



Applications for Bidirectional Electronically Steerable Phased Array (BESPA™) Antenna Systems with Passive UHF RFID Tags

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April 14, 2010

ITCS: Proven Technology

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- RF Controls' **Intelligent Tracking and Control System (ITCS®)** is a standards-based, real-time location system which accurately locates & tracks passive UHF tags
- We have adapted rigorously proven technology utilized in military tracking / target acquisition applications
- ITCS is unlike any technology currently used within the auto-ID industry and takes passive UHF RFID to new heights

Topical Questions

- Type approved by the FCC, and certified compliant with ETSI RF emissions regulations⁽¹⁾
- Compliant with applicable ISO and EPCglobal standards
- For the DoD, ITCS is ordnance friendly (HERO) yet offers superior operational capabilities
- ITCS can be applied across a range of product classes and assets; simply apply inexpensive “Gen2” passive tags
- Supports multiple business processes using a common AIT infrastructure

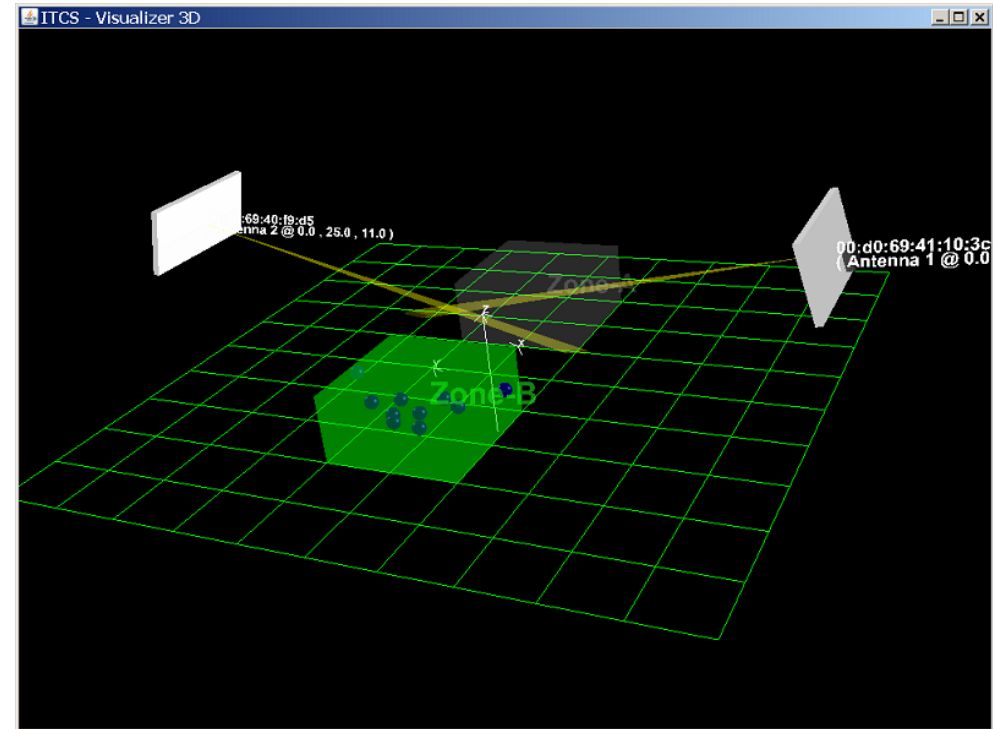
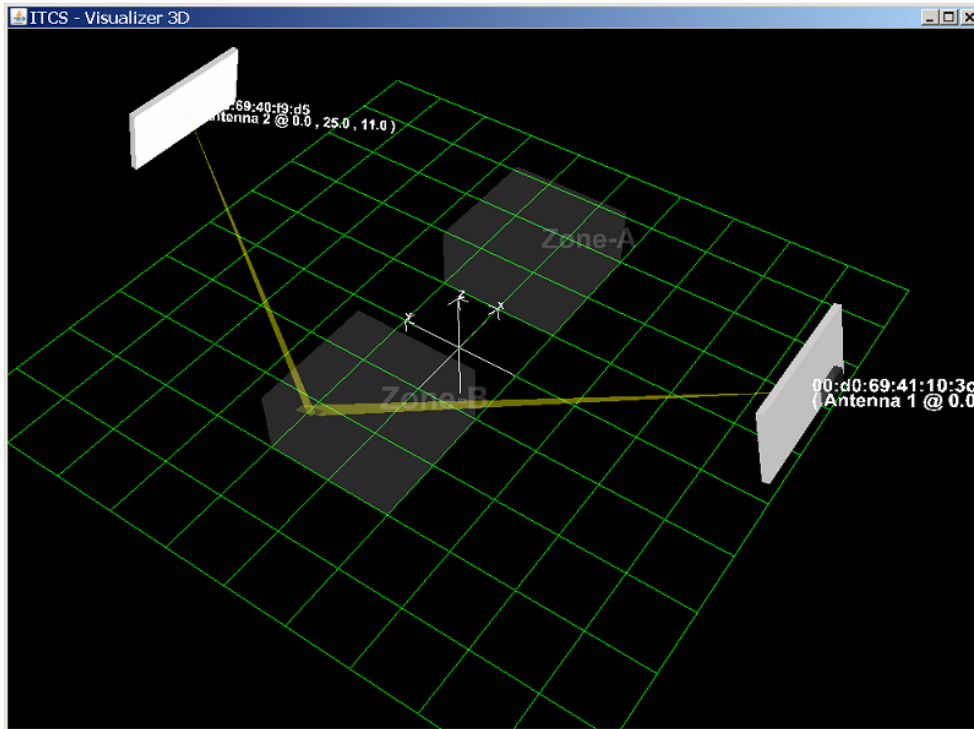
Note: 1) FCC CFR 47 Part 15.247; ETSI EN 302 208

ITCS Architecture

- Unique Bidirectional Electronically Steerable Phased Array (BESPA™) antenna technology
- ITCS employs distributed “smart antennas” – Signal Acquisition and Source Location (SASL®) modules
- One or more SASLs are managed by the ITCS Location Processor (LP)
- ITCS LP exposes collated, qualified data via a platform neutral API that is compliant with ISO/IEC 24730-1
- SASLs: software controlled antennas – superior intelligence at the edge

How ITCS Works

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- Distributed SASLs quickly scan volumes of interest
- Define multiple, variable size, non-contiguous scanning “zones”
- SASLs provide accurate locations of tags in 3D
- The ITCS Location Processor collates data from SASLs and presents qualified data via a platform neutral API

3D Location Video

UHF: Conventional vs. ITCS

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Characteristic	Conventional	ITCS
Energy focus	Spread over a wide “cone”	Place tag excitation energy only where it’s needed
Weak tag signals	Prone to interference, worsening SNR with increasing range; Rx antenna sees many unwanted signals	High gain directional antenna coupled to high performance reader
Multi-pathing	Severe problems with extraneous reads (e.g. at adjacent dock door portals)	Sophisticated multi-path ambiguity resolution algorithms <u>eliminate</u> spurious reads
Operating range	Forward link limited to $\approx 30'$	Maximum <u>operating range</u> of 120–130' with “-3” tags
Practicality in use	Antennas mounted close to where tagged objects move so damage is likely; sometimes there’s no room for a portal	Antennas mounted away from normal traffic and item movement – <u>distance is our friend</u> , not an impediment
Tag sensitivity	Increases the likelihood of extraneous or spurious reads and “dirty data”	The more sensitive the tag, the more valuable ITCS becomes

ITCS Performance

- ITCS can excite, read and accurately locate Higgs-3 and Monza3 based tags at 120–130'⁽²⁾
- A single SASL provides 3D tag location data
- ITCS can locate each tag in three dimensions with an accuracy of $\approx \pm 1.5'$ (<1' range accuracy)
- Proven statistical signal processing methods resolve ghost images caused by multi-pathing effects and negate spurious (extraneous) reads
- Tracking is accomplished by time-stamping tag location data in the ITCS LP's database

Note: 2) Operating range is critically dependent on tag characteristics

Locating Inventory

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The conventional approach requires numerous, fixed reader components plus hand-held readers, is difficult to adapt to variable plan-o-grams and does not support discovery of the locations of arbitrarily placed inventory

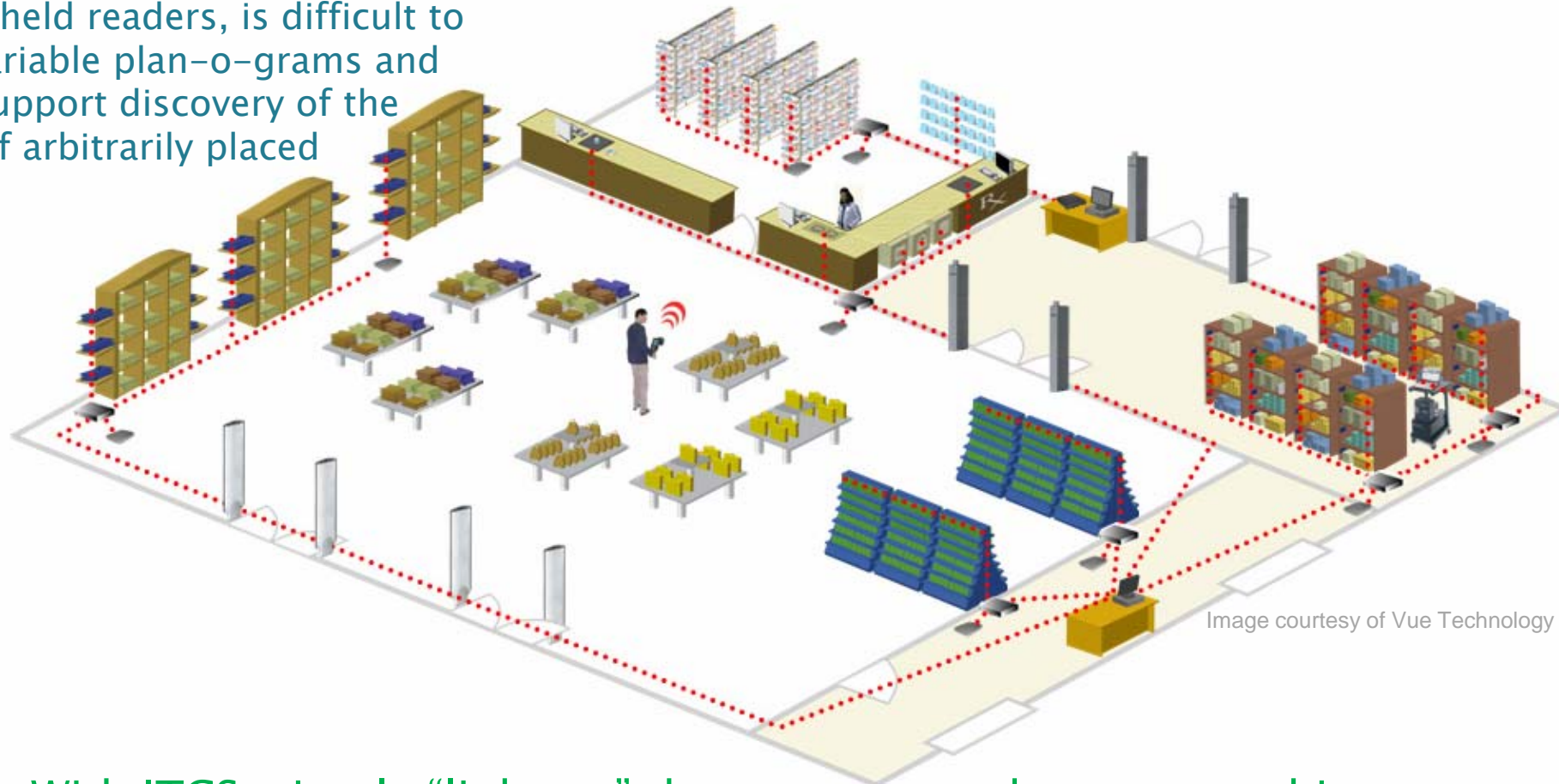


Image courtesy of Vue Technology

With ITCS, simply “light up” the store or stock room to achieve automated, real-time inventory monitoring; tagged goods may be positioned arbitrarily

Locating Inventory

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ITCS SASLs, one at
each end of the
long aisle



Food services distribution center, products in high bay metal racks
Ceiling 23', rack spacing 15' , 2 SASLs 100' apart
Aisle coverage is end to end, floor to top of pallets on the upper rack
Location accuracy $\sim \pm 1.5'$ in 3D, consistent throughout the aisle

The Familiar Portal

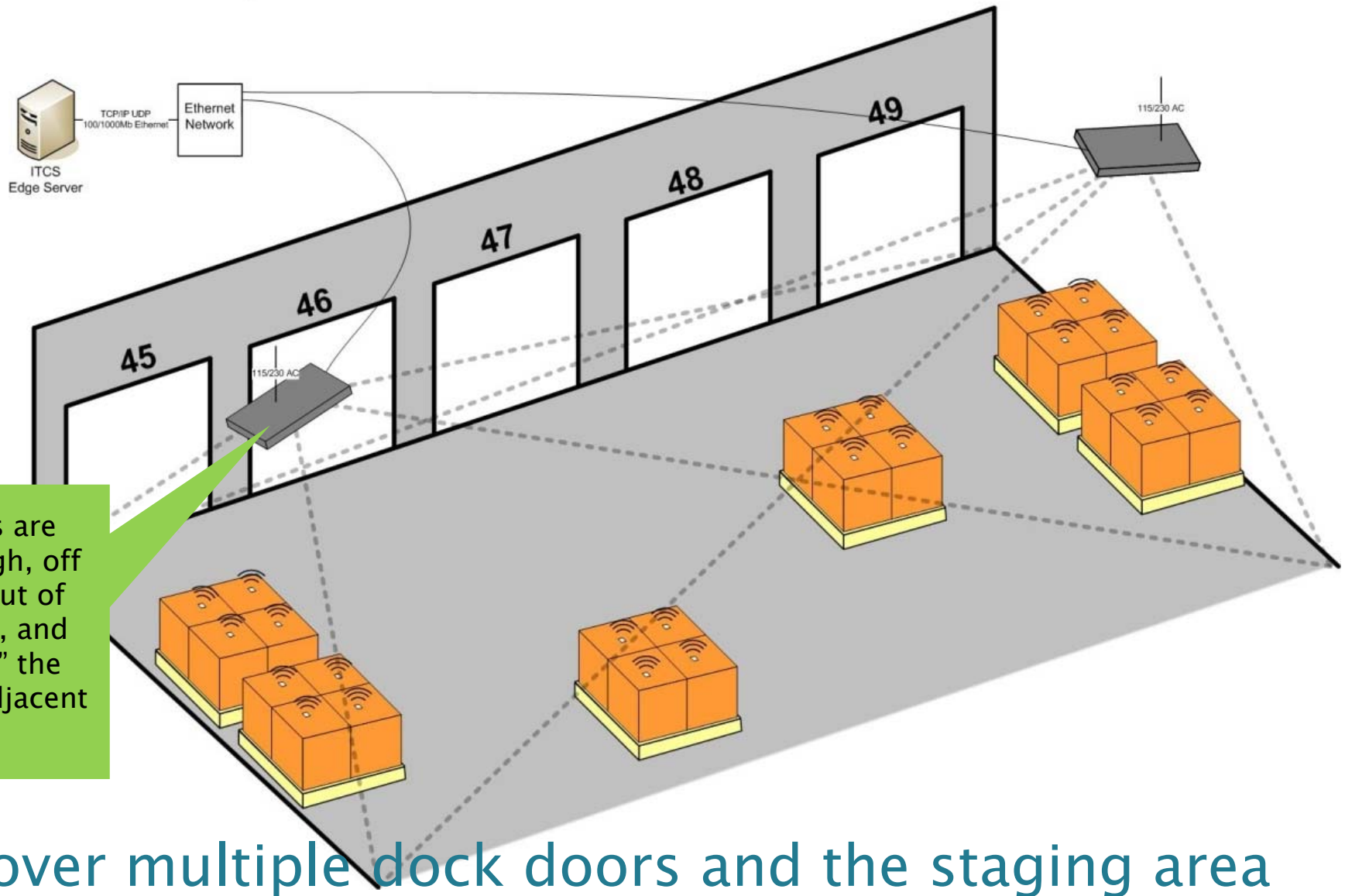
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Image Courtesy of USTRANSCOM

An Approach Using ITCS

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ITCS SASLs are mounted high, off the floor, out of harm's way, and "illuminate" the doors and adjacent areas

Cover multiple dock doors and the staging area

Selected ITCS Applications

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- ☑ Efficient goods receiving; pallet, carton/case, item
- ☑ Inventory location, leading to efficient directed workflow for associates
- ☑ Automated real-time monitoring of staging operations
- ☑ Confirmation of dispatch: right product, right door
- ☑ Capital asset management
- ☑ For perishable goods, proactively managing inventory on a first-to-expire, first-out (FEFO) basis to minimize spoilage

ITCS Applications

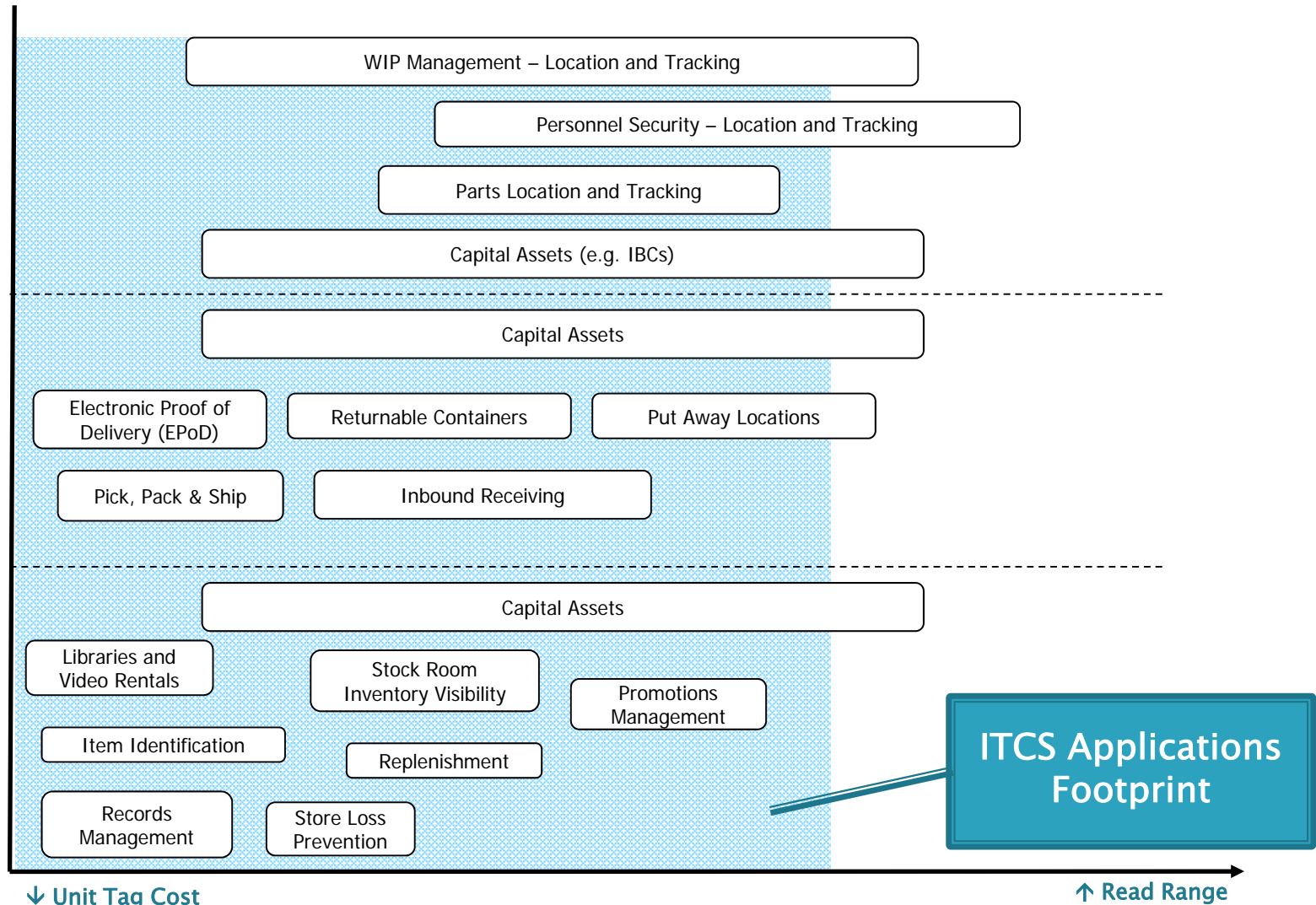
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Nature of the Business Environment

Manufacturing

Distribution and Warehousing

Retail Store or "Office"



Complementary RFID Technologies

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