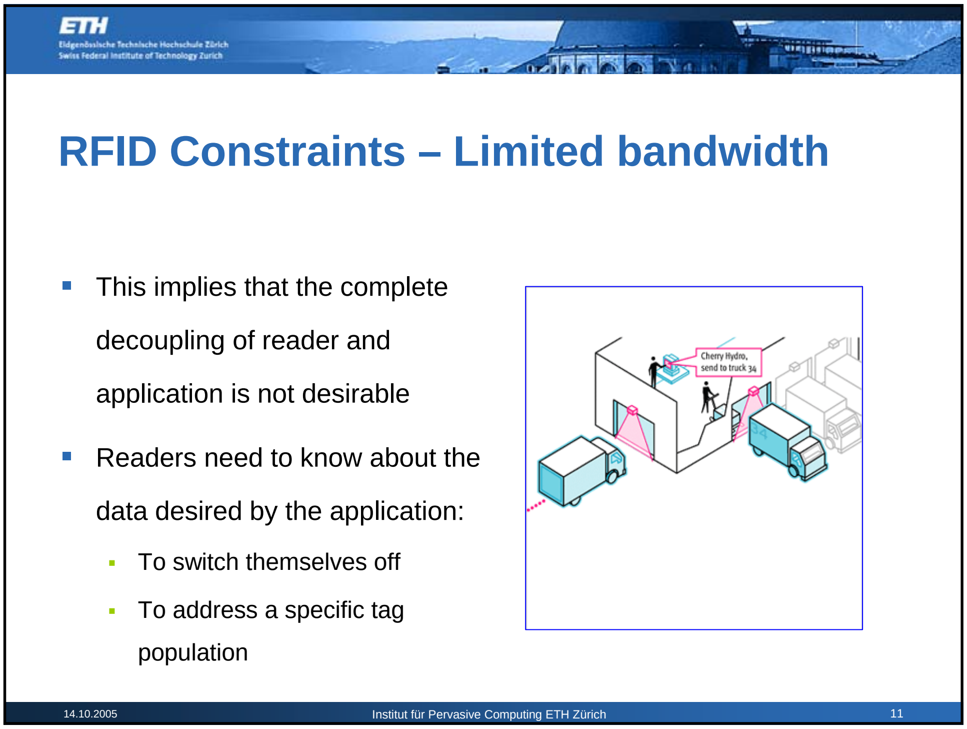
Cherry Hydro, send to truck 34

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RFID Constraints – Limited bandwidth

- This implies that the complete decoupling of reader and application is not desirable
- Readers need to know about the data desired by the application:
  - To switch themselves off
  - To address a specific tag population

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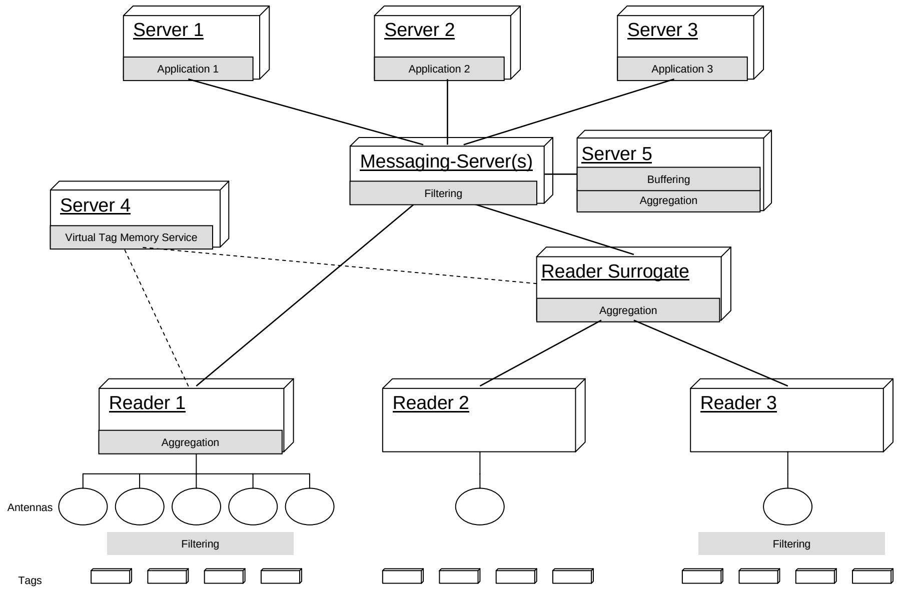
Other RFID constraints

- Heterogeneous reader landscape
  - Minimum computing capabilities vs full PC capabilities
- Tag memory organization varies

RFIDStack

- RFID middleware developed to address the application needs and RFID constraints
- based on a publish-subscribe messaging service that provides full content-based routing
  - Elvin by Mantara



Server 1
Application 1

Server 2
Application 2

Server 3
Application 3

Messaging-Server(s)
Filtering

Server 5
Buffering
Aggregation

Server 4
Virtual Tag Memory Service

Reader Surrogate
Aggregation

Reader 1
Aggregation

Reader 2

Reader 3

Antennas

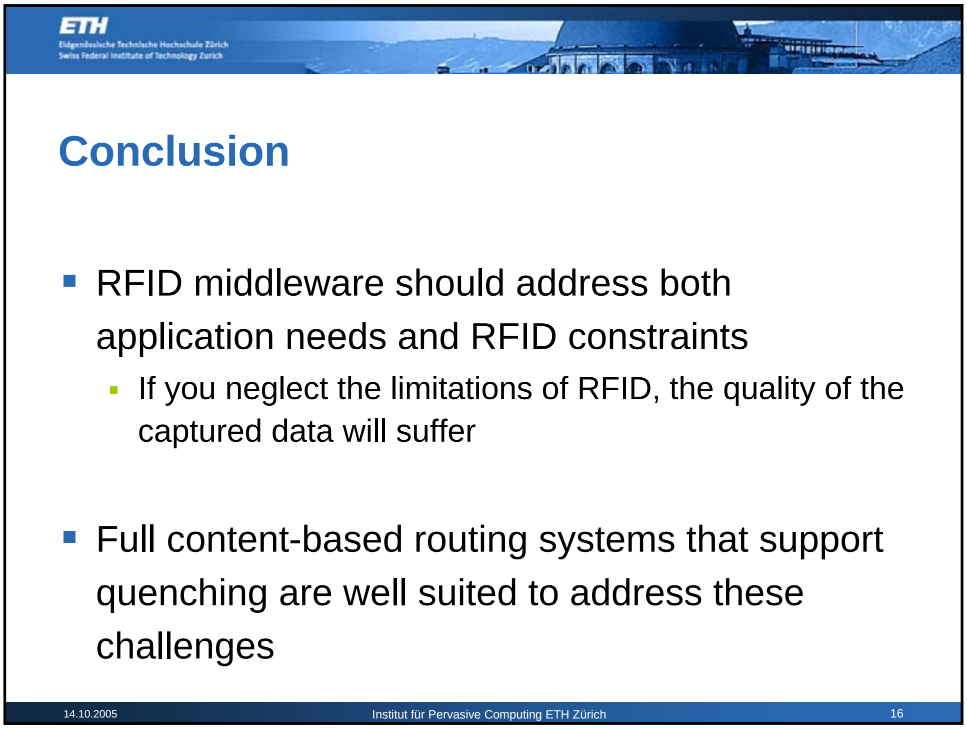
Filtering

Filtering

Tags

Related Work

- Savant, WinRFID
  - Focus on dealing with idiosyncrasies of different readers
  - Limited functionality addressing constraints of passive RFID
- Commercial products, e.g., SAP Auto-ID infrastructure
  - System monitoring
  - Strong focus on interpretation of RFID data in business context
- RFID reader interface standardization (EPC reader interface, SLRRP)



Conclusion

- RFID middleware should address both application needs and RFID constraints
    - If you neglect the limitations of RFID, the quality of the captured data will suffer
- Full content-based routing systems that support quenching are well suited to address these challenges