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Using Discrete System Simulation to Model the Lane County Criminal Justice System

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Background

- Project initiated and funded by Lane Council of Governments (LCOG)
- Goal: comprehensive simulation of the Lane County criminal justice system
  - From arrest to release from parole
- Determine bottlenecks of the system and how they effect the key outcomes
  - Public safety, time, cost, efficiency, etc.

Background (2)

- Use model to test scenarios that would be difficult to test in the actual system
  - That might interfere with the system operation
- Software package selected: ARENA

Literature Review

- First criminal justice system computer model
  - JUSSIM (Justice Simulation), Blumstein (1965)
    - Working with Law Enforcement and Administration of Justice
- JUSSIM dealt only with defendant flow
  - Lacked feedback mechanisms that might address recidivism
- JUSSIM II added this feedback

Literature Review (2)

- System Dynamics modeling technique by Bard (1977)
  - Emphasized the strength of feedback loops within the system
  - Defined key performance measures to evaluate the system.

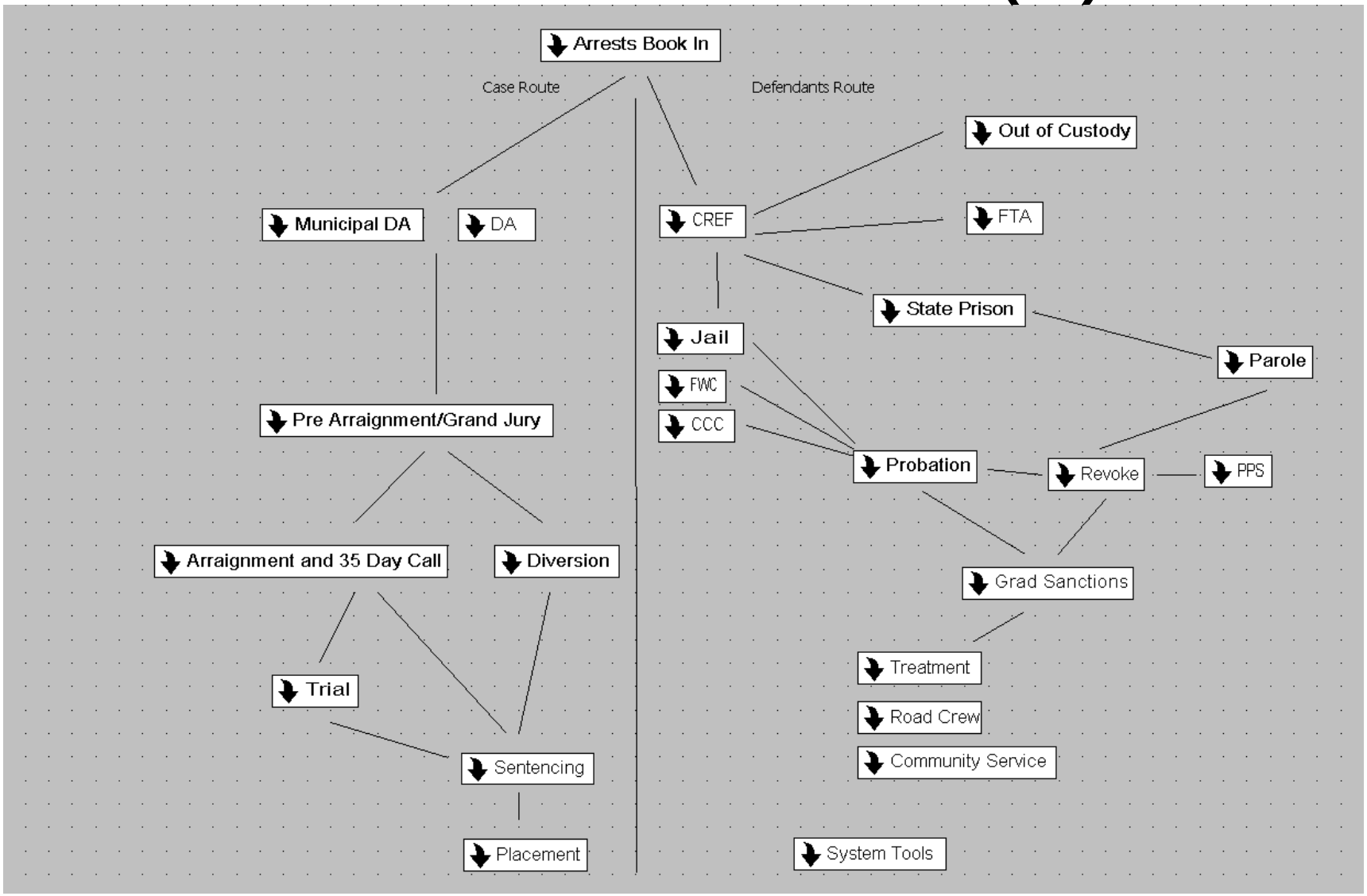
Literature Review (3)

- Juvenile Justice Simulation Model (JJSM)
  - Built as a discrete event flow model by Stewart (2004)
- Focused on
  - Final court outcomes
  - Recidivism
    - Subsequent reappearance of young defendants within the juvenile justice system
  - Simple cost comparisons between different policies and programs

Model: Overview

- Two main flows: Cases & Defendants
  - Case flow influences (provides data for) corresponding defendant flow
- Case flow includes: district attorney (DA), arraignment/grand jury, diversion, trial/sentencing
- Defendant flow includes: book-in, custody review, release or jail/custody, prison, released, …

Model: Overview (2)



Model: Key Resources

- DAs, City Attorneys, Federal prosecutors
- Book-in, CREF
- Grand Jury
- Trial (Circuit and Muni)
- Jail

Model: Jail Component

- Five components
  - Holding area
  - Housed pre-trial defendants
  - Housed post-trial defendants
  - Municipal Beds
  - Federal Beds
- Total number of beds is constrained
  - By space and available resources to support

Model: DA Component

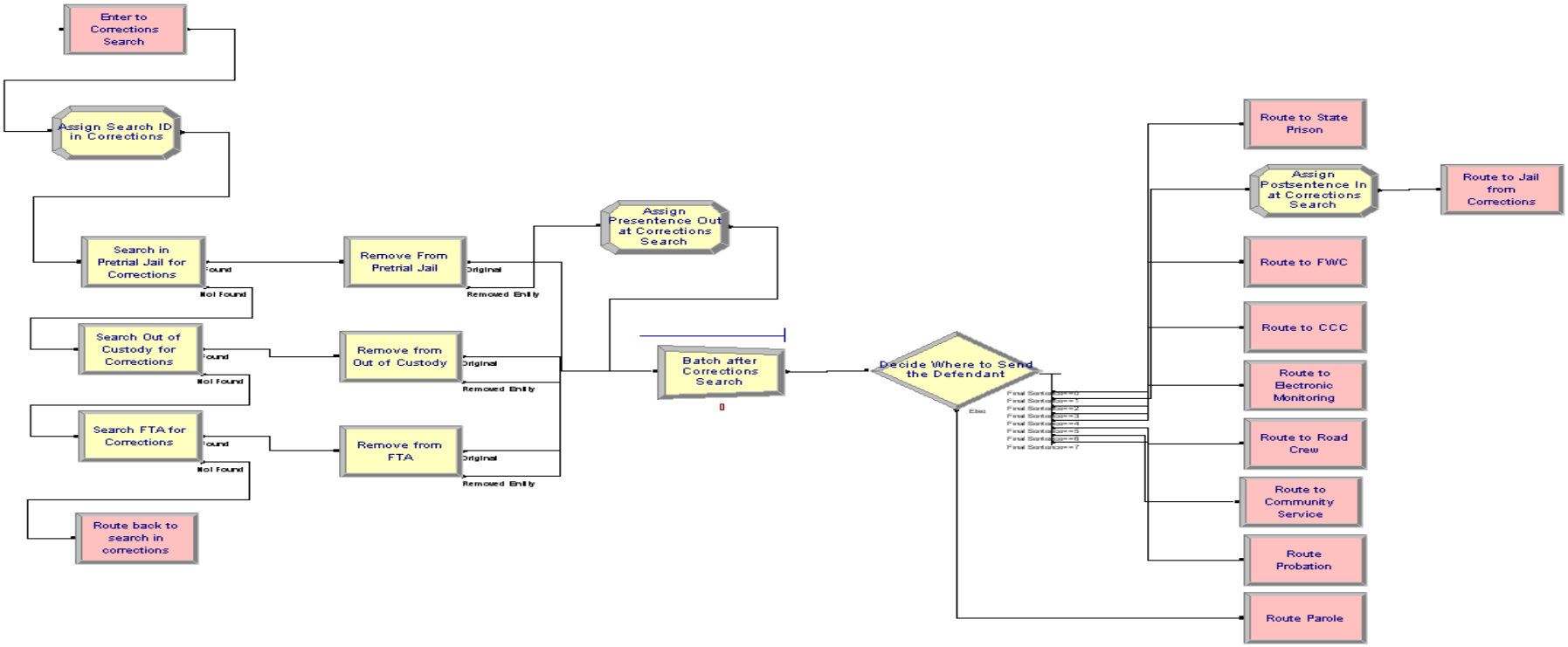
- The DA logic is challenging to model using the “standard” Arena modules
- DA spends time on each case depending on the workload and the priority of the cases
- There are two important time frames
  - Time for a case to move from one decision point to another (elapsed time)
  - Time for DA to process a case (process time)

Model: DA Component (2)

- Elapsed times
  - Arrest to filing (information)
  - Filing to arraignment or grand jury
  - Arraignment or grand jury to 35 day call
  - 35-day call to trial
  - Trial to sentencing
- Process times
  - Time required for DA to process the case to the next stage

Model: Search Component

- When case status is updated, information must be sent to the corresponding defendant
- Defendant must be "found" → search logic



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Model: Search Algorithm

- Check all possible places where defendant might be
- To transmit information:
  - Send defendant a copy of the case --or--
  - Bring defendant to the designated destination
- Implemented Using Arena's Search, Remove, and Route modules

Data Structure

- Model decision logic keyed to offense type
  - E.g., a DUII defendant is more likely to be released than an armed robbery suspect
- The data has three levels of detail
  - Specific offense type (AIRS Charge Code)
  - Groups of offense types (Felony/Misdemeanor, A/B/C, Violent/Non-Violent, Unclassified, Violations)
  - The general, overall average for all offense types
- Model substitutes aggregate data when detail data is missing

Data Example: Groupings by Offense Type

- This type of grouping is necessary because there are many very similar offense types

Offense Description	Bookin Percentage	Decide DA or MDA	Custody Ref Release Percentage	FTA percentage after CREF	FTA percentage after CLC
Felony Non-violent B	90	100	15	65	25
Felony Non-violent C	85	100	20	55	25
Misdemeanor Violent A	75	95	25	45	25
Misdemeanor Violent B	70	90	30	35	25
Misdemeanor Violent C	65	85	35	25	25
Misdemeanor Non-violent A	60	80	40	15	25
Misdemeanor Non-violent B	55	75	45	20	25
Misdemeanor Non-violent C	50	70	50	20	25
Violations	10	65	55	20	25
Parole Violation	100	100	10	90	0

Other Possible Data Groupings

- Split by age
- Split by sex
- Split by other demographics
- The model can handle any type of grouping as long as the data is available

Future Data Collection

- Data regarding the DA both elapsed and process times
- Probation, post prison supervision and parole
  - Inter-arrival times of a specific type of violation
  - Revoke percentages
- Detailed data on sentencing results
  - How long a defendant is sentenced to jail, prison, probation and community service

System Performance Indicators

- Average matrix points of released defendants
- Proportion of sentenced time actually served
- Ratio of sentenced time served to pre-sentence time served
- Failure to appear (FTA) percentage
- Measure of overall system cost vs. outcome or per offender
- Measure of system “balance”
- Recidivism is also of key interest
  - Model is not currently intended to address this

Model Testing

- Is model behavior is similar to the real system?
- Verification phase is nearly complete
  - Correcting errors in programming and specification
    - E.g., verifying that a convicted felon is routed to prison (rather than jail) if their sentence exceeds one year
- Test Scenarios
  - Reproduce base case
  - Experiment with DA resources

Test Scenario: Base Case

- Model run for base year 2001
- Test dataset used with offenses grouped into 13 types

	Monthly CREF Interviews	Matrix Releases	
		Total	Post-sentencing
Actual Data	628	413	44
Model Results	703	468	100

Test Scenario: DA Resources

- Three scenarios
  - 30 units (interpreted as ~15 people)
  - 60 units (~30 people = current situation
  - Essentially unlimited
- More DA resources should increase community safety
  - Measured by the average matrix points for released defendants
    - Lower is better

Test Scenario: DA Resources (2)

- Results:
  - At 30 units, the average is 828
  - At 60 units, the average is 393
  - With unlimited DA resources, the average is 333
- Interpretation
  - Model behaves plausibly--showing that changing DA resources would impact community safety

Next: Complete Model Testing

- Full model verification
  - visual and logical
- Testing the jail population composition
  - Number of Pre-trial vs. Post Trial
- Testing the distribution of defendants to other in custody places
  - Forest Work Camp
  - Community Corrections Center

Next: Conduct “Policy” Analysis

- Impact of Risk Assessment vs. Matrix points
- Impact of changing resources
  - DA
  - Public defenders (are these modeled?)
  - Jail space
  - Court resources (judges)
- Impact of FTA %
- Impact of lowering plea bargaining %
- Etc.

Future Work

- Modeling bargaining and negotiation between two sides (DA and Public Defenders)
- Improvements in post prison supervision (PPS)
  - key start to determine recidivism
- Recidivism (Feedback into the system from PPS to arrests)

References

- J. Belkin, A. Blumstein, W. Glass, and M. Lettre, "JUSSIM, An Interactive Computer Program and Its Uses in Criminal *Justice* Planning," Proceedings of the International Symposium on Criminal *Justice* Information and Statistical Systems, pp. *#67-477,* SEARCH Group Inc., Sacramento, California, October *1972*
- J. Belkin, A. Blumstein, and W. Glass, "JUSSIM II, An Interactive Feedback Model for Criminal Justice Planning," Urban Systems Institute, Carnegie-Mellon University, October 1973.
- J. F. Bard, Criminal justice dynamics: A planning model, Winter Simulation Conference Proceedings of the 9th conference on Winter simulation - Volume 1, Gaitherburg, Maryland, United States p258 – 268, 1977
- A. Stewart, N. Spencer, I. O'Connor, G. Palk, M. Livingston, T. Allard. Juvenile Justice Simulation Model, Australian Research Council Strategic Partnership with Industry Research and Training, August 2004