



# Delivery Context in Internet Protocols

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# Relevant Background

- chair, HTTP working group ('95-'99)
- editor & participant in many other IETF standards groups:
  - Internet Fax
  - Instant messaging
  - Content negotiation
- Project lead, Xerox PARC System 33



# Main points of this talk

- consider broader history & application for device context
- Content negotiation doesn't scale
- Vocabularies should be standards



# History

- Fax: reliable messaging based on simple negotiation
- Printing, color management: history of adaptation
- System 33: early net service that did adaptation
- HTTP & various extensions
- Web: Cache control, management, sharing
  - most web traffic is to very small number of sites
  - popular web sites use content distribution networks
- Internet Print Protocol
  - Discover printer capabilities, formats supported, paper sizes
- Session Initiation (SIP)
- EMail negotiation
  - “send HTML mail or plain text”
- Instant Messaging
  - Send Images? Audio? Video?  
not in standards proposals, but part of commercial IM



# Side-note: Vocabulary

- sender: agent with content
  - receiver: agent that gets content
  - client: initiator, transient agent
  - server: accepts client requests, available agent
- 
- In HTTP, client is receiver, server is sender, except in POST and PUT, which don't do content negotiation
  - Sender adapts content for receiver



# History: Fax

- Sender connects to receiver  
*over telephone line*
- receiver sends capabilities  
*negotiates bandwidth, resolution,  
compression methods*
- sender chooses format to match receiver  
capabilities  
*typically before paper is scanned*
- Standard mandates base mandatory-to-  
implement format  
*insures negotiation will succeed*



# History: System 33

- Xerox PARC project, 1988-1994
- document storage & content adaptation
- Attempted to deal with devices of different capabilities, screen size, resolution, color capabilities
- Client sends preferences, server adapts
- Added conversion to HTML



# Postscript Printer Descriptions

- capabilities (color space, memory)
- characteristics (resolution)
- initialization information
- font capabilities

Usage evolved over time





# History: Color management

- **Calibration:** return device to known characteristics
- **Characterization:** create profile that describes condition of device
- **Matching:** convert given content to appropriate content for device
- **Gamut:** range of capabilities
- **Device Profile:** describes gamut and other characteristics of device
- **Generic device profile:** by manufacturer, for all devices of a given model
- **Custom device profile:** describes a particular device after characterization
- **Render intent:** choice of method used for matching, depending on the purpose



# Content Negotiation in HTTP

- HTTP/1.0 RFC 1945 (May 1996)
- Accept (accept-charset, accept-language)
  - defaults?
  - pattern matching?
  - parameters?
- HTTP/1.1 RFC 1945 (Jan 1997)
  - q parameter
  - accept-encoding, accept-language



# Proposed HTTP Extensions

- TCN: Transparent Content Negotiation, RFC 2295, March 1998
  - Accept-Features request
  - “Alternates” response
  - “Negotiate” request
  - “TCN” response
  - “Variant-Vary” response
  - Variant etags

Multiple modes for exchange of context information

Which features are not needed for functioning with content distribution?
- RVSA: Remote Variant Selection Algorithm, RFC 2296, 1998
  - no features registry (predated CONNEG)
  - Allow intermediaries to participate in content selection



# Use today in HTTP

- “Accept” useless
- “Accept-Language” widely implemented, sent, but rarely used
- “Accept-Encoding” sometimes useful
- No interest in TCN or RVSA
- “User-Agent” most frequent use, but everyone is “Mozilla (Compatible)”
- Detection, when needed, done by JavaScript, Java “sniffers”



# IPP Internet Print Protocol

## RFC 2910, 2911

- Get-Printer-Attributes request
  - query for document-format, pdl-override, compression, job size, color capabilities, available printer drivers
- Print driver adapts user selectable job options, content, to match printer capabilities



# SIP: Session Initiation Protocol RFC 2543 (and others)

- HTTP-like protocol for establishing multimedia communication (voice, video)
- OPTIONS, INVITE methods allow discovering capabilities
- Negotiate bandwidth, codecs
- proposed extensions for negotiating other preferences



# EMail Extensions for Content Negotiation

- Address book
  - “send plain text or HTML?”
- Internet Fax
  - Use email-based image transmission
  - Message confirmation can indicate receiver capabilities
- VPIM: Voice Profile for Internet Mail
  - email-based voice messaging
  - Proposals to use IFax methods



# EMail negotiation proposal

draft-ietf-fax-content-negotiation-05.txt

- Sender has limited possible cases
- Sender prepares and sends “standard” presentation
- Receiver may select “better” presentation and request it





# RESCAP: resource capability protocol

- Create (DNS-indexed) resource capability services
- Include device capability, public keys, protocol capabilities, etc.
- Not moving very fast



# CONNEG: vocabulary for media features

- Started ~1996 out of HTTP working group
- Working group given narrow charter: create vocabulary for content negotiation started with HTTP use case
- Create “Media Feature Registry”: RFC 2506
- Define common media features: RFCs 2534, 2912, 2987
- Create syntax for media feature expressions RFCs 2533, 2738
- Shorthand for expressions: RFC 2938

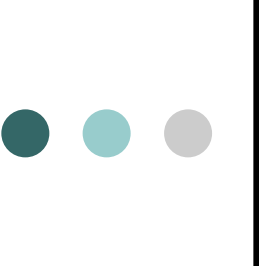


# CONNEG basics

- Registered features:
  - Display, print & fax:  
pix-x, pix-y, dpi, ua-media, paper-size
  - MIME type, charset, language
  - more elaborate capabilities for fax
  - proposed feature for xmlns
- Compact syntax for boolean expressions:  

```
( | (& (pi x-x=750) (pi x-y=500) (color=mapped))  
  (& (dpi=300) (ua-media=stationery)  
    (papersize=iso-A4) ) )
```
- Hash canonical syntax for references  

```
(& (dpi=100) (h. SBB5REA0MHC09CP2GM4V07PQP0) )  
where  
(h. SBB5REA0MHC09CP2GM4V07PQP0) : -  
  (& (pix-x<=200) (pix-y<=150) )  
end
```



# Warning: different meanings for same vocabulary term

- Capabilities:  
“I can display up to 300 dpi images”
- Characteristics  
“I have a 300 dpi screen”
- Preferences  
“I prefer images an integer fraction of 300 dpi”
- Content’s characteristics  
“This image was scanned at 300 dpi”
- Content preference for device capabilities  
“This image best viewed on a 300 dpi display”



# Standardize vocabularies

- listing, registering, using URIs for vocabulary terms not enough
- Vocabularies should be standards, with demonstrated interoperability
- Must include clear definition of interpretation, allowable content, implications for adaptation



## Avoid content-negotiation failure

- origin-server adaptation doesn't scale
- origin-unaware adaptation works poorly
- Many other protocols are too complex for deployment
- Receiver-makers: *"best viewed by" me!*  
content authors hate it
- want author-once, view many
  - Reuse & retransmission (forward, print)  
fail with adapted content
  - signatures & version management difficult



## Device-Independent Content

- Device-independent content may be “multi-modal”, self-adapt to context
- **Embedded vocabularies** in scripting language, media queries, need to be standards