

Synthetic Agent Relationship Adaptation Via Meta-Dialog

What people expect from an
intelligent agent

Emmett Coin
Industrial Poet

ejTalk, Inc. www.ejTalk.com



Who Am I?

- Emmett Coin
 - Industrial Poet
 - Rugged solutions via compact and elegant techniques
 - Focused on creating more powerful and richer dialog methods
- ejTalk
 - Frontiers of Human-Computer conversation
 - What does it take to “talk with the machine”?
 - Can we make it meta?



Ideas this talk should provoke...

- History and context dynamically modify dialog.
 - How it simplifies dialog design.
 - Why it improves conversational efficiency.
- Deconstructing big problems into manageable chunks.
 - How reassembling makes the whole greater than the sum of the chunks.
- Remembering and appropriate behavior
 - Why it improves consistency.
 - I know that you know that I know ...
- What do we expect from a real conversation?



Meta is a part of Automaticity

- Automaticity:
 - The fluent processing of information that requires little effort or attention.
 - The ability to do things without occupying the mind with the low level details required.
 - Knowing how to do something so well that you do not have to think about it while doing it.
 - The delegation of behavioral nuance.
 - Less micro-management.
 - Second nature
 - Riding a bike



“Automatic” Implies

- Rules
 - Proven algorithms
 - Describable by a formalism
 - High level semantics – derivable syntax
- Delegation
 - Relinquish control to a “separate” intelligence
 - Trust it will be accomplished
 - Accept a “high-level” activity summary.



How Dialogs Adapt Now

- Often they just don't
 - That's easy...
- Some use “Nth re-prompt” or “no-input” features
 - Handle errors and get back on track
 - Adapt just to lead you “back on the rails”
- Others will design in “collapsing” or “telescoping” prompts
 - Shorten evermore repetitious prompts in specific state
 - A small step in the right direction
- Where does this lead?
 - New Wants in the future?



Grice's Conversational Maxims

- Things that make a conversation feel more “real”
 - Truth (do not lie or invent)
 - Quantity (enough info – no more)
 - Relation (relevance)
 - Manner (avoid confusion, be brief and clear)



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Meta Dialog



Computer: {generate=>systemSignOn} [System starts]

Human: Hello, Cassandra.

Computer: {generate=>openingHello} {find=>userName}
[Some period of non-conversational time]

Human: Cassandra, you there?

Computer: {generate=>iAmHere}

Human: What's the date for my SpeechTEK presentation?

Computer: That's {date=>queryDate}.

Human: Do I have any meetings on the following Friday?

Computer: {date=>targetDate} is completely free.

Human: Okay, schedule a meeting with Chris at 11am.

Computer: Okay, a meeting with Chris at {timeDate=>targetTimeDate}.
[Another long pause ...]

Human: Are you there Cassandra?

Computer: {generate=>iAmHere}

Human: Goodbye Cassandra.

Computer: {generate=>systemSignOff} [System shuts down]



Raw Dialog



Computer: Cassandra here, let's get started! [System starts]

Human: Hello, Cassandra.

Computer: Greetings Emmett.

[Some period of non-conversational time]

Human: Cassandra, you there?

Computer: Yes, what do you need?

Human: What's the date for my SpeechTEK presentation?

Computer: That's Tuesday August 19, 2008.

Human: Do I have any meetings on the following Friday?

Computer: Friday, August 22nd is completely free.

Human: Okay, schedule a meeting with Chris at 11am.

Computer: Okay, a meeting with Chris at 11am on the 22nd.

[Another long pause ...]

Human: Are you there Cassandra?

Computer: Of course, I'm still here.

Human: Goodbye Cassandra.

Computer: Bye for now.

[System shuts down]

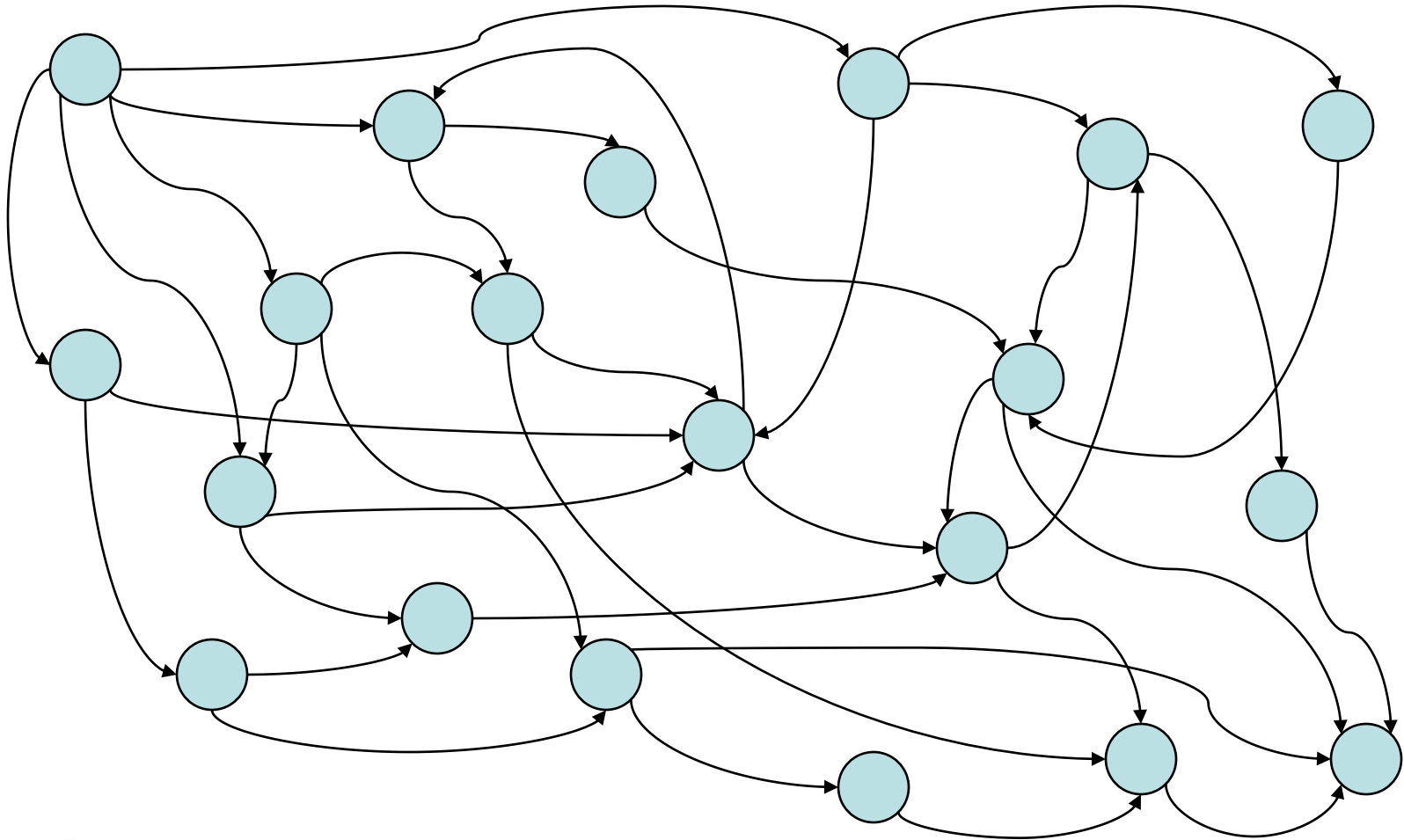


What the Blackbox Provides

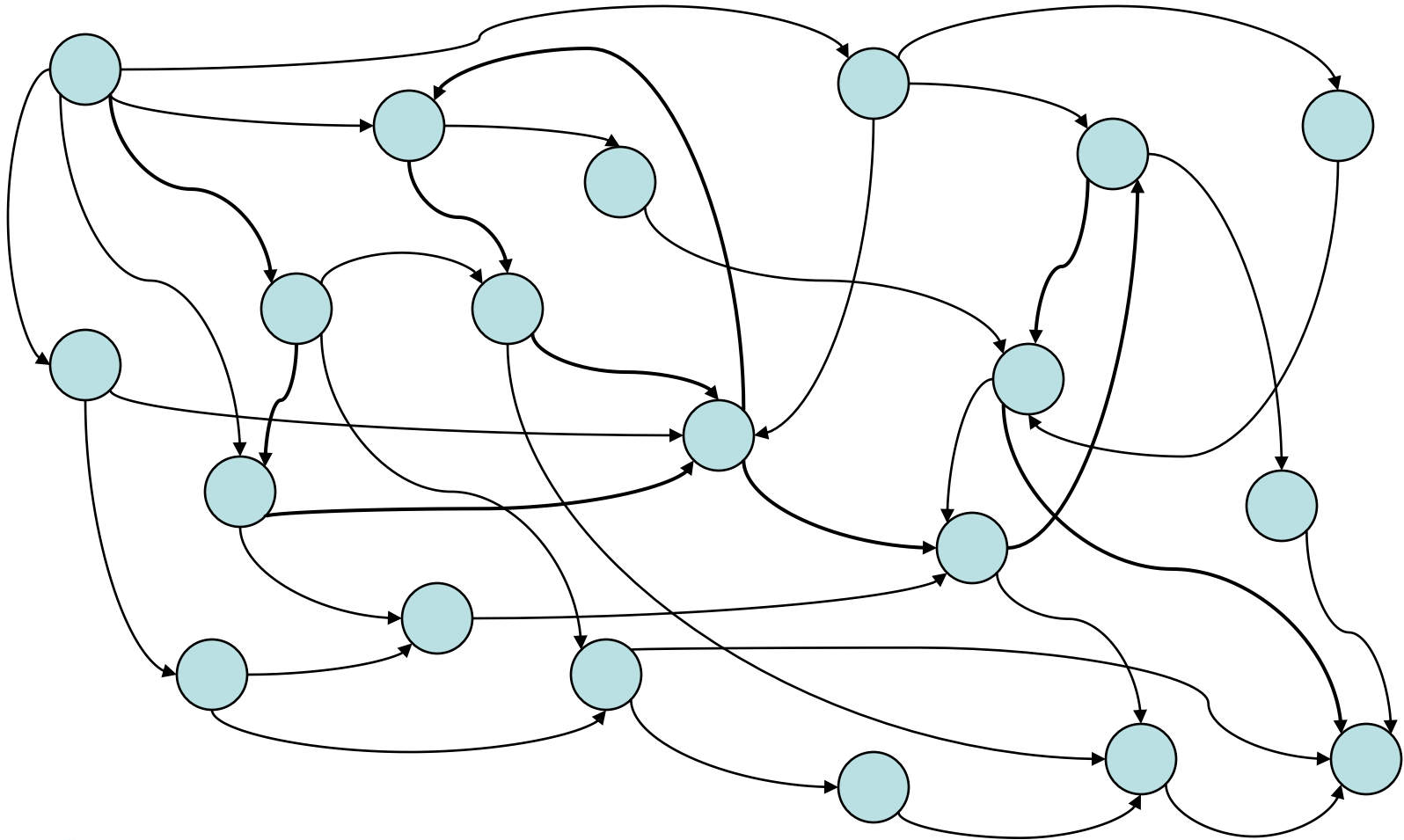
- Delegation of appropriateness
 - Operate at a purely semantic level.
- Consistency of behavior
 - Adaptation happens the same everywhere and every time
- Simplification of dialog design
 - No need to create different states for adaptive variations



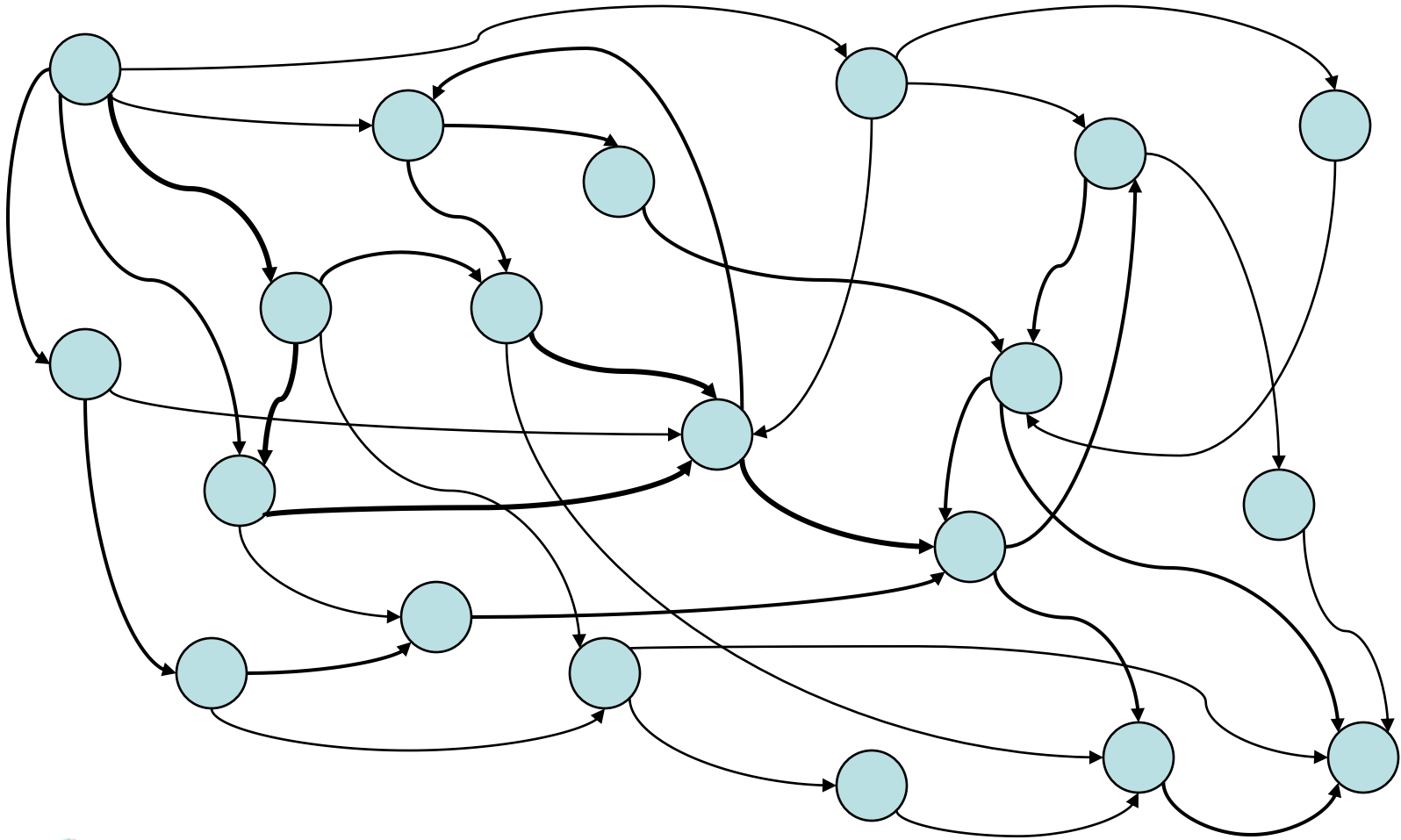
Dialog Network



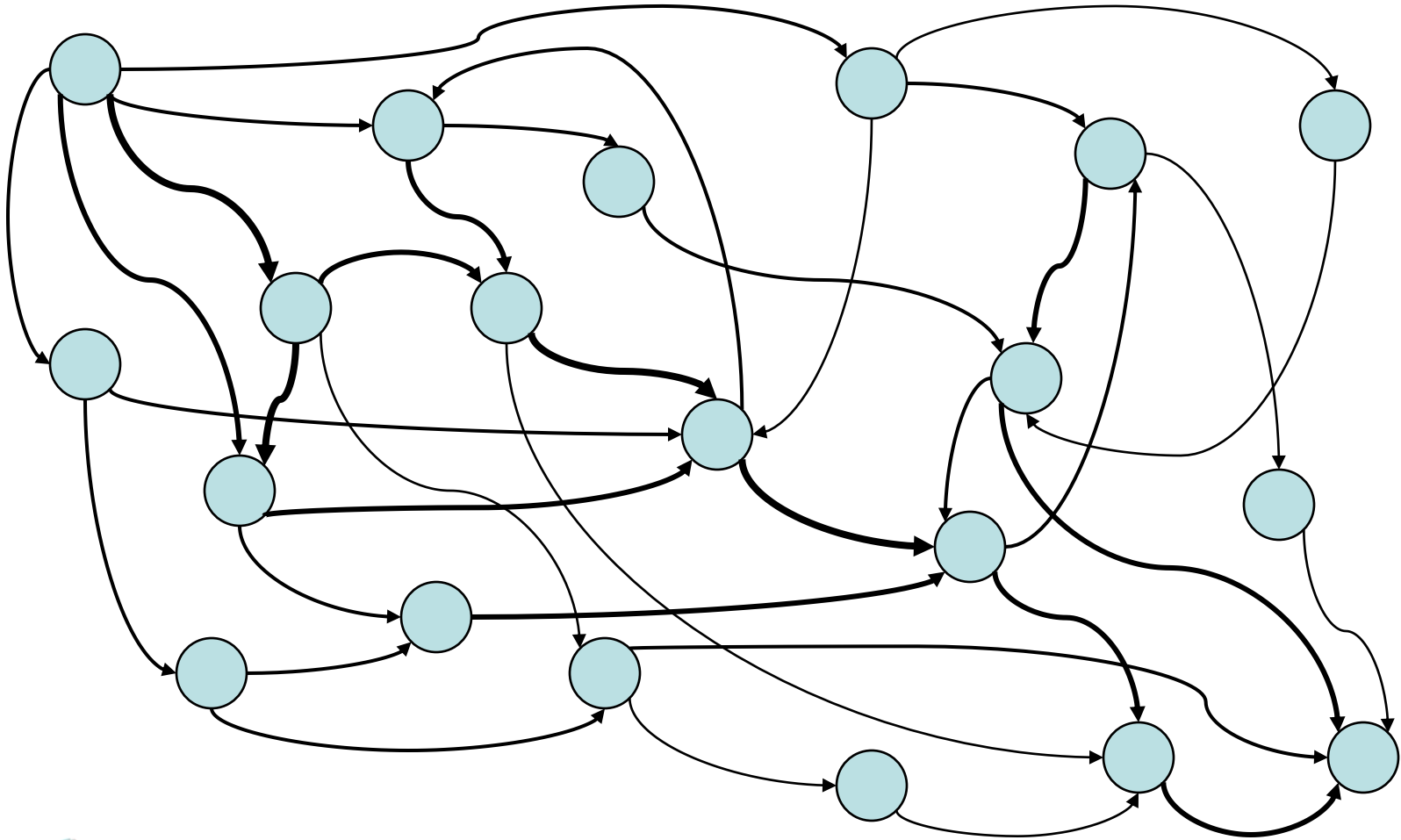
Dialog Network



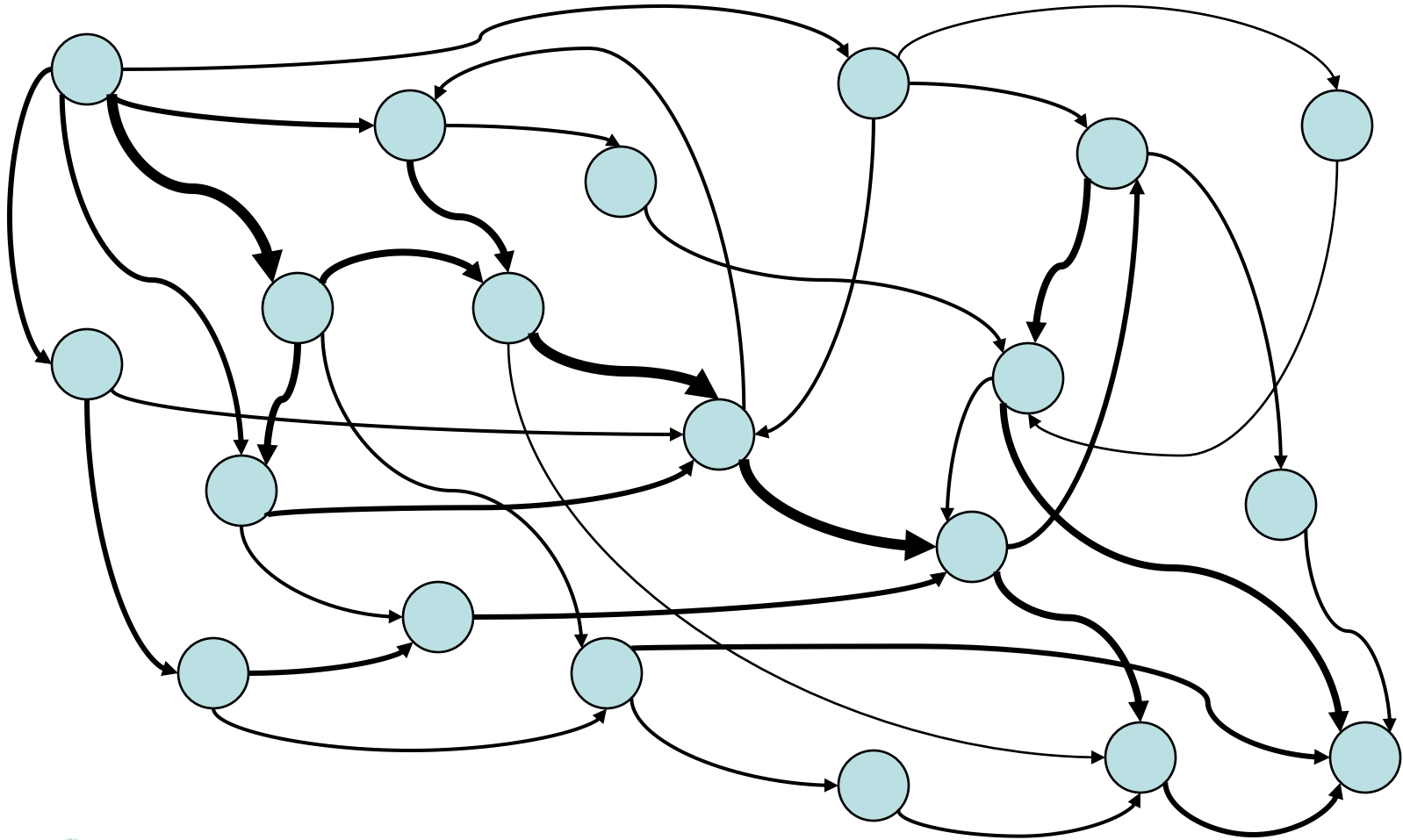
Dialog Network



Dialog Network



Dialog Network



Adaptation with Experience

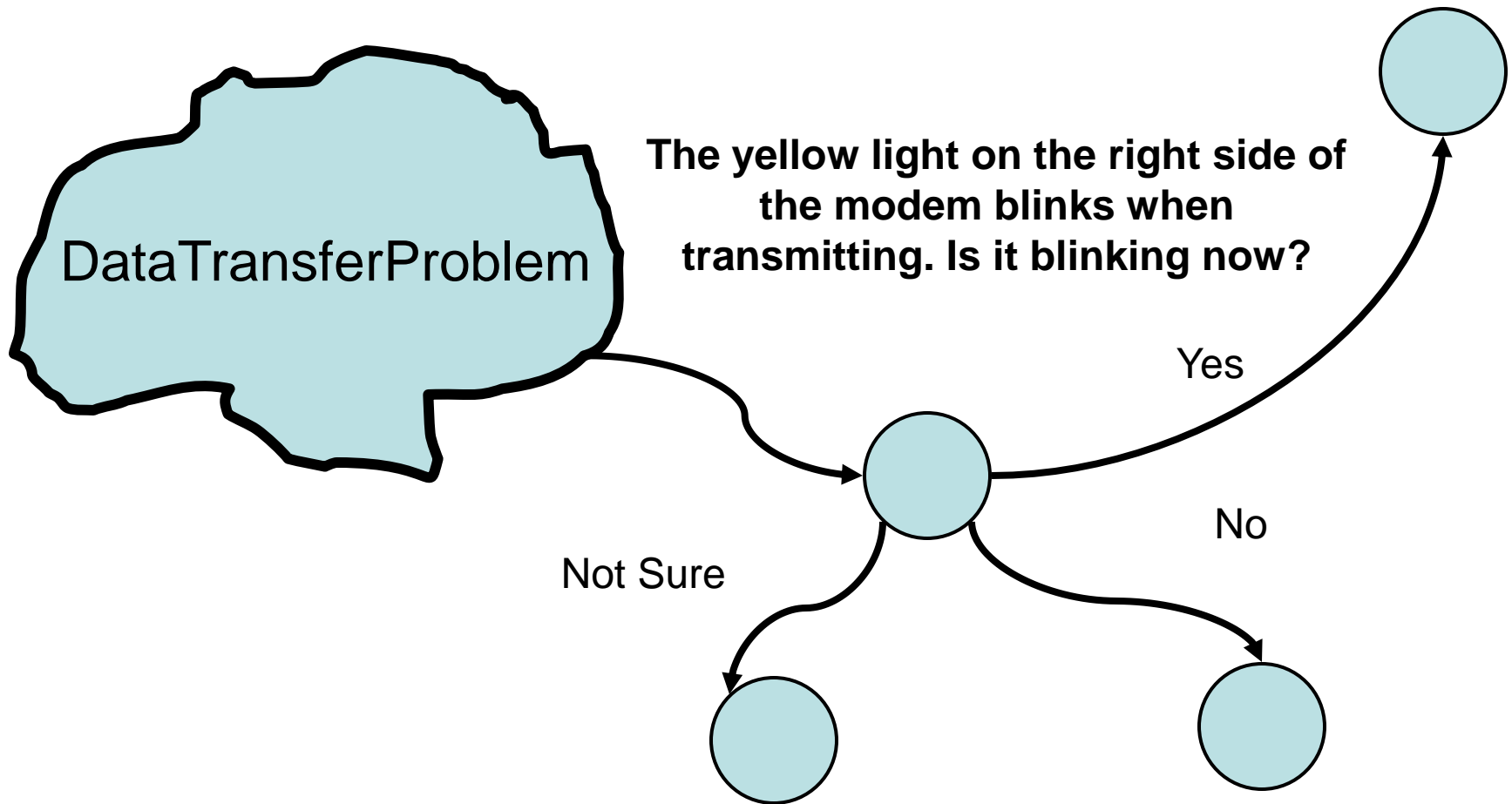
or Been There, Done That (BTDT)

- When people work together they always adapt their interaction style over time.
- Adaptation is about
 - Learning
 - Forgetting
- It is rude not to adapt (non-Griceian)
 - Wasting your partner's time
 - Underestimating their intelligence



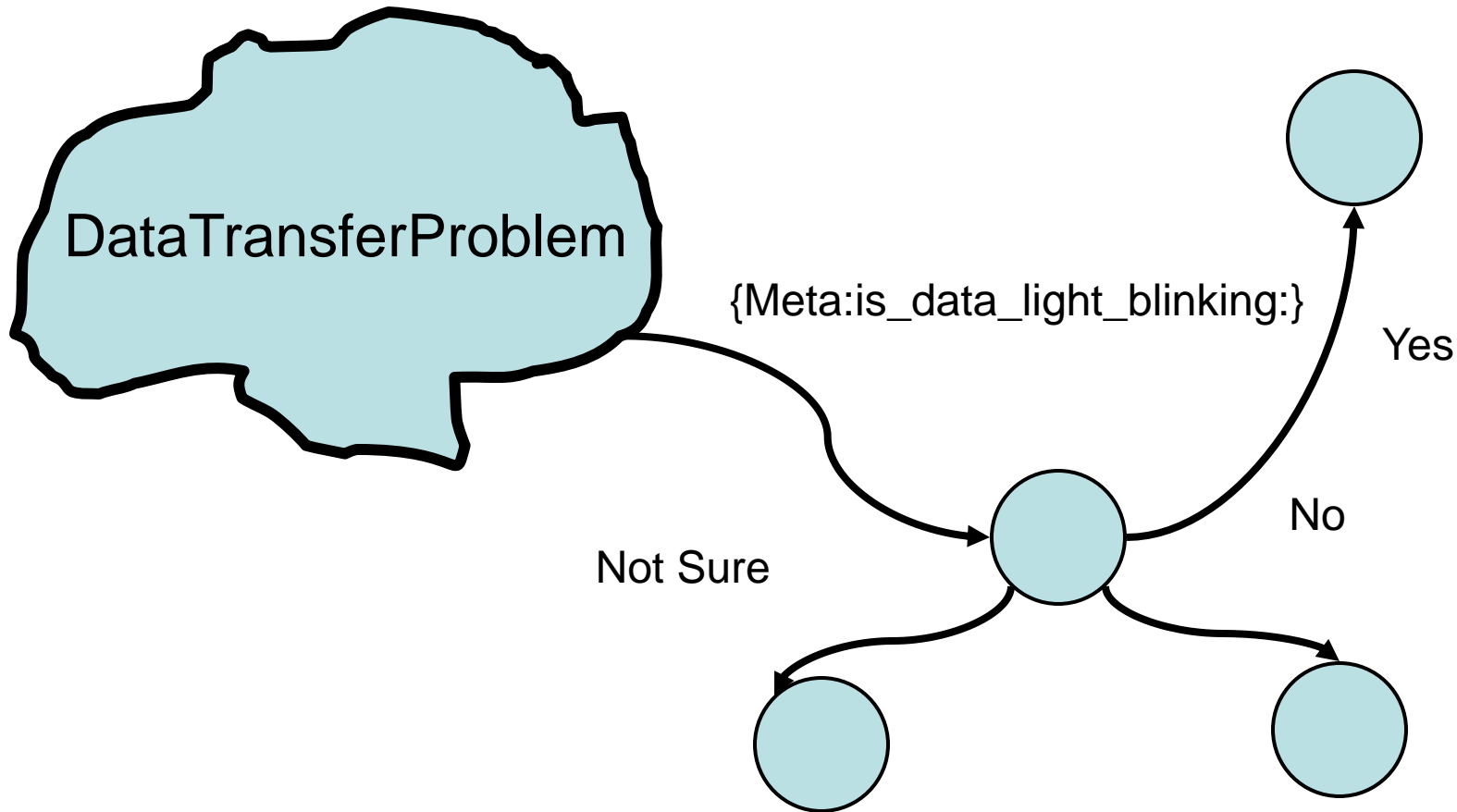
Searching for a Diagnosis

(troubleshooting a cable modem)



Searching for a Diagnosis

(troubleshooting a cable modem)



MetaText Levels:One Approach

{Meta:is_data_light_blinking:}

- **Introductory**
 - 1st Time visit
 - Purpose and rational
- **Tutorial**
 - How to do it
 - Expectations
- **Beginner**
 - Walk me thru it
 - Use all the terms
- **Normal**
 - Just right
 - I know what I'm doing
- **Expert**
 - Cut to the chase
 - Just as short as makes sense



MetaText

{Meta:is_data_light_blinking:}

[Semantics with the Prompts?]

```
<is_data_light_blinking>
  <val>Is the data transfer light blinking?</val>
  <intro>
    <val>We need to check if the data is being transmitted. The yellow light on the right side of
      the modem box should be blinking now. Is it?</val>
  </intro>
  <tutorial>
    <val>The yellow light on the right side of the modem blinks when transmitting. Is it blinking now?
    </val>
  </tutorial>
  <beginner>
    <val>Is the yellow modem transmit light blinking?</val>
  </beginner>
  <normal>
    <val>Is the yellow transmit light blinking?</val>
  </normal>
  <expert>
    <val>Is transmit blinking?</val>
  </expert>
</is_data_light_blinking>
```



MetaText

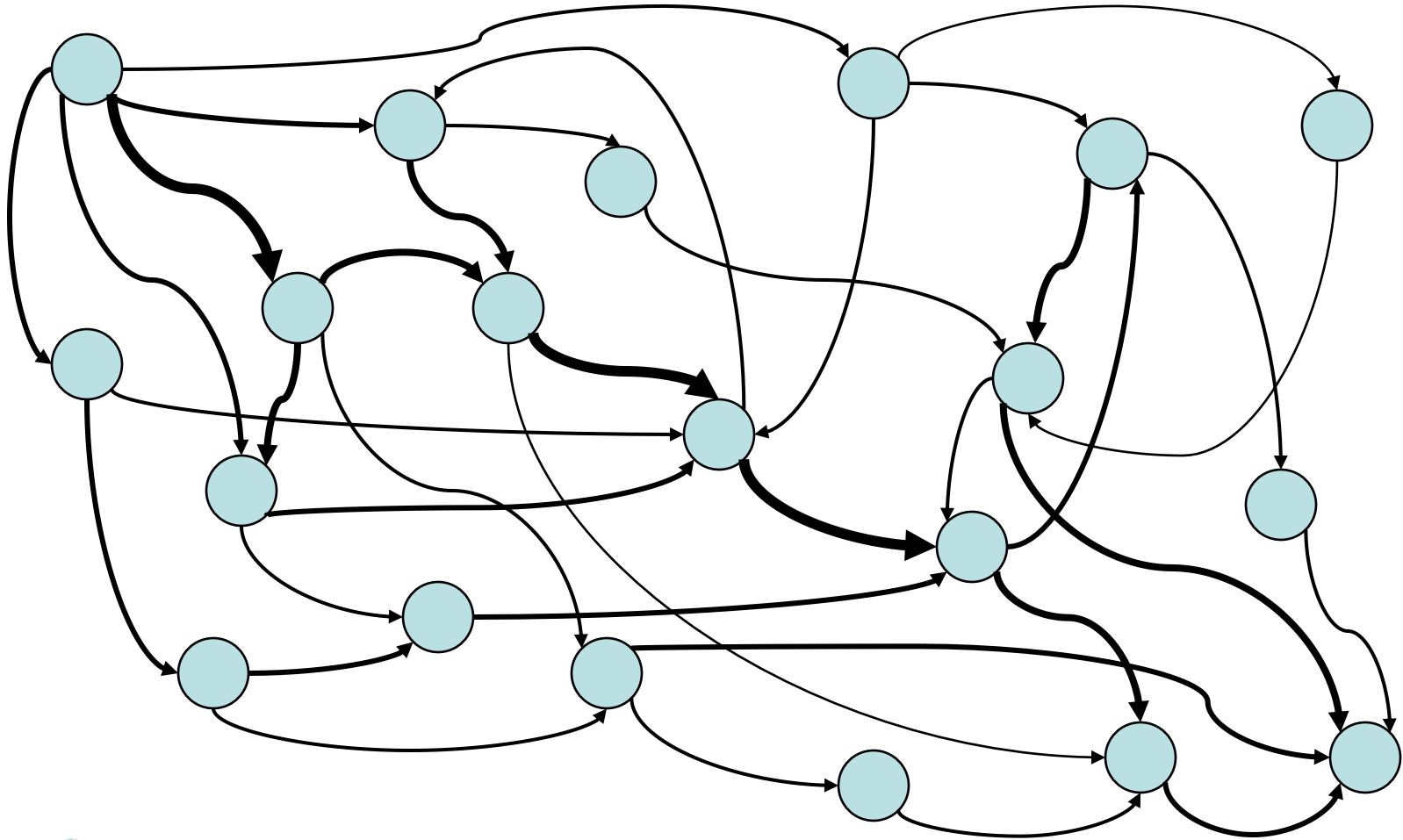
{Meta:is_data_light_blinking:}

[Some Antics with the Prompts?]

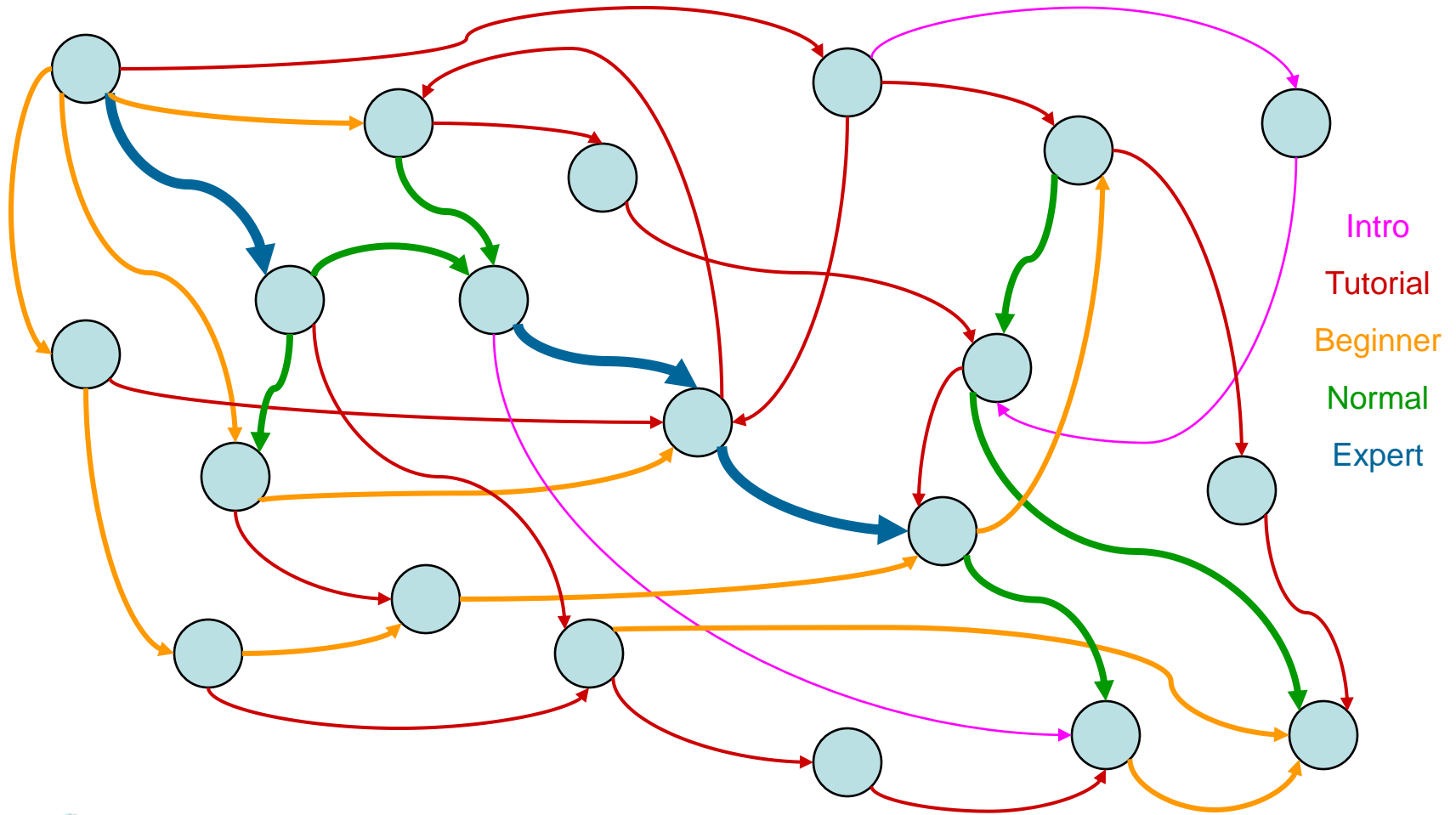
```
<is_data_light_blinking>  
  <val>Is the data transfer light blinking?</val>  
  <intro>  
    <val>We need to check if the data is being transmitted. The yellow light on the right side of  
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  </intro>  
  <tutorial>  
    <val>The yellow light on the right side of the modem blinks when transmitting. Is it blinking now?  
    </val>  
  </tutorial>  
  <beginner>  
    <val>Is the yellow modem transmit light blinking?</val>  
  </beginner>  
  <normal>  
    <val>Is the yellow transmit light blinking?</val>  
  </normal>  
  <expert>  
    <val>Is transmit blinking?</val>  
  </expert>  
</is_data_light_blinking>
```



Dialog Network



Dialog Network



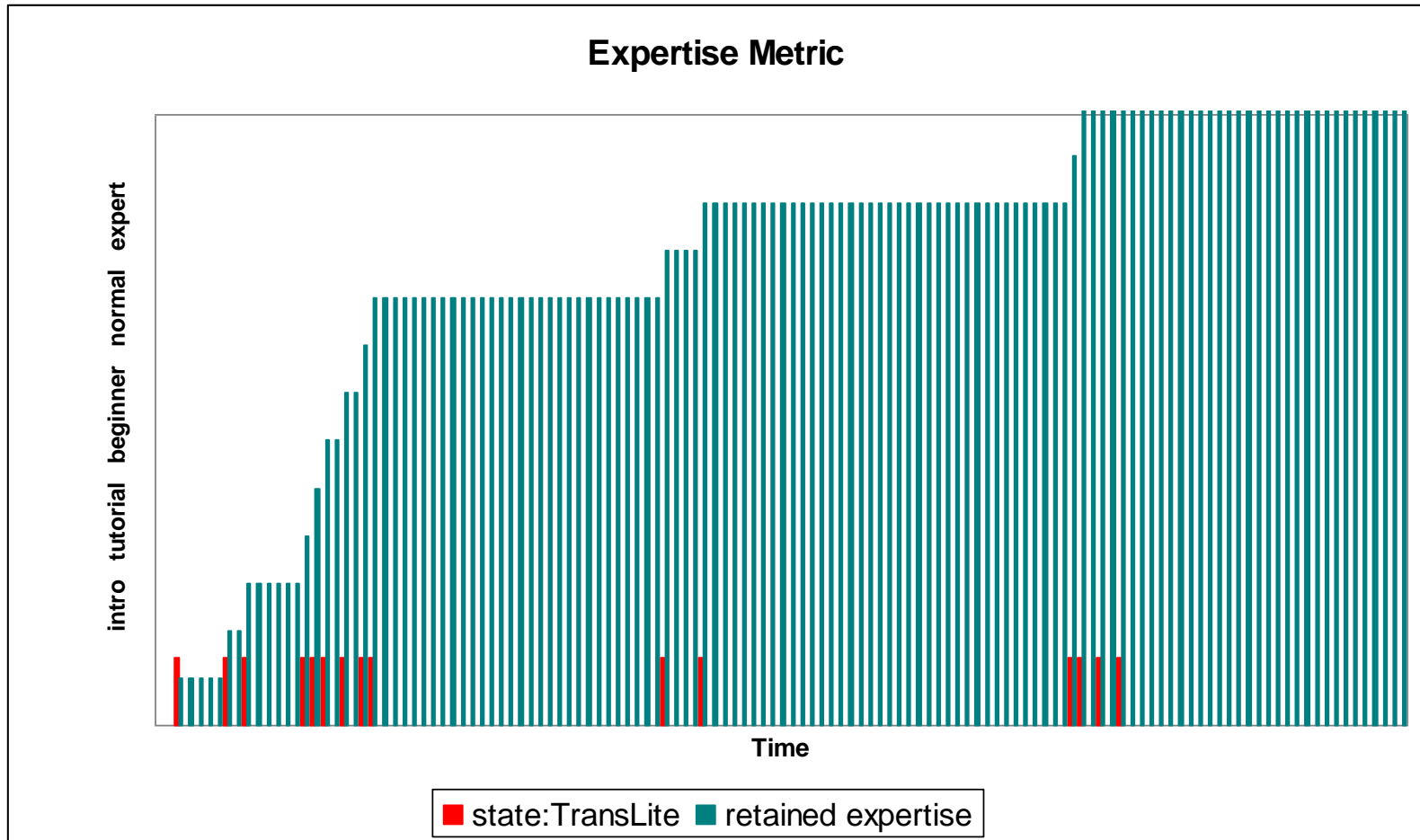
Navigating the meta-levels

- How to track expertise
 - Visit count is a good start
 - But human memory fades with time
- Meta makes it easier to build
 - Thinking Meta is like thinking O-O
 - Divides the work naturally



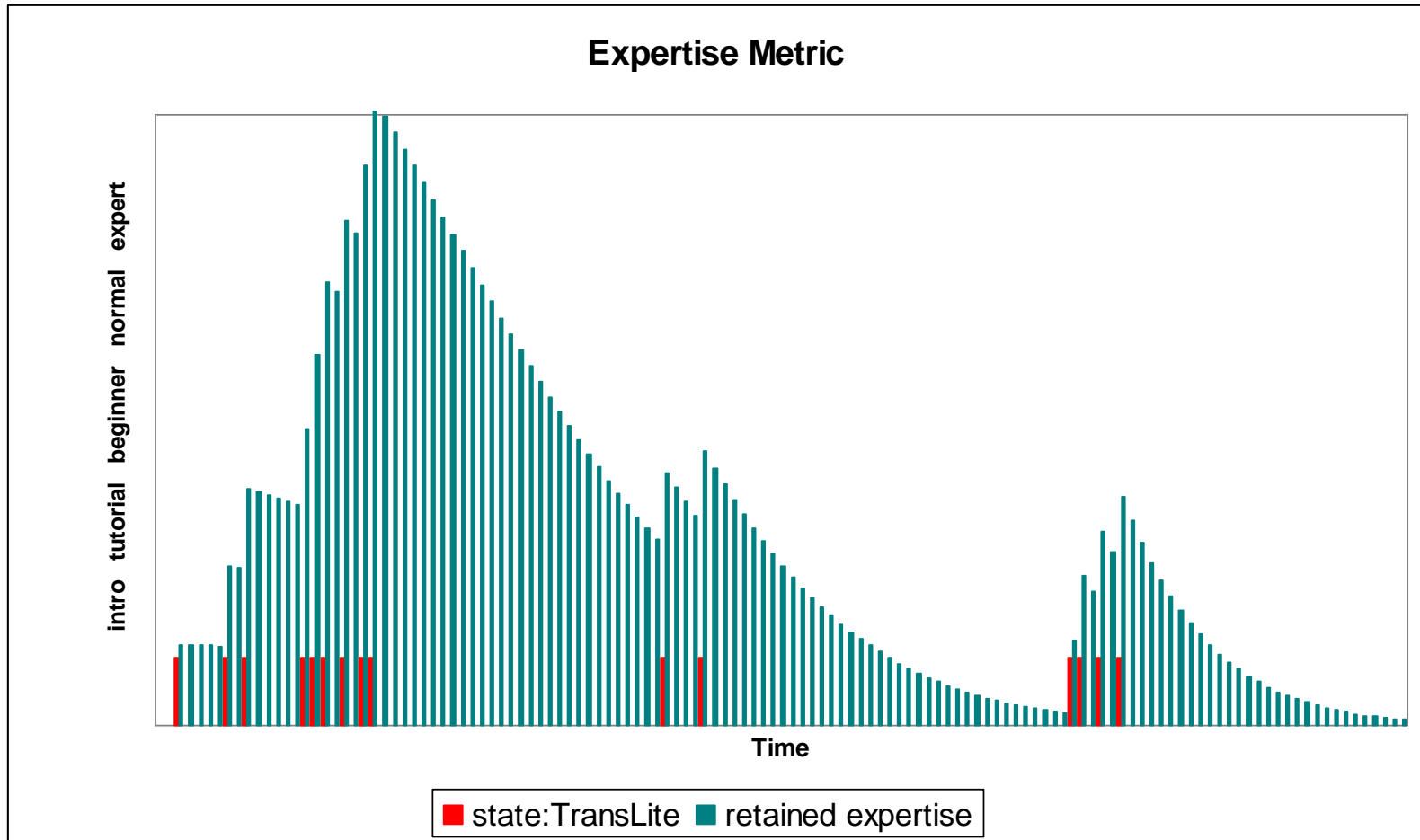
Tracking Expertise

(learnRate = 0.7)



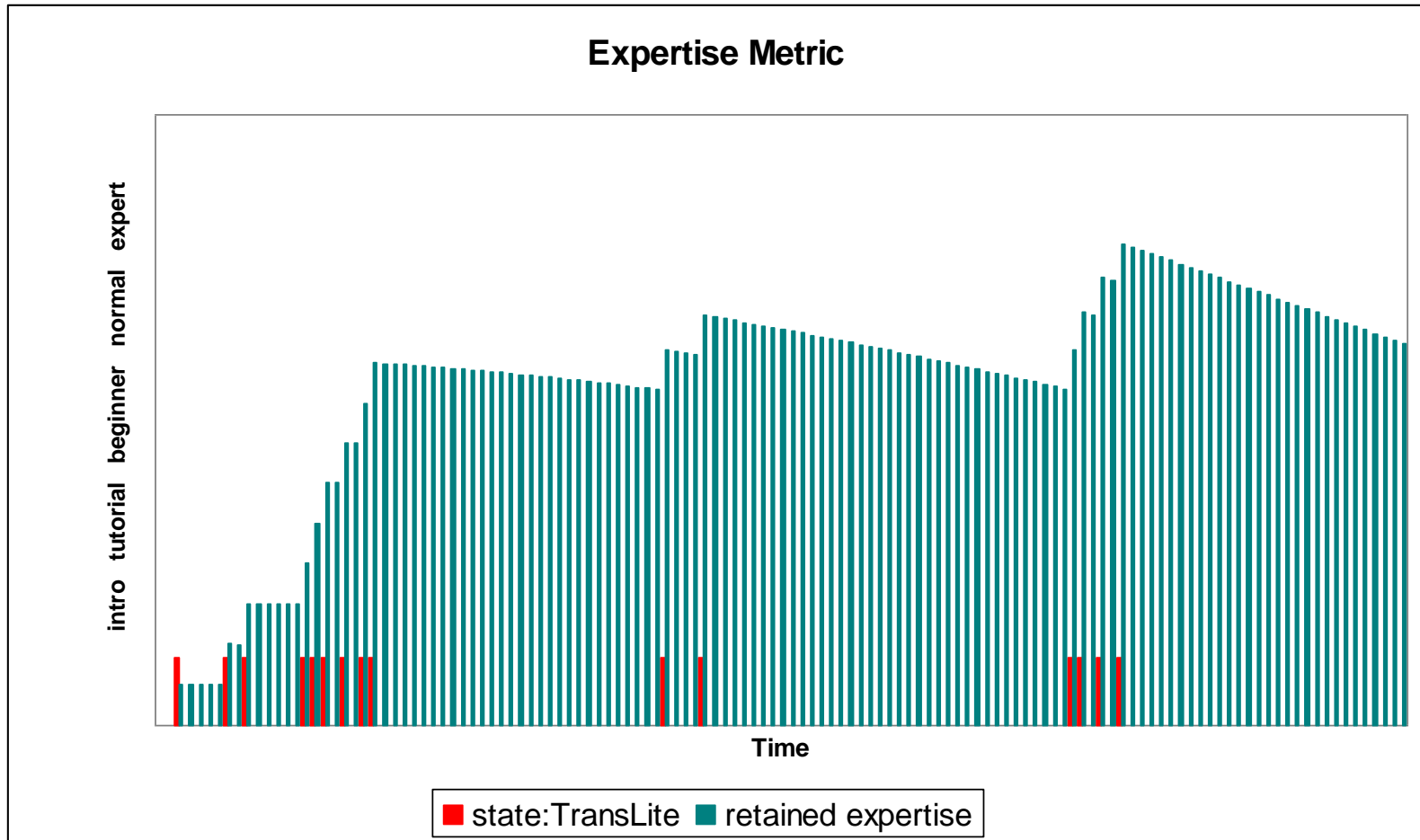
Tracking Expertise

(learnRate = 1.2, forgetRate = 1.1)



Tracking Expertise

(**learnRate** = 0.6, forgetRate = 0.07)



Summary

- Humans adapt all the time.
- Makes conversation more efficient and it sounds more natural.
- Simplifies dialog design by encapsulating (hiding) the complexity.
- As synthetic agents become longer term companions they will (must) behave more like a human.
- This functionality is easy to incorporate.



Remember

- **Delegation** at a semantic level
- Syntax is **Derived** in realtime
- **Consistency** of behavior over the entire system
- Simplifies dialog design (**Divide/Conquer**)
- Creates a more **Natural** experience
- Greater than the sum of the parts
(**Emergent Behavior**)



You are getting very sleepy...

- Delegation

- Derived

- Consistency

- Divide/Conquer

- Natural

- Emergent Behavior



Thank you



Emmett Coin
ejTalk, Inc
emmett@ejTalk.com



Further Areas for Refinement

- Response to common conversational courtesy.
- Human variability
- Anticipation of a goal



Meta Makes It Better

- More Natural
 - The user experience will be less rigid
- Easier to Author
 - Like all systems based on delegation (e.g. military) each level has a manageable amount of detail to react to
- Automatic?
 - People only drive a manual transmission car for fun (it usually costs more too!)
- What are the rules?
 - As subtle and sophisticated as needed but sensibly contained

