

# Information Systems Estimation of IT Systems On-Going Operations & Sustainment

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Bakari Dale, DASA-CE  
Denton Tarbet, Galorath Federal

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## IT Systems

- An information system is any organized system for the collection, organization, storage and communication of information. More specifically, it is the study of complementary networks of **hardware and software** that people and organizations use to **collect, filter, process, create** and **distribute data**. (Wikipedia)
- IT service management (ITSM) refers to the entirety of activities – directed by policies, organized and structured in processes and supporting procedures – that are performed by an organization or part of an organization to plan, deliver, operate and control IT services offered to customers.
- Estimation of the IT service management more complex than estimation of software.

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## IT Managed Service & LCC

- For software it has been shown that software maintenance is from 60% to 80% of LCC
- Minimal data for managed service of IT systems LCC but from empirical data it seems to be at least comparable. (not even considering the hardware Tech Refresh)
- If it is true that LCC for IT systems is driven by O&S then it follows that design of the systems should consider estimates of both development and O&S

And it follows that

Methods for developing high confidence estimates of IT systems O&S becomes critical in optimizing LCC

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## High Confidence Estimates of IT Systems O&S

- Utilize effective estimation models
- Use metrics to calibrate models
- Establish metrics data bases tailored to provide effective calibration data
- Provide budget in existing programs to collect and catalog IT Systems O&S metrics
- Integrate metrics into calibration of estimation models.

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## IT Systems Managed Service

- IT systems transition
- Systems planning and design
- IT systems in operation supporting user
- Managing the IT systems in operation
  - Hardware; Software; Storage; training; facilities
  - Maintenance Application Software not included
- End User Support
  - Tier 1, 2, and 3
  - Training and Documentation
- As in any estimation, IT Managed Service requires volume metrics

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## Managed Service Estimation Elements to Evaluate

- Purchased Hardware (Processors; network devices; storage)
- Purchased Software (OS, Network Systems, DBMS; COTS such as ERP)
- Software/Database system (Updates, manage redundancy; backups)
- Infrastructure Services (cloud; processors; network devices; RAID-SAN storage; Tier 1,2,3)
- End User Systems (desktop managed/unmanaged; notebooks; tablets or smart phones)
- Service Desk (Applications critical/non critical; servers; network issues; end user devices)

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## Managed Service Estimation Elements

Continued

- Training
- User Documentation (User Guides; Online Help, configuration control; distribution)
- Unique additional issues (PM, Administrative; Project SME)
- Facilities (facility development; cabling; Power)

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## Estimation Metrics

### Purchased Hardware & Infrastructure

- Hosted Services, servers
  - Number/locations of data centers
- PC, Desktops, Notebooks, Tablets
  - Number of users, SLA
- Storage (SAN, RAID,)
  - Number of storage devices, Tier 1,2,3
  - Metrics are often based on Terabytes of Storage
- Network devices (ports, routers, switches )
- Printers
- Other devices

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## Estimation Metrics Software and Database

- OS/DBMS
- Applications Software (Custom developed, CRM; ERP; SAP; COTS or GOTS)
- Database (redundancy required, methods)
- Metrics for License (total cost or cost by user)
- Unique configurations
- Maintenance (system level not applications)
- Data Backups
  - Estimated error rate
- SLA

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## Estimation Metrics Infrastructure Services

- Servers (number, type, availability required)
- Storage devices(number, complexity, )
- Networks (setup type, ports, devices)
  - Users supported
  - Load level
  - Physical Locations
- Experience of the M&S staff
- Security (globally/locally)

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## Estimation Metrics End User Services

- Setup type (desktop, notebook, tablet, fixed or mobile)
- Critical/Non-Critical applications
- SLA
- Configurations
  - Service from Cloud, data center, local servers
  - Thick, thin, or zero clients
  - Unique configurations
- Number of users
- Experience of service staff
- Training and experience of users

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## Estimation Metrics Service Desk

- Applications (critical and Non-Critical)
- Systems support(desktops, servers, storage devices, network devices)
- Response requirements
  - Number of users
  - SLA
  - Incidents (numbers and distribution)
  - Coverage (7X24; 5X12; )
  - Staff coverage (shifts, hr/shift, % per shift)
  - Applications/complexity/use intensity
  - Training level (users, support staff, service desk)
  - Allocation of incidents requiring Tier 2 and 3 response

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## Estimation Metrics End User Systems

- Desktops/notebooks Locked/unlocked
- Tablets, smart phones
- Number of users
- Critical/noncritical software
- SLA

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## Estimation Metrics Training

- Orientation, application, process
- Courseware (developed, purchase, update)
  - Training materials
- Topic (number, complexity, use intensity)
- Classic in class; CBT; self-directed
- Number of trainees, location
- Attrition

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## Estimation Metrics Additional Items

- Management
- Administrative support
- Systems planning
- Travel
- Typically estimated as a number of FTEs required.

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## Estimation Metrics Models to Develop Estimates

- Parametric models from custom spread sheets to commercial models for IS Estimation
- Metrics
  - Experience indicates metrics normally don't match the existing model requirements
  - Storage: metric is in Terabytes, but FTE estimate based on number of storage devices
  - Data base in number of data tables but model wants number of data bases.

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## Case Study Experience

- Experience indicates similar problems for metrics in IT systems as for software estimation.
  - Volume of work and duration of effort
  - Characteristics of staff, tools,
  - SLA
- Metrics are often not aligned to the data wanted to estimate the FTE support (i.e. have amount of storage but not number of storage devices)

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## Calibration of Models from Metrics

- Obtain historical performance metrics for O&S
- Normally expressed in FTEs (e.g. number of FTEs to maintain the set of servers )
- Develop regression function of FTEs as a function of the metric
- With the estimation model develop regression Equation with FTEs as a function of input parameter
- Assume the FTE from the data and the estimation model should be the same
- Establish an equation to relate the estimation model input to the metrics.

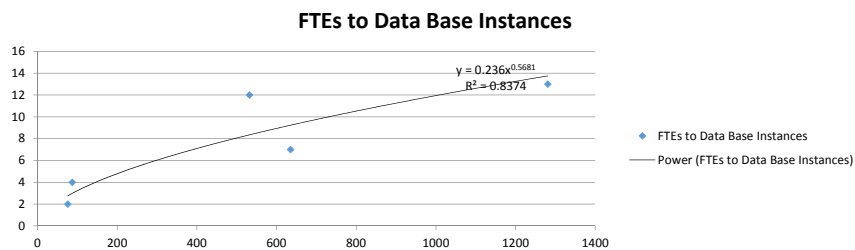
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## Sample Demonstration

- Consider Data Base Support
  - Model in Data Bases—Metrics in Data Base Instances
- Consider End User Computing
  - FTEs to support end user questions and problems
- FTEs to manage servers
  - Physical management of servers
  - Systems level support (UNIX, Windows)
- Data Base O&S
  - FTEs to manage DBMS maintenance, backups

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## Data Base Calibration



$$FTE_D = .303(DB)^{0.5681} \quad R_{\text{squared}} = 0.837$$

$$FTE_M = 0.1097 (DB) - 0.0795$$

$$\text{Setting } FTE_M = FTE_D$$

$$DB = 2.76 * DB_1^{0.5557}$$

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## Results from the case study

		Calibration for Oracle			Metrics for Calibration for SQL		
		DB calculated	SEER IT	SEER IT			
Total database Instances	FTE	hours	FTE				
76	2	30.0	6890.0	3.418	30.0	5142	2.6
87	4	32.0	7346	3.644	32.0	5481	2.7
532	12	89.0	20320	10.079	89.0	15134	7.5
635	7	98.0	22369.0	11.096	98.0	16658	8.3
1281	13	145.0	33067.0	16.402	145.0	24618	12.2

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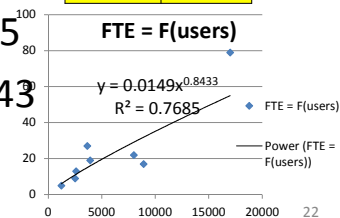
## End User Support

- Historical metrics
- Eliminated data for 3553 & 32000 special case
- Regression function
- $FTE_D = .0149(\text{users})^{.843}$

$$FTE_M = .0015(\text{users}) - 6E-15$$

$$\text{Users (M)} = 9.93(\text{Users(D)})^{.843}$$

EUC	
No of total users supported	FTE
1211	5
2500	9
2600	13
3553	7
3636	27
3917	19
8000	22
8905	17
17000	79
32000	9



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## End User Results

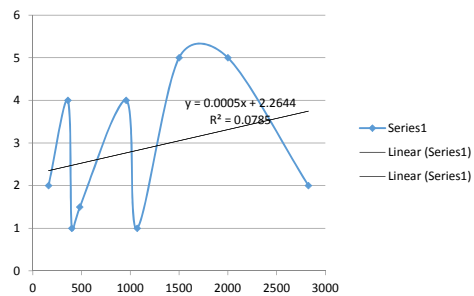
history metrics Data number of users	FTE from the history metrics Data	SEER IT hours	SEER IT FTE Estimate
1211	5	10069	5.0
2500	9	18012	8.9
2600	13	18587	9.2
3553	7	23879	11.8
3636	27	26827	13.3
3917	19	27612	13.7
8000	22	36415	18.1
8905	17	37956	18.8
17000	79	48763	24.2
32000	9	62303	30.9

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## Storage Systems Example of insufficient metrics

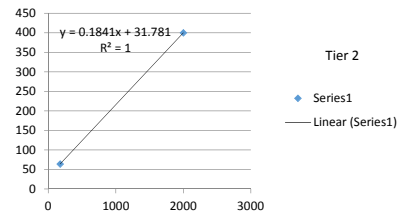
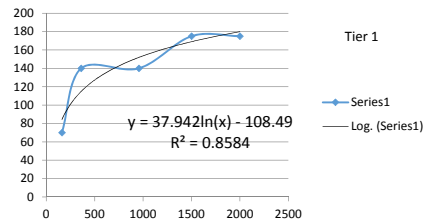
- Storage systems FTE support as function of number of devices.

Storage TB	Storage FTE
400	1
1070	1
957	4
2000	5
1500	5
2827	2
482	2
161	2
360	4

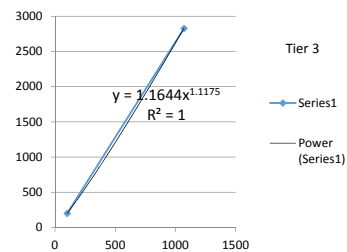


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## Storage Systems Assume 3 tiers for SLA



- Could not use the metrics data
- Developed a relationship for calibration using the SME past experience as the metric.



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## Servers from Metrics

- For servers (adjusted models for Unix/LINUX versus Wintel)
- $FTE_D = 0.1347(\text{servers})^{0.634}$
- $FTE_M = 0.0191(\text{servers}) + 4 * E-5$
- $Servers_M = 0.1347(\text{servers}_D)^{0.634}$

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## Server Calibration Results

Data		Calibrated Model Estimate		
Total Wintel server	FTE	hours	FTE for physical	% Diff
270	4	8685	4.30803571	7.7%
480	5	11921	5.91319444	18.3%
480	5			
769	24	15488	7.68253968	-68.0%
1025	5	17902	8.87996032	77.6%
1510	10	22146	10.985119	9.9%
1847	8	24731	12.2673611	

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## Summary

- Estimation for Management Services requires collection of more detail than just volume
- Using metrics data with details of source data provide reasonable method to calibrate an estimation model
- Using the concepts of equating model inputs to metrics with regression functions provided acceptable estimates
- Using the regression functions approach provides a continuous method to calibrate rather than discrete conversions with a set of Proxy conversions.
- High Fidelity estimates of Managed Service provide effective way to consider LCC in making design decisions for IT systems (new or migrations to private or public cloud)

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## Contact Information

- Bakari P. Dale
  - MAIS/IT Lead, Senior Analyst
  - DASA-CE
  - 703-697-1614
  - Bakari.p.dale.civ@mail.mil
- Denton Tarbet
  - Senior Consultant
  - Galorath Federal
  - 310-345-6810
  - dtarbet@galorath.com

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