

# Obstacles to Effective Conversation



Bruce Balentine, Chief Scientist  
Enterprise Integration Group

*bruce.balentine@gmail.com*

---

# Key Topics

- Interactivity
  - ✓
    - Turn-taking
    - Standardized error-recovery behaviors
    - Reusable speech-behavior patterns
- ✓
  - Theory of Mind
  - Memory
    - Short-term working memory
    - Long-term user profile and experience

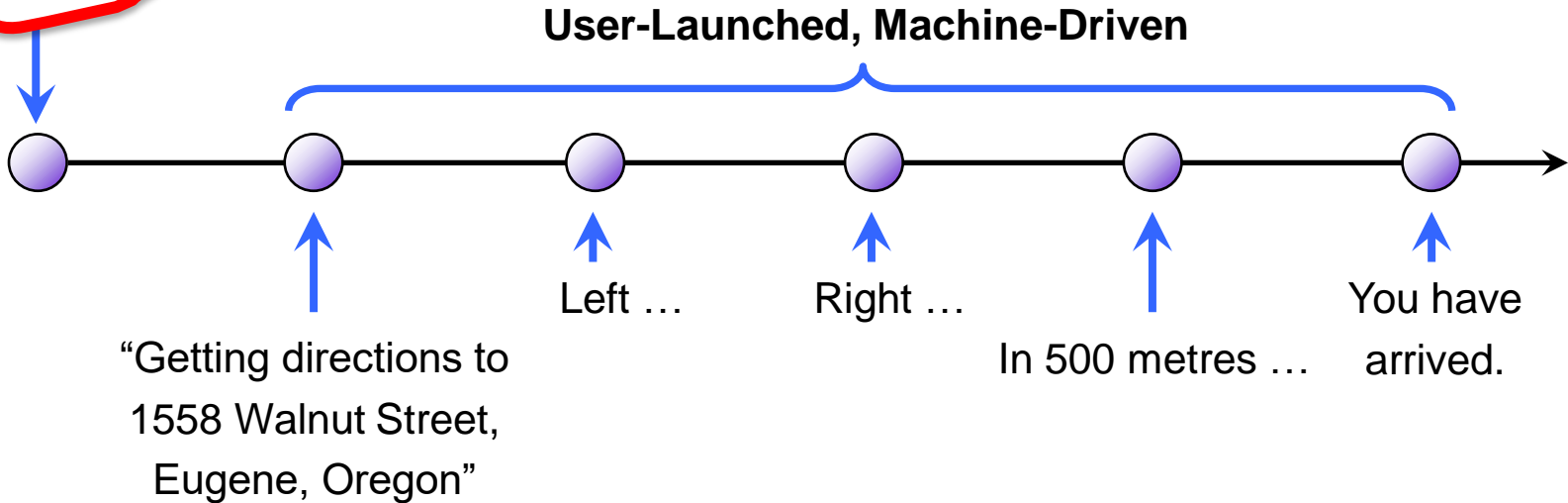
# Beads On a String



- At a given moment, anyone in a conversation may be:
  - Speaking
  - Silent (presumably listening)
  - Thinking of speaking (preparing)

# VUI “Conversation” is Often a 1-Shot

“Hey, Siri, take me to  
1558 Walnut Street in  
Eugene, Oregon!”



# Natural Language 1-Shot



Hey, Siri, give me directions to  
1558 Walnut Street, Eugene,  
Oregon, 97403, please.

**Redundancy**

**Wake-Up Word**

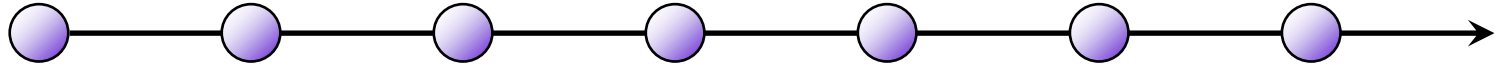
Alexa, play "Timber" by Pitbull.

**Redundancy**



**Courtesy Filler**

# Interactivity Complicates Things



- Whose turn is it to speak?
- When collisions happen, who yields?
- How does one take back a turn once it's lost?
- How does one handle partial utterances/restarts caused by interruptions?

# A Single Application State

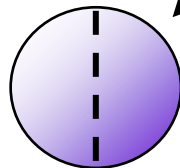
## Prompt

- pre-recorded digital audio
- text-to-speech synthesis
- non-speech audio
- silence/waiting
- visual cue

## spoken user input

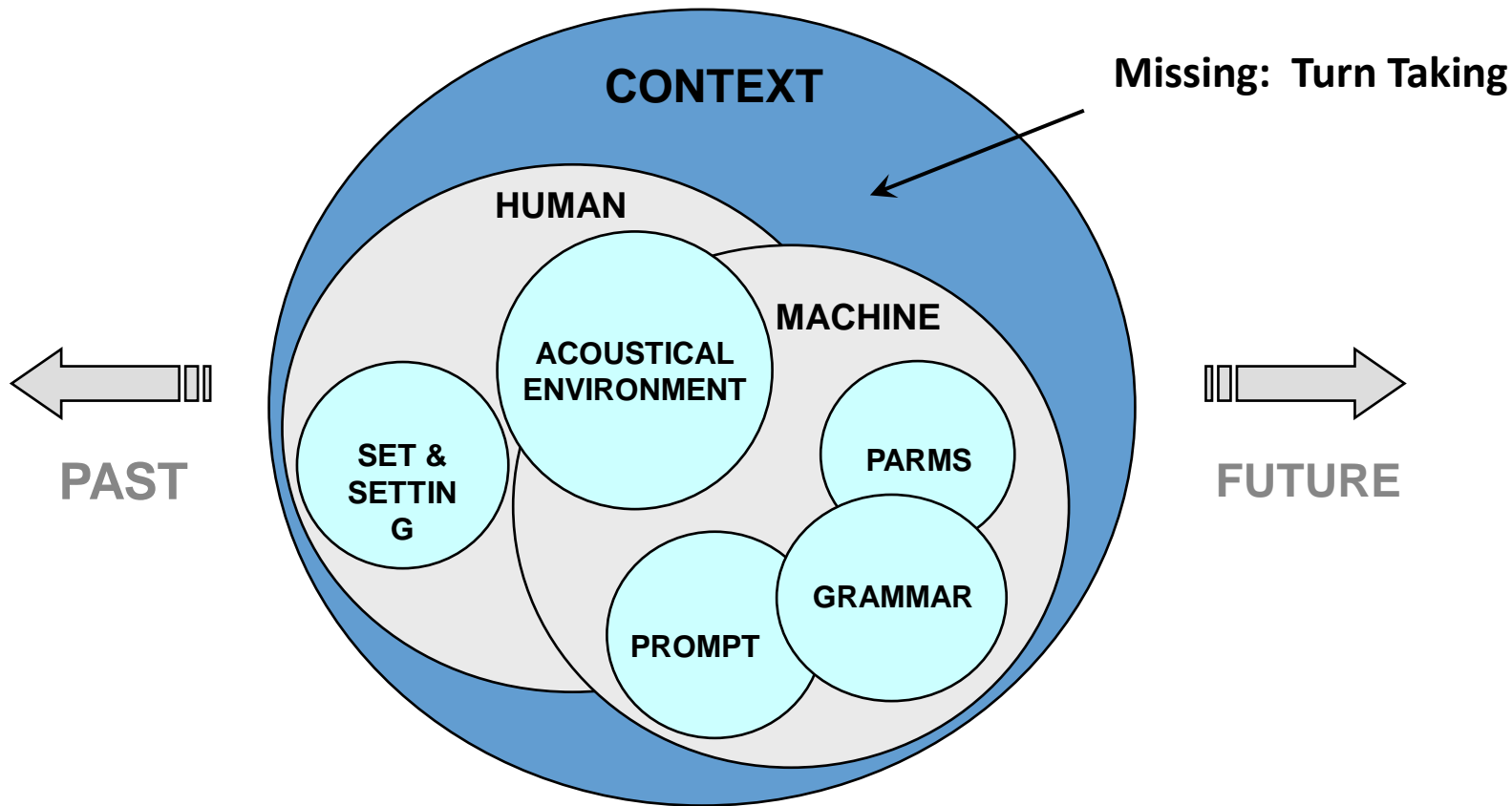
## Response

- can be any speech
- could be background noise
- expected to be in grammar
- result is highly uncertain



machine setup

# Inside a Bead





# Meta-Conversation

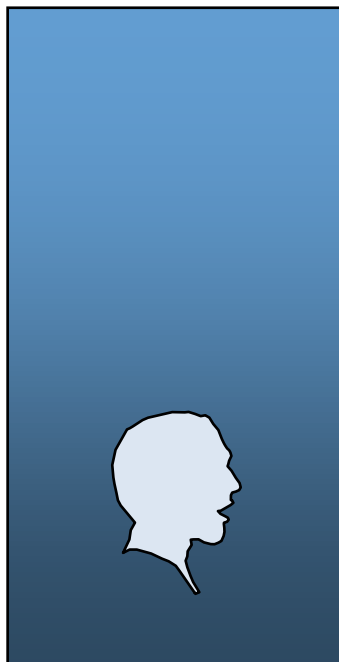
- “I need to go back and fix/change something.”
- “You need to stop talking and let me talk.”
- “Skip this part but keep talking ... I’ll stop you when I hear something I want.”
- “Whoa, slow down!”
- “What was that again?”
- “Let’s start over.”
- “No, that’s not right.”

# THEORY OF MIND

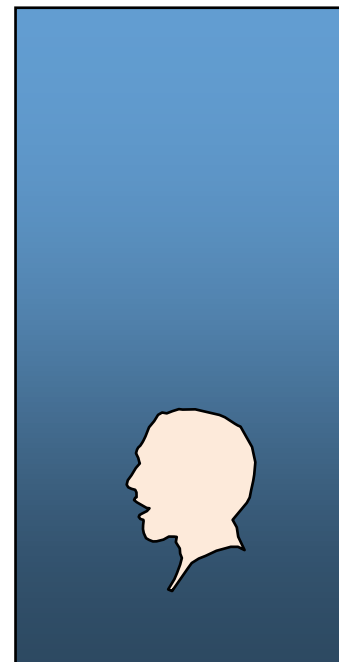
---

# Human to Human Conversation

HUMAN 1



HUMAN 2



Conscious Mind

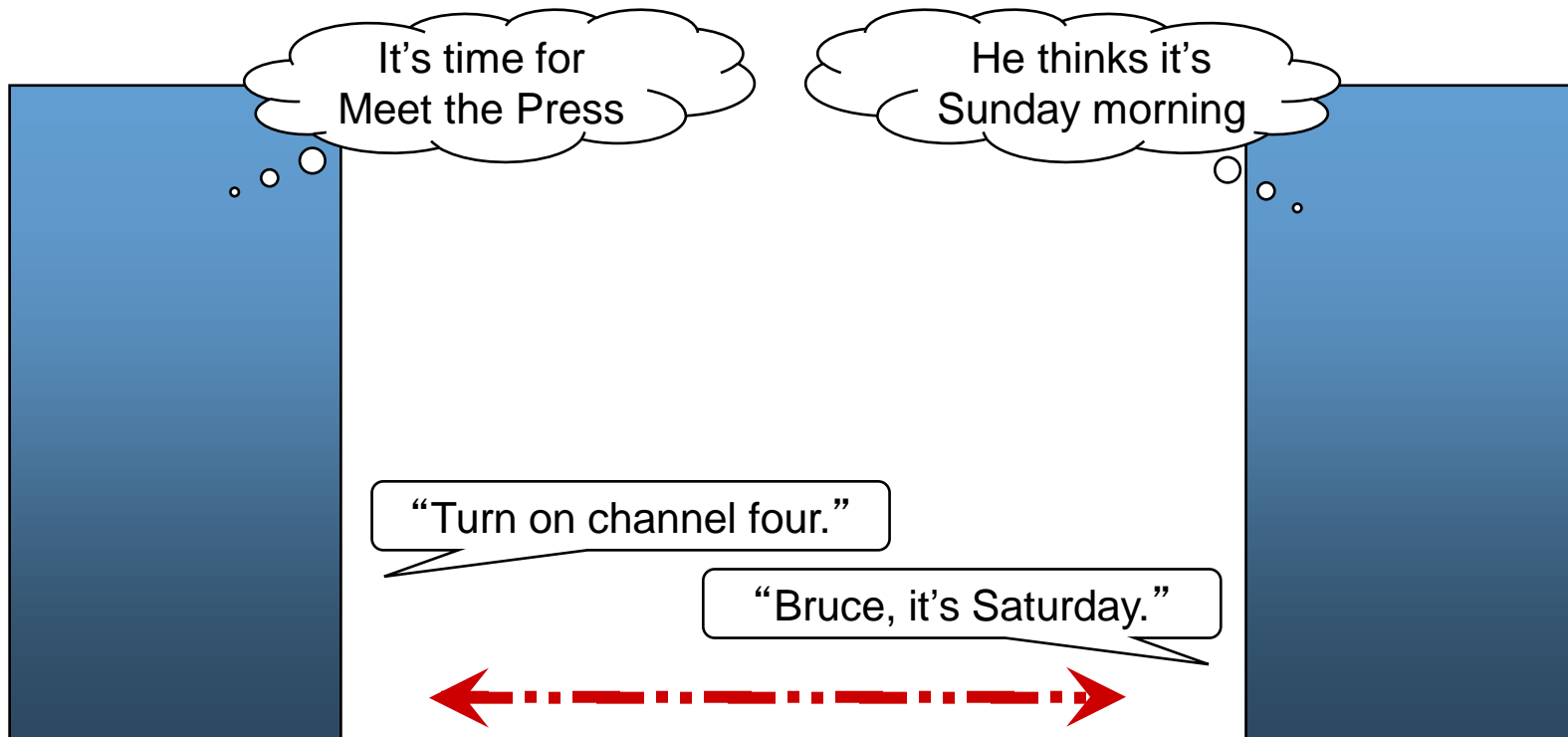
High-Level Functions  
(cognition)

Lower-Level Functions  
(perception)

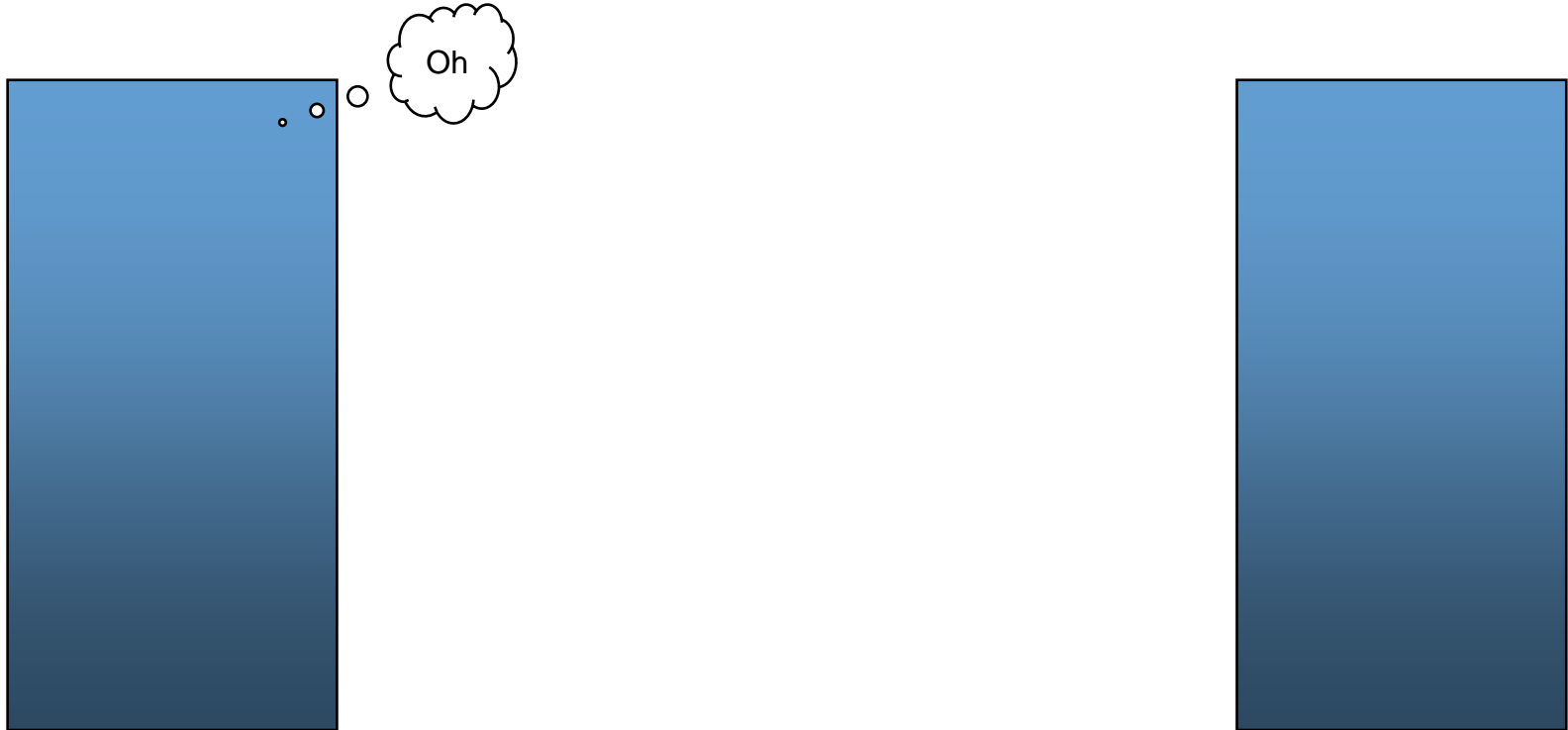
Physical Body



# Human to Human Conversation

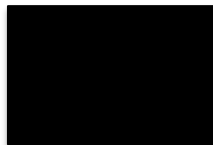


# Human to Human Conversation



# Human-Machine Conversation

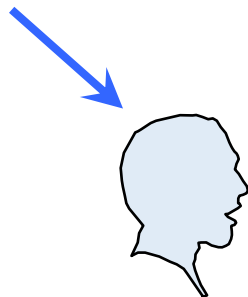
- **Conscious**
- **Intelligent**
- **Sentient**



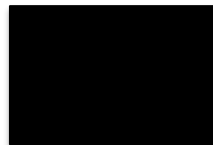
- **Good Pattern Recognition**
  - **Fast**
  - **Access to internet & data**
- 
- **NOT Conscious**
  - **NOT Intelligent**
  - **NOT Sentient**

# The Grand Illusion

**... and then trick the user  
into believing.**



**We'll just make this black-box ...**



**... into a simulated human!**

# Symptoms of False Theory

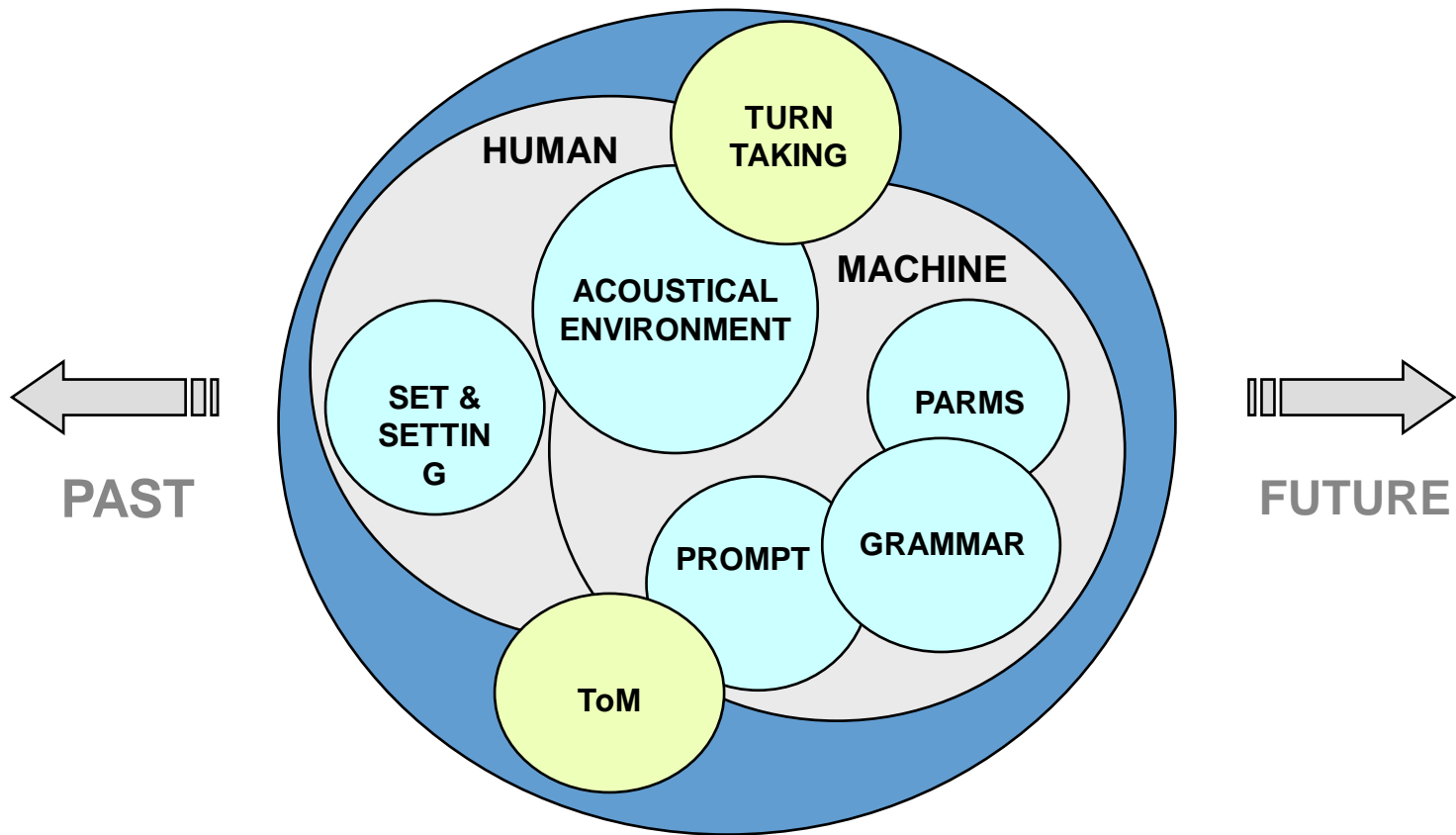
- Slowed, exaggerated speech
- Reduced, underspecified or telegraphic speech
- Meta-conversation guesses
- Assumption of working memory



# ToM Model: 4 Requirements

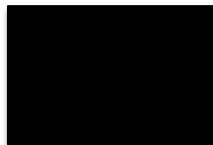
1. The behavior of the machine must be consonant with the user's evolving theory.
2. The machine must model the user, including the user's theory of the machine's mind.
3. The machine must model itself, including its own performance state-by-state.
4. The machine must model the conversation.

# Local Context



# Human-Machine Conversation

- **Conscious**
- **Intelligent**
- **Sentient**

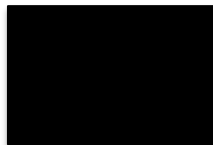


- **Good Pattern Recognition**
- **Fast**
- **Access to internet & data**

- 
- 
- **NOT Conscious**
  - **NOT Intelligent**
  - **NOT Sentient**

# Human-Machine Conversation

- **Conscious**
- **Intelligent**
- **Sentient**



- Good Pattern Recognition
- Fast
- Access to internet & data
- NOT Conscious
- NOT Intelligent
- NOT Sentient

Alien

# A Credible Entity

- These behaviors will penetrate rapidly once standardized.
- Every time users encounter conversational errors, they will know what to do.
- No one will care that it's not like “talking with a human.”
- In fact, it will be better than talking with a human. Faster, more effective, less frustrating.
- New devices will spread rapidly. AI will be comprehensible.
- Speech will become interactive rather than obtuse.
- This is the real value proposition.

# Thank You!

Bruce Balentine, Chief Scientist  
Enterprise Integration Group



*[bruce.balentine@gmail.com](mailto:bruce.balentine@gmail.com)*

---