Ubiquitous Access to IP Devices

Dr. Eric Burger
Deputy CTO, BEA Systems

Northwestern University
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Roadmap

- From the outside to the inside:
  Ubiquitous access to household devices
- From the inside to the outside:
  Access to information sources from digital IP phones
- Something on BEA

Prior Art

- What has been done
- What is old
- Digit transport in IP: DTMF, RFC 4733, H.245

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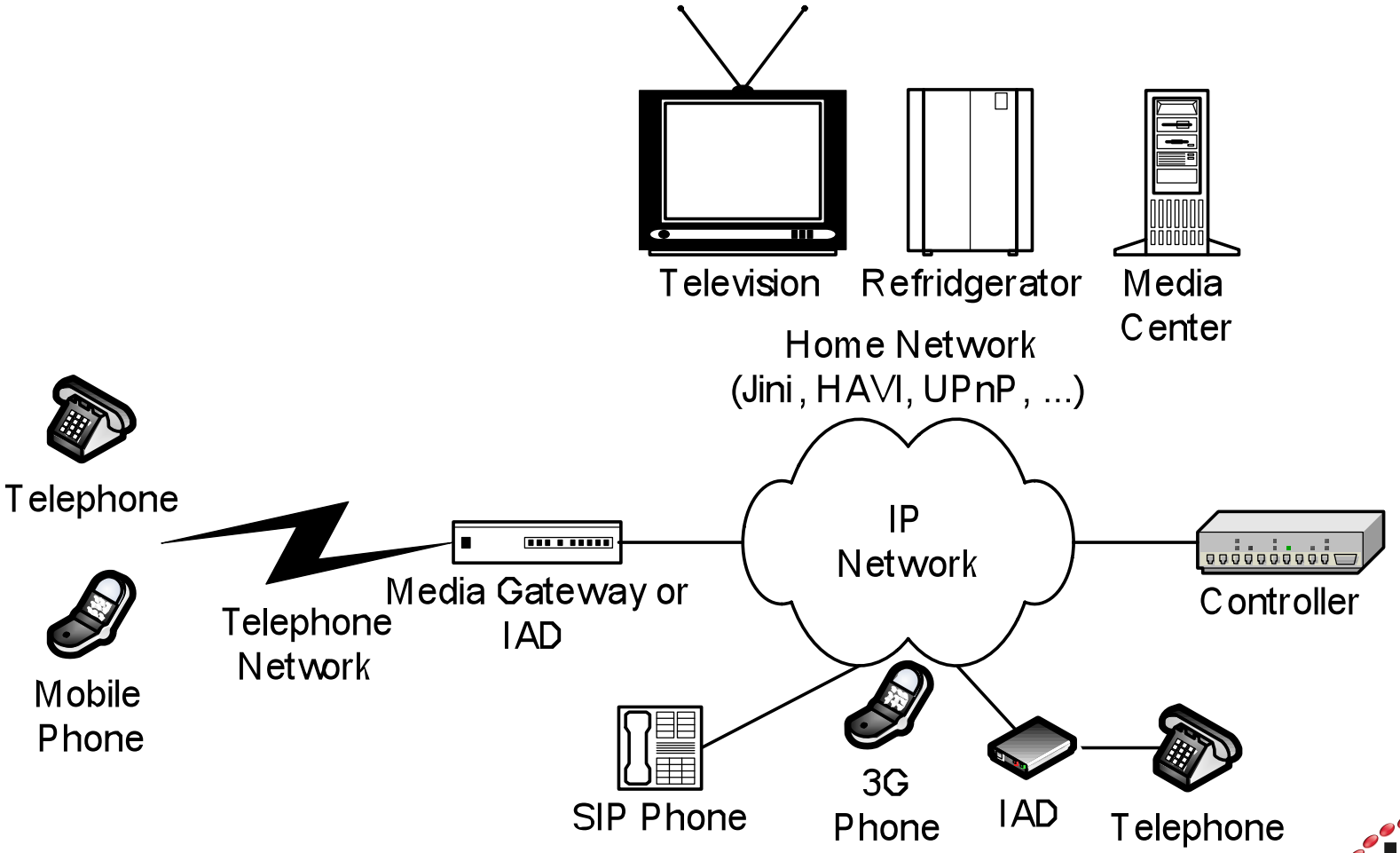
What's New

- Problem Space:
  How can we remotely control devices in the home from anywhere without special hardware in each consumer device?
- Constraints and Environment
  - Vast majority of candidate control devices are plain old telephones (12-key keypad, no or very limited display)
    - Includes enhanced devices in limited connectivity networks
  - Networked home means IP or OSGI access to devices
  - VoIP service providers and equipment providers provide gateway functionality between plain old telephone service (POTS) and IP
- Develop method for POTS phones to efficiently control any household device that enables control of multiple devices
- Leverage stimulus-markup design model

Consumer Network



Characteristics of Our Solution

- User Input Transmitted in Signaling Plane
- Signaling Is Named Stimulus
- Only SIP; no Media Processing Required

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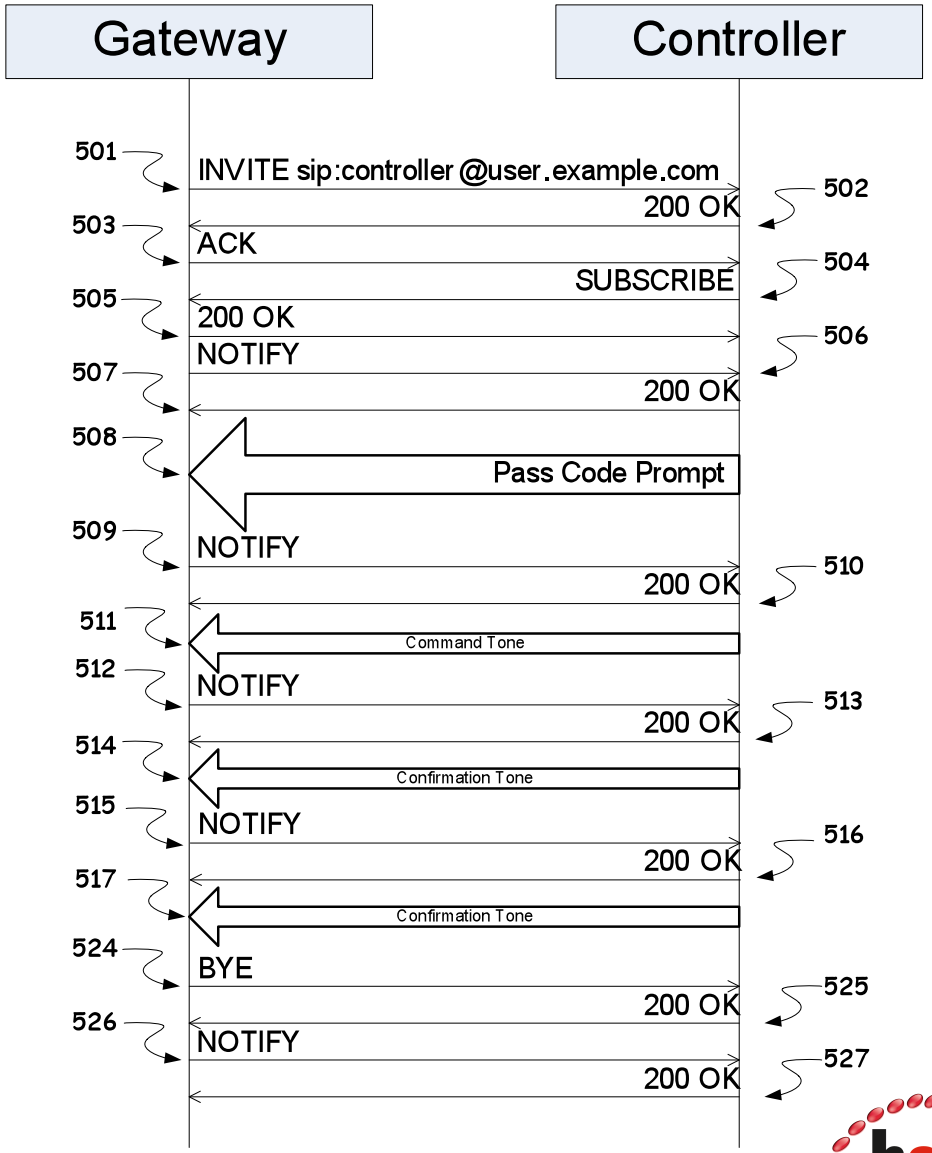
Key Press Markup Language and Protocol (KPML)

- SIP subscribe / notify mechanism for transporting state
- Subscribers (devices or controllers) specify state filters
  - Digit maps
- Notifiers (phone) respond when user enters digits that match maps

Sample Call Flow

- Phone (via gateway) calls controller
- Controller subscribes to phone state
- Controller plays pass code prompt
- User enters pass code digits
- User enters command
- User hangs up



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Sample KPML Request

```
<?xml version="1.0" encoding="UTF-8"?>
<kpml-request xmlns="urn:ietf:params:xml:ns:kpml-request"
   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
   xsi:schemaLocation="urn:ietf:params:xml:ns:kpml-request kpml-request.xsd"
   version="1.0">
   <pattern>
              <regex tag="passcode">x{1,6}</regex>
              <regex tag="PCOn">*1*</regex>
              <regex tag="PCOff">*1#</regex>
              <regex tag="OvenOn">*2*</regex>
              <regex tag="OvenOff">*2#</regex>
   </pattern>
</kpml-request>
```


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Sample KPML Response

```
<?xml version="1.0" encoding="UTF-8"?>
<kpml-response xmlns="urn:ietf:params:xml:ns:kpml-response"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="urn:ietf:params:xml:ns:kpml-response
    kpml-response.xsd"
  version="1.0"
  code="200"
  text="OK"
  digits="*1*"
  tag="PCOn" />
```


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Features of KPML

- Subscription-based: enables multiple, unrelated applications to subscribe to state
- Stimulus-Markup
  - Named events (tags), rather than digit strings
  - Enable application reuse
  - Enable multi-modal applications
- Standards-Based / Standards-Track
  - Interoperable with myriad devices from independent manufacturers for telephone remote control
  - Builds on SIP security and authentication model
    - Local user is really trusted user
    - No location dependency on who is a trusted user

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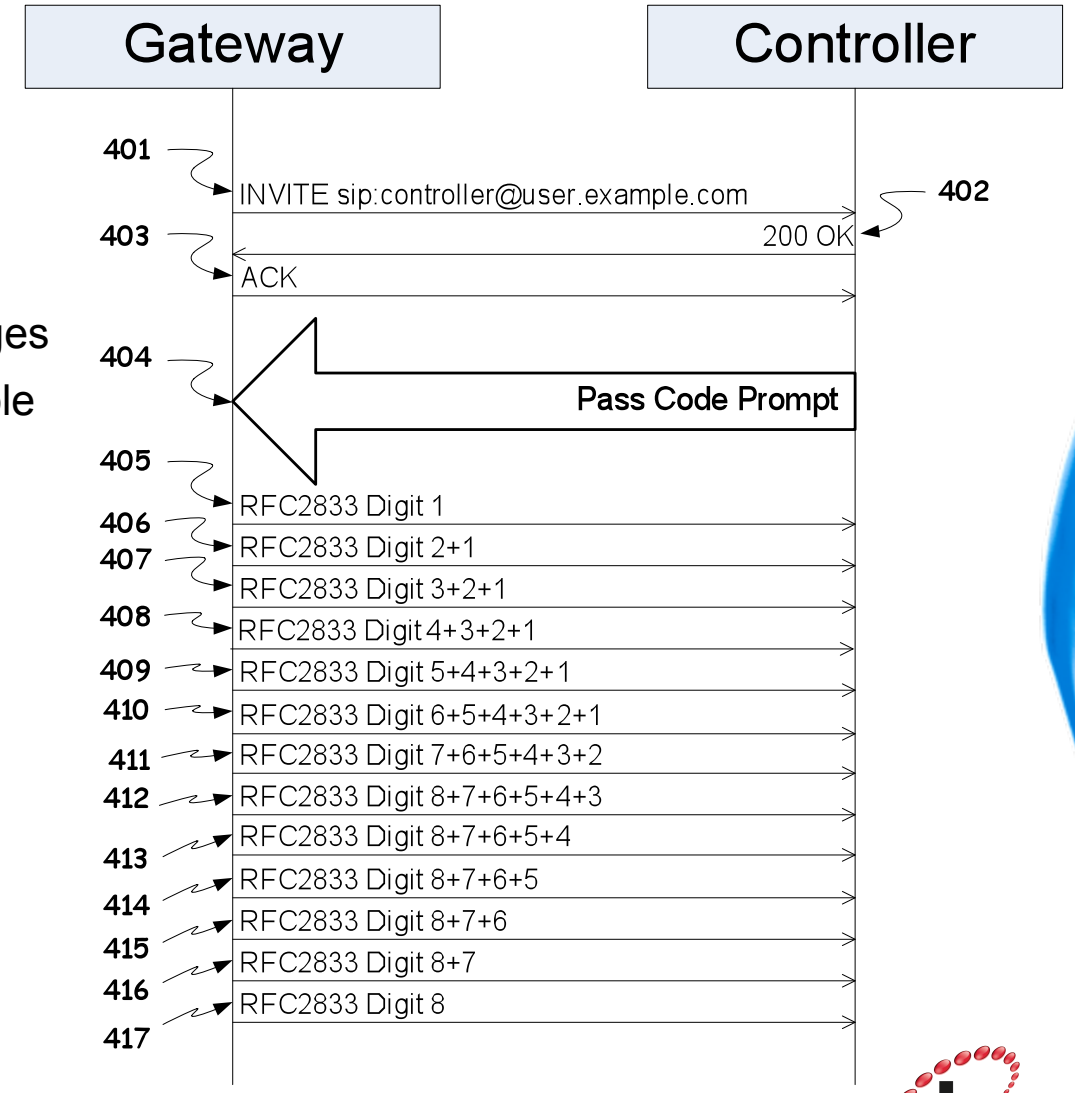
Results: Compare to RFC 4733

- Extract of call flow for collecting digits using RFC 4733
  - RFC 4733: many more messages
  - Still not, at protocol level, reliable transport
- Devices must have media stack
- Does not have multiple-application properties
- Does not have stimulus-markup properties



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Results

- DTMF is VoIP version of dial-up (G.711)
- Four commands executed
- Similar network use between RFC 4733 and KPML
  - KPML provides application, flexibility, and reliability properties

Protocol	Inbound Bytes	Outbound Bytes	Inbound Packets	Outbound Packets
DTMF	97,342	97,342	409	409
RFC 4733	5,597	50,177	48	209
KPML	5,323	52,901	11	217

Access to Information Sources From Digital IP Phones

- What's Been Done
- What's New
- Results
- Conclusion

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Prior Art

- What has been done
- What is old
- Digit transport in IP: DTMF, RFC 4733

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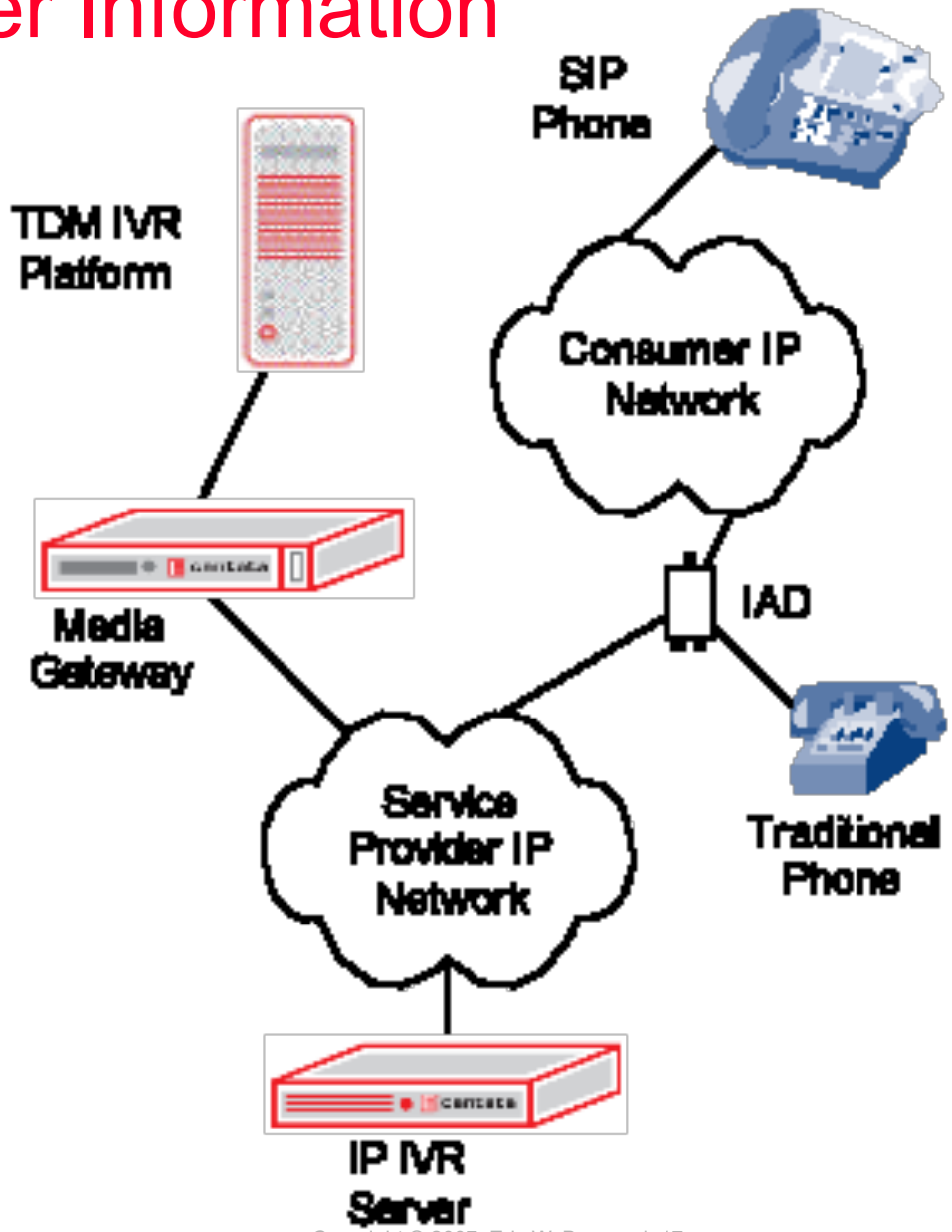
What's New

- Problem Space:
  How can we allow consumers to access network services in an IP environment without the consumer investing in new IP equipment?
- Constraints and Environment
  - Vast majority of candidate access devices are plain old telephones (12-key keypad, no or very limited display)
  - Consumers most often have integrated access devices (iads); some have IP-TDM (media) gateways
- Develop method for consumer devices to communicate user stimulus to network platforms efficiently and reliably in the ip network
- Leverage stimulus-markup design model

Consumer Information Services



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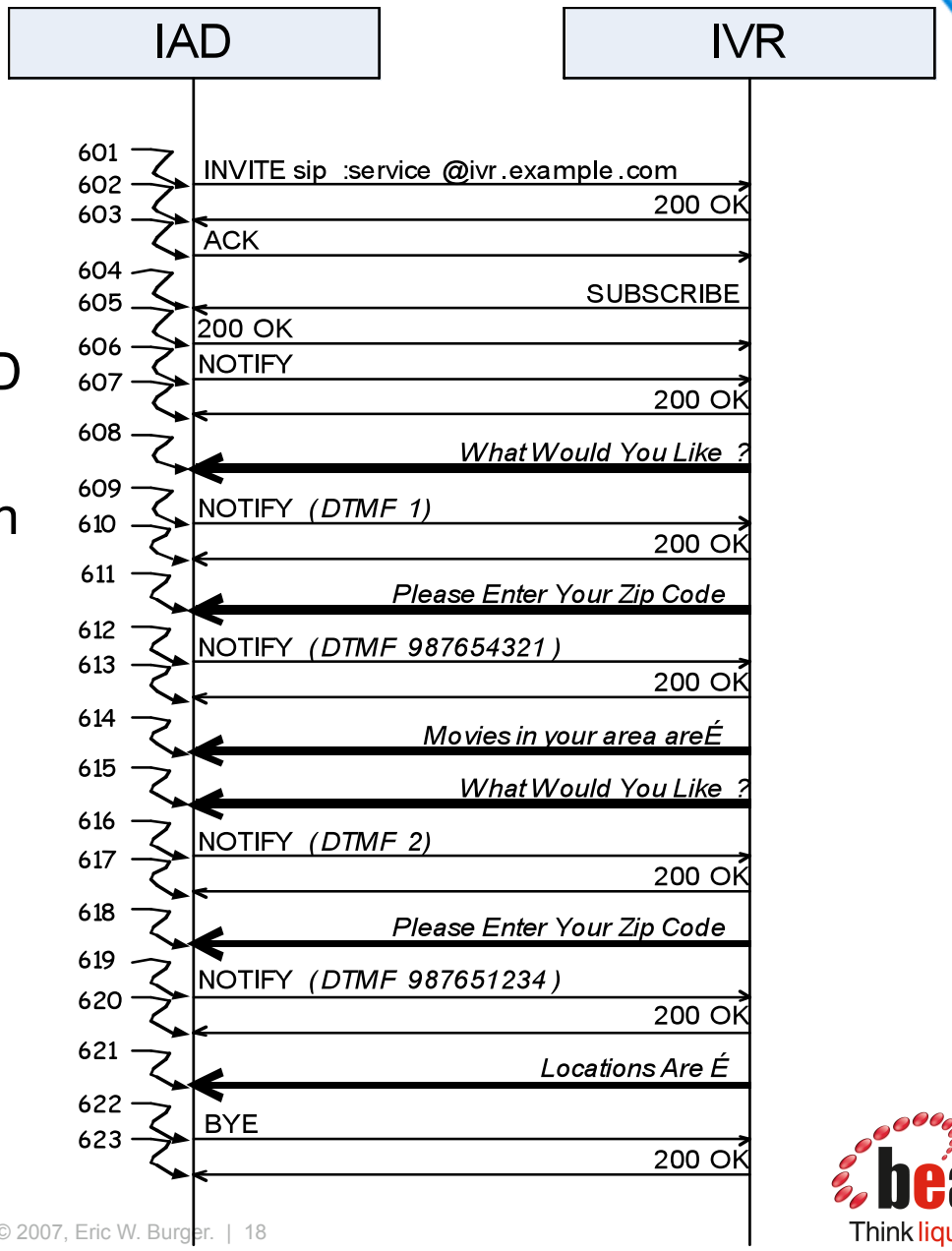
Sample Call Flow

- Phone (via IAD) calls IVR platform
- IVR platform subscribes to IAD state
- IVR platform plays introduction
- User enters selection
- And so on…



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  request kpml-request.xsd"
 version="1.0">
  <pattern>
         <regex tag="movies">1</regex>
         <regex tag="banking">2</regex>
  </pattern>
</kpml-request>
```


Sample KPML Response

```
<?xml version="1.0" encoding="UTF-8"?>
<kpml-response
  xmlns="urn:ietf:params:xml:ns:kpml-response"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-
  instance"
  xsi:schemaLocation="urn:ietf:params:xml:ns:kpml-
  response kpml-response.xsd"
   version="1.0" code="200" text="OK"
   digits="1" tag="movies"/>
```


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Characteristics of KPML for User Stimulus of Network Applications

- subscription-based: enables multiple, unrelated applications to subscribe to state
- Stimulus-Markup
  - Named events (tags), rather than digit strings
  - Enable application reuse
  - Enable multi-modal applications
- Standards-Based
  - Interoperable with myriad devices from independent manufacturers for telephone remote control
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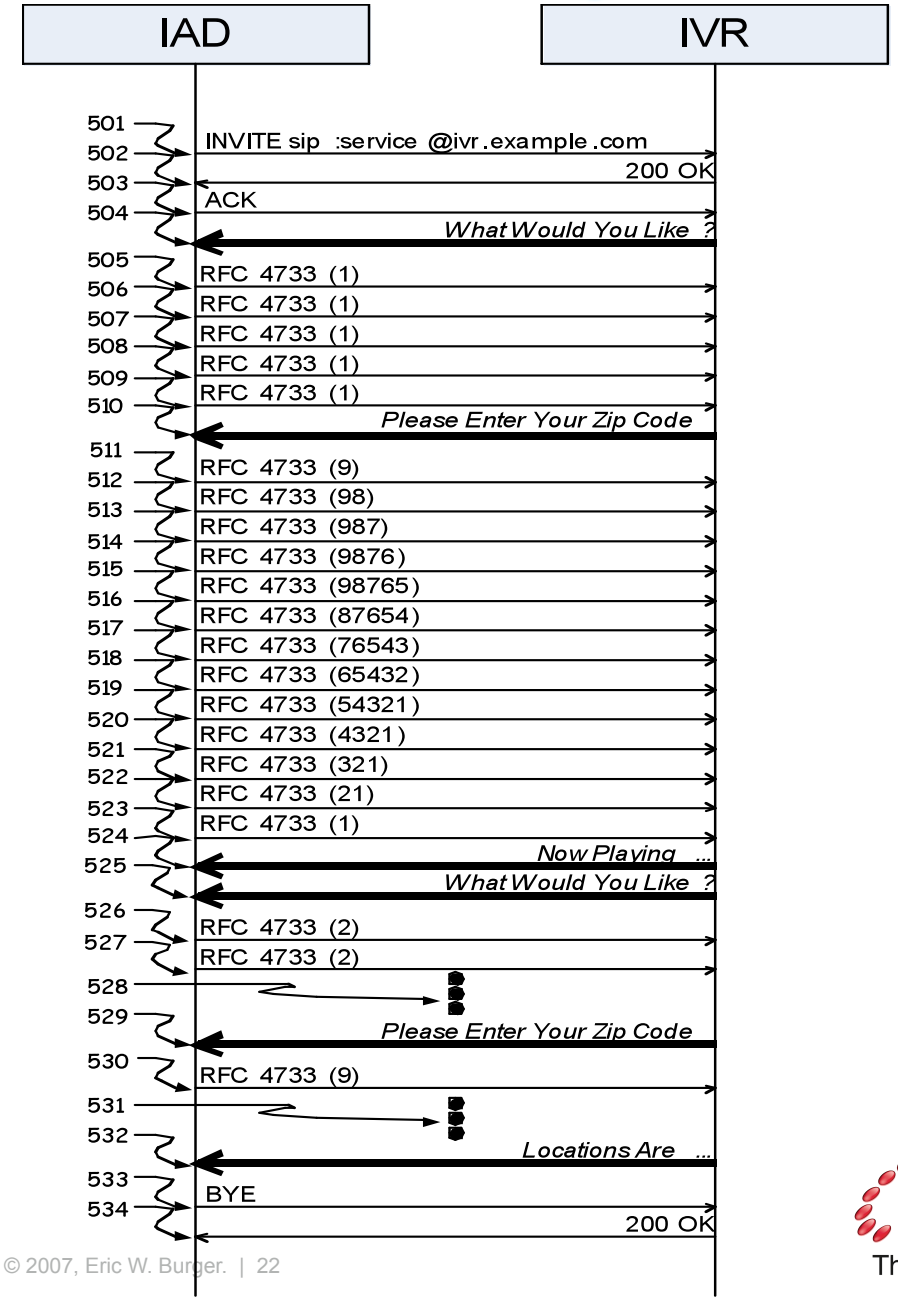

Results

- G.711 transports DTMF as tones in VoIP
- Two user requests tested: movie and bank lookup
- Network use between RFC 4733 and KPML
  - Comparable number of bytes
  - Consumer access networks have inbound >> outbound bandwidth
  - KPML provides application, flexibility, and reliability properties
- Demonstrates little to no penalty (and some benefit) of using reliable protocol to transport user stimulus

	Bytes		Packets	
	Inbound	Outbound	Inbound	Outbound
DTMF	555,096	145,042	2,331	608
RFC 4733	555,096	4,682	2,331	39
KPML	557,388	4,331	2,337	9

Status

- KPML is now RFC 4730
- Implementations from multiple vendors in IP gateways, PSTN gateways, IAD, and IP phone
- For first time:
  - Bringing reach of PSTN/POTS to the digital, networked household
  - Bringing Access to Legacy PSTN/POTS Services from the Digital, Networked Household
  - In an interoperable, multi-vendor environment
  - No specialized telephony hardware required

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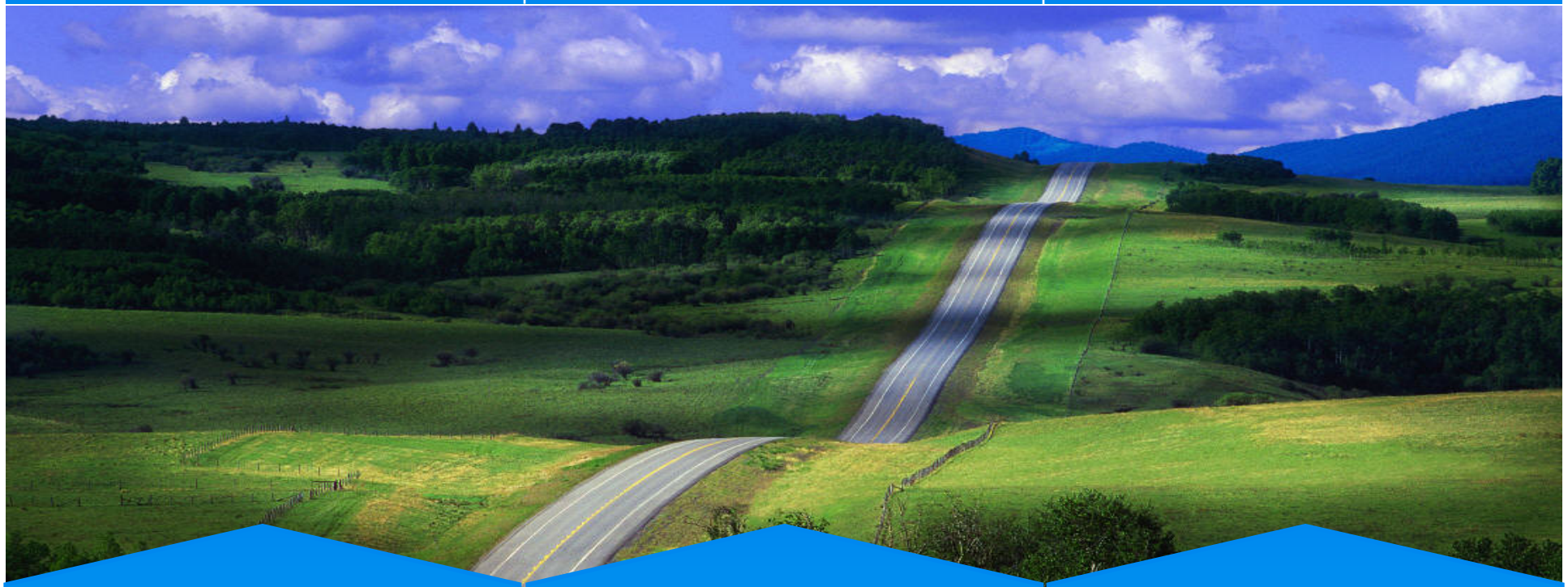
BEA Position

- #1 Java application server
- #1 SOA components
- 500 of top 500 telecom companies use BEA products
- New markets for BEA
  - Server virtualization
  - Real-time, interactive multimedia application infrastructure (network equipment)
  - Edge computing / sensor networks

Technology Roadmap Time Domains

0-12	12-24	24+



Engineering

- Core BEA development
- Delivering current roadmap functionality

Product Mgmt /Marketing

- Eentering BEA domain
- Planning the current roadmap and PRDs

Office of the CTO

- What may/may not intersect with BEA's current activities
- Leading and monitoring technology trends

Research Areas

- Web 2.0
- Semantics
- Edge Computing
- Legacy Integration
- Business Intelligence
- Virtualization
- Telecom 2.0

- Sensor Networks and Edge Computing
- “Death” of J2EE
- Software as a Service (SaaS)
- Communities of Interest (COI)
- Network of Services
- Emerging Development Paradigms

Questions

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Thank You

Eric Burger
eburger@bea.com

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