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# Identity and Location: implications for Security, Privacy and Resilience

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*Dagstuhl Seminar 15151*
*10 Apr 2015*

# Caveat

- I have 15 mins only ... so ...
- Highlight high-level ideas:
  - some examples from today's world.
- Make the case that identity and location need to be considered explicitly in the design and implementation of security, privacy and resilience mechanisms:
  - has impact on users, applications and services.
  - needs to be considered at system design overall.

# Scope and Definitions

- An **identity**:
  - a “name” (set of bits) that (uniquely) labels some entity (a device, a user, a host/node, etc.)
- A **locator**:
  - a “name” (set of bits) that labels allows the topological and/or geographical and/or physical position of an entity
- While these could be considered technical issues only, some form of **identity** and **location** might be used in in policies, SLAs, system configurations, etc.

# Identity and Location

- Identity is used for many protocols, services and applications:
  - identity required to access services
  - identity used for authentication and access control
- Already well-known problems on uses of identity and location, e.g.:
  - identity theft
  - location tracking
- Explicit identity and location may be required for operation of applications, services and systems.
- Explicit Identity and location may offer new opportunities for security, privacy and resilience.

# Example: mobile phone service

- Identity:
  - required to uniquely identify subscribers
- Location:
  - required to route calls correctly
- Without explicit use of identity and location, the mobile phone service would not function.
- (Also, smartphones have GPS.)
- However, it does mean that there is information about exactly where you are!
- This is largely understood and accepted.

# Identity

- End-to-end integrity of services:
  - end-to-end state
  - invariant / stable value to allow protocols to maintain a session or connection
- Can use middleboxes:
  - additional complexity
  - additional entity that needs to be trusted
  - additional point of attack for disrupting communication
- Trade-off:
  - service vs. visibility of identity

# IP addresses

- Provide both identity and location of a host:
  - overloaded semantics
- End-to-end state is tied to location:
  - mobility is harder
  - multiple connectivity is harder
  - packet-level security is bound to a location
- Can use middleboxes:
  - usual problem of an additional entity
- Trust boundary

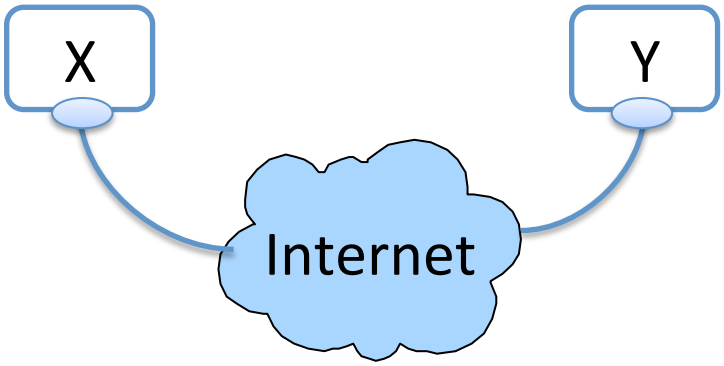
# New namespaces, separate semantics

- Semantic overload of IP address:
  - **locator** semantics + **identifier** semantics
  - ease implementation of multi-homing, mobility, etc …
- This is a well-known problem:
  - RFC4984, IAB (2007)
  - RFC2101, IAB (1997)
  - **IEN1 (1977)**
- Many “ID/Locator separation” solutions proposed:
  - HIP, LISP, SHIM6, SixOne – re-use of IP address
- **ILNP – deprecates use of IP addresses:**
  - **RFC 6740-6748 (Experimental, IRTF RRG)**

# “IP addresses considered harmful”

- **“IP addresses considered harmful”**
  Brian E. Carpenter
  ACM SIGCOMM CCR, vol. 44, issue 2, Apr 2014
  http://dl.acm.org/citation.cfm?id=2602215
  http://dx.doi.org/10.1145/2602204.2602215
- *Abstract*
  “This note describes how the Internet has got itself into deep trouble by over-reliance on IP addresses and discusses some possible ways forward.”

# ILNP: transport layer state example




A = IP address
P = port number

At X:
<TCP: $A_X$, $P_X$, $A_Y$, $P_Y$> <IP: $A_X$, $A_Y$>

At Y:
<TCP: $A_Y$, $P_Y$, $A_X$, $P_X$> <IP: $A_Y$, $A_X$>

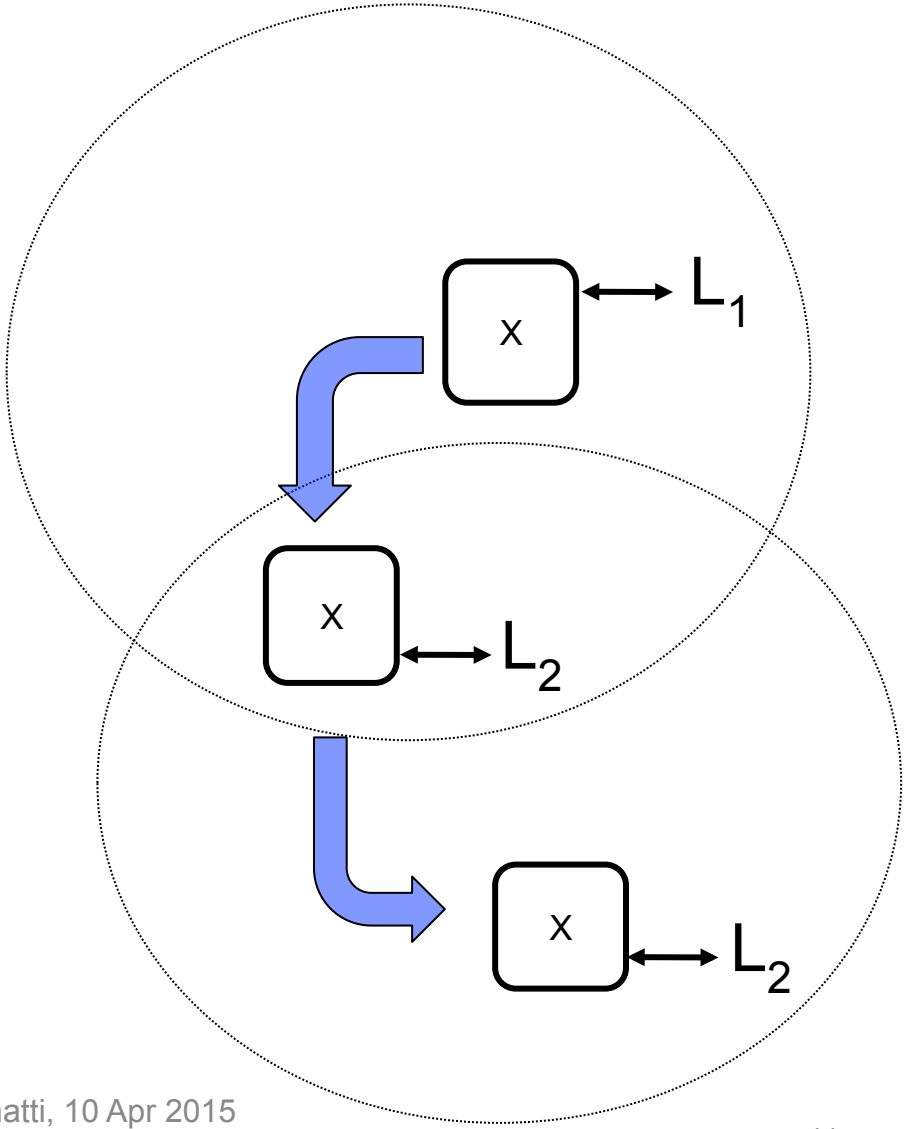
L = Locator
I = (Node) Identifier
P = port number

At X:
<TCP: $I_X$, $P_X$, $I_Y$, $P_Y$> <IP: $L_X$, $L_Y$>

At Y:
<TCP: $I_Y$, $P_Y$, $I_X$, $P_X$> <IP: $L_Y$, $L_X$>

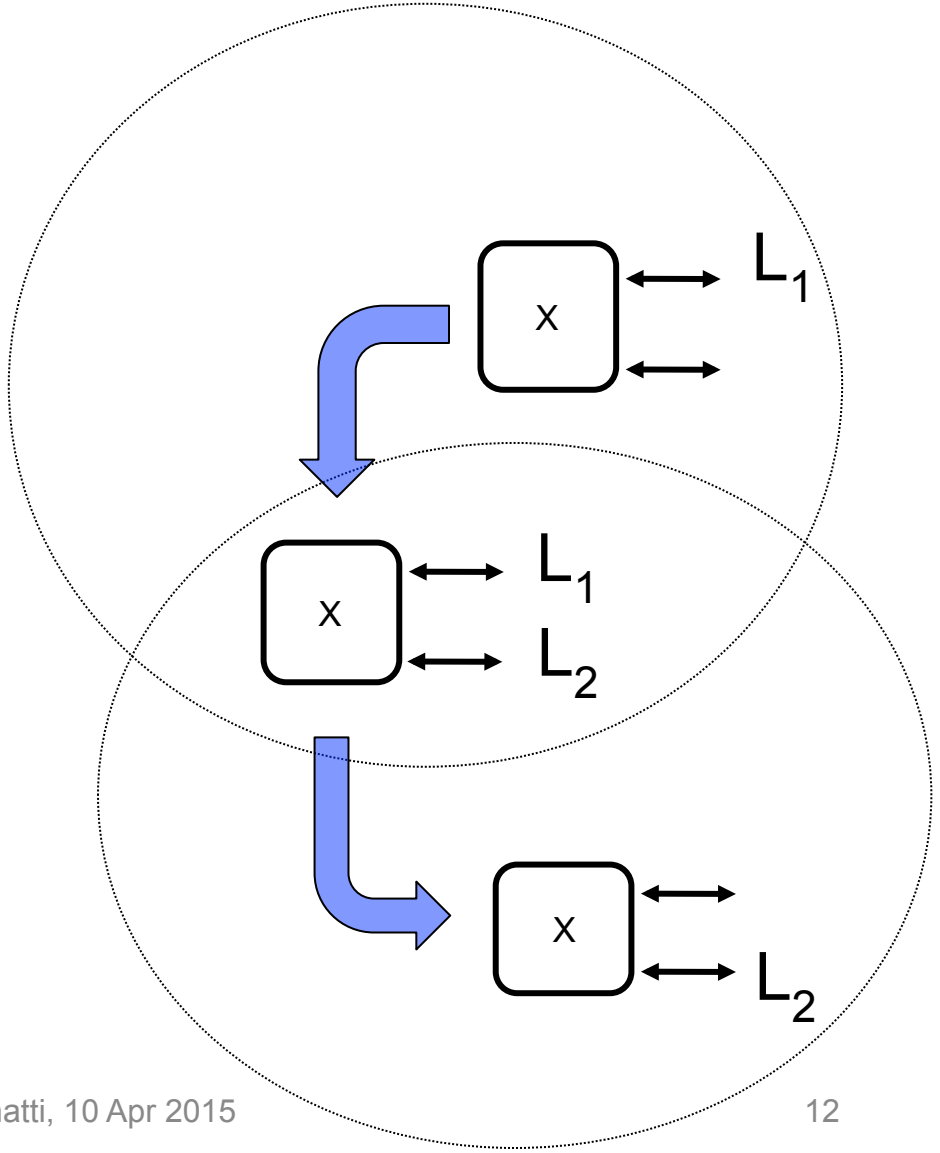
# Mobility: hard handoff

- Hard handoff model used by MIP
- ILNP supports hard handoff also:
  - move from one cell to another
  - drop locator (prefix) $L_1$, use locator (prefix) $L_2$

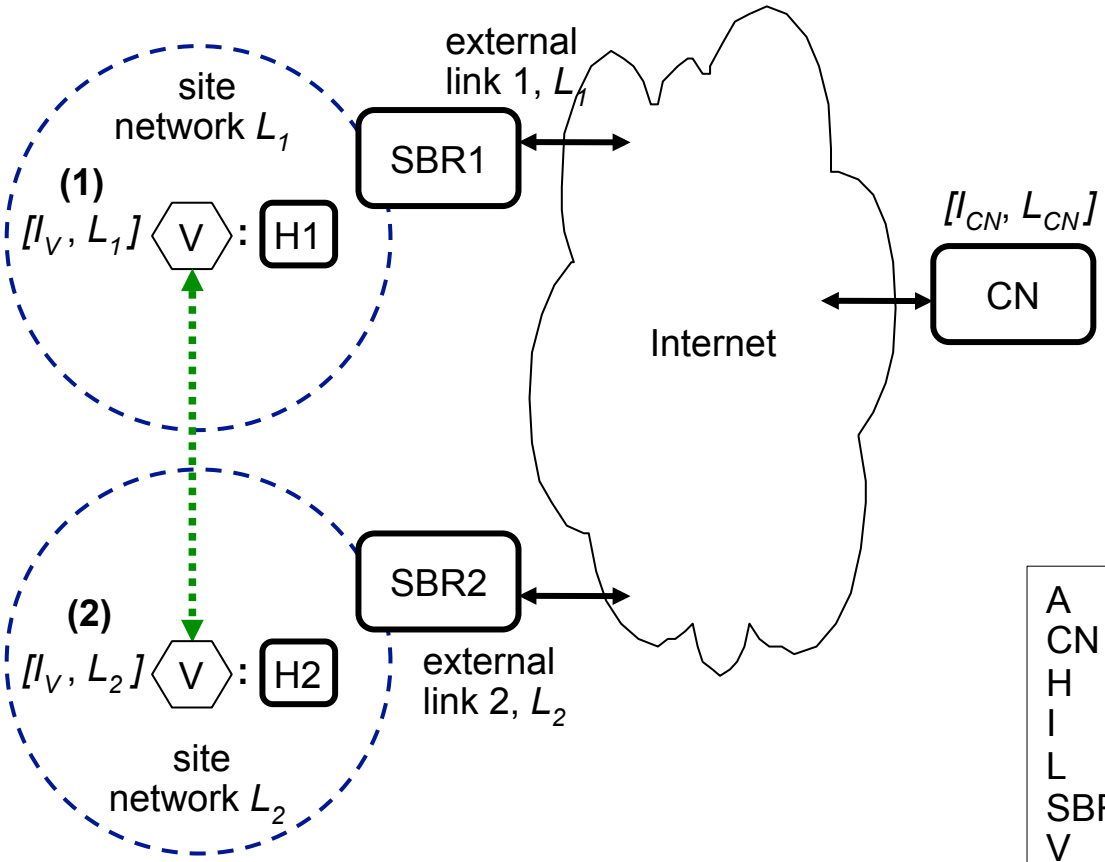


# Mobility: soft handoff

- ILNP support soft handoff (similar concept to CDMA)
- Both old locator ($L_1$) and new locator ($L_2$) used in overlap region
- Mobile host is multihomed during handoff



# Inter-Datacentre Movement for VM




| | |
|---|---|
| A | address (IP address) |
| CN | correspondent node |
| H | host |
| I | identifier |
| L | locator |
| SBR | site border router |
| V | virtual machine image |

# IPsec

- Packet-level security for IP.
- IP addresses form part of end-to-end session security association (SA).
- If address changes, SA is invalid.
- If an identity is used, end-to-end state is invariant:
  - dynamic binding to location
  - update to location needs to be protected but can be signalled end-to-end

# Summary: Identity and Location

- Sensitive information:
  - may expose privacy and security constraints.
- Opportunity:
  - explicit recognition of identity and location could be used for enhancing security and resilience.
- ILNP applies this to the network layer:
  - higher layer application of similar principles is possible and could lead to opportunities for enhanced security, privacy and resilience.