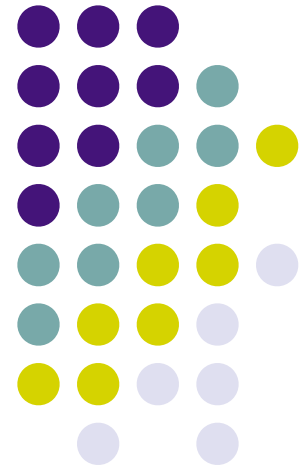


I2 and I3 – a status summary

Henning Schulzrinne
Columbia University
NENA Interim Meeting
Burlington, VT
April 6, 2004

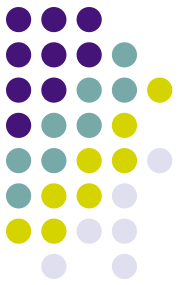


Three stages to VoIP 911



	spec. available?	use 10-digit admin. number?	mobility	callback number to PSAP?	caller location to PSAP?	PSAP modification	ALI (DB) modification	new services
I1	now	allowed	stationary	no	no	no	no	none
I2	Dec. 2004	no	stationary nomadic	yes	yes	no (8 or 10 digit)	update	none
I3	late 2004	no	stationary nomadic mobile	yes	yes	IP-enabled	ALI not needed MSAG replaced by DNS location in-band	GNP multimedia international calls

Requirements for I2 (Nate's)



- Wired VoIP calls will look like current wire line 9-1-1 calls or wireline compatibility mode (WCM) when they are delivered to the PSAP (COS may be different).
- Geo routing determination within the network that supports the VoIP call delivery is fine right up to the TGW. After that, the call will be routed via wireline compatibility techniques, i.e., dedicated trunk to the selective router and delivery of a key to the PSAP to retrieve the ALI information (either static record in the ALI DB or via NCAS).
- Only validated civil addresses are acceptable for display at the PSAP *unless* the call originates from either a WiFi, WiMAX or other wireless IP-capable delivery source in which case, display of an x-y coordinate is satisfactory along with a validated civil address for the location of the wireless base station - this is analogous to wireless call delivery today.
- The MSAG validation process will be coordinated with the 9-1-1 service providers responsible for the supporting DBMS for each ALI DB. It does not matter whether the address information has to be validated using a manual or automated process (similar to the PS-ALI process CER uses for the enterprise environment).
- The VoIP interconnection provider, that provides the ESGW and LGW interfaces to the E9-1-1 Service Provider Network, must provide its NENA Company ID to be delivered with the ALI to the PSAP. This VoIP provider should also provide a call history to assist in tracking troubles. If no other VoIP provider information is available, this VoIP provider is responsible to the Emergency Services community (i.e., PSAPs) for the emergency calls it delivers.

Why wireless-like properties for I2?



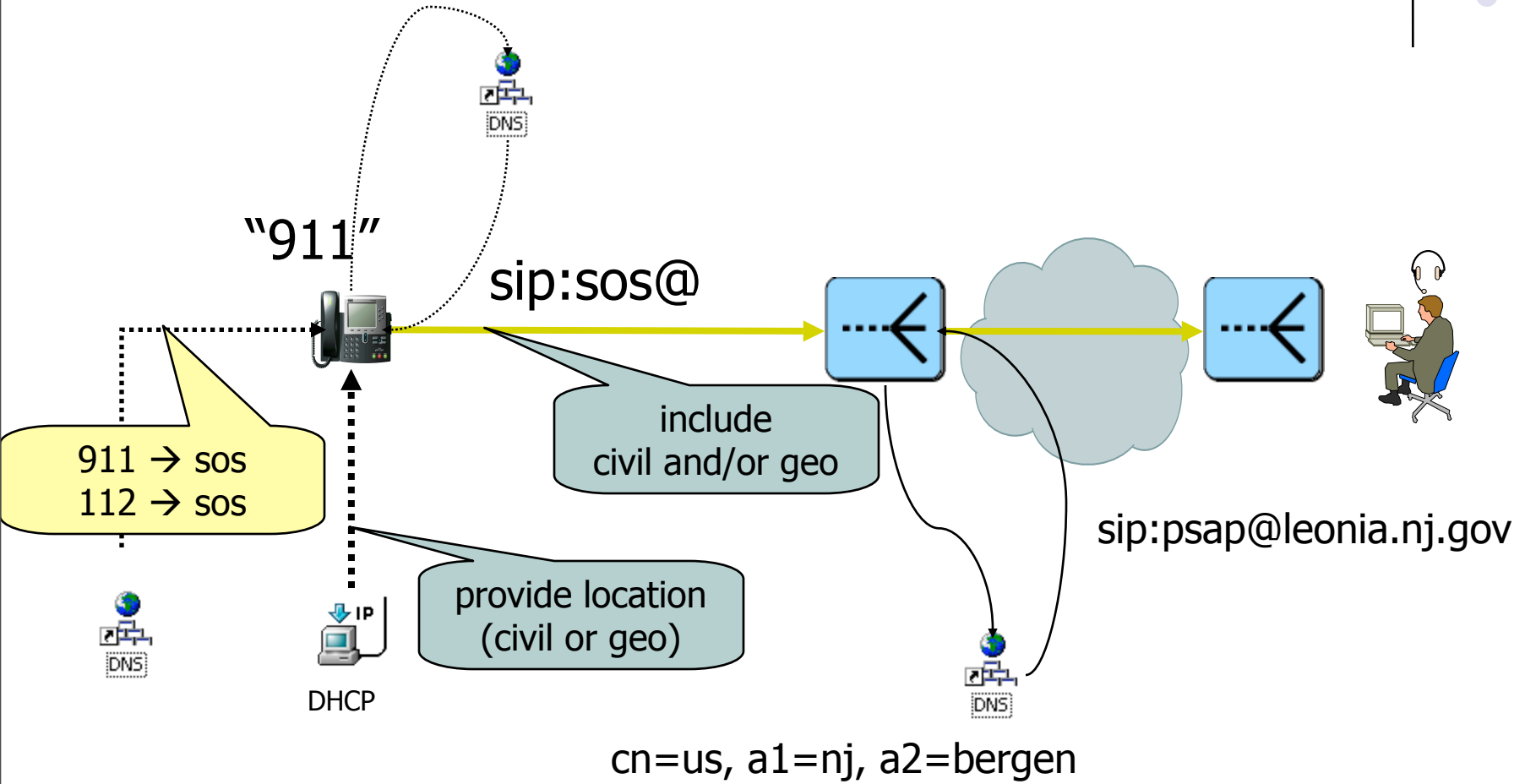
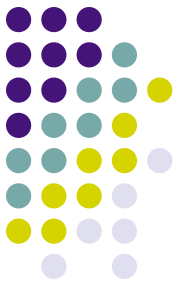
- Combination of factors:
 - Support for non-local numbers
 - can be resolved by assigning additional local number
 - Lack of universal ten-digit support
 - otherwise, could steer to right ALI
 - nomadic users
 - update processes for wireline ALI DB not fast enough
 - could share single location number (~wireless EDSK?)
- Can avoid by doing one of:
 - 10-digit ANI with nationwide ALI DB steering
 - disallow non-local numbers **and** nomadic users
 - assign additional local number to users

Requirements and assumptions for I3



- Do not assume existence of a carrier-like VSP.
 - Or: Consider each operator of a domain and proxy server is a VSP.
 - May not have contractual relationship with state, county, ...
 - Separate mechanism for verifying whether dues have been paid.
 - lots of options, from equipment “stamp” to ISP or VSP “tax”
- VSP may not know location of caller and may not be located in the United States.
- ISPs MUST provide civic and/or geo addresses to IP end systems.
- ISPs MAY provide PSAP URIs.
- VSPs MUST route emergency calls.
- Conversion from geo to civil and civil to geo SHOULD be avoided.
 - transmit both types of location if available
- Updates of caller location during an emergency call MUST be supported.
- Charging models have not been considered and are beyond the scope of this discussion.

I3 architecture

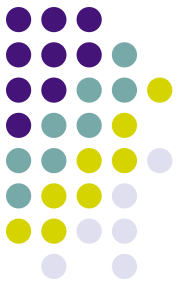


Consensus positions?



- Do *not* assume 10-digit or Phase-II enabled PSAP
 - → ESQK may not be call back number if VoIP terminal is using non-local area code
- Call routing based on civic or geodetic coordinates
- ESQK generally non-dialable
 - PSAP NPA-compatible
 - allocated by LGW, not by VSP or ISP
 - if out of resources, fallback routing **MUST** be provided
- Display civic information to call taker whenever available
 - may be location of WiFi or WiMax AP
- MSAG-style verification of civic addresses strong goal:
 - **MUST** for ISP-provided location
 - **MUST** for VSP manual entry (deprecated)
 - **SHOULD** for users on ISPs that do not offer location service
- I3 locations conveyed by call setup signaling (SIP) where possible
 - may be SIP UPDATE, not just INVITE

Some general design principles



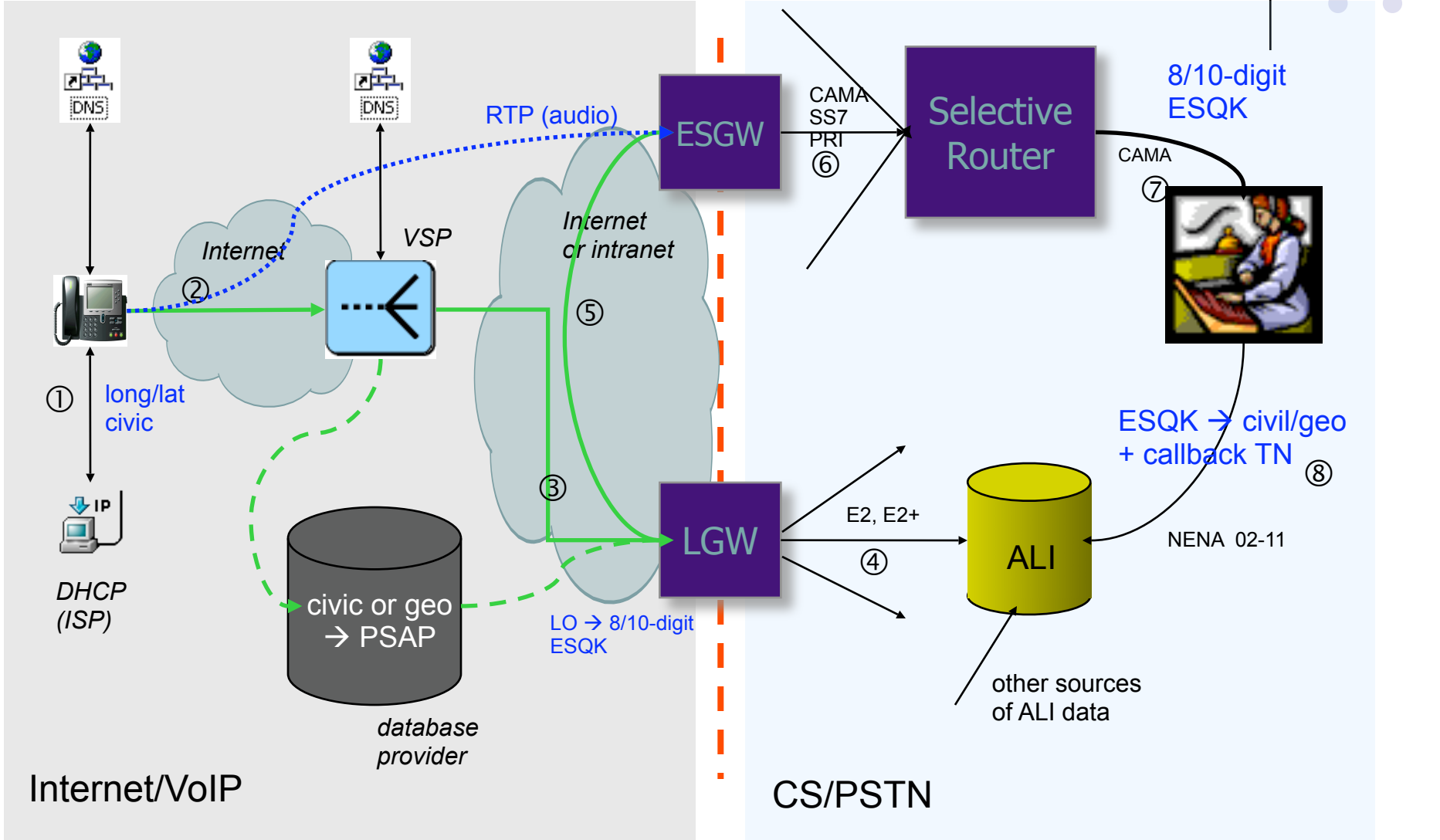
- Decouple orthogonal components:
 - *call identification* → seems non-controversial (“sos”)
 - *location determination* at end system
 - locally determined (typically, GPS)
 - DHCP: civic + geo
 - proxy-provided
 - maybe others (e.g., CDP-like or periodic broadcast)
 - *call routing* to PSAP or gateway
 - *civil location validation*
- May need multiple choices in some cases
 - operational issues (availability of MSAGs, etc.)
- No single point of failure – maintain distributed nature of 911 system
- Plan for re-use during I3
 - I2 and I3 are likely to co-exist – VSP and ISP should not need to know who is using what

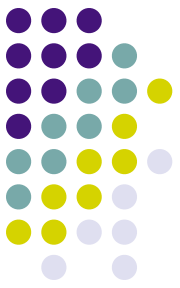
DNS



- Only generally-available distributed database
 - does not require pre-configuration in clients or proxies
 - sos.arpa later, sos-arpa.net now (registered...)
 - does not require small number of database providers
 - but maintenance can be outsourced
 - does not require central mapping server(s)
 - fully delegated administration, following administrative & governmental hierarchies
 - high-availability replicated root (if root fails, Internet lights dim)
- Use DNS for:
 - pointer to service boundary polygons (via HTTP?)
 - country-specific emergency numbers
 - civic address existence verification
 - URIs for PSAPs
- Alternative:
 - construct HTTP-based hierarchical retrieval (with caching)
 - very similar properties to DNS
 - basically, re-invents DNS over HTTP

Possible I2 architecture

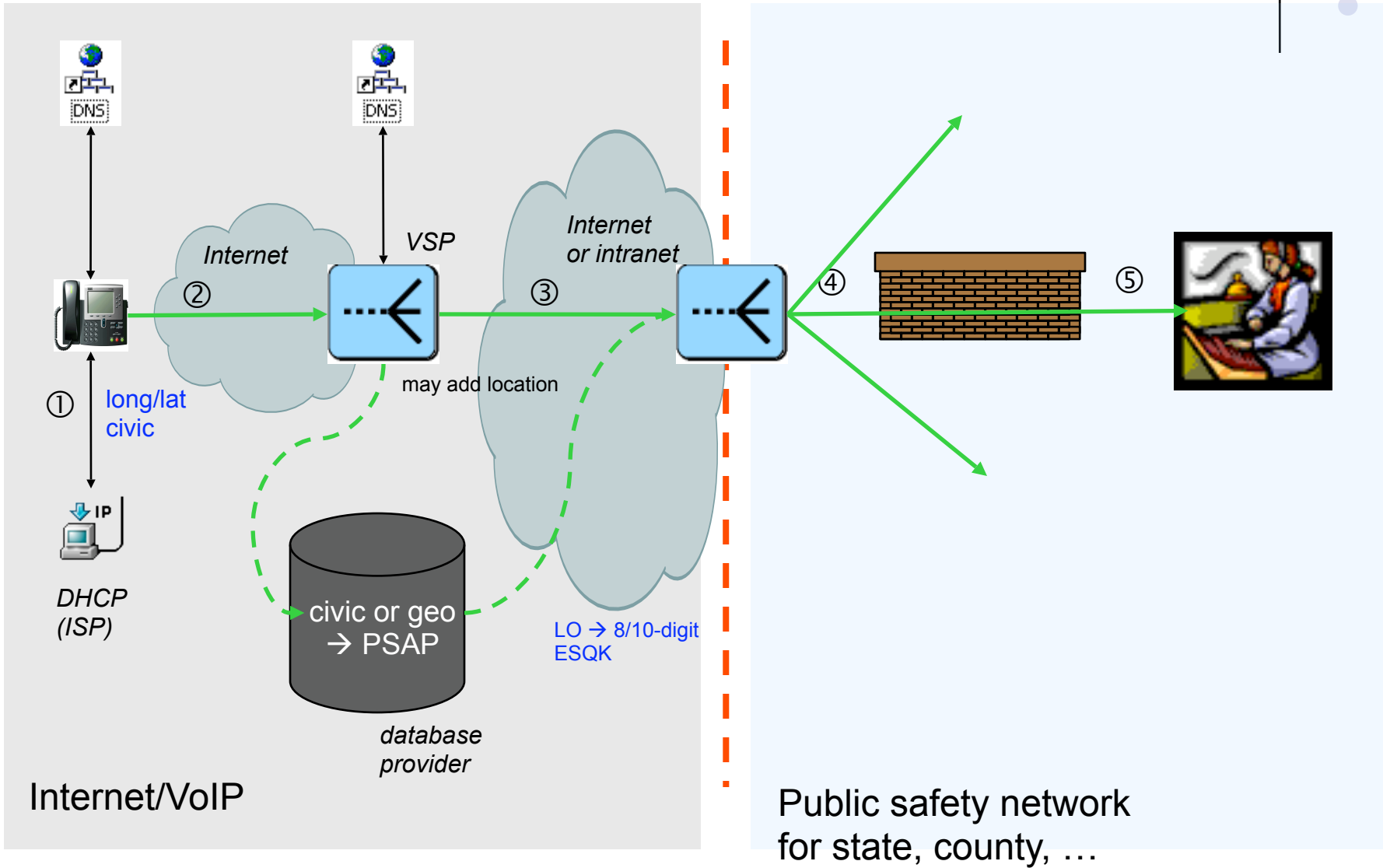
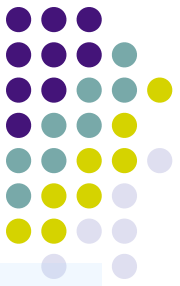




Notes on I2 architecture

- LGW can either proxy or redirect the SIP request
 - allocates ESQK from local pool
 - based on location of call (so that call reaches right SR and PSAP)
- There is no direct relation between LGW and ESGW
 - probably many more ESGWs than LGWs
- Location can be inserted by VSP proxy server, DHCP, or any other mechanism
- DNS may contain fallback LGWs
 - NAPTR weight indication

Transition to I3 architecture



Internet/VoIP

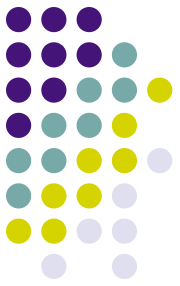
Public safety network
for state, county, ...

SIP transformations



	From	PA	Contact	To	R-URI	body
after UA	<i>caller@home</i>		call-back number	<i>sos@home</i>	<i>sos@home</i>	SDP (LO)
after VSP		verified identify			<i>sos@lgw</i>	SDP LO
after LGW					<i>esqk@esgw</i>	

Open issues



- Central database:
 - needed?
 - protocol (SIP?)
- Proxy—LGW protocol:
 - SIP (redirect to LGW)
 - returns LQSK
 - updates ALI with location
 - HTTP
- Allocation of EQSK:
 - needs to be local to PSAP due to 8-digit limitation
 - thus, dynamic allocation by LGW required
 - not a big deal if regional or local LGWs

Funding models



- Goals:
 - do not penalize possession of numbers and devices
 - do not encourage use of non-domestic VSPs
 - not voice-centric
- ISP fee
 - last-mile access provider
 - percentage of line charge, with rate adjustments
 - similar to USF computation
 - allow ISP to deduct cost of providing location
 - unfair to those with no 911 users?
 - IP address ranges
- National 911 fee
 - amount?
 - how collected?
- State & local taxes