

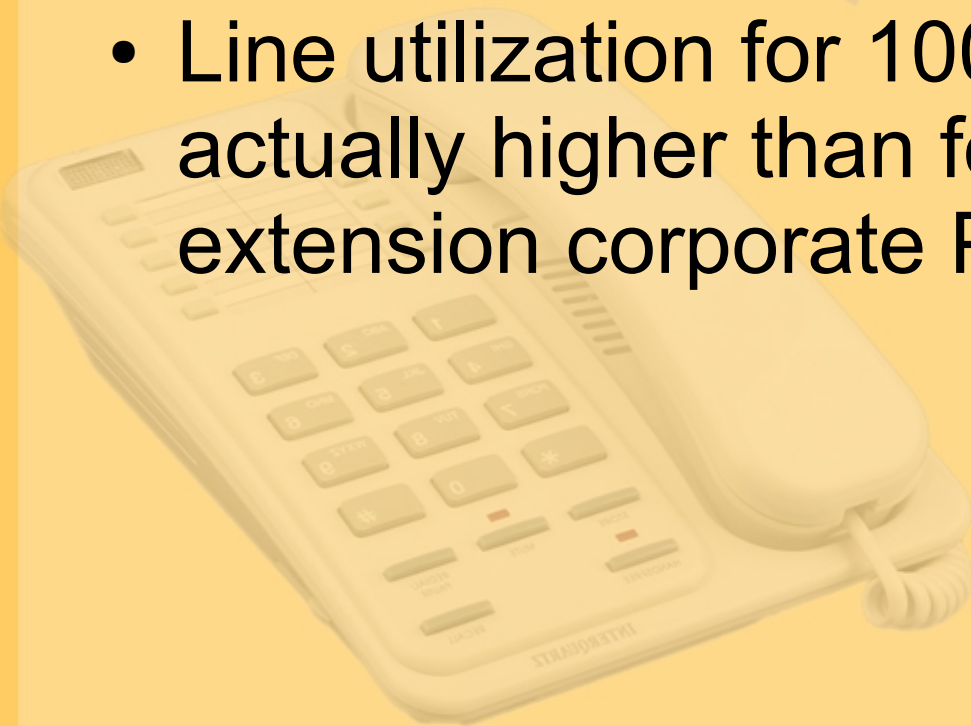
# Building an Enterprise-Level Call Center with Asterisk

by  
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# What is Enterprise-Level?

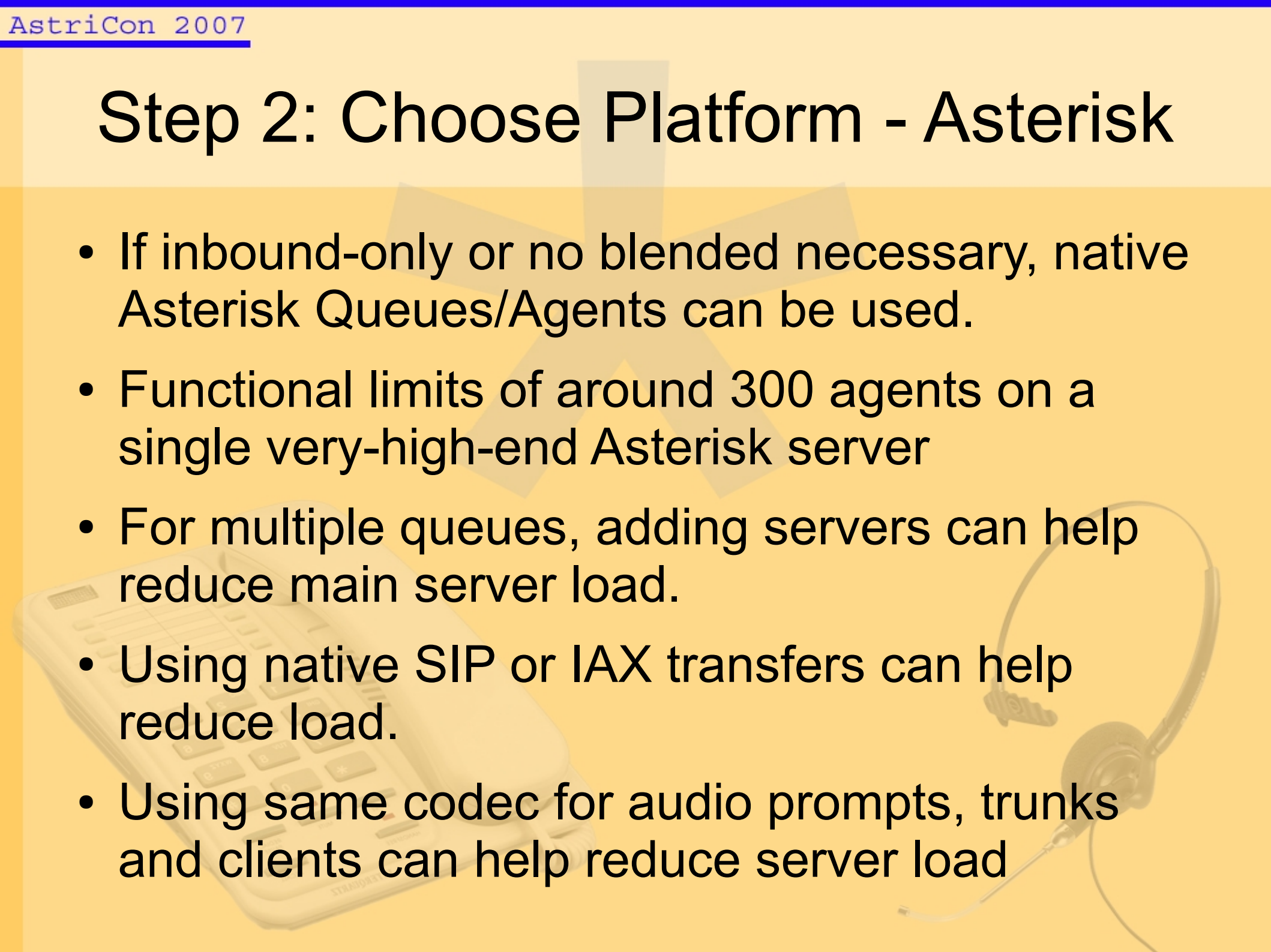
- For a standard PBX “Enterprise” usually means 1000+ extensions
- For a call center “Enterprise” usually means 100+ agent seats
- Line utilization for 100 seat call center is actually higher than for the average 1000-extension corporate PBX



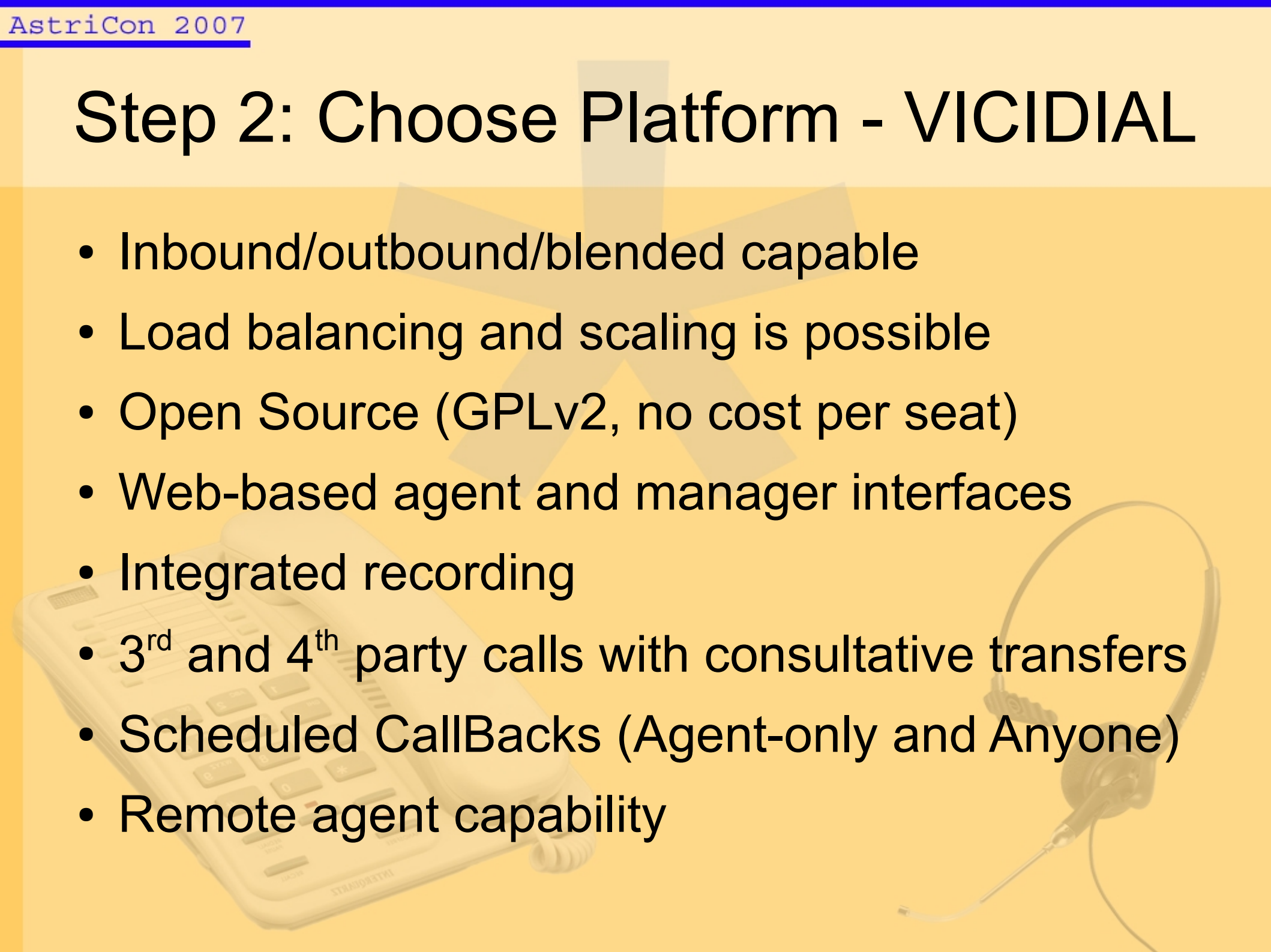
# Step 1: Define Requirements

- How many seats needed? (inbound/outbound/blended)
- How many incoming/outgoing lines?  
(what is the desired lines/agent ratio)
  - Inbound, usually 1/1 to 2/1
  - Outbound, anywhere from 1/1 to 10/1
- Level of recording and live monitoring needed?
- What telco/data infrastructure is available?
- Agent workstation hardware/software
- What reporting is needed?

## Step 2: Choose Platform - Asterisk

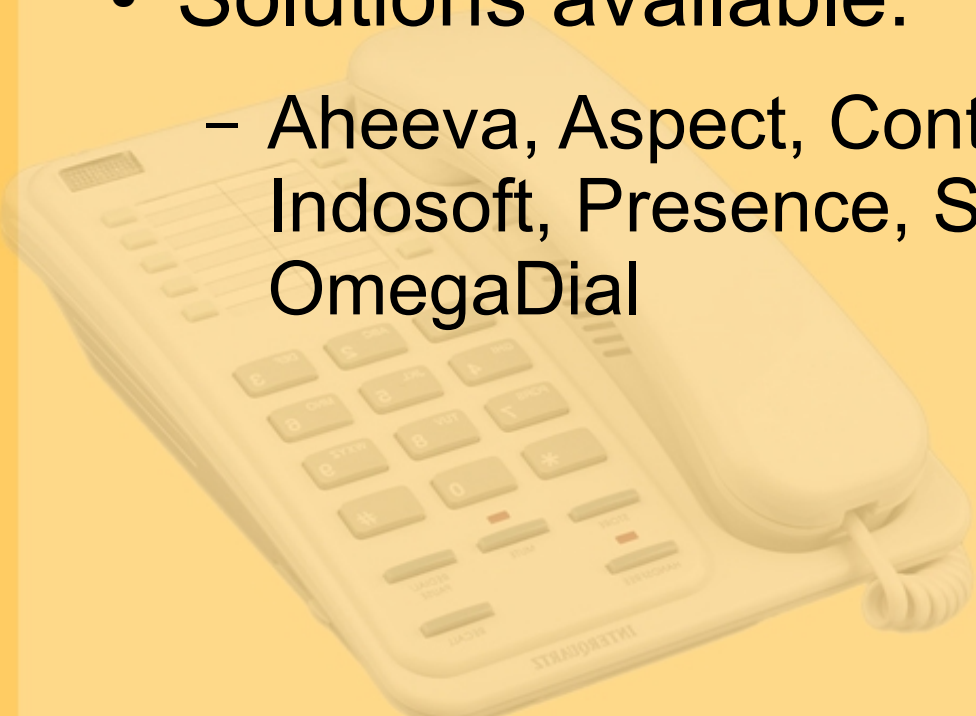
- If inbound-only or no blended necessary, native Asterisk Queues/Agents can be used.
  - Functional limits of around 300 agents on a single very-high-end Asterisk server
  - For multiple queues, adding servers can help reduce main server load.
  - Using native SIP or IAX transfers can help reduce load.
  - Using same codec for audio prompts, trunks and clients can help reduce server load
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- A faint background image of a telephone keypad and a headset is visible behind the text.

## Step 2: Choose Platform - VICIDIAL

- Inbound/outbound/blended capable
  - Load balancing and scaling is possible
  - Open Source (GPLv2, no cost per seat)
  - Web-based agent and manager interfaces
  - Integrated recording
  - 3<sup>rd</sup> and 4<sup>th</sup> party calls with consultative transfers
  - Scheduled CallBacks (Agent-only and Anyone)
  - Remote agent capability
- 
- A faint background image of a white telephone and a headset with a microphone, positioned behind the text.

# Step 2: Choose Platform - Proprietary

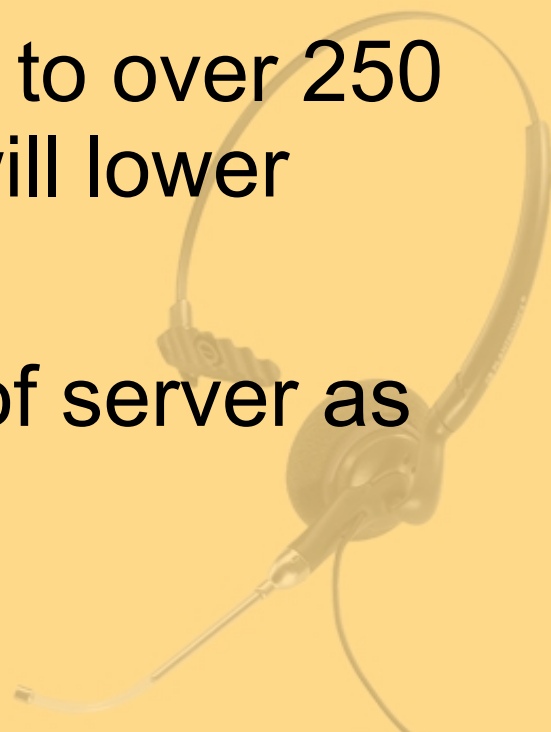
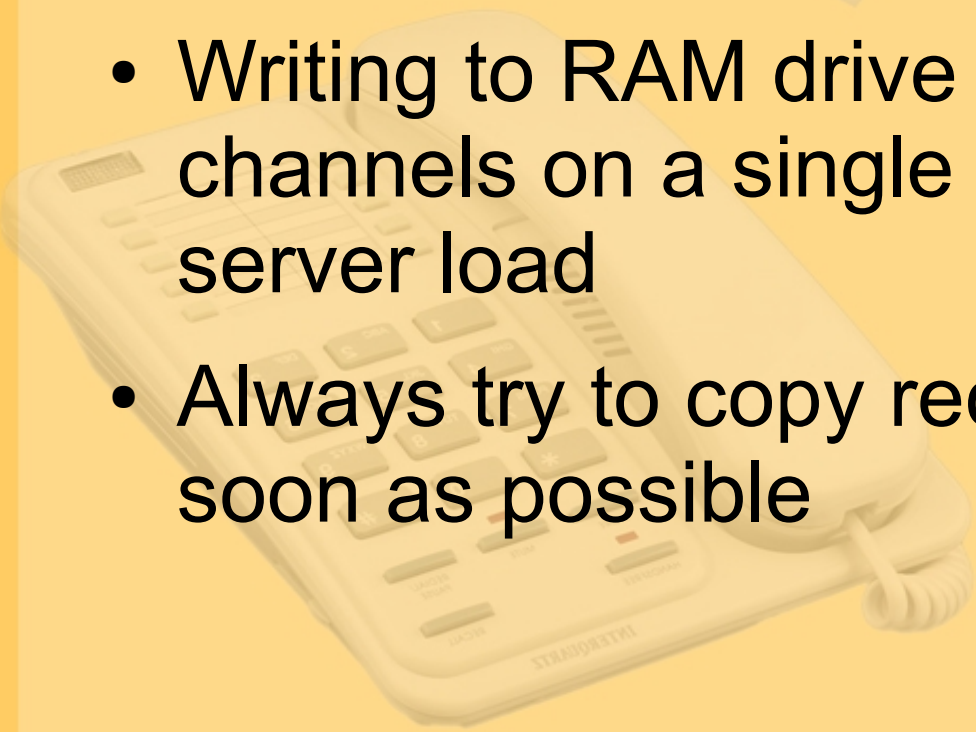
- Closed-source
- Per seat and/or per feature licensing
- More advanced functionality
- Solutions available:
  - Aheeva, Aspect, Contaque, DACX, DragonSuite, Indosoft, Presence, SineDialer, SkyyDialer, OmegaDial





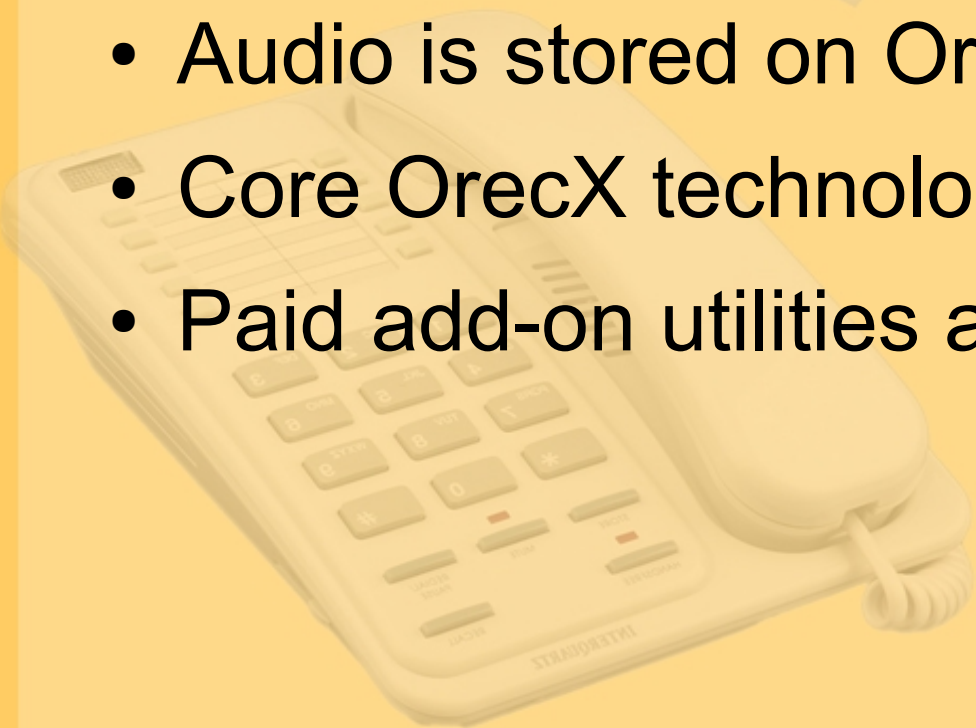
# Step 3: Native Asterisk Recording

- Works on all channel types
- Writing to hard drive directly has functional limit of 50-70 channels on a single server
  - Small 44-byte chunks causes lots of drive activity
- Writing to RAM drive extends limit to over 250 channels on a single server and will lower server load
- Always try to copy recordings off of server as soon as possible



## Step 3: OrecX Recording

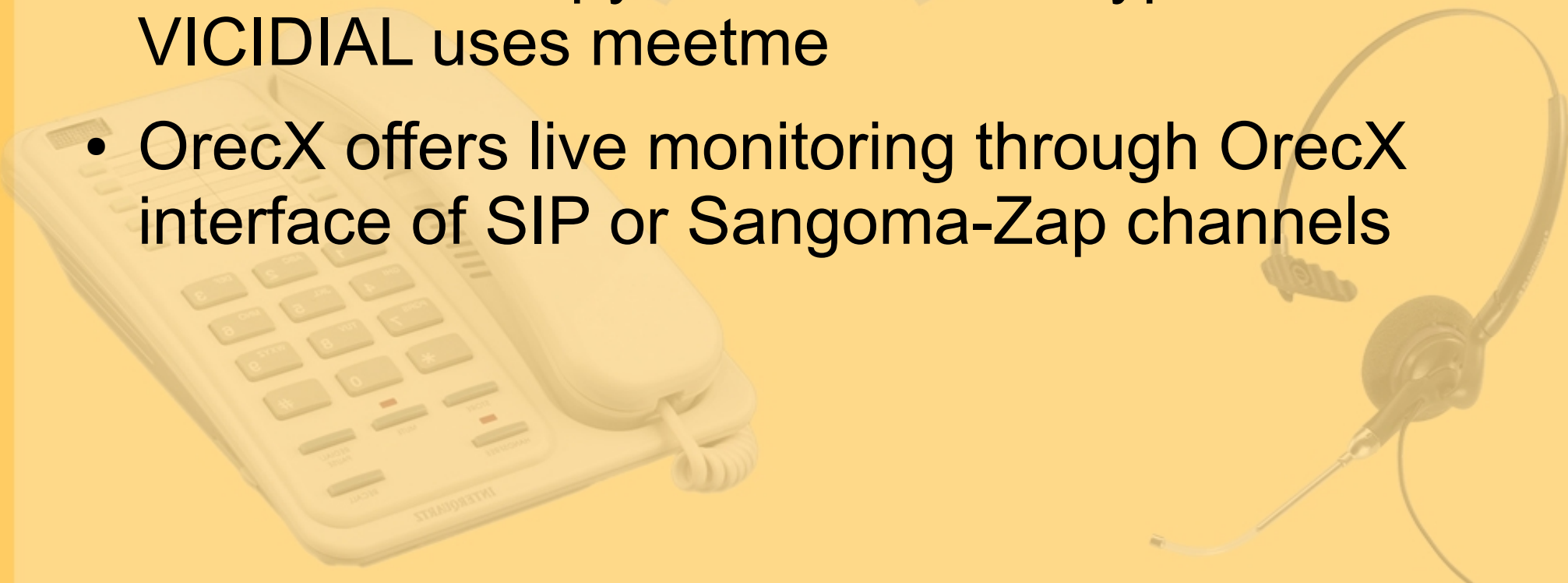
- SIP passive recording of streams through network tap on the switch or through the Asteirsk server
- Sangoma T1/E1 recording at kernel level
- Audio is stored on OrecX archive server
- Core OrecX technology is Open Source
- Paid add-on utilities available





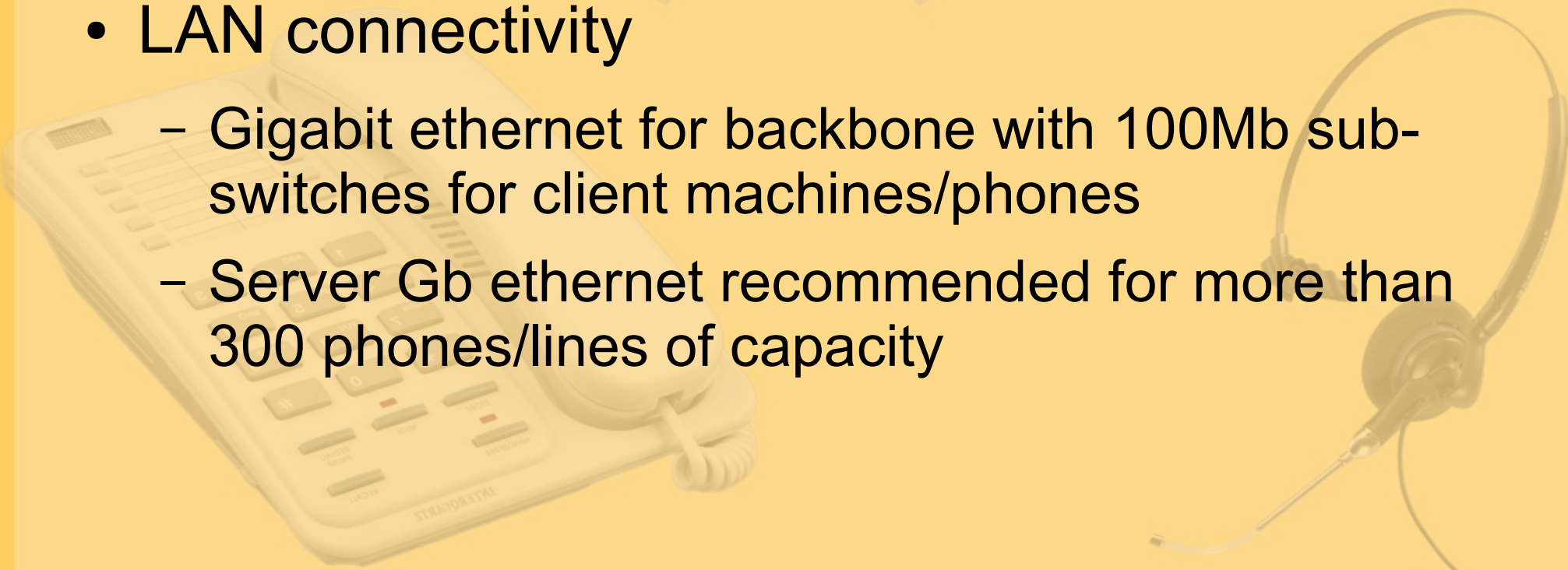
# Step 4: Live Monitoring Options

- T1/E1 monitoring through ZapBarge
- All-channel-type monitoring through ChanSpy
- VICIDIAL monitoring and barge-in available without ChanSpy on all channel-types, because VICIDIAL uses meetme
- OrecX offers live monitoring through OrecX interface of SIP or Sangoma-Zap channels

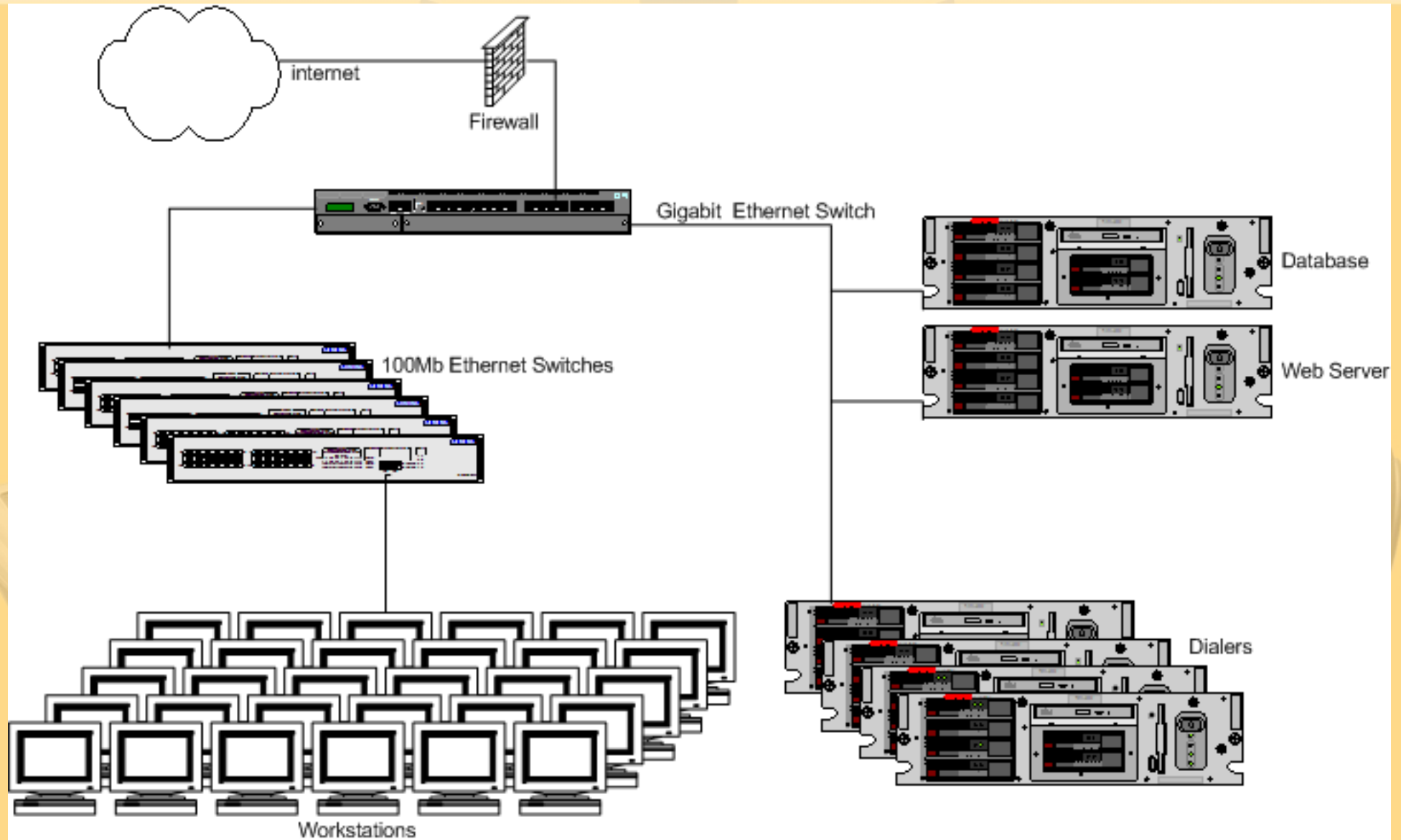


# Step 5: Data Infrastructure

- Internet connectivity
  - If using VOIP lines, always over-estimate requirements, especially if using public Internet
  - Fiber or co-located servers are best option
- LAN connectivity
  - Gigabit ethernet for backbone with 100Mb sub-switches for client machines/phones
  - Server Gb ethernet recommended for more than 300 phones/lines of capacity



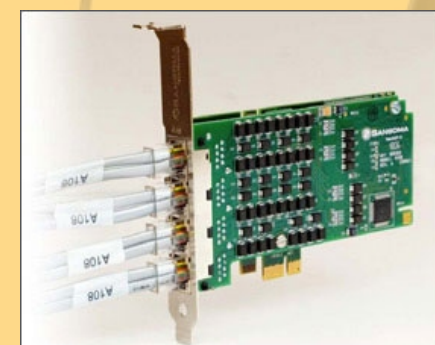
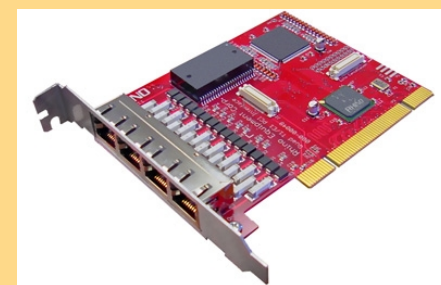
# Step 5: Data Infrastructure



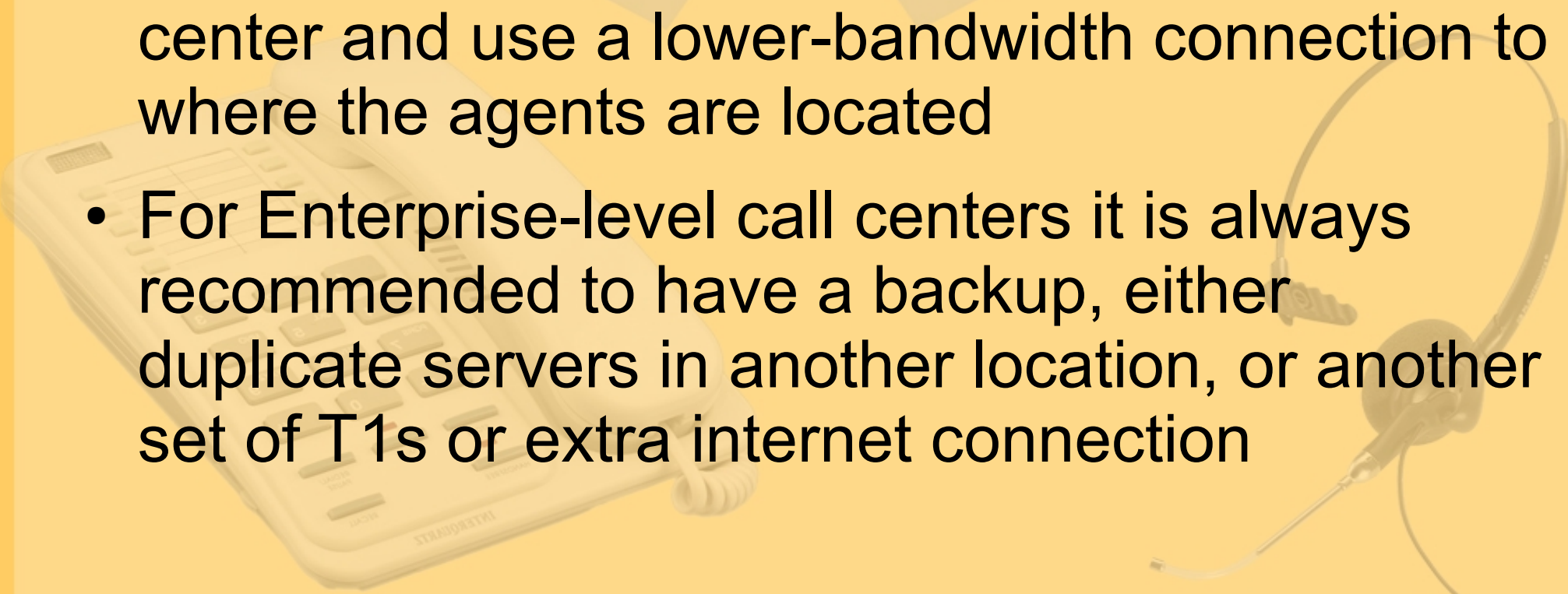
Basic 200-Seat Call Center LAN Diagram

# Step 6: Telco Infrastructure - T1/E1

- If using T1/E1 lines directly you will need a telco interface card from Digium, Rhino or Sangoma.
- Cards are PCI or PClexpress and are available with 1, 2, 4 or 8 ports
- Cards available with optional hardware-based echo-cancellation
- There are no Asterisk-compatible, direct DS3 interface cards currently available, so T1/E1s are required

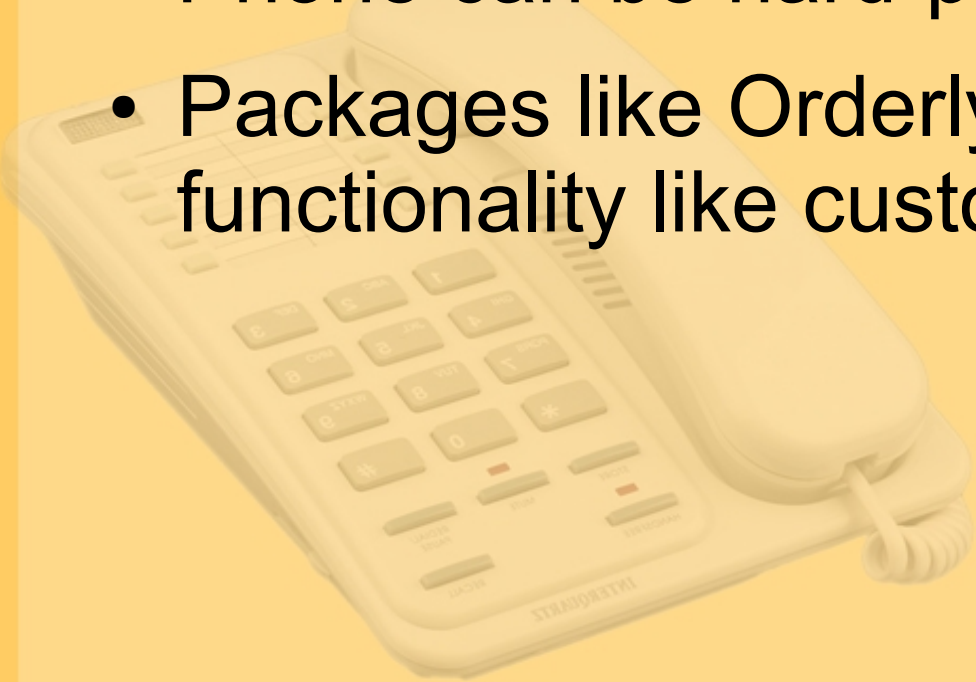


# Step 6: Telco Infrastructure - VOIP

- For on-premises equipment, use fiber DS3 or higher, preferably on the same backbone as provider, if not point-to-point
  - To save on bandwidth, put servers in a data center and use a lower-bandwidth connection to where the agents are located
  - For Enterprise-level call centers it is always recommended to have a backup, either duplicate servers in another location, or another set of T1s or extra internet connection
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# Step 7: Agent Workstations - Asterisk

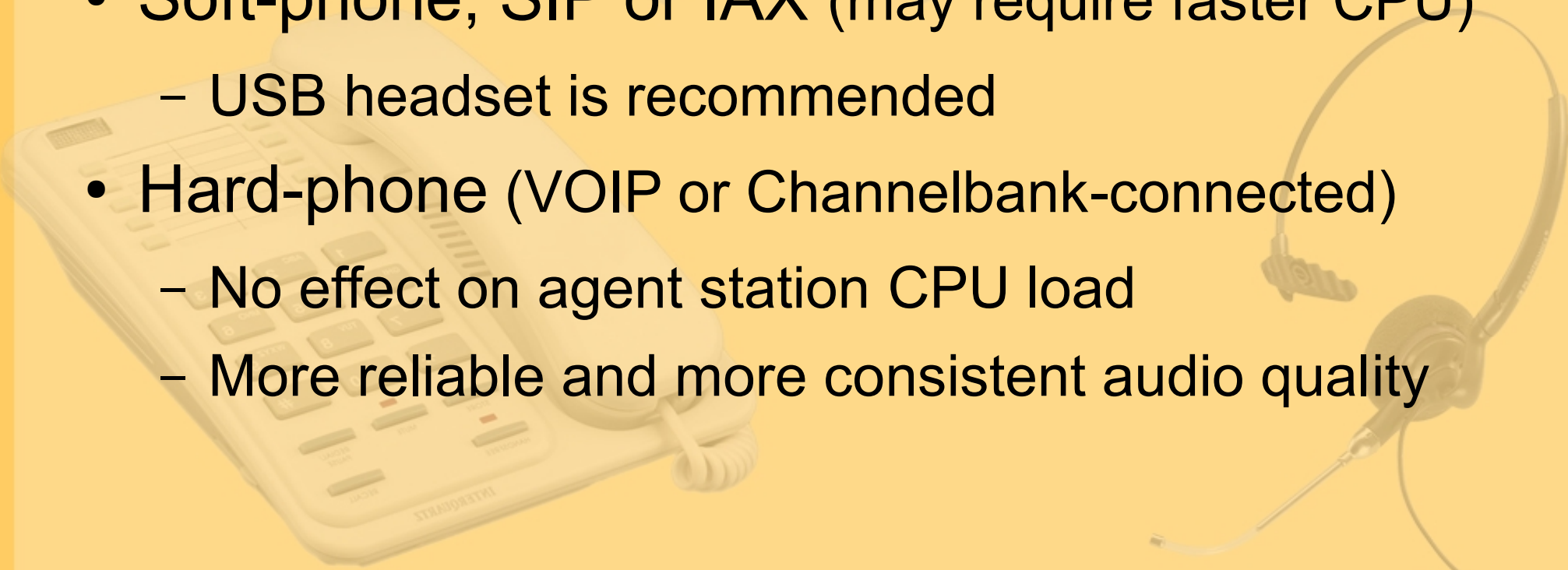
- Asterisk-only Queues does not require an agent computer
  - Add-ons can run an Agent web page pop-up on call connect
- Phone can be hard-phone or soft-phone
- Packages like OrderlyQ can add Queue functionality like customer-leave-callback





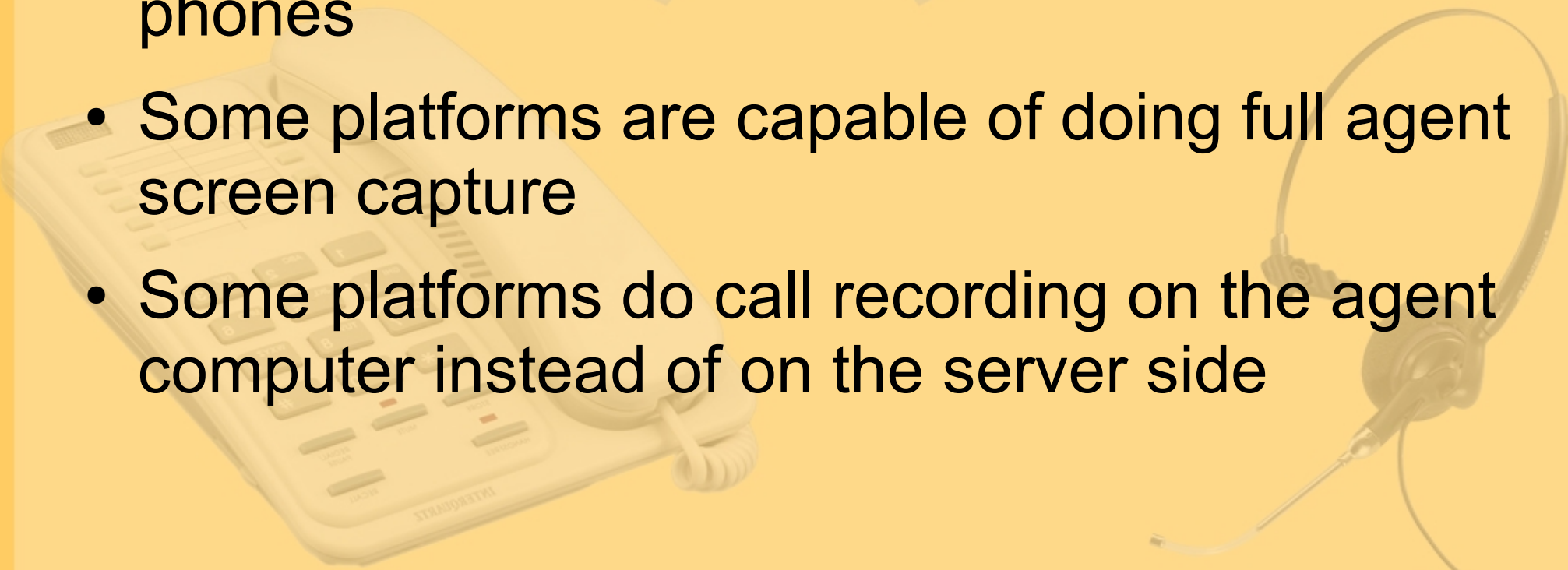
# Step 7: Agent Workstations - VICIDIAL

- Minimum PIII 500MHz with 128MB RAM
- Windows, Linux or Mac
- Modern web browser(Firefox, Opera or IE)
- Soft-phone, SIP or IAX (may require faster CPU)
  - USB headset is recommended
- Hard-phone (VOIP or Channelbank-connected)
  - No effect on agent station CPU load
  - More reliable and more consistent audio quality



# Step 7: Agent Workstation - Proprietary

- Many different options, Some platforms require Windows XP and P4 – 2GHz CPU – 512MB RAM minimum
- Some platforms allow only their proprietary soft-phones
- Some platforms are capable of doing full agent screen capture
- Some platforms do call recording on the agent computer instead of on the server side



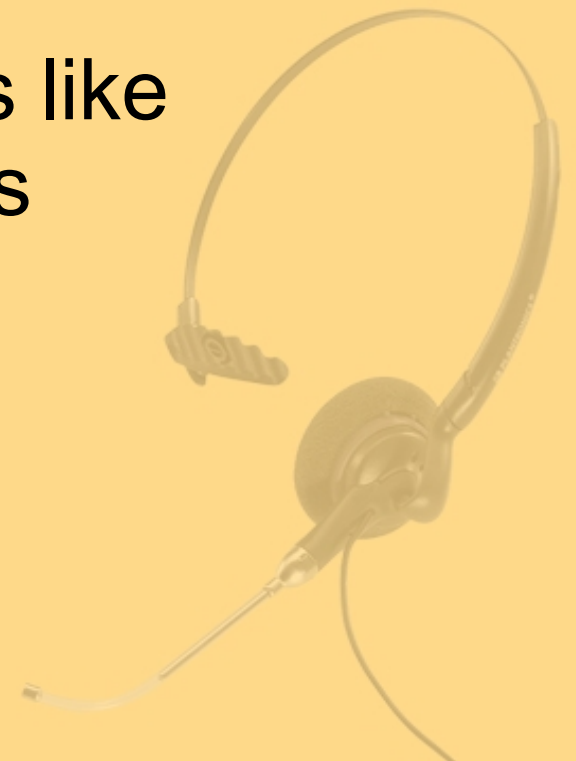
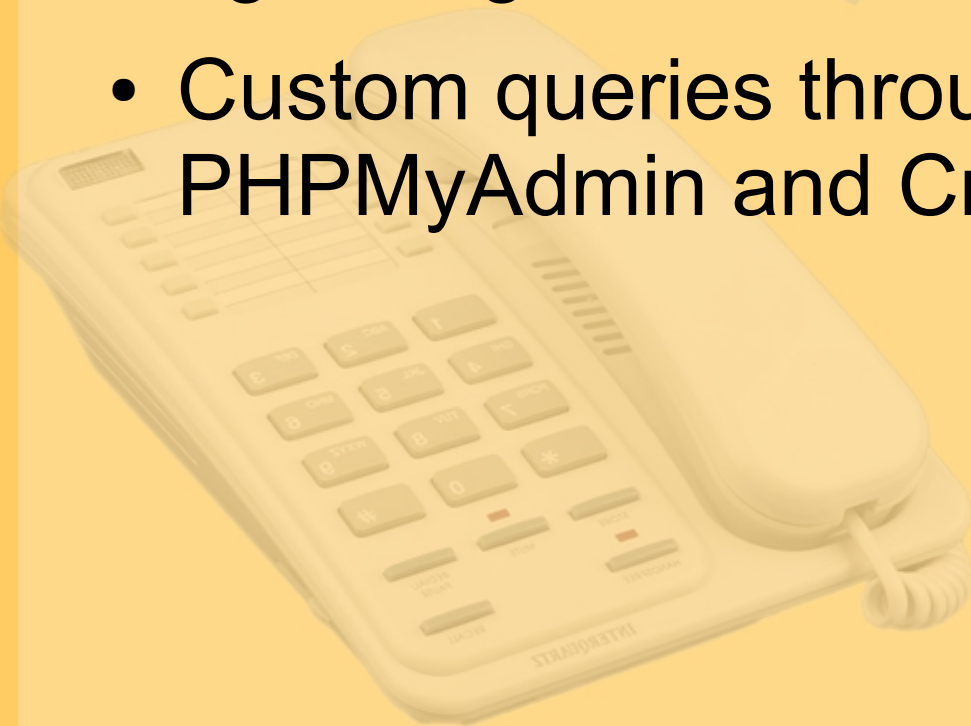
# Step 8: Reporting Options - Asterisk

- QueueMetrics proprietary reporting solution
- AsteriskGuru Queue Analyzer
- OrderlyStats
- Custom text-file or database queue\_log parsers



# Step 8: Reporting Options - VICIDIAL

- Integrated web-based reports included
- QueueMetrics compatibility with outbound
- Direct MySQL/ODBC access to raw call and agent logs
- Custom queries through programs like PHPMyAdmin and Crystal Reports



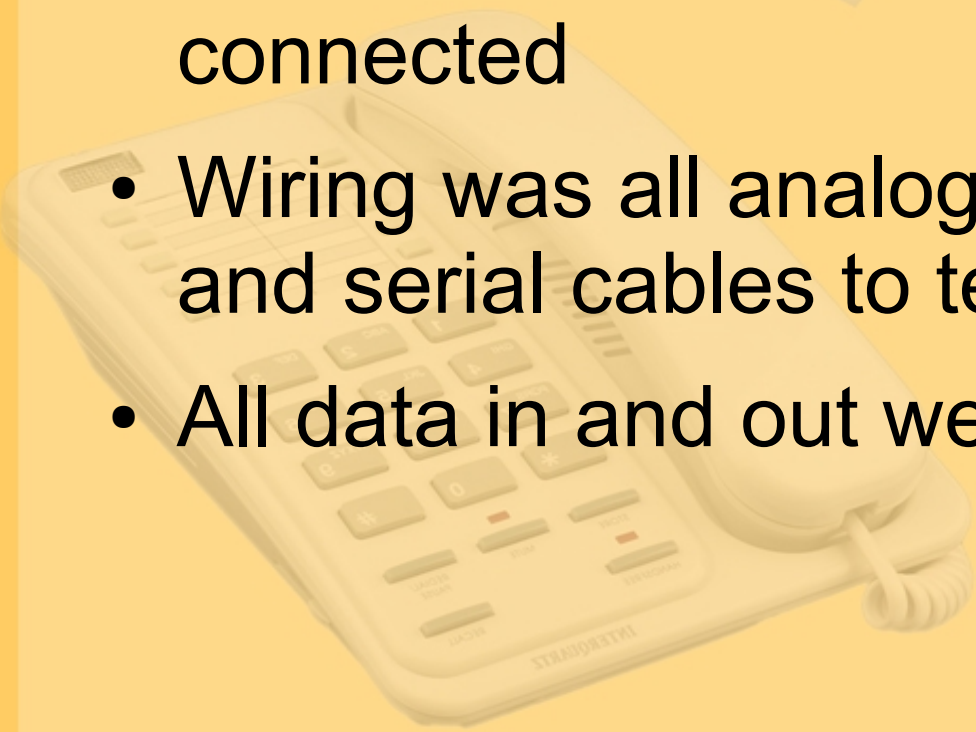
# Step 8: Reporting Options - Proprietary

- Many of these platforms come with extensive call activity analysis tools, statistical reports and call forecasting modules
- Commercial analytics add-on packages available
- Some allow ODBC access to raw logs



# Case Study: Existing Infrastructure

- 150 seats across 7 different systems
- Existing Dialer/PBX infrastructure was ASCII-terminal based with all analog extensions
- Inbound and outbound systems were not connected
- Wiring was all analog with 66-blocks to phones and serial cables to terminals
- All data in and out went through flat files only





# Case Study: New System Capacity

- All 150 agent seats capable of recording all calls and inbound/outbound/blended call handling
  - Greatly increase flexibility without outgrowing office
- Calls load-balanced across the entire system with a 3/1 lines to agent ratio
  - Adds 50% more lines than existing system
- Existing RBS, D4/AMI E&M Wink T1s changed to PRI/5ESS
  - All T1s are Bi-Directional with inbound/outbound
  - T1 PRIs allow for dynamic CID setting per campaign

# Case Study: New System Stations

- Existing CAT5 serial wiring was reused for agent station ethernet
  - Saves tens of thousands of dollars in wiring
- Existing phones and wiring reused with T1 channelbanks
  - Less equipment to purchase, staff was already familiar with existing phones and wiring
- 150 used P4 workstations purchased for agent stations, loaded with Ubuntu Linux
  - Largest single expense of the entire project

# Case Study: New System Servers

- Asterisk/VICIDIAL Load-Balanced Solution:
  - 6 Asterisk/VICIDIAL servers with quad-T1 card  
(Asus Board/Intel Core2-Duo/2GB RAM/  
SCSI-RAID/Sangoma a104)
  - 1 MySQL database server  
(Asus Board/Intel Core2-Quad/8GB RAM/SCSI RAID)
  - 1 Apache/PHP/eaccelerator server  
(Asus Board/Intel Core2-Duo/1GB RAM)
  - 1 Recording Archive server  
(Asus Board/Intel Core2-Duo/4TB SATA RAID/1GB RAM)

All systems use Slackware Linux with custom 2.6.17.11 Kernel

# Case Study: New Data Transfer

- ODBC greatly simplified integration with existing Sales and CRM data exchange
- Loading of leads directly into database
- Loading of Website-generated leads immediately into Dialer for callback
- New real-time reports and ability to much more easily make new reports



# Thank you!

Call Center panel tomorrow at 2:00PM and  
VICIDIAL sessions tonight and tomorrow night

For more information, go to:  
[eflo.net](http://eflo.net)  
[voip-info.org](http://voip-info.org)  
[asterisk.org](http://asterisk.org)

