Optimal Small Cell Deployment models

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Small Cells in More than 30 States

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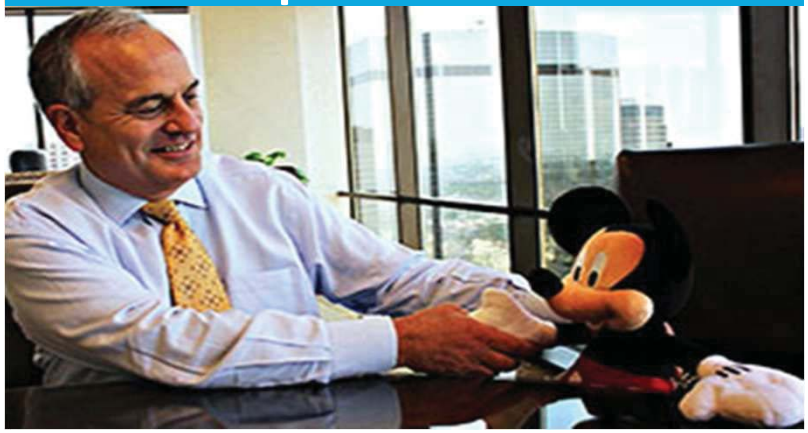
Small Cell – Current Installations

Outdoor

Indoor

Enterprise Customers



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Cost Efficient Availability

Small Cell Deployment: Flexible, Efficient, Scalable, Cost Effective, & Accountable

- Intervals need to Improve
- Venue Specific Solutions
- Wider Selection of Options
- Optimized Form Factor & Power Needs

Demand ▶ *Planning & Design* ▶ *Execution* ▶ *Turn Up & Operate* — ***200+ days***

Demand ▶ *Planning & Design* ▶ *Execution* ▶ *Turn Up & Operate* — ***30+ days***

Small Cell Process Hot Buttons

- Contract
- Site Acquisition and Compliance
- Transport
- Manual methods, procedures and long SLAs
- Nice to have vs. Must have

How we are getting to 30 days

- **Streamline Steps** – Removal of steps not required for 1AP or AT&T Transport
- **Process Improvement** – Revised SLAs/Durations, removal of steps deemed unnecessary
- **Development** – IT and Network Enhancements in support of Automation and System Integration

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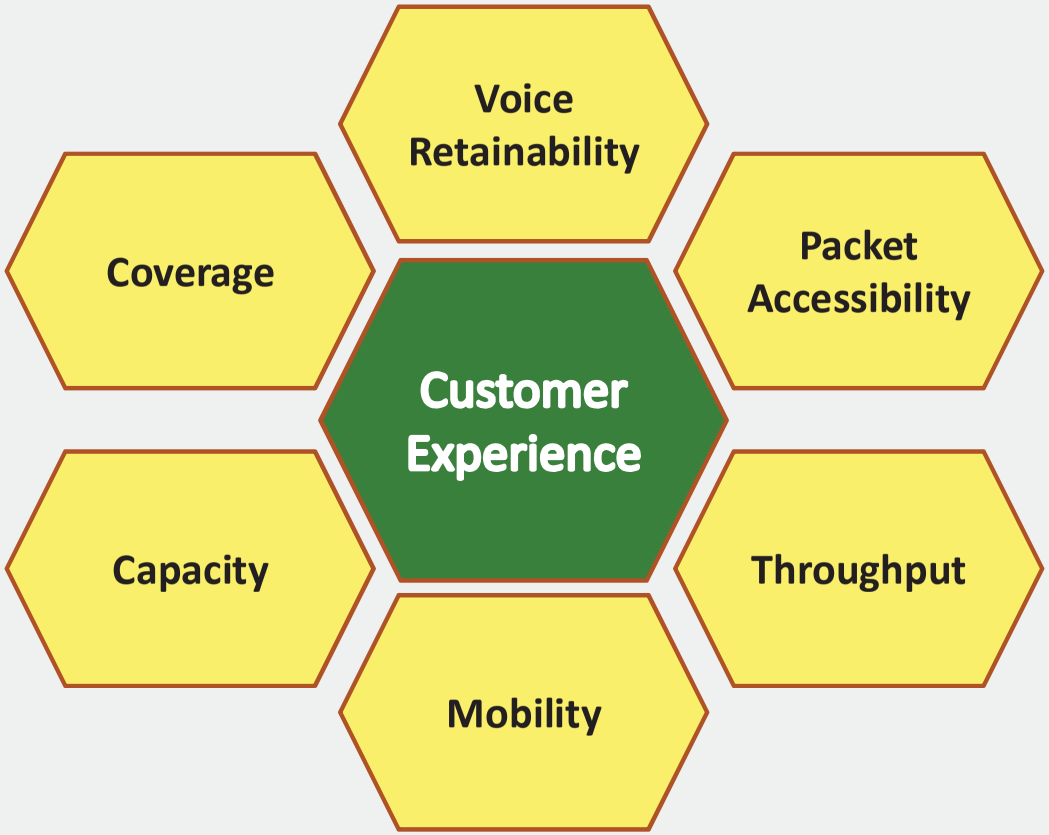
Small Cell Deployments – What is success?



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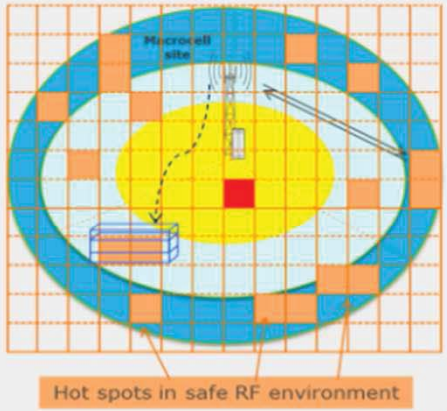
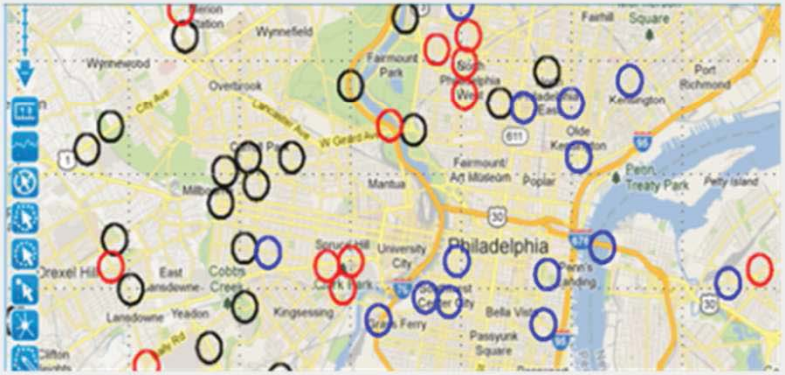
Deploying New Tools

State-of-the-art radio propagation and mathematical programming models to determine the optimal locations to place small cells



Defining Outdoor Opportunities



Identifying In Building Opportunities

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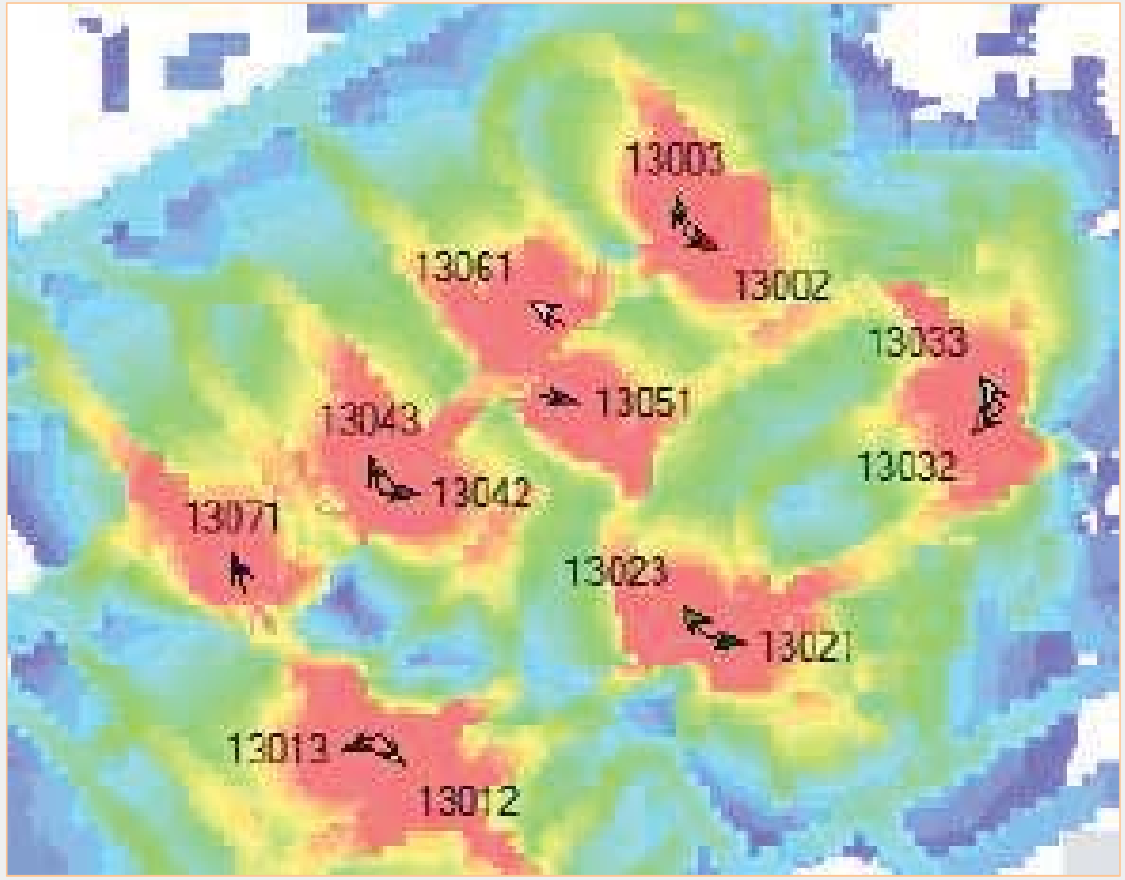
Interaction with the Macro Network



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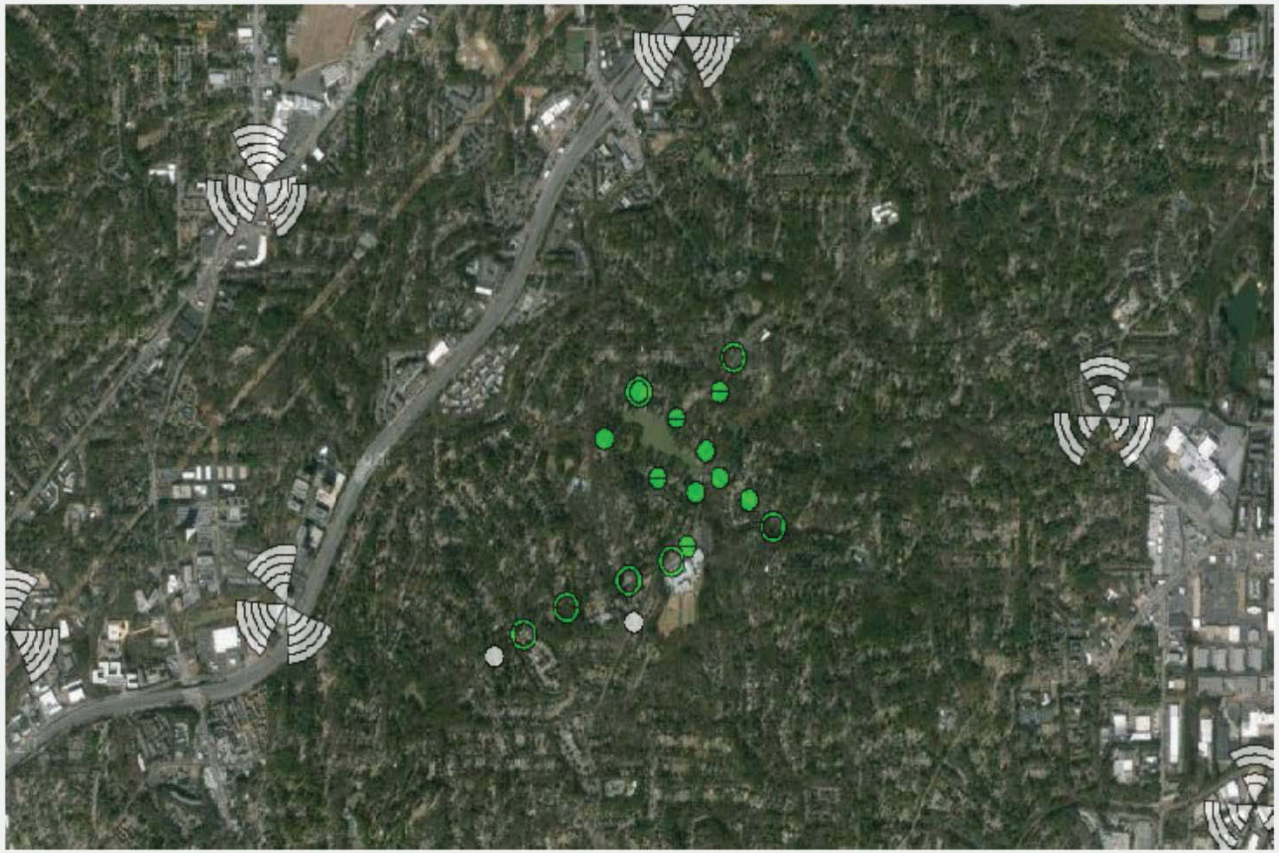
Macro Network HO - Mobility



- 22 Small Cells in Suburban Cluster
- Dense Foliage
- Busy Road through Center of Cluster
- Residential Streets Leading in and out of Cluster
- Terrain Blocks Macro Coverage

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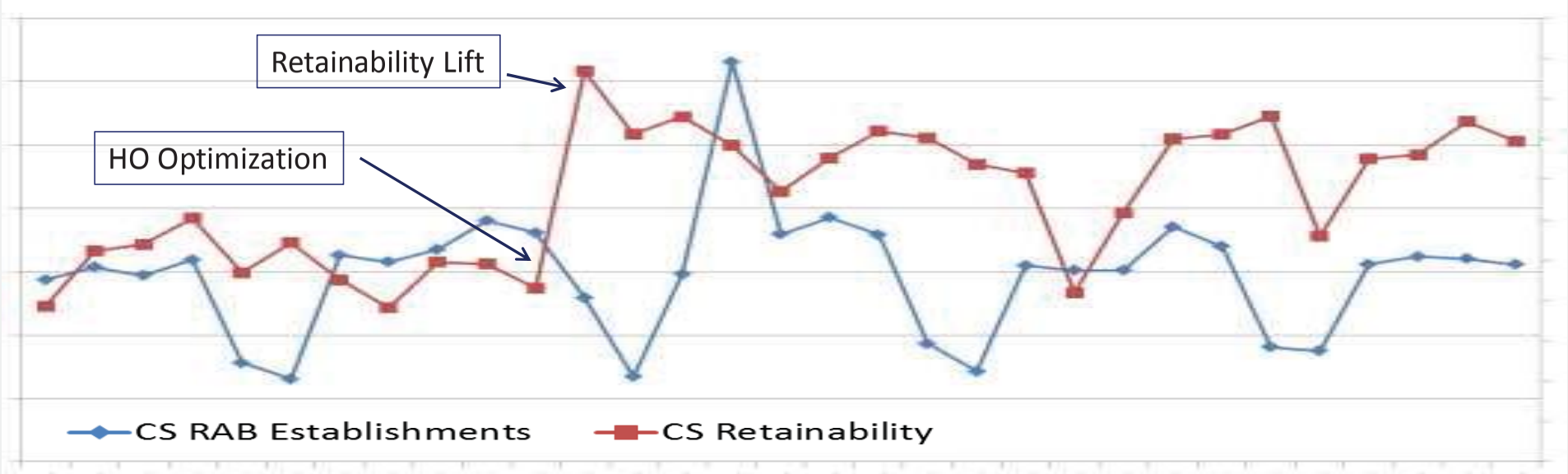
Performance with HO



- MAHO Based HO – Balance Coverage and Quality Thresholds
- Avoid Ping – Pong with the Macro
- Blind HO: Priority Neighbors with Fallback to MAHO

  CAUTION Blind HO works best with very predictable target HO cells

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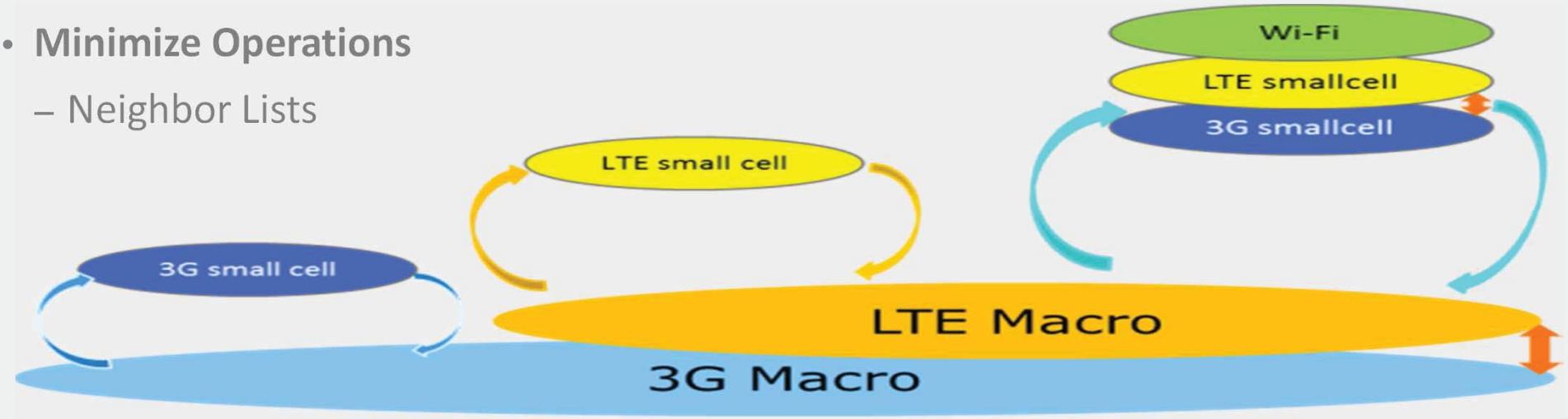
Layer Management

- **UE Camping Priority (Technology and Frequency Band)**
- **Best user experience**
  - Maximize Mobility Robustness & User Throughput
  - Maximize Stay on Preferred Layer
  - Minimize Inter-Layer Transitions & Inter-Technology Transitions
- **Minimize Operations**
  - Neighbor Lists



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Small Cell Technology – Investment

Small Cell Deployment Requires significant investment and planning

- Handsets require updates when adding bands.
- The small cell network must interact with the Macro network. Network interfaces must be developed and updates are required each time there is a change.

Risks

- Once the small cell network is deployed to improve customer service, customers will not appreciate a degradation of service if license is not renewed.
- Investment could be stranded.
- Once bands are added to handsets, it reduces the ability to add additional bands.

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