e164.space – a MODERN experiment

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Overview

Assumptions

System structure

Phases

Roles

Paxos consensus

Simple porting

User interface

System components

Pre-MODERN prototype

Student semester prototype (Akhilesh Mantripragada & Abhyuday Polineni, Columbia Computer Science)

Try it yourself: north.e164.space (currently hibernating)

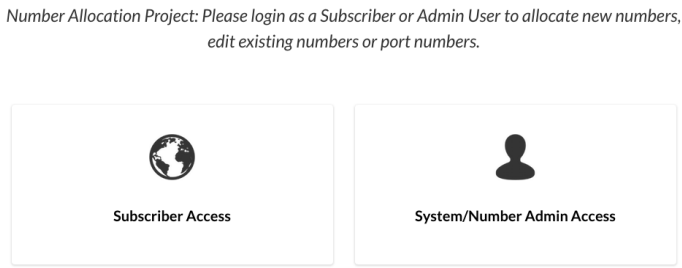
Fully distributed cloud-based system (currently, 3 servers)

Ensures that only one entity can access a number at one time
- resolves simultaneous access by majority vote
- but assumes cooperative (non-Byzantine) nodes

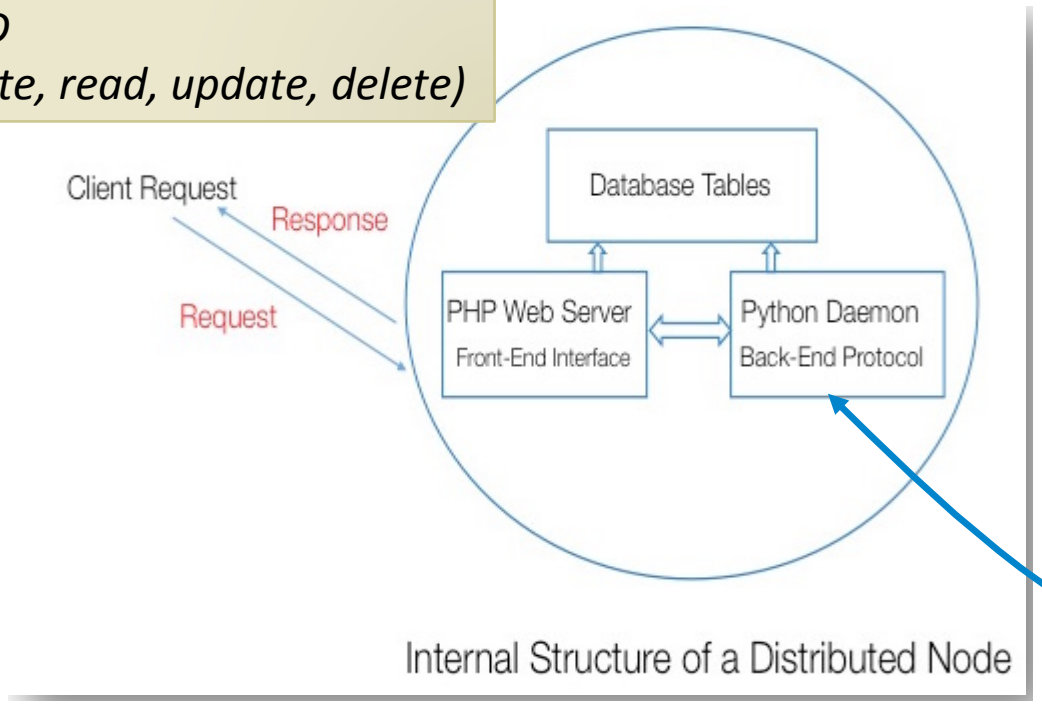
No single point of failure

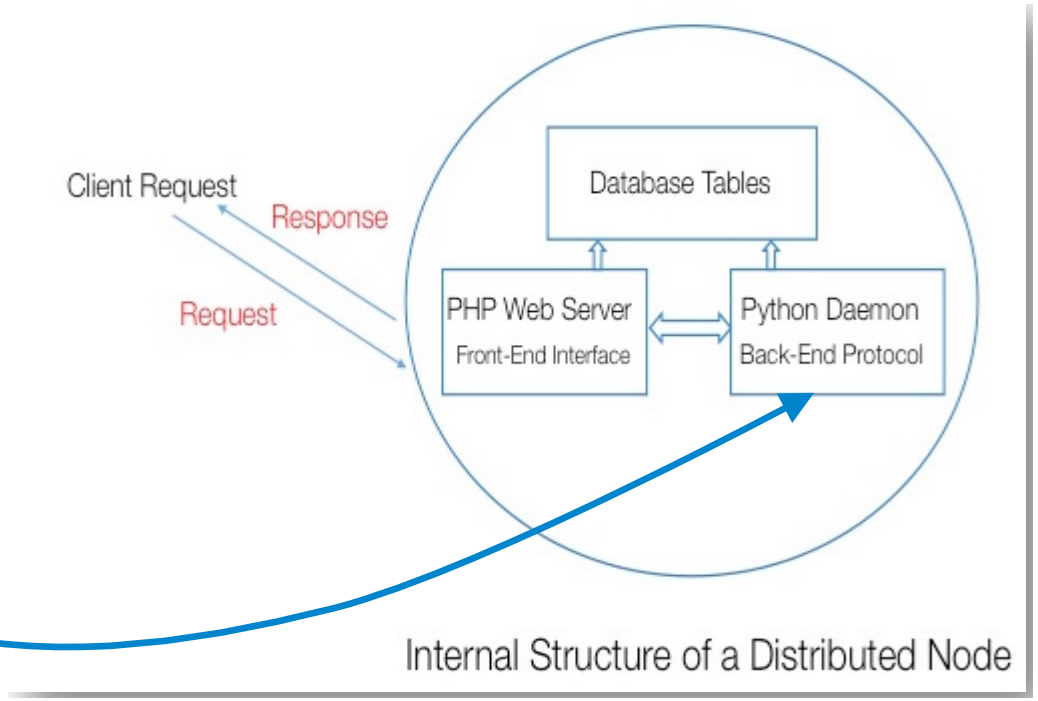
Agnostic on per-number meta data

PIN-based porting model
- consumer gets or sets PIN via web page
- provides PIN to gaining carrier



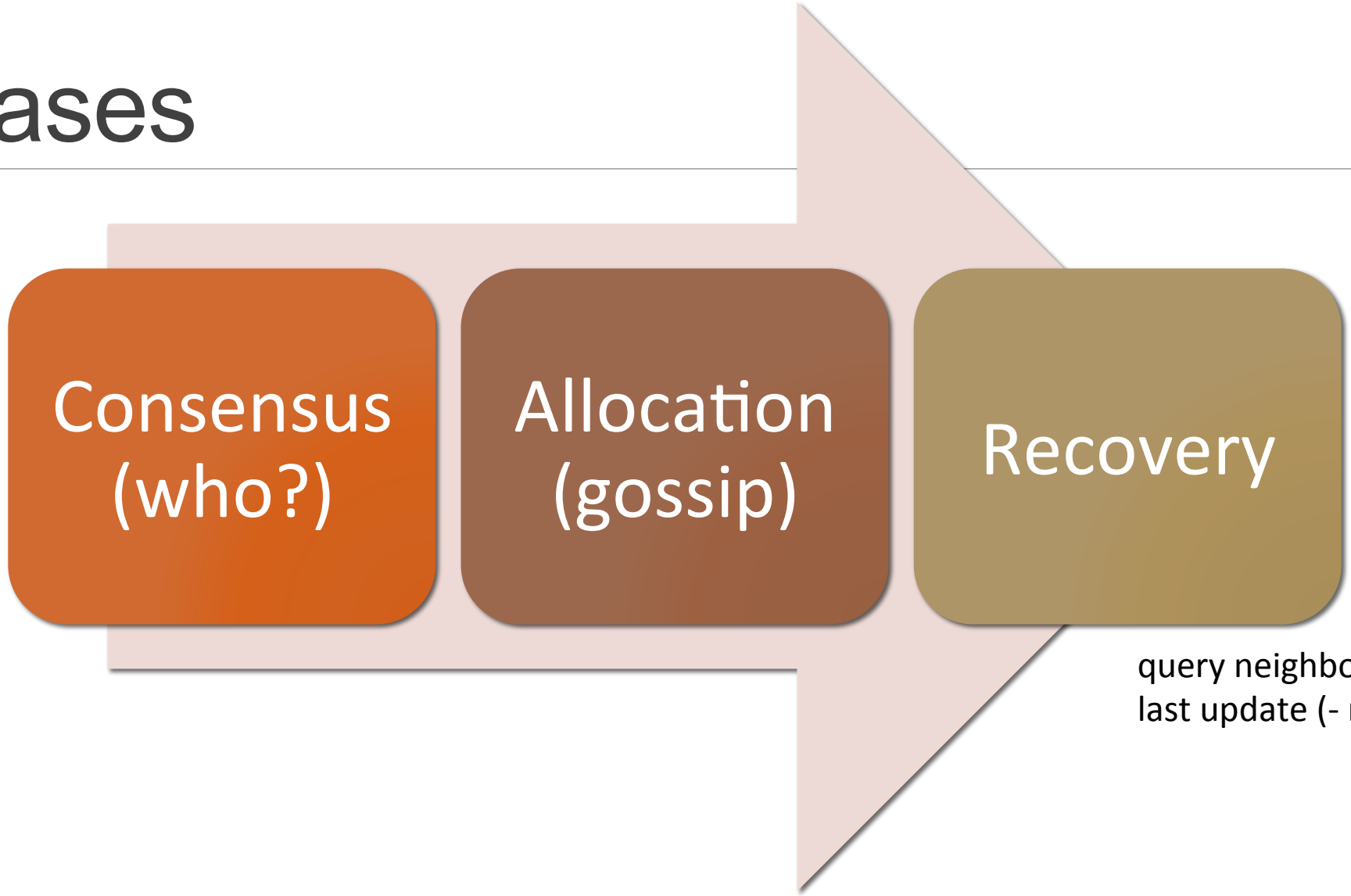
CRUD
(create, read, update, delete)





Paxos + management
(HTTPS)

Phases



query neighbor for log since last update (- max. time diff.)

Roles (= simplified real world)

	Responsible for	Can create which roles?	Can allocate what?	Can port what?
Subscriber	Number	-	one number	their number
OCN number administrator (“carrier”)	OCN	-	numbers for OCN	any number within OCN
OCN manager	OCN	OCN administrator	numbers for OCN	any number within OCN
System administrator	any OCN	OCN manager	OCNs, area codes	any number

Paxos for distributed consensus

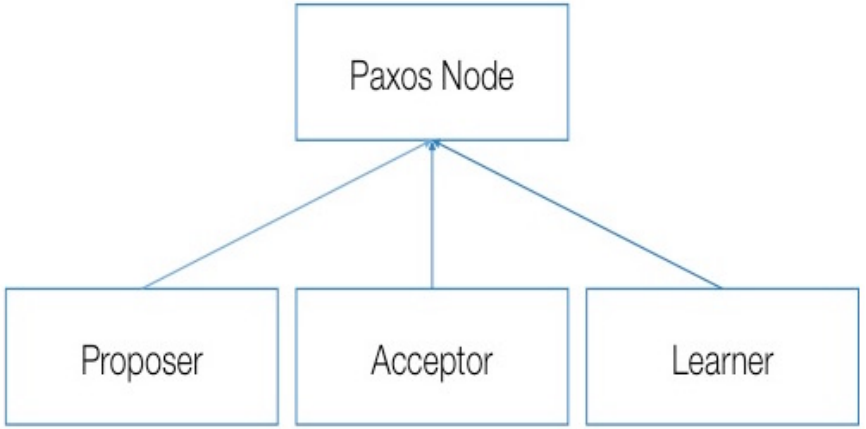
Collision (mainly) a problem during allocation of numbers

- assume that number holder will coordinate update operations
- but could apply distributed consensus to updates as well (→ overhead)

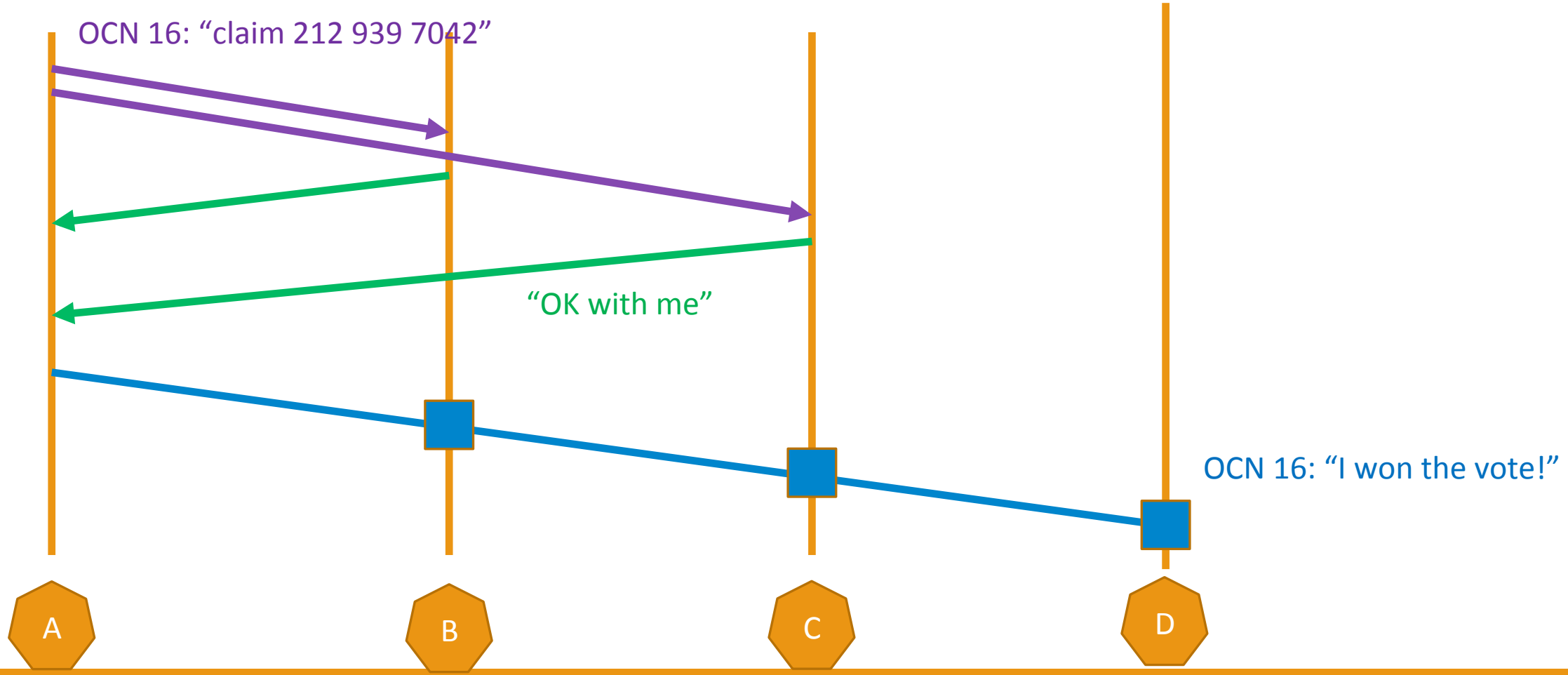
Any registrar can allocate any available number

Rely on quorum = N/2 + 1

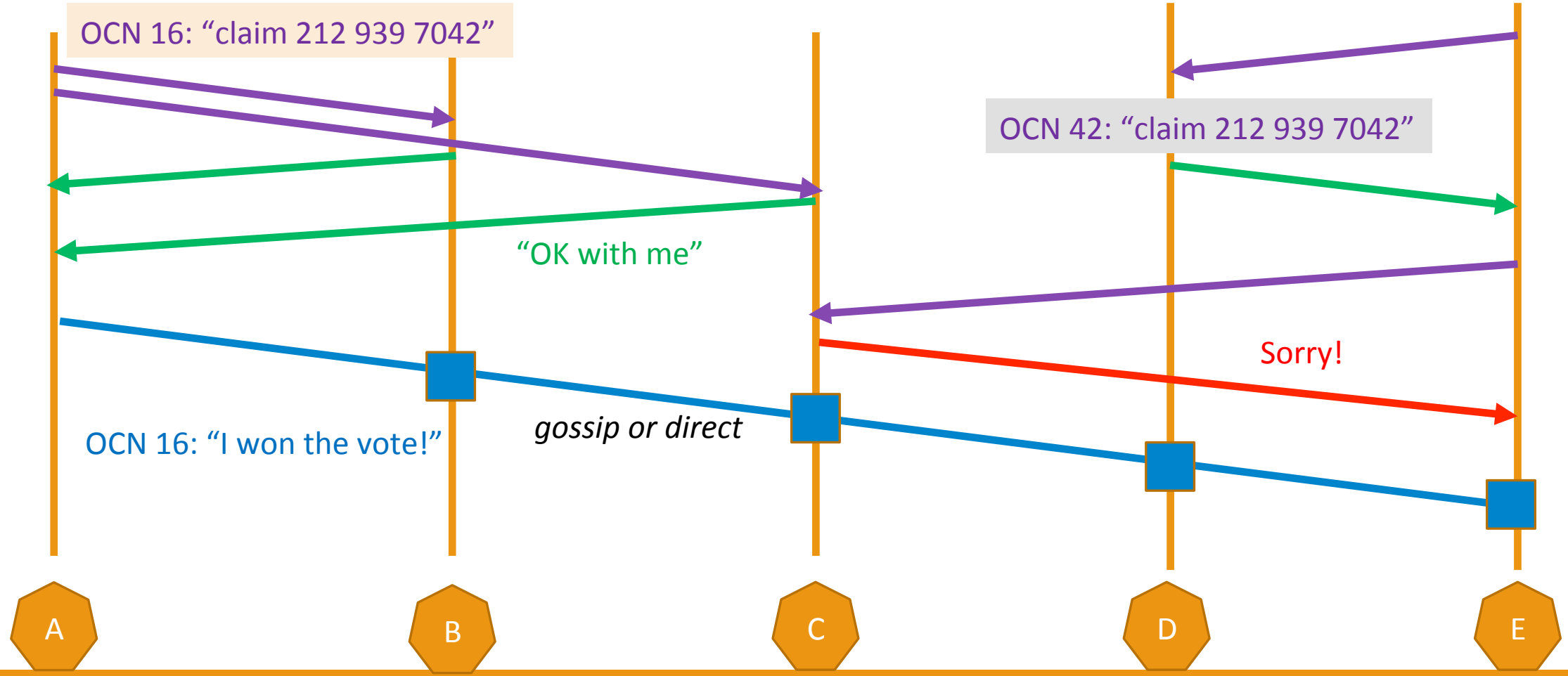
- N (registrar count) is assumed to be known and relatively static
- does not need to track minute-by-minute liveness
- uses heartbeat



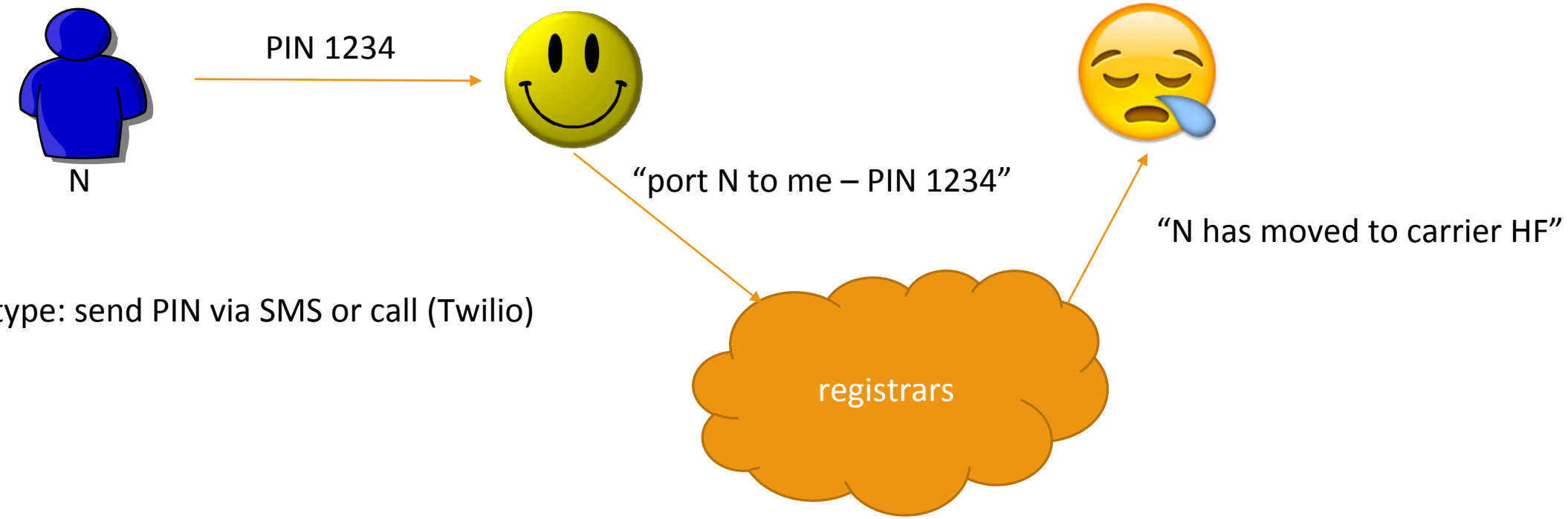
Simplified consensus



Simplified consensus

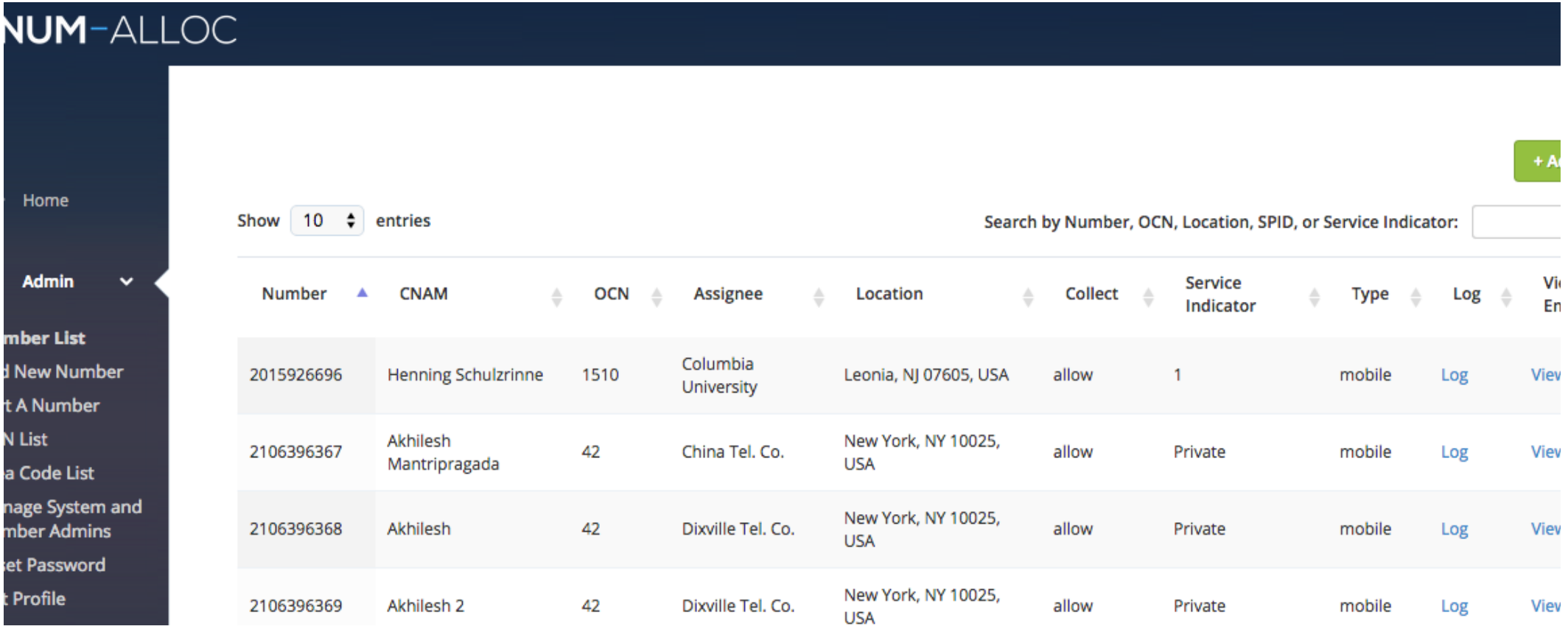


Simple porting



prototype: send PIN via SMS or call (Twilio)

Prototype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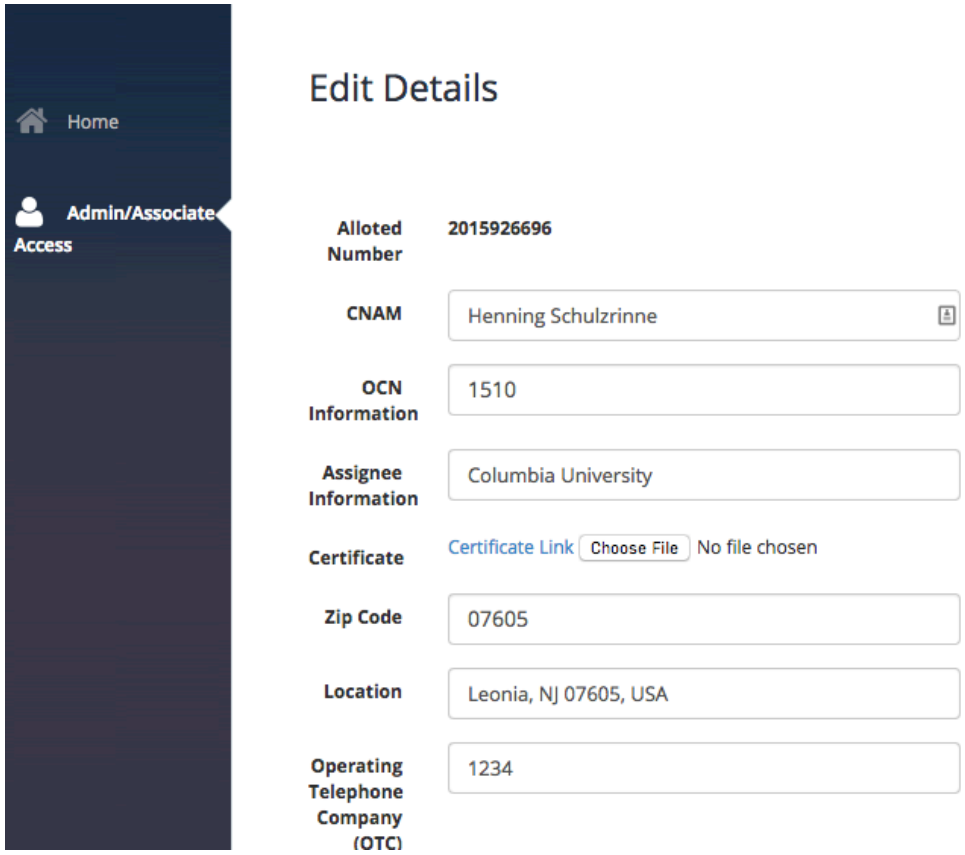
Prototype


Home
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Henning Schulzrinne
OCN Information
1510
Assignee Information
Columbia University
Certificate
Certificate Link
Choose File
No file chosen
Zip Code
07605
Location
Leonia, NJ 07605, USA
Operating Telephone Company (OTC)
1234

Number data structure

Field	Type
id	INT
number	BIGINT
cnam	VARCHAR
ocn	VARCHAR
assignee	VARCHAR
certificate	LONGTEXT
location_zip	VARCHAR
location	VARCHAR
otc	VARCHAR
rao	VARCHAR
bsp	VARCHAR
collect	ENUM
alt_spid	VARCHAR
service_indicator	VARCHAR
reachability	VARCHAR
type	ENUM
gusi	VARCHAR
pin	VARCHAR
password	VARCHAR
accesscode	VARCHAR
created_at	TIMESTAMP
updated_at	TIMESTAMP

Implementation

Front end

- HTML 5
- CSS 3
- JavaScript/Jquery
- Twitter Bootstrap

Back end

- PHP (front end)
- Laravel (PHP Framework)
- Python (messaging)
- MySQL

APIs: Google Maps, Mandrill (email), Twilio (SMS + voice)