draft-stanley-geopriv-int-ext & draft-polk-geopriv-int-relative-in-tlv

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Topics in this Presentation

• Overview and motivation for
  – http://www.ietf.org/id/draft-stanley-geopriv-int-ext-00.txt
  – Including example use cases
  – Including sample location definitions

• Use of

• Comparison (chair request) with
  – http://tools.ietf.org/id/draft-thomson-geopriv-indoor-location-00.txt
Proposal Motivation

• Satisfy the liaison request from IEEE
  – ... develop extensions to existing Civic binary encodings ... to support WLAN location applications...
    • A binary representation that supports the Point, Polygon, Arc Band, Rectangle, Circle, Ellipse, Cube, Cuboid, Sphere, and Ellipsoid shapes is required.
    • The binary representation should extend or be combinable with civic information already defined in RFC 4776 so that a single payload message can convey the location of a WLAN entity that combines Building Address, Floor and a determined/known reference point and reference location as represented by a shape.
Requirements

• Add relative location capability, with support for binary encoded shapes
• Easy mapping between XML and Binary representation in use for Civic/Geospatial
• Allow a variety of RF shapes to be represented
• No requirement to relate location information to a visual representation (although allowed)
• Extend Civic Location specification to provide additional definition flexibility for interior/indoor spaces, RF environments
Proposal Summary

• Define and register new xml elements for use in PIDF-LO
  – http://www.ietf.org/id/draft-stanley-geopriv-int-ext-00.txt
• Register the corresponding TLV binary mappings
• Extend the ‘INT’ mechanism defined in draft-rosen-geopriv-pidf-interior
  – Support private ‘INT’ element provided in baseline INT
  – Add an extension to support a set of ‘registered INT’ elements
• Define 4 shapes – point, circle, arcband, polygon
• Maintain a registry of these elements and TLV fields to enable vendor interoperability
• Multi-vendor proposal
Use Cases

• Asset Tracking & Workflow Management
  – Locate devices within a boundary defined administratively or by building boundaries
  – Integrate with back-end business policies, e.g. ROI analysis

• Network Routing Based on Location
  – Track a device that provides voice service and the network location of that device within the confines of a corporate building; relating the location to network topology

• Indoor Emergency Responders
  – Track devices capable of sending an emergency signal (not just voice) and provide the location to emergency systems

• Presence
  – Provide location indication for e.g., handheld devices that indicate an individual’s location, backend servers that provide proximity services such as closest free meeting room, location of meeting participants, nearest projector

• IT Manager Policy/AAA
  – Apply network policy based on location

• Network Management
  – Locate devices assists ability to debug network problems, client device performance, etc.
Cisco Systems
8200 NW 41st Street, Suite 400
Miami, Florida 33166
United States
Floor: 4
Suite: 400
- Reference: Front Door/AP-5
Center: 9m south; 34m east
Radius: 4m
Entire Civic Location - Circle

- `<country>US</country>`
- `<A1>Florida</A1>`
- `<A3>Miami</A3>`
- `<HNO>8200</HNO>`
- `<PRD>NW</PRD>`
- `<RD>41st</RD>`
- `<STS>Street</STS>`
- `<PC>33166</PC>`
- `<FLR>4</FLR>`
- `<INT>‘Suite’>400</INT>`
- `<INT N=‘Reference’>Front Door</INT>`
- `<INT N=‘Circle’/>`
- `<INT N=‘SHAPE-OFFSET-X’>+34</INT>`
- `<INT N=‘SHAPE-OFFSET-Y’>-9</INT>`
- `<INT N=‘SHAPE-OFFSET-Z’>+5</INT>`
- `<INT N=‘Radius’>4</INT>`

Existing PIDF-LO syntax

New ‘Private’ INT syntax

New ‘Registered’ INT syntax
Relative Location - Point

Cisco Systems
8200 NW 41st Street, Suite 400
Miami, Florida 33166
United States
Floor: 4
Suite: 400
- Reference: Front Door
- Offset: 10m north; 25m east
Entire Civic Location - Point

- <country>US</country>
- <A1>Florida</A1>
- <A3>Miami</A3>
- <HNO>8200</HNO>
- <PRD>NW</PRD>
- <RD>41<sup>st</sup></RD>
- <STS>Street</STS>
- <PC>33166</PC>
- <FLR>4</FLR>
- <INT>'Suite'>400</INT>
- <INT N='Reference'>Front Door</INT>
- <INT N='Point'/>
- <INT N='SHAPE-OFFSET-X'>+25</INT>
- <INT N='SHAPE-OFFSET-Y'>+10</INT>
- <INT N='SHAPE-OFFSET-Z'>+10</INT>

Existing PIDF-LO syntax

New ‘Private’ INT syntax

New ‘Registered’ INT syntax
Relative Location - Arcband

Cisco Systems
8200 NW 41st Street, Suite 400
Miami, Florida 33166
United States
Floor: 4
Suite: 400

- Reference: Front Door
- Offset: 2m south; 17m east
- Inner radius: 8m
- Outer radius: 18m
- Start angle: 329 degrees
- Opening: 82 degrees

LEGEND
- CONFERENCE / TRAINING ROOM
- QUIET ROOM/TOUCH DOWN STATION
- CAFE / BREAK / FITNESS
- COPY / WLAN
- GUEST (MOBILE) OFFICE / CUBE
Entire Civic Location - Arcband

- `<country>US</country>`
- `<A1>Florida</A1>`
- `<A3>Miami</A3>`
- `<HNO>8200</HNO>`
- `<PRD>NW</PRD>`
- `<RD>41st</RD>`
- `<STS>Street</STS>`
- `<PC>33166</PC>`
- `<FLR>4</FLR>`
- `<INT>`Suite`>`400`</INT>`
- `<INT N='Reference'>Front Door</INT>`
- `<INT N='Arcband'/>
- `<INT N='SHAPE-OFFSET-X'>+17</INT>`
- `<INT N='SHAPE-OFFSET-Y'>-2</INT>`
- `<INT N='SHAPE-OFFSET-Z'>+2</INT>`
- `<INT N='InnerRadius'>8</INT>`
- `<INT N='OuterRadius'>18</INT>`
- `<INT N='StartAngle'>329</INT>`
- `<INT N='Opening'>82</INT>`

Existing PIDF-LO syntax

New ‘Private’ INT syntax

New ‘Registered’ INT syntax
Relative Location – Polygon

Cisco Systems
8200 NW 41st Street, Suite 400
Miami, Florida 33166
United States
Floor: 4
Suite: 400

- Reference: Suite 400 Front Door
- Polygon: 5 points
- Point A: 8m south; 18m west
- Point B: 5m south; 20m west
- Point C: 6m south; 24m west
- Point D: 10m south; 25 west
- Point E: 13m south; 20m west
- GeoCenter: 10m south; 20m west
Entire Civic Location – Polygon w/Center

Existing PIDF-LO syntax

New ‘Private’ INT syntax

New ‘Registered’ INT syntax
int-relative-in-tlv

• Binary encodings of the registered ‘INT’ location extensions to PIDF-LO
  – Extension of mechanisms already in use, defined in RFC4776/5139

• For use in binary protocols

• Vendor interoperability assured via registration of these values
# Registered TLV fields

<table>
<thead>
<tr>
<th>Field</th>
<th>LocType</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>REF</td>
<td>201</td>
<td>Reference point or Starting point</td>
<td>‘Front Door’</td>
</tr>
<tr>
<td>POINT</td>
<td>202</td>
<td>Point</td>
<td>&lt;no data&gt;</td>
</tr>
<tr>
<td>CIRCLE</td>
<td>203</td>
<td>Circle</td>
<td>&lt;no data&gt;</td>
</tr>
<tr>
<td>ARCBAND</td>
<td>204</td>
<td>Arcband</td>
<td>&lt;no data&gt;</td>
</tr>
<tr>
<td>POLYGON</td>
<td>205</td>
<td>Polygon</td>
<td>&lt;no data&gt;</td>
</tr>
<tr>
<td>SHAPE-OFFSET-X</td>
<td>206</td>
<td>Shape Offset X</td>
<td>‘+10’</td>
</tr>
<tr>
<td>SHAPE-OFFSET-Y</td>
<td>207</td>
<td>Shape Offset Y</td>
<td>‘-20’</td>
</tr>
<tr>
<td>SHAPE-OFFSET-Z</td>
<td>208</td>
<td>Shape Offset Z</td>
<td>‘+2’</td>
</tr>
<tr>
<td>RAD</td>
<td>209</td>
<td>Radius of circle</td>
<td>‘+4’</td>
</tr>
<tr>
<td>INRAD</td>
<td>210</td>
<td>Inner radius of arcband</td>
<td>‘+8’</td>
</tr>
<tr>
<td>OUTRAD</td>
<td>211</td>
<td>Outer radius of arcband</td>
<td>‘+18’</td>
</tr>
<tr>
<td>STANGLE</td>
<td>212</td>
<td>Starting angle of arcband</td>
<td>329</td>
</tr>
<tr>
<td>OPEN</td>
<td>213</td>
<td>Opening angle of arcband</td>
<td>82</td>
</tr>
<tr>
<td>NUMPGONPTS</td>
<td>214</td>
<td>Number of points in the Polygon</td>
<td>‘5’</td>
</tr>
<tr>
<td>SHAPE-CENTER-X</td>
<td>215</td>
<td>Geographic center of polygon X</td>
<td>+10</td>
</tr>
<tr>
<td>SHAPE-CENTER-Y</td>
<td>216</td>
<td>Geographic center of polygon Y</td>
<td>-12.2</td>
</tr>
<tr>
<td>SHAPE-CENTER-Z</td>
<td>217</td>
<td>Geographic center of polygon Z</td>
<td>+0.4</td>
</tr>
</tbody>
</table>
Summary

• This proposal provides the ability to map to a binary format supporting the IEEE liaison
• Extends Civic Location specification to provide additional definition flexibility for interior/indoor spaces, RF environments
• Adds a relative location capability, with support for binary encoded shapes
## Analysis - Comparison

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>draft-stanley &amp; in-tlv</th>
<th>draft-thomson</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recognize/support need for additional location specification flexibility to indoor spaces</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Encoding Supported</td>
<td>XML, Binary</td>
<td>XML</td>
</tr>
<tr>
<td>Relative Location</td>
<td>Yes, enables both structural (e.g. door) and administrative entities. Uses local conventions</td>
<td>Yes, uses local datum. Uses Loc field for human-readable info.</td>
</tr>
<tr>
<td>Need for Local CRS</td>
<td>No; use local conventions and landmarks; offset (meters in NSEW) is needed</td>
<td>Local (unique) CRS needed</td>
</tr>
<tr>
<td>Location Base</td>
<td>Civic Location; conversion to WGS-84 unnecessary. RFC4119, 5139, 4776; minimizes development effort for extensions</td>
<td>WGS-84 Local CRS conversion to WGS-84 Requires new development</td>
</tr>
<tr>
<td>Scaling Factor, Pixel Offset</td>
<td>Not needed</td>
<td>Yes</td>
</tr>
<tr>
<td>Interior coordinate system</td>
<td>Building considered a self contained system; Axis of Cartesian Coordinate System point NESW</td>
<td>Local CRS constructed</td>
</tr>
<tr>
<td>Readily deployable</td>
<td>Yes, local Indoor datum (indoor conventions) of the building are established</td>
<td>Local CRS needs to be defined</td>
</tr>
<tr>
<td>Navigation support</td>
<td>Yes, if link to a tagged map is added</td>
<td>Construct graph using Local CRS</td>
</tr>
</tbody>
</table>
Recommendation

• Solutions have different characteristics
  – see previous slide

• Application needs (products, requirements) vary
  – Civic, WGS-84, XML, Binary
  – Deployment complexity of building unique CRSs

• Progress both proposals
Backup Slides
Assumptions

• Each shape XML/Binary object must be accompanied by a civic address object
• Confidence is always 95%
Common Notes for XML

• X Axis
  – East = + (Positive) X number
  – West = - (Negative) X number

• Y Axis
  – North = + (Positive) Y number
  – South = - (Negative) Y number
Asset Tracking

• Where are all devices belonging to a group, category or organization, other pertinent information, licensing, software version...etc

• What: Any network infrastructure or endpoint device

• Consumers: IT, End-users of endpoint device, 3rd party user of information (such as a parent tracking a child), other application servers

• Requirements: The ability to locate devices within a defined boundary defined by the building boundaries or admin defined areas within that.

• Ability to automatically act on location information to provide alarms, notifications... etc is important. This is done without mapping to a visual representation

• Alarms/notifications are often tied to “defined areas” within the building such as a secured area that covers multiple rooms or an area within a manufacturing floor

• Assets are defined by their relative location to the area where area is a well defined thing within the indoor space

• Representation: Typically both Point and Polygon are used
Network Routing Based on Location

• At the time of a phone call, the location of the caller determines how the call must be routed within a private telephone network
• Consumers: Backend systems, routers..etc that provide route decisions based on location information and forward
• Requirements: Ability to track any network device that provides voice service and the associated network location of that device within the confines of a corporate building while relating it to the network topology
• No requirement to provide location based on a map per se.
• Representation: Typically a Point would be used
Indoor Emergency Responders

• At the time of an emergency call, the location of the caller is determined and the backend system dispatches a notification to the corporate emergency responders where the emergency is

• Consumers: In addition to emergency personnel, the notification can be dispatched to the security/video system to target video capture in the area and feed that information to a backend system

• Requirements: Ability to track any device capable of sending an emergency signal (not just voice) and provide that location to systems that localize the emergency

• Could be visualization on a map for personnel but also coordinate based for video/security systems

• Representation: Both Point/Polygon are typically used depending on the consumer applications
Presence

• Unified client applications running on laptops, pdas...etc
• Buddy lists, meeting services...etc benefit if the person and their associated devices are known accurately
• Consumers: Handheld devices that visualize people, backend servers that can provide proximity services such as closest free meeting room, where are all the meeting participants, find nearest projector for my meeting
• Requires backend system integration that can automate some of the more “fancy” features related to proximity of resources...etc.
• Not just visualization on a map for handheld devices
• Representation: Some presence applications don’t even show a map they show a textual representation of the user’s location but if they do show location they usually show a Point even if a Polygon provides the underlying estimate of location
• This is one of the reasons why providing a centerpoint of the polygon is useful for certain applications
Policy

• The ability to determine location for devices to apply network policy when the device accesses the network or moves physically within the network
• Highly mobile networks, IP address is no longer enough to apply location aware policies
• Consumers: Backend policy enforcement and administration points that can define location policies as well as enforce policy based on where a device is physically located
• Requires a definition of location, not usually related a visual map
• Representation: Polygon/Point depending on whether the policy system wants to include location inaccuracies in the decisions made
Network Management

• Many network management tasks in a mobile environment are highly dependent on knowing where the user/device is

• Such as :
  – Troubleshooting client connection, coverage area problems
  – Performance analysis of clients based on location
  – ....etc

• By locating devices to an accurate level indoors the ability to isolate problems when debugging network problems will become easier or performance data will become more relevant ...etc

• Although visualization is often required, relating location to the other objects defined within the network management system are important such as nearest set of APs...etc

• Representation: Both a Point (for summary screens showing multiple devices located) and Polygon (for individual devices and summary screens where mgmt wants to show location accuracy depiction) are typically used that shows the possible position of devices based on the inaccuracies of location determination
Use cases where arcband/circle representations are used

- Arcbands are typically used in RF environments where directional antennas are used or determination techniques are used that can isolate to a “band” around a center point
- Examples include warehouses, hangers where a directional antenna points down a long narrow area within the area
- Circles are used where non-directional antennas are deployed and RF triangulation using RSSI or TDOA...etc is not possible to determine location—i.e. where a single AP (e.g. hotspot) is aware of your location relative to the hotspot AP