



SATURN

ATKINS



2009 SATURN User Group - Epsom

SATURN OBA-MUC

Thursday 5th November 2009

What is OBA?

Origin-Base Assignment

- An algorithm developed by Dr Hillel Bar-Gera
- A major breakthrough in both theory and practice for equilibrium traffic assignment

Mathematical Properties

- Wardrop equilibrium solution is guaranteed (for buffer networks)
- Restriction to solutions that are a-cyclic by origin
- Store link flows by origin
- Effective in eliminating residual flows

Advantages & Disadvantages: OBA v Frank-Wolfe

Advantages

- Exact solutions to Wardrop Equilibrium Assignment
- Accurate in assessing small schemes
- Eliminate “noise” that exists in Frank-Wolfe
- Natural algorithm for Warm Start
- Exact solutions for standard post-assignment analysis:
 - Trees/Forests/Selected Link Analysis
- No approximation to previous results
 - Required under FW with default DIDDLE option (ie SAVEIT=T)

Disadvantages:

- RAM Intensive as route flows are stored
- May be slower than FW (especially FW Multi-Core)
- Sensitive to poor network coding

History of SATURN-OBA

... more protracted than we would have preferred

Single User Class (SUC OBA)

- First available in SATURN 10.5
- Low cost add-on module
- Few applications

Multiple User Class (MUC OBA)

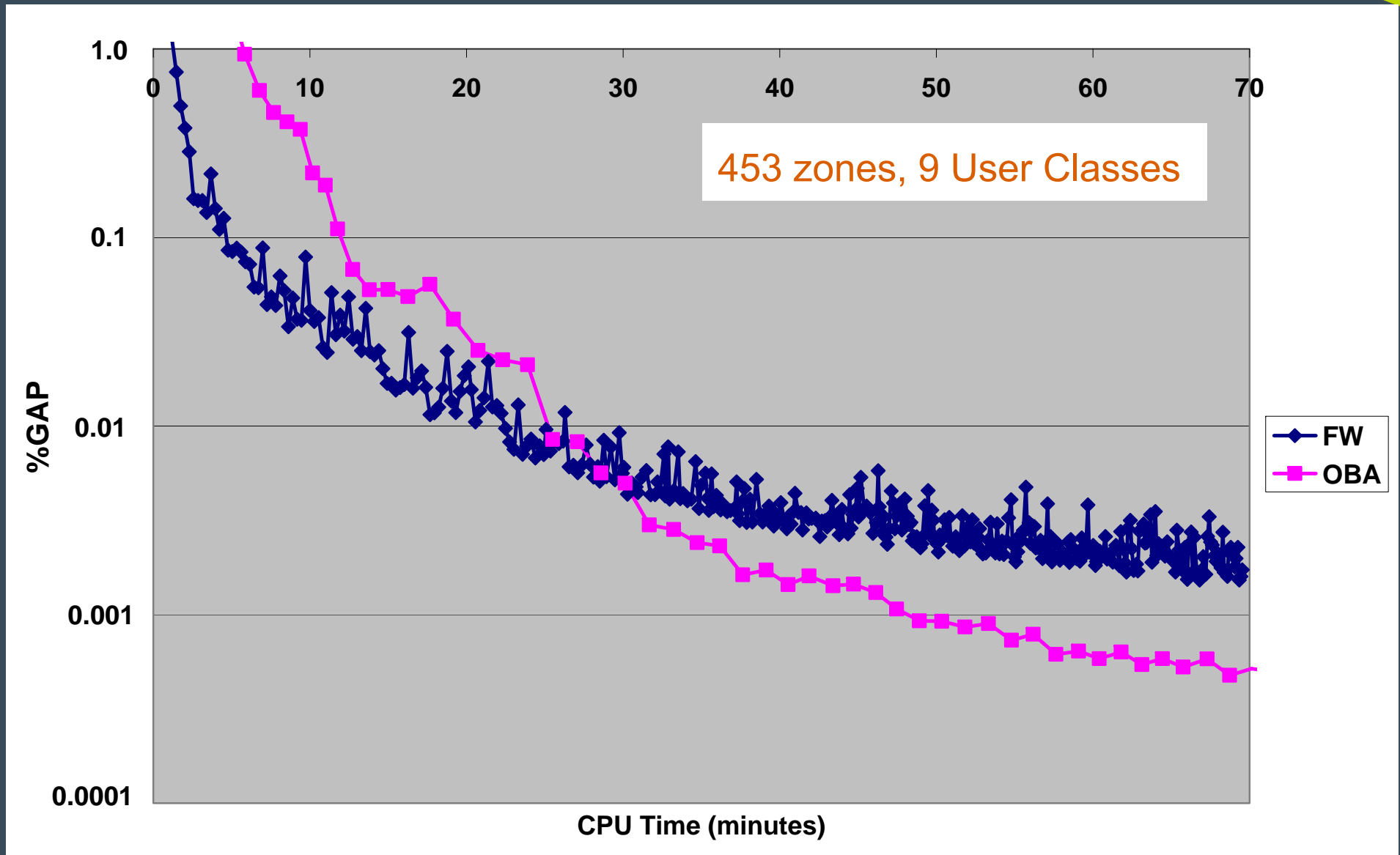
- An extended version of Hillel Bar-Gera's SUC OBA
- Implemented by Dr Yanling Xiang, Atkins
 - Paper at 2009ETC
- Previously released in Beta with v10.8.xx on request
- Bundled with full v10.9.12
 - Available to all users

SATURN OBA MUC: Performance

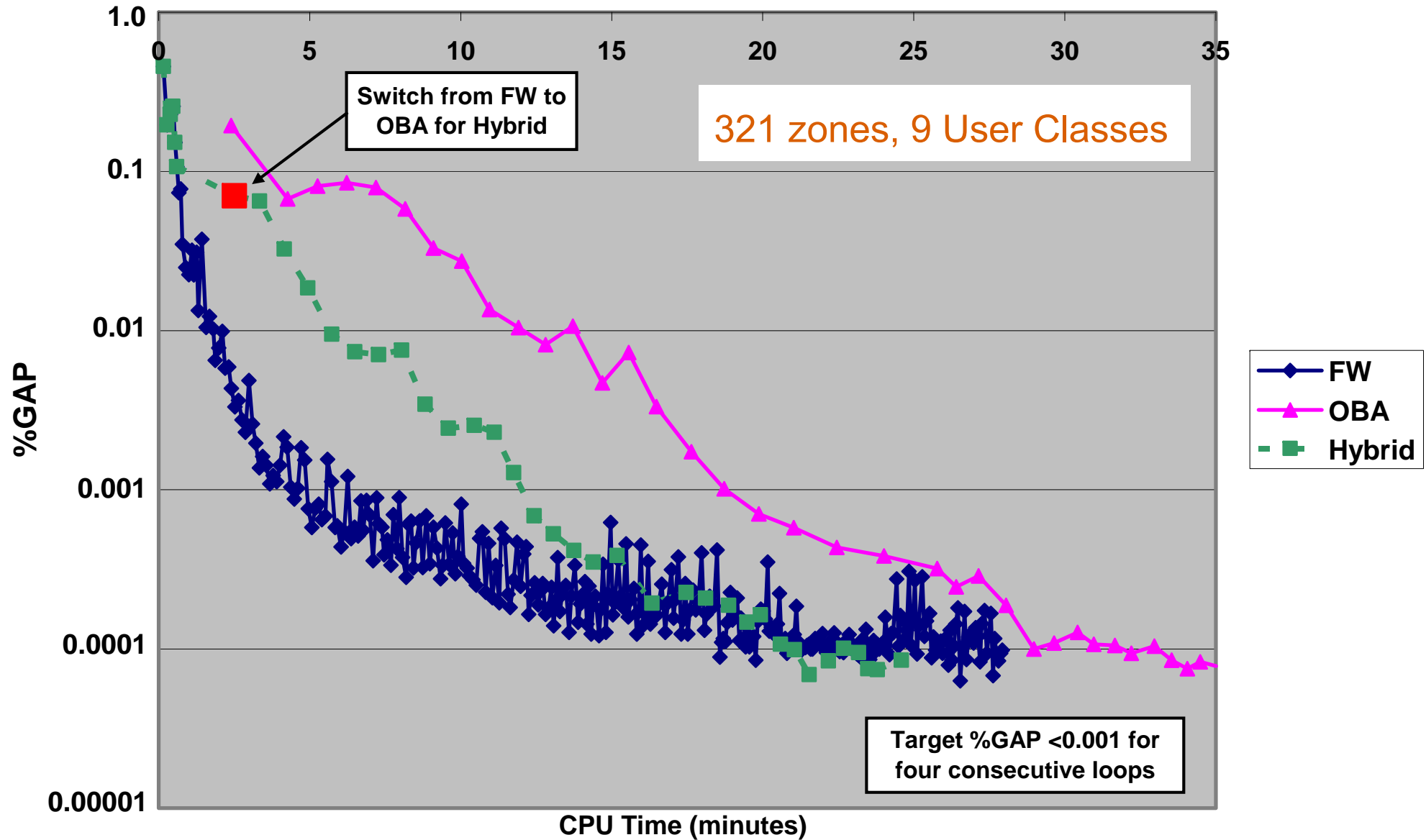
- **Reported in 2009 European Transport Conference Paper**
 - Benchmarked for Five Real-life applications
 - Frank-Wolfe
 - OBA-MUC
 - Some optimisation of SATURN network coding undertaken

 - **Comments:**
 - Typically higher levels of convergence with OBA MUC
 - Slower than FW
- Leads to:
- Development of Hybrid FW-OBA MUC algorithm
 - Initial FW assignment before switching to OBA MUC
 - Looks promising ... but very experimental

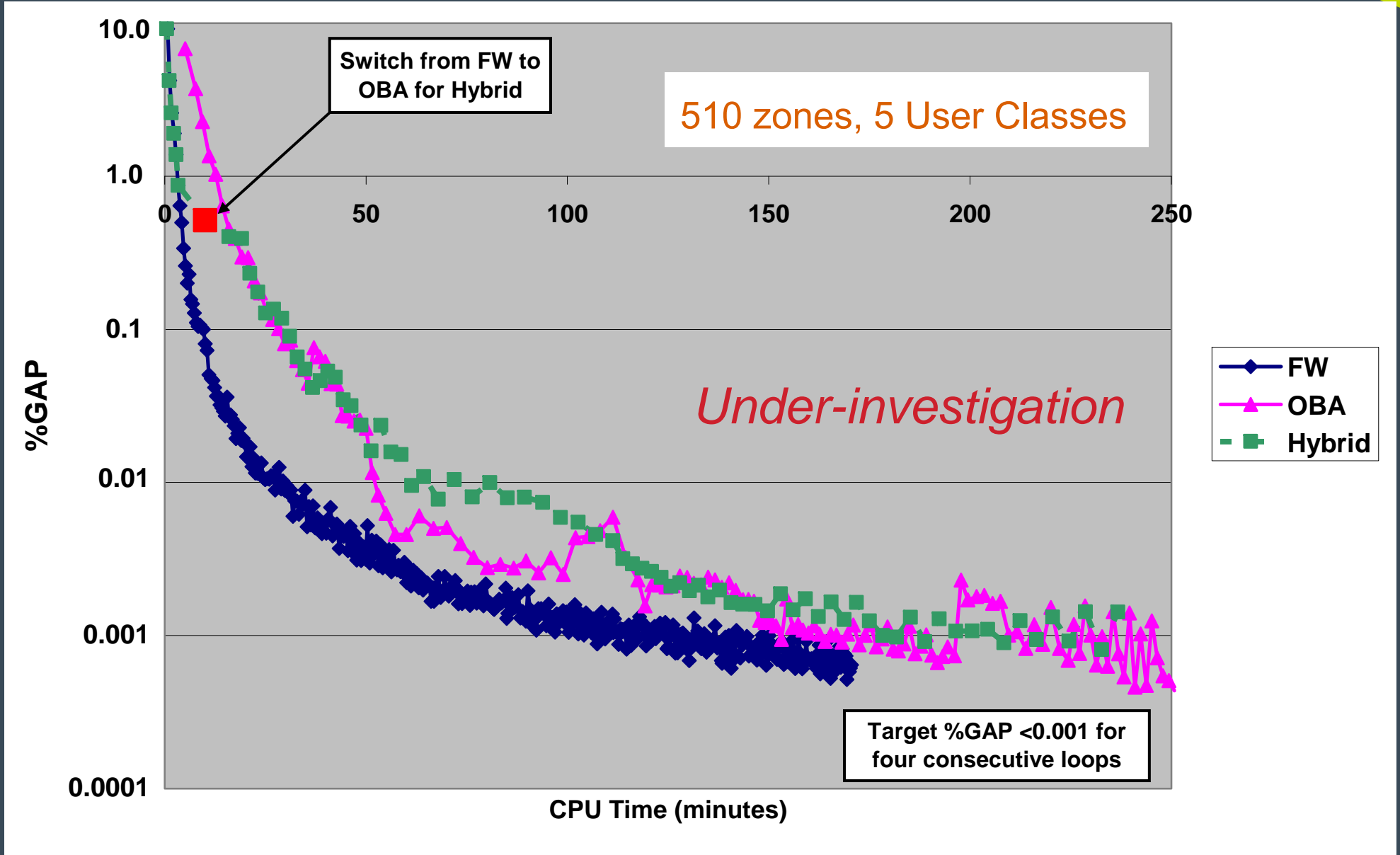
Benchmarks: FW v OBA-MUC (Model 2)



Benchmarks: + Hybrid (Model 3)



Benchmarks: + Hybrid (Model 4)



SATURN OBA MUC: Next Steps

- **Further testing work:**
 - Warm Start
 - Embed within GBMF / DIADEM
 - Optimisation (20+ years for FW!)
- **Secondary Analysis**
 - Further checks on procedures
- **Feedback from Users**

- **Longer term for Hybrid FW-OBA Algorithm**
 - FW Multi-Core already added
 - Clear potential
 - More development required
 - Optimisation strategies



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